

**COMPLIANCE WORLDWIDE INC.
TEST REPORT 349-12**

In Accordance with the Requirements of
FCC PART 27:2011 Subparts C & L

Issued to

**Cellular Specialties, Inc.
670 North Commercial Street
Manchester, NH 03010
(603) 626-6677**

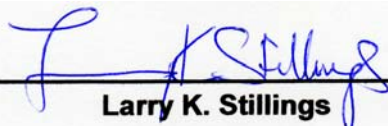
for

**Co-Pilot Beacon AWS
Model: CSI-CPBH-MG-AW4**

FCC ID: NVRCSICPBHMG-AW4


Report Issued on November 28, 2012

Tested by



Larry K. Stillings

Reviewed By



Brian F. Breault

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1. Scope

This test report certifies that the Cellular Specialties Co-Pilot Beacon CPBH-MG-AW4, as tested, meets the FCC Part 27 Subparts C & L requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

2. Product Details

- 2.1. Manufacturer:** Cellular Specialties
- 2.2. Model Number:** Co-Pilot Beacon CSI-CPBH-MG-AW4
- 2.3. Serial Number:** C1E20008
- 2.4. Description:** The Co-Pilot Beacon AWS is the first viable location based solution for simulcast CDMA Distributed Antenna Systems (DASs). It is designed to improve location accuracy of cell phones and wireless devices outdoors and within buildings.
- 2.5. Power Source:** 120 VAC, 60 Hz
- 2.6. EMC Modifications:** None

3. Product Configuration

3.1. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
Power Supply	APX Technologies	SP130P954ER	06502248	
Notebook PC	Dell	Latitude D610	19472301901	Configuring Unit

3.2. Cables

Cable Type	Length	Shield	From	To
RF, 50 Ω, SMA male – SMA male	1M	Yes	DUT	AWS Antennas
Pulse In	1M	Yes	DUT	Unterminated
EST Out	1M	Yes	DUT	Unterminated
GPS	5M	No	DUT	Garmin GPS Antenna
Power Supply	2M + 2M	Yes	DUT	120 VAC, 60 Hz
Serial 1	2M	Yes	DUT	Notebook PC
USB 1 & USB 2	2M	Yes	DUT	Notebook PC
Ethernet	2M	No	DUT	Notebook PC

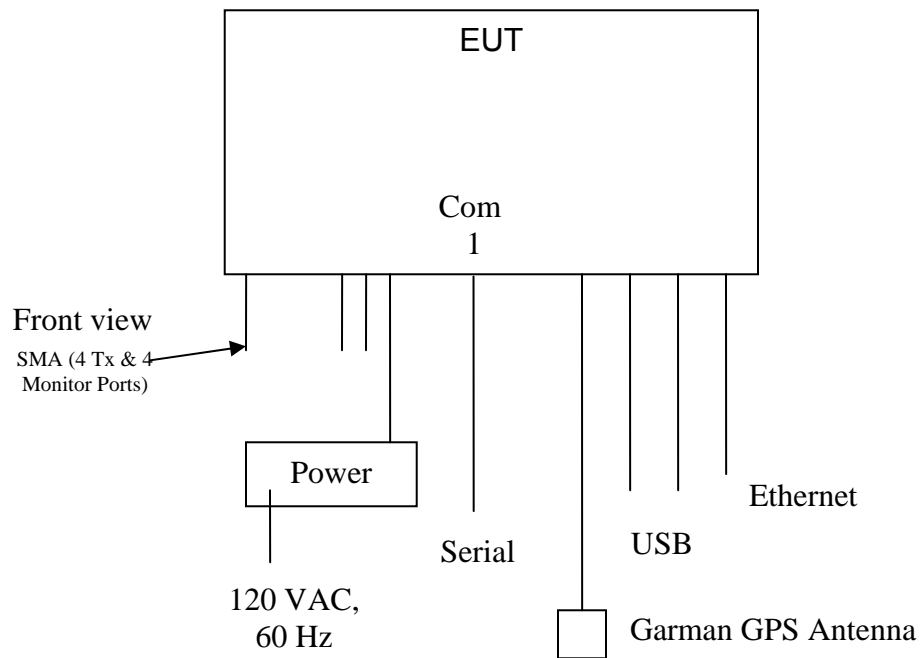
Notebook PC is connected only during setup

3. Product Configuration (continued)

3.3. Operational Characteristics & Software

- (1) The unit was allowed to power up normally and go through its configuration cycle.
- (2) Using the laptop as control the unit was configured to operate on individual channels and all channels as required.

3.4. Block Diagram



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
Spectrum Analyzer	Agilent Technologies	E4407B	MY45104493	12/22/2012
Spectrum Analyzer	Rohde & Schwarz	FSV40	100899	5/31/2013
EMI Receiver	Hewlett Packard	8546A	3330A00115	06/08/2014
Microwave Preamp	Hewlett Packard	8449B	3008A01323	12/01/2012
Bilog Antenna	Com-Power	AC-220	25509	8/31/2013
Horn Antenna	Electro-Metrics	EM-6961	6337	10/19/2013
Horn Antenna	Com-Power	AH-826	080151	08/27/2014
DMM / Temperature	Fluke	187	79690058	1/5/2013
Thermal Chamber	Associated Testing Labs	SLHU-1-CRLC	N/A	N/A
Barometric Pressure / Humidity / Temperature	Extech Instruments	SD700	Q590483	11/21/2012
AC Power Source	Combinova	AC Source 330	3475	UWCE

4.2. Measurement & Equipment Setup

Test Date: 11/19 to 11/28 2012
 Test Engineer: Larry Stillings
 Normal Site Temperature (15 – 35°C): 21.6
 Relative Humidity (20 -75%RH): 25

4.3. Test Procedure

The test measurements contained in this report are based on the requirements detailed in FCC Parts 2 & Part 27, Subparts C & L.

The test methods used to generate the data in this test report are in accordance with ANSI C63.4:2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

Measurements were made in accordance with TIA-603-C:2004 Land Mobile FM or PM Communications Equipment Measurement and Performance Standard.

5. Measurement Summary

Section Description or Test Requirement	FCC Part Reference	Test Report Section	Result	Comment
Power and Antenna height limits, Output Power	27.50 (d)	6.1	Compliant	
Occupied Bandwidth	Part 2.1049	6.2	Compliant	
Spurious Emissions at Antenna Terminals	27.53 (h)	6.3	Compliant	
Spurious Emissions at the Antenna Terminals Additional Requirements	27.53 (h)	6.4	Compliant	
Field Strength of Spurious Emissions	27.53 (h)	6.5	Compliant	
Frequency Stability	27.54 per Section 2.1055	6.6	Compliant	Must stay in frequency block
Public Exposure to Radio Frequency Energy Levels	27.52 per Section 1.1307 (b)(1)	6.7	Compliant	

6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d)

Requirement: An equivalent isotropically radiated power (EIRP) of 1640 watts / MHz when transmitting with an emissions bandwidth greater than 1 MHz

6.1.1. Peak Transmitter Output Power, Transmitter Only

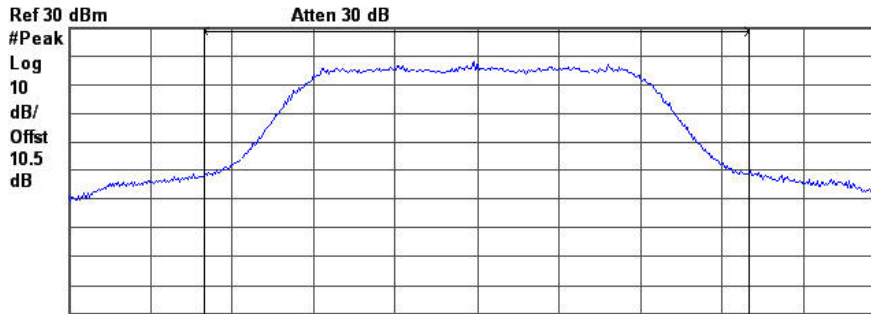
Channels	Frequency	Output Power		Result
	(MHz)	(W)	(dBm)	
Low Channel 25 – TX1	2111.25	0.122	20.51	Compliant
Mid Channel 450 – TX1	2132.50	0.074	18.71	Compliant
High Channel 875 – TX1	2153.725	0.071	18.51	Compliant
All Channels – TX1	2111.25 – 2153.725	0.139	21.42	Compliant
Low Channel 25 – TX2	2111.25	0.144	21.61	Compliant
Mid Channel 450 – TX2	2132.50	0.157	21.97	Compliant
High Channel 875 – TX2	2153.725	0.154	21.87	Compliant
All Channels – TX2	2111.25 – 2153.725	0.159	22.02	Compliant
Low Channel 25 – TX3	2111.25	0.112	20.50	Compliant
Mid Channel 450 – TX3	2132.50	0.112	20.48	Compliant
High Channel 875 – TX3	2153.725	0.089	19.51	Compliant
All Channels – TX3	2111.25 – 2153.725	0.126	20.99	Compliant
Low Channel 25 – TX4	2111.25	0.041	16.09	Compliant
Mid Channel 450 – TX4	2132.50	0.167	22.24	Compliant
High Channel 875 – TX4	2153.725	0.113	20.52	Compliant
All Channels – TX4	2111.25 – 2153.725	0.121	20.82	Compliant

6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

Low Channel 25 – TX1

Agilent 17:13:53 Nov 20, 2012 R T



Center 2.111 GHz Span 3 MHz
#Res BW 100 kHz #VBW 1 MHz Sweep 6 ms (601 pts)

Channel Power

Power Spectral Density

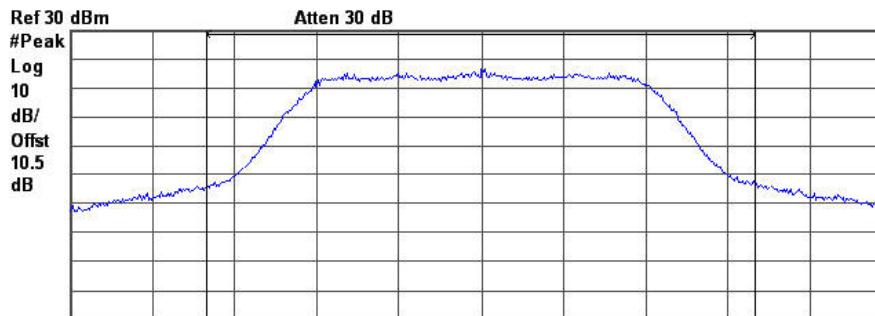
20.51 dBm /2.0000 MHz

-42.50 dBm/Hz



Mid Channel 450 – TX1

Agilent 17:23:18 Nov 20, 2012 R T



Center 2.132 GHz Span 3 MHz
#Res BW 100 kHz #VBW 1 MHz Sweep 6 ms (601 pts)

Channel Power

Power Spectral Density

18.71 dBm /2.0000 MHz

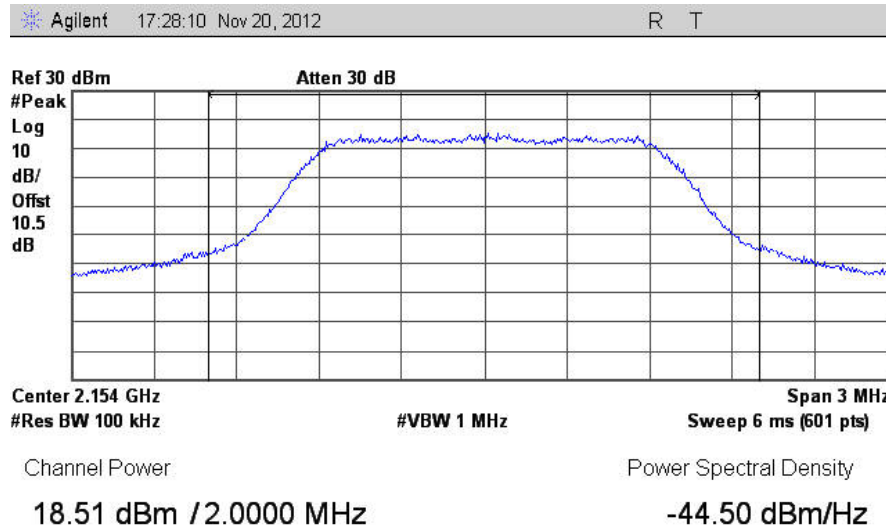
-44.30 dBm/Hz



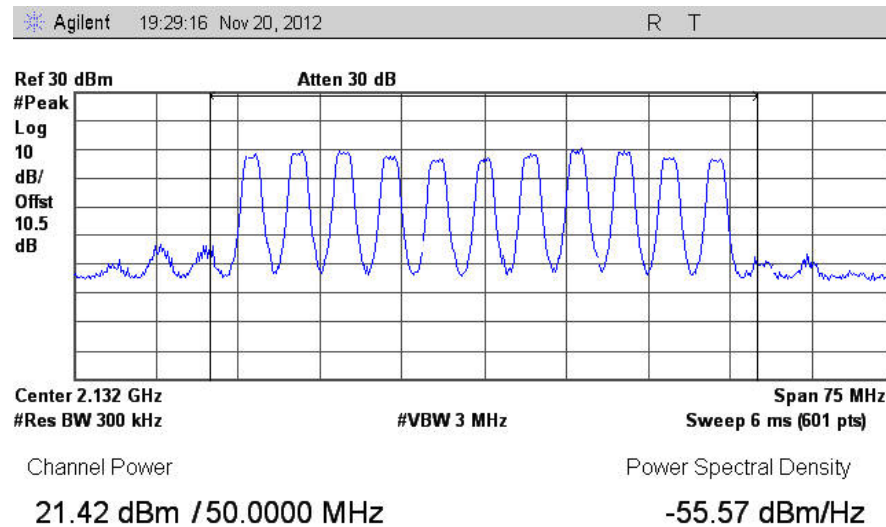
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

High Channel 875 – TX1



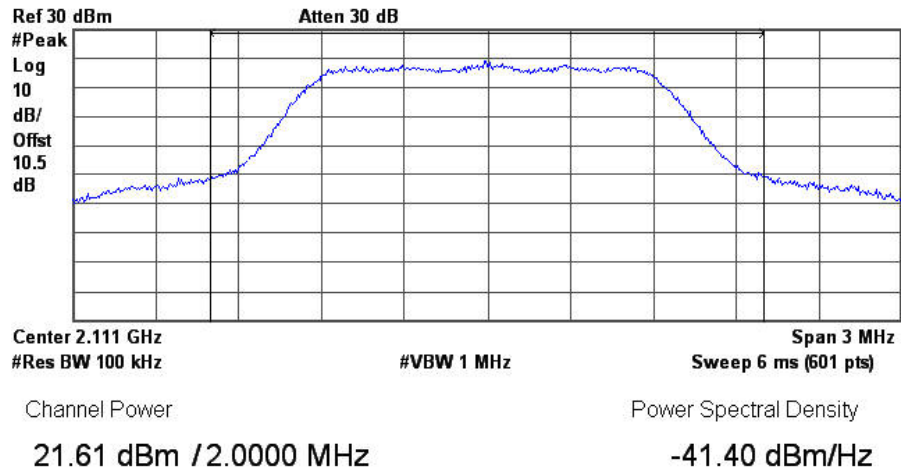
All Channels – TX1



6. Measurement Data

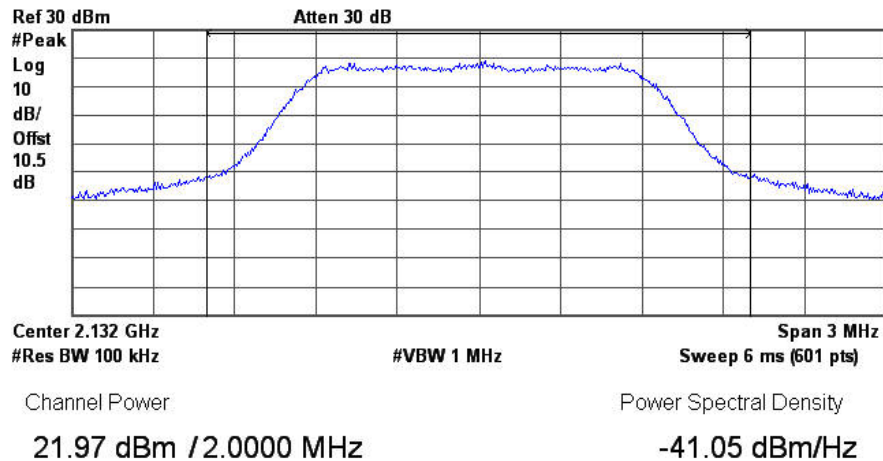
6.1. Power and Antenna Height Limits 27.50 (d) (cont)
Low Channel 25 – TX2

