



2.4 GHz WLAN (DTS Systems) FCC Test Report

FOR:
Embedded Wireless

Model Name: MPES1

**Product Description: Portable neck worn wireless device with GSM/GPRS/EDGE,
UMTS and WIFI radio**

FCC ID: R42MPES1

47 CFR Part 2, 15.247

TEST REPORT #: EMC_EMBED_019_14001_15.247_DTS_WLAN_rev3
DATE: 2015-1-13



FCC listed
A2LA Accredited

IC recognized #
3462E

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations. No deviations were ascertained.

Company	Description	Model #
Embedded Wireless	Portable neck worn wireless device with GSM/GPRS/EDGE, UMTS and WIFI radio	MPES1

Responsible for Testing Laboratory:

2014-1-13 Compliance Milton Ponce Deleon
(Manager Compliance)

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Date: 2015.01.14 11:27:18
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Date	Section	Name	Signature
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Responsible for the Report:

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(EMC Test Engineer)

Muhammad
Umair Anees

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Anees@cetecom.com
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Date	Section	Name	Signature
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The test results of this test report relate exclusively to the test item specified in Section3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
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Compliance Manager:	Milton Deleon
Responsible Project Leader:	Muhammad Anees

2.2 Identification of the Client

Applicant's Name:	Embedded Wireless Labs Sdn Bhd
Street Address:	702, Level 7, Uptown 2, 2, Jalan SS21/37, Damansara Uptown
City/Zip Code	Petaling Jaya, Selangor
Country	Malaysia
Contact Person:	Ken, Anand, Pragash
Phone No.	60376609787
Fax:	60376609786
e-mail:	pragash@embeddedwireless.com

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Applicant
Manufacturers Address:	---
City/Zip Code	---
Country	---

3 Equipment under Test (EUT)

3.1 Specification of the Equipment under Test

Marketing Name:	Pendant, mPERS Pendant, SPERS
Model Number:	MPES1
FCC-ID :	R42MPES1
Product Description:	Portable neck worn wireless activity monitor device equipped with pre-certified multiband 3G module and pre-certified 2.4GHz WLAN/BT combo module (BT function permanently de-activated in the host device under assessment)
Technology / Type(s) of Modulation:	2.4 GHz IEEE 802.11 b/g/n: CCK, BPSK, QPSK
Modes of Operation	IEEE 802.11 b/g/n , client only
Channel Bandwidths	20MHz (HT20)
Operating Frequency Ranges (MHz) / Channels:	Nominal band: 2400 – 2483.5; Center to center with HT20: 2412(ch 1) – 2462(ch 11), 11 channels
Antenna Information as declared:	internal, monopole, -0.6dBi
Power Supply/ Rated Operating Voltage Range:	battery; Vmin: 3.5V dc/ Vnom: 3.85V dc / Vmax: 4.2V dc
Rated Operating Temperature Range:	0°C ~ +35°C
Test Sample Status:	Prototype

3.2 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	Sample	HW/SW Version
1	5.19	Radiated	V1R5/V1.4
2	5.28	Conducted	V1R5/V1.4

3.3 Environmental conditions during Test:

The following environmental conditions were maintained during the course of testing:

Ambient Temperature: 20-25°C

Relative humidity: 40-60%

3.4 Dates of Testing:

10/6/2014 – 10/8/2014

3.5 Test modes of operation:

The below listed worst case test modes of operation have been established from the output power measurement and evaluation of long term test data available to the lab for the different data rates and modulations which are supported by the equipment.

Modes of Operation		Data rate (Mbps)	Modulation Scheme
2.4 GHz	802.11b	1.0	BPSK
	802.11g	6.0	BPSK
	802.11n (20 MHz)	MCS0: 6.5	BPSK

The device was configured with a manufacturer provided test SW, capable of setting the unit in different supported modulation schemes, data rates and channels of operation.

The Device was set to continuous framed Tx (burst) mode per test SW and could thus be operated with > 98% duty cycle during testing.

The EUT was tested on low, mid and high channels (2.4GHz) in 802.11b, 802.11g, and 802.11n (HT20) modes (n-mode is used with 20 MHz channel bandwidth (HT20) only).

4 Subject Of Investigation

The objective of the measurements applied by Cetecom Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations.

This test report is to support a request for new equipment authorization under the FCC ID **R42MPES1**. All testing was performed on the product referred to in Section 3 as EUT.

5 Summary of Measurement Results

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§15.247(e)	Power Spectral Density	Nominal	802.11b 802.11g 802.11n	■	□	□	□	Complies
§15.247(a)(1)	Emission Bandwidth	Nominal	802.11b 802.11g 802.11n	■	□	□	□	Complies
§15.247(b)(3)	Maximum Peak Conducted Output Power	Nominal	802.11b 802.11g 802.11n	■	□	□	□	Complies
§15.247(d)	Band edge compliance	Nominal	802.11b 802.11g 802.11n	■	□	□	□	Complies
§15.247(d)	TX Spurious emissions-Conducted	Nominal	802.11b 802.11g 802.11n	□	□	□	■	See Note
§15.247(d) §15.209(a)	TX Spurious emissions-Radiated	Nominal	802.11b 802.11g 802.11n	■	□	□	□	Complies
§15.207(a)	AC Conducted Emissions <30MHz	Nominal	802.11b 802.11g 802.11n	□	□	■	□	-

NA= Not Applicable; NP= Not Performed.

Note: Conducted spurious emissions test against non-restricted band limits is NOT PERFORMED since radiated spurious emissions against more stringent restricted band limits over the complete measurement range (9kHz to 40GHz) is passed.

6 Measurements

6.1 Radiated Measurement Procedure

ANSI C63.10 (2009) Section 8.3.1.1: Exploratory radiated emission measurements

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT. At near distances, for EUTs of comparably small size, it is relatively easy to determine the spectrum signature of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. A shielded room may be used for exploratory testing, but may have anomalies that can lead to significant errors in amplitude measurements.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed in an OATS with strong ambient signals. Caution should be taken if either antenna height between 1 and 4 meters or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.

The EUT should be set up in its typical configuration and arrangement, and operated in its various modes. For tabletop systems, cables or wires should be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions.

For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A step-by-step technique for determining this emission can be found in Annex C.

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually positioning the antenna close to the EUT and by moving the antenna over all sides of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz. If the EUT is a device with dimensions approximately equal to that of the measurement antenna beamwidth, the measurement antenna shall be aligned with the EUT.

ANSI C63.10 (2009) Section 8.3.1.2: Final radiated emission measurements

Based on the measurement results in 8.3.1.1, the one EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit is selected for the final measurement. The final measurement is then performed on a site meeting the requirements of 5.3, 5.4, or 5.5 as appropriate without variation of the EUT arrangement or EUT mode of operation. If the EUT is relocated from an exploratory test site to a final test site, the highest emission shall be remaximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarity and EUT azimuth are to be varied. In addition, the full frequency spectrum (for the range to be checked for meeting compliance) shall be investigated.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency spectrum investigation, particular focus should be made on those frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full spectrum test constitutes the compliance measurement.

For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the “cone of radiation” from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. The antenna may have to be higher or lower than the EUT, depending on the EUT’s size and mounting height, but the antenna should be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. If the transmission line for the measurement antenna restricts its range of height and polarization, the steps needed to ensure the correct measurement of the maximum emissions, shall be described in detail in the report of measurements. Data collected shall satisfy the report requirements of Clause 10.

NOTES

- 1— Where limits are specified by agencies for both average and peak (or quasi-peak) detection, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
- 2—Use of waveguide and flexible waveguide may be necessary at frequencies above 10 GHz to achieve usable signal-to noise ratios at required measurement distances. If so, it may be necessary to restrict the height search of the antenna, and special care should be taken to ensure that maximum emissions are correctly measured.
- 3—All presently known devices causing emissions above 10 GHz are physically small compared with the beam-widths of typical horn antennas used for EMC measurements. For such EUTs and frequencies, it may be preferable to vary the height and polarization of the EUT instead of the receiving antenna to maximize the measured emissions.

Radiated Measurement Uncertainty: ±3dB

6.1.1 Sample Calculations for Radiated Measurements

Measurements from the Spectrum Analyzer/ Receiver are used to calculate the Field Strength, taking into account the following parameters:

1. Measured reading in dB μ V
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

FS (dB μ V/m) = Measured Value on SA (dB μ V)+ Cable Loss (dB)+ Antenna Factor (dB/m)

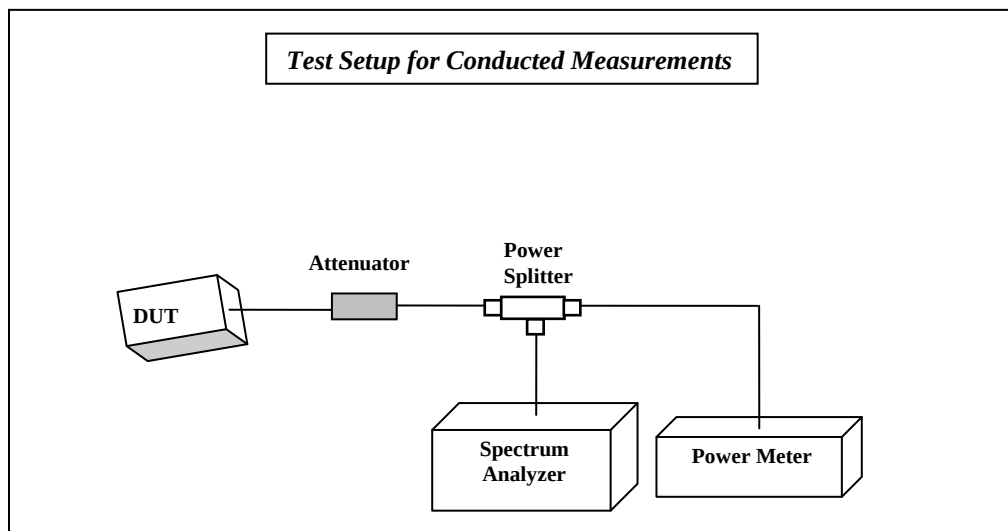
Eg:

Frequency (MHz)	Measured SA (dB μ V)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dB μ V/m)
1000	80.5	3.5	14	98.0

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the above equation.

6.2 RF Conducted Measurement Procedure

Measurement is according to FCC KDB 558074 D01 DTS Measurement Guidance v03r02. Test setup is shown below.



1. Connect the EUT to a PC equipped with WIFI test tool through USB cable.
2. Connect the EUT conducted port for Bluetooth/WIFI to the input of the spectrum analyzer as shown in the test setup above.
3. Enter test commands to set a specific WIFI test channel and verify on the spectrum analyzer.
4. Measurements are to be performed with the EUT set to the low, middle and high channels.

6.3 Maximum Conducted Output Power**6.3.1 Limits:**

FCC §15.247 (b)(3): 1W

6.3.2 Test Conditions:

Tnom: 21°C; Vnom: 3.85V

6.3.3 Test Procedure

Measurements are according to FCC KDB 558074 D01 DTS v03r02 section 9.2.1. §15.247 permits the maximum (average) conducted output power to be measured as an alternative to the maximum peak conducted output power. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth.

Spectrum Analyzer settings:**Maximum Average Output Power**

Span = 1.5 times the OBW.

RBW = 1-5 % of the OBW not to exceed 1 MHz

VBW $\geq$ 3xRBW

Sweep = auto

Detector function = RMS

Trace = Average of 100 traces

Use integrated band power method. Set channel bandwidth $\geq$ OBW bandwidth of the emission being measured.

OBW values are given in section 6.4

6.3.4 Test Result: 2.4 GHz Band

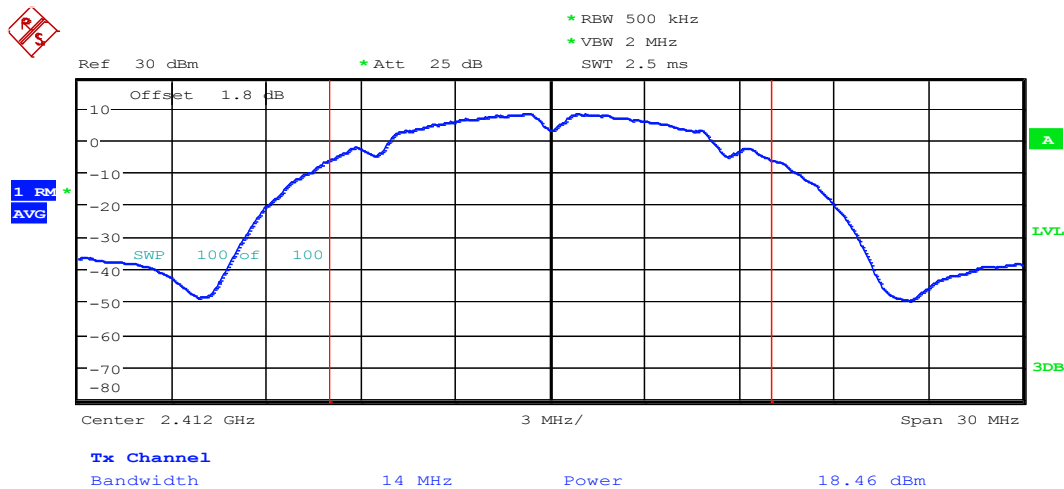
Measured Maximum Average Conducted Output Power (dBm)			
Mode	Frequency (MHz)		
	2412 Channel 1	2437 Channel 6	2462 Channel 11
802.11b	18.46	18.39	18.59
802.11g	16.06	16.03	16.08
802.11n /MCS0 (20 MHz)	15.96	15.96	15.99

6.3.5 Test Verdict:

Passed

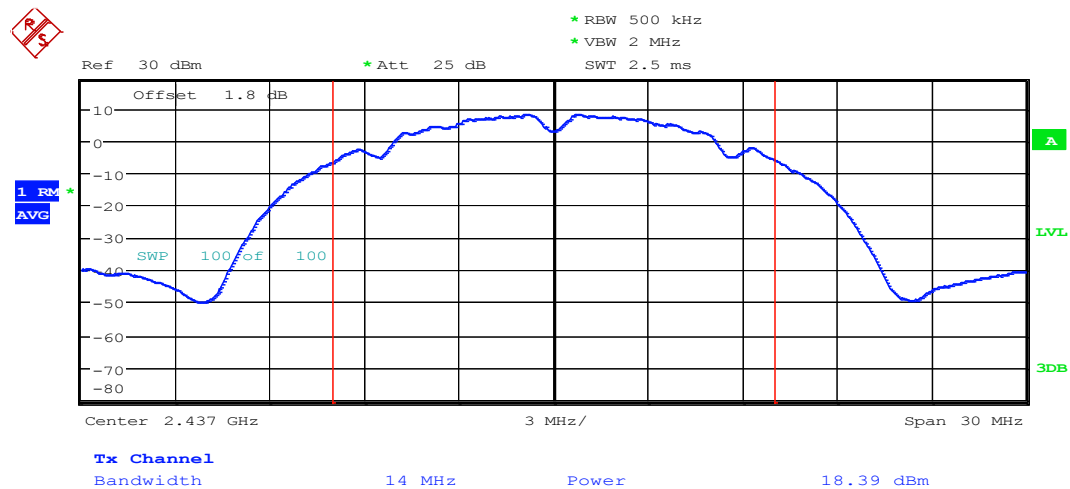
6.3.6 Test Data/plots: 2.4 GHz Band

Average Conducted Power 802.11b 2412 MHz



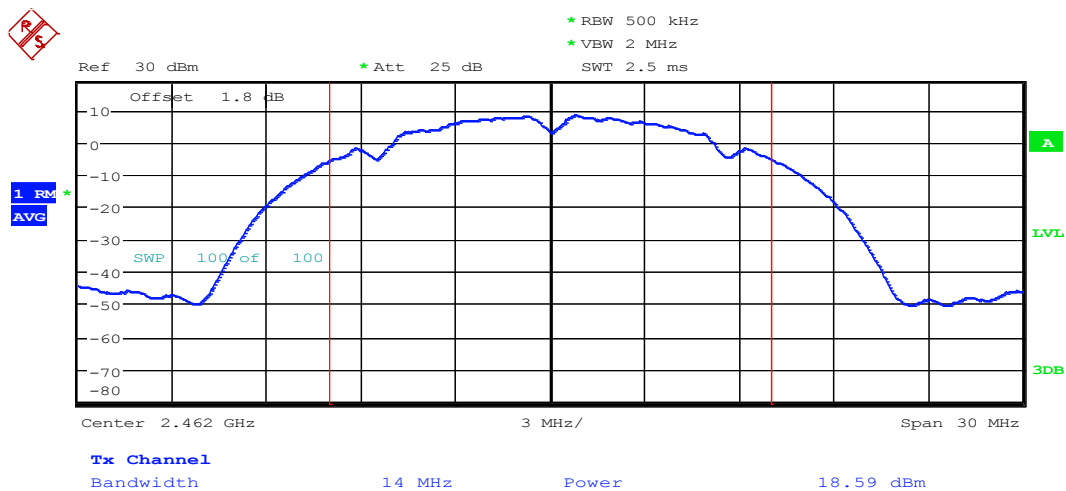
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Average Conducted Power 802.11b 2437 MHz



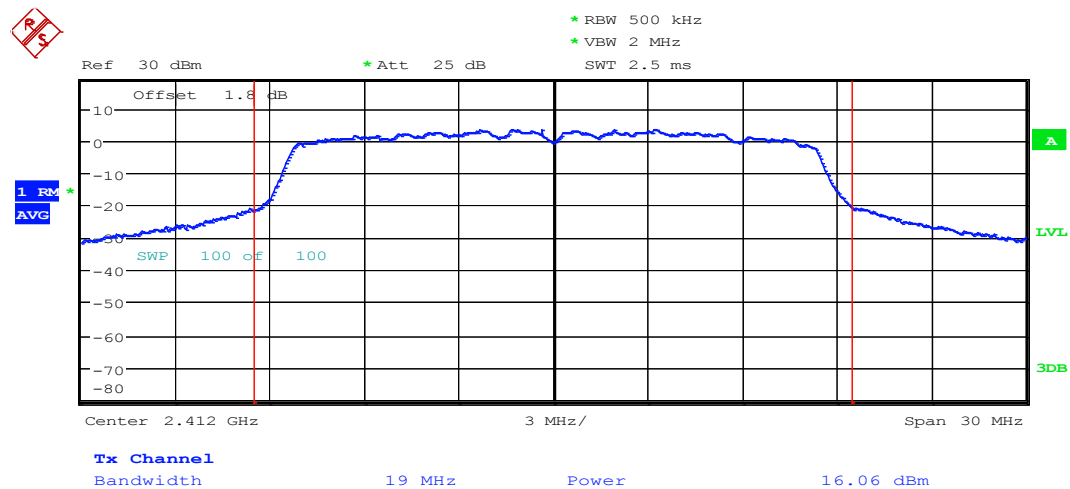
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Average Conducted Power 802.11b 2462 MHz



