

**COMPLIANCE WORLDWIDE INC.
TEST REPORT 120-13R3**

**In Accordance with the Requirements of
FCC PART 27:2012 Subparts C & L
FCC PART 20:2013**

Issued to

**Cellular Specialties, Inc.
670 North Commercial Street
Manchester, NH 03101
(603) 626-6677**

for

**Acela Digital Repeater AWS
Model: CSI-DRACELA-PR-AW**

FCC ID: NVRCSIDRACELAPRAW

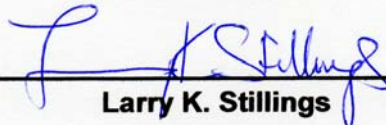
Original Report Issued on May 7, 2013

Revision R1 Issued on May 23, 2013


Revision R2 Issued on September 30, 2013

Revision R3 Issued on November 7, 2013

Tested by


Larry K. Stillings

Reviewed By


Brian F. Breault

This test report shall not be reproduced, except in full, without written permission from Compliance Worldwide, Inc.

Table of Contents

1. Scope	3
2. Product Details	3
2.1. Manufacturer	3
2.2. Model Number	3
2.3. Serial Number	3
2.4. Description	3
2.5. Power Source	3
2.6. Software Version	3
2.7. EMC Modifications	3
3. Product Configuration	4
3.1. Support Equipment	4
3.2. Cables	4
3.3. Operational Characteristics & Software	5
3.4. Block Diagram	5
4. Measurement Parameters	6
4.1. Measurement Equipment Used to Perform Test	6
4.2. Measurement & Equipment Setup	6
4.3. Test Procedure	6
5. Measurement Summary	7
6. Measurement Data	8
6.1. Power and Antenna Height Limits 27.50 (b)(4)	8
6.2. Bandwidth Limitations (FCC Part 2.1049)	20
6.3. Spurious Emissions at the Antenna Terminals 27.53 (c)	29
6.4. Field Strength of Spurious Emissions 27.53 (c)	46
6.5. Frequency Stability 27.54	50
6.6. Inter-modulation	51
6.7. Public Exposure to Radio Frequency Energy Levels 1.1307 (b)(1)	55
7. Test Site Description	56
8. Test Setup Photographs	57
Appendix A	61

1. Scope

This test report certifies that the Cellular Specialties Digital Repeater Acela AWS, 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. Revision R1 adds the 18 to 26.5 GHz Horn antenna to the equipment list. Revised R2 adds FCC Part 20 Rule. Revision R3 adds Output Power data with AGC Circuitry turned on.

2. Product Details

- 2.1. Manufacturer:** Cellular Specialties
- 2.2. Model Number:** CSI-DRACELA-PR-AW (CSI-DRACELA-B-AW)
- 2.3. Serial Number:** C1L20004, Item# CS12-558-419 (CS12-560-419)
- 2.4. Description:** This repeater consists of a single Module configured in a 2U high sealed enclosure for use on a train in the AWS frequency band. Through the use of two multiband cavity filters and front panel connectors which are terminated if not used, this repeater optionally provides connection to the Donor and Server antennas for type certified PCS, CELL and U7C repeaters. As the train moves between cell sites, the desired filter can then be switched to maintain coverage in the band licensed for that area.
The initial deployment of the product will use the following AWS bands blocks for operation A0B0, B0, B0C0 and B0C0D0 dependent on the trains' geographical location determined via a GPS receiver.
- 2.5. Power Source:** 72 VDC via Train power source.
- 2.6. Software Version:** N/A
- 2.7. EMC Modifications:** None

3. Product Configuration

3.1. Support Equipment

Device	Manufacturer	Model	Serial No.	Comment
RF Signal Generator	R & S	SMIQ06B	10090	Generating W-CDMA Signals
IQ Modulation Generator	R & S	AMIQ04	100540	Generating AWS Signals
Power Supplies (2)	Lambda	SWS600-36	n/a	Two In Series for 72 VDC
Notebook PC	Dell	Latitude C400	9760689253	Configuring Unit

3.2. Cables

Cable Type	Length	Shield	From	To
RF, 50 Ω , N male – N male	1M	Yes	DUT	Signal Generator
RF, 50 Ω , N male – N male	1M	Yes	DUT	50 Ω Load
Power Supply	2M + 2M	Yes	DUT	120 VAC, 60 Hz
Serial 1	2M	Yes	DUT	Notebook PC
USB 1	2M	Yes	DUT	Notebook PC
Ethernet	2M	No	DUT	Notebook PC

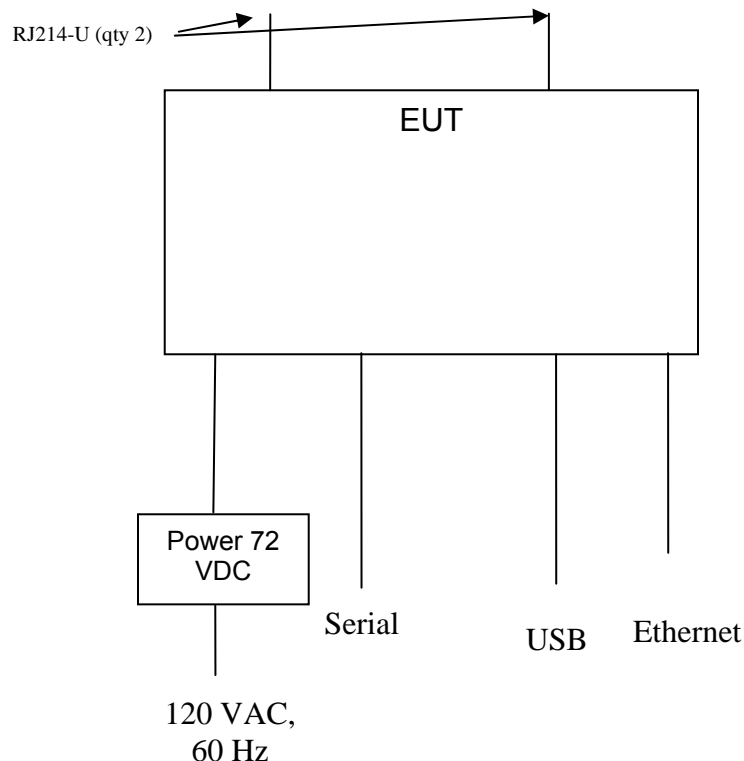
Notebook PC is connected only during setup

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 an RF Signal Generator on the Input and a Spectrum Analyzer on the output Downlink or Uplink frequencies a signal was generated over the intended bandwidth of operation.
- (3) The signal generator was configured to provide an AWS / LTE digital modulation to the input of the amplifier for the applicable AWS bands and bandwidths to be used by the product.
- (4) The unit's internal AGC circuitry was toggled on and off to determine the maximum output power for each of the Uplink and Downlink frequencies and still maintain compliance with the standard.

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	E4407B	MY45104493	2/26/2015
EMI Receiver	Hewlett Packard	8546A	3330A00115	6/8/2014
Microwave Preamp	Hewlett Packard	8449B	3008A01323	12/1/2013
Bilog Antenna	Com-Power	AC-220	25509	8/30/2013
Horn Antenna	Electro-Metrics	EM-6961	6337	10/19/2013
Horn Antenna	Com-Power	AH-826	080151	08/27/2014
RF Signal Generator	Rohde & Schwarz	SMIQ06B	100090	2/22/2015
Power Attenuator	Aeroflex / Weinschel	41-10-12	75411	CBU
Power Attenuator	Pasternack	PE7017-6	Cal ID# 233	CBU

4.2. Measurement & Equipment Setup

Test Dates: 2/5 to 2/7 2013,
11/7/2013

Test Engineer: Larry Stillings

Normal Site Temperature (15 – 35°C): 24

Relative Humidity (20 -75%RH): 33

4.3. Test Procedure

The test measurements contained in this report are based on the requirements detailed in FCC 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 27 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	
Field Strength of Spurious Emissions	27.53 (h)	6.4	Compliant	
Frequency Stability	27.54	6.5	N/A	The EUT does not translate the frequency of the input signal
Inter-modulation	N/A	6.6	Compliant	
Public Exposure to Radio Frequency Energy Levels	Section 1.1307 (b)(1)	6.7	Compliant	

6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d)(4)

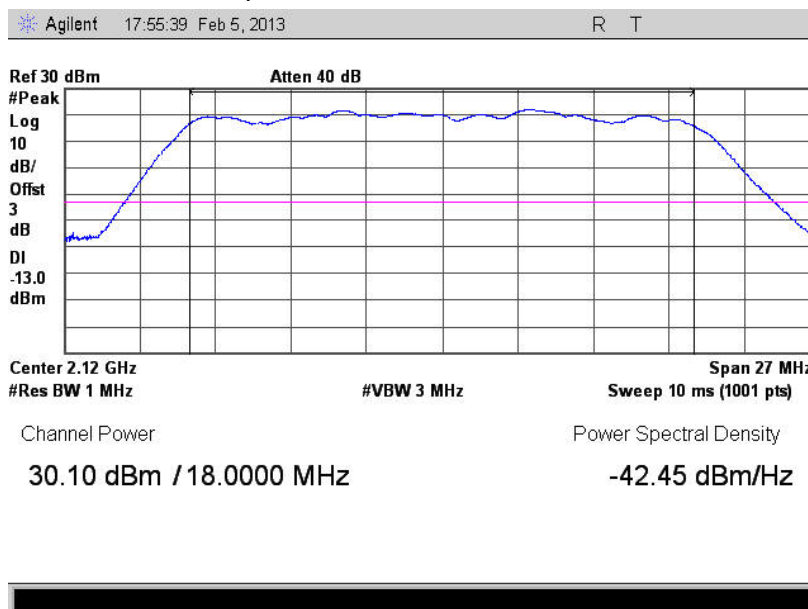
Requirement: Fixed and base stations transmitting a signal in the 2110-2155 MHz, band must not exceed an ERP of 1640 watts/MHz and an antenna height of 305 m HAAT.

Fixed, mobile, and portable (handheld) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground.

6.1.1. Peak Transmitter Output Power, Transmitter Only – AGC Off

AWS Bands (Blocks A,B,C,D,E,F)	Frequency	Output Power	
	(MHz)	(dBm)	(Watts)
Downlink (A0B0)	2111.0 – 2129.0 MHz	30.10	1.023
Uplink (A0B0)	1711.0 – 1729.0 MHz	33.87	2.438
Downlink (B0)	2120.5 – 2129.5 MHz	29.67	0.927
Uplink (B0)	1720.5 – 1729.5 MHz	33.58	2.280
Downlink (B0C0)	2120.25 – 2134.25 MHz	30.21	1.050
Uplink (B0C0)	1720.25 – 1734.25 MHz	33.64	2.312
Downlink (B0C0D0)	2121.0 – 2139.0 MHz	30.26	1.062
Uplink (B0C0D0)	1721.0 – 1739.0 MHz	34.24	2.655

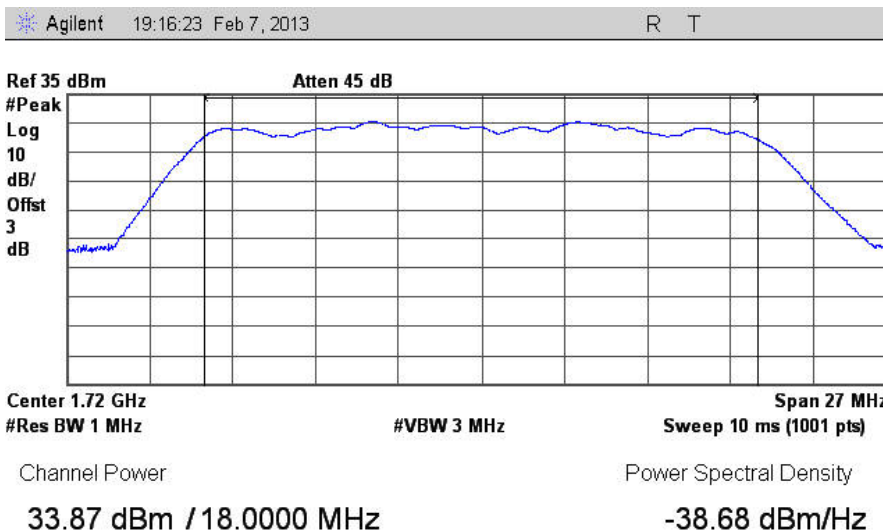
6.1.2. Peak Transmitter Output Power, 2120 MHz



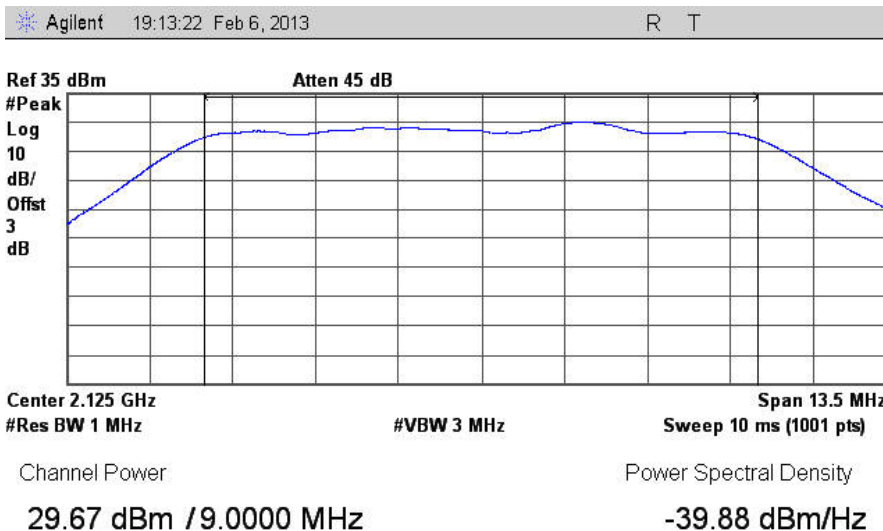
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.3. Peak Transmitter Output Power, 1720 MHz



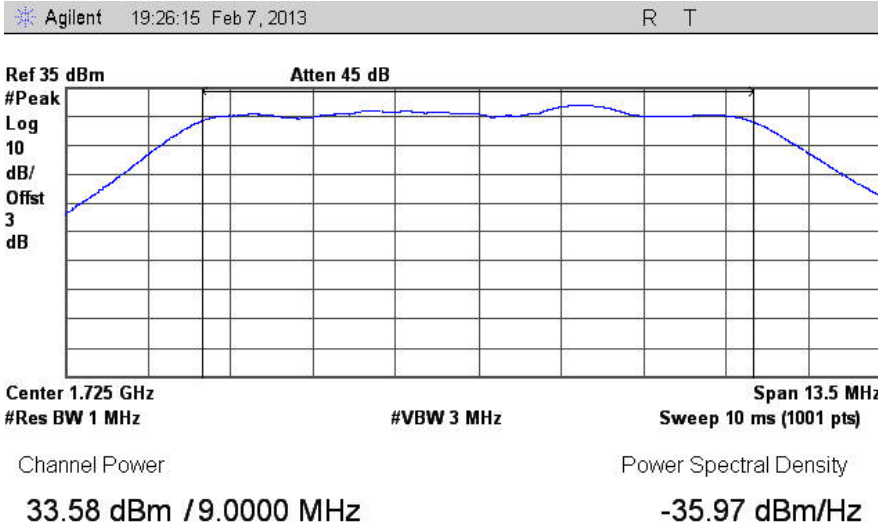
6.1.4. Peak Transmitter Output Power, 2125 MHz



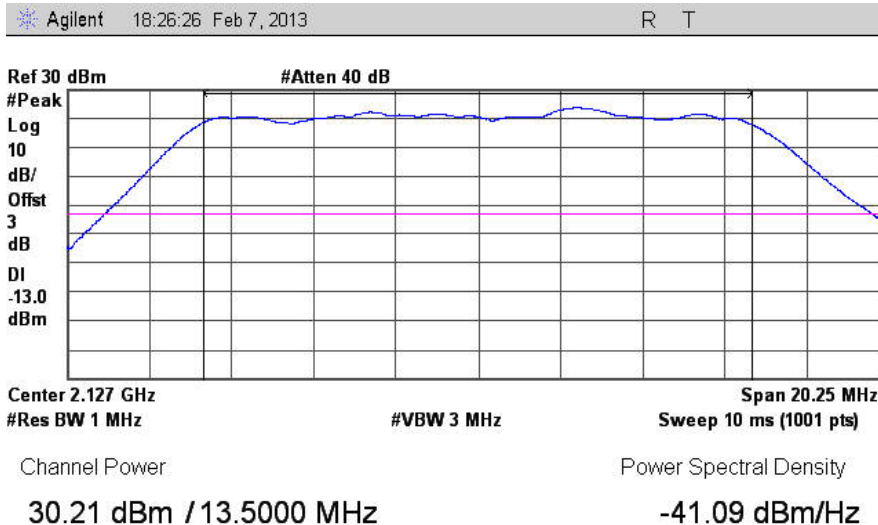
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.5. Peak Transmitter Output Power, 1725 MHz



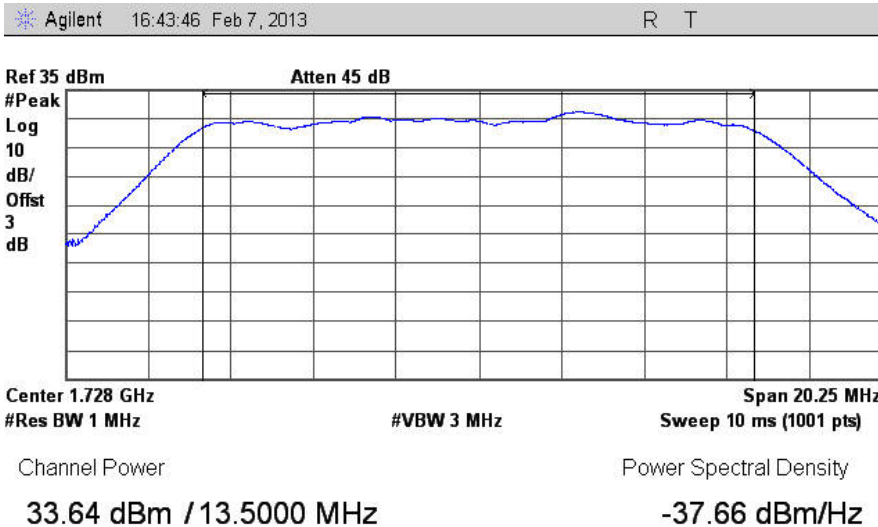
6.1.6. Peak Transmitter Output Power, 2127.5 MHz



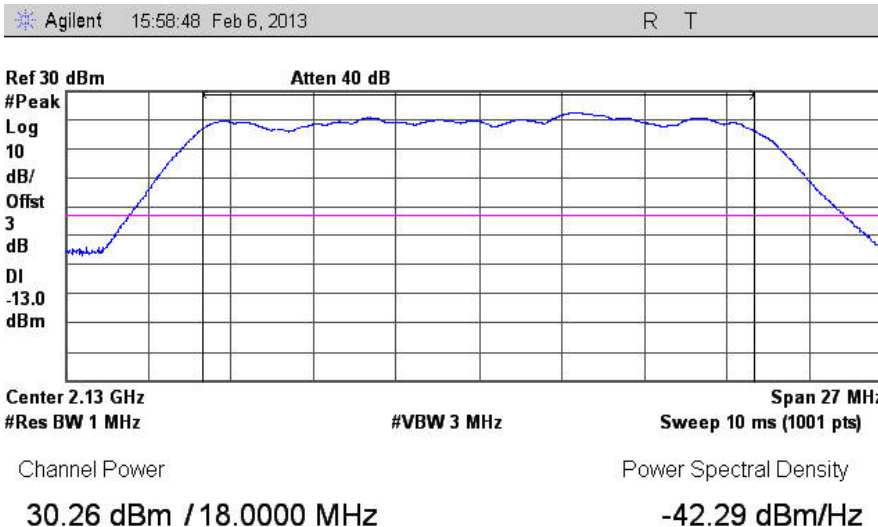
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.7. Peak Transmitter Output Power, 1727.5 MHz



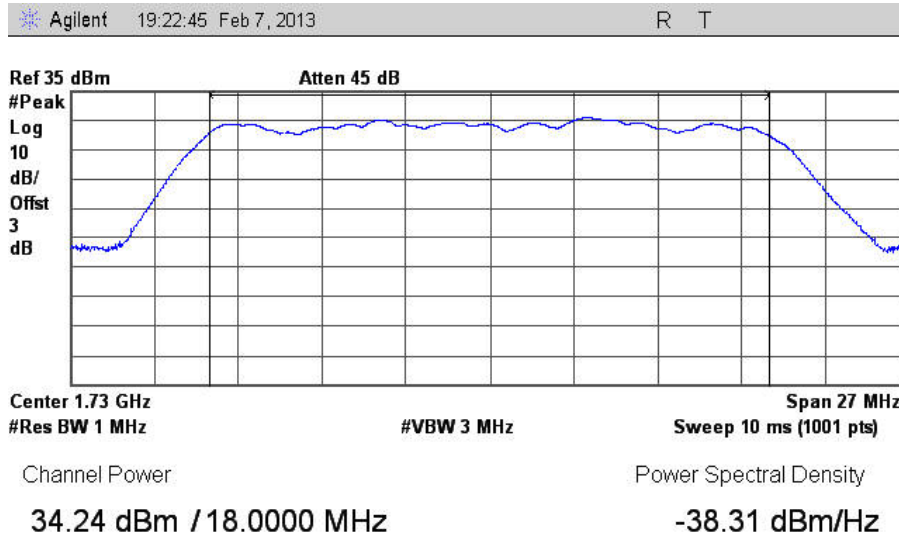
6.1.8. Peak Transmitter Output Power, 2130 MHz



6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.9. Peak Transmitter Output Power, 1730 MHz



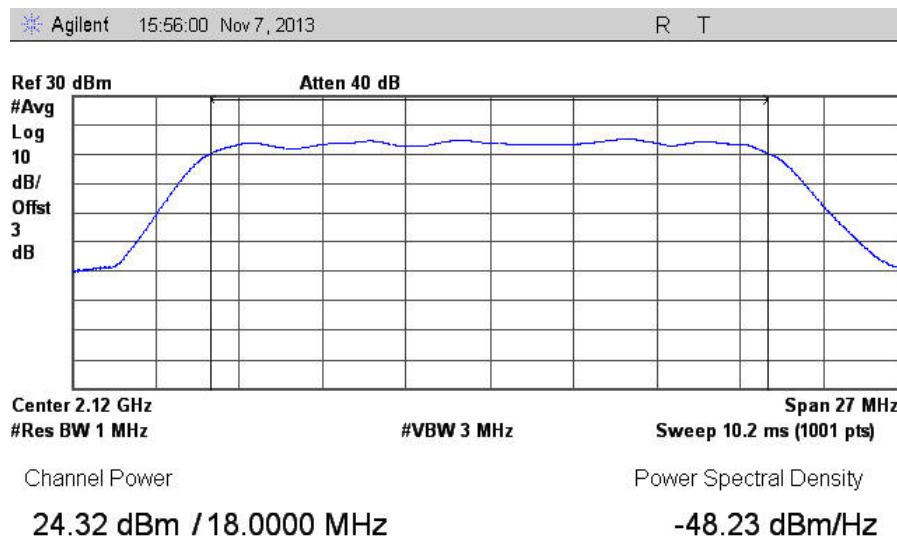
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d)(4) cont.