Agilent 18:06:40 Nov 20, 2012 R T



Mid Channel 450 – TX2

Agilent 18:04:27 Nov 20, 2012 R T

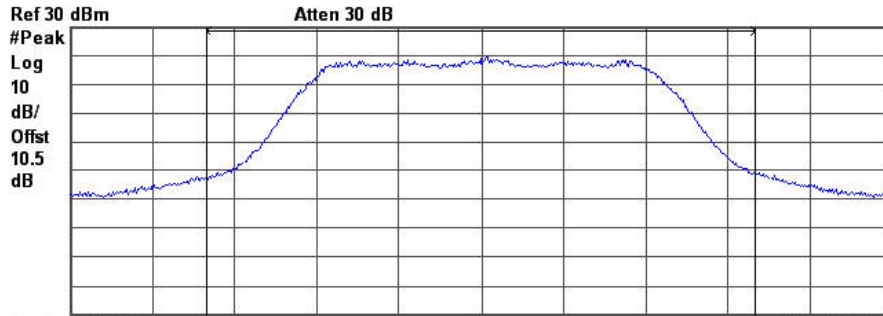


6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

High Channel 875 – TX2

Agilent 18:02:38 Nov 20, 2012 R T



Center 2.154 GHz #Res BW 100 kHz #VBW 1 MHz Span 3 MHz Sweep 6 ms (601 pts)

Channel Power

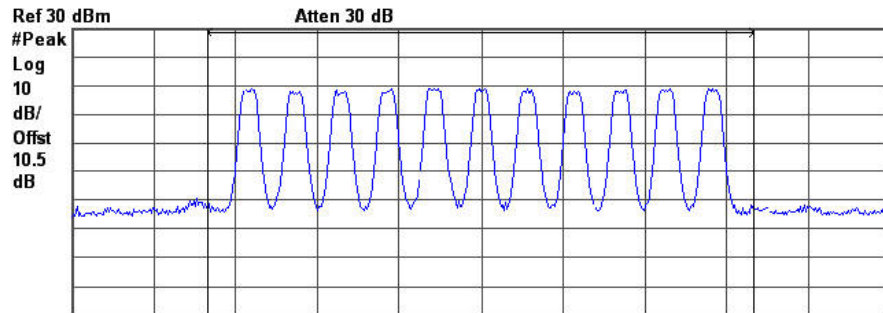
21.87 dBm / 2.0000 MHz

Power Spectral Density

-41.14 dBm/Hz

All Channels – TX2

Agilent 19:22:28 Nov 20, 2012 R T



Center 2.132 GHz #Res BW 300 kHz #VBW 3 MHz Span 75 MHz Sweep 6 ms (601 pts)

Channel Power

22.02 dBm / 50.0000 MHz

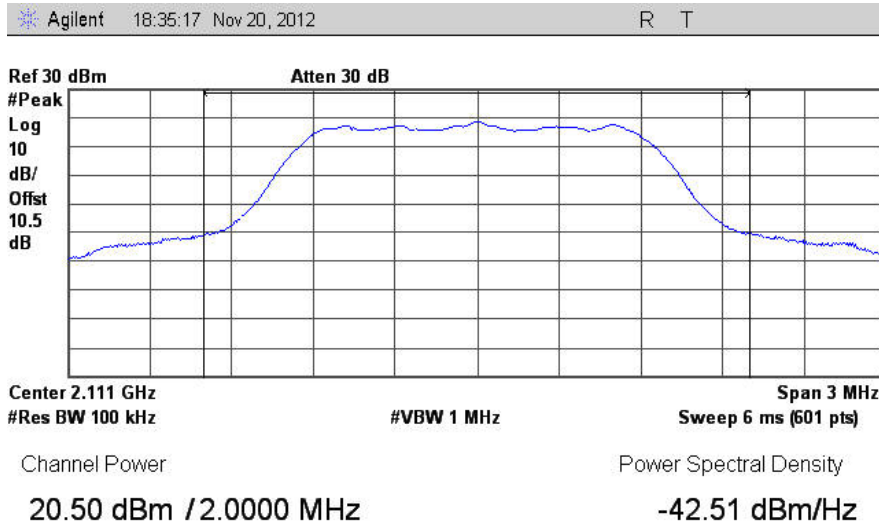
Power Spectral Density

-54.97 dBm/Hz

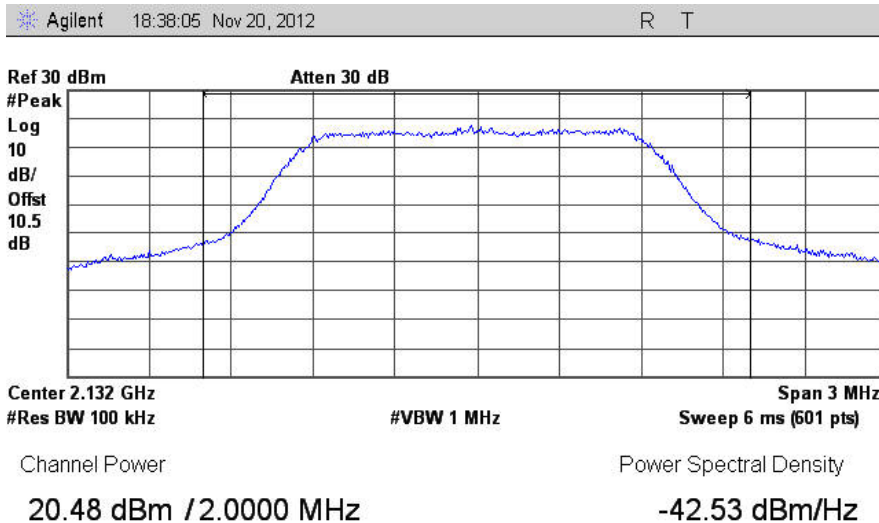
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

Low Channel 25 – TX3



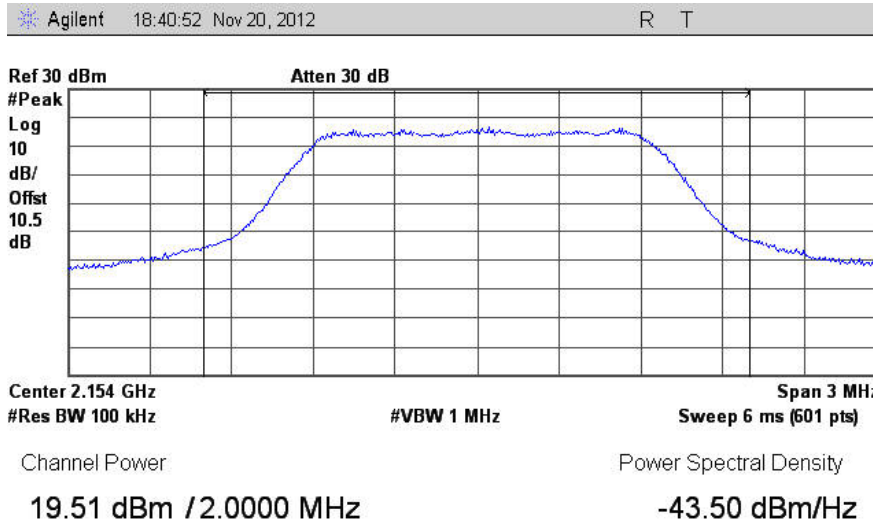
Mid Channel 450 – TX3



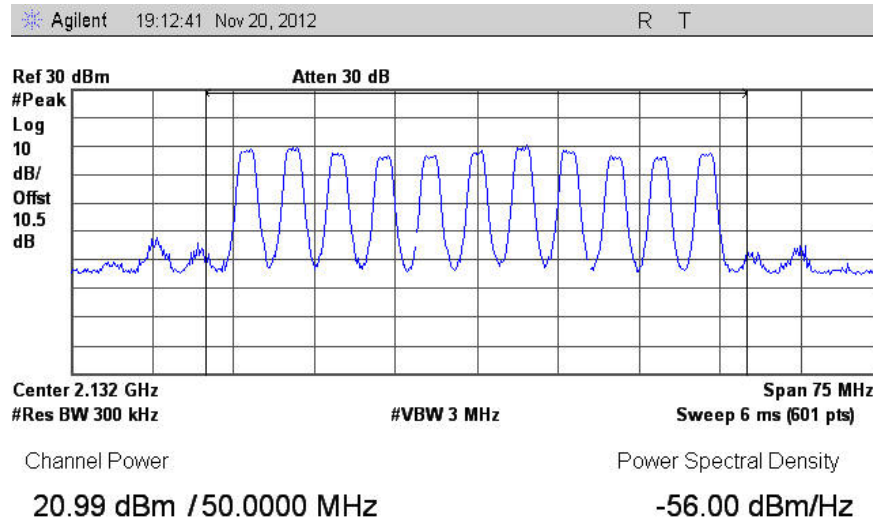
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

High Channel 875 – TX3



All Channels – TX3

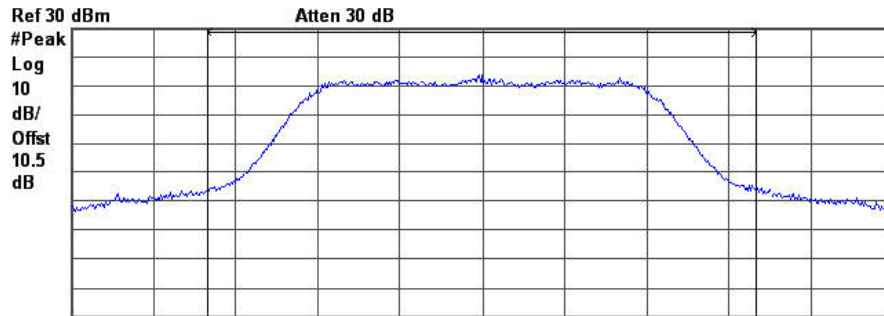


6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

Low Channel 25 – TX4

Agilent 19:03:56 Nov 20, 2012 R T



Center 2.111 GHz Span 3 MHz
#Res BW 100 kHz #VBW 1 MHz Sweep 6 ms (601 pts)

Channel Power

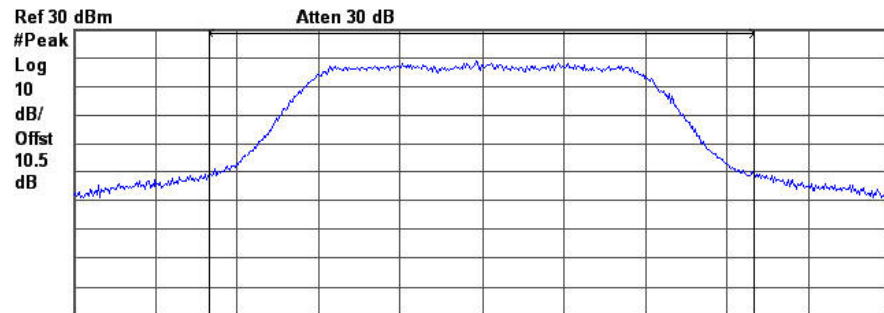
16.09 dBm /2.0000 MHz

Power Spectral Density

-46.92 dBm/Hz

Mid Channel 450 – TX4

Agilent 19:01:18 Nov 20, 2012 R T



Center 2.132 GHz Span 3 MHz
#Res BW 100 kHz #VBW 1 MHz Sweep 6 ms (601 pts)

Channel Power

22.24 dBm /2.0000 MHz

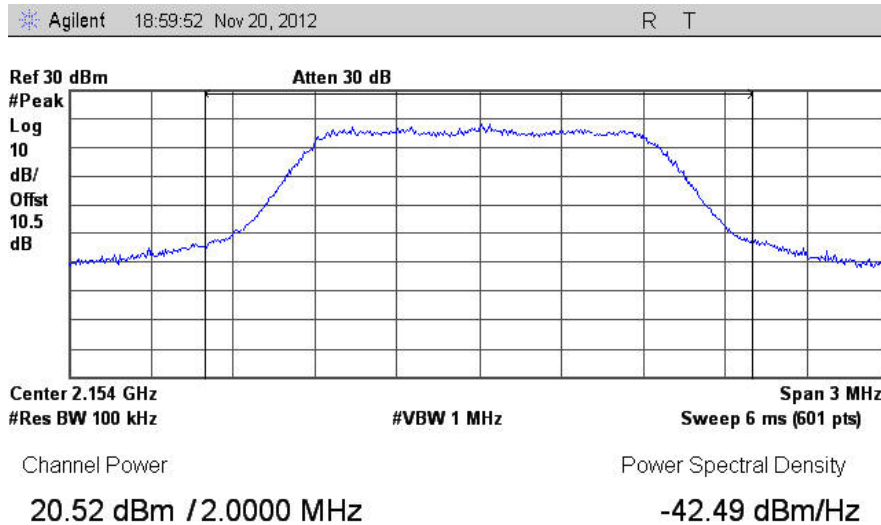
Power Spectral Density

-40.77 dBm/Hz

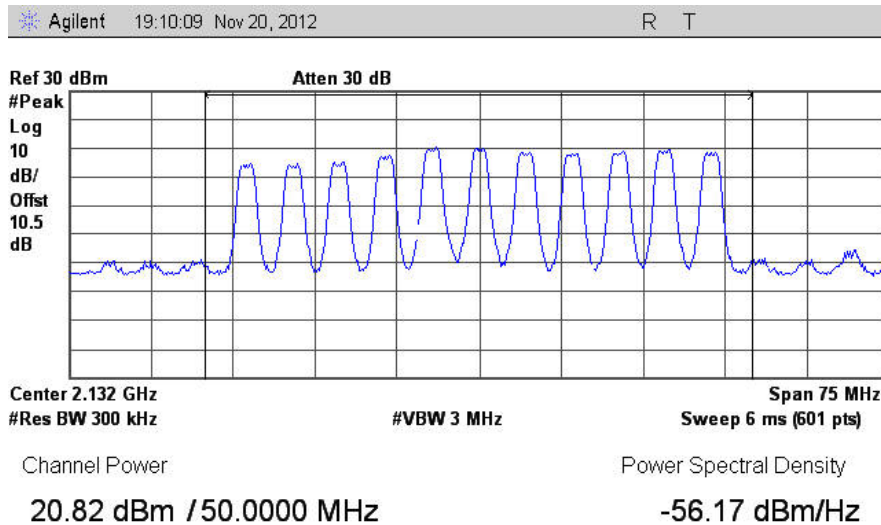
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (cont)

High Channel 875 – TX4



All Channels – TX4



6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (continued)

6.1.2. Maximum ERP

ERP is defined in FCC Title 47, Chapter I, Part 2, Subpart A, Section 2.1 as "Effective Radiated Power. The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction."

$$\text{ERP} = \text{Transmitter Power (dBm)} - \text{Cable Loss (dB)} + \text{Antenna Gain (dBi)}$$

The manufacturer of the device under test recommends 2 antennas for use with their product. The following table provides the worst case effective radiated power based on the measured transmitter output power and the antenna gain:

Channel	Frequency	Transmitter Power ¹	Cable Insertion Loss	Antenna Gain ²	Total Output Power	
	(MHz)				(dBm)	(dBm)
Low	2111.25	20.51	0.00	+3	23.51	0.224
Mid	2132.50	18.71	0.00	+3	21.71	0.148
High	2153.725	18.51	0.00	+3	21.51	0.142
All	2111.25 – 2153.725	21.42	0.00	+3	24.42	0.277
Low	2111.25	20.51	0.00	+14	34.51	2.825
Mid	2132.50	18.71	0.00	+14	32.71	1.866
High	2153.725	18.51	0.00	+14	32.51	1.782
All	2111.25 – 2153.725	21.42	0.00	+14	34.42	2.767
Low	2111.25	21.61	0.00	+3	24.61	0.289
Mid	2132.50	21.97	0.00	+3	24.97	0.314
High	2153.725	21.87	0.00	+3	24.87	0.307
All	2111.25 – 2153.725	22.02	0.00	+3	25.02	0.318
Low	2111.25	21.61	0.00	+14	34.61	2.891
Mid	2132.50	21.97	0.00	+14	34.97	3.141
High	2153.725	21.87	0.00	+14	34.87	3.069
All	2111.25 – 2153.725	22.02	0.00	+14	36.02	3.999

¹ Measured. See section 6.1.1.

