WARNING

OPERATING HAZARDS

READ THIS SHEET AND OBSERVE ALL SAFETY PRECAUTIONS

ALL PERSONS WHO WORK WITH OR ARE EXPOSED TO POWER TRANSISTORS MUST TAKE PRECAUTIONS TO PROTECT THEMSELVES AGAINST POSSIBLE SERIOUS BODILY INJURY. EXERCISE EXTREME CARE AROUND SUCH PRODUCTS. UNINFORMED OR CARELESS OPERATION OF THESE DEVICES CAN RESULT IN POOR PERFORMANCE, DAMAGE TO THE DEVICE OR PROPERTY, SERIOUS BODILY INJURY, AND POSSIBLY DEATH.

DANGEROUS HAZARDS EXIST IN THE OPERATION OF POWER TRANSISTORS

The operation of power tubes and power transistors involves one or more of the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

A. HIGH VOLTAGE – Normal operating voltages can be deadly. Additional information follows.

B. RF RADIATION – Exposure to RF radiation may cause serious bodily injury possibly resulting in blindness or death. Cardiac pacemakers may be affected. Additional information follows.

C. BERYLLIUM – OXIDE POISONING – Dust or fumes from BeO ceramics used as thermal links with power transistors are highly toxic and can cause serious injury or death. Additional information follows.

D. HOT SURFACES – Surfaces of air–cooled heat sinks radiators can reach temperatures of 100 degrees centigrade and cause burns if touched. Additional information follows.

E. RF BURNS – Circuit boards with RF power transistors contain high RF potentials. Do not operate an RF power module with the cover removed.

HIGH VOLTAGE

The transmitter operates at voltages high enough to kill through electrocution. Personnel should always break the primary circuits when access to the transmitter is required.

RADIO FREQUENCY RADIATION

Exposure of personnel to RF radiation should be minimized, personnel should not be permitted in the vicinity of open energized RF generating circuits, or RF transmission systems (waveguides, cables, connectors, etc.), or energized antennas. It is generally accepted that exposure to “high levels” of radiation can result in severe bodily injury including blindness. Cardiac pacemakers may be affected.

The effect of prolonged exposure to “low level” RF radiation continues to be a subject of investigation and controversy. It is generally agreed that prolonged exposure of personnel to RF radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where personnel heat load is above normal. A 10 mW/cm^2 per one tenth hour average level has been adopted by several U.S. Government agencies including the Occupational Safety and Health Administration (OSHA) as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute which recommends a 1.0 mW/cm^2 per one tenth hour average level exposure between 30 Hz and 300 MHz as the standard employee protection guide (ANSI C95.1–1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, such as cables, flanges and gaskets must be RF leakproof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna, open RF generating circuit, or RF transmission system while energized. Monitor the tube and RF system for RF radiation leakage at regular intervals and after servicing.

DANGER — BERYLLIUM OXIDE CERAMICS (BeO) – AVOID BREATHING DUST OR FUMES

BeO ceramic material is used as a thermal link to carry heat from a transistor to the heat sink. Do not perform any operation on any BeO ceramic which might produce dust or fumes, such as grinding, grit blasting, or acid cleaning. Beryllium oxide dust or fumes are highly toxic and breathing them can result in serious personal injury or death. BeO ceramics must be disposed of only in a manner prescribed by the device manufacturer.

HOT SURFACES

Heat sinks and reject loads are air–cooled or conduction–cooled. The air–cooled external surface can operate at a high temperature (up to 100° C). All hot surfaces may remain hot for an extended time after the transmitter is operated to off. To prevent serious burns, take care to prevent and avoid any bodily contact with these surfaces both during and for a reasonable cooling down period after operation.

BROADCAST ELECTRONICS, INC.

TRANSMITTER WARRANTY VOID NOTICE

THE PRODUCT WARRANTY WILL BE VOID IF THE TRANSMITTER IS INSTALLED AT A SITE WITH INADEQUATE LIGHTNING PROTECTION AND A DEFECTIVE TRANSMISSION LINE SYSTEM.

The transmitter is covered by a two year limited product warranty from Broadcast Electronics. However, the transmitter must be properly installed at a site with adequate lightning protection and transmission line systems. ***TO ENSURE THE TRANSMITTER WARRANTY IS VALID***, the transmitter must be installed: 1) as described by the INSTALLATION procedures presented in SECTION II of this manual, 2) at a transmitter site with a lightning protection system described in TRANSMITTER SITE LIGHTNING PROTECTION SYSTEM CHECKOUT (refer to SECTION II of this manual), and 3) at a transmitter site with a transmission line system described in TRANSMISSION LINE AND ANTENNA CHECKOUT (refer to SECTION II of this manual). ***FAILURE TO PROPERLY INSTALL THE TRANSMITTER, PROVIDE AN ADEQUATE LIGHTNING PROTECTION SYSTEM, OR PROVIDE AN ADEQUATE TRANSMISSION LINE SYSTEM WILL VOID THE WARRANTY ON THE TRANSMITTER.*** If any questions develop concerning the transmitter warranty and installation site systems, contact the Broadcast Electronics Customer Service Department.

BROADCAST ELECTRONICS, INC.

NOTICE TO THE EQUIPMENT USER

FCC Rule 73.1590 mandates the licensee of each AM station to make measurements for spurious and harmonic emissions to show compliance with the transmission system requirements of Section 73.44 of the Commission's Rules. It is the broadcast station's responsibility to ensure that the audio signal applied to a Broadcast Electronics E–Series AM transmitter conforms to the audio standard NRSC–1 (published as ANSI/EIA–549–1988). This is a mandatory requirement to ensure that the equipment complies to Section 73.44 and Section 73.128(C) of the Commission's Rules.

WARNING WARNING

OPERATING HAZARDS

WARNING

WARNING

THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.

The Broadcast Electronics AM transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with many built–in safety features, however good judgement, care, and common sense must be practiced to prevent accidents.

In addition to high voltages and currents, the AM transmitters contain multiple circuit grounds with high ac and dc potentials with respect to the cabinet which is at earth potential. The potentials could cause serious injury or death if maintenance personnel simultaneously touch a circuit ground and the cabinet. As a result, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Therefore, never energize the transmitter with test equipment connected to the transmitter output network, RF power module, RF combiner, or power supply components. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized if required.

SCOPE OF MANUAL

This manual consists of two sections which provides the following information for the Broadcast Electronics AM–2.5E and AM–5E AM Broadcast Transmitters.

A. PART I – Contains information relative to installation, operation, and maintenance applicable to the overall transmitter.

B. PART II – Contains detailed information for the following transmitter modular units.

1. POWER SUPPLY ASSEMBLY
2. RF POWER MODULE
3. OUTPUT NETWORK
4. EXCITER/CONTROLLER UNIT (ECU)

PART I - TABLE OF CONTENTS

PARAGRAPH		PAGE NO.
SECTION I	**GENERAL INFORMATION**	
1–1	INTRODUCTION	1–1
1–3	EQUIPMENT DESCRIPTION	1–1
1–4	GENERAL	1–1
1–6	EXCITER/CONTROL UNIT	1–1
1–12	OUTPUT NETWORK ASSEMBLY	1–4
1–13	RF POWER MODULE	1–4
1–15	POWER SUPPLY	1–4
1–16	COMBINER ASSEMBLY	1–4
1–17	TRANSMITTER CONFIGURATIONS	1–5
1–19	ACCESSORIES AND SPARE PARTS KITS	1–5
1–21	EQUIPMENT SPECIFICATIONS	1–5
SECTION II	**INSTALLATION**	
2–1	INTRODUCTION	2–1
2–3	UNPACKING	2–1
2–6	ENVIRONMENTAL REQUIREMENTS	2–1
2–8	COOLING AIR REQUIREMENTS	2–1
2–12	PRIMARY POWER	2–1
2–14	INSTALLATION	2–1
2–16	EQUIPMENT PLACEMENT	2–2
2–19	COMPONENT INSTALLATION	2–2
2–22	ECU CIRCUIT BOARDS	2–2
2–23	RF POWER MODULES	2–2
2–24	POWER SUPPLY	2–7
2–25	BATTERY INSTALLATION	2–8
2–26	CIRCUIT BOARD PROGRAMMING	2–8
2–28	EXCITER CIRCUIT BOARD	2–8
2–37	STEREO CIRCUIT BOARD	2–12
2–42	CONTROLLER CIRCUIT BOARD	2–12

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PARAGRAPH		PAGE NO.
2-55	POWER SUPPLY CIRCUIT BOARD	2-15
2-58	REMOTE CONTROL	2-16
2-59	GENERAL	2-16
2-84	WIRING	2-20
2-86	AUDIO INPUT CONNECTION	2-20
2-88	EXTERNAL STEREO RF INPUT	2-20
2-89	AM-2.5E/AM-5E RF TRANSMISSION LINE CONNECTION	2-20
2-90	EXTERNAL INTERLOCK	2-20
2-91	MODULATION MONITOR	2-20
2-92	AC POWER CONNECTIONS	2-22
2-95	GROUND	2-22
2-96	TRANSMITTER SITE LIGHTNING PROTECTION SYSTEM CHECKOUT	2-22
2-98	ANTENNA BALL-GAP LIGHTNING ARRESTOR	2-25
2-102	ANTENNA-TUNING-UNIT SPARK-GAP LIGHTNING ARRESTOR	2-25
2-103	TRANSMITTER SITE GROUNDING SYSTEM	2-25
2-104	CABLE PROTECTION	2-26
2-110	ANTENNA RF FEED LINE	2-26
2-111	TRANSMISSION LINE AND ANTENNA CHECKOUT	2-26
2-113	ANTENNA VSWR	2-26
2-114	COAXIAL SWITCH CONTROLLER	2-26
2-115	ATU AND PHASOR CHECKOUT	2-28
2-116	INITIAL CHECKOUT	2-28
2-118	PRELIMINARY OPERATION AND ADJUSTMENT	2-28
2-120	TUNING	2-28
2-126	POWER LEVEL AND MODULATION MONITOR CALIBRATION ADJUSTMENTS	2-29
2-138	STEREO ADJUSTMENT	2-30
2-149	SINGLE CHANNEL LEVEL	2-32

SECTION III	OPERATION	
3-1	INTRODUCTION	3-1
3-3	CONTROLS AND INDICATORS	3-1
3-5	OPERATION	3-12
3-6	TURN-ON	3-12
3-14	TURN OFF	3-13
3-16	METERING	3-13
3-17	FORWARD POWER	3-13
3-18	REFLECTED POWER	3-13
3-19	POWER ADJUST	3-13
3-21	MONO/STEREO OPERATION	3-14
3-23	STEREO OPERATION	3-14
3-24	MONO OPERATION	3-14
3-27	PILOT CONTROL	3-14
3-29	EXCITER MONITOR OPERATION	3-14
3-31	MONO/STEREO INDICATIONS	3-14
3-32	INPUT SELECTION	3-14
3-33	POLARITY SELECTION	3-15
3-34	X10 AUTORANGE INDICATIONS	3-15

PARAGRAPH		PAGE NO.
3–35	FAULT RESET	3–15
3–37	POWER SUPPLY FAULT RESET	3–15
3–39	OVER–CYCLE OFF	3–15
3–41	OVER–MODULATION PWM MUTE	3–15
3–43	TRANSMITTER MONITOR	3–15
3–45	BATTERY TEST	3–15
3–47	CONTROLLER PWM MUTE INDICATOR	3–16
3–49	CONTROLLER REMOTE FAIL–SAFE INDICATOR	3–16
3–51	EXCITER LOCK INDICATOR	3–16
3–53	EXCITER +5V/+15V/–15V INDICATORS	3–16
3–55	STEREO EQUALIZATION INDICATORS	3–16
3–57	RF POWER MODULE INDICATORS	3–16
3–59	POWER SUPPLY INDICATORS	3–16
3–61	EXCITER NEGATIVE LIMITER INDICATOR	3–16
3–63	HIGH/LOW AC LINE CONDITIONS	3–16

SECTION IV	THEORY OF OPERATION	
4–1	INTRODUCTION	4–1
4–5	FUNCTIONAL DESCRIPTION	4–1
4–6	ECU	4–1
4–7	GENERAL	4–1
4–8	STEREO CIRCUIT BOARD	4–1
4–11	EXCITER CIRCUIT BOARD	4–1
4–13	CONTROLLER CIRCUIT BOARD	4–2
4–18	POWER SUPPLY	4–2
4–19	RF POWER MODULE	4–2
4–24	RF COMBINER	4–7
4–27	OUTPUT NETWORK	4–7
4–31	POWER SUPPLY	4–8
4–34	POWER SUPPLY CIRCUIT BOARD	4–8
4–39	METERING	4–9
4–42	COOLING FANS	4–9
4–44	INTERFACE CIRCUIT BOARD (AM–5E ONLY)	4–9
4–46	DETAILED DESCRIPTION	4–9
4–47	POWER SUPPLIES	4–9
4–49	AC INPUT CIRCUITRY	4–9
4–53	ECU POWER SUPPLY ASSEMBLY	4–10
4–57	TRANSMITTER FLUSHING FANS	4–10
4–60	LOW–VOLTAGE POWER SUPPLY TRANSFORMER	4–10
4–62	POWER SUPPLY CIRCUIT BOARD	4–10
4–65	CONVENTIONAL RECTIFIER CIRCUITRY	4–13
4–68	SWITCHING POWER SUPPLY CIRCUIT	4–13
4–76	MODULATOR CIRCUIT BOARD	4–14
4–81	POWER AMPLIFIER CIRCUIT BOARDS	4–15
4–86	SEQUENCE OF OPERATION	4–15
4–91	RF CIRCUITRY	4–16
4–92	EXCITER CIRCUIT BOARD	4–16
4–98	STEREO CIRCUIT BOARD	4–17
4–102	RF POWER MODULE	4–17
4–109	RF COMBINER	4–21
4–110	HARMONIC BAND–PASS FILTER	4–22

PARAGRAPH		PAGE NO.
4-111	DIRECTIONAL COUPLER CIRCUIT BOARD	4-22
4-115	T-MATCHING NETWORK	4-22
4-116	LIGHTNING PROTECTION CIRCUIT BOARD	4-22
4-117	LIGHTNING DETECTION CIRCUIT BOARD	4-23
4-119	RF OUTPUT POWER CONTROL CIRCUITRY	4-23
SECTION V	**MAINTENANCE**	
5-1	INTRODUCTION	5-1
5-3	SAFETY CONSIDERATIONS	5-1
5-6	FIRST LEVEL MAINTENANCE	5-1
5-8	ROUTINE MAINTENANCE	5-1
5-9	INSPECTION AND CLEANING	5-2
5-10	CONTROLLER BATTERY	5-2
5-11	AIR FILTERS	5-2
5-12	FLUSHING FANS	5-2
5-14	SPARK GAP	5-2
5-15	SECOND LEVEL MAINTENANCE	5-2
5-18	ELECTRICAL ADJUSTMENTS	5-4
5-20	TRANSMITTER FREQUENCY RE-PROGRAMMING	5-4
5-22	TROUBLESHOOTING	5-4
5-24	TRANSMITTER INDICATORS	5-5
5-25	RF POWER MODULE REMOVAL	5-8
5-26	TRANSMITTER TROUBLESHOOTING PROCEDURES	5-8
5-27	TRANSMITTER COMPONENT LOCATIONS	5-8
5-28	COMPONENT REPLACEMENT PROCEDURE	5-13
5-34	INTEGRATED CIRCUITS	5-14
SECTION VI	**PARTS LIST**	
6-1	INTRODUCTION	6-1
SECTION VII	**DRAWINGS**	
7-1	INTRODUCTION	7-1

LIST OF TABLES

TABLE	DESCRIPTION	PAGE NO.
1-1	ELECTRICAL CHARACTERISTICS	1-5
1-2	PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS	1-9
3-1	AM-2.5E/AM-5E CONTROLS AND INDICATORS	3-1
3-2	ECU CONTROLS AND INDICATORS	3-3
3-3	POWER MODULE CONTROLS AND INDICATORS	3-11
5-1	AM-2.5E/AM-5E INDICATORS	5-5
5-2	AM-2.5E/AM-5E TROUBLESHOOTING	5-9
6-1	AM-2.5E/AM-5E REPLACEABLE PARTS LIST INDEX	6-1

LIST OF ILLUSTRATIONS

FIGURE	DESCRIPTION	PAGE NO.
1-1	AM-2.5E TRANSMITTER	1-2
1-2	AM-5E TRANSMITTER	1-3
2-1	AM-2.5E TRANSMITTER INSTALLATION	2-3
2-2	AM-5E TRANSMITTER INSTALLATION	2-5
2-3	TRANSMITTER MOVING	2-7
2-4	COMPONENT INSTALLATION	2-9
2-5	EXCITER CIRCUIT BOARD PROGRAMMING	2-11
2-6	STEREO CIRCUIT BOARD PROGRAMMING	2-13
2-7	CONTROLLER CIRCUIT BOARD PROGRAMMING	2-14
2-8	REMOTE CONTROL AND AUDIO CONNECTIONS	2-17
2-9	AM-2.5E/AM-5E RF OUTPUT CONNECTIONS	2-21
2-10	AM-2.5E PRIMARY AC WIRING	2-23
2-11	AM-5E PRIMARY AC WIRING	2-24
2-12	ANTENNA LIGHTNING PROTECTION SYSTEM	2-27
2-13	TEST EQUIPMENT CONNECTIONS, POWER LEVEL CALIBRATION	2-30
2-14	TEST EQUIPMENT CONNECTIONS, SEPARATION	2-31
2-15	EQUALIZATION LISSAJOUS PATTERNS	2-33
3-1	AM-2.5E/AM-5E CONTROLS AND INDICATORS	3-2
3-2	ECU CONTROLS AND INDICATORS	3-7
3-3	POWER MODULE CONTROLS AND INDICATORS	3-11
4-1	AM-2.5E BLOCK DIAGRAM	4-3
4-2	AM-5E BLOCK DIAGRAM	4-5
4-3	AM-2.5E/AM-5E POWER SUPPLY SIMPLIFIED SCHEMATIC	4-11
4-4	AM-2.5E/AM-5E RF CIRCUITRY SIMPLIFIED SCHEMATIC	4-18
5-1	REMOVING THE AIR FILTER	5-3
5-2	AM-2.5E COMPONENT LOCATOR	5-15
5-3	AM-5E COMPONENT LOCATOR	5-18
5-4	AM-2.5E/AM-5E ECU/POWER BLOCK/OUTPUT NETWORK ASSEMBLY COMPONENT LOCATOR	5-21

PART II - TABLE OF CONTENTS

I – POWER SUPPLY ASSEMBLY

II – RF POWER MODULE

III – OUTPUT NETWORK

IV – EXCITER/CONTROLLER UNIT (ECU)

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Information presented by this section provides a general description of the Broadcast Electronics AM-2.5E and AM-5E transmitters and lists equipment specifications.

1-3. EQUIPMENT DESCRIPTION.

1-4. GENERAL.

1-5. The Broadcast Electronics AM-2.5E transmitter is a CE compliant 2.5 kW solid-state C-QUAM™ stereo AM transmitter designed for continuous operation in the 522 kHz to 1705 kHz broadcast band (refer to Figure 1-1). The Broadcast Electronics AM-5E transmitter is a CE compliant 5 kW solid-state C-QUAM™ stereo AM transmitter designed for continuous operation in the 522 kHz to 1705 kHz broadcast band (refer to Figure 1-2). The AM-2.5E and AM-5E transmitters consists of modular components assembled in a single cabinet. The modular components include: 1) an exciter/control unit, 2) an output network assembly, 3) power block assemblies containing two RF power modules and a star combiner assembly, 4) power supply panel assemblies, and 5) an AC distribution panel assembly. Specific AM-2.5E/AM-5E features include:

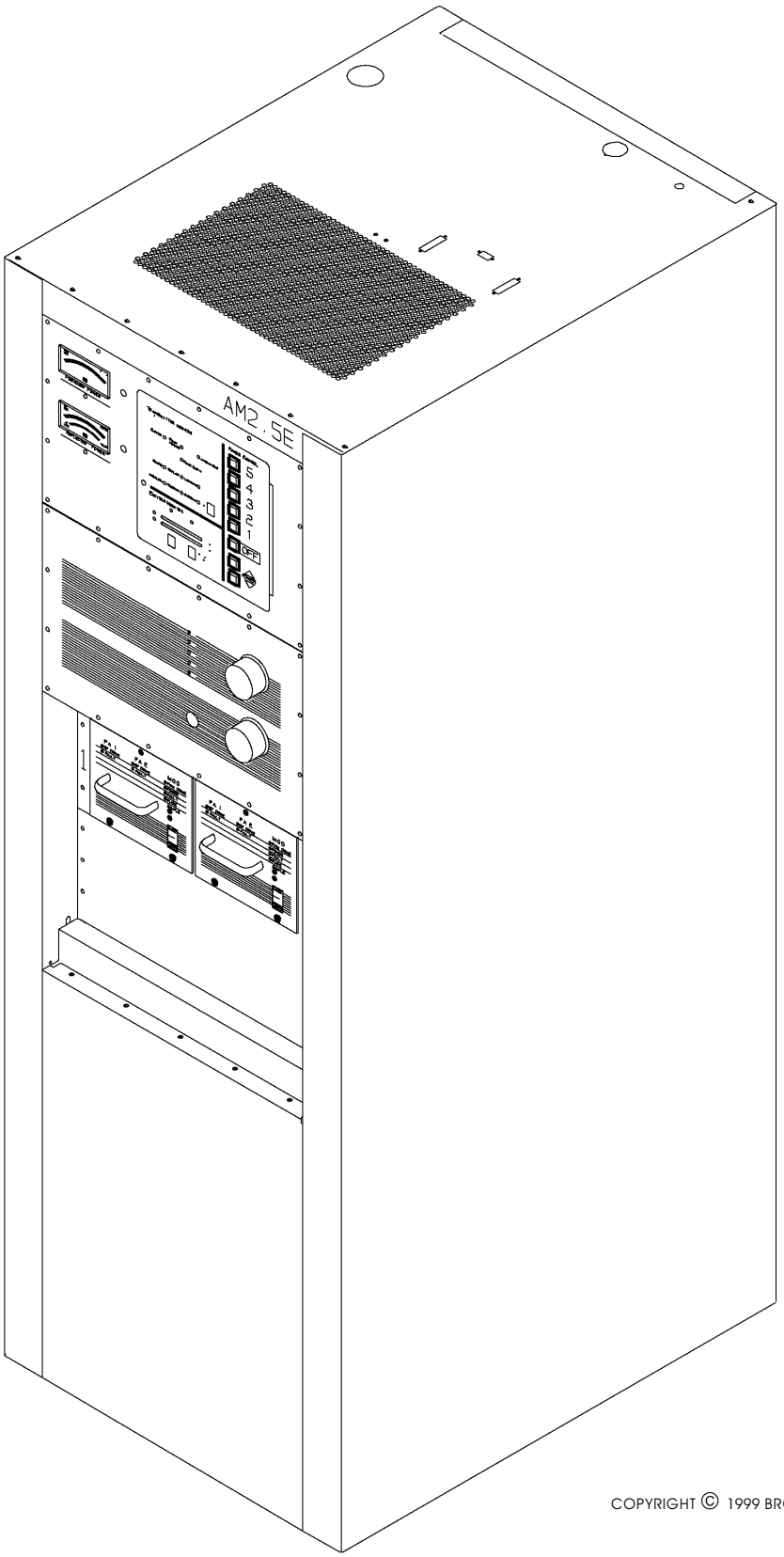
1. Built-in C-QUAM™ AM stereo circuitry.
2. High efficiency Class E solid-state RF power amplifier modules.
3. A high efficiency switching power supply.
4. Star combiner assembly. Each star combiner allows the removal of RF power modules without the use of dummy modules or bypass switches.
5. A built-in output matching network.
6. A CMOS digital controller with extensive VSWR detection and foldback circuitry which reduces carrier interruptions by weather conditions.
7. CE compliant design.

1-6. **EXCITER/CONTROL UNIT.** The transmitter exciter/control unit (ECU) is a modular assembly containing plug-in stereo, exciter, and controller circuit boards. In addition to the circuit boards, the ECU is equipped with forward and reflected power meters to provide transmitter output power status indications.

1-7. **Stereo Circuit Board.** The ECU stereo circuit board is a modular plug-in assembly containing C-QUAM™ AM stereo circuitry. The C-QUAM™ stereo system is a mode of AM stereo transmission utilizing amplitude modulated monaural (L+R) information and independently quadrature modulated stereo (L-R) information. The results produce a stereo transmission system compatible with mono receivers.

1-8. The stereo circuit board is designed with remote/local controlled mono left, mono right, mono L+R, and stereo modes of operation. Two equalization circuits are provided to allow the transmitter to be configured for operation into two different antennas.

C-QUAM™ is a registered trademark of Motorola Inc.



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597-1114-1

FIGURE 1-1. AM-2.5E TRANSMITTER

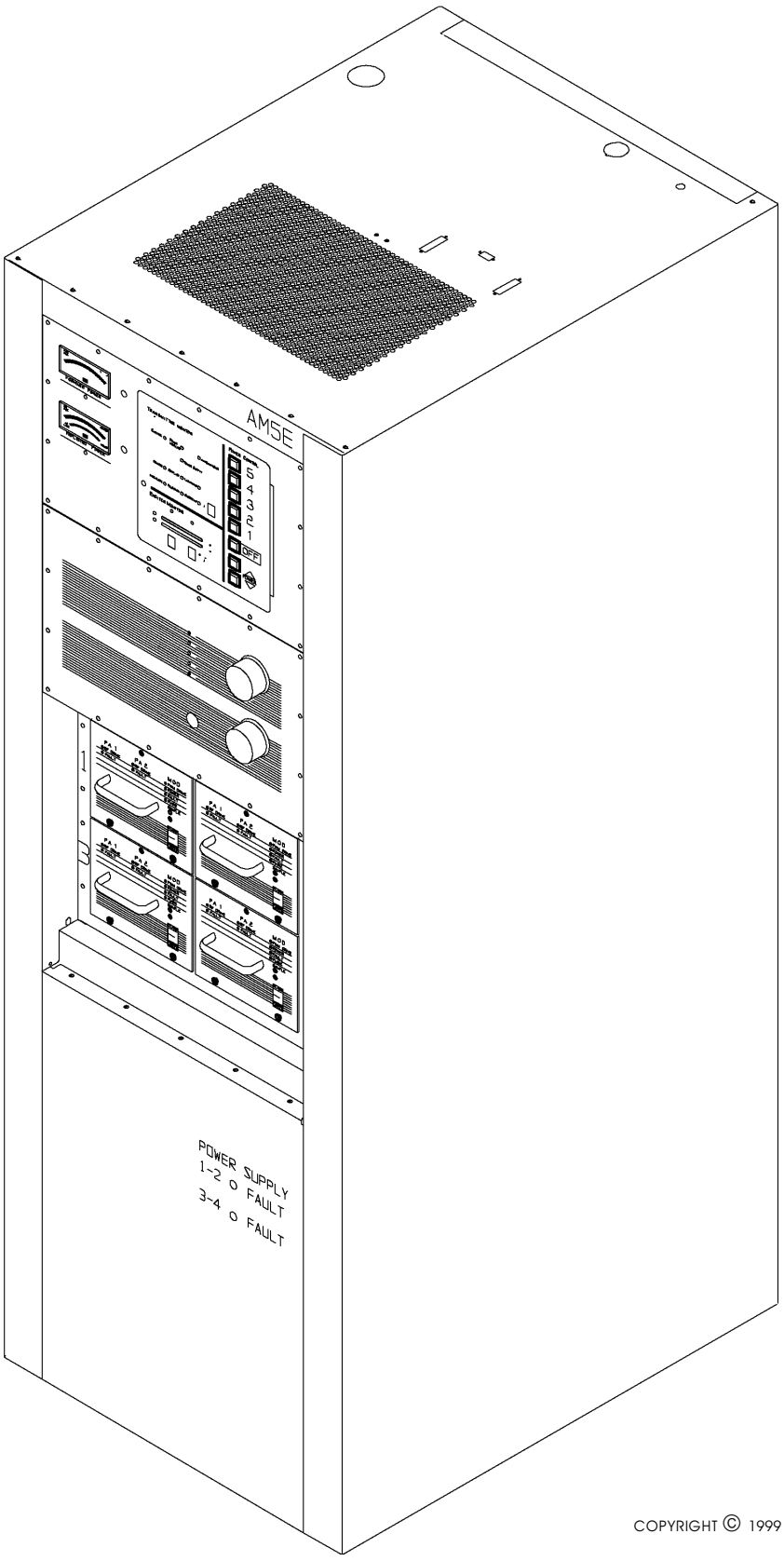

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FIGURE 1-2. AM-5E TRANSMITTER **597-1114-2**

1–9. **Exciter Circuit Board.** The ECU exciter circuit board is a modular plug–in exciter assembly. Instrumentation amplifiers provide balanced left and right channel transformerless audio inputs. The exciter carrier frequency is established by a digital frequency synthesizer. The synthesizer is a phase–locked–loop circuit which provides extremely accurate and reliable carrier frequency operation. A PWM (pulse–width–modulation) circuit is used to generate an RF drive signal for application to a modulator circuit board in an RF power module. If a stereo circuit board failure is encountered or when the stereo circuit board is removed from the ECU chassis, the exciter circuitry is designed to automatically configure to monophonic operation.

1–10. **Controller Circuit Board.** All transmitter control operations are directed by the ECU controller circuit board. The controller circuit board consists of CMOS logic control and monitoring circuitry. The circuitry is designed to interface to all popular remote control systems such as the Broadcast Electronics VMC–16 remote control system.

1–11. The transmitter power is controlled by a power control circuit. The circuit allows the transmitter to be operated at five power levels. A power trim circuit allows the transmitter output power to be adjusted to a precise level. An antenna interlock circuit is provided to prevent the transmitter from operating into an incorrect antenna. A reflected power detection circuit operates in association with the power control circuit to foldback the transmitter power during high VSWR conditions. In addition to the reflected power detector, a lightning detector circuit is provided to mute the transmitter when high voltage is present at the transmitter output during a lightning storm.

1–12. **OUTPUT NETWORK ASSEMBLY.** Matching of the transmitter impedance to the antenna is accomplished by the output network assembly. The assembly is equipped with an LC T network to match the transmitter output to the antenna. A bandpass filter is provided to attenuate all harmonic frequencies to FCC, DOC, and CCIR levels. The assembly also contains the lightning detection circuit board, a lightning protection circuit board, and a directional coupler assembly.

1–13. **RF POWER MODULE.** The AM–2.5E and AM–5E transmitters are equipped with RF power modules. A power module is a modular plug–in assembly containing two RF power amplifier circuit boards and one modulator circuit board. Each power module is equipped with MOSFET transistors to produce approximately 1375 watts of RF power.

1–14. The RF power modules are designed using Class E amplifier technology. A Class E amplifier exhibits high efficiency and provides superior audio performance. In addition to the superior efficiency and audio performance, the power modules are designed to be removed from the chassis for maintenance. The remaining power modules will provide full power to maintain on–air operation.

1–15. **POWER SUPPLY.** A modular switching power supply provides operating potentials for two RF power modules. The power supply design uses an SCR controlled bridge to rectify the ac line voltage into a dc potential. The supply is filtered and routed to the RF power modules for control and regulation. A fault detection circuit monitors power supply activity for failure conditions. A separate modular switching power supply provides operating potentials for the ECU circuitry.

1–16. **COMBINER ASSEMBLY.** The AM–2.5E and AM–5E are equipped with a star combining system. The system combines the outputs of the RF power modules to provide: 1) a 2.5 kW output in AM–2.5E models and 2) a 5 kW output in AM–5E models. If a power module is removed from the chassis, the remaining power modules will continue operation to maintain on–air operation.

1-17. **TRANSMITTER CONFIGURATIONS.**

1-18. The AM-2.5E and AM-5E transmitters can be ordered in the following configurations:

P/N	DESCRIPTION
907-2500-100	AM-2.5E 2.5 kW AM Transmitter for operation in the 522 kHz to 1705 kHz broadcast band, 10 kHz spacing, 196V - 256V ac single phase supply.
907-5000-100	AM-5E 5 kW AM Transmitter for operation in the 522 kHz to 1705 kHz broadcast band, 10 kHz spacing, 196V - 256V ac single phase supply.

1-19. **ACCESSORIES AND SPARE PARTS KITS.**

1-20. The following text presents accessories and spare parts kits available for use with the AM-2.5E and AM-5E transmitters.

P/N	DESCRIPTION
977-0038	AM-2.5E/AM-5E recommended semi-conductor kit.
977-0039	AM-2.5E 100% semi-conductor kit.
977-0040	AM-2.5E/AM-5E recommended spare parts kit. Includes selected meters, switches, fuses, filters, etc. Does not include semi-conductors.
977-0041	AM-5E 100% semi-conductor kit.
907-0016-110	VMC-16 Voice Remote Control Unit, AM-10A/ AM-6A/AM-2.5E/AM-5E.
977-0037	Basic semi-conductor kit, AM-10A/AM-6A/ AM-1A/AM-2.5E/AM-5E.

1-21. **EQUIPMENT SPECIFICATIONS.**

1-22. Refer to Table 1-1 for electrical specifications or Table 1-2 for physical specifications of the AM-2.5E and AM-5E transmitters.

TABLE 1-1. ELECTRICAL CHARACTERISTICS
(Sheet 1 of 5)

PARAMETER	SPECIFICATION
RF POWER OUTPUT	
AM-2.5E	12.5 W to 2.8 kW. Five preset power levels available by local or remote control. Will operate at a reduced power output (30-50% typical) with one-half of the power modules.
AM-5E	25 W to 5.6 kW. Five preset power levels available by local or remote control. Will operate at a reduced power output (30-50% typical) with one-half of the power modules.

TABLE 1-1. ELECTRICAL CHARACTERISTICS
(Sheet 2 of 5)

PARAMETER	SPECIFICATION
OUTPUT POWER REGULATION	Less than 1% change in output power with variation of ac line input voltage from 196V to 252V ac.
RF CARRIER FREQUENCY RANGE	522 kHz to 1705 kHz (as ordered). Accommodates 9 kHz or 10 kHz channel spacing (9 kHz spacing requires an optional crystal).
RF OUTPUT IMPEDANCE	50 Ohms, unbalanced. Matching network to optimize VSWR of 1.5 : 1 at any phase angle and carrier frequency.
OUTPUT CONNECTOR AM-5E AM-2.5E	Female 7/16 DIN connector. Requires 7/8 inch RF transmission line with 7/16 male DIN connector. Requires 1/2 inch RF transmission line with 7/16 male DIN connector.
LOAD VSWR	1.5 : 1 at full carrier power. Will operate into a higher VSWR with automatic power reduction. Open and short circuit protected.
HARMONIC AND SPURIOUS SUPPRESSION	Meets or exceeds FCC, DOC, and CCIR requirements when preceded by external NRSC-1 compatible audio low-pass filters.
CARRIER FREQUENCY STABILITY	±3ppm, 0° to 50° C (+32° to +122° F).
CARRIER SHIFT	Less than 1% at 95% negative modulation at 1 kHz.
TYPE OF MODULATION	Pulse Width Modulation of L+R envelope with integrated C-QUAM AM stereo. An RF input connector is also provided for an external stereo exciter.
OPERATING MODES	Stereo, mono L+R, mono L, mono R, by local or remote control.
MODULATION CAPABILITY AM-2.5E AM-5E	 Greater than 145% peak positive capability at 2.5 kW. Greater than 145% peak positive capability at 5 kW.
MODULATION INPUT INDICATION	Peak reading, color coded, LED bar graph display with an autorange feature for monitoring positive or negative input levels of four different audio channels (L/R or L+R/L-R).
AUDIO INPUT LEVEL	+10 dBm, ±1 dB, L=R (or mono) to produce 100% L+R envelope modulation. Other input levels can be accommodated.

TABLE 1-1. ELECTRICAL CHARACTERISTICS
(Sheet 3 of 5)

PARAMETER	SPECIFICATION
AUDIO INPUT IMPEDANCE	600 Ohms. Inputs are balanced, transformerless, and resistive with passive RFI filtering. Other impedances can be accommodated.
AUDIO FREQUENCY RESPONSE (MONOPHONIC)	±0.5 dB, 20 Hz to 10 kHz at 90% negative modulation (linear phase mode). +0.1 dB –3 dB, 20 Hz to 10 kHz at 90% negative modulation, standard configuration.
AUDIO HARMONIC DISTORTION	
Mono	Less than 0.8%, 20 Hz to 10 kHz at rated power. Less than 1.5%, 20 Hz to 10 kHz at 50% power. Less than 2.0%, 20 Hz to 10 kHz at 25% power. Less than 3.0%, 20 Hz to 10 kHz at 10% power. All mono audio harmonic distortion specifications are referenced to an audio input level which generates 90% modulation at 1 kHz (9 dBm).
Stereo	Less than 1.5% at 50% single channel modulation, 50 Hz to 10 kHz at rated power.
INTERMODULATION DISTORTION (MONO)	1.2% or less at 1:1 ratio. 1.7% or less at 4:1 ratio. 60/7000 Hz SMPTE standards with 85% modulation at rated power.
CCIF INTERMODULATION DISTORTION (MONO)	1.0% or less at 1:1 ratio. 4 kHz/5 kHz with 85% modulation at rated power.
TRANSIENT INTERMODULATION DISTORTION (MONO)	1.0% or less at 4:1 ratio. 2.96 kHz square wave 8 kHz sinewave with 85% modulation at rated power.
INCIDENTAL PHASE MODULATION (STEREOPHONIC)	Less than 2.0 degrees (0.035 radians) average or 30 dB (40 dB typical) below equivalent 100% L–R C–QUAM modulation, 50 Hz to 10 kHz at rated power. Measured with an audio input level which generates 95% negative L+R envelope modulation at 1 kHz (9.5 dBm).
STEREO SEPARATION	–30 dB or greater, 50 Hz to 10 kHz. Measured with 50% single channel modulation into a 50 ohm resistive load at rated power.
SQUAREWAVE OVERSHOOT	
Mono	0.1% or less at 400 Hz, 90% modulation with high frequency boost disabled.
Stereo	1.0% or less at 400 Hz, 50% single channel modulation with high frequency boost disabled.

TABLE 1-1. ELECTRICAL CHARACTERISTICS
(Sheet 4 of 5)

PARAMETER	SPECIFICATION
SQUAREWAVE TILT	1.0% or less at 40 Hz. 1.5% or less at 20 Hz. Measured with 90% negative modulation.
NOISE	
Mono	Greater than 65 dB below a reference level equivalent to 100% negative modulation in a 22 Hz to 30 kHz bandwidth, unweighted.
Stereo	Greater than 55 dB below a reference level equivalent to 100% negative modulation of either left or right channel in a 22 Hz to 30 kHz bandwidth, unweighted.
AC INPUT VOLTAGE	196V to 252V ac 50/60 Hz, single phase. Includes built–in MOVs for surge suppression.
AC POWER CONSUMPTION	
AM–2.5E	3.3 kW, no modulation of 2.5 kW carrier. 2.05 kW, 100% modulation of 2.5 kW carrier. Measured at 2.5 kW into a 50 ohm resistive load at 220V ac. 0.9 power factor.
AM–5E	6.7 kW, no modulation of 5 kW carrier. 10 kW, 100% modulation of 5 kW carrier. Measured at 5 kW into a 50 ohm resistive load at 220V ac. 0.9 power factor.
OVERALL EFFICIENCY	
AM–2.5E	75% or greater, 100% sinusoidal modulation of carrier, ac line to RF output. Measured at into 2.5 kW a 50 ohm resistive load at 220V ac.
AM–5E	75% or greater, 100% sinusoidal modulation of carrier, ac line to RF output. Measured at 5 kW into a 50 ohm resistive load at 220V ac.
SAFETY	Meets IEC 215 specifications.
REGULATORY	Meets CE specifications.
METERING	
AM–2.5E	Output Forward Power: 1) High scale – 0 to 3000 watts and 2) Low scale – 0 to 750 watts. Output Reflected Power: 1) High scale – 0 to 300 watts and 2) Low scale – 0 to 60 watts. Ac Line Voltage: Scale – 150 to 300 volts. AM–2.5 Forward Power Meter complies with FCC rule 78.1215 (a) within the 150 watt to 2800 watt range.

TABLE 1-1. ELECTRICAL CHARACTERISTICS
(Sheet 5 of 5)

PARAMETER	SPECIFICATION
METERING (CONT'D)	
AM-5E	Output Forward Power: 1) High scale - 0 to 6000 watts and 2) Low scale - 0 to 1500 watts. Output Reflected Power: 1) High scale - 0 to 600 watts and 2) Low scale - 0 to 150 watts. Ac Line Voltage: Scale - 150 to 300 volts. AM-5 Forward Power Meter complies with FCC rule 73.1215 (a) within the 300 watt to 5600 watt range.
RF MONITORING PROVISIONS	2 volts RMS nominal RF output sample into a 50 Ohm input. Adjustable from the transmitter front panel for each of the five power levels.
REMOTE INTERFACE	Built-in interface for most control and monitoring systems.

TABLE 1-2. PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS
(Sheet 1 of 2)

PARAMETER	SPECIFICATION
PHYSICAL	
DIMENSIONS	Width: 24.82 Inches (63.0 cm). Height: 71.32 Inches (181.2 cm) Depth: 31.55 Inches (80.1 cm)
WEIGHT	
AM-2.5E	410 Pounds (186 kg), unpacked.
AM-5E	525 Pounds (238 kg), unpacked.
CUBAGE	42.8Ft^3 (1.2 m^3).
ENVIRONMENTAL	
COOLING	
Type	Low velocity air with disposable filters.
Requirements - AM2.5E/AM-5E	500 Cubic Feet Per Minute (14.15 m^3/min).
OPERATING TEMPERATURE	0° to 50° C (+32° to +122° F)
OPERATING HUMIDITY	0 TO 95% (non-condensing)

TABLE 1-2. PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS
(Sheet 2 of 2)

PARAMETER	SPECIFICATION
MAXIMUM ALTITUDE	
60 Hz Models	0 to 10,000 feet above sea level (0 to 3048 Meters).
50 Hz Models	0 to 7,500 feet above sea level (0 to 2286 Meters).

NOTE –

For AM–2.5E, All specifications measured at 2.5 kW into a 50 ohm resistive load using Broadcast Electronics AS–10 modulation monitor.
For AM–5E, All specifications measured at 5 kW into a 50 ohm resistive load using Broadcast Electronics AS–10 modulation monitor.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information required for the installation and preliminary checkout of the Broadcast Electronics AM-2.5E and AM-5E transmitters.

2-3. UNPACKING.

2-4. The equipment becomes the property of the customer when the equipment is delivered to the carrier. Carefully unpack the transmitter. Perform a visual inspection to determine that no apparent damage has been incurred during shipment. All shipping materials should be retained until it is determined that the unit has not been damaged. Claims for damaged equipment must be promptly filed with the carrier or the carrier may not accept the claim.

2-5. The contents of the shipment should be as indicated on the packing list. If the contents are incomplete, or if the unit is damaged electrically or mechanically, notify both the carrier and Broadcast Electronics.

2-6. ENVIRONMENTAL REQUIREMENTS.

2-7. Table 1-2 provides environmental conditions which must be considered prior to transmitter installation. Refer to Table 1-2 in SECTION I, INTRODUCTION and ensure the transmitter is to be installed in an acceptable environment.

2-8. COOLING AIR REQUIREMENTS.

2-9. If outside air is to be used to cool the transmitter, the air inlet duct must be sized to allow adequate air flow. The air must be dry and well filtered. If intake louvers are used, operation of the louvers must be electrically interlocked with the transmitter operation.

2-10. If the heated transmitter air is to be ducted from the room, the duct system must not introduce any back-pressure on the equipment. Proper allowances for air flow will ensure that only a limited amount of heat is dissipated into the equipment interior. The duct system must allow for a minimum air flow of: 1) 500 cubic feet of air per minute for AM-2.5E models and 2) 700 cubic feet of air per minute for AM-5E models.

2-11. As a minimum requirement, any duct work must have a cross-sectional area equal to the exhaust area of the cabinet (refer to Figure 2-1 and 2-2). Sharp bends in the duct system will introduce back pressure and are not permissible. A radius bend must be used if a right angle turn is required. An exhaust fan may be used to overcome duct losses or overcome wind pressures if the duct is vented to the outside.

2-12. PRIMARY POWER.

2-13. The AM-2.5E and AM-5E transmitters are designed for operation from a 196V to 252V ac 50/60 Hz single phase power source. Consult the local electric utility company to ensure that the correct service is provided before connection of the transmitter to the primary power source.

2-14. INSTALLATION.

2-15. Each transmitter is wired, operated, tested, and inspected at the factory prior to shipment and is ready for installation when received. Prior to installation, this publication should be studied to obtain an understanding of the operation, circuitry, nomenclature, and installation requirements. Installation is accomplished as follows: 1) placement, 2) component installation, 3) circuit board programming, 4) remote control connections, 5) wiring, 6) initial checkout, and 7) preliminary operation and tuning.

2-16. **EQUIPMENT PLACEMENT.**

2-17. The transmitter is designed with access holes in the top of the cabinet to allow for the over-head ducting of ac power, RF transmission line, and ground strap wiring (refer to Figure 2-1/2-2). The floor must be capable of supporting the total transmitter weight of approximately 90 pounds per square foot. The floor support should be more than marginal to maintain proper cabinet alignment and reduce vibration.

2-18. Evaluate the installation site and determine the location of the transmitter. Once the location is determined, refer to Figure 2-3 and use a forklift to move the transmitter to the desired location. After the transmitter is placed in the desired location, remove the shipping skid as follows:

1. Refer to Figure 2-3 and remove the 5/16 inch shipping bolts securing the transmitter to the skid.
2. Once the bolts are removed, slide the transmitter off the skid.
3. Slide the transmitter to the exact location.

2-19. **COMPONENT INSTALLATION.**

WARNING ***ENSURE NO PRIMARY POWER IS CONNECTED TO THE TRANSMITTER BEFORE PROCEEDING.***

WARNING

2-20. Selected components of the AM-2.5E and AM-5E transmitters have been removed to prevent damage during shipment. The components removed from the transmitter are shipped in separate containers.

2-21. Remove all tape, wire ties, string, and packing material used for shipment. In addition, locate the component containers. To install the components, perform the following procedures.

2-22. **ECU CIRCUIT BOARDS.** The ECU circuit boards are removed for shipment. Locate the circuit board shipping container. To re-install the circuit boards, proceed as follows:

CAUTION ***THE TRANSMITTER MAY BE DAMAGED IF THE ECU CIRCUIT BOARDS ARE NOT***

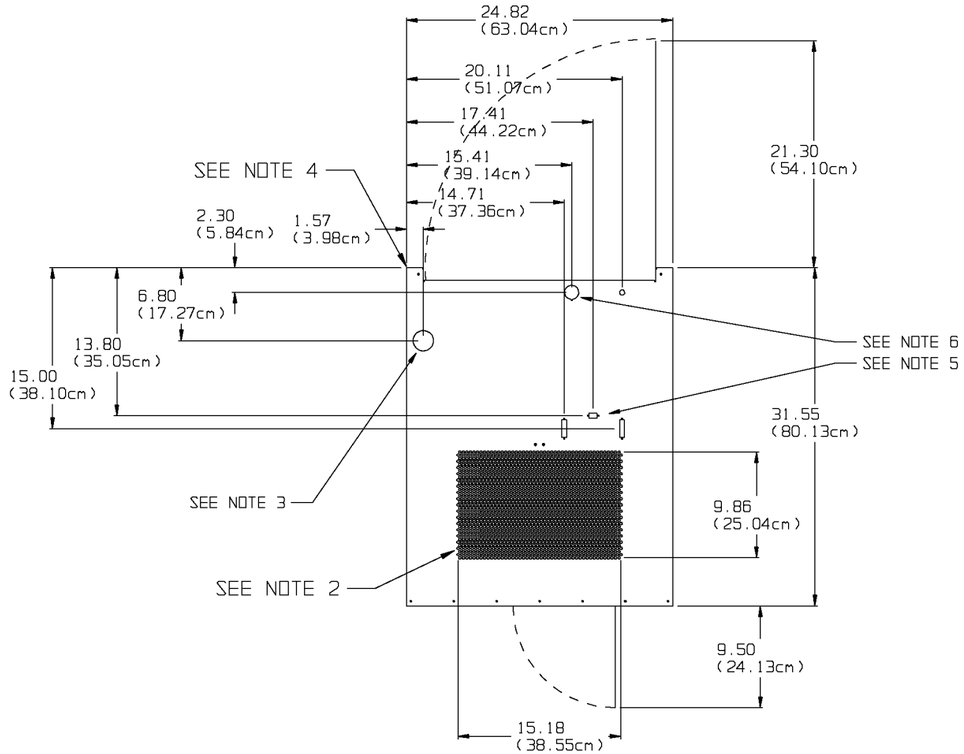
CAUTION ***SECURELY SEATED INTO THE CONNECTORS.***

1. Refer to Figure 2-4 to determine the circuit board location.
2. Insert the circuit board in the appropriate location.
3. Firmly press the circuit board into the connector.
4. Firmly press the circuit board into the connector again to ensure the circuit board is seated.
5. Repeat the procedure for each ECU circuit board.

CAUTION ***REMOVING OR INSTALLING AN RF POWER MODULE WITH THE TRANSMITTER ENERGIZED MAY RESULT***

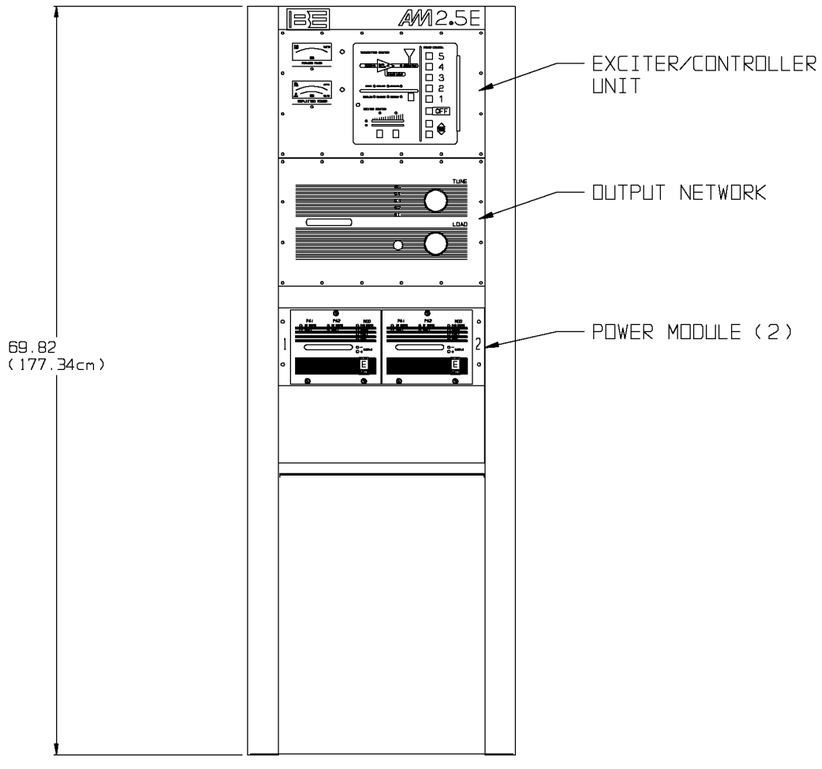
CAUTION ***IN DAMAGE TO THE MODULE.***

2-23. **RF POWER MODULES.** Each RF power module is removed for shipment. Locate the RF power module shipping containers. Refer to Figure 2-4 and re-install the modules.



NOTES:

1. AIR INLET AT REAR OF CABINET, 500 cfm (14.16 m^3/MIN.) FILTER REQUIRED - P/N 407-0062.
2. AIR OUTLET AT TOP OF CABINET, 9.86" X 15.18",(.25m X .38m)
3. ACCESS FOR AC POWER THROUGH CABINET TOP ACCESS HOLE.
4. GROUND STRAP ENTRY POINT IN LOWER RIGHT CORNER AT REAR OF CABINET. (SEE DETAIL "A")
5. REMOTE CONTROL AND AUDIO CONNECTIONS.
6. RF OUTPUT CONNECTION IS 7/16 INCH FEMALE DIN CONNECTOR. REQUIRES 1/2 INCH RF TRANSMISSION LINE WITH 7/16 INCH MALE DIN CONNECTOR.
7. HEAT DISSIPATION: 1800 WATTS MAXIMUM (6,000 BTU/HR.) FOR 2.8KW RF OUTPUT @ 125% AUDIO TONE MODULATION.
8. WEIGHT: 440 LBS (200 KGS); 565 LBS (257 KGS) PACKED.
9. PACKED CUBAGE: DOMESTIC 42.8 FT^3 (1.21 m^3) INTERNATIONAL 57.4 ^{3} FT (1.62 m^3)
10. AC POWER CONSUMPTION: 6.3KW AT 125% SINUSOIDAL MODULATION OF 2800 WATTS CARRIER.
11. AC POWER INPUT: 196-252 VAC SINGLE PHASE AT 40 AMPS MAXIMUM, 50/60 Hz. FUSED DISCONNECT SWITCH RECOMMENDED. FOR PROPER SIZING OF FUSES, REFER TO INSTRUCTION MANUAL AND NATIONAL ELECTRICAL CODE OR LOCAL CODES.
12. PRIMARY AC FUSED DISCONNECT: FUSE SIZE: 75A WIRE SIZE: #3 COPPER THHN OR EQUAL.



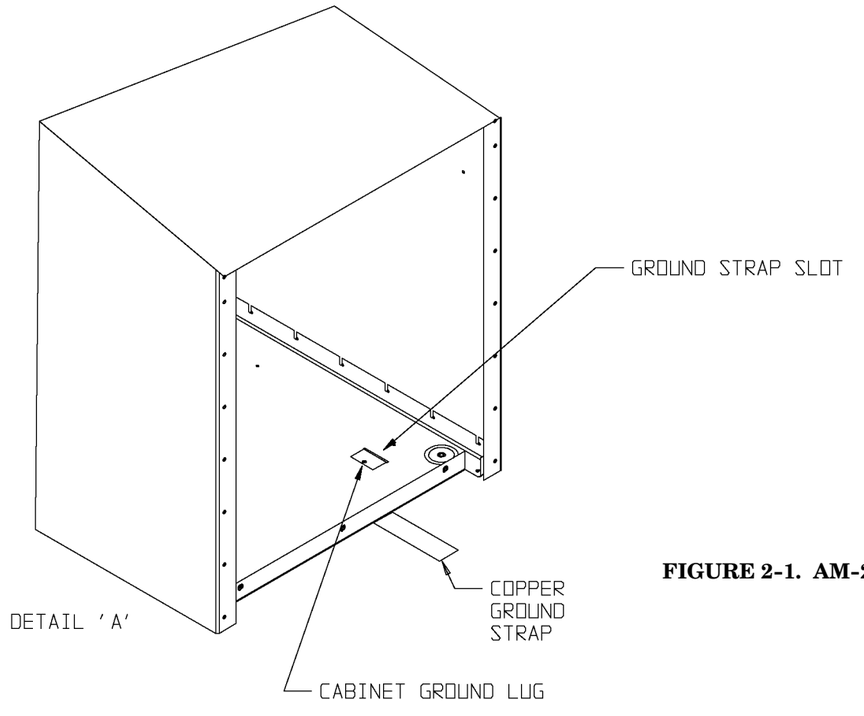


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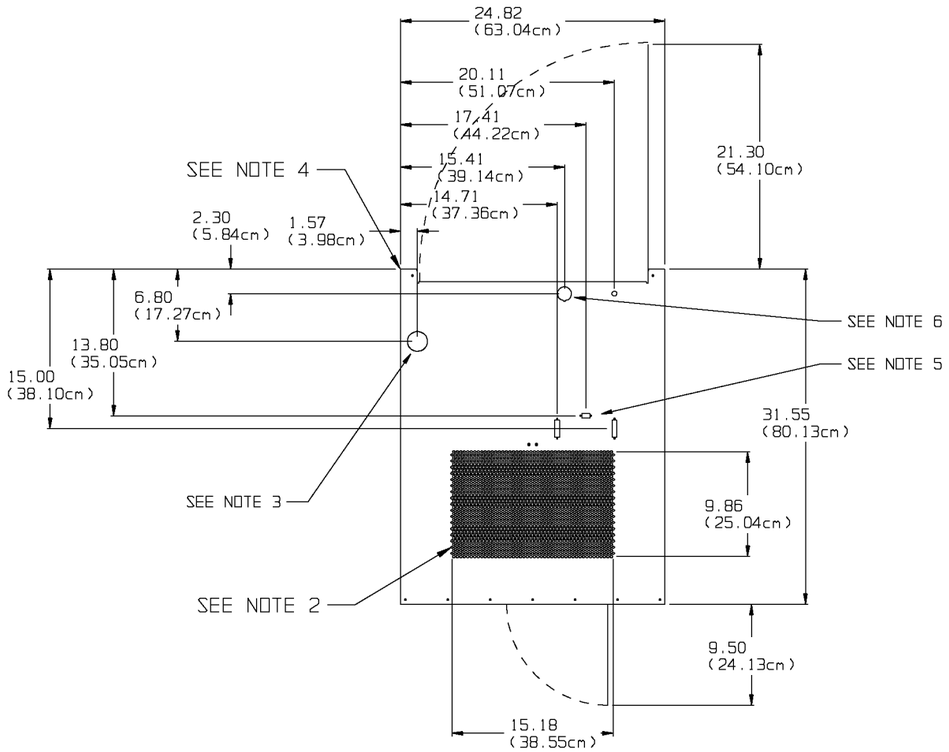
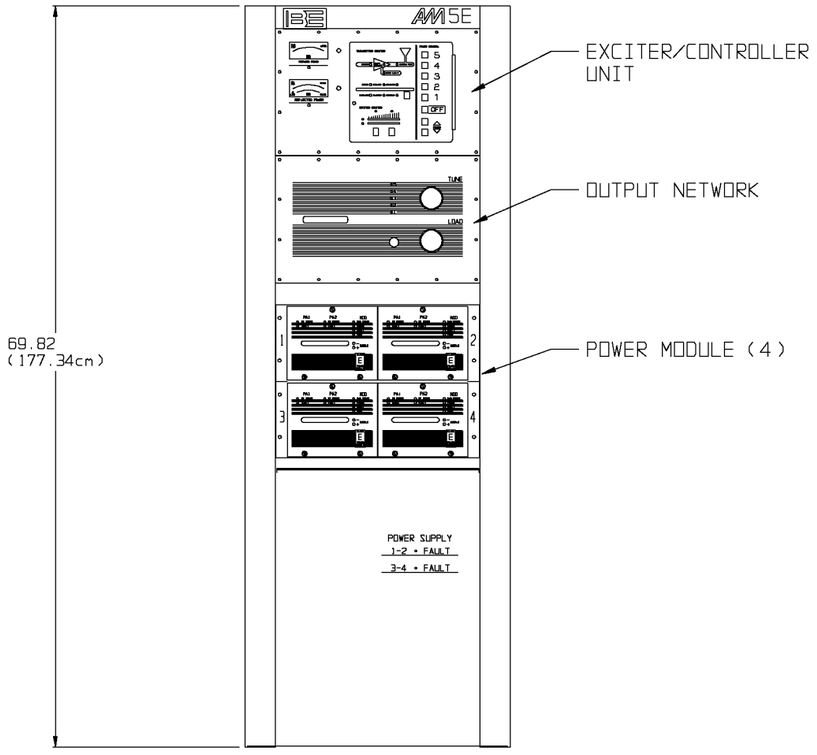
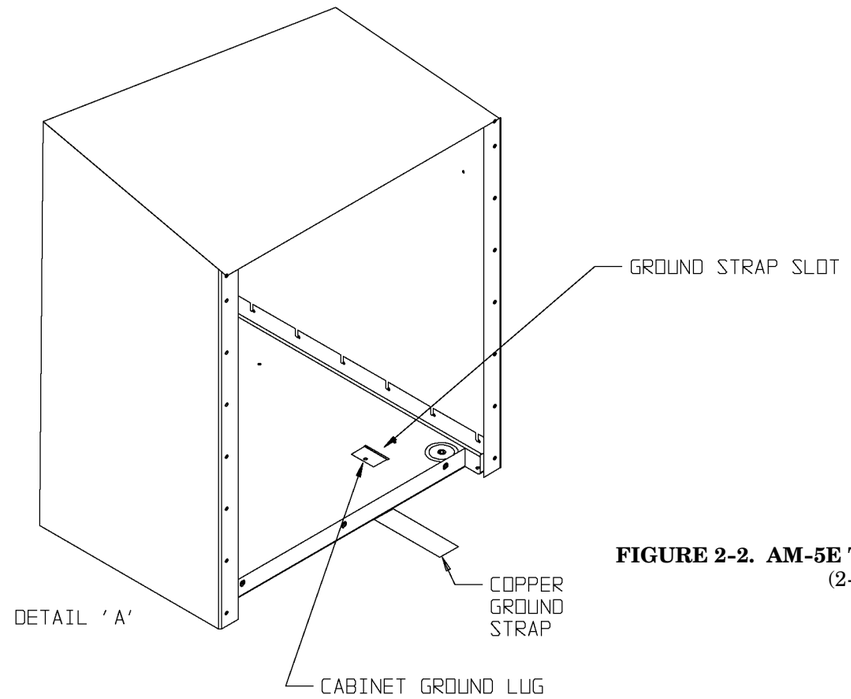
FIGURE 2-1. AM-2.5E TRANSMITTER INSTALLATION
(2-3/2-4)





NOTES:

1. AIR INLET AT REAR OF CABINET, 500 cfm (14.16 m^3/MIN.) FILTER REQUIRED - P/N 407-0062.
2. AIR OUTLET AT TOP OF CABINET, 9.86" X 15.18".(.25m X .38m)
3. ACCESS FOR AC POWER THROUGH CABINET TOP ACCESS HOLE.
4. GROUND STRAP ENTRY POINT IN LOWER RIGHT CORNER AT REAR OF CABINET. (SEE DETAIL "A")
5. REMOTE CONTROL AND AUDIO CONNECTIONS.
6. RF OUTPUT CONNECTION IS 7/16 INCH FEMALE DIN CONNECTOR. REQUIRES 7/8 INCH RF TRANSMISSION LINE WITH 7/16 INCH MALE DIN CONNECTOR.
7. HEAT DISSIPATION: 3500 WATTS MAXIMUM (12,000 BTU/HR.) FOR 5.6KW RF OUTPUT @ 125% AUDIO TONE MODULATION.
8. WEIGHT: 525 LBS (238 KGS); 650 LBS (300 KGS) PACKED.
9. PACKED CUBAGE: DOMESTIC 42.8 FT^3 (1.21 m^3) INTERNATIONAL 57.4 ^{3}FT (1.62 m^3)
10. AC POWER CONSUMPTION: 12.5KW AT 125% SINUSOIDAL MODULATION OF 5600 WATTS CARRIER.
11. AC POWER INPUT: 196-252 VAC SINGLE PHASE AT 85 AMPS MAXIMUM, 50/60 Hz. FUSED DISCONNECT SWITCH RECOMMENDED. FOR PROPER SIZING OF FUSES, REFER TO INSTRUCTION MANUAL AND NATIONAL ELECTRICAL CODE OR LOCAL CODES.
12. PRIMARY AC FUSED DISCONNECT:
    FUSE SIZE: 125A
    WIRE SIZE: #1 COPPER THHN OR EQUAL.



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597-1114-8

FIGURE 2-2. AM-5E TRANSMITTER INSTALLATION
(2-5/2-6)

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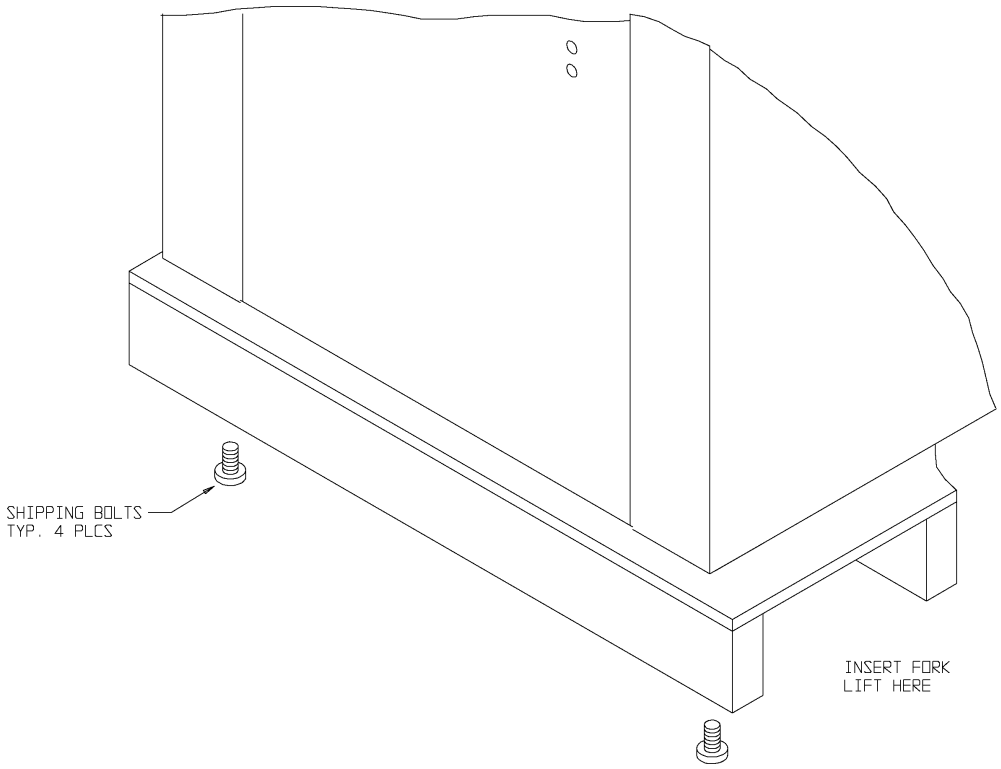

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FIGURE 2-3. TRANSMITTER MOVING **597-1114-27**

2-24. **POWER SUPPLY.** The transmitter power supply circuit boards may be removed for shipment. If the power supply circuit boards have been removed, locate the shipping container. Install each circuit board as follows:

CAUTION
CAUTION
THE TRANSMITTER MAY BE DAMAGED IF THE POWER SUPPLY CONNECTORS ARE NOT SECURELY SEATED INTO THE POWER SUPPLY CIRCUIT BOARD RECEPTACLES.

CAUTION
CAUTION
TO PREVENT DAMAGE TO THE POWER SUPPLY CIRCUIT BOARD, ENSURE THE CIRCUIT BOARD IS INSERTED INTO THE MOUNTING PINS AND THE CAPACITORS ON THE CIRCUIT SIDE OF THE BOARD ARE PLACED INTO THE PANEL CUTOUT PRIOR TO SLIDING THE CIRCUIT BOARD TO SEAT THE MOUNTING SLOTS INTO THE PINS.

1. Locate the mounting slots in the power supply circuit board and insert the board into the power supply mounting pins on the power supply panel. Ensure the circuit board is inserted with the capacitors on the circuit side of the board placed into the panel cutout prior to seating the circuit board in the mounting pins.
2. Slide the circuit board in a position to seat the circuit board slots in the mounting pins.

3. Secure the power supply circuit board mounting hardware.
4. Connect the power supply circuit board cables as follows:
   A. Securely connect 16-pin connector P1 to J1 on the power supply circuit board.
   B. Securely connect 12-pin connector P2 to J2 on the power supply circuit board.
   C. Securely connect 24-pin connector P3 to J3 on the power supply circuit board.
5. Repeat the procedure for each power supply circuit board.

2-25. **BATTERY INSTALLATION.** The ECU is equipped with a battery system. Refer to Figure 2-4 and install the battery in the battery receptacle.

2-26. **CIRCUIT BOARD PROGRAMMING.**

2-27. The AM-2.5E and AM-5E transmitters are designed with programmable transmitter operating characteristics. The operating characteristics are determined by the programmable circuitry on the ECU circuit boards (refer to Figure 2-4). Refer to the following text and program the circuitry for the desired operating characteristics.

2-28. **EXCITER CIRCUIT BOARD.** Exciter circuit board programming is presented in Figure 2-5. Refer to Figure 2-5 and program the circuit board as required.

2-29. **External Stereo Generator Select.** Programmable header J7 programs the circuitry if: 1) an external stereo generator is to be used with the transmitter or 2) the internal stereo circuit board is to be used with the transmitter. The transmitter is shipped with the circuit programmed for the internal stereo circuit board operation.

2-30. **Carrier Frequency Programming.** Eight position switch S2 programs the exciter carrier frequency. The switch is programmed for the station frequency at the factory. Refer to the factory test data sheets to check the programming of the switch. If the switch programming is not identical to programming recorded in the factory test data sheets, contact the Broadcast Electronics Customer Service Department.

2-31. **PWM Frequency Programming.** Four position switch S1 programs the PWM frequency. Refer to the factory test data sheets to check the programming of the switch.

2-32. **Frequency Synthesizer Programming.** Programmable header J6 determines the frequency synthesizer band of operation. Refer to the factory test data sheets to check the programming of the header.

2-33. **Pilot Tone Programming.** Programmable header J5 establishes the pilot tone frequency for 10 kHz carrier frequency operation and 9 kHz carrier frequency operation. Refer to the factory test data sheets to check the programming of the header.

2-34. **High-Pass Filter Defeat.** Left channel programmable header J12 and right channel programmable header J13 control an exciter second order 10 Hz high-pass filter. The high-pass filter is provided to remove low frequency residual products from specific audio processing units. The filter is shipped from the factory in the enabled position. Evaluate the audio processor and determine if low frequency residual products are present at the output of the audio processing unit. If no low frequency residual products are present, refer to Figure 2-5 and disable the high pass filter.

2-35. **High Frequency Boost Defeat.** Left channel programmable header J2 and right channel programmable header J3 control an exciter high frequency boost circuit. The high frequency boost circuit provides increased high frequency response to compensate for a Bessel filter in the PWM modulator. If the high frequency boost circuit is enabled to compensate for the filter, the circuit will result in a compromise between the frequency and transient response performance. If the high frequency boost circuit is enabled, the transmitter frequency response will increase approximately 2 dB at 10 kHz and the transient response will degrade. If the high frequency boost circuit is disabled, the transmitter frequency response will decrease approximately 2 dB at 10 kHz and the transient response will improve. The high frequency boost circuit is shipped from the factory in the disabled position.

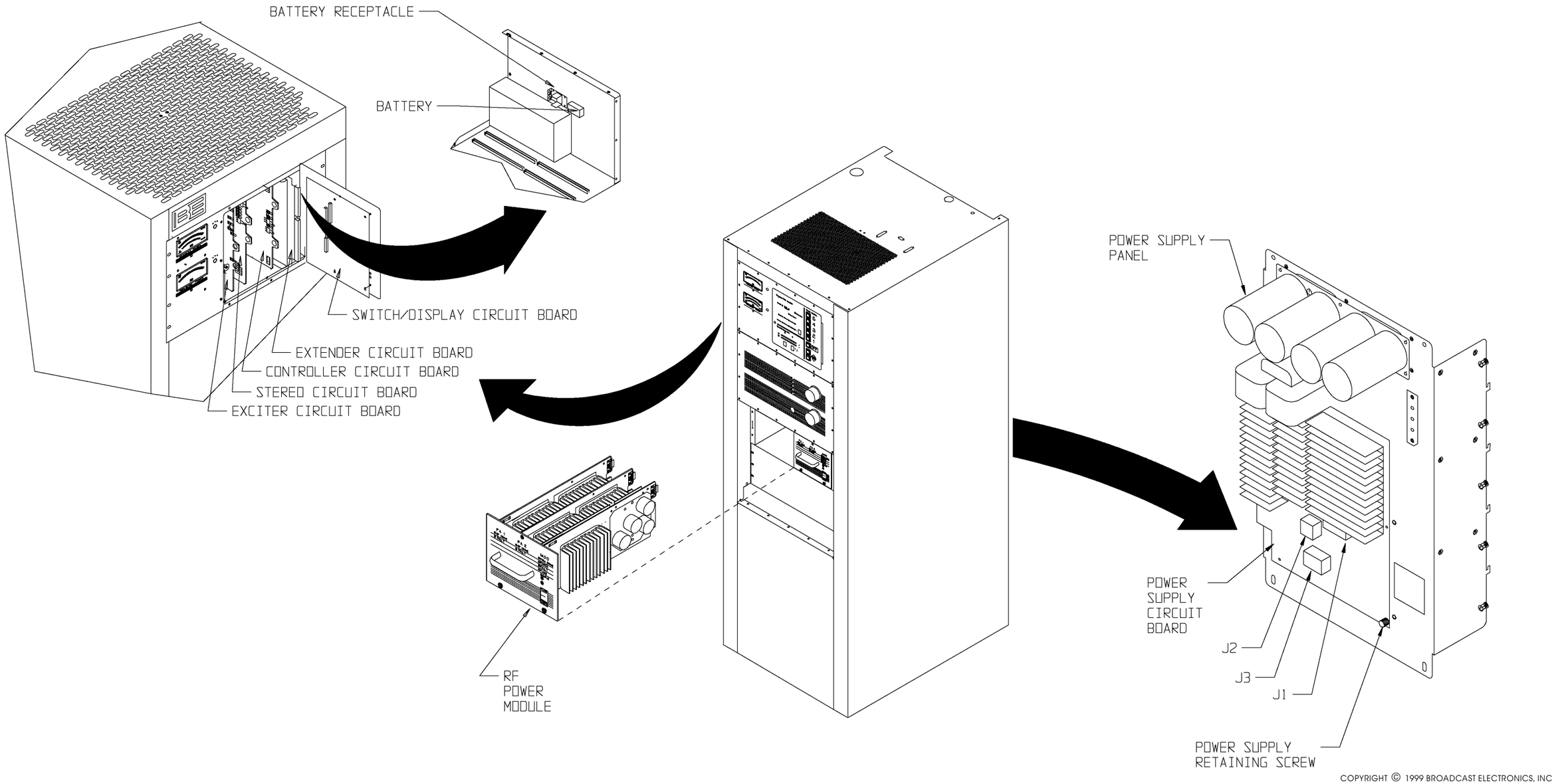

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FIGURE 2-5. COMPONENT INSTALLATION
(2-9/2-10)

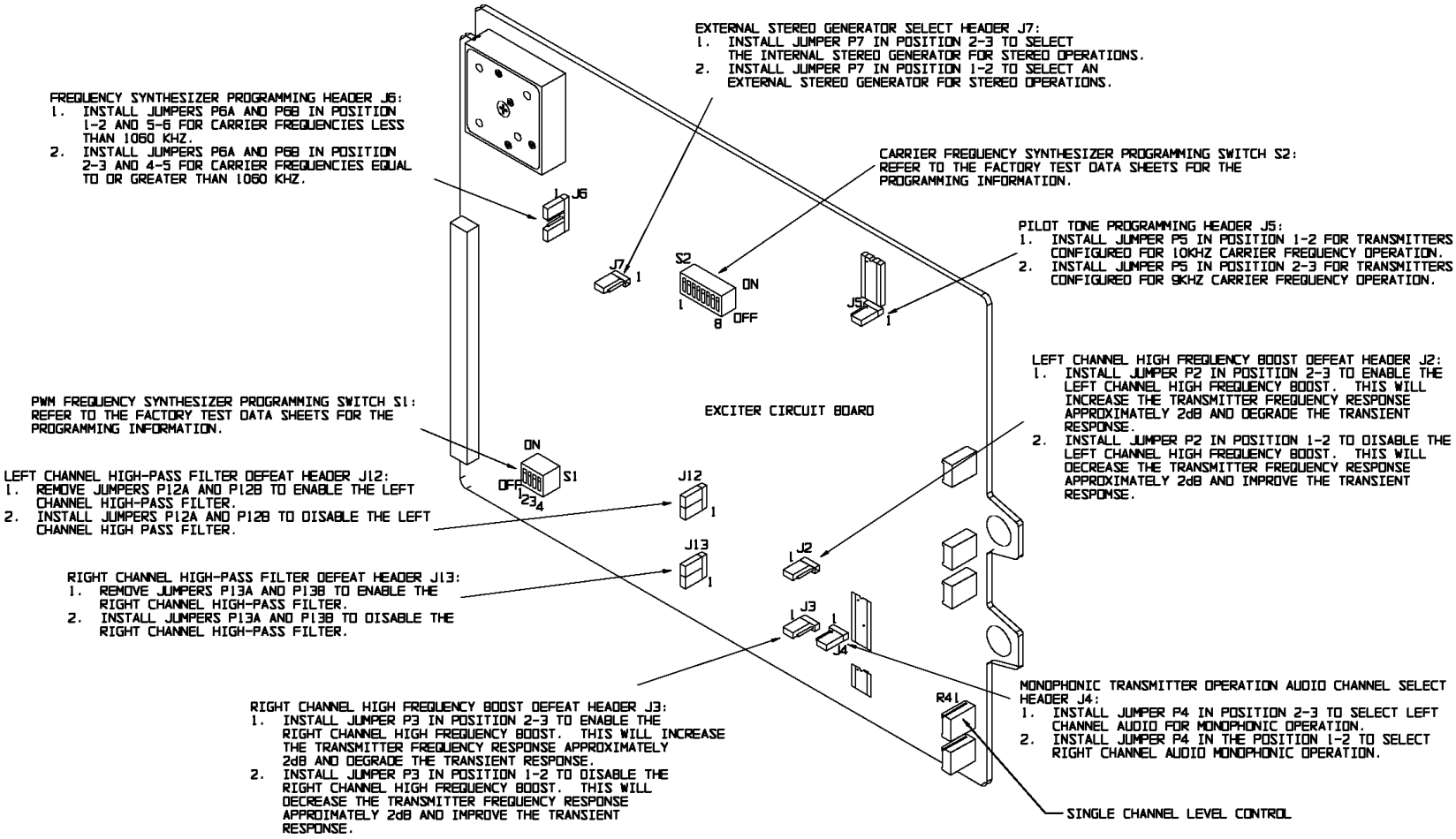

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FIGURE 2-5. EXCITER CIRCUIT BOARD PROGRAMMING

2–36. **Monophonic Transmitter Operation Channel Select.** Programmable header J4 selects either the left or right audio channel when the transmitter is operating in the monophonic mode with the stereo circuit board removed. The transmitter is shipped with the left channel audio selected for monophonic operations.

2–37. **STEREO CIRCUIT BOARD.** Stereo circuit board programming is presented in Figure 2–6. Refer to Figure 2–6 and program the circuit board as required.

2–38. **Antenna C Equalization Select.** Programmable header J6 selects equalization circuit 1 or equalization circuit 2 for operation with antenna C. The transmitter is shipped with equalization circuit 2 configured for operation with antenna C.

2–39. **Bandpass Filter Alignment.** Programmable header J5 configures the bandpass filter for alignment. The jumper must be installed in position 1–2.

2–40. **Bandpass Filter Programming.** Four position switches S2 through S4 program the bandpass filter. Refer to the factory test data sheets to check the programming of the switches.

2–41. **Equalization Control Select.** Programmable header J7 configures the equalization circuitry for either a momentary or constant antenna status signal. The transmitter is shipped with equalization control circuitry configured for a constant status signal.

2–42. **CONTROLLER CIRCUIT BOARD.** Controller circuit board programming is presented in Figure 2–7. Refer to Figure 2–7 and program the circuit board as required.

2–43. **Power Level Trim Reset Select.** Programmable header J12 determines if the power level control circuit is to reset when a power level switch/indicator is depressed. If the circuit is programmed to reset, the previous raise/lower information will be deleted and the transmitter will operate at the selected power level. If the circuit is programmed to retain the previous raise/lower information, the transmitter will operate above or below the selected power level as determined by previous raise/lower operations. For example, the transmitter is operating at power level 4 with the power level raised 5% by the power level raise/lower circuit. When power level 5 switch/indicator is depressed, the transmitter will operate at 5% above the power level 5 output due to the previously retained raise/lower information. The transmitter is shipped with power level trim reset circuit configured to reset.

2–44. **Antenna Power Level Programming.** Switches S1, S2, and S3 assign power levels to a specific antenna. This programs the antenna interlock circuit to the station antenna system to prevent the transmitter from operating into an antenna at an incorrect power level. Switch S1 programs the power levels for antenna A. Switch S2 programs the power levels for antenna B. Switch S3 programs the power levels for antenna C. Power level 2 is assigned to an antenna by switch 1 on S1, S2, and S3. Power level 3 is assigned to an antenna by switch 2 on S1, S2, and S3. Power level 4 is assigned to an antenna by switch 3 on S1, S2, and S3. Power level 5 is assigned to an antenna by switch 4 on S1, S2, and S3. Power level 1 is assigned to each antenna. Evaluate the antenna system and program the circuit as required.

2–45. **AC Power Failure Automatic Transmitter Shutdown Time.** Programmable headers J4, J5, J6, and J7 program the transmitter ac power failure automatic transmitter shutdown timer circuit. The circuit is designed to automatically operate the transmitter to off during a power failure after a specific time delay programmed by headers J4, J5, J6, and J7. J4 programs the circuit for a 1 minute shutdown time. J5 programs the circuit for a 4.5 minute shutdown time. J6 programs the circuit for a 17 minute shutdown time. J7 programs the circuit for a 68 minute shutdown time. The transmitter is shipped from the factory for a 1 minute shutdown time.

2–46. **Antenna Interlock Control Select.** Programmable header J1 controls the antenna interlock circuit. The circuit can be disabled if the transmitter is to operate into only one antenna. The transmitter is shipped from the factory with the antenna interlock circuit disabled.

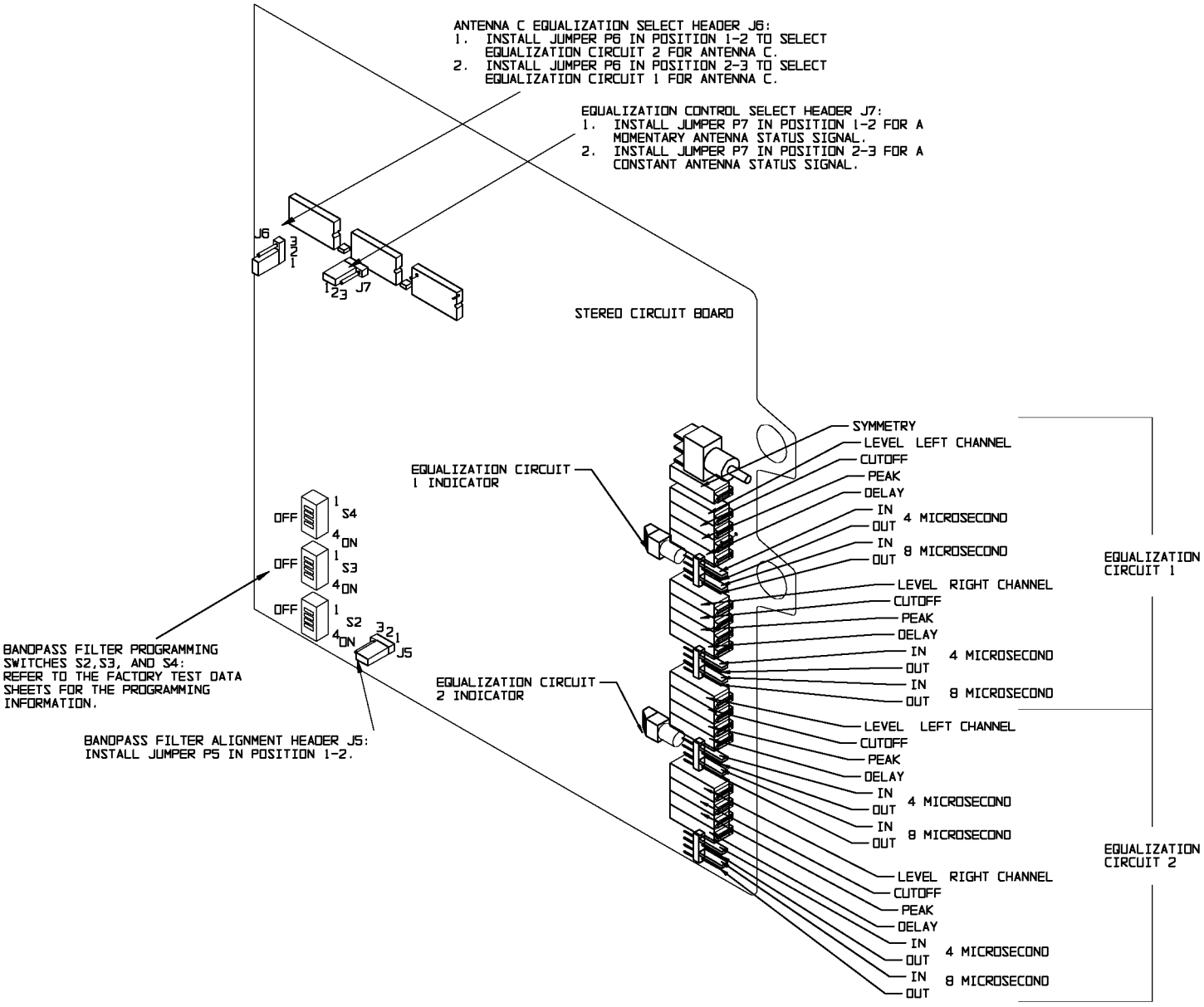

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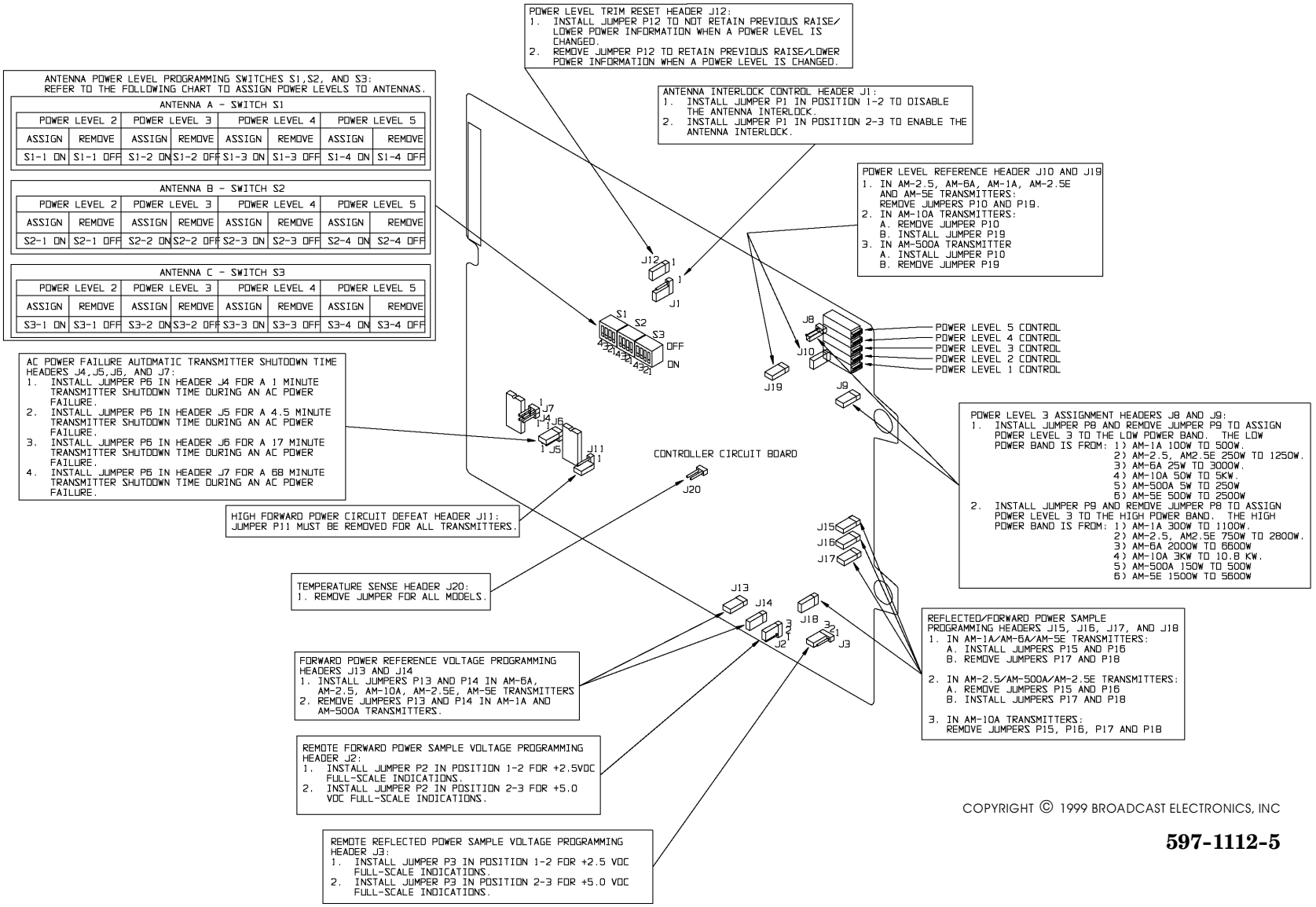
FIGURE 2-6. STEREO CIRCUIT BOARD PROGRAMMING



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597-1112-5

FIGURE 2-7. CONTROLLER CIRCUIT BOARD PROGRAMMING

2-47. **Power Level Reference.** Programmable headers J10 and J19 provide a reference for the power level circuit. For AM-2.5E/AM-5E transmitters, ensure jumpers P10 and P19 are removed.

2-48. **Power Level 3 Assignment.** Programmable header J8 and J9 control the assignment for the power level 3 switch/indicator. For the AM-2.5E, the power level 3 switch/indicator can be programmed to control power from: 1) 250 watts to 1250 watts or 2) 750 watts to 2800 watts. For the AM-5E, the power level 3 switch/indicator can be programmed to control power from: 1) 500 watts to 2500 watts or 2) 1500 watts to 5600 watts. The power level 3 switch/indicator is shipped from the factory to control power from: 1) 250 watts to 1250 watts on AM-2.5E models and 2) 500 watts to 2500 watts on AM-5E models. Program jumpers P8 and P9 as required.

2-49. **Remote Reflected Power Sample Voltage Programming.** Programmable header J3 controls the remote reflected power meter sample voltage. The remote reflected power sample can be programmed for a +5.0 volt dc or +2.5 volt dc full-scale meter indications. The transmitter is shipped from the factory programmed for +5.0 volt dc full-scale remote reflected power meter indications.

2-50. **Remote Forward Power Sample Voltage Programming.** Programmable header J2 controls the remote forward power meter sample voltage. The remote forward power sample can be programmed for a +5.0 volt dc or +2.5 volt dc full-scale meter indications. The transmitter is shipped from the factory programmed for +5.0 volt dc full-scale remote forward power meter indications.

2-51. **High Forward Power Defeat.** Programmable header J11 controls the high forward power detector circuit. Ensure jumper P11 is removed.

2-52. **Reflected/Forward Power Sample Programming.** Programmable headers J15, J16, J17, and J18 control the reflected and forward power sample levels. Headers J15 and J17 control the forward power sample. Headers J16 and J18 control the reflected power sample. For AM-2.5E models: 1) remove jumpers P15 and P16 and 2) install jumpers P17 and P18. For AM-5E models: 1) install jumpers P15 and P16 and 2) remove jumpers P17 and P18.

2-53. **Forward Power Reference Voltage Programming.** Programmable headers J13 and J14 establish the forward power reference level for a comparator circuit. For AM-2.5E/AM-5E models, ensure jumpers P13 and P14 are installed.

2-54. **Temperature Sense.** Header J20 controls the temperature sense sample voltage. Ensure P20 is removed for all models.

2-55. **POWER SUPPLY CIRCUIT BOARD.** The power supply circuit board programming is presented in the following text. Refer to the following text to check the power supply circuit board programming.

2-56. **Future Corrector Circuit.** Programmable headers J9 and J10 establish parameters for a future corrector circuit. Ensure jumper P9 is removed and P10 is installed.

2-57. **Model Programming.** Programmable headers J5 through J8 establish parameters for different AM E-Series transmitters. Refer to the following text for the programming information.

TRANSMITTER	***J5***	***J6***	***J7***	***J8***
AM-2.5E	Not Used	Not Used	Not Used	Not Used
AM-5E	Not Used	Not Used	Not Used	Not Used

2-58. **REMOTE CONTROL.**

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

2-59. **GENERAL.** The AM-2.5E and AM-5E transmitters are designed for complete remote control operations (refer to Figure 2-8). The transmitters will interface with almost any remote control unit such as the Broadcast Electronics model VMC-16 voice remote control system. The following text presents a description of the transmitter remote control functions and indications. The remote control connections are located at 25-pin D-type connectors J1 and J2. J1/J2 are located on the transmitter top-panel. The remote control functions are activated using a +5 to +15 volt dc signal. The remote indication functions: 1) require current limiting resistors and 2) provide up to 100 mA for indicators. A +5 volt supply is provided at J1 for remote control operations.

2-60. **Power Level Controls/Indicators.** The transmitter is designed with five customer adjustable operating power controls. The controls are located at J1-1 through J1-5. A +5 to +15 volt dc signal is required to activate the desired function.

2-61. Indications of power level control operations are located at J1-7 through J1-11. The power level status indicators will go LOW (0 volts dc) when activated.

2-62. **Transmitter Off Control/Indicator.** The transmitter off control is located at J1-6. A +5 to +15 volt dc signal is required to operate the transmitter to off. The indicator for the transmitter off control is located at J1-14. The off indicator will go LOW (0 volts dc) when activated.

2-63. **Power Level Raise/Lower Controls.** The transmitter is designed with raise and lower controls to adjust the transmitter output power level. The controls are equipped with ability to raise/lower power from 10% to 15% of the selected output power level. The controls are located at J1-15 and J1-16. A +5 to +15 volt dc signal is required to activate the desired function.

2-64. **Antenna Interlock Input.** The antenna interlock inputs are designed for the connection of the status signals from antenna A, B, and C. The inputs are located at J1-19 through J1-21. The inputs require a +5 to +15 volt dc signal to indicate an antenna ready status.

2-65. **Transmitter Mute Input.** The transmitter mute input is designed to mute the transmitter when activated. The input is located at J1-22. The input requires a +5 to +15 volt dc signal to mute the transmitter.

2-66. **Remote Failsafe Input.** The remote failsafe input is designed for the remote control unit failsafe control line. The input is located at J1-23. The input requires a +5 to +15 volt dc signal to indicate an enabled remote control unit.

2-67. **External Interlock Input.** The external interlock input is for the connection of an interlock external to the transmitter. The input is located at J1-24. The input requires a +5 to +15 volt dc signal to indicate a closed interlock.

2-68. **Interlock +5V.** The interlock +5 volt supply is provided for the external interlock. The +5 volt supply is located at J1-25.

2-69. **Exciter Mode Controls/Indicators.** The transmitter exciter is designed to be operated in the mono left, mono right, mono L+R, or stereo modes of operation. The controls are located at J2-1 through J2-4. A +5 to +15 volt dc signal is required to activate the desired function.

2-70. Indications of exciter modes of operations are located at J2-5 though J2-8. The exciter mode indicators will go LOW when activated.

2-71. **Remote Forward/Reflected Power Meter Indications.** Remote reflected power meter indications are located at J2-9 and J2-10. The indications are designed to be programmed for +5 volt dc full-scale meter indications or +2.5 volt dc full-scale meter indications.

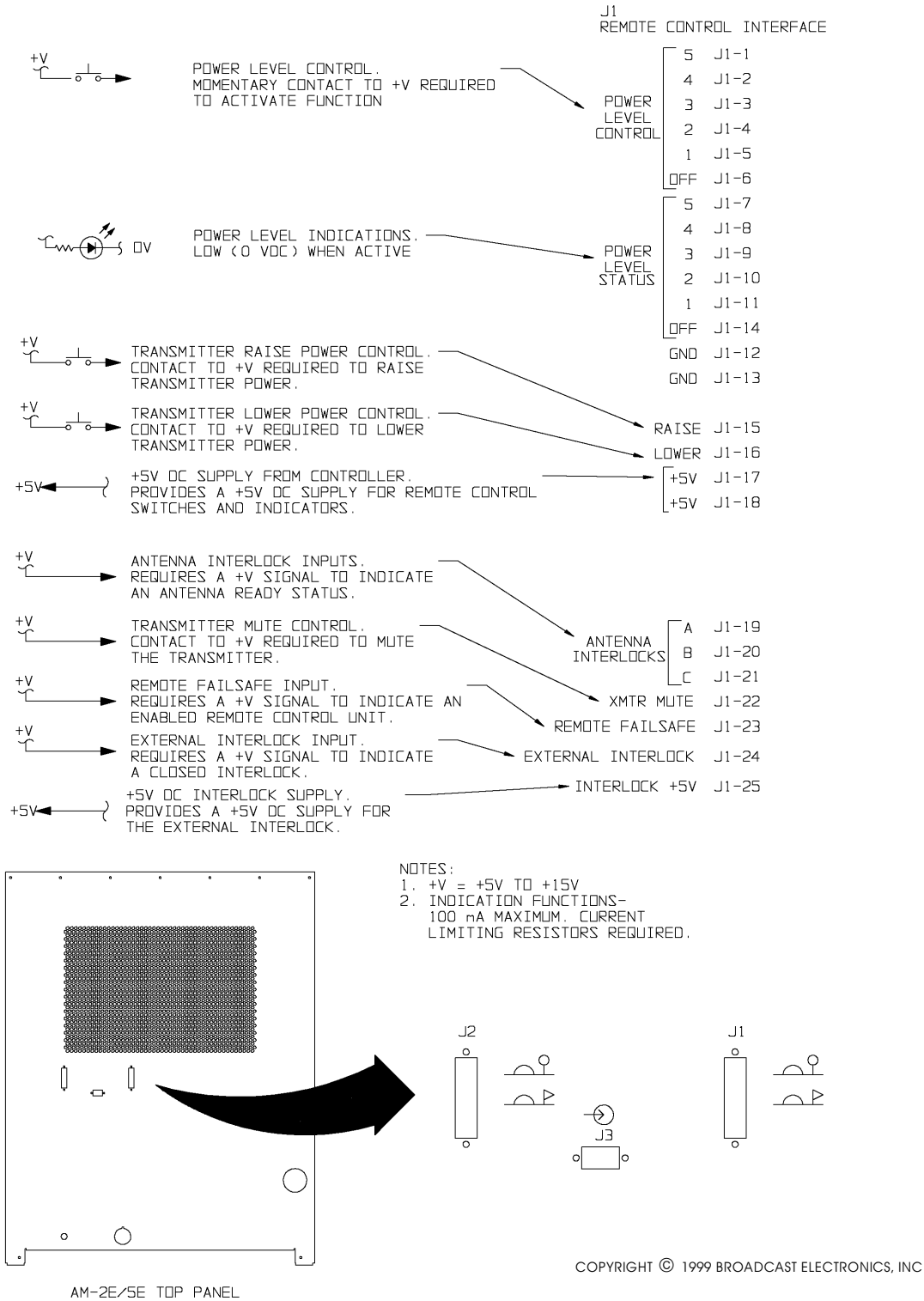

FIGURE 2-8. REMOTE CONTROL AND AUDIO CONNECTIONS (SHEET 1 OF 2)

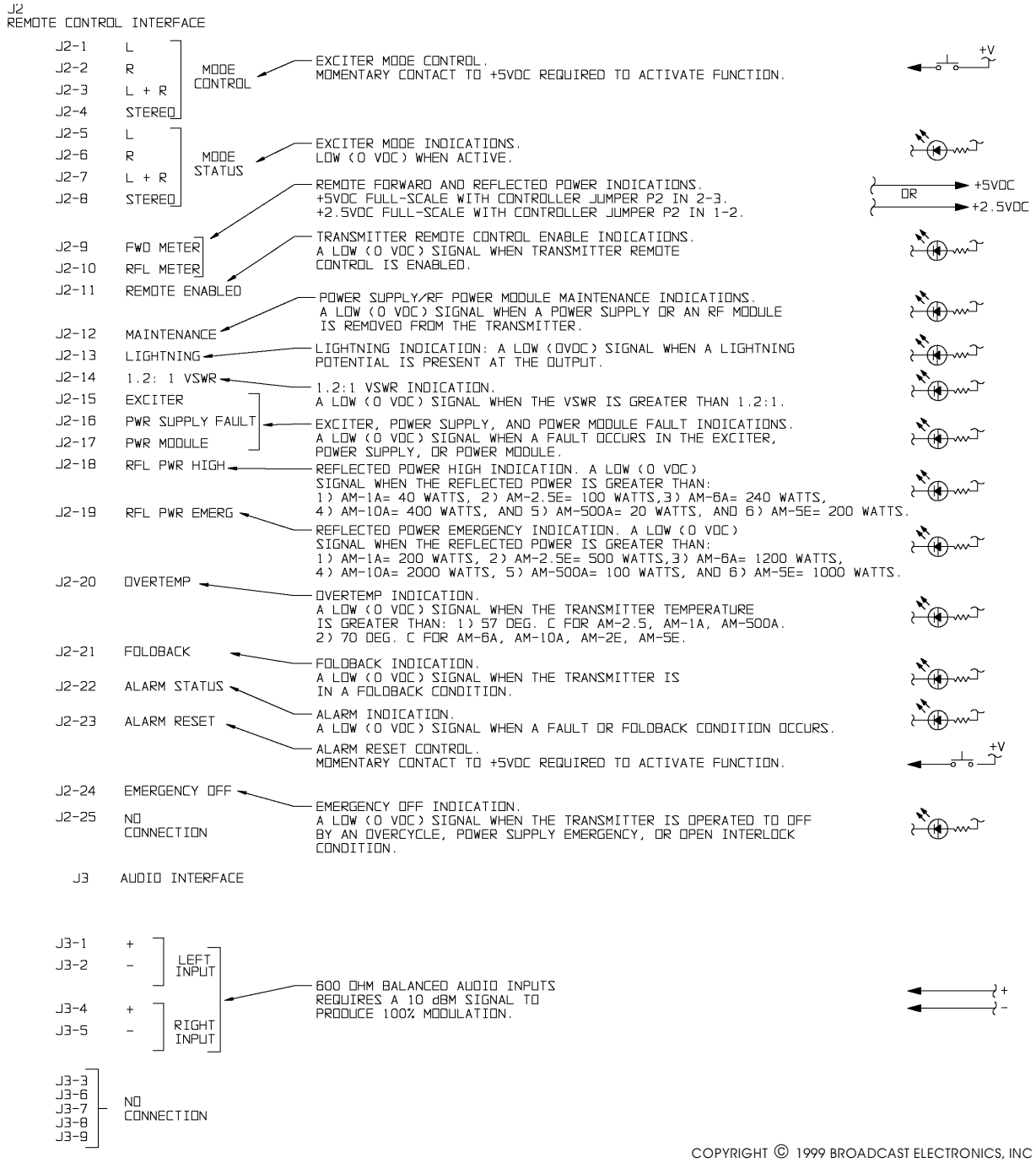

FIGURE 2-8. REMOTE CONTROL AND AUDIO CONNECTIONS (SHEET 2 OF 2)

2-72. **Remote Enabled Indications.** The remote enabled indicator provides a signal to indicate the status of transmitter remote control operations. The remote enabled indicator is located at J2-11. The indicator will go LOW to indicate when remote control operations are enabled.

2-73. **Maintenance Indications.** The maintenance indicator provides a signal to indicate when a transmitter power supply or an RF power module is removed from the transmitter for maintenance. The maintenance indicator is located at J2-12. The indicator will go LOW (0 volts dc) to indicate when a power supply is removed for maintenance.

2-74. **Lightning Indications.** The lightning indicator provides a signal to indicate when a greater than: 1) 1500 volt potential is present at the output for AM-2.5E models or 2) 2100 volt potential is present at the output for AM-5E models. The lightning indicator is located at J2-13. The indicator will go LOW (0 volts dc) to indicate when a lightning potential is present at the transmitter output.

2-75. **1.2 : 1 VSWR Indications.** The 1.2 : 1 VSWR indicator provides a signal to indicate when a greater than 1.2 : 1 VSWR condition is present at the transmitter output. The 1.2 : 1 indicator is located at J2-14. The indicator will go LOW (0 volts dc) to indicate when a 1.2 : 1 VSWR condition is present at the transmitter output.

2-76. **Exciter/PWR Supply/PWR Module Fault Indications.** The exciter, power supply, and power module fault indicators provide signals to indicate when an exciter, power supply, or a power module fault has occurred. The exciter, power supply, and power module fault indicators are located at J2-15 through J2-17. The indicators will go LOW (0 volts dc) to indicate when an exciter, power supply, or a power module fault has occurred.

2-77. **RFL PWR High Indications.** The reflected power high indicator provides a signal to indicate when: 1) 100 watts of reflected power is present at the transmitter output for AM-2.5E models or 2) 200 watts of reflected power is present at the transmitter output for AM-5E models. The high reflected power indicator is located at J2-18. The indicator will go LOW (0 volts dc) to indicate when a reflected power high condition is present at the transmitter output.

2-78. **RFL PWR Emergency Indications.** The reflected power emergency indicator provides a signal to indicate when greater than: 1) 500 watts of reflected power is present at the output of the AM-2.5E transmitter or 2) 1000 watts of reflected power is present at the output of the AM-5E transmitter. The reflected power emergency indicator is located at J2-19. The indicator will go LOW (0 volts dc) to indicate when a reflected power emergency condition is present at the transmitter output.

2-79. **Overtemp Indications.** The overtemp indicator provides a signal to indicate when the transmitter temperature is greater than 70°C. The overtemp indicator is located at J2-20. The indicator will go LOW (0 volts dc) to indicate when the transmitter temperature is greater than 70°C.

2-80. **Foldback Indications.** The transmitter is designed to automatically reduce power when one of the following fault condition occurs: 1) high reflected power, 2) high forward power, 3) high temperature, or 4) detection of a high voltage by the lightning circuit. The foldback indicator is located at J2-21. The indicator will go LOW (0 volts dc) to indicate when the transmitter is in a foldback condition.

2-81. **Alarm Status Indications.** The alarm status provides a signal to indicate when a fault or foldback condition occurs. The alarm status indicator is located at J2-22. The indicator will go LOW (0 volts dc) to indicate when the transmitter is in a fault or foldback condition.

2-82. **Alarm Reset Control.** The alarm reset control is designed to reset the fault detection circuitry. The alarm reset control is located at J2-23. A +5 to +15 volt dc signal is required to activate the function.

2–83. **Emergency Off Indications.** The emergency off indicator provides a signal to indicate when the transmitter is operated to off by any condition or event other than the use of the off switch. These conditions/events include: 1) an overcycle off condition, 2) a power supply emergency condition, or 3) an open interlock condition. A power supply emergency condition is when all the power supplies in the transmitter encounter faults. The emergency off indicator is located at J2–24. The indicator will go LOW (0 volts dc) to indicate when an emergency off condition is encountered.

2–84. **WIRING.**

2–85. Wiring consists of connecting audio, the RF transmission line, and ac power to the transmitter. Refer to the following text and connect the wiring to the transmitter.

2–86. **AUDIO INPUT CONNECTION.** The AM–2.5E and AM–5E transmitters are equipped with electronically balanced 600 Ohm left and right channel audio inputs. The audio inputs are located on the transmitter top–panel at J3 (refer to Figure 2–8). The inputs are designed to accept a +10 dBm signal at 600 Ohms.

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

2–87. Audio is interfaced to the transmitter by: 1) selecting the appropriate cable and 2) connecting the cable to the terminals of 9–pin D–type connector J3. J3 is located on the transmitter top–panel. To interface audio to the transmitter: 1) use Belden 8760 cable or equivalent and 2) refer to Figure 2–8 and connect the audio to the transmitter as follows:

1. Connect the plus signal line to the + terminal.
2. Connect the minus signal line to the – terminal.
3. Connect the shield to ground at the audio source end.

2–88. **EXTERNAL STEREO RF INPUT.** The transmitter is equipped with an external stereo RF input on the transmitter top–panel (refer to Figure 2–9). The input is designed for the connection of an external stereo generator or reference oscillator with a signal level from 5 to 15 volts peak–to–peak. If an external stereo signal/reference is to be applied to the transmitter, connect the signal to the **EXTERNAL RF INPUT** connector on the transmitter top–panel and program jumper P7 on the exciter circuit board in position 1–2.

2–89. **AM-2.5E/AM-5E RF TRANSMISSION LINE CONNECTION.** The AM–2.5E/AM–5E transmitter RF output connection is located on the transmitter top–panel (refer to Figure 2–9). The AM–5E requires 7/8 inch transmission line with a 7/16 male DIN connector. The AM–2.5E requires 1/2 inch transmission line with a 7/16 male DIN connector. To connect the RF transmission line to the transmitter, refer to Figure 2–9 and connect the 7/16 male DIN type connector to the **RF OUT** connector on the transmitter top–panel.

2–90. **EXTERNAL INTERLOCK.** The AM–2.5E/AM–5E is equipped with an external interlock such as for a test load. The interlock will turn off the transmitter RF output when opened. The interlock is located at J1–24 and J1–25 on the transmitter top–panel. Refer to **External Interlock Input** and **Interlock +5v** in the REMOTE CONTROL section of the preceding text and perform the procedures to connect equipment to the transmitter external interlock.

2–91. **MODULATION MONITOR.** The modulation monitor connection is located on the transmitter top–panel. Refer to Figure 2–9 and connect the modulation monitor to the **MOD MONITOR SAMPLE OUTPUT** receptacle.

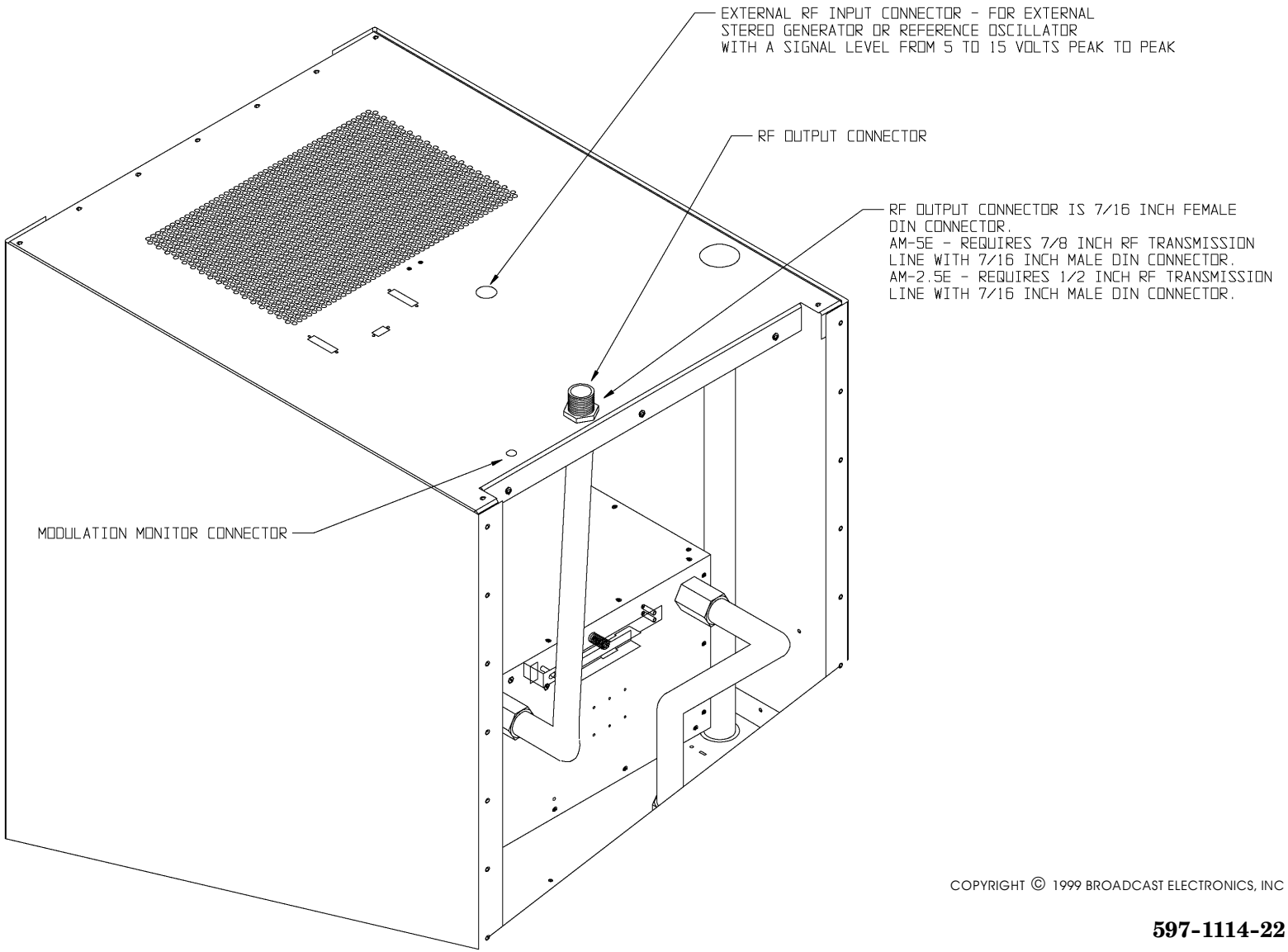

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FIGURE 2-9. AM-2.5E/AM-5E RF OUTPUT CONNECTIONS

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

WARNING ***ENSURE AN EARTH GROUND CONDUCTOR IS SECURELY CONNECTED TO THE TRANSMITTER AC GROUND LUG.***

WARNING

2-92. **AC POWER CONNECTIONS.** The AM-2.5E transmitter requires a single-phase source of 196V to 252V ac, 50 Hz or 60 Hz at 75 Amperes. The AM-5E transmitter requires a single-phase source of 196V to 252V ac, 50 Hz or 60 Hz at 125 amperes. For operating safety, the power source must be routed to the transmitter through a fused power disconnect (refer to Figures 2-10 and 2-11).

