COMPLIANCE WORLDWIDE INC.
TEST REPORT 155-16AR7

In Accordance with the Requirements of

FCC PART 27:2015 Subparts C & L
FCC PART 20:2015
IC RSS-139, Issue 3

Issued to

Westell, Inc.
750 North Commons Drive
Aurora, IL 60504
(630) 375-4724

for

DSP85 Series Digital Repeater
DSP85-251AW
Representing Model DSP85-L7/AW

FCC ID: NVRDSP85-L7AW
IC: 4307A-DSP85L7AW

Original Report Issued on March 3, 2016
Revision R7 Issued on February 14, 2017

Tested by

Larry K. Stillings

Reviewed By

Brian F. Breault

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1. Scope

This test report certifies that the Westell DSP85-L7/AW, as tested, meets the FCC Part 27 Subparts C & L and IC RSS-139, Issue 3 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 updates the report references to include IC RSS-131 and RSS-102 and updates the public exposure to radio frequency fields on page 66. Revision R5 updates FCC ID on cover page and updates the references in section 4.3 to ANSI/TIA-603-D 2010 and ANSI C63.26 2015, and replaces the radiated data in section 6.4 with Substitution Measurement data. Revision R6 adds booster gain to section 6.1.2 on page 8, and the above 1 GHz Radiated Test photographs on pages 69 & 70. Revision R7 adds the DC power input information to Section 2.8 on this page.

2. Product Details

2.1. Manufacturer: Westell Technologies, Inc.

2.2. Model Numbers: DSP85-251AW tested also represents Model DSP85-L7/AW

2.3. Serial Number: C6SL51193

2.4. Description: An in-building digital repeater is utilized to propagate over-the-air radio frequency signals from a local cell tower into buildings via a fiber or coax distributed antenna system (DAS). Once installed, a digital repeater provides the signal power necessary for wireless devices in the building to operate seamlessly.

2.5. Power Source: 120 VAC, 60 Hz via APX Technologies SP130P966ER

2.6. Software Version: N/A

2.7. EMC Modifications: None

2.8. DC voltages and currents of final transmitter stage

Frequency Range	1710 – 1755 MHz / 2110 – 2155 MHz
DC Input Voltage Range	+28 VDC, + 5 VDC (On-Off)
DC Current	130 mA @ 1 Watt

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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 Supply	APX Technologies	SP130P966ER	n/a	
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	2M	Yes	DUT	Notebook PC
USB	2M	Yes	DUT	Notebook PC
Ethernet	2M	No	DUT	Notebook PC

Notebook PC is connected only during setup

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3. Product Configuration (continued)

3.3. Operational Characteristics & Software

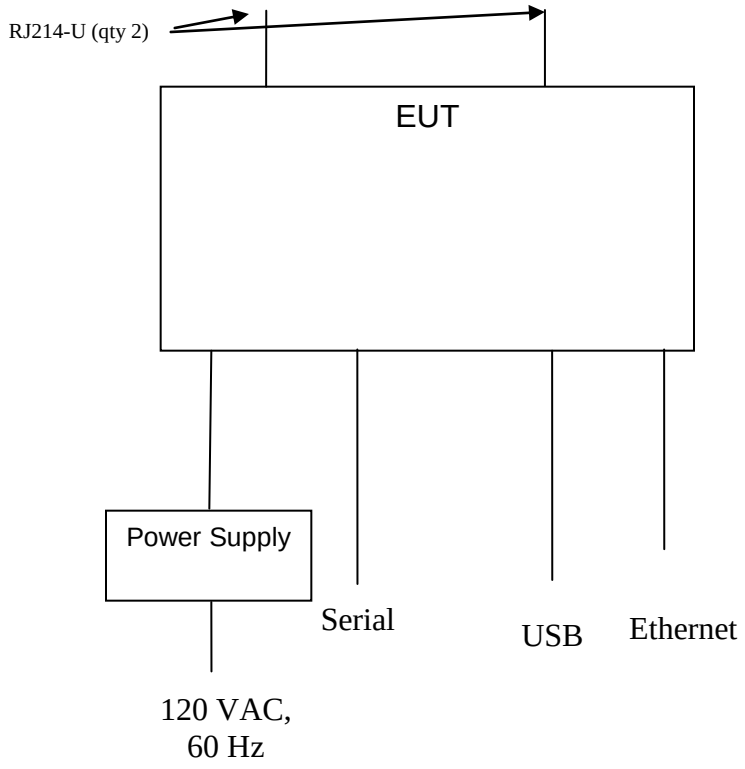
(1) The unit was allowed to power up normally and go through its configuration cycle.

(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 and AWS / LTE 4.1 MHz AWGN digital modulation to the input of the amplifier across the AWS bands to be used by the product.

(4) The units internal AGC threshold was determined by applying an input signal until a 1 dB increase in input signal did not cause a 1 dB in output signal for each of the Uplink and Downlink frequencies.

3.4. Block Diagram



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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz [1]	Rohde & Schwarz	ESR7	101156	7/23/2017	2 Years
Spectrum Analyzer 20 Hz – 40 GHz [2]	Rohde & Schwarz	FSV40	100899	7/23/2017	2 Years
Spectrum Analyzer, 9 kHz to 40 GHz [3]	Rohde & Schwarz	FSVR40	100909	7/23/2017	2 Years
EMI Receiver, 9 kHz to 6.5 GHz	Hewlett Packard	8546A	3650A00360	6/4/2016	2 Years
Biconilog Antenna, 30 MHz to 2 GHz	Sunol Sciences Corp	JB1	25509	5/15/2016	3 Years
Horn Antenna, 960 MHz – 18 GHz	Electro-Metrics	RGA-50 / 60	2813	7/15/2016	2 Years
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	7/21/2017	2 Years
Digital Barometer	Control Company	4195	ID236	10/8/2017	2 Years

[1] ESR7 Firmware revision: V2.26, Date installed: 8/15/2014 Previous V2.17, installed 6/11/2014.
[2] FSV40 Firmware revision: V2.30 SP1 Date installed: 10/22/2014 Previous V2.30, installed 7/23/2014.
[3] FSVR40 Firmware revision: V2.23, Date installed: 10/20/2014 Previous V1.63 SP1, installed 8/28/2013.

4.2. Measurement & Equipment Setup

Test Dates:	2/10/2016, 2/19/2016, 2/20/2016, 2/23/2016, 1/18/2017
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 and RSS-139, Issue 3.

The test methods used to generate the data is this test report are in accordance with ANSI C63.26:2015, American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services, FCC OET KDB 935210 D05 Indus Booster Basic Meas v01r01 dated 2-12-2016, Measurements Guidance for Industrial and Non-Consumer Signal Booster, Repeater and Amplifier Devices and FCC OET KDB 971168 D01 Power Meas License Digital Systems v02r02 dated 10-17-2014.

Measurements were also made in accordance with ANSI/TIA-603-D 2010 Land Mobile FM or PM Communications Equipment Measurement and Performance Standard.

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5. Measurement Summary

Section Description or Test Requirement	FCC Part 27 Reference	IC RSS-139 Reference	Test Report Section	Result	Comment
Power and Antenna height limits, Output Power	27.50 (d)	6.5	6.1	Compliant	
Occupied Bandwidth	Part 2.1049	RSS-GEN 6.6	6.2	Compliant	
Spurious Emissions at Antenna Terminals	27.53 (h)	6.6	6.3	Compliant	
Field Strength of Spurious Emissions	27.53 (h)	6.6	6.4	Compliant	
Frequency Stability	27.54	6.4	6.5	N/A	The EUT does not translate the frequency of the input signal
Out of Band Rejection	N/A	N/A	6.6	Compliant	FCC KDB 935210
Public Exposure to Radio Frequency Energy Levels	Section 1.1307 (b)(1)	RSS-GEN 3.2 RSS-102	6.7	Compliant	

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6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d)(4), RSS-139 Section 6.5

Requirement: Fixed and base stations transmitting a signal in the 2110-2180 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 1710–1780 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.

Test Method: KDB 935210 Section 3.5 & KDB 971168 Section 5.2

6.1.1. Mean Transmitter Output Power, Transmitter Only

Description of Measurement	Center Frequency	Output Power		Input Power
	(MHz)	(dBm)	(Watts)	(dBm)
Output Power	1715	29.66	0.925	-53.22
Output Power	1732.5	29.95	0.989	-55.12
Output Power	1750	29.92	0.982	-55.09
Output Power	2115	30.07	1.016	-52.78
Output Power	2132.5	30.25	1.059	-53.54
Output Power	2150	30.36	1.086	-53.73
3 dB Above AGC	1715	32.42	1.746	
3 dB Above AGC	1732.5	32.51	1.782	
3 dB Above AGC	1750	32.86	1.932	
3 dB Above AGC	2115	32.19	1.656	
3 dB Above AGC	2132.5	32.20	1.660	
3 dB Above AGC	2150	32.41	1.742	

Note: Input Power is AGC threshold Level

6.1.2 Booster Gain (85 dB Nominal)

Modulation Type	Frequency	Output Power	Input Power	Gain (dB)
	(MHz)	(dBm)	(dBm)	
AWGN	1715	29.66	-53.22	82.88
AWGN	1732.5	29.95	-55.12	85.07
AWGN	1750	29.92	-55.09	85.01
AWGN	2115	30.07	-52.78	82.85
AWGN	2132.5	30.25	-53.54	83.79
AWGN	2150	30.36	-53.73	84.09

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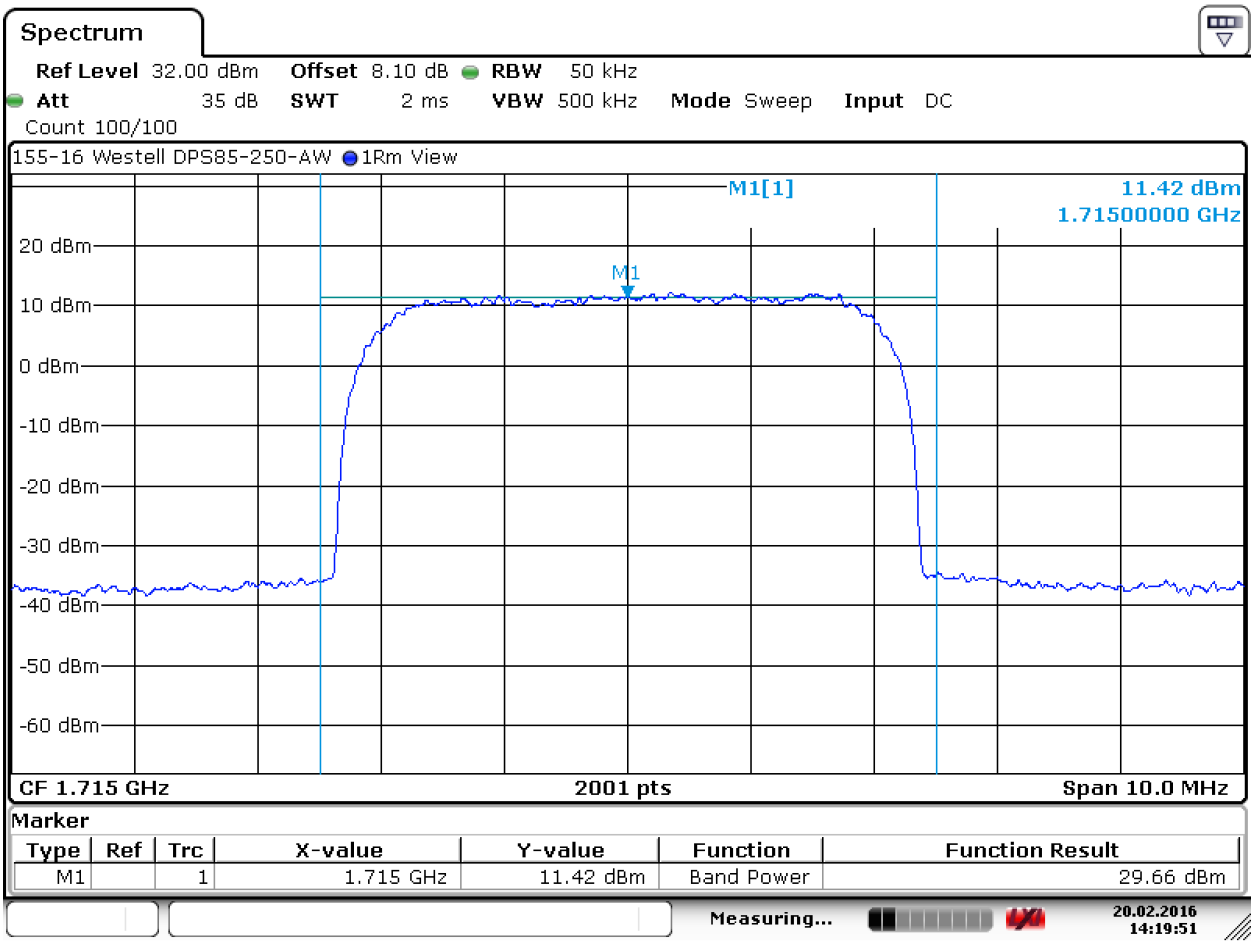
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.2. Mean Transmitter Output Power, 1715 MHz



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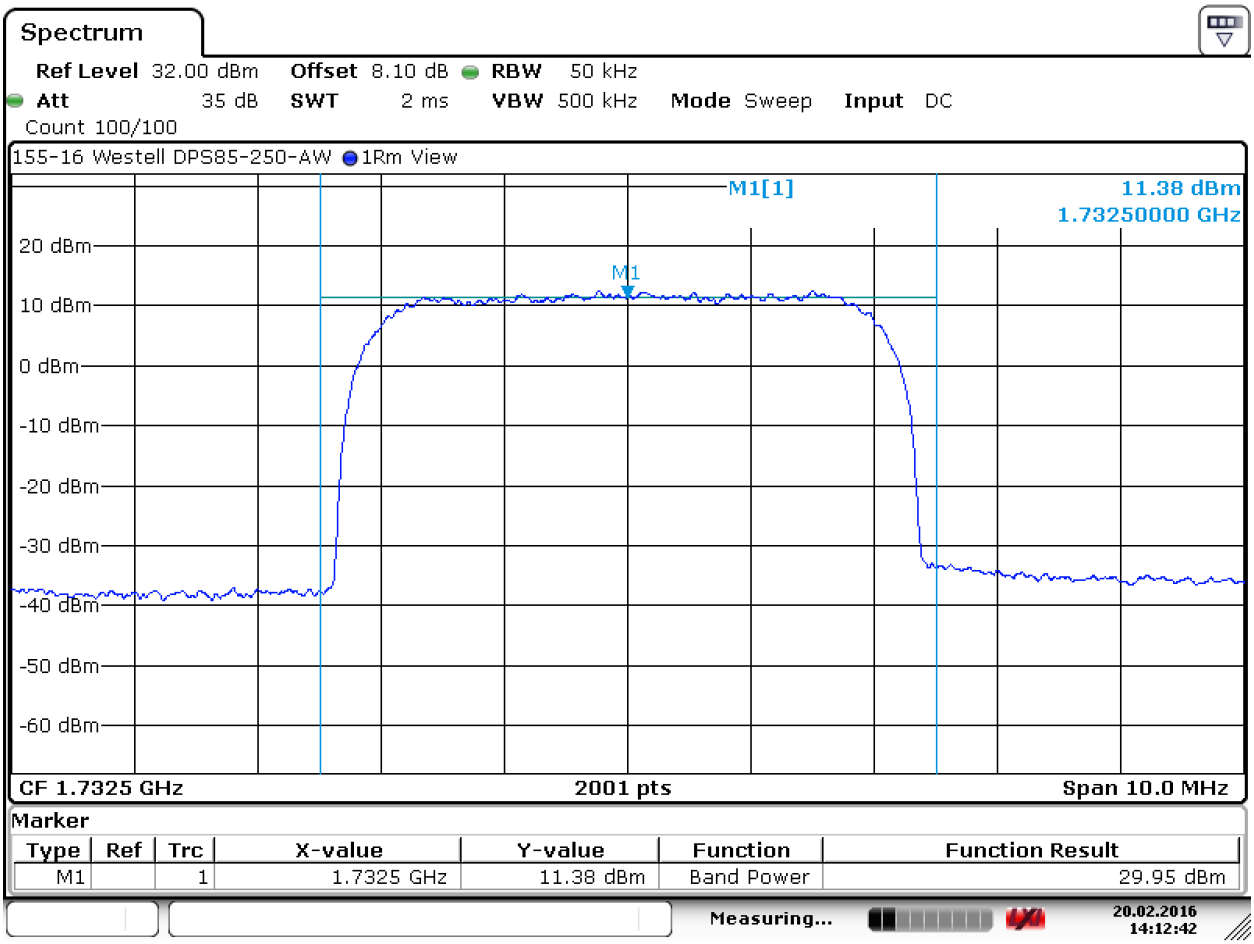
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.3. Mean Transmitter Output Power, 1732.5 MHz



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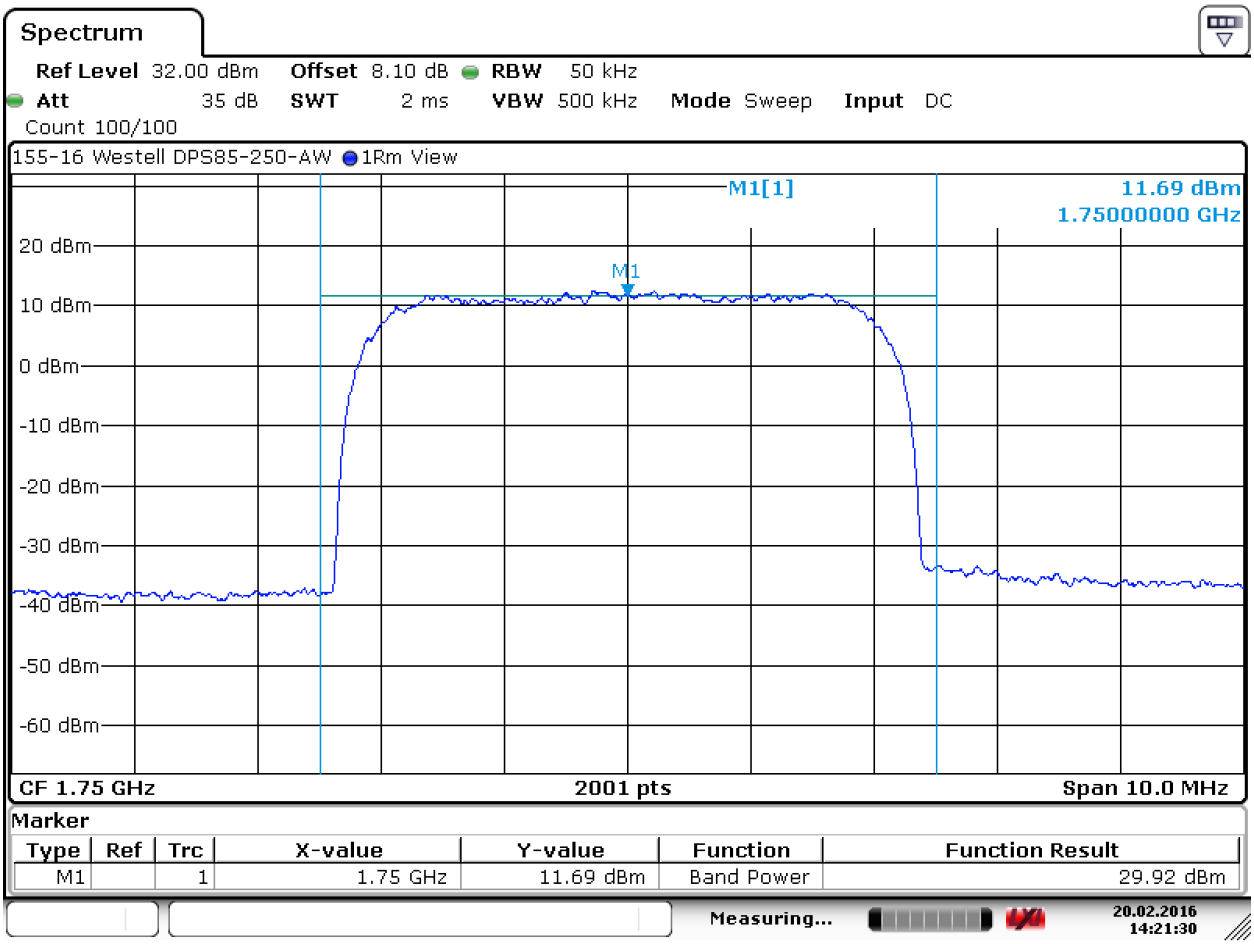
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.4. Mean Transmitter Output Power, 1750 MHz



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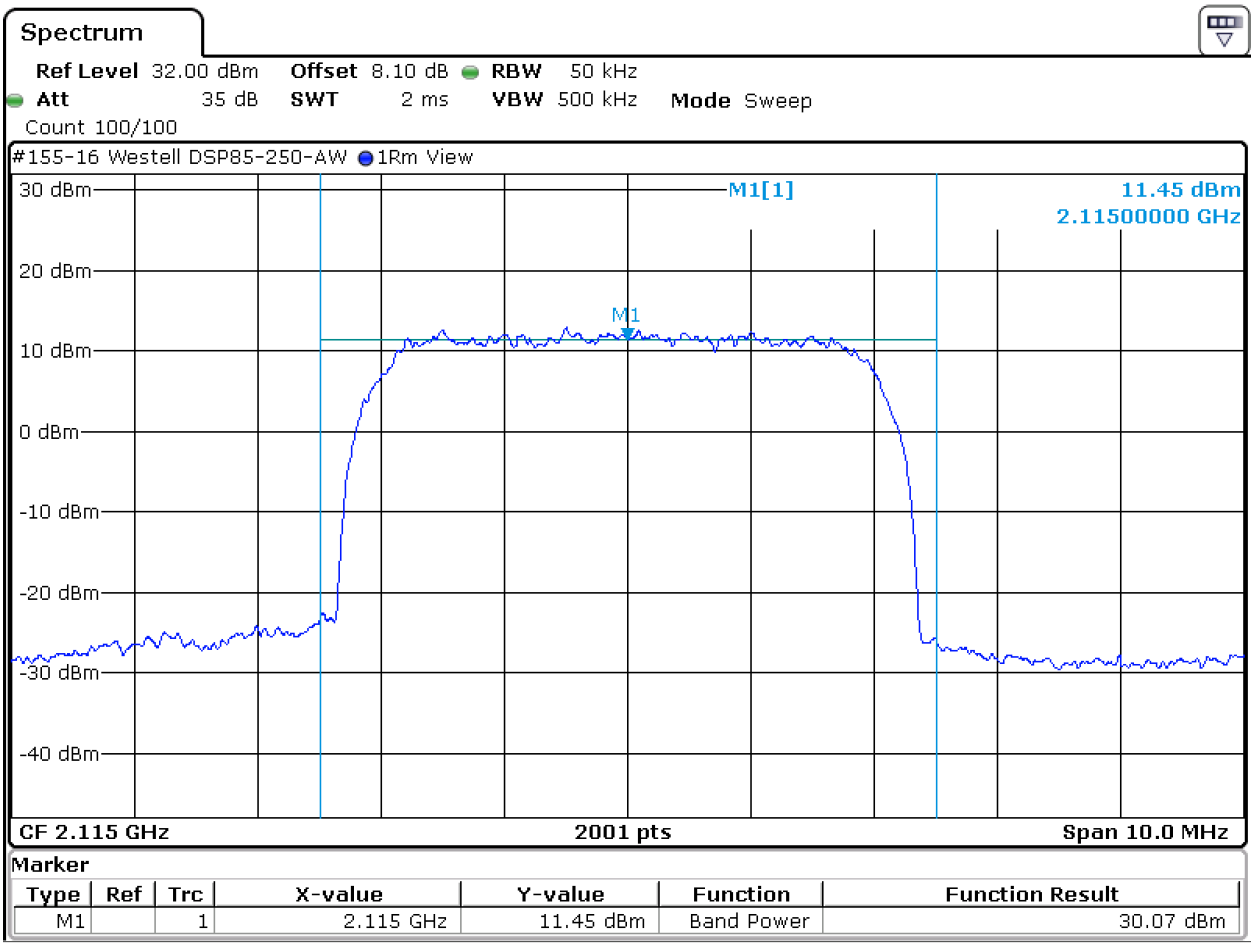
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.5. Mean Transmitter Output Power, 2115 MHz



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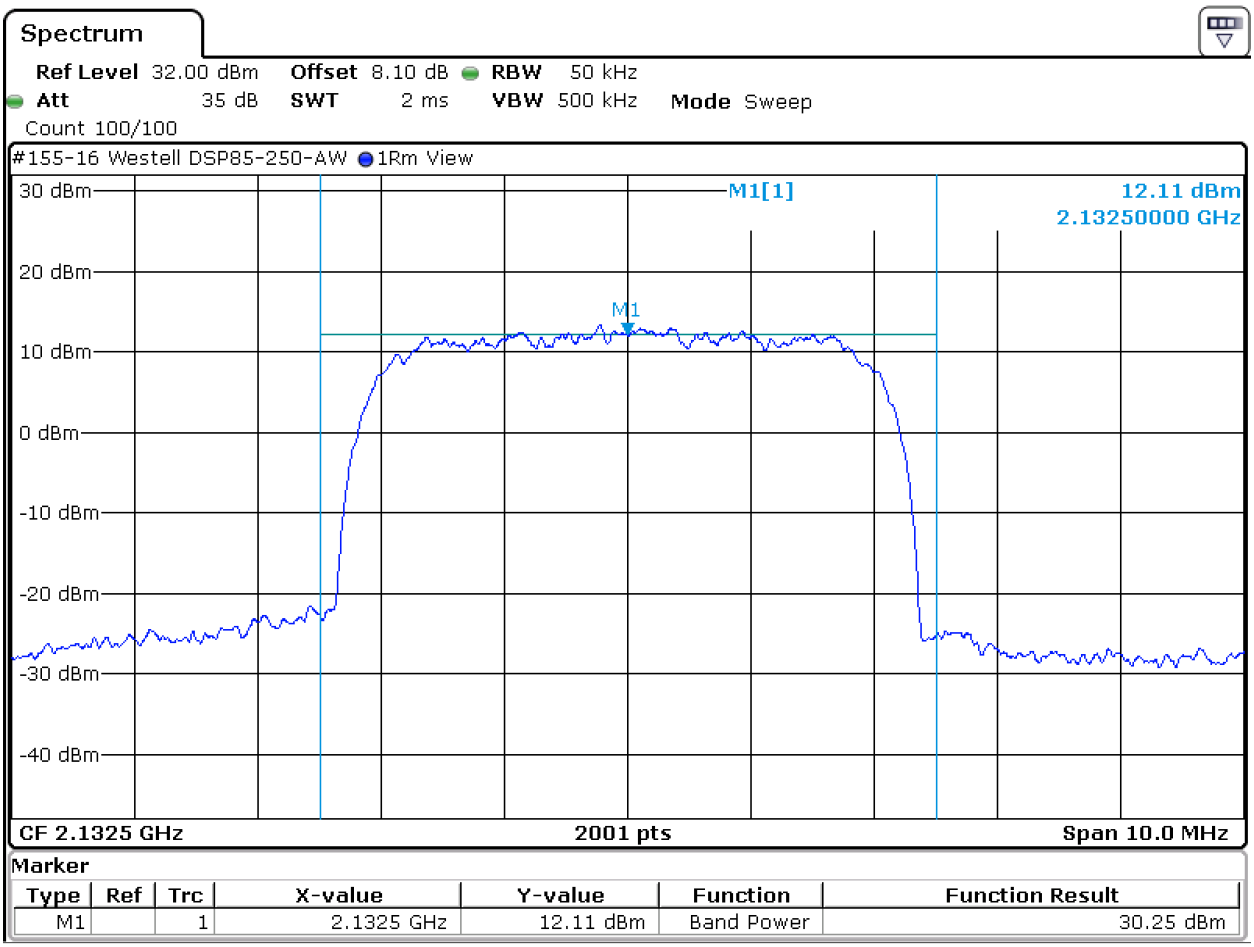
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.6. Mean Transmitter Output Power, 2132.5 MHz