² Customer supplied. 3 dBi for Indoor Applications, 14 dBi for Outdoor Applications

6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d) (continued)

6.1.2. Maximum ERP (cont)

ERP is defined in FCC Title 47, Chapter I, Part 2, Subpart A, Section 2.1 as "Effective Radiated Power. The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction."

$$ERP = \text{Transmitter Power (dBm)} - \text{Cable Loss (dB)} + \text{Antenna Gain (dBi)}$$

The manufacturer of the device under test recommends 2 antennas for use with their product. The following table provides the worst case effective radiated power based on the measured transmitter output power and the antenna gain:

Channel	Frequency	Transmitter Power ¹	Cable Insertion Loss	Antenna Gain ²	Total Output Power	
	(MHz)	(dBm)	(dB)	(dBi)	(dBm)	(Watts)
Low	2111.25	20.50	0.00	+3	23.50	0.224
Mid	2132.50	20.48	0.00	+3	23.48	0.223
High	2153.725	19.51	0.00	+3	22.51	0.178
All	2111.25 – 2153.725	20.99	0.00	+3	23.99	0.251
Low	2111.25	20.50	0.00	+14	34.50	2.818
Mid	2132.50	20.48	0.00	+14	34.48	2.805
High	2153.725	19.51	0.00	+14	33.51	2.244
All	2111.25 – 2153.725	20.99	0.00	+14	34.99	3.155

Low	2111.25	16.09	0.00	+3	19.09	0.081
Mid	2132.50	22.24	0.00	+3	25.24	0.334
High	2153.725	20.52	0.00	+3	23.52	0.225
All	2111.25 – 2153.725	20.82	0.00	+3	23.82	0.241
Low	2111.25	16.09	0.00	+14	30.09	1.021
Mid	2132.50	22.24	0.00	+14	36.24	4.207
High	2153.725	20.52	0.00	+14	34.52	2.831
All	2111.25 – 2153.725	20.82	0.00	+14	34.82	3.034

¹ Measured. See section 6.1.1.

² Customer supplied. 3 dBi for Indoor Applications, 14 dBi for Outdoor Applications

6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049)

Requirement: Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant.

6.2.1. Occupied (99% Power) Bandwidth

	Frequency	Occupied Bandwidth	Result
	(MHz)	(MHz)	
Low Channel – TX1	2111.250	1.2703	Compliant
Mid Channel – TX1	2132.500	1.2716	Compliant
High Channel – TX1	2153.725	1.2717	Compliant
Low Channel – TX2	2111.250	1.2710	Compliant
Mid Channel – TX2	2132.500	1.2711	Compliant
High Channel – TX2	2153.725	1.2703	Compliant
Low Channel – TX3	2111.250	1.2733	Compliant
Mid Channel – TX3	2132.500	1.2703	Compliant
High Channel – TX3	2153.725	1.2750	Compliant
Low Channel – TX4	2111.250	1.2721	Compliant
Mid Channel – TX4	2132.500	1.2739	Compliant
High Channel – TX4	2153.725	1.2687	Compliant

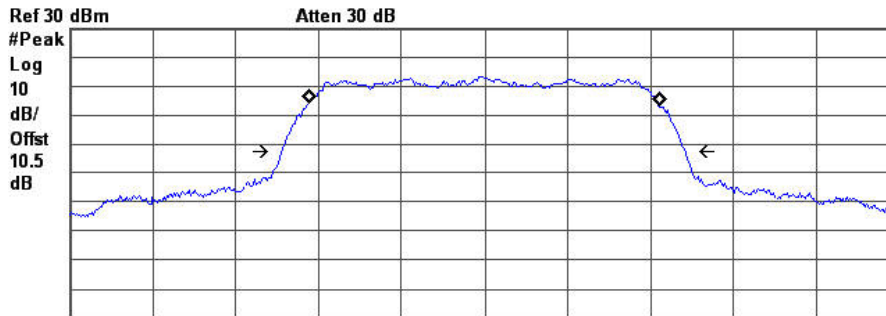
NOTE: EUT can only transmit a CDMA signal.

6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049) (cont)

6.2.1.1. Occupied (99% Power) Bandwidth Measurement, 2111.25 MHz – TX1

Agilent 17:39:03 Nov 20, 2012 R T



Center 2.111 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

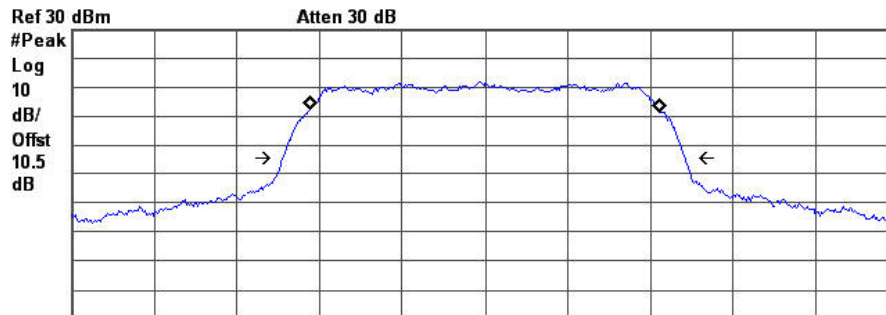
Occupied Bandwidth
1.2703 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -1.290 kHz
x dB Bandwidth 1.463 MHz

6.2.1.2. Occupied (99% Power) Bandwidth Input Signal, 2132.50 MHz – TX1

Agilent 17:36:51 Nov 20, 2012 R T



Center 2.132 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

Occupied Bandwidth
1.2716 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 456.045 Hz
x dB Bandwidth 1.460 MHz

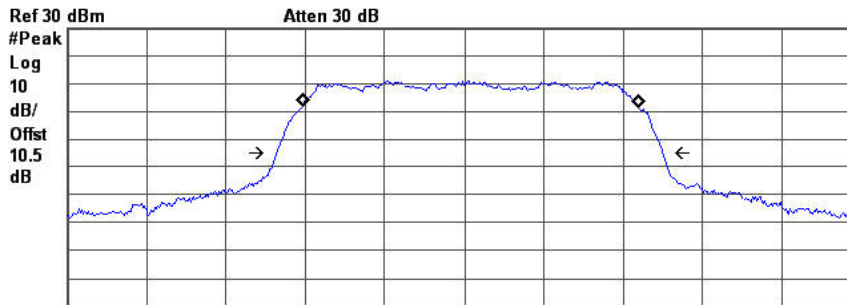
6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049) (continued)

6.2.1. Occupied (99% Power) Bandwidth (continued)

6.2.1.3. Occupied (99% Power) Bandwidth Measurement, 2153.725 MHz – TX1

Agilent 17:33:40 Nov 20, 2012 R T



Center 2.154 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

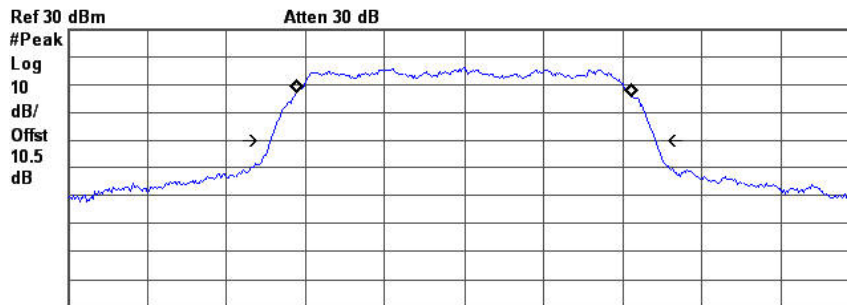
Occupied Bandwidth
1.2717 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 24.391 kHz
x dB Bandwidth 1.460 MHz

6.2.1.4. Occupied (99% Power) Bandwidth Measurement, 2111.25 MHz – TX2

Agilent 17:43:59 Nov 20, 2012 R T



Center 2.111 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

Occupied Bandwidth
1.2710 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -480.029 Hz
x dB Bandwidth 1.460 MHz

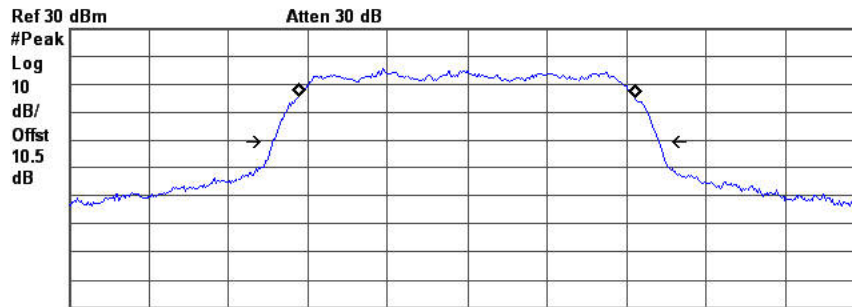
6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049) (continued)

6.2.1. Occupied (99% Power) Bandwidth (continued)

6.2.1.5. Occupied (99% Power) Bandwidth Input Signal, 2132.50 MHz – TX2

Agilent 17:48:33 Nov 20, 2012 R T



Center 2.132 GHz #Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts) Span 3 MHz

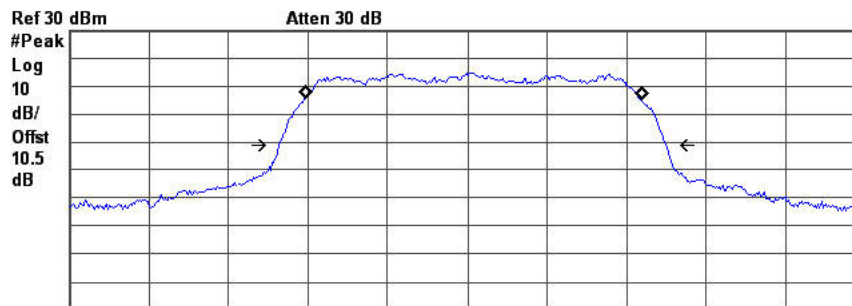
Occupied Bandwidth
1.2711 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error -1.930 kHz
x dB Bandwidth 1.458 MHz

6.2.1.6. Occupied (99% Power) Bandwidth Measurement, 2153.725 MHz – TX2

Agilent 17:54:07 Nov 20, 2012 R T



Center 2.154 GHz #Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts) Span 3 MHz

Occupied Bandwidth
1.2703 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 22.713 kHz
x dB Bandwidth 1.463 MHz

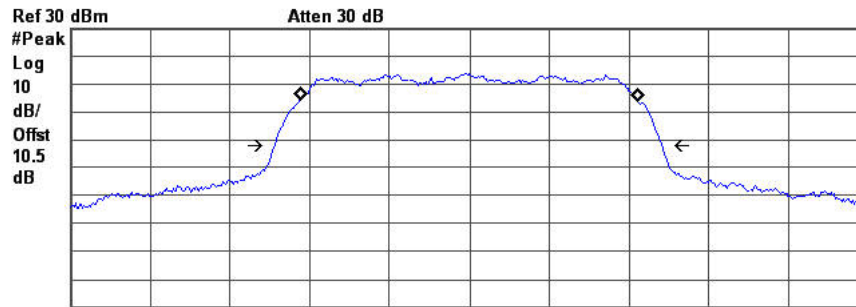
6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049) (continued)

6.2.1. Occupied (99% Power) Bandwidth (continued)

6.2.1.7. Occupied (99% Power) Bandwidth Measurement, 2111.25 MHz – TX3

Agilent 18:49:04 Nov 20, 2012 R T



Center 2.111 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

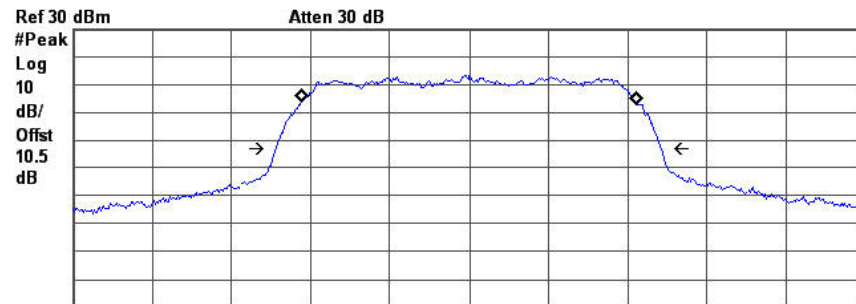
Occupied Bandwidth
1.2733 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 113.600 Hz
x dB Bandwidth 1.458 MHz

6.2.1.8. Occupied (99% Power) Bandwidth Input Signal, 2132.50 MHz – TX3

Agilent 18:45:37 Nov 20, 2012 R T



Center 2.132 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

Occupied Bandwidth
1.2703 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 2.300 kHz
x dB Bandwidth 1.461 MHz

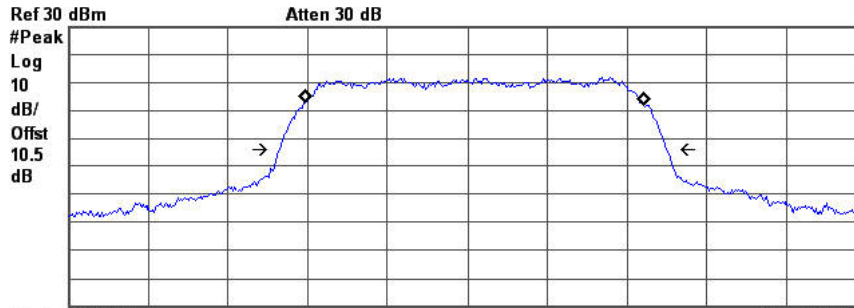
6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049) (continued)

6.2.1. Occupied (99% Power) Bandwidth (continued)

6.2.1.9. Occupied (99% Power) Bandwidth Measurement, 2153.725 MHz – TX3

Agilent 18:42:56 Nov 20, 2012 R T



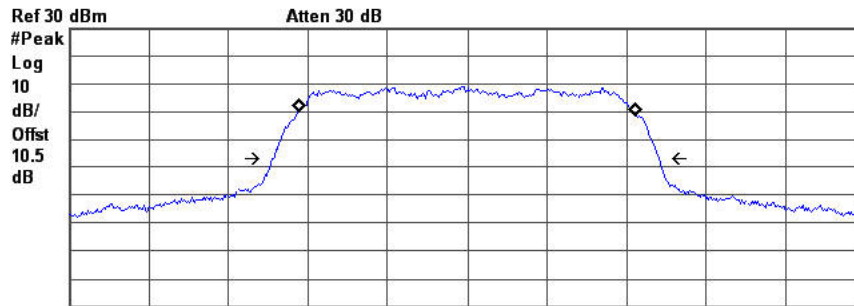
Center 2.154 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

Occupied Bandwidth 1.2750 MHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB

Transmit Freq Error 26.852 kHz
x dB Bandwidth 1.469 MHz

6.2.1.10. Occupied (99% Power) Bandwidth Measurement, 2111.25 MHz – TX4

Agilent 18:52:20 Nov 20, 2012 R T



Center 2.111 GHz Span 3 MHz
#Res BW 30 kHz #VBW 300 kHz Sweep 6 ms (601 pts)

Occupied Bandwidth 1.2721 MHz
Occ BW % Pwr 99.00 %
x dB -26.00 dB

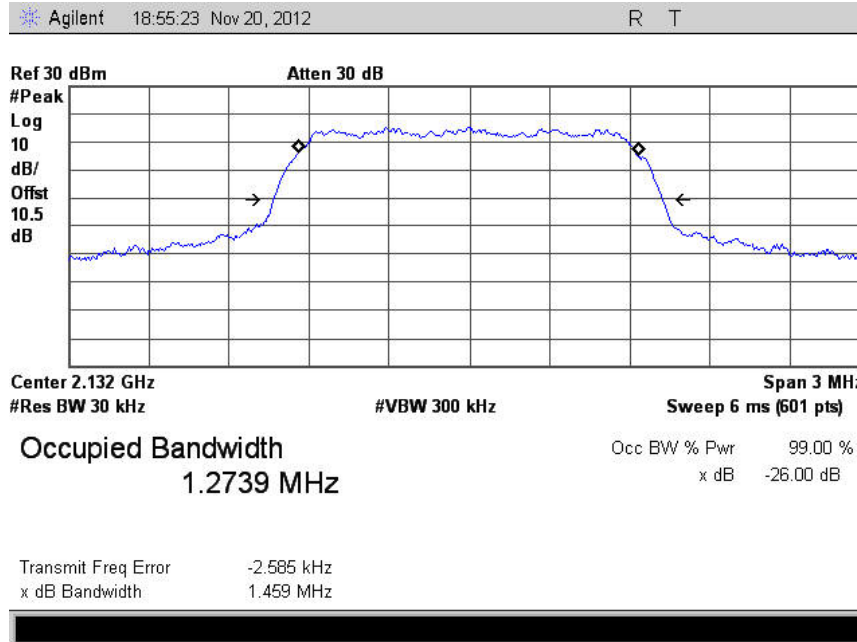
Transmit Freq Error -714.793 Hz
x dB Bandwidth 1.462 MHz

