

Emissions Test Report

EUT Name: Audio Player

Model No.: No519

CFR 47 Part 15.247: 2015 and RSS 247: 2015

Prepared for:

John Garay
Harman International Industries, Inc
50 Waterview Drive, Suite 240
Shelton, CT 06484
Tel: (203) 924-5349
Fax: (203) 924-2382

Prepared by:

TUV Rheinland of North America, Inc.
1279 Quarry Lane
Pleasanton, CA 94566
Tel: (925) 249-9123
Fax: (925) 249-9124
<http://www.tuv.com/>

Report/Reissue Date: July 21, 2016
Job # 0000137245
Report Number: 31660720.001

Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	03/08/2016	Original Document	N/A
1	07/21/2016	Corrected minor error to test report.	Kerwinn Corpuz
2	09/07/2016	Added note (Soft-AP mode) to EUT specifications.	Kerwinn Corpuz
3	10/06/2016	Replaced model from No.519 to No519	Kerwinn Corpuz

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer: Harman International Industries, Inc
50 Waterview Drive, Suite 240
Shelton, CT 06484
(203) 924-5349

Requester / Applicant: John Garay

Name of Equipment: Audio Player
Model No. No519
Type of Equipment: Intentional Radiator
Application of Regulations: CFR 47 Part 15.247: 2015 and RSS 247: 2015
Test Dates: 09 Feb 2016 to 04 Mar 2016

Guidance Documents:

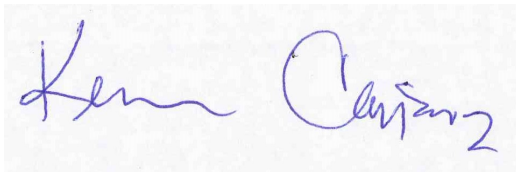
Emissions: ANSI C63.10-2013, KDB 558074 D01 DTS Measurement Guidance v03r05

Test Methods:

Emissions: ANSI C63.10-2013, KDB 558074 D01 DTS Measurement Guidance v03r05

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report contains data that are not covered by A2LA accreditation. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.



Kerwinn Corpuz

Test Engineer

Date September 7, 2016



David Spencer

A2LA Signatory

Date September 7, 2016



Industry
Canada Industrie
Canada

Testing Cert #3331.02

US5254

2932M-1

Table of Contents

1	Executive Summary	7
1.1	Scope	7
1.2	Purpose	7
1.3	Summary of Test Results	8
1.4	Special Accessories	8
1.5	Equipment Modifications	8
2	Laboratory Information	9
2.1	Accreditations & Endorsements	9
2.1.1	US Federal Communications Commission	9
2.1.2	NIST / A2LA	9
2.1.3	Canada – Industry Canada	9
2.1.4	Japan – VCCI	9
2.1.5	Acceptance by Mutual Recognition Arrangement	10
2.2	Test Facilities	10
2.2.1	Emission Test Facility	10
2.2.2	Immunity Test Facility	10
2.3	Measurement Uncertainty	10
2.3.1	Sample Calculation – radiated & conducted emissions	11
2.3.2	Measurement Uncertainty	11
2.3.3	Measurement Uncertainty Immunity	12
2.4	Calibration Traceability	12
3	Product Information	13
3.1	Product Description	13
3.2	Equipment Configuration	13
3.3	Operating Mode	13
3.4	Unique Antenna Connector	14
3.4.1	Results	14
4	Emissions	15
4.1	Output Power Requirements	15
4.1.1	Test Method	15
4.1.2	Results	16
4.2	Occupied Bandwidth	20
4.2.1	Test Method	20
4.2.2	Results	20
4.3	Peak Power Spectral Density	25
4.3.1	Test Method	25
4.3.2	Results	25
4.4	Out of Band Emissions	30
4.4.1	Test Method	30
4.4.2	Results	31

Table of Contents

4.5	Transmit Spurious Emissions	40
4.5.1	Test Methodology	40
4.5.2	Transmitter Spurious Emission Limit	41
4.5.3	Test Results	41
4.6	AC Conducted Emissions	71
4.6.1	Test Methodology	71
4.6.2	Test Results	71
4.7	Maximum Permissible Exposure	76
4.7.1	Test Methodology	76
4.7.2	RF Exposure Limit	76
4.7.3	EUT Operating Condition	77
4.7.4	Classification	77
4.7.5	Test Results	77
4.7.6	Sample Calculation	77
5	Test Equipment List	78
5.1	Equipment List	78
6	EMC Test Plan	79
6.1	Introduction	79
6.2	Customer	79
6.3	Equipment Under Test (EUT)	80
6.4	Test Specifications	84

Index of Tables

Table 1: Summary of Test Results.....	8
Table 2: RF Output Power at the Antenna Port – Test Results.....	16
Table 3: RF Output Power at the Antenna Port – Test Results.....	17
Table 4: Occupied Bandwidth – Test Results	21
Table 5: Occupied Bandwidth – Test Results	22
Table 6: Peak Power Spectral Density – Test Results	26
Table 7: Peak Power Spectral Density – Test Results Continues	27
Table 8: Emissions at the Band-Edge – Test Results.....	31
Table 9: Transmit Spurious Emission at Band-Edge Requirements	42
Table 10: AC Conducted Emissions – Test Results.....	71
Table 11: Customer Information.....	79
Table 12: Technical Contact Information	79
Table 13: EUT Specifications	80
Table 14: EUT Channel Power Specifications.....	82
Table 15: Interface Specifications.....	83
Table 16: Supported Equipment.....	83
Table 17: Description of Sample used for Testing.....	83
Table 18: Description of Test Configuration used for Radiated Measurement.	83
Table 19: Test Specifications	84

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.247: 2015 and RSS 247: 2015 based on the results of testing performed on 09 Feb 2016 to 04 Mar 2016 on the Audio Player Model No519 manufactured by Harman International Industries, Inc. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report. The 2412 MHz to 2462 MHz frequency band is covered in this document.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.10: 2013	Test Parameters (Measured)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.247 (d) RSS-GEN Sect.8.9, RSS 247 Sect. 6.2.1.2	Class B	Complied
Restricted Bands of Operation	CFR47 15.205, RSS GEN Sect.8.10	Class B	Complied
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.8.8	Class B	Complied
Occupied Bandwidth	CFR47 15.247 (a1), RSS GEN Sect.6.6	See plots	Complied
Maximum Output Power	CFR47 15.247 (b), RSS 247 Sect. 5.4.4, 6.2.4.1	17.10 dBm (802.11b) 14.69 dBm (802.11g) 13.93 dBm (HT 20) 12.48 dBm (HT 40)	Complied
Peak Power Spectral Density	CFR47 15.247 (e), RSS 247 Sect. 5.2.2	< 8 dBm/3kHz	Complied
Out of Band Emission	CFR47 15.247 (d), RSS 247 Sect.5.5	30 MHz - 26 GHz < 30 dBm/100kHz	Complied
RF Exposure	CFR47 15.247 (i), 2.1093 RSS-102 Issue 5	General Population	Complied

Note: This test report covers 2400 MHz to 2483.5 MHz band.

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission



TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (US5254). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / A2LA



TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab Code Testing Cert #3331.02). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada



TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI



The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0031

VCCI Registration No. for Santa Clara: A-0032

2.1.5 Acceptance by Mutual Recognition Arrangement



The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member

country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA. The 2305 Mission College, Santa Clara, 95054, USA location is considered a Pleasanton annex.

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Lab Code Testing Cert #3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2014, at a test distance of 3 meter and 5 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-k Ω resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-k Ω resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The *Combined Standard Uncertainty* is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{RAW} - \text{AMP} + \text{CBL} + \text{ACF}$$

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu\text{V/m} = 10^{\frac{\text{dB}\mu\text{V/m}}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

$$25 \text{ dBuV/m} + 17.5 \text{ dB} - 20 \text{ dB} + 1.0 \text{ dB} = 23.5 \text{ dBuV/m}$$

2.3.2 Measurement Uncertainty

Per CISPR 16-4-2	U _{lab}	U _{cispr}
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.3 dB

Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is $\pm 5.0\%$.	Per CISPR 16-4-2 Methods
--	--------------------------

2.3.3 Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is $\pm 8.2\%$.	Per IEC 61000-4-2
The estimated combined standard uncertainty for radiated immunity measurements is ± 4.10 dB.	Per IEC 61000-4-3
The estimated combined standard uncertainty for conducted immunity measurements with CDN is ± 3.66 dB	Per IEC 61000-4-6
The estimated combined standard uncertainty for power frequency magnetic field immunity is $\pm 2.9\%$.	Per IEC 61000-4-8

Thermo KeyTek EMC Pro

The estimated combined standard uncertainty for EFT fast transient immunity measurements is $\pm 2.6\%$.
The estimated combined standard uncertainty for surge immunity measurements is $\pm 2.6\%$.
The estimated combined standard uncertainty for voltage variation and interruption measurements is $\pm 1.74\%$.

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The Model No519, Mark Levinson Audio Player, a modern music player. It combines wireless and wired music streaming with a traditional CD player, plus connections for USB drives, additional digital sources, and Bluetooth audio and HARMAN Clari-Fi® technology for home capable of operating in the 2.4 GHz and 5 GHz frequency bands over 20 MHz and 40 MHz channels.

3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.3 Operating Mode

A description of the operation mode is given in the Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

3.4.1 Results

The Audio Player has an external Omnidirectional antenna and has maximum gain + 3.0 dBi. There are no beam forming and no additional antenna available.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.247: 2015 and RSS 247: 2015. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in section 8 of the standard were used.

4.1 Output Power Requirements

The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b):2015 and RSS 247: 2015 Sect. 5.4.4, and Sect. 6.2.4.

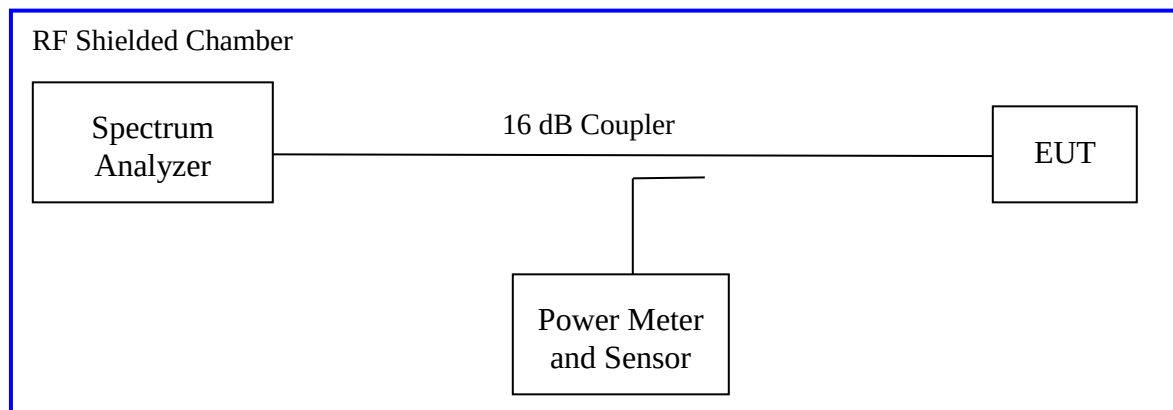
The maximum transmitted powers are

Band 2400-2483.5 MHz: 1 W

4.1.1 Test Method

The ANSI C63.10-2013 Section 11.9.2.2.2. conducted method was used to measure the channel power output. The preliminary investigation was performed at different data rate/ chain to determine the highest power output for each mode. The worst findings were conducted on 3 channels in each operating range per CFR47 Part 15.247(b): 2015 and RSS 247 Sect. 5.4.4; 2400 MHz to 2483.5 MHz. The worst mode results indicated below.

Test Setup:



Method AVGSA-1 of "KDB 558074 – DTS Measurement Guidance v03r05" applies since the EUT continuously transmits with duty cycle greater than 98%. Sample detector was used.

4.1.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 2: RF Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		Power Setting: See test plan	
Max. Directional Gain: + 3.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 22° C		Relative Humidity: 35%	
802.11b			
Operating Channel (MHz)	Limit [dBm]	Max Power [dBm]	Margin [dB]
2412.00	30.00	16.02	-13.98
2437.00	30.00	17.10	-12.90
2462.00	30.00	16.95	-13.05
Note: 1. The highest output power was observed at 802.11b mode, 1.0 Mbps, 1 Data Streams. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			
802.11g			
Operating Channel (MHz)	Limit [dBm]	Max Power [dBm]	Margin [dB]
2412.00	30.00	13.97	-16.03
2437.00	30.00	14.69	-15.31
2462.00	30.00	14.59	-15.41
Note: 1. The highest output power was observed at 802.11g mode, 6.0 Mbps, 1 Data Streams. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			

Table 3: RF Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		Power Setting: See test plan	
Max. Directional Gain: + 3.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 22° C		Relative Humidity: 35%	
802.11n			
Operating Channel (MHz)	Limit [dBm]	Max Power [dBm]	Margin [dB]
2412.00	30.00	13.15	-16.85
2437.00	30.00	13.93	-16.07
2462.00	30.00	13.73	-16.27
Note: 1. The highest output power was observed at HT20 MCS0, 1 Data Streams. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			
Operating Channel (MHz)	Limit [dBm]	Max Power [dBm]	Margin [dB]
2422.00	30.00	11.52	-18.48
2452.00	30.00	12.48	-17.52
Note: 1. The highest output power was observed at HT40 MCS0, 1 Data Streams. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			

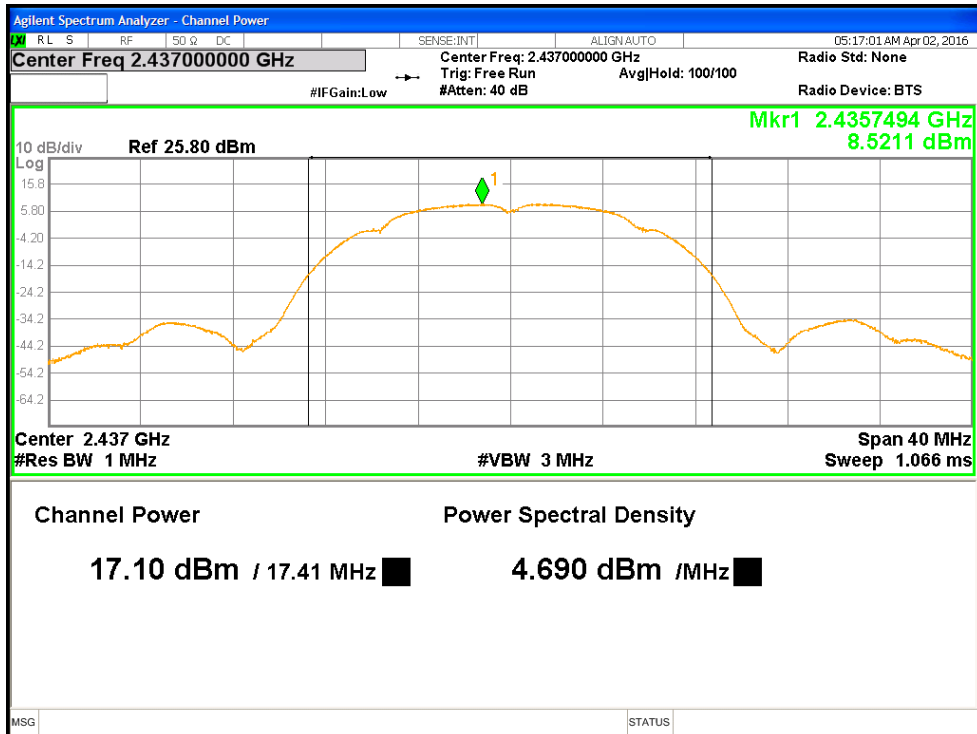


Figure 1: Maximum Transmitted Power, 2437 MHz at 11b 1Mbps

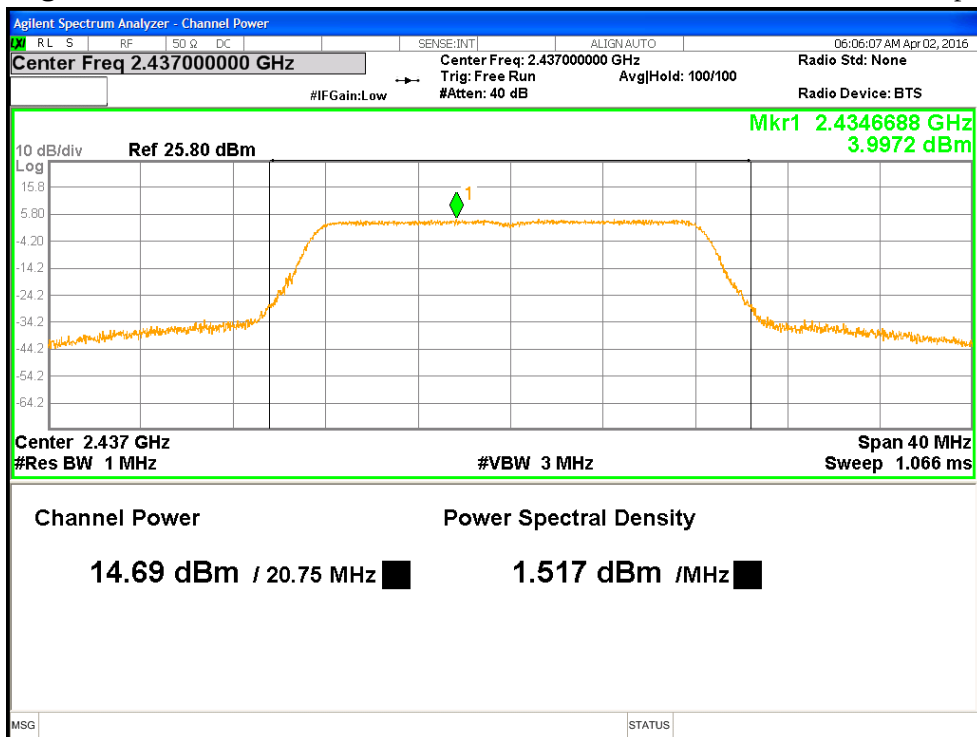


Figure 2: Maximum Transmitted Power, 2437 MHz at 11g 6Mbps

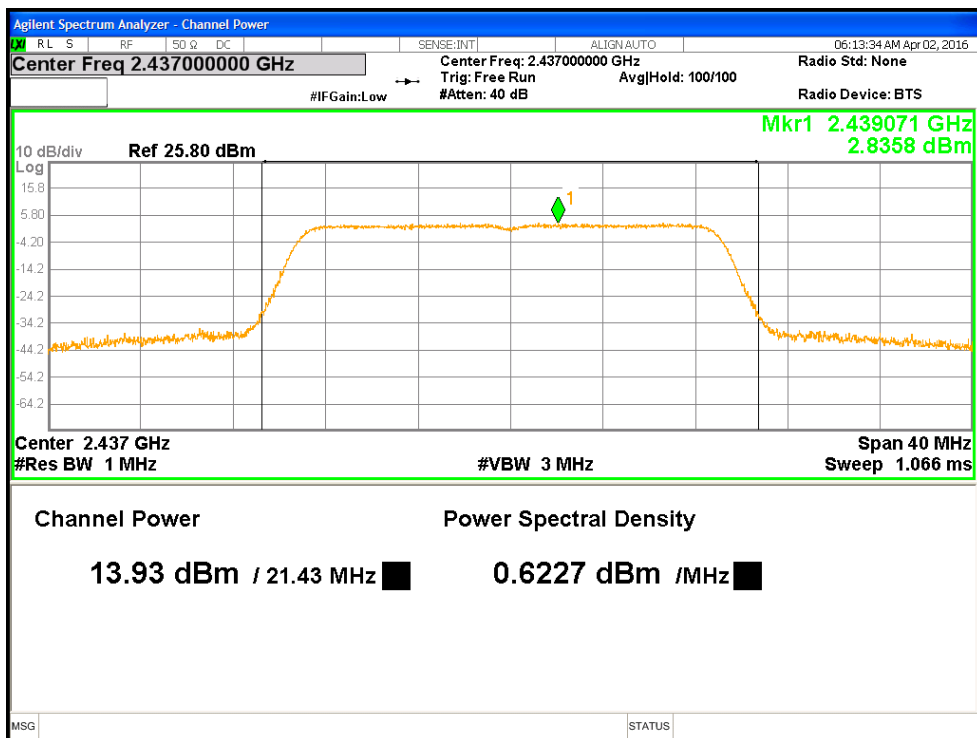


Figure 3: Maximum Transmitted Power, 2437 MHz at HT20 MCS0

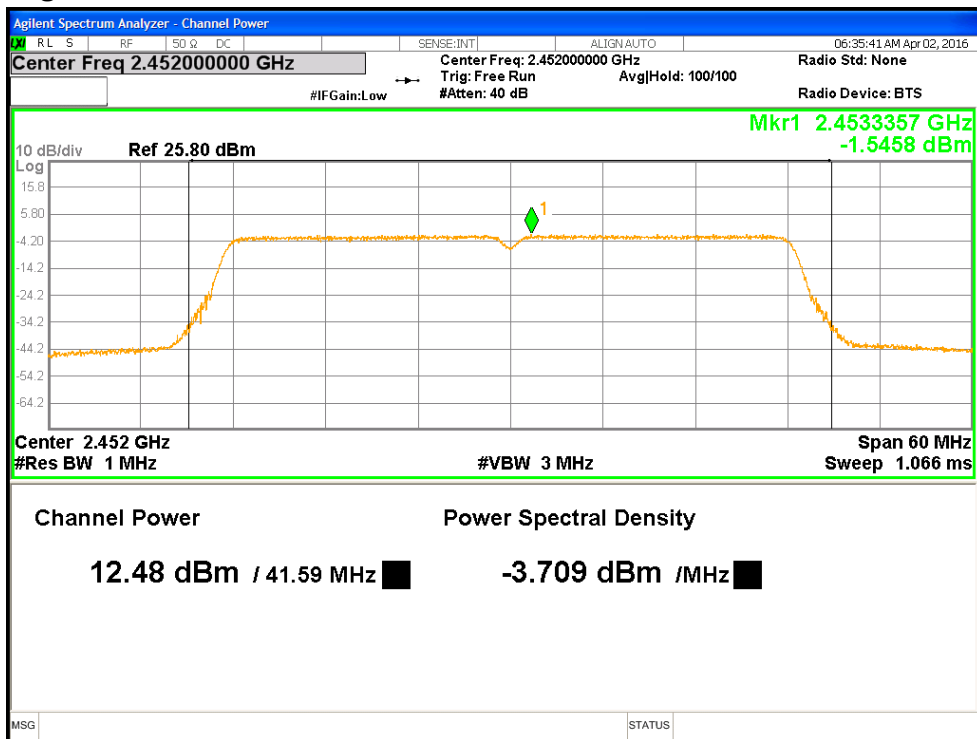


Figure 4: Maximum Transmitted Power, 2452 MHz at HT40 MCS0

4.2 Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

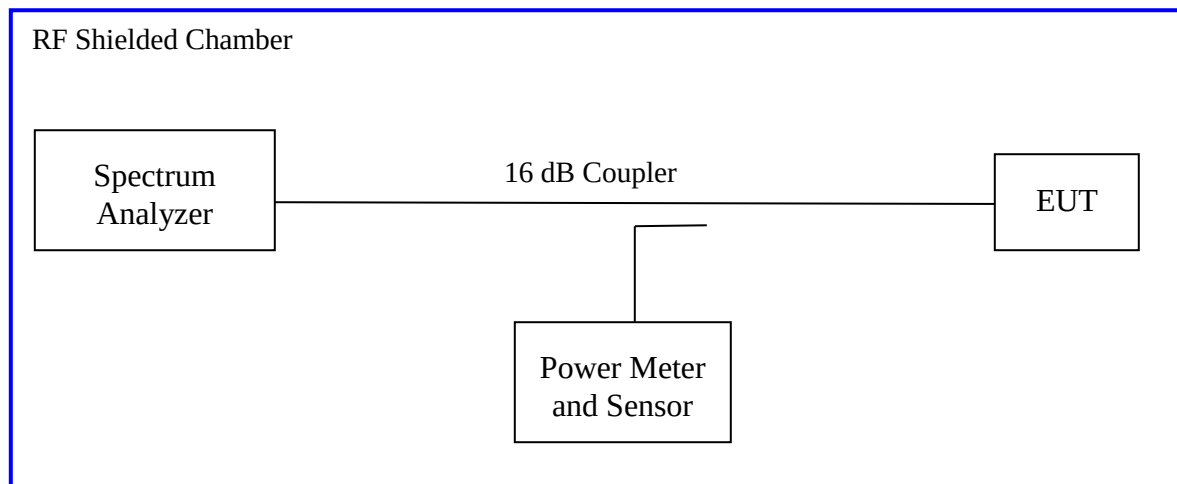
The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

The minimum 6 dB bandwidth shall be at least 500 kHz.

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth according to ANSI C63.10:2013 Section 11.8. The measurement was performed with modulation per CFR47 15.247(a) (2) 2015 and RSS Gen Sect. 6.6 2014. The preliminary investigation was performed to find the narrowest 6 dB bandwidth for each operational mode at different data rates. This worst finding was performed on 3 channels in each operating frequency range; 2400 MHz to 2483.5 MHz, a 6 dB bandwidth was used. The worst results indicated below.

Test Setup:



4.2.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 4: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature		
Antenna Type: Omnidirectional		Power Setting: See test plan
Max. Directional Gain: + 3.0 dBi		
Signal State: Modulated at 100%.		
Ambient Temp.: 22° C		Relative Humidity: 35%
802.11b		
Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	10.08	14.778
2437	10.09	14.986
2462	10.09	14.940
Note: 1. The bandwidth was measured at 1.0 Mbps. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		
802.11g		
Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	16.58	16.491
2437	16.58	16.503
2462	16.57	16.488
Note: 1. The bandwidth was measured at 6.0 Mbps. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		

Table 5: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature		
Antenna Type: Omnidirectional		Power Setting: See test plan
Max. Directional Gain: + 3.0 dBi		
Signal State: Modulated at 100%.		
Ambient Temp.: 22° C		Relative Humidity: 35%
802.11n		
Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2412	17.82	17.686
2437	17.82	17.697
2462	17.82	17.684
Note: 1. The bandwidth was measured at HT20 MCS0, 1 Data Streams. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		
802.11n		
Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
2422	36.54	36.187
2452	36.55	36.205
Note: 1. The bandwidth was measured at HT40 MCS0, 1 Data Streams. 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.		

