



Nemko Test Report: 2014_251898_BOOST_FCC_15247

Applicant: Texas Instruments, Inc.
12500 TI Blvd.
Dallas, TX 75243
USA

**Equipment Under Test:
(E.U.T.)** CC3100BOOST

FCC Identifier: Z64-CC310XKIT

Industry Canada Identifier: 4511-CC310XKIT

In Accordance With: **FCC Part 15, Subpart C, 15.247 and
Industry Canada RSS-210, Issue 8**
Digital Transmission Systems

Tested By: Nemko USA, Inc.
2210 Faraday Ave.
Suite 150
Carlsbad, CA 92008

TESTED BY:

David Light, Wireless Engineer

DATE: 17 February 2014

APPROVED BY:

Bruce Ketterling, EMC Manager

DATE: 13 March 2014

Number of Pages: 69

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Section 1. Summary of Test Results

Manufacturer: Texas Instruments, Inc.

Model No.: CC3100BOOST

Serial No.: F234

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 and Industry Canada RSS-210, Issue 8 for Digital Transmission Systems. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and Industry Canada.

- | | | | |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission | <input type="checkbox"/> | Production Unit |
| <input type="checkbox"/> | Class II Permissive Change | <input checked="" type="checkbox"/> | Pre-Production Unit |
| <input checked="" type="checkbox"/> | Family Listing | | |

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



NVLAP Lab Code 200116-0

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Summary Of Test Data

| NAME OF TEST | PARA. NO. | RESULT |
|---|------------------------------------|---------------|
| Powerline Conducted Emissions | FCC 15.207(a) / RSS-Gen 7.2.4 | Complies |
| Minimum 6 dB Bandwidth | FCC 15.247(a)(2) / RSS-210 A8.2(a) | Complies |
| Maximum Peak Power Output | FCC 15.247(b)(3) / RSS-210 A8.4(4) | Complies |
| Spurious Emissions (Antenna Conducted) | FCC 15.247(d) / RSS-210 A8.5 | Complies |
| Spurious Emissions (Restricted Bands) | FCC 15.209(a) / RSS-Gen 7.2.2 | Complies |
| Peak Power Spectral Density | FCC 15.247(e) / RSS-210 A8.2(b) | Complies |

Footnotes:

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

| | | | |
|-----------------------|--------------------------|-------------------------------------|--------------------------|
| Frequency Band (MHz): | 902-928 | 2400-2483.5 | 5725-5850 |
| | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

Operating Frequency of Test Sample: 2412 to 2462 MHz

Channel Spacing: 5 MHz

Modulation Types: OFDM

User Frequency Adjustment: Software controlled

Description of EUT

The CC3100BOOST is an evaluation board for the CC3100 device from Texas Instruments. The CC3100 device is an 802.11bgn Wi-Fi network processor designed for embedded applications that use low cost and low performance microcontrollers. The CC3100BOOST evaluation board will only function when attached to a Texas Instrument's Tiva-C series or MSP430 value line microcontroller launchpad evaluation board or when attached to a Texas Instrument's CC31xxEMUBOOST FTDI debug board. The Texas Instrument's CC31xxEMUBOOST FTDI debug board allows the CC3100BOOST to interface directly to a PC host using USB cable. In this configuration the PC emulates the low cost microcontroller.

Section 3. Occupied Bandwidth

| | |
|----------------------------------|--|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: FCC 15.247(a)(2) RSS-210 A8.2(a) |
| TESTED BY: David Light | DATE: 16 January 2014 |

Test Results: Complies.

Measurement Data: See 6 dB BW plot
Measured 6 dB bandwidth: 10 MHz (802.11b)
16 MHz (802.11g)
17 MHz (802.11n)
Channel Separation: 5 MHz

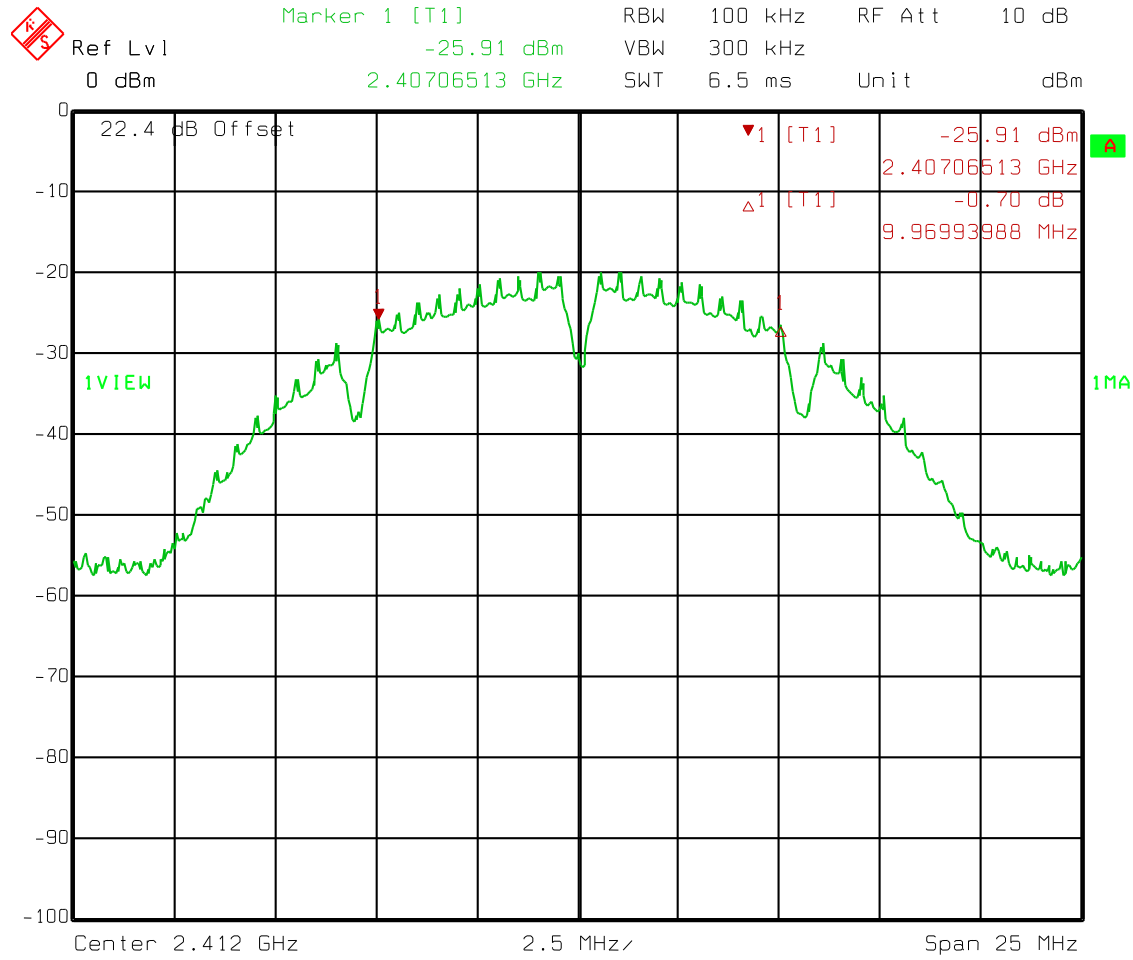
Test Conditions: 29 %RH
22 °C

Measurement Uncertainty: $\pm 1 \times 10^{-7}$ ppm

Test Equipment Used: 1036-1082-1472

Test Data – Occupied Bandwidth

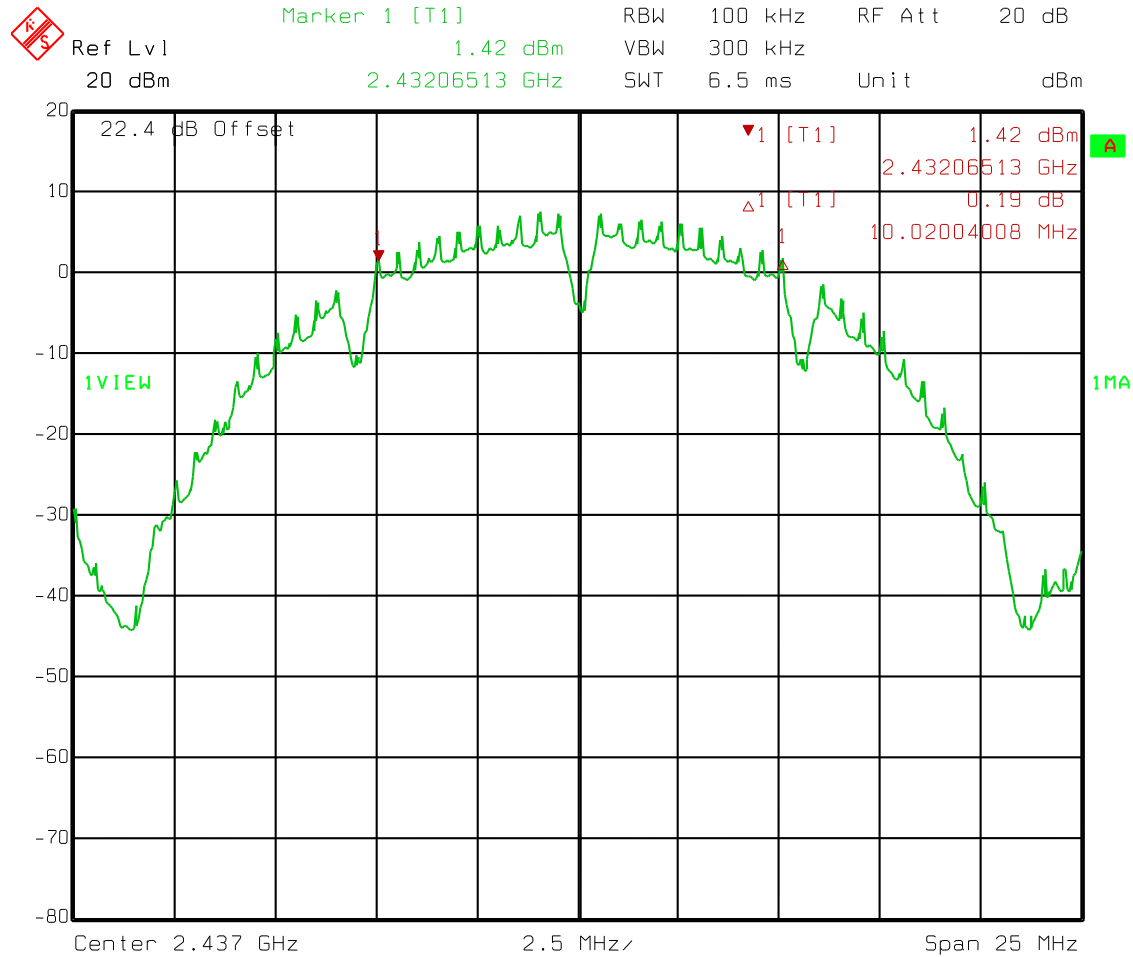
Low Channel
 Emission Bandwidth
 802.11b
 1 Mbps



Date: 16.JAN.2014 08:57:34

Test Data – Occupied Bandwidth

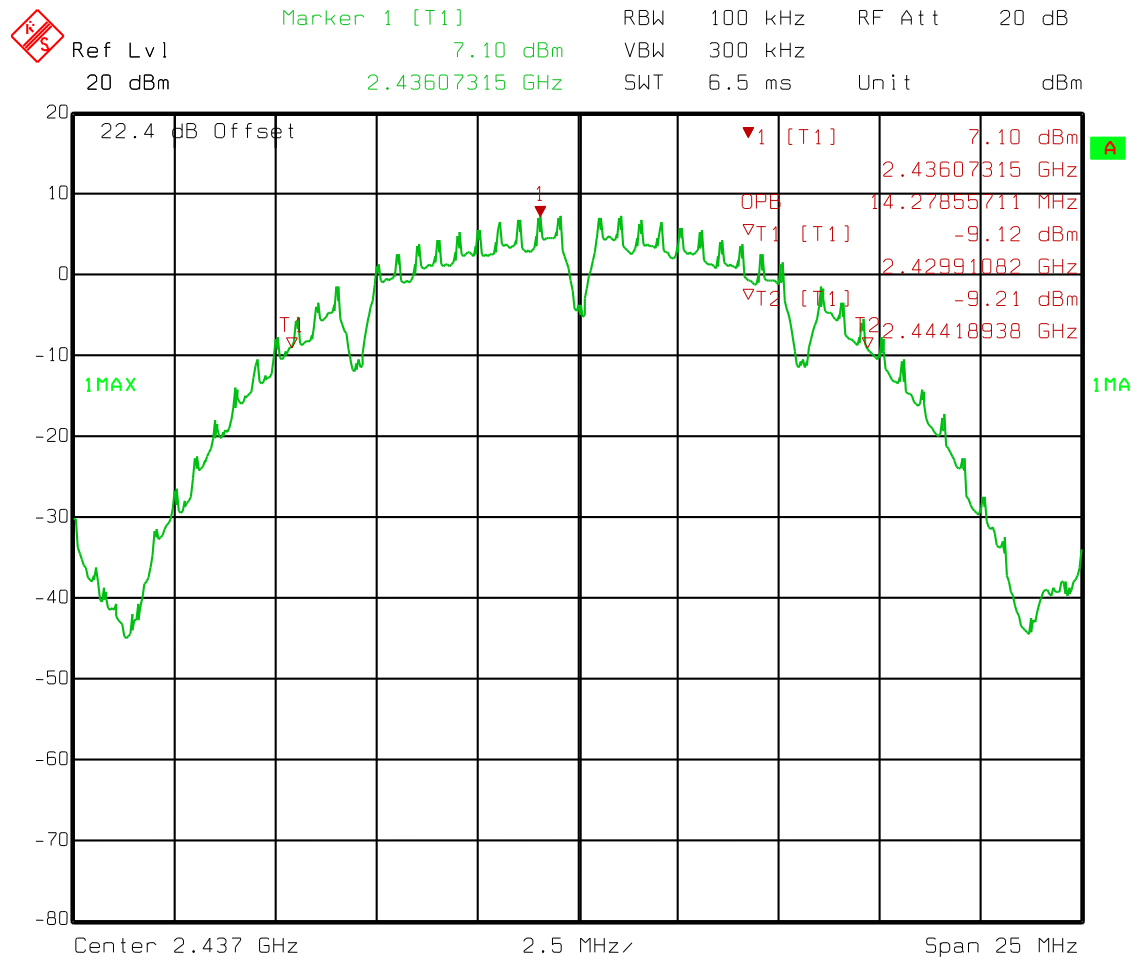
Mid Channel
Emission Bandwidth
802.11b
1 Mbps



Date: 16.JAN.2014 09:46:28

Test Data – Occupied Bandwidth

99% Bandwidth
 802.11b
 1 Mbps



Date: 16.JAN.2014 09:49:36

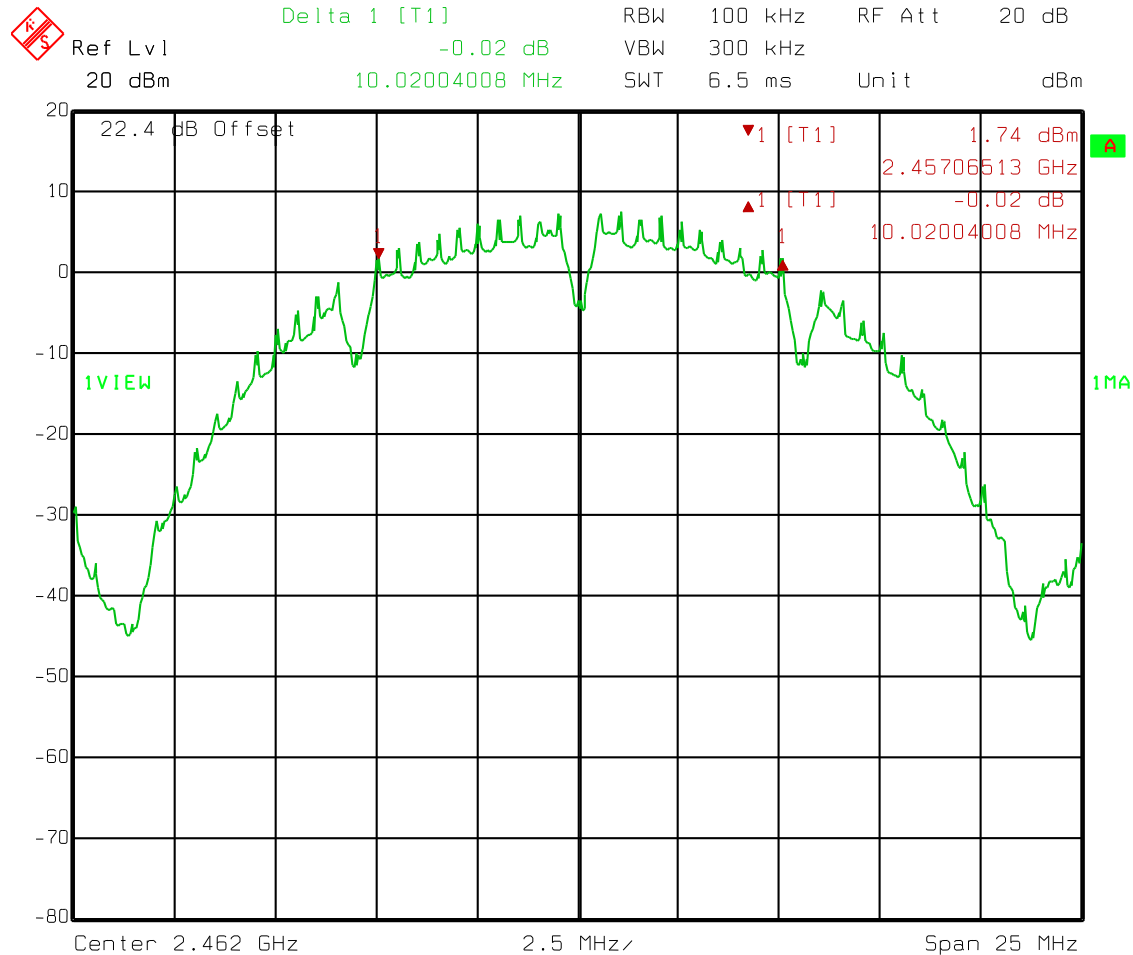
Test Data – Occupied Bandwidth

Emission Bandwidth

Upper Channel

802.11b

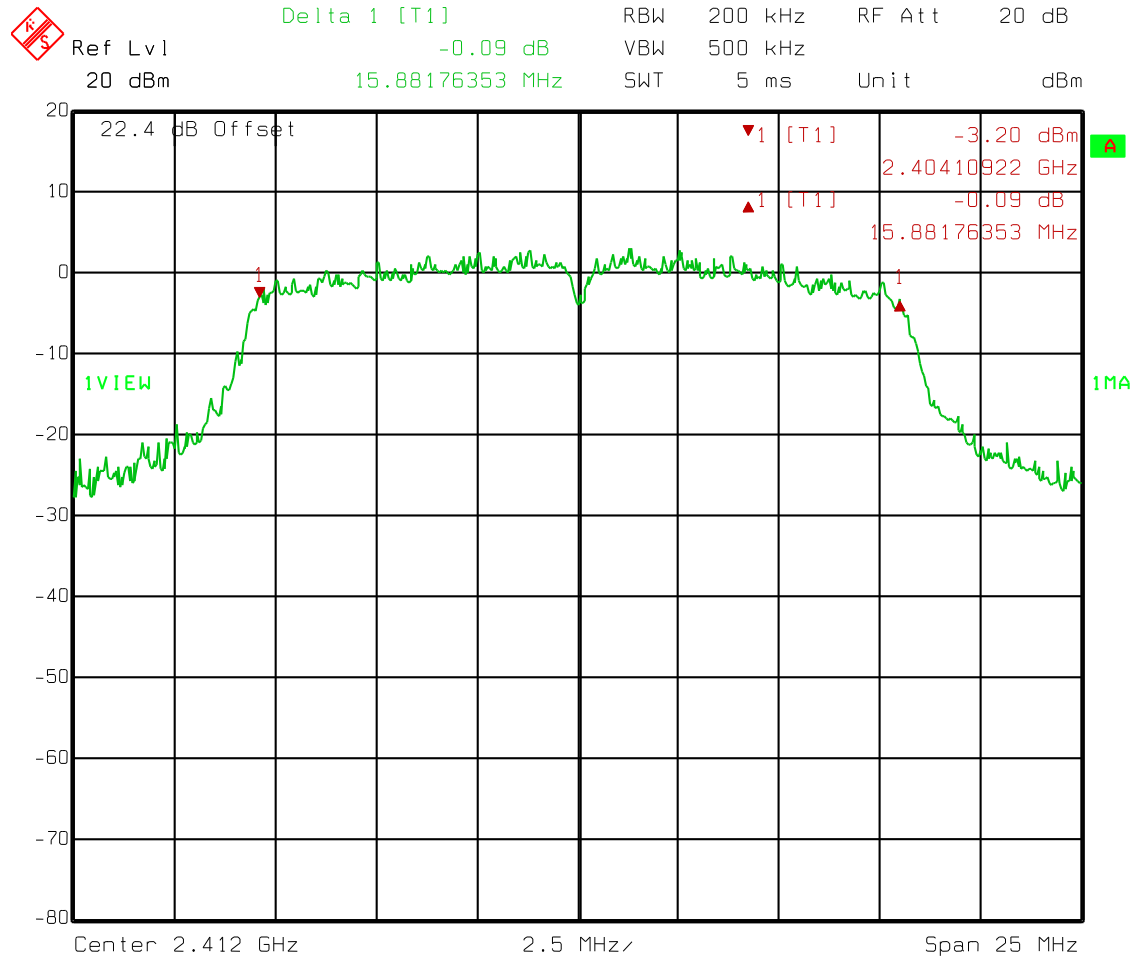
1 Mbps



Date: 16.JAN.2014 09:53:33

Test Data – Occupied Bandwidth

Low Channel
Emission Bandwidth
802.11g
6 Mbps

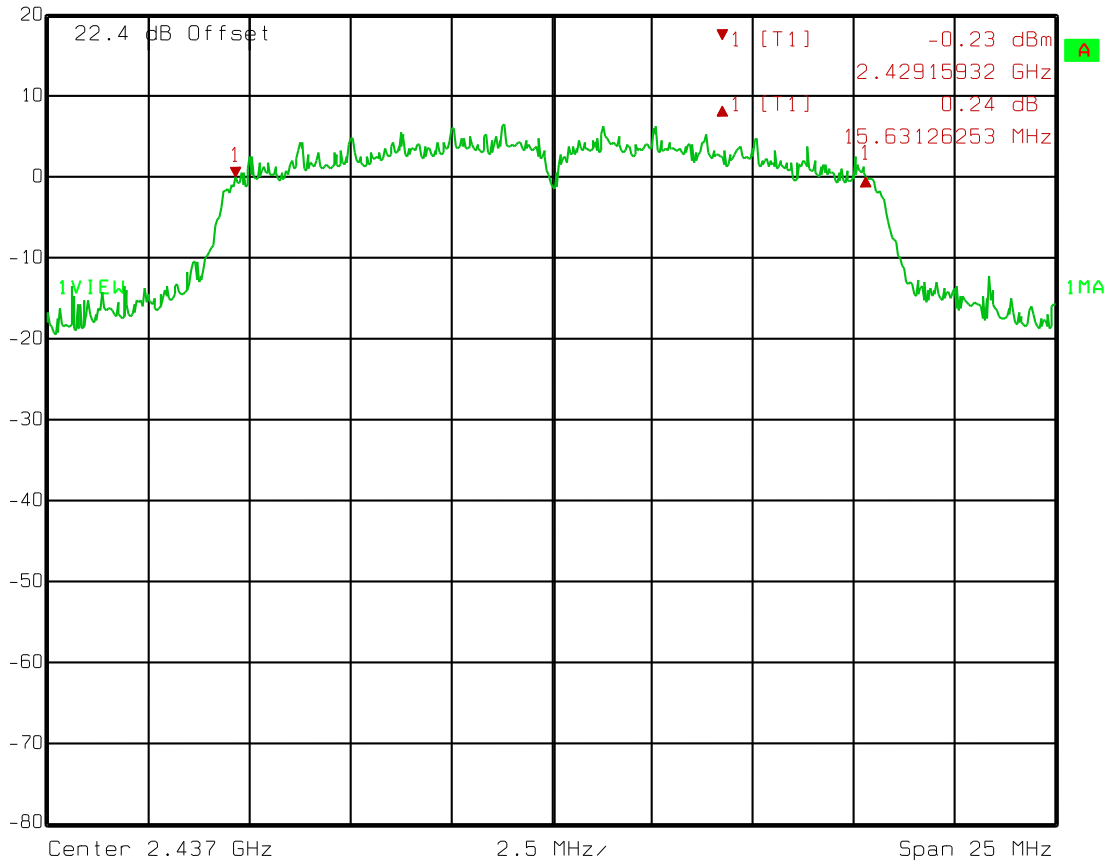


Date: 16.JAN.2014 10:10:32

Test Data – Occupied Bandwidth

Mid Channel
 Emission Bandwidth
 802.11g
 6 Mbps

| | | | | | |
|----|--------------|-----------------|---------|---------|----------|
| ES | Delta 1 [T1] | RBW | 200 kHz | RF Att | 20 dB |
| | Ref Lvl | 0.24 dB | VBW | 500 kHz | |
| | 20 dBm | 15.63126253 MHz | SWT | 5 ms | Unit dBm |