6. Measurement Data (continued)

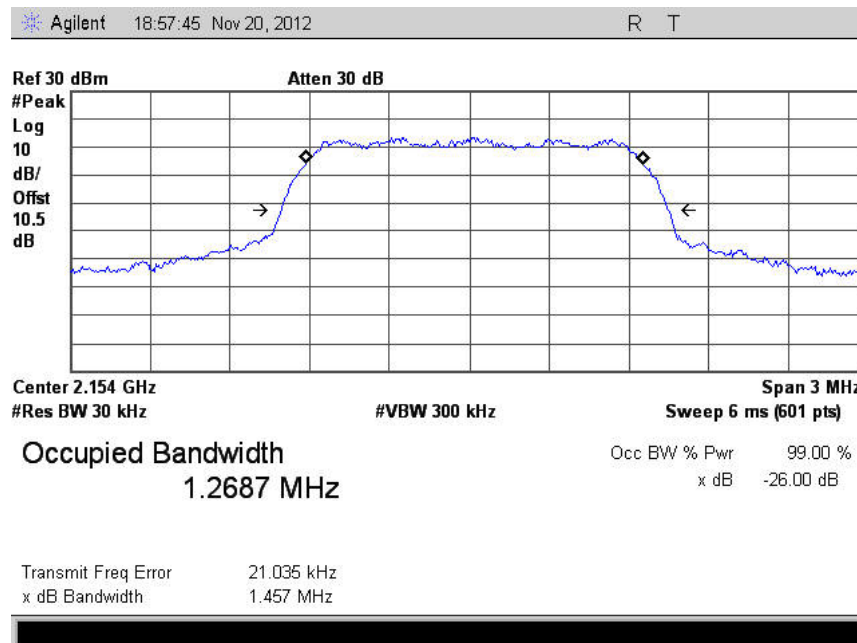
6.2. Bandwidth Limitations (FCC Part 2.1049) (continued)

6.2.1. Occupied (99% Power) Bandwidth (continued)

6.2.1.11. Occupied (99% Power) Bandwidth Input Signal, 2132.50 MHz – TX4



6.2.1.12. Occupied (99% Power) Bandwidth Measurement, 2153.725 MHz – TX4



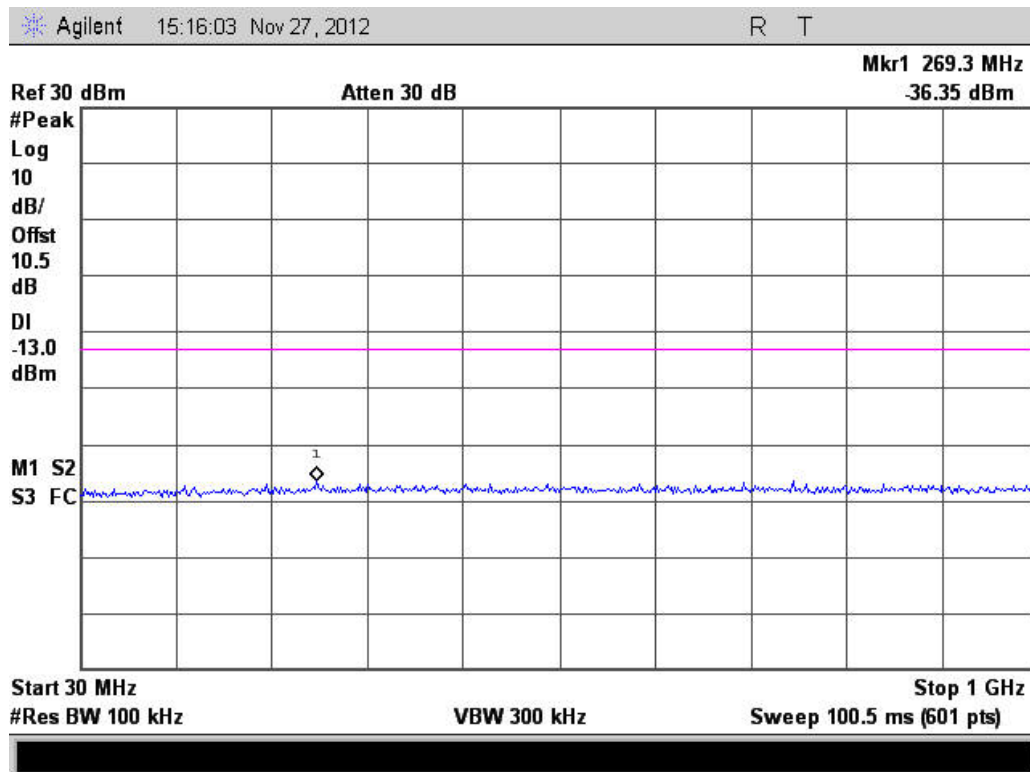
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h)

Requirement: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

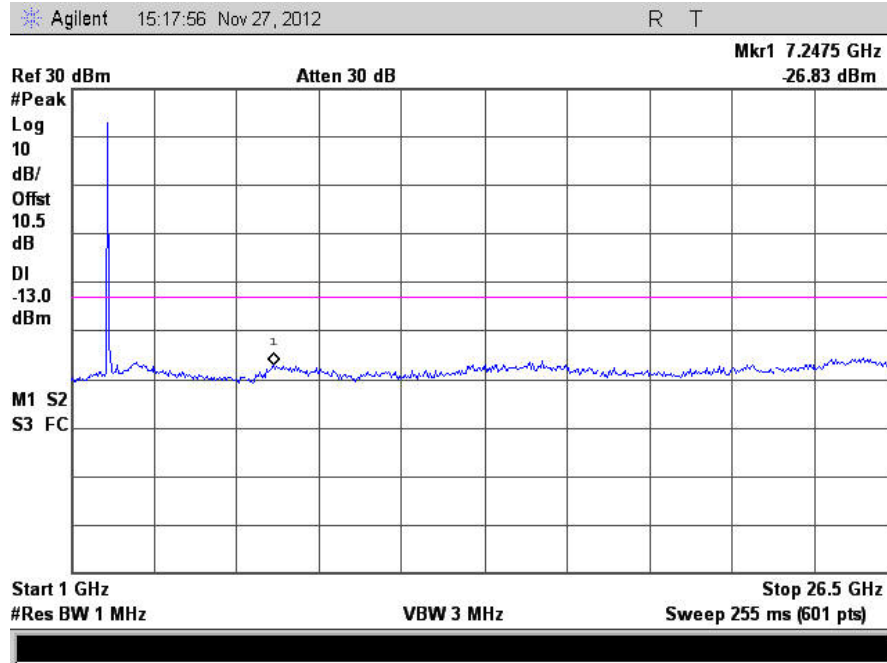
6.3.1. Low Channel, 30 MHz to 1 GHz – TX1



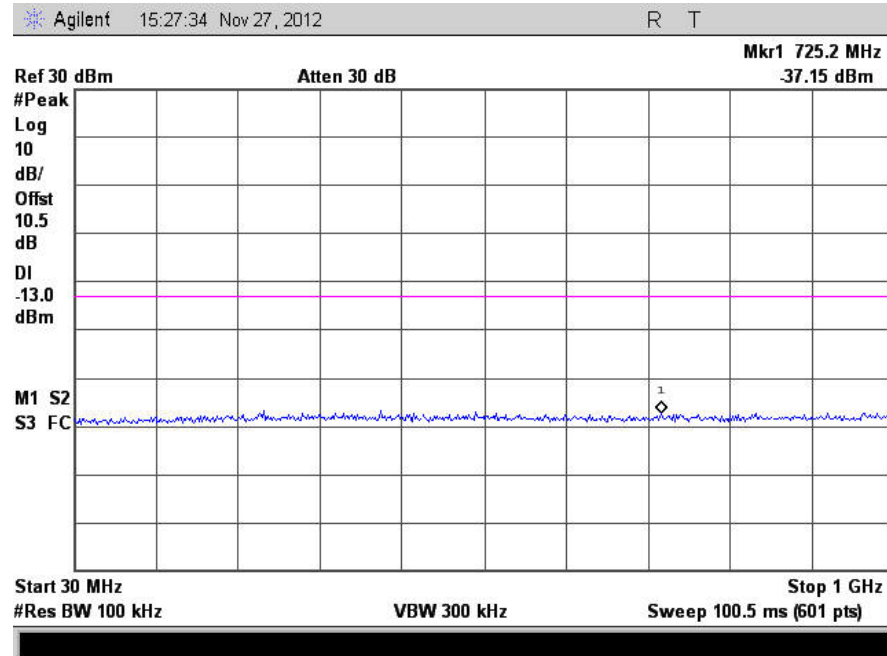
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.2. Low Channel, 1 to 26.5 GHz – TX1



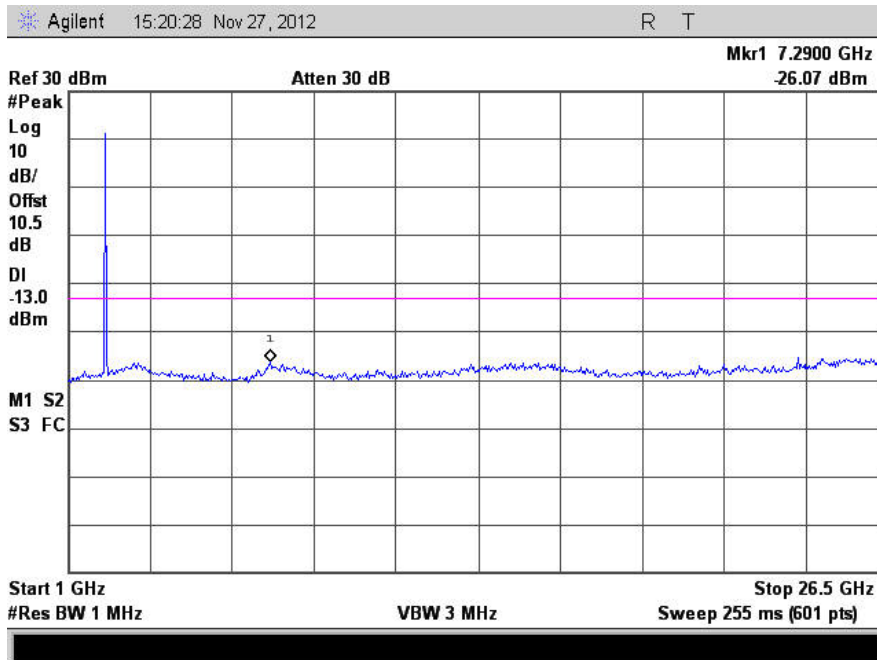
6.3.3. Mid Channel, 30 MHz to 1 GHz – TX1



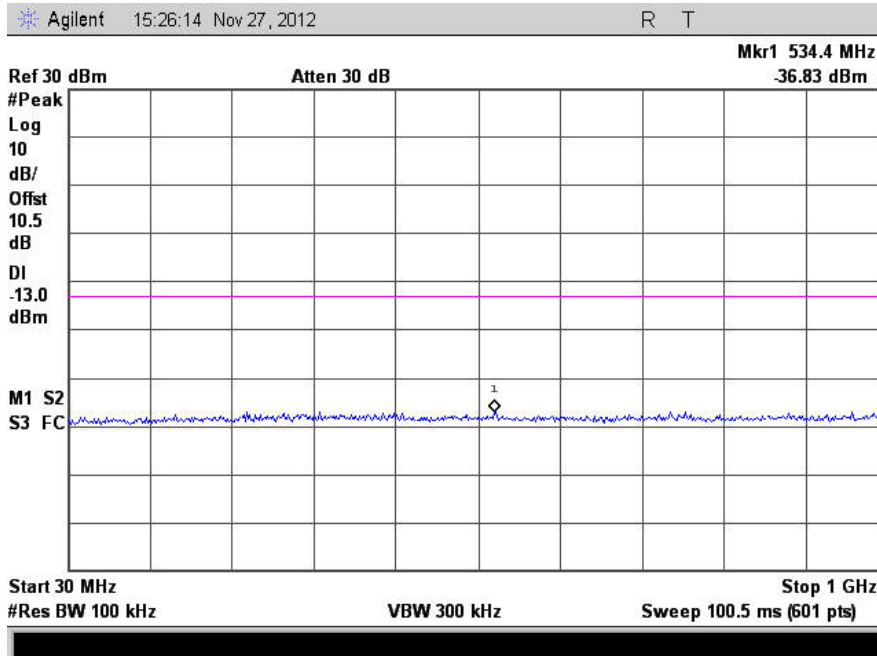
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.4. Mid Channel, 1 to 26.5 GHz – TX1



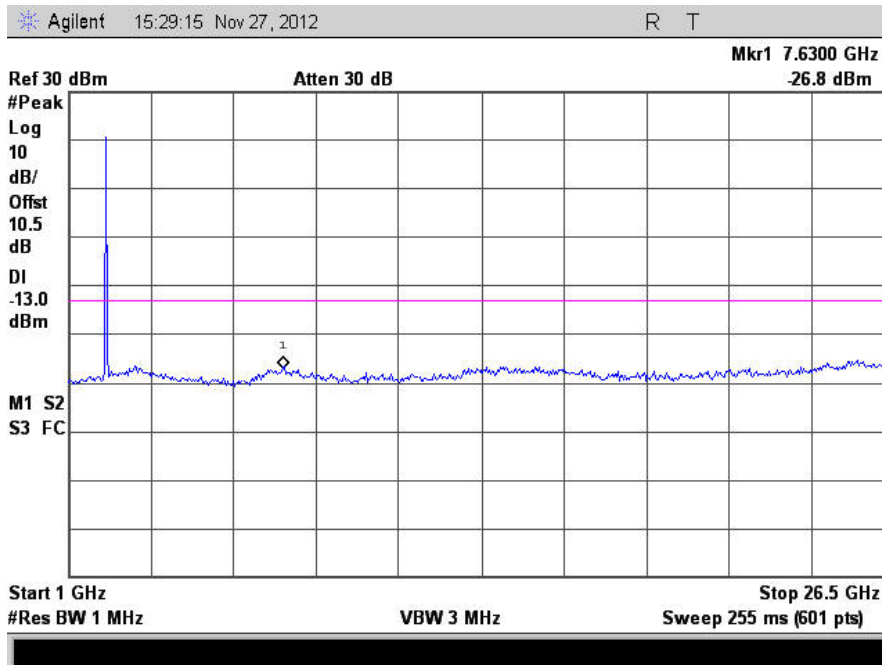
6.3.5. High Channel, 30 to 1000 MHz – TX1



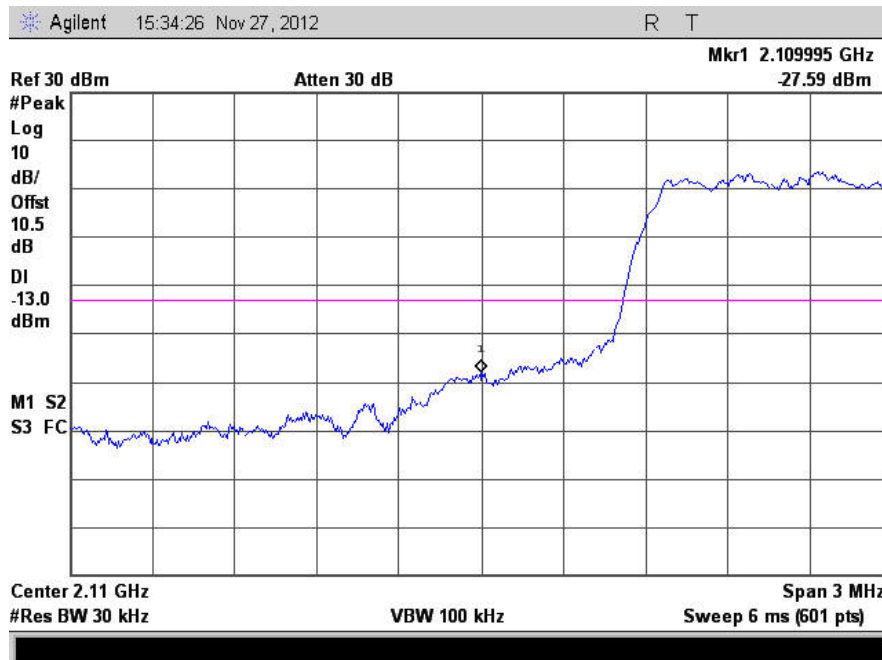
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.6. High Channel, 1 to 26.5 GHz – TX1