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

2-93. **Main ac Input -AM-2.5E.** Refer to Figure 2-10 and connect the 75 Ampere service to ac input/control device S1 through a fused service disconnect as shown. Ensure a utility company ground conductor is securely connected to the transmitter common ground system and the ac service ground wire is securely connected to the ac ground lug as shown.

2-94. **Main ac Input - AM-5E.** Refer to Figure 2-11 and connect the 125 ampere service to ac input/control device S1 through a fused service disconnect as shown. Ensure a utility company ground conductor is securely connected to the transmitter common ground system and the ac service ground wire is securely connected to the ac ground lug as shown.

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

WARNING ***ENSURE AN EARTH GROUND CONDUCTOR IS SECURELY CONNECTED TO THE TRANSMITTER GROUND LUG.***

WARNING

2-95. **GROUND.** The transmitter is equipped with a cabinet ground system for operating safety. The ground system requires the connection of an earth ground. Refer to Figures 2-10 and 2-11 and connect an earth ground to the cabinet ground lug as shown using a 2 inch (5.08 cm) wide copper strap.

2-96. **TRANSMITTER SITE LIGHTNING PROTECTION SYSTEM CHECKOUT.**

CAUTION ***THE TRANSMITTER SITE LIGHTNING PROTECTION SYSTEM MUST BE INSPECTED AND IN PROPER WORKING CONDITION FOR RELIABLE TRANSMITTER OPERATION.***

CAUTION

2-97. For reliable transmitter operation, the transmitter site lightning protection system must be inspected and in proper working condition. Due to the solid-state design of the transmitter, high voltage potentials from lightning activity can cause severe damage to the transmitter circuitry. Therefore, perform the following procedures to inspect and improve the lightning protection system at the transmitter site. Refer to the NAB Radio Handbook for additional transmitter site lightning protection system information.

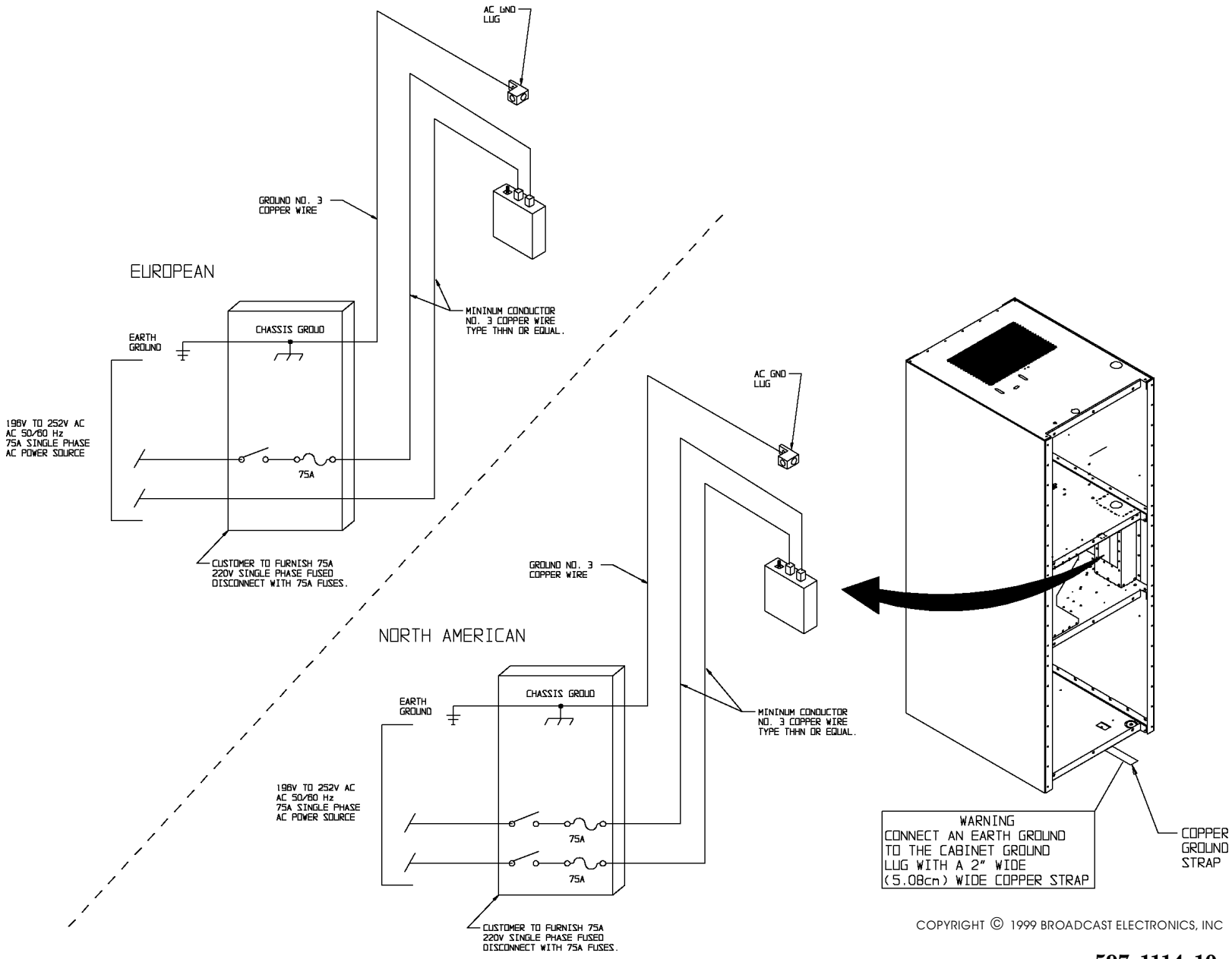

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FIGURE 2-10. AM-2.5E PRIMARY AC WIRING

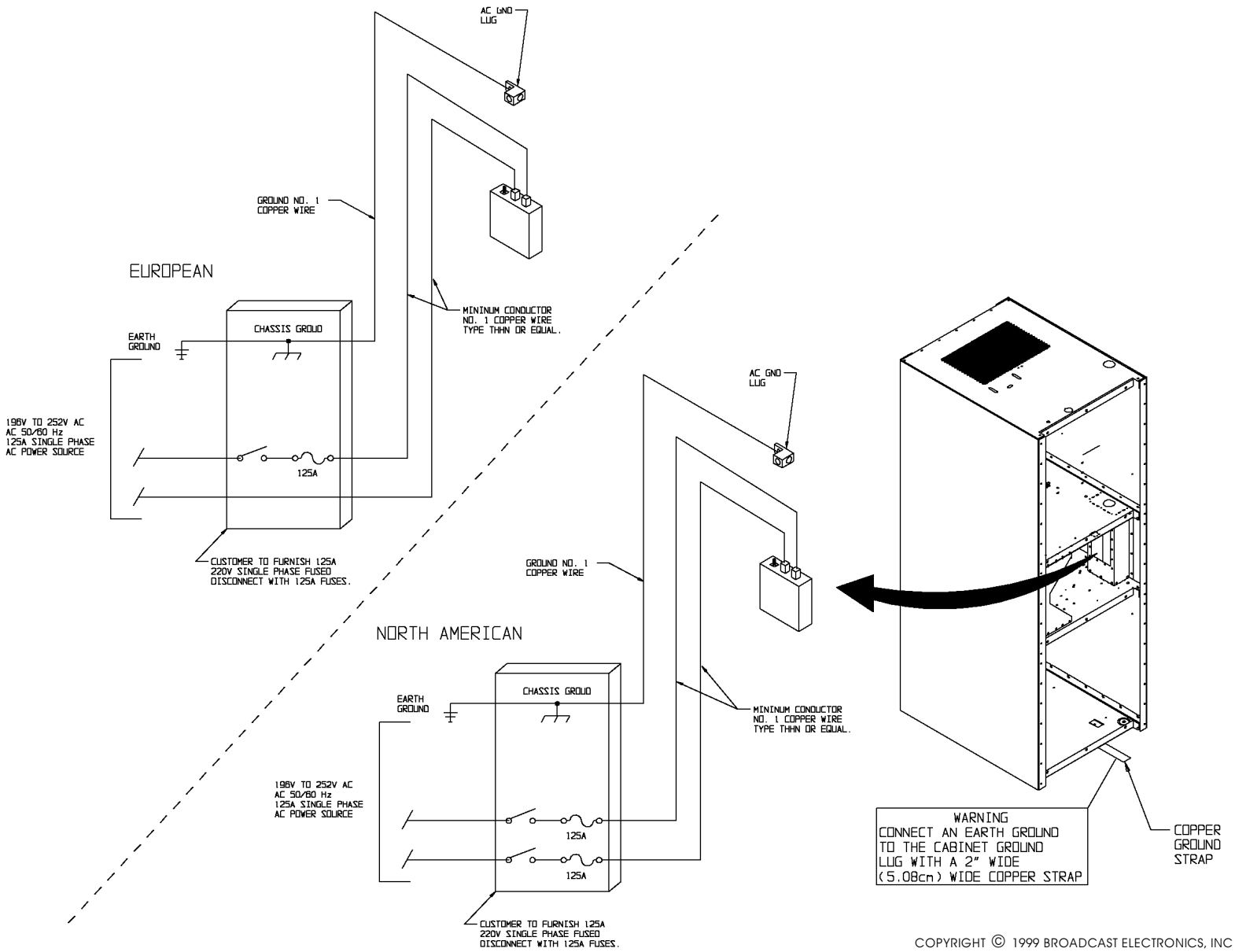

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FIGURE 2-11. AM-5E PRIMARY AC WIRING

2-98. **ANTENNA BALL-GAP LIGHTNING ARRESTOR.** Each tower in the antenna system must be equipped with a ball-gap lightning arrestor (refer to Figure 2-12). The ball-gap arrestor is designed to safely conduct lightning potentials to ground. Inspect the ball-gap arrestors by performing the following procedures.

2-99. **Ball-Gap Position.** The antenna ball-gap lightning arrestor must be aligned horizontally. Do not align the ball-gaps vertically. Vertical alignment allows rain water to collect on the balls. This reduces the gap separation and results in arcing during rain activity.

2-100. **Ball-Gap Separation.** The antenna ball-gap lightning arrestor must be adjusted for the proper separation. If the ball-gap separation is too wide, the arrestor will not function. If the ball-gap separation is too narrow, the arrestor will arc during normal transmitter operation. As a general rule: 1) a separation of approximately 0.020 in. for each peak kilovolt at the transmitter tower is required or 2) 0.125 inch for each 9.4 peak kilovolt at the transmitter tower is required.

2-101. The recommended method for ball-gap separation adjustment is to adjust the gap to prevent arcing during peak modulation activity. To adjust the separation, proceed as follows:

1. Adjust the ball-gap separation using the general rule presented in the preceding text.
2. Operate the transmitter at peak modulation and check the ball-gap for arcing activity.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

3. Operate the transmitter to off.
4. Adjust the ball-gap separation as follows:
   A. If no arcing activity is detected, reduce the ball-gap separation.
   B. If arcing activity is detected, increase the ball-gap separation.
5. Repeat the procedure until the ball-gap separation is adjusted for the smallest gap possible without arcing during peak modulation activity.

2-102. **ANTENNA-TUNING-UNIT SPARK-GAP LIGHTNING ARRESTOR.** The antenna-tuning-unit (ATU) must be equipped with a spark-gap lightning arrestor (refer to Figure 2-12). The spark-gap arrestor can be: 1) a ball-gap type or 2) a horn type. Adjust the spark-gap for the smallest possible gap without arcing during peak modulation activity.

2-103. **TRANSMITTER SITE GROUNDING SYSTEM.** The transmitter site grounding system must be properly connected for reliable transmitter operation. A typical transmitter site grounding system is shown in Figure 2-12. Perform the following procedures to ensure the grounding system connections are secure.

1. Ensure the antenna base ground strap is securely connected to the antenna ground plane radials.
2. Ensure the antenna ball-gap lightning arrestor is securely connected to the lightning ground rod system and to the antenna ground plane radials.
3. Ensure the ATU ground and the station RF ground is securely connected to the antenna ground plane radials.

2-104. **CABLE PROTECTION.** The ac line cable, audio/control cables, and the RF output transmission line require a combination of MOV and ferrite core protection to prevent the entry of lightning potentials (refer to Figure 2-12). Refer to the following text to install MOV and ferrite cores on the cables to prevent the conductance of lightning potentials. Ensure MOVs are connected from the ac line and audio/control cable conductors to the station RF ground as shown. The MOVs should be rated for 20,000 Ampere surges (BE P/N 140-0032).

2-105. **Ferrite Core.** The ac line cable, the audio/control cables, and the RF output transmission line also require the placement of ferrite cores. The cores are designed to create a high impedance for undesired current paths such as lightning. Ferrite cores for placement on ac line audio/control and RF output transmission line cables are located in the accessory parts kit. Locate the ferrite cores and install the cores by performing the following procedures.

2-106. **Modulation Monitor Core.** One 375-0009-001 ferrite core is designed to be installed on the modulation monitor cable. Install the core on the modulation monitor cable by: 1) routing the cable through the core and 2) wrapping the cable to create one cable loop around the core. The core can be installed at any location on the cable.

2-107. **Audio/Remote Control/Status Core.** A second 375-0009-001 ferrite core is designed to be installed on the audio and remote control/status cables. Install the core on the audio and remote control/status cables by: 1) routing the cables through the core and 2) if possible, wrapping the cables to create one cable loop cable around the core. The core can be installed at any location on the cables.

2-108. **Ac Input Core.** A 375-0007-001 ferrite core is shipped with the unit for installation on the transmitter ac input cable. Install the core by routing: 1) all ac line phase cables through the core or 2) all ac line phase cables and ground cable through the core. Place the core at any location between the wall mounted fused disconnect and the transmitter ac input switch.

2-109. **RF Output Core.** A second 375-0007-001 ferrite core is designed to be installed on the transmitter RF output transmission line cable. Install the core by routing the RF output cable through the core. Place the core at any location between the transmitter RF output connector and the next equipment connection in the RF output system such as the antenna phasing system. It is recommended the core be placed outside the transmitter cabinet.

2-110. **ANTENNA RF FEED LINE.** Check the antenna RF feed line between the ATU and the tower. Ensure the line contains one or more one foot diameter loops. The loops function as a series inductance and increase the impedance of the line.

2-111. **TRANSMISSION LINE AND ANTENNA CHECKOUT.**

CAUTION ***THE TRANSMISSION LINE AND ANTENNA MUST BE INSPECTED AND IN PROPER WORKING CONDITION FOR RELIABLE TRANSMITTER OPERATION.***

CAUTION

2-112. The transmission line and antenna must be inspected and in proper working condition for reliable transmitter operation. Perform the following procedures to inspect the transmission line and antenna.

2-113. **ANTENNA VSWR.** The AM-2.5E/AM-5E are designed to operate into an antenna with a maximum VSWR of 1.5 : 1. Check the antenna VSWR. If the VSWR is greater than 1.5 : 1, contact the Broadcast Electronics Customer Service Department. Typically, the antenna will require the installation of an additional tuning unit to reduce the antenna VSWR.

2-114. **COAXIAL SWITCH CONTROLLER.** To prevent damage to the transmitter, the transmitter must be muted during any antenna change sequence. Inspect the motorized coaxial switch controller and ensure the unit outputs a +5 volt to +15 volt mute signal. Ensure the mute signal is applied to the transmitter.

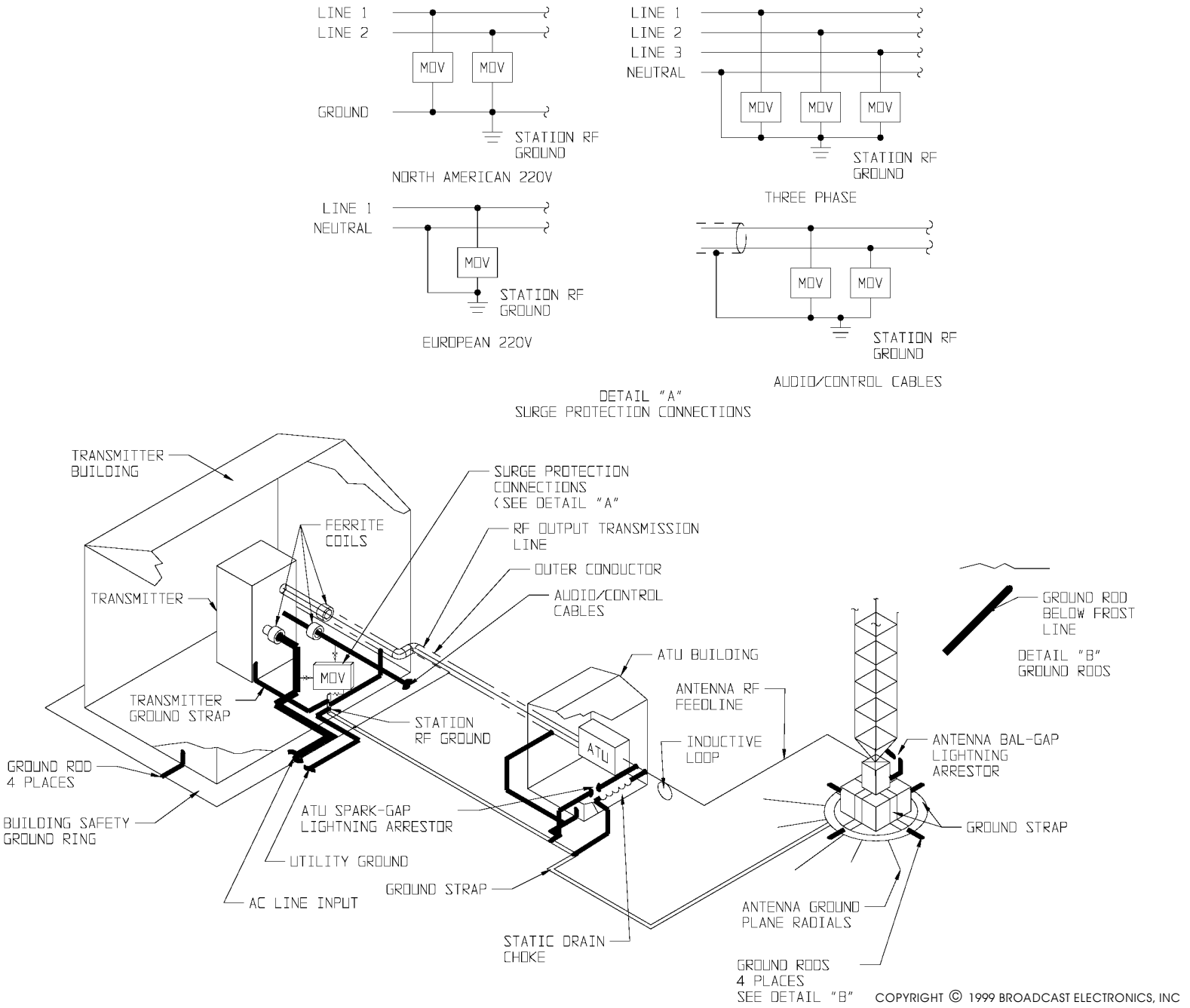

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FIGURE 2-12. ANTENNA LIGHTNING PROTECTION SYSTEM

2–115. **ATU AND PHASOR CHECKOUT.** Inspect the ATU and the antenna phasor unit (if installed in the system) for arcing activity during peak modulation periods. Repair or replace any devices to prevent arcing during peak modulation periods.

2–116. **INITIAL CHECKOUT.**

WARNING ***ENSURE PRIMARY POWER IS DISCONNECTED BEFORE PROCEEDING.***

WARNING

2–117. Prior to performing the preliminary operating procedures, the transmitter should be checked to ensure all installation and connection procedures have been performed. To check the transmitter, proceed as follows:

A. Ensure all ECU circuit boards, RF power modules, and power supply circuit boards are installed.

B. Ensure the RF output transmission line is connected to the transmitter output network.

C. Ensure the station earth ground is connected to the transmitter ground terminal.

D. Ensure all audio and control cables are connected to the transmitter.

E. Ensure the modulation monitor is connected to the transmitter.

F. Ensure all ac power connections are secure.

G. Ensure the station RF output transmission line system and antenna are in proper working condition.

H. Ensure the antenna lightning protection system is in proper working condition.

2–118. **PRELIMINARY OPERATION AND ADJUSTMENT.**

2–119. Adjust the transmitter for operation with the equipment at the installation site as follows:

WARNING ***THE TRANSMITTER POWER SUPPLY OPERATES FROM A HIGH FLOATING GROUND POTENTIAL. NEVER OPERATE THE TRANSMITTER WITH THE REAR-DOOR OPEN.***

WARNING

2–120. **TUNING.** The transmitter must be adjusted to operate into the station antenna. To tune the transmitter, proceed as follows:

2–121. Operate the rear–door ac on/off switch to ON. The ECU and power module front–panel indicators will illuminate.

2–122. Depress the power level 1 switch/indicator to illuminate the switch/indicator.

2–123. Operate the **FORWARD POWER** meter switch to LOW and observe the forward power indication.

2–124. Operate the **REFLECTED POWER** meter switch to LOW and observe the reflected power indication.

2–125. Tune the transmitter by adjusting the **TUNING** and **LOADING** controls as required for a minimum reflected power indication on the **REFLECTED POWER** meter.

2–126. **POWER LEVEL AND MODULATION MONITOR CALIBRATION ADJUSTMENTS.** The transmitter power levels are adjusted to the levels specified in the sales order at the factory. If no power levels are specified, the levels are adjusted as follows:

AM–2.5E	AM–5E
Power level 1 = 500 watts	Power level 1 = 1000 watts
Power level 2 = 1000 watts	Power level 2 = 2000 watts
Power level 3 = 1500 watts	Power level 3 = 3000 watts
Power level 4 = 2000 watts	Power level 4 = 4000 watts
Power level 5 = 2500 watts	Power level 5 = 5000 watts

2–127. If desired, the transmitter power levels can be changed at any time. If the transmitter power levels are adjusted, the modulation monitor output must also be re–calibrated. To change the power level and re–calibrate the modulation monitor output, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–128. Operate the transmitter rear–door ac on/off control switch to OFF and open the rear–door.

2–129. Refer to Figure 2–13 and connect the test equipment to the transmitter modulation connector as shown.

2–130. Operate the transmitter rear–door ac on/off control switch to ON.

2–131. Depress power level control 1 switch/indicator to illuminate the switch/indicator.

2–132. Operate the **FORWARD POWER** meter switch to **LOW** or **HIGH** as required and observe the forward power indication.

2–133. Refer to Figure 2–7 and adjust the power level 1 control to obtain the desired indication on the **FORWARD POWER** meter. The control range is from: 1) 250 watts to 1250 watts on AM–2.5E models and 2) 500 watts to 2500 watts on AM–5E models.

2–134. Refer to Figure 3–1 in SECTION III, OPERATION and adjust the power level 1 modulation monitor calibration control for a 5.7 volt peak–to–peak signal on the oscilloscope.

2–135. Repeat the procedure for power levels 2 through 5. The power level control ranges are as follows:

AM–2.5E

1. Power level 2 – 250 watts to 1250 watts.
2. Power level 3 – 250 watts to 1250 watts or 750 watts to 2800 watts as programmed by a jumper on the controller circuit board.
3. Power level 4 – 750 watts to 2800 watts.
4. Power level 5 – 750 watts to 2800 watts.

AM–5E

1. Power level 2 – 500 watts to 2500 watts.
2. Power level 3 – 500 watts to 2500 watts or 1500 watts to 5600 watts as programmed by a jumper on the controller circuit board.
3. Power level 4 – 1500 watts to 5600 watts.
4. Power level 5 – 1500 watts to 5600 watts.

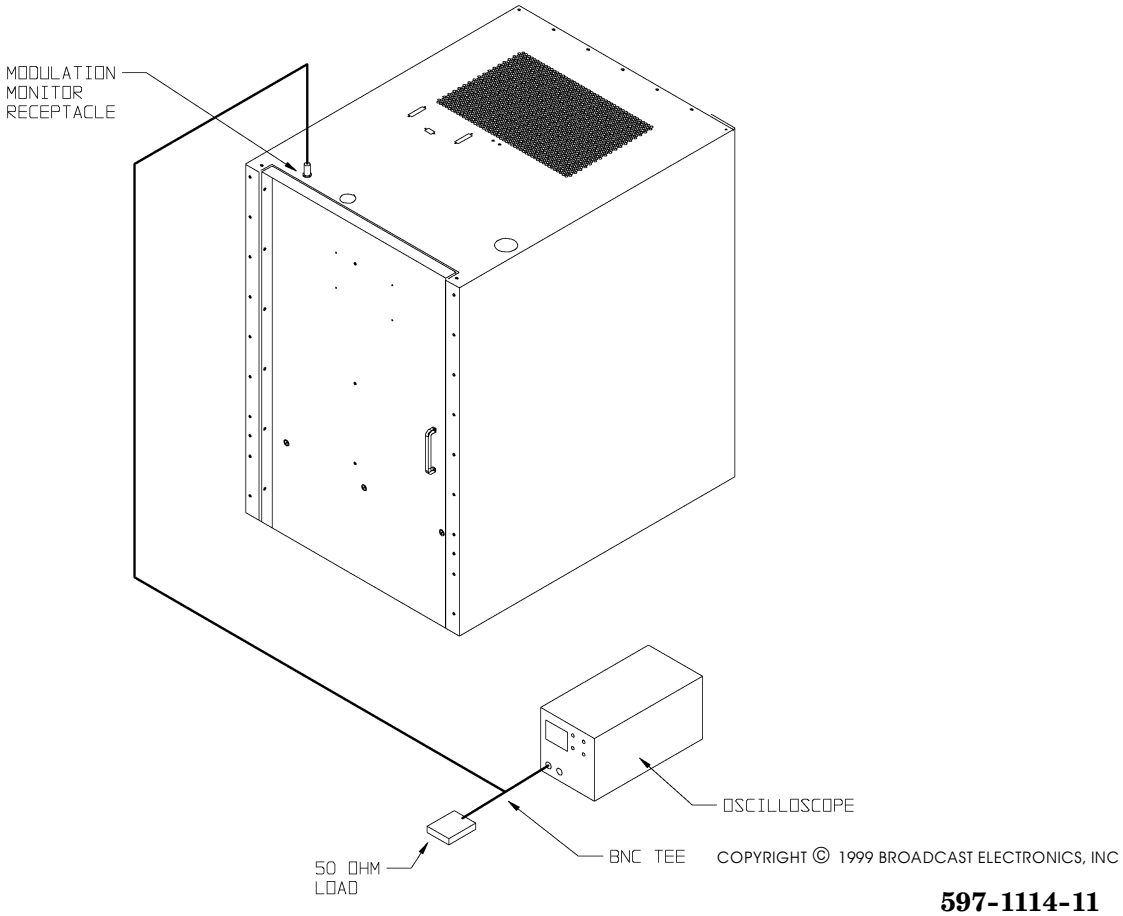

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FIGURE 2-13. TEST EQUIPMENT CONNECTIONS, POWER LEVEL CALIBRATION

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-136. Operate the transmitter rear-door ac on/off control switch to OFF.

2-137. Disconnect the cable from the transmitter modulation monitor connector.

2-138. **STEREO ADJUSTMENT.** If the transmitter is operated in the stereo mode, the transmitter stereo circuitry must be adjusted to compensate for antenna system variances. The primary objective in the adjustment of the transmitter is to configure the stereo circuitry to minimize distortion and maximize separation across the entire audio band. A proof of performance sheet is provided at the end of this section to record performance measurements. To adjust the stereo circuitry, perform the following procedures and record the measurements on the proof of performance sheet at the end of this section.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-139. Operate the transmitter rear-door ac on/off control switch to OFF.

2-140. Refer to Figure 2-14 and connect the test equipment as shown.

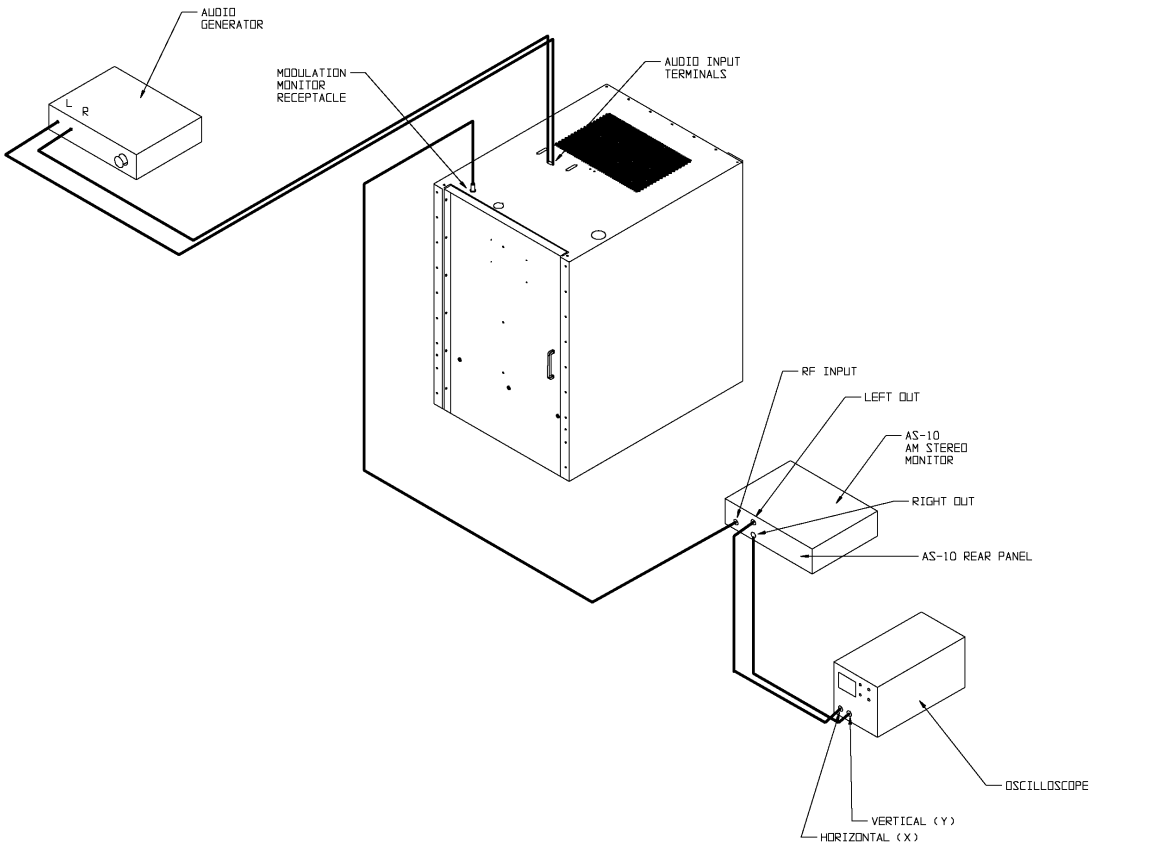

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FIGURE 2-14. TEST EQUIPMENT CONNECTIONS, SEPARATION

2-141. Operate the oscilloscope for: 1) 200 mV/div sensitivity and 2) dc coupled.

2-142. Refer to Figure 2-8 and connect an audio generator to the audio input terminals.

2-143. Operate the transmitter rear-door ac on/off control switch to ON.

2-144. Select the antenna which is configured for equalization circuit 1 operation (refer to STEREO CIRCUIT BOARD PROGRAMMING in the preceding text if required) and determine a power level.

2-145. Depress the desired power level switch/indicator to illuminate the switch/indicator.

2-146. Refer to SECTION III, OPERATION and perform the following:

1. Operate the stereo circuit board mode control switch to illuminate the stereo indicator. When power is applied to the transmitter, the stereo circuit board will automatically be configured to the stereo mode.
2. Operate the stereo circuit board pilot switch to off.
3. Ensure the equalization circuit 1 indicator on the stereo circuit board is illuminated.

2-147. Adjust equalization circuit 1 as follows:

1. Adjust the audio generator for a 1 KHz left channel output at +10 dBm and observe the lissajous pattern displayed on the oscilloscope.

2. Refer to Figure 2–6 and adjust the left channel level control to obtain a horizontal lissajous pattern (refer to Figure 2–15).

3. Adjust the group delay as follows:

   A. Configure the group delay circuitry for adjustment as follows:

      1. Refer to Figure 2–6 and configure the left channel 4 microsecond and 8 microsecond sections to in.

      2. Refer to Figure 2–6 and operate the left channel delay control fully counter-clockwise.

   B. Refer to Figure 2–6 and adjust the left channel delay control to close the oscilloscope display and obtain a straight-line lissajous display as shown in the maximum left channel separation lissajous pattern (refer to Figure 2–15). If the display will not close, proceed as follows:

      1. Refer to Figure 2–6 and: 1) configure only the 8 microsecond delay section to in and 2) adjust the left channel delay control to close the oscilloscope display.

      2. If the display will not close refer to Figure 2–6 and: 1) configure only the 4 microsecond delay section to in and 2) adjust the left channel delay control to close the oscilloscope display.

4. Adjust the separation at 7 kHz as follows:

   A. Adjust the audio generator for a 7 kHz left channel output at +10 dBm.

   B. Refer to Figure 2–6 and adjust the left channel cutoff and peak controls to obtain a maximum left channel separation lissajous pattern as shown in Figure 2–15.

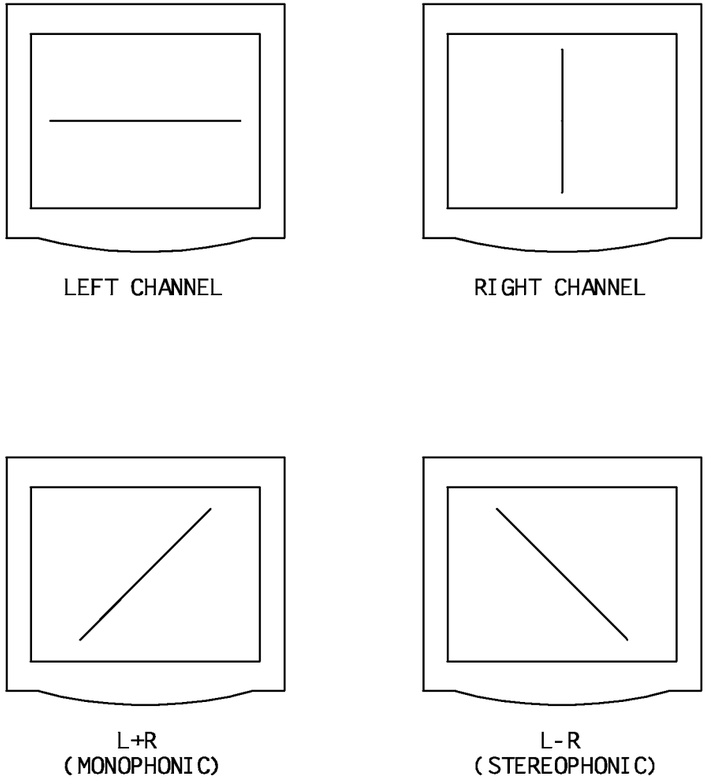
   C. If a maximum left channel lissajous pattern can not be obtained, refer to Figure 2–6 and adjust the left channel delay control to close the oscilloscope display and obtain a straight-line lissajous pattern (refer to Figure 2–15).

5. Repeat the entire procedure for the right channel. Adjust the right channel level, cutoff, peak, and delay controls as required to obtain optimum separation and distortion from the right channel.

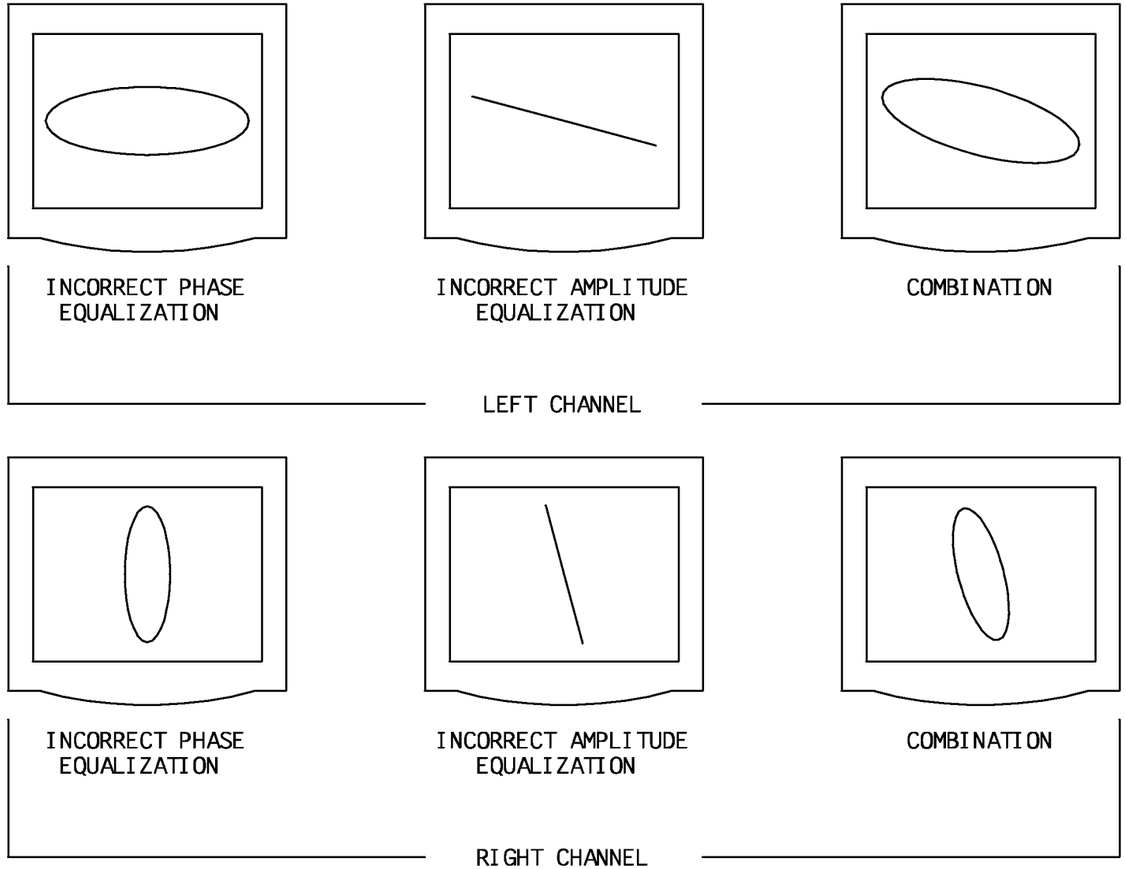
6. Repeat the entire procedure for equalization circuit 2. Adjust the equalization circuit 2 using the equalization 2 left/right channel level, cutoff, peak, delay, controls and the equalization 2 group delay sections to obtain optimum separation and distortion.

2–148. Once the stereo adjustment is complete: 1) refer to SECTION III, OPERATION and operate the pilot switch on the stereo circuit board to ON and 2) remove the test equipment.

2–149. **SINGLE CHANNEL LEVEL.** The transmitter is equipped with a single channel level control. When the transmitter is operating in the stereo mode, the level control is designed to boost a remaining audio channel level in the event of a failure in one channel. For transmitters operating in the stereo mode, adjust the single channel level control as follows:



MAXIMUM SEPARATION LISSAJOUS PATTERNS



POOR SEPARATION LISSAJOUS PATTERNS

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FIGURE 2-15. EQUALIZATION LISSAJOUS PATTERNS
(2-33/2-34)

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-150. Operate the transmitter rear-door ac on/off control switch to OFF.

2-151. If an audio processor is used with the transmitter, ensure the processor is connected as follows:

1. Ensure normal program audio is connected to the processor input.
2. Ensure the audio processor output is connected to the transmitter audio input.

2-152. Operate the transmitter rear-door ac on/off control switch to ON.

2-153. Depress a desired power level switch/indicator to illuminate the switch/indicator.

2-154. Refer to SECTION III, OPERATION and operate the stereo circuit board mode control switch to illuminate the stereo indicator.

2-155. Disable one channel applied to the transmitter.

2-156. If an audio processor is used with the transmitter, refer to the audio processor manual and adjust the processor single channel limiter as described in the procedure.

2-157. Refer to SECTION III, OPERATION and operate the stereo circuit board mode control switch to illuminate the mono left or mono right indicator as determined by the remaining operating audio channel applied to the transmitter.

2-158. Refer to Figure 2-5 and adjust the single channel level control on the exciter circuit board as required to obtain an approximate 100% modulation indication on the modulation monitor.

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. This section identifies all controls and indicators associated with the AM-2.5E/AM-5E transmitters and provides standard operating procedures.

3-3. CONTROLS AND INDICATORS.

3-4. Figures 3-1, 3-2, and 3-3 present the location of all controls and indicators associated with normal operation of the AM-2.5E and AM-5E transmitters. Tables 3-1, 3-2, and 3-3 present the functions of each control or indicator. Refer to Figures 3-1 through 3-3 and Tables 3-1 through 3-3 for a description of the controls and indicators associated with the AM-2.5E/AM-5E transmitters.

TABLE 3-1. AM-2.5E/AM-5E CONTROLS AND INDICATORS
(Sheet 1 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
1	**FORWARD POWER** Meter	Displays the transmitter forward power output in watts as selected by the **FORWARD POWER** Meter **LOW/HIGH/OFF** switch.
2	**FORWARD POWER** Meter **HIGH/LOW/OFF** Switch	Configures the **FORWARD POWER** meter: 1) to display forward power information on the HIGH scale, 2) to display forward power information on the LOW scale, or 3) to off. In the AM-2.5E: 1) the HIGH scale is from 0 to 3000 watts and 2) the LOW scale is from 0 to 750 watts. In the AM-5E: 1) the HIGH scale is from 0 to 6000 watts and 2) the LOW scale is from 0 to 1500 watts.
3	**REFLECTED POWER** Meter	Displays the transmitter reflected power output in watts or the ac input voltage in volts as selected by the **REFLECTED POWER HIGH/LOW/VAC** Switch.
4	**REFLECTED POWER** Meter **HIGH/LOW/VAC** Switch	Configures the **REFLECTED POWER** meter to display: 1) reflected power information on the HIGH scale, 2) reflected power information on the LOW scale, or 3) the ac input voltage. In the AM-2.5E: 1) the HIGH scale is from 0 to 300 watts and 2) the LOW scale is from 0 to 60 watts. In the AM-5E: 1) the HIGH scale is from 0 to 600 watts and 2) the LOW scale is from 0 to 150 watts. The ac volts scale is from 150 to 300 volts.

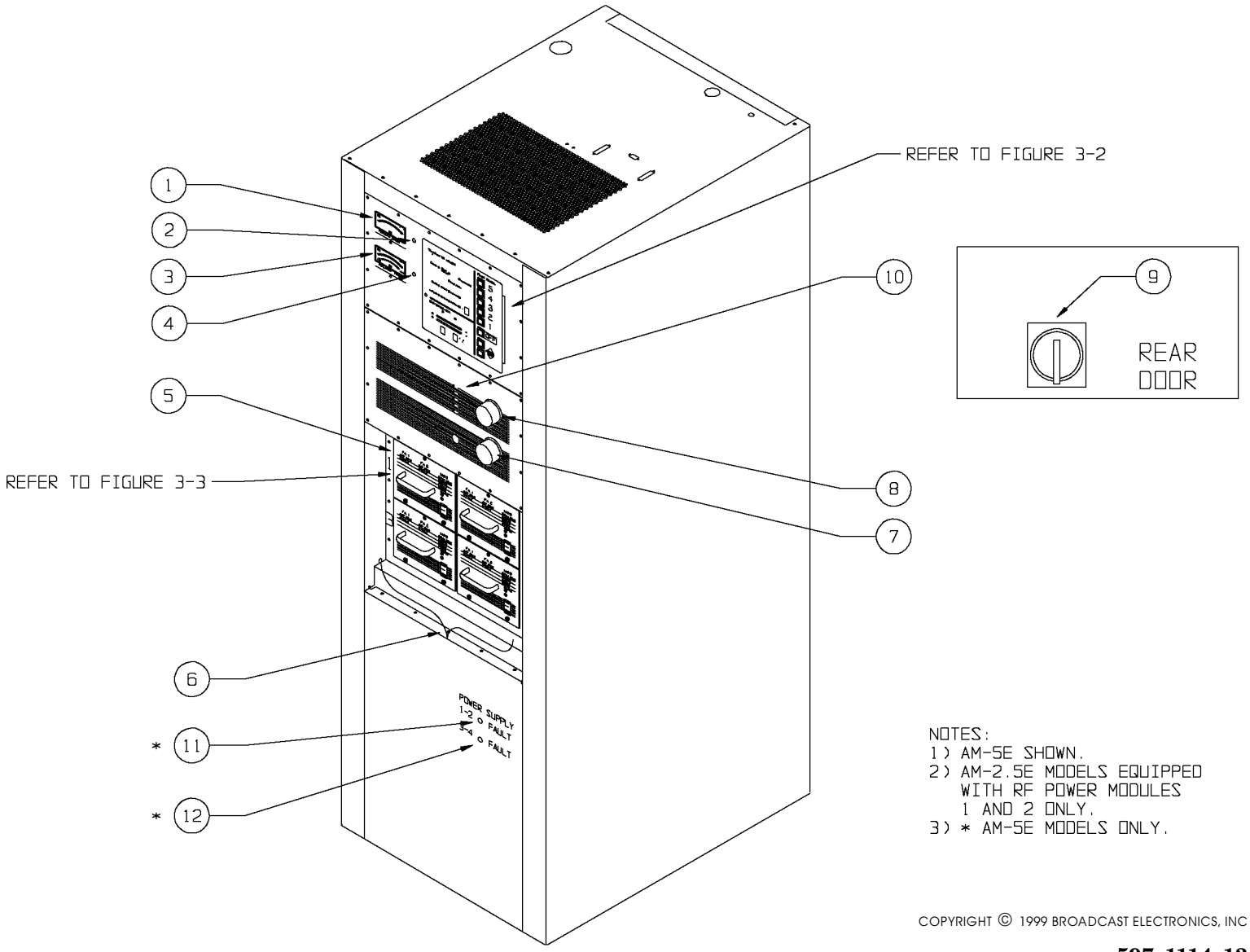

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FIGURE 3-1. AM-2.5E/AM-5E CONTROLS AND INDICATORS

TABLE 3-1. AM-2.5E/AM-5E CONTROLS AND INDICATORS
(Sheet 2 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
5	**RF POWER MODULE**	A modular plug-in assembly containing two RF power amplifier circuit boards and one modulator circuit board. The AM-2.5E is equipped with 2 power modules. The AM-5E is equipped with 4 power modules. Each power module is designed to output 1375 watts of RF power.
6	**POWER BLOCK**	An RF power amplifier assembly containing two RF power modules and a combiner unit.
7	**LOAD** Control	Operates in association with the **TUNE** control to match the transmitter output impedance to the antenna.
8	**TUNE** Control	Operates in association with the **LOAD** control to match the transmitter output impedance to the antenna.
9	**AC ON/OFF** Switch	Controls the application of ac power to the transmitter.
10	Modulation Monitor Calibration Controls	Calibrates the modulation monitor sample to power levels 1 through 5.
11	**POWER SUPPLY 1-2** Fault Indicator (AM-5E Only)	Illuminates to indicate a failure in the 1-2 power supply. The supply provides power for RF power modules 1-2.
12	**POWER SUPPLY 3-4** Fault Indicator (AM-5E Only)	Illuminates to indicate a failure in the 3-4 power supply. The supply provides power for RF power modules 3-4.

TABLE 3-2. ECU CONTROLS AND INDICATORS
(Sheet 1 of 6)

INDEX NO.	NOMENCLATURE	FUNCTION
1	**EXCITER** Indicator	Displays the operating status of the exciter. GREEN Display - Indicates normal exciter operation. RED Display - Indicates an exciter fault.

TABLE 3-2. ECU CONTROLS AND INDICATORS
(Sheet 2 of 6)

INDEX NO.	NOMENCLATURE	FUNCTION
2	**POWER MODULES** Indicator	Displays the operating status of the transmitter power modules. GREEN Display – Indicates all power modules are operating normally. YELLOW Display – Indicates an RF power module is removed from the transmitter. RED Display – Indicates a fault in an RF power module.
3	**POWER SUPPLY** Indicator	Displays the operating status of the transmitter power supply system. GREEN Display – Indicates normal power supply system operation. YELLOW DISPLAY – Indicates one or more power supplies are removed from the transmitter. RED Display – Indicates a power supply system fault.
4	**ANTENNA VSWR** Indicator	Displays the condition of the antenna system. GREEN Display – Indicates a normal antenna load. YELLOW Display – Indicates a VSWR condition of 1.2 : 1. RED Display – Indicates a high reflected/forward power indication. In the AM–2.5E, indicates a 100 watt reflected power condition or a condition which results in a high forward power indication of greater than 20%. In the AM–5E, indicates a 200 watt reflected power condition or a condition which results in a high forward power indication of greater than 20%. FLASHING RED Display – Indicates a reflected power emergency condition. In the AM–2.5E, indicates a 500 watt reflected power condition. In the AM–5E, indicates a 1000 watt reflected power condition.

TABLE 3-2. ECU CONTROLS AND INDICATORS
(Sheet 3 of 6)

INDEX NO.	NOMENCLATURE	FUNCTION
5	**POWER CONTROL** Switch/Indicators	SWITCHES – A group of five switches designed to select five customer adjustable transmitter operating output power levels. In the AM–2.5E, switches 1 and 2 can be adjusted to obtain output power levels from 250 to 1250 watts. Switches 4 and 5 can be adjusted to obtain output power levels from 750 to 2800 watts. Switch 3 is designed to be customer assigned to control power in the 250 to 1250 watt range or the 750 to 2800 watt range. In the AM–5E, switches 1 and 2 can be adjusted to obtain output power levels from 500 to 2500 watts. Switches 4 and 5 can be adjusted to obtain output power levels from 1500 to 5600 watts. Switch 3 is designed to be customer assigned to control power in the 500 to 2500 watt range or the 1500 to 5600 watt range. INDICATORS – Illuminates to indicate an associated power control switch has been selected.
6	**OFF** Switch/Indicator	SWITCH – Deenergizes the transmitter RF output power and configures the unit to off. INDICATOR – Illuminates to indicate the **OFF** switch has been selected.
7	**POWER ▲** Switch/ Indicator	SWITCH – Instructs the system controller to raise the transmitter output power. The switch is designed with the ability to raise power from 10% to 15% of the selected output power level. INDICATOR – During manual operating conditions, illuminates to indicate the **POWER ▲** switch is selected. During automatic raise conditions, the indicator will illuminate to indicate the rate of automatic power increase.
8	**POWER ▼** Switch/ Indicator	SWITCH – Instructs the system controller to lower the transmitter output power. The switch is designed with the ability to lower power from 10% to 15% of the selected output power level. INDICATOR – During manual operating conditions, illuminates to indicate the **POWER ▼** switch is selected. During automatic lower conditions, the indicator will illuminate to indicate the rate of automatic power decrease.

TABLE 3-2. ECU CONTROLS AND INDICATORS
(Sheet 4 of 6)

INDEX NO.	NOMENCLATURE	FUNCTION
9	**RESET** Switch/ Indicator	SWITCH – Clears the transmitter fault circuitry when: 1) the switch is depressed and 2) if the fault condition is removed. INDICATOR – Illuminates to indicate a fault has been encountered.
10	**EXCITER MONITOR STEREO** Indicator	Illuminates to indicate the exciter is configured to the stereo mode.
11	**EXCITER MONITOR MODE** Switch/ Indicator	SWITCH – Selects either left/right channel or L–R/L+R information for presentation on the **EXCITER MONITOR LED** bar–graph display. INDICATOR – Indicates the type of information selected for display on the exciter monitor. The **L/R** indicator will illuminate to indicate the display of left/right channel information. The **L+R/L–R** indicator will illuminate to indicate the display of L+R/ L–R information.
12	**EXCITER MONITOR +/- POLARITY** Switch/Indicator	SWITCH – Selects either positive or negative peak audio for application to the **EXCITER MONITOR** LED bar–graph display. INDICATOR – Indicates the signal polarity selected for display on the exciter monitor. The + indicator will illuminate to indicate the display of positive information. The – indicator will illuminate to indicate the display of negative information.
13	**EXCITER MONITOR** LED Bar–Graph Display	Displays left, right, L+R, or L–R audio channel peak levels as selected by the **EXCITER MONITOR MODE** and **POLARITY** switches. Each indicator will illuminate at the level indicated on the display. In addition, the display is equipped with an autorange feature to allow the monitoring of signals in the 0.5% to 14.5% range. Indications of autorange operation are provided by the **R/L–R** and **L/L+R X10** indicators.
14	**EXCITER MONITOR MONO** Indicator	Illuminates to indicate the exciter is configured to the mono L, mono R, or mono L+R mode of operation.
15	**R/L–R** Display **X10** Indicator	Illuminates to indicate the autorange feature is enabled to expand the **R/L–R** display by 10 to provide the resolution required for low level audio monitoring.

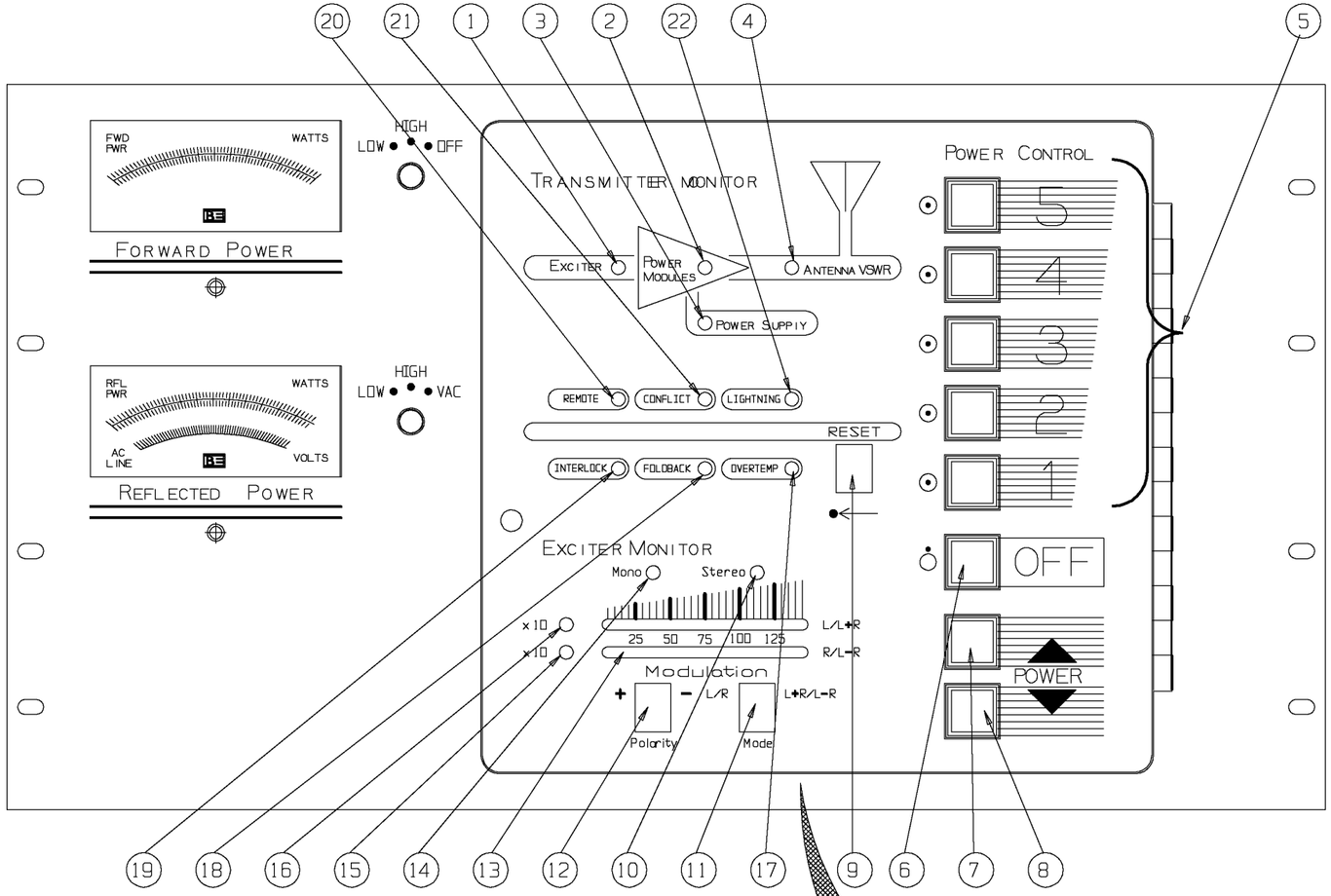

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FIGURE 3-2. ECU CONTROLS AND INDICATORS
(3-7/3-8)

TABLE 3-2. ECU CONTROLS AND INDICATORS
(Sheet 5 of 6)

INDEX NO.	NOMENCLATURE	FUNCTION
16	**L/L+R** Display **X10** Indicator	Illuminates to indicate the autorange feature is enabled to expand the **L/L+R** display by 10 to provide the resolution required for low level audio monitoring.
17	**OVERTEMP** Indicator	Illuminates to indicate when the transmitter operating temperature exceeds 70° C (158° F).
18	**FOLDBACK** Indicator	Illuminates to indicate when the transmitter is in a foldback condition. Foldback is when the transmitter output power is automatically reduced in response to one of the following fault conditions: 1) high reflected power, 2) high forward power, 3) high temperature, or 4) detection of a lightning potential.
19	**INTERLOCK** Indicator	Illuminates to indicate the internal interlock, external interlock, and the remote fail-safe are closed. The remote control fail-safe must be closed only when the transmitter is configured for remote control operation.
20	**REMOTE** Indicator	Illuminates to indicate transmitter remote control operations are enabled.
21	**CONFLICT** Indicator	Illuminates to indicate an incorrect power level is selected for operation into the antenna connected to the transmitter.
22	**LIGHTNING** Indicator	In the AM-2.5E, illuminates to indicate a 1500 volt or greater potential is present at the transmitter output. In the AM-5E, illuminates to indicate a 2100 volt or greater potential is present at the transmitter output.
23	**PWM** Mute Indicator	Illuminates to indicate the power control PWM signal is muted in response to a fault such as lightning, an exciter fault, a reflected power emergency, an open remote control fail-safe, or an external transmitter mute.
24	Remote Fail-safe Indicator	Illuminates to indicate the remote control unit is enabled.
25	Remote/Local Switch	Controls the transmitter remote control operations. When the switch is operated to remote, remote control operations are enabled. When the switch is operated to local, remote control operations are disabled.

TABLE 3-2. ECU CONTROLS AND INDICATORS
(Sheet 6 of 6)

INDEX NO.	NOMENCLATURE	FUNCTION
26	Battery OK Indicator	When the battery test switch is depressed, the indicator will: 1) illuminate to indicate the battery is operational or 2) not illuminate to indicate the battery is to be replaced.
27	Battery Test Switch	When depressed, evaluates the controller battery status. The status is displayed by the battery OK indicator.
28	Pilot On/Off Switch	Enables and disables the stereo pilot signal.
29	Stereo Indicator	Illuminates to indicate the exciter is configured to the stereo mode.
30	Mono L+R Indicator	Illuminates to indicate the exciter is configured to the mono L+R mode.
31	Mono Right Indicator	Illuminates to indicate the exciter is configured to the mono right mode.
32	Mono Left Indicator	Illuminates to indicate the exciter is configured to the mono left mode.
33	Exciter Mode Control Switch	Configures the exciter for stereo, mono L+R, mono left, or mono right operation. The switch is designed to configure the exciter to a different mode of operation each time the switch is depressed. The switch will advance to a mode of operation in the following order: 1) mono left, 2) mono right, 3) mono L+R, and 4) stereo.
34	Stereo Equalization 1 Indicator	Illuminates to indicate the exciter stereo equalization 1 circuit is active.
35	Stereo Equalization 2 Indicator	Illuminates to indicate the exciter stereo equalization 2 circuit is active.
36	Lock Indicator	Illuminates to indicate the exciter is locked to the programmed carrier frequency.
37	Exciter +5V Indicator	Illuminates to indicate the ECU +5V supply is operational.
38	Exciter +15V Indicator	Illuminates to indicate the ECU +15V supply is operational.
39	Exciter –15V Indicator	Illuminates to indicate the ECU –15V supply is operational.
40	Negative Limiter Indicator	Illuminates to indicate the negative limiter circuit is enabled. Factory adjusted to illuminate at approximately 94% negative modulation.

TABLE 3-3. POWER MODULE CONTROLS AND INDICATORS
(Sheet 1 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
1	**PA 1 RF DRIVE** Indicator	Illuminates to indicate RF drive is present at power amplifier 1.
2	**PA 1 FAULT** Indicator	Illuminates to indicate a fault has occurred in power amplifier 1.
3	**PA 2 RF DRIVE** Indicator	Illuminates to indicate RF drive is present at power amplifier 2.
4	**PA 2 FAULT** Indicator	Illuminates to indicate a fault has occurred in power amplifier 2.
5	**MOD PWM DRIVE** Indicator	Illuminates to indicate the exciter PWM drive is present at the modulator circuit board.
6	**MOD POWER** Indicator	Illuminates to indicate dc power is present at the modulator circuit board.

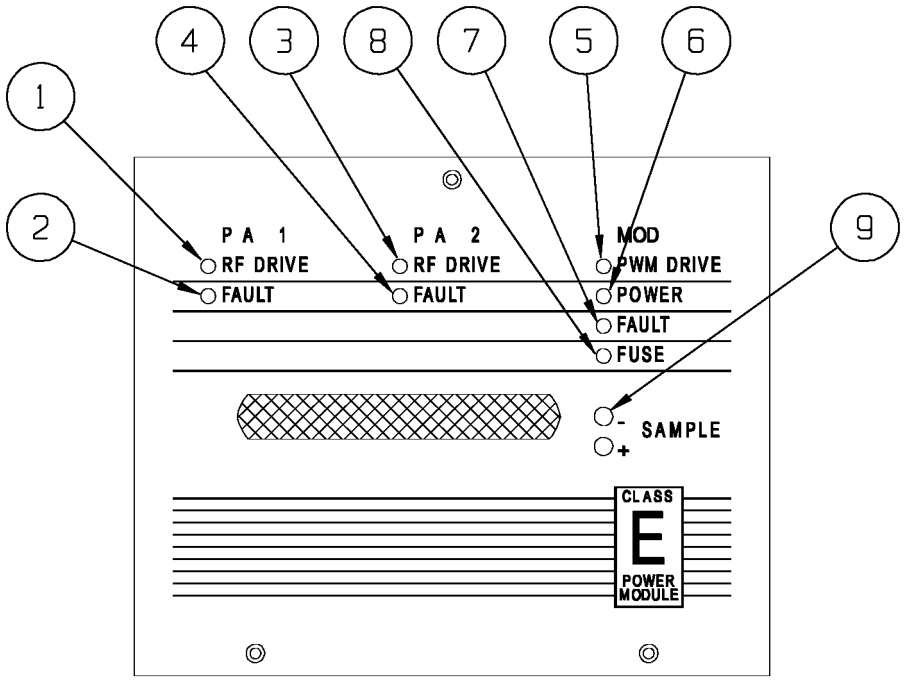

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FIGURE 3-3. POWER MODULE CONTROLS AND INDICATORS

TABLE 3-3. POWER MODULE CONTROLS AND INDICATORS
(Sheet 2 of 2)

INDEX NO.	NOMENCLATURE	FUNCTION
7	**MOD FAULT** Indicator	Illuminates to indicate a fault has occurred in the modulator circuit board.
8	**MOD FUSE** Indicator	Illuminates to indicate the modulator circuit board fuse has blown.
9	**MOD SAMPLE**	Provides a dc voltage sample of the modulator circuit board output. In the AM-2.5E, the sample will be equal to approximately 5.6 volts dc at 2.5 kW (refer to factory test data sheets). In the AM-5E, the sample will be equal to approximately 5.6 volts dc at 5 kW (refer to factory test data sheets).

3-5. OPERATION.

CAUTION

CAUTION WHEN AC POWER IS APPLIED TO THE TRANSMITTER AND THE RF DRIVE AND PWM DRIVE INDICATORS ON RF POWER MODULES IN A POWER BLOCK ARE EXTINGUISHED, THE RF POWER MODULES MUST BE REMOVED FROM THE TRANSMITTER CHASSIS TO PREVENT DAMAGE TO THE MODULES.

NOTE

NOTE ENSURE THE TRANSMITTER IS COMPLETELY INSTALLED PRIOR TO PERFORMING THE FOLLOWING PROCEDURES.

3-6. TURN-ON.

3-7. Operate the transmitter to ON by performing the following procedure.

3-8. Ensure the transmitter rear-panel ac on/off switch is operated to ON. The ECU and RF power module front-panel indicators will illuminate.

3-9. Observe the ECU and RF power module indicators. Ensure normal operating conditions are displayed by all indicators. If an indicator displays a fault condition, operate the ac power switch to off and refer to SECTION V, MAINTENANCE to locate the problem.

3-10. Select an output power level by depressing the desired power level switch/indicator. The following events will occur:

1. The power level switch indicator will illuminate.
2. The transmitter flushing fans will begin operation.
3. The transmitter output power will be displayed on the **FORWARD** and **REFLECTED** power meters.

3–11. Operate the **FORWARD** and **REFLECTED** power meters to observe the transmitter forward and reflected power indications.

3–12. Adjust the transmitter output power if required by performing the POWER ADJUST procedure presented in the following text.

3–13. If remote control operation is desired, operate the local/remote switch on the controller circuit board to remote. This will enable both local and remote operation.

3–14. **TURN OFF.**

3–15. Operate the transmitter to OFF by depressing the OFF switch/indicator to illuminate the switch/indicator. The transmitter will operate to off.

3–16. **METERING.**

3–17. **FORWARD POWER.** The forward power meter presents forward power indications. To operate the meter, proceed as follows:

1. To monitor low forward power levels, operate the **FORWARD POWER** meter switch to **LOW**. In the AM–2.5E, the **LOW** scale is from 0 to 300 watts. In the AM–5E, the **LOW** scale is from 0 to 1500 watts.
2. To monitor high forward power levels, operate the **FORWARD POWER** meter switch to **HIGH**. In the AM–2.5E, the **HIGH** scale is from 0 to 3000 watts. In the AM–5E, the **HIGH** scale is from 0 to 6000 watts.
3. To configure the **FORWARD POWER** meter to off, operate **FORWARD POWER** meter switch to **OFF**.

3–18. **REFLECTED POWER.** The reflected power meter presents reflected power and ac input indications. To operate the meter, proceed as follows:

1. To monitor low reflected power levels, operate the **REFLECTED POWER** meter switch to **LOW**. In the AM–2.5E, the **LOW** scale is from 0 to 60 watts. In the AM–5E, the **LOW** scale is from 0 to 150 watts.
2. To monitor high reflected power levels, operate the **REFLECTED POWER** meter switch to **HIGH**. In the AM–2.5E, the **HIGH** scale is from 0 to 300 watts. In the AM–5E, the **HIGH** scale is from 0 to 600 watts.
3. To monitor the ac input voltage, operate the **REFLECTED POWER** meter switch to **VAC**.

3–19. **POWER ADJUST.**

3–20. The **POWER ▲** and **▼** switches adjust the transmitter output power. To adjust the transmitter power, proceed as follows:

1. Depress the **POWER ▲** switch to increase the transmitter output power. Observe the transmitter output power indications on the **FORWARD** and **REFLECTED** power meters.

   The switch will increase power from 10% to 15% of the selected power level.

   OR

2. Depress the **POWER ▼** switch to decrease the transmitter output power. Observe the transmitter output power indications on the **FORWARD** and **REFLECTED** power meters.

   The switch will decrease power from 10% to 15% of the selected power level.

3-21. **MONO/STEREO OPERATION.**

3-22. To configure the transmitter for monophonic or stereophonic operation, perform the following procedures.

3-23. **STEREO OPERATION.** To configure the transmitter for stereo operations, depress the exciter mode control switch to illuminate the stereo indicator on the stereo circuit board. In addition, the ECU front-panel stereo indicator will illuminate.

3-24. **MONO OPERATION.** The transmitter can be configured to the monophonic mode by: 1) manually selecting the desired mono mode using the stereo circuit board or 2) automatically configuring the transmitter by removing the stereo circuit board. To configure the transmitter for mono operations, proceed as follows:

3-25. **Mono Operation - Stereo Circuit Board.** To configure the transmitter for mono operation using the stereo circuit board, depress the exciter mode control switch to illuminate the mono L+R, mono left, or mono right indicators on the stereo circuit board. In addition, the ECU front-panel **MONO** indicator will illuminate.

3-26. **Mono Operation - No Stereo Circuit Board.** In the event of a stereo circuit board failure, the transmitter will automatically configure to the monophonic mode when the stereo circuit board is removed from the ECU. To remove the stereo circuit board and configure the transmitter for monophonic operation, proceed as follows:

CAUTION ***TO PREVENT DAMAGE TO THE TRANSMITTER, ENSURE THE TRANSMITTER PRIMARY POWER IS OPERATED TO OFF BEFORE REMOVING THE STEREO CIRCUIT BOARD.***

CAUTION

1. Operate the transmitter primary power to off.
2. Completely remove the stereo circuit board from the ECU. Do not leave the circuit board in the ECU chassis.
3. Refer to Figure 2-5 in SECTION II, INSTALLATION and ensure the monophonic audio channel select jumper is configured for the desired audio channel.
4. If required, adjust the single channel level by referring to SECTION II, INSTALLATION and performing the SINGLE CHANNEL LEVEL procedure.

3-27. **PILOT CONTROL.**

3-28. The pilot switch on the stereo circuit board controls the pilot tone. Operate the pilot switch to on to enable the pilot tone. Operate the pilot switch to off to disable the pilot tone.

3-29. **EXCITER MONITOR OPERATION.**

3-30. The following text presents procedures for specific exciter monitoring functions. Perform the appropriate procedure for the type of monitor function desired.

3-31. **MONO/STEREO INDICATIONS.** The **MONO** and **STEREO** indicators display the operating mode of the exciter. The **MONO** indicator will illuminate to indicate when the exciter is configured for mono L+R, mono left, or mono right operation. The **STEREO** indicator will illuminate to indicate when the exciter is configured for stereo operation.

3-32. **INPUT SELECTION.** Depress the **L/R/L+R/L-R MODE** switch/indicator to: 1) illuminate the **L/R** indicator to select left and right channel information or 2) illuminate the **L+R/L-R** indicator to select **L+R** and **L-R** information. The selected parameter will appear on the **EXCITER MONITOR** display.

3–33. **POLARITY SELECTION.** Depress the **POLARITY** switch/indicator to: 1) illuminate the + indicator to select positive peak audio or 2) illuminate the – indicator to select negative peak audio. The selected parameter will appear on the **EXCITER MONITOR** display.

3–34. **X10 AUTORANGE INDICATIONS.** The **EXCITER MONITOR** display is designed with an autorange function to provide the appropriate resolution for the applied signal level. The **L/L+R** display **X10** indicator will illuminate to indicate the display is expanded by 10. The **R/L–R** display **X10** indicator will illuminate to indicate the display is expanded by 10.

3–35. **FAULT RESET.**

3–36. The transmitter monitors several parameters for fault conditions. The **RESET** indicator will illuminate to indicate a fault when one of the following conditions occur: 1) over–temperature, 2) exciter fault, 3) power supply fault, 4) RF power module fault, 5) high reflected/forward power, 6) reflected power emergency, or 7) lightning. Once the fault condition is removed, the fault circuitry must be reset. If a power supply fault is encountered, the transmitter AC power must be disconnected to remove the fault condition (refer to **POWER SUPPLY FAULT RESET** in the following text). To reset the fault circuitry, depress the **RESET** switch. The fault circuitry will be reset.

3–37. **POWER SUPPLY FAULT RESET.**

3–38. If a power supply fault is encountered, ac power must be disconnected from the transmitter to clear the fault. To reset a power supply fault, proceed as follows:

1. Operate the rear–door **ac ON/OFF** switch to off.
2. Operate the rear–door ac on/off switch to on.
3. Depress the **RESET** switch.

3–39. **OVER-CYCLE OFF.**

3–40. The transmitter controller is equipped with an on/off cycle counter circuit. The circuit is designed to monitor transmitter on/off cycles. If the transmitter is operated on/off seven times within 15 seconds, the transmitter will automatically operate to OFF. The power level or OFF switch/indicators will not respond. To operate the transmitter to ON, proceed as follows:

1. Do not depress any power level switch/indicators or the **OFF** switch/indicator for approximately 30 seconds. This allows the circuit to reset.
2. Depress the desired power level switch/indicator.

3–41. **OVER-MODULATION PWM MUTE.**

3–42. The transmitter is protected from modulation levels above 150% by an over–modulation circuit. If the transmitter modulation increases to a level above 150%, the PWM signal will be muted. This will mute the output power and prevent damage to the transmitter power supply modules.

3–43. **TRANSMITTER MONITOR.**

3–44. The **TRANSMITTER MONITOR** is designed to present the operating status of: 1) the exciter, 2) the RF power modules, 3) the power supply, 4) the antenna, 5) the remote control, 6) antenna conflict conditions, 7) lightning conditions, 8) interlocks, 9) foldback conditions, and 10) over–temperature conditions. Use the information presented in Table 3–2 to determine the status of the transmitter components and operating conditions.

3–45. **BATTERY TEST.**

3–46. The battery test and battery OK indicator check the ECU battery backup system. To check the ECU battery, depress the battery test switch. The battery OK indicator will illuminate to indicate an acceptable battery voltage. If the battery OK indicator does not illuminate, replace the battery.

3-47. **CONTROLLER PWM MUTE INDICATOR.**

3-48. The PWM mute indicator illuminates to indicate when the power control PWM signal is muted. The power control PWM signal is muted during: 1) lightning conditions, 2) an exciter fault, 3) reflected power emergency conditions, 4) an open remote control fail-safe, or 5) a transmitter mute control signal.

3-49. **CONTROLLER REMOTE FAIL-SAFE INDICATOR.**

3-50. The controller remote fail-safe indicator illuminates to indicate the remote control unit is enabled. The indicator will extinguish when the remote control unit is disabled.

3-51. **EXCITER LOCK INDICATOR.**

3-52. The exciter circuit board lock indicator illuminates to indicate when the exciter is locked to the programmed carrier frequency. The indicator will extinguish when the exciter is unlocked from the programmed carrier frequency.

3-53. **EXCITER +5V/+15V/-15V INDICATORS.**

3-54. The exciter circuit board +5V, +15V, and -15V indicators display the status of the operating potentials from the ECU power supply. The +5V, +15V, and -15V indicators will illuminate to indicate the +5 volt, +15 volt, and -15 supplies are operational.

3-55. **STEREO EQUALIZATION INDICATORS.**

3-56. The stereo circuit board equalization 1 indicator illuminates to indicate when equalization circuit 1 is selected. The stereo circuit board equalization 2 indicator illuminates to indicate when equalization circuit 2 is selected.

3-57. **RF POWER MODULE INDICATORS.**

3-58. The RF power module indicators are designed to present the operating status of the power amplifier circuit boards and the modulator circuit board. Use the information presented in Table 3-3 to determine the status of the power amplifier circuit boards and the modulator circuit board.

3-59. **POWER SUPPLY INDICATORS.**

3-60. On AM-5E models, the power supply indicators on the transmitter lower front-panel are designed to present the operating status of the power supply circuit boards. The AM-5E transmitter is equipped with power supply 1-2 and 3-4. The indicators illuminate to indicate a failure in a power supply.

3-61. **EXCITER NEGATIVE LIMITER INDICATOR.**

3-62. The exciter circuit board negative limiter indicator displays the status of the exciter negative limiter circuit. The indicator will illuminate to indicate the negative limiter circuit is enabled. The indicator is factory adjusted to illuminate at approximately 94% negative modulation.

3-63. **HIGH/LOW AC LINE CONDITIONS.**

3-64. The transmitter is equipped with an ac line monitor. The monitor will deenergize the transmitter in the event the ac power line is below 190 Volts or above 260 Volts. If this condition occurs: 1) the transmitter output power will be disabled and 2) a no fault or emergency condition will be generated. The transmitter will re-energize when the high/low ac line condition is removed.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section presents the theory of operation for the Broadcast Electronics AM-2.5E/AM-5E transmitters.

4-3. The following text presents the AM-2.5E/AM-5E transmitter overall theory of operation. The transmitter is divided into modular components for the discussion. The modular components consist of the: 1) exciter/control unit (ECU), 2) output network, 3) RF power module, 4) RF combiner, and 5) power supply. The ECU, RF power module, and power supply are presented in further detail by the publication sections at the end of this manual.

4-4. Figures 4-1 and 4-2 present the AM-2.5E and AM-5E block diagrams. Figure 4-1 presents the AM-2.5E block diagram. Refer to Figure 4-1 and the AM-2.5E overall schematic diagram in SECTION VII as required for the following discussion. Figure 4-2 presents the AM-5E block diagram. Refer to Figure 4-2 and the AM-5E overall schematic diagram in SECTION VII as required for the following discussion.

4-5. FUNCTIONAL DESCRIPTION.

4-6. ECU.

4-7. **GENERAL.** The transmitter ECU (exciter/control unit) is a modular assembly containing plug-in stereo, exciter, controller, and extender circuit board assemblies. A forward power meter is provided to monitor the transmitter forward output power. A reflected power/primary ac power meter provides reflected power and primary ac voltage indications. The ECU switch and display circuitry is contained on switch and display circuit boards. Power for the ECU is provided by a modular switching power supply unit.

4-8. **STEREO CIRCUIT BOARD.** The ECU stereo circuit board consists of C-QUAM AM stereo circuitry. C-QUAM AM stereo is a mode of AM stereo transmission utilizing amplitude modulated (L+R) information and independently quadrature modulated stereo (L-R) information. The results produce a stereo transmission system compatible with mono receivers.

4-9. The stereo circuit board is equipped with four modes of operation: 1) mono left, 2) mono right, 3) mono L+R, and 4) stereo. Configuring the circuit board to monophonic operation is accomplished by: 1) operating the circuit board to the mono left, mono right, or mono L+R mode or 2) removing the stereo circuit board. The circuit board is equipped with two equalization circuits. The circuits allow the transmitter to be configured for two different antenna patterns such as for a day pattern and a night pattern.

4-10. The stereo circuit board operates in association with the ECU exciter circuit board to provide RF drive to the RF power modules. The stereo circuit board receives left and right channel audio and an unmodulated TTL level RF signal at 4 times the carrier frequency from the exciter circuit board. The stereo circuit board outputs a TTL level RF signal to the exciter circuit board.

4-11. **EXCITER CIRCUIT BOARD.** The ECU exciter circuit board is a modular plug-in exciter assembly. The circuit board operates in association with the stereo circuit board to produce a C-QUAM AM stereo RF output. Instrumentation amplifiers provide balanced left and right channel transformerless audio inputs.

4–12. The exciter circuit board generates: 1) a PWM (pulse–width–modulation) signal and 2) an RF carrier frequency signal. The 122 kHz to 135 kHz PWM signal is routed for application to the modulator circuit boards in the RF power modules. The RF carrier frequency signal is applied to the power amplifier circuit boards in the RF power modules. The exciter carrier frequency is established by a digital frequency synthesizer. The synthesizer is a phase–locked–loop circuit which provides extremely accurate and reliable carrier frequency operation.

4–13. **CONTROLLER CIRCUIT BOARD.** All transmitter control operations are directed by the ECU controller circuit board. The controller circuit board is designed with CMOS control and monitoring circuitry.

4–14. The controller circuit board is designed with two interlock circuits. A transmitter external interlock is provided such as for a test load. An antenna interlock circuit is provided to prevent the transmitter from operating into an incorrect antenna.

4–15. The transmitter power is controlled by a power control circuit. The circuit allows the transmitter to be operated at five power levels. A power trim circuit allows the transmitter power to be increased or decreased as required. A high reflected power detection circuit, a high forward power detection circuit, and a high temperature detection circuit operate in association with the power control circuit to foldback the transmitter power during high reflected power, high forward power, and high temperature conditions. In addition, a lightning detector circuit is provided to mute the transmitter when lightning is present at the antenna.

4–16. Several monitoring and display circuits provide information on transmitter operating conditions. An RF power module status circuit displays: 1) if a module is removed for maintenance or 2) if a power module fault has occurred. A power supply status circuit displays: 1) if a power supply circuit board is removed for maintenance or 2) if a power supply fault has occurred. An exciter status circuit indicates if a fault has occurred in the exciter. An antenna status circuit displays: 1) 1.2 : 1 VSWR conditions, 2) high reflected power conditions, and 3) emergency reflected power conditions.

4–17. Additional display circuits include: 1) remote, 2) conflict, 3) lightning, 4) interlock, 5) over–temperature, and 6) reset. A remote indicator displays the status of the remote control system. A conflict indicator illuminates to indicate an incorrect power level is selected for operation into an antenna. A lightning indicator illuminates to indicate the presence of lightning at the transmitter output. An interlock indicator displays the status of the internal and external interlock. An over–temperature indicator illuminates to indicate a transmitter temperature greater than 70 degrees C. A reset indicator illuminates to indicate a transmitter fault has occurred. Transmitter faults include: 1) exciter failure, 2) power supply failure, 3) RF power module failure, 4) high reflected power conditions, 5) reflected power emergency conditions, 6) over–temperature conditions, 7) lightning conditions, and 8) 1.2:1 VSWR conditions.

4–18. **POWER SUPPLY.** DC operating potentials for the ECU assembly is provided by a modular switching power supply unit. The unit provides +5V, +15V, and –15V dc operating potentials for the ECU circuit boards. +5V, +15V, and –15V indicators are provided on the exciter circuit board.

4–19. **RF POWER MODULE.**

4–20. An RF power module is a plug–in assembly containing two RF amplifier circuit boards and a modulator circuit board. Each RF power module is designed to produce 1375 watts of RF power. Two RF power modules are contained in a power block. The AM–2.5E transmitter is equipped with 1 power block. The AM–5E transmitter is equipped with 2 power blocks.

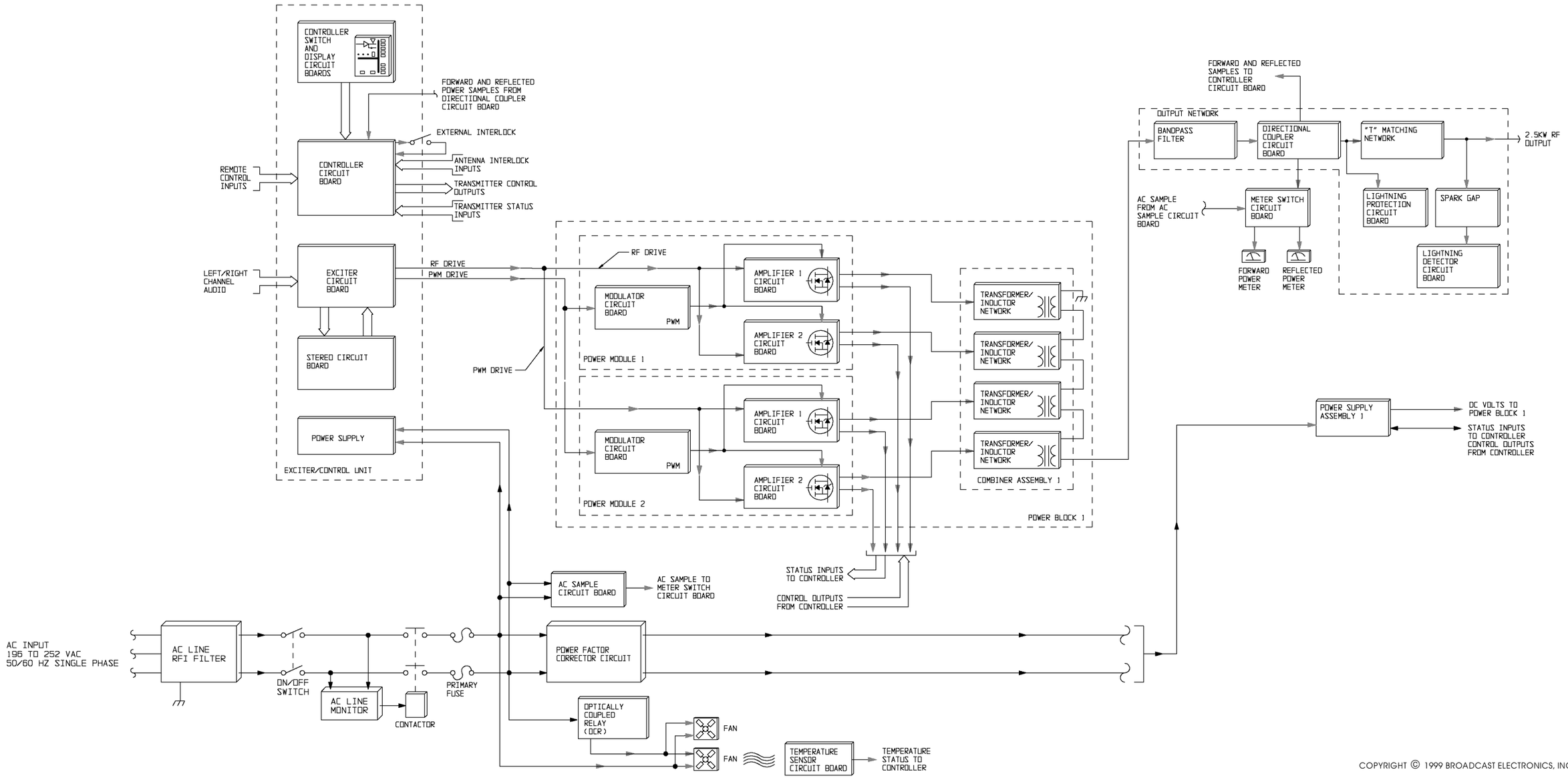

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FIGURE 4-1. AM-2.5E BLOCK DIAGRAM
(4-3/4-4)

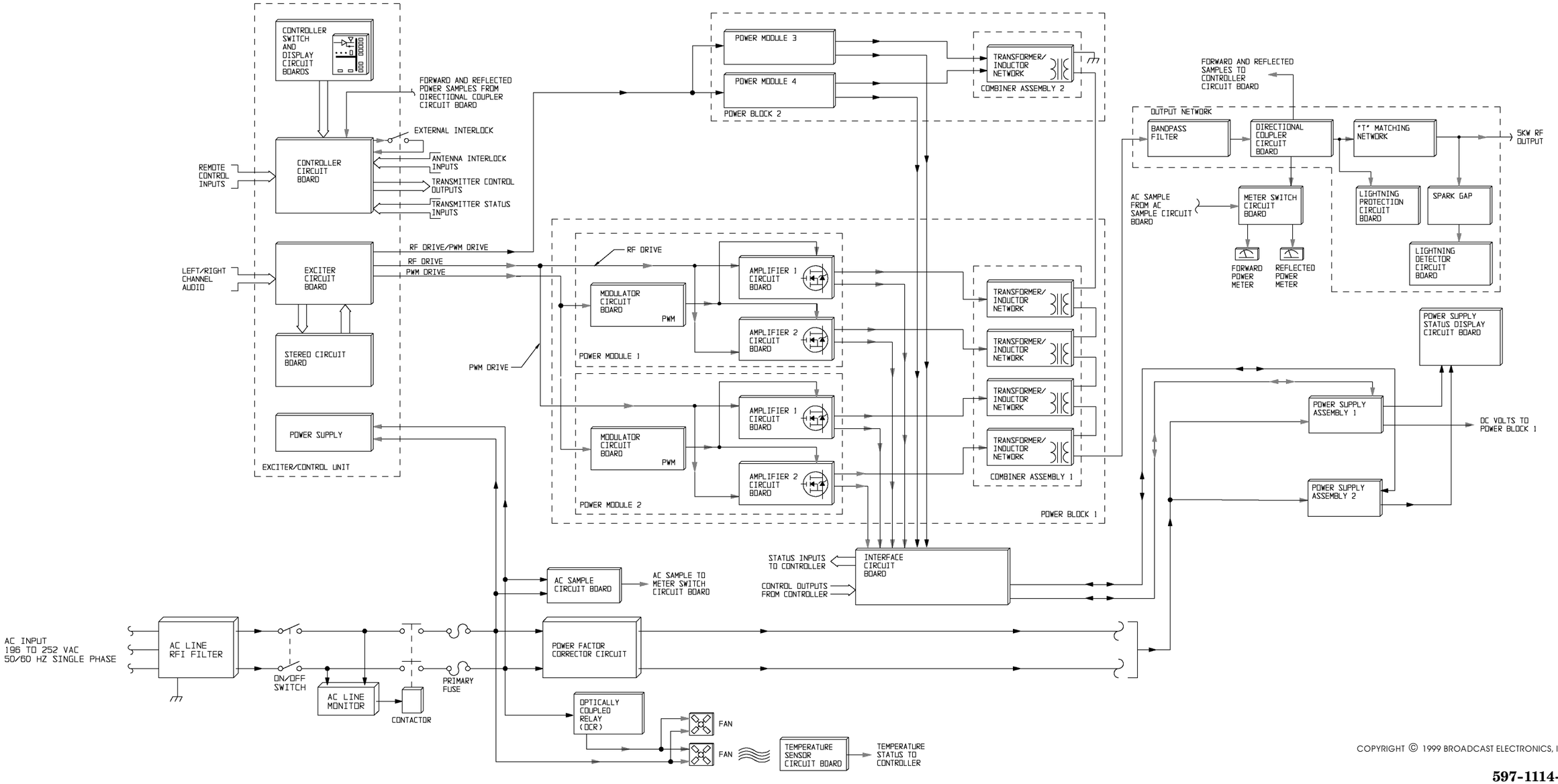

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FIGURE 4-2. AM-5E BLOCK DIAGRAM
(4-5/4-6)

4–21. The modular design of the RF power modules allow the modules to be removed from the transmitter for maintenance. The remaining power modules will provide power to maintain on–air operation.

4–22. The PWM signal from the exciter circuit board is applied to the modulator circuit board. The modulator circuit board is designed to amplify and convert the PWM signal to a dc voltage which varies at an audio rate. The output of the modulator circuit board is applied to the RF amplifier circuit boards. Four indicator circuits monitor and display the status of the: 1) PWM drive signal, 2) B+ dc supply, 3) modulator fault conditions, and 4) blown fuse conditions.

4–23. The RF amplifier circuit boards are designed with Class E amplifier technology and MOSFET power transistors. The circuit board operates from: 1) the varying dc voltage from the modulator circuit board and 2) the RF drive signal from the exciter circuit board. The RF drive signal from the exciter circuit board and the varying dc voltage from the modulator are applied to a push–pull power MOSFET transistor amplifier circuit. The amplifier circuit is designed to output approximately 687.5 watts of RF power. A fault detection circuit monitors amplifier operation for fault conditions.

4–24. **RF COMBINER.**

4–25. Power from each RF amplifier circuit board is applied to a star combiner network. The combiner components are located on the rear panel of each power block. The star combiner network consists of individual transformer and inductor networks for each amplifier circuit board. The combiner accepts RF power from each RF power module to produce the rated RF output power.

4–26. In addition to combining the RF power from the RF power modules, the combiner design allows one or more RF power modules to be removed from the transmitter for maintenance. The remaining RF power modules will continue to operate to maintain on–air operation. This is accomplished without the use of dummy modules or bypass switches.

4–27. **OUTPUT NETWORK.**

4–28. The output network is a modular assembly designed to match the transmitter impedance to the antenna. The assembly consists of a: 1) bandpass filter, 2) directional coupler circuit board, 3) T–matching network, 4) lightning protection circuit board, and 5) a lightning detection circuit board.

4–29. The bandpass filter is an eight element LC filter designed to attenuate all harmonic frequencies to FCC, DOC, and CCIR levels. The directional coupler circuit board consists of a circuit designed to sample the transmitter RF output. The circuit board generates both forward and reflected power samples for application to the controller circuit board. The “T” matching network consists of an LC network. The network is designed to match the transmitter impedance to the antenna.

4–30. A lightning protection circuit board is provided to protect the transmitter circuitry from direct lightning potentials. The circuit protects the transmitter by shunting lightning potentials to ground. The lightning detector circuit board is designed to mute the transmitter RF output during the presence of a lightning potential. The lightning detector circuit board is controlled by a spark gap. The circuit will respond to potentials of 1500 volts in AM–2.5E models and 2100 volts in AM–5E models. This prevents the transmitter from muting during near–by lightning activity.

4-31. **POWER SUPPLY.**

4-32. A single phase source of 196 to 252 volts ac 50/60 Hz is required to operate the transmitter. The power source is routed through an RFI filter to prevent the coupling of RFI components into or out-of the transmitter. A rear-door ac on/off switch provides ac power control and disconnects all ac power to the transmitter when the door is opened. The ac line is monitored for high/low conditions by an ac line voltage monitor. The transmitter primary ac power will be interrupted if the ac line is above 260 volts or below 195 volts. Primary fuses protect the transmitter from over-current conditions. A power factor corrector circuit modifies the ac line impedance to provide a power factor of approximately 0.9.

4-33. The ac line voltage is sampled at the ac sample circuit board. The sample circuit board provides an ac line voltage sample for application to the meter switch circuit board.

4-34. **POWER SUPPLY CIRCUIT BOARD.** DC operating potentials for the RF power modules are provided by power supply circuit boards. One power supply circuit board provides dc operating potentials for one power block. The AM-2.5E transmitter is equipped with 1 power supply circuit board. The AM-5E transmitter is equipped with 2 power supply circuit boards.

4-35. The power supply circuit board consists of a: 1) switching power supply circuit, 2) conventional bridge rectifier circuit, 3) fault detection circuit. The switching power supply circuit operates directly from the ac power source. No primary ac power transformer is included in the circuit. An SCR controlled bridge rectifier circuit and a switching regulator circuit converts ac potentials to dc potentials at a desired voltage. Control of the dc output voltage is provided by a power control PWM signal from the controller.

4-36. A transformer with five secondary windings provide low-voltage ac potentials to five full-wave bridge rectifiers circuits. The circuits provide dc operating potentials for the power supply circuit board and RF power module circuitry.

4-37. The power supply design provides the RF power modules with a constant and stable dc operating supply by not responding to fluctuations or surges in the ac line voltage. The supply will produce a constant dc voltage during high/low ac line voltage or surge conditions.

4-38. The switching power supply output voltage is controlled by a power control PWM signal from the controller circuit board. Current reduction at turn-on is controlled by a soft-start circuit. The circuit is designed to generate start pulses synchronized to the ac line phase to slowly bias the SCR bridge rectifier circuit on during initial turn-on operations. The switching regulator circuitry is monitored for proper operation by an overvoltage and loss-of-PWM signal circuitry. The switching regulator operation is performed by IGBT (insulated-gate-bi-polar-transistors) transistors. The IGBTs are designed to provide extremely reliable and efficient operation.

4-39. **METERING.**

4-40. The transmitter metering consists of the forward power meter, reflected power/primary ac input voltage meter, and the exciter modulation meter. Forward power information is presented on the forward power meter. Reflected power/primary ac input voltage information is presented on the reflected power/primary ac input voltage meter. The meters are controlled by three-position switches. Forward and reflected power samples for the metering circuitry are provided by the directional coupler circuit board. An ac sample for the reflected power/primary ac input voltage meter is provided by an ac sample circuit board.

4-41. Monitoring of exciter operations is provided by the exciter modulation monitor. Two 30 segment multi-color bar graph displays present L/L+R and R/L-R information. A X10 mode allows the monitoring of low level signals such as the pilot tone.

4-42. **COOLING FANS.**

4-43. The AM-2.5E/AM-5E transmitters are equipped with 2 cooling fans. The fans are controlled by an optically-coupled-relay. In the fans provide 500 CFM of cooling air for the transmitter. A temperature sensor circuit board monitors the transmitter air temperature and provides status information to the controller.

4-44. **INTERFACE CIRCUIT BOARD (AM-5E ONLY).**

4-45. On AM-5E models, communication between the controller, RF power modules, and the power supply circuit boards is provided by an interface circuit board. The circuit board: 1) routes status information from the RF power modules and power supply circuit boards to the controller and 2) routes control signals from the controller to the RF power modules and the power supply circuit boards.

4-46. DETAILED DESCRIPTION.

4-47. **POWER SUPPLIES.**

4-48. The AM-2.5E/AM-5E transmitters require a 196V to 252V ac single phase power source (refer to Figure 4-3). The following text presents ac power source required for each transmitter.

TRANSMITTER	AC POWER SOURCE
AM-2.5E	196V to 252V ac 50/60 Hz single phase at 75 Amperes.
AM-5E	196V to 252V ac 50/60 Hz single phase at 125 Amperes.

4-49. **AC INPUT CIRCUITRY.**

4-50. When the transmitter fused disconnect is closed, single phase ac power is routed through an RFI filter to rear-door ac input switch S1. The filter prevents the coupling of RFI components into or out-of the transmitter. S1 is the transmitter primary ac power safety device. S1 disconnects primary ac power when the transmitter rear door is opened.

4-51. The ac line is monitored for high/low conditions by an ac line voltage monitor. The monitor controls ac power contactor K2. The transmitter primary ac power will be interrupted if the ac line is above 260 volts or below 190 volts. Overload protection for the transmitter is provided by fuses F1 and F2.

4–52. A power factor corrector circuit consisting of inductors L3/L4 and capacitor C1 modifies the ac line impedance to provide a power factor of approximately 0.9. C1 is switched into the circuit during soft–start by the power factor corrector relay circuit board. The relay circuit board is controlled by a circuit on the power supply circuit board. Metal–Oxide–Varistors MOV1, MOV2, and MOV3 protect the transmitter power supply circuitry from ac line voltage surge potentials. AC power from the MOVs is applied to the following circuits: 1) the ECU power supply assembly, 2) the transmitter flushing fans, 3) low voltage power supply transformer T1, 4) the power supply circuit board, and 5) the ac sample circuit board.

4–53. **ECU POWER SUPPLY ASSEMBLY.**

4–54. The ECU power supply is a 40W modular switching power supply unit. The power supply assembly provides regulated +5V, +15V, and –15V operating potentials for the ECU circuit boards.

4–55. The power supply for the ECU controller circuit board is backed–up by a 9V battery. During an ac power failure, the battery will maintain the transmitter operating configuration stored in the controller logic circuitry. Once power is returned to the transmitter, the transmitter will automatically resume operation in the configuration appearing prior to the ac failure. If an extended ac power failure occurs, the transmitter will be operated to off by an ac loss/auto shutdown circuit.

4–56. The battery back–up system requires a standard 9V battery. The battery will maintain the controller logic for several months. Replace the battery approximately once a year to ensure proper transmitter operation during ac power failure conditions.

4–57. **TRANSMITTER FLUSHING FANS.**

4–58. Cooling air for the transmitter circuitry is provided by flushing fans B1 and B2. Control of the fans is provided by optically–coupled–relay (OCR) K1.

4–59. The flushing fans are controlled by a signal from the ECU controller circuit board. When a power level switch/indicator is depressed, the controller circuit board will enable optically–coupled relay (OCR) K1 to energize the fans. The fans will operate during transmitter operation.

4–60. **LOW-VOLTAGE POWER SUPPLY TRANSFORMER.**

4–61. Low–voltage operating potentials for the transmitter power supply circuit board and RF power modules are provided by ac power transformer T1. Transformer T1 consists of: 1) one primary winding and 2) five secondary windings. The secondary windings provide low–voltage ac potentials for application to five rectifier circuits on the power supply circuit board. The circuitry provides dc operating potentials for the power supply and the RF power modules.

4–62. **POWER SUPPLY CIRCUIT BOARD.**

4–63. Low and high voltage dc operating potentials for the RF power modules are provided by the power supply circuit board. The AM–2.5E is equipped with 1 power supply circuit board. The AM–5E is equipped with 2 power supply circuit boards. Each power supply circuit board provides dc operating potentials for two RF power modules.

4–64. The power supply circuit board is equipped with: 1) a switching power supply circuit designed to produce high–voltage operating potentials and 2) conventional rectifier circuitry designed to produce low–voltage operating potentials. The following text describes the circuitry.

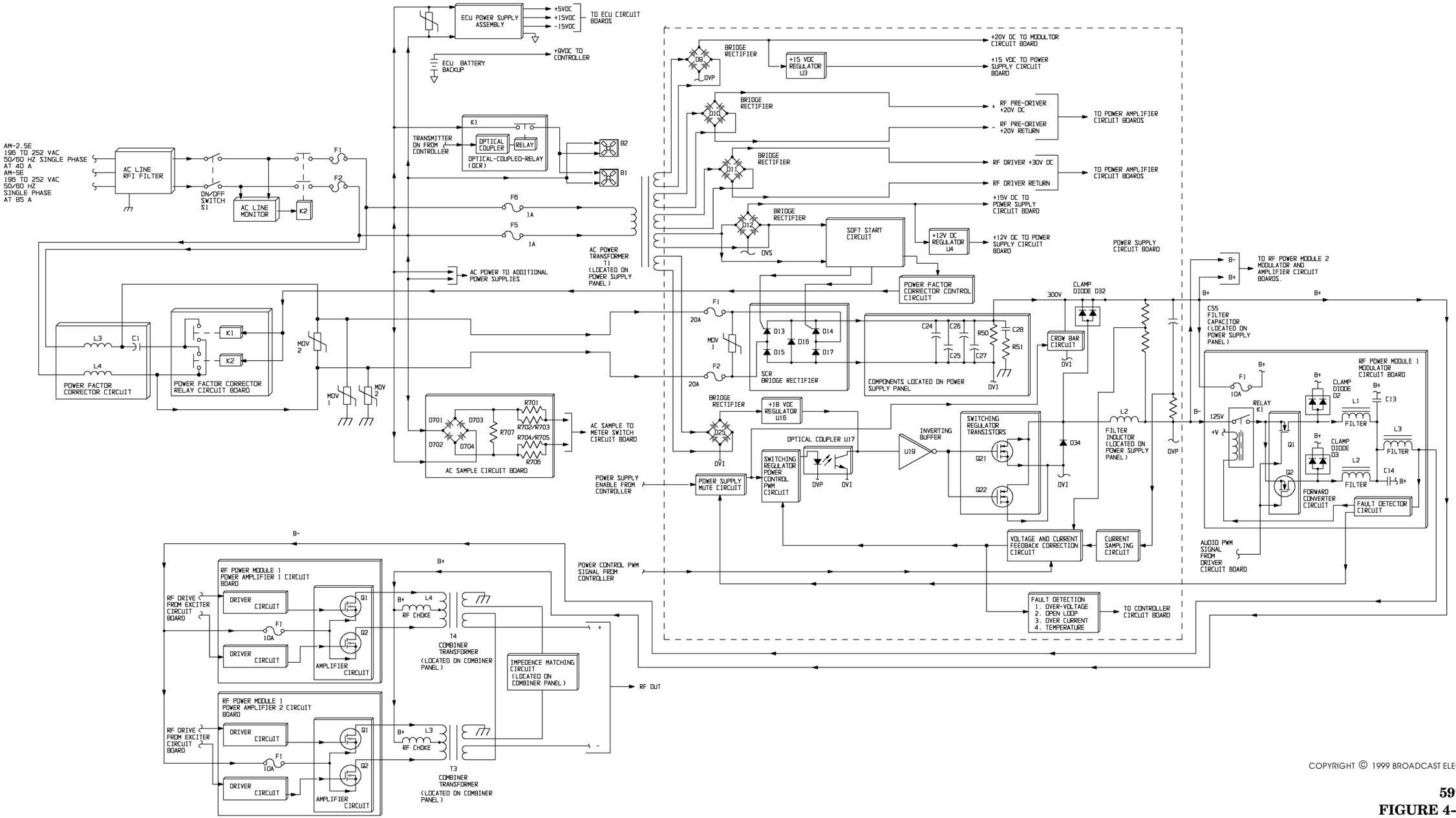

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FIGURE 4-3.
AM-2.5E/AM-5E POWER SUPPLY SIMPLIFIED SCHEMATIC
(4-11/4-12)

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4-65. **CONVENTIONAL RECTIFIER CIRCUITRY.** +30V and +20V dc operating potentials for the RF power modules are provided by four conventional rectifier circuits. AC power from a winding of ac power transformer T1 is applied to bridge rectifier D9. D9 rectifies the ac potential into an unregulated +20 volt ac supply for application to: 1) the modulator circuit board and 2) to regulator U3. U3 is a +15 volt dc regulator. The output of U3 routed for application to the components on the power supply circuit board.

4-66. AC power from a second winding of transformer T1 is applied to bridge rectifier D10. D10 rectifies the ac potential into an unregulated +20V dc supply for application to the RF power module power amplifier circuit boards. AC power from a third winding of power transformer T1 is applied to bridge rectifier D11. D11 rectifies the ac potential into an unregulated +30V dc supply for application to the RF power module power amplifier circuit boards. AC power from a fourth winding of power transformer T1 is applied to bridge rectifier D12. D12 rectifies the ac potential into an unregulated +15V dc supply for application to: 1) the power supply circuit board and 2) regulator U4. U4 is a +12 volt dc regulator. The output of U4 routed for application to the components on the power supply circuit board.

4-67. An ac sample from a winding of T1 is also routed to a soft-start circuit. The soft-start circuit is designed to generate control pulses synchronized with the ac line phase. A complete description of the soft-start circuit is presented in Rectifier/Soft-Start Circuit (refer to the following text).

4-68. **SWITCHING POWER SUPPLY CIRCUIT.** AC power from the power factor corrector circuitry is applied to fuses F1 and F2 on the power supply circuit board. The fuses protects the power supply circuitry from overload conditions. Metal-Oxide-Varistor MOV1 prevents damage to the switching power supply circuit from ac line voltage surge potentials.

4-69. **Rectifier/Soft-Start Circuit.** The ac line is full-wave rectified by an isolated SCR controlled bridge rectifier circuit. The SCR bridge rectifier consists of diodes D15 through D17 and SCRs D13 and D14. The rectifier is controlled by a soft-start circuit. The soft-start circuit is designed to: 1) determine when the ac line waveform crosses the 0 volt axis and 2) generate short duration pulses in synchronization with the ac line 0 volt crossings. The pulses are amplified and applied to the gates of the rectifier circuit SCR components to slowly bias the components on during initial start operations. This operation eliminates the component stress at power-on by limiting the supply in-rush current. The rectifier will output an unregulated and unfiltered dc supply at approximately 300V to an inductor and capacitor filter network.

4-70. The output of the rectifier circuit is applied to afilter consisting of capacitors C24 through C27. The output of the LC filter generates a 300V main operating supply for the RF power modules. The positive leg of the dc supply is the common for the dc voltages contained in the switching regulator circuitry and the RF power modules. The negative leg of the supply is regulated and controlled to generate the required operating potentials for the RF power modules.

4-71. **Switching Regulator Circuit.** The main operating supply is regulated by a buck-type switching regulator circuit. The switching regulator circuit generates the negative leg of the B supply. The regulator circuit consists of: 1) a power supply mute circuit, 2) a switching regulator power control PWM circuit, 3) optical coupler U17 4) inverting buffer U19, and 5) switching regulator transistors Q21 and Q22.

4–72. A dc operating supply for optical coupler U17 and buffer U19 is generated by bridge rectifier D25. D25 full–wave rectifies an ac potential from ac transformer T1 into an unregulated +20V supply. The supply is applied to +18V regulator U16. U16 outputs a +18V supply which is further regulated to a 5V operating potential by a resistive divider and a zener diode. The 5V supply is applied to optical couplers U17 and buffer U19.

4–73. Control of the regulator circuit is provided by the switching regulator power control PWM circuit, a current sampling circuit, and a voltage and current feedback correction circuit. Together, the circuits function in a closed–loop to control regulator operation. The switching regulator power control PWM circuit is designed to produce two out–of–phase square wave signals with varying duty cycles. The duty cycle is varied in response to the signal from the correction circuit. The output of the control circuit is applied to optical coupler U17. U17 provides isolation between two different ground circuits. The output of the coupler is applied to gate drive inverting buffer U19. The output of U19 is applied to the gates of IGBT switching regulator transistors Q21 and Q22. Q21 and Q22 are operated to on for a specific time duration to regulate the output voltage for varying load conditions.

4–74. The regulator circuit output voltage is directed by a 1 kHz power control PWM signal from the controller. The signal is applied to the correction circuit on the power supply circuit board. In addition to the 1 kHz PWM signal, a voltage and current sample from the regulator output is routed to the voltage and current feedback correction circuit. The correction circuit responds by evaluating the output samples and the power control signal and generating a correction voltage. The voltage is applied to the switching regulator power control PWM circuit to adjust the output of the regulator.

4–75. The output of the transistor switching regulator circuit is applied to filter inductor L2. Protection of the transistors from switching transients during turn on/off operation is provided by clamp diode D32. Clamp diode D32 protects the transistors by limiting positive peak voltages. The output of the regulator circuit is applied to circuitry on RF power module modulator circuit boards.

4–76. **MODULATOR CIRCUIT BOARD.**

4–77. The B– leg from the power supply circuit board is routed to circuitry on the RF power module modulator circuit board. The B– leg is applied to relay K1 on the modulator circuit board. K1 is controlled by a fault detector circuit. The relay is designed to immediately remove the supply from the forward converter circuit during a fault condition. The output of the relay is applied to the converter circuit.

4–78. Transistors Q1 and Q2 are the switching devices in the forward converter circuit. The circuit is controlled by the audio PWM signal from the driver circuit board. The circuit operates by switching the applied B– leg at a 122 kHz to 135 kHz rate. The duty cycle of the PWM signal is 40% with no modulation. The output of the forward converter circuit is applied to an LC PWM low–pass filter network. Protection of the transistors from switching transients is provided by clamp diodes D2 and D3. D2 and D3 limit the positive peak transients appearing on the output.

4–79. A sample of the modulator circuit output is routed to a fault detector circuit. The circuit will respond to a fault by: 1) routing a control signal to relay K1 to disconnect the amplifier circuit from the B– supply and 2) route a control signal to the power supply circuit board to momentarily mute the power supply. After a short delay, a control signal is routed to the power supply to enable the supply to provide power to RF module 2.

4–80. The B+ leg of the supply is also routed to the modulator circuit board. The B+ leg is applied to fuse F1 and is the common for the dc voltages contained in the power supply circuit board switching regulator circuit and the RF power modules. F1 is provided to protect clamp diodes D2 and D3 from overcurrent conditions.

4-81. **POWER AMPLIFIER CIRCUIT BOARDS.**

4-82. The power amplifier circuit board circuitry is configured in a Class E switching amplifier design. A Class E design is recognized by: 1) the application of the B+ power supply through an RF choke to combining transformers and 2) the use of only two MOSFET power transistors in a push-pull configuration per amplifier. The circuitry on each amplifier circuit board is identical, therefore only amplifier circuit board 1 will be discussed.

4-83. The dc voltage output of the modulator circuit board is routed to the power amplifier 1 circuitry through fuse F1. F1 protects the amplifier circuitry from over-current conditions. The supply is applied to a switching amplifier circuit consisting of transistors Q1 and Q2. The B+ leg of the main dc supply from the power supply circuit board is applied to Q1 and Q2 through choke L4 to a primary center tap of combiner transformer T4. RF choke L4: 1) prevents RF signals from entering the dc supply and 2) functions as the last series inductor for the PWM low-pass filter on the modulator circuit board.

4-84. The amplifier circuit is driven by the RF drive signal from the exciter circuit board. The RF drive signal consists of a square-wave signal at the carrier frequency. The signal is amplified prior to application to Q1 and Q2 by a driver circuit.

4-85. The amplifier circuit functions by switching the dc voltage from the modulator circuit board at an RF rate to produce a monophonic or a C-QUAM AM stereo signal at the programmed carrier frequency. The signal appears at the primary of combiner transformer T4. The RF signal is transferred to the secondary of T4 and routed to power amplifier 2 circuit board combiner transformer T3. The RF output signal from T4 is combined with the RF output signal from transformer T3 to generate a C-QUAM signal at approximately 1375 watts of carrier.

4-86. **SEQUENCE OF OPERATION.**

4-87. When transmitter switch S1 is closed, ac power is routed to contactor K2 and the ac line monitor. If the ac power line is between 190 and 260 volts, power from K2 is applied to: 1) the power factor corrector circuitry, 2) the ECU power supply, 3) fan control relay K1, 4) low-voltage ac power transformer T1, and 5) the ac sample circuit board. If the ac line voltage is not between 190 and 260 volts, the ac line monitor will open K2 and deenergize the transmitter. When ac power is applied to T1, a soft start circuit will detect the ac waveform. When this occurs, the power factor corrector control circuit will energize the relays on the power factor corrector circuit board to switch capacitor C1 in the circuit. This enables the power factor corrector circuitry to change the power factor to approximately 0.9. In response to the application of ac power with no error conditions, the following controller and RF power module indicators will illuminate green:

CONTROLLER INDICATORS

1. Exciter
2. Power Modules
3. Power Supply
4. Antenna
5. Mono or Stereo (depending on exciter mode of operation)
6. Exciter Circuit Board: 1) +15V, 2) -15V 3) Lock, and 4) +5V

RF POWER MODULE INDICATORS

1. PA 1 RF Drive
2. PA 2 RF Drive
3. PWM Drive

7. Stereo Circuit Board: 1) Mono L+R/Stereo/ Mono L/Mono R (depending on exciter mode of operation), 2) Equalization 1 or Equalization 2 (depending on antenna configuration)

4–88. A start sequence is initiated when a power level switch/indicator is depressed. Logic from the controller will enable optically–coupled–relay K1 to enable the flushing fans.

