

FCC CFR47 PART 22 CERTIFICATION

TEST REPORT

FOR

869-894MHz SINGLE-CHANNEL GSM/EDGE AMPLIFIER

MODEL: SCA9321-30C

FCC ID: E675JS0064

REPORT NUMBER: 03U1803-1

ISSUE DATE: MARCH 11, 2003

Prepared for
POWERWAVE TECHNOLOGIES, INC.
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NVLAQ[®]
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.
1801 E. St. ANDREW PLACE
SANTA ANA, CA 92705

Contact person: CLINT LAWRENCE
Telephone number: (916) 941-3167

2.1033(c)(2) FCC ID: E675JS0064

2.1033(c)(4) Types of Emissions: G7W (EDGE), GXW (GSM)

2.1033(c)(5) Frequency Range: 869 – 894 MHz

2.1033(c)(6) Range of Operation Power: 30Watts

2.1033(c)(7) Maximum Power Rating: 30 Watts

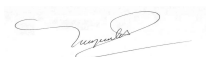
2.1033(c)(8) DC Voltage and DC Current: -48Vdc @ 2.9 A; typical

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

TYPE OF EQUIPMENT:	CELLULAR AMPLIFIER
MEASUREMENT DISTANCE:	3 METER
TECHNICAL LIMIT:	FCC 22.359, 22.917
FCC RULES:	PART 22
EQUIPMENT AUTHORIZATION PROCEDURE	CERTIFICATION / PERMISSIVE CHANGE
MODIFICATIONS MADE ON EUT	<input type="checkbox"/> YES (REFER TO PAGE 5) <input checked="" type="checkbox"/> 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.

TESTED BY:



REVIEWED and RELEASED BY:



VIEN TRAN
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

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

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 dB μ V 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 dB μ V/m. The 32 dB μ V/m value was mathematically converted to its corresponding level in μ V/m.

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

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

7. EQUIPMENT MODIFICATIONS

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

No changes were required in order to achieve compliance to FCC Part 22.

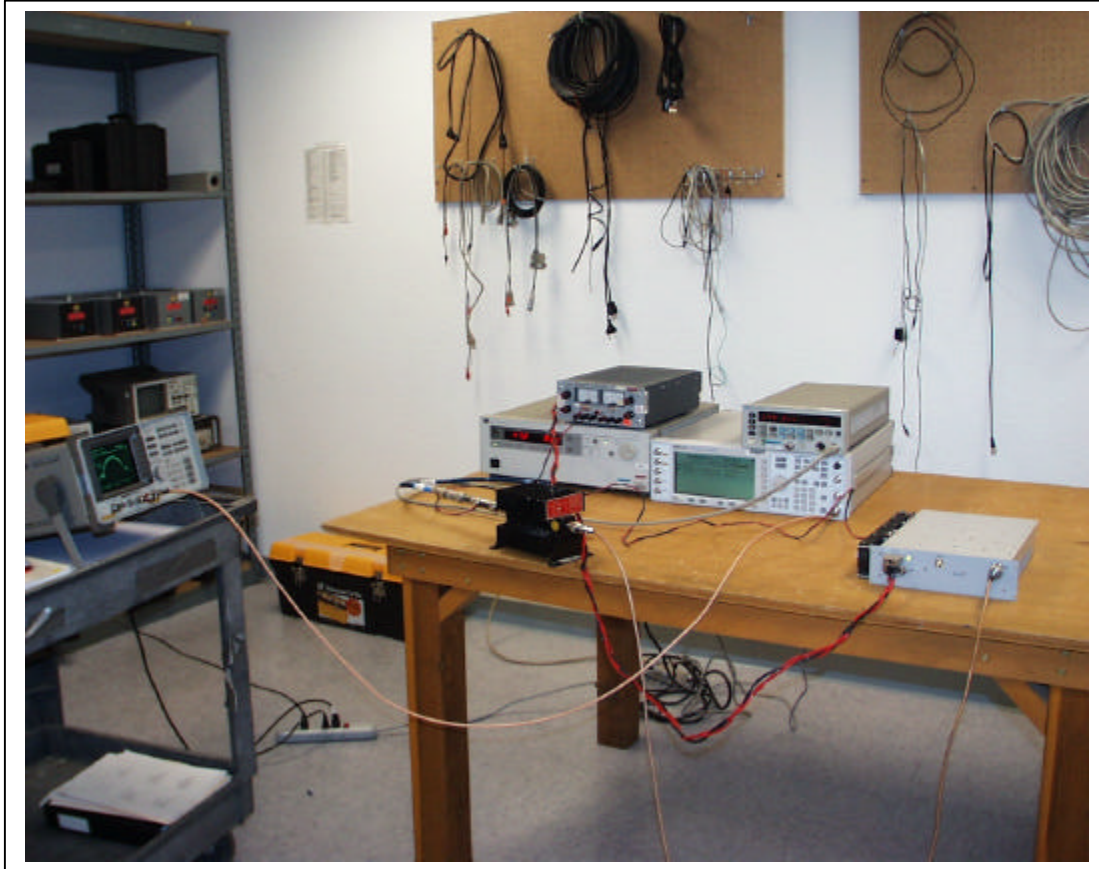
8. TEST EQUIPMENT LIST

TEST EQUIPMENT LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
LISN, 10 kHz ~ 30 MHz	FCC	50/250-25-2	114	9/6/2003
Line Filter	Lindgren	LMF-3489	497	NCR
LISN, 10 kHz ~ 30 MHz	Solar	012-50-R-24-BN	837990	9/6/2003
EMI Test Receiver	R & S	ESHS 20	827129/006	4/17/2003
SA RF Section, 22 GHz	HP	85660B	2140A01296	5/23/2003
Quasi-Peak Adaptor	HP	85650A	2811A01335	5/23/2003
Preamplifier, 1300 MHz	HP	8447D	2944A06833	8/22/2003
Antenna, Log Periodic 200 ~ 1000 MHz	EMCO	3146	2120	3/29/2003
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	NCR
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6739	2/4/2004

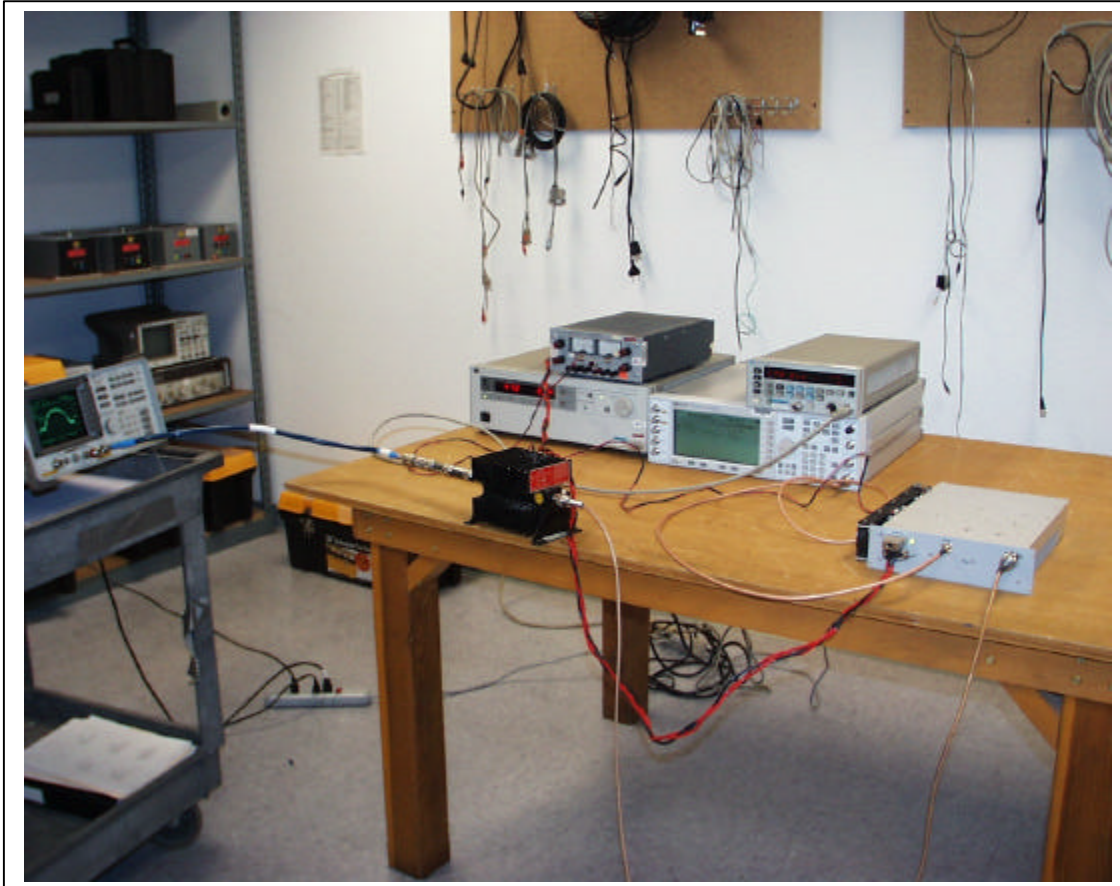
8a. SUPPORT EQUIPMENT

Device Type	Manufacturer	Model Number	Serial No.	CAL Due Date
SIGNAL GENERATOR	HP	E4431B	US39340352	11/14/03
HIGH POWER ATTENUATOR	NARDA	769.30	04983	N/A
POWER SUPPLY	HP	6032A	3510A-11129	7/31/03
POWER METER	HP	438A	3048U06458	9/30/03
POWER SENSOR	HP	8481A	2349A39834	9/13/04
DIRECTIONAL COUPLER	NARDA	4226-20	02404	N/A