6.3.7. 2110 MHz Lower Bandedge Measurement – TX1



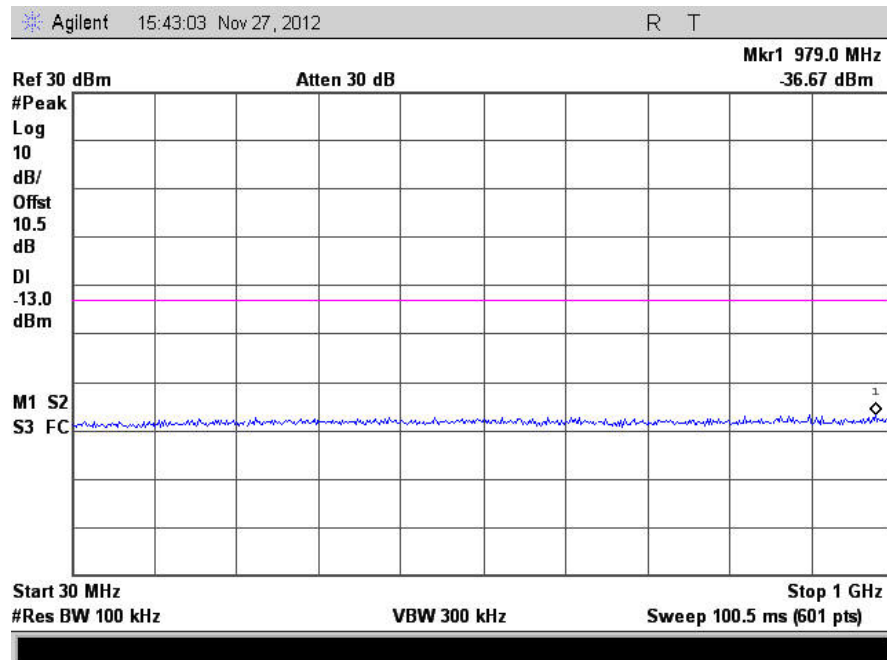
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.8. 2155 MHz Upper Bandedge Measurement – TX1



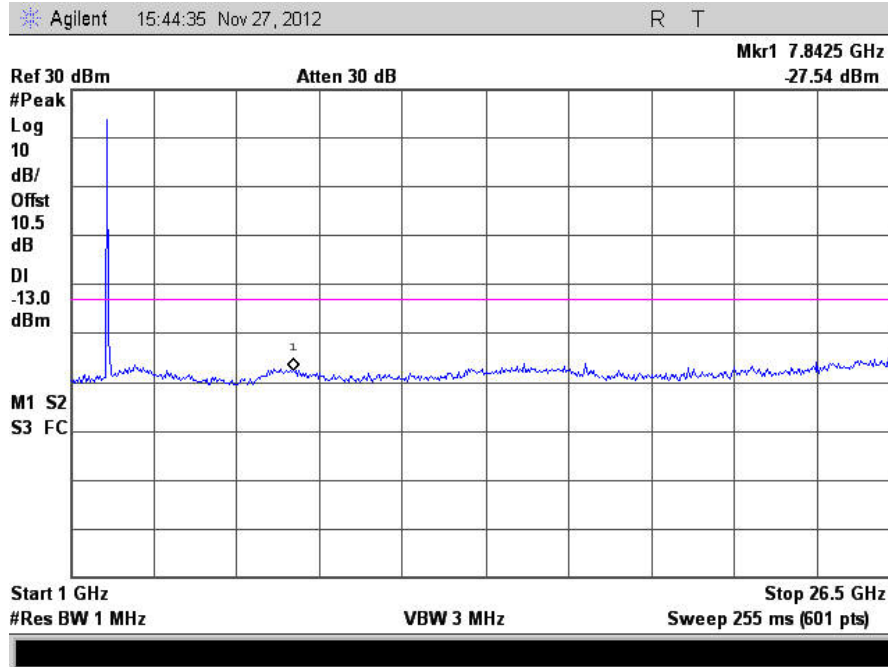
6.3.9. Low Channel, 30 MHz to 1 GHz – TX2



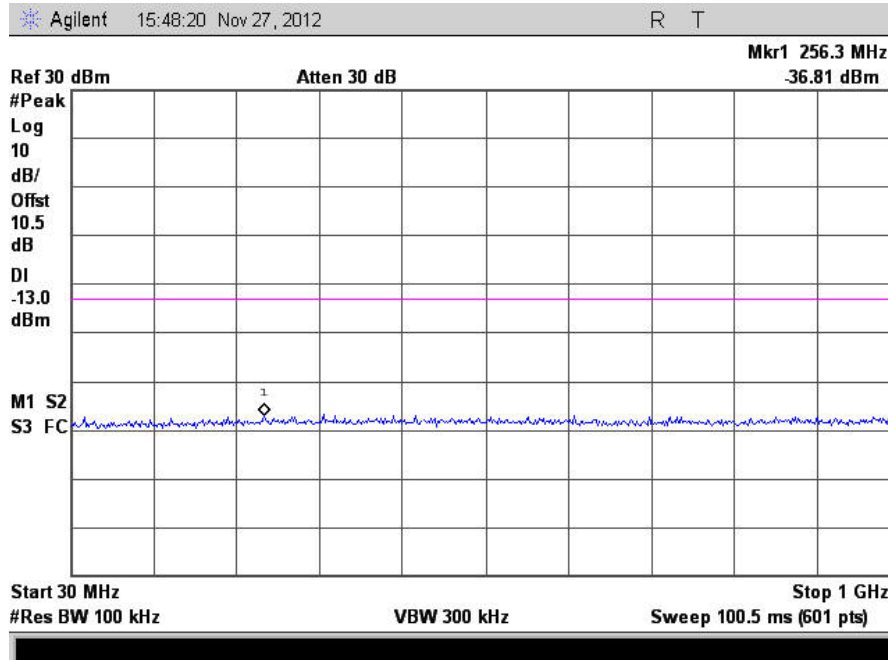
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.10. Low Channel, 1 to 26.5 GHz – TX2



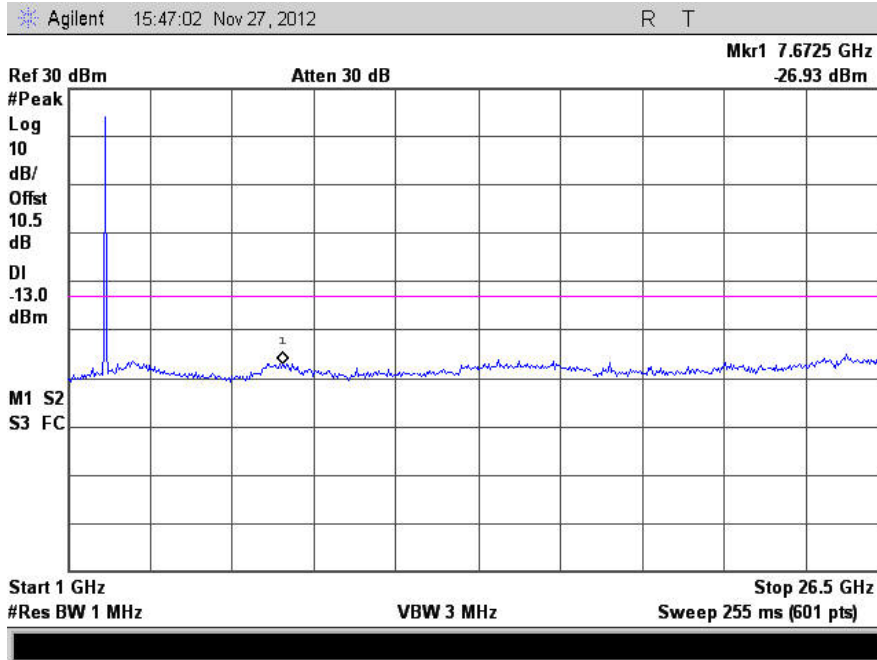
6.3.11. Mid Channel, 30 MHz to 1 GHz – TX2



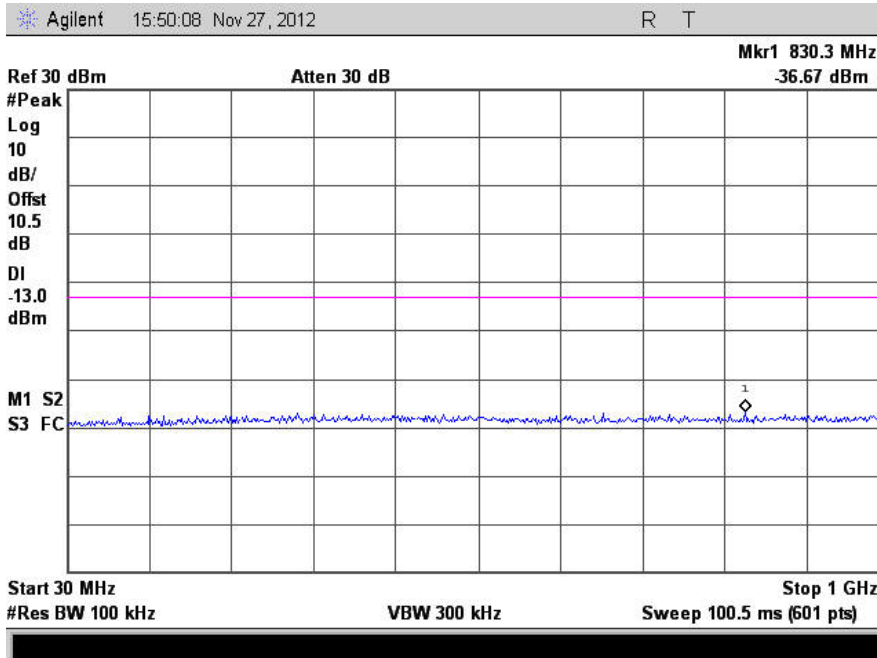
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.12. Mid Channel, 1 to 26.5 GHz – TX2



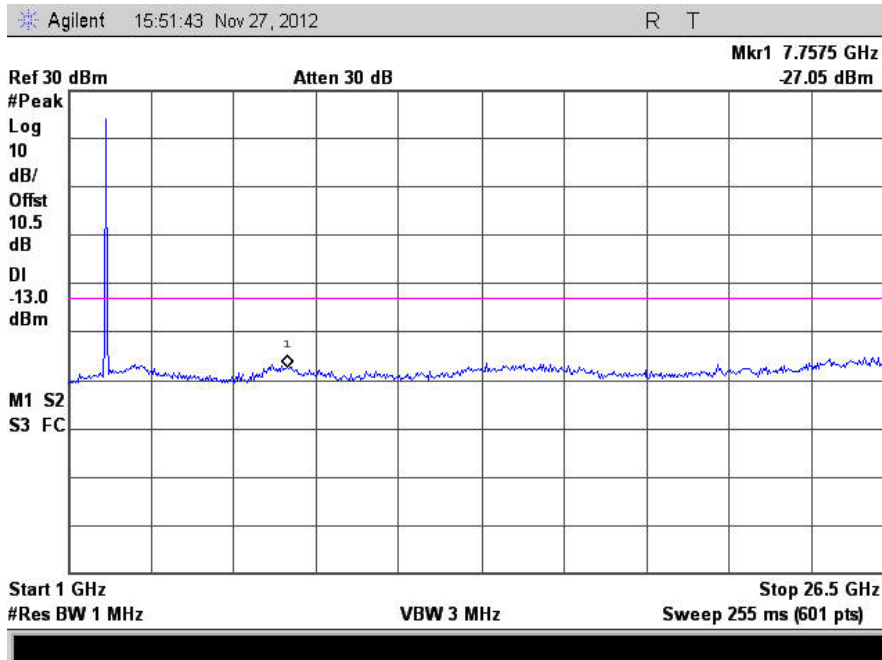
6.3.13. High Channel, 30 to 1000 MHz – TX2



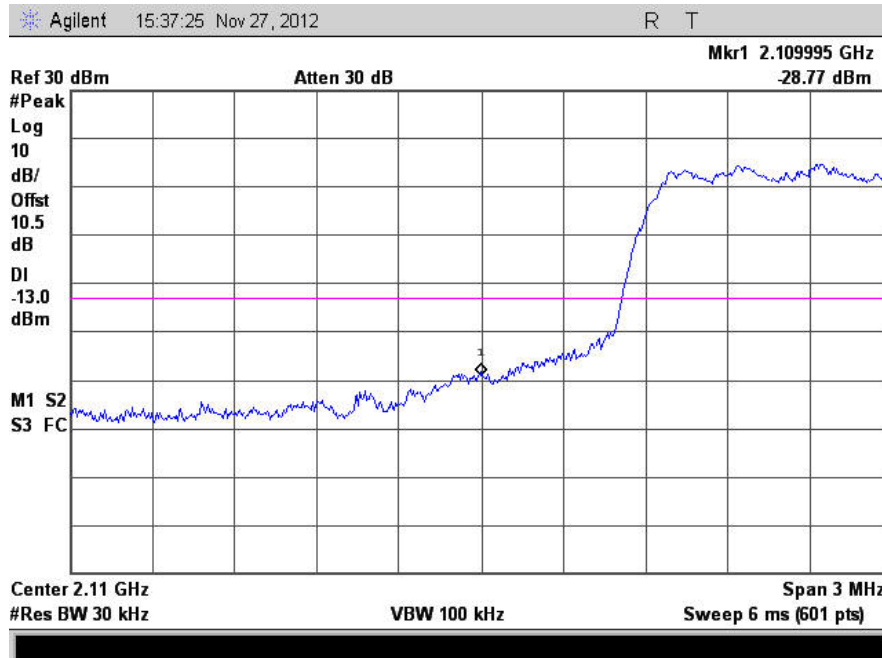
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.14. High Channel, 1 to 26.5 GHz – TX2



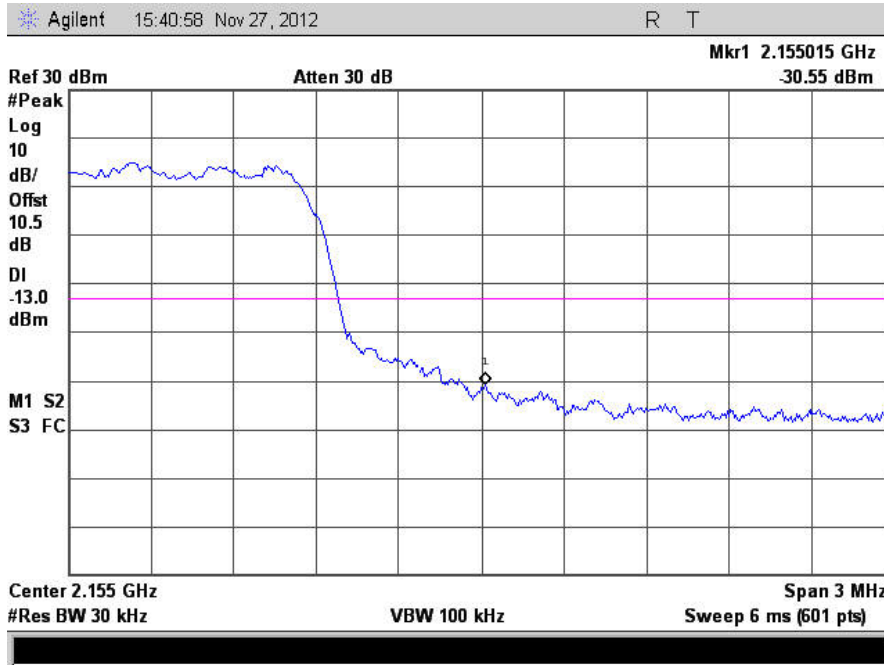
6.3.15. 2110 MHz Lower Bandedge Measurement – TX2



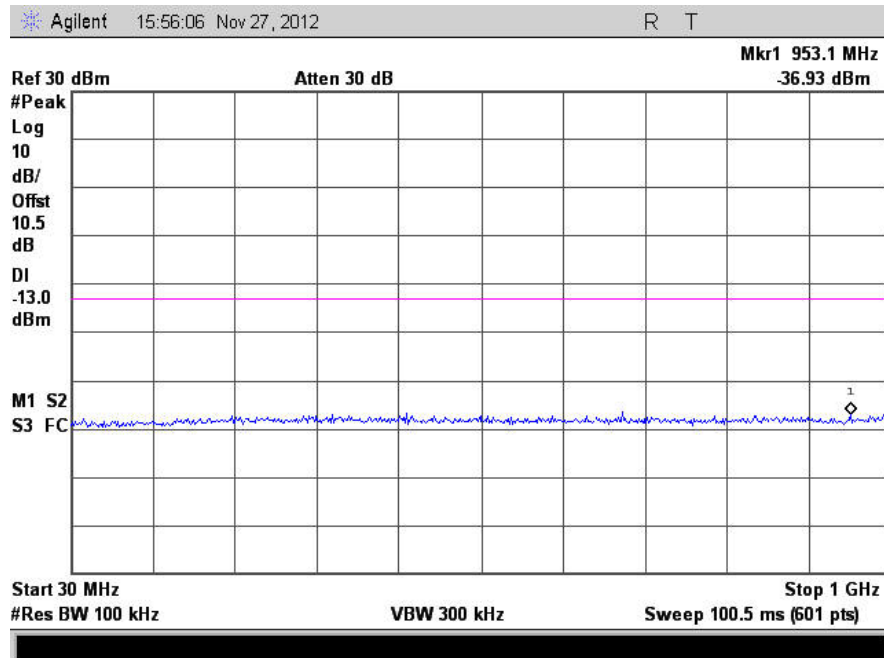
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.16. 2155 MHz Upper Bandedge Measurement – TX2



