FCC CFR47 PART 22 SUBPART H CERTIFICATION

TEST REPORT

FOR

SINGLE CHANNEL CELLULAR AMPLIFIER

MODEL: SCA9125-50

FCC ID: E675JS0039

REPORT NUMBER: 99U0404

ISSUE DATE: JULY 14, 1999

Prepared for
POWERWAVE TECHNOLOGIES, INC.
2026 McGAW AVENUE
IRVINE, CA 92614

Prepared by
COMPLIANCE CERTIFICATION SERVICES, INC.
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LAB CODE:200065-0

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1. FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part2, Subpart J, Sections 2.1033 – 2.1055.

2.1033(c)(1) Applicant: POWERWAVE TECHNOLOGIES, INC.
2026 McGAW AVENUE
IRVINE, CA 92614

Contact person: Robert Biedka

Telephone number: (949) 757-6605

2.1033(c)(2) FCC ID: E675JS0039

2.1033(c)(3) Instructions/Installation Manual

Refer to **Attachment**: User's Manual.

2.1033(c)(4) Type of emissions

DXW (TDMA)

2.1033(c)(5) Frequency Range

869 – 894 MHz

2.1033(c)(6) Range of Operation Power

55 Watts (47.4 dBm)

2.1033(c)(7) Maximum Power Rating

Section 22.913(a); Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.

2.1033(c)(8) Applied voltage and currents into the final transistor elements

24.5 Vdc @ 3 amps

2.1033(c)(9) Tune-up/Optimizations Procedure

Refer to user's manual

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2.1033(c)(10) Complete Circuit Diagrams and Functional Diagram

Refer to Schematics, Block Diagram and Parts list. Confidentiality is requested for these items.

2.1033(c)(10a) Means for Frequency Stabilization

Not Applicable. Eut is a power amplifier

2.1033(c)(10b) Means for Suppressing of Spurious radiation.

Manufacture will provide an external filter, which will be installed at the output of Eut's antenna terminal, to attenuate any harmonics and spurious emission. Please refer to **external filter specification.**

2.1033(c)(10c) Means for Limiting Modulation.

Not Applicable. Eut is a power amplifier.

2.1033(c)(10d) Means for Limiting Power.

External Power Control

2.1033(c)(11) Equipment Identification

A drawing of the equipment identification nameplate appears in file titled: PROPOSED FCC ID LABEL FORMAT.

2.1033(c)(12) Photographs

Photographs of the equipment, internal and external views, are found in the **Attachment**: Eut Photographs.

2.1033(c)(13) Description of Digital Modulation Techniques

TDMA (π/4 DQPSK)

2.1033(c)(14) Standard Test Condition

The power amplifier was tested under the following conditions.

DC Supply Voltage: 25.47Vdc
AC Supply Voltage: 120Vac, 60Hz

The amplifier was aligned and tuned up according to manufacturer's alignment procedure, prior to testing. All data presented represents the worst case parameter being measured.

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2.1033 Description of Various Base Station Configuration

Not Applicable.

2.1033 Use of Various Power Supplies

Normal operation is from 25.5 – 26.5 Vdc sources.

TYPE OF EQUIPMENT:	SCA9125-50 AMPLIFIER
MEASUREMENT DISTANCE:	3 METER
TECHNICAL LIMIT:	FCC 22.359, 22.917
FCC RULES:	PART 22
EQUIPMENT AUTHORIZATION PROCEDURE	CERTIFICATION
MODIFICATIONS MADE ON EUT	☐ YES (REFER TO PAGE 7) ☒ NO

The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC CFR 47, PART 22. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By

MIKE C.I. KUO / VICE - PRESIDENT
COMPLIANCE CERTIFICATION SERVICES

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2. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

3. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

4. MEASUREMENT INSTRUMENTATION

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, ridged waveguide liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for “Radio Interference Measuring Apparatus and Measurement Methods,” Publication 16.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

5. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

6. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

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The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/m

Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

7. EQUIPMENT MODIFICATIONS

To achieve compliance for FCC PART 22 requirement, the following change(s) were made during compliance testing:

N/A

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8. TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Site	Cal Date	Due Date
Receiver	**H.P.**	**8546A**	**3520A00259**	**A**	**03/99**	**03/00**
Bilog Antenna	**CHASE**	**CBL6112**	**2049**	**A**	**05/99**	**05/00**
Pre-Amp	**H.P.(P1_M)**	**8447D**	**2944A06833**	**A**	**09/98**	**10/99**
Spectrum Analyzer	**H.P.**	**8566B**	**3014A06685**	**N/A**	**07/99**	**07/00**
Spectrum Analyzer	**H.P.**	**8593EM**	**3710A00205**	**N/A**	**05/99**	**05/00**
Horn Antenna	**EMCO**	**3115**	**9001-3245**	**N/A**	**12/97**	**12/00**
Pre-Amp	**H.P. (1-26.5GHz)**	**8449B**	**3008A00369**	**N/A**	**04/99**	**04/00**
Power Meter	**H.P.**	**436A**	**2709A29209**	**N/A**	**02/99**	**02/00**
Power Sensor	**H.P.**	**8482A**	**2349A08568**	**N/A**	**02/99**	**02/00**

B) SUPPORT EQUIPMENT

Device Type	**Manufacturer**	**Model Number**	**Serial No.**	**FCC ID / DoC**
SIGNAL GENERATOR	H.P.	E4431A	US37230180	N/A
HIGH POWER ATTENUATOR	NARDA	769-30	03768	N/A
POWER SUPPLY	H.P.	6653A	3640A02704	N/A
AUXILIARY AMP	POWER SYSTEMS TECHNOLOGIES	N/A	N/A	N/A
MULTIFUNCTION SYNTHESIZER	H.P.	8904A	3633A08795	N/A

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9. EUT SETUP PHOTOS

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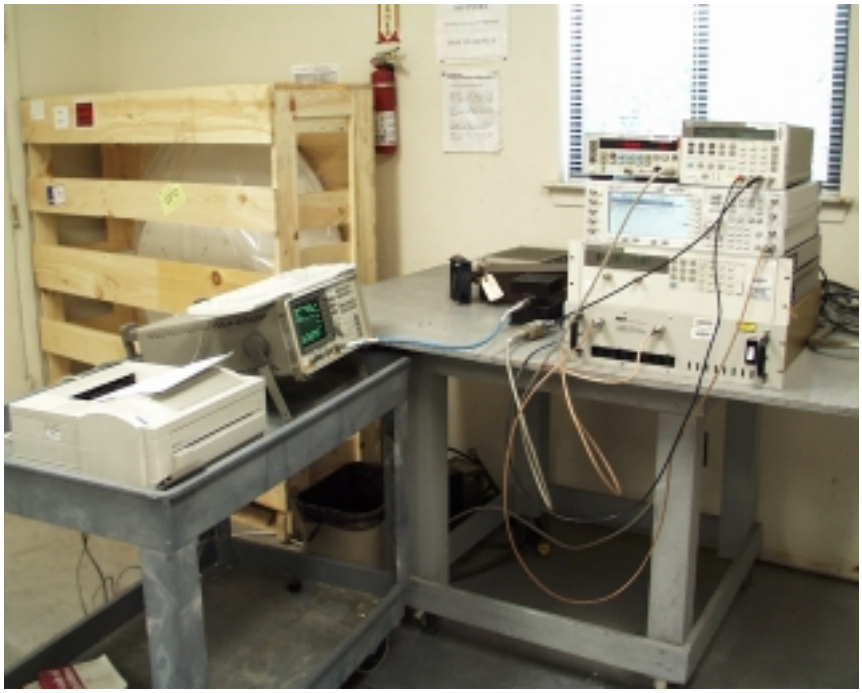

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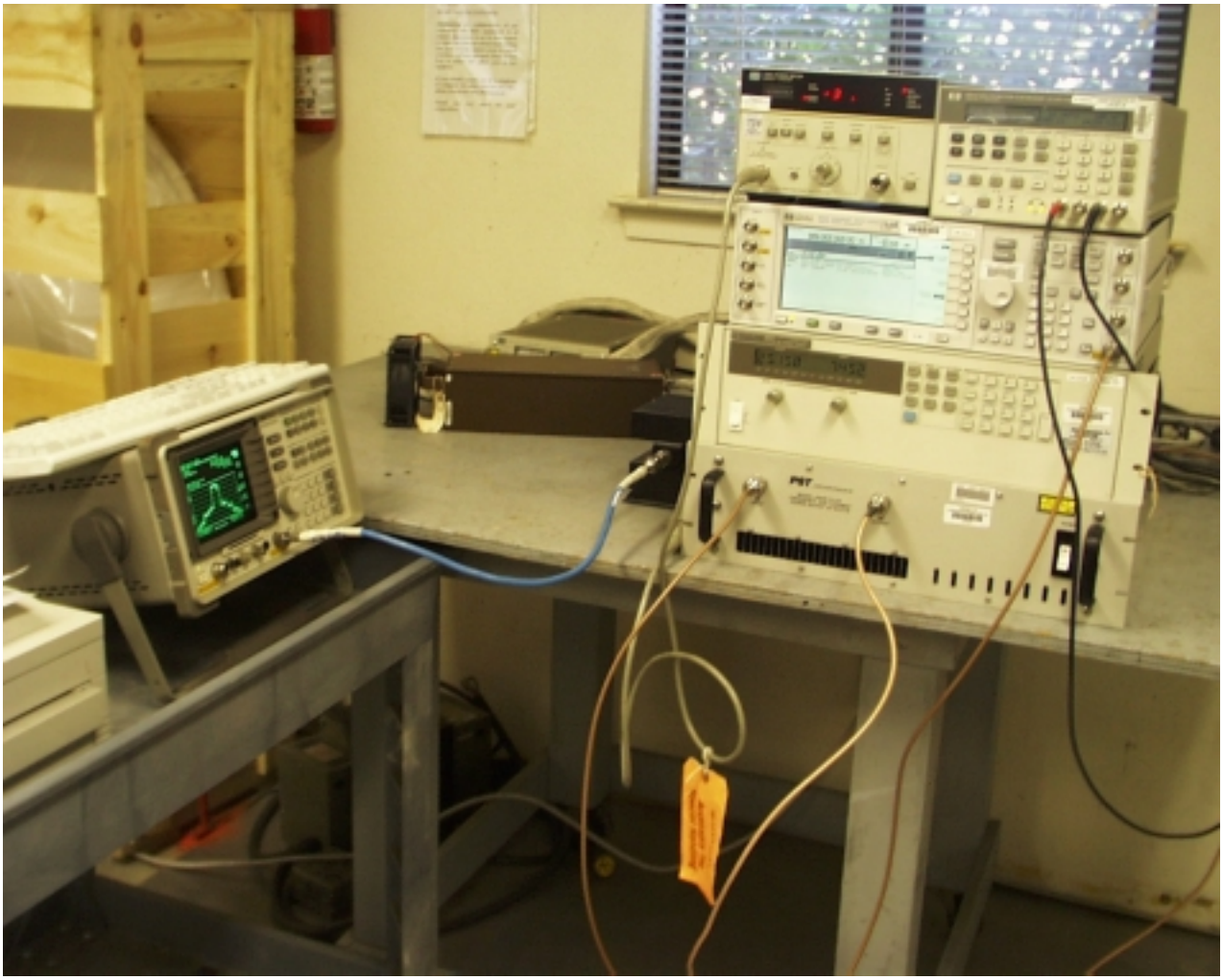