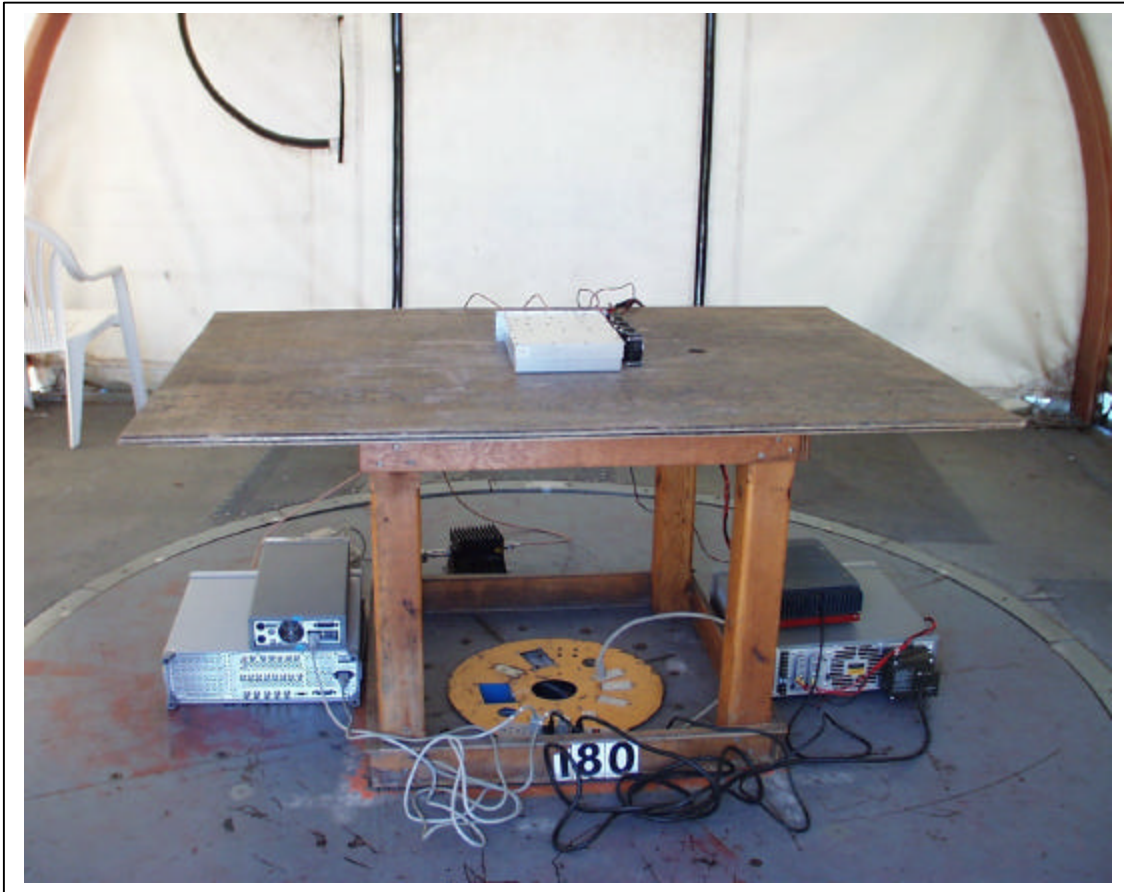
9. EUT SETUP PHOTOS



Occupied Bandwidth Input Setup



Occupied Bandwidth Output Setup

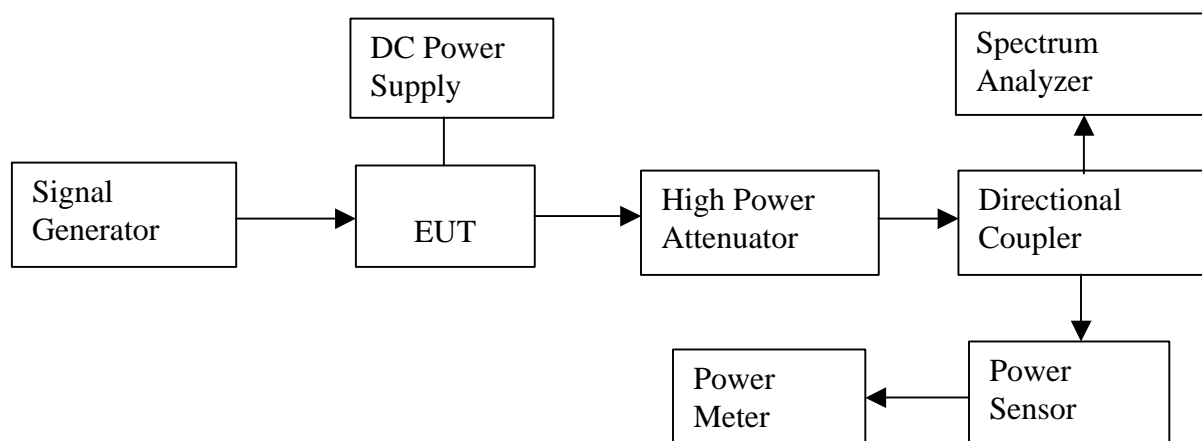


Radiated Emission Setup

10. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

CABLE NO: ALL	
I/O Port: INPUTS/OUTPUTS	Number of I/O ports of this type: ALL
Number of Conductors: 2	Connector Type: N TYPE and SMA
Capture Type: SCREW-IN	Type of Cable used: SHIELDED
Cable Connector Type: METAL HOOD	Cable Length: 0.4 ~ 1.5 meter
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: N/A	

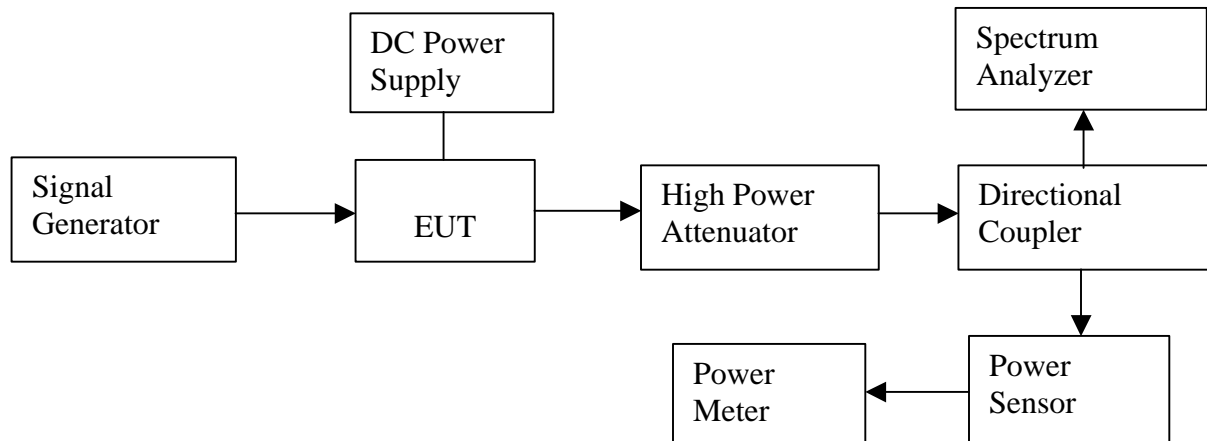
11. CONFIGURATION BLOCK DIAGRAM



12. PART 2: CERTIFICATION TEST REQUIREMENT:

SECTION 2.1046: RF POWER OUTPUT

TEST SETUP:



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:

The EUT was setup as shown above. The EUT was setup according to the manufacturer's tune-up procedure to give maximum output power of 30 Watts.

Test Result:

The EUT's measured output power was 30 Watts. See below attached plots.

UNIT MODEL NUMBER: SCA9321-30C		
Plot#	Description	Frequency (MHz)
1	GSM Power Output @ Low Channel	869.4
2	GSM Power Output @ Mid Channel	881.5
3	GSM Power Output @ High Channel	893.6
4	EDGE Power Output @ Low Channel	869.4
5	EDGE Power Output @ Mid Channel	881.5
6	EDGE Power Output @ High Channel	893.6

03U1803-1 _ POWERWAVE TECHNOLOGIES _ 3/7/03
869-894MHz GSM/EDGE AMPLIFIER (30W)

GSM

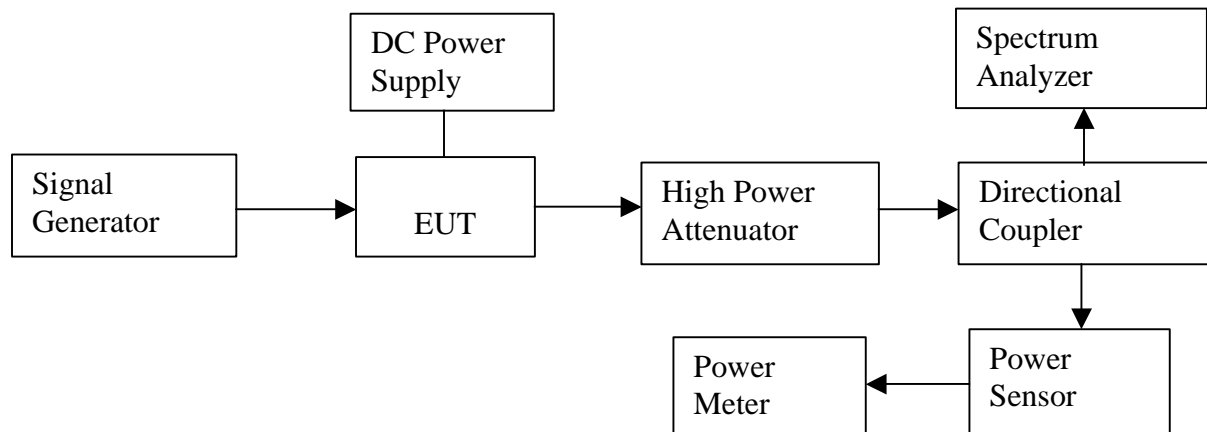
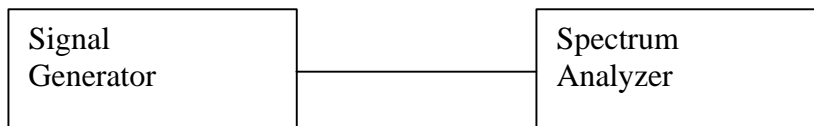
FRQ(MHz)	AVERAGE(dBm)	PEAK(dBm)
869.40	44.79	44.90
881.50	44.80	44.96
893.60	44.79	44.89

EDGE

FRQ(MHz)	AVERAGE(dBm)	PEAK(dBm)
869.40	44.89	48.24
881.50	44.82	48.24
893.60	44.81	48.24

SECTION 2.1047: MODULATION CHARACTERISTICS

Not applicable. EUT is a power amplifier.

SECTION 2.1049: OCCUPIED BANDWIDTH**TEST SETUP FOR OUTPUT:****TEST SETUP FOR INPUT:****Minimum Requirement:****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.

Test Procedure:

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

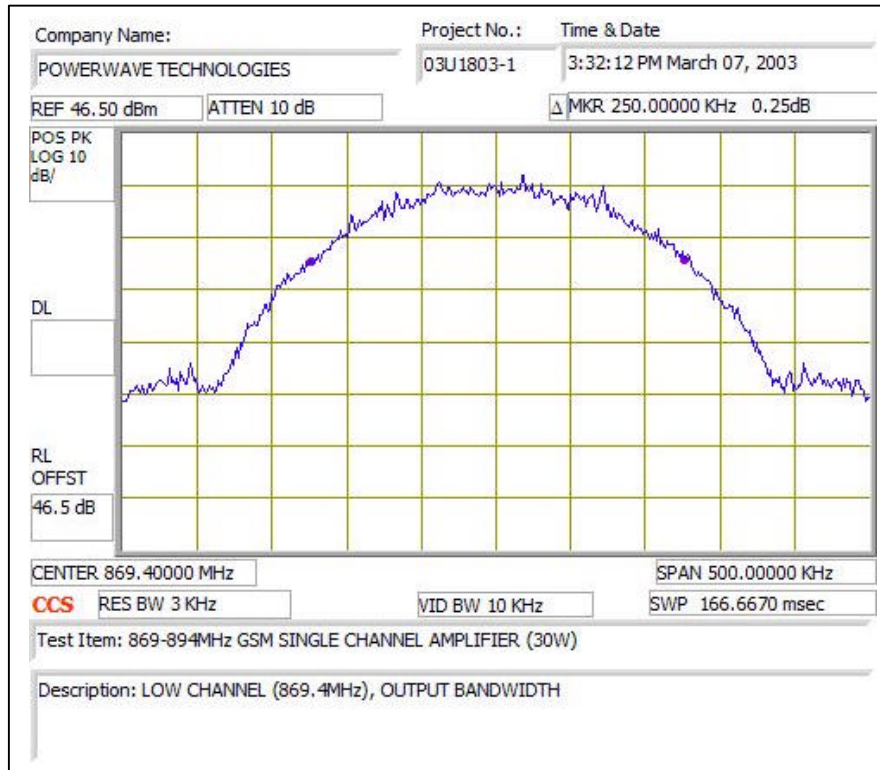
Use the setup for output shown above. Correct for external attenuation and cable loss. Set the power amplifier to the maximum output gain. Using the marker delta function, measure the 20dB bandwidth of the EUT's emission. Record the spectrum analyzer plot.

