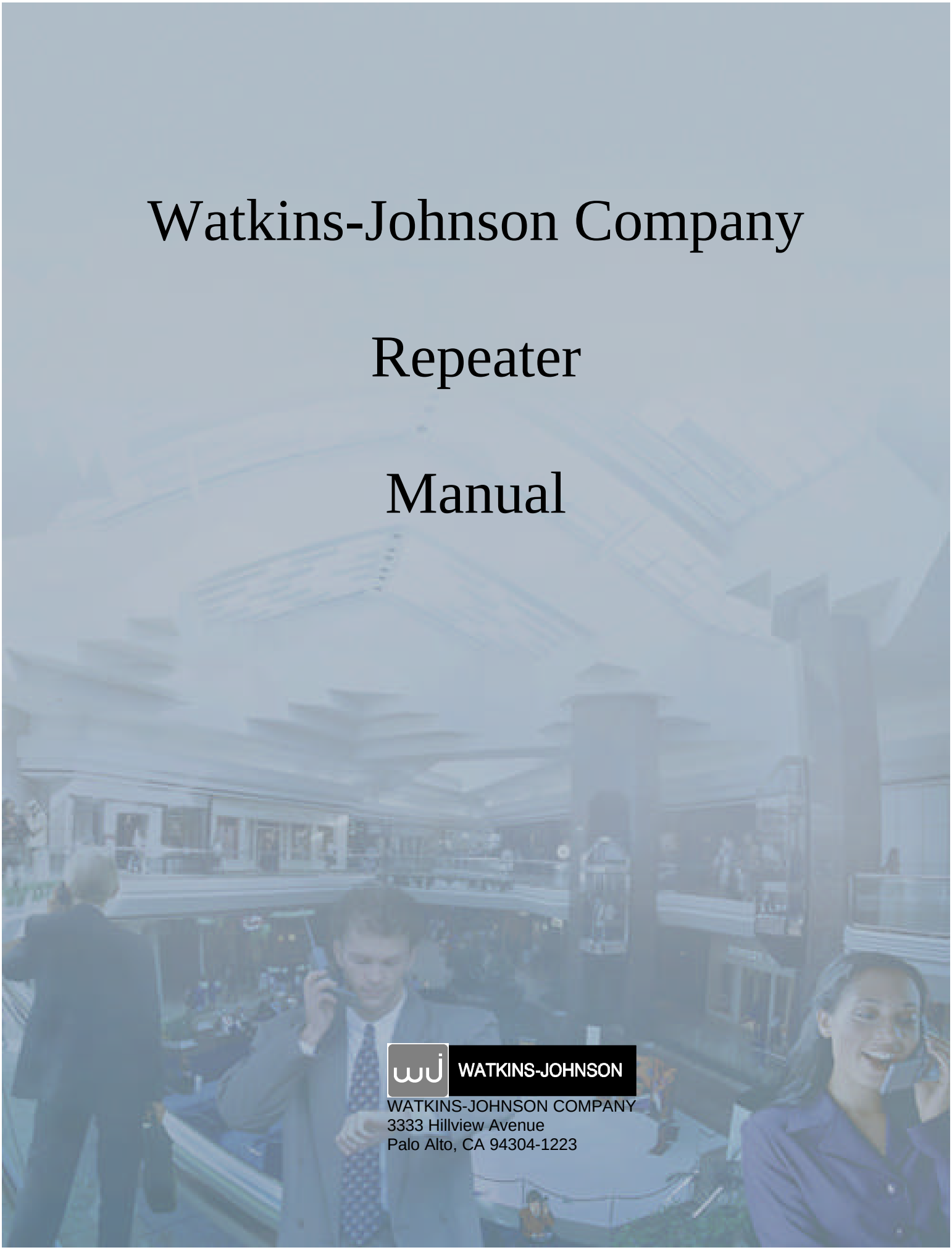
Watkins-Johnson Company

Repeater

Manual



WATKINS-JOHNSON

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Watkins-Johnson Company

PCS Repeater

Manual

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CHAPTER 1

GENERAL INFORMATION AND SAFETY PRECAUTIONS

1-1 INTRODUCTION

This manual provides information pertaining to the installation, operation, and maintenance of the Watkins-Johnson Repeaters, shown in Figure 1-1. The model number represents the type of repeater. This manual covers the following types of repeaters. The model numbers and letters are defined in the following example.

Example: **R1910CAD-1M** is a PCS indoor repeater, with CDMA modulation, using frequency bands A and D, 1.25mhz bandwidth, with a modem.

Repeater Model Number	Repeater Description
R1910	PCS Inbuilding Repeater
R1920	PCS High Power Repeater
R1930	PCS Medium Power Repeater
R1940	PCS Low Power Repeater
R810	Cellular Inbuilding Repeater
R820	Cellular High Power Repeater

Modulation	PCS Frequency Band	Bandwidth	Interface Option
CDMA = C TDMA = T GSM = G	AD* BE* FC*	-1 = 1.25 MHz -2 = 0.20 MHz -3 = 5.00 MHz -4 = 15.0 MHz -5 = 1.00 MHz -6 = 4.50 MHz -7 = 7.00 MHz	M= modem

* Specifies dual bands.
** The R810 and R820 cover the entire A or B band

This manual is divided into five chapters, the first four covering a particular topic for the operation and maintenance of the unit. Chapter 5 includes drawings to assist in mounting WJ repeaters. The topics are as follows:

Chapter	Topic
1	General Information and Safety Precautions
2	Installation
3	Operation
4	Scheduled Maintenance
5	Drawings

Figure 1-1. R1910 and R810 Repeater

Figure 1-2. R1920/30/40, R820 Repeater

Chapter 1 provides a general description of the Repeater and summarizes the electrical, mechanical, and environmental characteristics. It also provides a tabular listing of the Repeater performance specifications. Safety precautions to be observed while operating or servicing the unit are also explained.

Chapter 2 provides instructions for the initial inspection and installation of the Repeater. It describes the purpose and function of all I/O connectors, provides initial start-up instructions, and provides installation verification tests.

Chapter 3 describes the purpose and function of all remote controls and status indicators and explains how to operate the unit.

Chapter 4 provides a scheduled maintenance action index and describes maintenance procedures that should be performed on a regular basis, such as cleaning and inspection.

Chapter 5 provides drawings useful when mounting a WJ repeater to a structure.

1-2 SPECIFICATIONS

Table 1-1. R1910 Specification

DESCRIPTION	SPECIFICATION
Frequency	Band AD, BE, or FC
Output Power	100 mWatts CDMA 500 mWatts TDMA 500 mWatts PCS-1900 (GSM)
Filter Bandwidth	1.25 MHz CDMA (other filters available) 200KHz TDMA (other filters available) 200 kHz GSM-1900 (other filters available)
Noise Figure	4 dB Typical
Maximum Input without damage	-10 dBm
Input Impedance	50 ohms
Gain Range	40 dB to 70 dB or 65 dB to 95 dB
Gain Steps	2 dB
Signal Delay	5 usec max
Power	115 / 230 VAC, 60 / 50 Hz, 1.6 / 0.8 Amps
Alarms & Status	Synthesizer, Amplifiers, Power Amplifier, Output Power, Oscillation
Interface	RS-232 (modem optional)
Control	Gain, Channel frequency, Auto Level Control, and Tracking Offset
Cooling	Convection
Temperature	Operating: -10 to +45ºC Storage: -40 to +85ºC
Size	12” x 16” x 3”
Weight	19 lbs.
Weather Resistance	NEMA 12
Connectors	
RF	Type N
Control	9 pin Dsub Female
AC Power	NEMA Type 5-ISP

Table 1-2. R1920 Specification

DESCRIPTION	SPECIFICATION
Frequency	Band AD, BE, or FC
Output Power	8 Watts CDMA 10 Watts TDMA 15 Watts GSM-1900
Filter Bandwidth	1.25 MHz CDMA (other filters available) 200 kHz TDMA (other filters available) 200 kHz GSM-1900 (other filters available)
Noise Figure	4 dB Typical
Maximum Input without damage	-10 dBm
Input Impedance	50 ohms
Gain Range	65 dB to 95 dB
Gain Steps	2 dB
Signal Delay	5 usec max
Power	115 / 230 VAC, 60 / 50 Hz, 4 / 2 Amps
Alarms & Status	Synthesizer, Amplifiers, Power Amplifier, Output Power, Oscillation
Interface	RS-232 and modem
Control	Gain, Channel frequency, Auto Level Control, and Tracking Offset
Cooling	Convection
Temperature	Operating: -40 to +50ºC Storage: -40 to +85ºC
Size	14.5” x 16” x 9”
Weight	55 lbs.
Weather Resistance	NEMA 4X
Connectors	
RF	Type N
Control	9 pin D-sub, 3 pin circular(see section 2 for pinout information)
AC Power	3 pin Mini-circular(see section 2 for pinout information)
Battery	6 pin Mini-circular

Table 1-3. R1930 Specification

DESCRIPTION	SPECIFICATION
Frequency	Band AD, BE, or FC
Output Power	4 Watts CDMA
Filter Bandwidth	1.25 MHz CDMA (other filters available)
Noise Figure	4 dB Typical
Maximum Input without damage	-10 dBm
Input Impedance	50 ohms
Gain Range	65 dB to 95 dB
Gain Steps	2 dB
Signal Delay	5 usec max
Power	115 / 230 VAC, 60 / 50 Hz, 4 / 2 Amps
Alarms & Status	Synthesizer, Amplifiers, Power Amplifier, Output Power, Oscillation
Interface	RS-232 and modem
Control	Gain, Channel frequency, Auto Level Control, and Tracking Offset
Cooling	Convection
Temperature	Operating: -40 to +50ºC Storage: -40 to +85ºC
Size	14.5” x 16” x 9”
Weight	55 lbs.
Weather Resistance	NEMA 4X
Connectors	
RF	Type N
Control	9 pin D-sub, 3 pin circular(see section 2 for pinout information)
AC Power	3 pin Mini-circular(see section 2 for pinout information)
Battery	6 pin Mini-circular

Table 1-4. R1940 Specification

DESCRIPTION	SPECIFICATION
Frequency	Band AD, BE, or FC
Output Power	2 Watts CDMA
Filter Bandwidth	1.25 MHz CDMA (other filters available)
Noise Figure	4 dB Typical
Maximum Input without damage	-10 dBm
Input Impedance	50 ohms
Gain Range	65 dB to 95 dB
Gain Steps	2 dB
Signal Delay	5 usec max
Power	115 / 230 VAC, 60 / 50 Hz, 4 / 2 Amps
Alarms & Status	Synthesizer, Amplifiers, Power Amplifier, Output Power, Oscillation
Interface	RS-232 and modem
Control	Gain, Channel frequency, Auto Level Control, and Tracking Offset
Cooling	Convection
Temperature	Operating: -40 to +50ºC Storage: -40 to +85ºC
Size	14.5” x 16” x 9”
Weight	55 lbs.
Weather Resistance	NEMA 4X
Connectors	
RF	Type N
Control	9 pin D-sub, 3 pin circular(see section 2 for pinout information)
AC Power	3 pin Mini-circular(see section 2 for pinout information)
Battery	6 pin Mini-circular

Table 1-1. R810 Specification

DESCRIPTION	SPECIFICATION
Frequency	Band A or B
Output Power	100 mWatts
Filter Bandwidth	Entire A or B band
Noise Figure	4 dB Typical
Maximum Input without damage	-10 dBm
Input Impedance	50 ohms
Gain Range	40 dB to 70 dB
Gain Steps	2 dB
Signal Delay	5 usec max
Power	115 / 230 VAC, 60 / 50 Hz, 1.6 / 0.8 Amps
Alarms & Status	Synthesizer, Amplifiers, Power Amplifier, Output Power, Oscillation
Interface	RS-232 (modem optional)
Control	Gain, Channel frequency, Auto Level Control, and Tracking Offset
Cooling	Convection
Temperature	Operating: -10 to +45ºC Storage: -40 to +85ºC
Size	12” x 16” x 4”
Weight	19 lbs.
Weather Resistance	NEMA 12
Connectors	
RF	Type N
Control	9 pin Dsub Female
AC Power	NEMA Type 5-ISP

Table 1-1. R820 Specification

DESCRIPTION	SPECIFICATION
Frequency	Band A or B
Output Power	5 Watts
Filter Bandwidth	Entire A or B band
Noise Figure	4 dB Typical
Maximum Input without damage	-10 dBm
Input Impedance	50 ohms
Gain Range	55 dB to 85 dB
Gain Steps	2 dB
Signal Delay	5 usec max
Power	115 / 230 VAC, 60 / 50 Hz, 4 / 2 Amps
Alarms & Status	Synthesizer, Amplifiers, Power Amplifier, Output Power, Oscillation
Interface	RS-232 (modem optional)
Control	Gain, Channel frequency, Auto Level Control, and Tracking Offset
Cooling	Convection
Temperature	Operating: -10 to +45ºC Storage: -40 to +85ºC
Size	14.5” x 16” x 10”
Weight	55 lbs.
Weather Resistance	NEMA 12
Connectors	
RF	Type N
Control	9 pin D-sub, 3 pin circular(see section 2 for pinout information)
AC Power	3 pin Mini-circular(see section 2 for pinout information)
Battery	6 pin Mini-circular

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION:

Changes or modifications not expressly approved by the manufacturer responsible for compliance could void user's authority to operate the equipment.

