

**COMPLIANCE WORLDWIDE INC.
TEST REPORT 155-16AR3**

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

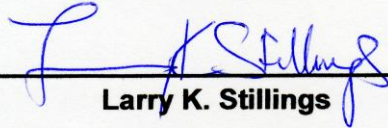
for

**DSP85 Series Digital Repeater
DSP85-251AW
Representing Model DSP85-PG/AW**

**FCC ID: NVRDSP85-PGAW
IC: 4307A-DSP85PGAW**


**Original Report Issued on March 3, 2016
Revision R3 Issued on September 30, 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-PG/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 R2 updates references to RSS-139 for an original certification filing. Revision R3 updates the FCC ID on the cover page, and adds booster gain to Section 6.1.3 on page 28, adds Radiated emissions photographs above 1 GHz in Section 8.

2. Product Details

- 2.1. Manufacturer:** Westell Technologies, Inc.
- 2.2. Model Numbers:** DSP85-251AW tested also represents Model DSP85-PG/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

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 |

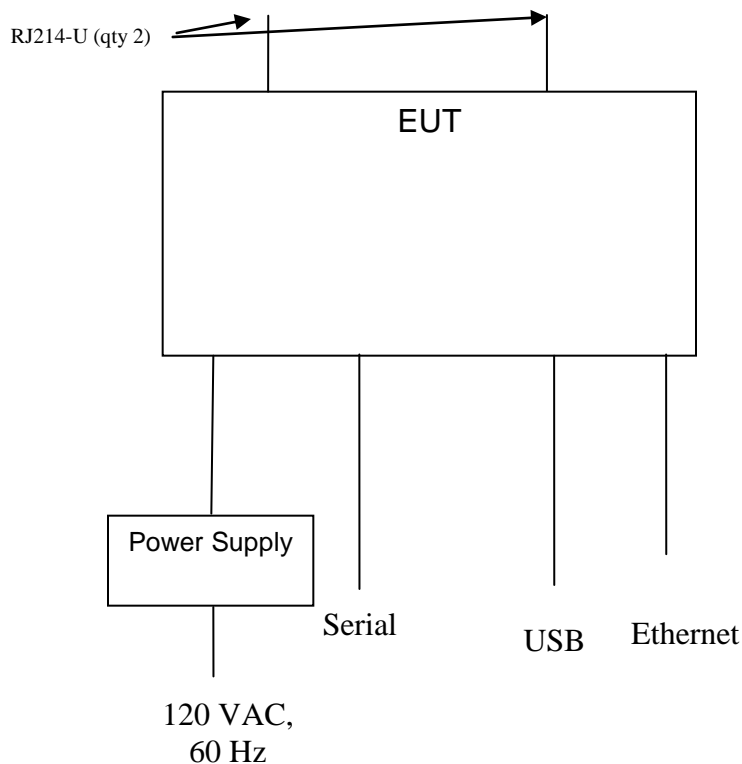
Notebook PC is connected only during setup

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 increase 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

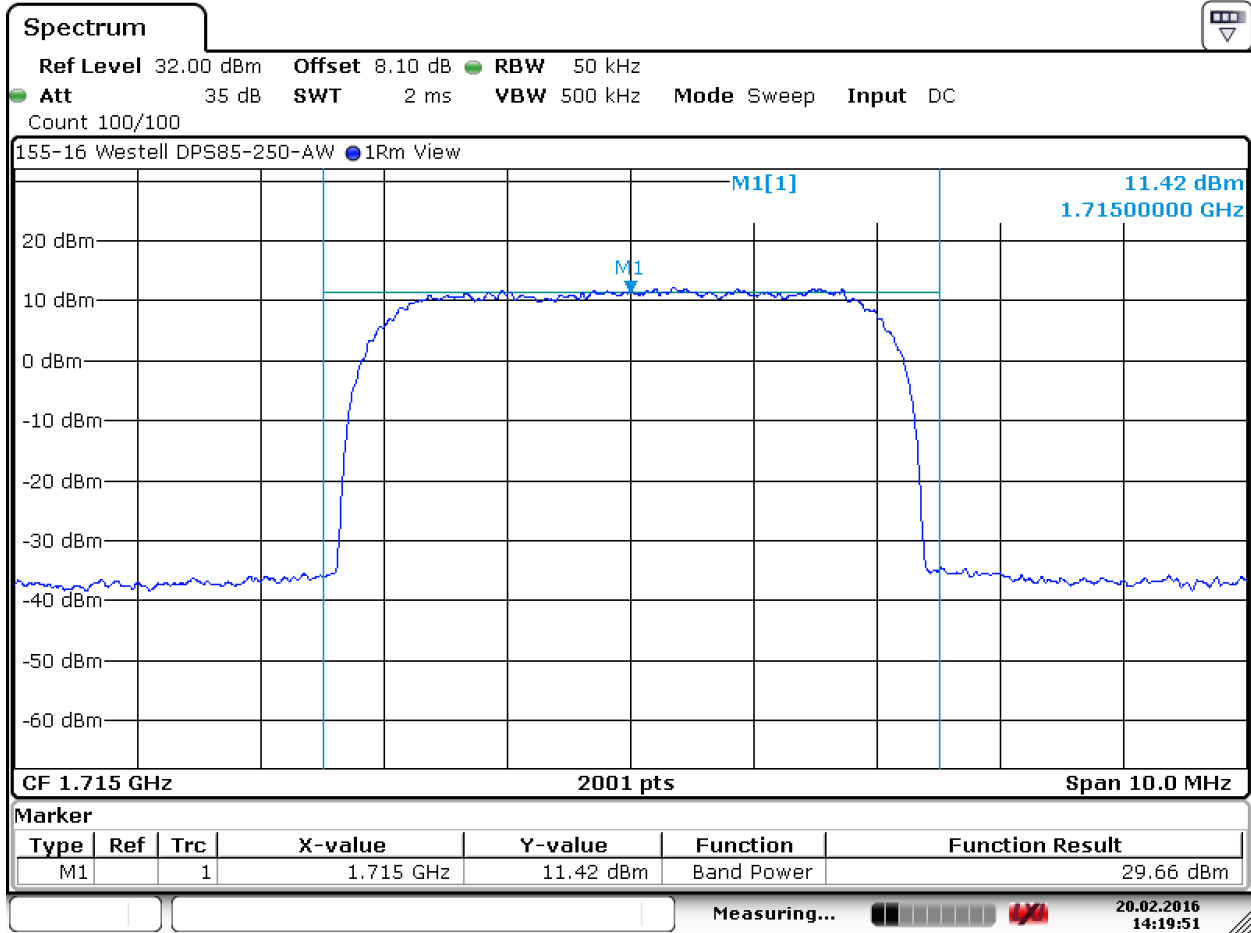
| Description of Measurement | Center Frequency | Output Power | |
|----------------------------|------------------|--------------|---------|
| | (MHz) | (dBm) | (Watts) |
| Output Power | 1715 | 29.66 | 0.925 |
| Output Power | 1732.5 | 29.95 | 0.989 |
| Output Power | 1750 | 29.92 | 0.982 |
| Output 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

