

**FCC CFR47 PART 24 SUBPART E BROADBAND**

**FCC Class II Permissive Change Filing Report**

***FOR***

**1930-1990MHz GSM/EDGE POWER AMPLIFIER (100W)**

**MODEL: SPA9329-35N**

**FCC ID: E675JS0062**

**REPORT NUMBER: 03U2072-1**

**ISSUE DATE: 07/02/2003**

*Prepared for*  
**POWERWAVE TECHNOLOGIES, INC.**  
**1117 WINDFIELD WAY, SUITE 100**  
**EL DORADO HILLS**  
**CA 95762**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES**  
**561F Monterey Road**  
**Morgan Hill, CA 95037**  
**U.S.A.**  
**TEL: (408) 463-0885**  
**FAX: (408) 463-0888**



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## 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** POWERWAVE TECHNOLOGIES, INC.  
1117 WINDFIELD WAY, SUITE 100  
EL DORADO HILLS, CA 95762

**EUT DESCRIPTION:** 1930-1990MHz GSM/EDGE POWER  
AMPLIFIER (100W)

**MODEL NUMBER:** SPA9329-35N

**DATE TESTED:** JUNE 30, 2003 – JULY 02, 2003

EQUIPMENT TYPE	INTENTIONAL RADIATOR 1930-1990 MHz (part 24)
MEASUREMENT PROCEDURE	ANSI 63.4 / 2001, TIA/EIA 603
PROCEDURE	FCC Class II Permissive Change
FCC RULE	CFR 47 PART 24 Subpart E

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 24 Subpart E-Broadband PCS. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit. **Note:** This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Test By:



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VIEN TRAN / FRANK IBRAHIM  
EMC TECHNICIAN / EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

Released For CCS By:



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THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

## **2. FCC CLASS II PERMISSIVE CHANGE FILING**

The amplifier operates in the frequency range of 1930 – 1990 MHz. The linear amplifier is capable of handling GSM/EDGE modulation with a maximum power of 97.72 Watts.

Reason for FCC II filing:

- Change #1      Addition of alarm functions;
- Change #2      Mechanical design changes to improve manufacturability;
- Change #3      Addition of option of operating from –48Vdc.

## **3. FACILITIES, LABORATORY AND ACCREDITATION**

### **3.1. FACILITIES**








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 16.

### **3.2. LABORATORY ACCREDITATION**

The laboratory and associated 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. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2)).

No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

### 3.3. LIST OF ACCREDITATIONS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	FCC Part 15, CISPR 22, AS/NZS 3548, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, CNS 13438	 200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	 R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	 ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	 ELA-171
Taiwan	BSMI	CNS 13438	 SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	 IC2324 A,B,C, and F

\*No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

## 4. CALIBRATION, METHODOLOGY AND UNCERTAINTY

### 4.1. EQUIPMENT 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.

### 4.2. TEST METHODOLOGY

Conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specifications for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Radiated Emission	
30MHz – 200 MHz	+/- 3.3dB
200MHz – 1000MHz	+4.5/-2.9dB
1000MHz – 2000MHz	+4.6/-2.2dB
Power Line Conducted Emission	
150kHz – 30MHz	+/-2.9

Any results falling within the above values are deemed to be marginal.

## 4.4 TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment were utilized for the emission tests documented in this report:

TEST EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Quasi-Peak Adaptor	HP	85650A	2521A01038	7/16/04
SA Display Section 3	HP	85662A	2314A04793	7/16/04
SA RF Section, 1.5 GHz	HP	85680A	2314A02604	11/26/03
Antenna, Log Periodic 200 ~ 1000 MHz	EMCO	3146	9107-3163	3/6/04
Antenna, Biconical	Eaton	94455-1	1214	3/6/04
Preamplifier, 1300 MHz	HP	8447D	2944A06550	8/22/03
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	9/6/03
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	837990	9/6/03
Line Filter	Lindgren	LMF-3489	497	CNR
EMI Test Receiver	R & S	ESHS 20	827129/006	7/17/04
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	2/4/04
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	9001-3245	2/4/04
Spectrum Analyzer	Agilent	8564EC	8212	5/13/05
Signal Generator	HP	83732B	US3449059	3/29/04
Amplifier	Miteq	NSP2600-SP	924342	4/25/04

## 5. APPLICABLE RULES

### 5.1. RF POWER OUTPUT §2.1046

#### § 24.232- POWER LIMIT

§24.232(a) Maximum Peak output power for base station transmitters should not exceed 100 Watts EIRP (equivalent isotropically radiated power).

§24.232(b) Mobile stations are limited to 2 Watts EIRP.

### 5.2. MODULATION CHARACTERISTICS §2.1047

Not applicable; EUT is an amplifier.

### **5.3. OCCUPIED BANDWIDTH §2.1049**

§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.

### **5.4. SPURIOUS EMISSIONS AT ANTENNA TERMINALS §2.1051**

#### **§ 24.238- EMISSION LIMITS**

§24.238(a) The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be less than  $43+10 \log$  (mean output power in watts) dBc below the mean power output outside a licensee's frequency block (-13dBm).