1-3 SAFETY CONSIDERATIONS

WARNING

To prevent personal injury, observe all safety precautions and warnings stated on the instrument and in this manual.

Specific warnings, cautions, and instructions are placed wherever applicable throughout this manual. These precautions must be observed during all phases of operation, service, and repair of this unit. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standard of design, manufacture, and intended use of this instrument.

1-4 DESCRIPTION

The WJ-R19XX Repeaters are used to extend the coverage of a PCS basestation. For example, inside buildings that do not allow sufficient signal strength from the basestation, there exists a hole in the coverage for wireless service. The WJ-R1910 is designed to solve that problem.

Likewise, tall buildings in a metropolitan area, or mountains in a more rural area, can reduce basestation signal strength such that pockets of unusable areas develop. The WJ-R1920/30/40 is designed to solve that problem.

The repeater receives the basestation signal via an external antenna see Figure 1-3. This signal is amplified and filtered by the repeater and ultimately retransmitted via a second antenna. The entire process is duplicated for the reverse path where the handset signal is amplified and filtered and retransmitted to the basestation. This technique provides PCS coverage inside buildings or in outside areas that previously did not have sufficient signal strength.

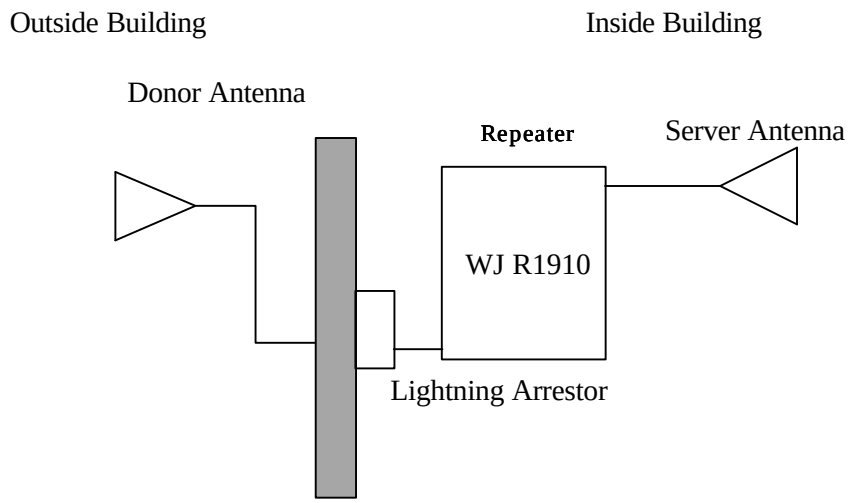


Figure 1-3. R1910/R810 Typical Usage

1-4.1 Remote Control

Remote control and status reporting of the repeater is provided either through an RS-232 serial interface or via modem using a standard POTS line. Either interface permits the control of channel frequency and gain, and can provide unit alarm status.

1-4.2 Prime Power

The R1910 and R810 is equipped with a power supply with an input of 115 / 230 VAC, 60 / 50 Hz, 1.6 / 0.8 Amps. Power consumption is approximately 65 Watts.

The R1920/30/40 and R820 is equipped with a power supply with an input of 115 / 230 VAC, 60 / 50 Hz, 4 / 2 Amps with an optional +24VDC/Battery input. Power consumption is approximately 250 Watts.

1-5 MECHANICAL

The R1910 and R810 are a 12 x 16 x 3 wall mount unit. Four mounting feet are provided for installation. The unit is designed to withstand a NEMA 12 type environment.

The R1920/30/40 and R820 a 12 x 16 x 3 tower mount unit. A mounting bracket is provided for installation. The unit is designed to withstand a NEMA 4X type environment.

1-6 ENVIRONMENTAL CONDITIONS

1-6.1 Non-operating Environmental Conditions

The Repeater will survive strains, jars, vibrations, or other conditions incident to normal maintenance, transportation, and handling. Temperature ranges can vary between -40°C and +85°C with humidity up to 95% non-condensing.

1-6.2 Operating Environmental Conditions

The R1910 and R810 can be installed and operated in a commercial environment with temperatures varying between -10°C and 45°C.

The R1920/30/40 and R820 can be installed and operated in an outdoor environment with temperatures varying between -40°C and 50°C.

1-6.3 Transportability

The Repeater can be transported by commercial land carriers or pressurized commercial air carriers without special handling provisions.

CHAPTER 2

INSTALLATION

2-1 INTRODUCTION

This chapter provides information for the installation, setup and alignment of the R19X0 PCS Repeater. The information consists of procedures for unpacking, inspection, and preparation for reshipment or storage, and description of unit connectors. It also provides initial start-up instructions and installation verification tests.

2-2 UNPACKING AND INSPECTION

Examine the shipping carton for damage before unpacking the unit. If the shipping carton is damaged, try to have the carrier's agent present when the equipment is unpacked. If carrier's agent is not available, retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

Verify that the equipment is complete, as listed on the packing slip. Contact Watkins-Johnson Company, Palo Alto, California, or your local Watkins-Johnson representative with details of any shortage.

The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. Thus, it is ready for use upon receipt. After unpacking and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. If external damage is visible, contact Watkins-Johnson Company.

2-3 PREPARATION FOR USE

2-3.1 Power Requirements

The R1910 is equipped with a power supply that accepts 115 / 230 VAC 1.6 / 0.8 Amps @ 60 / 50 Hz single phase. Power consumption of the R1910 is approximately 65 Watts. The R1920/30/40 is equipped with a power supply that accepts 115/230 VAC 4 / 2 Amps @ 50/60 Hz, with optional +24VDC/Battery input. Power consumption is approximately 250 Watts.

WARNING

> Removing or defeating the ground prong on the power cord may present a lethal shock hazard. Do not use an ac two-to-three wire adapter plug with this unit.

The R1910 power cord has a 3-conductor grounded plug complying with the National Electric Code (NEMA Type 5-15P) for 110 VAC operation. For the R1920/30/40, or for operation at other voltages, contact Watkins-Johnson Company or a qualified service technician.

2-3.2 Software Installation

The repeater control application provided on 3.5” floppy disks or CD-ROM, runs on any Personal Computer (PC) running Microsoft Windows 95, 98, or NT 4.0 or higher. The computer must also have one of two serial communications ports available for use, COM 1 or COM 2. To install the application, insert disk 1 into floppy disk drive A: and from the Start menu select Run and enter “a:\setup” in the text box of the Run window. Click the OK button and follow the instructions given.

2-3.3 Operating Environment

Environmental conditions during operation should normally be limited as follows:

R1910:

a. Maximum humidity: 95%

b. Temperature range: -10°C to +45°C.

R1920/30/40:

a. Temperature range: -40°C to +50°C.

2-4 PRE-INSTALLATION INFORMATION

2-4.1 R1910

You will need to know some basic information before beginning the R1910 installation. Write this information down, you will need it later on.

1. Base station location and Channel number to be repeated.
2. Reverse Tracking offset in dB (Optional).
3. Location where the Donor antenna is to be installed.
4. Location where the Server antenna is to be installed.
5. Phone number of modem line. (Optional)
6. Location where the R1910 is to be installed (Lat/Long).

2-4.2 R1920/30/40

You will need to know some basic information before beginning the R1920/30/40 installation. Write this information down, you will need it later on.

1. Base station location and Channel number to be repeated.
2. Reverse Tracking offset in dB (Optional).
3. Location where the Donor antenna is to be installed.
4. Location where the Server antenna is to be installed.
5 Phone number of modem line.
6. Location where the R1920 is to be installed (Lat/Long).

2-5 INSTALLATION INFORMATION

2-5.1 Donor Antenna Installation

The Donor antenna will be mounted outside. The antenna should be installed so that it is in line-of-sight of the base station and is pointed directly at it. If there is an arrow or polarity marking indicated on the antenna, ensure that it is pointing up. Be sure that the antenna or mast is properly grounded with a grounding strap. For clearances, grounding and mounting requirements please refer to Article 810 of NEC handbook.

For the R1910, determine where the RF cable will enter building and drill hole if necessary. A lightning suppressor is highly recommended. Install suppressor inside building where cable entry is. Attach grounding strap to lightning suppressor. Measure distance between antenna connection and lightning suppressor. Be sure to add some length for drip loop and cut cable. When routing cable, be careful not to kink, cut or damage cable. Install connectors on cable using the appropriate tool and connect to antenna and lightning suppressor connector labeled “Surge”.

2-5.2 Server Antenna Installation

The Server antenna should be located in an open area free from metallic obstruction if possible and in a location such that mobiles will always be at least 2 meters away. Mount antenna and route cable from antenna to R1910 location. When routing cable, be careful not to kink, cut or damage cable. No lightning suppression is needed if the antenna is indoors or under an overhang. Install connector using the appropriate tool and connect to antenna. For clearances, grounding and mounting requirements please refer to Article 810 of NEC handbook.

2-5.3 Proper Weather Sealing of RF Connectors.

It is important to properly weather-seal mated connectors against water migration into the RF connectors and coaxial cables. Water migration into the jumper cable will cause considerable signal attenuation and poor return loss. There are several commercial products available for this purpose. The following guidelines should be followed when weather sealing antennas:

- Make sure the connector and cable to be sealed are clean and dry.
- Wrap the sealant to ensure a continuous seal around the connector body and the coaxial cable. If you pre-wrap the connection with vinyl tape, be careful to leave extra space for the sealant to contact the connector body and the cable directly.
- After the entire connection has been covered with the manufacturer's recommended amount of sealant, mold and form the sealant by hand to ensure good contact and to force out trapped air.
- Carefully inspect the seal to make certain that all joints and openings are covered and sealed.
- Wrap the sealant with UV stabilized vinyl tape for additional protection.

2-5.4 R1910 Installation

Ambient temperature in the area where the unit is installed should not exceed 45°C. Be sure that unit is positioned upright to permit adequate air flow and that nearby equipment does not discharge hot air directly on the unit. The installation should allow a free flow of air around the outer surfaces of the chassis. Access to the bottom should be allowed so that input and output connections can be conveniently made or changed if desired. The unit weighs 19 pounds and may safely be carried and installed by a single person.

The preferred mounting of the R1910 is on 16” center studs. See mounting bracket installation at end of manual. If mounting to other surfaces, be sure to use appropriate hardware able to carry 19 lbs. Before mounting to wall, verify AC power outlet is within 10 feet. Attach the mounting brackets to the repeater. Screw in the bottom two ¼” X 1 1/2” bolts into studs. Slide in repeater and mark top two bolt locations. Remove repeater and install remaining two bolts. Slide in repeater and tighten bolts. Route cable between repeater and lightning suppressor. When routing cable, be careful not to kink, cut or damage cable. Install connectors using the appropriate tool and connect to lightning suppressor connector labeled “Protected” and repeater connector J3 Donor. Install connector on cable from Server antenna and connect to repeater connector J4 Server. Connect power cord.

2-5.5 R1920/30/40 Installation

First verify that the repeater to be installed is within 10 ft of A/C power and POTS line junction box. The maximum current rating of the branch circuit should be 20Amps. Install mounting plate 450420 to 2 pieces of channel mounted horizontally to tower, using 4 3/8” bolts. If installing optional battery backup, attach two 12” pieces of channel vertically to horizontal channel directly behind 450420 mounting plate. Attach S-218 shelf to each 12” channel after mounting plate is securely fastened. Mount repeater to mounting plate and secure using provided bolts. A 12-ft A/C power cord and modem cable are also supplied with the repeater.

2-5.5.1 Cable Wiring information

The R1920/30/40 is shipped with 2 cables that have flying leads at one end. Below is the pinout for those cable assemblies.

Label	Signal Name and Pinout
AC Power Cable	1- Ground(Green) 2- Line(Black) 3- Neutral(White)
Modem Cable	1- Ground(Green) 2- Tip(Red/Black) 3- Ring(Red/White)

WJ #	Connects to:	Cable Description	Manufacturer	MFG #
860000-	AC	3 Pin Mini-Change	Brad Harrison	40903
860000-	Battery	6-Pin Mini-Change	Brad Harrison	41621
860000-	Modem	3-Pin Micro-Change	Brad Harrison	703000D02F12
860000-	Remote control	5-Pin Micro-Change	Brad Harrison	705000A13F060

The Modem cable should be wired to the modem line surge protector (refer to section 2-5.6). Protection to the modem cable should be provided to avoid exposure to lightning and power conductors in accordance with NEC 725-54c & 800-30.

2-5.6 Required Hardware

1265-21	Joslyn Surgitron II AC line surge protector	Joslyn Electronic Systems Co.
7040-01-D	Joslyn Station Protector Modem Line Surge Protector	Joslyn Electronic Systems Co.
APT-NFNF-9	Type N F-F RF lightning protection	Andrew Corporation

Primary protection should be located no further than 12ft away from the unit.

2-5.7 Recommended hardware

Depending on the type of structure the R1920/30/40 will be mounted to, additional hardware may be required. Listed below is the manufacture name and commonly used hardware for a typical repeater installation.

