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Emissions
Test Report

EUT Name: Home Wi-Fi Router

Model No.: A010001

CFR 47 Part 15.247:2015 and RSS-247:2015

Prepared for:

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Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	10/15/2015	Original Document	N/A

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	eero inc 933 20th Street San Francisco, CA 94107
Requester / Applicant:	Clifford Clarke
Name of Equipment:	Home Wi-Fi Router
Model No.	A010001
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247:2015 and RSS-247:2015
Test Dates:	10 September 2015 to 09 October 2015

Guidance Documents:

Emissions: ANSI C63.10:2013, KDB 558074 D01 DTS Measurement Guidance v03r01

Test Methods:

Emissions: ANSI C63.10:2013, KDB 558074 D01 DTS Measurement Guidance v03r01

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	October 15, 2015	David Spencer	October 15, 2015
Test Engineer	Date	Laboratory Signature	Date

Testing Cert #3331.02 **US5254** **2932M-1**

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 10 September 2015 to 09 October 2015 on the Home Wi-Fi Router Model A010001 manufactured by eero 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 report documents the 2.4GHz radio characteristics for the Home Wi-Fi Router.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4:2009/ ANSI C63.10:2013	Test Parameters	Measured Value	Result
2402 MHz to 2480 MHz Band				
Spurious Emission in Transmitted Mode	CFR47 15.209, RSS-GEN Sect.8.9	Class B	-1.26 dB (Margin)	**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	-7.80 dB (Margin)	**Complied**
Occupied Bandwidth	CFR 47 15.247(a1), RSS Gen Sect. 6.6	N/A	20dB BW = 1.28 MHz 99% BW = 1.16 MHz	**Complied**
Channel Separation	CFR47 15.247 (a1), RSS 247 Sect. 5.1.2	> 591 kHz	1036 kHz	**Complied**
Number of Hopping Channels	CFR47 15.247 (a1), RSS 247 Sect. 5.1.4	>15	79 Channels	**Complied**
Average time occupancy of Channel	CFR47 15.247 (a1), RSS 247 Sect. 5.1.4	< 0.4 sec	364 mS	**Complied**
Maximum Transmitted Power	CFR47 15.247 (b1), RSS 247 Sect. 5.4.2	< 1Watt	385 uW	**Complied**
Out of Band Emission	CFR47 15.247 (d), RSS 247 Sect. 5.5	< -30 dBr	- 34.46 dBr (-48.96 dBm at 23.75 GHz)	**Complied**
Maximum Permissible Exposure	CFR47 15.247 (i), 2.1093 RSS-102 Issue 5	General Population	0.00014 mW/cm^2	**Complied**

Note: 1. Met restricted band emission requirements.
2. This report is only documented for 2402 – 2480MHz.

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 17025:2005 and ISO 9002 (Lab Code 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 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-kΩ 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-kΩ 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:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

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

Sample radiated emissions calculation @ 30 MHz

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

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainty Emissions

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 ± 5.0%.	Per CISPR 16-4-2 Methods

2.3.3 Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 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 ± 11.6%.	Per IEC 61000-4-8

Thermo KeyTek EMC Pro

The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 5.84%.
The estimated combined standard uncertainty for surge immunity measurements is ± 5.84 %.
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 3.48%.

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.

Measurement Uncertainty – Radio Testing

The estimated combined standard uncertainty for frequency error measurements is ± 3.88 Hz
The estimated combined standard uncertainty for carrier power measurements is ± 1.59 dB.
The estimated combined standard uncertainty for adjacent channel power measurements is ± 1.47 dB.
The estimated combined standard uncertainty for modulation frequency response measurements is ± 0.46 dB.
The estimated combined standard uncertainty for transmitter conducted emission measurements is ± 4.01 dB

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.

3 Product Information

3.1 Product Description

The Model A010001, Home Wi-Fi Router, is a Wi-Fi router for the home capable of operating in the 2.4 GHz and 5 GHz frequency bands over 20 MHz, 40 MHz and 80 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 a 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 a 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 Home Wi-Fi Router has seven custom integrated antennas. The 2.4GHz band uses custom integrated antenna, Antenna 3, and has a maximum gain + 2.51 dBi. No additional antenna available.

Refer to Table 13 for additional antenna information.

4 Emission Requirements – 2400 MHz to 2483.5 MHz Band

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.

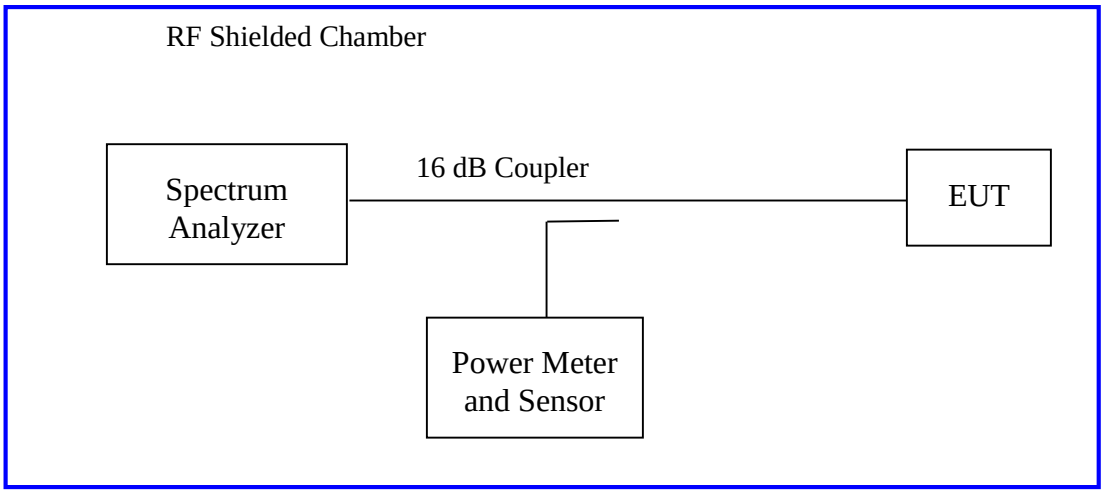
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b1) and RSS 247 Sect. 5.4.2: 2015

Frequency hopping systems in the 2400-2483.5 MHz band: 1 watts.

4.1.1 Test Method

The conducted method was used to measure the channel power output according to ANSI C63.10:2013 Section 11.9.2.2.2. The measurement was performed with modulation per CFR47 Part 15.247 (b 1):2015 and RSS 247 Sect. 5.4.2. This test was conducted on 3 channels on Home Wi-Fi Router. The worst mode result indicated below.

Test Setup:



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: Custom Integrated			**Power Setting:** See test plan	
Max. Directional Gain: + 2.51 dBi				
Signal State: Modulated at 100%.				
Ambient Temp.: 21° C			**Relative Humidity:**32%	
802.15.1 Mode				
Package	**Operating Channel**	**Limit [dBm]**	**Power [dBm]**	**Margin [dB]**
DH1	2402 MHz	+30.00	-9.04	-39.04
	2441 MHz	+30.00	-7.42	-37.42
	2480 MHz	+30.00	-6.38	-36.38
DH3	2402 MHz	+30.00	-9.80	-39.80
	2441 MHz	+30.00	-6.41	-36.41
	2480 MHz	+30.00	-6.48	-36.48
DH5	2402 MHz	+30.00	-9.86	-39.86
	2441 MHz	+30.00	-8.51	-38.51
	2480 MHz	+30.00	-7.19	-37.19
2-DH1	2402 MHz	+30.00	-8.68	-38.68
	2441 MHz	+30.00	-7.12	-37.12
	2480 MHz	+30.00	-6.10	-36.10
2-DH3	2402 MHz	+30.00	-9.95	-39.95
	2441 MHz	+30.00	-8.54	-38.54
	2480 MHz	+30.00	-7.43	-37.43
2-DH5	2402 MHz	+30.00	-11.73	-41.73
	2441 MHz	+30.00	-10.19	-40.19
	2480 MHz	+30.00	-9.16	-39.16
Note: 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 Continues

Test Conditions: Conducted Measurement, Normal Temperature				
Antenna Type: Custom Integrated			**Power Setting:** See test plan	
Max. Directional Gain: + 2.51 dBi				
Signal State: Modulated at 100%.				
Ambient Temp.: 21° C			**Relative Humidity:**32%	
802.15.1 Mode				
Package	**Operating Channel**	**Limit [dBm]**	**Power [dBm]**	**Margin [dB]**
3-DH1	2402 MHz	+30.00	-8.66	-38.66
	2441 MHz	+30.00	-7.14	-37.14
	2480 MHz	+30.00	-6.08	-36.08
3-DH3	2402 MHz	+30.00	-11.13	-41.13
	2441 MHz	+30.00	-9.64	-39.64
	2480 MHz	+30.00	-8.60	-38.60
3-DH5	2402 MHz	+30.00	-12.91	-42.91
	2441 MHz	+30.00	-11.42	-41.42
	2480 MHz	+30.00	-10.36	-40.36
BLE	2402 MHz	+30.00	-7.07	-37.07
	2442 MHz	+30.00	-5.22	-35.22
	2480 MHz	+30.00	-4.15	-34.15
Note: Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.				