4–89. Logic from the controller will also enable the SCR controlled bridge rectifier circuit on the power supply circuit board. The B+ dc potential from the rectifier is applied to the inductor and capacitor filter networks on the power supply panel. Generation of the B– leg is provided by the IGBT switching regulator circuit.

4–90. Power output of the regulator is controlled by the PWM signal from the controller. The regulator will increase or decrease power as determined by the PWM signal. The output of the regulator is routed to the modulator circuit board. The modulator POWER indicator will illuminate if the B+ supply from the power supply circuit board is present. The modulated output from the modulator circuit board is routed to the power amplifier 1 and power amplifier 2 circuit board for amplification.

4–91. **RF CIRCUITRY.**

4–92. **EXCITER CIRCUIT BOARD.** Audio for application to the AM–2.5E/AM–5E transmitter is applied to the exciter circuit board (refer to Figure 4–4). The exciter circuit board is designed to: 1) process left/right channel or monaural audio to generate a Pulse–Width–Modulated (PWM) signal at 122 kHz to 135 kHz and 2) generate an RF signal using a frequency synthesizer, a phase modulator for IPM correction, and an RF driver network.

4–93. Left channel audio is applied to an RFI filter and a defeatable 10 Hz high–pass filter. The 10 Hz high–pass filter is provided to remove low frequency residual products from specific audio processing units. Balanced–to–unbalanced signal conversion is provided by an instrumentation amplifier. The output of the instrumentation amplifier is applied to a defeatable high frequency boost circuit. The high frequency boost circuit is provided to increase high frequency response to compensate for a Bessel filter in the PWM modulator. The output of the high frequency boost circuit is applied to an active PWM filter/equalizer and a mode switching circuit. The output of the PWM filter is routed for application to the stereo circuit board.

4–94. The mode switching circuit is designed to select the left or right channel for mono left or mono right operation. A summing amplifier is provided as a mono support circuit to increase the gain of the circuit 6 dB during mono operations. The output of the summing amplifier is applied to a 24 uS delay and limiter circuit. The delay circuit is provided for stereo equalization. The negative limiter is provided to limit negative modulation from 90% to 100%.

4–95. The output of the 24 uS delay and negative limiter is applied to: 1) a PWM circuit and 2) an IPM comparator and corrector circuit. The PWM circuit is designed to output a square wave signal in which the duty cycle changes in response to the applied audio level. The output of the PWM circuit is applied to a PWM driver circuit. The PWM driver circuit consists of parallel transistor drivers to lower the impedance and improve reliability.

4–96. The transmitter carrier frequency is generated by digitally programmed frequency synthesizer circuit. The frequency synthesizer is designed to output: 1) the carrier frequency to a mono/stereo select circuit, 2) a FcX4 (carrier frequency times four) signal for application to the stereo circuit board, and 3) a 25 Hz pilot signal for application to the stereo circuit board. A mono/stereo select circuit functions as an automatic mono/stereo select switch. If a stereo signal from the internal stereo circuit board or an external stereo generator is present, the exciter will be configured for stereo operation. If the stereo signal is not present, the circuit will configure the exciter for mono operation. The output of the mono/stereo select circuit is applied to the IPM (Incidental Phase Modulation) signal generator and modulator. The IPM signal generator is designed to produce a waveform similar to the signal produced by the RF amplifier circuitry. The IPM generator signal is out–of–phase with the signal generated by the RF power modules. The signal is applied to a modulator circuit which will generate a phase compensated RF signal at the carrier frequency. The phase compensation will effectively cancel the IPM generated in the RF circuitry.

4–97. The output of the IPM circuitry is applied to an RF driver network. The network consists of a high/low side driver and output drive transistors.

4–98. **STEREO CIRCUIT BOARD.** Left/right channel audio and an RF signal at FcX4 (carrier frequency times four) from the exciter circuit board is applied to the stereo circuit board. The stereo circuit board is designed to generate a TTL level RF signal. The circuit board contains identical left/right channel and equalization 1/2 circuitry. Therefore, only the left channel equalization 1 circuit will be discussed.

4–99. Left channel audio from the exciter circuit board is applied to the left channel equalization 1 circuit. The equalization circuit consists of 1) a state variable low–pass filter, 2) an 8 uS group delay section, and 3) a 4 uS group delay section. The circuit is designed to equalize frequencies to produce maximum separation.

4–100. The output of each equalization circuit is routed to an equalization and mono/stereo select circuit. The equalization circuit selects equalization 1 or equalization 2 as determined by the selected antenna pattern. The mono/stereo circuit selects the required signals for stereo, mono left, mono right, or mono L+R operation.

4–101. The output of the equalization and mono/stereo select circuits is applied to a summing amplifier network. The network functions as a matrix to generate the L+R and L–R stereo signals. The output of the summing amplifier network is applied to a digital switching modulator. The modulator accepts: 1) the L+R and L–R signals and 2) four RF out–of–phase signals at the carrier frequency. The modulator outputs two signals: 1) an AM modulated signal containing the L+R information and 2) a double–sideband–suppressed–carrier signal referenced to a 90 degree carrier. The signals are summed and amplified at U37 to produce a quadrature signal. The output of U37 is applied to a fourth order linear phase bandpass filter. The output of the filter is applied to an amplitude limiter circuit. The limiting operation produces the phase modulation (L–R information) component of the C–QUAM signal. The output of the limiter circuit is routed to the exciter circuit board.

4–102. **RF POWER MODULE.** The PWM and RF drive signals from the exciter circuit board are routed to the RF power modules. The RF power modules consist of a modulator circuit board and two RF amplifier circuit boards.

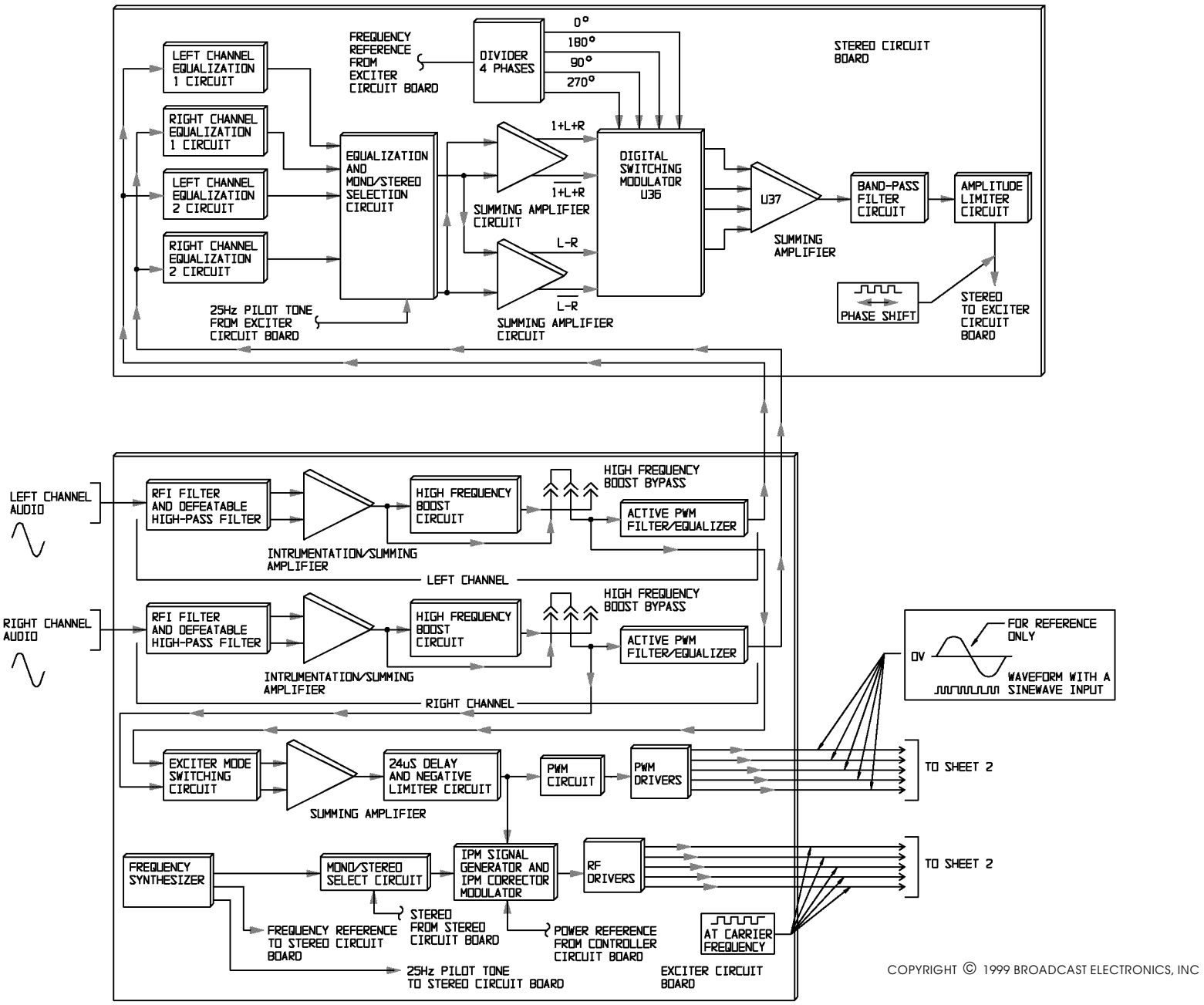

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FIGURE 4-4. AM-2.5E/AM-5E RF CIRCUITRY SIMPLIFIED SCHEMATIC (SHEET 1 OF 2)

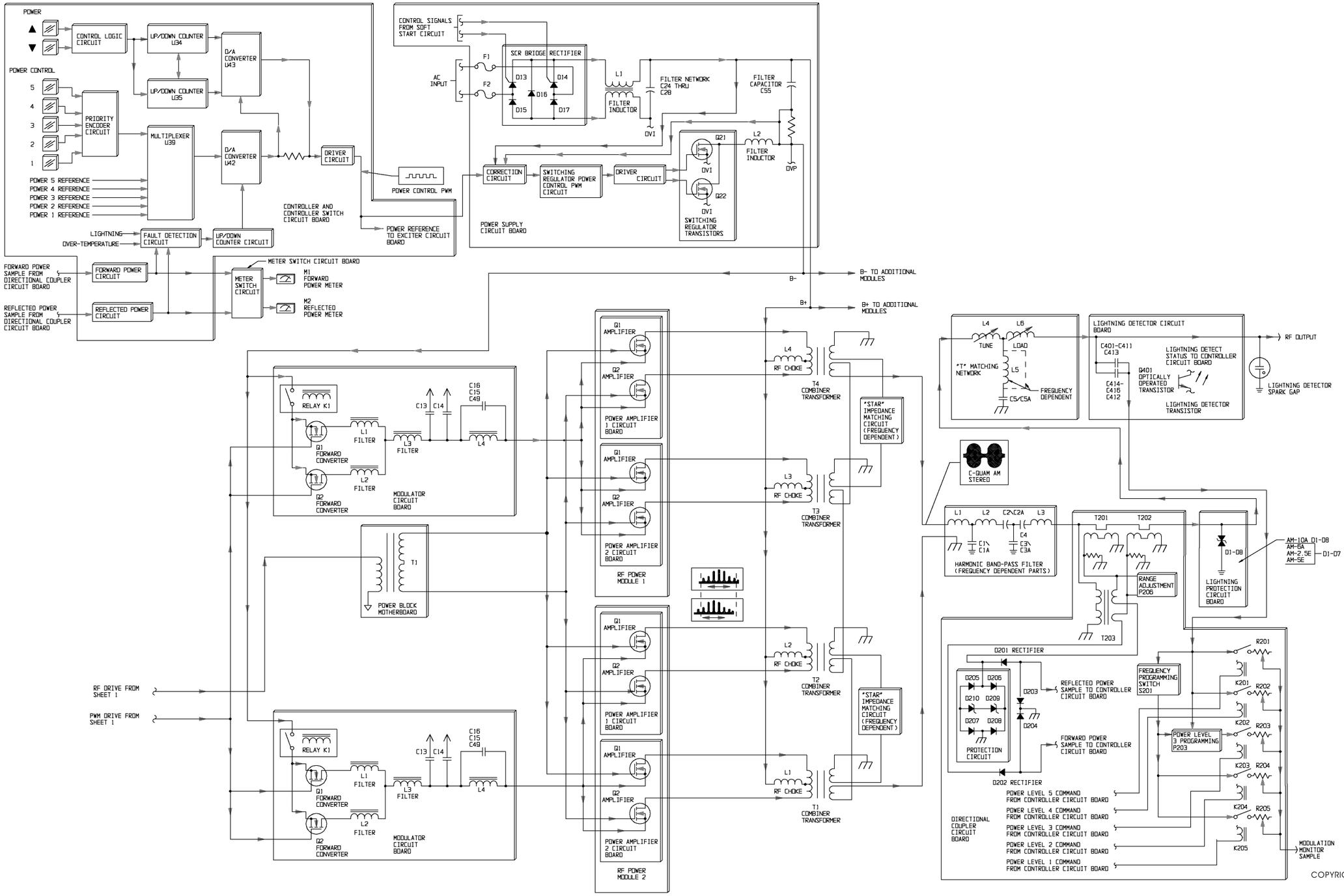

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FIGURE 4-4. AM-2.5E/AM-5E RF CIRCUITRY SIMPLIFIED SCHEMATIC (SHEET 2 OF 2)
(4–19/4–20)

4–103. **Modulator Circuit Board.** The modulator circuit board consists of a MOSFET forward converter circuit and a filter network. The forward converter circuit consists of MOSFET transistors Q1 and Q2. The filter network consists of inductors L1 through L3 and capacitors C13 through C16. A dc operating voltage for transistors Q1 and Q2 is provided by the power supply circuit board. The B– leg of the supply is routed through relay K1 to the transistors. K1 is provided to immediately terminate the supply during a modulator fault condition.

4–104. The PWM signal at a 15 volt level from the exciter circuit board is applied to the gates of MOSFET transistors Q1 and Q2. Q1/Q2 function to switch the B– leg at a 122 kHz to 135 kHz rate. The output from Q1/Q2 is applied to the LC low–pass filter network to convert the square–wave PWM signal to a dc voltage. The output from the filter will produce a 50 volt dc signal with: 1) a nominal PWM duty cycle of 40% and 2) no audio modulation. The dc voltage will vary from 0 to 125 volts with –100% to +150% modulation. The output of the filter network is applied to the drains of MOSFET amplifier transistors on the power amplifier circuit boards.

4–105. **Power Amplifier Circuit Boards.** The RF circuitry on the power amplifier circuit boards consists of a Class E MOSFET power amplifier circuit. Each power amplifier circuit board is designed to output approximately 350 watts. The power amplifier circuit boards are identical. Therefore, only power amplifier 1 will be discussed.

4–106. The MOSFET amplifier circuit is designed in a push–pull design Class E configuration. Class E power amplifier characteristics consist of: 1) the transistor drain–to–source voltage must be nominally zero immediately prior to the turn–on of the transistor and 2) the time slope of the drain–to–source voltage waveform must be nominally zero prior to the turn–on of the transistor. The Class E circuit results in: 1) lower device dissipation resulting in reduced transistor operating temperature which greatly increases component life, 2) an operating efficiency of 95% or greater, and 3) increased reliability when operated into VSWR conditions.

4–107. Additional characteristics of a Class E amplifier design is the application of dc power to the amplifier transistors. The B+ leg of the B supply is applied to RF choke L1. The choke is connected to the primary center tap winding of combiner transformer T1. The transistors are connected to the primary winding of the transformers.

4–108. Two signals are applied to the power amplifier 1 circuit board: 1) an RF square–wave signal from the driver circuit board and 2) a dc voltage from the modulator circuit board which varies at an audio rate. The RF square–wave signal at the carrier frequency is applied to the gates of MOSFETs Q1 and Q2. The varying dc voltage from the modulator circuit board is applied to the source of MOSFETs Q1 and Q2. Q1/Q2 operate in a push–pull configuration to develop approximately 350 watts of RF power at combiner transformer T1. The power at transformer T1 is combined with the 687.5 watts of RF power from power amplifier circuit board 2 to generate 1375 watts of RF power from the RF power module.

4–109. **RF COMBINER.** The RF combiner components are located on the rear–panel of each power block assembly. The combiner consists of a star combiner design. The star combiner contains an individual transformer, an RF choke, and an impedance matching circuit for each power amplifier circuit board. The impedance matching circuit consists of star inductors. The circuit presents the correct impedance when a module is removed from the chassis. This allows the transmitter to operate at an output power which is proportional to the modules removed from the power block chassis.

4–110. **HARMONIC BAND-PASS FILTER.** The output signal harmonic and spur frequencies are reduced to FCC, DOC, and CCIR levels by a band–pass filter. The filter consists of a fourth order LC network consisting of inductors L1 through L3 and capacitors C1 through C4. The components are located in the output network assembly and are frequency dependent. The output of the filter is routed to the directional coupler circuit board.

4–111. **DIRECTIONAL COUPLER CIRCUIT BOARD.** Transmitter forward and reflected power are sampled by a directional coupler circuit board. The directional coupler circuit board is designed to: 1) process the forward and reflected power samples for application to the controller circuit board and 2) calibrate the RF modulation monitor sample.

4–112. **Forward And Reflected Power Sample Circuit.** A voltage sample from the RF output is obtained by transformer T203. A current sample of the RF output is obtained by transformers T201 and T202. The current sample is converted to a voltage by a resistor network and applied to transformer T203. A voltage proportional to the square root of the forward power is obtained by summing the voltage from the secondary of T203 with the voltage sample from T201. A voltage proportional to the square root of the reflected power is obtained by summing the voltage from the secondary of T203 and with the voltage sample from T202. The forward power sample voltage is half–wave rectified by diode D202. The reflected power sample voltage is half–wave rectified by diode D201. Diodes D205 through D208 and zener diodes D209 and D210 protect the rectifier diodes from overvoltage conditions. The rectified forward and reflected power samples are routed for application to the controller circuit board. Programmable header J206 is provided to increase the adjustment range of the directional coupler circuitry. The header is programmed at the factory for the adjustment range required by the transmitter.

4–113. **Modulation Monitor Calibration Circuit.** A voltage sample for application to the modulation monitor calibration circuit is provided by the lightning detection circuit board. A sample from the RF output is obtained by a capacitor circuit and applied to a relay circuit on the directional coupler circuit board. The relay circuit is designed to select a voltage sample from a calibration potentiometer for application to the modulation monitor receptacle. The relays are controlled by power level 1 through 5 commands from the controller circuit board. Each relay circuit operates in an identical manner, therefore only the circuit for power level 5 will be explained.

4–114. A voltage is applied to the modulation monitor receptacle when the power level 5 command energizes relay K201. K201 applies a sample voltage to power level 5 modulation monitor calibration control R201. R201 is provided to obtain a 2 volt RMS sample to the modulation monitor receptacle. Frequency programming switch S201 is provided to compensate the RF sample for frequencies within the AM band for power levels 1 through 3. Power level programming switch P203 is provided to program the power level 3 circuit for low power range or high power range operation. The calibrated sample from potentiometer R201 is applied to the modulation monitor receptacle.

4–115. **T-MATCHING NETWORK.** Output matching to antenna loads for up to a VSWR condition of 1.4:1 at any phase angle relative to the 50 Ohm load is provided by a T–matching network. The T–matching network consists of tune control L4, load control L6, inductor L5 and capacitor C5/C5A. Inductor L5 and capacitor C5/C5A are frequency dependent components. The tune and load controls are designed to be adjusted to present the optimum impedance for the power amplifier modules.

4–116. **LIGHTNING PROTECTION CIRCUIT BOARD.** The transmitter is protected from lightning potentials present at the output network by the lightning protection circuit board. The circuit board consists of series connected transzorbs. The AM–2.5E transmitter is equipped with transzorbs D1 through D6. The AM–5E transmitter is equipped with transzorbs D1 through D7. The transzorbs are designed to conduct the lightning potentials to ground prior to the operation of the lightning detection circuit spark–gap.

4–117. **LIGHTNING DETECTION CIRCUIT BOARD.** Lightning potentials present at the transmitter output are detected by the lightning detection circuit board. The circuit board is equipped with an RF sampling circuit and an optically operated transistor circuit.

4–118. The RF sampling circuit consists of a parallel capacitor circuit. The circuit is designed to provide a constant RF voltage sample for application to the directional coupler circuit board. The optically operated transistor circuit is designed to detect lightning potentials present at the transmitter output. The circuit operates in association with the lightning detector spark–gap. When lightning is present at the transmitter RF output, the spark–gap will: 1) be biased on to conduct the potential to ground and 2) emit a light pulse to optically operated transistor Q401. Q401 will be biased on to output a lightning detect signal to the controller circuit board.

4–119. **RF OUTPUT POWER CONTROL CIRCUITRY.** The transmitter output power is controlled by circuitry on the controller and power supply circuit boards. The transmitter power level is controlled by a Pulse–Width–Modulated (PWM) signal generated by the controller circuit board. The power control PWM signal is routed for application to the power supply circuit board(s). The power supply circuit board(s) respond by routing the required dc voltage to the modulator circuit boards and the RF amplifier circuit boards. The following text presents a description of the RF power control circuitry.

4–120. **RF Output Power Control - Controller Circuit Board.** A transmitter RF output power level is selected by the power control 1 through power control 5 switch/indicators. The power control switch/indicators route a LOW control signal to a priority encoder circuit. The priority encoder circuit determines which control pulse is routed to the power control circuitry. The circuit allows transmitter off commands to be assigned a high priority. With no transmitter off commands present, the power control signal is applied to multiplexer U39. U39 selects a reference voltage from the power control potentiometers on the controller circuit board. The potentiometers are designed to establish a preset transmitter power level such as 1 kW. The voltage is used as the reference for digital–to–analog converter U42. With no fault conditions present, the voltage is applied without change to power trim digital–to–analog converter U43. With no power trim commands present, the reference voltage is applied to a driver circuit which converts the dc control voltage to a power control PWM signal. The power control PWM duty cycle responds to the changes in the voltage reference level. When the voltage reference increases, the power control PWM signal duty–cycle increases. When the voltage reference decreases, the power control PWM signal duty–cycle decreases. The power control PWM signal is routed for application to the power supply circuit board(s).

4–121. The transmitter output power level is trimmed to a precise level by the power up and down switches. The switches output a LOW control signal to a control logic circuit. The control logic circuit generates the required control signals to drive an up/down counter circuit. The circuit is designed to: 1) count up if power is required to be increased or 2) count down if power is required to be decreased. The up/down counter circuit output is converted to a dc potential by digital–to–analog converter U43. The output of U43 is summed with the dc potential from power control switch digital–to–analog converter U42 to generate a dc power control signal. The power control signal is applied to the driver circuit which converts the signal to a power control PWM signal.

4–122. **Automatic Power Control Circuitry.** The transmitter power control circuitry is equipped with several monitor circuits designed to determine if power control correction is required during adverse operating conditions. Circuitry on the controller circuit board monitors the transmitter components and the RF output for: 1) lightning, 2) high forward power, 3) high reflected power, and 4) over–temperature. If a lightning, high forward power, high reflected power, or over–temperature, condition occurs, a signal is routed to the fault detection circuit.

4–123. The fault detection circuit: 1) processes lightning and over–temperature signals and 2) analyzes forward and reflected power signals. As determined by the the fault condition, the fault detection circuit will generate a fast or slow control signal to the up/down counter circuit. The counter circuit will respond by decreasing the power control voltage at digital–to–analog converter U42. U42 will respond by decreasing the output power to an acceptable level. Once the condition which caused the fault to occur is removed, the fault detection circuitry will automatically output a control signal to increase power to a normal level.

4–124. **Forward/Reflected Power Circuitry.** Samples of the transmitter forward and reflected power are processed by forward and reflected power circuits on the controller circuit board. Forward power samples from the directional coupler circuit board are applied to the forward power circuit. The forward power circuit converts the sample into a dc signal for application to the fault detection circuitry and to the meter switch circuit board. Reflected power samples from the directional coupler circuit board are applied to the reflected power circuit. The reflected power circuit converts the sample into a dc signal for application to the fault detection circuit and the meter switch circuit board.

4–125. **Meter Switch Circuit Board.** Forward and Reflected power samples from the controller circuit board are applied to the meter switch circuit board. The circuit board allows the selection of forward power, reflected power, and ac input samples for display on forward power meter M1 and reflected power meter M2.

4–126. **RF Output Power Control - Power Supply Circuit Board/RF Power Modules.** The power control PWM signal from the controller circuit board is applied to a correction circuit on the power supply circuit board. The PWM signal is converted to a dc signal and combined with a dc feedback signal to generate a power control signal for application to the switch regulator power control PWM circuit. The circuit converts the dc signal into two PWM 180 degree out–of–phase square–wave drive signals. The square–wave drive signals are applied to a driver circuit. The driver circuit outputs the out–of–phase square–wave signals to an IGBT transistor regulator circuit. The regulator circuit transistors are operated to on for a specific time duration to generate a specific B– supply voltage. The B– supply voltage is filtered by capacitor C55 and applied to the forward power converter on the modulator circuit boards.

4–127. The main operating supply B+ leg is created by a SCR controlled bridge rectifier circuit. AC power from an ac input filter is applied to the SCR controlled bridge rectifier. The rectifier is controlled by a soft–start circuit. The full–wave rectified dc potential is filtered by capacitors C24 through C27. The output of the filter generates the positive leg of a B supply. The B+ line of the power supply is applied to the forward power converter circuit on modulator circuit boards and the RF amplifier transistors on RF amplifier circuit boards.

4–128. To provide an example of output power control operation, a 10 kW output level is required from the transmitter. The controller power control PWM duty–cycle will be approximately 85%. The power supply will respond by generating a 120 volt B– supply for application to the forward power converter on the modulator circuit boards. The modulator circuit boards will output a dc voltage which varies at an audio rate to the amplifier circuit boards. The amplifier circuit boards will respond by using the modulator circuit board dc voltage and the B+ leg of the main supply to amplify the RF drive signal from the exciter circuit board.

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance information, electrical adjustment procedures, and troubleshooting information for the Broadcast Electronics AM-2.5E and AM-5E transmitters.

5-3. SAFETY CONSIDERATIONS.

WARNING ***THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.***

WARNING

WARNING

WARNING

5-4. The AM-2.5E/AM-5E transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with many built-in safety features, however good judgement, care, and common sense must be practiced to prevent accidents.

5-5. In addition to high voltages and currents, the transmitter contains multiple circuit grounds with high ac and dc potentials with respect to the cabinet which is at earth potential. The potentials could cause serious injury or death if maintenance personnel simultaneously touch a circuit ground and the cabinet. As a result, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Therefore, never energize the transmitter with test equipment connected to the transmitter output network, RF power module, RF combiner, or power supply components. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

5-6. FIRST LEVEL MAINTENANCE.

5-7. First level maintenance consists of procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a maintenance log. Preventive maintenance of the transmitter consists of good housekeeping and checking performance levels using the meters and various indicators built into the equipment.

5-8. ROUTINE MAINTENANCE.

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

WARNING

5-9. **INSPECTION AND CLEANING.** On a regular basis, clean the equipment of accumulated dust using a brush and vacuum cleaner. Inspect the modulator circuit boards, RF amplifier circuit boards, and the power supply circuit boards for damage caused by components overheating. Overheated components are identified by circuit board discoloration near the component leads. Inspect the circuit boards for loose hardware as required.

5-10. **CONTROLLER BATTERY.** Periodically, the controller battery in the ECU assembly should be checked by depressing the battery test switch on the controller circuit board. The battery test indicator will illuminate to indicate the battery is operational. If the battery test indicator fails to illuminate, the battery must be replaced. A good-quality Alkaline battery is recommended for replacement. Typically, it is recommended the controller battery be replaced annually.

5-11. **AIR FILTERS.** The AM-2.5E/AM-5E transmitters are equipped with a single screen-type air filter. The screen filter is designed to be removed and cleaned using a brush and vacuum. A dirty filter results in restricted air flow and increased operating temperatures for the transmitter solid-state components. Check the filter approximately once a week. The filter is designed to be removed during transmitter operation. To remove the filter, proceed as follows:

1. Refer to Figure 5-1 and remove the six filter housing screws.
2. Using the handles, lift the filter housing off of the rear door.
3. Remove the filter.

5-12. **FLUSHING FANS.** Inspect the transmitter flushing fans for dust accumulation and periodically clean the fans using a brush and vacuum cleaner. Do not use compressed air and an air gun. The fans are cooled by air passing around each motor. If dust is allowed to accumulate on the motors, the ambient air temperature will increase due to restricted air flow. When the ambient air temperature increases, the fan motor bearing lubricant will gradually vaporize and bearing failure will occur.

5-13. It is recommended the flushing fan mounting hardware be periodically checked. The flushing fans are equipped with sealed bearings which do not permit lubrication. If a bearing fails, the motor must be replaced.

5-14. **SPARK GAP.** The output network is equipped with a spark gap. The spark gap is provided to safely conduct lightning potentials appearing at the transmitter output to ground. Inspect the spark gap annually to ensure the gap is operational.

5-15. SECOND LEVEL MAINTENANCE.

5-16. Second level maintenance consists of procedures required to adjust the transmitter circuitry or restore the transmitter to operation after a fault has occurred. The procedures consist of electrical adjustments, troubleshooting, and component replacement procedures.

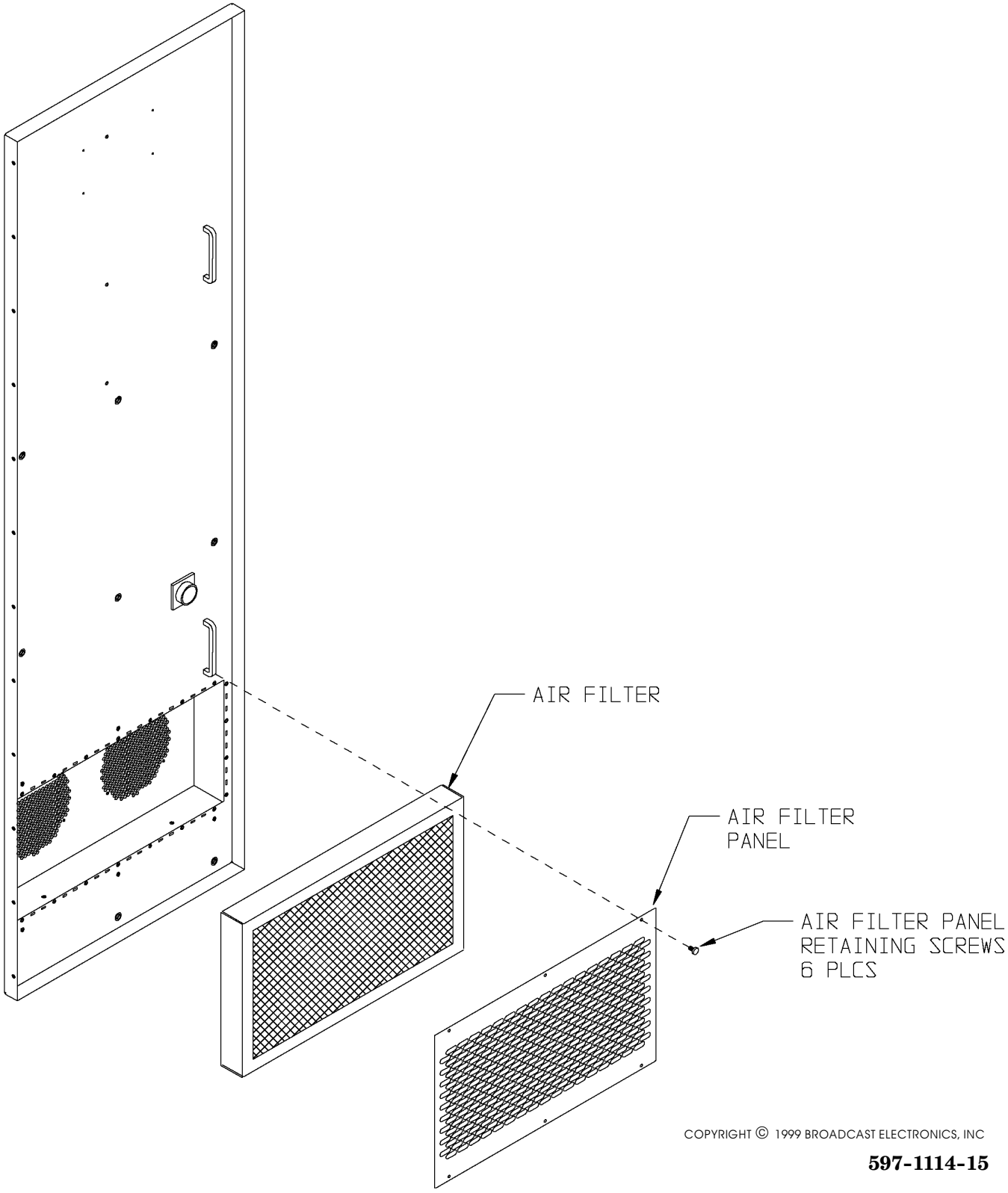

FIGURE 5-1. REMOVING THE AIR FILTER

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

5–17. The maintenance philosophy for the AM–2.5E/AM–5E transmitters consists of isolating a problem to a specific area. Once the specific area is located, subsequent troubleshooting using the information in the following text and the modular sections in PART II of this manual will assist in problem isolation to a replaceable assembly or component. If required, the assembly may be: 1) returned to the factory for repair or exchange or 2) repaired locally.

5–18. **ELECTRICAL ADJUSTMENTS.**

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

5–19. Adjustment procedures for controls associated with the transmitter circuitry is presented in the ECU, output network, RF power module, and power supply module sections of this manual. Determine the transmitter modular component requiring adjustment and refer to the appropriate section of this manual for the adjustment procedures.

5–20. **TRANSMITTER FREQUENCY RE-PROGRAMMING.**

5–21. The AM–2.5E/AM–5E transmitters are configured for a specific frequency when shipped from the factory. The transmitters are equipped with several frequency dependent parts and circuits. Due to the frequency dependent parts, frequency dependent circuits, and specialized procedures, the transmitters can not be reprogrammed for a different frequency in the field. If a transmitter is required to be programmed for a different frequency, contact the Broadcast Electronics Customer Service department.

5–22. **TROUBLESHOOTING.**

WARNING

WARNING

WARNING

WARNING

THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.

5–23. The AM–2.5E/AM–5E transmitters are equipped with extensive indicator and meter circuitry to allow the operator to isolate problems to a specific area within the transmitter. Due to the hazardous voltages and currents contained in the equipment, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. Therefore, the transmitter indicators and meters must be used to isolate a problem to a specific area.

5–24. **TRANSMITTER INDICATORS.** The following text presents a description of the transmitter indicators and typical meter indications. Refer to the following text as required to determine the function of a specific indicator.

TABLE 5-1. AM-2.5E/AM-5E INDICATORS
(Sheet 1 of 4)

ASSEMBLY	INDICATOR FUNCTION
ECU ASSEMBLY TRANSMITTER MONITOR	
EXCITER	GREEN DISPLAY – Indicates normal exciter operation. RED DISPLAY – Indicates no exciter RF drive or PWM output.
POWER MODULES	GREEN DISPLAY – Indicates all RF power modules are operating normally. YELLOW DISPLAY – Indicates one or more RF power modules are removed from the transmitter for maintenance. RED DISPLAY – Indicates a modulator or power amplifier circuit board fault in one or more RF power modules.
POWER SUPPLY	GREEN DISPLAY – Indicates normal power supply operation. RED DISPLAY – Indicates an open loop or over–voltage fault in one or more power supply modules. YELLOW Display – Indicates one or more power supplies are removed from the transmitter.

TABLE 5-1. AM-2.5E/AM-5E INDICATORS
(Sheet 2 of 4)

ASSEMBLY	INDICATOR FUNCTION
ANTENNA VSWR	GREEN DISPLAY – Indicates a normal antenna load. YELLOW DISPLAY – Indicates a VSWR condition of 1.2:1. RED Display – Indicates a high reflected/forward power condition. In the AM–2.5E, indicates a 100 watt reflected power condition or a condition which results in a high forward power indication of greater than 20%. In the AM–5E, indicates a 200 watt reflected power condition or a condition which results in a high forward power indication of greater than 20%. FLASHING RED Display – Indicates a reflected power emergency condition. In the AM–2.5E, indicates a 500 watt reflected power condition. In the AM–5E, indicates a 1000 watt reflected power condition.
REMOTE	Illuminates to indicate transmitter remote control operations are enabled. Extinguishes to indicate transmitter remote control operations are disabled: 1) using the remote/local switch on the controller circuit board or 2) due to a fault in the remote control unit.
CONFLICT	Illuminates to indicate an incorrect power level is selected for operation into the antenna connected to the transmitter.
LIGHTNING	In the AM–2.5E, Illuminates to indicate a 1500 volt or greater potential is present at the transmitter output. In the AM–5E, illuminates to indicate a 2100 volt or greater potential is present at the transmitter output.
INTERLOCK	Illuminates to indicate all internal and external interlocks are closed.
FOLDBACK	Illuminates to indicate when the transmitter is in a foldback condition. Foldback is when the transmitter output power is automatically reduced in response to one of the following fault conditions: 1) high reflected power, 2) high forward power, 3) high temperature, or 4) detection of a lightning potential.
OVERTEMP	Illuminates to indicate when the transmitter operating temperature exceeds 70 °C (158 °F).
RESET	Illuminates to indicate one or more of the following transmitter faults have occurred: 1) over–temperature, 2) exciter fault, 3) power supply fault, 4) RF power module fault, 5) high reflected power, 6) reflected power emergency, or 7) lightning. Once the fault condition is removed, the fault circuitry must be reset.

TABLE 5-1. AM2.5E/AM-5E INDICATORS
(Sheet 3 of 4)

ASSEMBLY	INDICATOR FUNCTION
CONTROLLER CIRCUIT BOARD	
PWM Mute	Illuminates to indicate the power control PWM signal is muted in response to a fault such as lightning, an exciter fault, a reflected power emergency, an open remote control fail-safe, an external transmitter mute, lightning, or high reflected or forward power.
Remote Fail-safe	Illuminates to indicate the remote control unit is enabled.
Battery OK	When the battery test switch is depressed, the indicator will: 1) illuminate to indicate the battery is operational or 2) not illuminate to indicate the battery is to be replaced.
STEREO CIRCUIT BOARD	
Stereo Equalization 1	Illuminates to indicate stereo equalization circuit 1 is active.
Stereo Equalization 2	Illuminates to indicate stereo equalization circuit 2 is active.
EXCITER CIRCUIT BOARD	
Exciter Lock	Illuminates to indicate the exciter is locked to the programmed carrier frequency.
Exciter +5V	Illuminates to indicate the ECU +5V supply is operational.
Exciter +15V	Illuminates to indicate the ECU +15V supply is operational.
Exciter -15V	Illuminates to indicate the ECU -15V supply is operational.
RF POWER MODULE	
PA 1 RF DRIVE	Illuminates to indicate RF drive from the exciter circuit board is present at power amplifier 1.
PA 1 FAULT	Illuminates to indicate a fault has occurred in power amplifier 1.
PA 2 RF DRIVE	Illuminates to indicate RF drive from the exciter circuit board is present at power amplifier 2.
PA 2 FAULT	Illuminates to indicate a fault has occurred in power amplifier 2.

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TABLE 5-1. AM-2.5E/AM-5E INDICATORS
(Sheet 4 of 4)

ASSEMBLY	INDICATOR FUNCTION
MOD PWM DRIVE	Illuminates to indicate the PWM drive signal from the exciter is present at the modulator circuit board.
MOD POWER	Illuminates to indicate dc power from the power supply circuit board is present at the modulator circuit board.
MOD FAULT	Illuminates to indicate a modulator, fuse, or power supply fault has occurred in the modulator circuit board.
MOD FUSE	Illuminates to indicate the modulator circuit board fuse has blown.
POWER SUPPLY 1-2	Illuminates to indicate an open loop, over-current, or over-voltage fault in the 1-2 power supply. The supply provides power for modules 1-2.
POWER SUPPLY 3-4 (AM-5E Only)	Illuminates to indicate an open loop, over-current, or over-voltage fault in the 3-4 power supply. The supply provides power for modules 3-4.
Exciter -15V	Illuminates to indicate the ECU -15V supply is operational.

CAUTION

CAUTION

WHEN AC POWER IS APPLIED TO THE TRANSMITTER AND THE RF DRIVE AND PWM DRIVE INDICATORS ON RF POWER MODULES IN A POWER BLOCK ARE EXTINGUISHED, THE RF POWER MODULES MUST BE REMOVED FROM THE TRANSMITTER CHASSIS TO PREVENT DAMAGE TO THE MODULES.

5-25. **RF POWER MODULE REMOVAL.** When ac power is applied to the transmitter, check the **RF DRIVE** and **PWM DRIVE** indicators on the RF power modules. If the **RF DRIVE** and **PWM DRIVE** indicators on RF power modules in a power block are extinguished, the RF power modules must be removed from the transmitter to prevent damage to the modules.

5-26. **TRANSMITTER TROUBLESHOOTING PROCEDURES.** Table 5-2 presents troubleshooting information for the AM-2.5E/AM-5E transmitters. Refer to Table 5-2 to isolate the problem to a specific assembly. Once the trouble is isolated, refer to the applicable modular section of this manual for the theory of operation and schematic diagrams to assist in problem resolution.

5-27. **TRANSMITTER COMPONENT LOCATIONS.** Figures 5-2 through 5-4 present transmitter component locations. Refer to Figures 5-2 to 5-4 as required during the troubleshooting procedures to locate components within the transmitter.

TABLE 5-2. AM-2.5E/AM-5E TROUBLESHOOTING
(Sheet 1 of 5)

SYMPTOM	CIRCUITRY TO CHECK
NO OUTPUT POWER NO NORMAL/FAULT INDICATIONS	1. Check the ac line voltage using the reflected power/ ac voltage meter. If no line voltage is present, check fuses F1 and F2. 2. Check the ±15 volt and +5 volt indicators on the exciter circuit board. If no indicators are illuminated, check the ECU power supply.
NO OUTPUT POWER NORMAL INDICATIONS NO CONTROL OPERATIONS	1. Transmitter operated to off due to 7 on/off cycles within 15 seconds. Operate the transmitter to on as follows: 1) do not depress any controller switch/indicators for approximately 30 seconds and 2) depress the desired power level switch/indicator. 2. Refer to the POWER SUPPLY section and troubleshoot the power supply circuit board for no 120 Hz signal output.
RED EXCITER INDICATION	1. Check the lock indicator on the exciter circuit board. If the lock indicator is not illuminated, refer to the ECU section and troubleshoot the exciter circuit board for lock indicator extinguished. 2. Remove the stereo circuit board and perform the following: 1) depress the RESET switch and 2) initiate transmitter operation. If the transmitter will not operate, refer to the ECU section and troubleshoot the exciter circuit board. If the transmitter operates, refer to the ECU section and troubleshoot the stereo circuit board.
YELLOW POWER MODULE INDICATION	1. Indicates one or more RF power modules are removed from the transmitter.
RED POWER MODULE INDICATION RED FAULT INDICATION ON A MODULE	1. Refer to the RF POWER MODULE section and troubleshoot the RF power module. 2. Visually inspect the RF power module combiner panel for discolored components.
YELLOW POWER SUPPLY INDICATION	1. Indicates one or more power supply modules are removed from the transmitter.
RED POWER SUPPLY INDICATION	1. Check for an over-temperature condition by inspecting the fans and filter. 2. If the fans and filter are normal, use the power supply fault display circuit boards in each cabinet to determine the defective power supply module. When the defective power supply is located, refer to the POWER SUPPLY MODULE section and troubleshoot the power supply module.

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TABLE 5-2. AM-2.5E/AM-5E TROUBLESHOOTING
(Sheet 2 of 5)

SYMPTOM	CIRCUITRY TO CHECK
YELLOW ANTENNA INDICATION	1. Check the antenna and phasor equipment. 2. Visually inspect the T–matching network for discolored components. 3. Refer to the OUTPUT NETWORK section and troubleshoot the directional coupler circuit board.
RED ANTENNA INDICATION	1. Check the antenna and phasor equipment. 2. Visually inspect the T–matching network for discolored components. 3. Refer to the OUTPUT NETWORK section of this manual and troubleshoot the directional coupler circuit board.
FLASHING RED ANTENNA INDICATION	1. Check the antenna and phasor equipment. 2. Visually inspect the spark gap in the output network assembly for a short circuit condition. 3. Check the antenna shorting switch on the output network assembly. 4. Visually inspect the T–matching network capacitors in the output network assembly for a short circuit condition. 5. Check the lightning protection circuit board in the output network assembly for a short circuit condition.
INTERLOCK INDICATOR EXTINGUISHED WHEN IN THE REMOTE CONTROL MODE	1. Operate remote/local switch to local. A. If the interlock indicator illuminates, ensure a +5 volt signal is applied to remote fail-safe input J1–23 on the ECU rear–panel when the remote control unit is enabled. 1. If the +5 volt signal is not present, troubleshoot the remote control unit. 2. If the +5 volt signal is present, check Q48 and U56 on the controller circuit board. B. If the interlock indicator is extinguished, check the cabinet and the external interlocks.
CONFLICT INDICATION	1. Ensure a +5 volt status signal from the selected antenna is applied to the antenna A, B, or C input on the ECU rear–panel. 2. Ensure the correct transmitter power level is selected for operation into the antenna. 3. Check the antenna interlock circuit programming on the controller circuit board. 4. Refer to the ECU section and troubleshoot the controller circuit board for a conflict indication.

TABLE 5-2. AM-2.5E/AM-5E TROUBLESHOOTING
(Sheet 3 of 5)

SYMPTOM	CIRCUITRY TO CHECK
NO OUTPUT POWER LIGHTNING INDICATOR ILLUMINATED	1. Transmitter operated to off due to 7 on/off cycles within 15 seconds. Operate the transmitter to on as follows: 1) do not depress any controller switch/indicators for approximately 30 seconds and 2) depress the desired power level switch/indicator. 2. Ensure J1 on output network is connected. 3. Check Q401 on the lightning detection circuit board.
NORMAL OUTPUT POWER LIGHTNING INDICATOR ILLUMINATED	1. Indicates the presence of lightning at the output of transmitter. Depress the RESET switch to reset the indicator.
INTERLOCK INDICATOR EXTINGUISHED	1. Ensure a +5 volt signal is applied to external interlock input J1–23 on the ECU rear panel.
OVERTEMP INDICATOR ILLUMINATED	1. Ensure the transmitter air filter is clean. 2. Check the transmitter fans in each cabinet. If the fans are not operating, check optical–coupled–relay (OCR) K1. 3. Ensure the transmitter exhaust area is clear of obstructions.
MISSING NORMAL/FAULT INDICATIONS FOR A POWER BLOCK	1. Check the fuses for the power supply: 1) power supply 1–2 = F6 and F7, 2) power supply 3–4 = F8 and F9 (AM–5E only). 2. Check power transformer T1 on the power supply panel.
NO L+R MODULATION ACTIVITY DURING MONO OPERATION	1. Ensure audio is present at J3–1/J3–2/J3–4/J3–5 on the ECU rear panel. 2. Check for audio at J101–29 through J101–31 and J101–36/J101–37 on the ECU motherboard. If no audio is present, check the filter components on the ECU motherboard. 3. Refer to the ECU section and troubleshoot the exciter circuit board.
NO L+R MODULATION ACTIVITY DURING STEREO OPERATION	1. Ensure audio is present at J3–1/J3–2/J3–4/J3–5 on the ECU rear panel. 2. Check for audio at J101–29 through J101–31 and J101–36/J101–37 on the ECU motherboard. If no audio is present, check the filter components on the ECU motherboard. 3. Refer to the ECU section and troubleshoot the exciter circuit board.

TABLE 5-2. AM-2.5E/AM-5E TROUBLESHOOTING
(Sheet 4 of 5)

SYMPTOM	CIRCUITRY TO CHECK
RF DRIVE INDICATORS EXTINGUISHED FOR A POWER BLOCK	1. Check the RF drive output on the ECU motherboard as follows: 1) output 1 –P101–7 and 2) output 2 – P101–47 (AM–5E only). 1. If no RF drive is present, refer to the ECU section and troubleshoot the exciter circuit board. 2. If RF drive is present at the exciter circuit board, check bridge rectifiers D10 and D11 on the power supply module for the power block. 2. Refer to the RF POWER MODULE section and troubleshoot each RF power module.
LOW DEMODULATOR LEFT CHANNEL MODULATION LEVEL WITH LOW EXCITER MONITOR LEFT CHANNEL MODULATION LEVEL	1. Refer to the ECU section and troubleshoot the exciter circuit board.
LOW DEMODULATOR RIGHT CHANNEL MODULATION LEVEL WITH LOW EXCITER MONITOR RIGHT CHANNEL MODULATION LEVEL	1. Refer to the ECU section and troubleshoot the exciter circuit board.
LOW DEMODULATOR LEFT CHANNEL MODULATION LEVEL WITH NORMAL EXCITER MONITOR LEFT CHANNEL MODULATION LEVEL	1. Refer to the ECU section and troubleshoot the stereo circuit board.
LOW DEMODULATOR RIGHT CHANNEL MODULATION LEVEL WITH NORMAL EXCITER MONITOR RIGHT CHANNEL MODULATION LEVEL	1. Refer to the ECU section and troubleshoot the stereo circuit board.
PWM DRIVE INDICATOR EXTINGUISHED ON A POWER BLOCK	1. Refer to the ECU section and troubleshoot the exciter circuit board.
PWM DRIVE AND RF DRIVE INDICATORS EXTINGUISHED ON ALL POWER BLOCKS	1. Refer to the ECU section and troubleshoot the exciter circuit board.

TABLE 5-2. AM-2.5E/AM-5E TROUBLESHOOTING
(Sheet 5 of 5)

SYMPTOM	CIRCUITRY TO CHECK
MOD PWR INDICATORS EXTINGUISHED ON A POWER BLOCK	1. Check for a power control PWM signal at the drain of Q22 on the controller circuit board. A. If the PWM signal is not present, refer to the ECU section and troubleshoot the controller circuit board for no power control PWM signal. B. If the PWM output is present, check for a LOW at Q13 on the controller circuit board. 1. If the LOW at Q13 is not present, refer to the ECU section and troubleshoot the controller circuit board for no transmitter on signal. 2. If the LOW at Q13 is present, refer to the POWER SUPPLY section and troubleshoot the power supply for no MOD POWER indicator on a power block.
REFLECTED POWER METER FLUCTUATES WITH MODULATION	1. Narrow-band antenna. Contact the Broadcast Electronics Customer Service Department.
FORWARD POWER METER FLUCTUATES WITH MODULATION	1. Enable the high-pass filter on the exciter circuit board.

5-28. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement on printed circuit boards requires extreme care to avoid damage to the circuit board traces. The following text describes the procedure to replace components on the circuit boards.

5-29. On all circuit boards, the adhesive securing the copper trace to the board melts at almost the same temperature at which solder melts. A circuit board trace can be destroyed by excessive heat or lateral movement during soldering. Use of a small iron with steady pressure is required for circuit board repairs.

5-30. To remove a component from a circuit board, cut the leads from the body of the defective component while the device is still soldered to the board.

5-31. Grip each component lead, one at a time, with long-nose pliers. Rotate the circuit board and touch a soldering iron to the lead at the solder connection. When the solder begins to melt, push the lead through the back side of the board. Each lead may now be heated independently and pulled out of each hole. The holes may be cleared of solder by carefully re-heating each hole with a low wattage iron and removing the residual solder with a soldering vacuum tool.

WARNING ***MOST SOLVENTS WHICH WILL REMOVE ROSIN FLUX ARE VOLATILE AND TOXIC BY THEIR NATURE AND SHOULD BE USED ONLY IN SMALL AMOUNTS IN A WELL VENTILATED AREA, AWAY FROM FLAME SUCH AS FROM A SOLDERING IRON OR SMOKING MATERIALS. OBSERVE THE MANUFACTURER'S CAUTIONARY INSTRUCTIONS.***

WARNING

WARNING

WARNING

5-32. Install the new component and apply solder from the bottom side of the circuit board. After soldering, remove flux with a cotton swab moistened with a suitable solvent. Rubbing alcohol is highly diluted and is not effective.

5-33. The board should be checked to ensure the flux has been removed and not just smeared. Rosin flux is not normally corrosive, but rosin will absorb enough moisture in time to become conductive and cause problems.

5-34. **INTEGRATED CIRCUITS.** Special care should be exercised with integrated circuits. Each integrated circuit must be installed by matching the integrated circuit notch with the notch on the socket. Do not attempt to remove an integrated circuit from a socket with your fingers. Use an integrated circuit puller to lightly pry the component from the socket.

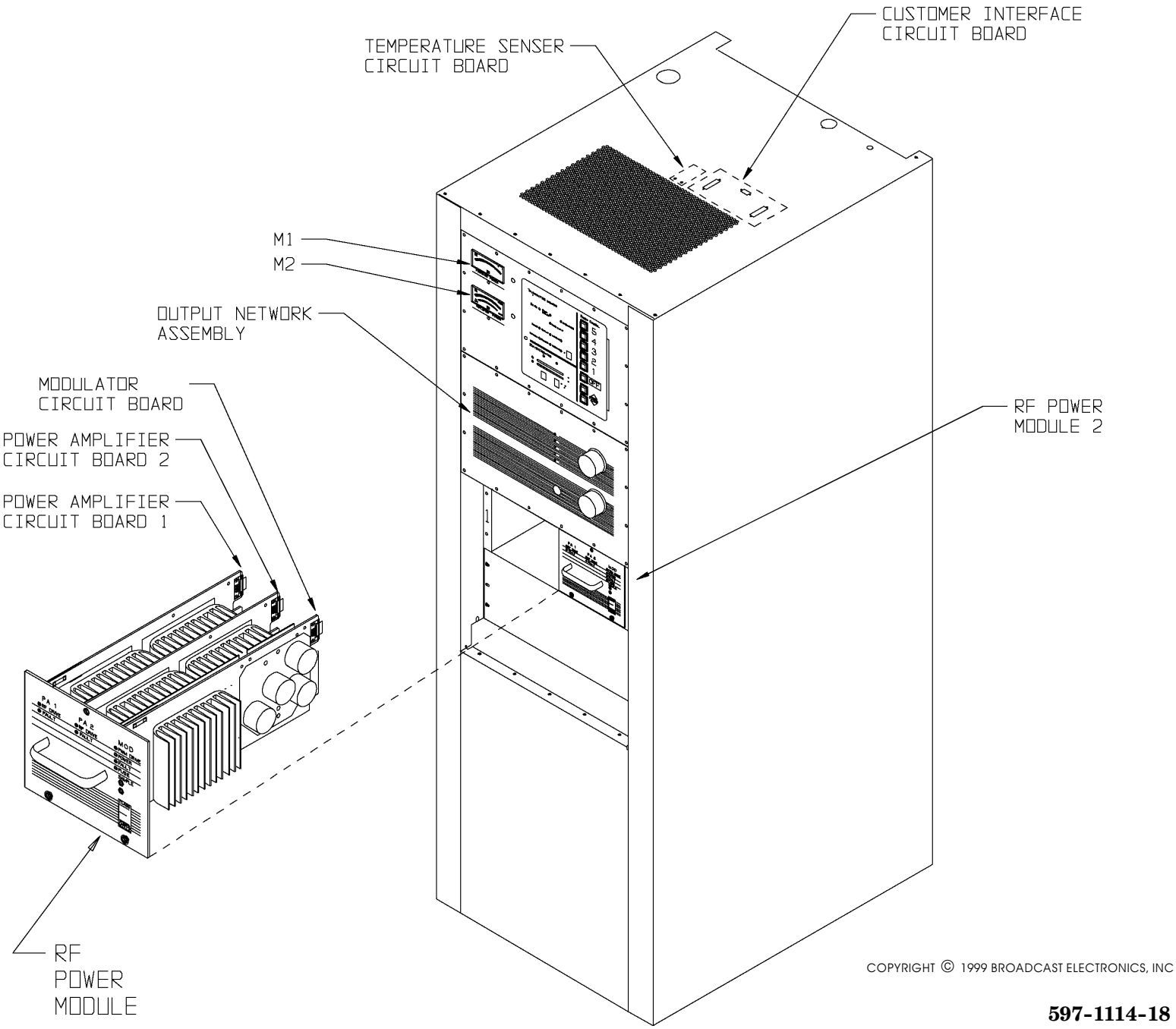

FIGURE 5-2. AM-2.5E COMPONENT LOCATOR (SHEET 1 OF 3)

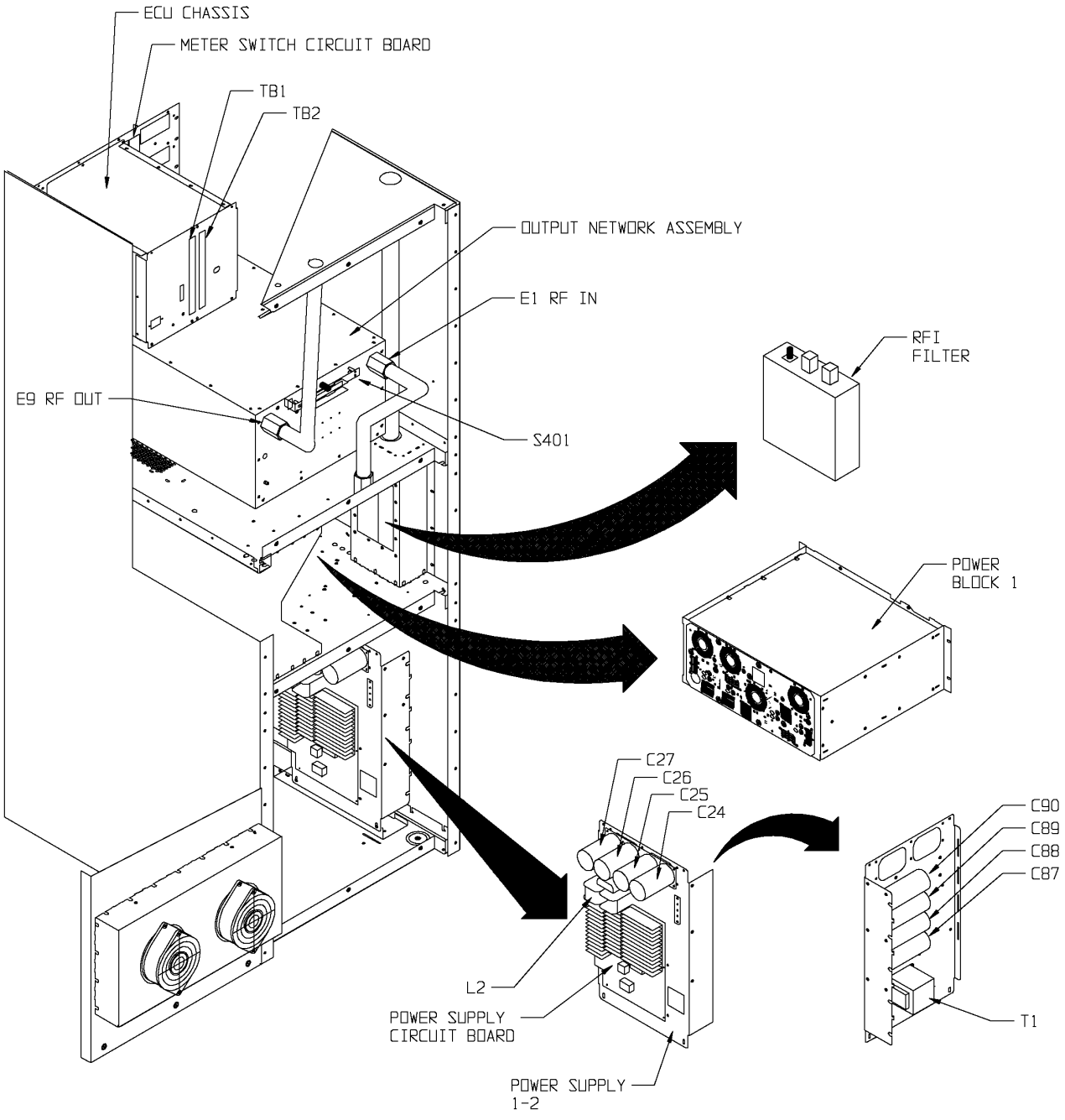

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FIGURE 5-2. AM-2.5E COMPONENT LOCATOR (SHEET 2 OF 3)

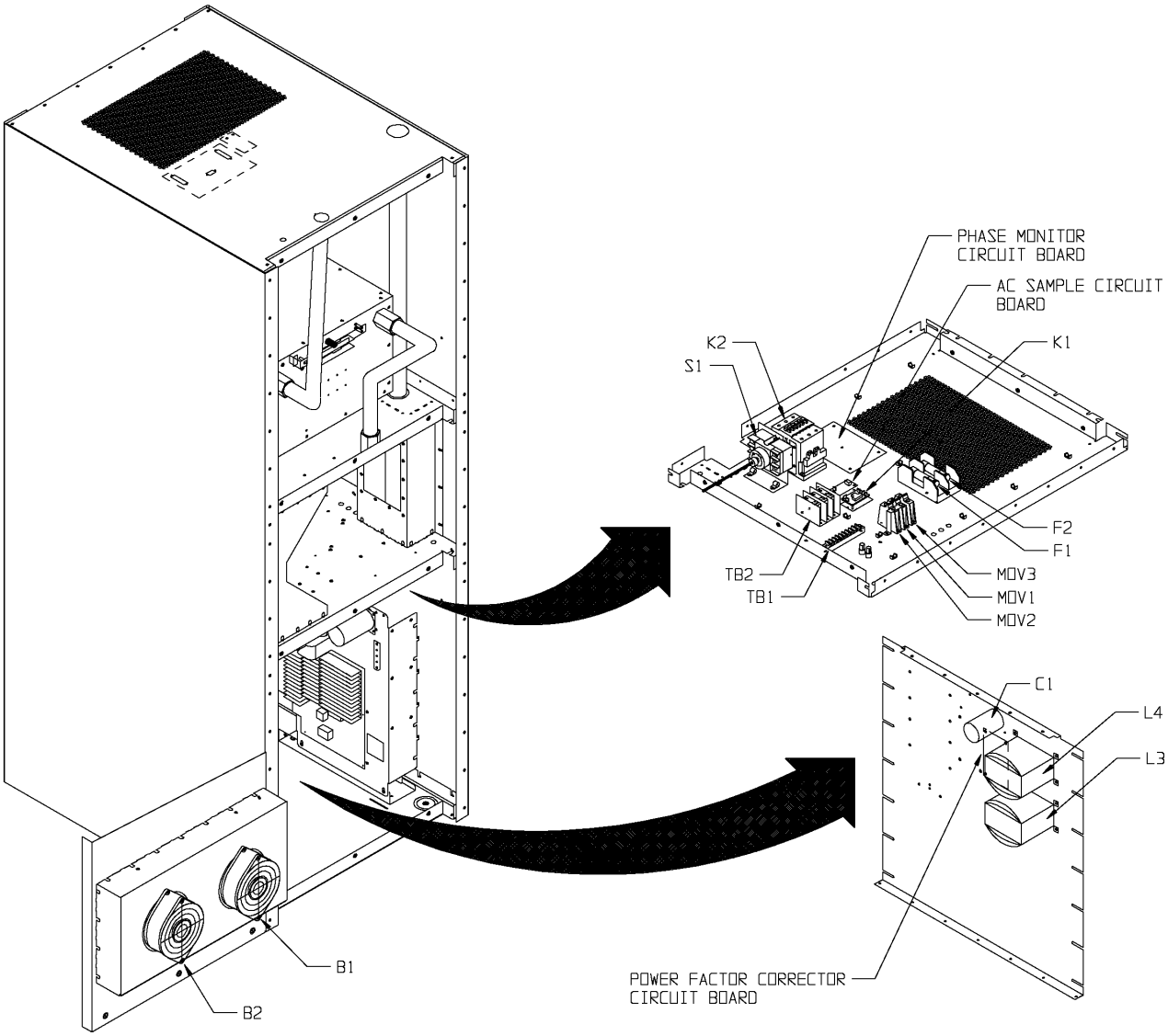

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FIGURE 5-2. AM-2.5E COMPONENT LOCATOR (SHEET 3 OF 3)

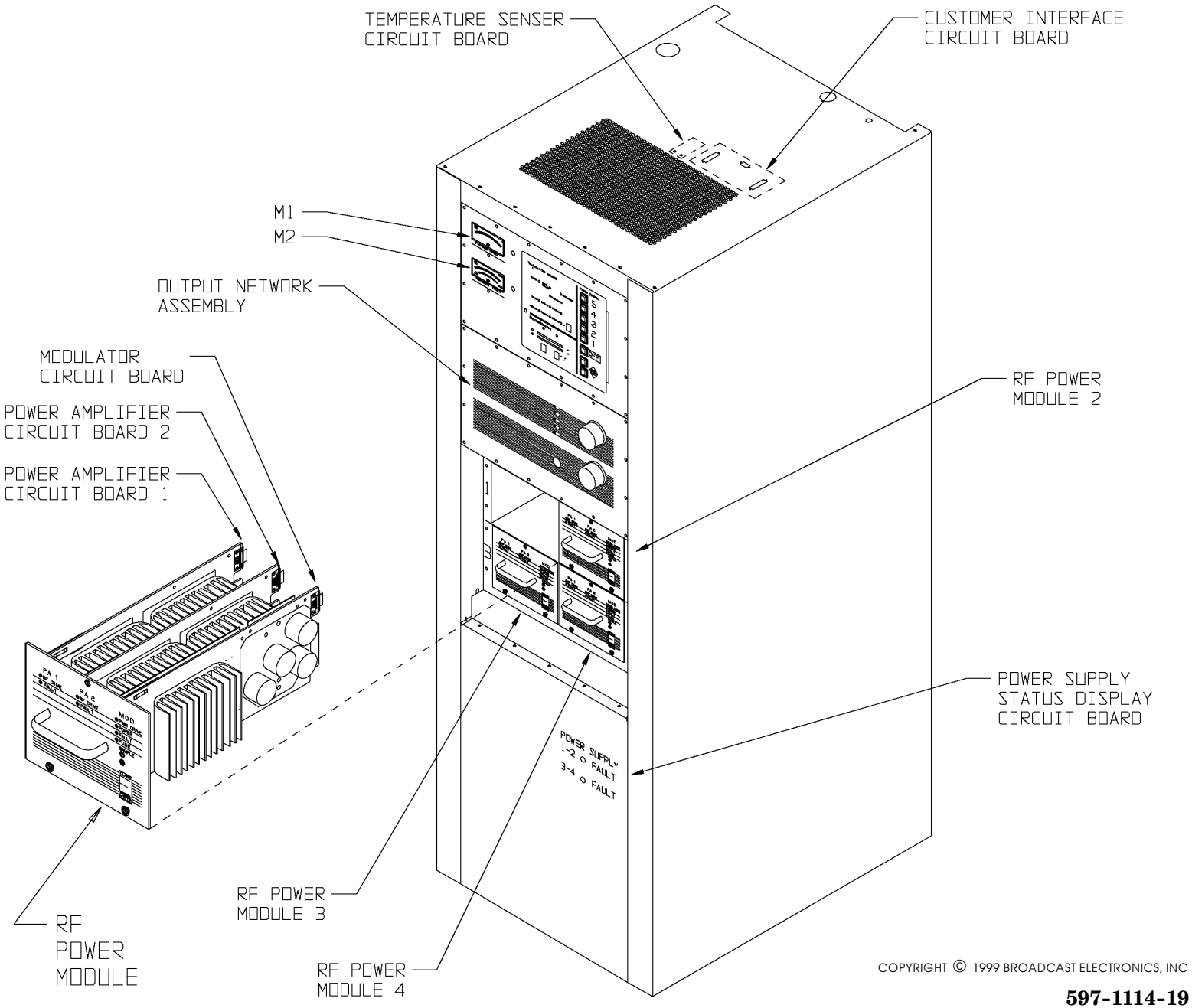

FIGURE 5-3. AM-5E COMPONENT LOCATOR (SHEET 1 OF 3)

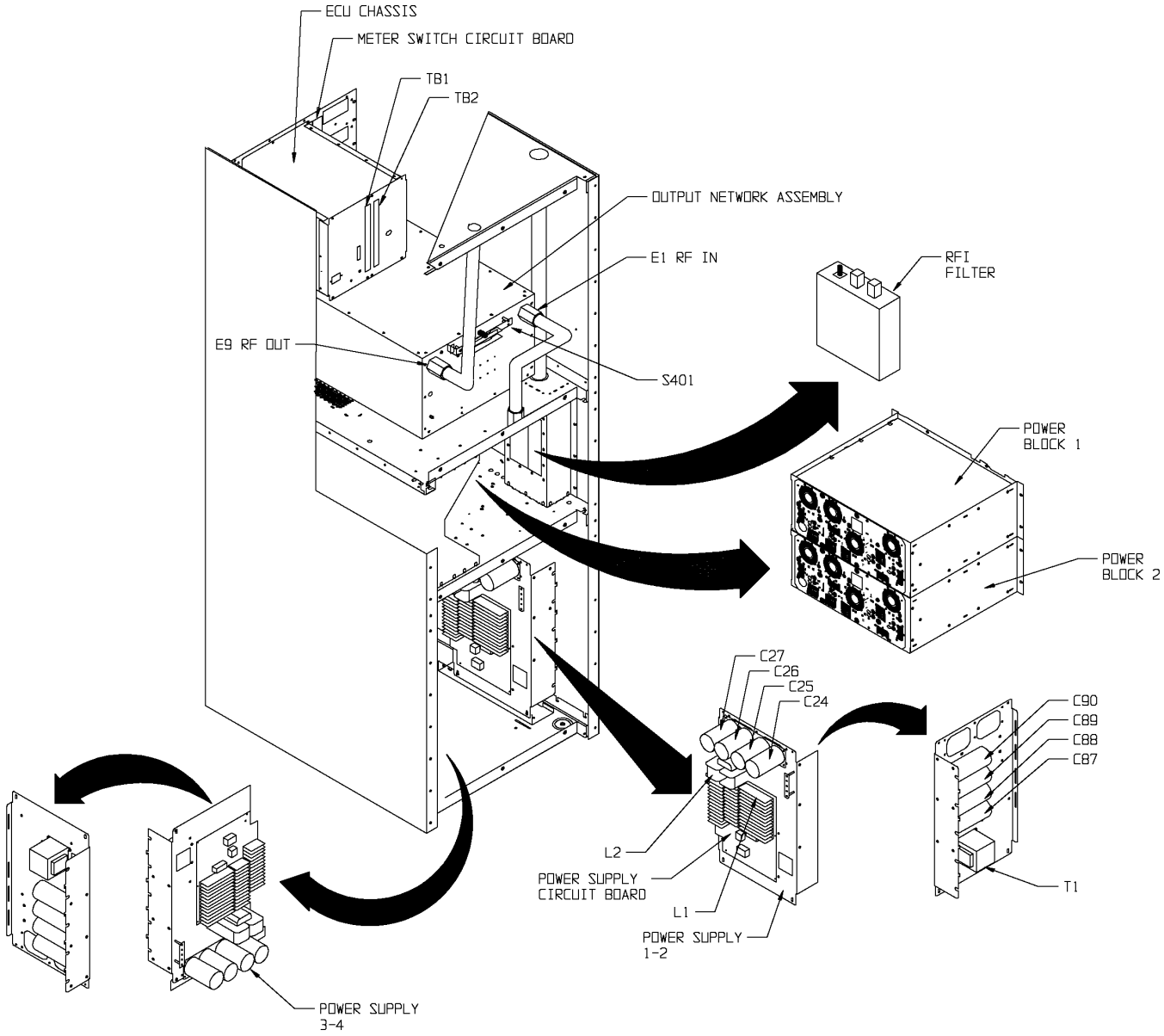

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FIGURE 5-3. AM-5E COMPONENT LOCATOR (SHEET 2 OF 3)

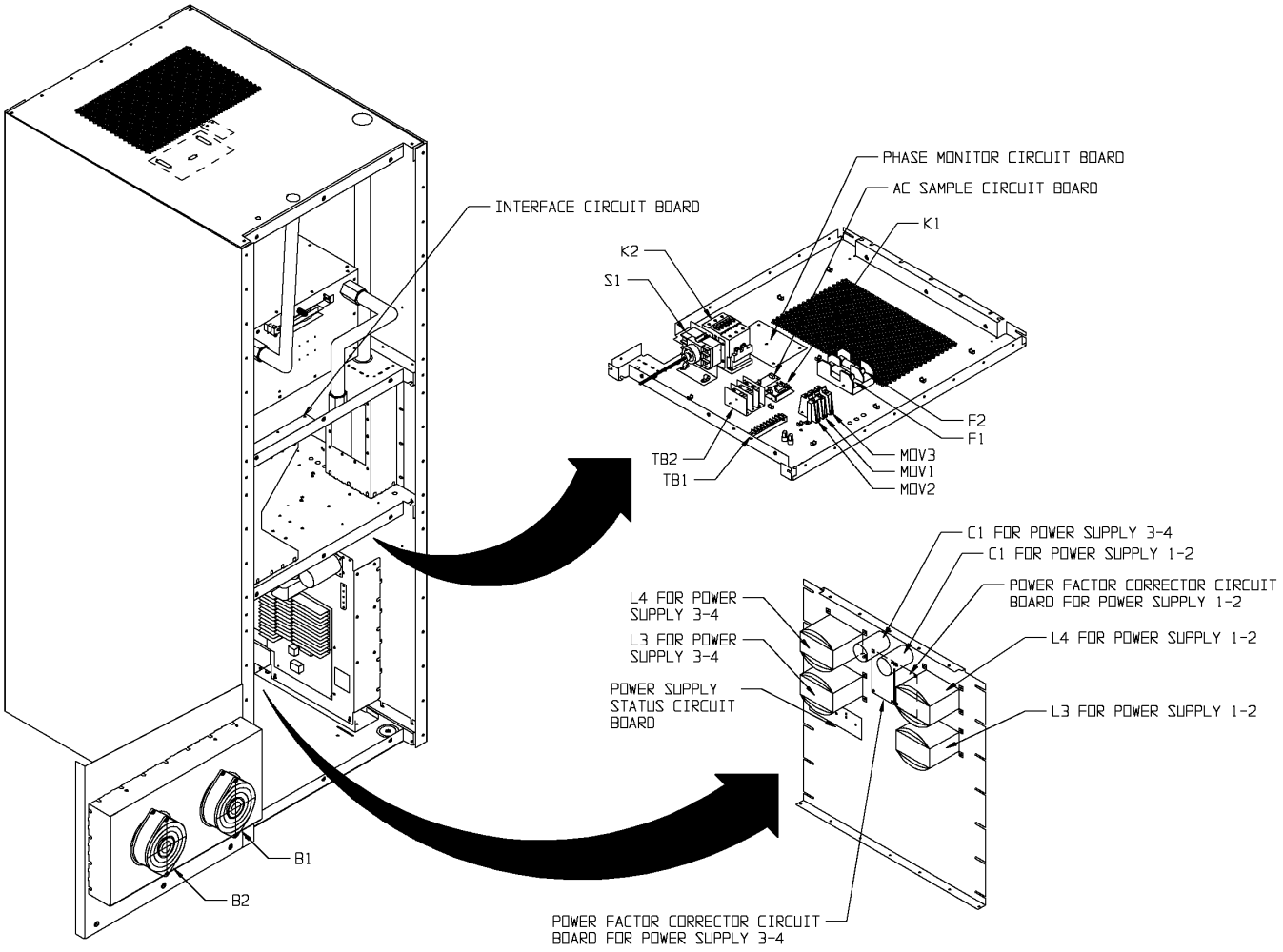

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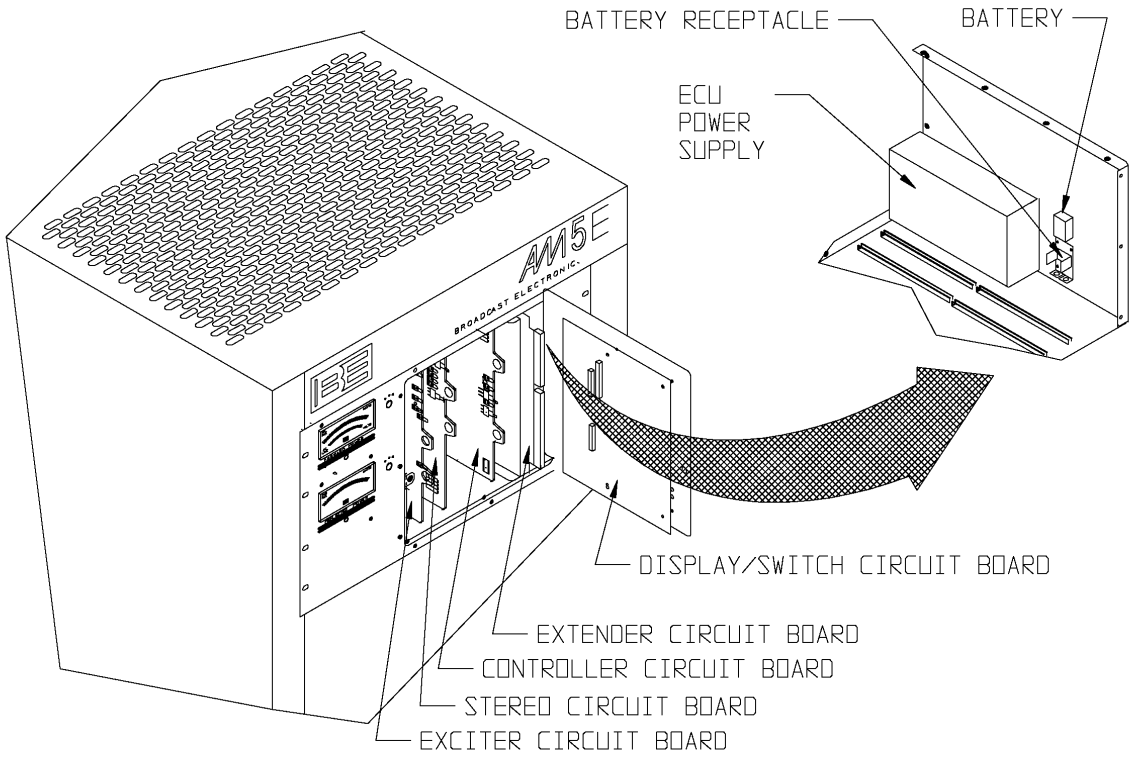
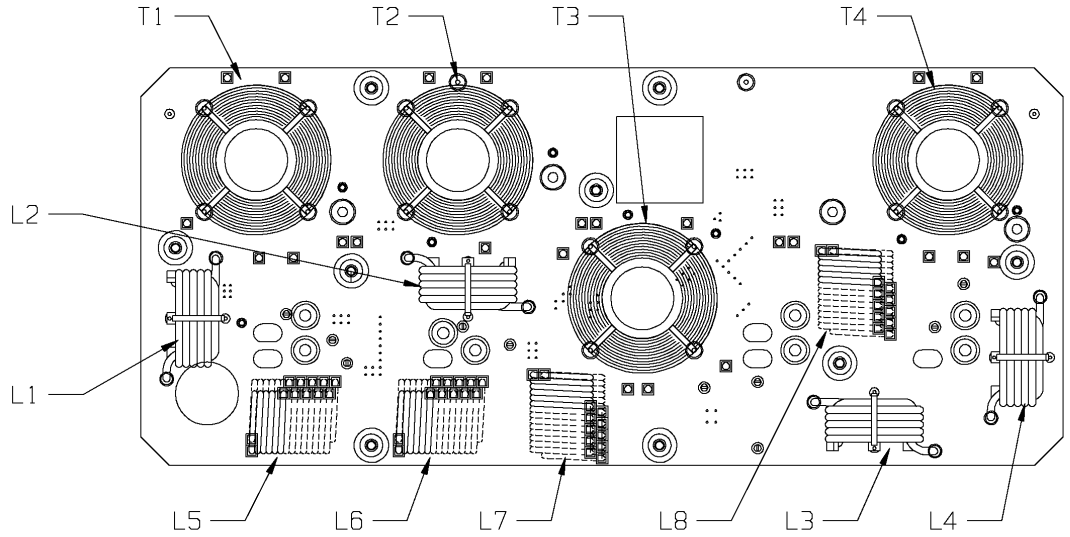
FIGURE 5-3. AM-5E COMPONENT LOCATOR (SHEET 3 OF 3)



ECU COMPONENT LOCATOR



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POWER BLOCK COMPONENT LOCATOR

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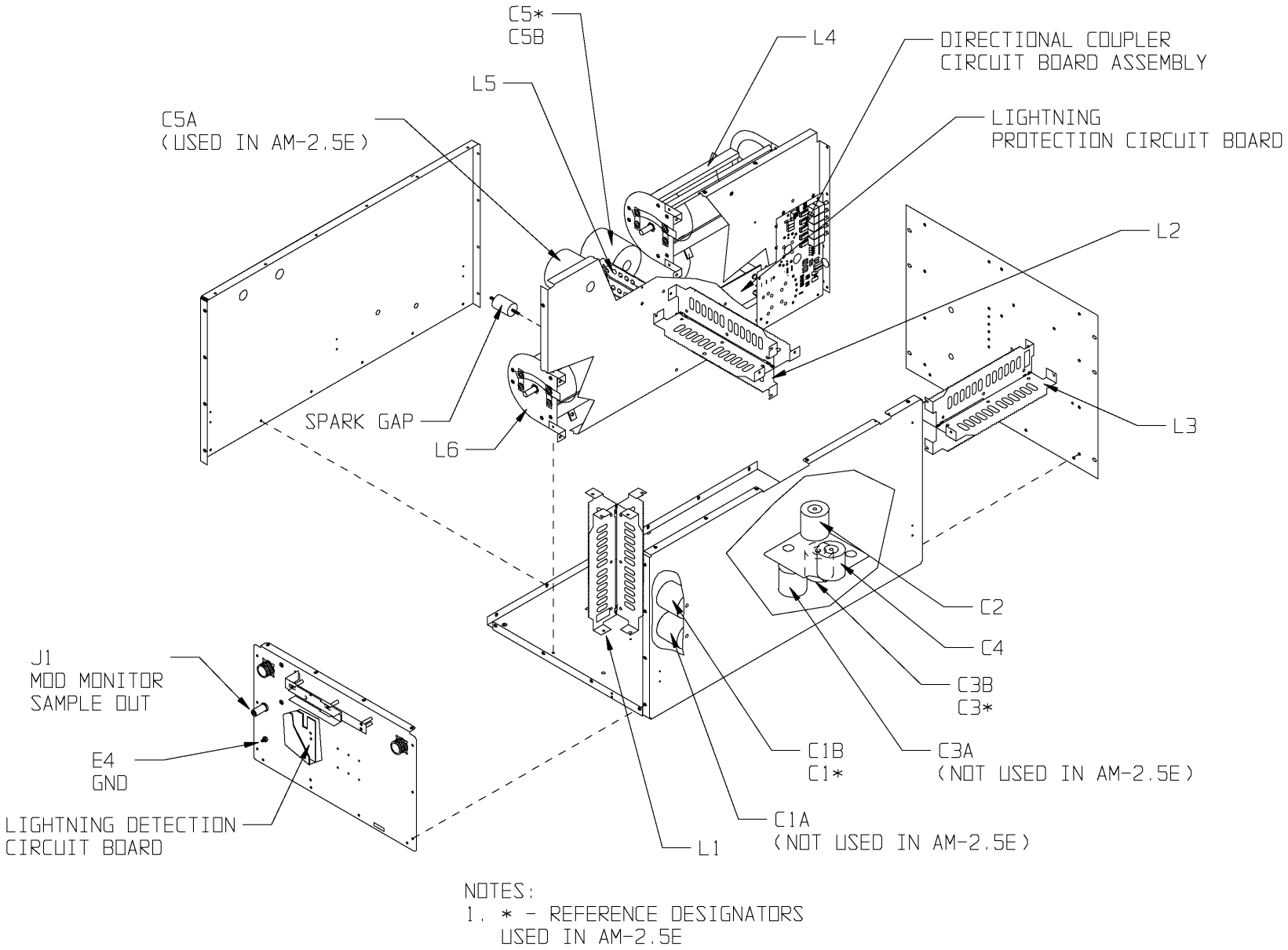
FIGURE 5-4. AM-2.5E/AM-5E ECU/POWER BLOCK/OUTPUT NETWORK ASSEMBLY COMPONENT LOCATOR (SHT 1 OF 2)



AM-2.5E/AM-5E OUTPUT NETWORK ASSEMBLY COMPONENT LOCATOR

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FIGURE 5-4. AM-2.5E/AM-5E ECU/POWER BLOCK/OUTPUT NETWORK ASSEMBLY COMPONENT LOCATOR (SHT 2 OF 2)

SECTION VI
PARTS LIST

6-1. INTRODUCTION.

6-2. This section provides parts lists for the AM-2.5E/AM-5E transmitter. The parts lists provide descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance. Each parts list entry in this section is indexed by reference designators appearing on the applicable schematic diagrams.

TABLE 6-1. AM-2.5E/AM-5E REPLACEABLE PARTS LIST INDEX (Sheet 1 of 2)

TABLE	DESCRIPTION	PART NO.	PAGE
6-2	AM-2.5E Transmitter	907-2500-100	6-3
6-3	AM-5E Transmitter	907-5000-100	6-3
6-4	AC Sample Circuit Board Assembly	917-0306-007	6-4
6-5	Temperature Sensor Circuit Board Assembly	917-0306-009	6-5
6-6	PFC Relay Board Circuit Board Assembly	917-0330	6-5
6-7	Optically Coupled Relay Circuit Board Assembly	919-0096-001	6-5
6-8	Optically Coupled Relay Circuit Board Assembly	919-0096	6-5
6-9	Harness Assembly	947-0210	6-6
6-10	Power Block Assembly, AM-2.5E	957-0022-021	6-7
6-11	Power Block Assembly, AM-5E	957-0022-051	6-7
6-12	Power Block Motherboard Circuit Board Assembly	917-0303	6-7
6-13	Combiner Circuit Board Assembly, AM-2.5E	917-0321-002	6-7
6-14	Combiner Circuit Board Assembly, AM-5E	917-0321-005	6-7
6-15	Accessory Parts Kit, AM-2.5E	957-0069	6-8
6-16	Accessory Parts Kit, AM-5E	957-0071	6-8
6-17	Frequency Dependant Kit, AM-2.5E, 522 - 650 KHZ	957-0015-121	6-9
6-18	Frequency Dependant Kit, AM-2.5E, 651 - 770 KHZ	957-0015-122	6-9
6-19	Frequency Dependant Kit, AM-2.5E, 771 - 920 KHZ	957-0015-123	6-9
6-20	Frequency Dependant Kit, AM-2.5E, 921 - 1080 KHZ	957-0015-124	6-9
6-21	Frequency Dependant Kit, AM-2.5E, 1081 - 1300 KHZ	957-0015-125	6-9
6-22	Frequency Dependant Kit, AM-2.5E, 1301 - 1580 KHZ	957-0015-126	6-10
6-23	Frequency Dependant Kit, AM-2.5E, 1581 - 1700 KHZ	957-0015-127	6-10
6-24	Frequency Dependant Kit, AM-5E, 522 - 650 KHZ	957-0015-151	6-10
6-25	Frequency Dependant Kit, AM-5E, 651 - 770 KHZ	957-0015-152	6-10
6-26	Frequency Dependant Kit, AM-5E, 771 - 920 KHZ	957-0015-153	6-10
6-27	Frequency Dependant Kit, AM-5E, 921 - 1080 KHZ	957-0015-154	6-11
6-28	Frequency Dependant Kit, AM-5E, 1081 - 1300 KHZ	957-0015-155	6-11
6-29	Frequency Dependant Kit, AM-5E, 1301 - 1580 KHZ	957-0015-156	6-11
6-30	Frequency Dependant Kit, AM-5E, 1581 - 1700 KHZ	957-0015-157	6-11
6-31	Power Block Frequency Dependant Kit, 522 - 650 KHZ	957-1025-061	6-11
6-32	Power Block Frequency Dependant Kit, 651 - 770 KHZ	957-1025-062	6-12
6-33	Power Block Frequency Dependant Kit, 771 - 920 KHZ	957-1025-063	6-12

TABLE 6-1. AM-2.5E/AM-5E REPLACEABLE PARTS LIST INDEX (Sheet 2 of 2)

TABLE	DESCRIPTION	PART NO.	PAGE
6-34	Power Block Frequency Dependant Kit, 921 - 1080 KHZ	957-1025-064	6-12
6-35	Power Block Frequency Dependant Kit, 1081 - 1300 KHZ	957-1025-065	6-12
6-36	Power Block Frequency Dependant Kit, 1301 - 1580 KHZ	957-1025-066	6-12
6-37	Power Block Frequency Dependant Kit, 1581 - 1700 KHZ	957-1025-067	6-12

TABLE 6-2. AM-2.5E TRANSMITTER - 907-2500-100

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1, B2	Fan, Patriot, 230 Vac	380–9001	2
C1	Capacitor, 50 uF, 370 Vac, Motor Run	047–5063–370	1
F1, F2	Fuse, 50 Amperes, Dual Element, Time Delay	334–2501	2
F7, F8	Fuse, 3AG, 250V, 2 Amperes	330–0200	2
K2	Contactor, 40 Amperes, 220/240 Vac, 50/60 Hz	341–0076	1
L3, L4	Inductor, 5.8 mH, 30 Amperes	370–2366	2
MOV1	Metal–Oxide Varistor, B40K275, 275V, 1680 Joules	140–0021	1
MOV2	Metal–Oxide Varistor, B40K275, 275V, 1680 Joules	140–0021	1
MOV3	Metal–Oxide Varistor, B40K275, 275V, 1680 Joules	140–0021	1
S1	Switch, Disconnect, Safety Interlock, 60 Amperes	341–0061	1
TB1	Barrier Strip, 9 Terminal	412–0090	1
TB2	Terminal Block, GOULD 63133	412–0050	1
----	Meter, 3.5 Inch (8.89 cm), Taut Band Type, FS = 1 mA dc ±1%, 35 Ohm Resistance (REFLECTED POWER Meter)	310–0068	1
----	Meter, 3.5 Inch (8.89 cm), Taut Band Type, FS = 1 mA dc ±1%, 35 Ohm Resistance (FORWARD POWER Meter)	310–0069	1
----	Filter, RFI, 30 Amperes	339–0030	1
----	Fuseholder, 60 Amperes, 250V, Reject Type	415–0019	1
----	Fuse Holder, AGC	415–2012	2
----	Connector, 7/16 DIN,Panel Jack, Solder	417–0716	1
----	Cable, L5PDF–BH, L5PDR ,17.5", LDF5	610–0009	1
----	Cable, L5PDM, L5PDR, 11.8", LDF5	610–0010	1
----	AC Sample Circuit Board Assembly	917–0306–007	1
----	Temperature Sensor Circuit Board Assembly	917–0306–009	1
----	PFC Relay Board Circuit Board Assembly	917–0330	1
----	Optically Coupled Relay Circuit Board Assembly	919–0096–001	1
----	Harness, AM–2.5E	947–0210	1
----	Exciter/Controller Assembly	957–0009–100	1
----	Power Module Assembly	957–0010–001	2
----	Power Block Assembly	957–0022–021	1
----	Output Network Assembly	957–0068	1
----	Accessory Parts Kit	957–0069	1
----	Power Supply Panel Assembly	957–0315–100	1

TABLE 6-3. AM-5E TRANSMITTER - 907-5000-100
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
B1, B2	Fan, Patriot, 230 Vac	380–9001	2
C1, C2	Capacitor, 50 uF, 370 Vac, Motor Run	047–5063–370	2
F1, F2	Fuse, 100 Amperes, Dual Element, Time Delay	334–0002	2
F7 thru F10	Fuse, 3AG, 250V, 2 Amperes	330–0200	4
K2	Contactor, 80 Amperes, 220/240Vac, 50/60 Hz	341–0074	1

TABLE 6-3. AM-5E TRANSMITTER - 907-5000-100
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
L3 thru L6	Inductor, 5.8 mH, 30 Amperes	370–2366	4
MOV1 thru MOV3	Metal–Oxide Varistor, B40K275, 275V, 1680 Joules	140–0021	3
S1	Switch, Disconnect, Safety Interlock, 60 Amperes	341–0061	1
TB1	Barrier Strip, 9 Terminal	412–0090	1
TB2	Terminal Block, GOULD 63133	412–0050	1
----	Meter, 3.5 Inch (8.89 cm), Taut Band Type, FS = 1 mA dc ±1%, 35 Ohm Resistance (REFLECTED POWER Meter)	310–0064	1
----	Meter, 3.5 Inch (8.89 cm), Taut Band Type, FS = 1 mA dc ±1%, 35 Ohm Resistance (FORWARD POWER Meter)	310–0065	1
----	Filter., RFI, 55 Amperes	339–0055	1
----	Fuseholder, 100 Amperes, 250V, Reject Type	415–0020	1
----	Fuse Holder, AGC	415–2012	4
----	Connector, 7/16 DIN,Panel Jack, Solder	417–0716	1
----	Cable, L5PDF–BH, L5PDR ,17.5", LDF5	610–0009	1
----	Cable, L5PDM, L5PDR, 11.8", LDF5	610–0010	1
----	AC Sample Circuit Board Assembly	917–0306–007	1
----	Temperature Sensor Circuit Board Assembly	917–0306–009	1
----	PFC Relay Board Circuit Board Assembly	917–0330	2
----	Optically Coupled Relay Circuit Board Assembly	919–0096–001	1
----	Exciter/Controller Assembly	957–0009–100	1
----	Power Module Assembly	957–0010–001	4
----	Power Block Assembly	957–0022–051	2
----	Output Network Assembly	957–0070	1
----	Accessory Parts Kit	957–0071	1
----	Power Supply Panel Assembly	957–0315–100	2
----	Harness, AM–5E	947–0212	1

TABLE 6-4. AC SAMPLE CIRCUIT BOARD ASSEMBLY - 917-0306-007

REF. DES.	DESCRIPTION	PART NO.	QTY.
C701	Capacitor, Polypropylene Film, .47 uF ±10%, 600V	033–4763	1
D701 thru D704	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	4
E701, E702	Terminal, Male Disconnect	410–0025	2
J701	Connector, 2–Pin	417–0700	1
R701 thru R706	Resistor, 150 k Ohm±1%, 1/4W	103–1561	6
R707	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
----	Blank, AC Sample Circuit Board	517–0306–007	1

TABLE 6-5. TEMPERATURE SENSOR CIRCUIT BOARD ASSEMBLY - 917-0306-009

REF. DES.	DESCRIPTION	PART NO.	QTY.
C902	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C906	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C907	Capacitor, Ceramic, 0.001 uF, 1 kV	002–1034	1
J901	Socket, 4–Pin	418–0255	1
R901	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R902	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R903	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
TP901, TP902	Terminal, Turret, Double Shoulder	413–1597	2
U901	Integrated Circuit, LM35DZ, Celsius Temperature Sensor, TO–92 Case	220–0035	1
----	Blank, Temperature Sensor, Circuit Board	517–0306–009	1

TABLE 6-6. PFC RELAY BOARD CIRCUIT BOARD ASSEMBLY - 917-0330

REF. DES.	DESCRIPTION	PART NO.	QTY.
J1	Socket, 4–Pin	418–0255	1
J2, J3	Stud, PEM, KFH–832–5ET, PCB Mount	426–8008	2
K1, K2	Relay, SPST, 30 Amperes	270–1213	2
R1	Resistor, 100k Ohm, 2W, ±5%	130–1062	1
----	Blank, PFC Relay Board Circuit Board	517–0330	1

TABLE 6-7. OPTICALLY COUPLED RELAY CIRCUIT BOARD ASSEMBLY - 919-0096-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Optically Coupled Relay Circuit Board Assembly	919–0096	1
	DELETE PARTS		
C3	Capacitor, Ceramic Disc, 0.1 uF, 600V	000–1051	1
R2	Resistor, 560 Ohm ±5%, 1/2W	110–5633	1

TABLE 6-8. OPTICALLY COUPLED RELAY CIRCUIT BOARD ASSEMBLY - 919-0096
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Ceramic, 0.001 uF, 1 kV	002–1034	1
C2	Capacitor, Electrolytic, 47 uF, 35V	020–4773	1
C3	Capacitor, Ceramic Disc, 0.1 uF, 600V	000–1051	1
C4	Capacitor, Ceramic, 0.001 uF, 1 kV	002–1034	1
D1	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1

TABLE 6-8. OPTICALLY COUPLED RELAY CIRCUIT BOARD ASSEMBLY - 919-0096
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D2	Diode, Zener, 1N5359, 24V ±10%, 5W	200–5359	1
D4	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D5	Bridge Rectifier, MDA970A3, 4 Amperes, 50–200V	239–0003	1
E1 thru E5	Terminal, Male Disconnect	410–0025	5
F1, F2	Fuse, 3 Amperes, 250V, Printed Circuit Board Mount	330–0055	2
K1	Relay, Printed Circuit Board Mount Coil: 24V dc, 660 Ohm ±10% Contacts: SPST–NO, 0.5 to 15A @ 12 to 240V ac Resistance	270–0054	1
MOV1	Varistor, 27V, V27ZA60	140–0023	1
R1	Resistor, 2 k Ohm ±3%, 10W, W/W	130–2032	1
R2	Resistor, 560 Ohm ±5%, 1/2W	110–5633	1
R3	Resistor, 820 Ohm ±5%, 1/2W	110–8233	1
R4	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R5	Resistor, 2 k Ohm ±3%, 10W, W/W	130–2032	1
U1	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6–Pin DIP	229–0033	1
XU1	Socket, 6–Pin DIP	417–0600	1
----	Blank, Optically Coupled Relay Circuit Board	519–0096	1

TABLE 6-9. HARNESS ASSEMBLY - 947-0210

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Pins, Connector	417–0036	4
----	Pins, Connector	417–0053	51
----	Pins, Connector	417–0142	42
----	Pins, Socket	417–0143	13
----	Connector Plug, 25–Pin	417–0251	2
----	Receptacle, 15–Pin, D–Type	417–1504	1
----	Kit, Housing, 15–Pin, D–Type	417–1510	1
----	Housing, Wire, MR, Female, 24–Pin, Amp	417–2402	2
----	Kit, Housing, 25–Pin	417–2510	2
----	Plug and Cord ET, AM–500 FAN	417–8500	2
----	3 Circuit–Commoning Bar, AMP MR	418–0054	2
----	Housing, Connector, 4–Pin	418–0233	1
----	Plug, Housing, 4–Pin	418–0240	3
----	Connector Housing, 6–Pin	418–0670	1
----	Connector Housing, 2–Pin, Female	418–0701	2
----	AC Line Cord, N.E.M.A. 3–Wire North American Plug	682–0001	1

TABLE 6-10. POWER BLOCK ASSEMBLY, AM-2.5E- 957-0022-021

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Power Block Motherboard Circuit Board Assembly	917–0303	1
----	Combiner Circuit Board Assembly	917–0321–002	1

TABLE 6-11. POWER BLOCK ASSEMBLY, AM-5E - 957-0022-051

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Power Block Motherboard Circuit Board Assembly	917–0303	1
----	Combiner Circuit Board Assembly	917–0321–005	1

TABLE 6-12. POWER BLOCK MOTHERBOARD CIRCUIT BOARD ASSEMBLY - 917-0303

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1, C2	Capacitor, Ceramic, Monolythic, .1 uF ±10%, 50V	003–1066	2
C3, C4	Capacitor, Polypropylene Film, 2.2 uF, 400V	030–2256	2
E1, E2, E5 thru E8 E11 thru E16 E22, E23	Stud, PEM, KFH–832–8ET, PCB Mount	426–8007	14
J3	Connector, Male, 24–Pin	417–2401	1
J1A thru J1F	Socket, Card Edge, AMP 531353–6	417–0300	6
J2A thru J2F	Connector, 15–Pin SUB–D, Female	417–0375	6
T1, T2	Transformer, P.A. Drive, AM–1/5	370–0037	2
----	Blank, Power Block Motherboard Circuit Board	517–0303	1

TABLE 6-13. COMBINER CIRCUIT BOARD ASSEMBLY, AM-2.5E - 917-0321-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
E1 thru E9	Stud, PEM, KFH–832–8ET, Printed Circuit Board Mount	426–8007	9
L1 thru L4	RF Choke Assembly	360–0107	4
T1 thru T4	Combiner Transformer Assembly	370–0060	4
TP1 thru TP10	Terminal Test Point, Oval Red	413–0106	10
----	Blank, Combiner Circuit Board Assembly	517–0321	1

TABLE 6-14. COMBINER CIRCUIT BOARD ASSEMBLY, AM-5E - 917-0321-005
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
E1 thru E9	Stud, PEM, KFH–832–8ET, Printed Circuit Board Mount	426–8007	9
L1 thru L4	RF Choke Assembly	360–0107	4

TABLE 6-14. COMBINER CIRCUIT BOARD ASSEMBLY, AM-5E - 917-0321-005
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
T1 thru T4	Combiner Transformer Assembly	370-0061	4
TP1 thru TP10	Terminal, Test Point, Oval, Red	413-0106	10
----	Blank, Combiner Circuit Board	517-0321	1

TABLE 6-15. ACCESSORY PARTS KIT, AM-2.5E - 957-0069

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Fuse, 3AG, 250V, 2 Amperes	330-0200	2
----	Fuse, 3AB, 15 Amperes, 65V, Very Fast	330-1502	1
----	Fuse, 3AB, 250V, 20 Amperes	330-2000	1
----	Fuse, 30 Amperes, 125V, 1/4x1-1/5850P Lead	334-0030-001	2
----	Fuse, AGC, 1A, 250V, Slow-Blow (for 115 Volt operation)	334-0100	1
----	Fuse, 5 X 20MM, 1.5 Amperes, Slow-Blow	334-1150	2
----	Battery, 9 Volt, Alkaline	350-0002	1
----	Ferrite Core Large AM Transmitter	375-0007-001	2
----	Core, 1.102 OD X .63 ID X .512 THK	375-0009	2
----	Adjustment Tool, Extended and Recessed Flat Blades	407-0186	1
----	Kit, Instruction Manual AM-2.5E/5E	977-1114	1

TABLE 6-16. ACCESSORY PARTS KIT, AM-5E - 957-0071

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Fuse, 3AG, 250V, 2 Amperes	330-0200	4
----	Fuse, 3AB, 15 Amperes, 65V, Very Fast	330-1502	2
----	Fuse, 3AB, 250V, 20 Amperes	330-2000	2
----	Fuse, 30 Amperes, 125V, 1/4x1-1/5850P Lead	334-0030-001	4
----	Fuse, AGC, 1 Ampere, 250V, Slow-Blow (For 115 Volt Operation)	334-0100	2
----	Fuse, 5 X 20MM, 1.5 Ampere, Slow-Blow	334-1150	4
----	Battery, 9 Volt, Alkaline	350-0002	1
----	Ferrite Core Large AM Transmitter	375-0007-001	2
----	Core, 1.102 OD X .63 ID X .512 THK	375-0009	2
----	Adjustment Tool, extended and recessed flat blades	407-0186	1
----	Kit, Instruction Manual, AM-2.5E/5E	977-1114	1

TABLE 6-17. FREQUENCY DEPENDANT KIT, AM-2.5E, 522 - 650 KHZ - 957-0015-121

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 522 – 650 KHZ	957–1015–001	1
----	Kit, Frequency Dependent Parts, Power Block, 522 – 650 KHZ	957–1025–061	1
----	Kit, Frequency Dependent Parts, Output Network, 522 – 650 KHZ	957–1035–121	1

TABLE 6-18. FREQUENCY DEPENDANT KIT, AM-2.5E, 651 - 770 KHZ - 957-0015-122

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 651 – 770 KHZ	957–1015–002	1
----	Kit, Frequency Dependent Parts, Power Block, 651 – 770 KHZ	957–1025–062	1
----	Kit, Frequency Dependent Parts, Output Network, 651 – 770 KHZ	957–1035–122	1

TABLE 6-19. FREQUENCY DEPENDANT KIT, AM-2.5E, 771 - 920 KHZ - 957-0015-123

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 771 – 920 KHZ	957–1015–003	1
----	Kit, Frequency Dependent Parts, Power Block, 771 – 920 KHZ	957–1025–063	1
----	Kit, Frequency Dependent Parts, Output Network, 771 – 920 KHZ	957–1035–123	1

TABLE 6-20. FREQUENCY DEPENDANT KIT, AM-2.5E, 921 - 1080 KHZ - 957-0015-124

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 921 – 1080 KHZ	957–1015–004	1
----	Kit, Frequency Dependent Parts, Power Block, 921 – 1080 KHZ	957–1025–064	1
----	Kit, Frequency Dependent Parts, Output Network, 921 – 1080 KHZ	957–1035–124	1

TABLE 6-21. FREQUENCY DEPENDANT KIT, AM-2.5E, 1081 - 1300 KHZ - 957-0015-125

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 1081 – 1300 KHZ	957–1015–005	1
----	Kit, Frequency Dependent Parts, Power Block, 1081 – 1300 KHZ	957–1025–065	1
----	Kit, Frequency Dependent Parts, Output Network, 1081 – 1300 KHZ	957–1035–125	1

TABLE 6-22. FREQUENCY DEPENDANT KIT, AM-2.5E, 1301 - 1580 KHZ - 957-0015-126

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 1301 – 1580 KHZ	957–1015–006	1
----	Kit, Frequency Dependent Parts, Power Block, 1301 – 1580 KHZ	957–1025–066	1
----	Kit, Frequency Dependent Parts, Output Network, 1301 – 1580 KHZ	957–1035–126	1

TABLE 6-23. FREQUENCY DEPENDANT KIT, AM-2.5E, 1581 - 1700 KHZ - 957-0015-127

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 1581 – 1700 KHZ	957–1015–007	1
----	Kit, Frequency Dependent Parts, Power Block, 1581 – 1700 KHZ	957–1025–067	1
----	Kit, Frequency Dependent Parts, Output Network, 1581 – 1700 KHZ	957–1035–127	1

TABLE 6-24. FREQUENCY DEPENDANT KIT, AM-5E, 522 - 650 KHZ - 957-0015-151

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 522 – 650 KHZ	957–1015–001	1
----	Kit, Frequency Dependent Parts, Power Block, 522 – 650 KHZ	957–1025–061	1
----	Kit, Frequency Dependent Parts, Output Network, 522 – 650 KHZ	957–1035–151	1

TABLE 6-25. FREQUENCY DEPENDANT KIT, AM-5E, 651 - 770 KHZ - 957-0015-152

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 651 – 770 KHZ	957–1015–002	1
----	Kit, Frequency Dependent Parts, Power Block, 651 – 770 KHZ	957–1025–062	1
----	Kit, Frequency Dependent Parts, Output Network, 651 – 770 KHZ	957–1035–152	1

TABLE 6-26. FREQUENCY DEPENDANT KIT, AM-5E, 771 - 920 KHZ - 957-0015-153

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 771 – 920 KHZ	957–1015–003	1
----	Kit, Frequency Dependent Parts, Power Block, 771 – 920 KHZ	957–1025–063	1
----	Kit, Frequency Dependent Parts, Output Network, 771 – 920 KHZ	957–1035–153	1

TABLE 6-27. FREQUENCY DEPENDANT KIT, AM-5E, 921 - 1080 KHZ - 957-0015-154

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 921 – 1080 KHZ	957–1015–004	1
----	Kit, Frequency Dependent Parts, Power Block, 921 – 1080 KHZ	957–1025–064	1
----	Kit, Frequency Dependent Parts, Output Network, 921 – 1080 KHZ	957–1035–154	1

TABLE 6-28. FREQUENCY DEPENDANT KIT, AM-5E, 1081 - 1300 KHZ - 957-0015-155

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 1081 – 1300 KHZ	957–1015–005	1
----	Kit, Frequency Dependent Parts, Power Block, 1081 – 1300 KHZ	957–1025–065	1
----	Kit, Frequency Dependent Parts, Output Network, 1081 – 1300 KHZ	957–1035–155	1

TABLE 6-29. FREQUENCY DEPENDANT KIT, AM-5E, 1301 - 1580 KHZ - 957-0015-156

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 1301 – 1580 KHZ	957–1015–006	1
----	Kit, Frequency Dependent Parts, Power Block, 1301 – 1580 KHZ	957–1025–066	1
----	Kit, Frequency Dependent Parts, Output Network, 1301 – 1580 KHZ	957–1035–156	1

TABLE 6-30. FREQUENCY DEPENDANT KIT, AM-5E, 1581 - 1700 KHZ - 957-0015-157

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Kit, Frequency Dependent Parts, Power Amplifier Modulator Circuit, Board, 1581 – 1700 KHZ	957–1015–007	1
----	Kit, Frequency Dependent Parts, Power Block, 1581 – 1700 KHZ	957–1025–067	1
----	Kit, Frequency Dependent Parts, Output Network, 1581 – 1700 KHZ	957–1035–157	1

TABLE 6-31. POWER BLOCK FREQUENCY DEPENDANT KIT, 522 - 650 KHZ - 957-1025-061

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 522 – 650 kHz	360–0114–XXX	4

TABLE 6-32. POWER BLOCK FREQUENCY DEPENDANT KIT, 651 - 770 KHZ - 957-1025-062

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 651 – 770 kHz	360–0114–XXX	4

TABLE 6-33. POWER BLOCK FREQUENCY DEPENDANT KIT, 771 - 920 KHZ - 957-1025-063

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 771 – 920 kHz	360–0114–XXX	4

TABLE 6-34. POWER BLOCK FREQUENCY DEPENDANT KIT, 921 - 1080 KHZ - 957-1025-064

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 921 – 1080 kHz	360–0114–XXX	4

TABLE 6-35. POWER BLOCK FREQUENCY DEPENDANT KIT, 1081 - 1300 KHZ - 957-1025-065

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 1081 – 1300 kHz	360–0114–XXX	4

TABLE 6-36. POWER BLOCK FREQUENCY DEPENDANT KIT, 1301 - 1580 KHZ - 957-1025-066

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 1301 – 1580 kHz	360–0114–XXX	4
L9	Inductor, 120 uH, 1.5 Amperes ±10%	360–1824	1

TABLE 6-37. POWER BLOCK FREQUENCY DEPENDANT KIT, 1581 - 1700 KHZ - 957-1025-067

REF. DES.	DESCRIPTION	PART NO.	QTY.
L5 thru L8	Coil, 1581 – 1700 kHz	360–0114–XXX	4
L9	Inductor, 100 uH, 1.5 Amperes ±10%	360–1823	1

SECTION VII
DRAWINGS

7-1. INTRODUCTION.

7-2. This section provides schematic diagrams and assembly diagrams as indexed below for the Broadcast Electronics AM-2.5E/AM-5E transmitters.