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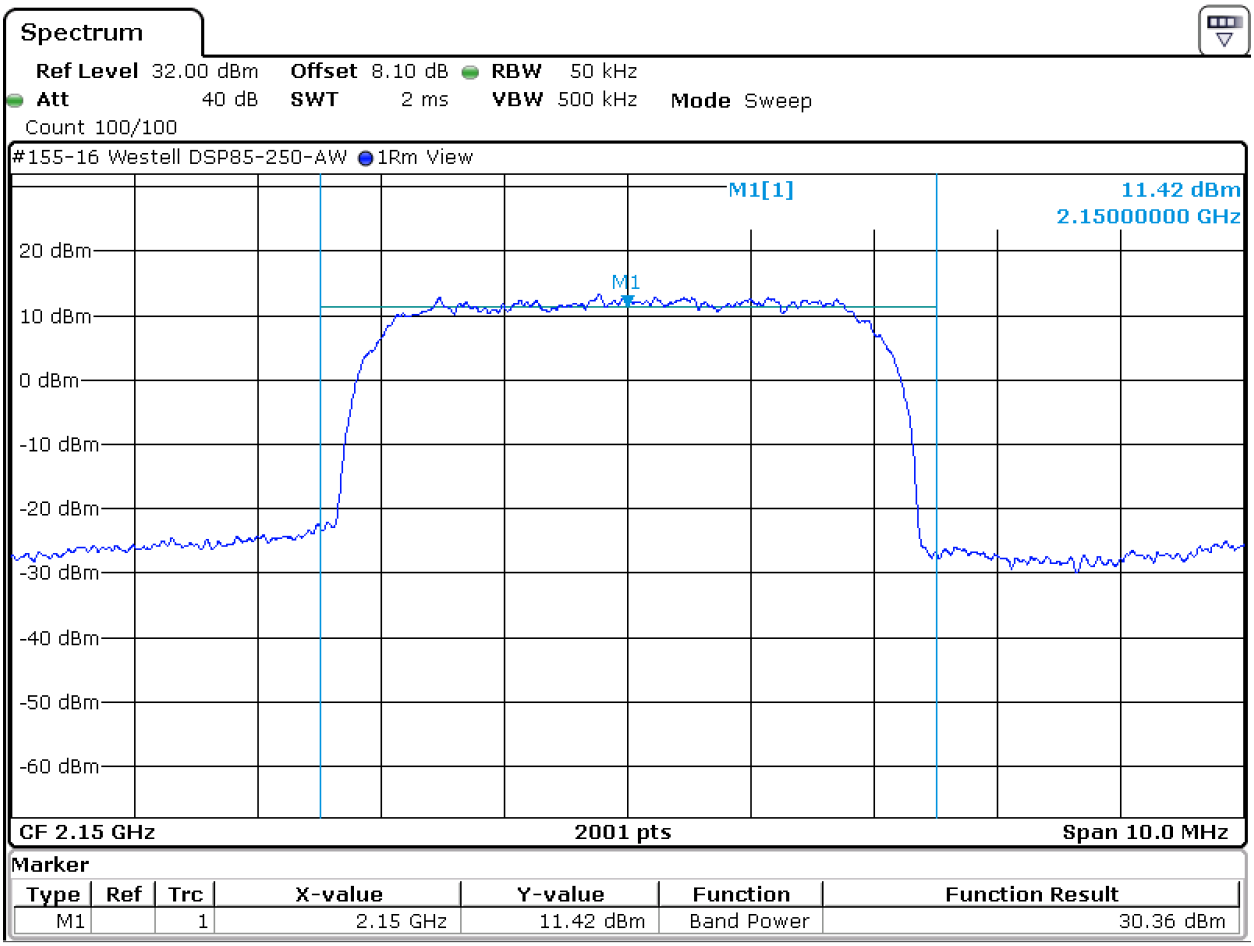
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.7. Mean Transmitter Output Power, 2150 MHz



Date: 23.FEB.2016 16:47:33

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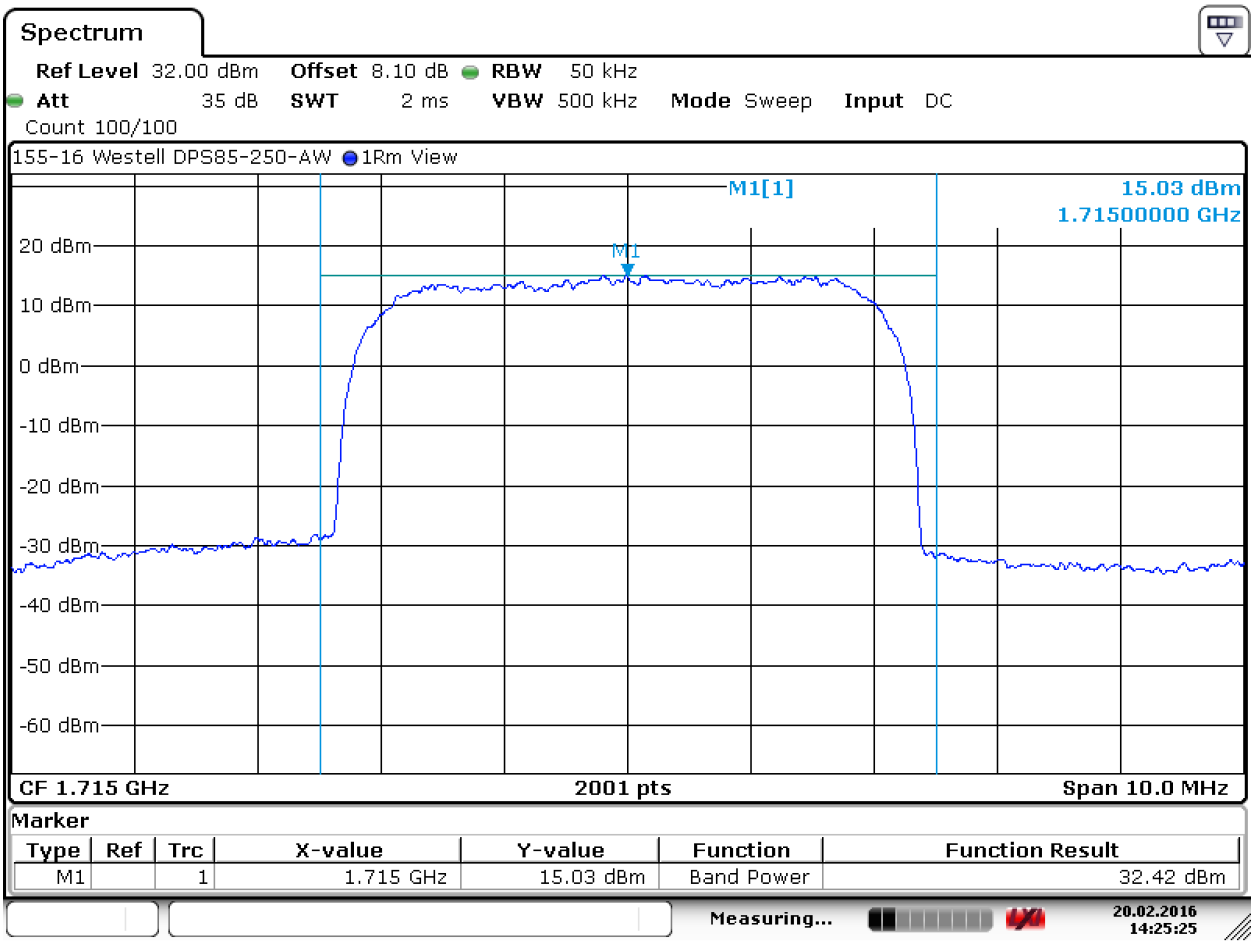
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.8. Mean Transmitter Output Power, 1715 MHz – 3 dB Increase to Input



Date: 20.FEB.2016 14:25:24

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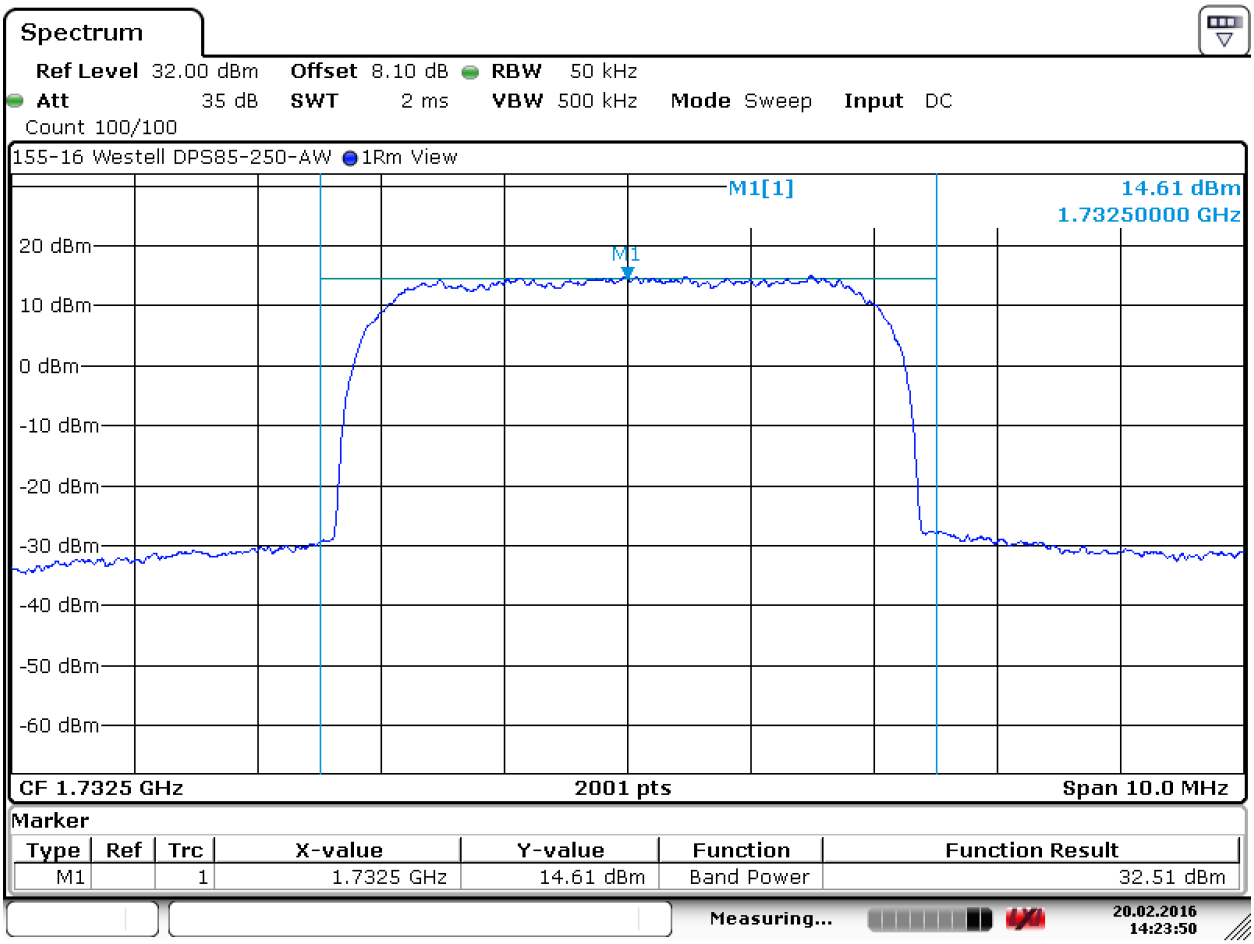
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.9. Mean Transmitter Output Power, 1732.5 MHz – 3 dB Increase to Input



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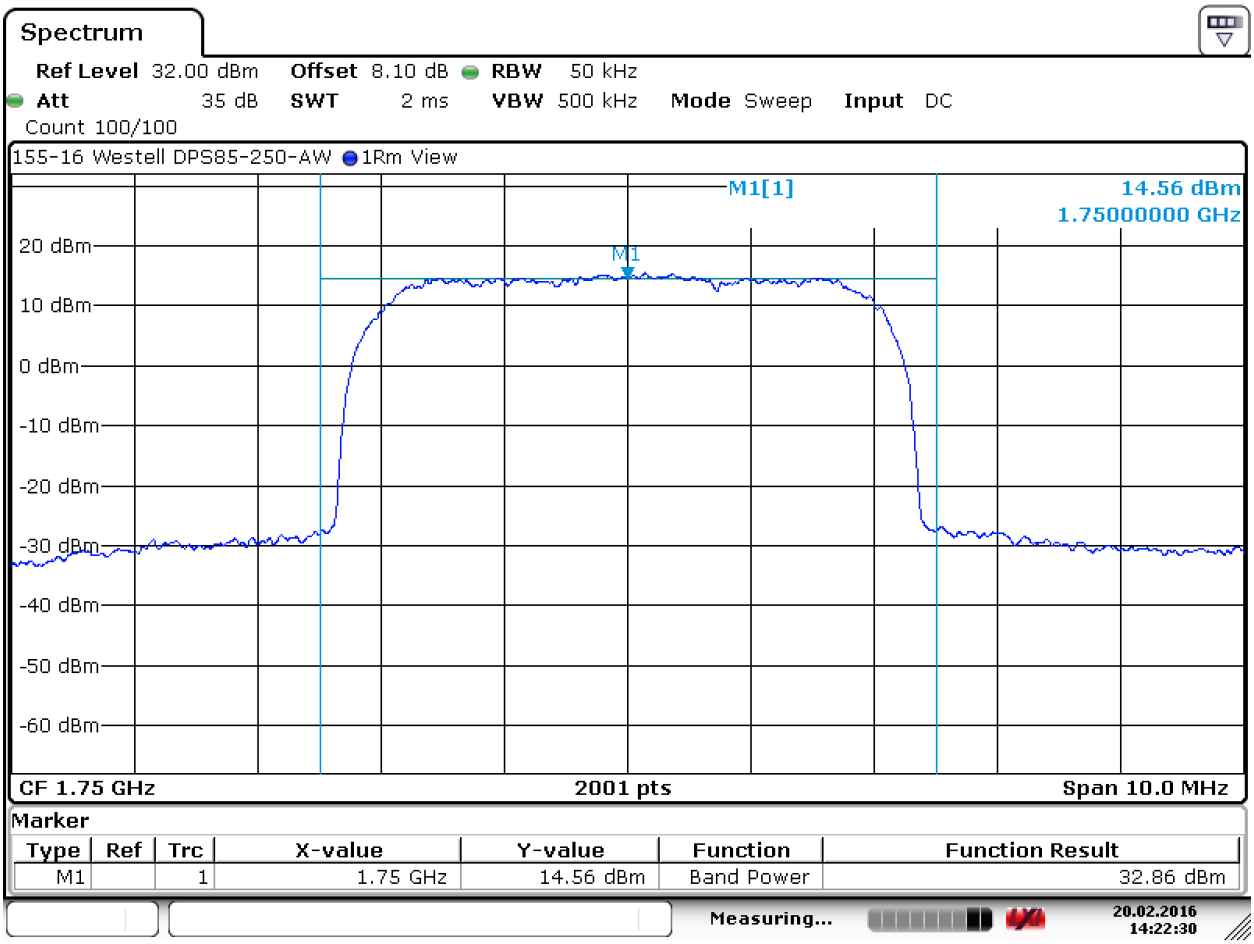
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d)(4), RSS-139 6.5 (cont.)

6.1.10. Mean Transmitter Output Power, 1750 MHz – 3 dB Increase to Input



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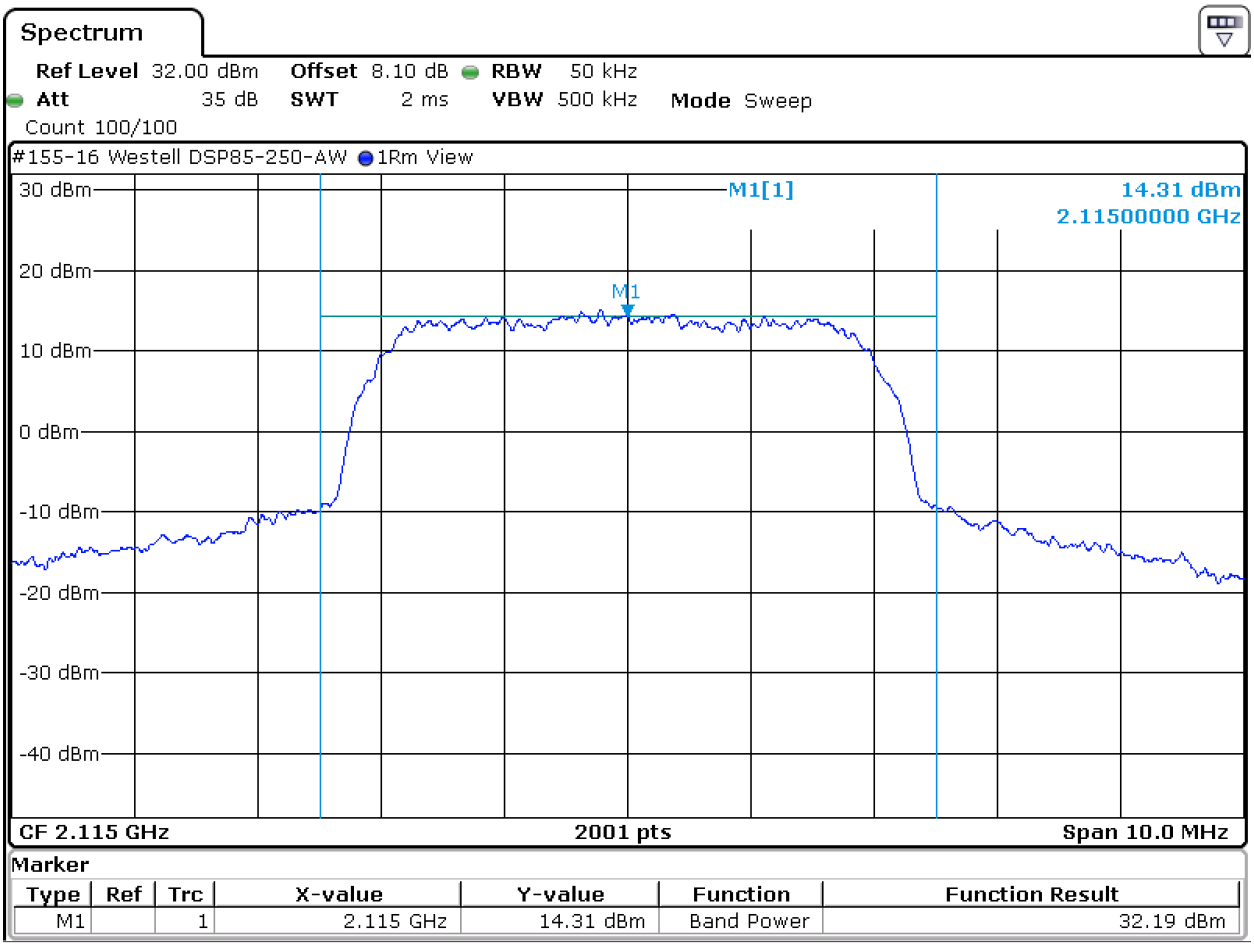
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (d)(4), RSS-139 6.5 (cont.)

6.1.11. Mean Transmitter Output Power, 2115 MHz – 3 dB Increase to Input



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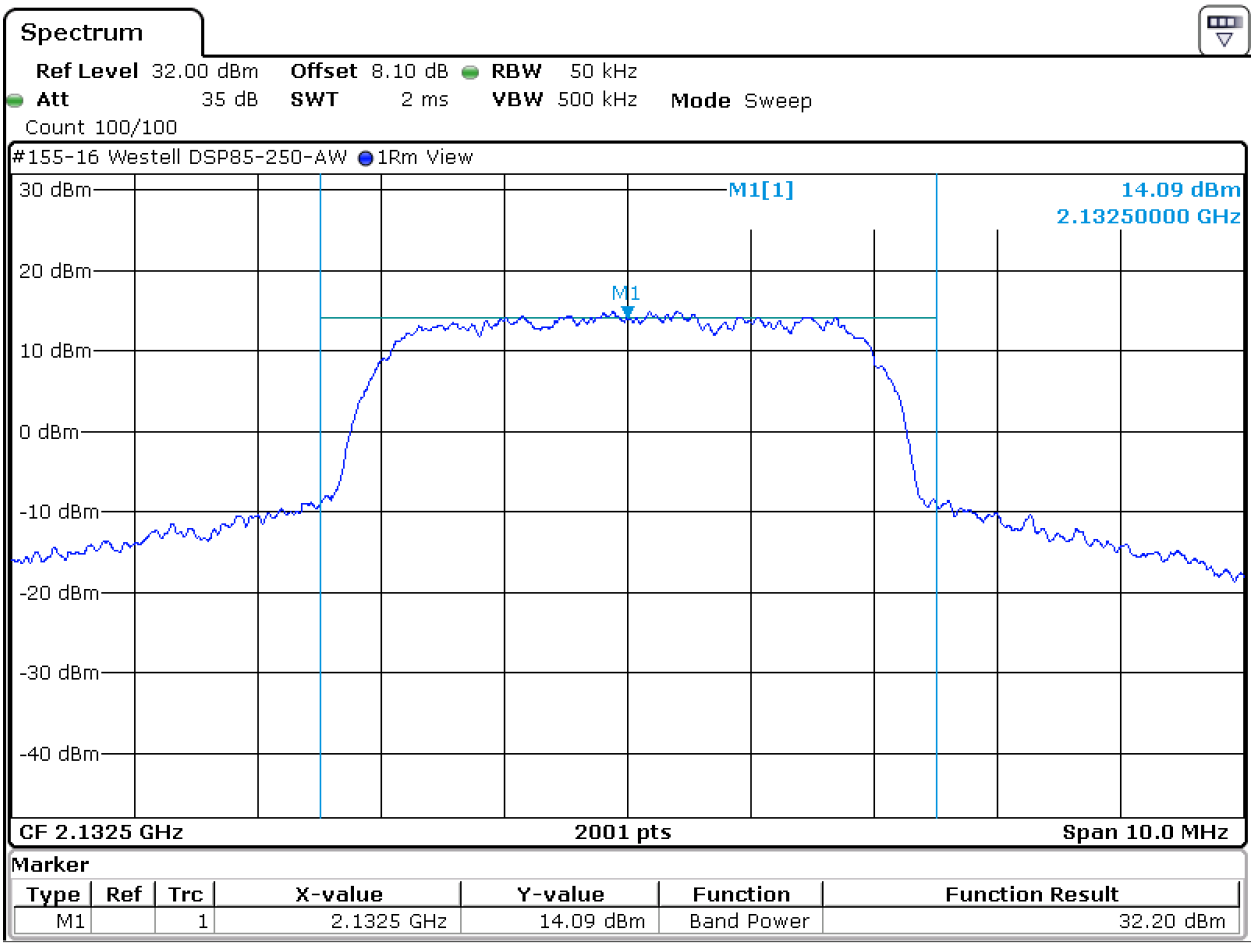
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.12. Mean Transmitter Output Power, 2132.5 MHz – 3 dB Increase to Input



