

1. 1. VERIFICATION OF COMPLIANCE

COMPANY NAME: POWERWAVE TECHNOLOGIES,INC.
2026 McGAW AVENUE
IRVINE, CA 92614
USA

CONTACT PERSON: GEORGE SOREMEKUN

TELEPHONE NO: (949)757-0530

MODEL NO/NAME: MCA 9XXX-60, MCR-3/4XXX

DATE TESTED: MAY 27,1998

TYPE OF EQUIPMENT:	MULTICARRIER CELLULAR AMPLIFIER SYSTEM
MEASUREMENT DISTANCE:	3 METER
TECHNICAL LIMIT:	FCC 22.359, 22.917
FCC RULES:	PART 15, PART 22
EQUIPMENT AUTHORIZATION PROCEDURE	TYPE ACCEPTANCE
MODIFICATIONS MADE ON EUT	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

The above equipment was tested by Compliance Consulting Services for compliance with the requirements set forth in the FCC CFR 47, PART 15 AND 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



HANS T. MELLBERG / ENGINEERING DIRECTOR
COMPLIANCE CONSULTING SERVICES

2. PRODUCT DESCRIPTION

The MCA9XXX-60 is a linear, feed-forward power amplifier that operates in the 25 MHz frequency band from 869 MHz to 894 MHz. The amplifier can simultaneously transmit multiple frequencies, with better than -65dBc third order intermodulation distortion (IMD). The amplifier system is modular in design, and is ideally suited for use in AMPS/TDMA/CDMA base stations. The plug-in Model MCA9503-60 amplifier modules can each provide 60Watts of power and function completely independently of each other. The amplifier modules are designed for parallel operation to produce high peak power output and backup redundancy for remote applications. The system is housed in the MCS6503-4 subrack which holds up to four MCA9503-60 amplifiers to produce up to 200Watts output.

The MCS6503-4 subrack contains an RF power splitter/combiner and a summary logic module that monitors the functional status of all plug-in amplifiers. The rear panel of the subrack has the system RF I/O connectors, an RF output sample connector, an DC power input terminals. The front panel of each amplifier module has unit level status/fault indicators and a power on/off circuit breaker. Primary power for the amplifier system is +27Vdc.

SYSTEM NO.	DESCRIPTION OF SYSTEM NO.	SUB-COMPONENT MODEL NO.	QTY PER SYSTEM	DESCRIPTION OF SUB-COMPONENT MODEL NO.
MCS6503-4	200W 869-894 MHz MCPA SYSTEM FOR BASE STATION EQUIPMENT	MCA9503-60	4	60W 869-894 MHz MCPA MODULE
		MCS6503-4	1	4-WAY 26" SUBRACK

3. 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.

4. 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))

5. 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.

6. 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.

7. 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).

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.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.8 \text{ uV/m}$$

8. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

9. RADIATED EMISSION LIMITS

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

15. TEST RESULT SUMMARY

FCC PART 15 Radiated Emission Test was conducted by operating the configuration as indicated below.

MCA9XXX-60 (RACK WITH 4 CELLULAR AMPS)							
OATS No: A / 3 meter		Data Report No. 980506A1		Date 05/06/98		Tested By: JUAN MARTINEZ	
Six Highest Radiated Emission Readings							
Frequency Range Investigated				30 MHz TO 9000 MHz			
Freq (MHz)	Meter Reading (dBuV)	C.F. (dB/m)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Polar (H/V)
45	9.60	+10.06	19.66	40	-20.43	P	V
56	11.3	+7.85	19.15	40	-20.85	P	V
163	8.2	+13.21	21.41	43.5	-22.09	P	V
233	10.2	+14.98	25.19	46	-20.81	P	V
261	9.4	+16.16	25.56	46	-20.44	P	V
324	11.8	+17.74	29.54	46	-16.46	P	V

C.F.(Correction Factor)=Antenna Factor + Cable Loss-Amplifier Gain

Corrected Reading = Metering Reading + C.F. Margin = Corrected Reading - Limits

P= Peak Reading

H= Horizontal Polarization/Antenna

Q= Quasi-peak

V= Vertical Polarization/Antenna

A= Average Reading

Comments: N/A

FCC PART 2 TYPE ACCEPTANCE TEST REQUIREMENT:

SECTION 2.985 RF POWER OUTPUT

Please refer to configuration block diagram for equipment connection. Power meter manufactured by Bird Elect. is used to measure the RF power output.