Use the setup for input shown above. Correct for external attenuation and cable loss. Using the marker delta function, measure the 20dB or 99% bandwidth of the signal generator's emission. Record the spectrum analyzer plot.

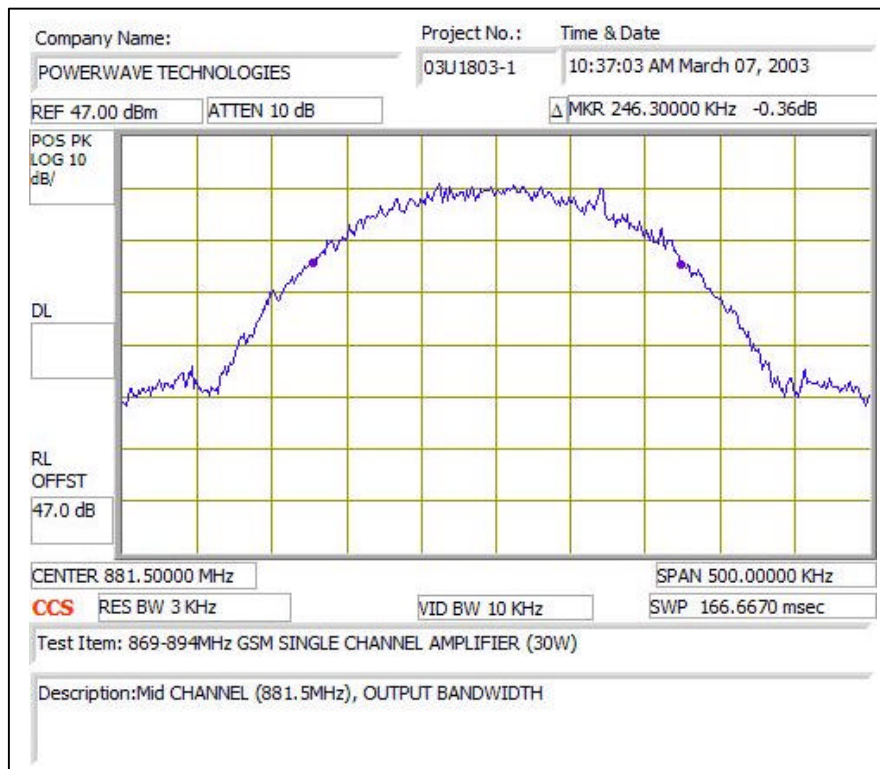
Test Results:

See plots below:

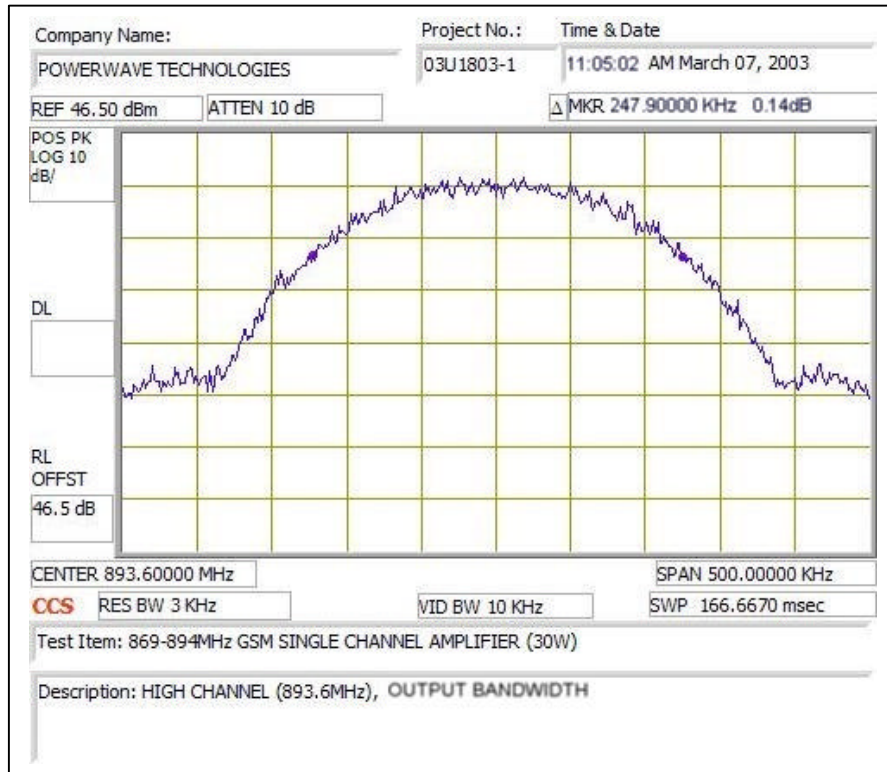
UNIT MODEL NUMBER: SCA9321-30C		
Plot#	Description	Frequency (MHz)
1	GSM 99% Output Bandwidth @ Low Channel	869.4
2	GSM 99% Output Bandwidth @ Mid Channel	881.5
3	GSM 99% Output Bandwidth @ High Channel	893.6
4	GSM 99% Input Bandwidth @ Low Channel	869.4
5	GSM 99% Input Bandwidth @ Mid Channel	881.5
6	GSM 99% Input Bandwidth @ High Channel	893.6
7	EDGE 99% Output Bandwidth @ Low Channel	869.4
8	EDGE 99% Output Bandwidth @ Mid Channel	881.5
9	EDGE 99% Output Bandwidth @ High Channel	893.6
10	EDGE 99% Input Bandwidth @ Low Channel	869.4
11	EDGE 99% Input Bandwidth @ Mid Channel	881.5
12	EDGE 99% Input Bandwidth @ High Channel	893.6