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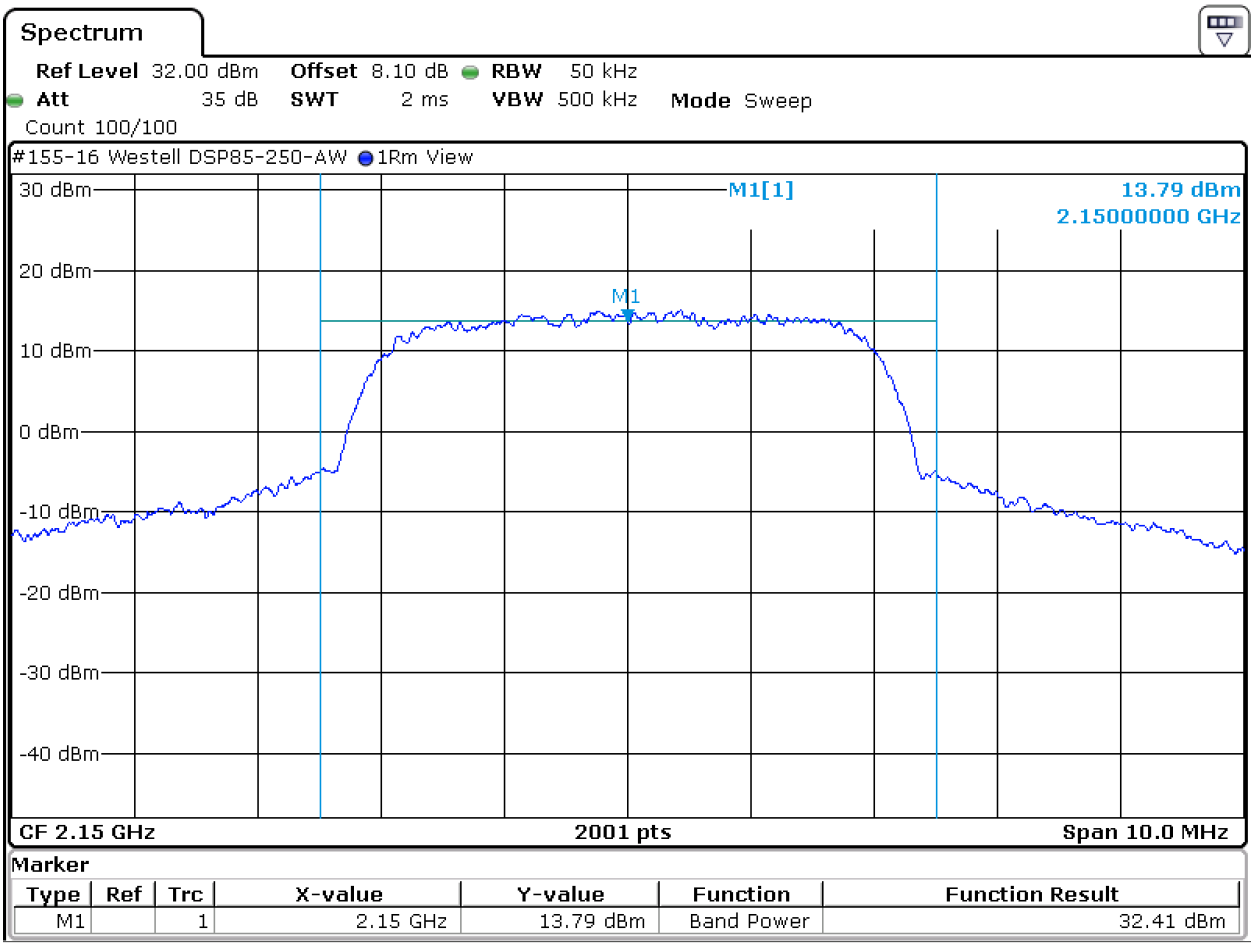
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.13. Mean Transmitter Output Power, 2150 MHz – 3 dB Increase to Input



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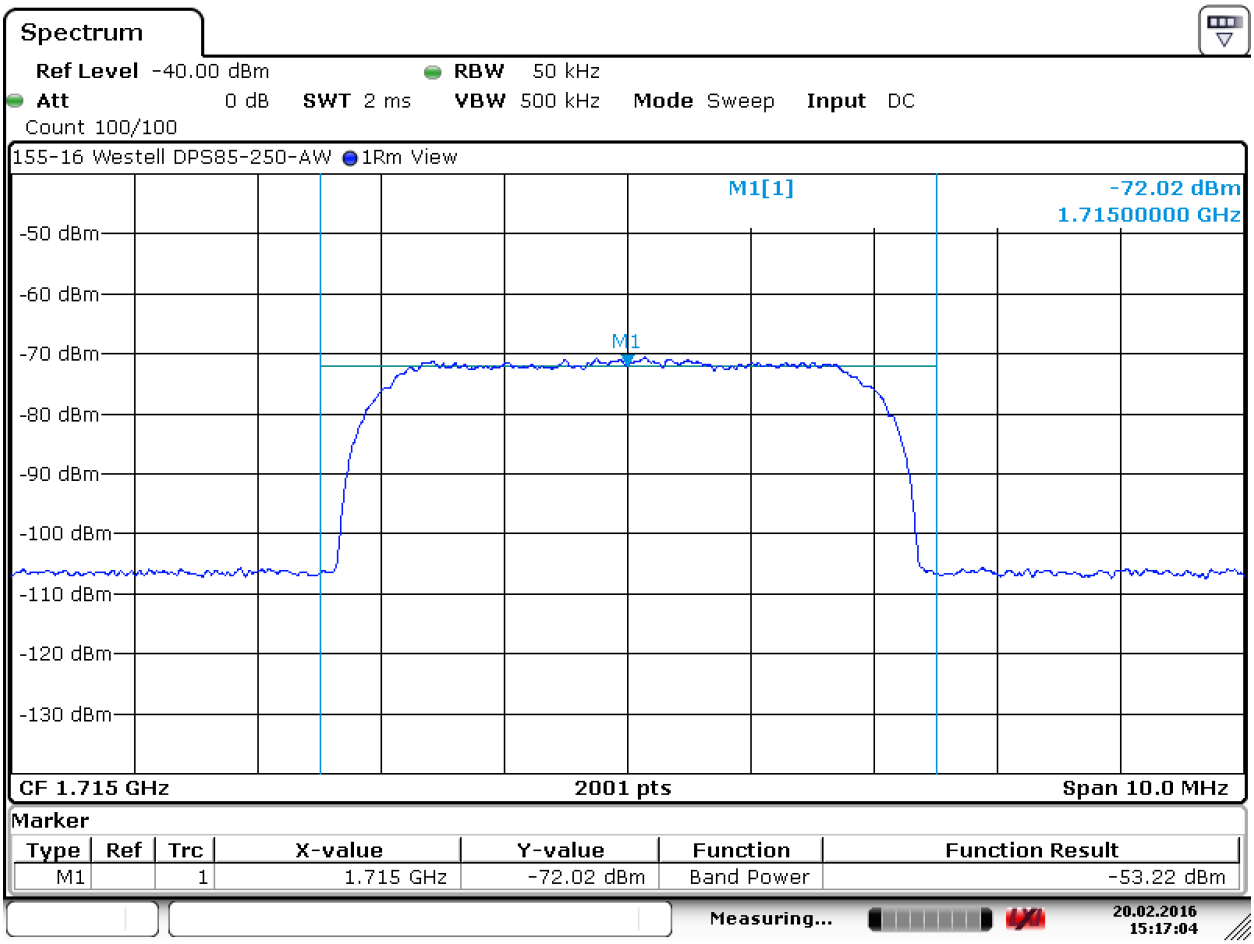
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.14. Mean Transmitter Output Power, 1715 MHz – Input Power



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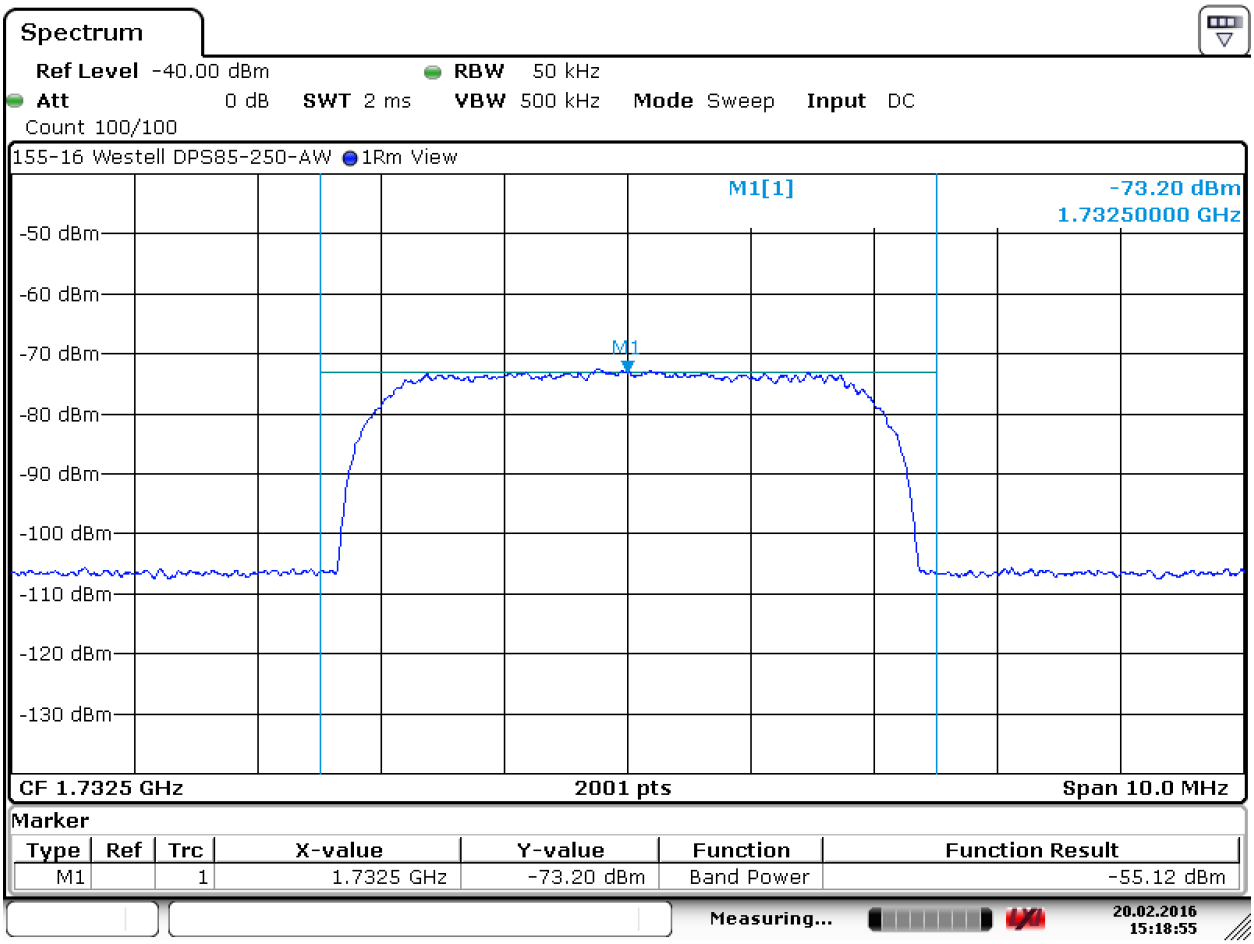
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.15. Mean Transmitter Output Power, 1732.5 MHz – Input Power



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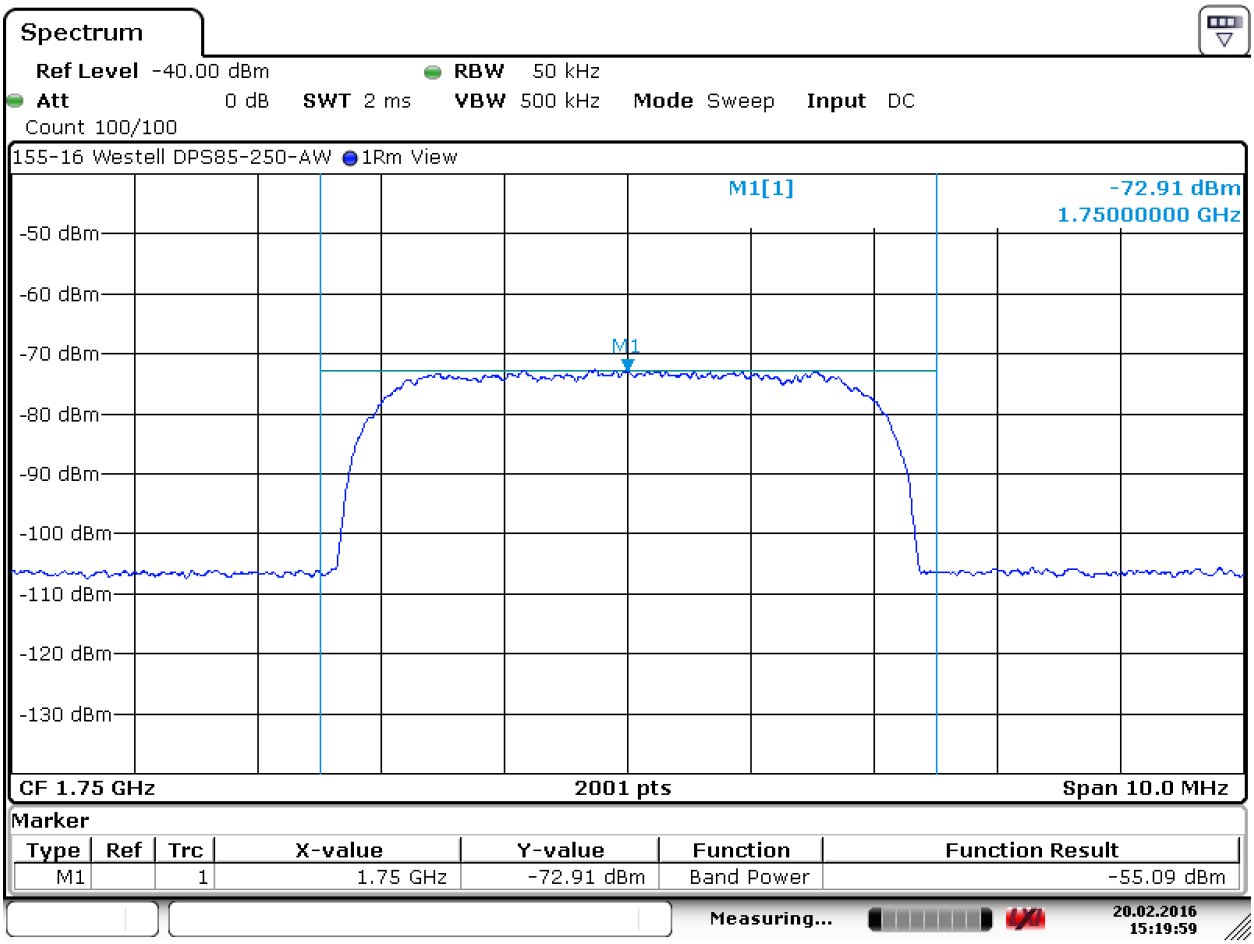
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.16. Mean Transmitter Output Power, 1750 MHz – Input Power



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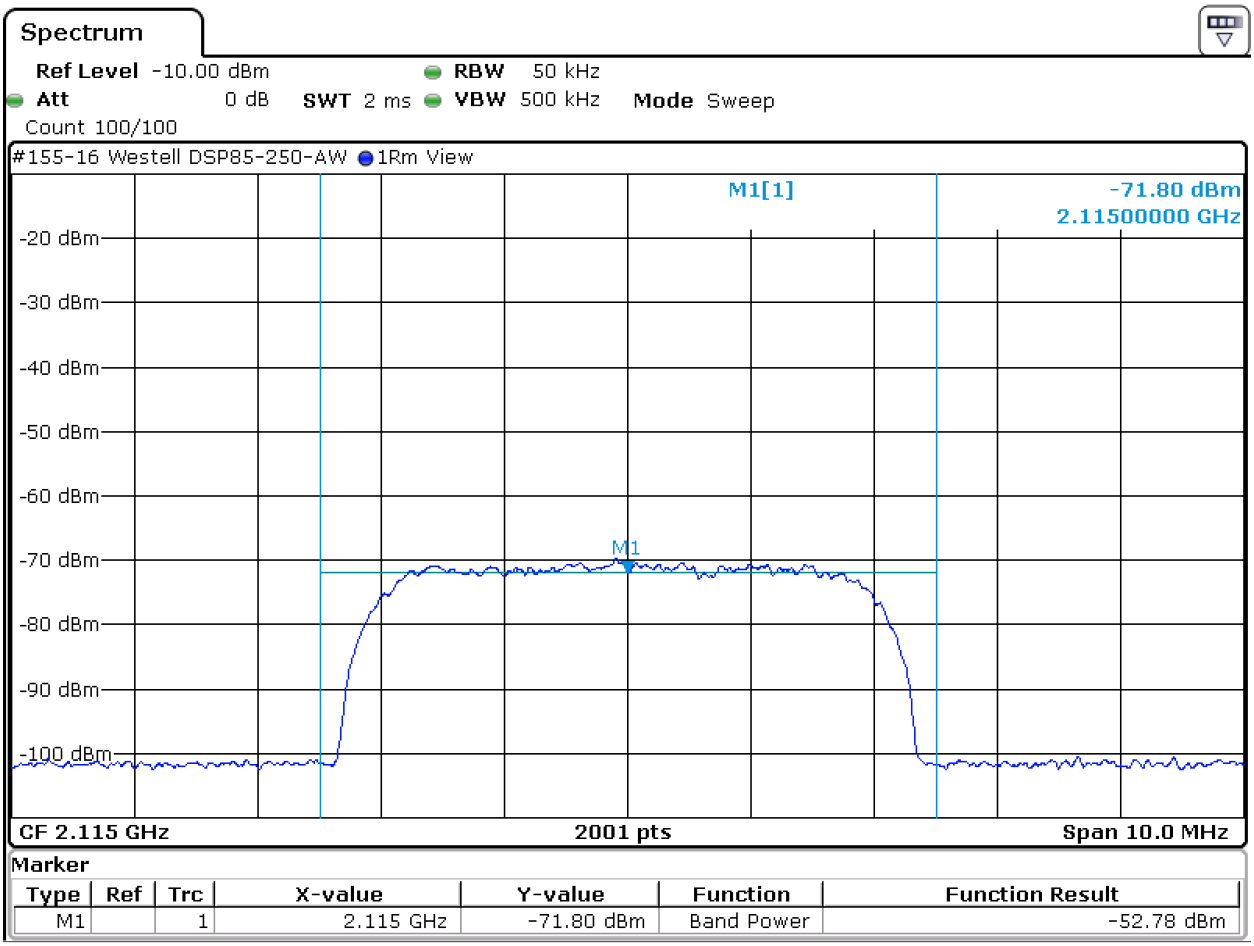
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.17. Mean Transmitter Output Power, 2115 MHz – Input Power



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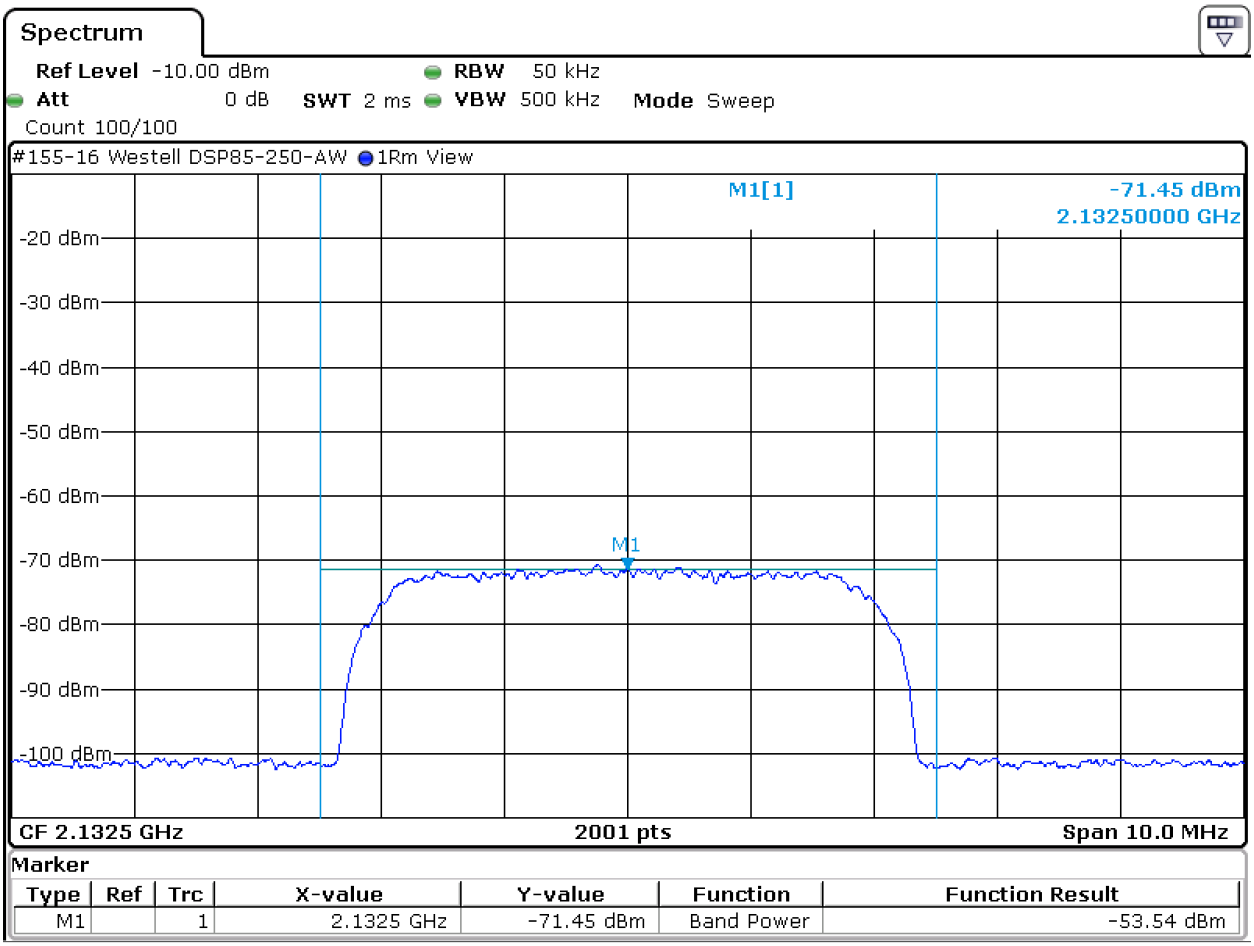
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.18. Mean Transmitter Output Power, 2132.5 MHz – Input Power



Date: 23.FEB.2016 16:17:27

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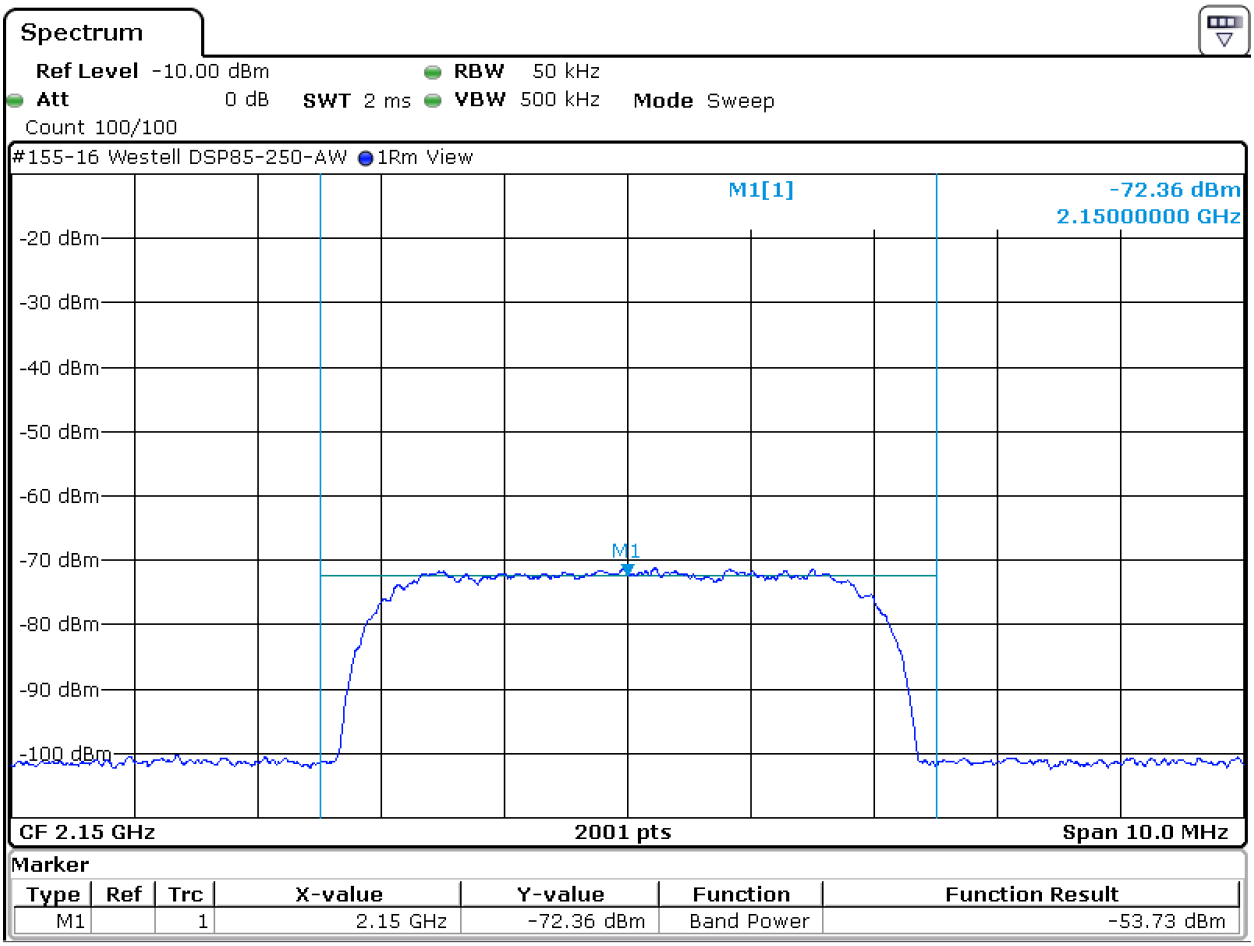
6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (cont)

6.1.19. Mean Transmitter Output Power, 2150 MHz – Input Power



Date: 23.FEB.2016 16:18:35

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6. Measurement Data

6.1. Power and Antenna Height Limits 27.50 (b)(4), RSS-139 6.5 (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."

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:

Description of Measurement	Center Frequency	Transmitter Power[1]	Cable Insertion Loss	Antenna Gain[2]	Total Output Power	
	(MHz)	(dBm)	(dB)	(dBi)	(dBm)	(Watts)
Output Power	1715	29.66	0.00	0.00	29.66	0.92
Output Power	1732.5	29.95	0.00	0.00	29.95	0.99
Output Power	1750	29.92	0.00	0.00	29.92	0.98
Output Power	2115	30.07	0.00	3.00	33.07	2.03
Output Power	2132.5	30.25	0.00	3.00	33.25	2.11
Output Power	2150	30.36	0.00	3.00	33.36	2.17
3 dB Above AGC	1715	32.42	0.00	0.00	32.42	1.75
3 dB Above AGC	1732.5	32.51	0.00	0.00	32.51	1.78
3 dB Above AGC	1750	32.86	0.00	0.00	32.86	1.93
3 dB Above AGC	2115	32.19	0.00	3.00	35.19	3.30
3 dB Above AGC	2132.5	32.20	0.00	3.00	35.20	3.31
3 dB Above AGC	2150	32.41	0.00	3.00	35.41	3.48

[1] Measured. See section 6.1.1.
[2] Customer supplied 3 dBi for Downlink, 0 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 30 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.

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6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6

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.