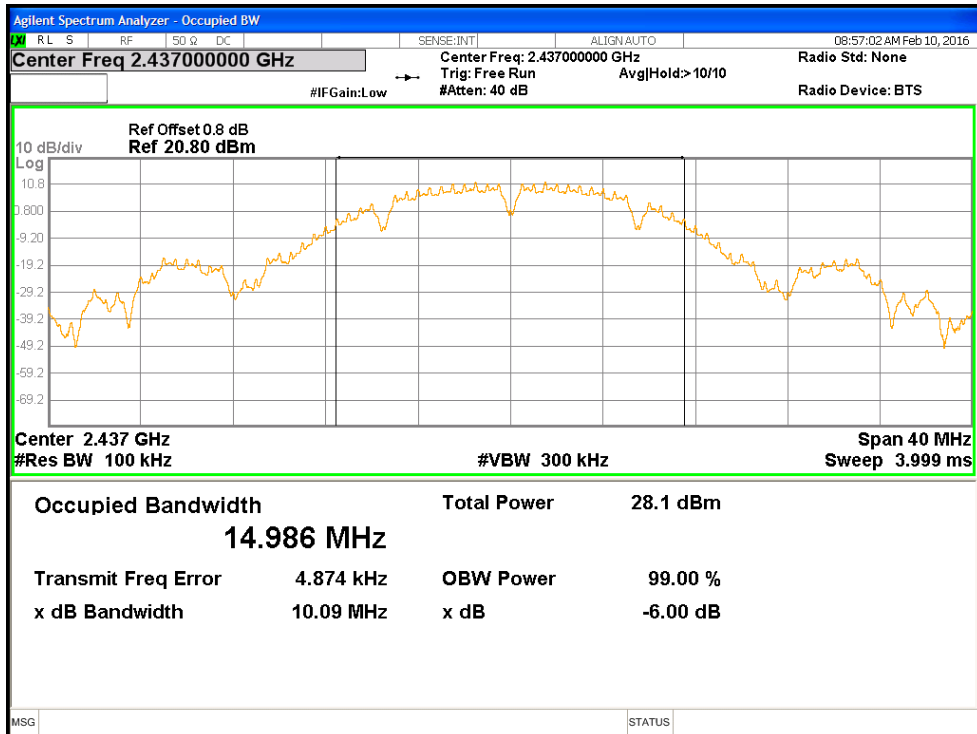


Figure 5: 6dB & 99% Occupied Bandwidth, 2437 MHz at 802.11b

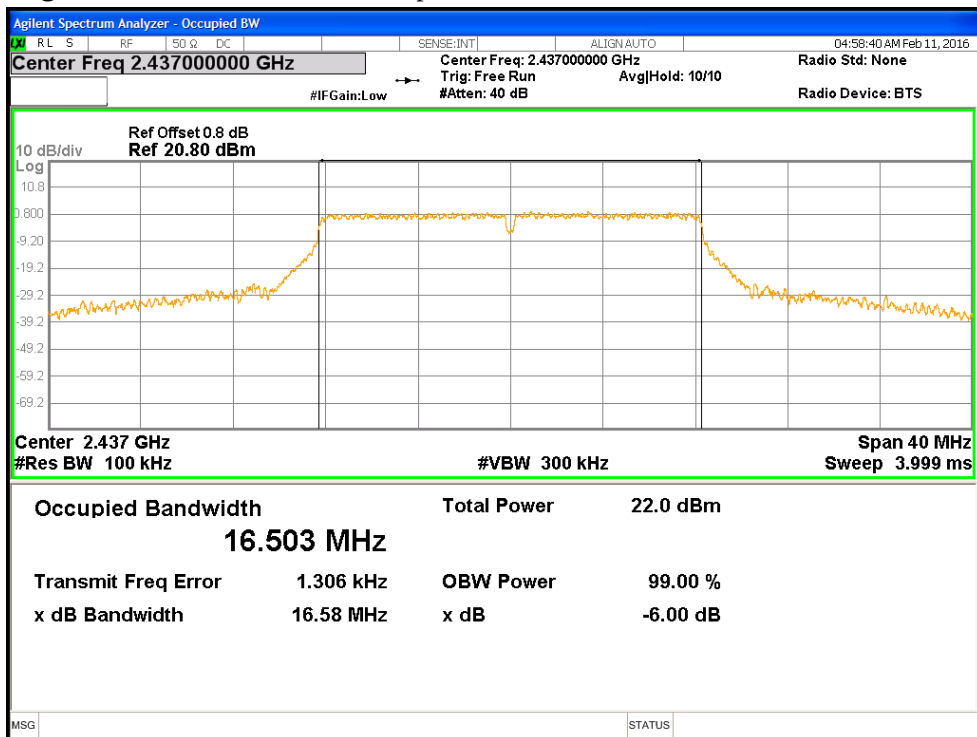


Figure 6: 6dB & 99% Occupied Bandwidth, 2437 MHz at 802.11g

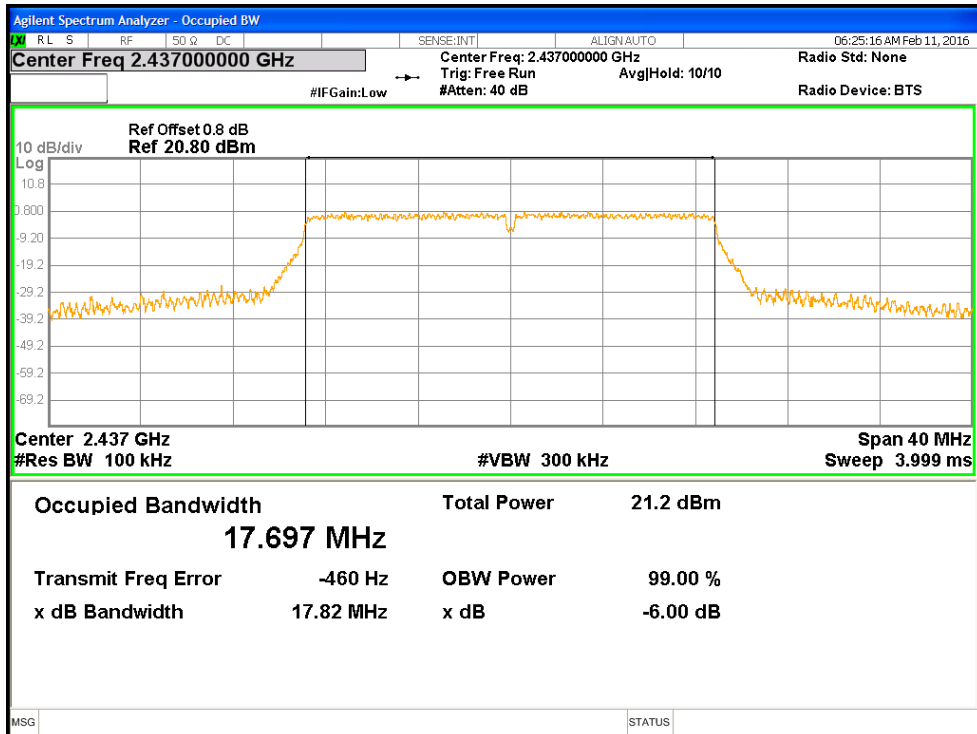


Figure 7: 6dB & 99% Occupied Bandwidth, 2437 MHz at HT20

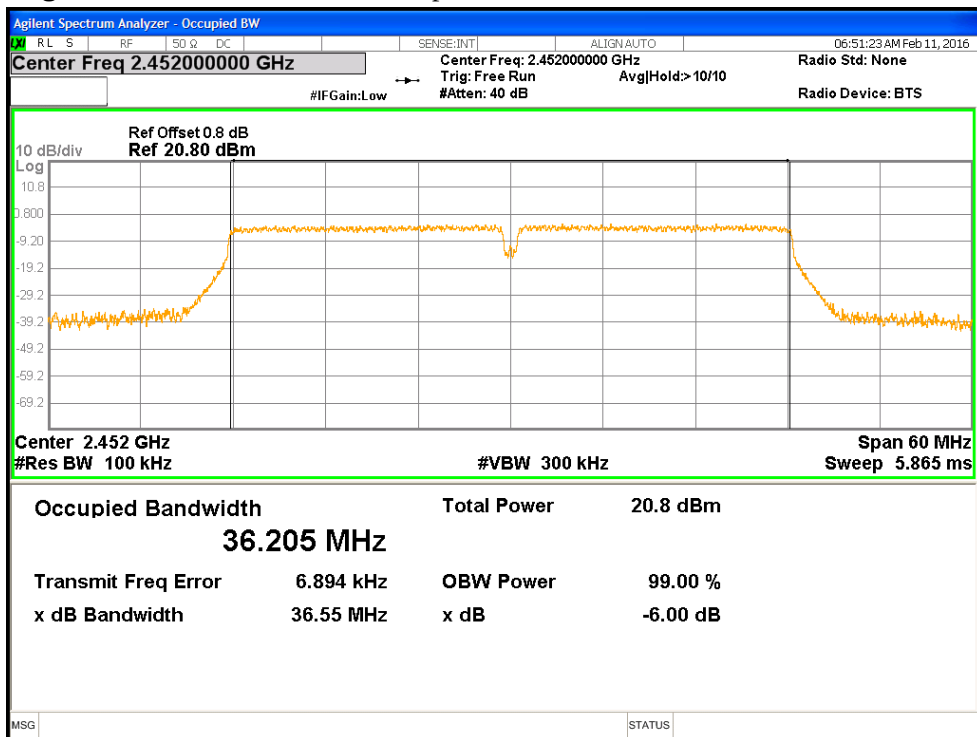


Figure 8: 6dB & 99% Occupied Bandwidth, 2452 MHz at HT40

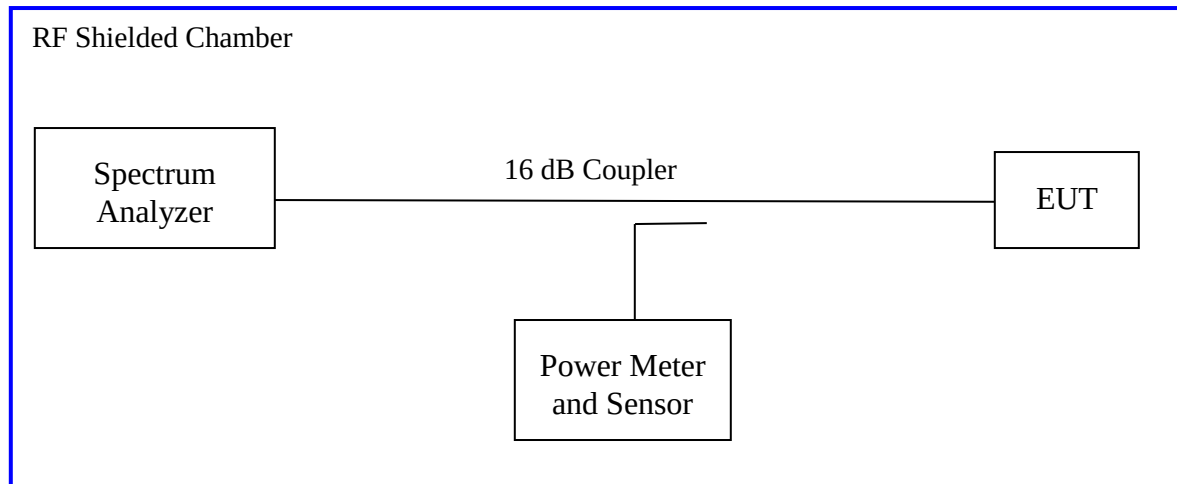
4.3 Peak Power Spectral Density

According to the CFR47 Part 15.247 (e) and RSS 247 Sect.5.2.2, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10-2013 Section 11.10.3. The measurement was performed with modulation per CFR47 Part 15.247 (e) and RSS 247 Sect.5.2.2. The pre-evaluation was performed to find the worst modes. The worst findings were conducted on 3 channels in each operating frequency range of 2400 MHz to 2483.5 MHz. The worst sample result indicated below.

Test Setup:



4.3.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 6: Peak Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		Power Setting: See test plan	
Max. Directional Gain: + 3.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 22° C		Relative Humidity: 35%	
802.11b			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2412	-16.34	8.00	-24.34
2437	-15.52	8.00	-23.52
2462	-15.25	8.00	-23.25
Note: 1. The highest peak output power was observed at 11b 1Mbps . 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			
802.11g			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2412	-20.72	8.00	-28.72
2437	-19.40	8.00	-27.40
2462	-19.28	8.00	-27.28
Note: 1. The highest peak output power was observed at 11g 6Mbps . 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			

Table 7: Peak Power Spectral Density – Test Results Continues

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Omnidirectional		Power Setting: See test plan	
Max. Directional Gain: + 3.0 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 22° C		Relative Humidity: 35%	
802.11n			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2412	-21.88	8.00	-29.88
2437	-21.27	8.00	-29.27
2462	-21.10	8.00	-29.10
Note: 1. The highest peak output power was observed at HT20 MCS0 . 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			
Frequency (MHz)	Max PPSD [dBm]	Limit [dBm]	Margin [dB]
2422	-26.59	8.00	-34.59
2452	-25.66	8.00	-33.66
Note: 1. The highest peak output power was observed at HT40 MCS0 . 2. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.			

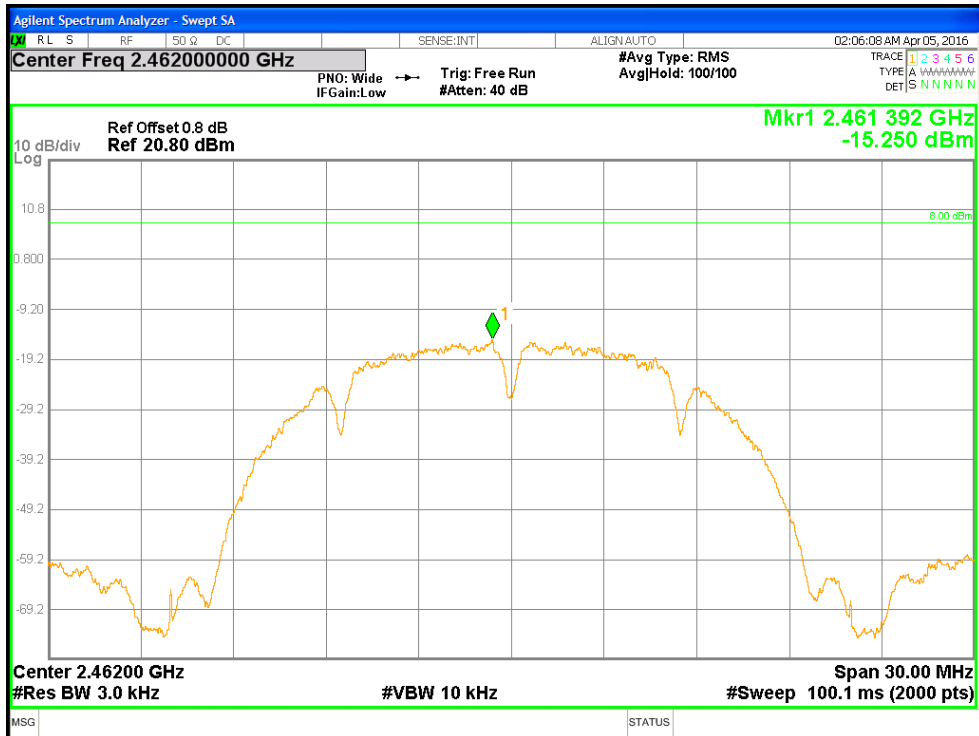


Figure 9: Power Spectral Density, 2437 MHz at 802.11b 1Mbps

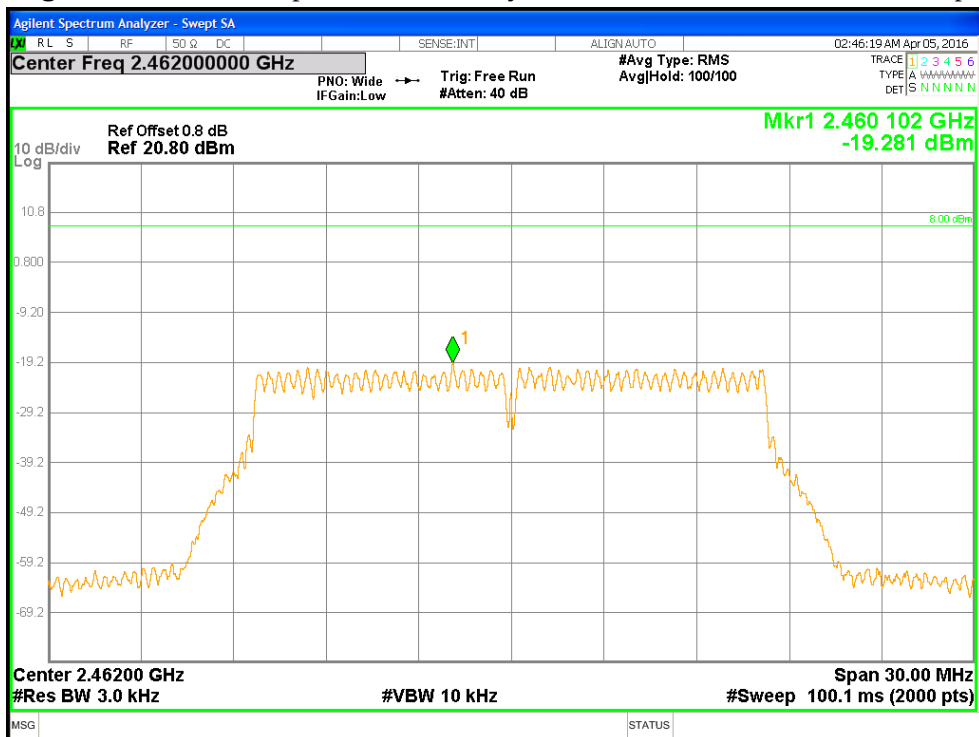


Figure 10: Power Spectral Density, 2437 MHz at 802.11g 6Mbps

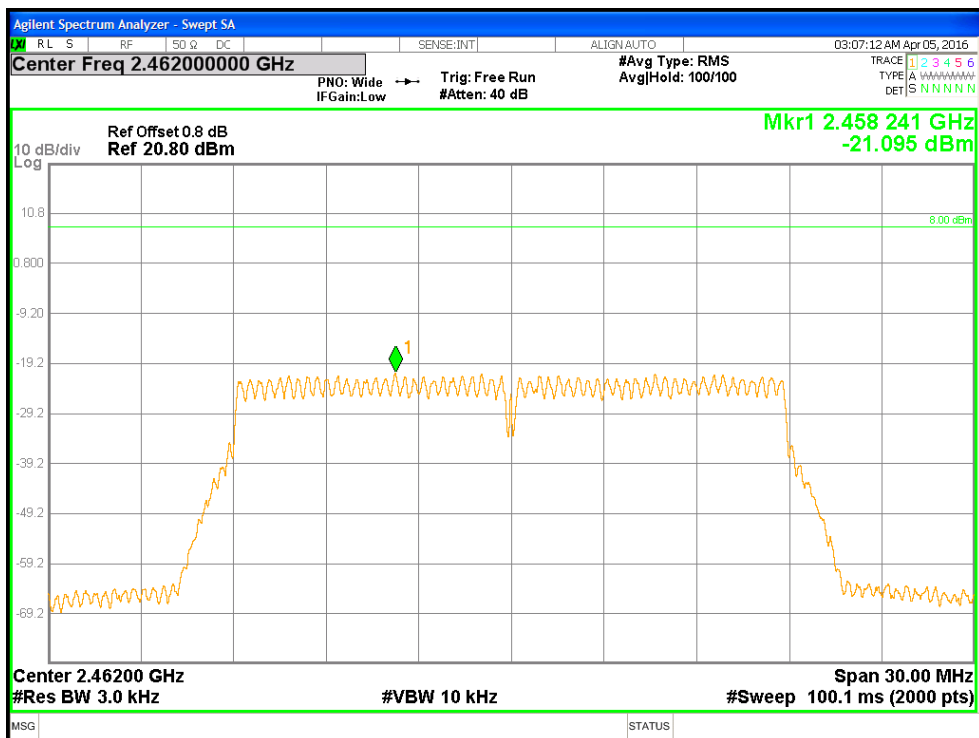


Figure 11: Power Spectral Density, 2437 MHz at HT20 MCS0

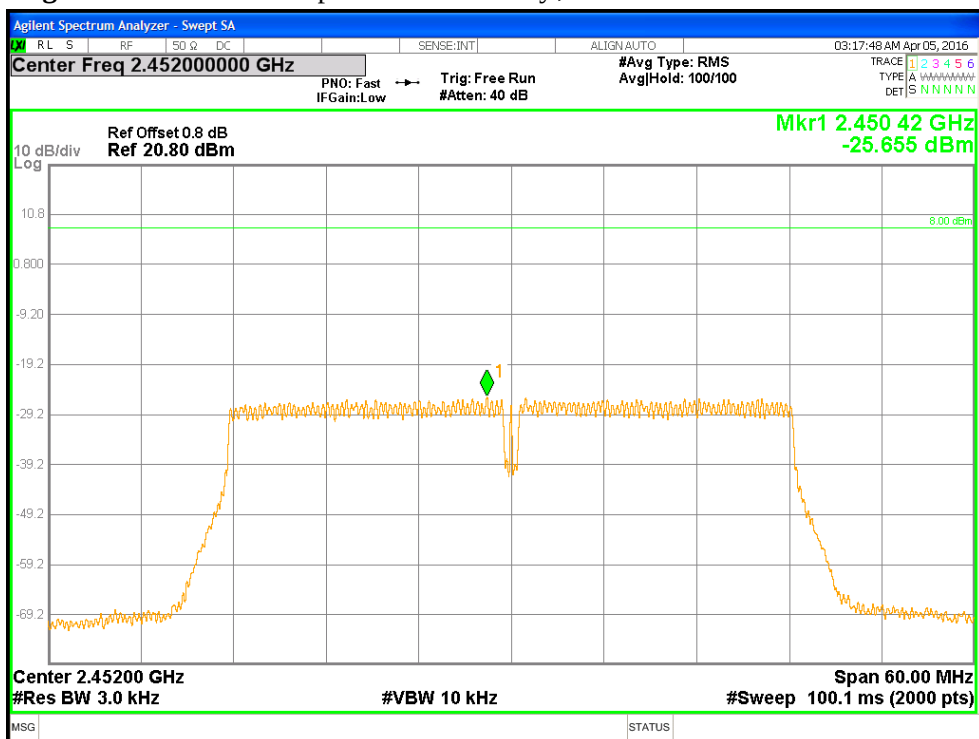


Figure 12: Power Spectral Density, 2452 MHz at HT40 MCS0

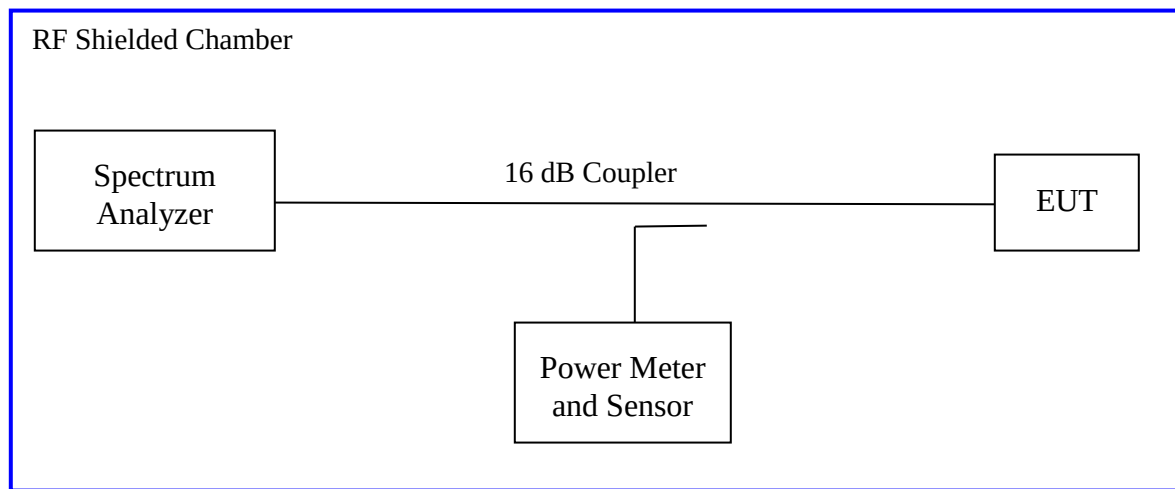
4.4 Out of Band Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmitting mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS-247 Sect. 5.5.

4.4.1 Test Method

The conducted method was used to measure the undesirable emission requirement. The measurement was performed with modulation. This test was conducted on 3 channels of Sample in each mode on Sample. The worst sample result indicated below.

Test Setup:



Measurement Procedure AVG2 of KDB 662911

4.4.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 8: Emissions at the Band-Edge – Test Results

Test Conditions: Conducted Measurement, Normal Temperature					
Antenna Type: Omnidirectional			Power Setting: See test plan		
Max. Directional Gain: + 3.0 dBi					
Signal State: Modulated at 100%.					
Ambient Temp.: 22° C			Relative Humidity: 35%		
Non-Restricted Frequency Band Emissions					
Freq. (MHz)	Mode	Measured (dBm)	Limit (dBm)	Plots	TX Freq. (MHz)
2400	11b-1Mbps	-38.45	-23.02	Fig. 13, 14	Pass
2483.5	11b-1Mbps	-48.18	-21.65	Fig. 15, 16	Pass
2400	11g-6Mbps	-32.89	-29.20	Fig. 17, 18	Pass
2483.5	11g-6Mbps	-43.11	-29.84	Fig. 19, 20	Pass
2400	HT20-MCS0	-33.47	-30.77	Fig. 21, 22	Pass
2483.5	HT20-MCS0	-41.78	-30.40	Fig. 23, 24	Pass
2400	HT40-MCS0	-40.88	-34.66	Fig. 25, 26	Pass
2483.5	HT40-MCS0	-45.00	-33.62	Fig. 27, 28	Pass
Note: 1. The stated limits for 30 dBr are relative to each individual output per KDB 662911 Method. 2. The worst case of each data rate is recorded.					