FIGURE	TITLE	NUMBER
7-1	OVERALL SCHEMATIC DIAGRAM, AM-2.5E	SB907-2500-100
7-2	SCHEMATIC DIAGRAM, TEMPERATURE SENSOR CIRCUIT BOARD	SA917-0306-009
7-3	SCHEMATIC DIAGRAM, AC SAMPLE CIRCUIT BOARD	SA917-0306-007
7-4	ASSEMBLY DIAGRAM, ECU DISPLAY CIRCUIT BOARD	AD917-0306-001/ -002/-003/-004/ -005/-006/-007/ -009/-014
7-5	SCHEMATIC DIAGRAM, POWER BLOCK MOTHERBOARD	SB917-0303
7-6	ASSEMBLY DIAGRAM, POWER BLOCK MOTHERBOARD	AC917-0303
7-7	ASSEMBLY DIAGRAM, COMBINER	AC917-0321/-001 -006
7-8	SCHEMATIC DIAGRAM, OPTICALLY COUPLED RELAY	SB919-0096/-001
7-9	ASSEMBLY DIAGRAM, OPTICALLY COUPLED RELAY (OCR)	AB919-0096/-001
7-10	SCHEMATIC DIAGRAM, CUSTOMER INTERFACE PRINTED CIRCUIT BOARD	SD917-0410
7-11	ASSEMBLY DIAGRAM, CUSTOMER INTERFACE PRINTED CIRCUIT BOARD	AB917-0410
7-12	SCHEMATIC DIAGRAM, POWER FACTOR CORRECTOR BOARD	SB917-0330
7-13	ASSEMBLY DIAGRAM, POWER FACTOR CORRECTOR BOARD	AB917-0330
7-14	SCHEMATIC DIAGRAM, INTERFACE CIRCUIT BOARD, AM-5E	SB917-0306-003
7-15	SCHEMATIC DIAGRAM, POWER SUPPLY STATUS CIRCUIT BOARD, AM-5E	SA917-0306-006

SEE SHEET 2 FOR DETAILS

917-0410 — 161, 162, 163, 164, 165 — 917-0301

TB1 TB2

POWER 5 COMMAND 1 — MOND LEFT CONTROL
POWER 4 COMMAND 2 — MOND RIGHT CONTROL
POWER 3 COMMAND 3 — MOND L & R CONTROL
POWER 2 COMMAND 4 — STEREO CONTROL
POWER 1 COMMAND 5 — MOND LEFT
OFF COMMAND 6 — MOND RIGHT
POWER 5 STATUS 7 — MOND L & R
POWER 4 STATUS 8 — STEREO
POWER 3 STATUS 9 — REMOTE FWD METER
POWER 2 STATUS 10 — REMOTE RFL METER
POWER 1 STATUS 11 — REMOTE ENABLED
OFF STATUS 12 — ANTENNA CONFLICT
REMOTE COMMON 13 — MAINTENANCE
REMOTE COMMON 14 — LIGHTNING
REMOTE COMMON 15 — 1.2:1 VSWR
RAISE COMMAND 16 — EXCITER FAULT
LOWER COMMAND 17 — POWER SUPPLY FAULT
REMOTE +5V 18 — POWER BLOCK FAULT
REMOTE +5V 19 — RFL POWER HIGH
REMOTE COMMON 20 — RFL PWR EMERG.
21 — OVERTEMP
22 — FOLDBACK
23 — ALARM
ANTENNA A INTERLOCK 24 — ALARM RESET
ANTENNA B INTERLOCK 25 — + LEFT INPUT
ANTENNA C INTERLOCK 26 — - AUDIO
EXTERNAL TRANSMITTER MUTE 27 — GROUND
REMOTE FAILSAFE 28 — + RIGHT INPUT
EXTERNAL INTERLOCK 29 — - AUDIO
+5V REMOTE INTERLOCK 30 — GROUND
EXTERNAL STEREO RF INPUT 167 — J11

PART OF ECU MOTHERBOARD 917-0301

TEMP SENSOR CATHODE ADJUST — P4 — J4 — RED, BLK, SHLD — 201 — P901 — J901 — TEMPERATURE SENSOR BD 917-0306-009

ANODE 8

P5 — J5 — WHT, BLK, GRN, RED, SHLD — 208 — P1 — J1
1 FORWARD POWER SAMPLE
2 REFLECTED POWER SAMPLE
3 DIRECTIONAL COUPLER RETURN
4 +5V TO RELAYS
5 GROUND
6 POWER LEVEL 1
7 POWER LEVEL 2
8 POWER LEVEL 3
9 POWER LEVEL 4
10 POWER LEVEL 5
11 LIGHTNING DETECTOR PULL-UP
12 LIGHTNING DETECTOR SENSE
13 LIGHTNING DETECTOR RETURN

P5 — J5 — BRN, GRN, BLU, YEL, ORN, RED, WHT, BLK — 209 — P1 — J1

OUTPUT NETWORK ASSEMBLY 957-0068

RF OUT — E9 — RF OUT 50 OHMS NOMINAL — E2 — GROUND STRAP
J2 — 166 — MODULATION MONITOR SAMPLE OUT
801
RF IN — E1 — #800
RF OUT — E5, E1

P5 — J5 — 205-1, 205-2, SHLD — P4 — J4
11 PWM
10 PWM

CTR — 206 — CTR — SHLD
P4 — J4 — RED, WHT, BLK, SHLD — 204
14 POWER BLOCK RF INPUT
15 POWER BLOCK RF GND
22 POWER BLOCK FAULT
13 POWER BLOCK MAINTENANCE-
16 POWER BLOCK MAINTENANCE +
23 POWER BLOCK FAULT COMMON

BLK, RED, WHT, SHLD
2 POWER BLOCK RF DRIVER -15V
1 POWER BLOCK RF DRIVER +15V
4 POWER BLOCK MODULATOR +20V
3

POWER BLOCK ASSEMBLY #1 957-0022-021 (PA1 - PA2)

CHASSIS
E27 B- IN 518
E28 B- IN 516
E5 B+ IN 517
E4 B+ IN 515

POWER BLOCK J4 P4
RF PRE-DRIVER +20V RETURN 20 GRN
POWER SUPPLY MUTE - 21 BLK
POWER SUPPLY MUTE + 17 WHT

METER SWITCH BOARD 917-0306-005

FORWARD POWER 0-3000W 0-750W — M1 1mA — 21 — PS02 — J502
REFLECTED POWER 0-300W 0-60W AC LINE 150-300V — M2 1mA — 22, 23, 24
1 FWD PWR (+)
2 FWD PWR (-)
3 RFL PWR (+)
4 RFL PWR (-)

BLK — K1 OCR 919-0096 — E4, E3, RED — E5, E1, E2 — PS01 — J501
4 AC SAMPLE + 2
5 AC SAMPLE - 3

PS01 — J501 — RED, BLK, SHLD — 200 — J4 — P4
1 FORWARD POWER METER
2 REFLECTED POWER METER
3 METER COMMON
JUMPER
4 +15V TO CABINET INTERLOCK
5 CABINET INTERLOCK

RED — 13 — TRANSMITTER ON +
18 SHLD
BLK — J4 — P4
14 POWER SUPPLY MAINTENANCE -
16 POWER SUPPLY EMERGENCY
17 POWER SUPPLY FAULT
19 CARRIER CONTROL PWM
20 120 Hz
21 TRANSMITTER ON
15 POWER SUPPLY STATUS COMMON

213 — BLK, RED, WHT, SHLD — P3 — J3
24 POWER BLOCK RF DRIVER -15V
20 POWER BLOCK RF DRIVER +15V
16 POWER BLOCK MODULATOR +20V
10 POWER SUPPLY STATUS COMMON
9 POWER SUPPLY CONTROL +
7 POWER SUPPLY MAINTENANCE +

202 — RED, BLK

WHT, RED, BLK, GRN, ORN, BLU, SHLD — 212
1 POWER SUPPLY ENABLE
3 POWER SUPPLY EMERGENCY
11 POWER SUPPLY MAINTENANCE -
5 CARRIER CONTROL PWM
4 POWER SUPPLY FAULT
8 120 HZ
13 POWER SUPPLY STATUS COMMON

POWER SUPPLY PCB ASSEMBLY #1 917-0315-001/002/004 (PA1 - PA2)

J3 — P3
POWER SUPPLY MUTE + 2 WHT
POWER SUPPLY MUTE - 6 BLK
RF PRE-DRIVER +20V RETURN 21 GRN — 210
POWER SUPPLY STATUS COMMON 14 SHLD

E6 E5 E11 E10
J3 — 22 RED, 15 BLK — 220

AC LINE CORD TO ECU ASSY — WHITE, GREEN, BLACK — 111, 115, 116
TB1 — 8 7 6 5 4 3 2 1 — 108, 109, 107
F1 50A — MOV1 — 103
F2 50A — MOV2 — 104
MOV3 — 105
106
PANEL GROUND — 148, 147, 146, 145
TB2 — 1 2 3 — 122, 123
F7 2A — 124
F8 2A — 125
112, 114, 117, 118, 113

E701 AC IN E702 — AC SAMPLE BOARD 917-0306-007 — J701 — P701 — 9, 8

AC IN 196-252V 50/60 Hz — GND — RFI FILTER — 101 S1, 102 SAFETY SWITCH — K2 — 137, 138, 139, 140, 135, 136 — 132, 133, 134 — PHASE MONITOR

L3 5.8 nH — L4 5.8 nH — C1 50nF — 141, 142, 143

917-0330 — J1 — RED, BLK, SHLD — 220 — J3, J2

FAN ASSEMBLY — P8 — J8 — B1 — B2

AC IN — P7 — J7 — 124, 125 — TB1 — 126 #505, #527 — 127 #503, #524

POWER SUPPLY PANEL ASSEMBLY #1 957-0315-100

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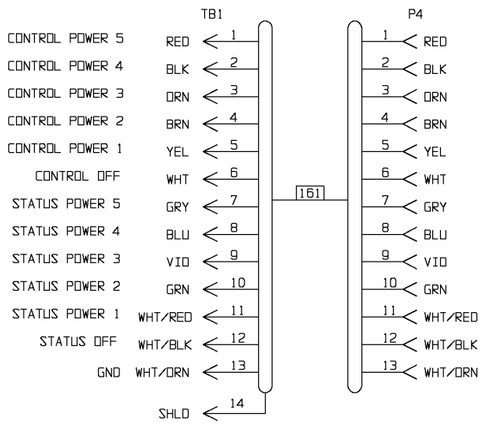
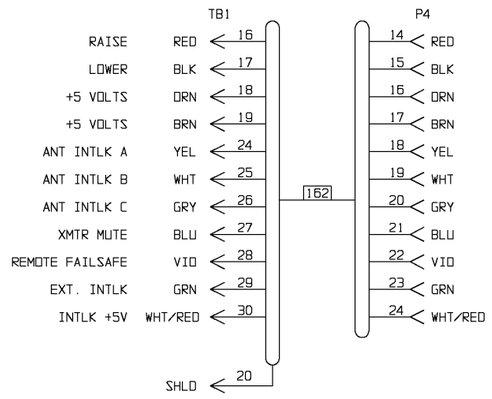
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xx ± .015 .xxx ± .005 ANGLES ± 1°

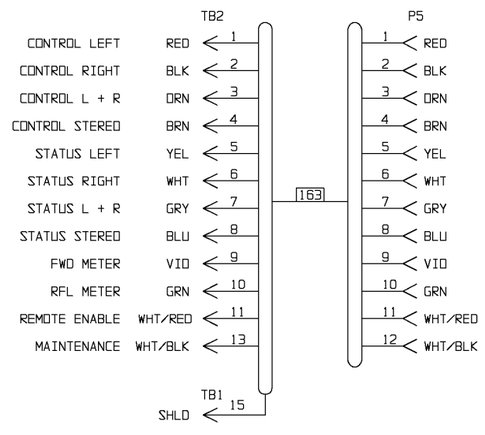
DWN. BY MSE 5-11-99
DESIGNER(S)
PROJ. LEADER
MFG.
MATERIAL
FINISH
SEE DWG RA592-0000
NEXT ASSY.

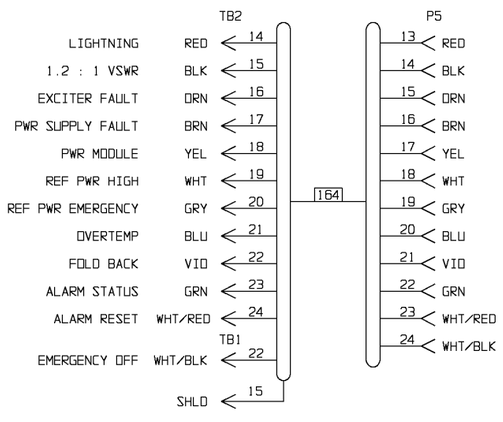
BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

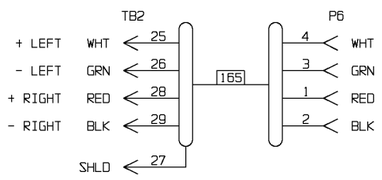
TITLE SCHEMATIC, OVERALL
TYPE S SIZE D DWG. NO. 907-2500-100 REV
MODEL SCALE NTS SHEET 1 OF 2











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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MSE 6-23-99
DESIGNER (S)
PROJ. LEADER
MFG.

MATERIAL
FINISH
SEE DWG RA582-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-8607

TITLE
OVERALL SCHEMATIC

TYPE S | SIZE D | DWG. NO. 907-2500-100 | REV A
MODEL | SCALE NTS | SHEET 2 OF 2

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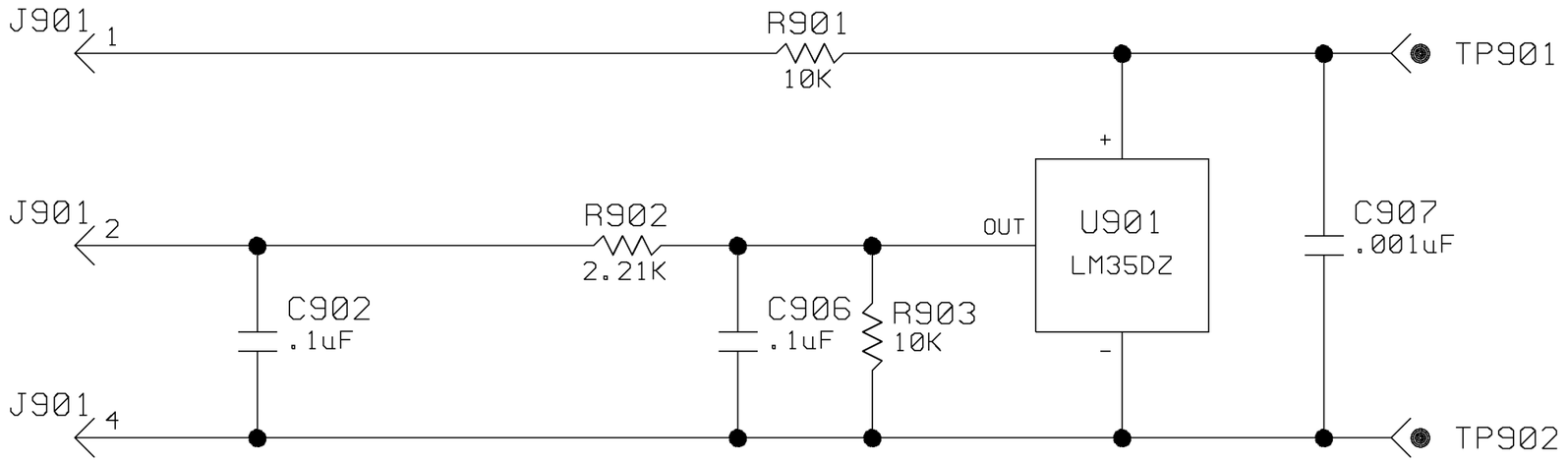

NOTES:

1. ALL REFERENCE DESIGNATORS START AT 901.
2. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENT USED: C907, J901, R903, TP902, U901
4. COMPONENTS NOT USED: C901,C903-C905.
5. SEE ASSEMBLY: AD917-0306

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MERKEL 1-2-96

CHKD

ME

PROJ. ENGR.

MFG.

MATERIAL
SEE BOM
917-0306-009

FINISH

SEE DWG RA592-0000

NEXT ASSY.
AD917-0306

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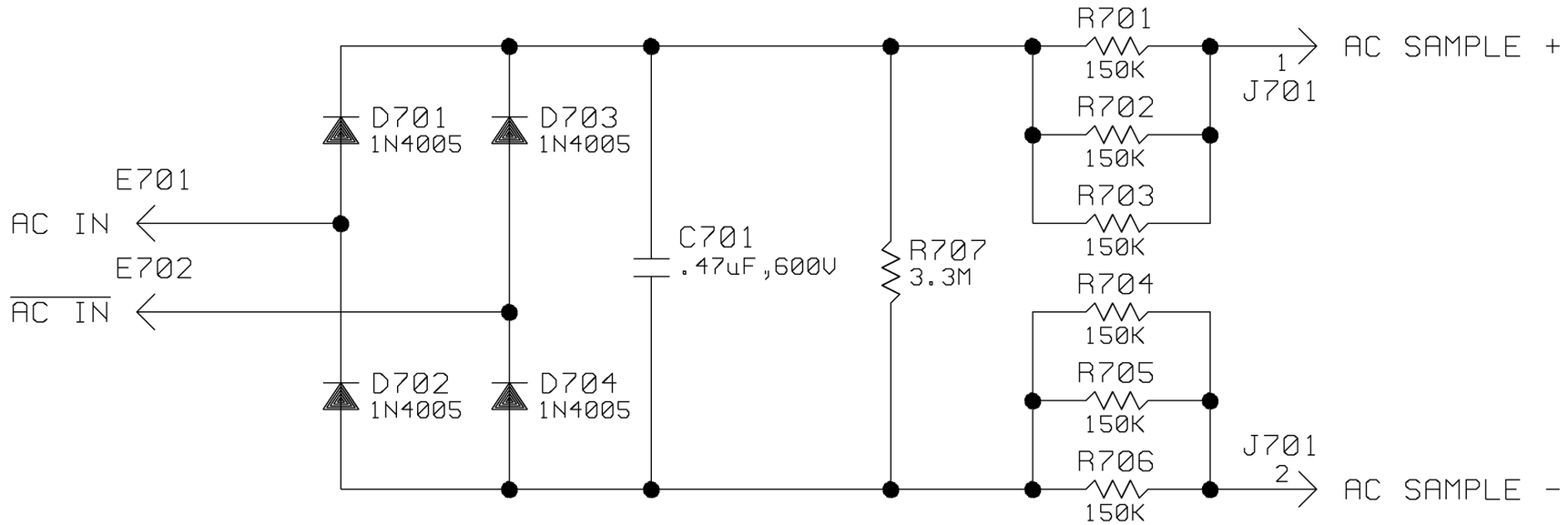
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
SCHEMATIC
TEMPERATURE SENSOR PCB

TYPE	SIZE	DWG. NO.	REV
S	A	917-0306-009	A

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1



NOTES:
1. ALL REFERENCE DESIGNATORS START AT 701.
2. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENT USED: C701, D704, E702, J701, R706
4. COMPONENTS NOT USED:
5. SEE ASSEMBLY: AD917-0306

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MERKEL 1-2-96	MATERIAL SEE BOM 917-0306-007	
CHKD		
ME	FINISH	
PROJ. ENGR.	SEE DWG RA592-0000	
MFG.	NEXT ASSY. AD917-0306	

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TITLE
SCHEMATIC
AC SAMPLE PCB

TYPE	SIZE	DWG. NO.	REV
S	A	917-0306-007	A

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1

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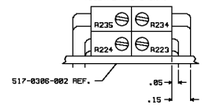
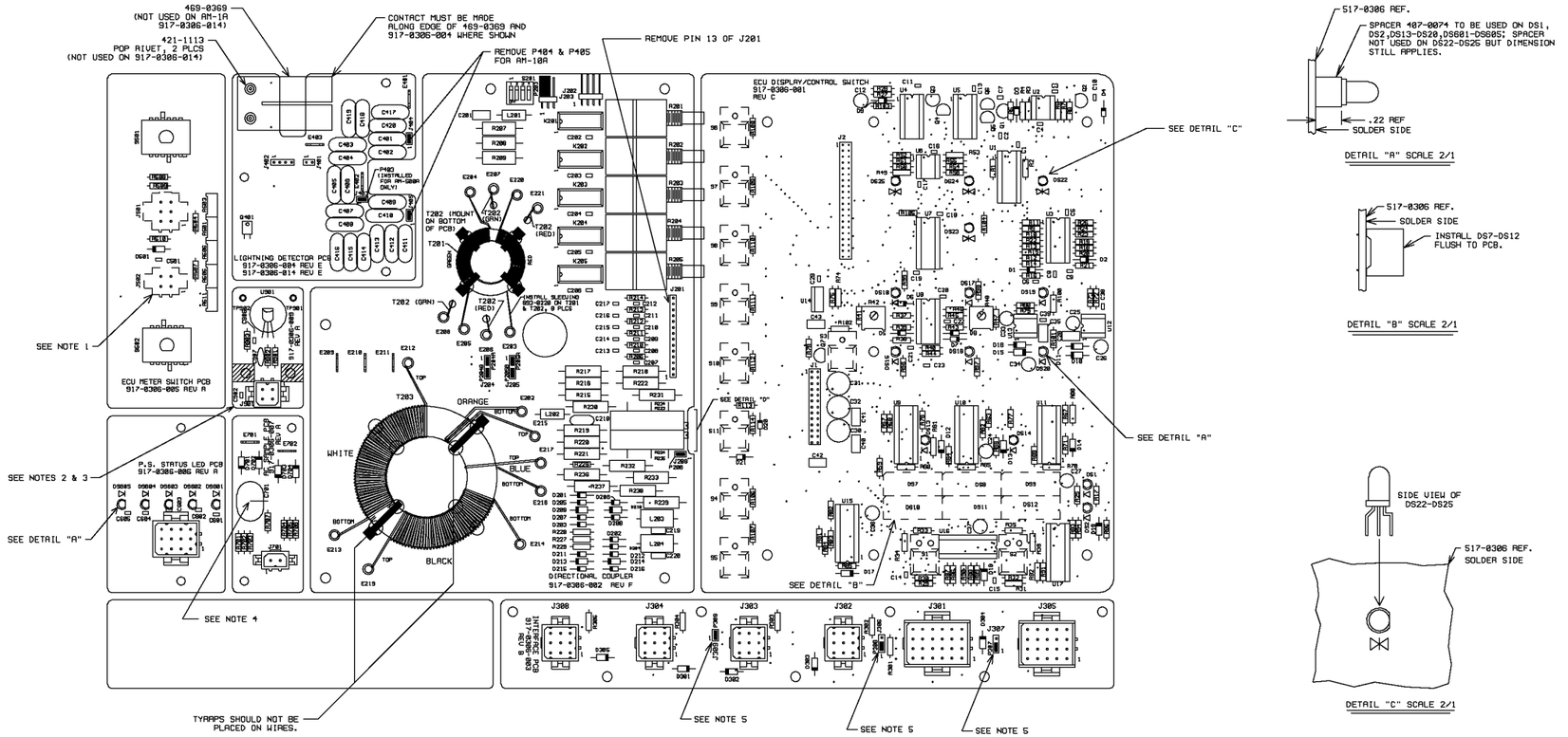
NOTES:
1. FORM LEADS FOR R223 & R224 .05" AWAY FROM COMPONENT BODY. FORM LEADS FOR R234 & R235 .15" AWAY FROM COMPONENT BODY.
2. GLUE R223,R224,R234 & R235 TOGETHER AS SHOWN.



DETAIL "D" SCALE 2/1



DETAIL "A" SCALE 2/1

DETAIL "B" SCALE 2/1

DETAIL "C" SCALE 2/1

COATING INSTRUCTIONS: (917-0306-009 PCB ONLY)
1. MASK BODY OF DEVICE U901 COMPLETELY. MASK TURRETS TP901 & TP902. INSERT 418-0240 DUMMY PLUG INTO J901. MASK BOTH SIDES OF PCB AT MOUNTING HOLES AS SHADED.
2. APPLY ONE COAT OF URETHANE CONFORMAL COATING (700-0126), TO BOTH SIDES OF PCB, PER VENDOR INSTRUCTIONS; THEN REMOVE MASKING.
3. ALLOW 15 MINUTES DRYING TIME.

NOTES:
1. ALL PARTS SHOWN WITH DASHED LINES TO BE MOUNTED FROM OPPOSITE SIDE.
2. U901 TO BE CENTERED IN .630 HOLE.
3. TEMP SENSOR PCB #916-0306-009 IS TO RECEIVE CONFORMAL COATING AFTER ASSEMBLY. SEE COATING INSTRUCTIONS.
4. COVER EXPOSED LEAD OF C701 WITH HEATSHRINK TUBING P/N 611-0058.
5. FOR AM-2A PLACE P306/P307 ON J306/J307 PINS 1 & 2. FOR AM-6A/AM-10A PLACE P306/P307 ON J306/J307 PINS 2 & 3. P309 USED ON AM-6A ONLY.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY	MERK 1-2-96
CHKD	
ME	
PROJ. ENGR.	JW 8-16-96
MFG.	

MATERIAL: SEE BOM'S 917-0306-001 THRU 917-0306-007, 917-0306-009, 917-0306-014
FINISH: SEE DWG RAS92-0000
NEXT ASSY.

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4100 N.24TH ST. P.O.BOX 3686 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: ASSEMBLY, ECU BREAK-AWAY PCB

TYPE	SIZE	DWG No.	REV
A	D	917-0306-001 THRU 917-0306-007,-009&-014	F

MODEL AM-6A & AM-10A | SCALE 1/1 | SHEET 1 OF 1

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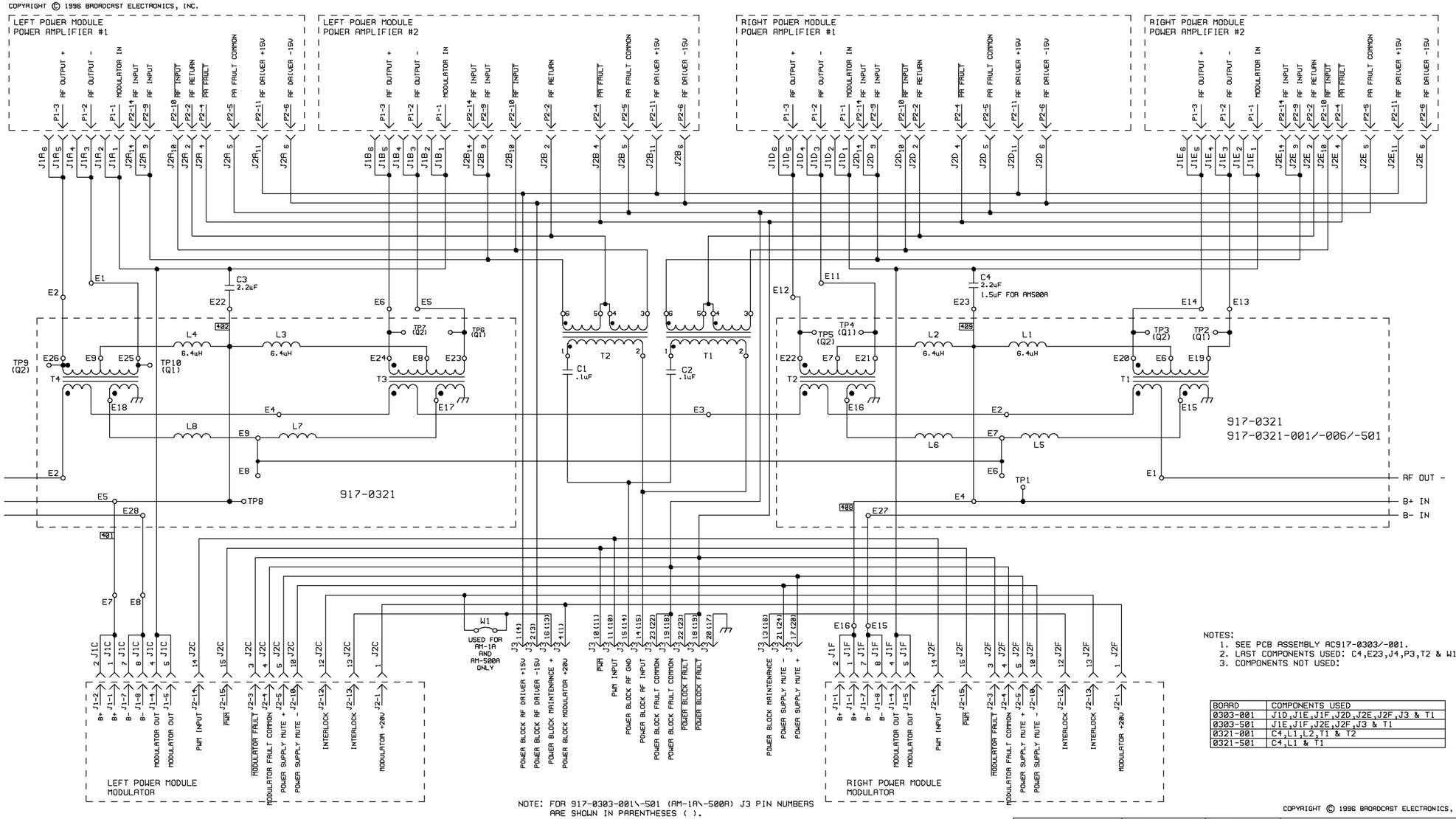

NOTES:
1. SEE PCB ASSEMBLY AC917-0303/-001.
2. LAST COMPONENTS USED: C4,E23,J4,P3,T2 & W1.
3. COMPONENTS NOT USED:

BOARD	COMPONENTS USED
0303-001	J1D,J1E,J1F,J2D,J2E,J2F,J3 & T1
0303-501	J1E,J1F,J2E,J2F,J3 & T1
0321-001	C4,L1,L2,T1 & T2
0321-501	C4,L1 & T1

NOTE: FOR 917-0303-001\-501 (AM-1A\-500A) J3 PIN NUMBERS ARE SHOWN IN PARENTHESES ( ).

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY 2-27-96
K. HAYDEN
CHKD
ME
PROJ. ENGR. JW 8-16-96
MFG.

MATERIAL SEE BOM'S 917-0303 917-0303-001 917-0303-501
FINISH
SEE DWG RA592-0008
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE SCHEMATIC - POWER BLOCK MOTHERBOARD & COMBINER

TYPE	SIZE	DWG. NO.	REV
S	B	917-0303/-001/-501	E

MODEL AM-1A SCALE NONE SHEET 1 OF 1

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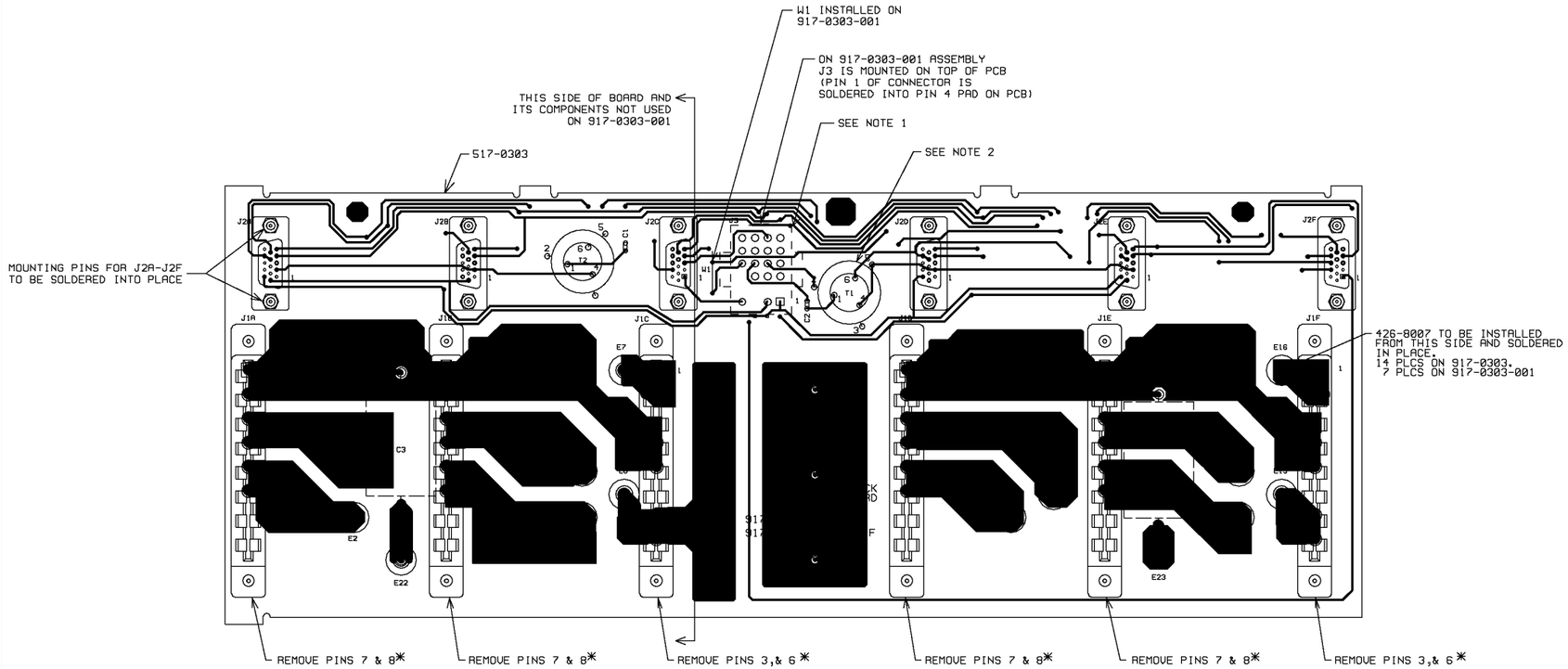

NOTES:

1. COMPONENTS SHOWN WITH DASHED LINES TO BE MOUNTED FROM OPPOSITE SIDE.
2. TERMINALS 1-2 ARE BLU; 3-4 ARE WHT; 5-6 ARE ORG.

* USE AMP TOOL #91116-1 TO REMOVE DESIGNATED PINS FROM J1A-J1F.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY 3-4-96 M. HAYDEN
CHKD
ME
PROJ. ENGR. 3-4-96 J. WESTBERG
MFG.

MATERIAL SEE B/M 917-0303 917-0303-001
FINISH
SEE DWG RA592-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB ASSEMBLY POWER BLOCK MOTHER BD

TYPE	SIZE	DWG No.	REV
A	C	917-0303 917-0303-001	F

MODEL AM-1A | SCALE 1/1 | SHEET 1 OF 1

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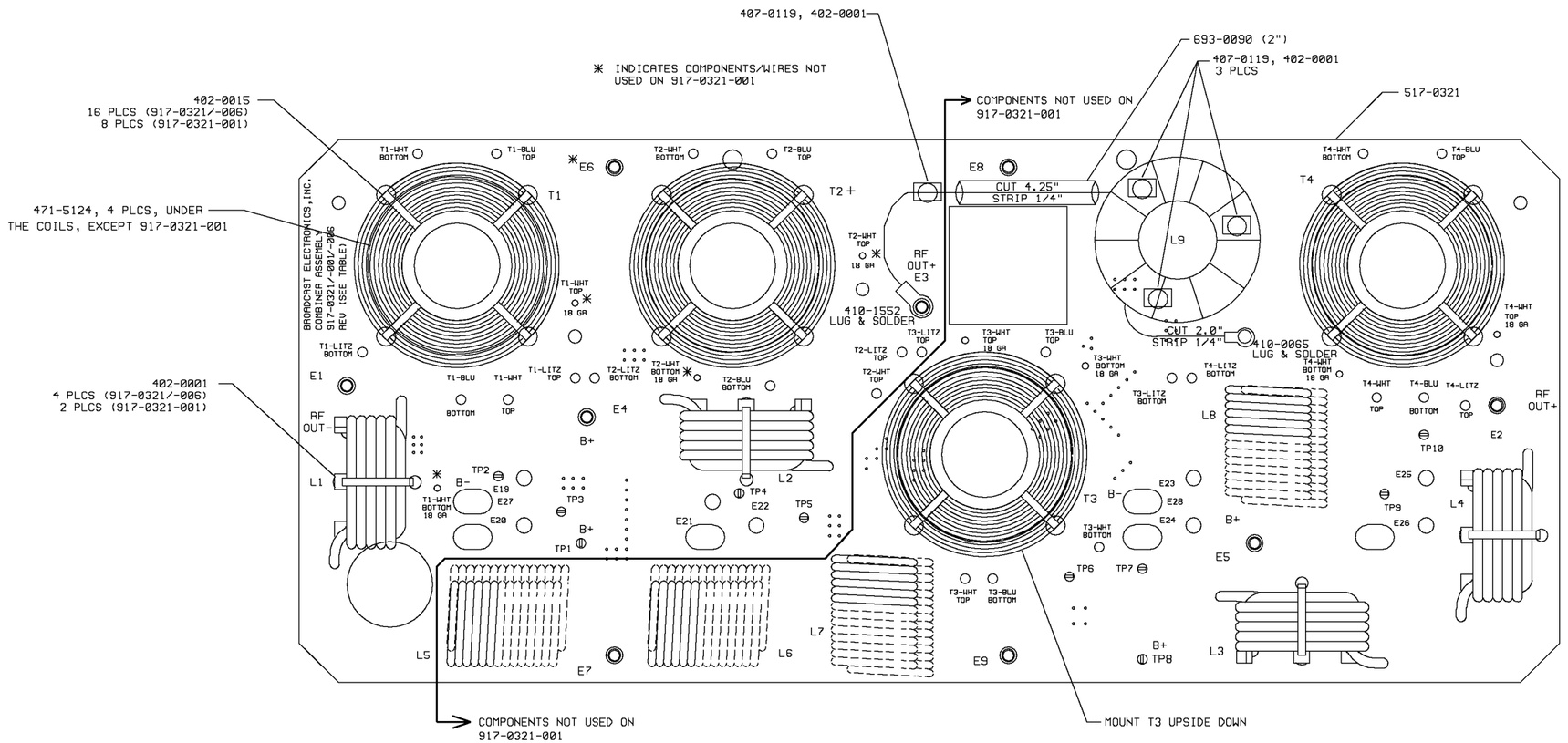

NOTES:

1. SEE SCHEMATIC SB917-0303/-001.
2. INSTALL L9 ON 1301-1580 KHz & 1581-1700KHz, AM-10A, ON 917-0321 ONLY.
3. LITZ WIRE TOP & BOTTOM REVERSED FOR 917-0321-002.

REVISION CHART	
REV	PCB DRAWING NO.
F	917-0321
E	917-0321-001
H	917-0321-002
H	917-0321-005
G	917-0321-006

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY 12-15-95 M. HAYDEN
DESIGNER(S)
PROJ. LEADER JW 8-15-96
MFG.

MATERIAL SEE BOM 917-0321 917-0321-001 917-0321-006
FINISH
NEXT ASSY.

BROADCAST ELECTRONICS INC.
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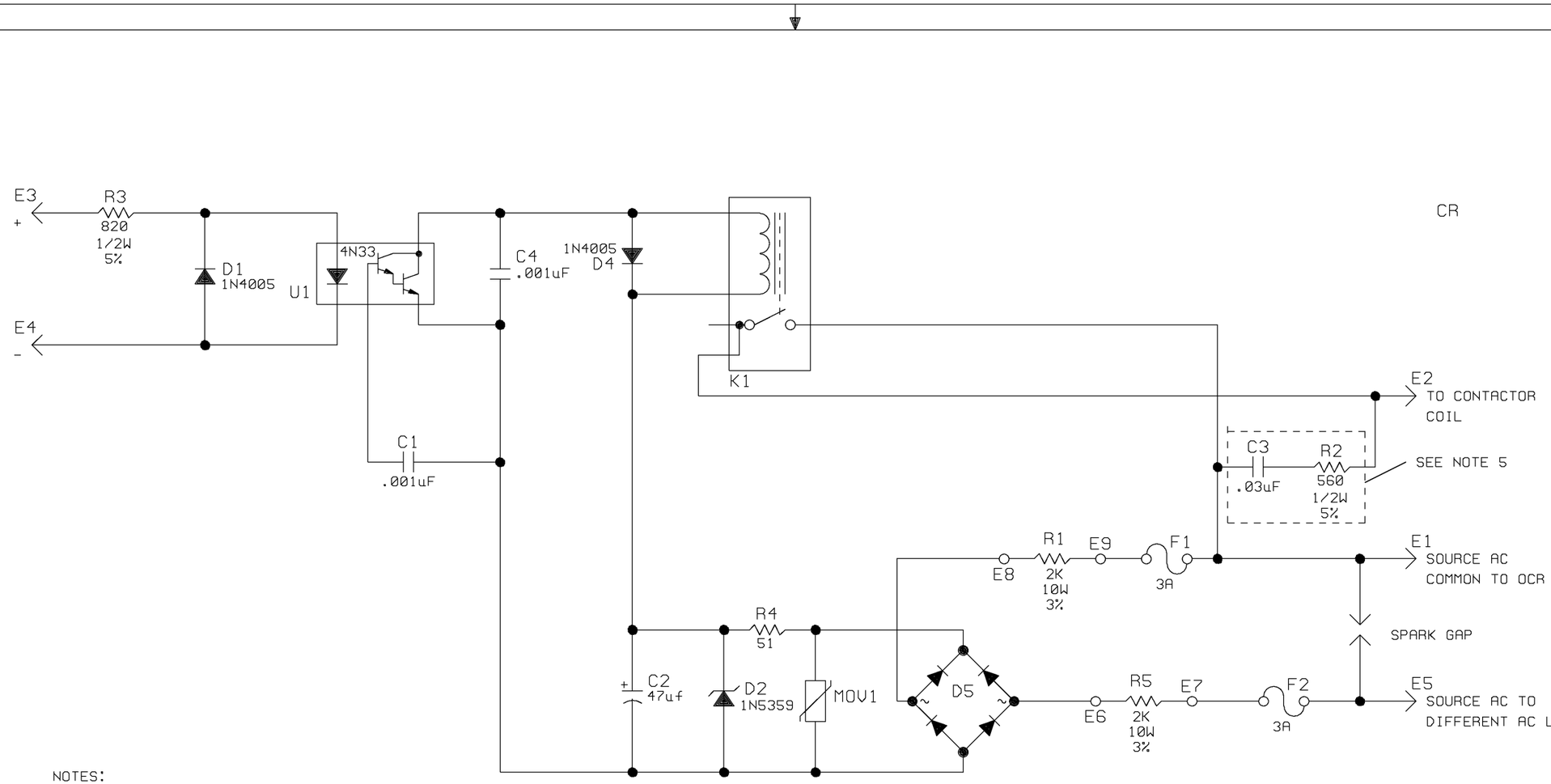
217/224-9600 FAX 217/224-9607

TITLE PCB ASSEMBLY COMBINER

TYPE	SIZE	DWG No.	REV
A	C	917-0321/-006 917-0321-001/002/005	H

MODEL AM-1A | SCALE 1/1 | SHEET 1 OF 1



NOTES:

1. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED:R5,F2,MOV1,C4, D4,U1,K1,E9
3. COMPONENTS NOT USED:D3
4. SEE ASSEMBLY:AB 919-0096
5. THESE COMPONENTS NOT USED ON 919-0096-001 C3,R2

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	JAH 11-26-91
CHKD	BG 11-92
ME	
PROJ. ENGR.	BG 11-92
MFG.	

MATERIAL	SEE B/M 919-0096 919-0096-001
FINISH	SEE DWG RA592-0000
NEXT ASSY.	

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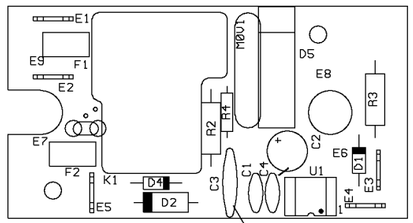
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: OPTICALLY COUPLED RELAY

TYPE	SIZE	DWG. NO.	REV
S	B	919-0096,-001	J

MODEL FM XMTR'S | SCALE NONE | SHEET 1 OF



REMOVE R2 AND C3 FROM 919-0096
TO MAKE 919-0096-001

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY
JAH 12-13-91

DESIGNER(S)

PROJ. LEADER
J.TUCKER 7-14-86

MFG.
J.STEINKAMP 7-14-86

MATERIAL
SEE B/M
919-0096
919-0096-001

FINISH

~~SEE DWG RA592-0000~~

NEXT ASSY.

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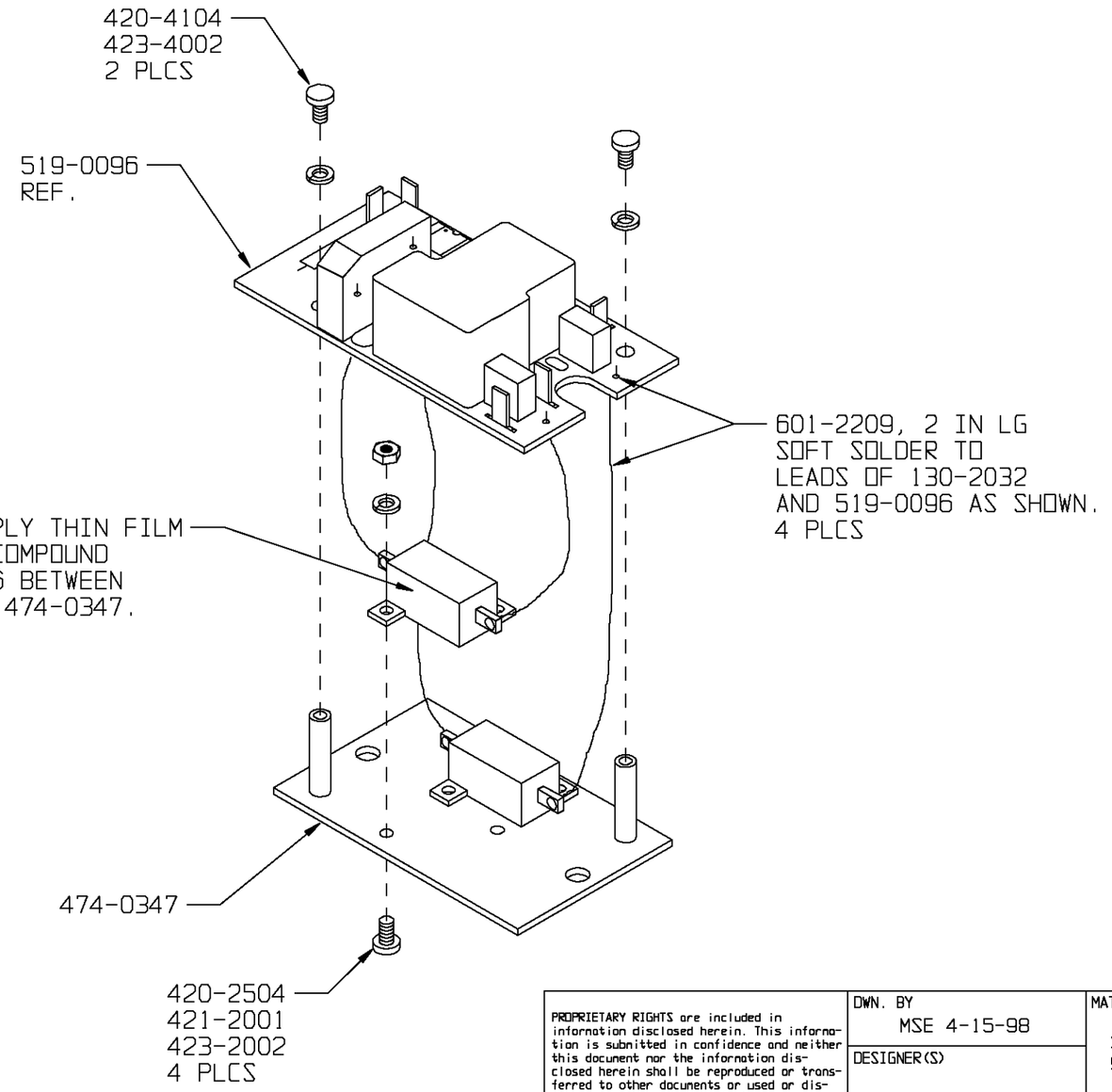
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
PCB ASSEMBLY
OPTICALLY COUPLED RELAY BD.

TYPE	SIZE	DWG No.	REV
A	B	919-0096, 919-0096-001	N

MODEL TRANSMITTERS | SCALE 1=1 | SHEET 1 OF 2



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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MSE 4-15-98

DESIGNER(S)

PROJ. LEADER

MFG.

MATERIAL
SEE BOM
919-0096, -001

FINISH

SEE DWG RA592-0000

NEXT ASSY.

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TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
ASSY, PCB OPTICALLY
COUPLED RELAY (OCR)

TYPE	SIZE	DWG. NO.	REV
A	B	919-0096, -001	N

MODEL	SCALE	SHEET
XMTRS	1/1	2 OF 2

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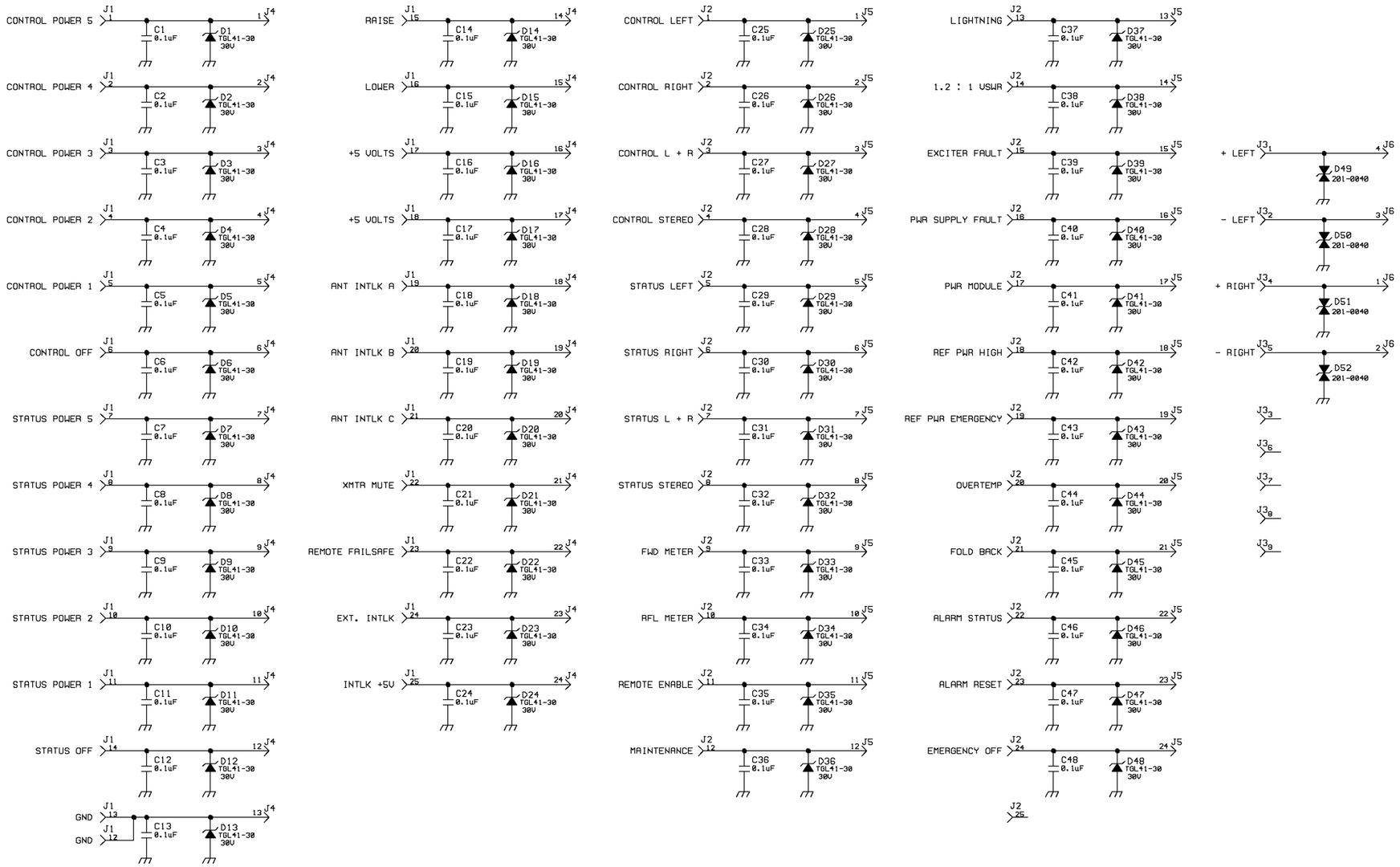

NOTES:

1. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED:C48,D52,J6
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY:AB917-0410

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	KWT 5-14-99
DESIGNER(S)	
PROJ. LEADER	8-27-99 J. WESTBERG
MFG.	
MATERIAL	SEE BOM 917-0410
FINISH	
NEXT ASSY.	917-0410

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217/224-9600 FAX 217/224-9607

TITLE: CUSTOMER INTERFACE PCB

TYPE	SIZE	DWG. NO.	REV
S	D	917-0410	A

MODEL NINJA | SCALE NONE | SHEET 1 OF 1

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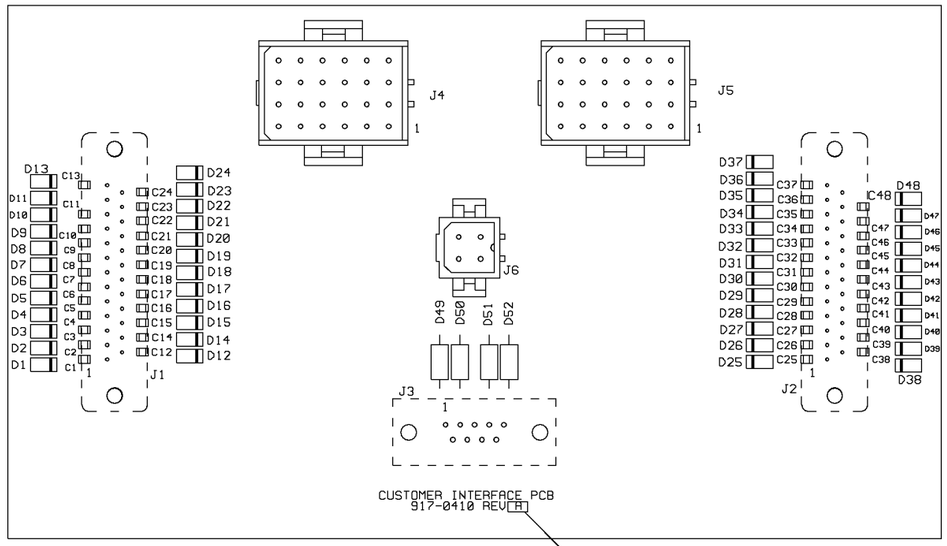

BOARD ASSEMBLY VENDOR TO MARK ASSEMBLY REVISION LEVEL HERE.

NOTES:

1) J1,J2 & J3 ARE MOUNTED ON THE SOLDER SIDE OF PCB.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY KWT 5-17-99

DESIGNER(S)

PROJ. LEADER 9-27-99
J. WESTBERG

MFG.

MATERIAL SEE BOM 917-0410

FINISH

NEXT ASSY.

BROADCAST ELECTRONICS INC.
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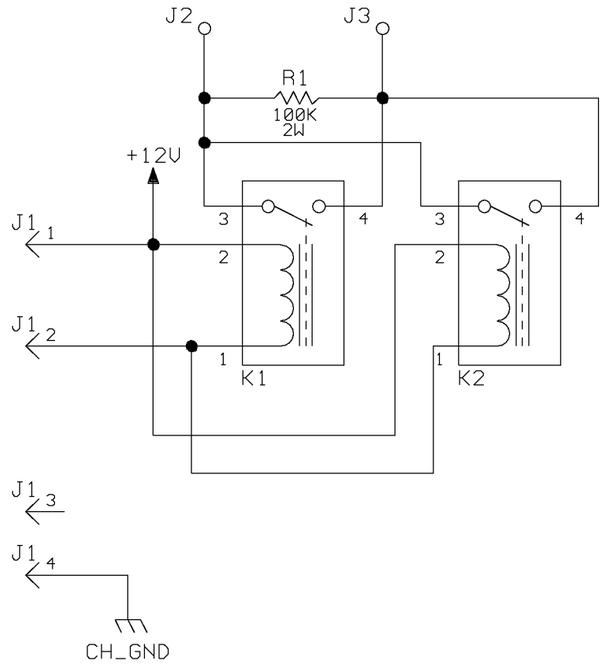
217/224-9600 FAX 217/224-9607

TITLE
CUSTOMER INTERFACE PCB

TYPE	SIZE	DWG No.	REV
A	B	917-0410	A

MODEL NINJA | SCALE 1/1 | SHEET 1 OF 1



NOTES:
1. SEE ASSEMBLY AB917-0330

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MSE 6-5-98
DESIGNER(S)
PROJ. LEADER
MFG.

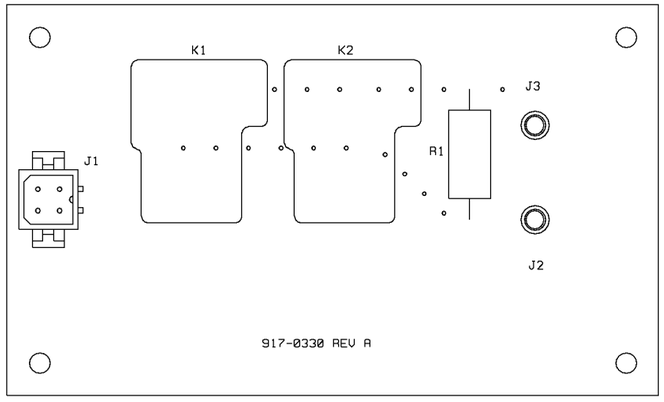
MATERIAL SEE BOM 917-0330
FINISH
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305
217/224-9600 FAX 217/224-9607

TITLE SCHEMATIC, PFC RELAY PCB

TYPE	SIZE	DWG. NO.	REV
S	B	917-0330	A

MODEL AM | SCALE NONE | SHEET 1 OF 1



NOTES:
1) SEE SCHEMATIC SB917-0330.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY MSE 6-9-98

DESIGNER(S)

PROJ. LEADER 9-27-99
J. WESTBERG

MFG.

MATERIAL
SEE BOM
917-0330

FINISH

NEXT ASSY.

BROADCAST ELECTRONICS INC.
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217/224-9600 FAX 217/224-9607

TITLE
PCB ASSY, PFC RELAY BOARD

TYPE	SIZE	DWG No.	REV
A	B	917-0330	A

MODEL AM 2.5A | SCALE 1/1 | SHEET 1 OF 1

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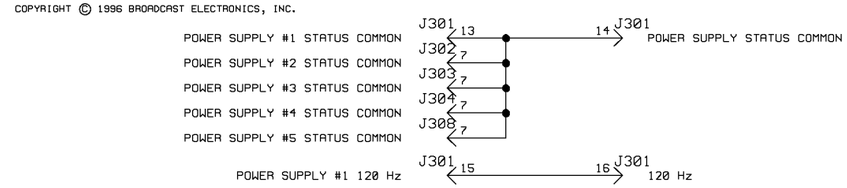

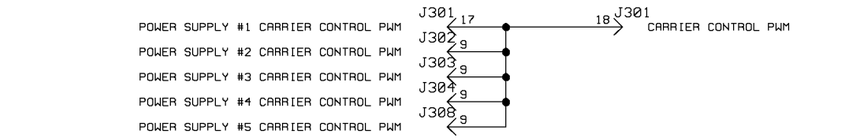

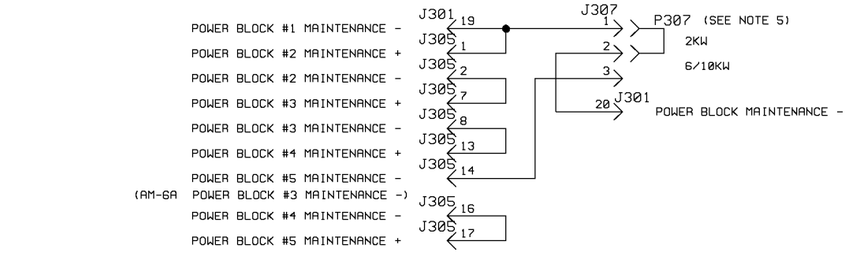

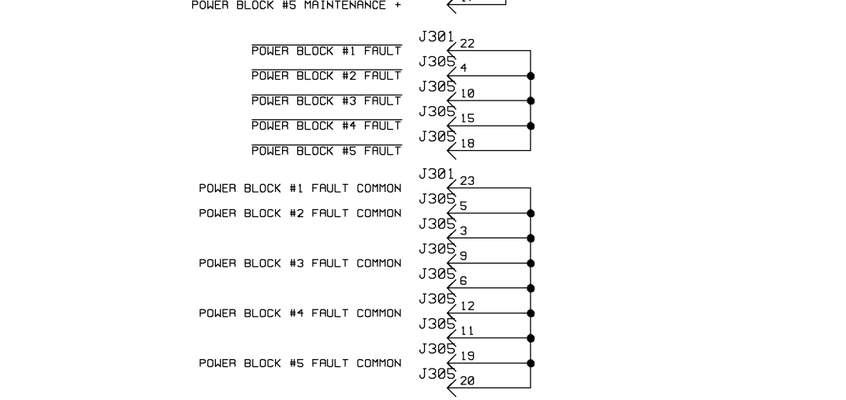

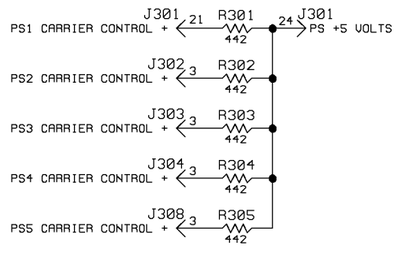

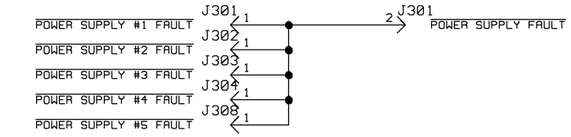

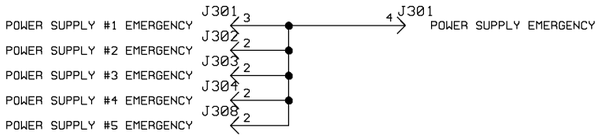

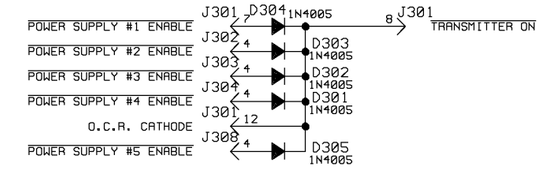

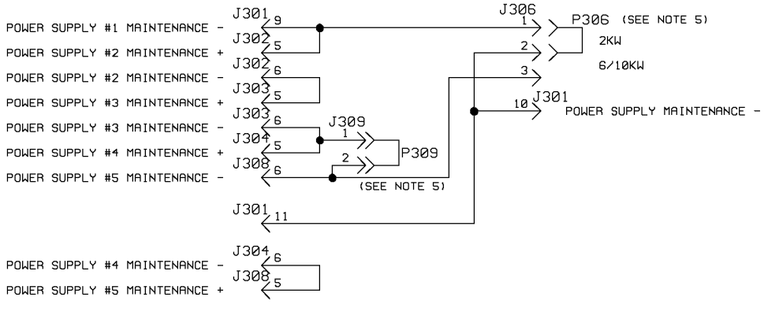

NOTES:
1. ALL REFERENCE DESIGNATORS START AT 301.
2. LAST COMPONENTS USED: D305, J309, R305.
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY: AD917-0306-003
5. FOR AM-2A PLACE P306/P307 ON J306/J307 PINS 1&2.
   FOR AM-6A/AM-10A PLACE P306/P307 ON J306/J307 PINS 2&3.
   FOR AM-6A PLACE P309 ON J309 PINS 1&2.

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	MERKEL 1-2-96
CHKD	
ME	
PROJ. ENGR.	JW 8-16-96
MFG.	
MATERIAL	SEE BOM 917-0306-003
FINISH	SEE DWG RAS92-0000
NEXT ASSY.	AD917-0306-003

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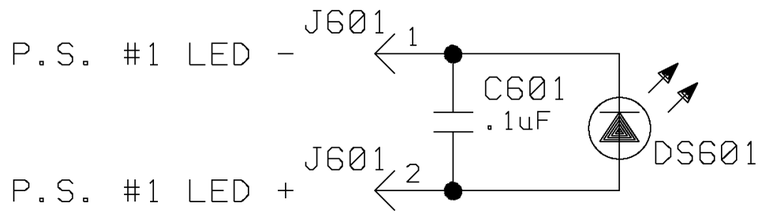
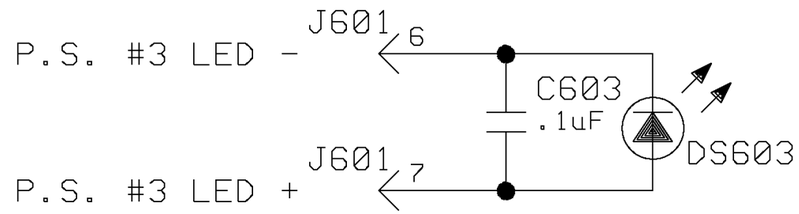
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

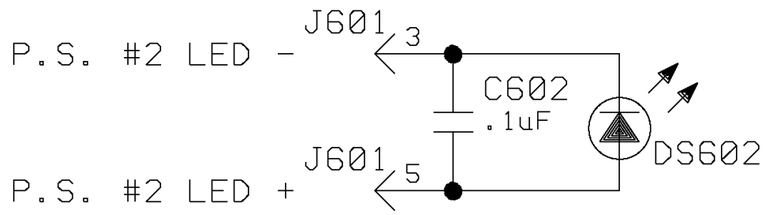
TITLE: SCHEMATIC INTERFACE PCB

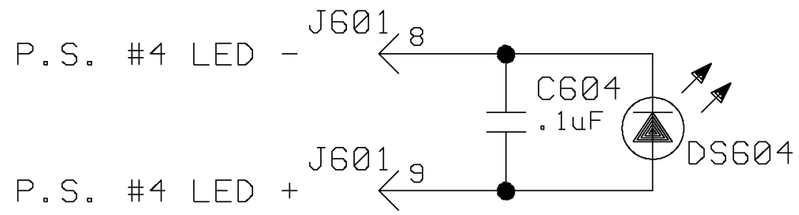
TYPE	SIZE	DWG. NO.	REV
S	B	917-0306-003	B

MODEL AM-1A,2A,6A,10A | SCALE NONE | SHEET 1 OF 1



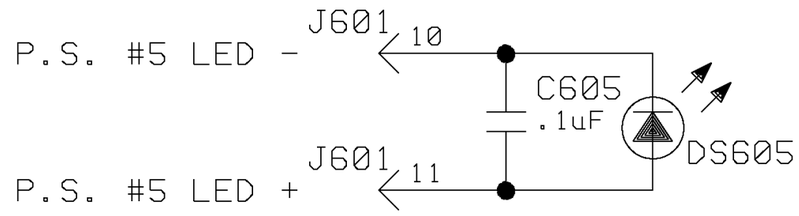






NOTES:

1. ALL REFERENCE DESIGNATORS START AT 601.
2. LAST COMPONENT USED: DS605, J601,C605
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY: AD917-0306



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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MERKEL 1-2-96

CHKD

ME

PROJ. ENGR.

MFG.

MATERIAL SEE BOM 917-0306-006

FINISH

SEE DWG RA592-0000

NEXT ASSY. AD917-0306

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TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
SCHEMATIC
POWER SUPPLY STATUS LED PCB

TYPE	SIZE	DWG. NO.	REV
S	A	917-0306-006	A

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1

TABLE OF CONTENTS

PARAGRAPH		PAGE NO.
SECTION I	**POWER SUPPLY THEORY OF OPERATION**	
1–1	Introduction	1–1
1–3	General Description	1–1
1–6	AC Input	1–1
1–8	Conventional Rectifier Circuitry	1–1
1–10	Soft–Start Circuit	1–1
1–12	AC Line Detection/Synchronization	1–2
1–16	Soft–Start Control Circuit	1–2
1–18	Power Factor Corrector Circuit Board Control Circuit	1–2
1–20	SCR Controlled Rectifier Circuit	1–5
1–23	Filter Circuit	1–5
1–25	Power Supply Enable Circuit	1–5
1–28	Switching Regulator Circuit	1–5
1–30	Low Voltage Power Supply	1–6
1–31	Switching Regulator Control Circuit	1–6
1–33	Switching Regulator Circuit Operation	1–6
1–34	Power Control/Correction Circuit	1–6
1–38	Fault Detection	1–7
1–43	Crowbar Circuit	1–7
1–47	Power Supply Circuit Grounds	1–8
SECTION II	**POWER SUPPLY CIRCUIT BOARD MAINTENANCE**	
2–1	Introduction	2–1
2–3	Safety Considerations	2–1
2–6	First Level Maintenance	2–1
2–8	Cleaning and Inspection	2–1
2–10	Second Level Maintenance	2–2
2–12	Troubleshooting	2–2
2–13	Safety Considerations	2–2
2–14	Removing/Installing a Power Supply Circuit Board	2–2
2–17	Troubleshooting Procedures	2–3
2–18	Component Replacement Procedure	2–4
SECTION III	**POWER SUPPLY CIRCUIT BOARD PARTS LIST**	
3–1	Introduction	3–1
SECTION IV	**POWER SUPPLY CIRCUIT BOARD DRAWINGS**	
4–1	Introduction	4–1

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE NO.
1–1	POWER SUPPLY CIRCUIT BOARD SIMPLIFIED SCHEMATIC	1–3

LIST OF TABLES

TABLE	TITLE	PAGE NO.
2–1	POWER SUPPLY MODULE TROUBLESHOOTING	2–3
3–1	REPLACEABLE PARTS LIST INDEX	3–1

SECTION I
POWER SUPPLY THEORY OF OPERATION

1-1. INTRODUCTION.

1-2. This section presents a general description of the Broadcast Electronics AM-2.5E/AM-5E transmitter power supply assembly.

1-3. GENERAL DESCRIPTION.

1-4. DC operating potentials for the RF power modules are provided by power supply assemblies (refer to Figure 1-1). The power supply assembly consists of: 1) a power supply circuit board and 2) filter and transformer components located on a power supply panel. One power supply assembly provides dc operating potentials for one power block. The AM-2.5E transmitter is equipped with 1 power supply assembly. The AM-5E transmitter is equipped with 2 power supply assemblies.

1-5. The modular design of the power supply assembly allows the power supply circuit board to be removed from the transmitter for maintenance. The following text presents a description of the power supply circuit board and the components located on the power supply panel assembly.

1-6. AC INPUT.

1-7. AC power from the ac input switch is applied through fuses F6 and F7 to power transformer T1. Fuses F6 and F7 protect the circuitry from over-current conditions. Transformer T1 consists of: 1) a single primary winding and 2) five secondary windings. The transformer is designed to provide low-voltage ac samples for application to five conventional bridge rectifier circuits.

1-8. CONVENTIONAL RECTIFIER CIRCUITRY.

1-9. AC power from a winding of power transformer T1 is applied to bridge rectifier D11. D11 rectifies the ac potential into an unregulated 30V dc supply for application to the RF power module power amplifier circuit boards. Capacitor C21 provides filtering for the supply. AC power from a second winding of transformer T1 is applied to bridge rectifier D10. D10 rectifies the ac potential into an unregulated +20V dc supply for the power supply circuit board circuitry. Capacitor C20 provides filtering for the supply. AC power from a third winding of ac power transformer T1 is applied to bridge rectifier D9. D9 rectifies the ac potential into an unregulated +20 volt dc supply for application to: 1) the modulator circuit board and 2) to regulator U3. U3 is a +15 volt dc regulator. The output of U3 routed for application to the components on the power supply circuit board. AC power from a fourth winding of power transformer T1 is applied to bridge rectifier D12. D12 rectifies the ac potential into an unregulated +15V dc supply for application to: 1) the power supply circuit board and 2) regulator U4. U4 is a +12 volt dc regulator. The output of U4 routed for application to the components on the power supply circuit board. An ac sample from the winding is routed for application to a soft-start circuit. Capacitor C15 provides filtering for the supply.

1-10. SOFT-START CIRCUIT.

1-11. An ac sample from the winding of T1 is also routed to a soft-start circuit. The soft-start circuit is designed to eliminate component stress during turn-on by limiting the current in-rush. The circuit consists of an ac line detection/synchronization and soft-start control circuits.

1-12. **AC LINE DETECTION/SYNCHRONIZATION.** An ac sample from a winding of transformer T1 is rectified by diodes D7 and D8 and applied to integrated circuit U6B. U6B functions as a zero phase detector. As the ac line phase approaches zero degrees, U6B will output a HIGH pulse. The HIGH pulse is applied to: 1) transistor Q2, 2) transistor Q7 of the soft-start circuit, and 3) ac line detector U5A/U5B. The pulse biases transistor Q2 and optical coupler U2 on. Q2 and U2 will output a pulse each time the ac line phase is zero. As a result, U2 will output a 120 Hz signal to the controller circuit board.

1-13. U5A and U5B function as an ac line voltage detector. When ac line voltage is present, U5A will output a LOW. The LOW allows transistor Q3 to be biased on. With Q3 on, a +12 volt dc signal is applied to optical coupler U1. When a power supply enable and a PWM OK signal is applied to U1, U1 will output a reference voltage to a soft-start control circuit for power supply operation. When ac line voltage is not present, U5A will output a HIGH, the HIGH biases transistor Q3 off to terminate power supply operation. When ac power is re-applied, U5B will maintain a HIGH for 100 milliseconds to allow the circuit to stabilize during turn-on operations.

1-14. In addition to the ac line voltage detection circuit, integrated circuit U6A functions as a low line voltage detector. When the dc supply is above the threshold at U6A, U6A will output a LOW to bias transistor Q1 off. As a result, a HIGH ac OK signal indicating acceptable ac line voltage is applied to optical coupler U9. When the dc supply is below 185 volts, U6A will output a HIGH to bias transistor Q1 on. As a result, a LOW ac OK signal indicating low ac line voltage is applied to optical coupler U9. When the voltage increases to approximately 190 volts, the output of U6A will go LOW to enable the power supply.

1-15. This circuit is also used to detect high ac line voltage potentials. If the ac line voltage is above approximately 270 volts, transistor Q28 will be biased on. With Q28 on, the input to U6A will be muted. When the input is muted: 1) the transmitter output power will be muted and 2) no transmitter fault or emergency condition will be generated.

1-16. **SOFT-START CONTROL CIRCUIT.** The soft-start control circuit consists of: 1) transistors Q4 through Q9 and 2) integrated circuit U7. The circuit is designed to generate short duration pulses in each time the ac line waveform crosses the 0 volt axis. The pulses are applied to an SCR controlled rectifier to slowly bias the components on during initial start operations. This operation eliminates the component stress at power-on by limiting the supply in-rush current.

1-17. The circuit generates the soft-start pulses from two signals: 1) a ramp signal and 2) a triangle signal. The ramp signal is generated by transistors Q4 and Q5. When ac line voltage is detected, a +12 volt signal from U1 is applied to transistor Q4. Q4 operates in association with capacitor C16 and transistor Q5 to generate a ramp voltage. The triangle signal is generated by transistors Q6 and Q7. Pulses from U6B are applied to transistor Q7. Q7 operates in association with capacitor C17 and transistor Q6 to generate a triangle signal. The triangle signal and the ramp signal are applied to comparator U7. U7 responds by generating a square-wave signal with a short duty cycle when the ac line phase is zero. The square-wave signal from U7 is applied to soft-start driver transistors Q8 and Q9. Q8 and Q9 will slowly bias the rectifier circuit on to limit the current in-rush.

1-18. **POWER FACTOR CORRECTOR CIRCUIT BOARD CONTROL CIRCUIT.**

1-19. Transistors Q26 and Q27 control a power factor corrector circuit board. During soft-start operation, ramp voltage will drop below approximately 3V. When this occurs, the output of transistor Q26 will go LOW. This LOW biases transistor Q27 on. With Q27 on, a LOW energizes two relays on the power factor corrector circuit board. With the relays energized, a capacitor is inserted into the circuit to enable power factor correction.

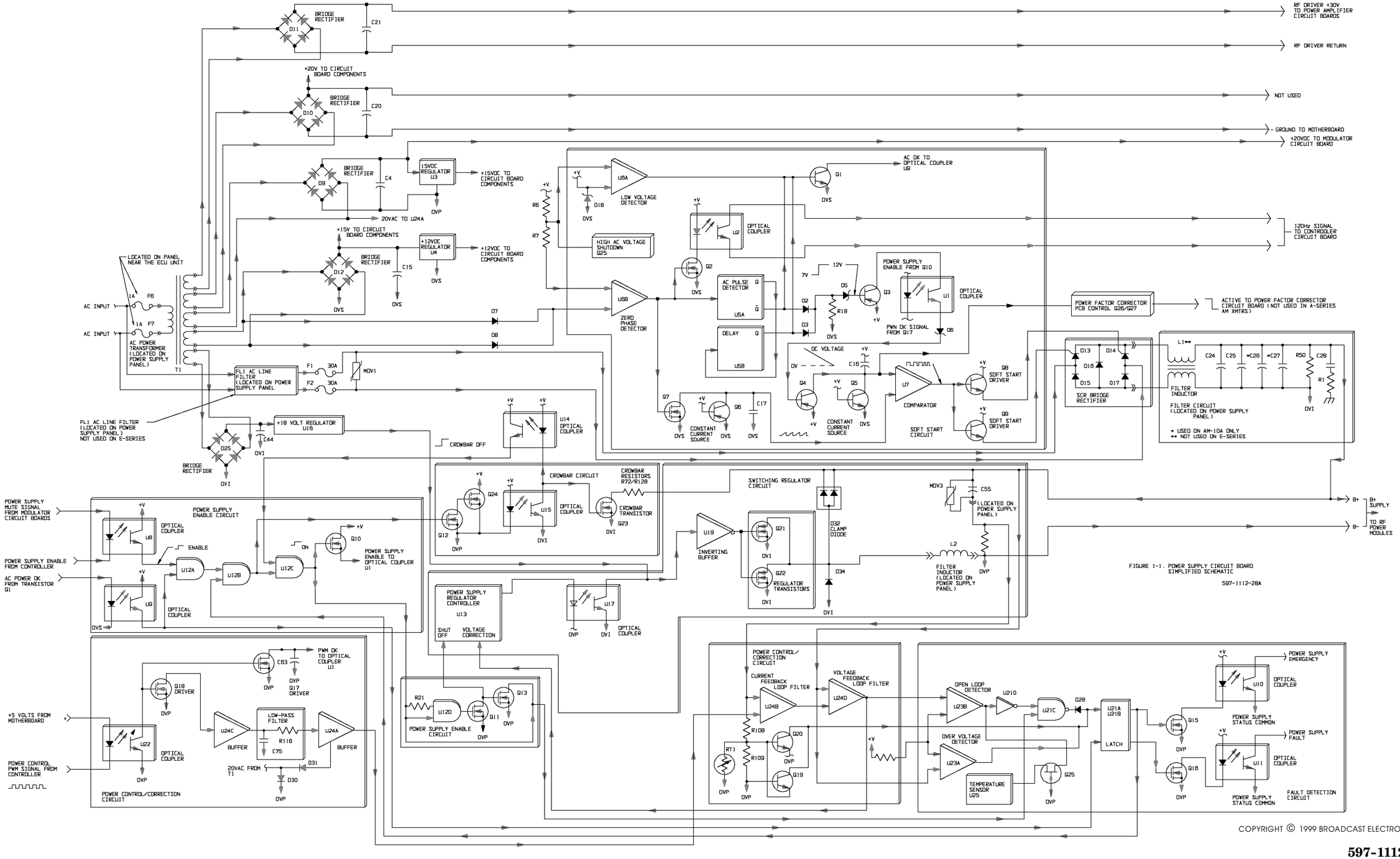

FIGURE 1-1. POWER SUPPLY CIRCUIT BOARD SIMPLIFIED SCHEMATIC

597-1112-28A

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597-1112-28A

FIGURE 1-1. POWER SUPPLY CIRCUIT BOARD SIMPLIFIED SCHEMATIC

(1-3/1-4)

1-20. **SCR CONTROLLED RECTIFIER CIRCUIT.**

1-21. The ac line voltage is rectified into a main dc supply for the modulator and amplifier circuitry by an SCR controlled bridge rectifier circuit. Primary ac power for the main dc supply is applied to fuses F1 and F2. The fuses protect the power supply circuitry from over-current conditions. Metal-Oxide-Varistor MOV1 prevents damage to the rectifier circuitry from ac line voltage surge potentials.

1-22. The SCR controlled rectifier circuit consists of diodes D15 through D17 and SCRs D13 and D14. The rectifier circuit is controlled by the soft-start control circuit. When power is required from the circuit, the soft-start circuit will output synchronized ac line pulses to SCRs D13 and D14. The SCRs will respond by slowly biasing the rectifier circuit on. The rectifier will output an unregulated and unfiltered dc supply at a maximum of 300V to an inductor and capacitor filter network located on the power supply panel.

1-23. **FILTER CIRCUIT.**

1-24. The output of the rectifier circuit is applied to a filter network consisting of capacitors C24 through C27. The filter is designed to remove the ripple in the supply. The output of the capacitor network generates the positive leg of the B supply. The B supply is the main operating supply for the RF power modules. The negative leg of the B supply is generated by a switching regulator circuit (refer to the following text).

1-25. **POWER SUPPLY ENABLE CIRCUIT.**

1-26. The power supply is controlled by a: 1) power supply enable signal from the controller and 2) power supply mute signal from the modulator circuit boards. When power supply operation is required, the controller will output a LOW power supply enable signal to optical coupler U8. With no mute signals present, U8 will output a HIGH to AND gate U12A. With a HIGH ac OK signal from U9 indicating the presence of ac power and no power supply faults, U12A will output a HIGH to U12B. With a HIGH from U21A/U21B, U12B will output a HIGH to U12C and to Q12. With a HIGH from U14 indicating the crowbar circuit is off, U12C will output a HIGH after a one second delay to: 1) transistor Q10, 2) AND gate U12D, and 3) NAND gate U21C. The HIGH biases Q12 and U15 on to disable the crowbar circuit. Q10 will respond by routing a HIGH power supply enable signal to optical coupler U1. U1 will output a dc voltage to enable the power supply soft-start circuit. AND gate U12D will output a HIGH to transistor Q11. The HIGH biases Q11 on to enable regulator controller U13 and bias Q13 off.

1-27. When a power supply mute operation is required, an RF power module modulator circuit board will output a mute signal to optical coupler U8. U8 will output a LOW to AND gate U12A. With a HIGH ac OK signal from U9, U12A will output a LOW to U12B. U12B will output a LOW to U12C and to Q12. The LOW biases Q12 and U15 off to enable the crowbar circuit. U12C will output a LOW to: 1) transistor Q10, 2) AND gate U12D. Q10 will be biased off to terminate power supply operation by disabling the drive to the SCR rectifier circuit. U12D will disable Q11 which allows a HIGH to disable regulator controller U13 and bias Q13 on. Q13 will output a LOW to disable the fault detection circuit to prevent erroneous fault indications during mute conditions.

1-28. **SWITCHING REGULATOR CIRCUIT.**

1-29. The B supply is regulated and controlled by a switching regulator circuit. The switching regulator circuit generates the - leg of the B supply and consists of: 1) a low voltage power supply circuit, 2) a power control network, 3) optical coupler U17, 4) inverting buffer U19, and 5) switching regulator transistors Q21 and Q22.

1-30. **LOW VOLTAGE POWER SUPPLY.** A dc operating supply for the optical couplers and the inverting buffers is generated by bridge rectifier D25. D25 full-wave rectifies an ac potential from ac transformer T1 into an unregulated +20V supply. The supply is applied to +18V regulator U16. The output of U16 is further regulated to a 5V operating potential by a resistive divider and a zener diode. The 5V supply is applied to optical coupler U17 and buffer U19.

1-31. **SWITCHING REGULATOR CONTROL CIRCUIT.** The switching regulator circuit is controlled by: 1) regulator controller U13 and 2) a power control/correction circuit. The circuits function in a closed-loop to control the operation of the switching regulator. As a result, the regulator outputs a precision dc operating voltage at the appropriate level for application to the RF power modules.

1-32. Integrated circuit U13 functions as the switching regulator controller. U13 is a PWM output device designed to produce two out-of-phase square wave signals with varying duty cycles. The duty cycle is varied in response to the signal from the voltage correction circuit. With a correction voltage present at U13, U13 will output a PWM square wave signal to optical coupler U17. U17 provides isolation for the transition of the signal from two different circuit ground potentials. The output of coupler U17 is inverted by inverting buffer U19.

1-33. **SWITCHING REGULATOR CIRCUIT OPERATION.** The PWM output of U19 is applied to the gates of IGBT (insulated-gate-bipolar-transistor) switching regulator transistors Q21 and Q22. The transistors function to regulate the negative leg of the B supply. The output of the transistor switching regulator circuit is applied to filter inductor L2. Protection of the transistors from switching transients during turn on/off operation is provided by clamp diode D32. Capacitor C55 provides filtering for the negative leg of the B supply. The output of the regulator circuit (B- leg) is applied to circuitry on the modulator circuit board.

1-34. **POWER CONTROL/CORRECTION CIRCUIT.**

1-35. The switching regulator output voltage is controlled by a PWM (pulse-width-modulated) signal from the controller. The PWM signal is a 1 kHz square-wave signal with a duty cycle which varies in response to different power levels. The PWM signal from the controller is applied to optical coupler U22. With a +5 volt signal from the motherboard, U22 will output the PWM signal to transistors Q17 and Q18. Q17 will discharge capacitor C63 when a 1 kHz control signal is present. C63 will output a LOW PWM OK signal to optical coupler U1. Q18 inverts the power control PWM signal. The output of Q18 is applied through buffer U24C to a low-pass filter consisting of: 1) resistors R115, R116, and R117 and 2) capacitors C75, C76, and C77. The filter converts the power control PWM square-wave signal into a dc control voltage. The voltage is routed through buffer U24A to U24B.

1-36. U24B functions as a current feedback loop filter. U24B differentially amplifies the dc control voltage and a current sample from the switching regulator output filter capacitor. As a result, U24B produces a dc control voltage for application to U24D.

1-37. U24D functions as a voltage feedback loop filter. U24D differentially amplifies the control voltage from U24B and a voltage sample from the B+ leg of the supply. As a result, U24D produces a dc control voltage for application to: 1) switching regulator controller U13 and 2) a fault detection circuit. U13 will respond to the correction voltage by changing the duty cycle of the PWM drive signal to optical coupler U17. The switching regulator circuit will respond by changing the output voltage to a level required by the power control PWM signal.

1-38. **FAULT DETECTION.**

1-39. A fault detection circuit monitors the regulator for four conditions: 1) over-voltage, 2) open-loop, 3) over-current, and 4) over temperature. Over-voltage conditions are monitored by U23A. U23A compares a sample of the B+ leg to a reference voltage. When the B+ sample exceeds the reference voltage, the output of U23A will go LOW. The LOW is routed to fault detector latch U21A/U21B. Open-loop conditions are monitored by U23B. U23B compares a correction voltage sample to a reference voltage. When the correction voltage sample exceeds the reference, the output of U23B will go LOW. The LOW is inverted at U21D and applied to NAND gate U21C. With a HIGH power supply enable signal from U12C, U21C will output a LOW to fault detector latch U21A/U21B.

1-40. Over-current conditions are monitored by transistors Q19 and Q20. When an over-current condition occurs, Q19 and Q20 will output a LOW. The LOW is routed to fault detector latch U21A/U21B. Over-temperature conditions are monitored by temperature sensor U25. When the power supply temperature exceeds 72 degrees C, U25 will output a LOW through transistor Q25 to U21D. The LOW is inverted at U21D and applied to NAND gate U21C.

1-41. With a LOW from U21C or U23A, latch U21A/U21B will: 1) output a HIGH to transistor Q16 and 2) output a LOW to transistor Q15 and to U12B. Transistor Q16 will be biased on and will output a LOW to enable optical coupler U11. U11 will respond by generating a power supply fault signal. AND gate U12B will output a LOW to: 1) disable regulator controller U13, 2) disable the SCR controlled rectifier circuit, and 3) initiate a logic sequence to enable the crowbar circuit (refer to the following text). Transistor Q15 will be biased off and will disable optical coupler U10. The output of U10 will open.

1-42. The output of U10 is connected in parallel with U10 on each power supply circuit board. When the output of U10 on each power supply circuit board is open, a HIGH power supply emergency signal to be applied to the controller. The power supply emergency signal indicates all power supply modules contain fault conditions.

1-43. **CROWBAR CIRCUIT.**

1-44. The power supply circuit board is equipped with a crowbar circuit to discharge the B supply during power supply off, ac off, and power supply mute conditions. The crowbar circuit consists of: 1) crowbar MOSFET Q23 and 2) resistor R72. Control of the circuit is provided by logic gates which monitor power supply off, ac off, and power supply mute conditions.

1-45. During a power supply off, ac off, or power supply mute condition, AND gate U12A will output a LOW to U12B. With a HIGH from U21A/U21B, U12B will output a LOW to transistor Q12. The LOW biases Q12 and optical coupler U15 off. As a result, a HIGH is applied to the gate of crowbar MOSFET Q23. The HIGH biases Q23 on to short the B supply and discharge capacitors C24, C25, C26, C27 and C55. Resistor R72 limits the current during shorting operations.

1-46. When U15 is biased off, optical coupler U14 will also be disabled. With U14 disabled, a LOW is applied to U12C. U12C will output a LOW to disable the PWM drive to the switching regulator circuit.

1–47. **POWER SUPPLY CIRCUIT GROUNDS.**

1–48. The power supply circuit board is equipped with three isolated circuit grounds: 1) 0VS, 2) 0VP, and 3) 0VI. The circuit grounds are at different potentials and are not referenced to earth ground. The 0VS ground is the circuit ground for the: 1) SCR controlled bridge rectifier circuit, 2) soft–start control circuit, 3) ac line voltage detector circuit, and 4) low–voltage detection circuit. The 0VP circuit ground is used to create the negative leg of the B supply. The 0VI ground is the circuit ground for the: 1) crowbar circuit, 2) switching regulator circuit, 3) inverting drive buffers, and 4) switching regulator transistors. The circuit grounds are used in association with the circuitry to generate the operating voltages for the RF power modules.

SECTION II
POWER SUPPLY CIRCUIT BOARD MAINTENANCE

2-1. INTRODUCTION.

2-2. This section provides maintenance information for the AM-2.5E/AM-5E transmitter power supply circuit board assembly.

2-3. SAFETY CONSIDERATIONS.

WARNING ***THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.***

WARNING

WARNING

WARNING

2-4. The AM-2.5E/AM-5E transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with many built-in safety features, however good judgement, care, and common sense must be practiced to prevent accidents.

2-5. In addition to high voltages and currents, the transmitters contain multiple circuit grounds with high ac and dc potentials with respect to the cabinet which is at earth potential. The potentials could cause serious injury or death if maintenance personnel simultaneously touch a circuit ground and the cabinet. As a result, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Therefore, never energize the transmitter with test equipment connected to the transmitter output network, RF power module, RF combiner, or power supply components. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-6. FIRST LEVEL MAINTENANCE.

2-7. First level maintenance consists of precautionary procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a performance log.

2-8. CLEANING AND INSPECTION.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-9. Ensure all transmitter primary power is disconnected and clean a circuit board of accumulated dust as required using a nylon bristle brush and vacuum cleaner. Inspect the circuit board for improperly seated semiconductors and components damage by overheating. In addition, inspect the circuit board for loose hardware. Repeat the procedure for each power supply circuit board in the transmitter.

2-10. SECOND LEVEL MAINTENANCE.

2-11. Second level maintenance is the performance of procedures required to restore a power supply circuit board to operation after a fault has occurred. The power supply circuit board contains no adjustments. Therefore, the following text presents only troubleshooting procedures.

2-12. TROUBLESHOOTING.

WARNING ***THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.***

WARNING

WARNING

WARNING

2-13. **SAFETY CONSIDERATIONS.** The AM-2.5E/AM-5E transmitters are equipped with extensive indicator and meter circuitry to allow the operator to isolate problems to a specific area within the transmitter. Due to the hazardous voltages and currents contained in the equipment, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-14. **REMOVING/INSTALLING A POWER SUPPLY CIRCUIT BOARD.** A power supply circuit board is removed by disconnecting three connectors, loosening the mounting hardware, and sliding the circuit board from the mounting pins. To remove or install a power supply circuit board, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-15. Disconnect all transmitter primary power.

2-16. To remove a power supply circuit board, proceed as follows:

1. Refer to Figure 5-2/5-3 in SECTION V, MAINTENANCE and locate the desired power supply circuit board to be removed.

2. Disconnect connectors P1, P2, and P3 on the circuit board assembly.

3. Loosen the power supply circuit board mounting hardware.

4. Lift the circuit board from the mounting pins and remove the circuit board from the cabinet.

2-17. **TROUBLESHOOTING PROCEDURES.** The power supply module troubleshooting procedures are presented in Table 2-1. During the execution of the troubleshooting information, perform all the procedures for a symptom. The symptom may contain multiple component failures. Once the trouble is isolated, refer to the circuit board theory of operation and schematic diagrams to assist in problem resolution.

TABLE 2-1. POWER SUPPLY MODULE TROUBLESHOOTING
(Sheet 1 of 2)

SYMPTOM	CIRCUITRY TO CHECK
1. RED POWER SUPPLY INDICATION	1. Check for an over-temperature condition by inspecting the fans and filter. 2.. Check transistors Q21 and Q22 as follows: A. Using a digital voltmeter, operate the voltmeter to diode check. On Q21, place the negative lead on the drain (center pin) and the positive lead on the source. 1. If the voltmeter indicates a non-shorted condition, check transistor Q23. 2. If the voltmeter indicates a shorted condition, proceed as follows: a. On Q21, place the negative lead on the drain (center pin) and the positive lead on the gate and record the voltmeter indication. b. On Q22, place the negative lead on the drain and the positive lead on the gate and record the voltmeter indication. c. The transistor with the lowest voltage is defective. 2. Place the negative lead on the drain of Q21 and the positive lead on the source and determine if a short circuit condition is present. 3. If a short circuit condition is present, defective Q21. B. Repeat the procedure for transistor Q22. 3. Check transistor Q23 as follows: A. Using a digital voltmeter, operate the voltmeter to diode check and troubleshoot transistor Q23 as follows: 1. Place the negative lead on the drain and the positive lead on the gate and determine if a short circuit condition is present.

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WARNING: DISCONNECT POWER PRIOR TO SERVICING

TABLE 2-1. POWER SUPPLY MODULE TROUBLESHOOTING
(Sheet 2 of 2)

SYMPTOM	CIRCUITRY TO CHECK
RED POWER SUPPLY INDICATION (CONT'D)	2. Place the negative lead on the drain and the positive lead on the source and determine if a short circuit condition is present. 3. If a short circuit condition is present, defective Q23. 3. Visually inspect crowbar resistor R72. 4. Check SCRs D13/D14 and diodes D15, D16, and D17 for a short circuit condition. 5. Replace all blown fuses on the circuit board.
NO 120 Hz SIGNAL OUTPUT	1. Check for a 120 Hz square-wave pulse at the source of transistor Q55 on the controller circuit board. A. If a 120 Hz signal is present, defective Q55 on the controller circuit board. B. If a 120 Hz signal is not present, defective U3 on the power supply circuit board. 2. Re-install the power supply circuit board and operate the transmitter. If the circuit board remains defective, contact the Broadcast Electronics Customer Service Department.
MOD PWR INDICATORS EXTINGUISHED ON A POWER BLOCK	1. Check U7, U9A, U9B, U9C, U9D, Q9 and Q21.

2-18. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement procedures for the power supply circuit board are presented in PART I SECTION V. Refer to COMPONENT REPLACEMENT in SECTION V as required for the replacement procedures.

SECTION III
POWER SUPPLY CIRCUIT BOARD
PARTS LIST

3-1. INTRODUCTION.

3-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the power supply circuit board. Each table entry in this section is indexed by reference designators appearing on the applicable schematic.

TABLE 3-1. REPLACEABLE PARTS LIST INDEX

TABLE	DESCRIPTION	PART NO.	PAGE
3-2	Power Supply Panel Assembly	957-0315-100	3-2
3-3	Power Supply Circuit Board Assembly	917-0315-001	3-2
3-4	Power Supply Bulk Capacitor Circuit Board Assembly	917-0315-002	3-9
3-5	Power Supply Capacitor Circuit Board Assembly	917-0315-004	3-9
3-6	Power Supply Panel Harness	947-0208	3-9

TABLE 3-2. POWER SUPPLY PANEL ASSEMBLY - 957-0315-100

REF. DES.	DESCRIPTION	PART NO.	QTY.
L2	Choke, 1.04 mH, AM Transmitter	370–2364	1
T1	Transformer, AM Transmitter Power Supply	376–0047	1
----	Pin Connector	417–0036	2
----	Pins, Connector	417–0053	10
----	Connector Housing, 2–Pin, Male	418–0702	1
----	Plug, Connector Housing, 12–Pin	418–1271	1
----	Power Supply Circuit Board Assembly	917–0315–001	1
----	Power Supply Bulk Capacitor Circuit Board Assembly	917–0315–002	1
----	Power Supply Capacitor Circuit Board Assembly	917–0315–004	1
----	Power Supply Harness Assembly	947–0208	1
----	Blank, Power Supply AC Input Circuit Board	517–0315–006	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 1 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C2	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003–1013	1
C3	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C4	Capacitor, Electrolytic, 2200 uF, 35V	014–2293	1
C5, C6	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C7, C8	Capacitor, Monolythic Ceramic, 0.1 uF, ±10%, 50V	003–1066	2
C9	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C10	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003–1013	1
C11	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C12	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C13, C14	Capacitor, Electrolytic, 10 uF, 50V	023–1076	2
C15	Capacitor, Electrolytic, 470 uF, 50V	024–4783	1
C16	Capacitor, Electrolytic, 100 uF, 35V	023–1084	1
C17	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C18, C19	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C20	Capacitor, Electrolytic, 2200 uF, 35V	014–2293	1
C21	Capacitor, Electrolytic, 27000 uF ±20%, 50V	020–2795–500	1
C22	Capacitor, Polyester, .15 uF ±10%, 600WV dc	030–1523	1
C23	Capacitor, Polypropylene Film, .47 uF ±10%, 600V	033–4763	1
C29	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C30, C31	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	2
C32	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C33	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C34	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C35	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C36	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C37	Capacitor, Monolythic Ceramic, .0027 uF ±5%, 100V	003–2723	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 2 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C38	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C39	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C40	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C41	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C42	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003–1013	1
C43	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C44	Capacitor, Electrolytic, 100 uF, 35V	023–1084	1
C45	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C46	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C47	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C49	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C50	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C52	Capacitor, Polyester, 2.2 uF, 400V	030–2256	1
C56, C57	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	2
C58	Capacitor, Monolythic Ceramic, 0.1 uF, ±10%, 50V	003–1066	1
C59, C60	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003–1013	2
C61	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C62	Capacitor, Electrolytic, 10 uF, 35V	023–1075	1
C63	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C64	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003–1013	1
C65, C66	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C67	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C68	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C69	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C70	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C71	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C72	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C73	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003–4723	1
C74	Capacitor, Monolythic Ceramic, 0.01 uF ±5%, 100V	003–1013	1
C75 thru C77	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	3
C78	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C79	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C80	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C81	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C82	Capacitor, Electrolytic, 100 uF, 35V	023–1084	1
C83	Capacitor, Monolythic Ceramic, .47 uF ±10% 50V	003–4743	1
C84	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C85	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C86	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C91 thru C94	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C95	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C96	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003–4723	1
C98	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C99	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 3 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	1
D2, D3	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
D4	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	1
D5 ,D6	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	2
D7, D8	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	2
D9	Bridge Rectifier, NAE 3060A, 1 Ampere, 200V	239–0001	1
D10	Bridge Rectifier, MDA970A3, 4 Amperes, 50–200V	239–0003	1
D11	Bridge Rectifier, MDA970A3, 4 Amperes, 50–200V	239–0003	1
D12	Bridge Rectifier, NAE 3060A, 1 Ampere, 200V	239–0001	1
D13, D14	Silicon Controlled Rectifiers, 2N6508, 25 Amperes, 600V	237–6508	2
D15	Rectifier, MR2406, 24 Amperes, 600V	230–0015	1
D16	Power Rectifier, Switchmode, MUR4100E, 4 Amperes, 1000V	230–0017	1
D17	Rectifier, MR2406, 24 Amperes, 600V	230–0015	1
D18	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	1
D19	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D21, D22	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
D23	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D24	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D25	Bridge Rectifier, NAE 3060A, 1 Ampere, 200V	239–0001	1
D26	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	1
D27	Diode, Zener, 1N4746, 18V ±10%, 1W	200–4746	1
D28	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D29	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D30, D31	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	2
D32	Rectifier, Fast Recovery, FEN30JP, 30 Amperes, 600V	230–0013	1
D34	Power Rectifier, Switchmode, MUR4100E, 4 Amperes, 1000V	230–0017	1
D37	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D39	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D40	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D41, D42	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
D43, D44	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	2
D45	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
F1, F2	Fuse, 30 Amperes, 125V, 1/4x1–1/4, Lead Type	334–0030–001	2
J1	Connector, Male, Printed Circuit Board Mount, PLB16M3N0A1	417–0376	1
J2	Receptacle, 12–Pin	417–1276	1
J3	Connector, AMP 6405051–1, MR Printed Circuit Board, Male 24–Pin	417–2401	1
J4	Receptacle, Male, 8–Pin In–Line, Right Angle	417–0080–001	1
J5 thru J7	Connector, Header, 2–Pin	417–4004	3
J9, J10	Receptacle, Male, 2–Pin In–line	417–4004	2
MOV1	Varistor, V320LA40B	140–0039	1
MOV2	Varistor, V320LA20AGE	140–0038	1
P4 thru P7, P9	Jumper, Programmable, 2–Pin	340–0004	5

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 4 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q1	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q2	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	1
Q3, Q4	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	2
Q5	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q6	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	1
Q7	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	1
Q8, Q9	Transistor, 2N2222A, TO-18 Case	210-2222	2
Q10 thru Q13	Transistor, 2N7000, FET, N-Channel, TO-92 Case	210-7000	4
Q14	Transistor, 2N7000, FET, N-Channel, TO-92 Case	210-7000	1
Q15 thru Q18	Transistor, 2N7000, FET, N-Channel, TO-92 Case	210-7000	4
Q19, Q20	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	2
Q21, Q22	Transistor, Insulated Gate Bipolar, IRGPC50U, TO-247 Case	210-4060	2
Q23	RF FET APT6018, 600V	210-6018	1
Q24	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	1
Q25	Field Effect Transistor, J3100, RF, N-Channel, TO-92 Case	212-0310	1
Q26, Q27	Transistor, 2N27000, FET, N-Channel, TO-92 Case	210-7000	2
Q28	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
R1	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R2	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R3, R4	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R5	Resistor, 150 k Ohm ±1%, 1/4W	103-1561	1
R6	Resistor, 21 k Ohm ±1%, 1/4W	103-2105	1
R7	Resistor, 6.34 k Ohm ±1%, 1/4W	103-6344	1
R8	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R9	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	1
R10 thru R12	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	3
R13	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R14	Resistor, 20.0 k Ohm ±1%, 1/4W	103-2051	1
R15	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R16	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R17	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R18	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R19	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R20	Resistor, 100 Ohm ±1%, 1/4W	100-1031	1
R22, R23	Resistor, 1.10 k Ohm ±1%, 1/4W	103-1104	2
R24	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R25	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R26	Resistor, 5.11 k Ohm ±1%, 1/4W	103-5141	1
R27	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R28	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R29, R30	Resistor, 3.32 k Ohm ±1%, 1/4W	103-3324	2
R31	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 5 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R32	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R33	Resistor, 665 Ohm ±1%, 1/4W	103–6653	1
R34	Resistor, 499 k Ohm ±1%, 1/4W	103–4996	1
R35	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R36	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R37, R38	Resistor, 82 Ohm ±5%, 2W	130–8223	2
R39, R40	Resistor, 270 Ohm ±5%, 1/2W	110–2733	2
R41, R42	Resistor, 47 Ohm ±5%, 2W	130–4723	2
R43	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R44	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R45	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R46	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R47	Resistor, 1.10 k Ohm ±1%, 1/4W	103–1104	1
R48, R49	Resistor, 47 Ohm ±5%, 2W	130–4723	2
R52	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R53	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R54	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R55	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R56	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R57	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R58	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R59	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R60, R61	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R62	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R63	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R64	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R65	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R66	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R67, R68	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R69	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R70	Resistor, 866 Ohm ±1%, 1/4W	103–8663	1
R71	Resistor, 100k Ohm ±5%, 2W	130–1062	1
R72	Resistor, 12 Ohm ±20%, 30W	130–1225	1
R73	Resistor, 34.8 k Ohm ±1%, 1/4W	103–3485	1
R74	Resistor, 39.2 k Ohm ±1%, 1/4W	100–3951	1
R75	Resistor, 39.2 k Ohm ±1%, 1/4W	100–3951	1
R76	Resistor, 1.10 k Ohm ±1%, 1/4W	103–1104	1
R77 thru R79	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	3
R80	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R81	Resistor, 393 Ohm ±5%, 1/2W	110–3933	1
R82, R83	Resistor, 100 Ohm ±1%, 1/4W	100–1031	2
R84	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R85	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R86	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R87	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 6 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R88	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R89	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R90	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R91	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R92	Resistor, 88.7 Ohm ±1%, 1/4W	103–8872	1
R93, R94	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R95	Resistor, 13 k Ohm ±1%, 1/4W	103–1305	1
R96	Resistor, 3.32 k Ohm ±1%, 1/4W	103–3324	1
R97	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R98	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R99	Resistor, 33.2 k Ohm ±1%, 1/4W	103–3325	1
R100, R101	Resistor, 5.11 k Ohm ±1%, 1/4W	103–5141	2
R102, R103	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R104	Resistor, 3.32 k Ohm ±1%, 1/4W	103–3324	1
R105 thru R107	Resistor, 0.1 Ohm ±1%, 10W, WW	130–1010	3
R108	Resistor, 475 Ohm ±1%, 1/4W	103–4753	1
R109	Resistor, 162 Ohm ±1%, 1/4W	100–1631	1
R110	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R111 thru R117	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	7
R118	Resistor, 39.2 k Ohm ±1%, 1/4W	100–3951	1
R119	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R120, R121	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R122	Resistor, 150 Ohm ±1%, 1/4W	100–1531	1
R123	Resistor, 82.5 Ohm ±1%, 1/4W	103–8251	1
R124	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R125	Resistor, 249 k Ohm ±1%, 1/4W	103–2496	1
R126	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R127	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R130	Resistor, 6.8 k Ohm ±5%, 1/2W,	110–6843	1
R134, R135	Resistor, 0.1 Ohm ±1%, 10W, WW	130–1010	2
R137, R138	Resistor, 82 Ohm ±5%, 2W	130–8223	2
R140	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R141	Resistor, 48.7 k Ohm ±1%, 1/4W	103–4875	1
R143	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R144	Resistor, 5.11 k Ohm ±1%, 1/4W	103–5141	1
R146	Resistor, 39.2 k Ohm ±1%, 1/4W	100–3951	1
R147	Resistor, 150 k Ohm ±1%, 1/4W	100–1531	1
R148	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R149, R150	Resistor, 1 k Ohm ±1%, 1/4W,	100–1041	2
R151	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R152	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R153	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R154	Resistor, 249 Ohm ±1%, 1/4W	103–2493	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 7 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
RT1	Thermistor, 100 Ohms ±20%	140-0030	1
TP1 thru TP12, TP14	Terminal, Test Point, Oval, Red	413-0106	13
U1, U2	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	2
U3, U4	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	2
U5	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16-Pin DIP	228-4538	1
U6	Voltage Comparator, LM393N, 8-Pin DIP	221-0393	1
U7	Integrated Circuit, TL311P, JFET-Input Differential Comparator, 8-Pin DIP	220-0311	1
U8 thru U11	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	4
U12	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U13	Integrated Circuit, SG3525AN, PWM Control	228-3525	1
U14, U15	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	2
U16	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	1
U17	Integrated Circuit, Opto-Isolator, 6N137, 8-Pin DIP	220-6137	1
U19	Integrated Circuit, Driver, Mosfet, TSC4429CAT, 5-Pin, TO-220 Case, Inverting	220-4429	1
U21	Integrated Circuit, MC14093B, Quad 2-Input NAND Schmitt Trigger, CMOS, 14-Pin DIP	220-4093	1
U22	Integrated Circuit, Opto-Isolator, 6N137, 8-Pin DIP	220-6137	1
U23	Voltage Comparator, LM393N, 8-Pin DIP	221-0393	1
U24	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U25	Temperature Sensor Chip, TMP01FP, 8-Pin DIP	229-1750	1
XU1, XU2	Socket, 6-Pin DIP	417-0600	2
XU5	Socket, 16-Pin DIP	417-1604	1
XU6, XU7	Socket, 8-Pin DIP	417-0804	2
XU8 thru XU11	Socket, 6-Pin DIP	417-0600	4
XU12	Socket, 14-Pin DIP	417-1404	1
XU13	Socket, 16-Pin DIP	417-1604	1
XU14, XU15	Socket, 6-Pin DIP	417-0600	2
XU17	Socket, 8-Pin DIP	417-0804	1
XU21	Socket, 14-Pin DIP	417-1404	1
XU22, XU23	Socket, 8-Pin DIP	417-0804	2
XU24	Socket, 14-Pin DIP	417-1404	1

TABLE 3-3. POWER SUPPLY CIRCUIT BOARD ASSEMBLY - 917-0315-001
(Sheet 8 of 8)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XU25	Socket, 8-Pin DIP	417-0804	1
----	Blank, Power Supply Circuit Board	517-0315-001	1

TABLE 3-4. POWER SUPPLY BULK CAPACITOR CIRCUIT BOARD ASSEMBLY - 917-0315-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
C24 thru C27	Capacitor, Electrolytic, 1500 uF, 450Vdc	013-1500	4
C28	Capacitor, Polypropylene Film, .47 uF, 600V	033-4763	1
R50	Resistor, 100k Ohm ±5%, 2W	130-1062	1
R51	Resistor, 36 Ohm ±5%, 2W	130-3623	1
R129	Resistor, 470k Ohm ±5%, 1/2W	110-4763	1
----	Blank, Power Supply Bulk Capacitor Circuit Board	517-0315-002	1

TABLE 3-5. POWER SUPPLY CAPACITOR CIRCUIT BOARD ASSEMBLY - 917-0315-004

REF. DES.	DESCRIPTION	PART NO.	QTY.
C87 thru C90	Capacitor, Electrolytic, 7200 uF, 200 WVDC	014-7200	4
MOV3	Metal Oxide Varistor, V130LA10A, 130V ac RMS, 10 Joules	140-0006	1
----	Blank, Power Supply Capacitor Circuit Board	517-0315-004	1

TABLE 3-6. POWER SUPPLY HARNESS ASSEMBLY - 947-0208

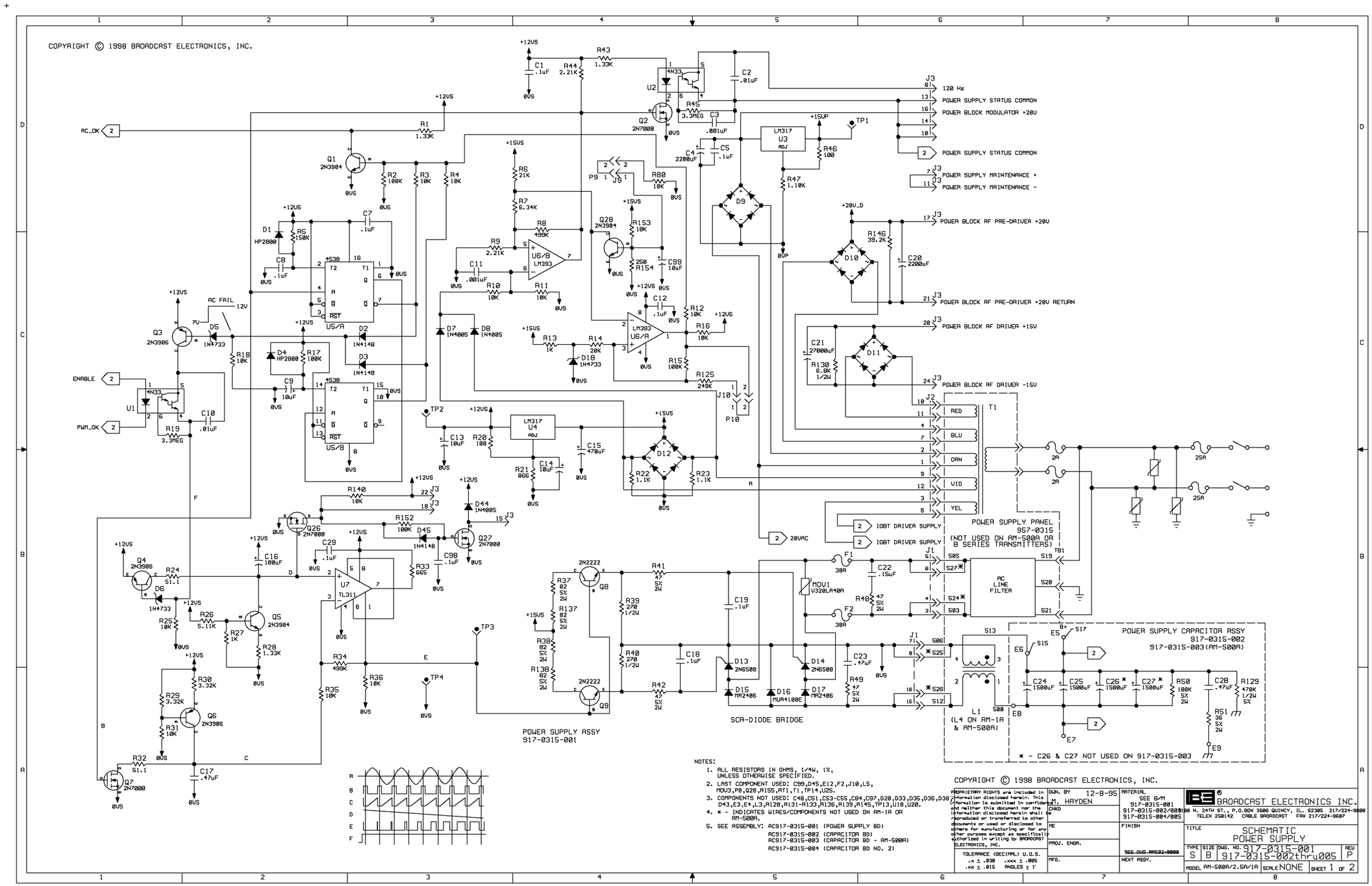
REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, FC112N2, Crimp Contact	417-0372	16
----	Connector, Female, PLB16F0000, Positronic	417-0377	1

SECTION IV
POWER SUPPLY CIRCUIT BOARD DRAWINGS

4-1. INTRODUCTION.

4-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the Broadcast Electronics AM-2.5E/AM-5E power supply circuit board.

FIGURE	TITLE	NUMBER
4-1	SCHEMATIC DIAGRAM, POWER SUPPLY CIRCUIT BOARD	SB917-0315-001/ -002/ -003/ -004/ -005
4-2	ASSEMBLY DIAGRAM, POWER SUPPLY CIRCUIT BOARD	AC917-0315-001/ -002/ -003/ -004/ -005
4-3	SCHEMATIC DIAGRAM, OVERALL POWER SUPPLY	SC957-0315-100



NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C99,D45,E12,F2,J10,L5, MOV3,P8,Q28,R155,RT1,T1,TP14,U25.
3. COMPONENTS NOT USED: C48,C51,C53-C55,C84,C97,D20,D33,D35,D36,D38, D43,E3,E4,L3,R128,R131-R133,R136,R139,R145,TP13,U18,U20.
4. * - INDICATES WIRES/COMPONENTS NOT USED ON AM-1A OR AM-500A.
5. SEE ASSEMBLY: AC917-0315-001 (POWER SUPPLY BD)
   AC917-0315-002 (CAPACITOR BD)
   AC917-0315-003 (CAPACITOR BD - AM-500A)
   AC917-0315-004 (CAPACITOR BD NO. 2)

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	M. HAYDEN	12-8-95
CHKD		
ME		
PROJ. ENGR.		
MFG.		