Manufacture Part Number	Description	Manufacture Name
A-1200-S	Slotted Channel	Thomas & Betts (Superstrut)
CM-100-3/8	Nylon Cone Nut	Thomas & Betts (Superstrut)
E-142-3/8x1-1/2	Hex Head Cap Screw	Thomas & Betts (Superstrut)
E-145-3/8	Standard Hex Nut	Thomas & Betts (Superstrut)
A-210	Bracket	Thomas & Betts (Superstrut)
S-218	14” Shelf	Thomas & Betts(Superstrut)

H-115-3	U-Bolt	Thomas & Betts(Superstrut)
99343	Power Splitter	Tessco

2-6 REPEATER INITIAL TURN-ON PROCEDURE

Verify all RF connectors are tightened and cables and antennas are secured. On the R1910 turn on the switch J1 located at the bottom of the unit and verify PWR led is illuminated green as well as the AMP and OSC LED's. For the R1920/30/40 remove the access cover push power switch, it should illuminate red.

2-7 SETUP

2-7.1 SERIAL INTERFACE

For the R1910, connect a 9-pin cable to connector J2 Control. For the R1920, connect a 9-pin cable to connector labeled Local Control. Connect the other end of the serial cable to the serial COM port on a PC. Verify software has been installed on PC. On PC click "WJ Repeater Control" icon. Choose the COM port the cable is attached to. After the Repeater window opens, all the parameters should begin appearing. If not, the wrong COM port may have been selected. The cable used to connect to the repeater is a temporary connection and should be no longer than 140ft.

For background on the entire installation process, please refer to NEC articles 725 and 800. This pertains especially to clearances from power and lightning conductors and transient protection.

2-7.2 MODEM INTERFACE

For the R1910, connect the 9-pin-to-phone-jack adapter to the J2 Control connector. Plug the phone line into the phone jack of the adapter. For the R1920, connect the supplied 3-pin modem cable to connector labeled "Modem" and the other end to the POTS line junction box. Connect an analog phone line to the modem of a PC. Verify software has been installed on the PC. On the PC, click the "WJ Repeater Control" icon on the Desktop or in the Start menu and follow these steps to establish a connection to the repeater.

1. Choose "Modem" from the interface selection window and press "OK".
2. Enter the phone number of the repeater when prompted, and press "OK".
3. When the main window appears, click "File" on the menu bar. Then select "Connect" from the menu.
4. When the Dialer window appears press the "Dial" button to call the repeater.

When a connection is established the Dialer window will disappear and, after several seconds, the repeater's parameters will be downloaded.

2-8 ISOLATION AND ALIGNMENT PROCEDURES

After completing the installation, turn-on procedure, and setup you must align and verify proper operation of the R19XX.

Note: Watkins-Johnson repeaters incorporate an over power protection algorithm. This algorithm detects when the repeater is transmitting at a power level above that allowed by the FCC. The repeater continuously reduces the gain of the repeater until the output power is reduced to an acceptable power level. An Osc/Max Pwr alarm is generated when this occurs.

2.8.1 ISOLATION PROCEDURE

Performing the isolation test will ensure proper system operation. If the Donor and Server antennas are not sufficiently isolated, the repeater will oscillate and MAY turn off, causing dropped calls and coverage holes.

a. Set Uplink and Downlink Gain settings to minimum. Turn off Downlink ALC and Uplink Tracking.

b. Set Donor Channel # to unused channel(s) with no signal activity. Note: This is not possible with full-band filters

c. Increase Downlink gain setting by 2dB. RSS should read minimum.

d. Increase Uplink gain by 2dB. RSS should still read minimum.

e. Repeat steps C and D until the maximum gain settings are reached. If there is any signal present at RSS or the OSC alarm turns red, there is not enough isolation between antennas, and you must increase the physical distance between antennas or change the Server antenna direction away from the Donor antenna.

f. Typical industry practice is to allow a 14dB margin between the gain setting and the oscillation point, but this is at the user's discretion.

g. As an alternative to steps a through f, set gains to desired levels and click the "OSC Test" button in the Repeater Control software. The repeater will automatically add 14dB to the Uplink and Downlink gain settings, and "Oscillation Test Active" will appear in the lower left-hand corner of the Repeater Control window.

h. After the message, "Oscillation Test Active" returns to "Device Online," verify no Alarms are illuminated red. If no alarms are red, the test is complete. If alarms are illuminated red, go to step i.

i. Reposition to Donor and/or Server antennas to improve isolation or lower Uplink and/or Downlink gain settings by 2dB, clear alarms, and return to step h.

2.8.2 ANTENNA ALIGNMENT PROCEDURE

a. Ensure correct Channel # is displayed and RF is turned ON. For multicarrier filters, the Channel # should be tuned to the center of the desired passband.

b. Increase the Downlink gain until signal is present on RSSI.

c. Adjust Donor Antenna for maximum signal deflection on RSSI.

d. Set FWD gain to desired level.

e. When ready, click the "OSC Test" button on the windows control software.

f. After test complete, verify no Alarms are illuminated red. If yes (no alarms red), skip to step "f". If no (alarms illuminated red) go to "g".

g. Reposition the Donor or Server antennas to improve isolation, or lower FWD or REV gain settings by 4dB, clear alarms and repeat step "c".

h. If using ALC *, enter ALC Level and enable. Repeat step "c". If not go to "g".

i. If using the serial interface, remove cable from J2, RS-232 on R1910. Test is complete.

2-8.2.1 Effects of obstruction on RF Signal Propagation

Radio path clearance between antennas is an essential criterion for any point-to-point communication system, and is one critical element of propagation conditions of a mobile communication system. If a fairly large object exists in the radiation path between two antennas, reduced received signal strength will occur because the radio link relies increasingly on energy diffracted around the obstructing object, rather than direct (line-of-sight) radiation.

Diffraction allows radio signals to propagate behind obstructions. Although the received signal strength decreases rapidly as a receiver moves deeply into the obstructed (shadowed) region, the diffraction field still exists and often has sufficient strength to produce a useful signal.

2-9 FCC REQUIREMENTS ON SPURIOUS

The FCC requires that all spurious signals emanating from the repeater must be at or below -13dBm outside your frequency band. There are several things one must consider when deploying repeaters. If you are deploying in a single carrier deployment then there are no other calculations you must make to verify that the FCC limits are being met. Multicarrier deployment is more complicated, but good solutions are readily available. The preferred method is to use one repeater per carrier. This method provides the highest composite output power without producing intermodulation products that exceed FCC requirements. A much lower cost solution involves using a repeater with a bandwidth wide enough to allow 2 or more signals to pass. This method provides the lowest cost solution but can limit composite output power depending on the frequency of the signals. The two methods are detailed below.

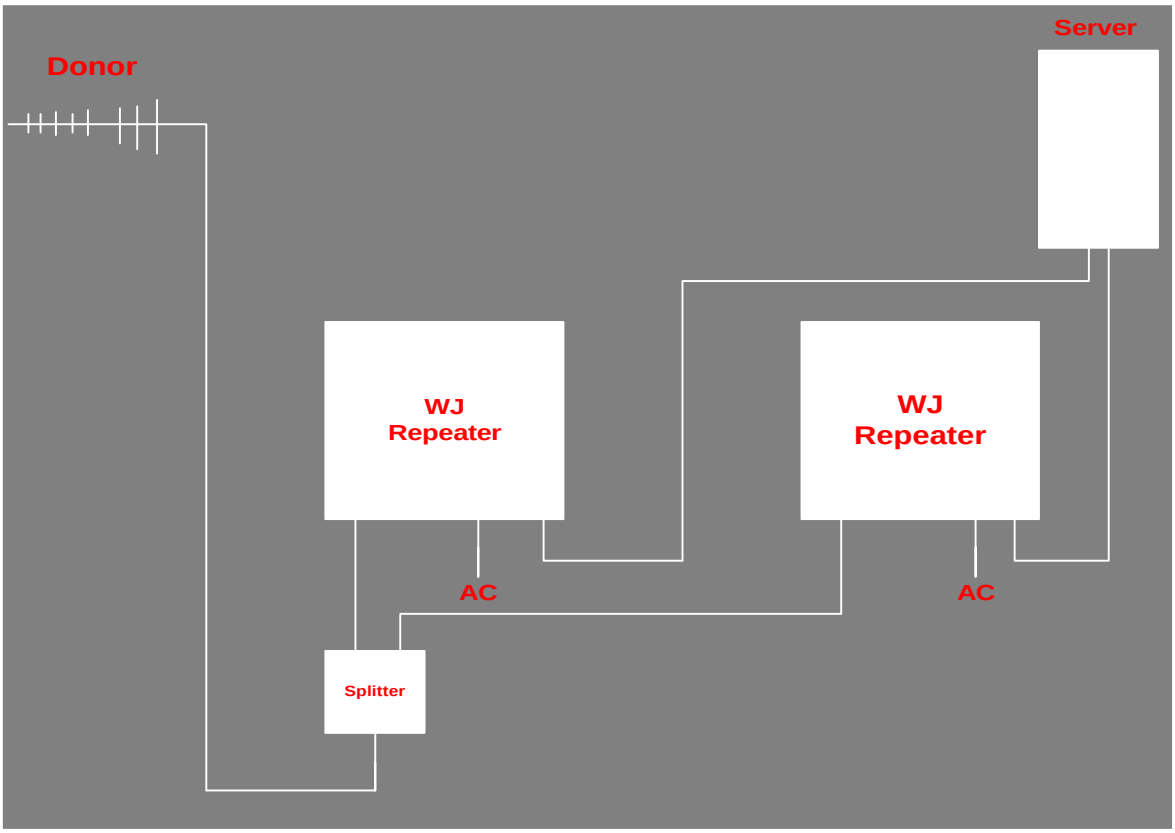
2-9.1 METHOD 1 – MULTIPLE REPEATERS

This method is straightforward and actually increases the composite output power of the system by maintaining the maximum output power per carrier. For example, a repeater with a 10Watt output will provide a composite of 20 Watts if used in a 2 repeater configuration where each repeater transmits 1 signal. See the Figure 1 below.

Figure 1 Multicarrier for Highest Output Power

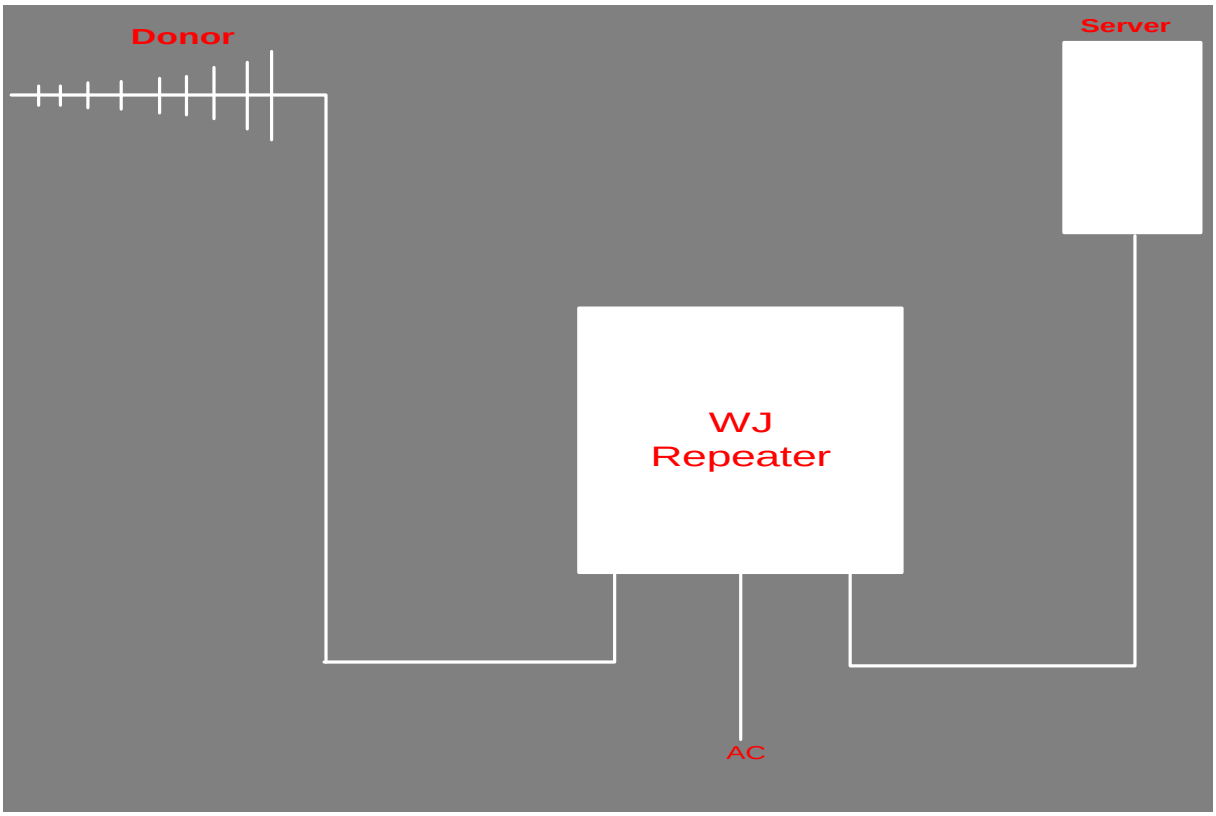
This arrangement can be expanded to more carriers if necessary. Notice how a dual polarized antenna is used for the server. This allows you to run each repeater output to the antenna without using a power combiner. The 3dB loss of signal power associated with a power combiner is eliminated.