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

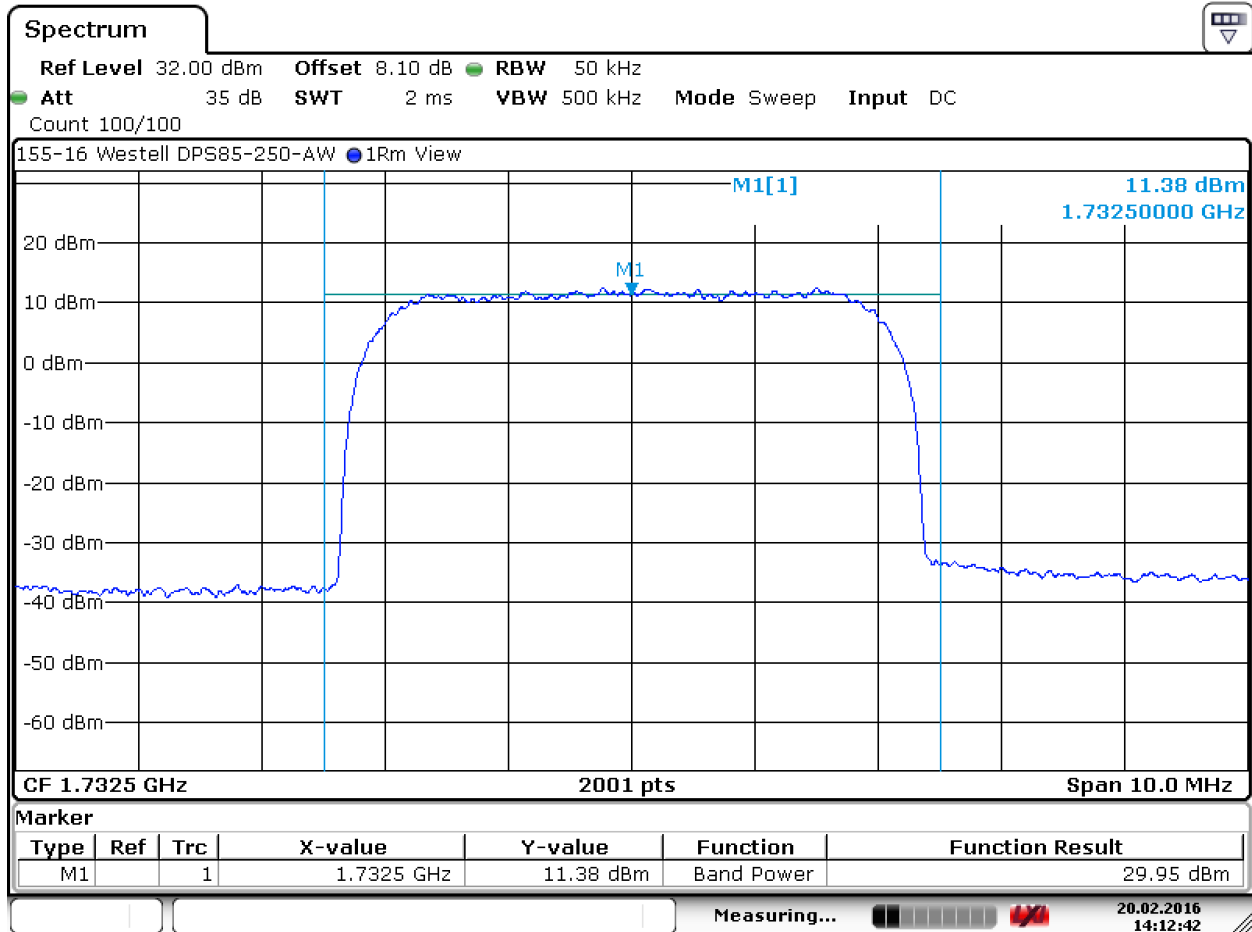


Date: 20.FEB.2016 14:19:50

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

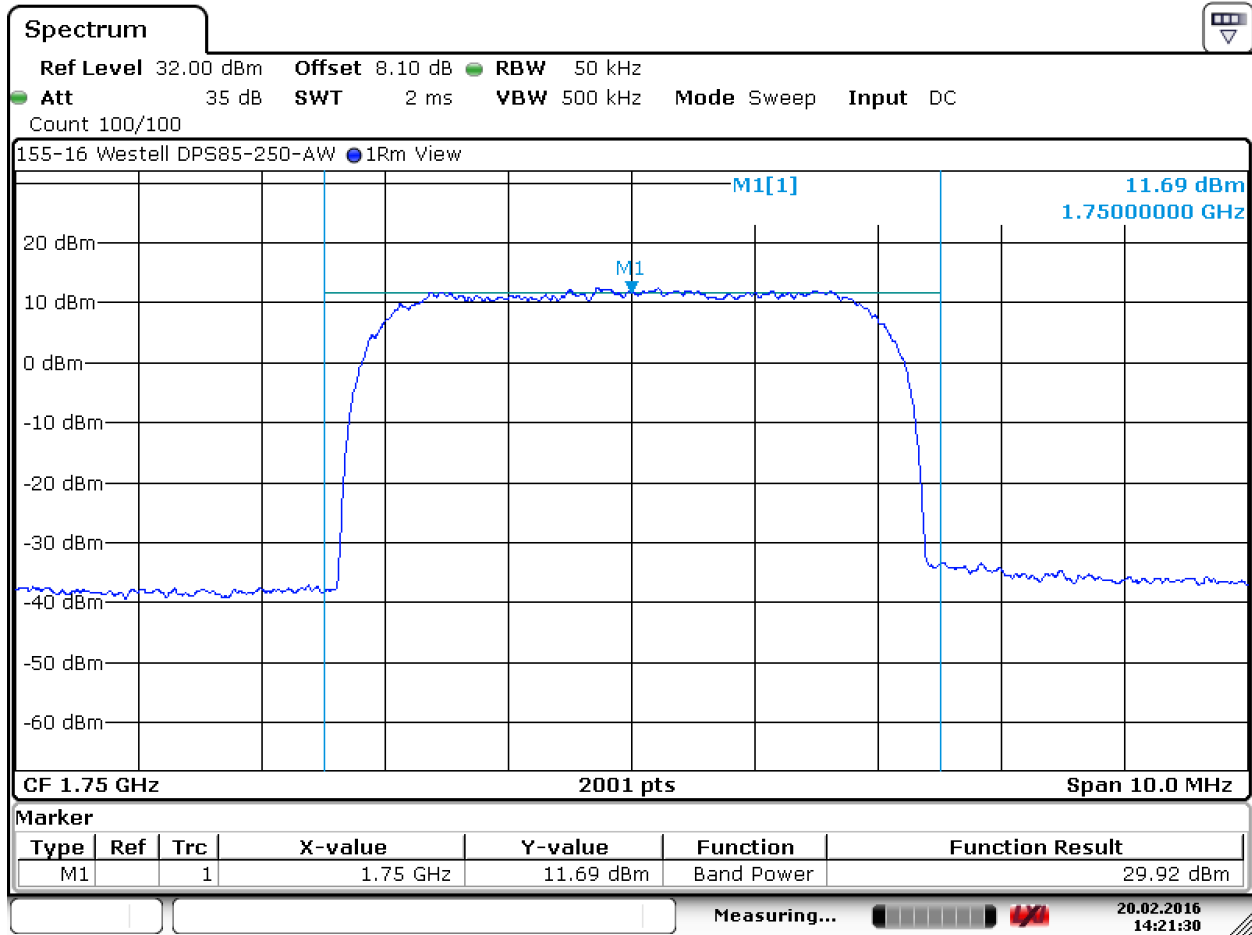


Date: 20.FEB.2016 14:12:42

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

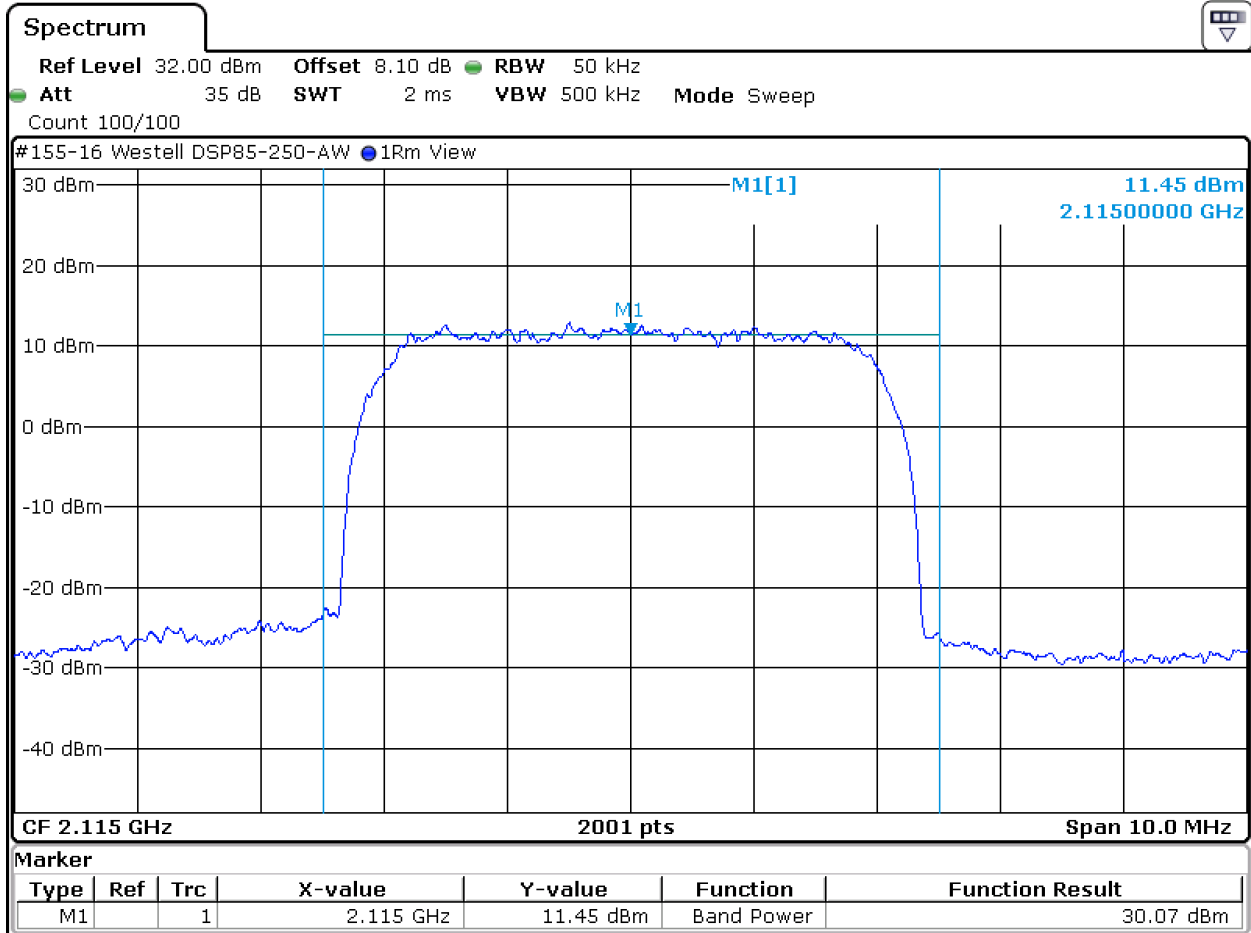


Date: 20.FEB.2016 14:21:30

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

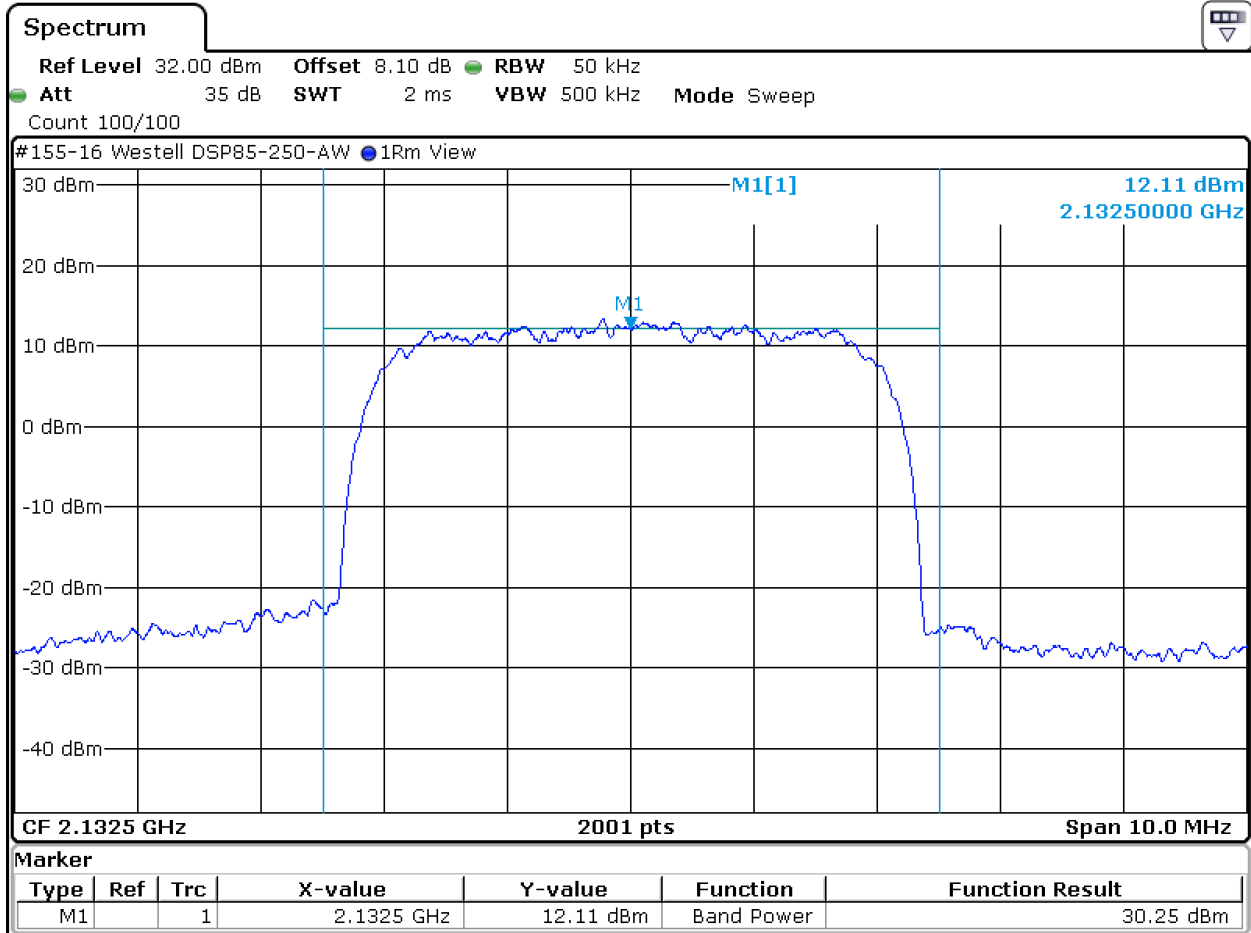


Date: 23.FEB.2016 15:36:57

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

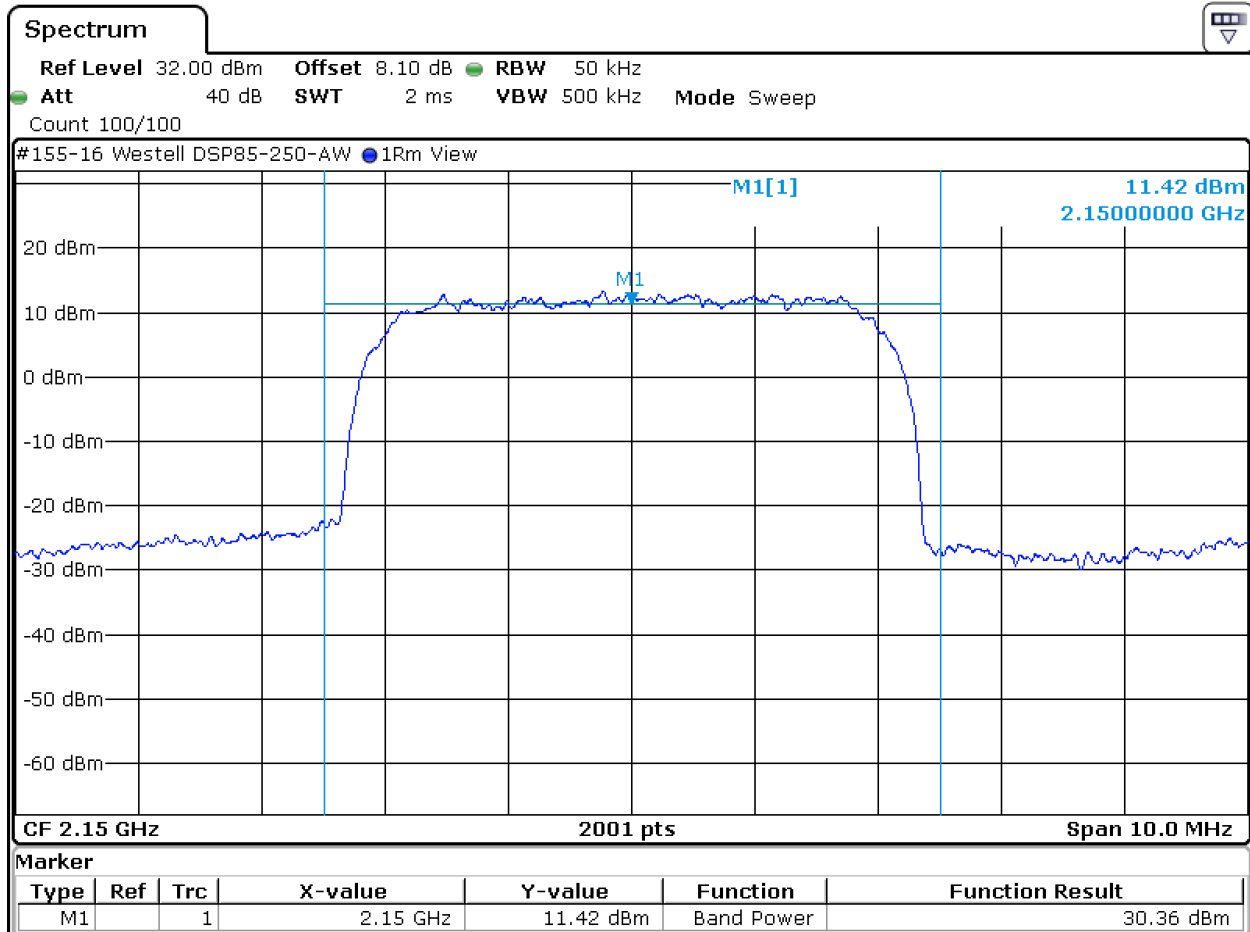


Date: 23.FEB.2016 15:33:45

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

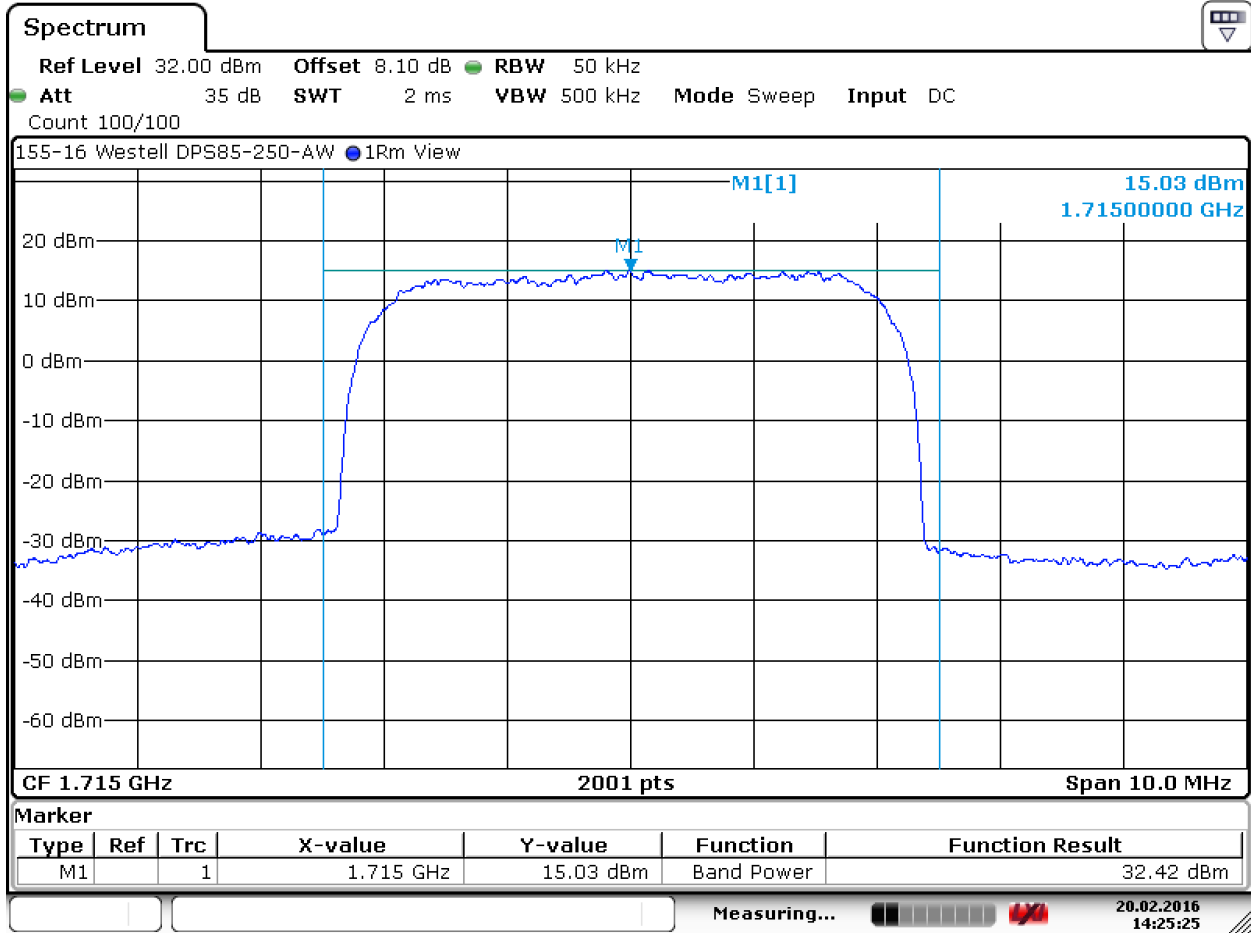


Date: 23.FEB.2016 16:47:33

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

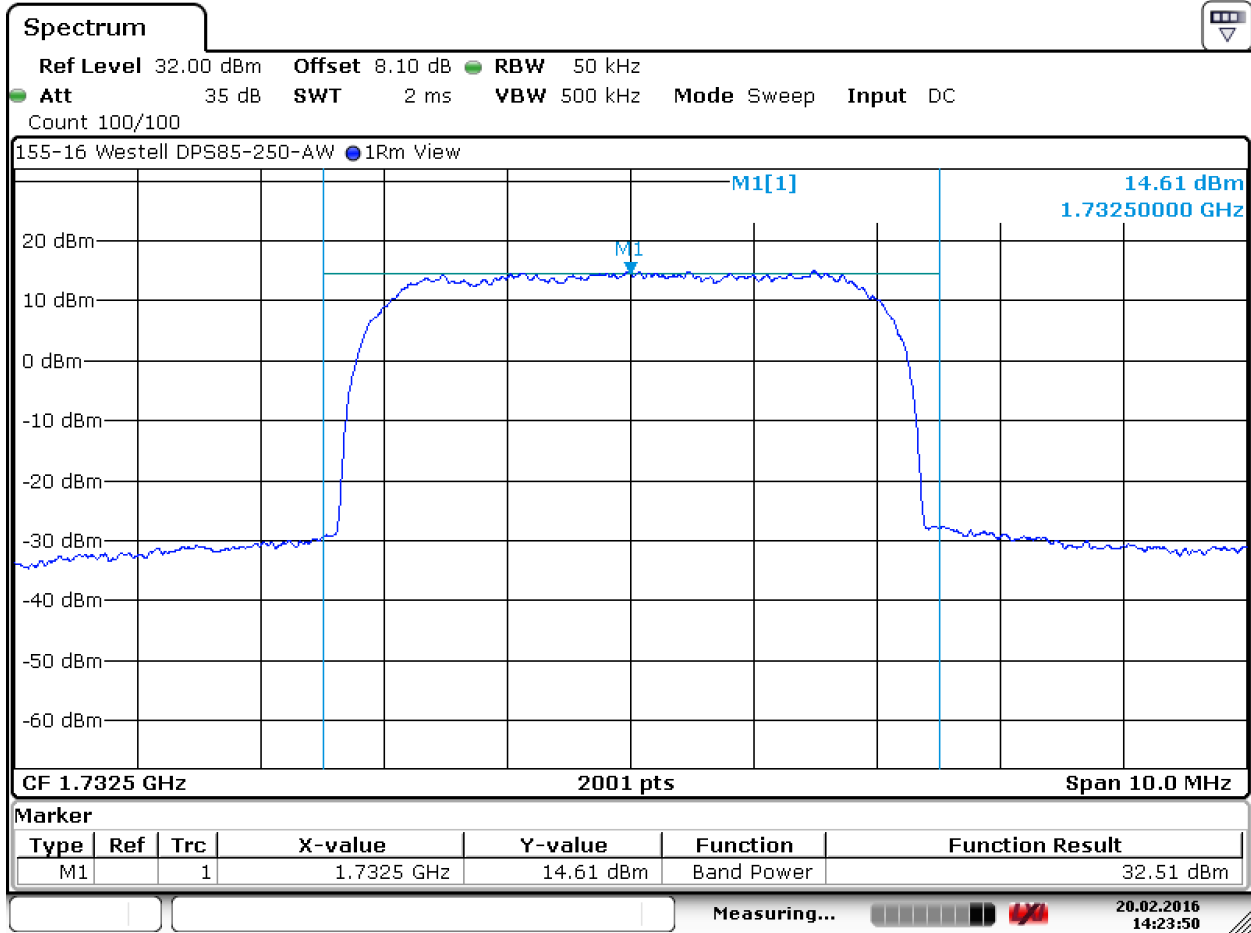


Date: 20.FEB.2016 14:25:24

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

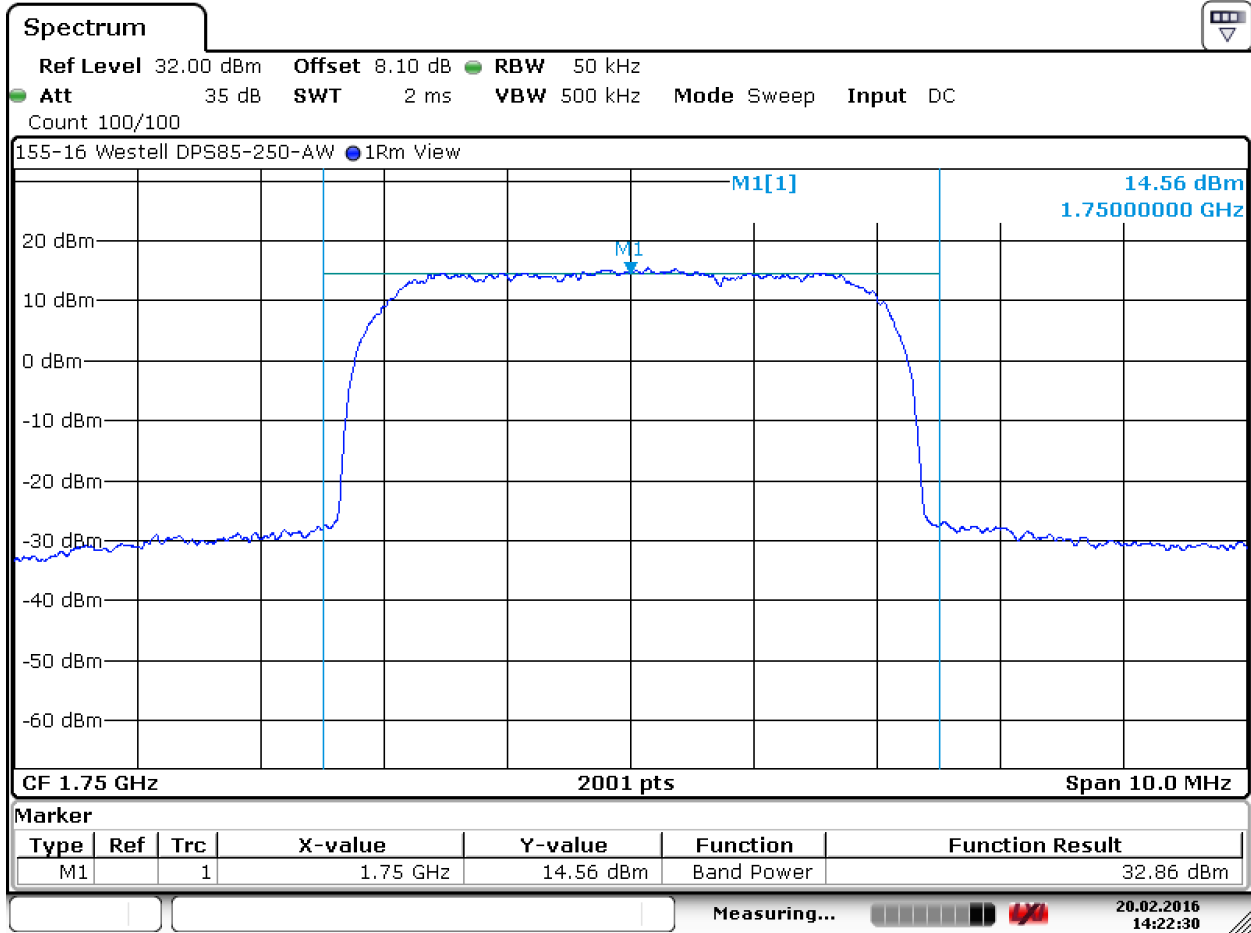


Date: 20.FEB.2016 14:23:49

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

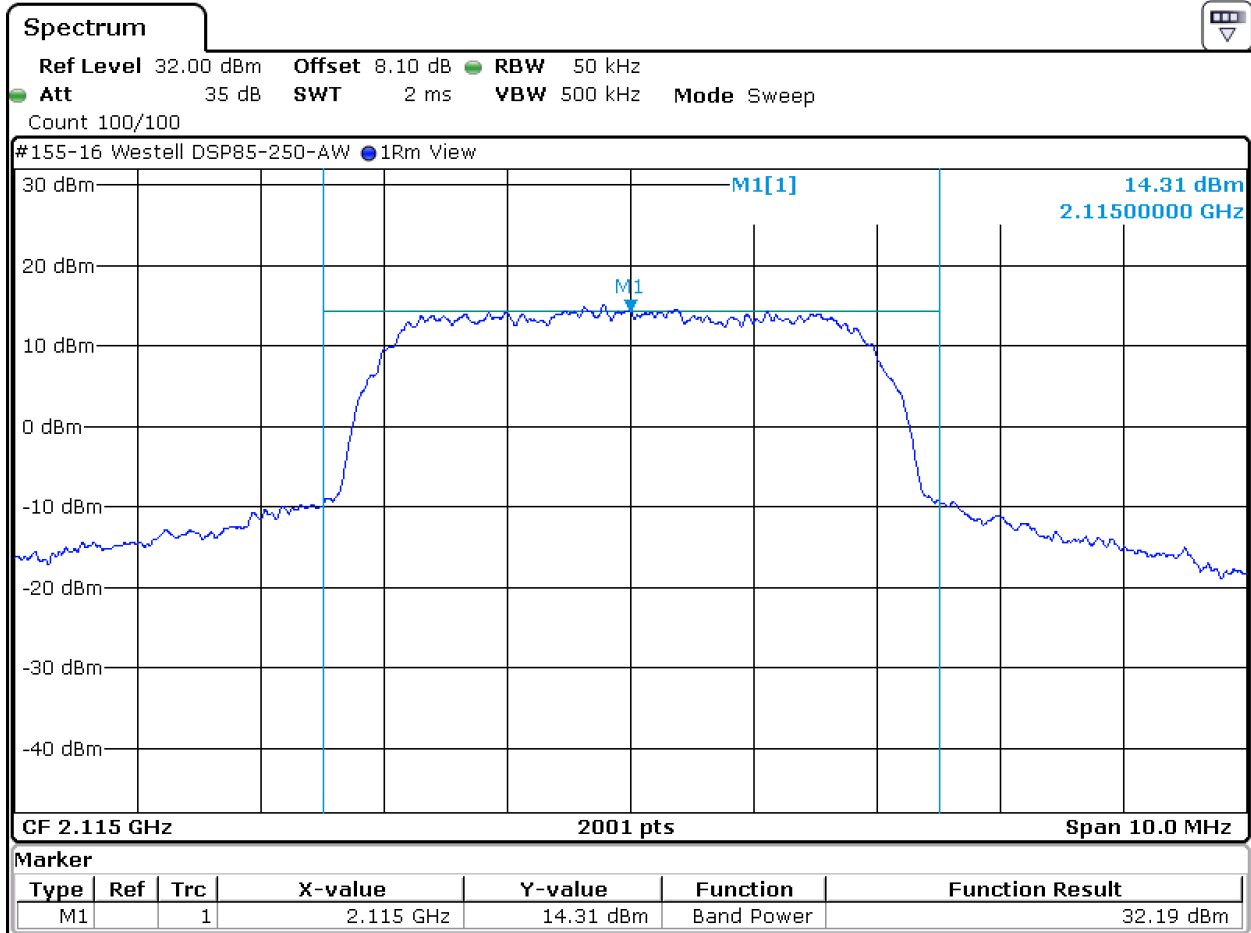