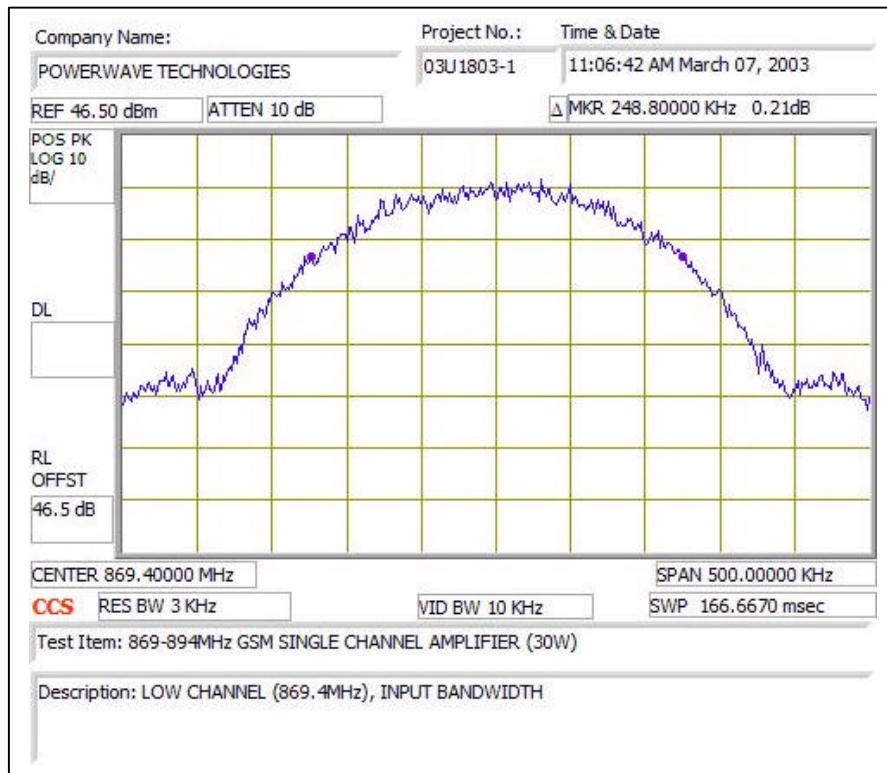
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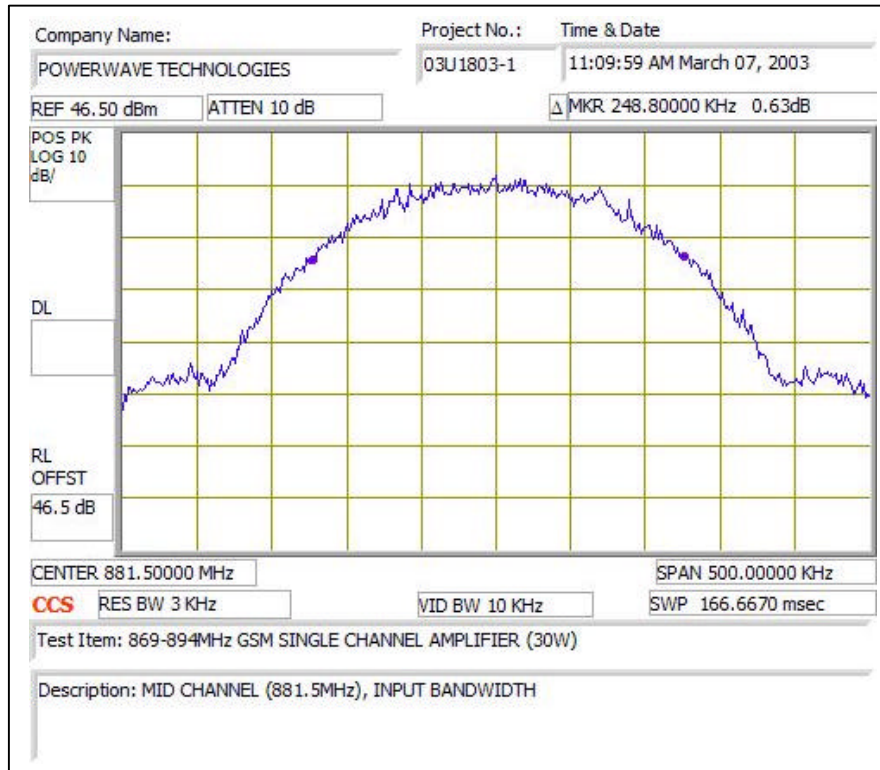
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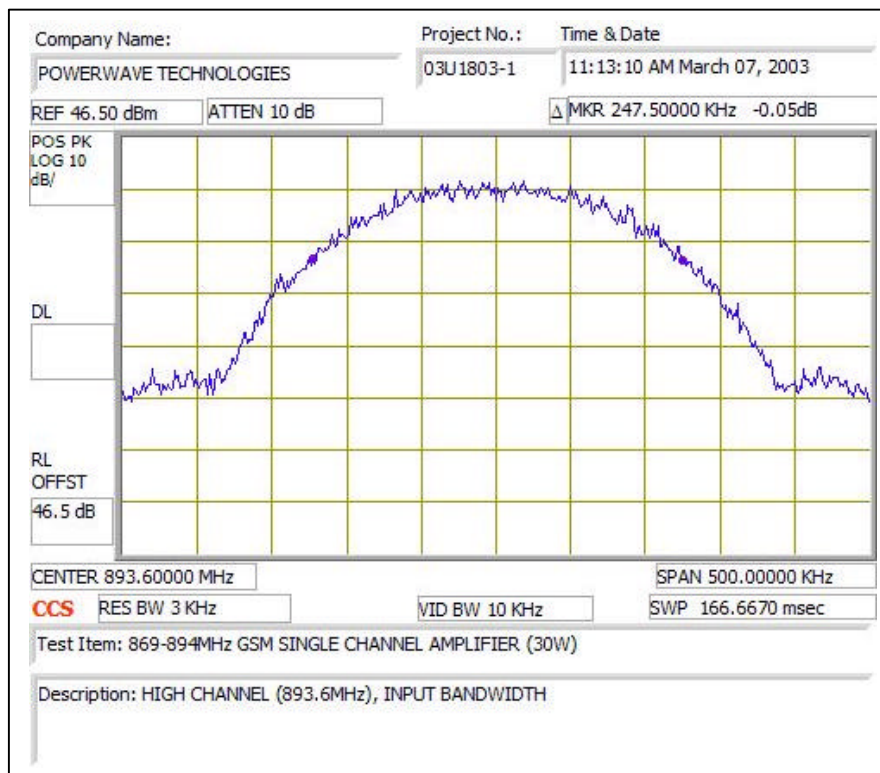
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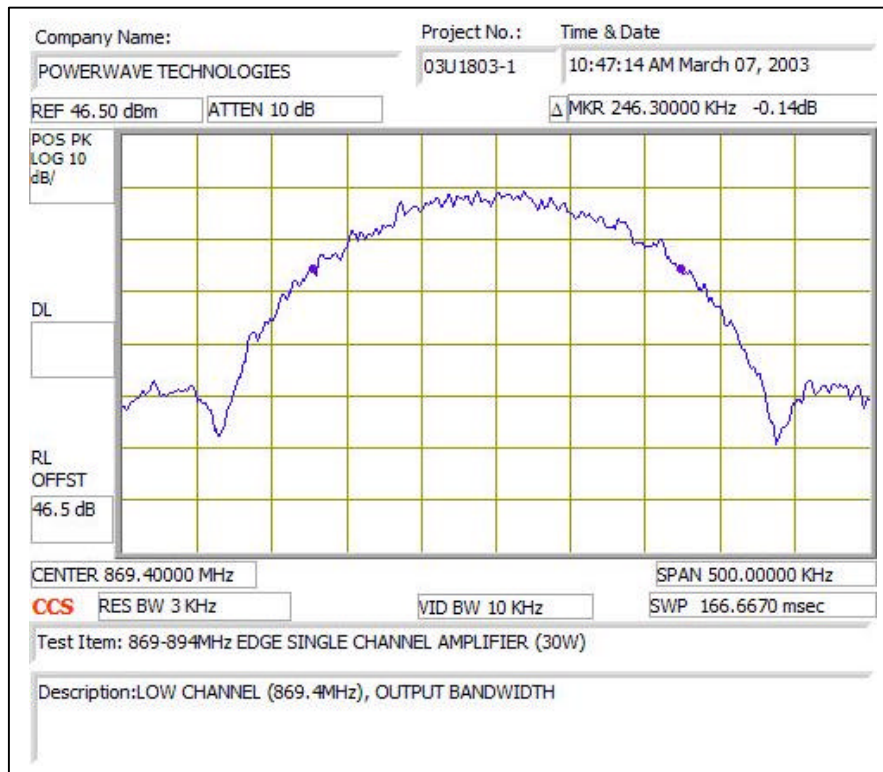
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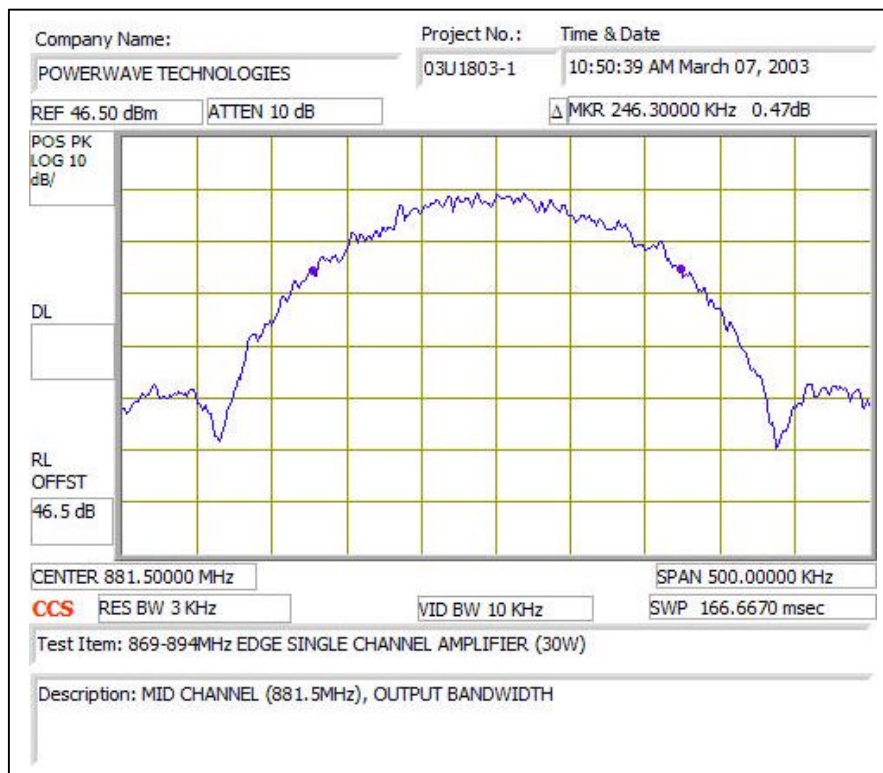
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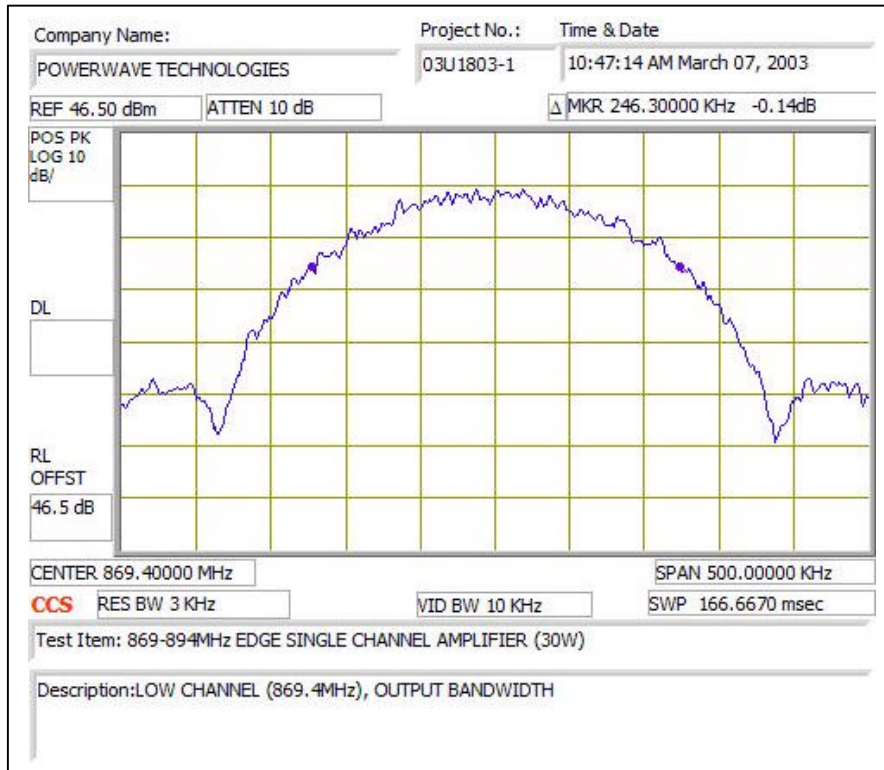
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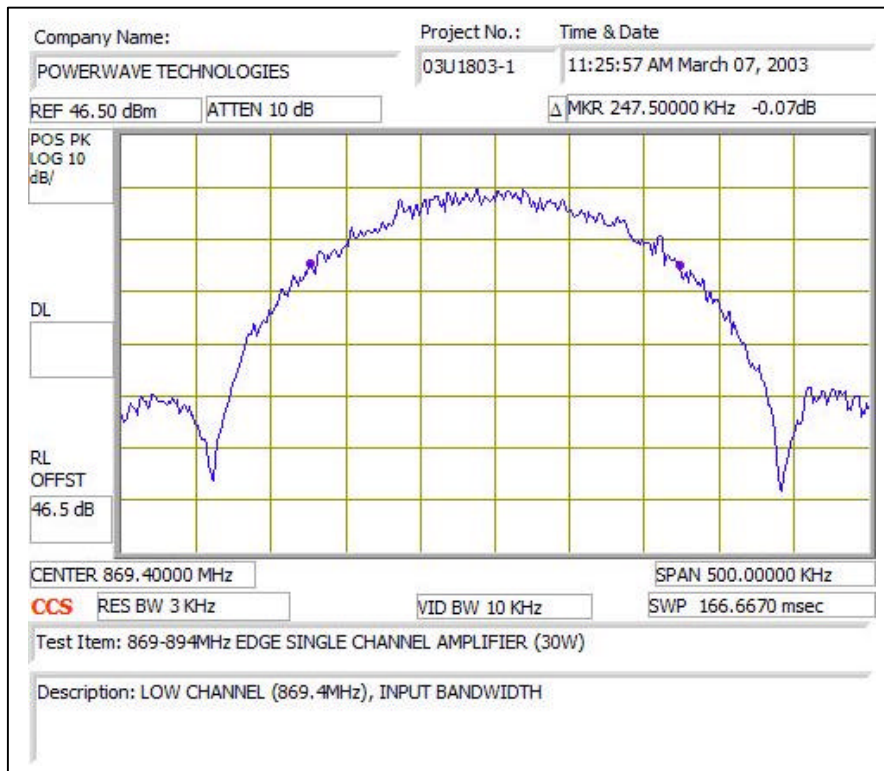
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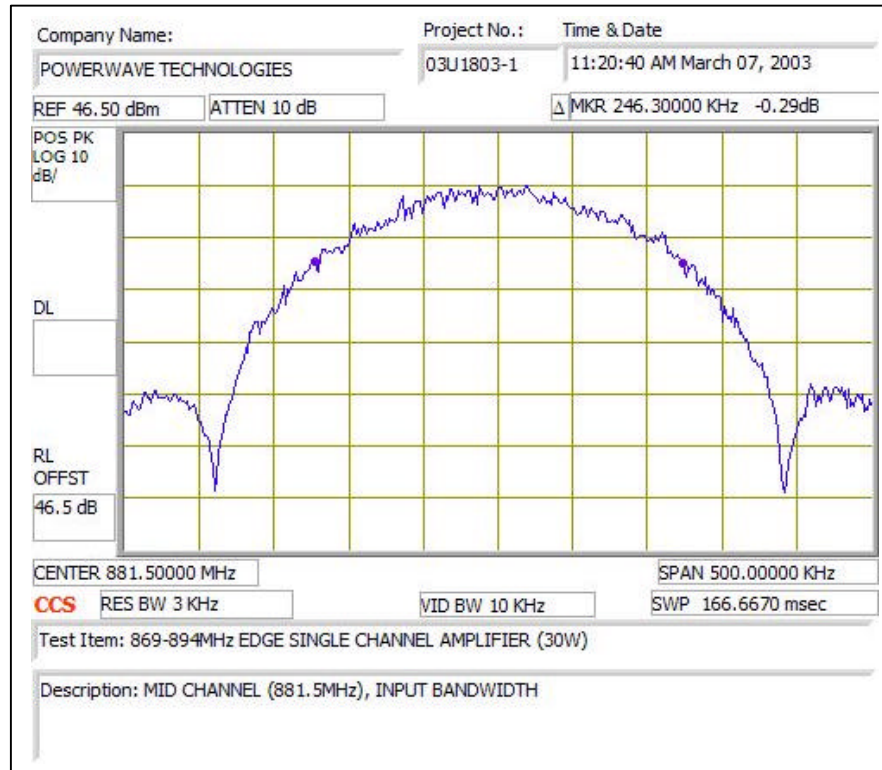
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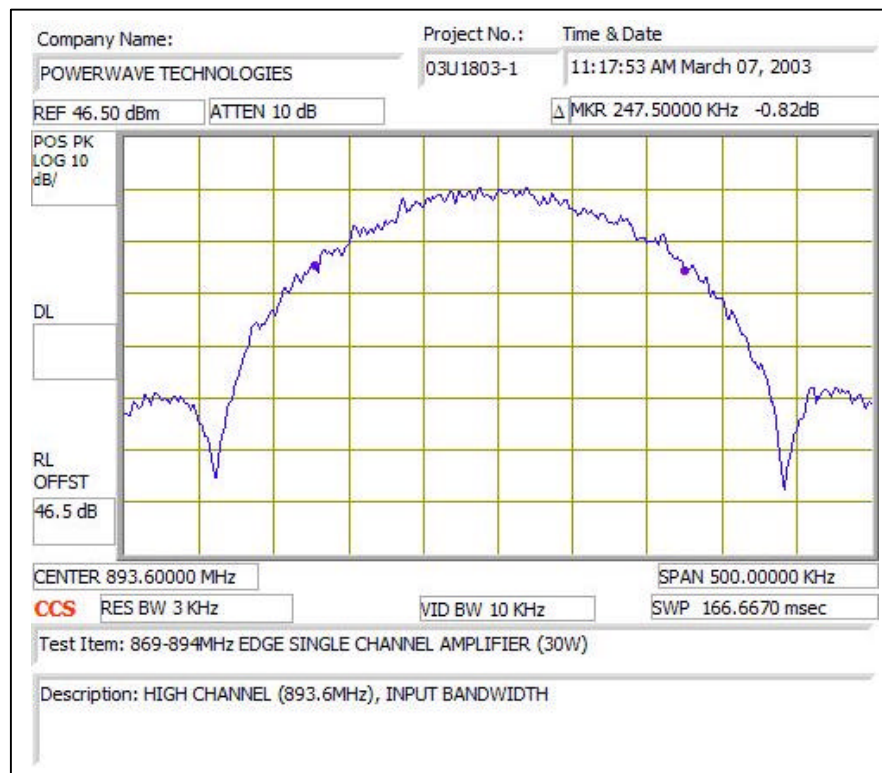
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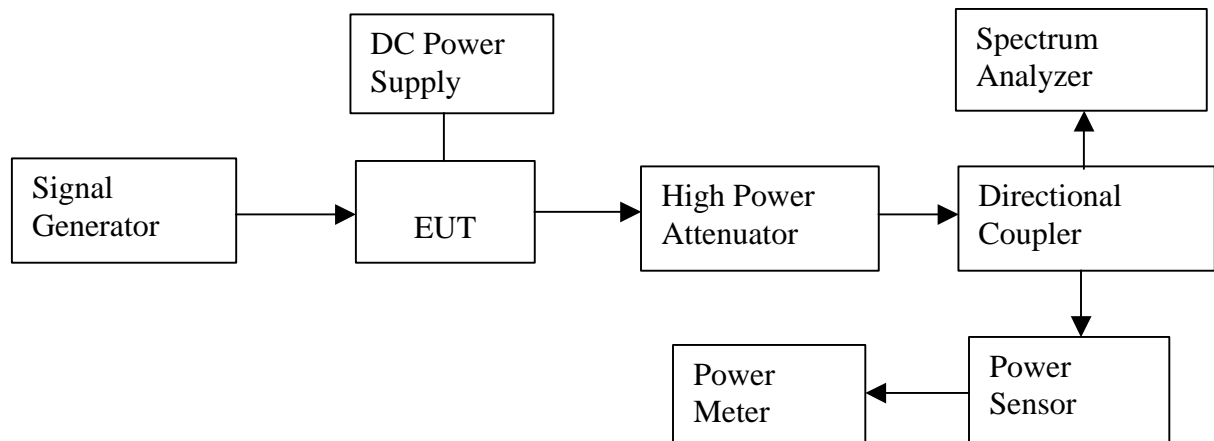
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11