6.1.10. Peak Transmitter Output Power, Transmitter Only – AGC On

AWS Bands (Blocks A,B,C,D,E,F)	Frequency	Output Power	
	(MHz)	(dBm)	(Watts)
Downlink (A0B0)	2111.0 – 2129.0 MHz	24.32	0.270
Uplink (A0B0)	1711.0 – 1729.0 MHz	31.33	1.358
Downlink (B0)	2120.5 – 2129.5 MHz	25.14	0.327
Uplink (B0)	1720.5 – 1729.5 MHz	31.20	1.318
Downlink (B0C0)	2120.25 – 2134.25 MHz	25.21	0.332
Uplink (B0C0)	1720.25 – 1734.25 MHz	31.80	1.514
Downlink (B0C0D0)	2121.0 – 2139.0 MHz	25.10	0.324
Uplink (B0C0D0)	1721.0 – 1739.0 MHz	31.47	1.403

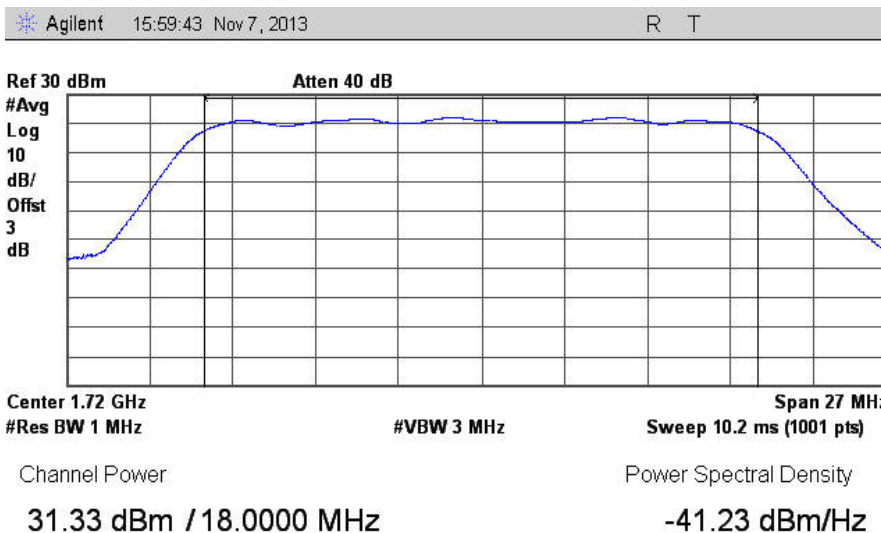
6.1.11. Peak Transmitter Output Power, 2120 MHz – AGC On



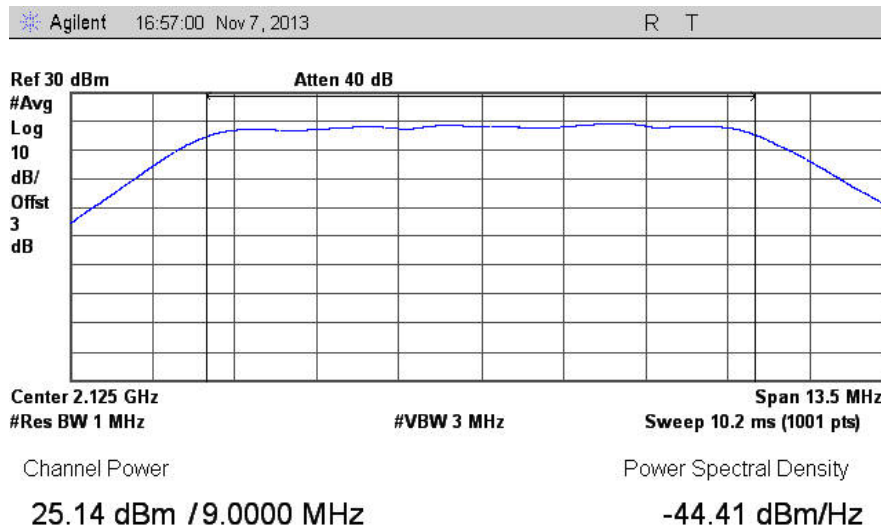
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.12. Peak Transmitter Output Power, 1720 MHz – AGC On



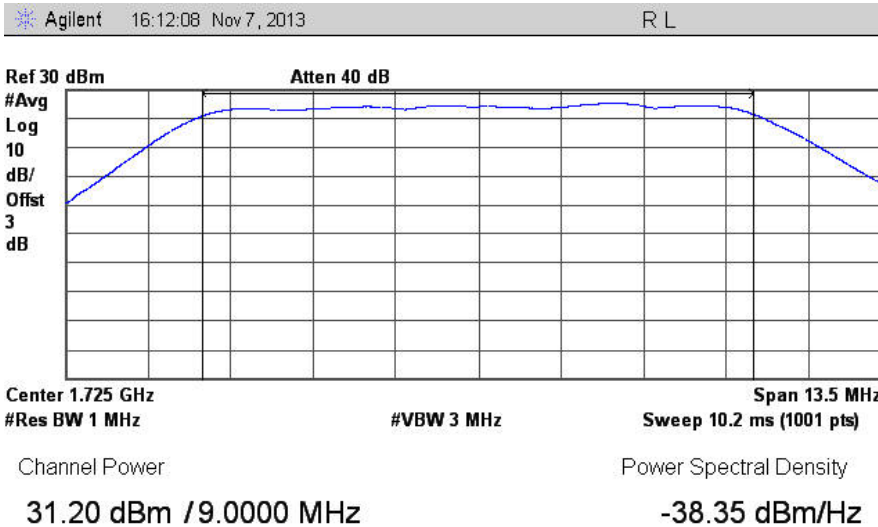
6.1.13. Peak Transmitter Output Power, 2125 MHz – AGC On



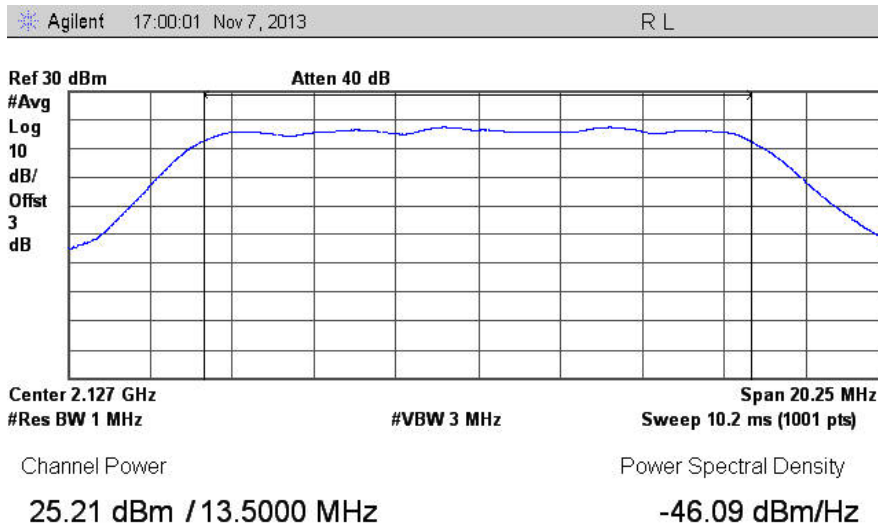
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.14. Peak Transmitter Output Power, 1725 MHz – AGC On



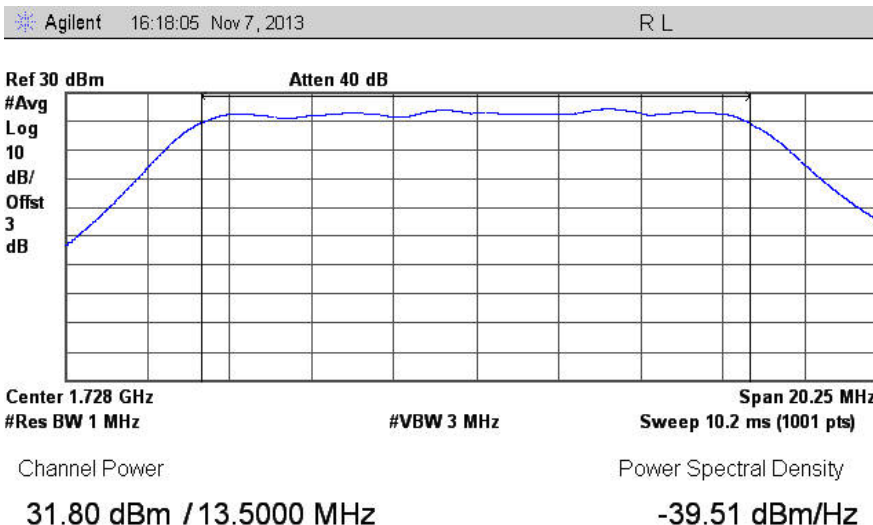
6.1.15. Peak Transmitter Output Power, 2127.5 MHz – AGC On



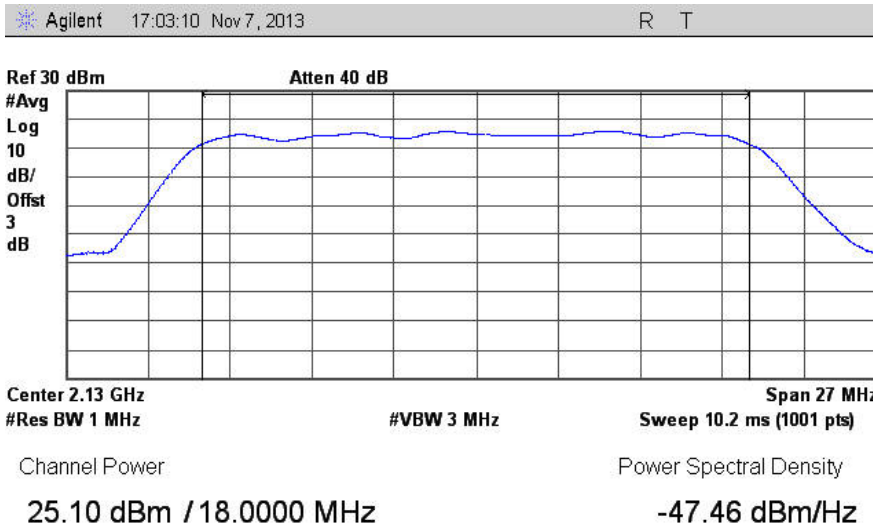
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.16. Peak Transmitter Output Power, 1727.5 MHz



6.1.17. Peak Transmitter Output Power, 2130 MHz

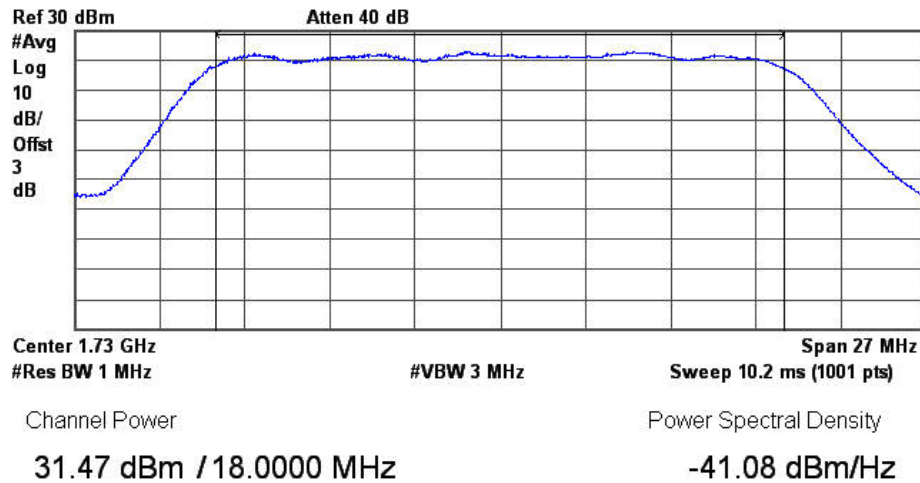


6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4) (cont)

6.1.18. Peak Transmitter Output Power, 1730 MHz

Agilent 17:04:39 Nov 7, 2013 R T



6. Measurement Data

6.1. Power and Antenna Height Limits (continued)

6.1.2. Maximum ERP with AGC Turned Off

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 one antenna and cable combination 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:

AWS Bands (Blocks A,B,C,D,E,F)	Frequency	Transmitter Power ¹	Cable Insertion Loss	Antenna Gain ²	Total Output Power	
	(MHz)	(dBm)	(dB)	(dBi)	(dBm)	(Watts)
Downlink (A0B0)	2111.0 – 2129.0 MHz	30.10	0.00	3.00	33.10	2.04
Uplink (A0B0)	1711.0 – 1729.0 MHz	33.87	0.00	-2.00	31.87	1.54
Downlink (B0)	2120.5 – 2129.5 MHz	29.67	0.00	3.00	32.67	1.85
Uplink (B0)	1720.5 – 1729.5 MHz	33.58	0.00	-2.00	31.58	1.44
Downlink (B0C0)	2120.25 – 2134.25 MHz	30.21	0.00	3.00	33.21	2.09
Uplink (B0C0)	1720.25 – 1734.25 MHz	33.64	0.00	-2.00	31.64	1.46
Downlink (B0C0D0)	2121.0 – 2139.0 MHz	30.26	0.00	3.00	33.26	2.12
Uplink (B0C0D0)	1721.0 – 1739.0 MHz	34.24	0.00	-2.00	32.24	1.67

¹ Measured. See section 6.1.1.

² Customer supplied 3 dBi for Downlink, -2 dBi for Uplink. Factor is a combination of both antenna gain and cable loss.

Note: EUT was tested without AGC turned on. The AGC will be set to 32 dBm for the Uplink band, and therefore the output power will never exceed 30 dBm / 1 Watt EIRP in the UpLink band based upon associated cable loss and antenna gain. Please see the next page for data with the AGC turned on.

6. Measurement Data

6.1. Power and Antenna Height Limits (continued)

6.1.2. Maximum ERP with AGC Turned On

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 = Transmitter Power (dBm) - Cable Loss (dB) + Antenna Gain (dBi)

The manufacturer of the device under test recommends one antenna and cable combination 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:

AWS Bands (Blocks A,B,C,D,E,F)	Frequency	Transmitter Power	Cable Insertion Loss	Antenna Gain	Total Output Power	
	MHz	dBm	dB	dBi	dBm	Watts
Downlink (A0B0)	2111.0 – 2129.0 MHz	24.32	0.00	3.00	27.32	0.540
Uplink (A0B0)	1711.0 – 1729.0 MHz	31.33	0.00	-2.00	29.33	0.857
Downlink (B0)	2120.5 – 2129.5 MHz	25.14	0.00	3.00	28.14	0.652
Uplink (B0)	1720.5 – 1729.5 MHz	31.20	0.00	-2.00	29.20	0.832
Downlink (B0C0)	2120.25 – 2134.25 MHz	25.21	0.00	3.00	28.21	0.662
Uplink (B0C0)	1720.25 – 1734.25 MHz	31.80	0.00	-2.00	29.80	0.955
Downlink (B0C0D0)	2121.0 – 2139.0 MHz	25.10	0.00	3.00	28.10	0.646
Uplink (B0C0D0)	1721.0 – 1739.0 MHz	31.47	0.00	-2.00	29.47	0.885

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

AWS Bands (Blocks A,B,C,D,E,F)	Frequency	Occupied Bandwidth	Result
	MHz	(MHz)	
Downlink (A0B0)	2111.0 – 2129.0 MHz	18.3854	Compliant
Uplink (A0B0)	1711.0 – 1729.0 MHz	18.3632	Compliant
Downlink (B0)	2120.5 – 2129.5 MHz	8.9755	Compliant
Uplink (B0)	1720.5 – 1729.5 MHz	8.9818	Compliant
Downlink (B0C0)	2120.25 – 2134.25 MHz	13.7054	Compliant
Uplink (B0C0)	1720.25 – 1734.25 MHz	13.6968	Compliant
Downlink (B0C0D0)	2121.0 – 2139.0 MHz	18.4636	Compliant
Uplink (B0C0D0)	1721.0 – 1739.0 MHz	18.4781	Compliant

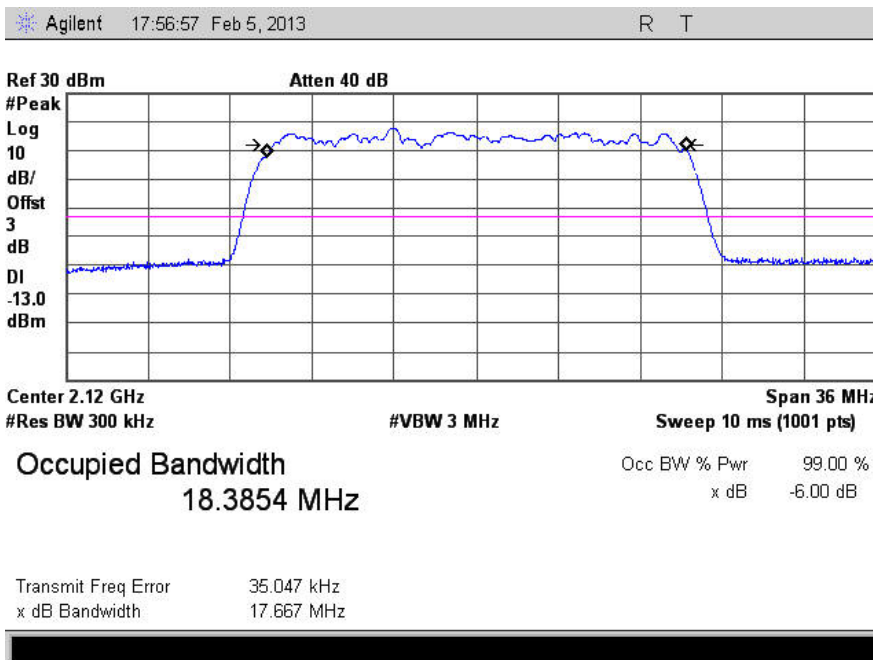
Test Number: 120-13R3

Issue Date: 11/7/2013

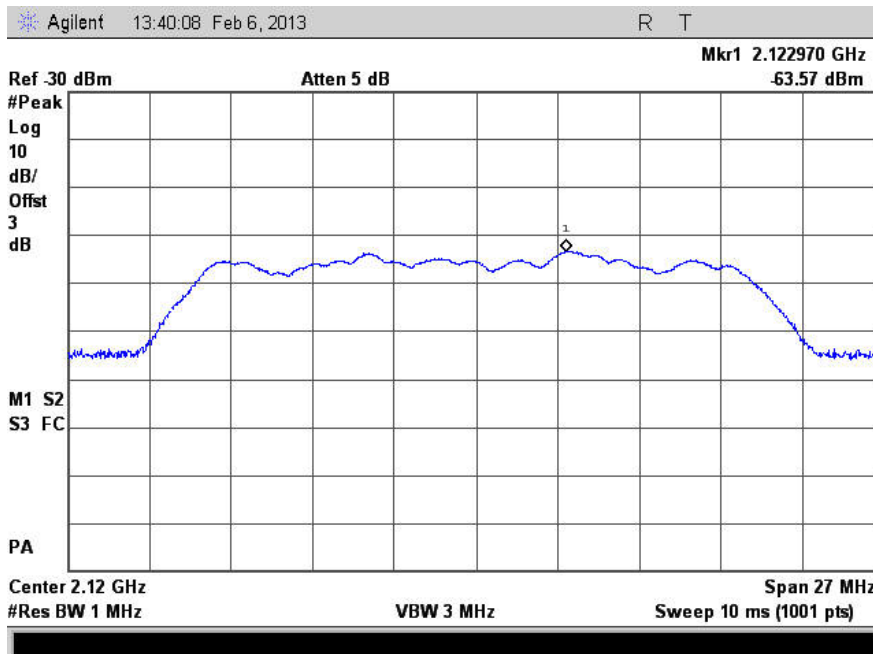
6. Measurement Data (continued)