Date: 7.JAN.2015 12:11:29

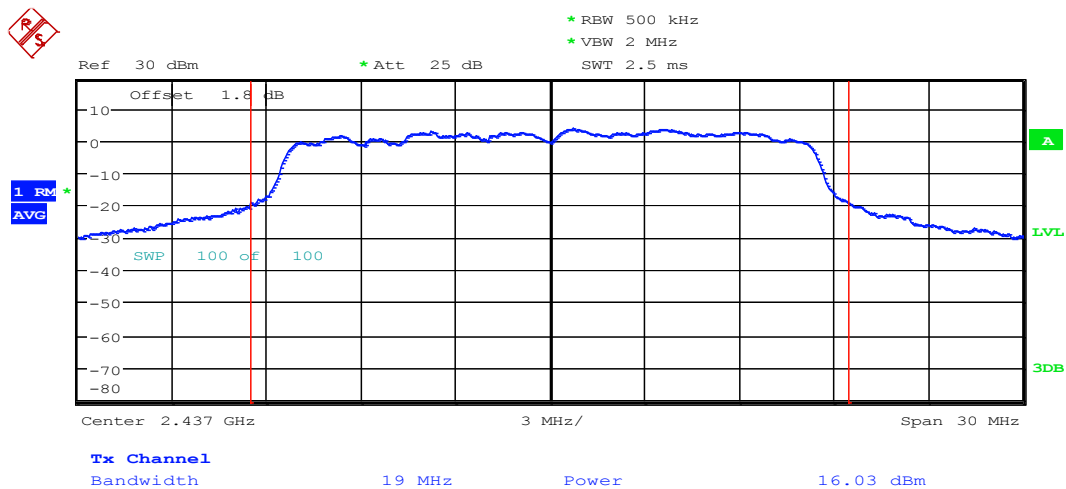
Average Conducted Power 802.11g 2412 MHz



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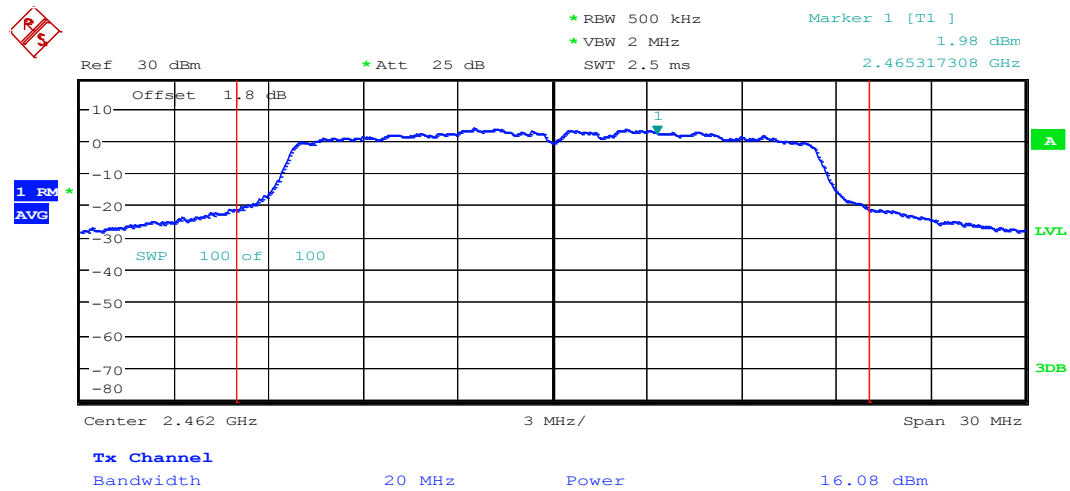


Average Conducted Power 802.11g 2437 MHz



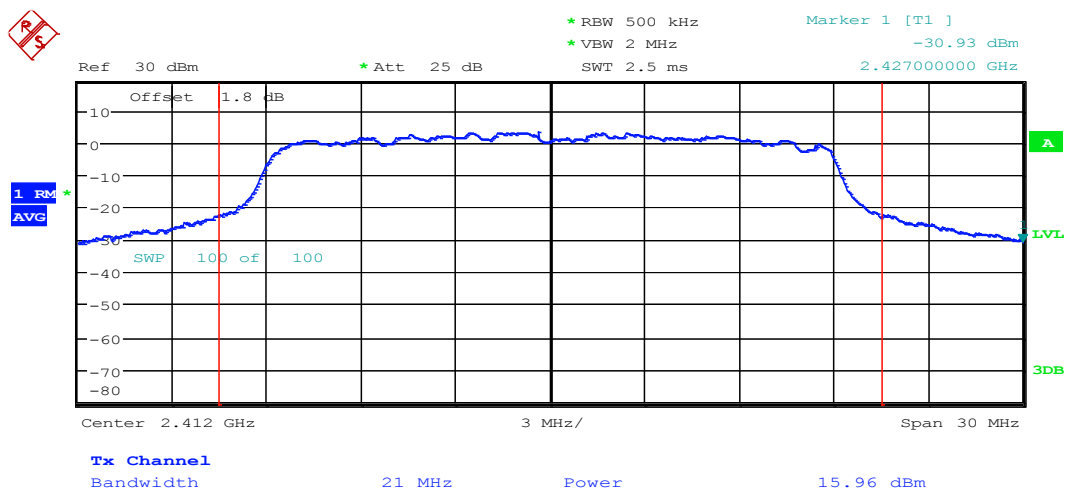
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Average Conducted Power 802.11g 2462 MHz



Date: 7.JAN.2015 12:17:21

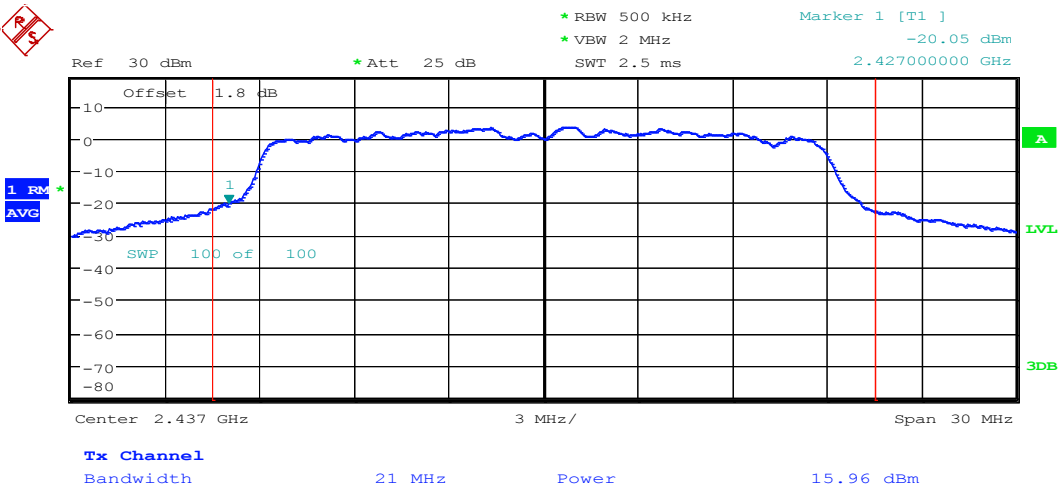
Average Conducted Power 802.11n-MCS0 (20MHz) 2412 MHz



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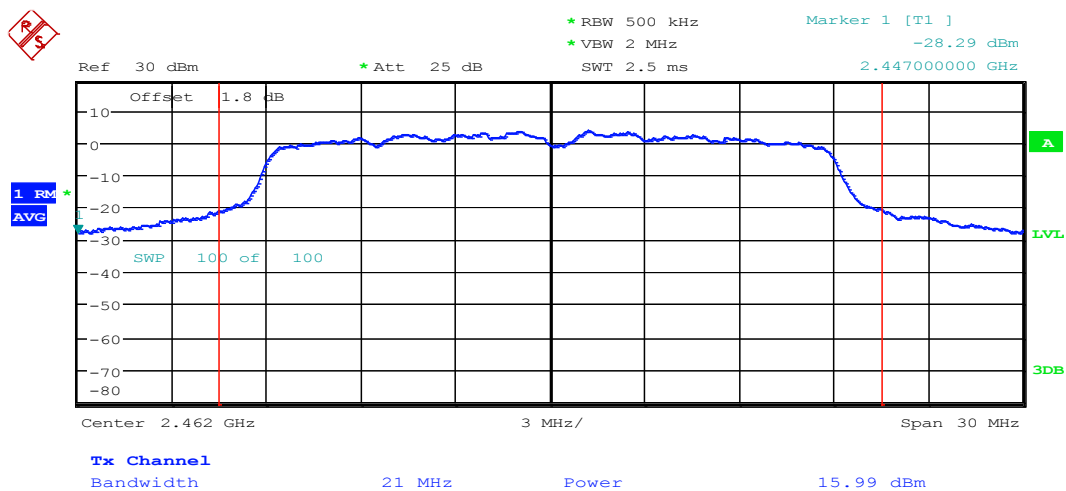


Average Conducted Power 802.11n-MCSO (20MHz) 2437 MHz



Date: 7.JAN.2015 12:21:21

Average Conducted Power 802.11n-MCSO (20MHz) 2462 MHz



Date: 7.JAN.2015 12:22:41

6.4 Occupied Bandwidth (20dB & 99%)**6.4.1 Limits:****§15.247 (a)(2)**

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.

6.4.2 Test Conditions:

Tnom: 22 °C; Vnom: 3.8V

6.4.3 Measurement procedure:

Measurement according to 558074 D01 DTS Meas Guidance v03r02 section 8.2 for the 6dB bandwidth and with the 99% bandwidth function of the spectrum analyzer.

Spectrum Analyzer settings:

Span= 2 to 5 x the occupied BW

RBW= 1% to 5 % of the occupied BW, unless otherwise specified

VBW≥ 3xRBW, Detector: Peak- Max hold;

Sweep Time: Auto

Allow the trace to stabilize

6.4.4 Test Result: 2.4 GHz Band

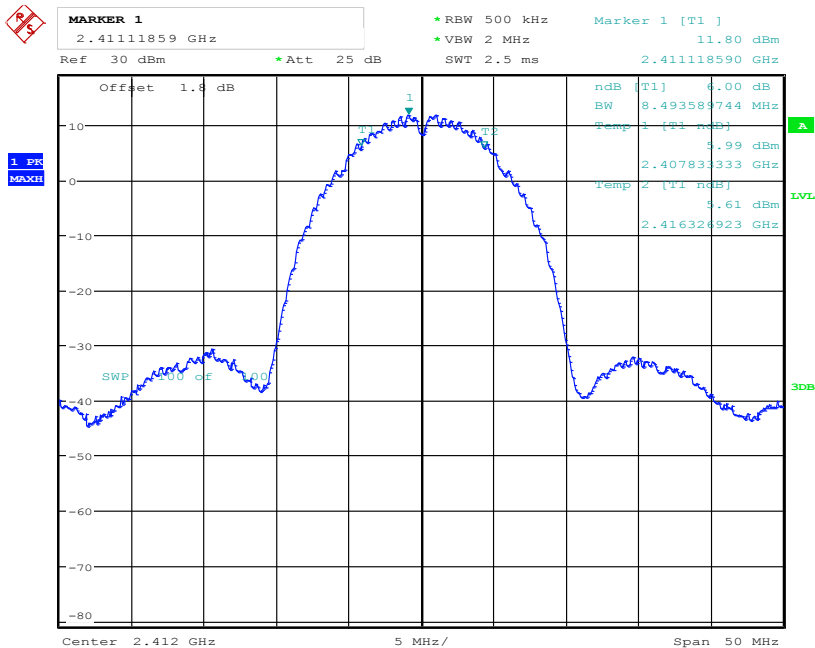
Occupied Bandwidth (MHz)						
Mode	Frequency (MHz)					
	2412 Channel 1		2437 Channel 6		2462 Channel 11	
	6dB	99%	6dB	99%	6dB	99%
802.11b	8.4	13.7	8.57	13.78	8.57	13.86
802.11g	16.26	18.58	16.3	18.5	16.64	20.2
802.11n (20MHz)	17.46	19.87	17.38	19.63	17.46	21.1
Measurement Uncertainty: ±100 kHz						

6.4.5 Measurement Result

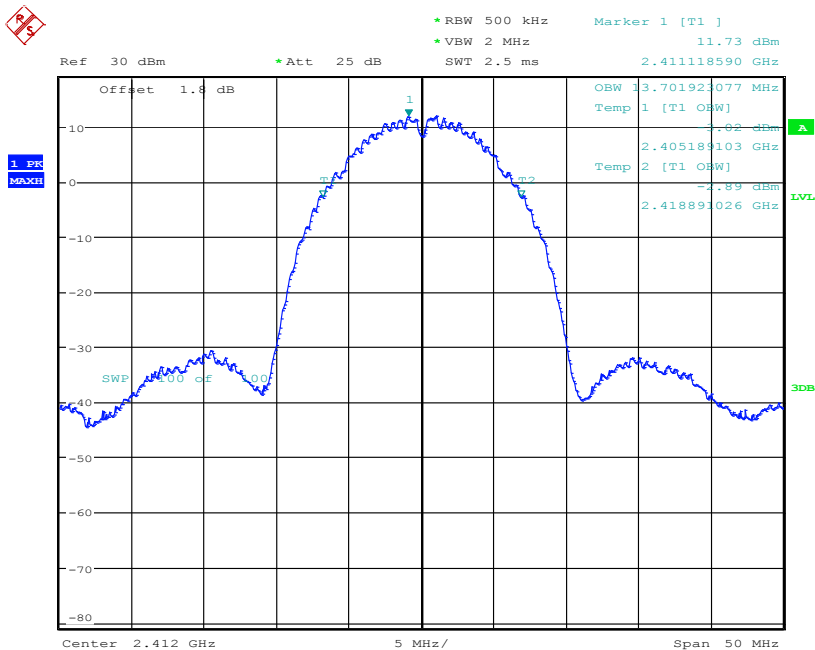
Pass.

6.4.6 Test Data/plots: 2.4 GHz Band

6dB & 99% Bandwidth 802.11b 2412 MHz

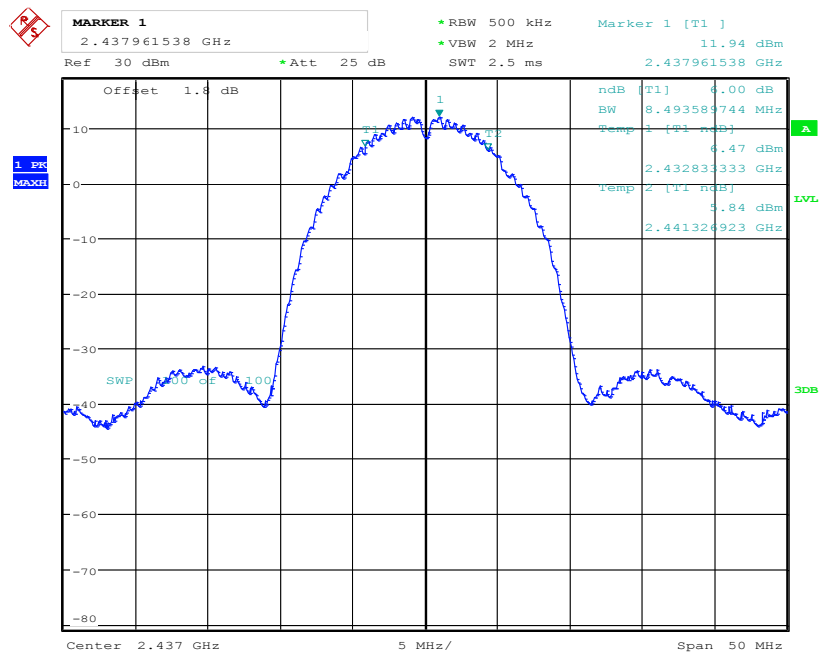


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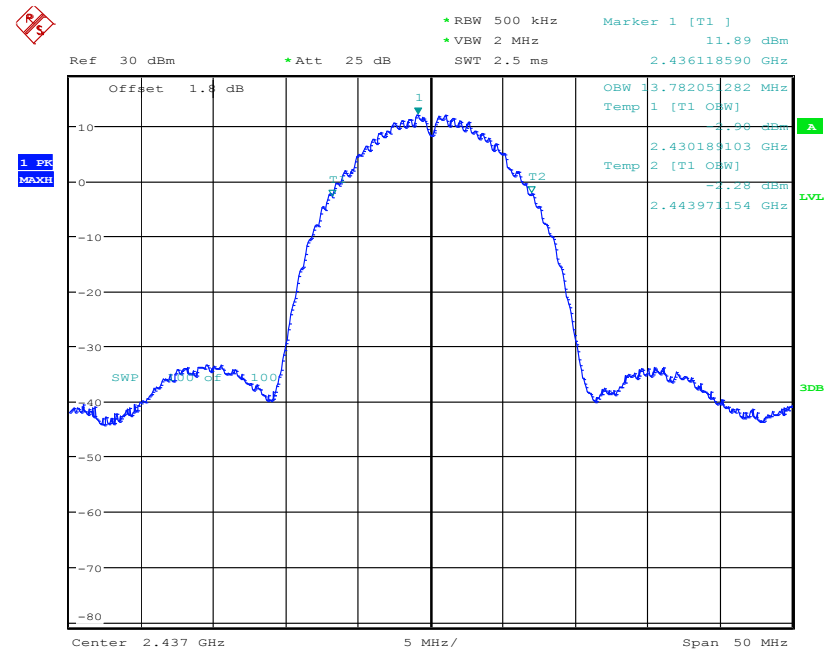


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6dB & 99% Bandwidth 802.11b 2437 MHz