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10. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

CABLE NO:1, 2	
I/O Port: : OUTPUT 1 & 2	Number of I/O ports of this type: 2
Number of Conductors: 2	**Connector Type: BNC TYPE**
Capture Type: SNAP-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length: 2.5 M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

CABLE NO: 3	
I/O Port:: RF OUT FROM SIGNAL GENERATOR	Number of I/O ports of this type:1
Number of Conductors: 2	**Connector Type: N-TYPE TO N-TYPE**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length:2.0M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

CABLE NO: 4	
I/O Port: AUXILIARY AMP RF OUTPUT	Number of I/O ports of this type:1
Number of Conductors: 2	**Connector Type: N-TYPE**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length: 1.5M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

CABLE NO: 5	
I/O Port: POWER SUPPLY	Number of I/O ports of this type: DC INPUT
Number of Conductors: 2 WIRES	**Connector Type: N/A**
Capture Type: N/A	**Type of Cable used: SHIELDED**
Cable Connector Type: N/A	**Cable Length:4.5M**
Bundled During Tests: NO	**Data Traffic Generated: NO**
Remark: N/A	

CABLE NO: 6	
I/O Port: RF OUT FROM EUT	Number of I/O ports of this type:1
Number of Conductors: 2	**Connector Type: N-TYPE**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length:4.5M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

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CABLE NO: 7	
I/O Port: ATTENUATOR RF-OUT	Number of I/O ports of this type:1
Number of Conductors: 2	**Connector Type: N TYPE**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length:3.5M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

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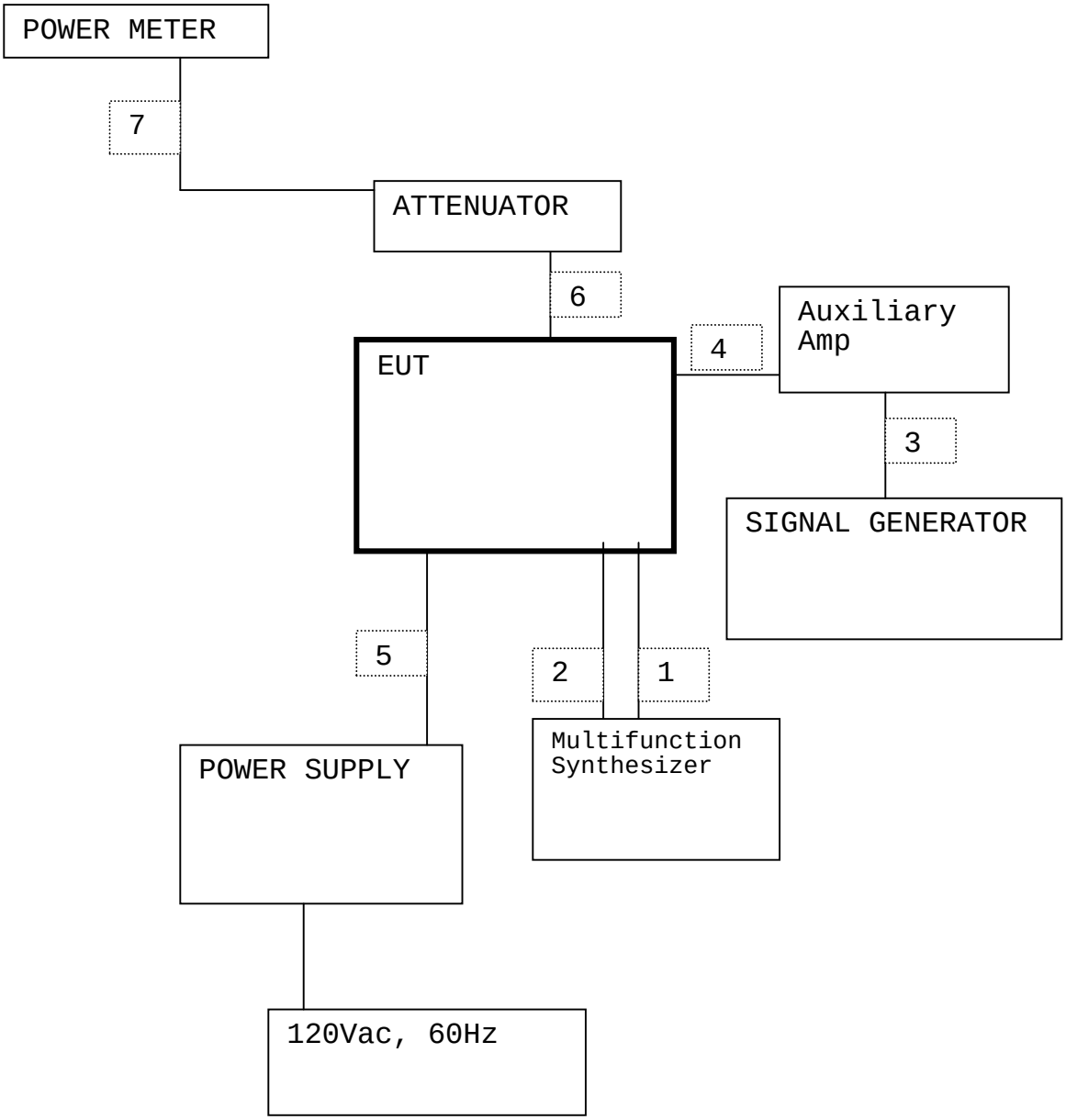
11. CONFIGURATION BLOCK DIAGRAM



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12. PART 2: CERTIFICATION TEST REQUIREMENT:

SECTION 2.1046: RF POWER OUTPUT

Test Equipment:
HP Power Meter/ 436A
HP Multifunction Synthesizer/ 8904A
AST Auxiliary amp
HP Signal Generator/ E4431A
HP DC power supply
Narda 30 dB attenuator
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

TEST SETUP:

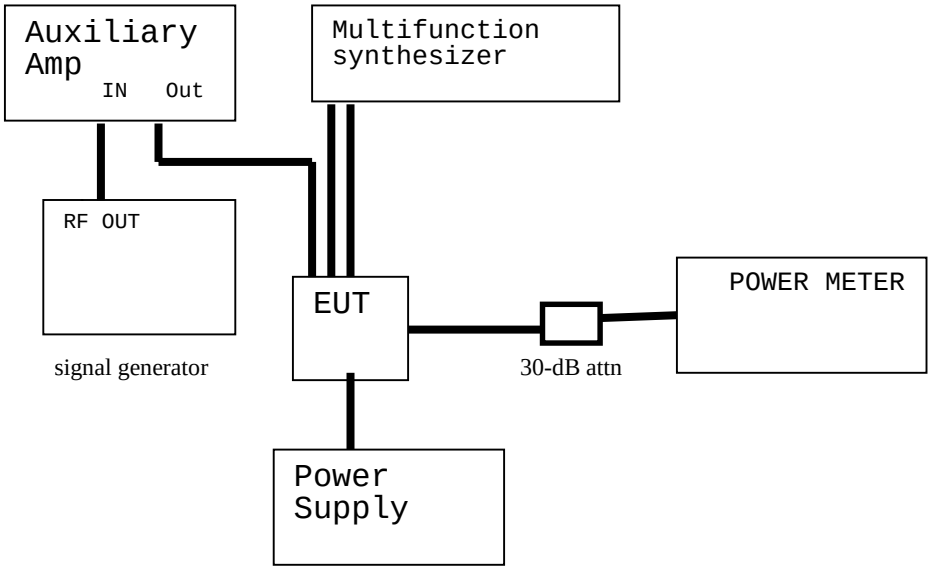

FIGURE 1

Minimum requirement:
Section 22.913(a); Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

Test procedure:
Figure 1. shows the setup for conducted RF power output measurement. RF power output was measured with a power meter. Set the power amplifier to the maximum output gain.

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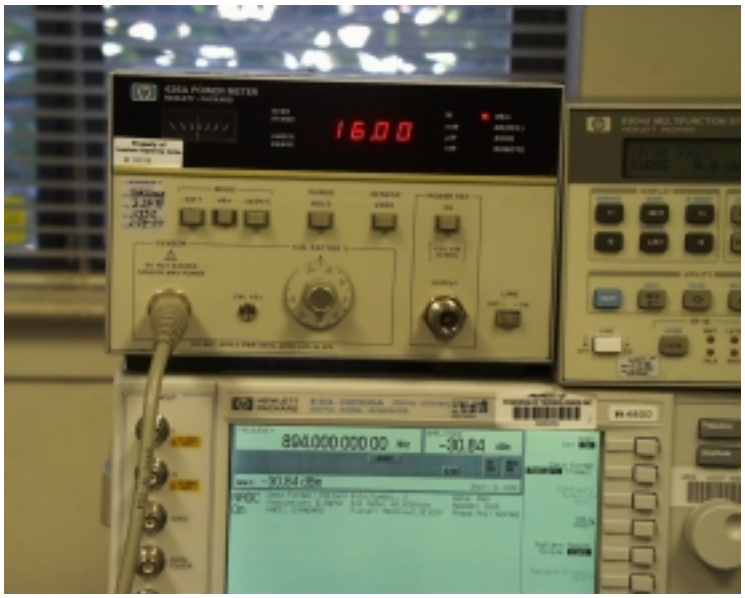
Test Result:
Please refer to power meter photograph. Photos will show 15.9dBm, by adding the attenuation and cable loss (31.7 dB) will be 47.5dBm (58 Watts)

Low channel Power Output

High channel Power Output



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SECTION 2.1047: MODULATION CHARACTERISTICS

Not applicable. EUT is a power amplifier.