6.2. Bandwidth Limitations (FCC Part 2.1049)

6.2.1.1. Occupied (99% Power) Bandwidth Measurement, 2111.0 – 2129.0 MHz



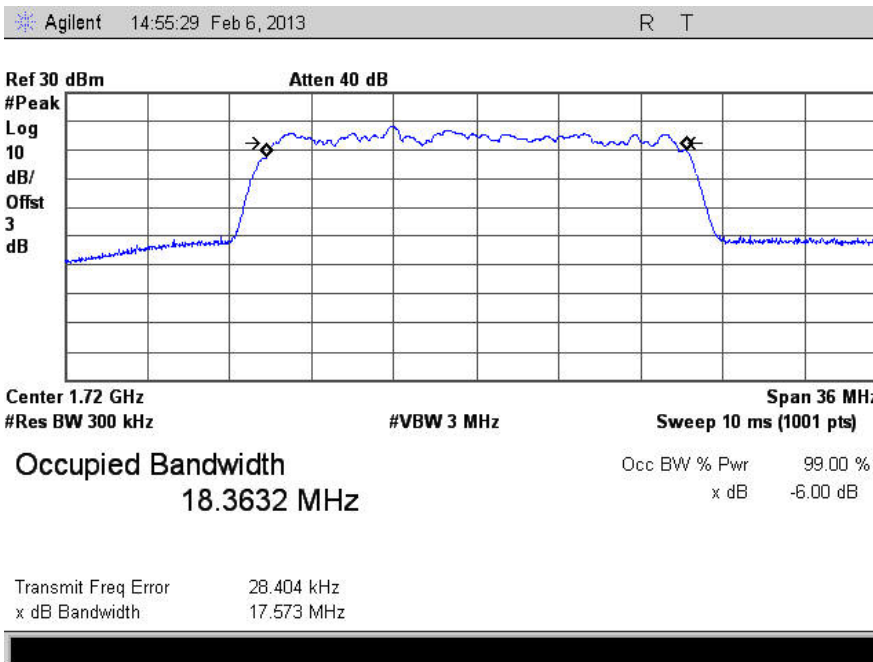
6.2.1.2. Occupied (99% Power) Bandwidth Input Signal, 2111.0 – 2129.0 MHz



6. Measurement Data (continued)

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

6.2.1.3. Occupied (99% Power) Bandwidth Measurement, 1711.0 – 1729.0 MHz



6.2.1.4. Occupied (99% Power) Bandwidth Input Signal, 1711.0 – 1729.0 MHz



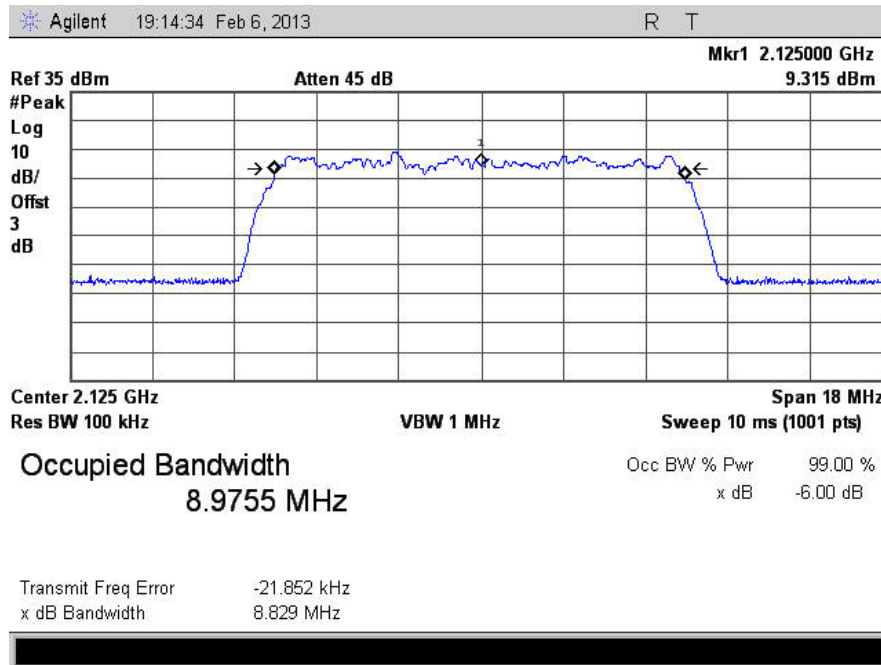
Test Number: 120-13R3

Issue Date: 11/7/2013

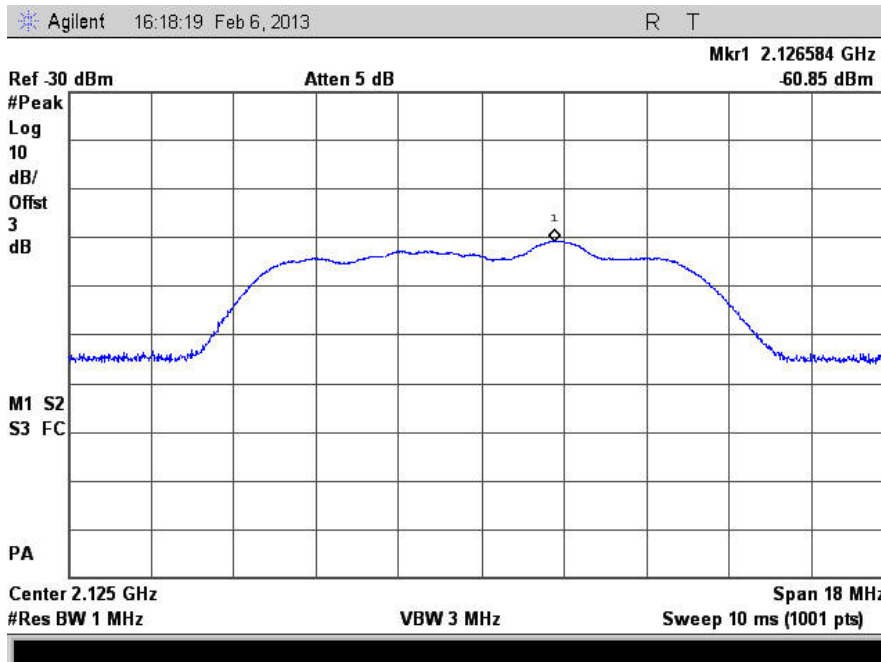
6. Measurement Data (continued)

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

6.2.1.5. Occupied (99% Power) Bandwidth Measurement, 2120.5 – 2129.5 MHz



6.2.1.6. Occupied (99% Power) Bandwidth Input Signal, 2120.5 – 2129.5 MHz



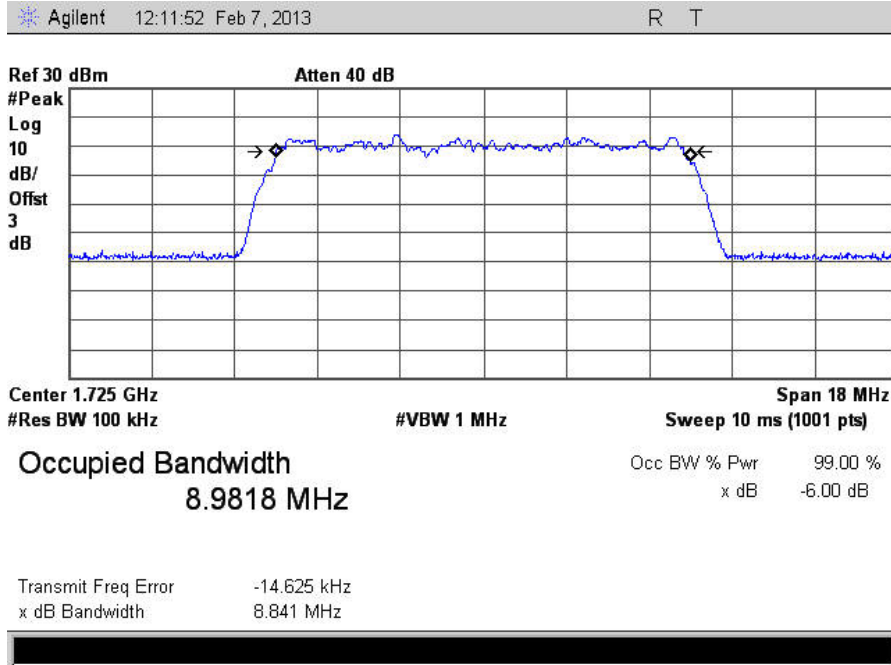
Test Number: 120-13R3

Issue Date: 11/7/2013

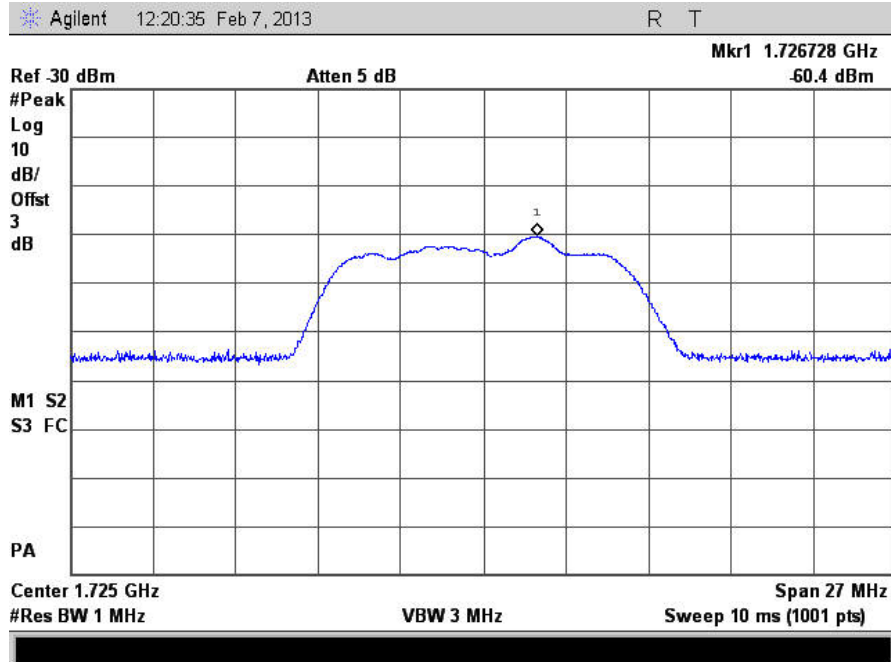
6. Measurement Data (continued)

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

6.2.1.7. Occupied (99% Power) Bandwidth Measurement, 1720.5 – 1729.5 MHz



6.2.1.8. Occupied (99% Power) Bandwidth Input Signal, 1720.5 – 1729.5 MHz



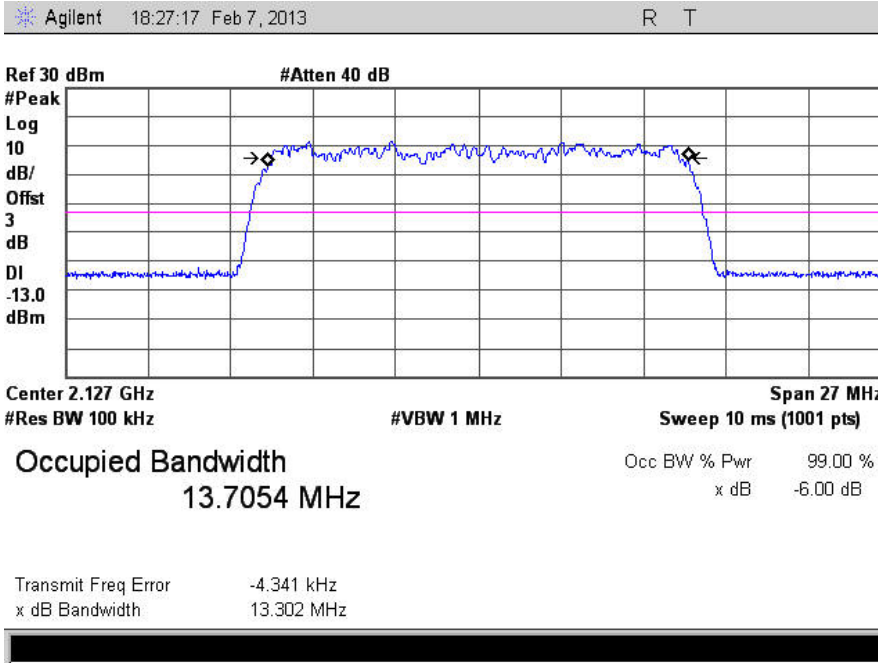
Test Number: 120-13R3

Issue Date: 11/7/2013

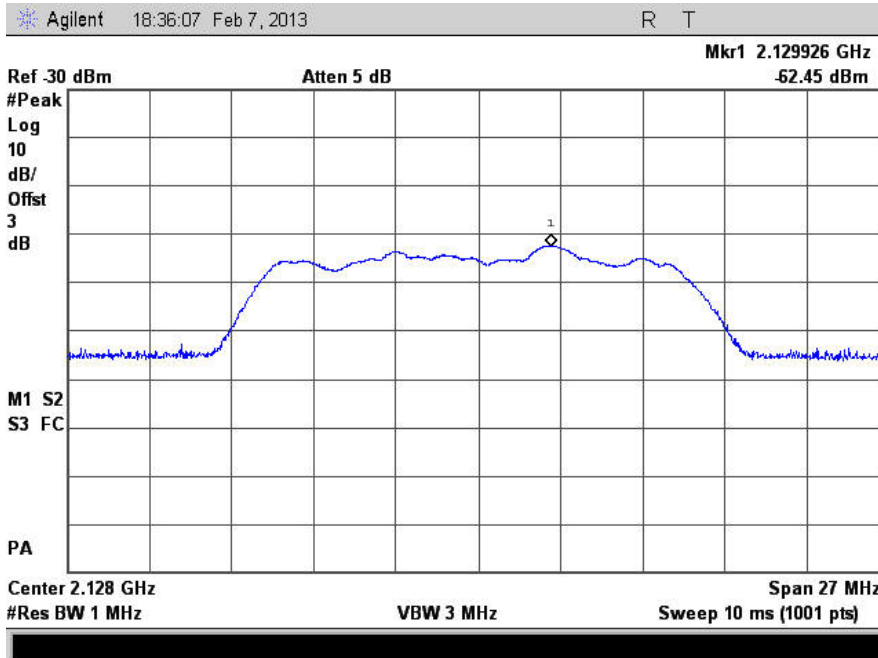
6. Measurement Data (continued)

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

6.2.1.9. Occupied (99% Power) Bandwidth Measurement, 2120.25 – 2134.25 MHz



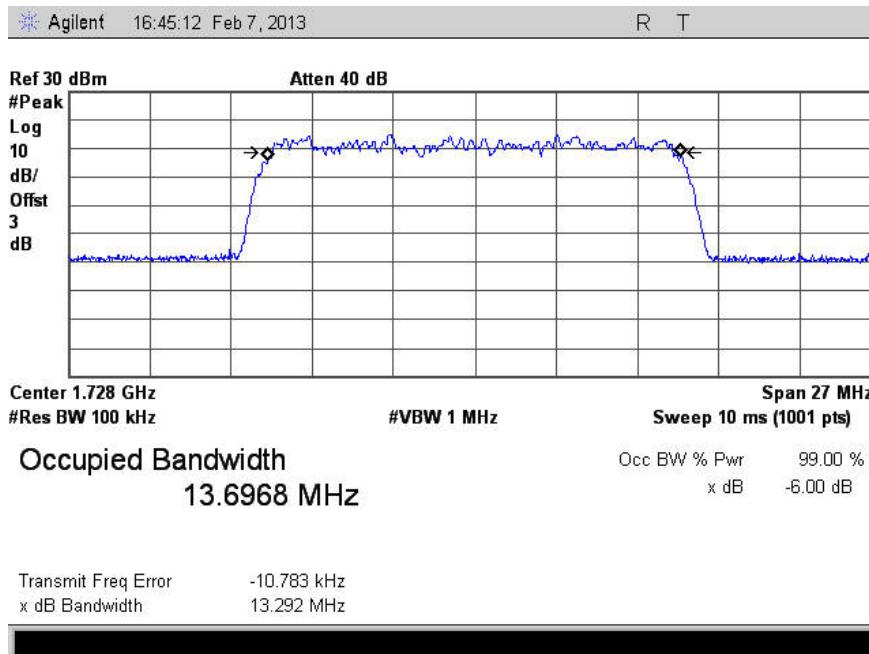
6.2.1.10. Occupied (99% Power) Bandwidth Input Signal, 2120.25 – 2134.25 MHz



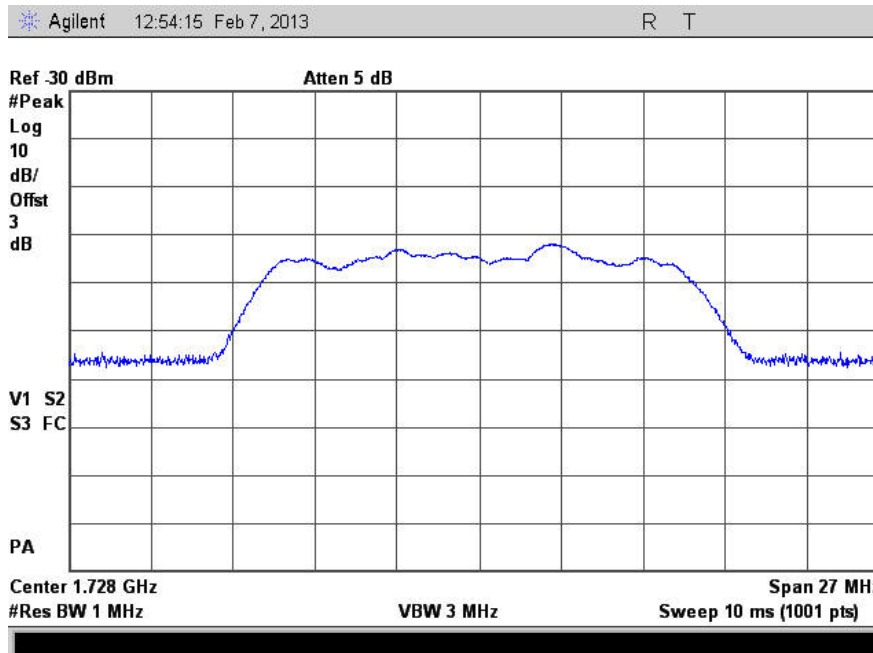
6. Measurement Data (continued)

