Excellence in Compliance Testing

Certification Test Report

FCC ID: VSFMS2
IC: 7980A-MS2

FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-247

ACS Report Number: 15-2133.W06.3B

Applicant: Juniper Systems, Inc.
Model(s): MS2G and MS2GC

Test Begin Date: **December 10, 2015**
Test End Date: **March 4, 2016**

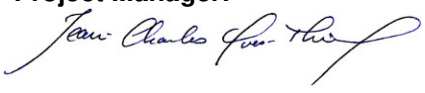
Report Issue Date: March 17, 2016

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY

FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

Project Manager:



Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

This report contains 102 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-247.

1.2 Applicant Information

Juniper Systems, Inc.
1132 West 1700 North
Logan, UT 84321

1.3 Product Description

The MS2G and MS2GC consist of ultra-rugged tablet computers, featuring a 7-inch touchscreen display and running Microsoft Windows 8.1/10 Professional, Bluetooth 4.0 and WLAN 802.11a/b/g/n. The two models are identical except that the MS2GC model includes a pre-approved cellular module (FCC ID: VSF25271/ IC:7980A-25271). This test report documents the compliance of Wi-Fi transceiver for operation in the 2.4 GHz ISM band.

Technical Details

Mode of Operation:	2.4 GHz WLAN IEEE 802.11b/g/n
Frequency Range:	2412 MHz - 2462 MHz
Number of Channels:	11
Channel Separation:	5 MHz
Modulations:	802.11b: DSSS 802.11b/n: OFDM
Antenna Type/Gain:	2x2 MIMO PIFA, 2.5 dBi (Primary antenna), PIFA, 2.0 dBi (Secondary Antenna)
Antenna Diversity	802.11b: SISO (Primary antenna) 802.11g: SISO, MIMO Cyclic Delay Diversity (CDD) 802.11n 20 MHz : SISO, MIMO Cyclic Delay Diversity (CDD), Spatial Multiplexing MIMO (SM-MIMO)
Input Power:	12VDC Power Supply

Model Number: MS2G and MS2GC

Test Sample Serial Number(s): MS2P58 (RF Conducted Emissions), MS2P34 (Radiated and Power Line Conducted Emissions).

Test Sample Condition: The equipment was provided in good condition without any physical damage.

1.4 Test Methodology and Considerations

The EUT was evaluated for radiated, power line and RF conducted emissions.

For radiated emissions, preliminary evaluation was performed for the EUT standalone as well as for the EUT powered through a wall adapter. The investigation was performed in three orthogonal orientations. Additional measurements were performed on two MS2 models configurations consisting of the MS2G and the MS2GC. No significant emission variation was observed between the models and the final measurements were performed on MS2G model. The Wi-Fi transceiver was evaluated in the SISO, MIMO CDD and SM-MIMO modes, where applicable. The results are provided for the configuration leading to the highest emissions as compared to the limits. The configurations use for the final measurements are provided below.

The RF conducted emissions measurements were performed for the EUT modified with a temporary RF connector for direct coupling to a spectrum analyzer. There is no RF output power compensation associated with the MIMO mode of operation. The measurements were performed on both primary and secondary antenna ports.

The EUT was also evaluated for intermodulation product for the MS2GC model which includes the EM7355 cellular module (FCC ID: VSF25271/ IC:7980A-25271). The Wi-Fi transceiver and Cell radios were set to transmit simultaneously and the intermodulation products were investigated and compared to the FCC Section 15.209 and the RSS-GEN general limits. All intermodulation products were found to be compliant.

Table 1.4-1: IEEE 802.11b/g/n Radio Test Configuration

Mode of Operation	Frequency (MHz)	Channel	Data Rate Setting	SISO/MIMO
802.11b	2412	1	1/2 Mbps[1]	SISO (Primary antenna only)
	2437	6		
	2462	11		
802.11g	2412	1	6 Mbps	MIMO (CDD)
	2437	6		
	2462	11		
802.11n 20 MHz	2412	1	MCS0 (CDD), MCS8 (SM-MIMO)	CDD, SM-MIMO
	2437	6		
	2462	11		

The EUT was also evaluated for unintentional emissions. The results are documented separately in a Declaration of Conformity/Verification test report.

[1] The 1 Mbps data rate was observed to lead to the highest radiated spurious emissions average levels while the 2Mbps data rate led slightly to the highest output power. All the measurements were performed using the 2 Mbps data rate except for the radiated spurious emissions which were evaluated using 1 Mbps.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 475089
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1050 Multi-device controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

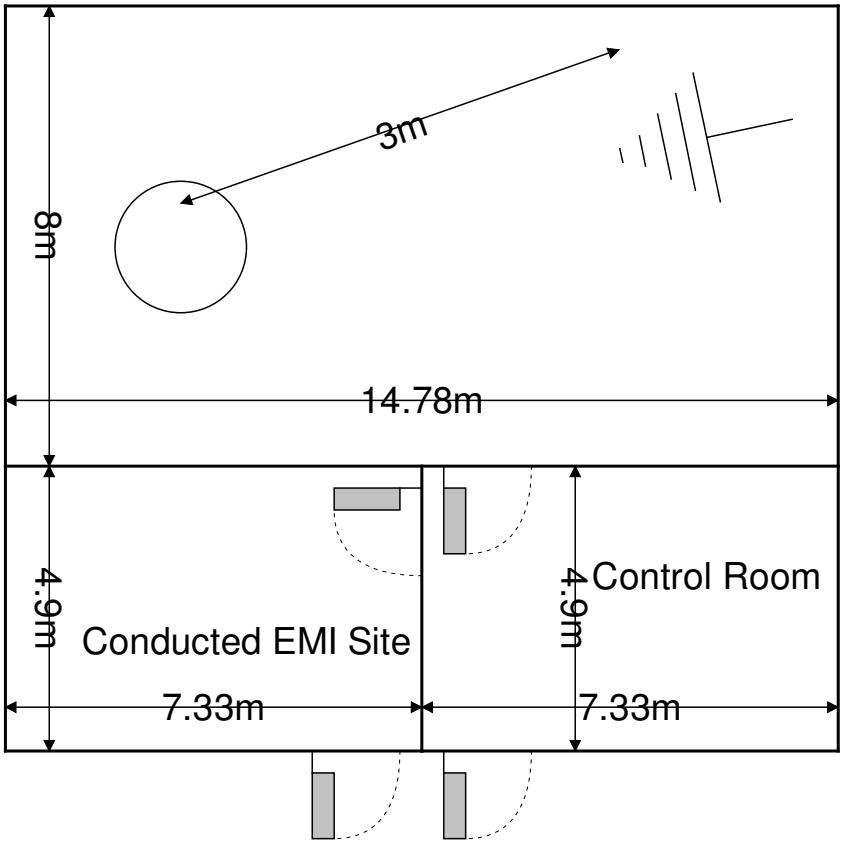

Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

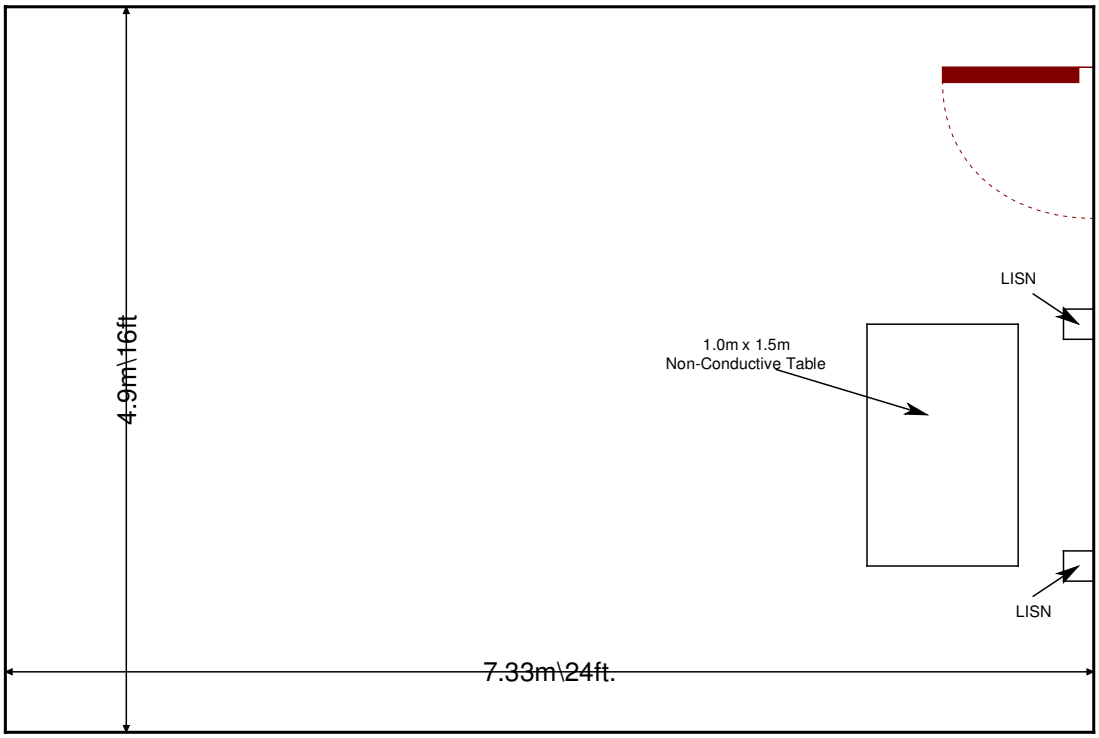

Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2014: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40 GHz.
- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2016.
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2016
- Industry Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015.
- Industry Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.
- FCC OET KDB Publication No. 662911 D01 Multiple Transmitter Output v02r01: Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g.,MIMO, Smart Antenna, etc), October 2013.
- FCC OET 13TR1003 Directional Gain of 802 11 MIMO with CDD 04 05 2013: Directional Gain of IEEE 802.11 MIMO Devices Employing Cyclic Delay Diversity, April 2013.

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment List

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
22	Agilent	8449B	Amplifiers	3008A00526	5/18/2015	5/18/2016
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/1/2015	7/1/2016
479	Electro-Metrics	ALP-70	Antennas	158	12/2/2013	12/2/2015
479	Electro-Metrics	ALP-70	Antennas	158	12/3/2015	12/3/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
653	Suhner	SF-102A	Cables	0944/2A	4/13/2015	4/13/2016
2002	EMCO	3108	Antennas	2147	11/19/2015	11/19/2017
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/14/2015	4/14/2017
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/18/2015	11/18/2016
2022	EMCO	LISN3825/2R	LISN	1095	9/14/2015	9/14/2017
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	11/11/2015	11/11/2016
2070	Mini Circuits	VHF-8400+	Filter	2070	11/17/2015	11/17/2016
2072	Mini Circuits	VHF-3100+	Filter	30737	11/17/2015	11/17/2016
2082	Teledyne Storm Products	90-010-048	Cables	2082	4/22/2015	4/22/2016
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/16/2015	11/16/2016
2089	Agilent Technologies, Inc.	83017A	Amplifiers	3123A00214	12/9/2015	12/9/2016
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/22/2015	7/22/2016
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/22/2015	8/22/2016
3004	Teseq	CFL 9206A	Attenuators	34720	10/7/2015	10/7/2016
RE619	Rhode & Schwarz	ESU26	Spectrum Analyzers	1302.6005K26 Ser. 100190	11/5/2014	11/5/2016

Notes:

- **NCR=No Calibration Required**
- **The calibration information cycle for asset 479 is provided to cover the entire test period. The asset was only used during the active period of the calibration cycle.**

5 SUPPORT EQUIPMENT

Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Juniper Systems, Inc.	MS2	MS2P34
2	12 VDC Power Supply	PhiHong	PSAA20R-120	P51904229A1
3	Earbuds	Maxell	N/A	N/A
4	Mouse	Insignia	NS-PNC5001	15G03A003432

Table 5-2: Cable Description (Radiated Emissions)

Cable #	Cable Type	Length	Shield	Termination
A	Power	1.5 m	No	Power Supply To EUT
B	Audio	0.92 m	No	Earbuds to EUT
C	USB	1.55 m	No	Mouse to EUT
D	Extension Power Cord	2.7 m	No	Power Supply to AC Mains

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

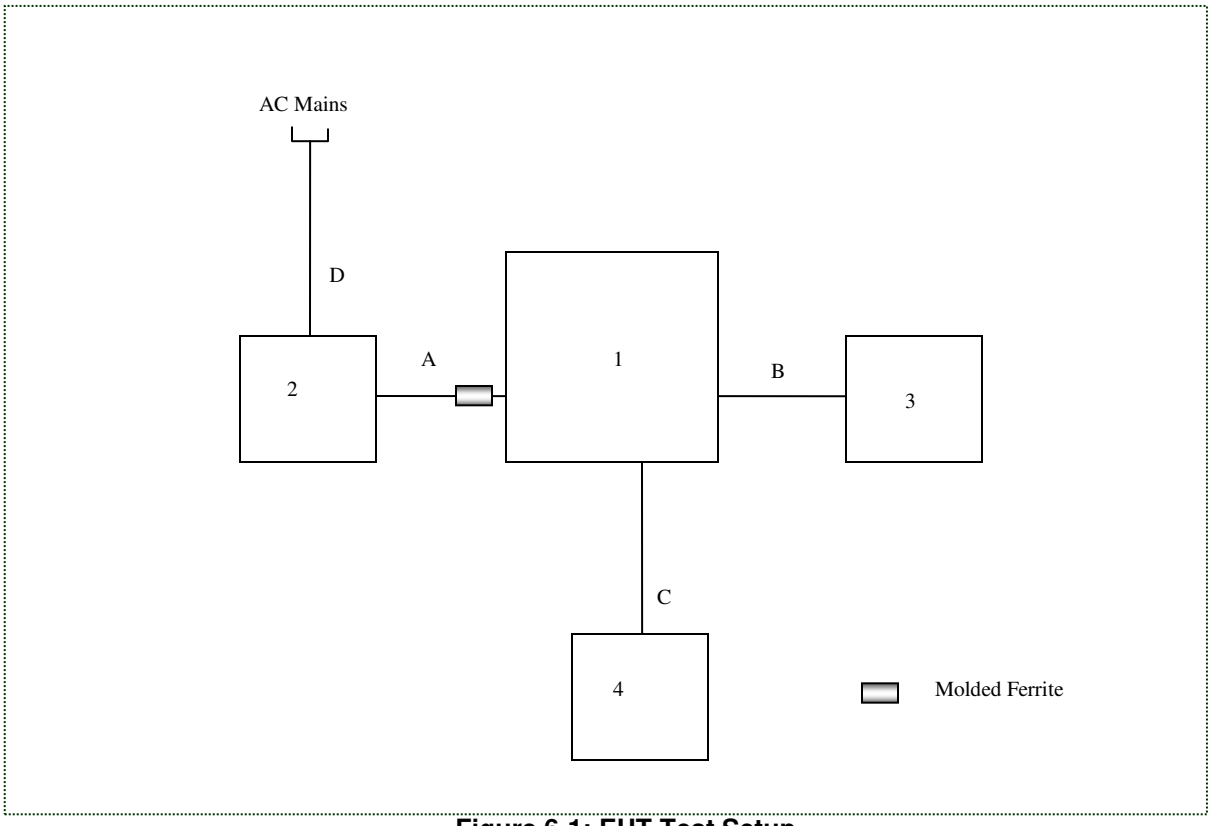

Figure 6-1: EUT Test Setup

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The MS2 uses a 2.5 dBi Internal PIFA that is soldered directly to the PCB as well as a 2.0 dBi PIFA printed in the PCB for the primary and secondary antennas, respectively. The antennas are neither removable nor accessible to the end-user. Thus, the equipment meets the requirements of FCC Section 15.203.

The directional gain is calculated per the FCC KDB Publication No. 662911 D01 Multiple Transmitter Output v02r01.

For MIMO CDD and SM-MIMO, the directional gain is calculated as:

$$Directional\ Gain = 10 \cdot log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$$

where
N_{SS} = the number of independent spatial streams of data.
N_{ANT} = the total number of antennas
$g_{j,k} = 10^{G_k/20}$ if the k_{th} antenna is being fed by spatial stream j, or zero if it is not
G_k is the gain in dBi of the k_{th} antenna

The Directional Gain can be calculated as:

$Directional\ Gain$ = $10*\log[\{(10^{2.5/20} + 10^{2/20})^2\}/2]$
= $10*\log(3.36)$
= 5.3 dB

7.2 6 dB Bandwidth - FCC: Section 15.247(a)(2) IC: RSS-247 5.5(1); 99% Bandwidth IC: RSS-GEN 6.6

7.2.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with ANSI C63.10:2013 Section 11.8 DTS Bandwidth Option 1. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the emissions and >> RBW.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission. The RBW was set to 1% to 5% of the approximated bandwidth. The occupied 99% bandwidth was measured by using 99% bandwidth equipment function of the spectrum analyzer.

7.2.2 Measurement Results

Results are shown below.

802.11b

Table 7.2.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth (MHz)
2412	8.36	10.25
2437	8.16	10.25
2462	8.12	10.25

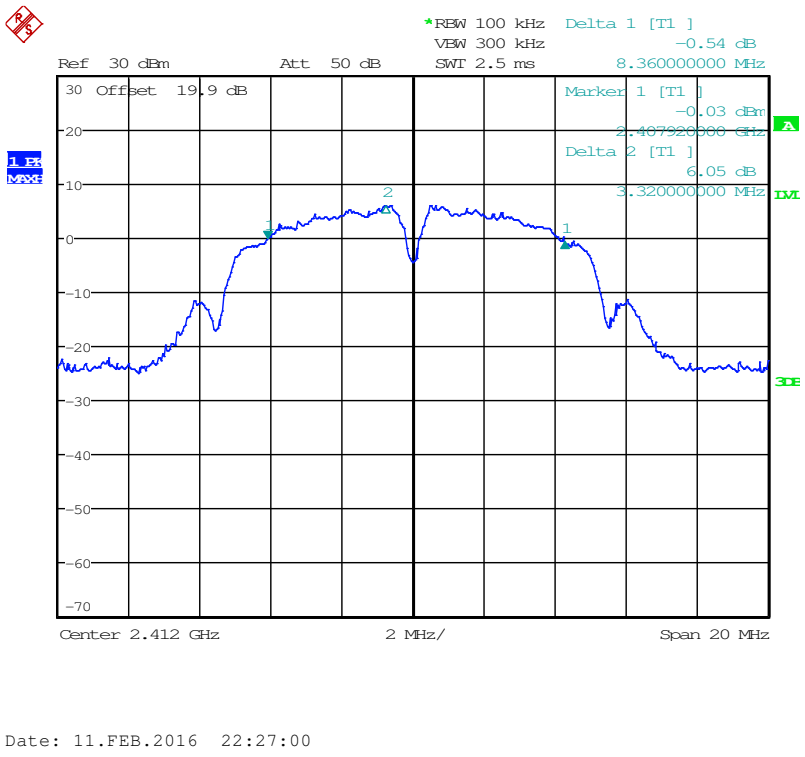

Figure 7.2.2-1: 6dB BW - Low Channel

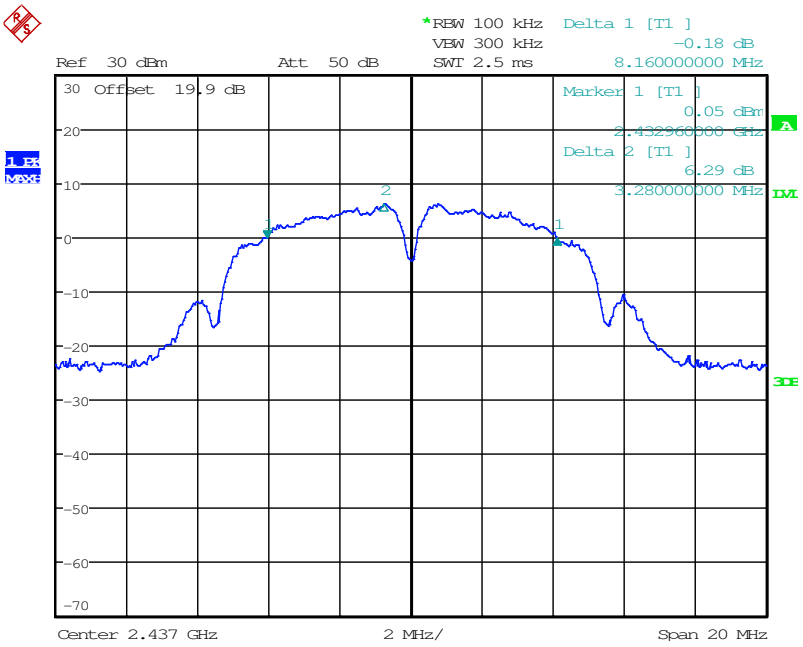

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Figure 7.2.2-2: 6dB BW - Middle Channel

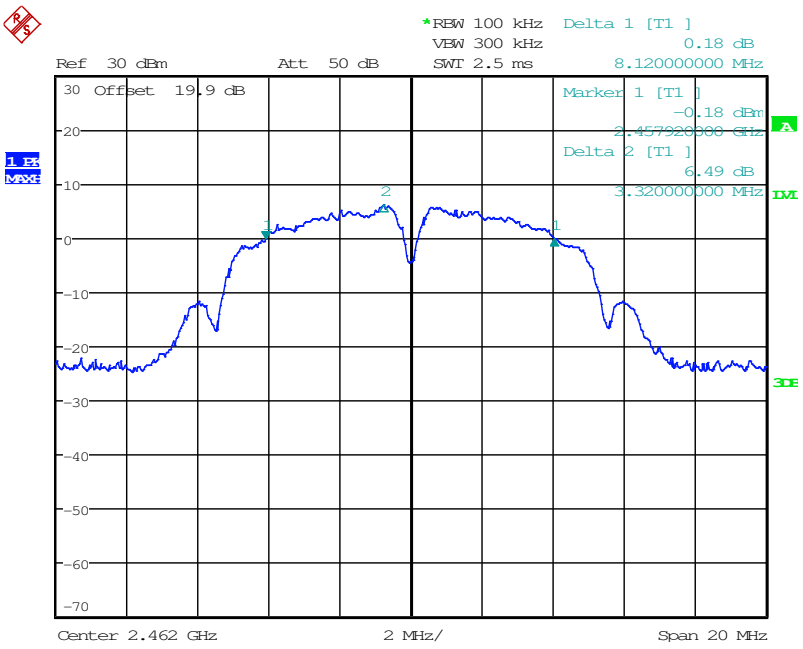

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Figure 7.2.2-3: 6dB BW - High Channel

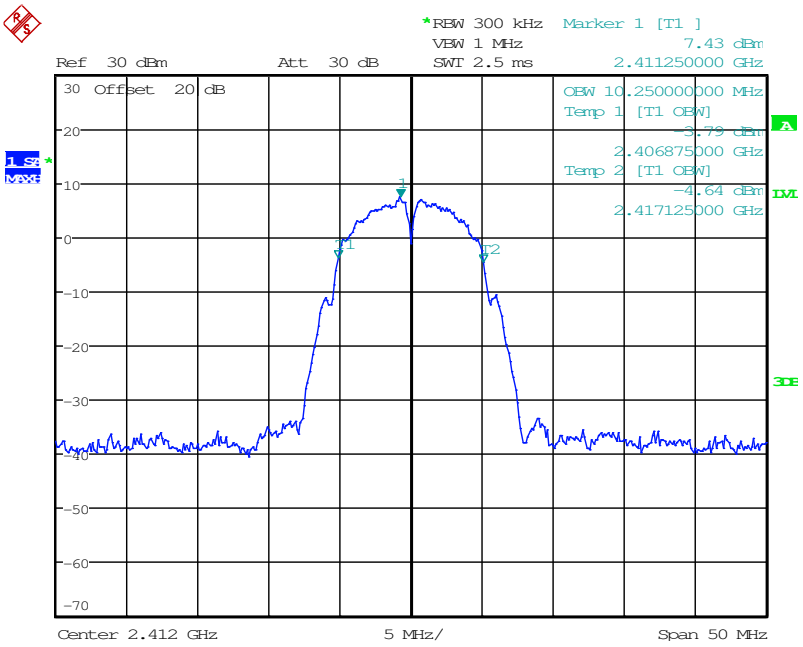

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Figure 7.2.2-4: 99% OBW - Low Channel

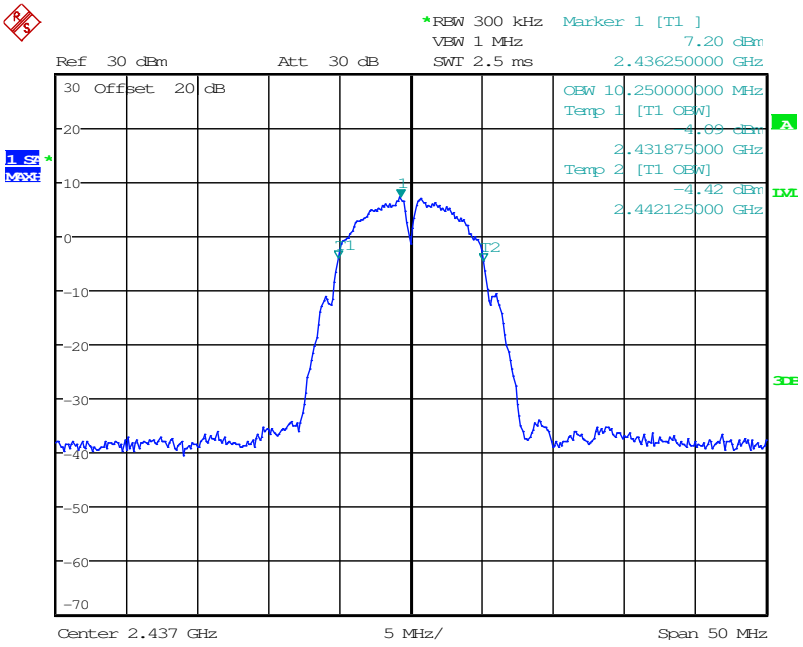

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Figure 7.2.2-5: 99% OBW - Middle Channel

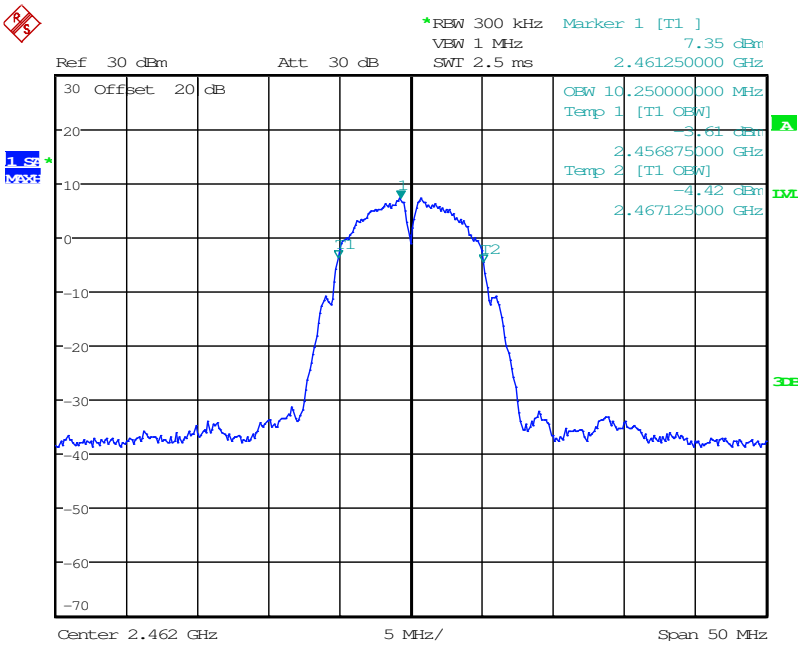

Figure 7.2.2-6: 99% OBW - High Channel

802.11g

Primary Antenna

Table 7.2.2-2: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth (MHz)
2412	16.02	16.63
2437	15.84	16.63
2462	16.20	16.75

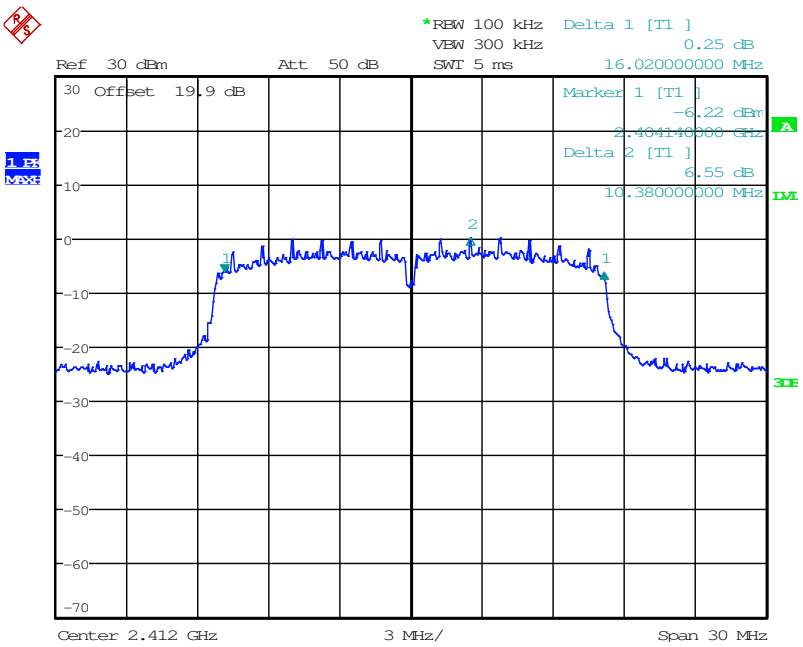

Figure 7.2.2-7: 6dB BW - Low Channel

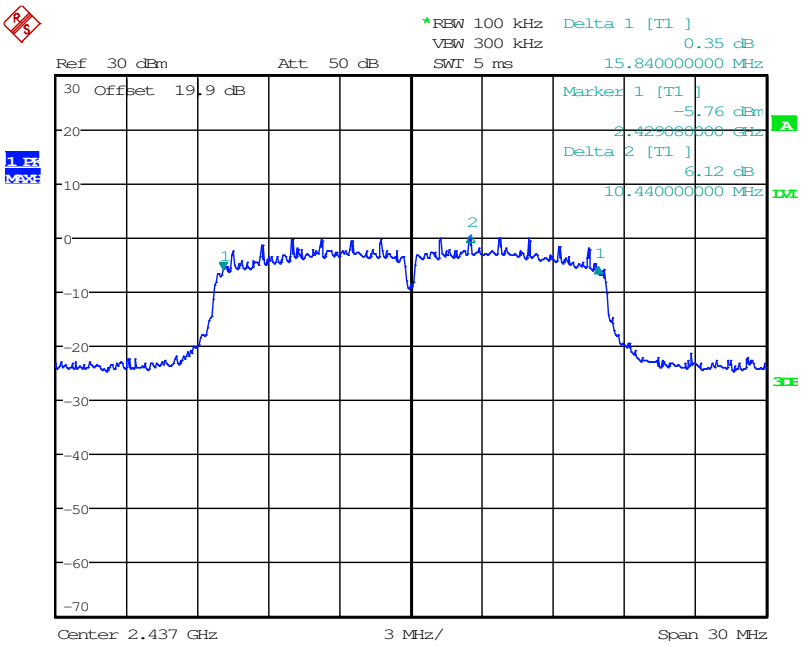

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Figure 7.2.2-8: 6dB BW - Middle Channel

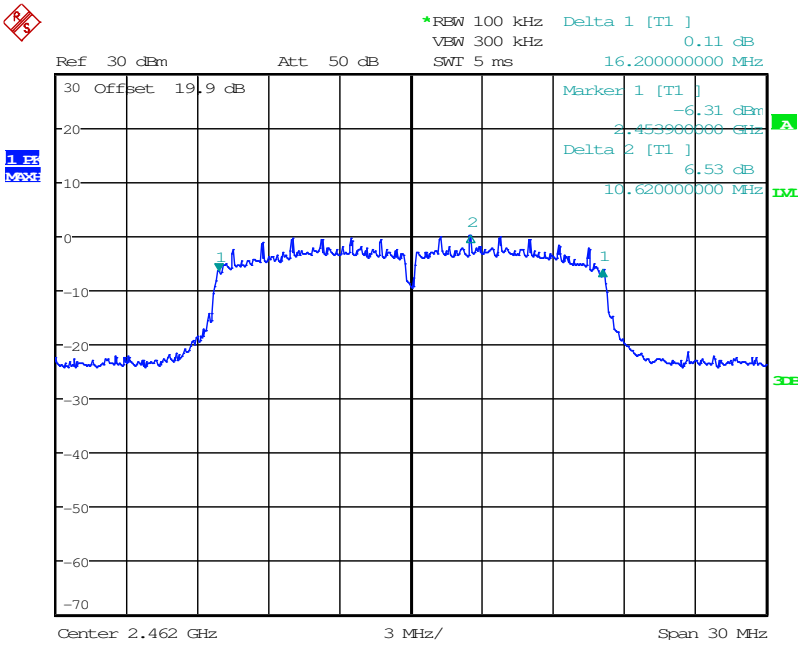

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Figure 7.2.2-9: 6dB BW - High Channel

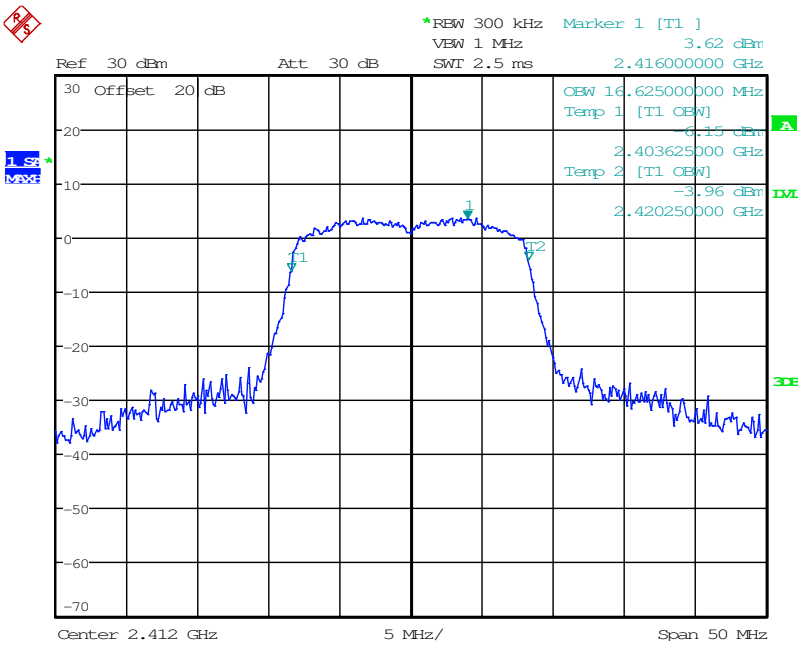

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Figure 7.2.2-10: 99% OBW - Low Channel

