FCC CFR47 PART 22 CERTIFICATION
CLASS II PERMISSIVE CHANGE
TEST REPORT

FOR

869-894MHz CDMA MULTI-CHANNEL AMPLIFIER

MODEL: NTGY71AB

FCC ID: E675JS0047

REPORT NUMBER: 02U1298-1

ISSUE DATE: MAY 16, 2002

Prepared for
POWERWAVE TECHNOLOGIES, INC.
1801 EAST ST. ANDREW PLACE
SANTA ANA, CA 92705 USA

Prepared by
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TEL: 408-463-0885
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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 EAST ST. ANDREW PLACE SANTA ANA, CA 92705
	Contact person:	JEFF DALE
	Telephone number:	(714) 466-1476
2.1033(c)(2)	**FCC ID:**	E675JS0047
2.1033(c)(4)	**Types of Emissions:**	F9W (CDMA & W-CDMA)
2.1033(c)(5)	**Frequency Range:**	869 – 894 MHz
2.1033(c)(6)	**Range of Operation Power:**	70 Watts
2.1033(c)(7)	**Maximum Power Rating:**	70 Watts
2.1033(c)(8)	**DC Voltage and Current:**	26Vdc @ 23.4 A Maximum; 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	☐ YES (REFER TO SECTION 8) ☒ 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:

FRANK IBRAHIM
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

REVIEWED and RELEASED BY:

MIKE HECKROTTE
CHIEF EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

This product is a linear, multichannel powe amplifier that operates in the 25MHZ frequency band from 869-894MHz, with a maximum power output of 70 Watts. It is designed to be mounted in an enclosure with EMI containment. Its flat base plate allows for mounting on a flat thermal-absorbing surface to provde adequate heat disspation.

Each amplifer module has a power, alarm, and control connector that allows the host system to monitor the amplifier module performance. Primary power for the amplifier is +26Vdc.

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 cla im 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.

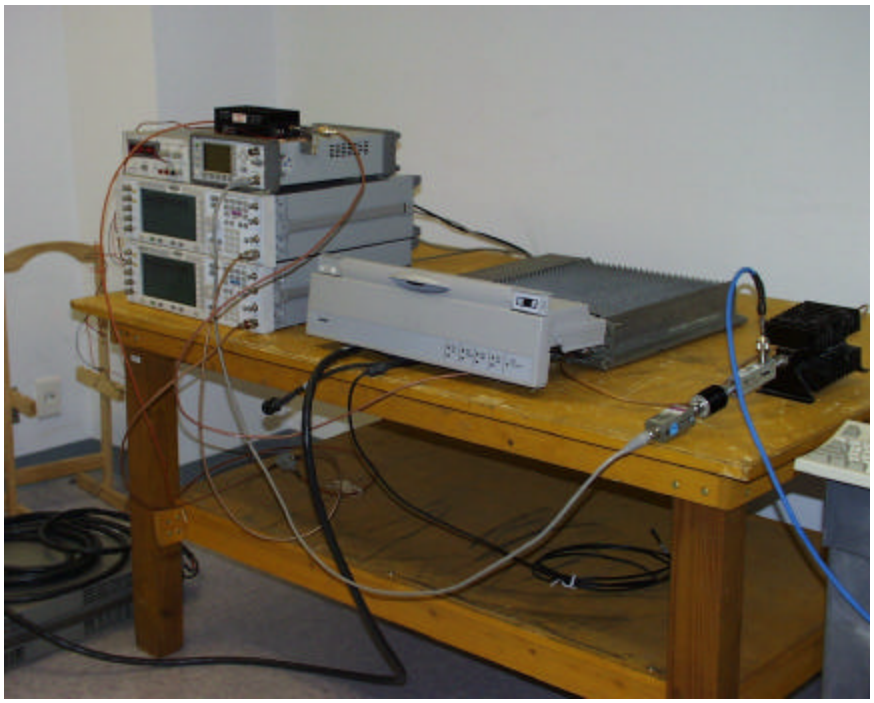
9. TEST EQUIPMENT LIST

Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Spectrum Display	HP	85662A	2152A03066	5/10/02
Spectrum Analyzer	HP100Hz - 22GHz	8566B	3014A06685	6/28/02
Quasi-Peak Detector	HP9K - 1GHz	85650A	3145A01654	6/28/02
Pre-amplifier,35.5 dB (1 - 26.5GHz)	HP	8449B	3008A00369	5/30/02
Horn Antenna(1 - 18GHz)	EMCO	3115	2238	6/20/02
Signal Generator	HP	83732B	US34490599	3/29/03
Horn Antenna(1 - 18GHz)	EMCO	3115	6717	1/31/03
Pre-Amplifier, 25 dB	HP 0.1 - 1300MHz	8447D (P_1M)	2944A06833	8/21/02
Antenna, Bicon	Eaton30 - 200MHz	94455-1	1197	8/2/02
Antenna, LP	EMCO200 - 2000MHz	3146	2120	8/2/02
Spectrum Analyzer	HP	8593EM	3710A00205	6/20/02

10. SUPPORT EQUIPMENT LIST

Device Type	Manufacturer	Model Number	Serial Number	FCC ID
Signal Generator	Agilent	E4432B	US40053261	N/A
DC Power Supply	HP	HP6674A	3501A-00976	N/A
DC Power Supply	HP	E3616A	Not Available	N/A
Power Meter	HP	E4418B	US39251104	N/A
Power Sensor	HP	481A	2702A78765	N/A
Attenuator	Weinschel	33-10-34	BH1396	N/A
Directional Coupler	HP	86205A	3140A03083	N/A
Attenuator	Narda	769-30	05204	N/A
Amplifier	Mini- Circuits	ZHL-42-SMA	H0100896-16	N/A

11. EUT SETUP PHOTOS



RF Conducted Measurements Setup

1 – 9GHz Radiated Emission Setup

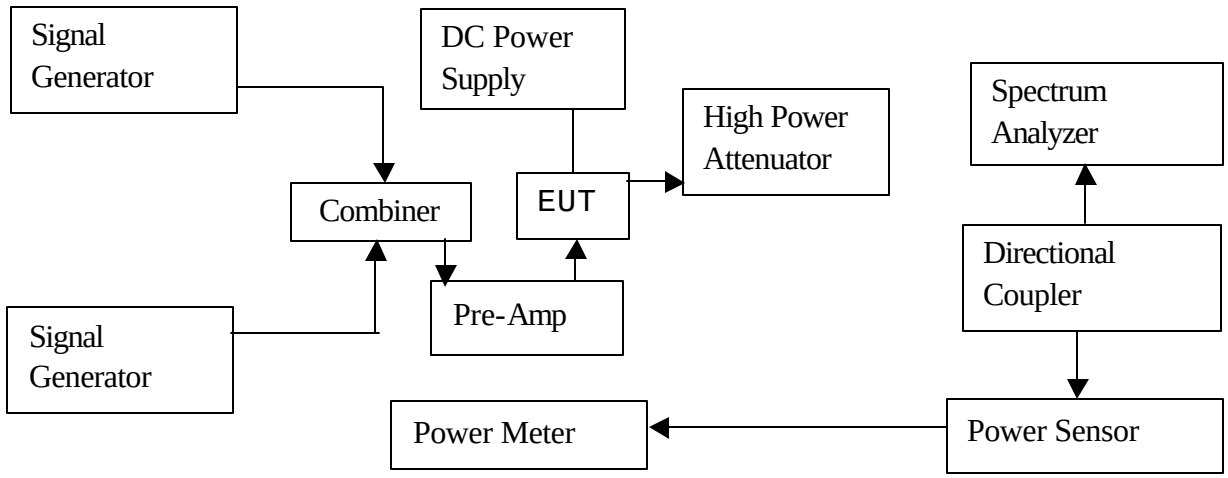
Part15 front view Radiated Emission Setup