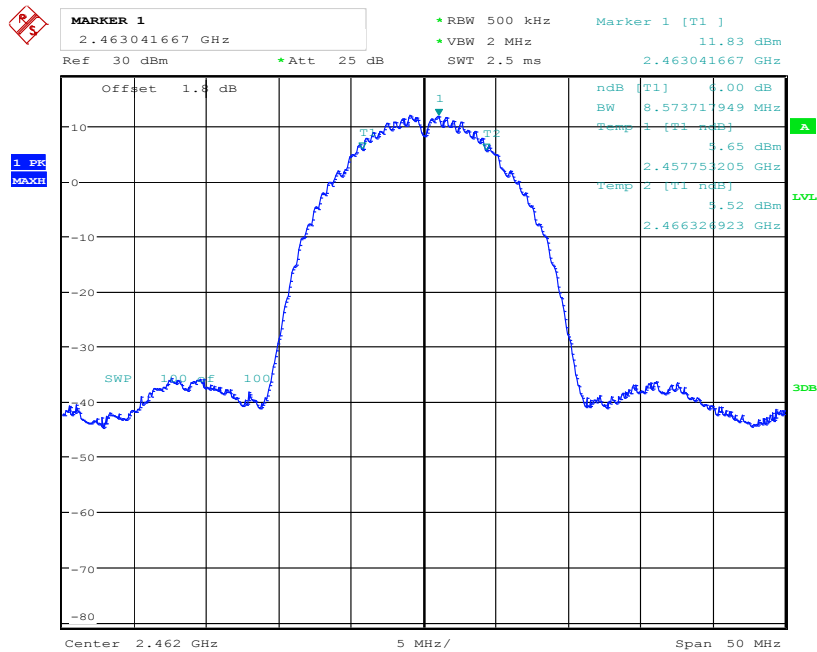


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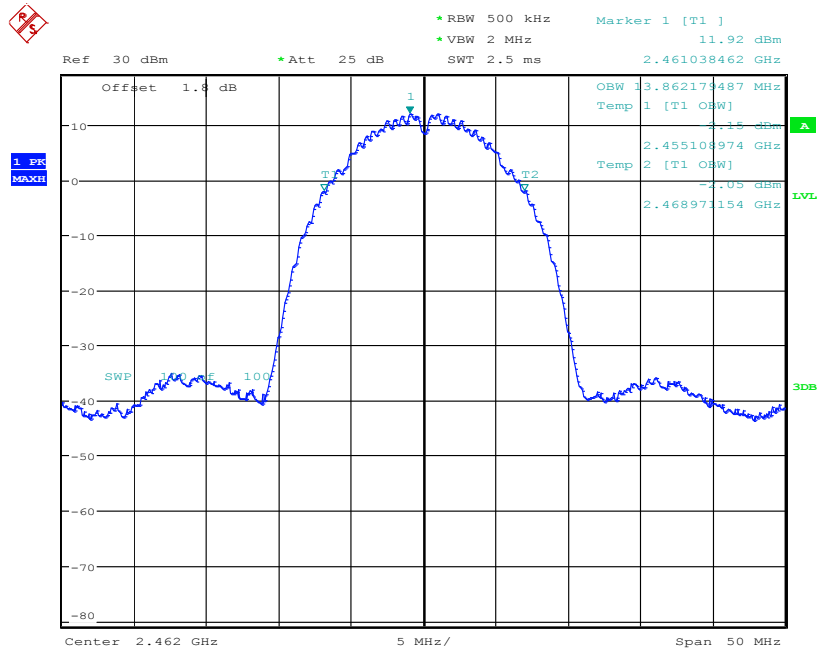


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6dB & 99% Bandwidth 802.11b 2462 MHz

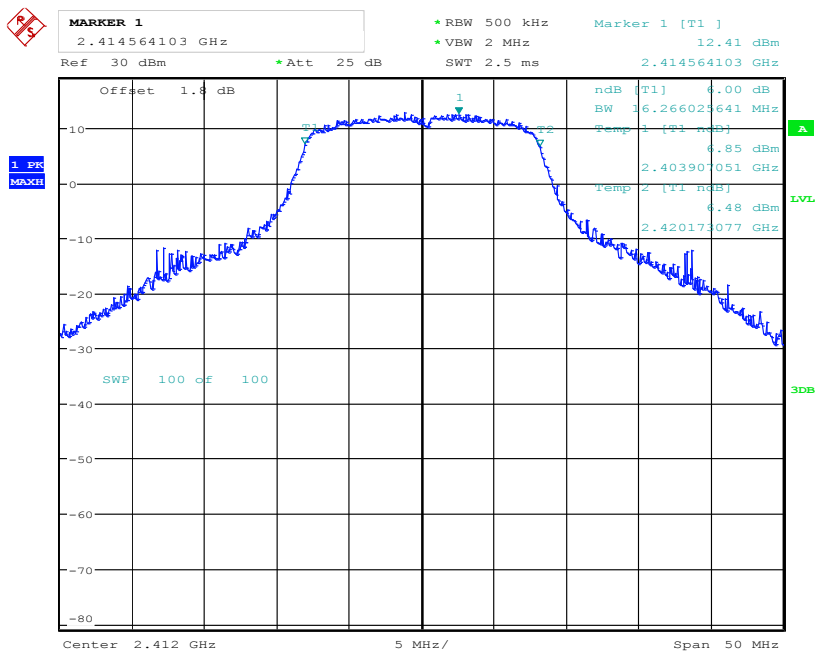


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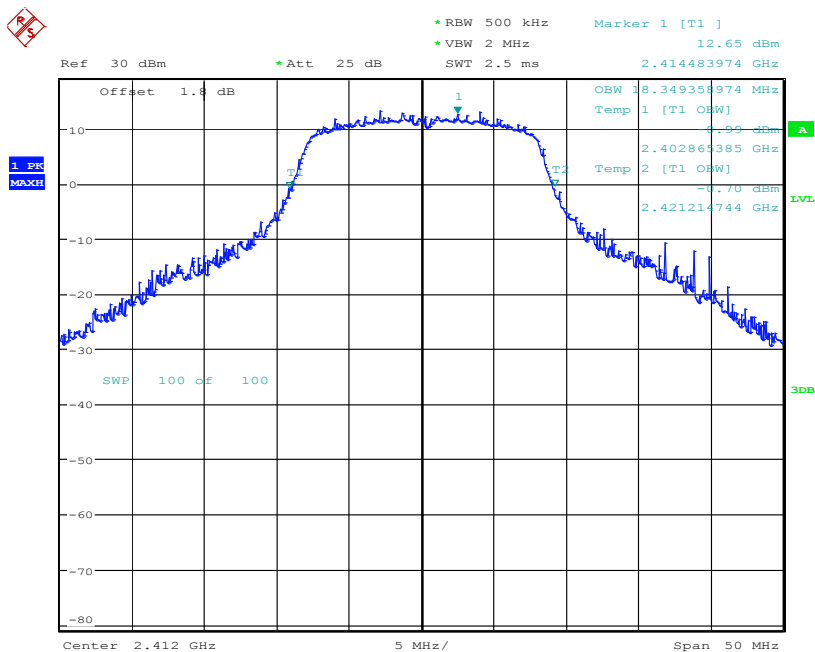


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6dB & 99% Bandwidth 802.11g 2412 MHz



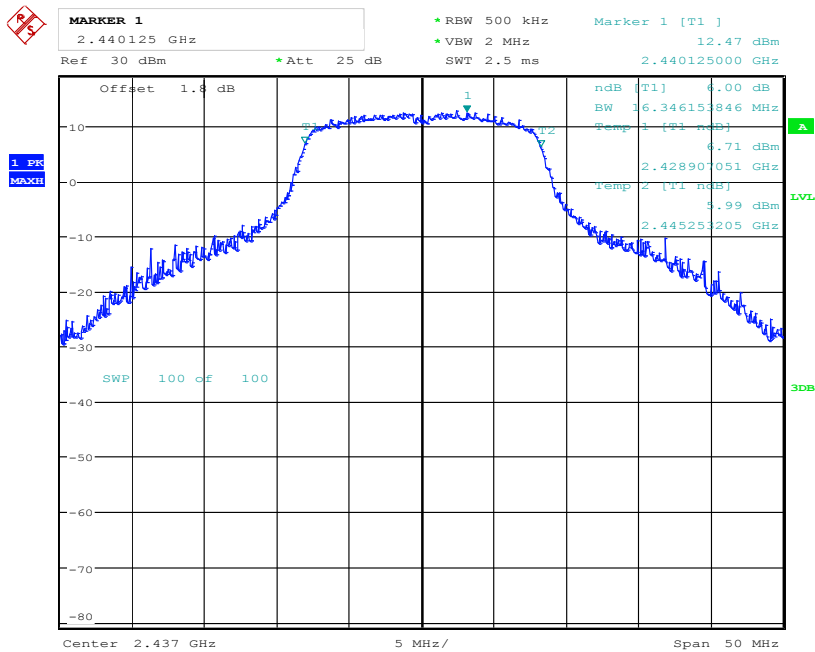
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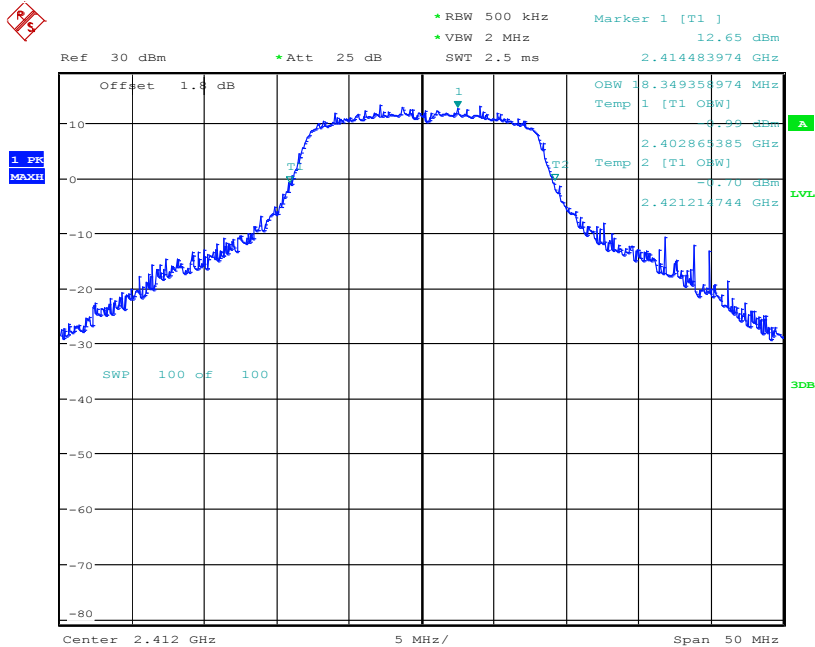
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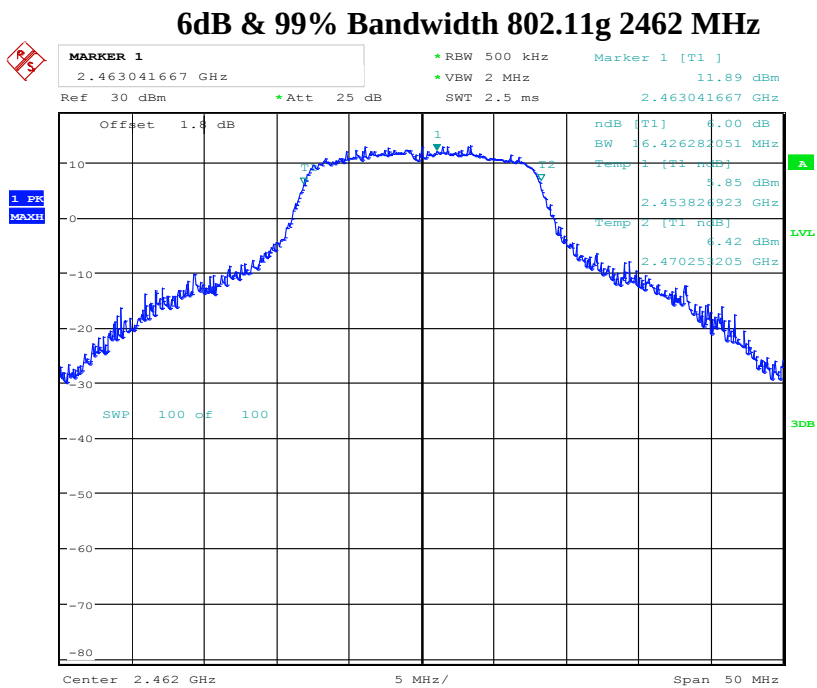
6dB & 99% Bandwidth 802.11g 2437 MHz