Test Method: KDB 935210 Section 3.4

6.2.1. Occupied (99% Power) Bandwidth

Description of Measurement	Center Frequency	Occupied Bandwidth	Result
	MHz	(MHz)	
Output	1715	4.177	Compliant
Output	1732.5	4.177	Compliant
Output	1750	4.177	Compliant
Output	2115	4.177	Compliant
Output	2132.5	4.188	Compliant
Output	2150	4.193	Compliant
Input	1715	4.192	Compliant
Input	1732.5	4.178	Compliant
Input	1750	4.192	Compliant
Input	2115	4.213	Compliant
Input	2132.5	4.213	Compliant
Input	2150	4.213	Compliant

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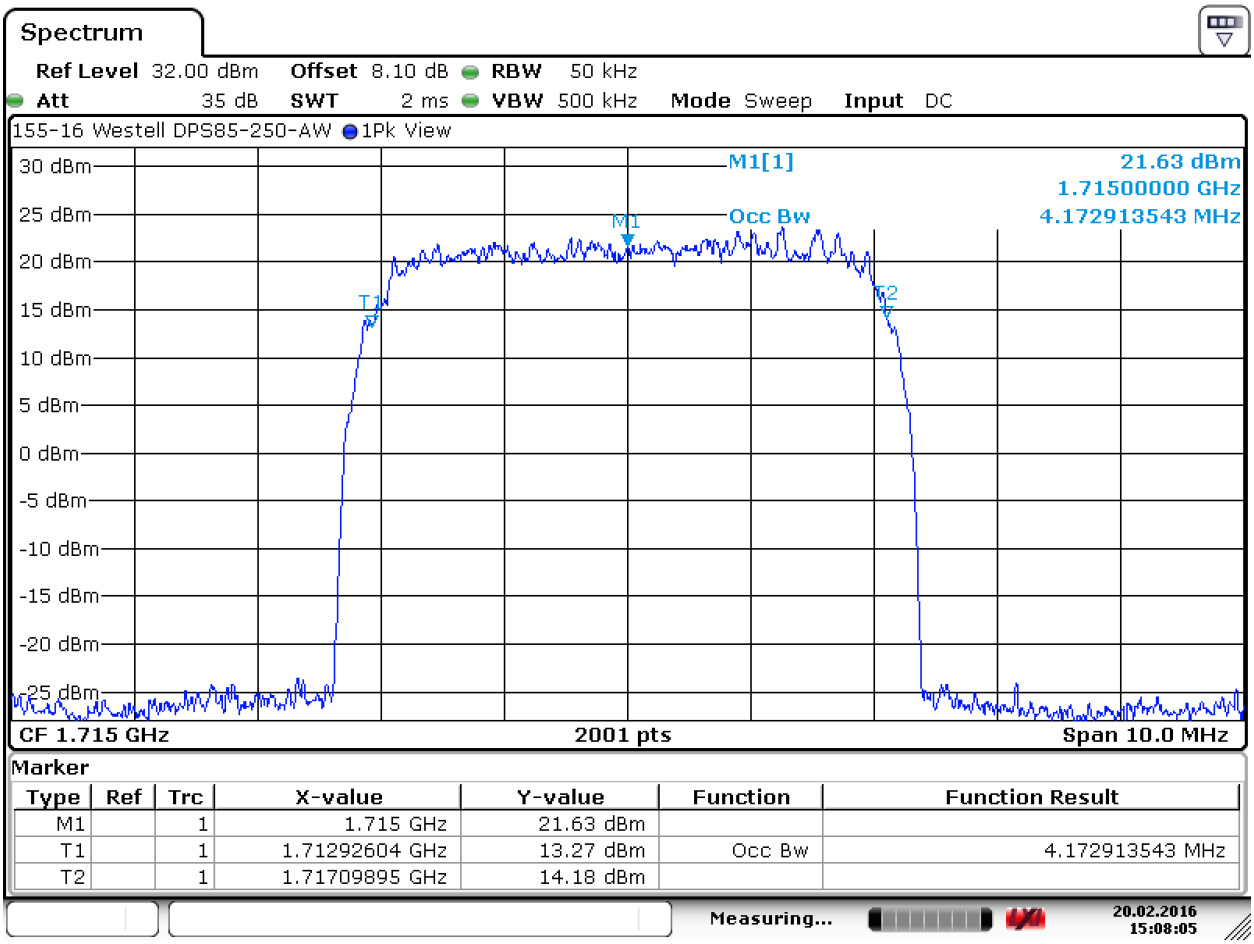
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.1. Occupied (99% Power) Bandwidth Measurement, 1715 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.715 GHz	21.63 dBm		
T1		1	1.71292604 GHz	13.27 dBm	Occ Bw	4.172913543 MHz
T2		1	1.71709895 GHz	14.18 dBm		

Date: 20.FEB.2016 15:08:05

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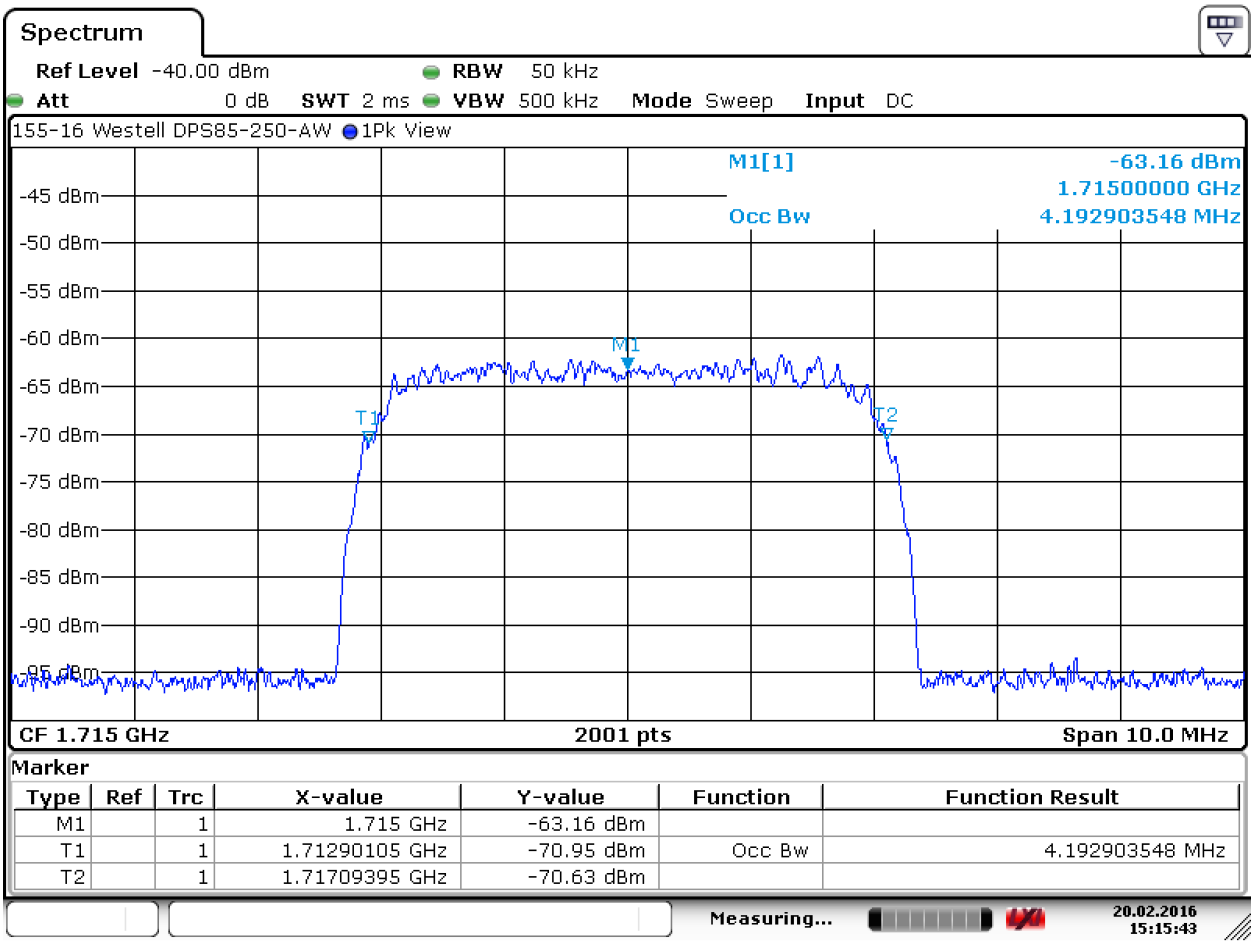
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.2. Occupied (99% Power) Bandwidth Input Signal, 1715 MHz



Date: 20.FEB.2016 15:15:43

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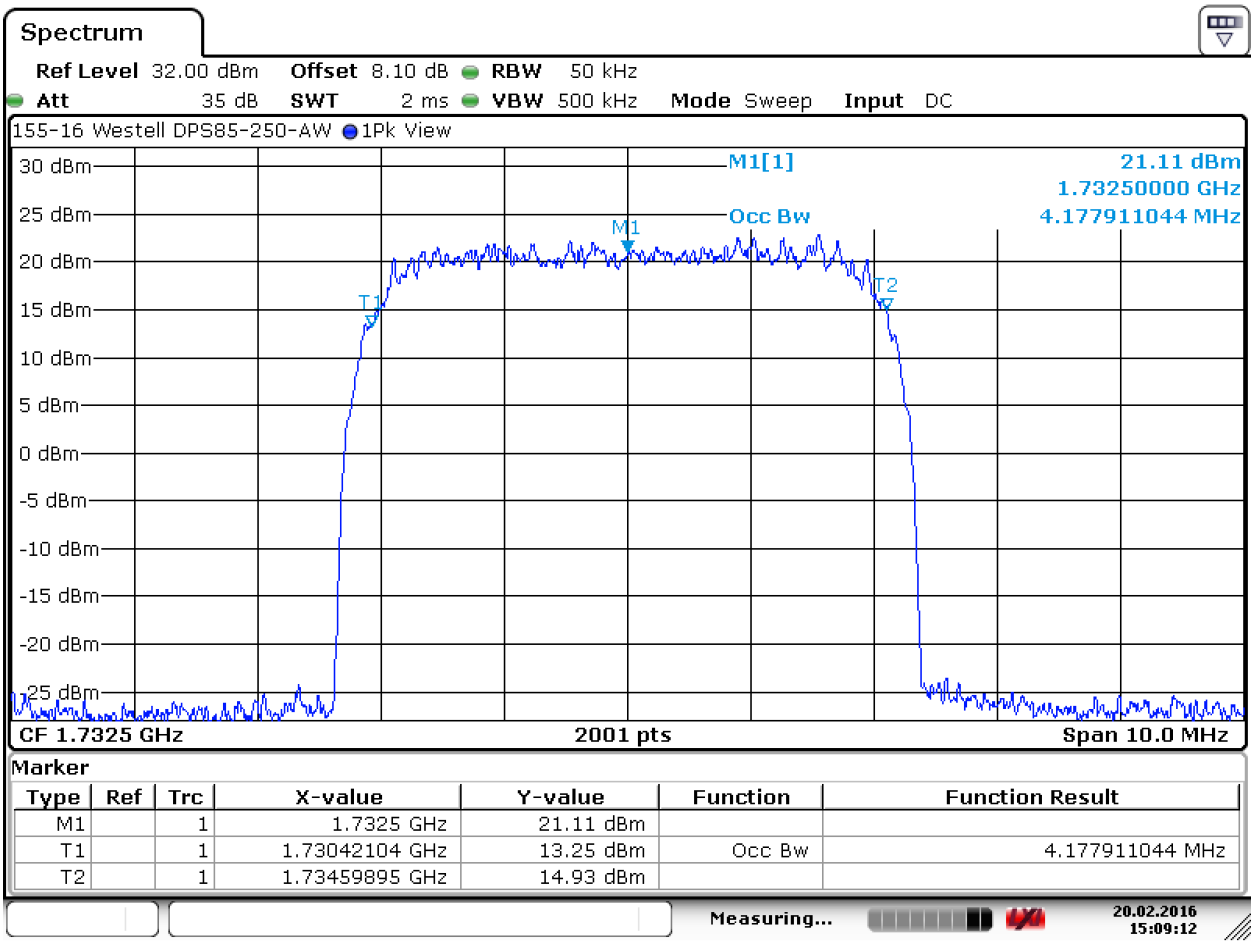
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.3. Occupied (99% Power) Bandwidth Measurement, 1732.5 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.7325 GHz	21.11 dBm		
T1		1	1.73042104 GHz	13.25 dBm	Occ Bw	4.177911044 MHz
T2		1	1.73459895 GHz	14.93 dBm		

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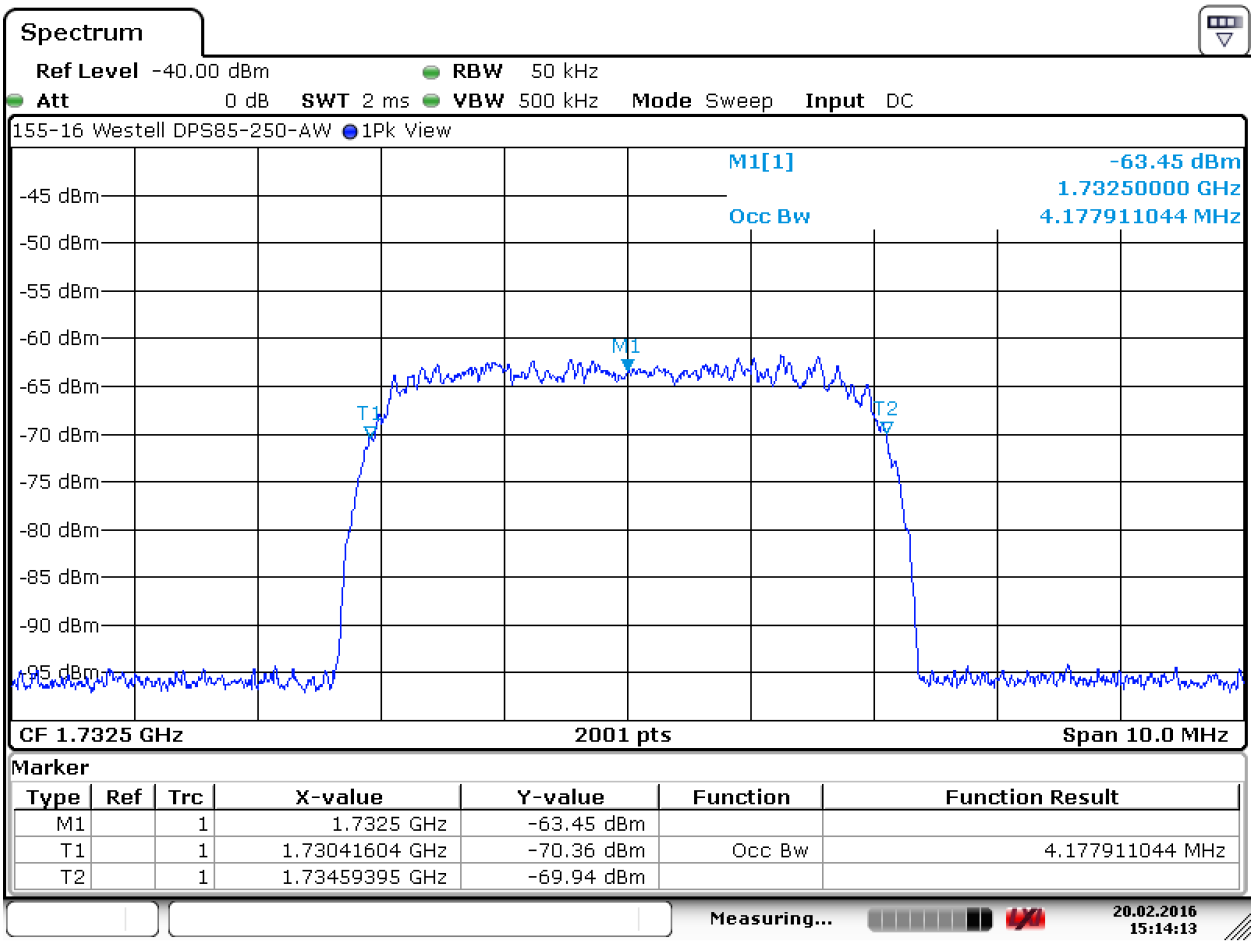
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.4. Occupied (99% Power) Bandwidth Input Signal, 1732.5 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.7325 GHz	-63.45 dBm		
T1		1	1.73041604 GHz	-70.36 dBm	Occ Bw	4.177911044 MHz
T2		1	1.73459395 GHz	-69.94 dBm		

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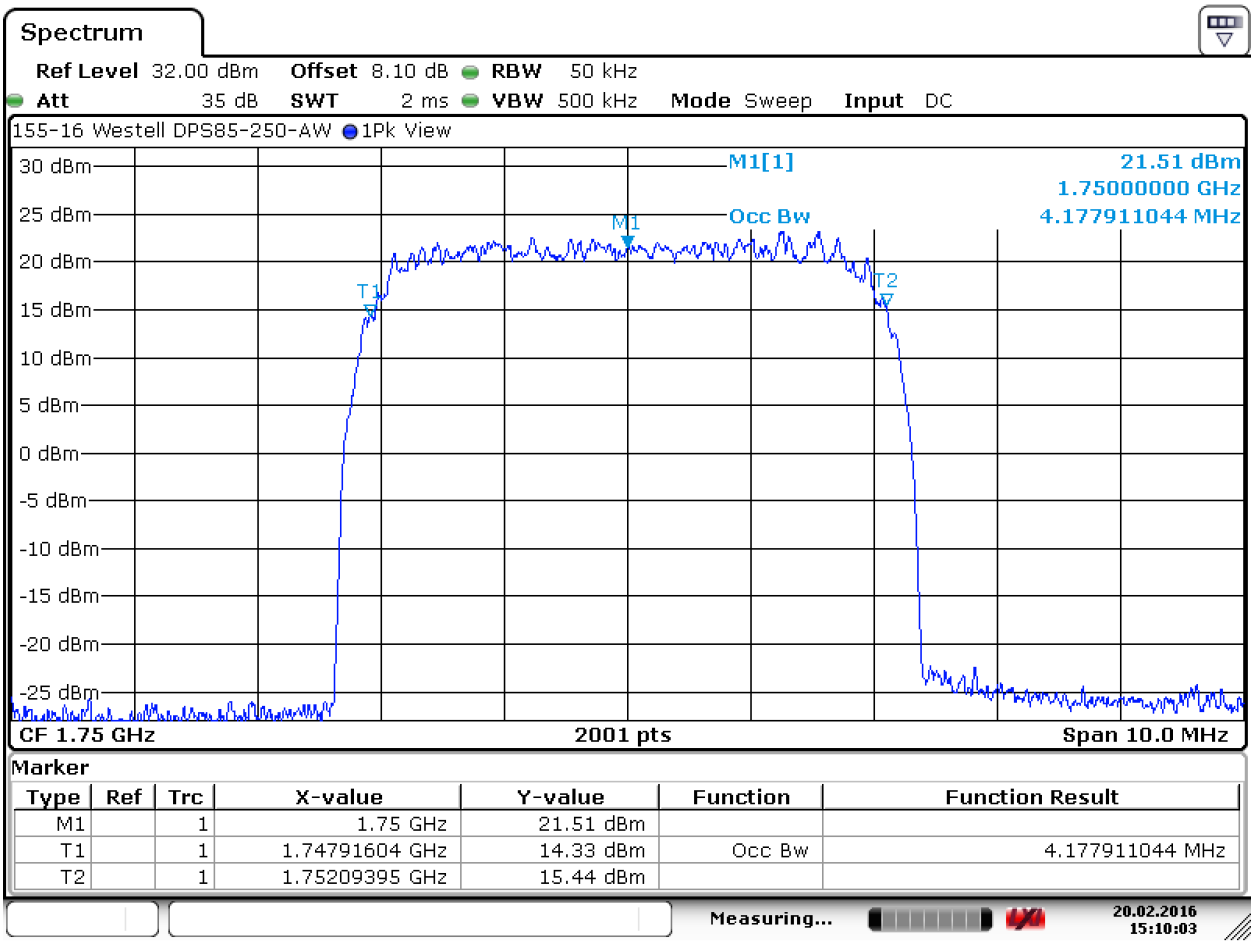
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.5. Occupied (99% Power) Bandwidth Measurement, 1750 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.75 GHz	21.51 dBm		
T1		1	1.74791604 GHz	14.33 dBm	Occ Bw	4.177911044 MHz
T2		1	1.75209395 GHz	15.44 dBm		

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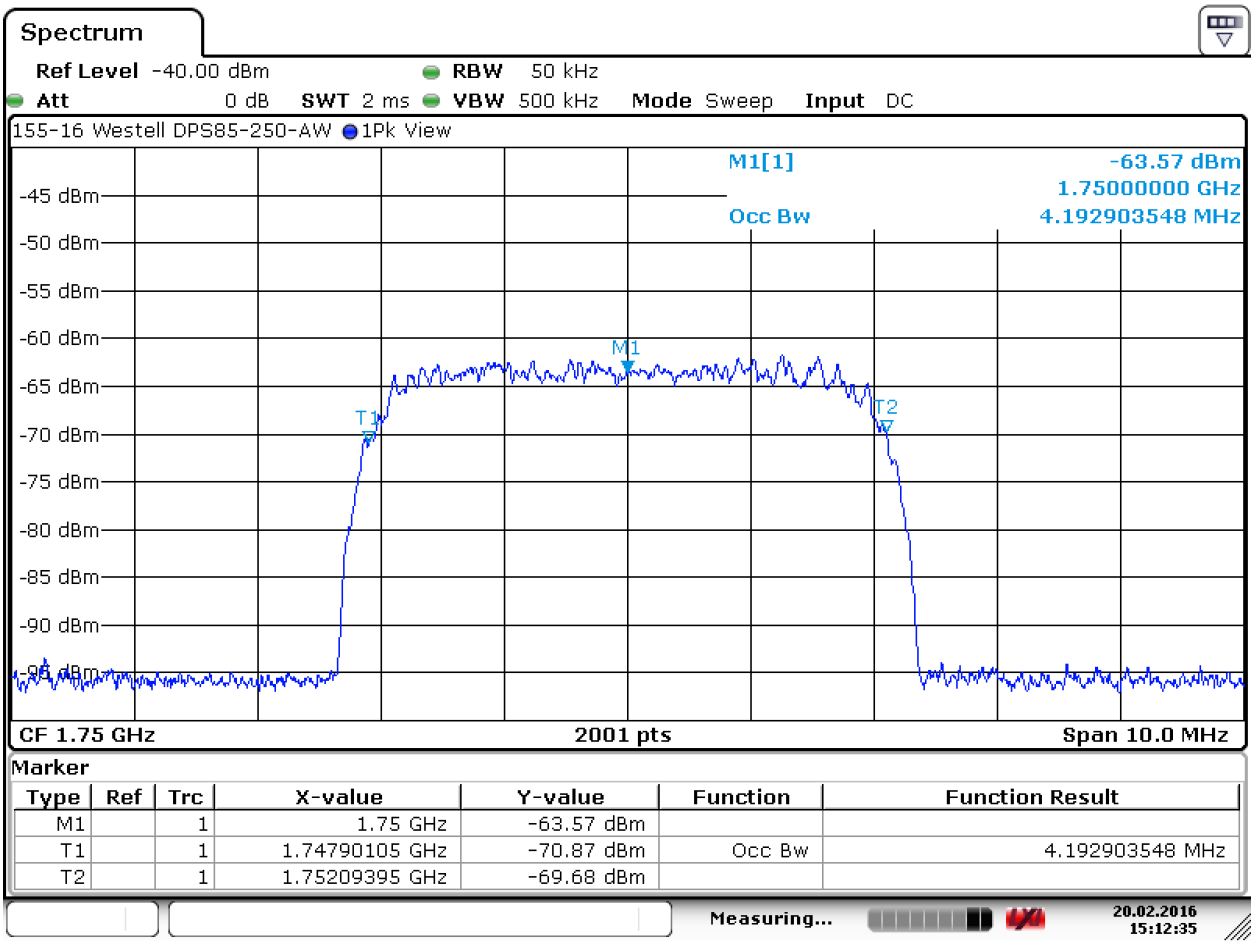
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.6. Occupied (99% Power) Bandwidth Input Signal, 1750 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.75 GHz	-63.57 dBm		
T1		1	1.74790105 GHz	-70.87 dBm	Occ Bw	4.192903548 MHz
T2		1	1.75209395 GHz	-69.68 dBm		

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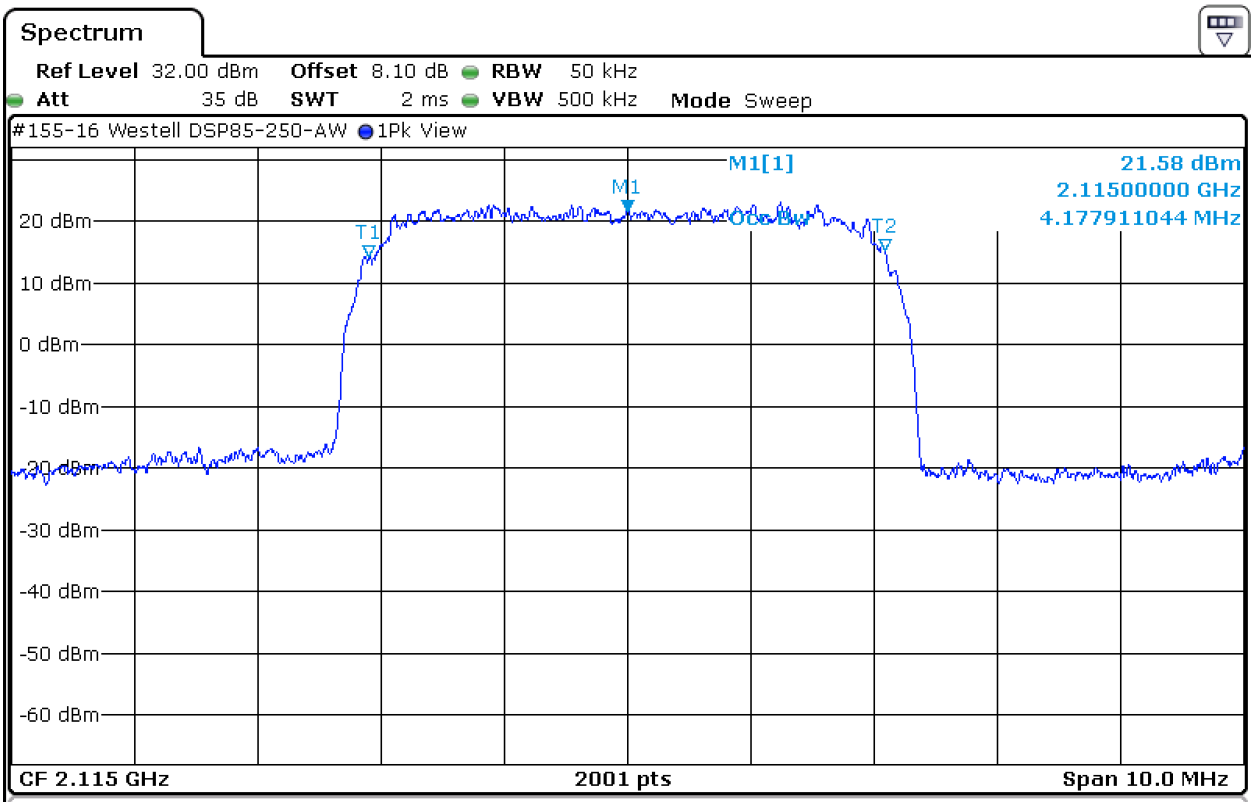
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.7. Occupied (99% Power) Bandwidth Measurement, 2115 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.115 GHz	21.58 dBm		
T1		1	2.11290605 GHz	14.25 dBm	Occ Bw	4.177911044 MHz
T2		1	2.11708396 GHz	15.29 dBm		