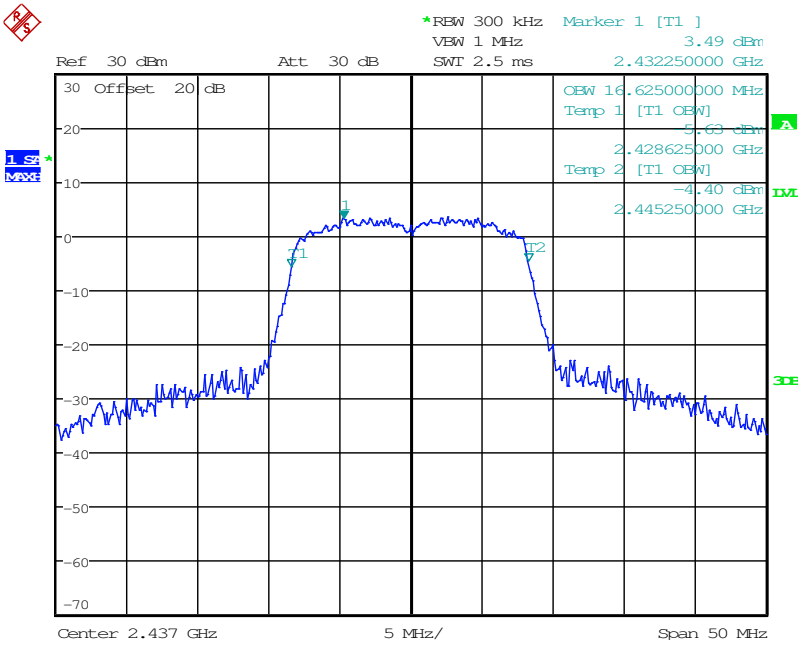

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Figure 7.2.2-11: 99% OBW - Middle Channel

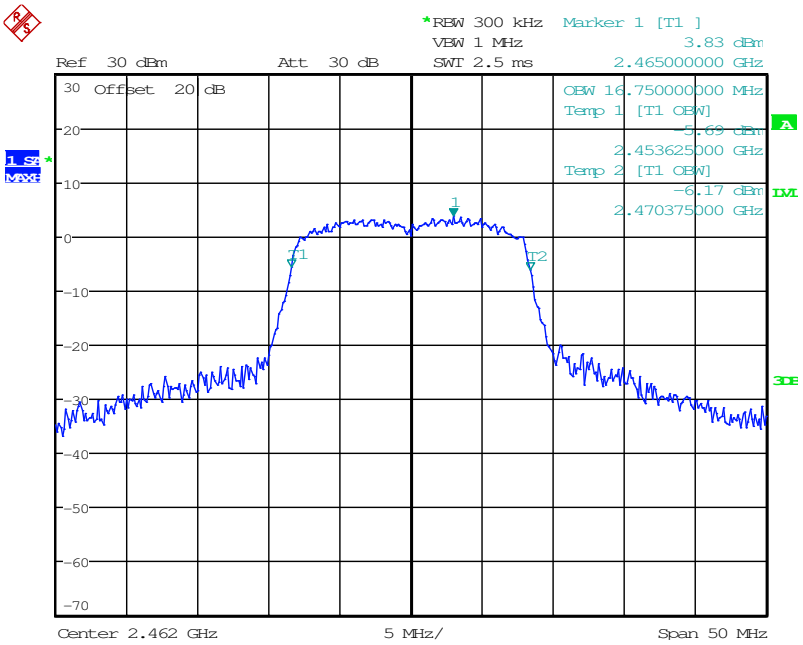

Figure 7.2.2-12: 99% OBW - High Channel

802.11g

Secondary Antenna

Table 7.2.2-3: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth (MHz)
2412	16.25	16.63
2437	16.01	16.63
2462	15.87	16.63

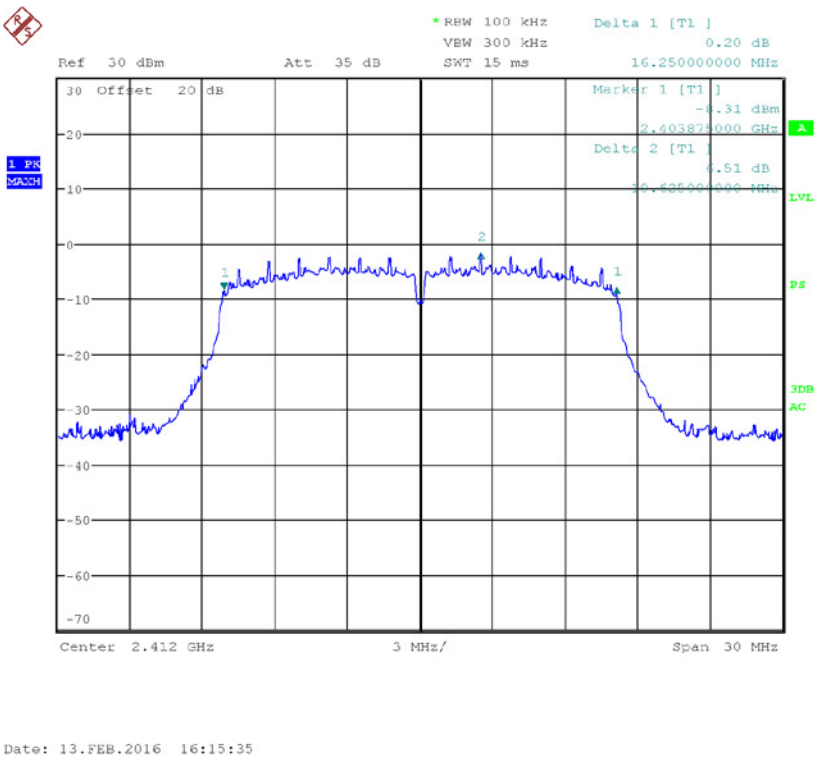

Figure 7.2.2-13: 6dB BW - Low Channel

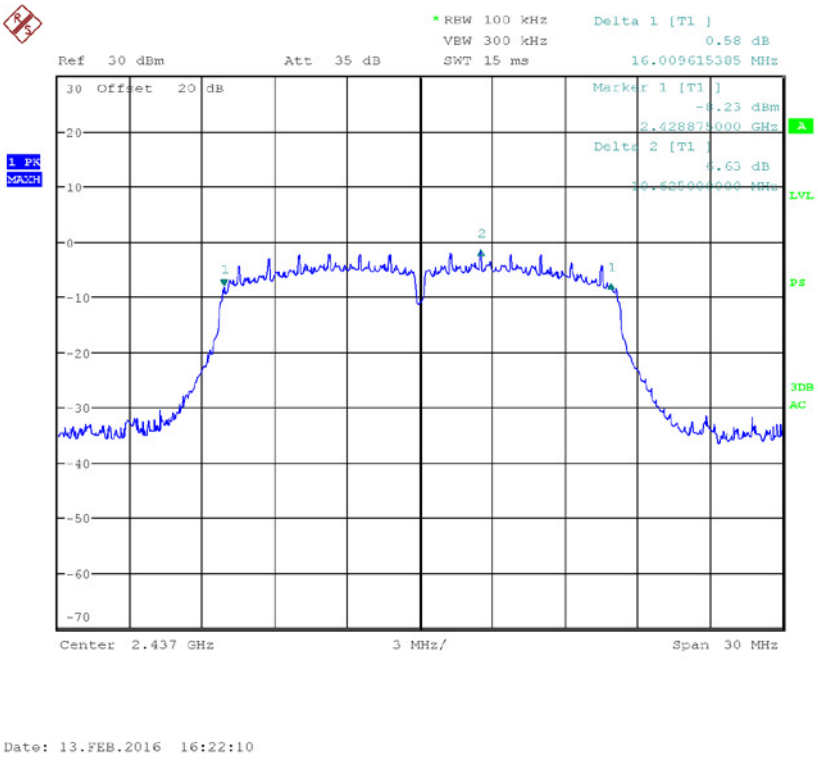

Figure 7.2.2-14: 6dB BW - Middle Channel

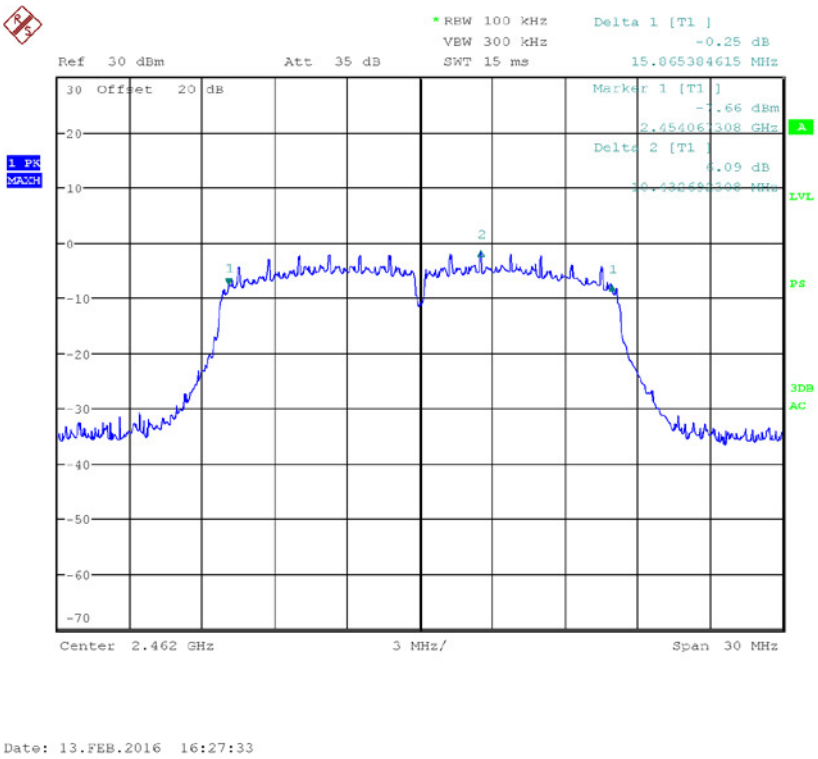

Figure 7.2.2-15: 6dB BW - High Channel

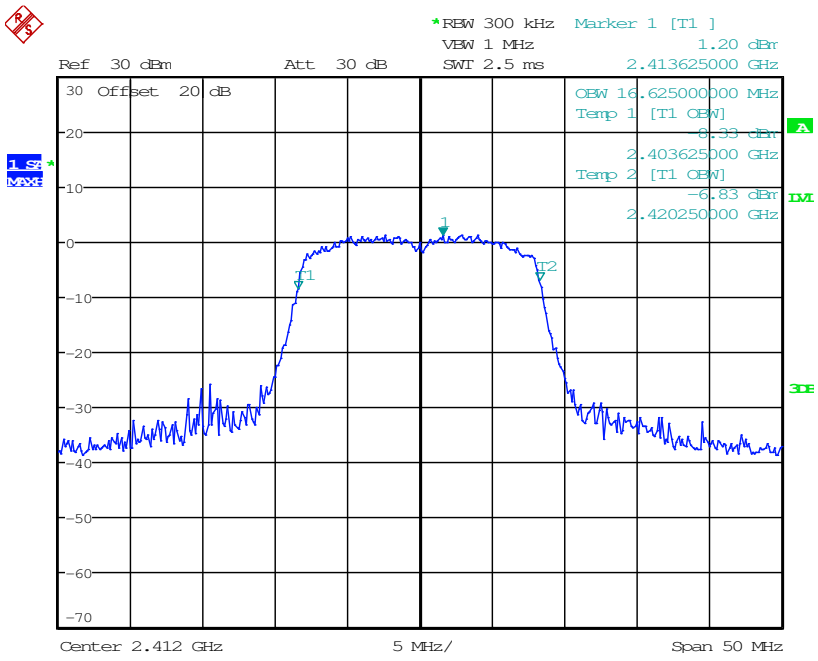

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Figure 7.2.2-16: 99% OBW - Low Channel

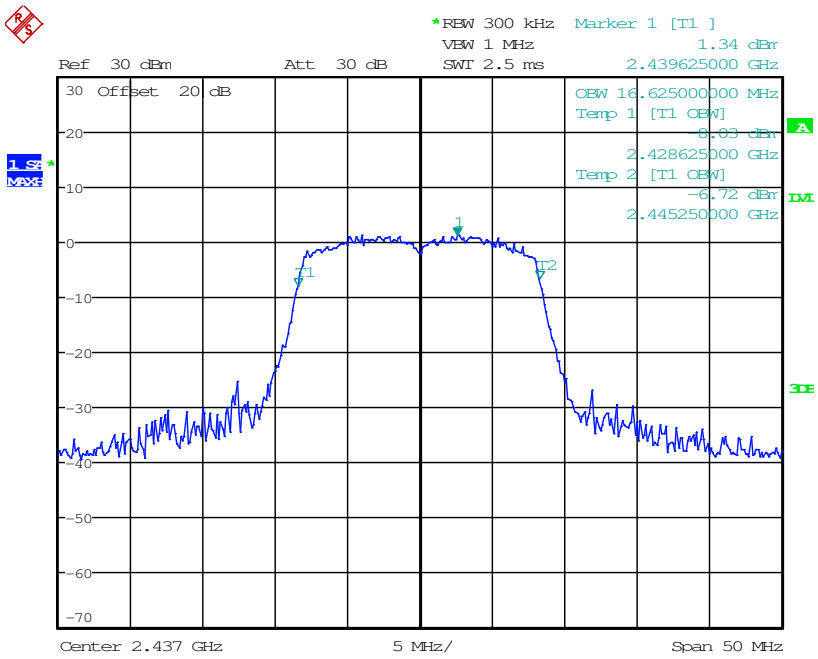

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Figure 7.2.2-17: 99% OBW - Middle Channel

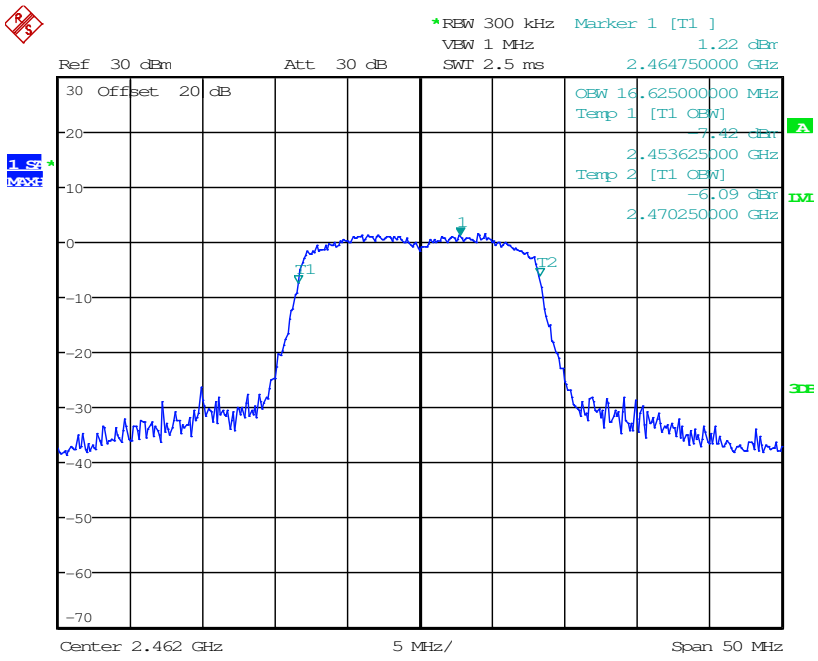


Figure 7.2.2-18: 99% OBW - High Channel

802.11n 20 MHz

Primary Antenna

Table 7.2.2-4: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth (MHz)
2412	16.80	17.50
2437	16.50	17.63
2462	16.50	17.63

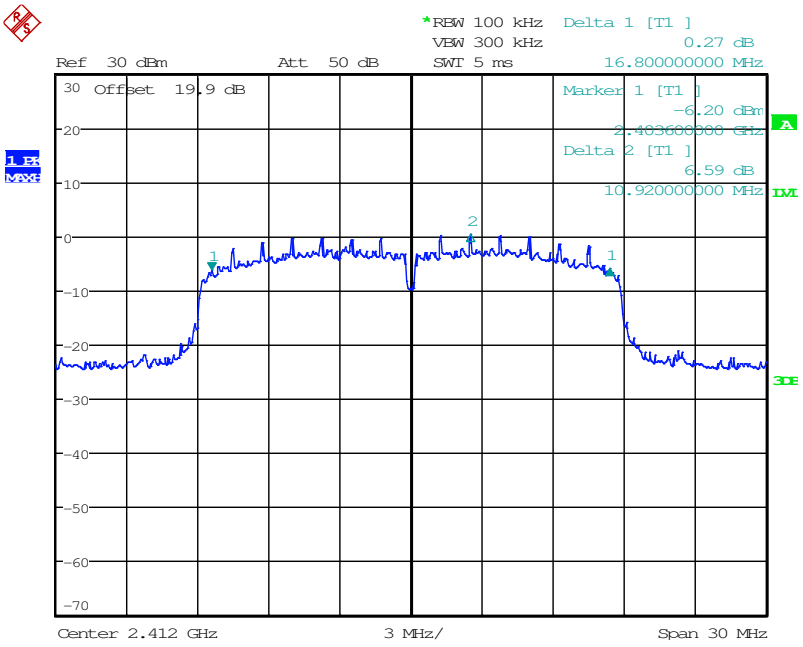
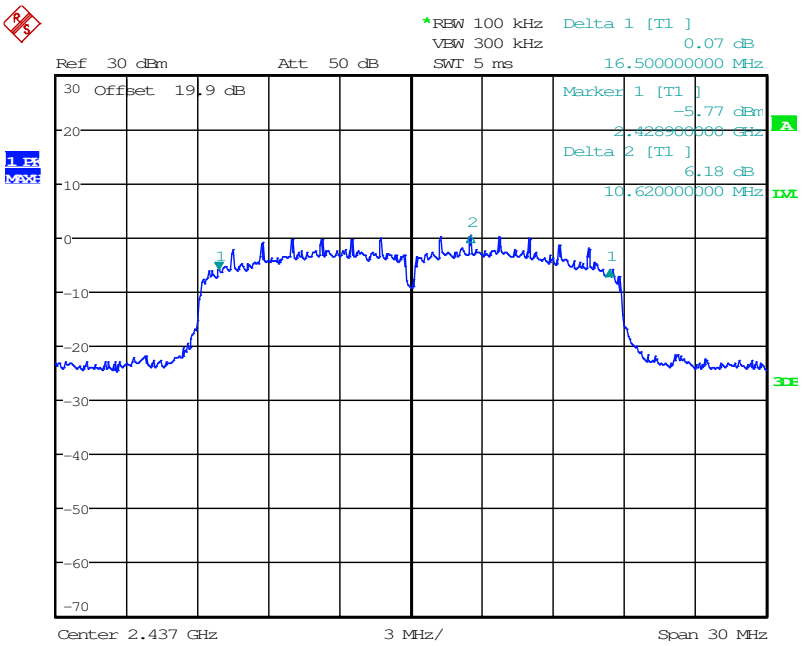
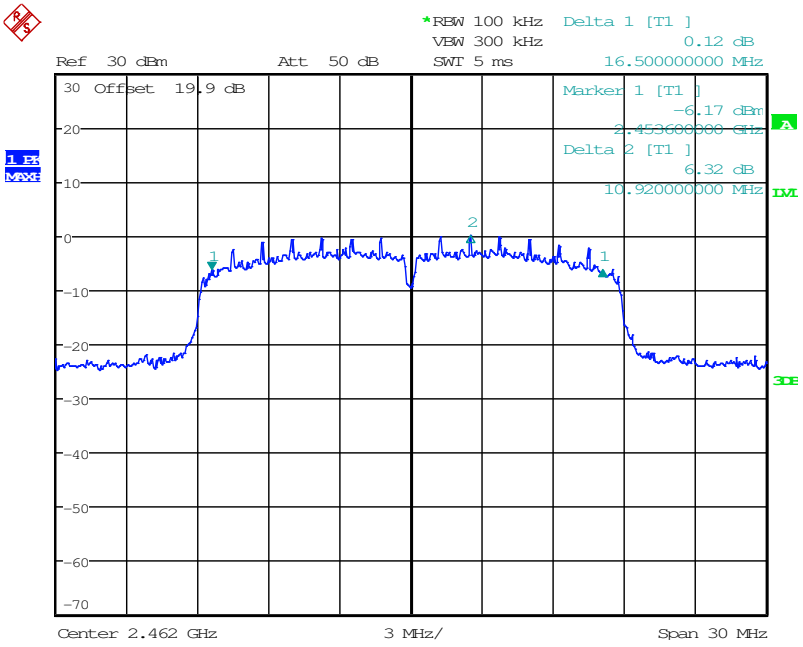


Figure 7.2.2-19: 6dB BW - Low Channel



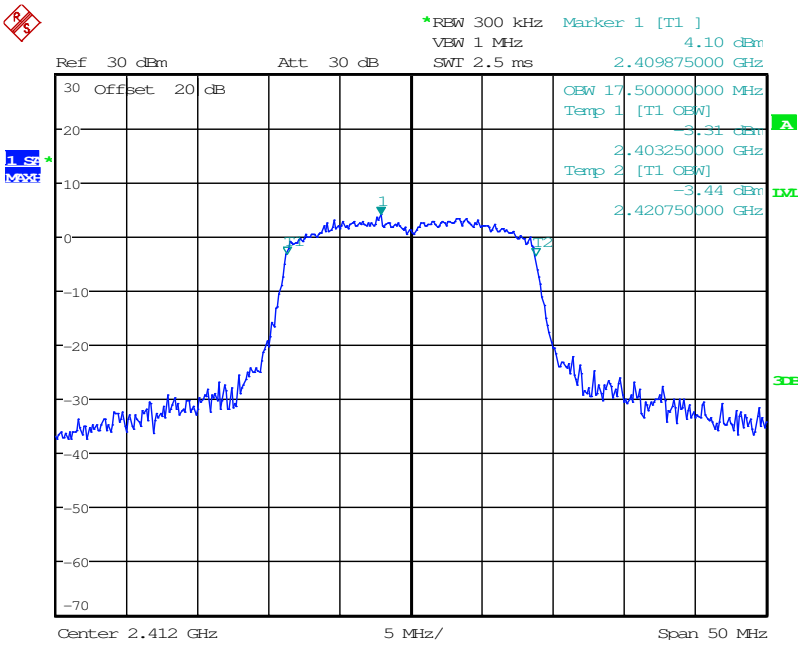
Date: 11.FEB.2016 22:39:47

Figure 7.2.2-20: 6dB BW - Middle Channel



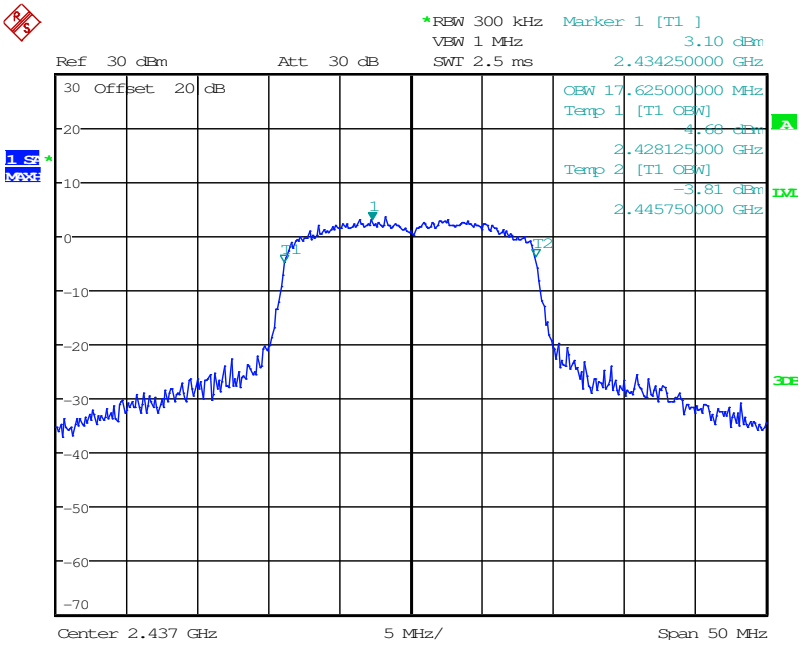
Date: 11.FEB.2016 23:27:51

Figure 7.2.2-21: 6dB BW - High Channel



Date: 10.FEB.2016 23:30:32

Figure 7.2.2-22: 99% OBW - Low Channel



Date: 10.FEB.2016 23:37:12

Figure 7.2.2-23: 99% OBW - Middle Channel

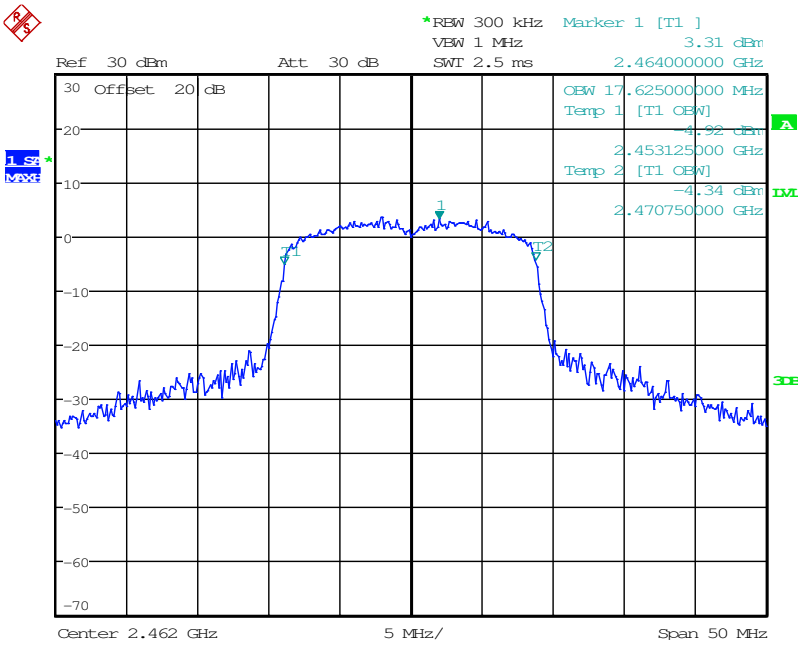


Figure 7.2.2-24: 99% OBW - High Channel

Secondary Antenna

Table 7.2.2-5: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth (MHz)
2412	16.25	17.63
2437	15.87	17.63
2462	16.30	17.63

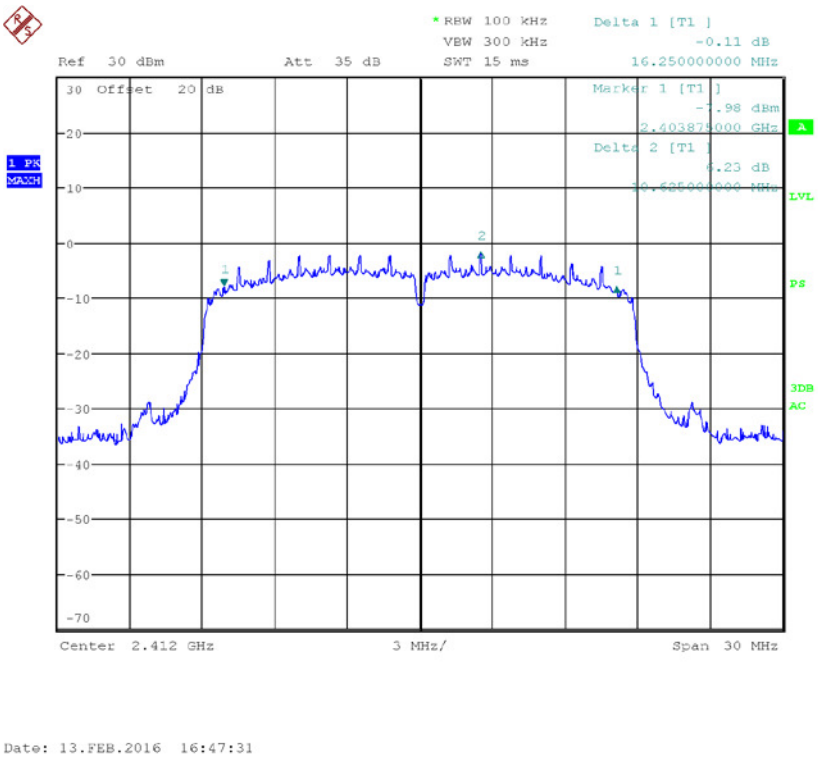


Figure 7.2.2-25: 6dB BW - Low Channel

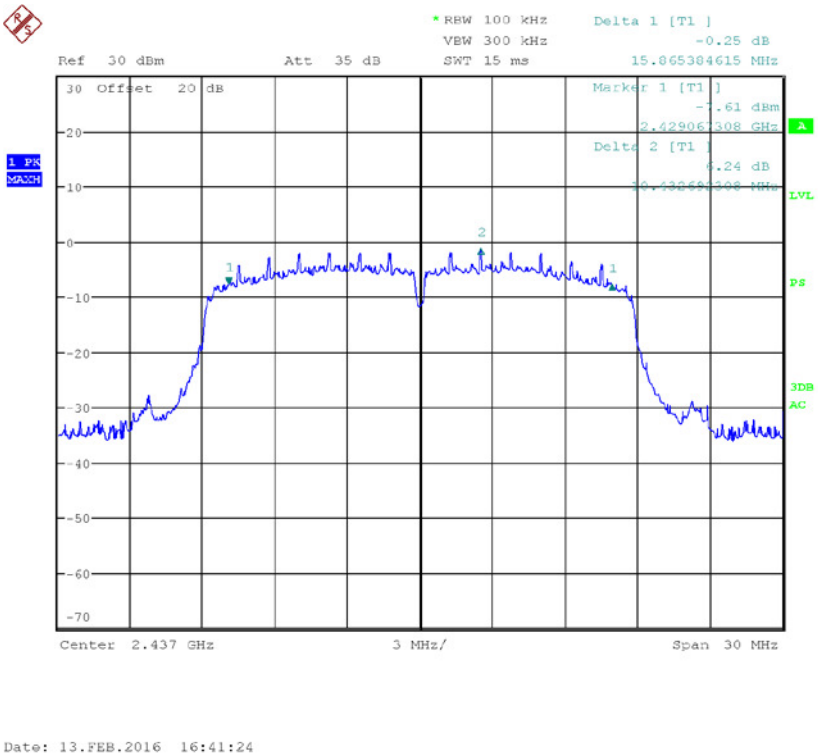


Figure 7.2.2-26: 6dB BW - Middle Channel

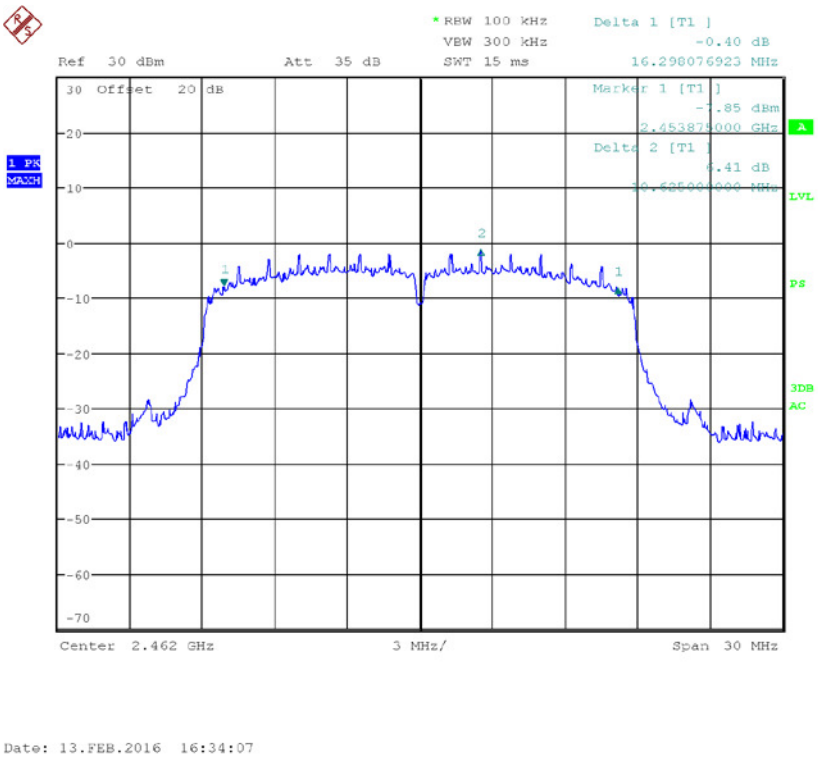
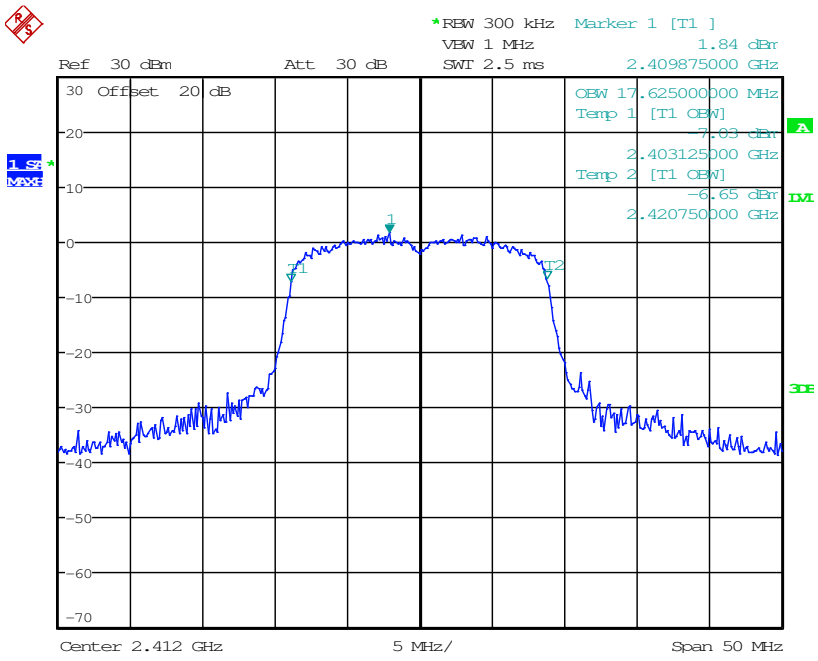
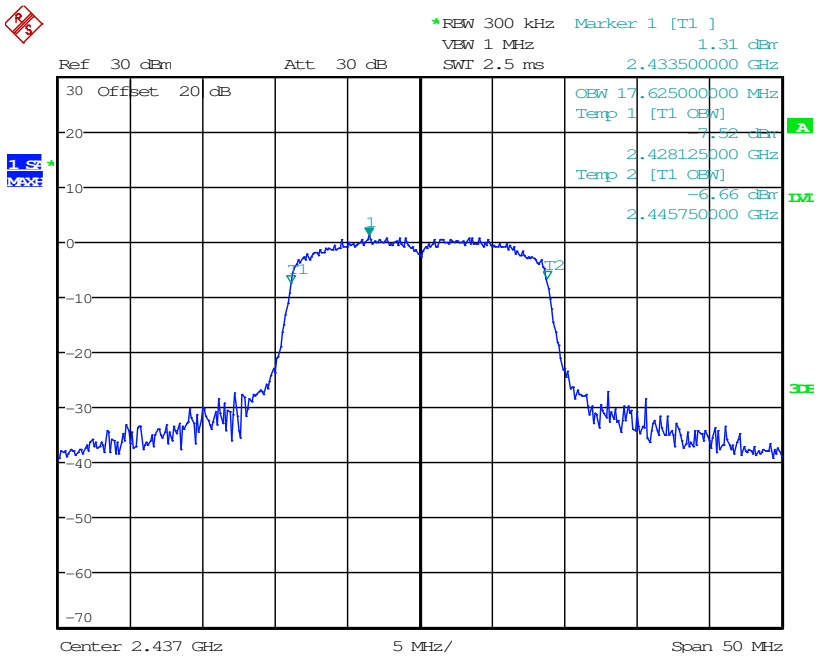


Figure 7.2.2-27: 6dB BW - High Channel



Date: 10.FEB.2016 21:19:37

Figure 7.2.2-28: 99% OBW - Low Channel



Date: 10.FEB.2016 21:13:09

Figure 7.2.2-29: 99% OBW - Middle Channel

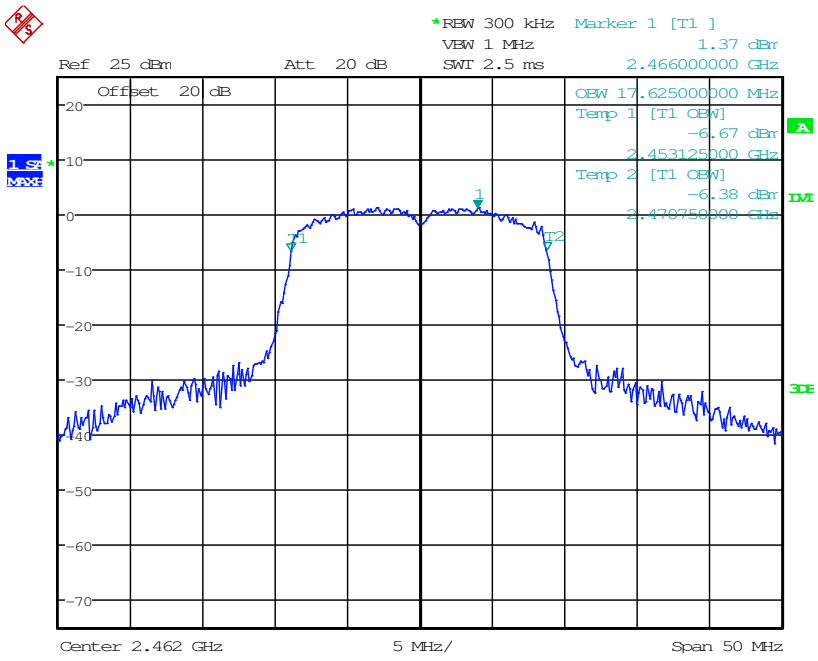


Figure 7.2.2-30: 99% OBW - High Channel

7.3 Maximum Conducted Output Power - FCC Section 15.247(b)(3) IC: RSS-247 5.4(4))

7.3.1 Measurement Procedure (Conducted Method)

The fundamental emission output power was measured in accordance with ANSI C63.10:2013 Section 11.9.2.2.2 Method AVGSA-1 for the 802.11b mode of operation and Section 11.9.2.2.4 Method AVGSA-2 for the 802.11g/n modes. Justification for the Duty Cycle correction factor used in provide is Section 7.7.