Part15 back view Radiated Emission Setup

12. 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:** 1 meter
Bundled During Tests: NO	**Data Traffic Generated:** YES
Remark: N/A	

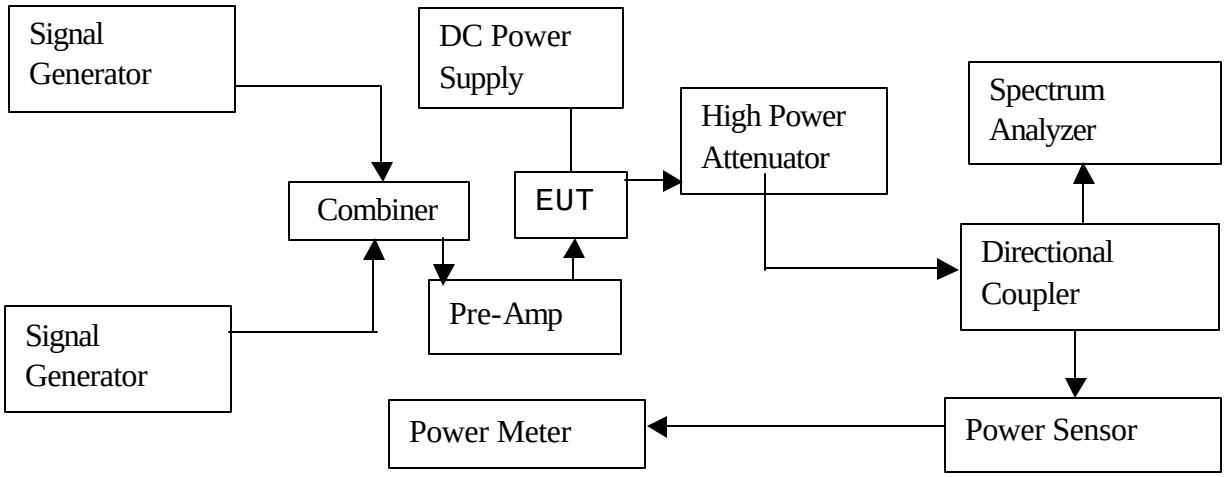
13. CONFIGURATION BLOCK DIAGRAM



14. PART 2: CERTIFICATION TEST REQUIREMENT:

14.1 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 70 Watts.

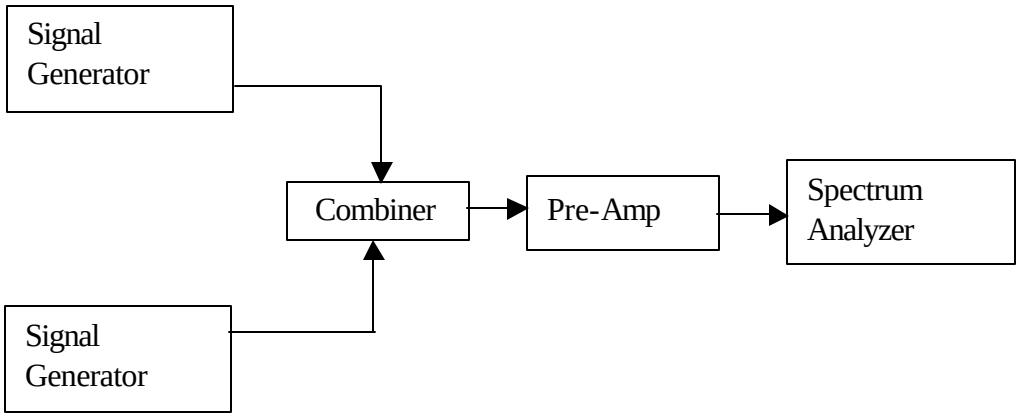
Test Result:
The EUT's measured output power was 70 Watts.

14.2 SECTION 2.1047: MODULATION CHARACTERISTICS

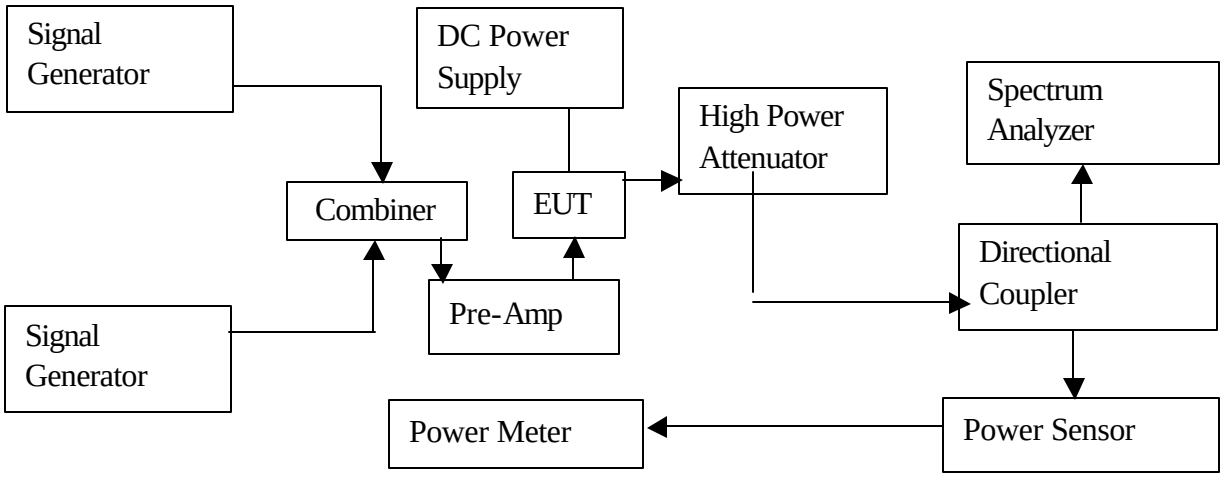
Not applicable. EUT is a power amplifier.

14.3 SECTION 2.1049: OCCUPIED BANDWIDTH

TEST SETUP FOR INPUT:



TEST SETUP FOR OUTPUT:



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 output signal bandwidth is representative of the input signal bandwidth.

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.

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.