Date: 23.FEB.2016 16:06:11

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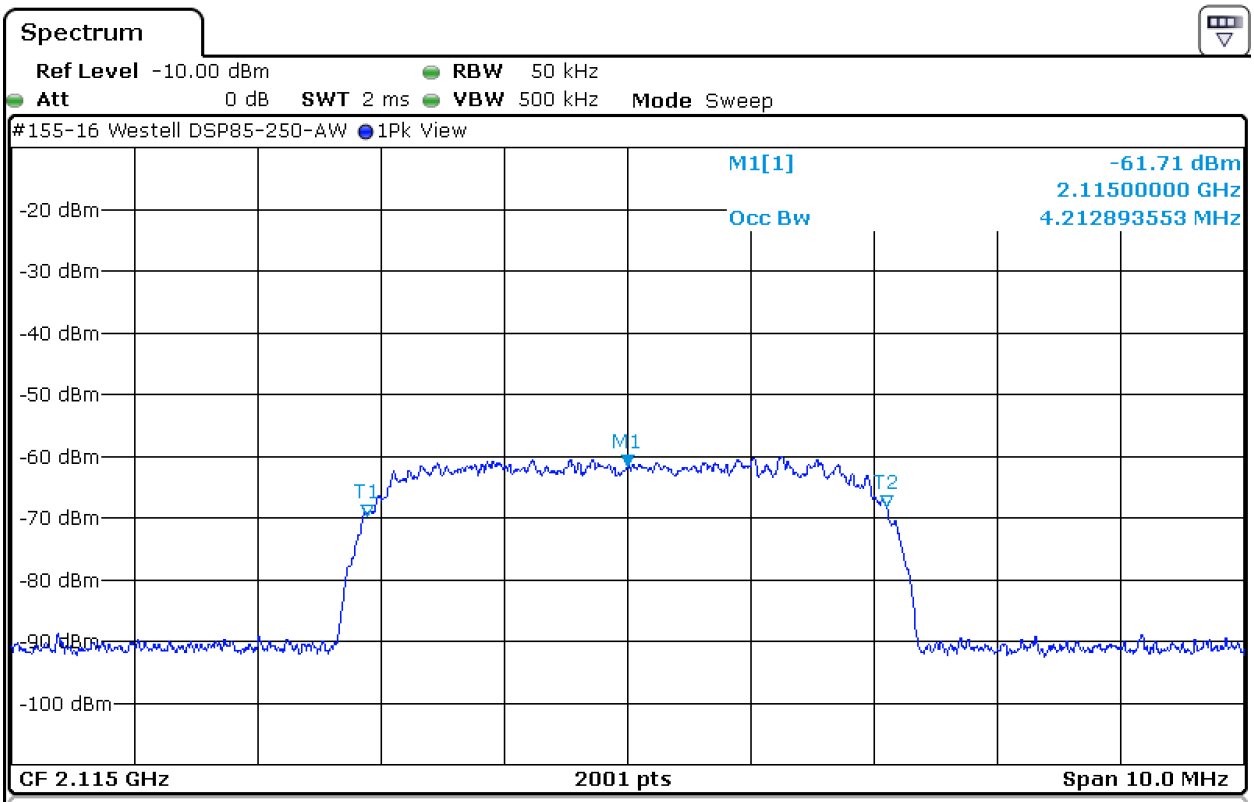
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.8. Occupied (99% Power) Bandwidth Input Signal, 2115 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.115 GHz	-61.71 dBm		
T1		1	2.11289105 GHz	-69.62 dBm	Occ Bw	4.212893553 MHz
T2		1	2.11710395 GHz	-68.33 dBm		

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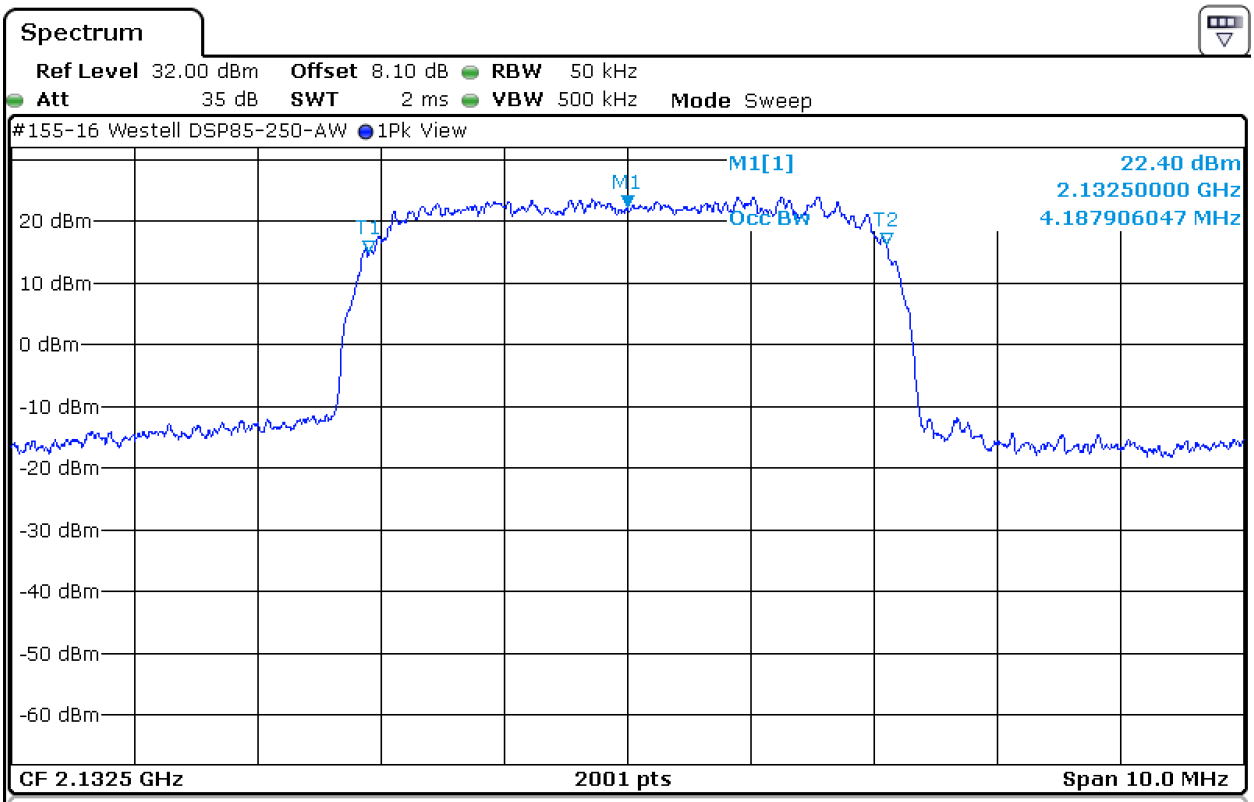
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.9. Occupied (99% Power) Bandwidth Measurement, 2132.5 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.1325 GHz	22.40 dBm		
T1		1	2.13040605 GHz	15.16 dBm	Occ Bw	4.187906047 MHz
T2		1	2.13459395 GHz	16.37 dBm		

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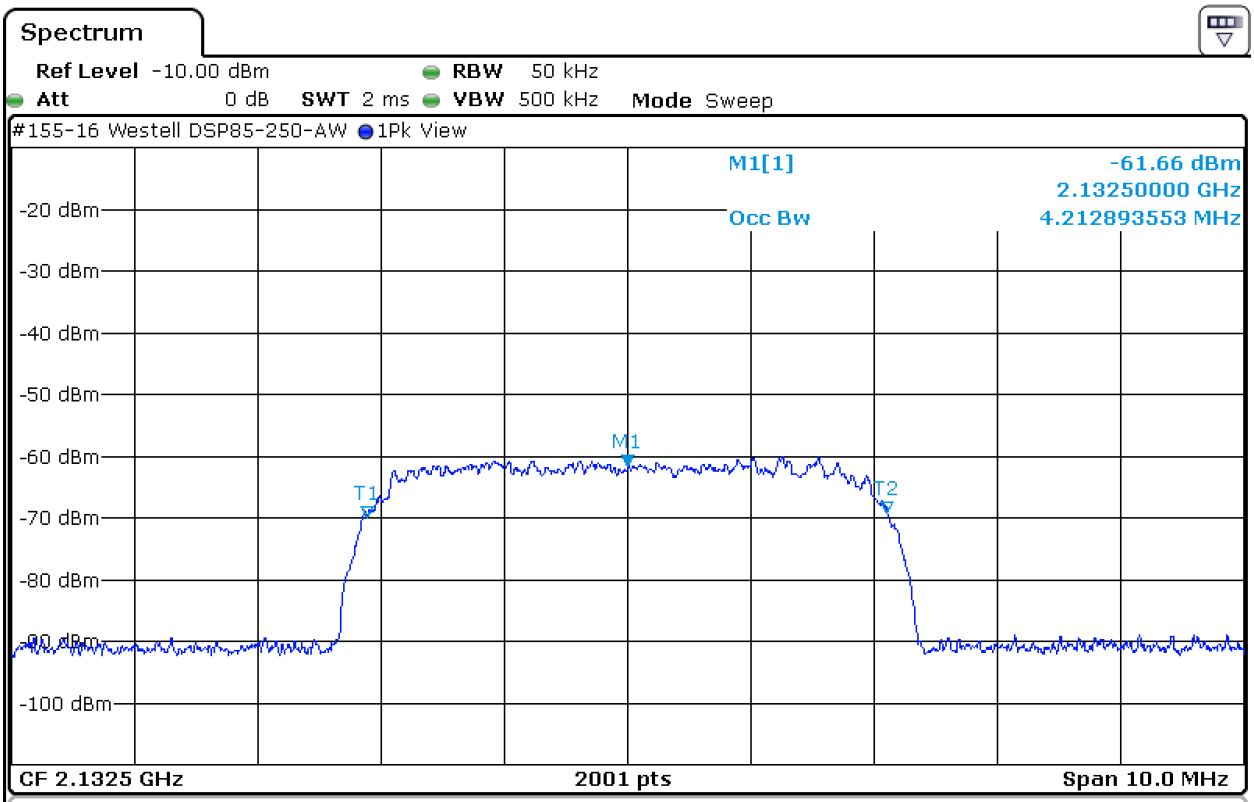
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.10. Occupied (99% Power) Bandwidth Input Signal, 2132.5 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.1325 GHz	-61.66 dBm		
T1		1	2.13039105 GHz	-69.97 dBm	Occ Bw	4.212893553 MHz
T2		1	2.13460395 GHz	-69.27 dBm		

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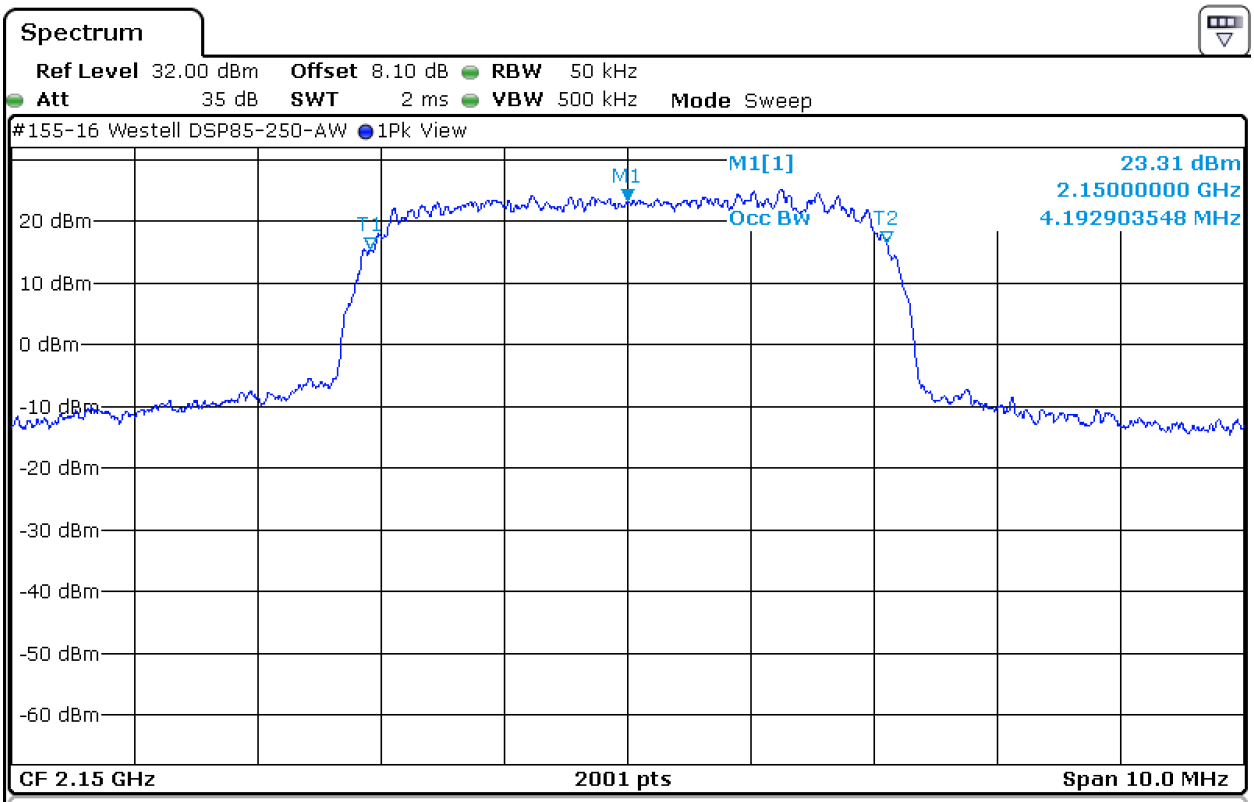
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.11. Occupied (99% Power) Bandwidth Measurement, 2150 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.15 GHz	23.31 dBm		
T1		1	2.14791104 GHz	15.43 dBm	Occ Bw	4.192903548 MHz
T2		1	2.15210395 GHz	16.66 dBm		

Date: 23.FEB.2016 16:09:24

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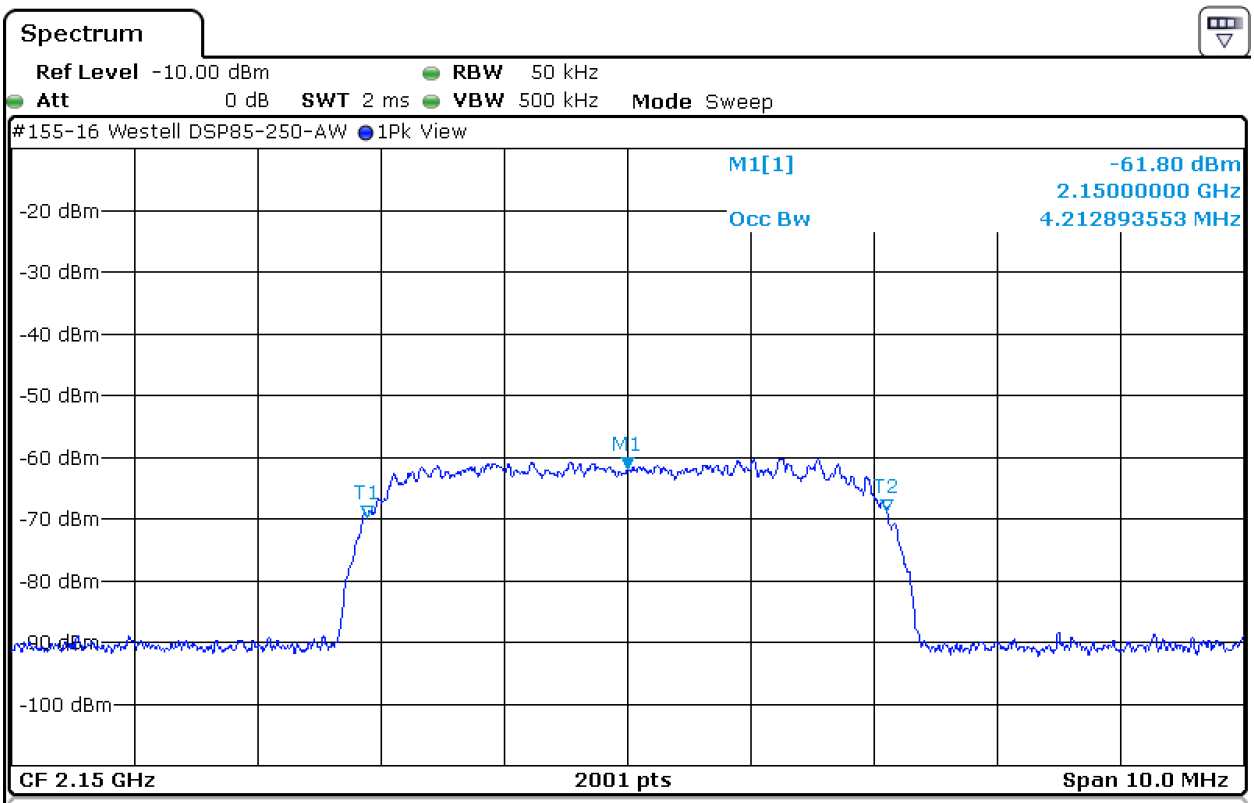
6. Measurement Data (continued)

6.2. Bandwidth Limitations FCC Part 2.1049, RSS-GEN 6.6 (continued)

6.2.1.12. Occupied (99% Power) Bandwidth Input Signal, 2150 MHz



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.15 GHz	-61.80 dBm		
T1		1	2.14789105 GHz	-69.74 dBm	Occ Bw	4.212893553 MHz
T2		1	2.15210395 GHz	-68.63 dBm		

Date: 23.FEB.2016 16:11:41

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6. Measurement Data (continued)

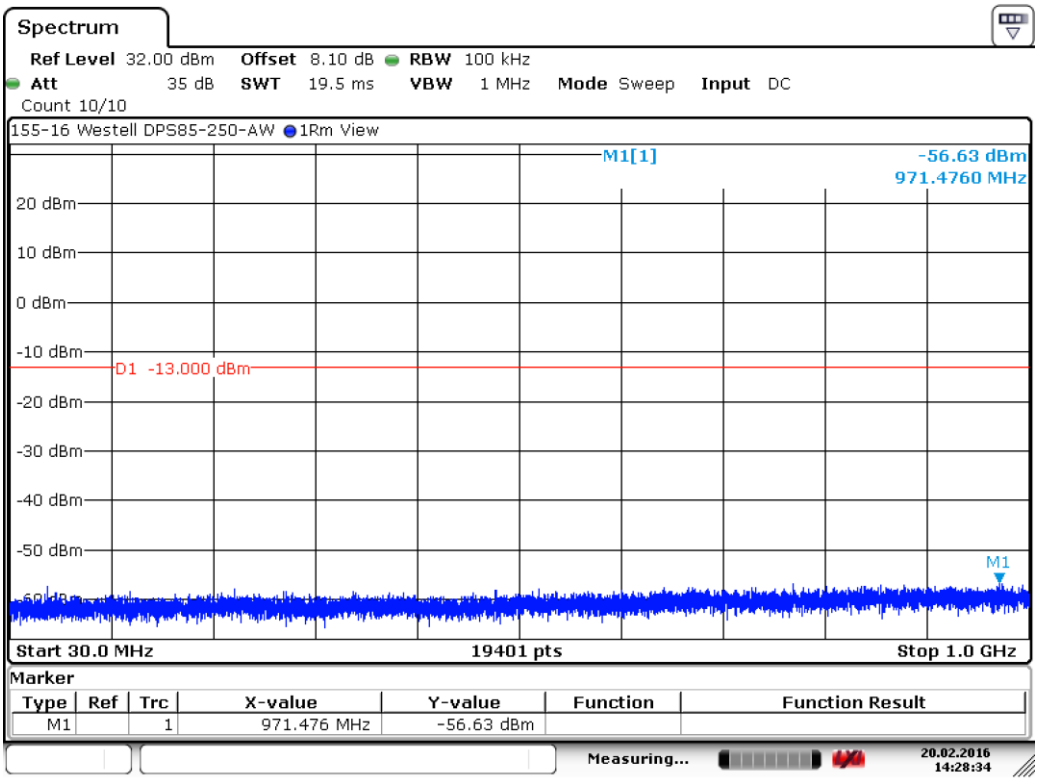
6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6

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.

Test Method: KDB 935210 Section 3.6.3

6.3.1. 1715 MHz, 30 MHz to 1 GHz



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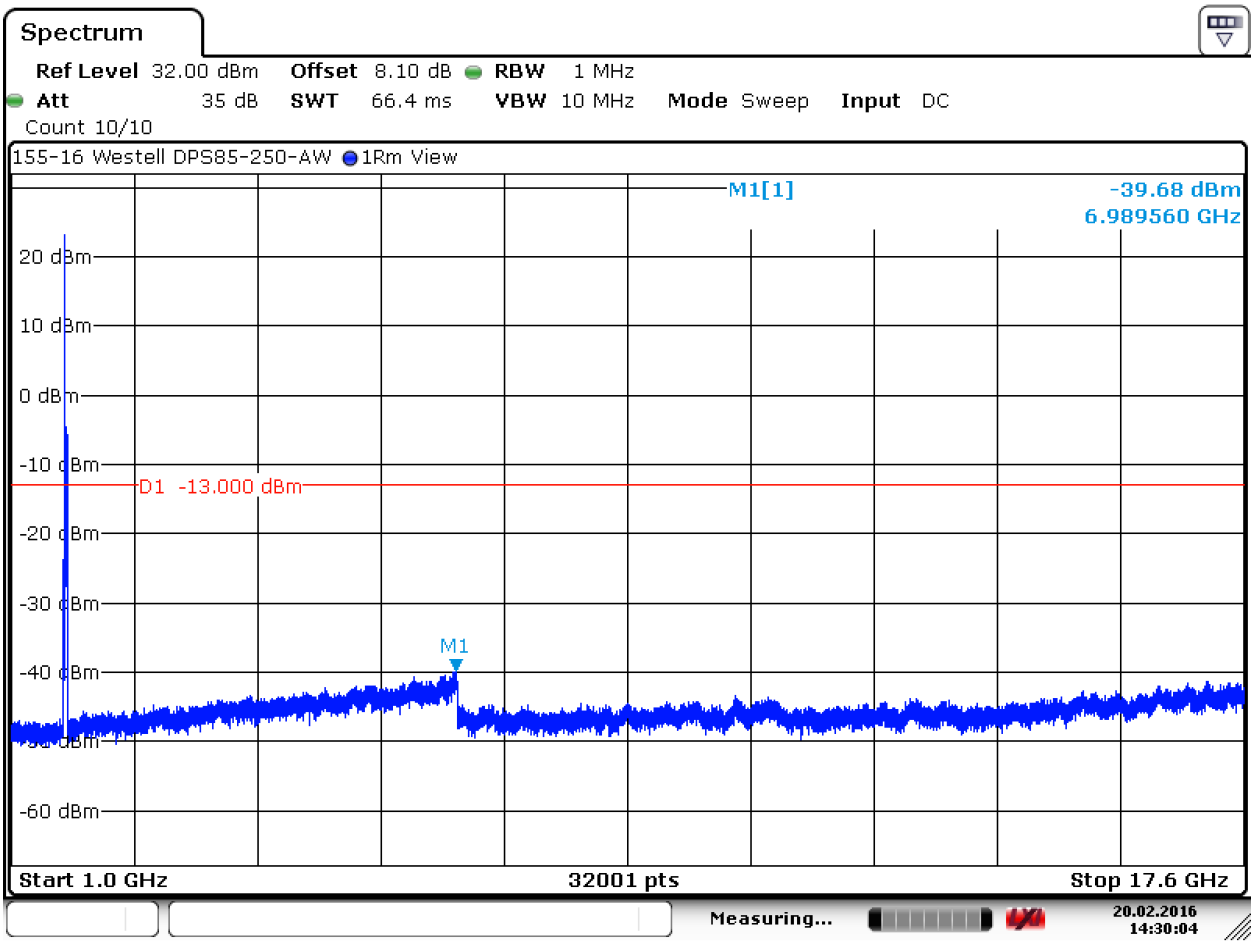
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.2. 1715 MHz, 1 to 17.6 GHz