### **5.5. FIELD STRENGTH OF SPURIOUS RADIATION §2.1053**

#### **§ 24.238- EMISSION LIMITS**

§24.238(a) The magnitude of each spurious and harmonic emission that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be less than  $43+10 \log$  (mean output power in watts) dBc below the mean power output outside a licensee's frequency block (-13dBm).

### **5.6. FREQUENCY STABILITY §2.1055**

Not Applicable ; EUT is an amplifier.

## 5.7 FREQUENCY RANGE TO BE INVESTIGATED §2.1057

§2.1057(a) In all of the measurements set forth in §2.1051 and §2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.

§2.1057(b) Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

§2.1057(c) The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be reported.

§2.1057(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

Spec limit: Frequency investigation range from 30 MHz to 20 GHz.

**5.8. RADIATED EMISSIONS, FCC PART 15, SECTIONS 109**Radiated Emissions Limits:

<b>Radiated Emission Technical Requirements For Class A Device</b>		
<b>Frequency (MHz)</b>	<b>FCC limits @ 10 meter Quasi-Peak/dBuV/m</b>	<b>CISPR 22 limits @10 meter Quasi-Peak/dBuV/m</b>
30 – 88	39.0	40
88 - 216	43.5	40
216 - 230	46.4	40
230 - 960	46.4	47
960 - 1000	49.5	47
Above 1000	49.5	N/A

Conducted Emissions Limits:

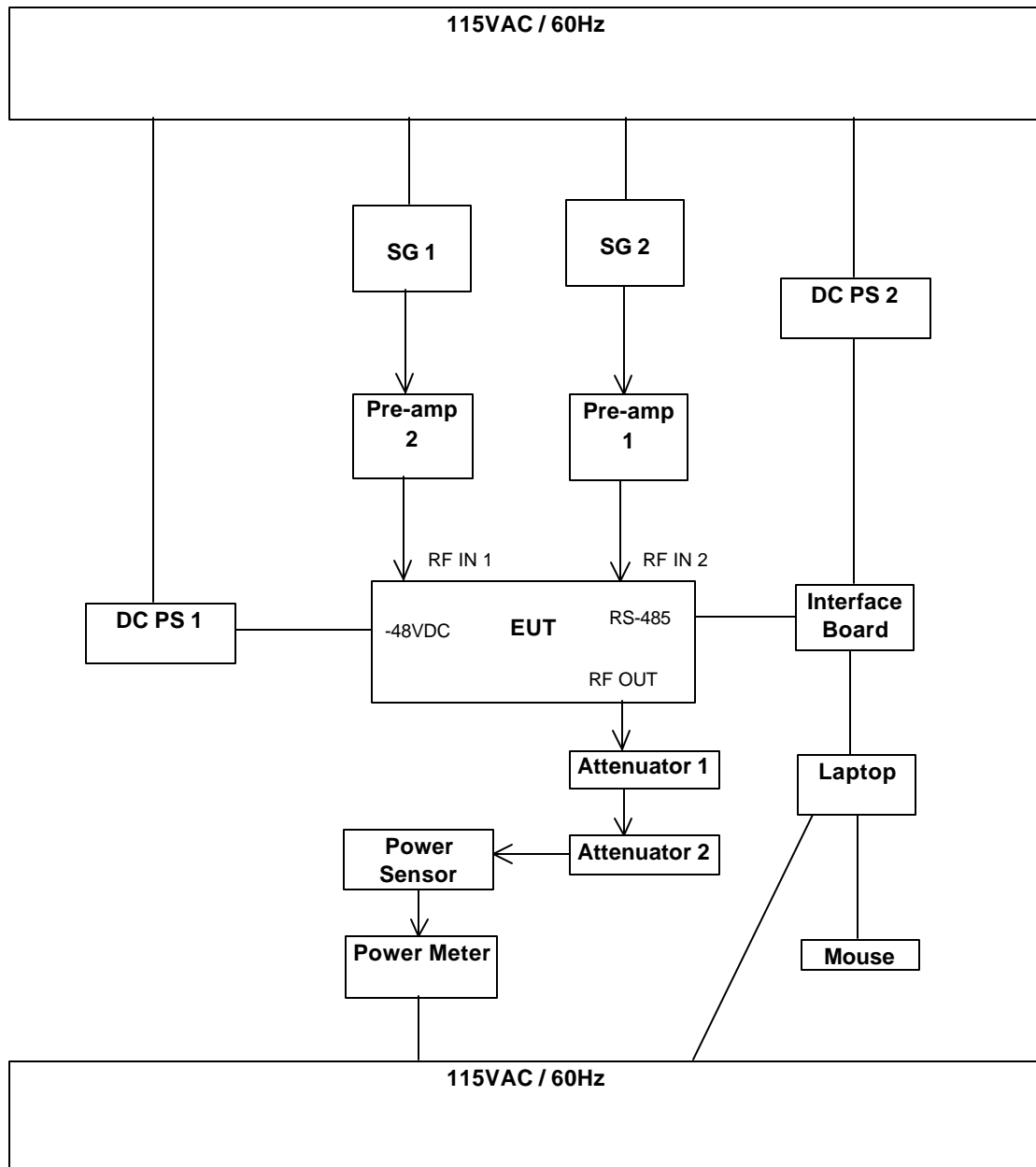
<b>Conducted Emission Technical Requirements For Class A Device</b>		
<b>Frequency (MHz)</b>	<b>FCC &amp; CISPR22 limits Quasi- Peak/dBuV</b>	<b>FCC &amp; CISPR22 limits Average/dBuV</b>
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5.0	56	46
5.0 - 30	60	50