Date: 16.JAN.2014 10:18:27

Test Data – Occupied Bandwidth

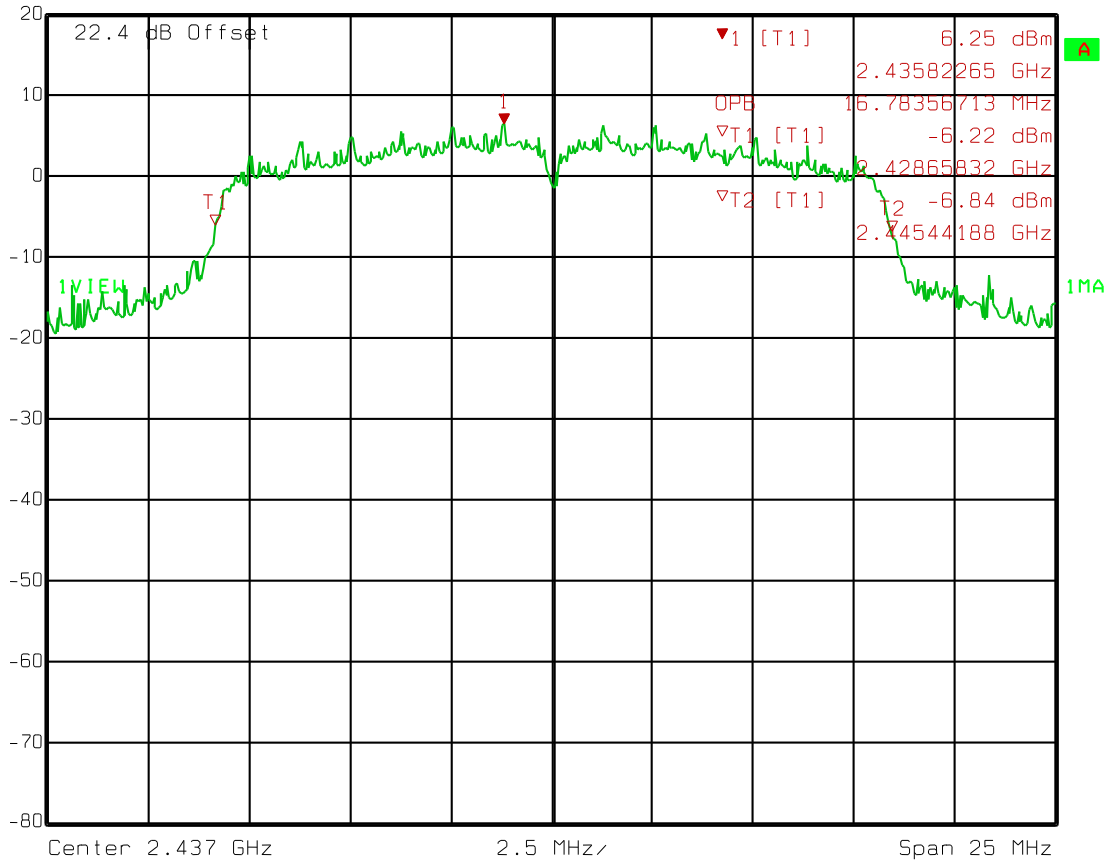
99% Bandwidth

802.11g

6 Mbps



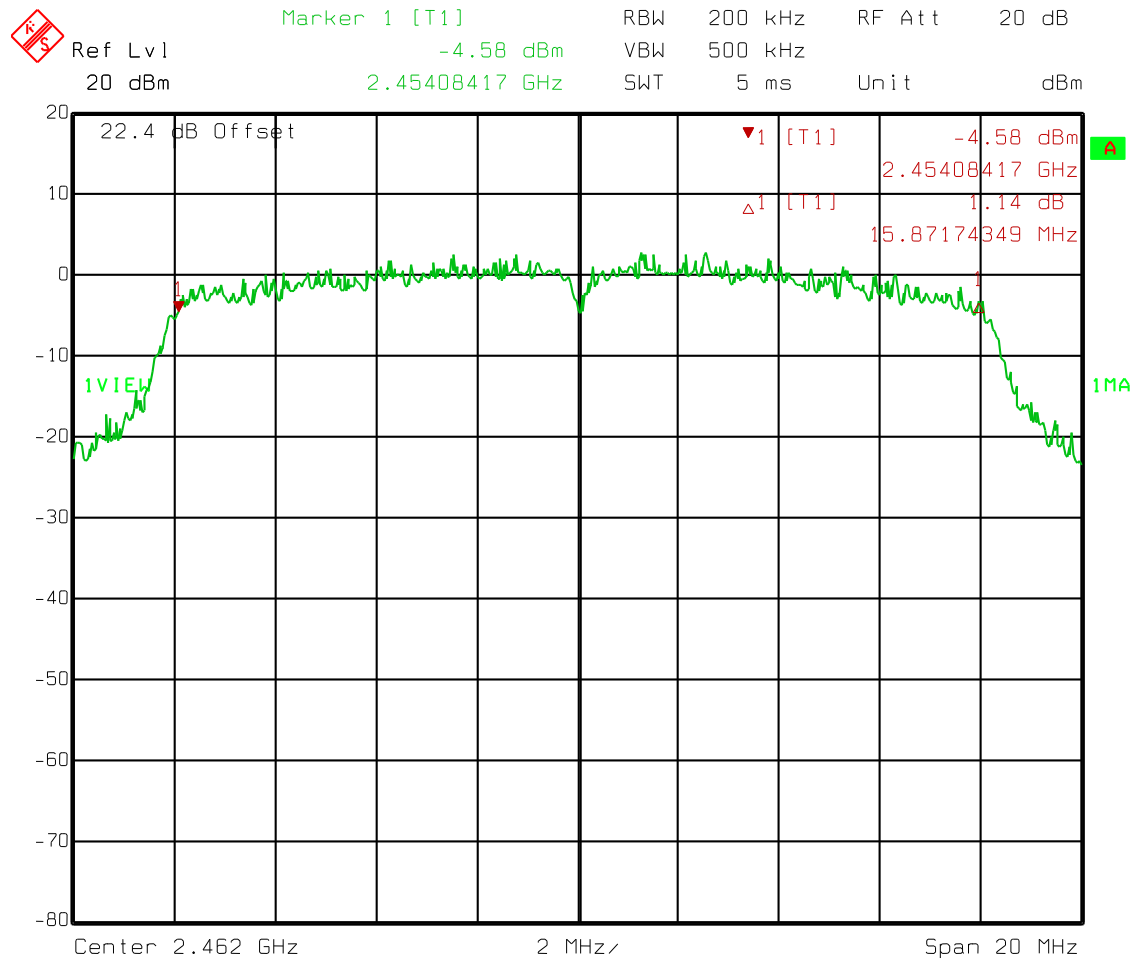
Marker 1 [T1] RBW 200 kHz RF Att 20 dB
 Ref Lvl 6.25 dBm VBW 500 kHz
 20 dBm 2.43582265 GHz SWT 5 ms Unit dBm



Date: 16.JAN.2014 10:18:58

Test Data – Occupied Bandwidth

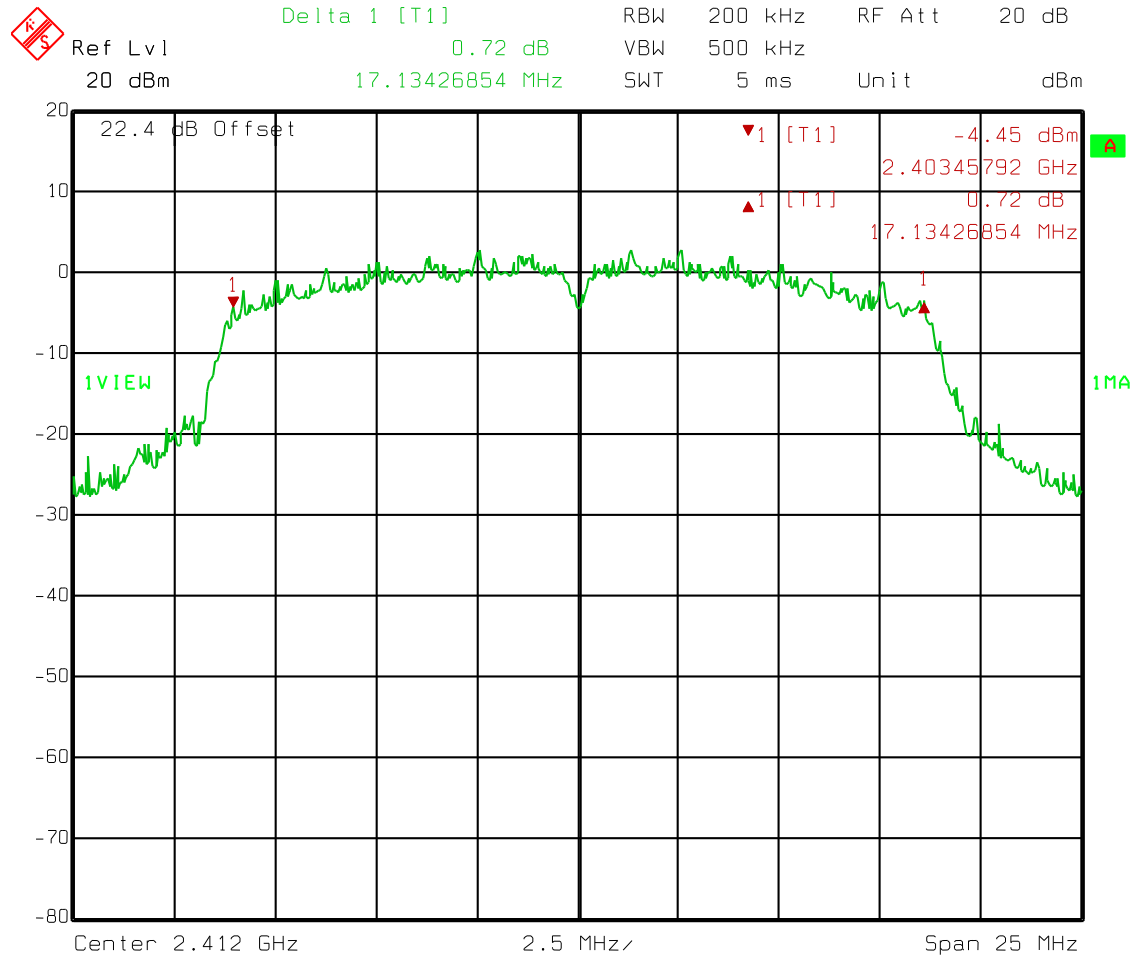
Upper Channel
802.11g
6 Mbps



Date: 16.JAN.2014 10:24:10

Test Data – Occupied Bandwidth

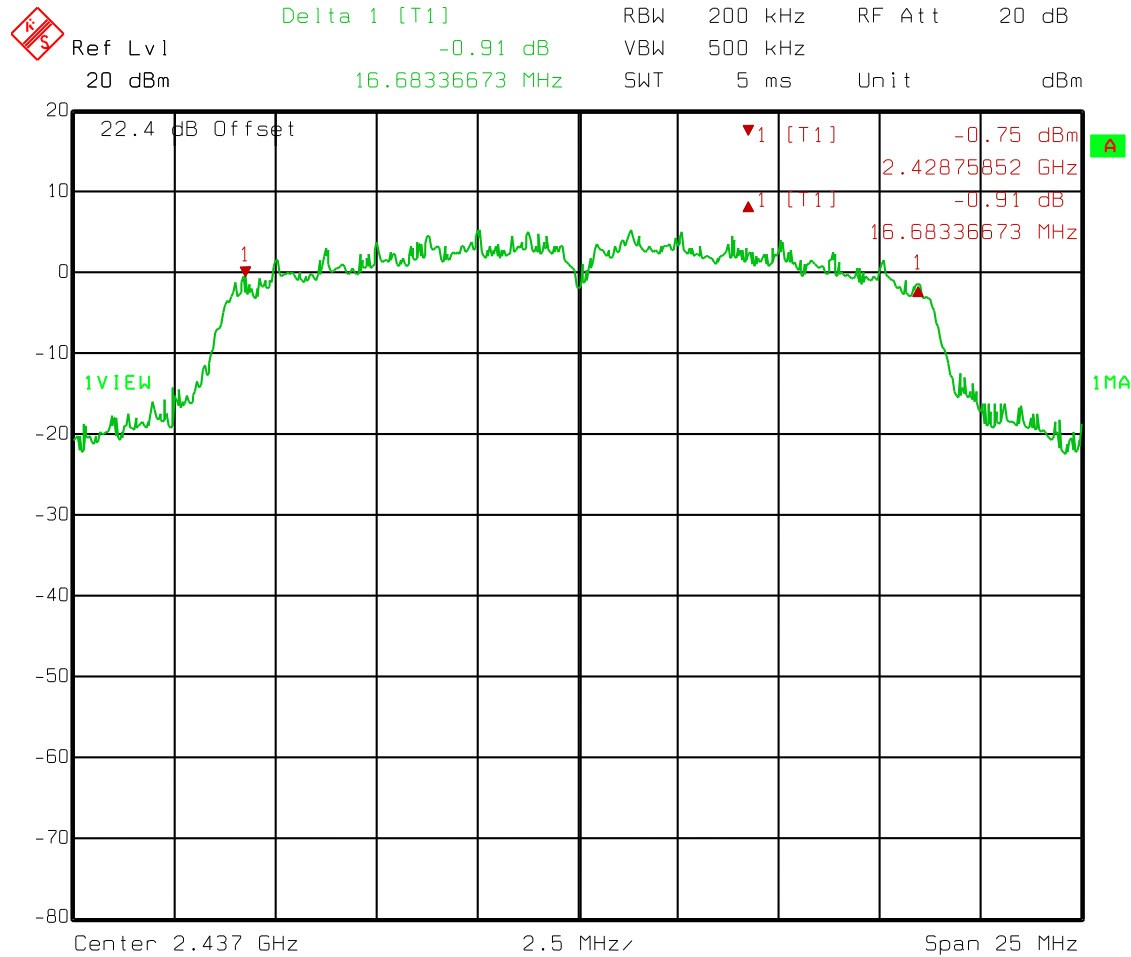
Low Channel
 Emission Bandwidth
 802.11n
 MCS0



Date: 16.JAN.2014 10:37:05

Test Data – Occupied Bandwidth

Mid Channel
Emission Bandwidth
802.11n
MCS0



Date: 16.JAN.2014 10:42:48

Test Data – Occupied Bandwidth

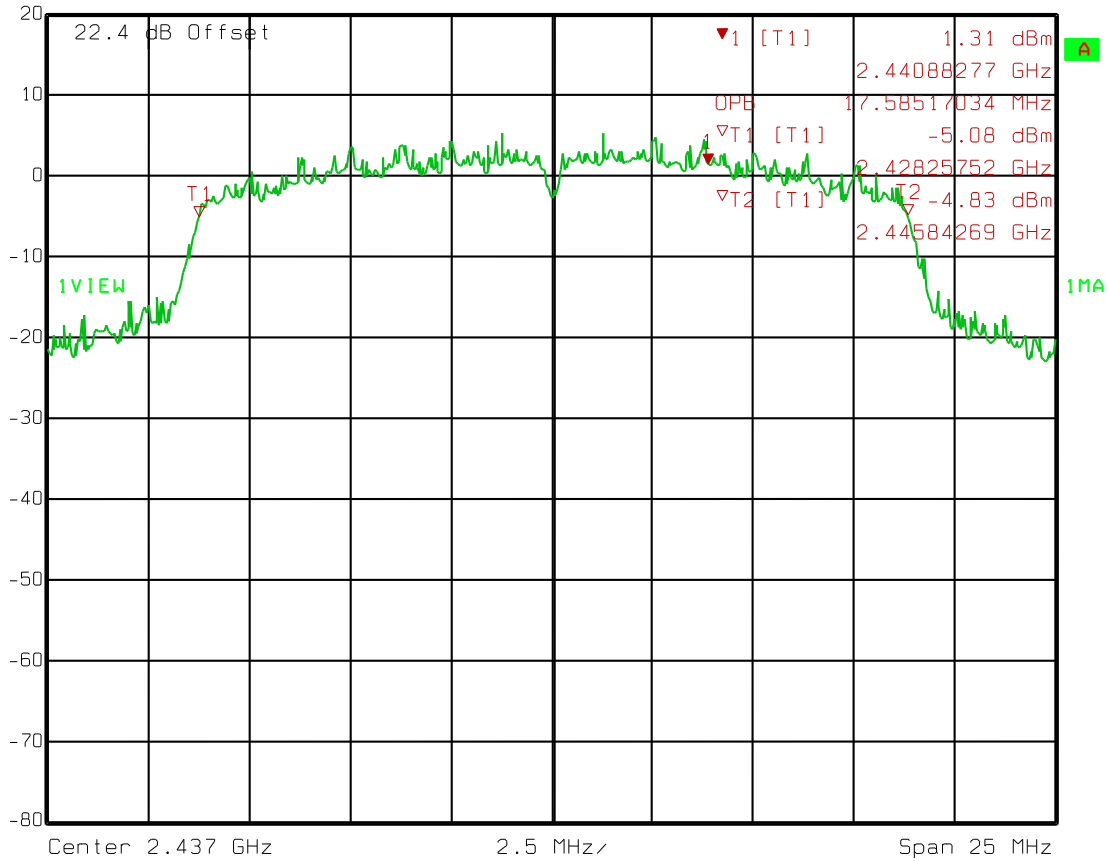
99% Bandwidth

802.11n

MCS0



Marker 1 [T1] RBW 200 kHz RF Att 20 dB
 Ref Lvl 1.31 dBm VBW 500 kHz
 20 dBm 2.44088277 GHz SWT 5 ms Unit dBm



Date: 16.JAN.2014 10:43:14

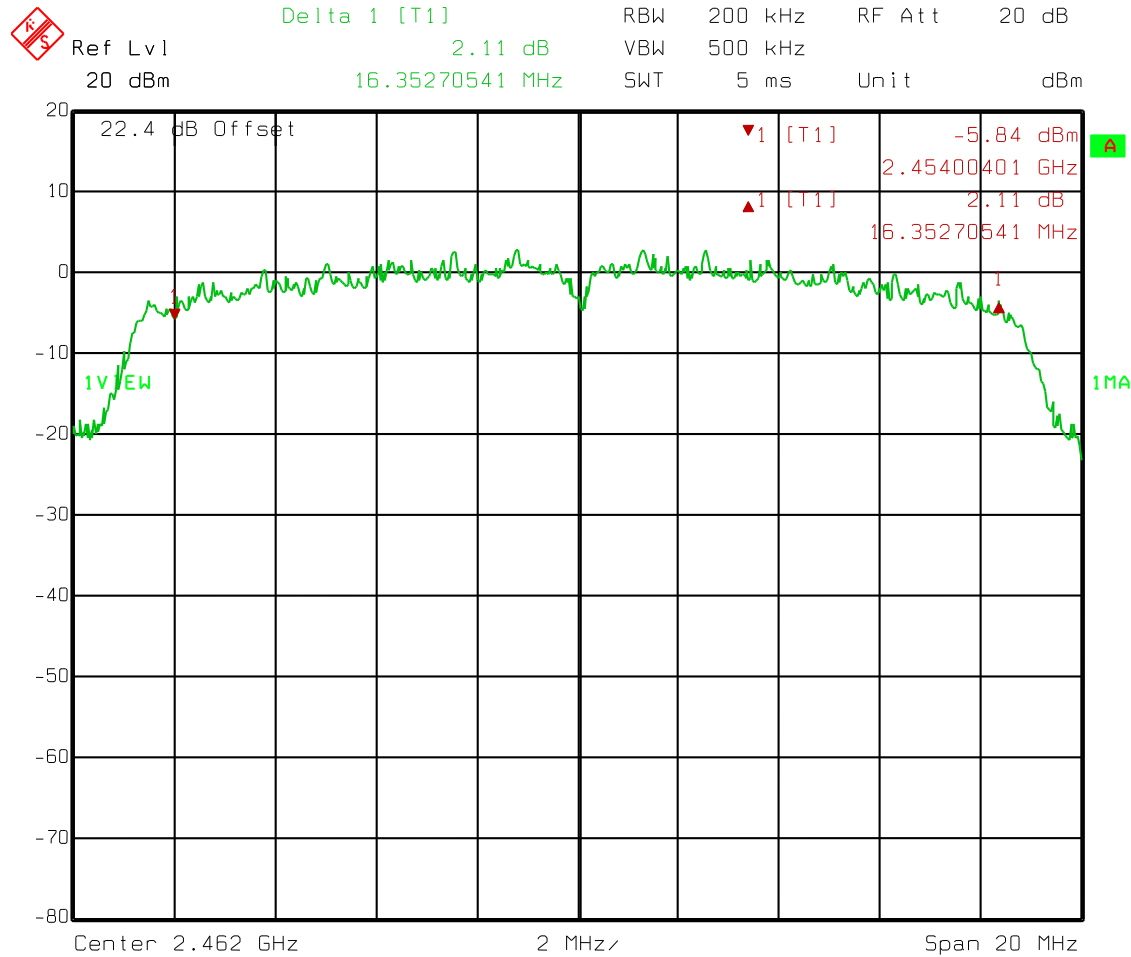
Test Data – Occupied Bandwidth

Emission Bandwidth

Upper Channel

802.11n

MCS0



Date: 16.JAN.2014 10:48:46

Section 4. Maximum Peak Output Power

| | |
|---|--|
| NAME OF TEST: Maximum Peak Output power | PARA. NO.: FCC 15.247(b)(3) RSS-210 A8.4(4) |
| TESTED BY: David Light | DATE: 16 January 2014 |

Test Results: Complies.