Date: 20.FEB.2016 14:30:03

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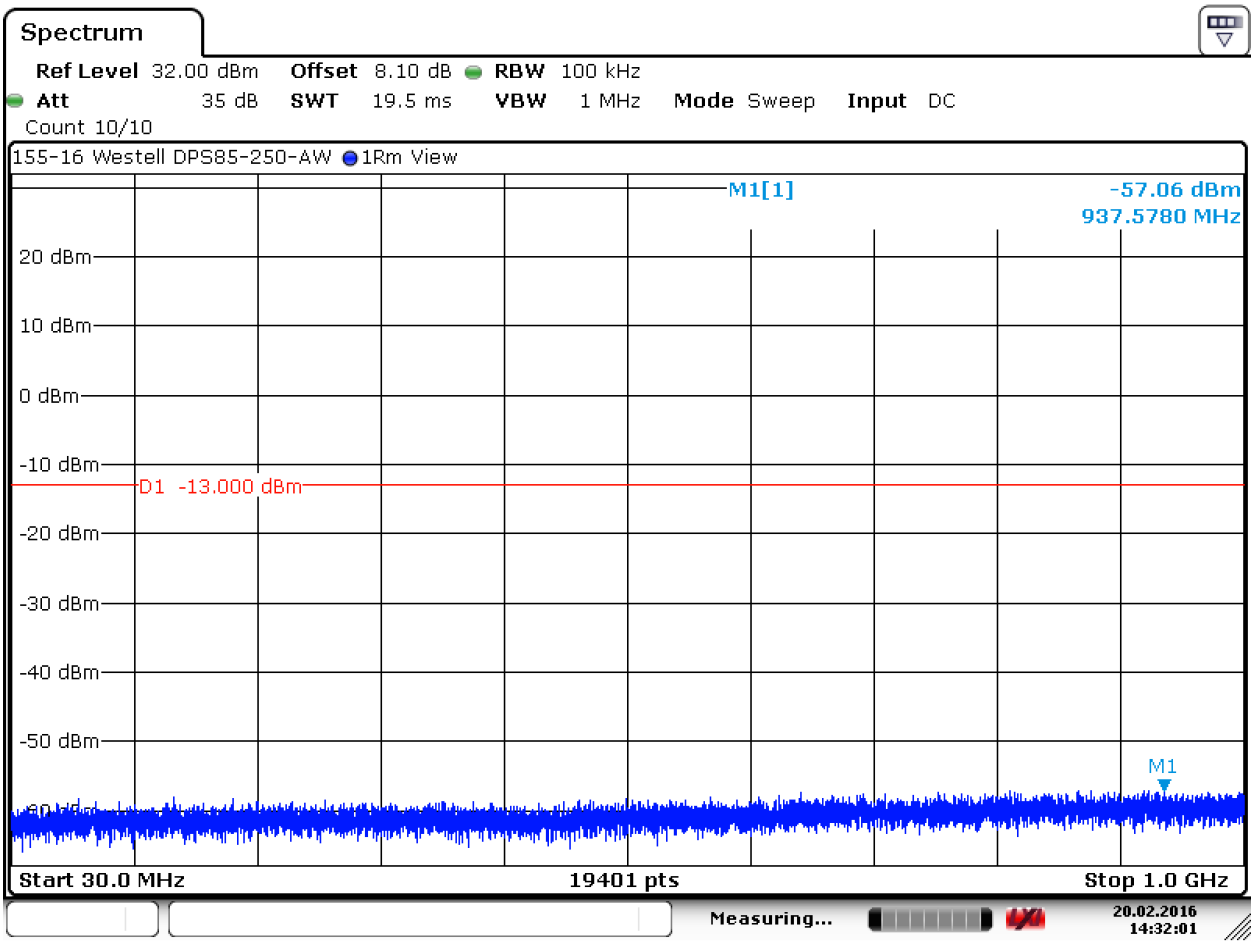
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.3. 1732.5 MHz, 30 MHz to 1 GHz



Date: 20.FEB.2016 14:32:00

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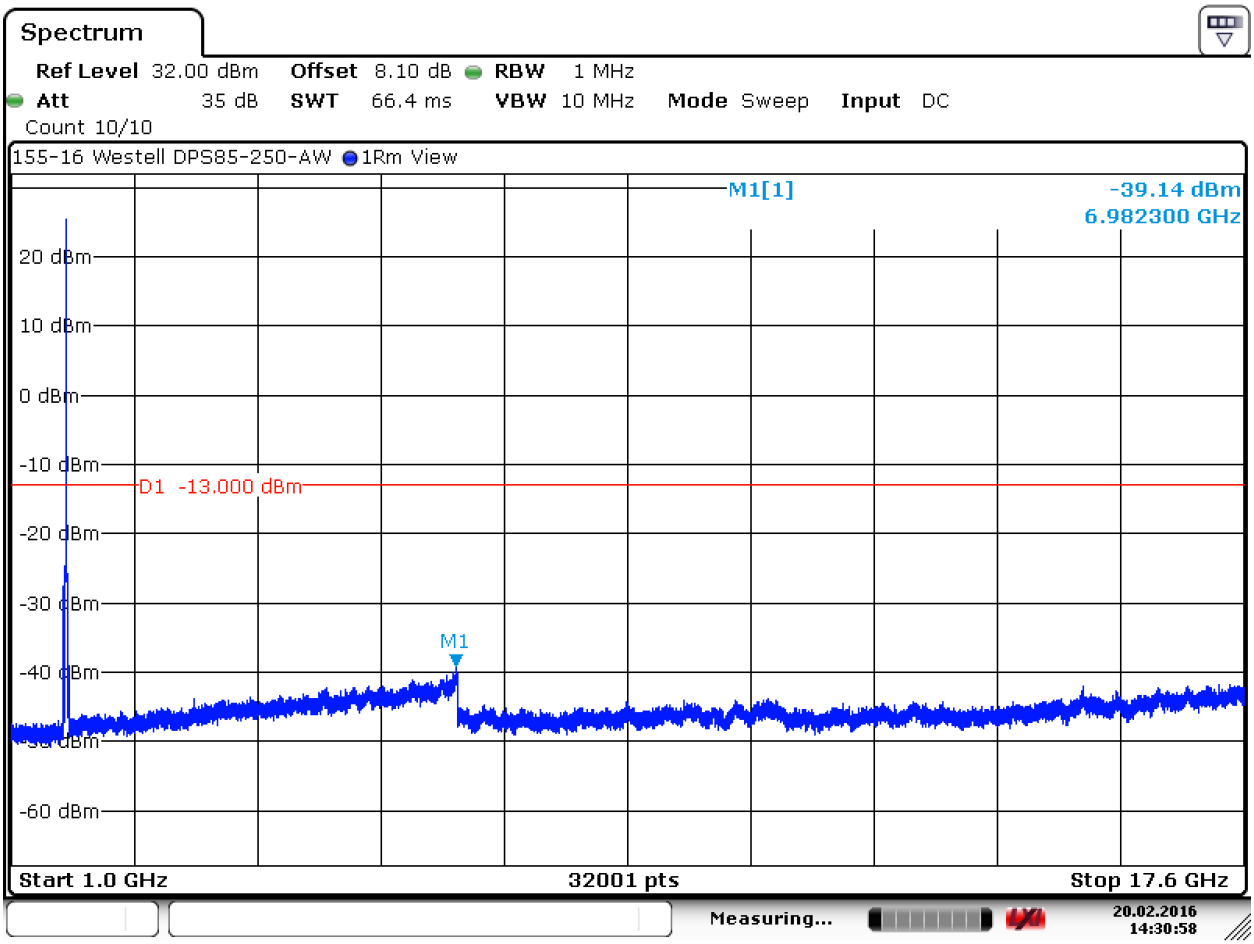
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.4. 1732.5 MHz, 1 to 17.6 GHz



Date: 20.FEB.2016 14:30:57

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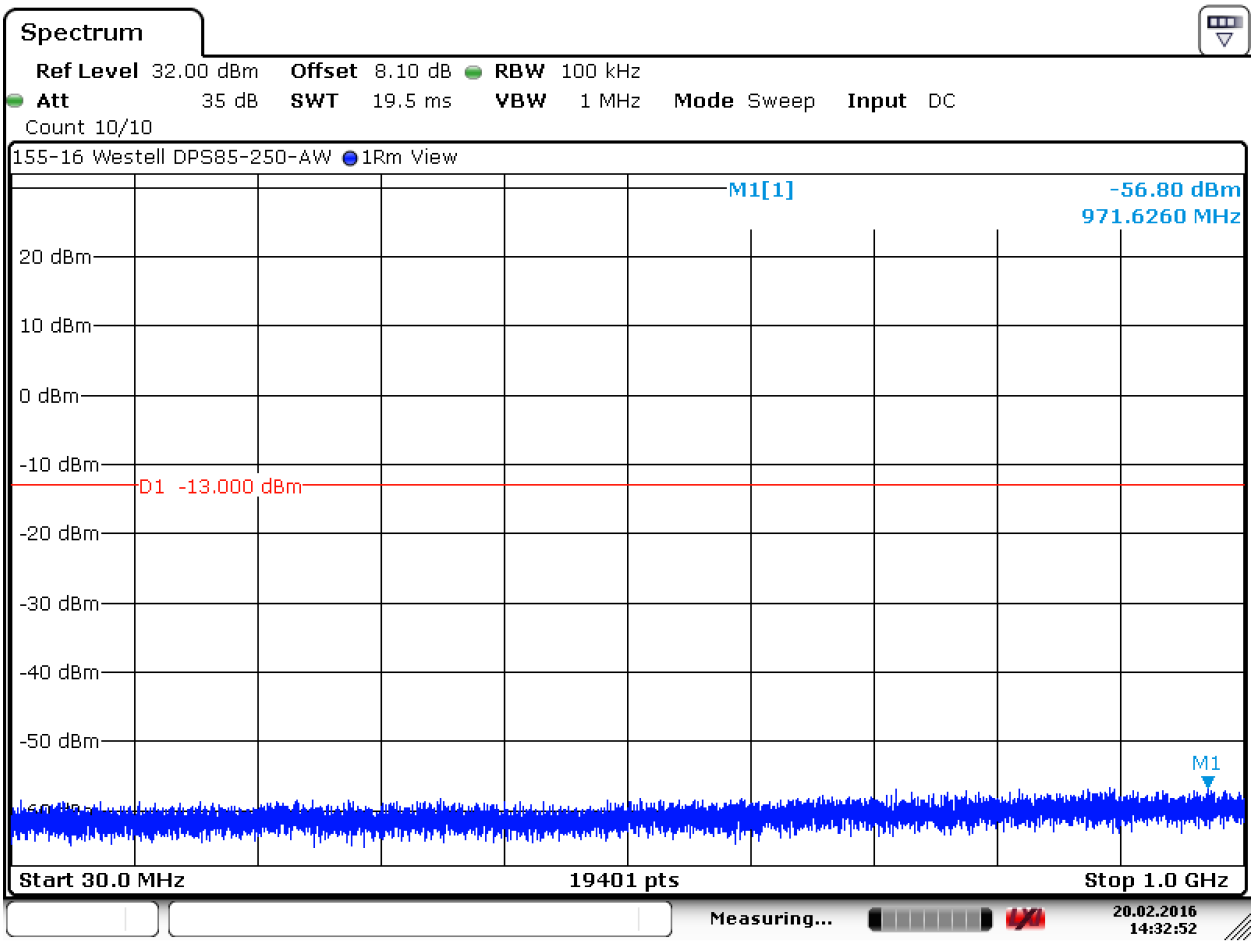
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.5. 1750 MHz, 30 MHz to 1 GHz



Date: 20.FEB.2016 14:32:52

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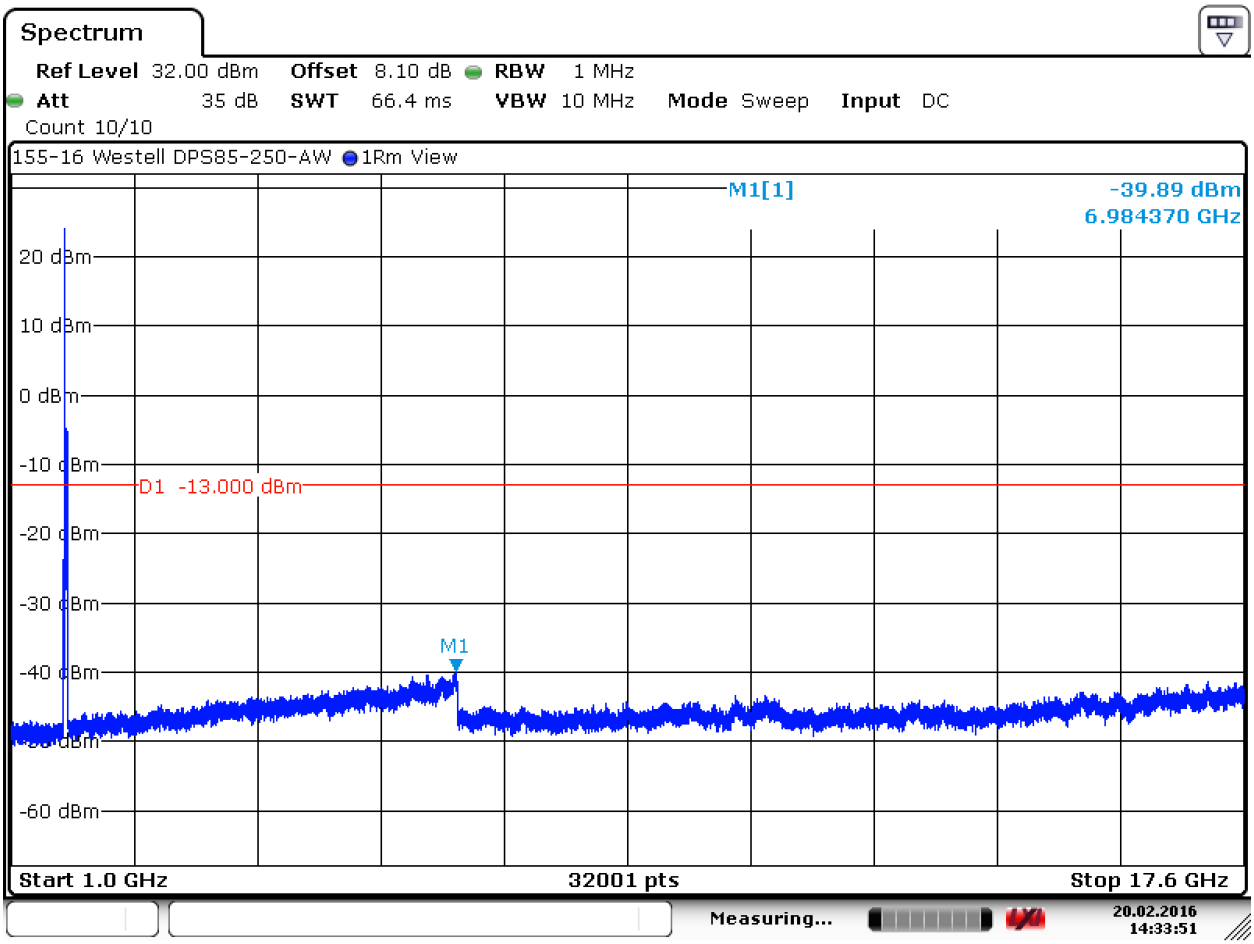
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.6. 1750 MHz, 1 to 17.6 GHz



Date: 20.FEB.2016 14:33:51

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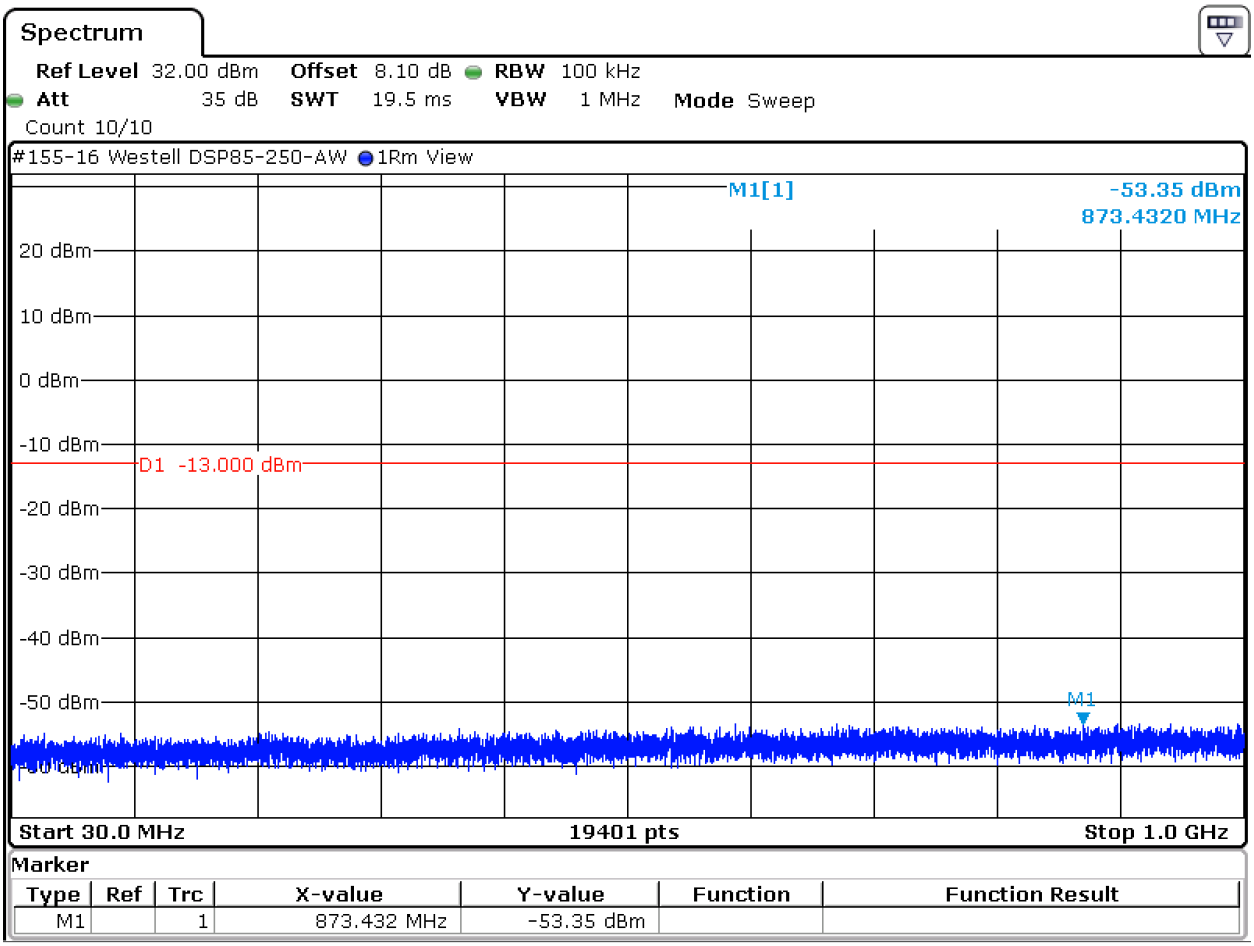
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.7. 2115 MHz, 30 MHz to 1 GHz



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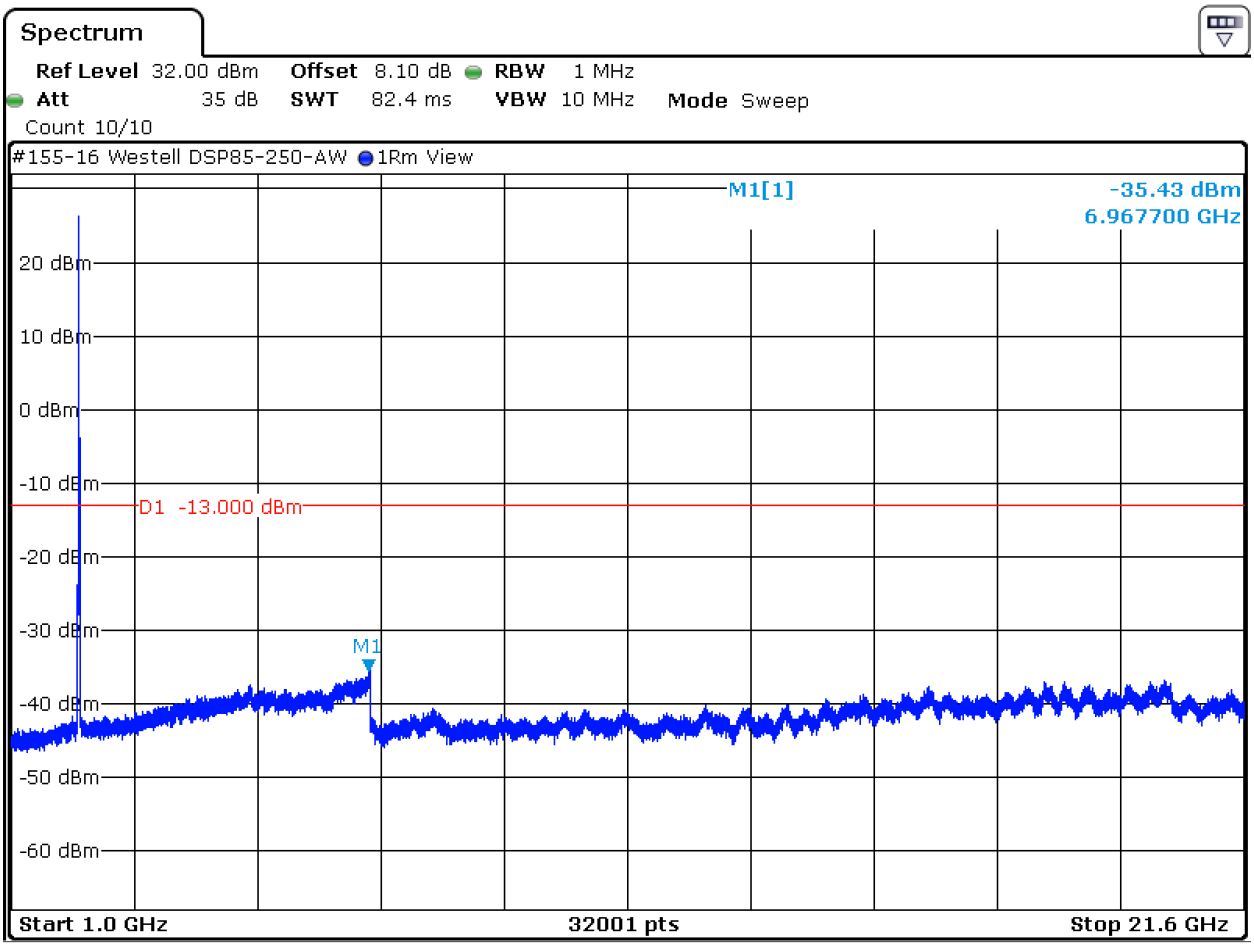
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.8. 2115 MHz, 1 to 21.6 GHz



Date: 23.FEB.2016 15:53:02

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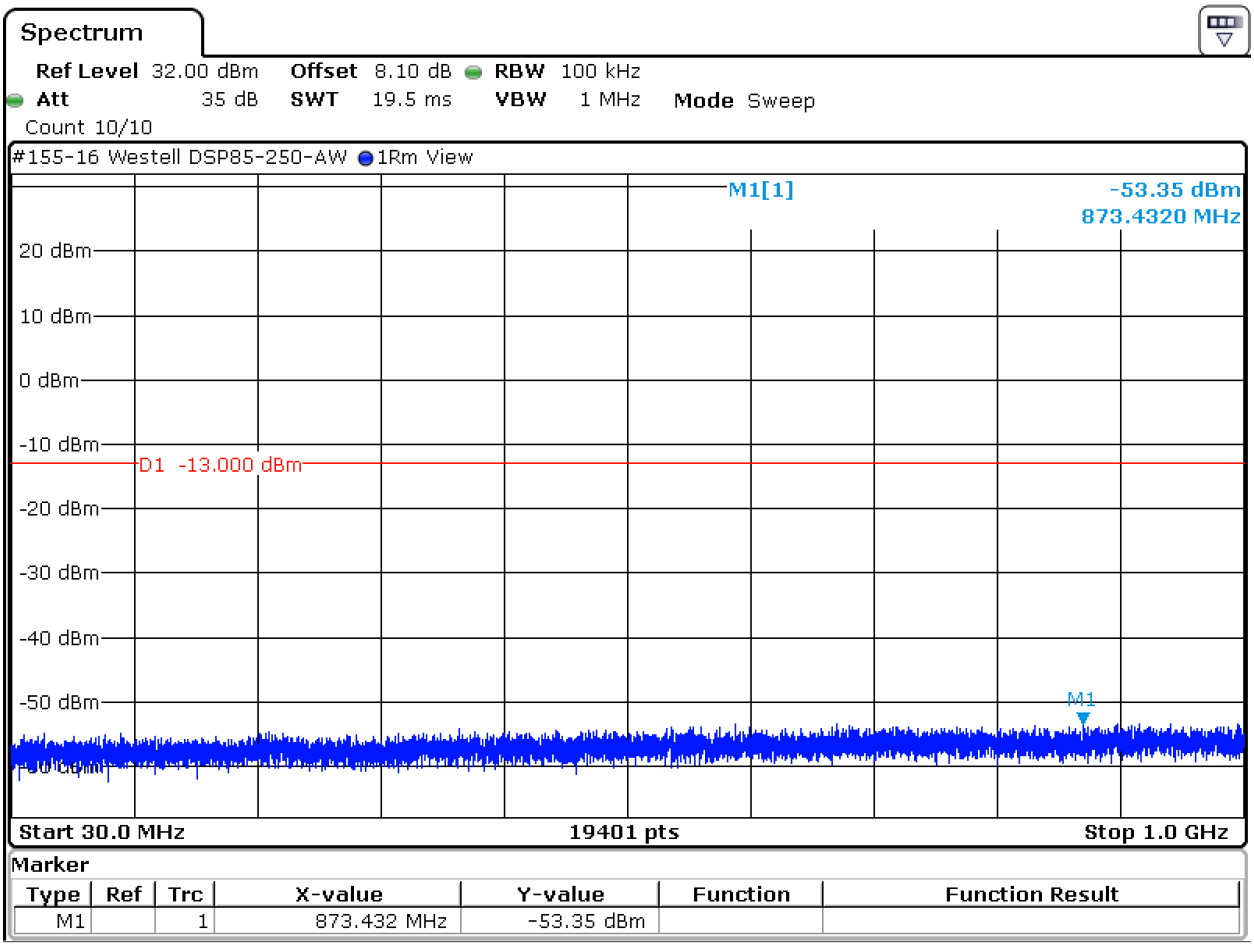
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.9. 2132.5 MHz, 30 MHz to 1 GHz



