

COMPLIANCE WORLDWIDE INC. TEST REPORT 155-16R2

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.
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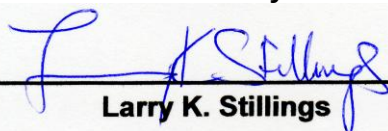
for

AWS Bidirectional Digital Repeater
DSP85-251AW

FCC ID: NVR-DSP251AWS
IC: 4307A-DSP251AWS

Original Report Issued on March 3, 2016
Revision R2 Issued on April 29, 2016

Tested by



Larry K. Stillings

Reviewed By



Brian F. Breault

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1. Scope

This test report certifies that the Westell DSP85-251AW, 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 R2 updates references to RSS-139 for an original certification filing.

2. Product Details

2.1. Manufacturer: Westell, Inc.

2.2. Model Numbers: DSP85-251AW

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

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

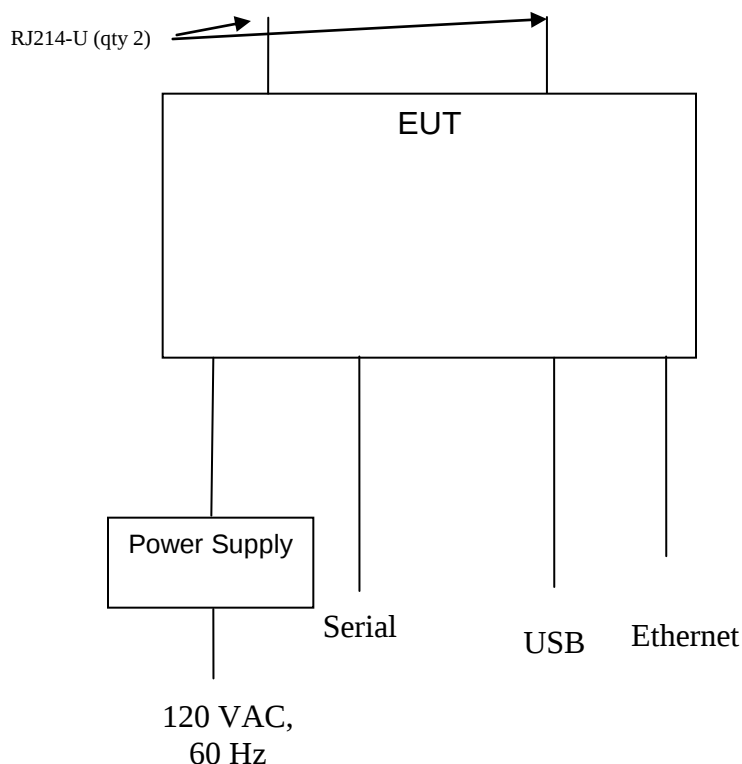
Notebook PC is connected only during setup

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 4.1 MHz AWGN digital modulation to the input of the amplifier across the AWS bands to be used by the product.
- (4) The unit's 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



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

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 in this test report are in accordance with ANSI C63.4:2014, 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, FCC OET KDB 935210 D05 Indus Booster Basic Meas v01 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 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	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	

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	
	(MHz)	(dBm)	(Watts)
Output Power	1715	29.66	0.925
Output Power	1732.5	29.95	0.989
Output Power	1750	29.92	0.982
Output Power	2115	30.07	1.016
Output Power	2132.5	30.25	1.059
Output Power	2150	30.36	1.086
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
Input Power	1715	-53.22	N/A
Input Power	1732.5	-55.12	N/A
Input Power	1750	-55.09	N/A
Input Power	2115	-52.78	N/A
Input Power	2132.5	-53.54	N/A
Input Power	2150	-53.73	N/A

Note: Input Power is AGC threshold Level

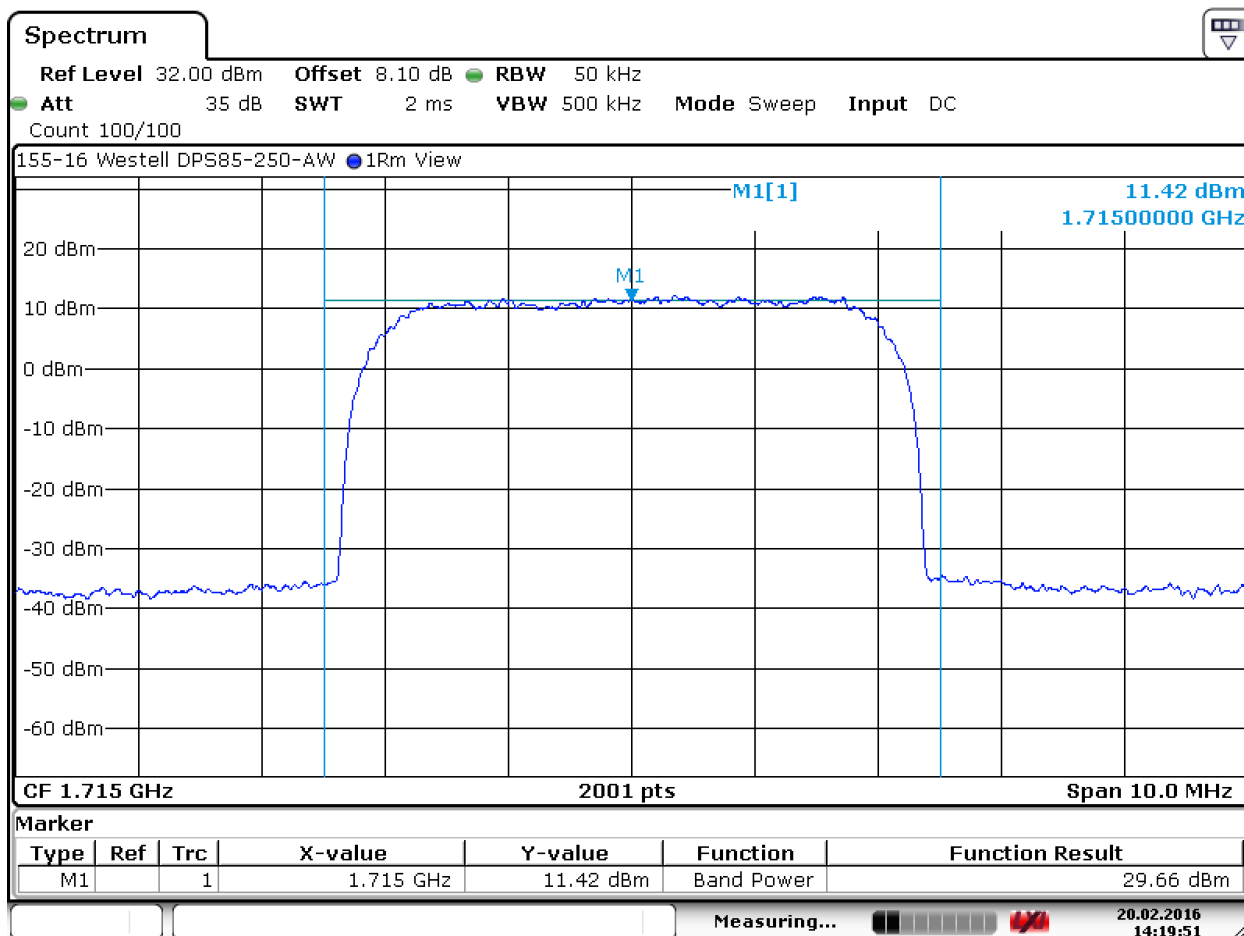
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 14:19:50

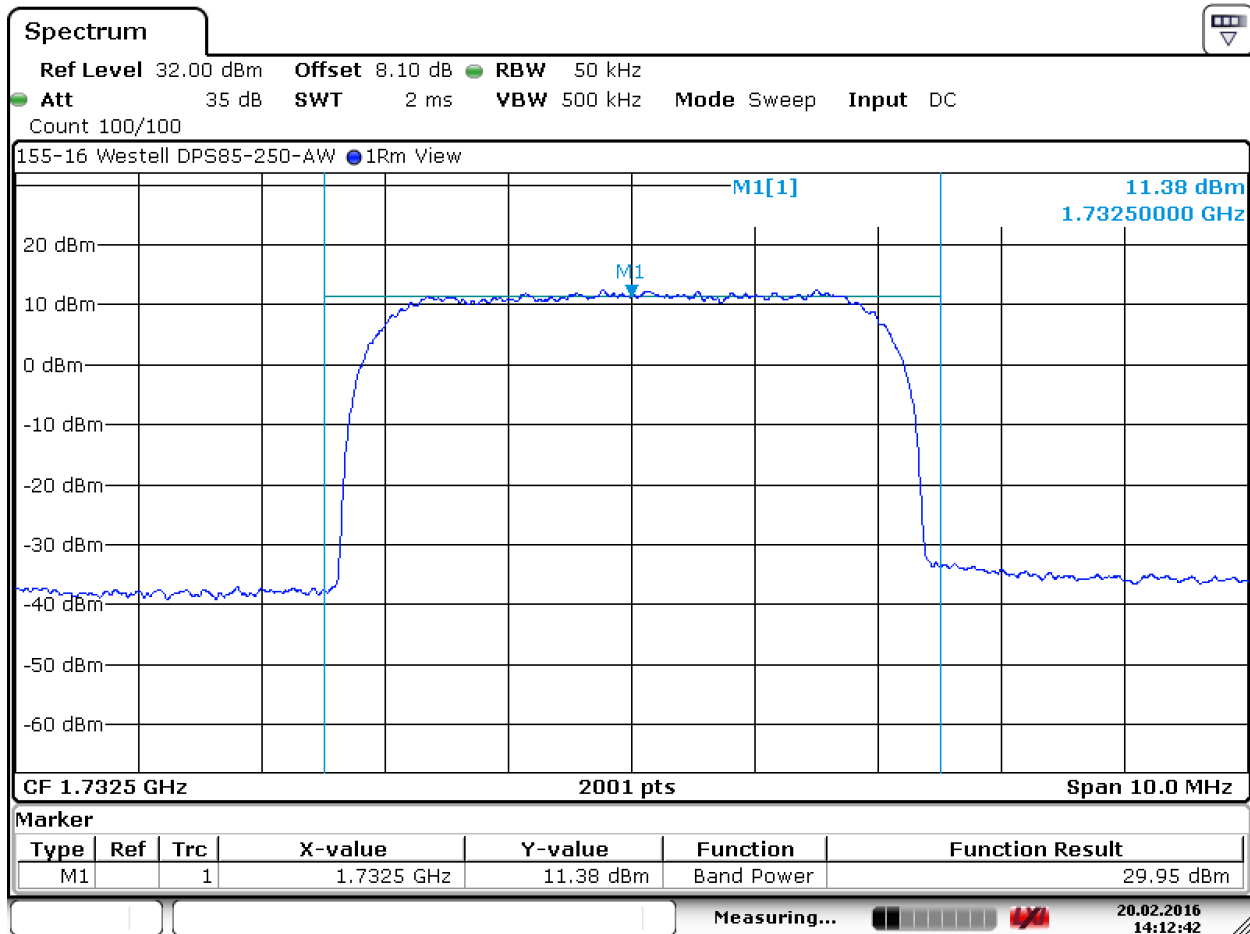
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 14:12:42

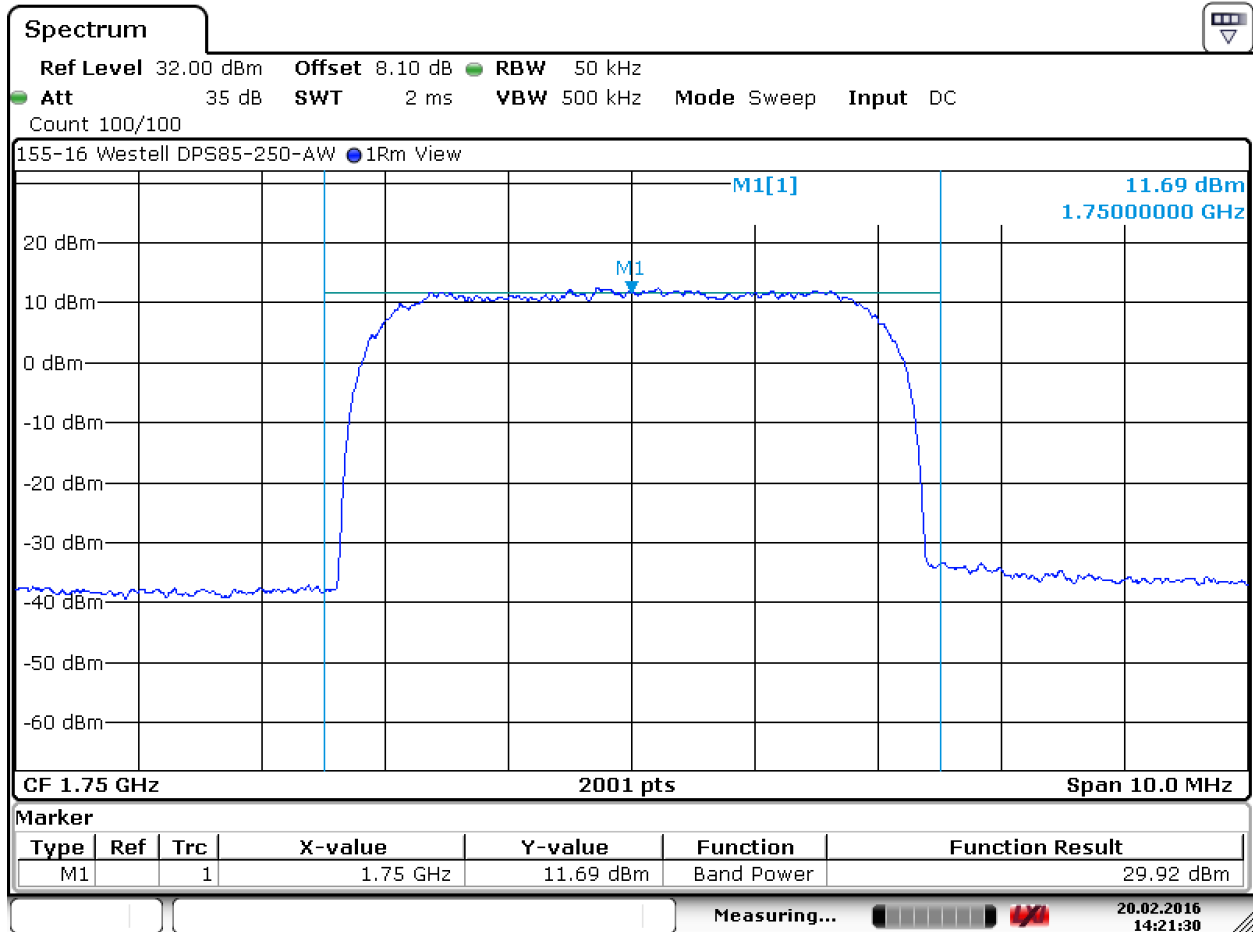
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 14:21:30

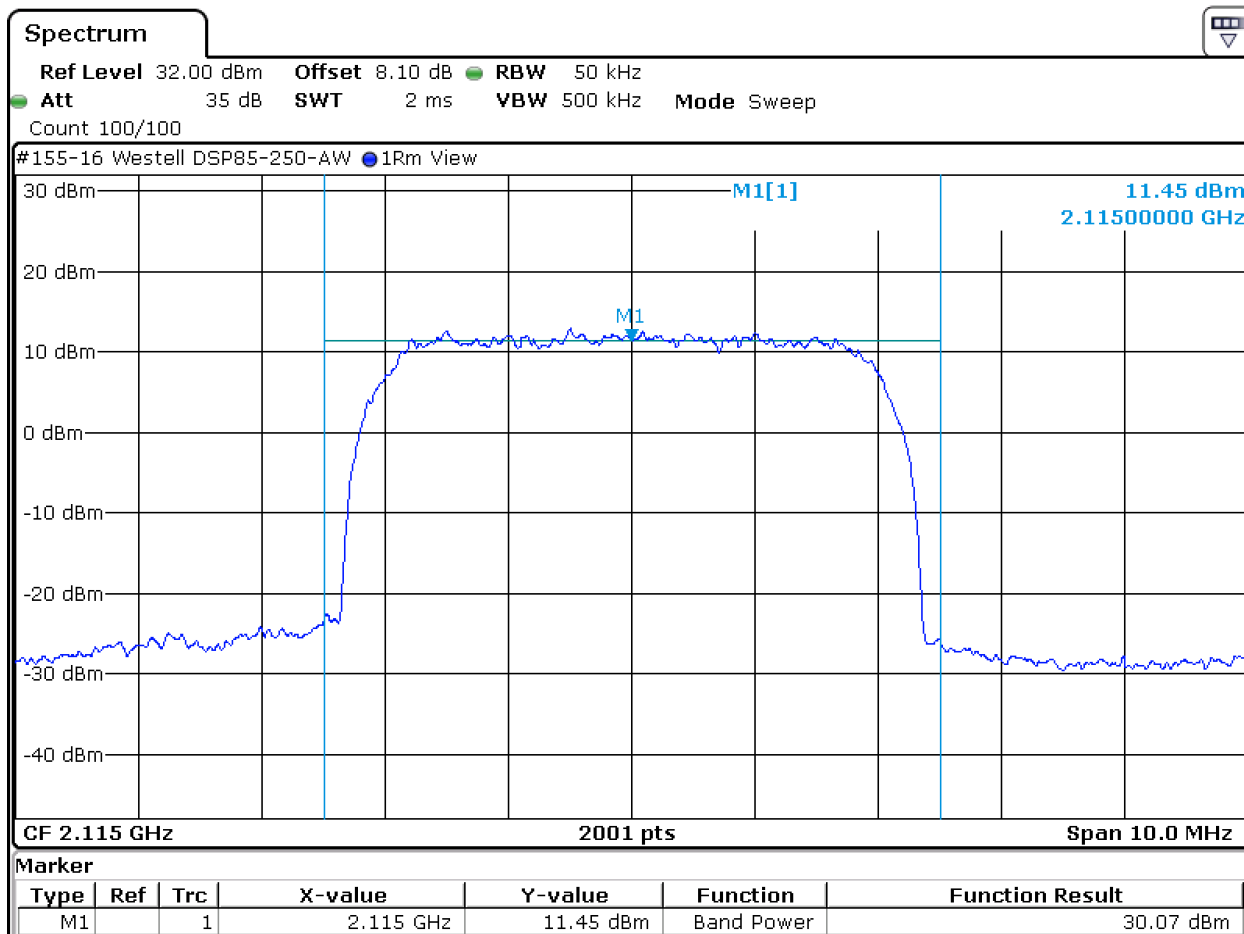
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 15:36:57

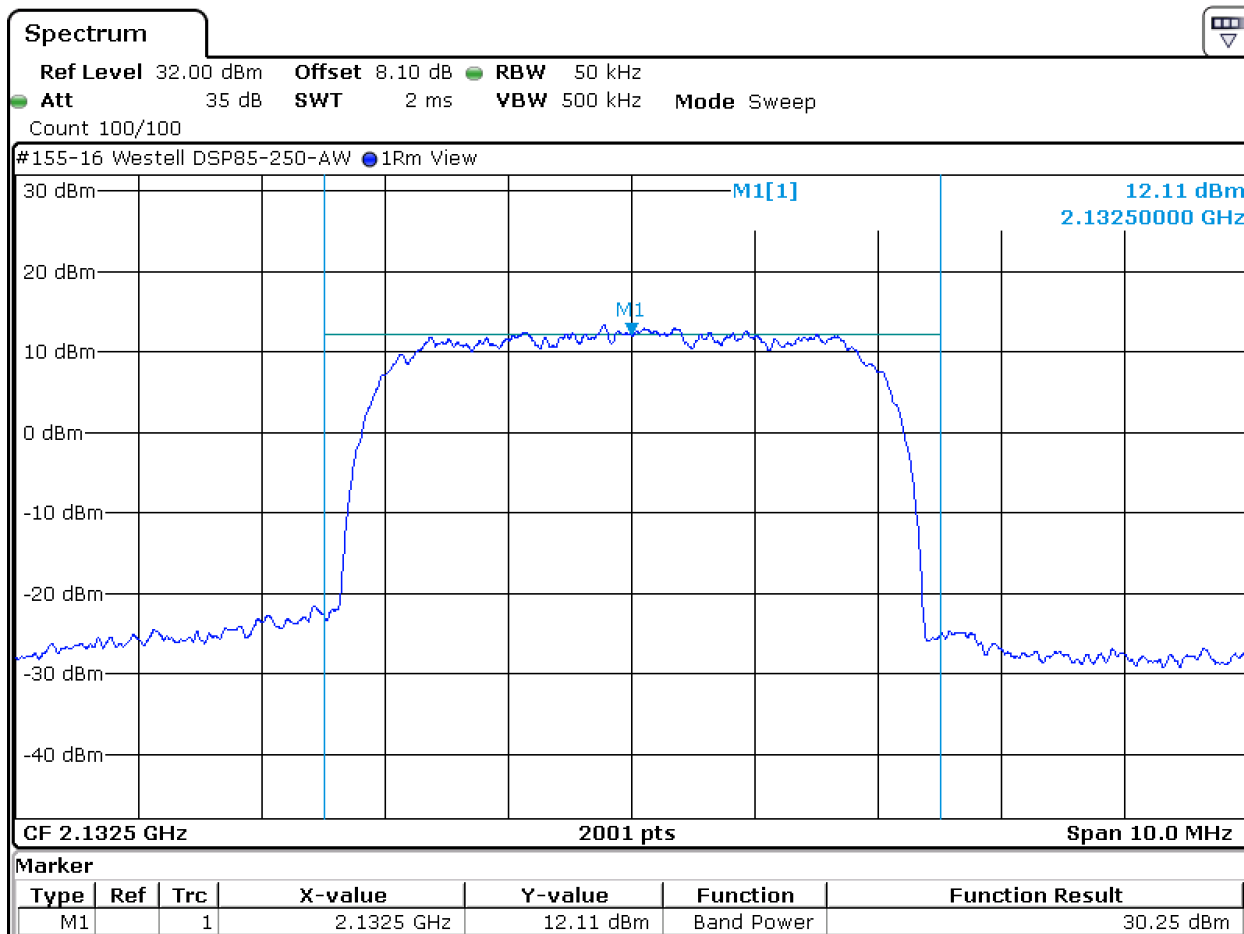
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 15:33:45