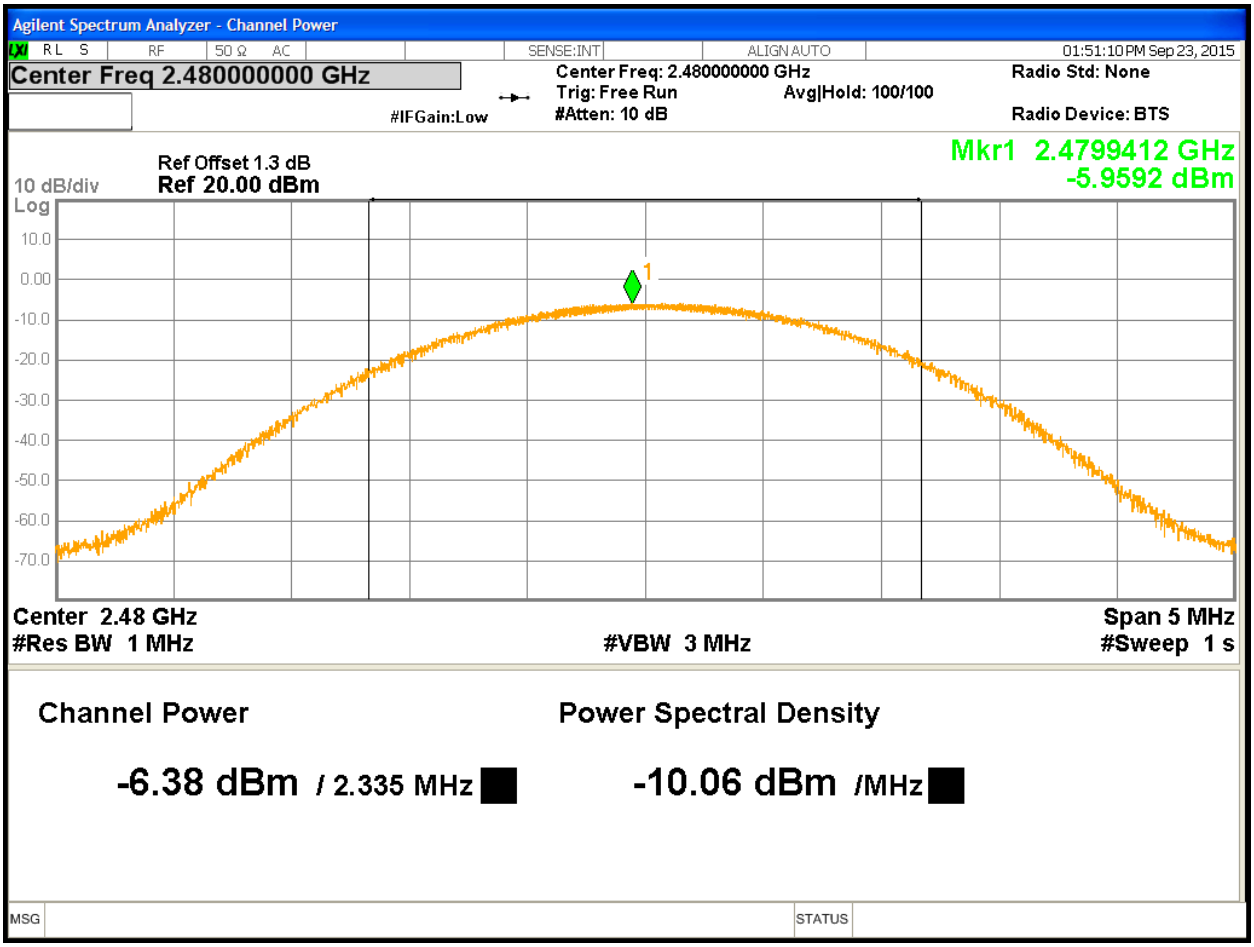


Figure 1: Maximum Transmitted Power, 2480 MHz (DH1)

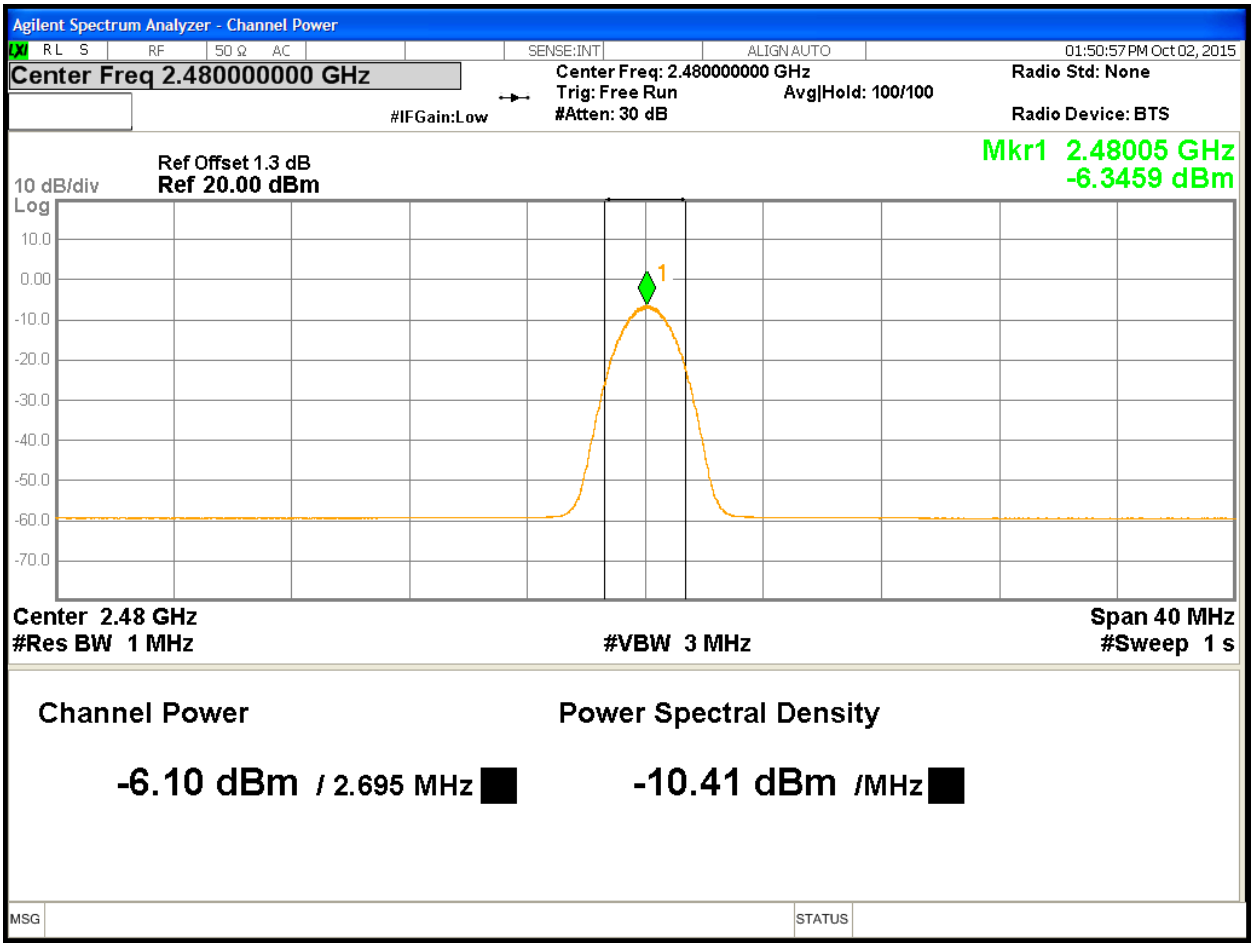


Figure 2: Maximum Transmitted Power, 2480 MHz (2-DH1)

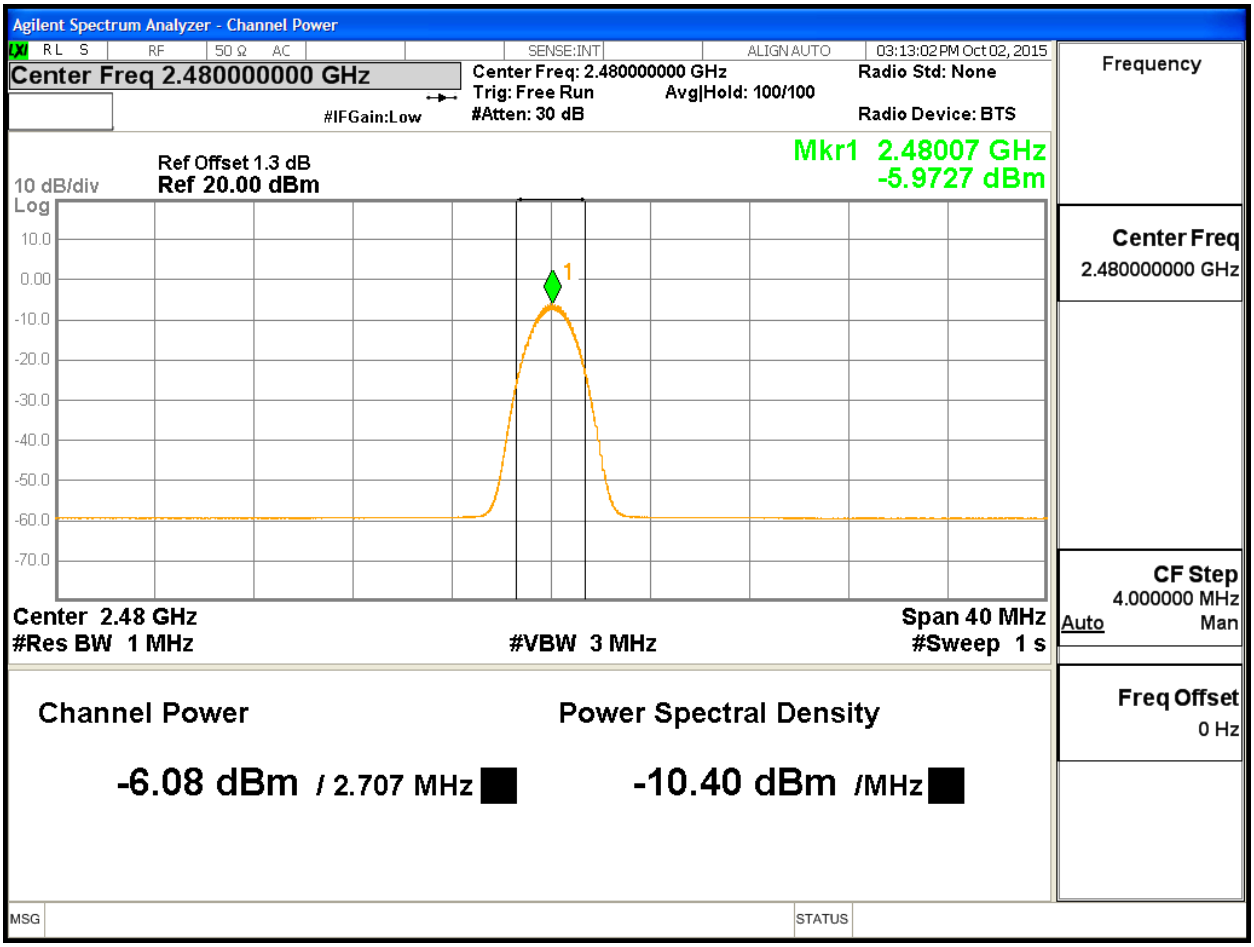


Figure 3: Maximum Transmitted Power, 2480 MHz (3-DH1)