Date: 23.FEB.2016 15:49:44

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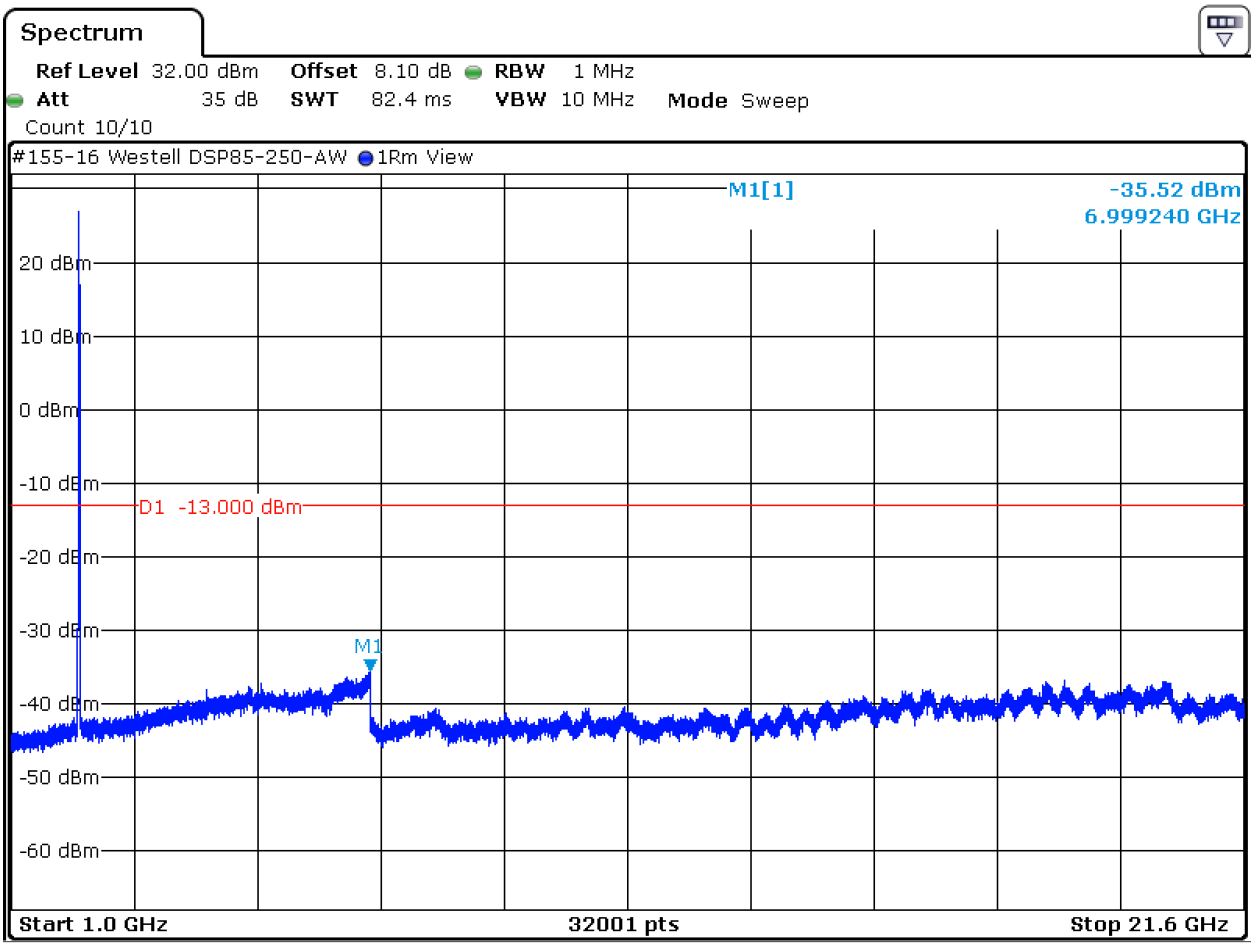
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.10. 2132.5 MHz, 1 to 21.6 GHz



Date: 23.FEB.2016 15:54:02

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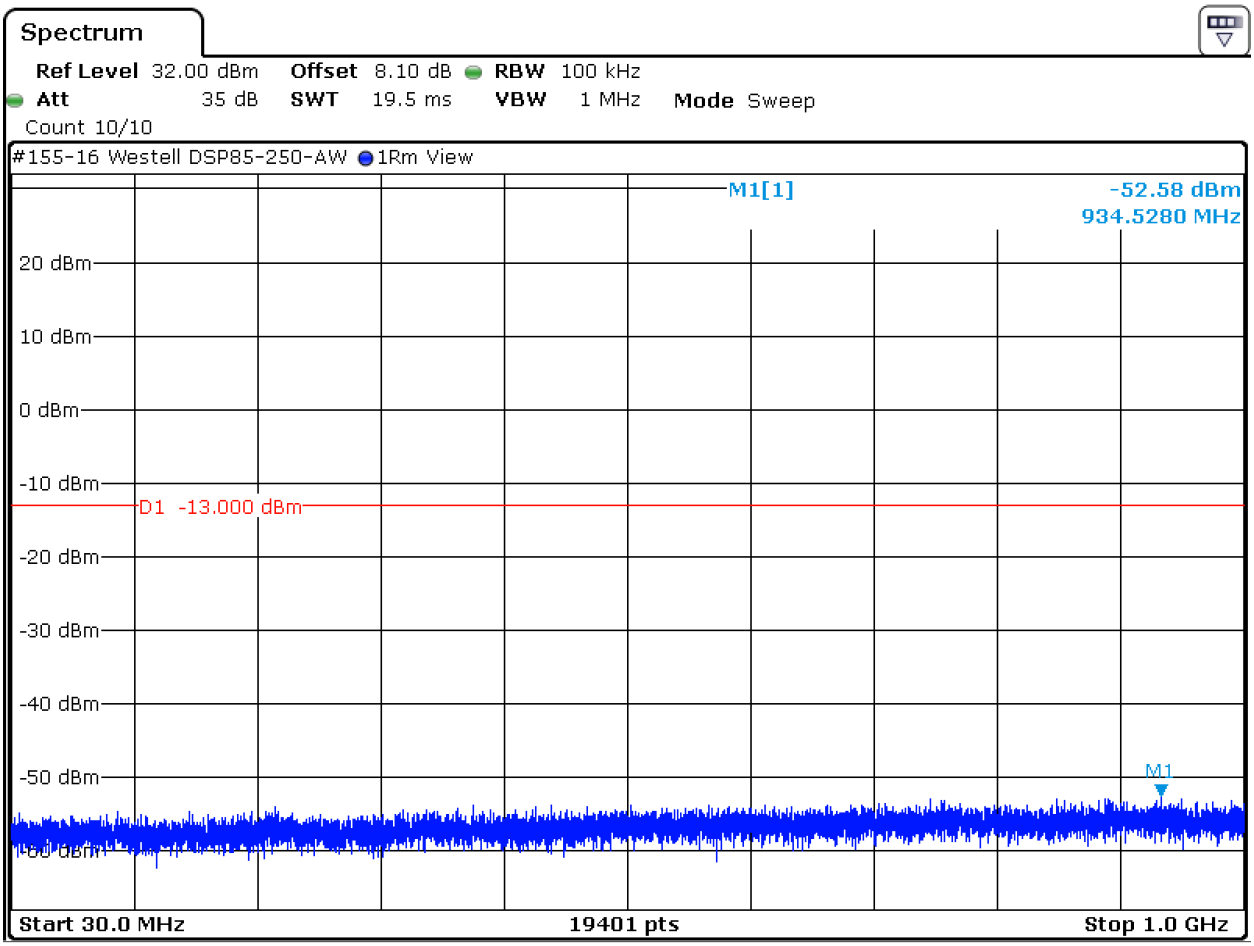
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.11. 2150 MHz, 30 MHz to 1 GHz



Date: 23.FEB.2016 15:56:24

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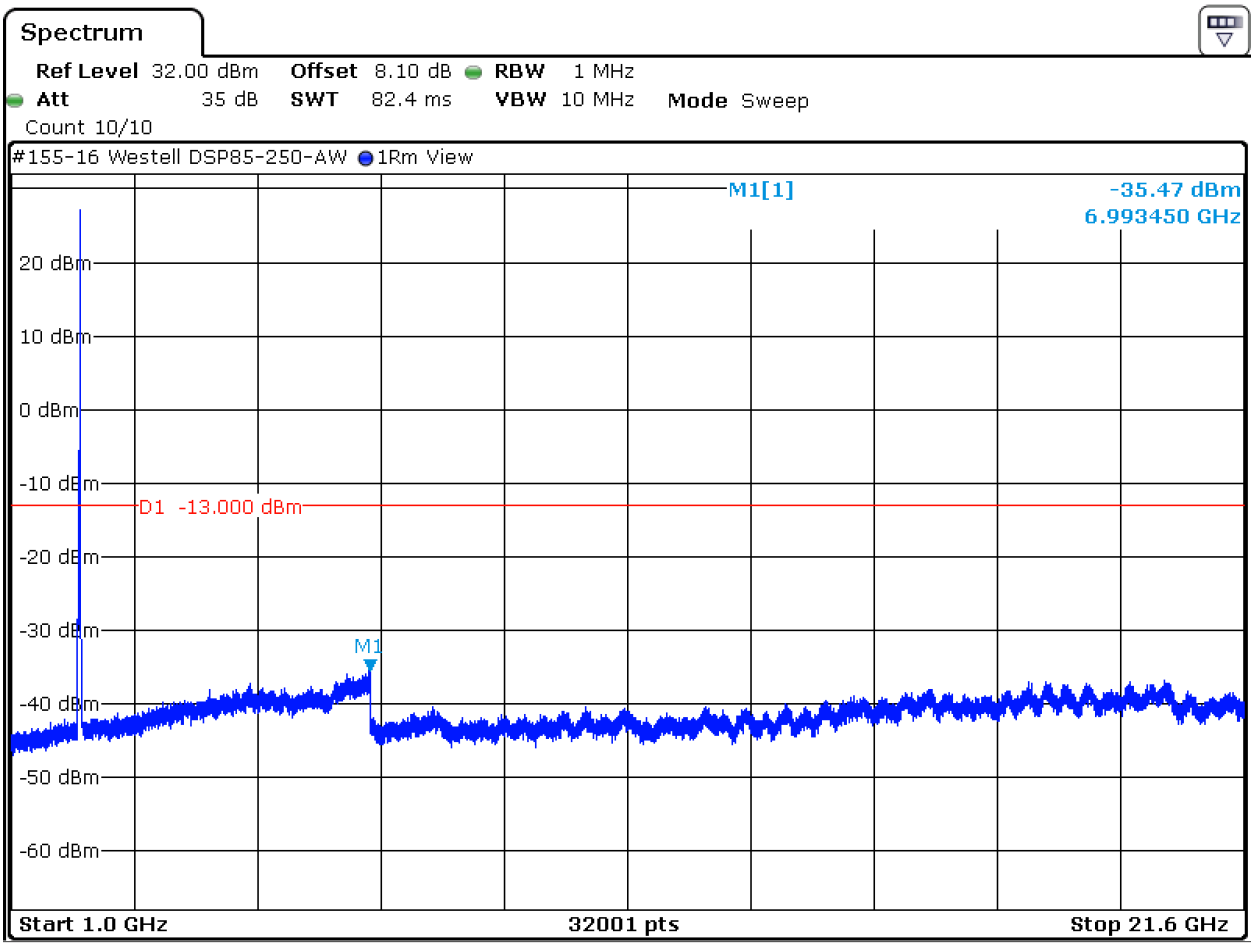
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.12. 2150 MHz, 1 to 21.6 GHz



Date: 23.FEB.2016 15:57:21

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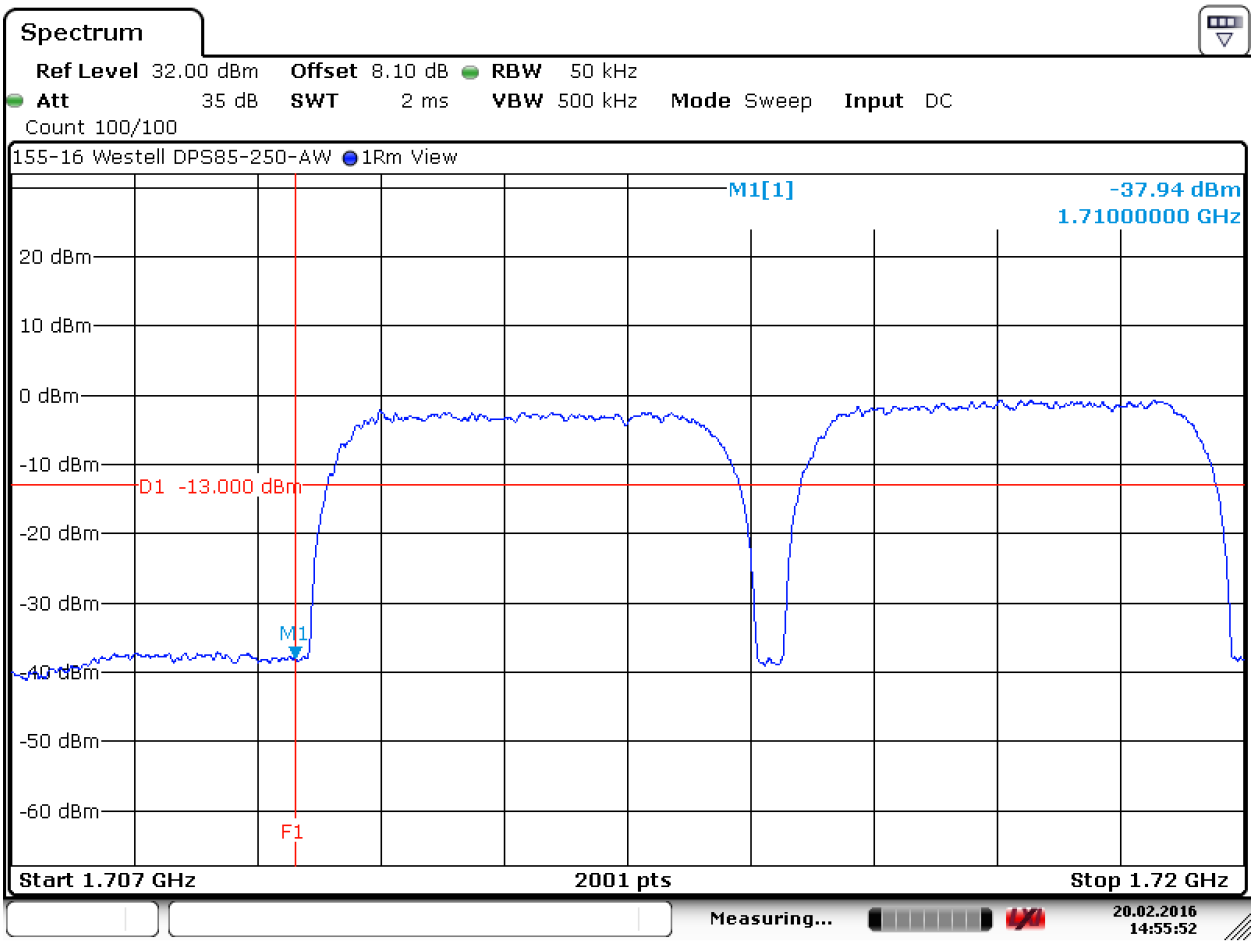
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.13. 1710 MHz Lower Bandedge



Date: 20.FEB.2016 14:55:52

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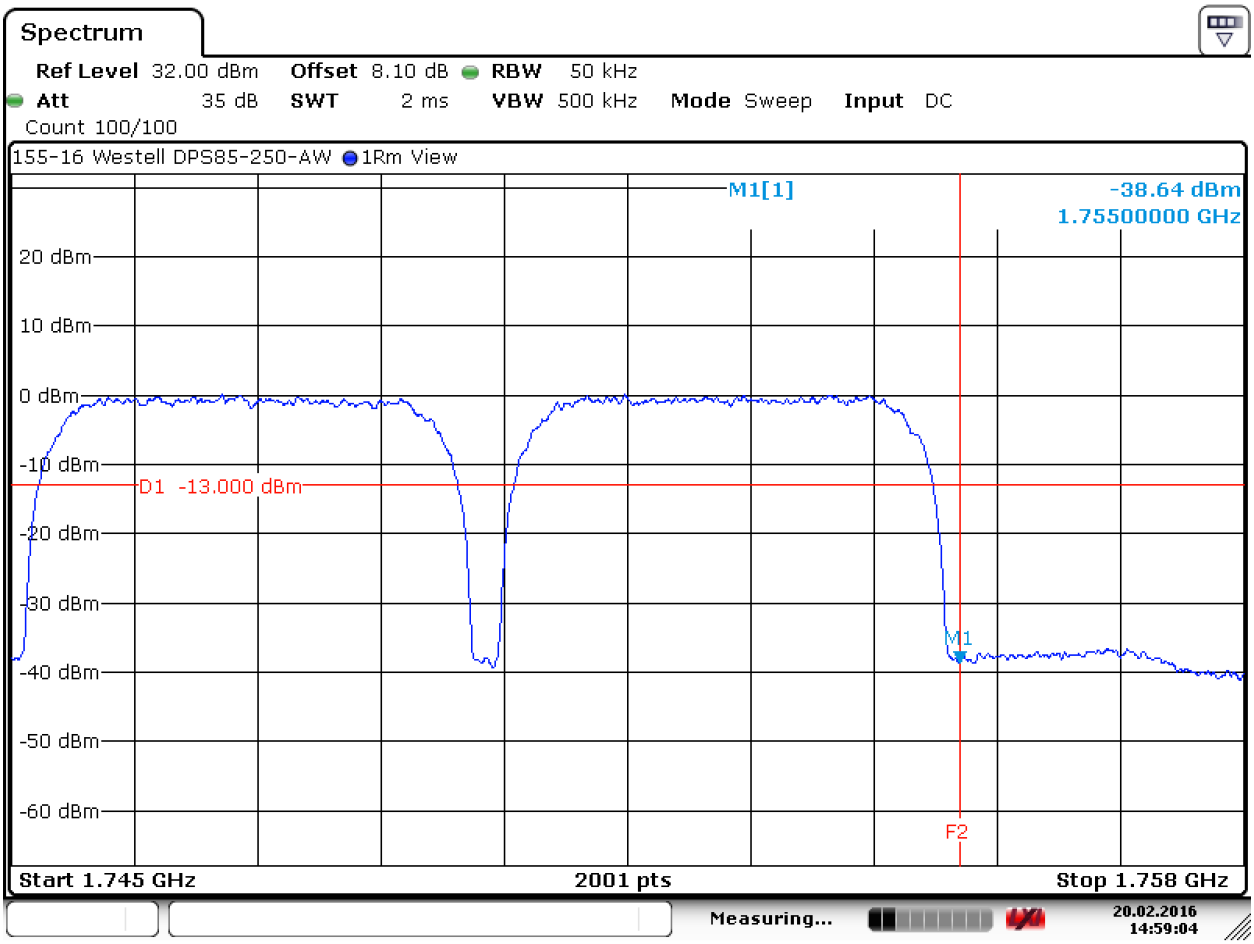
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.14. 1755 MHz Upper Bandedge



Date: 20.FEB.2016 14:59:04

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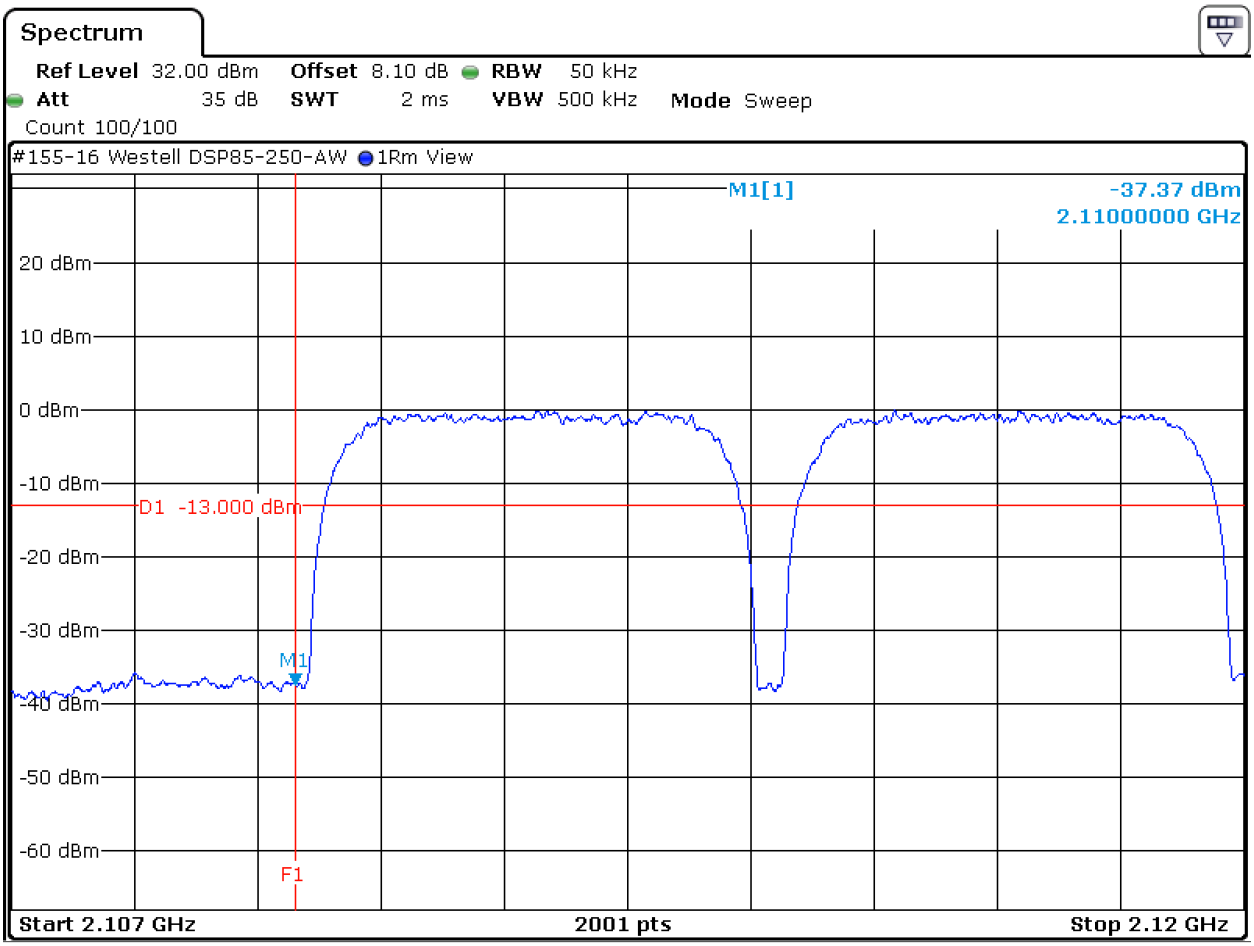
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.15. 2110 MHz, Lower bandedge



Date: 23.FEB.2016 16:00:51

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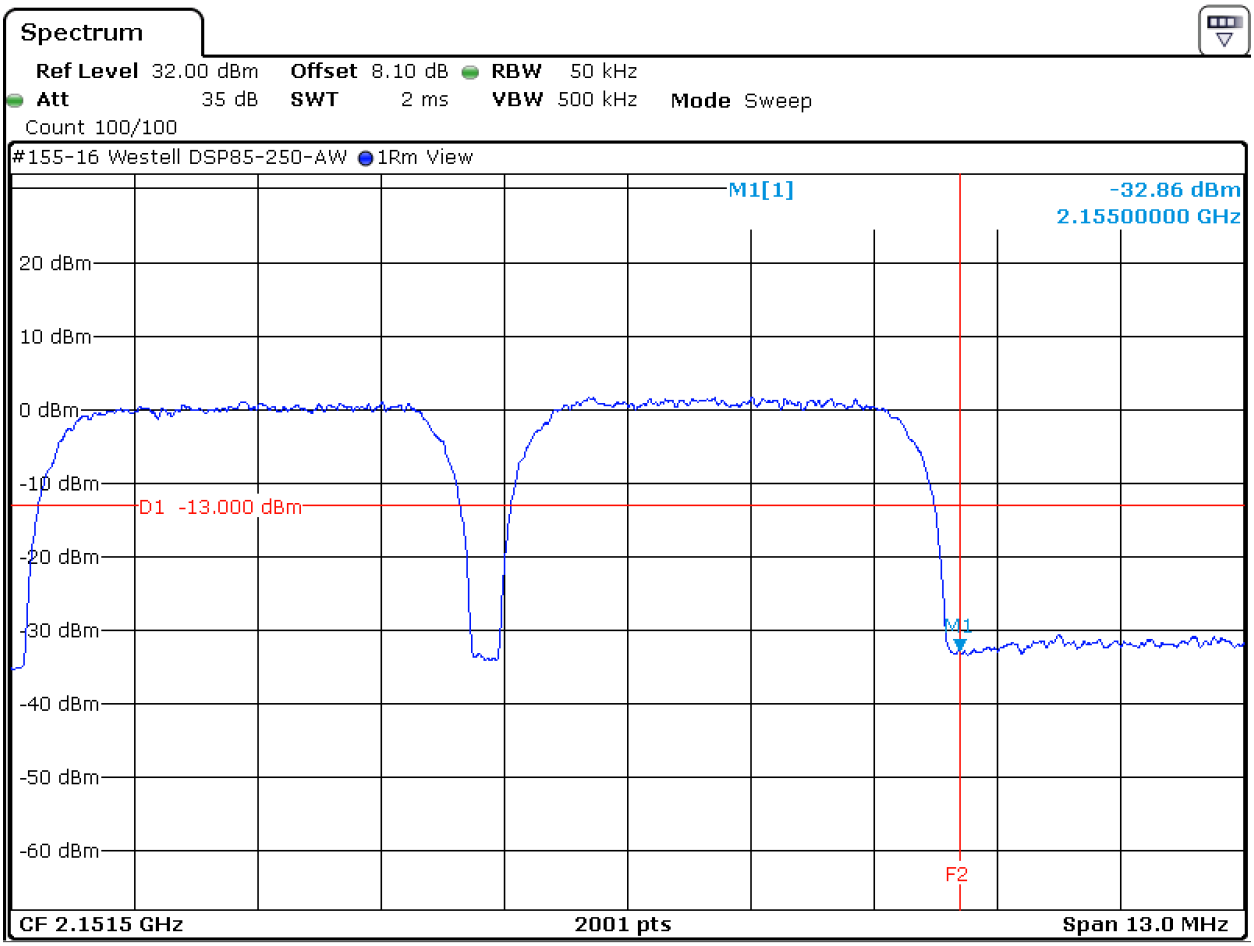
6. Measurement Data (continued)

6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6 (continued)

6.3.16. 2155 MHz, Upper bandedge



Date: 23.FEB.2016 16:03:04

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6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h), RSS-139 6.6

Requirement: For operations in the 1710-1780 MHz and 2110-2180 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.

Test Method: KDB 935210 Section 3.8

6.4.1. Measurement and Equipment Setup

Test Date:	2/19/2016, 1/20/2017
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/TIA-603-D 2010 Land Mobile FM or PM Communications Equipment Measurement and Performance Standards and ANSI C63.26 2015 American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services, Substitution Measurement Procedures.