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

6.2.1.11. Occupied (99% Power) Bandwidth Measurement, 1720.25 – 1734.25 MHz



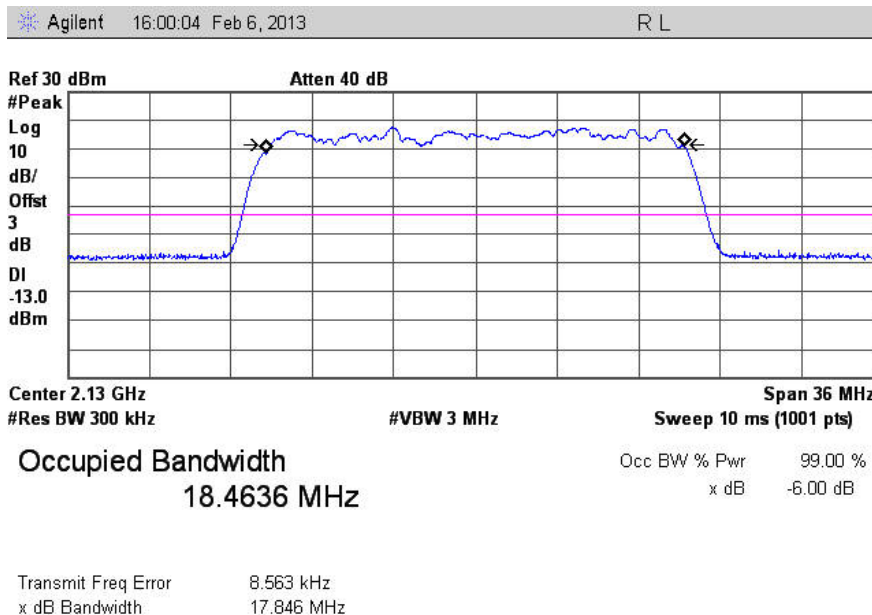
6.2.1.12. Occupied (99% Power) Bandwidth Input Signal, 1720.25 – 1734.25 MHz



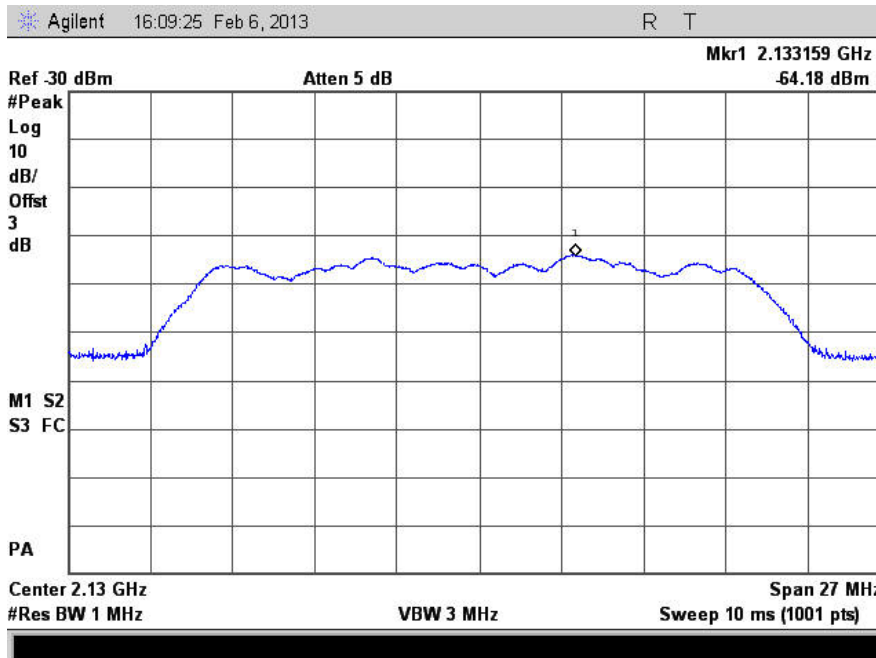
6. Measurement Data (continued)

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

6.2.1.13. Occupied (99% Power) Bandwidth Measurement, 2121.0 – 2139.0 MHz



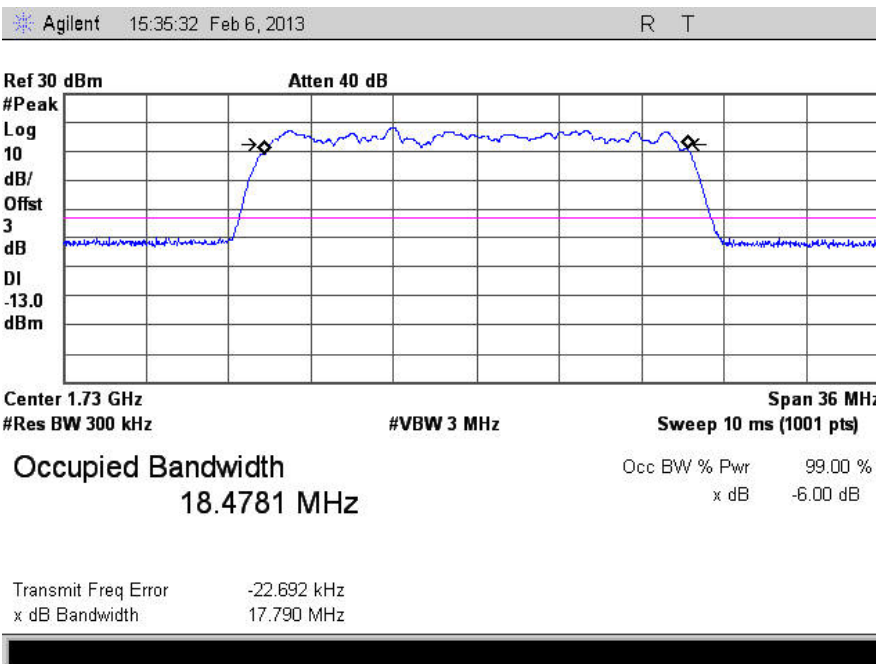
6.2.1.14. Occupied (99% Power) Bandwidth Input Signal, 2121.0 – 2139.0 MHz



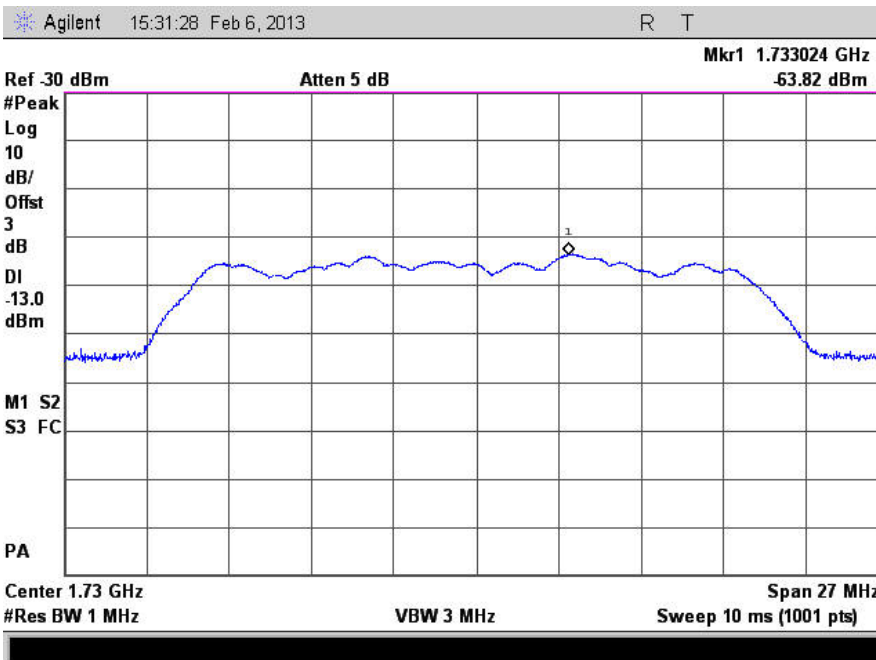
6. Measurement Data (continued)

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

6.2.1.15. Occupied (99% Power) Bandwidth Measurement, 1721.0 – 1739.0 MHz



6.2.1.16. Occupied (99% Power) Bandwidth Input Signal, 1721.0 – 1739.0 MHz



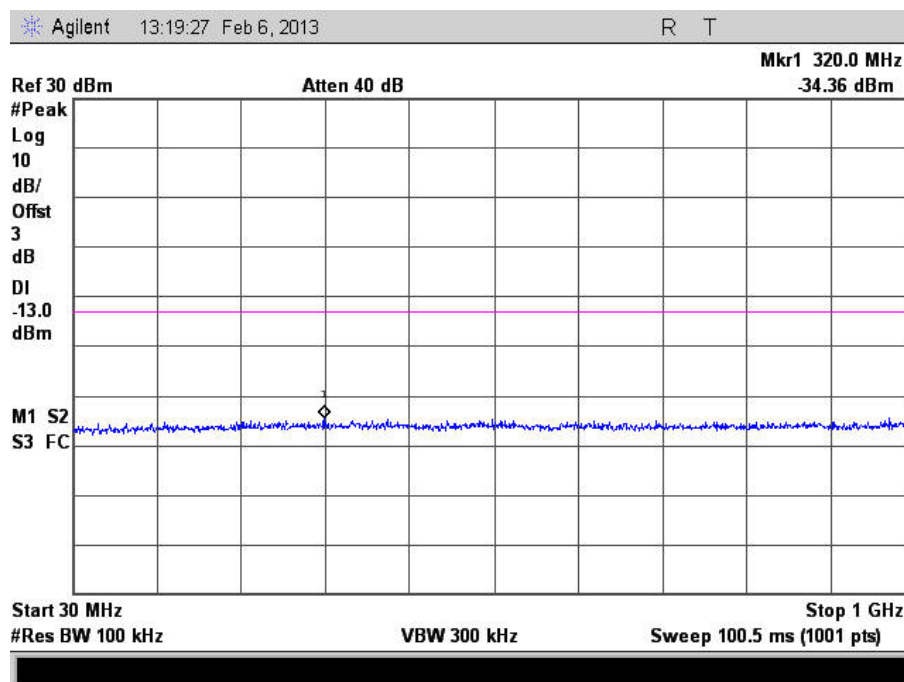
6. Measurement Data (continued)

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

Requirement: For operations in the 1710-1755 MHz and 2110-2155 MHz bands, the power of any emission outside of the licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

Compliance with this provision is based upon the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block a resolution bandwidth of at least one percent of the emissions bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

6.3.1. 2111.0 – 2129.0 MHz, 30 MHz to 1 GHz



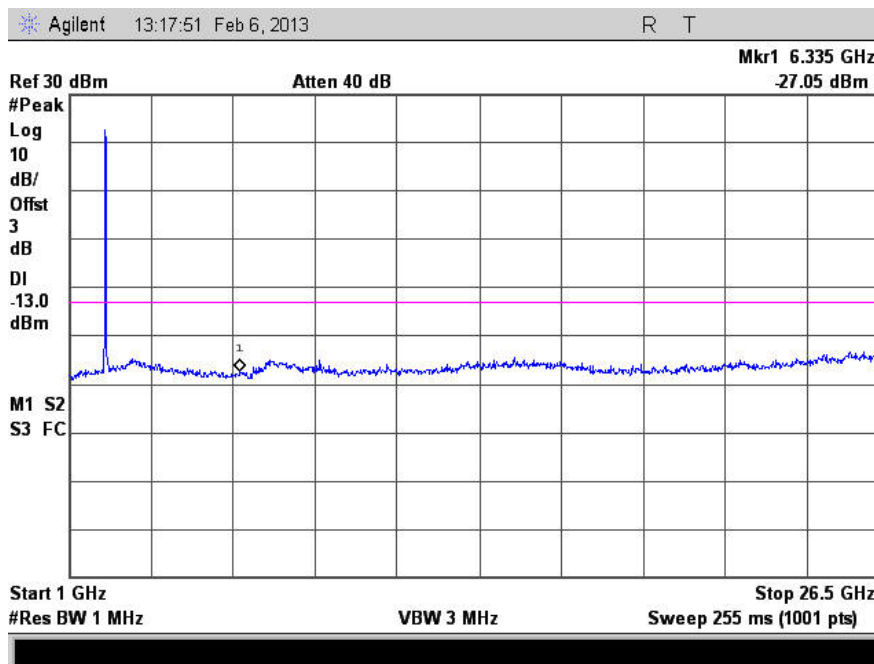
Test Number: 120-13R3

Issue Date: 11/7/2013

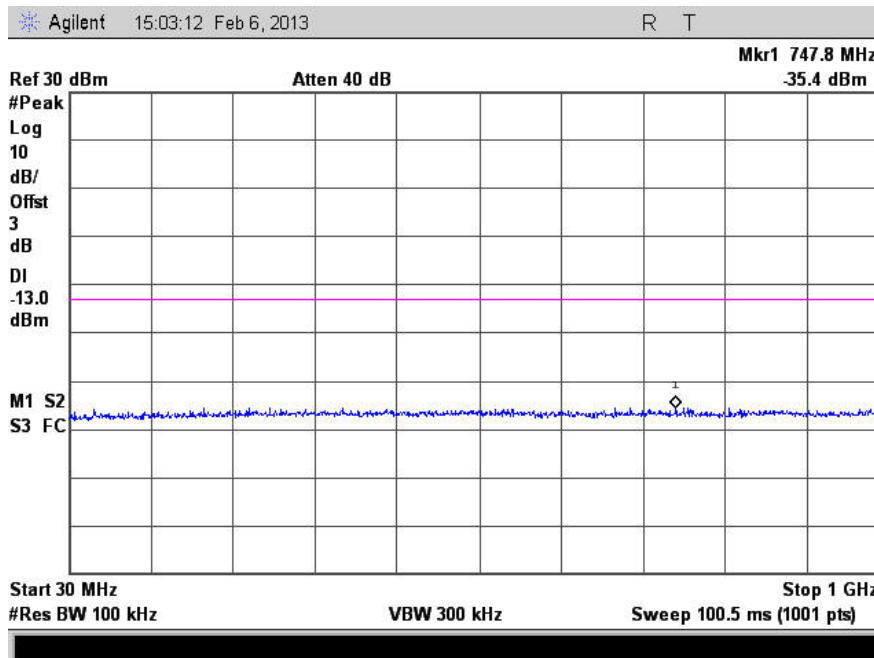
6. Measurement Data (continued)

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

6.3.2. 2111.0 – 2129.0 MHz, 1 to 26.5 GHz



6.3.3. 1711.00 – 1729.0 MHz, 30 MHz to 1 GHz



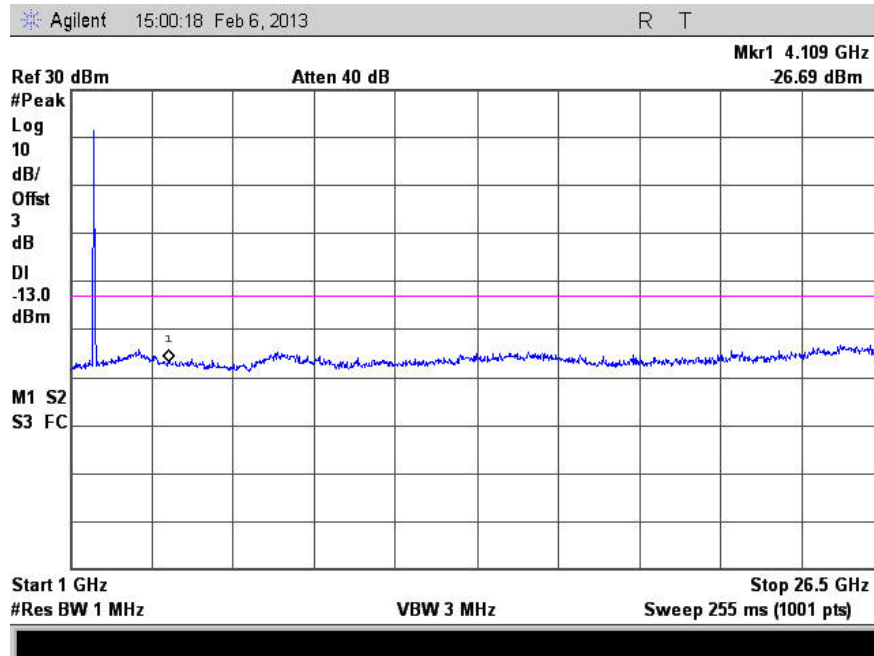
Test Number: 120-13R3

Issue Date: 11/7/2013

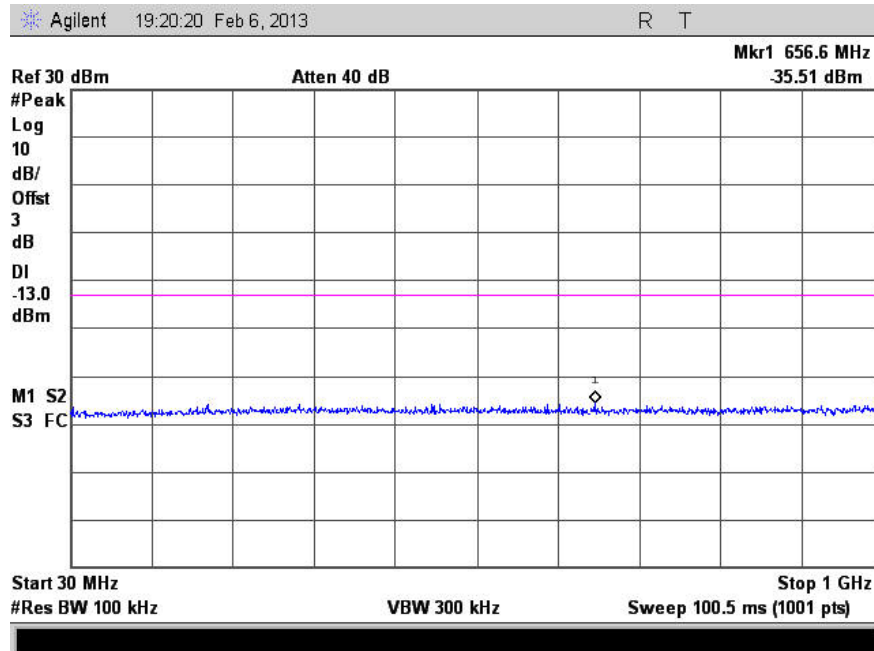
6. Measurement Data (continued)

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

6.3.4. 1711.0 – 1729.0 MHz, 1 to 26.5 GHz



6.3.5. 2120.5 – 2129.5 MHz, 30 MHz to 1 GHz



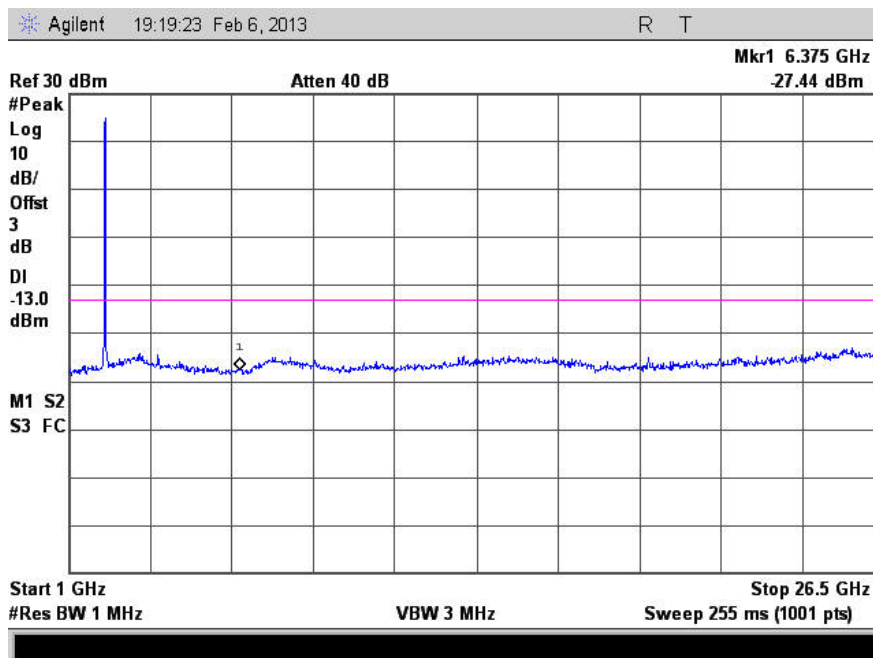
Test Number: 120-13R3

Issue Date: 11/7/2013

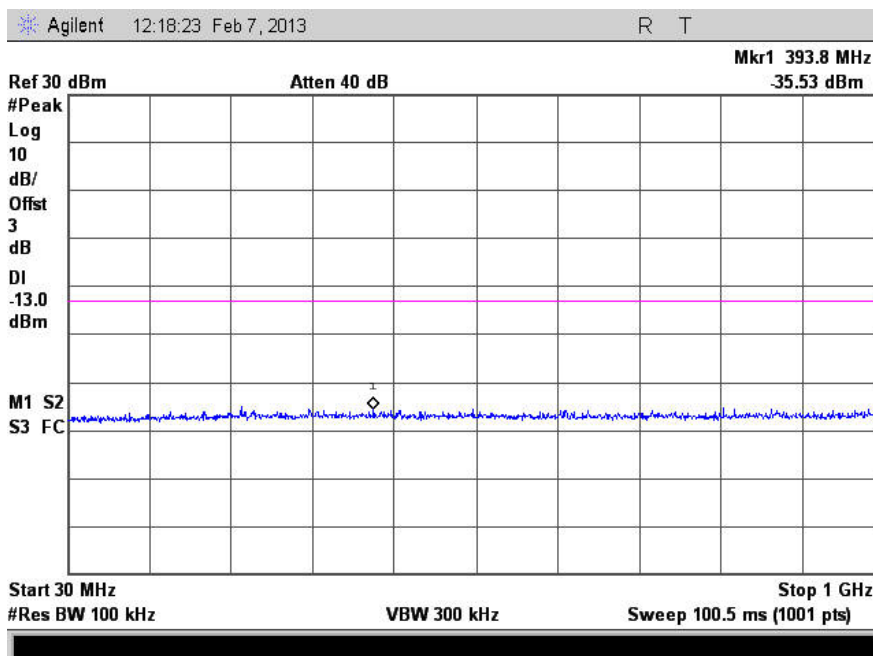
6. Measurement Data (continued)