MCA9XXX-60 (4 AMPS)	
NO. OF AMPLIFIER	MEASURED RF POWER OUTPUT
4	196W
3	145W
2	94W
1	BELOW NOISE FLOOR OF 35 dBuV

SECTION 2.987 MODULATION CHARACTERISTICS

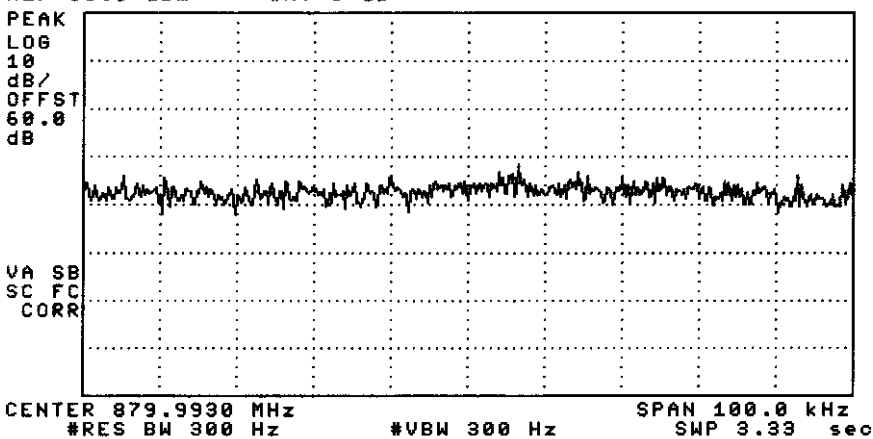
Not applicable. EUT is a power amplifier.

SECTION 2.989 OCCUPIED BANDWIDTH

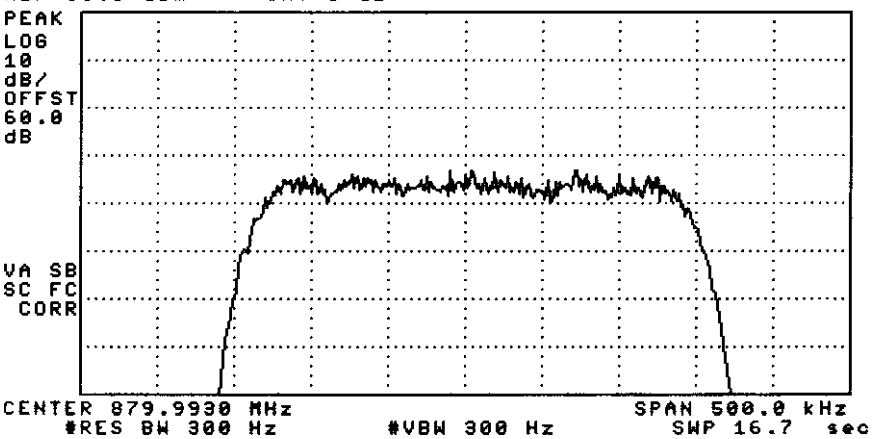
Please refer to configuration block diagram for equipment connections. Test result are presented in spectrum analyzer plot# 1, 2 showing CDMA modulations Which is worse case modulation. Plot #1 with Span=100kHz, and Plot#2 with Span=500kHz

09:17:04 MAY 27, 1998
OCC BW; POWERWAVE(MCA9XXX-60) CDMA
REF 50.0 dBm #AT 0 dB

2.32



09:18:08 MAY 27, 1998
OCC BW; POWERWAVE(MCA9XXX-60) CDMA
REF 50.0 dBm #AT 0 dB



12

SECTION 2.991 SPURIOUS EMISSION AT ANTENNA TERMINALS

Spurious emissions tests were performed for 2 input signals to amplifier. Worse case modulation tested CDMA. Spectrum was scanned from 30 MHz to 8940 MHz to search for spurious, harmonics, and intermodulation products emissions.