Test Results:
See plots below:

OCCUPIED BANDWIDTH		
Plot#	**Description**	**Bandwidth (MHz)**
1	W-CDMA 20dB Input Bandwidth @ Low Channel (870.875 MHz)	4.1
2	W-CDMA 20dB Input Bandwidth @ Mid Channel (881.5 MHz)	4.1
3	W-CDMA 20dB Input Bandwidth @ High Channel (892.125 MHz)	4.1
4	W-CDMA 20dB Output Bandwidth @ Low Channel (870.875 MHz)	4.1
5	W-CDMA 20dB Output Bandwidth @ Mid Channel (881.5 MHz)	4.1
6	W-CDMA 20dB Output Bandwidth @ High Channel (892.125 MHz)	4.1

COMPLIANCE CERTIFICATION SERVICES DOCUMENT NO:CCSUP4031A
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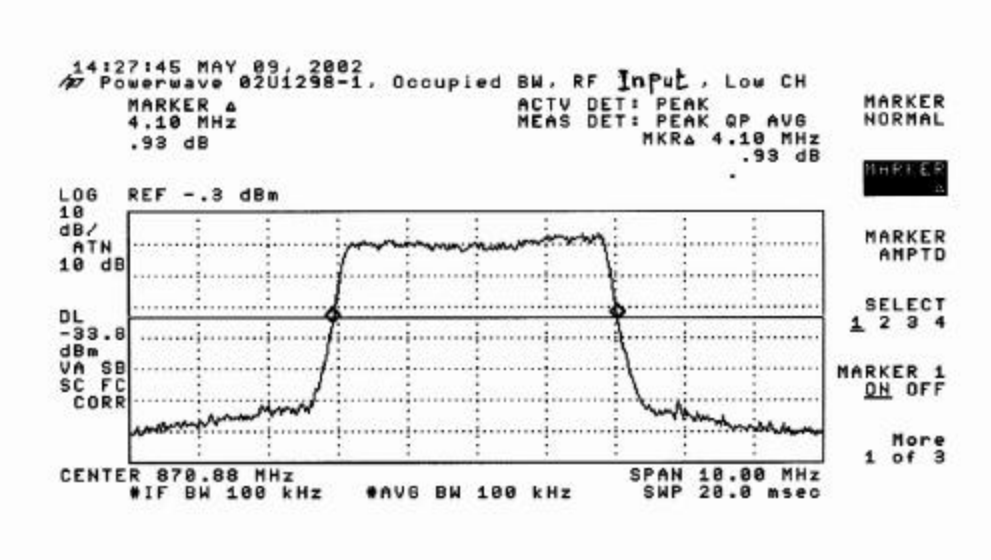

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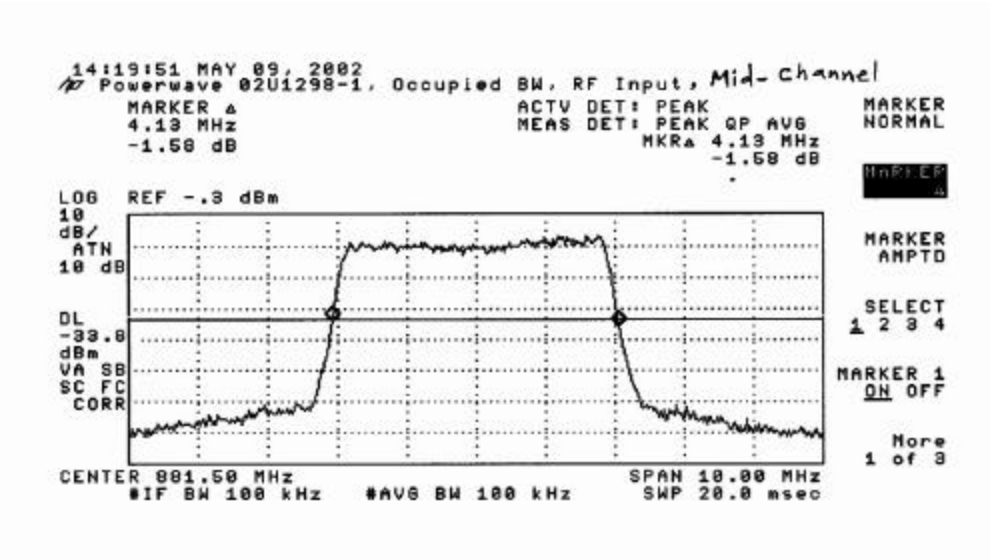

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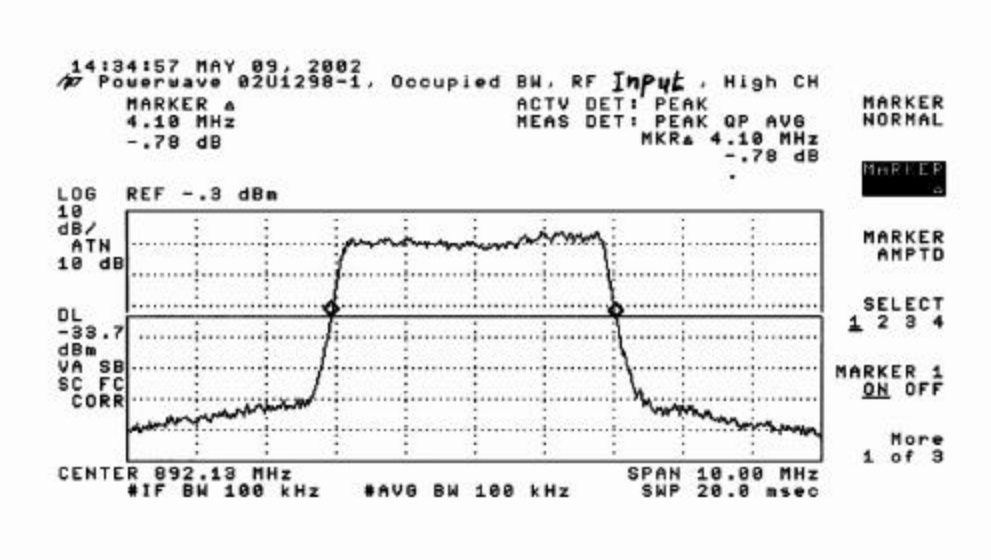

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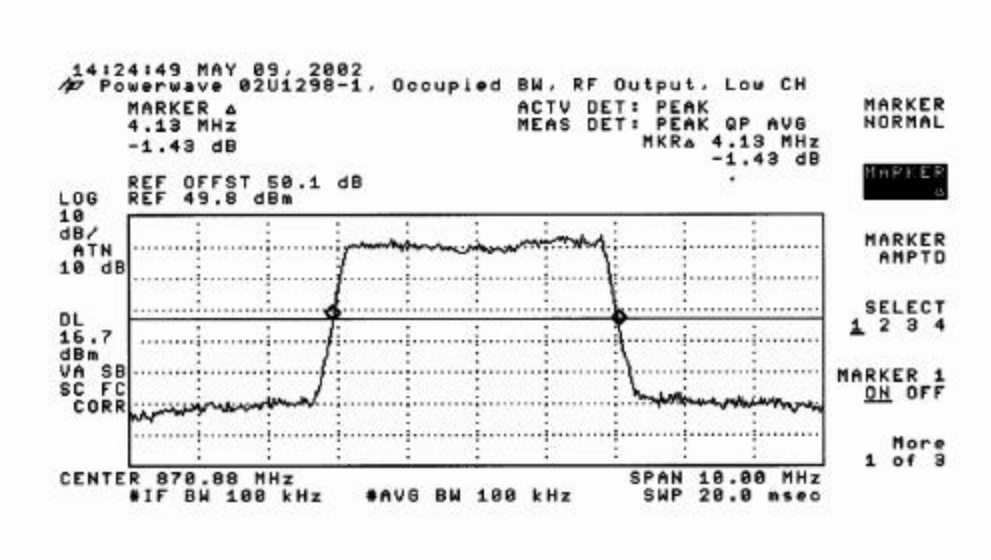

