FCC CFR47 PART 22 CERTIFICATION
CLASS II PERMISSIVE CHANGE
TEST REPORT

FOR

869-894MHz RACK MOUNTABLE MULTI-CHANNEL AMPLIFIER

MODEL: G3S-800-140-030

FCC ID: E675JS0051

REPORT NUMBER: 01U1057-1

ISSUE DATE: NOVEMBER 20, 2001

Prepared for
POWERWAVE TECHNOLOGIES, INC.
1801 E. St. ANDREW PLACE
SANTA ANA, CA 92705 USA

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

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COMPLIANCE CERTIFICATION SERVICES DOCUMENT NO:CCSUP4031A
561 F MONTEREY ROAD, MORGAN HILL, CA 95037 USA TEL:(408) 463-0885 FAX:(408) 463-0888

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: Jeff Dale
Telephone number: (714) 466-1476

2.1033(c)(2) FCC ID: E675JS0051

2.1033(c)(6) Range of Operation Power

180 Watts

2.1033(c)(7) Maximum Power Rating

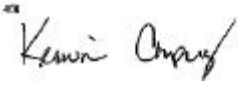
180 Watts

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, 2
EQUIPMENT AUTHORIZATION PROCEDURE	CERTIFICATION / PERMISSIVE CHANGE
MODIFICATIONS MADE ON EUT	☐ YES (REFER TO PAGE 7) ☒ NO

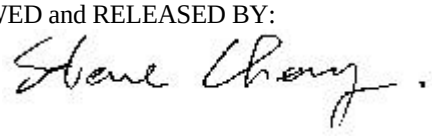
The above equipment was tested by Compliance Certification Services for compliance with the requirements set forth in the FCC CFR 47, PART 22. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results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

TESTED BY:



KERWIN CORPUZ
ASSOCIATE EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

REVIEWED and RELEASED BY:



STEVE CHENG
EMC ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

2. PERMISSIVE CHANGE

ADD GSM and EDGE WAVEFORMS TO THE PREVIOUS AMPLIFIER SYSTEM. NO HARDWARE OR SOFTWARE CHANGES WERE MADE TO THE EUT.

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

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 dBµV/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 dBµV/m)/20] = 39.8 µV/m

8. 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.

9. TEST EQUIPMENT LIST

Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
Spectrum Analyzer	H.P.	8593EM	3710A00205	06/20/01	06/20/02

9a. SUPPORT EQUIPMENT

Device Type	Manufacturer	Model Number	Serial No.	Cal Due
Signal Generator	Agilent	E4433B	US40051889	2/28/02
Signal Generator	Agilent	E4433B	US40053437	9/30/02
Power Meter	HP	E4418B	US39251104	5/17/02
Power Sensor	HP	8481A	US37298571	7/31/02
Dual Directional Coupler	HP	778D	18748	N/A
Dual Directional Coupler	HP	773D	2839A01650	N/A
500W Attenuator	Weinschel	53-30-34	MJ075	N/A
Pre-Amp	Mini-Circuits	ZHL-1042J-SMA	D061698-5	N/A
Combiner	Mini-Circuits	ZN4PD-920W	15542	N/A

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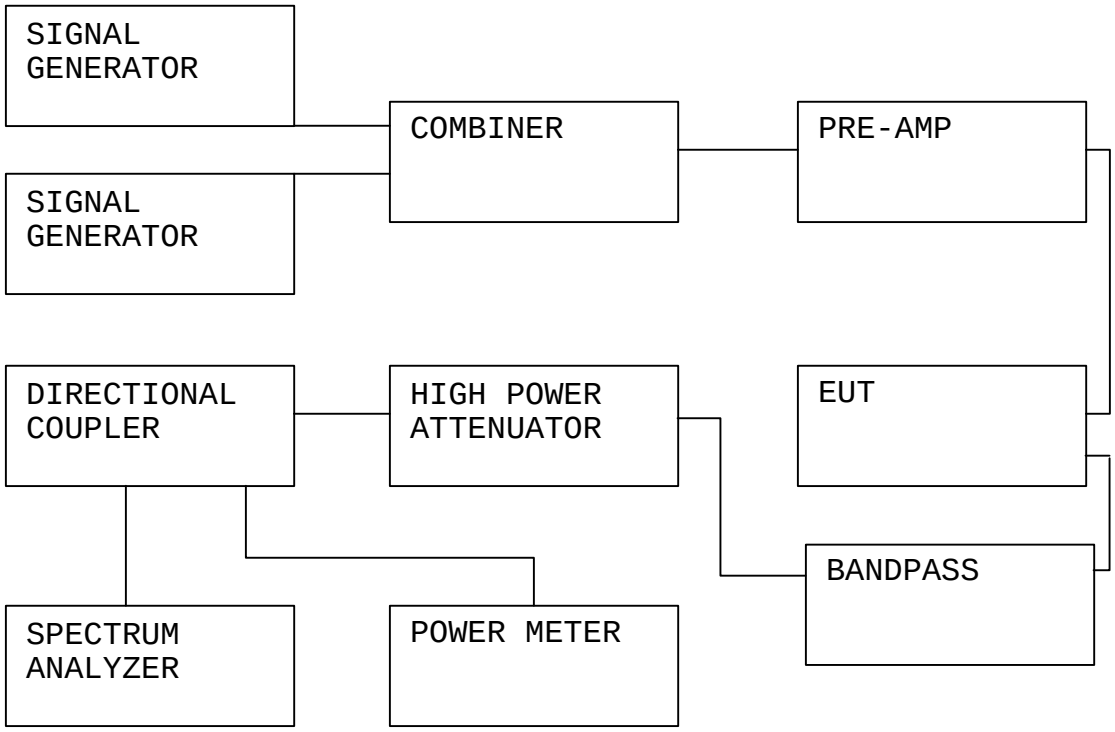
10. EUT SETUP PHOTOS

Conducted Measurement

11. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

CABLE NO: All	
I/O Port: ALL	Number of I/O ports of this type: ALL
Number of Conductors: 2	**Connector Type: N-TYPE to N-TYPE and SMA**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: METAL	**Cable Length:0.5 to 1.0 Meter**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: Similar cables used for all in setup below.	

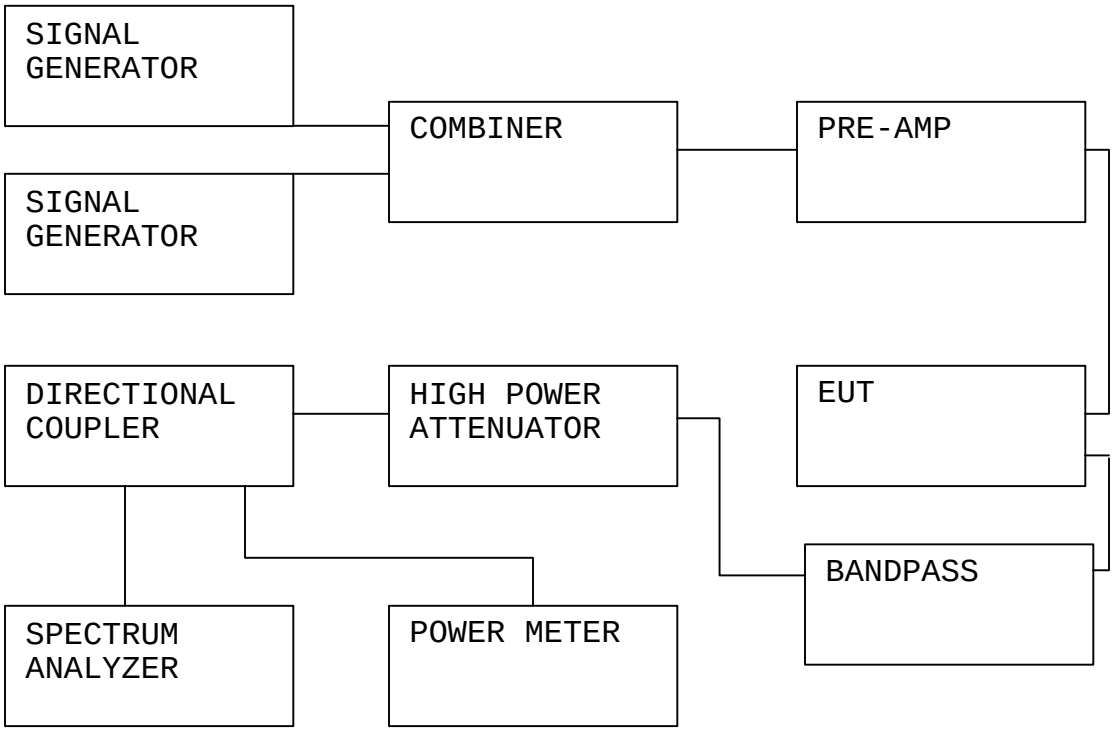
12. CONFIGURATION BLOCK DIAGRAM



13. PART 2: CERTIFICATION TEST REQUIREMENT:

SECTION 2.1046: RF POWER OUTPUT

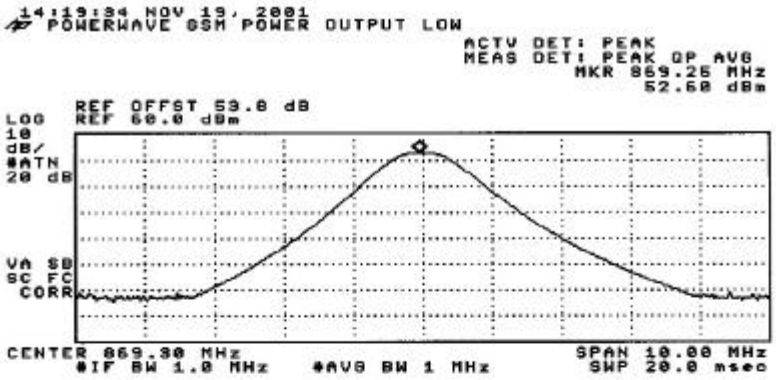
TEST SETUP:



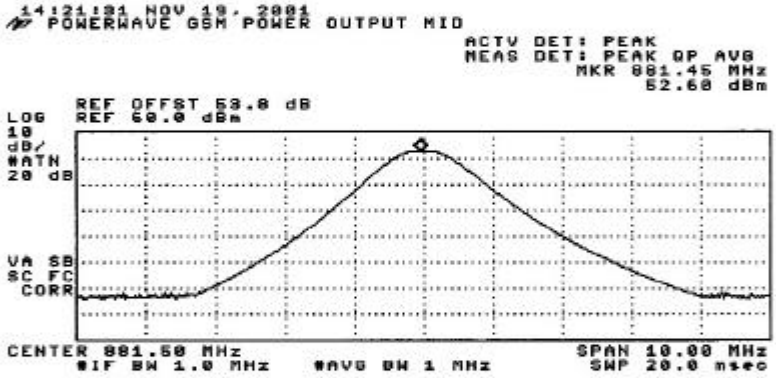
Minimum requirement:
Section 22.913(a); Maximum ERP.
The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

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 180 Watts.

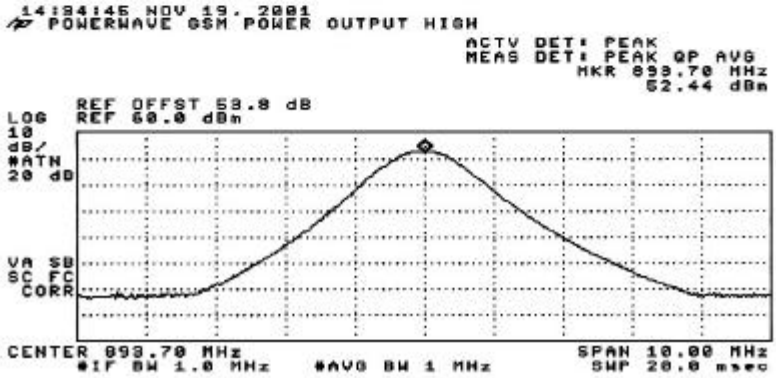
Test Result:
The EUT's measured output power was 180 Watts. See below attached plots.



LOW Channel

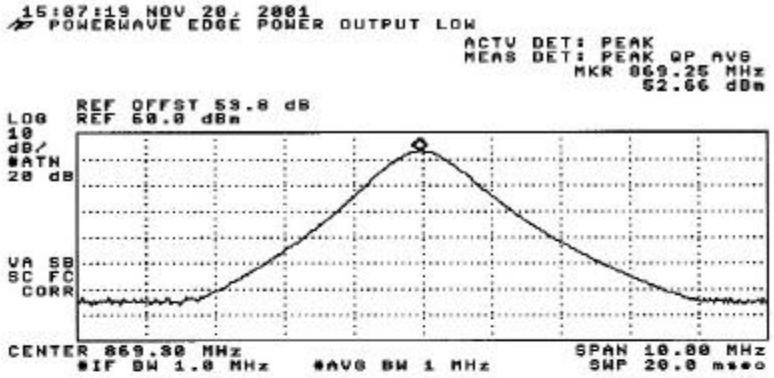


MID Channel

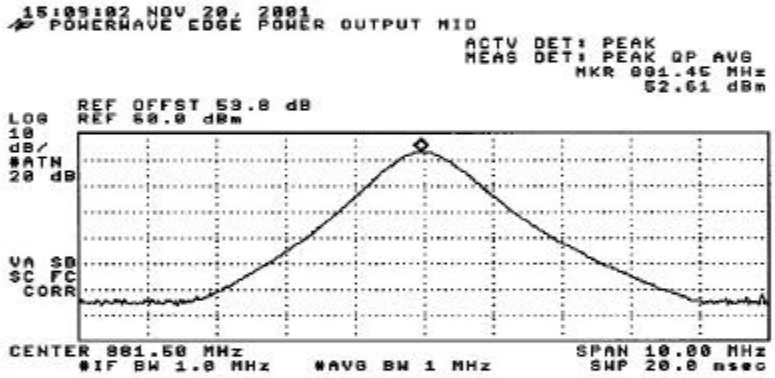


HIGH Channel

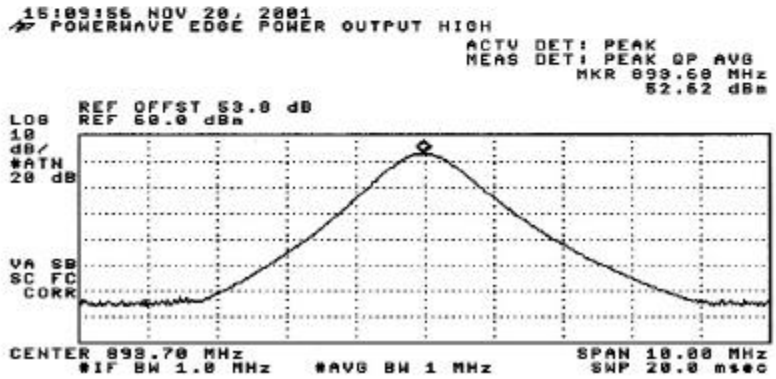
GSM Power Output



LOW Channel



MID Channel



HIGH Channel

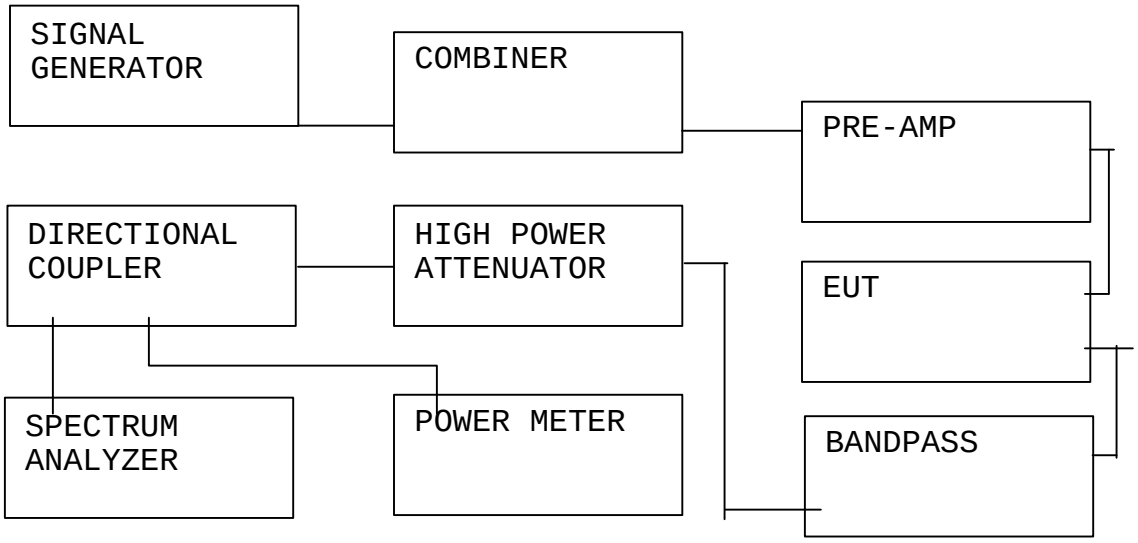
EDGE Power Output

SECTION 2.1047: MODULATION CHARACTERISTICS

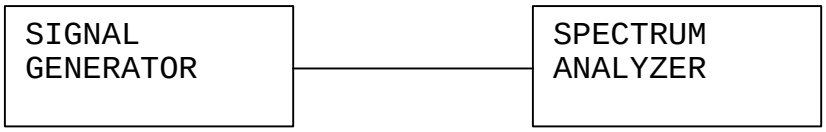
Not applicable. EUT is a power amplifier.