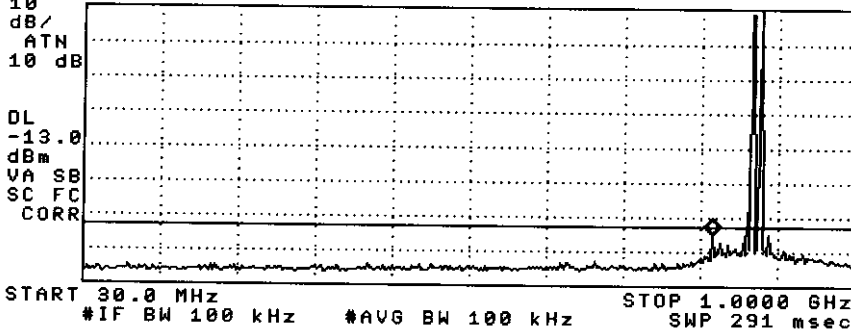
MCA9XXX-60 (4 AMPS)	
MODULATION TYPE: CDMA	
FREQUENCY RANGE	PLOT NUMBER
1 MHz TO 1 GHz	1
1 GHz TO 2.912 GHz	2
2.921 GHz TO 8.900 GHz	3
Intermodulation plot# 4, 5	
Intermodulation Emission: Plot# 6, 7	

Filtering device will be installed by manufacturer at RF output connector to reduce harmonics and spurious emissions.

12:33:56 MAY 06, 1998
OUT OF BAND; MCA9XXX-60 CDMA

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 820.6 MHz
-15.29 dBm

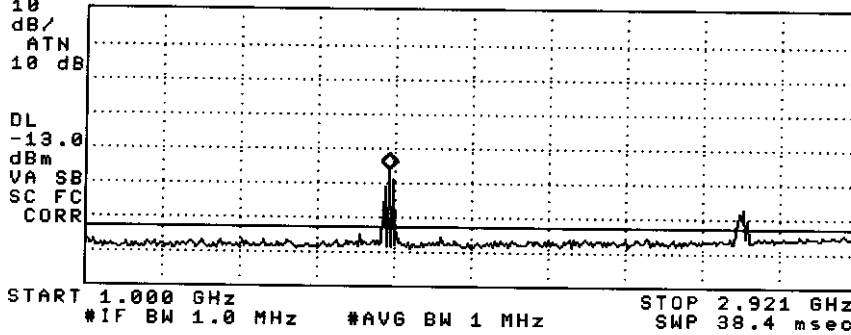
LOG REF OFFST 50.0 dB
10 REF 50.0 dBm



12:34:40 MAY 06, 1998
OUT OF BAND; MCA9XXX-60 CDMA

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.754 GHz
3.43 dBm

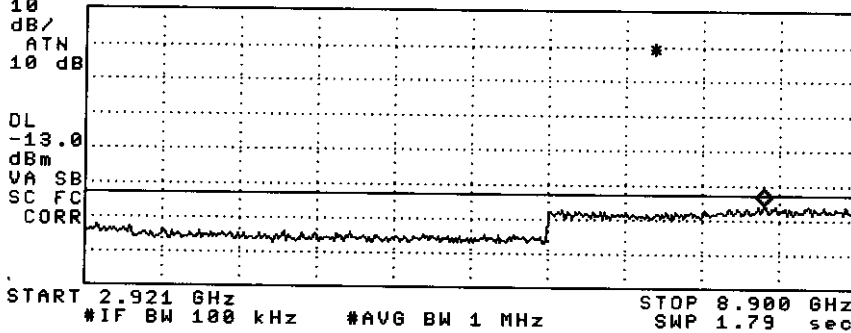
LOG REF OFFST 50.0 dB
10 REF 50.0 dBm



12:36:48 MAY 06, 1998
OUT OF BAND; MCA9XXX-60 CDMA

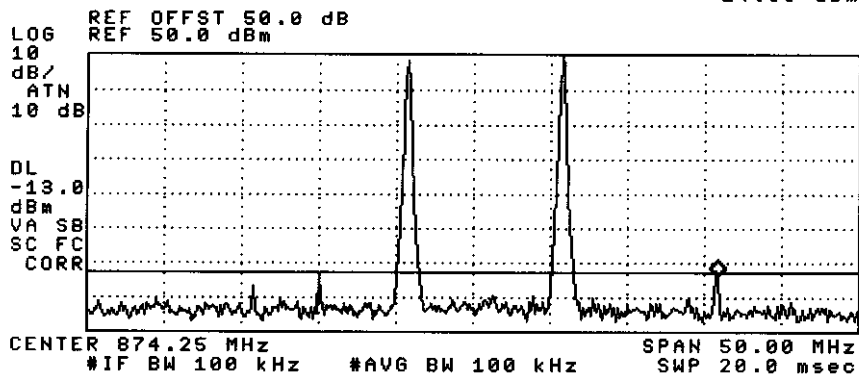
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 8.183 GHz
-15.91 dBm