MATERIAL: SEE B/M 917-0315-001, 917-0315-002/003, 917-0315-004/005
FINISH: SEE DWG RR592-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC POWER SUPPLY

TYPE	SIZE	DWG. NO.	REV
S	B	917-0315-001 917-0315-002thru005	P

MODEL AM-500A/2.5A/1A SCALE NONE SHEET 1 OF 2

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	KT	JW	9856
	MH	JW	9944
	MSE	JW	9960
	MH	JW	10030
492.			
	KT	JW	10087
	KT	JW	10135
	KT	JW	10161
	KT	JW	10205

	AM-500A	AM-1A	AM-2.5A	AM-GA/10A	AM-2.5E/5E
P4	OPEN	OPEN	1,2	1,2	2,3
P5	SHORT	SHORT	OPEN	SHORT	OPEN
P6	OPEN	OPEN	SHORT	OPEN	SHORT
P7	SHORT	OPEN	OPEN	OPEN	OPEN
P8	SHORT	SHORT	SHORT	SHORT	SHORT
P9	SHORT	SHORT	OPEN	SHORT	OPEN
P10	OPEN	OPEN	SHORT	OPEN	SHORT

NOTES:
1. * - INDICATES WIRES/COMPONENTS NOT USED ON AM-1A OR AM-500A.
2. INSTALL P4 THRU P10 PER TABLE.

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY 12-8-95 W. HAYDEN
CHKD
ME
PROJ. ENGR.
MFG.
MATERIAL
FINISH
SEE DWG RAE92-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC POWER SUPPLY

TYPE	SIZE	DWG. NO.	REV
S	B	917-0315-001	P

MODEL AM-500A/2.5A/1A SCALE NONE SHEET 2 OF 2

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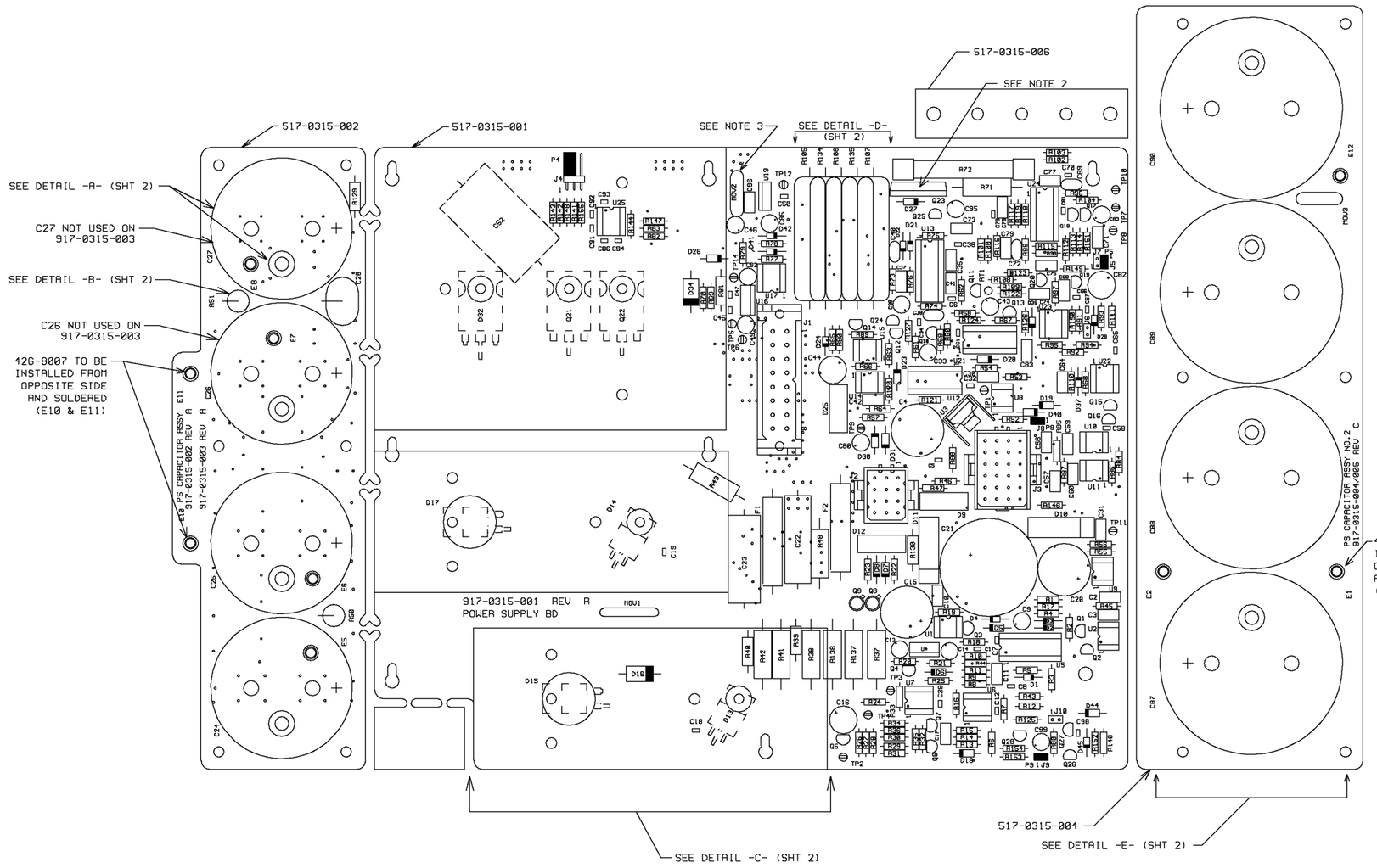

NOTES:

1. DASHED COMPONENT CS2 TO BE MOUNTED FROM OPPOSITE SIDE.
2. COMPONENT Q23 TO BE SLEEVED WITH HEAT SHRINK TUBING P/N 690-0221.
3. COMPONENT MOV2 TO BE SLEEVED WITH HEAT SHRINK TUBING P/N 611-5000.
4. INSTALL P4 THRU P10 PER TABLE.

	AM-500A	AM-1A	AM-2.5A	AM-6A/10A	AM-2.5E/5E
P4	OPEN	OPEN	SHORT	SHORT	SHORT
P5	SHORT	SHORT	OPEN	SHORT	OPEN
P6	OPEN	OPEN	SHORT	OPEN	SHORT
P7	SHORT	OPEN	OPEN	OPEN	OPEN
P8	SHORT	SHORT	SHORT	SHORT	SHORT
P9	SHORT	SHORT	OPEN	SHORT	OPEN
P10	OPEN	OPEN	SHORT	OPEN	SHORT

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY 12-12-95 M. HAYDEN
CHKD
ME
PROJ. ENGR.
MFG.

MATERIAL SEE B/M 917-0315-001 917-0315-002/003 917-0315-004/005
FINISH
~~SEE DWG RA592-0000~~
NEXT ASSY.

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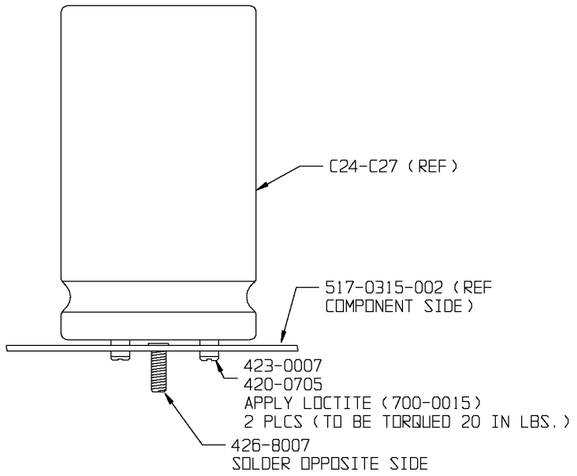
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

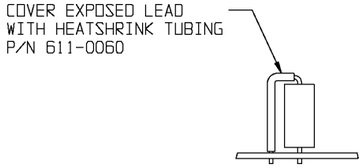
TITLE PCB ASSEMBLY
POWER SUPPLY/CAPACITOR BDS

TYPE	SIZE	DWG No.	REV
A	C	917-0315-002/003/004/005	R

MODEL AM-1A | SCALE 1/1 | SHEET 1 OF 2



DETAIL -A- SCALE 1/1
FOR C27-E8,C26-E7,C25-E6 & C24-E5



DETAIL -B- SCALE 1/1
FOR C28,R50 & R51

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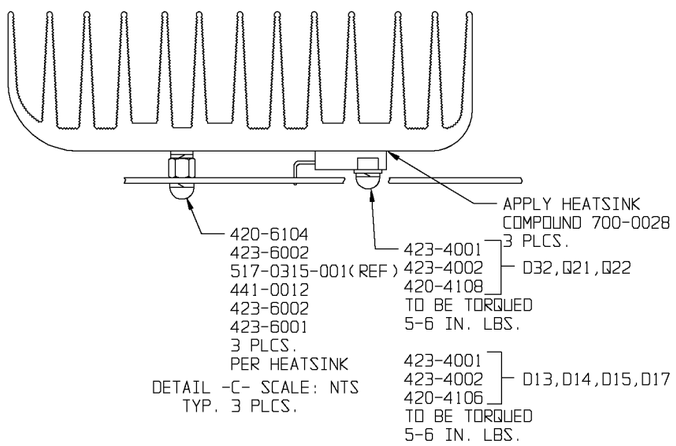
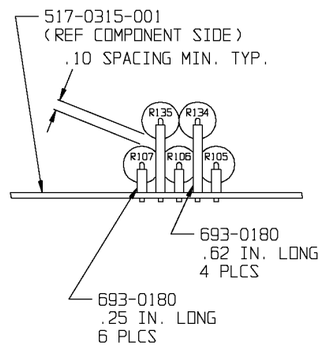
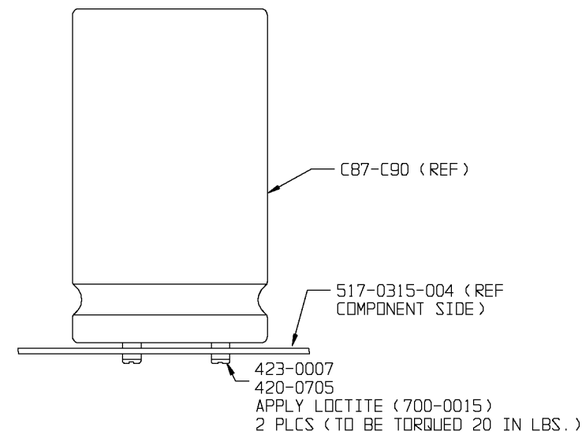
DETAIL -D- SCALE: NTS
FOR R105-R107,R134 & R135



DETAIL -C- SCALE: NTS
TYP. 3 PLCS.





DETAIL -E- SCALE: NTS

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

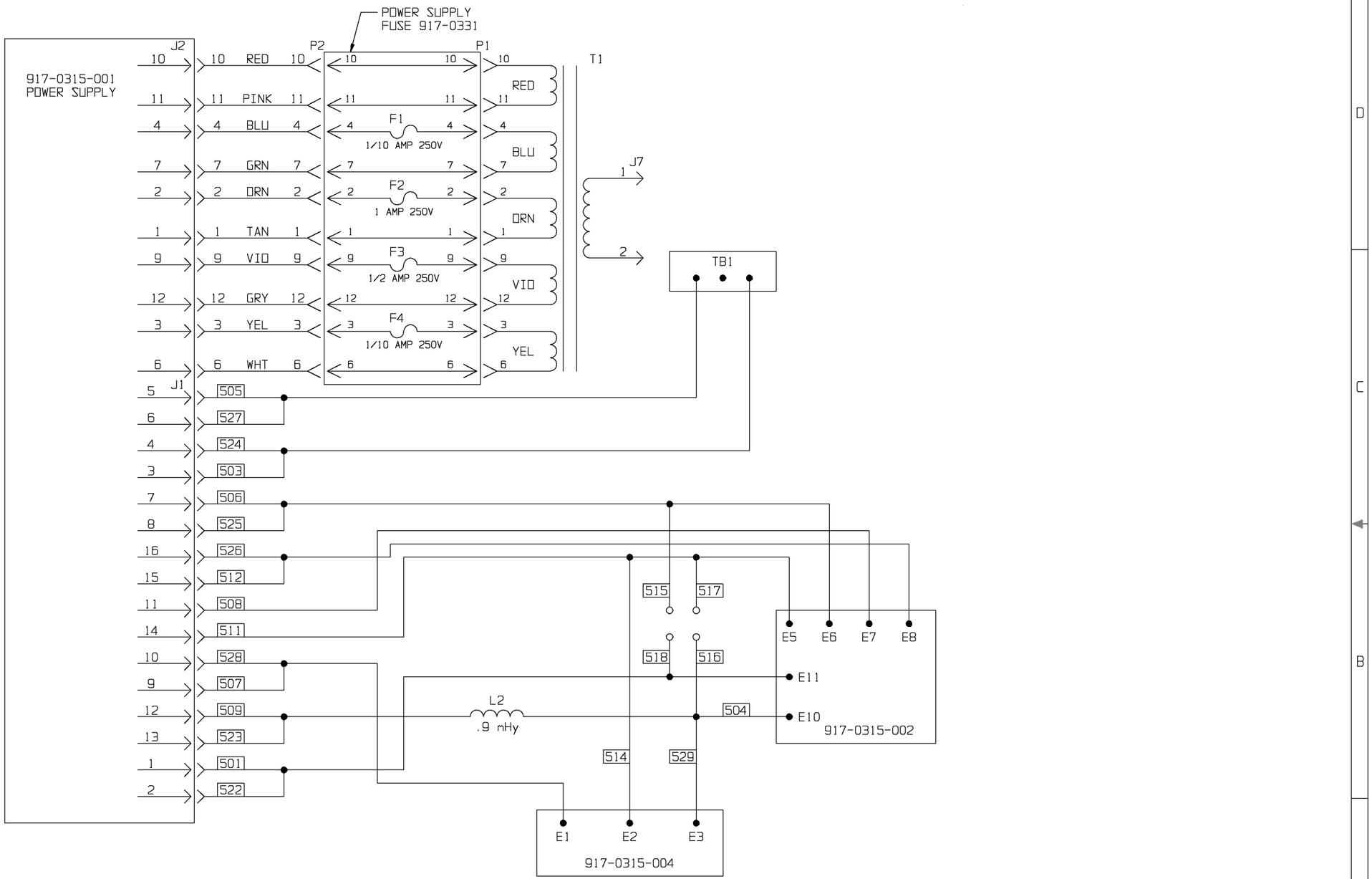
DWN. BY MH 1-22-96		MATERIAL
CHKD		
ME		FINISH
PROJ. ENGR. JW 8-16-96		SEE DWG RA592-0000
MFG.		NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE PCB ASSEMBLY
POWER SUPPLY/CAPACITOR BDS.

TYPE	SIZE	DWG. NO.	REV
A	C	917-0315-001/005	R

MODEL AM-1A SCALE ---- SHEET 2 OF 2



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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MSE 5-19-99
DESIGNER(S)
PROJ. LEADER
MFG.

MATERIAL SEE BOM 957-0315-100
FINISH SEE DWG RA592-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE SCHEMATIC
POWER SUPPLY AM-2.5E

TYPE	SIZE	DWG. NO.	REV
S	C	957-0315-100	A

MODEL AM-2.5E SCALE SHEET 1 OF 1

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TABLE OF CONTENTS

PARAGRAPH		PAGE NO.
SECTION I	**RF POWER MODULE THEORY OF OPERATION**	
1-1	Introduction	1-1
1-3	General Description	1-1
1-5	Modulator Circuit Board	1-1
1-6	Modulator Circuit	1-1
1-9	Fault Detection Circuits	1-1
1-16	Power Supply	1-2
1-18	RF Amplifier Circuit Board	1-5
1-20	Pre-Driver Circuit	1-5
1-22	Driver Circuit	1-5
1-23	RF Amplifier Circuit	1-5
1-26	RF Drive Status Circuit	1-6
1-27	Fault Detector Circuit	1-6
1-29	Power Supply Circuit	1-6
SECTION II	**RF POWER MODULE MAINTENANCE**	
2-1	Introduction	2-1
2-3	Safety Considerations	2-1
2-6	First Level Maintenance	2-1
2-8	Cleaning and Inspection	2-1
2-10	Second Level Maintenance	2-2
2-12	Troubleshooting	2-2
2-13	Safety Considerations	2-2
2-15	RF Power Module Assembly Procedure	2-3
2-16	RF Power Module Exchange Program	2-3
2-17	Troubleshooting Procedures	2-3
2-18	Component Replacement Procedure	2-3
SECTION III	**RF POWER MODULE PARTS LIST**	
3-1	Introduction	3-1
SECTION IV	**RF POWER MODULE DRAWINGS**	
4-1	Introduction	4-1

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE NO.
1-1	MODULATOR CIRCUIT BOARD SIMPLIFIED SCHEMATIC	1-3
1-2	POWER AMPLIFIER CIRCUIT BOARD SIMPLIFIED SCHEMATIC	1-7

LIST OF TABLES

TABLE	TITLE	PAGE NO.
2-1	RF POWER MODULE TROUBLESHOOTING	2-4
3-1	REPLACEABLE PARTS LIST INDEX	3-1

SECTION I
RF POWER MODULE THEORY OF OPERATION

1-1. INTRODUCTION.

1-2. This section presents a general description of the Broadcast Electronics AM-2.5E/AM-5E transmitter RF power module.

1-3. GENERAL DESCRIPTION.

1-4. An RF power module is a plug-in assembly containing two RF amplifier circuit boards and a modulator circuit board. Each RF power module is designed to produce 1375 watts of RF power. The modular design of the RF power assemblies allow the modules to be removed from the transmitter for maintenance. The remaining power modules will provide power to maintain on-air operation. The following text presents a description of the RF power modules.

1-5. MODULATOR CIRCUIT BOARD.

1-6. **MODULATOR CIRCUIT.** The modulator circuit board is designed to convert the CMOS level PWM signal from the exciter circuit board into a dc voltage which varies at the audio modulation rate (refer to Figure 1-1). The duty cycle of the 122 kHz to 135 kHz PWM signal is 40% with no audio modulation. The duty cycle varies to allow modulation of the transmitter from -100% to +150%. The PWM signal from the exciter circuit board is applied to integrated circuit U1. U1 is a high-speed optical coupler designed to provide isolation for the transition of the signal from the exciter circuit board ground system to the modulator circuit board ground system. The output of U1 is applied to level converter U11A. U11A converts the 5 volt signal to a 15 volt peak-to-peak signal. The output of U11A is applied to two MOSFET driver stages. A 9.7 volt dc bias signal is incorporated into the PWM signal by resistor R10, and zener diodes D17/D18.

1-7. Integrated circuits U2 and U13 are MOSFET driver stages. The outputs switch to: 1) a logic 1 at 2 volts and 2) a logic 0 at 0.8 volts. The output of U2 is applied to the gate of forward converter transistor Q1. The output of U13 is applied to the gate of forward converter transistor Q2. Q1 and Q2 are switched on/off by the PWM signal. The transistors convert the 125 volt B- supply to approximately 50 volts with a nominal PWM duty cycle of 40%. Catch diodes D2 and D3 clamps inductors L1 and L2 to prevent transistor damage from high switching voltages during transistor turn-off operations. A dc operating potential for Q1 and Q2 is provided by the B- supply from the power supply circuit board. Control of the B- leg is provided by relay K1. K1 immediately terminates the power supply during a power supply or modulator failure.

1-8. The output of transistors Q1 and Q2 are applied to an LC low-pass filter network consisting of: 1) inductor L1/L3 and capacitor C13 and 2) inductor L2/L3 and capacitor C14. The LC networks function with inductor L4 and capacitors C15/C16/C49 as a fifth-order Bessel low-pass filter designed to remove the 125 kHz frequency from the output signal. The output from L4/C15/C16/C49 is routed: 1) to a monitor circuit and 2) for application to the power amplifier circuit boards.

1-9. **FAULT DETECTION CIRCUITS.** The modulator circuitry is monitored for proper operation by four fault detection circuits. The fault detection circuits consist of: 1) a PWM drive detector, 2) a modulator fault detector, 3) a B+ supply fuse fault detector, and 4) a +20 volt power supply fault detector.

1–10. **PWM Drive Fault Detector.** A sample of the PWM drive signal from integrated circuit U2 is applied to comparator U3A. U3A compares the signal to a reference. When the PWM drive signal is present, the output of U3A will go HIGH. The HIGH is inverted at U5F. U5F will output a LOW to illuminate PWM drive indicator DS1. When the PWM drive signal is not present, the output of U3A will go LOW. The LOW is inverted at U5F. U5F will output a HIGH to extinguish PWM drive indicator DS1.

1–11. **Modulator Fault Detector.** A sample of the modulator circuit output is applied to comparator U3D. U3D compares the signal to a reference generated by a divider consisting of resistors R43 and R44. When the output signal from the modulator circuit is not present, the output of U3D will go LOW. The LOW is applied to a modulator status circuit (refer to the following text).

1–12. **B+ Supply Fuse Fault Detector.** The B+ supply is protected from over–current conditions on the modulator circuit board by fuse F1. The status of F1 is monitored by a B+ supply fuse fault detector circuit. The circuit consists of optical couplers U4/U12 and comparator U3B. When the fuse has blown, the output of couplers U4/U12 will go HIGH. The HIGH is applied to comparator U3B. U3B compares the signal to a reference. The output of U3B will go HIGH. The HIGH is inverted at U5C. U5C will output a LOW: 1) to illuminate fuse indicator DS2 and 2) to a modulator status circuit.

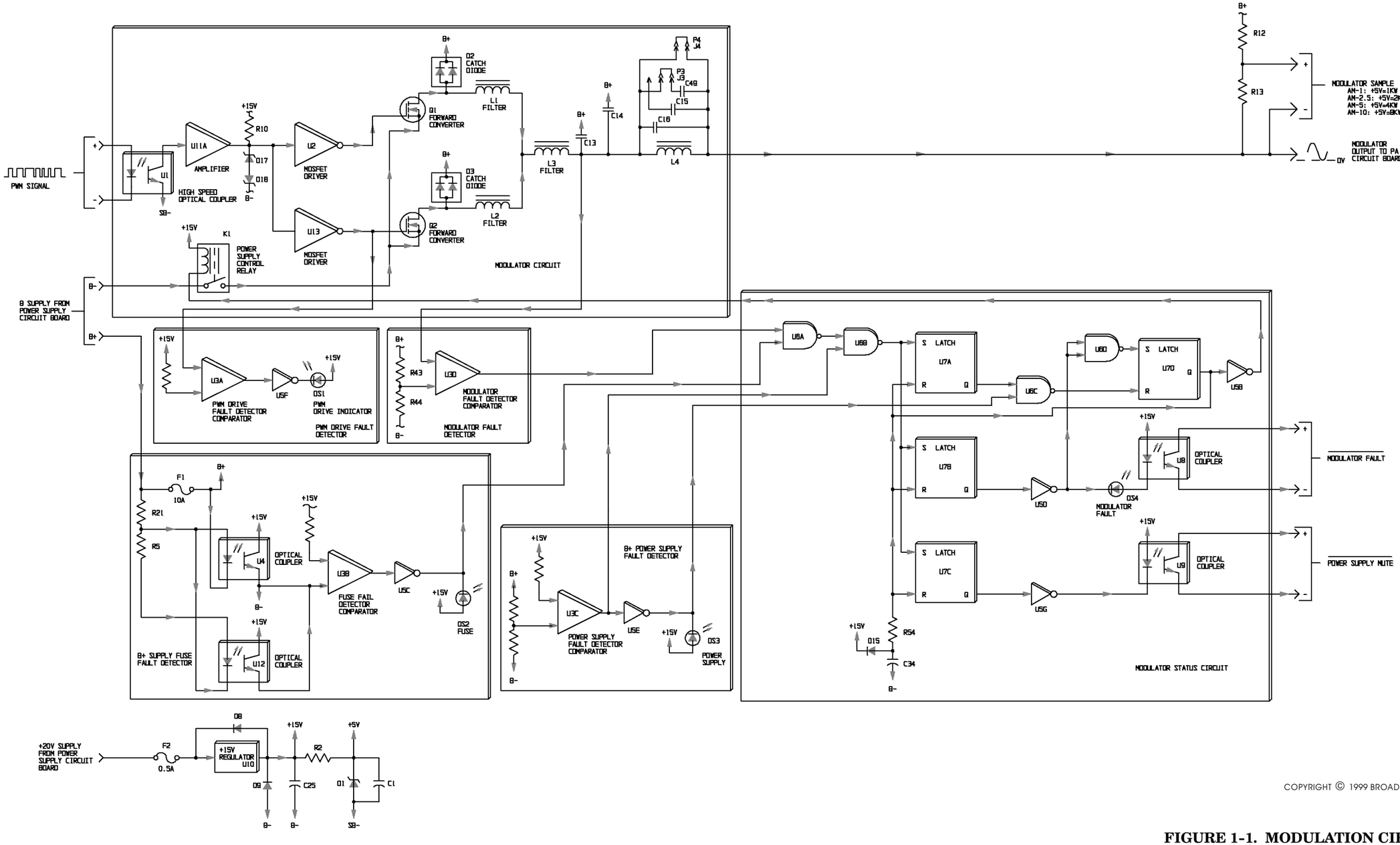
1–13. **B+ Power Supply Fault Detector.** The status of the B+ supply is monitored by a B+ power supply fault detector circuit. The circuit consists of B+ power supply fault detector comparator U3C. U3C compares the power supply sample to a reference. When the B+ power supply sample is present, the output of U3C will be HIGH. The HIGH is applied to inverter U5E and NAND gate U6B of the modulator status circuit. U5E will output a LOW to enable power supply indicator DS3. When the B+ power supply sample is not present, the output of U3C will be LOW. The LOW is applied to inverter U5E and NAND gate U6B of the modulator status circuit. U5E will output a HIGH to disable power supply indicator DS3.

1–14. **Modulator Status Circuit.** The modulator status circuit consists of: 1) NAND gates U6A, U6B, U6C, and U6D, 2) latches U7A, U7B, and U7C, 3) inverters U5B, U5D and U5G, and 4) optical couplers U8 and U9. When a LOW from the modulator fault detector or the B+ supply fuse fault detector is applied to NAND gate U6A, U6A will output a HIGH to U6B. With a HIGH from power supply fault detector U3C, U6B will output a LOW to latches U7B, U7C, and U7A. Latch U7C will output a HIGH to inverter U5G. U5G will output a LOW to enable power supply mute optical coupler U9. U9 will output a LOW power supply mute command to the power supply circuit board. When the supply is muted, comparator U3C will respond by routing a LOW to U5E. U5E will output a HIGH to: 1) disable power supply indicator DS3 and 2) NAND gate U6C.

1–15. Latch U7B will output a HIGH to inverter U5D. U5D will output a LOW to: 1) illuminate modulator fault indicator DS4, 2) enable modulator fault detector optical coupler U8, and 3) NAND gate U6D. U6D will output a HIGH to latch U7D. Latch U7A will output a HIGH to NAND gate U6C. With a HIGH from U5E, U6C will output a LOW to latch U7D. U7D will output a LOW to U5B. U5B will respond by routing a HIGH to bias relay K1 on. Relay K1 is provided to immediately disconnect the forward converter transistors from the power supply during a modulator fault or high B+ supply conditions.

1–16. **POWER SUPPLY.** A +20 volt operating potential for the modulator circuit board is provided by the applicable power supply circuit board. The +20 volt supply is applied through fuse F2 to +15 volt regulator U10. Fuse F2 protects the +20 volt supply from over–current conditions.

1–17. U10 is a three–terminal adjustable positive regulator containing internal thermal overload protection and short–circuit current limiting features. Further protection for U10 is provided by diodes D8 and D9. D8 protects the regulator from a short circuit on the regulator input. D9 protects the regulator from a reverse polarity potential applied to the output. Capacitor C25 provides filtering for the +15 volt supply. A sample of the +15 supply is regulated into a +5 volt supply by zener diode D1.



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597-1112-26

FIGURE 1-1. MODULATION CIRCUIT BOARD SIMPLIFIED SCHEMATIC
(1-3/1-4)

1-18. **RF AMPLIFIER CIRCUIT BOARD.**

1-19. Each RF power module is equipped with two RF amplifier circuit boards: 1) power amplifier 1 and 2) power amplifier 2. The circuit boards are designed with Class E power amplifier circuitry. Each circuit board is designed to produce approximately 687.5 watts of RF power. Figure 1-2 presents the RF amplifier circuit board circuitry. The RF amplifier circuit boards are identical, therefore only power amplifier 1 will be explained.

1-20. **PRE-DRIVER CIRCUIT.** A +15 volt peak-to-peak square-wave signal at the carrier frequency is applied to a transformer on the power block motherboard assembly. The transformer outputs two signals to inverter U5A.

1-21. The output from U5A is applied through inverters U5B/U5C to high/low side driver U7 and U8. U7/U8 output high and low drive signals to driver circuit transistors Q3/Q5 and Q4/Q6.

1-22. **DRIVER CIRCUIT.** The driver circuit consists of: 1) transistors Q3 and Q5 and 2) Q4 and Q6. Q3/Q5 and Q4/Q6 are MOSFET transistors configured as a push-pull driver circuit. The outputs of Q3/Q5 and Q4/Q6 are applied to MOSFET power transistors Q1 and Q2. Operating potentials for the driver circuitry is provided by the RF driver +30 volt supply. The supply is protected from over-voltage conditions by a regulator Q7. The regulator limits the voltage to approximately 47 volts dc. Fuse F2 protects the +30 volt supply from over-current conditions. Fuse F3 protects the driver circuit components from over-current conditions.

1-23. **RF AMPLIFIER CIRCUIT.** The RF amplifier circuit consists of switching MOSFET transistors Q1 and Q2. Q1 and Q2 are configured as a Class E switching amplifier network. Class E power amplifier characteristics consist of: 1) the transistor drain-to-source voltage must be nominally zero immediately prior to the turn-on of the transistor and 2) the time slope of the drain-to-source voltage waveform must be nominally zero prior to the turn-on of the transistor. The Class E circuit results in: 1) reduced device dissipation and lowers the transistor operating temperature which greatly increases the life of the components, 2) an operating efficiency of 95% or greater, and 3) increased reliability when operated into VSWR conditions.

1-24. Additional characteristics of a Class E amplifier design is the application of dc power to the amplifier transistors. The B+ and B- supplies are applied to RF choke L1 on the combiner assembly. The choke is connected to the primary center tap winding of combiner transformer T1. The transistors are connected to the primary winding of the transformers. The B- supply for the power amplifier is provided by the modulator circuit board. The modulator outputs a dc voltage which varies with audio modulation and functions as the RF ground for transistors Q1 and Q2. The RF ground potential will change in response to the applied audio. Fuse F1 protects the power amplifiers from over-current conditions.

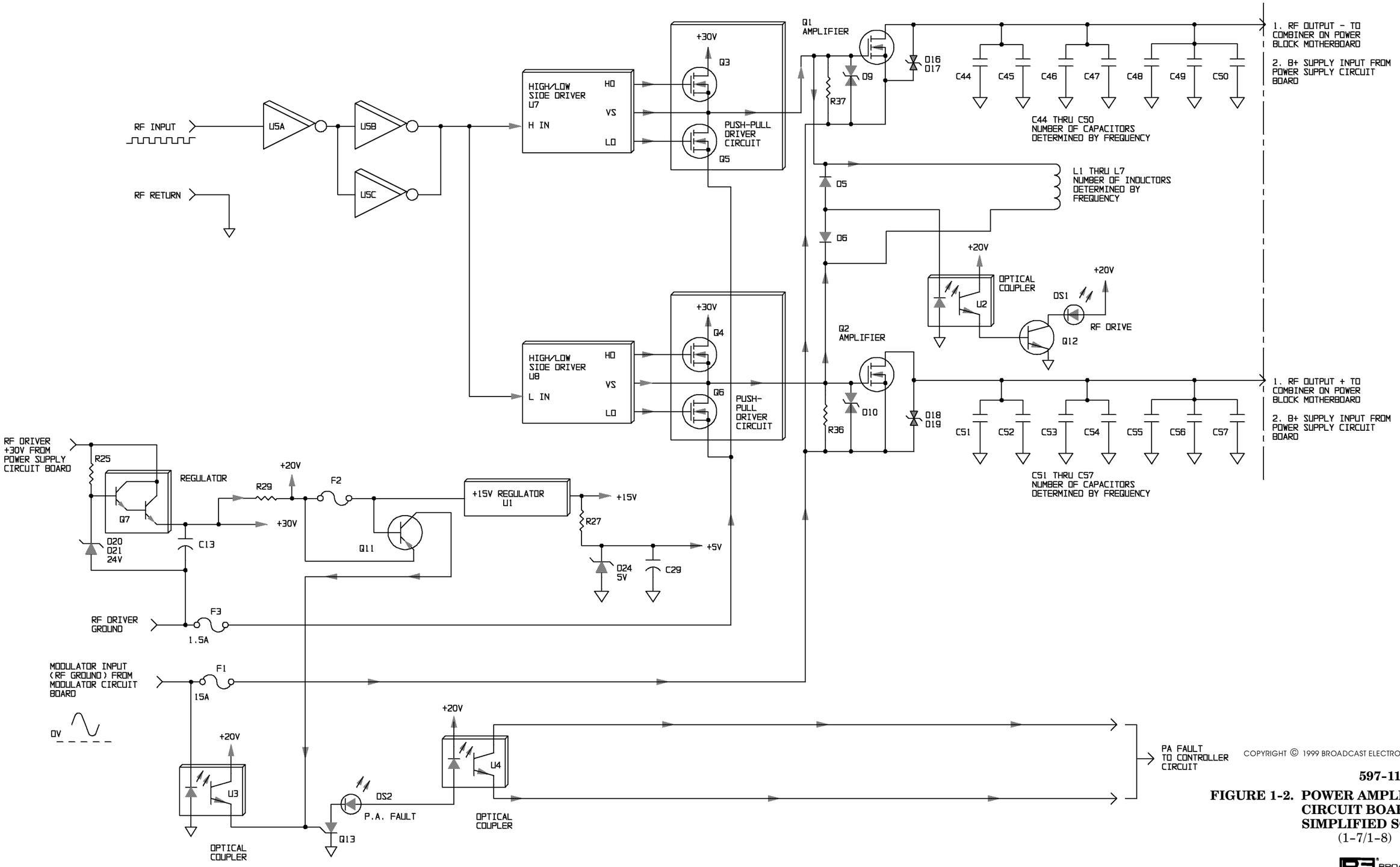
1-25. Transistors Q1 and Q2 operate together to generate approximately 687.5 watts of RF power. Q1 operates 180 degrees out-of phase with transistor Q2. Inductors L1 through L7 improve the efficiency of the drive circuit by storing the energy required to charge the input capacitance of the transistors. Transzorbs D9/D10 prevent the gates of Q1/Q2 from damage by transients during power on and off. Capacitors C 44 through C50 and C51 through C57 provide shaping for the Class E waveform. The RF power from power amplifier 1 is combined with the 687.5 watts of RF power from power amplifier circuit board 2 at a combiner transformer on the power block motherboard assembly to generate 1375 watts of RF power.

1-26. **RF DRIVE STATUS CIRCUIT.** The RF drive signal is monitored by an RF drive status circuit. When an RF drive signal is present, a sample of the RF drive signal is rectified by diodes D5/D6. The voltage from D5/D6 is applied to optical coupler U2. The output of U2 will go HIGH and bias transistor Q12 on. The output of Q12 will go LOW to illuminate RF drive status indicator DS1.

1-27. **FAULT DETECTOR CIRCUIT.** The power amplifier circuit board circuitry is monitored for fault conditions by a fault detector circuit. The circuit is designed to monitor two operations: 1) the +30 volt supply and 2) the modulator output voltage (RF ground). The modulator output is monitored by optical coupler U3. The +20 volt supply is monitored by transistor Q11. The power amplifier is protected from over-current conditions by fuse F1. The +30 volt supply is protected from over-current conditions by fuse F2.

1-28. The fault detector functions by monitoring fuses F1 and F2. When fuse F2 is blown, transistor Q11 will output +20 volts to silicon-controlled-rectifier (SCR) Q13. When fuse F1 is blown, optical coupler U3 will output +20 volts to SCR Q13. When either voltage is present, the voltage will bias Q13 on to illuminate PA fault indicator DS2 and bias optical coupler U4 on. U4 will respond by routing a PA fault signal to the controller circuit board.

1-29. **POWER SUPPLY CIRCUIT.** An operating potential for the amplifier circuit board circuitry is provided by the +30 volt supply from the power supply circuit board. The supply is protected from over-current conditions by fuse F2. The +30 supply is regulated into a: 1) +15 volt supply by U1 and 2) +20 volt supply by R29. U1 is a three-terminal adjustable regulator containing internal thermal and short-circuit current limiting features. Fuse F2 protects the +30 volt supply from over-current conditions. Fuse F1 protects the power amplifier components from over-current conditions. Fuse F3 protects the driver circuit components from over-current conditions.



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597-1112-27

FIGURE 1-2. POWER AMPLIFIER CIRCUIT BOARD SIMPLIFIED SCHEMATIC
(1-7/1-8)

SECTION II
RF POWER MODULE MAINTENANCE

2-1. INTRODUCTION.

2-2. This section provides maintenance information for the AM-2.5E/AM-5E transmitter RF power modules.

2-3. SAFETY CONSIDERATIONS.

WARNING

WARNING

WARNING

WARNING

THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.

2-4. The AM-2.5E/AM-5E transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with many built-in safety features, however good judgement, care, and common sense must be practiced to prevent accidents.

2-5. In addition to high voltages and currents, the transmitters contain multiple circuit grounds with high ac and dc potentials with respect to the cabinet which is at earth potential. The potentials could cause serious injury or death if maintenance personnel simultaneously touch a circuit ground and the cabinet. As a result, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Therefore, never energize the transmitter with test equipment connected to the transmitter output network, RF power module, RF combiner, or power supply components. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-6. FIRST LEVEL MAINTENANCE.

2-7. First level maintenance consists of precautionary procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a performance log.

2-8. CLEANING AND INSPECTION.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE ATTEMPTING ANY EQUIPMENT MAINTE-***

WARNING ***NANCE.***

CAUTION ***REMOVING OR INSTALLING AN RF POWER MODULE WITH THE TRANSMITTER ENERGIZED MAY RESULT***

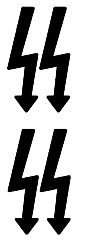
CAUTION ***IN DAMAGE TO THE MODULE. DO NOT REMOVE THE RF POWER MODULES WITH THE TRANSMITTER EN-ERGIZED.***

2-9. Ensure all transmitter primary power is disconnected and remove an RF power module. Clean the module of accumulated dust as required using a nylon bristle brush and vacuum cleaner. Inspect the circuit boards for improperly seated semiconductors and components damage by overheating. In addition, inspect the module for loose hardware. Repeat the procedure for each module in the transmitter.

2-10. SECOND LEVEL MAINTENANCE.

2-11. Second level maintenance is the performance of procedures required to restore an RF power module to operation after a fault has occurred. The RF power modules contain no electrical adjustments. Therefore, the following text presents only troubleshooting procedures.

2-12. TROUBLESHOOTING.



WARNING ***THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS***

WARNING ***WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE***

WARNING ***TRANSMITTER WITH TEST EQUIPMENT CON-NECTED TO THE TRANSMITTER OUTPUT***

WARNING ***NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.***

CAUTION ***REMOVING OR INSTALLING AN RF POWER MODULE WITH THE TRANSMITTER ENERGIZED MAY RESULT***

CAUTION ***IN DAMAGE TO THE MODULE. DO NOT REMOVE THE RF POWER MODULES WITH THE TRANSMITTER EN-ERGIZED.***

2-13. **SAFETY CONSIDERATIONS.** The AM-2.5E/AM-5E transmitters are equipped with extensive indicator and meter circuitry to allow the operator to isolate problems to a specific area within the transmitter. Due to the hazardous voltages and currents contained in the equipment, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-14. The RF power modules are not designed to be removed from the cabinet with the power energized. Therefore, operate the transmitter to off before removing an RF power module from the cabinet for maintenance procedures.

2-15. **RF POWER MODULE ASSEMBLY PROCEDURE.** In the event of a failure in an RF power module, the module will be required to be disassembled. The module must be properly re-assembled to prevent circuit board and connector mis-alignment. To re-assemble an RF power module, proceed as follows:

1. Locate the PA 2 circuit board and install the hex standoffs in the four locations at the rear of the circuit board.

2. Locate the PA 1 circuit board and install the front panel mounting bracket using the four Phillips-head screws. Do not secure the screws at this time. Repeat the procedure for the PA2 circuit board and the modulator circuit board.

3. Install the PA 1 circuit board in the PA 1 location on the RF power module front panel. Secure the circuit board bracket to the front panel using the hex nuts. Repeat the procedure for the PA 2 and modulator circuit boards.

4. Place the RF power module on a square and flat surface such as a table with the top of the module facing up.

5. Place the module front panel flush with the edge of the table and align the circuit boards as follows:

A. Move the PA 1 circuit board until the front of the circuit board is flush with the RF module front panel and the top edge of the circuit board is straight.

B. Secure the two Phillips-head screws which mount the circuit board to the bracket.

C. Repeat the procedure for the PA 2 and modulator circuit boards.

6. Rotate the module and repeat the alignment procedure for the bottom circuit board bracket screws. Secure the two Phillips-head screws mounting the circuit board to the bracket when each circuit board is properly aligned.

7. Install the hardware securing the PA 1 circuit board and the modulator circuit board to the standoffs.

2-16. **RF POWER MODULE EXCHANGE PROGRAM.** If an RF power module is determined to be defective, Broadcast Electronics has established an RF power module exchange program. The program allows the customer to exchange a defective module for a re-conditioned module. Terms of the program are available from the Broadcast Electronics Customer Service Department. If an RF power module is determined to be defective, troubleshoot the module or contact the Broadcast Electronics Customer Service department for terms of the module exchange program.

2-17. **TROUBLESHOOTING PROCEDURES.** The RF power module troubleshooting procedures are presented in Table 2-1. During the execution of the procedures, perform all troubleshooting procedures for a symptom. The symptom may contain multiple component failures. Once the trouble is isolated, refer to the circuit board theory of operation and schematic diagrams to assist in problem resolution.

2-18. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement procedures for the RF power modules are presented in PART I SECTION V. Refer to COMPONENT REPLACEMENT in SECTION V as required for the replacement procedures.

TABLE 2-1. RF POWER MODULE TROUBLESHOOTING
(Sheet 1 of 3)

SYMPTOM	CIRCUITRY TO CHECK
RF DRIVE INDICATOR EXTINGUISHED OR FLICKERING OR FAULT INDICATOR ILLUMINATED	1. Determine transistor reference voltages of a power amplifier with no faults as follows: A. Remove an operational power amplifier with no faults from an RF power module. B. Using a digital voltmeter, operate the voltmeter to diode check and determine a reference voltage for the transistors on the circuit board as follows: 1. Place the negative lead on the drain of Q1 (center pin) and the positive lead on the gate and determine the voltage. The voltage using a Fluke 77 meter = .45. 2. Place the negative lead on the drain of Q1 and the positive lead on the source and determine the voltage. The voltage using a Fluke 77 meter = .45. 2. Using the voltmeter as described in the preceding step, measure the drain-to-gate and drain-to-source voltage of transistor Q1 on the defective power amplifier circuit board. A. If the voltage is greater than ±0.1 volt of the reference, defective Q1, Q3, and Q5. B. If the voltage is equal to the reference, repeat the preceding step for transistor Q2 on the defective power amplifier circuit board. 3. Using a digital voltmeter, operate the voltmeter to diode check and troubleshoot transistor Q3 as follows: A. Place the negative lead on the drain of Q3 (center pin) and the positive lead on the gate and determine if a short circuit condition is present. B. Place the negative lead on the drain of Q3 and the positive lead on the source and determine if a short circuit condition is present. C. If a short circuit condition is present, defective Q3. 4. Repeat the procedure for transistors Q4, Q5, and Q6. 5. Visually inspect regulator U1 for broken leads. 6. Check and replace all blown fuses on the circuit board.

TABLE 2-1. RF POWER MODULE TROUBLESHOOTING
(Sheet 2 of 3)

SYMPTOM	CIRCUITRY TO CHECK
MOD PWM DRIVE INDICATOR EXTINGUISHED AND FAULT OR FUSE INDICATOR ILLUMINATED	1. Refer to RF DRIVE INDICATOR EXTINGUISHED OR FLICKERING OR FAULT INDICATOR ILLUMINATED in the preceding text and troubleshoot the power amplifier circuit board. 2. If no defective circuitry is located on the power amplifier circuit board, refer to FAULT OR FUSE INDICATOR ILLUMINATED in the following text and troubleshoot the modulator circuit board.
MOD PWM DRIVE INDICATOR EXTINGUISHED	1. Defective U2 or U13 on the modulator circuit board.
FAULT OR FUSE INDICATOR ILLUMINATED	1. Visually inspect regulator U10 for broken leads. 2. Determine transistor reference voltages of a modulator circuit board with no faults as follows: A. Remove a modulator with no faults from an RF power module. B. Using a digital voltmeter, operate the voltmeter to diode check and determine a reference voltage for the transistors on the circuit board as follows: 1. Place the negative lead on the drain of Q1 (center pin) and the positive lead on the gate and determine the voltage. The voltage using a Fluke 77 meter = 1.2V. 2. Place the negative lead on the drain of Q1 and the positive lead on the source and determine the voltage. The voltage using a Fluke 77 meter = .46V. 3. Using the voltmeter as described in the preceding step, measure the drain-to-gate and drain-to-source voltage of transistor Q1 on the defective modulator circuit board. A. If the voltage is greater than ±0.1 volt of the reference, proceed as follows: 1. Remove the wire from terminal E1. 2. Using the voltmeter as described in the preceding text, measure the drain-to-gate and drain-to-source voltage of transistor Q1 on the defective modulator circuit board. B. If the voltage at Q1 is greater than ± 0.1V of the reference, defective Q1. C. If the voltage at Q1 is equal to the reference, defective Q2.

TABLE 2-1. RF POWER MODULE TROUBLESHOOTING
(Sheet 3 of 3)

SYMPTOM	CIRCUITRY TO CHECK
FAULT OR FUSE INDICATOR ILLUMINATED (CONT'D)	4. Replace all blown fuses on the circuit board. 5. Re-install the modulator circuit board and install the RF module in the transmitter. If the modulator remains defective, replace U2 and U13. 6. If the modulator remains defective, contact the Broadcast Electronics Customer Service Department.

SECTION III
RF POWER MODULE
PARTS LIST

3-1. INTRODUCTION.

3-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the RF Power Module. Each table entry in this section is indexed by reference designators appearing on the applicable schematic.

TABLE 3-1. REPLACEABLE PARTS LIST INDEX

TABLE	DESCRIPTION	PART NO.	PAGE
3-2	Power Module Assembly	957-0010-001	3-2
3-3	Modulator Circuit Board Assembly	917-0302	3-2
3-4	Power Amplifier Circuit Board Assembly	917-0304	3-5
3-5	Power Module Frequency Dependant Kit, 522 - 650 kHz	957-1015-001	3-8
3-6	Power Module Frequency Dependant Kit, 651 - 770 kHz	957-1015-002	3-8
3-7	Power Module Frequency Dependant Kit, 771 - 920 kHz	957-1015-003	3-8
3-8	Power Module Frequency Dependant Kit, 921 - 1080 kHz	957-1015-004	3-8
3-9	Power Module Frequency Dependant Kit 1081 - 1300 kHz	957-1015-005	3-9
3-10	Power Module Frequency Dependant Kit 1301 - 1580 kHz	957-1015-006	3-9
3-11	Power Module Frequency Dependant Kit, 1581 - 1700 kHz	957-1015-007	3-9

TABLE 3-2. POWER MODULE ASSEMBLY - 957-0010-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Modulator Circuit Board Assembly	917–0302	1
----	Power Amplifier Circuit Board Assembly	917–0304	2

TABLE 3-3. MODULATOR CIRCUIT BOARD ASSEMBLY- 917-0302
(Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C2	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	1
C3	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C4	Capacitor, Monolythic Ceramic 1 uF ±10%, 100V	003–1041	1
C5	Capacitor, Electrolytic, 330 uF, 200V dc	013–3385–201	1
C6	Capacitor, Polypropylene Film, .47 uF, 250V, Oval	033–4743	1
C7	Capacitor, Mica, 1000 pF ±10%, 350V	046–0002	1
C8	Capacitor, Electrolytic, 330 uF, 200V dc	013–3385–201	1
C9	Capacitor, Polypropylene Film, .47 uF, 250V, Oval	033–4743	1
C10	Capacitor, Mica, 1000 pF ±10%, 350V	046–0002	1
C11, C12	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	2
C13, C14	Capacitor, Polypropylene Film, 2.2 uF, 400V	030–2256	2
C15, C16	Capacitor, Metallized Polypropylene Film, .068 uF ±10%, 250V	030–6843	2
C17	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	1
C18, C19	Capacitor, Electrolytic, 10 uF, 50V	023–1076	2
C20	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	1
C21	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C22	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C23	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C24	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C25	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C26, C27	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	2
C28 thru C32	Capacitor, Electrolytic, 10 uF, 50V	023–1076	5
C33	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	1
C34	Capacitor, Electrolytic, 47 uF, 35V	020–4773	1
C35	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C36, C37	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	2
C38, C39	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	2
C40	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C41	Capacitor, Electrolytic, 33 uF, 25V	020–3374	1
C42	Capacitor, Polypropylene Film, 2.2 uF, 400V	030–2256	1
C43	Capacitor, Polypropylene Film, .47 uF, 250V, Oval	033–4743	1
C44	Capacitor, Polypropylene Film, .033 uF, ±10%, 200V	030–3353	1
C45	Capacitor, Mica, 820 pF ±5%, 300V	042–8222	1
C46, C47	Capacitor, Monolythic Ceramic, .1 uF ±10%, 100V	003–1041	2
C48	Capacitor, Metallized Polypropylene Film, .068 uF ±10%, 250V	030–6843	1

TABLE 3-3. MODULATOR CIRCUIT BOARD ASSEMBLY - 917-0302
(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C49	Capacitor, Polypropylene Film, .033 uF ±10%, 200V	030-3353	1
C50	Capacitor, Mylar, 0.01 uF ±10%, 100V	031-1043	1
D1	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200-4733	1
D2, D3	Diode, Fast Recovery, 16JPF20	200-1620	2
D4	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D5	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D6	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D7	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
D8, D9	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	2
D10	Diode, 1N6276A, Silicon, Transient Voltage Suppressor, 16V ±0.05% Breakdown	206-6276	1
D11	Switchmode Power Rectifier, MUR460	230-0014	1
D12, D13	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D14, D15	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	2
D16	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D17	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
D18	Diode, Zener, 1N4728, 3.3V ±5%, 1W	201-4728	1
D19	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D20 thru D23	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	4
D24, D25	Diode, Schottky, 20V, 1 Amp, 1N5817	200-0019	2
DS1	Indicator, LED, Green, 521-9175, 3V @ 40 mA Maximum	323-9224	1
DS2	Indicator, LED, Red, 521-9212, 1.7V @ 50 mA Maximum	323-9217	1
DS3	Indicator, LED, Green, 521-9175, 3V @ 40 mA Maximum	323-9224	1
DS4	Indicator, LED, Red, 521-9212, 1.7V @ 50 mA Maximum	323-9217	1
F1	Fuse, 3AG, 20 Amperes, 250V	330-2000	1
F2	Fuse, MDL, 1 Ampere, 250V, Slow-Blow	334-0100	1
J3, J4	Jumper, Programmable, 2-Pin	340-0004	2
K1	Relay, SPST, 30 Amperes	270-1213	1
P2	Connector, 15-Pin, SUB-D, Male, Right Angle	417-0374	1
P3	Receptacle, Male, 3-Pin In-line	417-0003	1
P4	Receptacle, Male, 2-Pin In-line	417-4004	1
Q1, Q2	Modulator, FET MTY55N20E, 200V, 55 Amperes	210-0550	2
R1	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R2	Resistor, 470 Ohm ±5%, 1/2W	110-4733	1
R3	Resistor, 332 Ohm ±1%, 1/4W	103-3323	1
R4	Resistor, 1 Ohm ±5%, 1/4W	100-1013	1
R5	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R7	Resistor, 12k Ohm, 2W, ±5%	130-1253	1
R8	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R9	Resistor, 1 Ohm ±5%, 1/4W	103-1021	1
R10	Resistor, 3.65 k Ohm ±1%, 1/4W	103-3641	1
R11	Resistor, 1 Ohm ±5%, 1/4W	100-1021	1
R12	Resistor, 453 k Ohm ±1%, 1/4W	100-4561	1
R13	Resistor, 130 k Ohm ±1%, 1/4W	103-1306	1
R14	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1

TABLE 3-3. MODULATOR CIRCUIT BOARD ASSEMBLY - 917-0302
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R15	Resistor, 332 k Ohm ±1%, 1/4W	103-3326	1
R16	Resistor, 69.8 k Ohm ±1%, 1/4W	103-6985	1
R17	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	1
R18	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R19	Resistor, 3.65 k Ohm ±1%, 1/4W	103-3641	1
R20	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R21	Resistor, 27 k Ohm ±5%, 1W	120-2753	1
R22	Resistor, 22.1 k Ohm ±1%, 1/4W	103-2211	1
R23	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R24	Resistor, 332 k Ohm ±1%, 1/4W	103-3326	1
R25	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	1
R26	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R27	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R28	Resistor, 69.8 k Ohm ±1%, 1/4W	103-6985	1
R29	Resistor, 3.65 k Ohm ±1%, 1/4W	103-3641	1
R30	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R31	Resistor, 332 k Ohm ±1%, 1/4W	103-3326	1
R32	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	1
R33	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R34	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R35	Resistor, 1.33 k Ohm ±1%, 1/4W	103-1331	1
R38	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R39	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R40	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R41	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R42	Resistor, 8.66 k Ohm ±1%, 1/4W	100-8641	1
R43	Resistor, 499 k Ohm ±1%, 1/4W	103-4996	1
R44	Resistor, 8.25 k Ohm ±1%, 1/4W	103-8254	1
R45	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R46	Resistor, 1 Meg Ohm ±1%, 1/4W	103-1007	1
R47 thru R49	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	3
R51	Resistor, 15.4 k Ohm ±1%, 1/4W	103-1551	1
R52	Resistor, 39 Ohm ±5%, 1/2W	110-3923	1
R53	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R54, R55	Resistor, 100 Ohm ±1%, 1/4W	100-1031	2
R56, R57	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	2
R58	Resistor, 453 k Ohm ±1%, 1/4W	100-4561	1
TP1 thru TP4	Terminal, Test Point, Oval, Red	413-0106	4
TP5, TP6	Jack, Test, Right Angle Printed Circuit Board Mount	417-0004	2
U1	Integrated Circuit, Opto-Isolator, 6N137	220-6137	1
U2	Driver, TC4421CAT, 2 Ampere, 5-Pin, TO-220 Case	220-4421	1
U3	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U4	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	1

TABLE 3-3. MODULATOR CIRCUIT BOARD ASSEMBLY - 917-0302
(Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U5	Integrated Circuit, ULN2004, 7 NPN Darlington Driver Pack, 16–Pin DIP	226–2004	1
U6	Integrated Circuit, MC14093B, Quad 2–Input NAND Schmitt Trigger, CMOS, 14–Pin DIP	220–4093	1
U7	Integrated Circuit, MC14044BP, Quad NAND R–S Latch, CMOS, 16–Pin DIP	228–4044	1
U8, U9	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6–Pin DIP	229–0033	2
U10	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO–220 Case	227–0317	1
U11	Integrated Circuit, 14505, Hex Level Shifter, TTL to CMOS, 16–Pin DIP	228–4504	1
U12	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6–Pin DIP	229–0033	1
U13	Driver, TC4421CAT, 2 Ampere, 5–Pin, TO–220 Case	220–4421	1
XF1, XF2	Fuse Clips, AGC	415–2068	2
XU1	Socket, 8–Pin DIP	417–0804	1
XU3	Socket, 14–Pin DIP	417–1404	1
XU4	Socket, 6–Pin DIP	417–0600	1
XU5	Socket, 16–Pin DIP	417–1604	1
XU6	Socket, 14–Pin DIP	417–1404	1
XU7	Socket, 16–Pin DIP	417–1604	1
XU8, XU9	Socket, 6–Pin DIP	417–0600	2
XU11	Socket, 16–Pin DIP	417–1604	1
XU13	Socket, 6–Pin DIP	417–0600	1
----	Coil, 36 uH, MOD PWM	360–0108	2
----	Coil, 9.2 uH, MOD PWM	360–0109	1
----	Coil, 14 uH, MOD PWM	360–0110	1
----	Blank, Modulator Circuit Board	517–0302	1

TABLE 3-4. POWER AMPLIFIER CIRCUIT BOARD ASSEMBLY - 917-0304
(Sheet 1 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C2	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C3 thru C6	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 100V	003–1041	4
C8	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C10	Capacitor, Electrolytic, 100 uF, 35V	023–1084	1
C11	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C12	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 100V	003–1041	1

TABLE 3-4. POWER AMPLIFIER CIRCUIT BOARD ASSEMBLY - 917-0304
(Sheet 2 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C13	Capacitor, Electrolytic, 100 uF, 63V	015–1084	1
C15	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C16 thru C18	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	3
C19 thru C21	Capacitor, Monolytic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C23	Capacitor, Mylar Film, 0.01 uF ±10%, 200V	030–1043	1
C24	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C25	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C26	Capacitor, Ceramic, 0.001 uF, 1 kV	002–1034	1
C27, C28	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 200V	003–1065	2
C29 thru C32	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 100V	003–1041	4
C33	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C34	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 100V	003–1041	1
C36 ,C37	Capacitor, Mica, 39 pF ±5%, 500V	042–3912	2
C38, C39	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	2
C40 thru C43	Capacitor, Electrolytic, 1 uF, 50V	024–1064	4
C45 thru C55	Refer to Frequency Dependant Parts – Power Amplifier Table at the end of this section.		
C58	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C59	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
D1 thru D6	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	6
D9, D10	Transzorb Diode, 27 Volt, 1.5KE27CA	206–0027	2
D11	Diode, Zener 1N5229, 4.3V, 0.5W	201–0035	1
D16	Diode, Transzorb, Diode, 300BV, 1.5FE300CA	206–0300	1
D17	Transzorb Diode, 250BV, 1.5KE250CA	206–0250	1
D18	Diode, Transzorb, Diode, 300BV, 1.5FE300CA	206–0300	1
D19	Transzorb Diode, 250BV, 1.5KE250CA	206–0250	1
D20, D21	Diode, Zener, 1N4749, 24V, 10.5 Amperes	200–0024	2
D22, D23	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	2
D25 thru D28	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	4
D29, D30	Diode, Zener, 1N4742A, 12V ±5%, 1W	200–4742	2
D31	Diode, Zener, 1N4737A, 7.5V, 1W, 34 mA	200–4737	1
D32 thru D35	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	4
DS1	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum	323–9224	1
DS2	Indicator, LED, Red, 521–9212, 1.7V @ 50 mA Maximum	323–9217	1
F1	Fuse, 3AB, 15 Amperes, 65V, Very Fast	330–1502	1
F2, F3	Fuse, 5 X 20MM, 1.5 Ampere, Slow–Blow	334–1150	2
FC1, FC2	Fuse Clips, AGC	415–2068	2
FC3 thru FC6	Fuse Clips, Littlefuse, 111501	415–2069	4
L1, L2	Coil, 4uH	360–0112	2
L3 thru L7	Refer to Frequency Dependant Parts – Power Amplifier Table at the end of this section.		
P2	Connector, 15–Pin Sub–D, Male, Right Angle	417–0374	1
Q1, Q2	RF FET, APT6018, 600V	210–6018	2
Q3 thru Q6	Hexfet Power Mosfet, IRFI520G, TO–220 Fullpak	210–0520	4
Q7	Transistor, TIP120, NPN Darlington–Connected Silicon Power, 65W @ 25#C Case	210–0120	1

TABLE 3-4. POWER AMPLIFIER CIRCUIT BOARD ASSEMBLY - 917-0304
(Sheet 3 of 3)

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q11	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	1
Q12	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q13	Silicon Controlled Rectifier, GE6CA, 100V @ 1.6 Ampere	237-0006	1
R1	Resistor, 1 k Ohm ±5%,1W	120-1043	1
R2, R3	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R4	Resistor, 100 Ohm ±1%, 1/4W	100-1031	1
R5	Resistor, 1.10 k Ohm ±1%, 1/4W	103-1104	1
R6, R7	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R8 thru R11	Resistor, 27 Ohm ±5%, 1/4W	100-2723	4
R12	Resistor, 15k Ohm ±5%, 2W	130-1553	1
R13	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R14	Resistor, 1.10 k Ohm ±1%, 1/4W	103-1104	1
R15	Resistor, 1 k Ohm ±5%, 1W	120-1043	1
R16	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R18	Resistor, 1.10 k Ohm ±1%, 1/4W	103-1104	1
R20	Resistor, 1.96 k Ohm ±1%, 1/4W	103-1964	1
R21, R22	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R23	Resistor, 10 Meg Ohm ±5%, 1/4W	100-1083	1
R24	Resistor, 1.96 k Ohm ±1%, 1/4W	103-1964	1
R25	Resistor, 680 Ohm ±5%, 1/2W	110-6833	1
R26	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R27, R28	Resistor, 332 Ohm ±1%, 1/4W	103-3323	1
R29	Resistor, 300 Ohm ±5%, 2W, W/W	130-3004	1
R30, R31	Resistor, 2.67 k Ohm ±1%, 1/4W	103-2674	2
R32, R33	Resistor, 100 Ohm ±1%, 1/4W	100-1031	2
R34, R35	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R36, R37	Resistor, 300 Ohm ±5%, 2W, W/W	130-3004	2
R38	Resistor, 562 Ohm ±1%, 1/4W	103-5623	1
R39, R40	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
U1	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO-220 Case	227-0317	1
U2 thru U4	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	3
U5	Integrated Circuit, MC14584, 14-Pin Schmitt	228-4584	1
U7, U8	Driver High and Low Side, IR2110	227-2110	2
XU2 thru XU4	Socket, 6-Pin DIP	417-0600	3
XU5, XU7, XU8	Socket, 14-Pin DIP	417-1404	3
----	Blank, Power Amplifier Circuit Board Assembly	517-0304	1

TABLE 3-5. POWER MODULE FREQUENCY DEPENDANT KIT, 522 - 650 KHZ - 957-1015-001

REF. DES.	DESCRIPTION	PART NO.	QTY.
C45, C56	Capacitor, Mica, 1600 pF, 1 kV	042–1622	4
C46 thru C55	Capacitor, Mica, 1800 pF, 1 kV	042–1832	20
L3, L4	Inductor, PA Drive	360–0113–XXX	4
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

TABLE 3-6. POWER MODULE FREQUENCY DEPENDANT KIT, 651 - 770 KHZ - 957-1015-002

REF. DES.	DESCRIPTION	PART NO.	QTY.
C46, C55	Capacitor, Mica, 1600 pF, 1 kV	042–1622	4
C47 thru C54	Capacitor, Mica, 1800 pF, 1 kV	042–1832	16
L3, L4	Inductor, PA Drive	360–0113–XXX	4
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

TABLE 3-7. POWER MODULE FREQUENCY DEPENDANT KIT, 771 - 920 KHZ - 957-1015-003

REF. DES.	DESCRIPTION	PART NO.	QTY.
C47 thru C54	Capacitor, Mica, 1800 pF, 1 kV	042–1832	16
L3, L4	Inductor, PA Drive	360–0113–XXX	4
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

TABLE 3-8. POWER MODULE FREQUENCY DEPENDANT KIT, 921 - 1080 KHZ - 957-1015-004

REF. DES.	DESCRIPTION	PART NO.	QTY.
C48, C53	Capacitor, Mica, 1600 pF, 1 kV	042–1622	4
C49 thru C52	Capacitor, Mica, 1800 pF, 1 kV	042–1832	8
C47, C54	Capacitor, Mica, 910 pF, 1 kV	042–9122	4
L5, L7	Inductor, PA Drive	360–0113–XXX	4
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

TABLE 3-9. POWER MODULE FREQUENCY DEPENDANT KIT, 1081 - 1300 KHZ - 957-1015-005

REF. DES.	DESCRIPTION	PART NO.	QTY.
C48, C53	Capacitor, Mica, 1600 pF, 1 kV	042–1622	4
C49 thru C52	Capacitor, Mica, 1800 pF, 1 kV	042–1832	8
L5, L7	Inductor, PA Drive	360–0113–XXX	4
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

TABLE 3-10. POWER MODULE FREQUENCY DEPENDANT KIT, 1301 - 1580 KHZ - 957-1015-006

REF. DES.	DESCRIPTION	PART NO.	QTY.
C48, C53	Capacitor, Mica, 910 pF, 1 kV	042–9122	4
C49 thru C52	Capacitor, Mica, 1600 pF, 1 kV	042–1622	8
L5, L6, L7	Inductor, PA Drive	360–0113–XXX	6
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

TABLE 6-11. POWER MODULE FREQUENCY DEPENDANT KIT, 1581 - 1700 KHZ - 957-1015-007

REF. DES.	DESCRIPTION	PART NO.	QTY.
C49, C52	Capacitor, Mica, 1600 pF, 1 kV	042–1622	4
C50, C51	Capacitor, Mica, 1800 pF, 1 kV	042–1832	4
L5, L6, L7	Inductor, PA Drive	360–0113–XXX	6
----	Blank, PA Capacitor Board Circuit Board	517–0318–001	2
----	Blank, PA Inductor Board Circuit Board	517–0319–001	2

SECTION IV
RF POWER MODULE DRAWINGS

4-1. INTRODUCTION.

4-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the Broadcast Electronics AM-2.5E/AM-5E transmitter RF power module.

FIGURE	TITLE	NUMBER
4-1	SCHEMATIC DIAGRAM, MODULATOR CIRCUIT BOARD	SB917-0302/-001
4-2	ASSEMBLY DIAGRAM, MODULATOR CIRCUIT BOARD	AD917-0302/-001
4-3	SCHEMATIC DIAGRAM, POWER AMPLIFIER CIRCUIT BOARD	SB917-0304
4-4	ASSEMBLY DIAGRAM, POWER AMPLIFIER CIRCUIT BOARD	AD917-0304

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PART	BOARDS	
	0302	-001
C13	2.2uF	1.5uF
C14	2.2uF	1.5uF
F1	20A	10A
L1	36uH	87uF
L2	36uH	87uF
L4	14uH	23uF
Q1	MTY55N20E	IRFP250
Q2	MTY55N20E	IRFP250

NOTES:
1. ALL RESISTORS IN OHMS; 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C50, D25, DS4, E6, F2, J4, K1, L4, P4, Q2, R58, TP6, U13.
3. COMPONENTS NOT USED: R6,R36,R37,R50,R59.
4. SEE ASSEMBLY: AD 917-0302.
5. # INDICATES PART NOT USED ON 917-0302.
6. + INDICATES PART NOT USED ON 917-0302-001.

TYPICAL WAVEFORMS & VOLTAGES

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	1-30-96	MATERIAL: SEE B/M 917-0302
M. HAYDEN		
CHKD		
ENG		FINISH
PROJ. ENGR.		
JW 8-16-96		~~SEE DWG RA592-0000~~
MFG.		NEXT ASSY.

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4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC MODULATOR BD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0302/-001	G

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1

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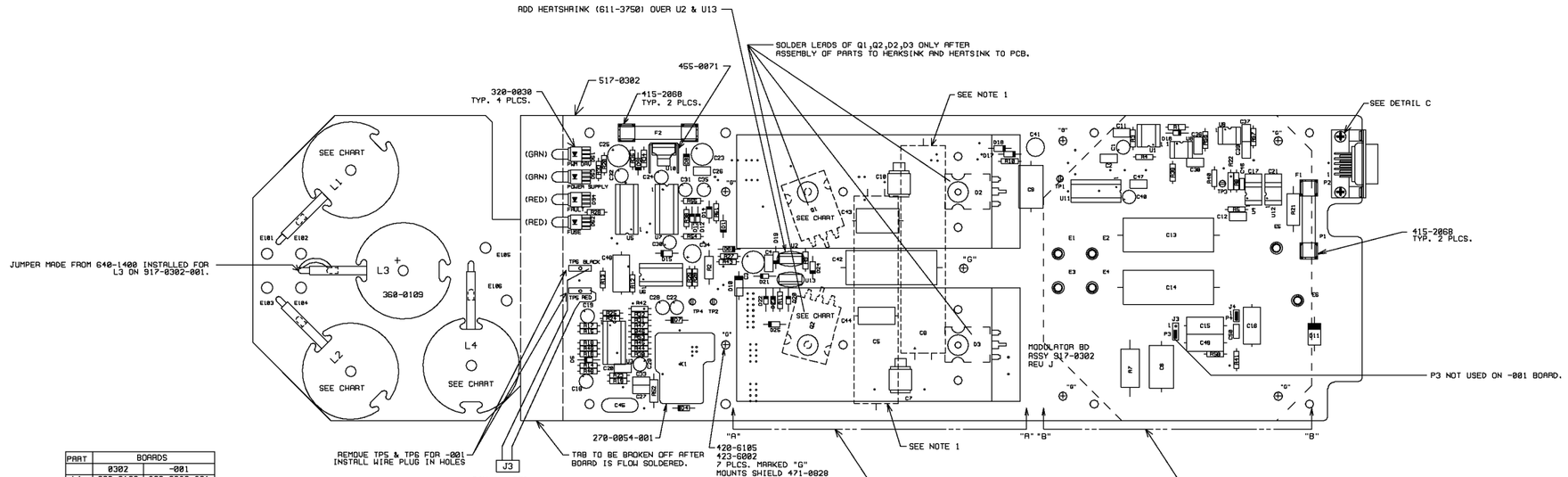
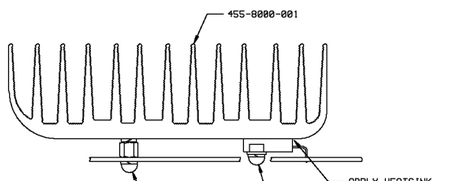
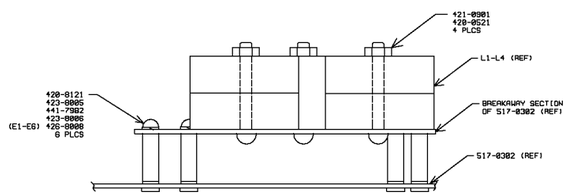


PART	BOARDS	
	0302	-001
L1	360-0108	360-0038-001
L2	360-0108	360-0038-001
L4	360-0110	360-0037-001
Q1	MTY55N20E	IRFP250
Q2	MTY55N20E	IRFP250
C14	030-2256	030-1530
F1	330-2000	330-1001
L3	360-0109	640-1400
C13	030-2256	030-1530
P3	INSTALLED	REMOVED

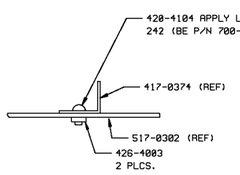


DETAIL A-A SCALE 1/1
TYP. 2 PLCS.



NOTE: L1,L2,L3 & L4 IN DETAIL B-B TO BE ELECTRICALLY TESTED AFTER MOUNTING ON 517-0302 BREAKAWAY, BUT BEFORE MOUNTING ON MODULATOR BOARD.

DETAIL B-B SCALE 1/1



DETAIL "C" SCALE 1/1

NOTES:
1) DASHED COMPONENTS TO BE MOUNTED ON OPPOSITE SIDE.
2) C13 & C14 MOUNT FLAT ON BOARD; C42 MOUNTS ON ITS EDGE.
3) SEE SCHEMATIC SB917-0302.
4) + INDICATES PART NOT USED ON 917-0302-001.
5) JUMPER IS INSTALLED IN PLACE OF L3 ON 917-0302-001.

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.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

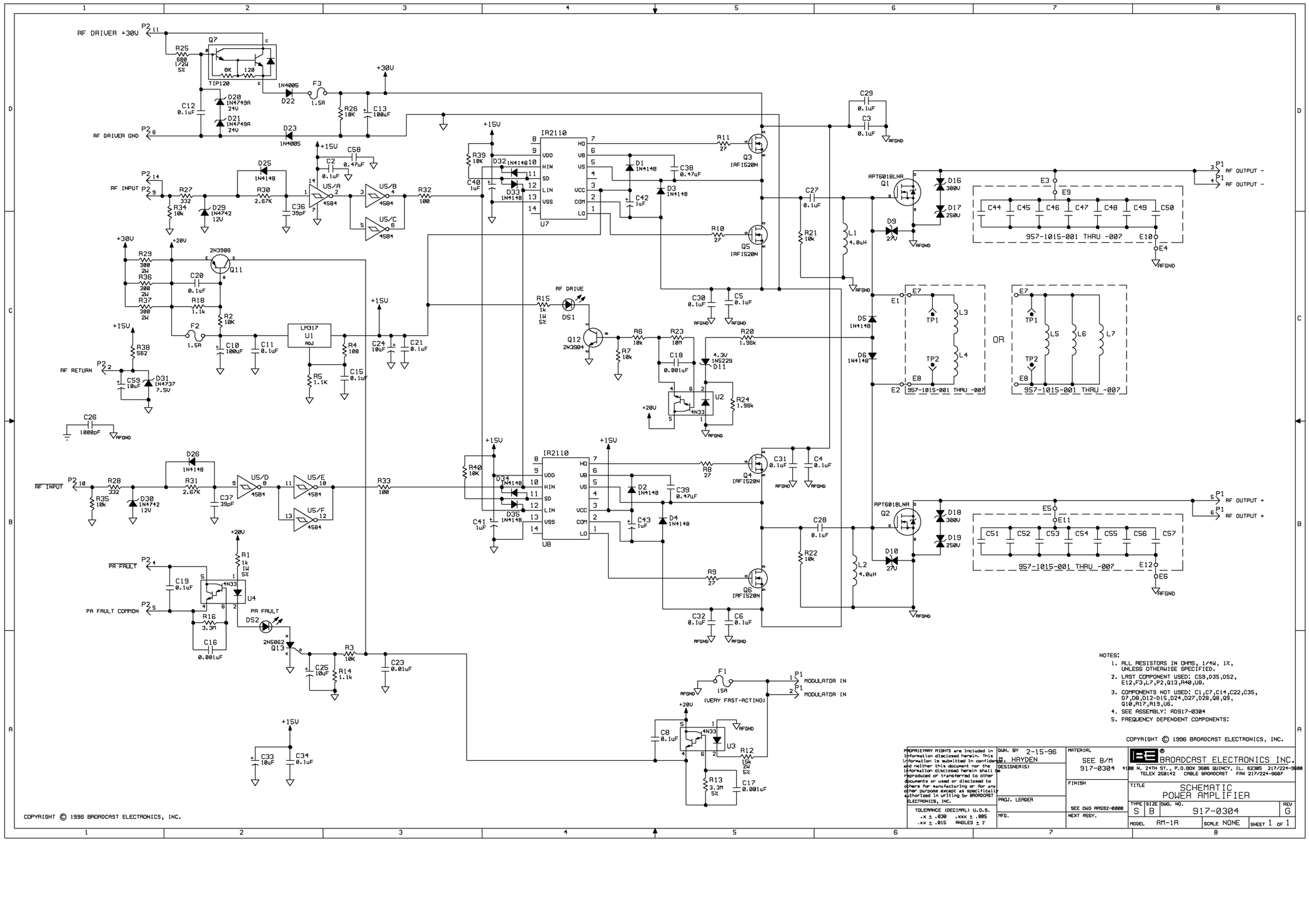
DWN. BY 2-20-96 M. HAYDEN
DESIGNER(S)
PROJ. LEADER
MFG.
MATERIAL SEE B/M 917-0302
FINISH ---------
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST. P.O.BOX 3606 QUINCY,IL. 62305
217/224-9600 FAX 217/224-9607

TITLE PCB ASSEMBLY MODULATOR BD

TYPE A | SIZE D | DWG No. 917-0302/-001 | REV J

MODEL AM-1A/AM-500A | SCALE 1/1 | SHEET 1 OF 1



NOTES:

1. ALL RESISTORS IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C58,D35,DS2, E12,F3,L7,P2,Q13,R40,U8.
3. COMPONENTS NOT USED: C1,C7,C14,C22,C35, D7,D8,D12-D15,D24,D27,D28,Q8,Q9, Q10,R17,R19,U6.
4. SEE ASSEMBLY: RDS17-0304
5. FREQUENCY DEPENDENT COMPONENTS:

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.xx ± .015 ANGLES ± 1°

DWN. BY 2-15-96
W. HAYDEN
DESIGNER(S)
PROJ. LEADER
MFG.

MATERIAL
SEE B/M
917-0304
FINISH
SEE DWG RAS92-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
SCHEMATIC
POWER AMPLIFIER

TYPE	SIZE	DWG. NO.	REV
S	B	917-0304	G

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1

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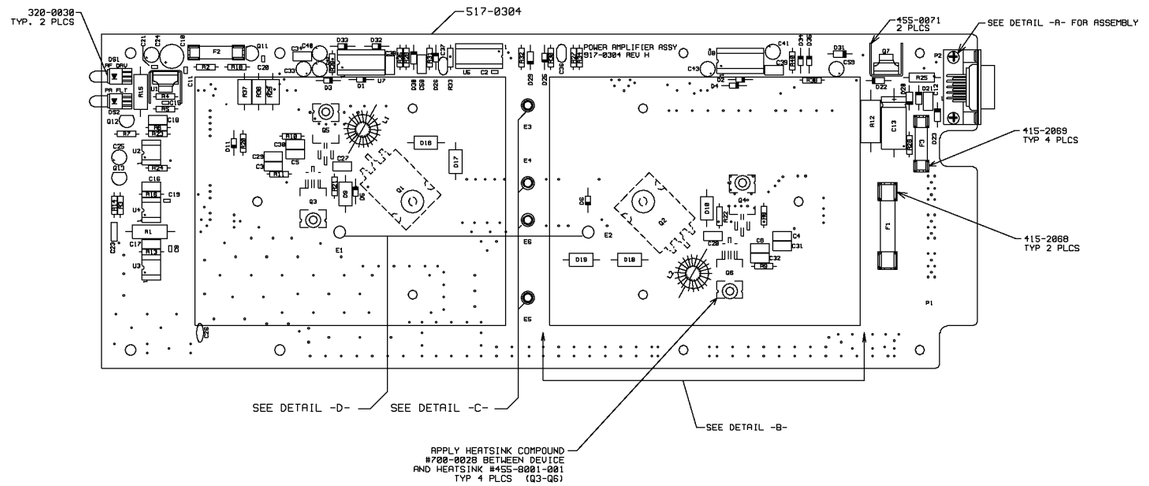

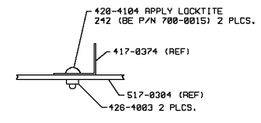

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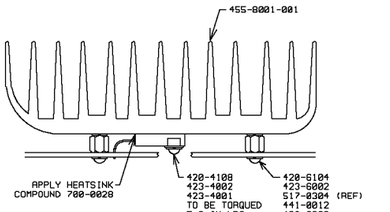
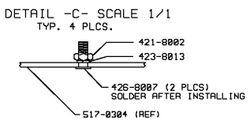
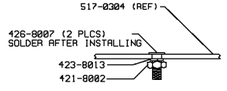


DETAIL -B- SCALE=NTS
TYP. 2 PLCS.



DETAIL -C- SCALE 1/1
TYP. 4 PLCS.



DETAIL -D- SCALE 1/1
TYP. 2 PLCS.

NOTES:
1. SEE SCHEMATIC SB917-0304.

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.XX ± .015 ANGLES ± 1°

DWN. BY 3-21-96
M. HAYDEN
DESIGNER(S)

PROJ. LEADER
JW 8-16-96
MFG.

MATERIAL
SEE B/M
917-0304

FINISH

NEXT ASSY.

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TITLE
PCB ASSEMBLY
POWER AMP BD

TYPE	SIZE	DWG No.	REV
A	D	917-0304	H

MODEL AM-1A | SCALE 1/1 | SHEET 1 OF 1

TABLE OF CONTENTS

PARAGRAPH		PAGE NO.
SECTION I	**OUTPUT NETWORK THEORY OF OPERATION**	
1-1	Introduction	1-1
1-3	Functional Description	1-1
SECTION II	**OUTPUT NETWORK MAINTENANCE**	
2-1	Introduction	2-1
2-3	Safety Considerations	2-1
2-6	First Level Maintenance	2-1
2-8	Cleaning and Inspection	2-1
2-10	Second Level Maintenance	2-2
2-12	Electrical Adjustments	2-2
2-13	Modulation Calibration Controls	2-2
2-14	Directional Coupler Null Controls	2-2
2-15	Troubleshooting	2-2
2-16	Safety Considerations	2-2
2-17	Output Network Assembly Component Locations	2-2
2-18	Troubleshooting Procedures	2-3
2-19	Component Replacement Procedure	2-3
SECTION III	**OUTPUT NETWORK ASSSEMBLY PARTS LIST**	
3-1	Introduction	3-1
SECTION IV	**OUTPUT NETWORK ASSEMBLY DRAWINGS**	
4-1	Introduction	4-1

LIST OF TABLES

TABLE	TITLE	PAGE NO.
2-1	DIRECTIONAL COUPLER CIRCUIT BOARD TROUBLESHOOTING	2-3
2-2	LIGHTNING DETECTION CIRCUIT BOARD/ SPARK GAP TROUBLESHOOTING	2-3
2-3	LIGHTNING PROTECTION CIRCUIT BOARD TROUBLESHOOTING	2-3
3-1	REPLACEABLE PARTS LIST INDEX	3-1

SECTION I
OUTPUT NETWORK THEORY OF OPERATION

1-1. INTRODUCTION.

1-2. This section presents the theory of operation for the AM-2.5E/AM-5E output network assembly.

1-3. FUNCTIONAL DESCRIPTION.

1-4. The output network assembly contains the: 1) harmonic band-pass filter, 2) directional coupler circuit board, 3) lightning protection circuit board, 4) T-matching network, 5) lightning detection circuit board, and 6) spark gap. The theory of operation for the output network assembly components is presented in PART I SECTION IV, THEORY OF OPERATION. Refer to SECTION IV as required for a description of the output network assembly components.

SECTION II
OUTPUT NETWORK MAINTENANCE

2-1. INTRODUCTION.

2-2. This section provides maintenance information for the AM-2.5E/AM-5E transmitter output network assembly.

2-3. SAFETY CONSIDERATIONS.

WARNING THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.

2-4. The AM-2.5E/AM-5E transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with many built-in safety features, however good judgement, care, and common sense must be practiced to prevent accidents.

2-5. In addition to high voltages and currents, the transmitters contain multiple circuit grounds with high ac and dc potentials with respect to the cabinet which is at earth potential. The potentials could cause serious injury or death if maintenance personnel simultaneously touch a circuit ground and the cabinet. As a result, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Therefore, never energize the transmitter with test equipment connected to the transmitter output network, RF power module, RF combiner, or power supply components. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-6. FIRST LEVEL MAINTENANCE.

2-7. First level maintenance consists of precautionary procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a performance log.

2-8. CLEANING AND INSPECTION.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE ATTEMPTING ANY EQUIPMENT MAINTE-***

WARNING ***NANCE.***

2-9. Ensure all transmitter primary power is disconnected and clean the output network assembly of accumulated dust using a nylon bristle brush and vacuum cleaner. Inspect the components for damage by overheating and arcing. In addition, check the components for loose hardware.

2-10. SECOND LEVEL MAINTENANCE.

2-11. Second level maintenance is the performance of procedures required to restore the ECU to operation after a fault has occurred. The procedures are divided into electrical adjustments procedures and troubleshooting.

2-12. ELECTRICAL ADJUSTMENTS.

2-13. **MODULATION CALIBRATION CONTROLS.** Modulation calibration controls R201 through R205 calibrate the modulation sample for each power level. A complete description of the procedure to adjust the power level controls is presented in SECTION II, INSTALLATION. Refer to POWER LEVEL AND MODULATION CALIBRATION ADJUSTMENT in SECTION II for the adjustment procedure.

2-14. **DIRECTIONAL COUPLER NULL CONTROLS.** Directional coupler null controls R223, R224, R234, and R235 null the directional coupler sampling circuit. Due to the critical nature of the directional coupler null controls, the controls are not considered field adjustable. If the controls are required to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the directional coupler null controls.

2-15. TROUBLESHOOTING.

WARNING ***THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS***

WARNING ***WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE***

WARNING ***TRANSMITTER WITH TEST EQUIPMENT CON-NECTED TO THE TRANSMITTER OUTPUT***

WARNING ***NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.***

2-16. **SAFETY CONSIDERATIONS.** The AM-2.5E/AM-5E transmitters are equipped with extensive indicator and meter circuitry to allow the operator to isolate problems to a specific area within the transmitter. Due to the hazardous voltages and currents contained in the equipment, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-17. **OUTPUT NETWORK ASSEMBLY COMPONENT LOCATIONS.** Component locations for the output network assembly are presented in PART I SECTION V, MAINTENANCE. Refer to TRANSMITTER COMPONENT LOCATIONS in SECTION V to locate components within the output network assembly.

2–18. **TROUBLESHOOTING PROCEDURES.** The output network assembly troubleshooting procedures are presented in Tables 2–1 through 2–3. Table 2–1 presents the directional coupler circuit board troubleshooting. Table 2–2 presents the lightning detection circuit board and spark gap troubleshooting. Table 2–3 presents the lightning protection circuit board troubleshooting. Refer to Tables 2–1 through 2–3 to isolate the problem to a specific circuit. Once the trouble is isolated, refer to the circuit board theory of operation presented in PART I SECTION IV and the schematic diagrams presented in this section to assist in problem resolution.

TABLE 2-1. DIRECTIONAL COUPLER CIRCUIT BOARD TROUBLESHOOTING

SYMPTOM	CIRCUITRY TO CHECK
HIGH REFLECTED POWER METER INDICATION WHEN ACTUAL REFLECTED POWER IS LOW	1. Check diode D201 through D210.

TABLE 2-2. LIGHTNING DETECTION CIRCUIT BOARD/SPARK GAP TROUBLESHOOTING

SYMPTOM	CIRCUITRY TO CHECK
HIGH REFLECTED POWER CONDITION	1. Check the lightning detection circuit board for a short circuit condition.
NO LIGHTNING DETECTION OPERATION	1. Check the spark gap. 2. Check optically operated transistor Q401 on the lightning detection circuit board.

TABLE 2-3. LIGHTNING PROTECTION CIRCUIT BOARD TROUBLESHOOTING

SYMPTOM	CIRCUITRY TO CHECK
HIGH REFLECTED POWER OR SHORTED OUTPUT CONDITION	1. Check the circuit board for a short circuit condition.

2–19. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement procedures for the output network assembly are presented in PART I SECTION V. Refer to COMPONENT REPLACEMENT in SECTION V as required for the replacement procedures.

SECTION III
OUTPUT NETWORK ASSEMBLY
PARTS LIST

3-1. INTRODUCTION.

3-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the output network assembly. Each table entry in this section is indexed by reference designators appearing on the applicable schematic.

TABLE 3-1. REPLACEABLE PARTS LIST INDEX (Sheet 1 of 2)

TABLE	DESCRIPTION	PART NO.	PAGE
3-2	Output Network Assembly, AM-2.5E	957-0068	3-3
3-3	Output Network Assembly, AM-5E	957-0070	3-3
3-4	Lightning Protection Circuit Board, AM-2.5E	917-0216-003	3-3
3-5	Lightning Protection Circuit Board, AM-5E	917-0216-001	3-3
3-6	Directional Coupler Circuit Board Assembly	917-0306-002	3-4
3-7	Lightning Detection Circuit Board Assembly	917-0306-004	3-5
3-8	Harness Output Network Assembly	947-0211	3-5
3-9	Output Network Frequency Dependant Parts, AM-2.5E 522 - 650 KHZ	957-1035-121	3-6
3-10	Output Network Frequency Dependant Parts, AM-2.5E 651 - 770 KHZ	957-1035-122	3-6
3-11	Output Network Frequency Dependant Parts, AM-2.5E 771 - 920 KHZ	957-1035-123	3-6
3-12	Output Network Frequency Dependant Parts, AM-2.5E 921 - 1080 KHZ	957-1035-124	3-7
3-13	Output Network Frequency Dependant Parts, AM-2.5E 1081 - 1300 KHZ	957-1035-125	3-7
3-14	Output Network Frequency Dependant Parts, AM-2.5E 1301 - 1580 KHZ	957-1035-126	3-7
3-15	Output Network Frequency Dependant Parts, AM-2.5E 1581 - 1700KHZ	957-1035-127	3-8
3-16	Output Network Frequency Dependant Parts, AM-5E 522 - 650 KHZ	957-1035-151	3-8
3-17	Output Network Frequency Dependant Parts, AM-5E 651 - 770 KHZ	957-1035-152	3-8
3-18	Output Network Frequency Dependant Parts, AM-5E 771 - 920 KHZ	957-1035-153	3-9
3-19	Output Network Frequency Dependant Parts, AM-5E 921 - 1080 KHZ	957-1035-154	3-9
3-20	Output Network Frequency Dependant Parts, AM-5E 1081 - 1300 KHZ	957-1035-155	3-9

TABLE 3-1. REPLACEABLE PARTS LIST INDEX (Sheet 2 of 2)

TABLE	DESCRIPTION	PART NO.	PAGE
3-21	Output Network Frequency Dependant Parts, AM-5E 1301 - 1580 KHZ	957-1035-156	3-10
3-22	Output Network Frequency Dependant Parts, AM-5E 1581 - 1700KHZ	957-1035-157	3-10

TABLE 3-2. OUTPUT NETWORK ASSEMBLY, AM-2.5E- 957-0068

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 thru C5	Refer to Frequency Dependant Parts, Output Network Table in the following text.	----	-
L1 thru L3, L5	Refer to Frequency Dependant Parts, Output Network, AM–1 Table in the following text.	----	-
----	Spark Gap, 1.5KV	140–0031	1
----	Coil, Variable, 16 uH, 20 Amps, AM Transmitter	360–0088	2
----	BNC Receptacle, Bulkhead, UG492A/U	417–0017	1
----	Lightning Protection Circuit Board Assembly	917–0216–003	1
----	Directional Coupler Circuit Board Assembly	917–0306–002	1
----	Lightning Detector Circuit Board Assembly	917–0306–004	1
----	Output Network Harness	947–0211	1

TABLE 3-3. OUTPUT NETWORK ASSEMBLY, AM-5E - 957-0070

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Spark Gap, 2.1 kV	140–0024	1
----	Coil, Variable, 16 uH, 20 Amperes, AM Transmitter	360–0088	2
----	BNC Receptacle, Bulkhead, UG492A/U	417–0017	1
----	Connector, 7/16 DIN, Panel Jack, Solder	417–0716	2
----	Lightning Protection Circuit Board Assembly	917–0216–001	1
----	Directional Coupler Circuit Board Assembly	917–0306–002	1
----	Lightning Detector Circuit Board Assembly	917–0306–004	1
----	Output Network Harness	947–0211	1

TABLE 3-4. LIGHTNING PROTECTION CIRCUIT BOARD ASSEMBLY, AM-2.5E - 917-0216-003

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1, D2	Transzorb, 1.5KE300CA, 300BV	206–0300	2
D3 thru D5	Transzorb, 1.5KE250CA, 250BV	206–0250	3
D6	Transzorb, 1.5KE250CA, 300BV	206–0300	1
----	Blank, Lightning Protection Circuit Board	517–0216	1

TABLE 3-5. LIGHTNING PROTECTION CIRCUIT BOARD ASSEMBLY, AM-5E - 917-0216-001 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D1	Transzorb, 1.5KE400CA, 400BV	206–0400	1
----	Blank, Lightning Protection Circuit Board	517–0216	1

TABLE 3-5. LIGHTNING PROTECTION CIRCUIT BOARD ASSEMBLY, AM-5E - 917-0216-001 (Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D2, D3 thru D6	Transzorb, 1.5KE300CA, 300BV	206–0300	5
D7	Transzorb, 1.5KE400CA, 400BV,	206–0400	1

TABLE 3-6. DIRECTIONAL COUPLER CIRCUIT BOARD ASSEMBLY - 917-0306-002 (Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C201	Capacitor, Mylar Film, 0.01 uF ±10%, 200V	030–1043	1
C202 thru C217	Capacitor, Ceramic, Monolythic, .1 uF ±10%, 50V	003–1066	16
C218	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C219, C220	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031–2033	2
D201 thru D204	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	4
D205 thru D208	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	4
D209, D210	Diode, Zener, 1N4749, 24V, 10.5 Amperes	200–0024	2
D211, D212	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
D213, D214	Diode, Zener, 1N4749, 24V, 10.5 Amperes	200–0024	2
D215, D216	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
E202 thru E208	Turret, Double Shoulder	413–0025	7
E209 thru E211	Terminal, Male Disconnect	410–0025	3
E212 thru E217	Turret, Double Shoulder	413–0025	6
E219 thru E221	Turret, Double Shoulder	413–0025	3
J201	Receptacle, Male, 20–Pin In–Line	417–0200	1
J202, J203	Receptacle, Male, 8–Pin In–Line, Right Angle	417–0080–001	2
J204 thru J206	Receptacle, Male, 20–Pin In–Line	417–0200	3
K201 thru K205	Relay, SPST, 5V dc, 500 Ohm, Reed	270–0062	5
L201	Coil, Molded, Shielded, 5.6 uH	364–0056	1
L202	Coil, Molded, Shielded, 56 uH	360–0093	1
L203, L204	RF Choke, 10 mH ±10%, 6.3 Ohms DC Resistance, 220 mA Maximum	364–0670	2
P203, P204A	Jumper, Programmable, 2–Pin	340–0004	2
P204B, P205A	Jumper, Programmable, 2–Pin	340–0004	2
P205B, P206	Jumper, Programmable, 2–Pin	340–0004	2
R201 thru R205	Potentiometer, 250 Ohm, 2W, Double, 1–Turn	192–2533	5
R206	Resistor, 30.1 Ohm ±1%, 1/4W	103–3011	1
R207 thru R209	Resistor, 18 Ohm ±1%, 3W	130–1821	3
R210 thru R214	Resistor, 30.1 Ohm ±1%, 1/4W	103–3011	5

TABLE 3-6. DIRECTIONAL COUPLER CIRCUIT BOARD ASSEMBLY - 917-0306-002
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R215 thru R222	Resistor, 200 Ohm ±1%, 1W	120–2031	8
R223, R224	Potentiometer, 20 k ±10%, 1W, Horizontal, 22 Turn	178–2056	2
R226 thru R229	Resistor, 10 Ohm ±1%, 1/4W	103–1021	4
R230 thru R233	Resistor, 150 Ohm ±1%, 1W	120–1531	4
R234, R235	Potentiometer, 20 k ±10%, 1W, Horizontal, 22 Turn	178–2056	2
R236 thru R239	Resistor, 200 Ohm ±1%, 1W	120–2031	4
S201	Switch, SPST, 4– Position, 8–Pin DIP Dual In–line	340–0002	1
T201, T202	Transformer, Current, AM–1/5	370–0040	2
T203	Transformer, Voltage, AM–1/5	370–0041	1
----	Blank, Directional Coupler Circuit Board	517–0306–002	1

TABLE 3-7. LIGHTNING DETECTOR CIRCUIT BOARD ASSEMBLY - 917-0306-004

REF. DES.	DESCRIPTION	PART NO.	QTY.
C401 thru C420	Capacitor, Mica, 1000 pF ±5%, 500V	042–3913	20
E201, E202	Terminal, Male Disconnect	410–0025	2
E403	Terminal, Male Disconnect	410–0025	1
J401, J402	Receptacle, Male, 20–Pin In–Line	417–0200	2
J403 thru J405	Receptacle, Male, 2–Pin In–line	417–4004	3
P403 thru P405	Jumper, Programmable, 2–Pin	340–0004	3
Q401	Phototransistor, 1.8 mA, IC AT 5V	215–0001	1
S401	Finger Contact Strip	469–0369	1
----	Blank, Lightning Detector Circuit Board	517–0306–004	1

TABLE 3-8. HARNESS OUTPUT NETWORK ASSEMBLY - 947-0211

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Contact Housing, 4–Pin In–line	417–0138	2
----	Pins, Connector	417–0142	13
----	Plug, Housing, 2–Pin	417–0499	1
----	Plug, Housing, 14–Pin	417–1401	1
----	Connector, 15–Pin, D–Type	417–1500	1
----	Pins, Crimp Type	417–8766	21
----	Plug, BNC, Dual Crimp	418–0034	1

TABLE 3-9. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 522-650 KHZ, AM-2.5E - 957-1035-121

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 5100 pF, 6kV, 20 Amperes, ±5%	044-5123-292	1
C2	Capacitor, Mica, 3300 pF, 8kV, 16 Amperes, ±5%	044-3323-292	1
C3	Capacitor, Mica, 5100 pF, 6kV, 20 Amperes, ±5%	044-5123-292	1
C4	Capacitor, Mica, 8200 pF, 4kV, 20 Amperes, ±5%	044-8223-291	1
C5	Capacitor, Mica, 3900 pF, 8kV, 18 Amperes, ±5%	044-3923-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-10. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 651-770 KHZ, AM-2.5E - 957-1035-122

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 4300 pF, 8kV, 18 Amperes, ±5%	044-4323-292	1
C2	Capacitor, Mica, 2700 pF, 8kV, 15 Amperes, ±5%	044-2723-292	1
C3	Capacitor, Mica, 4300 pF, 8kV, 18 Amperes, ±5%	044-4323-292	1
C4	Capacitor, Mica, 6800 pF, 4kV, 18 Amperes, ±5%	044-6823-291	1
C5	Capacitor, Mica, 3300 pF, 8kV, 16 Amperes, ±5%	044-3323-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-11. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 771-920 KHZ, AM-2.5E - 957-1035-123

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 3600 pF, 8kV, 18 Amperes, ±5%	044-3623-292	1
C2	Capacitor, Mica, 2200 pF, 8kV, 13 Amperes, ±5%	044-2223-292	1
C3	Capacitor, Mica, 3600 pF, 8kV, 18 Amperes, ±5%	044-3623-292	1
C4	Capacitor, Mica, 5600 pF, 4kV, 18 Amperes, ±5%	044-5623-291	1
C5	Capacitor, Mica, 2700 pF, 8kV, 15 Amperes, ±5%	044-2723-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-12. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 921-1080 KHZ, AM-2.5E - 957-1035-124

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 3300 pF, 8kV, 16 Amperes, ±5%	044-3323-292	1
C2	Capacitor, Mica, 2000 pF, 10kV, 12 Amperes, ±5%	044-2023-292	1
C3	Capacitor, Mica, 3300 pF, 8kV, 16 Amperes, ±5%	044-3323-292	1
C4	Capacitor, Mica, 4700 pF, 6kV, 16 Amperes, ±5%	044-4723-291	1
C5	Capacitor, Mica, 2200 pF, 8kV, 13 Amperes, ±5%	044-2223-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-13. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 1081-1300 KHZ, AM-2.5E - 957-1035-125

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 2700 pF, 8kV, 15 Amperes, ±5%	044-2723-292	1
C2	Capacitor, Mica, 1600 pF, 10kV, 12 Amperes, ±5%	044-1623-292	1
C3	Capacitor, Mica, 2700 pF, 8kV, 15 Amperes, ±5%	044-2723-292	1
C4	Capacitor, Mica, 3900 pF, 6kV, 15 Amperes, ±5%	044-3923-291	1
C5	Capacitor, Mica, 1800 pF, 10kV, 13 Amperes, ±5%	044-1823-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-14. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 1301-1580 KHZ, AM-2.5E - 957-1035-126

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 2200 pF, 8kV, 13 Amperes, ±5%	044-2223-292	1
C2	Capacitor, Mica, 1300 pF, 10kV, 11.0 Amperes, ±5%	044-1323-292	1
C3	Capacitor, Mica, 2200 pF, 8kV, 13 Amperes, ±5%	044-2223-292	1
C4	Capacitor, Mica, 3300 pF, 6kV, 15 Amperes, ±5%	044-3323-291	1
C5	Capacitor, Mica, 1600 pF, 10kV, 12 Amperes, ±5%	044-1623-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-15. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 1581-1700 KHZ, AM-2.5E - 957-1035-127

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1	Capacitor, Mica, 1800 pF, 10kV, 13 Amperes, ±5%	044-1823-292	1
C2	Capacitor, Mica, 1100 pF, 10kV, 10 Amperes, ±5%	044-1123-292	1
C3	Capacitor, Mica, 1800 pF, 10kV, 13 Amperes, ±5%	044-1823-292	1
C4	Capacitor, Mica, 2700 pF, 6kV, 13 Amperes, ±5%	044-2723-291	1
C5	Capacitor, Mica, 1300 pF, 10kV, 11 Amperes, ±5%	044-1323-292	1
L1	Coil, All Frequency	360-1251-XXX	1
L2	Coil, All Frequency	360-1252-XXX	1
L3	Coil, All Frequency	360-1253-XXX	1
L5	Coil, All Frequency	360-1255-XXX	1

TABLE 3-16. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 522-650 KHZ, AM-5E - 957-1035-151

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 2700 pF, 8kV, 15 Amperes, ±5%	044-2723-292	2
C2	Capacitor, Mica, 3300 pF, 12kV, 24 Amperes, ±5%	044-3323-293	1
C3A, C3B	Capacitor, Mica, 2700 pF, 8kV, 15 Amperes, ±5%	044-2723-292	2
C4	Capacitor, Mica, 8200 pF, 4kV, 20 Amperes, ±5%	044-8223-291	1
C5A	Capacitor, Mica, 2400 pF, 6kV, 13 Amperes, ±5%	044-2423-291	1
C5B	Capacitor, Mica, 1500 pF, 6kV, 9.1 Amperes, ±5%	044-1523-291	1
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

TABLE 3-17. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 651-770 KHZ, AM-5E - 957-1035-152

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 2200 pF, 8kV, 13 Amperes, ±5%	044-2223-292	2
C2	Capacitor, Mica, 2700 pF, 12kV, 22 Amperes, ±5%	044-2723-293	1
C3A, C3B	Capacitor, Mica, 2200 pF, 8kV, 13 Amperes, ±5%	044-2223-292	2
C4	Capacitor, Mica, 6800 pF, 4kV, 18 Amperes, ±5%	044-6823-291	1
C5A	Capacitor, Mica, 1500 pF, 6kV, 9.1 Amperes, ±5%	044-1523-291	1
C5B	Capacitor, Mica, 1800 pF, 6kV, 11 Amperes, ±5%	044-1823-291	1
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

TABLE 3-18. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 771-920 KHZ, AM-5E - 957-1035-153

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 1800 pF, 10kV, 13 Amperes, ±5%	044-1823-292	2
C2	Capacitor, Mica, 2200 pF, 12kV, 20 Amperes, ±5%	044-2223-293	1
C3A, C3B	Capacitor, Mica, 1800 pF, 10kV, 13 Amperes, ±5%	044-1823-292	2
C4	Capacitor, Mica, 5600 pF, 4kV, 18 Amperes, ±5%	044-5623-291	1
C5A	Capacitor, Mica, 1500 pF, 6kV, 9.1 Amperes, ±5%	044-1523-291	1
C5B	Capacitor, Mica, 1200 pF, 6kV, 8.2 Amperes, ±5%	044-1223-291	1
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

TABLE 3-19. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 921-1080 KHZ, AM-5E - 957-1035-154

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 1600 pF, 10kV, 12 Amperes, ±5%	044-1623-292	2
C2	Capacitor, Mica, 2000 pF, 15kV, 20 Amperes, ±5%	044-2023-293	1
C3A, C3B	Capacitor, Mica, 1600 pF, 10kV, 12 Amperes, ±5%	044-1623-292	2
C4	Capacitor, Mica, 4700 pF, 6kV, 16 Amperes, ±5%	044-4723-291	1
C5A, C5B	Capacitor, Mica, 1100 pF, 6kV, 8.2 Amperes, ±5%	044-1123-291	2
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

TABLE 3-20. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 1081-1300 KHZ, AM-5E - 957-1035-155

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 1300 pF, 10kV, 11 Amperes, ±5%	044-1323-292	2
C2	Capacitor, Mica, 1600 pF, 15kV, 18 Amperes, ±5%	044-1623-293	1
C3A, C3B	Capacitor, Mica, 1300 pF, 10kV, 11 Amperes, ±5%	044-1323-292	2
C4	Capacitor, Mica, 3900 pF, 6kV, 15 Amperes, ±5%	044-3923-291	1
C5A, C5B	Capacitor, Mica, 910 pF, 6kV, 7.5 Amperes, ±5%	044-9113-291	2
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

TABLE 3-21. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 1301-1580 KHZ, AM-5E - 957-1035-156

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 1100 pF, 10kV, 10 Amperes, ±5%	044-1123-292	2
C2	Capacitor, Mica, 1200 pF, 15kV, 15 Amperes, ±5%	044-1223-293	1
C3A, C3B	Capacitor, Mica, 1100 pF, 10kV, 10 Amperes, ±5%	044-1123-292	2
C4	Capacitor, Mica, 3300 pF, 6kV, 15 Amperes, ±5%	044-3323-291	1
C5A, C5B	Capacitor, Mica, 820 pF, 6kV, 6.8 Amperes, ±5%	044-8213-291	2
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

TABLE 3-22. OUTPUT NETWORK FREQUENCY DEPENDANT PARTS, 1581-1700 KHZ, AM-5E - 957-1035-157

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1A, C1B	Capacitor, Mica, 910 pF, 10kV, 9.1 Amperes, ±5%	044-9113-292	2
C2	Capacitor, Mica, 1100 pF, 20kV, 15 Amperes, ±5%	044-1123-293	1
C3A, C3B	Capacitor, Mica, 910 pF, 10kV, 9.1 Amperes, ±5%	044-9113-292	2
C4	Capacitor, Mica, 2700 pF, 6kV, 13 Amperes, ±5%	044-2723-291	1
C5A, C5B	Capacitor, Mica, 620 pF, 6kV, 6.2 Amperes, ±5%	044-6213-291	2
L1	Coil, All Frequency	360-1501-XXX	1
L2	Coil, All Frequency	360-1502-XXX	1
L3	Coil, All Frequency	360-1503-XXX	1
L5	Coil, All Frequency	360-1505-XXX	1

SECTION IV
OUTPUT NETWORK ASSEMBLY DRAWINGS

4-1. INTRODUCTION.

4-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the Broadcast Electronics AM-2.5E/AM-5E transmitter output network assembly.

FIGURE	TITLE	NUMBER
4-1	SCHEMATIC DIAGRAM, OUTPUT NETWORK AM-2.5E ASSEMBLY	SB957-0068
4-2	SCHEMATIC DIAGRAM, DIRECTIONAL COUPLER CIRCUIT BOARD	SB917-0306-002
4-3	SCHEMATIC DIAGRAM, LIGHTNING DETECTOR CIRCUIT BOARD	SB917-0306-004
----	REFER TO PART I, SECTION VII FOR THE ECU DISPLAY CIRCUIT BOARD ASSEMBLY	AD917-0306-001/ -002/-003/-004/-005 /-006/-007/-009/-014
4-4	ASSEMBLY DIAGRAM, LIGHTNING PROTECTION BOARD	AB917-0216-003

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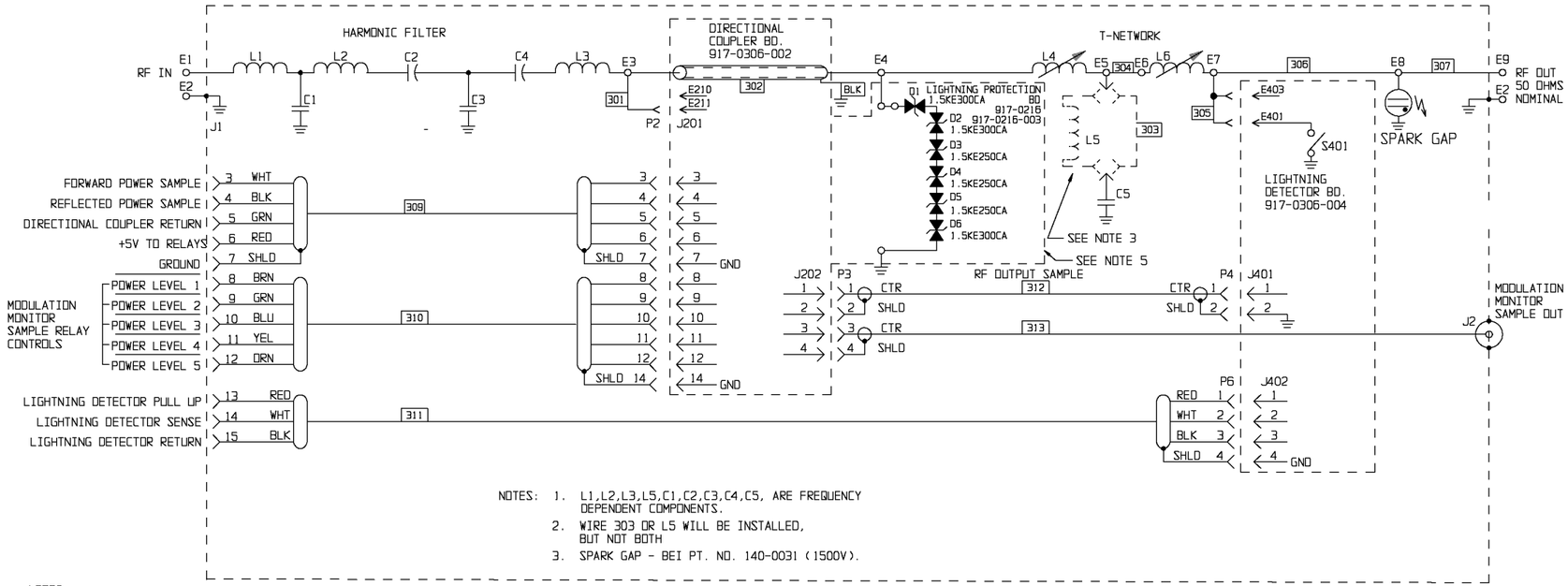
SCHEMATIC AM-2.5E OUTPUT NETWORK ASSEMBLY



NOTES: 1. L1,L2,L3,L5,C1,C2,C3,C4,C5, ARE FREQUENCY DEPENDENT COMPONENTS.
2. WIRE 303 OR L5 WILL BE INSTALLED, BUT NOT BOTH
3. SPARK GAP - BEI PT. NO. 140-0031 (1500V).

NOTES:
1. USE LITZ WIRE BEI NO. 600-2300 FOR L1, L2, L3 AND L5.

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MSE 5-19-99
CHKD
ME
PROJ. ENGR.
MFG.

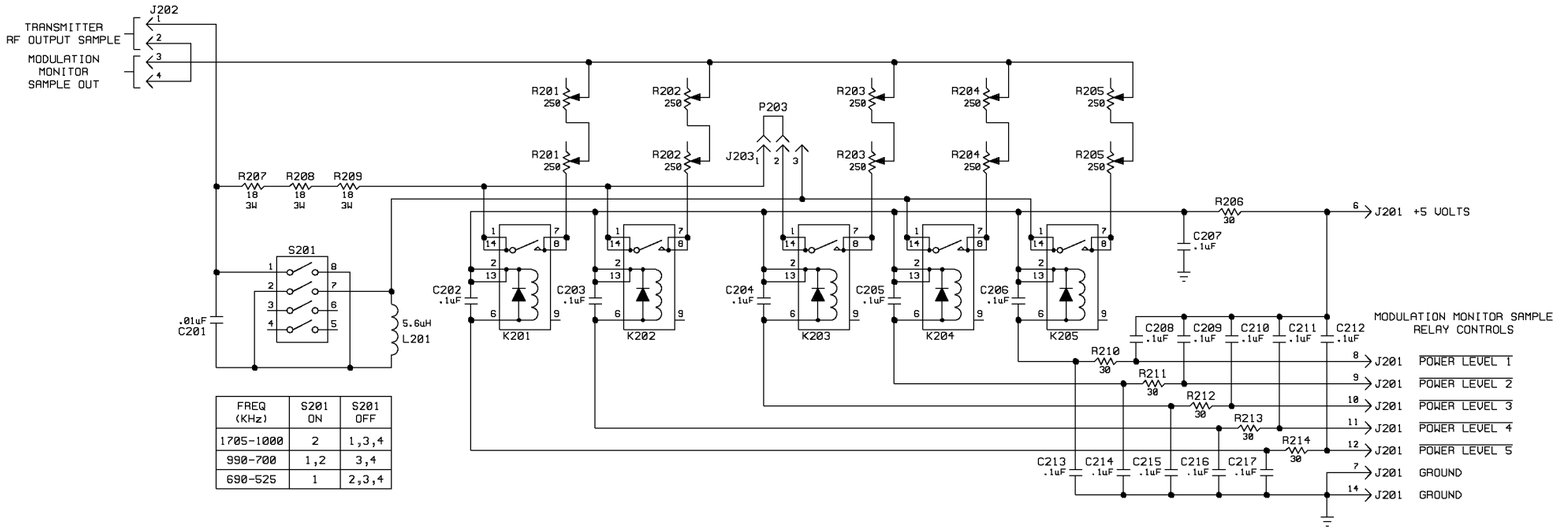
MATERIAL SEE B/M 957-0068
FINISH
SEE DWG RA592-0000
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST.,P.O.BOX 3606 QUINCY,IL 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE SCHEMATIC OUTPUT NETWORK ASSEMBLY

TYPE	SIZE	DWG. NO.	REV
S	B	957-0068	A

MODEL AM-2.5E SCALE NONE SHEET 1 OF 1



NOTES:

1. ALL REFERENCE DESIGNATORS START AT 201.
2. ALL RESISTORS IN OHMS: 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENTS USED: C220, D216, E221, J206, K205, L204, R239, S201, T203, W201
4. COMPONENTS NOT USED: E201, E218, R225
5. SEE ASSEMBLY: AD917-0306
6. FOR POWER LEVEL 3 = HIGH POWER PLACE P203 ON J203 PINS 1&2. FOR POWER LEVEL 3 = LOW POWER PLACE P203 ON J203 PINS 2&3.
7. AM-1A/AM-500A: PLACE P204A/P205A ON J204/J205 PINS 2&3; AND PLACE P204B/P205B ON J204/J205 PIN 4 ONLY.
   AM-5A/AM-10A: PLACE P204A/P205A ON J204/J205 PINS 1&2; AND PLACE P204B/P205B ON J204/J205 PINS 3&4 AS SHOWN.
8. AM-1A/AM-500A: REMOVE W201 AND CONNECT WIRE #301 TO E210.
   AM-5A/AM-10A: PLACE W201 ON E209 & E210; AND CONNECT WIRE #301 TO E211 AS SHOWN.
9. WIRE #301 & #302 ARE PART OF OUTPUT NETWORK WIRE HARNESS ASSEMBLY.