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:

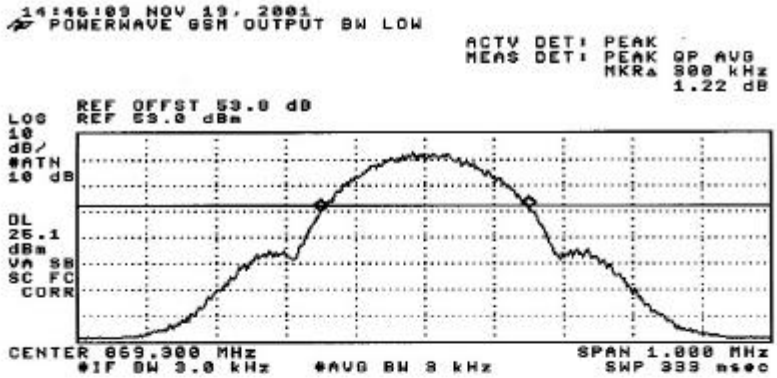
The Eut's occupied bandwidth is compared to the input source plot (signal generator) and output plot (power amplifier) to check that the input signal bandwidth is not greater at the output of amplifier.

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.

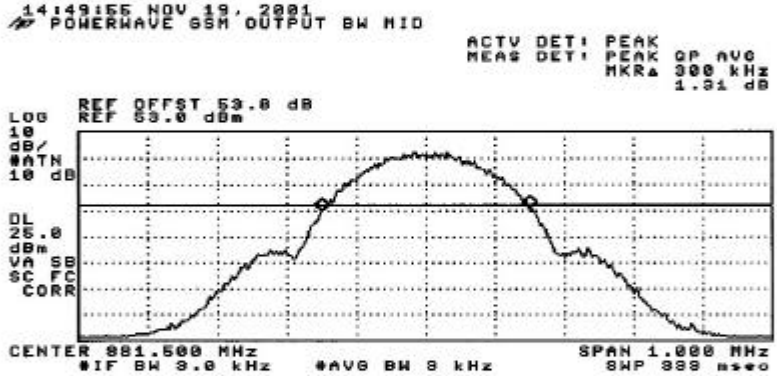
Use the setup for input shown above. Correct for external attenuation and cable loss. Using the marker delta function, measure the 20dB bandwidth of the signal generator's emission. Record the spectrum analyzer plot.

Test Results:

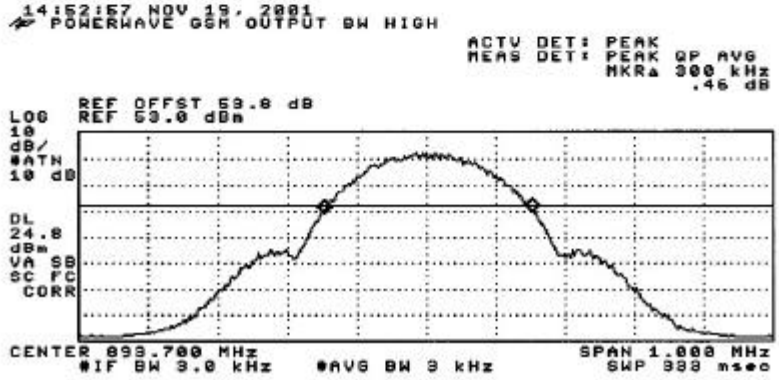
See plots below:



LOW Channel

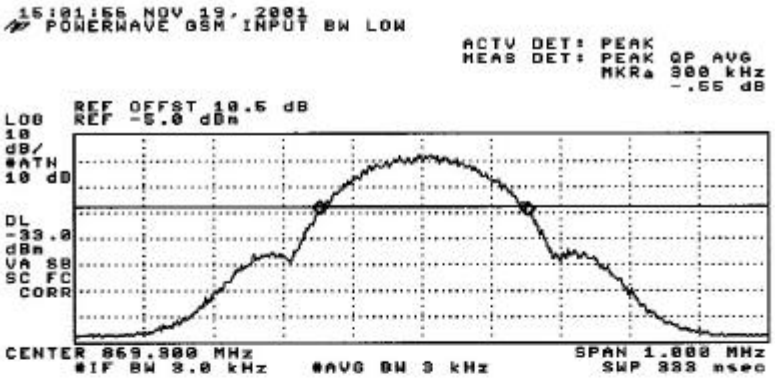


MID Channel

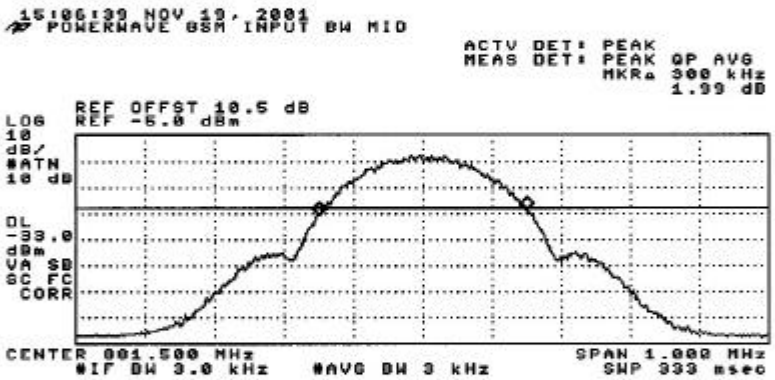


HIGH Channel

GSM BANDWIDTH OUTPUT



LOW Channel



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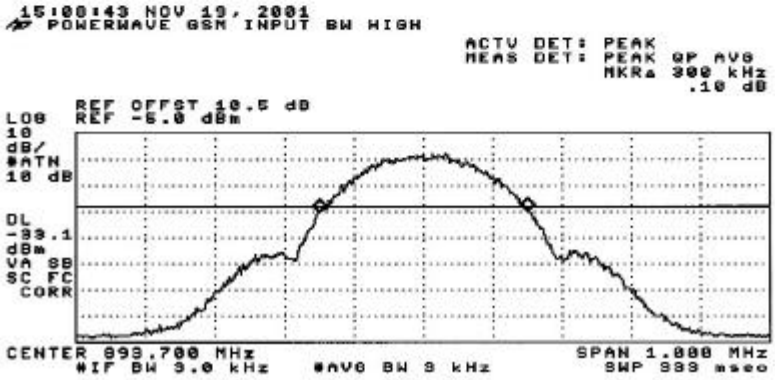
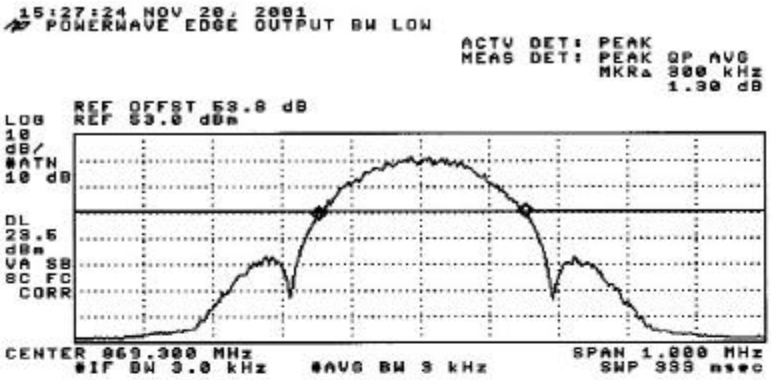
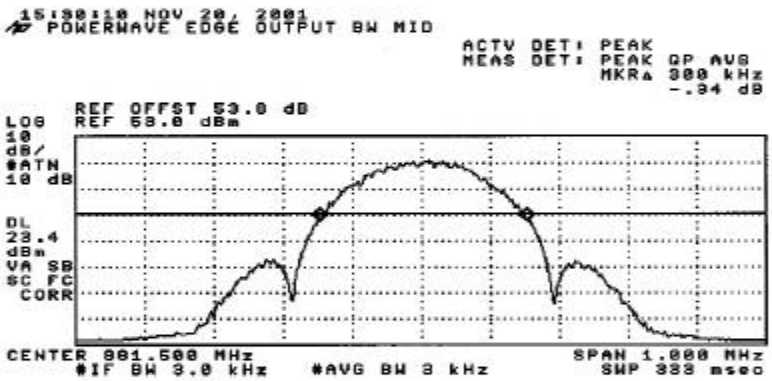