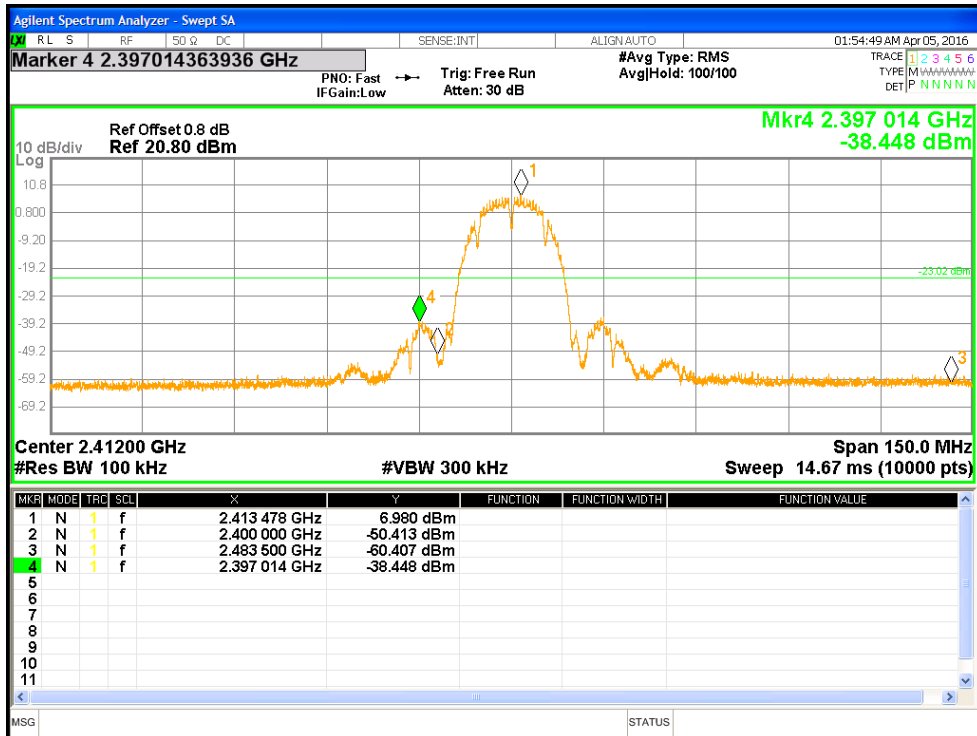


Figure 13: Measured Bandedge for 802.11b-1Mbps at 2412 MHz

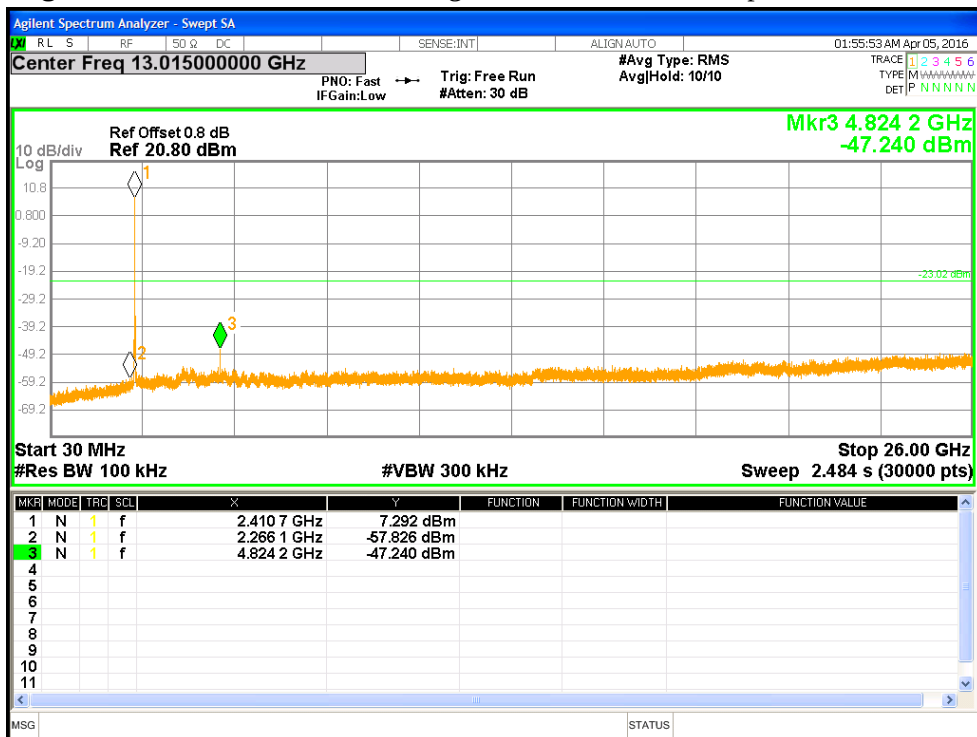


Figure 14: Out of Band Emissions for 802.11b-1Mbps at 2412 MHz

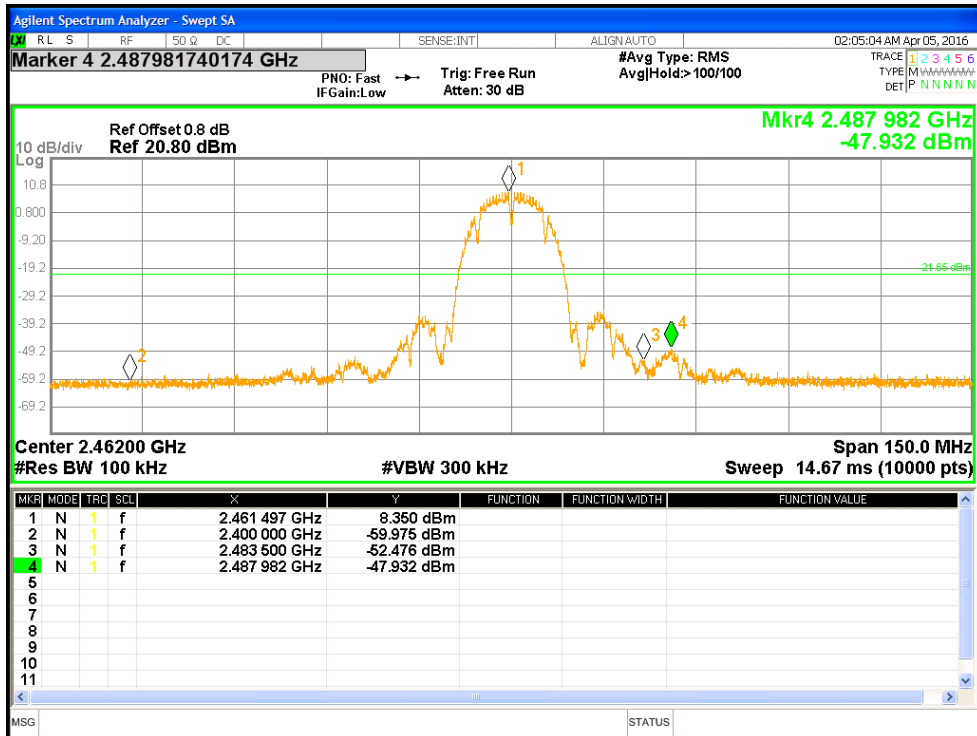


Figure 15: Measured Bandedge for 802.11b-1Mbps at 2462 MHz

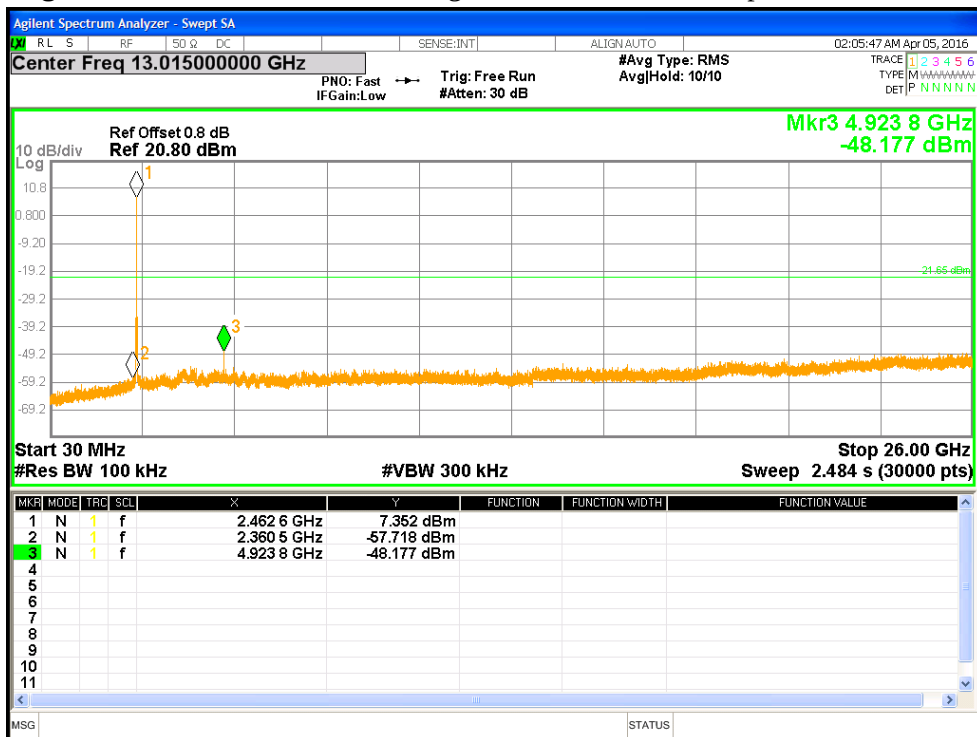


Figure 16: Out of Band Emissions for 802.11b-1Mbps at 2462 MHz

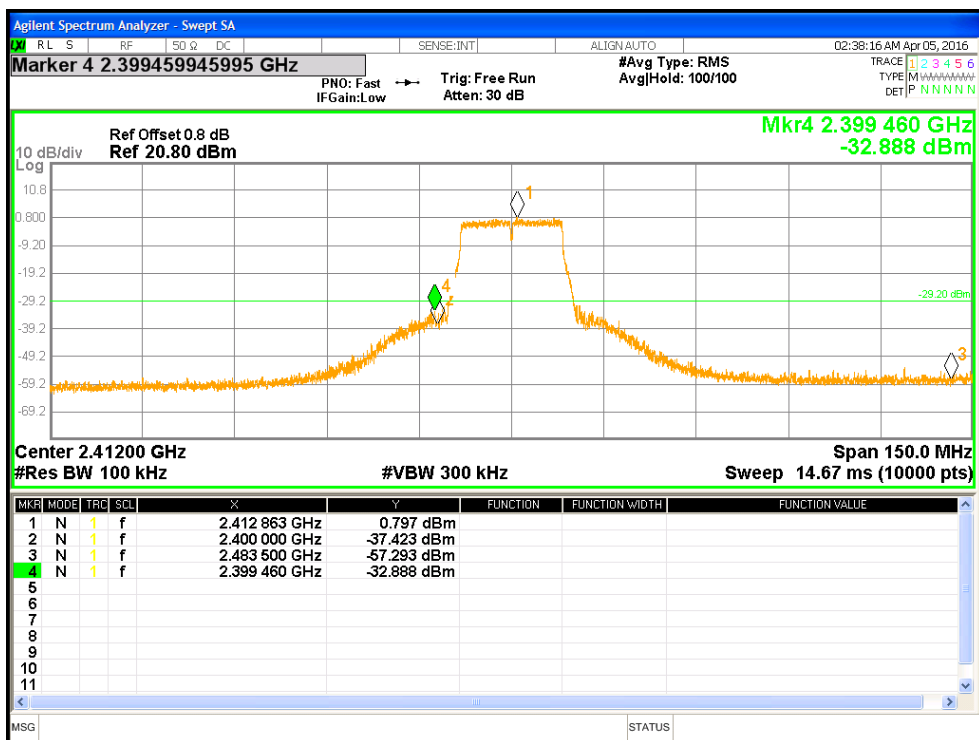


Figure 17: Measured Bandedge for 802.11g-6Mbps at 2412 MHz

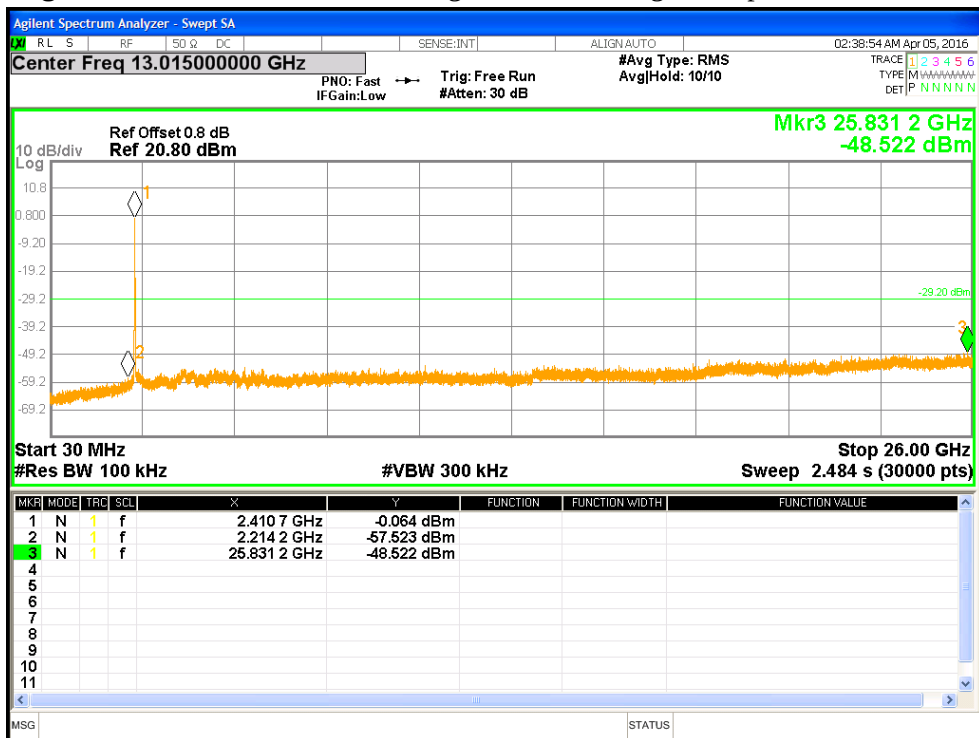


Figure 18: Out of Band Emissions for 802.11g-6Mbps at 2412 MHz

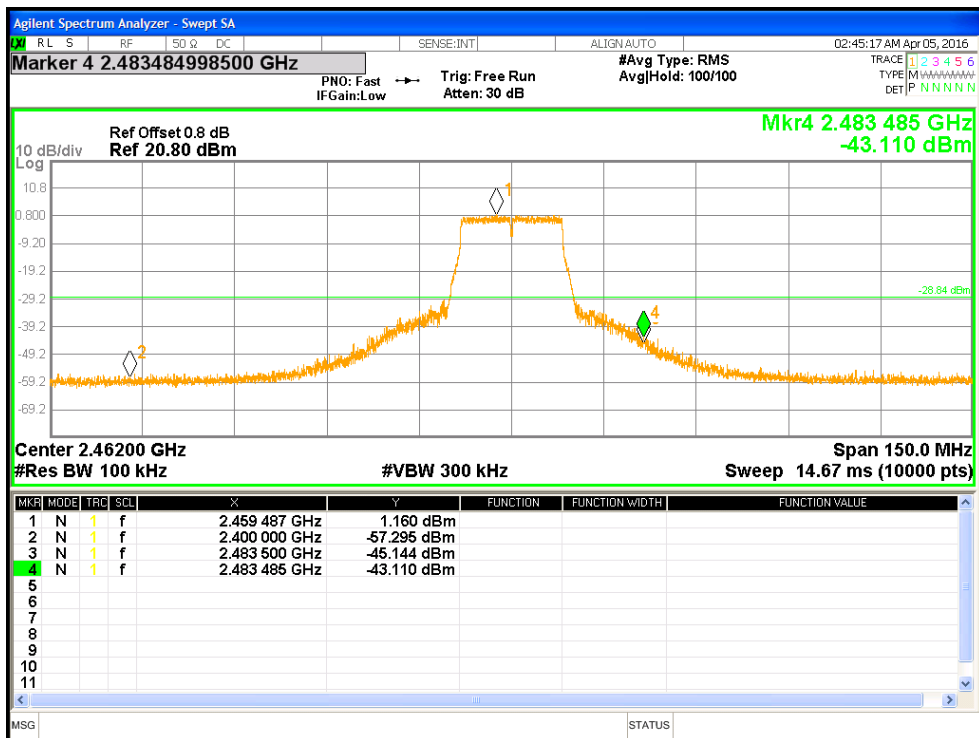


Figure 19: Measured Bandedge for 802.11g-6Mbps at 2462 MHz

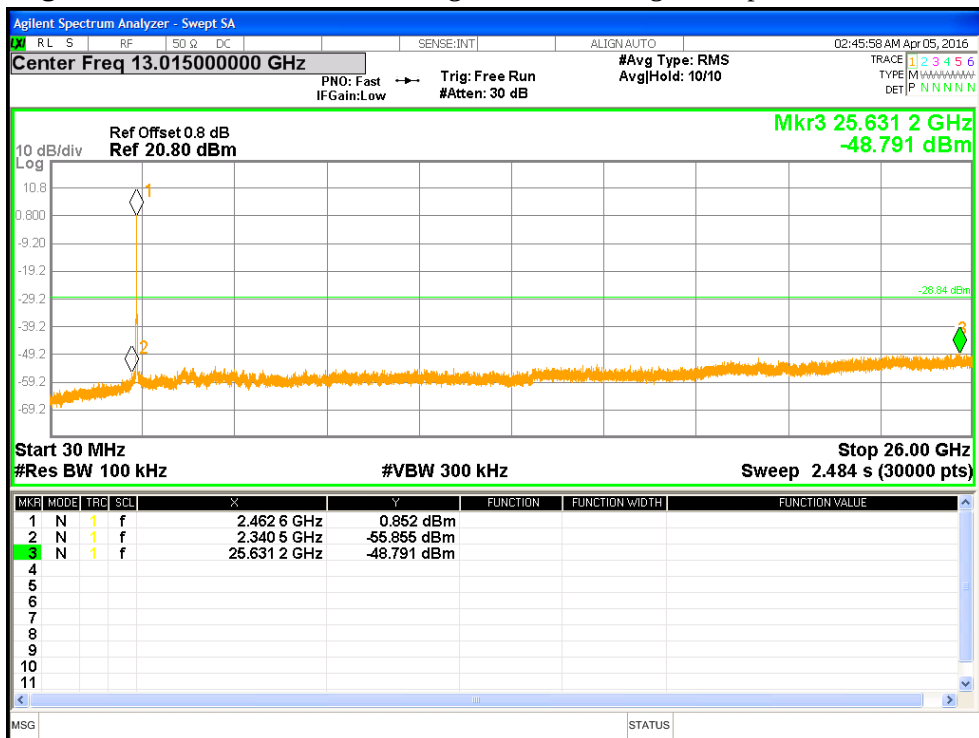


Figure 20: Out of Band Emissions for 802.11g-6Mbps at 2462 MHz

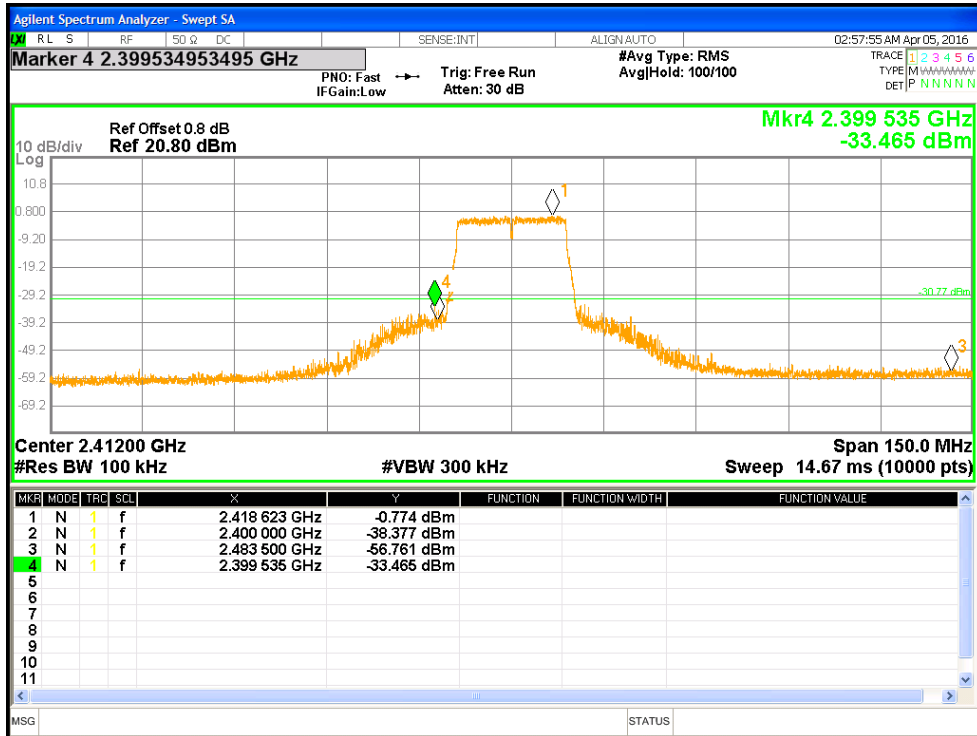


Figure 21: Measured Bandedge for HT20-MCS0 at 2412 MHz

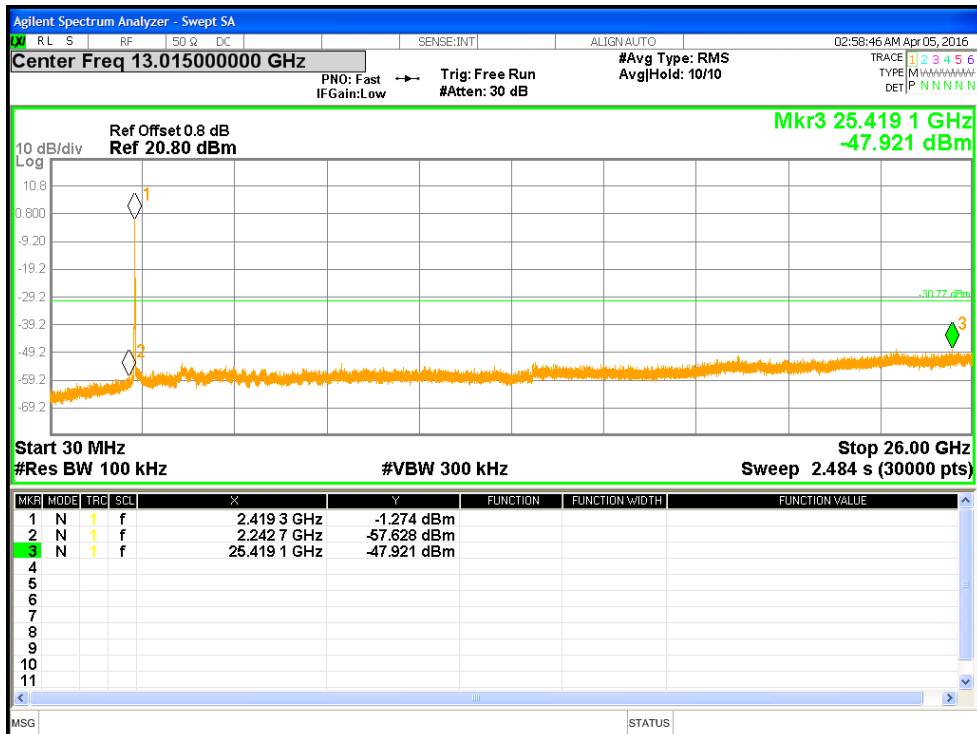


Figure 22: Out of Band Emissions for HT20-MCS0 at 2412 MHz

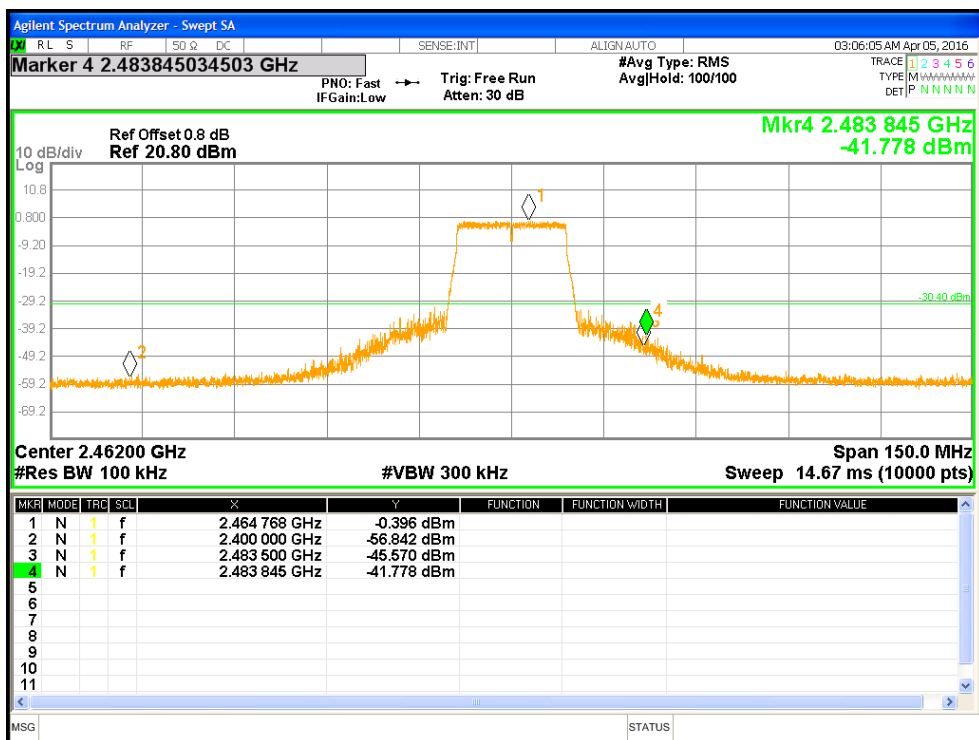


Figure 23: Measured Bandedge for HT20-MCS0 at 2462 MHz

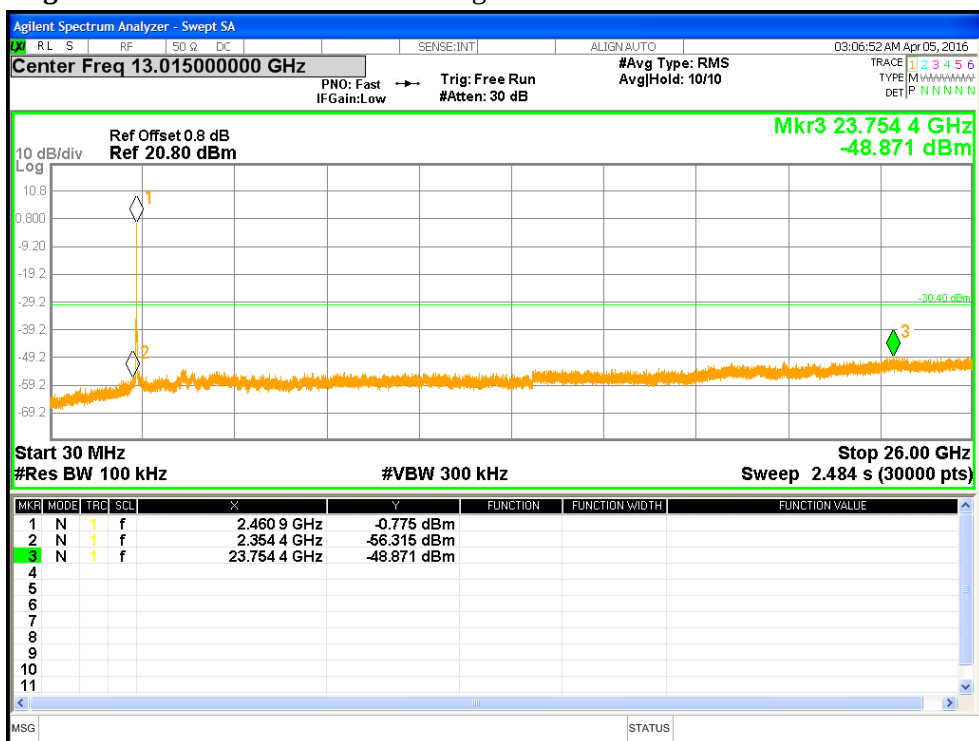


Figure 24: Out of Band Emissions for HT20-MCS0 at 2462 MHz

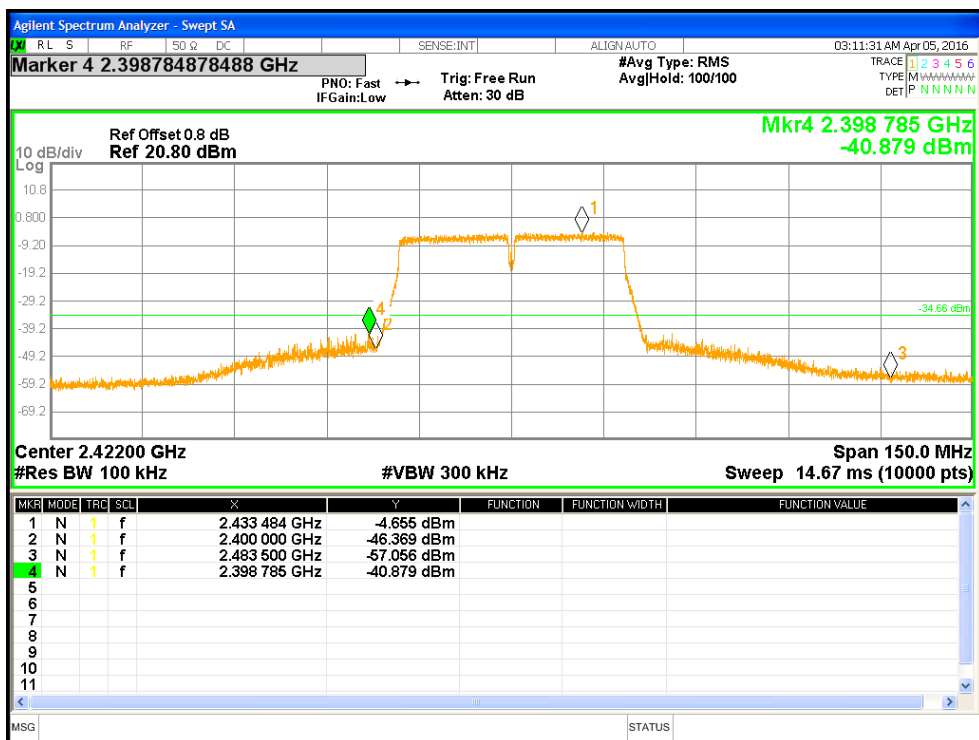


Figure 25: Measured Bandedge for HT40-MCS0 at 2422 MHz

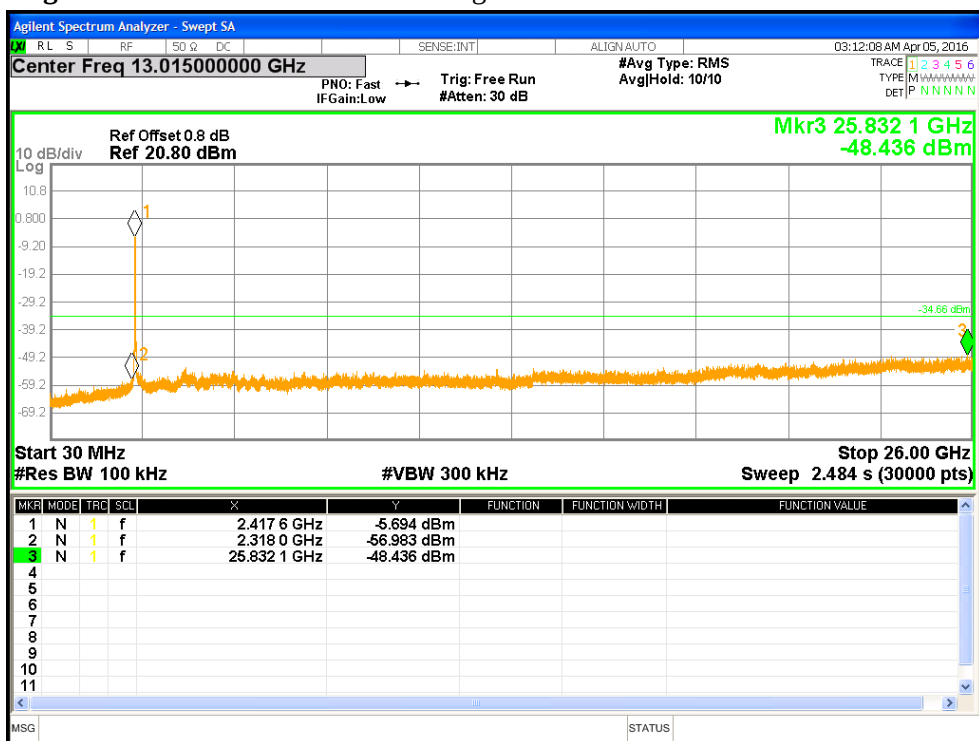


Figure 26: Out of Band Emissions for HT40-MCS0 at 2422 MHz

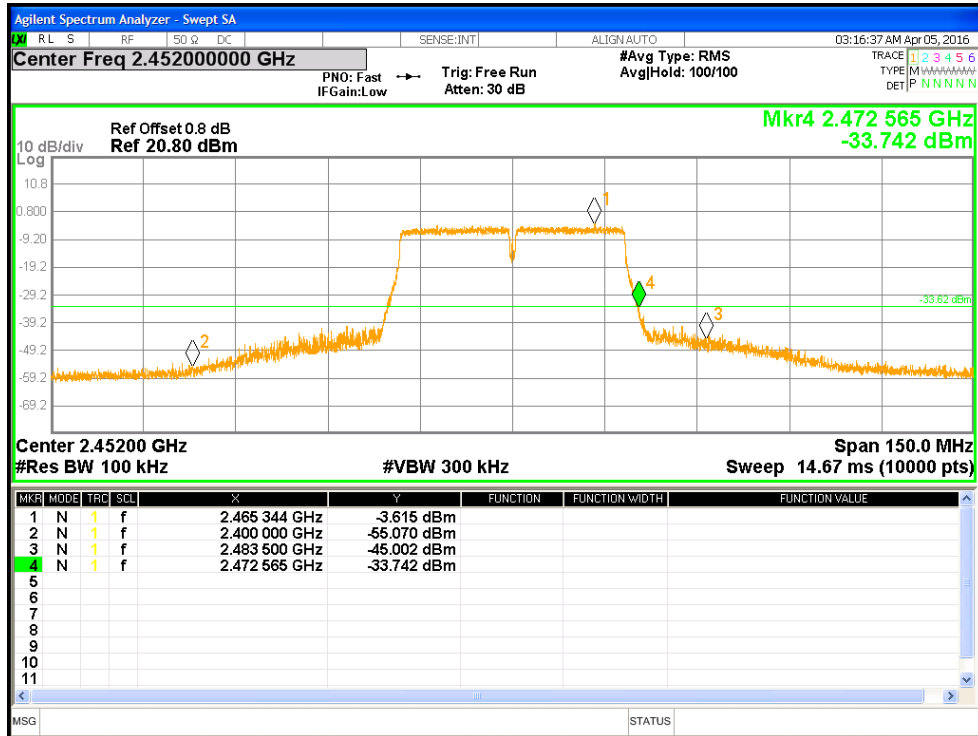


Figure 27: Measured Bandedge for HT40-MCS0 at 2452 MHz

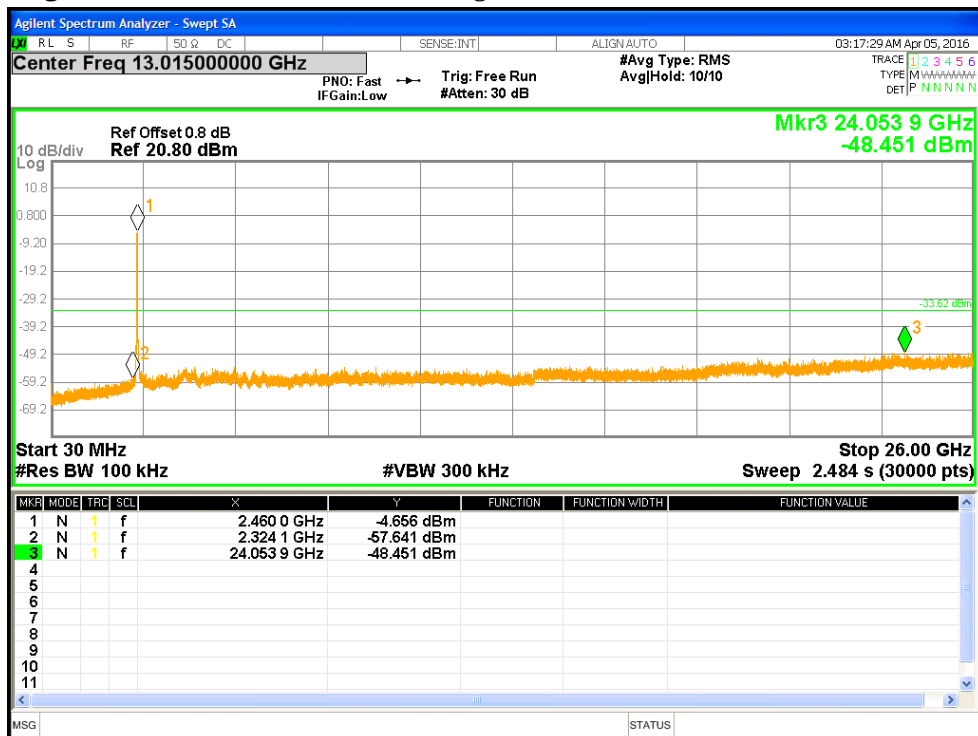


Figure 28: Out of Band Emissions for HT40-MCS0 at 2452 MHz

4.5 Transmit Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS 247 Sect.5.5.

4.5.1 Test Methodology

4.5.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pres-scans were performed to determine the worst data rate.

4.5.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

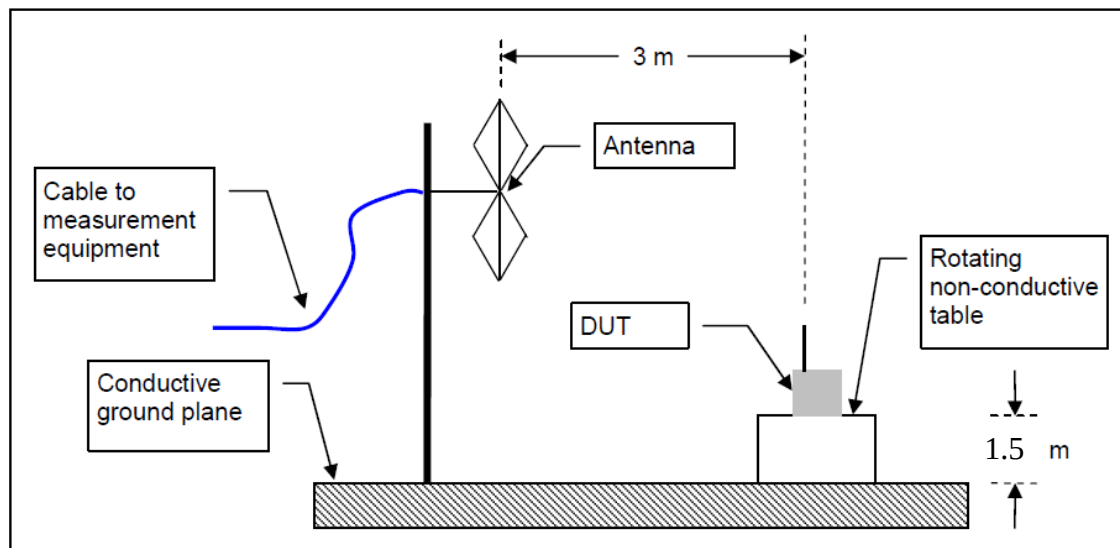
Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

Final results are: 802.11b (covered 802.11g and HT20 for 20 MHz channel BW) and HT40.

4.5.1.3 Deviations

None.

Test Setup:



4.5.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2015 and RSS Gen Sect. 8.10: 2014.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490.....	2400/F (kHz)	300
0.490-1.705.....	24000/F (kHz)	30
1.705-30.0.....	30	30
30-88.....	100 **	3
88-216.....	150 **	3
216-960.....	200 **	3
Above 960.....	500	3

All harmonics and spurious emission which are outside of the restricted band shall be 20dB below the in-band emission.

4.5.3 Test Results

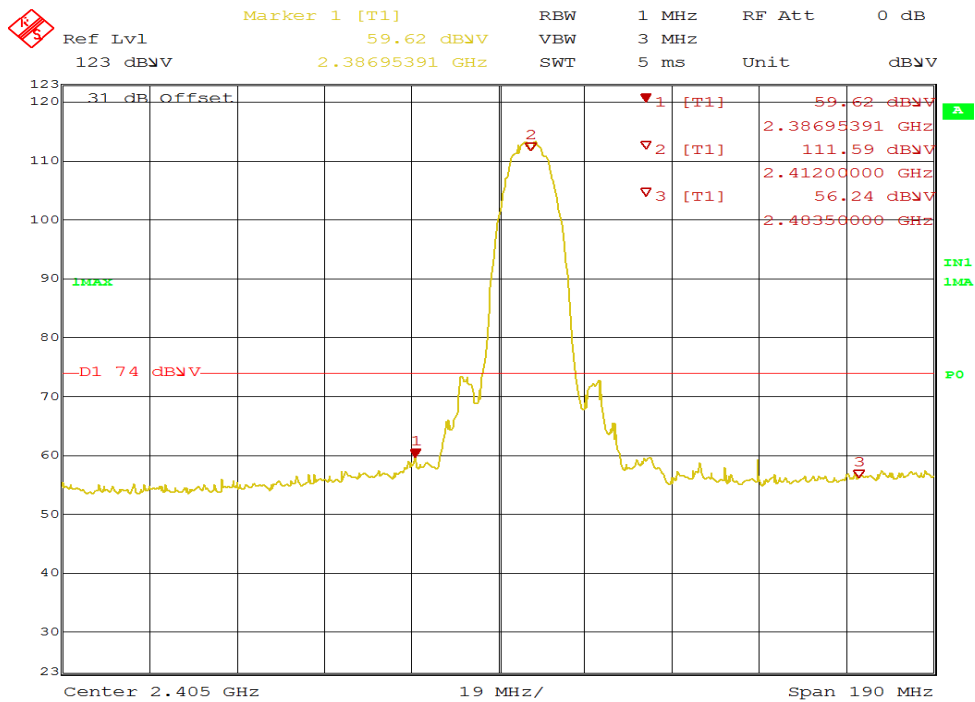
The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 9: Transmit Spurious Emission at Band-Edge Requirements

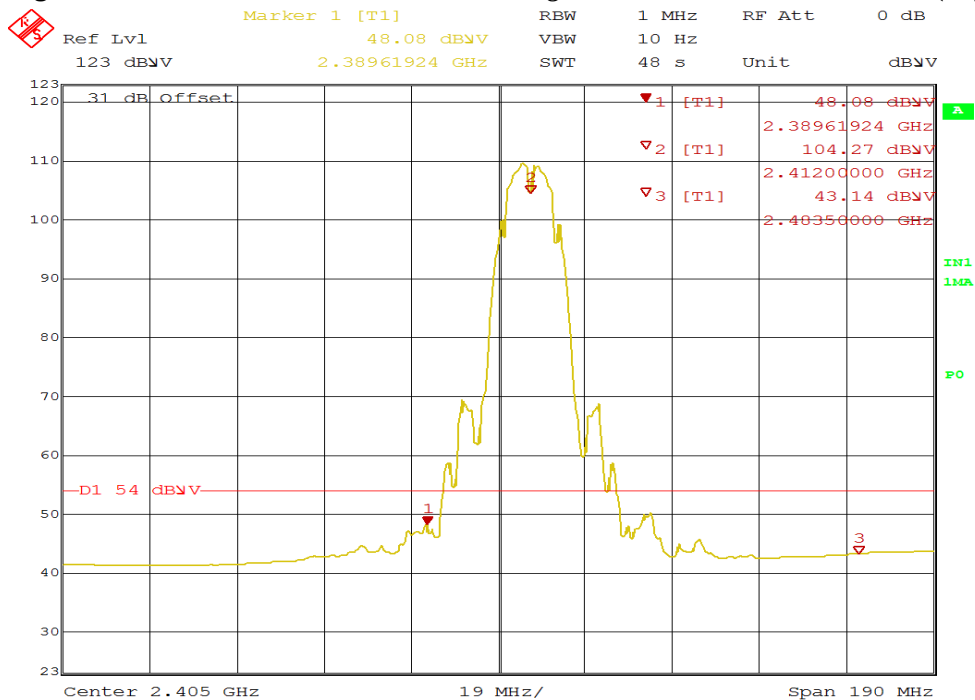
Test Conditions: Radiated Measurement								
Antenna Type: Omnidirectional				Power Setting: See test plan				
Max. Directional Gain: + 3.0 dBi								
Signal State: Modulated at 100%.								
Ambient Temp.: 23° C				Relative Humidity:37%				
Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Pol. (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2387.0	59.62	V	74	-14.38	Pk	161	118	PLOT 29: 11b-1Mbps-2412MHz-TP13
2389.6	48.08	V	54	-5.92	Ave	161	118	PLOT 30: 11b-1Mbps-2412MHz-TP13
2388.5	58.34	H	74	-15.66	Pk	131	177	PLOT 31: 11b-1Mbps-2412MHz-TP13
2389.2	44.29	H	54	-9.71	Ave	131	177	PLOT 32: 11b-1Mbps-2412MHz-TP13
2483.5	59.88	V	74	-14.12	Pk	159	101	PLOT 33: 11b-1Mbps-2462MHz-TP13
2483.5	51.76	V	54	-2.24	Ave	159	101	PLOT 34: 11b-1Mbps-2462MHz-TP13
2484.6	57.05	H	74	-16.95	Pk	136	146	PLOT 35: 11b-1Mbps-2462MHz-TP13
2483.5	45.59	H	54	-8.41	Ave	136	146	PLOT 36: 11b-1Mbps-2462MHz-TP13
2389.2	70.11	V	74	-3.89	Pk	166	116	PLOT 37: 11g-6Mbps-2412MHz-TP17
2390.0	50.74	V	54	-3.26	Ave	166	116	PLOT 38: 11g-6Mbps-2412MHz-TP17
2389.2	65.22	H	74	-8.78	Pk	130	178	PLOT 39: 11g-6Mbps-2412MHz-TP17
2390.0	46.87	H	54	-7.13	Ave	130	178	PLOT 40: 11g-6Mbps-2412MHz-TP17
2483.5	70.12	V	74	-3.88	Pk	164	107	PLOT 41: 11g-6Mbps-2462MHz-TP17
2483.5	50.07	V	54	-3.93	Ave	164	107	PLOT 42: 11g-6Mbps-2462MHz-TP17
2483.5	63.27	H	74	-10.73	Pk	134	144	PLOT 43: 11g-6Mbps-2462MHz-TP17
2483.5	45.28	H	54	-8.72	Ave	134	144	PLOT 44: 11g-6Mbps-2462MHz-TP17
2389.6	73.68	V	74	-0.32	Pk	166	110	PLOT 45: HT20-MCS0-2412MHz- TP16
2390.0	50.40	V	54	-3.60	Ave	166	110	PLOT 46: HT20-MCS0-2412MHz- TP16
2390.0	68.25	H	74	-5.75	Pk	127	172	PLOT 47: HT20-MCS0-2412MHz- TP16
2390.0	46.43	H	54	-7.57	Ave	127	172	PLOT 48: HT20-MCS0-2412MHz- TP16
Note: 1. The emissions were measured at the adjacent restricted band of the fundamental signal. 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205.								

Band-Edge Results, continue								
Freq. (MHz)	Level (dBuV/m)	Pol. (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2485.0	73.60	V	74	-0.40	Pk	203	153	PLOT 49: HT20-MCS0-2462MHz- TP16
2483.5	49.82	V	54	-4.18	Ave	203	153	PLOT 50: HT20-MCS0-2462MHz- TP16
2485.4	68.12	H	74	-5.88	Pk	123	190	PLOT 51: HT20-MCS0-2462MHz- TP16
2483.5	46.10	H	54	-7.90	Ave	123	190	PLOT 52: HT20-MCS0-2462MHz- TP16
2390.0	73.82	V	74	-0.18	Pk	164	112	PLOT 53: HT40-MCS0-2422MHz-TP15
2390.0	51.23	V	54	-2.77	Ave	164	112	PLOT 54: HT40-MCS0-2422MHz-TP15
2390.0	69.52	H	74	-4.48	Pk	132	179	PLOT 55: HT40-MCS0-2422MHz-TP15
2390.0	46.79	H	54	-7.21	Ave	132	179	PLOT 56: HT40-MCS0-2422MHz-TP15
2483.9	73.13	V	74	-0.87	Pk	170	108	PLOT 57: HT40-MCS0-2452MHz-TP15
2483.5	51.54	V	54	-2.46	Ave	170	108	PLOT 58: HT40-MCS0-2452MHz-TP15
2484.6	65.95	H	74	-8.05	Pk	125	192	PLOT 59: HT40-MCS0-2452MHz-TP15
2483.5	46.13	H	54	-7.87	Ave	125	192	PLOT 60: HT40-MCS0-2452MHz-TP15
Note: 1. The emissions were measured at the adjacent restricted band of the fundamental signal. 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205.								



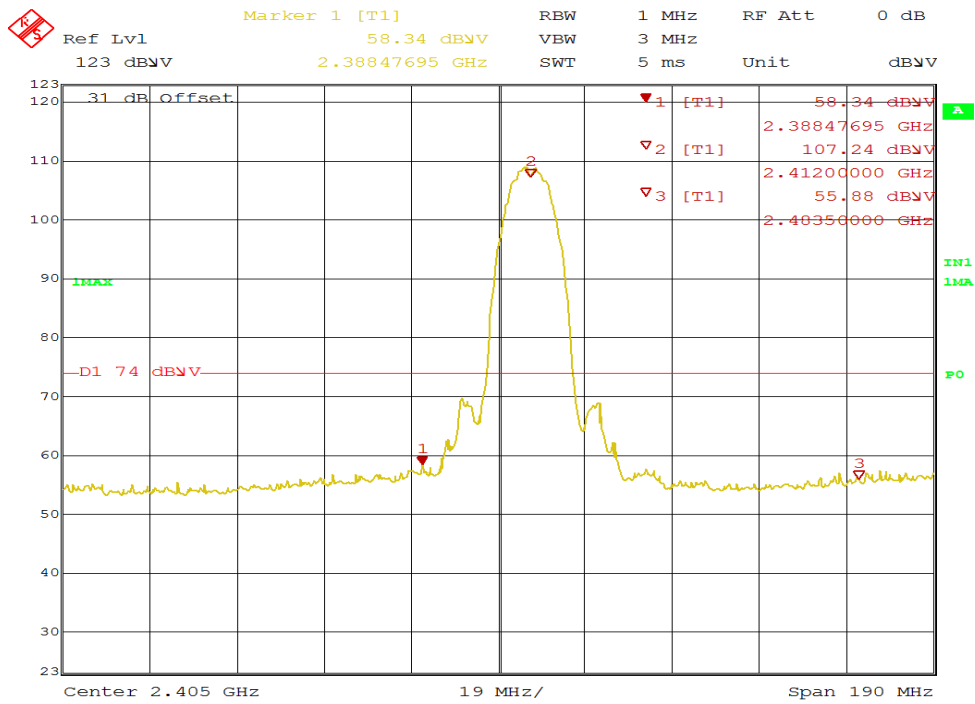
Date: 11.FEB.2016 13:15:11

Figure 29: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b – Vert. (Pk)



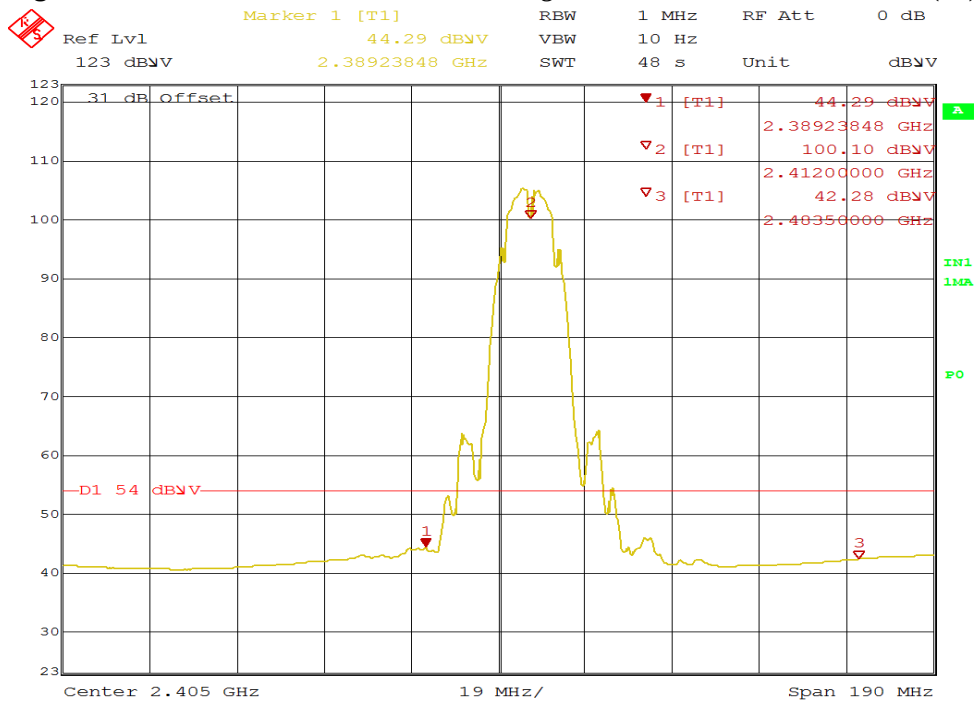
Date: 11.FEB.2016 13:12:49

Figure 30: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b – Vert. (Ave)



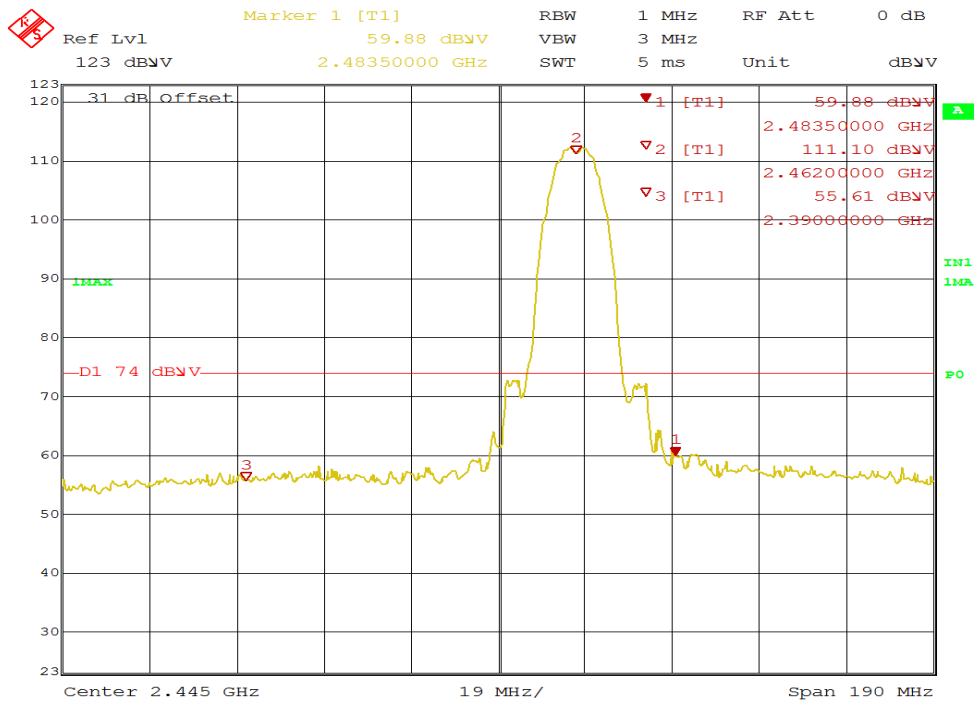
Date: 11.FEB.2016 13:19:15

Figure 31: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b – Horz. (Pk)