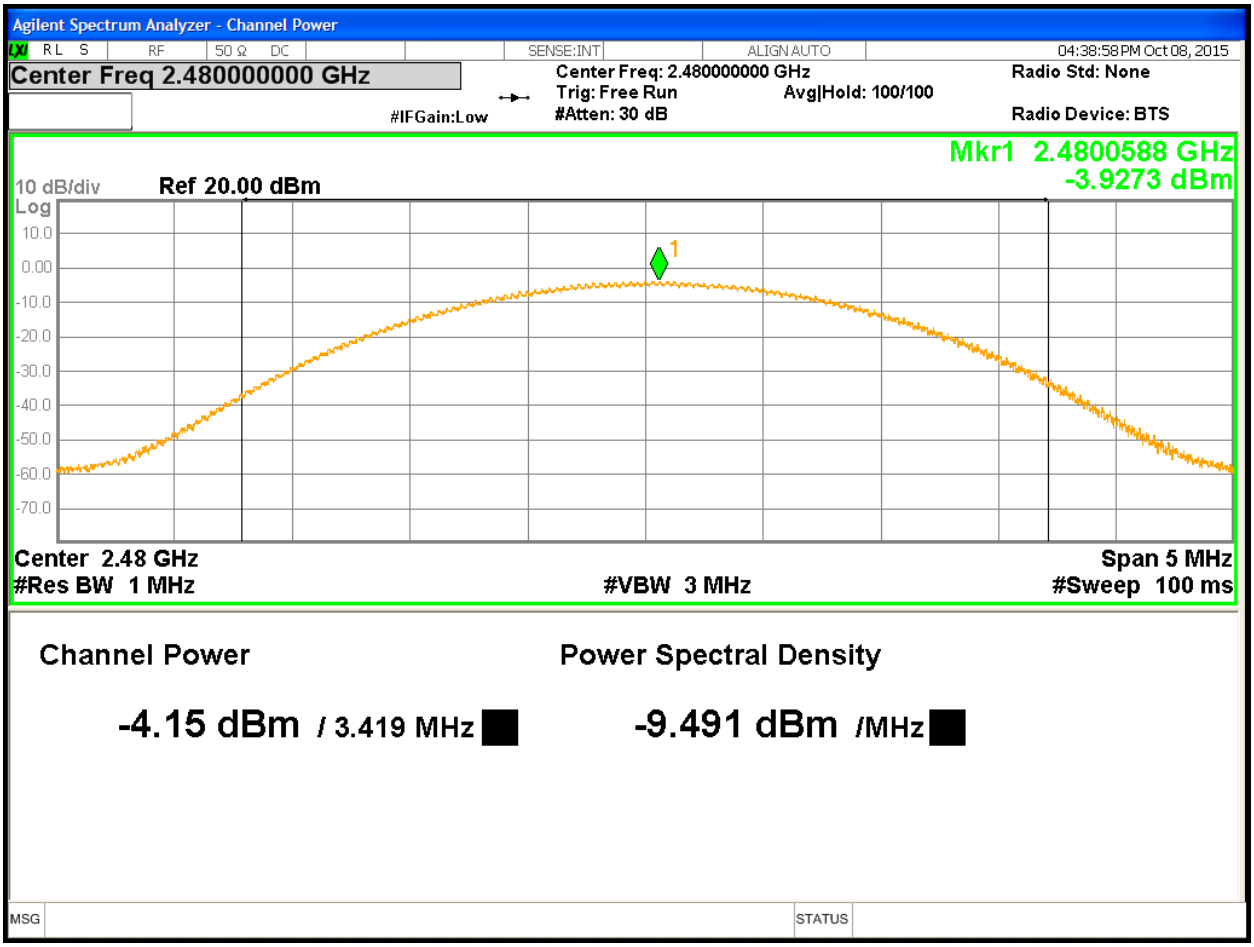


Figure 4: Maximum Transmitted Power, 2480 MHz (BLE)

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.

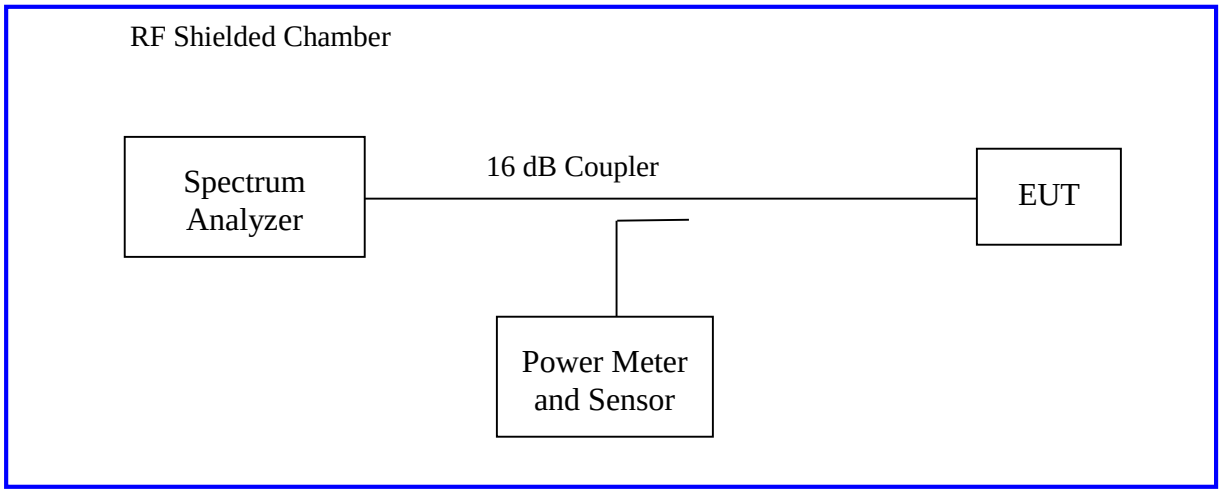
The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

20 dB bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.247(a) (1) 2015 and RSS Gen Sect. 6.6: 2014. This test was conducted on 3 channels on Home Wi-Fi Router. The worst sample result indicated below.

Test Setup:



4.2.2 Results

These measurements were used for information only

Table 4: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Custom Integrated		**Power Setting:** See test plan	
Max. Directional Gain: + 2.51 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 23° C		**Relative Humidity:**39%	
Bandwidth (MHz)			
Package	**Freq. (MHz)**	**20dB Bandwidth MHz**	**99% Bandwidth MHz**
DH1	2402	0.874	0.840
	2441	0.867	0.841
	2480	0.865	0.840
DH3	2402	0.828	0.876
	2441	0.886	0.869
	2480	0.881	0.874
DH5	2402	0.829	0.869
	2441	0.874	0.875
	2480	0.880	0.873
2-DH1	2402	1.267	1.160
	2441	1.244	1.160
	2480	1.243	1.160
2-DH3	2402	1.278	1.162
	2441	1.275	1.162
	2480	1.277	1.160

Table 5: Occupied Bandwidth – Test Results Continues

Test Conditions: Conducted Measurement, Normal Temperature			
Antenna Type: Custom Integrated		**Power Setting:** See test plan	
Max. Directional Gain: + 2.51 dBi			
Signal State: Modulated at 100%.			
Ambient Temp.: 23° C		**Relative Humidity:**39%	
Bandwidth (MHz)			
Package	**Freq. (MHz)**	**20dB Bandwidth MHz**	**99% Bandwidth MHz**
2-DH5	2402	1.256	1.162
	2441	1.276	1.157
	2480	1.277	1.164
3-DH1	2402	1.211	1.150
	2441	1.207	1.151
	2480	1.207	1.150
3-DH3	2402	1.209	1.157
	2441	1.211	1.156
	2480	1.211	1.159
3-DH5	2402	1.210	1.157
	2441	1.202	1.153
	2480	1.211	1.160
Package	**Freq. (MHz)**	**6dB Bandwidth MHz**	**99% Bandwidth MHz**
BLE	2402	0.649	1.059
	2442	0.651	1.058
	2480	0.651	1.058

Note: 1. Worst case for frequency range is plotted below.
2. BLE was tested as DTS.
3. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.