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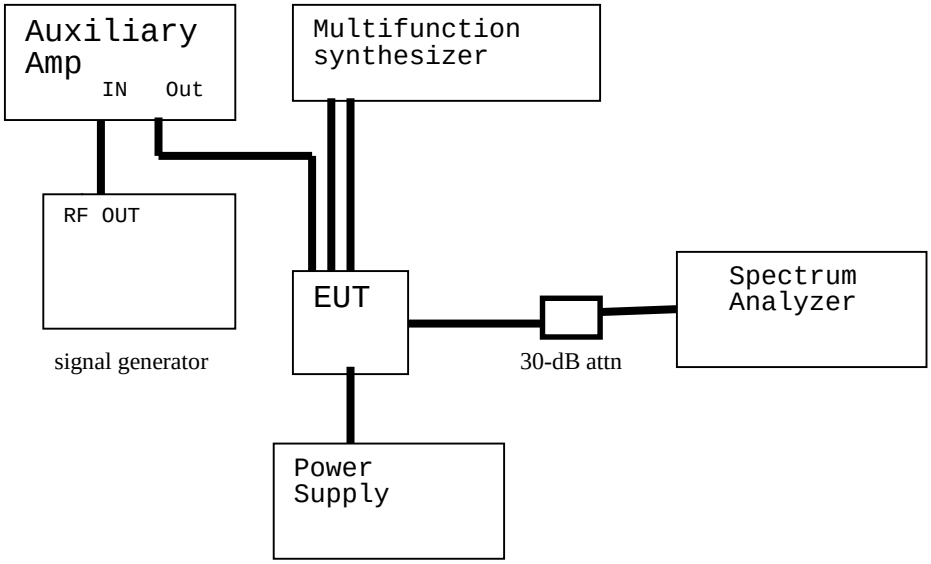
SECTION 2.1049: OCCUPIED BANDWIDTH

Test Equipment:
HP Spectrum Analyzer/ 8593EM
HP Multifunction Synthesizer/ 8904A
AST Auxiliary amp
HP Signal Generator/ E4431A
HP DC power supply
Narda 30 dB attenuator
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

TEST SETUP "A" FOR OUTPUT FROM EUT



TEST SETUP "B" FOR INPUT PLOT FROM SIGNAL GENERATOR

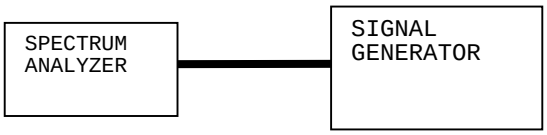


FIGURE 2

Minimum:
Section 2.1049(i); transmitters designed for other types of modulation-when modulated by an appropriate signal of sufficient amplitude to be representative of the type of service in which used. A description of the input signal should be supplied.

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Test Procedure:

The Eut's occupied bandwidth is compared to the input source plot (signal generator) and output plot (power amplifier) and check that the input signal bandwidth is not greater at the output of amplifier.

Use setup **A** and connect output from Eut to spectrum analyzer, making sure that enough external attenuation is being used to protect input of spectrum analyzer. Use the **REF LVL OFF** function to correct for external attenuation and cable loss. Set the spectrum to the frequency that will be measured. Set the power amplifier to the maximum output gain. Record the signal generator level for future reference. Set spectrum **SWEEP TIME** to **AUTO** and slowly reduce **RES BW.** to 300Hz and **AVG BW** to 300Hz. Use enough **SPAN** to display the whole signal on spectrum analyzer. Activate the **MAX HOLD** function and wait while the spectrum analyzer captures the envelope of the transmitted occupied bandwidth. Set the **TRACE** function to **VIEW**. Label plot as **OUTPUT FROM EUT** and plot result.

Use setup **B** and connect signal generator to spectrum analyzer, make sure that the input signal from signal generator is low enough, before connecting to spectrum analyzer. Keep all settings on spectrum analyzer the same and only remove the **REF LVL OFF** function, which was used to correct the external attenuation. Set the spectrum to the frequency that will be measured. Set spectrum **SWEEP TIME** to **AUTO** and slowly reduce **RES BW.** to 300Hz and **AVG BW** to 300Hz. Use enough **SPAN** to display the whole signal on spectrum analyzer. Activate the **MAX HOLD** function and wait while the spectrum analyzer captures the envelope of the transmitted occupied bandwidth. Set the **TRACE** function to **VIEW**. Label plot as **INPUT FROM SIGNAL GENERATOR** and plot result. This test was repeated for the low and high channels.

Test results:
Plots were made for the output of the amplifier and another for the input from signal generator. TDMA modulation was used for this test. Three power amplifiers were tested. Each amplifier contain a different isolator OMC, Raditek, and Sonoma.

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OMC ISOLATOR	
869MHz(LOW)	
MODULATION TYPE: TDMA	
	PLOT NUMBER
OUTPUT OF AMPLIFIER	**1**
IN FROM SIGNAL GENERATOR	**2**
894MHz(HIGH)	
MODULATION TYPE: TDMA	
	PLOT NUMBER
OUTPUT OF AMPLIFIER	**3**
IN FROM SIGNAL GENERATOR	**4**

RADITEK ISOLATOR	
869MHz(LOW)	
MODULATION TYPE: TDMA	
	PLOT NUMBER
OUTPUT OF AMPLIFIER	**5**
IN FROM SIGNAL GENERATOR	**6**
894MHz(HIGH)	
MODULATION TYPE: TDMA	
	PLOT NUMBER
OUTPUT OF AMPLIFIER	**7**
IN FROM SIGNAL GENERATOR	**8**

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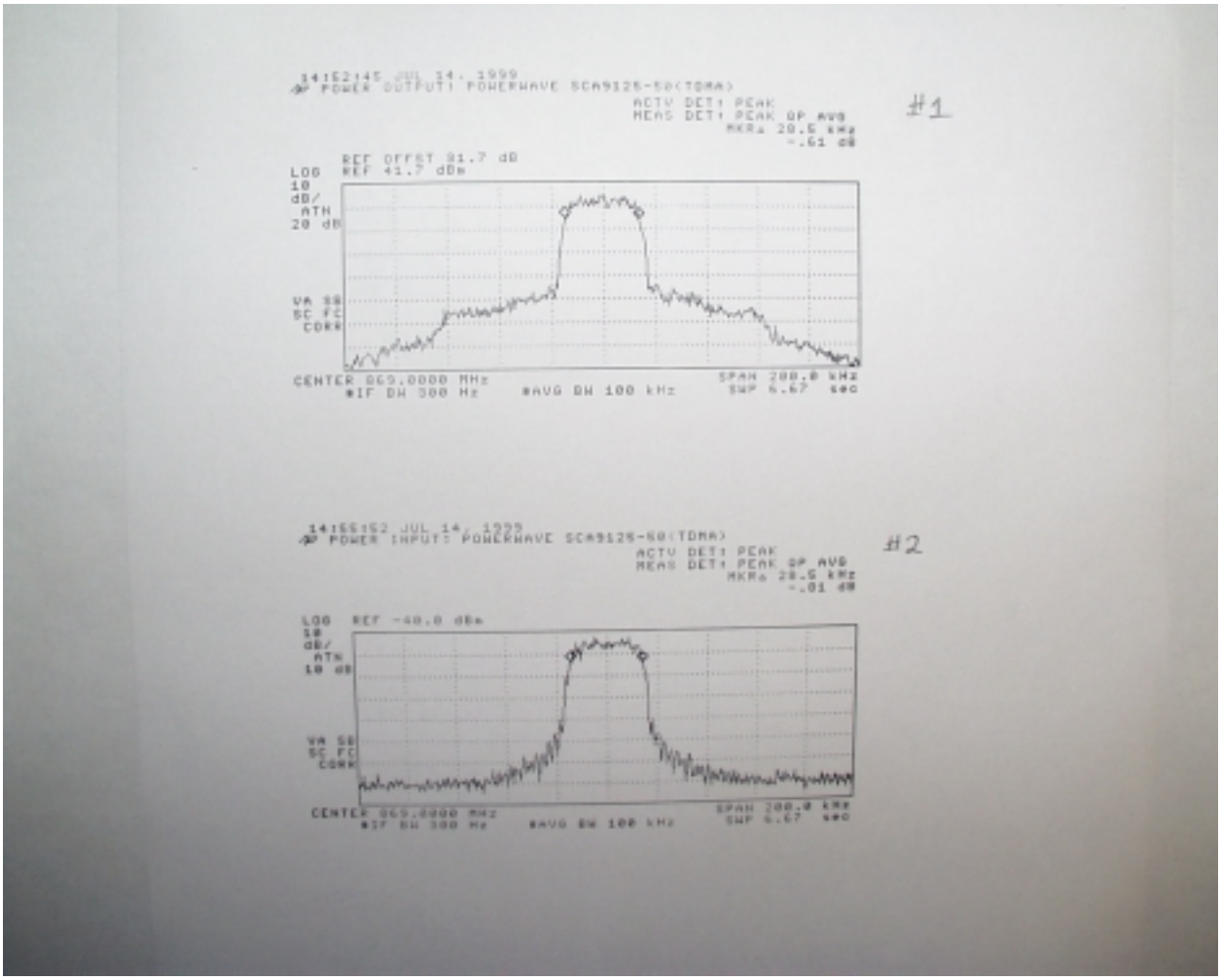

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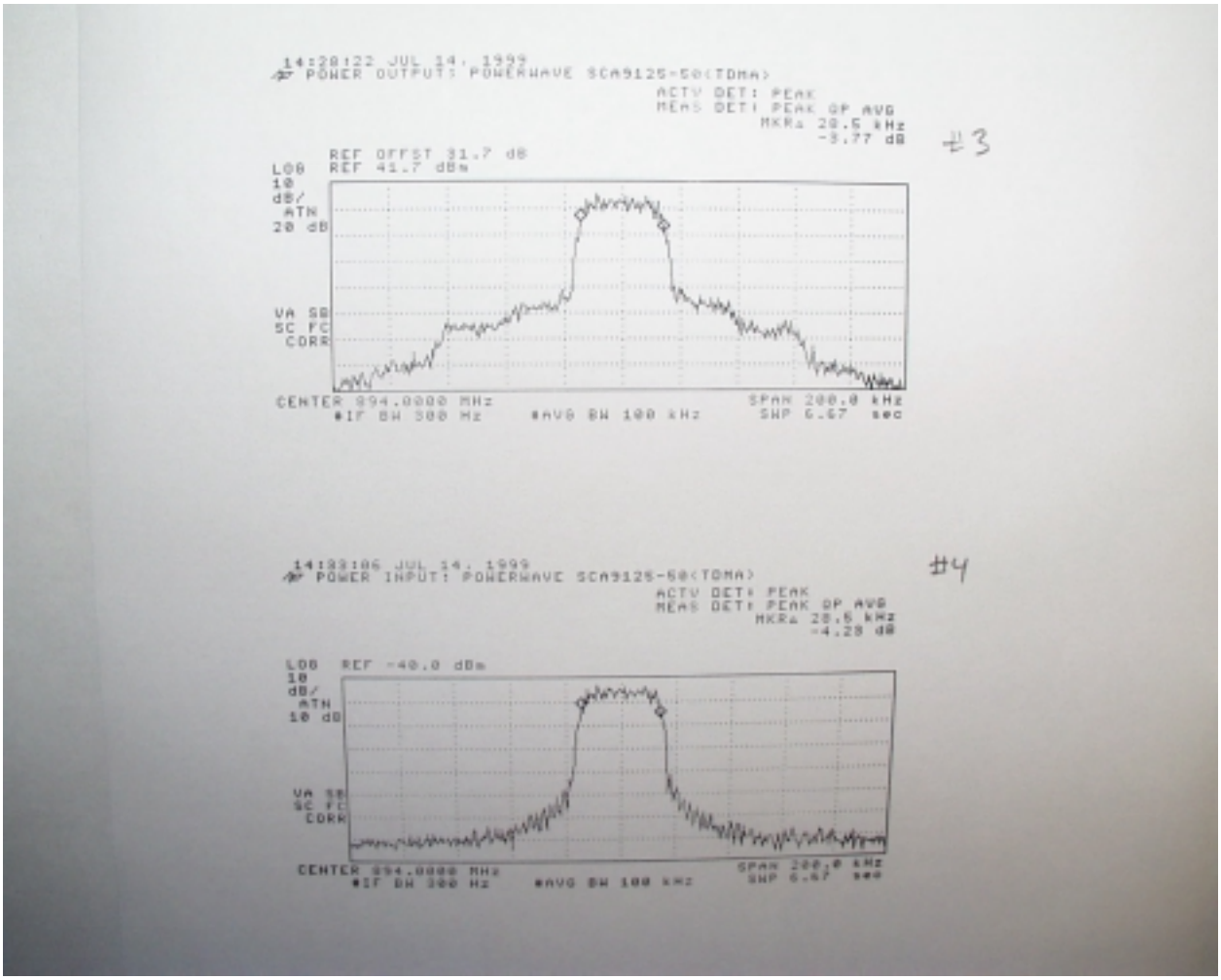