Measurement Data: Refer to attached data

Test Conditions: 29 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

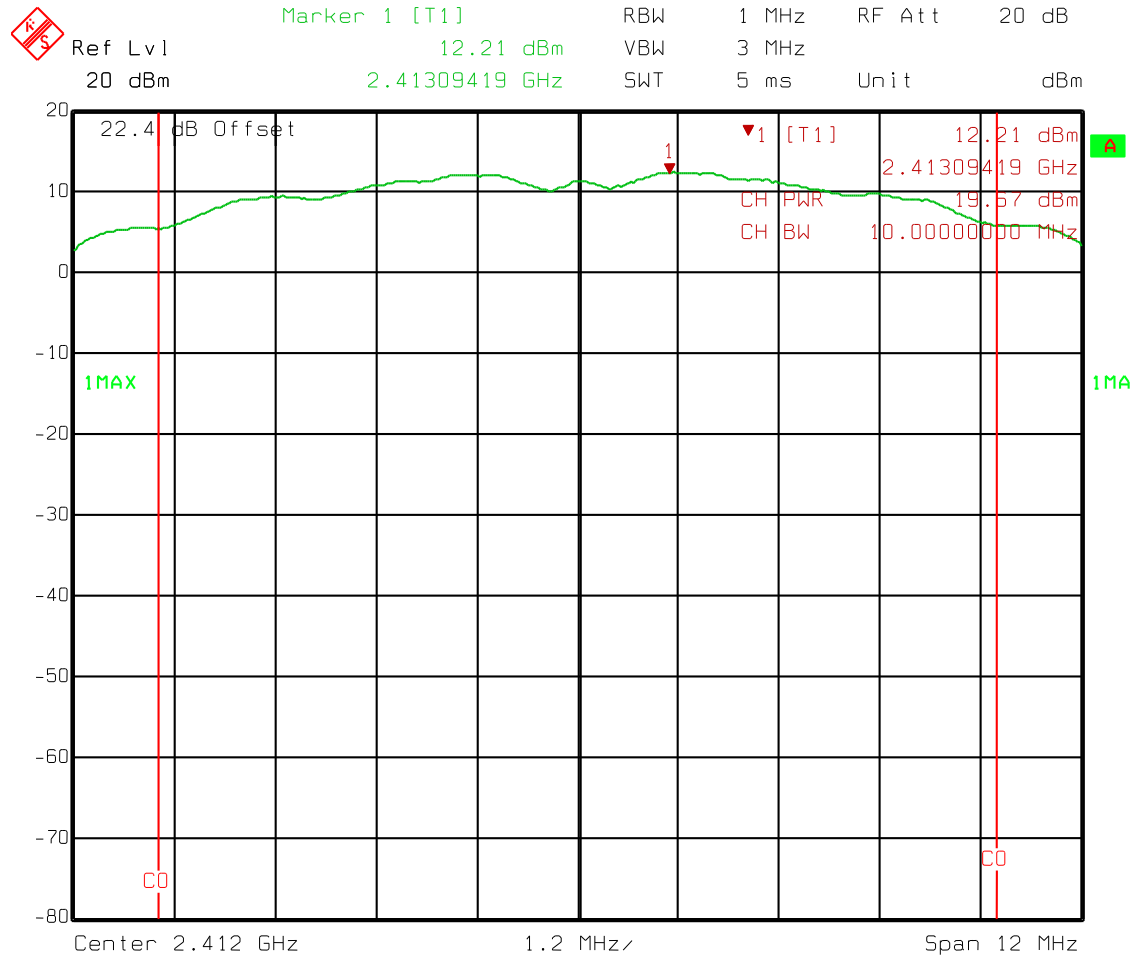
Test Equipment Used: 1036-1082-1472

- This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.
- For battery powered equipment, the device was tested with a fresh battery per 15.31(e).
- The device was tested on three channels per 15.31(l).
- This test was performed radiated.

The highest EIRP is 23.67 dBm (232.8 mW) based on manufacturer's stated antenna gain of 2 dBm maximum.

Test Data – Peak Power

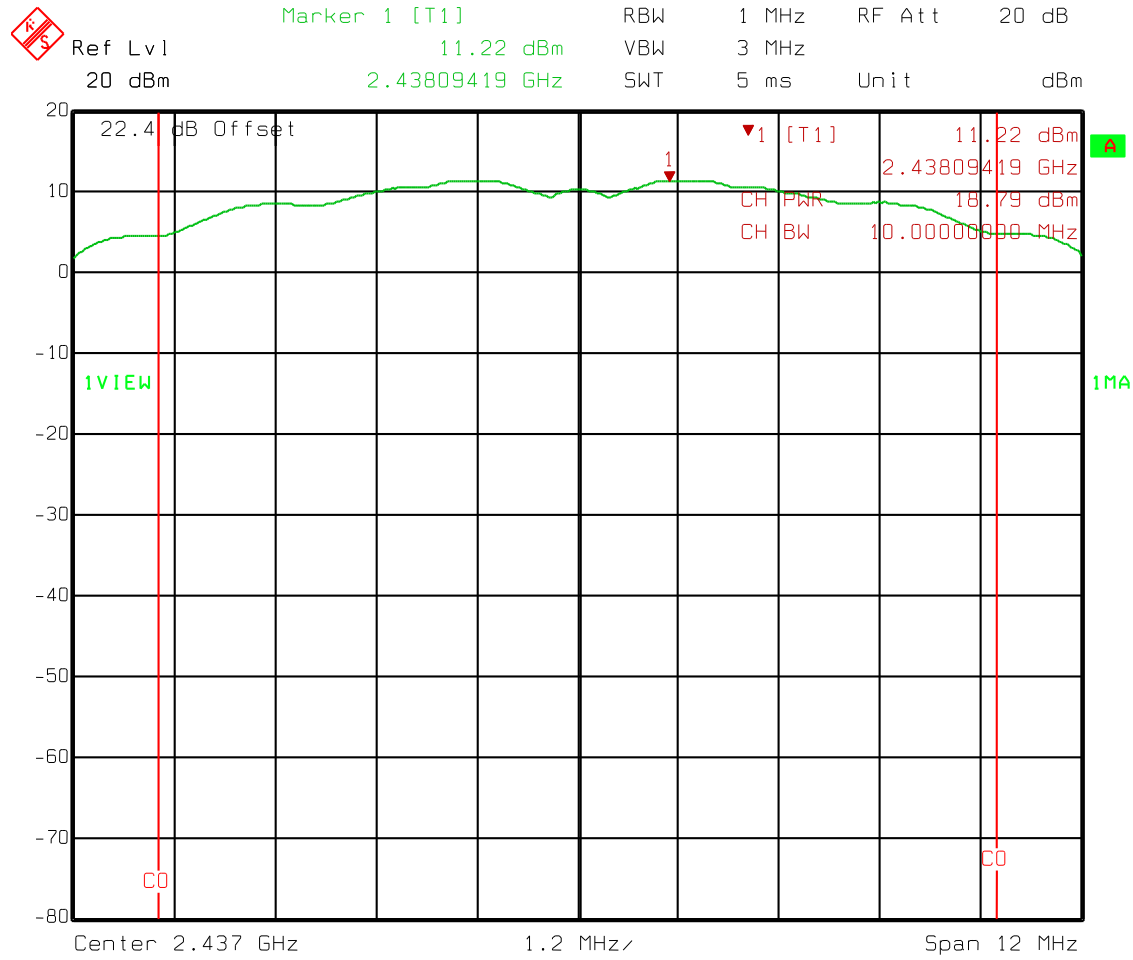
Low Channel
 Peak Power
 802.11b
 1 Mbps