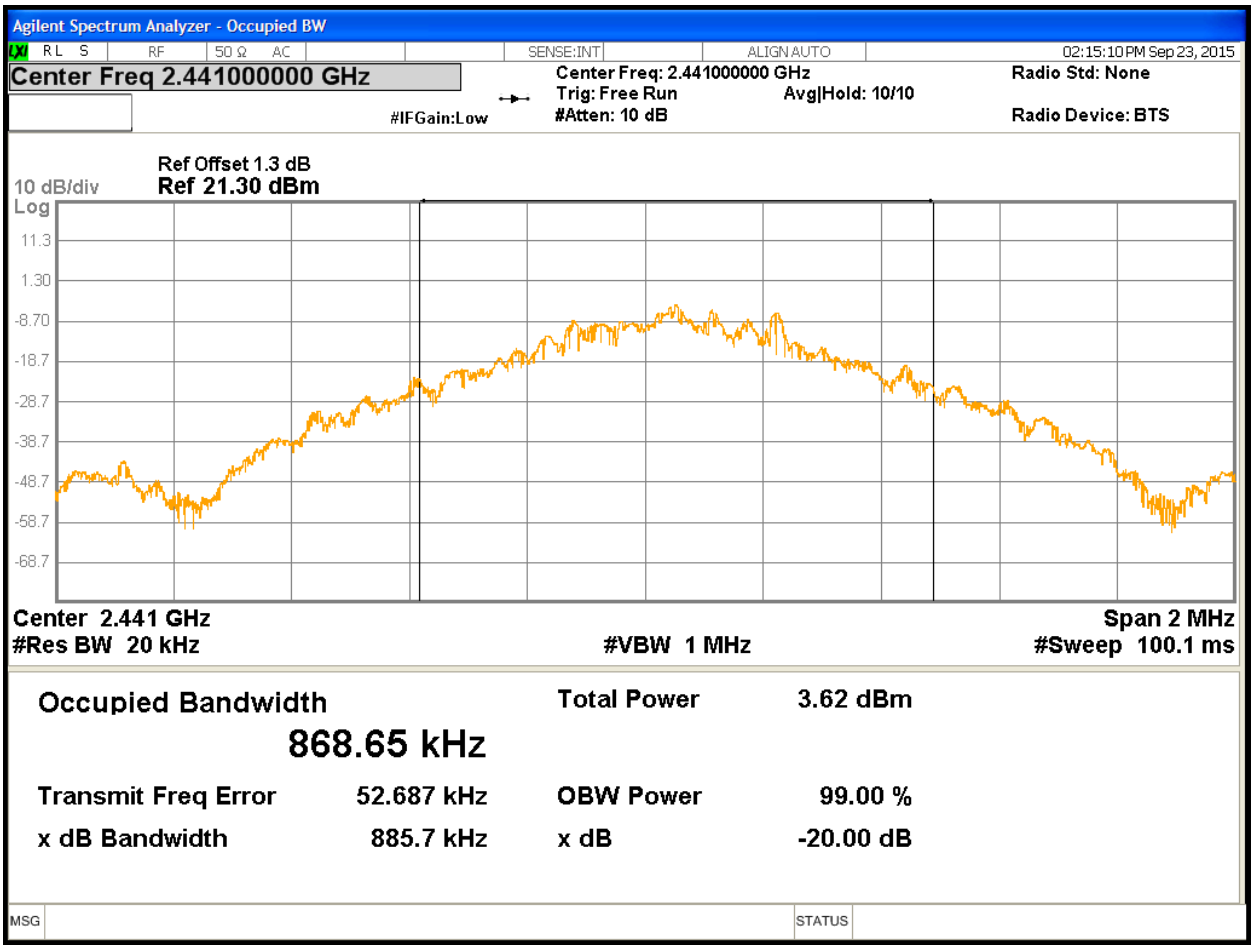


Figure 5: Occupied Bandwidth at 2441 MHz (DH3)

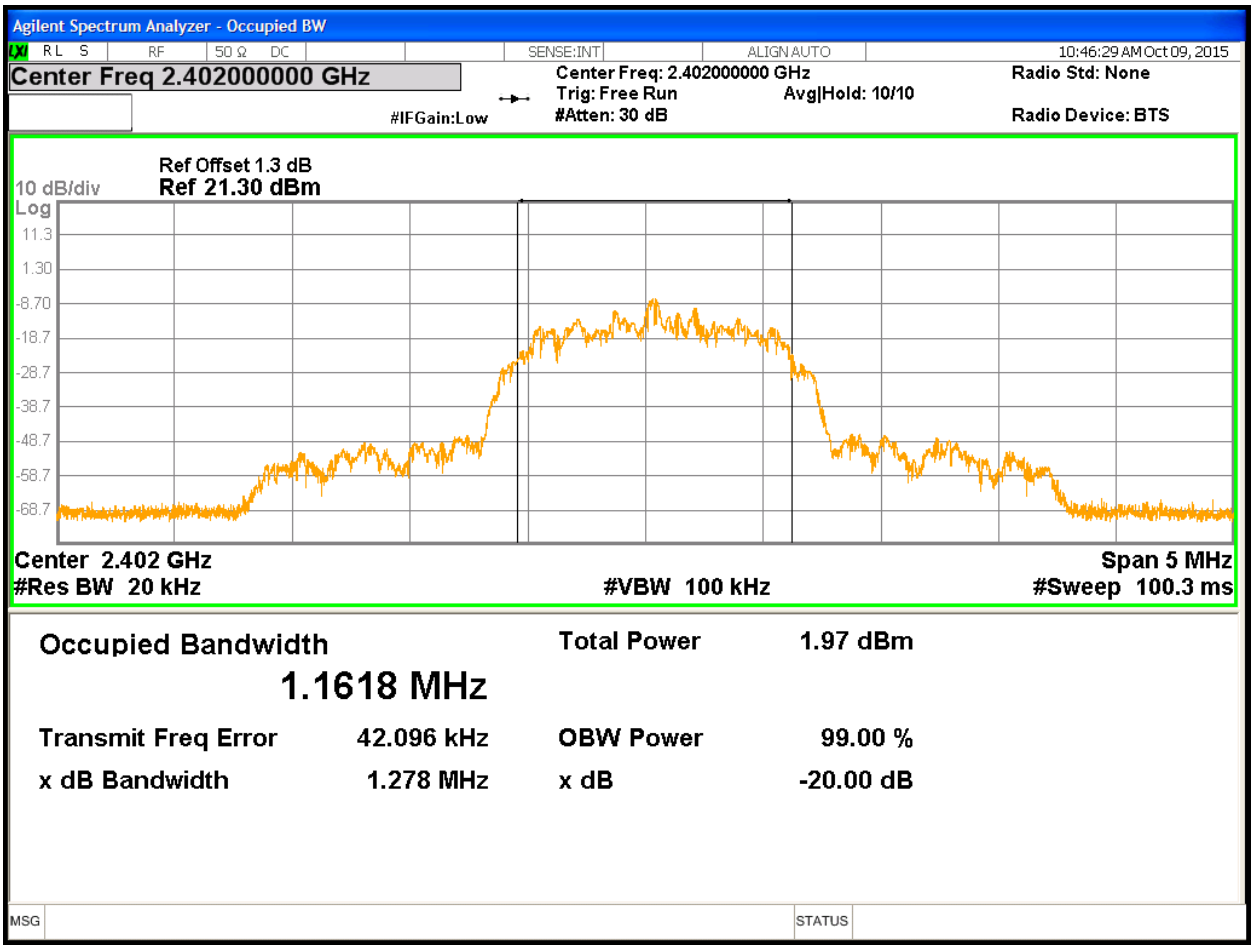


Figure 6: Occupied Bandwidth at 2402 MHz (2-DH3)

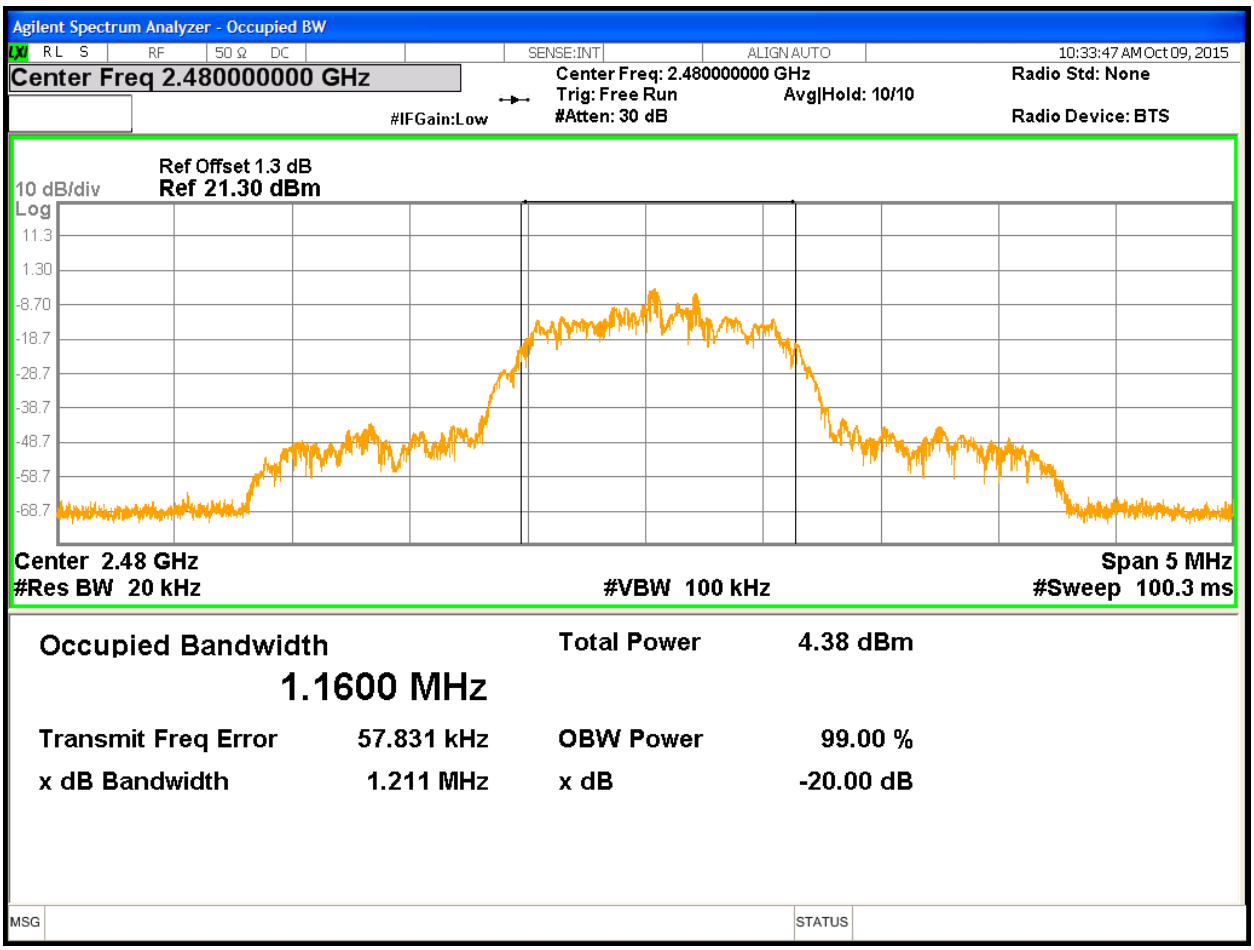


Figure 7: Occupied Bandwidth at 2480 MHz (3-DH5)