LOG REF OFFST 50.0 dB
10 REF 40.0 dBm



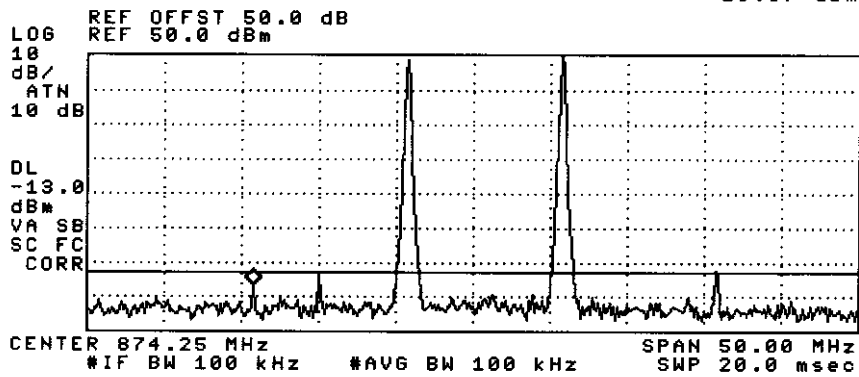
12:30:31 MAY 06, 1998
TWO TONE; MCA9XXX-60 CDMA

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 890.13 MHz
-14.09 dBm

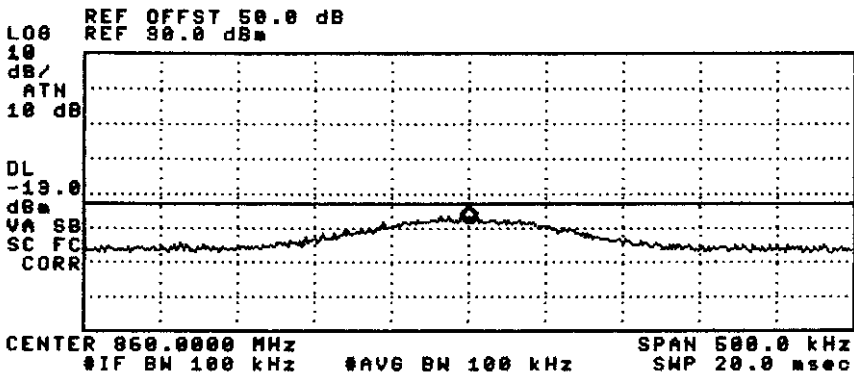


12:31:00 MAY 06, 1998
TWO TONE; MCA9XXX-60 CDMA

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 860.00 MHz
-16.67 dBm

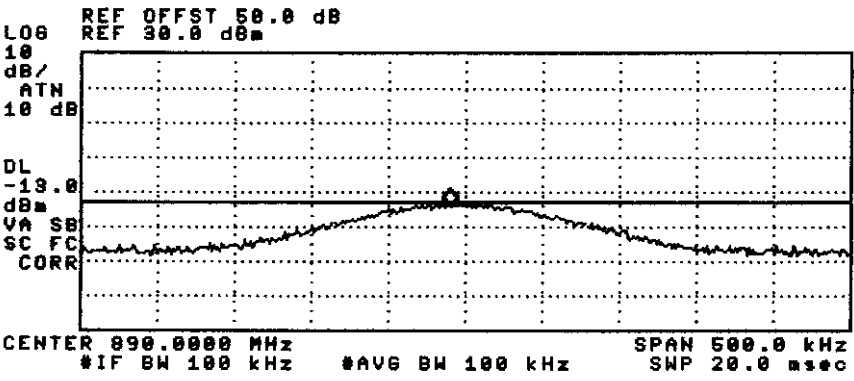


14:15:35 MAY 05, 1998
 CLOSE VIEW TWO TONE (860MHz); POWERWAVE MCA9XXX-60
 ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 860.0000 MHz
 -18.67 dBm