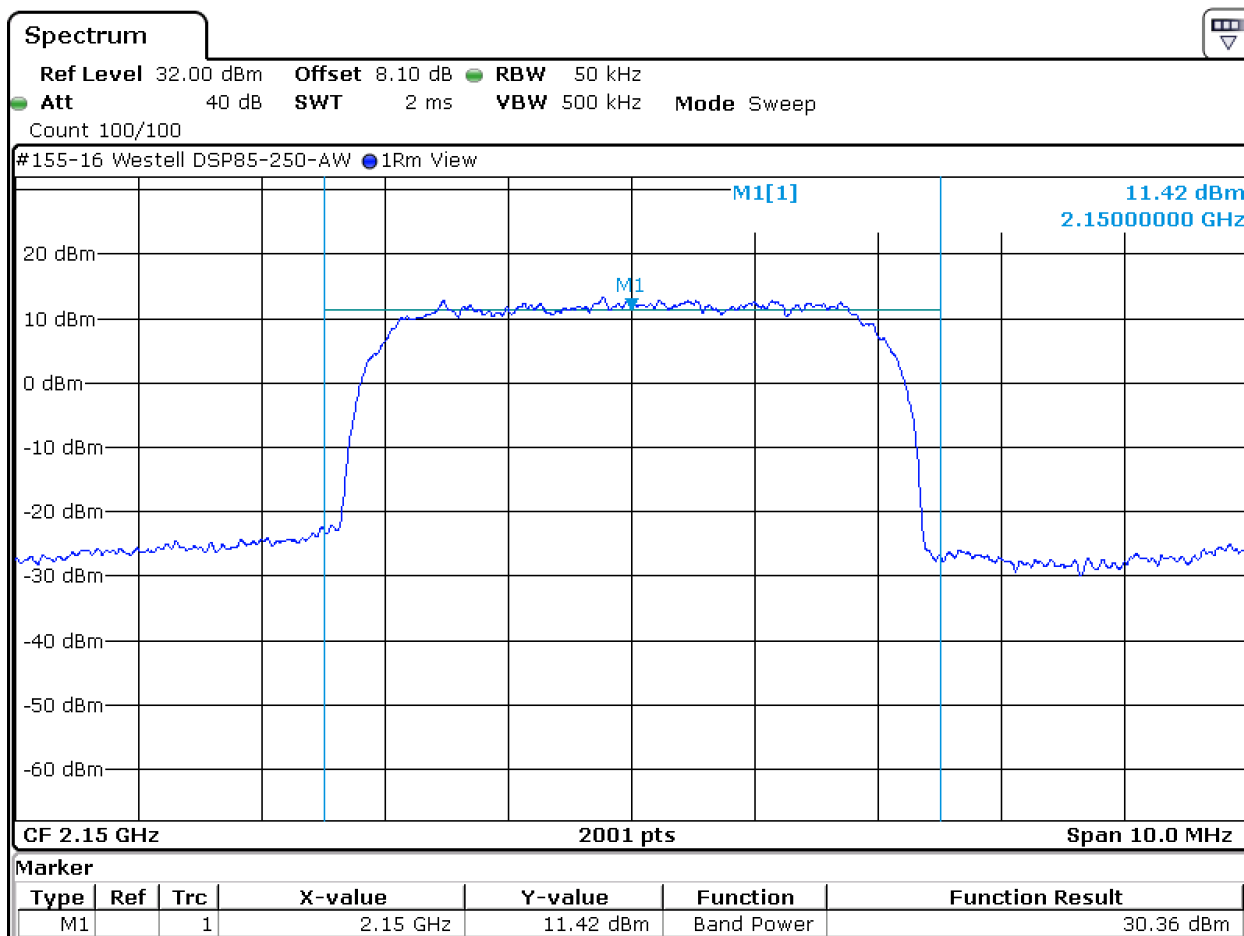
Test Number: 155-16R2

Issue Date: 4/29/2016

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

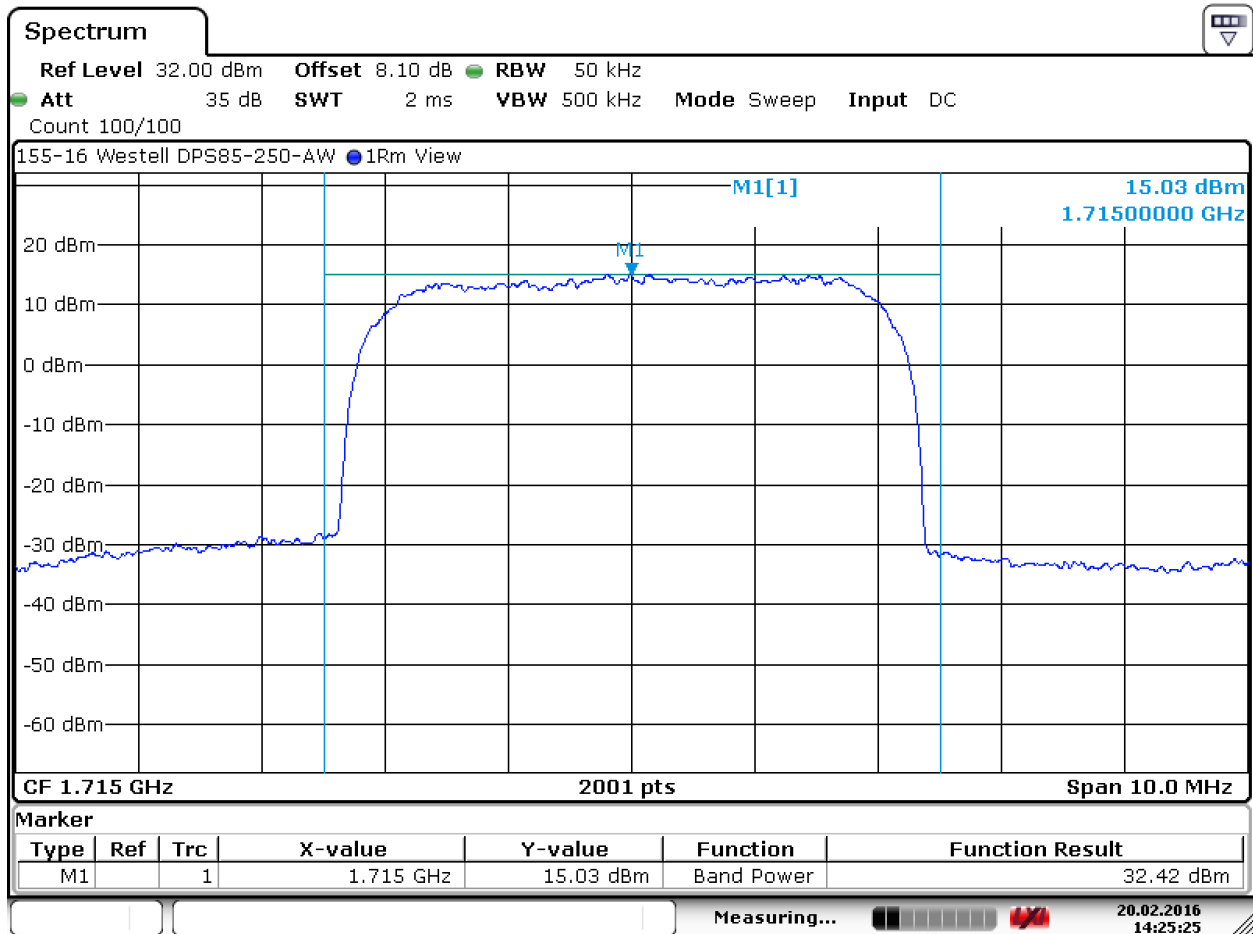
Test Number: 155-16R2

Issue Date: 4/29/2016

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

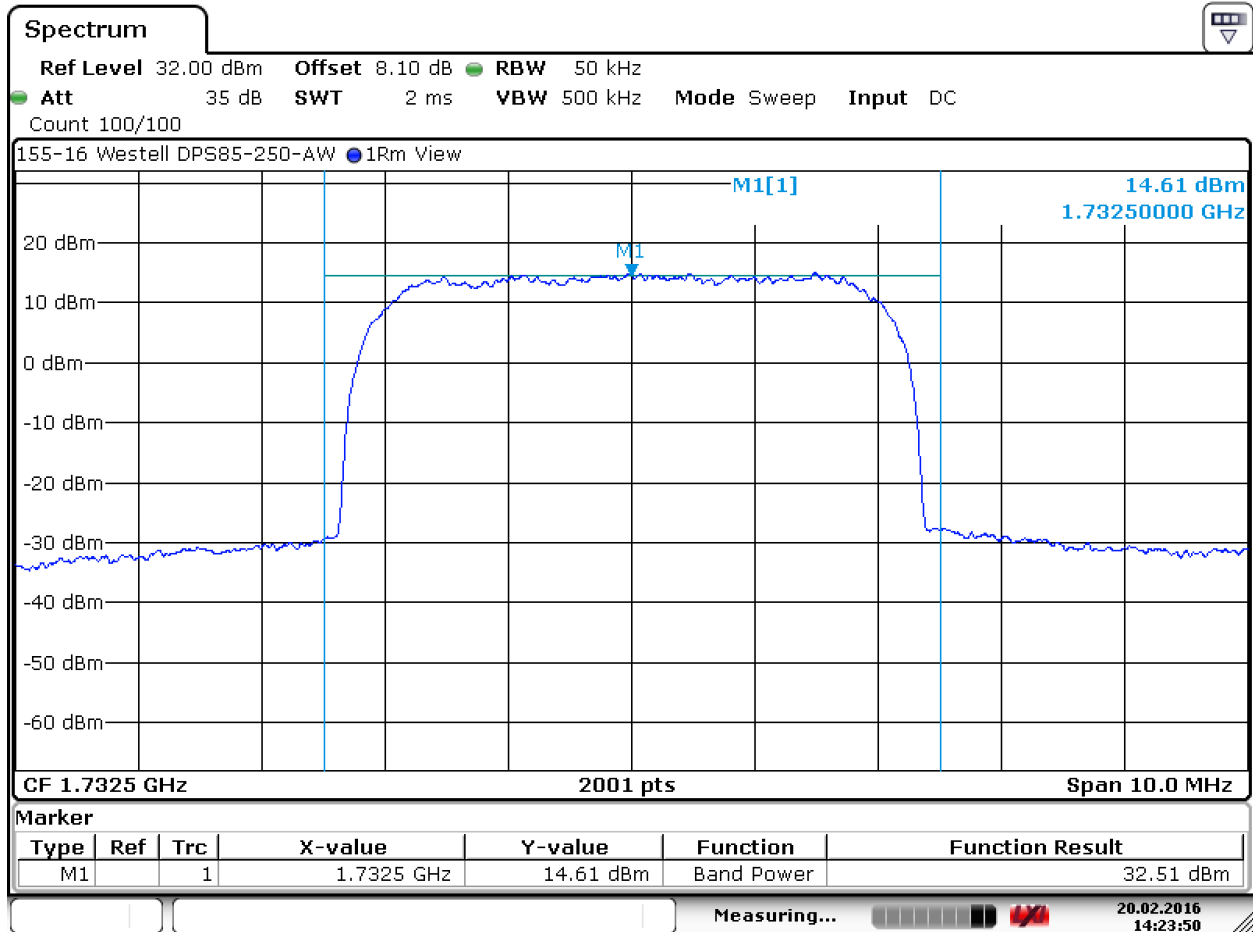
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 14:23:49

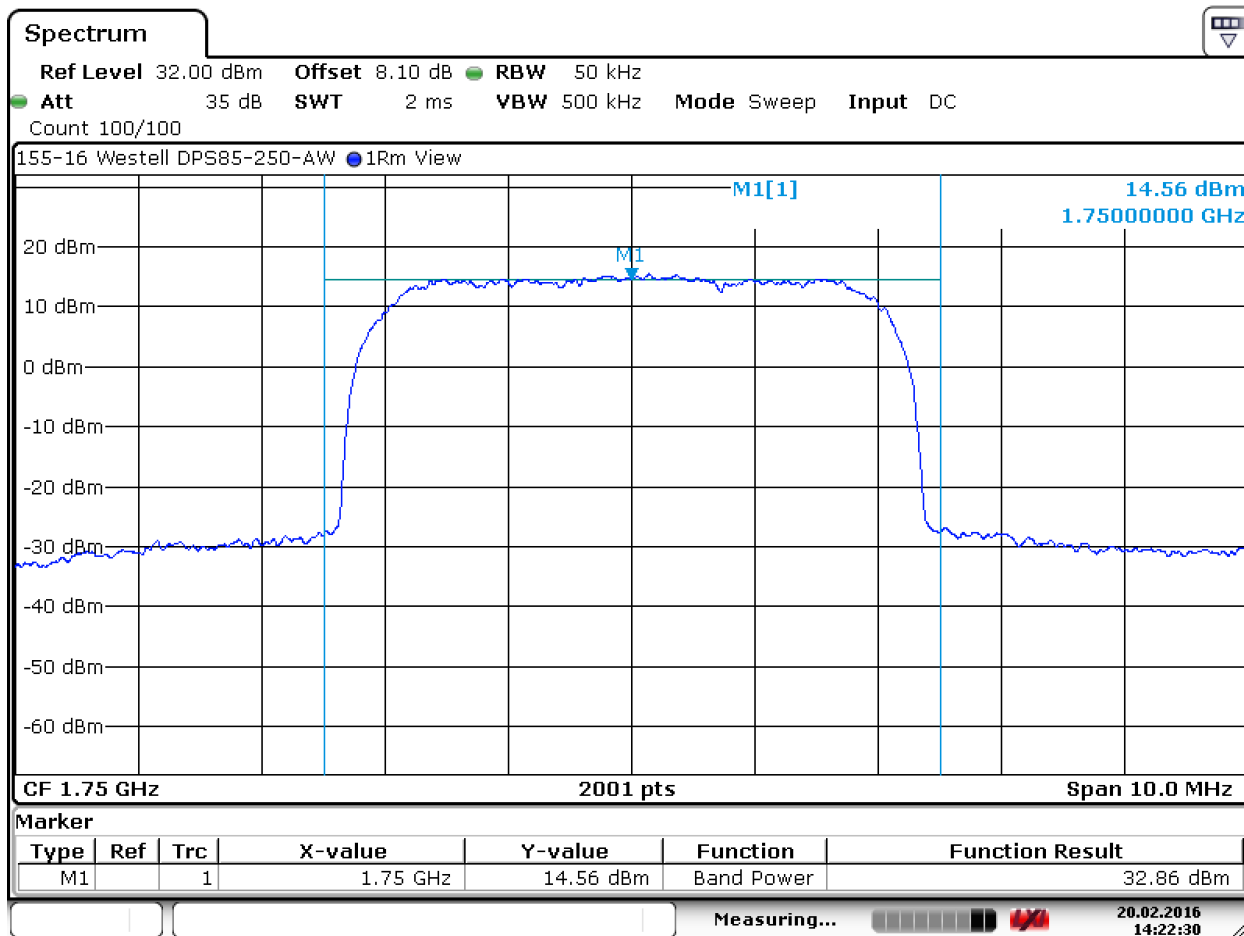
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 14:22:30

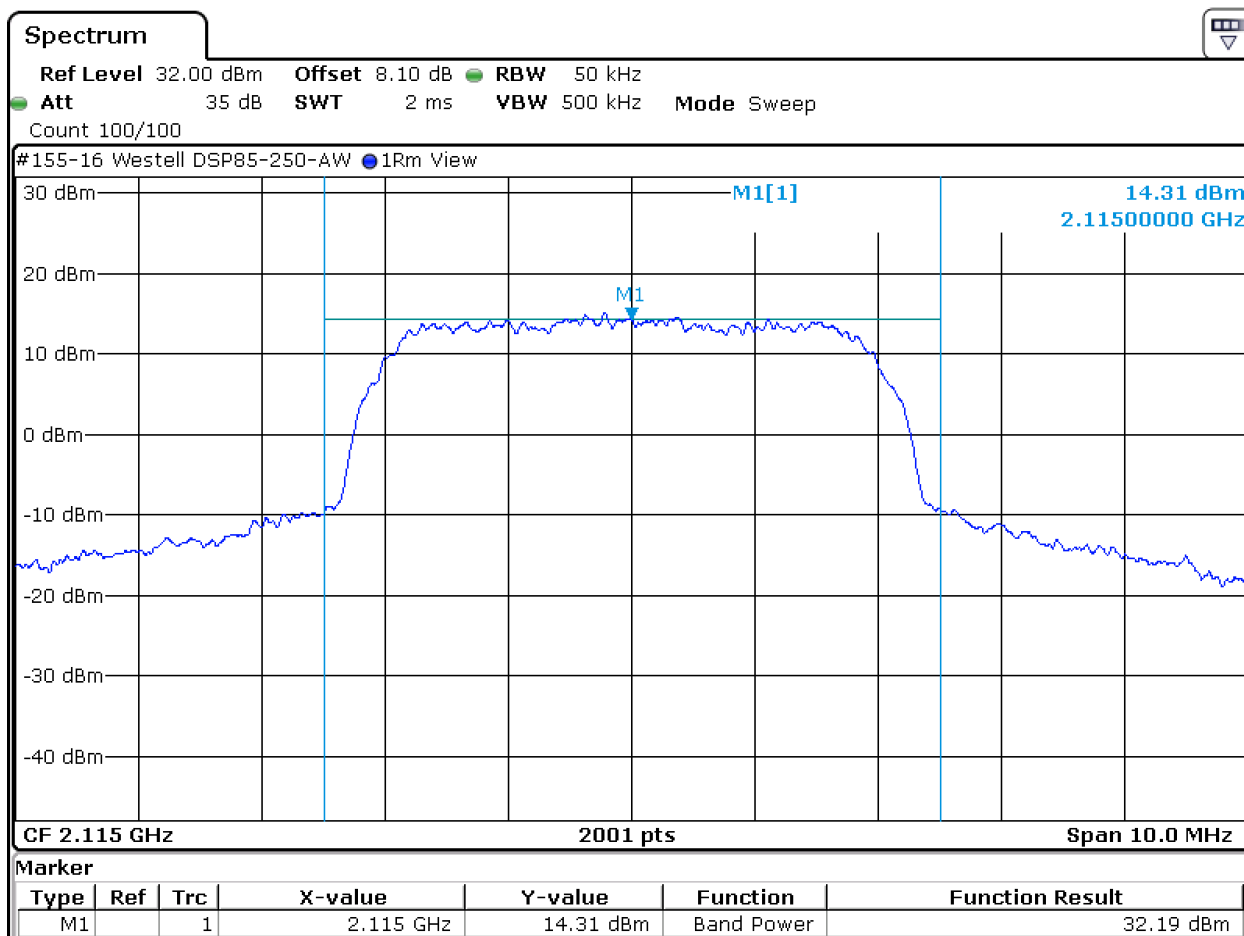
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 15:47:57

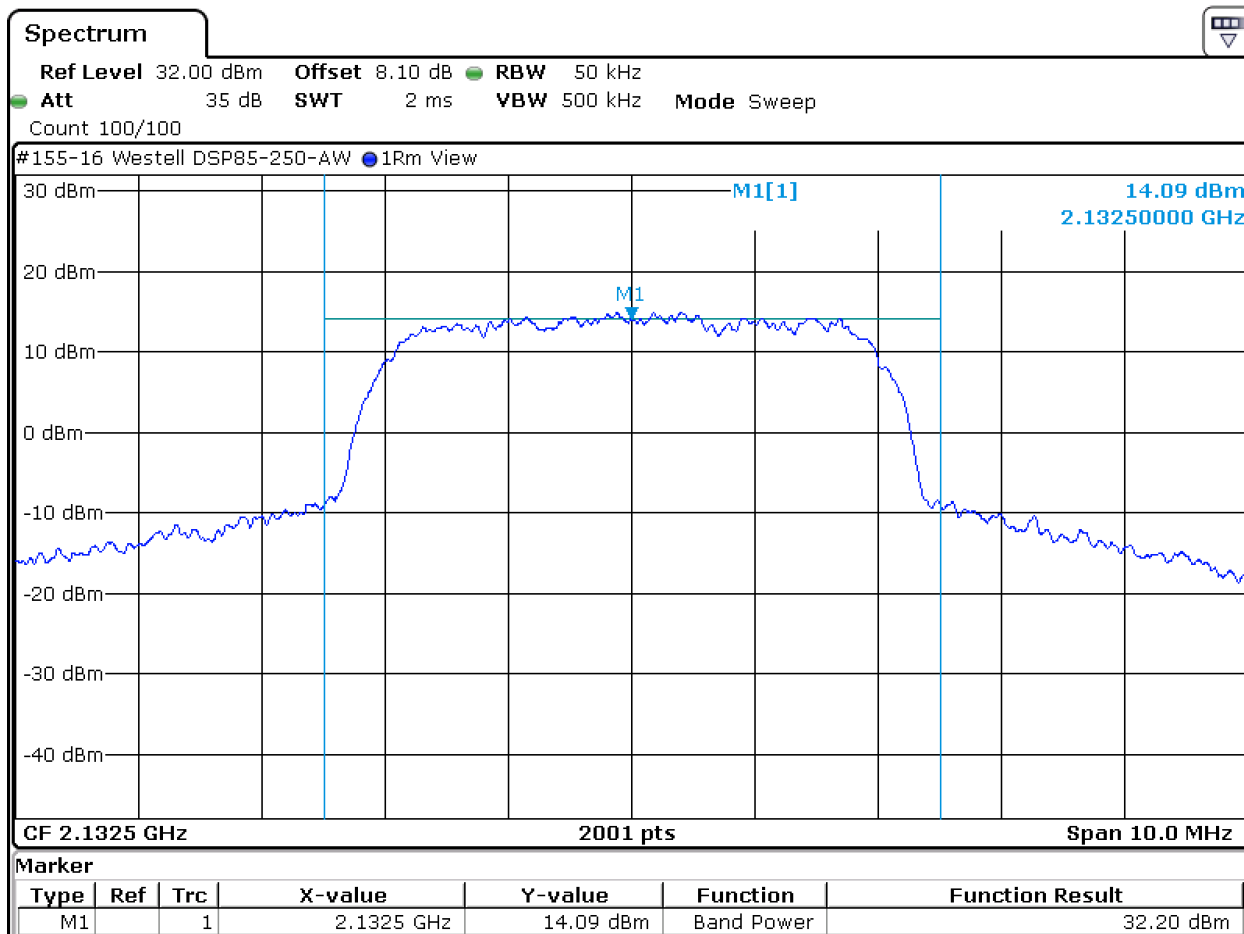
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 15:46:17

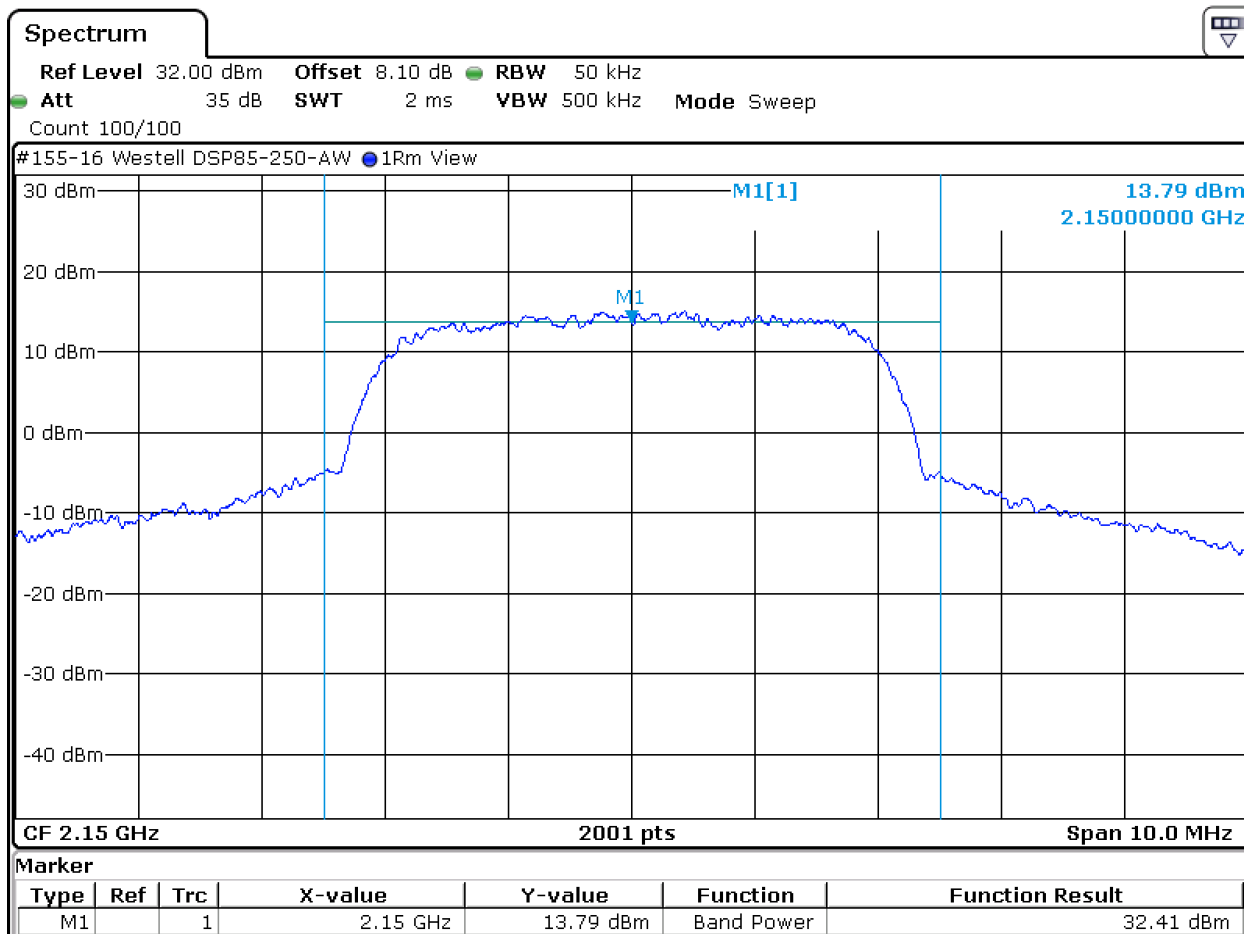
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 15:44:51