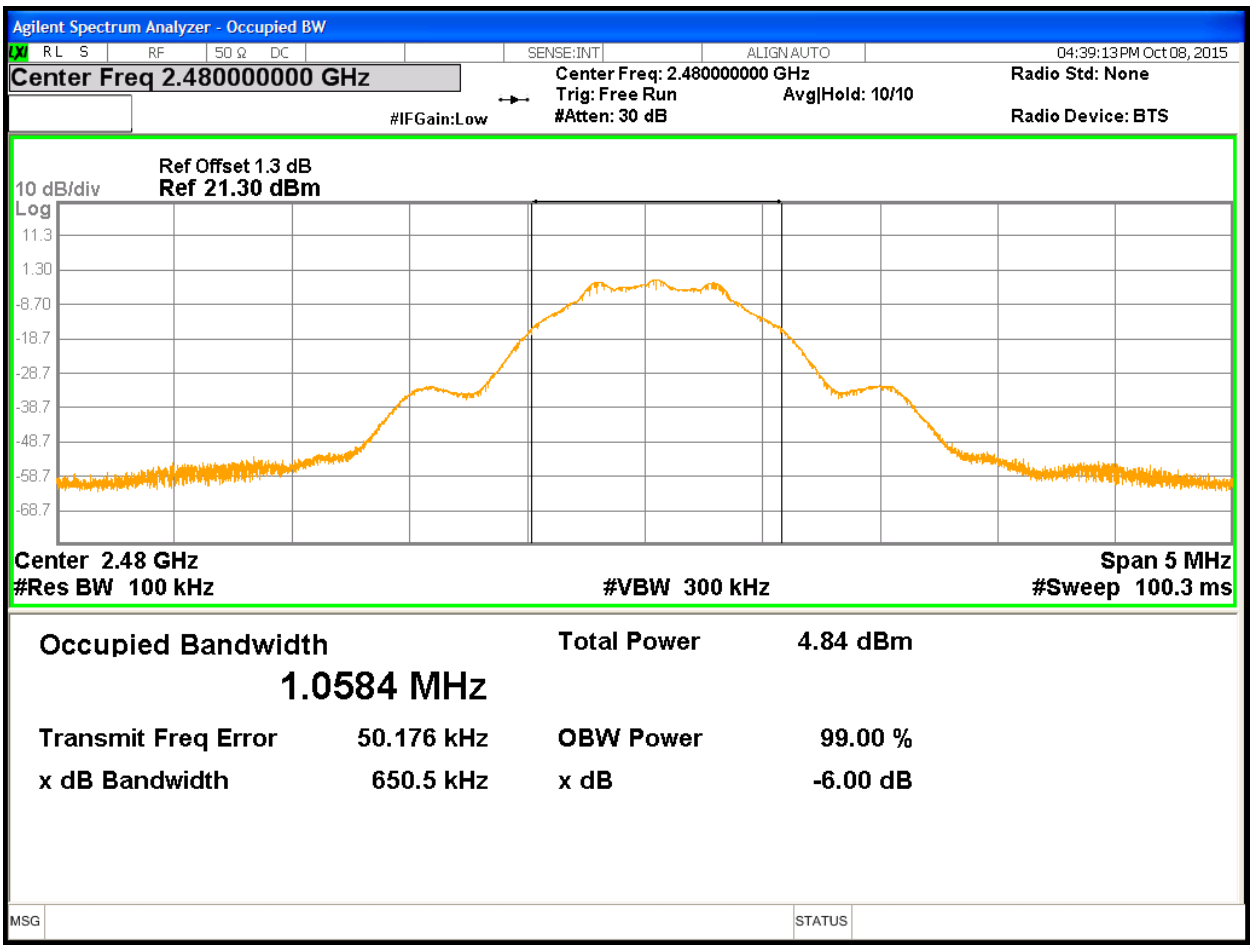


Figure 8: Occupied Bandwidth at 2480 MHz (BLE)

4.3 Hopping Frequency Requirements

The Frequency Hopping Requirements are applicable to the equipment using Frequency Hopping Spread Spectrum (FHSS) modulation.

Per CFR47 15.247 (a1), RSS 247 Sect.5.1.2 and 5.1.4, frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

The setup was identical to RF output power measurement.

4.3.1 Results

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

Table 6: Frequency Hopping Requirements

Test Conditions: Conducted Measurement, Normal Temperature					
Antenna Type: Custom Integrated			**Power Setting:** See test plan		
Max. Directional Gain: + 2.51 dBi					
Signal State: Modulated at 100%.					
Ambient Temp.: 23° C			**Relative Humidity:**39%		
Average Occupancy Time					
Package	**Pulse Width (ms)**	**# of Pulses (3.2s)**	**Ave. Time (ms)**	**Limit (s)**	**Result**
DH1	0.40	76	304.0	< 0.4	Pass
DH3	0.99	36	356.4	< 0.4	Pass
DH5	0.99	27	267.3	< 0.4	Pass
2-DH1	0.41	81	332.1	< 0.4	Pass

2-DH3	0.59	41	241.9	< 0.4	Pass
2-DH5	0.60	32	192.0	< 0.4	Pass
3-DH1	0.41	82	336.2	< 0.4	Pass
3-DH3	0.40	91	364.0	< 0.4	Pass
3-DH5	0.46	42	193.2	< 0.4	Pass

Note: 1. Since the dwell time in each channel must less than 0.4 seconds. The total time for dwell all 79 channels is 31.6 seconds. To determine the average dwell time, the frequency 2441MHz was sample in 3.2 second, 1/10th of the total 79 channel dwell time.
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.

Minimum Channel Separation

Package	Hopping Separation (kHz)	Two-Third of 20dB Bandwidth Limit (kHz)	Result
DH1	992	> 582.70	Pass
DH3	1036	> 590.70	Pass
DH5	984	> 586.70	Pass
2-DH1	1002	> 844.71	Pass
2-DH3	990	> 852.04	Pass
2-DH5	1008	> 851.38	Pass
3-DH1	1008	> 807.37	Pass
3-DH3	984	> 807.37	Pass
3-DH5	1002	> 807.37	Pass

Note: The EUT was hopping randomly all 79 operating channels. The channel separation was measured at the middle channel, 2441 MHz. Two-Third of the highest 20dB bandwidth was used.