#0

14:16:37 MAY 05, 1998
 CLOSE VIEW TWO TONE (890MHz); POWERWAVE MCA9XXX-60
 ACTV DET: PEAK
 MEAS DET: PEAK QP AVG
 MKR 889.9900 MHz
 -14.21 dBm



#1

SECTION 2.995 FREQUENCT STABILITY

Not Applicable. Device is a power amplifier.

SECTION 2.993 FIELD STRENGTH OF SPURIOUS RADIATION

Technical Limits applied Section 22.359, 22.917 emission masks

(a) Analog modulation applied. All readings CDMA Vertical polarized on second Harmonic @ 1760MHz @3meter with Bilog Antenna

4 Amplifiers 196WATTS Output:

$$(\sqrt{30} * 196) / 3 = 25.56 \text{ V/m} = 148.15 \text{ dBuV/m}$$

$$\text{Emission Masks} = 43 + 10 \log (196) = 65.9$$

$$148.15 - 65.9 = 82.2$$

<u>dBuV</u>	<u>AF</u>	<u>CL</u>	<u>dBuV/m</u>	<u>LIMIT</u>	<u>MARGIN</u>
45.3	27.89	6.74	79.93	82.2	-2.27

3 Amplifiers 145WATTS Output:

$$(\sqrt{30} * 145) / 3 = 21.98 \text{ V/m} = 146.84 \text{ dBuV/m}$$

$$\text{Emission Masks} = 43 + 10 \log (145) = 64.6$$

$$146.84 - 64.6 = 82.2$$

<u>dBuV</u>	<u>AF</u>	<u>CL</u>	<u>dBuV/m</u>	<u>LIMIT</u>	<u>MARGIN</u>
42.8	27.89	6.74	77.43	82.2	-4.77

2 Amplifiers 94WATTS Output:

$$(\sqrt{30} * 94) / 3 = 17.7 \text{ V/m} = 144.96 \text{ dBuV/m}$$

$$\text{Emission Masks} = 43 + 10 \log (94) = 62.7$$

$$144.96 - 62.7 = 82.2$$

<u>dBuV</u>	<u>AF</u>	<u>CL</u>	<u>dBuV/m</u>	<u>LIMIT</u>	<u>MARGIN</u>
37.7	27.89	6.74	72.33	82.2	-9.87

ONE AMPLIFIER READING WAS BELOW NOISE FLOOR OF 35dBuV

From second to tenth harmonics emission data @ 1 meter, please refer to worksheet attached.

Compliance Certification Services										5/5/1998
Fcc Part 22.359										Juan Martinez
Powerwave Technologies										Site A(1Meter)
MULTICARRIER CELLULAR AMPLIFIER SYSTEM (MCA9XXX-60)										
fo=880MHz										
F(MHz)	PK dBuv	AF (dB)	CL (dB)	AMP (dB)	DIST (dB)	OTHER (dB)	TOTAL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dBuV/m)	
							PK	PK	PK	
1760P	93.3	26	2.34	-35.5	-10.45	0	75.69	82	-6	
2640P	67.1	29.9	2.88	-35.5	-10.45	1	54.93	82	-27	
3520P	66.6	33.1	4.68	-35.5	-10.45	1	59.43	82	-23	
4400P	66.6	32.3	5.22	-35.5	-10.45	1	59.17	82	-23	
5280P	61.9	34.7	5.4	-35.5	-10.45	1	57.05	82	-25	
6160P	48.8	35.5	5.58	-35.5	-10.45	1	44.93	82	-37	
7040P	51.3	36.2	6.48	-35.5	-10.45	1	49.03	82	-33	
7920P(n.f.)	46.9	37	6.84	-35.5	-20	1	36.24	82	-46	
8800P(n.f.)	46.8	38.1	7.38	-35.5	-20	1	37.78	82	-44	
n.f.: Noise Floor										RES VBW
AF: Antenna Factor										PK: 1MHz 1MHz
AMP: Pre-amp gain										PK: Peak
CL: Cable loss										

DIST: Distance Correction(-10.45dB, 3ft.)