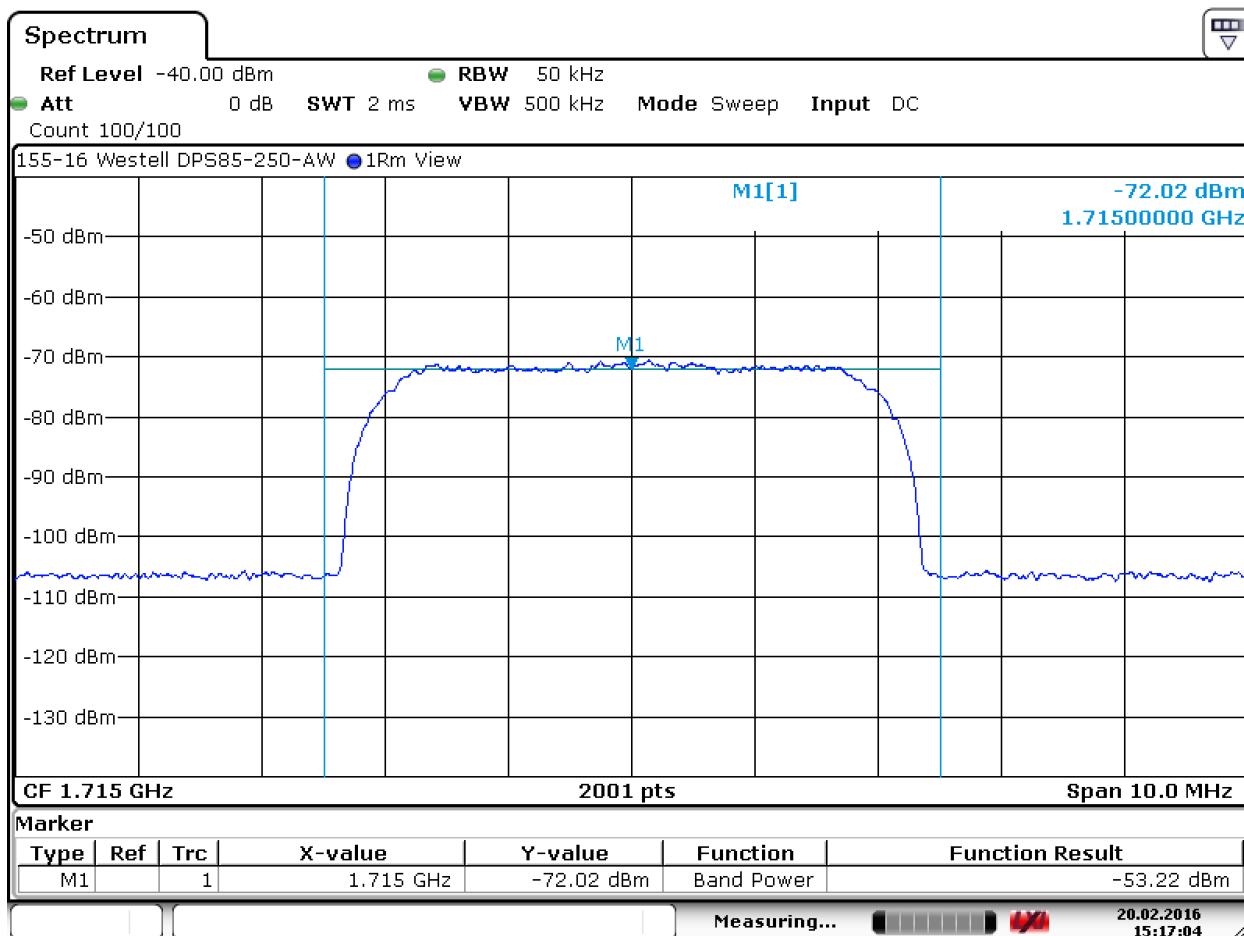
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 15:17:03

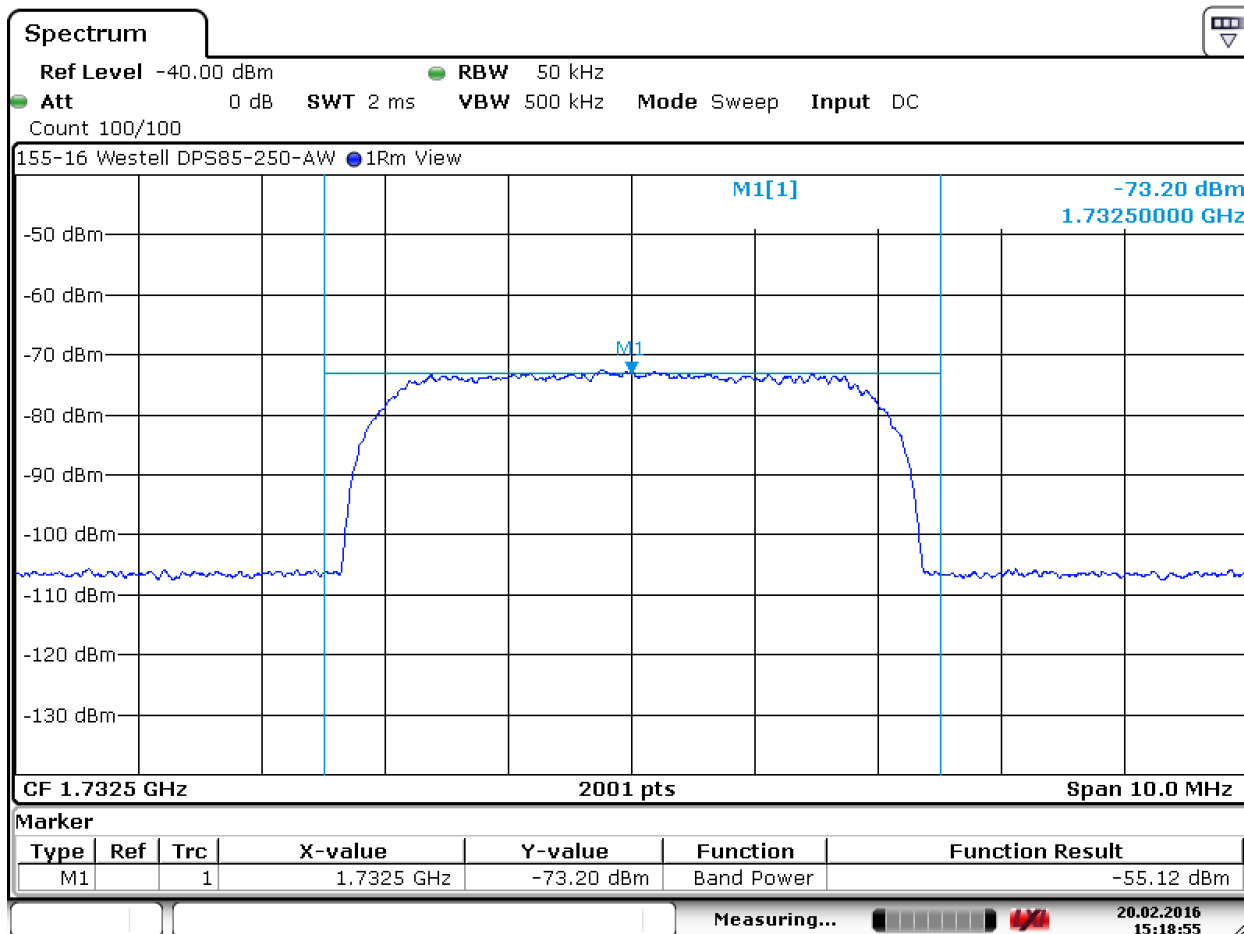
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 15:18:54

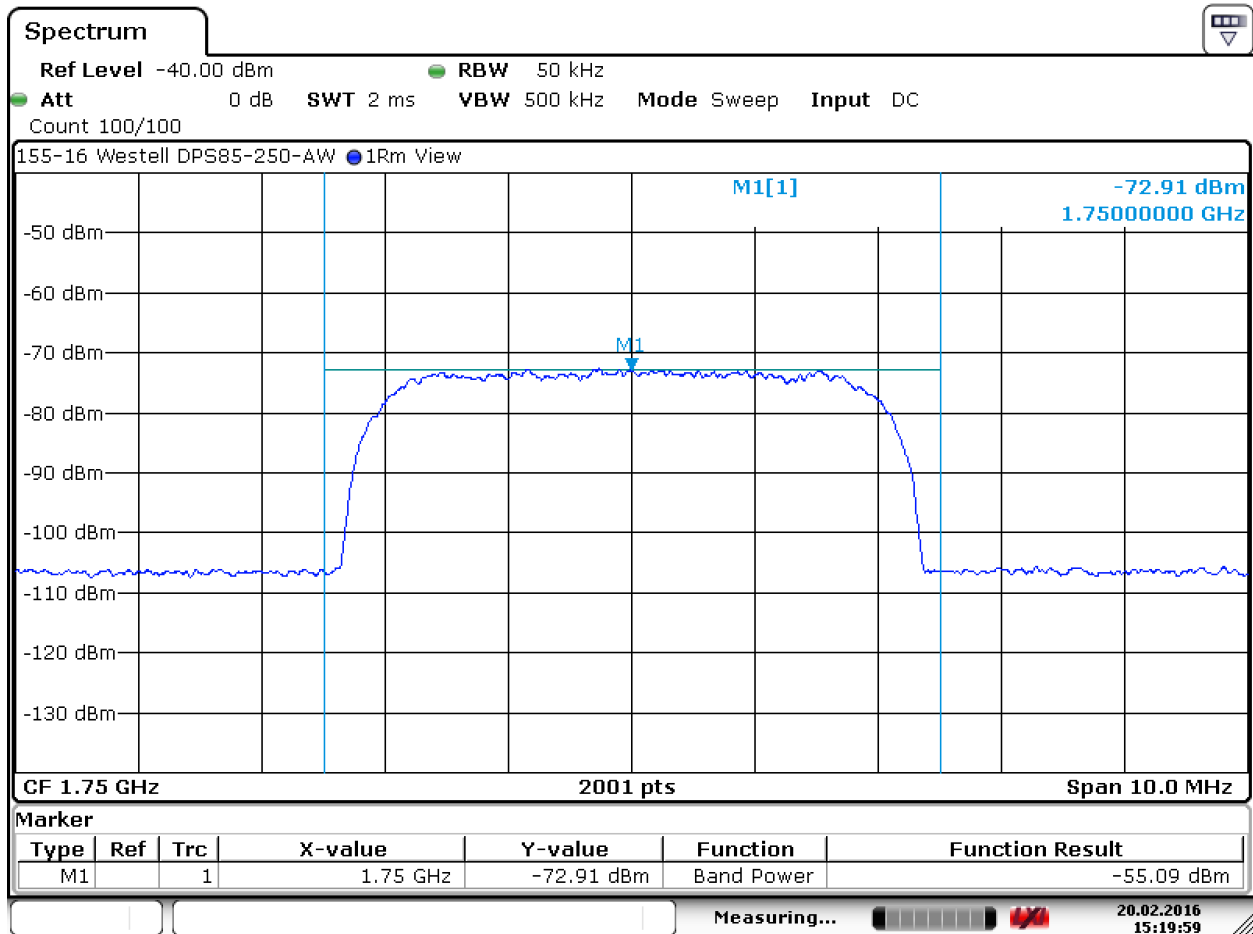
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 15:19:59

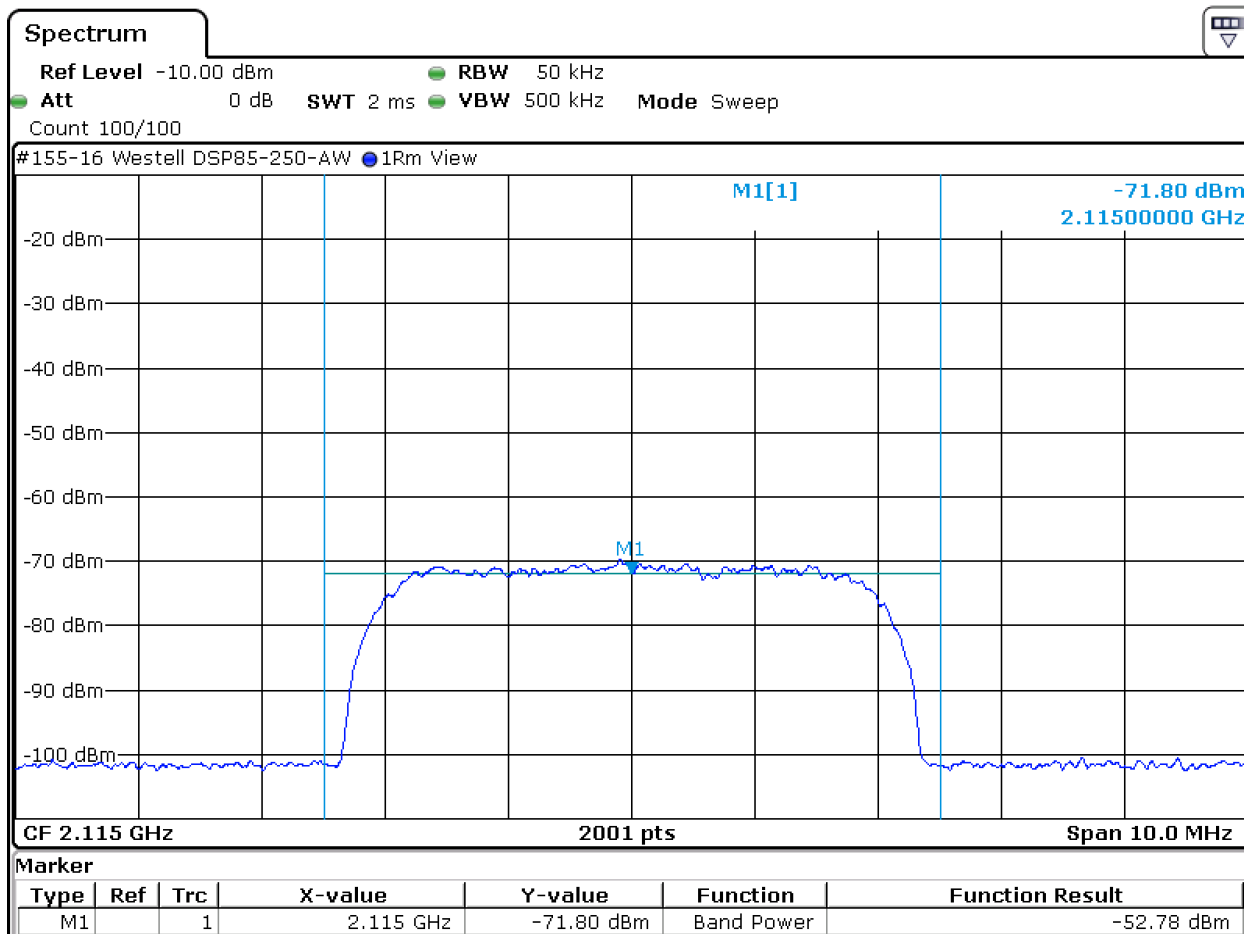
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 16:15:50

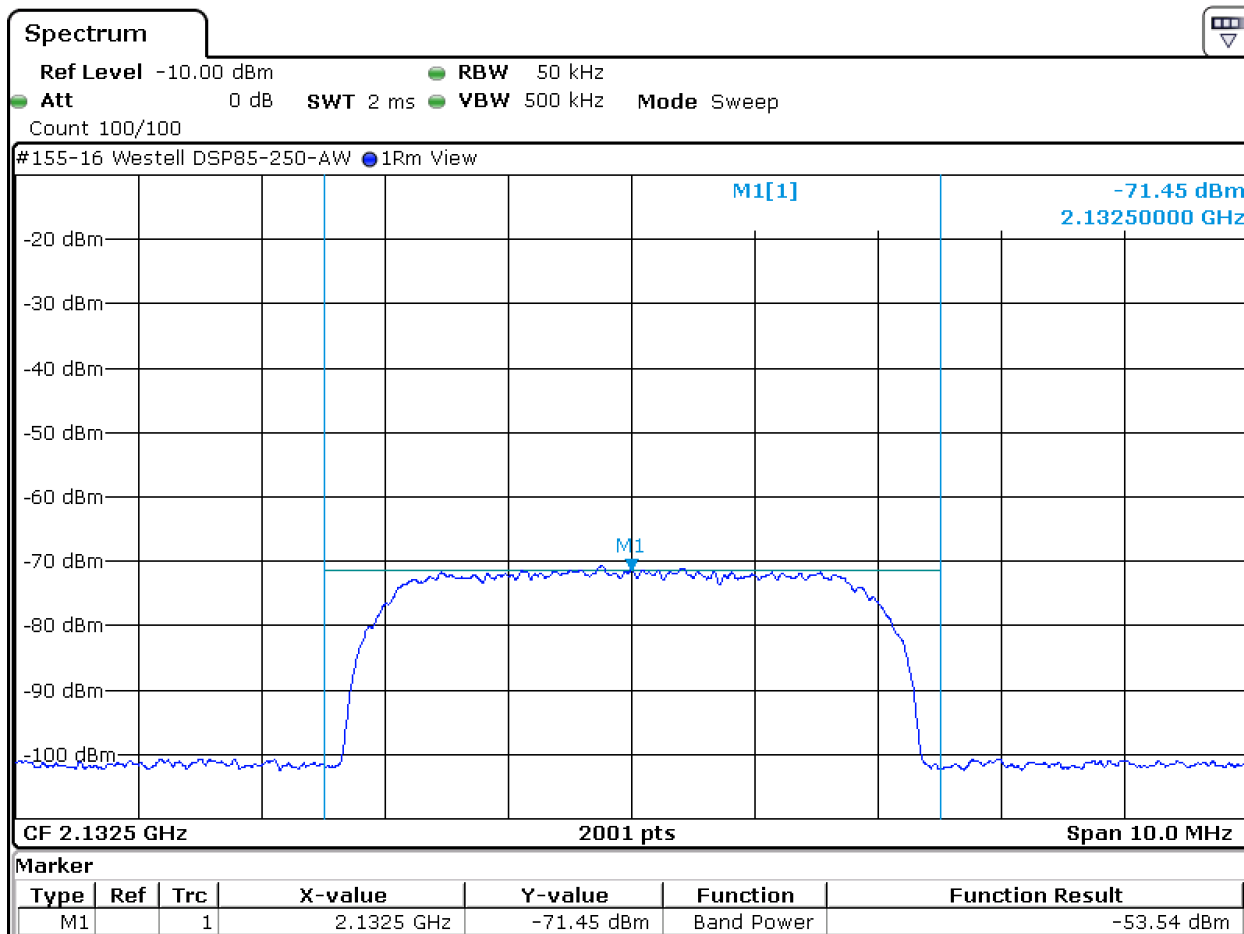
Test Number: 155-16R2

Issue Date: 4/29/2016

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

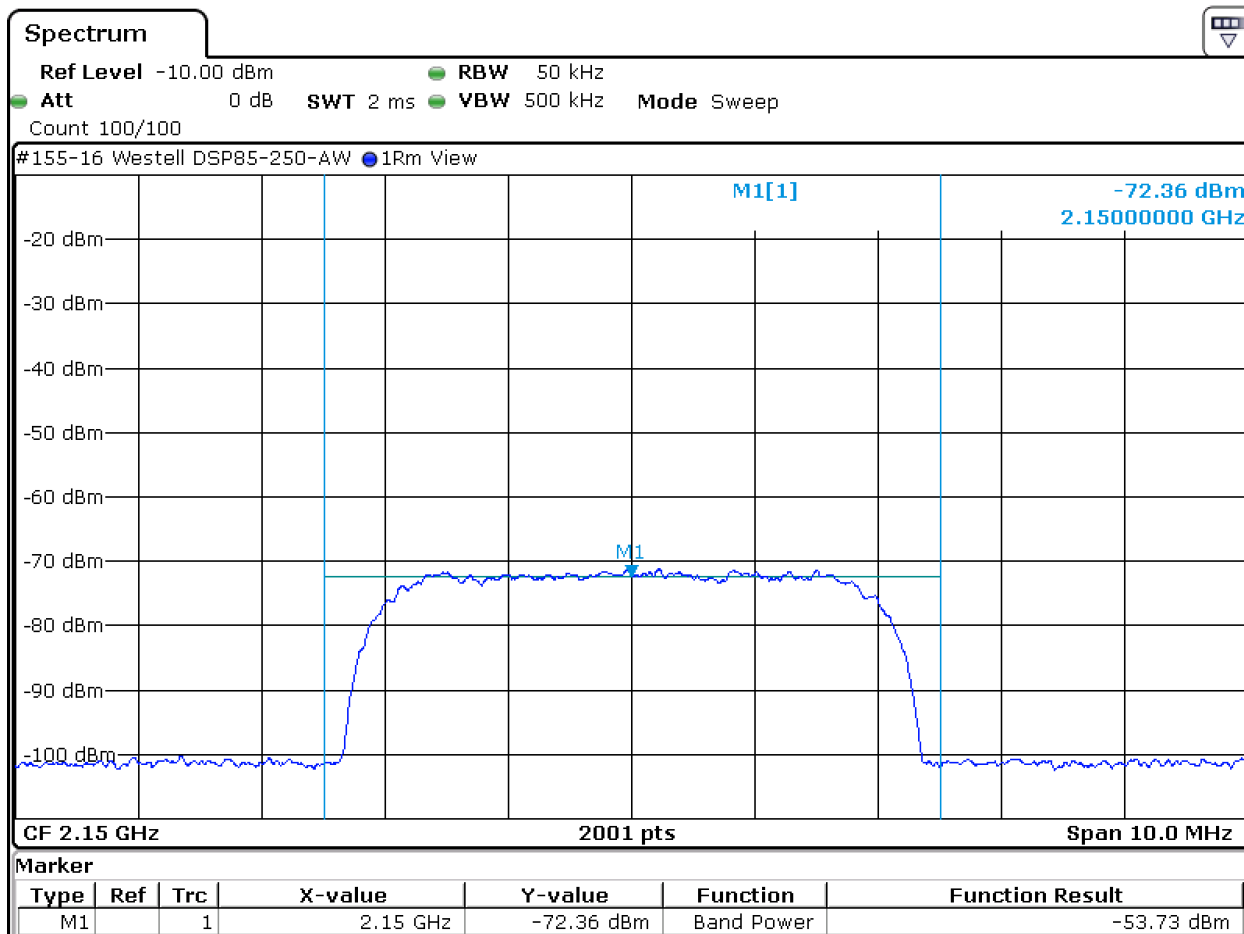
Test Number: 155-16R2

Issue Date: 4/29/2016

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

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.