HIGH Channel

GSM BANDWIDTH INPUT



LOW Channel



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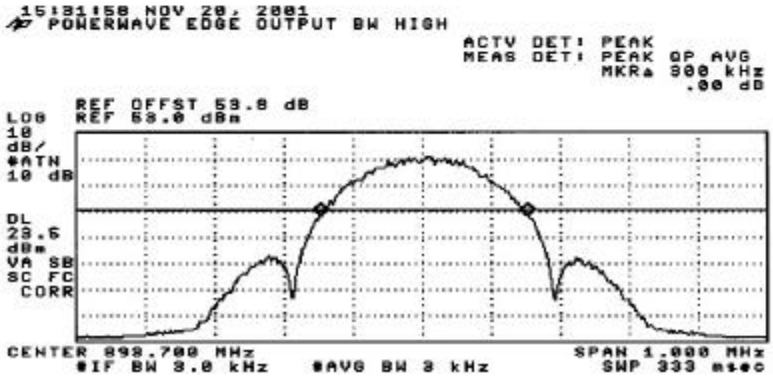
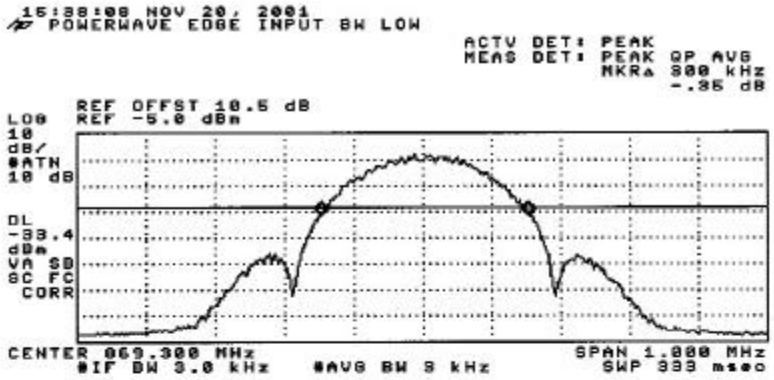
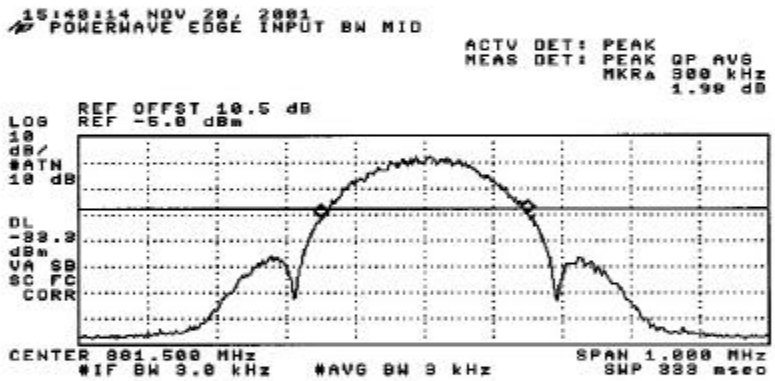


HIGH Channel

EDGE BANDWIDTH OUTPUT



LOW Channel



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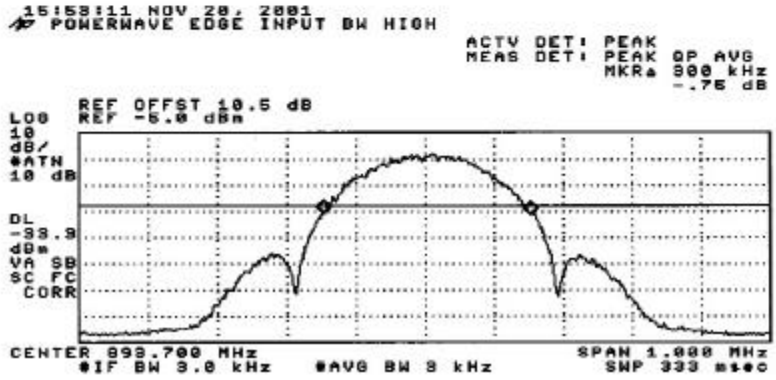
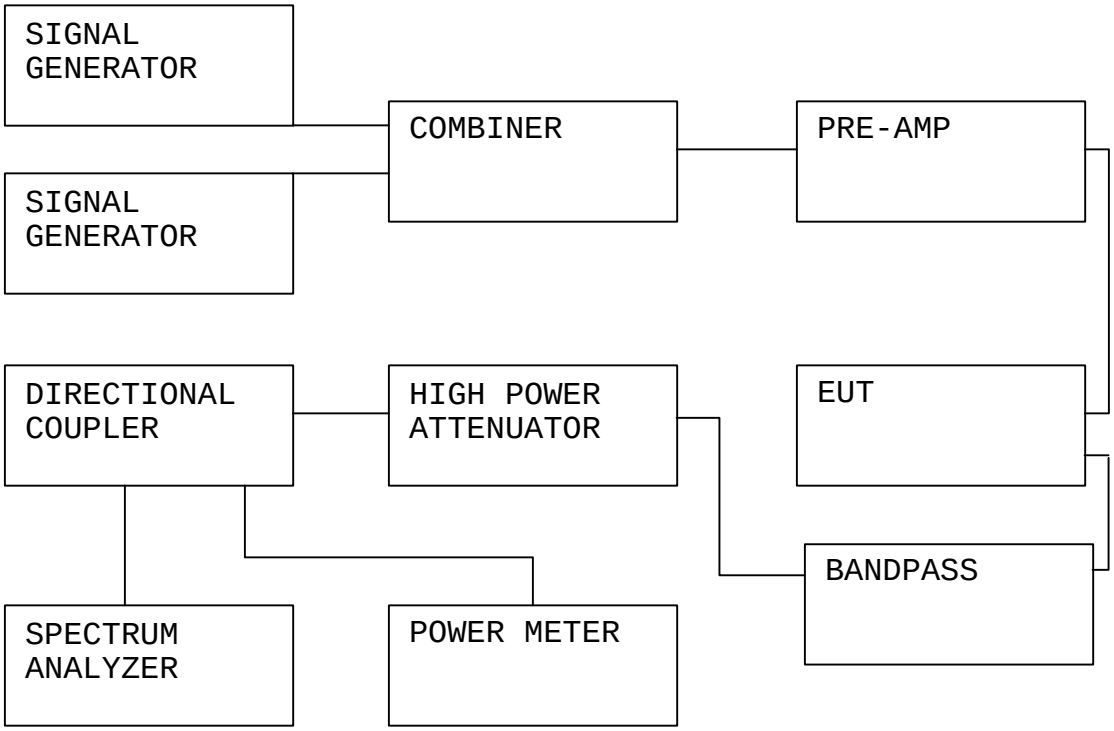


HIGH Channel

EDGE BANDWIDTH INPUT

SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINALS

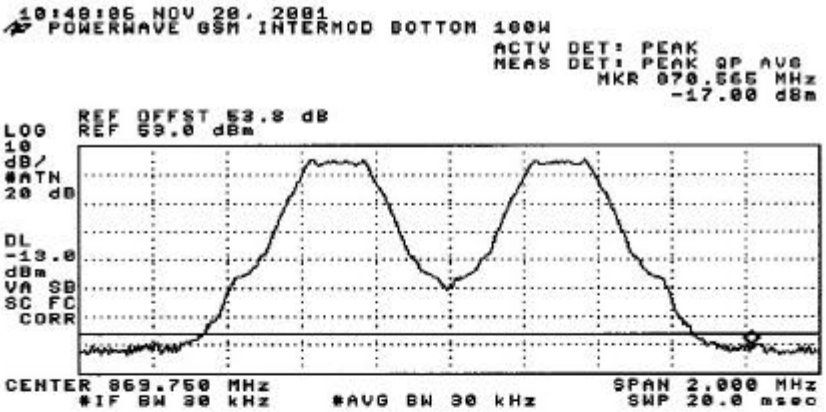
TEST SETUP:



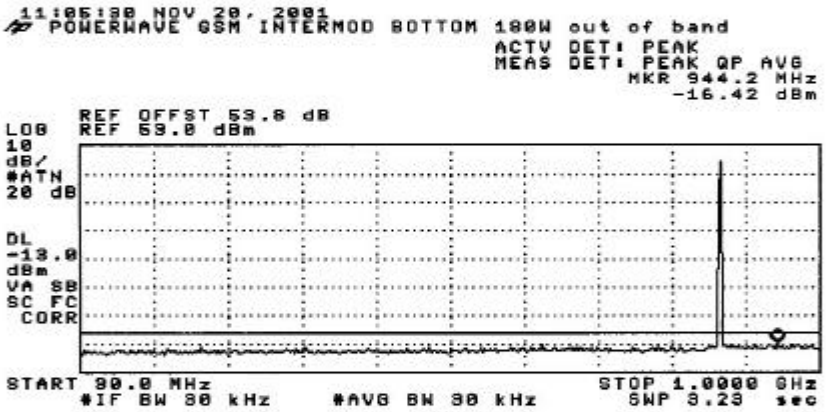
Minimum Requirement:
Section 22.917(e):
For Base stations transmitters the magnitude of each spurious, harmonic, and intermodulation emissions that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be more than 43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

Test Procedure:
Input 2 modulated signals to the amp to produce 180 watts composite power. Set the RES & VID BW to 30kHz and the DISPLAY LINE to –13dBm. Scan the EUT from 30MHz to the 10th harmonic of carrier and check for spurious, harmonic, and intermodulation emissions.