This method produces the highest composite output power at the expense of more equipment.



2-9.2 Method 2 – Wider Bandwidth Repeater

This method is much less costly but must be used and deployed carefully. The repeater in this case uses a filter that passes 2 or more signals. The inter-modulation products that are produced by these signals must be kept to below -13dBm to comply with the FCC (Note that the inband spurious may need to be kept below –13dBm in order to comply with an air interface standard). You can see from Figure 2 that the amount of equipment necessary is one half that as seen in the multiple repeater deployment.



Notice how simple the deployment is. No combiner or dual polarized antenna is required. This method is the lowest cost method but sacrifices output power.

The intermodulation products produced with Method 2 will look something like Figure 3.

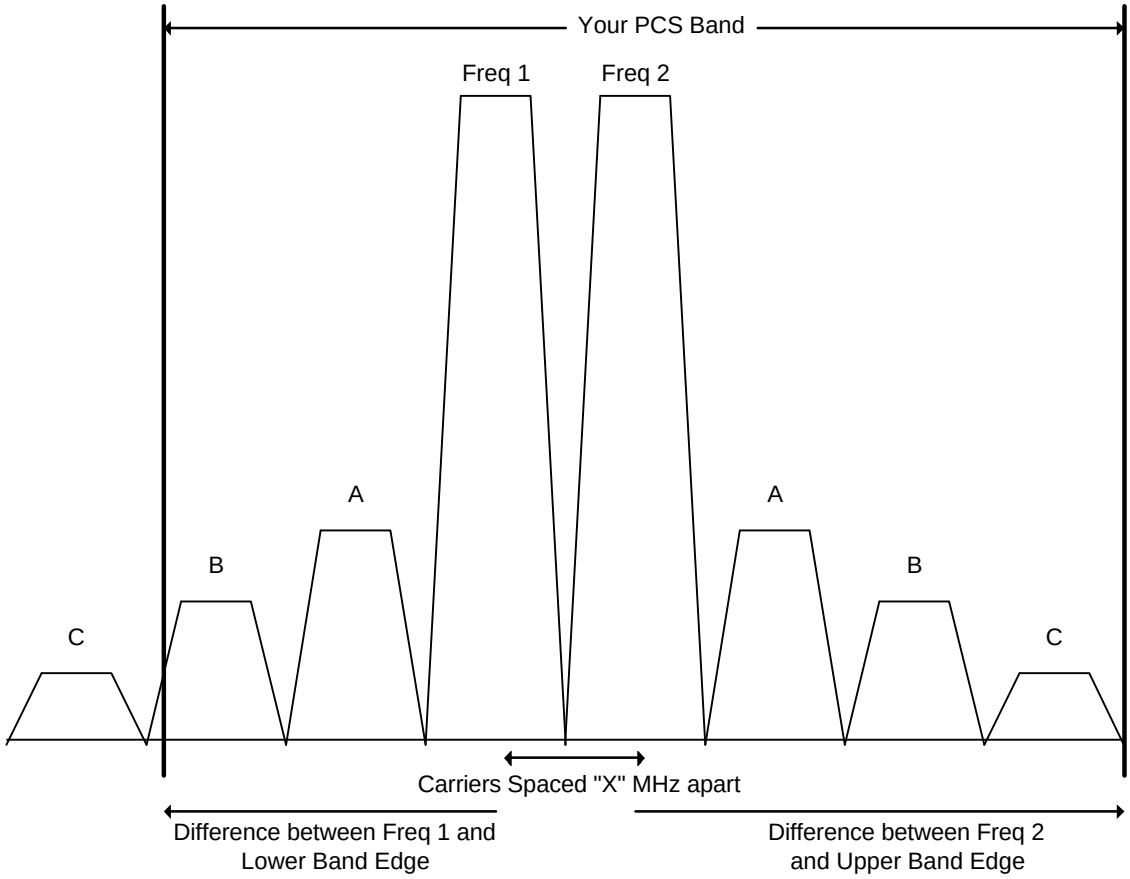


Figure 3

The 2 large signals depict the carriers (Freq 1 & Freq 2). The other signals are intermodulation products (A, B, C) created by these two signals. What is important for the FCC is to keep the level of these intermodulation products below -13dBm outside your licensed band. The FCC does not regulate Spurious within your frequency band (although your air interface may require that in-band spurious levels in your system be kept below a certain level.). The power of the intermodulation products decreases as the intermodulation product increases (A>B>C). See the charts below to ensure that you are not exceeding the FCC requirements.

The following tables and charts should be used to verify proper operation of the method 2 multicarrier configuration.

Table 1 Output Power vs. Signal Number for Indoor Repeaters

R1910			
Air Interface	# of Carriers	Composite Power (dBm)	Spurious A,B,C
CDMA	1 or more	20	< -13dBm
TDMA	1	27	< -13dBm
	2 or more	20	< -13dBm
GSM	1	27	< -13dBm
	2 or more	20	< -13dBm

CDMA

Table 2 identifies the number of channels that must be left unoccupied between the CDMA carrier and the licensed band edge. The maximum composite output power can be obtained when the CDMA carriers are positioned adjacent (i.e. 25 channels apart) and adequate frequency is left unoccupied between the carrier and the band edge.

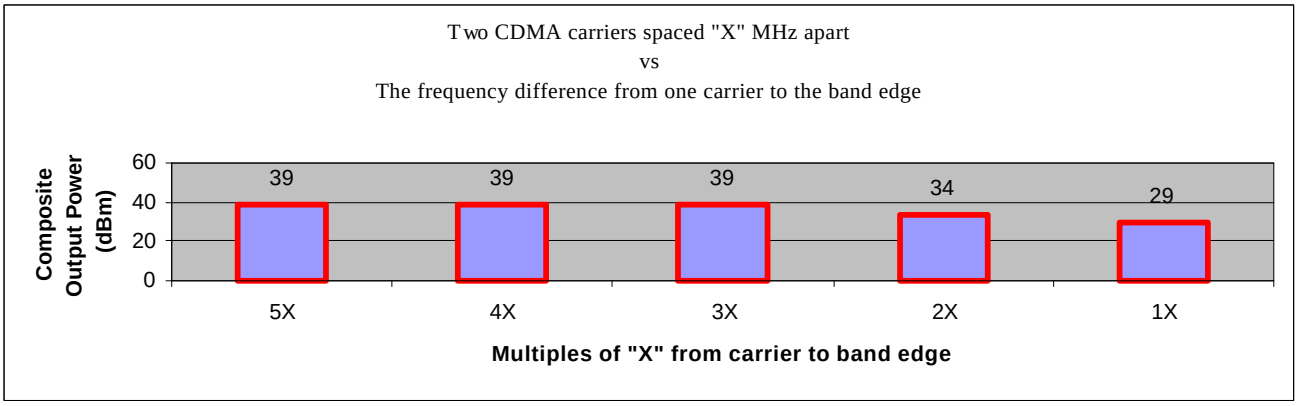
Number of Adjacent Signals	Minimum number of unoccupied channels to band edge	Composite Power		
		R1920C	R1930C	R1940C
2	50	8Watts	4Watts	2Watts
3	100			

Table 2 CDMA Adjacent Spacing

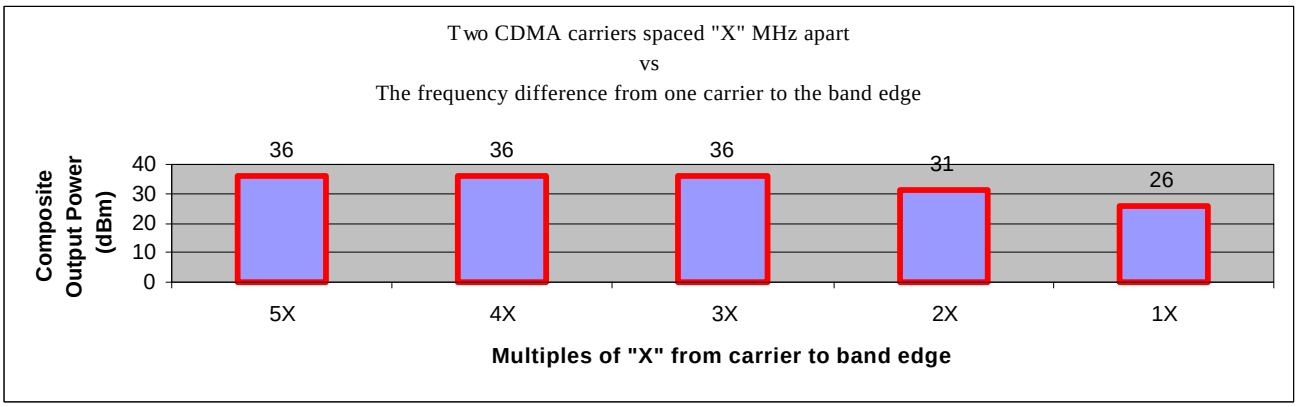
If the CDMA signals are NOT adjacently located then you must use the following graphs to determine the maximum output power.

NOTE: These following charts do NOT take into consideration inband spurious. If your air interface requires that inband spurious be kept below a specified power level (i.e. –13dBm) then assume that the lowest composite power shown on the following product charts is the maximum power allowed to be transmitted.

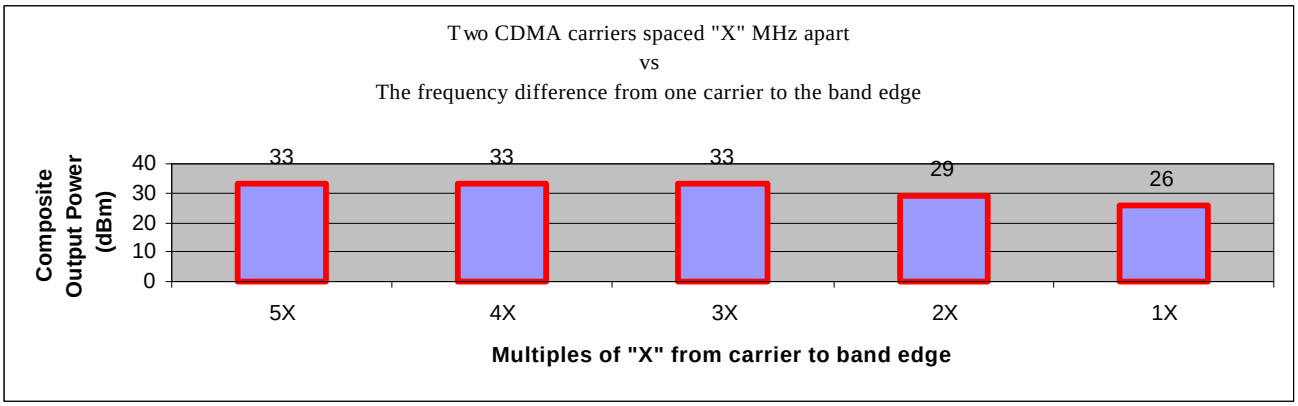
R1920C Chart 1 CDMA out of band spurious limitations



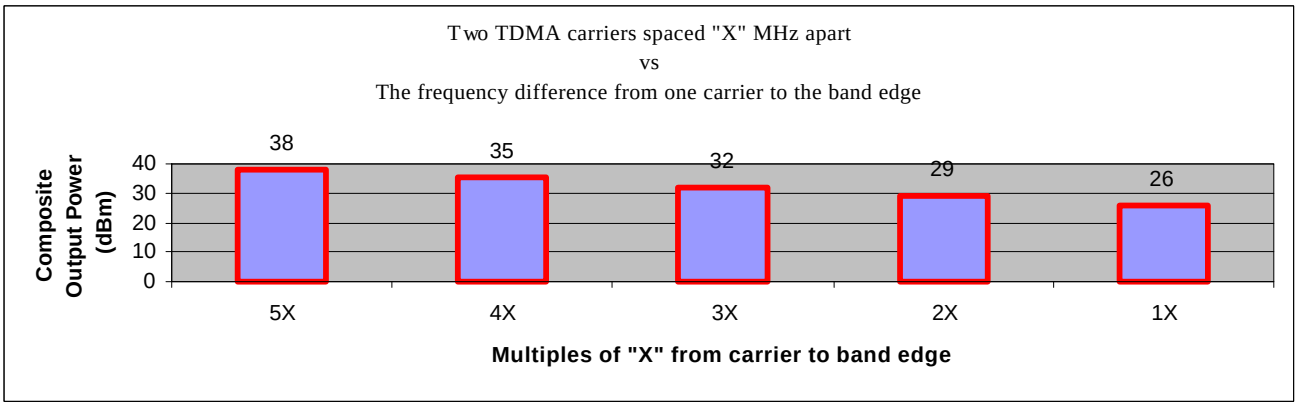
R1930C Chart 2 CDMA out of band spurious limitations