OTHER: High pass filter insertion loss

*FSY Microwave high pass filter (fo=1.804MHz)

16. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION FOR CONFIGURATION #1

CABLE NO:1	
I/O Port: : RF OUTPUT TO POWER METER	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:1.5 M
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO:2	
I/O Port:: RF INOUT	Number of I/O ports of this type:1
Number of Conductors: 2	Connector Type: SMA
Capture Type: SCREW-IN	Type of Cable used: SHIELDED
Cable Connector Type: METAL	Cable Length:2.0
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO:3	
I/O Port: EUT (27Vdc INPUT)	Number of I/O ports of this type:1
Number of Conductors: 8	Connector Type: POWER CONNECTORS
Capture Type: SNAP-IN	Type of Cable used: UN-SHIELDED
Cable Connector Type: PLASTIC	Cable Length: 2.5
Bundled During Tests: NO	Data Traffic Generated: NO
Remark: N/A	

CABLE NO:4	
I/O Port: ATTENUATOR RF-OUT	Number of I/O ports of this type:1
Number of Conductors: 2	Connector Type: N TYPE TO SMA
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	

10. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80 cm above the ground screen. Antenna to EUT distance is 3 meters . During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

11. AMBIENT CONDITIONS

The ambient conditions at the time of final tests were as follows:

	Radiated Emission	Conducted Emission
Temperature	17° C	21° C
Humidity	81%	62%

12. EQUIPMENT MODIFICATIONS

Not Applicable

13. TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Site	Cal Date	Due Date
Spectrum Analyzer	H.P.	8593EM	3710A00205	F	05/97	05/98
Spectrum Analyzer	H.P.	8566B	3014A06685	A	08/97	08/98
Bilog Antenna	CHASE	CBL6112	2049	A	05/97	05/98
Horn Antenna	EMCO	3115	9001-3245	A	12/97	12/00
Pre-Amp	H.P.(P2)	8447D	2944A06265	A	09/97	09/98
Pre-Amp	H.P. (1-26.5GHz)	8449B	3008A00369	A	04/98	04/99

Device Type	Manufacturer	Model Number	Serial No.	FCC ID / DoC
SIGNAL GENERATOR	ROHDE & SCHWARZ	SMIQ 03	DEZ3346	N/A
SIGNAL GENERATOR	H.P.	E4432A	US3626061A	N/A
POWER METER	BIRD ELEC.	250E	N/A	N/A
HIGH POWER ATTENUATOR	NARDA	269-30	06260	N/A
POWER SUPPLY	POWER TEN INC.	P62B-30100	1007075	N/A

EXTERNAL I/O CABLE COSTRUCTION DESCRIPTION FOR CONFIGURATION #2

CABLE NO:1	
I/O Port: : RF OUTPUT TO POWER METER	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: SHIELEDDED
Cable Connector Type: METAL	Cable Length:1.5 M
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO:2	
I/O Port:: RF INOUT	Number of I/O ports of this type:1
Number of Conductors: 2	Connector Type: SMA
Capture Type: SCREW-IN	Type of Cable used: SHIELEDDED
Cable Connector Type: METAL	Cable Length:2.0
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