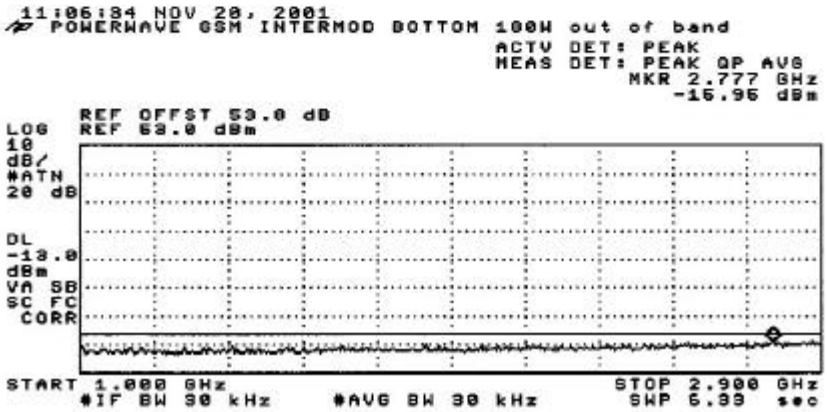
Test Result:
Plots were taken with 2 inputs at the high end of the band, with 2 inputs at the low end of the band and 1 input of each ends of the band. Plots were of the intermodulation products and of the out-of-band emissions from 30MHz to the 10th harmonic of the carrier frequency.



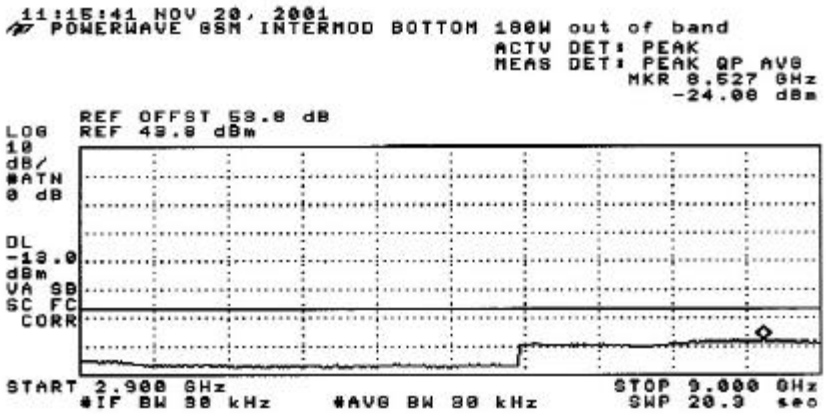
GSM Intermodulation @ Low end (869.45 & 870.05 MHz)



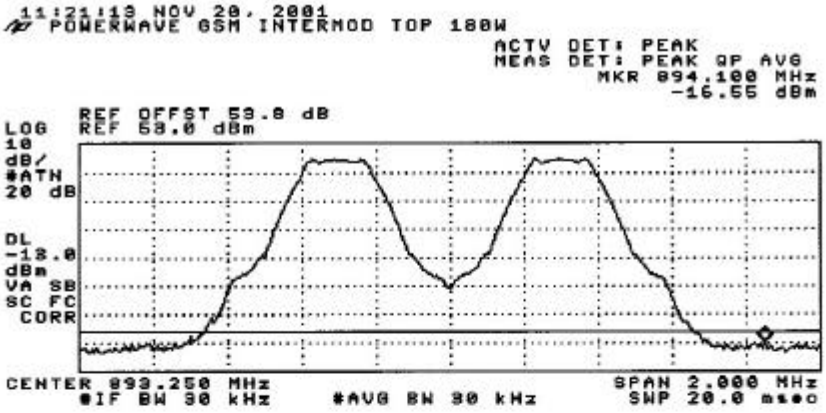
GSM Intermodulation @ Low end (30-1000 MHz out-of-band)



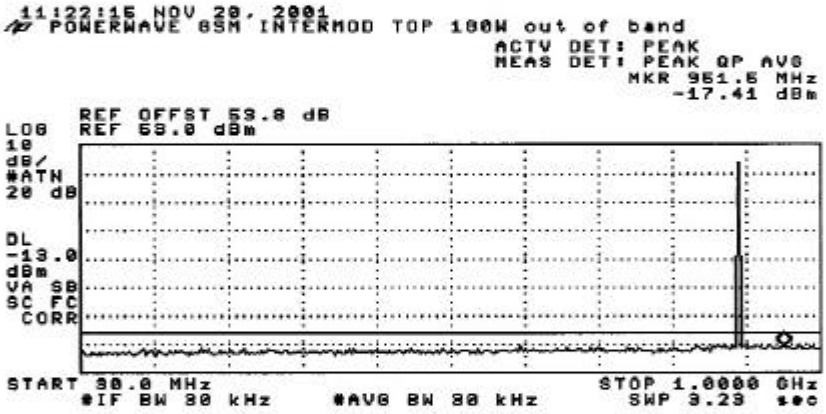
GSM Intermodulation @ Low end (1-2.9 GHz out-of-band)



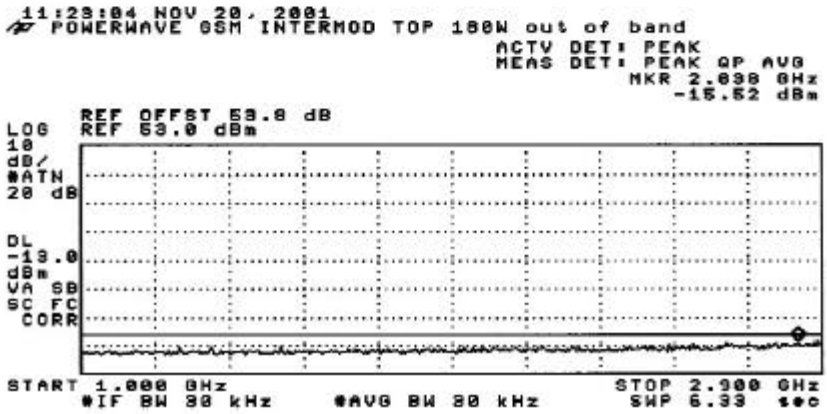
GSM Intermodulation @ Low end (2.9-9 GHz out-of-band)



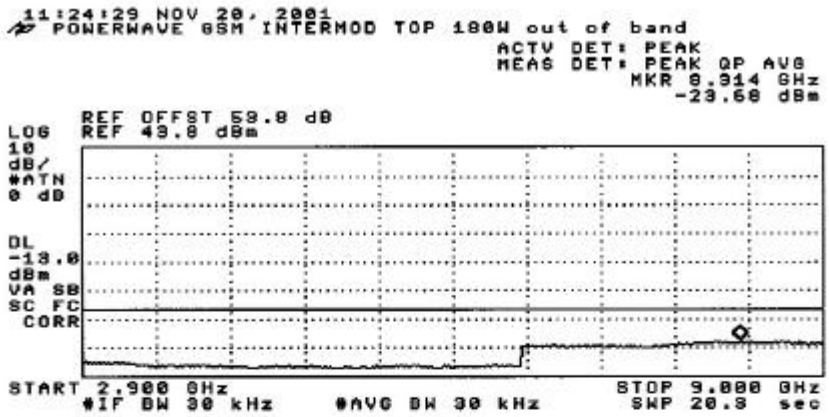
GSM Intermodulation @ High end (892.95 & 893.55 MHz)



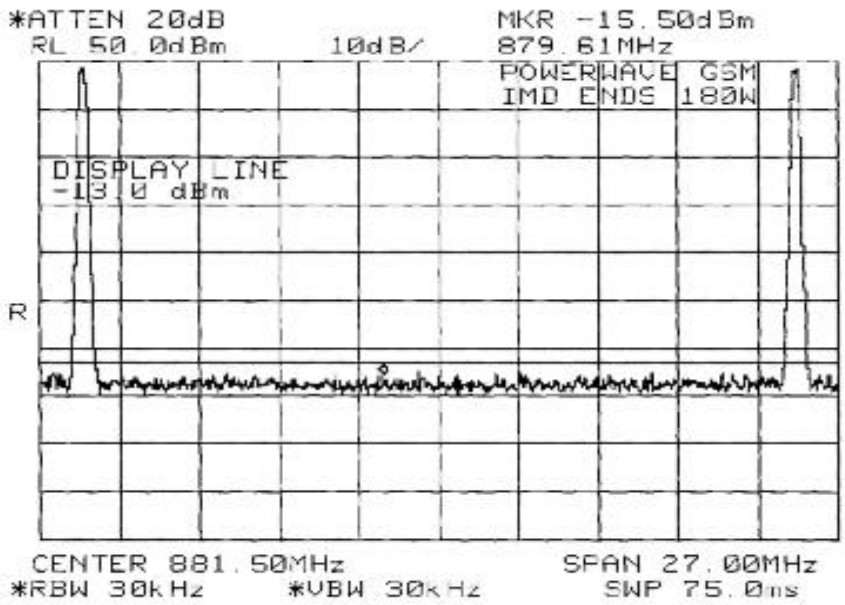
GSM Intermodulation @ High end (30-1000 MHz out-of-band)