Date: 20.FEB.2016 14:22:30

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

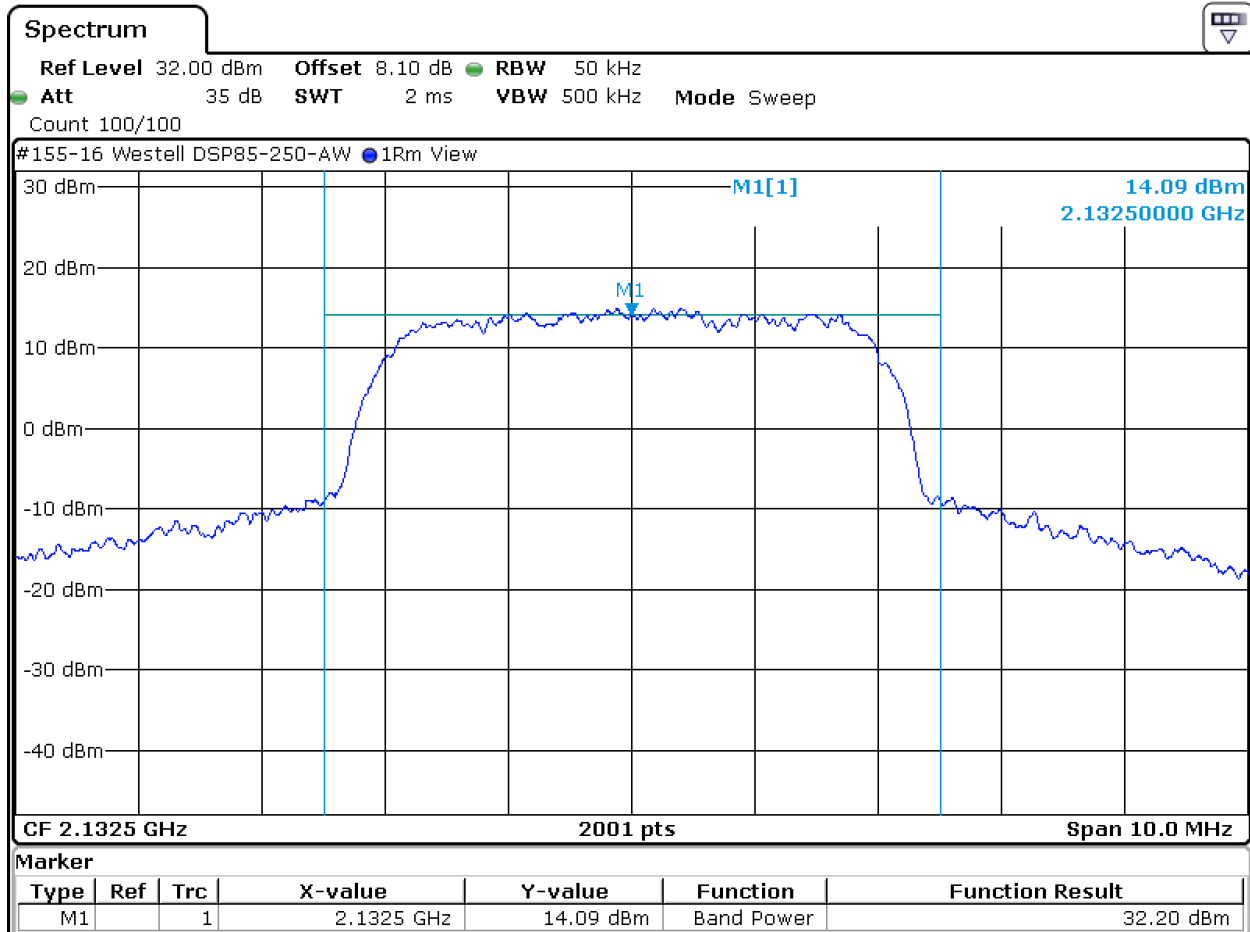


Date: 23.FEB.2016 15:47:57

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

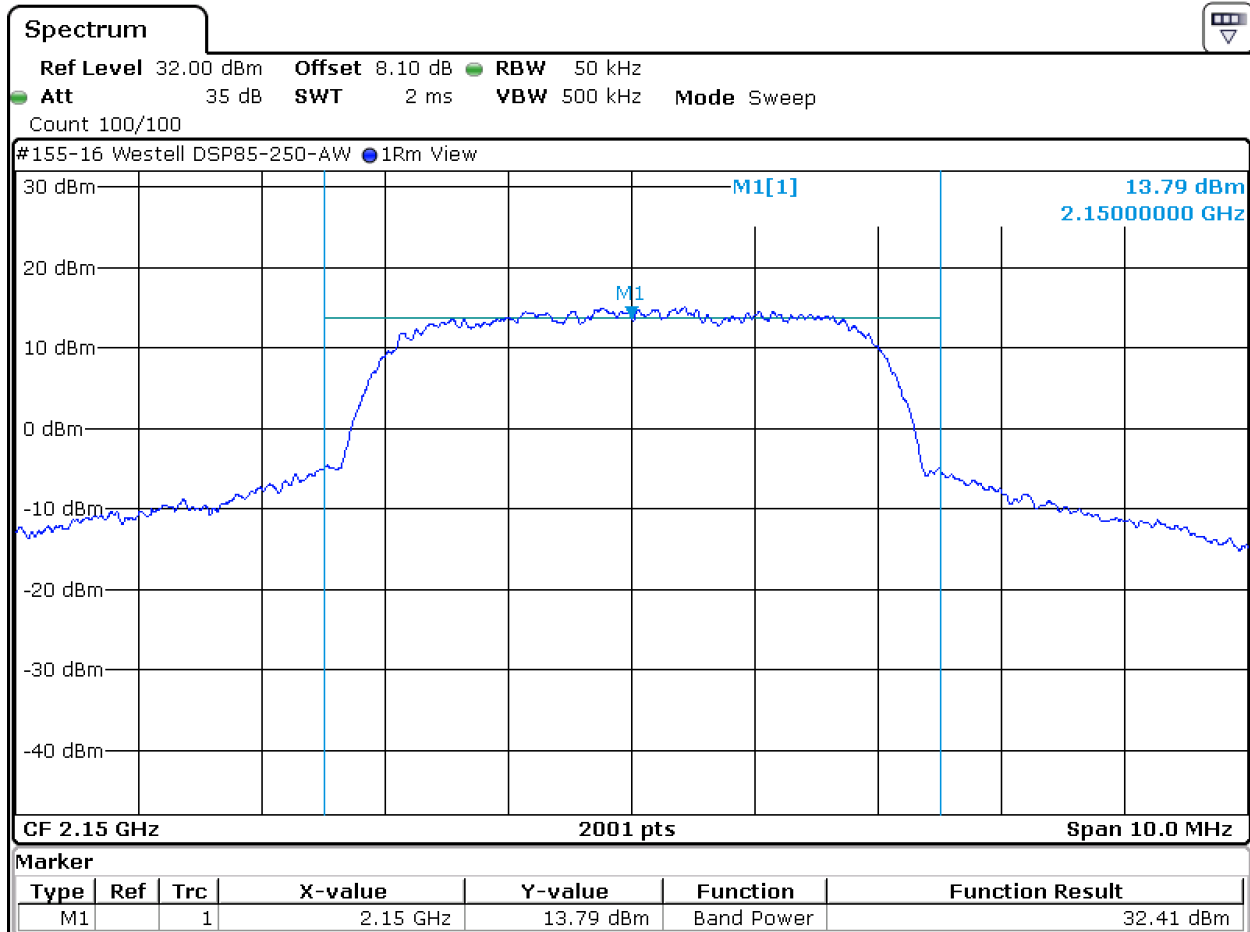


Date: 23.FEB.2016 15:46:17

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

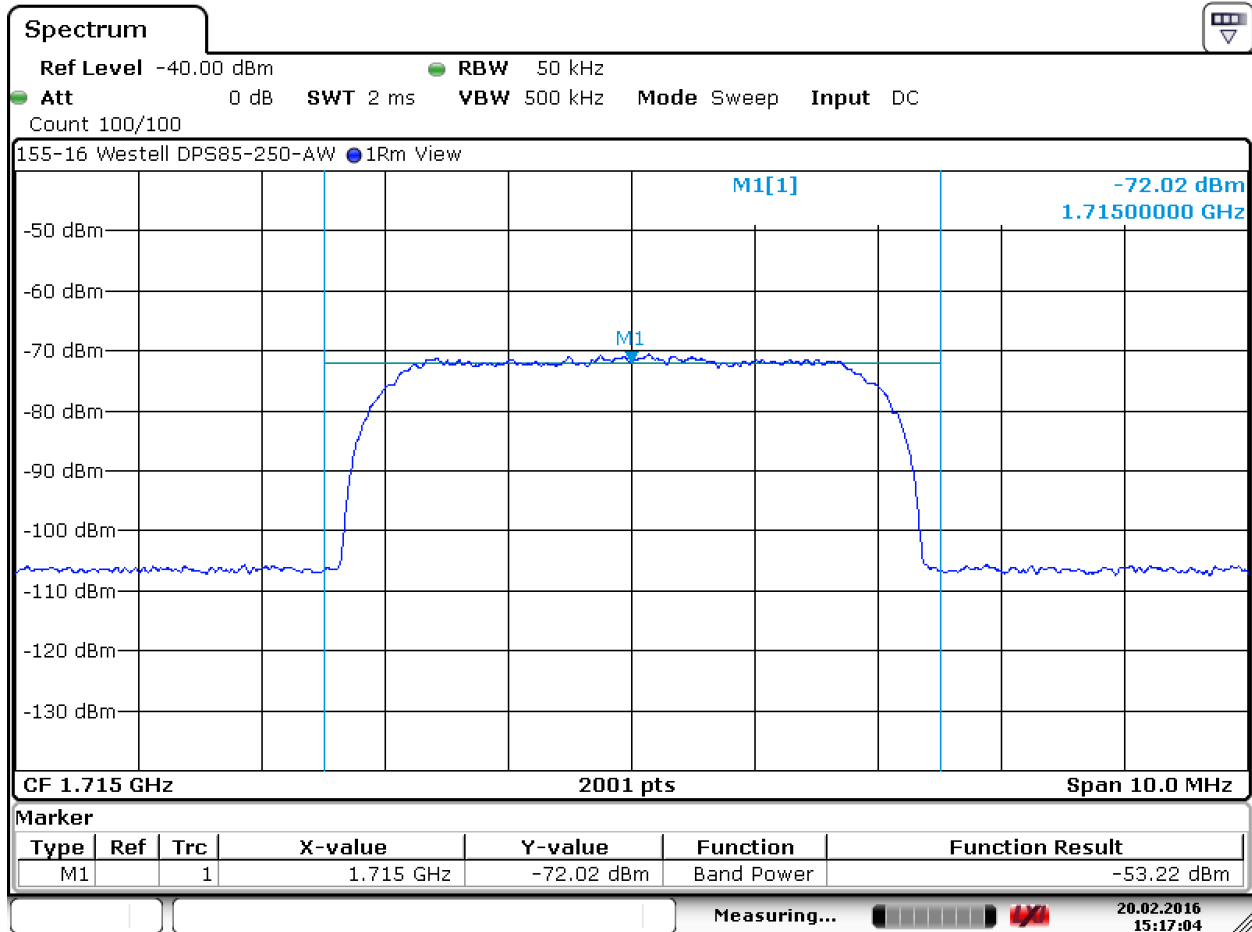


Date: 23.FEB.2016 15:44:51

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

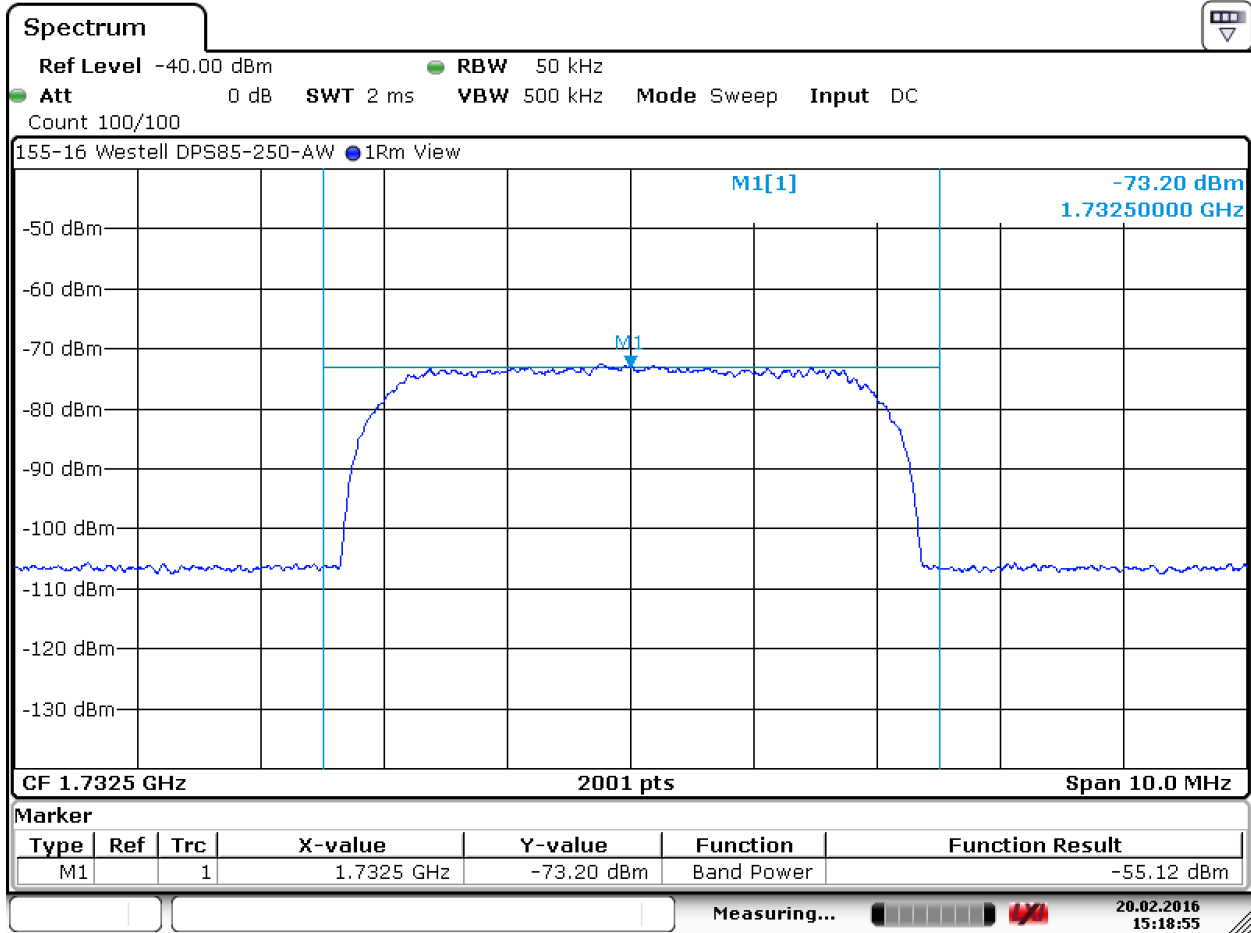


Date: 20.FEB.2016 15:17:03

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

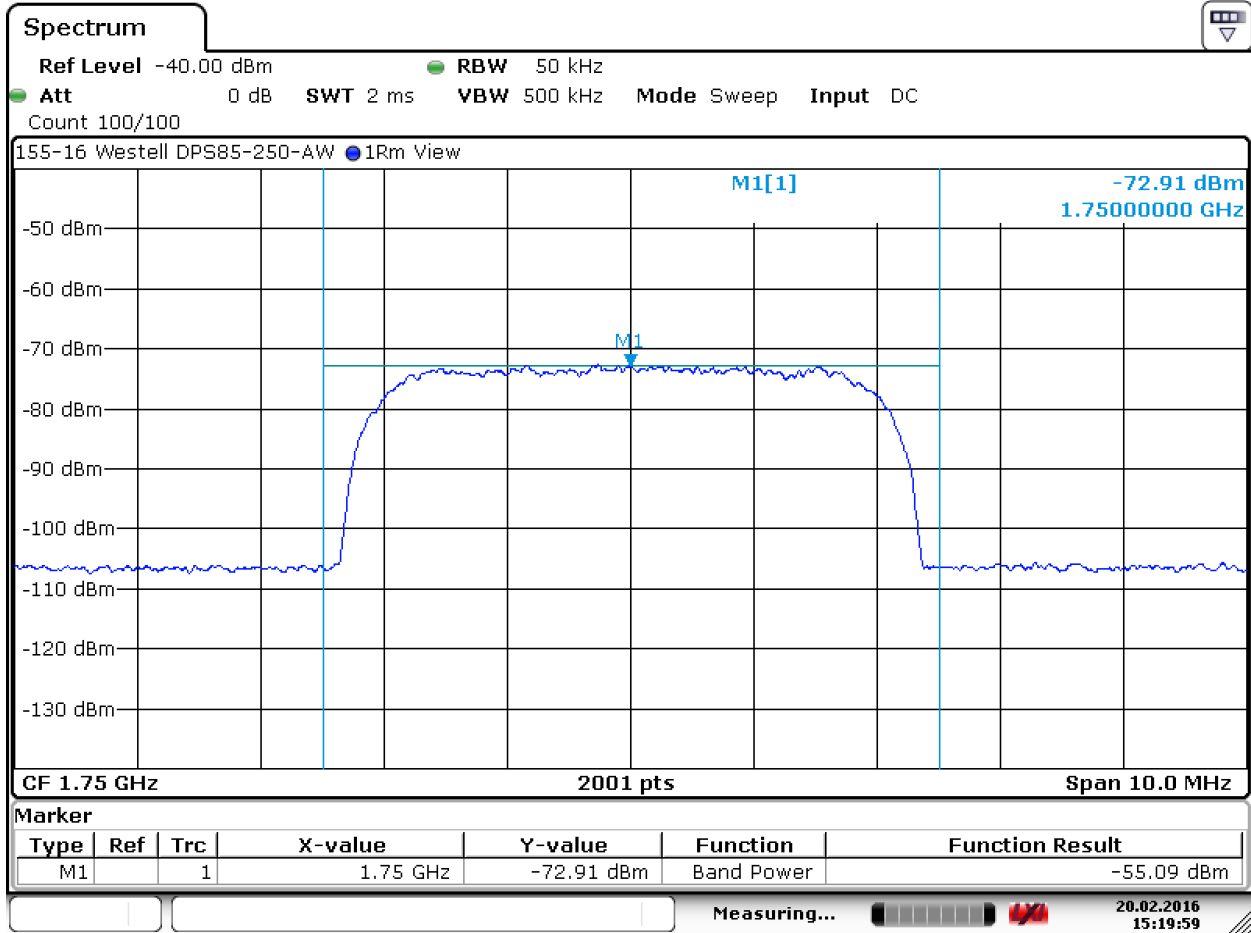


Date: 20.FEB.2016 15:18:54

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

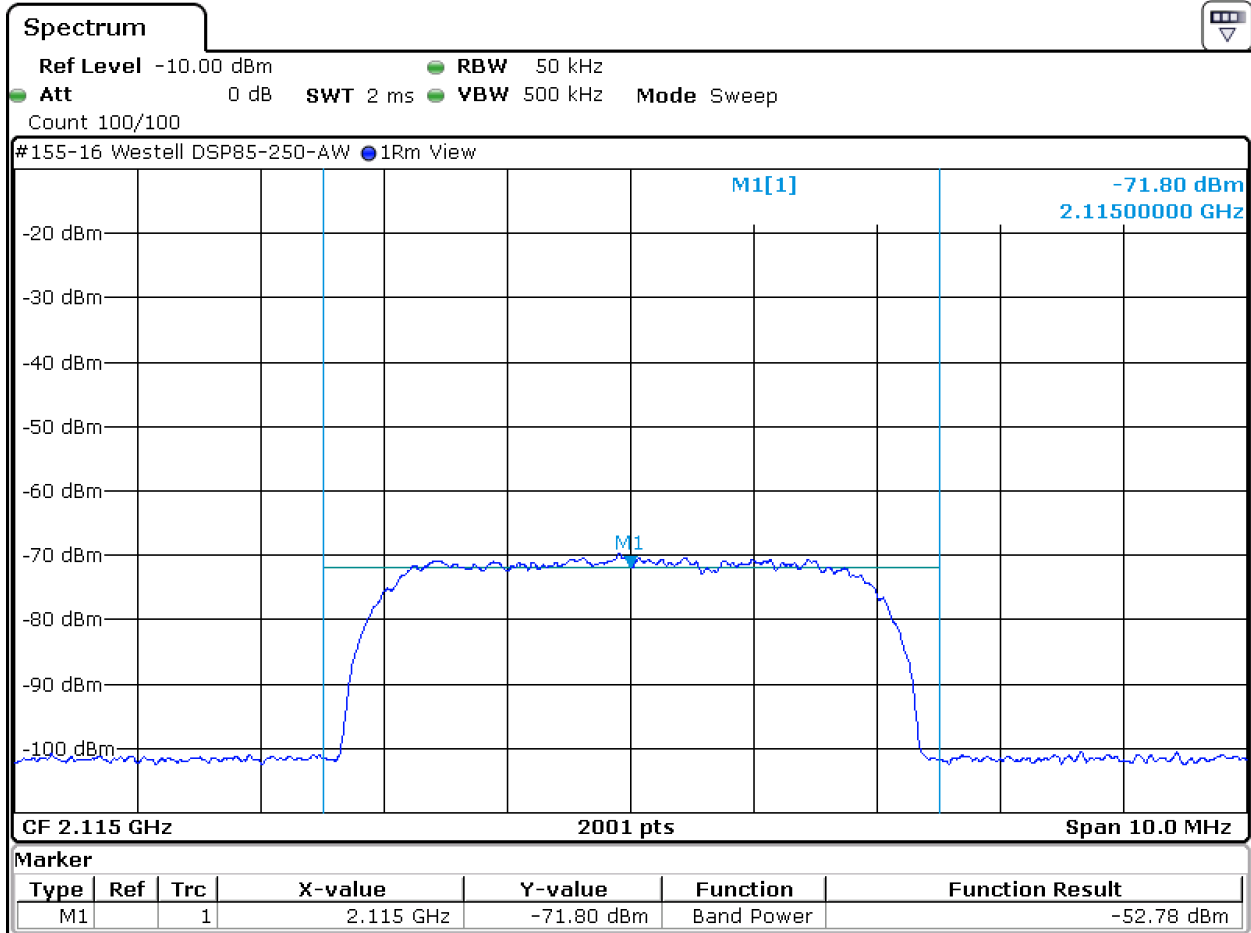


Date: 20.FEB.2016 15:19:59

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

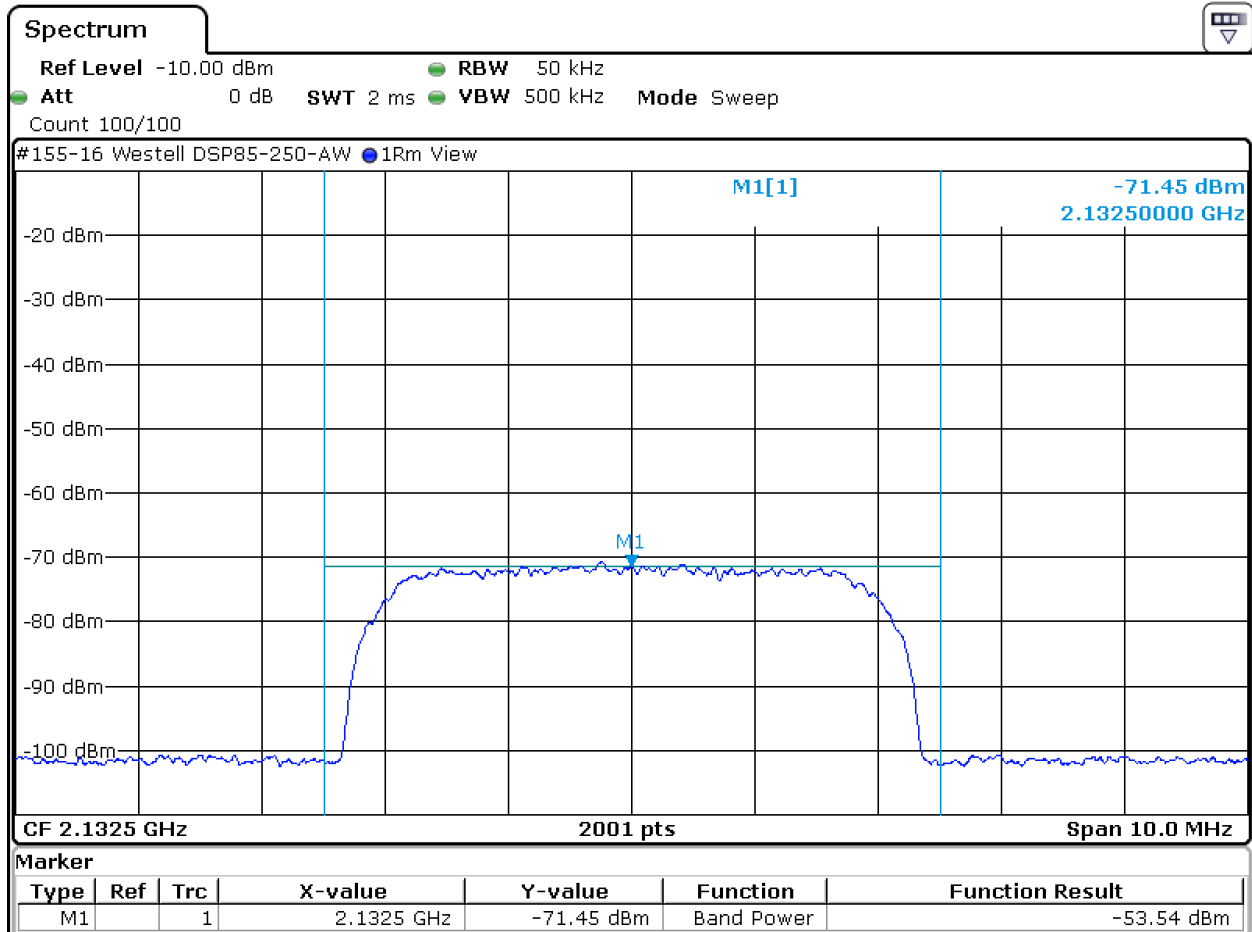


Date: 23.FEB.2016 16:15:50

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

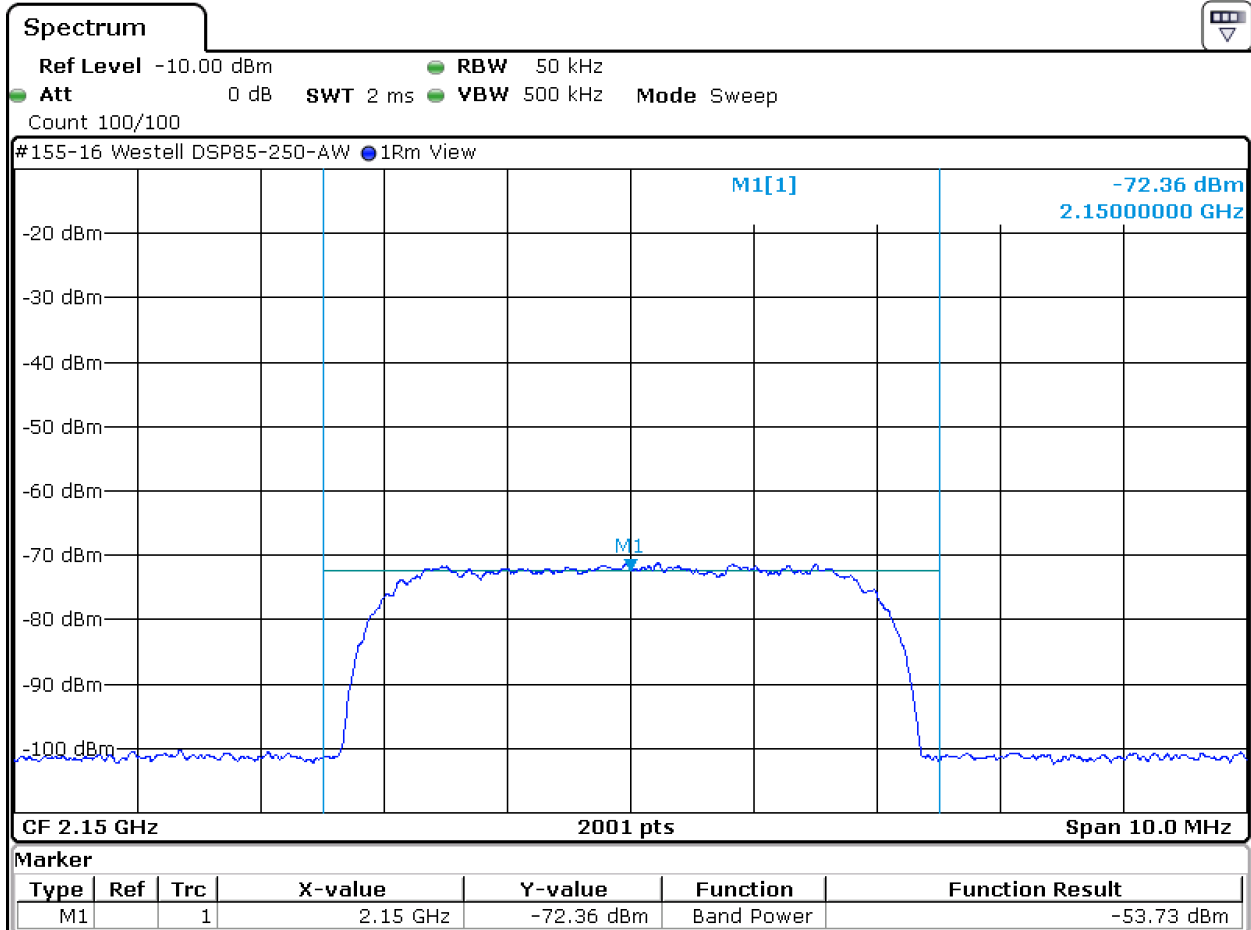


Date: 23.FEB.2016 16:17:27

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."