The RF output of the equipment under test was directly connected to the input of the spectrum analyzer through suitable attenuation.

The total output power levels for the MIMO modes were calculated in accordance with FCC KDB Publication No. 662911 “Emissions Testing of Transmitters with Multiple Outputs in the Same Band” in order to account for the two TX antenna paths by summing the output power across all transmitter outputs.

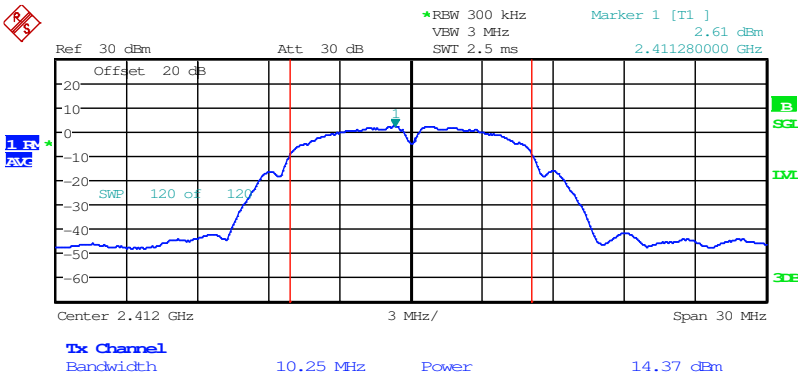
7.3.2 Measurement Results

Results are shown below.

802.11b

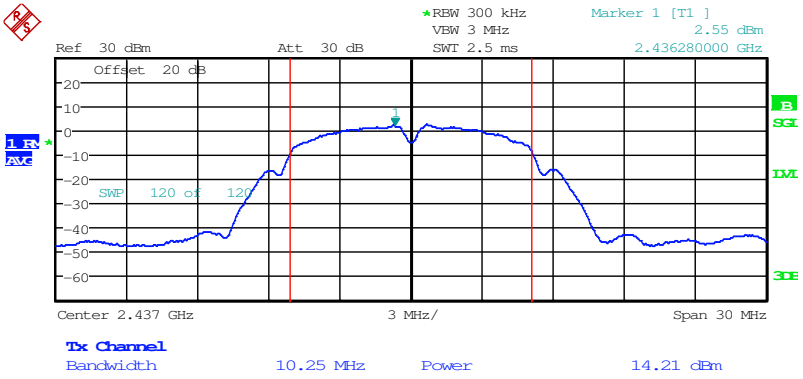
Table 7.3.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
2412	14.37
2437	14.21
2462	14.20



Date: 10.FEB.2016 22:57:06

Figure 7.3.2-1: RF Output Power - Low Channel



Date: 10.FEB.2016 23:00:26

Figure 7.3.2-2: RF Output Power - Middle Channel

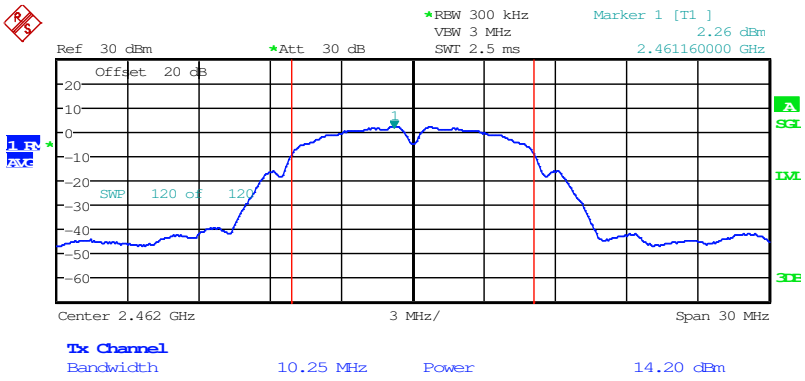


Figure 7.3.2-3: RF Output Power - High Channel

802.11g

Table 7.3.2-2: RF Output Power

Frequency [MHz]	Primary Antenna Level [dBm]	Secondary Antenna Level [dBm]	MIMO Level [dBm]
2412	11.40	8.92	13.34
2437	11.30	9.02	13.32
2462	11.19	9.05	13.26

Note: The MIMO Level is computed using the linear summation of the level of the primary and secondary antennas.

Primary Antenna

Table 7.3.2-3: RF Output Power

Frequency [MHz]	Primary Antenna Level [dBm]	Duty Cycle Correction [dB]	Corrected Level [dBm]
2412	11.24	0.16	11.40
2437	11.14	0.16	11.30
2462	11.03	0.16	11.19

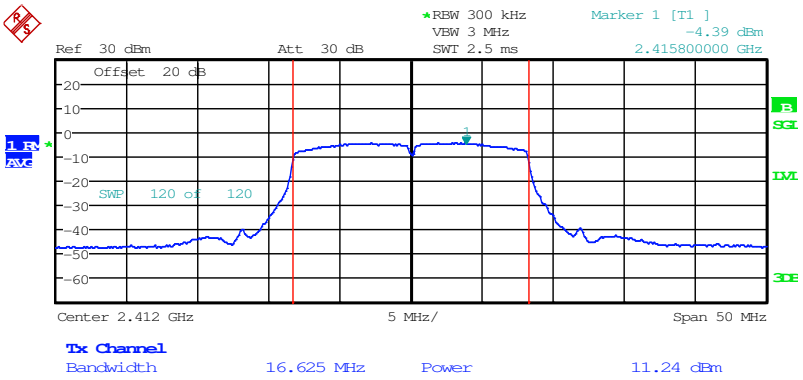
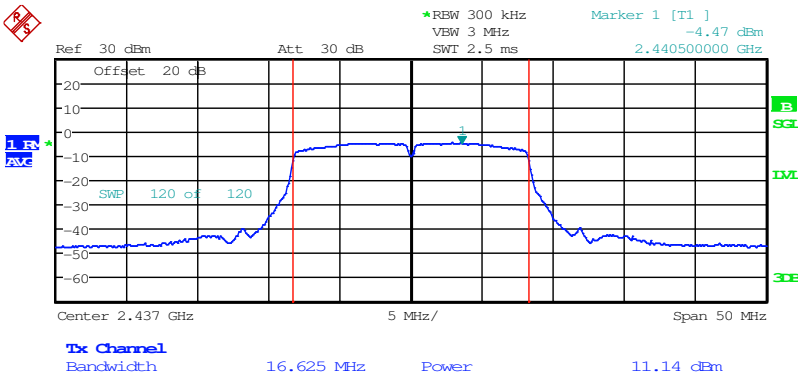
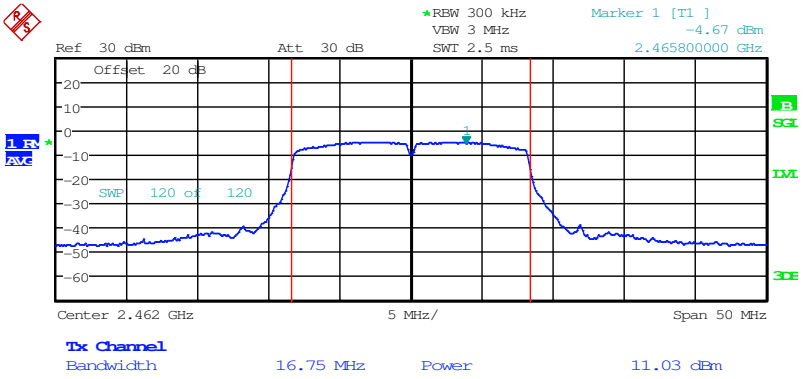


Figure 7.3.2-4: RF Output Power - Low Channel



Date: 10.FEB.2016 23:19:06

Figure 7.3.2-5: RF Output Power - Middle Channel



Date: 10.FEB.2016 23:14:45

Figure 7.3.2-6: RF Output Power - High Channel

Secondary Antenna

Table 7.3.2-4: RF Output Power

Frequency [MHz]	Secondary Antenna Level [dBm]	Duty Cycle Correction [dB]	Corrected Level [dBm]
2412	8.76	0.16	8.92
2437	8.86	0.16	9.02
2462	8.89	0.16	9.05

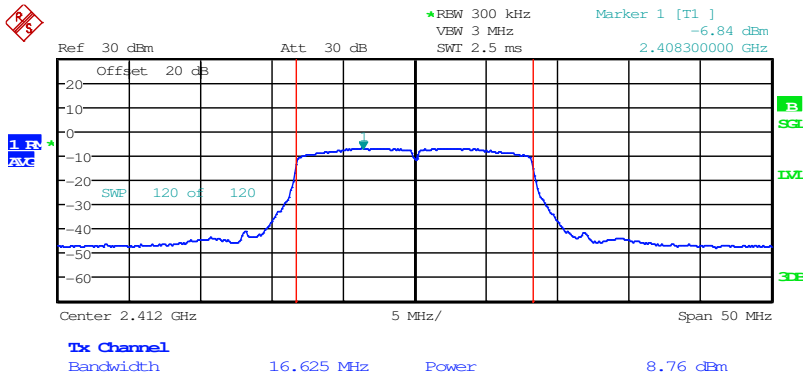
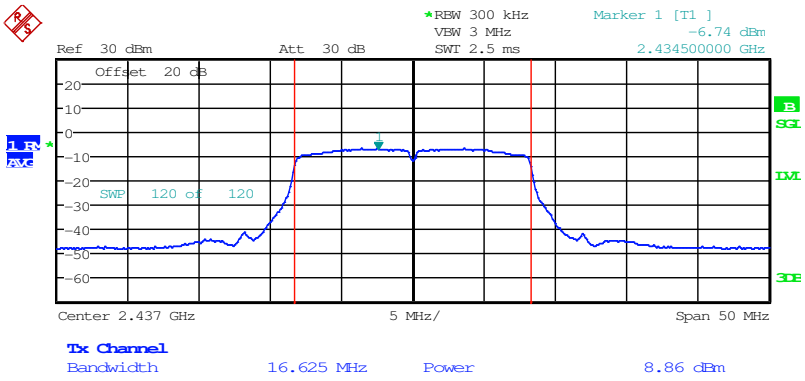
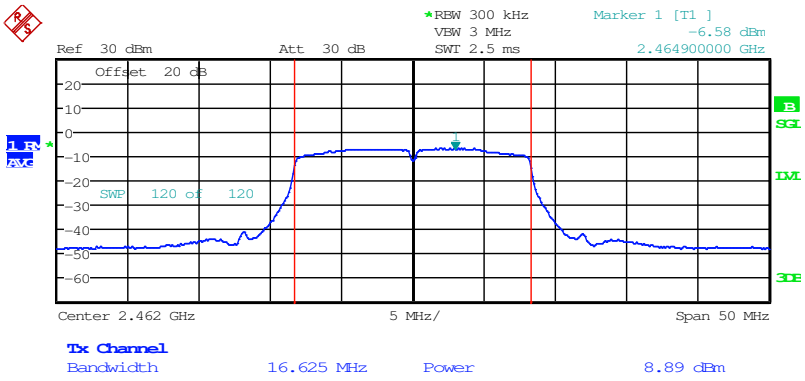


Figure 7.3.2-7: RF Output Power - Low Channel



Date: 10.FEB.2016 21:32:45

Figure 7.3.2-8: RF Output Power - Middle Channel



Date: 10.FEB.2016 21:39:07

Figure 7.3.2-9: RF Output Power - High Channel

802.11n 20 MHz

Table 7.3.2-5: RF Output Power

Frequency [MHz]	Primary Antenna Level [dBm]	Secondary Antenna Level [dBm]	MIMO Level [dBm]
2412	11.12	8.79	13.12
2437	11.01	8.83	13.07
2462	11.00	9.11	13.17

Note: The MIMO Level is computed using the linear summation of the level of the primary and secondary antennas.

Primary Antenna

Table 7.3.2-6: RF Output Power

Frequency [MHz]	Primary Antenna Level [dBm]	Duty Cycle Correction [dB]	Corrected Level [dBm]
2412	10.92	0.2	11.12
2437	10.81	0.2	11.01
2462	10.80	0.2	11.00

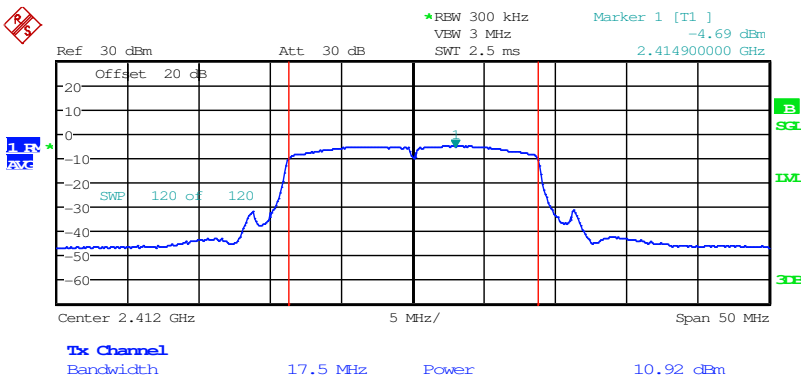
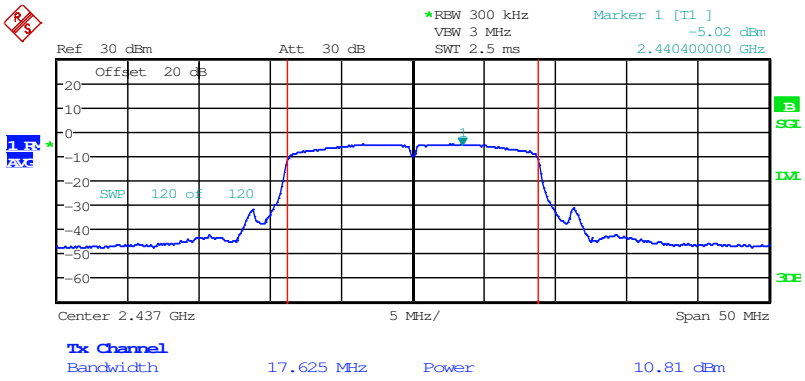
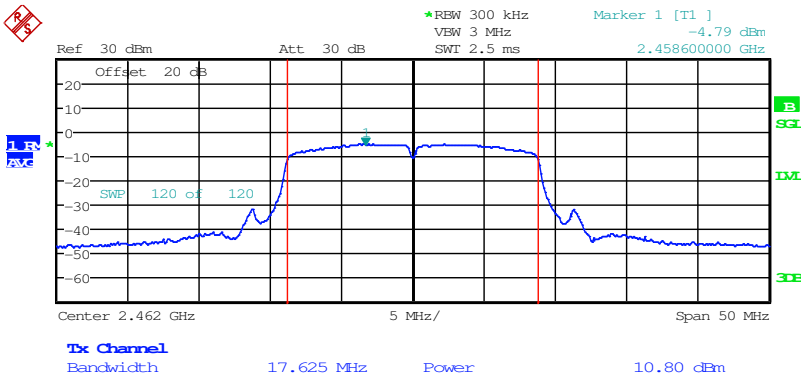


Figure 7.3.2-10: RF Output Power - Low Channel



Date: 10.FEB.2016 23:39:14

Figure 7.3.2-11: RF Output Power - Middle Channel



Date: 10.FEB.2016 23:42:57

Figure 7.3.2-12: RF Output Power - High Channel

Secondary Antenna

Table 7.3.2-7: RF Output Power

Frequency [MHz]	Primary Antenna Level [dBm]	Duty Cycle Correction [dB]	Corrected Level [dBm]
2412	8.59	0.2	8.79
2437	8.63	0.2	8.83
2462	8.91	0.2	9.11

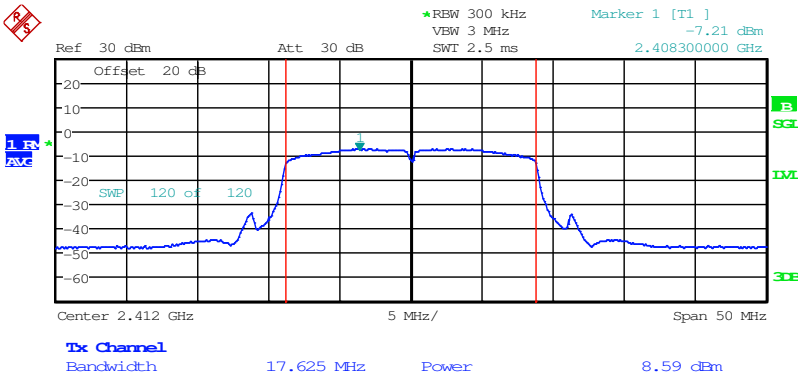
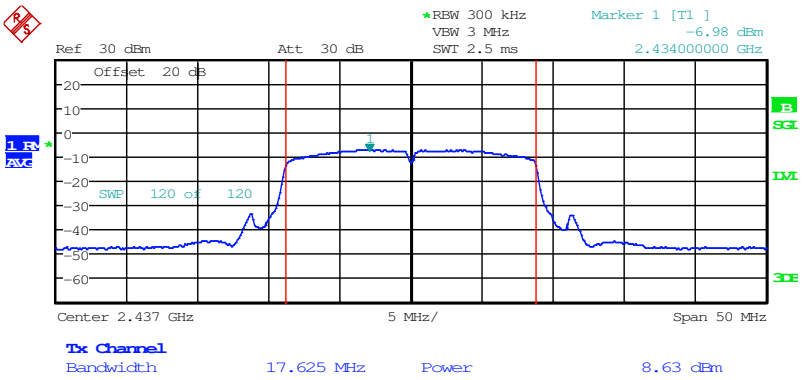
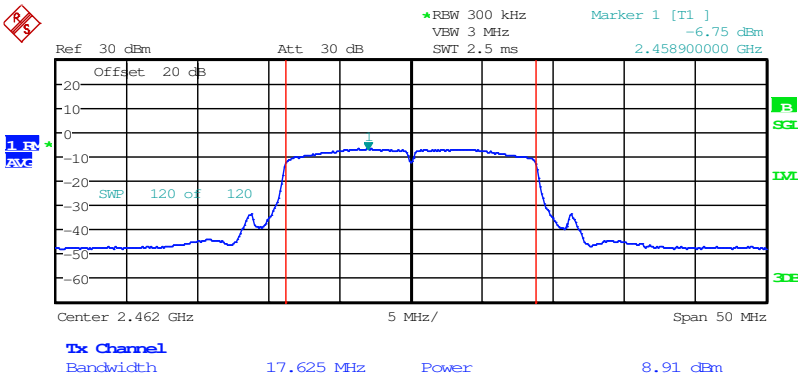


Figure 7.3.2-13: RF Output Power - Low Channel



Date: 10.FEB.2016 21:14:58

Figure 7.3.2-14: RF Output Power - Middle Channel



Date: 10.FEB.2016 21:08:33

Figure 7.3.2-15: RF Output Power - High Channel

7.4 Band-Edge Compliance and Spurious Emissions-FCC 15.247(d) IC: RSS-247 5.5

7.4.1 Band-Edge Compliance of RF Conducted Emissions

7.4.1.1 Measurement Procedure

The RF output port of the EUT was directly connected to the input of the spectrum analyzer via suitable attenuation. The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, and the VBW was set to 300 kHz.

7.4.1.2 Measurement Results

Results are shown below.