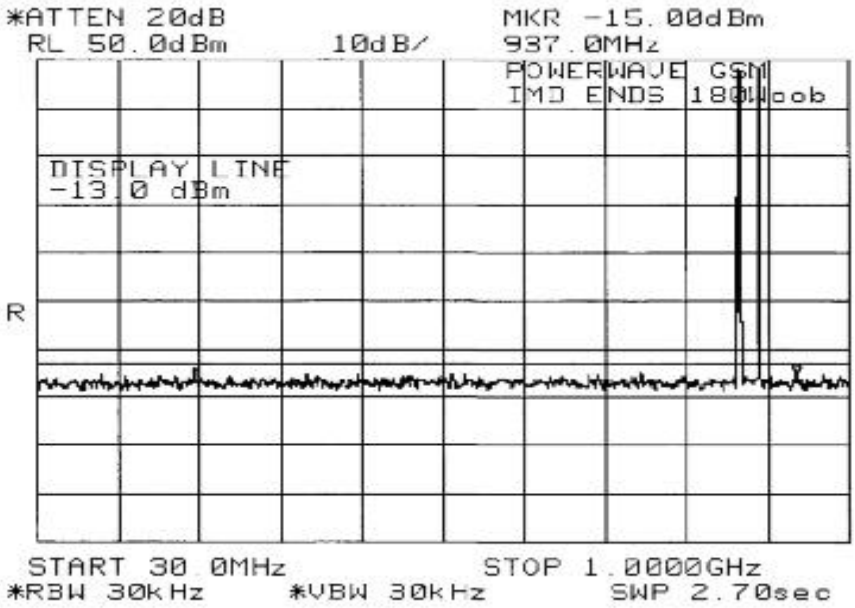
GSM Intermodulation @ High end (1-2.9 GHz out-of-band)



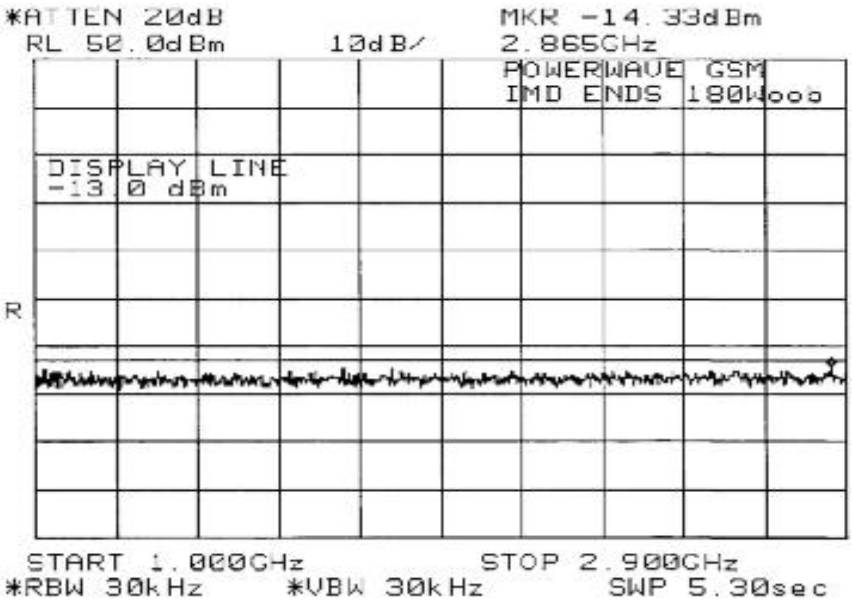
GSM Intermodulation @ High end (2.9-9 GHz out-of-band)



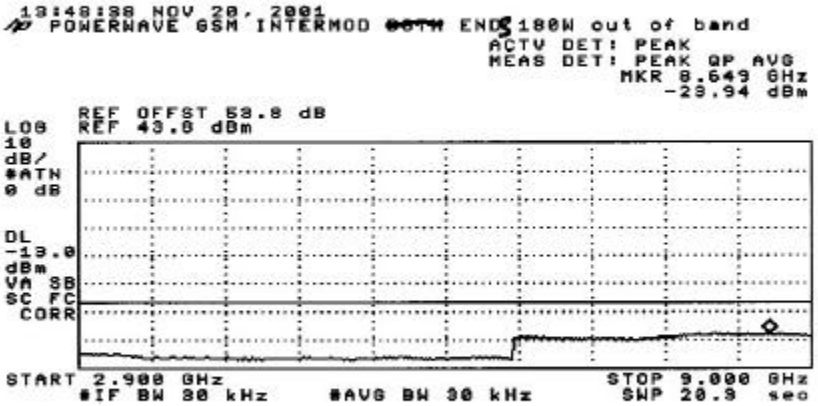
GSM Intermodulation @ Both ends (869.45 & 893.55 MHz)



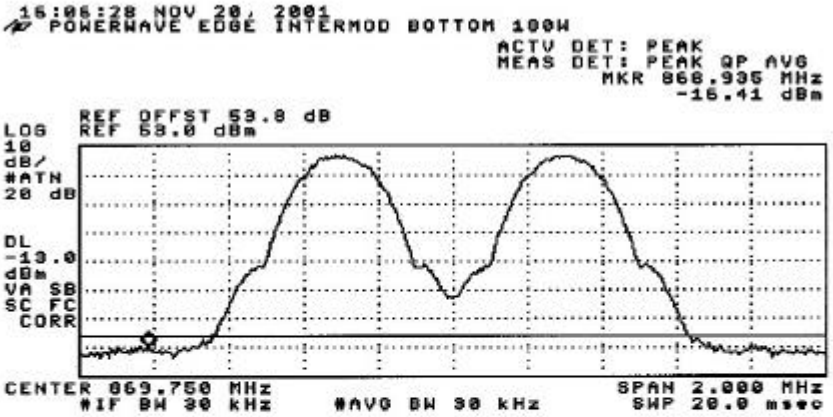
GSM Intermodulation @ Both ends (30-1000 MHz out-of-band)



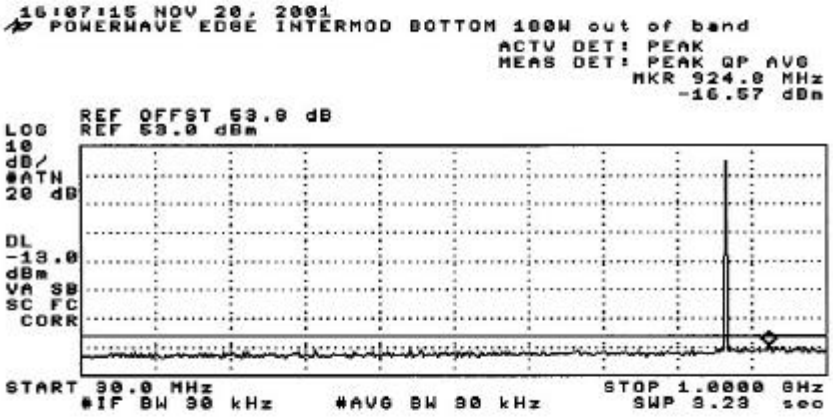
GSM Intermodulation @ Both ends (1-2.9 GHz out-of-band)



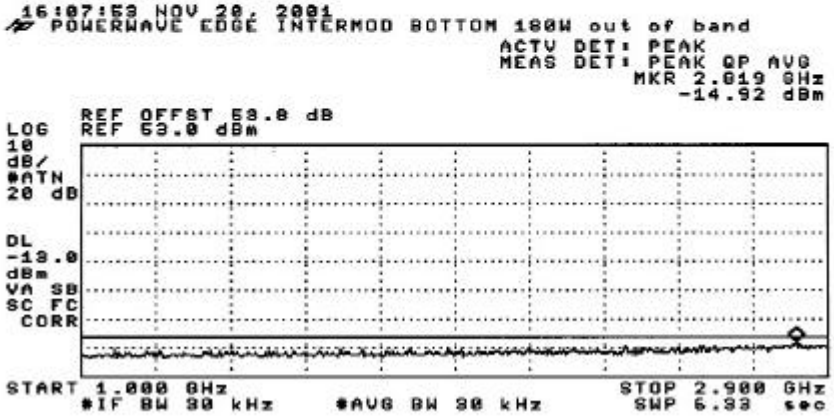
GSM Intermodulation @ Both ends (2.9-9 GHz out-of-band)



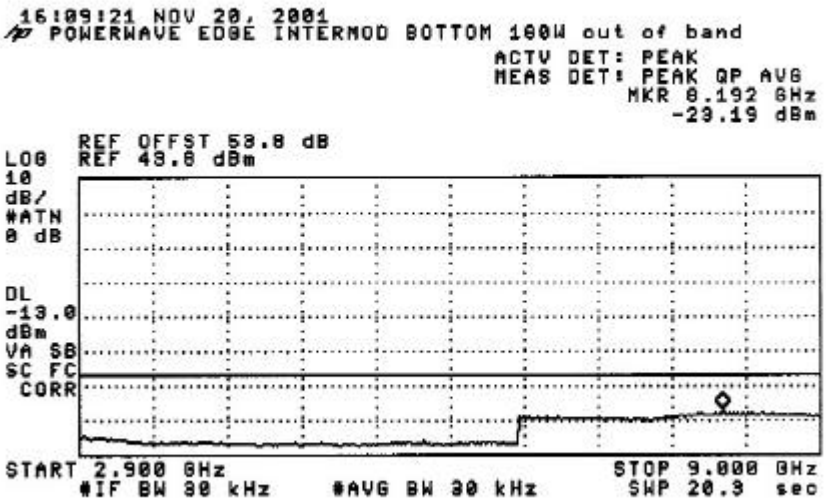
EDGE Intermodulation @ Low end (869.45 & 870.05 MHz)