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

6.3.6. 2120.5 – 2129.5 MHz, 1 to 26.5 GHz



6.3.7. 1720.5 – 1729.5 MHz, 30 MHz to 1 GHz



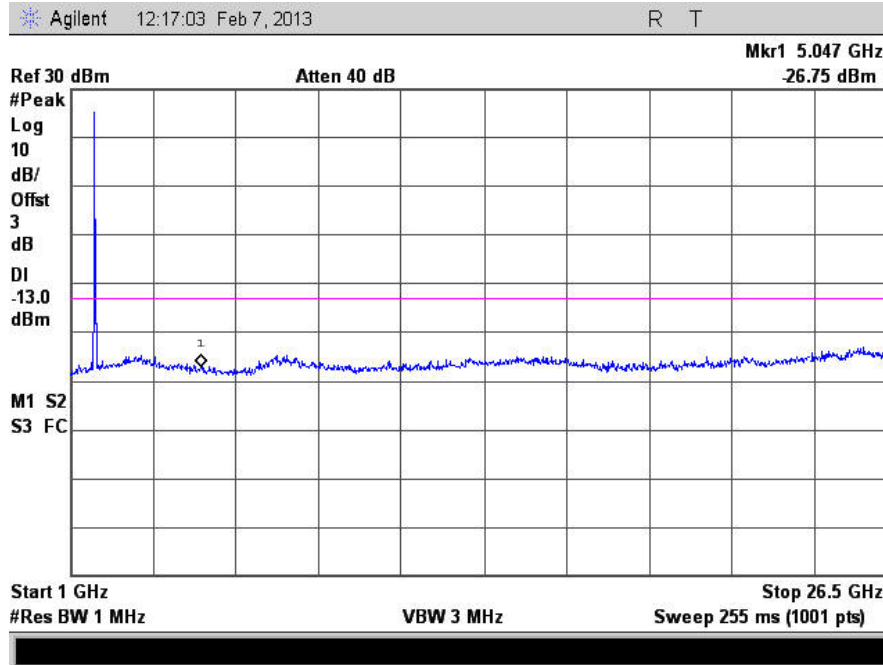
Test Number: 120-13R3

Issue Date: 11/7/2013

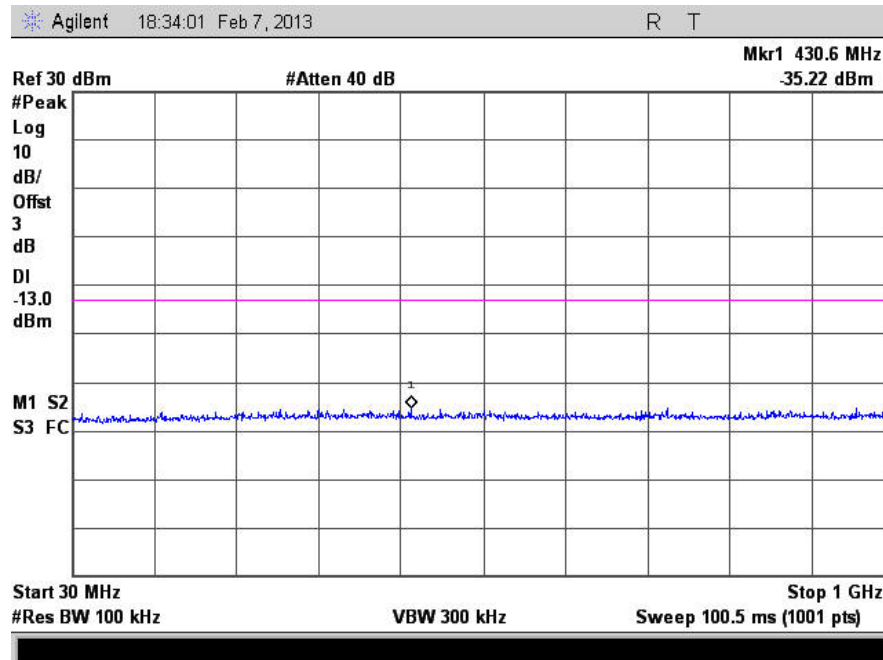
6. Measurement Data (continued)

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

6.3.8. 1720.5 – 1729.5 MHz, 1 to 26.5 GHz



6.3.9. 2120.25 – 2134.25 MHz, 30 MHz to 1 GHz



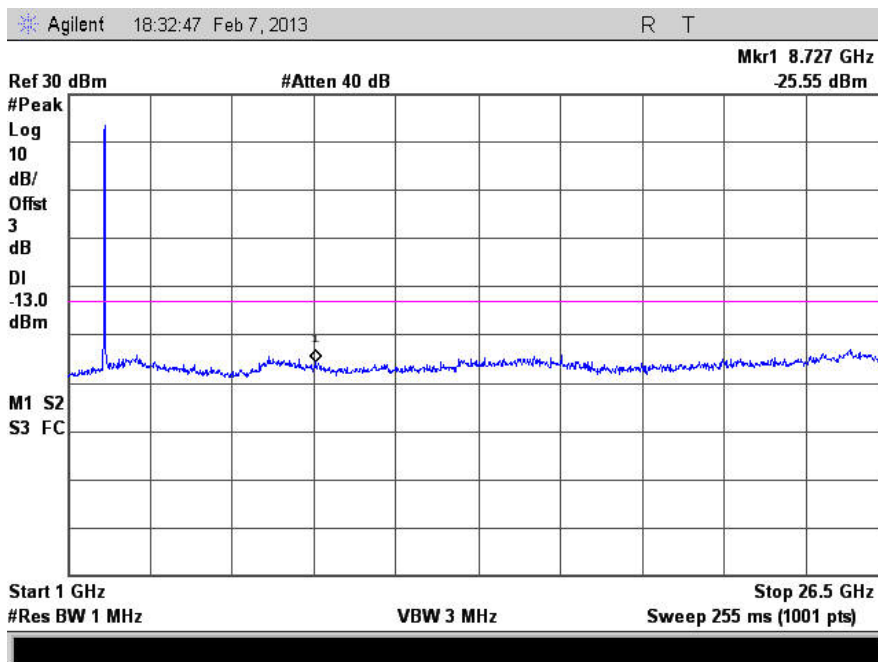
Test Number: 120-13R3

Issue Date: 11/7/2013

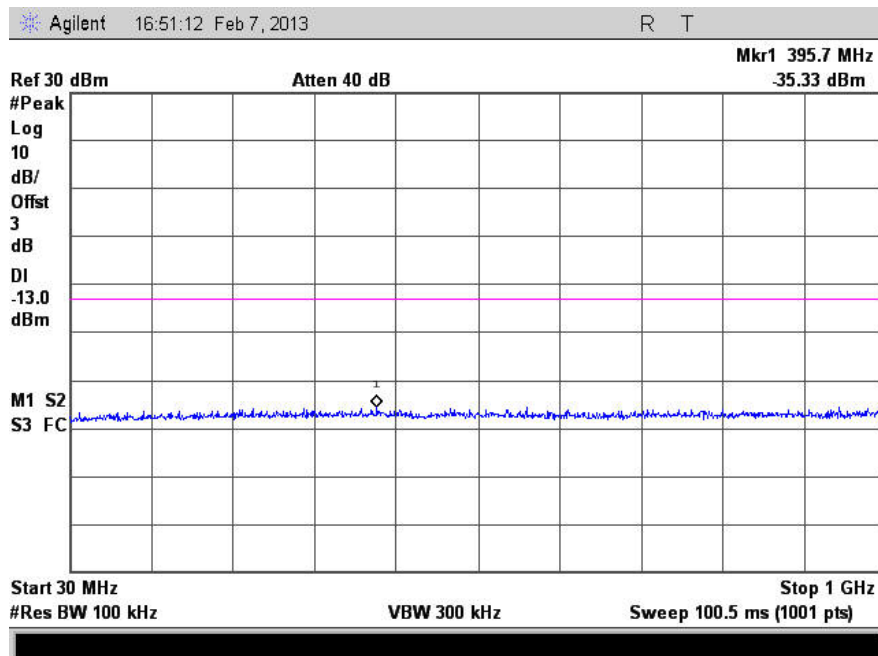
6. Measurement Data (continued)

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

6.3.10. 2120.25 – 2134.25 MHz, 1 to 26.5 GHz



6.3.11. 1720.25 – 1734.25 MHz, 30 MHz to 1 GHz



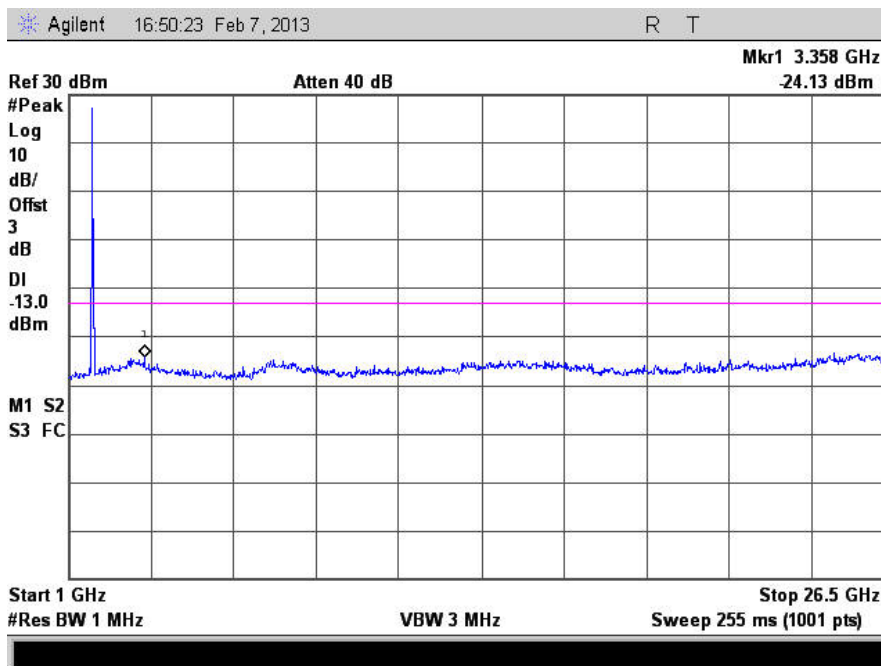
Test Number: 120-13R3

Issue Date: 11/7/2013

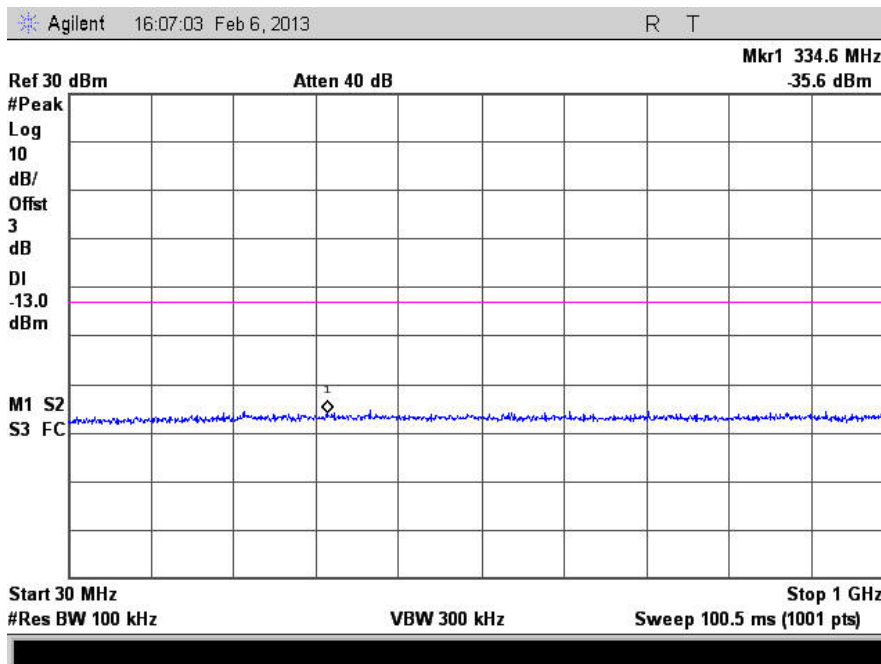
6. Measurement Data (continued)

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

6.3.12. 1720.25 – 1734.25 MHz, 1 to 26.5 GHz



6.3.13. 2121.0 – 2139.0 MHz, 30 MHz to 1 GHz



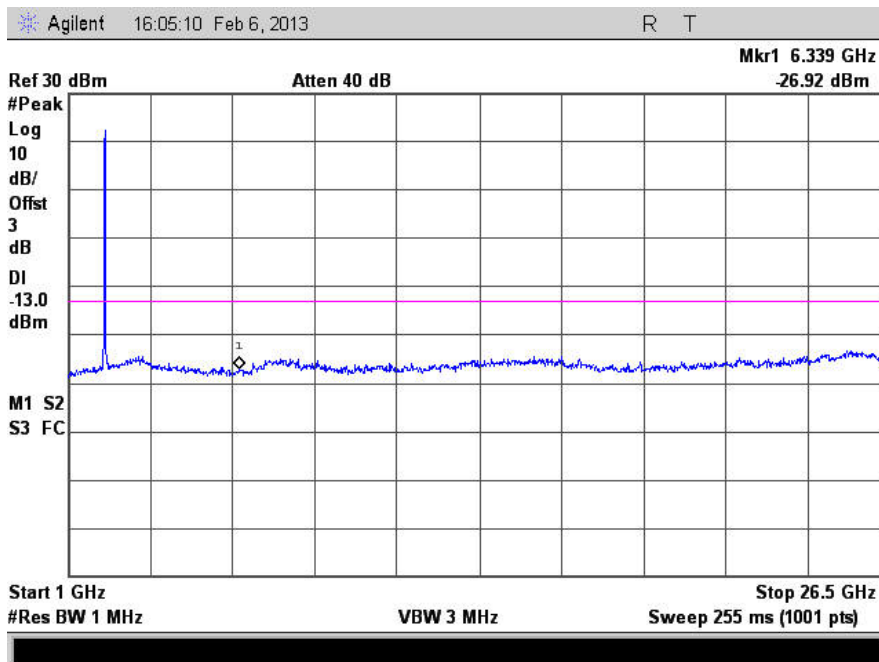
Test Number: 120-13R3

Issue Date: 11/7/2013

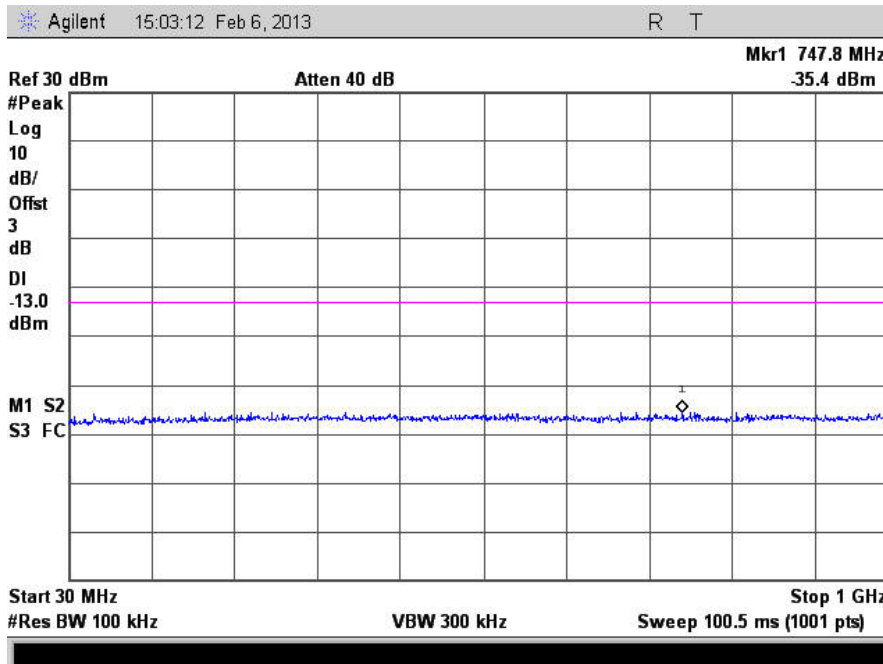
6. Measurement Data (continued)

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

6.3.14. 2121.0 – 2139.0 MHz, 1 to 26.5 GHz



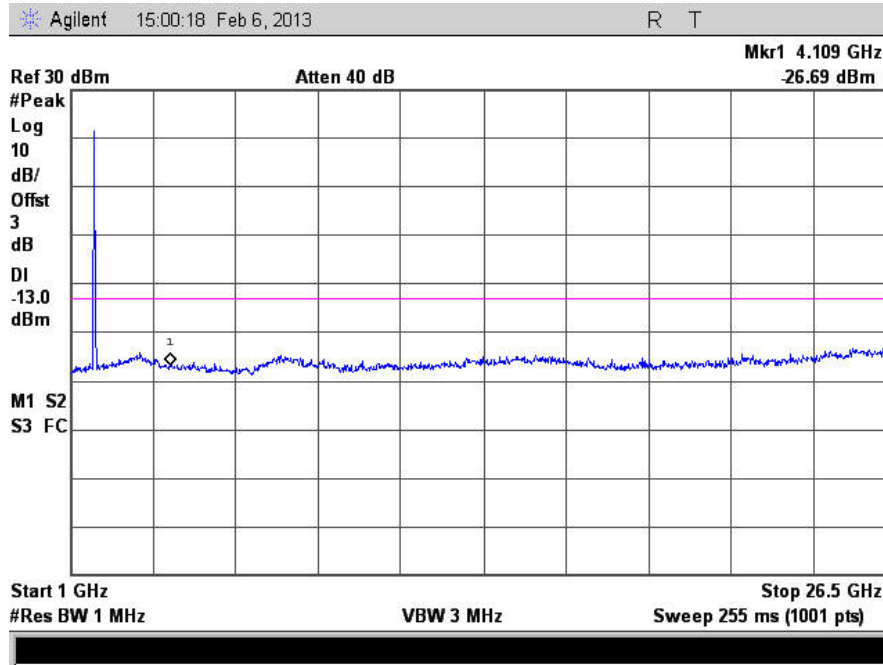
6.3.15. 1721.0 – 1739.0 MHz, 30 MHz to 1 GHz



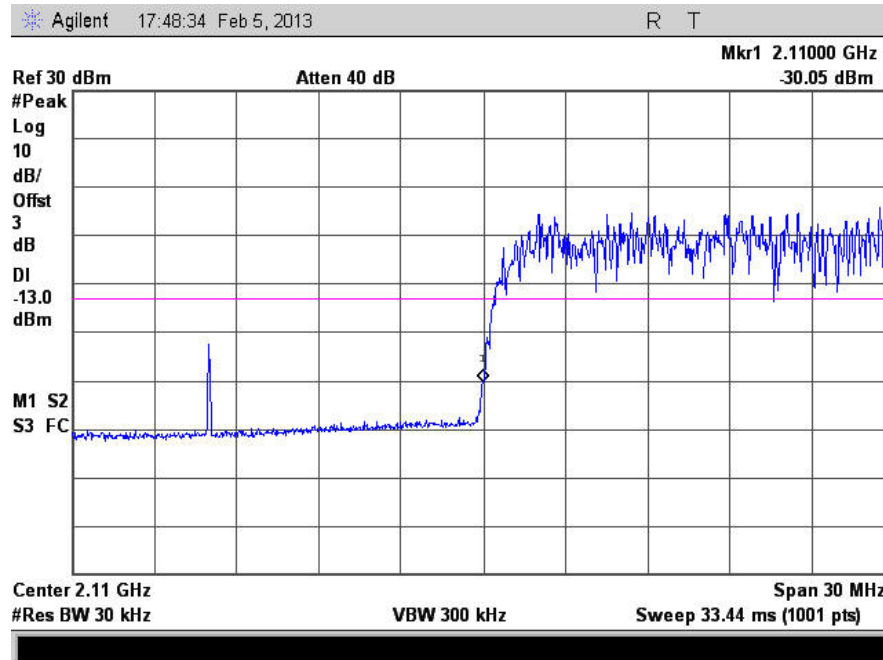
6. Measurement Data (continued)