12

SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINALS**TEST SETUP:****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.

Test Procedure:

Input single modulated signal to the amp to produce 33 watts composite power. Set the RES & VID BW to 30kHz and the DISPLAY LINE to -13 dBm. Scan the EUT from 15MHz to the 10th harmonic of carrier and check for spurious, harmonic, and intermodulation emissions.

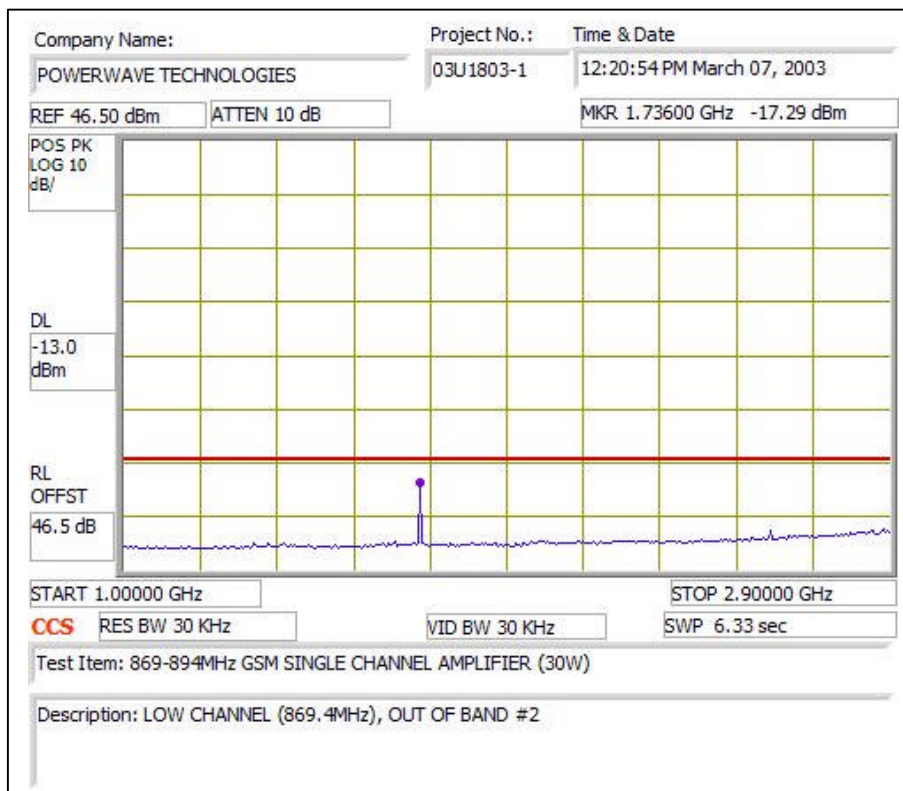
Test Result:

Plots were taken with single input at low, mid, and high of the band. Plots were taken of the out-of-band emissions from 15MHz to the 10th harmonic of the carrier frequency.

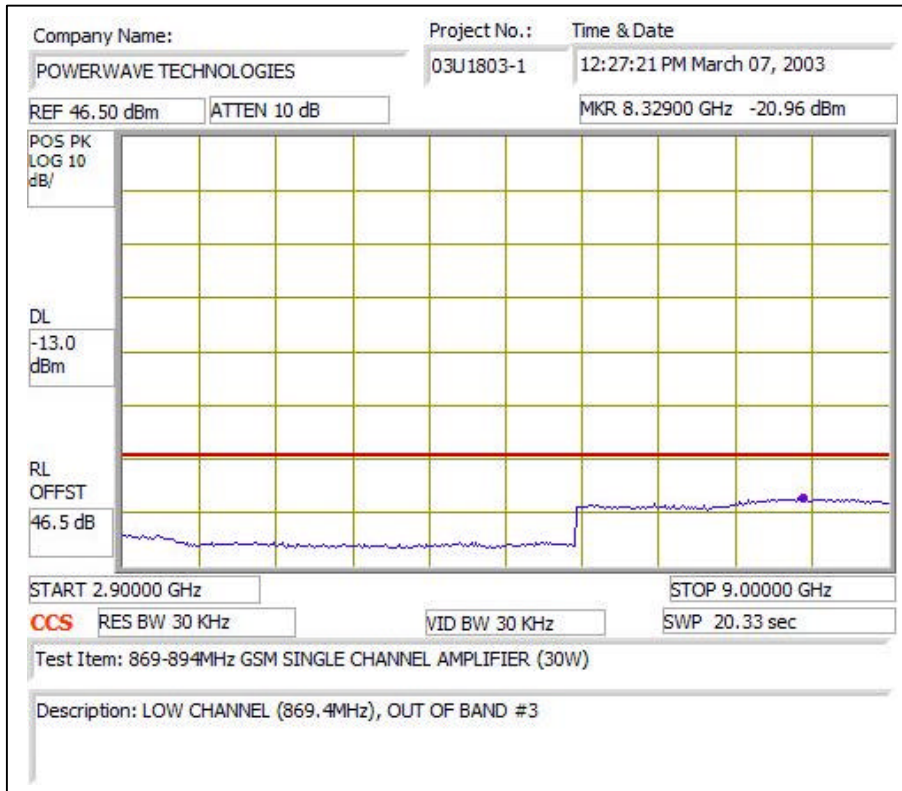
UNIT MODEL NUMBER: SCA9321-30C		
Plot#	Description	Frequency (MHz)
13	GSM Out-of-Band #1 @ Low Channel	15 - 1000
14	GSM Out-of-Band #2 @ Low Channel	1000 - 2900
15	GSM Out-of-Band #3 @ Low Channel	2900 - 9000
16	GSM Out-of-Band #1 @ Mid Channel	15 - 1000
17	GSM Out-of-Band #2 @ Mid Channel	1000 - 2900
18	GSM Out-of-Band #3 @ Mid Channel	2900 - 9000
19	GSM Out-of-Band #1 @ High Channel	15 - 1000
20	GSM Out-of-Band #2 @ High Channel	1000 - 2900
21	GSM Out-of-Band #3 @ High Channel	2900 - 9000
22	EDGE Out-of-Band #1@ Low Channel	15 - 1000
23	EDGE Out-of-Band #2@ Low Channel	1000 - 2900
24	EDGE Out-of-Band #3@ Low Channel	2900 - 9000
25	EDGE Out-of-Band #1@ Mid Channel	15 - 1000
26	EDGE Out-of-Band #2@ Mid Channel	1000 - 2900
27	EDGE Out-of-Band #3@ Mid Channel	2900 - 9000
28	EDGE Out-of-Band #1@ High Channel	15 - 1000
29	EDGE Out-of-Band #2@ High Channel	1000 - 2900
30	EDGE Out-of-Band #3@ High Channel	2900 - 9000