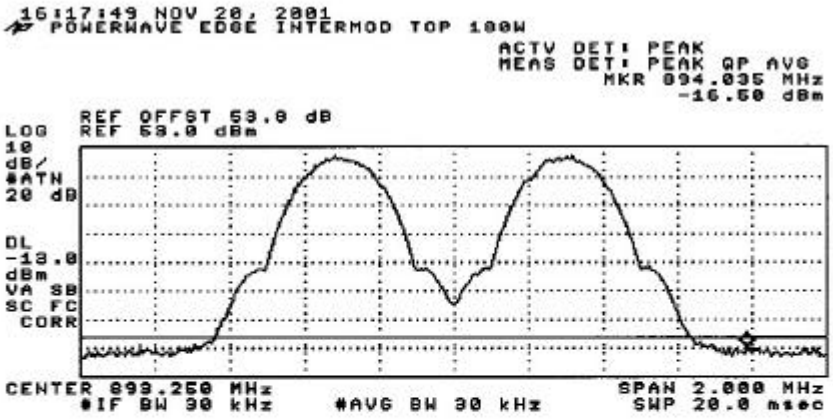
EDGE Intermodulation @ Low end (30-1000 MHz out-of-band)



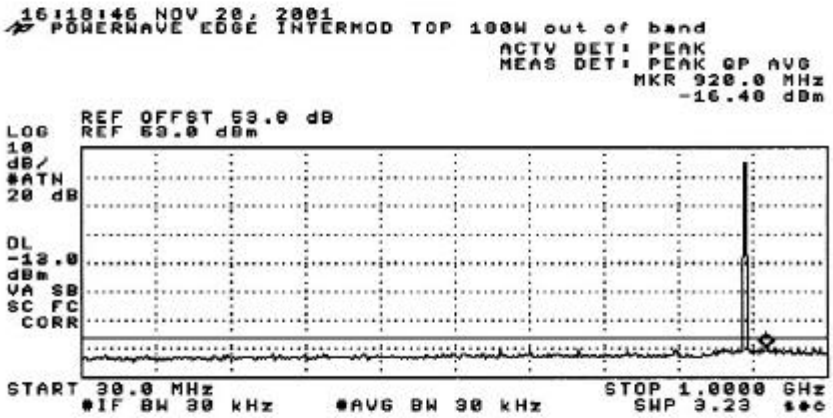
EDGE Intermodulation @ Low end (1-2.9 GHz out-of-band)



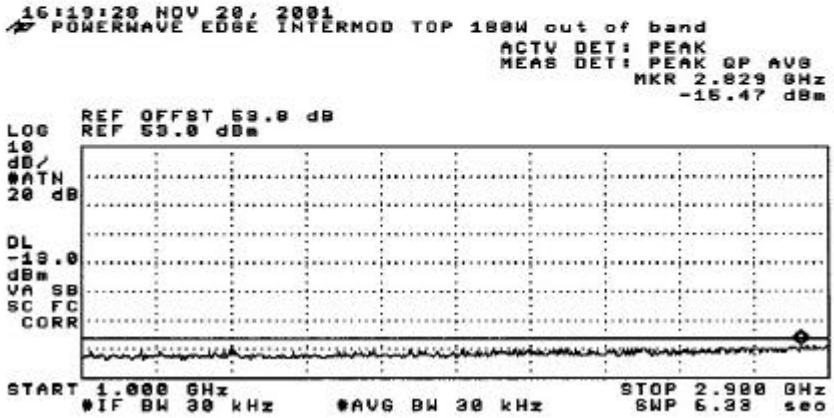
EDGE Intermodulation @ Low end (2.9-9 GHz out-of-band)



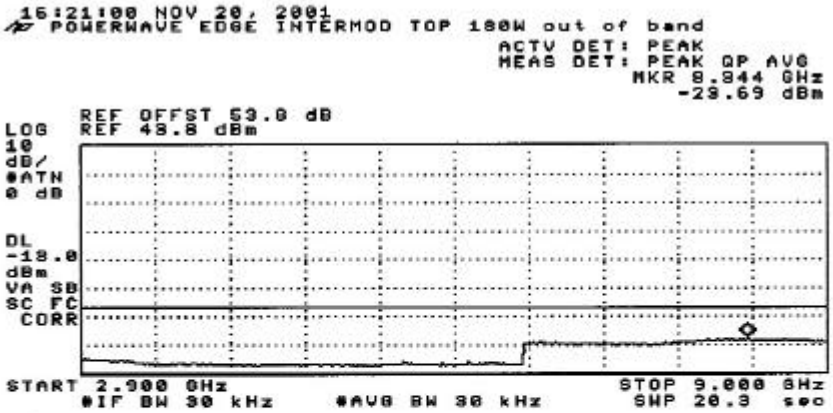
EDGE Intermodulation @ High end (892.95 & 893.55 MHz)



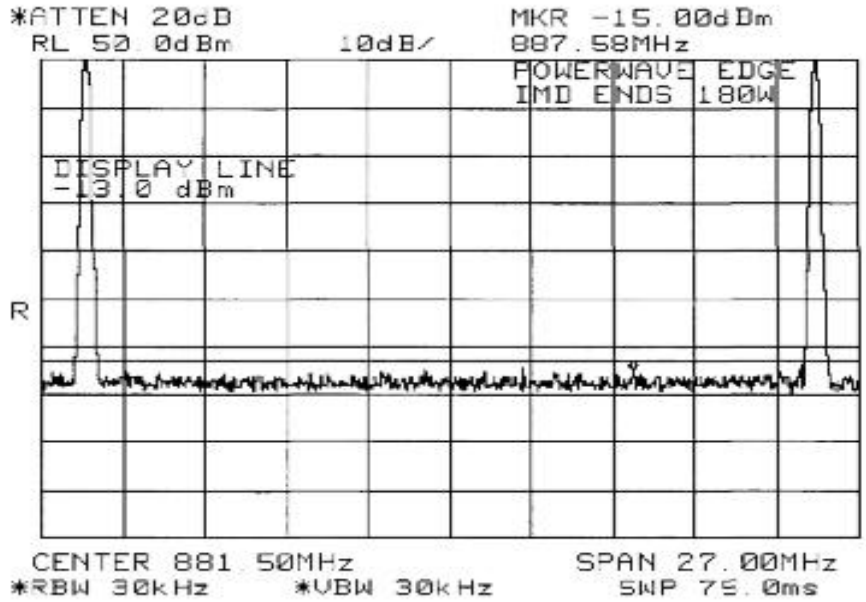
EDGE Intermodulation @ High end (30-1000 MHz out-of-band)



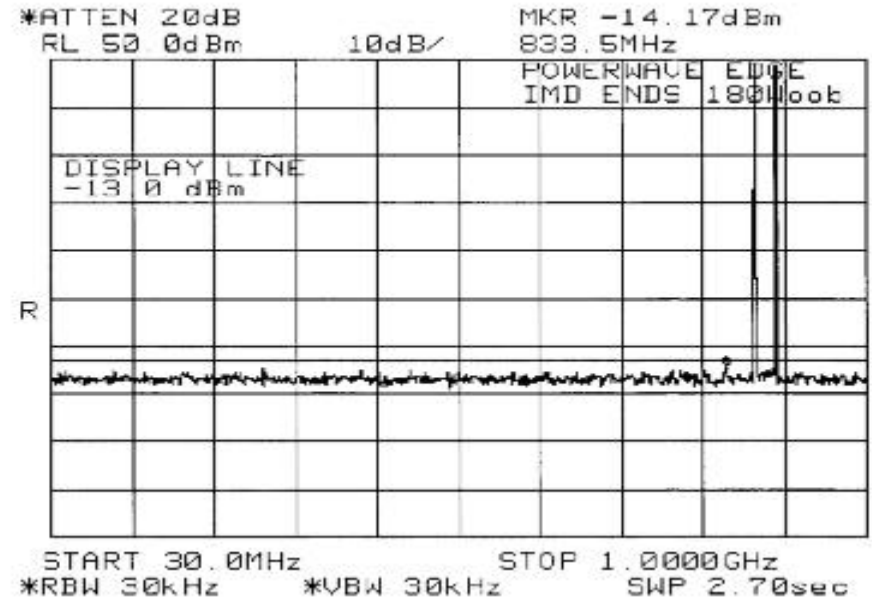
EDGE Intermodulation @ High end (1-2.9 GHz out-of-band)