Date: 16.JAN.2014 09:33:00

Test Data – Peak Power

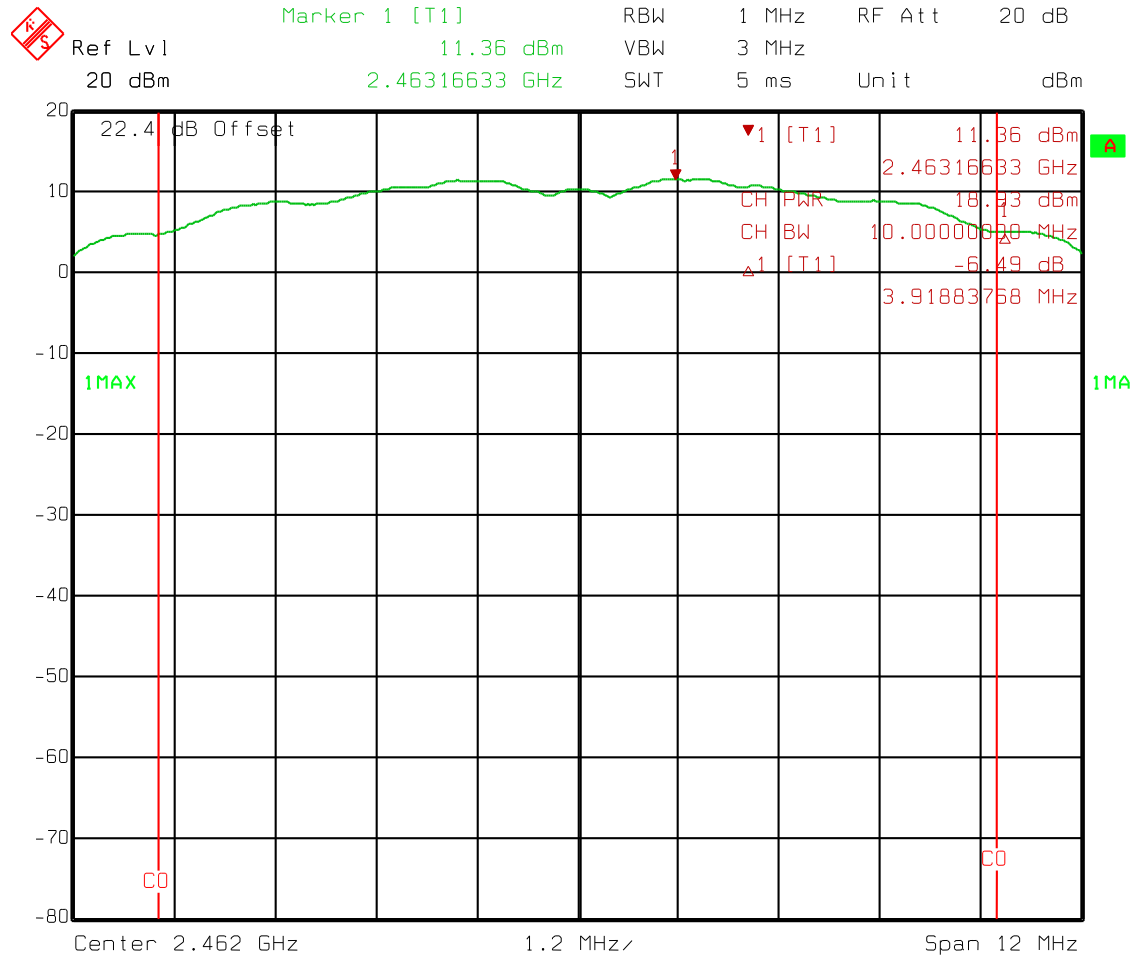
Mid Channel
Peak Power
802.11b
1 Mbps



Date: 16.JAN.2014 09:47:34

Test Data – Peak Power

Peak Power
Upper Channel
802.11b
1 Mbps



Date: 16.JAN.2014 09:54:46

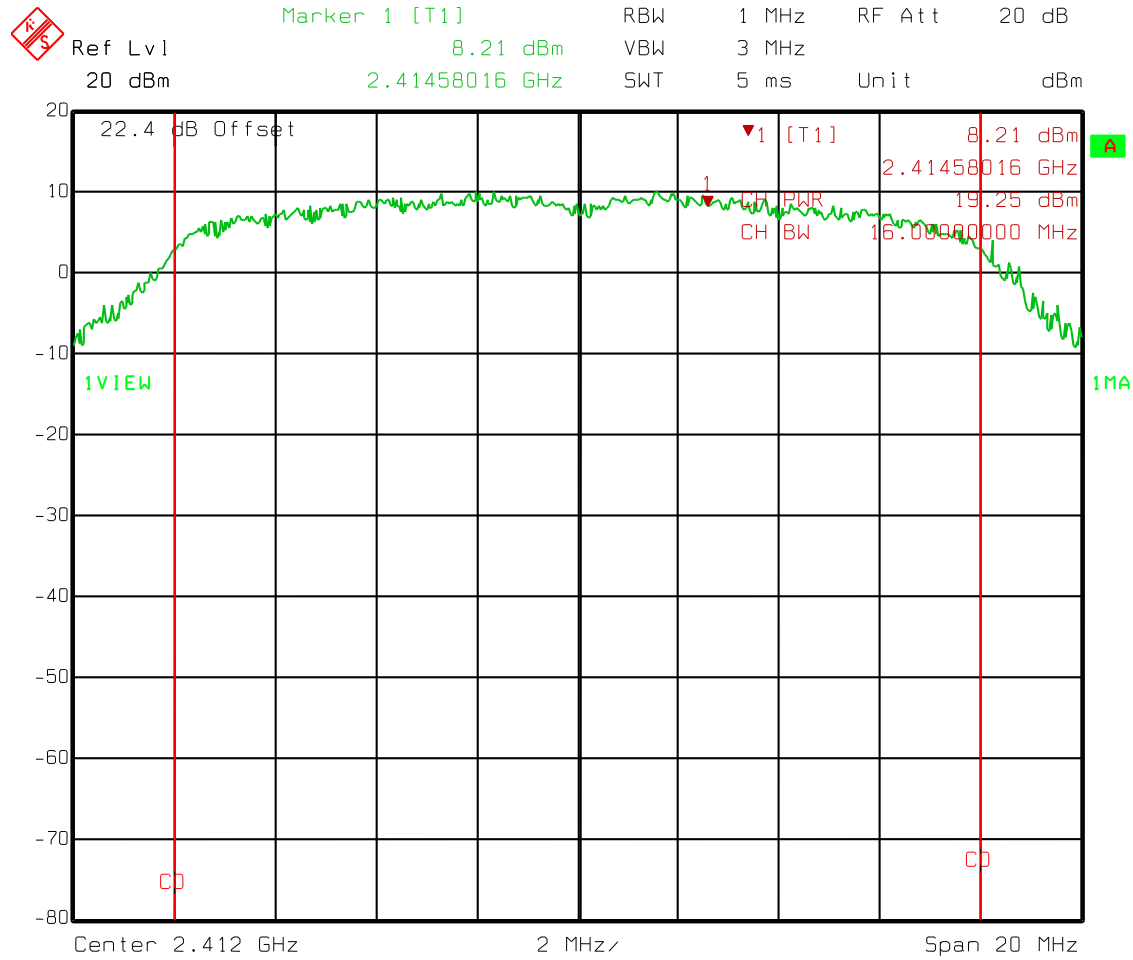
Test Data – Peak Power

Low Channel

Peak Power

802.11g

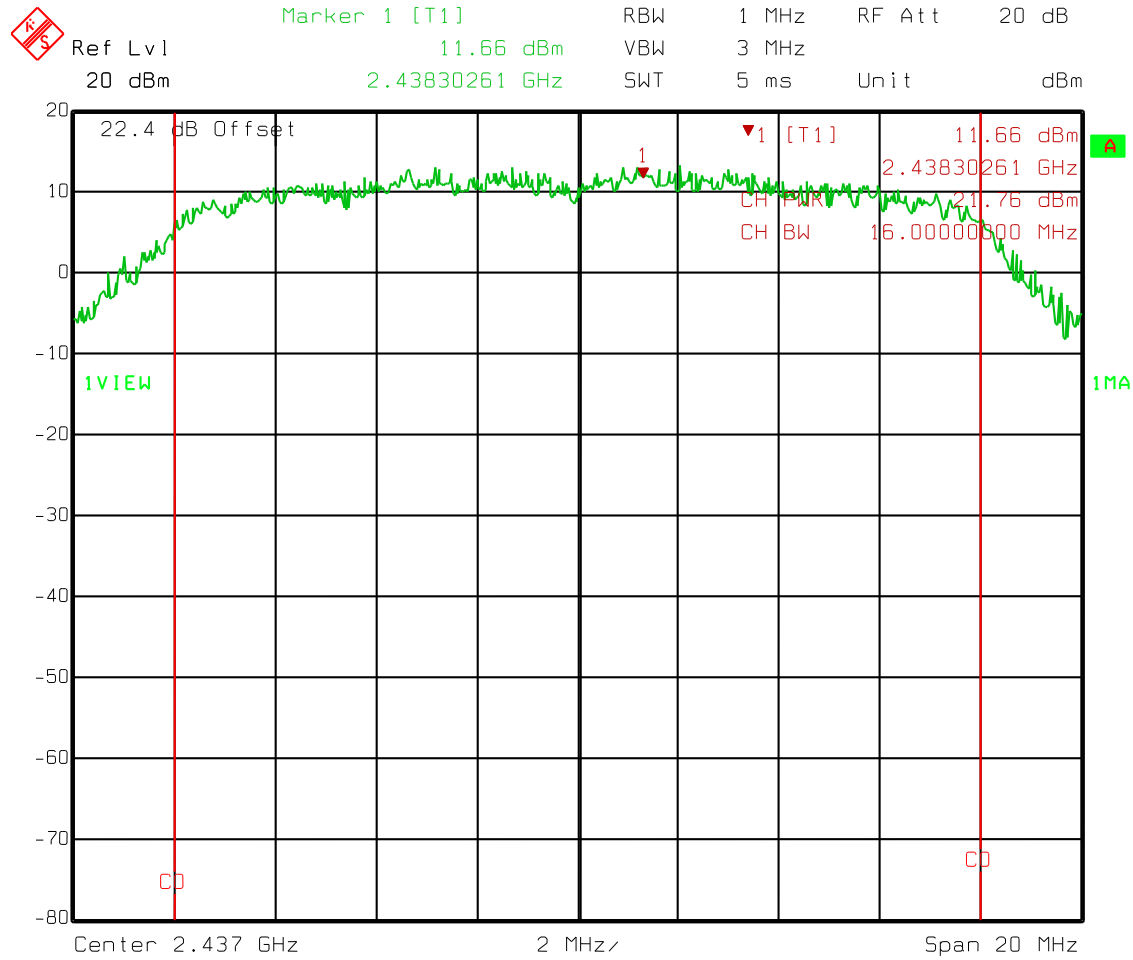
6 Mbps



Date: 16.JAN.2014 10:12:21

Test Data – Peak Power

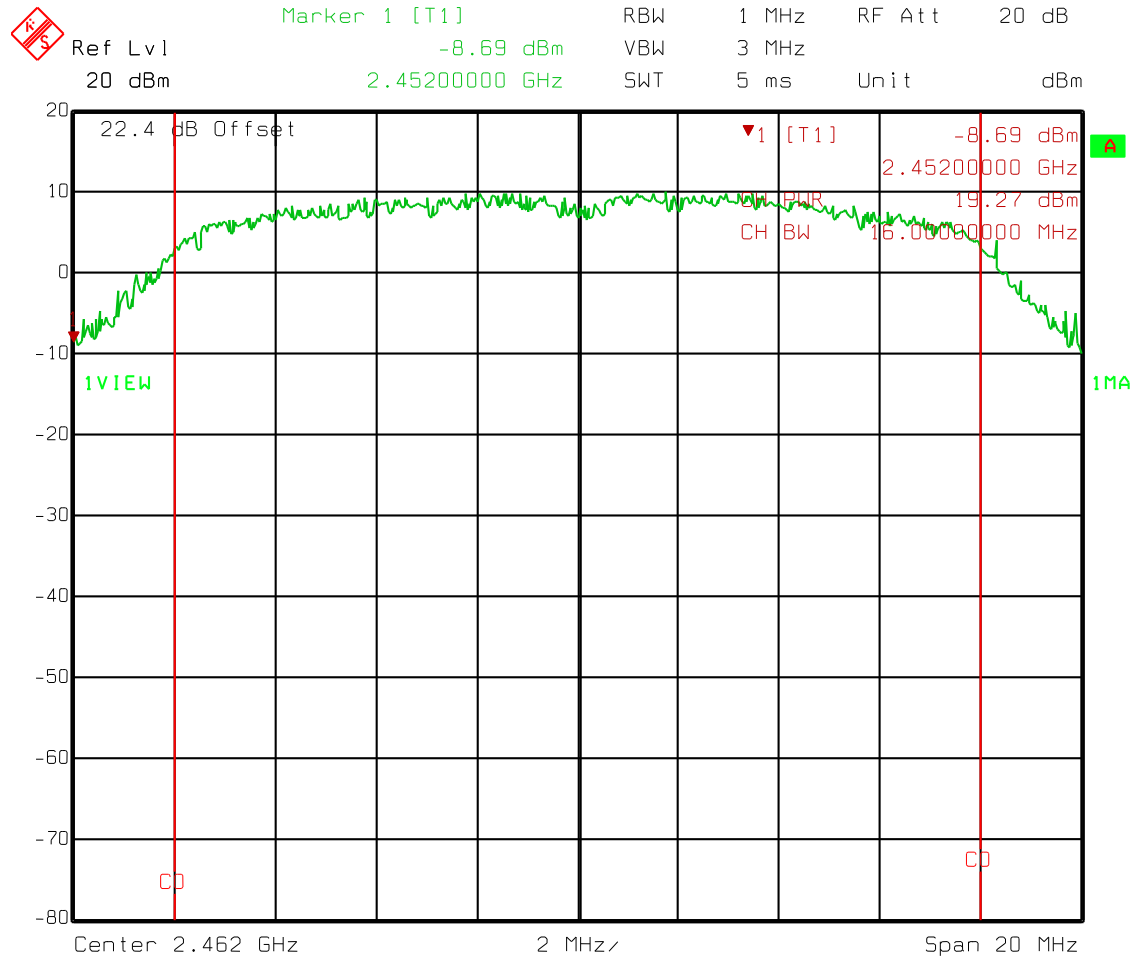
Mid Channel
Peak Power
802.11g
6 Mbps



Date: 16.JAN.2014 10:20:48

Test Data – Peak Power

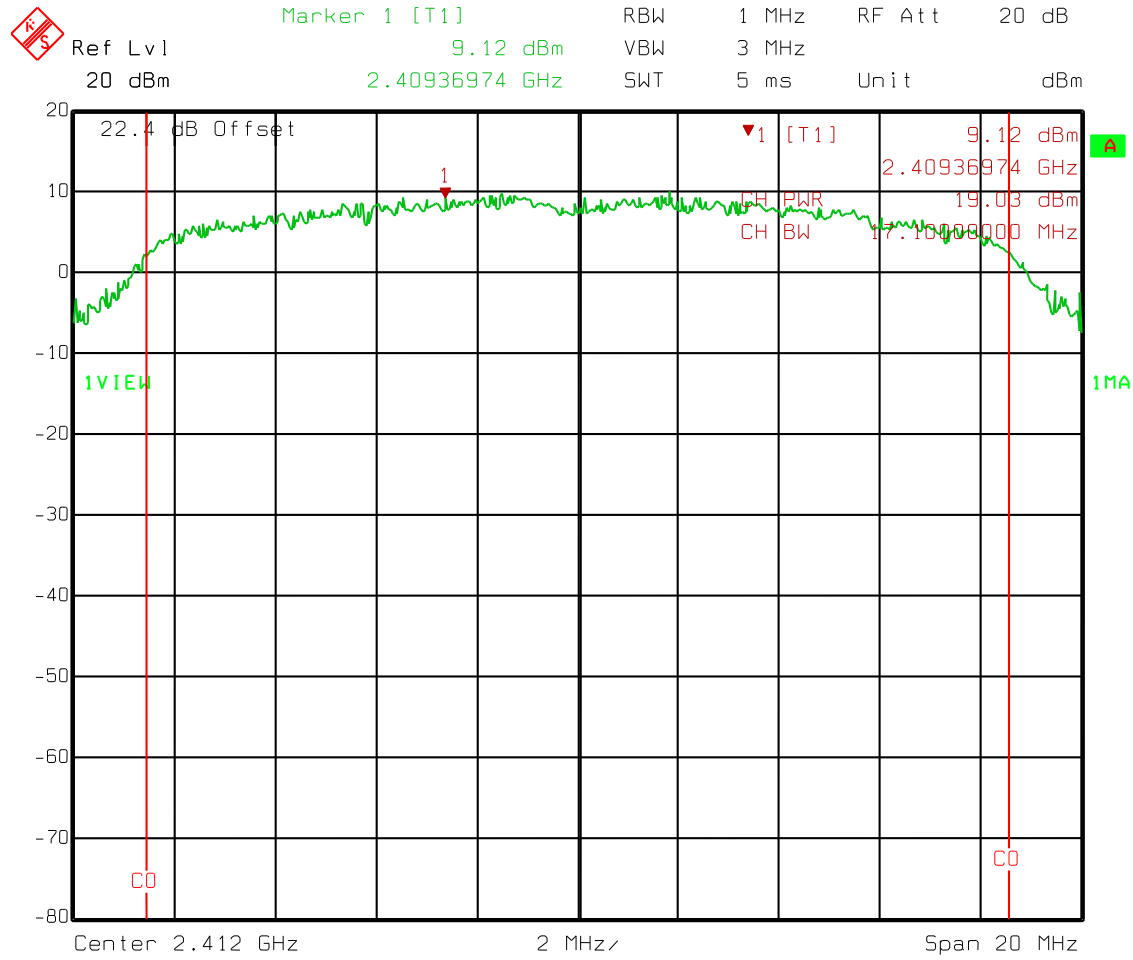
Peak Power
Upper Channel
802.11g
6 Mbps



Date: 16.JAN.2014 10:22:40

Test Data – Peak Power

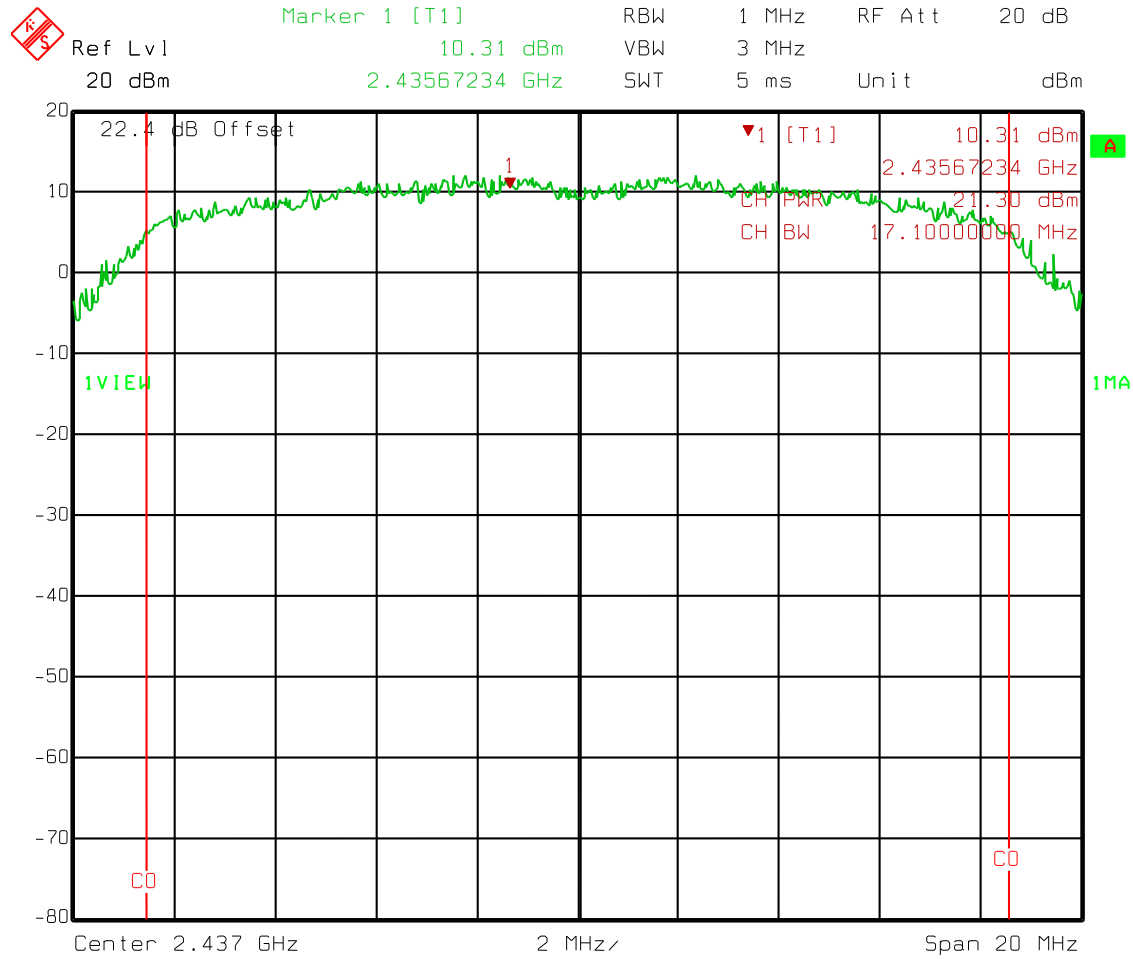
Low Channel
Peak Power
802.11n
MCS0



Date: 16.JAN.2014 10:38:41

Test Data – Peak Power

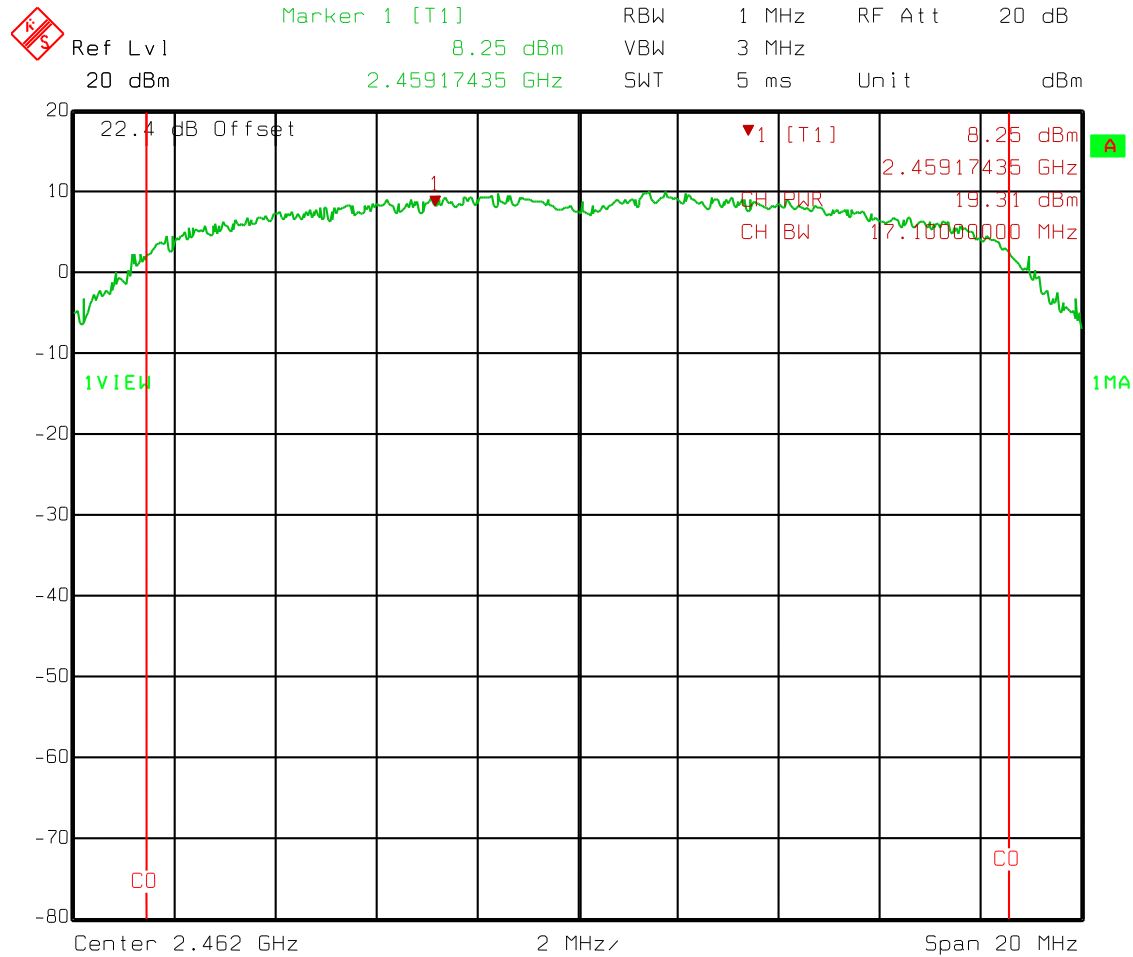
Mid Channel
Peak Power
802.11n
MCS0



Date: 16.JAN.2014 10:44:14

Test Data – Peak Power

Peak Power
Upper Channel
802.11n
MCS0



Date: 16.JAN.2014 10:49:20

Section 5 Spurious Emissions at Antenna Terminals

| | |
|---|-----------------------|
| NAME OF TEST: Spurious Emissions at Antenna Terminals | PARA. NO.: 15.247 (d) |
|---|-----------------------|

| |
|------------------------|
| TESTED BY: David Light |
|------------------------|

| |
|-----------------------|
| DATE: 16 January 2014 |
|-----------------------|

Test Results: Complies.

Measurement Data: See attached plots.