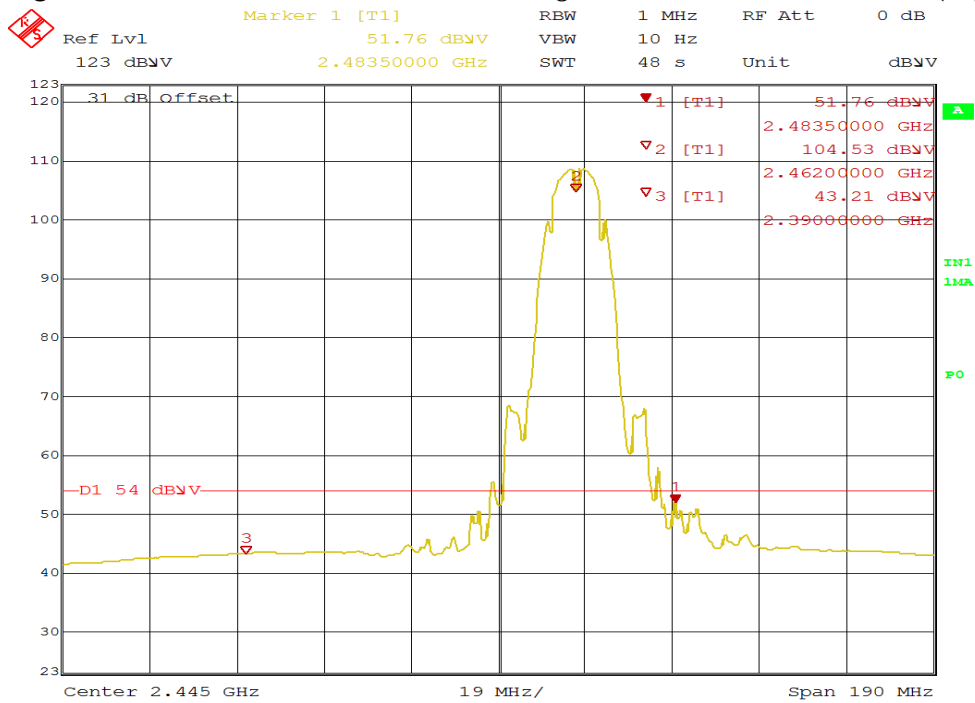
Date: 11.FEB.2016 13:21:22

Figure 32: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11b – Horz. (Ave)



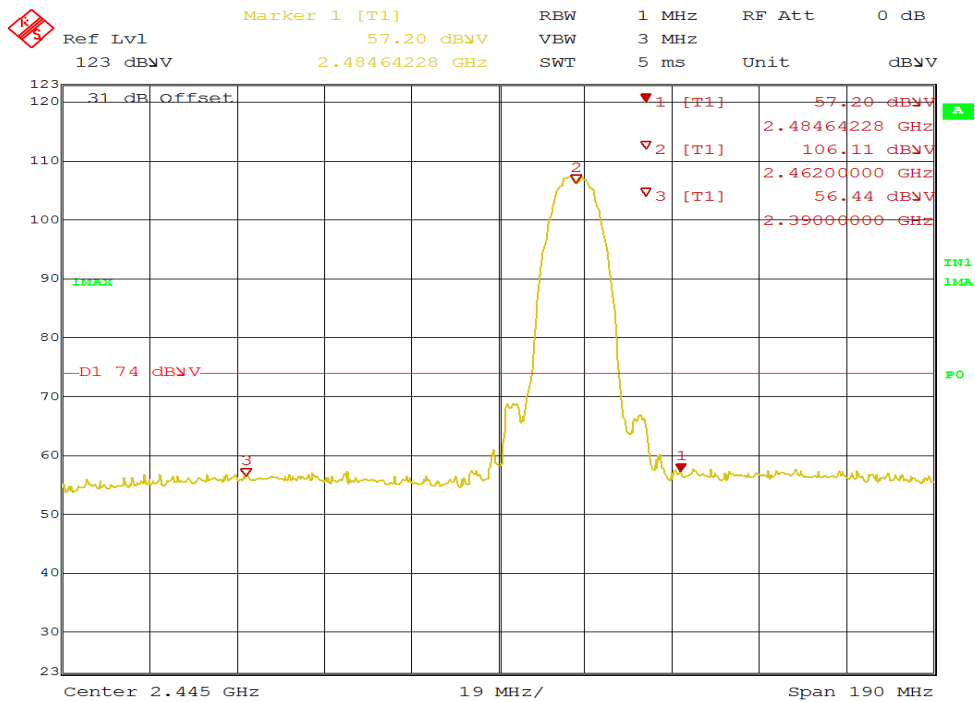
Date: 11.FEB.2016 13:33:36

Figure 33: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b – Vert. (Pk)



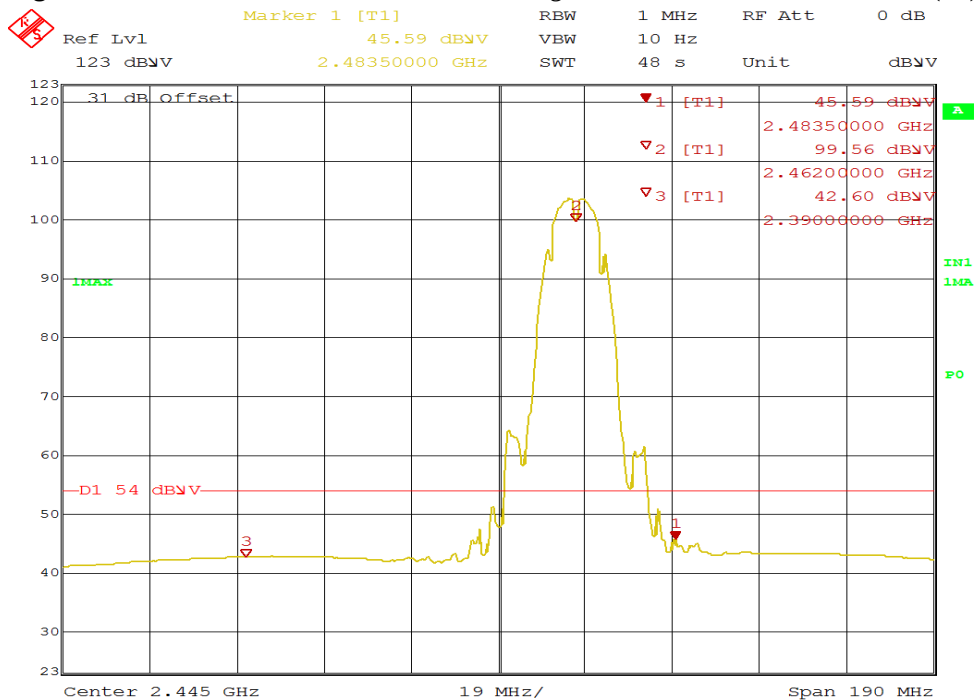
Date: 11.FEB.2016 13:36:04

Figure 34: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b – Vert. (Ave)



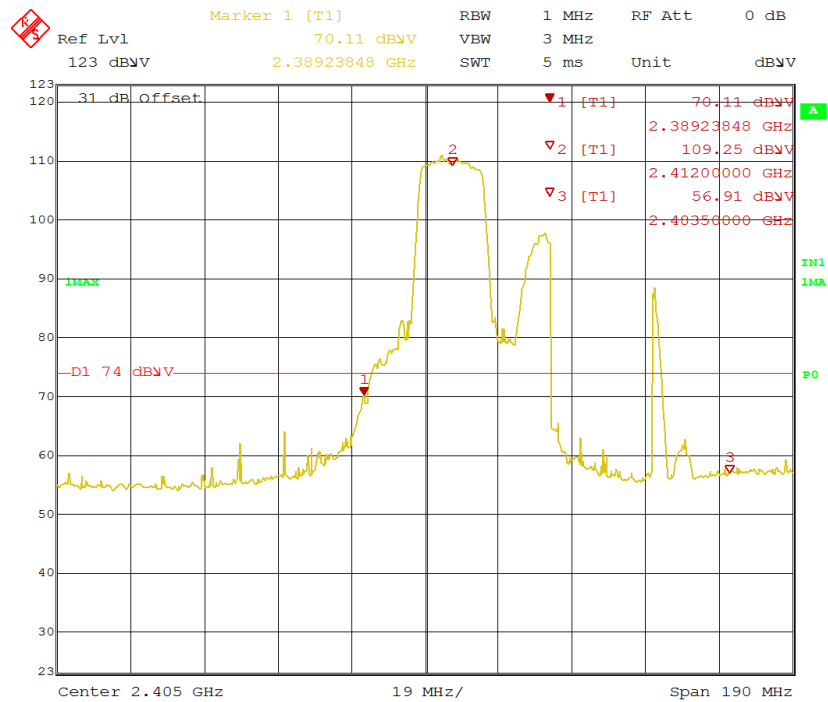
Date: 11.FEB.2016 13:41:52

Figure 35: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b – Horz. (Pk)



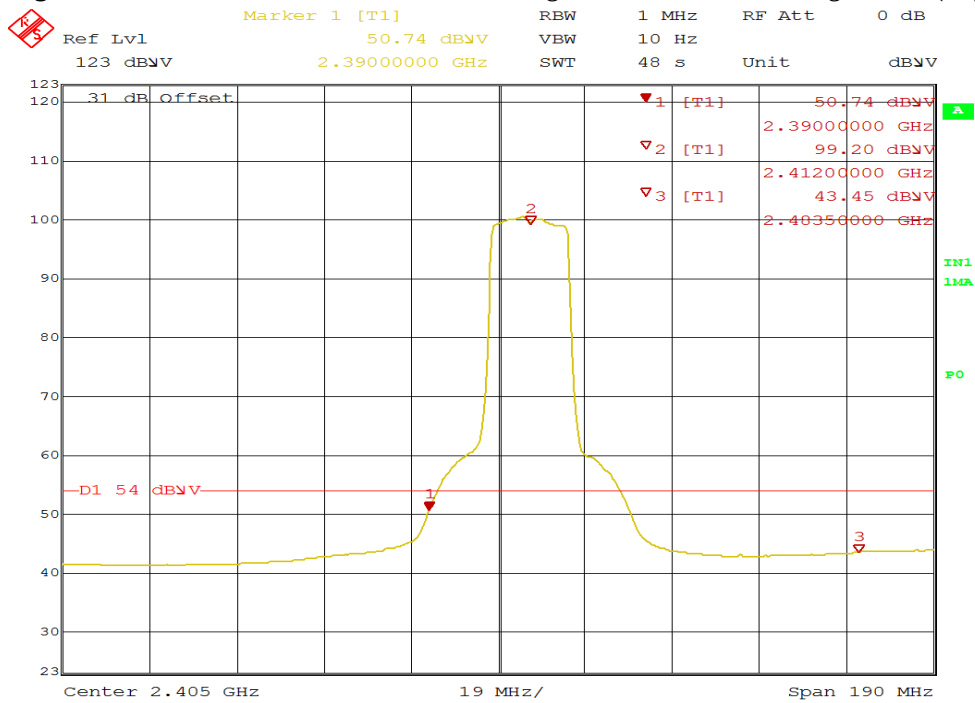
Date: 11.FEB.2016 13:43:52

Figure 36: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11b – Horz. (Ave)



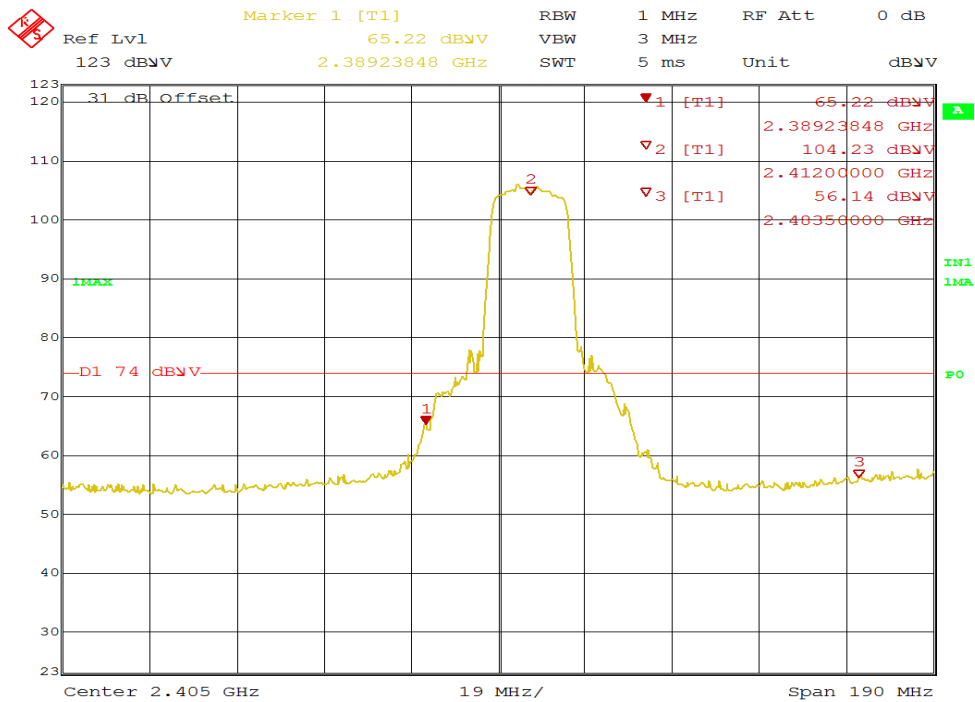
Date: 11.FEB.2016 14:23:05

Figure 37: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g – Vert. (Pk)



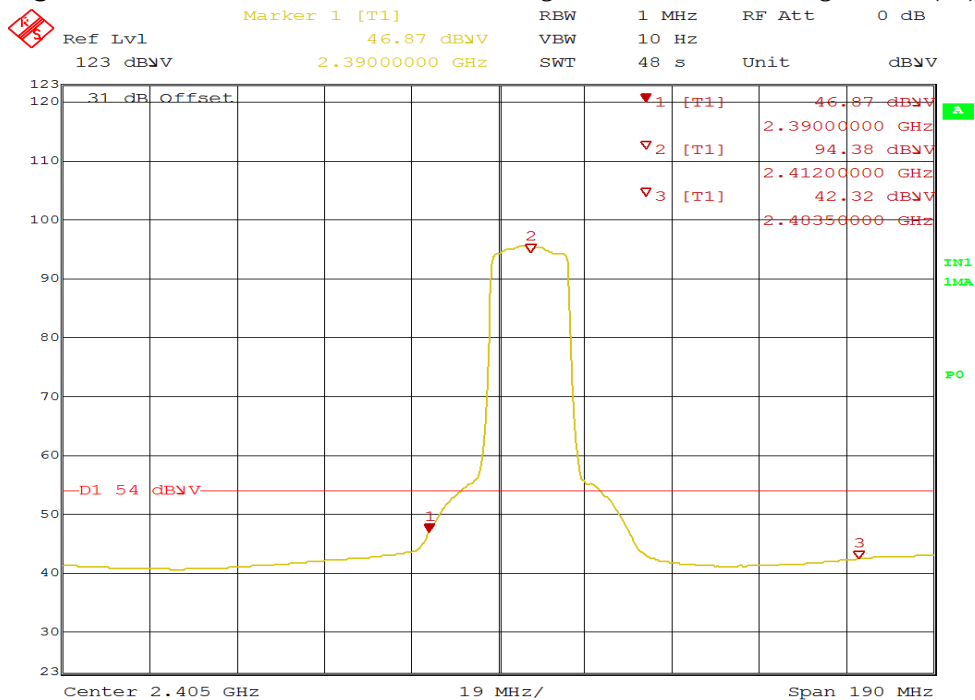
Date: 11.FEB.2016 14:24:40

Figure 38: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g – Vert. (Ave)



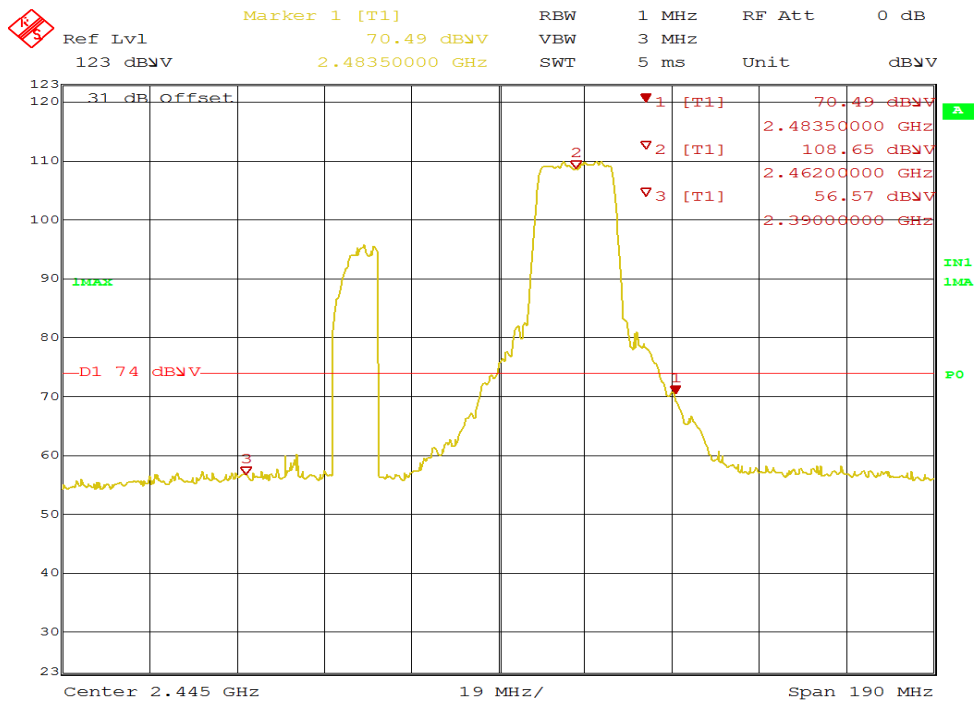
Date: 11.FEB.2016 14:35:51

Figure 39: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g – Horz. (Pk)



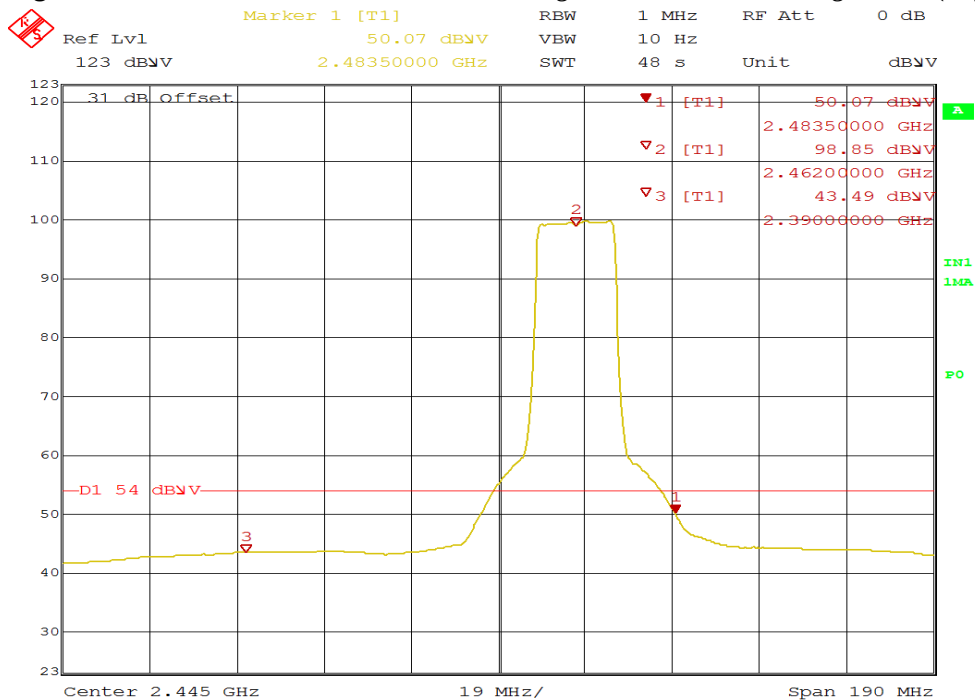
Date: 11.FEB.2016 14:37:59

Figure 40: Radiated Emission at 2390 MHz Edge for 2412 MHz-802.11g – Horz. (Ave)



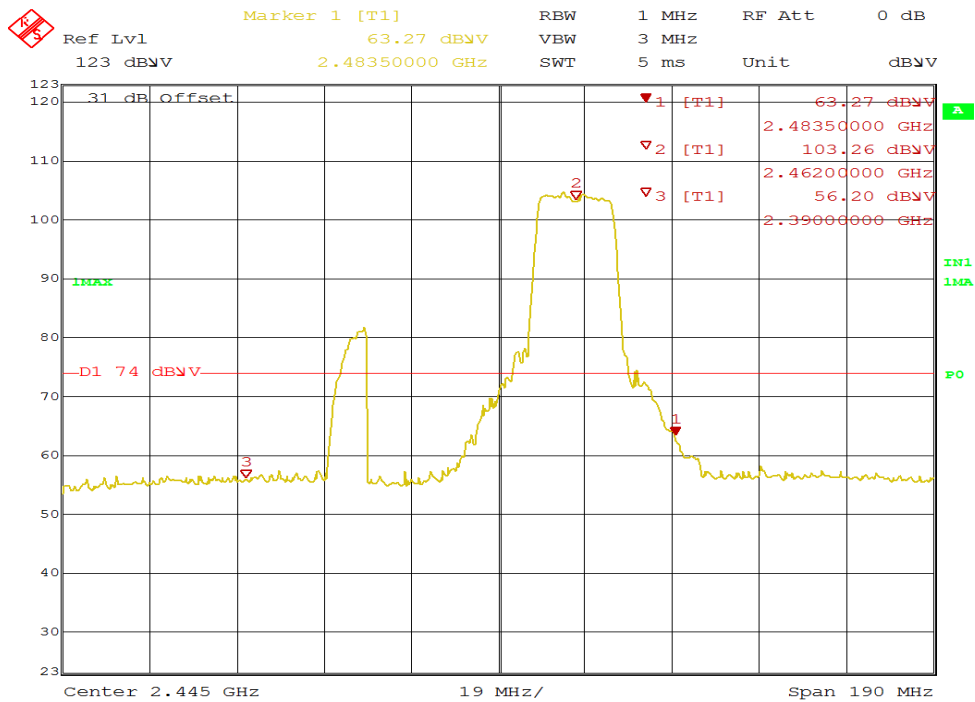
Date: 11.FEB.2016 13:58:24

Figure 41: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Vert. (Pk)



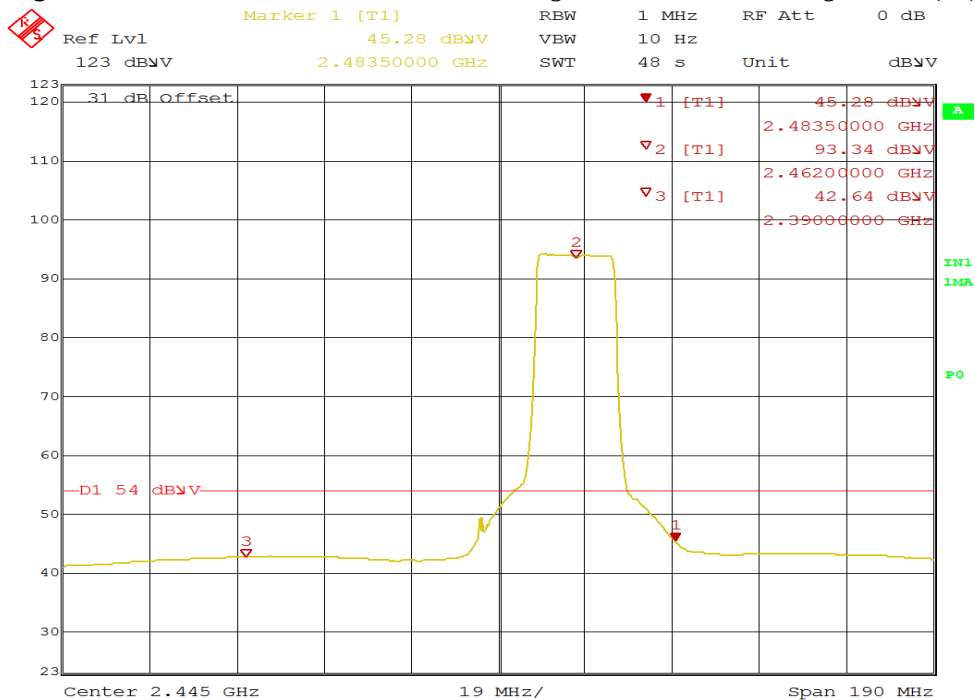
Date: 11.FEB.2016 14:01:49

Figure 42: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Vert. (Ave)



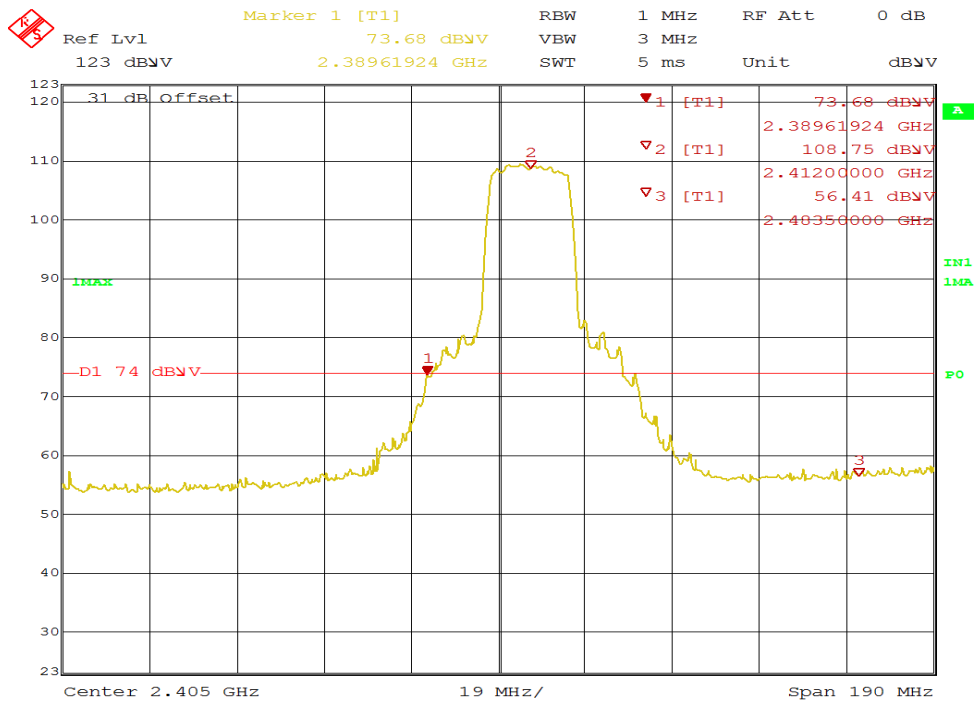
Date: 11.FEB.2016 14:05:35

Figure 43: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Horz. (Pk)