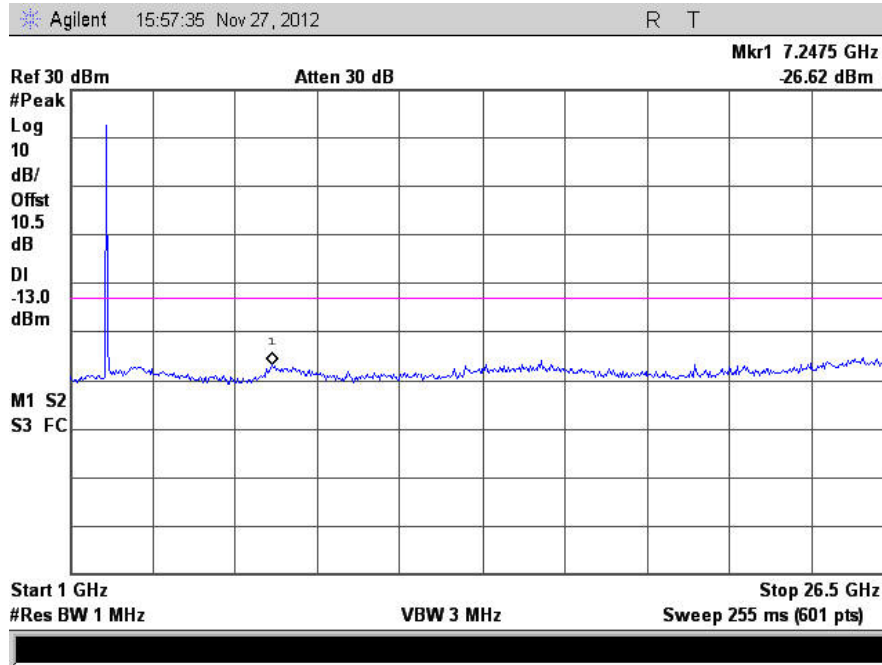
6.3.17. Low Channel, 30 MHz to 1 GHz – TX3



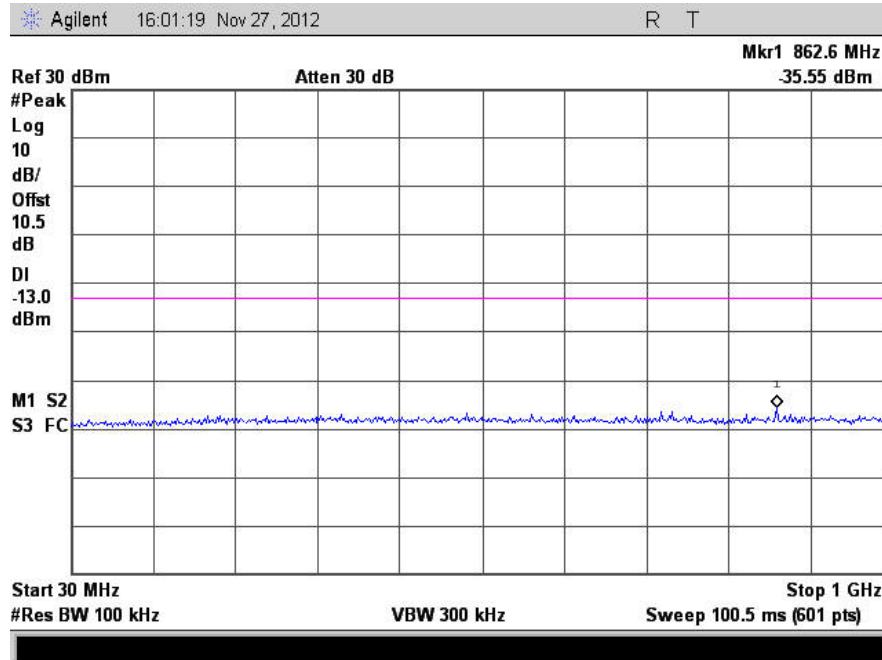
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.18. Low Channel, 1 to 26.5 GHz – TX3



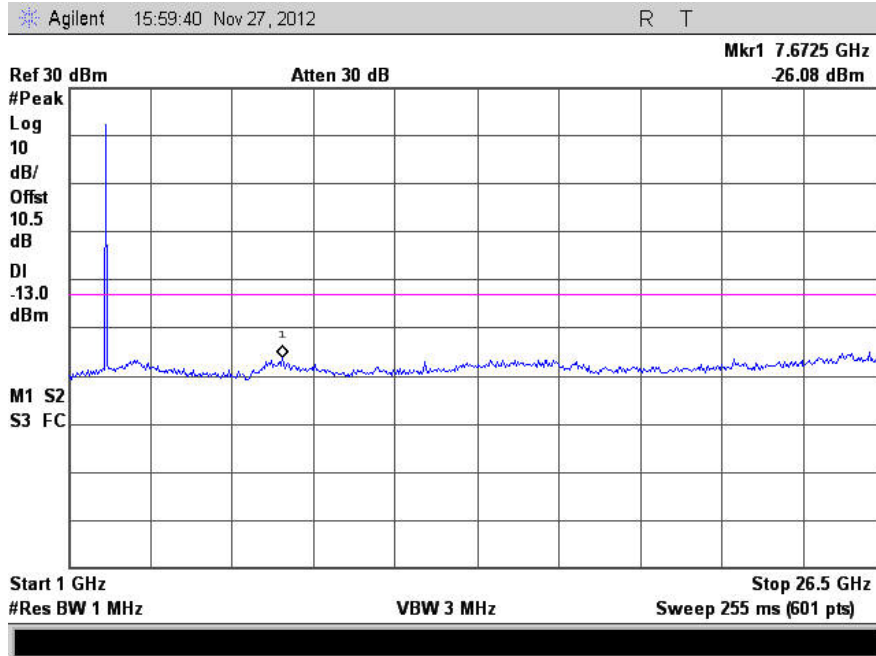
6.3.19. Mid Channel, 30 MHz to 1 GHz – TX3



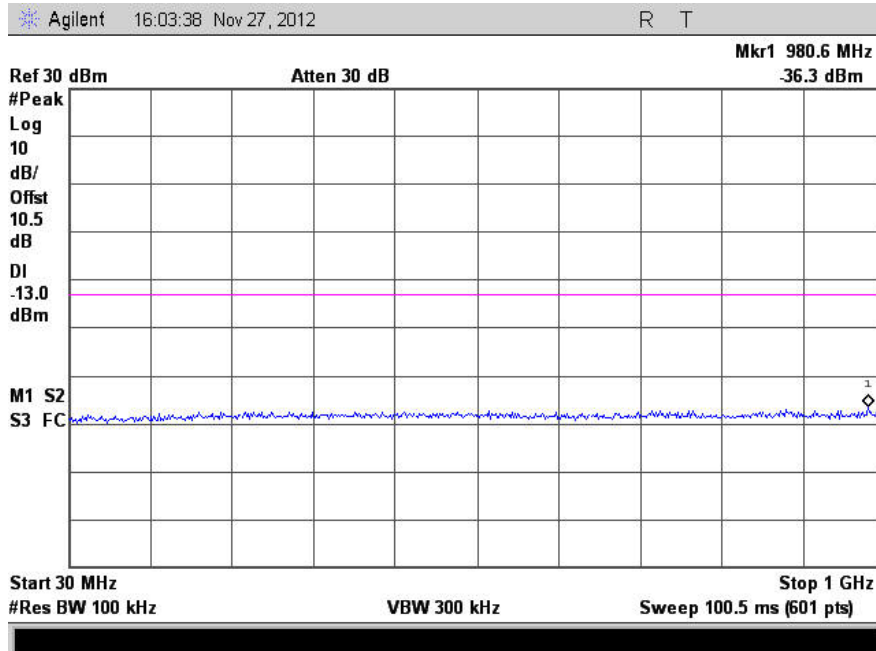
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.20. Mid Channel, 1 to 26.5 GHz – TX3



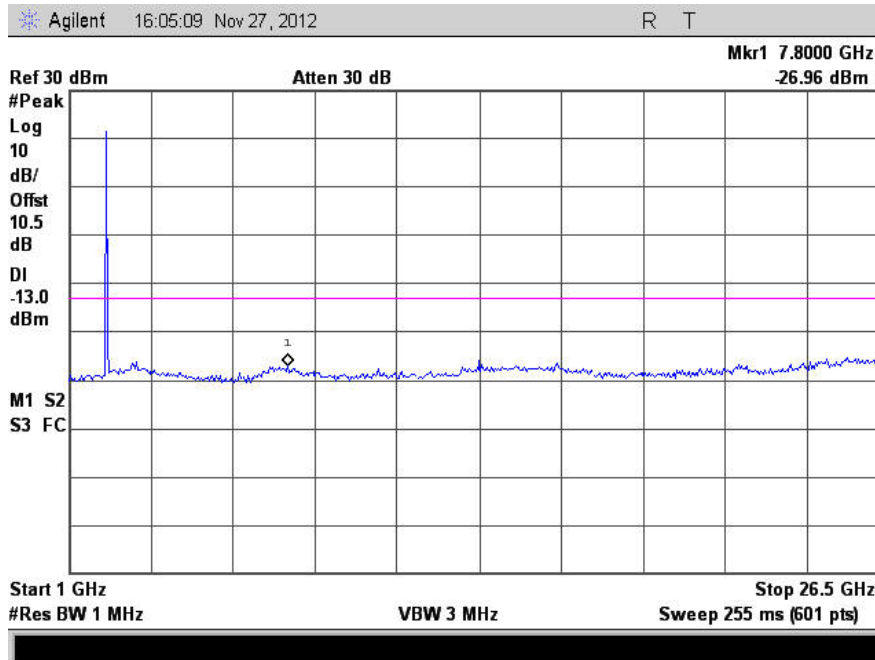
6.3.21. High Channel, 30 to 1000 MHz – TX3



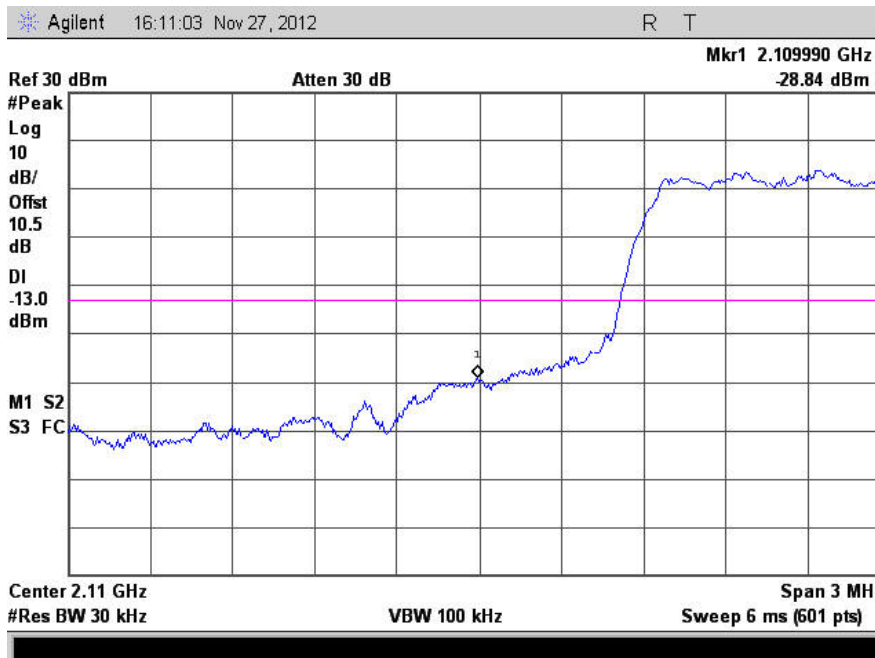
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.22. High Channel, 1 to 26.5 GHz – TX3



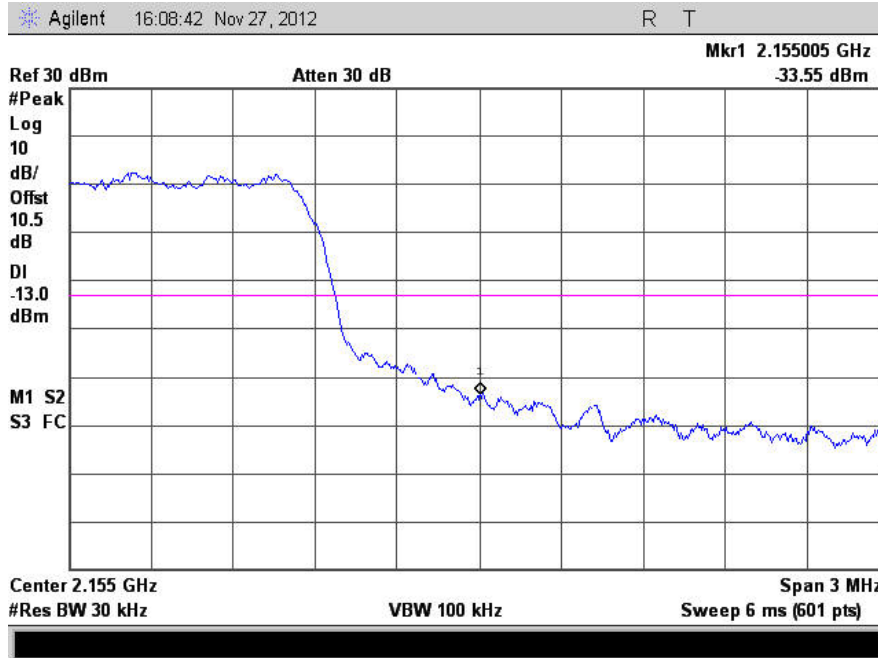
6.3.23. 2110 MHz Lower Bandedge Measurement – TX3



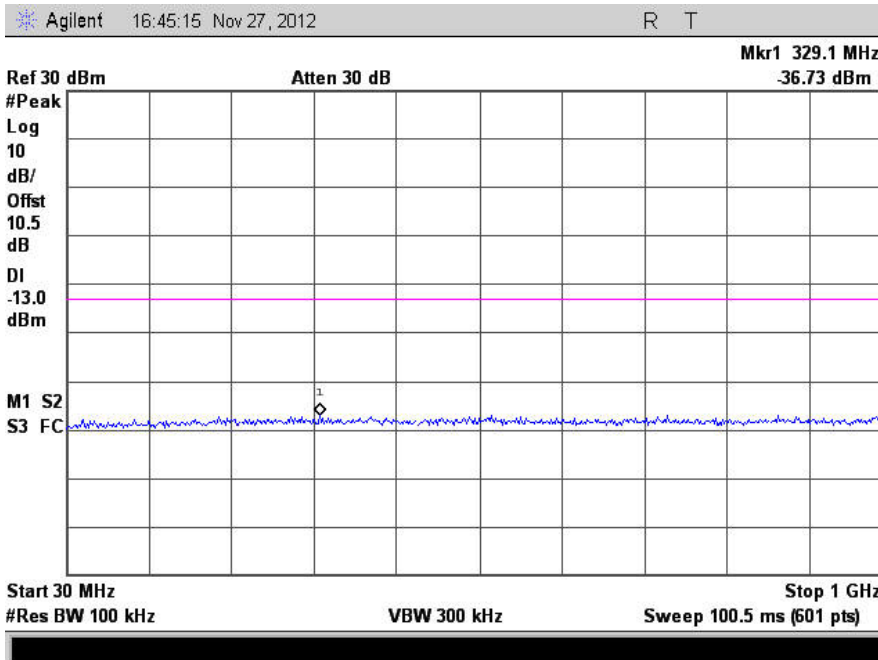
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.24. 2155 MHz Upper Bandedge Measurement – TX3



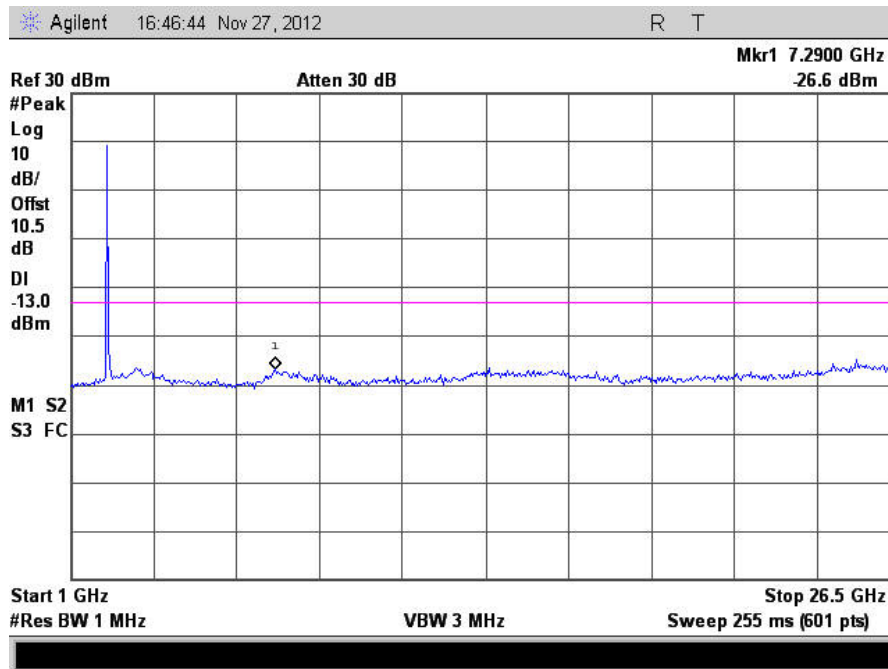
6.3.25. Low Channel, 30 MHz to 1 GHz – TX4