Test Conditions: 29 %RH
 22 °C

Measurement Uncertainty: +/-1.7 dB

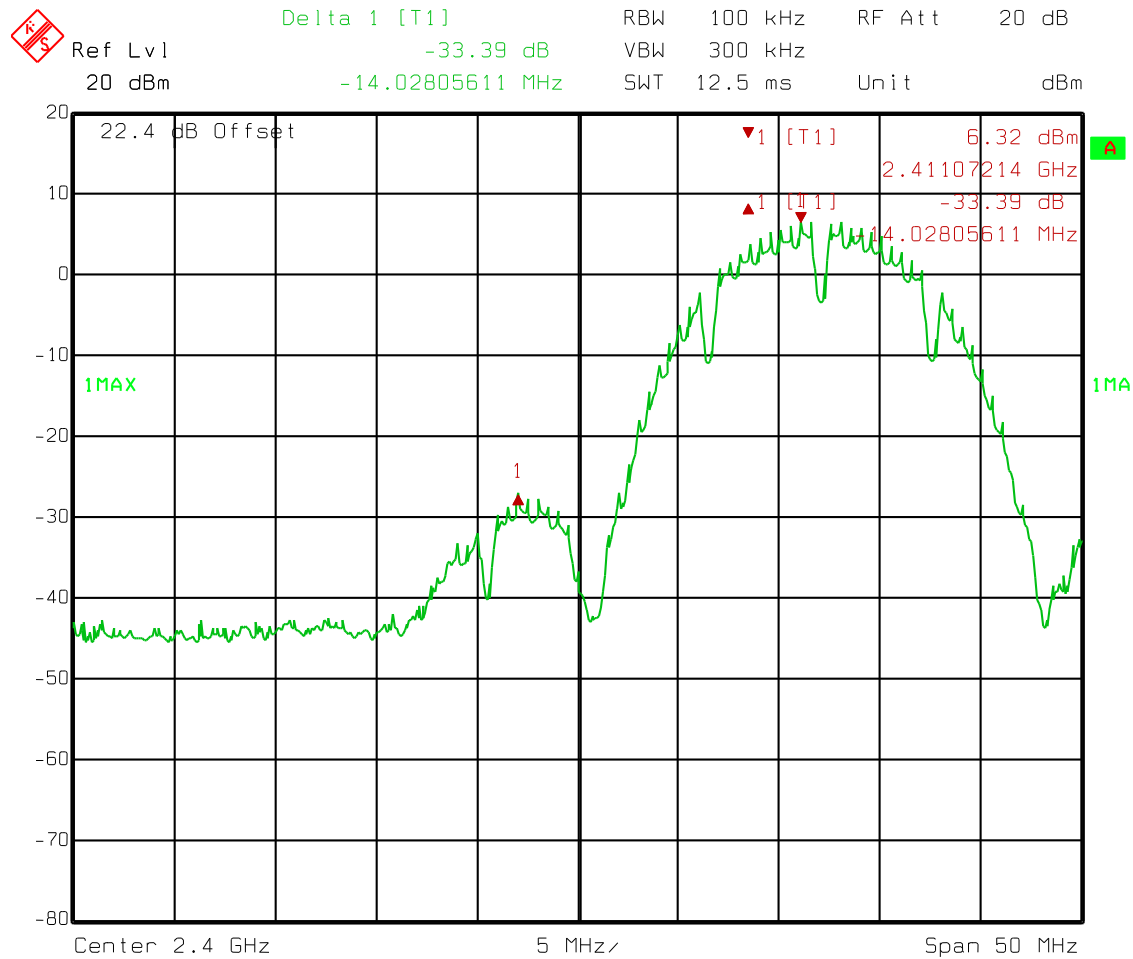
Test Equipment Used: 1036-1082-1472

Test Data – Spurious Emissions at Antenna Terminals

Lower Band Edge

802.11b

1 Mbps



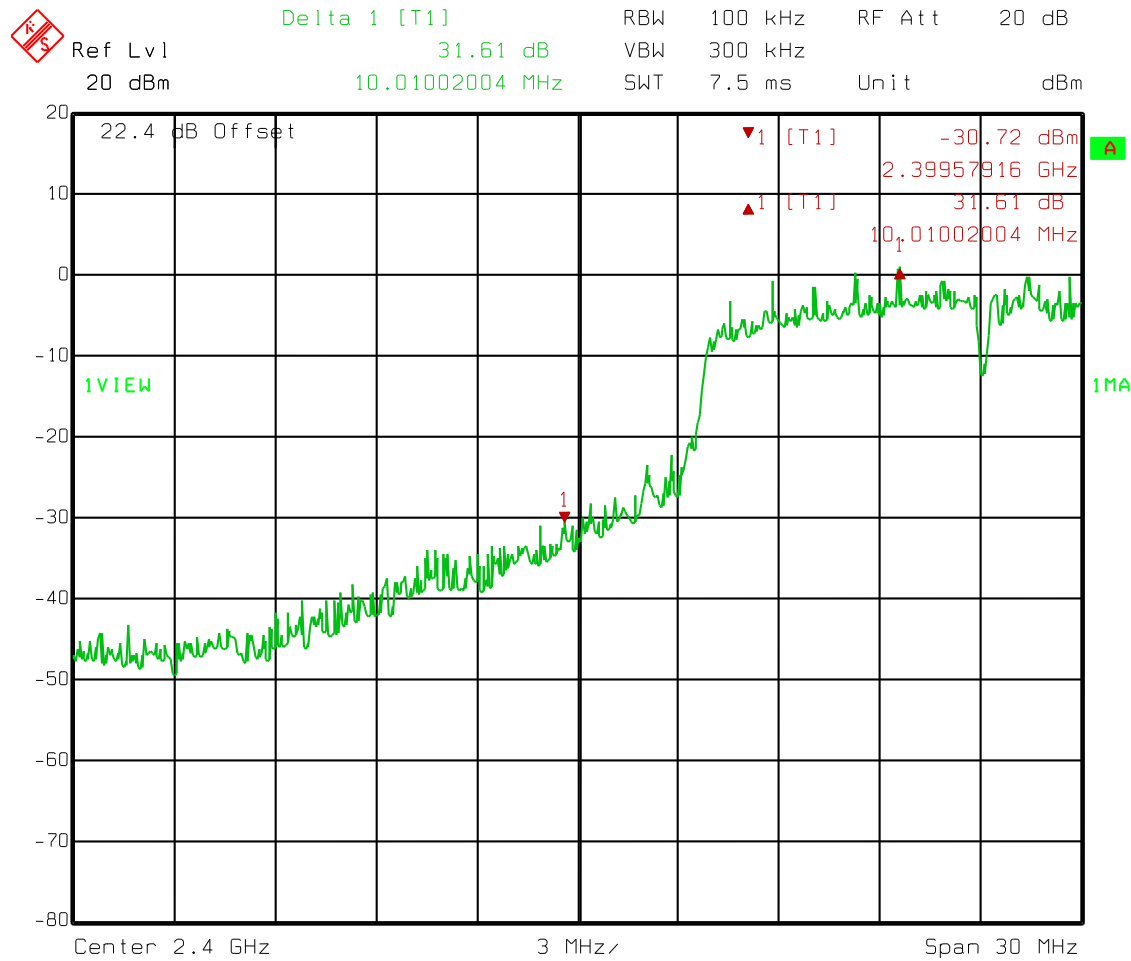
Date: 16.JAN.2014 09:41:10

Test Data – Spurious Emissions at Antenna Terminals

Lower Band Edge

802.11g

6 Mbps



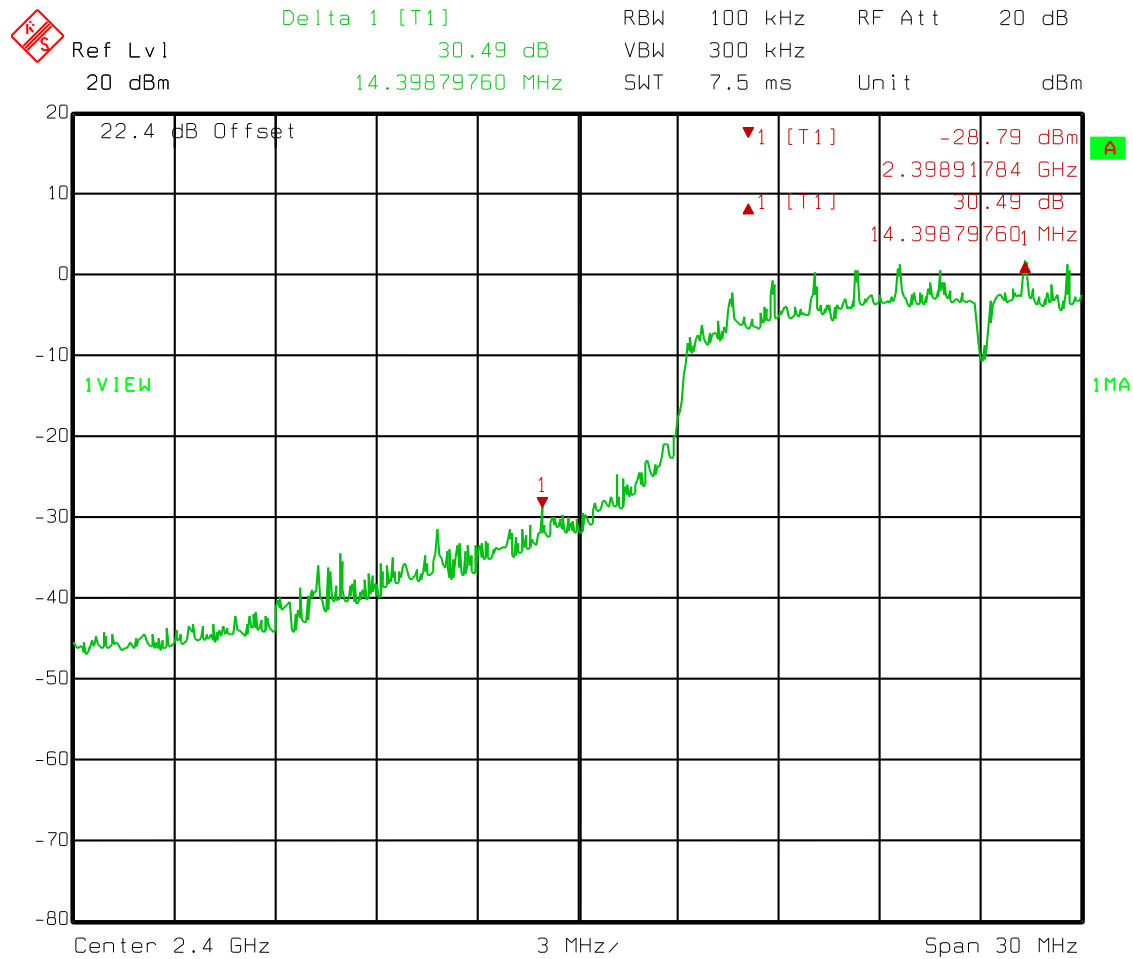
Date: 16.JAN.2014 10:13:42

Test Data – Spurious Emissions at Antenna Terminals

Lower Band Edge

802.11n

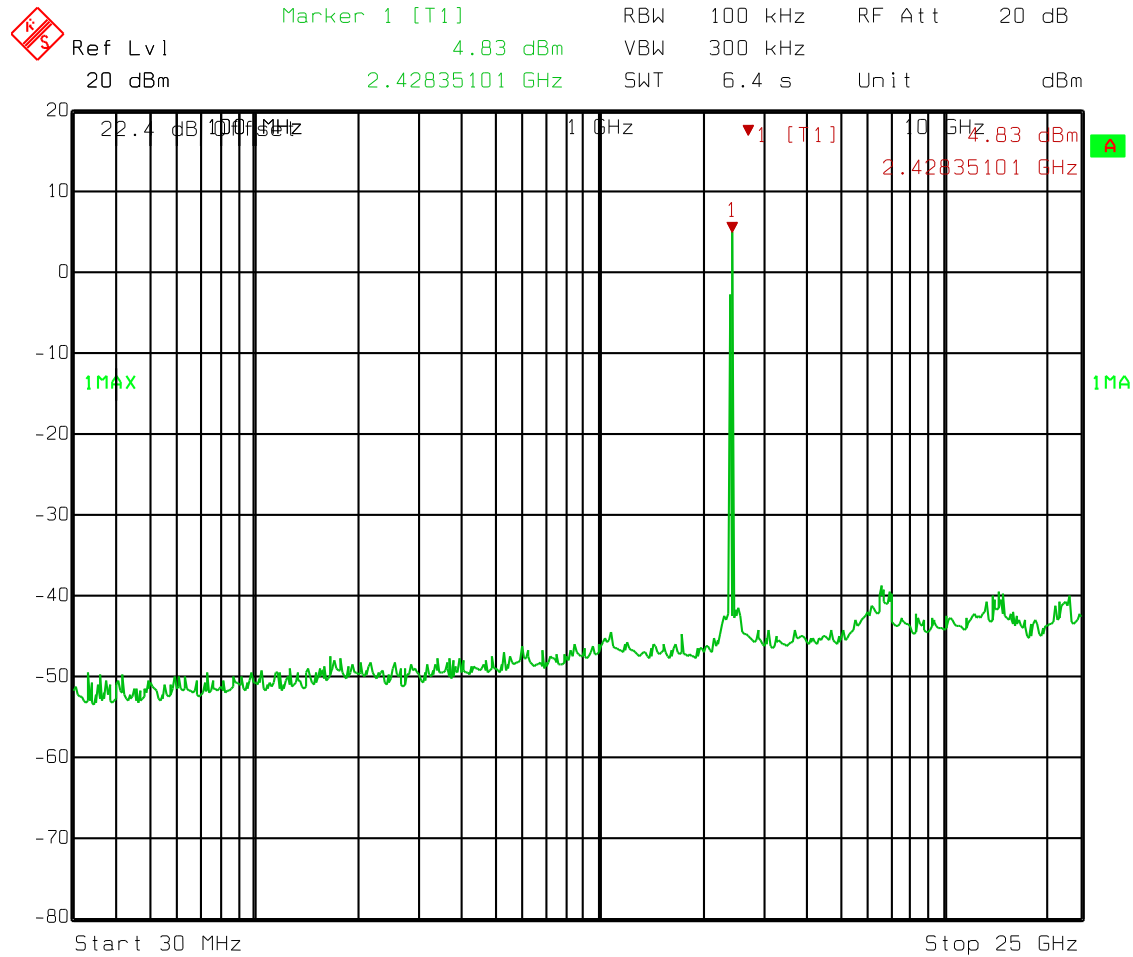
MCS0



Date: 16.JAN.2014 10:39:54

Test Data – Spurious Emissions at Antenna Terminals

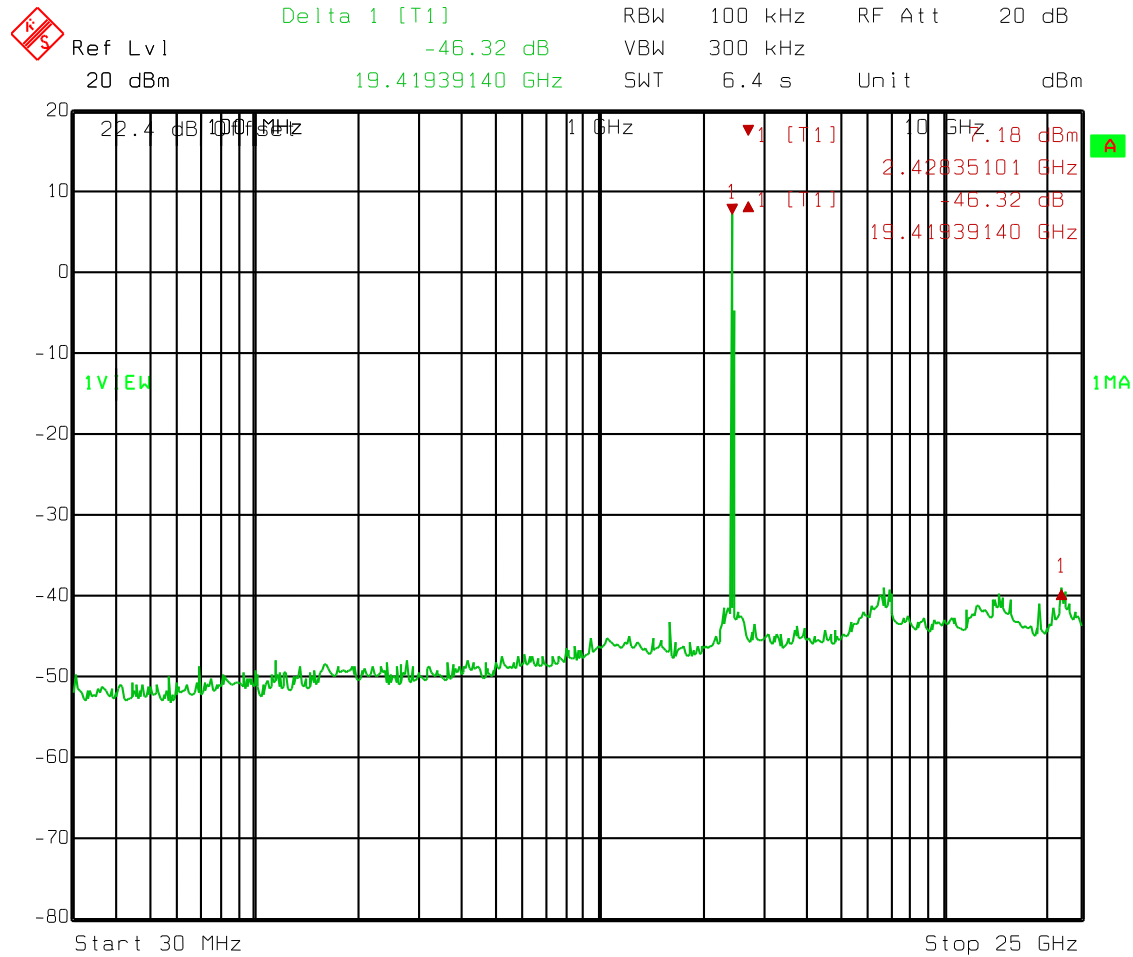
Spurious Emission
Low Channel
802.11b
1 Mbps



Date: 16.JAN.2014 09:39:35

Test Data – Spurious Emissions at Antenna Terminals


Spurious Emissions
Mid Channel
802.11b
1 Mbps

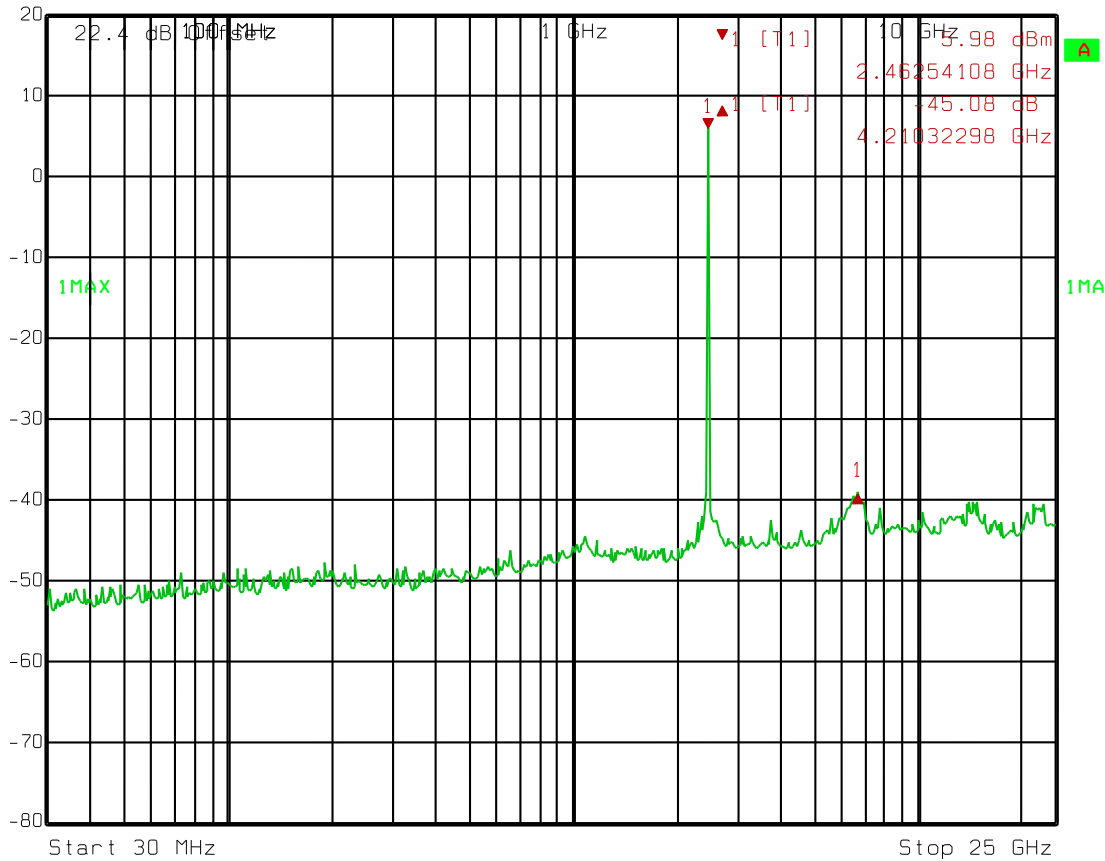


Date: 16.JAN.2014 09:51:00

Test Data – Spurious Emissions at Antenna Terminals

Spurious Emissions
Upper Channel
802.11b
1 Mbps

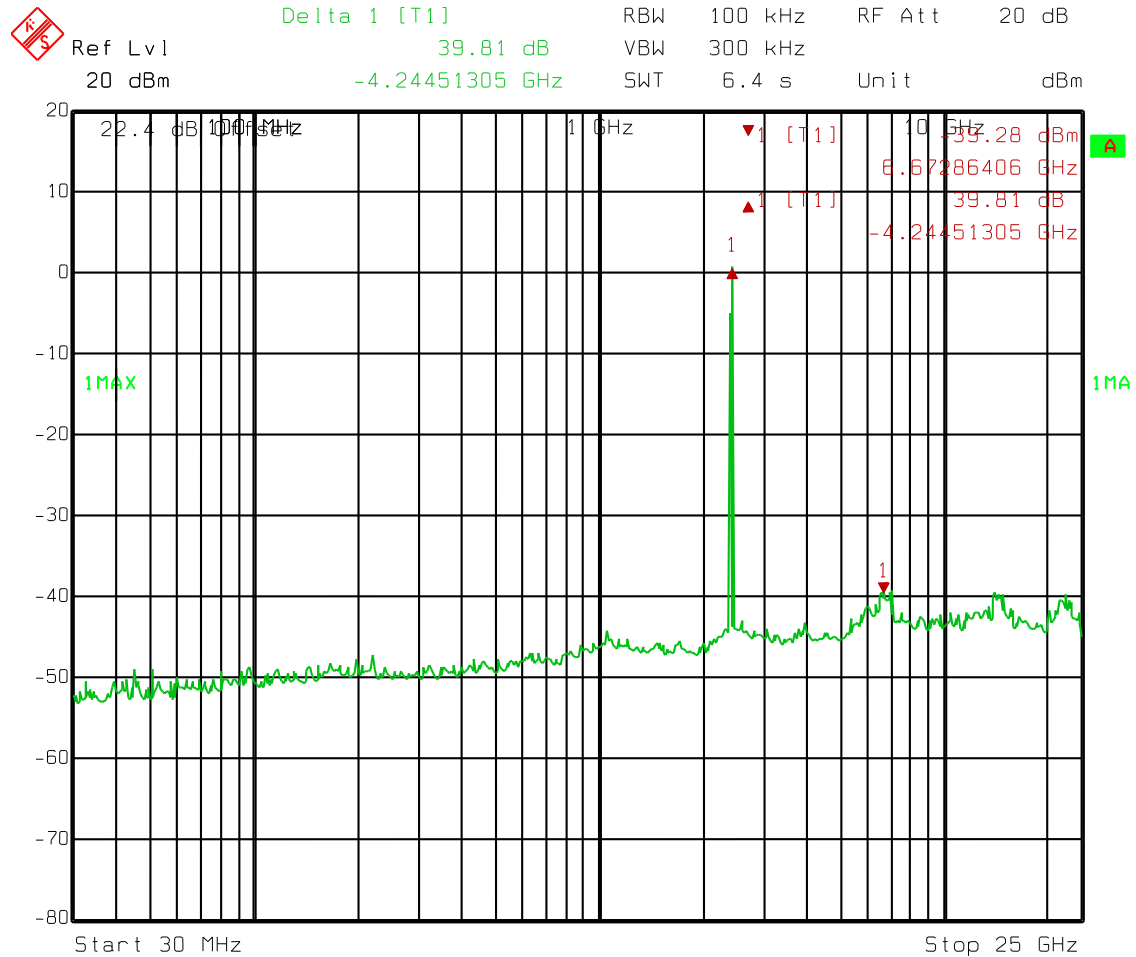
 Delta 1 [T1] RBW 100 kHz RF Att 20 dB
Ref Lvl -45.08 dB VBW 300 kHz
20 dBm 4.21032298 GHz SWT 6.4 s Unit dBm



Date: 16. JAN. 2014 09:56:42

Test Data – Spurious Emissions at Antenna Terminals

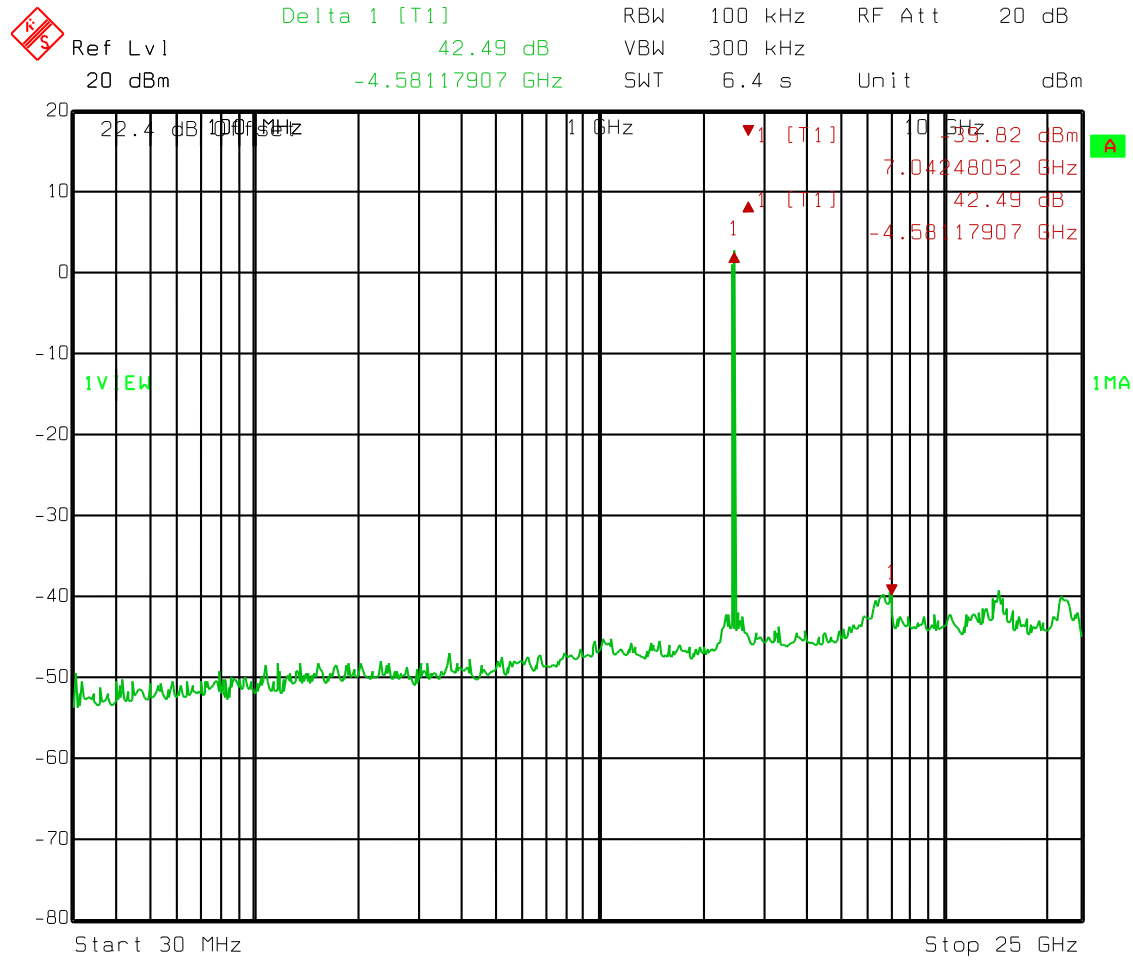
Spurious Emission
Low Channel
802.11g
6 Mbps



Date: 16.JAN.2014 10:15:10

Test Data – Spurious Emissions at Antenna Terminals

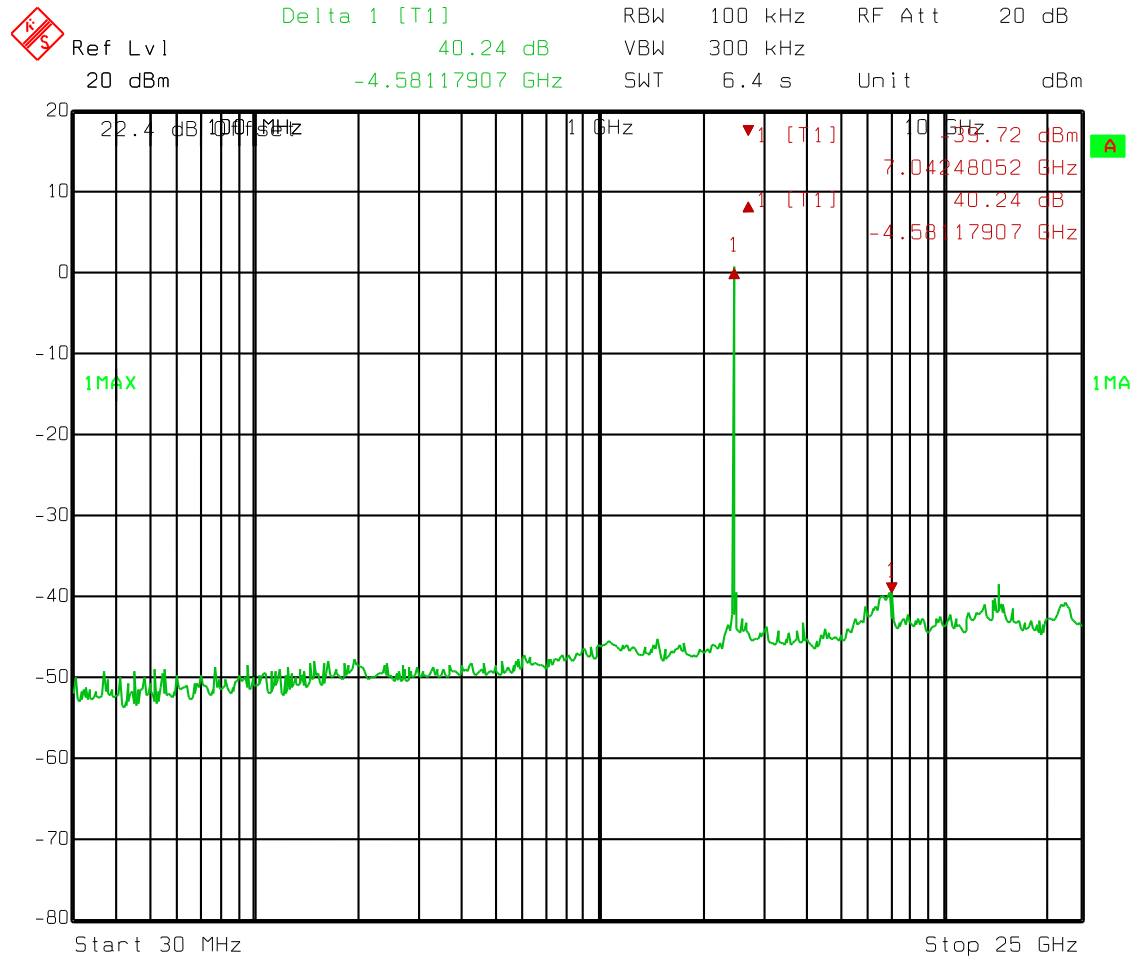
Spurious Emissions
 Mid Channel
 802.11g
 6 Mbps