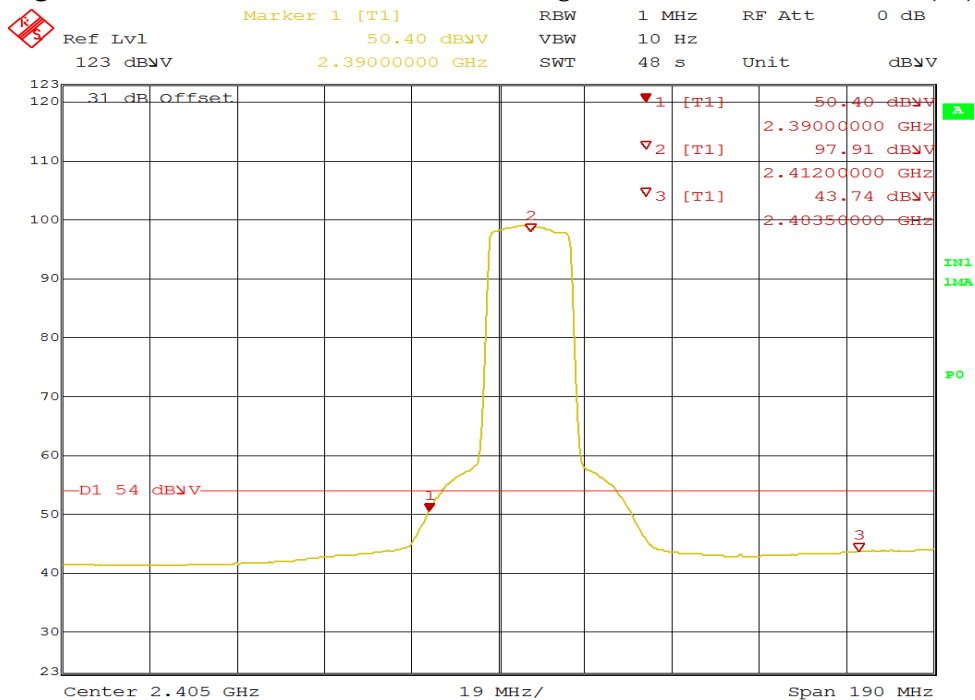
Date: 11.FEB.2016 14:07:46

Figure 44: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-802.11g – Horz. (Ave)



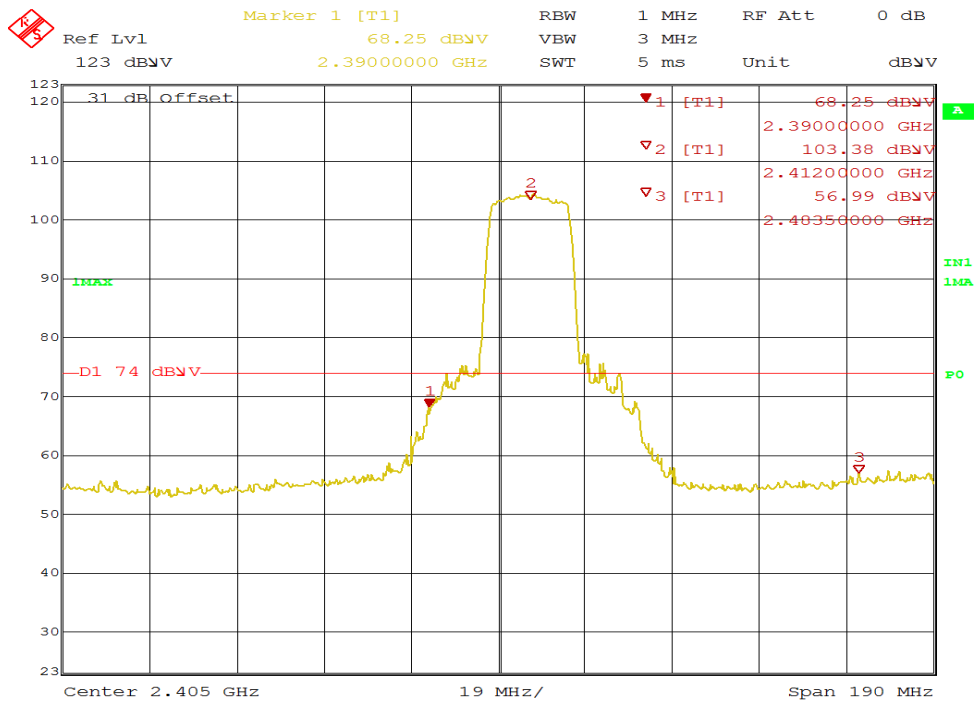
Date: 11.FEB.2016 14:51:56

Figure 45: Radiated Emission at 2390 MHz Edge for 2412 MHz-HT20 – Vert. (Pk)



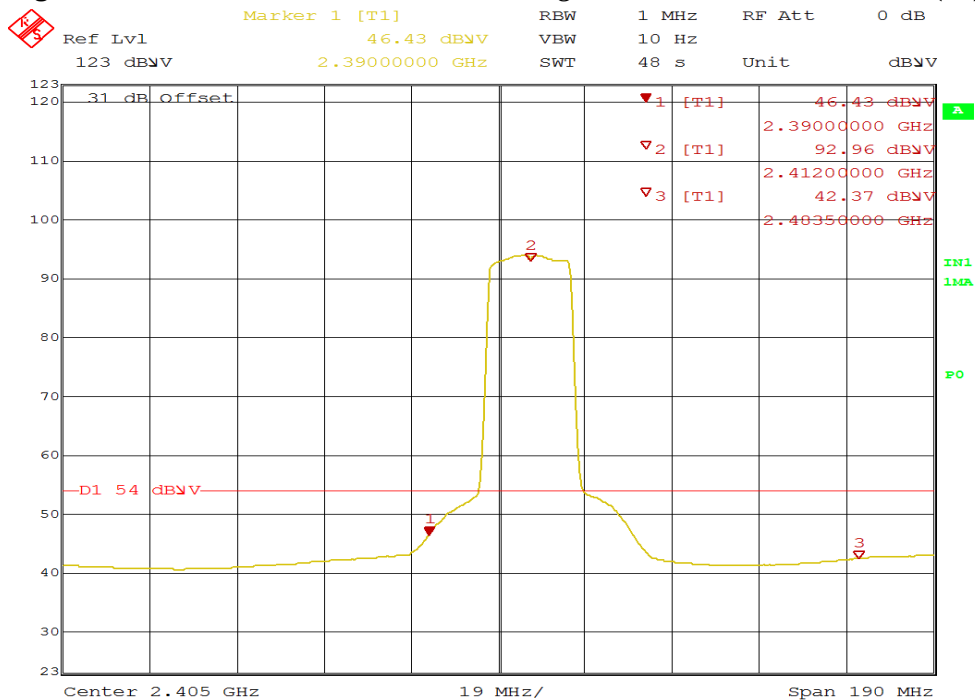
Date: 11.FEB.2016 14:53:48

Figure 46: Radiated Emission at 2390 MHz Edge for 2412 MHz-HT20 – Vert. (Ave)



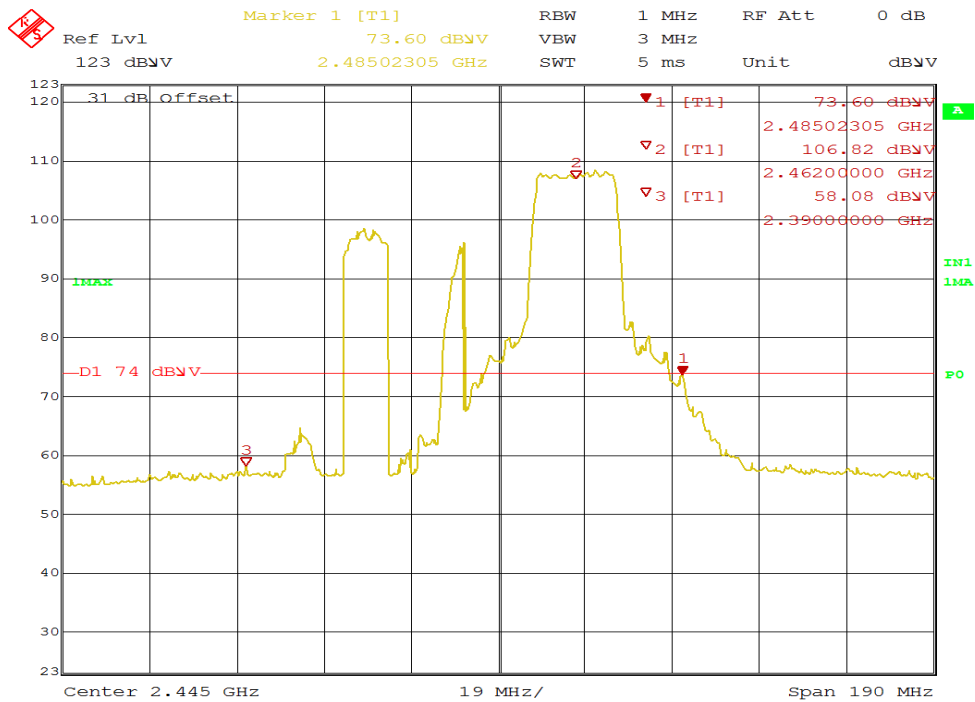
Date: 11.FEB.2016 14:57:01

Figure 47: Radiated Emission at 2390 MHz Edge for 2412 MHz-HT20 – Horz. (Pk)



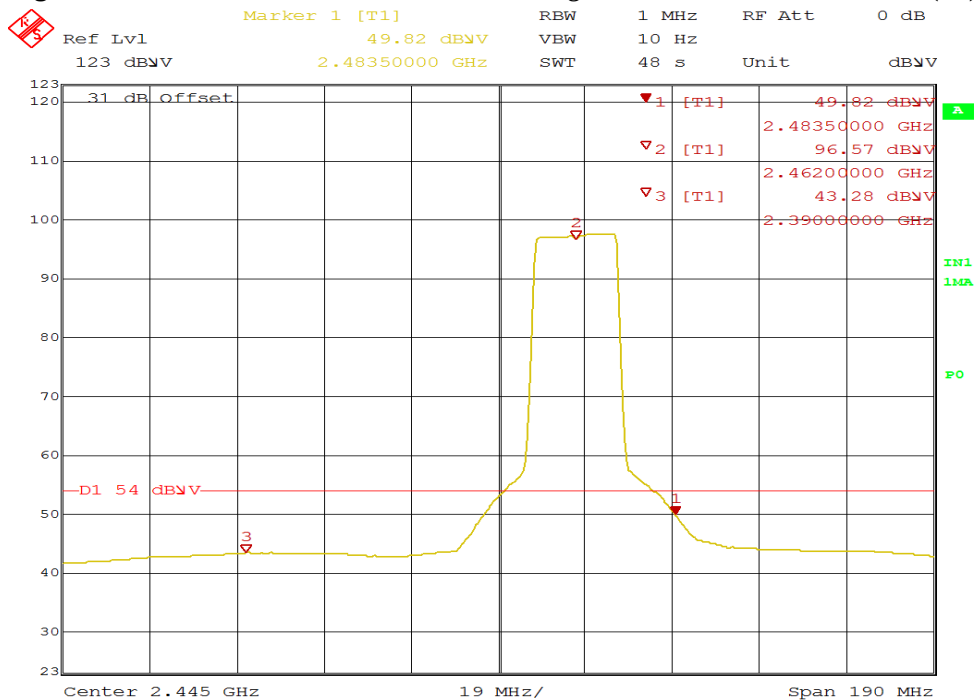
Date: 11.FEB.2016 14:58:54

Figure 48: Radiated Emission at 2390 MHz Edge for 2412 MHz-HT20 – Horz. (Ave)



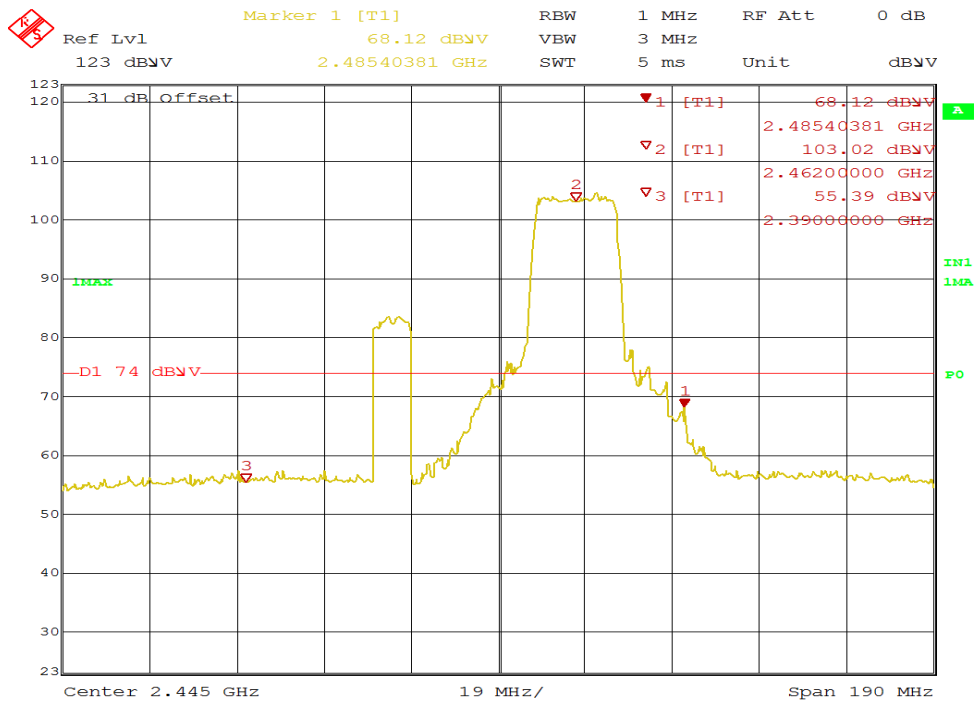
Date: 11.FEB.2016 15:05:07

Figure 49: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-HT20 – Vert. (Pk)



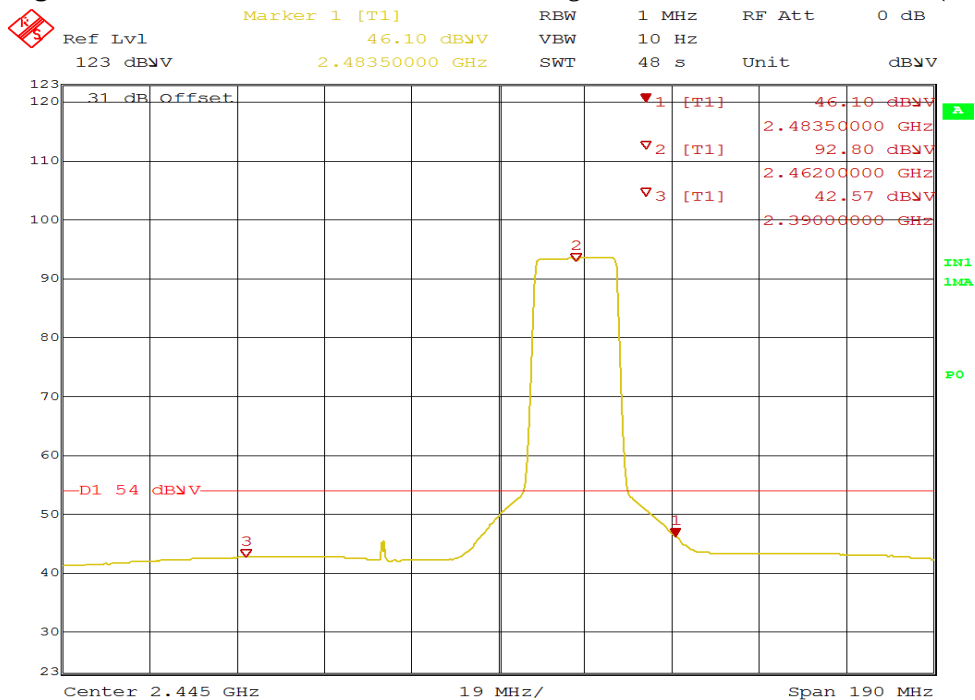
Date: 11.FEB.2016 15:07:07

Figure 50: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-HT20 – Vert. (Ave)



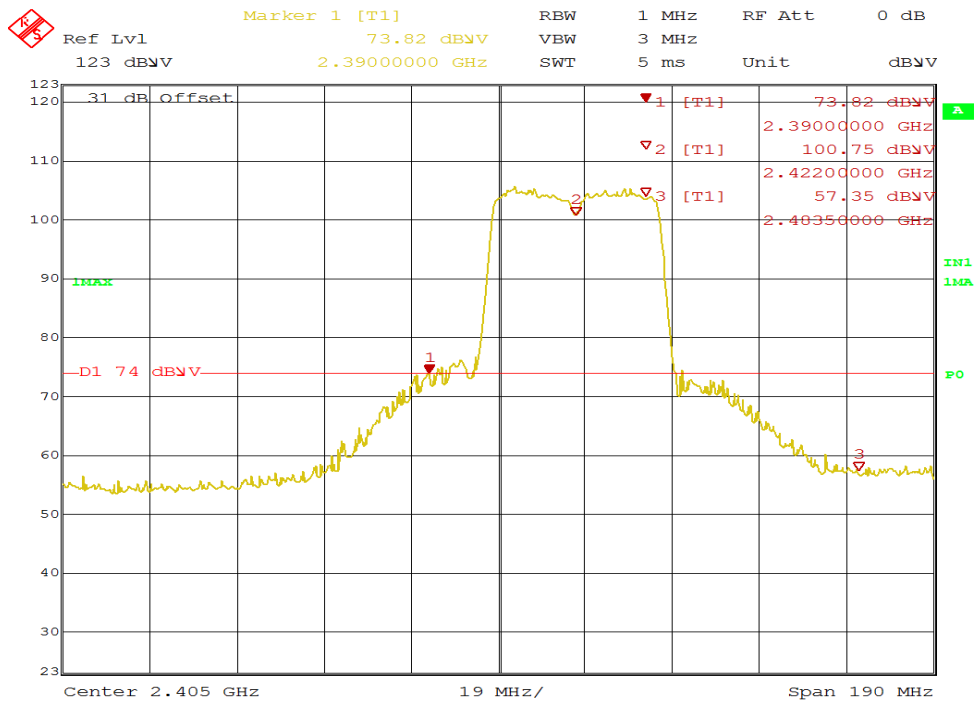
Date: 11.FEB.2016 15:10:10

Figure 51: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-HT20 – Horz. (Pk)



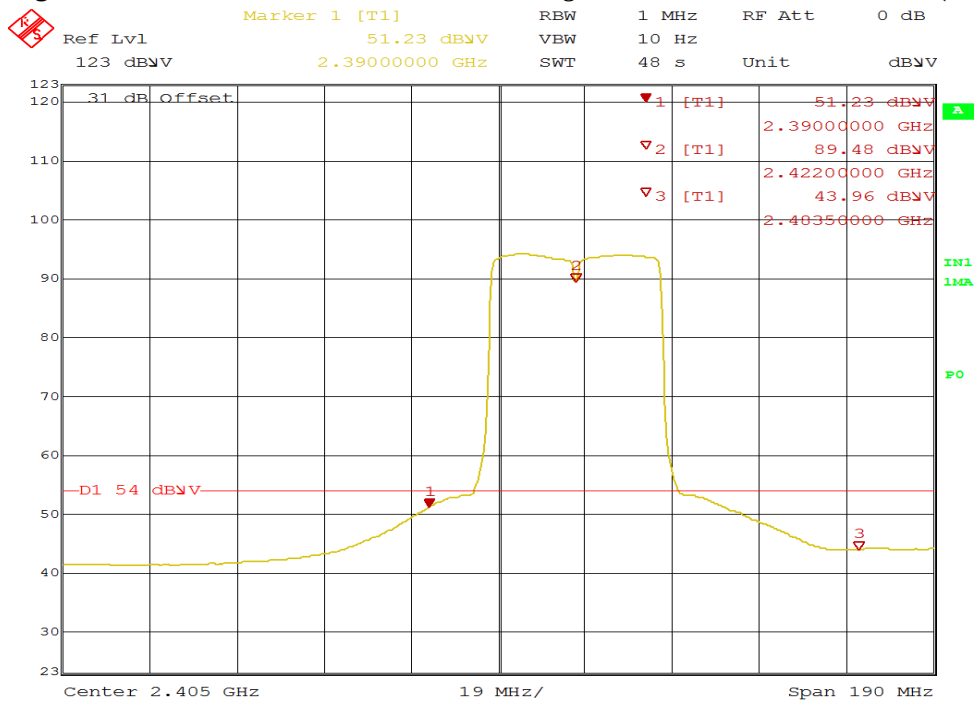
Date: 11.FEB.2016 15:11:49

Figure 52: Radiated Emission at 2483.5 MHz Edge for 2462 MHz-HT20 – Horz. (Ave)



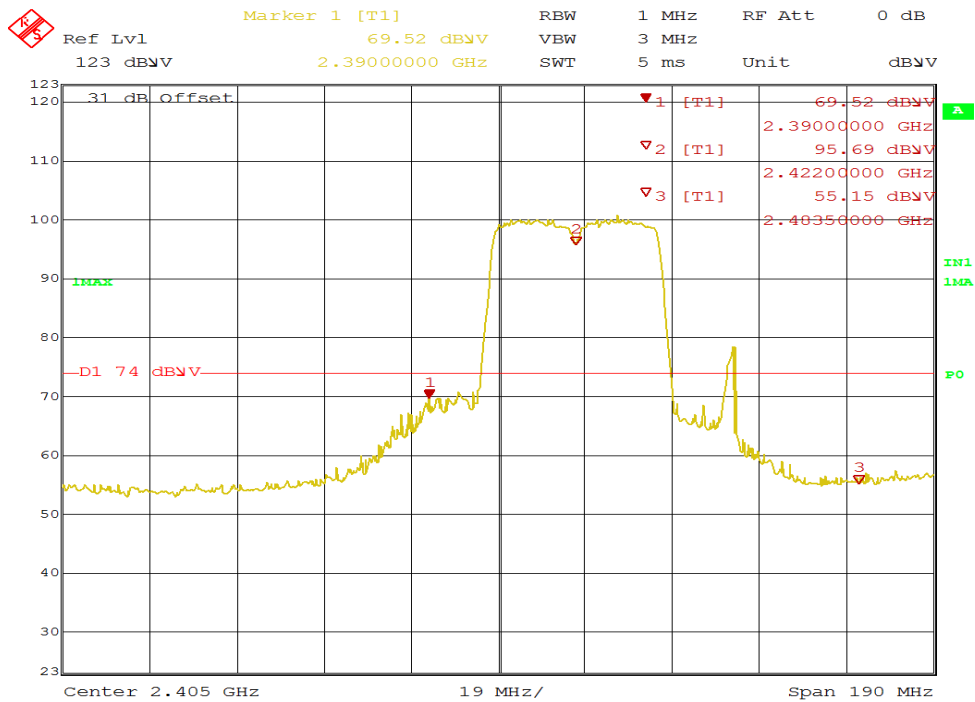
Date: 11.FEB.2016 15:27:38

Figure 53: Radiated Emission at 2390 MHz Edge for 2422 MHz-HT40 – Vert. (Pk)



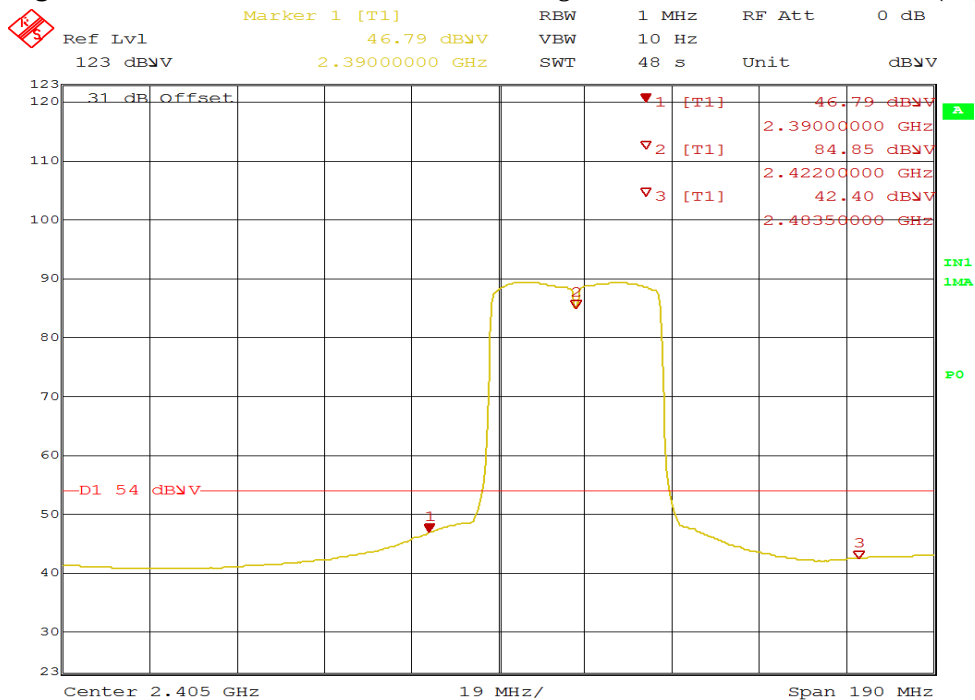
Date: 11.FEB.2016 15:30:19

Figure 54: Radiated Emission at 2390 MHz Edge for 2422 MHz-HT40 – Vert. (Ave)