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

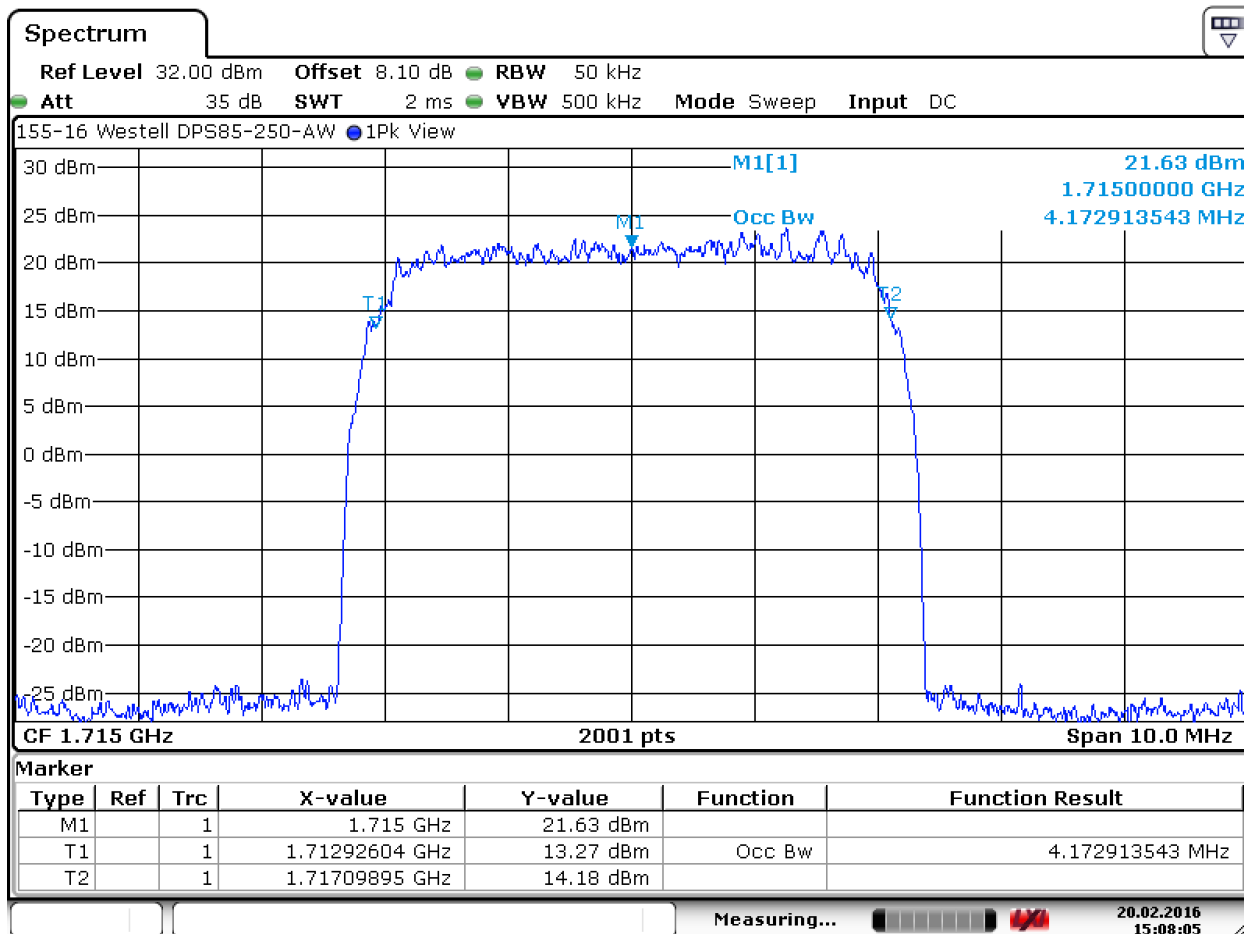
Test Number: 155-16R2

Issue Date: 4/29/2016

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



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

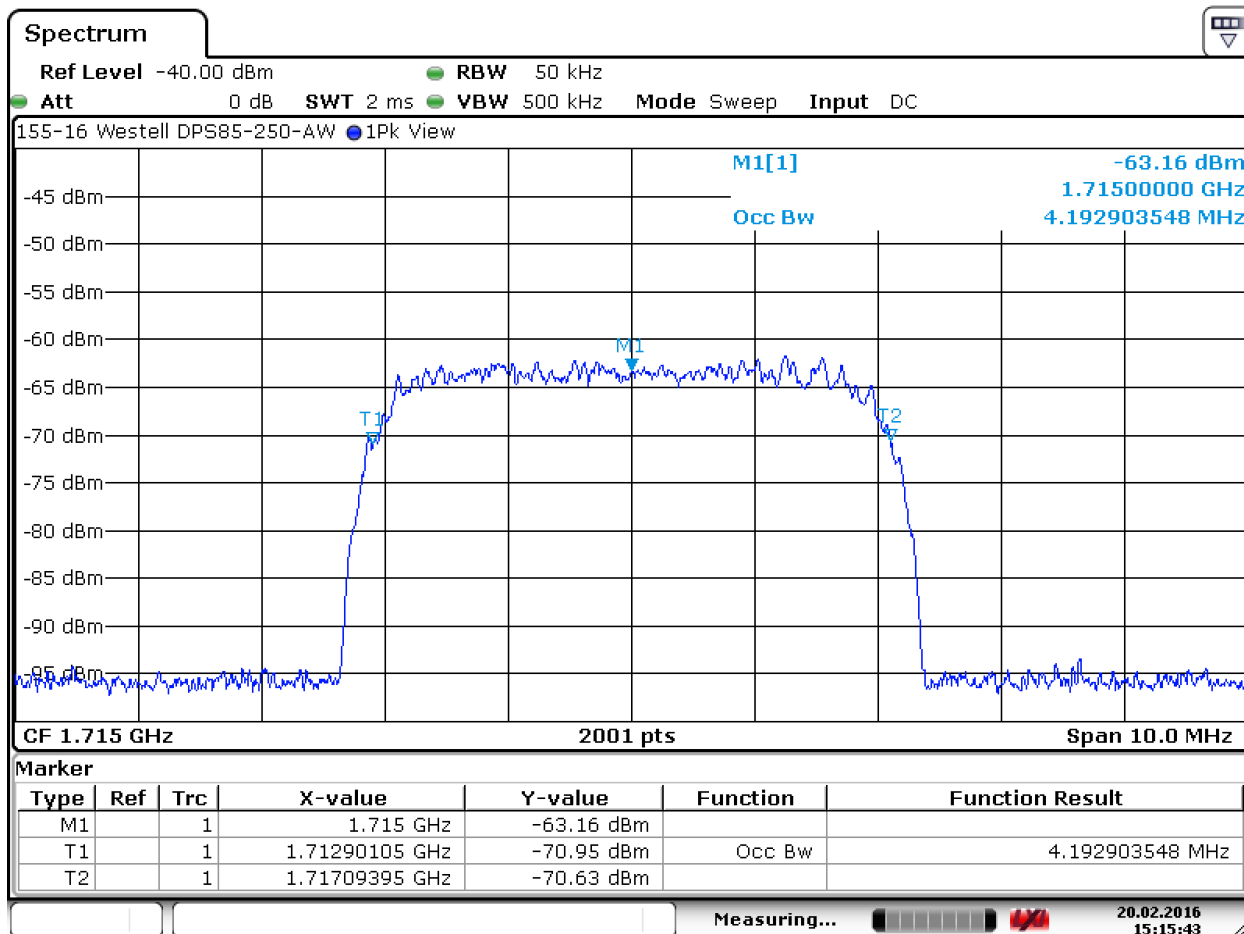
Test Number: 155-16R2

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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

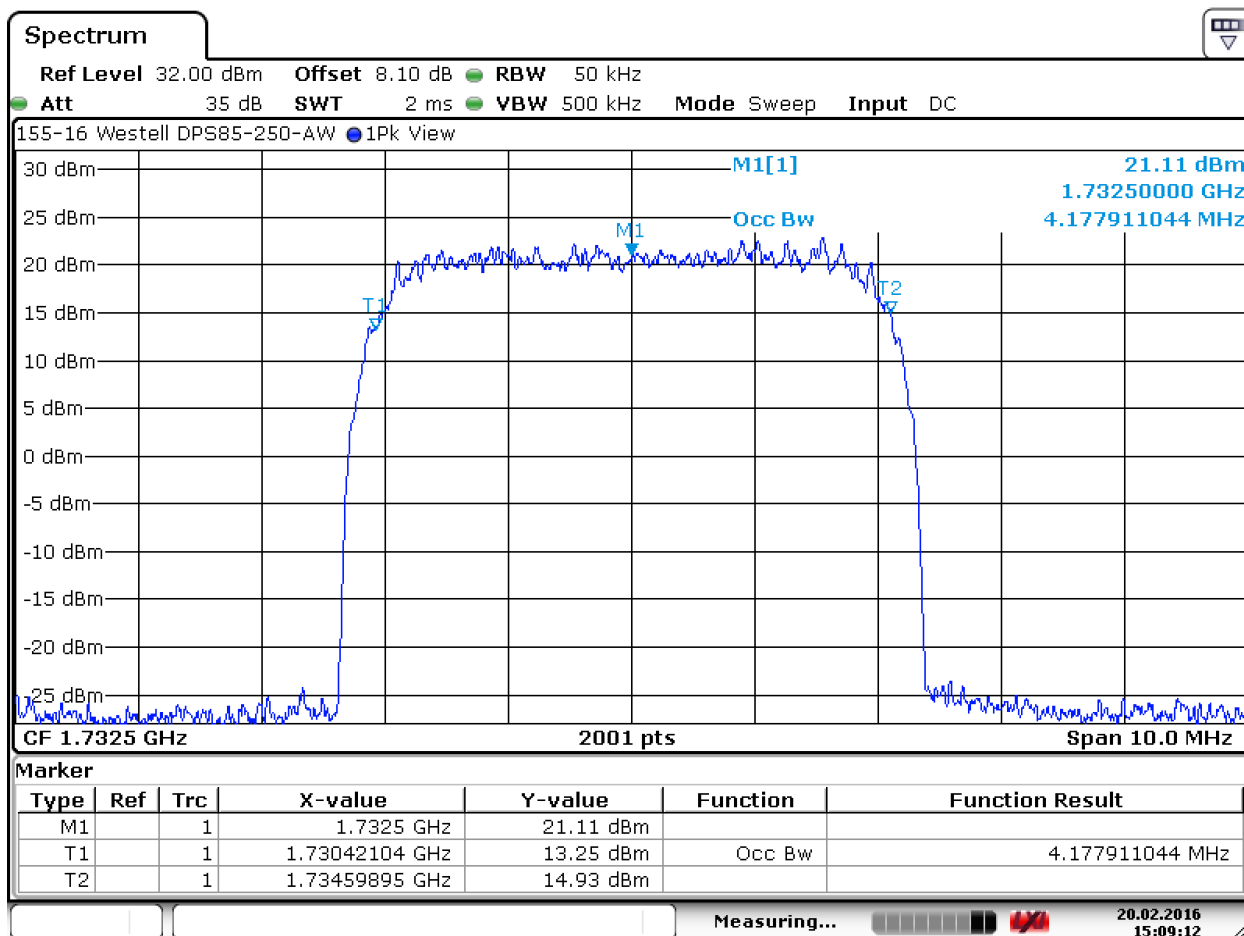
Test Number: 155-16R2

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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



Date: 20.FEB.2016 15:09:12

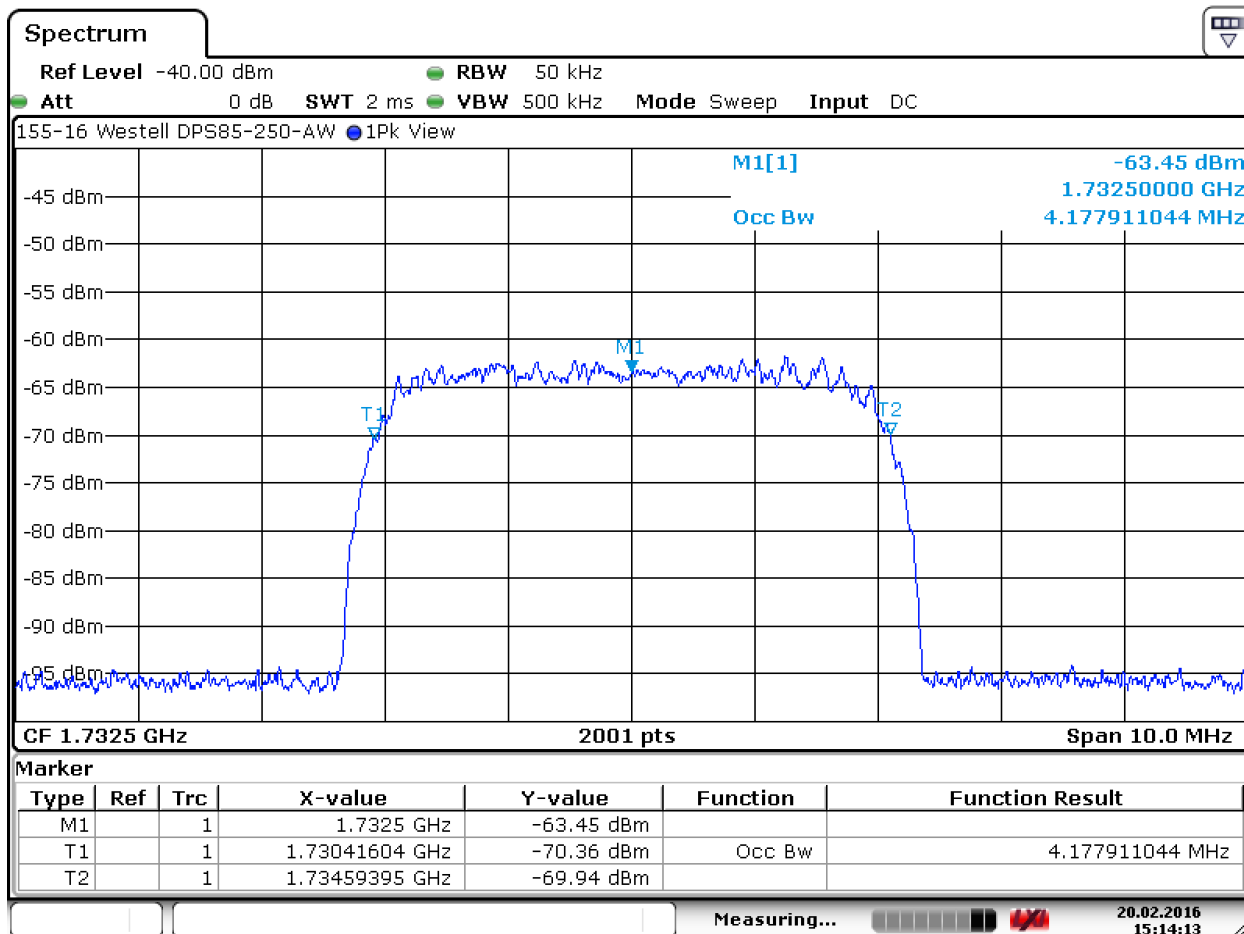
Test Number: 155-16R2

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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



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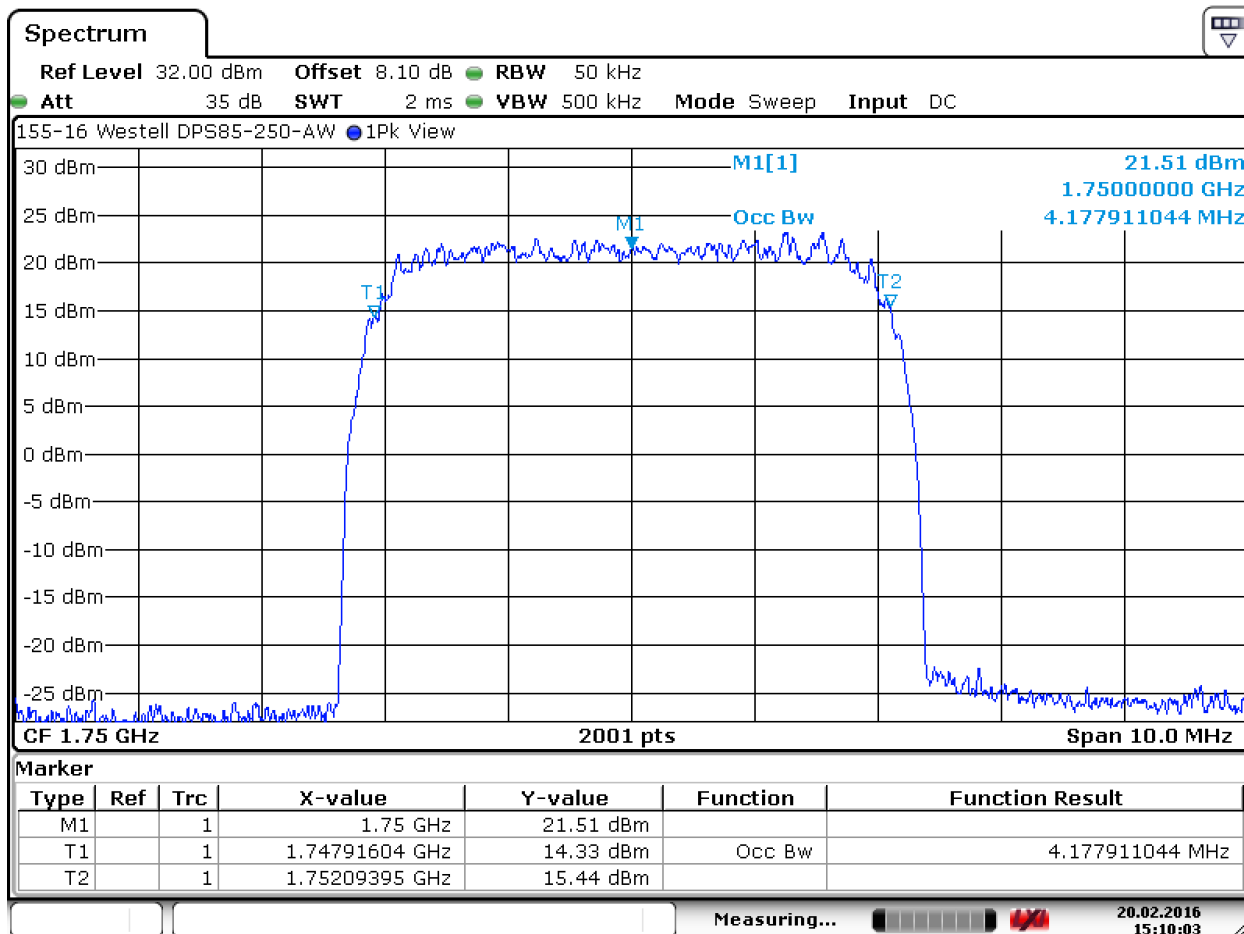
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 15:10:02

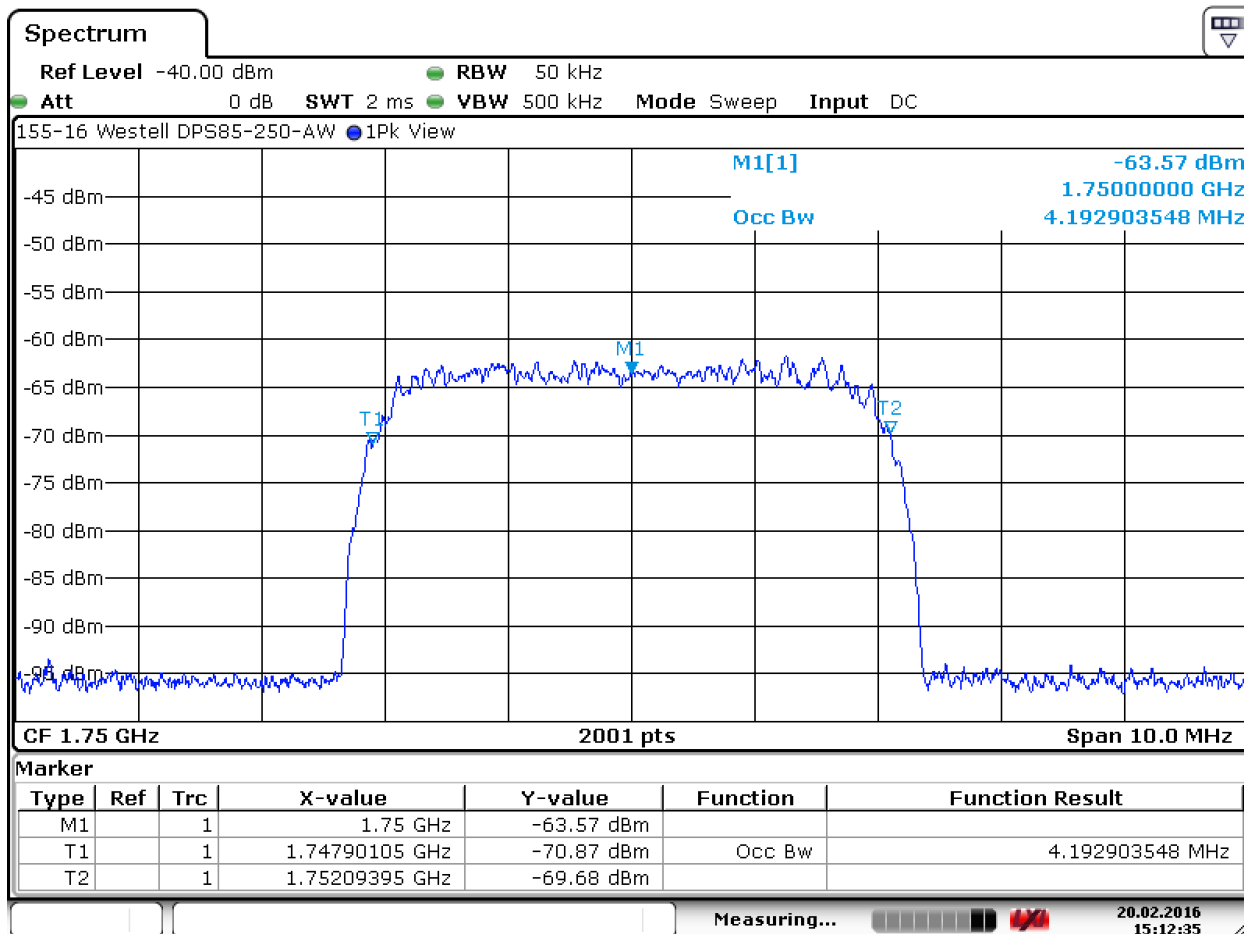
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 20.FEB.2016 15:12:34

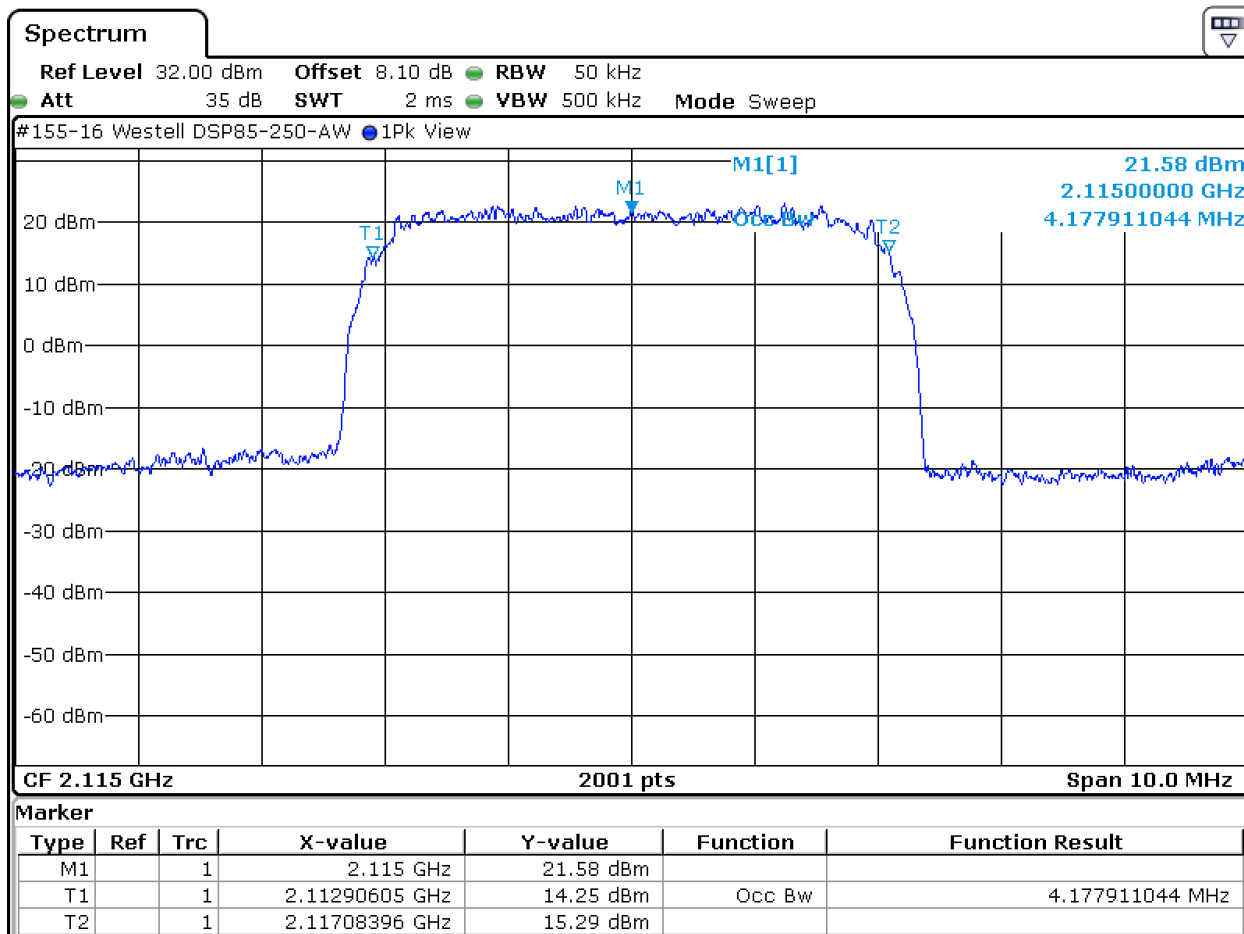
Test Number: 155-16R2

Issue Date: 4/29/2016

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



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

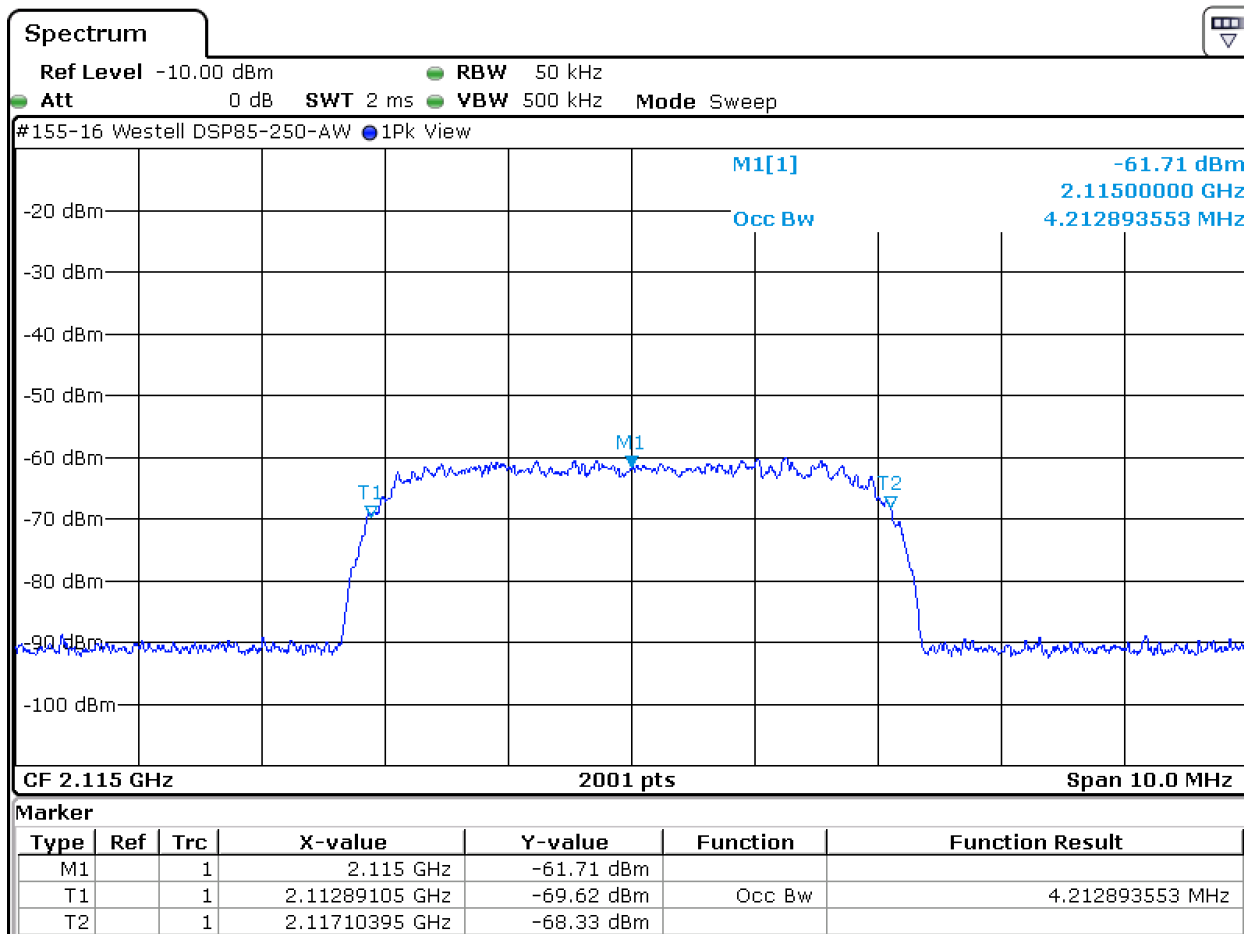
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 16:14:26