Date: 16.JAN.2014 10:17:20

Test Data – Spurious Emissions at Antenna Terminals

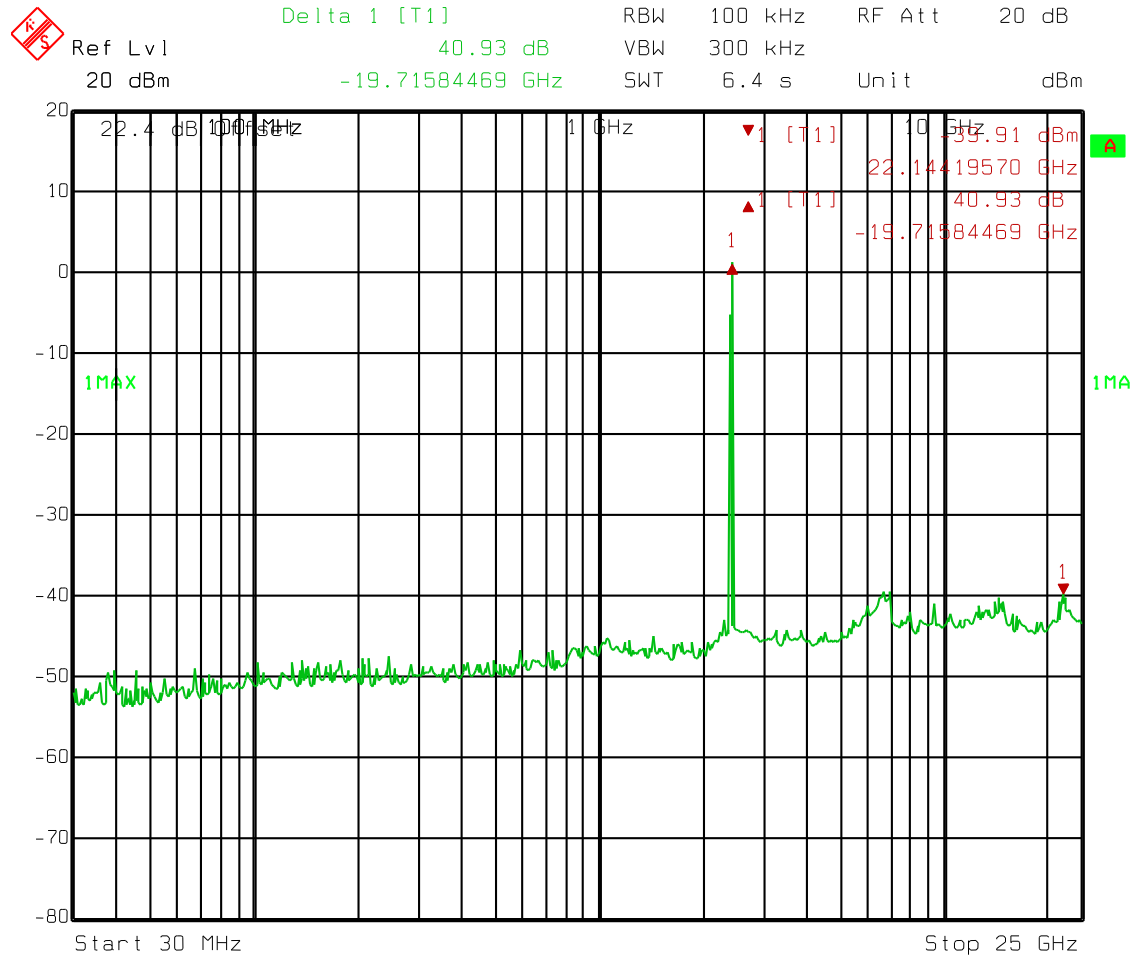
Spurious Emissions
Upper Channel
802.11g
6 Mbps



Date: 16.JAN.2014 10:25:32

Test Data – Spurious Emissions at Antenna Terminals

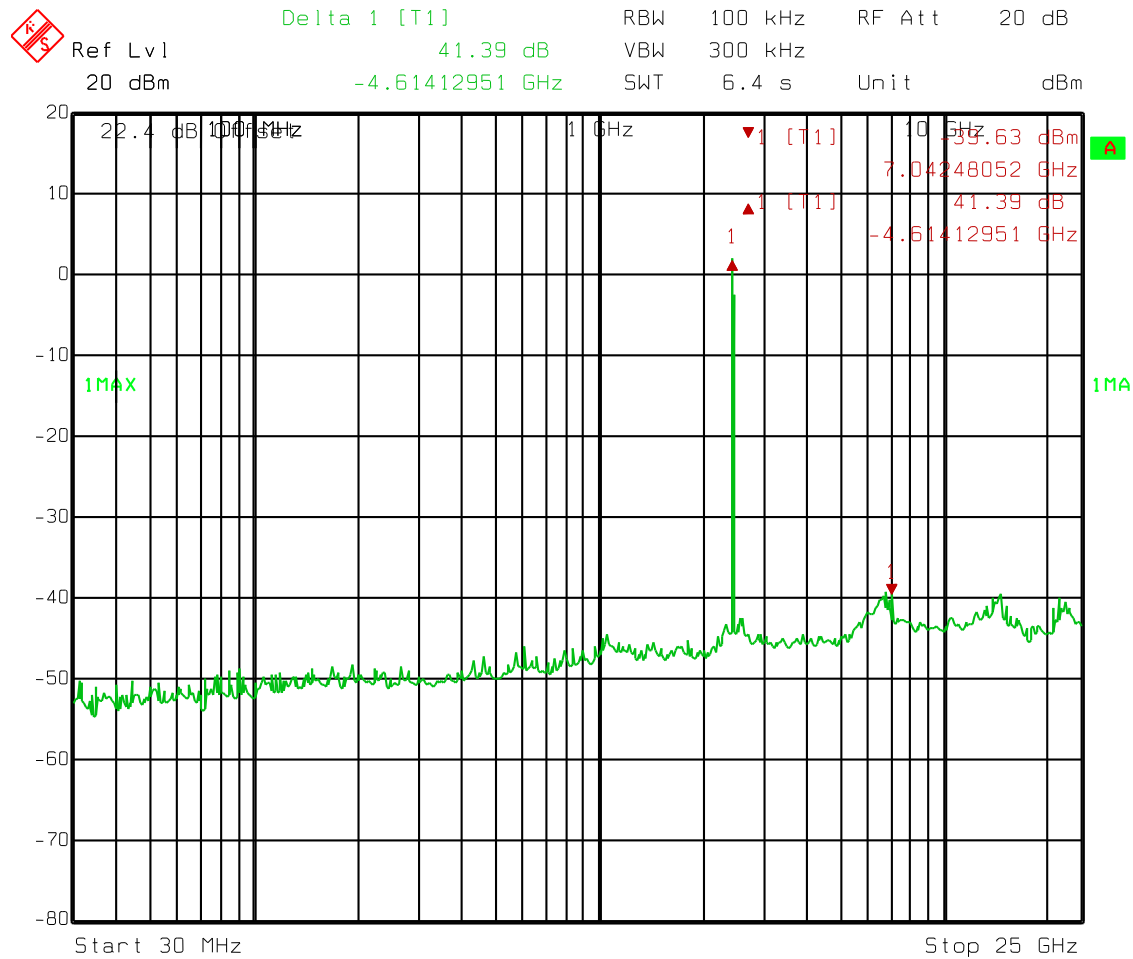
Spurious Emission
Low Channel
802.11n
MCS0



Date: 16.JAN.2014 10:40:38

Test Data – Spurious Emissions at Antenna Terminals

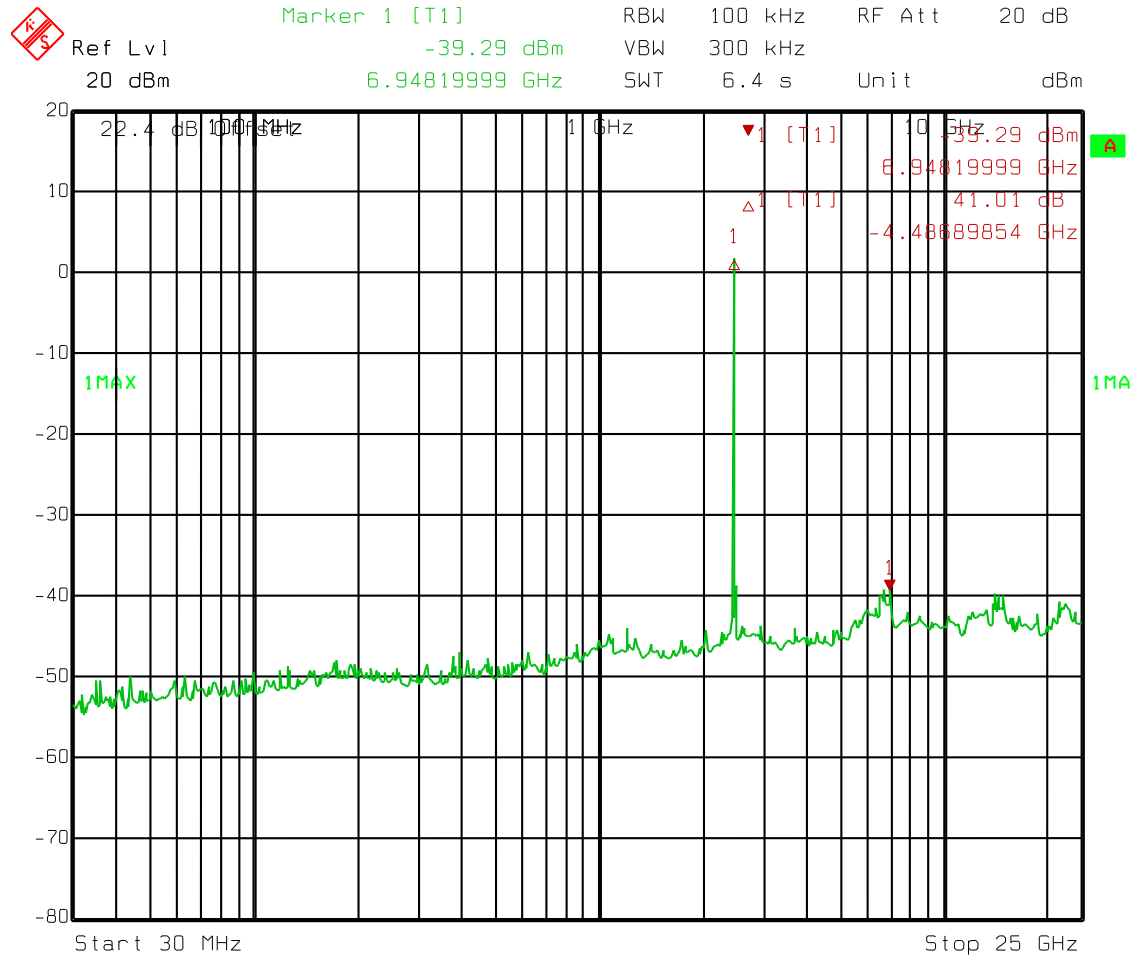
Spurious Emissions
 Mid Channel
 802.11n
 MCS0



Date: 16. JAN. 2014 10:45:20

Test Data – Spurious Emissions at Antenna Terminals

Spurious Emissions
Upper Channel
802.11n
MCS0



Date: 16.JAN.2014 10:46:43

Section 6. Radiated Emissions

| | |
|----------------------------------|---|
| NAME OF TEST: Radiated Emissions | PARA. NO.: FCC 15.209(a) RSS-Gen 7.2.2 |
| TESTED BY: David Light | DATE: 16 January 2014 |

Test Results: Complies.

Measurement Data: See attached table.

Test Conditions: 29 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1036-1763-529-901-1016-1766

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33
- The device was tested on three channels per 15.31(l).
- No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o). Band edge data is presented below.

| RBW (MHz) | VBW (MHz) | Freq. Range (MHz) | Detector Function | Measurement Peak/Avg) |
|-----------|-----------|-------------------|-------------------|-----------------------|
| 0.100 | 0.300 | <1000 | Peak | Peak/Avg) |
| 1.0 | 3.0 | >1000 | Peak | Peak |
| 1.0 | 10.0 | >1000 | RMS | Avg |

Radiated Emissions

CC3100BOOST

| Meas. Freq. (MHz) | Ant. Pol. (H/V) | Atten. (dB) | Meter Reading (dBuV) | Antenna Factor (dB) | Path Loss (dB) | RF Gain (dB) | Corrected Reading (dBuV/m) | Spec. limit (dBuV/m) | CR/SL Diff. (dB) | Pass Fail Unc. | Comment |
|-------------------|-----------------|-------------|----------------------|---------------------|----------------|--------------|----------------------------|----------------------|------------------|----------------|----------------|
| | | | | | | | | | | | 802.11b 1 Mbps |
| 2483.5 | H | 0.0 | 51.7 | 28.6 | 8.8 | 31.8 | 57.3 | 74.0 | -16.7 | Pass | Ch 11 |
| 2483.5 | H | 0.0 | 44.8 | 28.6 | 8.8 | 31.8 | 50.4 | 54.0 | -3.6 | Pass | |
| 2483.5 | V | 0.0 | 48.5 | 28.6 | 8.8 | 31.8 | 54.1 | 74.0 | -19.9 | Pass | |
| 2483.5 | V | 0.0 | 41.3 | 28.6 | 8.8 | 31.8 | 46.9 | 54.0 | -7.1 | Pass | |
| | | | | | | | | | | | 802.11g 6 Mbps |
| 2483.5 | H | 0.0 | 49 | 28.6 | 8.8 | 31.8 | 54.6 | 74.0 | -19.4 | Pass | Ch 11 |
| 2483.5 | H | 0.0 | 42 | 28.6 | 8.8 | 31.8 | 47.6 | 54.0 | -6.4 | Pass | |
| 2483.5 | V | 0.0 | 56.6 | 28.6 | 8.8 | 31.8 | 62.2 | 74.0 | -11.8 | Pass | |
| 2483.5 | V | 0.0 | 47.2 | 28.6 | 8.8 | 31.8 | 52.8 | 54.0 | -1.2 | Pass | |
| | | | | | | | | | | | 802.11n MCS0 |
| 2483.5 | H | 0.0 | 53.3 | 28.6 | 8.8 | 31.8 | 58.9 | 74.0 | -15.1 | Pass | Ch 11 |
| 2483.5 | H | 0.0 | 42.5 | 28.6 | 8.8 | 31.8 | 48.1 | 54.0 | -5.9 | Pass | |
| 2483.5 | V | 0.0 | 56.3 | 28.6 | 8.8 | 31.8 | 61.9 | 74.0 | -12.1 | Pass | |
| 2483.5 | V | 0.0 | 48 | 28.6 | 8.8 | 31.8 | 53.6 | 54.0 | -0.4 | Pass | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Section 7. Peak Power Spectral Density

| | |
|---|-----------------------|
| NAME OF TEST: Peak Power Spectral Density | PARA. NO.: 15.247(e) |
| TESTED BY: David Light | DATE: 16 January 2014 |

Test Results: Complies.

Measurement Data: See attached data..

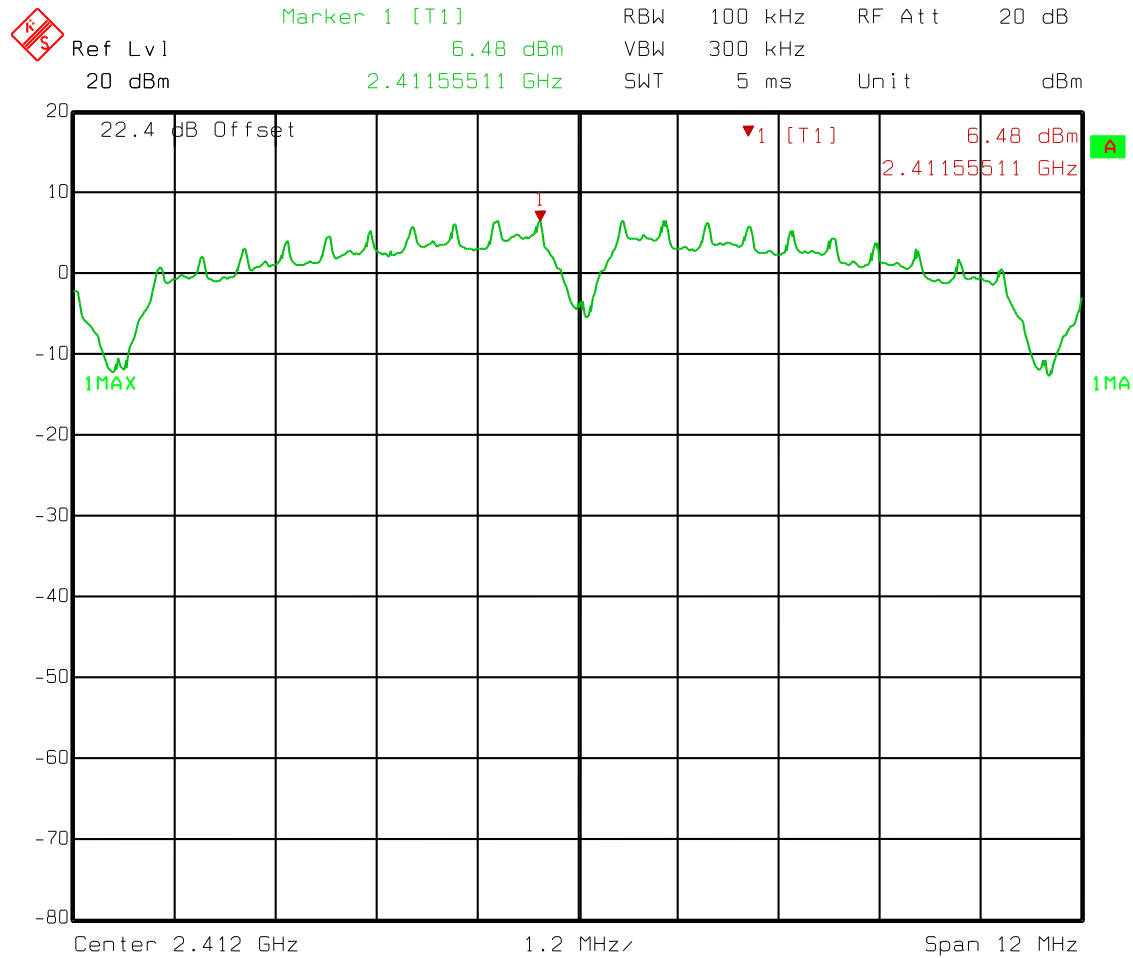
Test Conditions: 29 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1036-1082-1472