802.11b

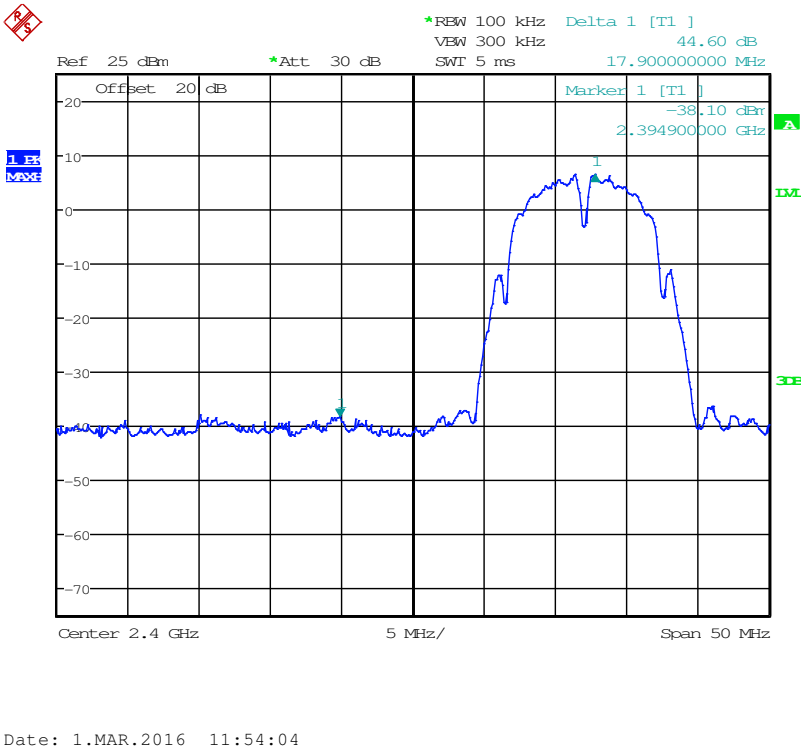


Figure 7.4.1.2-1: Lower Band-edge

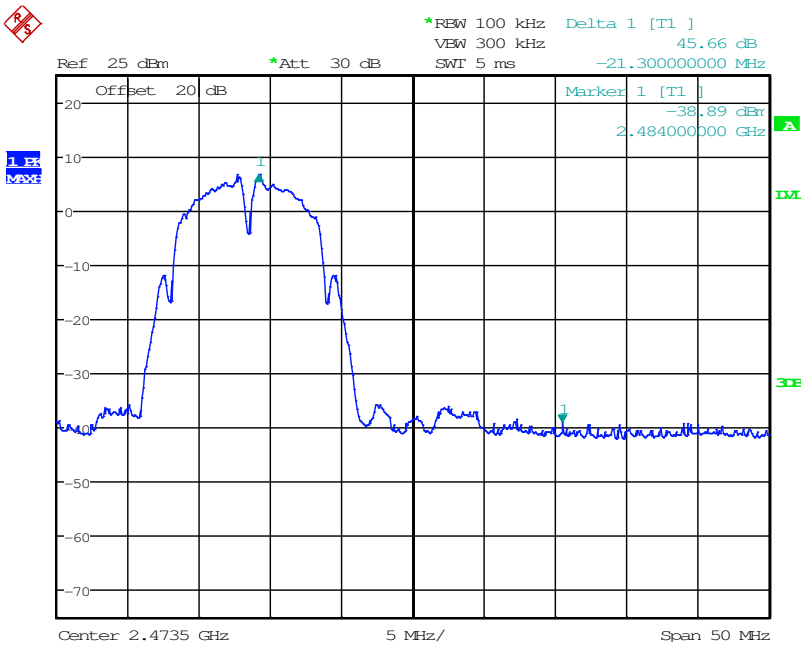


Figure 7.4.1.2-2: Upper Band-edge

802.11g

Primary Antenna

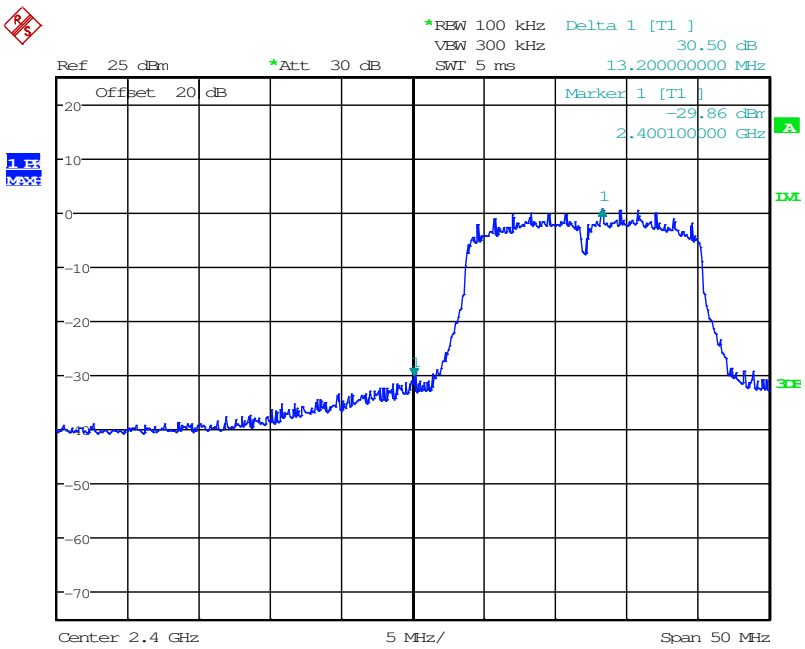


Figure 7.4.1.2-3: Lower Band-edge

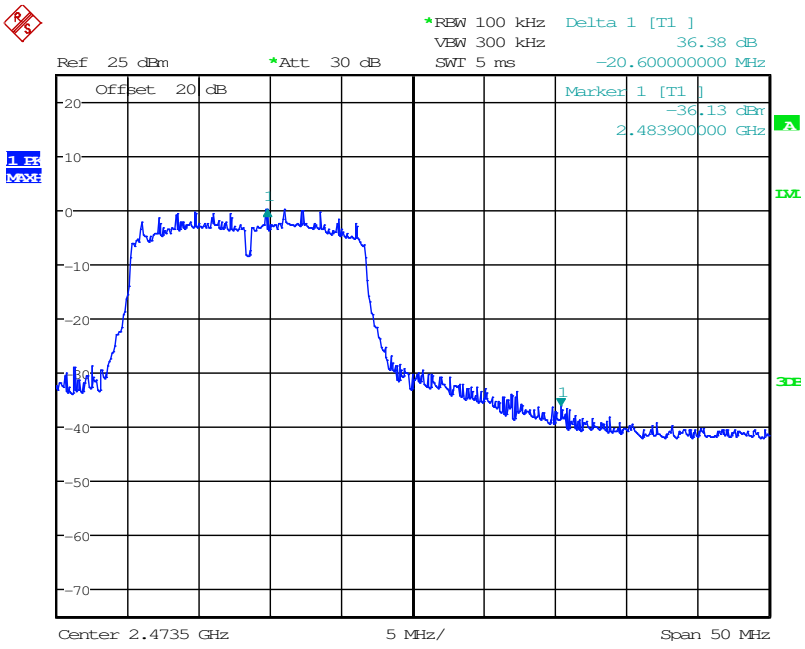


Figure 7.4.1.2-4: Upper Band-edge

Secondary Antenna

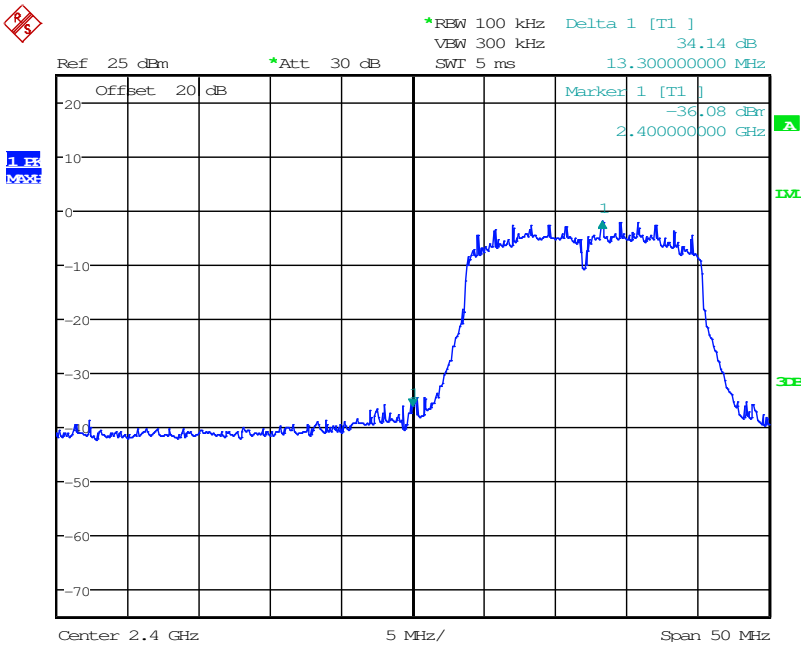


Figure 7.4.1.2-4: Lower Band-edge

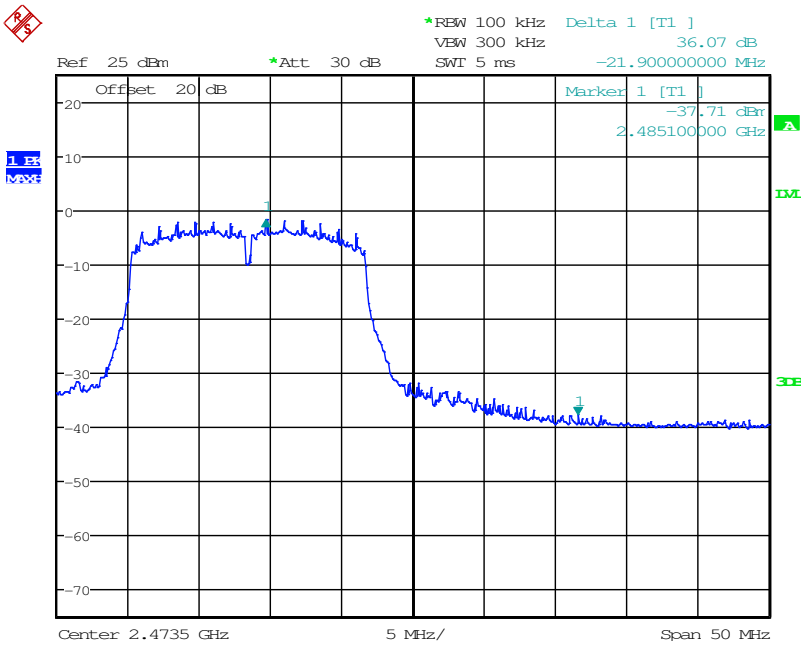


Figure 7.4.1.2-5: Upper Band-edge

802.11n 20 MHz

Primary Antenna

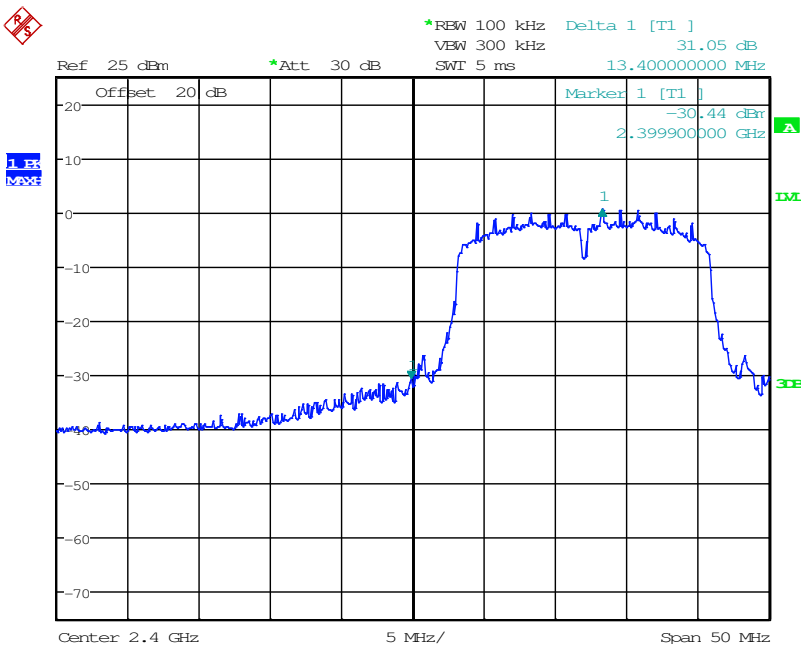


Figure 7.4.1.2-6: Lower Band-edge

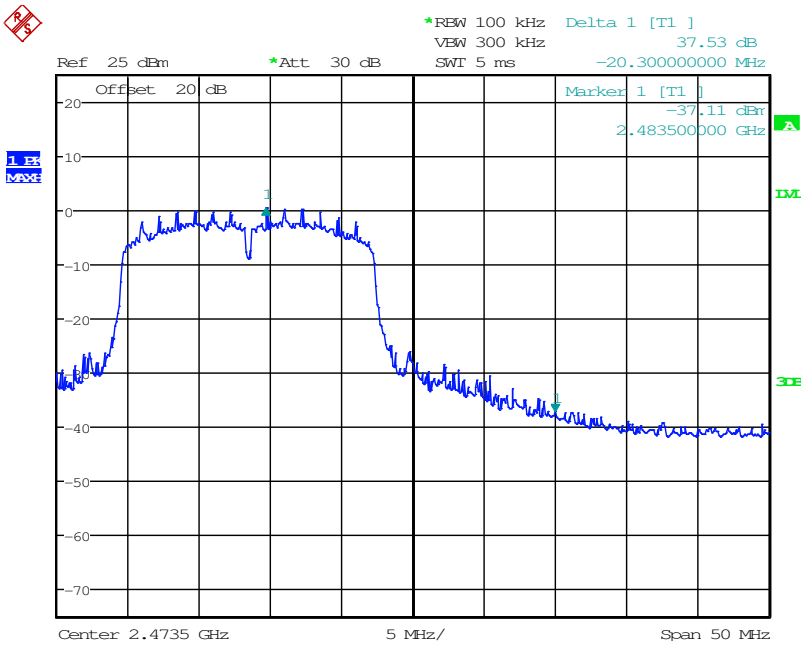
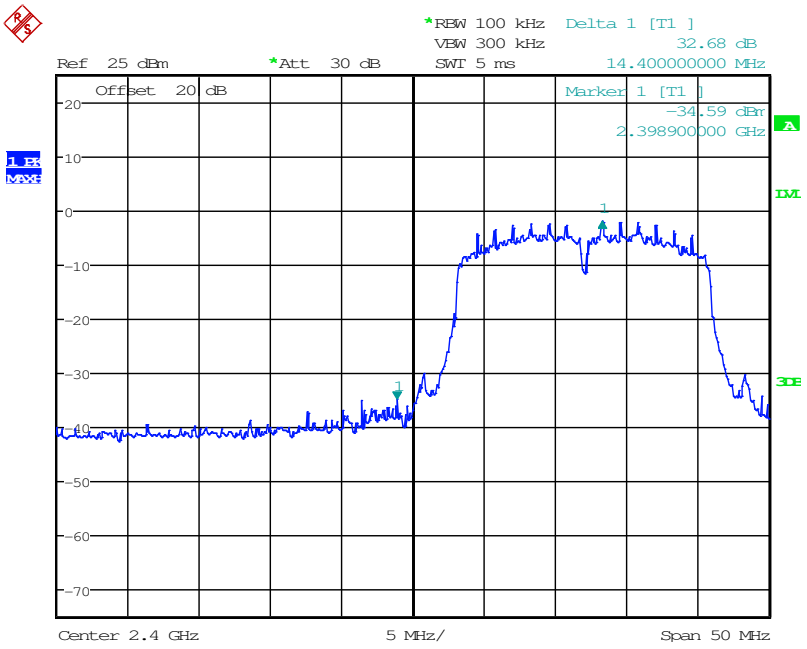


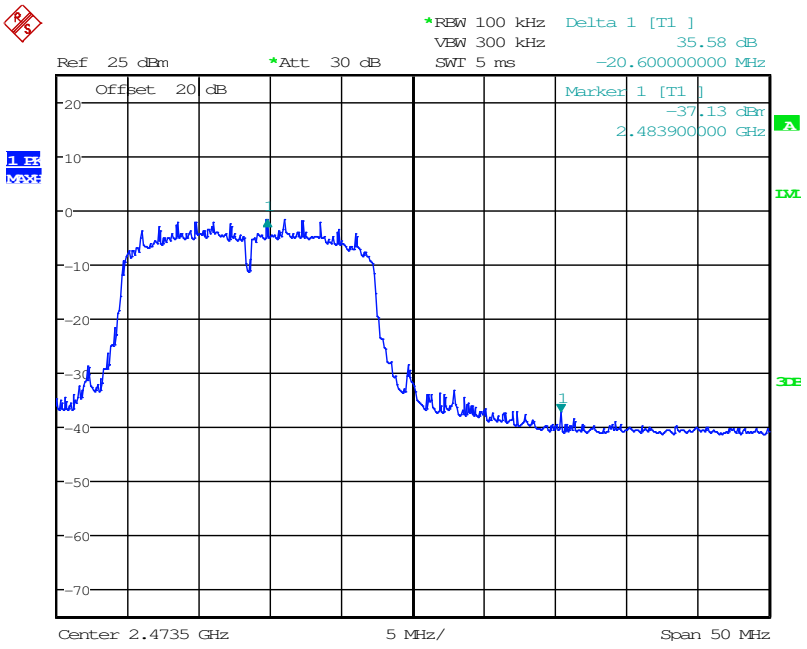
Figure 7.4.1.2-7: Upper Band-edge

Secondary Antenna



Date: 10.FEB.2016 15:23:10

Figure 7.4.1.2-8: Lower Band-edge



Date: 10.FEB.2016 15:37:37

Figure 7.4.1.2-9: Upper Band-edge

7.4.2 RF Conducted Spurious Emissions

7.4.2.1 Measurement Procedure

The RF Conducted Spurious Emissions were measured in accordance with ANSI C63.10:2013 Section 11.11 Emissions in non-restricted frequency bands. The RF output port of the equipment under test was directly connected to the input of the spectrum analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 26 GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak Max Hold function of the analyzer was utilized. The reference level was determined by measuring the Peak PSD level in any 100 kHz bandwidth within the DTS channel bandwidth.

7.4.2.2 Measurement Results

Results are shown below.