\* Limit decreases linearly with Log (f)

## 6. TEST SETUP, PROCEDURES, AND RESULTS

### 6.1.1 RF CONDUCTED POWER OUTPUT

#### TEST SETUP



TEST PROCEDURE

The EUT was connected to two signal generators, output signals from the signal generators were injected to the EUT to make sure the amplifier was operated at rated power, the reading at the power meter was confirmed to be 49.9 dBm.

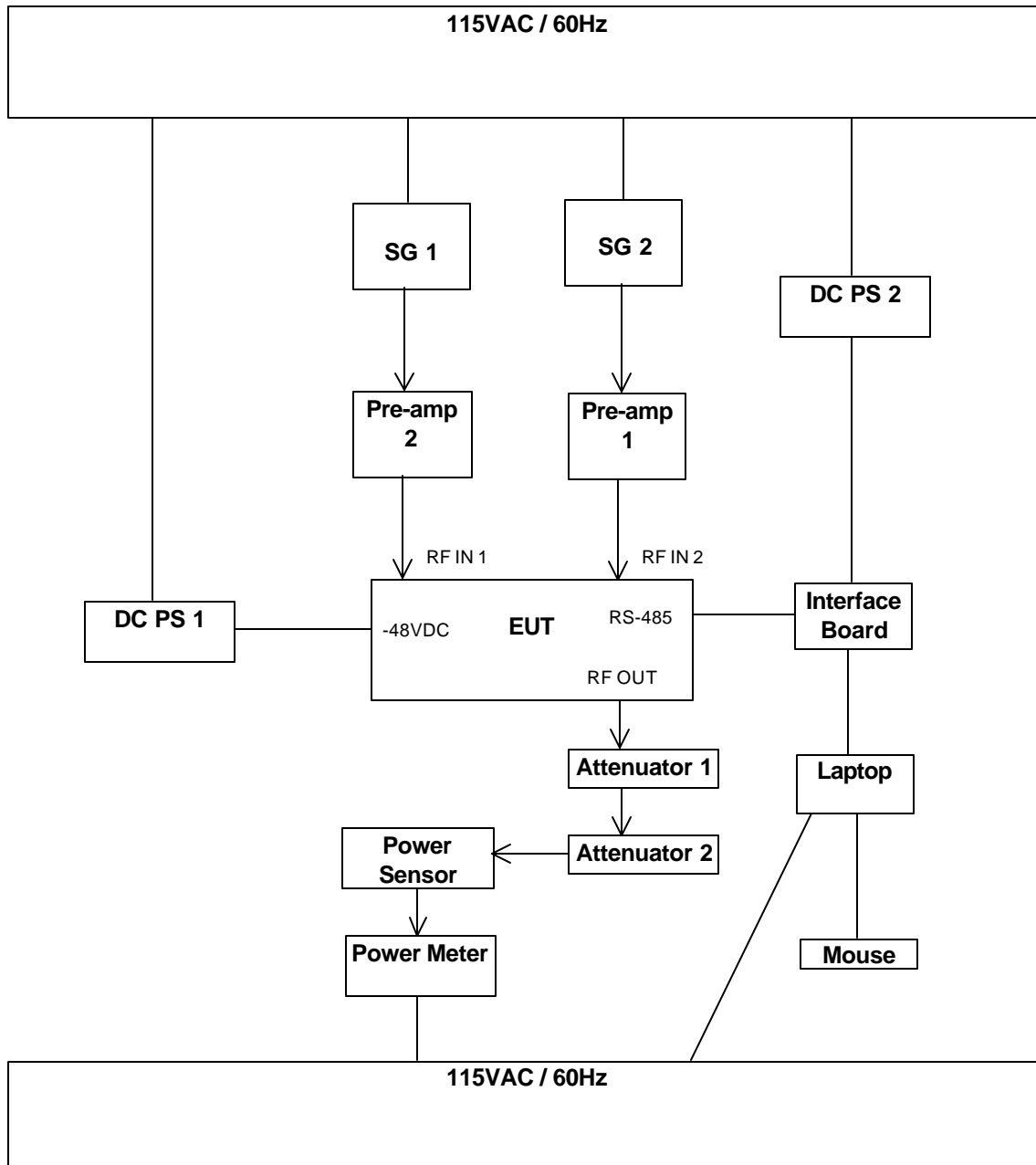
RESULT

No non-compliance noted, see table below.