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

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

| 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

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

6.1.3. Booster gain – 85 dB Nominal

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

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

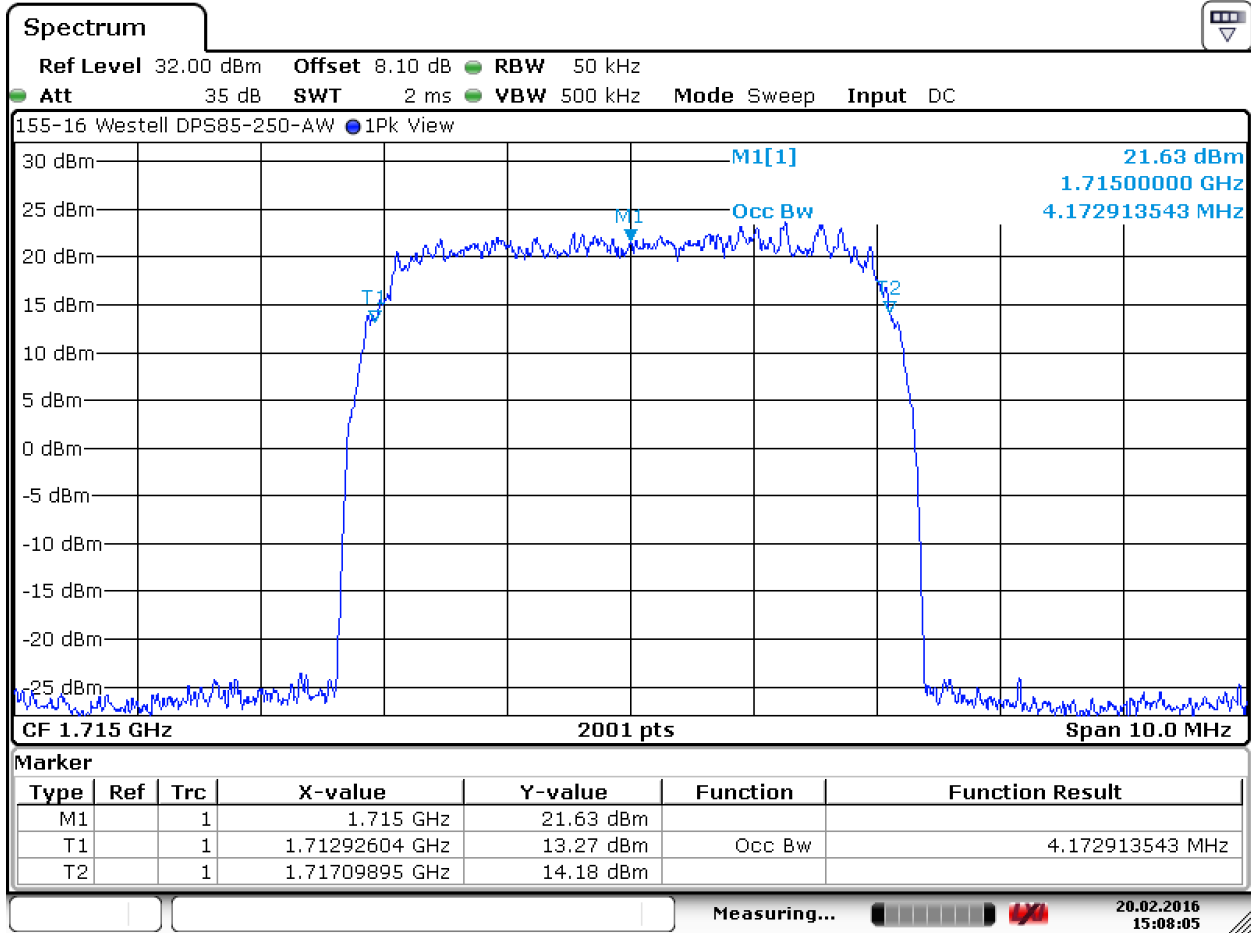
6.2.1. Occupied (99% Power) Bandwidth

| 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 |

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

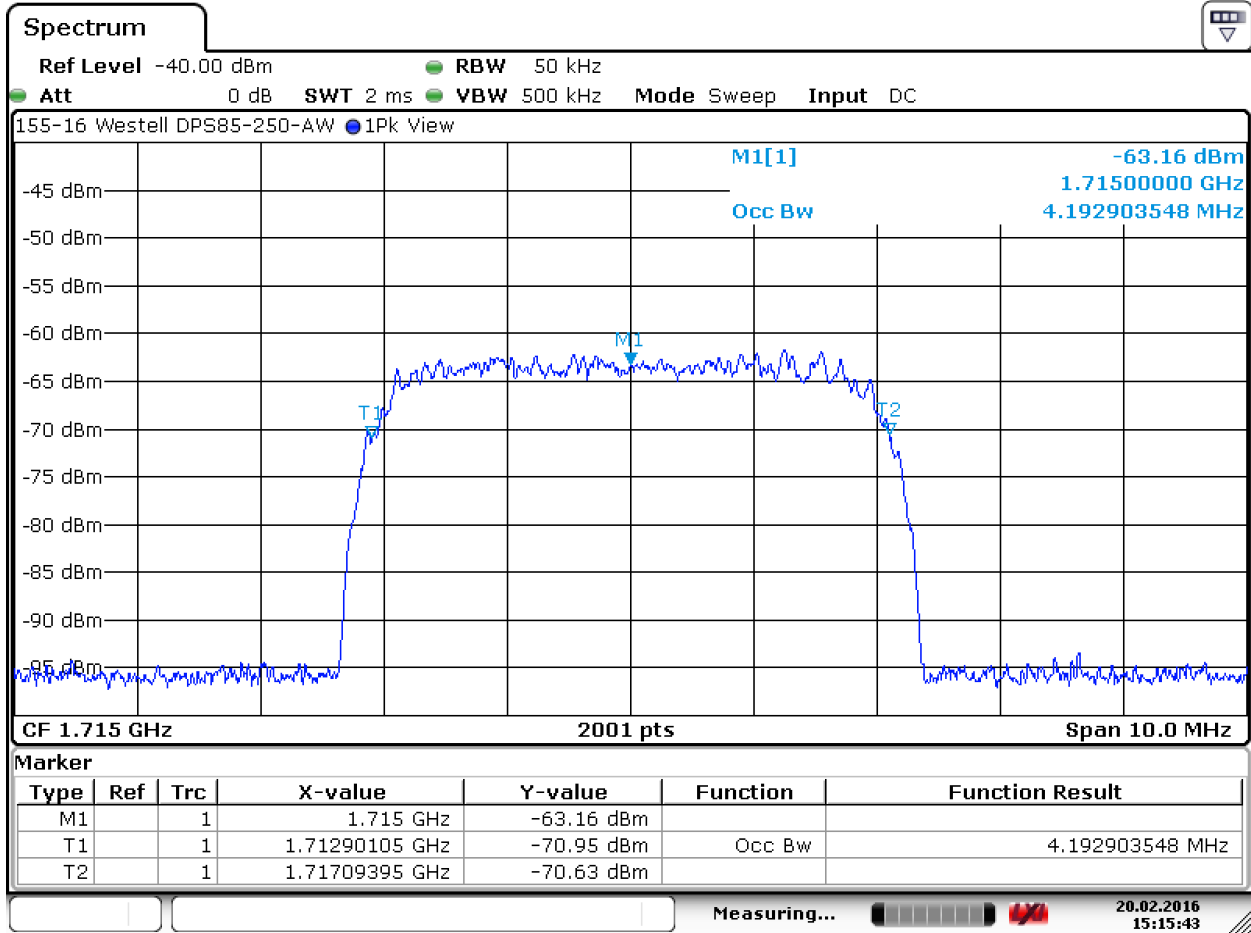
Test Number: 155-16AR3

Issue Date: 9/30/2016

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

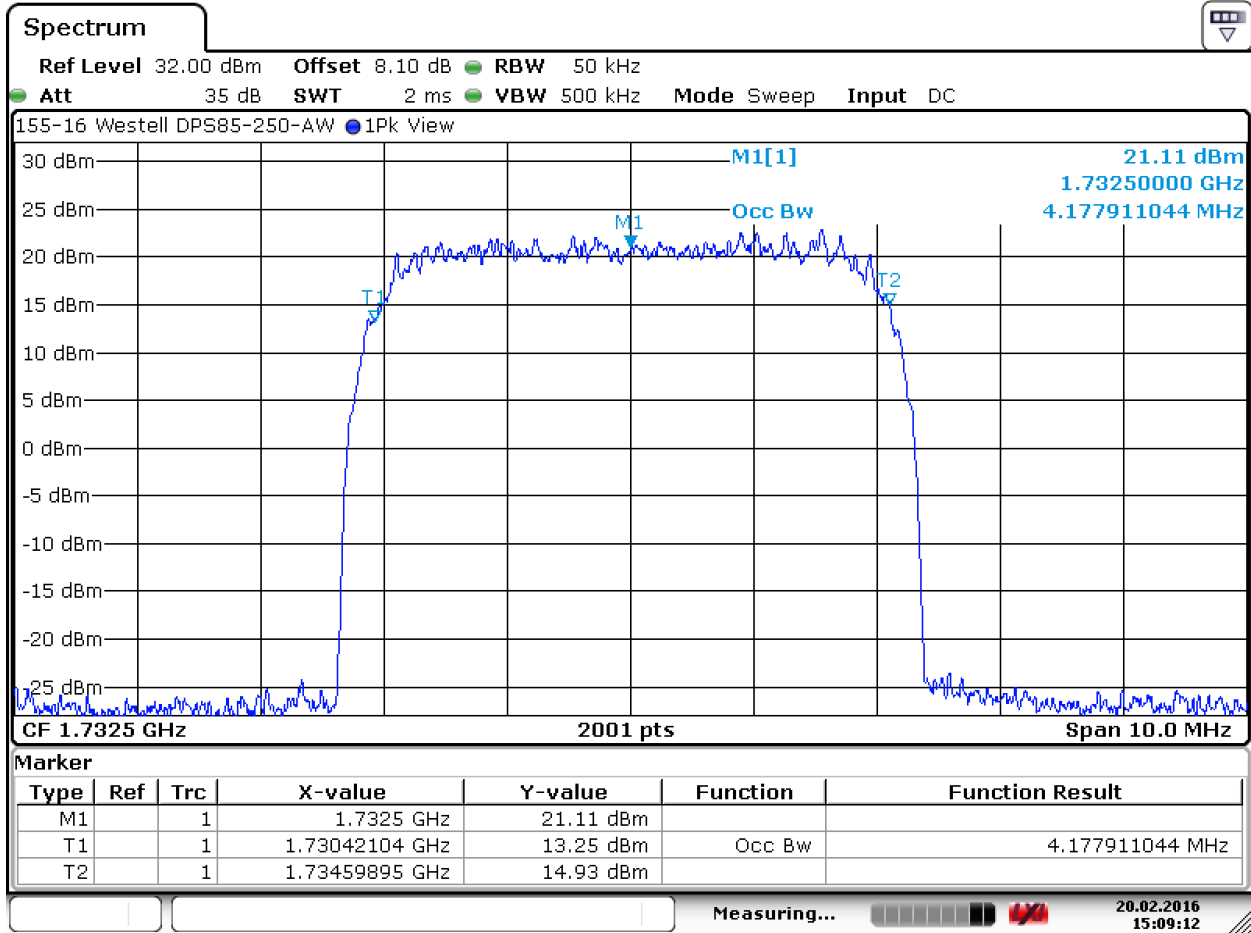


Date: 20.FEB.2016 15:15:43

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

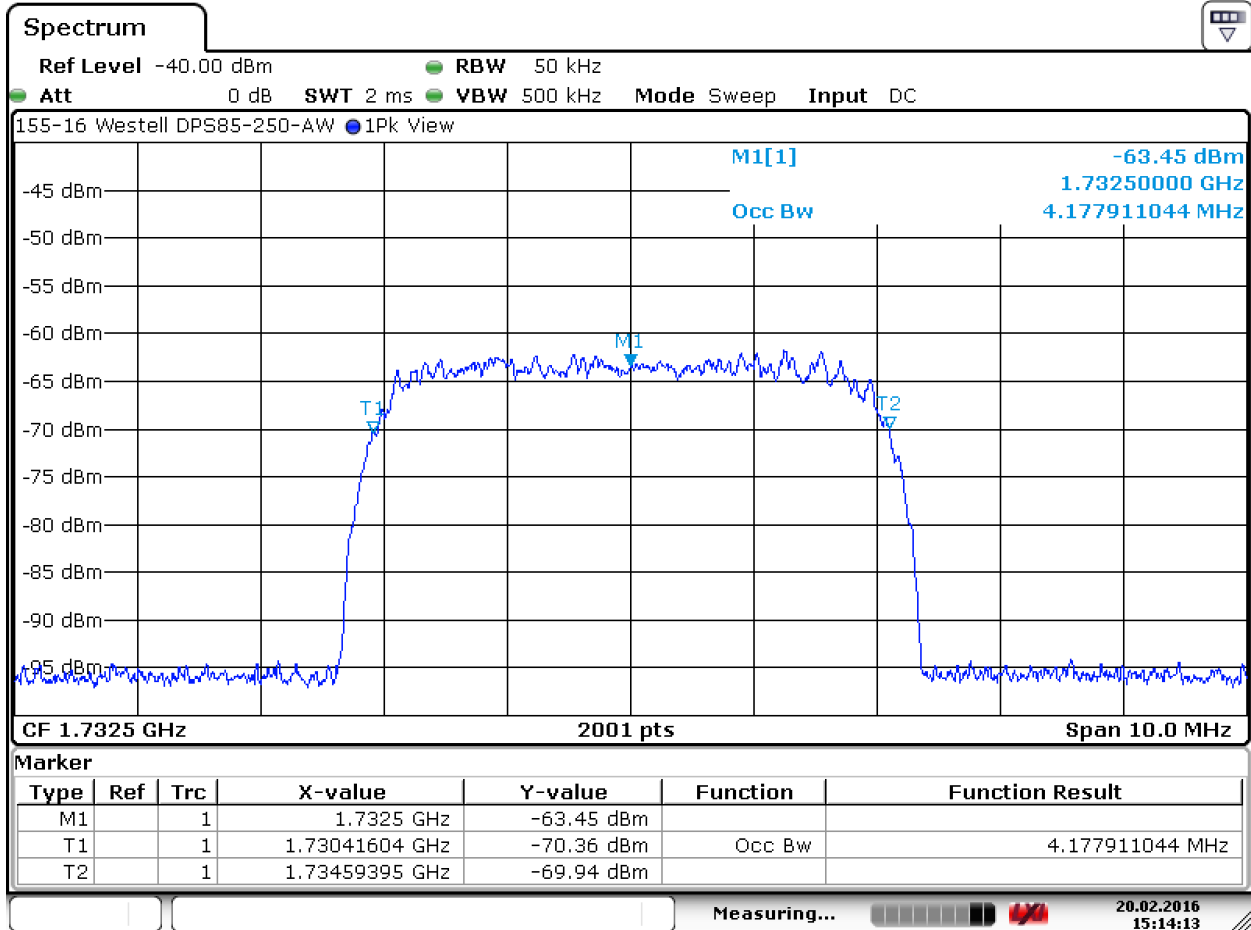
Test Number: 155-16AR3

Issue Date: 9/30/2016

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

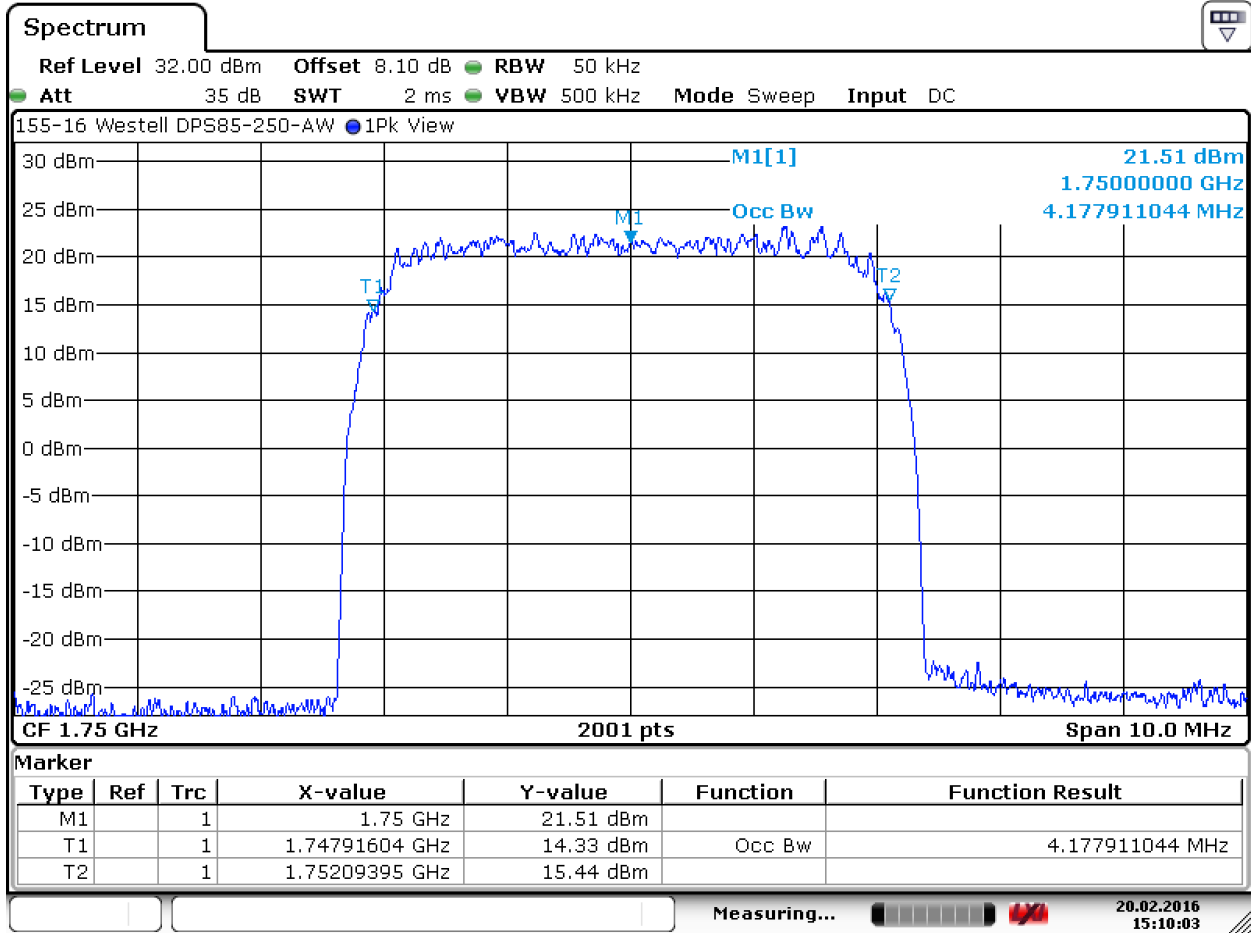


Date: 20.FEB.2016 15:14:13