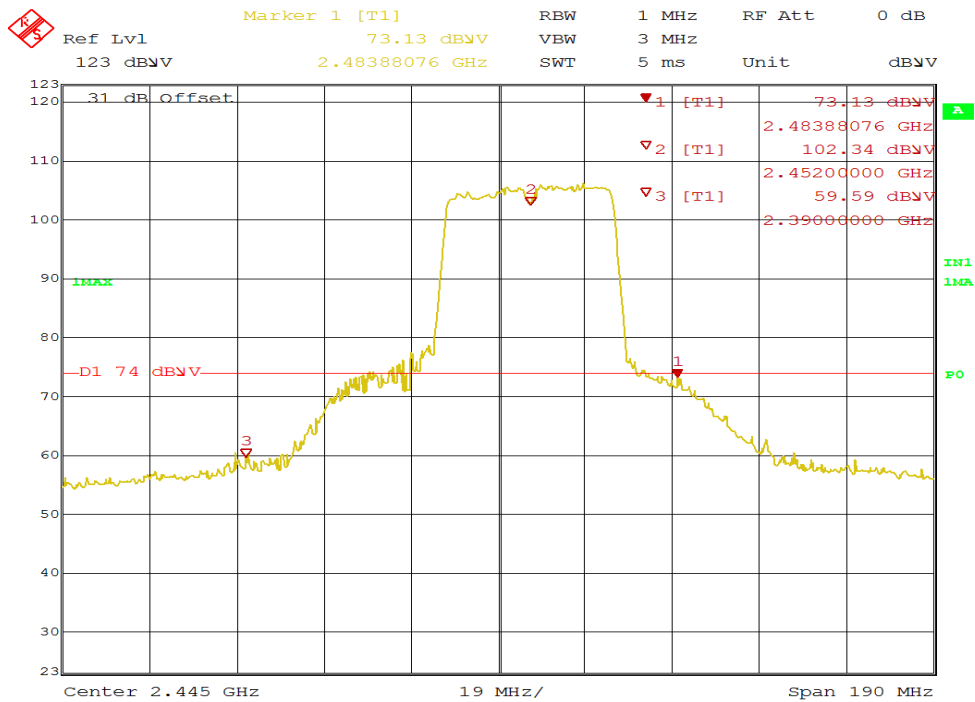
Date: 11.FEB.2016 15:34:04

Figure 55: Radiated Emission at 2390 MHz Edge for 2422 MHz-HT40 – Horz. (Pk)



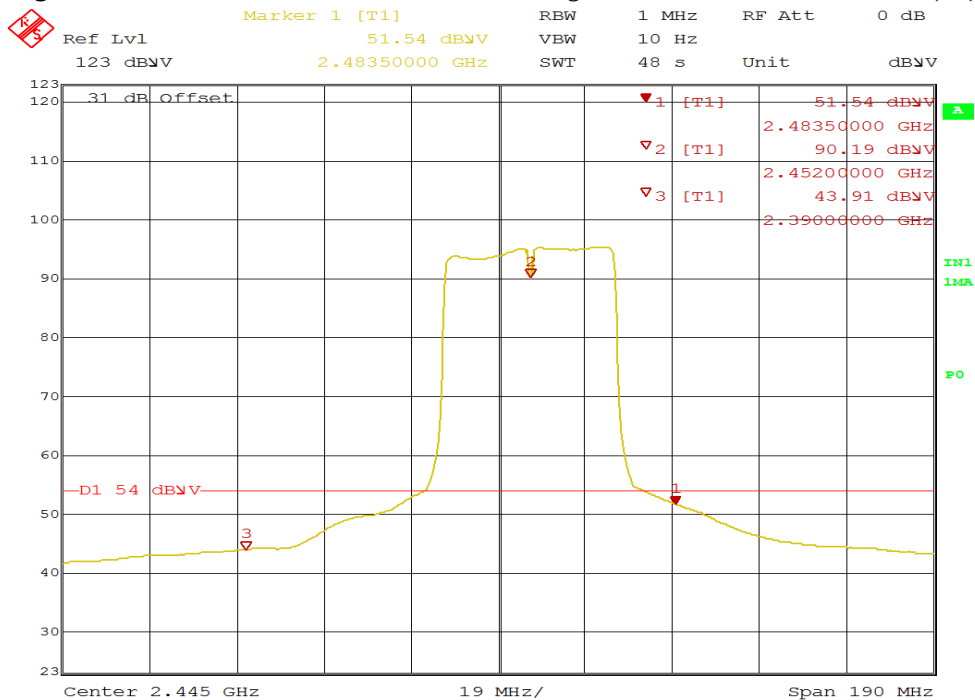
Date: 11.FEB.2016 15:36:17

Figure 56: Radiated Emission at 2390 MHz Edge for 2422 MHz-HT40 – Horz. (Ave)



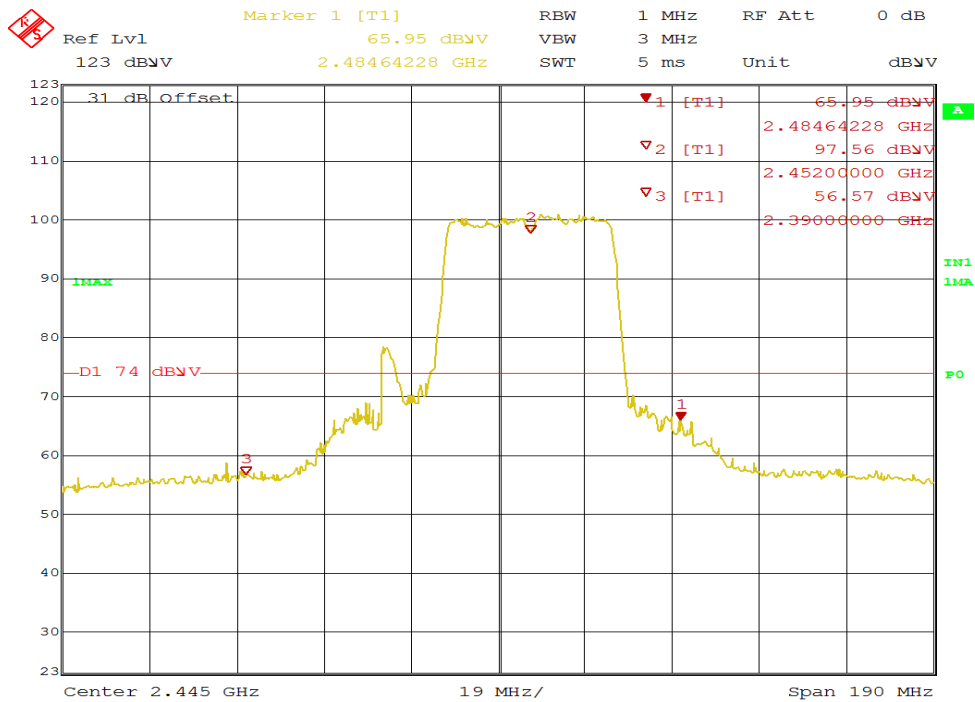
Date: 11.FEB.2016 15:40:50

Figure 57: Radiated Emission at 2483.5 MHz Edge for 2452 MHz-HT40 – Vert. (Pk)



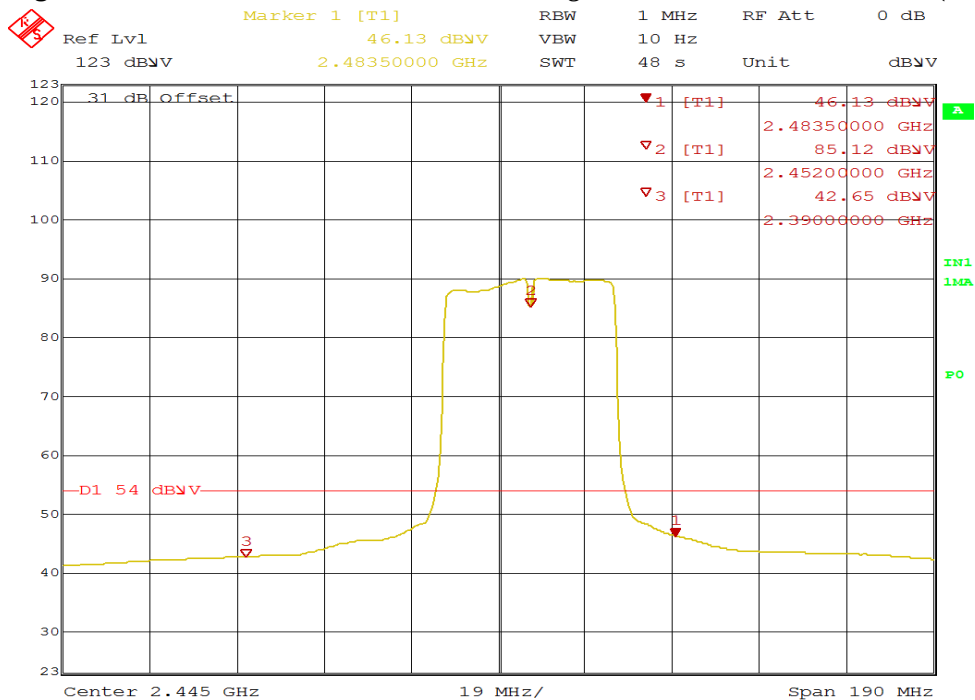
Date: 11.FEB.2016 15:42:46

Figure 58: Radiated Emission at 2483.5 MHz Edge for 2452 MHz-HT40 – Vert. (Ave)



Date: 11.FEB.2016 15:46:39

Figure 59: Radiated Emission at 2483.5 MHz Edge for 2452 MHz-HT40 – Horz. (Pk)



Date: 11.FEB.2016 15:48:23

Figure 60: Radiated Emission at 2483.5 MHz Edge for 2452 MHz-HT40 – Horz. (Ave)

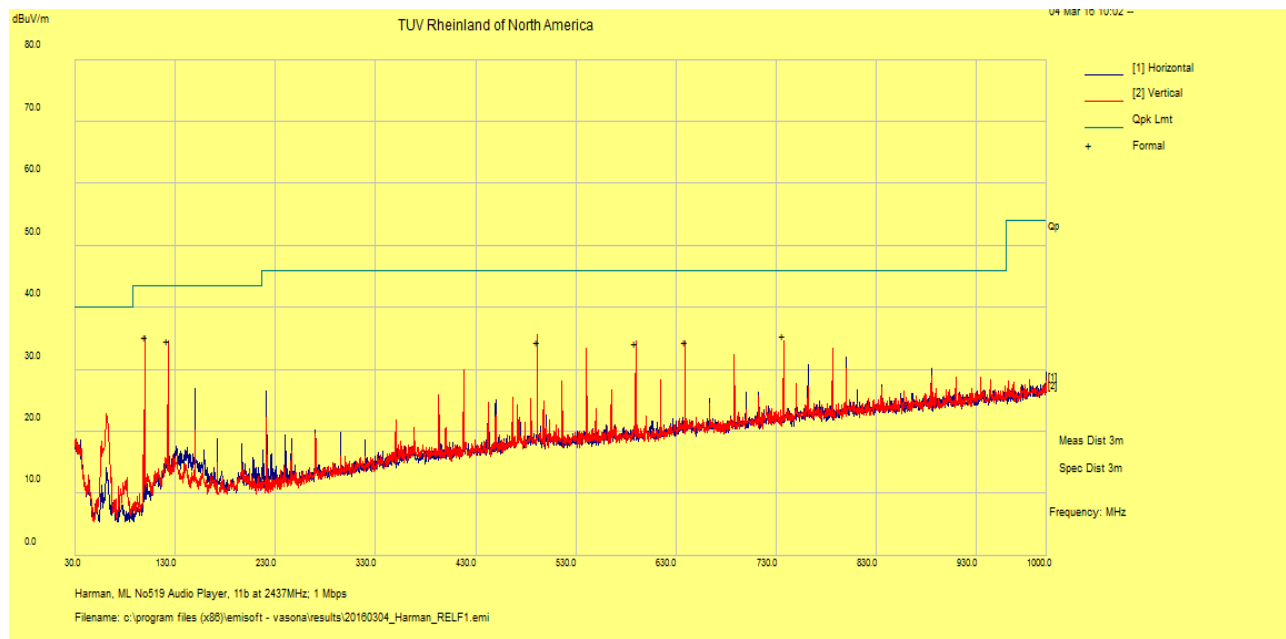
SOP 1 Radiated Emissions

Tracking # 31660720.001 Page 1 of 11

EUT Name	Audio Player	Date	Mar 04, 2016
EUT Model	No519	Temp / Hum in	22° C / 40%rh
EUT Serial	916	Temp / Hum out	N/A
EUT Config.	802.11b at 1 Mbps	Line AC / Freq	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	RBW / VBW	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	Performed by	Kerwinn Corpuz

30 MHz – 1 GHz Transmit at 2437 MHz

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
99.99	53.97	3.12	-21.77	35.32	QP	V	100	324	43.50	-8.18
122.87	49.19	3.26	-17.86	34.59	QP	V	109	164	43.50	-8.91
491.49	43.77	4.66	-13.95	34.48	QP	V	105	32	46.00	-11.53
589.82	42.02	4.95	-12.70	34.27	QP	V	101	361	46.00	-11.74
638.98	41.08	5.08	-11.71	34.45	QP	V	100	192	46.00	-11.55
737.26	40.93	5.35	-10.80	35.47	QP	V	120	361	46.00	-10.53



Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty

Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: 1. Worst case was observed on Mid channel of 802.11b, 1 Mbps mode.

2. Tested preliminary are 802.11b, 802.11g, HT20 and HT40 (low, mid & high channel).

3. To reduce complexity and bulkiness of the report Worst case Plots is placed in the report.

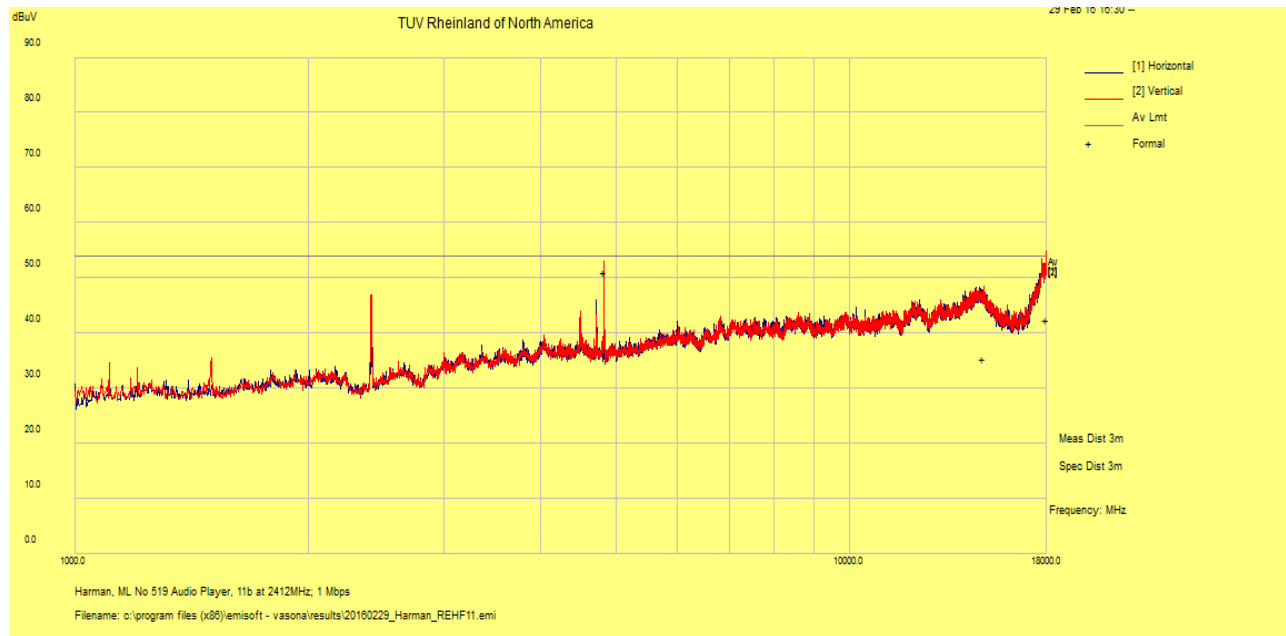
SOP 1 Radiated Emissions

Tracking # 31660720.001 Page 2 of 11

EUT Name	Audio Player	Date	Feb 29, 2016
EUT Model	No519	Temp / Hum in	23° C / 39%rh
EUT Serial	919	Temp / Hum out	N/A
EUT Config.	802.11b at 1 Mbps	Line AC / Freq	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	RBW / VBW	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	Performed by	Kerwinn Corpuz

1 – 18 GHz Transmit at 2412 MHz (Low Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
4824.02	66.15	1.89	-17.07	50.96	Average	V	176	130	54.00	-3.04
14914.36	38.62	3.35	-6.70	35.28	Average	V	152	361	54.00	-18.72
17974.35	36.62	4.02	1.85	42.49	Average	V	214	152	54.00	-11.51



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty

Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: None.

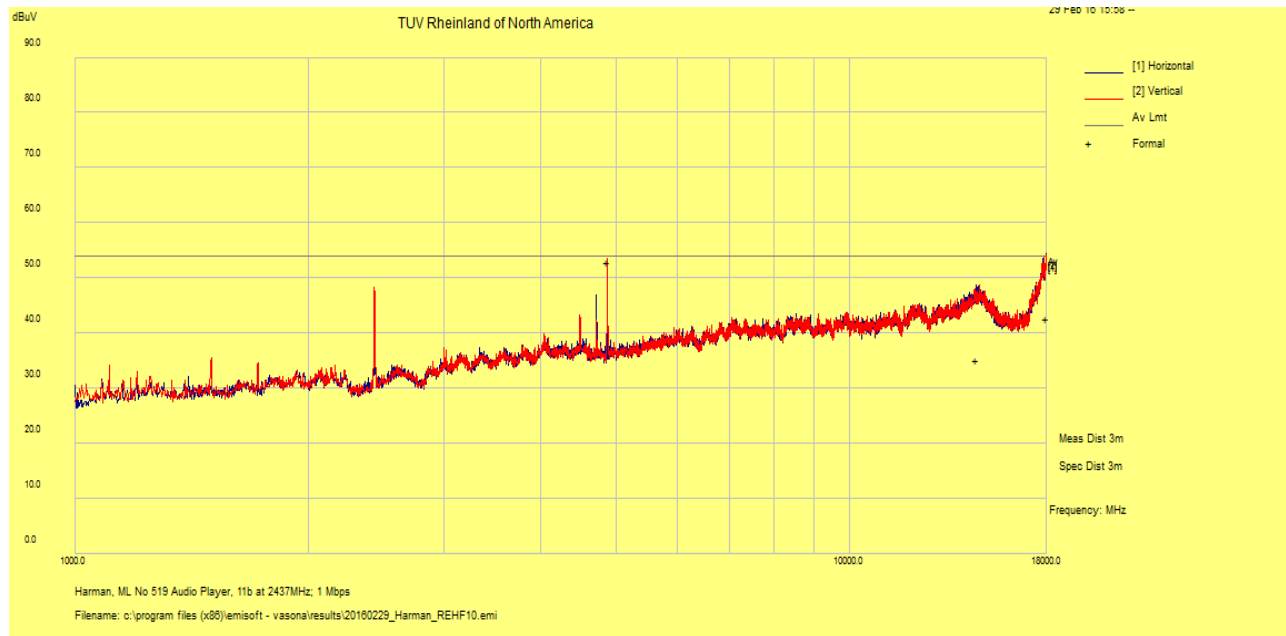
SOP 1 Radiated Emissions

Tracking # 31660720.001 Page 3 of 11

EUT Name	Audio Player	Date	Feb 29, 2016
EUT Model	No519	Temp / Hum in	23° C / 39%rh
EUT Serial	919	Temp / Hum out	N/A
EUT Config.	802.11b at 1 Mbps	Line AC / Freq	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	RBW / VBW	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	Performed by	Kerwinn Corpuz

1 – 18 GHz Transmit at 2437 MHz (Mid Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
14596.58	38.46	3.44	-6.87	35.03	Average	H	157	66	54.00	-18.97
17988.40	36.30	4.04	2.19	42.53	Average	H	195	314	54.00	-11.47
4873.94	67.74	1.88	-16.76	52.86	Average	V	169	130	54.00	-1.14



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: None.

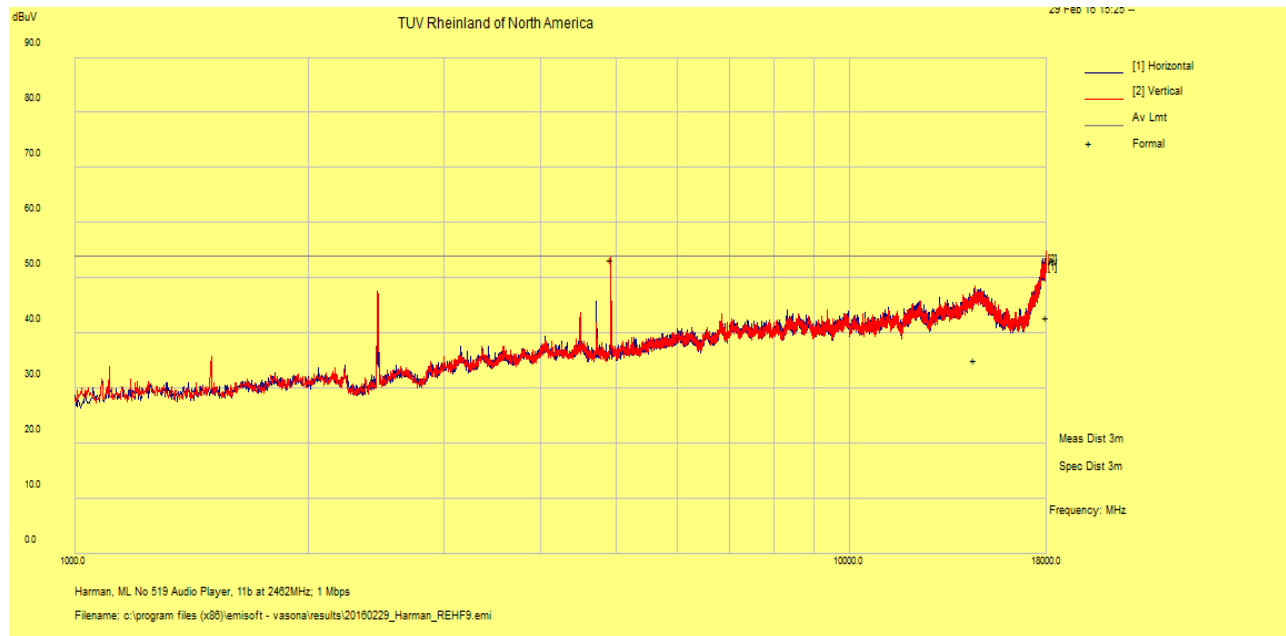
SOP 1 Radiated Emissions

Tracking # 31660720.001 Page 4 of 11

EUT Name	Audio Player	Date	Feb 29, 2016
EUT Model	No519	Temp / Hum in	23° C / 39%rh
EUT Serial	919	Temp / Hum out	N/A
EUT Config.	802.11b at 1 Mbps	Line AC / Freq	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	RBW / VBW	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	Performed by	Kerwinn Corpuz

1 – 18 GHz Transmit at 2462 MHz (High Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
17993.42	36.58	4.04	2.32	42.94	Average	H	220	272	54.00	-11.06
4923.94	67.88	1.89	-16.42	53.36	Average	V	196	130	54.00	-0.64
14526.00	39.05	3.42	-7.29	35.18	Average	V	231	220	54.00	-18.82



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty

Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: Other than spectrum noise floor, emission at the limit is the fundamental frequency.

SOP 1 Radiated Emissions						Tracking # 31660720.001 Page 5 of 11				
EUT Name		Audio Player				Date		Mar 03, 2016		
EUT Model		No519				Temp / Hum in		22° C / 37%rh		
EUT Serial		916				Temp / Hum out		N/A		
EUT Config.		802.11b at 1 Mbps				Line AC / Freq		110 Vac / 60 Hz		
Standard		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				RBW / VBW		1 MHz/ 3 MHz		
Dist/Ant Used		3m – EMCO3115 / 1m – AHA-840				Performed by		Kerwinn Corpuz		
18 – 26 GHz Transmit at 2412 MHz (Low Channel)										
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
21655.31	43.70	5.40	-9.75	39.35	Pk	V	120	0	54.00	-14.65

dBuV/m TUV Rheinland of North America US MBF 10 14:50 --

Harman, ML No519 Audio Player, 11b at 2412MHz, 1 Mbps
Filename: c:\program files (x86)\emisoft - vasona\results\20160303_Harman_REHF1.emi

Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty	
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp	
Note: No significant emissions was observed for 802.11b, 802.11g and 802.11n - HT20. Measured spectrum noise floor.	

SOP 1 Radiated Emissions						Tracking # 31660720.001 Page 6 of 11				
EUT Name		Audio Player				Date		Mar 03, 2016		
EUT Model		No519				Temp / Hum in		22° C / 37%rh		
EUT Serial		916				Temp / Hum out		N/A		
EUT Config.		802.11b at 1 Mbps				Line AC / Freq		110 Vac / 60 Hz		
Standard		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				RBW / VBW		1 MHz/ 3 MHz		
Dist/Ant Used		3m – EMCO3115 / 1m – AHA-840				Performed by		Kerwinn Corpuz		
18 – 26 GHz Transmit at 2437 MHz (Mid Channel)										
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
21655.31	44.53	5.40	-9.75	40.18	Pk	V	120	0	54.00	-13.82

TUV Rheinland of North America

Harman, ML No519 Audio Player, 11b at 2437MHz, 1 Mbps
Filename: c:\program files (x86)\emisoft - vasona\results\20160303_Harman_REHF2.emi

Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty	
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp	
Note: No significant emissions was observed for 802.11b, 802.11g and 802.11n - HT20. Measured spectrum noise floor.	

SOP 1 Radiated Emissions						Tracking # 31660720.001 Page 7 of 11				
EUT Name		Audio Player				Date		Mar 03, 2016		
EUT Model		No519				Temp / Hum in		22° C / 37%rh		
EUT Serial		916				Temp / Hum out		N/A		
EUT Config.		802.11b at 1 Mbps				Line AC / Freq		110 Vac / 60 Hz		
Standard		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				RBW / VBW		1 MHz/ 3 MHz		
Dist/Ant Used		3m – EMCO3115 / 1m – AHA-840				Performed by		Kerwinn Corpuz		
18 – 26 GHz Transmit at 2462 MHz (High Channel)										
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
21671.34	44.32	5.40	-9.77	39.95	Pk	V	120	0	54.00	-14.05

TUV Rheinland of North America

[1] Horizontal
[2] Vertical
Av Lmt

Meas Dist 1m
Spec Dist 3m
Frequency: MHz

Harman, ML No519 Audio Player, 11b at 2462MHz, 1 Mbps
Filename: c:\program files (x86)\emisoft - vasona\results\20160303_Harman_REHF3.emi

Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty	
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp	
Note: No significant emissions was observed for 802.11b, 802.11g and 802.11n - HT20. Measured spectrum noise floor.	