Minimum Number of Channels

Range (2402MHz -2480MHz)	Min. Channel Limit	Result
79	15	Pass

Note: N/A

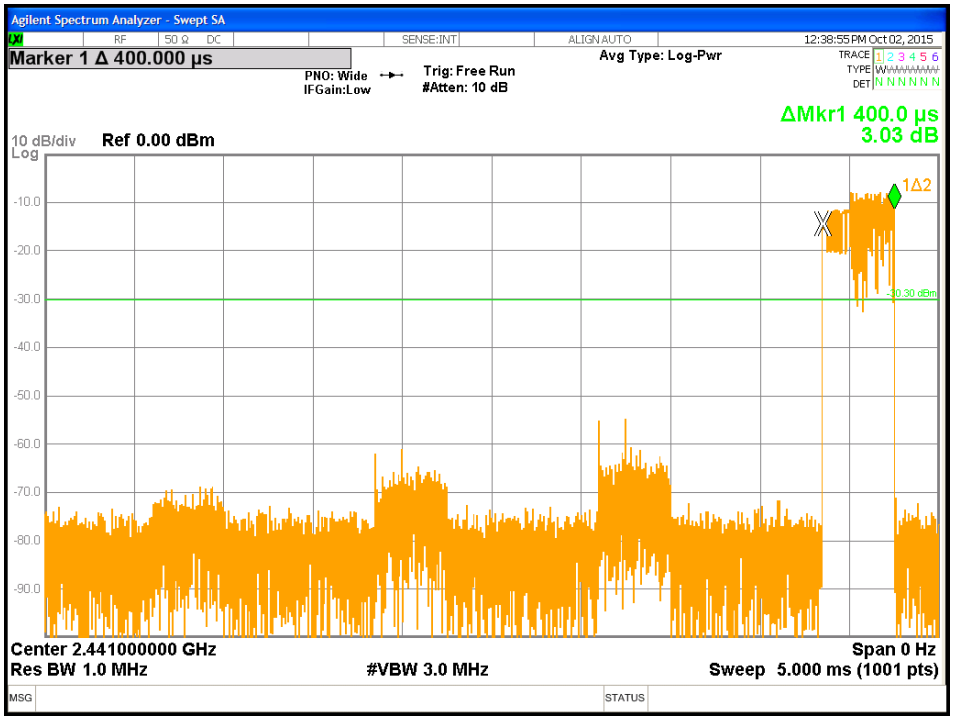


Figure 9: Pulse Width at 2441MHz for 3-DH3

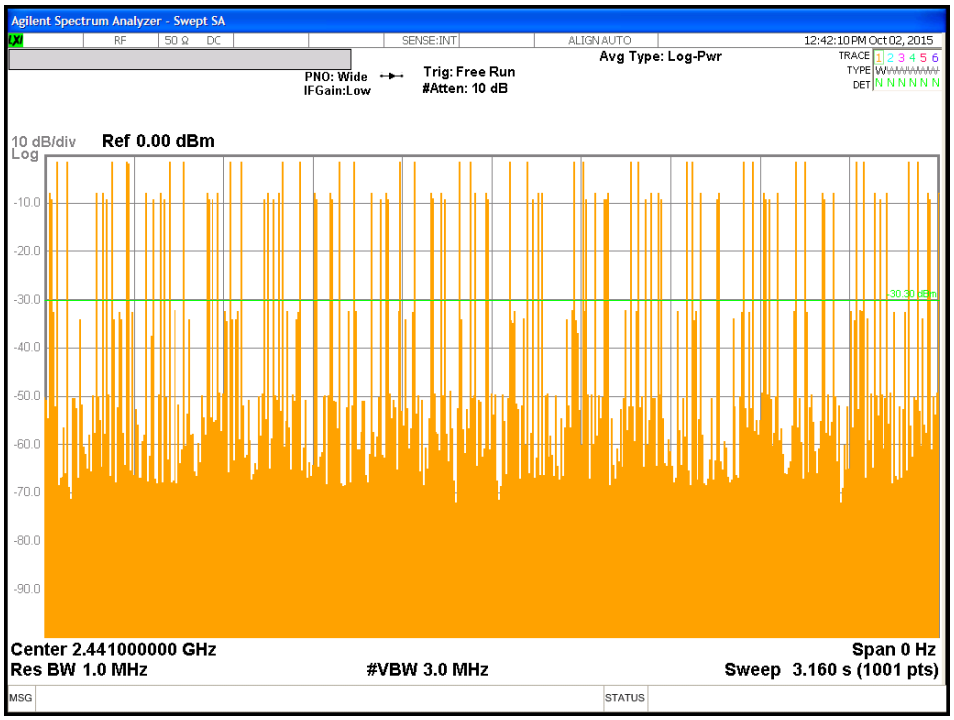


Figure 10: Average Dwell Time for Channel 2441MHz – 91 Pulses

Note: There are 91 pulses in 3.16 seconds.

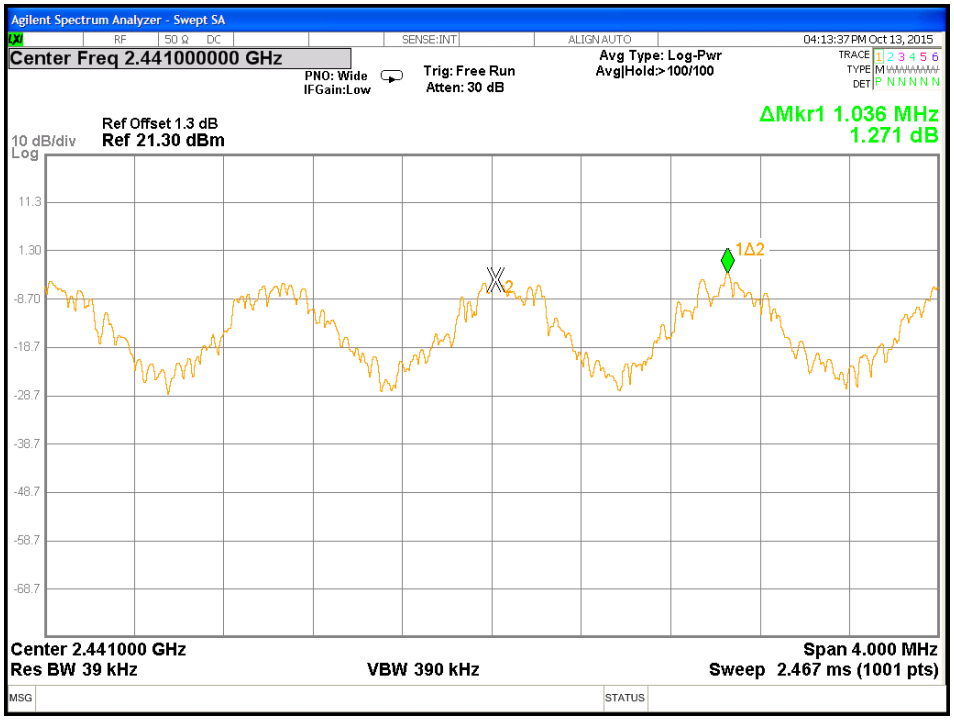


Figure 11: Hopping Separation for DH3

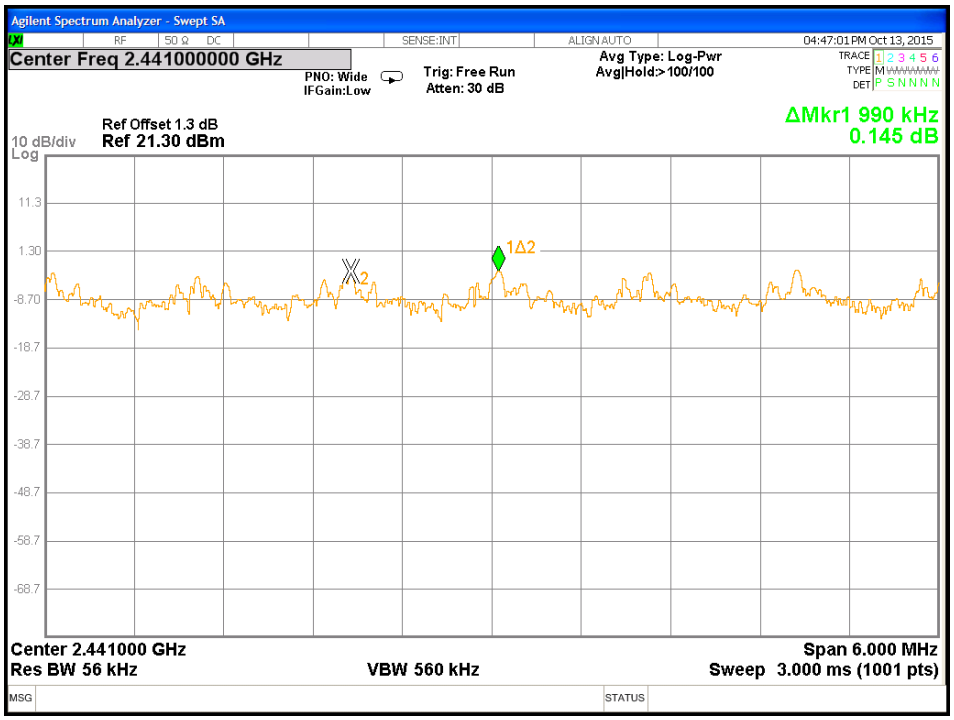


Figure 12: Hopping Separation for 2-DH3

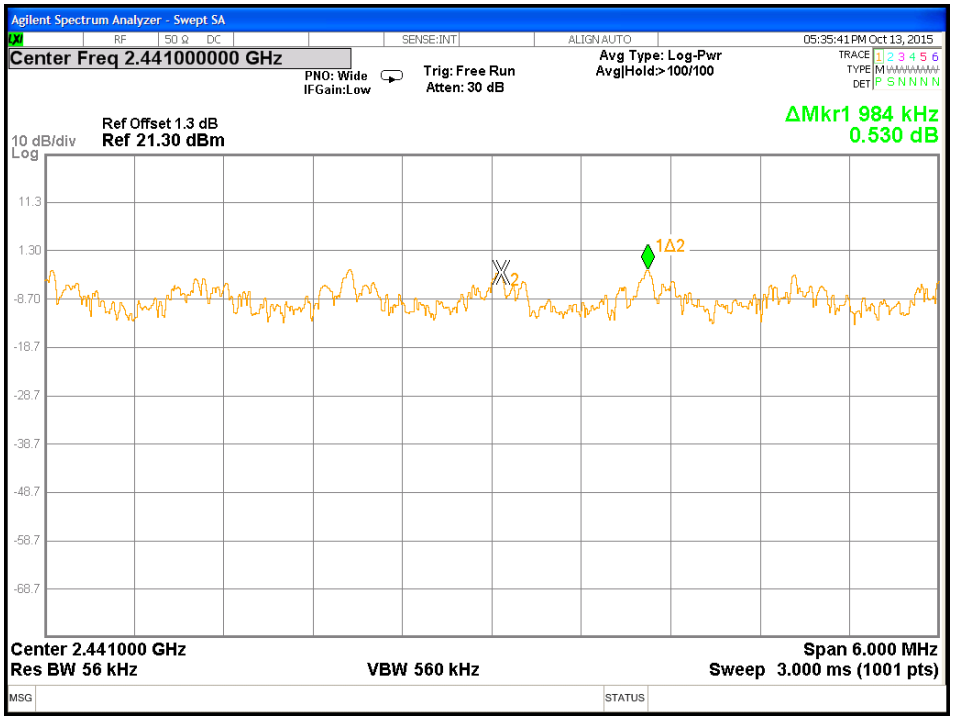


Figure 13: Hopping Separation for 3-DH3

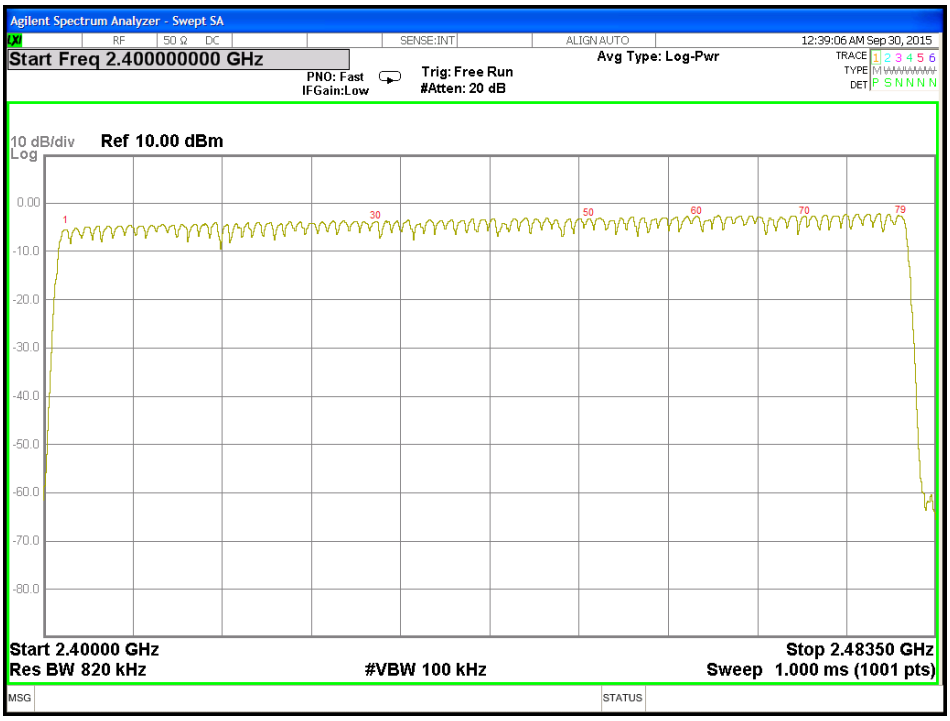


Figure 14: Number of Operating Channels (79)

4.4 Out of Band Emission requirements

The setup was identical to RF output power measurement. Intentional radiators operating under the alternative provisions to the general emission limits, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If the frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Any frequency outside the band of 2400 MHz to 2483.5 MHz, the power output level must be below 20 dB from the in-band transmitting signal; CFR 47 Part 15.215, 15.247(d) and RSS 247 Sect.5.5.