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

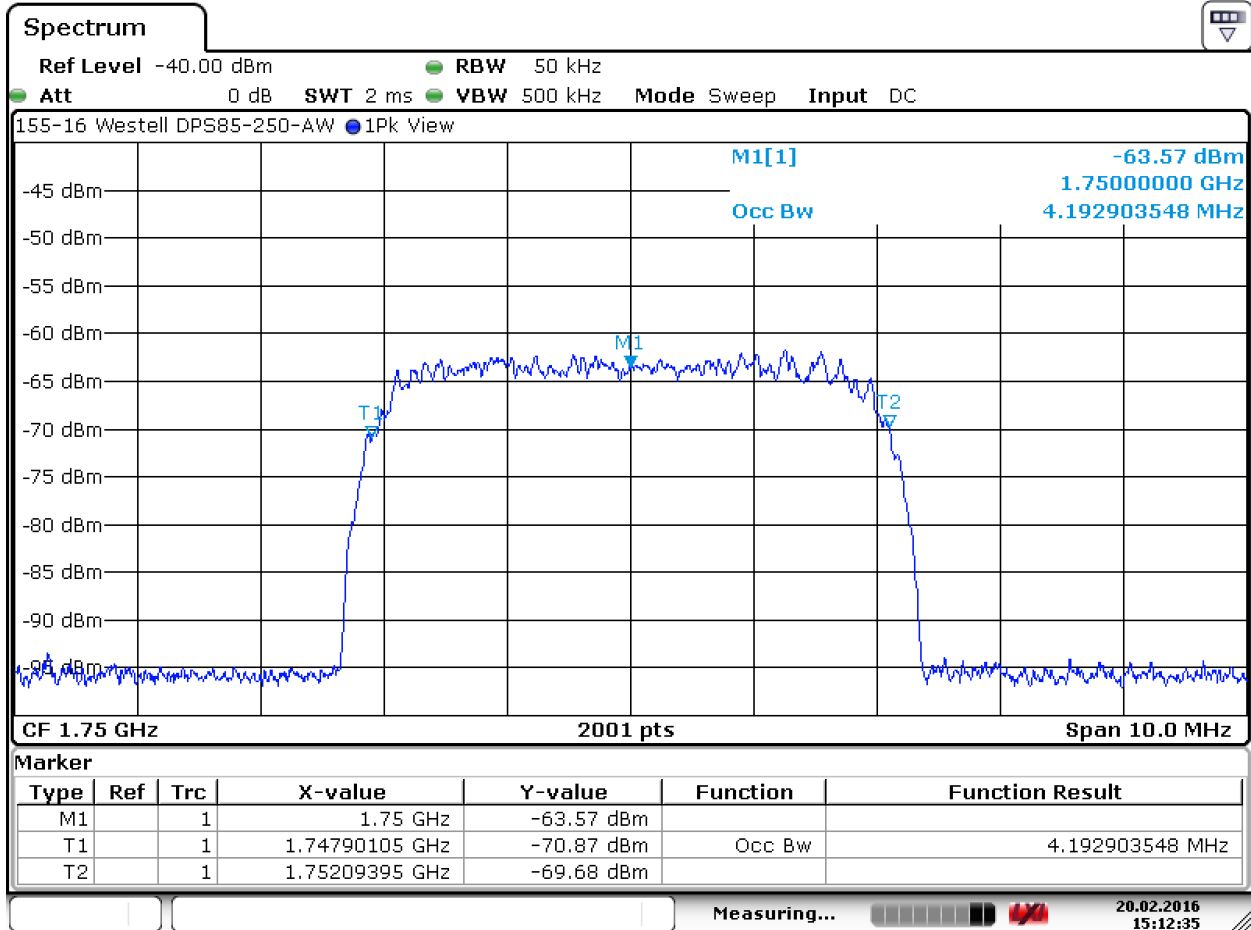
Test Number: 155-16AR3

Issue Date: 9/30/2016

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

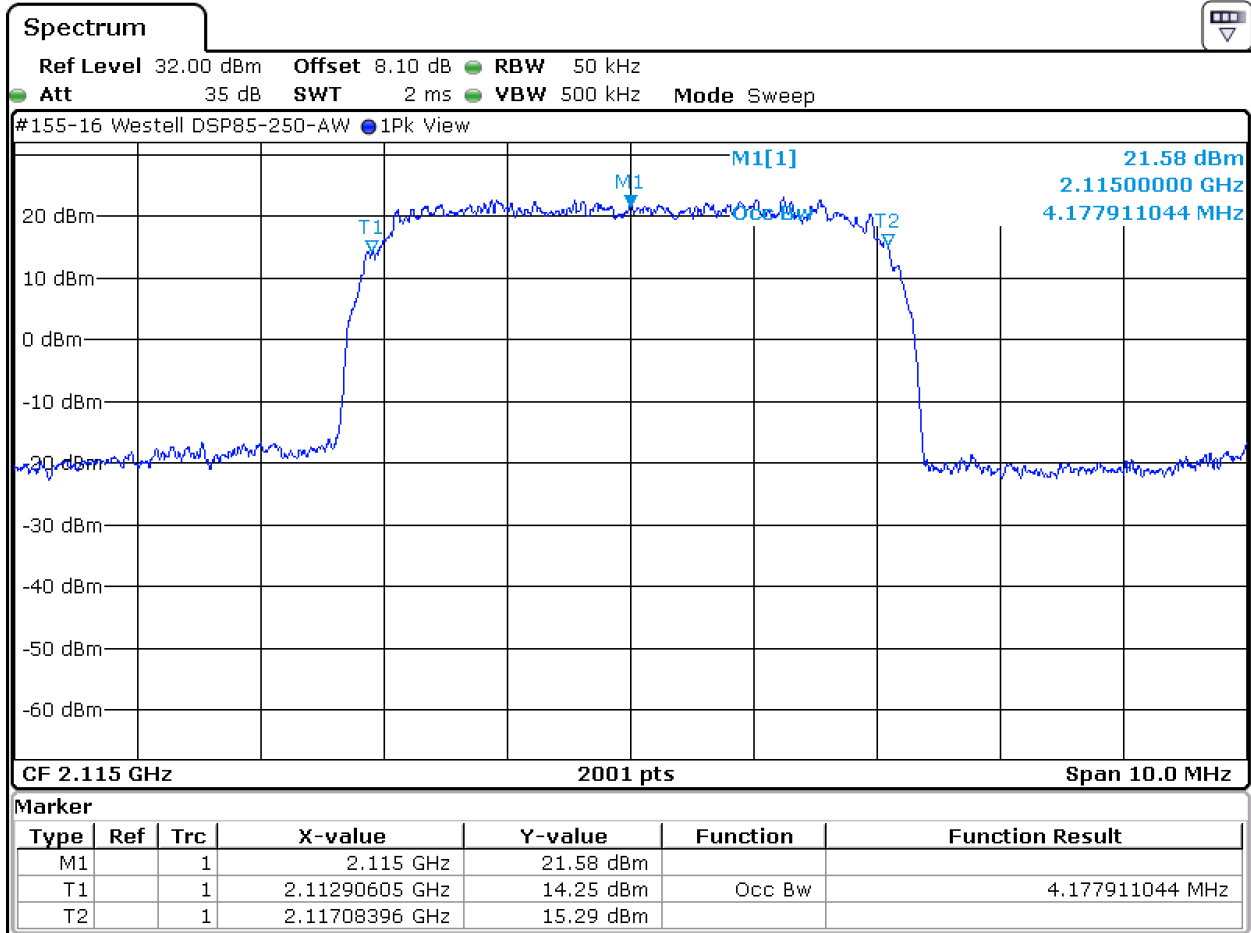


Date: 20.FEB.2016 15:12:34

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

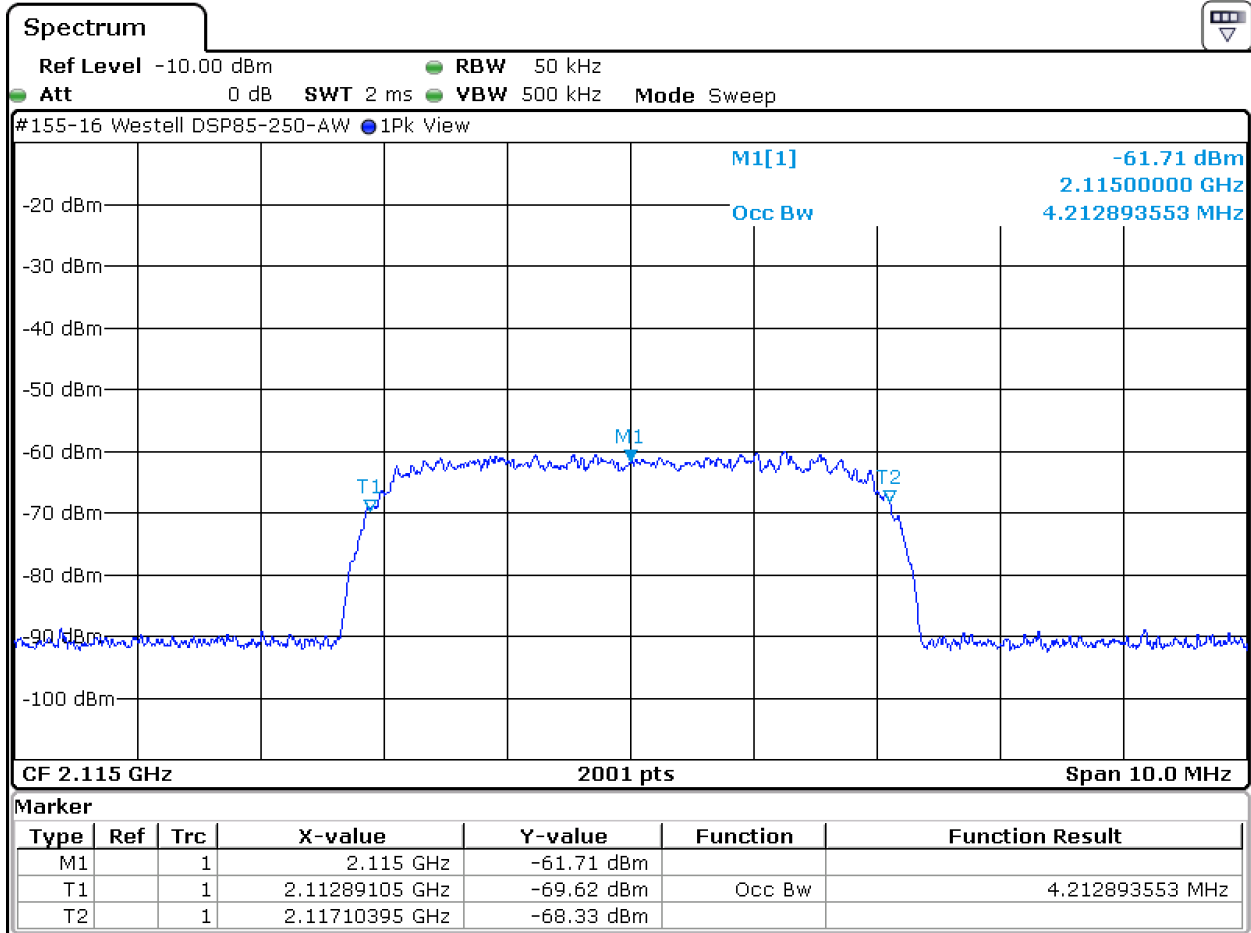


Date: 23.FEB.2016 16:06:11

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

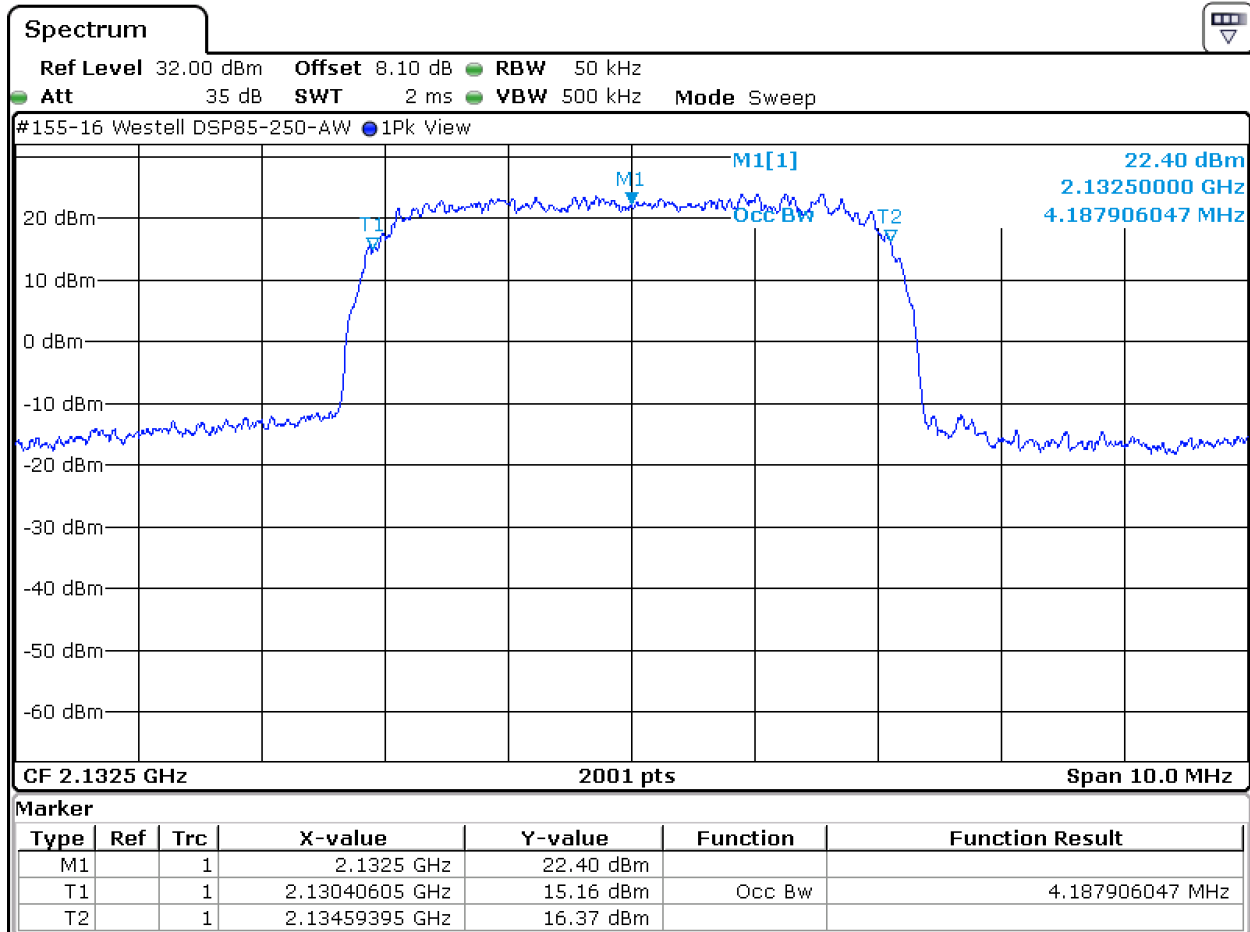


Date: 23.FEB.2016 16:14:26

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

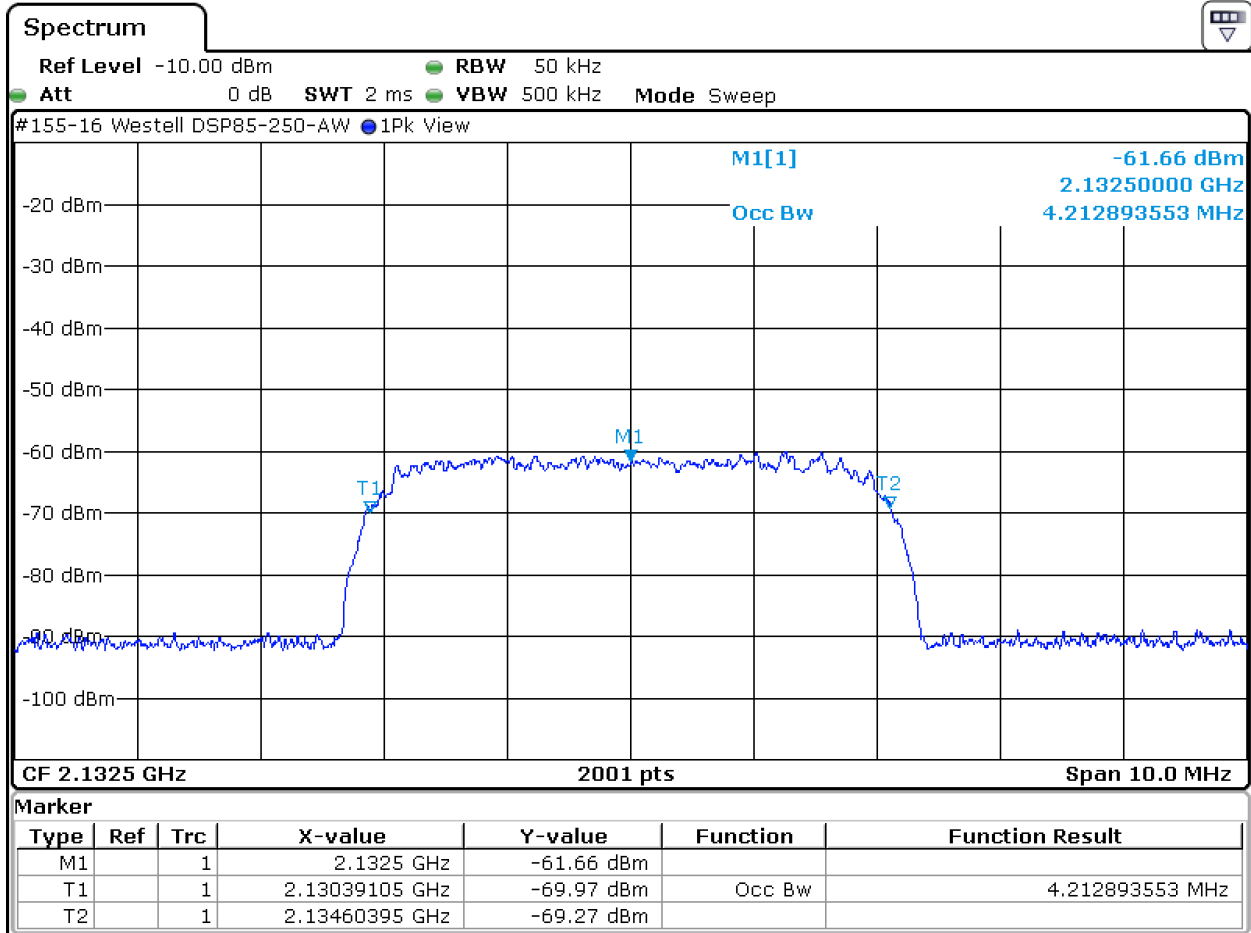


Date: 23.FEB.2016 16:07:45

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

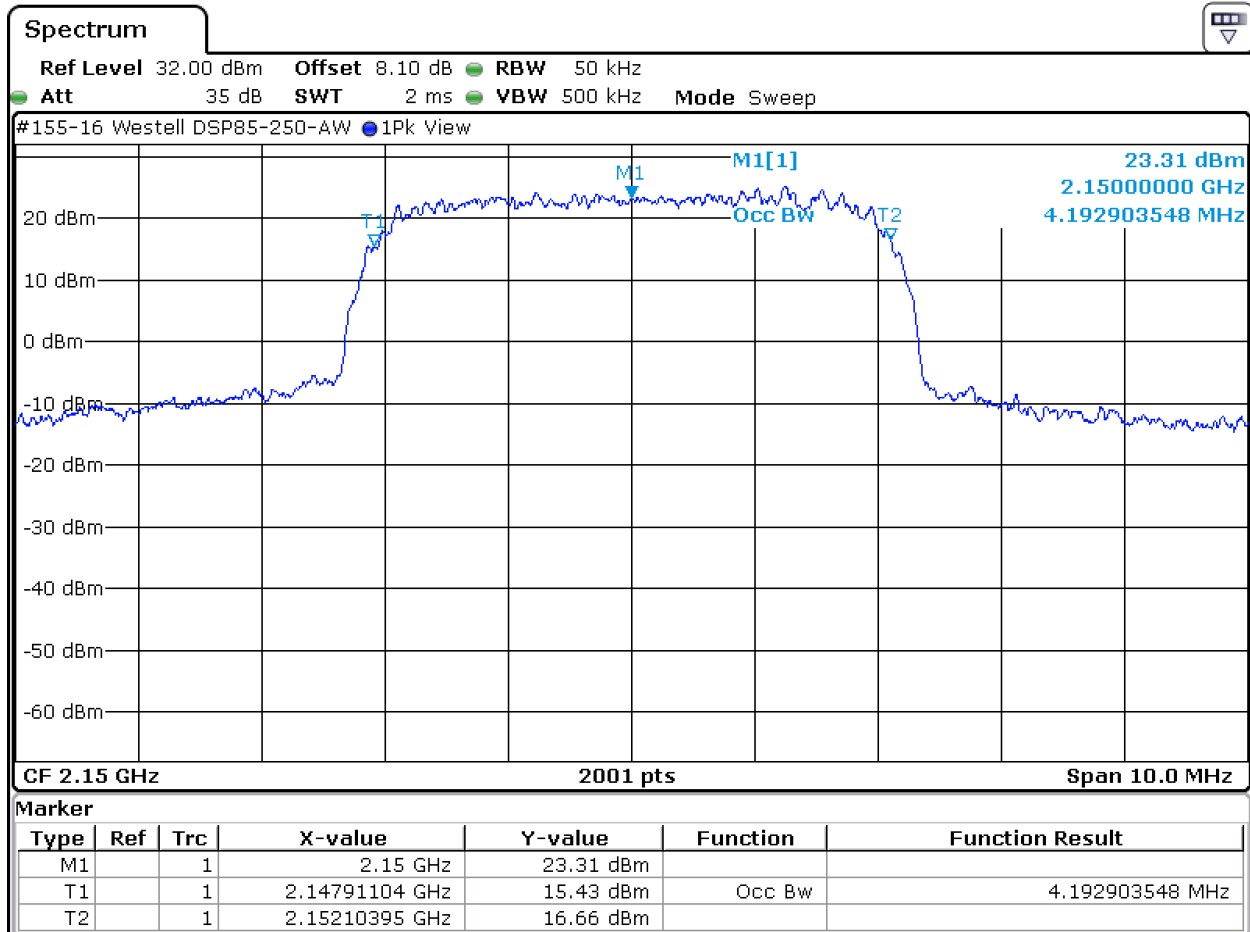


Date: 23.FEB.2016 16:12:59

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

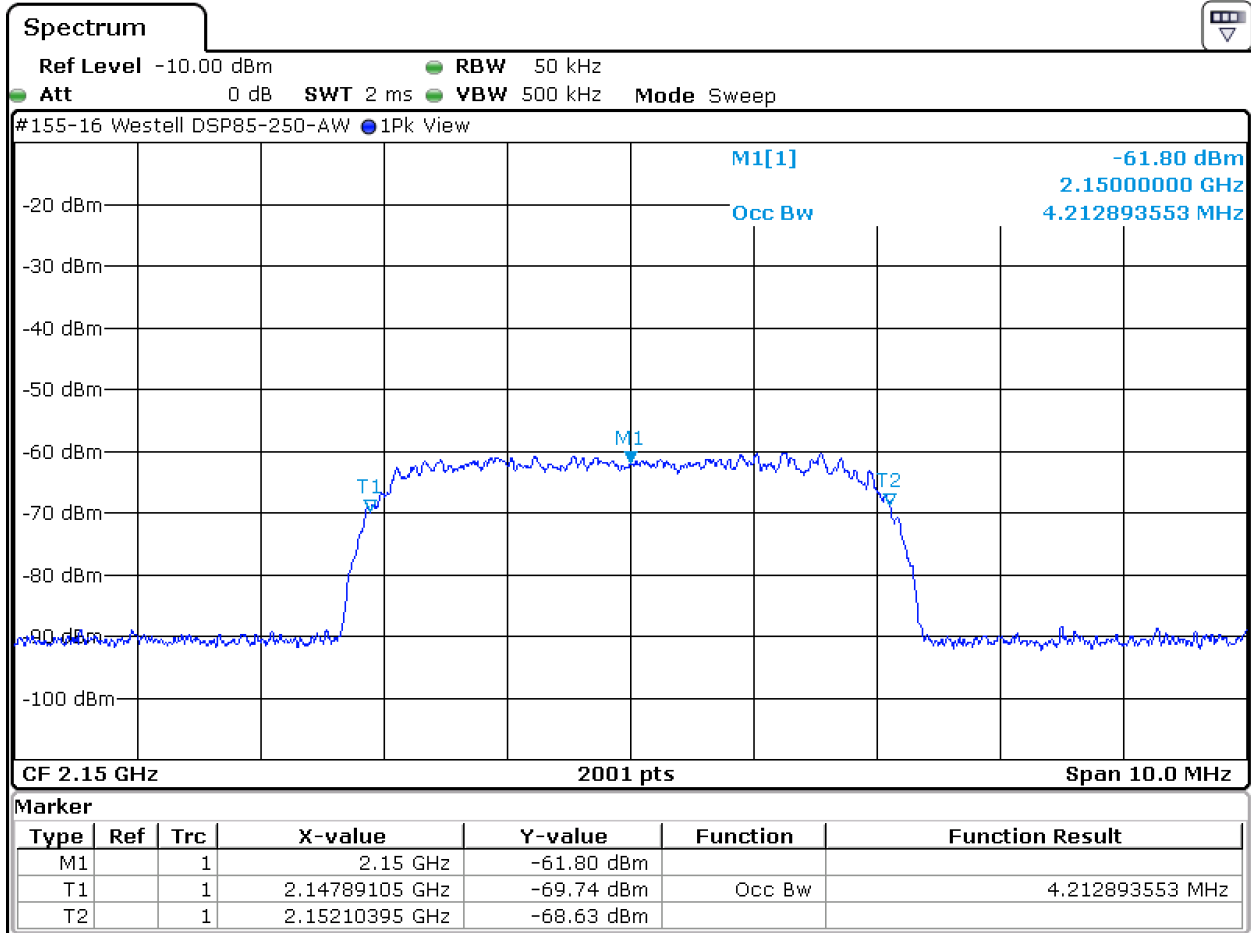


Date: 23.FEB.2016 16:09:24

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)

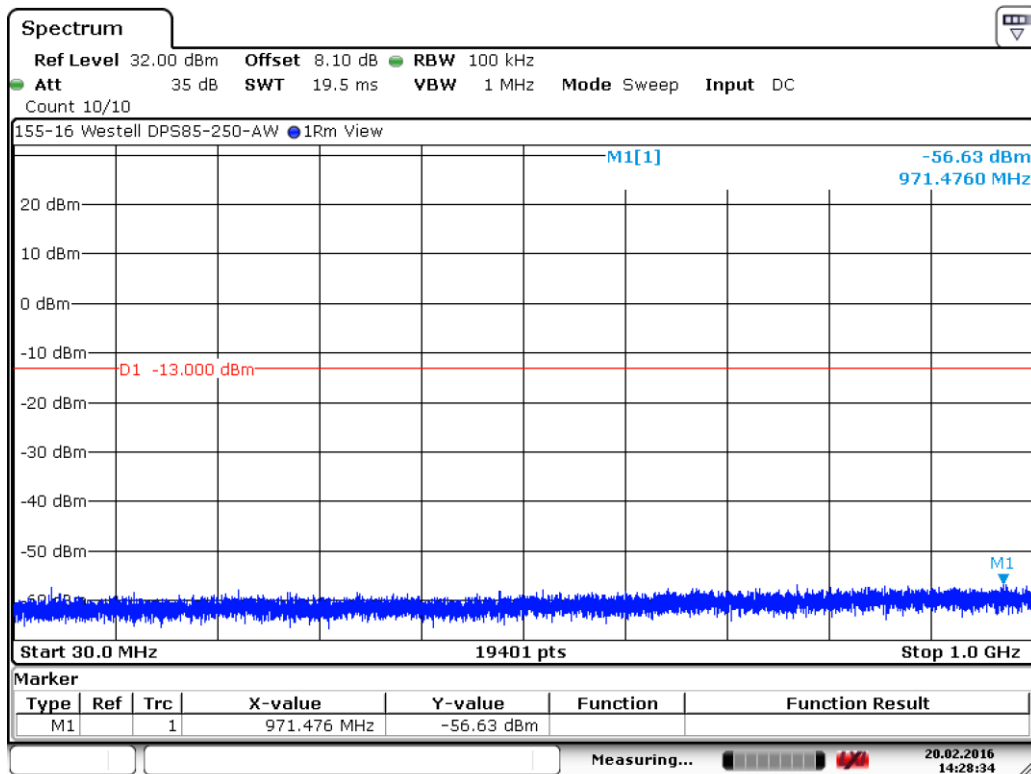
6.3. Spurious Emissions at the Antenna Terminals 27.53 (h), RSS-139 6.6