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	MERKEL 1-2-96
CHKD	
ME	
PROJ. ENGR.	
MFG.	
MATERIAL	SEE BOM
	917-0306-002
FINISH	
	SEE DWG AR592-0000
NEXT ASSY.	AD917-0306

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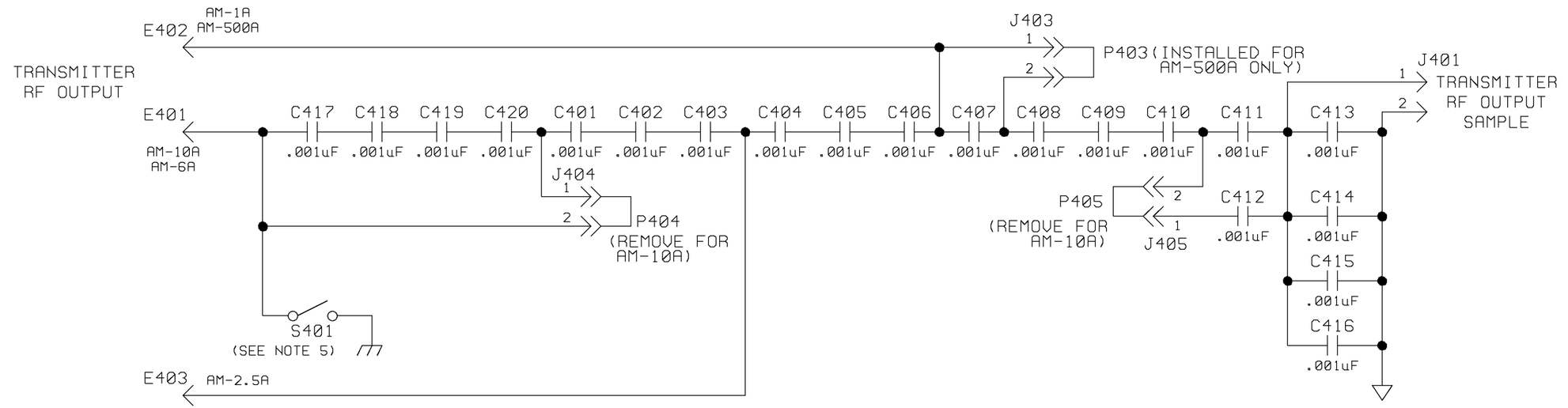
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC
DIRECTIONAL COUPLER PCB

TYPE S | SIZE B | DWG. NO. 917-0306-002 | REV B

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1



NOTES:

1. ALL REFERENCE DESIGNATORS START AT 401.
2. LAST COMPONENT USED: C420, E403, J405, P405, Q401, S401
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY: AD917-0306-004/014.
5. S401 NOT USED ON 917-0306-014 (AM-1A).

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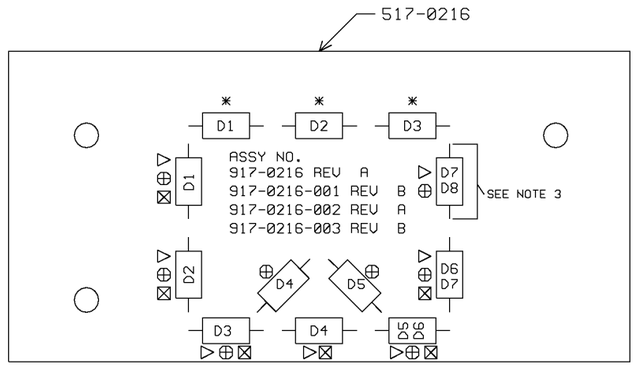
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY 1-2-96 MERKEL	MATERIAL SEE BOM 917-0306-004 917-0306-014	BROADCAST ELECTRONICS INC.
CHKD		4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
ME	FINISH	TELEX 250142 CABLE BROADCAST FAX 217/224-9607
PROJ. ENGR.	SEE DWG RA592-0000	TITLE: SCHEMATIC LIGHTNING DETECTOR PCB
MFG.	NEXT ASSY. 957-0064	TYPE S · SIZE B · DWG. NO. 917-0306-004/014 · REV B
		MODEL AM-1A · SCALE NONE · SHEET 1 OF 1



NOTES:

1. ✱ - INDICATES COMPONENTS USED ON 917-0216 (AM-1).
   ▷ - INDICATES COMPONENTS USED ON 917-0216-001 (AM-5).
   ⊕ - INDICATES COMPONENTS USED ON 917-0216-002 (AM-10).
   ⊠ - INDICATES COMPONENTS USED ON 917-0216-003 (AM-2.5).
2. SEE SCHEMATIC SB 957-0008 (AM-1).
   SEE SCHEMATIC SB 957-0024 (AM-2.5).
   SEE SCHEMATIC SB 957-0017 (AM-5).
   SEE SCHEMATIC SB 957-0020 (AM-10).
3. FOR 917-0216-003 A JUMPER (601-0018, 18 GAUGE BUS WIRE) REPLACES D7/D8.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES + 1°

DWN. BY 6-30-92
M. HAYDEN
CHKD
ME
PROJ. ENGR. 12-17-92
JERRY WESTBERG
MFG.

MATERIAL
SEE B/M'S
917-0216/-001
917-0216-002
917-0216-003
FINISH
~~SEE DWG RA592-0000~~
NEXT ASSY.
957-0008/0017
957-0020/0024

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TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
PCB ASSEMBLY
LIGHTNING PROTECTION BD.

TYPE	SIZE	DWG No.	REV
A	B	917-0216/-001/-002/-003	C

MODEL AM-1/2.5/5/10 SCALE 1/1 SHEET 1 OF 1

TABLE OF CONTENTS

PARAGRAPH		PAGE NO.
SECTION I	**ECU THEORY OF OPERATION**	
1-1	Introduction	1-1
1-3	General Description	1-1
1-5	Functional Description	1-1
1-6	ECU Display Circuit Board	1-1
1-9	Exciter Monitor Mode Control Circuit	1-1
1-10	Autorange Circuit	1-2
1-11	Polarity Control Circuit	1-2
1-12	Half-Wave Rectifier Circuit	1-2
1-13	Meter Circuitry	1-2
1-14	Indicator Circuitry	1-2
1-16	Reset Switch	1-2
1-17	ECU Switch Circuit Board	1-2
1-19	ECU Meter Switch Circuit Board	1-3
1-21	Motherboard	1-3
1-24	Controller Circuit Board	1-3
1-26	Cabinet/External Interlock and Remote Control Fail-Safe	1-3
1-31	External Mute	1-4
1-33	Antenna Interlock	1-4
1-36	Remote Control	1-9
1-38	Power On	1-9
1-43	Power Control Circuit	1-10
1-46	Power Control Trim Circuit	1-11
1-50	Transmitter Off	1-11
1-51	AC Power Interruptions	1-12
1-55	Forward and Reflected Power Circuitry	1-12
1-57	Foldback Protection	1-13
1-71	Attack Signal Operation	1-16
1-73	1.2: 1 VSWR Conditions	1-16
1-74	Foldback Recovery	1-16
1-82	Exciter Monitoring	1-17
1-84	Power Supply Monitoring	1-18
1-88	RF Power Module Monitoring	1-18
1-91	Fault Circuit	1-19
1-93	Oscillator Circuit	1-19
1-95	Over-Cycle Off Circuit	1-19
1-97	Power Supply Circuit	1-19
1-99	Exciter Circuit Board	1-20
1-100	Left/Right Channel Input Circuit	1-20
1-104	Mono Mode Switching	1-23
1-105	24 uS Delay Circuit	1-23
1-106	Negative Limiter	1-23
1-107	IPM Correction Circuit	1-23
1-109	PWM Circuit	1-23
1-110	PWM Driver Circuit	1-24
1-111	Frequency Synthesizer	1-24
1-117	PWM Reference Circuit	1-24
1-118	Lock Detector Circuit	1-25

PARAGRAPH		PAGE NO.
1-120	Stereo Detection Circuit	1-25
1-124	IPM Wave Shape Circuit	1-25
1-125	Phase Modulator Circuit	1-25
1-128	RF Drive Circuit	1-26
1-129	Exciter Failure Detector Circuit	1-26
1-130	Power Supply Circuits	1-26
1-131	Stereo Circuit Board	1-26
1-132	Equalization Circuitry	1-26
1-134	8 Microsecond Delay Circuit	1-29
1-135	4 Microsecond Delay Circuit	1-29
1-136	All-Pass Filter	1-29
1-137	Equalization Selection Circuit	1-29
1-138	L+R and L-R Matrix Circuit	1-29
1-142	Phase Modulator Circuit	1-30
1-146	Band-Pass Filter	1-31
1-147	Transistor Amplifier Circuit	1-31
1-148	Amplitude Limiter Circuit	1-31
1-149	Output Network	1-31
1-150	Operating Mode Selection and Indication Circuit	1-31
1-155	Equalization Selection	1-32
1-158	Pilot Signal	1-32
1-160	Power Supply Filter Network	1-32
1-161	ECU Power Supply Assembly	1-32
SECTION II	**TRANSMITTER ECU MAINTENANCE**	
2-1	Introduction	2-1
2-3	Safety Considerations	2-1
2-6	ECU Circuit Board Installation/Removal	2-1
2-9	First Level Maintenance	2-2
2-11	Cleaning and Inspection	2-2
2-13	Second Level Maintenance	2-2
2-15	Electrical Adjustments	2-2
2-17	ECU Extender Circuit Board Operation	2-3
2-19	Controller Circuit Board Adjustments	2-3
2-20	P1 Set - P5 Set Controls	2-3
2-21	FWD and RFL Calibrations	2-3
2-22	ECU Meter Switch Circuit Board Adjustments	2-3
2-23	Forward Power Meter Low and High Scale Calibrations	2-3
2-24	Reflected Power Meter Low and High Scale Calibrations	2-3
2-25	FWD and RFL Calibrations	2-4
2-26	Stereo Circuit Board Adjustments	2-4
2-27	Stereo Adjustment	2-4
2-28	Exciter Circuit Board Adjustments	2-4
2-29	Modulation Calibration	2-4
2-30	Phase Modulator Calibration	2-4
2-31	Symmetry Control	2-4
2-32	IPM Correction Circuit Controls	2-4
2-33	Single Chan Mono Level Control	2-4
2-34	Average Modulation Limit Control	2-4
2-35	Neg Limit Control	2-4
2-48	Frequency Calibration Control	2-5

PARAGRAPH		PAGE NO.
2–58	Display Circuit Board Adjustments	2–6
2–59	L/L+R and R/L–R Display Calibration Control	2–6
2–66	Troubleshooting	2–6
2–67	Safety Considerations	2–6
2–68	Troubleshooting Procedures	2–7
2–69	Component Replacement Procedure	2–11
SECTION III	**ECU ASSEMBLY PARTS LIST**	
3–1	Introduction	3–1
SECTION IV	**ECU ASSEMBLY DRAWINGS**	
4–1	Introduction	4–1

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE NO.
1–1	CONTROLLER CIRCUIT BOARD SIMPLIFIED SCHEMATIC	1–5
1–2	EXCITER CIRCUIT BOARD SIMPLIFIED SCHEMATIC	1–21
1–3	STEREO CIRCUIT BOARD SIMPLIFIED SCHEMATIC	1–27

LIST OF TABLES

TABLE	TITLE	PAGE NO.
2–1	EXCITER CIRCUIT BOARD TROUBLESHOOTING	2–7
2–2	STEREO CIRCUIT BOARD TROUBLESHOOTING	2–9
2–3	CONTROLLER CIRCUIT BOARD TROUBLESHOOTING	2–10
2–4	ECU POWER SUPPLY TROUBLESHOOTING	2–11
3–1	REPLACEABLE PARTS LIST INDEX	3–1

SECTION I
ECU THEORY OF OPERATION

1-1. INTRODUCTION.

1-2. This section presents a general description of the Broadcast Electronics AM-2.5E/AM-5E transmitter ECU (Exciter/Controller unit).

1-3. GENERAL DESCRIPTION.

1-4. The AM-2.5E/AM-5E transmitter control, status/monitoring circuitry, audio/power PWM generation, stereo generation circuitry, and meter display circuitry is contained in the ECU (Exciter/Controller unit) assembly. The ECU is a modular control center designed for the installation of the: 1) controller circuit board assembly, 2) ECU display and switch circuit boards, 3) transmitter forward/reflected power meter displays, 4) exciter circuit board assembly, 5) stereo generator circuit board assembly, and 6) ECU power supply assembly.

1-5. FUNCTIONAL DESCRIPTION.

1-6. ECU DISPLAY CIRCUIT BOARD.

1-7. The ECU display circuit board contains the controller status display indicators, the power control switch/indicators, and meter display circuitry (refer to schematic diagram SD917-0206-001/-008). The circuit board is equipped with the following display indicators: 1) exciter, 2) power supply, 3) power module, 4) antenna, 5) interlock, 6) remote control, 7) lightning, 8) antenna interlock, 9) foldback, and 10) over-temperature. Control switches include power level 1, power level 2, power level 3, power level 4, power level 5, raise power, and lower power switch/indicators. The meter display circuitry consists of a driver circuit and a stereo 30-segment LED bar-graph display.

1-8. The ECU display circuit board also contains left/L+R and right/L-R audio metering circuits. The left/L+R and right/L-R metering circuits are identical. Therefore, only the left/L+R metering circuit will be discussed in the following text.

1-9. **EXCITER MONITOR MODE CONTROL CIRCUIT.** Left, right, and L+R metering samples from the exciter circuit board and an L-R meter sample from the stereo circuit board are applied to integrated circuit U1. U1 is controlled by latch U5A and mode switch S1. When S1 is depressed, a LOW is applied to inverter U4B. U4B outputs a HIGH to clock latch U5A. The Q output of U5A will respond by routing a HIGH to: 1) U1 and 2) bias Q3 on to illuminate the L+R/L-R switch LED. U1 will select L+R/L-R information for application to the autorange circuitry. When S1 is depressed again, a HIGH from U4B will clock latch U5A. The $\overline{Q}$ output of U5A will respond by routing a HIGH to: 1) U1 and 2) bias Q4 on to illuminate the left/right switch LED. U1 will select left/right channel audio for application to the autorange circuit.

1-10. **AUTORANGE CIRCUIT.** The autorange circuit consists of integrated circuits U2A, U3A, and U3B. An output of U1 is routed to integrated circuit U2A and U3A. U3A is configured as an amplifier stage. U2A is configured as an amplifier/buffer stage. When audio is applied to the circuit, U3A amplifies the audio. The output of U3A is half-wave rectified by diode D1. The output of D1 is applied to integrated circuit U3B. U3B is configured as a comparator. When the audio level is above the threshold at U3B, U3B will output a HIGH to transistor Q1. The HIGH biases Q1 off to configure U2A as a buffer. When the audio level is below the threshold at U3B, U3B will output a LOW to: 1) bias Q1 on to configure U2A as an amplifier with a gain of 10 and 2) illuminate X10 indicator DS1. The output of U2A is routed for application to the polarity control circuit.

1-11. **POLARITY CONTROL CIRCUIT.** Positive or negative signal monitoring is controlled by polarity switch S2. Audio from the mode control circuit is applied to integrated circuit U6A and U7. U6A is configured as an inverting buffer. When S1 is depressed, a LOW is applied to inverter U4C. U4C outputs a HIGH to clock latch U5B. The Q output of U5B will respond by routing a HIGH to: 1) U7 and 2) bias Q6 on to illuminate the negative switch LED. U7 will select inverted audio from U6A for application to a rectifier circuit. When S1 is depressed again, a HIGH from U4C will clock latch U5B. U5B will respond by routing a HIGH to: 1) U7 and 2) bias Q5 on to illuminate the positive switch LED. U7 will select non-inverted audio for application to a rectifier circuit.

1-12. **HALF-WAVE RECTIFIER CIRCUIT.** Integrated circuit U8A and U8B function as a half-wave rectifier circuit. Audio from integrated circuit U7 is applied to U8A/U8B. U8A/U8B half-wave rectify the audio for application to the meter display circuitry. Resistor R38 and capacitor C21 establish the meter ballistics.

1-13. **METER CIRCUITRY.** The output of the half-wave rectifier circuit is applied to a meter circuit consisting of: 1) integrated circuits U9, U10, and U11, and 2) 10-segment LEDs DS7, DS8, and DS9. The output from U8B is applied to meter drivers U9, U10, and U11. U9/U10/U11 control 10-segment LED sections DS7, DS8 and DS9. Drivers U9/U10/U11 function to illuminate the required segments of DS7/DS8/DS9 to display the left/L+R levels. One-shot U12 is provided to identify short modulation peaks.

1-14. **INDICATOR CIRCUITRY.** The display circuit board is equipped with several indicators. DS22, DS23, DS24, and DS25 are bi-color LEDs providing status indications for the exciter, power supply, RF power modules, and antenna. The indicators are controlled by drivers on the controller circuit board. When activated, the drivers will output a HIGH to illuminate the indicators. A yellow display is generated when the red and green LEDs are illuminated simultaneously.

1-15. Indicators DS15 through DS20 provide status indications for over-temperature, foldback, antenna conflict, lightning, remote control, and interlock conditions. The indicators are controlled by drivers on the controller circuit board. When activated, the drivers will output a LOW to illuminate the indicators.

1-16. **RESET SWITCH.** The reset of fault conditions is provided by switch S3. When S3 is depressed, a HIGH is routed to the controller circuit board to reset the fault conditions. The switch LED will illuminate when one of the following fault condition occurs: 1) over-temperature, 2) exciter, 3) power supply, 4) RF power module, 5) reflected power high, 6) reflected power emergency, 7) lightning conditions, or 8) 1.2 : 1 VSWR.

1-17. **ECU SWITCH CIRCUIT BOARD.**

1-18. ECU power level switches S803 through S807, raise switch S801, lower switch S802, and off switch S808 are located on the controller switch circuit board (refer to schematic diagram SD917-0206-001/-008). The switches output +15 volts to activate a function.

1-19. **ECU METER SWITCH CIRCUIT BOARD.**

1-20. ECU meter switches S501 and S502 are located on the ECU meter switch circuit board (refer to schematic diagram SD917-0206-005). The switches control the signals applied to the forward and reflected power meters. Low scale control R501 and high scale control R503 calibrate the forward power meter. Low scale control R505, high scale control 506, and ac sample control R511 calibrate the reflected power meter.

1-21. **MOTHERBOARD.**

1-22. The interfacing of transmitter status signals, audio, PWM/RF drive signals, and operating commands to/from the ECU circuit boards is provided by the ECU motherboard assembly (refer to schematic diagram SB917-0201). Connectors J4, J5, and J6 route status inputs and control commands to/from the ECU assembly. 80-pin connector J101 is provided for the exciter circuit board. 50-pin connector J201 is provided for the stereo exciter circuit board. 80-pin connector J302 and 50-pin connector J301 are provided for the controller circuit board. Connector J8 routes status signals to/from the display circuit board. Connector J10 routes control and status signals to/from the switch circuit board.

1-23. The motherboard also contains RFI filters for the ECU remote inputs and outputs. The filter circuitry consists of single PI-section low-pass RC and LC networks. The networks prevent RFI from entering the exciter and controller circuitry.

1-24. **CONTROLLER CIRCUIT BOARD.**

1-25. All transmitter operations are directed by the controller circuit board (refer to Figure 1-1). The controller circuit board is a digital CMOS logic assembly containing control and parameter monitoring/display circuitry. The control circuitry includes an antenna interlock circuit, a power control network, and a foldback control circuit. The monitor/display circuitry includes exciter, power supply, power module, antenna, interlock, remote control, lightning, antenna interlock, foldback, and over-temperature networks. The circuitry determines the transmitter output power control operating characteristics and responses to fault conditions such as an ac power failure, load failure, power supply failure, or remote control unit failure.

1-26. **CABINET/EXTERNAL INTERLOCK AND REMOTE CONTROL FAIL-SAFE.** The controller circuit board monitors: 1) an external interlock and 2) a remote control fail-safe interlock. The external interlock is any interlock external to the transmitter such as a test load interlock. The remote control fail-safe is an input requiring a +5 to +15 volt signal to indicate the remote control unit is operational. If the external interlock and the remote control fail-safe are closed, the ECU interlock indicator will illuminate and the transmitter may be energized. If the external interlock opens or the remote control fail-safe signal is removed, the transmitter will immediately de-energize and the interlock indicator will extinguish.

1-27. **External Interlock.** The transmitter external interlock is an optically coupled input designed to accept the output of a series interlock switch circuit external to the transmitter. The circuit accepts a +5 volt to +15 volt output of an interlock circuit external to the transmitter such as from a test load. Optical coupling of the external interlock input to the controller circuitry is provided by U11. Diode D17 protects the circuit from a reverse polarity potential applied to the input.

1–28. A HIGH is required at the input of coupler U11 when the external interlock is closed. U11 will output a HIGH to OR gate U69B in the transmitter enable circuit. The HIGH will configure U69B to output a HIGH to AND gate U71B. U71B will output a HIGH cabinet command to allow the transmitter to be energized. U71B also outputs a HIGH to NAND gate U71D. With a HIGH fail-safe command, U71D will output a HIGH to illuminate the interlock indicator. When the external interlock is opened, a LOW is applied to U11. The output of U11 will go LOW. OR gate U69B will respond by outputting a LOW to AND gate U71B. U71B will output a LOW cabinet command. A LOW cabinet command configures a power control circuit to operate the transmitter to off. U71D will output a LOW to: 1) extinguish the interlock indicator and 2) generate a LOW operate command. A LOW operate command mutes: 1) the exciter PWM signal and 2) the power supply circuit board(s).

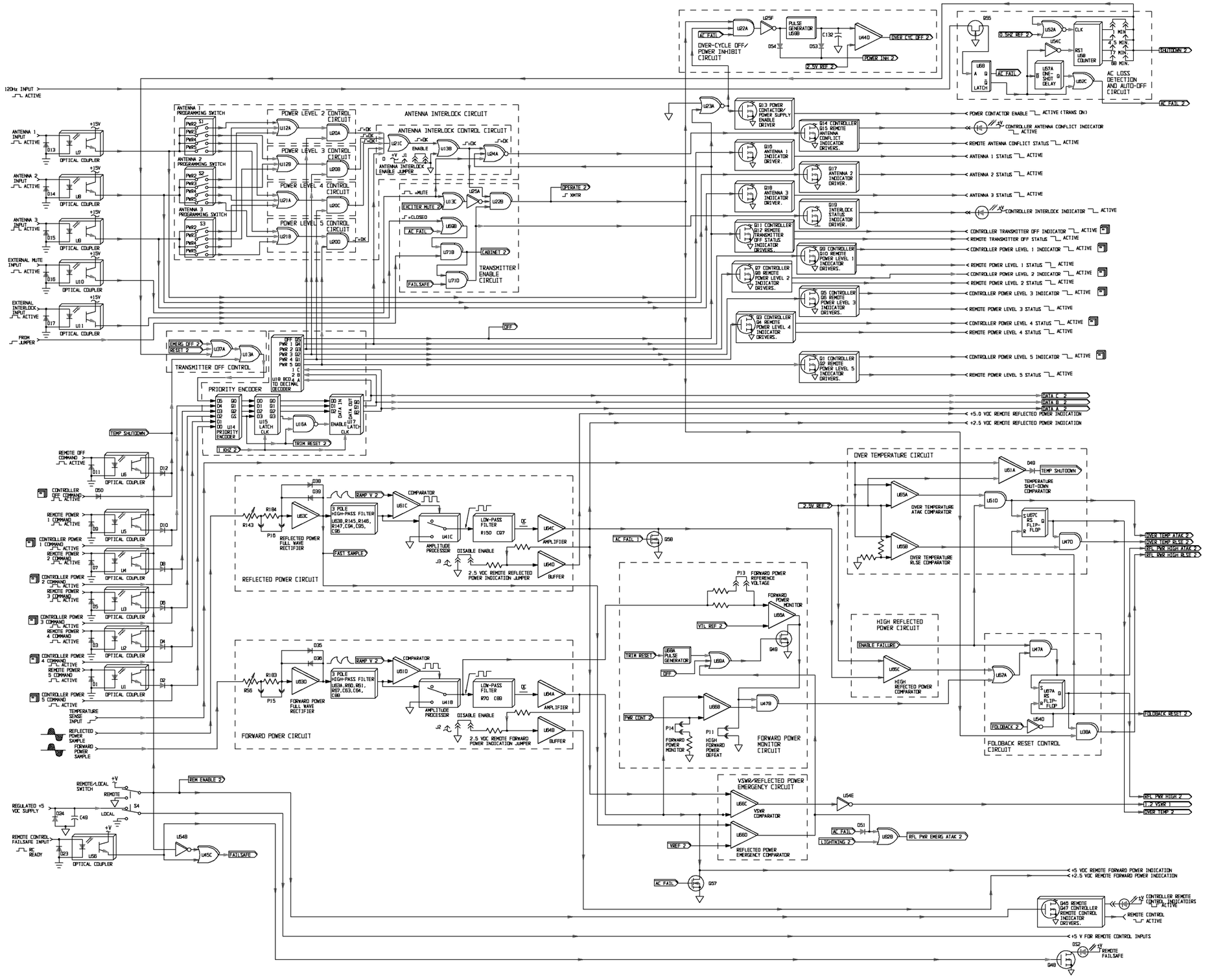
1–29. **Remote Control Fail-safe.** The remote control fail-safe input is designed to accept a +5 to +15 volt output from the remote control unit fail-safe connection. The signal is optically coupled to the controller circuitry by integrated circuit U56. Diode D23 protects the circuit from a reverse polarity potential applied to the input.

1–30. A HIGH is required at the input of U56 to indicate when the remote control unit is operational. The output of coupler U56 will go HIGH. The HIGH will configure OR gate U45C to output a HIGH fail-safe signal. The fail-safe signal is applied to AND gate U71D. With a HIGH cabinet signal, U71D will output a HIGH to illuminate the interlock indicator. The HIGH will also bias driver transistor Q48 on to illuminate remote fail-safe indicator DS2. When the remote control fail-safe signal is removed, a LOW is applied to U56. The output of U56 will go LOW. The LOW generates a LOW transmitter operate command to mute: 1) the exciter PWM signal, 2) the power supply circuit board(s), and 3) extinguish remote fail-safe indicator DS2. The LOW from U56 will generate a LOW fail-safe command. The LOW is applied to U71D. U71D will output a LOW to extinguish the interlock indicator.

1–31. **EXTERNAL MUTE.** The controller circuit board monitors the transmitter mute signal. The external mute input is designed to accept a +5 to +15 volt output from an antenna switch controller RF mute circuit. The signal is optically coupled to the controller circuitry by U10. Diode D16 protects the circuit from a reverse polarity potential applied to the input.

1–32. A HIGH is required at the input of coupler U10 when the external mute circuit is required to mute the transmitter RF power output. U10 will output a HIGH to OR gate U13C and NOR gate U24A. U13C will output a HIGH to inverter U25A. U25A will output a LOW to U22B. The LOW will configure U22B to output a LOW operate command to mute: 1) the exciter PWM signal and 2) the power supply circuit board(s). U24A will output a LOW to disable the antenna conflict indicator operations.

1–33. **ANTENNA INTERLOCK.** The controller circuit board is equipped with an antenna interlock circuit. The circuit accepts: 1) control signals from power levels 2 through 5, and 2) status inputs from three antenna systems. The antenna interlock circuit consists of: 1) programming switches S1 through S3, 2) OR gates U12A/B and U21A/B, and 3) NAND gates U20A through U20D. The circuit analyzes the information and determines if a correct antenna system and power level is selected for operation.



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597-1112-29

FIGURE 1-1. CONTROLLER CIRCUIT BOARD SIMPLIFIED SCHEMATIC (SHEET 1 OF 2)

(1-5/1-6)

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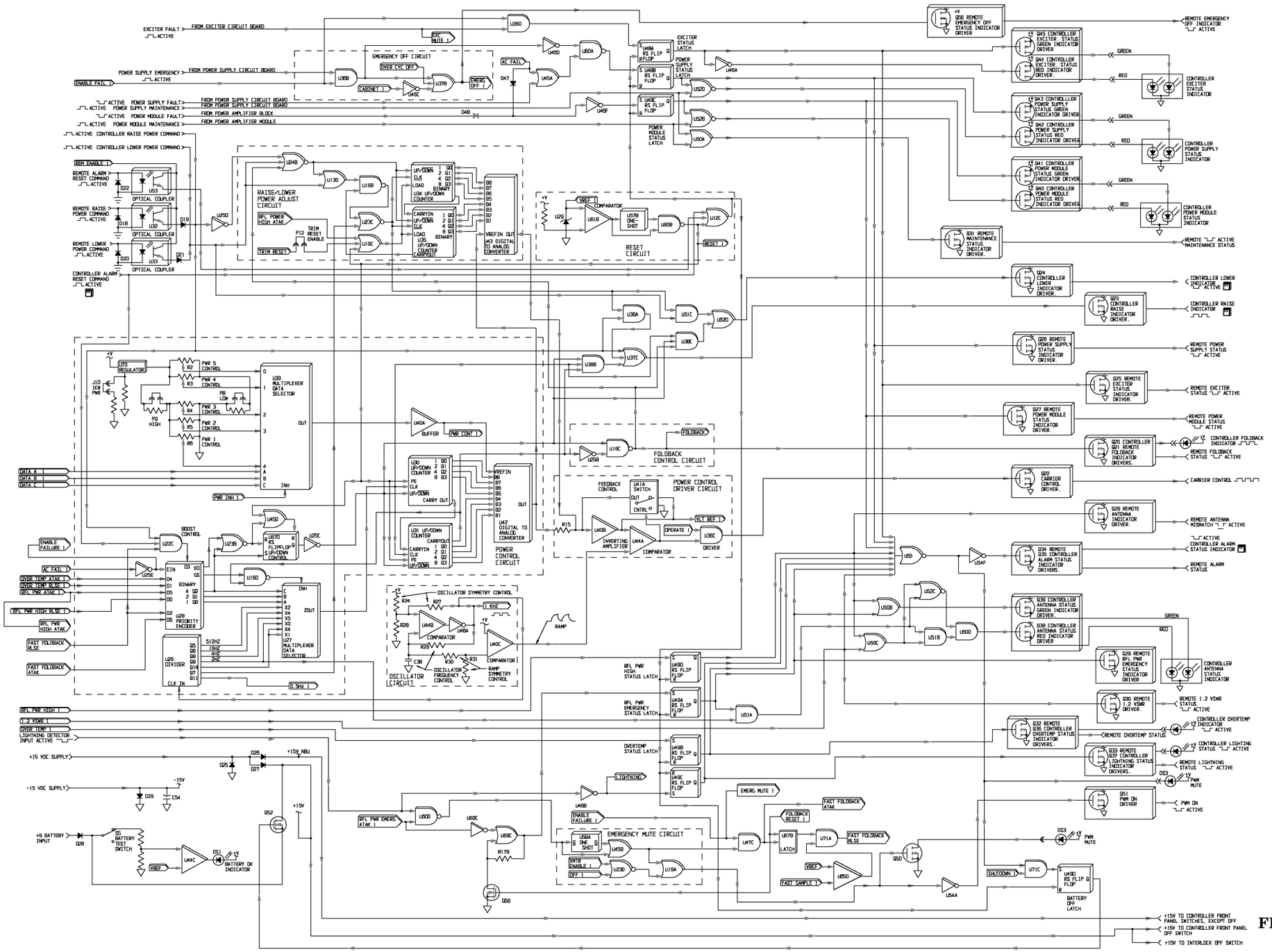

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597-1112-29B

FIGURE 1-1. CONTROLLER CIRCUIT BOARD SIMPLIFIED SCHEMATIC (SHEET 2 OF 2)

(1-7/1-8)

1-34. To provide an operational example, antenna 1 is designed to operate with power level 2. When antenna 1 is connected to the transmitter, a HIGH status signal is applied to optical coupler U7. U7 outputs a HIGH to switch S1. S1 is a four-section SPST switch. The S1 switch sections are assigned the following power levels: 1) power level 2, 2) power level 3, 3) power level 4, and 4) power level 5. The switch is programmed by closing the switch sections for the power levels which are acceptable for the antenna 1 system. The outputs of programming switch S1 are applied to a control network consisting of: 1) a power level 2 circuit, 2) a power level 3 circuit, 3) a power level 4 circuit, and 4) a power level 5 circuit. Each power level control circuit contains an OR gate to monitor the status of the antenna systems and an AND gate to monitor the status of the selected power level.

1-35. With S1 programmed to operate with power level 2, the HIGH from U7 is applied to OR gate U12A. U12A will output a HIGH to NAND gate U20A. With power level 2 selected, a HIGH from BCD-to-decimal decoder U18 will be applied to U20A. U20A will respond by routing a HIGH to OR gate U21C. U21C will output a HIGH to OR gate U13B. Programmable jumper J1 is provided to disable the antenna interlock circuit. With the antenna interlock circuit enabled, U13B will output a HIGH to NOR gate U24A and AND gate U22B. With no mute or off commands present, U24A will output a LOW to disable antenna conflict indicator driver Q16. With a closed interlock system and no ac failures or fail-safe conditions present, U22B will output a HIGH operate command to enable the transmitter.

1-36. **REMOTE CONTROL.** The transmitter control functions, status indications, and metering signals are designed for remote operation. Control functions require a +5 volt to +15 volt dc signal to activate the function. Status indications will output a LOW (0 volts) when active. The remote meter indications can be programmed for +5 volt or +2.5 volt full-scale meter operations. The circuitry may be interfaced to any type of remote control unit.

1-37. Remote control of the transmitter is enabled or disabled by remote/local switch S4. S4 enables remote control operation by applying a positive voltage to optical couplers U1 through U6, U32/U33, and U53. S4 disables remote control operation by applying a ground to the couplers. The remote position allows both local and remote transmitter control. The local position allows only local control of the transmitter. The remote control inputs and outputs are RFI filtered on the motherboard for maximum reliability.

1-38. **POWER ON.** A transmitter power on operation initiates a sequence to determine if all the interlocks are closed and the remote control unit is operational. RF output power from the transmitter is enabled by commands from the power level 1 through power level 5 switch/indicators. Each power level switch/indicator provides a one-button power on start command and configures the transmitter for a specific power output level. Each switch/indicator will illuminate as selected to indicate the command has been received and stored by the controller power control circuit.

1-39. Transmitter power is enabled when a power level switch/indicator is activated. For example, when the ECU power level 2 switch/indicator is depressed, a HIGH is applied to priority encoder U14. When a remote power level 2 command activated, a HIGH is applied to optical coupler U4. U4 will output a HIGH to U14. U14 analyzes power level and off commands to determine priorities when two switches are operated simultaneously. The off command is assigned the highest priority. When the power level 2 command is received, U14 will output a binary number to latch U15. U15 outputs the binary number to latch U17. U15 and U17 operate in association to provide the appropriate output timing of the binary number to the antenna interlock circuit and to the power control circuit.

1–40. The binary power level 2 command from latch U17 is routed to: 1) BCD–to–decimal decoder U18 and 2) multiplexer U39. U18 is designed to decode the binary number from U17 and output a HIGH on the appropriate control line to indicate the selected power level. With the power level 2 selected, a HIGH from BCD–to–decimal decoder U18 is applied to AND gate U20A. With antenna 1 switch S1 programmed to operate with power level 2, a HIGH from OR gate U12A is also applied to U20A. U20A will respond by routing a HIGH to OR gate U21C. U21C will output a HIGH to OR gate U13B. U13B will output a HIGH to U22B.

1–41. AND gates U69B, U71B, and U71D monitor the status of the external interlock, the remote control fail-safe input, and the external/exciter mute commands. The circuit functions to determine if all the interlocks are closed, the remote control unit is operational, and the exciter is operational. If the external interlock is closed and the remote control unit is operational, U71D will output a HIGH to U22B. If no external or exciter mute commands are present, U13C will output a LOW to inverter U25A. U25A will output a HIGH to U22B. With a HIGH antenna interlock signal from U13B indicating a proper antenna/power level selection, U22B will output a HIGH operate command to the power control circuit, an exciter/power supply mute circuit, and a high reflected power circuit.

1–42. The HIGH operate signal is routed to the power control circuit to allow the transmitter to be energized. If the remote control unit fails, or the external or exciter mute signal is activated, U22B will output a LOW operate command. The LOW operate command mutes: 1) the exciter PWM signal and 2) the power supply circuit board(s). If the cabinet or external interlock is opened, AND gate U71B will output a LOW cabinet command. A LOW cabinet command configures the power control circuit to operate the transmitter to off. U71D will output a LOW to: 1) extinguish the interlock indicator and 2) generate a LOW operate command. A LOW operate command mutes: 1) the exciter PWM signal and 2) the power supply circuit board(s).

1–43. **POWER CONTROL CIRCUIT.** Binary power level information from latch U17 is applied to multiplexer U39. U39 decodes the power level number and selects a reference voltage from a potentiometer network. Potentiometers R2 through R6 provide a voltage reference proportional to output power for power levels 1 through 5. For example, power level 2 selected for operation. With power level 2 selected, U39 will select a reference voltage from potentiometer R5. The voltage is routed through buffer U40B to digital–to–analog converter U42.

1–44. U42 is designed to output a reference voltage to a power control driver circuit. U42 is controlled by up/down counters U30 and U31, multiplexer U27, priority encoder U28, and divider U26. The up/down counters, multiplexer, and priority encoder function to output clock signals to U42 in response to fault conditions. U42 will respond by increasing/decreasing the power reference voltage in response to foldback and release commands from U27. With no foldback or release signals, U42 will output the power level 2 reference voltage without change to a power control driver circuit.

1–45. **Power Control Driver Circuit.** The power control driver circuit consists of: 1) operational amplifiers U40B and U44A, 2) switch U41A, and 3) AND gate U36C. The power level reference voltage from U42 is applied to integrated circuit U40B. U40B is configured as an inverting amplifier. The output of U40B is applied to comparator U44A and switch U41A. U41A is controlled by the sample from the output of U44A. U41A is a feedback control network designed to convert the reference voltage from U40B to a voltage proportional to power. U44A compares the power level reference to a ramp signal generated by integrated circuit U40C. U44A produces a square–wave PWM (pulse–width–modulated) signal which varies in response to the power level. The signal is ANDed at U36C with the operate signal from U22B. With a HIGH operate signal from U22B, the PWM signal is routed through carrier control driver Q22 to the power supply circuit board.

1–46. **POWER CONTROL TRIM CIRCUIT.** The transmitter RF output power level can be trimmed to a desired level by the raise/lower switch/indicators. When a raise or lower switch/indicator is depressed, a HIGH is applied to the raise/lower power adjust circuit. The circuit consists of: 1) logic gates U24B, U31D, U16B, U23C, and U19C, 2) up/down counters U34 and U35, and 3) digital–to–analog converter U43. The circuit is designed to increase or decrease RF output power by increasing/decreasing the reference voltage.

1–47. Logic gates U24B, U31D, U16B, U23C, and U19C control up/down counters U34 and U35. NOR gate U24B and OR gate U31D monitor raise, lower, and foldback signals. NOR gate U24B is designed to configure counters U34/U35 to count up or down. U24B will output a HIGH to configure U34/U35 to count up. U24B will output a LOW to configure U34/U35 to count down. For example, when the raise switch/indicator is depressed, a HIGH is applied to U34/U35. The HIGH configures U34/U35 to count up. U34/U35 will output binary numbers to digital–to–analog converter U43. U43 decodes the numbers from U34/U35 and increases the power control reference voltage generated from power control D–to–A converter U42. U42 outputs the increased reference voltage to the power control driver circuit to increase the RF output power.

1–48. Logic gates U16B, U23C, and U19C control the loading of counters U34/U35. The logic gates monitor: 1) high reflected power conditions, 2) reset conditions, and 3) trim reset operations. Trim reset is when the power control trim is reset to mid–range when a power level switch/indicator is depressed. If a trim reset condition, a reset condition, or a high reflected power condition occurs, U19C will output a HIGH to counters U34/U35. The HIGH resets counters U34/U35 to mid–range.

1–49. **Trim Reset.** Trim reset is a function which resets the power control trim function to mid–range when a power level switch/indicator is depressed. When a power level switch is depressed, a HIGH trim reset command from U14 is applied through jumper P12 to OR gate U19C. U19C will output a HIGH to up/down counters U34/U35. The HIGH configures U34/U35 to mid–range. With U34/U35 at mid–range, the power trim circuit can be raised or lowered an equal amount. Jumper P12 allows the trim reset function to be disabled if required.

1–50. **TRANSMITTER OFF.** RF output power is immediately terminated when the ECU off switch is depressed. When the off switch/indicator is depressed, a HIGH is applied to OR gate U13A. U13A will output a HIGH to priority encoder U14. U14 will output a binary number through latches U15/U17 to BCD–to–decimal decoder U18 and to multiplexer U39. U18 will output a HIGH to NOR gate U23A. U23A will output a HIGH to bias power contactor driver Q13 off to disable the fans and the power supplies. U39 will respond by terminating the power control reference voltage to terminate the power control PWM signal

1-51. **AC POWER INTERRUPTIONS.** The AM-2.5E/AM-5E transmitters are designed to respond to two different types of ac power interruptions: 1) momentary and 2) extended. The transmitter will respond to a momentary power interruption by automatically returning to on-air operation immediately after power is returned to the transmitter. Automatic return of the transmitter to on-air operation is provided by the controller circuit board battery backup circuit which maintains the transmitter configuration information. In the event of an extended ac power interruption, the controller circuit board is equipped with a programmable ac loss/auto-off circuit. The circuit is designed to output an off command once power is returned to the transmitter. The ac loss circuit may be programmed to output an off command after a 1 minute, 4.5 minute, 17 minute, or 68 minute ac power interruption. The circuit primarily designed to be used to prevent the transmitter from automatically returning to an incorrect antenna or power level after a power failure.

1-52. The ac loss detection/auto-off circuit consists of: 1) one-shots U57A/U68B, 2) divider U58, 3) OR gate U62C, 4) NOR gate U52A, and inverter U54C. When ac power is applied to the unit, 120 Hz pulses from an ac detection circuit on the power supply circuit board are applied to integrated circuit U68B. U68B will respond by routing a LOW pulse to: 1) one-shot U57A, 2) OR gate U62C, and 3) inverter U54C. One-shot U57A responds by providing a one second delay to allow the circuitry to stabilize. U54C responds by inverting the LOW to provide a HIGH reset pulse to counter U58. The HIGH disables counter U58 and prevents the counter from generating an ac fail command.

1-53. When ac power interruption is detected, U68B: 1) routes a HIGH pulse to one-shot U57A, OR gate U62C, and inverter U54C and 2) outputs a LOW $\overline{\text{ac fail}}$ command. U57A will output a HIGH to U62C. U62C will output a a HIGH ac fail command. U54C inverts HIGH to output a LOW to counter U58. U58 will begin a count operation. 0.5 Hz clock pulses for U58 are provided by U52A and an battery backed-up oscillator. Programmable jumper P6 programs the counter to provide a 1, 4.5, 17, or 68 minute shutdown command. When the programmed time has elapsed, U58 will output a HIGH shutdown command to OR gate U37A. The HIGH is routed through U37A and U31A to priority encoder U14 to automatically operate the transmitter to off.

1-54. The shutdown signal is also applied to AND gate U71C. If fault conditions have occurred, U71C will AND a LOW from NOR gate U55 to output a LOW to latch U49D. U49D will output a LOW to bias transistor Q52 on to maintain the battery supply and the fault indication circuitry. If no fault conditions exist, U71C will AND a HIGH from NOR gate U55. U71C will output a HIGH to latch U49D. U49D will output a HIGH to bias transistor Q52 off to terminate battery operation.

1-55. **FORWARD AND REFLECTED POWER CIRCUITRY.** Transmitter forward and reflected power voltage samples are processed by forward and reflected power monitoring circuits. The circuits are identical therefore, only the forward power circuit will be described.

1–56. A voltage sample of the forward power is applied through potentiometer R56 and resistor R183 to integrated circuit U63D. Potentiometer R56 allows the forward power circuit to be calibrated. U63D operates in association with diodes D35/D36 as a full–wave rectifier. The full–wave rectified output from U63D is applied to a third order high–pass filter consisting of U63A, R60, R61, R67, C63, C64, and C88. The dc output of the filter is applied to comparator U61D. U61D compares the forward power sample to a ramp voltage generated by integrated circuit U40C. U61D will output a square–wave signal equal to the forward power voltage sample. The output of U63D is applied to switch U41B. U41B functions as a feedback control device designed to convert the forward power voltage sample into a signal proportional to power. The square–wave output from U41B is applied to a low–pass filter consisting of resistor R70 and capacitor C89. The output of the low–pass filter generates a dc voltage which is proportional to the forward power. The voltage is amplified by operational amplifier U64A. The output of U64A is applied to: 1) the fault detection circuitry, 2) a +5 volt full–scale meter output, and 3) buffer U64B. Buffer U64B operates in association with programmable jumper P2 to provide a +2.5 volt full–scale meter output. Jumper P2 enables or disables the +2.5 volt full–scale meter output.

1–57. **FOLDBACK PROTECTION.** The controller circuit board is designed to monitor several operating parameters for problem conditions. Several of the monitored conditions are routed to a foldback circuit. The foldback circuit will automatically reduce the transmitter RF output power to an acceptable operating level to prevent damage to the transmitter. The controller monitors: 1) the cabinet temperature for over–temperature conditions, 2) reflected power for a high reflected power condition, 3) forward power for high forward power conditions, and 4) lightning detector for lightning conditions. When an over–temperature, high reflected power, or a high VSWR condition occurs, the foldback indicator will illuminate to indicate the transmitter is in a foldback condition.

1–58. If the controller detects a high reflected/forward power, a high VSWR, lightning, or an over–temperature condition, the foldback circuit will automatically reduce the transmitter RF output power to an acceptable operating level to prevent damage to the transmitter. If the controller detects a high reflected power or VSWR condition, the antenna status indicator will illuminate as described below to indicate the problem.

ANTENNA STATUS INDICATOR	CONDITION
YELLOW	1.2 : 1 VSWR or greater.
RED	High reflected power condition. A reflected power condition equal to 100 watts for AM–2.5E models or 200 watts for AM–5E models.
FLASHING RED	Reflected power emergency condition. A reflected power condition equal to 500 watts for AM–2.5E models or 1000 watts for AM–5E models.

1–59. **High Forward Power Circuitry**. High forward power conditions are monitored by a high forward power fault detection circuit. Integrated circuits U66A and U66B are configured as comparators designed to monitor forward power conditions. U66B functions as an output power monitor. Integrated circuit U66B compares a forward power sample from U64A to a power control sample. U66A compares a forward power sample from U41B to a voltage reference.

1-60. Comparators U66A/U66B operate in association to monitor high forward power conditions. U66A/U66B use the high reflected power attack circuitry to reduce the transmitter power when a high forward power condition occurs. When the transmitter power is greater than 90%, U66B will output a HIGH. When a high forward power conditions results in the forward power sample to increase above the voltage reference by approximately 20%, the output of U66A will go HIGH. The HIGH is applied to AND gate U47B. With a HIGH from U66B, U47B will output a HIGH to OR gate U62A. U62A will output a HIGH to AND gate U47A. With a HIGH enable failure signal, U47A will output: 1) a HIGH reflected power high attack signal to priority encoder U28 and 2) a HIGH to latch U67A. The HIGH reflected power attack signal is used by U28 to initiate an attack sequence to reduce the transmitter output power. The HIGH to U67A will configure U67A to output a HIGH reflected power signal to enable latch U48D. U48D will output a HIGH to bias: 1) alarm status indicator driver transistors Q34 and Q35 on and 2) antenna indicator driver Q28 on. When the transmitter power is reduced to approximately 90%, the output of U66B will go LOW. The LOW is applied to U47B. U47B will output a LOW through U62A to U47A. U47A will respond by routing a LOW to terminate the high reflected power attack signal. The indicators will remain illuminated until the alarm reset switch is depressed.

1-61. **High Reflected Power Circuitry.** Integrated circuit U65C monitors reflected power conditions. U65C compares a reflected power sample from U64C to a voltage reference. When the reflected power sample increases above the voltage reference, the output of U65C will go HIGH. The HIGH is applied through OR gate U62A to AND gate U47A. With a HIGH enable failure signal, U47A will output: 1) a HIGH reflected power high attack signal to priority encoder U28 and 2) a HIGH to latch U67A. The HIGH reflected power attack signal is used by U28 to initiate an attack sequence to reduce the transmitter output power. The HIGH to U67A will configure U67A to output a HIGH reflected power signal to enable latch U48D. U48D will output a to HIGH to bias: 1) alarm status indicator driver transistors Q34 and Q35 on and 2) antenna mismatch indicator driver Q28 on.

1-62. **Over-temperature Circuitry.** Over-temperature conditions are monitored by an over-temperature fault detection circuit. A dc voltage representing the transmitter temperature is applied to: 1) integrated circuits U65A/U65B and 2) integrated circuit U61A. When the temperature voltage increase above a reference voltage, the output of U65A will go HIGH. The HIGH is routed to AND gate U51D. With a HIGH enable failure signal, U51D will output: 1) a HIGH over-temperature attack signal to priority encoder U28 and 2) a HIGH to latch U67C. The HIGH over temperature attack signal is used by U28 to initiate an attack sequence to reduce the transmitter output power. The HIGH to U67C will configure U67C to output a HIGH: 1) over-temperature signal to latch U49B and 2) to AND gate U47D. The output of U49B will go HIGH to bias: 1) alarm status indicator driver transistors Q34 and Q35 on and 2) over-temperature indicator drivers Q32 and Q36 on. When the transmitter temperature is reduced to 70 degrees C, the output of U65A will go LOW and the output of U65B will go HIGH. The LOW is applied to U51D. U51D will output a LOW to terminate the over-temperature attack signal. The indicators will remain illuminated until the alarm reset switch is depressed. The from HIGH from U65B is also applied to U47D. With the HIGH from U67C, U47D will output a over temperature release signal to encoder U28.

1-63. U61A is configured as a comparator designed to monitor extreme temperature conditions. When the temperature voltage increases above the reference voltage, the output of U61A will go HIGH. U61A will output a HIGH temperature shutdown command to U13A of the transmitter off control circuit.

1-64. **Reflected Power Emergency.** Reflected power emergency conditions are monitored by comparator U66D. U66D compares a reflected power sample to a fast voltage reference from U63C. When a reflected power emergency causes the sample to increase above the reference, the output of U66D will go LOW. The LOW is applied to OR gate U62B. U62B will output a LOW reflected power emergency attack signal to NAND gate U60D. With a HIGH lightning detector signal indicating no lightning activity, U60D will output a HIGH to latch U59A and OR gate U45B. U45B will output a HIGH: 1) to AND gate U47C, 2) to OR gate U19A, and 3) emergency mute command. With a HIGH enable failure signal, U47C will output a HIGH fast foldback attack signal to priority encoder U28. U19A will output a HIGH to: 1) bias driver transistor Q50 on to illuminate PWM mute indicator DS3 and 2) inverter U54A. U54A will output a LOW to bias driver transistor Q51 off to mute the PWM signal.

1-65. A LOW reflected power emergency attack signal is also applied to inverter U60C. U60C will output a HIGH to OR gate U69C. U69C is designed as a latching gate. When a reflected power emergency attack signal is present, a LOW foldback reset command will bias transistor Q56 off. This allows the output of U69C to be latched HIGH to maintain the indicator circuitry when the condition is removed.

1-66. The HIGH from U69C is applied to reflected power emergency latch U49A. The output of U49A will go HIGH. The HIGH is applied to: 1) OR gate U50B, 2) NOR gate U55, 3) AND gate U51A, and 4) transistor Q29. OR gate U50B will output a HIGH to bias Q39 off to disable the green antenna status indicator. NOR gate U55 will output a LOW which is inverted at U54F. U54F will output a HIGH to bias Q34 and Q35 on to enable the alarm indicator. U51A ANDs a 2 Hz signal with the HIGH from U49A to generate a flashing signal to OR gate U50C. U50C will output the signal through U51 and U50 to transistor Q38. The output of Q38 will flash to generate a flashing red antenna status indicator. Transistor Q29 will be biased on to provide a LOW remote reflected power emergency signal.

1-67. **Lightning Conditions.** Lightning conditions are monitored by NAND gate U60D. When lightning is detected at the transmitter output, the lightning detector status input will go LOW. The LOW is applied to NAND gate U60D and inverter U46B. U60D will output a HIGH to latch U59A and to OR gate U45B. With a HIGH from U60D, U45B will output a HIGH: 1) to AND gate U47C, 2) to OR gate U19A, and 3) emergency mute command. With a HIGH enable failure signal, U47C will output a HIGH fast foldback attack signal to priority encoder U28. U19A will output a HIGH to: 1) bias driver transistor Q50 on to illuminate PWM mute indicator DS3 and 2) inverter U54A. U54A will output a LOW to bias driver transistor Q51 off to mute the PWM signal.

1-68. Inverter U46B will respond by routing a HIGH to latch U49C. The output of U49C will go HIGH. The HIGH is applied to NOR gate U55 and to transistors Q33 and Q37. The HIGH will bias Q33 and Q37 on to illuminate the lightning status indicators. NOR gate U55 will output a LOW which is inverted at U54F. U54F will output a HIGH to bias Q34 and Q35 on to enable the alarm indicator.

1-69. **Foldback Indication.** Two circuit functions are monitored to indicate when the transmitter is in a foldback condition: 1) when the Q2 output of U28 is HIGH and 2) when the carryout signal of U31 is HIGH. When priority encoder U28 outputs a binary number in response to an attack signal, the Q2 output of U28 will be HIGH. The HIGH is applied to latch U67D. The Q output of U67D will go HIGH. The HIGH is inverted at U25C and applied to NAND gate U16C.

1–70. When a foldback condition, counter U31 will not be clocked to a maximum number resulting in a HIGH carryout signal. The HIGH is inverted at U25B. U25B will output a LOW to U16C. With a LOW from U25B or U25C, U16C will output a HIGH to foldback indicator driver transistors Q20 and Q21. The transistors will be biased on to indicate the transmitter is in a foldback condition.

1–71. **ATTACK SIGNAL OPERATION.** During high reflected/forward power, reflected power emergency, over–temperature, or lightning conditions, an attack signal is applied to priority encoder U28. U28 is designed to determine priorities if two attack signals occur simultaneously. U28 will respond by routing a binary number to multiplexer U27. U27 will respond by selecting a clock signal from integrated circuit U26. U26 is a divider designed to generate several clock signals. The clock signals are used to drive the power control circuit up/down counters up or down as determined by the type of attack or release signal applied to U28. For example, a high reflected power condition selects a 4 Hz clock signal. An over–temperature signal will select a 1/16th Hz clock signal.

1–72. The signal from U27 is applied to up/down counters U30/U31. U30/U31 will respond by counting down and routing binary numbers to digital–to–analog converter U42. U42 will respond by routing a reduced voltage reference to U43. U43 will output a reduced reference voltage to reduce the transmitter output power.

1–73. **1.2 : 1 VSWR CONDITIONS.** 1.2 : 1 VSWR conditions are monitored by a VSWR detection circuit. The detection circuit consists of comparator U66C. U66C compares a forward power sample to a reflected power sample. When the reflected power sample increases above a forward power sample at approximately 1.2: 1, the output of U66C will go LOW. The LOW is inverted at U54E. U54E will output a HIGH 1.2 : 1 VSWR signal to OR gate U50C. U50C will output a HIGH to AND gate U51B and NAND gate U52C. With a LOW reflected power emergency signal from U51A, U51B will output a LOW to AND gate U50D. With a HIGH from U50C and a LOW from U51A, AND gate U52C will output a LOW to U50D. U50D will respond by routing a LOW to antenna status red indicator driver Q38. The output of Q38 will go LOW to bias the red antenna indicator on. With no reflected power conditions, the output of OR gate U50B will be LOW. The LOW biases the green antenna indicator on. This will result in a yellow antenna LED indication.

1–74. **FOLDBACK RECOVERY.** When the foldback circuit is activated in response to a problem, the controller will initiate a recovery sequence. The following text describes the reflected power recovery, over temperature recovery, and reflected power emergency/lightning recovery.

1–75. **High Reflected Power Recovery.** When the reflected power is reduced to a level below the reference at U65C, U65C will output a LOW to U62A. With a LOW from U47B, U62A will output a LOW to U47A. U47A will output a LOW reflected power high attack signal to terminate foldback operation. Once the problem which caused the high reflected power condition is removed, the transmitter will output a high reflected power release signal (refer to the following text).

1–76. **High Forward Power Recovery.** High forward power conditions use the high reflected power circuitry to reduce/recover the transmitter output power. When the transmitter power is reduced to approximately 90%, the output of comparator U66B will go LOW. The LOW is applied to AND gate U47B. U47B will output a LOW through U62A to AND gate U47A. U47A will respond by routing a LOW to terminate the high reflected power attack signal. Once the problem which caused the high forward power condition is removed, the transmitter will output a high reflected power release signal (refer to the following text).

1-77. **High Reflected Power Release Signal.** A reflected power release signal is controlled by AND gate U38A. When condition causing the high forward/reflected power condition is removed, a HIGH operate signal, a HIGH 1.2 : 1 VSWR signal from comparator U66C, and a HIGH from latch U67A will be ANDed at U38A. U38A will respond by routing a HIGH reflected power release signal to priority encoder U28. U28 will respond by routing a binary number to multiplexer U27. U27 will respond by selecting a clock signal from integrated circuit U26. U26 is a divider designed to generate several clock signals. The clock signals are used to drive the power control circuit up/down counters up as determined by the type of release signal applied to U28. For example, a high reflected power release condition selects a 2 Hz clock signal. The 2 Hz clock signal from U27 is applied to up/down counters U30/U31. U30/U31 will respond by counting up and routing binary numbers to digital-to-analog converter U42. U42 will respond by routing an increased voltage reference to U43. U43 will output an increased reference voltage to increase the transmitter output power.

1-78. **Over-Temperature Recovery.** When the condition which caused the over-temperature problem is removed, the transmitter will initiate a recovery sequence. The output of comparator U65A will go LOW. The LOW is applied to AND gate U51D. With a HIGH enable failure signal, U51D will output a LOW to terminate the over-temperature attack signal.

1-79. When the temperature is reduced to approximately 55 degrees C, the output of comparator U65B will go HIGH. The HIGH is applied to AND gate U47D. With the HIGH from latch U67C, U47D will output a HIGH over-temperature release signal to priority encoder U28. U28 will respond by routing a binary number to multiplexer U27. U27 will respond by selecting a 1/16 Hz clock signal from integrated circuit U26. The 1/16 Hz clock signal from U27 is applied to up/down counters U30/U31. U30/U31 will respond by counting up and routing binary numbers to digital-to-analog converter U42. U42 will respond by routing an increased voltage reference to U43. U43 will output an increased reference voltage to increase the transmitter output power.

1-80. **Reflected Power Emergency/Lightning Recovery.** When the condition which caused the reflected power emergency/lightning problem is removed, the transmitter will initiate a recovery sequence. The sequence is initiated by comparator U65D. U65D compares a fast reflected power voltage sample to a reference voltage. When the sample voltage is below the reference, the output of U65D will go HIGH. The HIGH is applied to AND gate U71A. With a HIGH from latch U67B, U71A will output a fast foldback release signal to priority encoder U28. U28 will respond by routing a binary number to multiplexer U27. U27 will respond by selecting a 512 Hz clock signal from integrated circuit U26. The 512 Hz clock signal from U27 is applied to up/down counters U30/U31. U30/U31 will respond by counting up and routing binary numbers to digital-to-analog converter U42. U42 will respond by routing an increased voltage reference to U43. U43 will output an increased reference voltage to increase the transmitter output power.

1-81. In addition to the sequence initiated by U65D, a HIGH foldback reset command is applied to transistor Q56. The HIGH biases Q56 on to unlatch OR gate U69C. U69C will output a LOW to latch U49A to allow the latch to be reset.

1-82. **EXCITER MONITORING.** The operating condition of the exciter is monitored by a exciter status circuit. During an exciter fault condition, the exciter fault status input will go HIGH. The HIGH is applied to AND gate U36D. With a HIGH enable failure signal, U36D will output a HIGH to latch U48A. U48A will output a HIGH to: 1) bias driver transistor Q45 off to extinguish the exciter indicator green LED and 2) inverter U46A. U46A will output a LOW to bias driver transistor Q44 on. This will illuminate the exciter indicator red LED.

1-83. A HIGH exciter fault signal is also applied to OR gate U13C. U13C will output a HIGH to inverter U25A. U25A will output a LOW to AND gate U22B. U22B will output a LOW transmitter operate command to mute: 1) the exciter PWM signal and 2) the power supply circuit board(s).

1-84. **POWER SUPPLY MONITORING.** The power supply(s) operating condition is monitored by a power supply status circuit. The following text presents the power supply monitoring operations.

1-85. **Power Supply Fault.** During a power supply fault condition, the power supply fault status input will go LOW. The LOW is applied to OR gate U45A. With a LOW ac fail signal present, U45A will output a LOW to NAND gate U60A. With a HIGH power supply emergency signal present from U46D, U60A will output a HIGH to latch U48B. U48B will output a HIGH to: 1) bias driver transistor Q43 off to extinguish the power supply indicator green LED and 2) NOR gate U52D. U52D will output a LOW to bias driver transistor Q42 on. This will illuminate the power supply indicator red LED.

1-86. **Power Supply Emergency Condition.** During a power supply emergency condition, the power supply emergency fault status input will go HIGH. The HIGH is applied to AND gate U36B. With a HIGH enable failure signal present, U36B will output a HIGH to: 1) inverter U46D and 2) OR gate U37B. U46D will output a LOW to NAND gate U60A. U60A will output a HIGH to latch U48B. U48B will output a HIGH to: 1) bias driver transistor Q43 off to extinguish the power supply indicator green LED and 2) NOR gate U52D. U52D will output a LOW to bias driver transistor Q42 on to illuminate the power supply indicator red LED. With a HIGH from U36B applied to U37B, U37B will output a HIGH emergency off signal to OR gate U37A. This configures U37A and OR gate U13A to generate a transmitter off signal.

1-87. **Power Supply Maintenance Condition.** During a power supply maintenance condition, the power supply maintenance fault status input will go HIGH. The HIGH is applied to NOR gate U52D. U52D will output a LOW to bias transistor Q42 on. This will illuminate the power supply indicator red LED. With no power supply fault indications, the output of U48B will be LOW. The LOW bias driver transistor Q43 on to illuminate the power supply indicator green LED. The simultaneous illumination of the indicator green and red LEDs will produce a yellow maintenance indication.

1-88. **RF POWER MODULE MONITORING.** The RF power module operating condition is monitored by an RF power module status circuit. The following text presents the RF power module monitoring operations.

1-89. **RF Power Module Fault.** During an RF power module fault, the power supply fault status input will go LOW. The LOW is applied to inverter U46F. U46F will output a HIGH to latch U48C. U48C will output a HIGH to: 1) bias driver transistor Q41 off to extinguish the RF power module indicator green LED and 2) NOR gate U52B. U52B will output a LOW to bias driver transistor Q40 on. This will illuminate the RF power module indicator red LED.

1-90. **RF Power Module Maintenance Condition.** During an RF power module maintenance condition, the RF power module maintenance fault status input will go HIGH. The HIGH is applied to NOR gate U52B. U52B will output a LOW to bias transistor Q40 on. This will illuminate the RF power module indicator red LED. With no RF power module fault indications, the output of U48C will be LOW. The LOW will bias driver transistor Q41 on to illuminate the RF power module indicator green LED. This simultaneous illumination the indicator green and red LEDs will produce a yellow maintenance indication.

1-91. **FAULT CIRCUIT.** Exciter, power supply, RF power module, reflected power high, reflected power emergency, over-temperature, lightning, or a 1.2 : 1 VSWR conditions are monitored for faults by individual status circuits. In the event of a fault, the appropriate circuit will latch the fault for display by the controller circuit board indicators. If a circuit detects a fault condition, a HIGH signal will be applied to NOR gate U55. U55 will output a LOW to inverter U54F. U54F will output a HIGH to bias alarm driver transistors Q34 and Q35 on to illuminate the alarm indicator.

1-92. When a fault condition is removed, the fault circuit latch must be manually reset using the reset switch. When the reset switch is depressed, a HIGH reset command is applied to OR gate U12C. U12C will output a HIGH reset command to latches U48A, U48B, U48C, U48D, U49A, U49B, and U49C. The Q output of each latch will go LOW. The LOWs are applied to NOR gate U55. U55 will output a HIGH to inverter U54F. U54F will output a LOW to bias driver transistors Q34 and Q35 off to extinguish the alarm indicator.

1-93. **OSCILLATOR CIRCUIT.** Reference frequencies for controller circuit operation are provided by an oscillator circuit. The oscillator circuit consists of: 1) comparators U40C and U44B, 2) resistors R24, R28, R27, R29, R30 and R31, 3) capacitor C38, and 4) inverter U46A. The oscillator is designed to output a 1 kHz square wave signal. Oscillator symmetry control is provided by resistors R24 and R27. The oscillator frequency is controlled by resistor R29 and capacitor C38.

1-94. Integrated circuit U40C compares a 1 kHz signal to a reference voltage. As a result, U40C will output a ramp signal to comparator U44A. U44A uses the signal to generate the power control PWM signal. The ramp symmetry is controlled by R30 and R31.

1-95. **OVER-CYCLE OFF CIRCUIT.** The controller circuit board is equipped with an over-cycle circuit. The circuit is designed to prevent damage to the crowbar resistors on the power supply circuit board during 7 transmitter on/off cycles within 15 seconds. Conditions causing the transmitter to over-cycle off include ac failure and manual on/off control operation. The circuit consists of AND gate U22A, inverter U25F, pulse generator U59B, capacitor C132, and comparator U44D.

1-96. The circuit monitors the transmitter off, power supply mute, and ac fail conditions. AND gate U22B provides off signals during manual off operations. NOR gate U23A provides an off signal during power supply mute conditions. $\overline{\text{AC fail}}$ provides an off signal during ac fail conditions. During a transmitter off operation, a LOW from AND gate U22B, NOR gate U23A, or $\overline{\text{AC fail}}$ is applied to AND gate U22A. U22A will output a LOW to inverter U25F. U25F will output a HIGH: 1) to pulse generator U59B and 2) power inhibit signal. U59B will output a HIGH to capacitor C132. If the transmitter is operated to off 7 times within 15 seconds, capacitor C132 will charge and provide a HIGH to comparator U44D. When the voltage increases above the reference, U44D will output a HIGH over-cycle off command to OR gate U37B. U37B will output a HIGH emergency off command to operate the transmitter to off if one of the following conditions occur: 1) open cabinet or external interlock, 2) power supply emergency, 3) over-cycle off, or 4) the ac line is above 260 Volts. The emergency off signal is routed to the remote panel by transistor Q56.

1-97. **POWER SUPPLY CIRCUIT.** The controller circuit board operates from ±15 volt dc supplies. The +15 volt supply is equipped with a battery backup system. A nine volt battery provides a dc supply to maintain the controller logic during an ac power failure. Switch S5 allows the battery to be tested. When switch S5 is depressed, the battery voltage is applied to comparator U44C. If the battery voltage is above the reference, the output of U44C will go LOW to illuminate battery ok indicator DS1.

1–98. The battery backup system is equipped with a battery save function. If no fault conditions have occurred during a power failure, NOR gate U55 will output a HIGH to AND gate U71C. With a HIGH shutdown signal, U71C will output a HIGH to latch U49D. U49D will output a HIGH to bias transistor Q52 off to terminate battery operation.

1–99. **EXCITER CIRCUIT BOARD.**

1–100. **LEFT/RIGHT CHANNEL INPUT CIRCUIT.** Left/right channel audio from the studio or audio processing equipment is applied to the exciter circuit board left and right channel input circuits (refer to Figure 1–2). The input circuits consist of: 1) RFI filters, 2) high–pass filter networks, 3) instrumentation amplifiers, 4) high frequency boost circuitry, and 5) active PWM filter equalizers. The left and right channel input circuits are identical. Therefore, only the left channel input circuit is discussed.

1–101. Left channel audio is applied to a balanced 600 Ohm resistive impedance network and an 80 kHz RFI filter network. The impedance and RFI filter networks are located on the motherboard assembly. The output of the circuitry on the motherboard is applied to a defeatable 10 Hz high–pass filter network consisting of capacitors C147 through C150 and jumpers P12A and P12B. The 10 Hz high–pass filter is provided to remove low frequency residual products from specific audio processing units. Jumpers P12A and P12B are provided to bypass the high–pass filter networks. The output from the high–pass filter network is applied to an instrumentation amplifier.

1–102. Integrated circuits U1A, U1B, and U2A are configured as an instrumentation amplifier circuit. The circuit is designed to provide balanced–to–unbalanced signal conversion. The output of the instrumentation amplifier is applied to a defeatable high frequency boost circuit. The high frequency boost circuit is designed to increase high frequency response to compensate for a Bessel filter in the pulse–width–modulation (PWM) modulator circuit. If the high frequency boost circuit is enabled, the circuit will result in a compromise between the frequency and transient response performance. If the high frequency boost circuit is enabled, the transmitter frequency response will increase approximately 2 dB at 10 kHz and the transient response will degrade. If the high frequency boost circuit is disabled, the transmitter frequency response will decrease 2 dB at 10 kHz and the transient response will improve. Programmable jumper P2 is provided to bypass the left channel high frequency boost circuit if required. The output of the high frequency boost circuit is routed to an active PWM filter/equalizer and a mono mode switching circuit.

1–103. Integrated circuits U3A and U3B are configured as an active PWM filter/equalizer. The PWM filter/equalizer is a fifth order low–pass filter. The filter is incorporated into the circuit to match the characteristics of a filter contained in the pulse–width–modulation (PWM) circuitry. The filter is required to provide: 1) accurate left and right channel metering and 2) superior stereo equalization. The output from the PWM filter/equalizer is routed for application to the stereo circuit board.

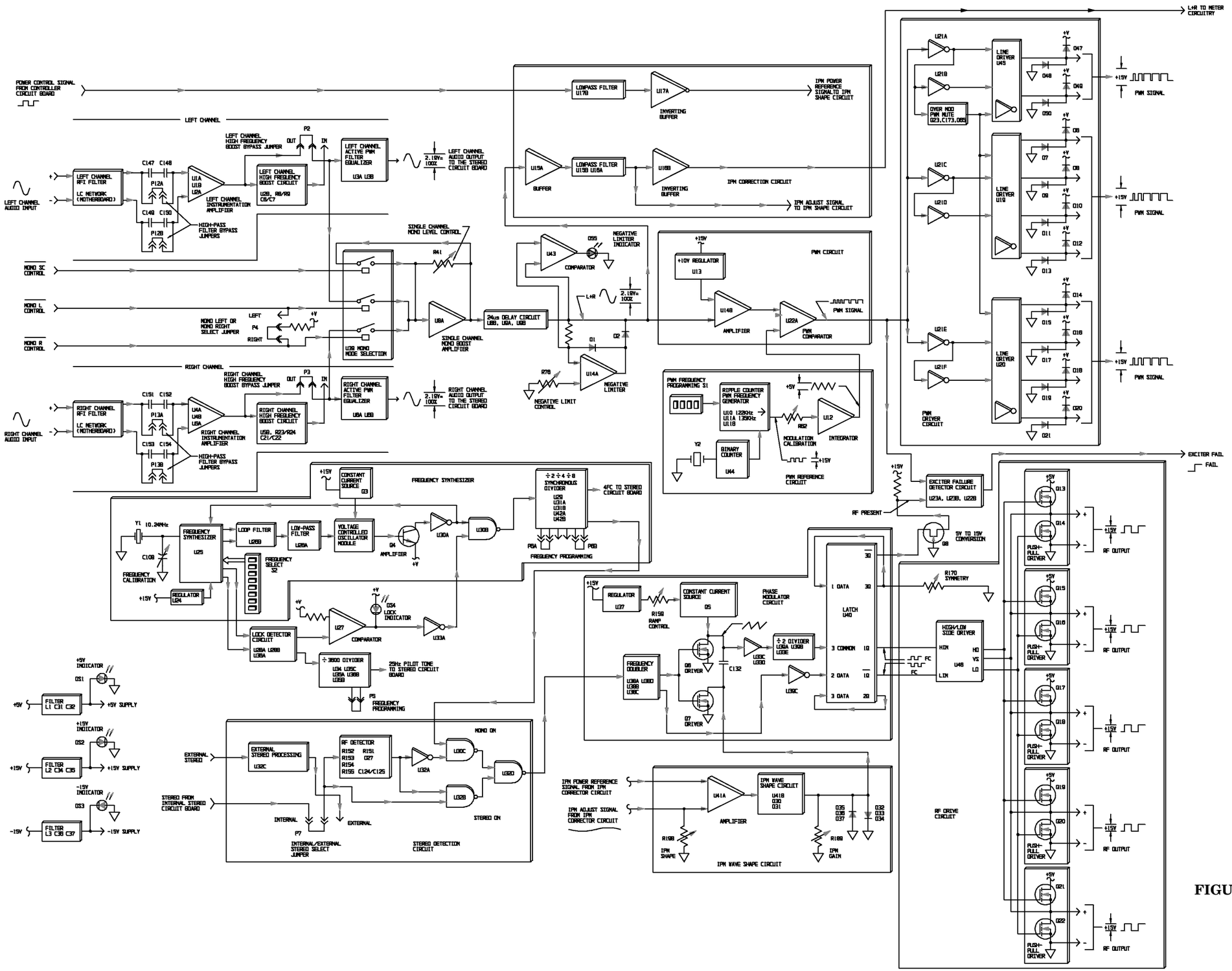

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FIGURE 1-2. EXCITER CIRCUIT BOARD SIMPLIFIED SCHEMATIC
(1-21/1-22)

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1–104. **MONO MODE SWITCHING.** Left and right channel audio from the input circuit is applied to monophonic mode selection integrated circuit U39. U39 is controlled by: 1) mono L, mono R, and mono SC signals from the stereo circuit board and 2) mono left or mono right channel select jumper P4. If the transmitter is equipped with the stereo circuit board and monophonic operation is required, LOW control signals from the following control lines are applied to configure U39 to select the desired monophonic audio: 1) mono SC control line and 2) mono L or mono R control lines. If the transmitter is not equipped with the stereo circuit board, jumper P4 is installed in the left or right channel position to configure U39 to select left or right channel audio for monophonic operation. The output of U39 is applied to single channel monophonic boost amplifier U8A. The monophonic boost circuit is designed to provide up to 6 dB of additional gain for monophonic operations. This level allows the transmitter to operate at 100% modulation. Potentiometer R41 allows the adjustment of the monophonic boost level. A monophonic boost control in most audio processing equipment also provides additional gain for monophonic conditions. If the transmitter is configured for stereo operation, U39 sums the left and right channels to produce the stereo L+R information. The L+R information is applied through monophonic boost circuit U8A to the 24 uS delay circuit.

1–105. **24 uS DELAY CIRCUIT.** Integrated circuits U8B, U9A, and U9B are configured as a 24 uS delay circuit. The delay circuit is incorporated into the L+R audio path to ensure all required stereo equalization will be performed in the L–R audio path. This eliminates the requirement for complex adjustable delay circuitry in the L+R path.

1–106. **NEGATIVE LIMITER.** The output from the delay circuit is applied to a negative limiter circuit. The circuit consists of integrated circuit U14A, diodes D1 and D2, and negative limit control R76. The circuit is designed to prevent the loss of carrier during negative modulation. Potentiometer R76 allows the circuit to be adjusted from 90% to 100%. The output of the limiter is applied a incidental–phase–modulation (IPM) correction circuit and a PWM circuit. A sample from the negative limiter circuit is applied to comparator U43. When the negative limiter circuit is enabled, the output of U43 will go high to illuminate negative limiter indicator DS5.

1–107. **IPM CORRECTION CIRCUIT.** L+R audio from negative limiter U14A is applied through buffer U15A to a low–pass filter. The filter is a fifth order low–pass filter consisting of integrated circuits U15B and U16A. The filter is designed to provide: 1) the correct time delay for IPM correction and 2) the correct frequency response for L+R metering. The output from the filter: 1) is applied to inverting buffer U16B and 2) provides an IPM adjust signal to the IPM corrector circuit. Buffer U16B inverts the L+R signal and removes a dc sample introduced by the negative limiter. The output of U16B is applied to the L+R metering circuitry.

1–108. A power control PWM signal from the controller circuit board is applied to low–pass filter U17B. U17B is designed to convert the power control PWM signal to a dc control voltage. The output of U17B is applied to inverting amplifier U17A. The output of U17A provides an IPM power reference signal to the IPM wave shape circuit.

1–109. **PWM CIRCUIT.** L+R audio from the negative limiter circuit is applied to amplifier U14B. U14B amplifies the L+R signal to a 4 volt peak–to–peak level with a –0.5 volt dc potential. This provides a 40% nominal duty cycle at the output of a PWM comparator to allow the circuitry to modulate the transmitter from –100% to +150%. The output of U14B is applied to high–speed PWM comparator U22A. U22A compares the L+R signal with a reference signal from integrator U12 to generate a square–wave PWM control signal. The square wave duty cycle varies in response to the L+R audio level. The output of U22A is applied to the PWM driver circuit and an exciter failure detector circuit.

1-110. **PWM DRIVER CIRCUIT.** The PWM control signal from PWM comparator U22A is applied a PWM driver circuit. The circuit consists of: 1) inverters U21A through U21F, 2) line drivers U19, U20, and U45, and 3) diodes D6 through D21 and D47 through D50. The PWM control signal is applied to inverters U21A through U21F. The inverted PWM signals from U21A through U21F are applied to inverting line drivers U19, U20, and U45. U19, U20, and U45 operate in parallel to lower the output impedance. The outputs from U19, U20, and U45 are applied to each RF amplifier module modulator circuit board. Diodes D6 through D21 and D47 through D50 protect U19/U20/U45 from latch-up conditions. The PWM circuit is protected from over-modulation conditions by an over-modulation PWM mute circuit consisting of transistor Q23, capacitor C173, and diode D65. If the modulation level increases above 150%, the circuit will output a HIGH to mute line drivers U19, U20, and U45.

1-111. **FREQUENCY SYNTHESIZER.** The exciter circuit board frequency synthesizer is a phase-locked-loop circuit which generates and maintains the phase and frequency of a voltage-controlled-oscillator (VCO) to a high level of precision. The circuit is designed with the ability to synthesize: 1) 119 frequencies within the 522 kHz to 1705 kHz AM broadcast band in 10 kHz increments or 2) 123 frequencies within the 522 kHz to 1705 kHz AM broadcast band in 9 kHz increments.

1-112. The synthesizer operates from binary coded carrier frequency information entered into frequency programming switch S2. The binary formatted frequency is applied to frequency synthesizer integrated circuit U25. U25 operates from 10.24 MHz reference oscillator Y1. Capacitor C108 allows the reference to be calibrated. Regulator U24 provides a stable voltage supply for frequency synthesizer U25.

1-113. Once programmed, U25 will output a series of rectangular-wave pulses to loop filter U26B and low-pass filter U26A. U26A and U26B function together to generate a stable dc control voltage for application to a voltage-controlled-oscillator (VCO) module. The control voltage is used by the VCO module to generate a precision frequency reference. A constant current source for the VCO module is provided by transistor Q3.

1-114. Precision alignment of the VCO output is maintained by the phase-locked-loop design. Feedback samples are monitored by a lock detector circuit. If the VCO frequency shifts from the programmed operating state, the output of U25 will change to adjust the control voltage and maintain a stable VCO output.

1-115. The output of the VCO module is applied through transistor amplifier Q4 to inverter U30A. The output of U30A is applied to NAND gate U30B. A sample of U30A is applied to U25 for feedback.

1-116. The output of U30B is applied to a synchronous divider consisting of integrated circuits U29, U31A, U31B, U42A, and U42B. Depending on the carrier frequency: 1) the original synthesizer frequency or a divide-by-2 frequency is used to generate a 4XFc (four times carrier frequency) signal for application to the stereo circuit board and 2) a divide-by-4 or a divide-by-8 signal is used to generate the carrier frequency. The carrier frequency is applied to NAND gate U30C. Jumpers P6A and P6B program the divider as determined by the carrier frequency.

1-117. **PWM REFERENCE CIRCUIT.** The PWM frequency is generated by oscillator Y2, binary counter U44, and switch S1. The PWM frequency generator outputs a 115.4 kHz to 138.5 kHz signal to an integrator circuit. The PWM frequency is: 1) generated by one of four different crystals and 2) determined by several operating parameters. The output of U44 is applied to Integrator U12. U12 is designed to generate a precision triangle-wave signal for application to PWM comparator U22A. Programming switch S1 is used to program the PWM frequency generator circuit. The PWM frequency, crystal, and switch programming are recorded in the final test data sheets.

1–118. **LOCK DETECTOR CIRCUIT.** The frequency synthesizer circuit is monitored for proper operation by a lock detector circuit. Integrated circuits U28A, U28B, and U36A function as a lock detector circuit. The circuit monitors an output sample signal and a divided VCO sample signal from U25. If the VCO and the reference phases are within ±180 degrees, the VCO is locked to the correct frequency. If the phases are out of tolerance, the output of U36A will go LOW. The LOW is applied to comparator U27. The output of U27 will go HIGH to extinguish lock indicator DS4 and is inverted at U33A. U33A will output a LOW to U30B which mutes the output of the frequency synthesizer.

1–119. A sample from the lock detector circuit is applied to divide–by–3600 circuit. The circuit consists of integrated circuits U34, U35A, U35B, U35C, and U36B. The divider circuit is designed to generate a 25 Hz pilot signal for application to the stereo circuit board.

1–120. **STEREO DETECTION CIRCUIT.** The presence of a stereo signal is detected by a stereo detection circuit. This circuit allows the transmitter to be: 1) converted to monophonic operation by removing the stereo circuit board or 2) converted to stereophonic operation by inserting the stereo circuit board. The circuit will also detect the presence of an external stereo signal.

1–121. Stereo signals from the stereo circuit board are applied to programmable jumper P7. P7 selects a stereo signal from the internal stereo circuit board or from an external source. The external source is applied to a processing circuit consisting of integrated circuit U32C and the associated circuitry. The processing circuit provides ac coupling, over–voltage limiting, and square–wave generation.

1–122. Either an external or internal stereo signal from P7 is applied to an RF detector circuit. The RF detector consists of: 1) resistors R151 through R155, 2) capacitors C124 and C125, and 3) diode D27. The detector rectifies the signal for application to an automatic mono/stereo select circuit consisting of integrated circuits U32A, U30B, U32C, and U32D.

1–123. The mono/stereo select circuit will route a stereo or mono signal to an RF drive circuit in response to the presence of stereo. If a stereo signal is present, the output of U32A will be LOW. The LOW will disable mono on gate U30C and enable stereo on gate U32B. The stereo signal from U32B will be applied through NAND gate U32D to a phase modulator circuit. If a stereo signal is not present, the output of U32A will be HIGH. The HIGH will enable U30C and disable U32B to allow the monophonic RF signal to be applied to the phase modulator circuit.

1–124. **IPM WAVE SHAPE CIRCUIT.** The IPM adjust and IPM power reference signals from the IPM correction circuit are applied to an IPM wave shape circuit. The signals are amplified at U41A. The output of U41A is applied to an IPM wave shape circuit consisting of integrated circuit U41B and diodes D30 and D31. The circuit is designed to output a phase modulated signal which is equal in amplitude and out–of–phase with the phase modulation component in the RF amplifier section. Potentiometer R198 controls the shape of the IPM correction signal. Potentiometer R189 controls the amplitude of the IPM correction signal. Diodes D32 through D37 provide over–voltage protection. The output of the IPM wave shape circuit is applied to the phase modulator circuit.

1–125. **PHASE MODULATOR CIRCUIT.** A phase modulator circuit is incorporated into the exciter circuitry to cancel incidental–phase–modulation (IPM) in the RF amplifier section of the transmitter. The circuit is designed to insert a phase modulation component which is equal in amplitude and out of phase with the phase modulation in the RF amplifier section. This feedforward approach is designed to effectively cancel (IPM) in the transmitter.

1–126. The phase modulator circuit accepts a mono or stereo signal from NAND gate U32D. The signal is applied to a frequency doubler circuit consisting of integrated circuits U38A, U38B, U38C, and U38D. The output of the frequency doubler is applied to the gates of transistors Q6 and Q7. An IPM correction signal from the IPM wave shape circuit is applied to the drains of Q6 and Q7.

1–127. Transistors Q6 and Q7 function to produce a triangle–shaped waveform which is equal in amplitude and out–of–phase with the IPM in the RF amplifier section. The output from Q6 and Q7 is converted to a square–wave at U33C and U33D. The signal from U33C/U33D is applied to a divider circuit consisting of integrated circuits U39A, U39B, and U33E. The output of the divider is used to clock the RF carrier signal from the frequency doubler circuit at latch U40. U40 outputs a phase compensated carrier frequency to the RF drive circuit. Potentiometer R170 is provided to adjust the symmetry of the RF carrier signal.

1–128. **RF DRIVE CIRCUIT.** The RF drive circuit consists of high/low side driver U46 and transistors Q13 through Q22. Complementary phase compensated square–wave signals at the carrier frequency are applied to U46. U46 outputs high and low driver signals for application to a transistor array consisting of transistors Q13 through Q20. The transistors output a +15 volt peak–to–peak square–wave signal at the carrier frequency for application to the power block motherboard.

1–129. **EXCITER FAILURE DETECTOR CIRCUIT.** The exciter circuitry is equipped with an exciter failure detector circuit. The circuit consists of integrated circuits U22B, U23A, and U23B. Two signals are routed to the detector circuit: 1) the PWM control signal and 2) an RF present signal from transistor Q8 and latch U40. The circuit is designed to output a HIGH during the following conditions: 1) the loss of the PWM signal or 2) the loss of the RF signal. The HIGH is routed to the circuitry on the controller circuit board.

1–130. **POWER SUPPLY CIRCUITS.** The exciter circuit board operates from three power supplies: 1) a +5 volt supply, 2) a +15 volt supply, and 3) a –15 volt supply. Each supply is equipped with a filter network. The +5 volt supply filter consists of inductor L1 and capacitors C31/C32. The output of the filter is applied to: 1) +5 volt indicator DS1 and 2) the exciter circuit board components. The +15 volt supply filter consists of inductor L2 and capacitors C34/C35. The output of the filter is applied to: 1) +15 volt indicator DS2 and 2) the exciter circuit board components. The –15 volt supply filter consists of inductor L3 and capacitors C36/C37. The output of the filter is applied to: 1) –15 volt indicator DS3 and 2) the exciter circuit board components.

1–131. **STEREO CIRCUIT BOARD.**

1–132. **EQUALIZATION CIRCUITRY.** The stereo circuit board is equipped with two equalization circuits: 1) equalization circuit 1 and 2) equalization circuit 2 (refer to Figure 1–3). The circuits are designed to provide equalization for two antenna patterns such as: 1) a day pattern and 2) a night pattern. The equalization circuits are identical and contain identical left and right channel circuitry. Therefore, only the left channel of equalization circuit 1 will be discussed.

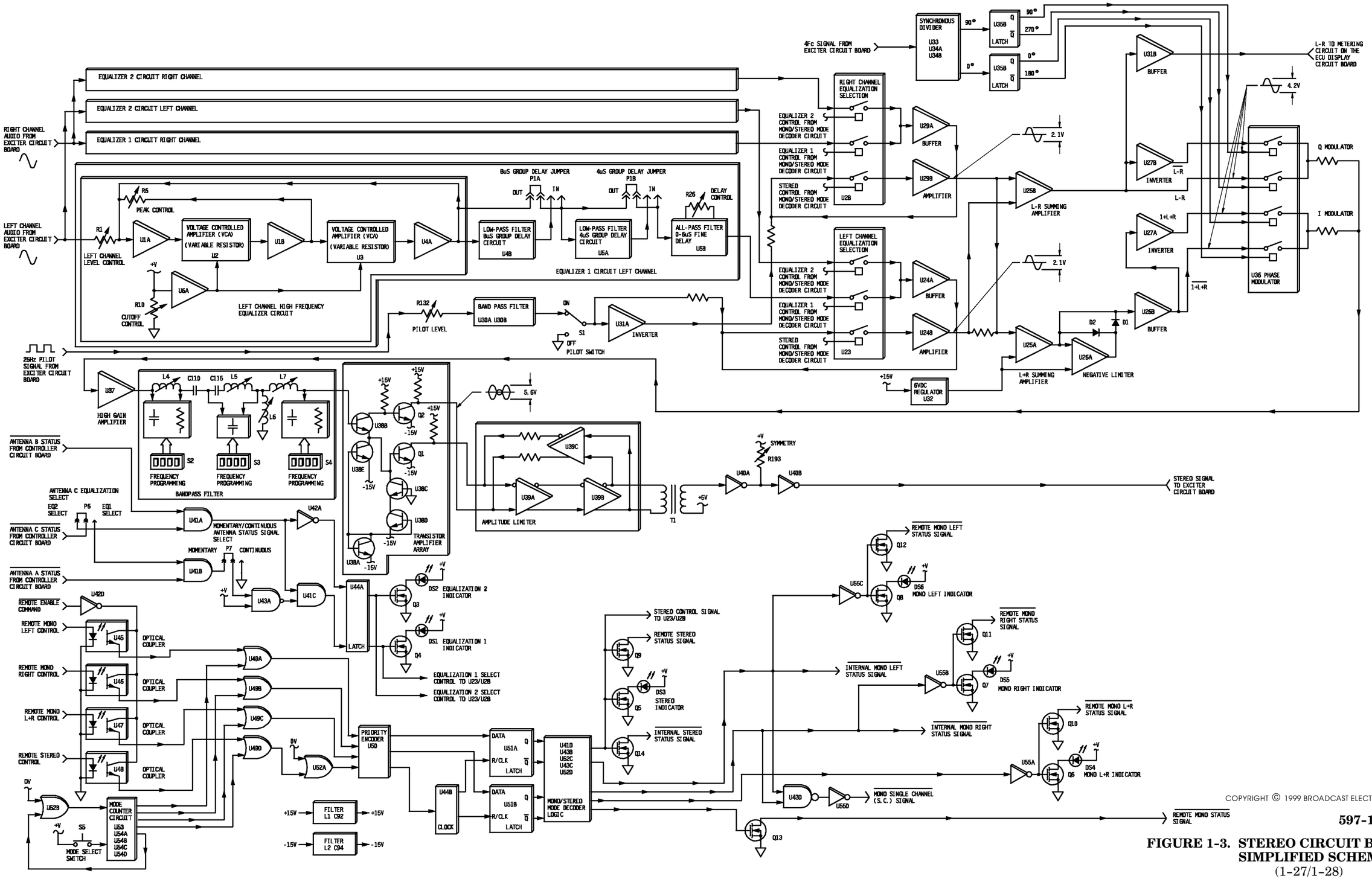

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FIGURE 1-3. STEREO CIRCUIT BOARD SIMPLIFIED SCHEMATIC
(1-27/1-28)

1–133. Left channel audio from the exciter circuit board is applied to a left channel high frequency equalizer network in the equalization 1 circuit. The high frequency equalizer consists integrated circuits U1A, U2, U1B, U3, U4A, and U6A. The equalizer circuit is a second order state variable low–pass filter designed to compensate for high frequency and phase problems caused by antenna/phasor units. The filter is equipped with an adjustable corner frequency. The corner frequency is established by a voltage generated by potentiometer R20 and buffer U6A. The voltage is applied to voltage–controlled–amplifiers U2 and U3 which control the corner frequency of the equalizer circuit. In addition to the variable corner frequency, the filter is equipped with a variable peak level. Potentiometer R6 controls the signal peak near the corner frequency. Potentiometer R1 controls the left channel level. The output of the circuit is applied to an 8 microsecond delay circuit.

1–134. **8 MICROSECOND DELAY CIRCUIT.** Integrated circuit U4B is configured as an 8 microsecond delay circuit. The delay circuit is a third order low–pass filter designed to provide 8 microseconds of delay to match low and mid frequency delay equalization requirements. The output of the circuit is routed to 8 microsecond delay select jumper P1A. P1A allows the delay circuit to be bypassed if 8 microseconds of delay is not required for equalization operation.

1–135. **4 MICROSECOND DELAY CIRCUIT.** Integrated circuit U5A is configured as a 4 microsecond delay circuit. The delay circuit is a third order low–pass filter designed to provide 4 microseconds of delay to match low and mid frequency delay equalization requirements. The output of the circuit is routed to 4 microsecond delay select jumper J1B. J1B allows the delay circuit to be bypassed if 4 microseconds of delay is not required for equalization operation.

1–136. **ALL-PASS FILTER.** Integrated circuit U5B is configured as an all–pass filter circuit. The circuit is designed to provide a continuously adjustable 0–6 microsecond delay for equalization operation. Potentiometer R26 controls the amount of delay.

1–137. **EQUALIZATION SELECTION CIRCUIT.** The outputs of equalization circuits 1 and 2 are applied to an equalization selection circuit consisting of integrated circuits U23 and U28. U23 and U28 are single–pole switch arrays designed to select audio from the equalization 1 or equalization 2 circuit. U23 and U28 are controlled by: 1) HIGH equalization 1 and equalization 2 control signals from latch U44A and 2) a HIGH stereo signal from the mono/stereo mode decoder circuit. The circuit is designed to select audio in response to the antenna pattern and mode of operation. For example, stereo audio from equalization circuit 1 is required. A HIGH from latch U44A will enable the equalization 1 switches in U23 and U28. U23 and U28 respond by routing audio to an L+R and L–R matrix circuit.

1–138. **L+R AND L-R MATRIX CIRCUIT.** Left and right channel audio from the equalization selection circuit is applied to an L–R and L+R matrix circuit. The circuit consists of integrated circuits U24A, U24B, U25A, U26A, U26B, U27A, U29A, U29B, U25B, U31B, U27B, U27A, and U32. The circuit is designed to generate L+R and L–R audio for application to a phase modulator circuit.

1–139. To provide an example of circuit operation, stereo audio is required from equalization circuit 1. Left channel audio from the equalization circuit 1 input of U23 is applied to buffer U24A. Right channel audio from the equalization circuit 1 input of U28 is applied to buffer U29A. U24A and U29A will output audio which is summed with a pilot signal from pilot on/off switch S1. The audio/pilot signal is applied to the inputs of U23/U28. With a HIGH from the stereo control line of mono/stereo mode decoder circuit: 1) U23 will route the left channel audio/pilot signal to amplifier U24B and 2) U28 will route the right channel audio/pilot signal to amplifier U29B. U24B/U29B amplify the signal to approximately 2.1 volts peak–to–peak. The outputs of U24B/U29B are applied to L+R summing amplifier U25A and L–R summing amplifier U25B.

1–140. A dc voltage for application to L+R summing amplifier U25A is provided by regulator U32. U32 provides a bias voltage for the L+R audio to generate a 1+L+R audio signal. The output of summing amplifier U25A is applied to a negative limiter circuit consisting of integrated circuit U26A and diodes D1 and D2. The circuit is designed to limit negative modulation to –95%. This prevents the loss of carrier during negative modulation. The output of negative limiter U26A is routed through buffer U26B to a phase modulator circuit as a $\overline{1+L+R}$ signal and inverter U27B. U27B generates a 1+L+R signal for application to a phase modulator circuit.

1–141. Left and right channel are summed at U25B to produce an L–R signal. The L–R signal is applied to: 1) a phase modulator circuit as an L–R signal, 2) to inverter U27B, and 3) buffer U31B. U27B generates a $\overline{L-R}$ signal for application to a phase modulator circuit. U31B is designed to buffer the L–R signal for application to an L–R metering circuit on the ECU display circuit board.

1–142. **PHASE MODULATOR CIRCUIT.** 1+L+R, $\overline{1+L+R}$, L–R, and $\overline{L-R}$ signals are applied to a phase modulator circuit. The phase modulator circuit consists of: 1) phase modulator U36, 2) a synchronous divider consisting of integrated circuits U33, U34A, and U34B, and 3) latches U35A and U35B.

1–143. The phase modulator circuit operates from four phase references generated by a synchronous divider and latches U35A/U35B. A reference at four times the carrier frequency from the exciter circuit board is applied to a synchronous divider circuit. The circuit divides the signal by four and generates two outputs which are 90 degrees out–of–phase. The outputs are applied to latches U35A/U35B. U35A/U35B generate four reference signals: 1) 0 degrees, 2) 90 degrees, 3) 180 degrees, and 4) 270 degrees. The reference signals are used to drive phase modulator U36.

1–144. Integrated circuit U36 is a switch array configured as a phase modulator. The four reference signals from latches U35A/U35B are used to drive the 1+L+R, $\overline{1+L+R}$, L–R, and $\overline{L-R}$ signals at U36. The output of U36 produces two signals: 1) a normal AM modulated signal reference to a 0 degree carrier containing the L+R information (I modulator) and 2) a double side–band suppressed carrier signal referenced to a 90 degree carrier containing the L–R information (Q modulator). The signals are summed to produce a quadrature AM signal.

1–145. The quadrature AM signal is applied to integrated circuit U37. U37 is a high–speed operational amplifier designed to amplify the quadrature signal to a 1 volt peak–to–peak level with no modulation. The output of the amplifier is applied to a band–pass filter.

1-146. **BAND-PASS FILTER.** The output of amplifier U37 is applied to a forth order linear phase band-pass filter. The band-pass filter consists of: 1) inductors L4, L5, L6, and L7, 2) capacitors C110 and C115, and 3) programming switches S2, S3, and S4. The filter provides proper amplitude limiting during high single channel conditions. Programming switches S2, S3, and S4 select resistor and capacitor combinations to program the filter for specific groups of frequencies within the AM broadcast band. Inductors L4, L5, L6, and L7 tune the filter for proper operation. The output of the filter is applied to a transistor amplifier array.

1-147. **TRANSISTOR AMPLIFIER CIRCUIT.** The output of the band-pass filter is applied to a transistor array consisting of transistors Q1, Q2, U38B, U38C, U38D, and U38E. The signal is amplified to a 2 volt peak-to-peak level by transistors U38B, U38C, U38D, and U38E. The transistors also perform unbalanced-to-balanced signal conversion. The balanced signal from transistors U38B, U38C, U38D, and U38E are buffered by transistors Q1 and Q2 for application to the amplitude limiter circuit.

1-148. **AMPLITUDE LIMITER CIRCUIT.** The balanced quadrature signal from the transistor amplifier circuit is applied to an amplitude limiter circuit. The amplitude limiter circuit consists of integrated circuits U39A, U39B, and U39C. The circuit produces phase modulation containing the L-R information. The output of the limiter is applied to an output network.

1-149. **OUTPUT NETWORK.** The 1 volt peak-to-peak phase modulated signal from the amplitude limiter circuit is applied to transformer T1. T1 is provided to increase the voltage to a 5 volt peak-to-peak level. The output of T1 is buffered by inverters U40A and U40B. Potentiometer R193 adjusts the symmetry of the signal to null the second harmonic frequency. The output of U40B is routed for application to the exciter circuit board.

1-150. **OPERATING MODE SELECTION AND INDICATION CIRCUIT.** The stereo circuit board can be configured for stereo, mono left, mono right, or mono L+R operation. The circuit board is configured for the desired mode of operation by a mode selection and indication circuit. HIGH remote mono left, mono right, mono L+R, and stereo commands are applied to optical couplers U45 through U48. The outputs of U45 through U48 are applied to OR gates U49A through U49D.

1-151. Local control operations are directed by mode select switch S5. S5 controls a mode counter circuit consisting of integrated circuits U53, U54A, U54B, U54C, and U54D. The switch operates by advancing the counter each time the switch is depressed. This results in the circuit advancing through the modes of operation in the following order: 1) stereo, 2) mono left, 3) mono right, or 4) mono L+R. The mode counter circuit selects a mode by routing a HIGH control command to the OR gates U49A through U49D.

1-152. OR gates U49A through U49D select a command from the remote control optical couplers or the local mode counter circuit. For example, the circuit board is desired to be configured for stereo operation. A HIGH from remote stereo optical coupler U48 or the local mode control circuit is applied to OR gate U49D. U49D outputs a HIGH through OR gate U52A to priority encoder U50. U50 monitors the OR gates for additional commands and determines the highest priority mode of operation. Once the mode of operation is determined, U50 will output a two bit binary code to a mono/stereo decoder circuit.

1–153. The mono/stereo mode decoder circuit consists of: 1) latches U44B, U51A, and U51B and 2) mono/stereo decoder logic U41D, U43B, U43C, U52C, and U52D. Latches U51A and U51B latch the two bit binary code and produce complementary outputs for application to the mono/stereo decoder logic. Latch U44B operates as a clock for U51A/U51B. The mono/stereo decoder logic decodes the binary code and outputs a HIGH to: 1) transistors Q5, Q9, and Q14 and 2) equalization select integrated circuits U23 and U28. Transistor Q14 will respond by generating a LOW internal stereo status signal. Transistor Q5 will output a LOW to bias stereo indicator DS3 to on. Transistor Q9 will respond by generating a LOW remote stereo status signal.

1–154. Selection and indication of the mono left, mono right, and mono L+R modes of operation are performed in an identical manner. When the mono left or mono right mode is selected, a HIGH will be routed to NAND gate U43D. The output of U43D will go HIGH. The HIGH is inverted at U55D to produce a LOW mono single channel signal for application to the exciter circuit board. When the mono left, mono right, or mono L+R mode is selected a HIGH is applied to transistor Q13. Q13 will respond by generating a LOW remote mono status signal.

1–155. **EQUALIZATION SELECTION.** Equalization circuit selection is determined by the antenna connected to the transmitter. Antenna A selects equalization circuit 1. Antenna B selects equalization circuit 2. Antenna C can be programmed to select equalization circuit 1 or equalization circuit 2.

1–156. Antenna A, B, and C status signals are applied to AND gates U41A and U41B. Programmable jumper P6 selects equalization circuit 1 or equalization circuit 2 for antenna C operations.

1–157. The circuit selects equalization circuit 1 or 2 when a status signal is applied to U41A/U41B. For example, a LOW is applied to U41B when antenna A is selected. U41B will output a LOW to NAND gate U43A. Programmable jumper P7 programs the equalization selection circuit for momentary or continuous signals. With P7 programmed for momentary signals, U43A will output a HIGH to AND gate U41C. With a HIGH from U41A, U41C will output a HIGH to latch U44A. U44A will output a HIGH to: 1) integrated circuits U23 and U28 to select equalization circuit 1 and 2) transistor Q4. Q4 will go LOW to bias equalization 1 indicator DS1 on.

1–158. **PILOT SIGNAL.** A 25 Hz square–wave signal from the exciter circuit board is applied through potentiometer R132 to a band–pass filter consisting of integrated circuits U30A and U30B. Potentiometer R132 is designed to provide pilot level control. The band–pass filter converts the square–wave signal to a sine–wave signal.

1–159. The output of the band–pass filter is applied through switch S1 to: 1) integrated circuit U23 and 2) inverter U31A. U31A inverts the signal for application to integrated circuit U28. Switch S1 is provided to disable the pilot signal.

1–160. **POWER SUPPLY FILTER NETWORK.** The stereo circuit board operates from ±15 volt power supplies. Each supply is equipped with a filter network. The +15 volt supply filter consists of inductor L1 and capacitor C92. The output of the filter is applied to the stereo circuit board components. The –15 volt supply filter consists of inductor L2 and capacitor C94. The output of the filter is applied to the stereo circuit board components.

1–161. **ECU POWER SUPPLY ASSEMBLY.**

1–162. The ECU assembly is equipped with a modular 40W switching power supply assembly. The supply provides regulated +5V, +15V, and –15V operating potentials for the ECU circuit boards.

1–163. The power supply for the ECU controller circuit board is back–up by a 9V battery. During an ac power failure, the battery will maintain the transmitter operating configuration stored in the controller logic circuitry. Once power is returned to the transmitter, the transmitter will automatically resume operation in the configuration appearing prior to the ac failure. If an extended ac power failure occurs, the transmitter will be operated to off by an ac loss/auto shutdown circuit on the controller circuit board.

SECTION II
TRANSMITTER ECU MAINTENANCE

2-1. INTRODUCTION.

2-2. This section provides maintenance information for the AM-2.5E/AM-5E transmitter ECU (exciter/control unit).

2-3. SAFETY CONSIDERATIONS.

WARNING

WARNING

WARNING

WARNING

THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.

2-4. The AM-2.5E/AM-5E transmitters contain high voltages and currents. If safety precautions are not practiced, contact with the high voltages and currents could cause serious injury or death. The transmitter is equipped with many built-in safety features, however good judgement, care, and common sense must be practiced to prevent accidents.

2-5. In addition to high voltages and currents, the transmitters contain multiple circuit grounds with high ac and dc potentials with respect to the cabinet which is at earth potential. The potentials could cause serious injury or death if maintenance personnel simultaneously touch a circuit ground and the cabinet. As a result, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Therefore, never energize the transmitter with test equipment connected to the transmitter output network, RF power module, RF combiner, or power supply components. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-6. ECU CIRCUIT BOARD INSTALLATION/REMOVAL.

2-7. The transmitter ECU is equipped with three circuit boards: 1) exciter, 2) stereo, and 3) controller. Each circuit board is equipped with finger holes for the ease of removal and installation. To remove a circuit board, grasp the board using the finger holes and firmly pull the circuit board out of the ECU.

CAUTION ***THE TRANSMITTER MAY BE DAMAGED IF THE ECU CIRCUIT BOARDS ARE NOT SECURELY SEATED INTO***

CAUTION ***THE CONNECTORS.***

2-8. To install the circuit boards: 1) the boards must be inserted into the proper location in the ECU and 2) the boards must be firmly seated into the ECU motherboard. To install a circuit board, proceed as follows:

1. Refer to Figure 5-4 in PART I, SECTION V MAINTENANCE to determine the circuit board location.
2. Insert the circuit board in the appropriate location.
3. Firmly press the circuit board into the connector to engage the connector housing.
4. Firmly press the circuit board into the connector again to engage the connector pins.
5. Repeat the procedure for each ECU circuit board.

2-9. FIRST LEVEL MAINTENANCE.

2-10. First level maintenance consists of precautionary procedures applied to the equipment to prevent future failures. The procedures are performed on a regular basis and the results recorded in a performance log.

2-11. CLEANING AND INSPECTION.

WARNING ***NEVER OPEN THE EQUIPMENT UNLESS ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED. ENSURE ALL TRANSMITTER PRIMARY POWER IS DISCONNECTED BEFORE ATTEMPTING MAINTENANCE ON ANY AREA WITHIN THE TRANSMITTER.***

WARNING

2-12. Clean the ECU circuit boards of accumulated dust as required using a nylon bristle brush and vacuum cleaner. Inspect the circuit boards for improperly seated semiconductors and components damage by overheating. In addition, inspect the ECU for loose hardware. Ensure all ECU interconnecting cables are secure.

2-13. SECOND LEVEL MAINTENANCE.

2-14. Second level maintenance is the performance of procedures required to restore the ECU to operation after a fault has occurred. The procedures are divided into electrical adjustments procedures and troubleshooting.

2-15. ELECTRICAL ADJUSTMENTS.

2-16. The following text provides electrical adjustment procedures for the transmitter ECU. The procedures are presented in the following order.

1. ECU Extender Circuit Board Operation.
2. Controller Circuit Board Adjustments.
3. ECU Meter Switch Circuit Board Adjustments.

4. Stereo Circuit Board Adjustments.
5. Exciter Circuit Board Adjustments.
6. Display Circuit Board Adjustments.

2-17. **ECU EXTENDER CIRCUIT BOARD OPERATION.**

2-18. The ECU is equipped with an extender circuit board. The circuit board is designed to allow access to the ECU circuit board components for maintenance procedures. To use the circuit board for maintenance procedures, proceed as follows:

1. Refer to Figure 5-4 in PART I, SECTION V MAINTENANCE and locate the extender circuit board assembly in the ECU.
2. Remove the extender circuit board from the ECU.
3. Loosen the extender circuit board locking nut.
4. Completely extend the circuit board.
5. Tighten the extender circuit board locking nut.
6. Remove the circuit board required for maintenance and place the extender circuit board in the location in the ECU.
7. Place the desired circuit board onto the extender circuit board.
8. Firmly press the circuit board into the extender circuit board connectors.

2-19. **CONTROLLER CIRCUIT BOARD ADJUSTMENTS.**

2-20. **P1 SET - P5 SET CONTROLS.** The P1 SET through P5 SET controls adjust the ECU POWER CONTROL 1 through 5 controls to desired levels. A complete description of the procedure to adjust the power level controls is presented in SECTION II, INSTALLATION. Refer to POWER LEVEL AND MODULATION CALIBRATION ADJUSTMENT in SECTION II for the adjustment procedure.

2-21. **FWD AND RFL CALIBRATIONS.** FWD CAL control R56 and RFL CAL control R143 calibrate the transmitter forward and reflected power samples. Due to the critical nature of the FWD CAL and RFL CAL controls, the controls are not considered field adjustable. If the controls are required to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the FWD and RFL CAL controls.

2-22. **ECU METER SWITCH CIRCUIT BOARD ADJUSTMENTS.**

2-23. **FORWARD POWER METER LOW AND HIGH SCALE CALIBRATIONS.** Low scale control R501 and high scale control R504 calibrate the forward power meter. Due to the critical nature of the low scale and high scale meter calibrate controls, the controls are not considered field adjustable. If the controls are required to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the low and high scale forward power meter controls.

2-24. **REFLECTED POWER METER LOW AND HIGH SCALE CALIBRATIONS.** Low scale control R505, high scale control R506, and ac sample control R511 calibrate the reflected power meter. Due to the critical nature of the low scale, high scale, and ac sample meter calibrate controls, the controls are not considered field adjustable. If the controls are required to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the low scale, high scale, and ac sample reflected power meter controls.

2-25. **FWD AND RFL CALIBRATIONS.** FWD CAL control R56 and RFL CAL control R143 calibrate the transmitter forward and reflected power samples. Due to the critical nature of the FWD CAL and RFL CAL controls, the controls are not considered field adjustable. If the controls are required to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the FWD and RFL CAL controls.

2-26. **STEREO CIRCUIT BOARD ADJUSTMENTS.**

2-27. **STEREO ADJUSTMENT.** The stereo adjustment consists of configuring the equalization circuitry on the stereo circuit board to obtain the optimum stereo performance. The equalization circuitry consists of the equalization circuit 1 and equalization circuit 2 controls. A complete description of the procedure to adjust the equalization controls is presented in SECTION II, INSTALLATION. Refer to STEREO ADJUSTMENT in SECTION II for the adjustment procedure.

2-28. **EXCITER CIRCUIT BOARD ADJUSTMENTS.**

2-29. **MODULATION CALIBRATION.** Modulation calibration control R62 calibrates the exciter modulation circuit. Due to the critical nature of the modulation calibration control, the control is not considered field adjustable. If the control is to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the modulation calibration control.

2-30. **PHASE MODULATOR CALIBRATION.** Phase modulator calibration control R159 calibrates the exciter phase modulator circuit. Due to the critical nature of the phase modulator calibration control, the control is not considered field adjustable. If the control is to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the phase modulator calibration control.

2-31. **SYMMETRY CONTROL.** Symmetry calibration control R170 adjusts the exciter RF output square-wave signal. Due to the critical nature of the symmetry control, the control is not considered field adjustable. If the control is to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the symmetry control.

2-32. **IPM CORRECTION CIRCUIT CONTROLS.** IPM GAIN control R189, IPM TRACK control R104, IPM SHAPE CONTROL R198, and IPM ZERO SET control R191 calibrate the IPM correction circuit. Due to the critical nature of the IPM correction circuit controls, the controls are not considered field adjustable. If the controls are to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the IPM correction circuit controls.

2-33. **SINGLE CHAN MONO LEVEL CONTROL.** SINGLE CHAN MONO LEVEL control R41 is designed to boost a remaining audio channel level in the event of a failure in one channel. A complete description of the procedure to adjust the SINGLE CHAN MONO LEVEL control is presented in SECTION II, INSTALLATION. Refer to SINGLE CHANNEL LEVEL in SECTION II for the adjustment procedure.

2-34. **AVERAGE MODULATION LIMIT CONTROL.** Average modulation limit control R217 limits the average tone modulation. The control is adjusted to limit at 110% tone modulation. Due to the critical nature of the modulation calibration control, the control is not considered field adjustable. If the control is to be adjusted, contact the Broadcast Electronics Customer Service Department for information and instructions to adjust the average modulation limit control.