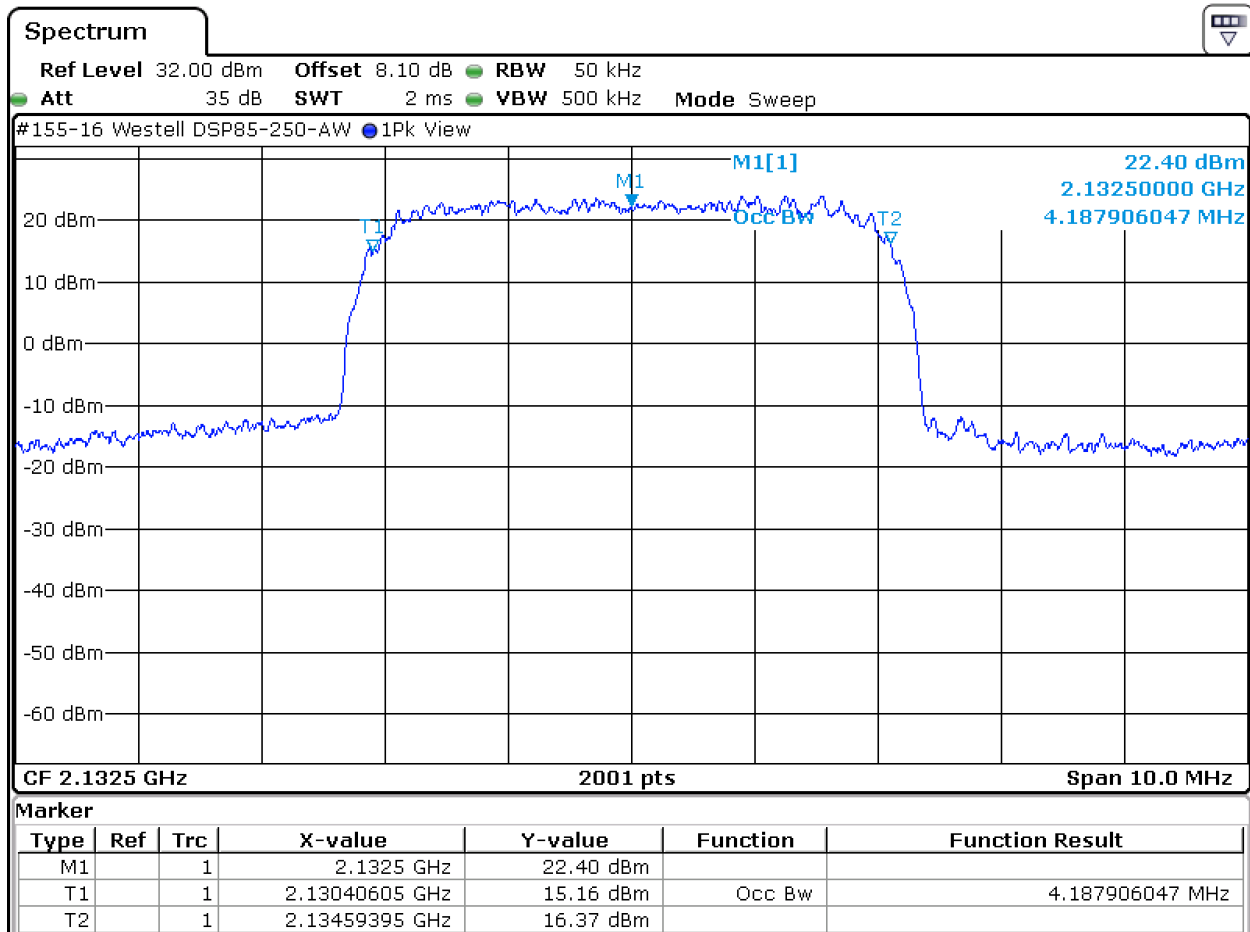
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 16:07:45

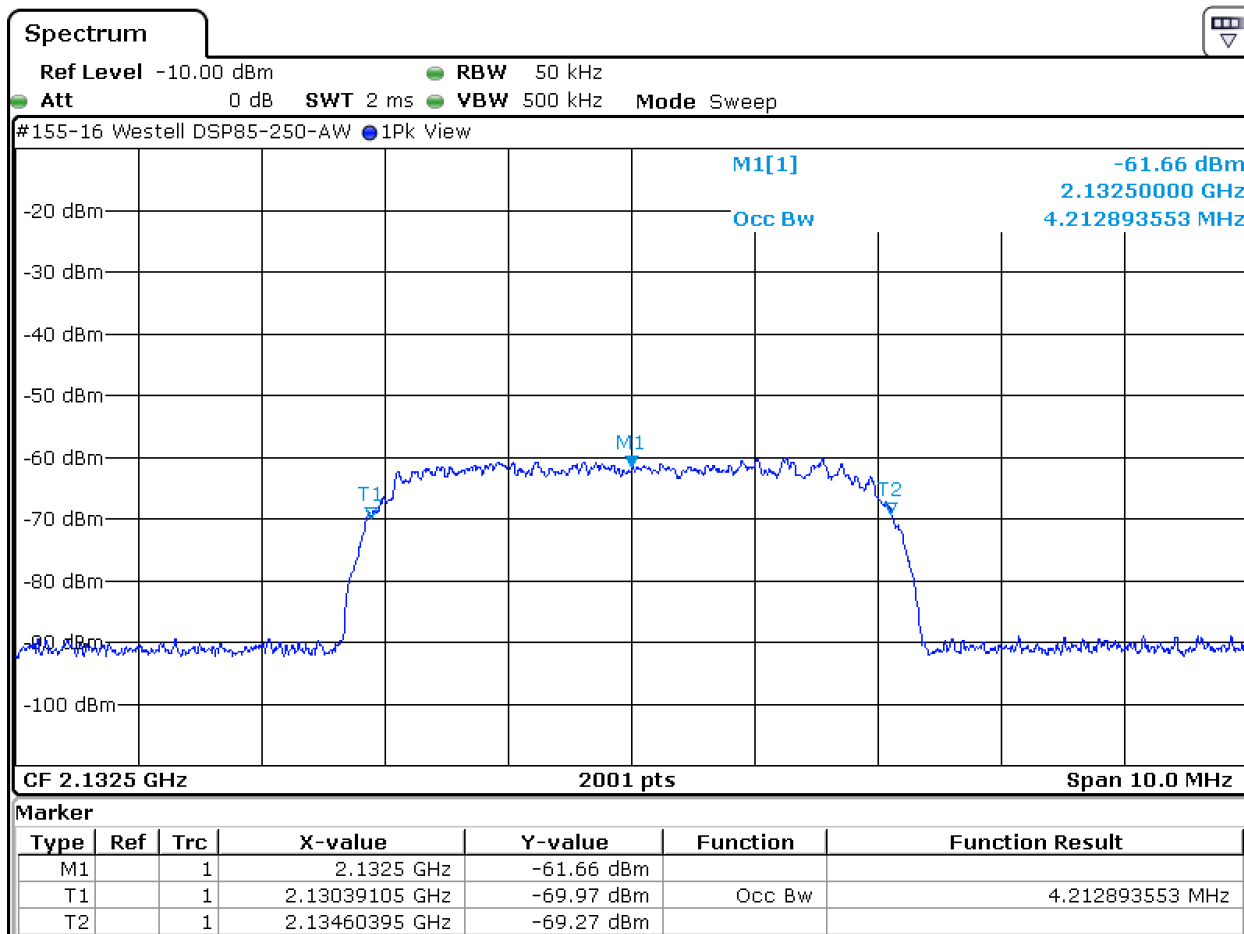
Test Number: 155-16R2

Issue Date: 4/29/2016

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



Date: 23.FEB.2016 16:12:59

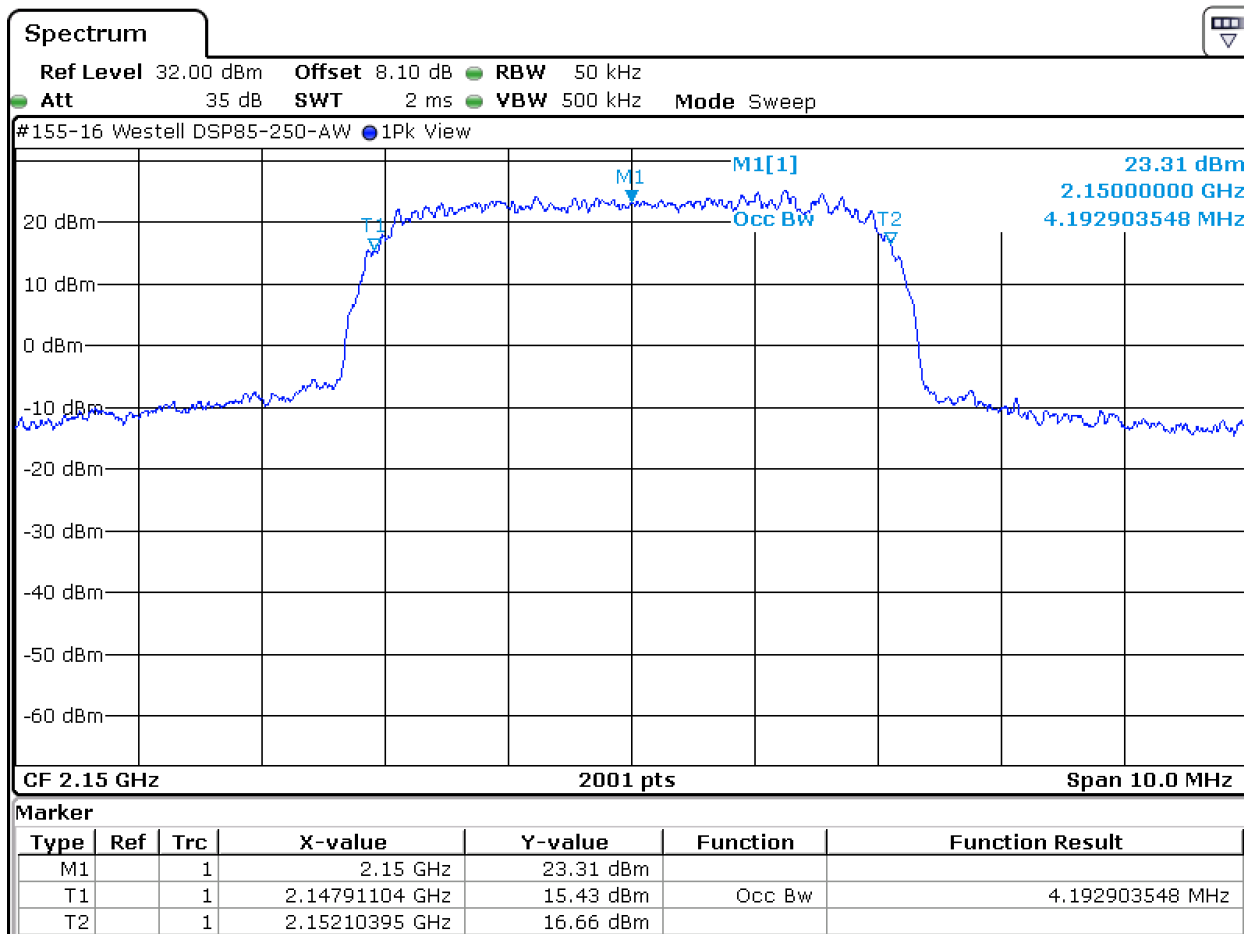
Test Number: 155-16R2

Issue Date: 4/29/2016

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



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

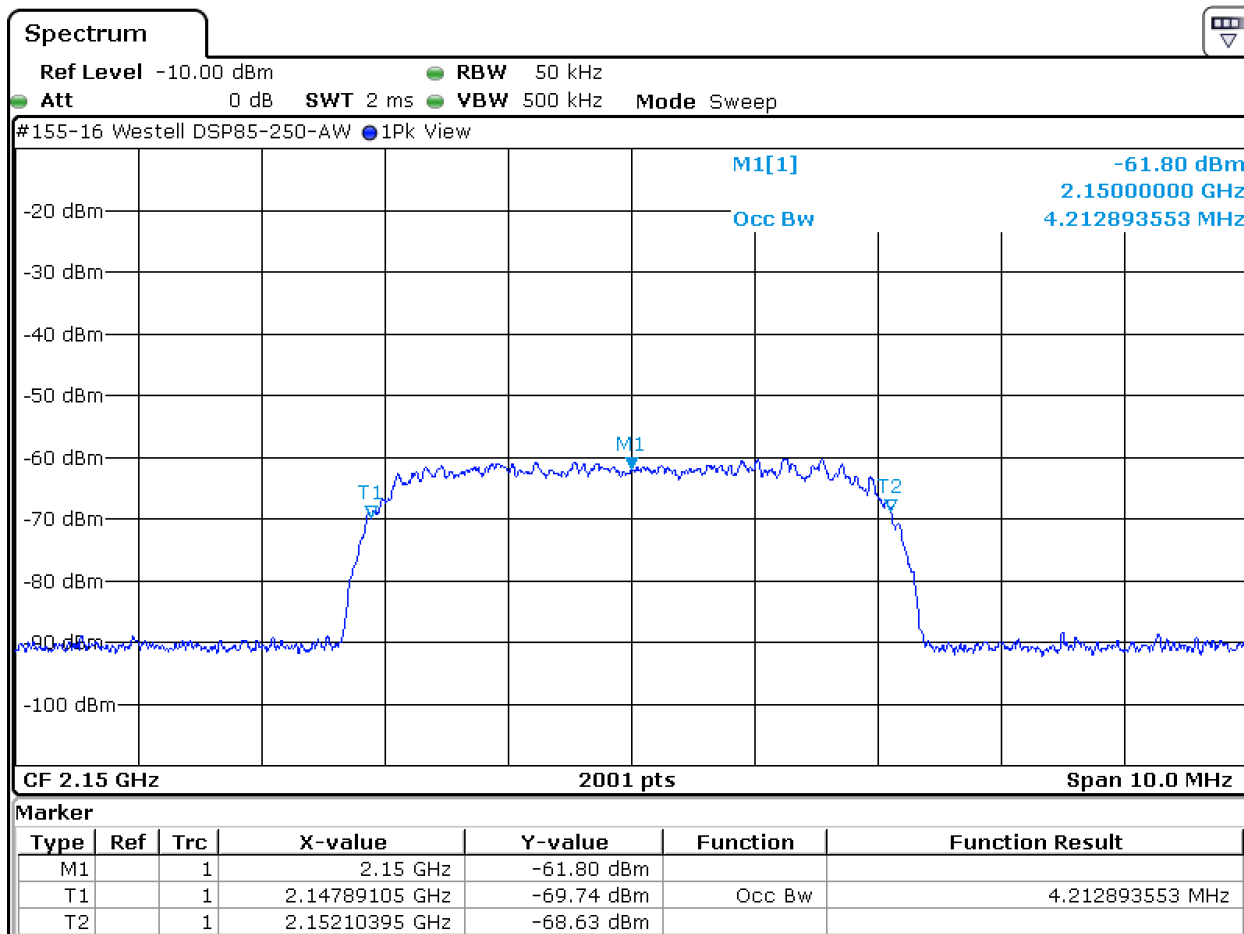
Test Number: 155-16R2

Issue Date: 4/29/2016

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



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

6. Measurement Data (continued)

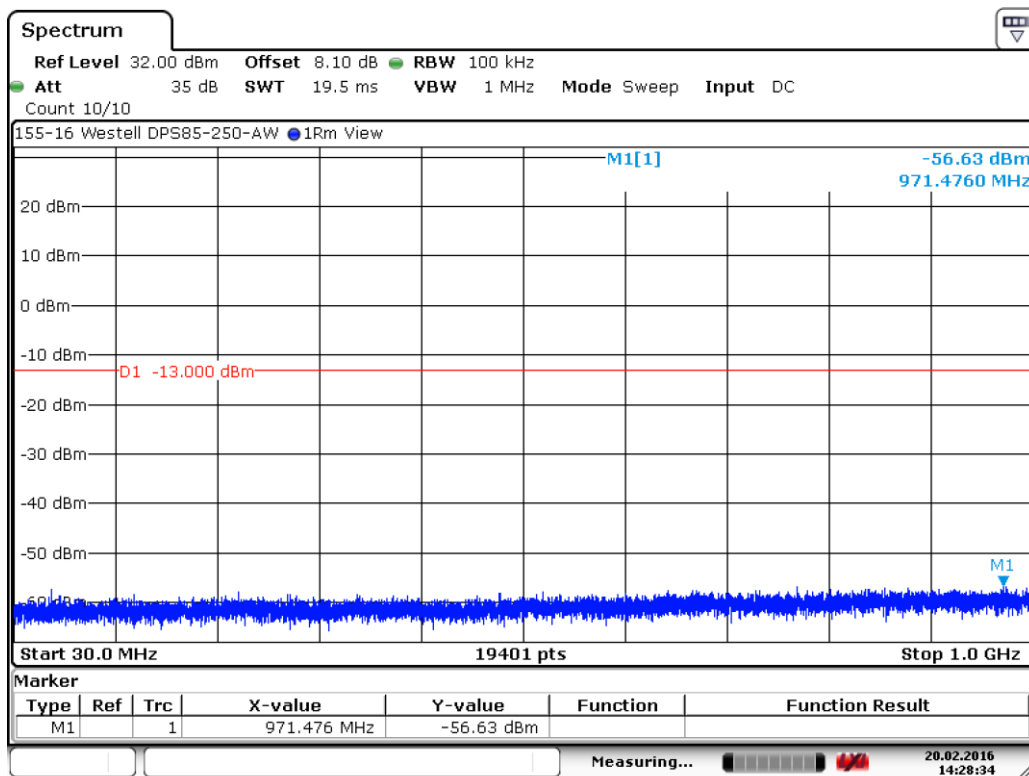
6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6