802.11b

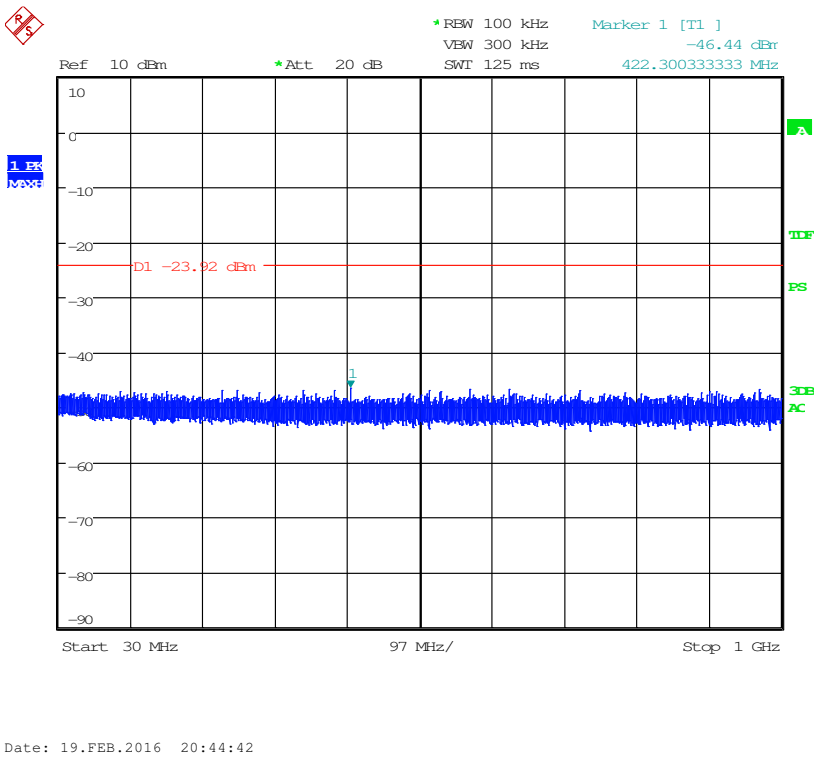


Figure 7.4.2.2-1: 30 MHz – 1 GHz – Low Channel

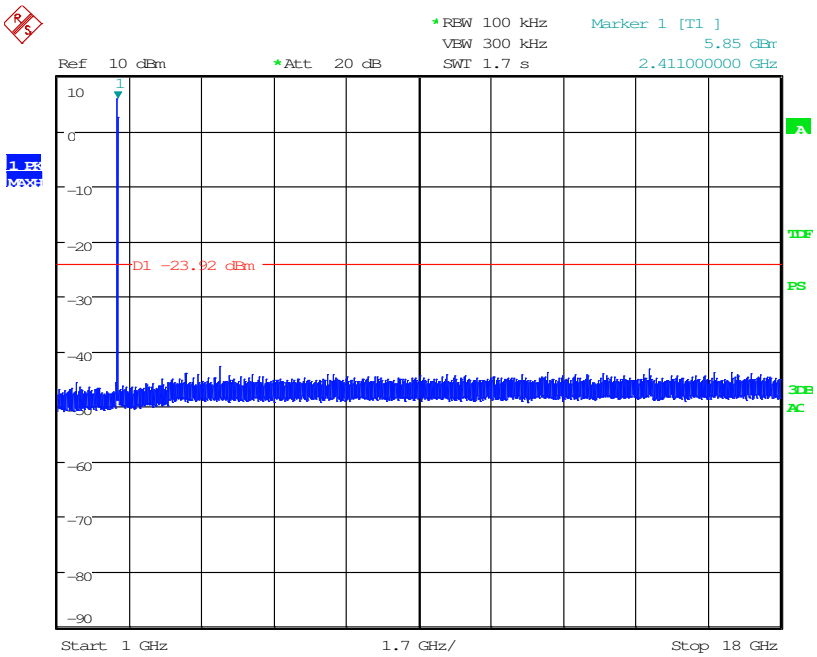


Figure 7.4.2.2-2: 1 GHz –10 GHz – Low Channel

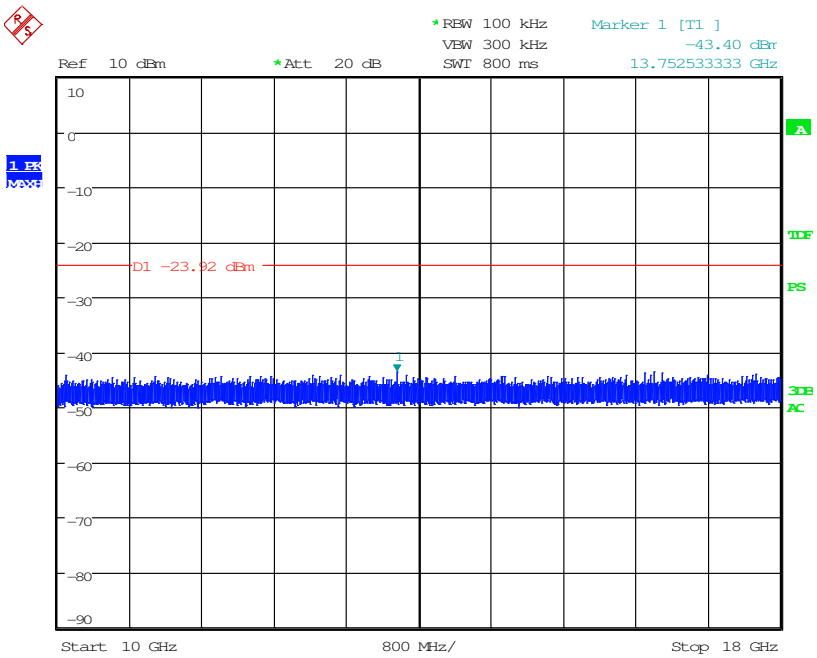


Figure 7.4.2.2-3: 10 GHz –18 GHz – Low Channel

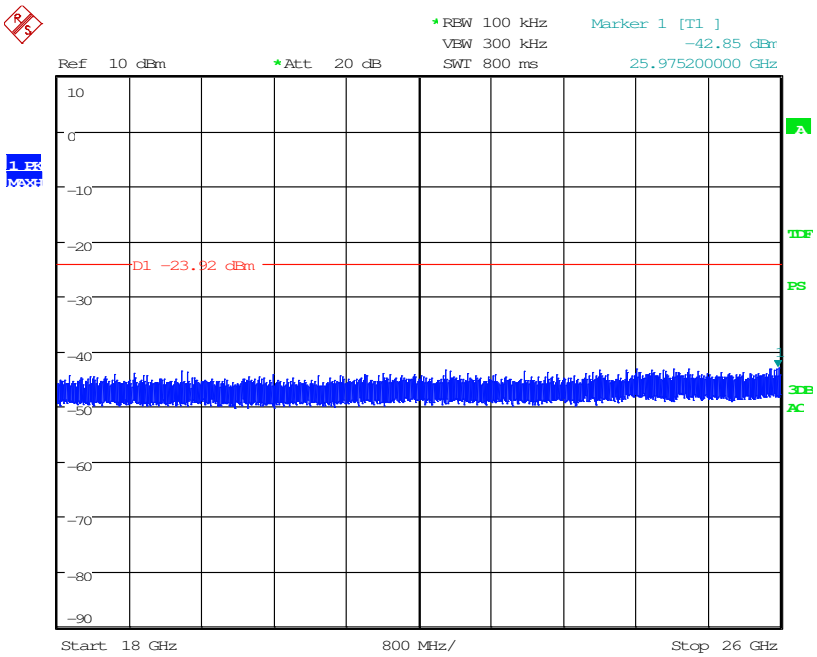


Figure 7.4.2.2-4: 18 GHz – 26 GHz – Low Channel

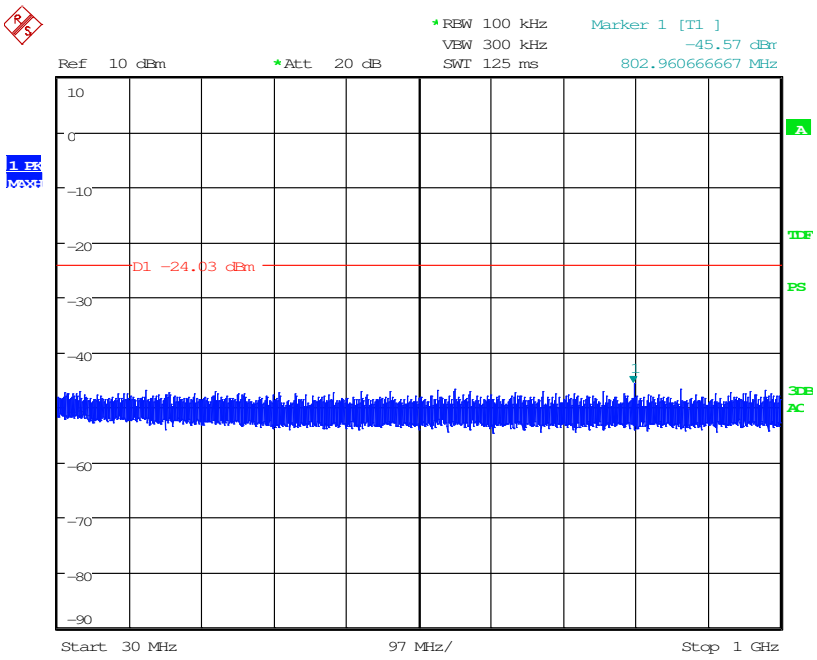


Figure 7.4.2.2-5: 30 MHz – 1 GHz –Middle Channel

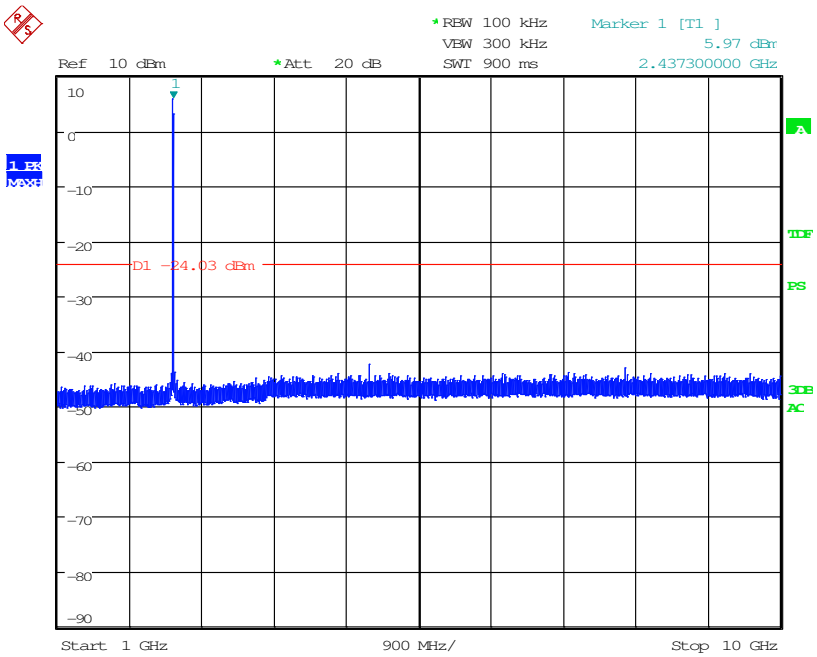


Figure 7.4.2.2-6: 1 GHz –10 GHz – Middle Channel

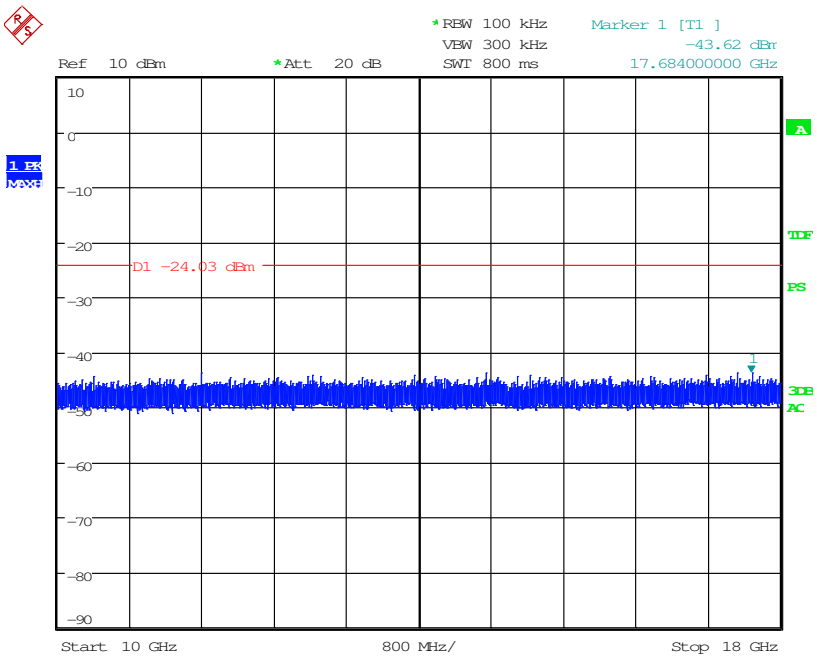


Figure 7.4.2.2-7: 10 GHz –18 GHz – Middle Channel

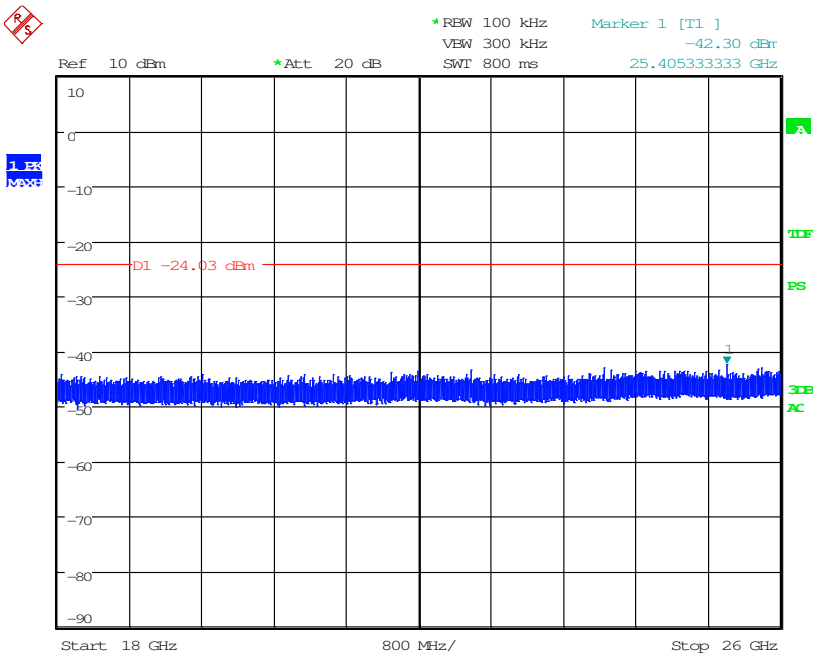


Figure 7.4.2.2-8: 18 GHz – 26 GHz – Middle Channel

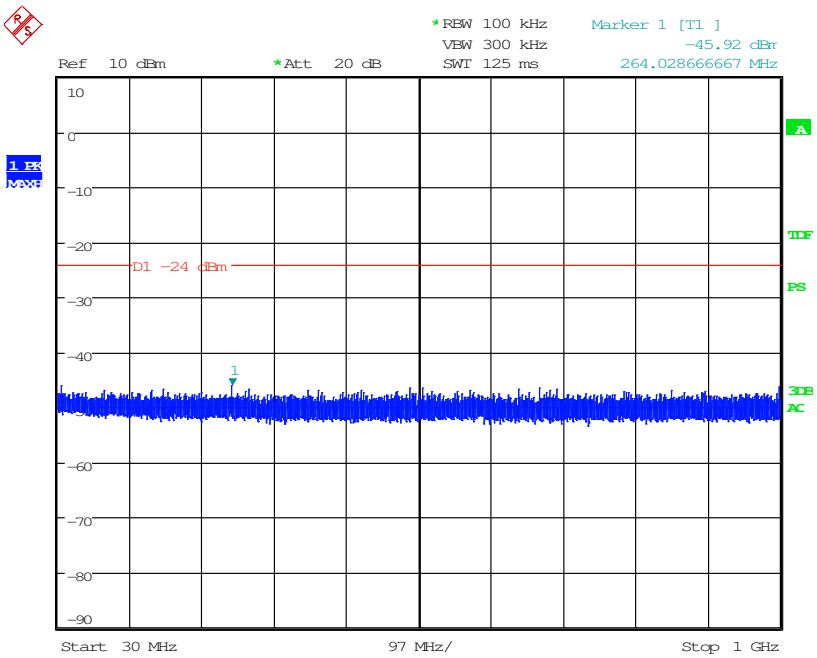


Figure 7.4.2.2-9: 30 MHz – 1 GHz – High Channel

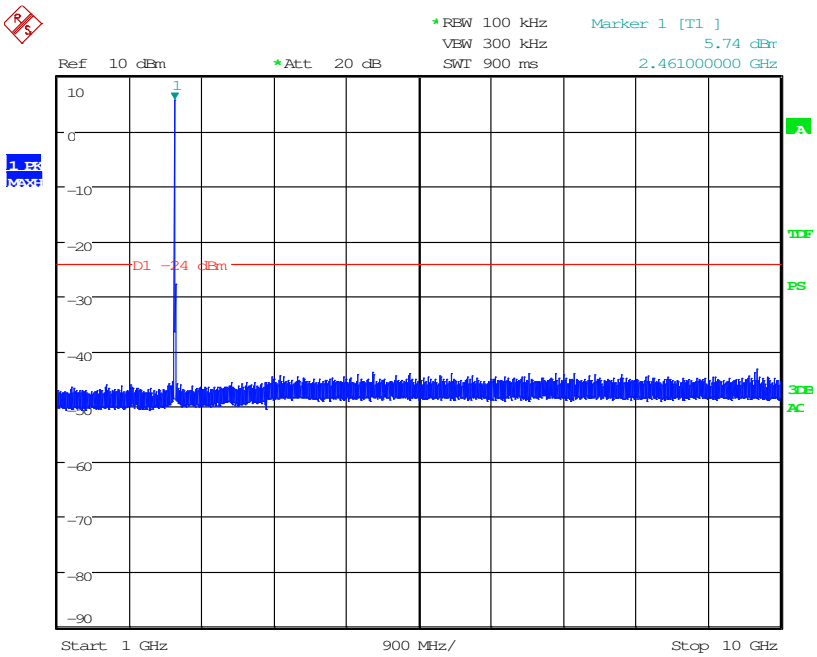


Figure 7.4.2.2-10: 1 GHz –10 GHz –High Channel

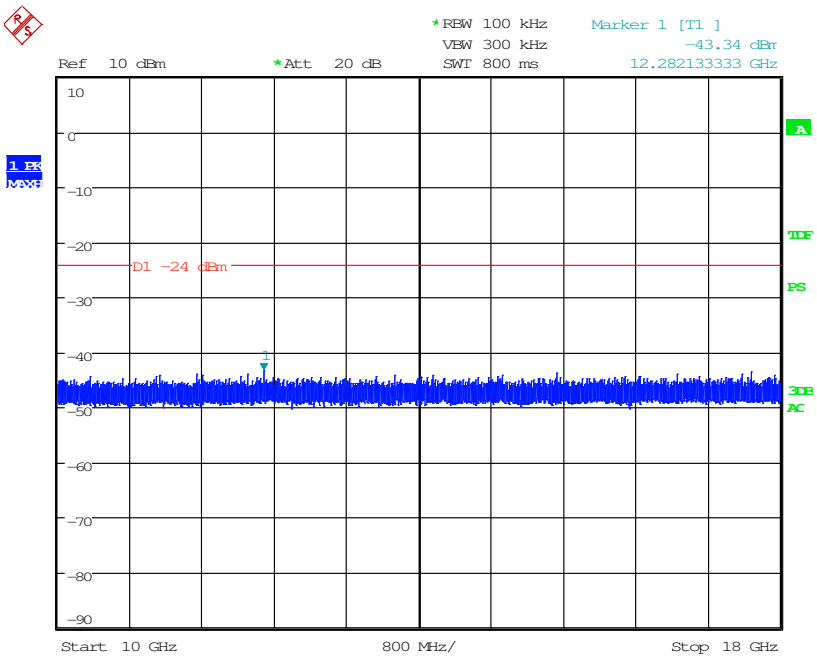


Figure 7.4.2.2-11: 10 GHz – 18 GHz –High Channel

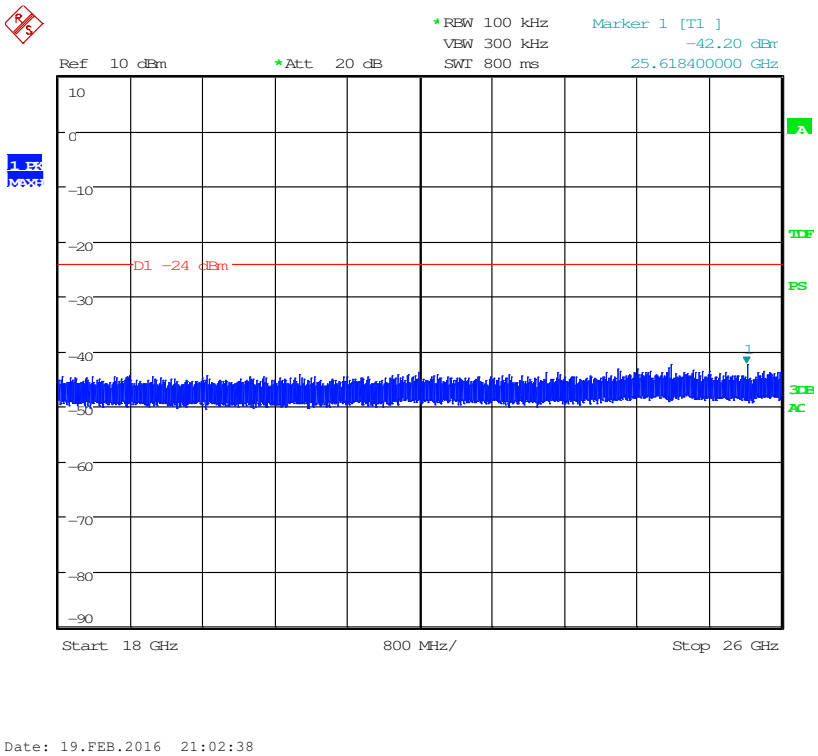


Figure 7.4.2.2-12: 18 GHz – 26 GHz –High Channel

802.11g
Primary Antenna

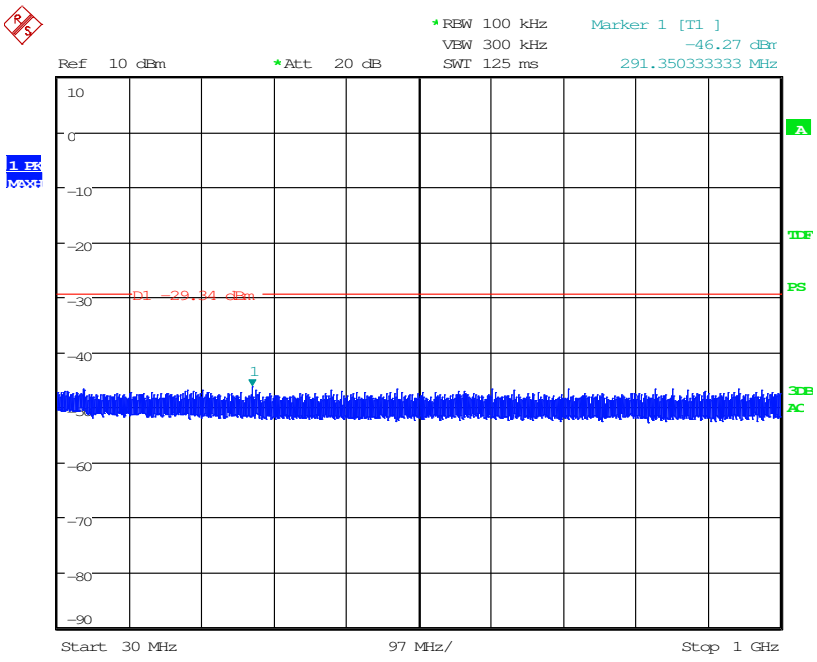


Figure 7.4.2.2-13: 30 MHz – 1 GHz – Low Channel

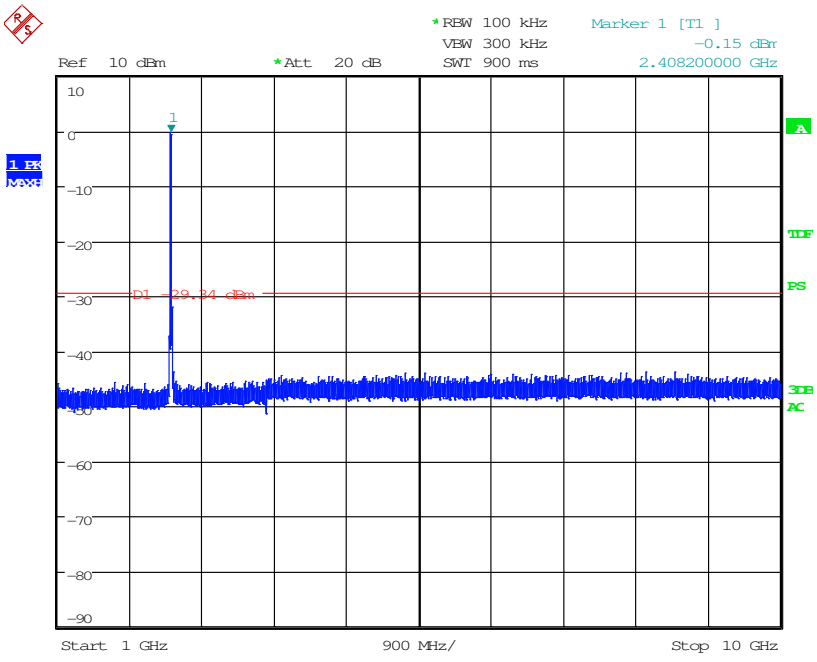


Figure 7.4.2.2-14: 1 GHz –10 GHz – Low Channel

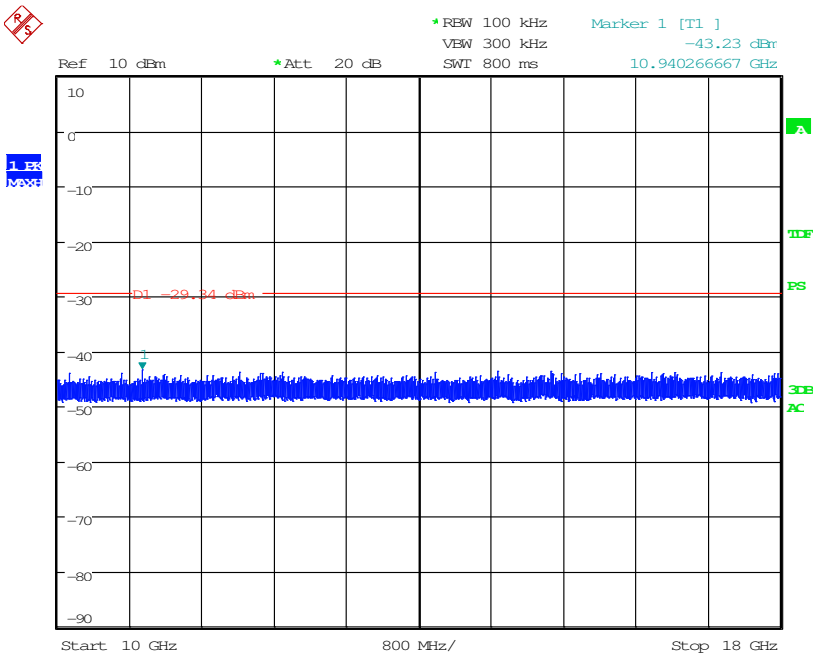


Figure 7.4.2.2-15: 10 GHz –18 GHz – Low Channel

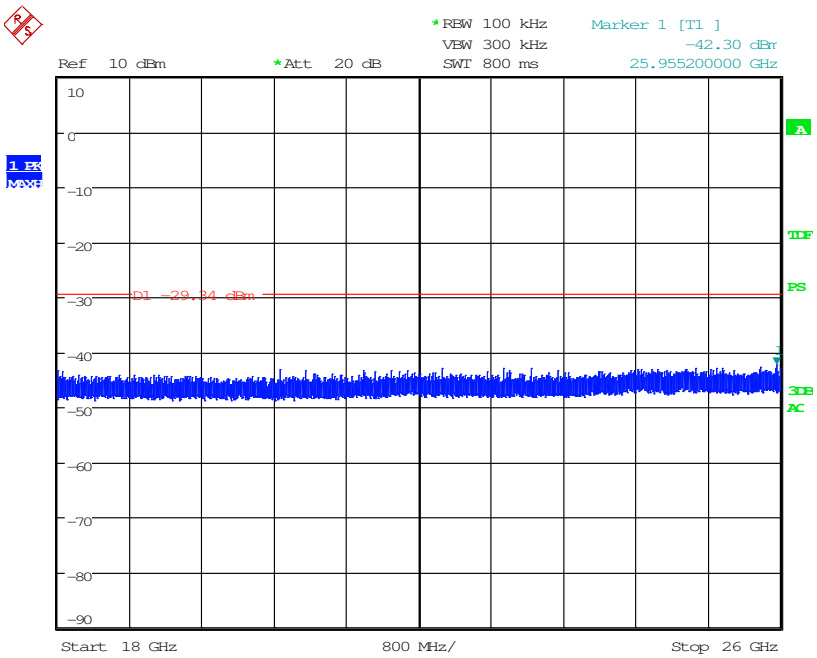


Figure 7.4.2.2-16: 18 GHz – 26 GHz – Low Channel

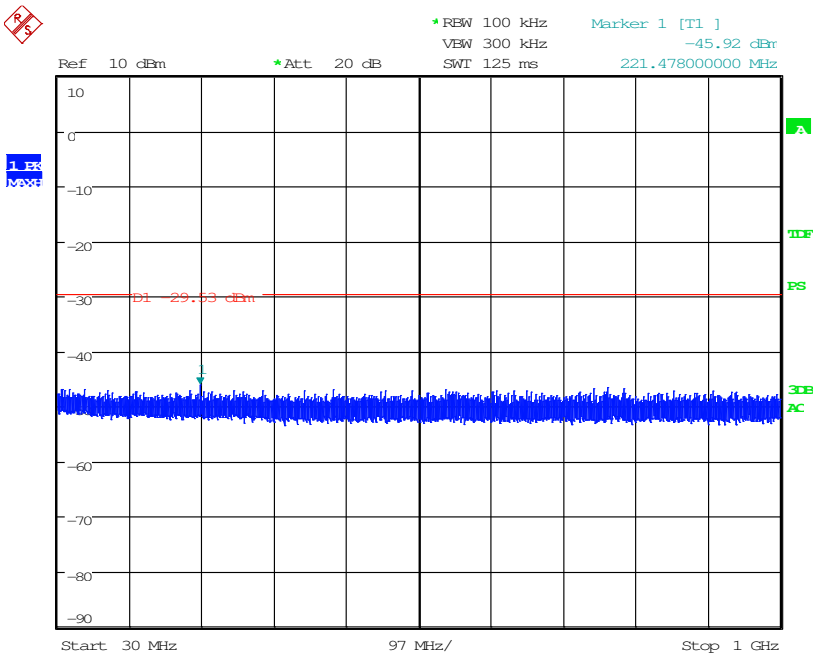


Figure 7.4.2.2-17: 30 MHz – 1 GHz –Middle Channel

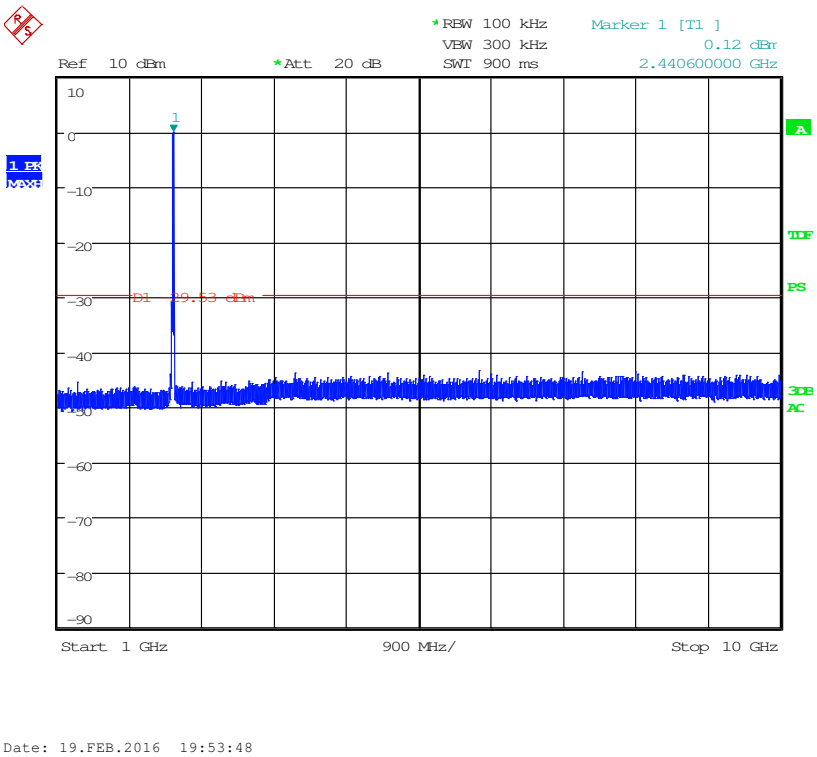


Figure 7.4.2.2-18: 1 GHz – 10 GHz – Middle Channel

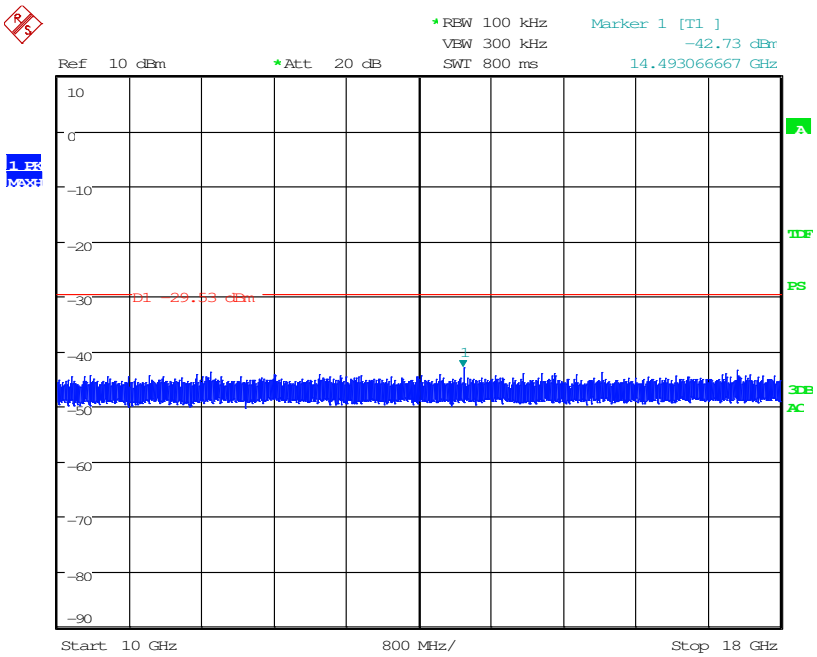


Figure 7.4.2.2-19: 10 GHz – 18 GHz – Middle Channel

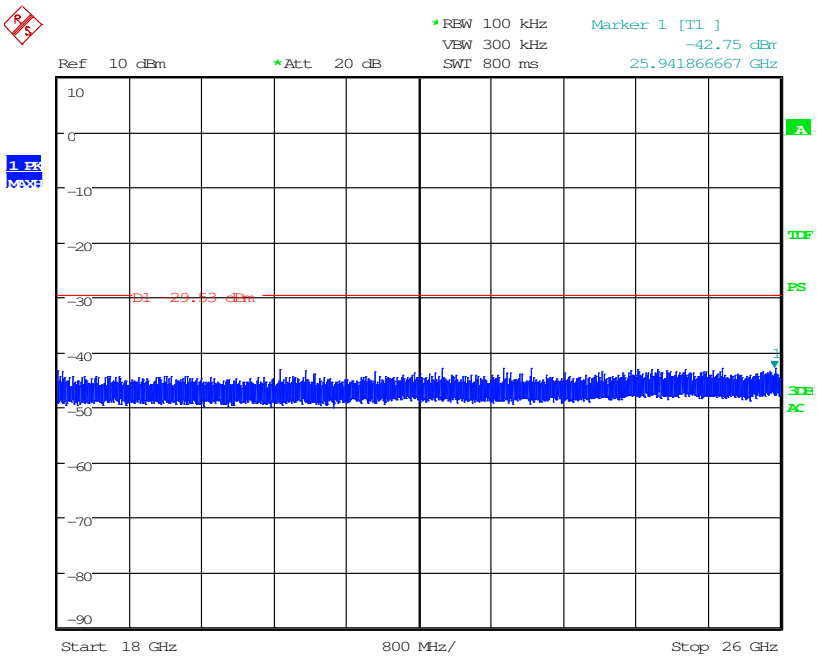


Figure 7.4.2.2-20: 18 GHz – 26 GHz – Middle Channel

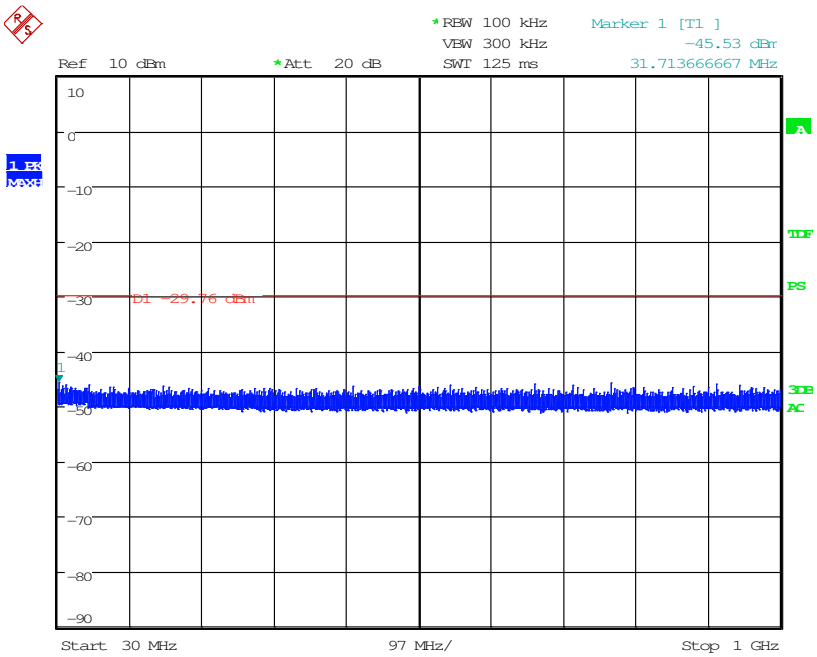


Figure 7.4.2.2-21: 30 MHz – 1 GHz – High Channel

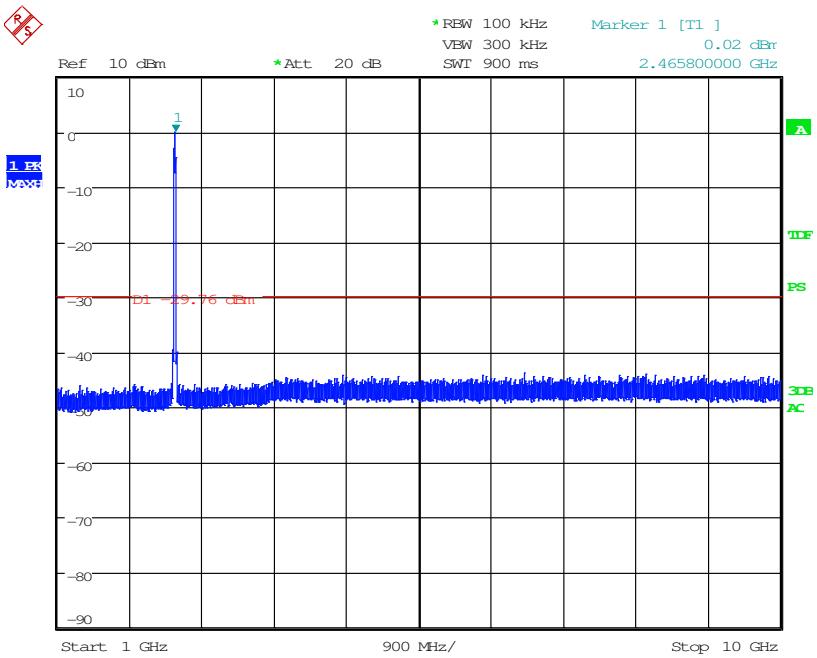


Figure 7.4.2.2-22: 1 GHz – 10 GHz –High Channel

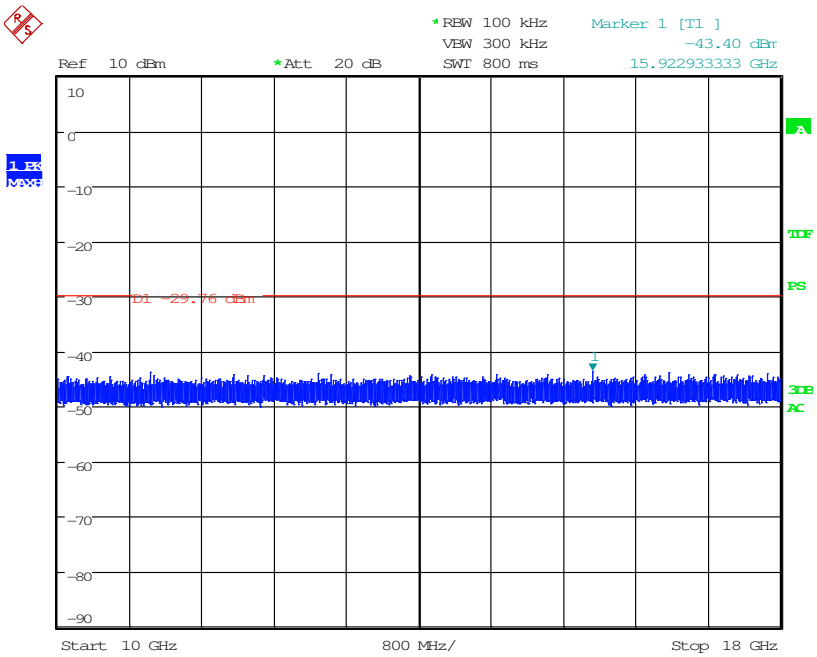


Figure 7.4.2.2-23: 10 GHz – 18 GHz –High Channel

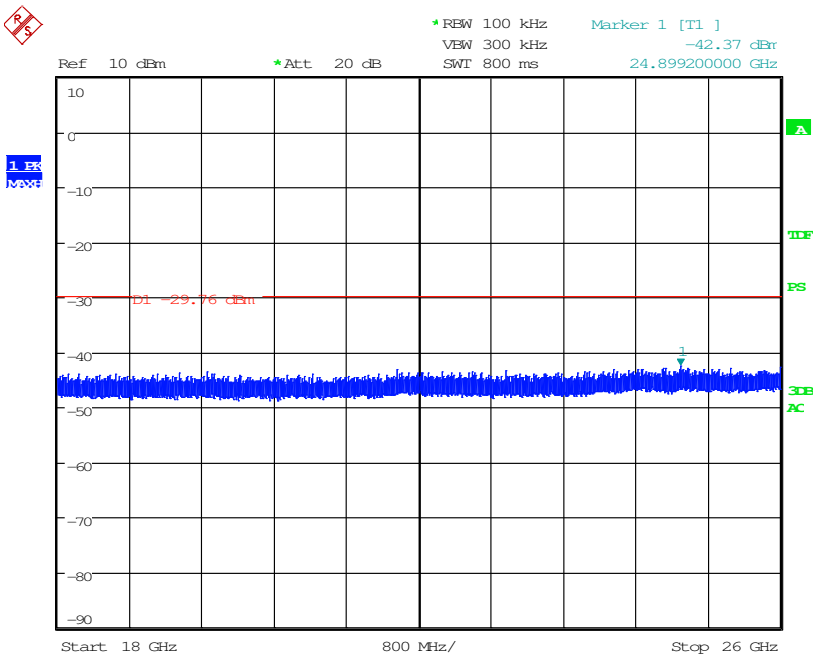


Figure 7.4.2.2-24: 18 GHz – 26 GHz –High Channel

Secondary Antenna

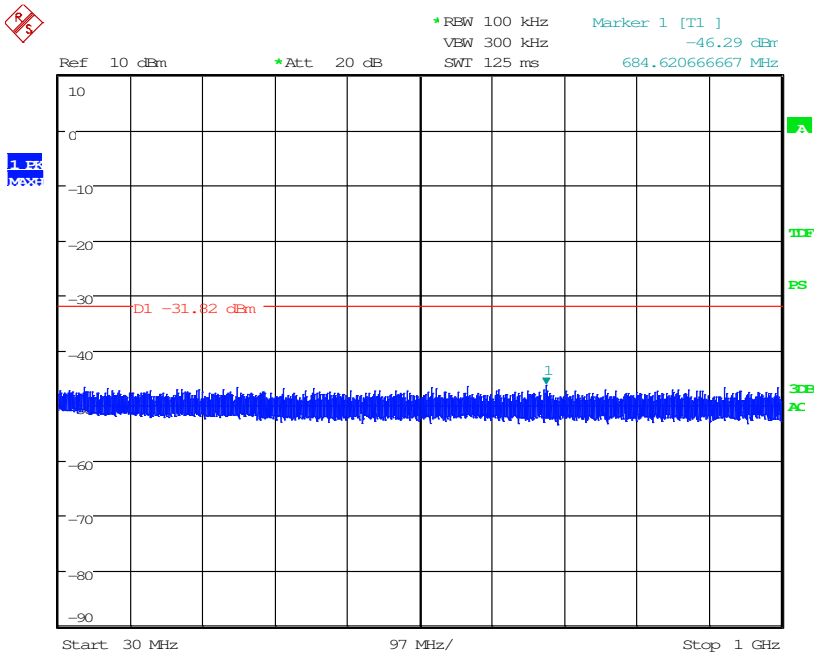


Figure 7.4.2.2-25: 30 MHz – 1 GHz – Low Channel

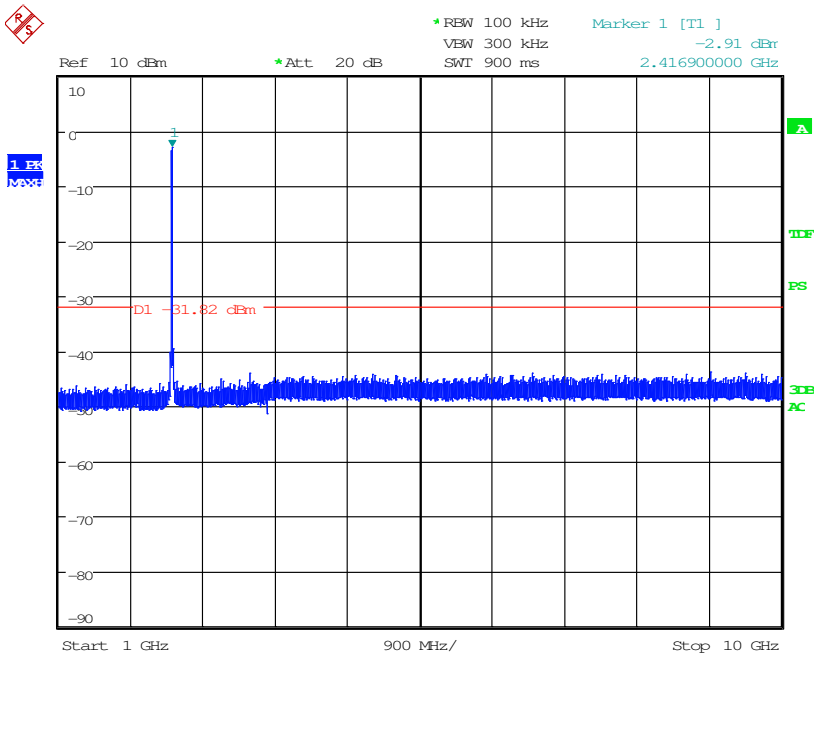


Figure 7.4.2.2-26: 1 GHz –10 GHz – Low Channel

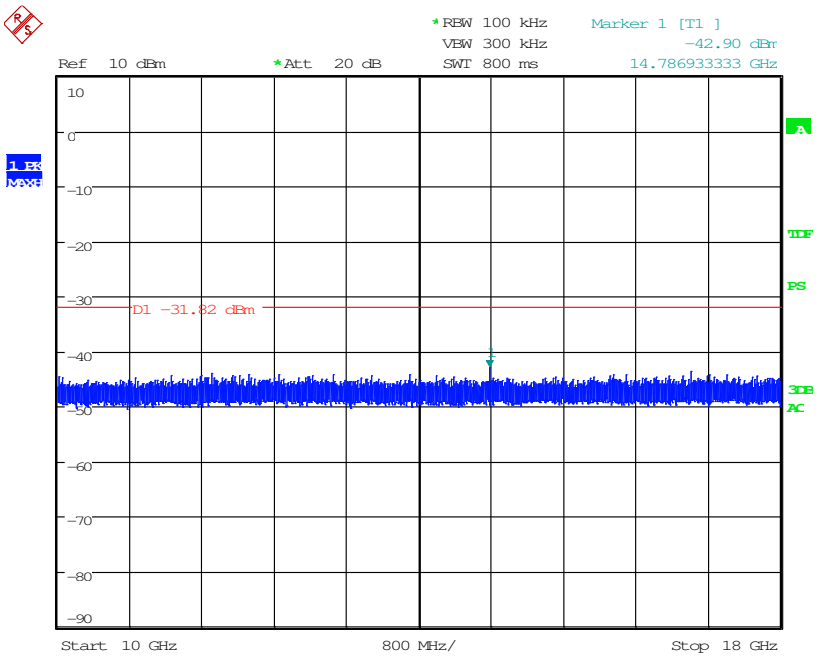


Figure 7.4.2.2-27: 10 GHz –18 GHz – Low Channel

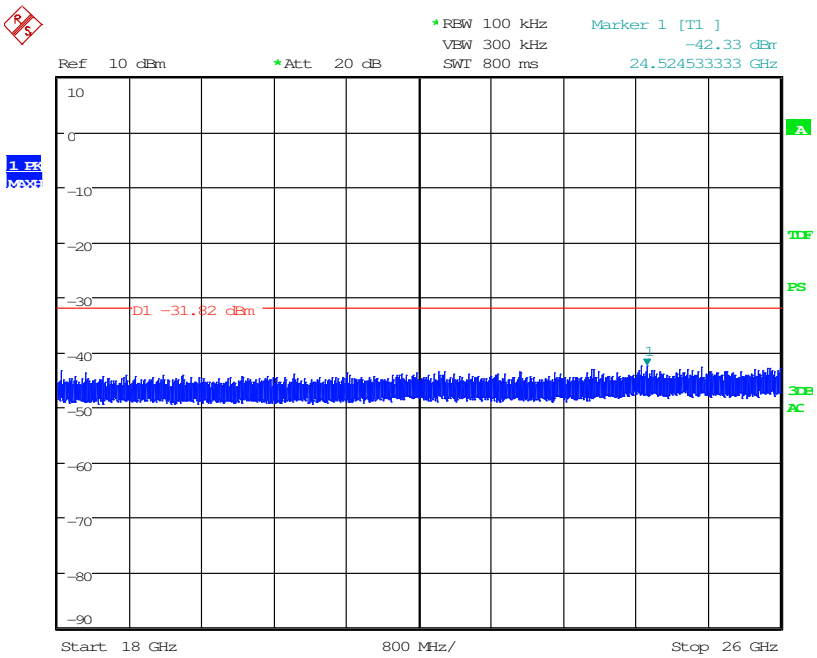


Figure 7.4.2.2-28: 18 GHz – 26 GHz – Low Channel

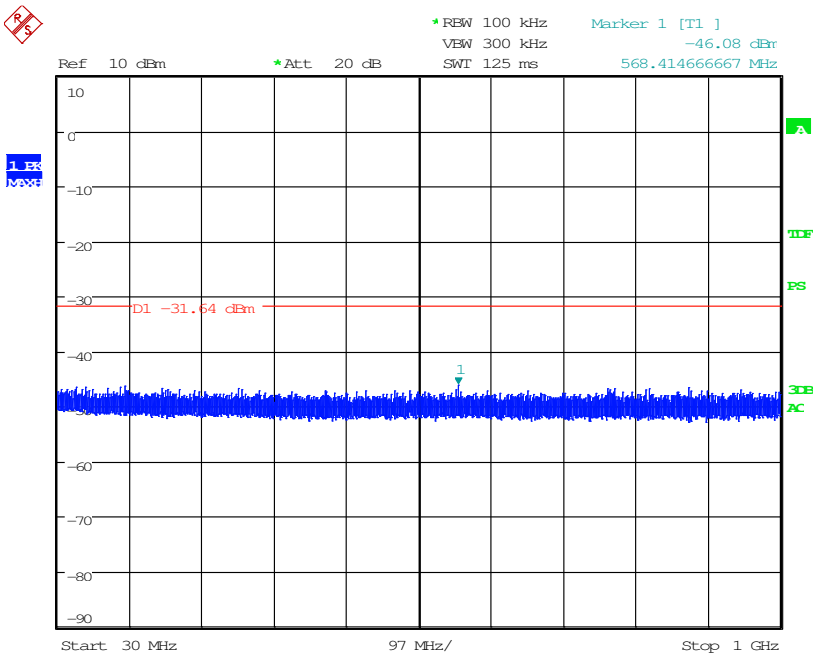


Figure 7.4.2.2-29: 30 MHz – 1 GHz –Middle Channel

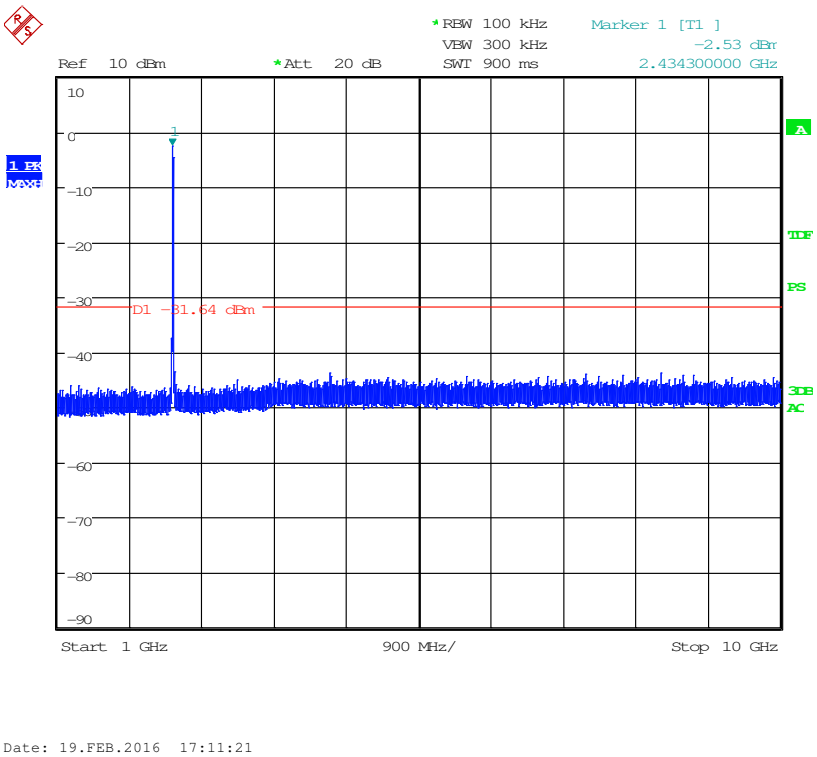


Figure 7.4.2.2-30: 1 GHz – 10 GHz – Middle Channel

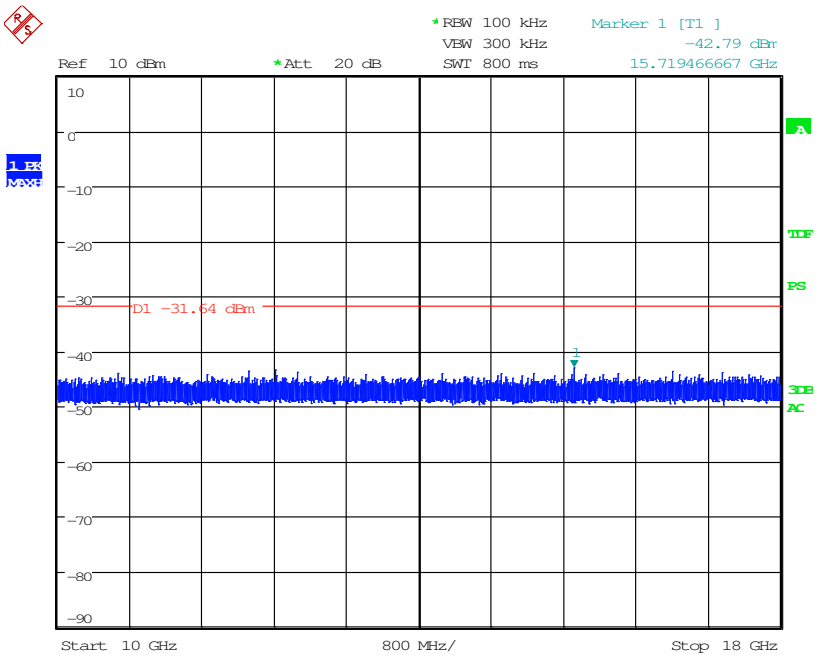


Figure 7.4.2.2-31: 10 GHz – 18 GHz – Middle Channel

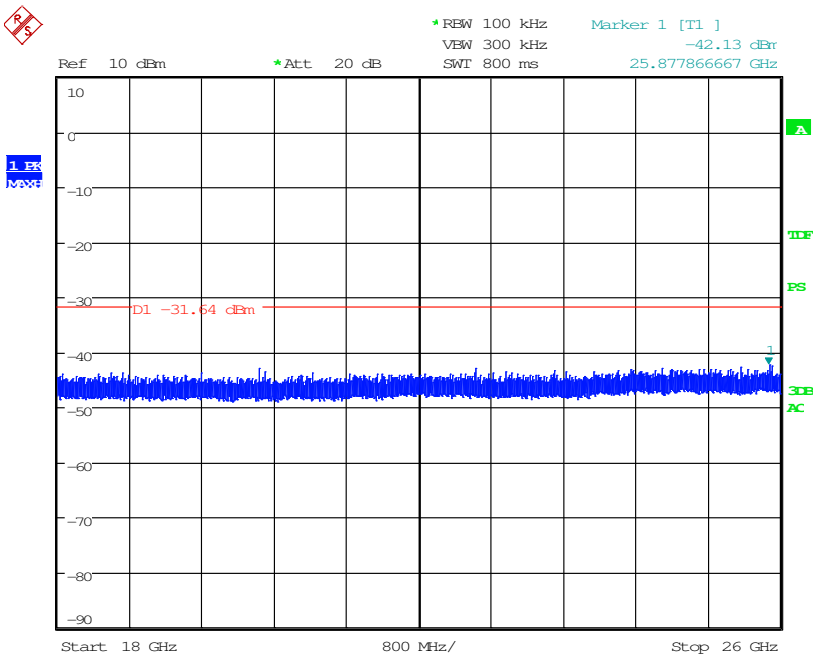


Figure 7.4.2.2-32: 18 GHz – 26 GHz – Middle Channel

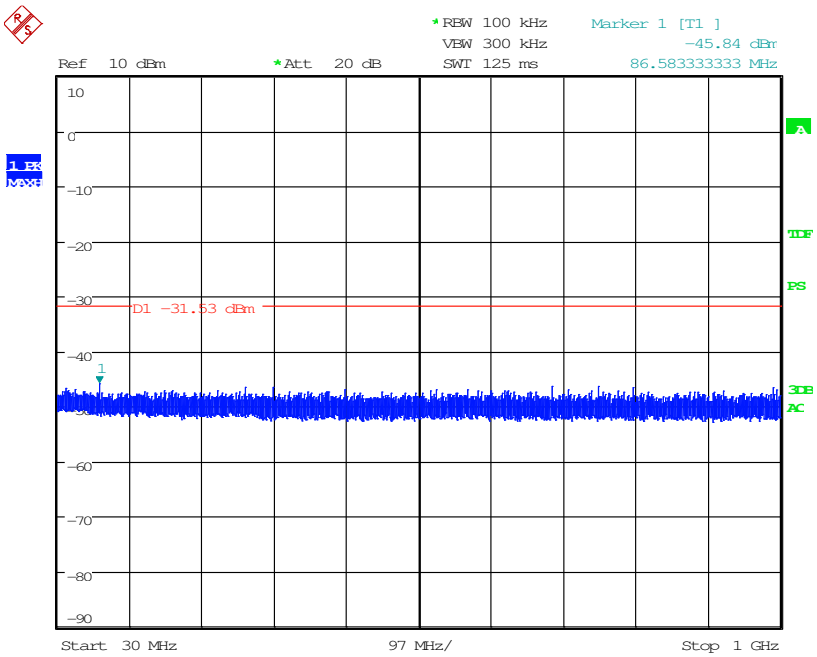


Figure 7.4.2.2-33: 30 MHz – 1 GHz – High Channel

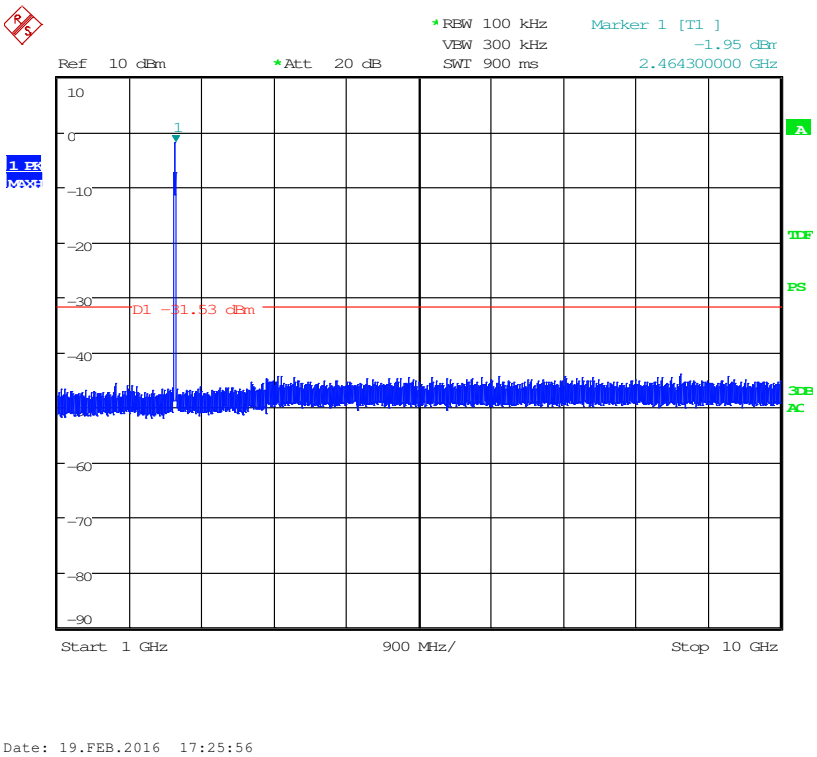


Figure 7.4.2.2-34: 1 GHz – 10 GHz –High Channel

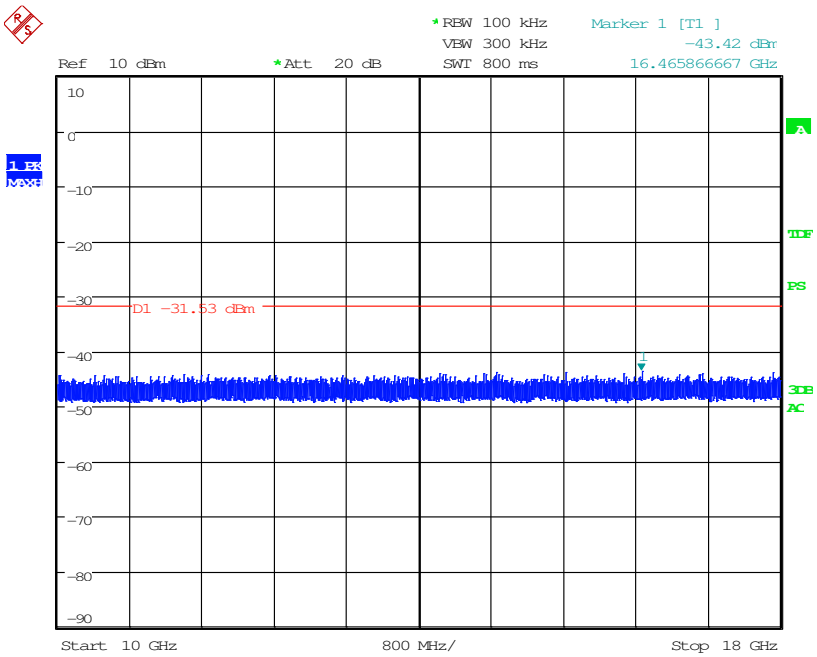


Figure 7.4.2.2-35: 10 GHz – 18 GHz –High Channel

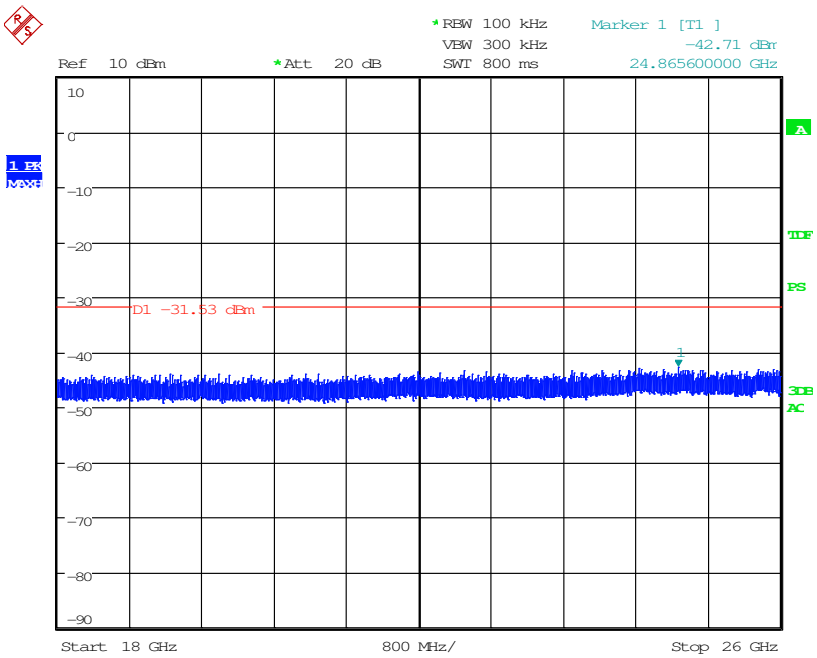


Figure 7.4.2.2-36: 18 GHz – 26 GHz –High Channel

802.11n 20MHz
Primary Antenna

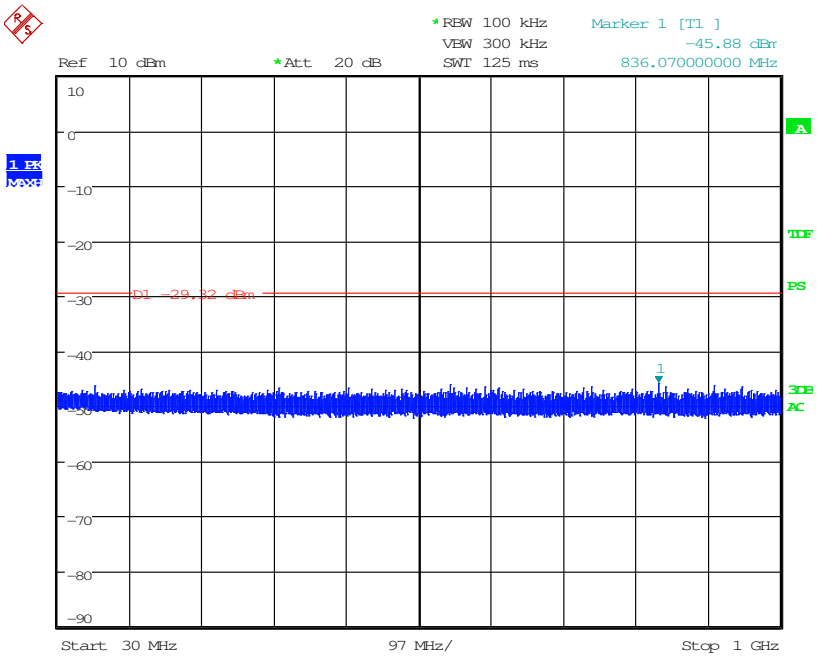


Figure 7.4.2.2-37: 30 MHz – 1 GHz – Low Channel

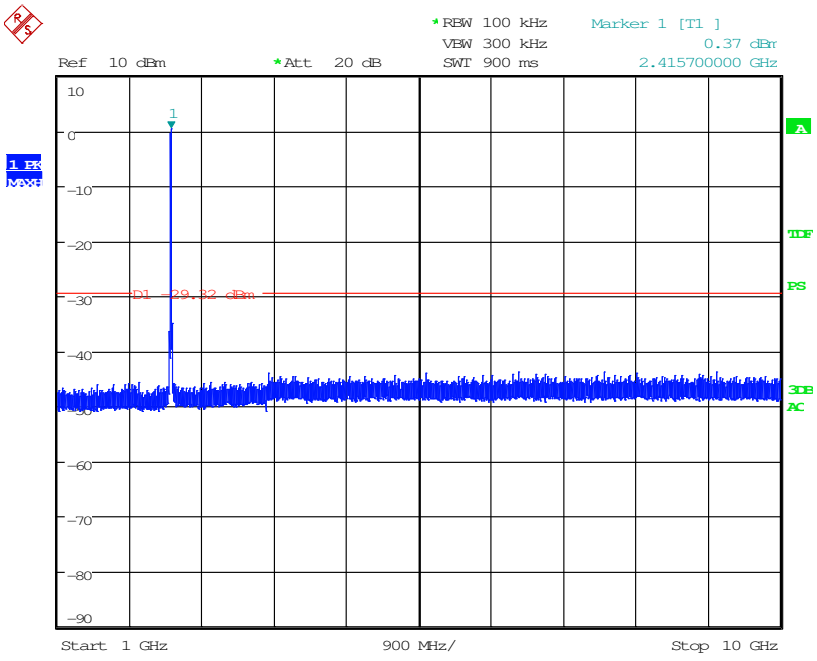


Figure 7.4.2.2-38: 1 GHz –10 GHz – Low Channel

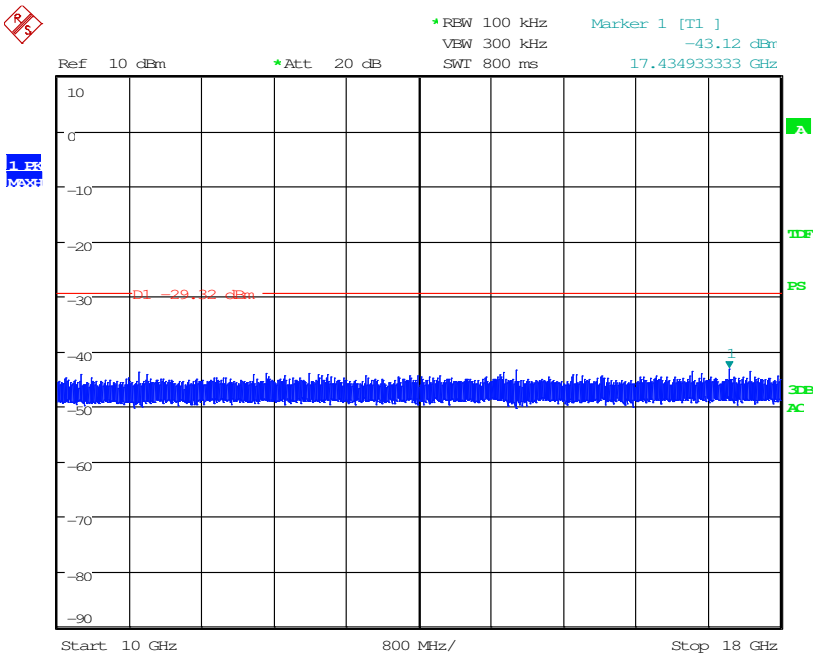


Figure 7.4.2.2-39: 10 GHz –18 GHz – Low Channel

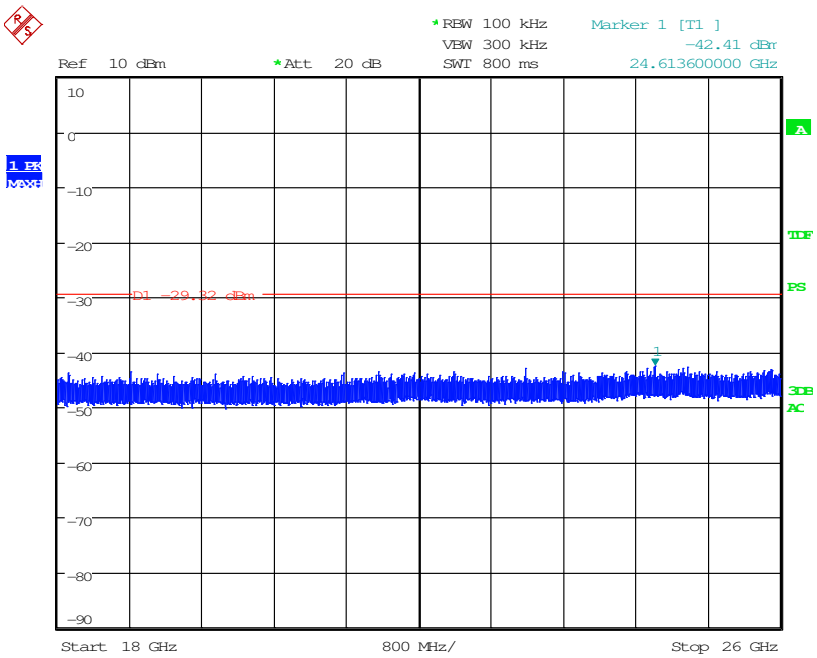


Figure 7.4.2.2-40: 18 GHz – 26 GHz – Low Channel