Channel	Frequency, Modulation	AV Conducted Output Power (dBm)	PK Conducted Output Power (dBm)	Limit AV Power (dBm)	Margin (dB)
Low	1.930, GSM	49.90	52.71	50	-0.1
Middle	1.960, GSM	49.90	52.83	50	-0.1
High	1.990, GSM	49.90	51.86	50	-0.1
Low	1.930, EDGE	49.90	55.08	50	-0.1
Middle	1.960, EDGE	49.90	55.09	50	-0.1
High	1.990, EDGE	49.90	55.08	50	-0.1

## 6.1.2 RF RADIATED POWER OUTPUT

### TEST SETUP



TEST PROCEDURE:

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 1.0m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or average detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- 5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 6). The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- 7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 8). The maximum signal level detected by the measuring receiver shall be noted, use 1MHz setting for RBW and VBW.
- 9). The transmitter shall be replaced by a substitution antenna.
- 10). The substitution antenna shall be oriented for vertical polarization.
- 11). The substitution antenna shall be connected to a calibrated signal generator.
- 12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- 13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- 14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- 15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- 16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
- 17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.

RESULT

This test is not applicable as the EUT is an RF Amplifier and does not include an antenna.

## **6.2. OCCUPIED BANDWIDTH**

Not Applicable; FCC CLASS II change.

### **6.3. SPURIOUS EMISSIONS AT ANTENNA TERMINAL**

Not Applicable; FCC CLASS II change.

## 6.4 FIELD STRENGTH OF SPURIOUS RADIATION

Detector Function Setting of Test Receiver

Frequency Range (MHz)	Detector Function	Resolution Bandwidth	Video Bandwidth
Above 1000	<input checked="" type="checkbox"/> Peak <input type="checkbox"/> Average	<input checked="" type="checkbox"/> 1 MHz <input type="checkbox"/> 1 MHz	<input checked="" type="checkbox"/> 1 MHz <input type="checkbox"/> 10 Hz