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



Date: 20.FEB.2016 14:28:33

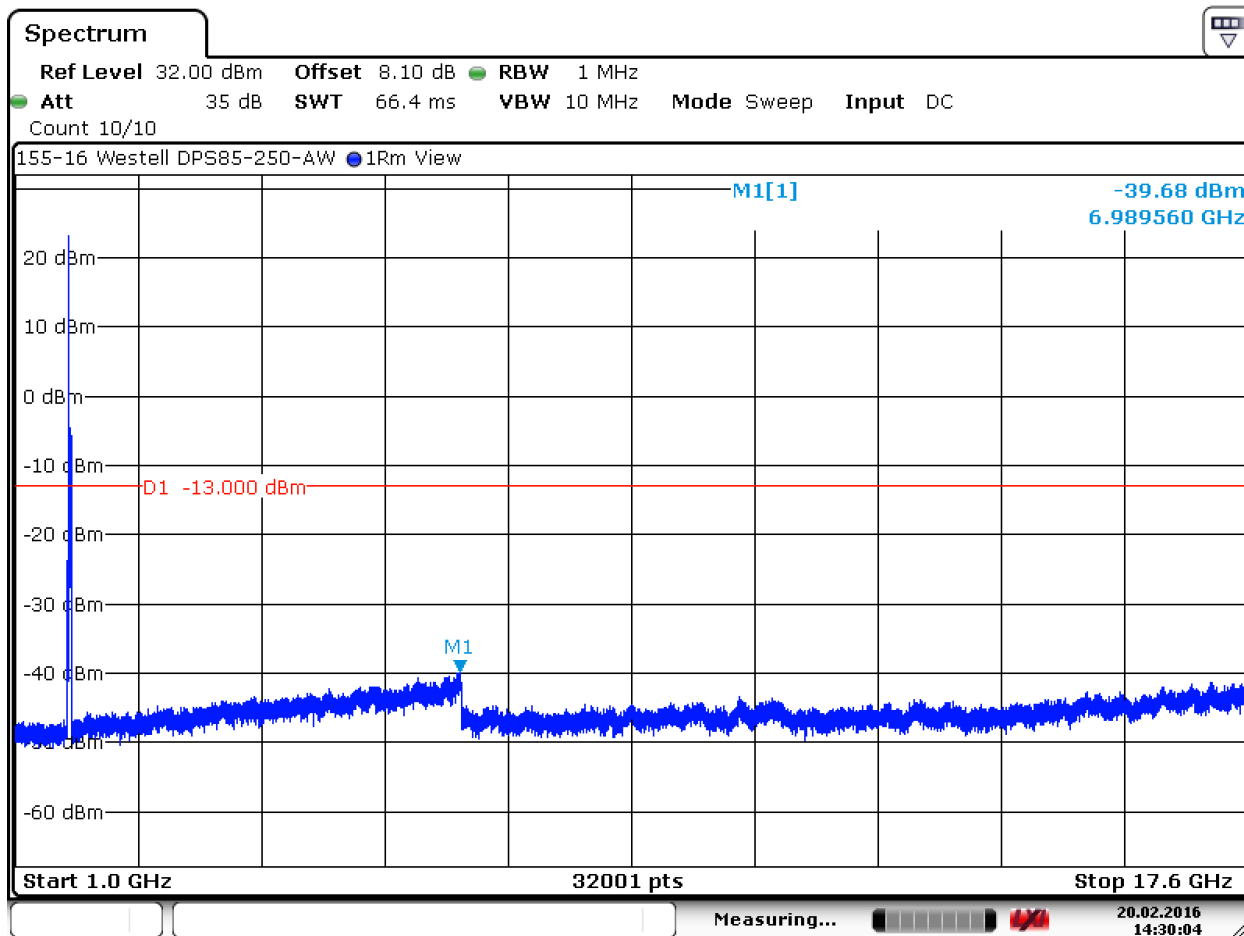
Test Number: 155-16R2

Issue Date: 4/29/2016

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

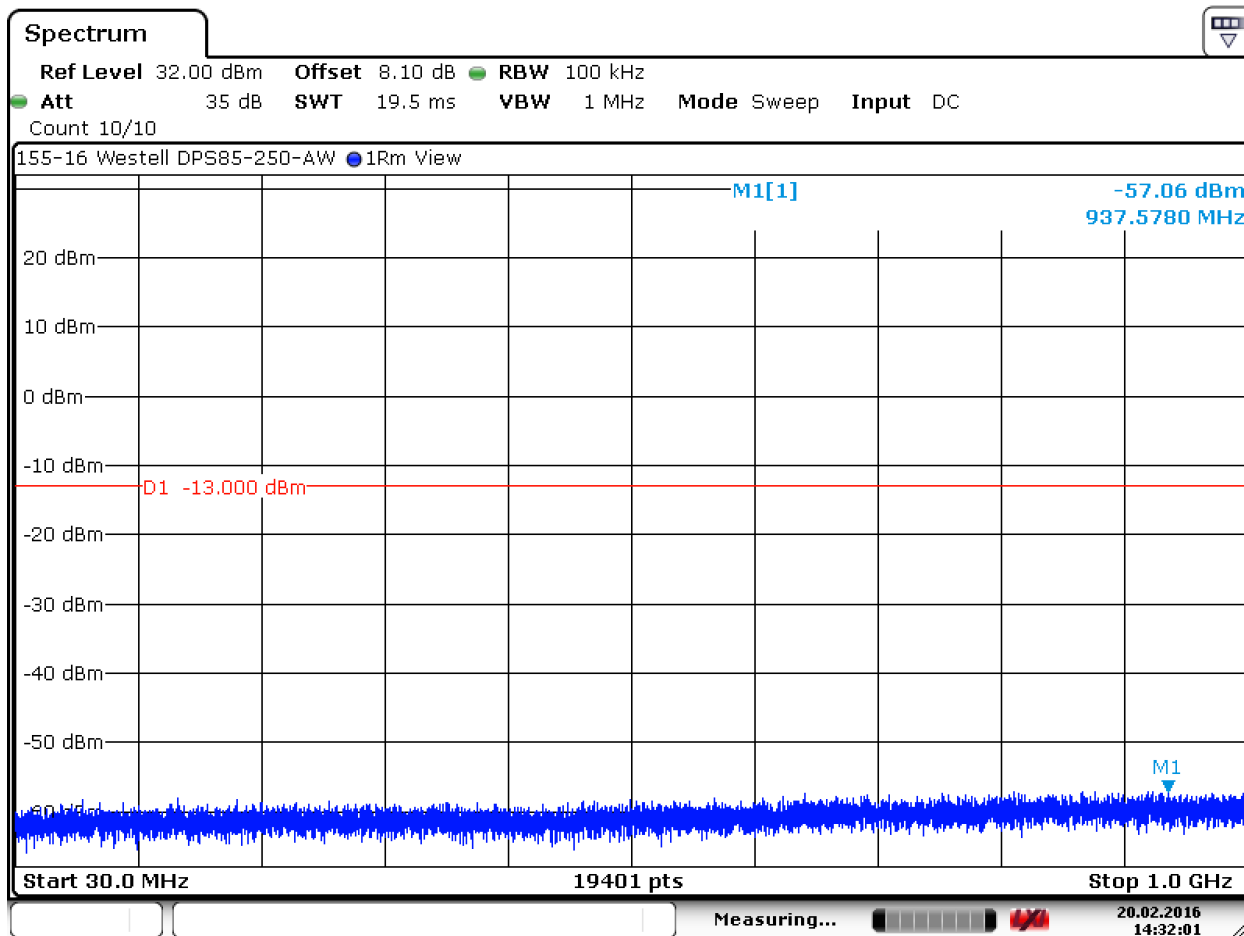
Test Number: 155-16R2

Issue Date: 4/29/2016

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

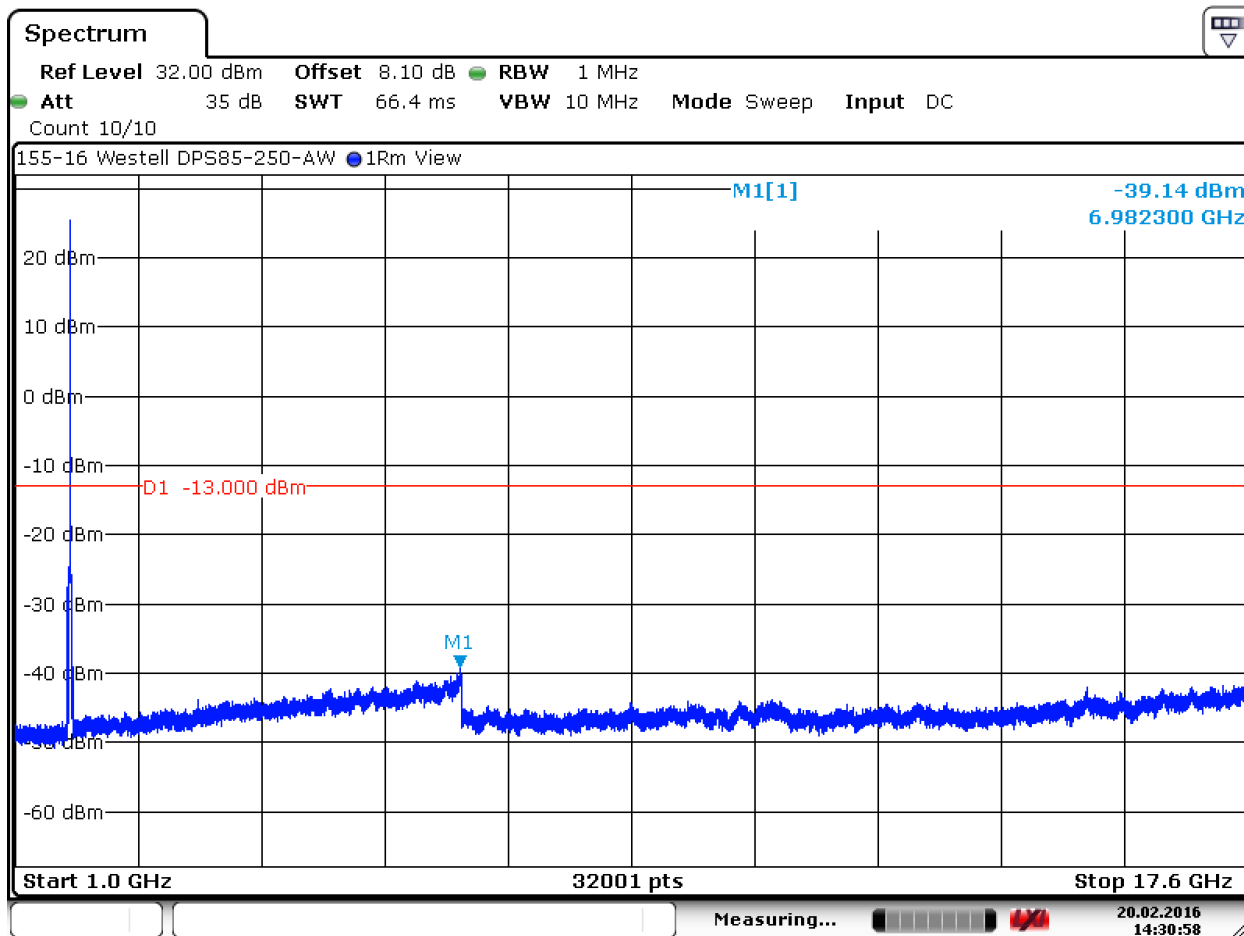
Test Number: 155-16R2

Issue Date: 4/29/2016

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

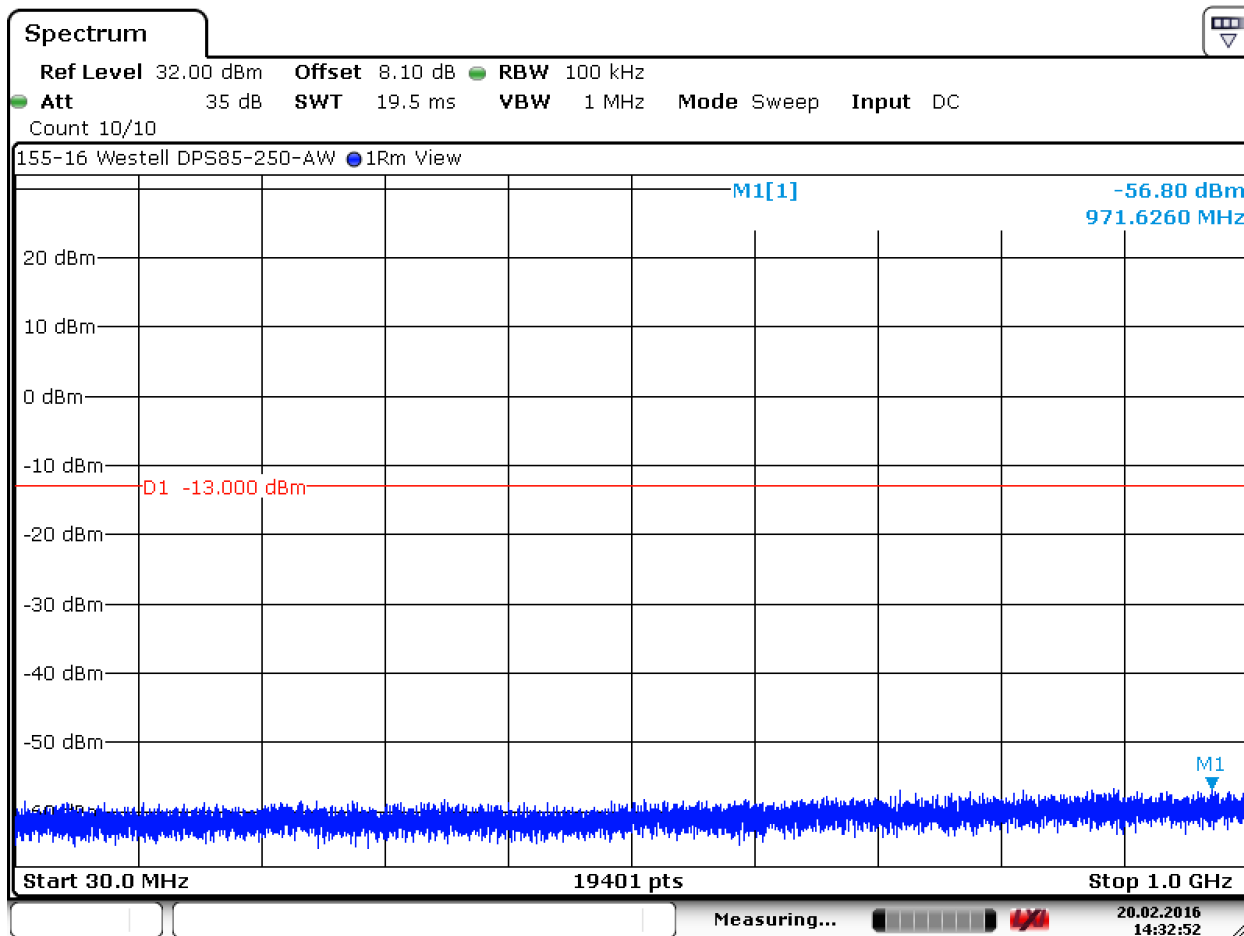
Test Number: 155-16R2

Issue Date: 4/29/2016

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

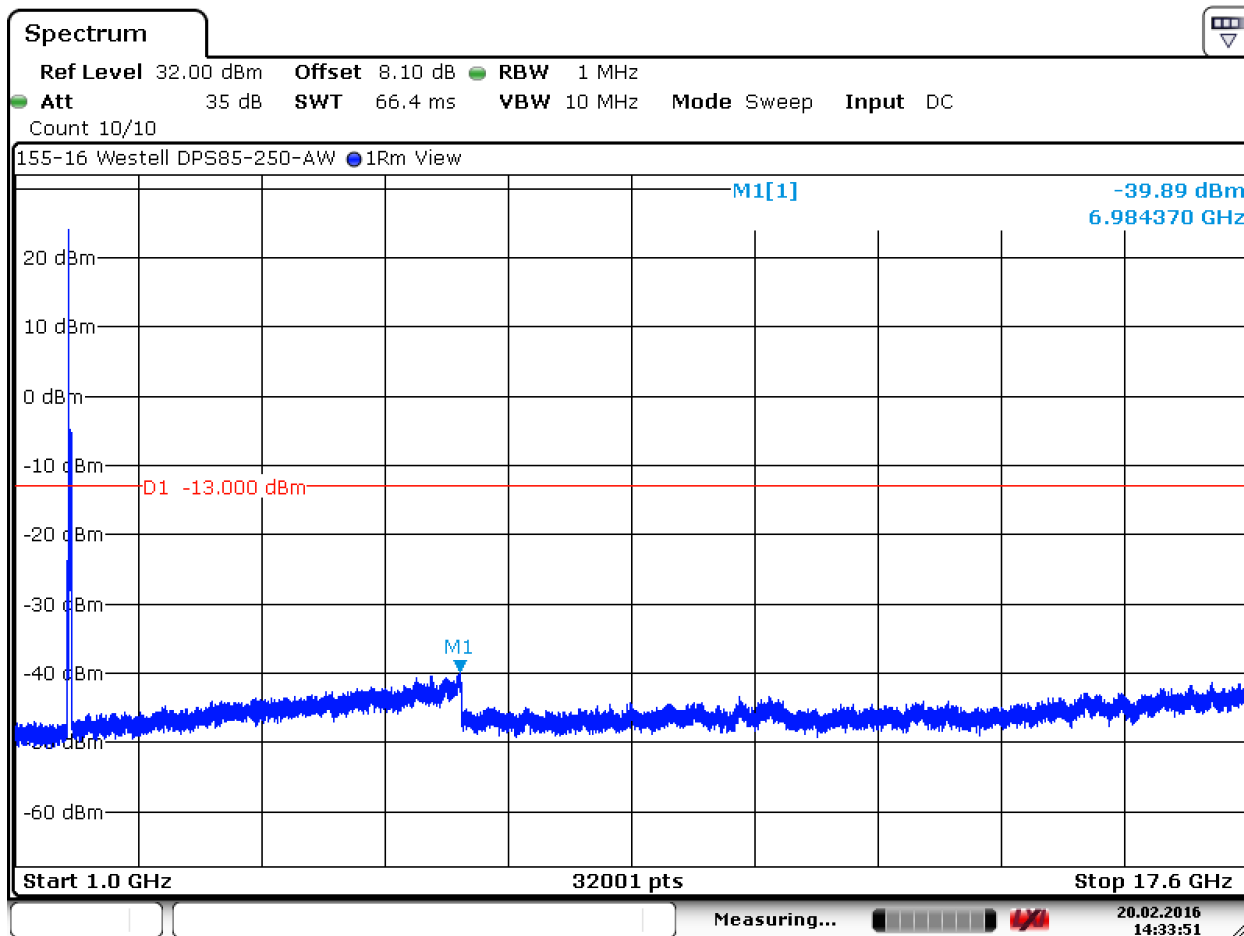
Test Number: 155-16R2

Issue Date: 4/29/2016

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

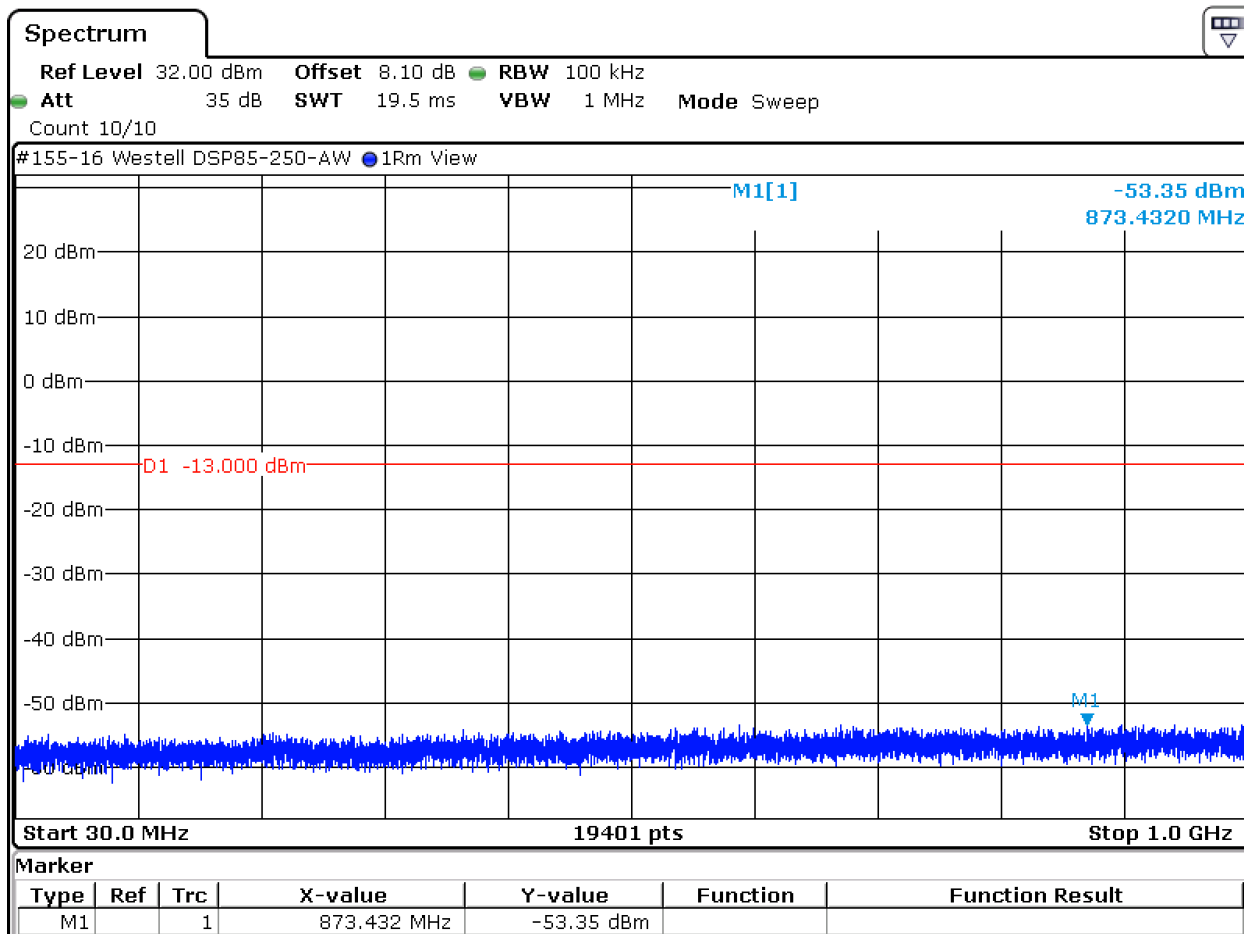
Test Number: 155-16R2

Issue Date: 4/29/2016

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



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

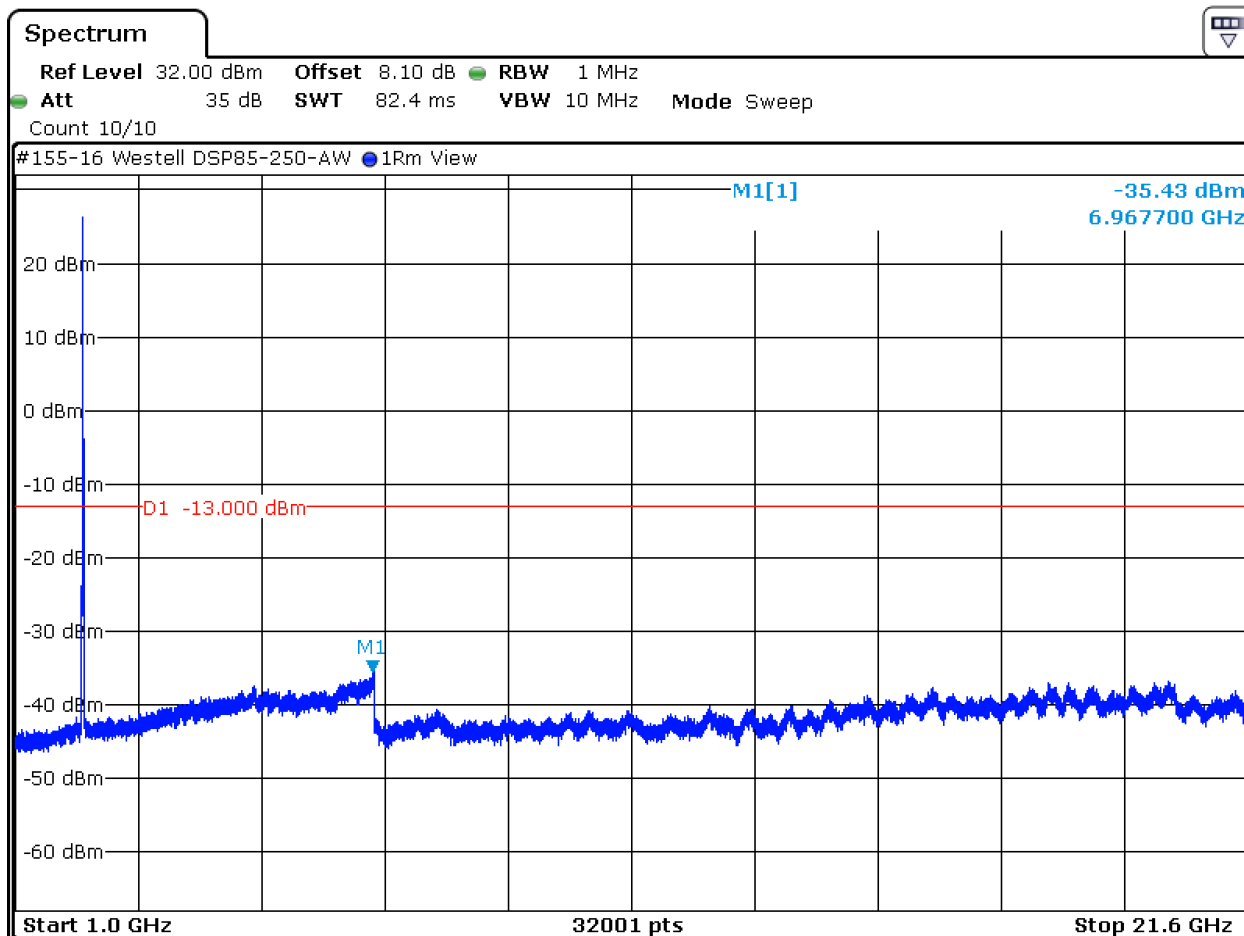
Test Number: 155-16R2

Issue Date: 4/29/2016

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

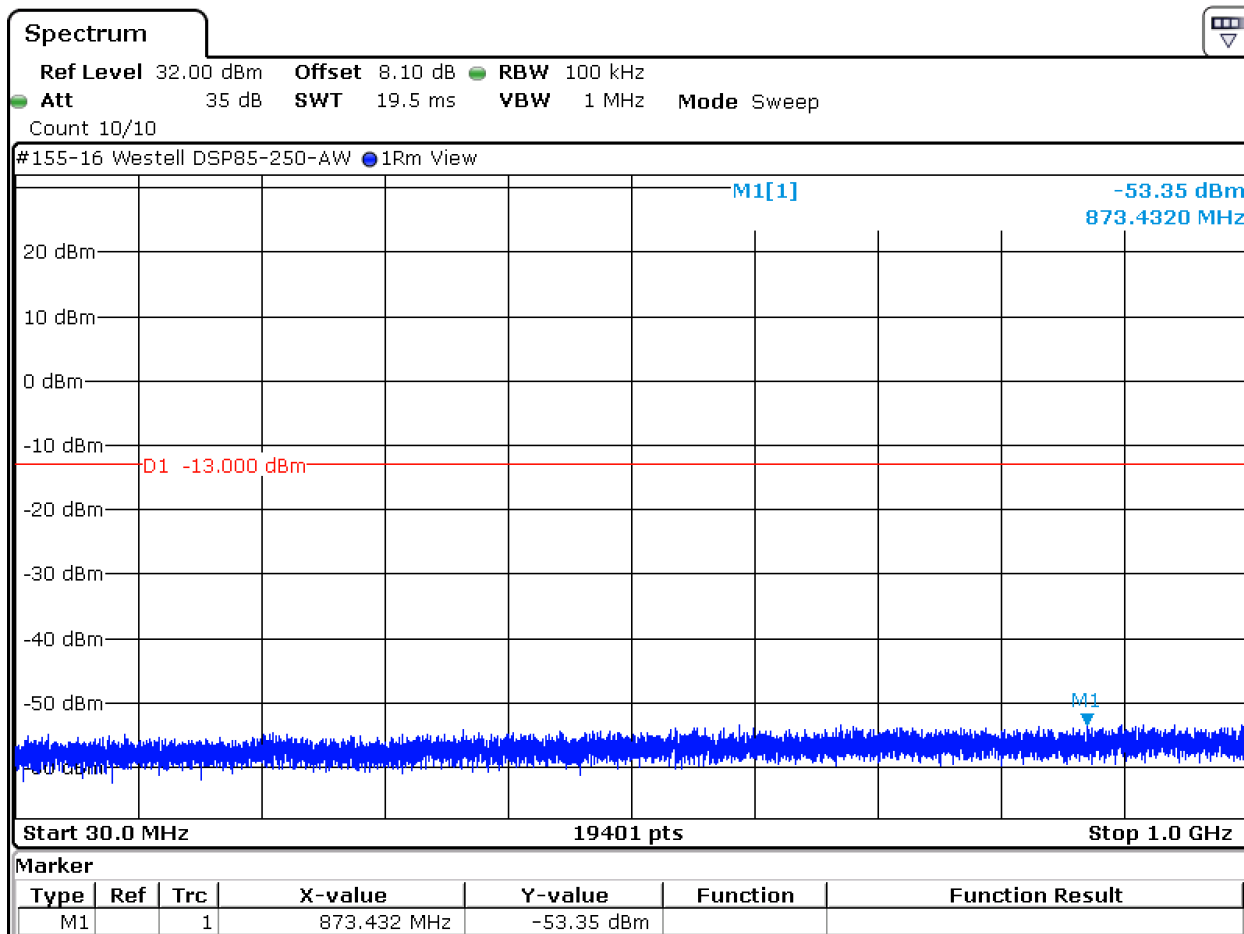
Test Number: 155-16R2