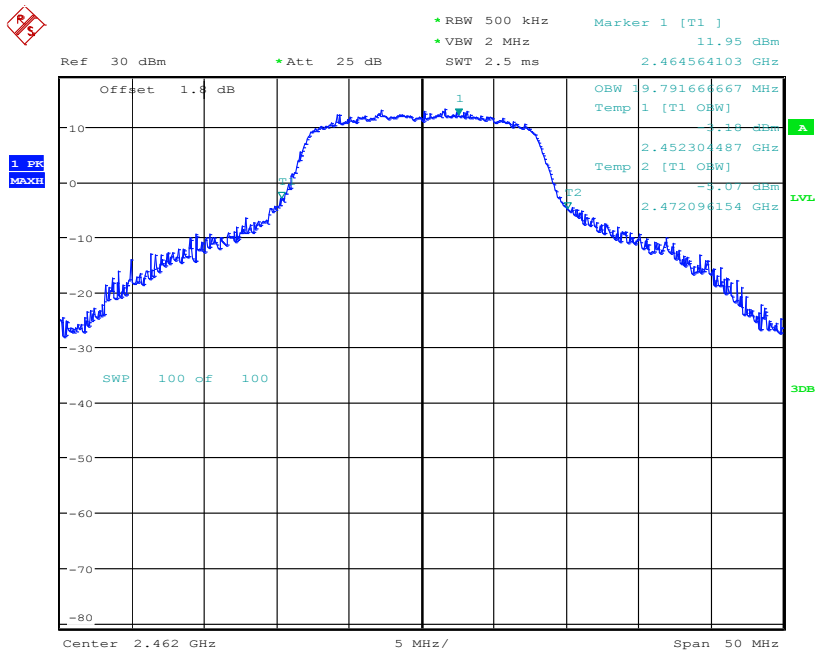
Date: 7.JAN.2015 11:32:07



Date: 7.JAN.2015 11:28:50



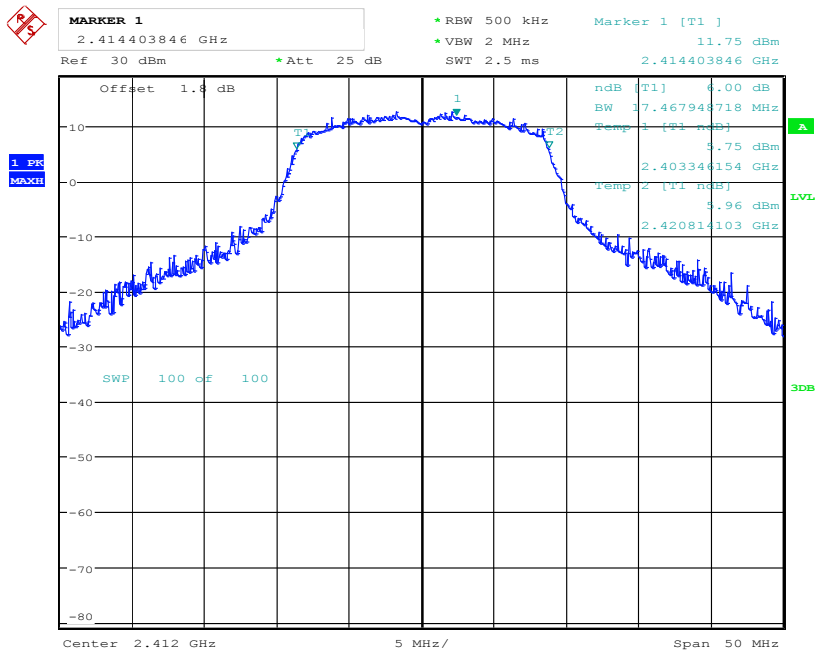
Date: 7.JAN.2015 11:35:47



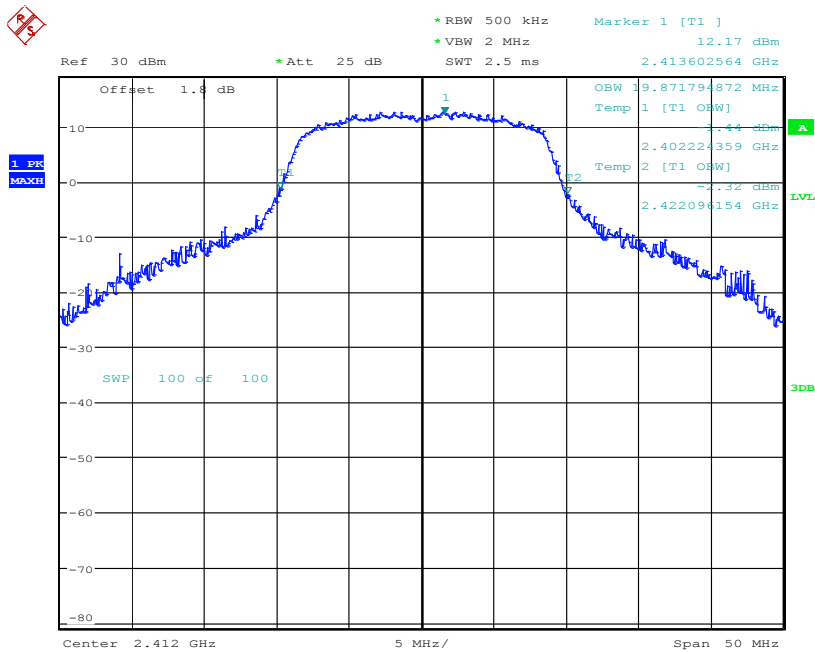
Date: 7.JAN.2015 11:33:56



6dB & 99% Bandwidth 802.11n -MCS0 (20 MHz) 2412 MHz



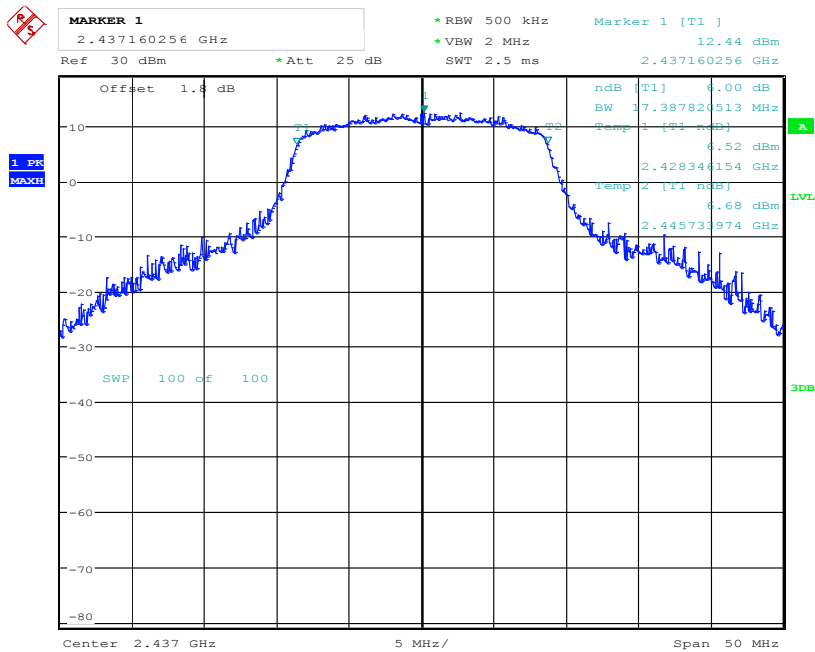
Date: 7.JAN.2015 11:42:10



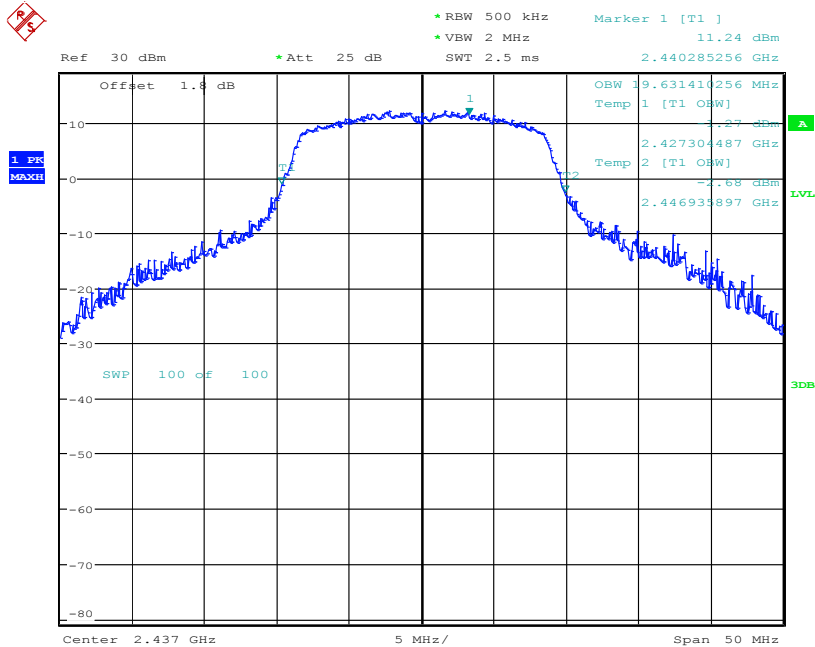
Date: 7.JAN.2015 11:40:20



6dB & 99% Bandwidth 802.11n -MCS0 (20 MHz) 2437 MHz

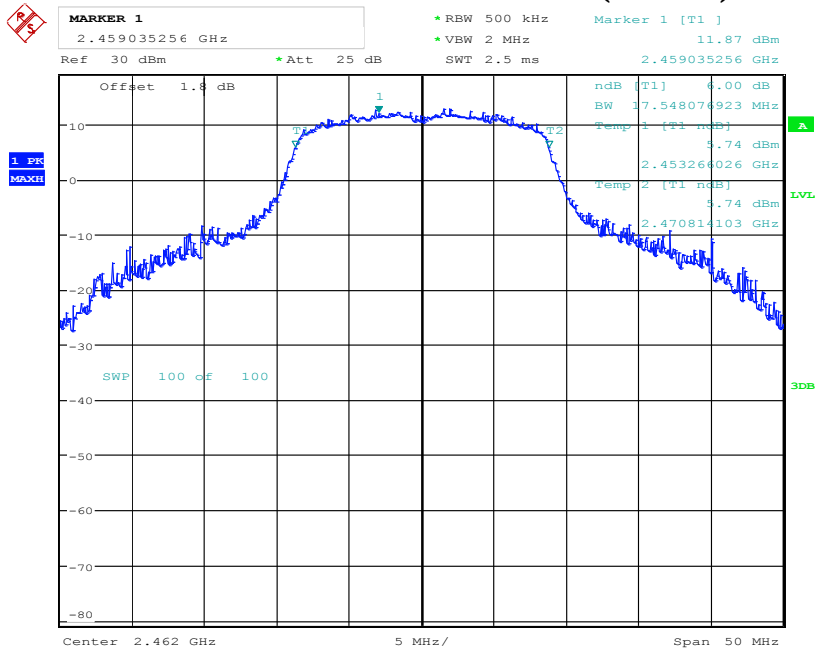


Date: 7.JAN.2015 11:44:24

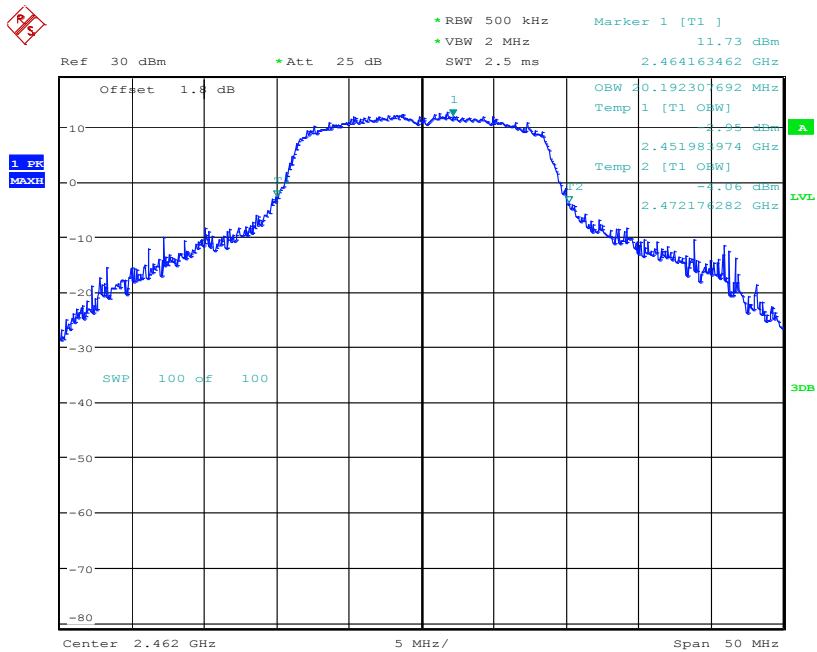


Date: 7.JAN.2015 11:43:28

6dB & 99% Bandwidth 802.11n -MCS0 (20 MHz) 2462 MHz



Date: 7.JAN.2015 11:47:54



Date: 7.JAN.2015 11:46:03

6.5 Power Spectral Density**6.5.1 Limits:****§ 15.247 (e)**

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

6.5.2 Test Conditions:

Tnom: 22 °C; Vnom: 3.8V

6.5.3 Measurement procedure:

Measurement according to FCC KDB 558074 D01 DTS v03r02 section 10.3

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 x the DTS BW
3. Set the RBW=100 kHz, VBW $\geq 3 \times$ RBW and sweep time = auto.
4. Trace mode = Average of 100 traces
5. Detector = RMS
6. Allow trace to fully stabilize and use peak marker function to determine the highest level as the PSD.

6.5.4 Test Data: 2.4 GHz Band

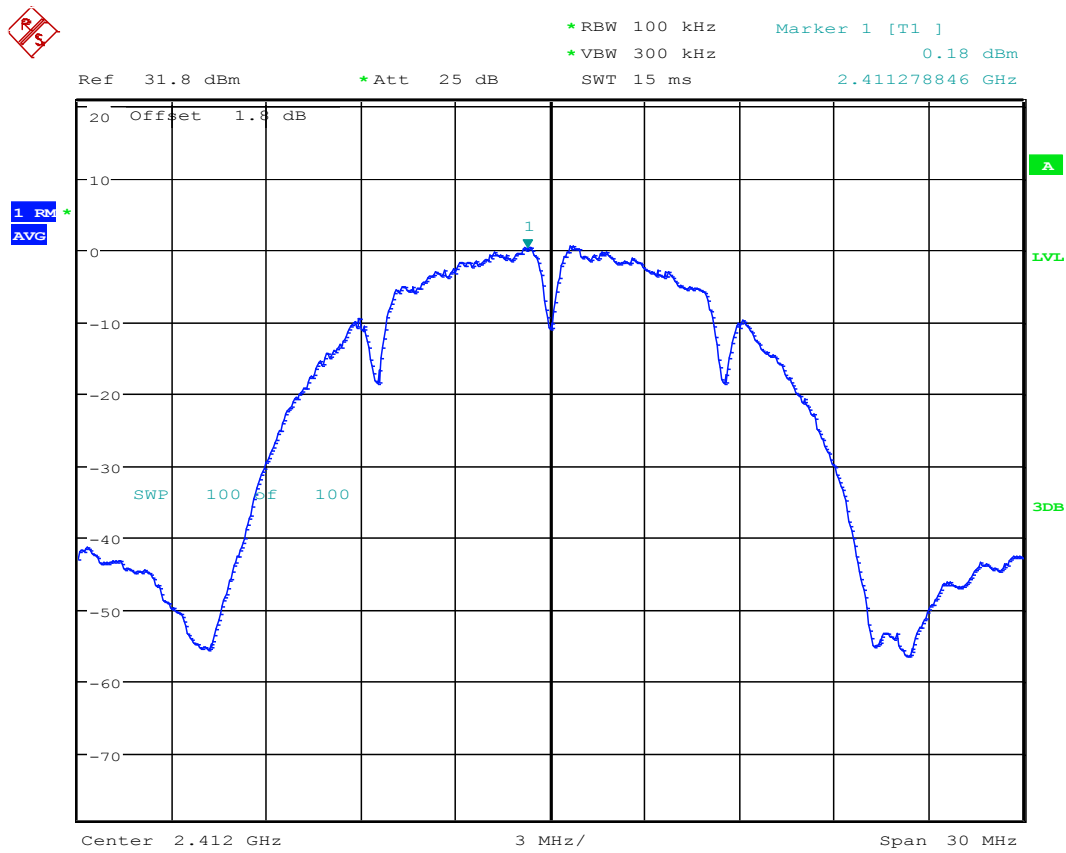
Power Spectral Density (dBm)			
Mode	Frequency (MHz)		
	2412 Channel 1	2437 Channel 6	2462 Channel 11
802.11b	0.18	0.71	0.66
802.11g	-2.74	-3.16	-3.13
802.11n	-2.91	-3.53	-3.9

6.5.5 Measurement Result

Pass.