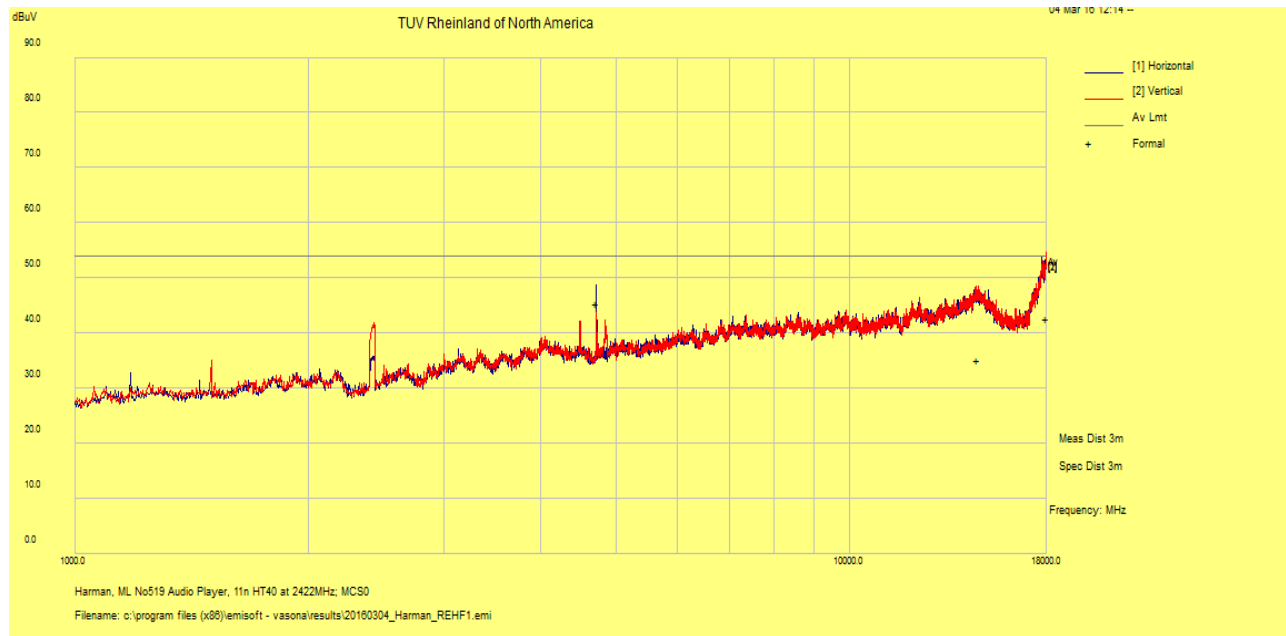
SOP 1 Radiated Emissions

Tracking # 31660720.001 Page 8 of 11

EUT Name	Audio Player	Date	Mar 04, 2016
EUT Model	No519	Temp / Hum in	22° C / 40%rh
EUT Serial	916	Temp / Hum out	N/A
EUT Config.	802.11n at HT40 MCS0	Line AC / Freq	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	RBW / VBW	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	Performed by	Kerwinn Corpuz

1 – 18 GHz Transmit at 2422 MHz (Low Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
4718.56	60.45	1.83	-16.96	45.32	Average	V	104	124	54.00	-8.68
14672.53	38.20	3.42	-6.53	35.09	Average	V	235	86	54.00	-18.91
17978.14	36.55	4.02	1.94	42.51	Average	V	225	320	54.00	-11.49



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty

Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: None.

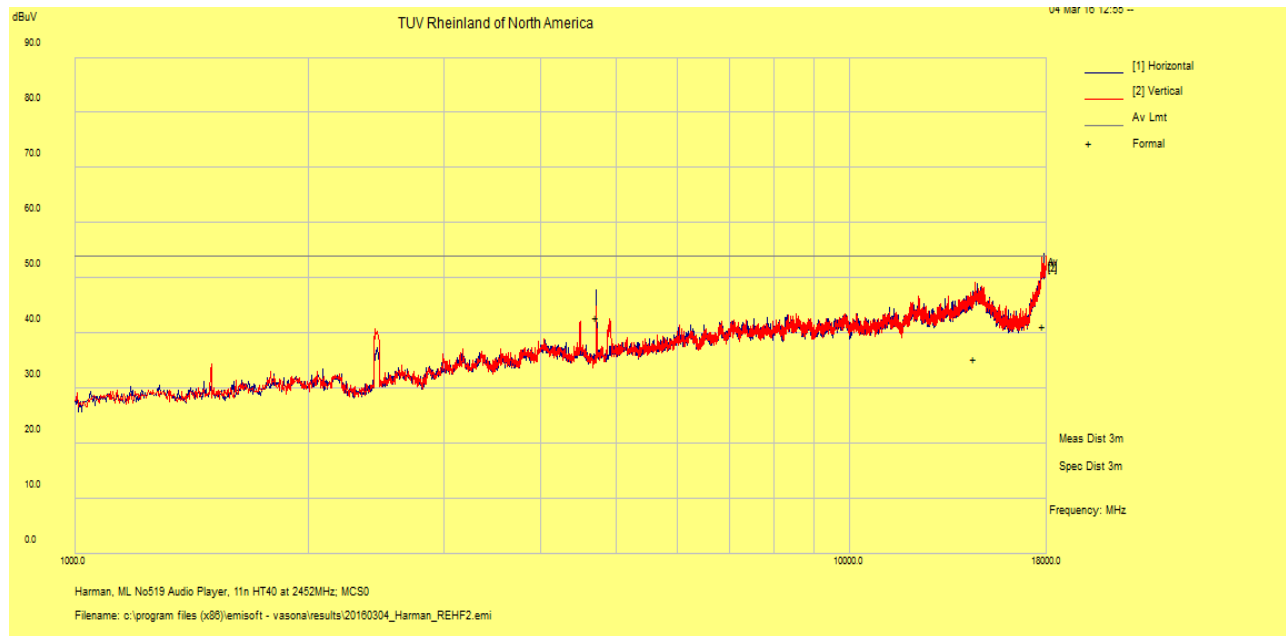
SOP 1 Radiated Emissions

Tracking # 31660720.001 Page 9 of 11

EUT Name	Audio Player	Date	Mar 04, 2016
EUT Model	No519	Temp / Hum in	22° C / 40%rh
EUT Serial	916	Temp / Hum out	N/A
EUT Config.	802.11n at HT40 MCS0	Line AC / Freq	110 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	RBW / VBW	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	Performed by	Kerwinn Corpuz

1 – 18 GHz Transmit at 2452 MHz (High Channel)

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
4718.55	57.97	1.83	-16.96	42.84	Average	H	131	184	54.00	-11.16
17842.33	36.57	3.98	0.62	41.17	Average	H	130	2	54.00	-12.83
14531.09	39.11	3.42	-7.29	35.24	Average	V	219	40	54.00	-18.76



Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty

Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

Note: None.

SOP 1 Radiated Emissions						Tracking # 31660720.001 Page 10 of 11					
EUT Name	Audio Player					Date	Mar 03, 2016				
EUT Model	No519					Temp / Hum in	22° C / 37%rh				
EUT Serial	916					Temp / Hum out	N/A				
EUT Config.	802.11n at HT40 MCS0					Line AC / Freq	110 Vac / 60 Hz				
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN					RBW / VBW	1 MHz/ 3 MHz				
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840					Performed by	Kerwinn Corpuz				
18 – 26 GHz Transmit at 2422 MHz (Low Channel)											
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
21687.38	43.56	5.40	-9.79	39.16	Pk	V	120	0	54.00	-14.84	

dBuV/m TUV Rheinland of North America US MRF 10 1.2/00 --

Harman, ML No519 Audio Player, 11n, HT40 at 2422MHz; MCS0
Filename: c:\program files (x86)\emisoft - vasona\results\20160303_Harman_REHF4.emi

Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty	
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp	
Note: No significant emissions was observed. Measured spectrum noise floor.	

SOP 1 Radiated Emissions						Tracking # 31660720.001 Page 11 of 11				
EUT Name		Audio Player				Date		Mar 03, 2016		
EUT Model		No519				Temp / Hum in		22° C / 37%rh		
EUT Serial		916				Temp / Hum out		N/A		
EUT Config.		802.11n at HT40 MCS0				Line AC / Freq		110 Vac / 60 Hz		
Standard		CFR47 Part 15 Subpart C, RSS-247, RSS-GEN				RBW / VBW		1 MHz/ 3 MHz		
Dist/Ant Used		3m – EMCO3115 / 1m – AHA-840				Performed by		Kerwinn Corpuz		
18 – 26 GHz Transmit at 2452 MHz (High Channel)										
Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB
22056.11	44.08	5.46	-10.22	39.32	Pk	H	120	0	54.00	-14.68

dBuV/m TUV Rheinland of North America U3 MBF 10 12/11 --

Harman, ML No519 Audio Player, 11n, HT40 at 2452MHz; MCS0
Filename: c:\program files (x86)\emisoft - vasona\results\20160303_Harman_REHF5.emi

Spec Margin = E-Field AVG - Limit, E-Field AVG = FIM AVG+ Total CF ± Uncertainty	
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp	
Note: No significant emissions was observed. Measured spectrum noise floor.	

4.6 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4: 2014. These test methods are listed under the laboratory's A2LA Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2015 and RSS Gen: 2015 Sect. 8.8.

4.6.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs.

Testing is performed in Lab 5. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

4.6.1.1 Deviations

There were no deviations from this test methodology.

4.6.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 10: AC Conducted Emissions – Test Results

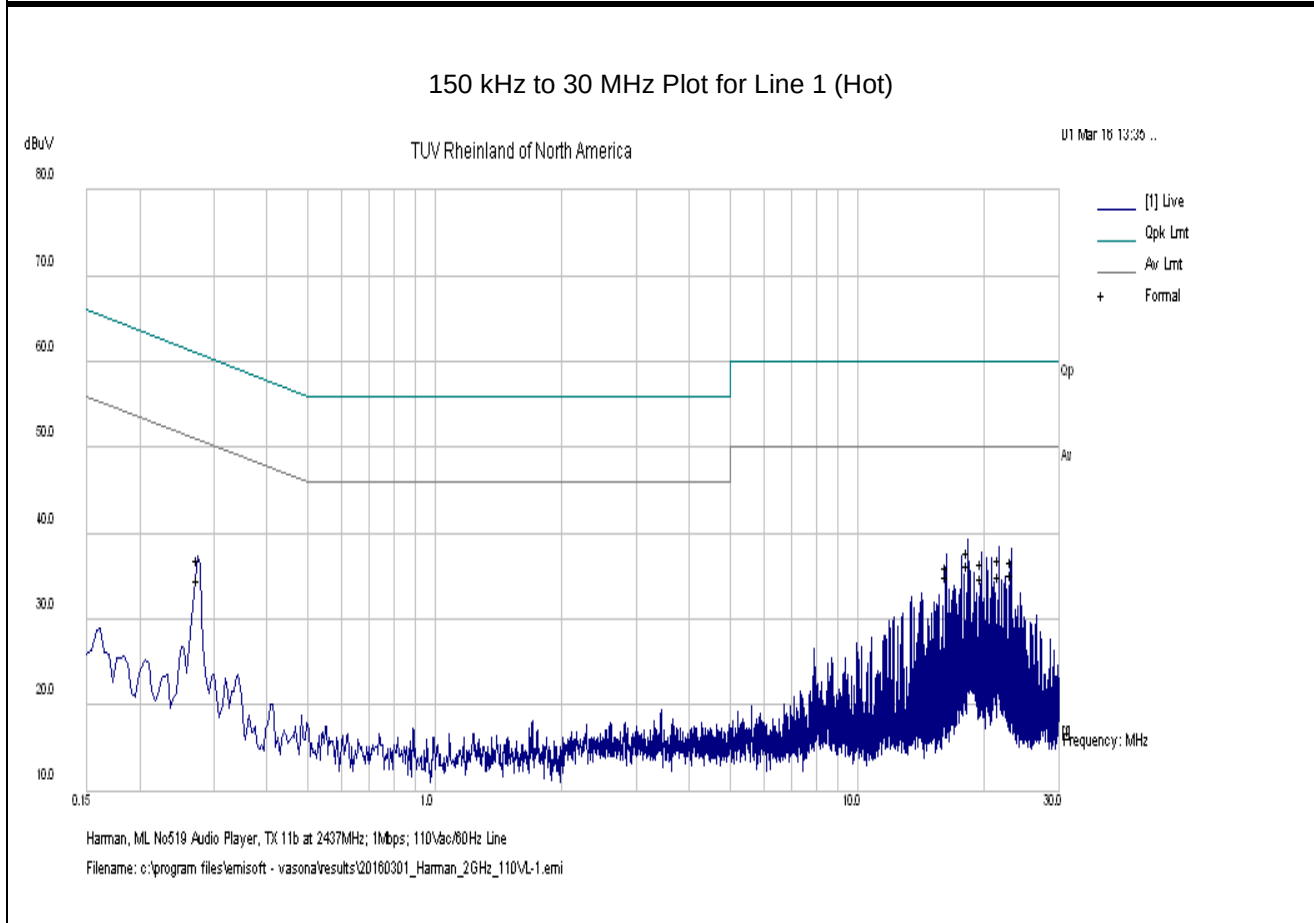
Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Custom Integrated		Power Level: See Test Plan
AC Power: 110 Vac/60 Hz		Configuration: Tabletop
Ambient Temperature: 22° C		Relative Humidity: 39% RH
Configuration	Frequency Range	Test Result
Line 1 (Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 2 Conducted Emissions						Tracking # 31660720.001 Page 1 of 4			
EUT Name		Audio Player		Date		Mar 01, 2016			
EUT Model		No519		Temp / Hum in		22° C / 39% rh			
EUT Serial		919		Temp / Hum out		N/A			
EUT Config.		TX mode		Line AC / Freq		110Vac / 60Hz			
Standard		CFR47 Part 15.207 and RSS Gen		RBW / VBW		9 kHz / 30 kHz			
Lab/LISN		Lab #5 /Com-Power, Line 1		Performed by		Kerwinn Corpuz			
Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.273	26.85	9.96	0.13	36.94	QP	Live	61.02	-24.08	Pass
0.273	24.53	9.96	0.13	34.61	Ave	Live	51.02	-16.41	Pass
16.228	25.90	10.17	-0.02	36.05	QP	Live	60.00	-23.95	Pass
16.228	24.88	10.17	-0.02	35.03	Ave	Live	50.00	-14.97	Pass
18.243	27.61	10.19	-0.04	37.76	QP	Live	60.00	-22.24	Pass
18.243	26.16	10.19	-0.04	36.30	Ave	Live	50.00	-13.70	Pass
19.709	26.31	10.20	-0.07	36.44	QP	Live	60.00	-23.56	Pass
19.709	24.56	10.20	-0.07	34.69	Ave	Live	50.00	-15.31	Pass
21.663	26.88	10.22	-0.10	37.00	QP	Live	60.00	-23.00	Pass
21.663	24.92	10.22	-0.10	35.04	Ave	Live	50.00	-14.96	Pass
23.129	26.54	10.22	-0.12	36.64	QP	Live	60.00	-23.36	Pass
23.129	25.17	10.22	-0.12	35.27	Ave	Live	50.00	-14.73	Pass
Spec Margin = QP./Ave. - Limit, ± Uncertainty									
Combined Standard Uncertainty $u_c(y) = \pm 1.2$ dB Expanded Uncertainty $U = k u_c(y)$ $k = 2$ for 95% confidence									
Notes: EUT was setup as table top equipment and transmitted at 2437 MHz in 802.11b at 1 Mbps									

SOP 2 Conducted Emissions

Tracking # 31660720.001 Page 2 of 4

EUT Name	Audio Player	Date	Mar 01, 2016
EUT Model	No519	Temp / Hum in	22° C / 39% rh
EUT Serial	919	Temp / Hum out	N/A
EUT Config.	TX mode	Line AC	110Vac / 60Hz
Standard	CFR47 Part 15.207 and RSS Gen	RBW / VBW	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 1	Performed by	Kerwinn Corpuz



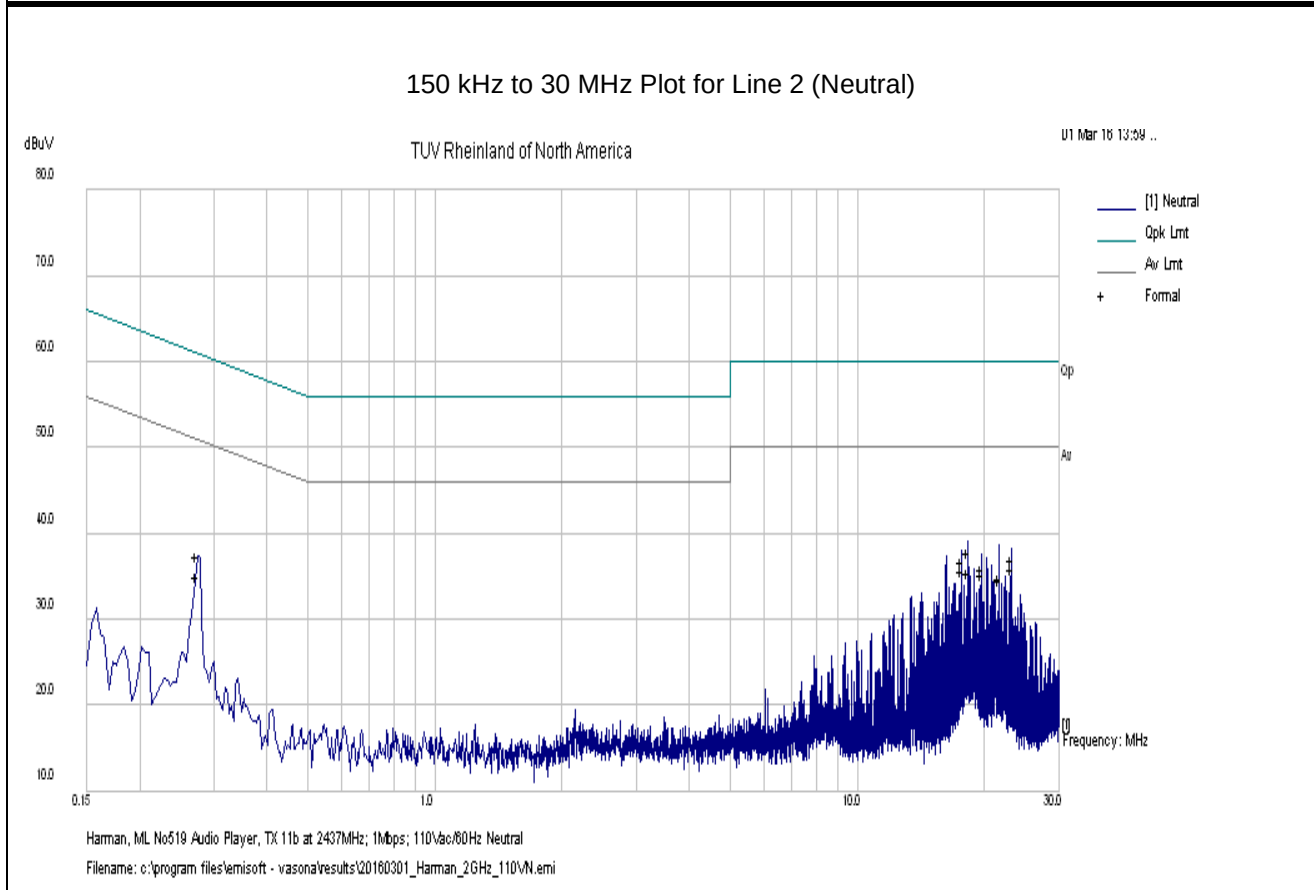
Note: Met FCC Class B limit.

SOP 2 Conducted Emissions						Tracking # 31660720.001 Page 3 of 4			
EUT Name	Audio Player					Date	Mar 01, 2016		
EUT Model	No519					Temp / Hum in	22° C / 39% rh		
EUT Serial	919					Temp / Hum out	N/A		
EUT Config.	TX mode					Line AC / Freq	110Vac / 60Hz		
Standard	CFR47 Part 15.207 and RSS Gen					RBW / VBW	9 kHz / 30 kHz		
Lab/LISN	Lab #5 /Com-Power, Line 2					Performed by	Kerwinn Corpuz		
Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.272	27.30	9.96	0.13	37.38	QP	Neutral	61.05	-23.67	Pass
0.272	24.93	9.96	0.13	35.01	Ave	Neutral	51.05	-16.04	Pass
17.694	26.57	10.19	-0.04	36.72	QP	Neutral	60.00	-23.28	Pass
17.694	25.59	10.19	-0.04	35.74	Ave	Neutral	50.00	-14.26	Pass
18.244	27.65	10.19	-0.04	37.79	QP	Neutral	60.00	-22.21	Pass
18.244	25.35	10.19	-0.04	35.50	Ave	Neutral	50.00	-14.50	Pass
19.708	25.82	10.20	-0.07	35.95	QP	Neutral	60.00	-24.05	Pass
19.708	25.09	10.20	-0.07	35.22	Ave	Neutral	50.00	-14.78	Pass
21.665	24.49	10.22	-0.10	34.61	QP	Neutral	60.00	-25.39	Pass
21.665	24.73	10.22	-0.10	34.85	Ave	Neutral	50.00	-15.15	Pass
23.128	26.90	10.22	-0.12	37.00	QP	Neutral	60.00	-23.00	Pass
23.128	25.82	10.22	-0.12	35.92	Ave	Neutral	50.00	-14.08	Pass
Spec Margin = QP./Ave. - Limit, ± Uncertainty									
Combined Standard Uncertainty $u_c(y) = \pm 1.2$ dB Expanded Uncertainty $U = k u_c(y)$ $k = 2$ for 95% confidence									
Notes: EUT was setup as table top equipment and transmitted at 2437 MHz in 802.11b at 1 Mbps									

SOP 2 Conducted Emissions

Tracking # 31660720.001 Page 4 of 4

EUT Name	Audio Player	Date	Mar 01, 2016
EUT Model	No519	Temp / Hum in	22° C / 39% rh
EUT Serial	919	Temp / Hum out	N/A
EUT Config.	TX mode	Line AC	110Vac / 60Hz
Standard	CFR47 Part 15.207 and RSS Gen	RBW / VBW	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 2	Performed by	Kerwinn Corpuz



Note: Met FCC Class B Limit.

4.7 Maximum Permissible Exposure

4.7.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this calculation is declared by the manufacturer, and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

4.7.2 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	...	...	1.0	6
300 - 1500	...	...	f/300	6
1500 - 100,000	...	...	5	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/ f ²)	30
30–300	27.5	0.037	0.2	30
300 - 1500	...	...	f/1500	30
1500 - 100,000	...	...	1.0	30

F = Frequency in MHz

* = Plane-wave equivalent power density

4.7.3 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

4.7.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a **Mobile Device**.

See below calculation for 2.437 GHz RF Exposure at a distance of 20cm.

4.7.5 Test Results

4.7.5.1 Antenna Gain

The 2.437 GHz transmitting maximum antenna gain is +3.0 dBi or 1.995 (numeric).

4.7.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement.

Limit for MPE (from FCC part 1.1310 table1) is 1.0 mW/cm²

The highest measured total power is +17.27 dBm or 53.33 mW

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

$P_d = (53.33 * 1.995) / (1600\pi) = 0.02117 \text{ mW/cm}^2$, which is 0.97883 mW/cm² below to the limit.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.7.6 Sample Calculation

The Friss transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where;

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

$\pi \approx 3.1416$

R = distance between observation point and center of the radiator

in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
Bilog Antenna	Sunol Sciences	JB3	A102606	07/08/2014	07/08/2016
Horn Antenna	Sunol Sciences	DRH-118	A040806	02/10/2015	02/10/2017
Antenna (18-40 GHz)	Com-Power	AHA-840	105005	07/08/2015	07/08/2016
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/26/2016	01/26/2017
Spectrum Analyzer	Agilent	N9030A	US51350291	03/06/2015	03/06/2016
Spectrum Analyzer	Rohde Schwarz	ESIB	832427/002	01/15/2016	01/15/2017
Spectrum Analyzer	Rohde Schwarz	FSV40	1321.3008K40	11/01/2015	11/01/2016
Amplifier	Sonoma Instruments	310	185516	01/18/2016	01/18/2017
Amplifier	Miteq	TTA1800-30-4G	1842452	01/20/2016	01/20/2017
Power Meter	Agilent	E4418B	MY41295336	01/20/2016	01/20/2017
Power Sensor	Hewlett Packard	E9300A	MY51400025	01/20/2016	01/20/2017
AC Power Source	California Instruments	1001P	L06329	NCR	NCR
Multimeter	Fluke	177	92780312	01/19/2016	01/19/2017
Thermo Chamber	Tenney	T30RS	10.785-19	01/21/2016	01/21/2017

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 11: Customer Information

Company Name	Harman International Industries, Inc
Address	50 Waterview Drive, Suite 240
City, State, Zip	Shelton, CT 06484
Country	USA
Phone	(203) 924-5349
Fax	(203) 924-2382

Table 12: Technical Contact Information

Name	John Garay
E-mail	John.garay@harman.com
Phone	(203) 924-5349
Fax	(203) 924-2382

6.3 Equipment Under Test (EUT)

Table 13: EUT Specifications

EUT Specifications	
Dimensions	W: 17.25in (438.15mm) x D: 15.25-16in (387.35-406.4mm) x H: 6in (152.4mm)
AC Input	100-240V AC, 50 – 60 Hz
Environment	Indoor
Operating Temperature Range:	+10 to +40 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	Lab1 (L1)
Part Number	Stream820/4WE10-4-D3
RF Software Version	Marvell-sdio-fw_14.66.35-p25.bb
802.11-radio modules	
Operating Mode	802.11b, 802.11g, 802.11n (HT20 and HT40)
Transmitter Frequency Band	2.4 GHz – 2.4835 GHz
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	Omnidirectional
Antenna Gain	+3.0 dBi
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☐ Other describe: 16QAM and 64 QAM
Data Rate	802.11b: 1 Spatial Stream: 1, 2, 5.5, 11 Mbps 802.11g: 1 Spatial Stream: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n HT20: 1 Spatial Stream: 13, 26, 39, 52, 78, 104, 117, 130 /156 Mbps (LGI) 802.11n HT40: 1 Spatial Stream: 27, 54, 81, 108, 162, 216, 243, 270 / 324, 370 Mbps (LGI)
TX/RX Chain (s)	Single; no beam forming
Directional Gain Type	☒ Uncorrelated ☐ Beam-Forming ☐ Other describe:

EUT Specifications	
Type of Equipment	☒ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☐ Other:
Note: this device operates as Client mode (normal operation) or Soft-AP mode (use to setup only).	

Table 14: EUT Channel Power Specifications

Max Power for single Chain

TP Setting	No.	Frequency (MHz)	Target Power Value dBm			
			802.11b	802.11g	802.11n (HT20)	802.11n (HT40)
13	1	2412	16.02			
13	6	2437	17.1			
13	11	2462	16.95			
17	1	2412		13.97		
17	6	2437		14.69		
17	11	2462		14.59		
16	1	2412			13.15	
16	6	2437			13.93	
16	11	2462			13.73	
15	3	2422				11.52
15	9	2452				12.48
Note: The adjusted power target values are updated at the evaluated frequencies.						

Table 15: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
Ethernet	RJ45	☒ No	☒ Metric: 2 m	☐ N/A

Table 16: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Lenovo	T420	R8-G4YVG 11/06	Setup EUT operating channel
Note: None.				

Table 17: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
Audio Player	919 & 916*	Omnidirectional Antenna	Radiated Emissions
	919	Omnidirectional Antenna	Radiated Bandedge Emissions, AC Conducted Emissions
	919	Direct Connection	Peak Transmit Power, Peak Power Spectral Density, Occupied Bandwidth, Band-Edge, Out-of-Band Emissions
Note: *Serial #919 had RF communication issue. Therefore, Serial #916 was used to investigate as secondary unit.			

Table 18: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
Audio Player	Omnidirectional	Transmit	EUT laid flat.	N/A	N/A
Note: None.					

6.4 Test Specifications

Table 19: Test Specifications

Emissions and Immunity	
Standard	Requirement
CFR 47 Part 15.247: 2015	All
RSS 247 Issue 1, 2015	All

END OF REPORT