### TEST SETUP

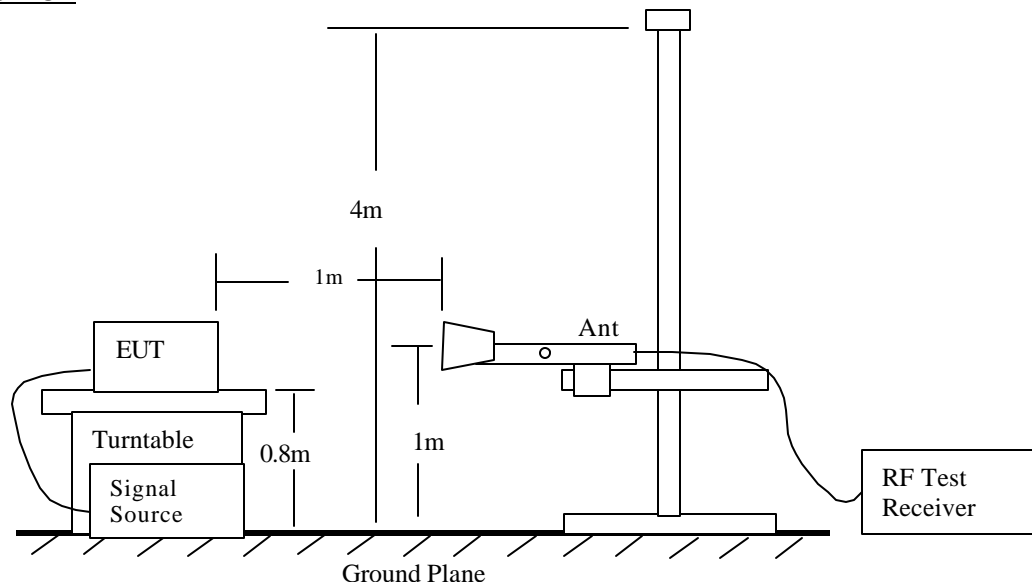


Fig 1: Radiated Emission Measurement

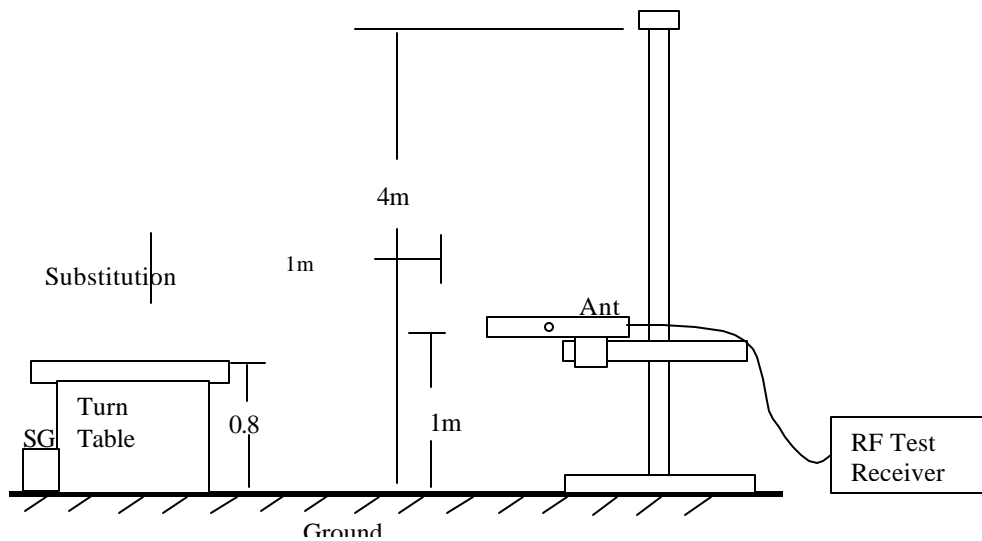


Fig 2: Radiated Emission – Substitution Method set-up

#### TEST PROCEDURE

- 1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- 2). The test antenna shall be oriented initially for vertical polarization located 1.2m from the EUT to correspond to the frequency of the transmitter.
- 3). The output of the test antenna shall be connected to the measuring receiver and either a peak or average detector was used for the measurement as indicated on the report. The detector selection is based on how close the emission level was approaching the limit.
- 4). The transmitter shall be switched on, if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- 5). The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 6). The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- 7). The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- 8). The maximum signal level detected by the measuring receiver shall be noted, set RBW and VBW to 1MHz.
- 9). The transmitter shall be replaced by a substitution antenna.
- 10). The substitution antenna shall be oriented for vertical polarization.
- 11). The substitution antenna shall be connected to a calibrated signal generator.
- 12). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.

- 13). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- 14). The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver.
- 15). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
- 16). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.
- 17). The measure of the effective radiated power is the larger of the two levels recorded, at the input to the substitution antenna, corrected for the gain of the substitution antenna if necessary.

#### RESULT

No non-compliance noted:

07/02/03      **High Frequency Substitution Measurement**  
**Compliance Certification Services, Morgan Hill Open Field Site**

**Test Engr:** Frank Ibrahim  
**Project #:** 03U2072-1  
**Company:** Powerwave Technologies  
**EUT Descrip.:** 1930-1990 MHz 100W Power Amplifier  
**EUT M/N:** SPA9392-70N  
**Test Target:** FCC PART 24  
**Mode Oper:** EUT amplifying 2 signals at full load

**Test Equipment:**

<b>EMCO Horn 1-18GHz</b>	<b>Pre-amplifier 1-26GHz</b>	<b>Spectrum Analyzer</b>	<b>Horn &gt; 18GHz</b>	<b>Limit</b>
T73: S/N: 6717 @ 1m	187 Mitea 924342	Agilent 8564E Analyzer	T117: ARA 18-26GHz: S/N:1013	

Hi Frequency Cables

<input type="checkbox"/> (2 ft)	<input type="checkbox"/> (2 ~ 3 ft)	<input checked="" type="checkbox"/> (4 ~ 6 ft)	<input type="checkbox"/> (12 ft)
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Bandedge:  
RBW=>1% Emissions BW  
VBW=> 3\*RBW