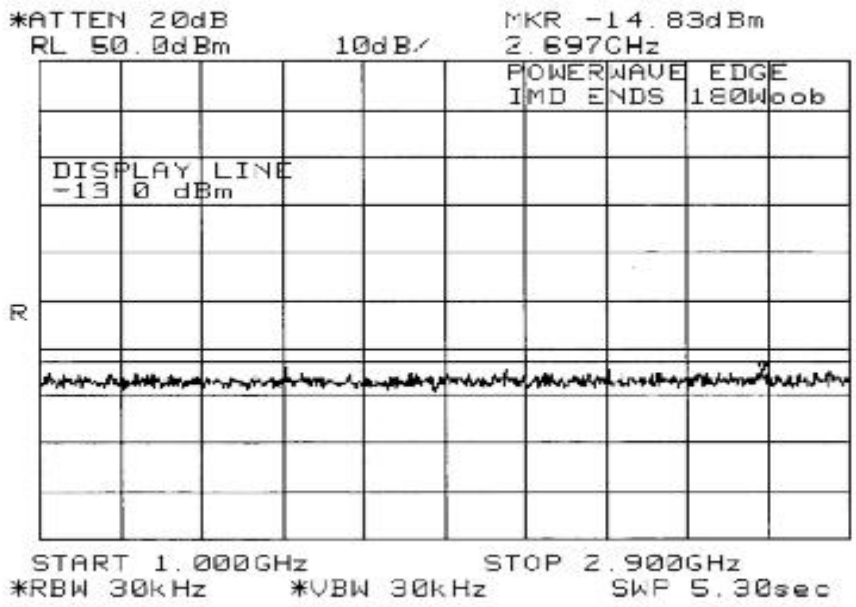
EDGE Intermodulation @ High end (2.9-9 GHz out-of-band)



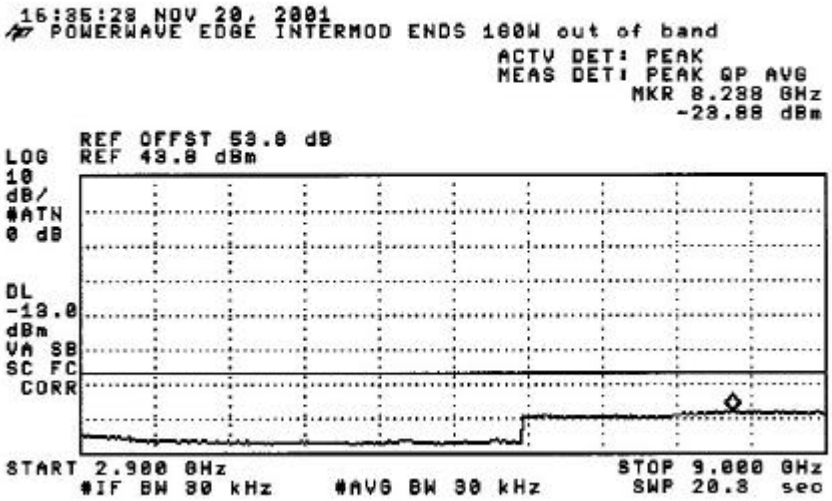
EDGE Intermodulation @ Both ends (869.45 & 893.55 MHz)



EDGE Intermodulation @ Both ends (30-1000 MHz out-of-band)



EDGE Intermodulation @ Both ends (1-2.9 GHz out-of-band)

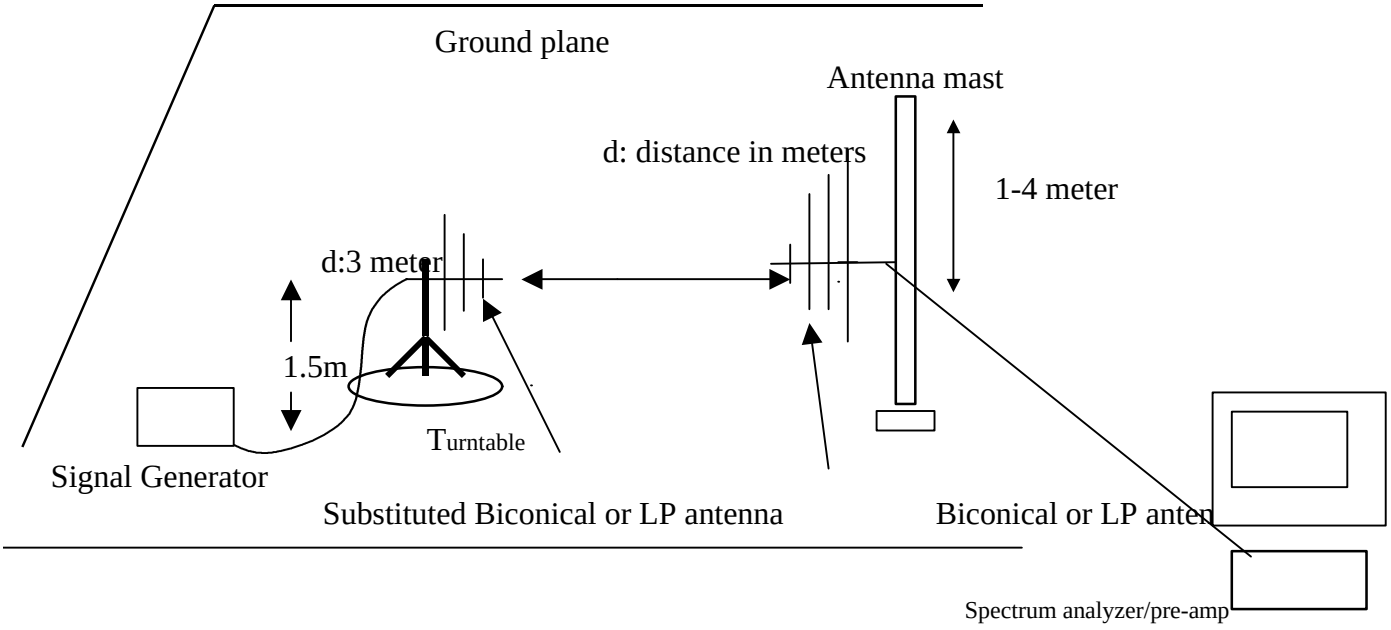


EDGE Intermodulation @ Both ends (2.9-9 GHz out-of-band)

SUBSTITUTION METHOD: (RADIATED EMISSIONS)

Test Set-up:

Radiated BELOW 1GHz



Radiated ABOVE 1 GHz

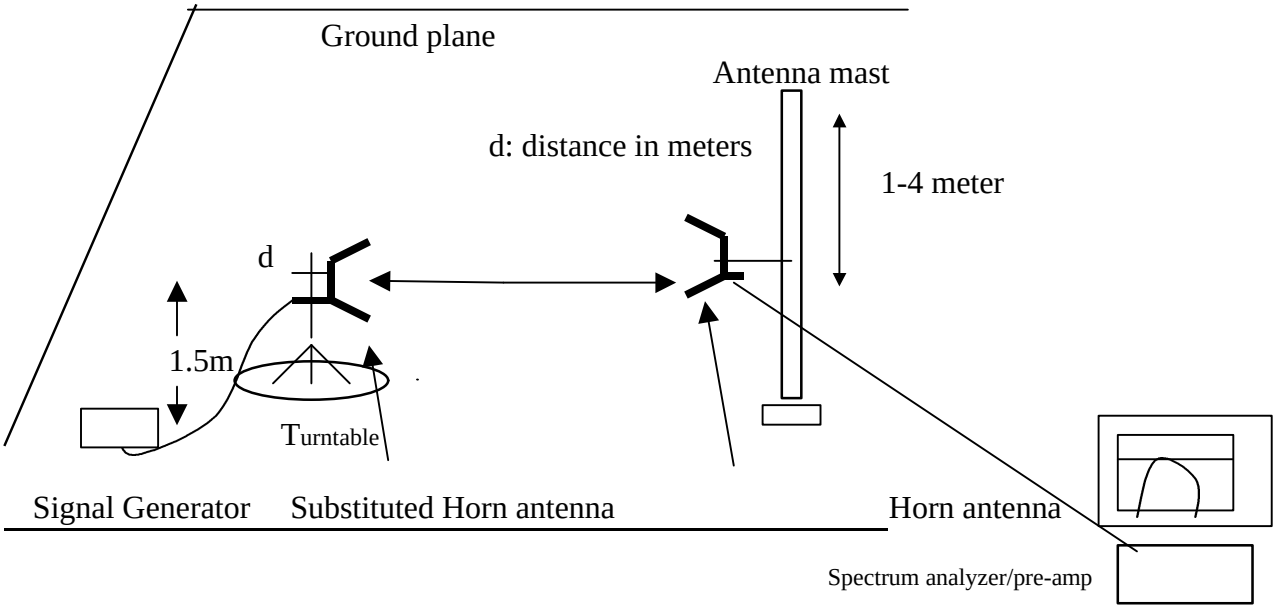


FIG. 11

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 calculated the true reading, is: True reading = dBm + GdBd - 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:
Due to Permissive Class II Change did not effect the RF section of main board, Radiated Emission was not tested.

SECTION 2.1055: FREQUENCY STABILITY

Not Applicable. Eut is a power amplifier.