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6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h), RSS-139 6.6 (continued)

6.4.3. Horizontal Polarity

Frequency (MHz)	Antenna Height (cm)	Signal Gen Amp (dBm)	At Antenna Level (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
73.0413	255	-61.40	-63.00	-7.7	-70.70	-13.00	-57.70
82.8508	400	-57.00	-58.00	-8.0	-66.00	-13.00	-53.00
100.0078	200	-41.00	-42.13	-8.5	-50.63	-13.00	-37.63
124.9998	247	-49.00	-49.50	-8.4	-57.90	-13.00	-44.90
149.9885	200	-50.00	-50.61	-7.7	-58.31	-13.00	-45.31
169.9929	138	-39.40	-40.83	-7.5	-48.33	-13.00	-35.33
175.0126	150	-40.00	-41.43	-7.2	-48.63	-13.00	-35.63
186.6644	100	-39.80	-41.32	-7.2	-48.52	-13.00	-35.52
196.6663	100	-47.10	-48.47	-7.5	-55.97	-13.00	-42.97
200.0356	170	-36.70	-38.28	-7.5	-45.78	-13.00	-32.78
203.3164	100	-41.80	-43.33	-7.5	-50.83	-13.00	-37.83
213.3484	140	-45.40	-46.93	-7.9	-54.83	-13.00	-41.83
220.0074	100	-36.70	-38.36	-7.9	-46.26	-13.00	-33.26
225.0219	100	-34.96	-36.65	-7.9	-44.55	-13.00	-31.55
230.0063	100	-38.30	-40.00	-8.4	-48.40	-13.00	-35.40
250.0165	100	-45.50	-46.98	-8.7	-55.68	-13.00	-42.68
275.0144	100	-37.50	-39.36	-8.5	-47.86	-13.00	-34.86
300.0501	100	-36.70	-38.66	-7.8	-46.46	-13.00	-33.46
400.0088	210	-41.40	-43.70	-8.0	-51.70	-13.00	-38.70
425.0281	180	-46.00	-48.44	-7.8	-56.24	-13.00	-43.24
475.0329	153	-50.00	-52.47	-7.7	-60.17	-13.00	-47.17
575.0380	130	-43.70	-46.51	-8.1	-54.61	-13.00	-41.61
600.0033	115	-40.50	-43.42	-8.3	-51.72	-13.00	-38.72
625.0354	100	-41.40	-44.41	-8.2	-52.61	-13.00	-39.61
675.0428	100	-44.50	-47.50	-8.2	-55.70	-13.00	-42.70
700.1210	100	-41.60	-44.84	-8.2	-53.04	-13.00	-40.04
725.0262	100	-42.80	-46.14	-8.1	-54.24	-13.00	-41.24
775.0507	150	-42.00	-45.37	-7.9	-53.27	-13.00	-40.27
799.9991	147	-29.70	-33.26	-7.9	-41.16	-13.00	-28.16
825.0557	141	-40.60	-44.15	-7.9	-52.05	-13.00	-39.05
850.0648	143	-39.00	-42.61	-7.9	-50.51	-13.00	-37.51
875.0632	130	-38.50	-42.16	-7.9	-50.06	-13.00	-37.06
900.0703	194	-46.00	-49.68	-7.9	-57.58	-13.00	-44.58
925.0671	120	-39.00	-42.88	-8.0	-50.88	-13.00	-37.88
950.0290	175	-42.80	-46.69	-8.1	-54.79	-13.00	-41.79
975.0641	172	-55.50	-58.70	-8.1	-66.80	-13.00	-53.80
999.9854	168	-30.70	-34.78	-8.2	-42.98	-13.00	-29.98

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6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h), RSS-139 6.6 (continued)

6.4.4. Vertical Polarity

Frequency (MHz)	Antenna Height (cm)	Signal Gen Amp (dBm)	At Antenna Level (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)
100.0223	100	-56.60	-57.30	-8.5	-65.80	-13.00	-52.80
124.9954	100	-50.20	-50.92	-8.4	-59.32	-13.00	-46.32
150.0612	100	-43.80	-45.17	-7.5	-52.67	-13.00	-39.67
170.0023	100	-36.40	-37.89	-7.2	-45.09	-13.00	-32.09
175.0056	250	-34.70	-36.22	-7.2	-43.42	-13.00	-30.42
186.6667	204	-37.80	-39.36	-7.2	-46.56	-13.00	-33.56
200.0310	100	-28.40	-30.04	-7.5	-37.54	-13.00	-24.54
213.3328	200	-45.00	-46.70	-7.9	-54.60	-13.00	-41.60
220.0057	214	-36.00	-37.68	-7.9	-45.58	-13.00	-32.58
225.0088	218	-34.17	-35.87	-7.9	-43.77	-13.00	-30.77
230.0033	182	-40.73	-42.45	-8.4	-50.85	-13.00	-37.85
233.3447	191	-41.60	-43.33	-8.4	-51.73	-13.00	-38.73
236.6869	186	-44.73	-46.44	-8.4	-54.84	-13.00	-41.84
275.0249	180	-41.89	-43.74	-8.5	-52.24	-13.00	-39.24
300.0661	158	-40.00	-42.00	-7.8	-49.80	-13.00	-36.80
325.0843	150	-52.60	-54.28	-7.8	-62.08	-13.00	-49.08
350.0130	136	-49.60	-51.46	-7.8	-59.26	-13.00	-46.26
375.0125	120	-53.40	-54.48	-7.9	-62.38	-13.00	-49.38
400.0036	110	-41.51	-43.78	-8.0	-51.78	-13.00	-38.78
425.0255	105	-50.20	-52.14	-7.8	-59.94	-13.00	-46.94
475.0230	100	-47.51	-49.92	-7.7	-57.62	-13.00	-44.62
575.0290	167	-37.07	-39.91	-8.1	-48.01	-13.00	-35.01
625.0387	150	-42.28	-45.14	-8.2	-53.34	-13.00	-40.34
675.0369	140	-49.20	-51.43	-8.2	-59.63	-13.00	-46.63
700.1354	134	-42.17	-45.39	-8.2	-53.59	-13.00	-40.59
725.0504	120	-42.17	-45.43	-8.1	-53.53	-13.00	-40.53
775.0479	110	-39.17	-42.61	-7.9	-50.51	-13.00	-37.51
799.9981	110	-29.11	-32.65	-7.9	-40.55	-13.00	-27.55
825.0539	110	-39.30	-42.88	-7.9	-50.78	-13.00	-37.78
850.0489	100	-39.63	-43.26	-7.9	-51.16	-13.00	-38.16
875.0576	100	-27.70	-31.42	-7.9	-39.32	-13.00	-26.32
900.0552	160	-38.90	-42.67	-7.9	-50.57	-13.00	-37.57
925.0615	144	-42.00	-45.83	-8.0	-53.83	-13.00	-40.83
950.0491	100	-37.74	-41.68	-8.1	-49.78	-13.00	-36.78
999.9836	137	-26.28	-30.36	-8.2	-38.56	-13.00	-25.56

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6. Measurement Data (continued)

6.4. Field Strength of Spurious Emissions 27.53 (h), RSS-139 6.6 (continued)

6.4.5. Measurement and Equipment Setup

Test Date:	2/19/2016
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

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6. Measurement Data (continued)

6.5. Frequency Stability 27.54, RSS-139 6.4 and RSS-GEN

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

Test Method: KDB 935210 Section 3.7

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

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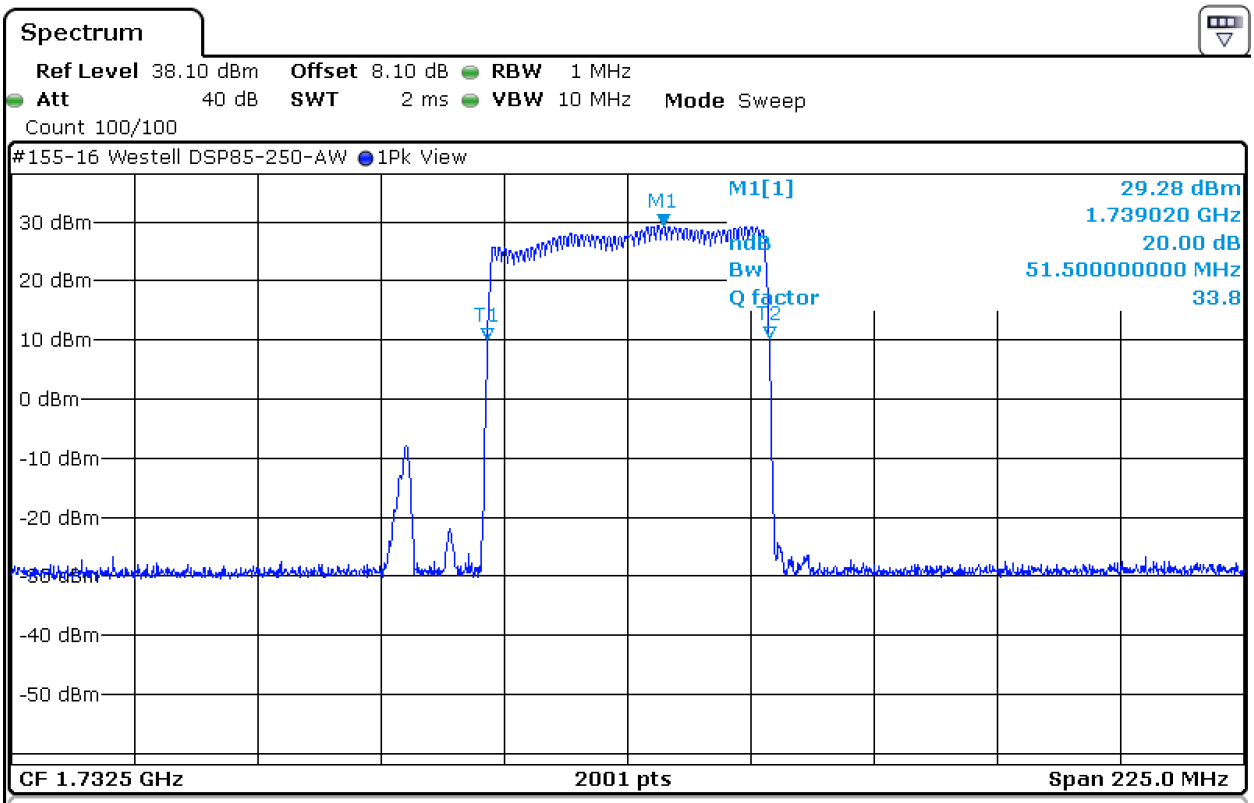
6. Measurement Data (continued)

6.6. Out of Band Rejection FCC KDB 935210

Requirement: Over a +/- 250 % span of the passband of the EUT measure the 20 dB bandwidth of the pass band of the EUT.

Test Method: KDB 935210 Section 3.3

6.6.1. 1732.5 MHz Center Frequency



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.73902 GHz	29.28 dBm	ndB down	51.5 MHz
T1		1	1.70686 GHz	9.94 dBm	ndB	20.00 dB
T2		1	1.75836 GHz	10.24 dBm	Q factor	33.8

Date: 23.FEB.2016 16:44:07

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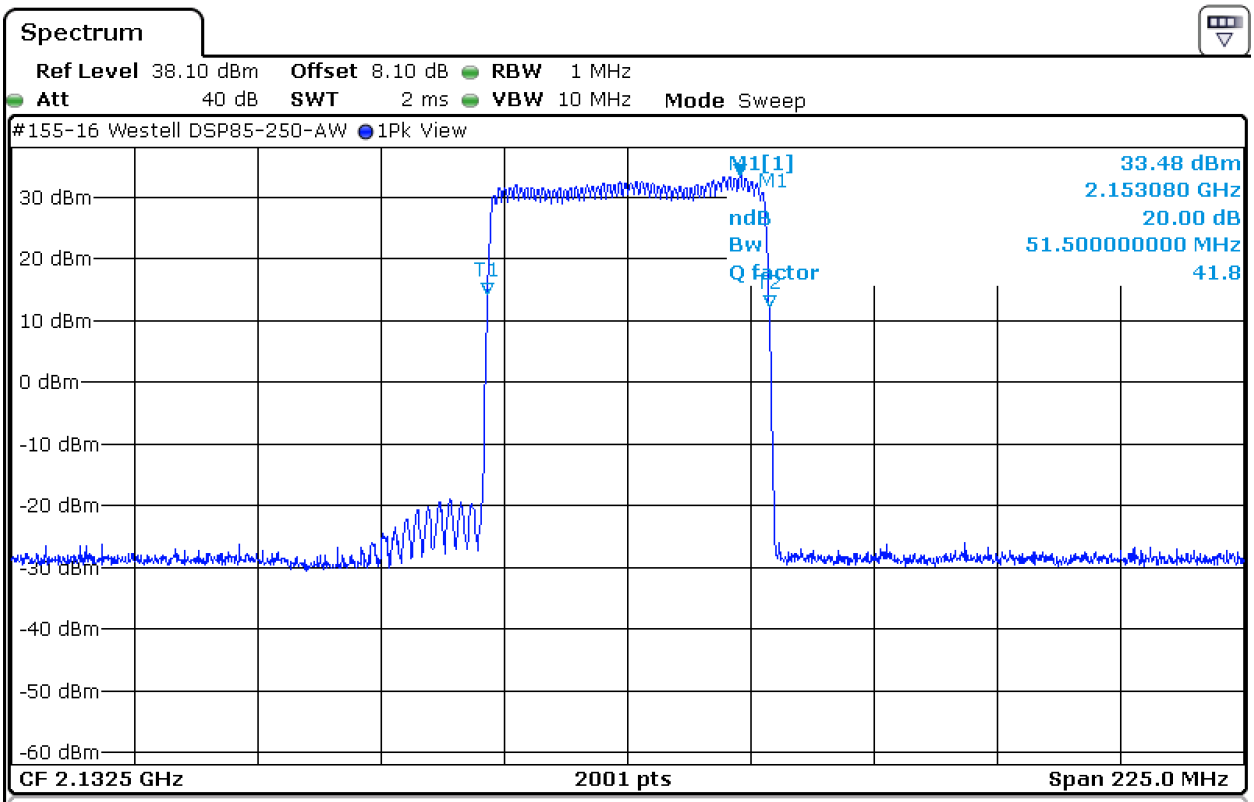
6. Measurement Data (continued)

6.6. Out of Band Rejection FCC KDB 935210 (continued)

6.6.2. 2132.5 MHz, Center Frequency



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.15308 GHz	33.48 dBm	ndB down	51.5 MHz
T1		1	2.10686 GHz	14.42 dBm	ndB	20.00 dB
T2		1	2.15836 GHz	12.36 dBm	Q factor	41.8

Date: 23.FEB.2016 16:26:11

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6. Measurement Data (continued)

6.7. Public Exposure to Radio Frequency Energy Levels 1.1307 (b)(1), RSS-GEN, Issue 4 Section 3.2, RSS 102

Center Frequency (MHz)	MPE Distance (cm)	DUT Output Power (dBm)	DUT Antenna Gain (dBi)	Power Density		FCC Limit (mW/cm^2)	IC Limit (W/m^2)
				(mW/cm^2)	(W/m^2)		
	(1)	(2)	(3)	(4)		(5)	(6)
1715	20.0	29.66	0.00	0.1839629	1.8396286	1	4.25
1733	20.0	29.95	0.00	0.1966664	1.9666639	1	4.28
1750	20.0	29.92	0.00	0.1953125	1.9531255	1	4.31
2115	20.0	30.07	3.00	0.4033947	4.0339466	1	4.91
2133	20.0	30.25	3.00	0.4204653	4.2046528	1	4.93
2150	20.0	30.36	3.00	0.4312510	4.3125103	1	4.96

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

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.
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.
6. Reference IC RSS-102 Section 4 Table 4 General Pulbic (Uncontrolled Environment) for equipment operating from 300 to 6000 MHz, the W/m^2 limit is determined by the formula 0.2619 * F (MHz) ^ 0.6834

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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 the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025:2005 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1)** and VCCI (Member number 3168) under registration number A-0208.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 22, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

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. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

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

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8. Test Setup Photographs

8.1 Antenna Port Conducted Emissions

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8. Test Setup Photographs (cont)

8.2 Radiated Emissions (Front)

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8. Test Setup Photographs (cont)

8.3 Radiated Emissions (Rear) 30 MHz to 1 GHz

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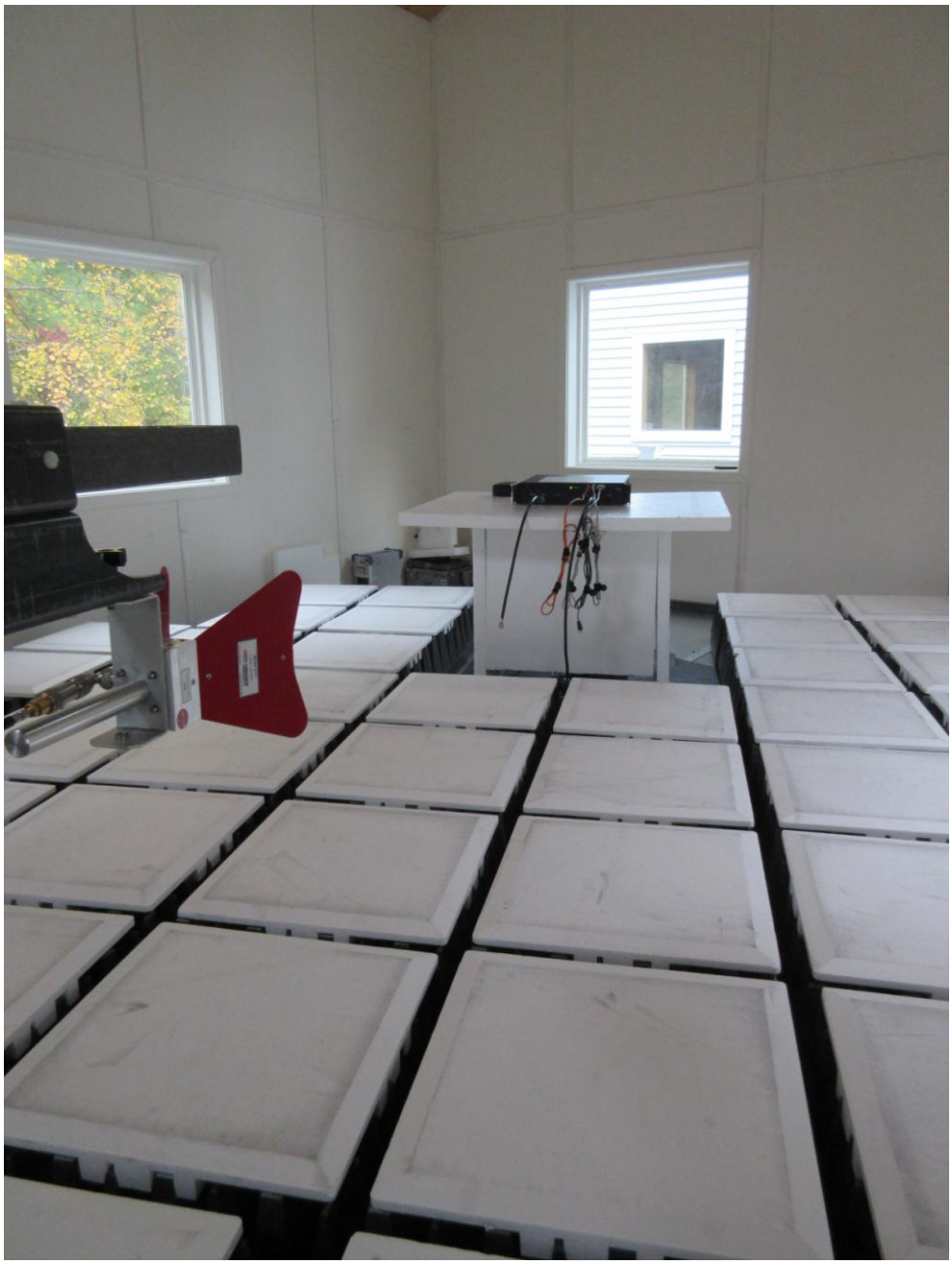
8. Test Setup Photographs (cont)

8.4 Radiated Emissions (Front) 1 to 18 GHz



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8. Test Setup Photographs (cont)

8.5 Radiated Emissions (Rear) 1 to 18 GHz

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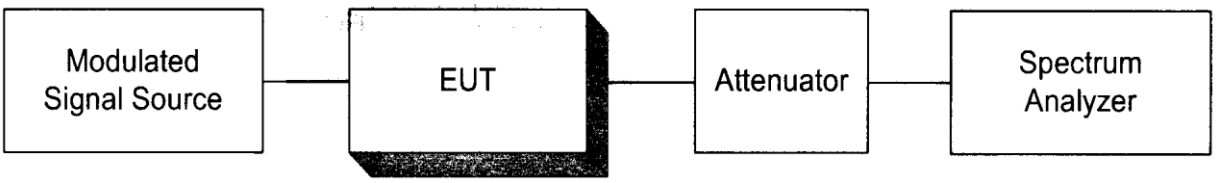
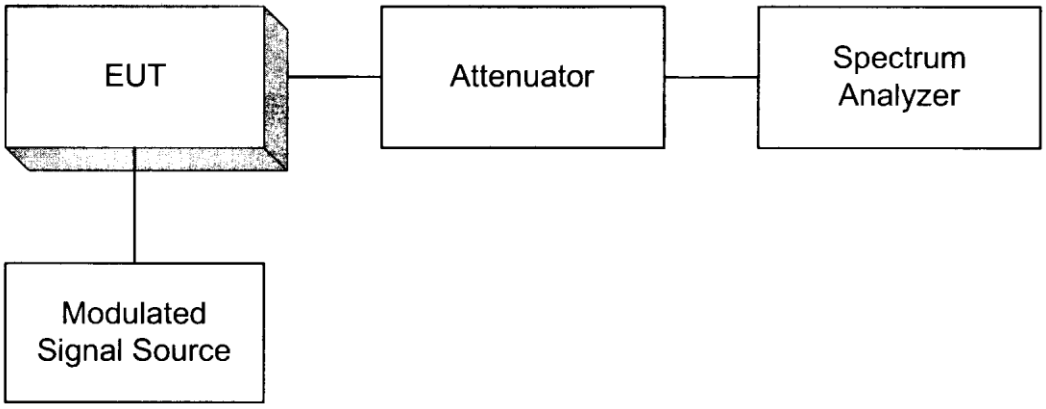
Appendix A

RF Output Power



Occupied Bandwidth



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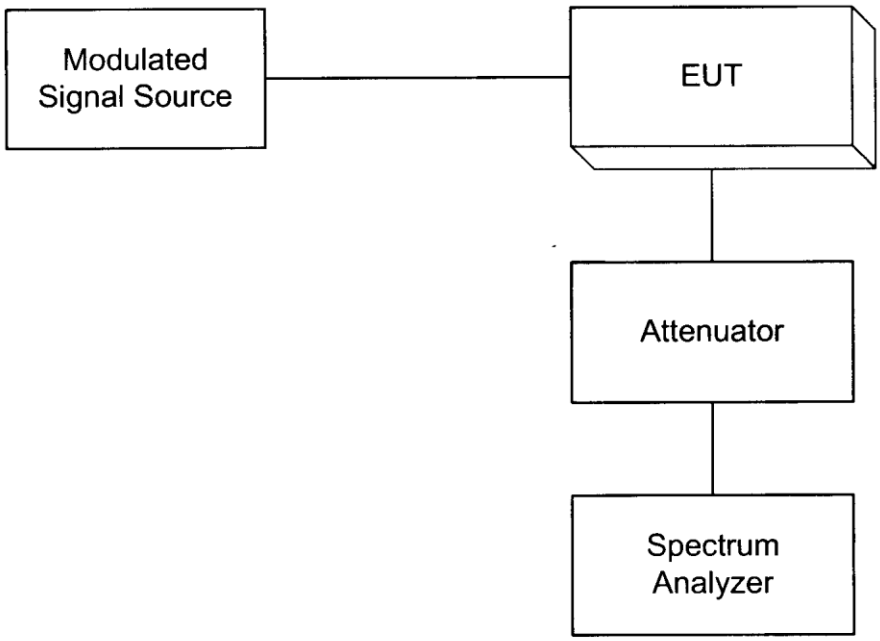
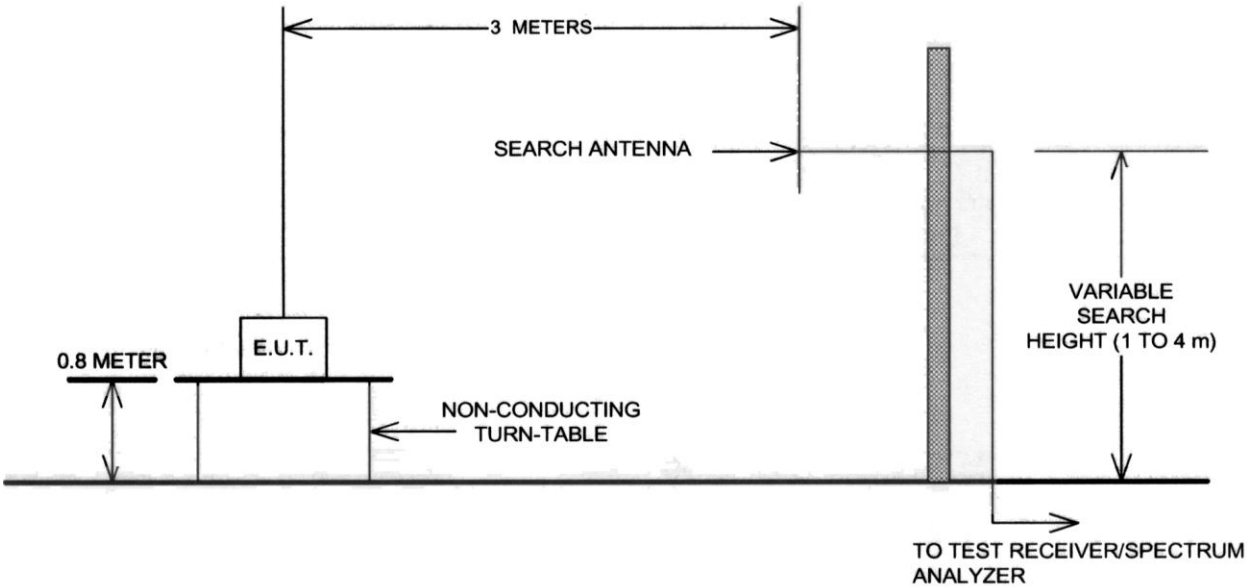
Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation



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