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

6.3.16. 1721.0 – 1739.0 MHz, 1 to 26.5 GHz



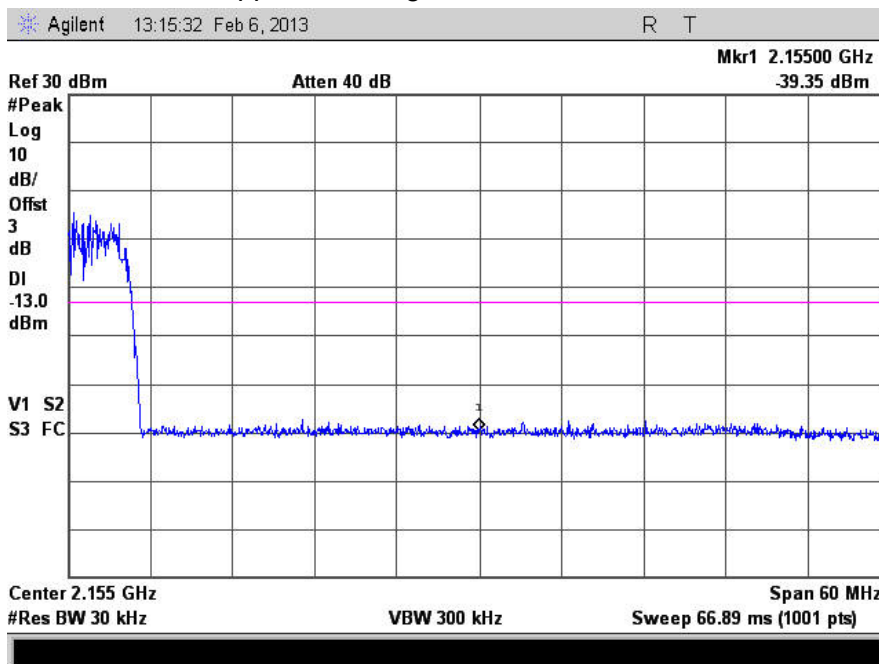
6.3.17. 2110.0 MHz, Lower Bandedge Measurement with A0B0 Filter



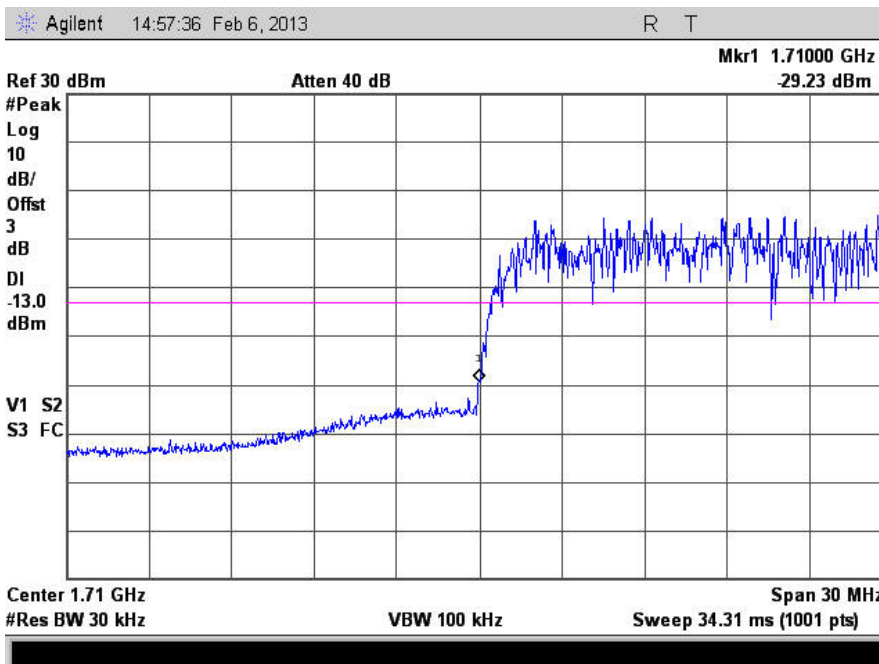
6. Measurement Data (continued)

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

6.3.18. 2155.0 MHz, Upper Bandedge Measurement with A0B0 Filter



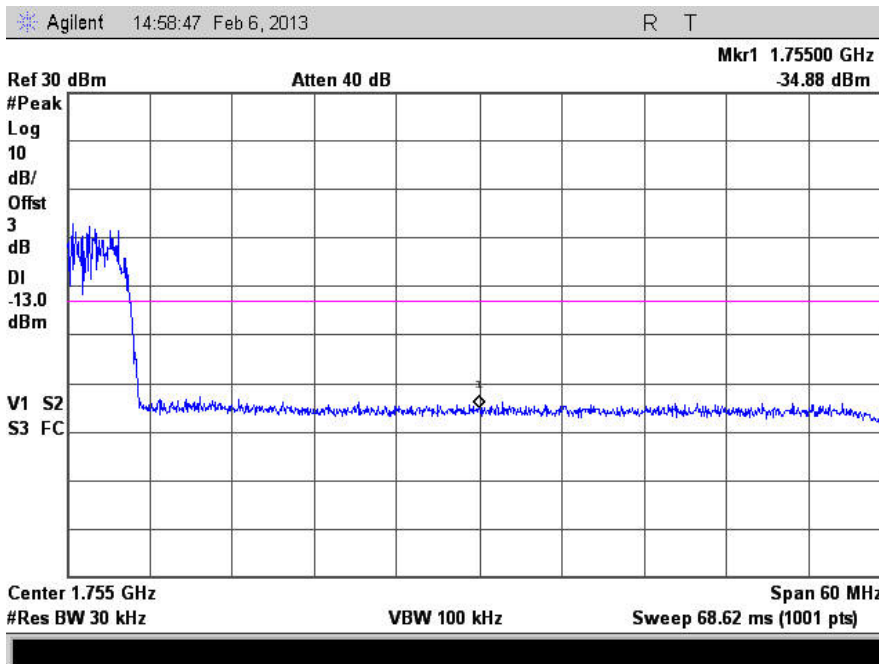
6.3.19. 1710.0 MHz, Lower Bandedge Measurement with A0B0 Filter



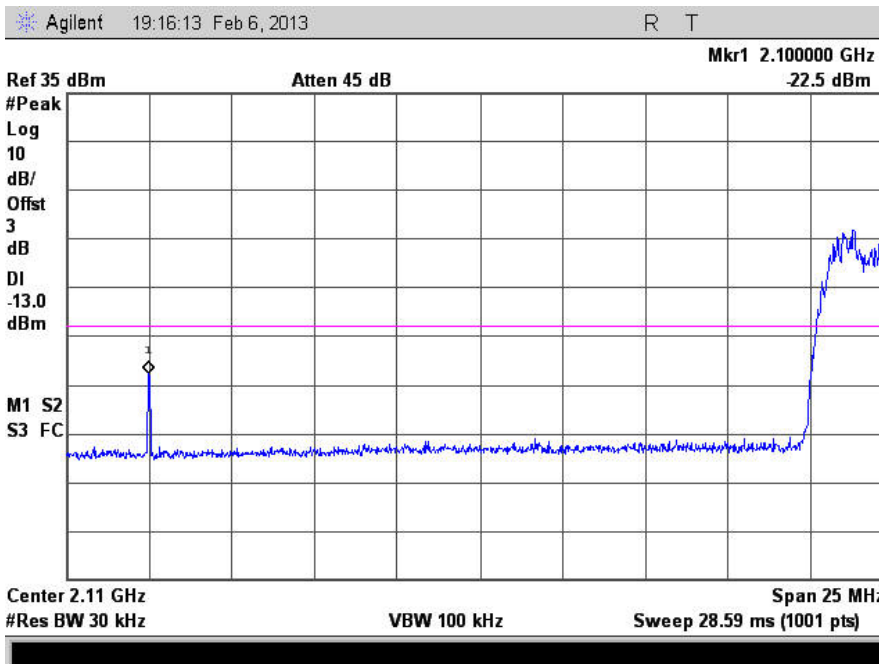
6. Measurement Data (continued)

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

6.3.20. 1755.0 MHz, Upper Bandedge Measurement with A0B0 Filter



6.3.21. 2110.0 MHz, Lower Bandedge Measurement with B0 Filter



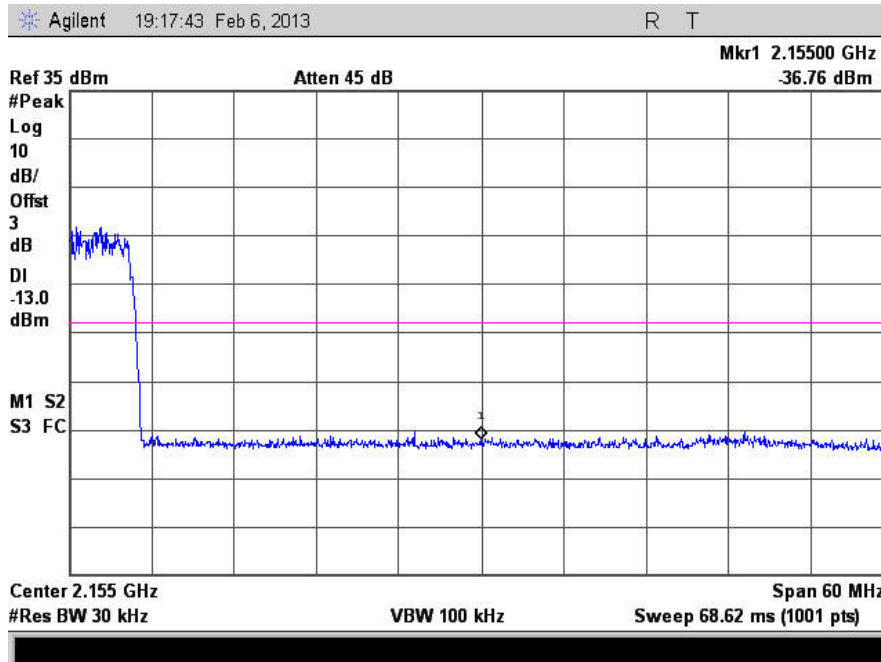
Test Number: 120-13R3

Issue Date: 11/7/2013

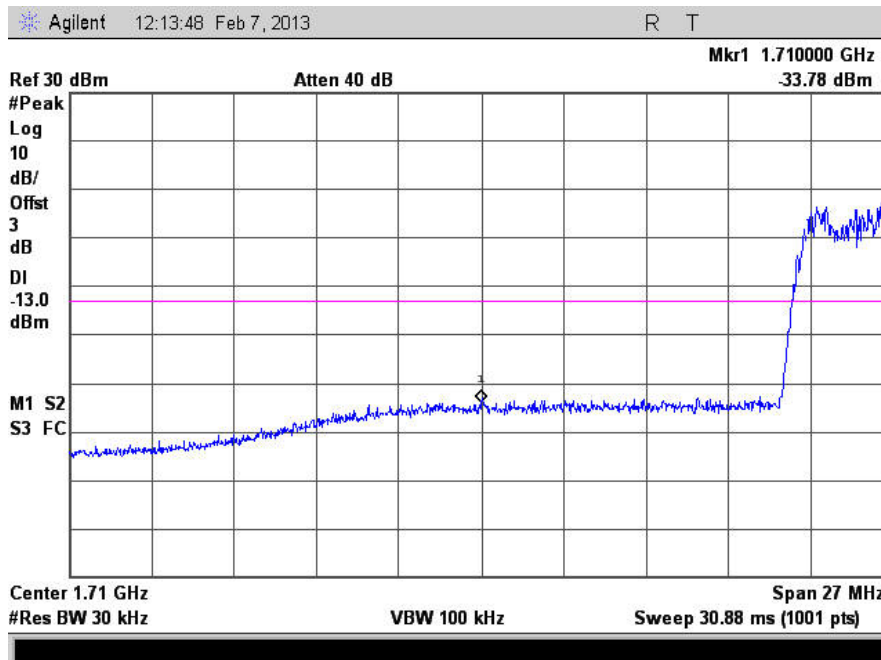
6. Measurement Data (continued)

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

6.3.22. 2155.0 MHz, Upper Bandedge Measurement with B0 Filter



6.3.23. 1710.0 MHz, Lower Bandedge Measurement with B0 Filter



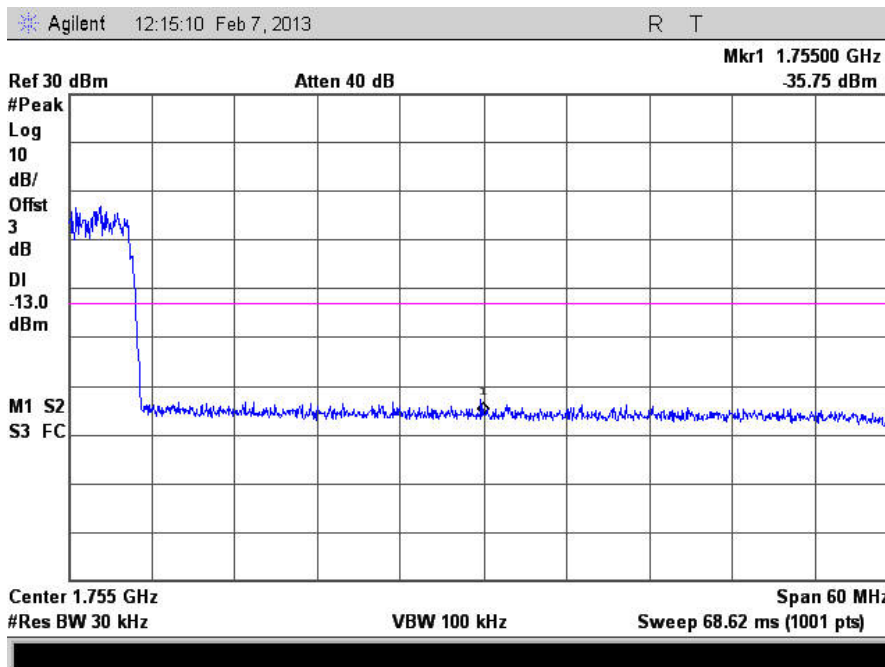
Test Number: 120-13R3

Issue Date: 11/7/2013

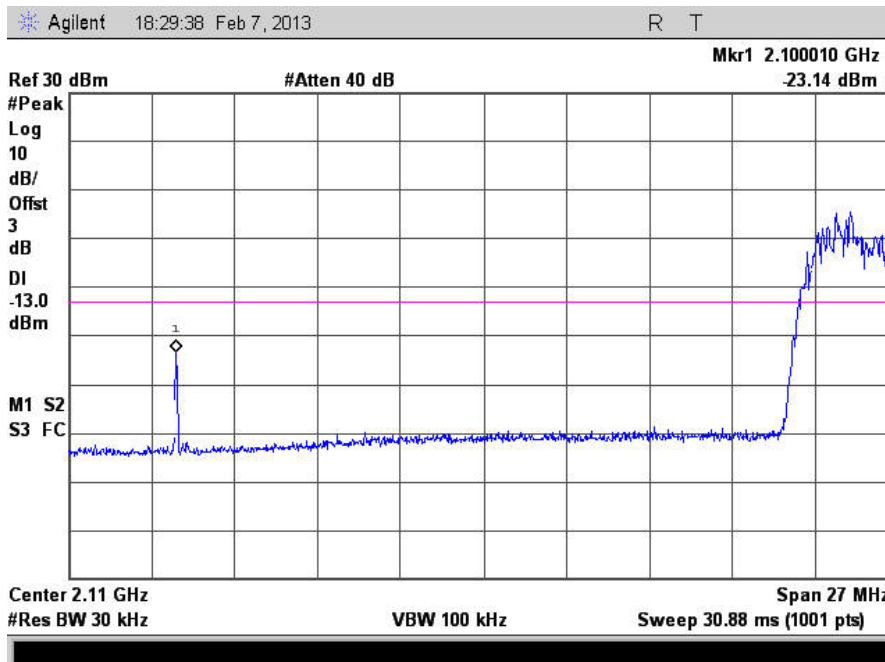
6. Measurement Data (continued)

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

6.3.24. 1755.0 MHz, Upper Bandedge Measurement with B0 Filter



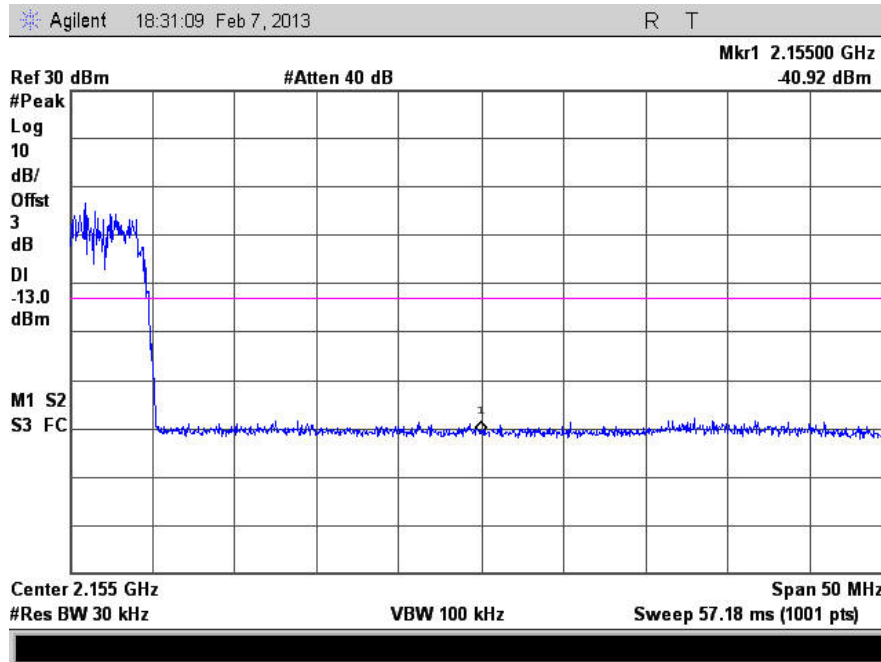
6.3.25. 2110.0 MHz, Lower Bandedge Measurement with B0C0 Filter



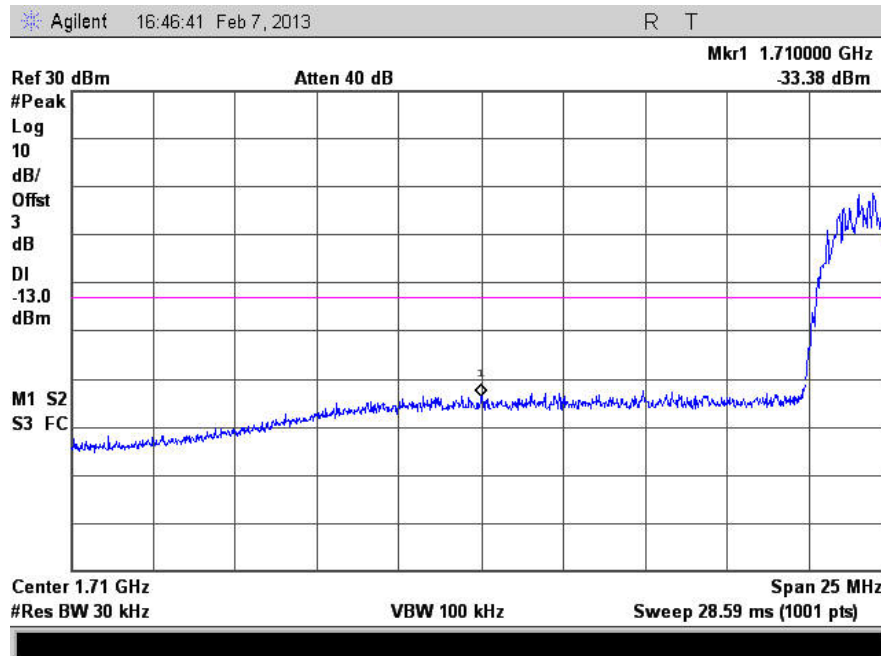
6. Measurement Data (continued)

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

6.3.26. 2155.0 MHz, Upper Bandedge Measurement with BOC0 Filter



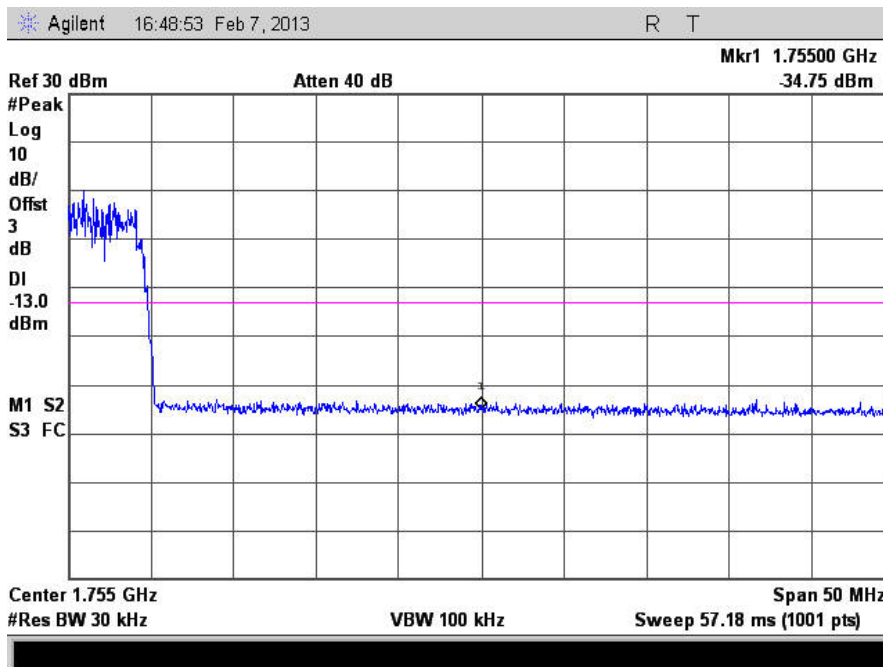
6.3.27. 1710.0 MHz, Lower Bandedge Measurement with BOC0 Filter