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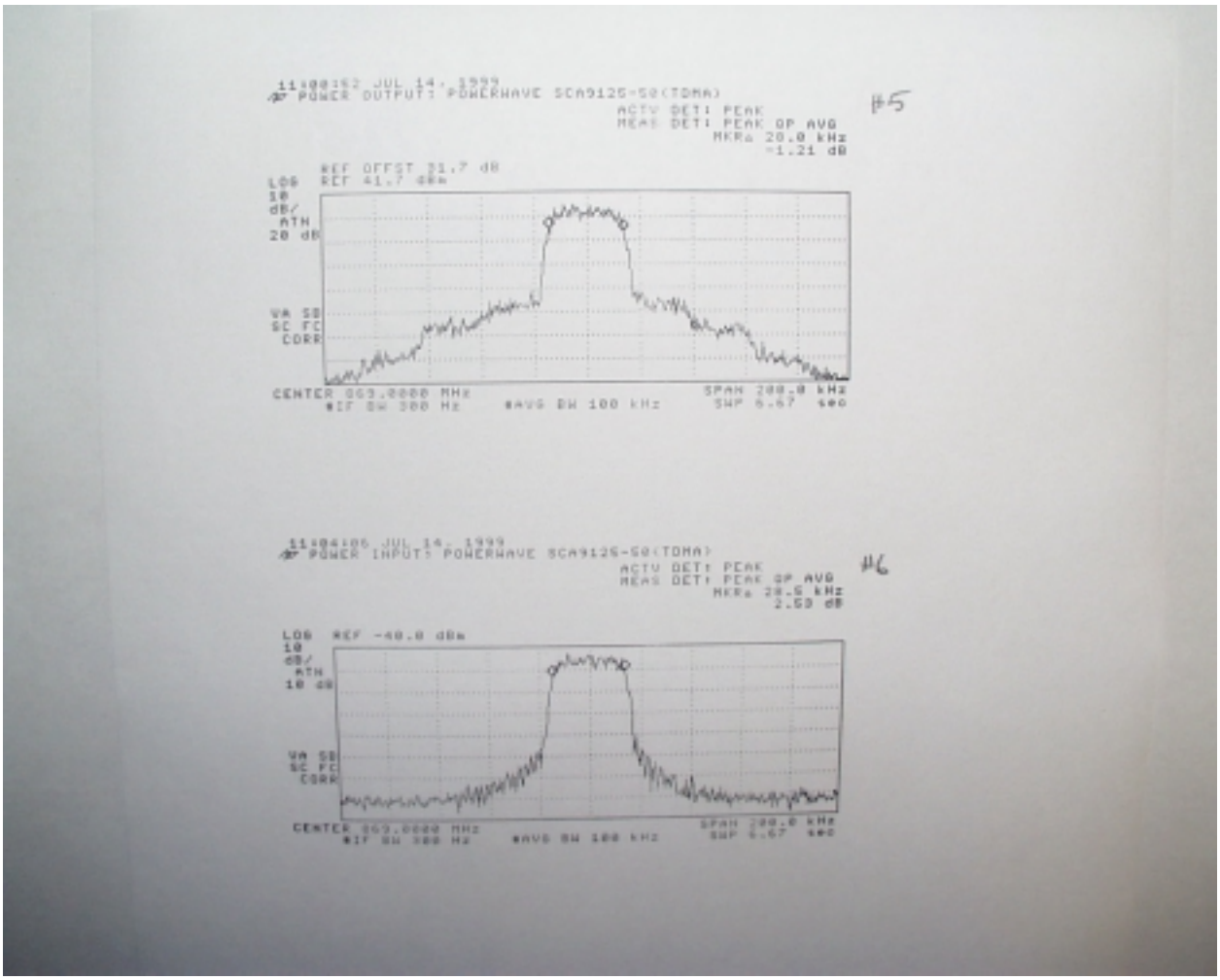

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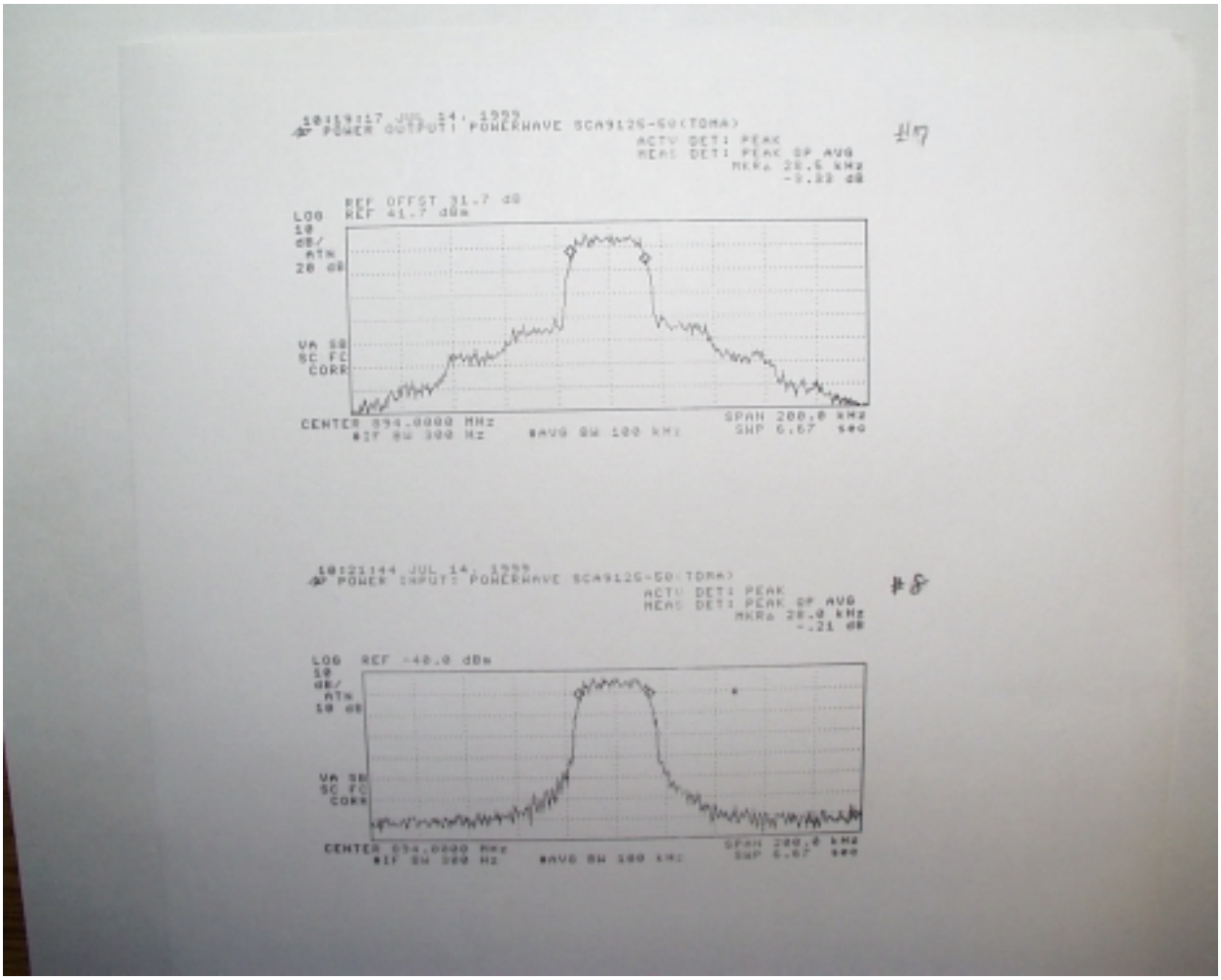

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OMC ISOLATOR	
869MHz(LOW)	
MODULATION TYPE: TDMA	
	PLOT NUMBER
OUTPUT OF AMPLIFIER	**9**
IN FROM SIGNAL GENERATOR	**10**
894MHz(HIGH)	
MODULATION TYPE: TDMA	
	PLOT NUMBER
OUTPUT OF AMPLIFIER	**11**
IN FROM SIGNAL GENERATOR	**12**