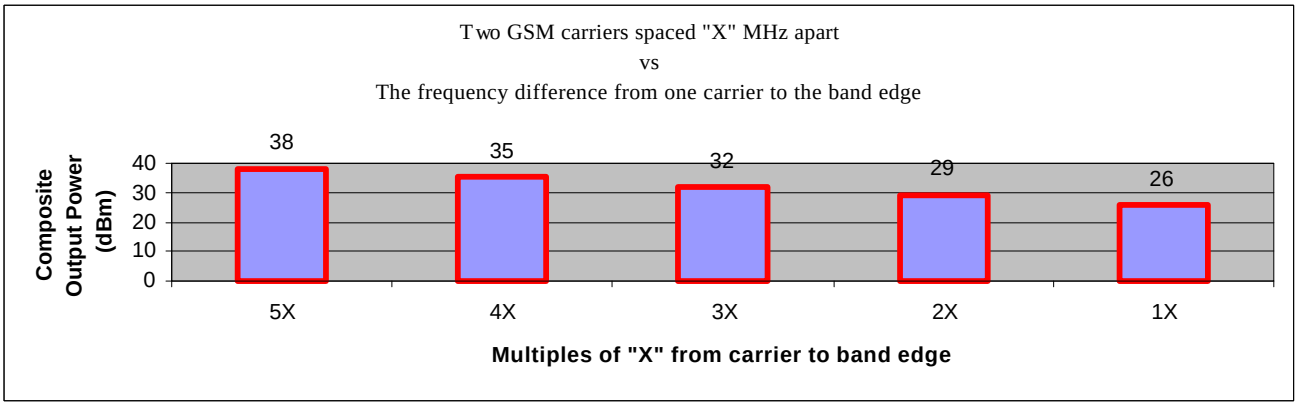
R1940C Chart 3 CDMA out of band spurious limitations



R1920T Chart 4 TDMA out of band spurious limitations



R1920G Chart 5 GSM out of band spurious limitations



CDMA Example for out of band spurious:

Air Interface: CDMA

Block: A (1930MHz to 1945MHz)

Channels: 100 (1935.0 MHz)

150 (1937.5 MHz)

Repeater: R1920C

The frequency difference between the two carriers is (1937.5MHz - 1935.0MHz = 2.5MHz = X). The frequency difference from the band edge to the carrier is (1935.0MHz - 1930.0MHz = 5.0MHz). Therefore, there are (5.0MHz / 2.5MHz = 2) multiples of X from the carrier to the band edge. Using Chart 1 we see that the composite power must be kept below 34dBm.

2-10 CONNECTORS

Figure 2-7.1 shows the connectors and Table 2-1 provides a description of each connector on the R1910 unit.

Table 2-1. R1910 Connectors

Reference Designator	Label	Description
J1	AC PWR IN	This POWER connector is a multipin connector cabling a user-supplied ac power source (110 VAC, 60 Hz) to the power supply in this unit.
J2	RS-232	This 9 pin D-sub female connector is provided for RS-232 communications between the R1910 and a PC.
J3	SERVER	Receives Handsets RF, Transmits Base Stations RF, connects to Server antenna.
J4	DONOR	Receives Base Stations RF, Transmits Handsets RF, connects to Donor antenna.

Figure 2-7.1 R1910 I/O Connections

Figure 2-7.2 shows the connectors and Table 2-2 provides a description of each connector on the R1920 unit.

Table 2-2. R1920 Connectors

Label	Description
AC 110/220 VAC	This POWER connector is a multipin connector cabling a user-supplied ac power source (110/220 VAC, 60 Hz) to the power supply in this unit.
+24 VDC 9A BATTERY	This connector cables directly to the optional BB42 battery backup unit.
LOCAL CONTROL	This 9 pin D-sub female connector is provided for RS-232 local communications between the R1920 and a PC.
MODEM	This 3 pin circular connector is for POTS line interface to the R1920.
REMOTE CONTROL	This connector cables to the optional EX6 repeater expander unit.
SERVER	Receives Handsets RF, Transmits Base Stations RF, connects to Server antenna.
DONOR	Receives Base Stations RF, Transmits Handsets RF, connects to Donor antenna

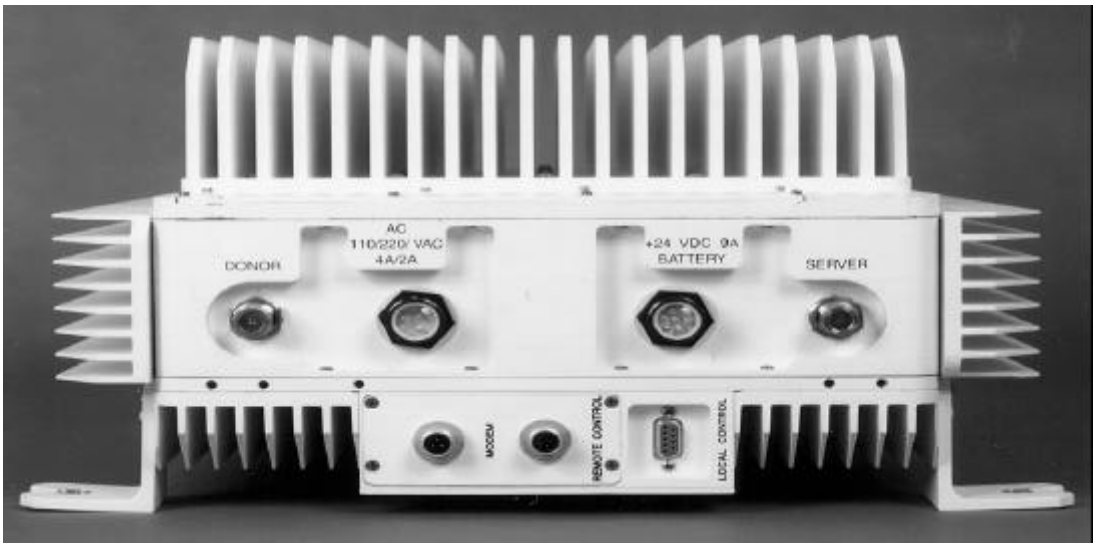


Figure 2.7.2 R1920 I/O Connections

2-11 STORAGE

Environmental conditions during storage and shipment should normally be limited as follows:

a. Maximum humidity: 95% (no condensation)

b. Temperature range: -40°C to +85°C

2-12 PACKING FOR RESHIPMENT OR STORAGE

If the R19X0 must be prepared for reshipment or storage, use the original packing and shipping materials, if possible. Otherwise, the following general instructions should be used for repackaging with commercially available materials:

a. Wrap unit in heavy paper or plastic.

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use a layer of shock-absorbing material 70 to 100 mm (3 to 4 inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside container. Protect rear panel connectors with cardboard.

d. Seal shipping container securely.

e. Mark shipping container FRAGILE to ensure careful handling.

f. In any correspondence, refer to instrument by model number and full serial number.

CHAPTER 3

OPERATION

3-1 INTRODUCTION

This chapter provides information for operating the PCS Repeater. The R1910 is designed to work in an indoor environment only, while the R1920/30/40 is designed to work in an outdoor environment.

The R1910 and R1920/30/40 are fully compliant with FCC part 24. For the R1910, there are no panel controls other than the power switch. For the R1920/30/40, there are no external controls or indicators. Access to A/C power connects and interface connections are via an access panel.

The operator must be familiar with the control software being used and the operation and functional capabilities of the R19X0.

3-2 OPERATING INSTRUCTIONS

The following paragraphs provide a description of the control functions and operation of the R19X0 PCS Repeater.

3-2.1 Power-up Sequence

For the R1910, to turn on the unit, push the “1” side of the power switch rocker arm to the depressed position. For the R1920/30/40, remove the access panel and push the power switch. The unit will go through an initialization, which includes restoring the unit to its last powered-up state and checking the alarm status.

Table 3-1. Initial Parameter Status

Parameter	R1910 Initial Value	R1920/30/40 Initial Value
Band	AD,BE,FC	AD,BE,FC
Channel	0-1199 CDMA 1-1999 TDMA 512-810 PCS-1900 (GSM)	0-1199 CDMA 1-1999 TDMA 512-810 PCS-1900 (GSM)
DOWNLINK RF	1930-1990MHz	1930-1990MHz
DOWNLINK Gain	65-95dB	65-95dB
DOWNLINK Power Out	0 to +27dBm	+15 to +41.5dBm
UPLINK RF	1850-1910MHz	1850-1910MHz
UPLINK Gain	65-95dB	65-95dB
UPLINK Power Out	0 to +27dBm	0 to +27dBm
UPLINK RSS	> -70dBm	>-70dBm
Alarms	Green	Green

3-2.2 WJ Repeater Control Application

The repeater is controlled via either a standard RS-232 interface or via modem interface using a POTS line with the, Windows 95/NT based, Watkins-Johnson Company Repeater Control application. Figure 3-1 shows the control panel of the application.

At the top of the panel is a menu bar with two menu items, File and Help. The File menu item provides a means of changing interfaces, connecting or disconnecting from a modem, closing the application, and also has a maintenance feature used by the factory. The Help menu item contains a copyright notice and software version information.

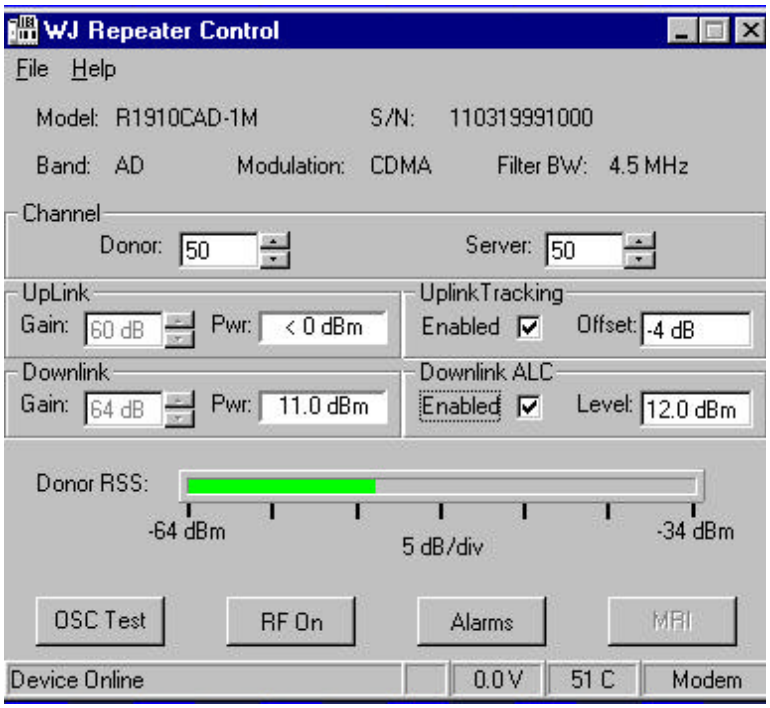


Figure 3-1. Repeater Control Panel

3-2.2.1 Starting Control Software

With the left mouse button, double-click the phone icon labeled “WJ Repeater Control.” The application will launch and request which interface to use for communicating with the repeater. Select the either one of two Com ports, or the modem, and press the OK button. Pressing Cancel will quit the application. The repeater must be equipped with the modem option in order to use the modem interface.

When the application is running and using the serial interface, it is able to detect the presence of a repeater on the selected serial Com port. When a repeater is detected, the application reads its

current configuration and settings and displays them in the application window. See figure 3.1. When no repeater is detected the application clears the window.

3-2.2.3 Unit Type and Configuration Parameters

At the top of the window is displayed the repeater's model number, serial number, frequency band, modulation, and filter bandwidth parameters. The "Band" parameter is the PCS band setting of the repeater. There are 9 possible PCS bands combined into 3 dual band selections, AD, BE, and FC. Bands AD, BE, and FC are wide band options that give the repeater the ability to operate in two bands. The modulation parameter displays which modulation type the repeater is configured for, CDMA, TDMA, or GSM. The bandwidth parameter is the filter bandwidth of the repeater.

3-2.2.4 Channel Number and RF Frequency Parameters

Channel number parameters Donor and Server are used to set the RF frequency of the donor and server RF paths. The Donor channel controls the RF frequency being transmitted on the downlink. The Server channel controls the RF frequency being transmitted on the uplink. If the repeater is not configured for dual frequency operation, the two channel numbers will track each other. The actual frequency of a selected channel number can be viewed by placing the mouse pointer over the channel number of interest.

The repeater can be set to any allowable frequency/channel in the band of the repeater by changing the channel number. The channel can be changed by either clicking the Up/Down arrow next to the channel, or by placing the cursor in the channel number box and typing in a new channel number. Don't forget to press the <Enter> key when typing in a channel number. When the channel number is changed the forward and reverse frequencies for that channel are computed for display.

It is important to insure that the frequency/channel that the repeater is set to is at least half the bandwidth away from the band edge in which the repeater is to be operated. For example, if operating a repeater with a 5MHz filter that needs to be set to the bottom edge of Band A, the repeater should be tuned such that the frequency/channel is 2.5MHz away from the beginning of Band A. This is done to ensure that no out-of-band signal is amplified.

3-2.2.5 Downlink and Uplink Gain Parameters

The gain values for the corresponding RF paths can be changed by either clicking the Up/Down arrow next to the gain parameter, or by placing the cursor in the desired parameter window and typing in the value. The ability to change the downlink gain parameter is disabled when the Auto-Leveling Control (ALC) feature is enabled. Also, the ability to change the uplink gain parameter is disabled when the Reverse Tracking (Rev Tracking) feature is enabled.