2-35. **NEG LIMIT CONTROL.** NEG LIMIT control R76 limits the negative L+R information to prevent excessive modulation when the L+R signal is summed with the pilot tone. The NEG LIMIT control is adjusted in the following procedure.

2-36. **Procedure.** To adjust NEG LIMIT control R76, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-37. Disconnect all transmitter primary power.

2-38. Connect the audio generator to the TB2 LEFT INPUT and RIGHT INPUT audio terminals on the ECU rear-panel.

2-39. Adjust NEG LIMIT control R76 on the exciter circuit board fully counterclockwise.

2-40. Adjust the audio generator for a L=R 1 kHz output at +10 dBm.

2-41. Adjust the AM stereo modulation monitor to indicate positive L+R modulation.

2-42. Energize the transmitter primary power and operate the transmitter.

2-43. Observe the modulation monitor and ensure the monitor indicates 100% positive L+R modulation. If the monitor does not indicate 100% L+R modulation, adjust the audio generator level slightly for a +100% L+R modulation indication on the monitor.

2-44. Adjust the AM stereo modulation monitor to indicate negative L+R modulation.

2-45. Adjust NEG LIMIT control R76 on the exciter circuit board until the AM stereo Modulation monitor indicates -95% L+R modulation.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-46. Disconnect all transmitter primary power.

2-47. Remove all test equipment.

2-48. **FREQUENCY CALIBRATION CONTROL.** Frequency calibration control C108 calibrates the exciter frequency synthesizer. The frequency calibration control is adjusted in the following procedure.

2-49. **Procedure.** To adjust frequency calibration control C108, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2-50. Disconnect all transmitter primary power.

2-51. Remove the exciter circuit board and install the ECU extender circuit board in the exciter circuit board location.

2-52. Install the exciter circuit board on the extender circuit board.

2-53. Connect a frequency counter to test point TP15 on the exciter circuit board.

2-54. Energize the transmitter primary power and operate the transmitter.

2-55. Adjust frequency calibration control C108 on the exciter circuit board for the carrier frequency.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–56. Disconnect all transmitter primary power.

2–57. Remove all test equipment and replace the exciter circuit board.

2–58. **DISPLAY CIRCUIT BOARD ADJUSTMENTS.**

2–59. **L/L+R AND R/L-R DISPLAY CALIBRATION CONTROL.** L/L+R calibration control R42 and R/L–R calibration control R48 calibrate the L/L+R and R/L–R displays. The L/L+R and R/L–R calibration controls are adjusted in the following procedure.

2–60. **Procedure.** To adjust L/L+R calibration control R42 and R/L–R calibration control R48, proceed as follows:

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–61. Disconnect all transmitter primary power.

2–62. Connect the audio generator to the TB2 LEFT INPUT and RIGHT INPUT audio terminals on the ECU rear–panel. Operate the transmitter at a normal output power and the EXCITER MONITOR for L+R/L–R indications.

2–63. Adjust the audio generator for an in–phase L=R 1 kHz output at a level to generate 100% modulation as indicated by the modulation monitor. Adjust L/L+R calibration control R42 until the EXCITER MONITOR just indicates 100% L+R modulation.

2–64. Adjust the audio generator for an out–of–phase L=R 1 kHz output at a level to generate 100% L–R modulation as indicated by the modulation monitor. Adjust R/L–R calibration control R48 until the EXCITER MONITOR just indicates 100% L–R modulation.

WARNING ***DISCONNECT ALL TRANSMITTER PRIMARY POWER BEFORE PROCEEDING.***

WARNING

2–65. Disconnect all transmitter primary power and remove all test equipment.

2–66. **TROUBLESHOOTING.**

WARNING ***THE TRANSMITTER CONTAINS MULTIPLE CIRCUIT GROUNDS WITH HIGH AC AND DC POTENTIALS WITH RESPECT TO THE CABINET WHICH IS AT EARTH POTENTIAL. DO NOT ENERGIZE THE TRANSMITTER WITH TEST EQUIPMENT CONNECTED TO THE TRANSMITTER OUTPUT NETWORK, RF POWER MODULE, RF COMBINER, OR POWER SUPPLY COMPONENTS.***

WARNING

WARNING

WARNING

2–67. **SAFETY CONSIDERATIONS.** The AM–2.5E/AM–5E transmitters are equipped with extensive indicator and meter circuitry to allow the operator to isolate problems to a specific area within the transmitter. Due to the hazardous voltages and currents contained in the equipment, operation of the transmitter with test equipment connected to transmitter output network, RF power module, RF combiner, or power supply components is extremely dangerous and must not be attempted. Test equipment may be connected to the ECU circuit boards from the front of the transmitter using the supplied extender circuit board with power energized. Therefore, the transmitter indicators and meters must be used to isolate a problem to a specific area. The maintenance procedures presented in this section should be performed only by trained and experienced maintenance personnel.

2-68. **TROUBLESHOOTING PROCEDURES.** The ECU assembly troubleshooting procedures are presented in Tables 2-1 through 2-4. Table 2-1 presents the exciter circuit board troubleshooting. Table 2-2 presents the stereo circuit board troubleshooting. Table 2-3 presents the controller circuit board troubleshooting. Table 2-4 presents the ECU power supply troubleshooting. Refer to Tables 2-1 through 2-4 to isolate the problem to a specific circuit. Once the trouble is isolated, refer to the circuit board theory of operation and schematic diagrams to assist in problem resolution.

TABLE 2-1. EXCITER CIRCUIT BOARD TROUBLESHOOTING
(Sheet 1 of 3)

SYMPTOM	CIRCUITRY TO CHECK
LOCK INDICATOR EXTINGUISHED	1. Refer to the factory test data sheets and ensure the exciter circuit board frequency synthesizer (S1, S2, and J6) is programmed for the correct operating frequency. 2. Check U25 pin 1 for a 0V to 5V square-wave signal at FcX4 (carrier frequency times four) or FcX8 (carrier frequency times eight). A. If the square-wave signal at U25 is not present, check for a greater than 13 volt dc signal at the anode of D23. 1. If the dc voltage is present, defective VCO, Q4, or U30A. 2. If the dc voltage is not present, defective Q3 or C106. B. If the square wave signal at U25 is below FcX4 or FcX8, measure the dc voltage at J8 of the VCO assembly. 1. If the dc voltage at TP7 is greater than 13 volts, defective VCO. 2. If the dc voltage at TP7 is less than 2 volts, defective U25, U26A, U26B, Y1, or U24. C. If the square wave signal at U25 is above FcX4 or FcX8, measure the dc voltage at TP7 of the VCO assembly. 1. If the dc voltage at TP7 is greater than 13 volts, defective U25, U26B, U26A, Y1, or U24. 2. If the dc voltage at J8 is less than 2 volts, defective VCO.
NO L+R MODULATION OF CARRIER DURING MONO-PHONIC OPERATION	1. Remove the stereo circuit board if present and place J4 in the left or right channel position as determined by the channel with applied audio. 2. Insert a +10 dBm 1 kHz signal in the appropriate audio channel and check for audio at U39 pins 3 and 6. A. If the audio is not present, defective: 1) left channel - U39, U2A, U2B, U1A, or U1B 2) right channel - U39, U4A, U4B, U5A, or U5B. B. If the audio is present, defective U8A, U8B, U9A, U9B, U14B, or U13.

TABLE 2-1. EXCITER CIRCUIT BOARD TROUBLESHOOTING
(Sheet 2 of 3)

SYMPTOM	CIRCUITRY TO CHECK
NO L+R MODULATION DURING STEREO OPERATION	1. Defective U39, U8A, U8B, U9A, U9B, U14B, or U13.
RF DRIVE INDICATORS EXTINGUISHED ON A POWER BLOCK	1. Check for a square-wave carrier frequency signal at U46 pins 1 and 7. A. If the carrier frequency signal is present, defective Q13 through Q22, L4, D38 through D45, or D51, D52. B. If the carrier frequency signal is not present, check for a 0V-5V p-p square-wave carrier frequency signal present at U40 pins 1 and 16. 1. If the carrier frequency signal is present, defective U46. 2. If the carrier frequency signal is not present, defective U40.
PWM DRIVE INDICATOR EXTINGUISHED ON A POWER MODULE	1. Defective U21A through U21F, U19, U20, U45, D6 through D21, or D47 through D50.
RED EXCITER INDICATOR ILLUMINATED ON TRANSMITTER MONITOR	1. Check the frequency synthesizer programming at S1, S2, and J6 2. Check for a square-wave carrier frequency signal at U23 pin 12. A. If the carrier frequency signal is present, check for a 4V p-p 125 kHz to 133 kHz PWM triangle-wave at TP-5. 1. If the PWM signal is present, defective U22A or U23A. 2. If the PWM signal is not present, defective U10, Q1, U42A, U31A. B. If the carrier frequency signal at U23 pin 12 is not present, check for a 2XFC (two times carrier frequency) at TP-9. 1. If the carrier frequency signal is present, defective U33C or U33D, U39A, U39B, U39C U40 or Q8. 2. If the carrier frequency signal is not present, check for a carrier frequency signal at TP-15. a. If the signal is present, defective Q5, Q6, Q7, U37, U38A, U38B, U38C, or U38D. b. If the signal is not present, check for a 0V-5V p-p carrier frequency signal at U29 pin 12. 1. If the carrier frequency signal is present, defective U31B, U42B, U32A, U32B, U32C, U32D, U30C or P7. 2. If the carrier frequency signal is not present, defective U33A, U30B, or U29.

TABLE 2-1. EXCITER CIRCUIT BOARD TROUBLESHOOTING
(Sheet 3 of 3)

SYMPTOM	CIRCUITRY TO CHECK
LOW DEMODULATOR LEFT CHANNEL MODULATION LEVEL WITH LOW EXCITER MONITOR LEFT CHANNEL MODULATION LEVEL	1. Defective U2A, U2B, U1A, U1B, U3A, U3B or P2 programming.
LOW DEMODULATOR RIGHT CHANNEL MODULATION LEVEL WITH LOW EXCITER MONITOR RIGHT CHANNEL MODULATION LEVEL	1. Defective U5A, U5B, U4A, U4B, U6A, U6B or P3 programming.

TABLE 2-2. STEREO CIRCUIT BOARD TROUBLESHOOTING
(Sheet 1 of 2)

SYMPTOM	CIRCUITRY TO CHECK
RED EXCITER INDICATOR ILLUMINATED ON TRANSMITTER MONITOR	1. Insert a 1 kHz audio signal at +10 dBm into the left channel and operate the stereo circuit board to stereo. Check for a 3.0V p-p quadrature AM signal at TP-7. A. If the signal is present, defective U40A, U40B, T1, U39A, U39B, or U39C. B. If the signal is not present, check for a quadrature AM signal at U38 pin 3. 1. If the signal is present, defective U38A, U38B, U38C, U38D, U38E, Q1, or Q2. 2. If the signal is not present, check for a quadrature AM signal at U37 pin 1. a. If the signal is present, defective U37, L4, L5, L6, L7, D3, D4, or the S2, S3, or S4 programming. b. If the signal is not present, defective U36, U35A, U35B, U34A, U34B, U33, U32, or U26.
NO L-R MODULATION PRESENT AT THE EXCITER MONITOR METER	1. Defective U25B, U27B or U31B.

TABLE 2-2. STEREO CIRCUIT BOARD TROUBLESHOOTING
(Sheet 2 of 2)

SYMPTOM	CIRCUITRY TO CHECK
LOW DEMODULATOR LEFT CHANNEL MODULATION LEVEL WITH NORMAL EXCITER MONITOR LEFT CHANNEL MODULATION LEVEL	1. Insert a +10 dBm 1 kHz signal into the left channel. Check for a 2V p-p 1 kHz signal at U4 pin 1. A. If the signal is present, defective U4B, U5A, U5B, or J1. B. If the signal is not present, defective U1A, U2, U1B, U3, or U4A .
LOW DEMODULATOR RIGHT CHANNEL MODULATION LEVEL WITH NORMAL EXCITER MONITOR RIGHT CHANNEL MODULATION LEVEL	1. Insert a +10 dBm 1 kHz signal into the right channel. Check for a 2V p-p 1 kHz signal at U10 pin 1. A. If the signal is present, defective U10B, U11A, U11B, or J2. B. If the signal is not present, defective U7A, U8, U7B, U9, or U10A.

TABLE 2-3. CONTROLLER CIRCUIT BOARD TROUBLESHOOTING
(Sheet 1 of 2)

SYMPTOM	CIRCUITRY TO CHECK
NO POWER CONTROL PWM SIGNAL	1. Check for a 1 kHz 15V p-p square-wave signal at TP-7. A. If the square-wave signal is present, defective Q22. B. If the square-wave signal is not present, check for a 1 kHz 50% duty-cycle square-wave signal at TP8. 1. If the square-wave signal is not present, defective U44B, U40C, or U46E. C. If the square-wave signal is not present, check for a dc voltage proportional to power at TP11. 1. If the dc voltage is present, defective U44A, U40B, U41A, U42, or U43. 2. If the dc voltage is not present, contact the Broadcast Electronics Customer Service Department. 2. Check for a HIGH at U36C pin 8. A. If the HIGH is present, defective U36C. B. If the HIGH is not present, contact the Broadcast Electronics Customer Service Department.

TABLE 2-3. CONTROLLER CIRCUIT BOARD TROUBLESHOOTING
(Sheet 2 of 2)

SYMPTOM	CIRCUITRY TO CHECK
NO TRANSMITTER ON SIGNAL OUTPUT	1. Check for a HIGH at U23A pin 3. A. If the HIGH is present, defective Q13. B. If the HIGH is not present, check for a LOW at U23A pin 2. 1. If the LOW is present, defective U23A. 2. If a HIGH is present, contact the Broadcast Electronics Customer Service Department.
CONFLICT INDICATOR ILLUMINATED	1. Check U7, U8, U9, S1, S2, S3, U12A, U12B, U21A, U21B, U21C, U20A, U20B, U20C, U20D, U19, and U13.

TABLE 2-4. ECU POWER SUPPLY TROUBLESHOOTING

SYMPTOM	CIRCUITRY TO CHECK
NO OUTPUT POWER NO NORMAL/FAULT ECU INDICATIONS	1. Check the ECU power supply fuse. 2. Check the ECU power supply assembly.

2-69. **COMPONENT REPLACEMENT PROCEDURE.** Component replacement procedures for the ECU assembly circuit boards are presented in PART I SECTION V. Refer to COMPONENT REPLACEMENT in SECTION V as required for the replacement procedures.

SECTION III
ECU ASSEMBLY
PARTS LIST

3-1. INTRODUCTION.

3-2. This section provides descriptions and part numbers of electrical components, assemblies, and selected mechanical parts required for maintenance of the ECU assembly. Each table entry in this section is indexed by reference designators appearing on the applicable schematic.

TABLE 3-1. REPLACEABLE PARTS LIST INDEX

TABLE	DESCRIPTION	PART NO.	PAGE
3-2	Exciter/Controller Assembly	957-0009-100	3-2
3-3	ECU Controller Circuit Board Assembly	917-0205	3-2
3-4	ECU Extender Circuit Board Assembly	917-0208	3-11
3-5	Stereo Circuit Board Assembly	917-0209	3-11
3-5	ECU Exciter Circuit Board Assembly	917-0300	3-20
3-6	ECU Motherboard Circuit Board Assembly	917-0301	3-29
3-7	ECU Display/Control Switch Circuit Board	917-0306-001	3-31
3-8	Meter Switch Circuit Board Assembly	917-0306-005	3-34
3-9	ECU Wire Harness	947-0153	3-34

TABLE 3-2. EXCITER/CONTROLLER ASSEMBLY - 957-0009-100

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Varistor, V275LA20A GE	140-0036	1
----	Power Input Connector/RFI Filter, 3 Amperes, 250V ac, 50/60 Hz	339-0008	1
----	Filter, Window, Grey	467-1001-1	1
----	Power Supply, SMPS, 3 Output, 40W	540-0006	1
----	ECU Controller Circuit Board Assembly	917-0205	1
----	ECU Extender Circuit Board Assembly	917-0208	1
----	Stereo Circuit Board Assembly	917-0209	1
----	ECU Exciter Circuit Board Assembly	917-0300	1
----	ECU Motherboard Circuit Board Assembly	917-0301	1
----	ECU Display/Controller Switch Circuit Board Assembly	917-0306-001	1
----	Meter Switch Circuit Board Assembly	917-0306-005	1
----	ECU Harness Assembly	947-0153	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 1 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 thru C33	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	33
C34, C35	Capacitor, Electrolytic, 10 uF, 35V, Non-Polarized	023-1075	2
C36, C37	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	2
C38	Capacitor, Mylar, 0.033 uF, 50V	038-1049	1
C39 thru C48	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	10
C49	Capacitor, Electrolytic, 10 uF, 35V, Non-Polarized	023-1075	1
C50	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	1
C51, C52	Capacitor, Electrolytic, 10 uF, 25V, Non-Polarized	023-1075	2
C53	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	1
C54 thru C56	Capacitor, Electrolytic, 10 uF, 35V, Non-Polarized	023-1075	3
C57	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	1
C58	Capacitor, Electrolytic, 2.2 uF, 25V dc	013-2064	1
C59	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	1
C60	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030-1033	1
C61, C62	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	2
C63	Capacitor, Electrolytic, 2.2 uF, 25V dc	013-2064	1
C64	Capacitor, Electrolytic, 10 uF, 35V, Non-Polarized	023-1075	1
C65, C66	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	2
C67	Capacitor, Electrolytic, 1 uF, 50V	024-1064	1
C68 thru C71	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	4
C72, C73	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030-1033	2
C74	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	1
C75 thru C87	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030-1033	13
C88	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 2 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C89	Capacitor, Electrolytic, 2.2 uF, 25V dc	013–2064	1
C90, C91	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C92	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C93	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C94	Capacitor, Electrolytic, 2.2 uF, 25V dc	013–2064	1
C95	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C96	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C97	Capacitor, Electrolytic, 2.2 uF, 25V dc	013–2064	1
C98, C99	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	2
C100	Capacitor, Mylar Film, 0.1 uF ±10%, 50V	003–1066	1
C101	Capacitor, Monolythic Ceramic, .47 uF ±20%, 50V	003–4743	1
C102	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C103	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C104, C105	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C106	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C107	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C108	Capacitor, Electrolytic, 1 uF, 50V	024–1064	1
C109	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C110	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C111 thru C114	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C115	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C116	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C117, C118	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C121	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C122 thru C125	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C126 thru C128	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C129	Capacitor, Mylar Film, 0.01 uF ±10%, 200V	030–1043	1
C130	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C131	Capacitor, Electrolytic, 1 uF, 50V	024–1064	1
C132	Capacitor, Electrolytic, 33 uF, 35V	024–3374	1
C133, C134	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C135	Capacitor, Mica, 270 pF ±5%, 300V	041–2722	1
C136, C137	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	2
D1	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D2	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D3	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D4	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D5	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D6	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D7	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D8	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D9	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D10	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D11	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D12	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 3 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
D13 thru D18	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	6
D19	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D20	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
D21	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D22 thru D29	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	8
D30, D31	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	2
D32	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D33	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	1
D34, D35	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D36, D37	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	2
D38	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D39, D40	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	2
D41	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	1
D42	Diode, HP5082–2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201–2800	1
D44 thru D45	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
D49 thru D51	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	3
D53 thru D64	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	12
DS1, DS2	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum	323–9224	2
DS3	Indicator, LED, Yellow, 521–9176, 3V @ 40 mA Maximum	323–9225	1
E10	Terminal, Turret, Double Shoulder	413–1597	1
J1 thru J3	Receptacle, Male, 3–Pin In–line	417–0003	3
J4 thru J20	Receptacle, Male, 2–Pin In–line	417–4004	17
P1 thru P3	Jumper, Programmable, 2–Pin	340–0004	3
P6	Jumper, Programmable, 2–Pin	340–0004	1
P8 thru P19	Jumper, Programmable, 2–Pin	340–0004	12
P301	Receptacle, 50–Pin Dual In–line	417–0147	1
P302	Connector, Female, 80–Pin, Dual In–Line Printed Circuit Board Mount	417–0188	1
Q1 thru Q37	Transistor, 2N7000, FET, N–Channel, TO–92 Case	210–7000	37
Q38 thru Q45	Transistor, VP0106N3, FET, P–Channel, TO–92 Case	210–0106	8
Q46 thru Q51	Transistor, 2N7000, FET, N–Channel, TO–92 Case	210–7000	6
Q52	Transistor, VP0106N3, FET, P–Channel, TO–92 Case	210–0106	1
Q53, Q54	Transistor, 2N3906, PNP, Silicon, TO–92 Case	210–3906	2

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 4 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q55	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	1
Q57 thru Q59	Transistor, 2N7000, FET, N-Channel, TO-92 Case	210-7000	3
R1	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R2 thru R6	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179-1053	5
R7	Resistor, 301 k Ohm ±1%, 1/4W	103-3061	1
R8	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R9	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	1
R10	Resistor, 4.42 k Ohm ±1%, 1/4W	103-4441	1
R11, R12	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	2
R13	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R14	Resistor, 43.2 k Ohm ±1%, 1/4W	103-4325	1
R15	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R16	Resistor, 20.0 k Ohm ±1%, 1/4W	103-2051	1
R17	Resistor, 2.32 k Ohm ± 1%, 1/4W	103-2341	1
R18	Resistor, 1.74 k Ohm ± 1%, 1/4W	103-1744	1
R19, R20	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	2
R21	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	1
R22	Resistor, 1.47 k Ohm, ±1%, 1/4W	103-1474	1
R23	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R24	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R25	Resistor, 301 k Ohm ±1%, 1/4W	103-3061	1
R26 thru R28	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	3
R29	Resistor, 20.0 k Ohm ±1%, 1/4W	103-2051	1
R30	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R31	Resistor, 301 k Ohm ±1%, 1/4W	103-3061	1
R32	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R33 thru R35	Resistor, 2.21 k Ohm ±1%, 1/4W	103-2241	3
R36	Resistor, 392 Ohm ±1%, 1/4W	103-3923	1
R37, R38	Resistor, 240 Ohm ±1%, 1/4W	103-2431	2
R39	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R40	Resistor, 4.75 k Ohm ±1%, 1/4W	103-4741	1
R41	Resistor, 240 Ohm ±1%, 1/4W	103-2431	1
R42	Resistor, 392 Ohm ±1%, 1/4W	103-3923	1
R43	Resistor, 182 Ohm, ±1%, 1/4W	103-1823	1
R44	Resistor, 392 Ohm ±1%, 1/4W	103-3923	1
R45	Resistor, 4.75 k Ohm ±1%, 1/4W	103-4741	1
R46	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R47	Resistor, 1 Meg Ohm ±1%, 1/4W	103-1007	1
R48	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R49	Resistor, 90.9 k Ohm ±1%, 1/4W	103-9095	1
R50	Resistor, 47.5 k Ohm ±1%, 1/4W	103-4755	1
R51	Resistor, 121 k Ohm ±1%, 1/4W	103-1261	1
R52	Resistor, 301 k Ohm ±1%, 1/4W	103-3061	1
R53, R54	Resistor, 10 Ohm, ±1%, 1/4W	103-1021	2

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 5 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R55	Resistor, 392 Ohm ±1%, 1/4W	103–3923	1
R56	Potentiometer, 500 Ohm ±10%, 1 1/4W	178–5001	1
R57	Resistor, 750 Ohm ±1%, 1/4W	103–7503	1
R58	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R59	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R60, R61	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	2
R62	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R63, R64	Resistor, 392 Ohm ±1%, 1/4W	103–3923	2
R65, R66	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R67	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	1
R68 thru R70	Resistor, 47.5 k Ohm, ±1%, 1/4W	103–4755	3
R71	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	1
R72	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R73	Resistor, 4.7 Meg Ohm ±5%, 1/4W	100–4773	1
R74	Resistor, 150 Ohm ±1%, 1/4W	100–1531	1
R75	Resistor, 61.9 k Ohm ±1%, 1/4W	103–6195	1
R76	Resistor, 3.92 k Ohm ±1%, 1/4W	103–3924	1
R77	Resistor, 1.47 k Ohm, ±1%, 1/4W	103–1474	1
R78	Resistor, 4.7 Meg Ohm ±5%, 1/4W	100–4773	1
R79, R80	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R81, R82	Resistor, 20.0 k Ohm ±1%, 1/4W	103–2051	2
R83	Resistor, 4.7 Meg Ohm ±5%, 1/4W	100–4773	1
R84	Resistor, 47.5 k Ohm ±1%, 1/4W	103–4755	1
R85	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R86	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R87	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R88	Resistor, 150 k Ohm ±1%, 1/4W	103–1561	1
R89	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	1
R90	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R91	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R92	Resistor, 25.5 k Ohm ±1%, 1/4W	103–2551	1
R93	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R94	Resistor, 10 Ohm, ±1%, 1/4W	103–1021	1
R95	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R96	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R97	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R98	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R99	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R100	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R101	Resistor, 240 Ohm ±1%, 1/4W	103–2431	1
R102	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R103	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R104	Resistor, 16.9 k Ohm ±1%, 1/4W	103–1695	1
R105	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R106	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R107	Resistor, 1.47 k Ohm, ±1%, 1/4W	103–1474	1
R108	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 6 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R109	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R110 thru R122	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	13
R123	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R124	Resistor, 5.76 k Ohm ±1%, 1/4W	103–5764	1
R125	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R126 thru R130	Resistor, 240 Ohm ±1%, 1/4W	103–2431	5
R131 thru R133	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	3
R134	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R135	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R136	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	1
R137	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R138	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R139, R140	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R141	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R142	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R143	Potentiometer, 500 Ohm ±10%, 1 1/4W	178–5001	1
R144	Resistor, 750 Ohm ±1%, 1/4W	103–7503	1
R145 thru R147	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	3
R148 thru R150	Resistor, 47.5 k Ohm, ±1%, 1/4W	103–4755	3
R151	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	1
R152	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R153	Resistor, 499 Ohm ±1%, 1/4W	103–4993	1
R154, R155	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R156	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R157	Resistor, 90.9 k Ohm ±1%, 1/4W	103–9095	1
R158	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R159	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R160	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R161	Resistor, 301 k Ohm ±1%, 1/4W	103–3061	1
R162	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R163	Resistor, 499 Ohm ±1%, 1/4W	103–4993	1
R164, R165	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R166	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R167	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100–3373	1
R168	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R169	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R170	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R171	Resistor, 26.1 k Ohm, ±1%, 1/4W	103–2615	1
R172, R173	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R174 thru R176	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	3
R177	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R179, R181	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 7 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R183, R184	Resistor, 392 Ohm ±1%, 1/4W	103–3923	2
R187, R188	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R189	Resistor, 20.0 k Ohm ±1%, 1/4W	103–2051	1
R190	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R191	Resistor, 4.7 Meg Ohm ±5%, 1/4W	100–4773	1
R192 thru R194	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R195	Resistor, 26.1 k Oh ±1%, 1/4W	103–2615	1
R196	Resistor, 121 k Ohm ±1%, 1/4W	103–1261	1
R197	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R198	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R199	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R200	Resistor, 2.2 Meg Ohm ±5%, 1/4W	100–2273	1
R201 thru R205	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	5
R206	Resistor, 475 k Ohm ±1%, 1/4W	103–4731	1
R207, R208	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R209	Resistor, 1.47 k Ohm, ±1%, 1/4W	103–1474	1
R210	Resistor, 499 Ohm ±1%, 1/4W	103–4993	1
RN1, RN2	Resistor Network, 10 k Ohm ±2%, 1W Resistors, 8–Pin Single In–Line Package	226–1051	2
RN3, RN4	Resistor Network, 9–100 k Ohm, ±2%, .17W Resistors, 10–Pin Single In–Line Package	226–1060	2
RN5	Resistor Network, 10 k Ohm ±2%, 1W Resistors, 8–Pin Single In–Line Package	226–1051	1
RN6, RN7	Resistor Network, 9–100 k Ohm, ±2%, 2.7W Resistors, 10–Pin Single In–Line Package	226–1060	2
RN8	Resistor Network, 10 k Ohm ±2%, 1W Resistors, 8–Pin Single In–Line Package	226–1051	1
S1 thru S3	Switch, SPST, 4–Position, 8–Pin DIP Dual In–Line	340–0002	3
S4	Switch, Miniature Toggle, DPDT, 0.4 vA Maximum at 20V ac or dc	340–0060	1
S5	Switch, Push, N.O. Momentary Contact, Miniature, 1A @ 120V Maximum	343–6330	1
TP1 thru TP6	Test, Jack, Right Angle PC Mounting	417–0004	6
TP7 thru TP12	Terminal, Turret, Double Shoulder	413–1597	6
U1 thru U11	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6–Pin DIP	229–0033	11
U12	Integrated Circuit, CD4075BE, RCA	225–0006	1
U13	Integrated Circuit, CD4071B, OR Gate, CMOS, 14–Pin DIP	225–0005	1
U14	Integrated Circuit, MC14532B, 8–Bit Priority Encoder, CMOS, 16–Pin DIP	228–4532	1
U15	Integrated Circuit, MC14076, Quad D Register, CMOS, 16–Pin DIP	228–4076	1
U16	Integrated Circuit, MC14011BCP, Quad 2–Input NAND Gate, CMOS, 14–Pin DIP	228–4011	1
U17	Integrated Circuit, MC14076, Quad D Register, CMOS, 16–Pin DIP	228–4076	1
U18	Integrated Circuit, MC14028BCP, BCD–to–Decimal Decoder, CMOS	228–4028	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 8 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U19	Integrated Circuit, CD4075BE, RCA	225-0006	1
U20	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U21	Integrated Circuit, CD4075BE, RCA	225-0006	1
U22	Integrated Circuit, MC14073B, Tripple 3-Input AND Gate, CMOS, 14-Pin DIP	228-4073	1
U23	Integrated Circuit, MC14001, CMOS, Quad 2-Input NOR Gate, 14-Pin DIP	228-4001	1
U24	Integrated Circuit, Triple 3 Input NOR Gates, CMOS, 14-Pin DIP	220-4025	1
U25	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14-Pin DIP	228-4069	1
U26	Integrated Circuit, 14 Stage Counter, CMOS, 16-Pin DIP	228-4020	1
U27	Integrated Circuit, MC14512B, 8 Channel Data Selector, CMOS	228-4512	1
U28	Integrated Circuit, MC14532B, 8-Bit Priority Encoder, CMOS, 16-Pin DIP	228-4532	1
U29	Integrated Circuit, LM3362Z-2.5, Precision Voltage Reference, 2.5V ±4%, -0 to ±70°C, TO-92 Case	229-0336	1
U30, U31	Integrated Circuit, MC14516B, Binary Up/Down Counter, CMOS, 16-Pin DIP	228-4516	2
U32, U33	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	2
U34, U35	Integrated Circuit, MC14516B, Binary Up/Down Counter, CMOS, 16-Pin DIP	228-4516	2
U36	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U37	Integrated Circuit, CD4075BE, RCA	225-0006	1
U38	Integrated Circuit, MC14073B, Tripple 3-Input AND Gate, CMOS, 14-Pin DIP	228-4073	1
U39	Integrated Circuit, MC14051, 8-Bit Analog Multiplexer, CMOS, 16-Pin DIP	220-4051	1
U40	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U41	Integrated Circuit, MC14053B, Analog Multiplexers/Demultiplexers, CMOS MSI, 16-Pin DIP	220-4053	1
U42, U43	Integrated Circuit, DAC-08CP, D-A Converter, 8-Bit, 16-Pin DIP	220-0801	2
U44	Integrated Circuit, LM339AN, Quad Comparator, 14-Pin DIP	221-0339	1
U45	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U46	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14-Pin DIP	228-4069	1
U47	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U48, U49	Integrated Circuit, MC14043BP, CMOS, Quad NOR Gate, 16-Pin DIP	220-4043	2
U50	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U51	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U52	Integrated Circuit, MC14001, CMOS, Quad 2-Input NOR Gate, 14-Pin DIP	228-4001	1
U53	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	1
U54	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14-Pin DIP	228-4069	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 9 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U55	Integrated Circuit, CD4078BE, RCA	225–0007	1
U56	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6–Pin DIP	229–0033	1
U57	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16–Pin DIP	228–4538	1
U58	Integrated Circuit, 14 Stage Counter, CMOS, 16–Pin DIP	228–4020	1
U59	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16–Pin DIP	228–4538	1
U60 4011	Integrated Circuit, MC14011BCP, Quad 2–Input NAND Gate, CMOS, 14–Pin DIP	228–1	
U61	Integrated Circuit, LM339AN, Quad Comparator, 14–Pin DIP	221–0339	1
U62	Integrated Circuit, CD4071B, OR Gate, CMOS, 14–Pin DIP	225–0005	1
U63, U64	Integrated Circuit, TLO74CN, Quad JFET–Input Operational Amplifier, 14–Pin DIP	221–0074	2
U65, U66	Integrated Circuit, LM339AN, Quad Comparator, 14–Pin DIP	221–0339	2
U67	Integrated Circuit, MC14043BP, CMOS, Quad NOR Gate, 16–Pin DIP	220–4043	1
U68	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16–Pin DIP	228–4538	1
U69	Integrated Circuit, CD4075BE, RCA	225–0006	1
U70	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO–92 Case	220–0317	1
U71	Integrated Circuit, CD4081B, Quad 2–Input AND Gate, CMOS, 14–Pin DIP	225–0008	1
XS5	Switch Cap, Red	343–6331	1
XU1 thru XU11	Socket, 6–Pin DIP	417–0600	11
XU12, XU13	Socket, 14–Pin DIP	417–1404	2
XU14, XU15	Socket, 16–Pin DIP	417–1604	2
XU16	Socket, 14–Pin DIP	417–1404	1
XU17, XU18	Socket, 16–Pin DIP	417–1604	2
XU19 thru XU25	Socket, 14–Pin DIP	417–1404	7
XU26 thru XU28	Socket, 16–Pin DIP	417–1604	3
XU30, XU31	Socket, 16–Pin DIP	417–1604	3
XU32, XU33	Socket, 6–Pin DIP	417–0600	2
XU34, XU35	Socket, 16–Pin DIP	417–1604	2
XU36 thru XU38	Socket, 14–Pin DIP	417–1404	3
XU39	Socket, 16–Pin DIP	417–1604	1
XU40	Socket, 14–Pin DIP	417–1404	1
XU41 thru XU43	Socket, 16–Pin DIP	417–1604	3
XU44 thru XU47	Socket, 14–Pin DIP	417–1404	4
XU48, XU49	Socket, 16–Pin DIP	417–1604	2
XU50 thru XU52	Socket, 14–Pin DIP	417–1404	3
XU53	Socket, 6–Pin DIP	417–0600	1

TABLE 3-3. ECU CONTROLLER CIRCUIT BOARD ASSEMBLY - 917-0205
(Sheet 10 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XU54, XU55	Socket, 14–Pin DIP	417–1404	2
XU56	Socket, 6–Pin DIP	417–0600	1
XU57 thru XU59	Socket, 16–Pin DIP	417–1604	3
XU60 thru XU66	Socket, 14–Pin DIP	417–1404	7
XU67, XU68	Socket, 16–Pin DIP	417–1604	2
XU69	Socket, 14–Pin DIP	417–1404	1
XU71	Socket, 14–Pin DIP	417–1404	1
XU71	Socket, 16–Pin DIP	417–1604	1
----	Blank, ECU Controller Circuit Board, AM–1	517–0205	1

TABLE 3-4. ECU EXTENDER CIRCUIT BOARD ASSEMBLY - 917-0208

REF. DES.	DESCRIPTION	PART NO.	QTY.
----	Connector, Female, 80–Pin, Dual In–Line, Printed Circuit Board Mount	417–0188	1
----	Header, Right Angle, 50–Pin	417–0152	1
----	ECU Extender Card Support, AM Transmitter	471–0849	1
----	Header, Right Angle, 80–Pin	417–8001	1
----	Receptacle, 50–Pin Dual In–line	417–0147	1
----	Blank, ECU Extender Circuit Board, AM–1	517–0208	1

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 1 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1, C2	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C3, C4	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	2
C5	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C6	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C7	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C8	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C9	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C10	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C11	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C12	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C13	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C14	Capacitor, Mica, 330 pF ±5%, 500V	042–3322	1
C15 thru C18	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C19, C20	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	2
C21	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 2 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C22	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C23	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C24	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C25	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C26	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C27	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C28	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C29	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C30	Capacitor, Mica, 330 pF ±5%, 500V	042–3322	1
C31 thru C34	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C35, C36	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	2
C37	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C38	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C39	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C40	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C41	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C42	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C43	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C44	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C45	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C46	Capacitor, Mica, 330 pF ±5%, 500V	042–3322	1
C47 thru C50	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C51, C52	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	2
C53	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C54	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C55	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C56	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C57	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C58	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C59	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C60	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C61	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C62	Capacitor, Mica, 330 pF ±5%, 500V	042–3322	1
C63 thru C80	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	18
C81, C82	Capacitor, Electrolytic, 100 uF, 50V	020–1085	2
C83, C84	Capacitor, Mylar Film, 0.47 uF ±2%, 100V	030–4753	2
C85	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C86, C87	Capacitor, Mylar Film, 0.47 uF ±2%, 100V	030–4753	2
C88 thru C90	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C91	Capacitor, Electrolytic, 10 uF, 25V, Non–Polarized	023–1075	1
C92	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C93	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C94	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C95 thru C98	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 3 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C99 thru C102	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003–4723	4
C103, C104	Capacitor, Electrolytic, 10 uF, 25V, Non–Polarized	023–1075	2
C105	Capacitor, Ceramic Disc, 3.3 pF, 1000V	000–3302	1
C106, C107	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C108	Capacitor, Mica, 620 pF ±5%, 300V	040–6223	1
C109	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	1
C110	Capacitor, Mica, 180 pF ±5%, 500V	042–1822	1
C111	Capacitor, Mica, 620 pF ±5%, 300V	040–6223	1
C112	Capacitor, Mica, 220 pF ±5%, 500V	040–2223	1
C113	Capacitor, Monolythic Ceramic, 0.0015 uF ±5%, 100V	003–1523	1
C114	Capacitor, Monolythic Ceramic, .0027 uF ±5%, 100V	003–2723	1
C115	Capacitor, Mica, 750 pF ±5%, 500V	042–7522	1
C116	Capacitor, Mica, 560 pF ±5%, 500V	040–5623	1
C117	Capacitor, Monolythic Ceramic, 0.0015 uF ±5%, 100V	003–1523	1
C118	Capacitor, Mica, 820 pF ±5%, 300V	042–8222	1
C119	Capacitor, Mica, 270 pF ±5%, 300V	041–2722	1
C120	Capacitor, Mica, 180 pF ±5%, 500V	042–1822	1
C121	Capacitor, Mica, 620 pF ±5%, 300V	040–6223	1
C122 thru C128	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	7
C129, C130	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	2
C131 thru C133	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C134	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	1
C135, C136	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C137	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C138 thru C144	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C145	Capacitor, Electrolytic, 10 uF, 35V, Non–Polarized	023–1075	1
C146, C147	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C148 thru C151	Capacitor, Monolythic Ceramic, 470 pF ±5%, 200V	003–4713	4
C152 thru C164	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	13
C165 thru C168	Capacitor, Mylar Film, 0.01 uF ±10%, 200V	030–1043	4
C169, C170	Capacitor, Mica, 180 pF ±5%, 500V	042–1822	2
C171, C172	Capacitor, Electrolytic, 10 uF, 25V, Non–Polarized	023–1075	2
C173, C174	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	2
C175	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
D1, D2	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
D3, D4	Diode, 1N4737, Zener, 7.5V ±10%, 1W	200–4737	2
D5 thru D9	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	5
DS1 thru DS3	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum	323–9224	3
DS4 thru DS6	Indicator, LED, Yellow, 521–9176, 3V @ 30 mA Maximum	323–9225	3

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 4 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
E1 thru E4	Terminal, Turret, Double Shoulder	413-1597	4
J1 thru J4	Connector, Header, Right Angle, 8-Pin	417-0807	4
J5 thru J7	Receptacle, Male, 3-Pin In-line	417-0003	3
L1 thru L3	Coil, Toroid, 22 uH ±10%, 34 Turns of No. 30 Enameled Copper Wire on B.E. No. 360-0023 Form	360-0049	3
L4	Shielded Adjustable Coil, 64-163 uH, 155 mA Maximum, 9.98 Ohms DC Resistance	360-0077	1
L5, L6	Shielded Adjustable Coil, 26-71 uH, 185 mA Maximum, 6.97 Ohms DC Resistance	360-0062	2
L7	Shielded Adjustable Coil, 12-29 uH, 225 mA Maximum, 4.72 Ohms DC Resistance	360-0078	1
P1A	Jumper, Programmable, 2-Pin	340-0004	1
P2A	Jumper, Programmable, 2-Pin	340-0004	1
P1B	Jumper, Programmable, 2-Pin	340-0004	1
P2B	Jumper, Programmable, 2-Pin	340-0004	1
P3B	Jumper, Programmable, 2-Pin	340-0004	1
P4A	Jumper, Programmable, 2-Pin	340-0004	1
P5 thru P7	Jumper, Programmable, 2-Pin	340-0004	3
P31	Jumper, Programmable, 2-Pin	340-0004	1
P201	Receptacle, 50-Pin Dual In-line	417-0147	1
Q1, Q2	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	2
Q3 thru Q14	Transistor, 2N7000, FET, N-Channel, TO-92 Case	210-7000	12
R1	Potentiometer, 5 k Ohm ±10%, 1W	179-5043	1
R2	Resistor, 8.25 k Ohm ±1%, 1/4W	103-8254	1
R3	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R4	Resistor, 6.04 k Ohm, ±1%, 1/4W	103-6044	1
R5	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R6	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179-1053	1
R7	Resistor, 24.9 k Ohm ±1%, 1/4W	103-2495	1
R8	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R9	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R10	Potentiometer, 500 Ohm ±10%, 1 1/4W	178-5001	1
R11	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R12	Resistor, 4.75 k Ohm ±1%, 1/4W	103-4741	1
R13	Resistor, 24.9 k Ohm ±1%, 1/4W	103-2495	1
R14	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R15	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R16	Resistor, 4.75 k Ohm ±1%, 1/4W	103-4741	1
R17 thru R19	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	3
R20 thru R22	Resistor, 4.99 k Ohm ±1%, 1/4W	100-5041	3
R23, R24	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	2
R25	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 5 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R26	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R27	Potentiometer, 5 k Ohm ±10%, 1W	179–5043	1
R28	Resistor, 8.25 k Ohm ±1%, 1/4W	103–8254	1
R29	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R30	Resistor, 6.04K Ohm, ±1%, 1/4W	103–6044	1
R31	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R32	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R33	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R34	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R35	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R36	Potentiometer, 500 Ohm ±10%, 1 1/4W	178–5001	1
R37	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R38	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R39	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R40	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R41	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R42	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R43 thru R45	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	3
R46 thru R48	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	3
R49, R50	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R51	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R52	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R53	Potentiometer, 5 k Ohm ±10%, 1W	179–5043	1
R54	Resistor, 8.25 k Ohm ±1%, 1/4W	103–8254	1
R55	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R56	Resistor, 6.04K Ohm ±1%, 1/4W	103–6044	1
R57	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R58	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R59	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R60	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R61	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R62	Potentiometer, 500 Ohm ±10%, 1 1/4W	178–5001	1
R63	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R64	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R65	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R67	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R68	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R69 thru R71	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	3
R72 thru R74	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	3
R75, R76	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R77	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R78	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R79	Potentiometer, 5 k Ohm ±10%, 1W	179–5043	1
R80	Resistor, 8.25 k Ohm ±1%, 1/4W	103–8254	1

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 6 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R81	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R82	Resistor, 6.04 k Ohm ±1%, 1/4W	103–6044	1
R83	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R84	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R85	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R86	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R87	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R88	Potentiometer, 500 Ohm ±10%, 1 1/4W	178–5001	1
R89	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R90	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R91	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R92	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R93	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R94	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R95 thru R97	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	3
R98 thru R100	Resistor, 4.99 k Ohm ±1%, 1/4W	100–5041	3
R101, R102	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R103	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R104	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R105 thru R109	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	5
R110	Resistor, 178 k Ohm ±1%, 1/4W	103–1761	1
R111	Resistor Network, 10–10 k Ohm 0.5% Resistors, 0.7W Total Dissipation, 16–Pin DIP	226–0392	1
R112	Resistor, 1.15 k Ohm ±1%, 1/4W	103–1156	1
R113	Resistor, 6.04 k Ohm ±1%, 1/4W	103–6044	1
R114	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R115	Resistor, 442 Ohm ±1%, 1/4W	103–4423	1
R116	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R117	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R118	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	1
R119	Resistor, 499 k Ohm ±1%, 1/4W	103–4996	1
R120 thru R126	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	7
R127	Resistor, 178 k Ohm ±1%, 1/4W	103–1761	1
R128	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R129, R130	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R131	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R132	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R133	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R134	Resistor, 82.5 k Ohm ±1%, 1/4W	103–8255	1
R135	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R136	Resistor, 205 k Ohm, ±1%, 1/4W	103–2056	1
R137	Resistor, 71.5 k Ohm ±1%, 1/4W	103–7155	1
R138	Resistor, 909 Ohm ±1%, 1/4W	103–9031	1
R139	Resistor, 178 k Ohm ±1%, 1/4W	103–1761	1

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 7 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R140, R141	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R142	Resistor, 5.23 k Ohm, ±1%, 1/4W	103–5251	1
R143	Resistor, 5.49 k Ohm, ±1%, 1/4W	103–5494	1
R144	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R145	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	1
R146, R147	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R148 thru R151	Resistor, 100 Ohm ±1%, 1/4W	100–1031	4
R152, R153	Resistor, 22.1 Ohm ±1%, 1/4W	103–2212	2
R154, R155	Resistor, 2 k Ohm ±1%, 1/4W	100–2041	2
R156	Resistor, 88.7 Ohm, ±1%, 1/4W	103–8872	1
R157, R158	Resistor, 182 Ohm ±1%, 1/4W	103–1823	2
R159	Resistor, 442 Ohm ±1%, 1/4W	103–4423	1
R160	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R161	Resistor, 182 Ohm ±1%, 1/4W	103–1823	1
R162, R163	Resistor, 221 Ohm ±1%, 1/4W	103–2213	2
R164	Resistor, 182 Ohm, ±1%, 1/4W	103–1823	1
R165, R166	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R167	Resistor, 182 Ohm, ±1%, 1/4W	103–1823	1
R168	Resistor, 240 Ohm ±1%, 1/4W	103–2431	1
R169	Resistor, 5.23 k Ohm, ±1%, 1/4W	103–5251	1
R170 thru R172	Resistor, 442 Ohm, ±1%, 1/4W	103–4423	3
R173	Resistor, 240 Ohm ±1%, 1/4W	103–2431	1
R174	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R175	Resistor, 240 Ohm ±1%, 1/4W	103–2431	1
R176	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R177	Resistor, 22.1 Ohm ±1%, 1/4W	103–2212	1
R178	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R179	Resistor, 22.1 Ohm ±1%, 1/4W	103–2212	1
R180	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R181, R182	Resistor, 1.5 k Ohm ±1%, 1/4W	103–1504	2
R183 thru R188	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	6
R189	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R190	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R191	Resistor, 2 k Ohm ±1%, 1/4W	100–2041	1
R192	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R193	Potentiometer, 10 k Ohm ±10%, 1 1/4W	179–1053	1
R194	Resistor, 24.9 k Ohm ±1%, 1/4W	103–2495	1
R195	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	1
R196	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R197 thru R200	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	4
R201, R202	Resistor, 240 Ohm ±1%, 1/4W	103–2431	2
R203	Resistor, 82.5 k Ohm ±1%, 1/4W	103–8255	1
R204	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R205	Resistor, 49.9 k Ohm ±1%, 1/4W	103–4951	1

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 8 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R206	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R207	Resistor, 49.9 k Ohm ±1%, 1/4W	103-4951	1
R208	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R209	Resistor, 49.9 k Ohm ±1%, 1/4W	103-4951	1
R210	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R211	Resistor, 49.9 k Ohm ±1%, 1/4W	103-4951	1
R212	Resistor, 3.3 Meg Ohm ±5%, 1/4W	100-3373	1
R213	Resistor, 49.9 k Ohm ±1%, 1/4W	103-4951	1
R214	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R215	Resistor, 2 k Ohm ±1%, 1/4W	100-2041	1
R216	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R217	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R218 thru R221	Resistor, 240 Ohm ±1%, 1/4W	103-2431	4
R222 thru R225	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	4
R226	Resistor, 5.23 k Ohm, ±1%, 1/4W	103-5251	1
R227	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R228	Resistor, 22.1 Ohm ±1%, 1/4W	103-2212	1
S1	Switch, Toggle, SPDT, 5A @ 125V ac & 28V dc	348-0123	1
S2 thru S4	Switch, SPST, 4-Position, 8-Pin DIP Dual In-Line	340-0002	3
S5	Switch, Push, N.O. Momentary Contact, Miniature, 1A @ 120V Maximum	343-6330	1
T1	Transformer, RF DRIVE	370-0046	1
TP1 thru TP10	Terminal, Turret, Double Shoulder	413-1597	10
U1	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
U2, U3	Integrated Circuit, 2150A, Voltage Controlled Amplifier, 8-Pin DIP	220-2150	2
U4 thru U7	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	4
U8, U9	Integrated Circuit, 2150A, Voltage Controlled Amplifier, 8-Pin DIP	220-2150	2
U10 thru U12	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	3
U13, U14	Integrated Circuit, 2150A, Voltage Controlled Amplifier, 8-Pin DIP	220-2150	2
U15 thru U18	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	4
U19, U20	Integrated Circuit, 2150A, Voltage Controlled Amplifier, 8-Pin DIP	220-2150	2
U21, U22	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	2
U23	Integrated Circuit, DG212CJ, QUAD SPST Switch, CMOS, 16-Pin DIP	220-0212	1
U24 thru U27	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	4
U28	Integrated Circuit, DG212CJ, QUAD SPST Switch, CMOS, 16-Pin DIP	220-0212	1
U29 thru U31	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	3

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 9 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U32	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO-92 Case	220-0317	1
U33	Integrated Circuit, 74HC4022, Octal Counter/Divider, CMOS, 16-Pin DIP	221-4022	1
U34	Integrated Circuit, 74HC4002N, Dual 4 Input NOR Gate 14-Pin DIP	221-4002	1
U35	Integrated Circuit, 74HC74N, Dual D-Type Flip Flop, 14-Pin DIP	221-7474	1
U36	Integrated Circuit, DG-271, 201HS, CMOS SPST Analog Switch 16-Pin DIP	220-0017	1
U37	Integrated Circuit, NE5539N, UHF Operational Amplifier, 14-Pin DIP	220-5539	1
U38	Integrated Circuit, CA3183E, Five Transistor Array, NPN, 16-Pin DIP	220-3183	1
U39	Integrated Circuit, MC10116P, Triple Differential Amplifier, 16-Pin DIP	220-0116	1
U40 4132	Integrated Circuit, 74HC132N, Quad NAND Gate, Schmitt Trigger, 1 14-Pin DIP		221-
U41	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U42	Integrated Circuit, MC14584, Hex Schmitt Trigger, CMOS, 14-Pin DIP	228-4584	1
U43	Integrated Circuit, MC14093B, Quad 2-Input NAND Schmitt Trigger CMOS, 14-Pin DIP	220-4093	1
U44	Integrated Circuit, MC14013BCP, Dual D-Type Flip-Flop, CMOS, 14-Pin DIP	228-4013	1
U45 thru U48	Integrated Circuit, 4N33, Optical Isolator, NPN Photo Transistor/Infared Emitting Diode Type, 1500V Isolation, Response: 30 kHz Maximum, Current: 50 mA Maximum, 6-Pin DIP	229-0033	4
U49	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U50	Integrated Circuit, MC14532B, CMOS, 8-Bit Priority Encoder	228-4532	1
U51	Integrated Circuit, MC14013BCP, Dual D-Type Flip-Flop, CMOS, 14-Pin DIP	228-4013	1
U52	Integrated Circuit, CD4071B, OR Gate, CMOS, 14-Pin DIP	225-0005	1
U53	Integrated Circuit, CD4017B, 10-Output Counter/Divider, CMOS, 16-Pin DIP	220-4017	1
U54	Integrated Circuit, CD4081B, Quad 2-Input AND Gate, CMOS, 14-Pin DIP	225-0008	1
U55	Integrated Circuit, MC14584, Hex Schmitt Trigger, CMOS, 14-Pin DIP	228-4584	1
XU1	Socket, 8-Pin DIP	417-0804	1
XU4 thru XU7	Socket, 8-Pin DIP	417-0804	4
XU10 thru XU12	Socket, 8-Pin DIP	417-0804	3
XU15 thru XU18	Socket, 8-Pin DIP	417-0804	4
XU21, XU22	Socket, 8-Pin DIP	417-0804	2
XU23	Socket, 16-Pin DIP	417-1604	1
XU24 thru XU27	Socket, 8-Pin DIP	417-0804	4

TABLE 3-5. STEREO CIRCUIT BOARD ASSEMBLY - 917-0209
(Sheet 10 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XU28	Socket, 16–Pin DIP	417–1604	1
XU29 thru XU31	Socket, 8–Pin DIP	417–0804	3
XU33	Socket, 16–Pin DIP	417–1604	1
XU34, XU35	Socket, 14–Pin DIP	417–1404	2
XU36	Socket, 16–Pin DIP	417–1604	1
XU37	Socket, 14–Pin DIP	417–1404	1
XU38, XU39	Socket, 16–Pin DIP	417–1604	2
XU40 thru XU44	Socket, 14–Pin DIP	417–1404	5
XU45 thru XU48	Socket, 6–Pin DIP	417–0600	4
XU49	Socket, 14–Pin DIP	417–1404	1
XU50	Socket, 16–Pin DIP	417–1604	1
XU51, XU52	Socket, 14–Pin DIP	417–1404	2
XU53	Socket, 16–Pin DIP	417–1604	1
XU54, XU55	Socket, 14–Pin DIP	417–1404	2
----	Socket/Spacer, LED	407–0074	2
----	Switch Cap, Red	343–6331	1
----	Blank, Stereo Circuit Board, AM1, AM5	517–0209	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 1 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1, C2	Capacitor, Electrolytic, 10 uF, 35V	023–1075	2
C3 thru C5	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C6	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C7	Capacitor, Mica, 150 pF ±5%, 500V	040–1522	1
C8	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C9	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C10	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C11	Capacitor, Mica, 150 pF ±5%, 500V	040–1522	1
C12	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C14	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C15	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C16, C17	Capacitor, Electrolytic, 10 uF, 35V	023–1075	2
C18 thru C20	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C21	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C22	Capacitor, Mica, 150 pF ±5%, 500V	040–1522	1
C23	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C24	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C25	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C26	Capacitor, Mica, 150 pF ±5%, 500V	040–1522	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 2 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C27	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C29	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C30, C31	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C32	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C33	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C34	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C35	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C36	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1
C37 thru C39	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C40	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	1
C41	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C42	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C43	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C44	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C45	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C46	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C47	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C48	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C49	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C50	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C51	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C52	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C53	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C54	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C55, C56	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C57, C58	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031–2033	2
C59	Capacitor, Mica, 150 pF ±5%, 500V	040–1522	1
C60	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031–2033	1
C61, C62	Capacitor, Electrolytic, 10 uF, 50V	023–1076	2
C63 thru C67	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	5
C68	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C69, C70	Capacitor, Electrolytic, 10 uF, 50V	023–1076	2
C71, C72	Capacitor, Electrolytic, 100 uF, 35V	023–1084	2
C73, C74	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	2
C75	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C76	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C77	Capacitor, Mica, 1000 pF ±1%, 100V	041–1031	1
C78	Capacitor, Mica, 250 pF ±1%, 500V	042–2521	1
C79 thru C81	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C82	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1
C83	Capacitor, Electrolytic, 1 uF, 50V, Non–Polarized	020–1064	1
C84	Capacitor, Mylar Film, 0.047 uF ±10%, 100V	030–4743	1
C85, C88	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C89	Capacitor, Electrolytic, 1 uF, 50V, Non–Polarized	020–1064	1
C90	Capacitor, Mica, 390 pF ±5%, 100V	042–3922	1
C91 thru C93	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C93	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C94	Capacitor, Electrolytic, 22 uF, 50V	024–2274	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 3 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C96, C97	Capacitor, Polycarbonate, 0.10 uF ±1%, 100V	030–1051	2
C98	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003–4723	1
C99	Capacitor, Mylar, 0.01 uF ±10%, 100V	031–1043	1
C100	Capacitor, Mica, 500 pF ±1%, 500V	042–5021	1
C101, C102	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C103	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003–4723	1
C104	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C105, C106	Capacitor, Electrolytic, 22 uF, 50V	024–2274	2
C107	Capacitor, Monolythic Ceramic, 56 pF ±10%, 200V	001–5613	1
C108	Capacitor, Variable, Polycarbonate, 2–27 pF	096–0009	1
C109	Capacitor, Mica, 150 pF ±5%, 500V	040–1522	1
C110	Capacitor, Ceramic Disc, 68 pF ±5%, N1500, 63V dc	000–6814	1
C111	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C112, C113	Capacitor, Monolythic Ceramic, 0.0015 uF ±5%, 100V	003–1523	2
C114	Capacitor, Mylar, 0.01 uF ±10%, 100V	031–1043	1
C115 thru C117	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C118	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C119, C120	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C121	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C122 thru C124	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C125	Capacitor, Electrolytic, 1 uF, 50V, Non–Polarized	020–1064	1
C126 thru C129	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	4
C130	Capacitor, Mica, 68 pF ±5%, 500V	040–6813	1
C131	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C132	Capacitor, Silvered Mica, 100 pF ±5%, 500V	040–1022	1
C133, C134	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	2
C135, C136	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C137	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	1
C138	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C140	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C141	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C143, C144	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C145	Capacitor, Mica, 33 pF ±5%, 500V	042–3312	1
C146	Capacitor, Electrolytic, 33 uF, 25V	020–3374	1
C147 thru C154	Capacitor, Polycarbonate, 0.10 uF ±1%, 100V	030–1051	8
C155	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C156	Capacitor, Monolythic Ceramic, 0.0047 uF ±5%, 100V	003–4723	1
C157	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C158, C159	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	2
C160	Capacitor, Mica, 22 pF ±5%, 500V	040–2213	1
C162	Capacitor, Mica, 22 pF ±5%, 500V	040–2213	1
C163 thru C165	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	3
C166	Capacitor, Monolythic Ceramic, .47 uF ±10%, 50V	003–4743	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 4 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C167	Capacitor, Electrolytic, 1 uF, 50V, Non-Polarized	020-1064	1
C168 thru C170	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	3
C171, C172	Capacitor, Electrolytic, 1 uF, 50V, Non-Polarized	020-1064	2
C173	Capacitor, Monolythic Ceramic, 0.0015 uF ±5%, 100V	003-1523	1
C174	Capacitor, Electrolytic, 2.2 uF ±30%, 50V, Non-Polarized	020-2264	1
C175, C176	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003-1066	2
D1, D2	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	2
D4 thru D21	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	18
D22	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	1
D23	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203-4005	1
D24 thru D27	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	4
D29 thru D46	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	18
D47 thru D50	Diode, HP5082-2800, High Voltage, Schottky Barrier Type, 70V, 15 mA	201-2800	4
D51 thru D67	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203-4148	17
D68	Diode, Zener, 1N4739A, 9.1V ±5%, 1W	200-0009	1
D69	Diode, Zener, 1N4732A, 4.7V ±5%, 1W	200-4732	1
DS1 thru DS5	Indicator, LED, Green, 521-9175, 3V @ 40 mA Maximum	323-9224	5
E1 thru E4	Terminal Test Point, Oval Red	413-0106	4
J2 thru J5	Receptacle, Male, 3-Pin In-line	417-0003	4
J6	Receptacle, Male, 20-Pin In-Line	417-0200	1
J7	Receptacle, Male, 3-Pin In-line	417-0003	1
J8 thru J11	Receptacle, Single Pin	417-0071-001	4
J12, J13	Receptacle, Male, 20-Pin In-Line	417-0200	2
L1 thru L4	Coil, Toroid, 22 uH ±10%, 34 Turns of No. 30 Enameled Copper Wire on B.E. No. 360-0023 Form	360-0049	4
L5	Coil, Molded, Shielded, 56 uH	360-0093	1
L6	Coil, Molded, 2.2 uH	364-2200	1
P2 thru P5	Jumper, Programmable, 2-Pin	340-0004	4
P6A, P6B	Jumper, Programmable, 2-Pin	340-0004	2
P7	Jumper, Programmable, 2-Pin	340-0004	1
P12A	Jumper, Programmable, 2-Pin	340-0004	1
P12B	Jumper, Programmable, 2-Pin	340-0004	1
P13A	Jumper, Programmable, 2-Pin	340-0004	1
P13B	Jumper, Programmable, 2-Pin	340-0004	1
P101	Connector, Female, 80-Pin, Dual In-Line, PCB Mount	417-0188	1
Q3, Q4	Transistor, 2N3904, NPN, Silicon, TO-92 Case	211-3904	2
Q5	Transistor, 2N3906, PNP, Silicon, TO-92 Case	210-3906	1
Q6, Q7	Transistor, 2N7000, FET, N-Channel, TO-92 Case	210-7000	2

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 5 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
Q8	Field Effect Transistor, J3100, RF, N-Channel, TO-92 Case	212-0310	1
Q13 thru Q22	Field Effect Transistor, VN88AD, Metal-Oxide/Silicon, N-Channel Enhancement Type, TO-220-AB Case	210-0088	10
Q23	Transistor, 2N7000, N-Channel, TO-92 Case	210-7000	1
R1	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R2	Resistor, 221 k Ohm ±1%, 1/4W	103-2216	1
R3	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R4	Resistor, 221 k Ohm ±1%, 1/4W	103-2216	1
R5	Resistor Network, 10-10 k Ohm 0.5% Resistors, 0.7W Total Dissipation, 16-Pin DIP	226-0392	1
R8, R9	Resistor, 26.7 k Ohm ±1%, 1/4W	103-2675	2
R10 thru R12	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	3
R14	Resistor, 15 k Ohm ±5%, 1/4W	100-1551	1
R15	Resistor, 100 Ohm ±1%, 1/4W	100-1031	1
R16	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R17	Resistor, 221 k Ohm ±1%, 1/4W	103-2216	1
R18	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R18	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R19	Resistor, 221 k Ohm ±1%, 1/4W	103-2216	1
R20	Resistor Network, 10-10 k Ohm 0.5% Resistors, 0.7W Total Dissipation, 16-Pin DIP	226-0392	1
R23, R24	Resistor, 26.7 k Ohm ±1%, 1/4W	103-2675	2
R25 thru R27	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	3
R29	Resistor, 15 k Ohm ±5%, 1/4W	100-1551	1
R30	Resistor, 100 Ohm ±1%, 1/4W	100-1031	1
R31	Resistor, 221 Ohm ±1%, 1/4W	103-2213	1
R32, R33	Resistor, 1.24 k Ohm ±1%, 1/4W	103-1244	2
R34	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	1
R35	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R36, R37	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	2
R38, R39	Resistor, 39.2 k Ohm ±1%, 1/4W	100-3951	2
R40	Resistor, 221 Ohm ±1%, 1/4W	103-2213	1
R41	Resistor, 3.83 k Ohm ±1%, 1/4W	103-3841	1
R41	Potentiometer, 20 k Ohm ±10%, 1/2W	178-2054	1
R42	Resistor, 20.0 k Ohm ±1%, 1/4W	103-2051	1
R43 thru R54	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	12
R55	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R58 thru R61	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	4
R62	Potentiometer, 10 k Ohm ±10%, 1/2W	177-1054	1
R63	Resistor, 34 k Ohm ±1%, 1/4W	103-3405	1
R64	Resistor, 2.2 Meg Ohm ±5%, 1/4W	100-2273	1
R65	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R66	Resistor, 2.2 Meg Ohm ±5%, 1/4W	100-2273	1
R67	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 6 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R68	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R69	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R70	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R71	Resistor, 845 Ohm ±1%, 1/4W	103–8453	1
R72	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R73	Resistor, 47.5 k Ohm ±1%, 1/4W	103–4755	1
R74	Resistor, 453 k Ohm ±1%, 1/4W	100–4561	1
R75	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R76	Potentiometer, 1 k Ohm ±10%, 1/2W	178–1044	1
R77	Resistor, 34 k Ohm ±1%, 1/4W	103–3405	1
R78	Resistor, 22.1 k Ohm ±1%, 1/4W	103–2211	1
R79	Resistor, 1.33 k Ohm ±1%, 1/4W	103–1331	1
R80, R81	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R82, R83	Resistor, 10 Ohm ±1%, 1/4W	103–1021	2
R84	Resistor, 845 Ohm ±1%, 1/4W	103–8453	1
R85	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R86 thru R88	Resistor, 9.09 k Ohm ±1%, 1/4W	103–9041	3
R89, R90	Resistor, 8.45 k Ohm ±1%, 1/4W	103–8454	2
R91	Resistor, 5.6 Meg Ohm ±5%, 1/4W	100–5673	1
R92, R93	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R94	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R99	Resistor, 34 k Ohm ±1%, 1/4W	103–3405	1
R100	Resistor, 66.5 k Ohm ±1%, 1/4W	103–6655	1
R101, R102	Resistor, 26.7 k Ohm ±1%, 1/4W	103–2675	2
R112	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R113, R114	Resistor, 10 Ohm ±1%, 1/4W	103–1021	2
R115	Resistor, 34 k Ohm ±1%, 1/4W	103–3405	1
R116, R117	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R118	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R119	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R120	Resistor, 365 Ohm ±1%, 1/4W	103–3631	1
R121	Resistor, 51.1 Ohm ±1%, 1/4W	103–5112	1
R122 thru R125	Resistor, 9.53 k Ohm ±1%, 1/4W	103–9534	4
R126 thru R128	Resistor, 7.50 k Ohm ±1%, 1/4W	103–7541	3
R129	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R130	Resistor, 10 Ohm ±1%, 1/4W	103–1021	1
R131	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R132	Resistor, 221 Ohm ±1%, 1/4W	103–2213	1
R133	Resistor, 26.7 k Ohm ±1%, 1/4W	103–2675	1
R134	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R135	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R136	Resistor, 2.2 Meg Ohm ±5%, 1/4W	100–2273	1
R137	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R138 thru R140	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	3

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 7 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R142	Resistor, 2.2 Meg Ohm ±5%, 1/4W	100–2273	1
R143	Resistor, 221 Ohm ±1%, 1/4W	103–2213	1
R144	Resistor, 3.83 k Ohm ±1%, 1/4W	103–3841	1
R145	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R146	Resistor, 221 Ohm ±1%, 1/4W	103–2213	1
R147	Resistor, 24.9 Ohm ±1%, 1/4W	103–2490	1
R148	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R149, R150	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	2
R151	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R152	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R153	Resistor, 3.83 k Ohm ±1%, 1/4W	103–3841	1
R154	Resistor, 453 k Ohm ±1%, 1/4W	100–4561	1
R155	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R156	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R157	Resistor, 845 Ohm ±1%, 1/4W	103–8453	1
R158	Resistor, 221 Ohm ±1%, 1/4W	103–2213	1
R159	Potentiometer, 2 k Ohm ±10%, 1/2W	177–2044	1
R160	Resistor, 1.24 k Ohm ±1%, 1/4W	103–1244	1
R161	Resistor, 3.83 k Ohm ±1%, 1/4W	103–3841	1
R162	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R163	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R164	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R165	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R166	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R167	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R168	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R169	Resistor, 15 k Ohm ±5%, 1/4W	100–1551	1
R170	Potentiometer, 20 k Ohm ±10%, 1/2W	178–2054	1
R171	Resistor, 15 k Ohm ±5%, 1/4W	100–1551	1
R172 thru R179	Resistor, 22.1 Ohm ±1%, 1/4W	103–2212	8
R180	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R181	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R182	Resistor, 68.1 k Ohm ±1%, 1/4W	103–6815	1
R183	Resistor, 7.50 k Ohm ±1%, 1/4W	103–7541	1
R184	Resistor, 46.4 k Ohm ±1%, 1/4W	103–4645	1
R185	Resistor, 113 k Ohm ±5%, 1/4W	103–1136	1
R186	Resistor, 4.75 k Ohm ±1%, 1/4W	103–4741	1
R187	Resistor, 18.2 k Ohm ±1%, 1/4W	103–1825	1
R188	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R189	Potentiometer, 1 k Ohm ±10%, 1/2W	178–1044	1
R190	Resistor, 2.10 k Ohm ±1%, 1/4W	103–2104	1
R191	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R192 thru R194	Resistor, 113 k Ohm ±5%, 1/4W	103–1136	3
R195	Resistor, 100 Ohm ±1%, 1/4W	100–1031	1
R196	Resistor, 121 Ohm ±1%, 1/4W	100–1231	1
R197	Resistor, 2.94 k Ohm ±1%, 1/4W	103–2941	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 8 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R198	Potentiometer, 1 k Ohm ±10%, 1/2W	178–1044	1
R199	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R200	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R201	Resistor, 10 Meg Ohm ±5%, 1/4W	100–1083	1
R202	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R203 thru R209	Resistor, 22.1 Ohm ±1%, 1/4W	103–2212	7
R210, R211	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R212	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R213, R214	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R215	Resistor, 1 Meg Ohm ±1%, 1/4W	103–1007	1
R216	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R217	Potentiometer, 2 k Ohm ±10%, 1/2W	178–1044	1
R218	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
S1	Switch, SPST, 4–Position, 8–Pin DIP Dual In–line	340–0002	1
S2	Switch, SPST, 8–Segment, 16–Pin DIP	340–0003	1
TP1 thru TP19	Terminal Test Point, Oval Red	413–0106	19
U1, U2	Integrated Circuit, TL072CP, Dual JFET–Input Operational Amplifier, 8–Pin DIP	221–0072	2
U3	Amplifier, Dual Operational, RC4227GNB, Raytheon, 8–Pin DIP	221–4227	1
U4, U5	Integrated Circuit, TL072CP, Dual JFET–Input Operational Amplifier, 8–Pin DIP	221–0072	2
U6	Amplifier, Dual Operational, RC4227GNB Raytheon, 8–Pin DIP	221–4227	1
U7	Integrated Circuit, DG212CJ, Quad, SPST Switch, 16–Pin DIP	220–0212	1
U8, U9	Amplifier, Dual Operational, RC4227GNB Raytheon, 8–Pin DIP	221–4227	2
U10	Integrated Circuit, MC14526BCP, Programmable Divide–by–N 4–Bit Counter, CMOS, 16–Pin DIP	220–4526	1
U11	Integrated Circuit, MC14013BCP, Dual D–Type Flip–Flop, CMOS, 14–Pin DIP	228–4013	1
U12	Integrated Circuit, NE5534AN, Low Noise Operational Amplifier, 8–Pin DIP	221–5534	1
U13	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO–92 Case	220–0317	1
U14 thru U17	Amplifier, Dual Operational, RC4227GNB, Raytheon, 8–Pin DIP	221–4227	4
U19, U20	Integrated Circuit, 74C24ON, Inverting Tri State, 20–Pin DIP	220–4240	2
U21	Integrated Circuit, CD4069CN, Hex Inverter, CMOS, 14–Pin DIP	228–4069	1
U22	Integrated Circuit, LM319N, Dual Comparator, 14–Pin DIP	221–0319	1
U23	Integrated Circuit, MC14538B, Dual Retriggerable, Resettable Monostable Multivibrator, CMOS, 16–Pin DIP	228–4538	1
U24	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO–92 Case	220–0317	1
U26	Amplifier, Dual Operational, RC4227GNB, Raytheon, 8–Pin DIP	221–4227	1
U27	Integrated Circuit, TL311P, JFET–Input Differential Comparator, 8–Pin DIP	220–0311	1
U28	Integrated Circuit, 74LS123, Schottky Dual Monostable Multivibrator, 16–Pin DIP	220–2123	1

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 9 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U29	Integrated Circuit, 74HC4022, Octal Counter/Divider, 16–Pin DIP	221–4022	1
U30	Integrated Circuit, 74HC132N, Quad Schmitt Nand Gates	221–4132	1
U31	Integrated Circuit, 74HC4002N, Dual 4 Input NOR Gate 14–Pin DIP	221–4002	1
U32	Integrated Circuit, 74HC132N, Quad Schmitt Nand Gates	221–4132	1
U33	Integrated Circuit, MC74HC14, Hex Schmitt Trigger Inverter,	220–4106	1
U34	Integrated Circuit, MC14040B, CMOS MSI, 12–Bit Binary Counter, 16–Pin DIP	220–4040	1
U35	Integrated Circuit, MC14073B, Tripple 3–Input AND Gate, CMOS, 14–Pin DIP	228–4073	1
U36	Integrated Circuit, MC14013BCP, Dual D–Type Flip–Flop, CMOS, 14–Pin DIP	228–4013	1
U37	Integrated Circuit, LM317LZ, Adjustable Positive Voltage Regulator, 1.2 to 37V @ 0.1 Ampere, TO–92 Case	220–0317	1
U38, U39	Integrated Circuit, 74HC132N QUAD Schmitt Nand Gates	221–4132	2
U40	Integrated Circuit, 74HC75N, Quad D Latch	221–7475	1
U41	Amplifier, Dual Operational, RC4227GNB, Raytheon, 8–Pin DIP	221–4227	1
U42	Integrated Circuit, 74HC74N Dual D Flip Flop	221–7474	1
U43	Integrated Circuit, TL311P, JFET–Input Differential Comparator, 8–Pin DIP	220–0311	1
U44	Integrated Circuit, MC14060B, 14–Bit Binary Counter and Oscillator, CMOS MSI, 16–Pin DIP	220–4060	1
U45	Integrated Circuit, 74C24ON, Inverting Tri State, 20–Pin DIP	220–4240	1
U46	Driver, High and Low Side, IR2112, 14–Pin DIP	227–2112	1
U47	Integrated Circuit, LM319N, Dual Comparator, 14–Pin DIP	221–0319	1
XU1 thru XU6	Socket, 8–Pin DIP	417–0804	6
XU4	Socket, 14–Pin DIP	417–1404	1
XU7	Socket, 16–Pin DIP	417–1604	1
XU8, XU9	Socket, 8–Pin DIP	417–0804	2
XU10	Socket, 16–Pin DIP	417–1604	1
XU11	Socket, 14–Pin DIP	417–1404	1
XU12	Socket, 8–Pin DIP	417–0804	1
XU14 thru XU17	Socket, 8–Pin DIP	417–0804	4
XU19, XU20	Socket, 20–Pin DIP	417–2004	2
XU21, XU22	Socket, 14–Pin DIP	417–1404	2
XU23	Socket, 16–Pin DIP	417–1604	1
XU25	Receptacle, 28–Pin DIP	417–2804	1
XU26, XU27	Socket, 8–Pin DIP	417–0804	2
XU28	Socket, 16–Pin DIP	417–1604	1
XU29	Socket, 16–Pin DIP	417–1604	1
XU30 thru XU33	Socket, 14–Pin DIP	417–1404	4
XU34	Socket, 16–Pin DIP	417–1604	1
XU35, XU36	Socket, 14–Pin DIP	417–1404	2
XU38, XU39	Socket, 14–Pin DIP	417–1404	2

TABLE 3-6. ECU EXCITER CIRCUIT BOARD ASSEMBLY - 917-0300
(Sheet 10 of 10)

REF. DES.	DESCRIPTION	PART NO.	QTY.
XU40	Socket, 16–Pin DIP	417–1604	1
XU41	Socket, 8–Pin DIP	417–0804	1
XU42	Socket, 14–Pin DIP	417–1404	1
XU43	Socket, 8–Pin DIP	417–0804	1
XU44	Socket, 16–Pin DIP	417–1604	1
XU45	Socket, 20–Pin DIP	417–2004	1
XU46, XU47	Socket, 14–Pin DIP	417–1404	2
	10 kHz SPACING		
Y1	Crystal, 48PD1002, 10.24 MHz, HC–18 Cinox	390–0013	1
	9 kHz SPACING		
Y1	Crystal, 9.216 MHz, HC–18 Cinox	390–0017	1
----	Potentiometer, 2k Ohm ±10%, .5W	178–2044	1
----	Integrated Circuit, MC145151P, Parallel Input, PLL Frequency Synthesizer, CMOS, 28–Pin DIP	220–5151	1
----	Blank, ECU Exciter Circuit Board	517–0300	1
----	VCO Module Circuit Board Assembly	917–0069	1

TABLE 3-7. ECU MOTHERBOARD CIRCUIT BOARD ASSEMBLY - 917-0301
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1, C2	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031–2033	2
C3, C4	Capacitor, Polyester, 0.015 uF ±10%, 100V	030–1532	2
C5, C6	Capacitor, Polyester, 0.0022 uF ±10%, 100V	031–2033	2
C7, C8	Capacitor, Polyester, 0.015 uF ±10%, 100V	030–1532	2
C9 thru C59	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	51
C61 thru C65	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	5
C66	Capacitor, Electrolytic, 100 uF, 35V	023–1084	1
C67 thru C84	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	18
C85	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C86, C87	Capacitor, Mica, 680 pF ±5%, 300V	040–6824	2
C88 thru C90	Capacitor, Polyester, 0.015 uF ±10%, 100V	030–1532	3
C91 thru C109	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	19
D1	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	1
J7	Receptacle, 6–Pin	417–0677	1
J8	Connector, AMP 1–87502–8, Header Straight Post Double Row, 40–Pin	417–4040	1
J9, J10	Receptacle, Male, 13–Pin Dual In–Line	417–2600	2

TABLE 3-7. ECU MOTHERBOARD CIRCUIT BOARD ASSEMBLY - 917-0301
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
J11	Receptacle, BNC	417-0203	1
J12	Connector, Male, 2-Pin In-Line	417-4004	1
J101	Connector Header, 80-Pin, Dual In-Line	417-0254	1
J201	Connector, AMP 102567-6, Header Straight Post Double Row, 50-Pin	417-0255	1
J301	Connector, AMP 102567-6, Header Straight Post Double Row, 50-Pin	417-0255	1
J302	Connector Header, 80-Pin, Dual In-Line	417-0254	1
L1 thru L4	Coil, Shielded, 560 uH ±10%, Molded	360-0072	4
L5, L6	RF Choke, 910 uH ±5%, 79 mA Maximum, 15.8 Ohms DC Resistance	360-0047	2
P4 thru P6	Connector, 25-Pin D-Type	418-2500	3
P12	Switch, Jumper Programmable	340-0004	1
R1	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	1
R2, R3	Resistor, 442 Ohm ±1%, 1/4W	103-4423	2
R4	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	1
R5	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R6	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	1
R7, R8	Resistor, 442 Ohm ±1%, 1/4W	103-4423	2
R9	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	1
R10	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R11	Resistor, 47 Ohm ±5%, 1W	120-4723	1
R15 thru R18	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	4
R19 thru R22	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	4
R23 thru R28	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	6
R29 thru R34	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	6
R35 thru R40	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	6
R41 thru R45	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	5
R47 thru R51	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	5
R53, R54	Resistor, 442 Ohm ±1%, 1/4W	103-4423	2
R55	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R56, R57	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	2
R56	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R58	Resistor, 200 Ohm ±1%, 1/4W	103-2003	1
R59	Resistor, 442 Ohm ±1%, 1/4W	103-4423	1
R60 thru R62	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	3
R63, R64	Resistor, 3.92 k Ohm ±1%, 1/4W	103-3924	2
R65	Resistor, 47 Ohm ±5%, 1W	120-4723	1
R66 thru R72	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	7
R73	Resistor, 47 Ohm ±5%, 1W	120-4723	1
R74	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R75	Resistor, 442 Ohm ±1%, 1/4W	103-4423	1
R76	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R77	Resistor, 51.1 Ohm ±1%, 1/4W	103-5112	1
R78 thru R84	Resistor, 1.15 k Ohm ±1%, 1/4W	103-1156	7
R84	Resistor, 10 Ohm ±1%, 1/4W	103-1021	1
R86 thru R95	Resistor, 10 Ohm ±1%, 1/4W	103-1021	10
TB1, TB2	Barrier Strip, 30-Position	412-3000	2
----	Blank, ECU Motherboard Circuit Board	517-0301	1

TABLE 3-8. ECU DISPLAY/CONTROL SWITCH CIRCUIT BOARD - 917-0306-001
(Sheet 1 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
C1 thru C11	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	11
C12	Capacitor, Electrolytic, 1 uF, 50V	024–1064	1
C13 thru C23	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	11
C24, C25	Capacitor, Electrolytic, 10 uF, 50V	023–1076	2
C26, C27	Capacitor, Electrolytic, 33 uF, 35V	024–3335	2
C28	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C29	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	1
C30 thru C32	Capacitor, Electrolytic, 100 uF, 35V	023–1084	3
C33	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C34	Capacitor, Electrolytic, 33 uF, 35V	024–3335	1
C35	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	1
C36	Capacitor, Electrolytic, 33 uF, 35V	024–3335	1
C37	Capacitor, Electrolytic, 10 uF, 50V	023–1076	1
C38, C39	Capacitor, Monolythic Ceramic, 0.1 uF ±10%, 50V	003–1066	2
C40 thru C43	Capacitor, Ceramic, 0.001 uF ±10%, 200V	030–1033	4
D1 thru D9	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	9
D10, D11	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	2
D12 thru D14	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	3
D15, D16	Diode, 1N4005, Silicon, 600V @ 1 Ampere	203–4005	2
D17 thru D19	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	3
D20, D21	Diode, 1N4148, Silicon, 75V @ 0.3 Amperes	203–4148	2
DS1, DS2	Indicator, LED, Yellow, 521–9176, 3V @ 30 mA Maximum	323–9225	2
DS7	LED, MV57164, Red, High Efficiency 10–Segment Bar Graph Array	320–7164	1
DS8, DS9	LED, MV54164, Green, High Efficiency 10–Segment Bar Graph Array	320–4164	2
DS10	LED, MV57164, Red, High Efficiency 10–Segment Bar Graph Array	320–7164	1
DS11, DS12	LED, MV54164, Green, High Efficiency 10–Segment Bar Graph Array	320–4164	2
DS13, DS14	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum	323–9224	2
DS15, DS16	Indicator, LED, Red, 521–9212, 1.7V @ 50 mA Maximum	323–9217	2
DS17, DS18	Indicator, LED, Yellow, 521–9176, 3V @ 30 mA Maximum	323–9225	2
DS19, DS20	Indicator, LED, Green, 521–9175, 3V @ 40 mA Maximum	323–9224	2
DS22 thru DS25	LED, Tri–Color Common Cathode	320–0031	4
J1	Receptacle, Male, 13–Pin Dual In–Line	417–2600	1
J2	Connector, AMP 1–87502–8, Header Straight Post Double Row, 40–Pin	417–4040	1
Q1, Q2	Field Effect Transistor, J271, P–Channel JFET, TO–92 Case	210–0271	2
Q3 thru Q6	Transistor, 2N27000, FET, N–Channel, TO–92 Case	210–7000	4
Q7	Transistor, 2N3904, NPN, Silicon, TO–92 Case	211–3904	1
R1 thru R3	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R4	Resistor, 11.0 k Ohm ±1%, 1/4W	103–1105	1
R5, R6	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	2
R7	Resistor, 11.0 k Ohm ±1%, 1/4W	103–1105	1
R8	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R9	Resistor, 24.3 k Ohm ±1%, 1/4W	103–2435	1
R10	Resistor, 825 Ohm ±1%, 1/4W	103–8253	1
R11	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R12	Resistor, 22 Meg Ohm ±5%,1/4W	100–2283	1

TABLE 3-8. ECU DISPLAY/CONTROL SWITCH CIRCUIT BOARD - 917-0306-001
(Sheet 2 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R13	Resistor, 22.1 k Ohm ±1%, 1/4W	103–2211	1
R14	Resistor, 221 k Ohm ±1%, 1/4W	103–2216	1
R15	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R16	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R17	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R18	Resistor, 24.3 k Ohm ±1%, 1/4W	103–2435	1
R19	Resistor, 825 Ohm ±1%, 1/4W	103–8253	1
R20	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R21	Resistor, 22 Meg Ohm ±5%,1/4W	100–2283	1
R22	Resistor, 22.1 k Ohm ±1%, 1/4W	103–2211	1
R23	Resistor, 221 k Ohm ±1%, 1/4W	103–2216	1
R24	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R25	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R26	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R27	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R28	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R29	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R30	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R31	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R32	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R33 thru R36	Resistor, 240 Ohm ±1%, 1/4W	103–2431	4
R37	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R38	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R39	Resistor, 10 Meg Ohm ±5%, 1/4W	100–1083	1
R40	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R41	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R42	Potentiometer, 1 k Ohm ±10%, 1/2W	175–1034	1
R43	Resistor, 100 k Ohm ±1%, 1/4W	103–1062	1
R44	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R45	Resistor, 10 Meg Ohm ±5%, 1/4W	100–1083	1
R46	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	1
R47	Resistor, 2.21 k Ohm ±1%, 1/4W	103–2241	1
R48	Potentiometer, 1 k Ohm ±10%, 1/2W	175–1034	1
R49	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R50, R51	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R52, R53	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	2
R54, R55	Resistor, 10 k Ohm ±1%, 1/4W	100–1051	2
R56	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R57	Resistor, 499 Ohm ±1%, 1/4W	103–4993	1
R58	Resistor, 1.21 k Ohm ±1%, 1/4W	103–1214	1
R59 thru R61	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	3
R62	Resistor, 499 Ohm ±1%, 1/4W	103–4993	1
R63	Resistor, 1.21 k Ohm ±1%, 1/4W	103–1214	1
R64	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R65	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R66	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	1
R67	Resistor, 499 Ohm ±1%, 1/4W	103–4993	1
R68	Resistor, 1.21 k Ohm ±1%, 1/4W	103–1214	1
R69 thru R71	Resistor, 1 k Ohm ±1%, 1/4W	100–1041	3

TABLE 3-8. ECU DISPLAY/CONTROL SWITCH CIRCUIT BOARD - 917-0306-001
(Sheet 3 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
R72	Resistor, 82.5 k Ohm ±1%, 1/4W	103-8255	1
R73	Resistor, 15 k Ohm ±5%, 1/4W	100-1551	1
R74	Resistor, 121 Ohm ±1%, 1/4W	100-1231	1
R75	Resistor, 604 Ohm ±1%, 1/4W	100-6031	1
R76, R77	Resistor, 240 Ohm ±1%, 1/4W	103-2431	2
R78	Resistor, 10 k Ohm ±1%, 1/4W	100-1051	1
R79	Resistor, 82.5 k Ohm ±1%, 1/4W	103-8255	1
R80	Resistor, 15 k Ohm ±5%, 1/4W	100-1551	1
R81	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R82	Resistor, 1.21 k Ohm ±1%, 1/4W	103-1214	1
R83 thru R85	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	3
R86	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R87	Resistor, 1.21 k Ohm ±1%, 1/4W	103-1214	1
R88 thru R90	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	3
R91	Resistor, 499 Ohm ±1%, 1/4W	103-4993	1
R92	Resistor, 1.21 k Ohm ±1%, 1/4W	103-1214	1
R93 thru R95	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	3
R96 thru R102	Resistor, 240 Ohm ±1%, 1/4W	103-2431	7
R103	Resistor, 1 k Ohm ±1%, 1/4W	100-1041	1
R104, R105	Resistor, 100 k Ohm ±1%, 1/4W	103-1062	2
R106 thru R112	Resistor, 240 Ohm ±1%, 1/4W	103-2431	7
R113	Resistor, 174 Ohm ±1%, 1/4W	100-1731	1
R114	Resistor, 825 Ohm ±1%, 1/4W	103-8253	1
S1, S2	Switch, SPDT, Momentary MP Series, 2 Green, C&K MP01R2266 CBE	340-0130	2
S3	Switch, SPDT, Momentary MP Series, 1 Red, C&K MP01R123 CBE	340-0030	1
S4, S5	Switch, SPDT, Momentary MP Series, 1 Yellow, C&K MP01R125 CBE	340-0162	2
S6 thru S10	Switch, SPDT, Momentary MP Series, 1 Green, C&K MP01R126 CBE	340-0161	5
S11	Switch, SPDT, Momentary MP Series, 1 Red, C&K MP01R123 CBE	340-0030	1
U1	Integrated Circuit, DG212CJ, QUAD SPST Switch, CMOS, 16-Pin DIP	220-0212	1
U2	Amplifier, Dual OP, RC4227GNB Raytheon, 8-Pin DIP	221-4227	1
U3	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U4	Integrated Circuit, MC14584, Hex Schmitt Trigger, CMOS, 14-Pin DIP	228-4584	1
U5	Integrated Circuit, MC14013BCP, Dual D-Type Flip-Flop, CMOS, 14-Pin DIP	228-4013	1
U6	Integrated Circuit, TL072CP, Dual JFET-Input Operational Amplifier, 8-Pin DIP	221-0072	1
U7	Integrated Circuit, DG212CJ, QUAD SPST Switch, CMOS, 16-Pin DIP	220-0212	1
U8	Integrated Circuit, TLO74CN, Quad JFET-Input Operational Amplifier, 14-Pin DIP	221-0074	1
U9 thru U11	Integrated Circuit, LM3914N, Dot/Bar Display Driver, 18-Pin DIP	229-3914	3

TABLE 3-8. ECU DISPLAY/CONTROL SWITCH CIRCUIT BOARD - 917-0306-001
(Sheet 4 of 4)

REF. DES.	DESCRIPTION	PART NO.	QTY.
U12, U13	Integrated Circuit, NE555N, Timer, 8–Pin DIP	229–0555	2
U14	Integrated Circuit, LM317T, Adjustable Positive Voltage Regulator, 1.2V to 37V, 1.5 Ampere, TO–220 Case	227–0317	1
U15 thru U17	Integrated Circuit, LM3914N, Dot/Bar Display Driver, 18–Pin DIP	229–3914	3
XU1	Socket, 16–Pin DIP	417–1604	1
XU2	Socket, 8–Pin DIP	417–0804	1
XU3 thru XU5	Socket, 14–Pin DIP	417–1404	3
XU6	Socket, 8–Pin DIP	417–0804	1
XU7	Socket, 16–Pin DIP	417–1604	1
XU8	Socket, 14–Pin DIP	417–1404	1
XU9 thru XU11	Socket, 18–Pin DIP	417–1804	3
XU12, XU13	Socket, 8–Pin DIP	417–0804	2
XU15 thru XU17	Socket, 18–Pin DIP	417–1804	3
----	Blank, ECU Display/Control Switch Circuit Board	517–0306–001	1

TABLE 3-9. METER SWITCH CIRCUIT BOARD ASSEMBLY - 917-0306-005

REF. DES.	DESCRIPTION	PART NO.	QTY.
C501	Capacitor, Monolythic Ceramic, 0.1 Ohm ±10%, 50V	003–1066	1
D501	Diode, Zener, 1N4733A, 5.1V ±5%, 1W	200–4733	1
J501	Receptacle, 6–Pin	417–0677	1
J502	Socket, 4–Pin	418–0255	1
R501	Potentiometer, 500 Ohm, 1/2W	178–5030	1
R503	Potentiometer, 2 k Ohm ±10%, 1/2W	178–2044	1
R504	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R505	Potentiometer, 500 Ohm, 1/2W	178–5030	1
R506	Potentiometer, 2 k Ohm ±10%, 1/2W	178–2044	1
R507	Resistor, 3.01 k Ohm ±1%, 1/4W	103–3014	1
R508	Resistor, 2.74 k Ohm ±1%, 1/4W	103–2744	1
R509, R510	Resistor, 1.62 k Ohm ±1%, 1/4W	103–1624	2
R511	Potentiometer, 50 k Ohm ±10%, 1/2W	178–5054	1
S501, S502	Switch, Rotary, 3 Position 2 Pole	340–0134	2
----	Blank, Meter Switch Circuit Board	517–0306–005	1

TABLE 3-10. ECU WIRE HARNESS - 947-0153
(Sheet 1 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
P1	Housing, SL–156, 3 Position	417–0306	1
P1	Plug, Ribbon Cable, 26–Pin Dual In–line	418–2600	1

TABLE 3-10. ECU WIRE HARNESS - 947-0153
(Sheet 2 of 2)

REF. DES.	DESCRIPTION	PART NO.	QTY.
P2	Connector, Ribbon Cable, 40 Conductor	418-4001	1
P2	Housing, SL-156, 6 Position	417-0606	1
P3	Plug, Ribbon Cable, 26-Pin Dual In-Line	418-2600	1
P7	Connector Housing, 6-Pin	418-0670	1
P8	Connector, Ribbon Cable, 40 Conductor	418-4001	1
P10	Plug, Ribbon Cable, 26-Pin Dual In-line	418-2600	1
P502	Plug, Housing, 4-Pin	418-0240	1
P801	Plug, Ribbon Cable, 26-Pin Dual In-Line	418-2600	1
----	Pins, Connector	417-0053	10

SECTION IV
ECU ASSEMBLY DRAWINGS

4-1. INTRODUCTION.

4-2. This section provides assembly drawings, wiring diagrams, and schematic diagrams as listed below for the Broadcast Electronics ECU assembly.

FIGURE	TITLE	NUMBER
4-1	SCHEMATIC DIAGRAM, ECU CONTROLLER CIRCUIT BOARD	SB917-0205
4-2	ASSEMBLY DIAGRAM, ECU CONTROLLER CIRCUIT BOARD	AC917-0205
4-3	COMPONENT LOCATOR, ECU CONTROLLER BOARD	----------
4-4	SCHEMATIC DIAGRAM, ECU MOTHERBOARD	SB917-0301
4-5	ASSEMBLY DIAGRAM, ECU MOTHERBOARD	AC917-0301
4-6	SCHEMATIC DIAGRAM, EXCITER CIRCUIT BOARD	SB917-0300
4-7	ASSEMBLY DIAGRAM, EXCITER CIRCUIT BOARD	AC917-0300
4-8	COMPONENT LOCATOR, ECU EXCITER BOARD	----------
4-9	SCHEMATIC DIAGRAM, STEREO CIRCUIT BOARD	SD917-0209
4-10	ASSEMBLY DIAGRAM, STEREO CIRCUIT BOARD	AC917-0209
4-11	COMPONENT LOCATOR, ECU STEREO BOARD	----------
4-12	SCHEMATIC DIAGRAM, ECU DISPLAY/CONTROL SWITCH CIRCUIT BOARDS	SB917-0306-001
4-13	SCHEMATIC DIAGRAM, ECU METER SWITCH CIRCUIT BOARD	SB917-0306-005
4-14	REFER TO PART I, SECTION VII FOR THE ECU DISPLAY CIRCUIT BOARD ASSEMBLY-002/-003/-004/-005	AD917-0306-001/ /-006/-007/-009/-014

P301 POWER 5 COMMAND 31
P301 POWER 5 SWITCH 1
P301 POWER 4 COMMAND 30
P301 POWER 4 SWITCH 2
P301 POWER 3 COMMAND 29
P301 POWER 3 SWITCH 3
P301 POWER 2 COMMAND 28
P301 POWER 2 SWITCH 4
P301 POWER 1 COMMAND 27
P301 POWER 1 SWITCH 5
P301 OFF COMMAND 26
P301 OFF SWITCH 6

U1 4N33 D1 1N4005 R110 3.3MEG 5% C75 .001uF D2 1N4148
U2 4N33 D3 1N4005 R111 3.3MEG 5% C76 .001uF D4 1N4148
U3 4N33 D5 1N4005 R112 3.3MEG 5% C77 .001uF D6 1N4148
U4 4N33 D7 1N4005 R113 3.3MEG 5% C78 .001uF D8 1N4148
U5 4N33 D9 1N4005 R114 3.3MEG 5% C79 .001uF D10 1N4148
U6 4N33 D11 1N4005 R115 3.3MEG 5% C80 .001uF D12 1N4148
RN1 10K

D50 1N4148
TEMP SHUTDOWN 5
REM_ENA 4
EMERGOFF 3
RESET 4
SHUTDOWN 4
U37/A 4075
R188 100K
+15V_NBU

P302 ANTENNA A INTERLOCK 41
P302 ANTENNA B INTERLOCK 42
P302 ANTENNA C INTERLOCK 43
P302 EXTERNAL TRANSMITTER MUTE 44
P302 CABINET INTERLOCK 30
P302 EXTERNAL INTERLOCK 45

U7 4N33 D13 1N4005 R116 3.3MEG 5% C81 .001uF
U8 4N33 D14 1N4005 R117 3.3MEG 5% C82 .001uF
U9 4N33 D15 1N4005 R118 3.3MEG 5% C83 .001uF
U10 4N33 D16 1N4005 R119 3.3MEG 5% C84 .001uF
U11 4N33 D17 1N4005 R120 3.3MEG 5% C85 .001uF

RN2 10K RN8 10K RN2 10K
EXT/GND

S1 S2 S3
RN4 100K RN3 100K

AC_FAIL 4
U22/A 4073
U25/F 4069
R196 121K C130 10uF R197 10 U59/B 1538
R199 4.75K C131 1uF C132 33uF R200 2.2M
D56 1N4148 D55 1N4148 D53 1N4148 D54 1N4148 PWR_INH 2
R198 100K
U44/D LM339
R201 100K
UREF 4
+15V

C1 .1uF U14 1532
C2 .1uF U15 4076
C3 .1uF U17 4076
C4 .1uF U18 4028
C5 .1uF
C6 .1uF U13/A 4071
C8 .1uF U16/A 4011
1KHZ 2
2,5 TRIM RESET

OVER CYC OFF 3
A 2
B 2
C 2
OFF 1,5

PWR5 PWR4 PWR3 PWR2 PWR1 OFF

P301 POWER 5 INDICATOR 32
P301 POWER 5 STATUS 12
P301 POWER 4 INDICATOR 33
P301 POWER 4 STATUS 13
P301 POWER 3 INDICATOR 34
P301 POWER 3 STATUS 14
P301 POWER 2 INDICATOR 35
P301 POWER 2 STATUS 15
P301 POWER 1 INDICATOR 36
P301 POWER 1 STATUS 16
P301 OFF INDICATOR 7
P301 OFF STATUS 11

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 2N7000

C9 .1uF U20/A 4081
C10 .1uF U19/B 4075
C11 .1uF U21/C 4075
C12 .1uF U23/A 4081
C13 .1uF U24/A 4025
C14 .1uF U25/A 4069
C15 .1uF U22/B 4073
U20/B 4081
U20/C 4081
U20/D 4081
U12/A 4075
U12/B 4075
U21/A 4075
U21/B 4075
U13/B 4071
P1 J1

ANTENNA INTERLOCK DEFEAT

ANTENNA INTERLOCK	
JUMPER POSITION	INTERLOCK FUNCTION
1-2	DEFEATED
2-3	ACTIVE

T_MUTE 4
EXC_MUTE 3
OPERATE 2,5
CABINET 3
FAILSAFE 4
U71/B 4081
U69/B 4075
U71/D 4081
U13/C 4071 NC

P302 TRANSMITTER ON 57
P301 ANTENNA CONFLICT INDICATOR 45
P302 ANTENNA CONFLICT 6
P301 ANTENNA A STATUS 8
P301 ANTENNA B STATUS 9
P301 ANTENNA C STATUS 10
P301 INTERLOCK INDICATOR 43
EXT/GND

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NOTES:
1. ALL RESISTORS IN OHMS: 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C137, D64, DS3, E10, J20, P302, Q59, R210, RN8, S5, TP12, U71
3. COMPONENTS NOT USED: C119-120, D46,D48, DS2 E1-9, R178, R180, R182, R185-186
4. SEE ASSEMBLY: AC 917-0205
5. N INDICATES PAGE No. OF SIGNAL CONTINUATION.

AC	2-16-99	SEE SHEET 5.	KT		10095
AB	10-8-97	UPDATED NOTES: ALSO SEE SHEET 5.	KT	JW	9871

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	JAH 7-6-90
CHKD	MH 7-17-91
ME	
PROJ. ENGR.	JW 7-17-91
MFG.	
MATERIAL	SEE B/M 917-0205
FINISH	SEE DWG RA592-0000
NEXT ASSY.	AC 917-0205

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: ECU CONTROLLER

TYPE	SIZE	DWG. NO.	REV
S	B	917-0205	AE

MODEL AM-1/2.5/5 SCALE NONE SHEET 1 OF 5

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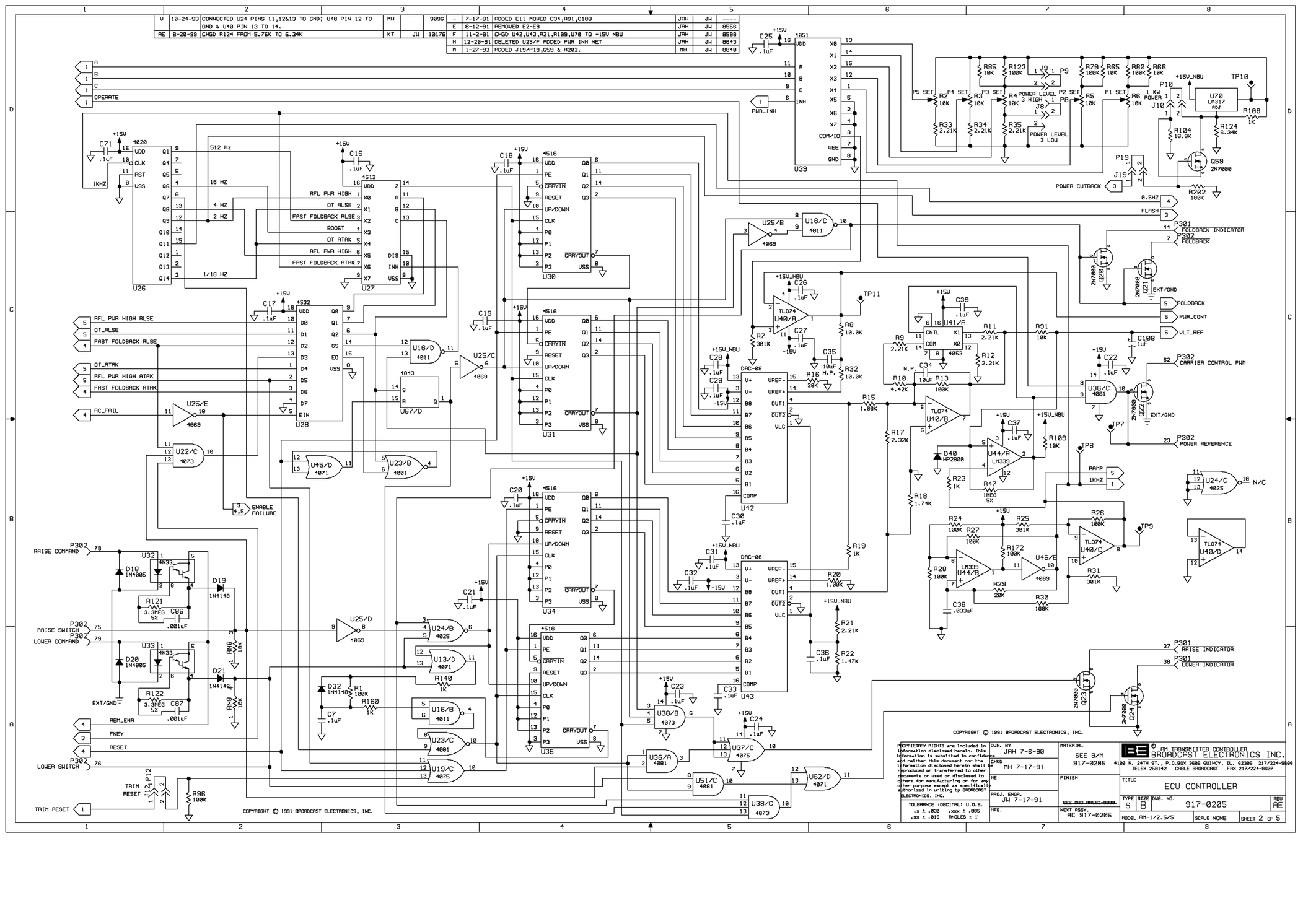
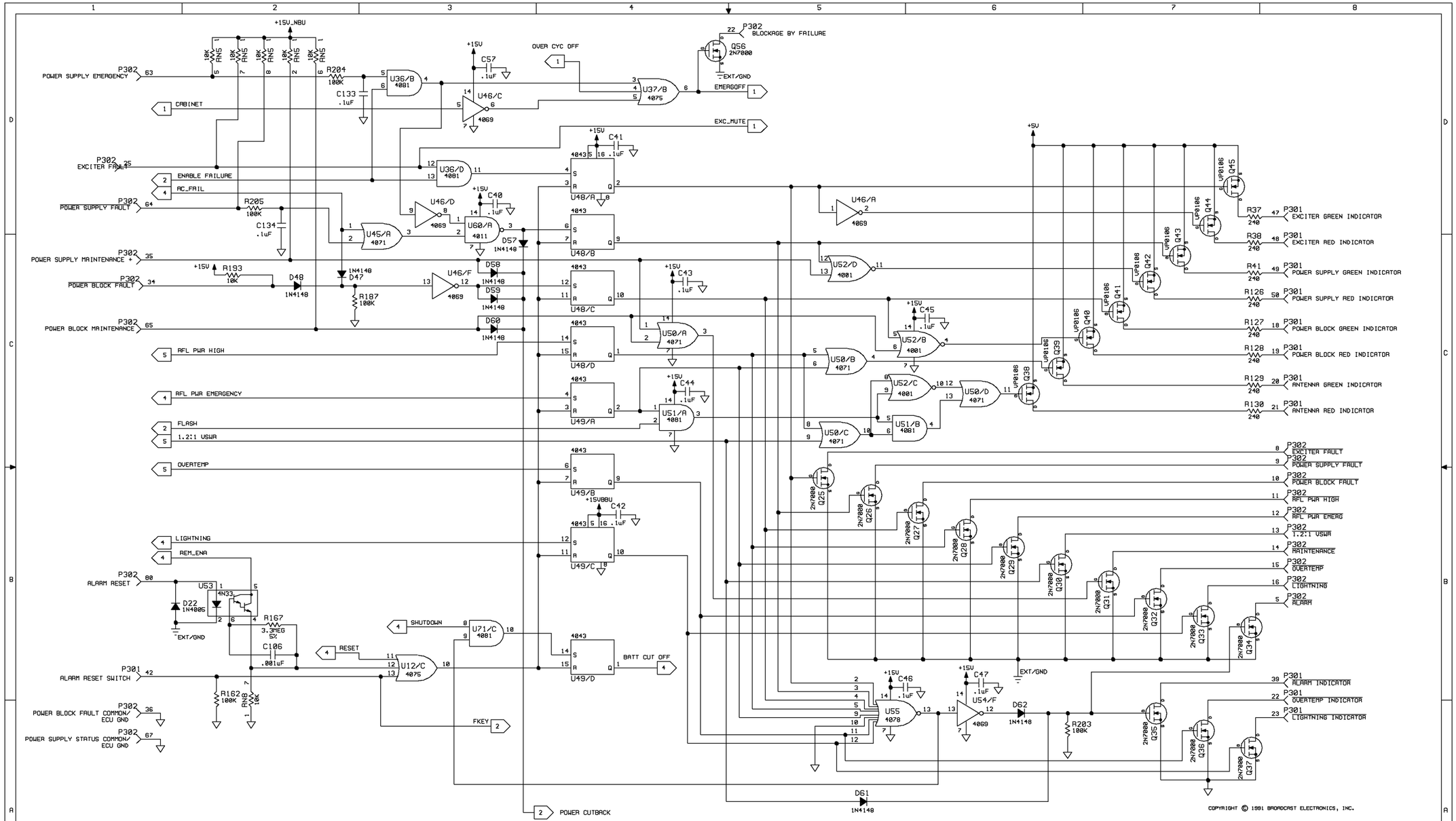
V	10-24-93	CONNECTED U24 PINS 11,12&13 TO GND; U40 PIN 12 TO GND & U48 PIN 13 TO 14.	MH		9896	-	7-17-91	ADDED E11 MOVED C34,R91,C100	JAH	JW	----
						E	8-12-91	REMOVED E2-E9	JAH	JW	8558
AE	8-28-99	CHGD R124 FROM 5.76K TO 6.34K	KT	JW	10176	F	11-2-91	CHGD U42,U43,R21,R189,U70 TO +15U NBU	JAH	JW	8598
						H	12-28-91	DELETED U25/F ADDED PWR INH NET	JAH	JW	8643
						M	1-27-93	ADDED J19/P19,Q59 & R202.	MH	JW	8848





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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

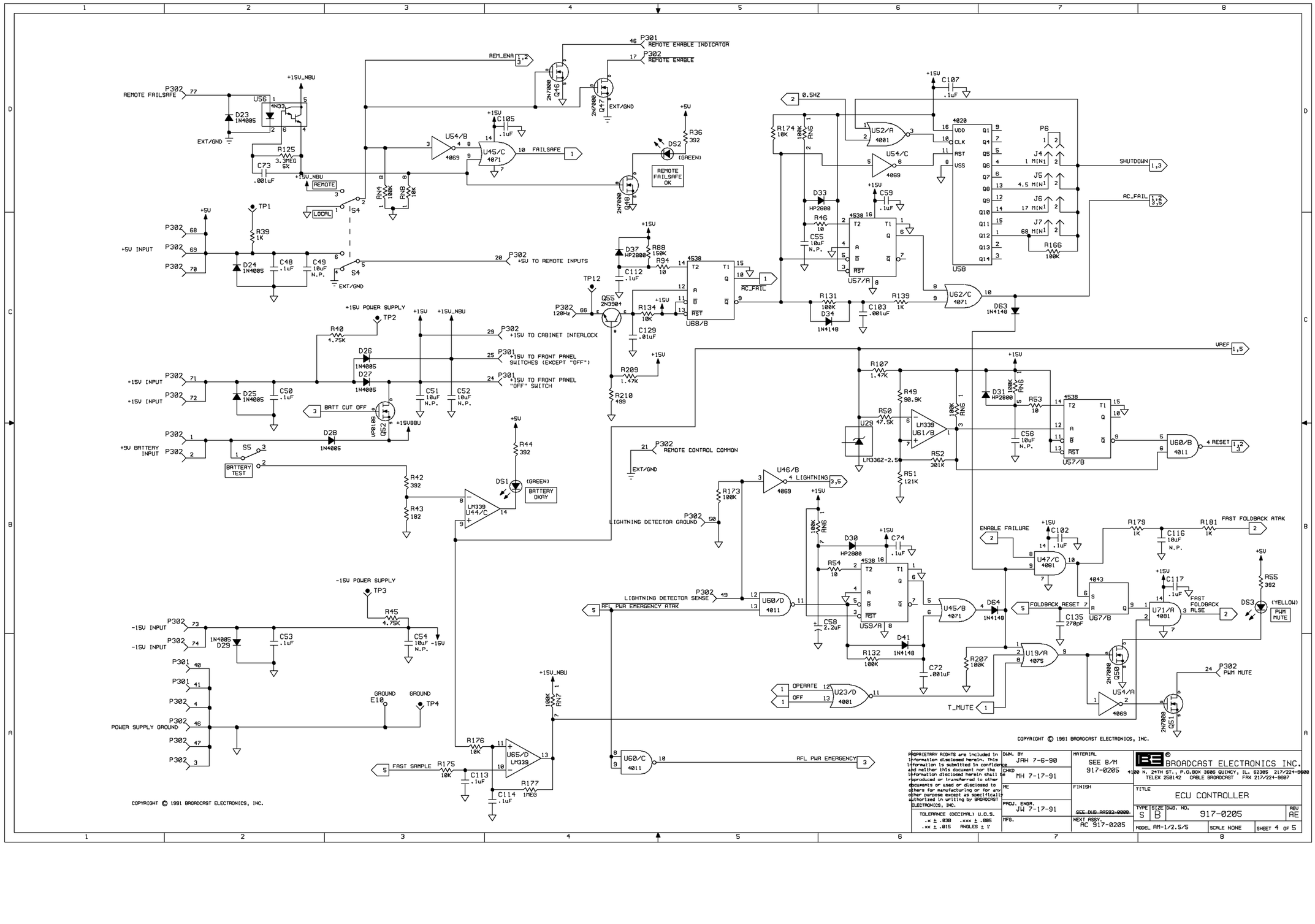
DWN. BY	JAH 7-6-90
CHKD	MH 7-17-91
ME	
PROJ. ENGR.	JW 7-17-91
MFG.	
MATERIAL	SEE B/M 917-0205
FINISH	~~SEE DWG AA592-0000~~
NEXT ASSY.	