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

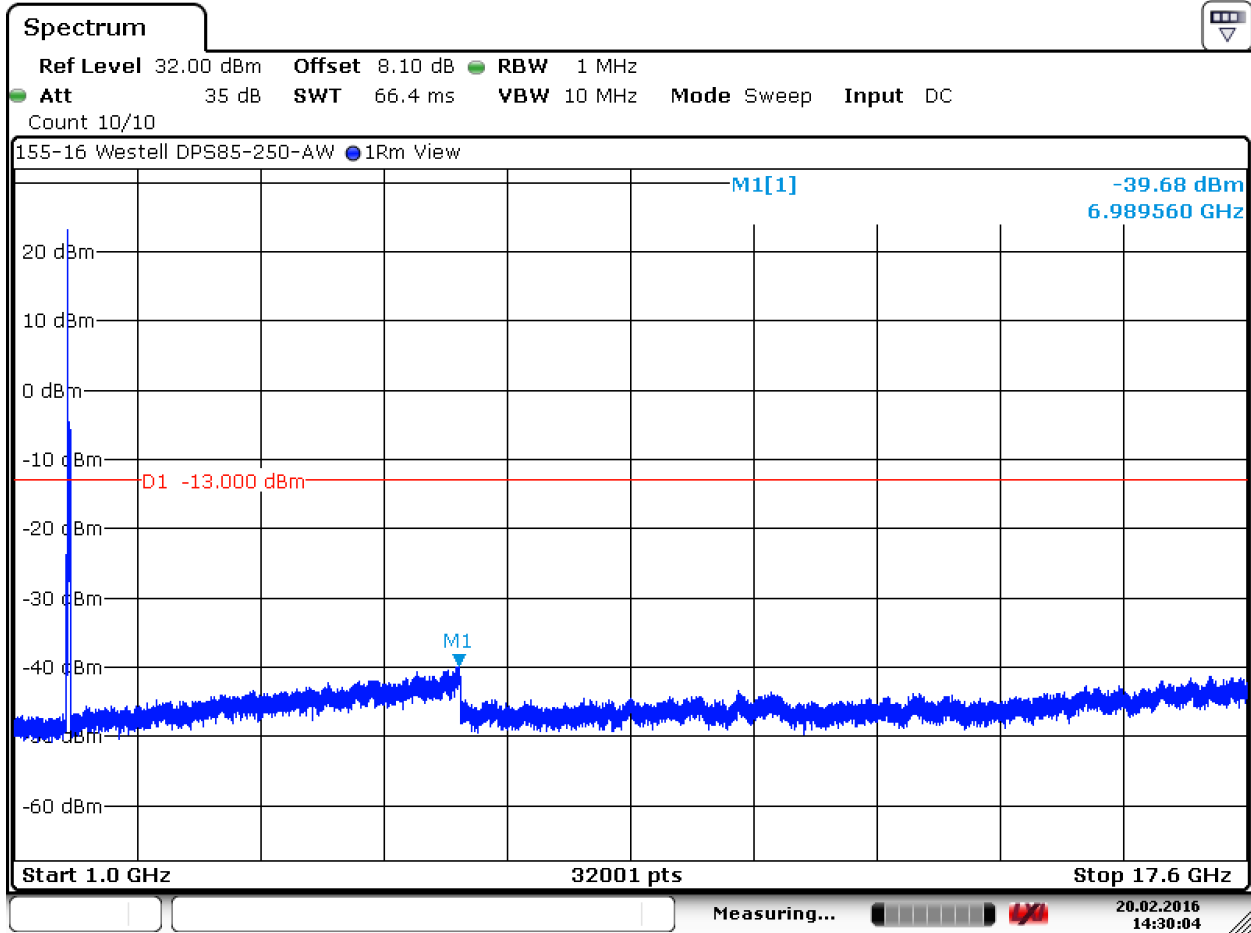


Date: 20.FEB.2016 14:28:33

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

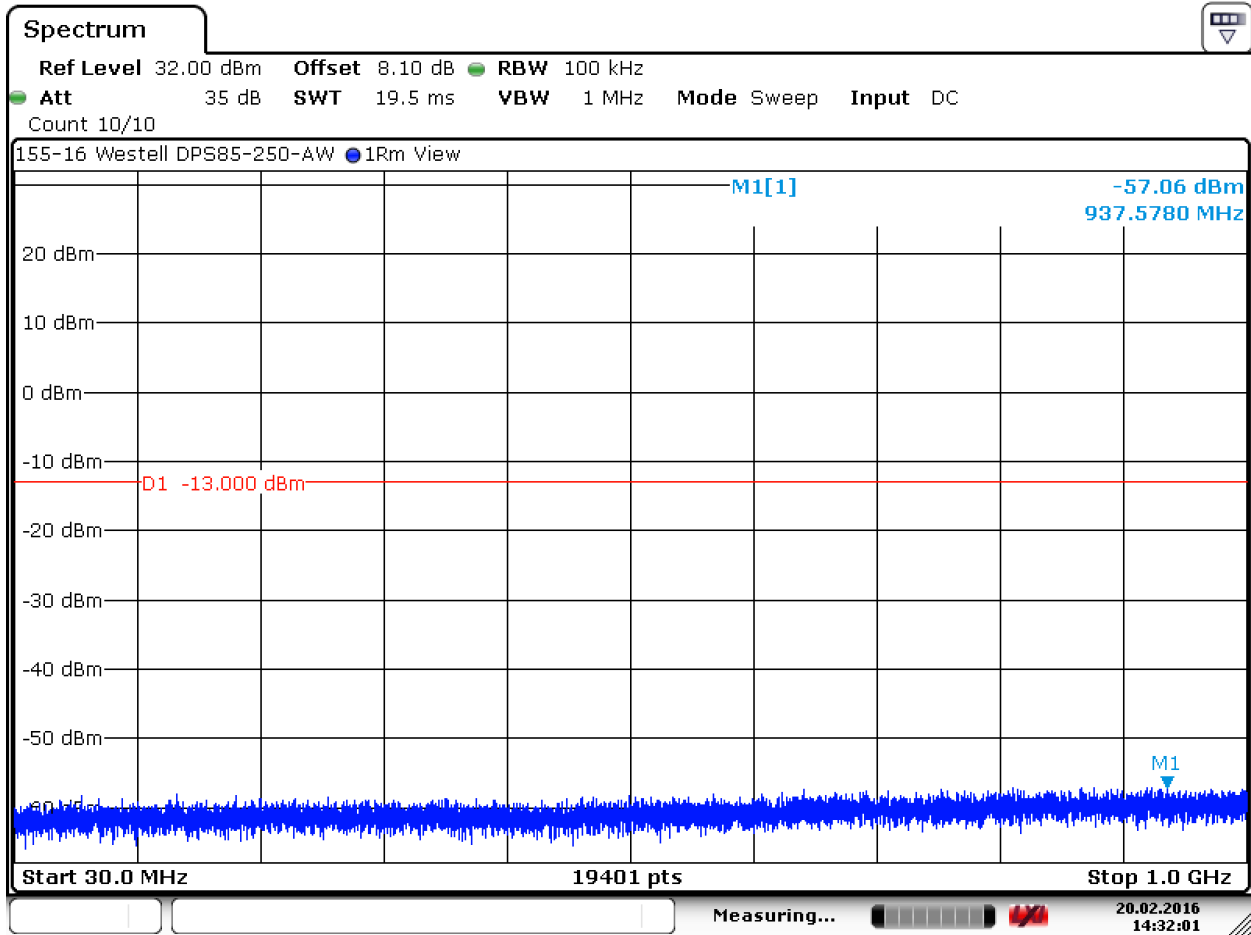
Test Number: 155-16AR3

Issue Date: 9/30/2016

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

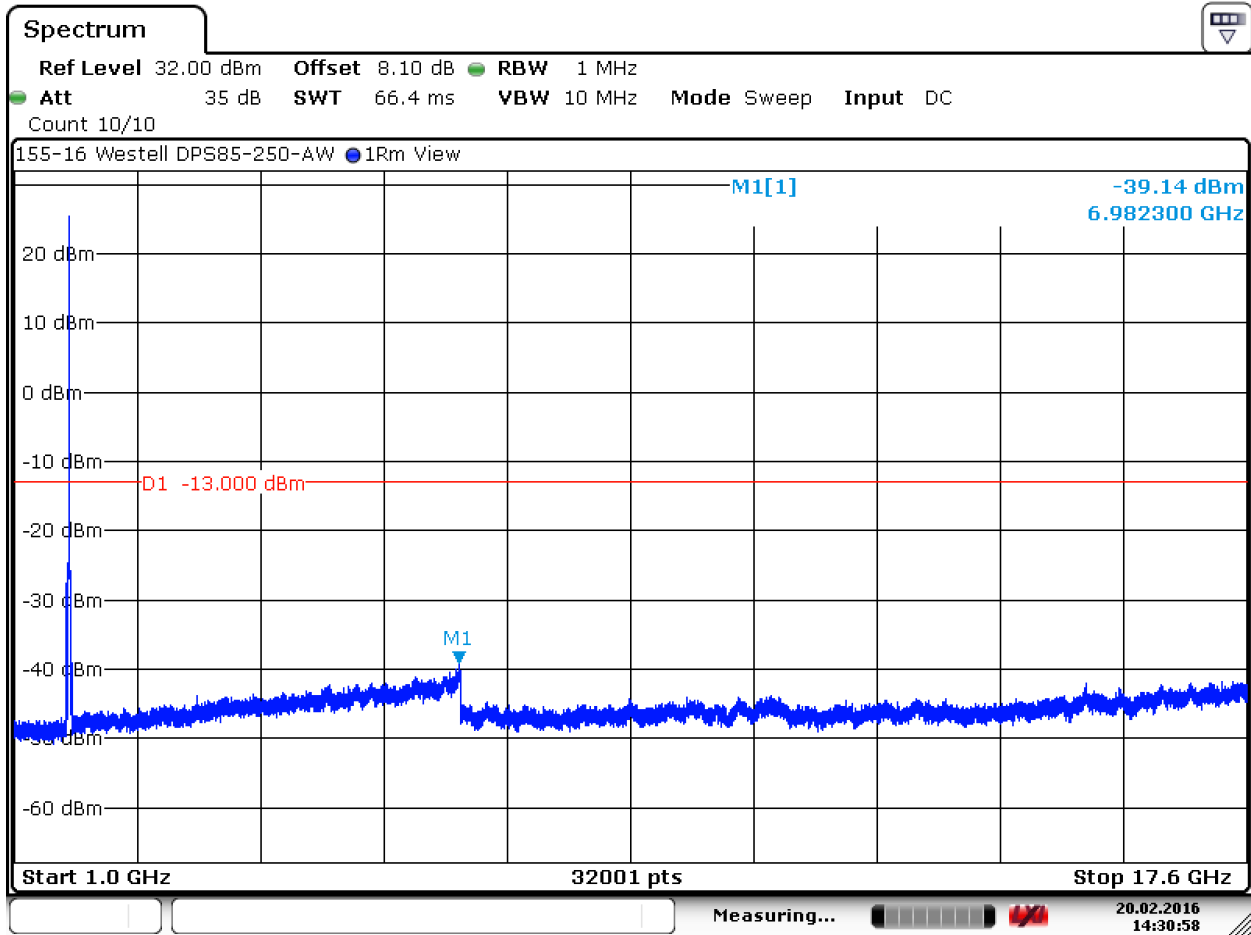


Date: 20.FEB.2016 14:32:00

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

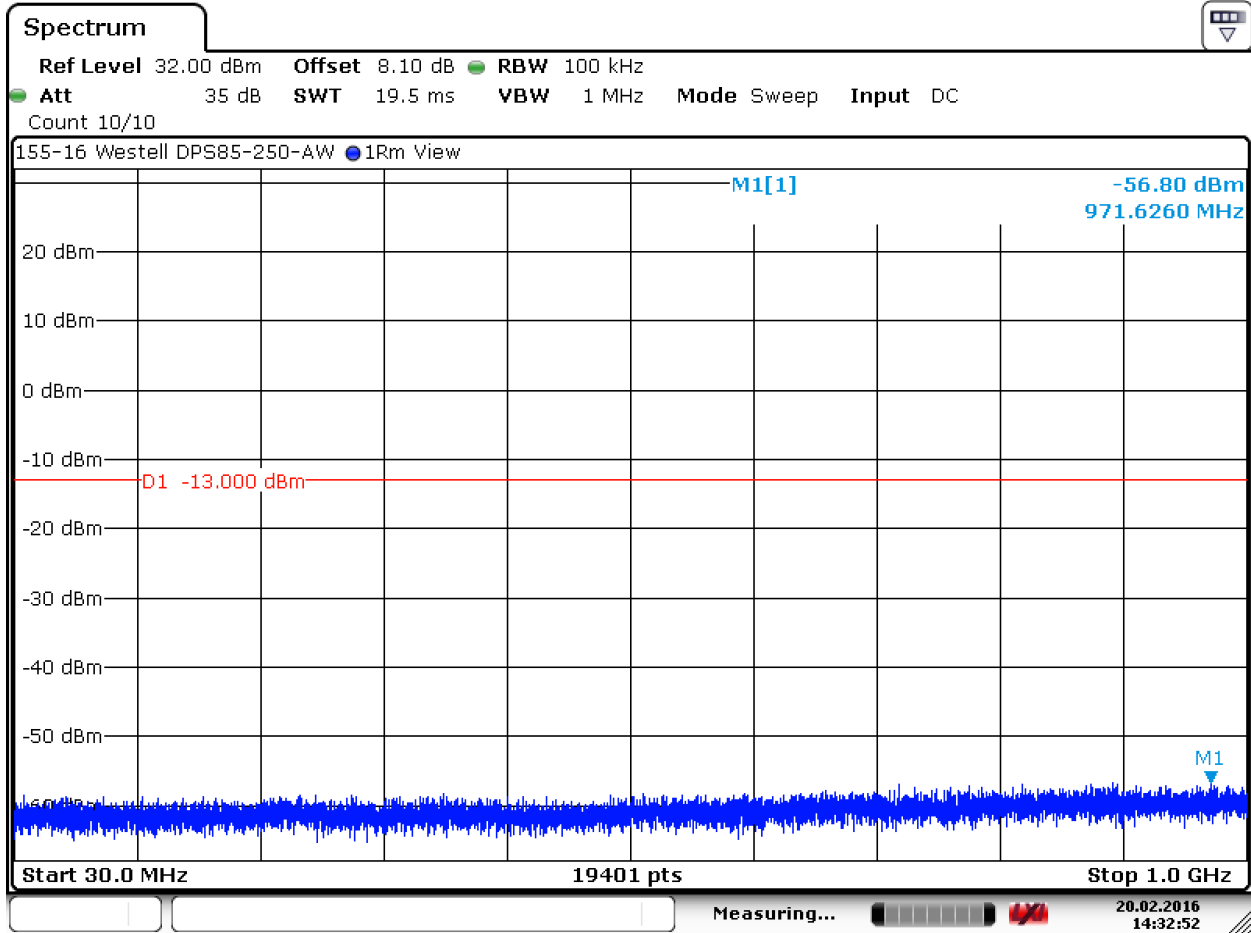


Date: 20.FEB.2016 14:30:57

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

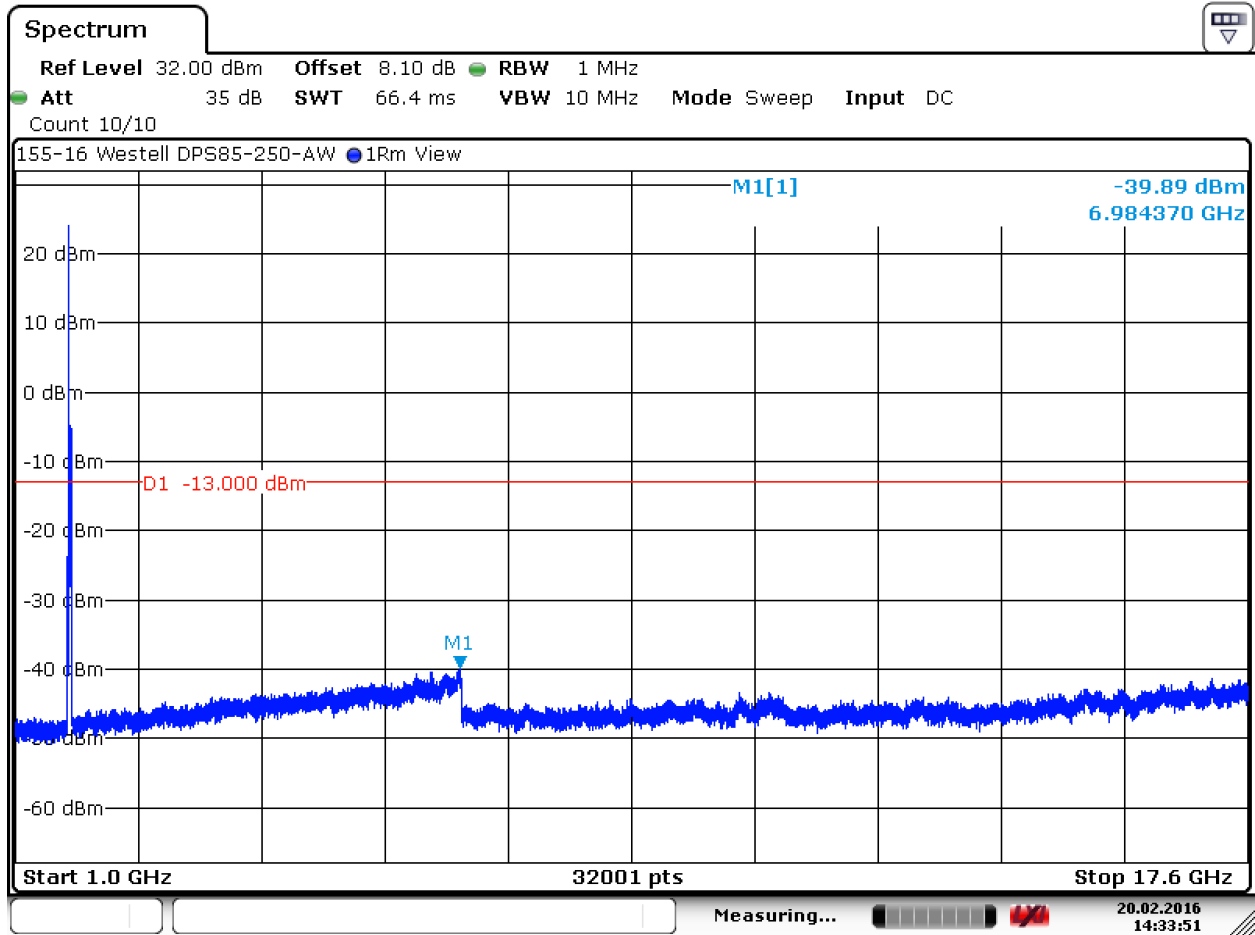
Test Number: 155-16AR3

Issue Date: 9/30/2016

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

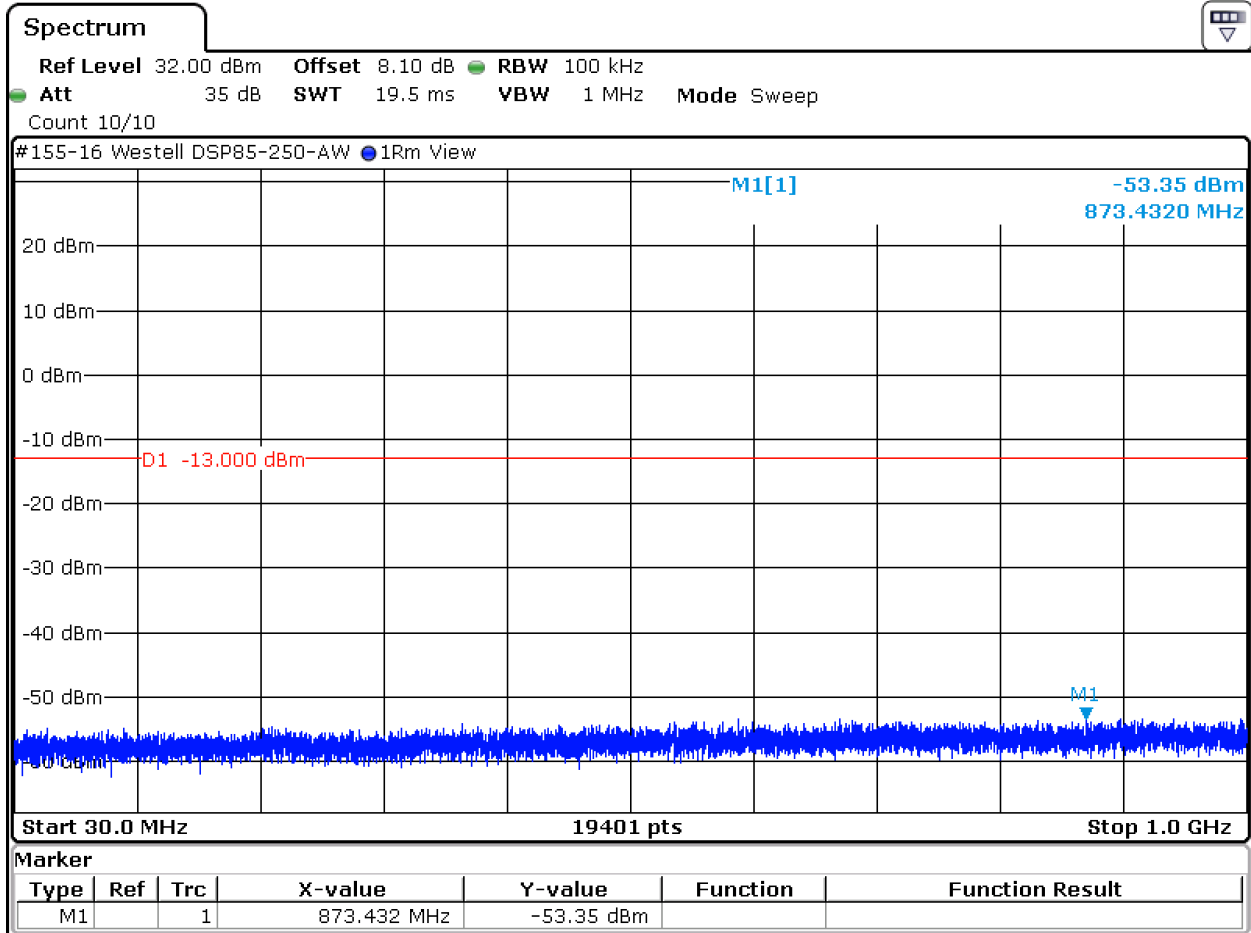


Date: 20.FEB.2016 14:33:51

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

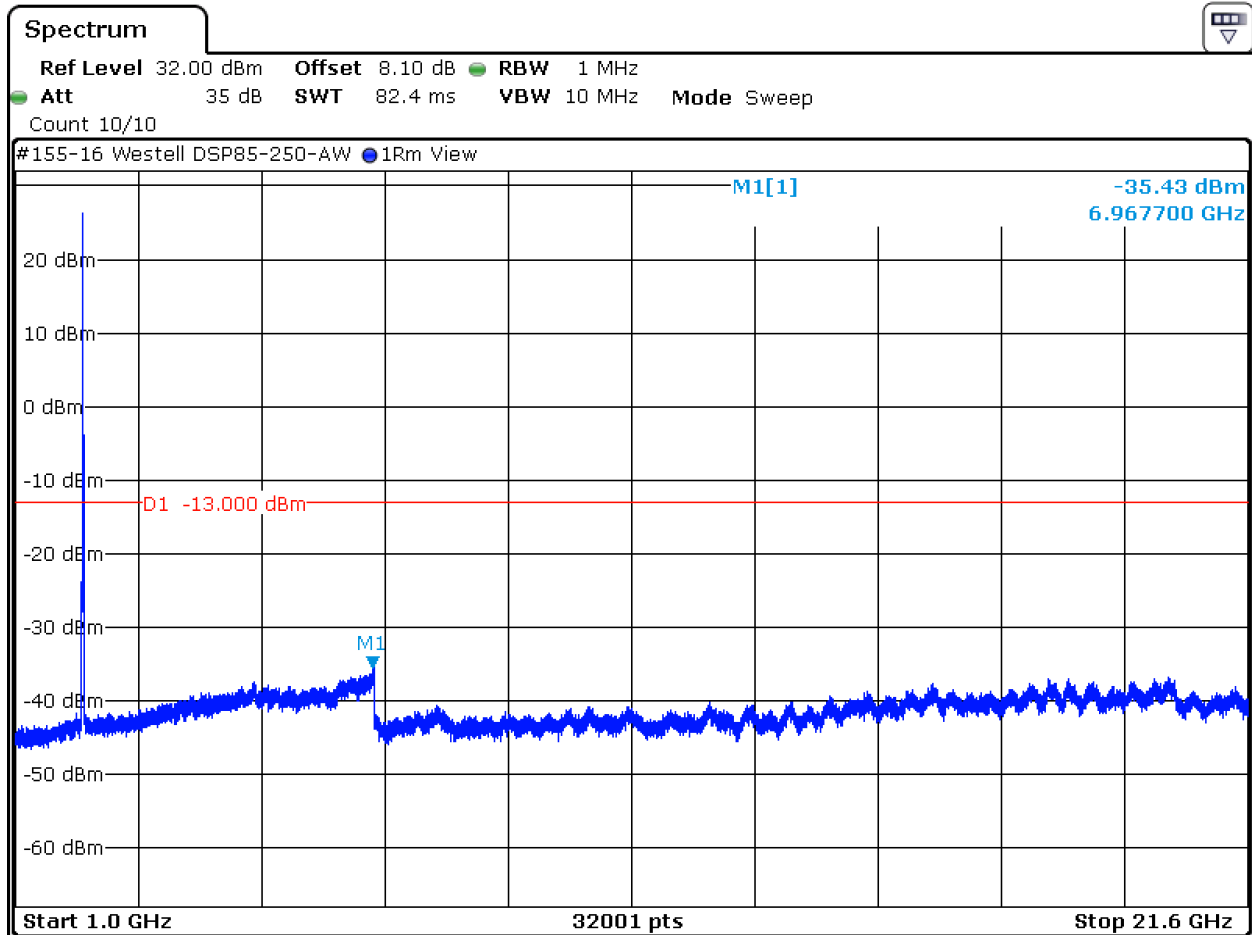


Date: 23.FEB.2016 15:49:44

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

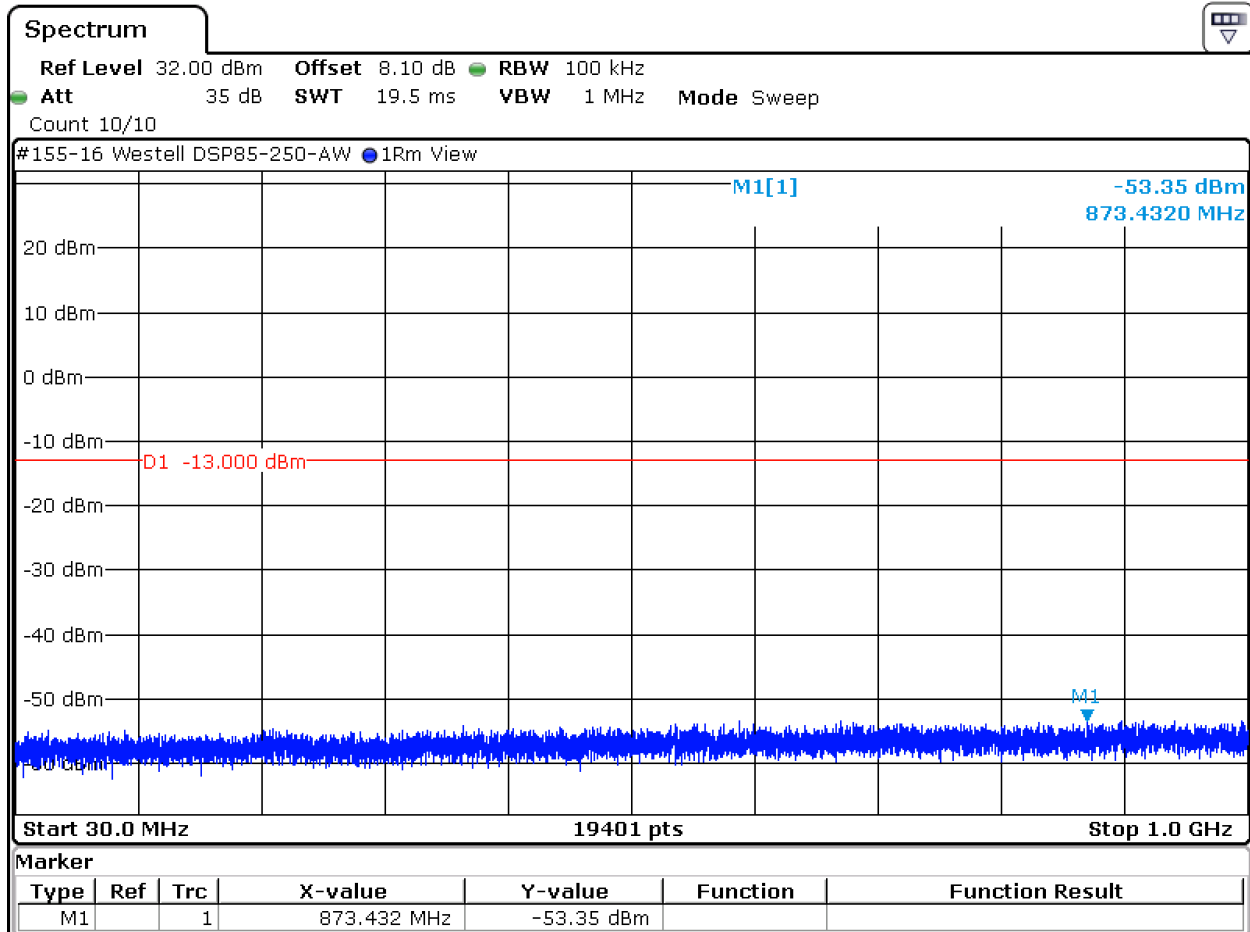