6.5.6 Measurement Plots: 2.4 GHz Band

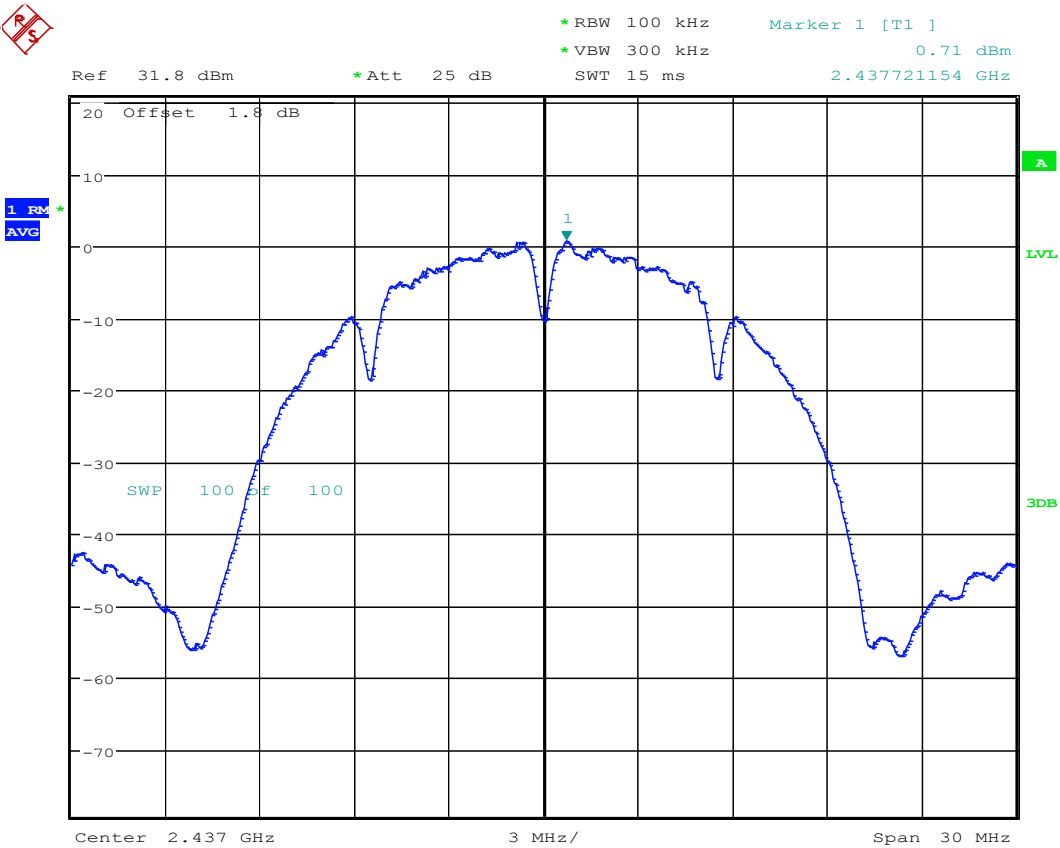
Power Spectral Density 802.11b 2412 MHz



Date: 13.JAN.2015 17:47:28



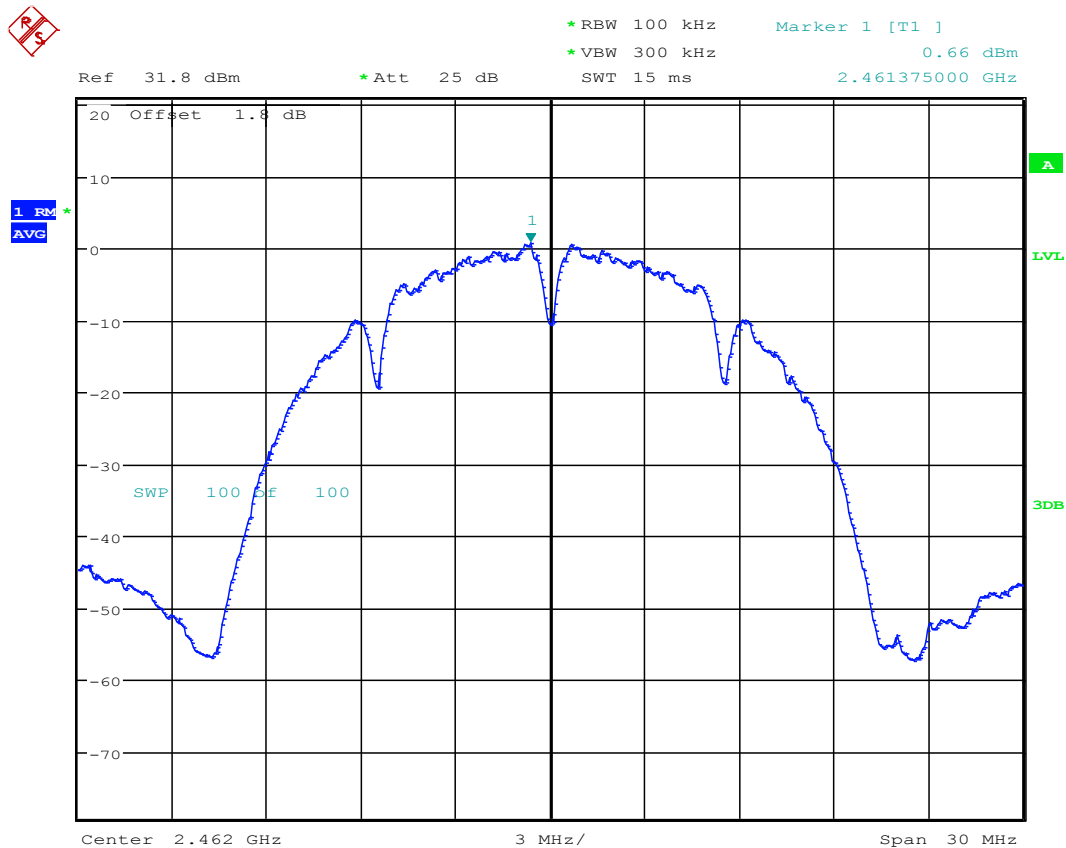
Power Spectral Density 802.11b 2437 MHz



Date: 13.JAN.2015 17:49:26



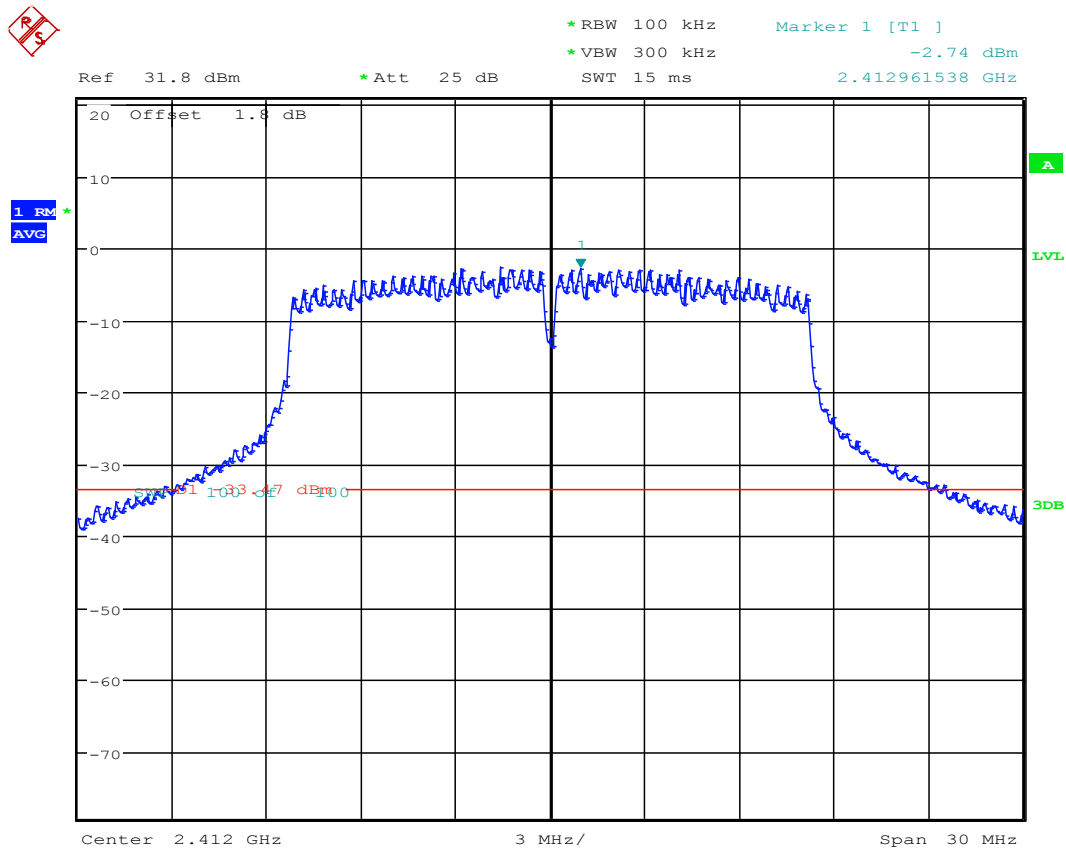
Power Spectral Density 802.11b 2462 MHz



Date: 13.JAN.2015 17:52:07



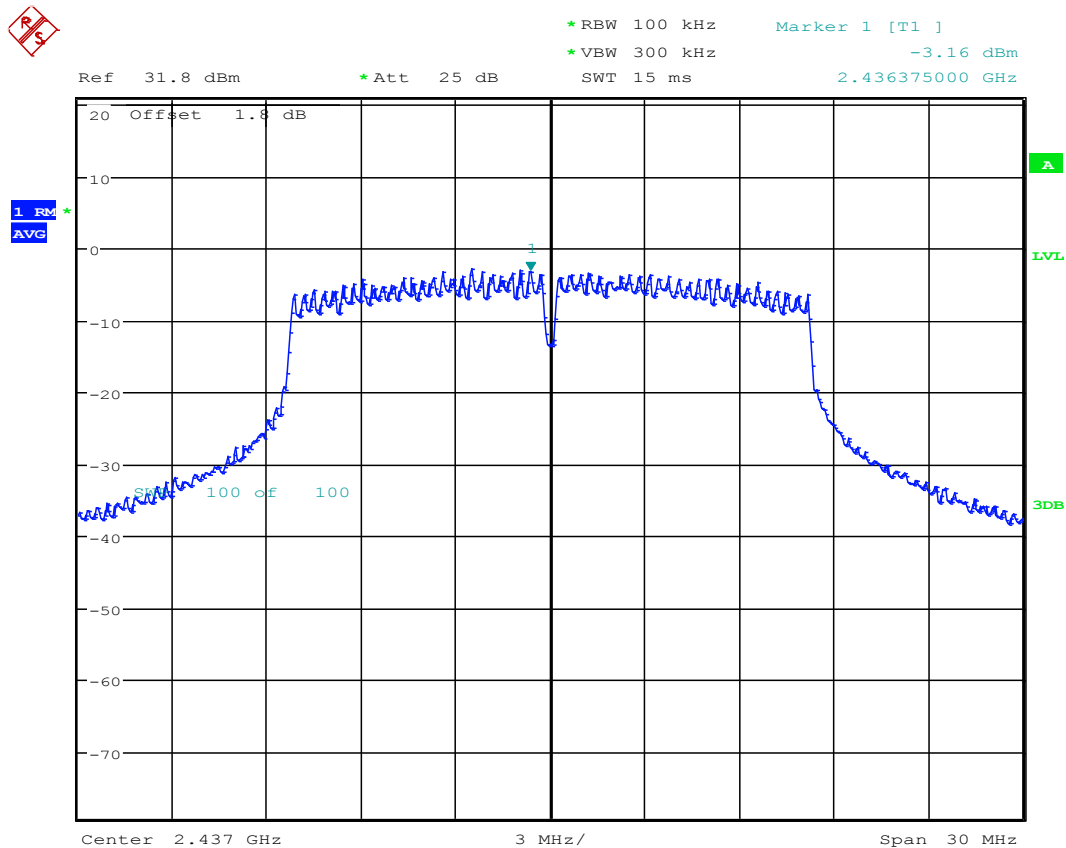
Power Spectral Density 802.11g 2412 MHz



Date: 14.JAN.2015 09:34:39



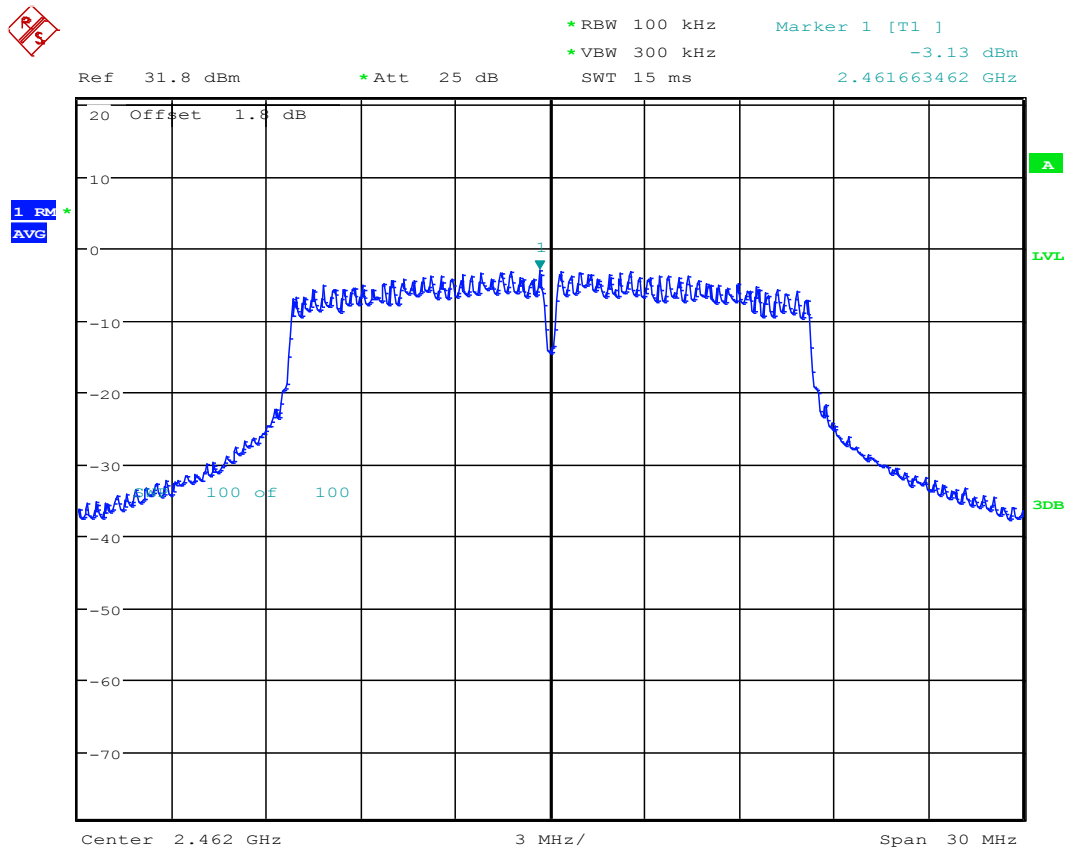
Power Spectral Density 802.11g 2437 MHz



Date: 13.JAN.2015 17:55:05



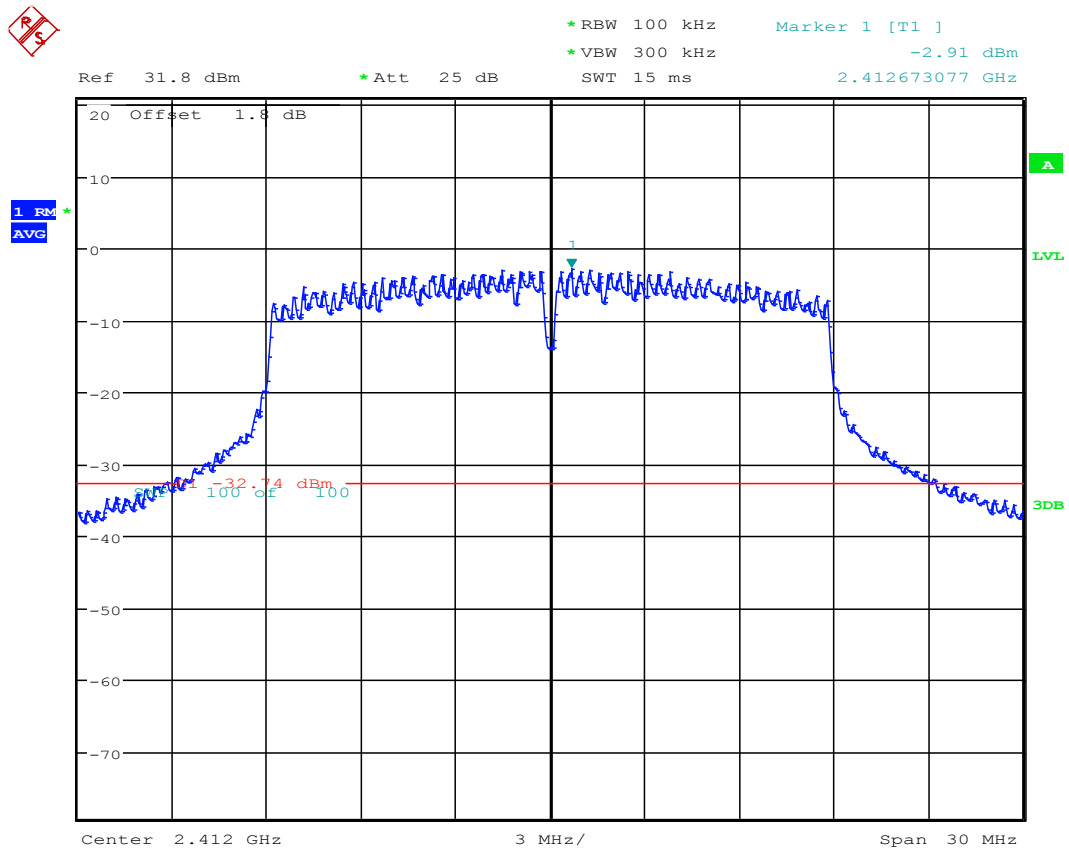
Power Spectral Density 802.11g 2462 MHz



Date: 13.JAN.2015 17:55:56



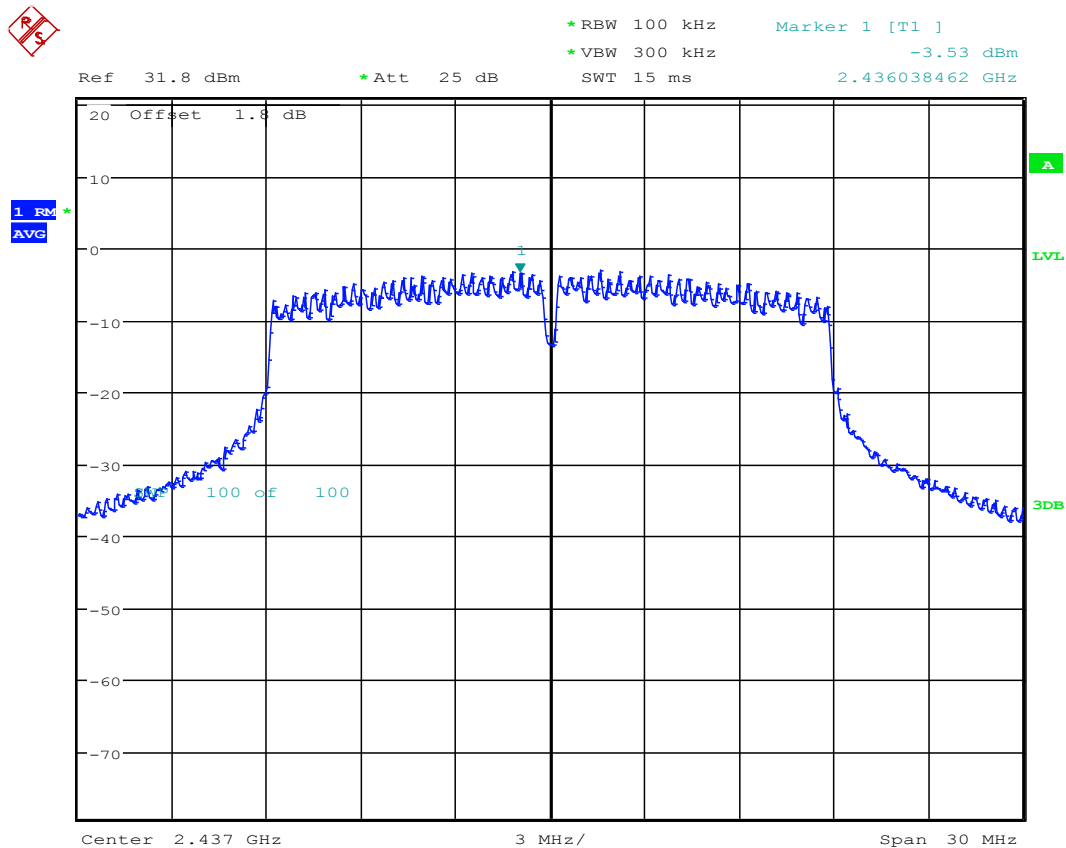
Power Spectral Density 802.11n -MCS0 (20MHz) 2412 MHz



Date: 14.JAN.2015 09:42:22



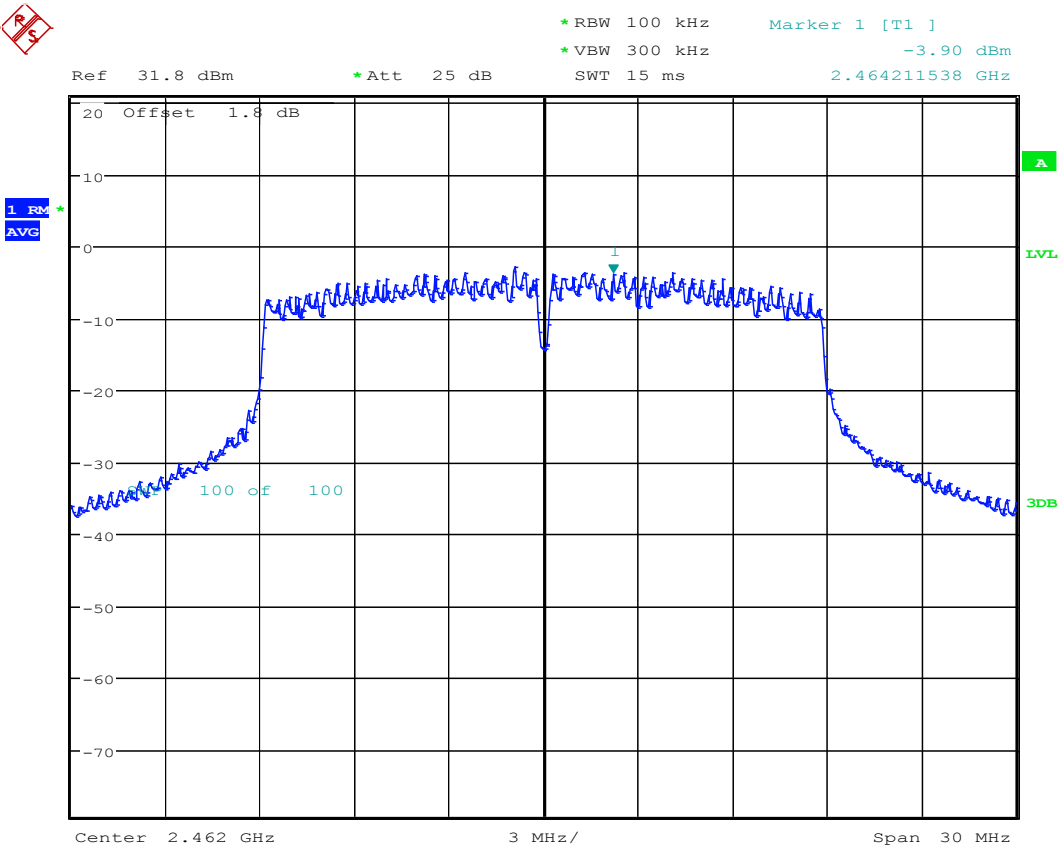
Power Spectral Density 802.11n -MCS0 (20MHz) 2437 MHz



Date: 13.JAN.2015 18:02:25



Power Spectral Density 802.11n -MCS0 (20MHz) 2462 MHz



Date: 13.JAN.2015 18:03:09

6.6 Band Edge Compliance – at restricted and non-restricted band edges**6.6.1 Limits:**

§15.209/15.205/15.247 (d)

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 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
6.215 - 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	2690 - 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	(²)
13.36 - 13.41			

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

6.6.2 Test Conditions:

Tnom: 21°C; Vnom: 3.8V

6.6.3 Measurement Procedure:

These measurements are performed according to FCC KDB 558074 D01 DTS Measurement Guidance v03r02.

Band edge measurements have been carried out as conducted setup. Since the power measurements were performed with average method, emissions into non-restricted bands are performed with average detector as well. According to the FCC rules, the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz bandwidth (i.e., 30dBc). The reference level is already established from the previous section of the report section 6.5, Power Spectral Density. For each channel, a limit line is drawn 30dB below the peak PSD level in section 6.5 of the report. Emission level measurements are carried out as detailed in section 11.3 of the FCC KDB 558074 D01 DTS Measurement Guidance v03r02 using average detector method.

Low band edge (2400MHz) is measured as normal emission test as specified in section 11 of the referenced KDB. Since high band edge (2483.5MHz) falls next to the restricted band (2483.5-2500MHz), it is measured as restricted band.

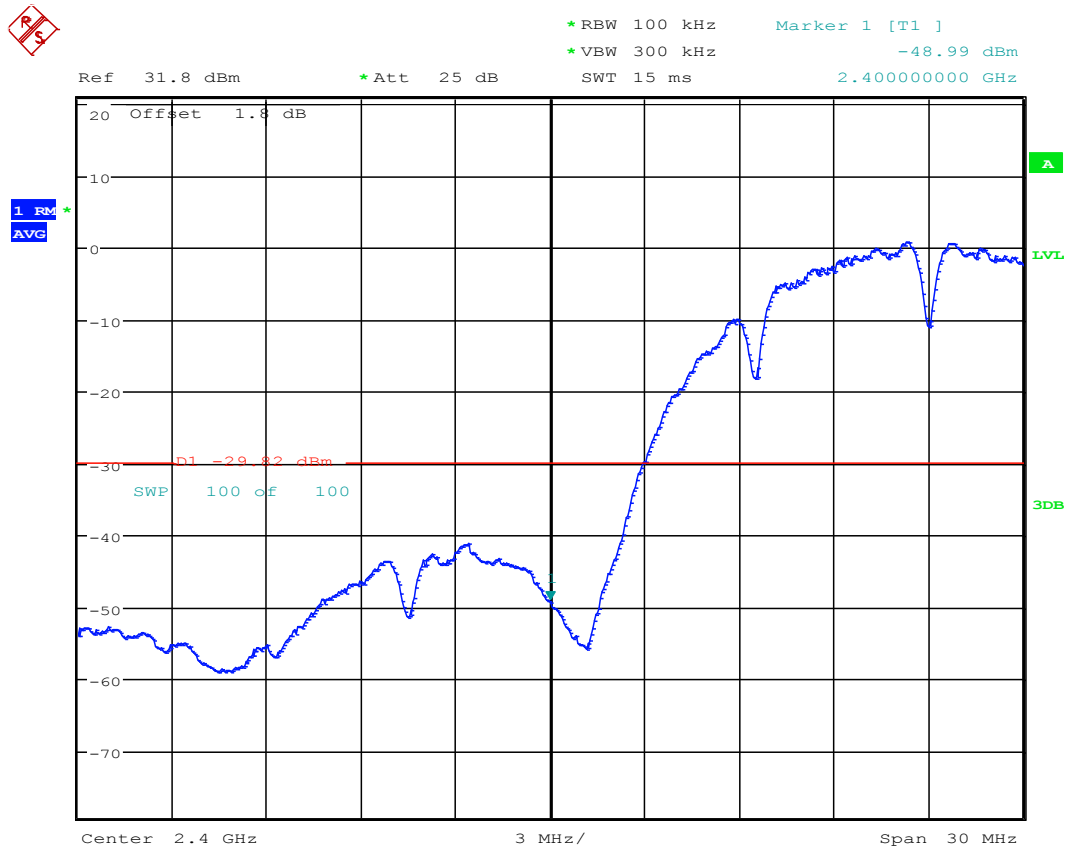
Section 12.2.2 is followed for the measurement of the upper restricted band. Only worst case modulation (802.11b) is measured.

6.6.4 Measurement Result

Pass.