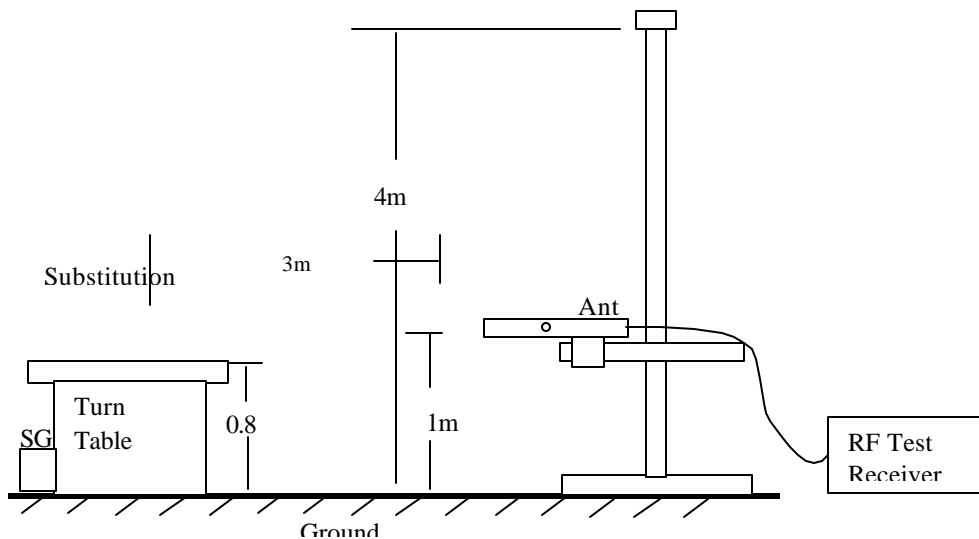
Spurious  
RBW=1MHz  
VBW=1MHz

f GHz	SA reading (dBm)	SG reading (dBm)	CL (dB)	Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Notes
<b>Low Channel</b>								
15.500	64.8	-64.0	1.9	14.9	-51.0	-13.0	-38.0	V, Spurious
<b>Mid Channel</b>								
15.700	63.3	-65.7	1.9	15.2	-52.3	-13.0	-39.3	V, Spurious
<b>High Channel</b>								
15.900	64.3	-64.4	1.9	15.6	-50.7	-13.0	-37.7	V, Spurious
<b>Low Channel</b>								
15.500	64.8	-64.7	1.9	14.9	-51.7	-13.0	-38.7	H, Spurious
<b>Mid Channel</b>								
15.700	61.5	-67.6	1.9	15.2	-54.2	-13.0	-41.2	H, Spurious
<b>High Channel</b>								
15.500	64.5	-64.5	1.9	14.9	-51.5	-13.0	-38.5	H, Spurious

**Note:** EUT scanned 1-20 GHz, no other signals found

## 6.5. RADIATED EMISSIONS, FCC PART 15, SECTIONS 209

### TEST SETUP



### Test Procedures

The EUT was placed on a wooden table 80 cm above the ground screen. The antenna to EUT distance was 3 meters from the leading edge of the turntable to the antenna for the frequency range of 30-1000 MHz, and 1m from the center of the EUT to the horn antenna for the frequency range of 1-20 GHz. During the test, the table was rotated 360 degrees to maximize emissions and the antenna was positioned from 1 to 4 meters above the ground screen to further maximize emissions. Measurements were made with the antenna polarized in both the vertical and the horizontal positions.

The EUT test configuration was according to Section 8 of ANSI C63.4.

The following procedure was used to make the measurements: The frequency range of interest was monitored at a fixed antenna height and EUT azimuth. The Frequency span was set small enough to easily differentiate between broadcast stations, intermittent ambient signals and EUT emissions. The EUT was rotated through 360 degrees to maximize emissions received. During the rotation if emission increased by more than 1 dB, or if another emission appeared that was greater by 1 dB, the EUT was returned to the azimuth where the maximum occurred, and additional cable manipulation was performed to further maximize received emissions.

The antenna was moved up and down to further maximize the suspected highest amplitude signal. If the emission increased by 1 dB or more, or if another emission appeared that was greater by 1dB or more, the antenna was returned to the height where maximum signal was observed, and, cables were manipulated to produce highest emissions, noting frequency and amplitude.

#### RESULT

No non-compliance noted:



FCC, VCCI, CISPR, CE, AUSTEL, NZ  
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001  
PHONE: (408) 463-0885 FAX: (408) 463-0888

**Project #:** 03U2072-1  
**Report #:** 030701A01  
**Date & Time:** 07/01/03 9:43 AM  
**Test Engr:** Frank Ibrahim

**Company:** Powerwave Technologies  
**EUT Description:** 1930-1990 MHz 100W Power Amplifier, model: SPA9329-70N  
**Test Configuration :** EUT, 2 SG, 2 Pre-amplifiers, 2 Attenuators, 2 DC PS, Power Sensor, Power Meter, Laptop, Mouse  
**Type of Test:** FCC CLASS A  
**Mode of Operation:** EUT amplifying 1960 and 1962 MHz signals at full load