Peak Power Spectral Density

Low Channel
Density
802.11b
1 Mbps

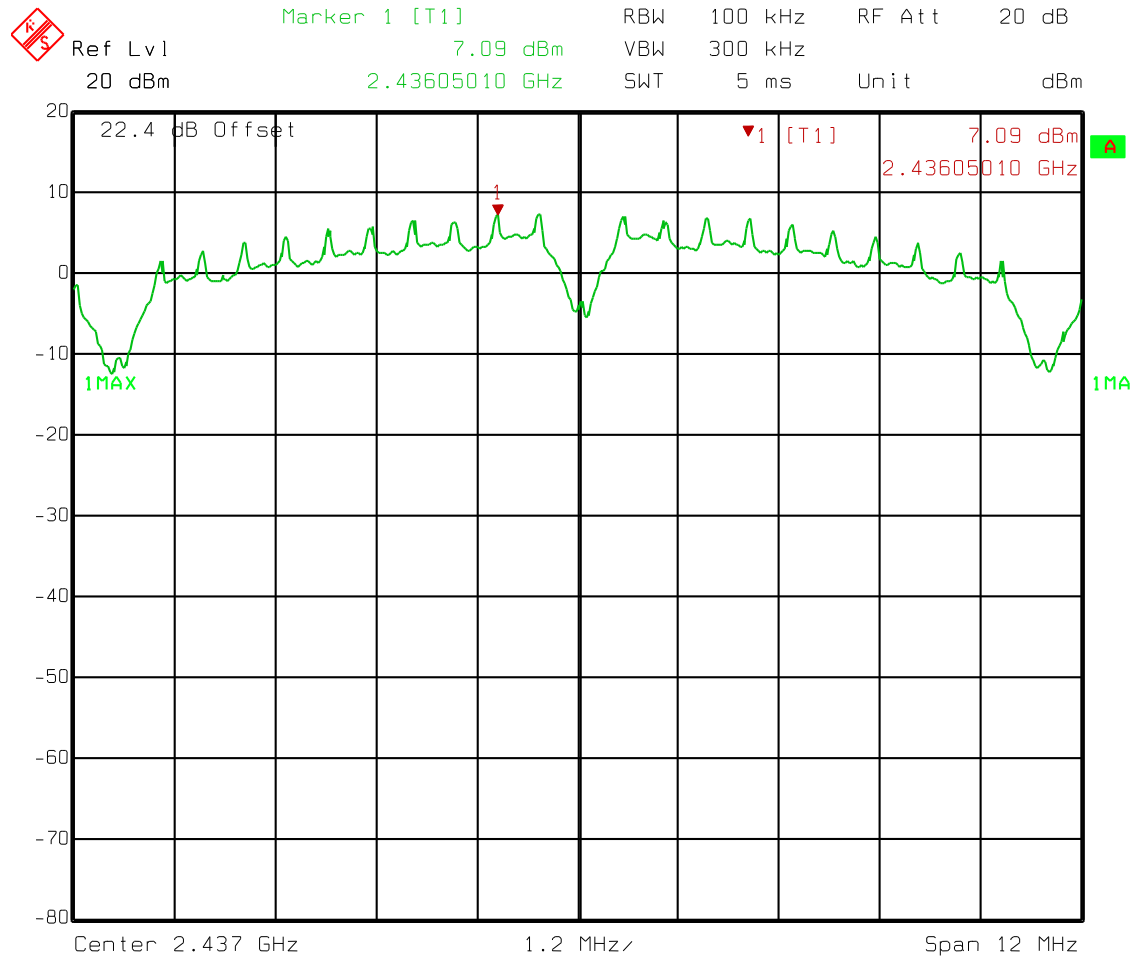


Date: 16.JAN.2014 09:37:50

Spectral Density = 6.48 dBm - 15.2 dB = -8.72 dBm

Peak Power Spectral Density

Density
Mid Channel
802.11b
1 Mbps

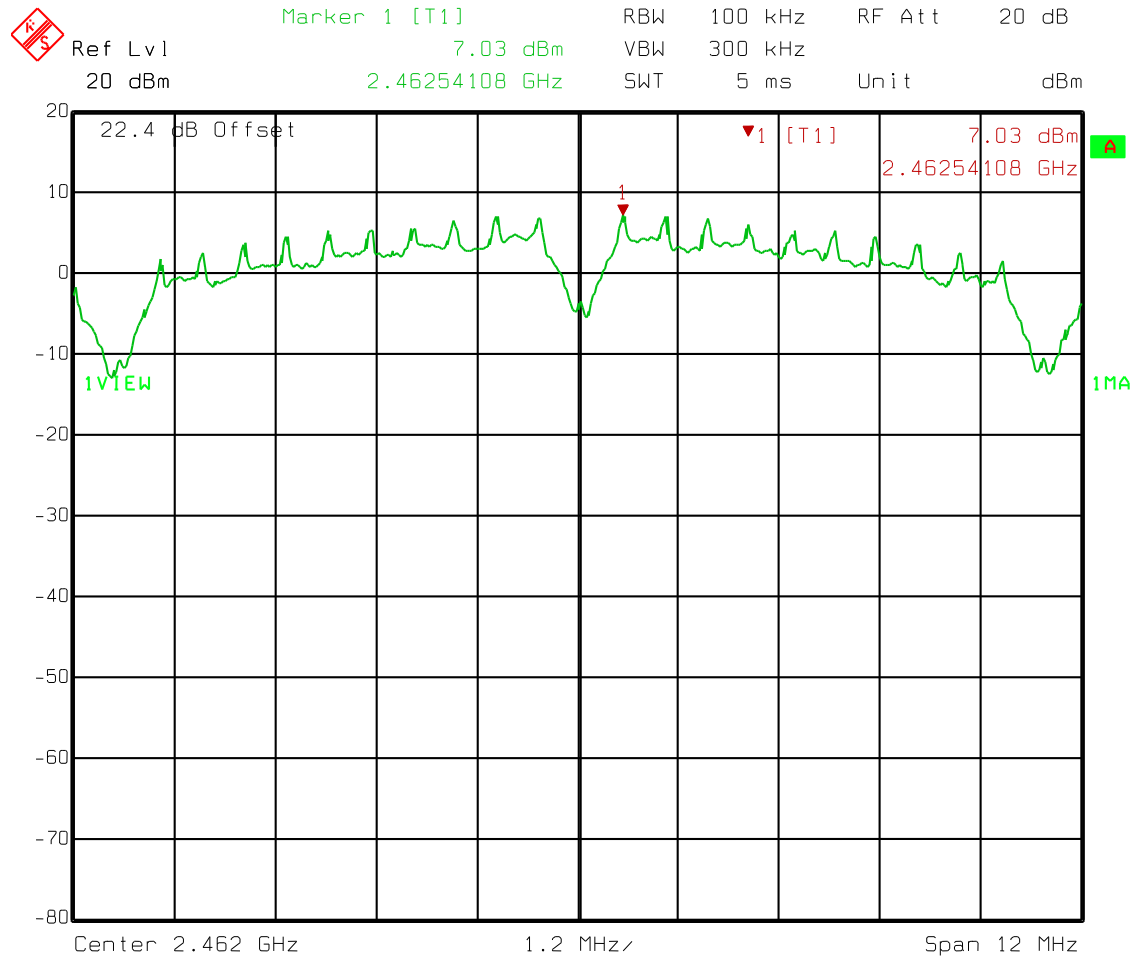


Date: 16.JAN.2014 09:48:19

Spectral Density = 7.09 dBm - 15.2 dB = -8.11 dBm

Peak Power Spectral Density

Density
Upper Channel
802.11b
1 Mbps

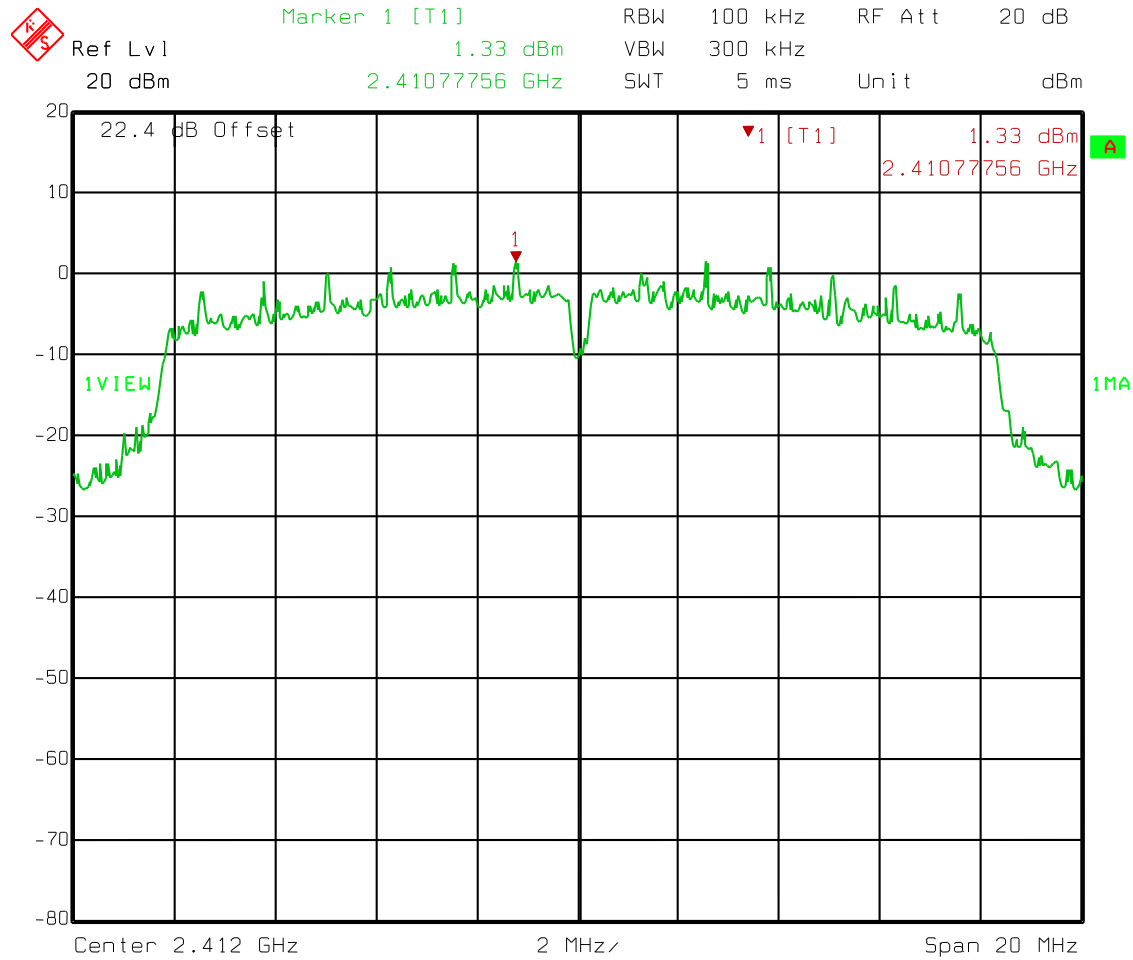


Date: 16.JAN.2014 09:55:32

Spectral Density = 7.03 dBm - 15.2 dB = -8.17 dBm

Peak Power Spectral Density

Low Channel
Density
802.11g
6 Mbps

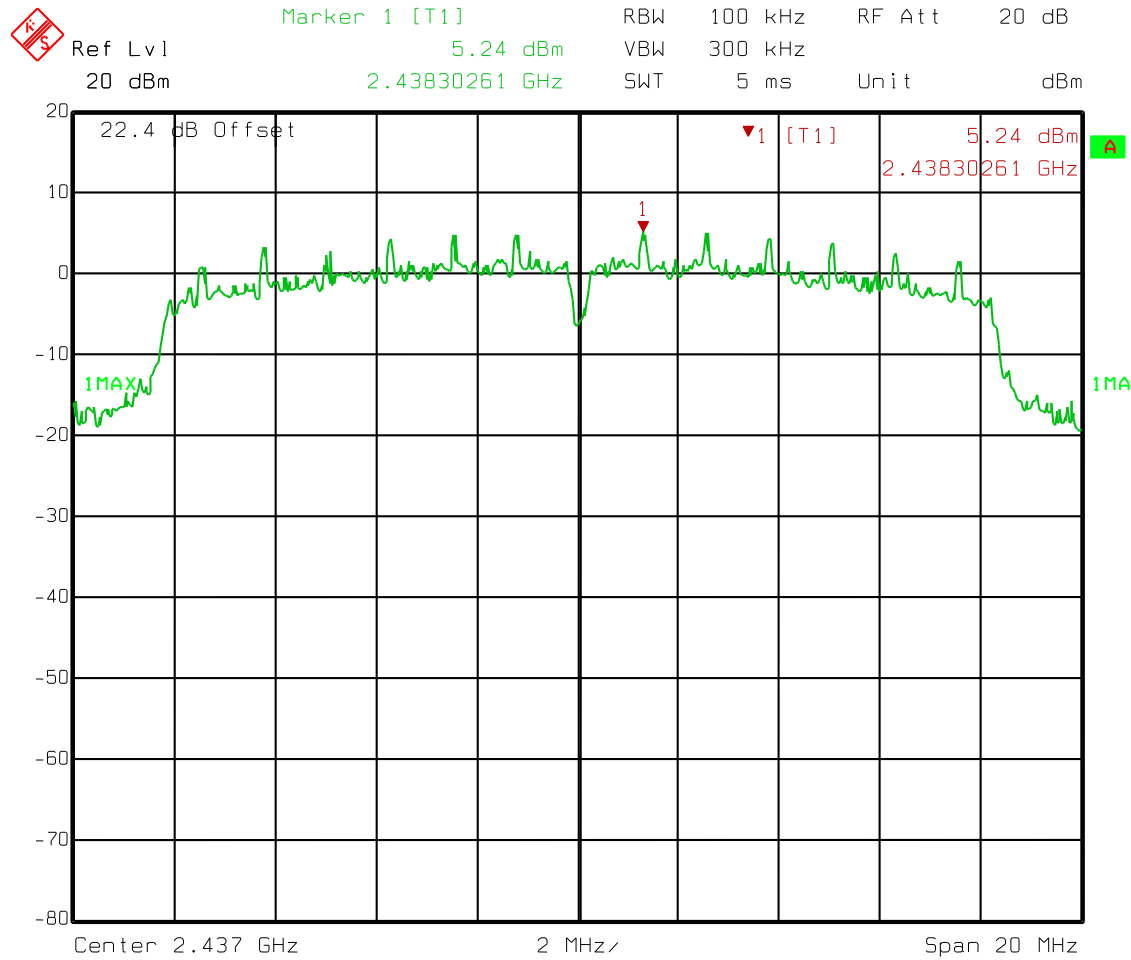


Date: 16.JAN.2014 10:12:48

$$\text{Spectral Density} = 1.33 \text{ dBm} - 15.2 \text{ dB} = -13.87 \text{ dBm}$$

Peak Power Spectral Density

Density
Mid Channel
802.11g
6 Mbps

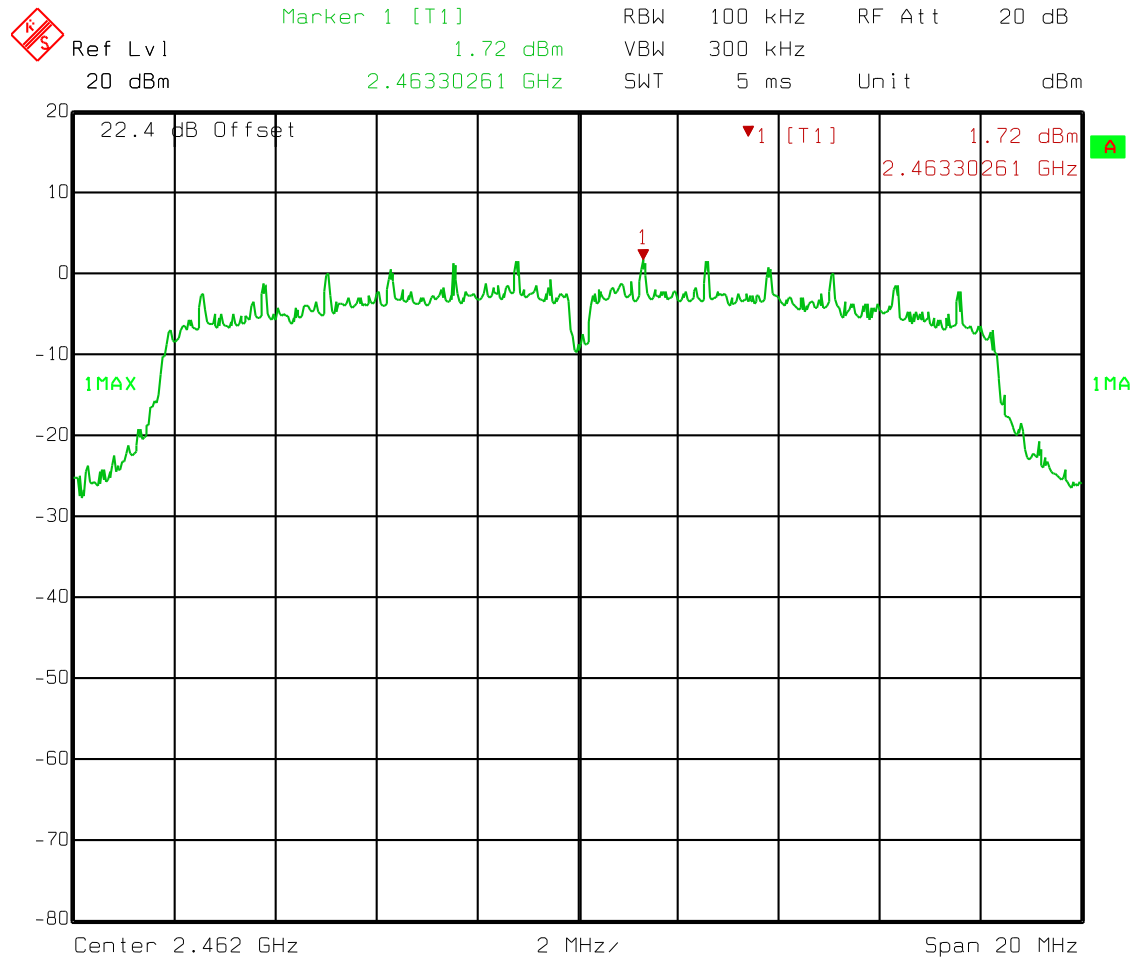


Date: 16.JAN.2014 10:20:12

Spectral Density = 5.24 dBm - 15.2 dB = -9.96 dBm

Peak Power Spectral Density

Density
 Upper Channel
 802.11g
 6 Mbps

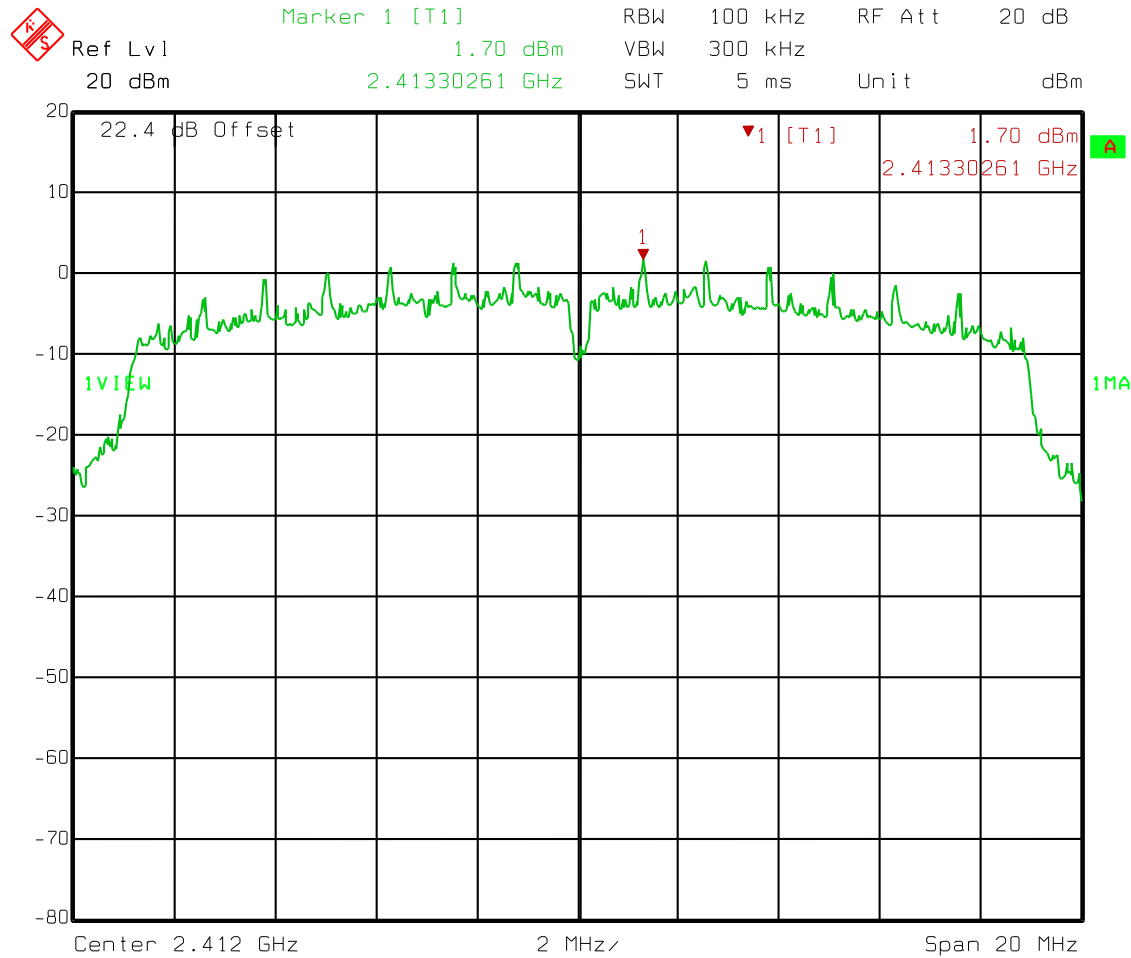


Date: 16.JAN.2014 10:24:40

Spectral Density = 1.72 dBm - 15.2 dB = -13.48 dBm

Peak Power Spectral Density

Low Channel
 Density
 802.11n
 MCS0

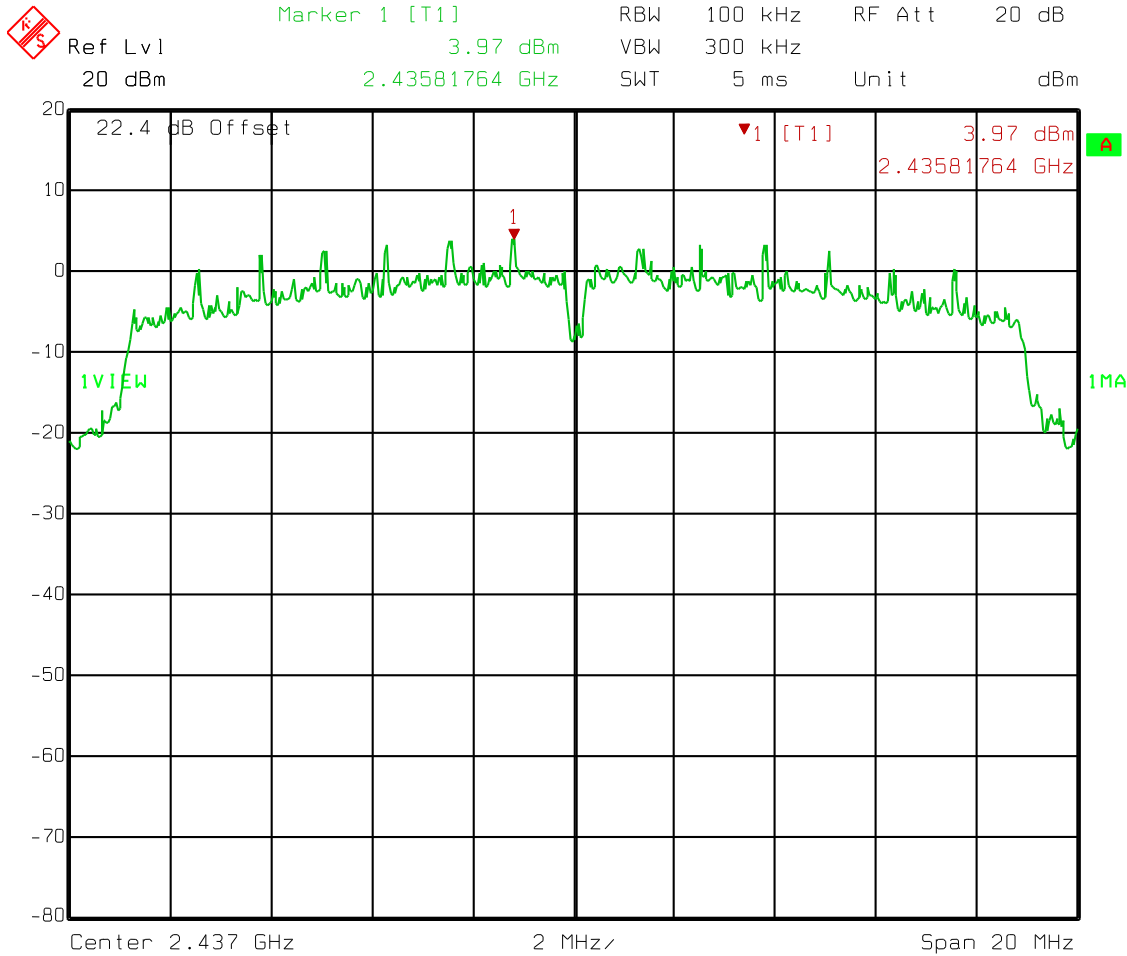


Date: 16.JAN.2014 10:39:09

Spectral Density = 1.70 dBm - 15.2 dB = -13.50 dBm

Peak Power Spectral Density

Density
Mid Channel
802.11n
MCS0

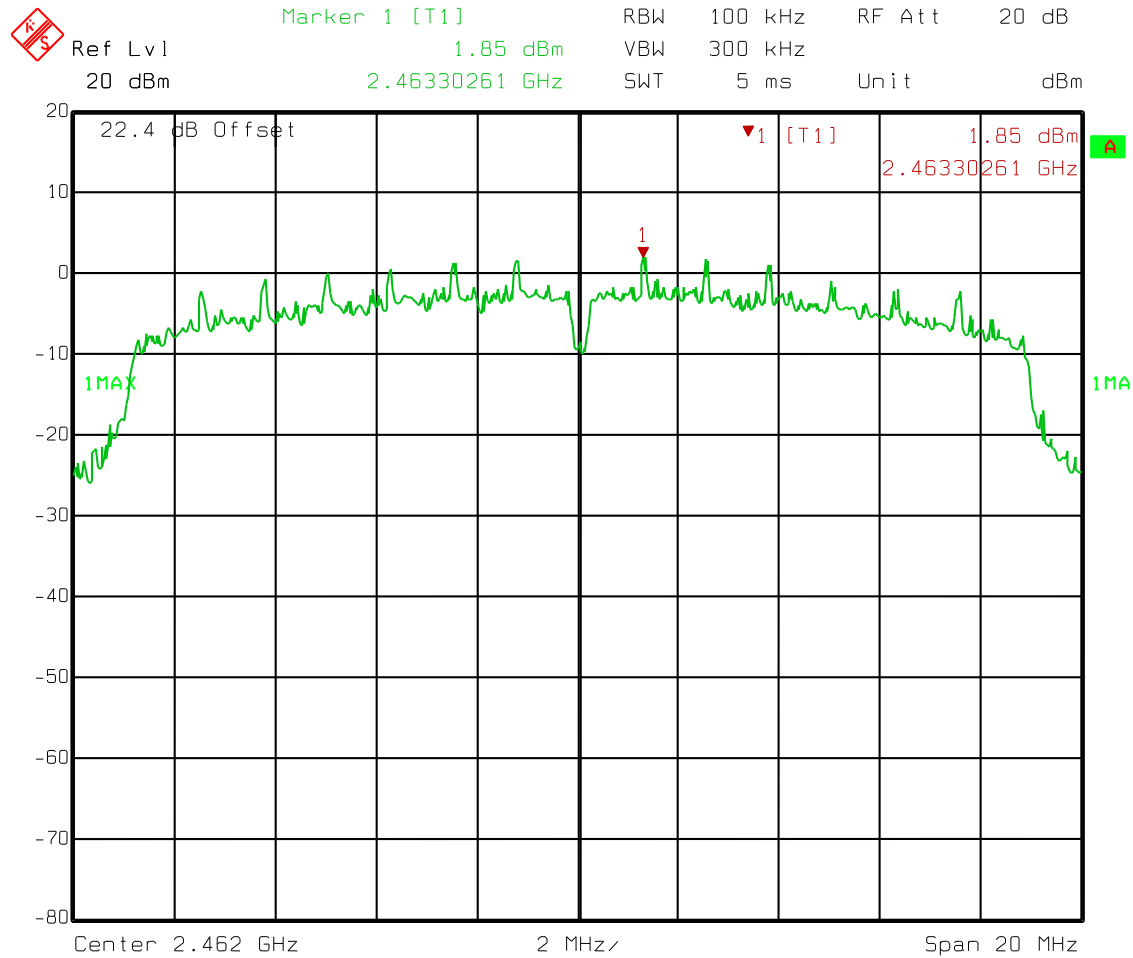


Date: 16.JAN.2014 10:44:40

Spectral Density = 3.97 dBm - 15.2 dB = -11.23 dBm

Peak Power Spectral Density

Density
Upper Channel
802.11n
MCS0



Date: 16.JAN.2014 10:47:11

Spectral Density = 1.85 dBm - 15.2 dB = -13.35 dBm

Section 8. Powerline Conducted Emissions

| | |
|---|---|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: FCC 15.207(a) RSS-Gen 7.2.4 |
| TESTED BY: Mark Phillips | DATE: 05 February 2014 |

Test Results: Complies.