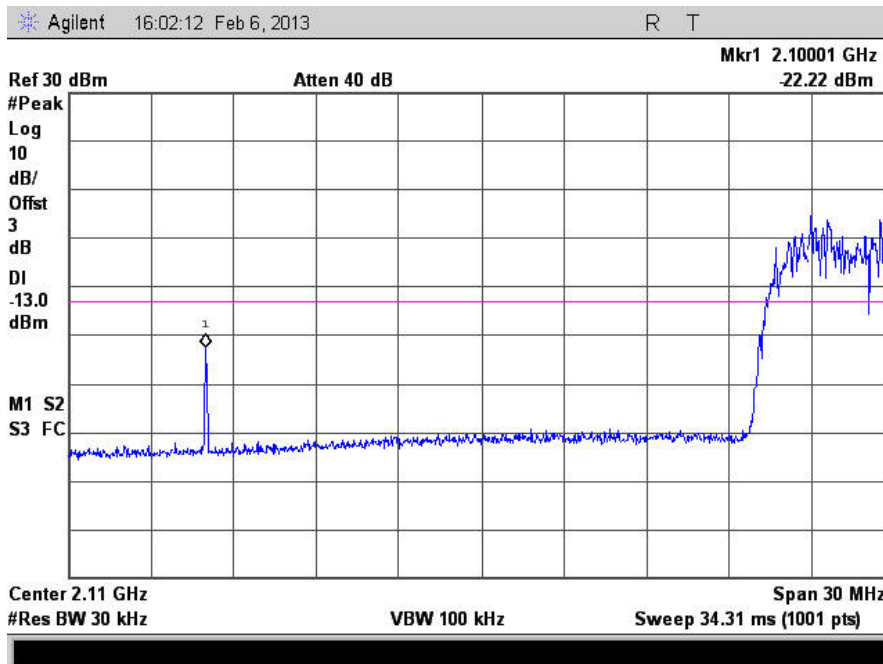
6. Measurement Data (continued)

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

6.3.28. 1755.0 MHz, Upper Bandedge Measurement with BOC0 Filter



6.3.29. 2110.0 MHz, Lower Bandedge Measurement with BOC0D0 Filter



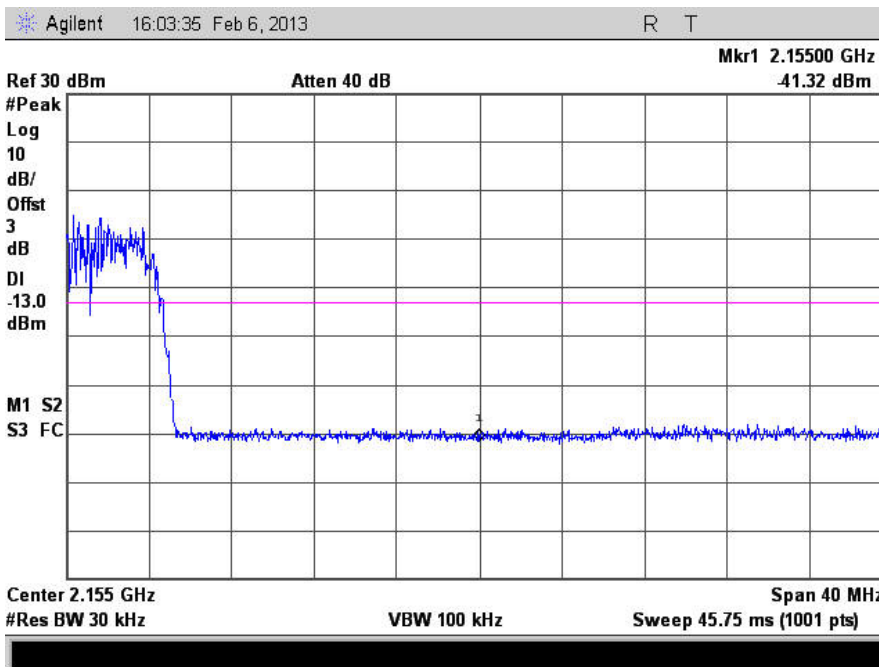
Test Number: 120-13R3

Issue Date: 11/7/2013

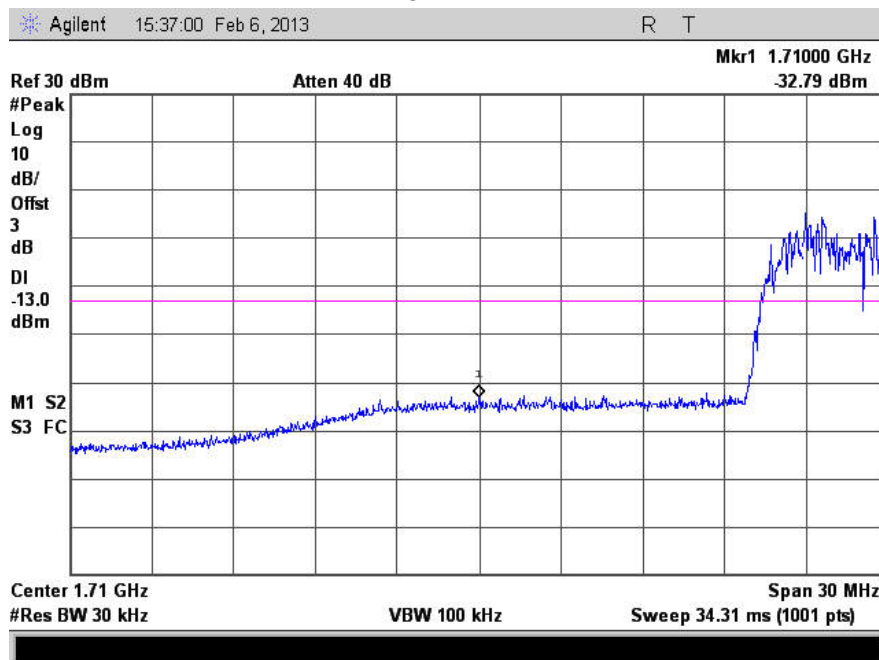
6. Measurement Data (continued)

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

6.3.30. 2155.0 MHz, Upper Bandedge Measurement with B0C0D0 Filter



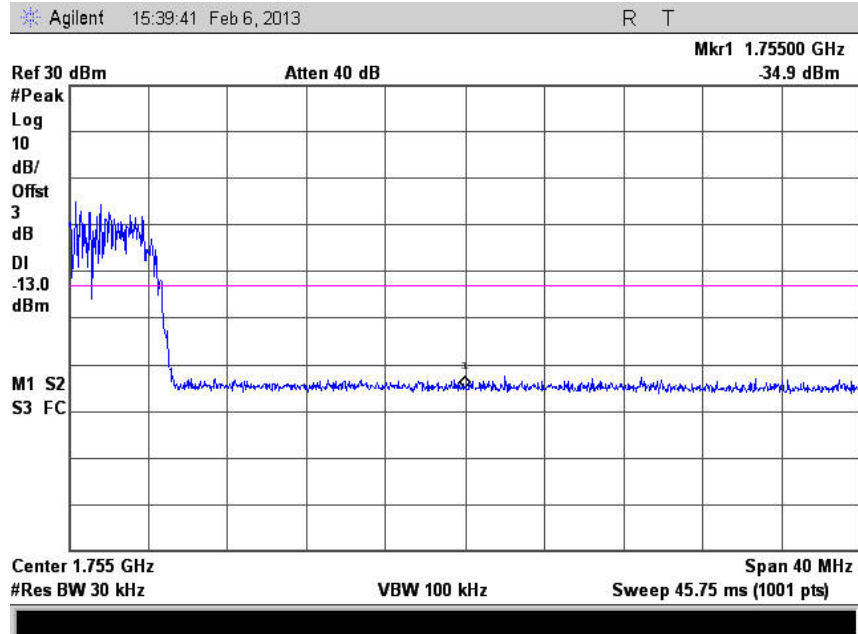
6.3.31. 1710.0 MHz, Lower Bandedge Measurement with B0C0D0 Filter



6. Measurement Data (continued)

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

6.3.32. 1755.0 MHz, Upper Bandedge Measurement with BOC0D0 Filter



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

Requirement: For operations in the 1710-1755 MHz and 2110-2155 MHz bands, the power of any emission outside of the licensee's frequency block shall be attenuated below the transmitter power (P) by at least $43 + 10 \log (P)$ dB.

Compliance with this provision is based upon the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block a resolution bandwidth of at least one percent of the emissions bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

6.4.1. Measurement and Equipment Setup

Test Date:	1/25/2013
Test Engineer:	Cody Merry
Site Temperature (°C):	22
Relative Humidity (%RH):	32
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

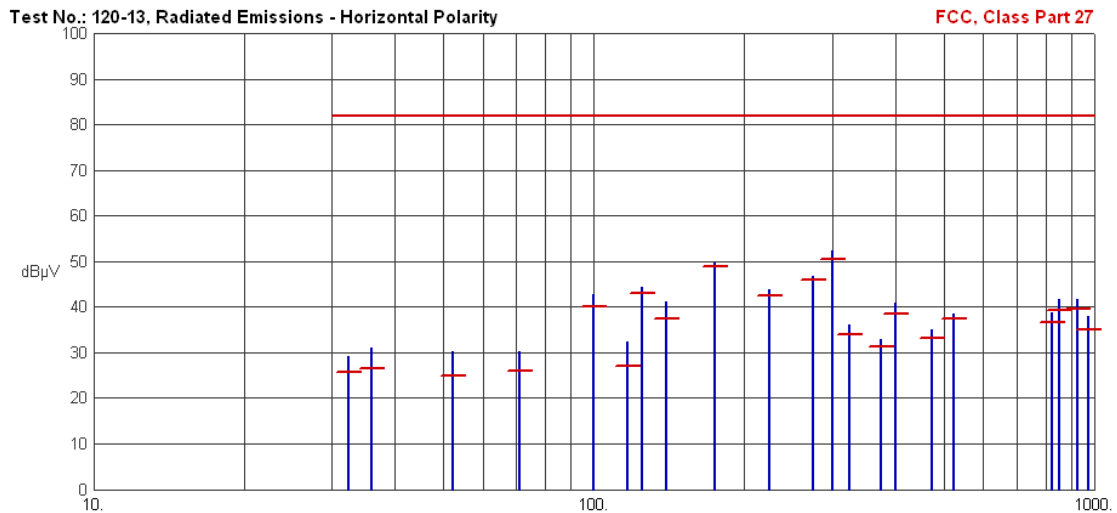
6.4.2 Test Procedure

Test measurements were made in accordance with ANSI C63.4-2003, 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

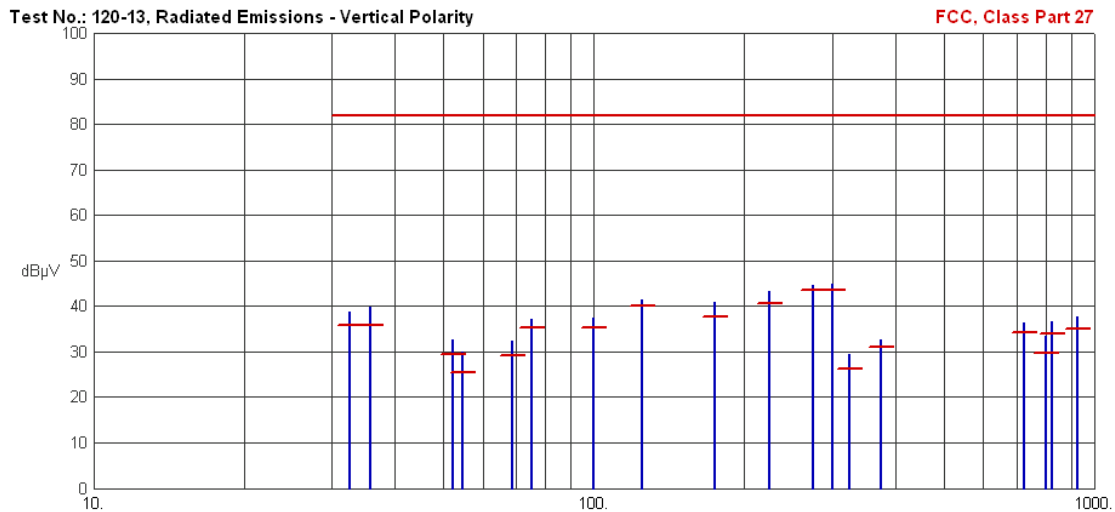


Frequency (MHz)	Pk Amp (dBμV/m)	QP Amp (dBμV/m)	QP Limit (dBμV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
32.3174	29.19	25.79	82.00	-56.21	N/A	N/A	
35.9729	31.14	26.55	82.00	-55.45	N/A	N/A	
52.1760	30.35	24.92	82.00	-57.08	N/A	N/A	
71.0806	30.14	26.09	82.00	-55.91	N/A	N/A	
100.0095	42.67	40.15	82.00	-41.85	N/A	N/A	
116.6634	32.52	27.17	82.00	-54.83	N/A	N/A	
124.9950	44.29	43.09	82.00	-38.91	N/A	N/A	
140.0051	41.21	37.56	82.00	-44.44	N/A	N/A	
175.0042	49.65	49.01	82.00	-32.99	N/A	N/A	
225.0109	43.95	42.40	82.00	-39.60	N/A	N/A	
275.0057	46.72	45.96	82.00	-36.04	N/A	N/A	
300.0604	52.29	50.41	82.00	-31.59	N/A	N/A	
325.0117	36.20	33.95	82.00	-48.05	N/A	N/A	
375.0308	32.90	31.39	82.00	-50.61	N/A	N/A	
400.0433	40.85	38.65	82.00	-43.35	N/A	N/A	
475.0465	35.07	33.06	82.00	-48.94	N/A	N/A	
525.0395	38.49	37.34	82.00	-44.66	N/A	N/A	
825.0488	38.70	36.58	82.00	-45.42	N/A	N/A	
850.0566	41.71	39.27	82.00	-42.73	N/A	N/A	
925.0576	41.59	39.64	82.00	-42.36	N/A	N/A	
975.0483	38.11	35.14	82.00	-46.86	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
32.5224	38.80	35.94	82.00	-46.06	N/A	N/A	
35.7227	39.78	35.93	82.00	-46.07	N/A	N/A	
52.3070	32.71	29.52	82.00	-52.48	N/A	N/A	
54.6344	29.91	25.57	82.00	-56.43	N/A	N/A	
68.8659	32.39	29.19	82.00	-52.81	N/A	N/A	
74.9821	37.18	35.43	82.00	-46.57	N/A	N/A	
100.0206	37.43	35.21	82.00	-46.79	N/A	N/A	
124.9898	41.46	40.12	82.00	-41.88	N/A	N/A	
174.9936	40.84	37.84	82.00	-44.16	N/A	N/A	
224.9992	43.23	40.67	82.00	-41.33	N/A	N/A	
274.9926	44.70	43.60	82.00	-38.40	N/A	N/A	
300.0625	44.94	43.47	82.00	-38.53	N/A	N/A	
325.0062	29.47	26.32	82.00	-55.68	N/A	N/A	
375.0104	32.78	30.94	82.00	-51.06	N/A	N/A	
725.0537	36.26	34.20	82.00	-47.80	N/A	N/A	
800.0538	33.41	29.72	82.00	-52.28	N/A	N/A	
825.0361	36.52	33.87	82.00	-48.13	N/A	N/A	
925.0655	37.68	35.04	82.00	-46.96	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:	01/25/2013
Test Engineer:	Cody Merry
Site Temperature (°C):	24
Relative Humidity (%RH):	33
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 Average
Antenna Height:	1 to 4 meters

6.4.6. Radiated Emissions above 1 GHz

There were no measureable emissions above 1 GHz

6. Measurement Data (continued)

6.5. Frequency Stability 27.54

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

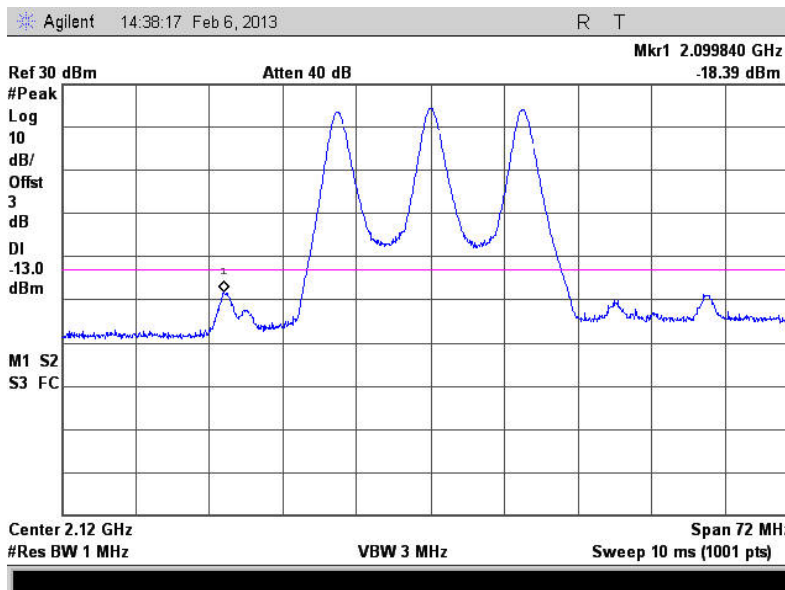
Note: The EUT does not translate the input frequency and therefore this testing was not performed.

6. Measurement Data (continued)

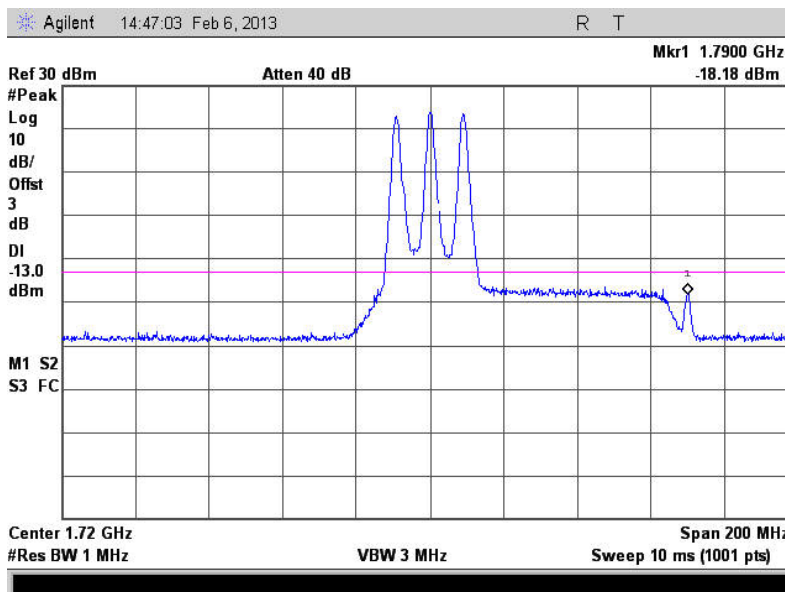
6.6. Inter-modulation

Requirement: Using the maximum drive level determined in the output power section apply three CW tones at low, mid and high frequencies in the band and verify the inter-modulation products do not exceed -13 dBm conducted.

6.6.1. 2120 MHz, A0B0 Filter, Inter-modulation products, with 3 Modulated Carriers



6.6.2. 1720 MHz, A0B0 Filter, Inter-modulation products, with 3 Modulated Carriers



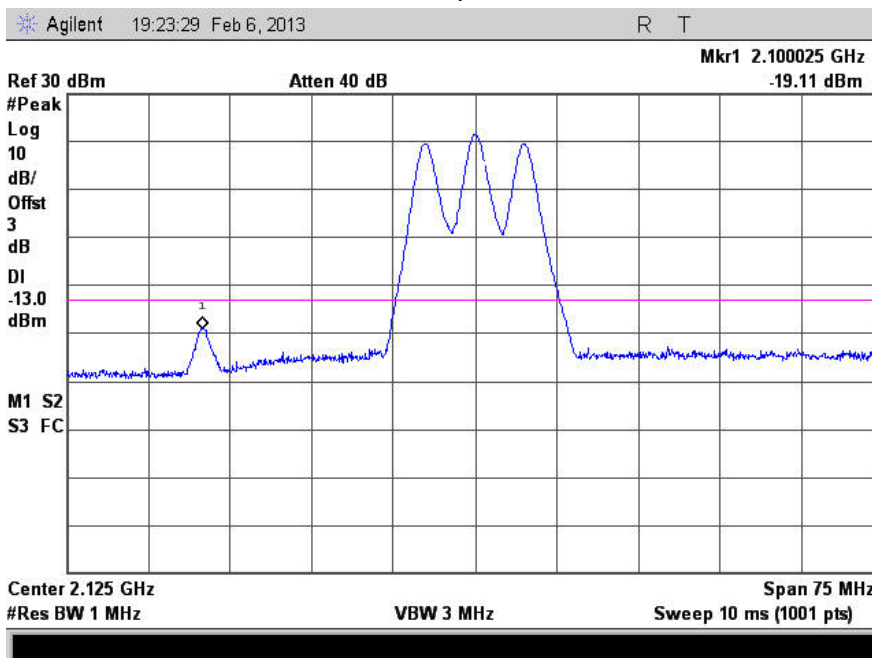
Test Number: 120-13R3

Issue Date: 11/7/2013

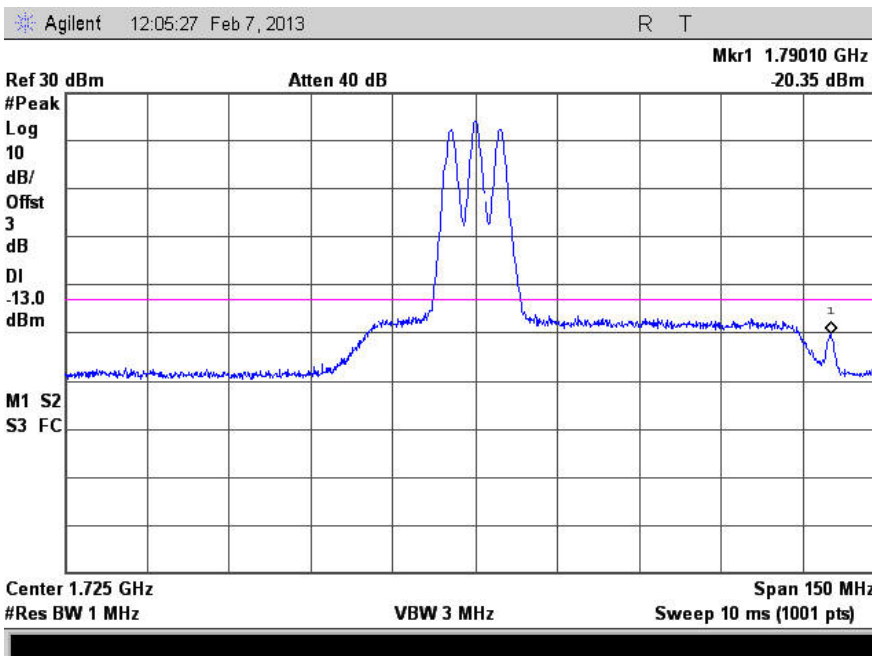
6. Measurement Data (continued)

6.6. Inter-modulation (continued)

6.6.3. 2125 MHz, B0 Filter, Inter-modulation products, with 3 Modulated Carriers



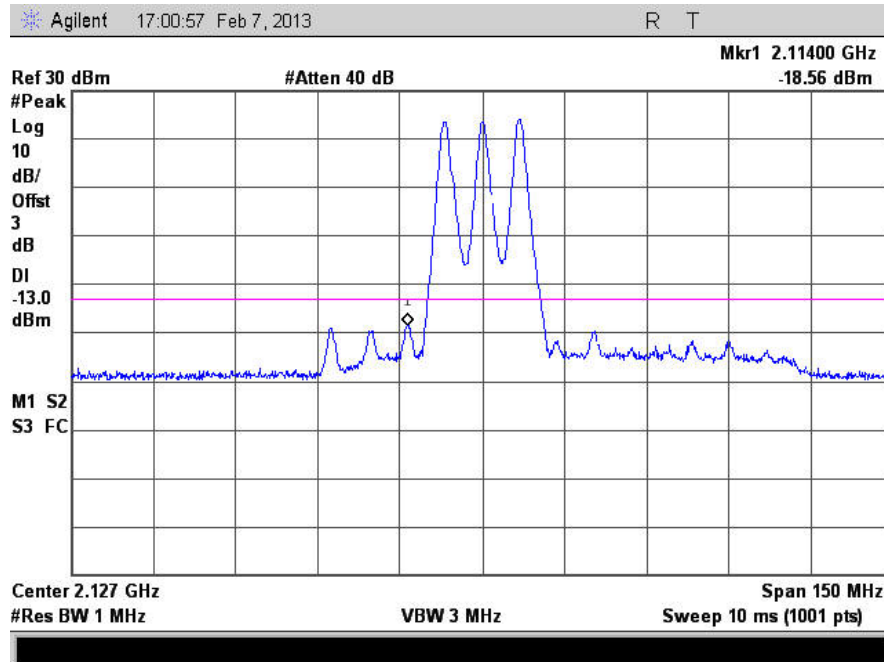
6.6.4. 1725 MHz, B0 Filter Inter-modulation products, with 3 Modulated Carriers



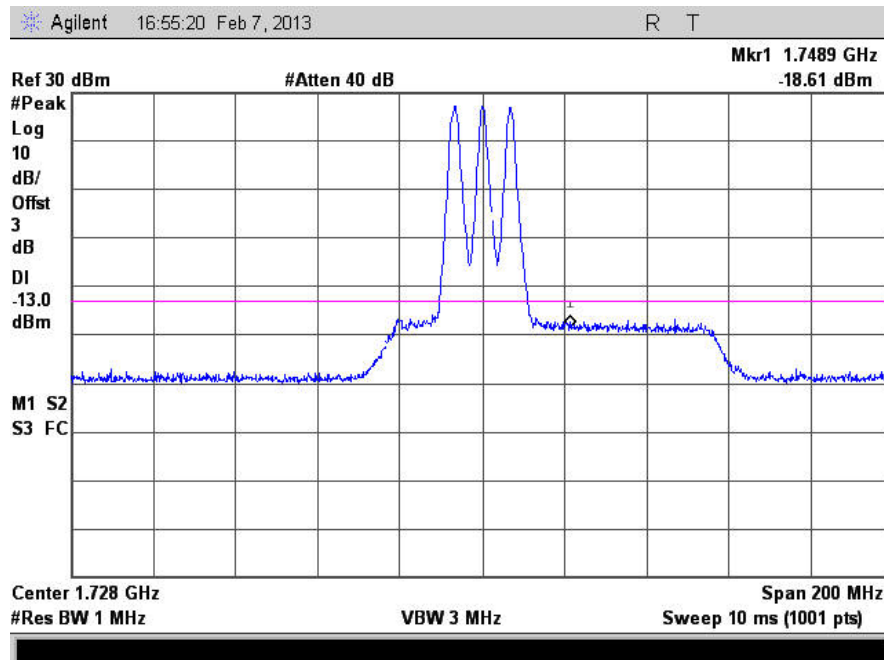
6. Measurement Data (continued)

6.6. Inter-modulation (continued)

6.6.5. 2127.5 MHz, B0C0 Filter, Inter-modulation products, with 3 Modulated Carriers



6.6.6. 1727.5 MHz, B0C0 Filter, Inter-modulation products, with 3 Modulated Carriers



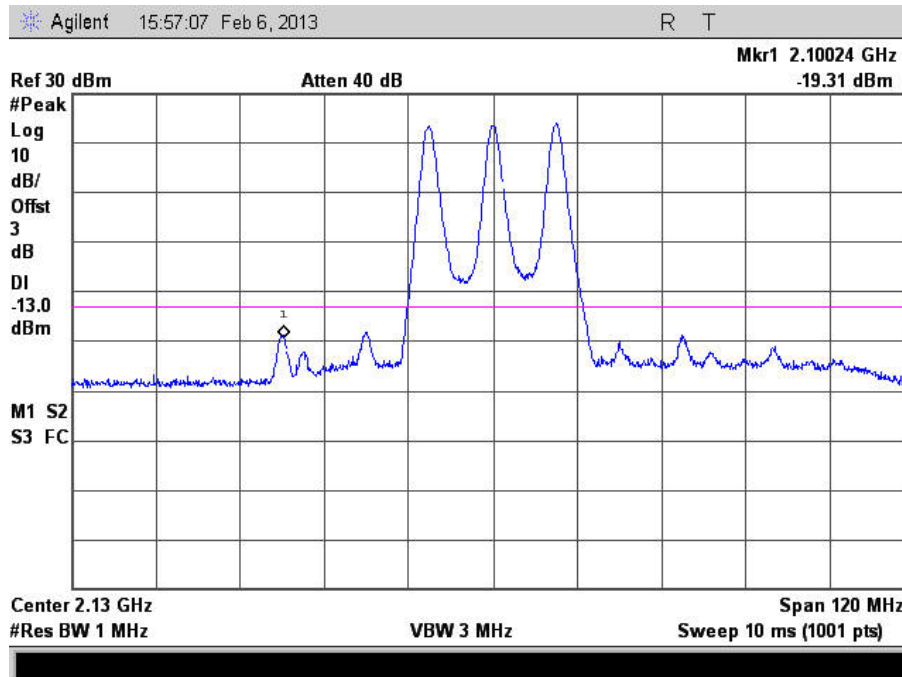
Test Number: 120-13R3

Issue Date: 11/7/2013

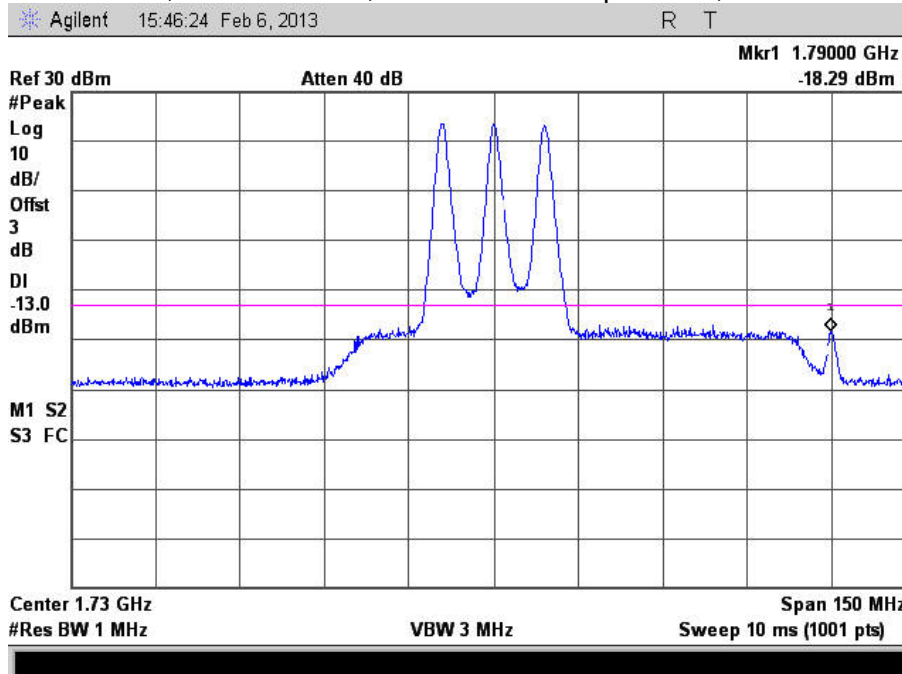
6. Measurement Data (continued)

6.6. Inter-modulation (continued)

6.6.7. 2130 MHz, B0C0D0 Filter, Inter-modulation products, with 3 Modulated Carriers



6.6.8. 1730 MHz, B0C0D0 Filter, Inter-modulation products, with 3 Modulated Carriers



6. Measurement Data (continued)
6.7. Public Exposure to Radio Frequency Energy Levels 1.1307 (b)(1)

AWS Band Block (A0B0C0D0)	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		Limit (mW/cm2)	Result
				(mW/cm2)	(W/m2)		
	(1)	(2)	(3)	(4)		(5)	
A0B0	20.0	30.10	3.00	0.4061909	4.0619086	1	Compliant
A0B0	20.0	33.87	-2.00	0.3060061	3.0600614	1	Compliant
B0	20.0	29.67	3.00	0.3679003	3.6790030	1	Compliant
B0	20.0	33.58	-2.00	0.2862399	2.8623988	1	Compliant
B0C0	20.0	30.21	3.00	0.4166104	4.1661044	1	Compliant
B0C0	20.0	33.64	-2.00	0.2902219	2.9022188	1	Compliant
B0C0D0	20.0	30.26	3.00	0.4214346	4.2143456	1	Compliant
B0C0D0	20.0	34.24	-2.00	0.3332193	3.3321930	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 for combination of cable loss and antenna gain.
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.

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**).

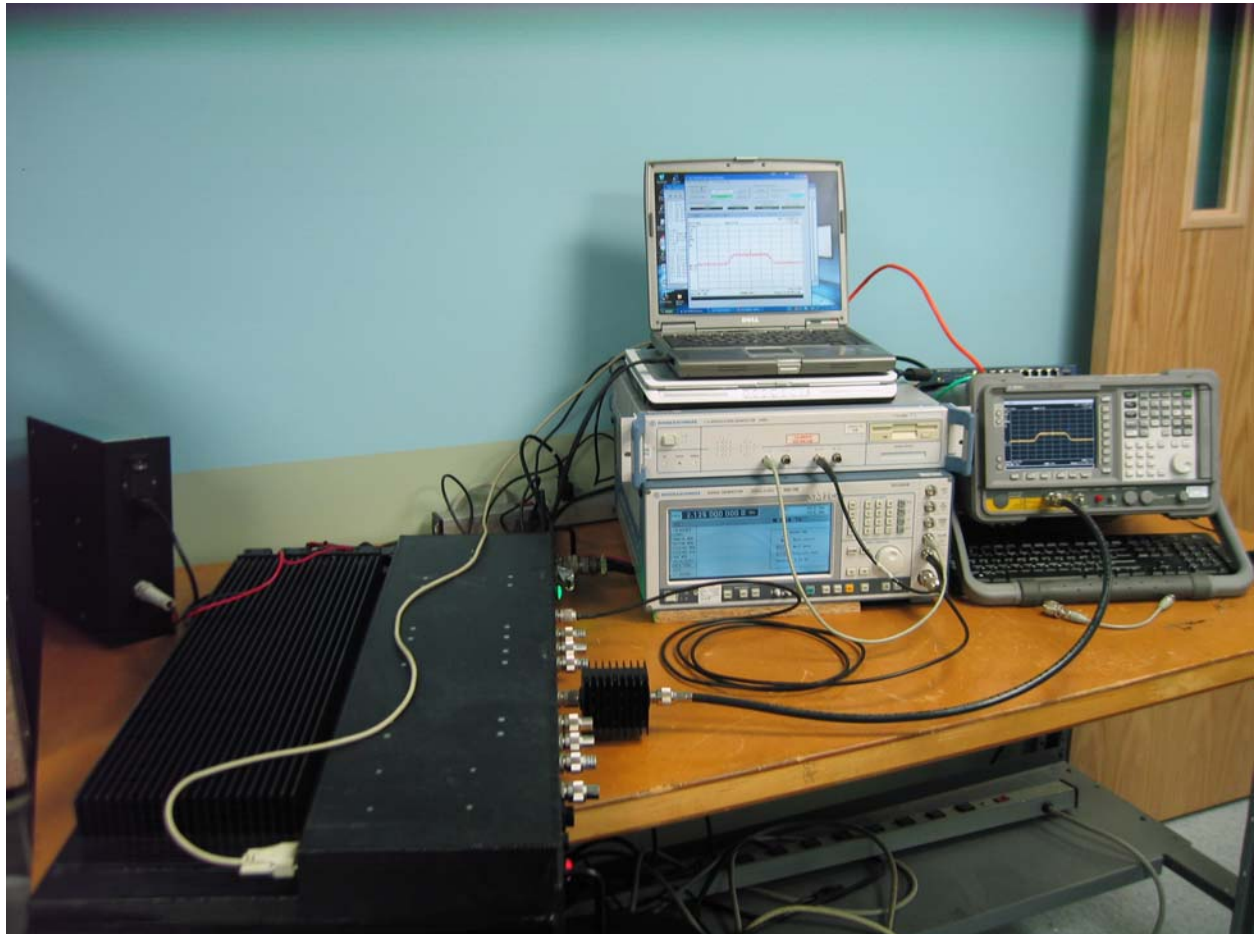
The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

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)



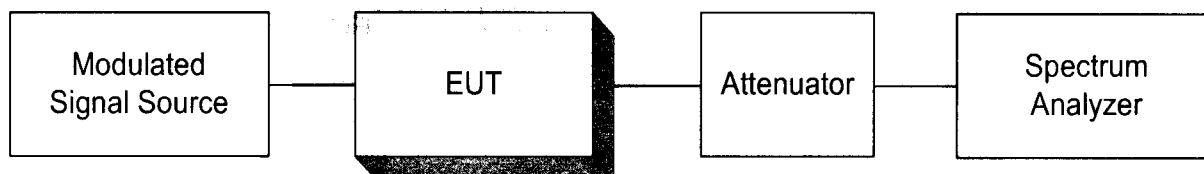
8. Test Setup Photographs (cont)

Radiated Emissions (Rear) 30 MHz to 1 GHz

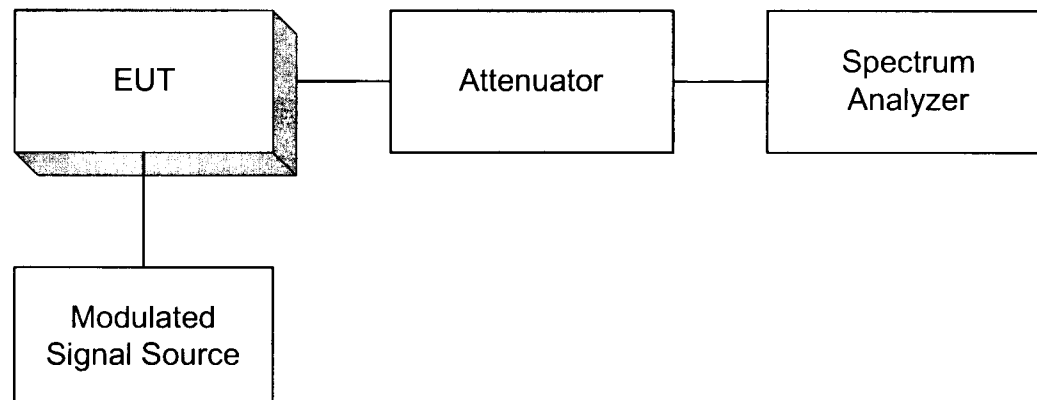


Appendix A

RF Output Power

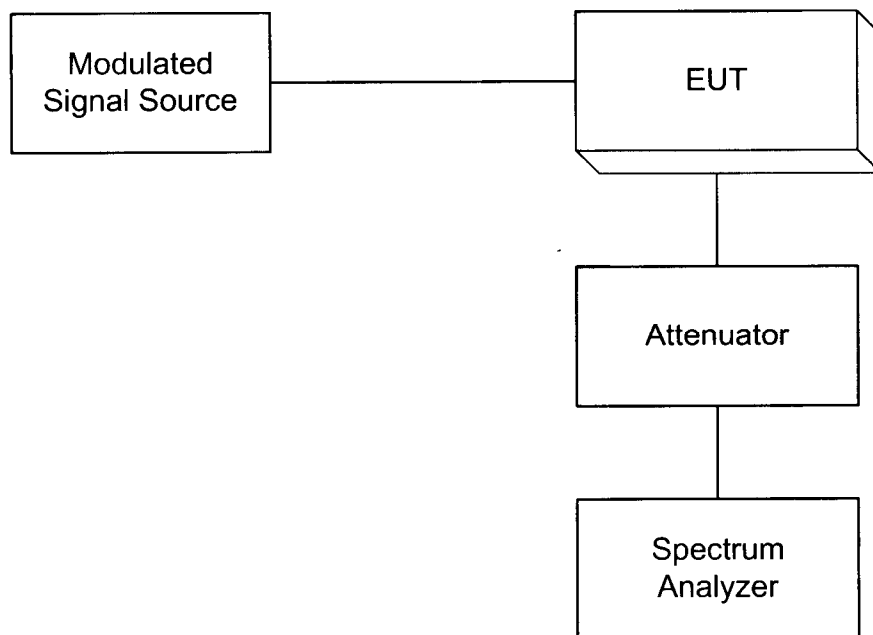


Occupied Bandwidth



Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation