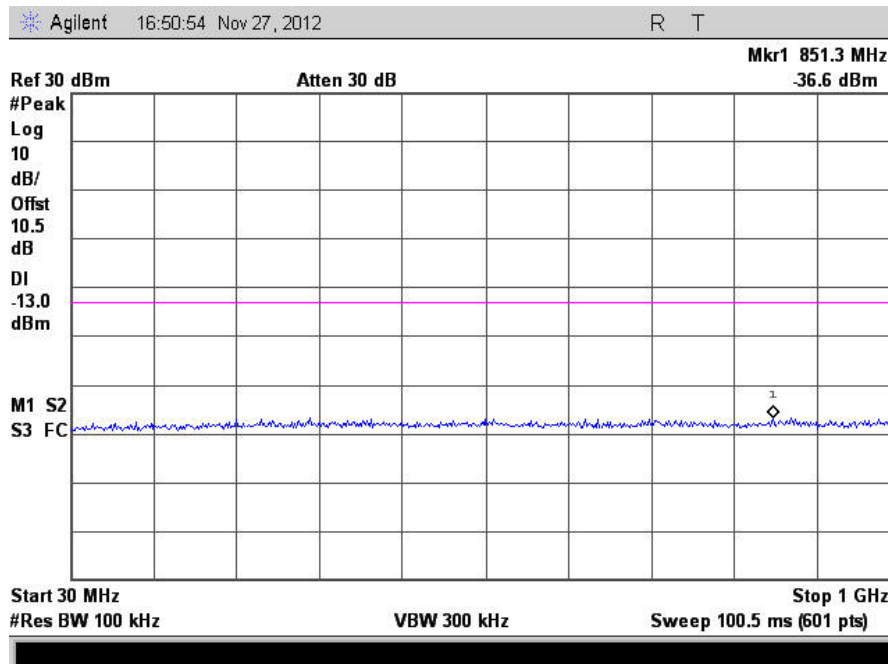
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.26. Low Channel, 1 to 26.5 GHz – TX4



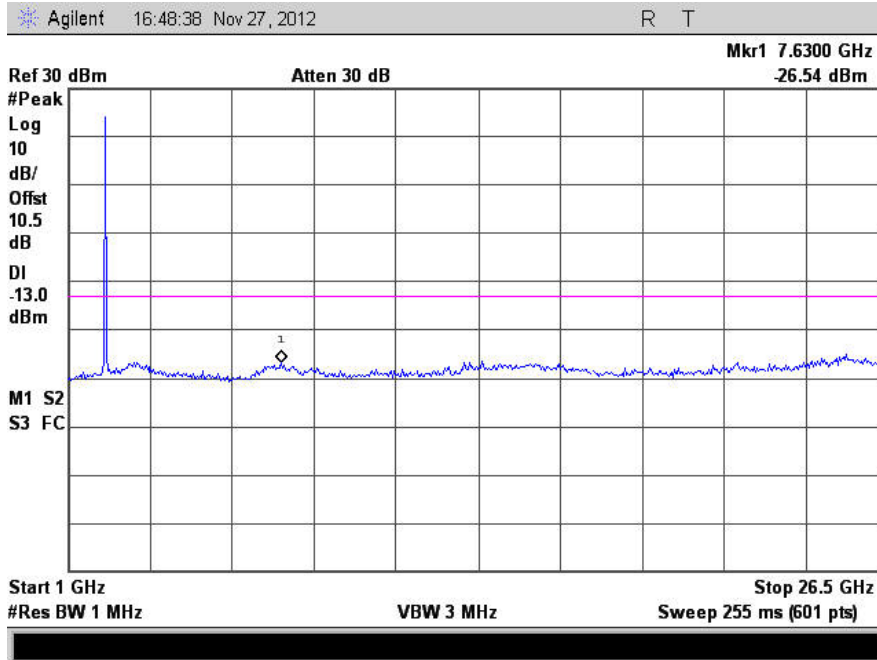
6.3.27. Mid Channel, 30 MHz to 1 GHz – TX4



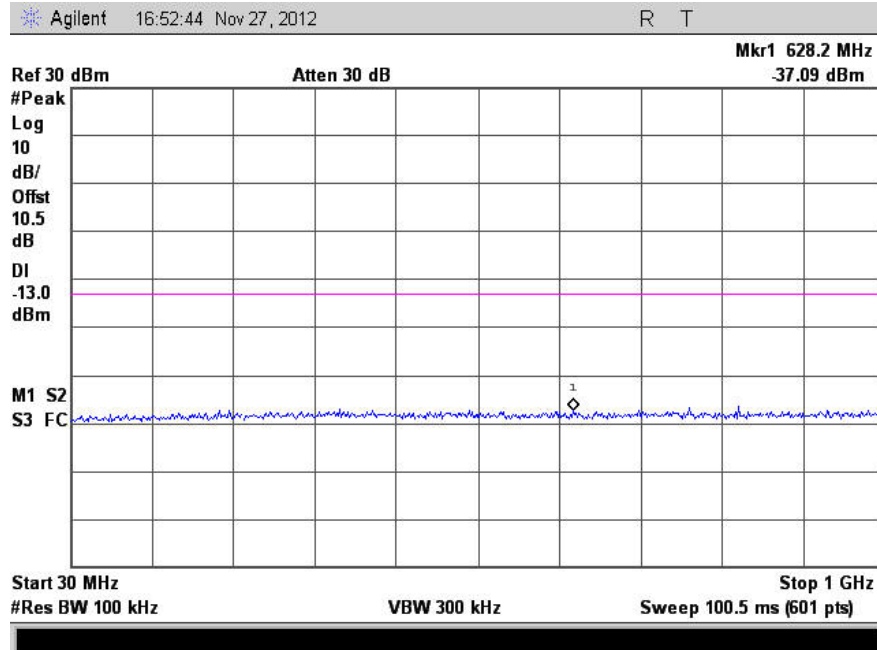
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.28. Mid Channel, 1 to 26.5 GHz – TX4



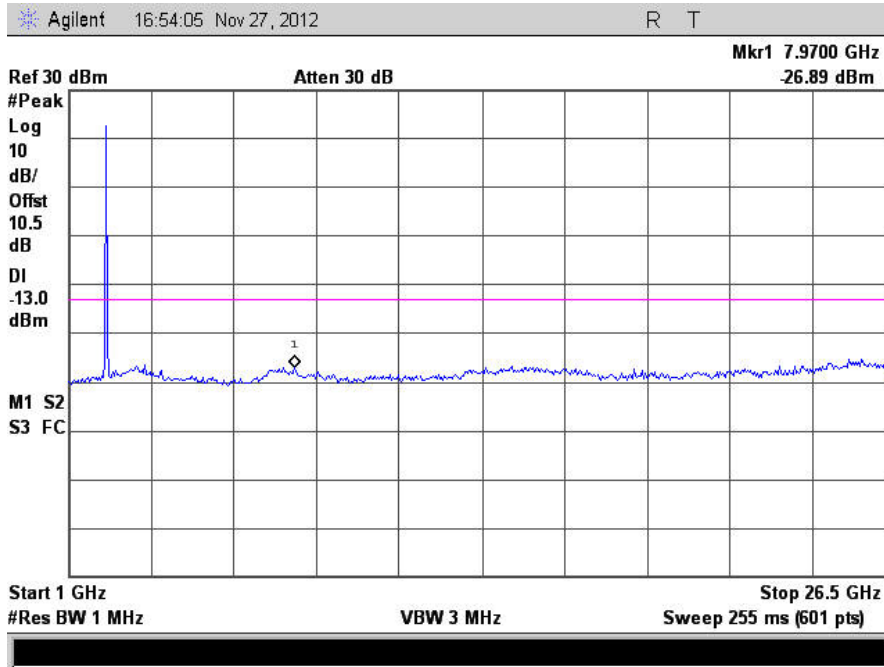
6.3.29. High Channel, 30 to 1000 MHz – TX4



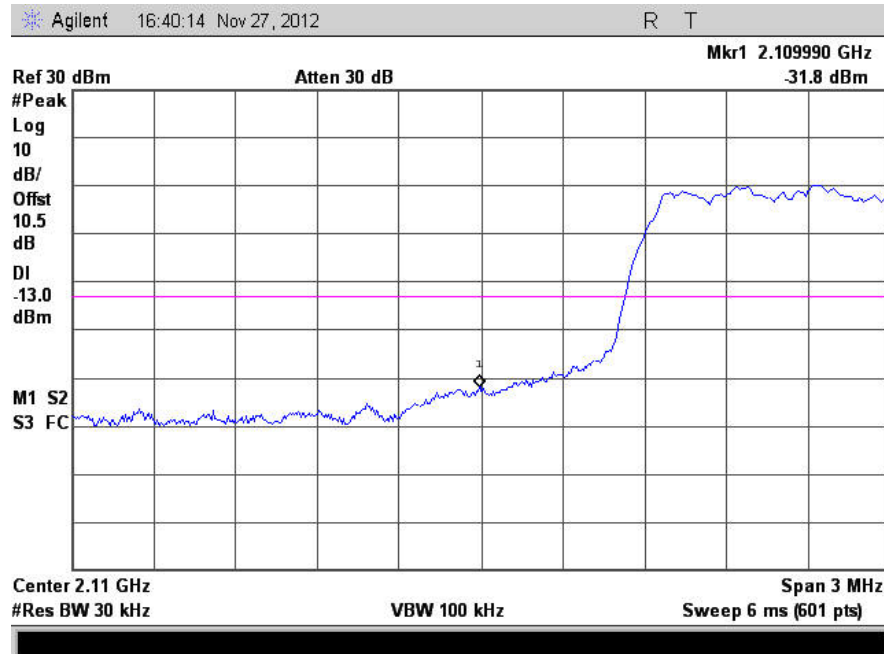
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.30. High Channel, 1 to 26.5 GHz – TX4



6.3.31. 2110 MHz Lower Bandedge Measurement – TX4



6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h) (continued)

6.3.32. 2155 MHz Upper Bandedge Measurement – TX4



6. Measurement Data (continued)**6.4. Field Strength of Spurious Emissions 27.53 (h)**

Requirement: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB

6.4.1. Measurement and Equipment Setup

Test Date:	08/21/2012
Test Engineer:	Cody Merry
Site Temperature (°C):	25
Relative Humidity (%RH):	47
Frequency Range:	30 MHz to 1 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	120 kHz
EMI Receiver Avg Bandwidth:	300 kHz
Detector Functions:	Peak and Quasi-Peak.
Antenna Height:	1 to 4 meters

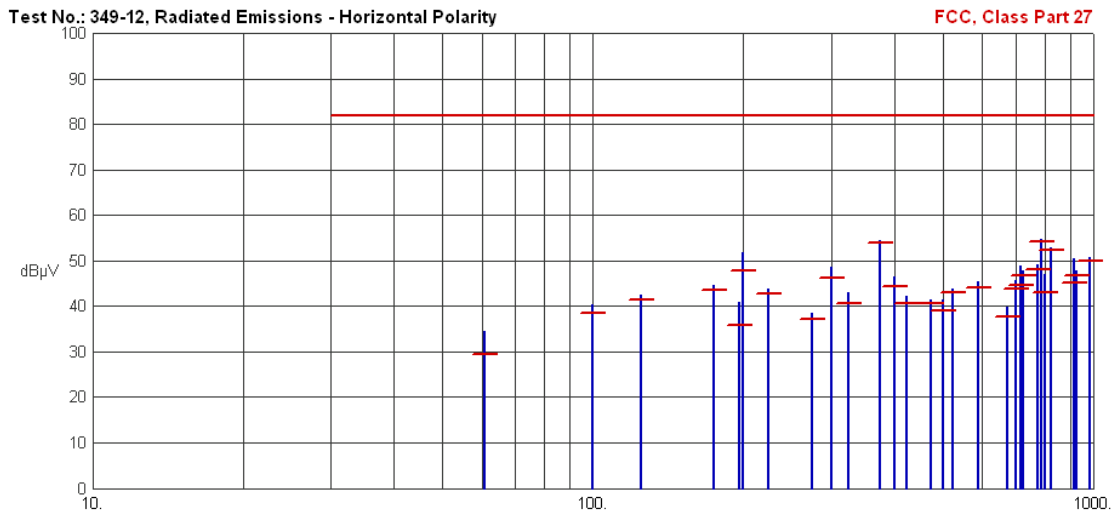
6.4.2 Test Procedure

Test measurements were made in accordance with ANSI C63.4-2009, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h) (continued)

6.4.3. Horizontal Polarity

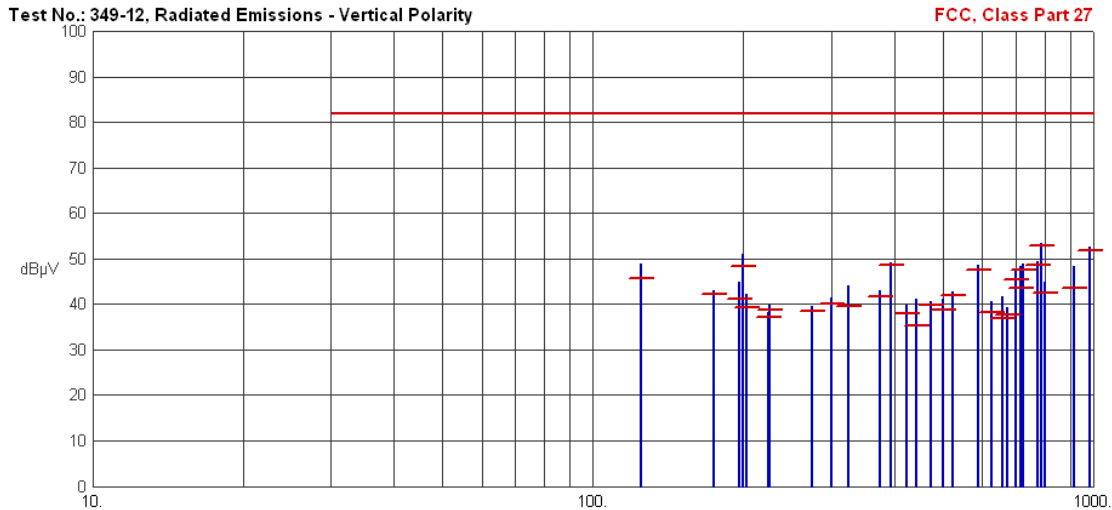


Frequency (MHz)	Pk Amp (dBµV/m)	QP Amp (dBµV/m)	QP Limit (dBµV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
60.7302	34.59	29.54	82.00	-52.46	N/A	N/A	
100.0196	40.37	38.62	82.00	-43.38	N/A	N/A	
125.0096	42.39	41.33	82.00	-40.67	N/A	N/A	
175.0192	44.67	43.61	82.00	-38.39	N/A	N/A	
196.5969	41.03	35.73	82.00	-46.27	N/A	N/A	
200.0486	51.84	47.81	82.00	-34.19	N/A	N/A	
225.0098	43.95	42.74	82.00	-39.26	N/A	N/A	
275.0318	38.63	37.28	82.00	-44.72	N/A	N/A	
300.0601	48.58	46.30	82.00	-35.70	N/A	N/A	
325.0250	42.92	40.58	82.00	-41.42	N/A	N/A	
375.0244	54.56	53.91	82.00	-28.09	N/A	N/A	
400.0711	46.55	44.37	82.00	-37.63	N/A	N/A	
425.0423	42.25	40.64	82.00	-41.36	N/A	N/A	
475.0413	41.55	40.77	82.00	-41.23	N/A	N/A	
500.0749	41.45	38.93	82.00	-43.07	N/A	N/A	
525.0408	43.83	43.13	82.00	-38.87	N/A	N/A	
589.8255	45.34	44.05	82.00	-37.95	N/A	N/A	
675.0659	39.82	37.70	82.00	-44.30	N/A	N/A	
700.1419	45.82	43.75	82.00	-38.25	N/A	N/A	
717.6479	48.97	44.59	82.00	-37.41	N/A	N/A	
725.0652	47.72	46.91	82.00	-35.09	N/A	N/A	
775.0754	49.27	48.24	82.00	-33.76	N/A	N/A	
786.4241	54.82	54.37	82.00	-27.63	N/A	N/A	
800.0606	47.17	43.11	82.00	-38.89	N/A	N/A	
825.0762	52.92	52.37	82.00	-29.63	N/A	N/A	
914.1573	50.40	45.20	82.00	-36.80	N/A	N/A	
925.0931	47.84	46.82	82.00	-35.18	N/A	N/A	
983.0349	50.77	49.91	82.00	-32.09	N/A	N/A	