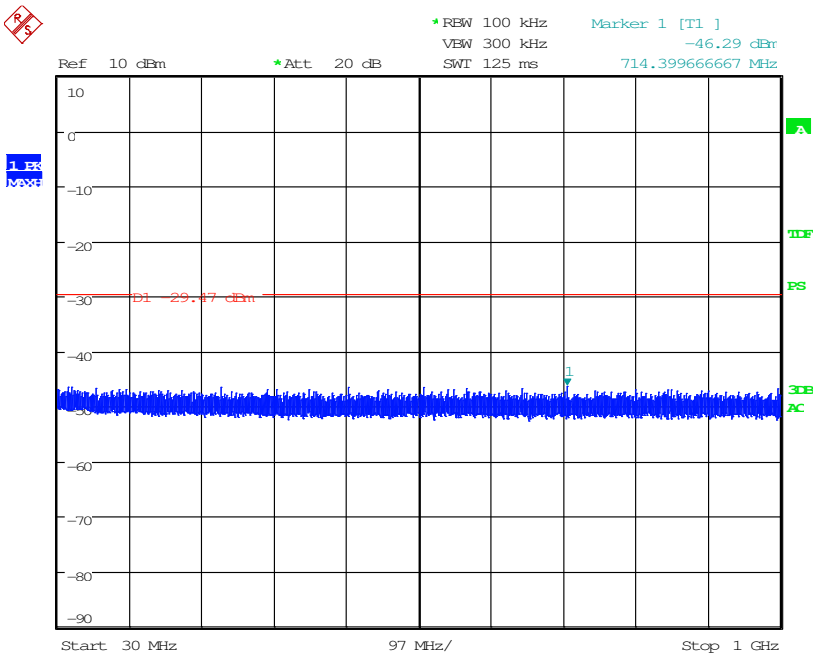


Figure 7.4.2.2-41: 30 MHz – 1 GHz –Middle Channel

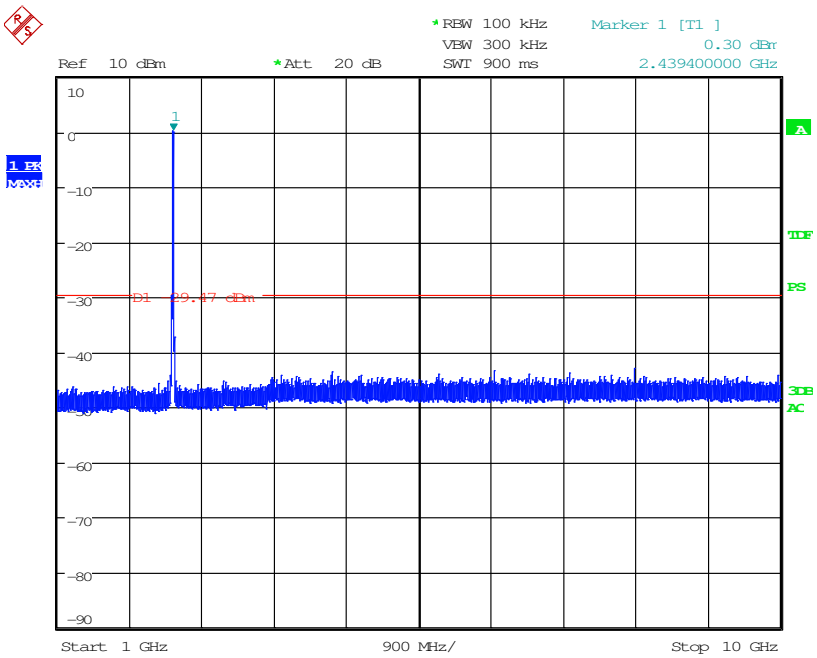


Figure 7.4.2.2-42: 1 GHz –10 GHz – Middle Channel

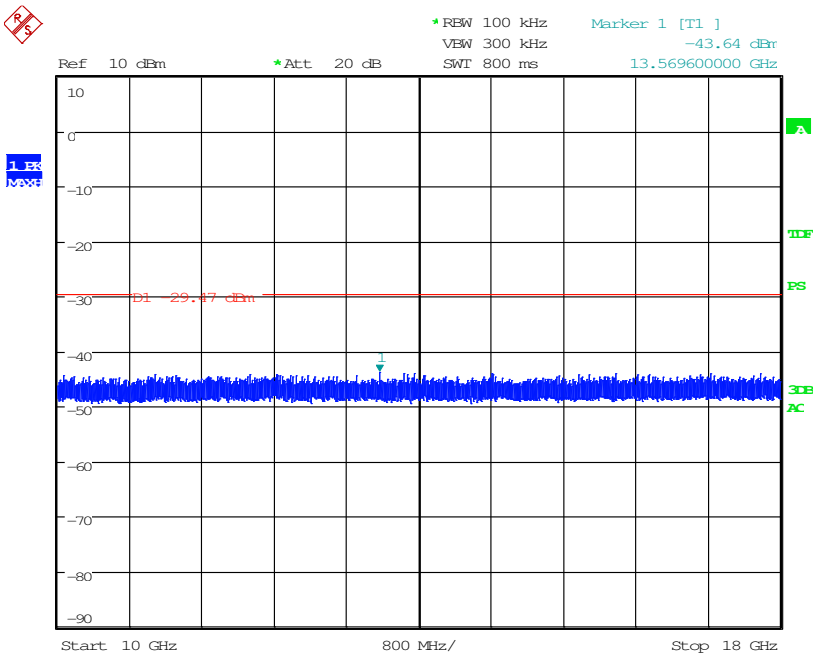


Figure 7.4.2.2-43: 10 GHz –18 GHz – Middle Channel

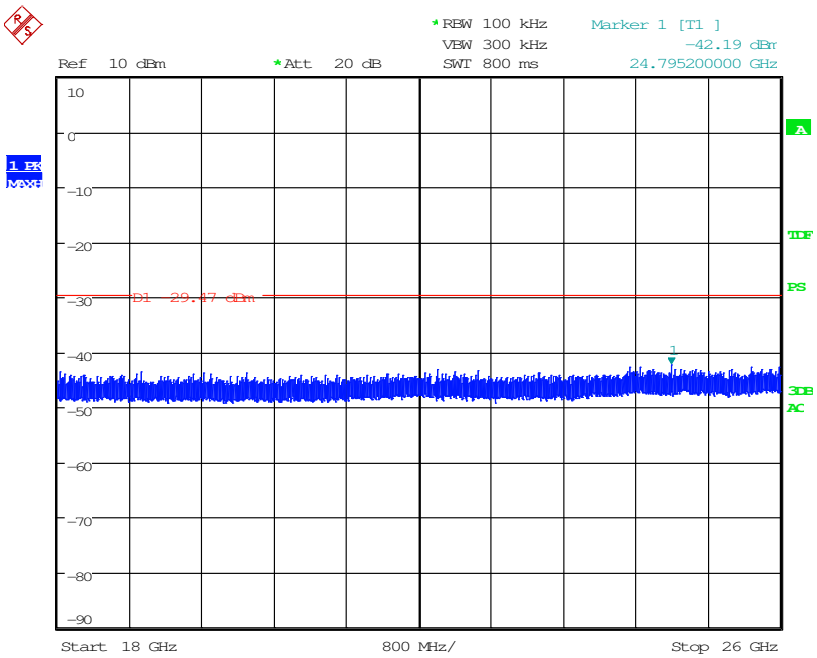


Figure 7.4.2.2-44: 18 GHz – 26 GHz – Middle Channel

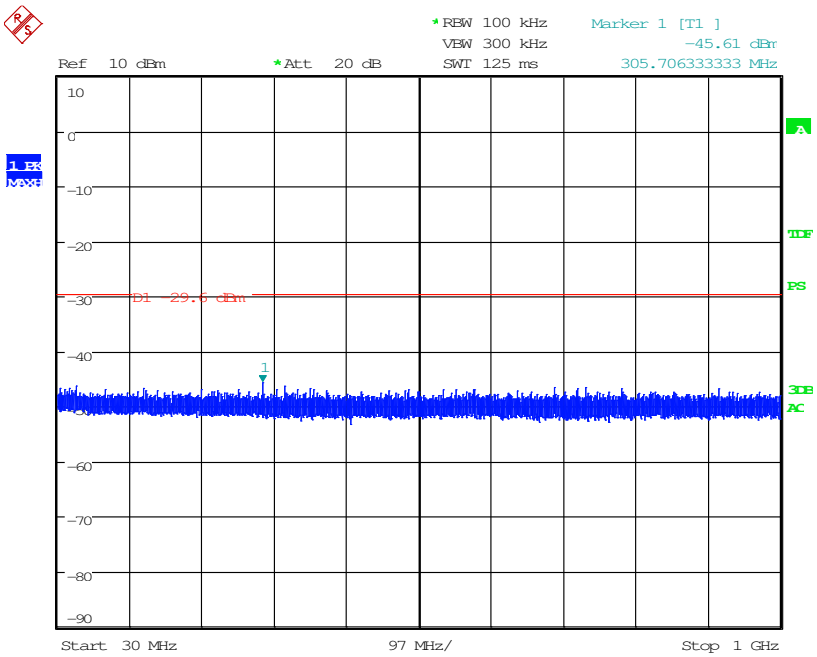


Figure 7.4.2.2-45: 30 MHz – 1 GHz – High Channel

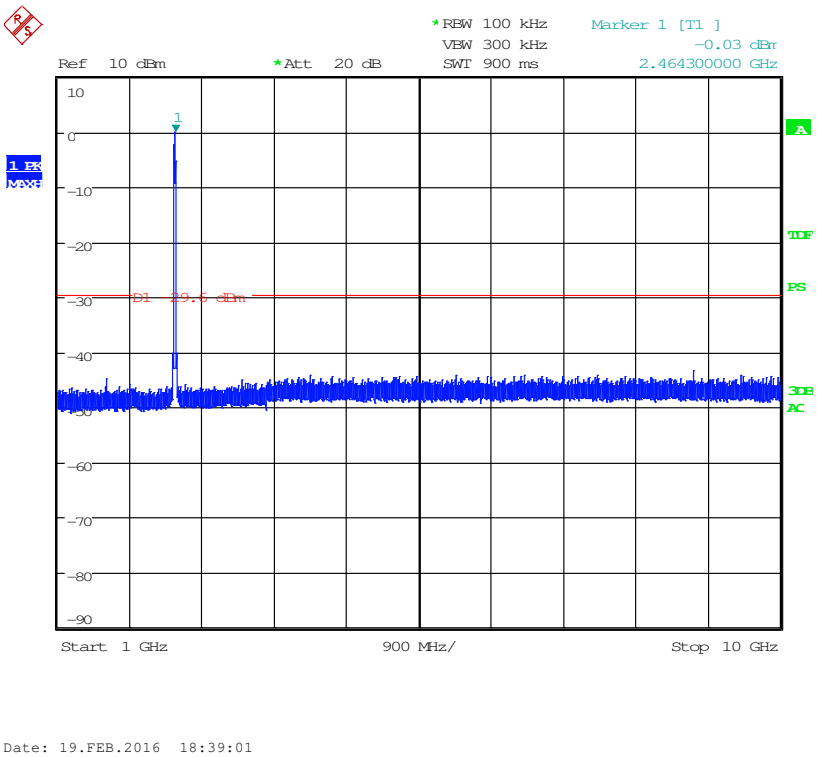


Figure 7.4.2.2-46: 1 GHz –10 GHz –High Channel

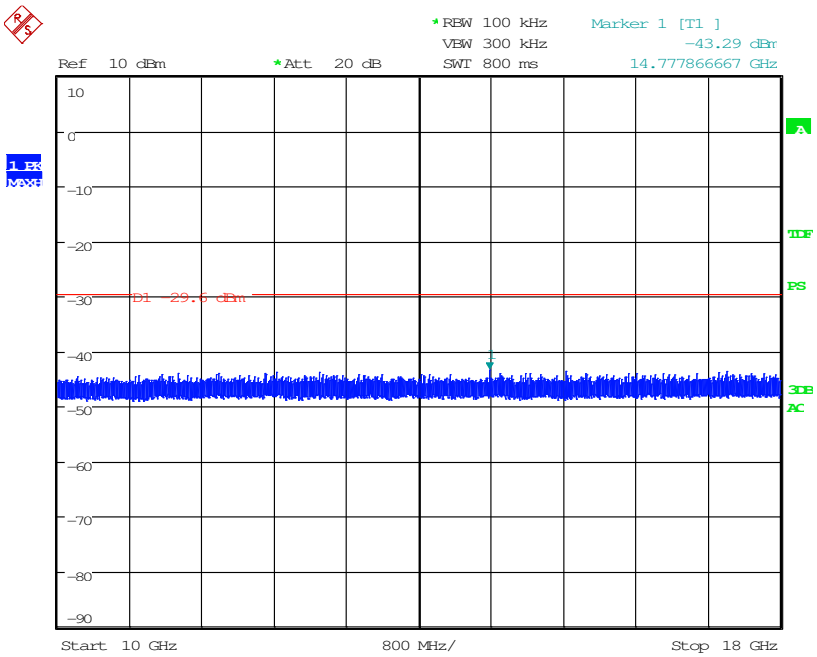


Figure 7.4.2.2-47: 10 GHz – 18 GHz –High Channel

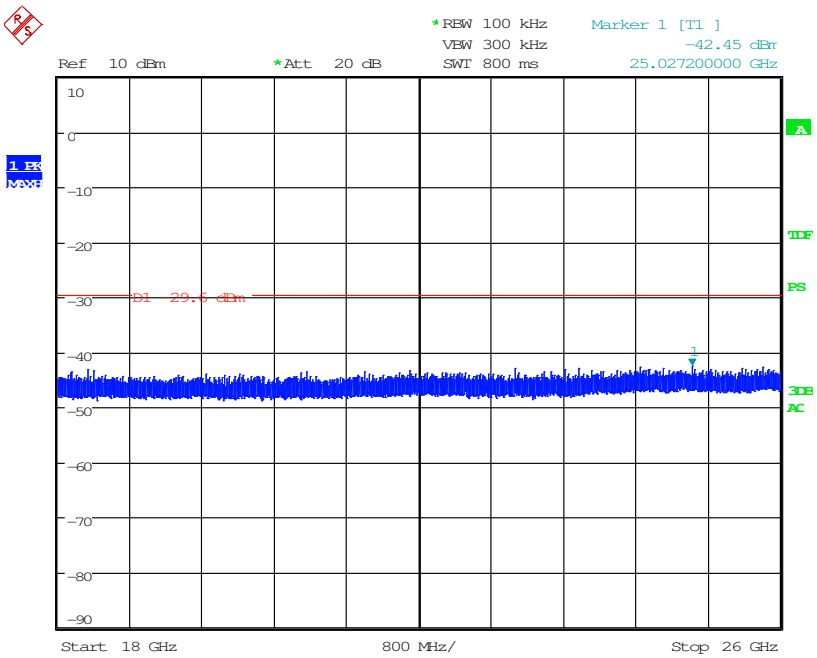


Figure 7.4.2.2-48: 18 GHz – 26 GHz –High Channel

Secondary Antenna

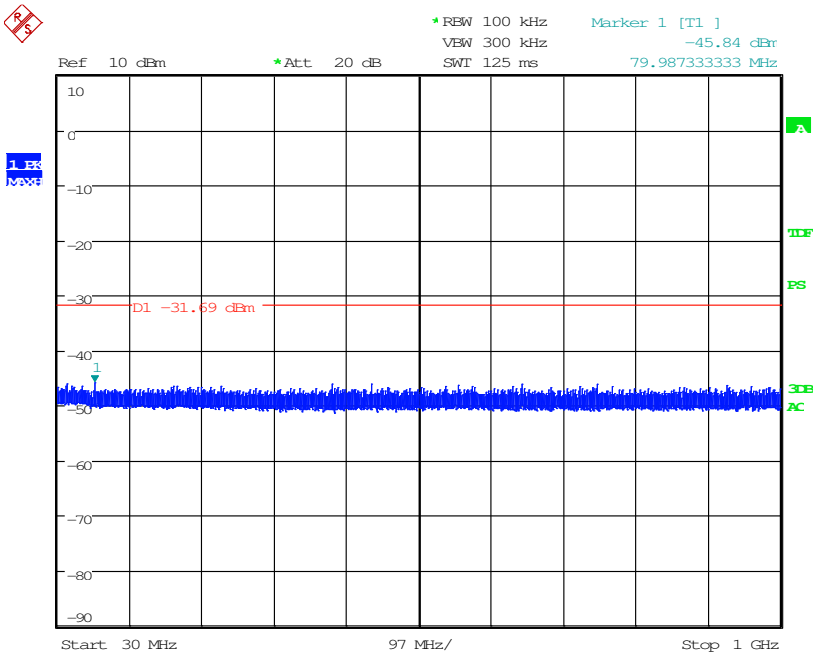


Figure 7.4.2.2-49: 30 MHz – 1 GHz – Low Channel

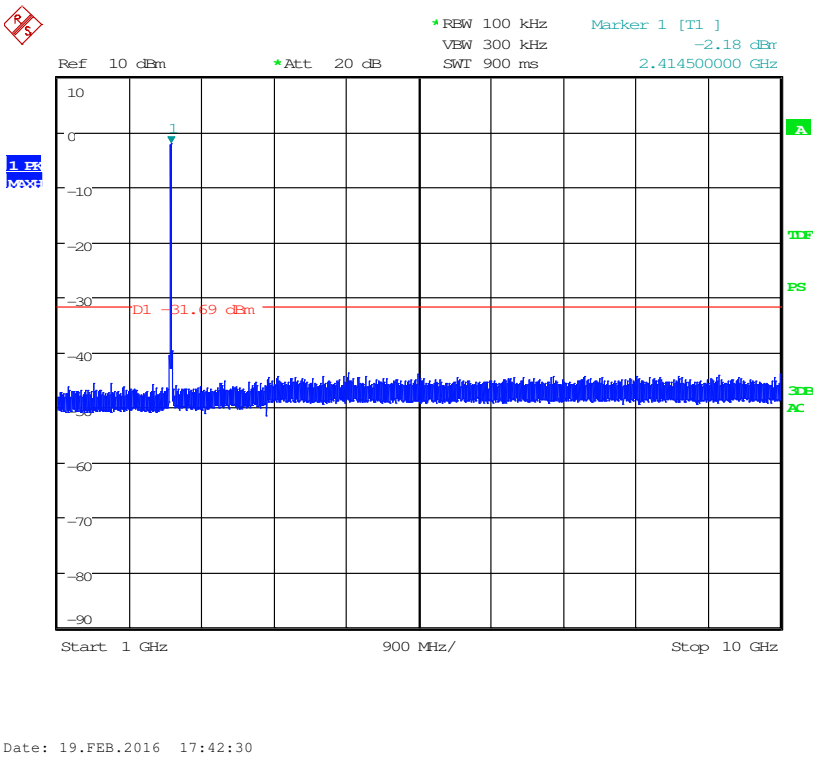


Figure 7.4.2.2-50: 1 GHz –10 GHz – Low Channel

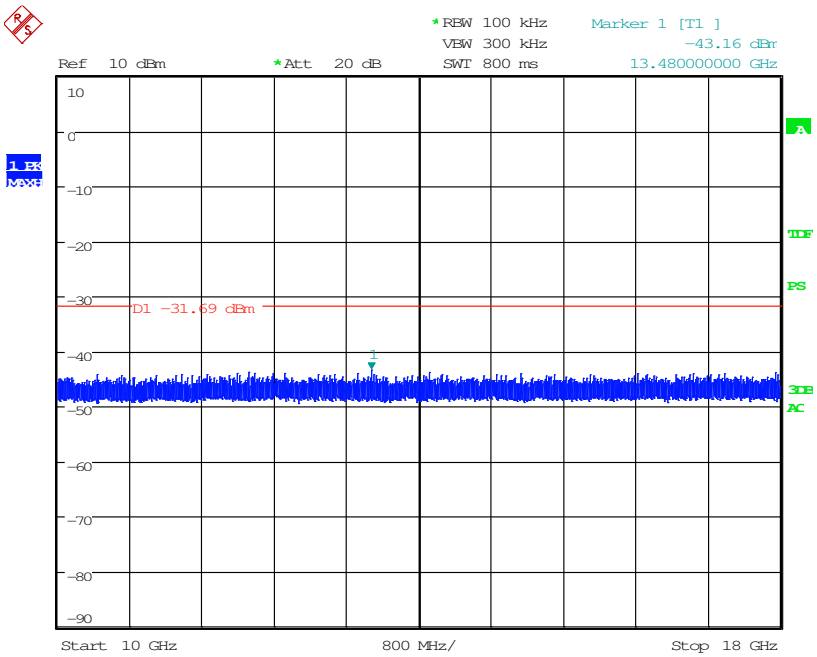


Figure 7.4.2.2-51: 10 GHz –18 GHz – Low Channel

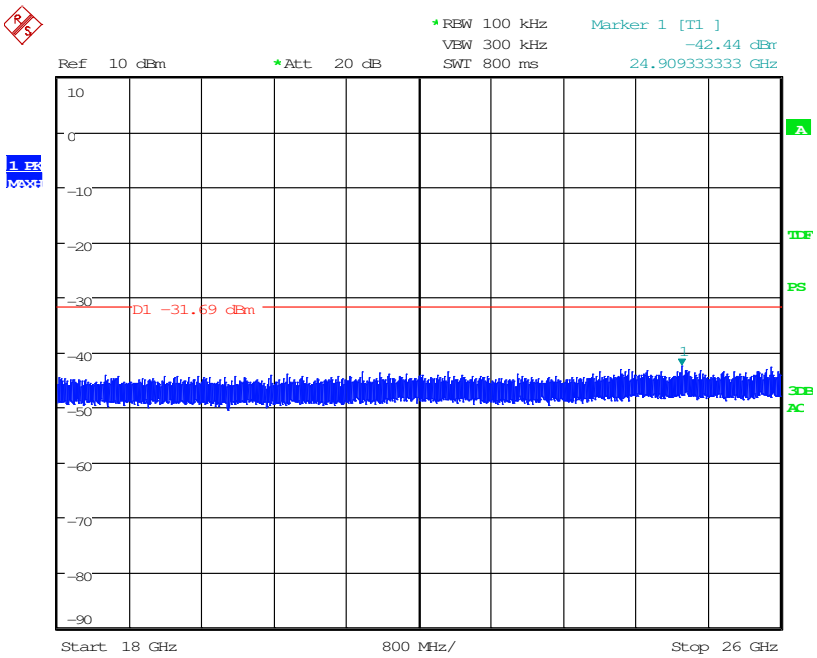


Figure 7.4.2.2-52: 18 GHz – 26 GHz – Low Channel

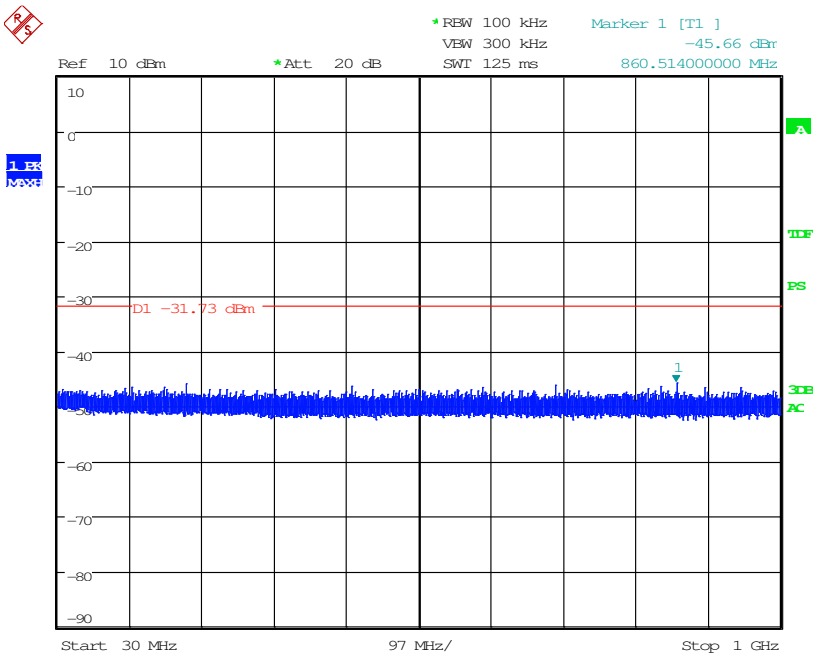


Figure 7.4.2.2-53: 30 MHz – 1 GHz –Middle Channel

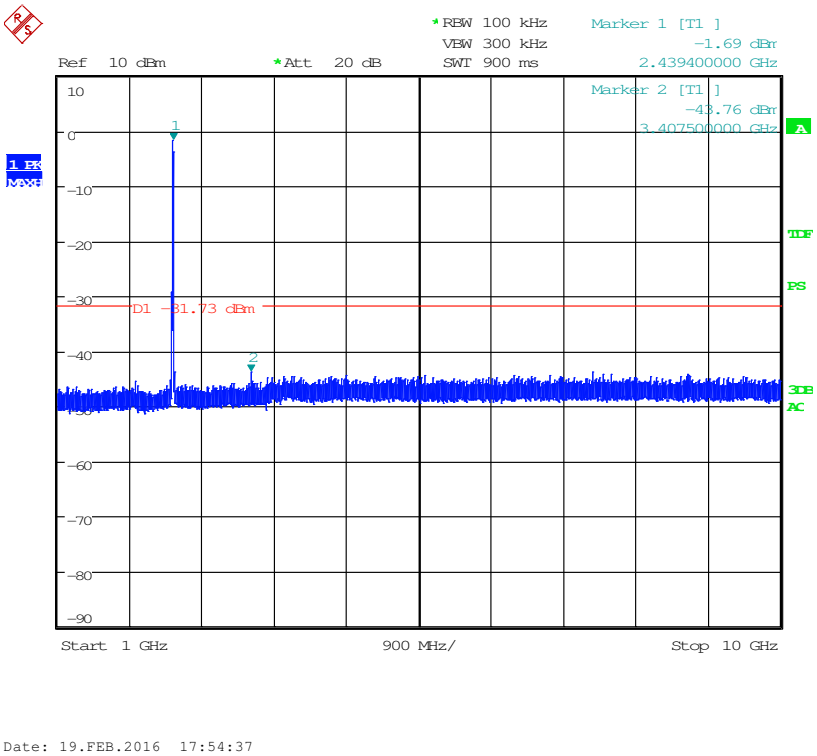


Figure 7.4.2.2-54: 1 GHz –10 GHz – Middle Channel

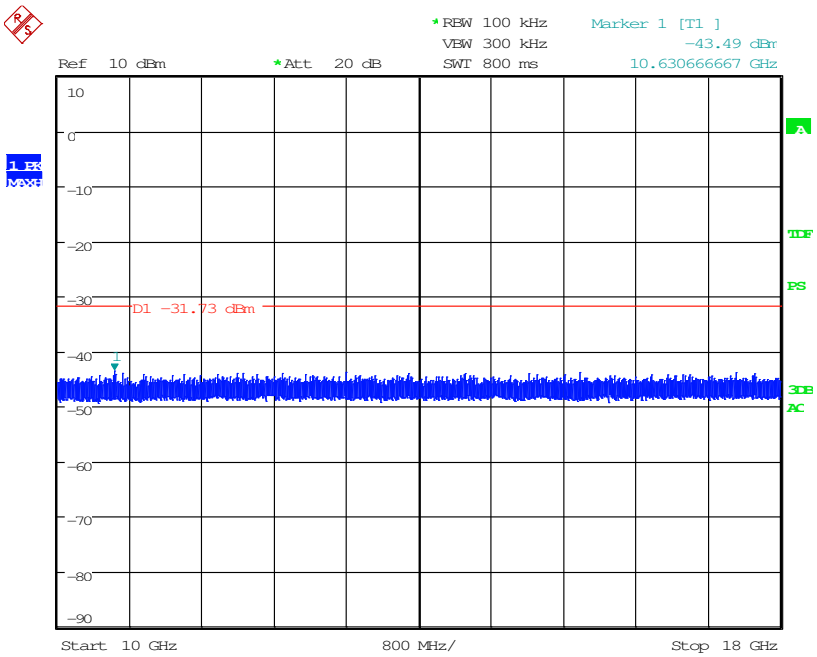


Figure 7.4.2.2-55: 10 GHz –18 GHz – Middle Channel

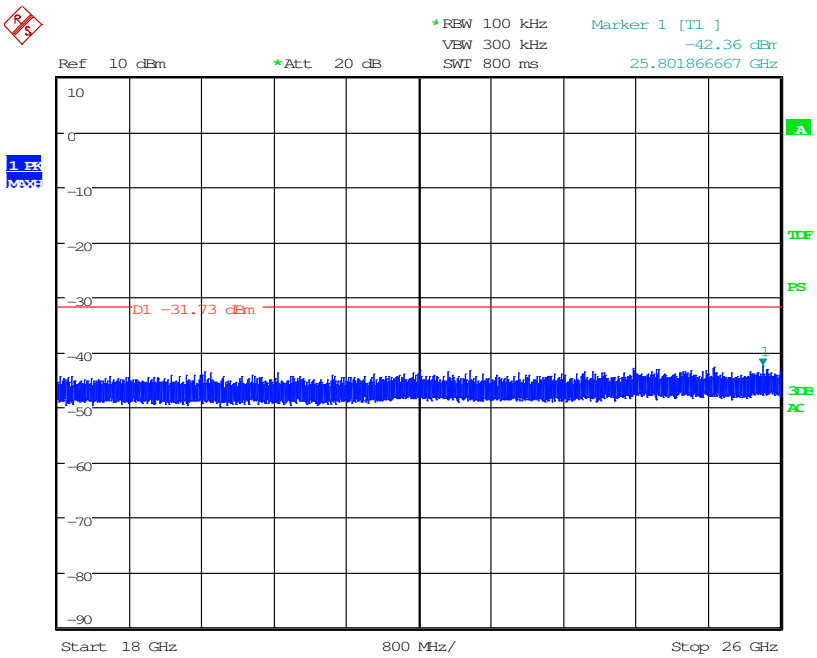


Figure 7.4.2.2-56: 18 GHz – 26 GHz – Middle Channel

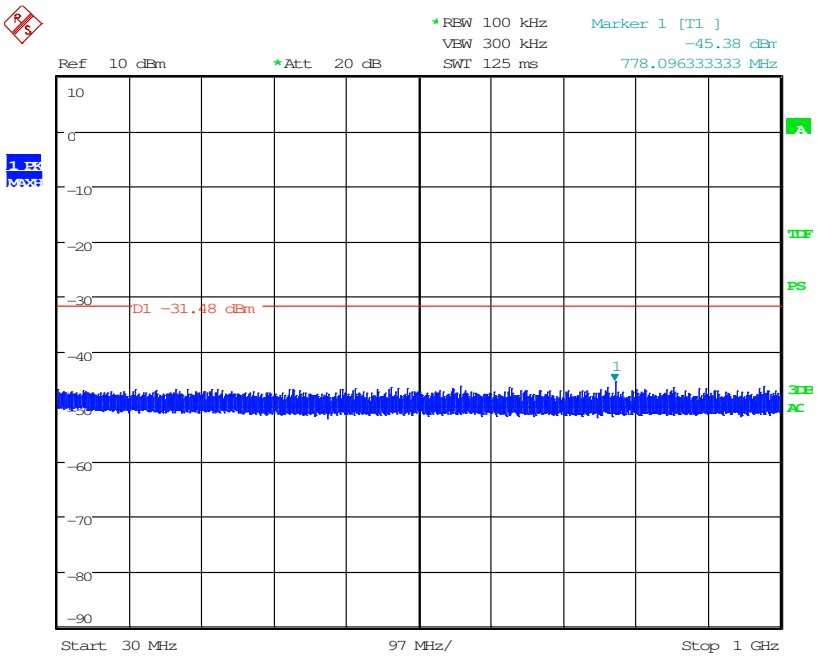


Figure 7.4.2.2-57: 30 MHz – 1 GHz – High Channel

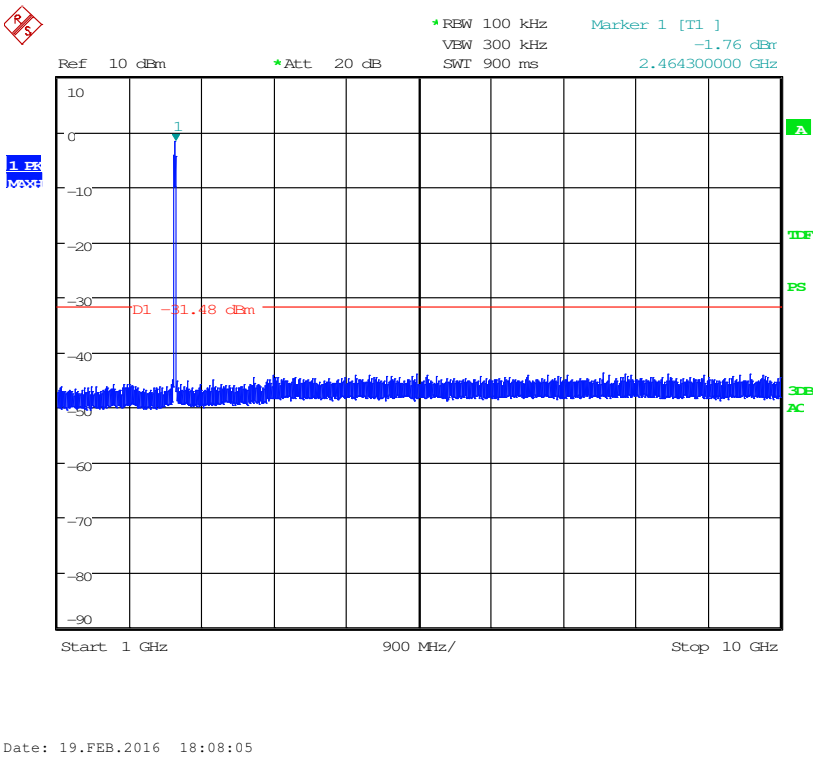


Figure 7.4.2.2-58: 1 GHz –10 GHz –High Channel

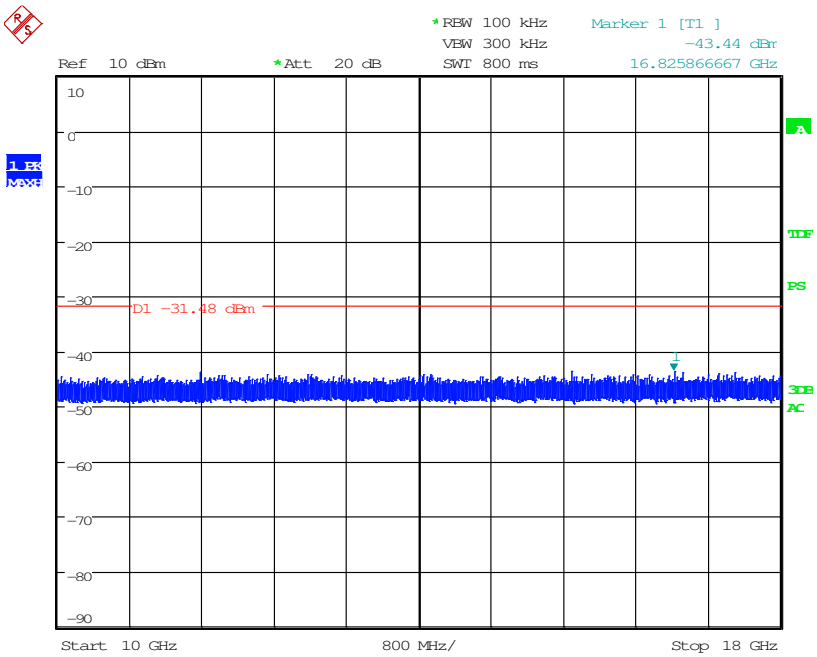


Figure 7.4.2.2-59: 10 GHz – 18 GHz –High Channel

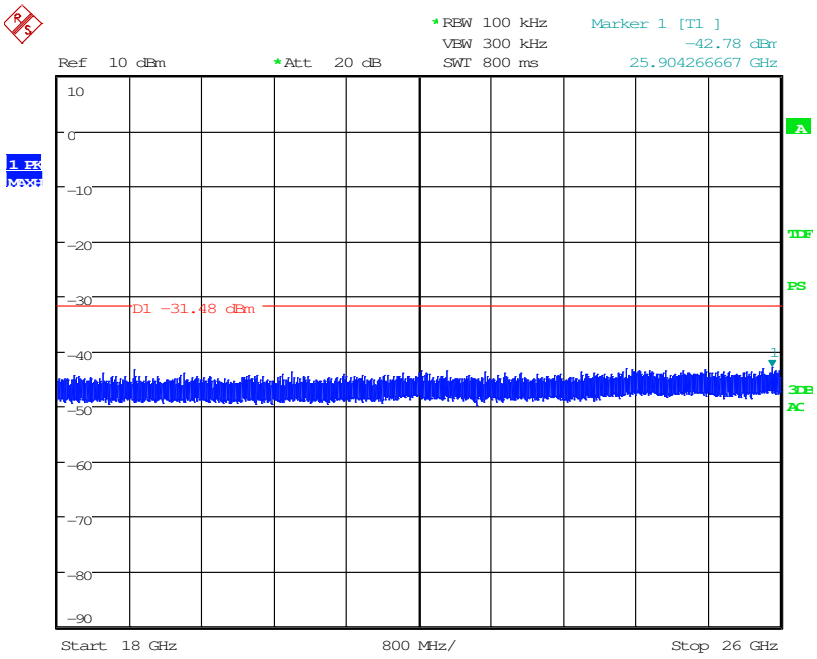


Figure 7.4.2.2-60: 18 GHz – 26 GHz –High Channel

7.4.3 Radiated Spurious Emissions into Restricted Frequency Bands - FCC 15.205, 15.209; IC: RSS-210 2.2, RSS-Gen 8.9, 8.10

7.4.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 26 GHz, 10 times the highest fundamental frequency. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using VBW of 30 Hz over a 5 second sweep.

7.4.3.2 Measurement Results

Radiated band-edge and spurious emissions found in the restricted frequency bands of 9 kHz to 26 GHz are reported in the tables below.

802.11b

Table 7.4.3.2-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2390	52.56	42.42	H	0.31	52.87	42.73	74.0	54.0	21.1	11.3
2390	51.45	41.33	V	0.31	51.76	41.64	74.0	54.0	22.2	12.4
4824	41.35	35.91	H	8.60	49.95	44.51	74.0	54.0	24.0	9.5
4824	43.63	39.33	V	8.60	52.23	47.93	74.0	54.0	21.8	6.1
Middle Channel (2437 MHz)										
4874	41.51	33.35	H	8.78	50.29	42.13	74.0	54.0	23.7	11.9
4874	42.95	36.15	V	8.78	51.73	44.93	74.0	54.0	22.3	9.1
High Channel (2462 MHz)										
2483.5	56.48	48.15	H	0.79	57.27	48.94	74.0	54.0	16.7	5.1
2483.5	55.93	46.61	V	0.79	56.72	47.40	74.0	54.0	17.3	6.6
4924	40.02	31.81	H	8.96	48.98	40.77	74.0	54.0	25.0	13.2
4924	40.93	33.74	V	8.96	49.89	42.70	74.0	54.0	24.1	11.3

Note: The emissions above 4.93 GHz were attenuated below the limits and the noise floor of the measurement equipment.

802.11g

Table 7.4.3.2-2: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2390	78.46	54.69	H	-5.60	72.86	49.09	74.0	54.0	1.1	4.9
2390	77.27	54.03	V	-5.60	71.67	48.43	74.0	54.0	2.3	5.6
4824	45.91	33.53	H	2.99	48.90	36.52	74.0	54.0	25.1	17.5
4824	45.39	31.87	V	2.99	48.38	34.86	74.0	54.0	25.6	19.1
Middle Channel (2437 MHz)										
4874	45.09	32.08	H	3.16	48.25	35.24	74.0	54.0	25.7	18.8
4874	41.91	31.23	V	3.16	45.07	34.39	74.0	54.0	28.9	19.6
High Channel (2462 MHz)										
2483.5	78.50	56.60	H	-5.15	73.35	51.45	74.0	54.0	0.7	2.6
2483.5	76.92	54.79	V	-5.15	71.77	49.64	74.0	54.0	2.2	4.4