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: ECU CONTROLLER

TYPE	SIZE	DWG. NO.	REV
S	B	917-0205	AE

MODEL AM-1/2.5/5 SCALE NONE SHEET 3 OF 5


P301 REMOTE ENABLE INDICATOR
P302 REMOTE ENABLE
REM_ENA
EXT/GND
+15V_NBU
P302 REMOTE FAILSAFE
U56 4N33
D23 1N4005
R125 3.3MEG 5%
C73 .001uF
REMOTE
LOCAL
S4
U54/B 4069
U45/C 4071
FAILSAFE
C105 .1uF
DS2 (GREEN)
R36 392
REMOTE FAILSAFE OK
RN4 100K
RN8 10K
TP1
R39 1K
+5V INPUT
D24 1N4005
C48 .1uF
C49 10uF N.P.
P302 +5V TO REMOTE INPUTS
+15V POWER SUPPLY
TP2
R40 4.75K
D26 1N4005
D27 1N4005
+15V INPUT
D25 1N4005
C50 .1uF
C51 10uF N.P.
C52 10uF N.P.
P302 +15V TO CABINET INTERLOCK
P301 +15V TO FRONT PANEL SWITCHES (EXCEPT "OFF")
P301 +15V TO FRONT PANEL "OFF" SWITCH
BATT CUT OFF
Q52 VP0106
+15VBBU
+9V BATTERY INPUT
S5
BATTERY TEST
D28 1N4005
R42 392
R43 182
DS1 (GREEN)
BATTERY OKAY
LM339 U44/C
R44 392
P302 REMOTE CONTROL COMMON
EXT/GND
U46/B 4069
4 LIGHTNING
LIGHTNING DETECTOR GROUND
R173 100K
-15V POWER SUPPLY
TP3
R45 4.75K
C54 10uF -15V N.P.
-15V INPUT
D29 1N4005
C53 .1uF
P302 POWER SUPPLY GROUND
GROUND E10
GROUND TP4
+15V_NBU
RN7 100K
R176 10K
R175 10K
C113 .1uF
C114 .1uF
R177 1MEG
FAST SAMPLE
U65/D LM339
U60/C 4011
RFL PWR EMERGENCY
TP12
Q55 2N3904
P302 120Hz
R134 10K
C129 .01uF
R209 1.47K
R210 499
U68/B
D37 HP2800
R88 150K
R94 10
C112 .1uF
AC_FAIL
R131 100K
D34 1N4148
R139 1K
C103 .001uF
U62/C 4071
D63 1N4148
R46 10
C55 10uF N.P.
U57/A
D33 HP2800
C59 .1uF
R174 10K
RN6 100K
U52/A 4001
U54/C 4069
C107 .1uF
U58 4020
P6
J4 1 MIN
J5 4.5 MIN
J6 17 MIN
J7 68 MIN
R166 100K
SHUTDOWN 1,3
AC_FAIL 1,2 3,5
VREF 1,5
R107 1.47K
R49 90.9K
R50 47.5K
U29 LM3362-2.5
U61/B LM339
R52 301K
R51 121K
RN1 100K
D31 HP2800
R53 10
C56 10uF N.P.
U57/B
U60/B 4011
4 RESET 1,2 3
LIGHTNING DETECTOR SENSE
RFL PWR EMERGENCY ATAK
U60/D 4011
D30 HP2800
R54 10
C74 .1uF
C58 2.2uF
U59/A
D41 1N4148
R132 100K
U45/B 4071
D64 1N4148
C72 .001uF
OPERATE
OFF
U23/D 4001
T_MUTE
ENABLE FAILURE
U47/C 4001
R179 1K
C116 10uF N.P.
R181 1K
FAST FOLDBACK ATAK
FOLDBACK_RESET
C135 270pF
U67/B
U71/A 4081
FAST FOLDBACK RLSE
R207 100K
U19/A 4075
Q50 2N7000
U54/A 4069
Q51 2N7000
P302 PWM MUTE
DS3 (YELLOW)
PWM MUTE
R55 392
C117 .1uF
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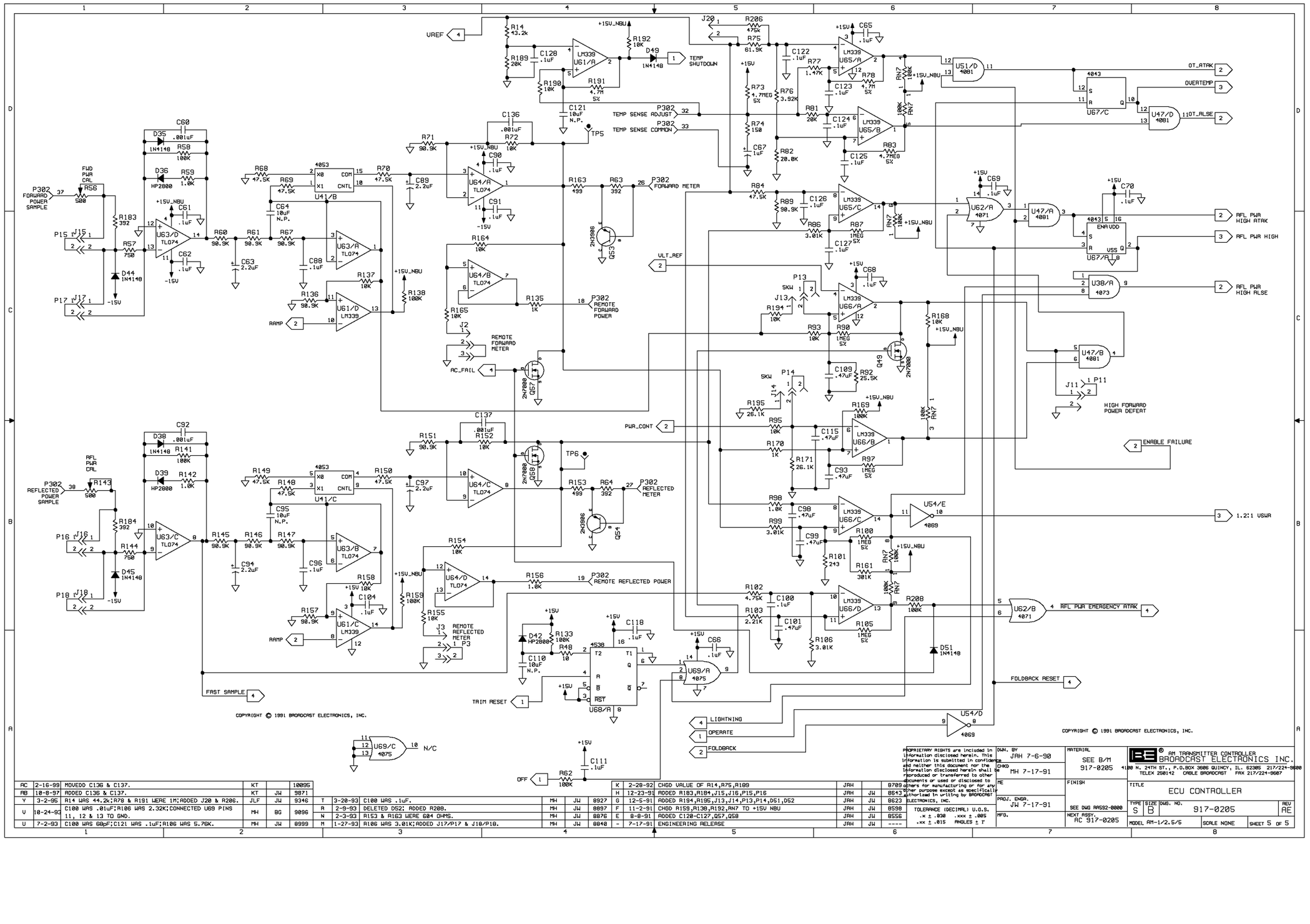
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°
DWN. BY JAH 7-6-90
CHKD MH 7-17-91
ME
PROJ. ENGR. JW 7-17-91
MFG.
MATERIAL SEE B/M 917-0205
FINISH
SEE DWG #RS92-0000
NEXT ASSY. AC 917-0205
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE ECU CONTROLLER
TYPE S SIZE B DWG. NO. 917-0205 REV AE
MODEL RM-1/2.5/5 SCALE NONE SHEET 4 OF 5



AC	2-16-99	MOVEDD C136 & C137.	KT		10095
AB	10-8-97	ADDED C136 & C137.	KT	JW	9871
Y	3-2-95	R14 WAS 44.2K;R78 & R191 WERE 1M;ADDED J20 & R206.	JLF	JW	9346
U	10-24-93	C100 WAS .01uF;R106 WAS 2.32K;CONNECTED U69 PINS 11, 12 & 13 TO GND.	MH	BG	9096
U	7-2-93	C100 WAS 68pF;C121 WAS .1uF;R106 WAS 5.76K.	MH	JW	8999

T	3-20-93	C100 WAS .1uF.	MH	JW	8927
R	2-9-93	DELETED DS2; ADDED R208.	MH	JW	8897
N	2-3-93	R153 & R163 WERE 604 OHMS.	MH	JW	8876
M	1-27-93	R106 WAS 3.01K;ADDED J17/P17 & J18/P18.	MH	JW	8840

K	2-28-92	CHGD VALUE OF R14,R75,R189	JAH		8709
H	12-23-91	ADDED R183,R184,J15,J16,P15,P16	JAH	JW	8643
G	12-5-91	ADDED R194,R195,J13,J14,P13,P14,DS1,DS2	JAH	JW	8623
F	11-2-91	CHGD R159,R138,R192,RN7 TO +15V_NBU	JAH	JW	8598
E	8-8-91	ADDED C128-C127,Q57,Q58	JAH	JW	8556
-	7-17-91	ENGINEERING RELEASE	JAH	JW	----

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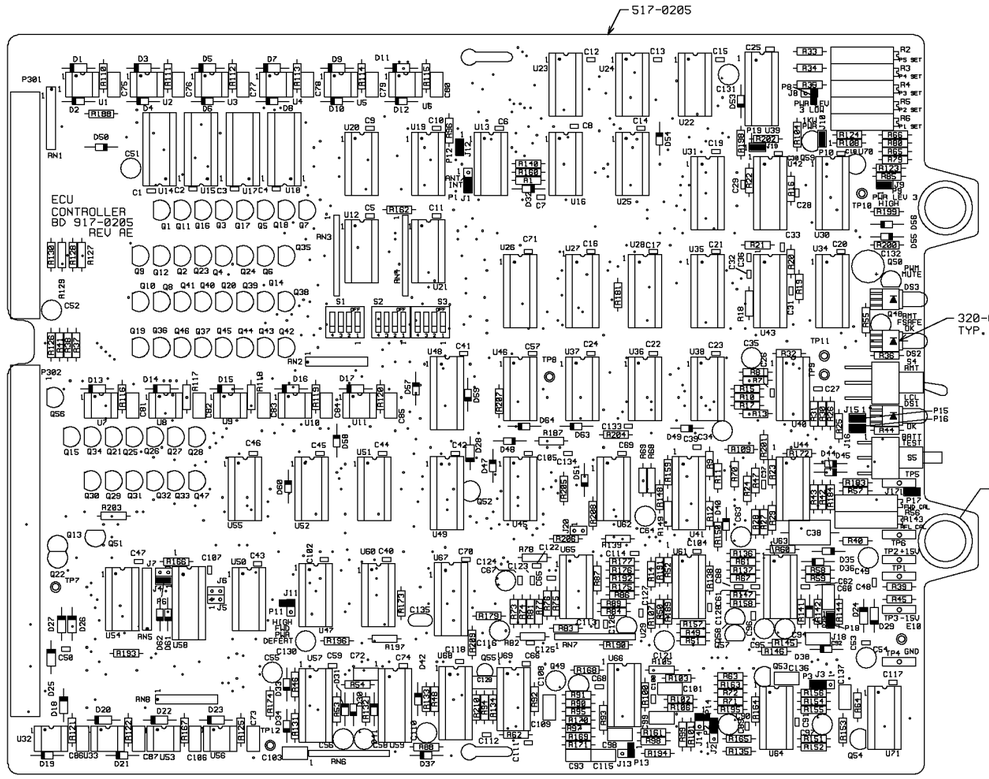
DWN. BY	JAH 7-6-90
CHKD	MH 7-17-91
ME	
PROJ. ENGR.	JW 7-17-91
MFG.	
MATERIAL	SEE B/M 917-0205
FINISH	SEE DWG RA592-0000
NEXT ASSY.	AC 917-0205

® AM TRANSMITTER CONTROLLER
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3086 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: ECU CONTROLLER

TYPE	SIZE	DWG. NO.	REV
S	B	917-0205	AE

MODEL AM-1/2.5/5 | SCALE NONE | SHEET 5 OF 5



NOTES:
1. SEE SCHEMATIC SB 917-0205

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REV	DATE	DESCRIPTION	BY	CHKD	ECO
AE	8-20-99	CHGD R124 FROM A 103-5764 TO A 103-6344.	KT		10176
AD	5-24-99	ADDED Q56	KT	JW	10148
AC	2-16-99	CHGD NETS OF C136 & C137 PIN 2.	KT	JW	10095

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY	JAH 1-22-91
CHKD	MH 5-20-91
ME	
PROJ. ENGR.	JW 7-17-91
MFG.	
MATERIAL	SEE B/M 917-0205
FINISH	-----
~~SEE DWG RA592-0000~~	
NEXT ASSY.	-----

BROADCAST ELECTRONICS INC.
4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB ASSEMBLY
ECU CONTROLLER BD

TYPE	SIZE	DWG No.	REV
A	C	917-0205	AE

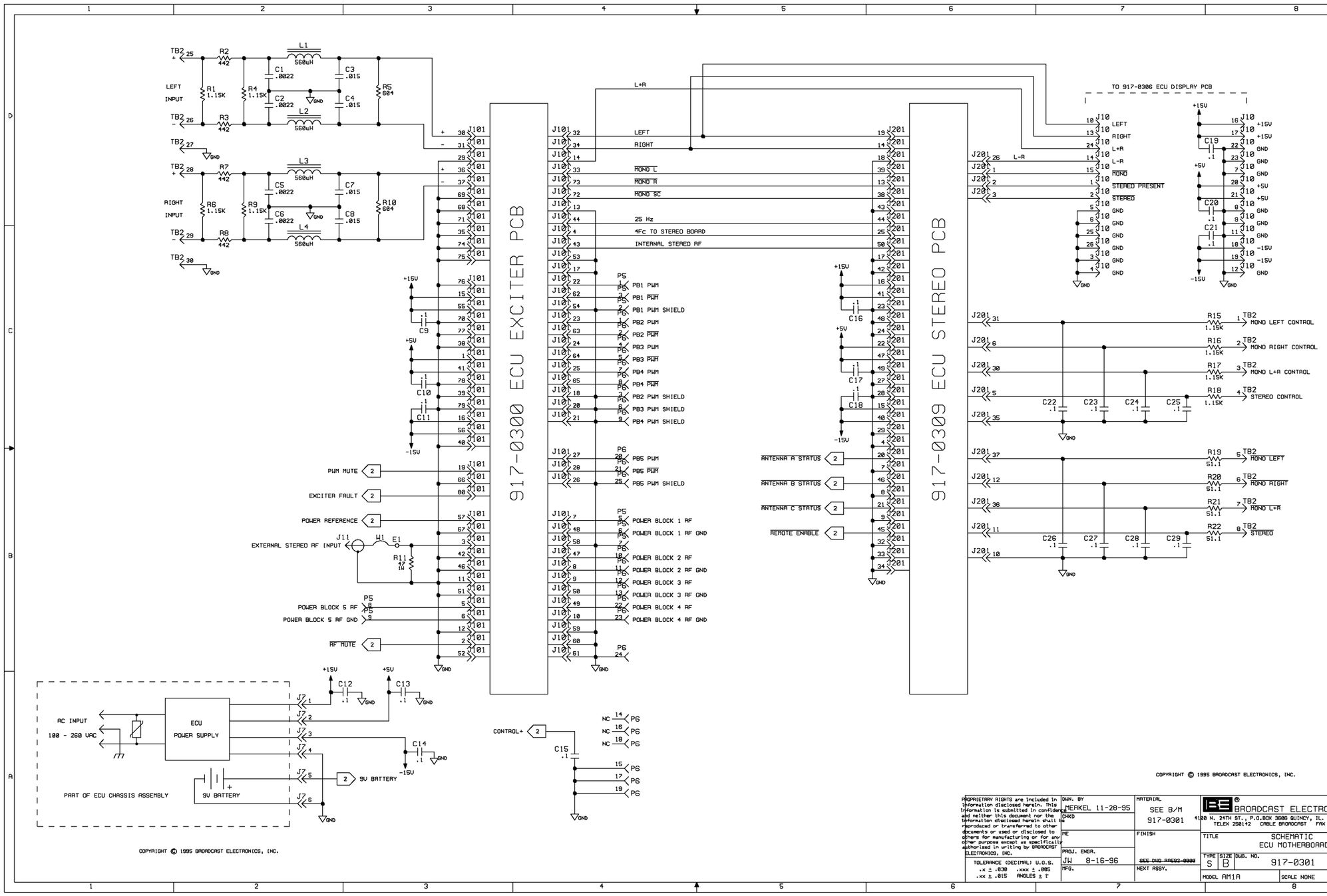
MODEL AM-1/2.5/5 | SCALE 1=1 | SHEET 1 OF 1

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
C1	C1	C60	B3	C119	B2	D49	B3	Q31	B1
C2	C1	C61	B3	C120	C3	D50	C1	Q32	B1
C3	C2	C62	B3	C121	B2	DS1	B3	Q33	B1
C4	C2	C63	B3	C122	B2	DS2	C3	Q34	B1
C5	C2	C64	B2	C123	B2	DS3	C3	Q35	C2
C6	C2	C65	B2	C124	B2	E10	B3	Q36	C1
C7	C2	C66	B2	C125	B2	J1	C2	Q37	C1
C8	C2	C67	B2	C126	B2	J2	B3	Q38	C2
C9	C2	C68	B2	C127	B2	J3	B3	Q39	C2
C10	C2	C69	B2	C128	B3	J4	B1	Q40	C1
C11	C2	C70	B2	C129	B2	J5	B1-B2	Q41	C1
C12	C2	C71	C2	D1	C1	J6	B1-B2	Q42	C2
C13	C2	C72	B2	D2	C1	J7	B1	Q43	C2
C14	C2	C73	B2	D3	C1	J8	C3	Q44	C2
C15	C3	C74	B2	D4	C1	J9	C3	Q45	C1-C2
C16	C2	C75	C1	D5	C1	J10	C3	Q46	C1
C17	C2	C76	C1	D6	C1	J11	B2	Q47	B1
C18	C3	C77	C2	D7	C2	J12	C2	Q48	C3
C19	C3	C78	C2	D8	C2	P1	C2	Q49	B2
C20	C3	C79	C2	D9	C2	P2	B3	Q50	C3
C21	C3	C80	C2	D10	C2	P3	B3	Q51	B1
C22	C2	C81	B1-C1	D11	C2	P6	B1	Q52	B2
C23	C3	C82	B1-C1	D12	C2	P8	C3	Q53	B3
C24	C2	C83	B2-C2	D13	C1	P9	C3	Q54	B3
C25	C3	C84	B2-C2	D14	C1	P10	C3	Q55	B2
C26	C3	C85	B2-C2	D15	C2	P11	B2	Q56	B2
C27	C3	C86	B1	D16	C2	P12	C2	Q57	B3
C28	C3	C87	B1	D17	C2	P301	C1	Q58	B3
C29	C3	C88	B3	D18	B1	P302	B1-C1	R1	C2
C30	C3	C89	B3	D19	A1	Q1	C1	R2	C3
C31	C3	C90	B3	D20	B1	Q2	C1	R3	C3
C32	C3	C91	B3	D21	A1	Q3	C1-C2	R4	C3
C33	C3	C92	B3	D22	B1	Q4	C1-C2	R5	C3
C34	B3	C93	A2	D23	B1-B2	Q5	C2	R6	C3
C35	C3	C94	B3	D24	B3	Q6	C2	R7	C3
C36	C3	C95	B3	D25	B1	Q7	C2	R8	C3
C37	B3	C96	B3	D26	B1	Q8	C1	R9	B3
C38	B3	C97	B3	D27	B1	Q9	C1	R10	C3
C39	B3	C98	B2	D28	B2	Q10	C1	R11	B3
C40	B2	C99	B2-B3	D29	B3	Q11	C1	R12	B3
C41	C2	C100	B2	D30	B2	Q12	C1	R13	B3
C42	B2	C101	B2-B3	D31	B2	Q13	B1	R14	B2
C43	B2	C102	B2	D32	C2	Q14	C2	R15	C3
C44	B2	C103	A2-B2	D33	B2	Q15	B1	R16	C3
C45	B2	C104	B3	D34	B2	Q16	C1	R17	C3
C46	B2	C105	B2	D35	B3	Q17	C2	R18	C3
C47	B1	C106	B1	D36	B3	Q18	C2	R19	C3
C48	B3	C107	B1	D37	A2	Q19	C1	R20	C3
C49	B3	C108	B2	D38	B3	Q20	C1-C2	R21	C3
C50	B1	C109	B2	D39	B3	Q21	B1	R22	C3
C51	C1	C110	B2	D40	B3	Q22	B1	R23	B3
C52	C1	C111	B2	D41	B2	Q23	C1	R24	B3
C53	B3	C112	B2	D42	B2	Q24	C2	R25	B3
C54	B3	C113	B2	D43	B2	Q25	B1	R26	B3-C3
C55	B2	C114	B2	D44	B3	Q26	B1	R27	B3
C56	B2	C115	A2	D45	B3	Q27	B1	R28	B3
C57	C2	C116	B2	D46	B2	Q28	B1	R29	B3
C58	B2	C117	B3	D47	C3	Q29	B1	R30	B3-C3
C59	B2	C118	B2	D48	B3	Q30	B1	R31	B3-C3

FIGURE 4-3. COMPONENT LOCATOR, ECU CONTROLLER BOARD
(Sheet 1 of 2)

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
R32	C3	R91	B2	R150	B3	TP3	B3	U51	B2
R33	C3	R92	B2	R151	B3	TP4	B3	U52	B2
R34	C3	R93	B2	R152	A3-B3	TP5	B3	U53	B1
R35	C3	R94	B2	R153	B3	TP6	B3	U54	B1
R36	C3	R95	B2	R154	B3	TP7	B1	U55	B2
R37	C1	R96	C2	R155	B3	TP8	C2	U56	B1-B2
R38	C1	R97	B2	R156	B3	TP9	C3	U57	B2
R39	B3	R98	B2	R157	B3	TP10	C3	U58	B1
R40	B3	R99	B2-B3	R158	B3	TP11	C3	U59	B2
R41	C1	R100	B2	R159	B2-B3	U1	C1	U60	B2
R42	B3	R101	B3	R160	C2	U2	C1	U61	B3
R43	B3	R102	B3	R161	B2	U3	C1-C2	U62	B2
R44	B3	R103	B2-B3	R162	C2	U4	C2	U63	B3
R45	B3	R104	C3	R163	B3	U5	C2	U64	B3
R46	B2	R105	B2-B3	R164	B3	U6	C2	U65	B2
R47	B3	R106	B3	R165	B3	U7	B1-C1	U66	B2
R48	B2	R107	B2	R166	B1	U8	B1-C1	U67	B2
R49	B3	R108	C3	R167	B1	U9	B2-C2	U68	B2
R50	B2	R109	B3	R168	B2	U10	B2-C2	U69	B2
R51	B3	R110	C1	R169	B2	U11	B2-C2	U70	C3
R52	B2-B3	R111	C1	R170	B2	U12	C2	U71	B3
R53	B2	R112	C2	R171	B2	U13	C2		
R54	B2	R113	C2	R172	B3	U14	C1		
R55	C3	R114	C2	R173	B2	U15	C1		
R56	B3	R115	C2	R174	B2	U16	C2		
R57	B3	R116	C1	R175	B2	U17	C2		
R58	B3	R117	C1	R176	B2	U18	C2		
R59	B3	R118	C2	R177	B2	U19	C2		
R60	B3	R119	C2	R178	A2	U20	C2		
R61	B3	R120	C2	R179	B2	U21	C2		
R62	B2	R121	B1	R180	B2	U22	C3		
R63	B3	R122	B1	R181	C2	U23	C2		
R64	B3	R123	C3	R182	B2	U24	C2		
R65	C3	R124	C3	R183	B3	U25	C2		
R66	C3	R125	B2	R184	C3	U26	C2		
R67	B3	R126	C1	R185	C3	U27	C2		
R68	B2	R127	C1	R186	C3	U28	C2		
R69	B2	R128	C1	R187	B3	U29	B2		
R70	B3	R129	C1	R188	C1	U30	C3		
R71	B3	R130	C1	R189	B2-B3	U31	C3		
R72	B3	R131	B2	R190	B2	U32	B1		
R73	B2	R132	B2	R191	B2	U33	B1		
R74	B2	R133	B2	R192	B2	U34	C3		
R75	B2	R134	B2	R193	B1	U35	C3		
R76	B2	R135	B3	RN1	C1	U36	B2-C2		
R77	B2	R136	B3	RN2	C2	U37	B2-C2		
R78	B2	R137	B3	RN3	C2	U38	B3-C3		
R79	C3	R138	B3	RN4	C2	U39	B3		
R80	C3	R139	B2	RN5	B1	U40	B3-C3		
R81	B2	R140	C2	RN6	A2	U41	B3		
R82	B2	R141	B3	RN7	B2	U42	C3		
R83	B2	R142	B3	RN8	B1	U43	C3		
R84	B2	R143	B3	S1	C2	U44	B3		
R85	C3	R144	B3	S2	C2	U45	B2		
R86	B2	R145	B3	S3	C2	U46	B2-C2		
R87	B2	R146	B3	S4	C3	U47	B2		
R88	B2	R147	B3	S5	B3	U48	B2-C2		
R89	B2	R148	B2	TP1	B3	U49	B2		
R90	B2	R149	B2-B3	TP2	B3	U50	B2		

FIGURE 4-3. COMPONENT LOCATOR, ECU CONTROLLER BOARD
(Sheet 2 of 2)



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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	MERKEL 11-28-95
CHKD	
ME	
PROJ. ENGR.	JW 8-16-96
MFG.	
MATERIAL	SEE B/M 917-0301
FINISH	
~~SEE DWG RAE92-9000~~	
NEXT ASSY.	

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3886 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE	SCHEMATIC ECU MOTHERBOARD		
TYPE	SIZE	DWG. NO.	REV
S	B	917-0301	D
MODEL AM1A	SCALE NONE	SHEET 1 OF 2	

917-0305 ECU CONTROLLER PCB
COPYRIGHT © 1995 BROADCAST ELECTRONICS, INC.
ANTENNA A INTERLOCK
ANTENNA B INTERLOCK
ANTENNA C INTERLOCK
EXTERNAL TRANSMITTER MUTE
REMOTE FAILSAFE
EXTERNAL INTERLOCK
EXCITER FAULT
POWER SUPPLY FAULT
POWER BLOCK FAULT
LIGHTNING
OVERTEMP
ANTENNA CONFLICT
POWER 5 COMMAND
POWER 4 COMMAND
POWER 3 COMMAND
POWER 2 COMMAND
POWER 1 COMMAND
OFF COMMAND
POWER 5 STATUS
POWER 4 STATUS
POWER 3 STATUS
POWER 2 STATUS
POWER 1 STATUS
OFF STATUS
+5V TO RELAYS
DIRECTIONAL COUPLER RETURN
LIGHTNING DETECTOR RETURN
POWER SUPPLY FAULT
POWER SUPPLY MAINTENANCE +
POWER BLOCK FAULT
POWER BLOCK MAINTENANCE
POWER SUPPLY EMERGENCY
EMERGENCY OFF
+15V TO CABINET INTERLOCK
CABINET INTERLOCK
TRANSMITTER ON
CARRIER CONTROL PWM
FORWARD POWER SAMPLE
REFLECTED POWER SAMPLE
FORWARD METER
REFLECTED METER
LIGHTNING DETECTOR SENSE
LIGHTNING DETECTOR PULLUP
TEMPERATURE SENSOR CATHODE
TEMPERATURE SENSOR ADJUST
TRANSMITTER ON +
POWER SUPPLY #1 CONTROL +
METER COMMON
TEMPERATURE SENSOR ANODE
POWER SUPPLY STATUS COMMON
POWER BLOCK FAULT COMMON
POWER BLOCK MAINTENANCE -
POWER SUPPLY MAINTENANCE -
REMOTE +5V
RAISE COMMAND
LOWER COMMAND
ALARM RESET
REMOTE FORWARD METER
REMOTE REFLECTED METER
POSITION P12 ON PIN 1 ONLY FOR AM1A
CONTROL+
REMOTE ENABLED
MAINTENANCE
ALARM
AFL PWR HIGH
1.21 VSWR
AFL PWR EMERG.
FOLDBACK
+5V FOR REMOTE INTERLOCKS
REMOTE COMMON
9V BATTERY
TO 917-0306 ECU DISPLAY PCB
POWER 5 SWITCH
POWER 4 SWITCH
POWER 3 SWITCH
POWER 2 SWITCH
POWER 1 SWITCH
OFF SWITCH
RAISE SWITCH
LOWER SWITCH
ALARM RESET SWITCH
POWER 5 INDICATOR
POWER 4 INDICATOR
POWER 3 INDICATOR
POWER 2 INDICATOR
POWER 1 INDICATOR
OFF INDICATOR
RAISE INDICATOR
LOWER INDICATOR
ALARM INDICATOR
ANTENNA CONFLICT INDICATOR
INTERLOCK INDICATOR
FOLDBACK INDICATOR
REMOTE ENABLED INDICATOR
OVERTEMP INDICATOR
LIGHTNING INDICATOR
EXCITER GREEN INDICATOR
EXCITER RED INDICATOR
POWER BLOCK GREEN INDICATOR
POWER BLOCK RED INDICATOR
POWER MODULES GREEN INDICATOR
POWER MODULES RED INDICATOR
ANTENNA GREEN INDICATOR
ANTENNA RED INDICATOR
+15V NBU
+15V TO OFF SWITCH
ANTENNA A STATUS
ANTENNA B STATUS
ANTENNA C STATUS
TO CLOCK TIMER OPTION
MODULATION MONITOR SAMPLE RELAY CONTROLS
POWER LEVEL 5
POWER LEVEL 4
POWER LEVEL 3
POWER LEVEL 2
POWER LEVEL 1
RF MUTE
REMOTE ENABLE
120 Hz
PWM MUTE
EXCITER FAULT
POWER REFERENCE
1. LAST COMPONENTS USED: R96, C110, L6, J302, P6
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TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°
DWN. BY MERKEL 11-28-95
CHKD
ME
PROJ. ENGR. JW 8-16-96
MFG.
MATERIAL SEE B/M 917-0301
FINISH
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE SCHEMATIC ECU MOTHERBOARD
TYPE S SIZE B DWG. NO. 917-0301 REV D
MODEL AM1A SCALE NONE SHEET 2 OF 2

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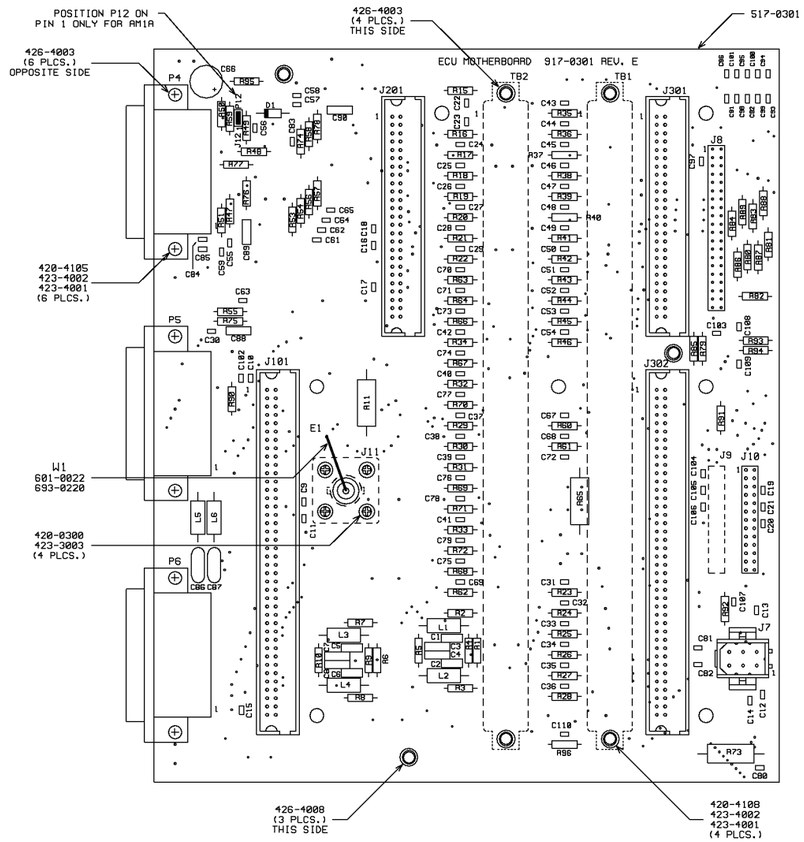

NOTES:
1. ALL PARTS SHOWN WITH DASHED LINES TO BE MOUNTED FROM OPPOSITE SIDE.
2. TAPE TO BE PLACED OVER MOUNTING HOLES OF J9, J11, TB1, & TB2 BEFORE SOLDER REFLOW.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY MERKEL 11-28-95
CHKD
ME
PROJ. ENGR. JW 8-16-96
MFG.

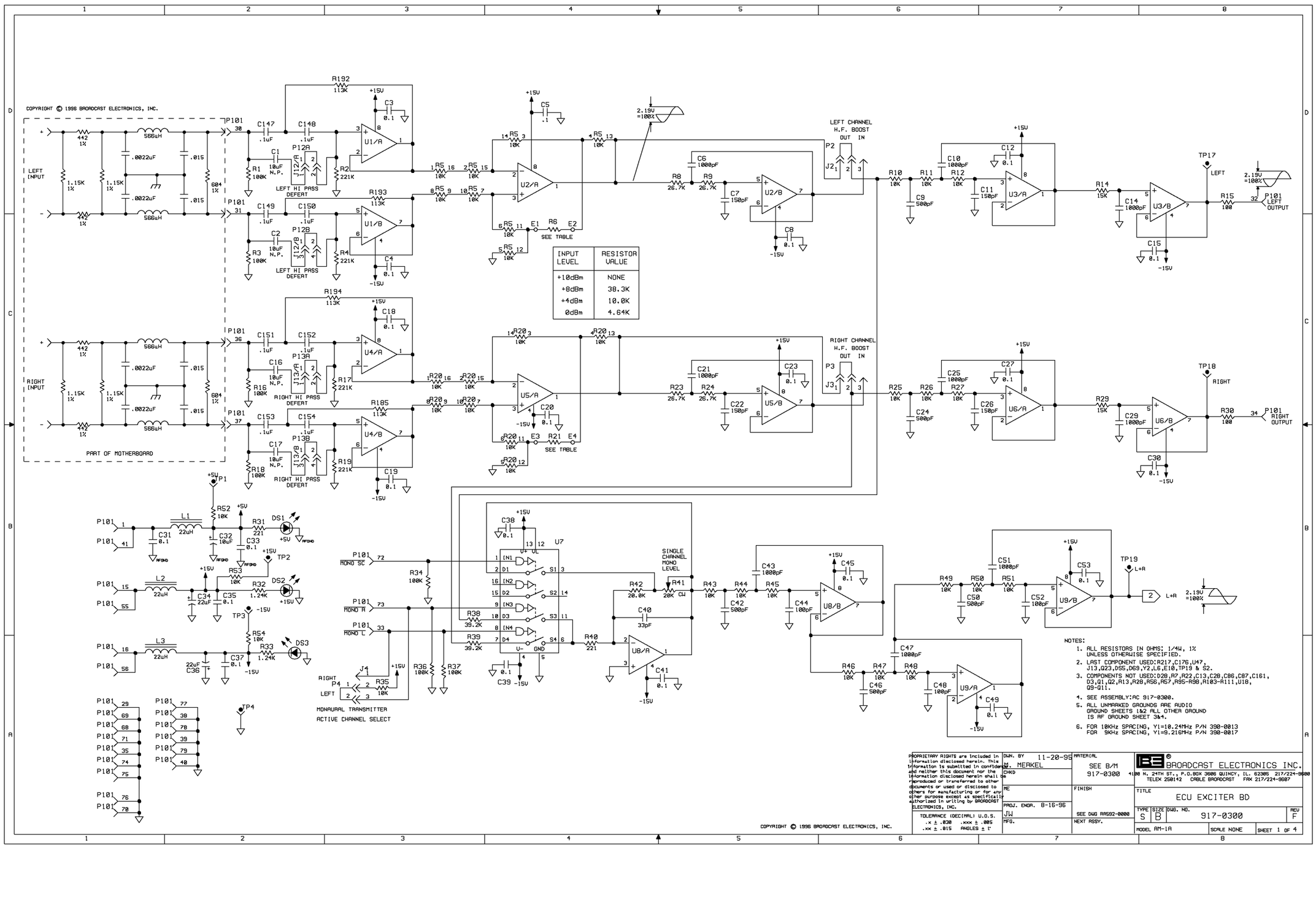
MATERIAL SEE BOM 917-0301
FINISH
~~SEE DWG AA592-0000~~
NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE
ASSEMBLY
ECU MOTHERBOARD

TYPE	SIZE	DWG No.	REV
A	C	917-0301	E

MODEL AM1A SCALE 1:1 SHEET 1 OF 1


COPYRIGHT © 1996 BROADCAST ELECTRONICS, INC.
LEFT INPUT
RIGHT INPUT
PART OF MOTHERBOARD
P101
LEFT HI PASS DEFEAT
RIGHT HI PASS DEFEAT
SEE TABLE
INPUT LEVEL
RESISTOR VALUE
+10dBm
NONE
+8dBm
38.3K
+4dBm
10.0K
0dBm
4.64K
LEFT CHANNEL H.F. BOOST
RIGHT CHANNEL H.F. BOOST
OUT IN
TP17 LEFT
TP18 RIGHT
2.19V =100%
P101 LEFT OUTPUT
P101 RIGHT OUTPUT
MONAURAL TRANSMITTER ACTIVE CHANNEL SELECT
MONO SC
MONO R
MONO L
SINGLE CHANNEL MONO LEVEL
TP19 L+R
NOTES:
1. ALL RESISTORS IN OHMS: 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED:R217,C176,U47, J13,Q23,DS5,D69,Y2,L6,E10,TP19 & S2.
3. COMPONENTS NOT USED:D28,R7,R22,C13,C28,C86,C87,C161, D3,Q1,Q2,R13,R28,R56,R57,R95-R98,R103-R111,U18, Q9-Q11.
4. SEE ASSEMBLY:AC 917-0300.
5. ALL UNMARKED GROUNDS ARE AUDIO GROUND SHEETS 1&2 ALL OTHER GROUND IS RF GROUND SHEET 3&4.
6. FOR 10KHz SPACING, Y1=10.24MHz P/N 398-0013 FOR 9KHz SPACING, Y1=9.216MHz P/N 398-0017
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TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°
DWN. BY M. MERKEL 11-20-95
CHKD
ME
PROJ. ENGR. JW 8-16-96
MFG.
MATERIAL SEE B/M 917-0300
FINISH
SEE DWG RA592-0000
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE ECU EXCITER BD
TYPE S SIZE B DWG. NO. 917-0300 REV F
MODEL AM-1A SCALE NONE SHEET 1 OF 4
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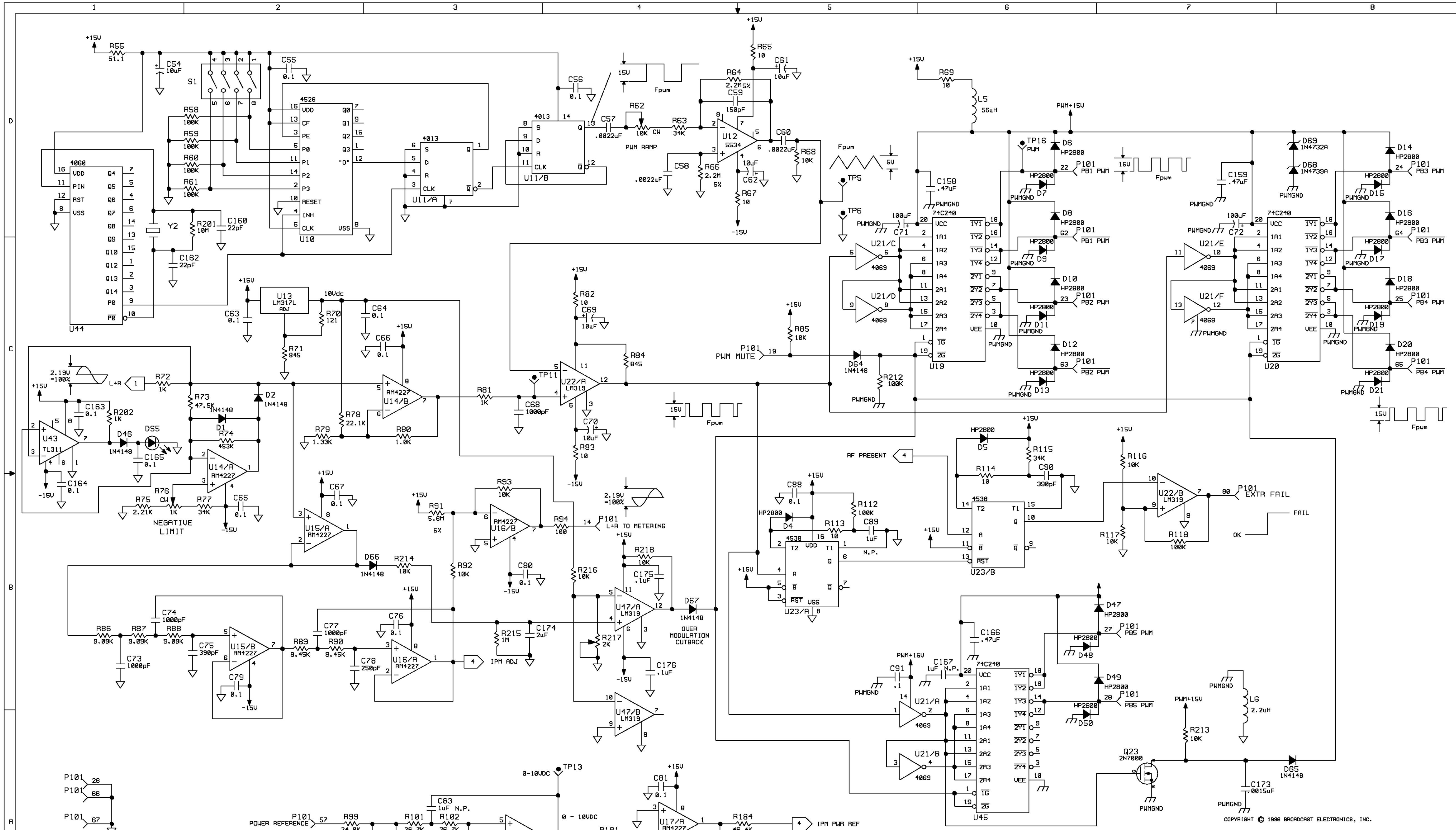

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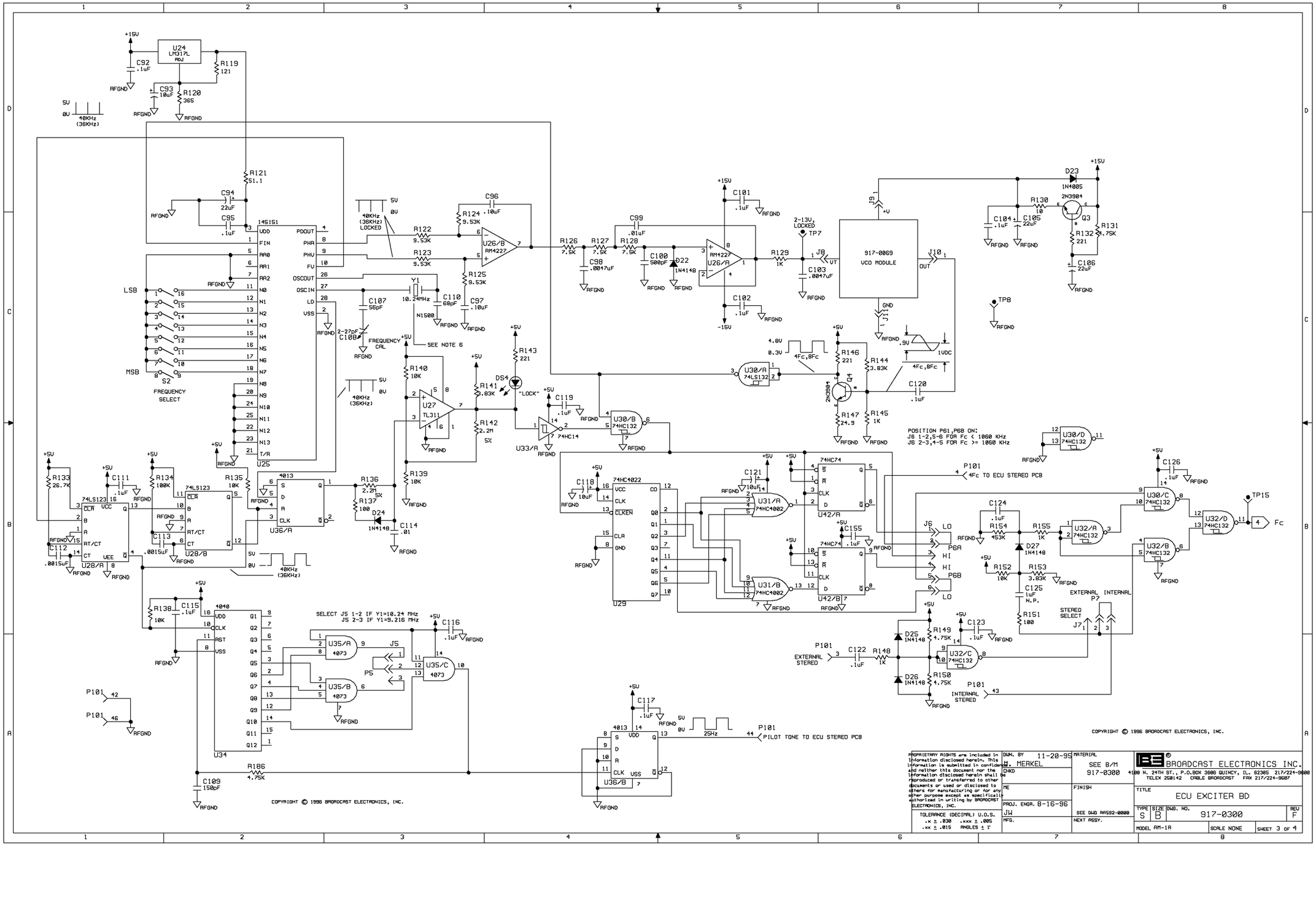
TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY 11-20-95 M. MERKEL	MATERIAL SEE B/M 917-0300	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607	
CHKD			
ME	FINISH	TITLE ECU EXCITER BD	
PROJ. ENGR. 8-16-96 JW	SEE DWG AA592-0000	TYPE S SIZE B DWG. NO. 917-0300	REV F
MFG.	NEXT ASSY.	MODEL AM-1A SCALE NONE	SHEET 2 OF 4


U24 LM317L ADJ
C92 .1uF
R119 121
C93 10uF
R120 365
5V 0V 40KHz (36KHz)
R121 51.1
C94 22uF
C95 .1uF
74S151
LSB
MSB
S2 FREQUENCY SELECT
U25
40KHz (36KHz) LOCKED
R122 9.53K
R123 9.53K
C96
R124 9.53K
U26/B RM4227
R125 9.53K
C97 .10uF
C107 56pF
C108 2-27pF
FREQUENCY CAL
Y1 10.24MHz
C110 68pF
N1500
SEE NOTE 6
R126 7.5K
R127 7.5K
R128 7.5K
C98 .0047uF
C99 .01uF
C100 500pF
D22 1N4148
U26/A RM4227
C101 .1uF
C102 .1uF
R129 1K
2-13V, LOCKED
TP7
J8
C103 .0047uF
917-0069 VCO MODULE
J10
OUT
J9
+V
GND
D23 1N4005
R130 10
2N3904 Q3
C104 .1uF
C105 22uF
R131 3.75K
R132 221
C106 22uF
TP8
4.0V 0.3V 4Fc,8Fc
U30/A 74LS132
R146 221
R144 3.83K
Q4 2N3904
.9V 1VDC 4Fc,8Fc
C120 .1uF
R147 24.9
R145 1K
POSITION P61,P68 ON:
J6 1-2,5-6 FOR Fc < 1060 KHz
J6 2-3,4-5 FOR Fc >= 1060 KHz
U30/D 74HC132
R140 10K
U27 TL311
R143 221
DS4 "LOCK"
R141 3.83K
R142 2.2M 5%
C119 .1uF
U33/A 74HC14
U30/B 74HC132
R139 10K
R136 2.2M 5%
R137 100
D24 1N4148
C114 .01
R133 26.7K
C111 .1uF
74LS123
C112 .0015uF
C113 .0015uF
R134 100K
R135 10K
U28/A
U28/B
U36/A 4013
C118 10uF
74HC4022
U29
C121 10uF
U31/A 74HC4002
U31/B 74HC4002
74HC74
U42/A
U42/B
C155 .1uF
P101 4Fc TO ECU STEREO PCB
J6 LO HI P6A HI P6B LO
C124 .1uF
R154 453K
R155 1K
D27 1N4148
R152 10K
R153 3.83K
C125 1uF N.P.
R151 100
EXTERNAL INTERNAL STEREO SELECT
P7 J7
U32/A 74HC132
U32/B 74HC132
U32/C 74HC132
U32/D 74HC132
C126 .1uF
TP15 Fc
R138 10K
C115 .1uF
4040
U34
SELECT J5 1-2 IF Y1=10.24 MHz
J5 2-3 IF Y1=9.216 MHz
U35/A 4073
U35/B 4073
U35/C 4073
J5 P5
C116 .1uF
P101 42
P101 46
C117 .1uF
4013 U36/B
5V 0V 25Hz
P101 44 PILOT TONE TO ECU STEREO PCB
R186 4.75K
C109 150pF
P101 EXTERNAL STEREO
C122 .1uF
R148 1K
C123 .1uF
R149 4.75K
R150 4.75K
D25 1N4148
D26 1N4148
P101 43 INTERNAL STEREO
RFGND
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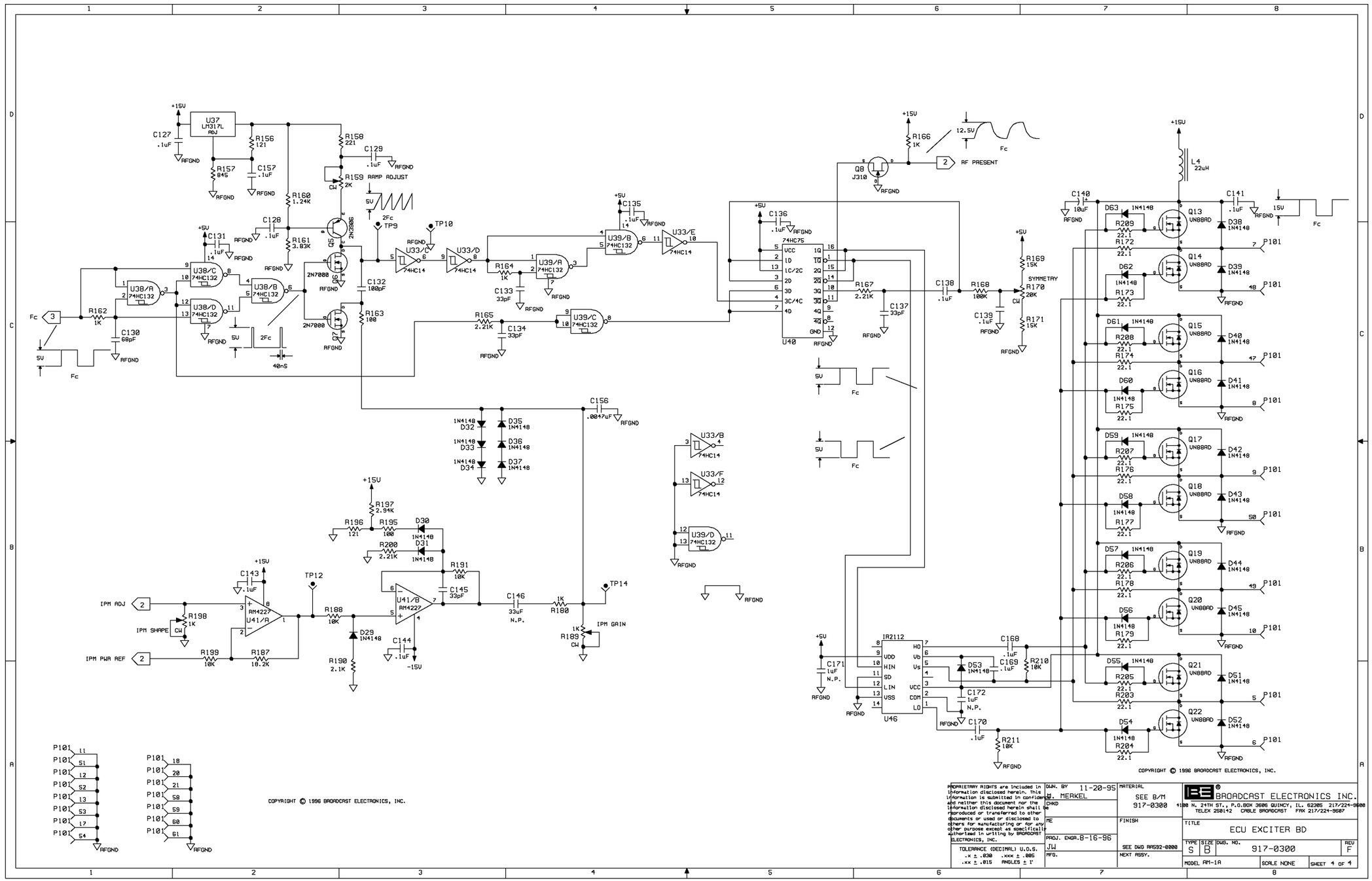
TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°
DWN. BY 11-20-95 M. MERKEL
CHKD
ME
PROJ. ENGR. 8-16-96 JW
MFG.
MATERIAL SEE B/M 917-0300
FINISH
SEE DWG AA592-0000
NEXT ASSY.
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3800 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607
TITLE ECU EXCITER BD
TYPE S SIZE B DWG. NO. 917-0300 REV F
MODEL AM-1A SCALE NONE SHEET 3 OF 4


U37 LM317L ADJ
C127 .1uF
R156 121
R157 845
C157 .1uF
R158 221
C129 .1uF
R159 2K RAMP ADJUST
R160 1.24K
C126 .1uF
R161 3.83K
Q5 2N3906
Q6 2N7000
Q7 2N7000
C132 100pF
R163 100
C131 .1uF
U38/A 74HC132
U38/C 74HC132
U38/B 74HC132
U38/D 74HC132
R162 1K
C130 68pF
40nS
TP9
TP10
U33/C 74HC14
U33/D 74HC14
C135 .1uF
U39/B 74HC132
U33/E 74HC14
R164 1K
C133 33pF
U39/A 74HC132
R165 2.21K
C134 33pF
U39/C 74HC132
C136 .1uF
74HC75
U40
R167 2.21K
C137 33pF
Q8 J310
R166 1K
12.5V
RF PRESENT
C138 .1uF
R168 100K
R169 15K SYMMETRY
R170 20K
R171 15K
C139 .1uF
L4 22uH
C140 10uF
C141 .1uF
D63 1N4148
R209 22.1
Q13 UN88RD
D38 1N4148
R172 22.1
Q14 UN88RD
D62 1N4148
D39 1N4148
R173 22.1
D61 1N4148
R208 22.1
Q15 UN88RD
D40 1N4148
R174 22.1
Q16 UN88RD
D60 1N4148
D41 1N4148
R175 22.1
D59 1N4148
R207 22.1
Q17 UN88RD
D42 1N4148
R176 22.1
Q18 UN88RD
D58 1N4148
D43 1N4148
R177 22.1
D57 1N4148
R206 22.1
Q19 UN88RD
D44 1N4148
R178 22.1
Q20 UN88RD
D56 1N4148
D45 1N4148
R179 22.1
D55 1N4148
R205 22.1
Q21 UN88RD
D51 1N4148
R203 22.1
Q22 UN88RD
D54 1N4148
D52 1N4148
R204 22.1
P101
C156 .0047uF
D32 1N4148
D33 1N4148
D34 1N4148
D35 1N4148
D36 1N4148
D37 1N4148
U33/B 74HC14
U33/F 74HC14
U39/D 74HC132
R197 2.94K
R196 121
R195 100
D30 1N4148
R200 2.21K
D31 1N4148
R191 10K
C145 33pF
U41/B RM4227
U41/A RM4227
C143 .1uF
TP12
TP14
IPM ADJ
IPM SHAPE
IPM PWR REF
R198 1K
R199 10K
R187 18.2K
R188 10K
D29 1N4148
R190 2.1K
C144 .1uF
-15V
C146 33uF N.P.
R180 1K
R189 1K
IPM GAIN
IA2112
U46
C171 1uF N.P.
C172 1uF N.P.
C168 .1uF
C169 .1uF
D53 1N4148
R210 10K
C170 .1uF
R211 10K
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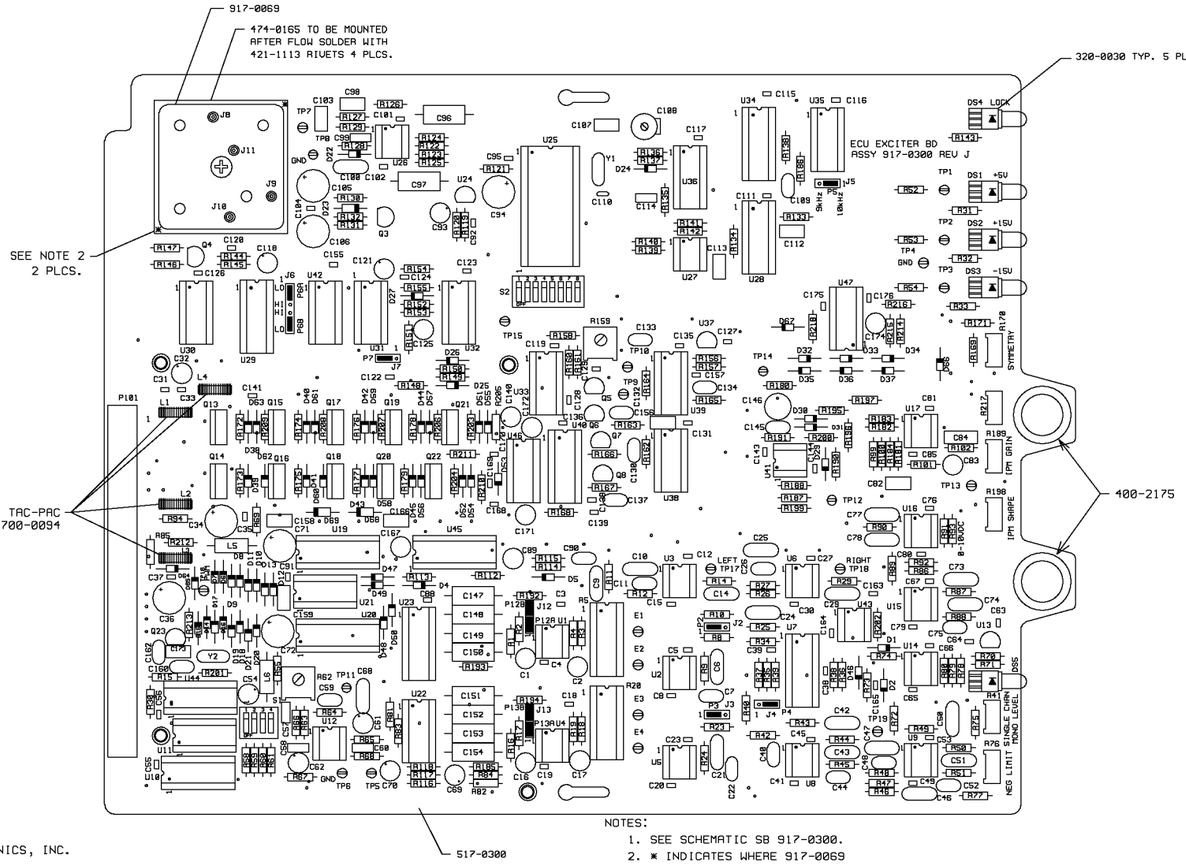
BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCST FAX 217/224-9607
ECU EXCITER BD
917-0300
REV F
SCALE NONE
SHEET 1 OF 1



NOTES:

1. SEE SCHEMATIC SB 917-0300.
2. * INDICATES WHERE 917-0069 IS TO BE SOLDERED TO 474-0165 2 PLCS.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

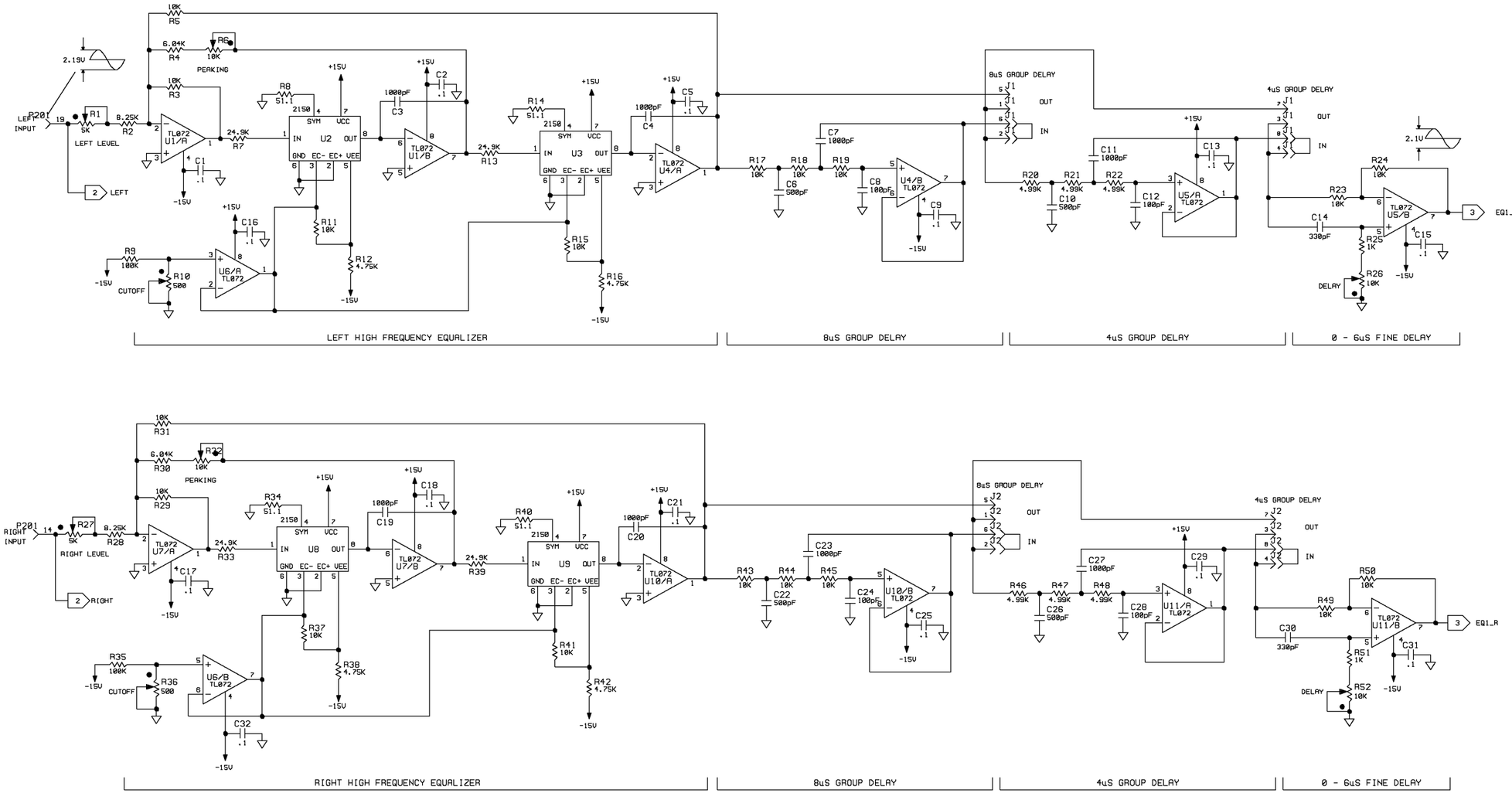
DWN. BY 11-27-95 M. MERKEL	MATERIAL SEE B/M 917-0300	BROADCAST ELECTRONICS INC.
CHKD		4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607
ME	FINISH	TITLE PCB ASSEMBLY ECU EXCITER BD
PROJ. ENGR. 8-16-96 JW	~~SEE DWG AA592-0000~~	TYPE A · SIZE C · DWG No. 917-0300 · REV J
MFG.	NEXT ASSY.	MODEL AM-1A · SCALE 1/1 · SHEET 1 OF 1

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
C1	B3	C62	B2	C121	C2	D23	C2	P12B	B3
C2	B3	C63	B4	C122	C2	D24	C3	P13A	B3
C3	B3	C64	B3-B4	C123	C2	D25	C2	P13B	B3
C4	B3	C65	B3	C124	C2	D26	C2	P101	B2-C2
C5	B3	C66	B3	C125	C2	D27	C2	Q1	B2
C6	B3	C67	B3	C126	C2	D30	C3	Q2	C4
C7	B3	C68	B2	C127	C3	D31	C3	Q3	C2
C8	B3	C69	A2-B2	C128	C3	D32	C3	Q4	C2
C9	B3	C70	B2	C129	C3	D33	C3	Q5	C3
C10	B3	C71	B2	C130	B3	D34	C3	Q6	C3
C11	B3	C72	B2	C131	C3	D35	C3	Q7	B3-C3
C12	B3	C73	B3-B4	C132	C3	D36	C3	Q8	B3
C14	B3	C74	B3-B4	C133	C3	D37	C3	Q9	B3-C3
C15	B3	C75	B3	C134	C3	D38	C2	Q10	C3
C16	B3	C76	B3	C135	C3	D39	B2	Q11	B3
C17	B3	C77	B3	C136	C3	D40	C2	Q12	B3
C18	B3	C78	B3	C137	B3	D41	B2	Q13	B2-C2
C19	B3	C79	B3	C138	B3	D42	C2	Q14	B2
C20	A3	C80	B3	C139	B3	D43	B2	Q15	B2-C2
C21	B3	C81	C3	C140	C2	D44	C2	Q16	B2
C22	B3	C82	B3	C141	C2	D45	B2	Q17	B2-C2
C23	B3	C83	B3	C142	C2	DS1	C4	Q18	B2
C24	B3	C84	B3-C3	C143	C3	DS2	C4	Q19	B2-C2
C25	B3	C85	B3	C144	C3	DS3	C4	Q20	B2
C26	B3	C86	B3	C145	C3	DS4	C4	R1	B3
C27	B3	C87	B3	C146	C3	E1	B3	R2	B3
C29	B3	C88	B2	C147	B2	E2	B3	R3	B3
C30	B3	C89	B2	C148	B2	E3	B3	R4	B3
C31	C2	C90	B3	C149	B2	E4	B3	R5	B3
C32	C2	C91	B2	C150	B2	E5	B2	R8	B3
C33	C2	C92	C2	C151	B2	E6	B2	R9	B3
C34	B2	C93	C2	C152	B2	E7	C2	R10	B3
C35	B2	C94	C2-C3	C153	B2	E8	B2	R11	B3
C36	B2	C95	C3	C154	B2	E9	B2	R12	B3
C37	B2	C96	C2	C155	C2	E10	B2	R14	B3
C38	B3	C97	C2	C156	C3	J2	B3	R15	B2
C39	B3	C98	C2	C157	C3	J3	B3	R16	B3
C40	B3	C99	C2	D1	B3	J4	B3	R17	B3
C41	A3	C100	C2	D2	B3	J5	C3	R18	B3
C42	B3	C101	C2	D3	C3	J6	C2	R19	B3
C43	B3	C102	C2	D4	B2	J7	C2	R20	B3
C44	B3-A3	C103	C2	D5	B2	J8	C2	R23	B3
C45	B3	C104	C2	D6	B2	J9	C2	R24	B3
C46	A3	C105	C2	D7	B2	J10	C2	R25	B3
C47	B3	C106	C2	D8	B2	J11	C2	R26	B3
C48	B3	C107	C3	D9	B2	J12	B3	R27	B3
C49	A3	C108	C3	D10	B2	J13	B3	R29	B3
C50	B3	C109	C3	D11	B2	L1	C2	R30	B2
C51	B3-B4	C110	C3	D12	B2	L2	B2	R31	C3-C4
C52	A3	C111	C3	D13	B2	L3	B2	R32	C3-C4
C53	B3	C112	C3	D14	B2	L4	C2	R33	C3-C4
C54	B2	C113	C3	D15	B2	P2	B3	R34	B3
C55	B2	C114	C3	D16	B2	P3	B3	R35	B3
C56	B2	C115	C3	D17	B2	P4	B3	R36	B3
C57	B2	C116	C3	D18	B2	P5	C3	R37	B3
C58	B2	C117	C3	D19	B2	P6A	C2	R38	B3
C59	B2	C118	C2	D20	B2	P6B	C2	R39	B3
C60	B2	C119	C3	D21	B2	P7	C2	R40	B3
C61	B2	C120	C2	D22	C2	P12A	B3	R41	B4

FIGURE 4-8. COMPONENT LOCATOR, ECU EXCITER BOARD
(Sheet 1 of 2)

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
R42	B3	R101	B3	R160	C3	U7	B3		
R43	B3	R102	B3-B4	R161	C3	U8	B3		
R44	B3	R103	B3	R162	B3	U9	B3		
R45	B3	R104	B4	R163	C3	U10	B2		
R46	A3	R105	C3-C4	R164	C3	U11	B2		
R47	A3	R106	C3-C4	R165	C3	U12	B2		
R48	B3	R107	C3	R166	B3	U13	B4		
R49	B3	R108	C3-B3	R167	B3	U14	B3		
R50	B3	R109	C3-B3	R168	B3	U15	B3		
R51	B3	R110	C3-B3	R169	C4	U16	B3		
R52	C3	R111	C3-B3	R170	C4	U17	B3-C3		
R53	C3	R112	B2	R171	C3-C4	U18	B3-C3		
R54	C3	R113	B2	R172	B2-C2	U19	B2		
R55	B2	R114	B2	R173	B2	U20	B2		
R56	B2	R115	B2	R174	B2-C2	U21	B2		
R57	B2	R116	B2	R175	B2	U22	B2		
R58	B2	R117	B2	R176	B2-C2	U23	B2		
R59	B2	R118	B2	R177	B2	U24	C2		
R60	B2	R119	C2	R178	B2-C2	U25	C3		
R61	B2	R120	C2	R179	B2	U26	C2		
R62	B2	R121	C2-C3	R180	C3	U27	C3		
R63	B2	R122	C2	R181	B4	U28	C3		
R64	B2	R123	C2	R182	C3	U29	C2		
R65	B2	R124	C2	R183	C3	U30	C2		
R66	B2	R125	C2	R184	C3	U31	C2		
R67	A2-B2	R126	C2	R185	B2	U32	C2		
R68	B2	R127	C2	R186	C3	U33	C3		
R69	B2	R128	C2	R187	C3	U34	C3		
R70	B4	R129	C2	R188	C3	U35	C3		
R71	B4	R130	C2	R189	B4	U36	C3		
R72	B3	R131	C2	R190	B3	U37	C3		
R73	B3	R132	C2	R191	B4	U38	B3-C3		
R74	B3	R133	C3	R192	B3	U39	C3		
R75	B4	R134	C3	R193	B2	U40	B3-C3		
R76	B4-A4	R135	C3	R194	B3	U41	C3		
R77	A3-A4	R136	C3	S1	B2	U42	C2		
R78	B3	R137	C3	S2	C3	Y1	C3		
R79	B3	R138	C3	T1	B2				
R80	B3	R139	C3	TP1	C3				
R81	B2	R140	C3	TP2	C3				
R82	A2	R141	C3	TP3	C3				
R83	B2	R142	C3	TP4	C3				
R84	B2	R143	C3-C4	TP5	B2				
R85	B2	R144	C2	TP6	B2				
R86	B3	R145	C2	TP7	C2				
R87	B3	R146	C2	TP8	C2				
R88	B3	R147	C2	TP9	C3				
R89	B3	R148	C2	TP10	C3				
R90	B3	R149	C2	TP11	B2				
R91	B3	R150	C2	TP12	B3				
R92	B3	R151	C2	TP13	B4				
R93	B3	R152	C2	TP14	C3				
R94	B2	R153	C2	TP15	C3				
R95	C3	R154	C2	U1	B3				
R96	C3	R155	C2	U2	B3				
R97	C3	R156	C3	U3	B3				
R98	B3	R157	C3	U4	B3				
R99	B3	R158	C3	U5	B3				
R100	B3	R159	C3	U6	B3				

FIGURE 4-8. COMPONENT LOCATOR, ECU EXCITER BOARD
(Sheet 2 of 2)



P201 18
P201 43
P201 17
P201 42

EQ1

NOTES:
1. ALL RESISTORS IN OHMS: 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: R228,C175,U55,L7,T1,D9,TP10,E4, S5,J7,P201,Q14,D56
3. COMPONENTS NOT USED: P8 - P200
4. SEE ASSEMBLY: AC917-0209

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MERK 12-20-90
CHKD MH 7-30-91
ME
PROJ. ENGR. EJA 7-30-91
MFG.

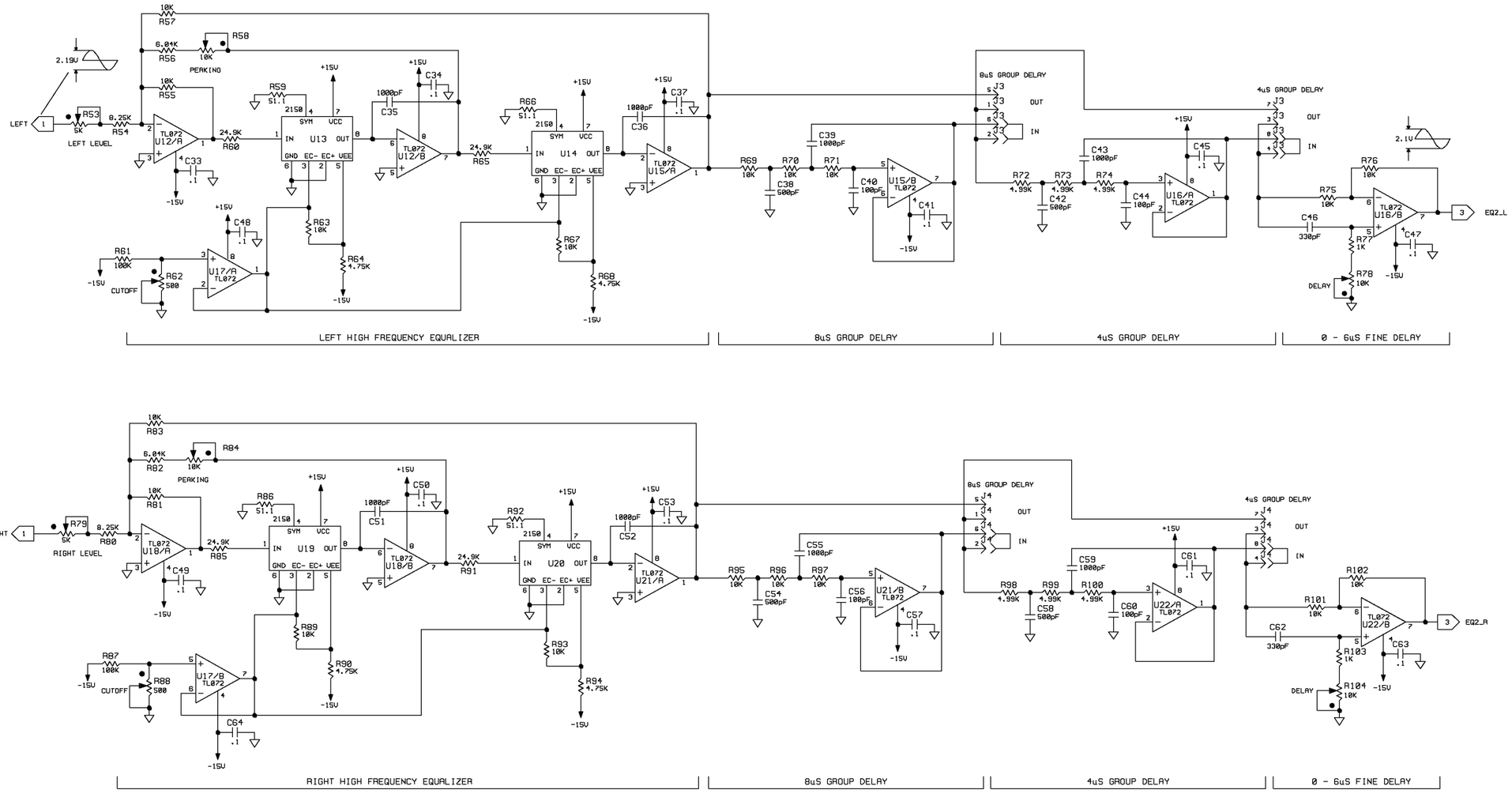
MATERIAL SEE B/M 917-0209
FINISH
SEE DWG RA592-0000
NEXT ASSY. AC917-0209

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE SCHEMATIC- ECU STEREO BOARD

TYPE S | SIZE B | DWG. NO. 917-0209 | REV J

MODEL RM-1 | SCALE NONE | SHEET 1 OF 5



EQ2

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

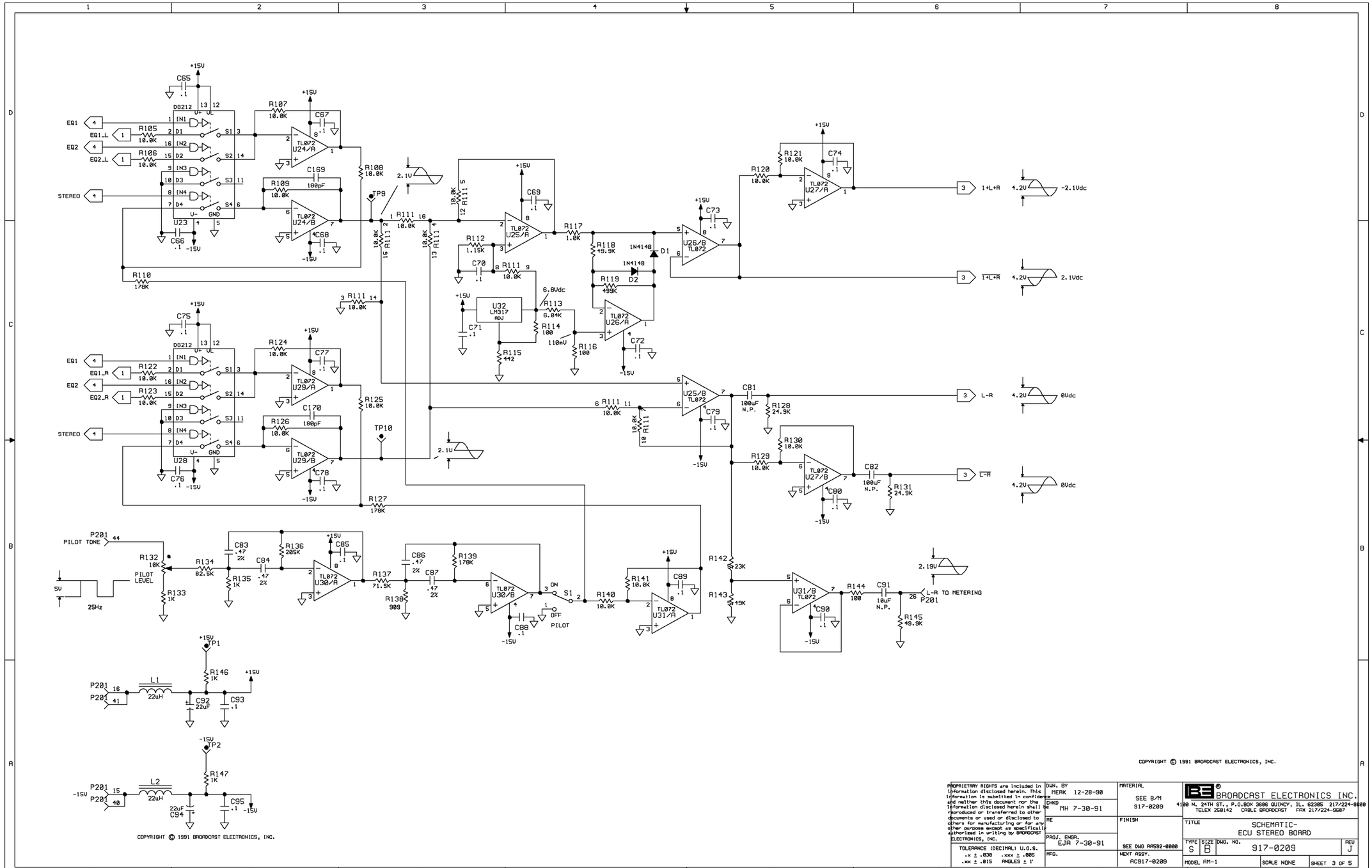
DWN. BY	MERK 12-28-90
CHKD	MH 7-30-91
ME	
PROJ. ENGR.	EJA 7-30-91
MFG.	
MATERIAL	SEE B/M 917-0209
FINISH	SEE DWG RA552-0000
NEXT ASSY.	AC917-0209

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC- ECU STEREO BOARD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0209	J

MODEL AM-1 | SCALE NONE | SHEET 2 OF 5



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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY MERK 12-28-90	MATERIAL SEE B/M 917-0209	BROADCAST ELECTRONICS INC. 4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600 TELEX 250142 CABLE BROADCAST FAX 217/224-9607	
CHKD MH 7-30-91		TITLE SCHEMATIC- ECU STEREO BOARD	
ME	FINISH		
PROJ. ENGR. EJA 7-30-91	SEE DWG RA592-0000	TYPE S SIZE B DWG. NO. 917-0209	REV J
MFG.	NEXT ASSY. AC917-0209	MODEL AM-1 SCALE NONE	SHEET 3 OF 5

FREQUENCY BAND	S2				S3				S4			
	1	2	3	4	1	2	3	4	1	2	3	4
522-850 KHz	1	1	0	1	0	1	0	1	0	1	0	1
860-1200 KHz	0	0	1	0	1	0	1	0	1	0	0	0
1210-1700 KHz	0	0	0	0	0	0	0	0	0	0	0	0

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	MERK 12-28-90
CHKD	MH 7-30-91
ME	
PROJ. ENGR.	EJA 7-30-91
MFG.	
MATERIAL	SEE B/M 917-0209
FINISH	SEE DWG RR592-0000
NEXT ASSY.	AC917-0209

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC- ECU STEREO BOARD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0209	J

MODEL AM-1 | SCALE NONE | SHEET 4 OF 5

Q0	Q1	MODE
0	0	MONO L
1	0	MONO R
0	1	MONO L+R
1	1	STEREO

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

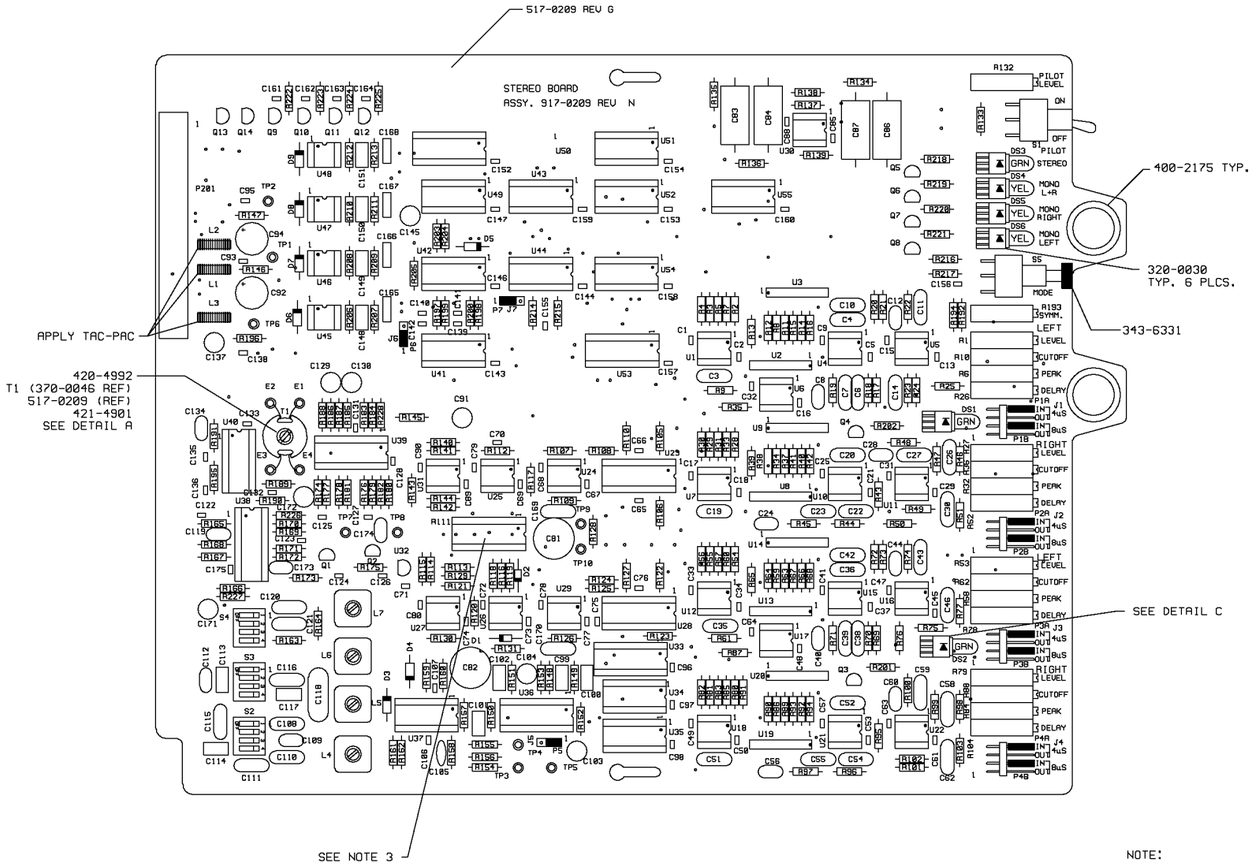
DWN. BY	MERK 12-28-90	MATERIAL	SEE B/M 917-0209
CHKD	MH 7-30-91		
ME		FINISH	SEE DWG RA532-0000
PROJ. ENGR.	EJA 7-30-91		
MFG.		NEXT ASSY.	RC917-0209

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC- ECU STEREO BOARD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0209	J

MODEL AM-1 | SCALE NONE | SHEET 5 OF 5



NOTE:

1. TRIM ALL COMPONENT LEADS ON SOLDER SIDE TO .10 MAX.
2. SEE SCHEMATIC SD917-0209.
3. R111 TO BE MOUNTED W/O SOCKET.

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TOLERANCE (DECIMAL) U.O.S.
.X ± .030 .XXX ± .005
.XX ± .015 ANGLES ± 1°

DWN. BY	MERK 12-28-90
CHKD	MH 7-30-91
ME	
PROJ. ENGR.	EJA 7-30-91
MFG.	

MATERIAL	SEE B/M 917-0209
FINISH	
	SEE DWG RASS2-0000
NEXT ASSY.	

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4100 N.24TH ST. P.O.BOX 3606 QUINCY,IL. 62305 PH. 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: PCB ASSEMBLY- ECU STEREO BOARD

TYPE	SIZE	DWG No.	REV
A	C	917-0209	N

MODEL AM-1 SCALE NONE SHEET 1 OF 1

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
C1	C2	C60	B3	C119	B1	D3	B2	R3	C2
C2	C2	C61	B3	C120	B1	D4	B2	R4	C2
C3	C2	C62	B3	C121	B1	D5	C2	R5	C2
C4	C3	C63	B3	C122	B1	D6	C1	R6	C3
C5	C3	C64	B2	C123	B1	D7	C1	R7	C2
C6	C3	C65	B2	C124	B2	D8	C1	R8	C2
C7	C3	C66	C2	C125	B1	D9	C1	R9	C2
C8	C3	C67	C2	C126	B2	DS1	C3	R10	C3
C9	C3	C68	C2	C127	B2	DS2	B3	R11	C3
C10	C3	C69	C2	C128	C2	DS3	C3	R12	C2
C11	C3	C70	C2	C129	C1-C2	DS4	C3	R13	C2
C12	C3	C71	B2	C130	C2	DS5	C3	R14	C3
C13	C3	C72	B2	C131	C2	DS6	C3	R15	C3
C14	C3	C73	B2	C132	B1	E1	C1	R16	C3
C15	C3	C74	B2	C133	C1	E2	C1	R17	C3
C16	C3	C75	B2	C134	C1	E3	C1	R18	C3
C17	C2	C76	B2	C135	C1	E4	C1	R19	C3
C18	B2	C77	B2	C136	B1-C1	J1	C3	R20	C3
C19	B2	C78	B2	C137	C1	J2	B3	R21	C3
C20	C3	C79	C2	C138	C1	J3	B3	R22	C3
C21	B3	C80	B2	C139	C2	J4	B3	R23	C3
C22	B3	C81	B2	C140	C2	J5	B2	R24	C3
C23	B3	C82	B2	C141	C2	J6	C2	R25	C3
C24	B2	C83	C2-D2	C142	C2	J7	C2	R26	C3
C25	C3	C84	C2-D2	C143	C2	L1	C1	R27	C3
C26	C3	C85	C3	C144	C2	L2	C1	R28	C2
C27	C3	C86	C3-D3	C145	C2	L3	C1	R29	C2
C28	C3	C87	C3-D3	C146	C2	L4	B2	R30	C2
C29	B3	C88	D3	C147	C2	L5	B2	R31	C2
C30	B3	C89	C2	C148	C2	L6	B2	R32	C3-B3
C31	C3	C90	C2	C149	C2	L7	B2	R33	C2
C32	C2	C91	C2	C150	C2	P1A	C3	R34	C2
C33	B2	C92	C1	C151	C2	P1B	C3	R35	C2
C34	B2	C93	C1	C152	C2	P2A	B3	R36	C3
C35	B2	C94	C1	C153	C2	P2B	B3	R37	C3
C36	B3	C95	C1	C154	C2	P3A	B3	R38	C2
C37	B3	C96	B2	C155	C2	P3B	B3	R39	C2
C38	B3	C97	B2	C156	C3	P4A	B3	R40	C3
C39	B3	C98	B2	C157	C2	P4B	B3	R41	C3
C40	B3	C99	B2	C158	C2	P5	B2	R42	C3
C41	B3	C100	B2	C159	C2	P6	C2	R43	B3-C3
C42	B3	C101	B2	C160	C2-C3	P7	C2	R44	B3
C43	B3	C102	B2	C161	D1	P201	C1-D1	R45	B3
C44	B3	C103	B2	C162	D1	Q1	B1	R46	C3
C45	B3	C104	B2	C163	D1-D2	Q2	B2	R47	C3
C46	B3	C105	B2	C164	D2	Q3	B3	R48	C3
C47	B3	C106	B2	C165	C2	Q4	C3	R49	B3
C48	B3	C107	B2	C166	C2	Q5	C3	R50	B3
C49	B2	C108	B1	C167	C2	Q6	C3	R51	B3
C50	B2	C109	B1	C168	C2	Q7	C3	R52	B3
C51	B2	C110	B1	C169	B2	Q8	C3	R53	B3
C52	B3	C111	B1	C170	B2	Q9	D1	R54	B2
C53	B3	C112	B1	C171	B1	Q10	D1	R55	B2
C54	B3	C113	B1	C172	B1	Q11	D1-D2	R56	B2
C55	B3	C114	B1	C173	B1	Q12	D2	R57	B2
C56	B2	C115	B1	C174	B2	Q13	D1	R58	B3
C57	B3	C116	B1	C175	B1	Q14	D1	R59	B2
C58	B3	C117	B1	D1	B2	R1	C3	R60	B2
C59	B3	C118	B1	D2	B2	R2	C2	R61	B2

FIGURE 4-11. COMPONENT LOCATOR, ECU STEREO BOARD
(Sheet 1 of 2)

REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE	REF	ZONE
R62	B3	R121	B2	R180	B2-C2	TP5	B2	U54	C2
R63	B3	R122	B2	R181	B2-C2	TP6	C1	U55	C2
R64	B2	R123	B2	R182	B2-C2	TP7	B2		
R65	B2	R124	B2	R183	C2	TP8	B2		
R66	B3	R125	B2	R184	C2	TP9	B2		
R67	B3	R126	B2	R185	C2	TP10	B2		
R68	B3	R127	B2	R186	C1	U1	C2		
R69	B3	R128	B2	R187	C2	U2	C2-C3		
R70	B3	R129	B2	R188	C1	U3	C2-C3		
R71	B3	R130	B2	R189	C1	U4	C3		
R72	B3	R131	B2	R190	B1	U5	C3		
R73	B3	R132	D3	R191	C1	U6	C2-C3		
R74	B3	R133	C3-D3	R192	C3	U7	B2-C2		
R75	B3	R134	D3	R193	C3	U8	B2-B3		
R76	B3	R135	D2	R194	C3	U9	C2-C3		
R77	B3	R136	C2	R195	C1	U10	B3-C3		
R78	B3	R137	D3	R196	C1	U11	B3-C3		
R79	B3	R138	D3	R197	C2	U12	B2		
R80	B2	R139	C3	R198	C2	U13	B2-B3		
R81	B2	R140	C2	R199	C2	U14	B2-B3		
R82	B2	R141	C2	R200	C2	U15	B3		
R83	B2	R142	B2	R201	B3	U16	B3		
R84	B3	R143	C2-B2	R202	C3	U17	B2-B3		
R85	B2	R144	B2	R203	C2	U18	B2		
R86	B2	R145	C2	R204	C2	U19	B2-B3		
R87	B2	R146	C1	R205	C2	U20	B2-B3		
R88	B3	R147	C1	R206	C2	U21	B3		
R89	B2-B3	R148	B2	R207	C2	U22	B3		
R90	B2	R149	B2	R208	C2	U23	C2		
R91	B2	R150	B2	R209	C2	U24	C2		
R92	B3	R151	B2	R210	C2	U25	C2		
R93	B3	R152	B2	R211	C2	U26	B2		
R94	B3	R153	B2	R212	C2	U27	B2		
R95	B3	R154	B2	R213	C2	U28	B2		
R96	B3	R155	B2	R214	C2	U29	B2		
R97	B3	R156	B2	R215	C2	U30	C3-D3		
R98	B3	R157	B2	R216	C3	U31	C2		
R99	B3	R158	B2	R217	C3	U32	B2		
R100	B3	R159	B2	R218	C3	U33	B2		
R101	B3	R160	B2	R219	C3	U34	B2		
R102	B3	R161	B2	R220	C3	U35	B2		
R103	B3	R162	B2	R221	C3	U36	B2		
R104	B3	R163	B1	R222	D1	U37	B2		
R105	C2	R164	B1	R223	D1	U38	B1		
R106	B2	R165	B1	R224	D2	U39	C1-C2		
R107	C2	R166	B1	R225	D2	U40	C1		
R108	C2	R167	B1	R226	B1	U41	C2		
R109	B2	R168	B1	R227	B1	U42	C2		
R110	C2	R169	B1	R228	C2	U43	C2		
R111	B2	R170	B1	S1	C3-D3	U44	C2		
R112	C2	R171	B1	S2	B1	U45	C1-C2		
R113	B2	R172	B1	S3	B1	U46	C1-C2		
R114	B2	R173	B1	S4	B1	U47	C1-C2		
R115	B2	R174	B1-C1	S5	C3	U48	C1-C2		
R116	B2	R175	B2	T1	C1	U49	C2		
R117	C2-B2	R176	B2-C2	TP1	C1	U50	C2		
R118	B2	R177	B1-C1	TP2	C1	U51	C2		
R119	B2	R178	B2-C2	TP3	B2	U52	C2		
R120	B2	R179	B2-C2	TP4	B2	U53	C2		

FIGURE 4-11. COMPONENT LOCATOR, ECU STEREO BOARD
(Sheet 2 of 2)

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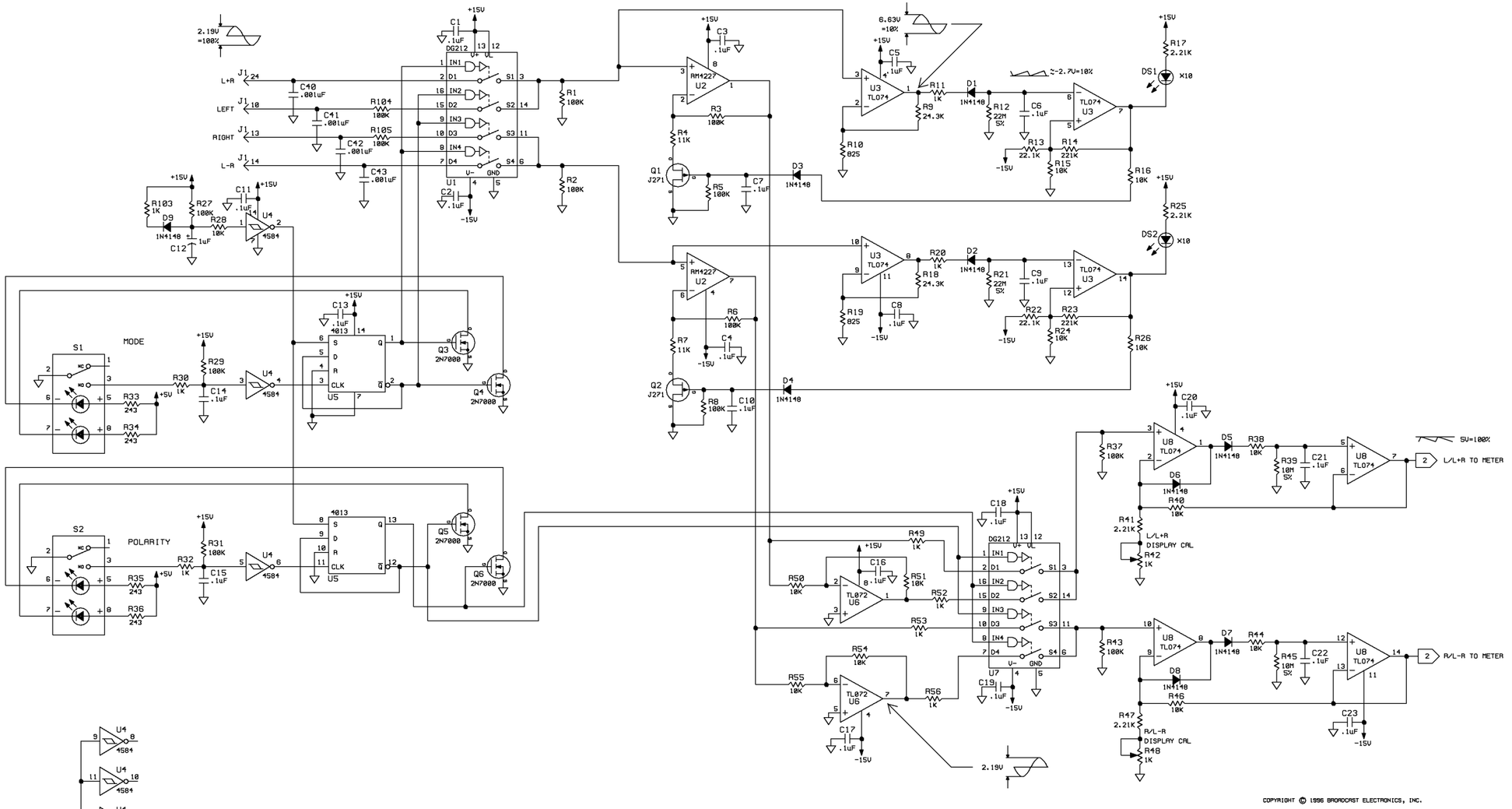

NOTES:
1. ALL RESISTORS IN OHMS: 1/4W, 1% UNLESS OTHERWISE SPECIFIED.
2. LAST COMPONENT USED: C43, D21, DS25, J2, Q7, R114, S11, U17
3. COMPONENTS NOT USED:
4. SEE ASSEMBLY: AD917-0306-001.

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DWN. BY	11-25-95
M. HAYDEN	
CHKD	
ME	
PROJ. ENGR.	
MFG.	
MATERIAL	SEE BOM's 917-0306-001
FINISH	
	SEE DWG AR532-0000
NEXT ASSY.	

TOLERANCE (DECIMAL) U.O.S. .x ± .030 .xxx ± .005 .xx ± .015 ANGLES ± 1°

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC - ECU DISPLAY/ ECU CONTROL SWITCH BD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0306-001	A

MODEL AM-1A | SCALE NONE | SHEET 1 OF 3

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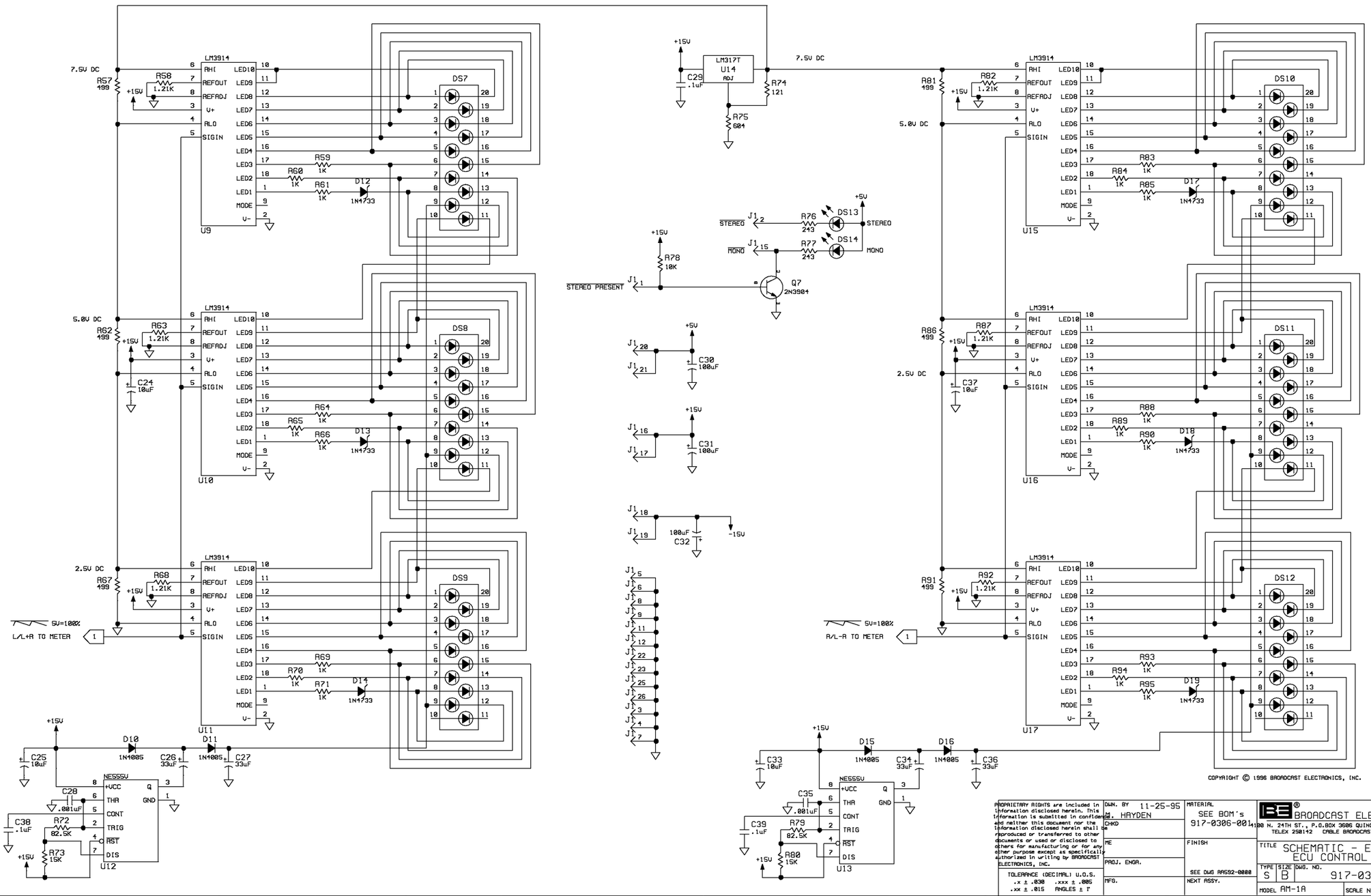

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

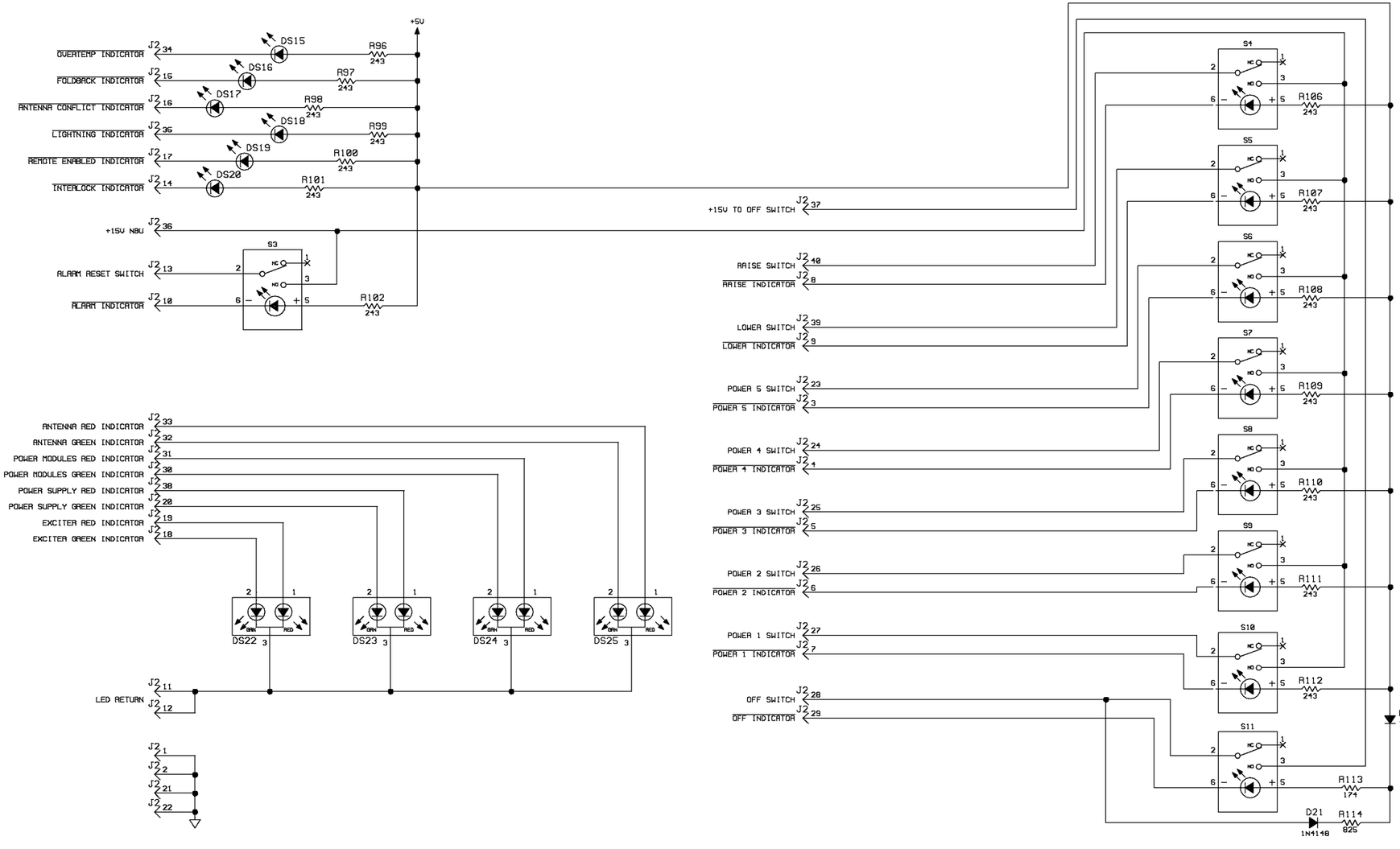
DWN. BY	11-25-95
CHKD	
ENGR.	HAYDEN
ME	
PROJ. ENGR.	
MFG.	
MATERIAL	SEE BOM's 917-0306-001
FINISH	
NEXT ASSY.	SEE DWG RAS92-0088

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC - ECU DISPLAY/ ECU CONTROL SWITCH BD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0306-001	A

MODEL AM-1A | SCALE NONE | SHEET 2 OF 3



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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY 11-25-95
M. HAYDEN
CHKD
ME
PROJ. ENGR.
MFG.

MATERIAL
SEE BOM'S
917-0306-001

FINISH
SEE DWG RASS2-0800

NEXT ASSY.

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE SCHEMATIC - ECU DISPLAY/ ECU CONTROL SWITCH BD

TYPE	SIZE	DWG. NO.	REV
S	B	917-0306-001	A

MODEL AM-1A | SCALE NONE | SHEET 3 OF 3

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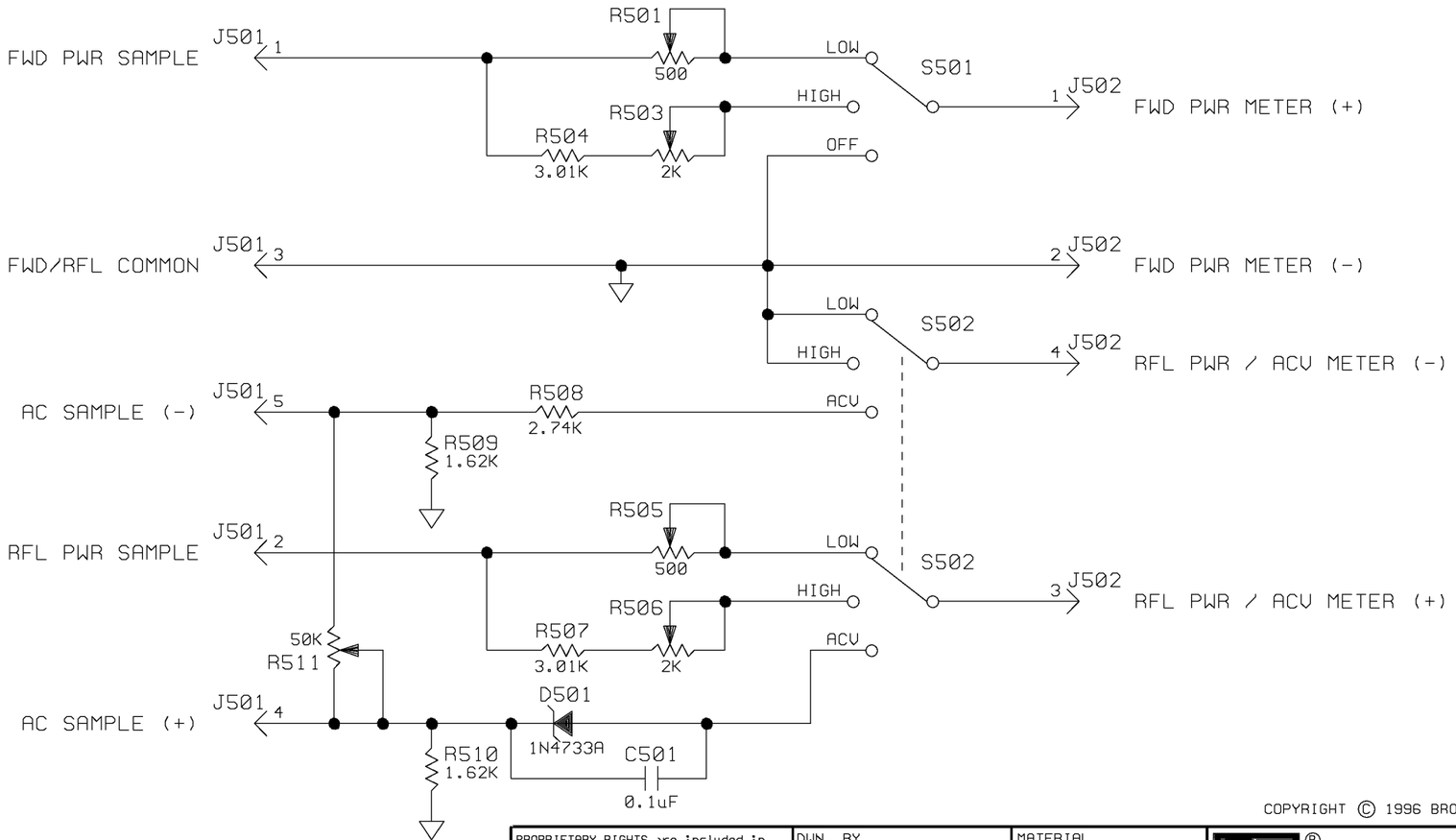

NOTES:

1. ALL REFERENCE DESIGNATORS START AT 501.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 1%, UNLESS OTHERWISE SPECIFIED.
3. LAST COMPONENT USED: D501, J502, R511, S502
4. COMPONENTS NOT USED: R502
5. SEE ASSEMBLY: AD917-0306

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TOLERANCE (DECIMAL) U.O.S.
.x ± .030 .xxx ± .005
.xx ± .015 ANGLES ± 1°

DWN. BY	MERKEL 1-2-96
CHKD	
ME	
PROJ. ENGR.	
MFG.	
MATERIAL	SEE BOM 917-0306-005
FINISH	SEE DWG RA592-0000
NEXT ASSY.	AD917-0306

BROADCAST ELECTRONICS INC.
4100 N. 24TH ST., P.O.BOX 3606 QUINCY, IL. 62305 217/224-9600
TELEX 250142 CABLE BROADCAST FAX 217/224-9607

TITLE: SCHEMATIC
ECU METER SWITCH PCB

TYPE	SIZE	DWG. NO.	REV
S	B	917-0306-005	A

MODEL AM-1A | SCALE NONE | SHEET 1 OF 1