6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h) (continued)

6.4.4. Vertical Polarity



Frequency (MHz)	Pk Amp (dBµV/m)	QP Amp (dBµV/m)	QP Limit (dBµV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
125.0213	48.88	45.62	82.00	-36.38	N/A	N/A	
175.0207	42.99	42.12	82.00	-39.88	N/A	N/A	
196.6013	44.84	41.16	82.00	-40.84	N/A	N/A	
200.0358	51.17	48.31	82.00	-33.69	N/A	N/A	
203.3559	42.35	39.40	82.00	-42.60	N/A	N/A	
225.0198	38.13	37.06	82.00	-44.94	N/A	N/A	
225.0261	39.72	38.70	82.00	-43.30	N/A	N/A	
275.0313	39.55	38.58	82.00	-43.42	N/A	N/A	
300.0638	41.54	40.10	82.00	-41.90	N/A	N/A	
325.0188	44.10	39.51	82.00	-42.49	N/A	N/A	
375.0436	43.06	41.71	82.00	-40.29	N/A	N/A	
393.2142	49.12	48.55	82.00	-33.45	N/A	N/A	
425.0309	39.72	37.95	82.00	-44.05	N/A	N/A	
442.1239	41.16	35.23	82.00	-46.77	N/A	N/A	
475.0398	40.76	39.74	82.00	-42.26	N/A	N/A	
500.0924	41.12	38.82	82.00	-43.18	N/A	N/A	
525.0571	42.71	41.87	82.00	-40.13	N/A	N/A	
589.8355	48.68	47.55	82.00	-34.45	N/A	N/A	
625.0679	40.61	38.16	82.00	-43.84	N/A	N/A	
658.2499	41.78	36.85	82.00	-45.15	N/A	N/A	
675.0576	39.31	37.70	82.00	-44.30	N/A	N/A	
700.1497	47.23	45.41	82.00	-36.59	N/A	N/A	
717.6451	48.28	43.67	82.00	-38.33	N/A	N/A	
725.0702	48.93	47.59	82.00	-34.41	N/A	N/A	
775.0701	49.34	48.65	82.00	-33.35	N/A	N/A	
786.4314	53.50	52.98	82.00	-29.02	N/A	N/A	
800.1759	44.96	42.61	82.00	-39.39	N/A	N/A	
913.7740	48.36	43.60	82.00	-38.40	N/A	N/A	
983.0417	52.64	51.94	82.00	-30.06	N/A	N/A	

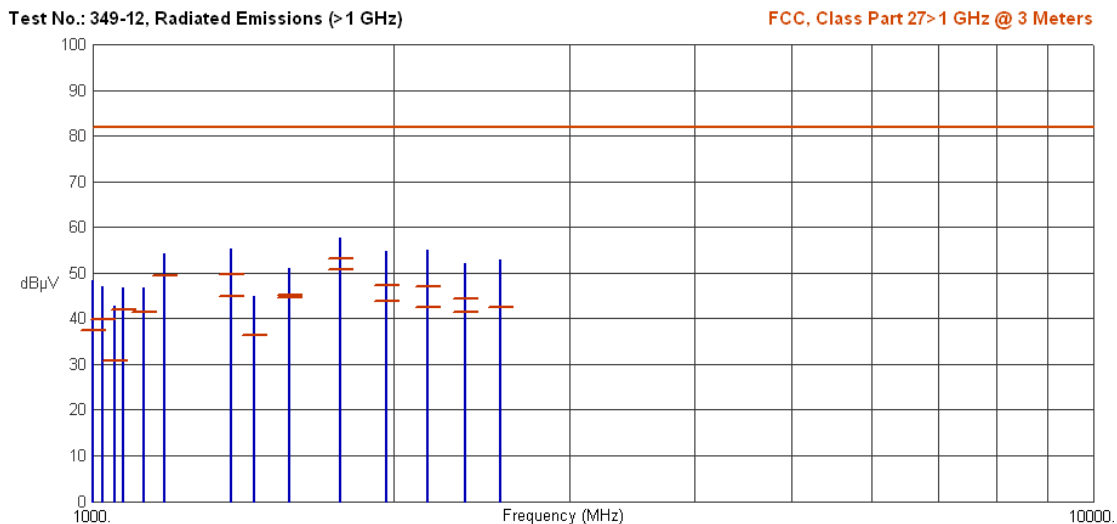
6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h) (continued)

6.4.5. Measurement and Equipment Setup

Test Date:	8/21/2012
Test Engineers:	Cody Merry
Site Temperature (°C):	25
Relative Humidity (%RH):	47
Frequency Range:	Above 1 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth:	3 MHz
Detector Functions:	Peak and EMI Average
Antenna Height:	1 to 4 meters

6.4.6. Radiated Emissions Above 1 GHz – Horizontal & Vertical



6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h) (continued)

6.4.7. Radiated Emissions data above 1 GHz – Horizontal & Vertical

Frequency (MHz)	Pk Amp (dBµV/m)	Av Amp (dBµV/m)	Av Limit (dBµV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
1000.0075	48.27	37.40	82.00	-44.60	N/A	N/A	
1025.1213	47.08	39.98	82.00	-42.02	N/A	N/A	
1052.1050	42.85	30.75	82.00	-51.25	N/A	N/A	
1075.0550	46.69	41.96	82.00	-40.04	N/A	N/A	
1125.0375	46.66	41.41	82.00	-40.59	N/A	N/A	
1179.5463	54.17	49.39	82.00	-32.61	N/A	N/A	
1376.0825	55.28	49.61	82.00	-32.39	N/A	N/A	
1376.3700	51.26	44.99	82.00	-37.01	N/A	N/A	
1450.1675	44.99	36.51	82.00	-45.49	N/A	N/A	
1572.8275	50.92	44.60	82.00	-37.40	N/A	N/A	
1572.8663	50.74	45.12	82.00	-36.88	N/A	N/A	
1769.4038	55.72	50.74	82.00	-31.26	N/A	N/A	
1769.4175	57.82	53.25	82.00	-28.75	N/A	N/A	
1966.0463	54.87	47.38	82.00	-34.62	N/A	N/A	
1966.0725	52.73	43.80	82.00	-38.20	N/A	N/A	
2162.6388	52.29	42.53	82.00	-39.47	N/A	N/A	
2162.6788	55.03	47.14	82.00	-34.86	N/A	N/A	
2359.2250	51.43	41.37	82.00	-40.63	N/A	N/A	
2359.2944	52.13	44.25	82.00	-37.75	N/A	N/A	
2555.7282	52.96	42.58	82.00	-39.42	N/A	N/A	

6. Measurement Data (continued)

6.5. Frequency Stability 27.54 per Section 2.1055

Requirement: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized band of operation.

The temperature shall be varied from -30 to +50 degrees C in increments of 10 degrees C allowing time for the product to stabilize at each of the temperature steps.

Also, the frequency stability shall be measured with a variation of supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Temperature Degrees C	Frequency (MHz)	85% Nominal Voltage	115% Nominal Voltage
-30	2132.4625	2132.4625	2132.4625
-20	2132.4625	2132.4625	2132.4625
-10	2132.4750	2132.4750	2132.4750
0	2132.4875	2132.4875	2132.4875
10	2132.4875	2132.4875	2132.4875
20	2132.4875	2132.4875	2132.4875
30	2132.4875	2132.4875	2132.4875
40	2132.4875	2132.4875	2132.4875
50	2132.4625	2132.4625	2132.4625
Max Deviation	0.0250	0.0250	0.0250

6. Measurement Data (continued)

6.6. Public Exposure to Radio Frequency Energy Levels 27.52 per 1.1307 (b)(1)

Channel	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm ²)	Result
				(mW/cm ²)	(W/m ²)		
	(1)	(2)	(3)	(4)		(5)	
Low	20.0	20.51	3.0000	0.0446406	0.4464061	1	Compliant
Mid	20.0	18.71	3.0000	0.0294938	0.2949376	1	Compliant
High	20.0	18.51	3.0000	0.0281663	0.2816632	1	Compliant
All	20.0	21.42	3.0000	0.0550466	0.5504656	1	Compliant
Low	20.0	21.61	3.0000	0.0575082	0.5750825	1	Compliant
Mid	20.0	21.97	3.0000	0.0624784	0.6247844	1	Compliant
High	20.0	21.87	3.0000	0.0610563	0.6105625	1	Compliant
All	20.0	22.02	3.0000	0.0632019	0.6320190	1	Compliant
Low	20.0	20.5	3.0000	0.0445379	0.4453794	1	Compliant
Mid	20.0	20.48	3.0000	0.0443333	0.4433331	1	Compliant
High	20.0	19.51	3.0000	0.0354593	0.3545930	1	Compliant
All	20.0	20.99	3.0000	0.0498575	0.4985746	1	Compliant
Low	20.0	16.09	3.0000	0.0161336	0.1613356	1	Compliant
Mid	20.0	22.24	3.0000	0.0664860	0.6648599	1	Compliant
High	20.0	20.52	3.0000	0.0447435	0.4474352	1	Compliant
All	20.0	20.82	3.0000	0.0479435	0.4794355	1	Compliant

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

1. Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Actual separation distance was calculated for outdoor applications.
2. Section 6.1.2 of this test report. Note that the value has been adjusted to include the cable insertion loss.
3. Data supplied by the client. 3 dBi for Indoor, 14 dBi for Outdoor Applications
4. Power density is calculated from field strength measurement and antenna gain.
5. Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.

6. Measurement Data (continued)

6.6. Public Exposure to Radio Frequency Energy Levels 27.52 per 1.1307 (b)(1)

Channel	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm ²)	Result
				(mW/cm ²)	(W/m ²)		
	(1)	(2)	(3)	(4)		(5)	
Low	20.0	20.51	14.0000	0.5619920	5.6199201	1	Compliant
Mid	20.0	18.71	14.0000	0.3713044	3.7130444	1	Compliant
High	20.0	18.51	14.0000	0.3545930	3.5459299	1	Compliant
All	20.0	21.42	14.0000	0.6929951	6.9299507	1	Compliant
Low	20.0	21.61	14.0000	0.7239860	7.2398596	1	Compliant
Mid	20.0	21.97	14.0000	0.7865569	7.8655690	1	Compliant
High	20.0	21.87	14.0000	0.7686527	7.6865268	1	Compliant
All	20.0	22.02	14.0000	0.7956648	7.9566480	1	Compliant
Low	20.0	20.5	14.0000	0.5606995	5.6069947	1	Compliant
Mid	20.0	20.48	14.0000	0.5581233	5.5812329	1	Compliant
High	20.0	19.51	14.0000	0.4464061	4.4640612	1	Compliant
All	20.0	20.99	14.0000	0.6276682	6.2766823	1	Compliant
Low	20.0	16.09	14.0000	0.2031095	2.0310946	1	Compliant
Mid	20.0	22.24	14.0000	0.8370090	8.3700903	1	Compliant
High	20.0	20.52	14.0000	0.5632875	5.6328754	1	Compliant
All	20.0	20.82	14.0000	0.6035735	6.0357347	1	Compliant

Note: For outdoor installations, users must be instructed to be at least 23 cm away from the high gain antenna when the device is in operation.

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

- Reference CFR 2.1093(b): For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Actual separation distance was calculated for outdoor applications.
- Section 6.1.2 of this test report. Note that the value has been adjusted to include the cable insertion loss.
- Data supplied by the client. 3 dBi for Indoor, 14 dBi for Outdoor Applications
- Power density is calculated from field strength measurement and antenna gain.
- Reference CFR 1.1310, Table 1: Limits for Maximum Permissible Exposure (MPE), Section (B): Limits for General Population/Uncontrolled Exposure.

7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with Federal Communications Commission (FCC) and Industry Canada standards. A description of the test sites is on file with the FCC (registration number **96392**) and Industry Canada (file number **IC 3023A-1**).

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane required by EN 55022.

Both sites are designed to test products or systems 1.5 meter W x 1.5 meter L x 2.0 meter H, floor standing or table top.

8. Test Setup Photographs

Antenna Port Conducted Emissions



8. Test Setup Photographs (cont)

Radiated Emissions (Front)



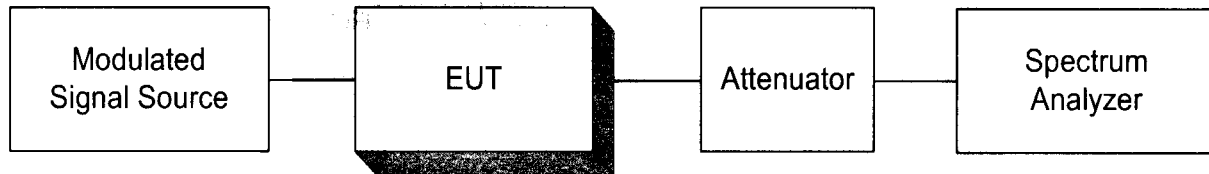
8. Test Setup Photographs (cont)

Radiated Emissions (Rear)

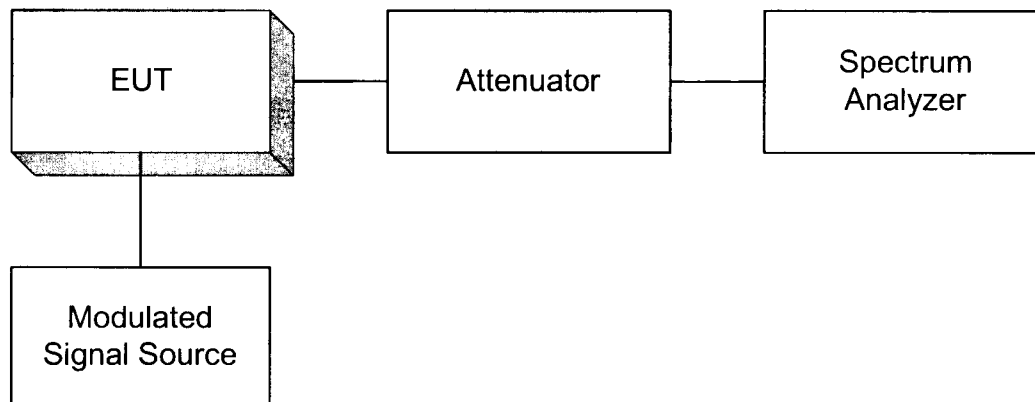


Appendix A

RF Output Power

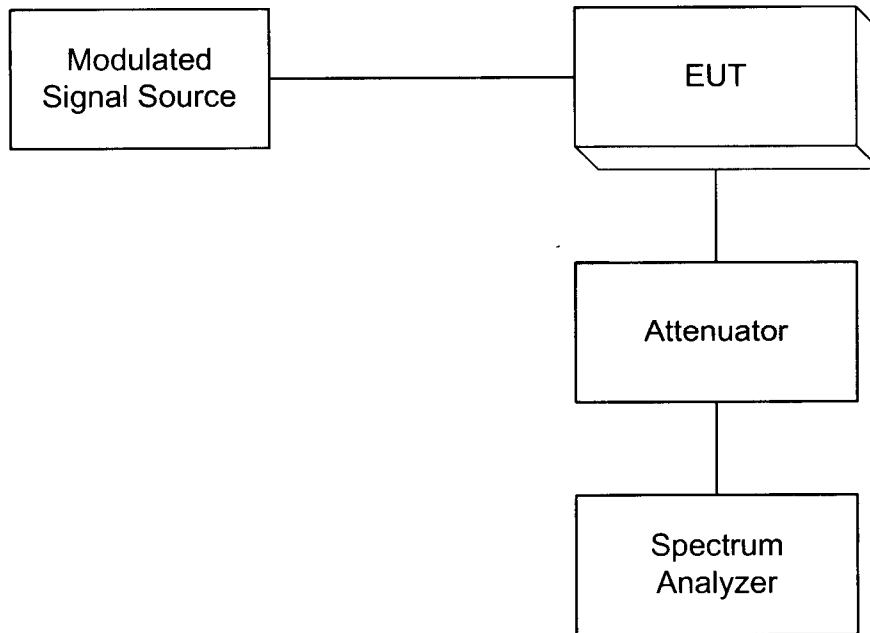


Occupied Bandwidth



Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation