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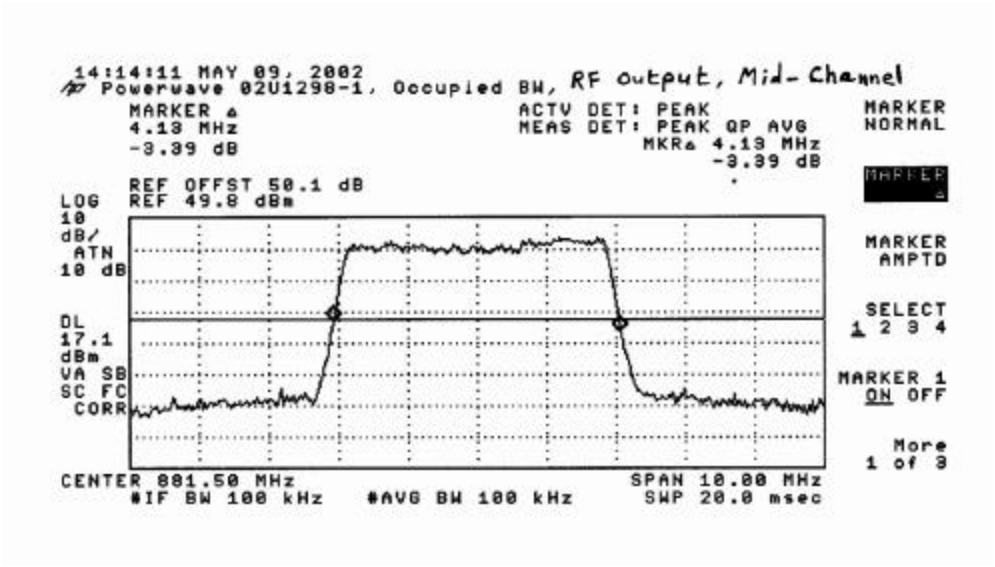

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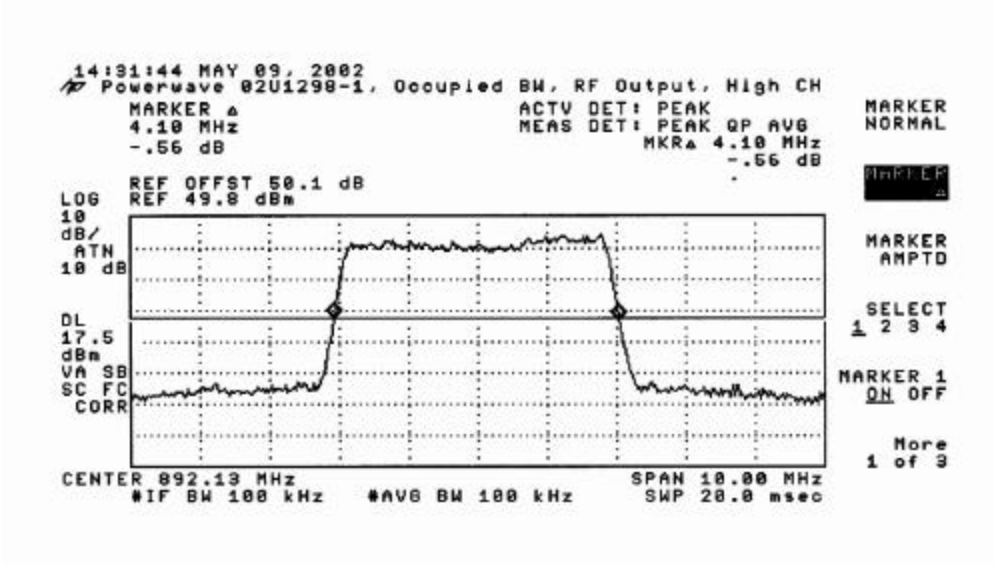

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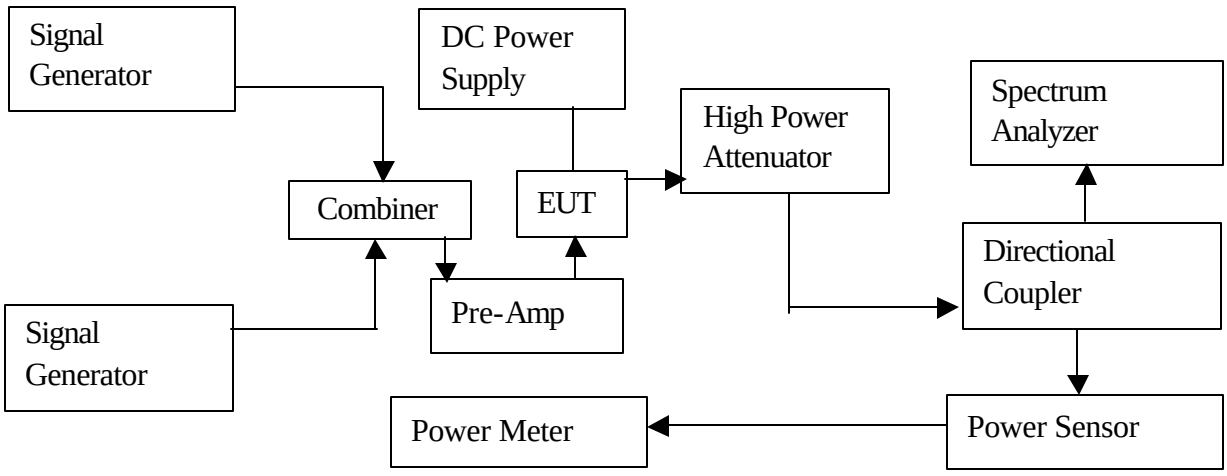
14.4 SECTION 2.1051: SPURIOUS EMISSION AT ANTENNA TERMINALS

TEST SETUP:

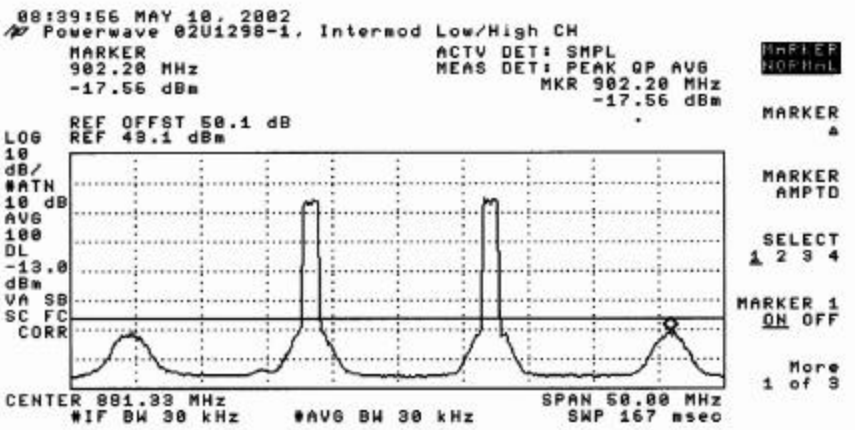


Minimum Requirement:
Section 22.917(e):
For Base stations transmitters the magnitude of each spurious, harmonic, and intermodulation emissions that can be detected when the equipment is operated under conditions specified in the instruction manual and/or alignment procedure, shall not be more than 43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

Test Procedure:
Input 2 tones modulated signals to the amp to produce 70 watts composite power. Set the RES & VID BW to 30kHz and the DISPLAY LINE to –13dBm. Scan the EUT from 30 MHz 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 15 MHz to 9GHz.

INTERMODULATION EMISSIONS		
Plot#	**Description**	**Frequency (MHz)**
7	W-CDMA 2 tones Intermodulation, Low & High Channels	874.625, 888.375
8	W-CDMA 2 tones Intermodulation, Low & Low Channels	874.625, 882.125
9	W-CDMA 2 tones Intermodulation, High & High Channels	886.500, 888.375
10	W-CDMA 2 tones Intermodulation, Bandedge, Low Channel	869.000
11	W-CDMA 2 tones Intermodulation, Bandedge, High Channel	894.000
12	W-CDMA 2 tones Intermodulation Out-of-Band, Low & Low	15 - 1000
13	W-CDMA 2 tones Intermodulation Out-of-Band, Low & Low	1000 - 2900
14	W-CDMA 2 tones Intermodulation Out-of-Band, Low & Low	2900 - 9000
15	W-CDMA 2 tones Intermodulation Out-of-Band, Low & High	15 - 1000
16	W-CDMA 2 tones Intermodulation Out-of-Band, Low & High	1000 - 2900
17	W-CDMA 2 tones Intermodulation Out-of-Band, Low & High	2900 - 9000
18	W-CDMA 2 tones Intermodulation Out-of-Band, High & High	15 - 1000
19	W-CDMA 2 tones Intermodulation Out-of-Band, High & High	1000 - 2900
20	W-CDMA 2 tones Intermodulation Out-of-Band, High & High	2900 - 9000



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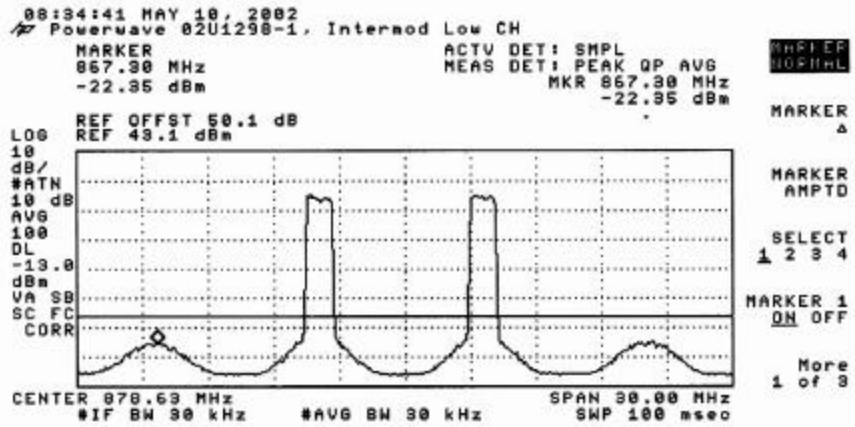

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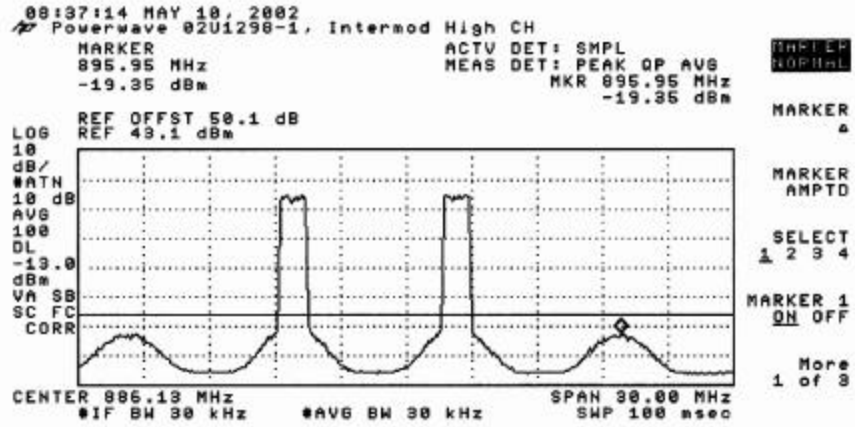

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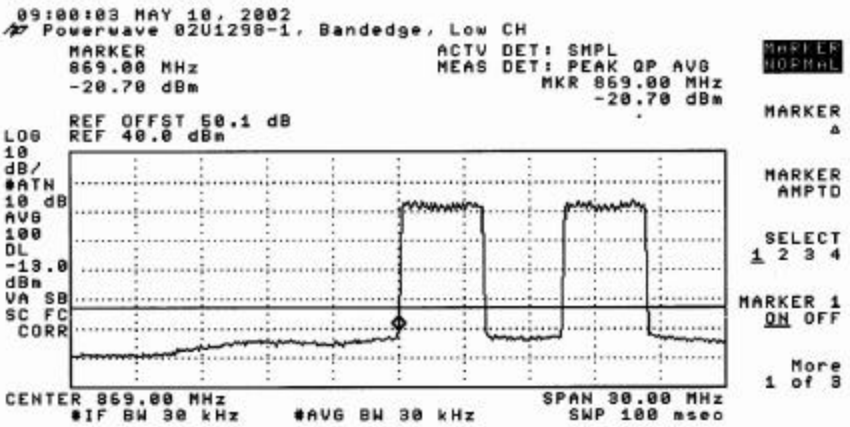

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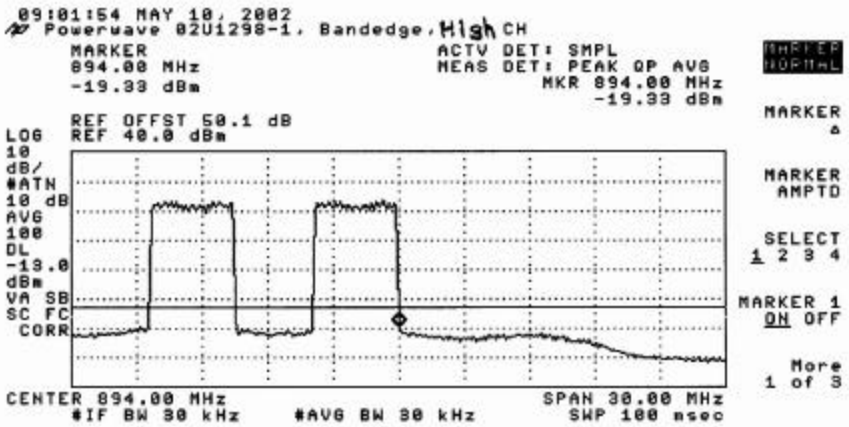

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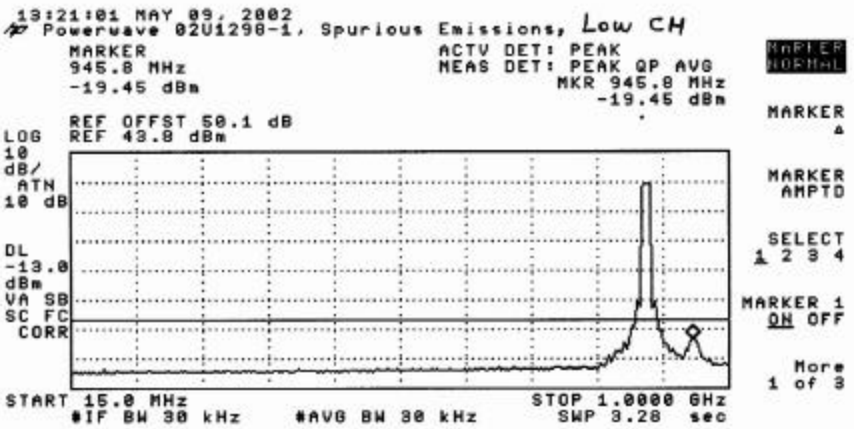