6.6.5 Test Data/plots: 2.4 GHz Band

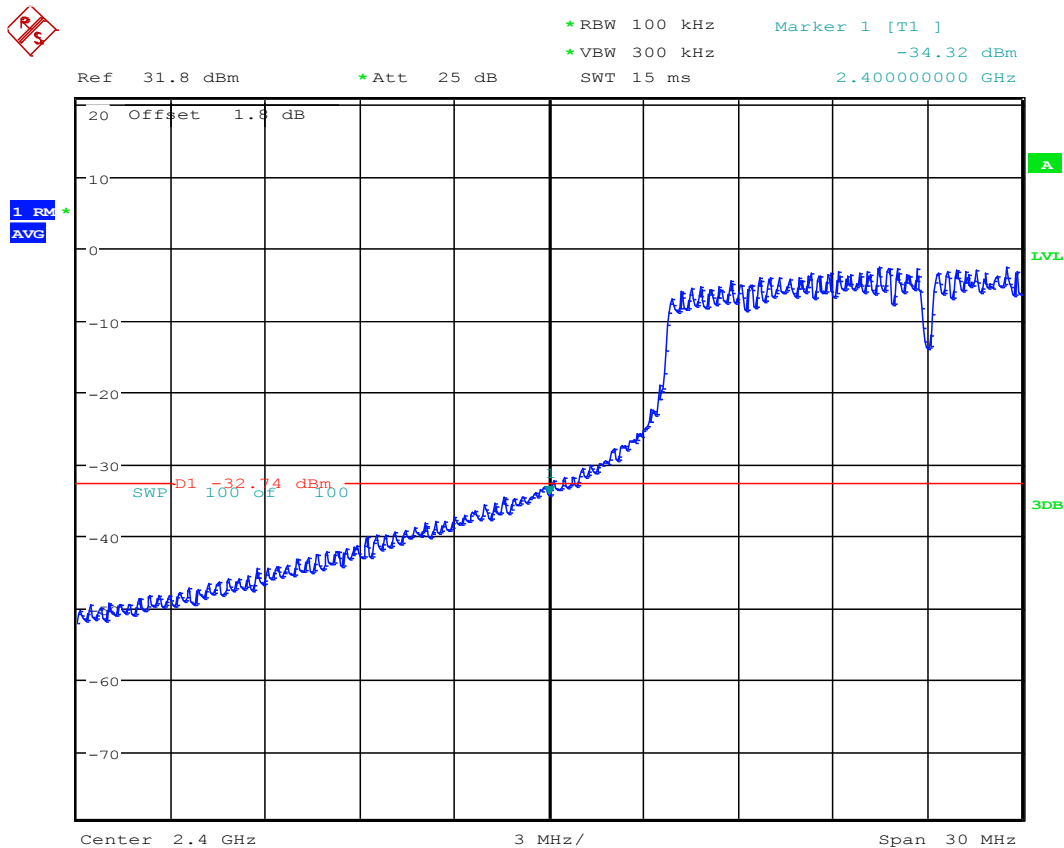
Lower band edge –Ch Low- 802.11b (Average) Conducted



Date: 13.JAN.2015 18:08:32

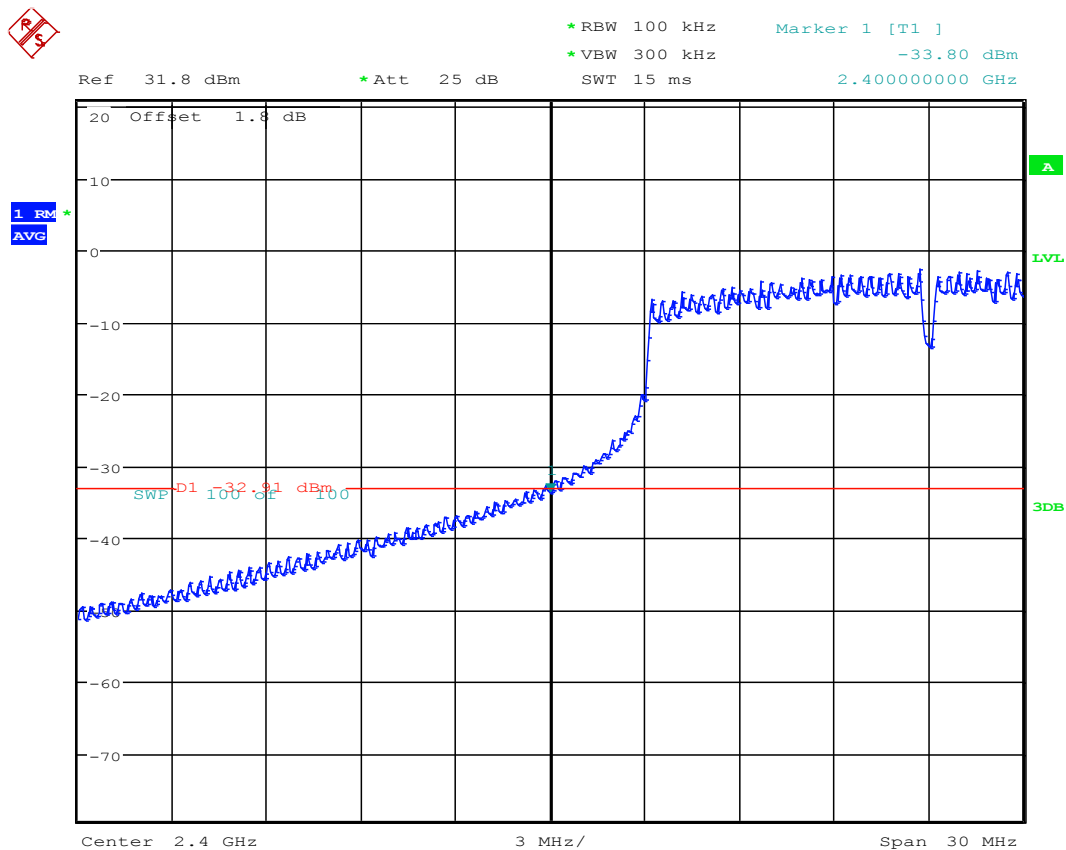


Lower band edge –Ch Low- 802.11g (Average) Conducted



Date: 14.JAN.2015 09:36:36

Lower band edge –Ch Low- 802.11n (Average) Conducted

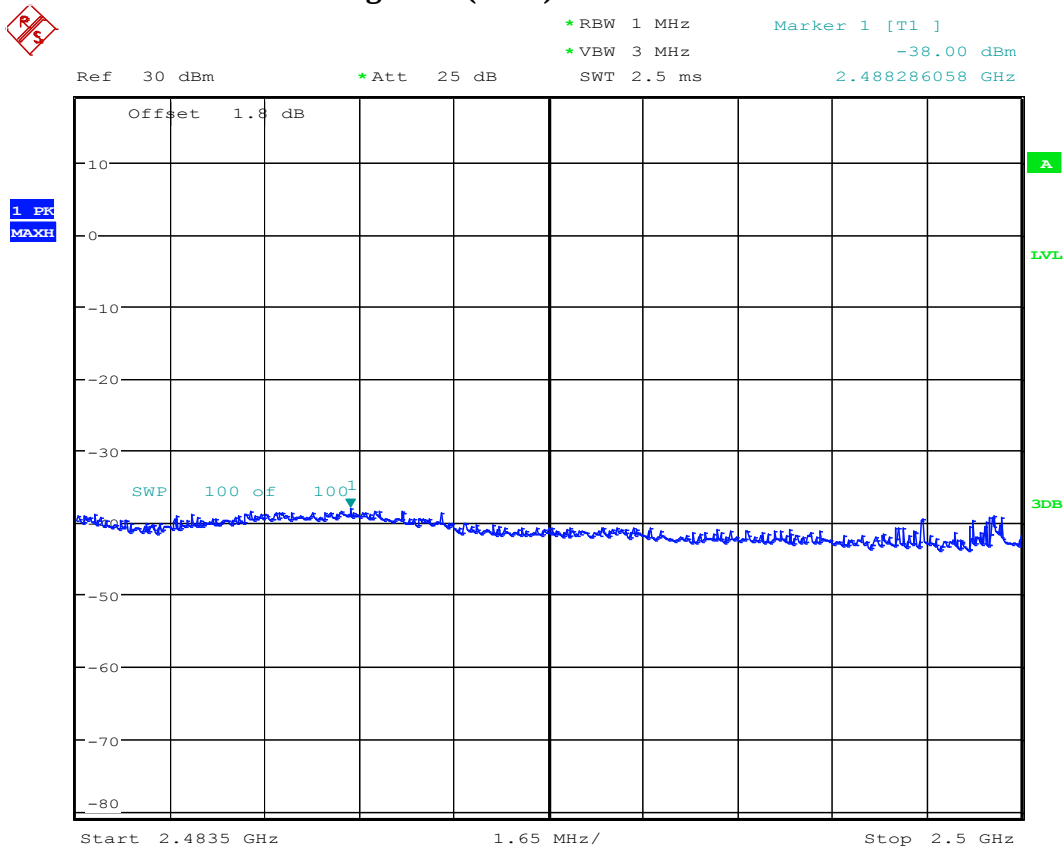


Date: 14.JAN.2015 09:43:45

6.6.6 Restricted Band (Conducted)

Channel 11 (2462MHz) which is closest to the restricted band (2483.5MHz-2500MHz) and is at the upper band edge is set to determine compliance.

Upper restricted band – Ch High 11b (Peak)



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Maximum EIRP level = -38 dBm + 2 dB(*) = -36 dBm

(* min antenna gain to be assumed acc. to action 12.2.6 of KDB 558074 D01)

Converting the EIRP level to an equivalent electric field strength using the following relationship:

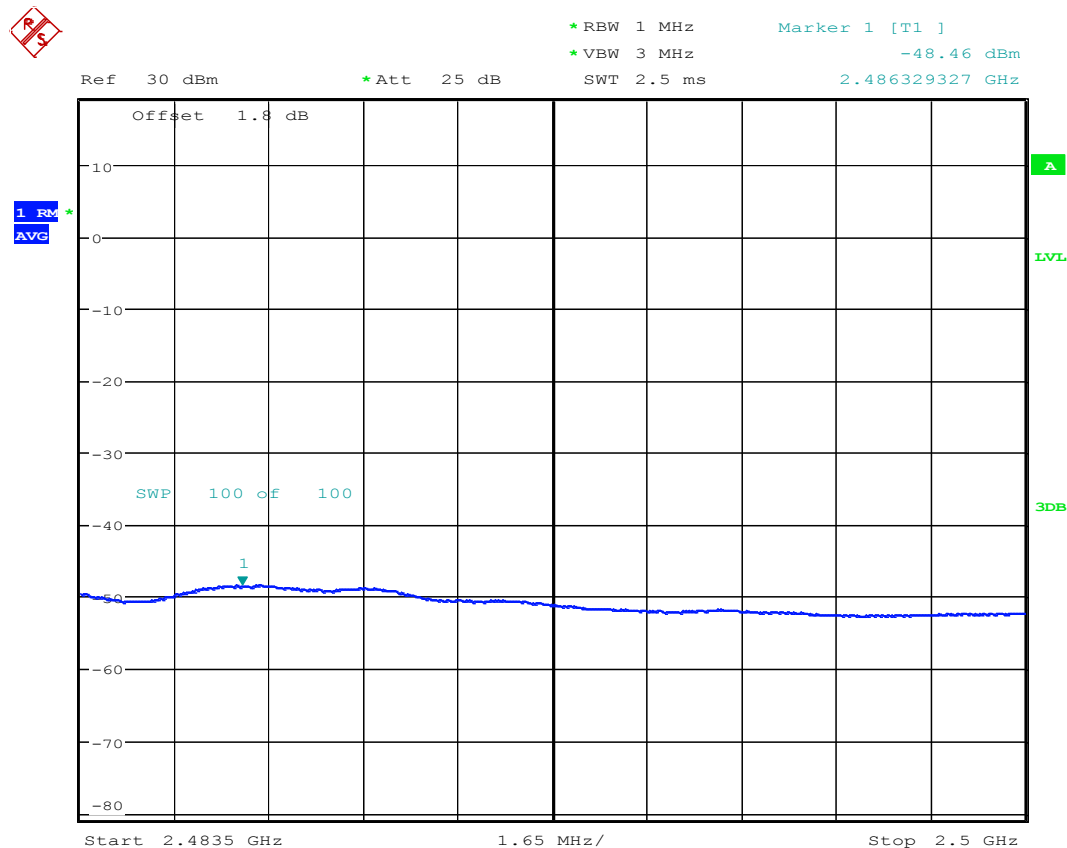
$$E = \text{EIRP} - 20\log D + 104.8$$

$$E = -36 - 9.54 + 104.8$$

$$E = 59.26 \text{ dBuV/m}$$

This value pass the FCC limit of 74 dBuV/m for peak measurement.

Upper restricted band – Ch High 11b (Average)



Date: 7.JAN.2015 14:34:22

Maximum EIRP level = -48.46 + 2 dB = -46.46 dBm

Converting the EIRP level to an equivalent electric field strength using the following relationship:

$$E = \text{EIRP} - 20\log D + 104.8$$

$$E = -46.46 - 9.54 + 104.58$$

$$E = 48.8 \text{ dBuV/m}$$

This value pass the FCC limit of 54 dBuV/m for average measurement.

6.7 Radiated Transmitter Spurious Emissions:

6.7.1 Limits:

§15.247/15.205/15.209

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
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
6.215 - 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	2690 - 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	(²)
13.36 - 13.41			

Frequency of emission (MHz)	Field strength (μV/m)
30–88	100 (40dBμV/m)
88–216	150 (43.5 dBμV/m)
216–960	200 (46 dBμV/m)
Above 960	500 (54 dBμV/m, average) (Peak limit: 54 dBμV/m,)

Frequency of emission (MHz)	Field strength (μV/m)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30

6.7.2 Test Conditions:

Tnom: 23 °C; Vnom: 3.8V

6.7.3 Measurement procedure:

Measurement according to ANSI C63.10:2009 (also refer to section 6.1 in this test report)

6.7.4 Test Result:

Test mode: *Modulation:* 802.11b has the worst case maximum output power according to 6.3.4. Hence it's been chosen for TX radiated emissions.

Unless mentioned otherwise, the emissions outside the limit lines in the plots are from the transmit signal.

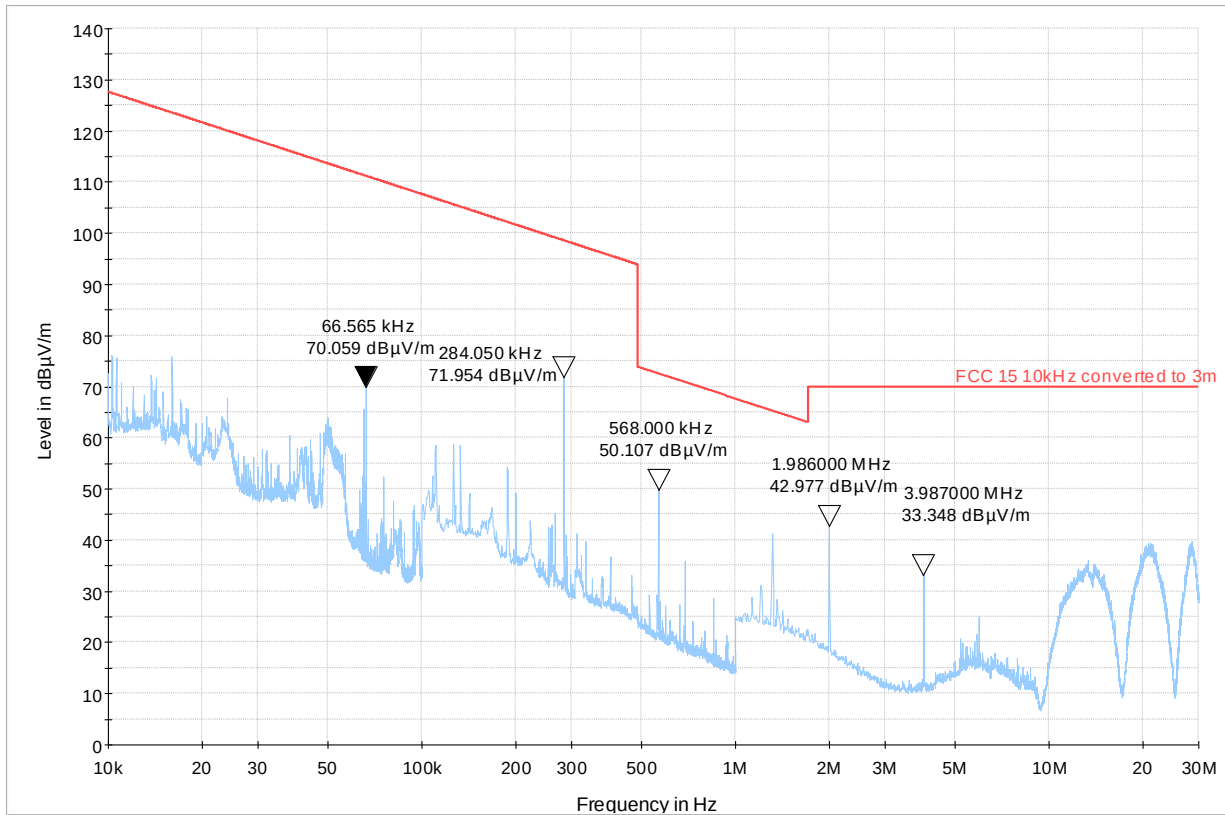
Plots reported here represent the worst case emissions for horizontal and vertical antenna polarizations and for three orientations of the EUT.

6.7.5 Measurement Result

Pass.