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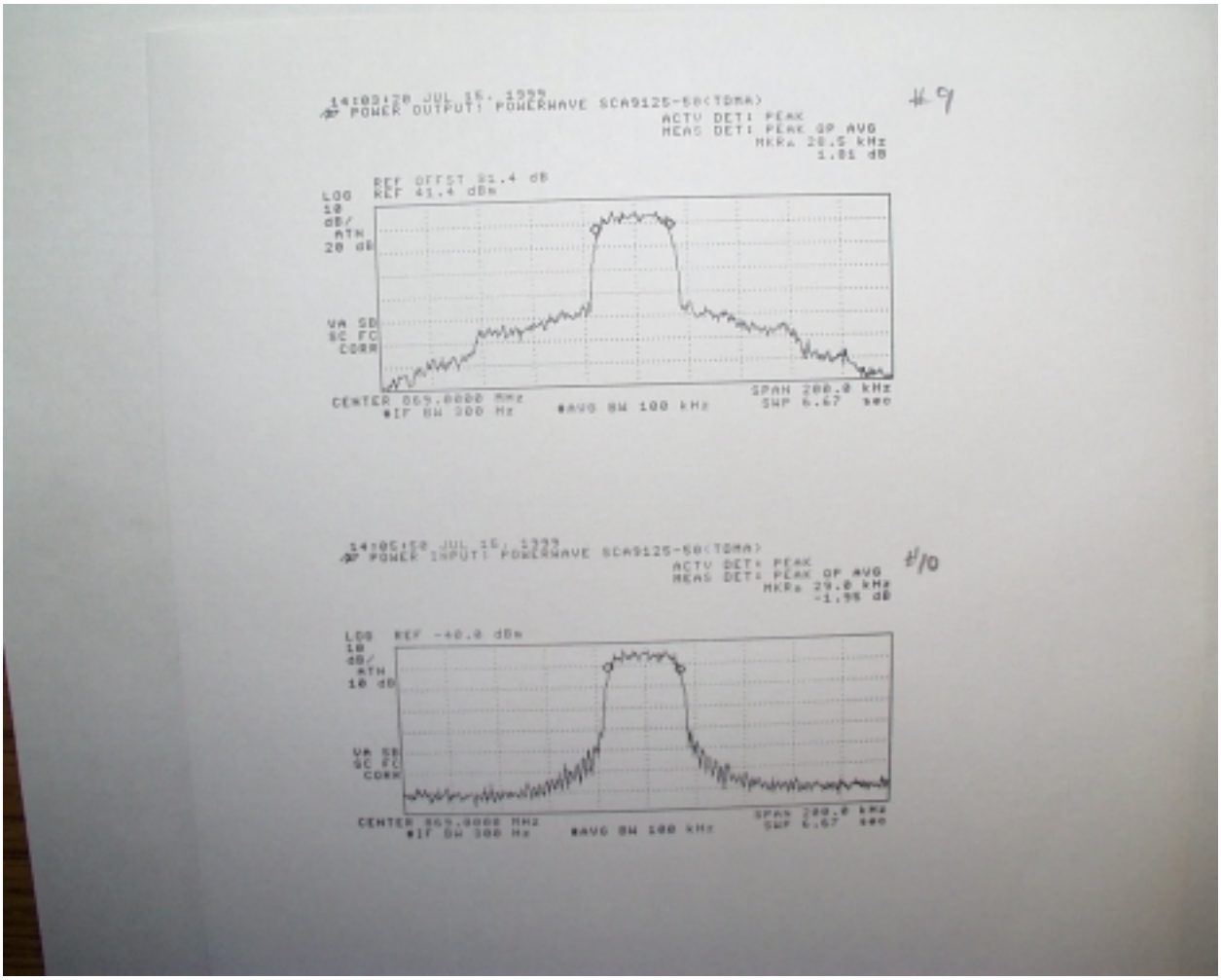

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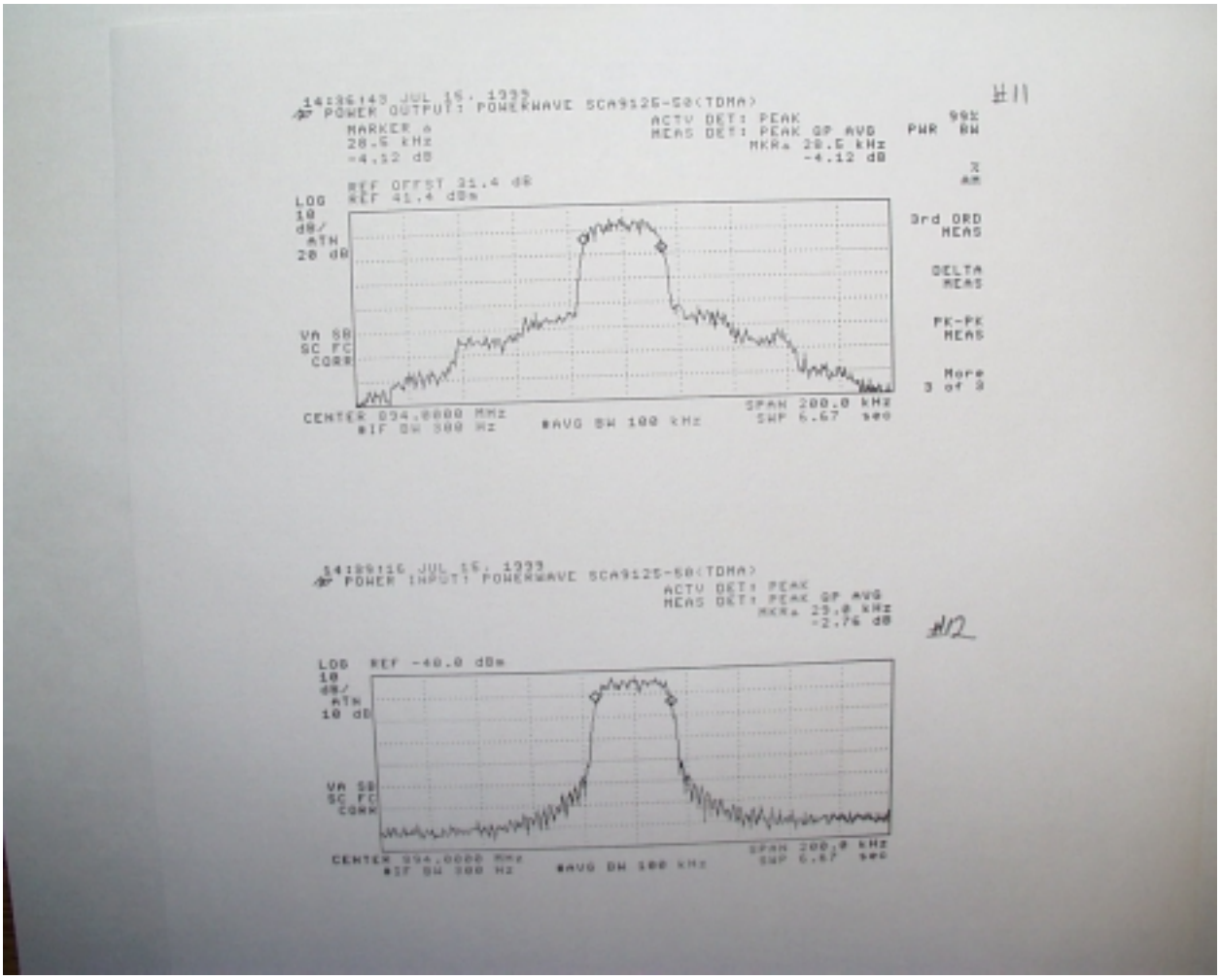

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SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINALS

Test Equipment:
HP Spectrum Analyzer/ 8593EM
HP Multifunction Synthesizer/ 8904A
AST Auxiliary amp
HP Signal Generator/ E4431A
HP DC power supply
Narda 30 dB attenuator
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

TEST SETUP:

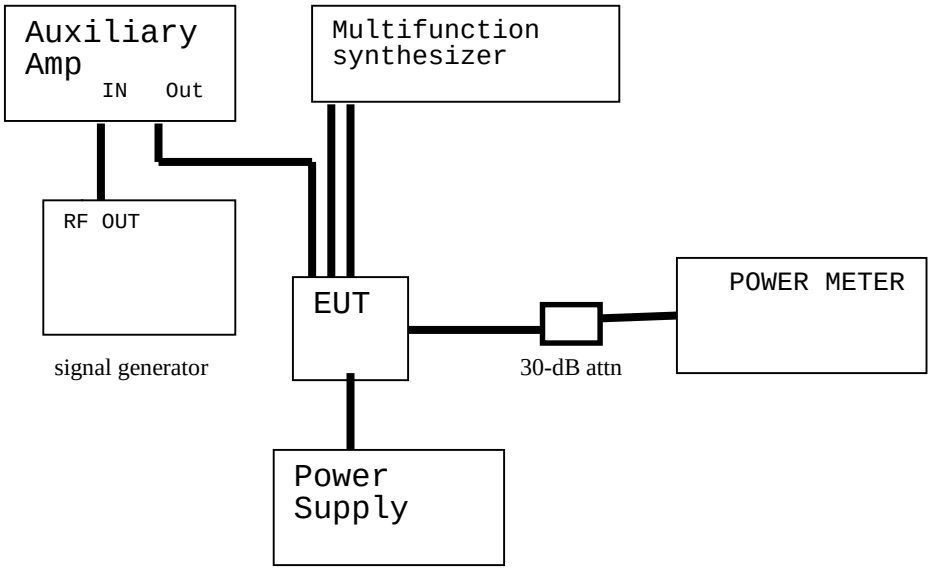

FIGURE 3

Note: Second harmonic of Eut fails Fcc specification, so manufacture will provide an external filter, which will be installed at the output of Eut's antenna terminal, to attenuate second harmonic. Please **refer to EXTERNAL FILTER SPECIFICATION** for information on the filter.

Minimum Requirement:
Section 22.917(e):
For Base stations transmitters the magnitude of each spurious, harmonic, and intermodulation emissions that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be more than 43 + 10 log (P) dBc below the mean power output, which is equivalent to –13 dBm.

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Test Procedure:
Scan Eut from 1MHz to the 10th harmonic of carrier and check for spurious, harmonic, and intermodulation emissions. Set the **RES Bw**: 30kHz and using the **DISPLAY LINE** place it at –13dBm. Use enough attenuation to prevent overload on the spectrum analyzer input, which can cause overload. This test was repeated for low and high channels.