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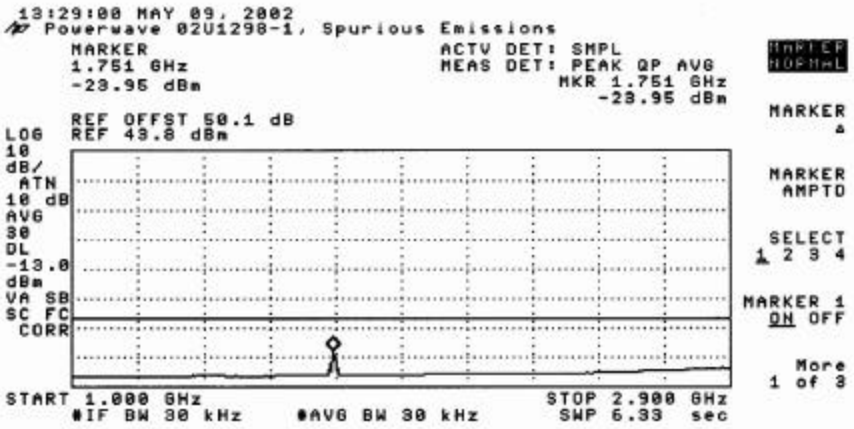

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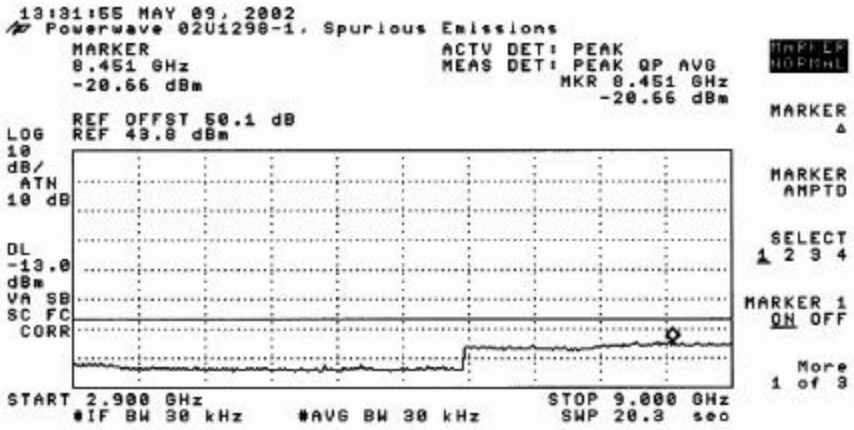

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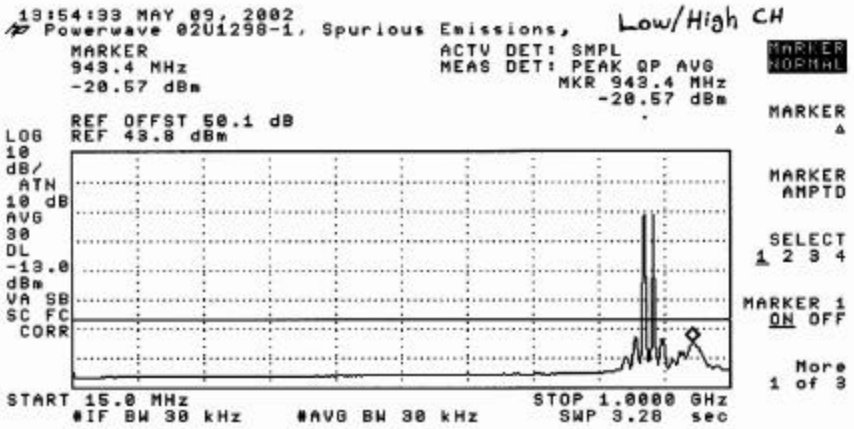

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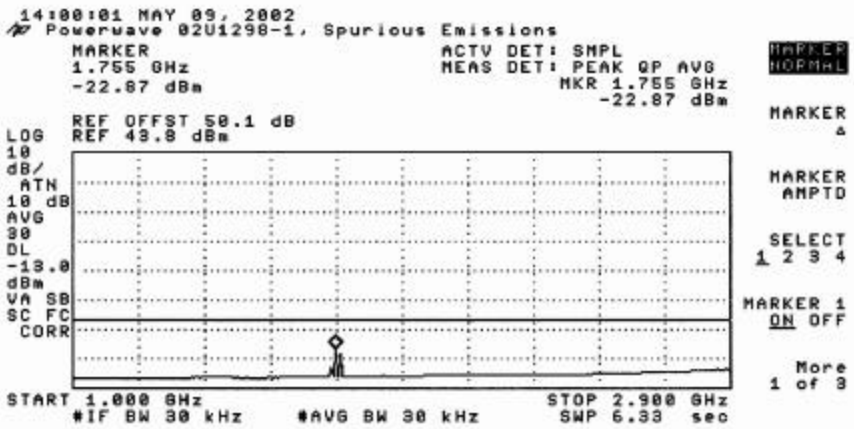

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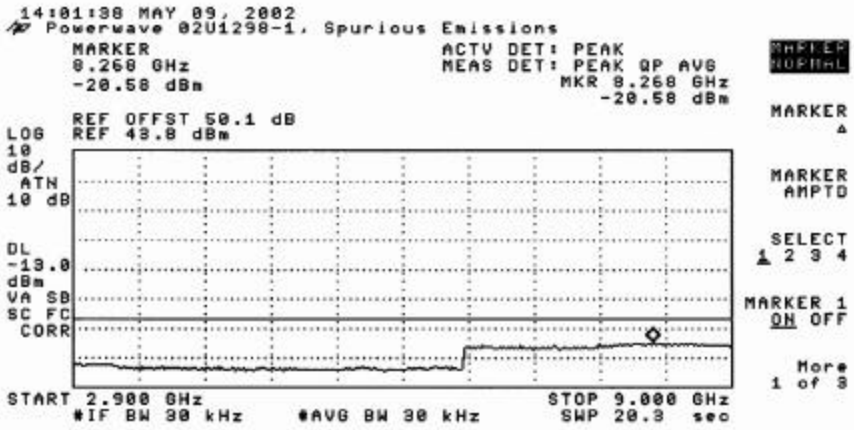

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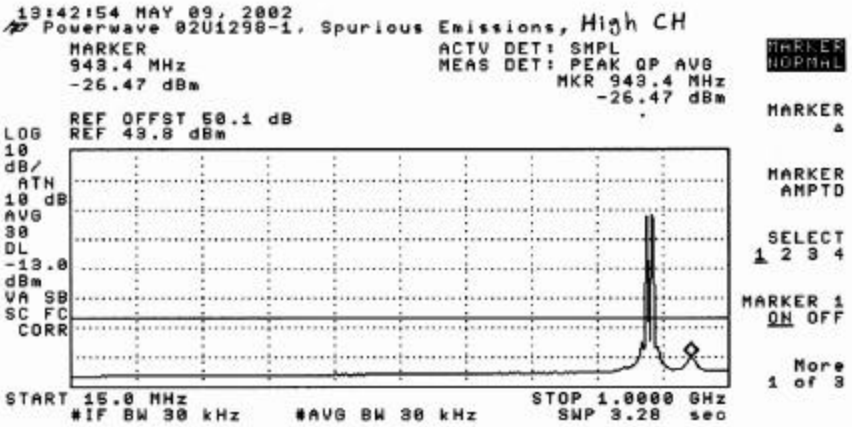