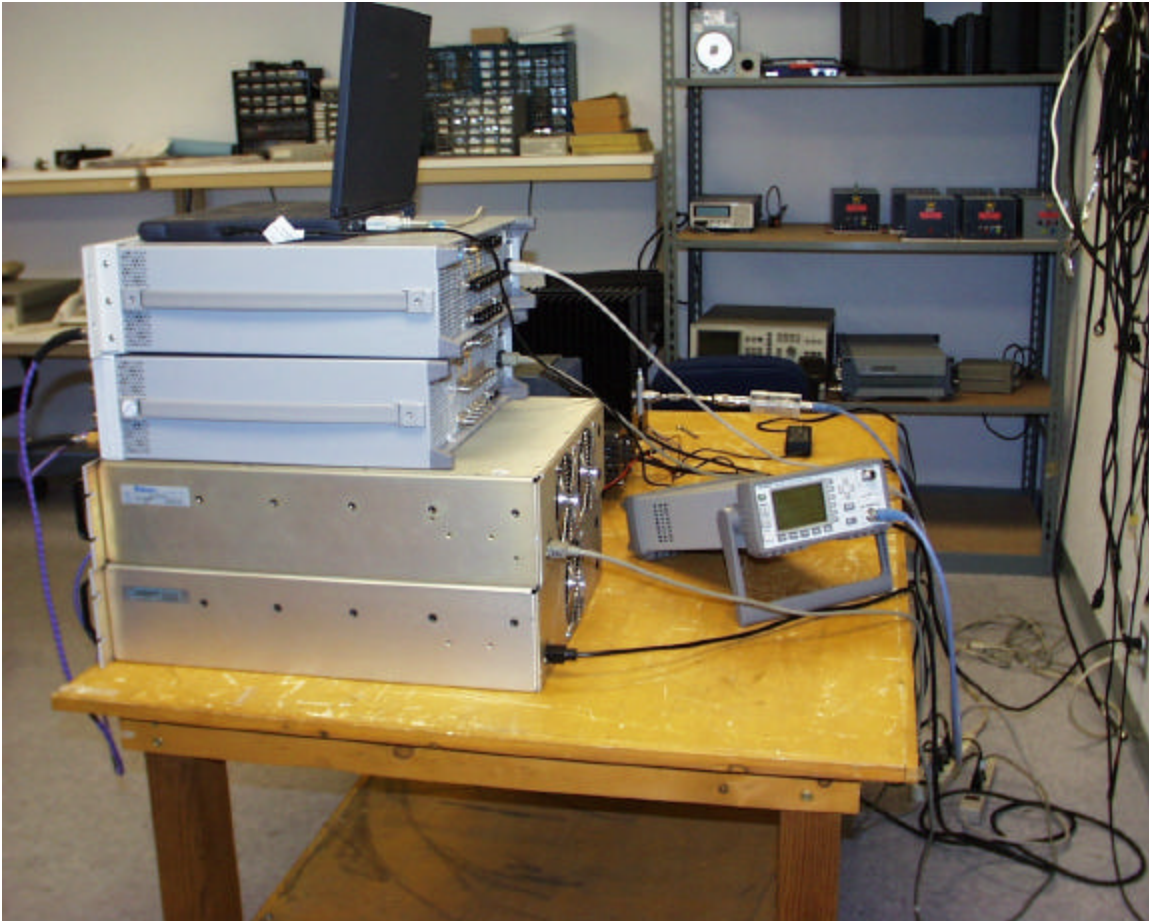
☒ A-Site ☐ B-Site ☐ C-Site ☐ F-Site

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit FCC A	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
66.30	48.00	6.36	1.30	27.01	28.65	39.10	-10.45	10mV	0.00	1.00	P
169.70	47.00	15.98	2.05	26.75	38.28	43.50	-5.22	10mV	0.00	1.00	P
235.00	52.30	11.76	2.42	26.57	39.92	46.40	-6.48	10mV	0.00	1.00	P
233.00	37.80	11.70	2.41	26.57	25.34	46.40	-21.06	10mH	0.00	1.00	P
240.00	49.80	11.92	2.46	26.55	37.63	46.40	-8.77	10mH	0.00	3.00	P
454.00	34.50	16.74	3.41	27.51	27.14	46.40	-19.26	10mH	0.00	1.00	P
EUT scanned vertically and horizontally 30-1000 MHz											
Total data #: 6											