Test Result:
Plots of the out-of-band should be made from 1MHz to 10th harmonic of the carrier frequency. Second harmonic of Eut fails Fcc specification, so manufacture will provide an **external filter** ,with the unit, to attenuate the second harmonic. Please refer **to EXTERNAL FILTER SPECIFICATION** for information on the filter. Three amplifiers were tested. Each amplifier contain a different isolator OMC, Raditek, and Sonoma

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OMC ISOLATOR	
869MHz(LOW)	
MODULATION TYPE: TDMA	
FREQUENCY RANGE	**PLOT NUMBER**
1 MHz TO 2.921 GHz	**13**
2.921 GHz TO 9 GHz	**14**
894MHz(HIGH)	
MODULATION TYPE: TDMA	
FREQUENCY RANGE	**PLOT NUMBER**
1 MHz TO 2.921 GHz	**15**
2.921 GHz TO 9 GHz	**16**

RADITEK ISOLATOR	
869MHz(LOW)	
MODULATION TYPE: TDMA	
FREQUENCY RANGE	**PLOT NUMBER**
1 MHz TO 2.921 GHz	**17**
2.921 GHz TO 9 GHz	**18**
894MHz(HIGH)	
MODULATION TYPE: TDMA	
FREQUENCY RANGE	**PLOT NUMBER**
1 MHz TO 2.921 GHz	**19**
2.921 GHz TO 9 GHz	**20**

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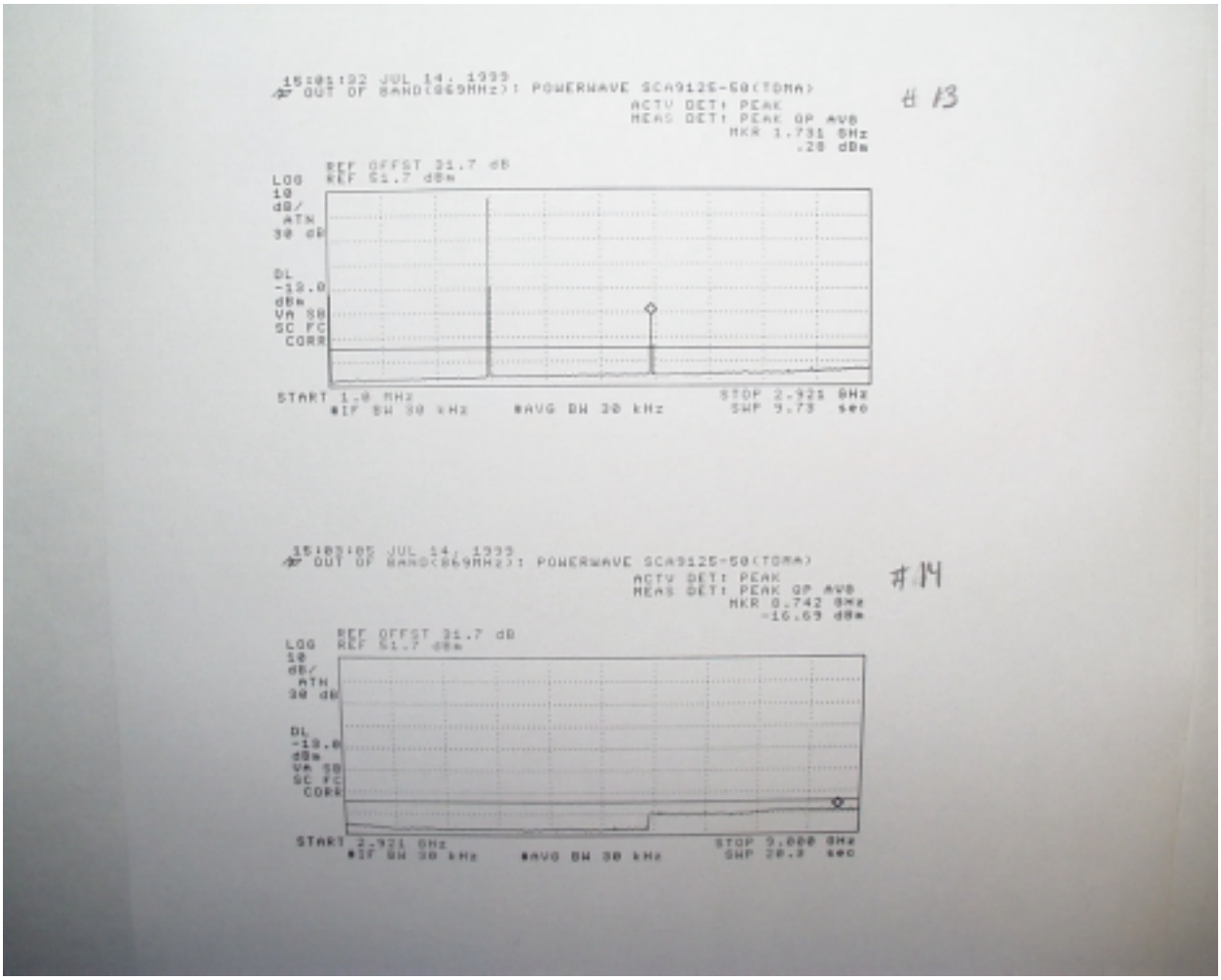

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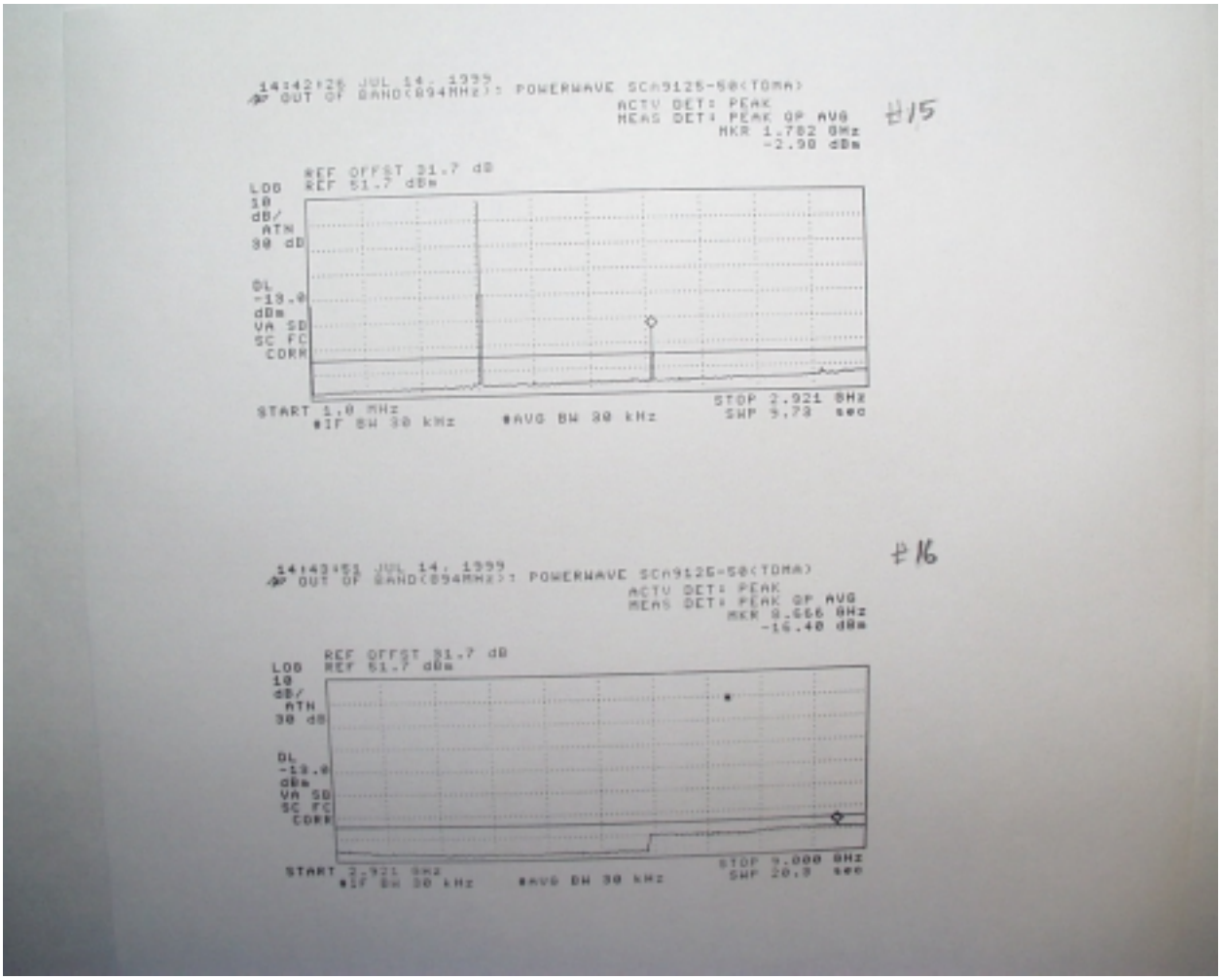

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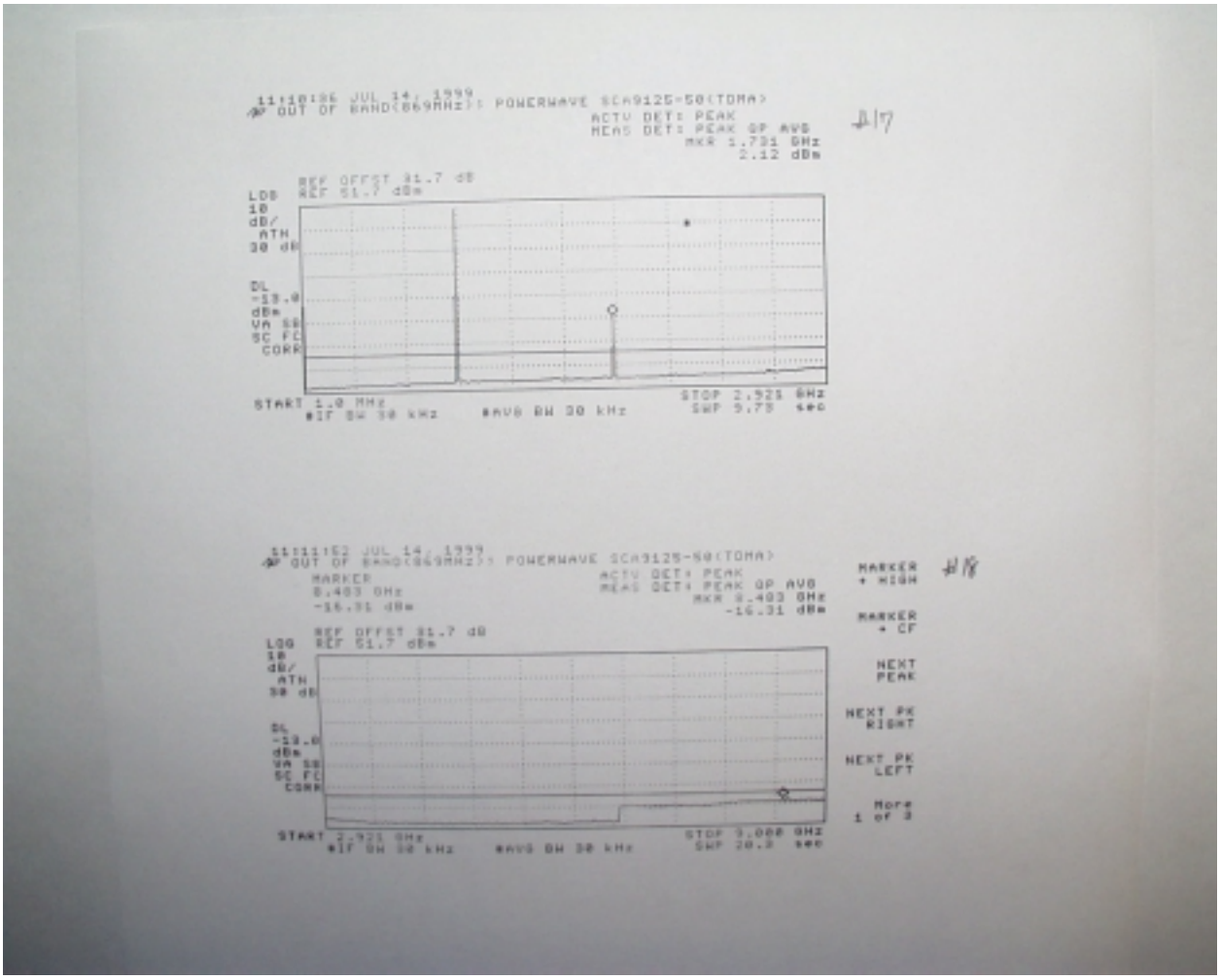