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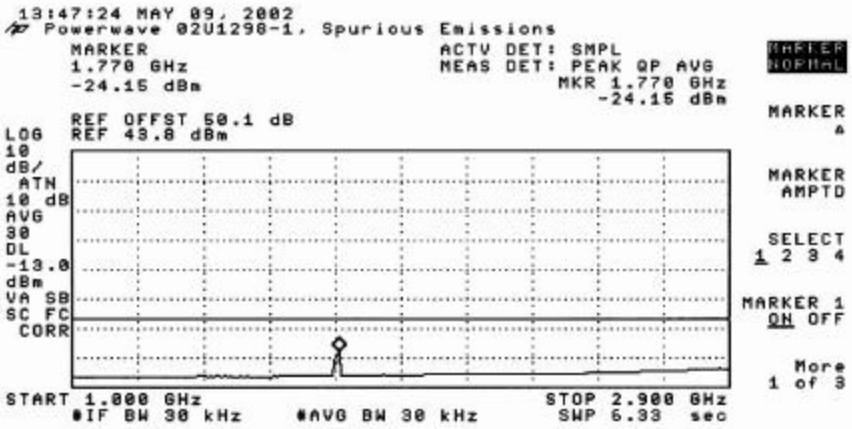

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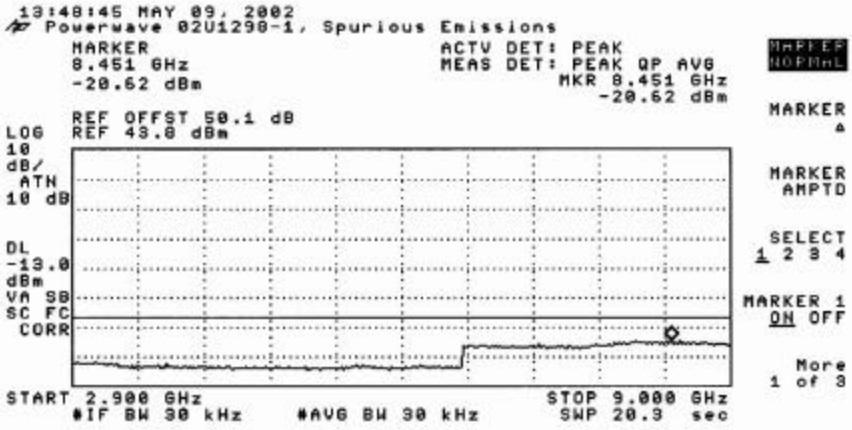

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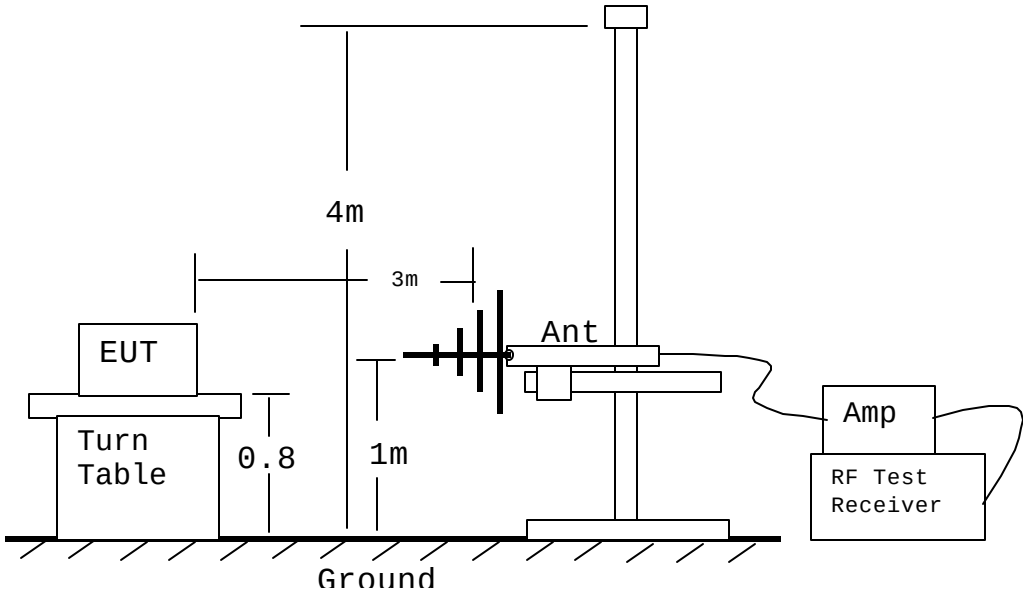
14.5 SECTION 2.1055: FREQUENCY STABILITY

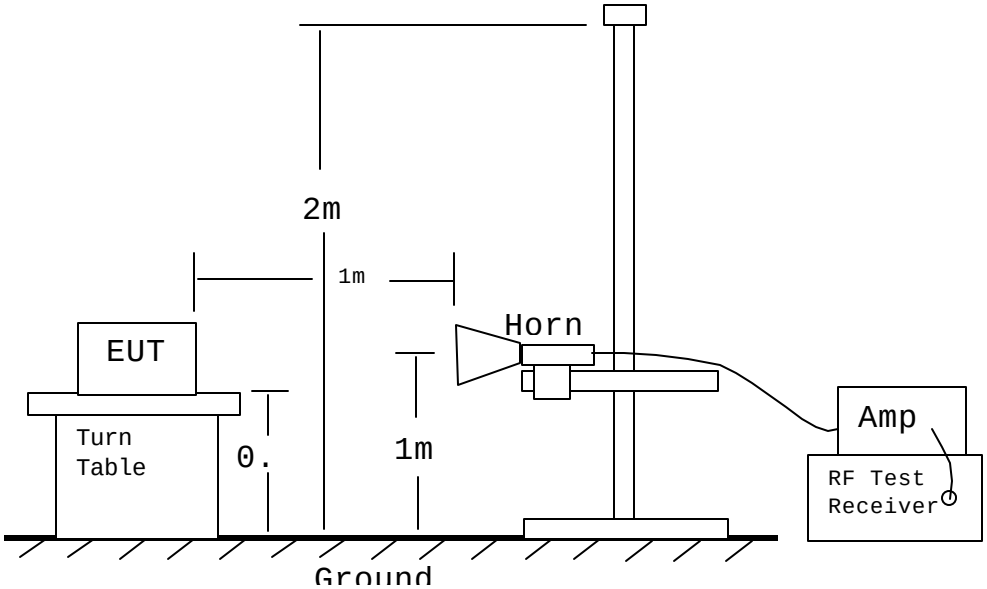
Not Applicable. Eut is a power amplifier.

15. RADIATED EMISSIONS PART 22

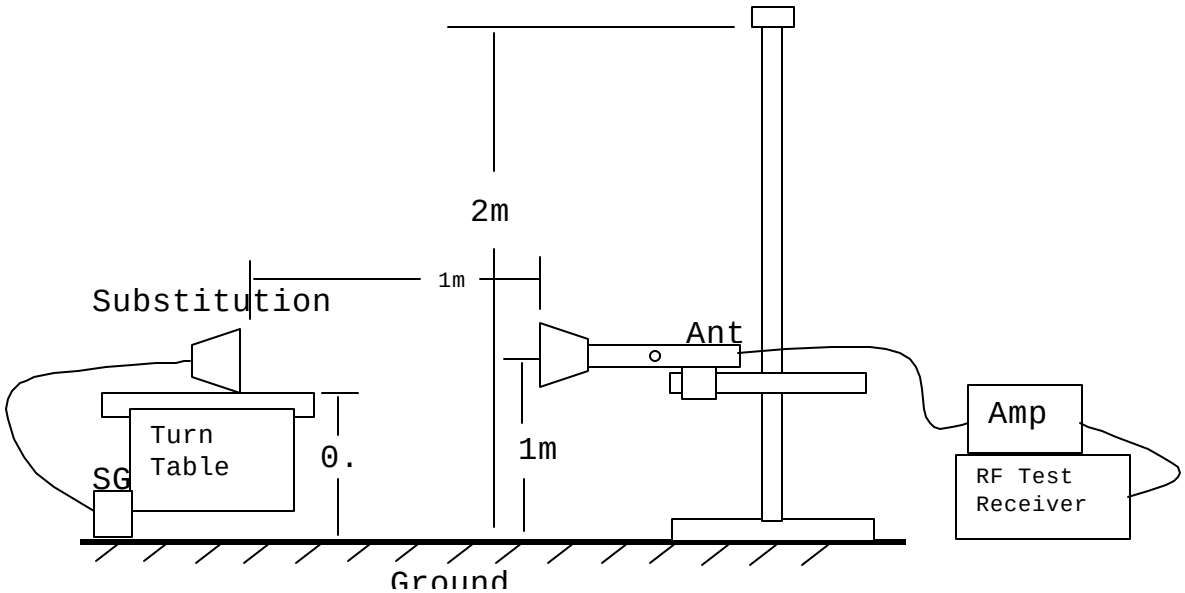
Test Set-up:



Radiated Emission Test 30 – 1000 MHz (Bilog)



Radiated Emission Test 1 – 9 GHz (Horn)



Substitution Method above1 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 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:
See radiated emission data attached below.

Date: 5/9/02
Client: Powerwave Technologies, Inc.
Project #: 02U1298-1
EUT: 869 - 894 MHz CDMA Multi Channel Amplifier, Model: NTGY71AB
Tester: Frank Ibrahim

Freq (GHz)	SG reading (dBm)	CL (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1.738	-84	1.1	6.05	-79.05	-13	-66.05
2.607	-100	1.3	6.85	-94.45	-13	-81.45
3.476	-108	1.5	6.75	-102.75	-13	-89.75
4.345	-98	1.8	7.35	-92.45	-13	-79.45
5.214	-96	2.0	7.75	-90.25	-13	-77.25
6.083	-95	2.2	8.25	-88.95	-13	-75.95
6.952	-90	2.4	8.45	-83.95	-13	-70.95
7.821	-92	2.5	8.15	-86.35	-13	-73.35
8.69	-92	2.7	8.25	-86.45	-13	-73.45

Low Channel, Vertical

Freq (GHz)	SG reading (dBm)	CL (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1.738	-88	1.1	6.05	-83.05	-13	-70.05
2.607	-99	1.3	6.85	-93.45	-13	-80.45
3.476	-101	1.5	6.75	-95.75	-13	-82.75
4.345	-100	1.8	7.35	-94.45	-13	-81.45
5.214	-100	2.0	7.75	-94.25	-13	-81.25
6.083	-98	2.2	8.25	-91.95	-13	-78.95
6.952	-95	2.4	8.45	-88.95	-13	-75.95
7.821	-93	2.5	8.15	-87.35	-13	-74.35
8.69	-94	2.7	8.25	-88.45	-13	-75.45

Low Channel, Horizontal

Freq (GHz)	SG reading (dBm)	CL (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1.763	-78	1.1	6.05	-73.05	-13	-60.05
2.644	-96	1.3	6.85	-90.45	-13	-77.45
3.526	-94	1.5	6.75	-88.75	-13	-75.75
4.407	-95	1.8	7.35	-89.45	-13	-76.45
5.289	-95	2.0	7.75	-89.25	-13	-76.25
6.17	-90	2.2	8.25	-83.95	-13	-70.95
7.052	-89	2.4	8.45	-82.95	-13	-69.95
7.933	-90	2.5	8.15	-84.35	-13	-71.35
8.815	-91	2.7	8.25	-85.45	-13	-72.45

Middle Channel, Vertical

Freq (GHz)	SG reading (dBm)	CL (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1.763	-73	1.1	6.05	-68.05	-13	-55.05
2.644	-90	1.3	6.85	-84.45	-13	-71.45
3.526	-96	1.5	6.75	-90.75	-13	-77.75
4.407	-97	1.8	7.35	-91.45	-13	-78.45
5.289	-97	2.0	7.75	-91.25	-13	-78.25
6.17	-97	2.2	8.25	-90.95	-13	-77.95
7.052	-93	2.4	8.45	-86.95	-13	-73.95
7.933	-94	2.5	8.15	-88.35	-13	-75.35
8.815	-95	2.7	8.25	-89.45	-13	-76.45

Middle Channel, Horizontal

Freq (GHz)	SG reading (dBm)	CL (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1.788	-86	1.1	6.05	-81.05	-13	-68.05
2.682	-90	1.3	6.85	-84.45	-13	-71.45
3.576	-90	1.5	6.75	-84.75	-13	-71.75
4.47	-90	1.8	7.35	-84.45	-13	-71.45
5.364	-80	2.0	7.75	-74.25	-13	-61.25
6.258	-80	2.2	8.25	-73.95	-13	-60.95
7.152	-80	2.4	8.45	-73.95	-13	-60.95
8.046	-85	2.5	8.15	-79.35	-13	-66.35
8.94	-85	2.7	8.25	-79.45	-13	-66.45

High Channel, Vertical

Freq (GHz)	SG reading (dBm)	CL (dB)	Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)
1.788	-90	1.1	6.05	-85.05	-13	-72.05
2.682	-90	1.3	6.85	-84.45	-13	-71.45
3.576	-90	1.5	6.75	-84.75	-13	-71.75
4.47	-90	1.8	7.35	-84.45	-13	-71.45
5.364	-80	2.0	7.75	-74.25	-13	-61.25
6.258	-80	2.2	8.25	-73.95	-13	-60.95
7.152	-80	2.4	8.45	-73.95	-13	-60.95
8.046	-85	2.5	8.15	-79.35	-13	-66.35
8.94	-85	2.7	8.25	-79.45	-13	-66.45

High Channel, Horizontal

16. 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 3 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 C63.4/1992.

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 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.

COMPLIANCE Certification Services

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 #: 02U1298-1
Report #: 020508A01
Date& Time: 05/08/02 10:49 AM
Test Engr: Frank Ibrahim

Company: Powerwave Technologies, Inc.
EUT Description: 869 - 894 MHz CDMA Multichannel Amplifier, model: NTGY71AB
Test Configuration : EUT, SG, 2 Attenuators, Directional Coupler, Power Sensor, Power Meter
Type of Test: EN 55022 CLASS B
Mode of Operation: Normal receive mode

<< Main Sheet

Freq. (MHz)	Reading (dBuV)	AF (dB)	Closs (dB)	Pre-amp (dB)	Level (dBuV/m)	Limit EN_B	Margin (dB)	Pol (H/V)	Az (Deg)	Height (Meter)	Mark (P/Q/A)
44.45	43.70	12.22	1.02	27.63	29.31	30.00	-0.69	10mV	0.00	1.00	QP
120.00	44.50	10.42	1.71	27.50	29.13	30.00	-0.87	10mV	0.00	1.00	QP
126.04	43.40	11.32	1.75	27.51	28.96	30.00	-1.04	10mV	0.00	1.00	P
633.30	40.20	19.83	4.17	28.57	35.62	37.00	-1.38	10mV	0.00	1.00	QP
600.00	41.00	19.04	4.06	28.56	35.54	37.00	-1.46	10mV	0.00	1.00	QP
83.33	44.90	8.21	1.39	27.61	26.90	30.00	-3.10	10mH	0.00	1.00	P

END OF REPORT