Measurement Data: See attached data..

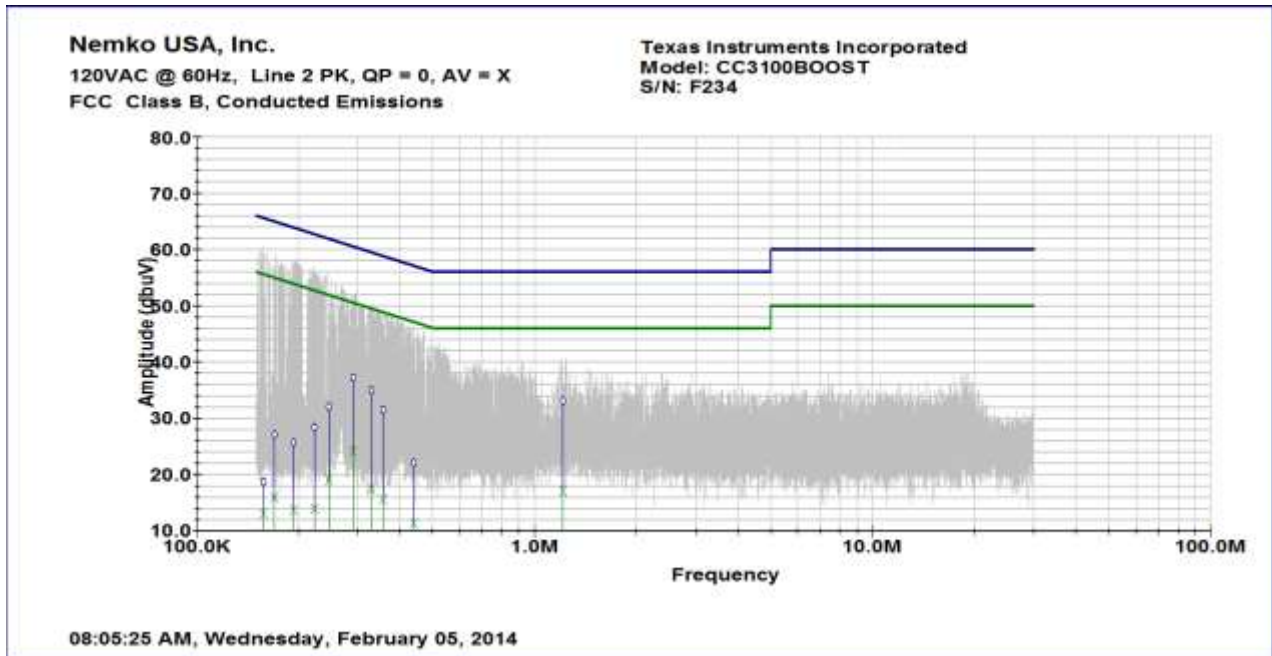
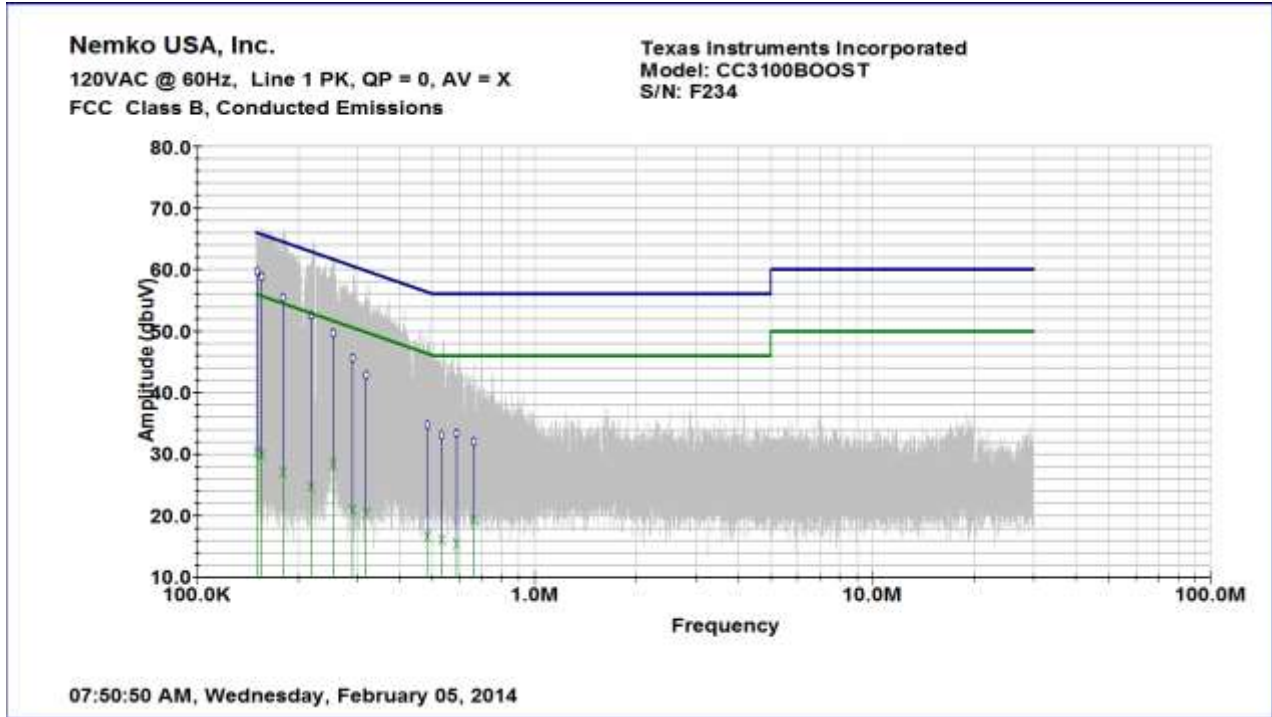
Test Conditions: 29 %RH
22 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: E1029-E1026

Test Data – Powerline Conducted Emissions

CC3100BOOST



Test Data – Powerline Conducted Emissions

CC3100BOOST

| Frequency | QP | Average | QP | Average | QP | Average | |
|-----------|-----------|-----------|--------|---------|--------|---------|------|
| | Corrected | Corrected | Limit | Limit | Margin | Margin | |
| kHz | (dBuV) | (dBuV) | (dBuV) | (dBuV) | (dB) | (dB) | Line |
| 151.1 | 59.8 | 30.3 | 66.0 | 55.9 | 6.2 | 25.6 | 1 |
| 155.9 | 58.9 | 29.9 | 65.8 | 55.7 | 6.9 | 25.8 | 1 |
| 179.9 | 55.5 | 27.0 | 65.1 | 54.5 | 9.6 | 27.5 | 1 |
| 218.3 | 52.6 | 24.7 | 64.0 | 52.9 | 11.4 | 28.2 | 1 |
| 253.5 | 49.7 | 28.4 | 63.0 | 51.6 | 13.3 | 23.2 | 1 |
| 289.3 | 45.6 | 21.0 | 62.0 | 50.5 | 16.4 | 29.5 | 1 |
| 317.4 | 42.9 | 20.3 | 61.2 | 49.8 | 18.3 | 29.5 | 1 |
| 481.3 | 34.8 | 16.7 | 56.5 | 46.3 | 21.7 | 29.6 | 1 |
| 531.0 | 33.2 | 16.1 | 56.0 | 46.0 | 22.8 | 29.9 | 1 |
| 587.1 | 33.5 | 15.4 | 56.0 | 46.0 | 22.5 | 30.6 | 1 |
| 660.8 | 32.1 | 19.4 | 56.0 | 46.0 | 23.9 | 26.6 | 1 |
| | | | | | | | |
| 157.8 | 18.7 | 13.0 | 65.8 | 55.6 | 47.1 | 42.6 | 2 |
| 170.1 | 27.1 | 15.9 | 65.4 | 55.0 | 38.3 | 39.1 | 2 |
| 193.9 | 25.7 | 13.6 | 64.7 | 53.9 | 39.0 | 40.3 | 2 |
| 222.9 | 28.5 | 13.9 | 63.9 | 52.7 | 35.4 | 38.8 | 2 |
| 246.0 | 32.1 | 19.1 | 63.3 | 51.9 | 31.2 | 32.8 | 2 |
| 290.6 | 37.3 | 24.1 | 62.0 | 50.5 | 24.7 | 26.4 | 2 |
| 328.7 | 35.0 | 17.4 | 60.9 | 49.5 | 25.9 | 32.1 | 2 |
| 356.6 | 31.6 | 15.6 | 60.1 | 48.8 | 28.5 | 33.2 | 2 |
| 438.3 | 22.2 | 11.3 | 57.8 | 47.1 | 35.6 | 35.8 | 2 |
| 1212.5 | 33.2 | 17.0 | 56.0 | 46.0 | 22.8 | 29.0 | 2 |

Section 9. Test Equipment List

| Asset Tag | Description | Manufacturer | Model | Serial # | Last Cal | Next Cal |
|-----------|--------------------------------------|---------------------|------------------------|------------|----------------------|-------------|
| 529 | Antenna, DRWG | EMCO | 3115 | 2505 | 31-Oct-2012 | 31-Oct-2014 |
| 901 | Preamplifier | Sonoma | 310 N | 130607 | 21-Nov-2013 | 21-Nov-2014 |
| E1019 | Two Line V- Network | Rohde & Schwarz | ENV216 | 101045 | 13-Apr-2013 | 13-Apr-2014 |
| E1026 | EMI Test Receiver 9kHz to 7GHz | Rohde & Schwarz | ESCI 7 | 100800 | 15-Jul-2013 | 15-Jul-2014 |
| 1016 | Preamplifier | Hewlett Packard | 8449A | 2749A00159 | 20-Aug-2013 | 20-Aug-2014 |
| 1036 | Spectrum Analyzer | Rohde & Schwartz | FSEK30 | 830844/006 | 15-Jul-2013 | 15-Jul-2015 |
| 1472 | Attenuator, 20dB, DC 18 Ghz | Omni Spectra | 20600-20db | | 31-Dec-1969 | |
| 1763 | Antenna, Bilog | Schaffner | CBL 6111D | 22926 | 07-Mar-2013 | 07-Mar-2014 |
| 1082 | Cable | Astrolab | 32027-2- 29024-72TC | None | Verify before use | NA |
| 1766 | Filter | Microlab | BRM50702 | 041 | Verify before use | NA |

ANNEX A - TEST DETAILS

| | |
|---|------------------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) / 7.2.4 |
|---|------------------------------|

Minimum Standard: Conducted limits.

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Conducted Emission (MHz) | Limit (dBmV) | |
|---------------------------------------|--------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

| | |
|---|-----------------------------------|
| NAME OF TEST: Maximum Peak Output Power | PARA. NO.: 15.247(b)(3) / A8.4(4) |
|---|-----------------------------------|

Minimum Standard: The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Measurement Method

5.2.1 Maximum Peak Conducted Output Power Level

§15.247(b)(3) specifies that the maximum peak conducted output power for DTS transmitters in any of the three authorized frequency bands is 1 watt (30 dBm). The following procedures can be used to determine the maximum peak conducted output power from a DTS EUT using a spectrum analyzer.

5.2.1.1 Measurement Procedure PK1:

1. This procedure requires availability of a spectrum analyzer resolution bandwidth that is \geq EBW.
2. Set the RBW \geq EBW.
3. Set VBW \geq 3 x RBW.
4. Set span = zero.
5. Sweep time = auto couple.
6. Detector = peak.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use peak marker function to determine the peak amplitude level within the fundamental emission.

5.2.1.2 Measurement Procedure PK2:

1. This procedure provides an integrated measurement alternative when the maximum available RBW < EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW = 3 MHz.
4. Set the span to a value that is 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges (for some analyzers, this may require a manual override to ensure use of peak detector). If the spectrum analyzer does not have a band power function, sum the spectrum levels (in linear power units) at 1 MHz intervals extending across the EBW of the spectrum.

5.2.2 Maximum Conducted (Average) Output Power Level

§15.247(b)(3) permits the maximum conducted output power to be measured as an alternative to a peak power measurement to demonstrate compliance to the one watt (30 dBm) output power limit. The maximum conducted output power is the highest total transmit power occurring in any mode when averaged over the EUT EBW. This measurement requires that the EUT be configured to transmit continuously (at a minimum duty cycle of 98%) at full power over the measurement duration. Time intervals during which the transmitter is off or transmitting at reduced power levels shall not be included.

The spectrum analyzer must be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW in order to ensure bin-to-bin spacing of \leq RBW/2 so that narrowband signals are not lost between frequency bins (the use of a greater number of measurement points than the minimum requirement is recommended).

The following procedures are acceptable for determining the maximum conducted output power with a spectrum analyzer.

5.2.2.1 Measurement Procedure AVG1 (power averaging over the EBW with slow sweep speed):

1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW \geq 3 MHz.
4. Detector = power average (RMS).
5. Ensure that the number of measurement points in the sweep \geq 2 x (span/RBW).
6. Manually set the sweep time to: \geq 10 x (number of measurement points in sweep) x (transmission symbol period).
7. Perform the measurement over a single sweep.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUT over the EBW.

Note: If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

5.2.2.2 Measurement Procedure AVG2 (trace averaging over the EBW):

1. Set the analyzer span to 5-30% greater than the EBW.
2. Set the RBW = 1 MHz.
3. Set the VBW \geq 3 MHz.
4. Ensure that the number of measurement points in the sweep \geq 2 x (span/RBW).
5. Sweep time = auto couple.
6. Detector = power averaging (RMS) or sample.
7. Employ trace averaging in power averaging (RMS) mode over a minimum of 100 traces.
8. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges to determine the maximum conducted output power of the EUT over the EBW. If the analyzer does not have a band power function, sum the spectral levels (in linear power units) at 1 MHz intervals extending across the entire EBW.

| | |
|----------------------------------|-----------------------------------|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 15.247(a)(2) / A8.2(a) |
|----------------------------------|-----------------------------------|

Minimum Standard: Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Method Of Measurement:

5.1.1 EBW Measurement Procedure:

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

5.1.2 Alternate EBW Measurement Procedure:

The automatic bandwidth measurement capability of a spectrum analyzer may be employed if it implements the functionality described above (e.g., RBW = 1-5% of EBW, VBW $\geq 3 \times$ RBW, peak detector with maximum hold). When using this capability, care should be taken to ensure that the bandwidth measurement is not influenced by any nulls in the fundamental emission.

Number of channels tested:

| Tuning range | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

| | |
|---|---------------------------|
| NAME OF TEST: Spurious Emissions(conducted) | PARA. NO.: 15.247(d)/A8.5 |
|---|---------------------------|

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

5.4.1.1 Measurement Procedure – Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Set the span to 5-30 % greater than the EBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW. Next, determine the power in 100 kHz band segments outside of the authorized frequency band using the following measurement:

5.4.1.2 Measurement Procedure - Unwanted Emissions

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize (this may take some time, depending on the extent of the span).

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified above.

Number of channels tested:

| Tuning range | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

| | |
|---|-------------------------|
| NAME OF TEST: Radiated Spurious Emissions | PARA. NO.: 15.209/7.2.2 |
|---|-------------------------|

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

| Frequency (MHz) | Field Strength (µV/m @ 3m) | Field Strength (dB @ 3m) |
|-----------------|----------------------------|--------------------------|
| 30 - 88 | 100 | 40.0 |
| 88 - 216 | 150 | 43.5 |
| 216 - 960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

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15.205 Restricted Bands

| MHz | MHz | MHz | GHz |
|-------------------|---------------------|---------------|-------------|
| 0.09-0.11 | 16.42-16.423 | 399.9-410 | 4.5-5.25 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.125-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2655-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | 1718 | | |

Number of channels tested:

| Tuning range | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

| | |
|---|------------------------------|
| NAME OF TEST: Transmitter Power Density | PARA. NO.: 15.247(d)/A8.2(b) |
|---|------------------------------|

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method of Measurement:

5.3.1 Measurement Procedure PKPSD:

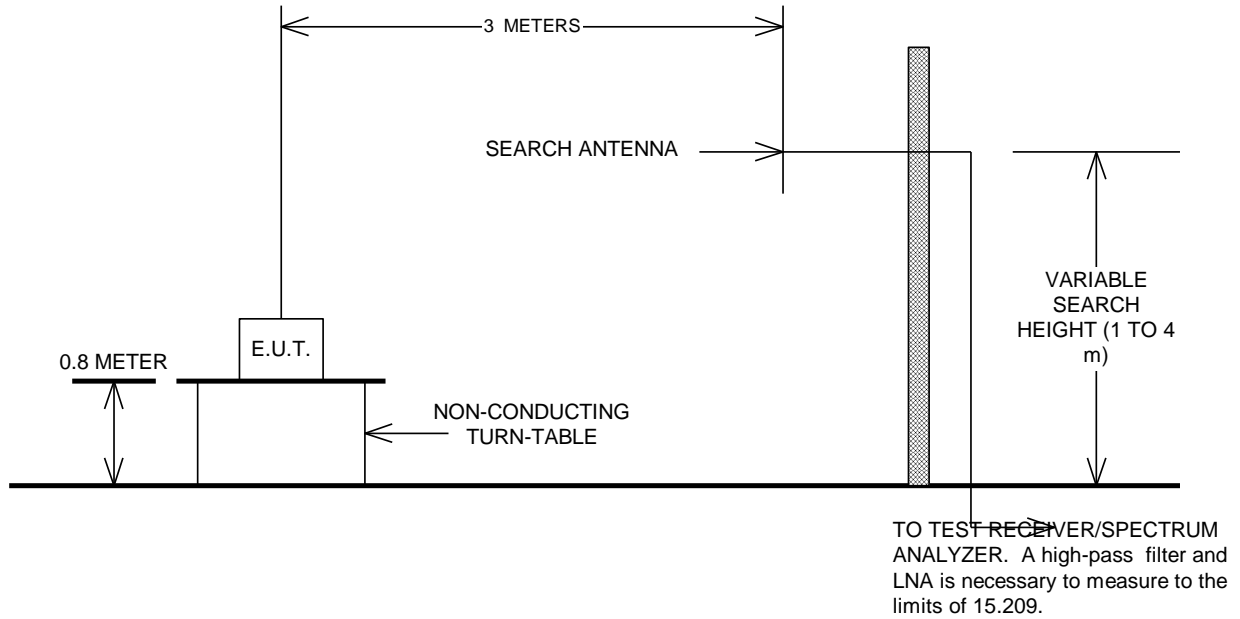
1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 100 kHz.
3. Set the VBW \geq 300 kHz.
4. Set the span to 5-30 % greater than the EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent value in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3\text{ kHz}/100\text{ kHz} = -15.2\text{ dB})$.
11. The resulting peak PSD level must be \leq 8 dBm.

5.3.2 Measurement Procedure AVGPSD:

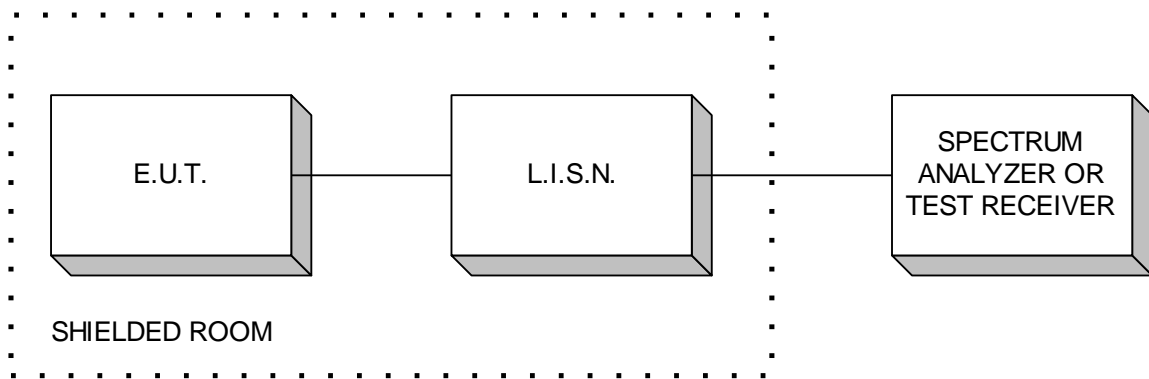
1. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
2. Set the analyzer span to 5-30% greater than the EBW.
3. Set the RBW = 100 kHz.
4. Set the VBW \geq 300 kHz.
5. Detector = power average (RMS).
6. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$ (use of a greater number of measurement points than this minimum requirement is recommended).
7. Manually set the sweep time to: $\geq 10 \times (\text{number of measurement points in sweep}) \times (\text{transmission symbol period})$.
8. Perform the measurement over a single sweep.
9. Use the peak marker function to determine the maximum level in any 100 kHz band segment within the fundamental EBW.
10. Scale the observed power level to an equivalent level in 3 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log(3\text{ kHz}/100\text{ kHz} = -15.2\text{ dB})$.
11. The resulting PSD level must be \leq 8 dBm

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions



Conducted Emissions



Peak Power at Antenna Terminals
Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)