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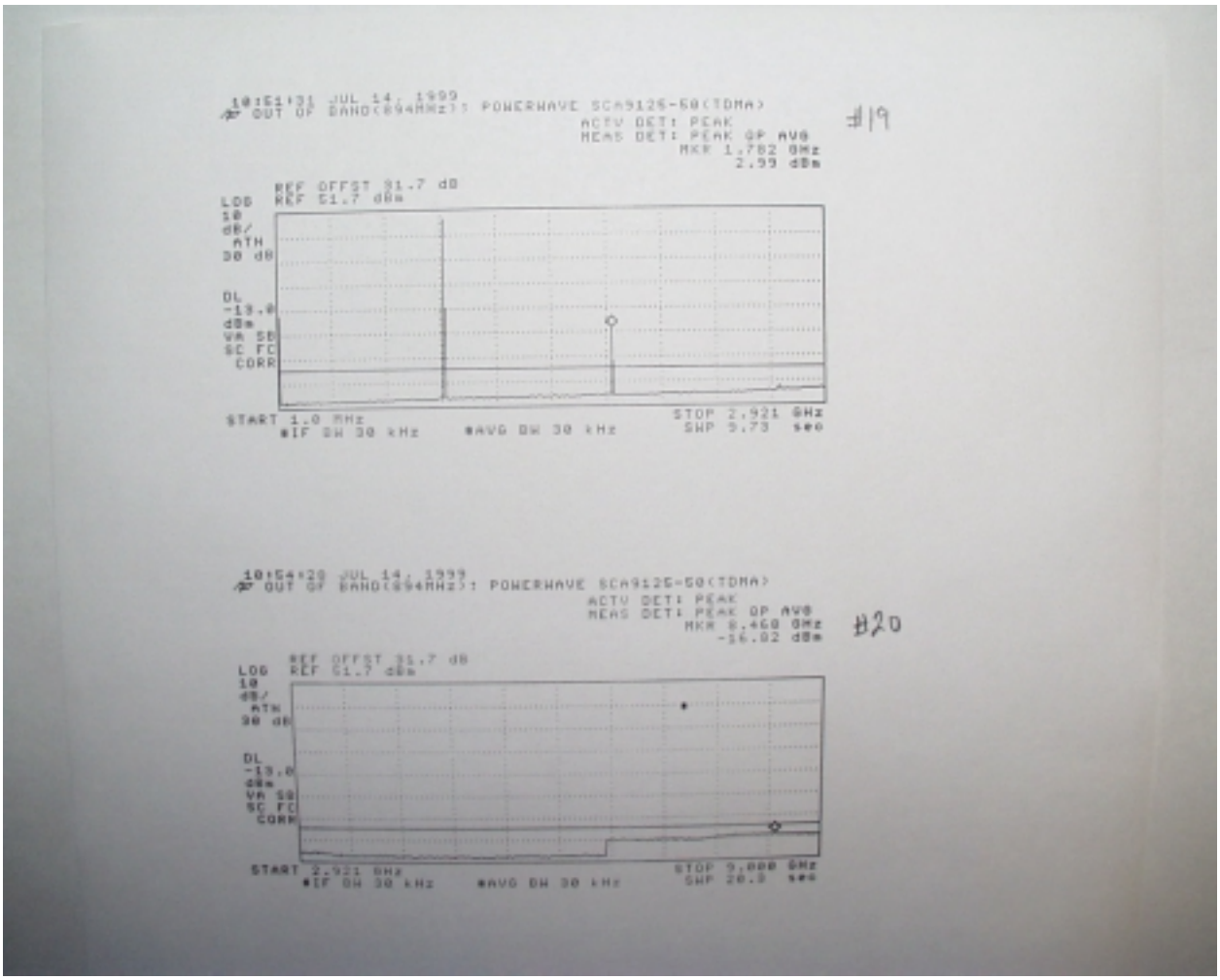

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SONOMA ISOLATOR	
869MHz(LOW)	
MODULATION TYPE: TDMA	
FREQUENCY RANGE	**PLOT NUMBER**
1 MHz TO 2.921 GHz	**21**
2.921 GHz TO 9 GHz	**22**
894MHz(HIGH)	
MODULATION TYPE: TDMA	
FREQUENCY RANGE	**PLOT NUMBER**
1 MHz TO 2.921 GHz	**23**
2.921 GHz TO 9 GHz	**24**

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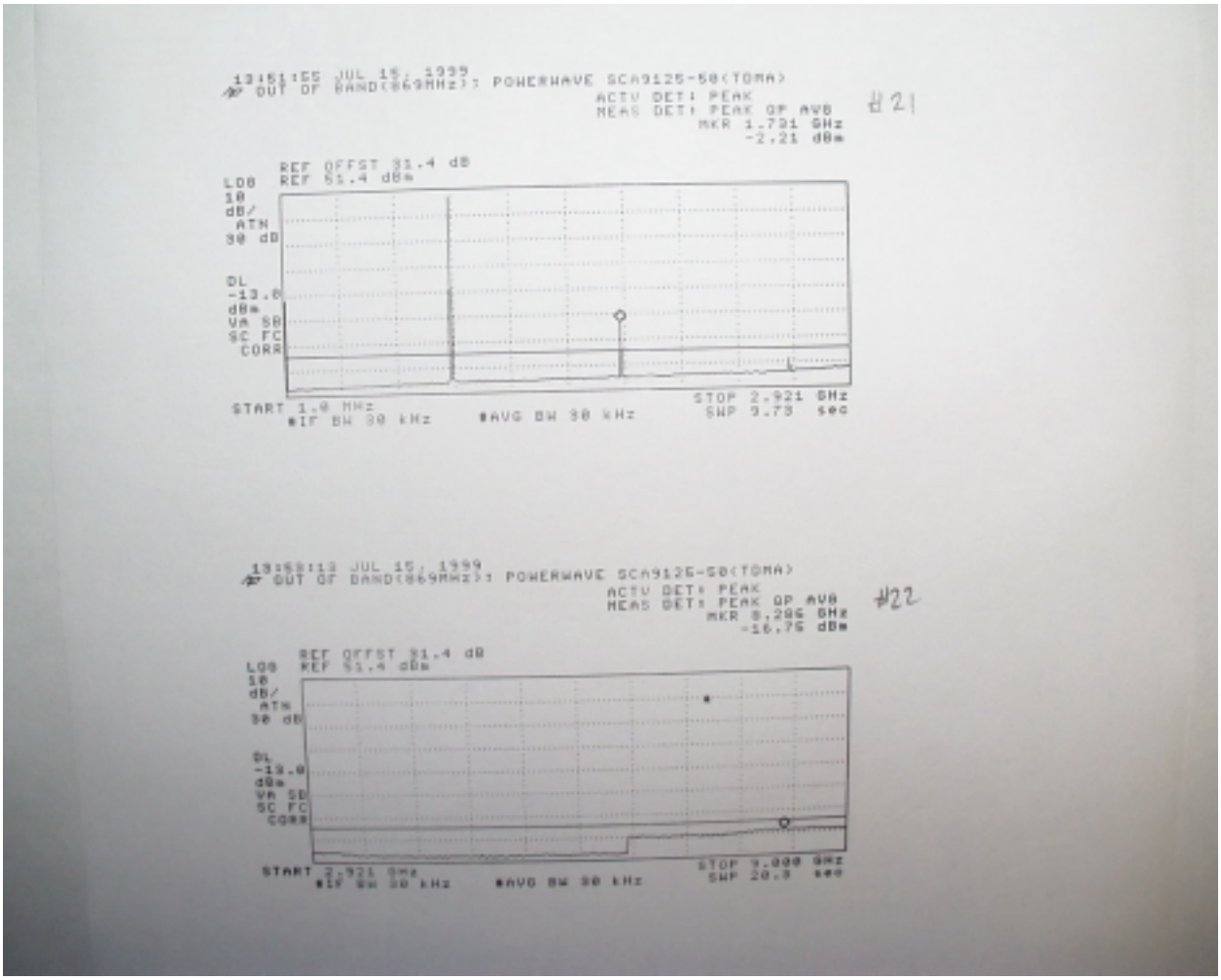

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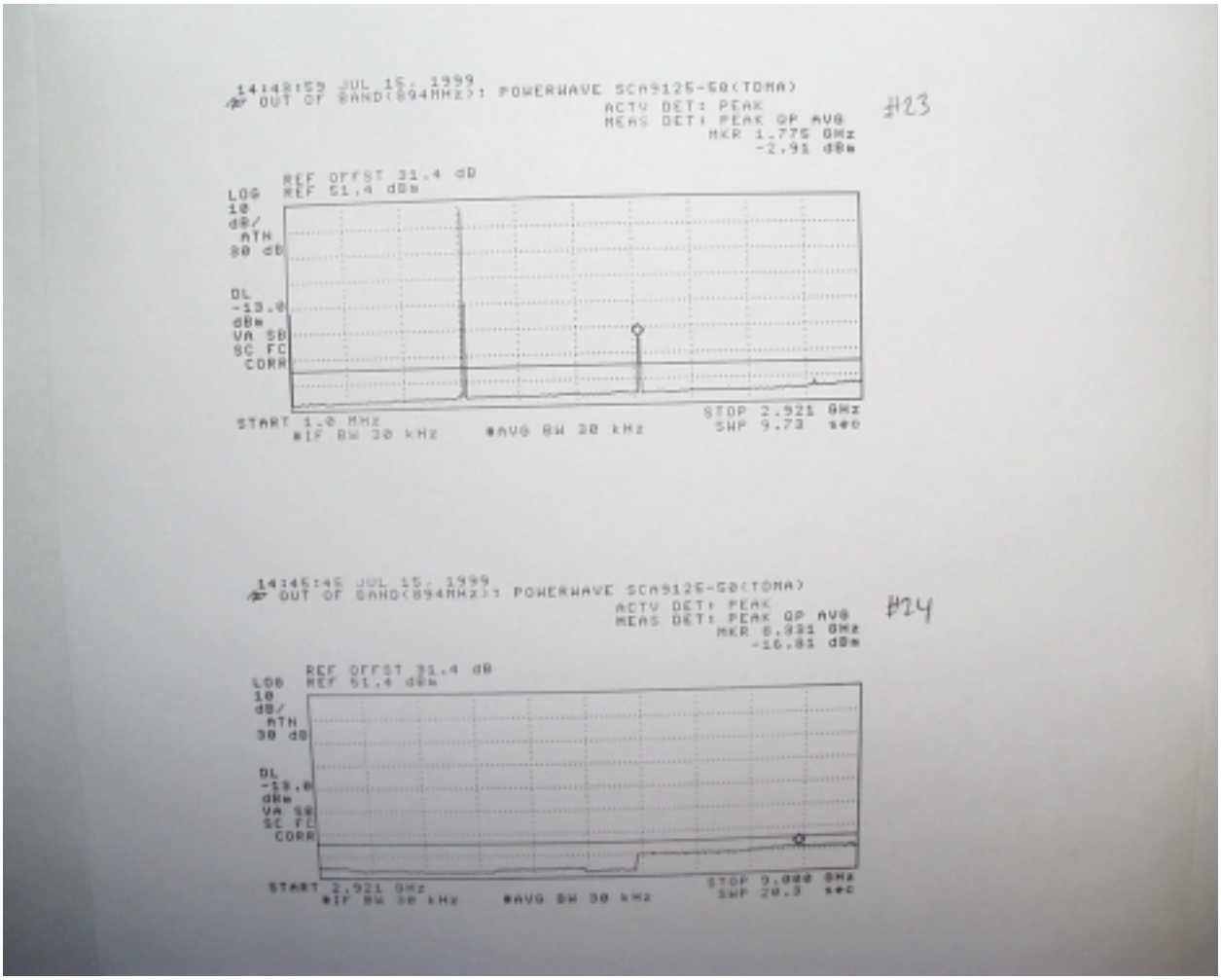