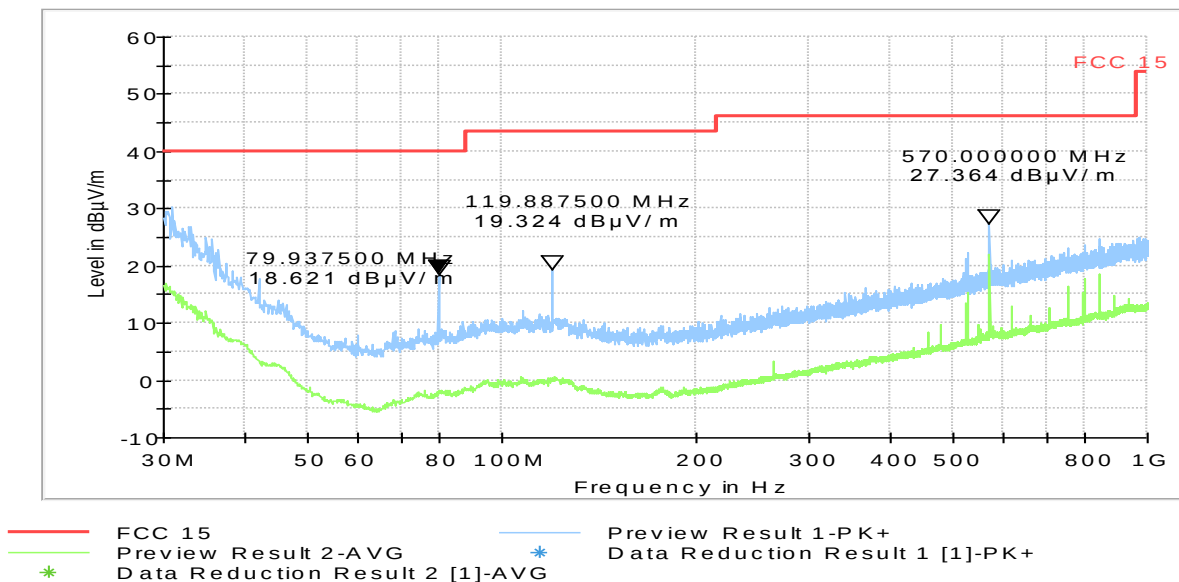
6.7.6 Test data/ plots: 2.4 GHz Band

Transmitter Radiated Spurious Emission: Ch Mid- 9kHz – 30MHz- 802.11b-mode

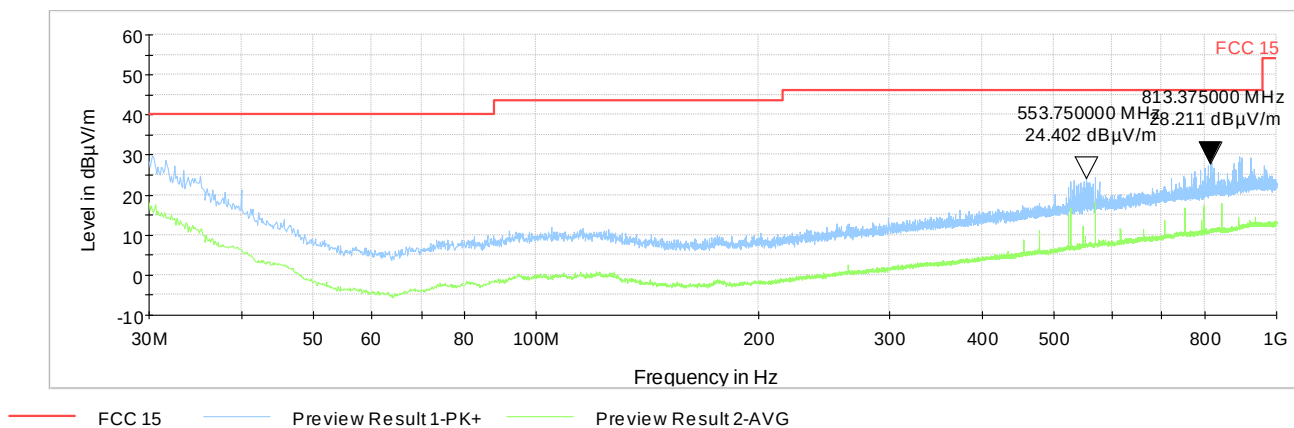


— FCC 15 10kHz converted to 3m — Preview Result 1-PK+

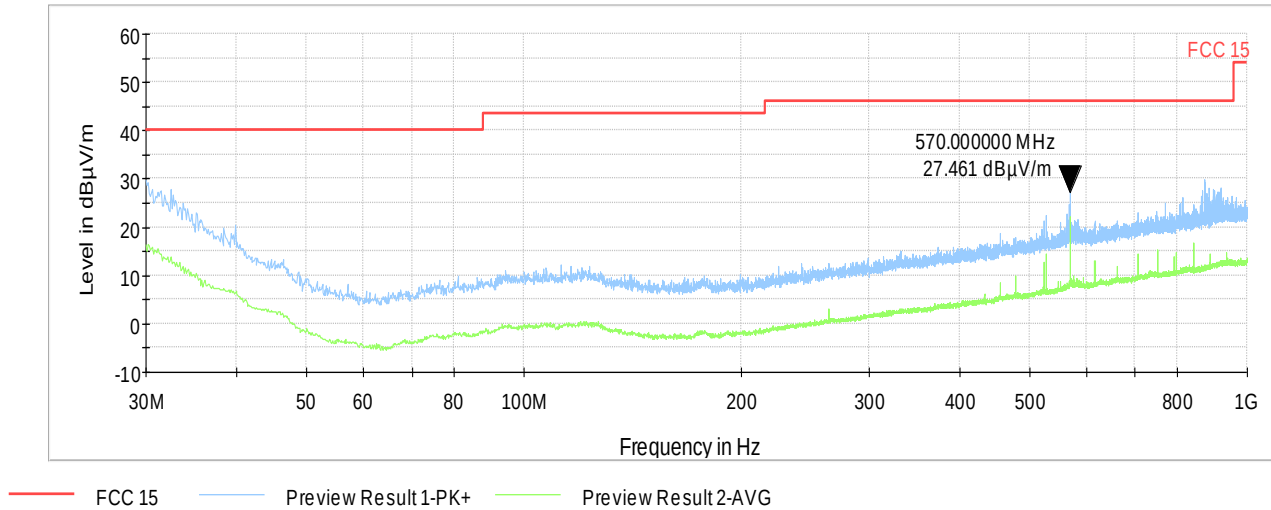
Transmitter Radiated Spurious Emission: Ch Low- 30 MHz – 1GHz- 802.11b-mode



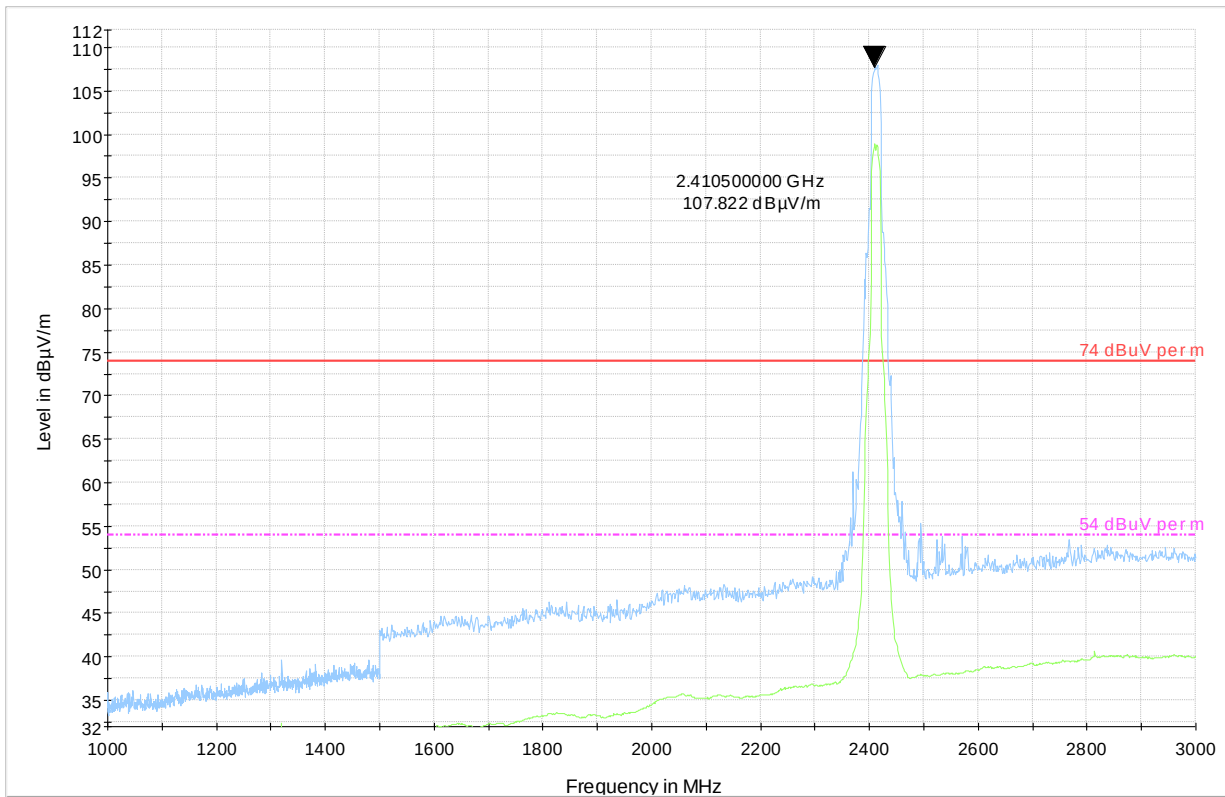
Transmitter Radiated Spurious Emission: Ch Mid- 30 MHz – 1GHz- 802.11b-mode



Transmitter Radiated Spurious Emission: Ch High- 30 MHz – 1GHz- 802.11b-mode



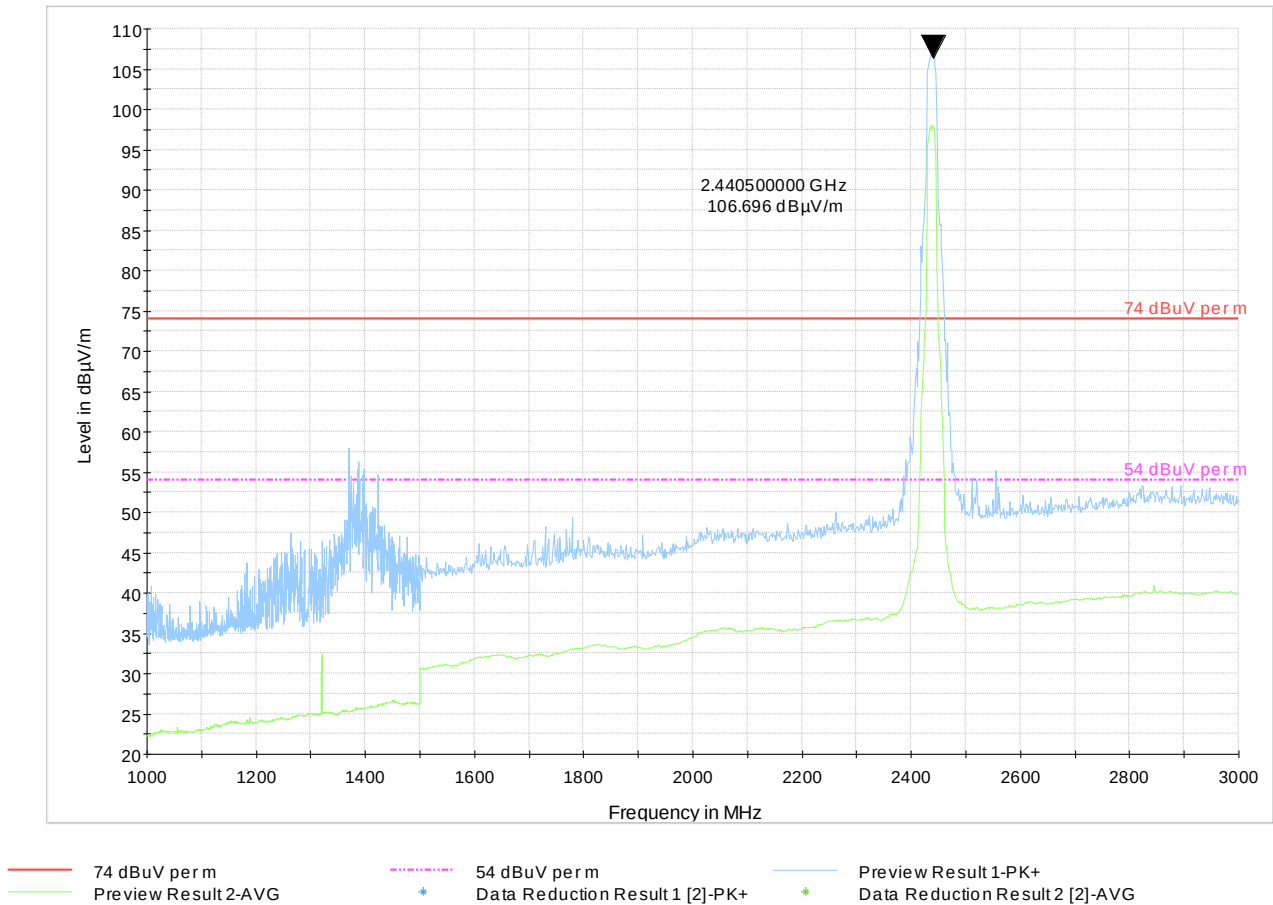
Transmitter Radiated Spurious Emission: Ch Low- 1 GHz – 3GHz- 802.11b-mode



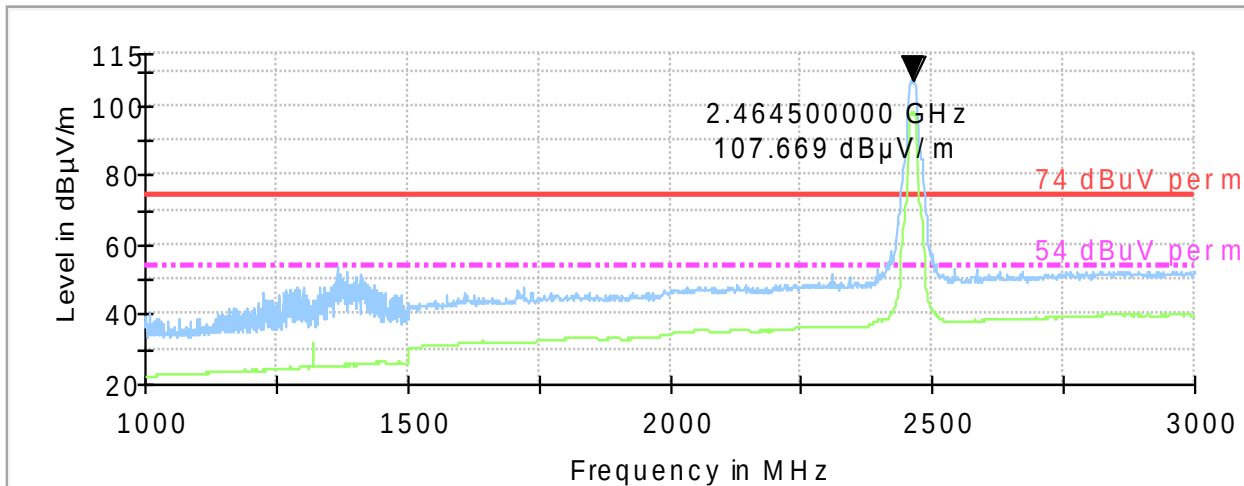
— 74 dBμV per m
— Preview Result 2-AVG
- - - - - 54 dBμV per m
* Data Reduction Result 1 [2]-PK+
— Preview Result 1-PK+
* Data Reduction Result 2 [2]-AVG



Transmitter Radiated Spurious Emission: Ch Mid- 1 GHz – 3GHz- 802.11b-mode

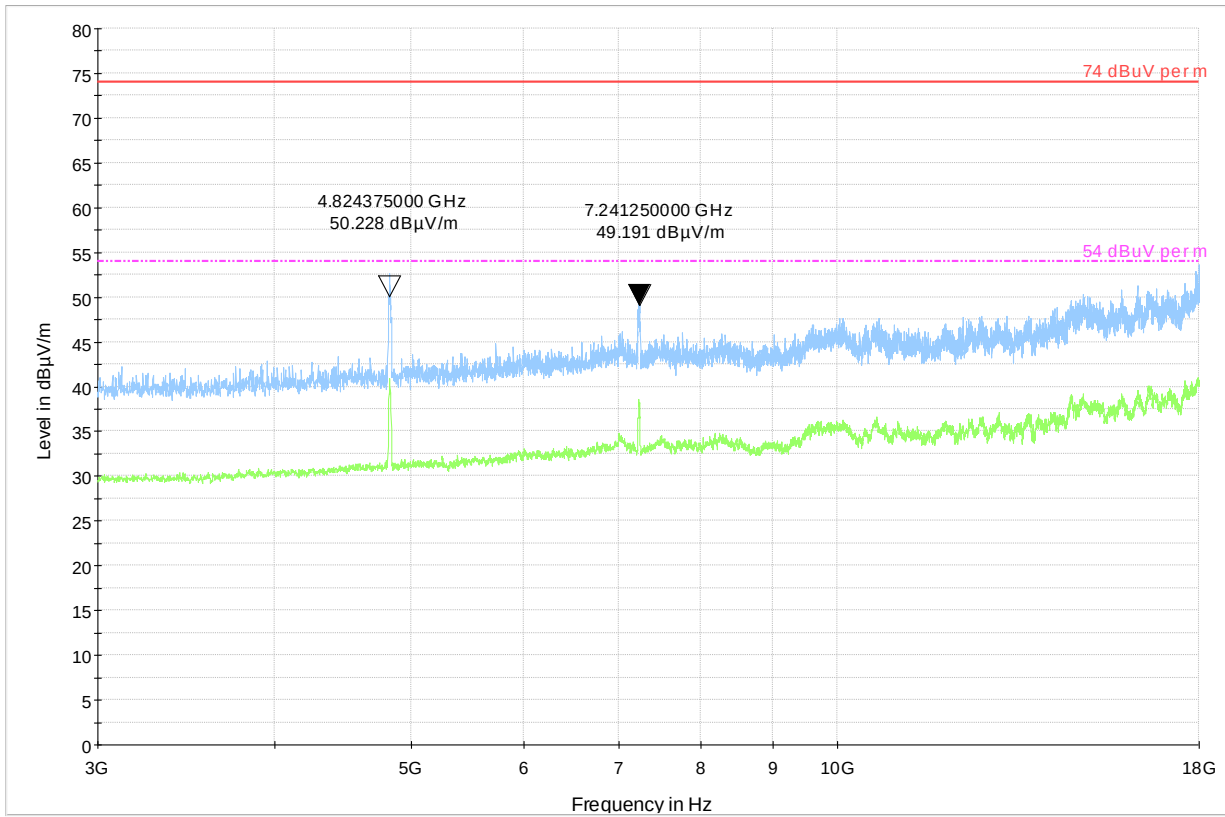


Transmitter Radiated Spurious Emission: Ch High- 1 GHz – 3GHz- 802.11b-mode



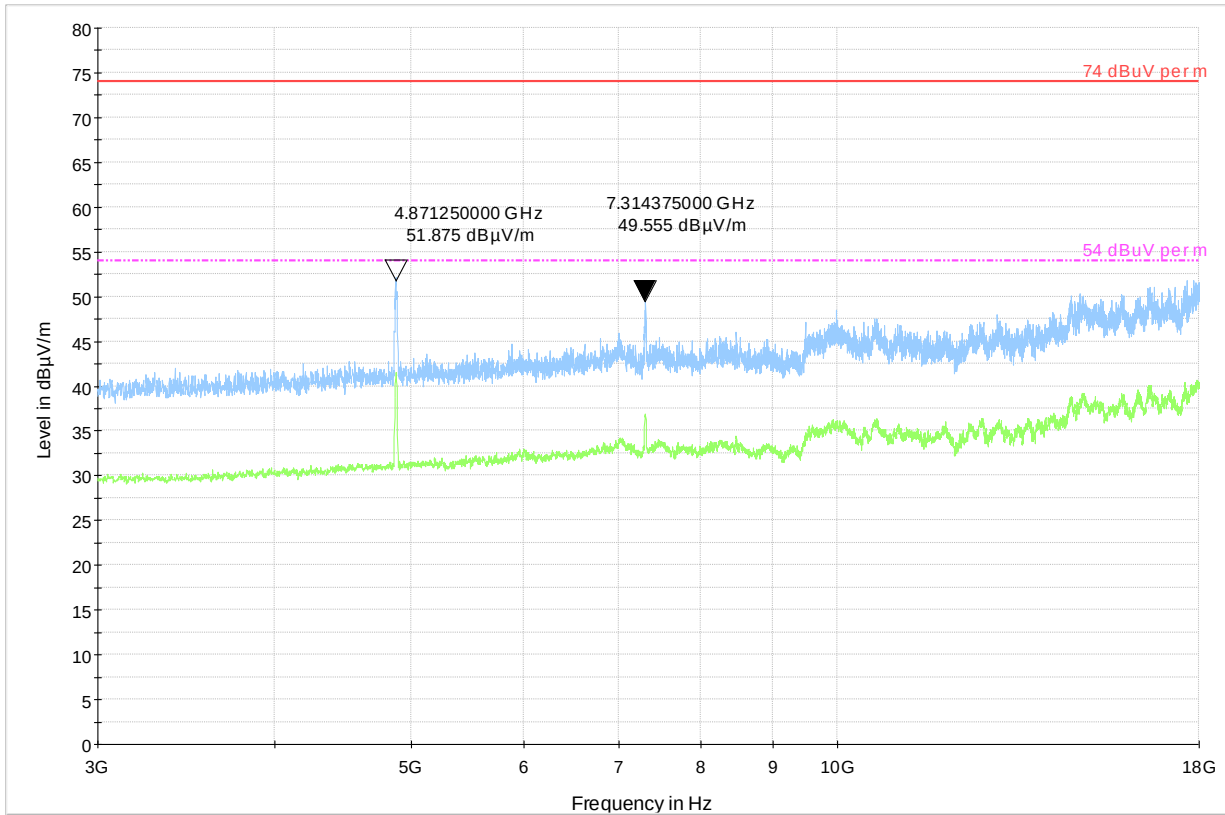
- | | | | |
|---|--------------------------------|-------|---------------------------------|
| — | 74 dBμV per m | - - - | 54 dBμV per m |
| — | Preview Result 1-PK+ | — | Preview Result 2-AVG |
| * | Data Reduction Result 1 [2]-PK | * | Data Reduction Result 2 [2]-AVG |