4924	44.32	32.13	H	3.33	47.65	35.46	74.0	54.0	26.3	18.5
4924	44.63	31.55	V	3.33	47.96	34.88	74.0	54.0	26.0	19.1

Note: The emissions above 4.93 GHz were attenuated below the limits and the noise floor of the measurement equipment.

802.11n 20 MHz CDD

Table 7.4.3.2-3: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2390	78.09	54.18	H	-5.60	72.49	48.58	74.0	54.0	1.5	5.4
2390	76.45	52.22	V	-5.60	70.85	46.62	74.0	54.0	3.2	7.4
4824	45.41	32.60	H	2.99	48.40	35.59	74.0	54.0	25.6	18.4
4824	44.33	31.52	V	2.99	47.32	34.51	74.0	54.0	26.7	19.5
Middle Channel (2437 MHz)										
4874	44.77	31.83	H	3.16	47.93	34.99	74.0	54.0	26.1	19.0
4874	44.40	31.21	V	3.16	47.56	34.37	74.0	54.0	26.4	19.6
High Channel (2462 MHz)										
2483.5	77.97	54.80	H	-5.15	72.82	49.65	74.0	54.0	1.2	4.4
2483.5	77.17	54.01	V	-5.15	72.02	48.86	74.0	54.0	2.0	5.1
4924	44.38	31.74	H	3.33	47.71	35.07	74.0	54.0	26.3	18.9
4924	44.20	31.36	V	3.33	47.53	34.69	74.0	54.0	26.5	19.3

Note: The emissions above 4.93 GHz were attenuated below the limits and the noise floor of the measurement equipment.

802.11n 20 MHz SM-MIMO

Table 7.4.3.2-4: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel (2412 MHz)										
2390	77.03	51.99	H	-5.60	71.43	46.39	74.0	54.0	2.6	7.6
2390	74.95	50.49	V	-5.60	69.35	44.89	74.0	54.0	4.7	9.1
4824	46.58	32.30	H	2.99	49.57	35.29	74.0	54.0	24.4	18.7
4824	45.20	31.35	V	2.99	48.19	34.34	74.0	54.0	25.8	19.7
Middle Channel (2437 MHz)										
4874	45.13	31.47	H	3.16	48.29	34.63	74.0	54.0	25.7	19.4
4874	44.71	31.16	V	3.16	47.87	34.32	74.0	54.0	26.1	19.7
High Channel (2462 MHz)										
2483.5	77.54	52.86	H	-5.15	72.39	47.71	74.0	54.0	1.6	6.3
2483.5	76.12	52.08	V	-5.15	70.97	46.93	74.0	54.0	3.0	7.1
4924	44.20	31.25	H	3.33	47.53	34.58	74.0	54.0	26.5	19.4
4924	44.44	31.21	V	3.33	47.77	34.54	74.0	54.0	26.2	19.5

Note: The emissions above 4.93 GHz were attenuated below the limits and the noise floor of the measurement equipment.

7.4.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 52.56 + 0.31 = 52.87 dBµV/m
Margin: 74 dBµV/m – 52.87 dBµV/m = 21.1dB

Example Calculation: Average
Corrected Level: 42.42 + 0.31 = 42.73 dBµV/m
Margin: 54 dBµV/m – 42.73 dBµV/m = 11.3 dB

7.5 Power Spectral Density - FCC Section 15.247(e) IC: RSS-247 5.2(2)

7.5.1 PSD Measurement Procedure (Conducted Method)

The power spectral density was measured in accordance with ANSI 63.10-2013 Section 11.10.2 Method PKPSD (peak PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable and external attenuation. The spectrum analyzer RBW was set to 100 kHz and VBW 300 kHz. Span was adjusted to 1.5 times the 6 dB bandwidth and the sweep time was set to auto.

The total PSD levels for the MIMO modes were calculated in accordance with FCC KDB Publication No. 662911 “Emissions Testing of Transmitters with Multiple Outputs in the Same Band” in order to account for the two TX antenna paths by summing the PSD level across all transmitter outputs.

7.5.2 Measurement Results

Results are shown below.

802.11b

Table 7.5.2-1: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-6.02	8	14.02
2437	-6.74	8	14.74
2462	-6.22	8	14.22

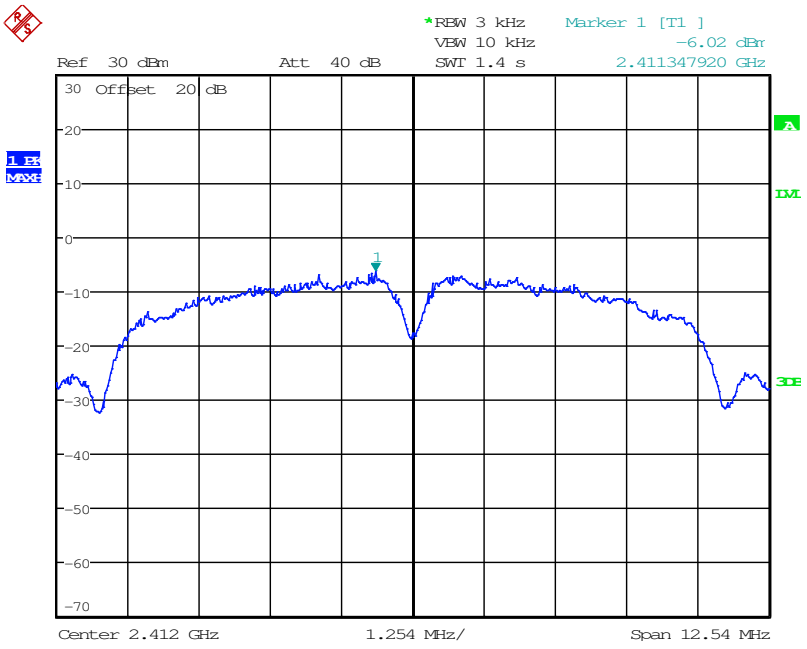


Figure 7.5.2-1: Power Spectral Density - Low Channel

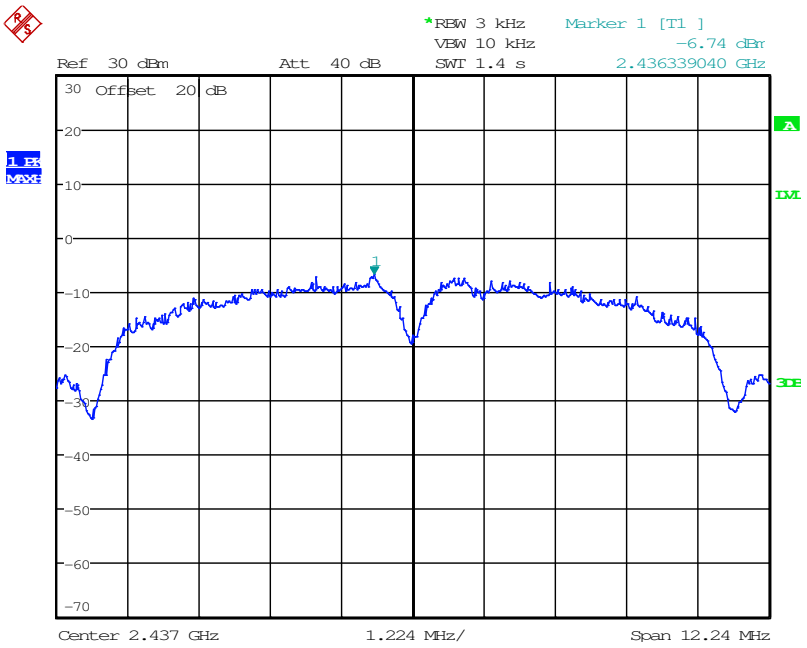


Figure 7.5.2-2: Power Spectral Density - Middle Channel

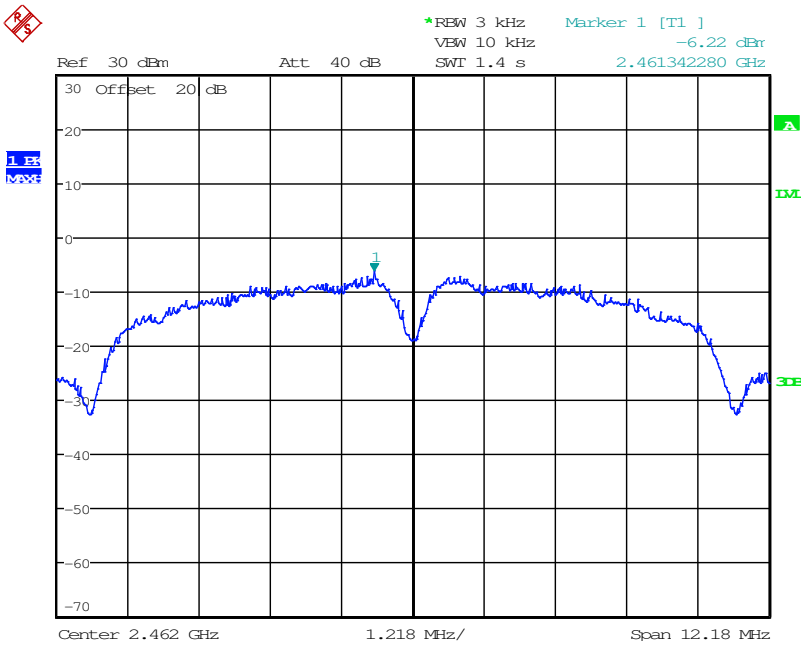


Figure 7.5.2-3: Power Spectral Density – High Channel

802.11g

Table 7.5.2-2: Power Spectral Density (MIMO)

Frequency [MHz]	Primary Antenna PSD [dBm]	Secondary Antenna PSD [dBm]	MIMO Level [dBm]	Limit (dBm)	Margin (dB)
2412	-12.87	-15.68	-11.04	8	19.04
2437	-12.99	-14.92	-10.84	8	18.84
2462	-13.18	-15.38	-11.13	8	19.13

Note: The MIMO Level is computed using the linear summation of the level of the primary and secondary antennas.