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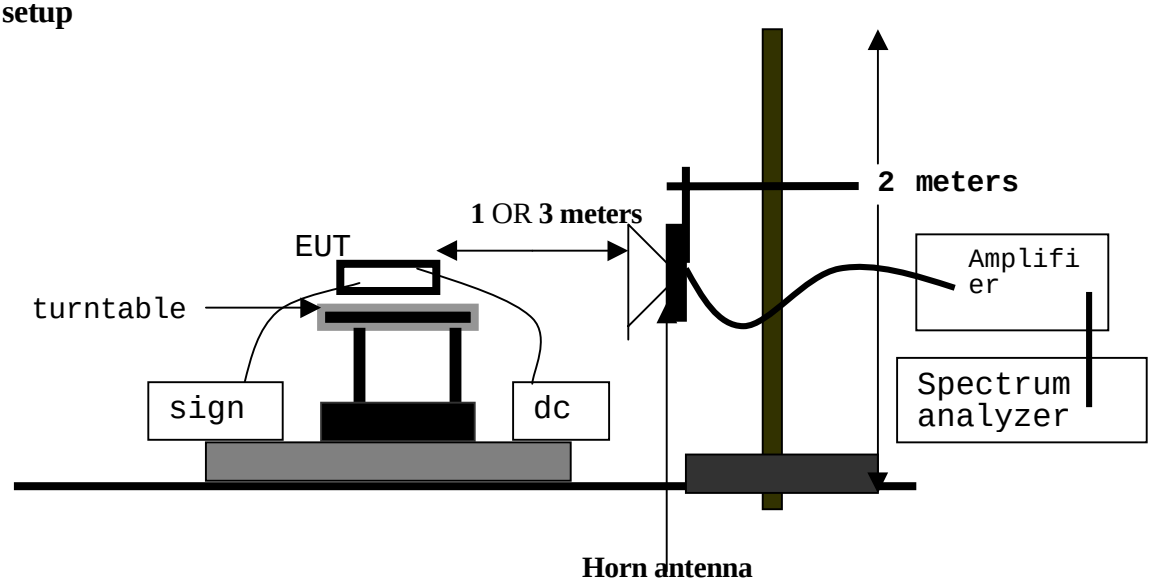
SECTION 2.1053: FIELD STRENGTH OF SPURIOUS RADIATION

Test Equipment:
HP Spectrum Analyzer/ 8593EM
HP Multifunction Synthesizer/ 8904A
AST Auxiliary amp
HP Signal Generator/ E4431A
HP DC power supply
Narda 30 dB attenuator
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test setup



Radiated Emissions Configuration

Minimum Requirement:

Section 22.917(e):

The magnitude of each spurious and harmonic emissions detected as being radiated from the EUT must be at a level no more than 43 + 10 log (mean output power, watts) dB below the mean power output (-13dBm).
Resultant radiated field at 3 meters from –13dBm source feeding isotropic antenna: 82 dBuV/m.

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Test procedure:

1 Meter test

EUT antenna output was terminated with a 50-ohm load. The EUT was placed on a outdoors-wooden table. The search antenna placed 3 ft from the EUT. With the transmitter operating at full power the turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction is determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

Test Result:
Please refer to attached spreadsheet.

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Sheet1

Radidated Emissions

POWERWAVE
Cellular Amp SCA9125-50

Compliance Certification Service
Pete Krebill
7/14/99

F(MHz)	Level (dBuV)	AF (dB)	CL (dB)	AMP (dB)	FILTER (dB)	DIST (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
VERTICAL									
PEAK									
1763	87.6	26.1	2.34	-35.5	1	-10.5	71.04	82	-10.96
2644	78.8	29	2.79	-35.5	1	-10.5	65.59	82	-16.41
3526	69.9	33.1	4.1	-35.5	1	-10.5	62.1	82	-19.9
4407	62.5	32.3	5	-35.5	1	-10.5	54.8	82	-27.2
5289	60.9	34.65	5.4	-35.5	1	-10.5	55.95	82	-26.05
6170	52.6	35.3	5.7	-35.5	1	-10.5	48.6	82	-33.4
7052	49	36.2	6	-35.5	1	-10.5	46.2	82	-35.8
7933	47.7	37	6.4	-35.5	1	-10.5	46.1	82	-35.9
8815	48.1	38.2	6.7	-35.5	1	-10.5	48	82	-34
HORIZONTAL									
PEAK									
1763	89.9	26.1	2.34	-35.5	1	-10.5	73.34	82	-8.66
2644	87.1	29	2.79	-35.5	1	-10.5	73.89	82	-8.11
3526	71.3	33.1	4.1	-35.5	1	-10.5	63.5	82	-18.5
4407	70.7	32.3	5	-35.5	1	-10.5	63	82	-19
5289	56.4	34.65	5.4	-35.5	1	-10.5	51.45	82	-30.55
6170	53.2	35.3	5.7	-35.5	1	-10.5	49.2	82	-32.8
7052	49.7	36.2	6	-35.5	1	-10.5	46.9	82	-35.1
7933	48.1	37	6.4	-35.5	1	-10.5	46.5	82	-35.5
8815	48.4	38.2	6.7	-35.5	1	-10.5	48.3	82	-33.7

AF= ANTENNA FACTOR
CL=CABLE LOSS

FILTER=HP FILTER INSERTION LOSS
DIST=DISTANCE CORRECTION TO 3 METERS

Page 1

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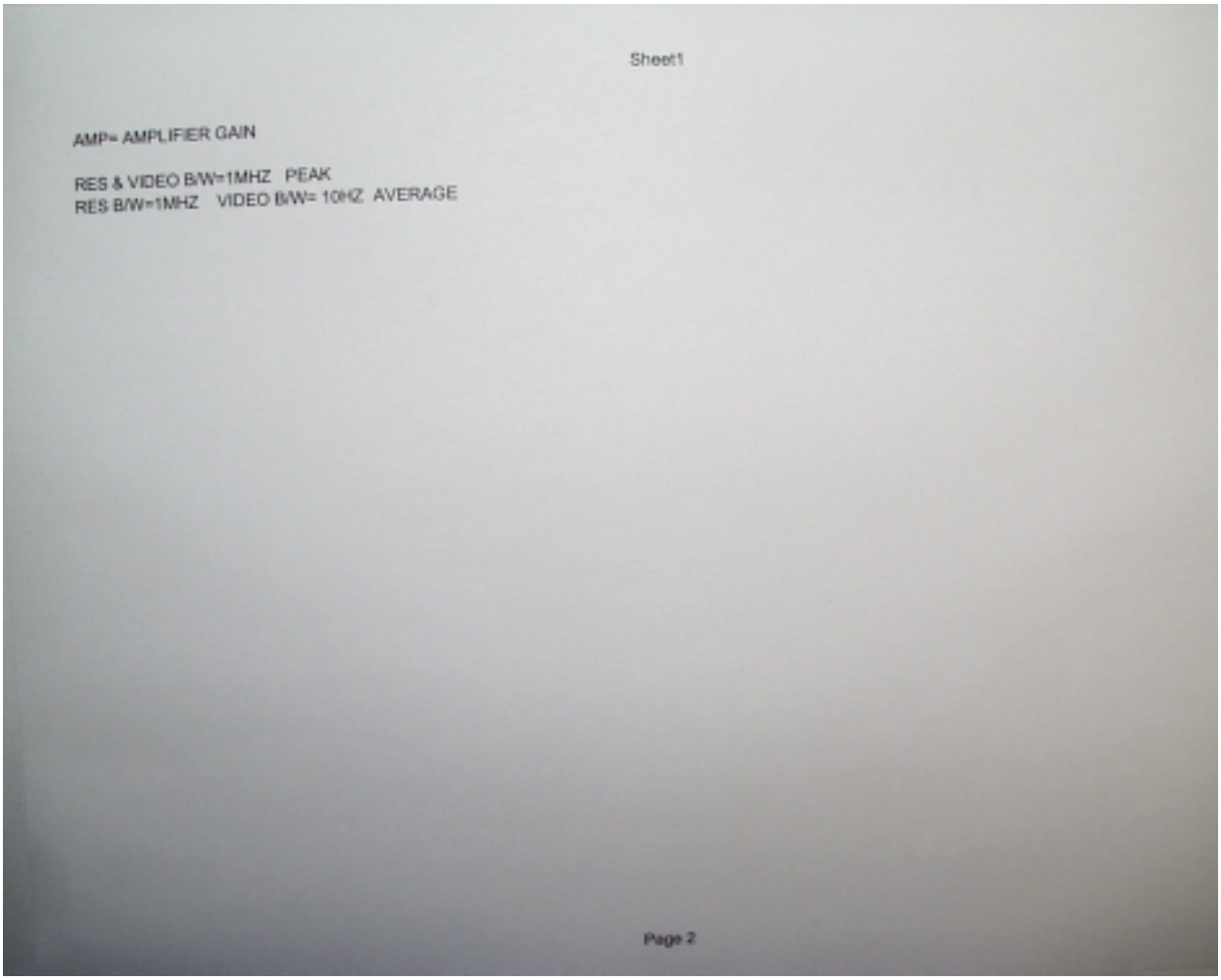

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SECTION 2.1055: FREQUENCT STABILITY

Not Applicable. Eut is a power amplifier

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