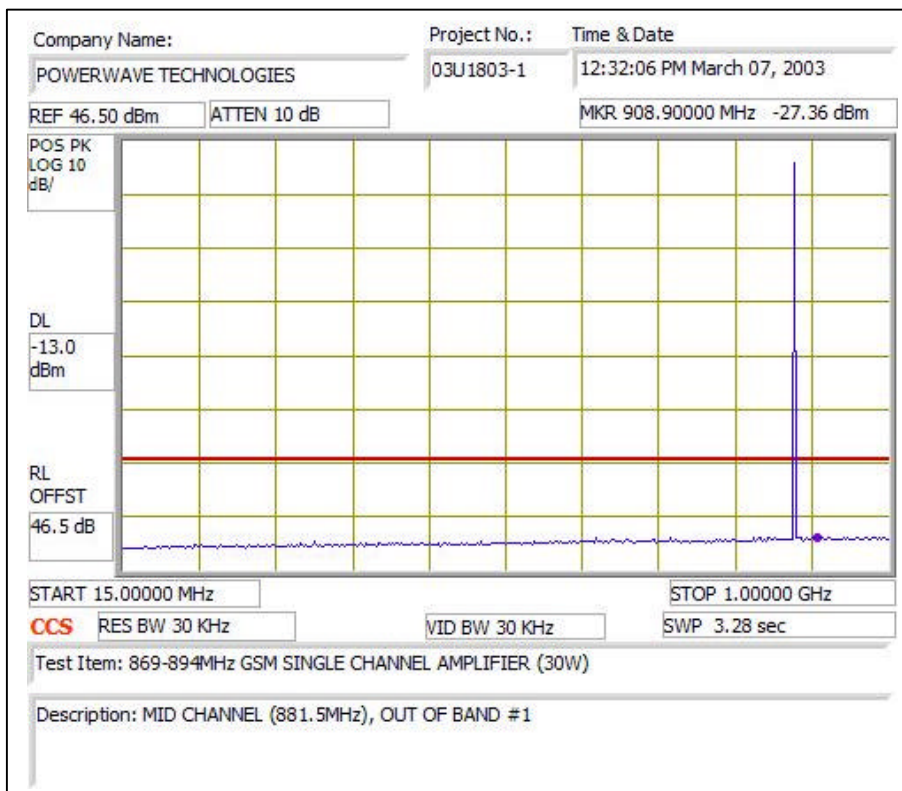
1.3



1.4



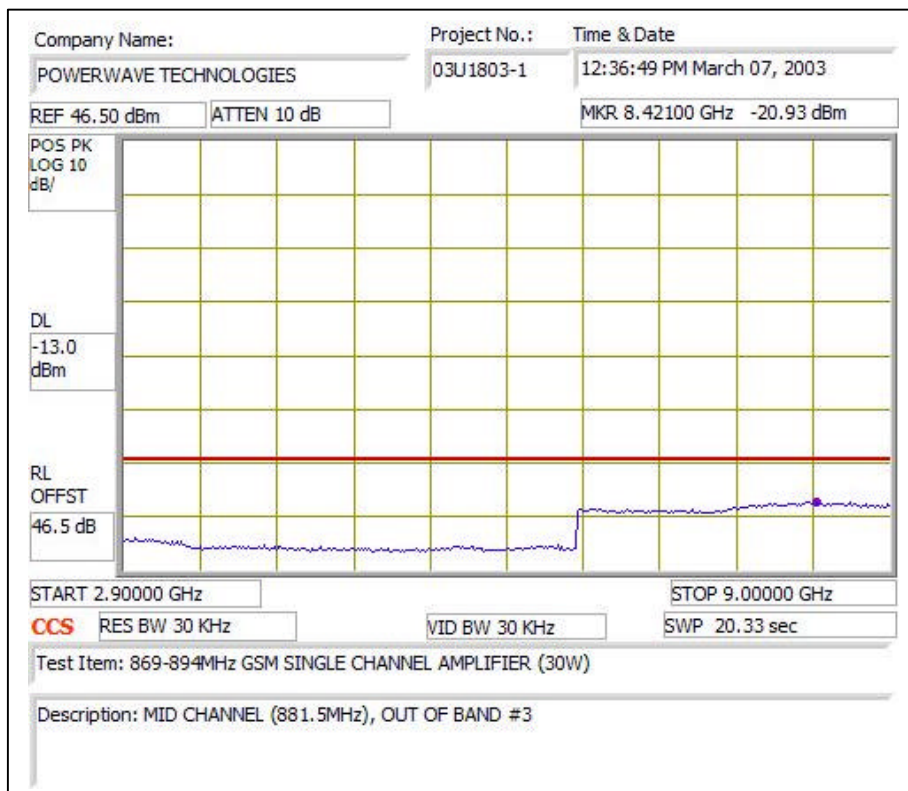
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16



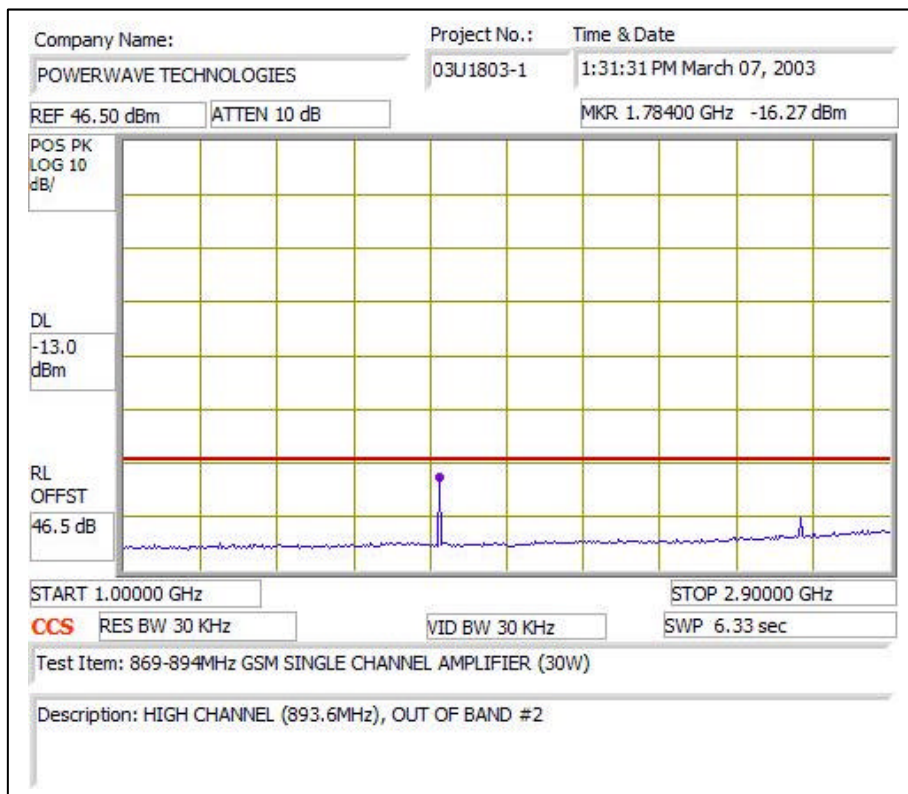
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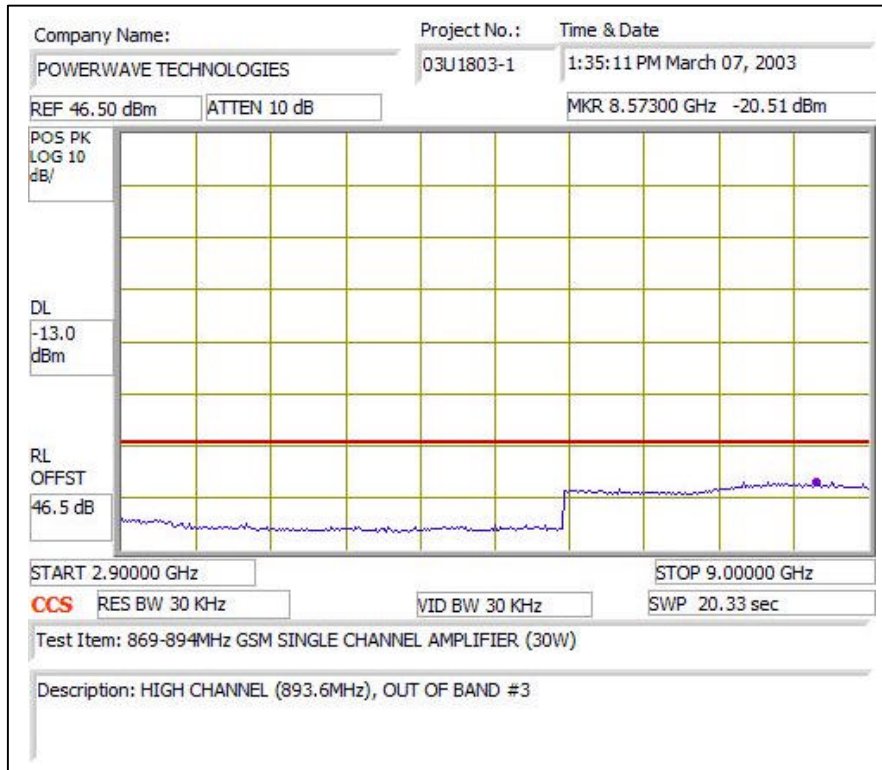
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20



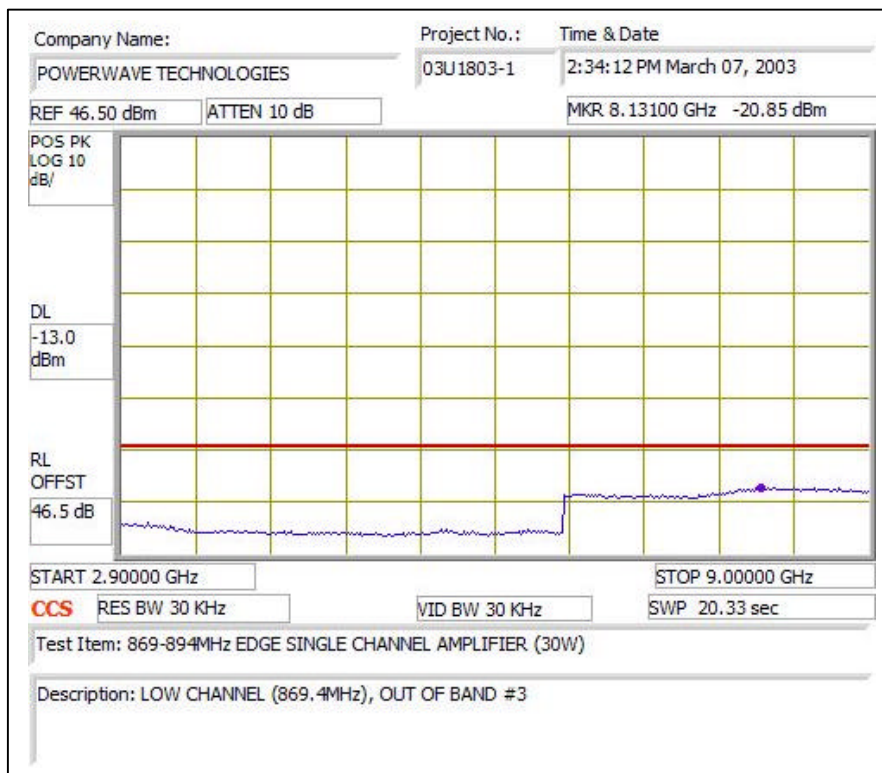
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22