Date: 23.FEB.2016 15:53:02

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

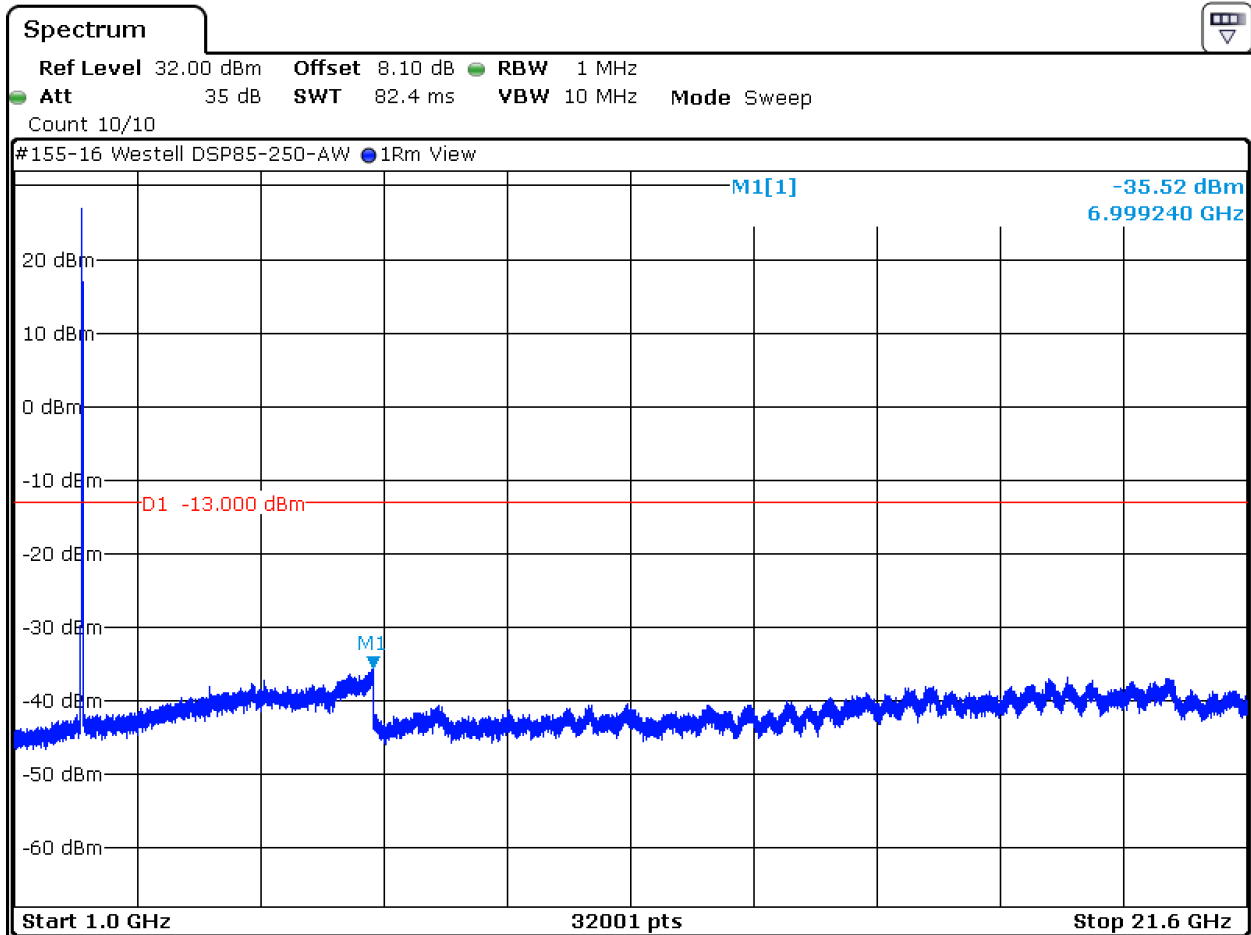
Test Number: 155-16AR3

Issue Date: 9/30/2016

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

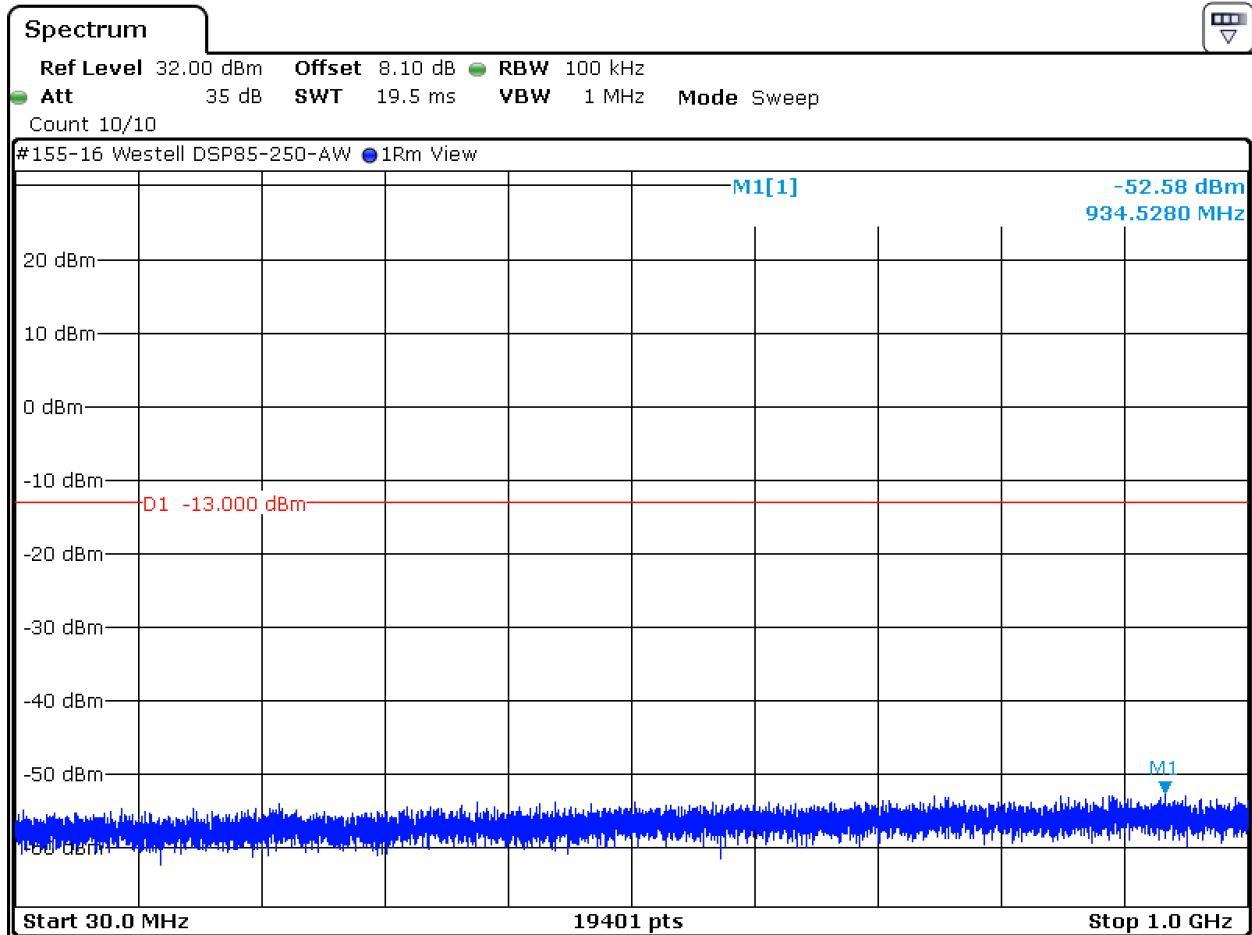


Date: 23.FEB.2016 15:54:02

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

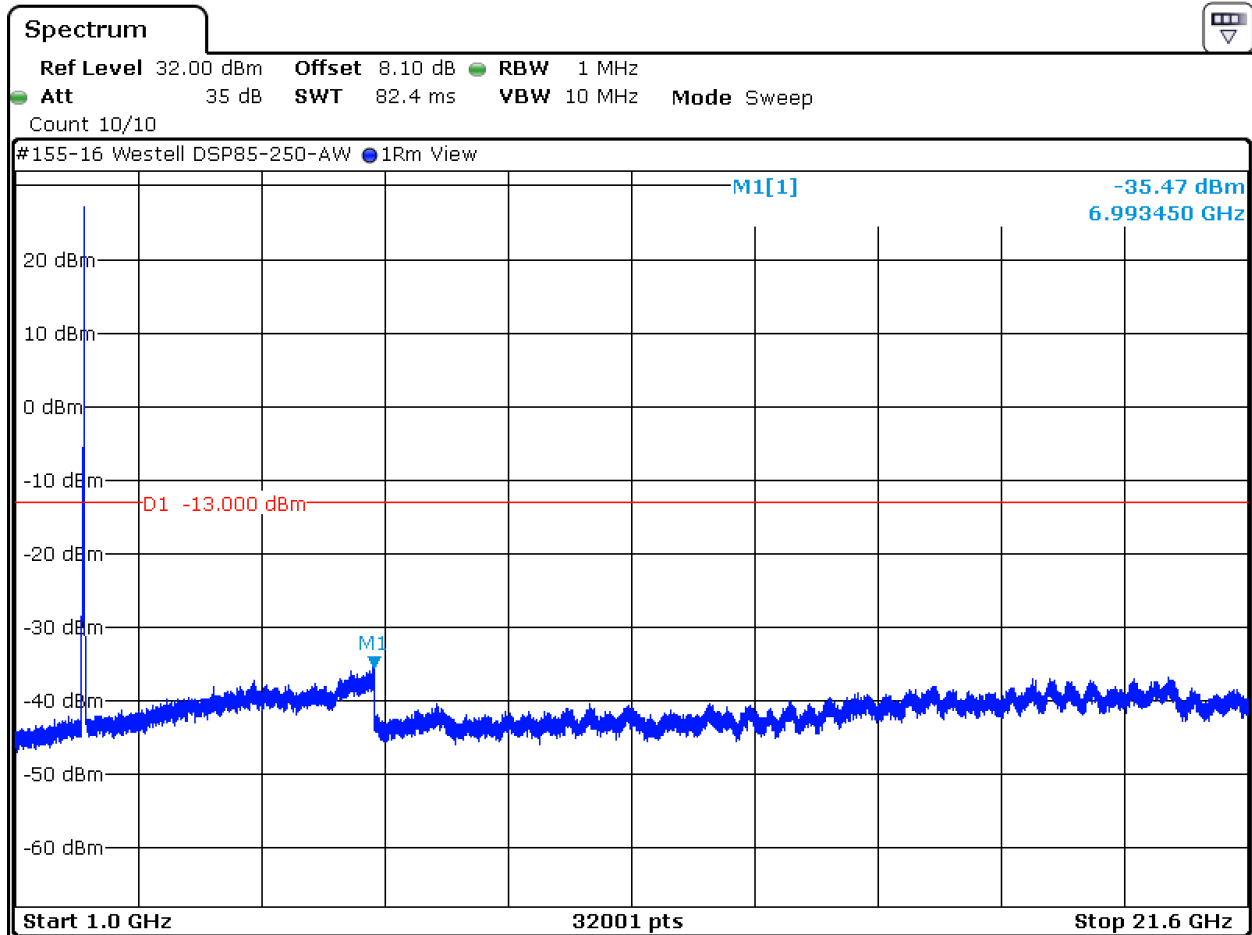


Date: 23.FEB.2016 15:56:24

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

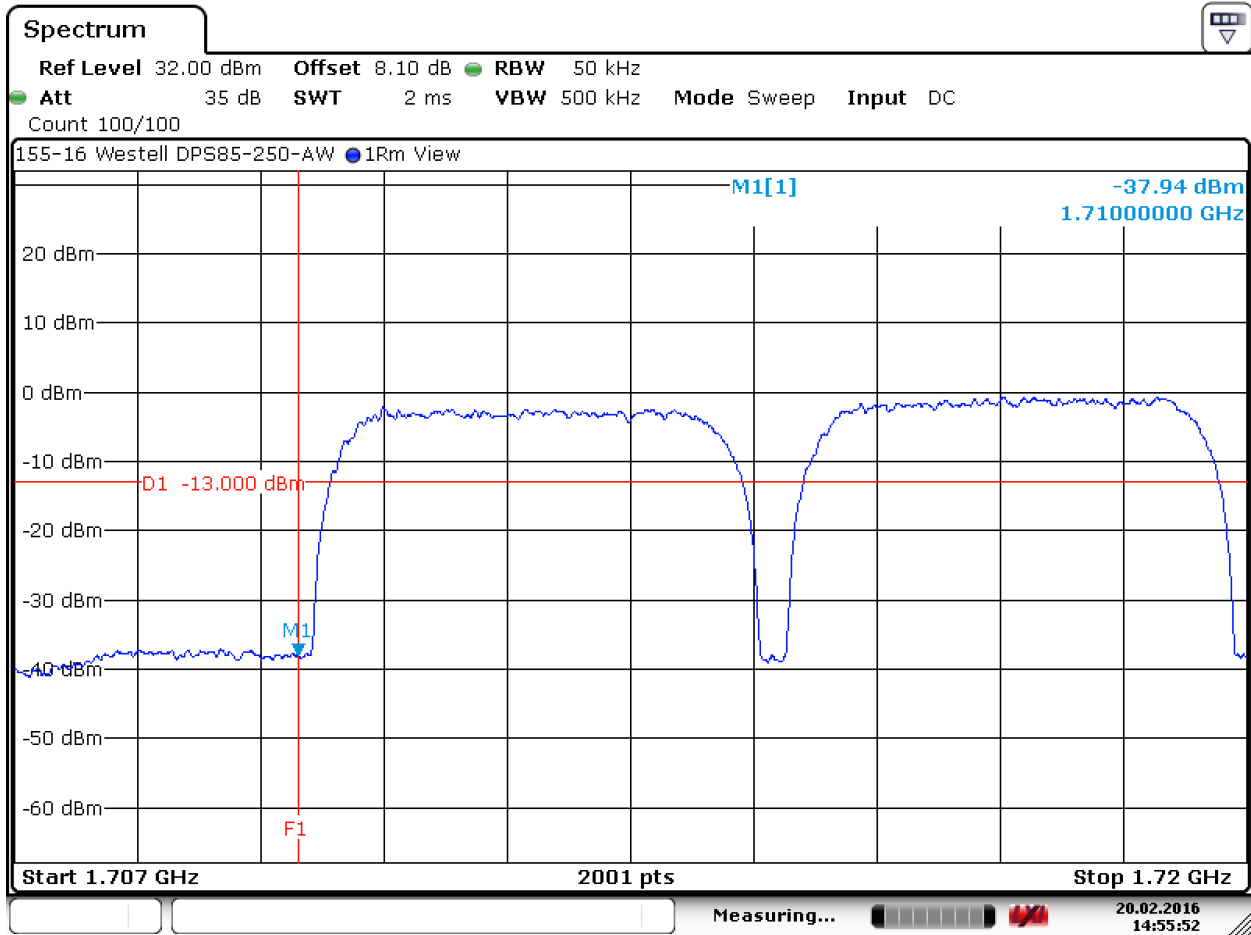


Date: 23.FEB.2016 15:57:21

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

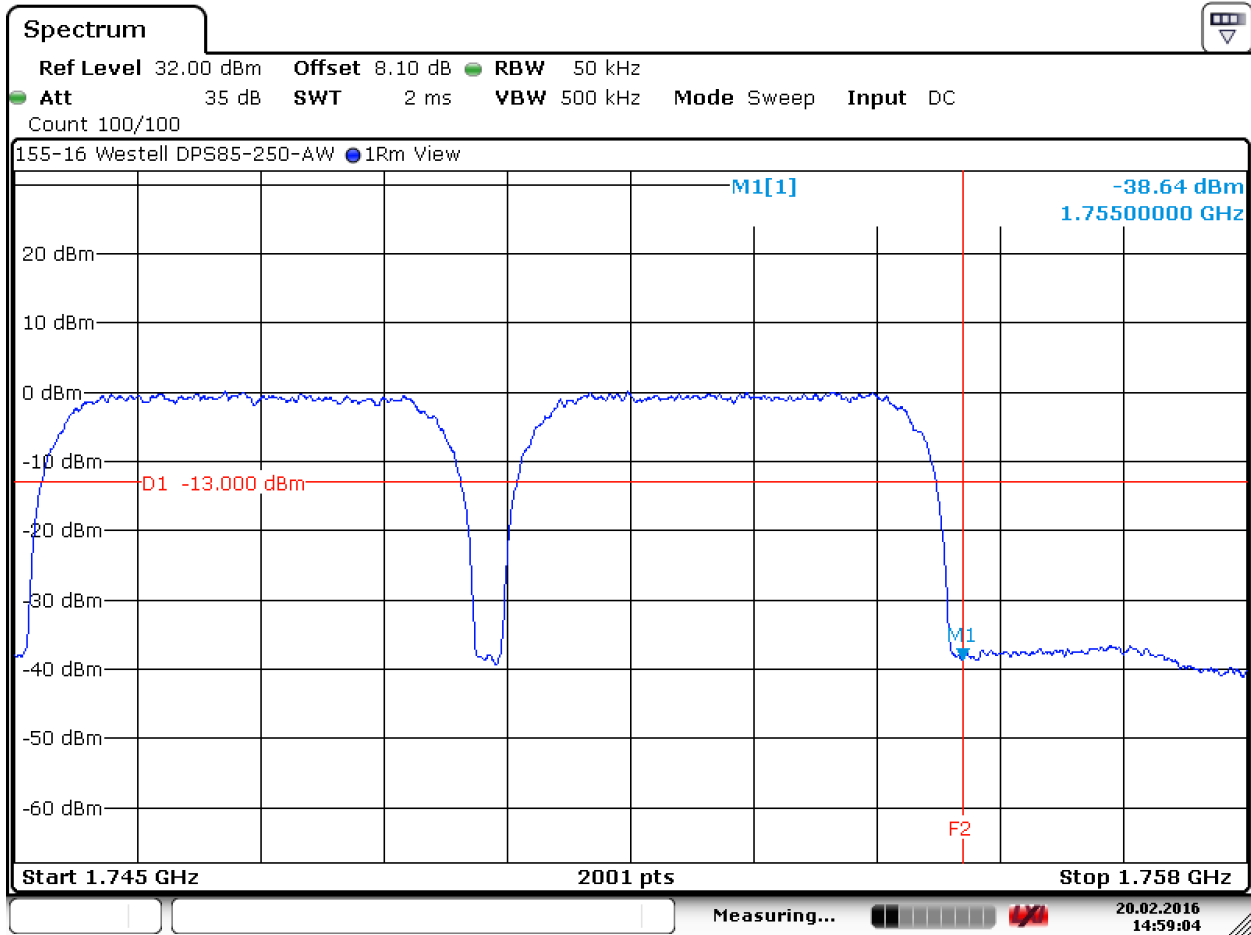


Date: 20.FEB.2016 14:55:52

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

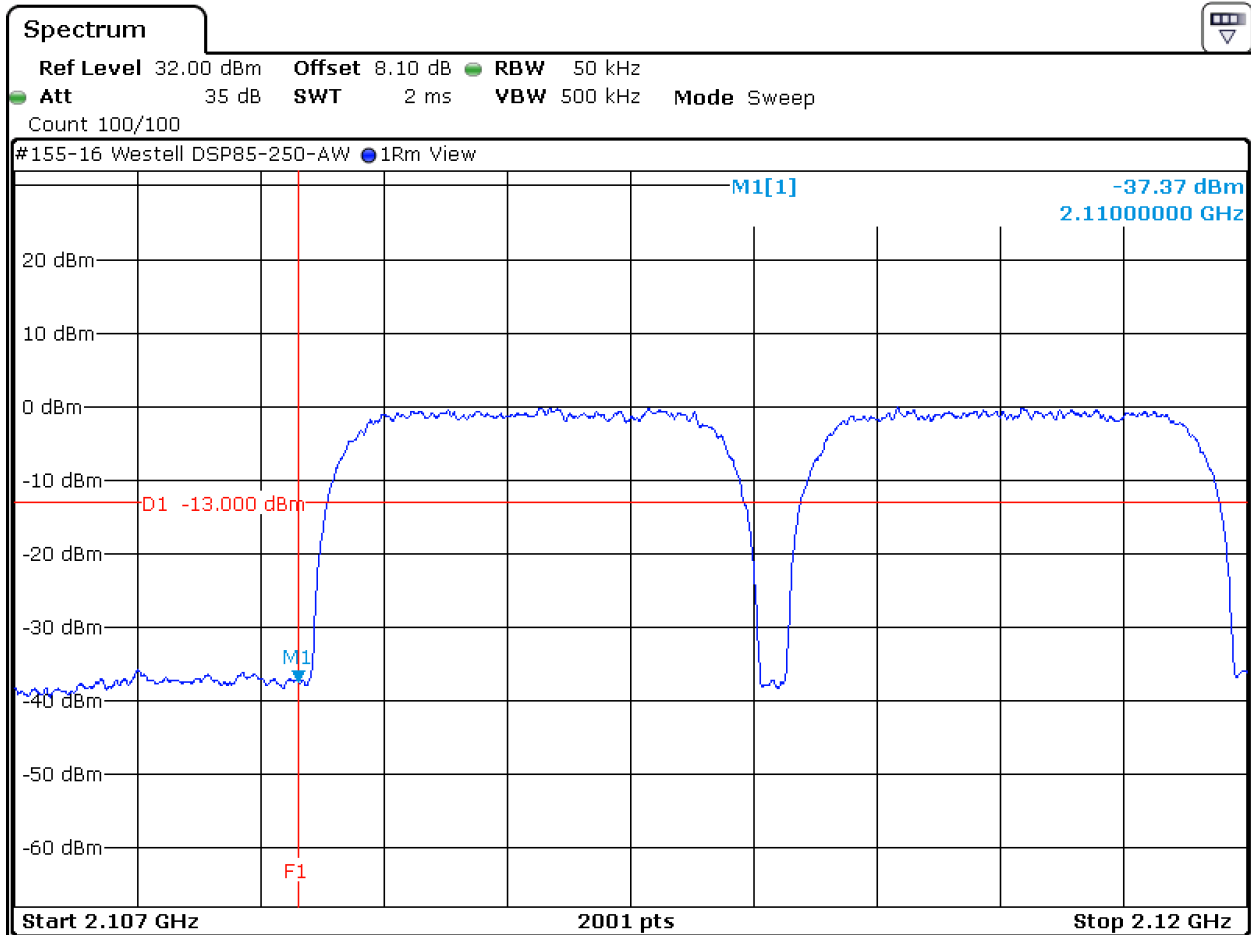


Date: 20.FEB.2016 14:59:04

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

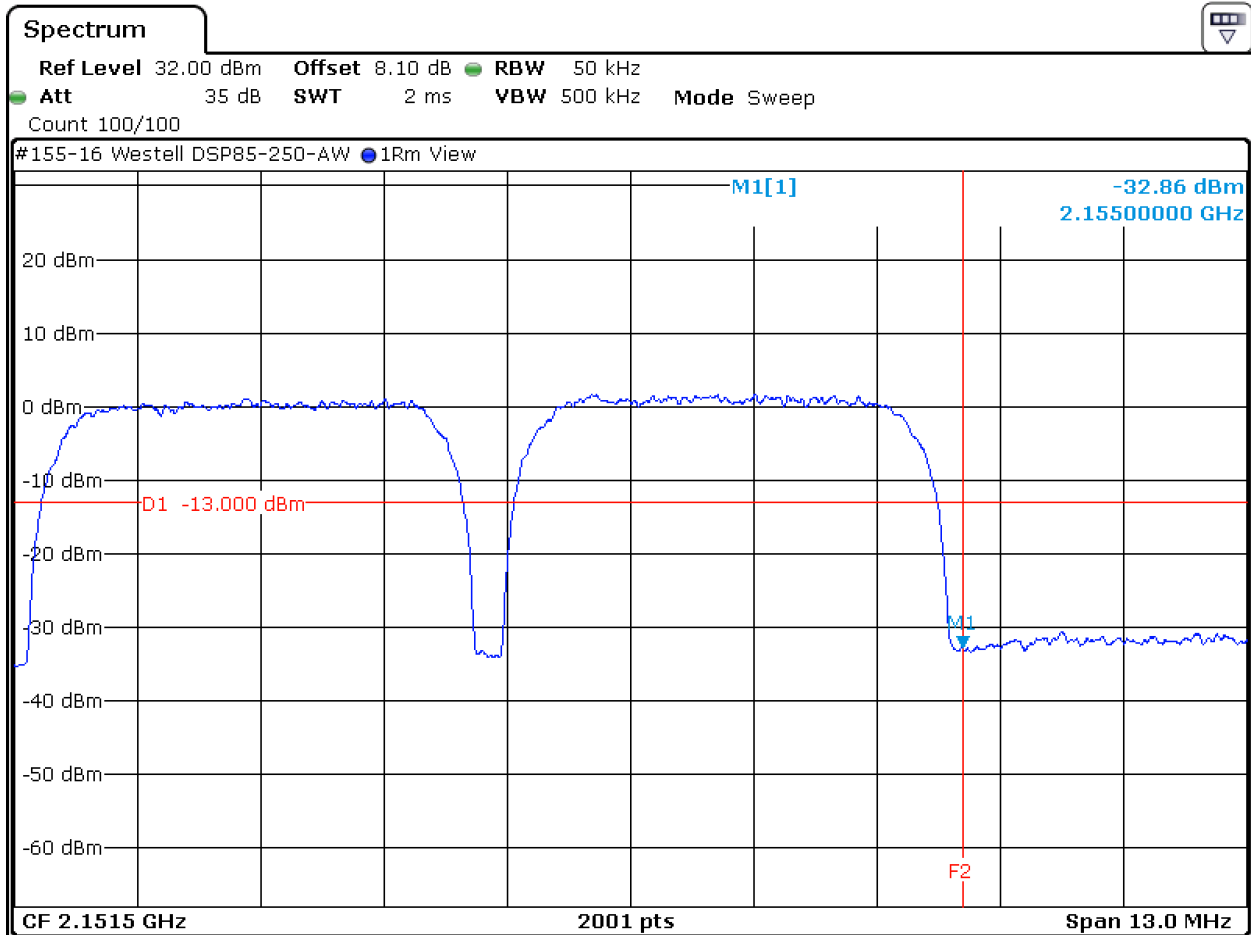


Date: 23.FEB.2016 16:00:51

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 |