## 7. ATTACHMENT

### 7.1 EUT SETUP PHOTOS

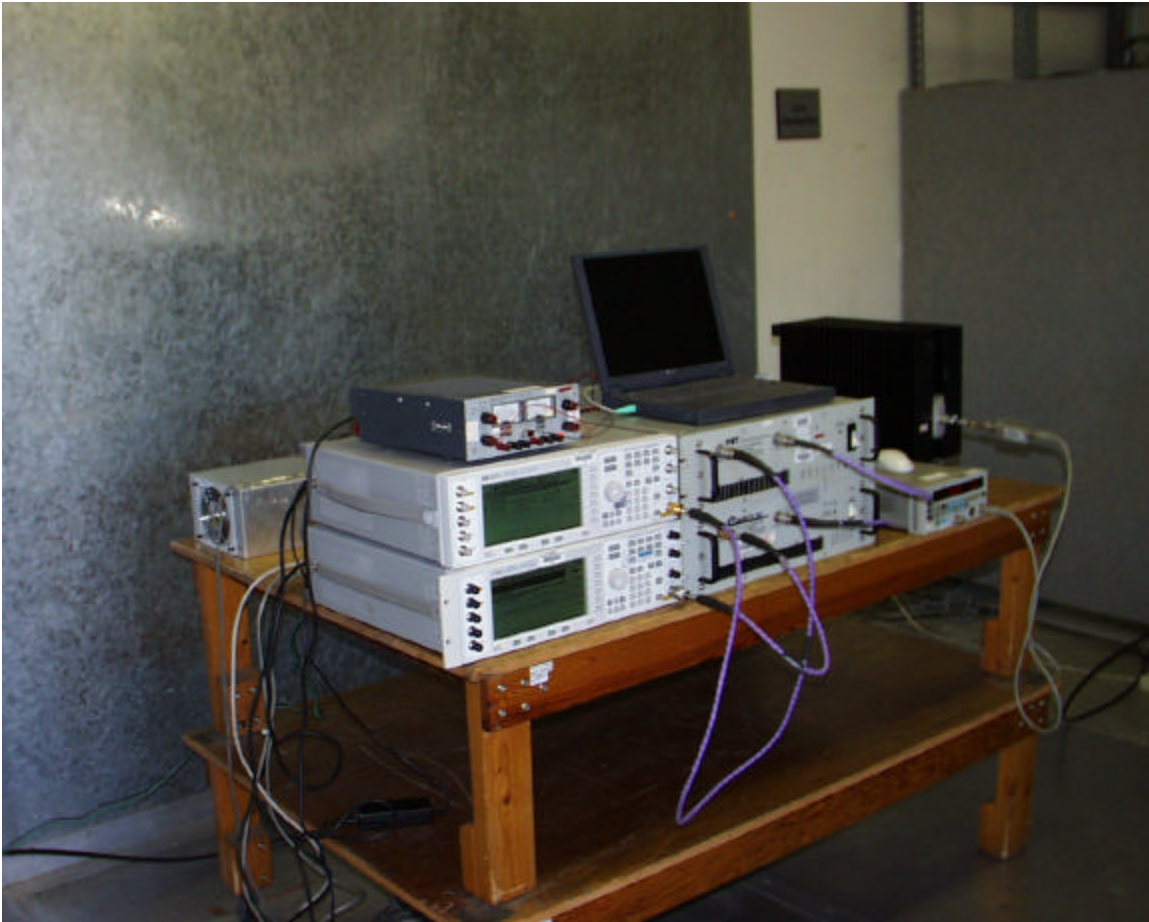
#### CONDUCTED RF MEASUREMENTS



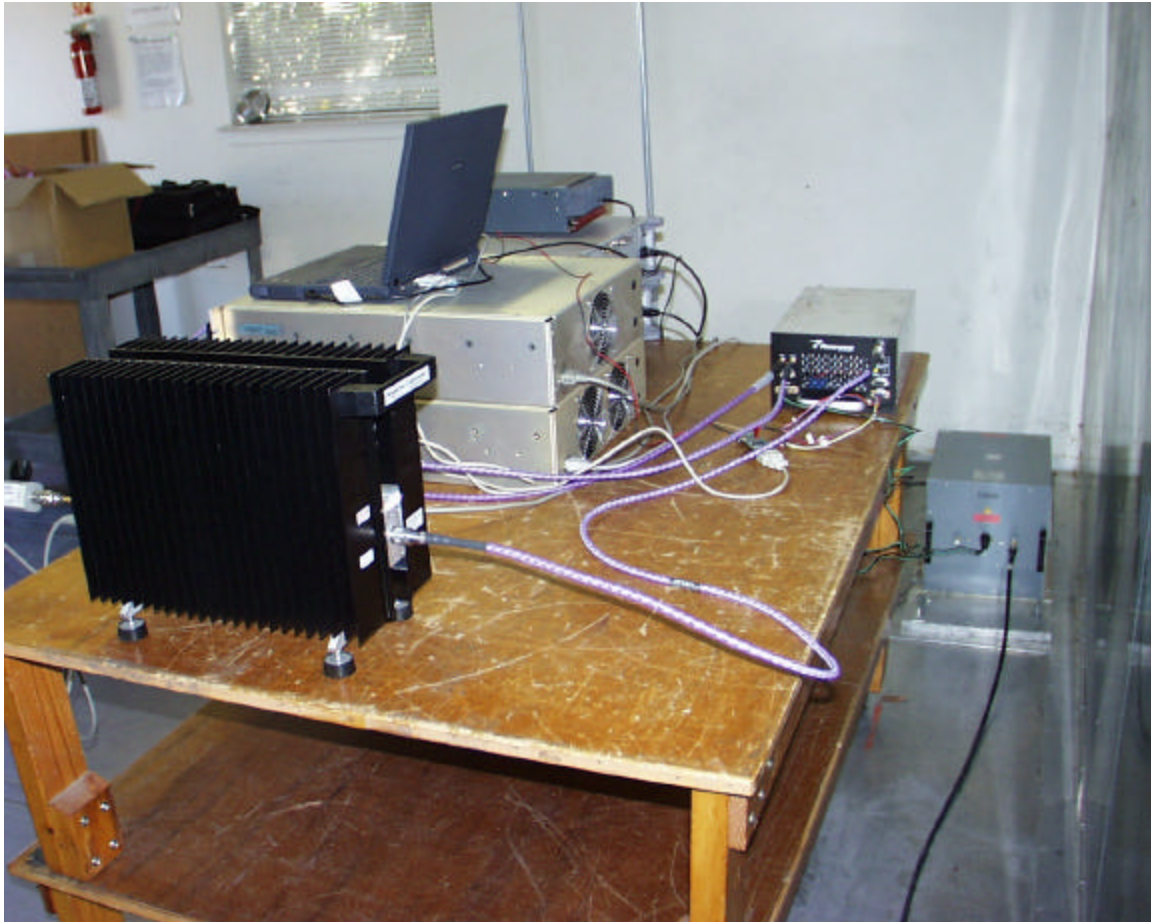
### **RADIATED EMISSIONS, FRONT**



**RADIATED EMISSIONS, BACK**

**POWER LINE CONDUCTED EMISSIONS, FRONT**

## **POWER LINE CONDUCTED EMISSIONS, BACK**



**END OF REPORT**