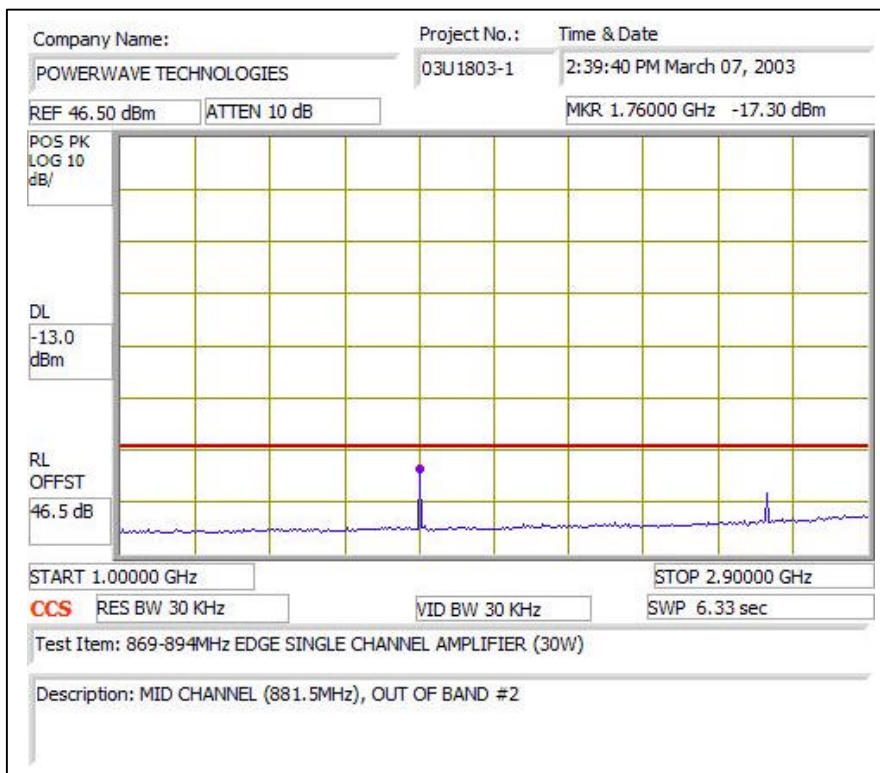
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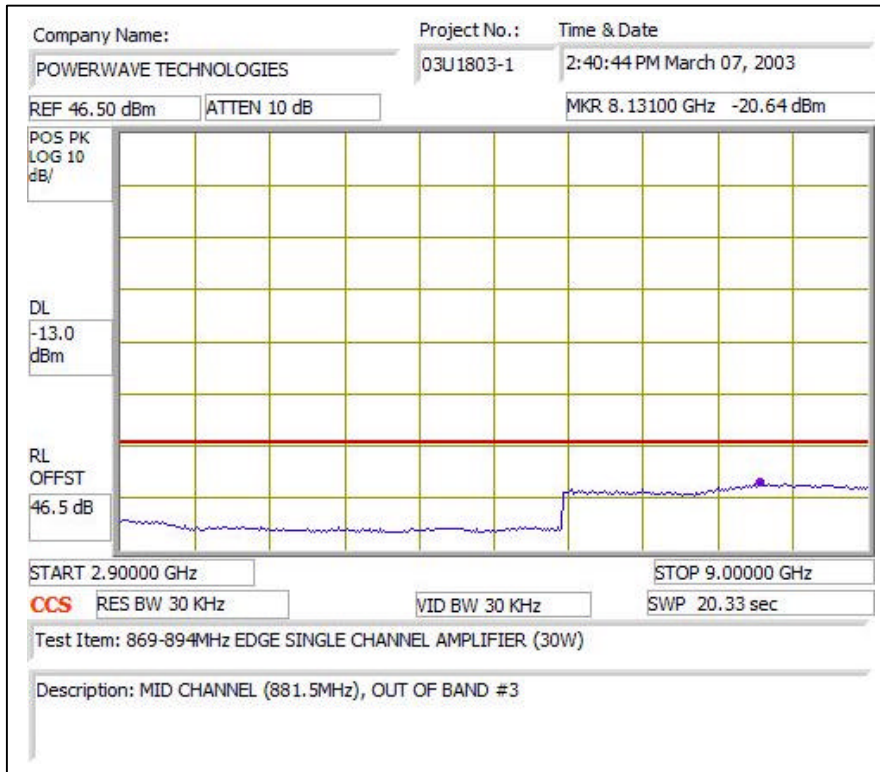
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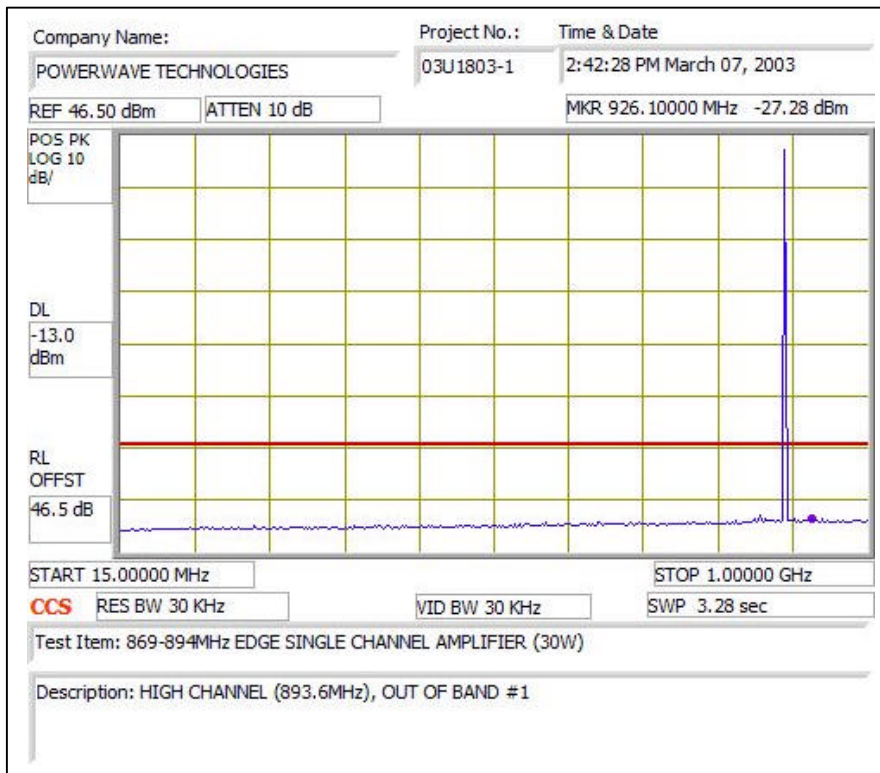
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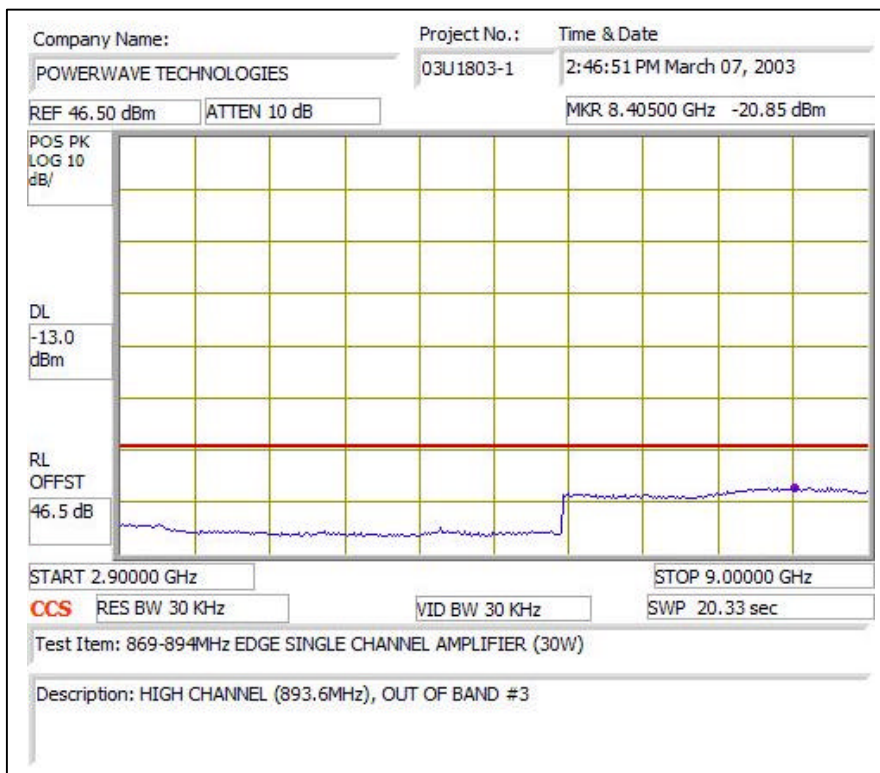
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28