Transmitter Radiated Spurious Emission: Ch Low- 3 GHz – 18GHz- 802.11b-mode



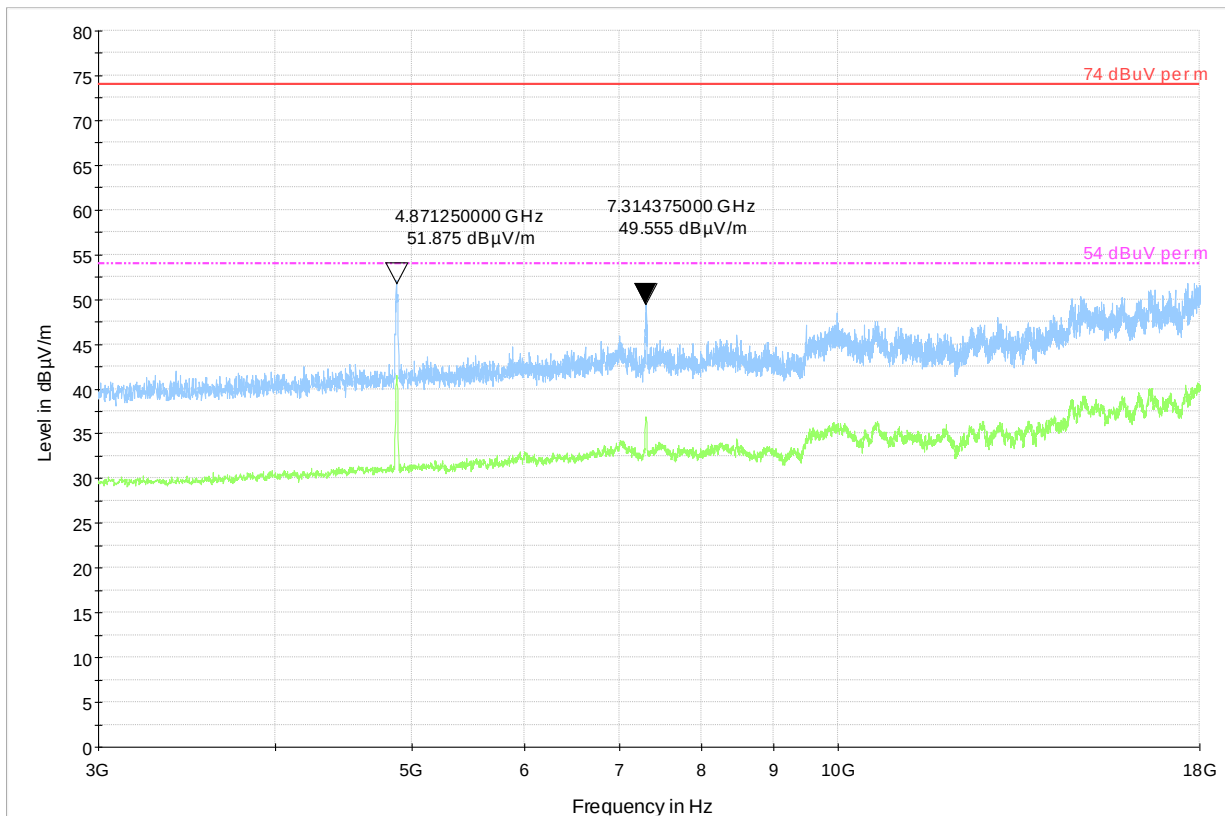
— 74 dBuV per m - - - 54 dBuV per m — Preview Result 1-PK+ — Preview Result 2-AVG

Transmitter Radiated Spurious Emission: Ch Mid- 3 GHz – 18GHz- 802.11b-mode



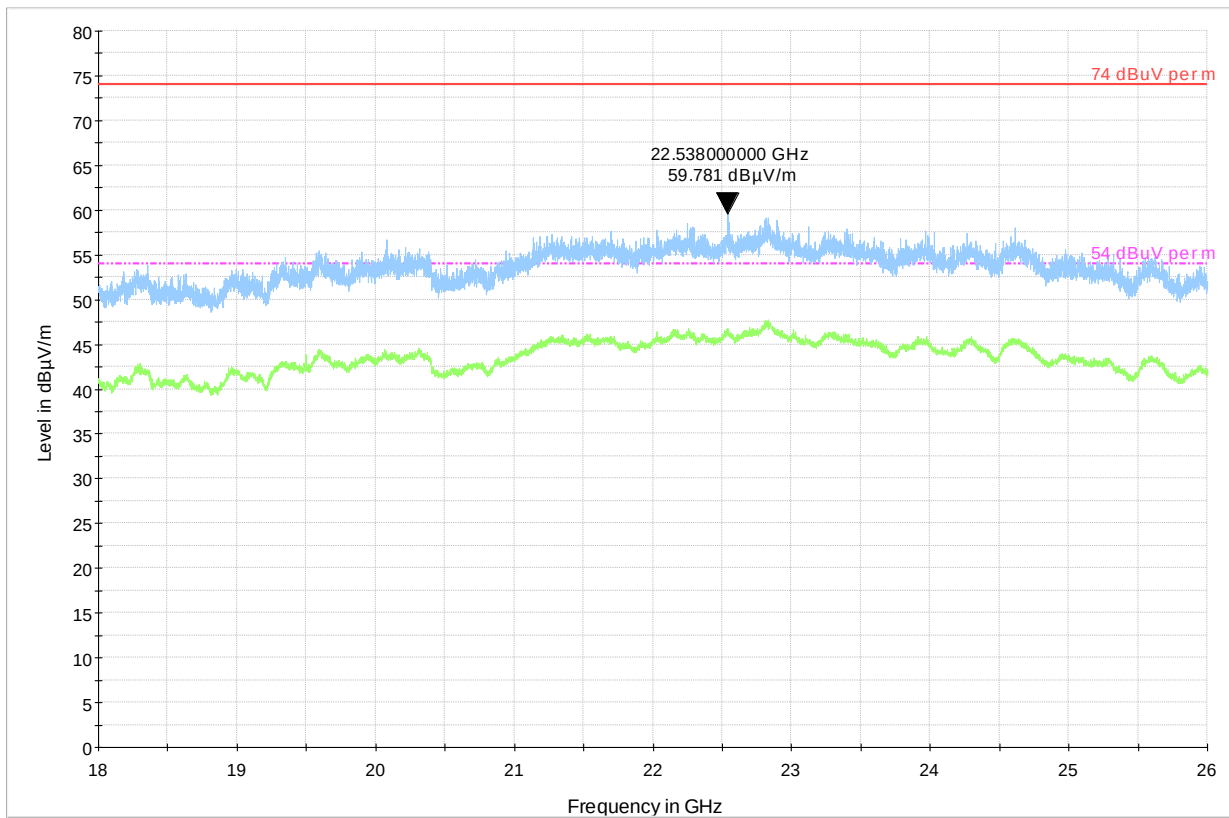
74 dBμV per m 54 dBμV per m Preview Result 1-PK+ Preview Result 2-AVG

Transmitter Radiated Spurious Emission: Ch High- 3 GHz – 18GHz- 802.11b-mode



— 74 dB μ V per m - - - 54 dB μ V per m — Preview Result 1-PK+ — Preview Result 2-AVG

Transmitter Radiated Spurious Emission: Ch Mid- 18 GHz – 26 GHz- 802.11b-mode

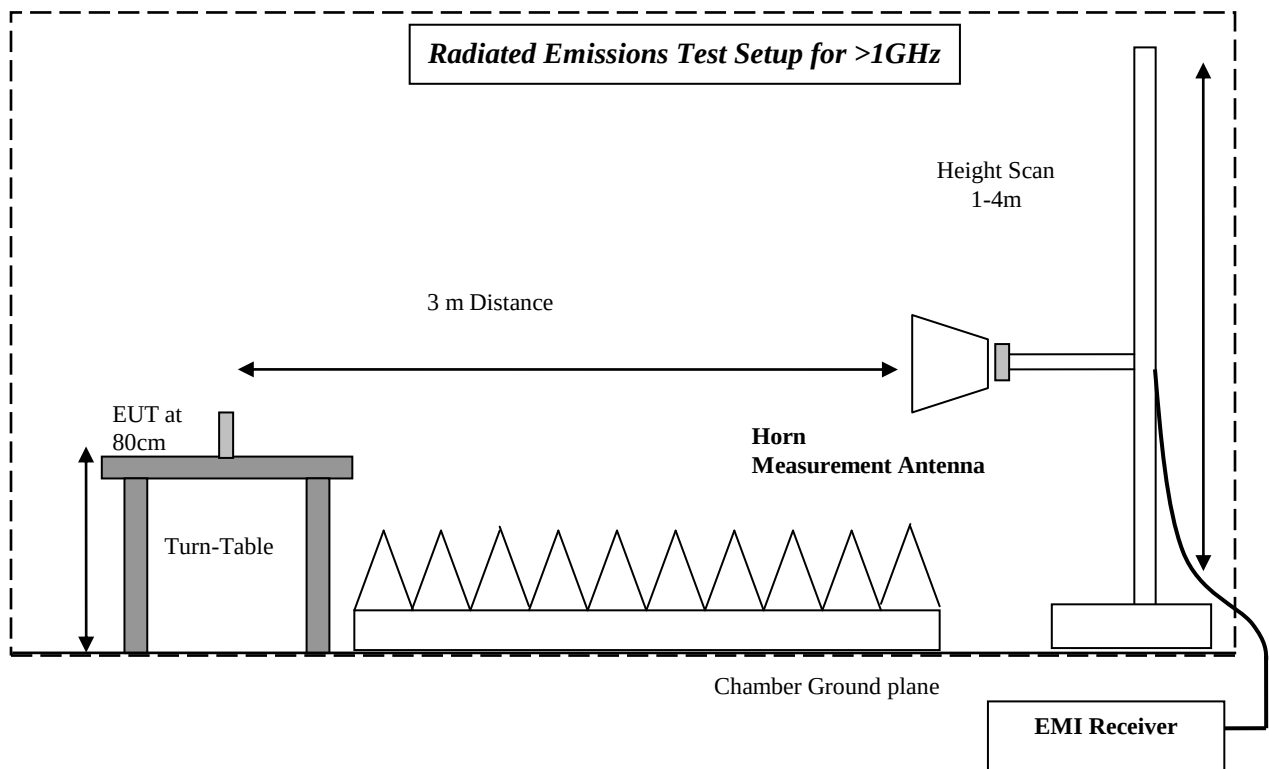
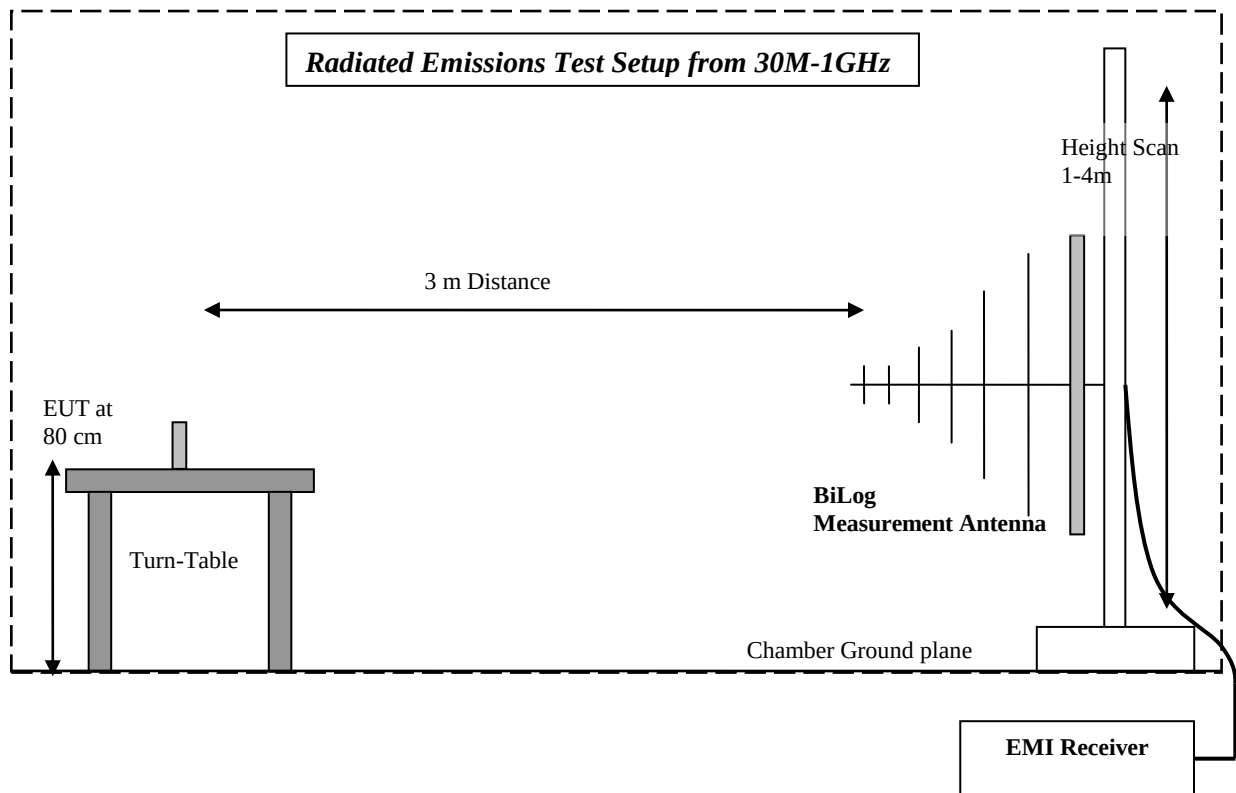


74 dBμV per m 54 dBμV per m Preview Result 1-PK+ Preview Result 2-AVG

7 Test Equipment and Ancillaries used for tests

Equipment Name	Manufacturer	Type/Model	Serial No.	Cal Date	Cal Interval	Next cal date
3m Semi- Anechoic Chamber:						
Spectrum Analyzer	Rohde und Schwarz	FSU 26	200302	6/2013	2 years	6/2015
Spectrum Analyzer	Rohde und Schwarz	FSV 40	0547	7/2014	2 years	7/2016
Receiver	Rohde und Schwarz	ESR3	101663	2/2013	2 years	2/2015
LISN	Rohde und Schwarz	ESV 216	101129	1/2013	2 years	1/2015
Radio Communications Tester	Rohde and Schwarz	CMU 200	121672	7/2013	2 years	7/2015
Log Periodic Antenna	Rohde and Schwarz	HL 050	100515	4/2013	3 year	4/2016
Ultralog Antenna	Rohde and Schwarz	HL 562	100495	2/2012	3 year	2/2015
Double-ridge Horn Antenna (1G-18G)	ETS-Lindgren	3117-PA	00167061	7/2014	3 year	7/2017
Double-ridge Horn Antenna (18G-40G)	ETS-Lindgren	3116C-PA	00166821	7/2014	3 year	7/2017
Loop Antenna	ETS-Lindgren	6512	00164698	7/2014	3 year	7/2017
Open Switch Control Unit	Rohde and Schwarz	OPS 130	10085	n/a		
Extention Unit Open Switch Control Unit	Rohde and Schwarz	OSP 150	10086	n/a		
Turn Table TT	Maturo	1.5 SI	TT 1.5SI/204/60709 10	n/a		
Compact antenna Mast	Maturo	CAM 4.0-P	CAM4.0-P/067/6000910	n/a		
Multiple Control Unit	Maturo	MCU	2140910	n/a		
Pre-Amplifier	Rohde and Schwarz	TS-PR 18	100072	Part of the system calibration		
High Pass Filter	Mini-Circuits	SHP-1200+	RUU11201224			
High Pass Filter	Wainwright Instr.	WHKX 3.0/18	109			

8 Test Setup Diagram:



9 Revision History

Date	Report Name	Changes to report	Report prepared by
2014-10-30	EMC_EMBED_019_14001_15.247_DTS_WLAN	First official version	M. Umair Anees
2014-12-15	EMC_EMBED_019_14001_15.247_DTS_WLAN_rev1	Formatting, improved text	M.Umair Anees
2014-1-7	EMC_EMBED_019_14001_15.247_DTS_WLAN_rev2	Added conducted measurements section 6.4, 6.5, 6.6	M.Umair Anees
2014-1-13	EMC_EMBED_019_14001_15.247_DTS_WLAN_rev3	Revised sections 6.4, 6.5 and 6.6	M.Umair Anees

Test Report #: EMC_EMBED_019_14001_15.247_DTS_WLAN_rev3 FCC ID: R42MPES1

Date of Report : 2015-1-13