Issue Date: 4/29/2016

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

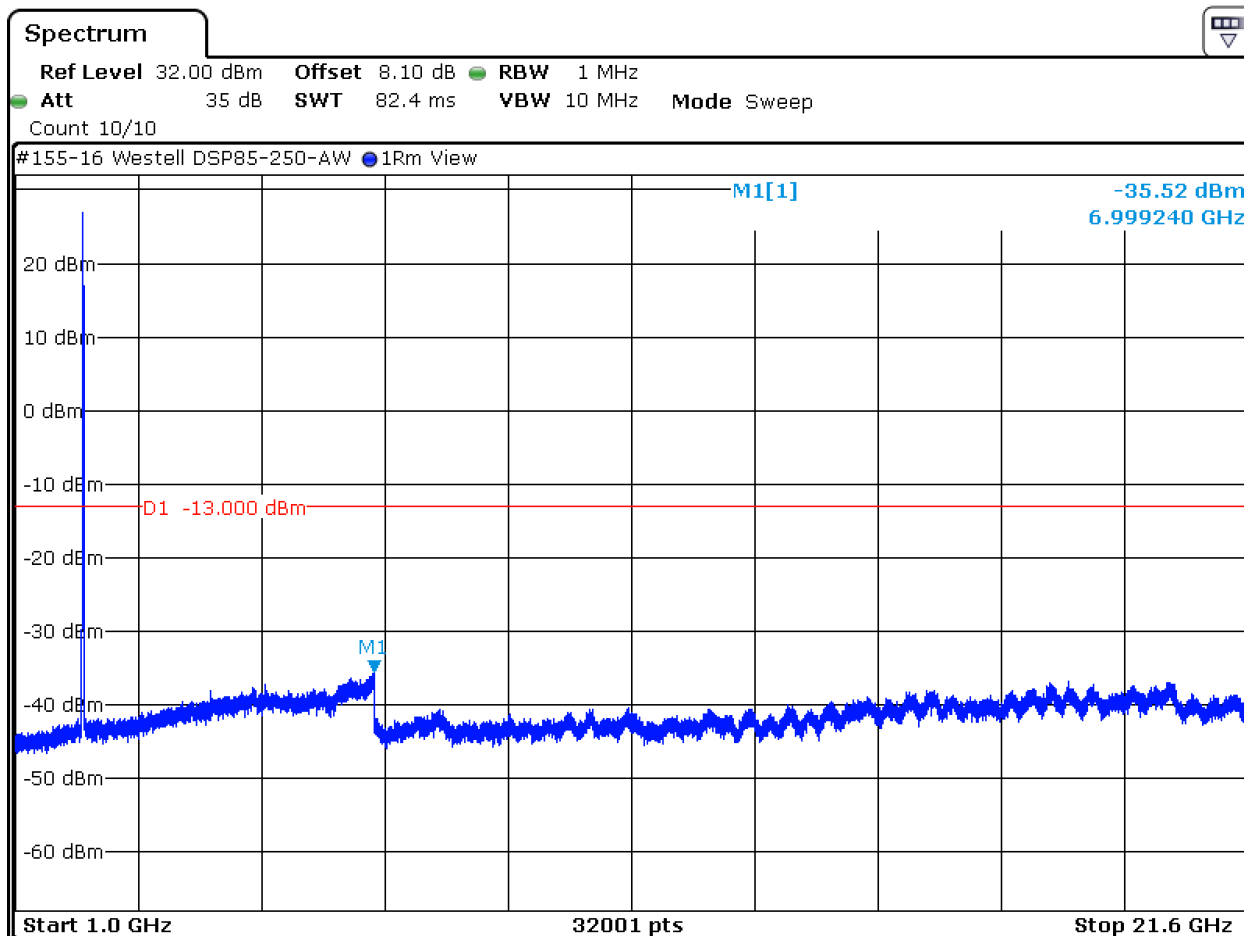
Test Number: 155-16R2

Issue Date: 4/29/2016

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

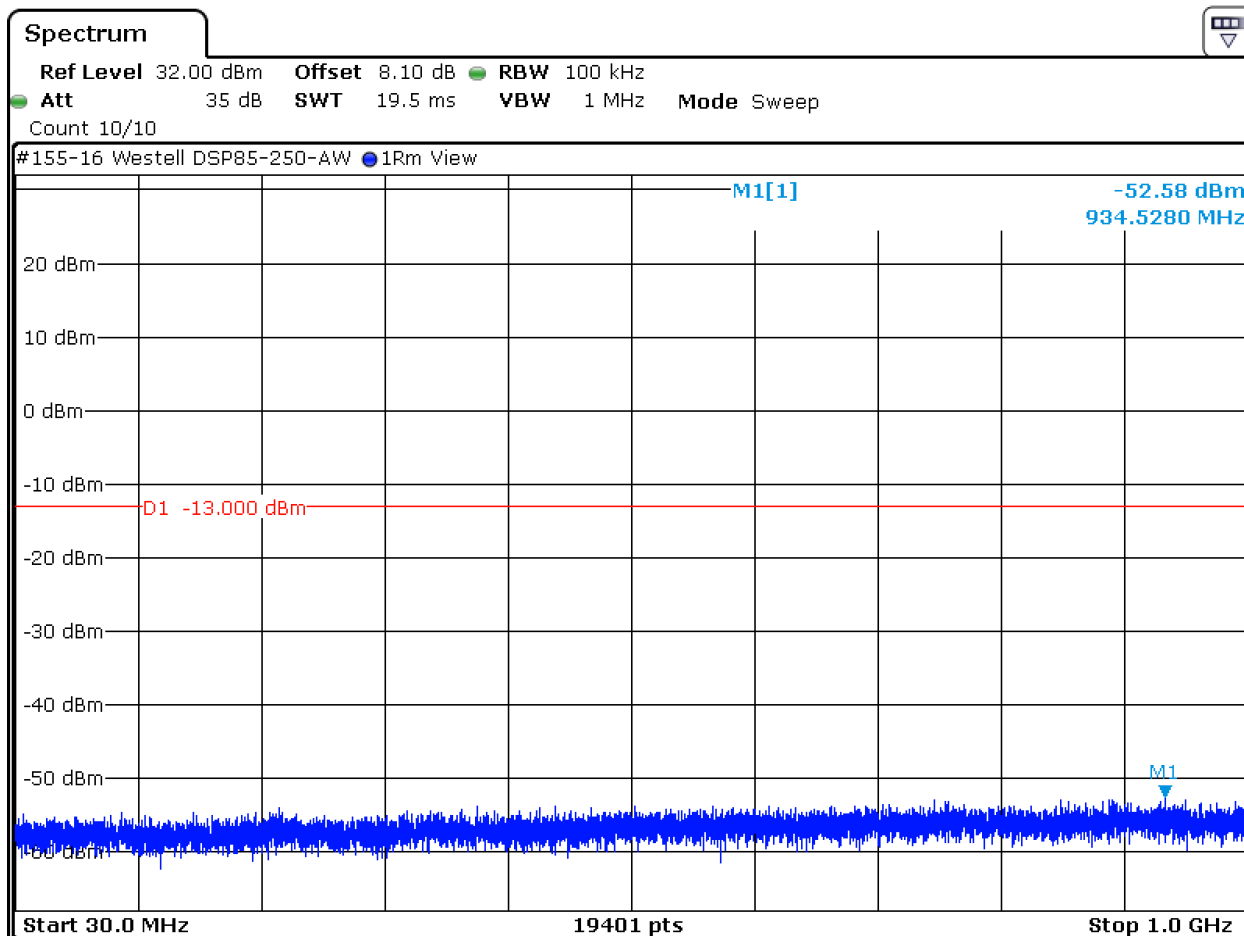
Test Number: 155-16R2

Issue Date: 4/29/2016

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

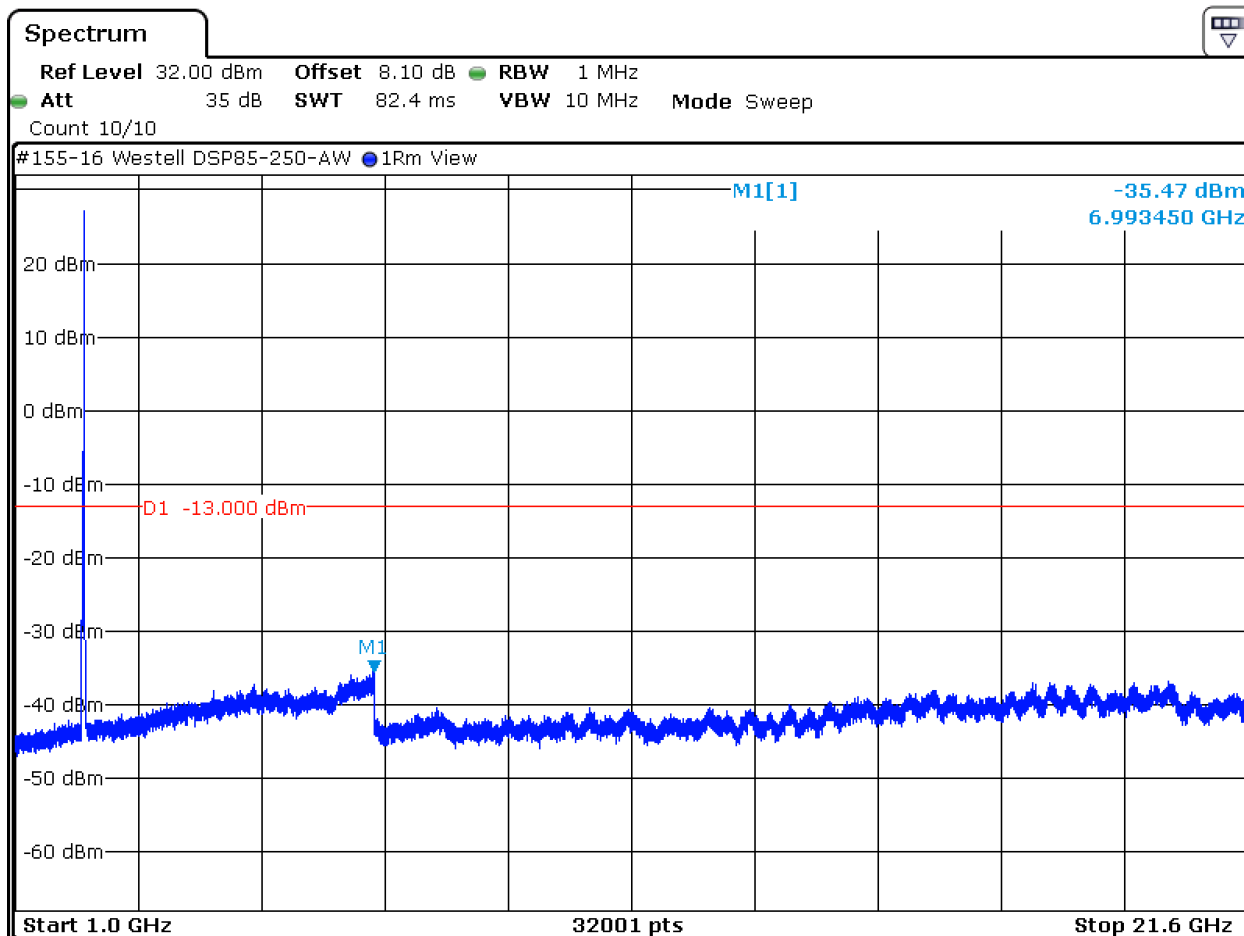
Test Number: 155-16R2

Issue Date: 4/29/2016

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

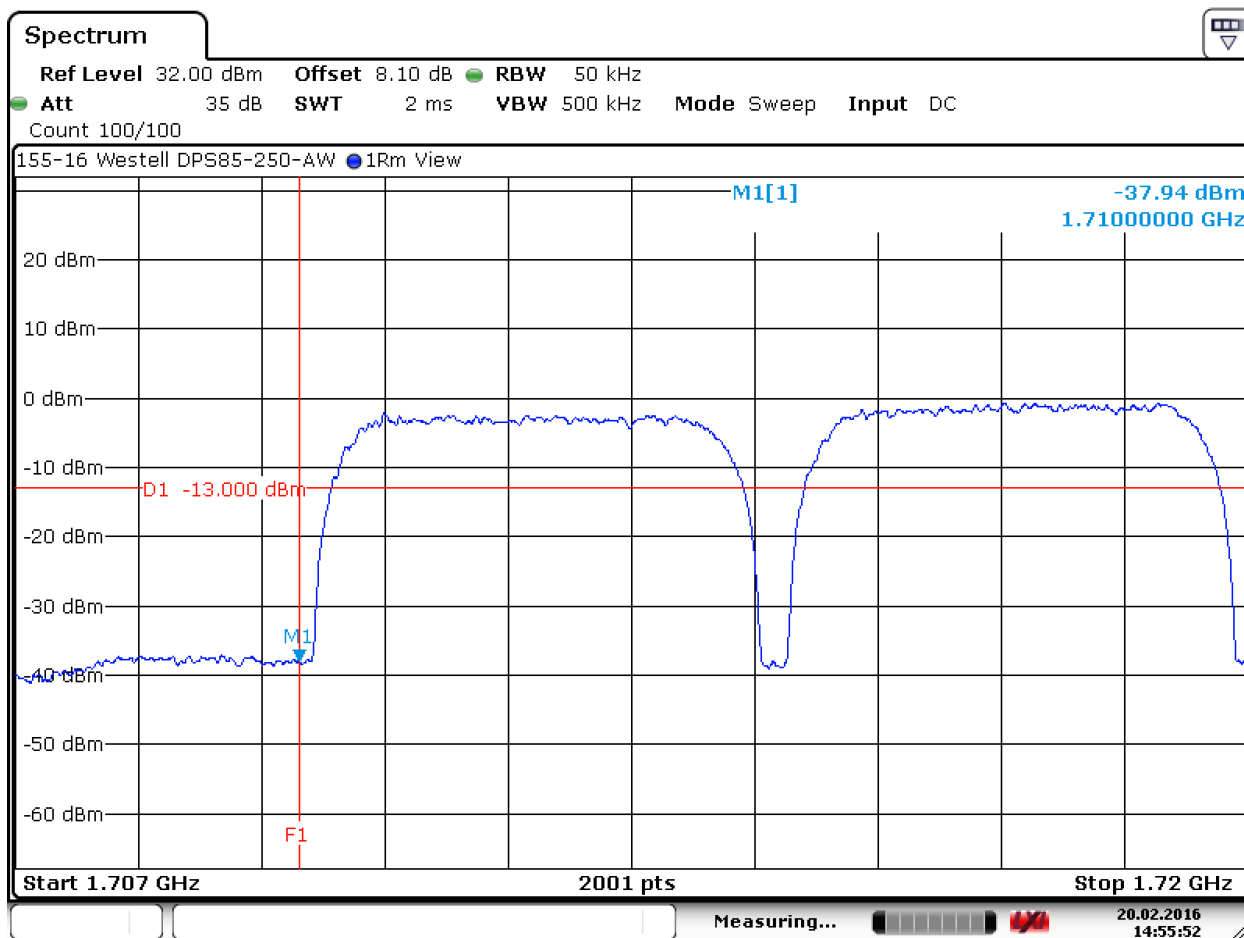
Test Number: 155-16R2

Issue Date: 4/29/2016

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

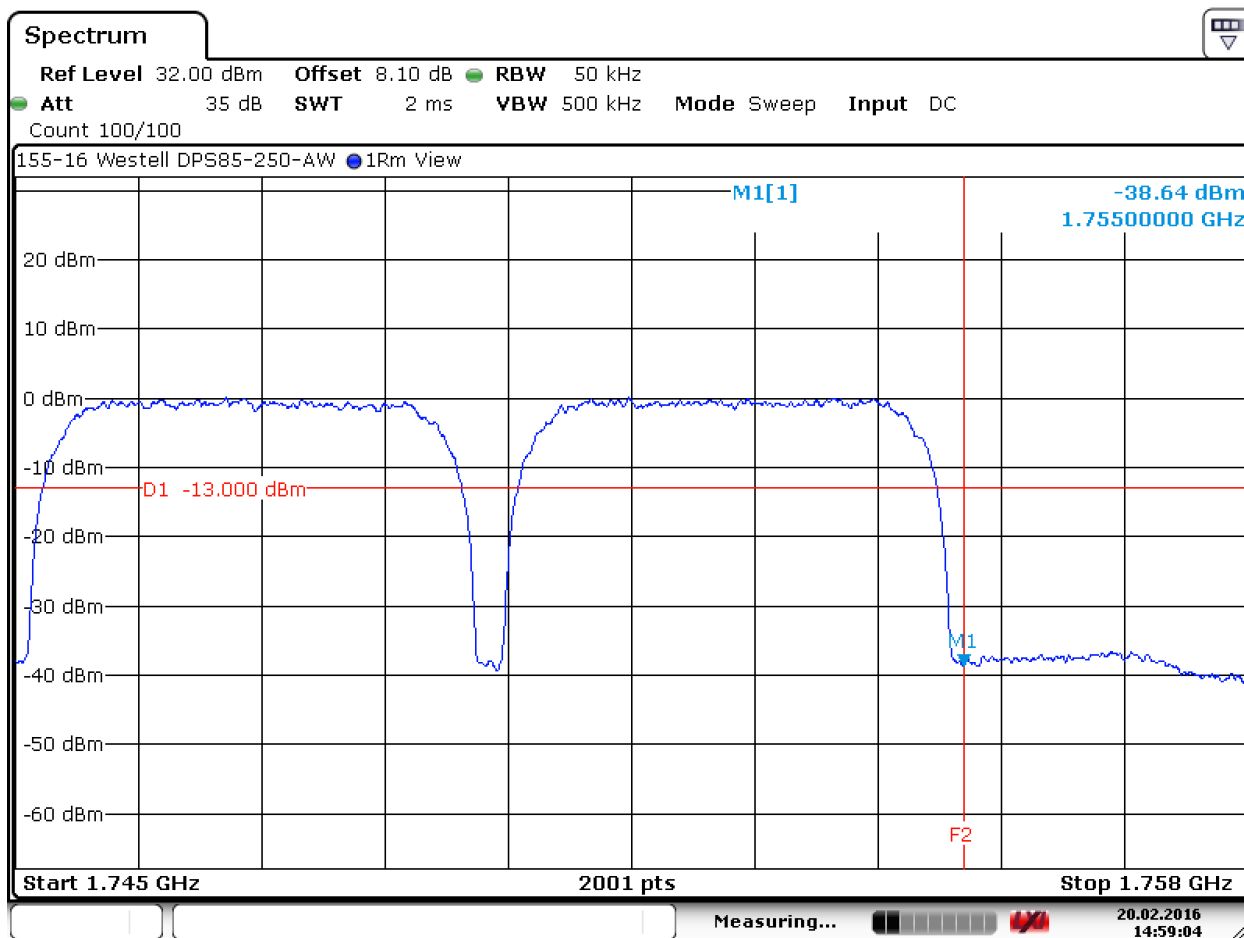
Test Number: 155-16R2

Issue Date: 4/29/2016

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

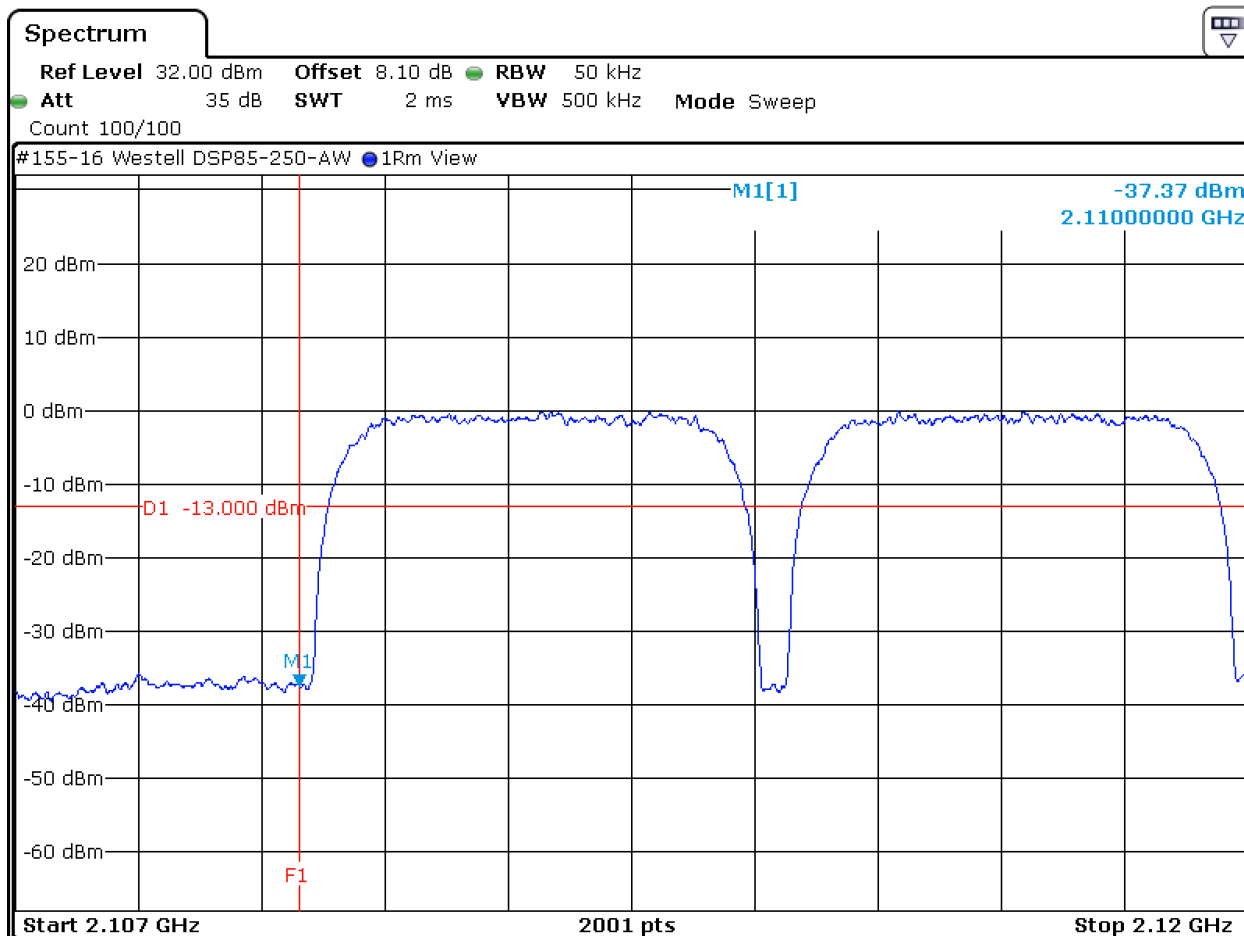
Test Number: 155-16R2

Issue Date: 4/29/2016

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

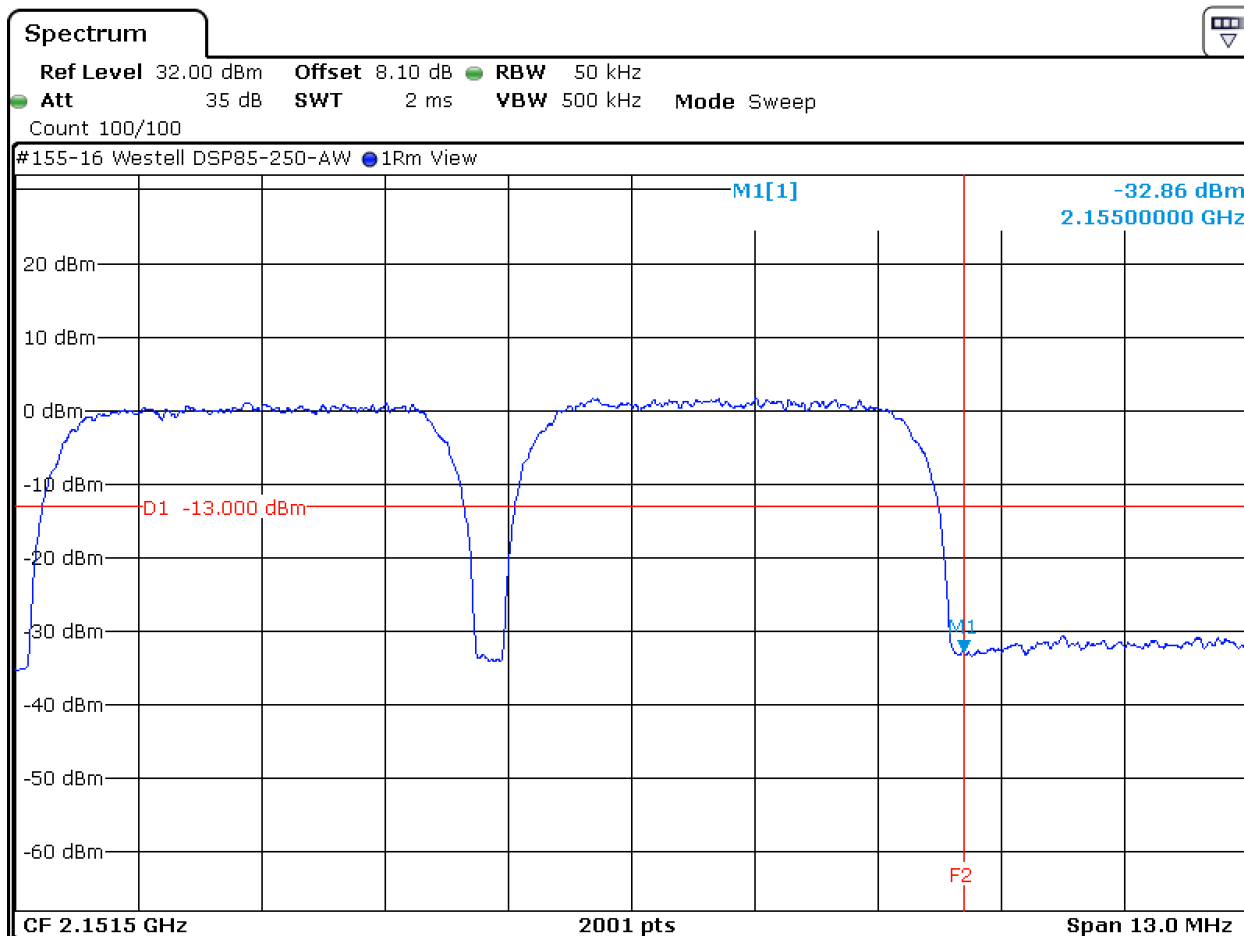
Test Number: 155-16R2

Issue Date: 4/29/2016

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

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
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