3-2.2.6 RF Power Out Parameters

The "Pwr" parameters display the current RF power out of the repeater level in dBm. These are status information only

3-2.2.7 Auto-Leveling Control

The Auto-Leveling Control (ALC), when enabled, commands the repeater to maintain the downlink path RF output power level indicated in the “Level” box, +/-2dB, by automatically adjusting the downlink gain as appropriate up to the maximum power of the specific unit. (The valid range for ALC is 0 to 27dBm for the R1910 and 15 to 41.5dBm for the R1920.) When ALC is enabled, control of the downlink path gain is no longer allowed. The downlink gain display box will turn into a status indicator displaying the current gain setting, as controlled by the repeater. Valid range for ALC is based on modulation format. Use of ALC is not recommended if there are ANY gain settings that produce oscillation.

3-2.2.8 Reverse Tracking Control

The Reverse Tracking, when enabled, commands the repeater to keep the uplink path gain at the “Offset” level from the forward path gain. For example, suppose that the forward gain had been set to 68dB, and the Reverse Tracking level set to -4dB. When Reverse Tracking is enabled, the reverse gain would be automatically set to 64dB. When this feature is enabled, manual control of the uplink gain is no longer allowed and the gain setting shown is under the automatic control of the repeater. Reverse Tracking is limited to +/- 10dB.

3-2.2.9 Received Signal Strength (RSS)

The “Donor RSS” parameter is a graphical display of the received (input) signal strength in the downlink RF path.

3-2.2.10 Oscillation Test

The “OSC Test” button initiates the oscillation test function. The purpose of the oscillation is to check the isolation between the donor and server antennas. Ideally, the test should only be performed on an unused channel to avoid unnecessary interruptions of a working network. When the oscillation test button is pressed the operator is presented with a window asking for the channel number to use for the test. Enter the channel numbers and press “OK” to start the test, or press “Cancel” to quit.

The application disables ALC and Tracking, if enabled, and raises the gain of each RF path by approximately 14dB, and monitors the oscillation alarm. The test takes approximately 15 seconds. When the test is complete, the gain, ALC, and Tracking settings are restored to their original settings. If an oscillation alarm occurred you must clear the alarm by pressing the “Clear Alarms” button on the alarm window.

Note: Watkins-Johnson repeaters incorporate an over power protection algorithm. This algorithm detects when the repeater is transmitting at a power level above that allowed by the FCC. The repeater continuously reduces the gain of the repeater until the output power is reduced to an acceptable power level. An Osc/Max Pwr alarm is generated when this occurs.

3-2.2.11 RF ON/OFF

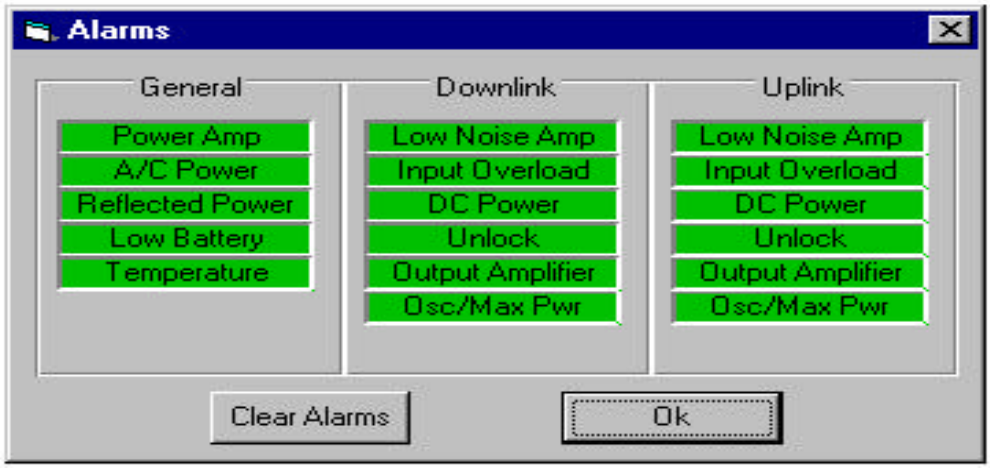
The RF ON/OFF button is both a status indicator and a control. The name on the button is the state of RF paths in the repeater. When the button reads “RF On” then both RF paths are powered-up and operational. When the button reads “RF Off” both RF paths are powered-down, making the repeater non-operational. Also, when the RF paths in the repeater are turned-off the button will turn red for emphasis.

3-2.2.12 Alarms

The Alarm button is both an indicator, telling the operator that an alarm has been detected in the repeater by turning red, and a control that brings up a separate alarm window that displays all possible alarms, when its pressed.

In the alarm window are three groupings of alarms. There are a group of five General Alarms and a group of alarms for each RF path. When an alarm condition is detected, the alarm parameter on the panel will turn red, and stay red as long as the alarm is present. With the exception of an Oscillation alarm and a General Power Amp alarm, the repeater maintains operation as much as it is able.

When there is an oscillation alarm, the unit will automatically lower the gain of the unit. If the oscillation occurs even at the lowest gain setting, then the unit will shut down. However, if an oscillation alarm or Power Amp alarm occurs, the repeater automatically shuts down the RF chains and ceases to function and the “RFon” button on the WJ Repeater Control will turn red and read “RFoff.” Once this occurs, the only way to clear the alarm in the repeater is to click the “Clear Alarms” button. After clearing, the unit will continue to shut down as long as the alarm is present. The A/C alarm will only turn on if the WJ Battery Backup has been installed and activated, indicating that the battery backup is powering the unit since there is an A/C Power failure.



3-2.2.13 Multiple Repeater Interface

The Multiple Repeater Interface (MRI) is a unit that allows a user to communicate over a modem with up to six repeaters over the same modem connection. When this application detects the presence of a MRI unit, the MRI button on the main window is enabled. Pressing the MRI button

brings up the MRI Configuration window, which allows repeaters to be added or removed from the MRI unit.

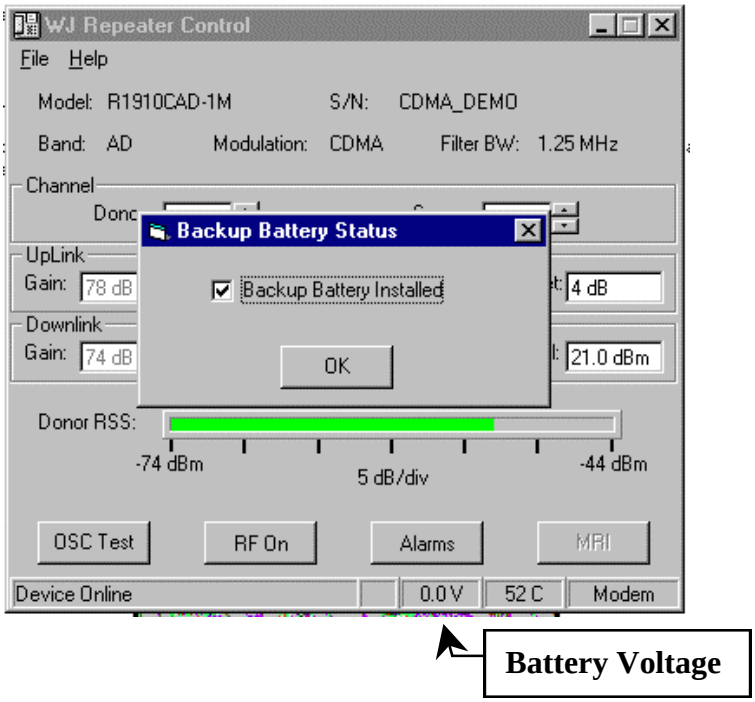
3-2.2.14 Status Bar

At the bottom of the panel is a status bar that displays four pieces of information. Beginning in the left most, and largest box, is basic status information about the operation of the application. . The second box from the left is only active when communicating to a MRI unit. When a MRI unit is detected, this box will display the repeater number of the repeater that the application is communicating with. The third box from the left displays the voltage level of the backup battery if one is installed. The next box displays the internal temperature of the repeater in degrees centigrade. The right most box displays the currently selected interface that the application is using to communicate with the repeater.

When using the serial RS-232 interface, the application is able to detect the presence of a repeater. When one is not detected the panel clears all the data fields, disables all parameter input fields, and displays a status message on the status bar of “No Device.” When a repeater is connected to the serial port and turned on, the application will detect its presence and download and display its configuration. It will also change the status bar to indicate a device was found and re-enable all parameter entry fields.

3-2.2.15 Battery Back-Up Installation

To activate the optional Battery Back-Up, click on the battery back-up voltage indicator, and the Battery Back-Up Status widow will appear. By checking the Battery Backup Installed box, the unit will be able to use the Battery Back-Up as an alternate source of power in the case of a power failure.


WJ Repeater Control
File Help
Model: R1910CAD-1M
S/N: CDMA_DEMO
Band: AD
Modulation: CDMA
Filter BW: 1.25 MHz
Channel
Backup Battery Status
Backup Battery Installed
OK
UpLink
Gain: 78 dB
4 dB
Downlink
Gain: 74 dB
21.0 dBm
Donor RSS:
-74 dBm
5 dB/div
-44 dBm
OSC Test
RF On
Alarms
MRI
Device Online
0.0 V
52 C
Modem
Battery Voltage

CHAPTER 4

SCHEDULED MAINTENANCE

4-1 INTRODUCTION

The WJ PCS Repeaters are designed to operate for extended periods of time with minimum routine maintenance. Inspection and performance tests should be conducted at regular intervals consistent with the facility's normal scheduling and after troubleshooting. No routine adjustments are required. Troubleshooting and performance tests can be most effectively carried out if the technician first familiarizes himself with the operating instructions and circuit descriptions.

4-2 SCHEDULED MAINTENANCE ACTION INDEX

The scheduled maintenance action index is provided in Table 4-1. It lists the maintenance action to be taken, gives the paragraph reference for detailed instruction, and specifies the maximum time intervals between equipment cleaning, inspection, and performance checks.

WARNING

Whenever possible, all preventive maintenance should be performed with the power cord disconnected from prime power source.

4-3 EQUIPMENT REQUIRED

No special tools or test equipment are required for performing routine preventive maintenance.

4-4 PREVENTIVE MAINTENANCE PROCEDURES

The R19XX repeaters are designed to operate for extended periods of time with minimum maintenance. Normally, the only preventive maintenance tasks to consider are:

a. Cleaning the unit.

b. Inspecting the outside of the unit for physically worn, damaged, loose, or overheated parts.

c. Performing a performance check of the unit.

If the equipment is used in an environment where a great deal of dust, high temperature, or high humidity is present, the frequency of the checks should be increased.

Table 4-1. Scheduled Maintenance Action Index

PM Action	Paragraph Reference	Schedule
Cleaning outside of equipment	4-4.1	Every 12 months or when dust is seen on the surface of the equipment.
Inspecting for damage or wear	4-4.2	When the unit is not operating properly.

4-4.1 Exterior Cleaning

Remove loose dirt accumulated on the outside of the unit with a moist paper towel, cloth, or brush. The brush is good for removing dirt on and around the connectors. Dirt and grease which is not removed can be cleaned off with a paper towel or cloth made moist with a detergent and water solution. Do not use an abrasive cleaner.

4-4.2 Inspection for Damage or Wear

Many potential or existing troubles can be detected by making a visual inspection of the unit. For this reason, a complete visual inspection should be made on a regular basis and whenever the unit is inoperative. Damage due to overheating may be the result of other less apparent troubles in the unit. Mechanical parts such as pin connectors and power switch should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4-4.3 Fuse Replacement

WJ PCS repeaters are protected by replaceable fuses and circuit breakers. A blown fuse can result from a variety of conditions, including improper installation, faulty power supply, excessive output power levels, AC power line transients, etc. WJ should be contacted if a repeater fuse needs frequent service.

The R1910 series repeater is equipped with a 250V/3A, 5 x 20 mm Time-Lag Fuse (Buss GMC-3A or equivalent), located at the power entry module (Fig 4-1). To replace fuse, first push the AC power 1/0 switch to the 0 position (OFF), and remove AC power cord from the unit. Remove fuse holder with a flatblade screwdriver, replace fuse, and snap back into position. Reconnect AC power cord and push the AC Power ON/OFF Switch to the 1 (ON) position. The unit should operate normally.

The R1920/30/40 series repeaters are equipped with an AC circuit breaker, located behind the front access panel (Fig 4-2). Remove the access panel. The power switch, labeled S1, is a DPDT push button ON/OFF type with a red LED that lights up only when the power supply output voltages are present. Push it once to disengage AC power from the unit. The circuit breaker, labeled F1, is a thermally activated device with a push button reset. Push the circuit breaker reset button, a distinct click should be heard. Now push the AC power switch, a click should be heard and the button should light up red, indicating that the unit is operating normally. Although not necessary, as an added measure of safety, the AC power cord can be removed before servicing the breaker.

The fuse labeled F2 is a 250V/15A, ¼ x 1 ¼ Time-Delay Fuse (Buss MDA-15 or equivalent) on the +24VDC input line. It requires servicing only for repeaters with +24V input, such as battery backup. To avoid the possibility of a large spark occurring as the fuse is replaced, it is recommended that the +24V power source be disconnected while servicing the F2 fuse.

4-5 GENERAL MAINTENANCE

A complete inspection of the unit should be made during the cleaning operation for signs of mechanical and electrical failures. Mechanical parts, including connectors, should be checked for wear, loose connections, bad alignment, or other possible causes of defective operation. Worn parts should be replaced and loose connectors tightened. Check for loose cable connections, and tighten those connectors. Remove the fuse and check for corrosion or damage, replace when either occurs.

After a repair has been made, alignment should be carried out, if necessary, and appropriate performance tests should be used to verify proper operation.

4-6 ALIGNMENT

This unit requires that the gain be set correctly for both server and donor paths, to avoid oscillation. See section 2-8.

4-7 REPAIR

All repairs to WJ PCS repeaters should be performed by a Watkins-Johnson authorized technician. Any unauthorized repair could void the warranty.

Figure 4-1

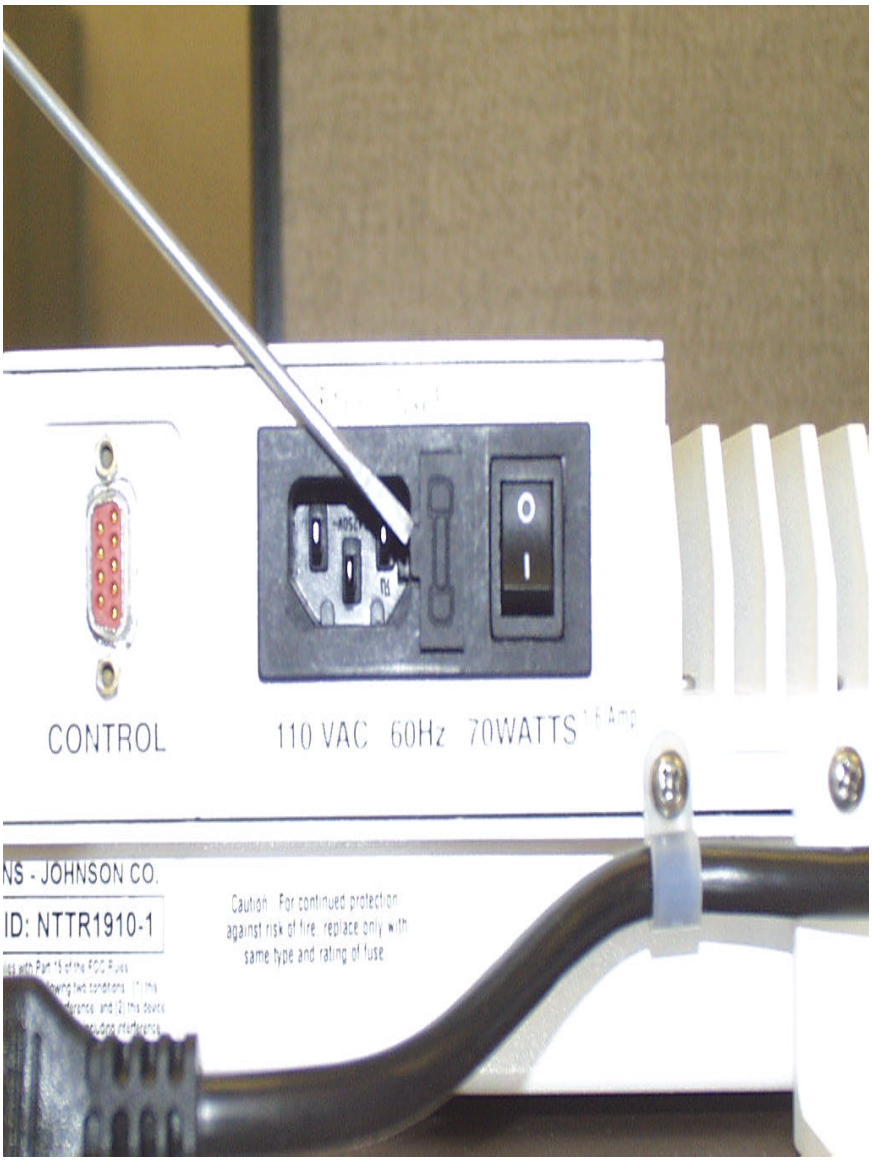
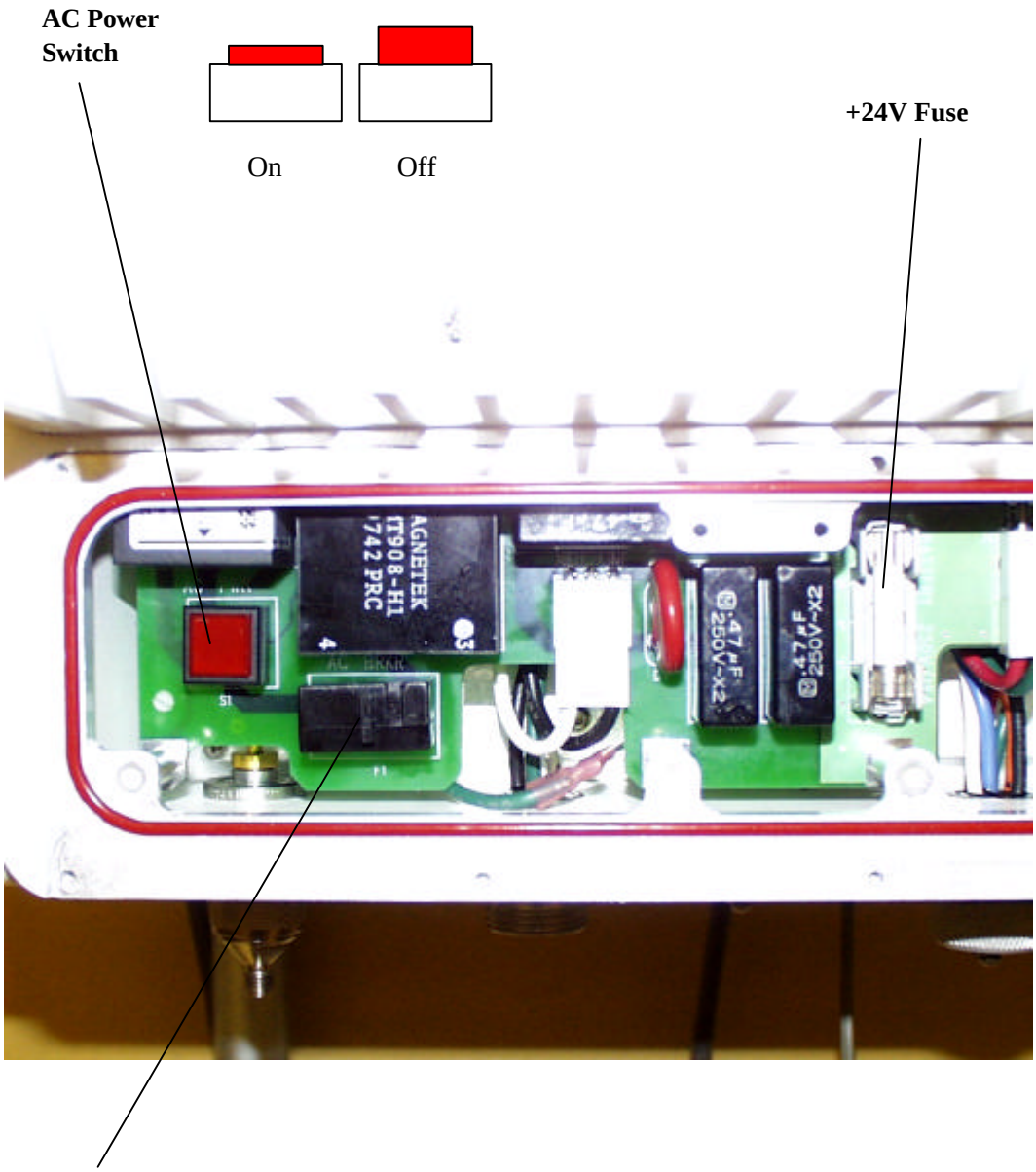

CONTROL
110 VAC 60Hz 70WATTS
NS - JOHNSON CO.
ID: NTTR1910-1
Caution: For continued protection against risk of fire, replace only with same type and rating of fuse.

Figure 4-2


AC Power Switch
On
Off
+24V Fuse
AC Circuit Breaker
Press to reset.

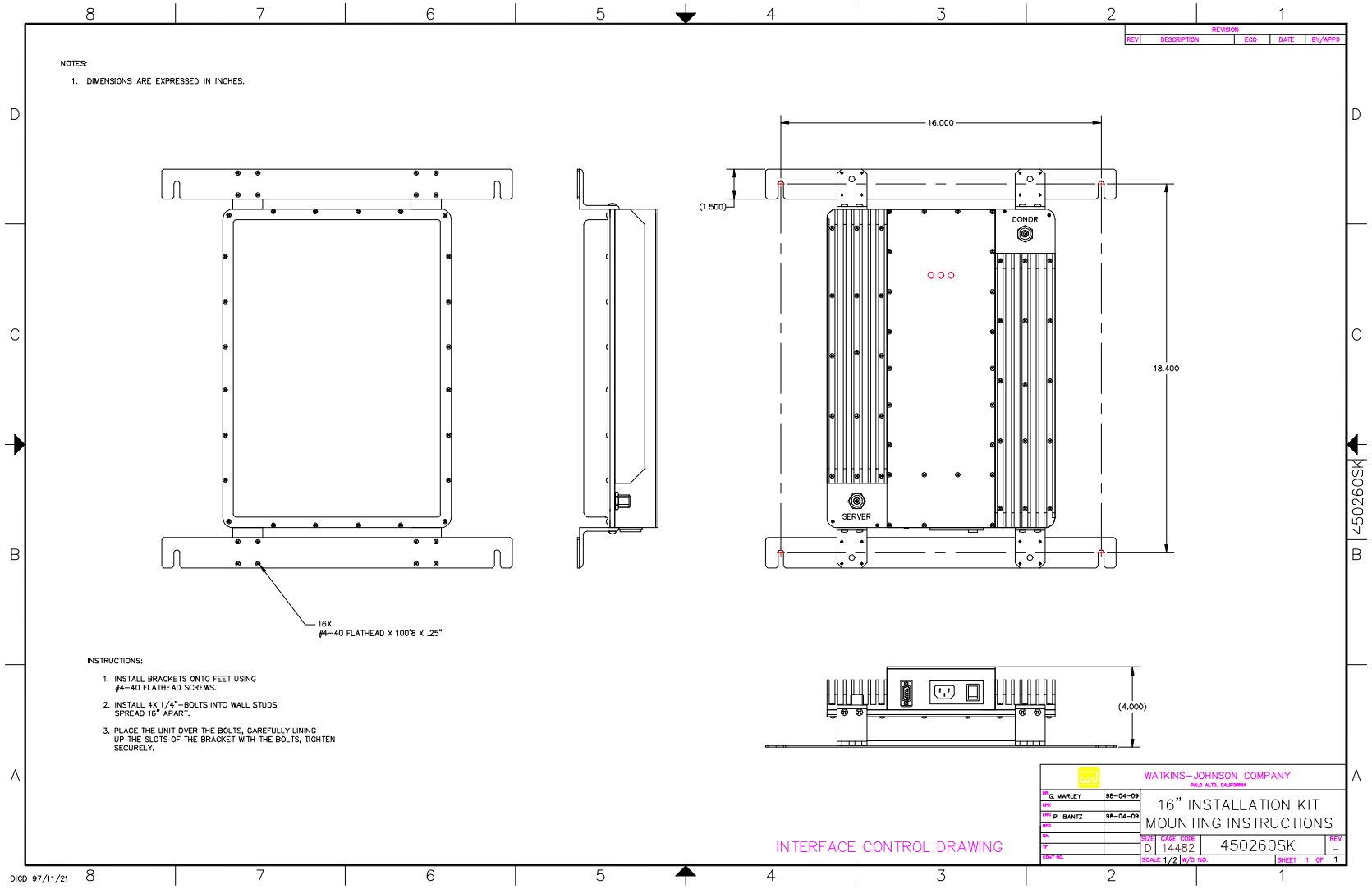

NOTES:
1. DIMENSIONS ARE EXPRESSED IN INCHES.
16.000
(1.500)
DONOR
SERVER
18.400
16X
#4-40 FLATHEAD X 100°8 X .25"
(4.000)
INSTRUCTIONS:
1. INSTALL BRACKETS ONTO FEET USING #4-40 FLATHEAD SCREWS.
2. INSTALL 4X 1/4"-BOLTS INTO WALL STUDS SPREAD 16" APART.
3. PLACE THE UNIT OVER THE BOLTS, CAREFULLY LINING UP THE SLOTS OF THE BRACKET WITH THE BOLTS, TIGHTEN SECURELY.
INTERFACE CONTROL DRAWING
WATKINS-JOHNSON COMPANY
PALO ALTO, CALIFORNIA
G. MARLEY 98-04-09
P BANTZ 98-04-09
16" INSTALLATION KIT
MOUNTING INSTRUCTIONS
SIZE D
CAGE CODE 14482
450260SK
REV -
SCALE 1/2
W/O NO.
SHEET 1 OF 1
450260SK
DICD 97/11/21