The setup was identical to RF output power measurement.

This test was conducted on 3 channels on Home Wi-Fi Router.

4.1.1 Results

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

Table 7: Band Edge Requirements – Test Results

Test Conditions: Conducted Measurement, Normal Temperature				
Antenna Type: Custom Integrated			**Power Setting:** See test plan	
Max. Directional Gain: + 2.51 dBi				
Signal State: Modulated at 100%.				
Ambient Temp.: 23° C			**Relative Humidity:**35%	
-30 dBr Band Edge Results				
Package	**Operating Freq. (MHz)**	**Limit (dBm)**	**Measured Value (dBm)**	**Result**
DH5	2402	-34.46	-59.90	Pass
	2441	-32.77	-63.17	Pass
	2480	-32.61	-61.32	Pass
2-DH5	2402	-33.73	-59.24	Pass
	2441	-32.22	-59.19	Pass
	2480	-31.16	-58.12	Pass

3-DH5	2402	-33.73	-59.43	Pass
	2441	-32.23	-59.87	Pass
	2480	-31.14	-59.54	Pass
Note: The stated limits for 20 dBr are relative to each individual output per KDB 662911 Method. The worst case of each data rate is recorded.				

Out of Band Emission				
Package	**Operating Freq. (MHz)**	**Limit (dBm)**	**Measured Value (dBm)**	**Result**
DH5	2402	-34.46	-48.96 dBm (23.749GHz)	Pass
	2441	-32.77	-48.92 dBm (23.796GHz)	Pass
	2480	-32.61	-48.12 dBm (22.253GHz)	Pass
2-DH5	2402	-33.73	-49.63 dBm (21.745GHz)	Pass
	2441	-32.22	-49.09 dBm (24.337GHz)	Pass
	2480	-31.15	-49.52 dBm (23.937GHz)	Pass
3-DH5	2402	-33.73	-49.28 dBm (22.615GHz)	Pass
	2441	-32.23	-48.53 dBm (23.808GHz)	Pass
	2480	-31.14	-49.46 dBm (24.077GHz)	Pass
Note: 1. The stated limits are relative to each individual output per KDB 662911 Method. 2. Plots for all the measurements stated above were taken including other modes. To reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.				