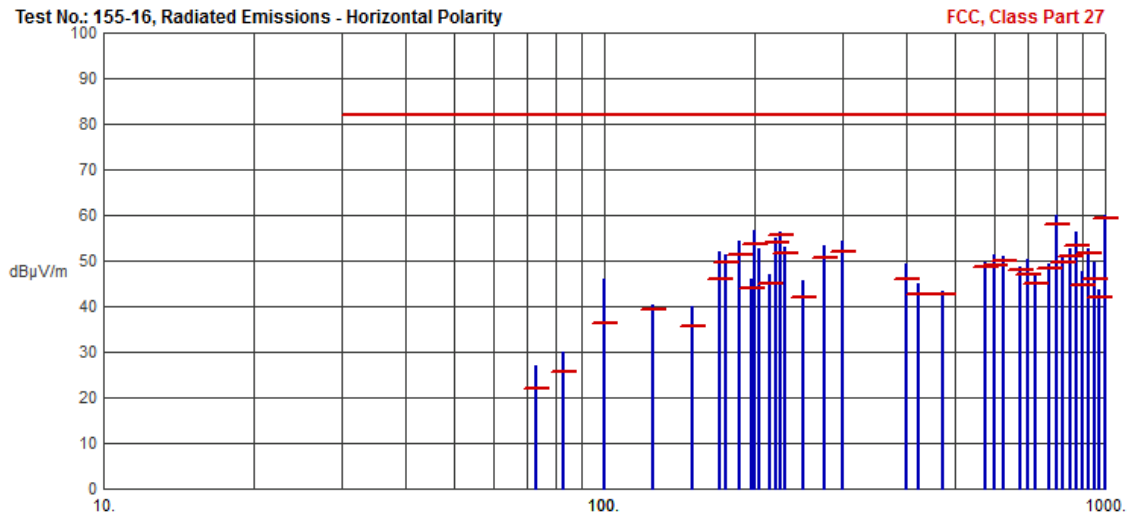
6.4.2 Test Procedure

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)

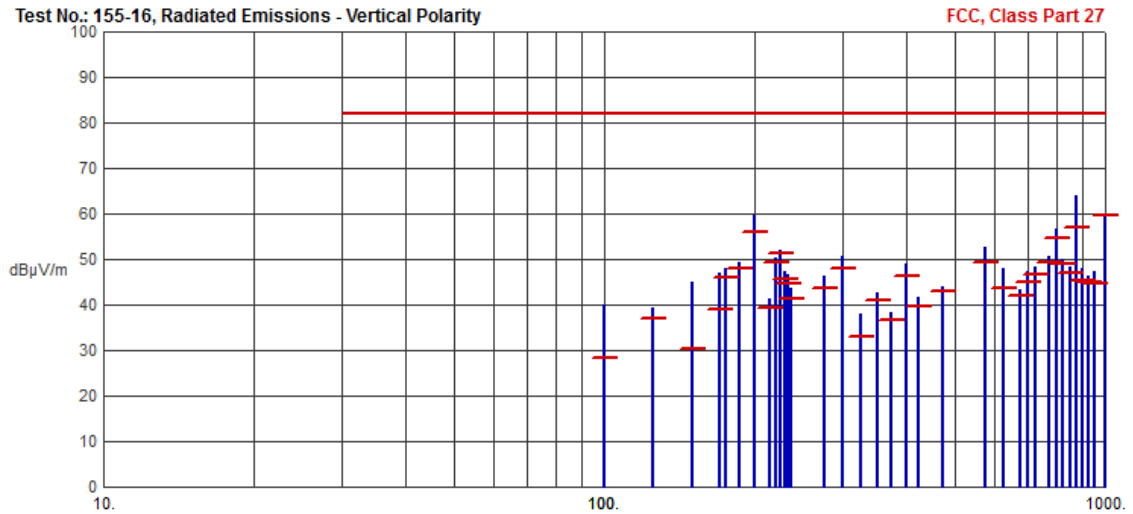
6.4.3. Horizontal Polarity

| 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.

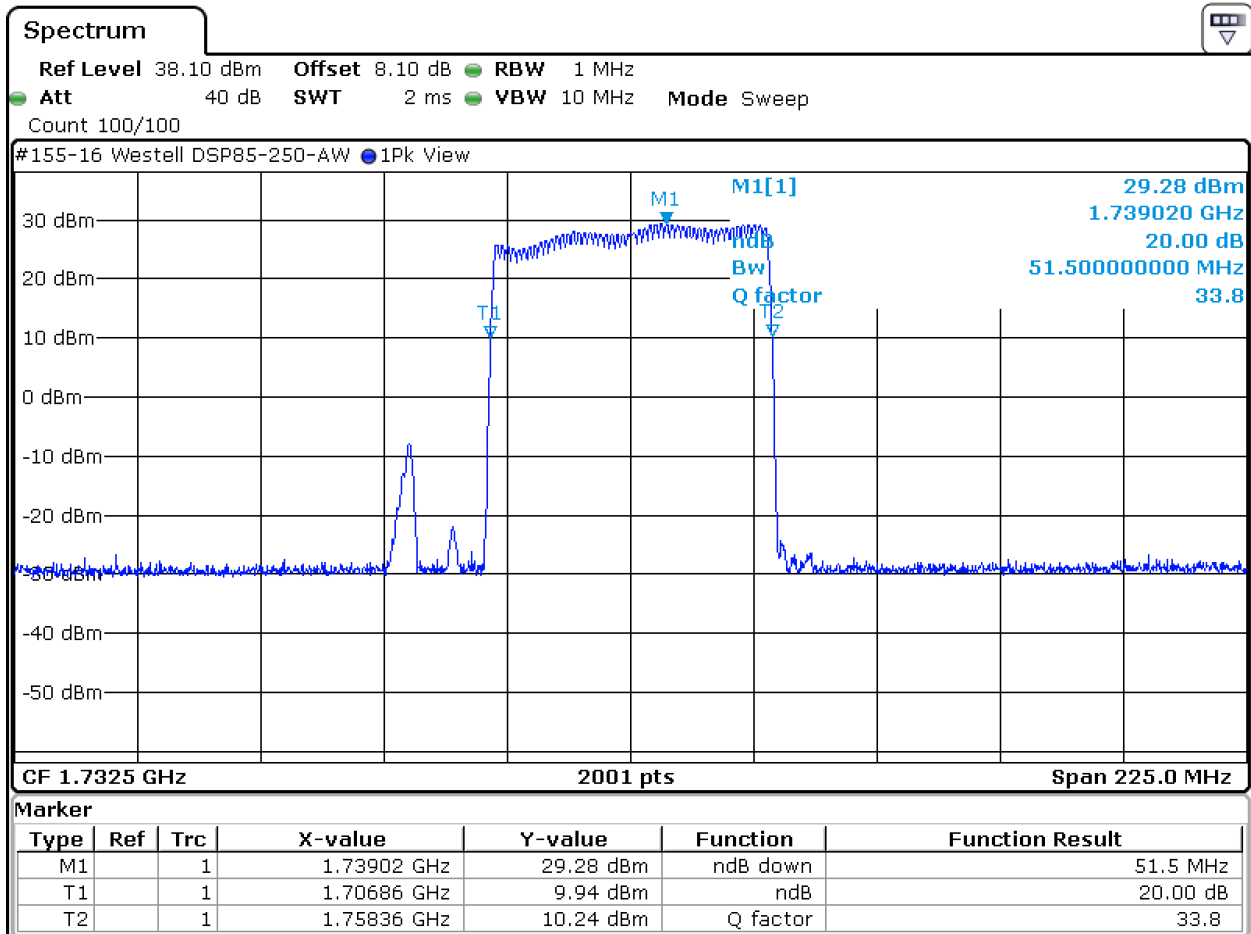
6. Measurement Data (continued)

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

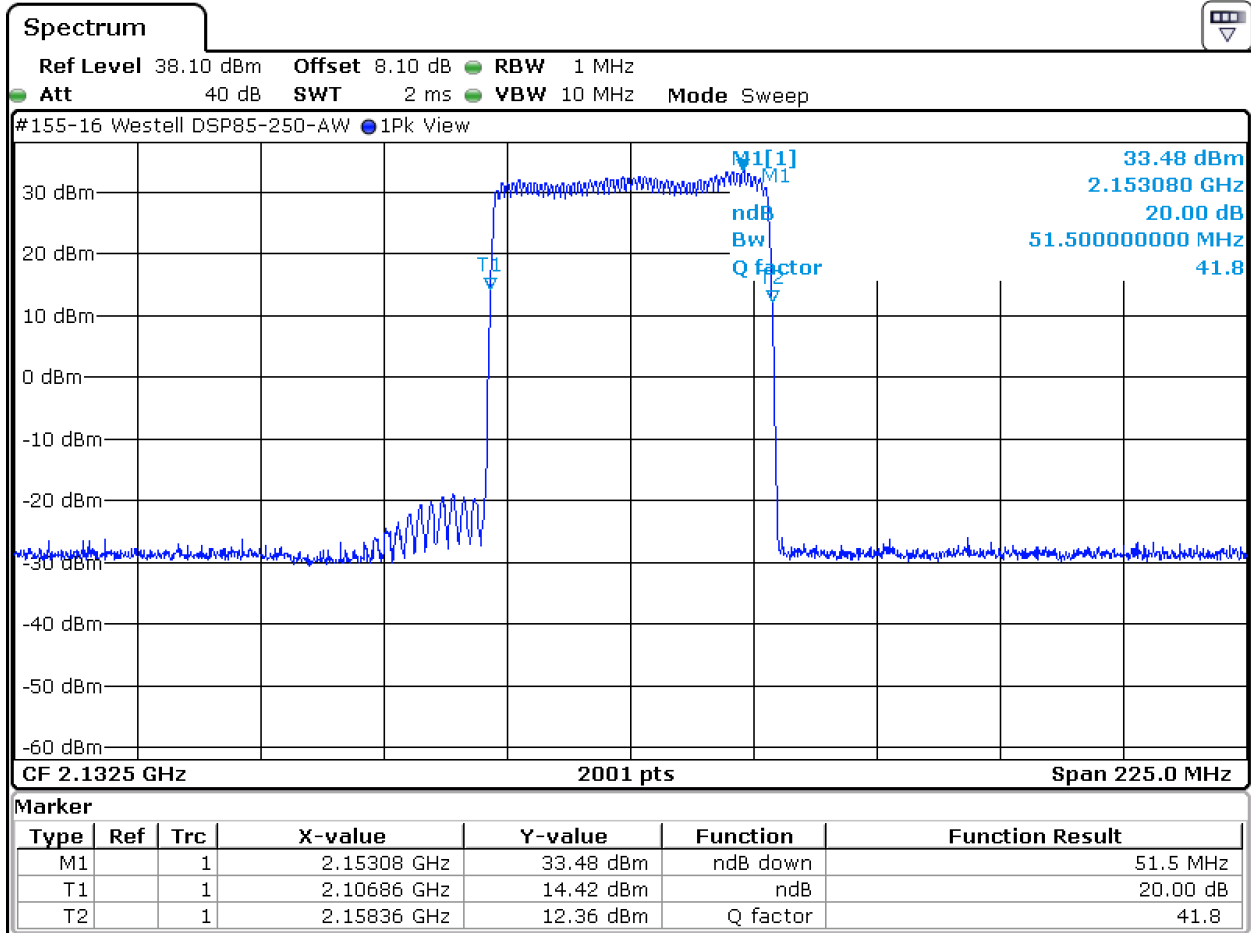


Date: 23.FEB.2016 16:44:07

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 * F (MHz) ^ 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



8. Test Setup Photographs (cont)

8.4 Radiated Emissions (Front) 1 to 18 GHz



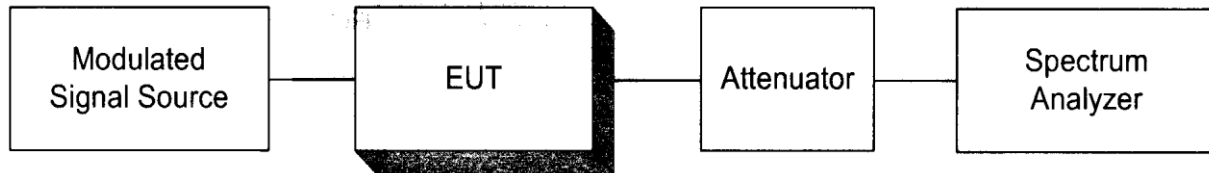
8. Test Setup Photographs (cont)

8.5 Radiated Emissions (Rear) 1 to 18 GHz

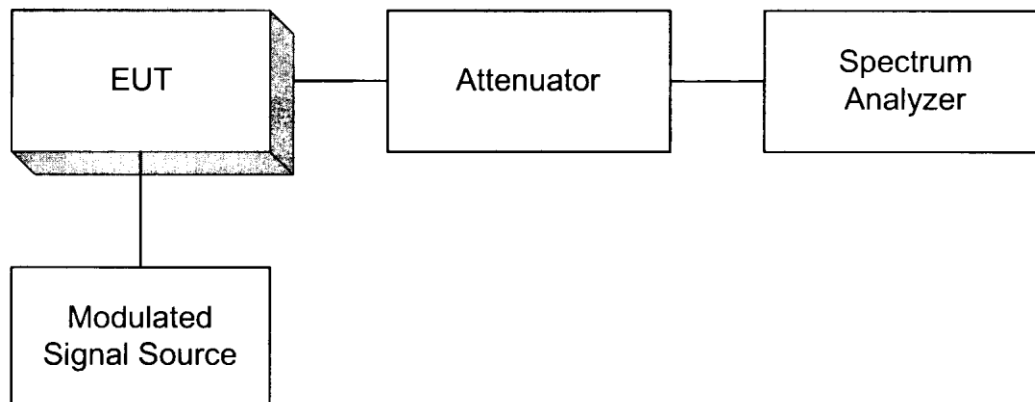


Appendix A

RF Output Power

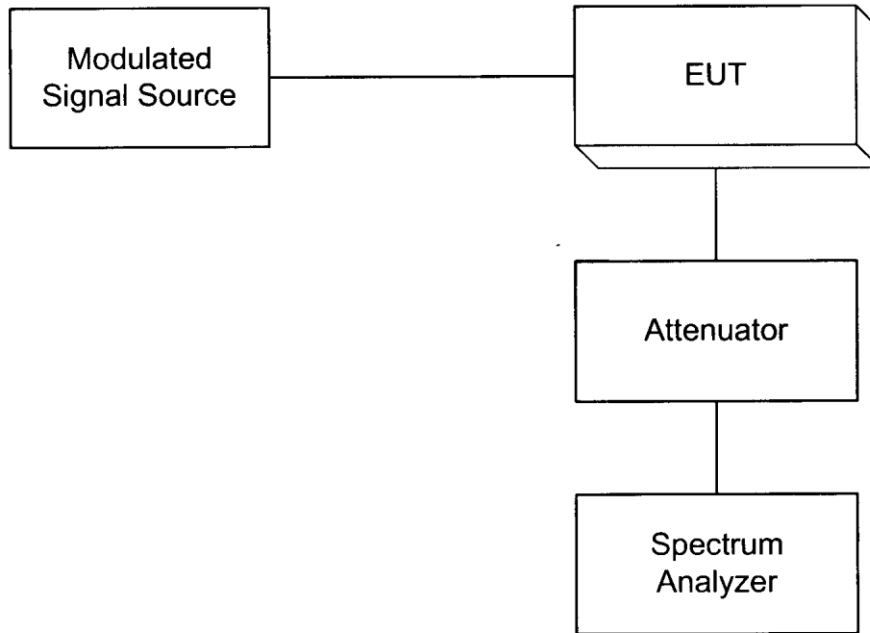


Occupied Bandwidth



Appendix A

Spurious Emissions at the Antenna Terminals



Field Strength of Spurious Radiation