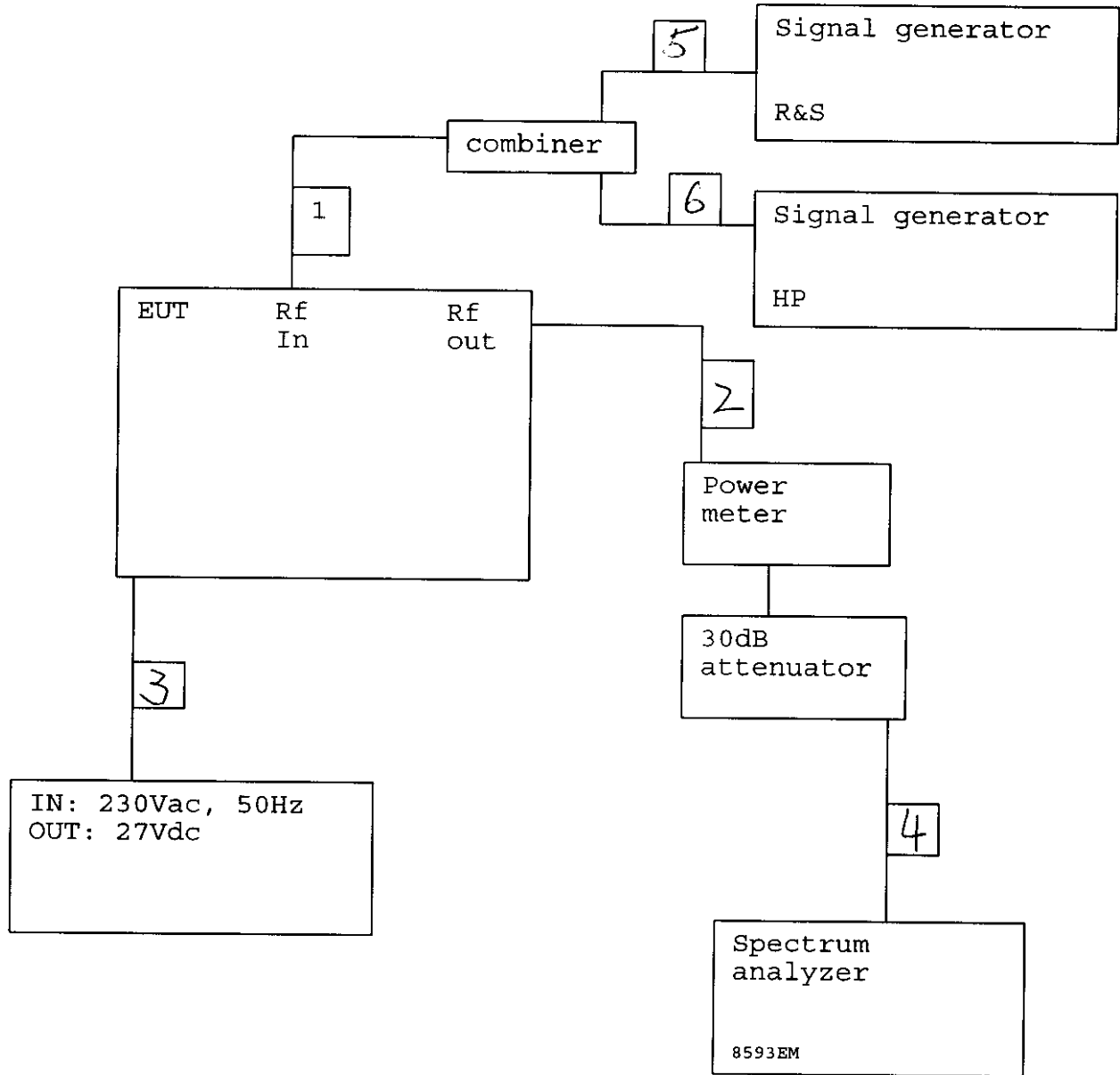
CABLE NO:3	
I/O Port: EUT (27Vdc INPUT)	Number of I/O ports of this type:1
Number of Conductors: 8	Connector Type: POWER CONNECTORS
Capture Type: SNAP-IN	Type of Cable used: UN-SHIELEDDED
Cable Connector Type: PLASTIC	Cable Length: 2.5
Bundled During Tests: NO	Data Traffic Generated: NO
Remark: N/A	