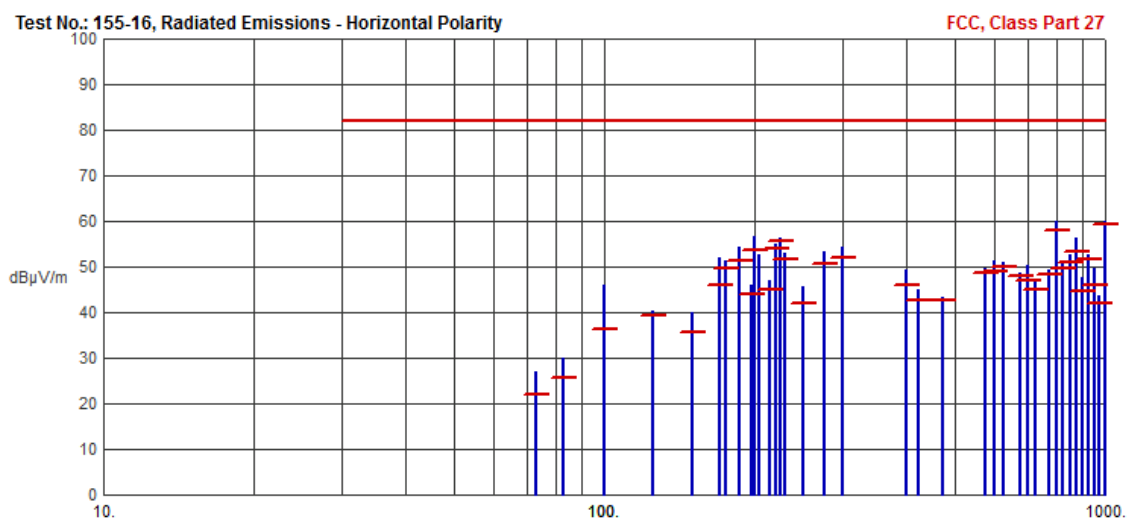
6.4.2 Test Procedure

Test measurements were made in accordance with ANSI C63.4-2014, 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), RSS-139 6.6 (continued)

6.4.3. Horizontal Polarity



6. Measurement Data (continued)

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

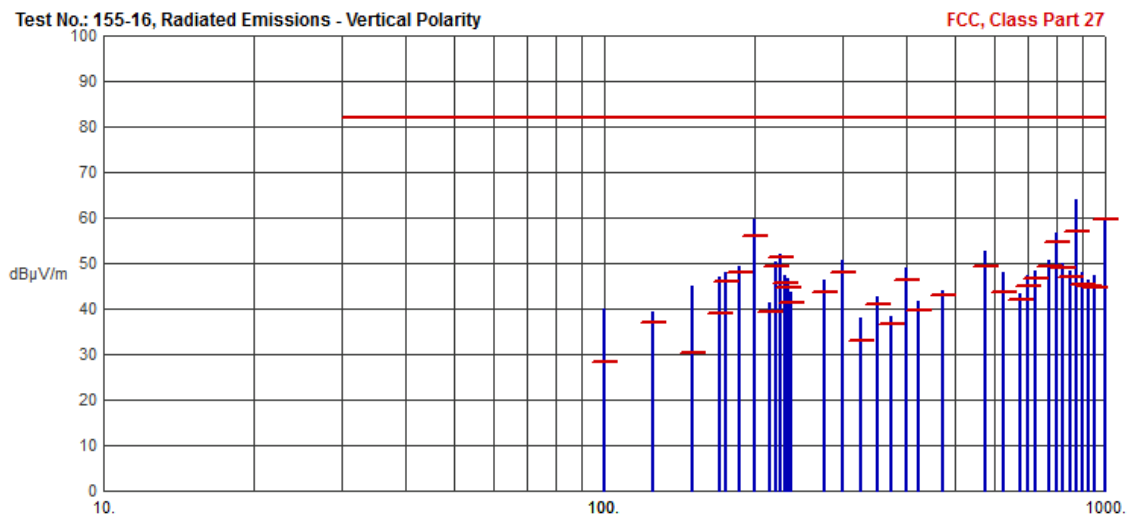
6.4.3. Horizontal Polarity

Frequency (MHz)	Pk Amp (dBμV/m)	QP Amp (dBμV/m)	QP Limit (dBμV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
73.0413	26.98	21.92	82.00	-60.08	N/A	N/A	
82.8508	29.95	25.69	82.00	-56.31	N/A	N/A	
100.0078	45.95	36.29	82.00	-45.71	N/A	N/A	
124.9998	40.40	39.31	82.00	-42.69	N/A	N/A	
149.9885	40.01	35.52	82.00	-46.48	N/A	N/A	
169.9929	51.99	45.98	82.00	-36.02	N/A	N/A	
175.0126	51.30	49.61	82.00	-32.39	N/A	N/A	
186.6644	54.29	51.32	82.00	-30.68	N/A	N/A	
196.6663	46.04	44.16	82.00	-37.84	N/A	N/A	
200.0356	56.60	53.53	82.00	-28.47	N/A	N/A	
213.3484	46.92	45.11	82.00	-36.89	N/A	N/A	
220.0074	54.96	53.87	82.00	-28.13	N/A	N/A	
225.0219	56.43	55.56	82.00	-26.44	N/A	N/A	
230.0063	53.15	51.70	82.00	-30.30	N/A	N/A	
250.0165	45.72	42.04	82.00	-39.96	N/A	N/A	
275.0144	53.25	50.52	82.00	-31.48	N/A	N/A	
300.0501	54.22	51.89	82.00	-30.11	N/A	N/A	
400.0088	49.41	45.97	82.00	-36.03	N/A	N/A	
425.0281	44.94	42.76	82.00	-39.24	N/A	N/A	
475.0329	43.48	42.59	82.00	-39.41	N/A	N/A	
575.0380	49.55	48.73	82.00	-33.27	N/A	N/A	
600.0033	51.42	49.15	82.00	-32.85	N/A	N/A	
625.0354	51.11	49.93	82.00	-32.07	N/A	N/A	
675.0428	48.70	47.89	82.00	-34.11	N/A	N/A	
700.1210	50.17	46.89	82.00	-35.11	N/A	N/A	
725.0262	46.96	45.11	82.00	-36.89	N/A	N/A	
775.0507	49.50	48.31	82.00	-33.69	N/A	N/A	
799.9991	59.95	58.16	82.00	-23.84	N/A	N/A	
825.0557	50.56	49.52	82.00	-32.48	N/A	N/A	
850.0648	52.54	51.16	82.00	-30.84	N/A	N/A	
875.0632	56.38	53.43	82.00	-28.57	N/A	N/A	
900.0703	47.57	44.55	82.00	-37.45	N/A	N/A	
925.0671	52.81	51.83	82.00	-30.17	N/A	N/A	
950.0290	49.81	46.09	82.00	-35.91	N/A	N/A	
975.0641	43.67	41.95	82.00	-40.05	N/A	N/A	
999.9854	60.00	59.34	82.00	-22.66	N/A	N/A	

6. Measurement Data (continued)

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

6.4.4. Vertical Polarity



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)	Pk Amp (dBμV/m)	QP Amp (dBμV/m)	QP Limit (dBμV/m)	Margin (dB)	Ant Ht (cm)	Table (Deg)	Comments
100.0223	39.90	28.49	82.00	-53.51	N/A	N/A	
124.9954	39.26	37.11	82.00	-44.89	N/A	N/A	
150.0612	44.87	30.26	82.00	-51.74	N/A	N/A	
170.0023	47.00	38.91	82.00	-43.09	N/A	N/A	
175.0056	48.13	45.90	82.00	-36.10	N/A	N/A	
186.6667	49.24	47.94	82.00	-34.06	N/A	N/A	
200.0310	59.68	56.08	82.00	-25.92	N/A	N/A	
213.3328	41.38	39.44	82.00	-42.56	N/A	N/A	
220.0057	50.39	49.42	82.00	-32.58	N/A	N/A	
225.0088	52.10	51.18	82.00	-30.82	N/A	N/A	
230.0033	47.21	45.75	82.00	-36.25	N/A	N/A	
233.3447	46.65	44.60	82.00	-37.40	N/A	N/A	
236.6869	43.77	41.45	82.00	-40.55	N/A	N/A	
275.0249	46.18	43.77	82.00	-38.23	N/A	N/A	
300.0661	50.59	48.13	82.00	-33.87	N/A	N/A	
325.0843	38.11	32.85	82.00	-49.15	N/A	N/A	
350.0130	42.71	41.04	82.00	-40.96	N/A	N/A	
375.0125	38.35	36.83	82.00	-45.17	N/A	N/A	
400.0036	48.94	46.45	82.00	-35.55	N/A	N/A	
425.0255	41.67	39.82	82.00	-42.18	N/A	N/A	
475.0230	43.99	43.00	82.00	-39.00	N/A	N/A	
575.0290	52.65	49.29	82.00	-32.71	N/A	N/A	
625.0387	47.95	43.63	82.00	-38.37	N/A	N/A	
675.0369	43.43	42.04	82.00	-39.96	N/A	N/A	
700.1354	47.50	44.85	82.00	-37.15	N/A	N/A	
725.0504	48.35	46.74	82.00	-35.26	N/A	N/A	
775.0479	50.51	49.45	82.00	-32.55	N/A	N/A	
799.9981	56.73	54.67	82.00	-27.33	N/A	N/A	
825.0539	50.16	48.93	82.00	-33.07	N/A	N/A	
850.0489	48.18	46.99	82.00	-35.01	N/A	N/A	
875.0576	64.09	57.14	82.00	-24.86	N/A	N/A	
900.0552	48.06	45.47	82.00	-36.53	N/A	N/A	
925.0615	46.32	44.92	82.00	-37.08	N/A	N/A	
950.0491	47.40	44.72	82.00	-37.28	N/A	N/A	
999.9836	59.98	59.54	82.00	-22.46	N/A	N/A	

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

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.

Test Number: 155-16R2

Issue Date: 4/29/2016

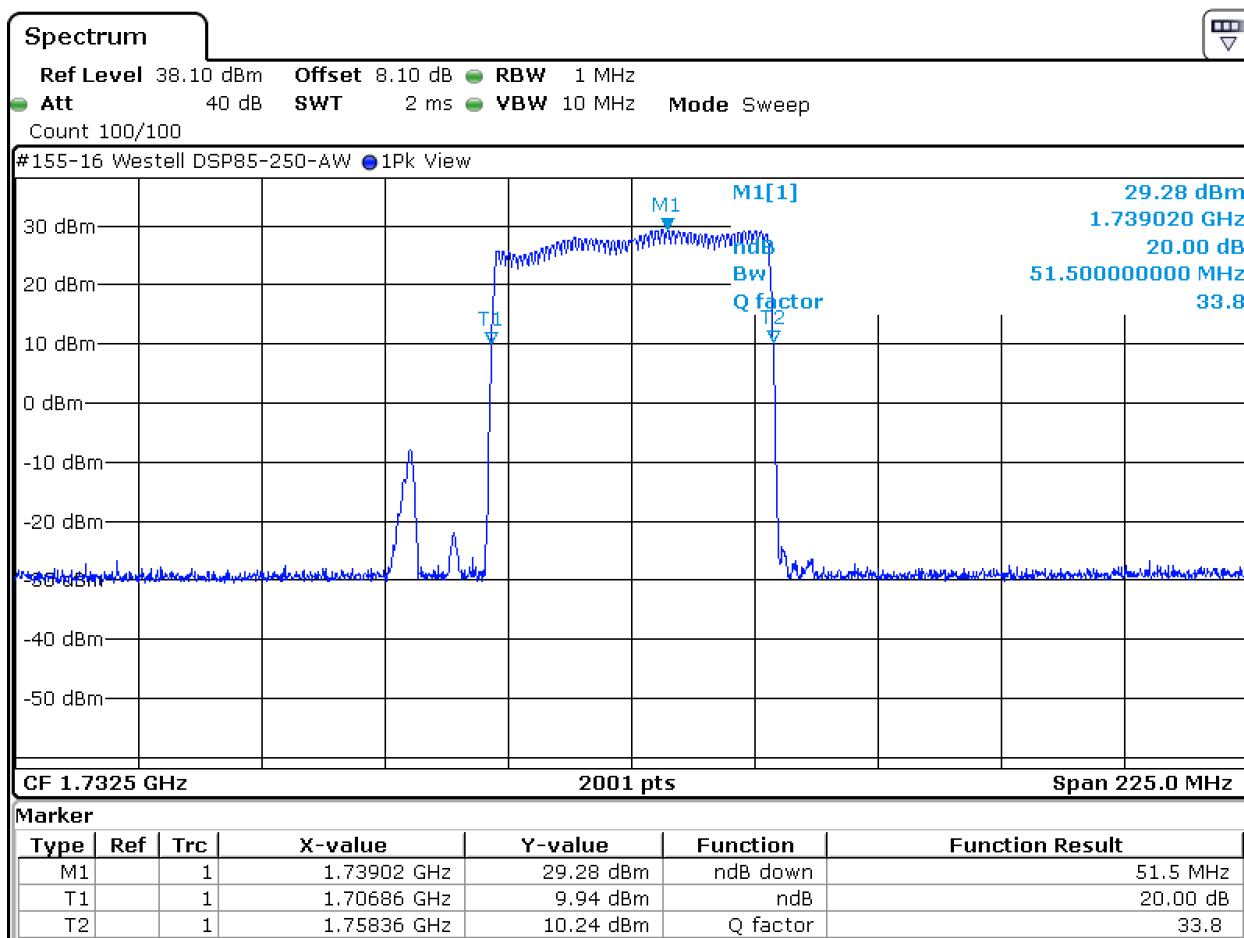
6. Measurement Data (continued)

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



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

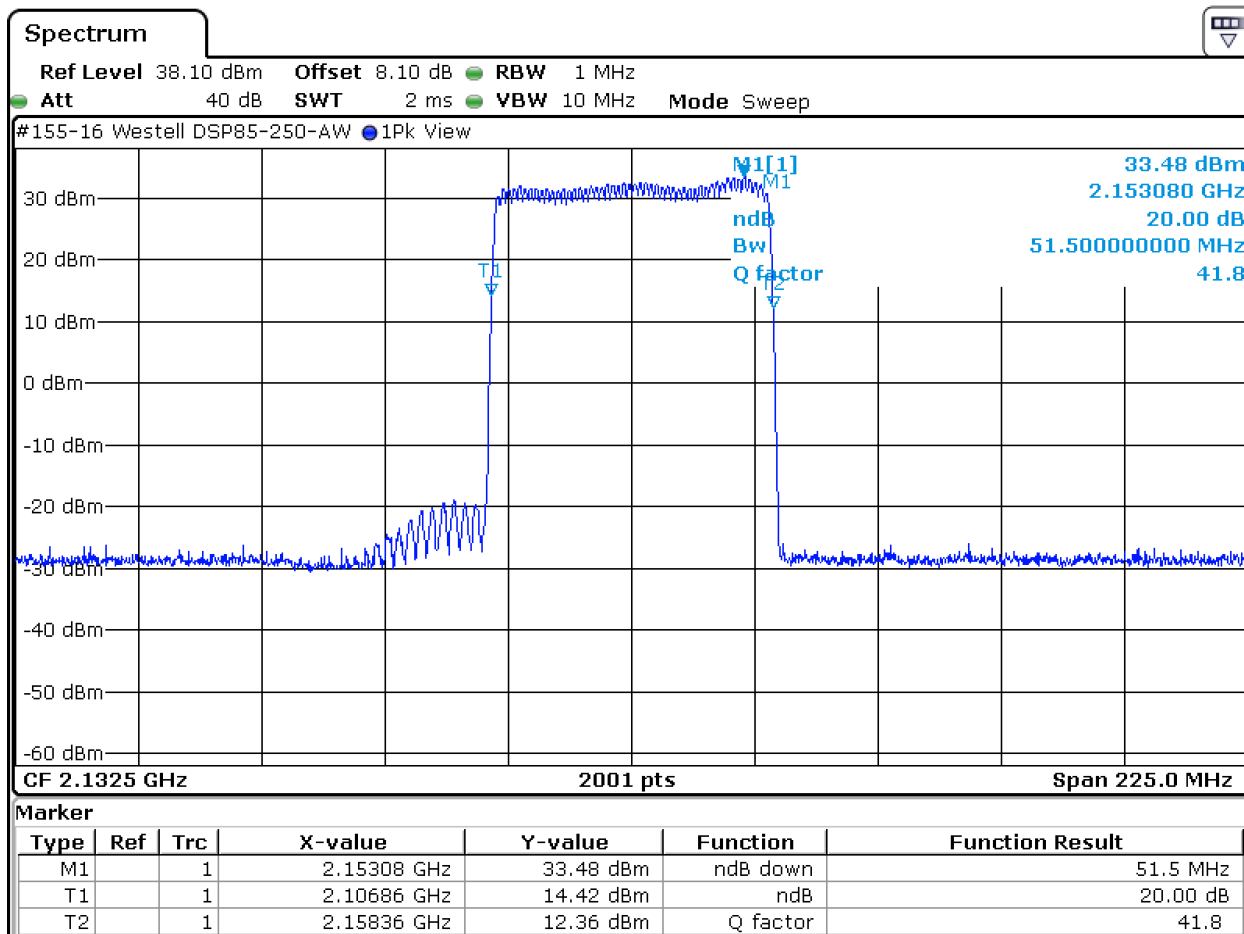
Test Number: 155-16R2

Issue Date: 4/29/2016

6. Measurement Data (continued)

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

6.6.2. 2132.5 MHz, Center Frequency



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

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 Public (Uncontrolled Environment) for equipment operating from 300 to 6000 MHz, the W/m² limit is determined by the formula $0.2619 \times F \text{ (MHz)}^{\wedge} 0.6834$

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)



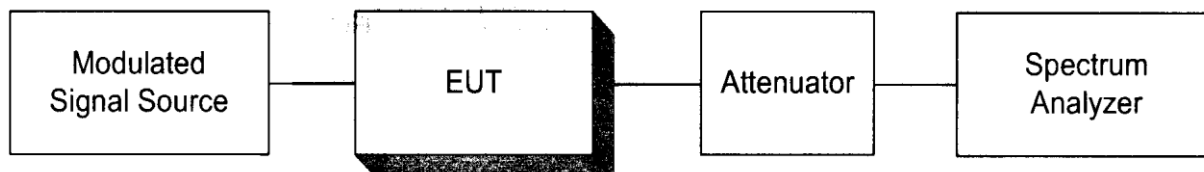
8. Test Setup Photographs (cont)

Radiated Emissions (Rear) 30 MHz to 1 GHz

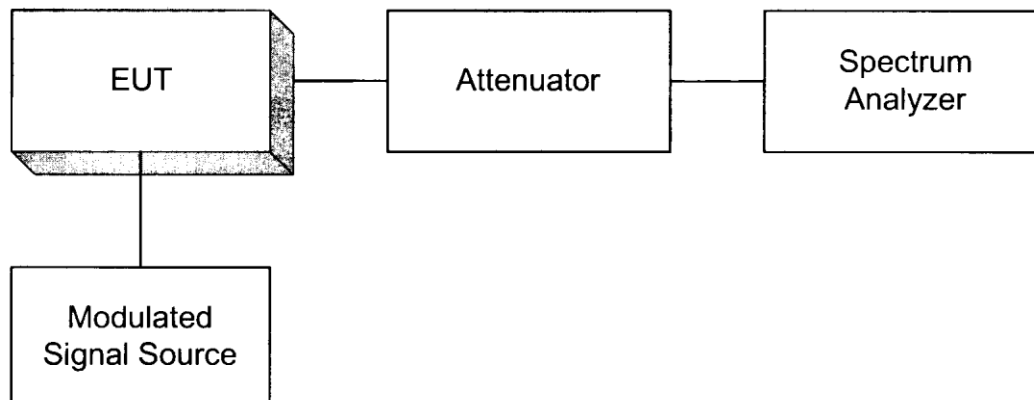


Appendix A

RF Output Power

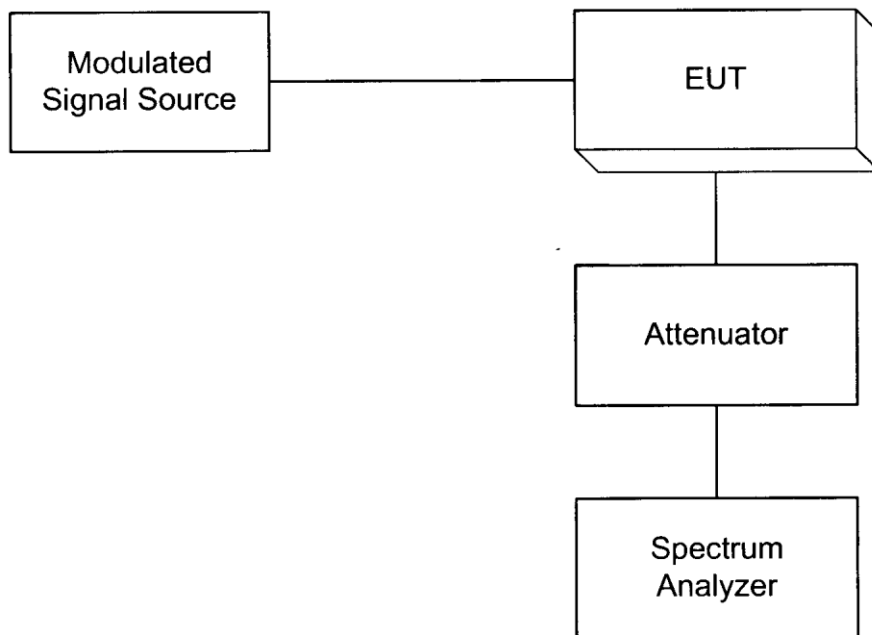


Occupied Bandwidth



Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation