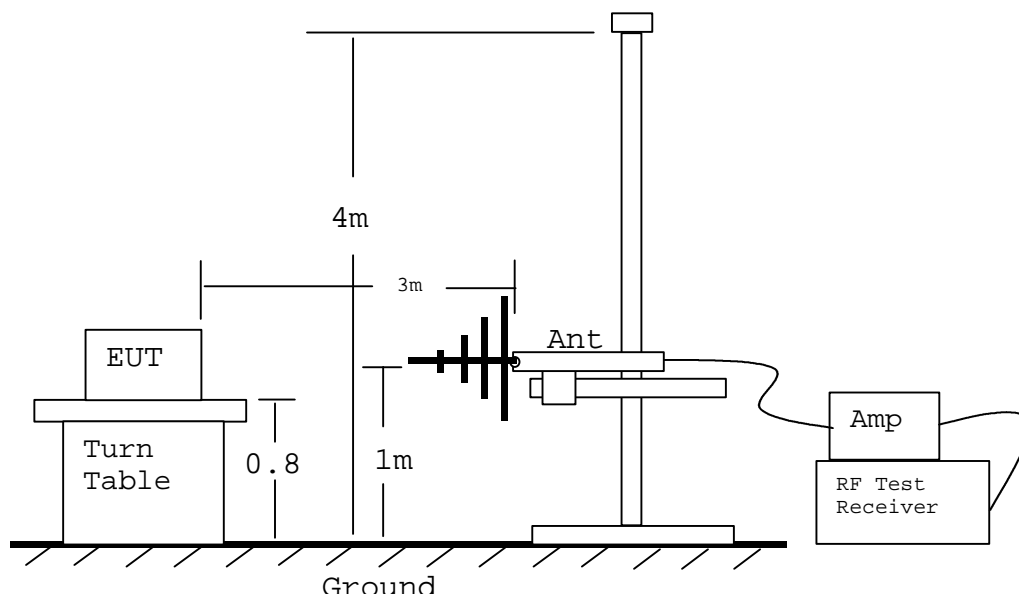
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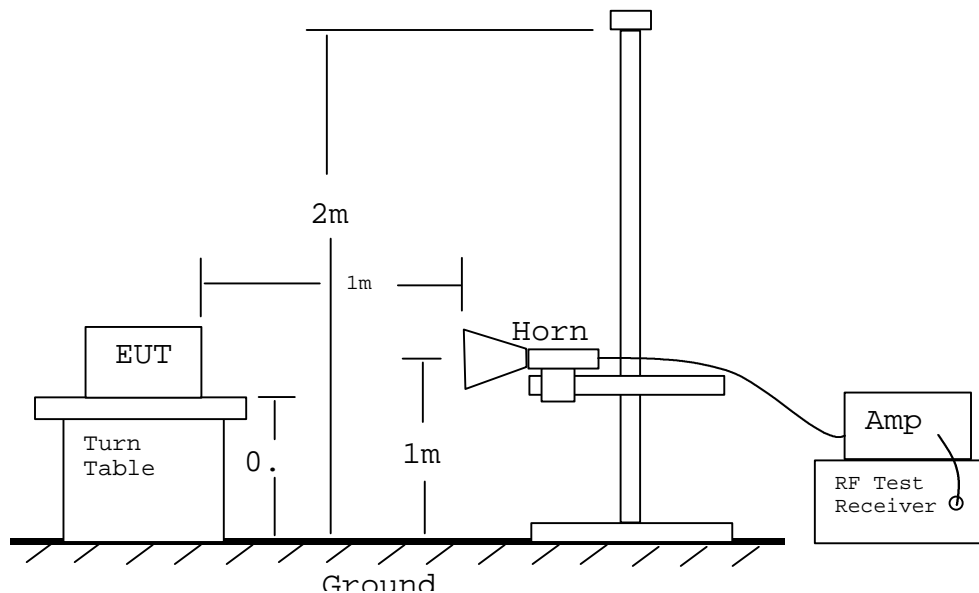
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SECTION 2.1055: FREQUENCY STABILITY

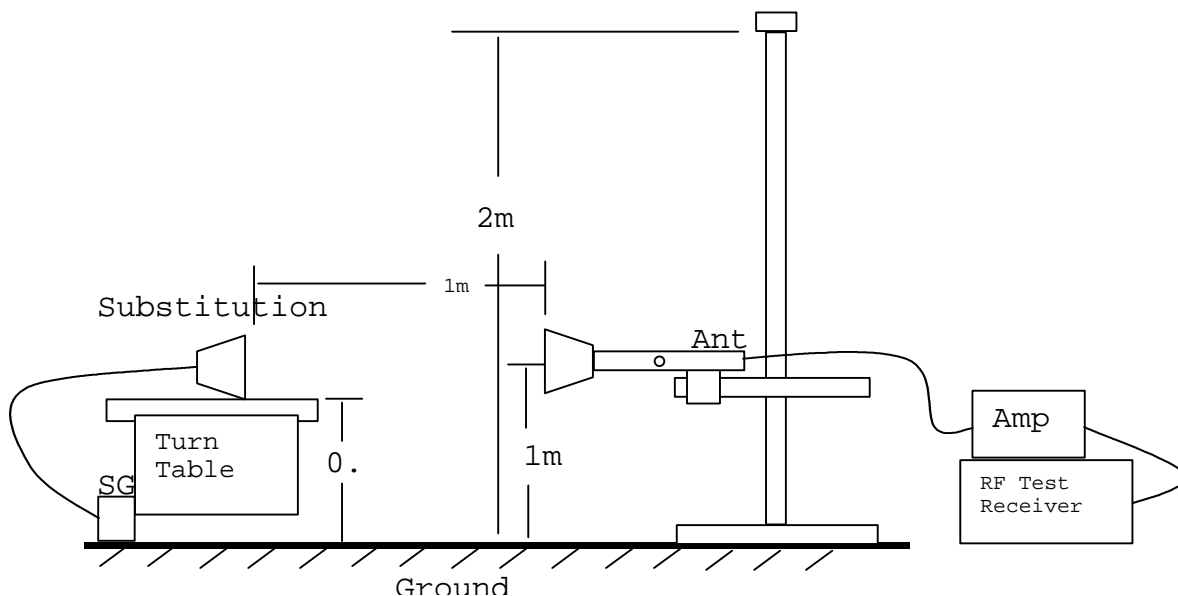
Not Applicable. Eut is a power amplifier.

RADIATED EMISSIONS**Test Set-up:**

Radiated Emission Test 30 – 1000 MHz (Bilog)



Radiated Emission Test 1 – 9 GHz (Horn)



Substitution Method above 1 GHz

RADIATED EMISSION TEST PROCEDURE

The actual signal generated by the measured equipment may be determined by means of a substitution measurement in which a known signal source replaces the device to be measured.

- A. The substitution antenna will replace the Eut antenna in the same position and in vertical polarization. The frequency of the signal generator shall be set to the frequencies that were measured on the Eut. The test antenna shall be raised and lowered, if necessary, to ensure that the maximum signal is still being received. The signal generator, output level, shall be adjusted until an equal or a known related level to what was measured from the Eut is obtained in the spectrum analyzer.

The radiated power is equal to the power supplied by the signal generator

The formula, to calculate the true reading, is: $\text{True reading} = \text{dBm} + \text{GdBd} - \text{CL}$

dBm = signal generator output level

GdBd = the gain in dBd of the substitution antenna

CL = the cable loss

The calculated True reading is then compared to the limit and should not exceed the limit. This method must be performed for every emission measured from the Eut. This shall also be repeated for horizontal polarization.

Test Result:

See radiated emission data attached below.

03/12/03

High Frequency Measurement

Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: vien tran

Project #: 03U1803-1

Company: Powerwave Technologies

EUT Descrip.: 869-894MHz GSM/EDGE SINGLE CHANNEL AMPLIFIER

EUT M/N: SGA9321-30C (FCC ID:E67JS0064; IC: 2868C-SCA9321)

Test Target: FCC22

Mode Oper: EUT Amplifying at Low, Mid, High Channels

Frequency	SA reading	SG reading	CL	Gain	Gain	ERP	Limit	Margin	Notes
(GHz)	(dBuV)	(dBm)	(dB)	(dBi)	(dBd)	(dBm)	(dBm)	(dB)	
Spurious Emissions									
Low Channel = 869.4MHz									
1.74	39.70	-42.21	0.41	7.50	5.35	-37.27	-13.00	-24.27	V, 2nd Harmonic
2.61	43.00	-59.45	0.62	8.00	5.85	-54.22	-13.00	-41.22	V, Noise floor
3.48	47.00	-53.72	0.77	8.80	6.65	-47.84	-13.00	-34.84	V, Noise floor
4.35	40.00	-56.63	0.88	7.50	5.35	-52.16	-13.00	-39.16	V, Noise floor
1.74	36.00	-44.86	0.41	8.00	5.85	-39.42	-13.00	-26.42	H, 2nd Harmonic
2.61	44.00	-61.26	0.62	8.80	6.65	-55.23	-13.00	-42.23	H, Noise Floor
3.48	47.70	-54.80	0.77	8.00	5.85	-49.72	-13.00	-36.72	H, Noise Floor
4.35	42.40	-52.83	0.88	8.80	6.65	-47.06	-13.00	-34.06	H, Noise Floor
Mid Channel = 881.5MHz									
1.76	40.50	-42.67	0.41	7.50	5.35	-37.73	-13.00	-24.73	V, 2nd Harmonic
2.64	45.43	-54.57	0.62	8.00	5.85	-49.34	-13.00	-36.34	V, Noise floor
1.76	37.00	-46.93	0.41	8.80	6.65	-40.69	-13.00	-27.69	H, 2nd Harmonic
2.64	38.00	-65.10	0.62	7.50	5.35	-60.37	-13.00	-47.37	H, Noise floor
Hi Channel = 893.6MHz									
1.79	39.40	-44.81	0.42	7.50	5.35	-39.88	-13.00	-26.88	V, 2nd Harmonic
2.68	40.00	-57.23	0.63	8.00	5.85	-52.01	-13.00	-39.01	V, Noise floor
1.79	37.70	-45.39	0.42	8.80	6.65	-39.16	-13.00	-26.16	H, 2nd Harmonic
2.68	37.00	-63.52	0.63	7.50	5.35	-58.80	-13.00	-45.80	H, Noise floor

SA: Spectrum Analyzer, HP 8593EM, S/N: 3710A00205

CL: cable loss (5ft), FLEXCO

SG: Signal Generator, HP 83732B, S/N: US34490599

Pre-Amp: Miteq NSP2600 -44, S/N: 646456

TX Antenna: Dipole, Compliance Design, Roberts, S/N: 1116
Horn, EMCO 3115, S/N: 6717RX Antenna: Bicon, Eston 94455-1, S/N: 1214
LP, EMCO 3146, S/N: 3163
Horn, EMCO 3115, S/N: 6739

RADIATED EMISSION PART 15

RADIATED EMISSION TEST PROCEDURE

The EUT was placed on a wooden table 80 cm above the ground screen and all other support equipment were placed on the flush mounted turntable. Antenna to EUT distance was at 3 meter, measured E-Field with the range of 30M – 1GHz and a distance of 1 meter, measured 1GHz and above frequency. 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 C63.4/2001.

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 ambient. 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.

Test Result:

See attached file below.



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

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PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #: 03U1803-1
Report #: 030305 A1
Date & Time: 03/05/03 9:31 AM
Test Engr: VIEN TRAN

Company: POWERWAVE TECHNOLOGIES
EUT Description: 869-894MHz GSM/EDGE SINGLE CHANNEL AMPLIFIER (30W)
Test Configuration : EUT, 2 DC Power supplies, Power Sensor, Power meter, Attenuator, SG
Type of Test: FCC class B 15.209
Mode of Operation: EUT amplifying at Low, Mid, high channel

[<< Main Sheet](#)

Freq.	Reading	AF	Closs	Pre-amp	Level	Limit	Margin	Pol	Az	Height	Mark
(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	EN_B	(dB)	(H/V)	(Deg)	(Meter)	(P/Q/A)
402.10	41.50	15.67	3.26	27.28	33.15	37.00	-3.85	10mV	0.00	1.00	P
432.14	40.50	16.38	3.39	27.41	32.85	37.00	-4.15	10mV	0.00	1.00	P
342.10	41.00	15.09	2.99	26.85	32.24	37.00	-4.76	10mV	0.00	1.00	P
228.10	38.40	10.98	2.40	26.59	25.20	30.00	-4.80	10mV	0.00	1.00	P
396.14	40.20	15.58	3.23	27.24	31.78	37.00	-5.22	10mV	0.00	1.00	P
378.24	40.00	15.42	3.15	27.11	31.46	37.00	-5.54	10mV	0.00	1.00	P
6 Worst Data											