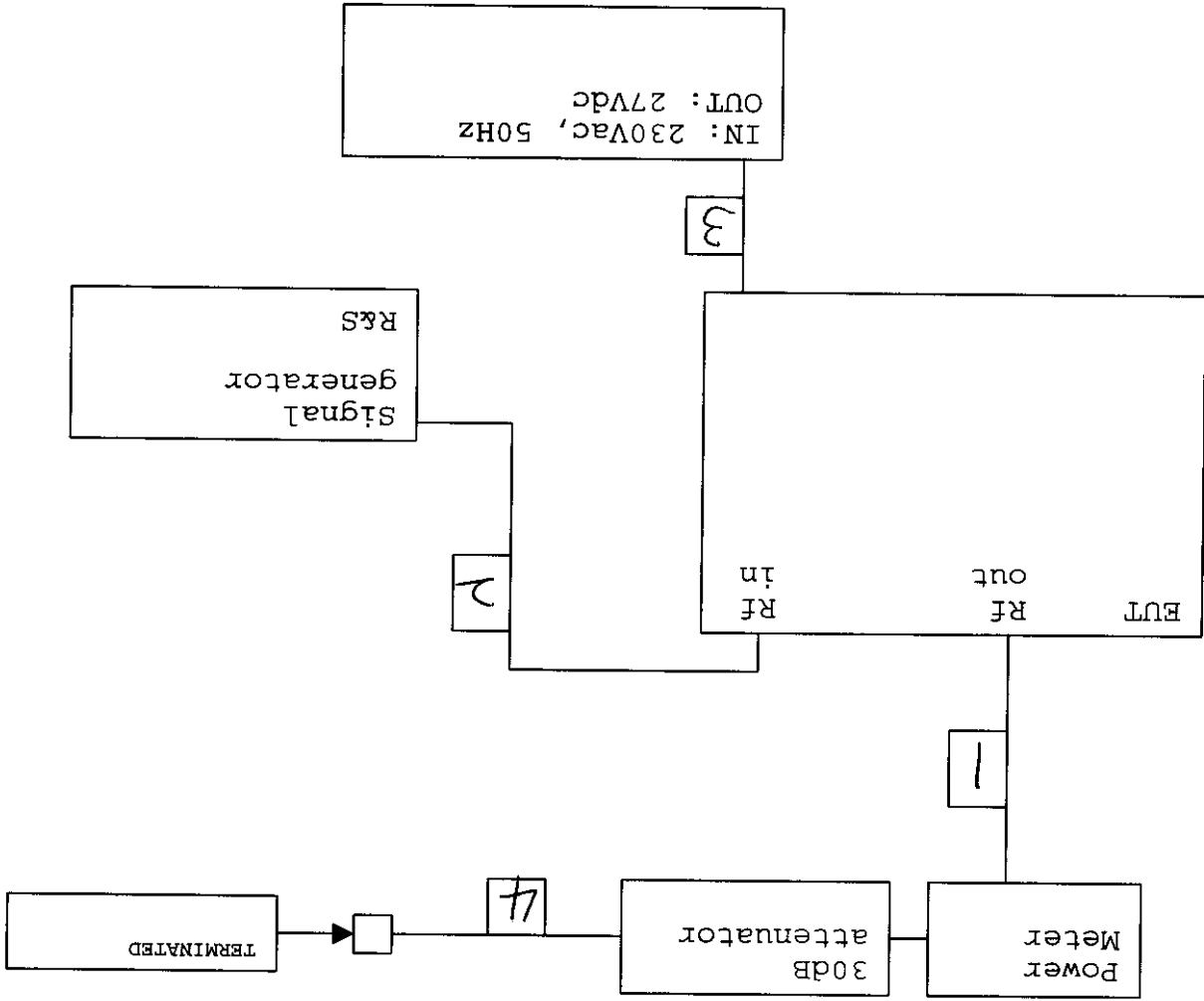
CABLE NO:4	
I/O Port: ATTENUATOR RF-OUT	Number of I/O ports of this type:1
Number of Conductors: 2	Connector Type: N TYPE TO SMA
Capture Type: SCREW-IN	Type of Cable used: SHIELEDDED
Cable Connector Type: METAL	Cable Length:1.5M
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: Terminated	

CABLE NO:5	
I/O Port: SIGNAL TO COMBINER	Number of I/O ports of this type:3
Number of Conductors: 2	Connector Type: SMA
Capture Type: SCREW-IN	Type of Cable used: SHIELEDDED
Cable Connector Type: METAL	Cable Length: 1M
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

CABLE NO:6	
I/O Port: SIGNAL TO COMBINER	Number of I/O ports of this type:1
Number of Conductors: 2	Connector Type: SMA
Capture Type: SCREW-IN	Type of Cable used: SHIELDED
Cable Connector Type: METAL	Cable Length: 1M
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

18. CONFIGURATION BLOCK DIAGRAM# 2 (TWO TONES TESTS, DIRECT CONNECTION)





17. CONFIGURATION BLOCK DIAGRAM# 1 (RADIATED EMISSION TESTS)