Primary Antenna

Table 7.5.2-3: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-12.87	8	20.87
2437	-12.99	8	20.99
2462	-13.18	8	21.18

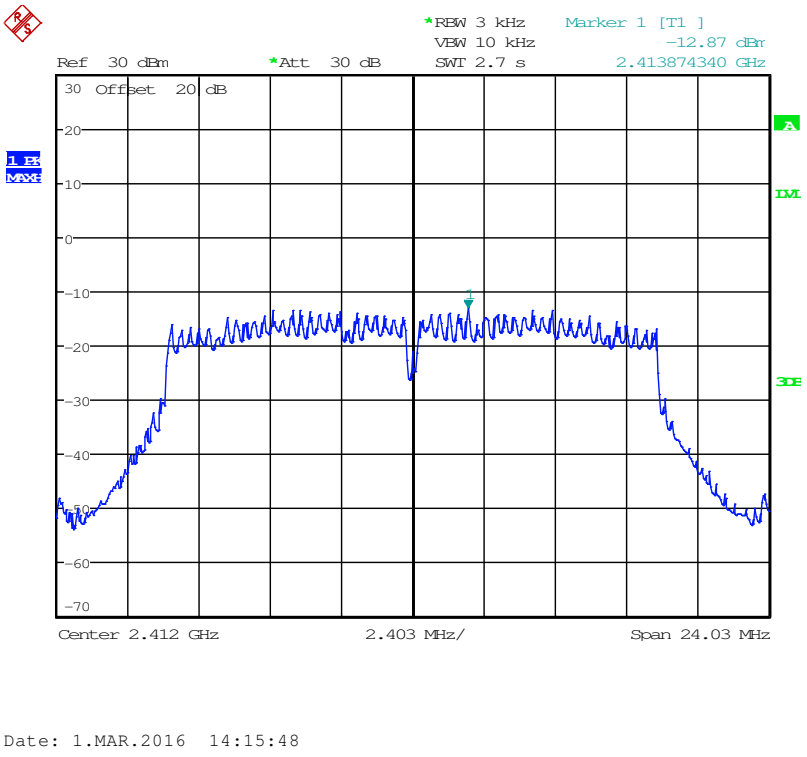


Figure 7.5.2-4: Power Spectral Density - Low Channel

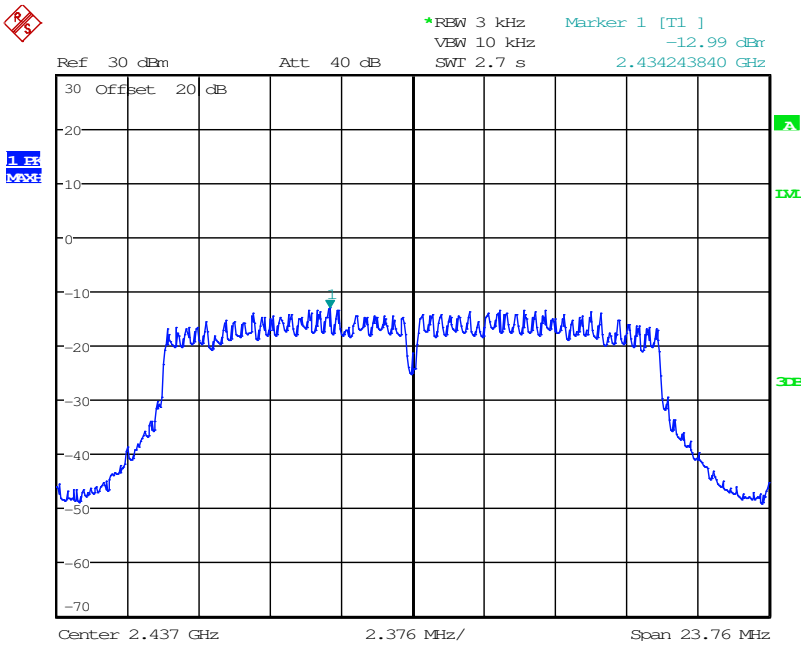


Figure 7.5.2-5: Power Spectral Density - Middle Channel

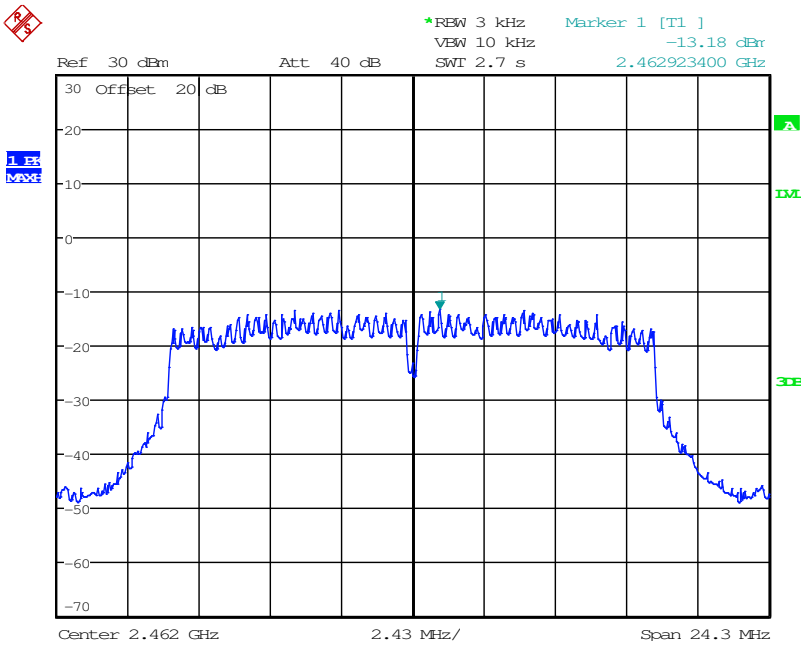


Figure 7.5.2-6: Power Spectral Density – High Channel

Secondary Antenna

Table 7.5.2-4: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-15.68	8	23.68
2437	-14.92	8	22.92
2462	-15.38	8	23.38

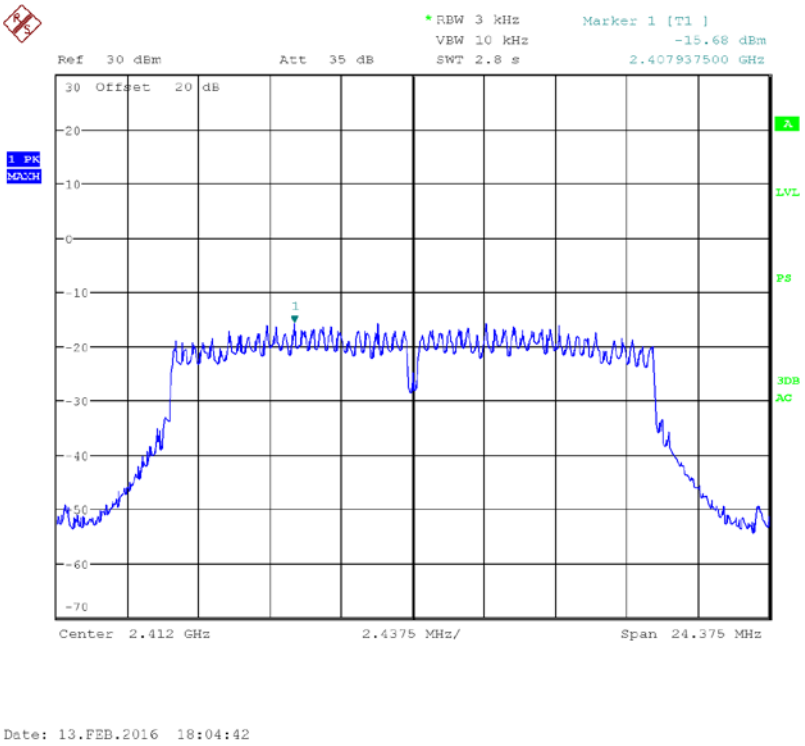


Figure 7.5.2-7: Power Spectral Density - Low Channel

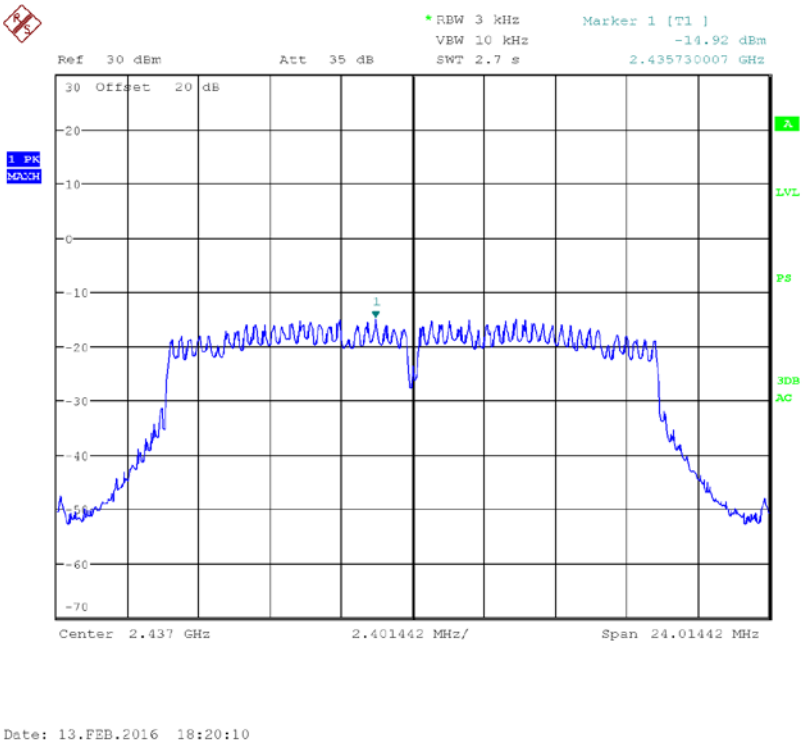


Figure 7.5.2-8: Power Spectral Density - Middle Channel

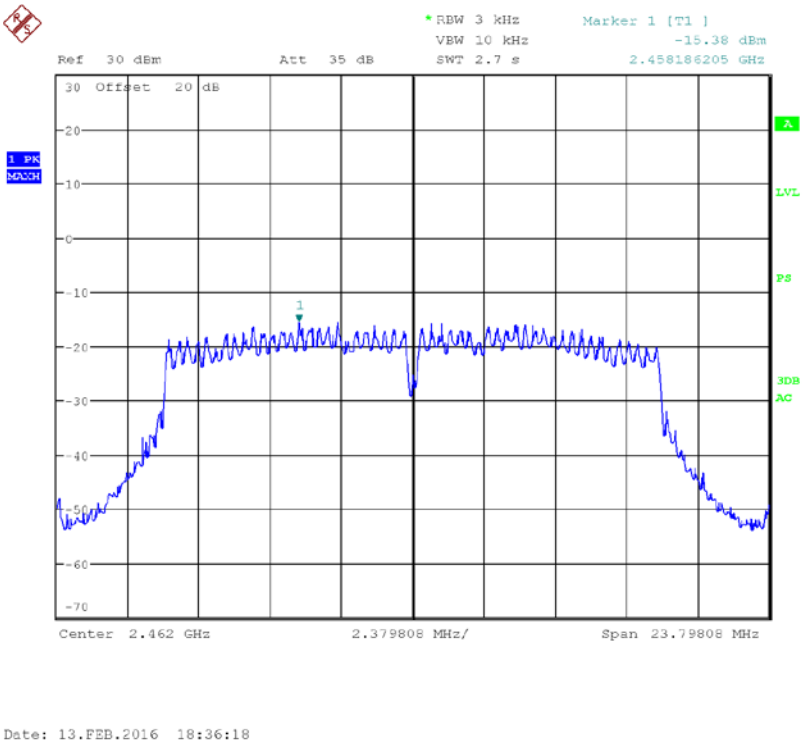


Figure 7.5.2-9: Power Spectral Density – High Channel

802.11n 20MHz

Table 7.5.2-5: Power Spectral Density (MIMO)

Frequency [MHz]	Primary Antenna PSD [dBm]	Secondary Antenna PSD [dBm]	MIMO Level [dBm]	Limit (dBm)	Margin (dB)
2412	-11.83	-15.31	-10.22	8	18.22
2437	-12.91	-15.36	-10.95	8	18.95
2462	-12.22	-15.1	-10.42	8	18.42

Primary Antenna

Table 7.5.2-6: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-11.83	8	19.83
2437	-12.91	8	20.91
2462	-12.22	8	20.22

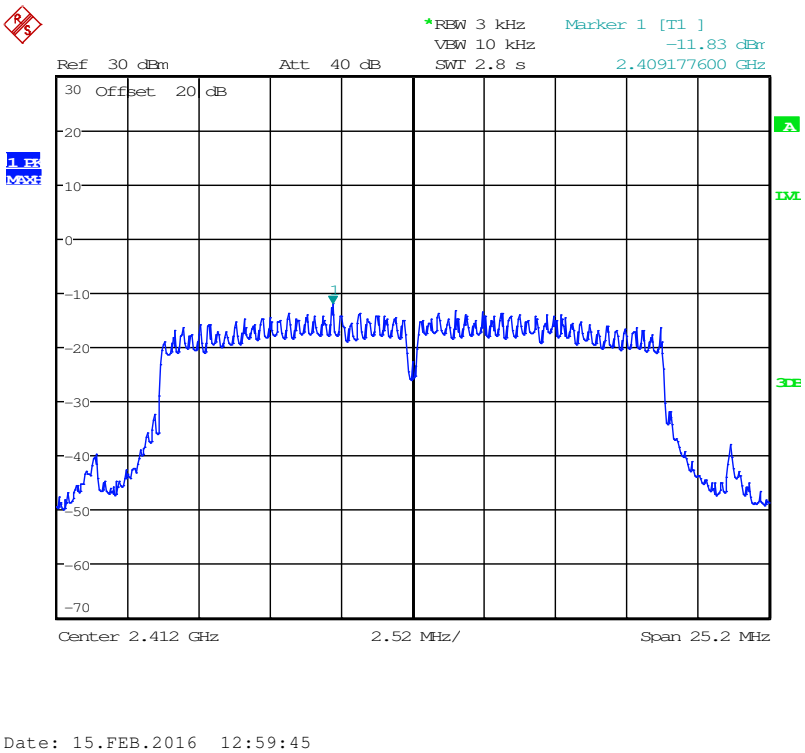


Figure 7.5.2-10: Power Spectral Density - Low Channel

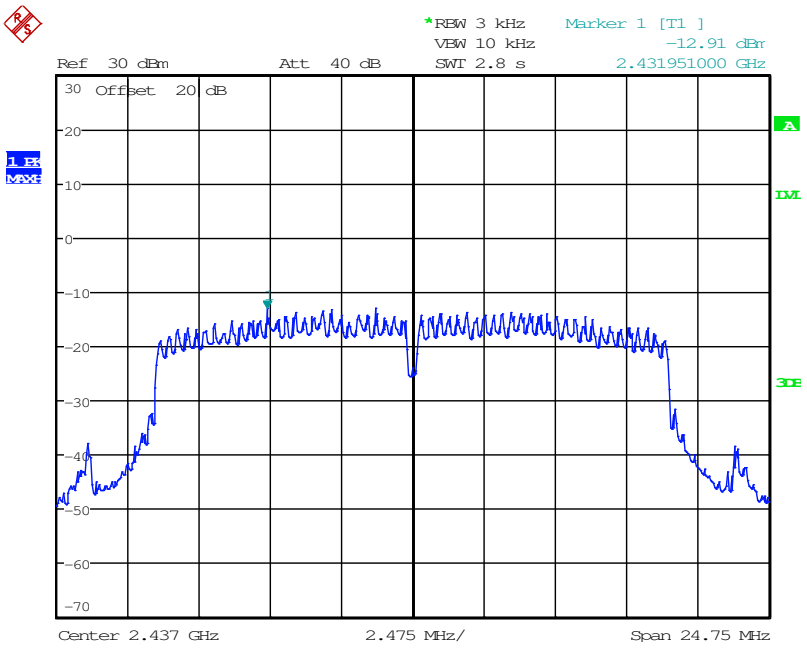


Figure 7.5.2-11: Power Spectral Density - Middle Channel

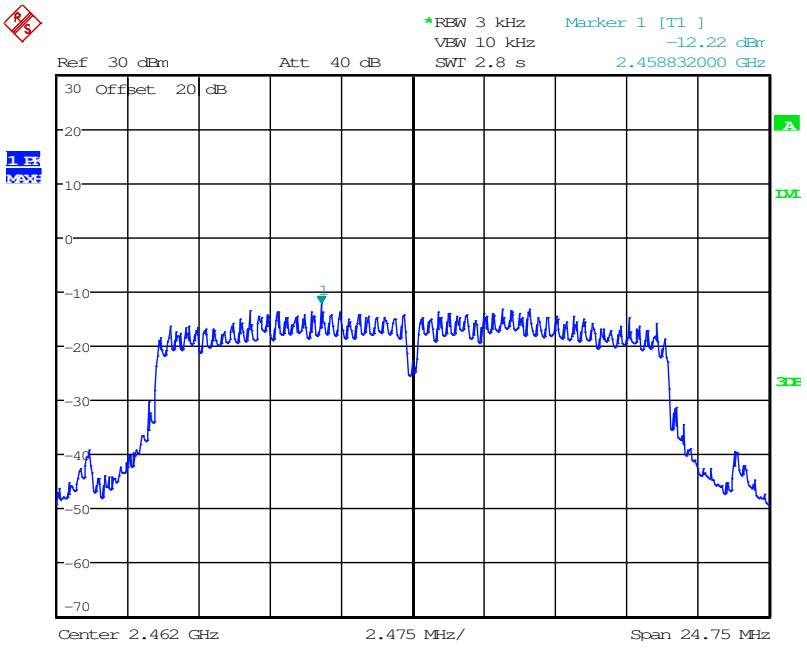


Figure 7.5.2-12: Power Spectral Density – High Channel

Secondary Antenna

Table 7.5.2-7: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
2412	-15.31	8	23.31
2437	-15.36	8	23.36
2462	-15.1	8	23.1

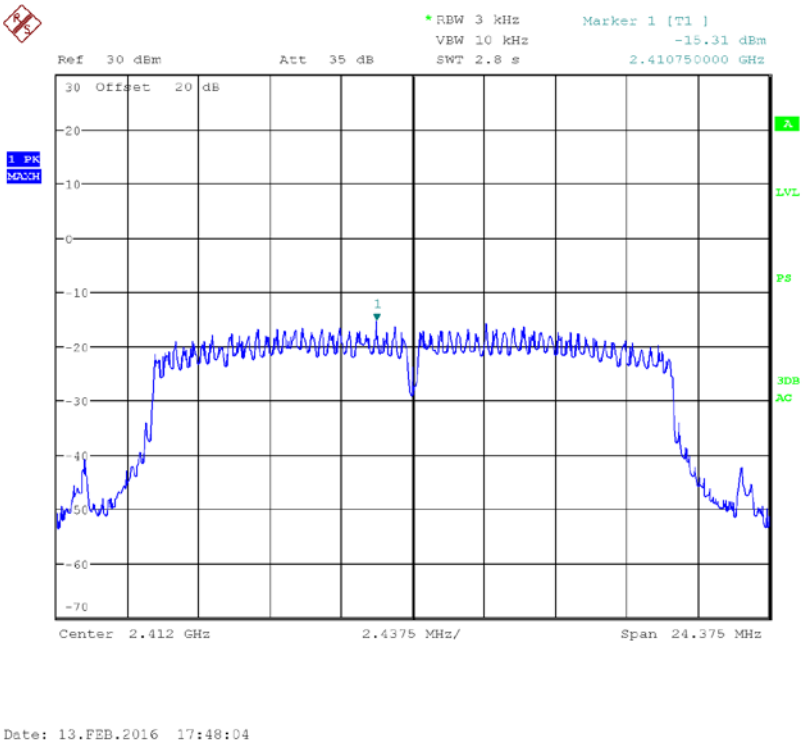


Figure 7.5.2-13: Power Spectral Density - Low Channel

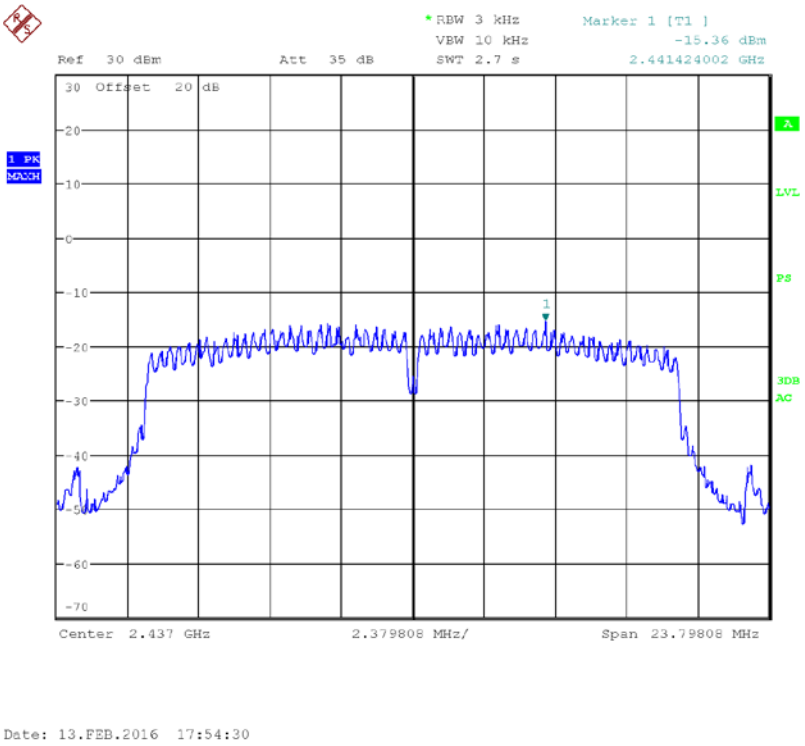


Figure 7.5.2-14: Power Spectral Density - Middle Channel

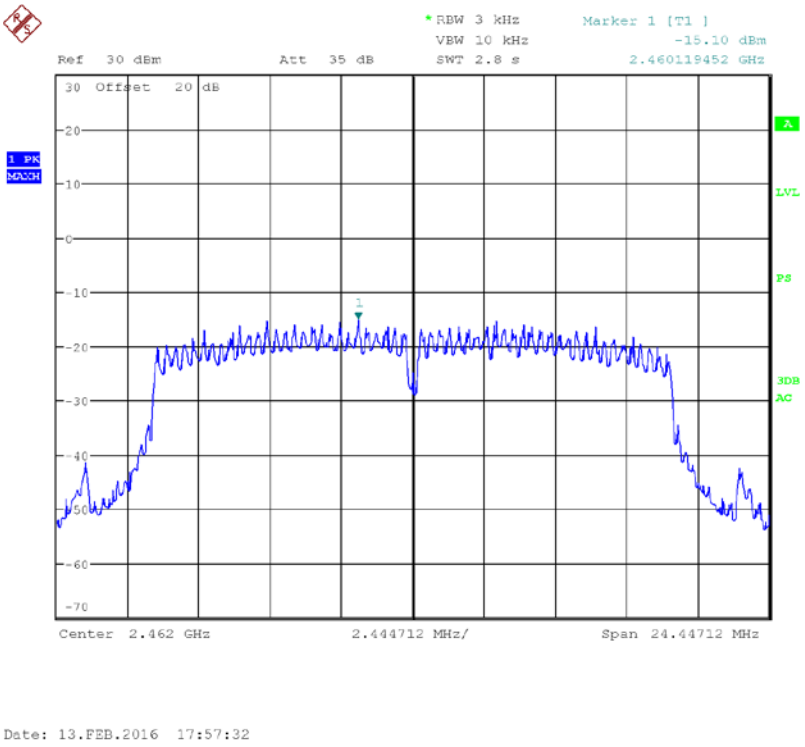


Figure 7.5.2-15: Power Spectral Density – High Channel

7.6 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 8.8

7.6.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.6.2 Measurement Results

Results are shown below.

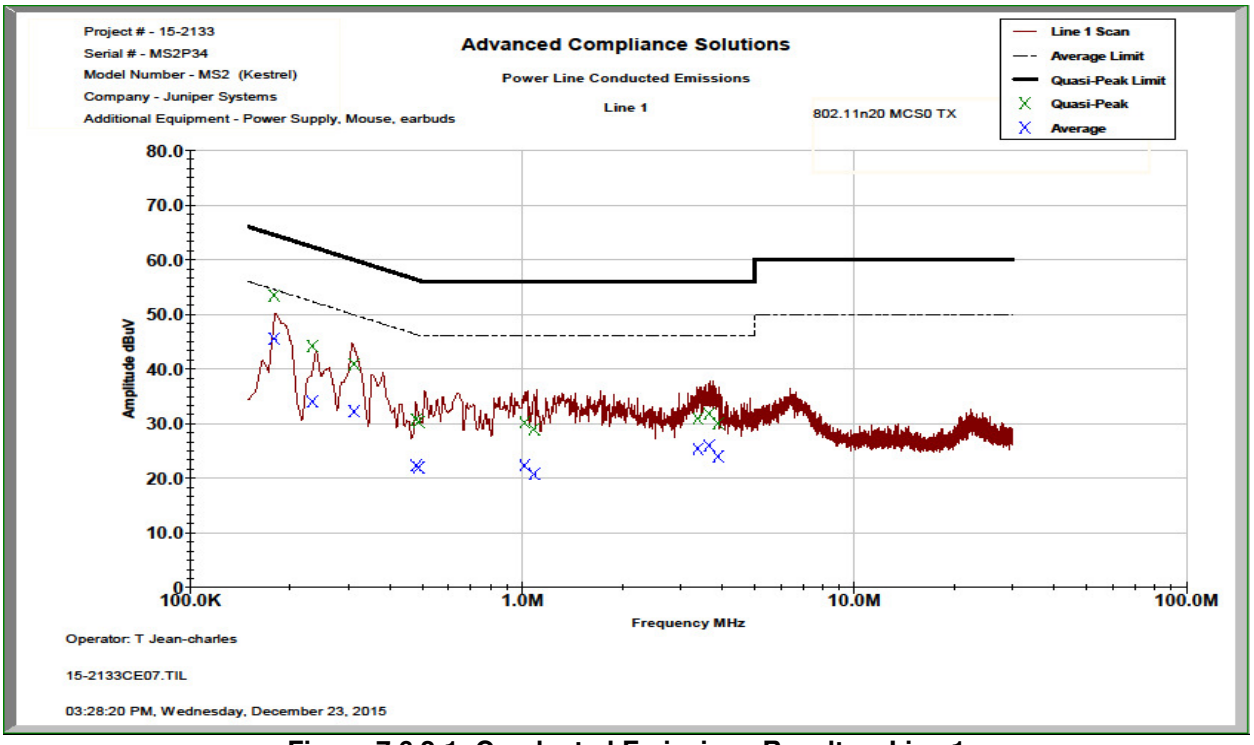


Figure 7.6.2-1: Conducted Emissions Results – Line 1

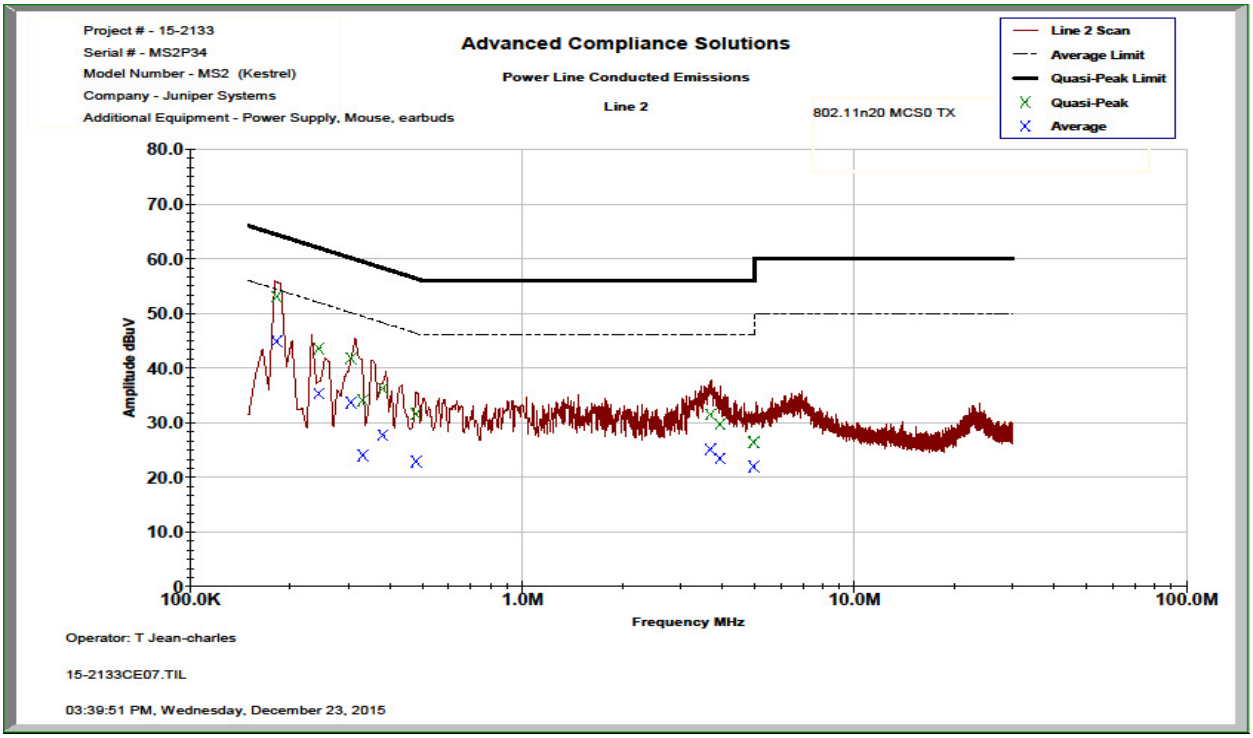


Figure 7.6.2-2: Conducted Emissions Results – Line 2

Table 7.6.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3
☐ Line 4
☐ To Ground ☒ Floating
☐ Telecom Port _____
☒ dBµV ☐ dBµA

Plot Number: 15-2133CE07
Power Supply Description: 12 VDC

Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.17925	43.272	35.322	10.20	53.48	45.53	64.52	54.52	11.0	9.0
0.2336	34.005	23.772	10.21	44.21	33.98	62.32	52.32	18.1	18.3
0.312062	30.73	22.037	10.20	40.93	32.24	59.92	49.92	19.0	17.7
0.48	20.545	12.11	10.21	30.75	22.32	56.34	46.34	25.6	24.0
0.4882	20.113	11.763	10.21	30.32	21.97	56.20	46.20	25.9	24.2
1.01804	19.999	12.12	10.20	30.20	22.32	56.00	46.00	25.8	23.7
1.0852	18.78	10.513	10.20	28.98	20.72	56.00	46.00	27.0	25.3
3.38365	20.575	15.053	10.35	30.93	25.41	56.00	46.00	25.1	20.6
3.65976	21.427	15.587	10.35	31.78	25.94	56.00	46.00	24.2	20.1
3.8911	19.664	13.637	10.35	30.02	23.99	56.00	46.00	26.0	22.0
Line 2									
0.18245	42.856	34.664	10.22	53.08	44.89	64.37	54.37	11.3	9.5
0.244238	33.348	25.121	10.22	43.56	35.34	61.95	51.95	18.4	16.6
0.305524	31.563	23.45	10.21	41.78	33.66	60.09	50.09	18.3	16.4
0.331488	23.912	13.786	10.21	34.12	24.00	59.41	49.41	25.3	25.4
0.38085	26.018	17.546	10.20	36.22	27.75	58.26	48.26	22.0	20.5
0.48	21.39	12.652	10.21	31.60	22.86	56.34	46.34	24.7	23.5
3.68961	21.049	14.704	10.39	31.44	25.09	56.00	46.00	24.6	20.9
3.94334	19.264	13.03	10.39	29.65	23.42	56.00	46.00	26.3	22.6
4.98	15.951	11.438	10.44	26.39	21.88	56.00	46.00	29.6	24.1
4.9801	15.855	11.487	10.44	26.30	21.93	56.00	46.00	29.7	24.1

7.7 Duty Cycle

7.7.1 Measurement Procedure

The duty cycle was measured in accordance with ANSI C63.10 Section 11.6 Duty cycle (D), transmission duration (T), and maximum power control level. The unit was connected directly to the input of the spectrum analyzer via suitable attenuation. The RBW and VBW were set to 10 MHz and the number of sweep points across duration T was set to exceed 100.

7.7.2 Measurement Results

The results for all the modes of operation are provided below.

Table 7.7.2-1 Duty Cycle Correction Factor

Mode	Time On (ms)	Period (ms)	Duty Cycle %	Correction Factor (dB)
802.11b	6.220	6.300	98.7	0.06
802.11g	2.090	2.170	96.3	0.16
802.11n 20 MHz	1.912	2.002	95.5	0.2

Notes:
The correction factor was calculated as 10*log (Time on/Period)
Per ANSI C63.10 duty cycle correction factor is not needed for duty cycle > 98%

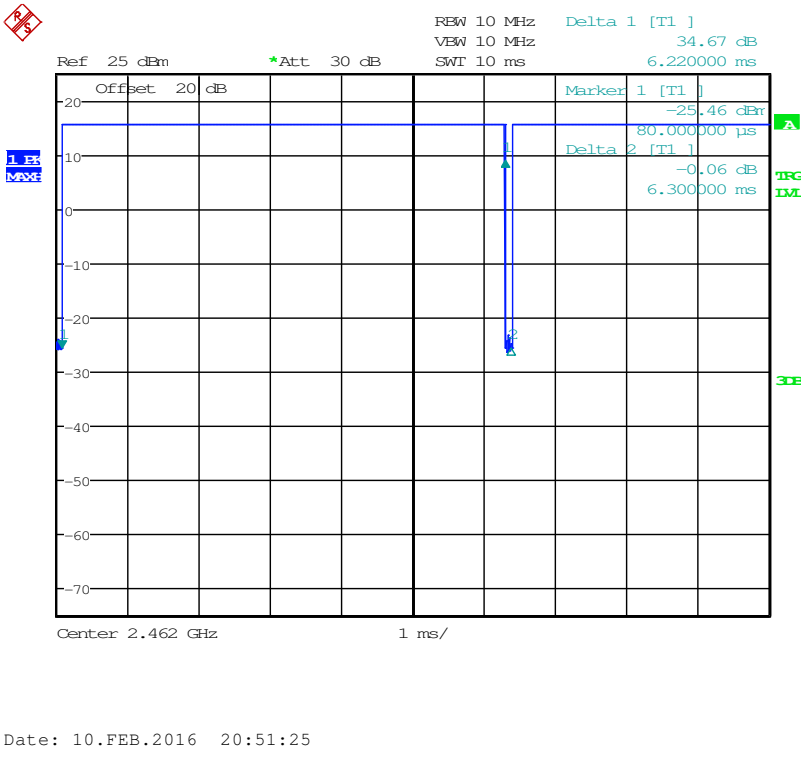


Figure 7.7.2-1: Duty Cycle 802.11b

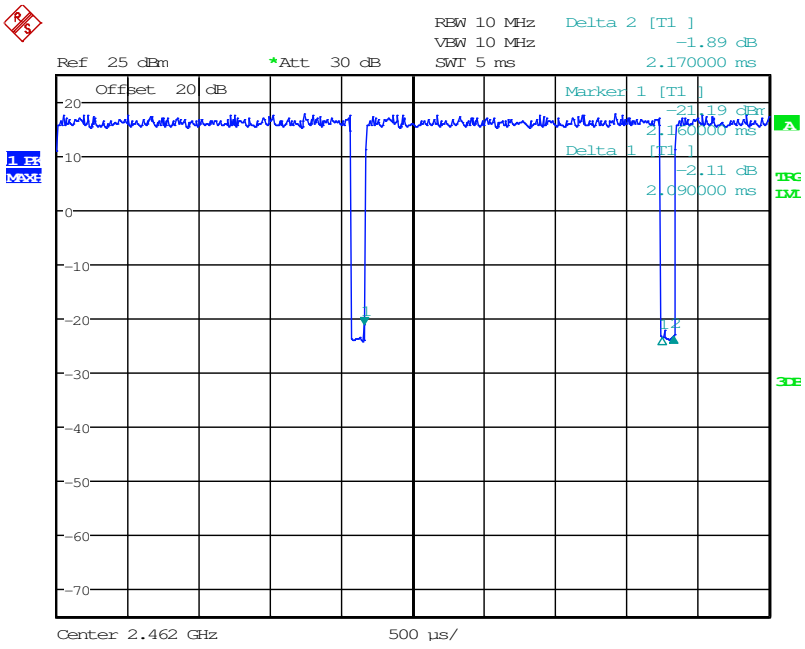


Figure 7.7.2-2: Duty Cycle 802.11g

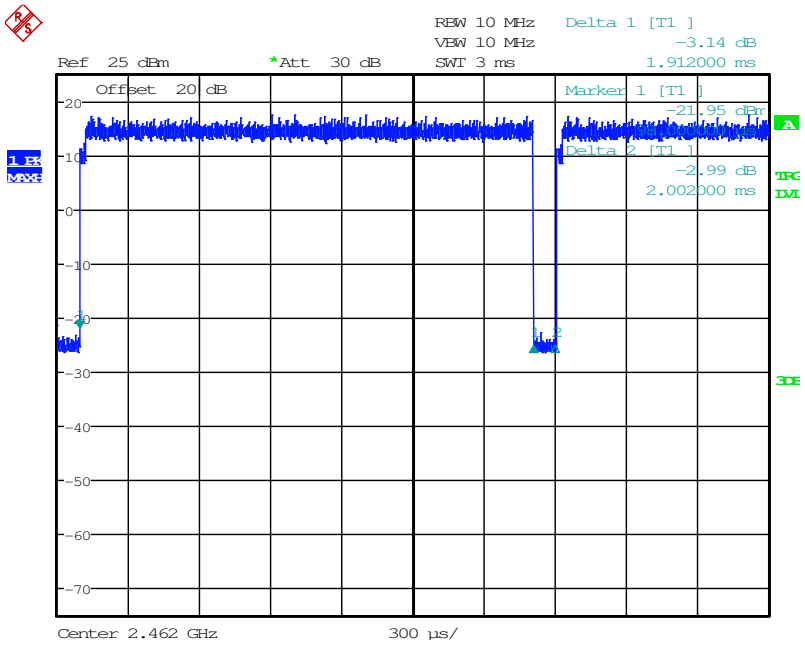


Figure 7.7.2-3: Duty Cycle 802.11n 20 MHz

8 CONCLUSION

In the opinion of ACS, Inc., the models MS2G and MS2GC manufactured by Juniper Systems, Inc. meet the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-247 for the test procedures documented in the test report.

END REPORT