Figure 5-1

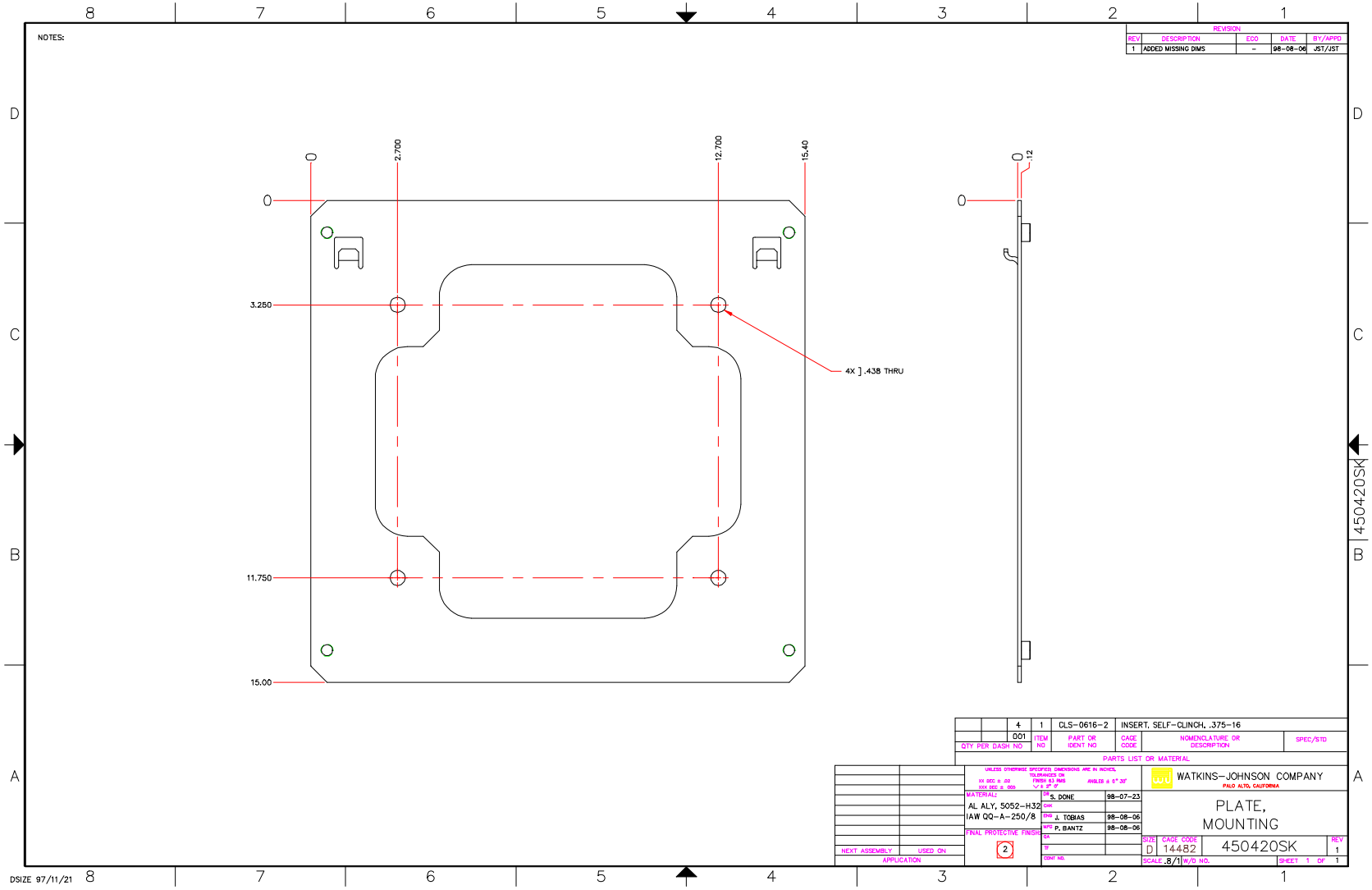

NOTES:
REVISION
REV DESCRIPTION ECO DATE BY/APPD
1 ADDED MISSING DIMS – 98-08-06 JST/JST
0
2.700
12.700
15.40
3.250
11.750
15.00
4X] .438 THRU
.12
450420SK
4 001 CLS-0616-2 INSERT, SELF-CLINCH, .375-16
QTY PER DASH NO ITEM NO PART OR IDENT NO CAGE CODE NOMENCLATURE OR DESCRIPTION SPEC/STD
PARTS LIST OR MATERIAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
MATERIAL: AL ALY, 5052-H32 IAW QQ-A-250/8
FINAL PROTECTIVE FINISH
DR S. DONE 98-07-23
DSN J. TOBIAS 98-08-06
MFG P. BANTZ 98-08-06
WATKINS-JOHNSON COMPANY
PALO ALTO, CALIFORNIA
PLATE, MOUNTING
SIZE D CAGE CODE 14482 450420SK REV 1
SCALE .8/1 W/O NO. SHEET 1 OF 1
NEXT ASSEMBLY USED ON
APPLICATION
DSIZE 97/11/21

Figure 5-2

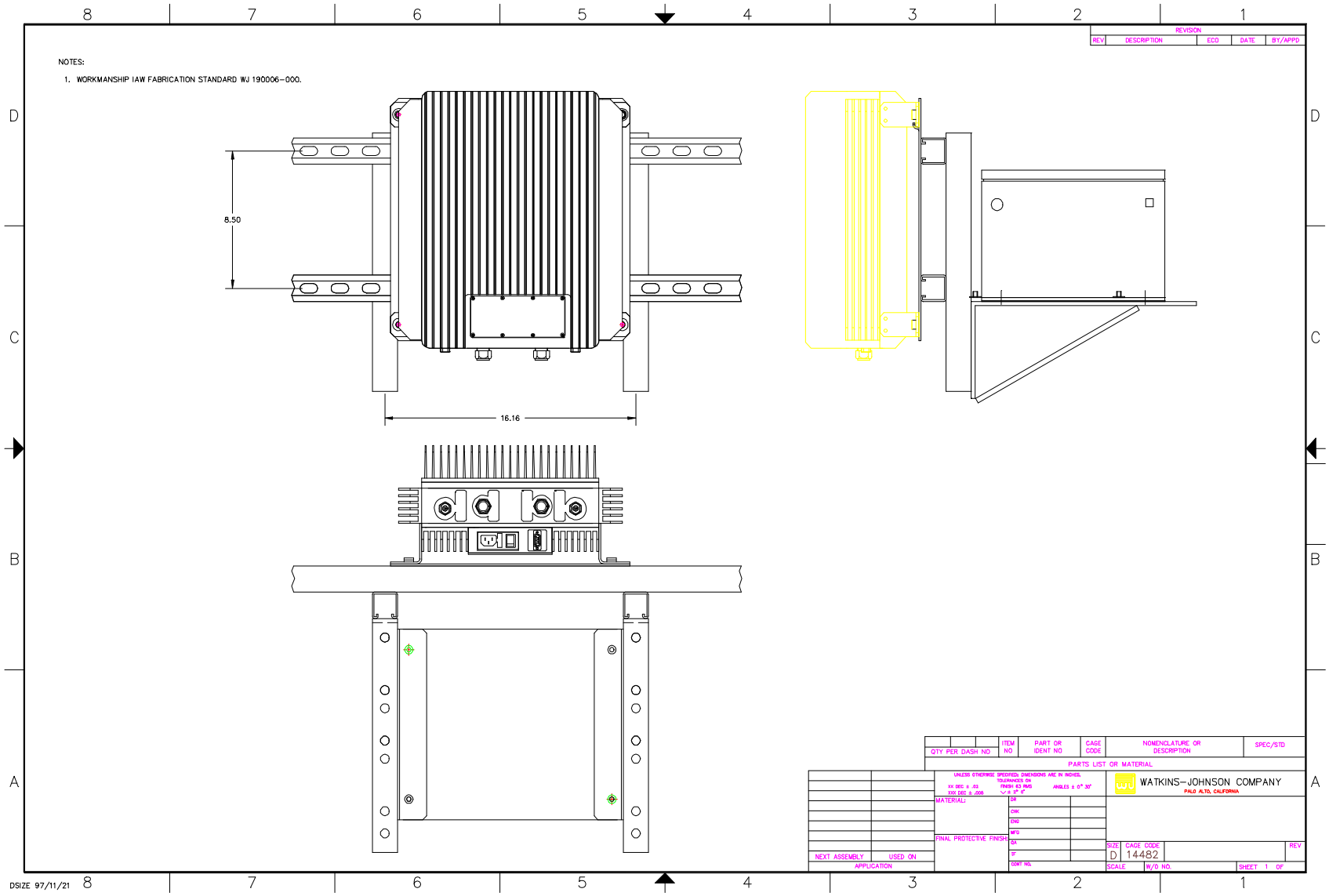
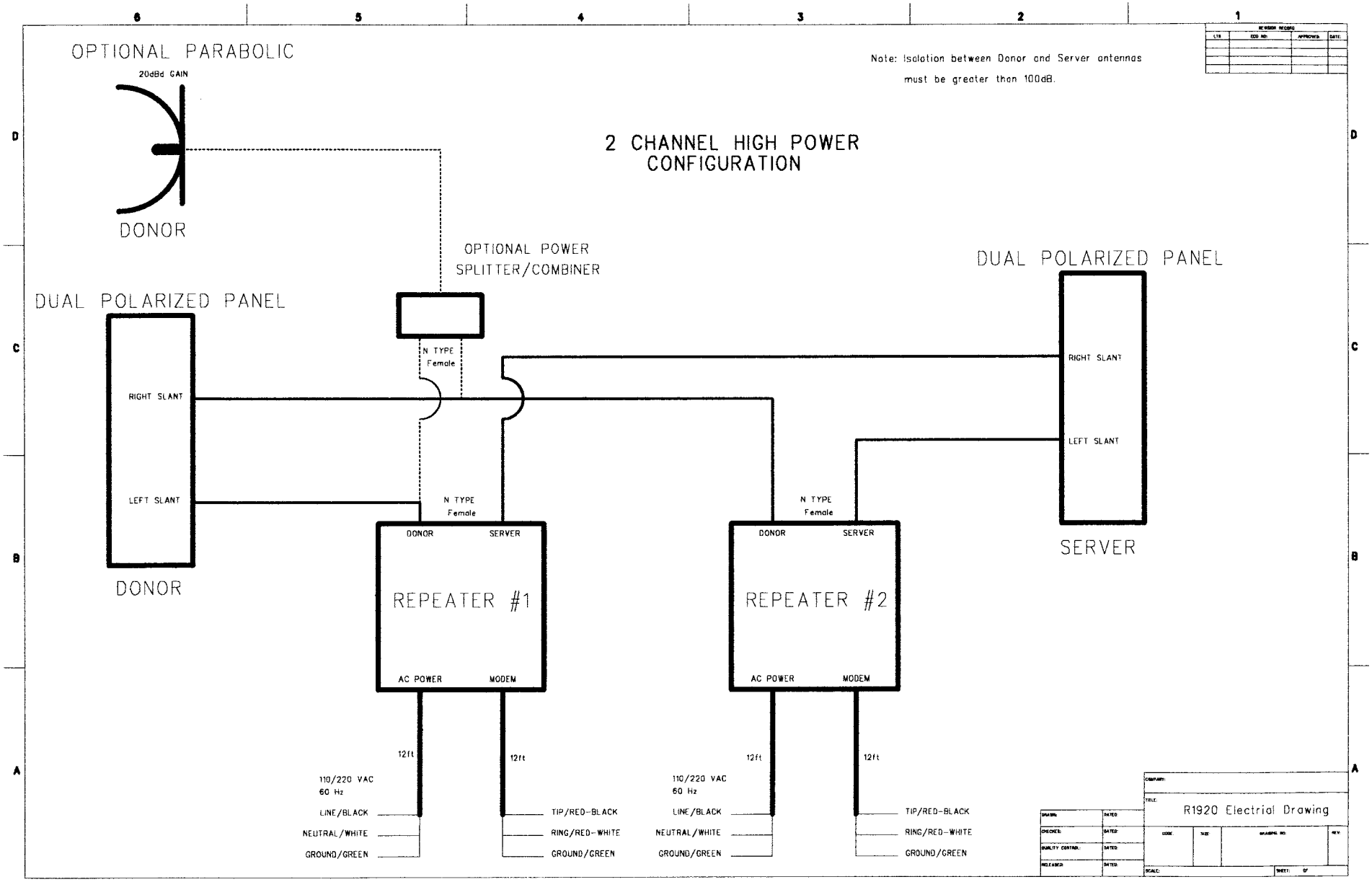

NOTES:
1. WORKMANSHIP IAW FABRICATION STANDARD WJ 190006-000.
8.50
16.16
REVISION
REV
DESCRIPTION
ECO
DATE
BY/APPD
QTY PER DASH NO
ITEM NO
PART OR IDENT NO
CAGE CODE
NOMENCLATURE OR DESCRIPTION
SPEC/STD
PARTS LIST OR MATERIAL
WATKINS-JOHNSON COMPANY
PALO ALTO, CALIFORNIA
MATERIAL:
FINAL PROTECTIVE FINISH
NEXT ASSEMBLY
USED ON
APPLICATION
SIZE
CAGE CODE
D
14482
REV
SCALE
W/O NO.
SHEET 1 OF
DSIZE 97/11/21

Figure 5-3



-1 - Wed Jun 30 14:08:46 1999