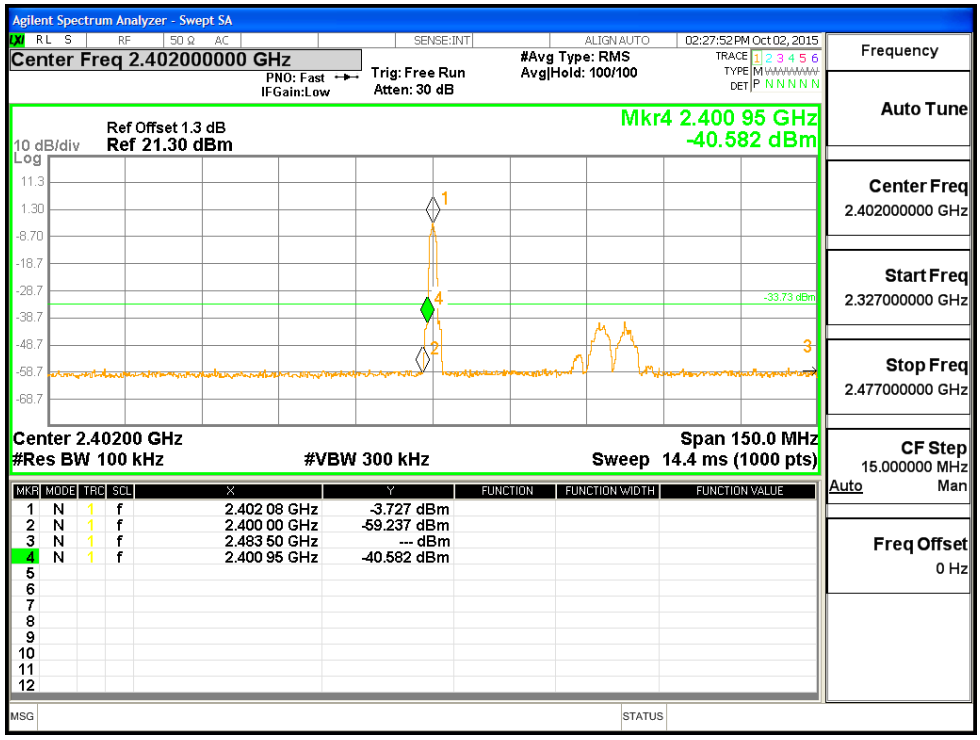


Figure 15: Band Edge Requirements at 2402 MHz – 2-DH5

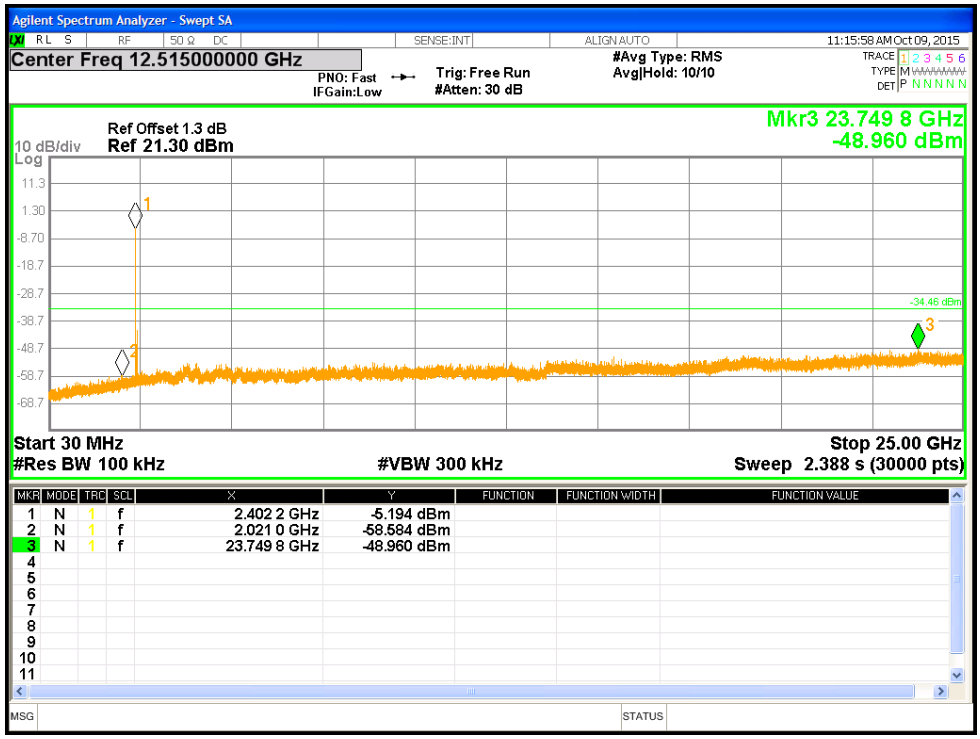


Figure 16: Out of Band Emission Requirements at 2402 MHz – DH5

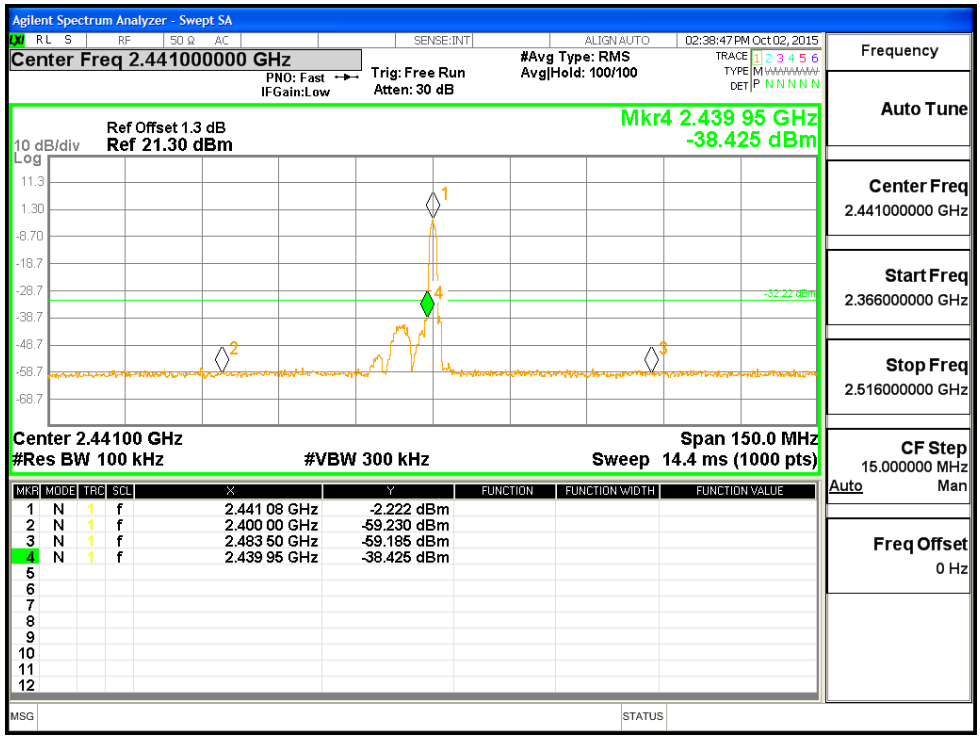


Figure 17: Band Edge Requirements at 2441 MHz – 2-DH5

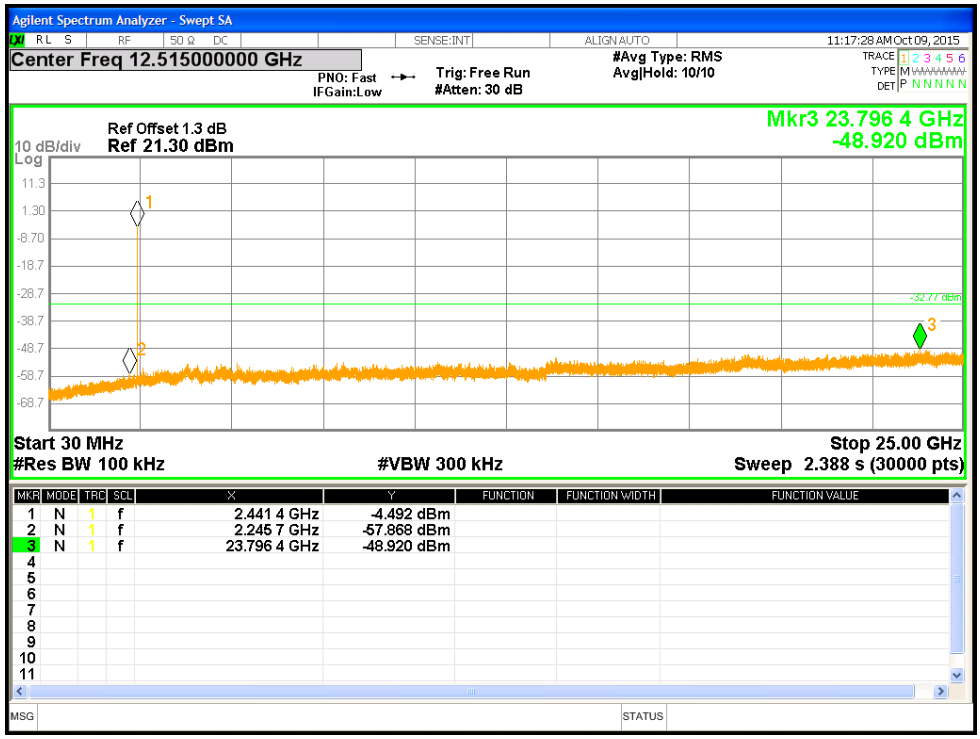


Figure 18: Out of Band Emission Requirements at 2441 MHz – DH5

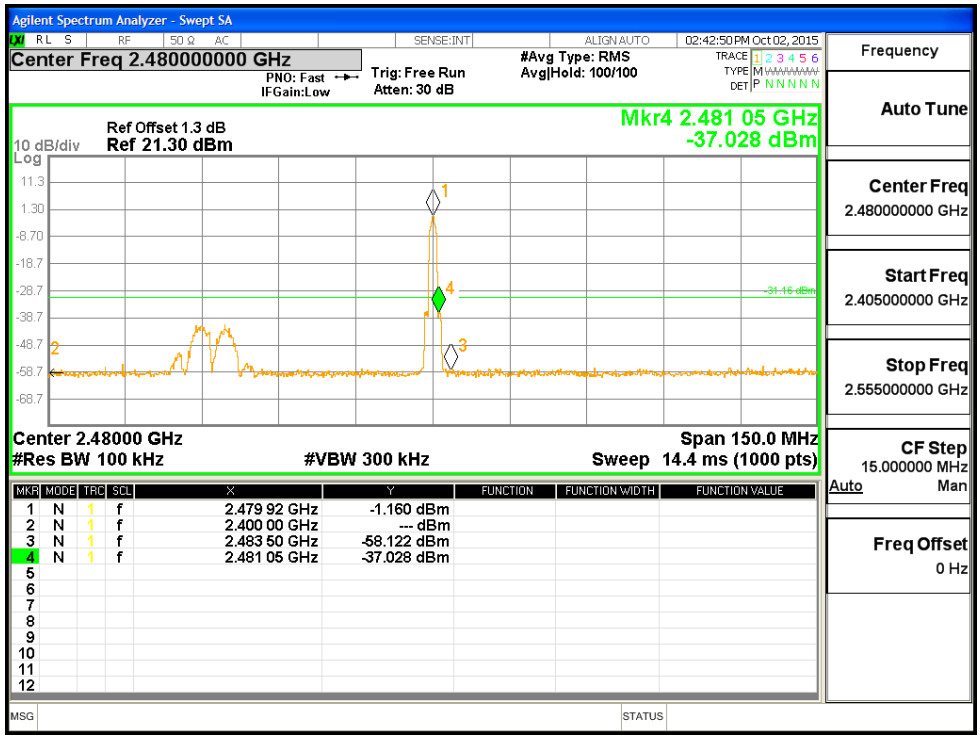


Figure 19: Band Edge Requirements at 2480 MHz – 2-DH5

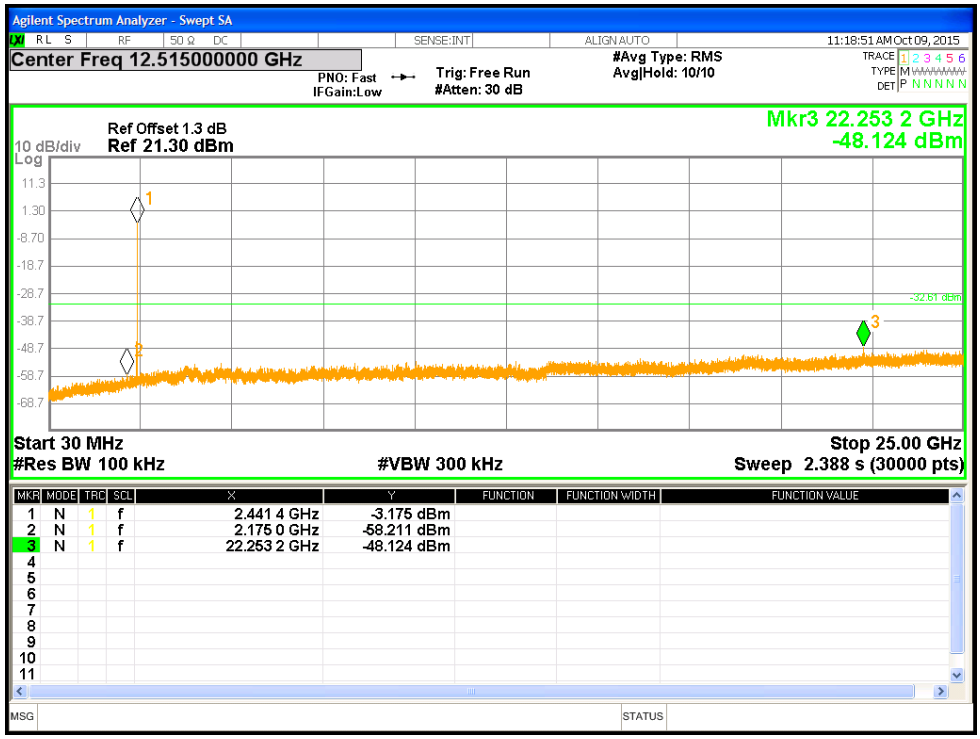


Figure 20: Out of Band Emission Requirements at 2480 MHz – DH5

4.5 Transmitter Spurious 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

4.6.1 Test Methodology

4.6.1.1 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.

4.6.1.2 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.

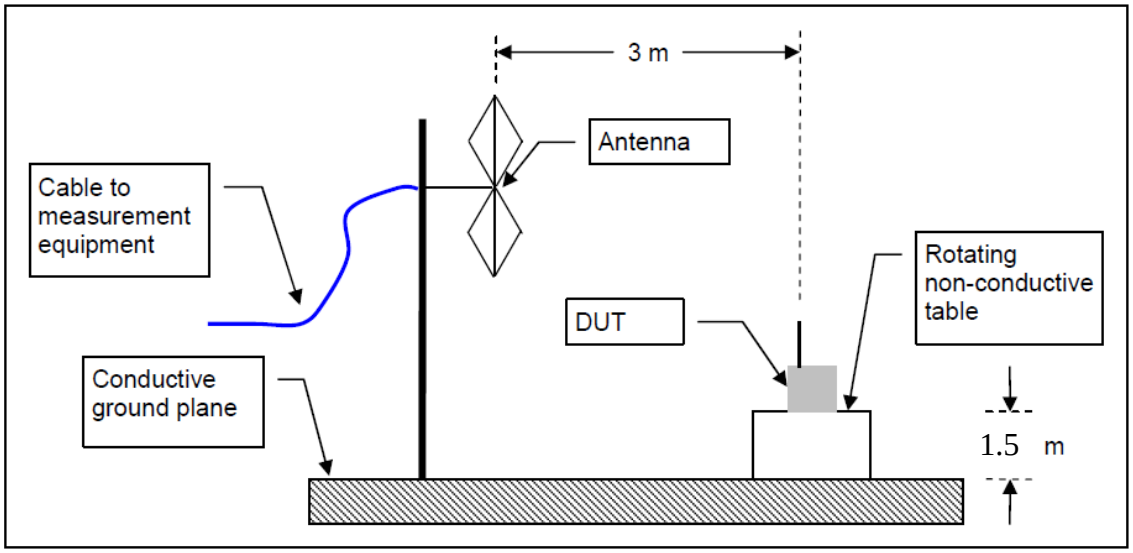
Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final scans performed on the worst case for three operating channels: 2402 MHz, 2441 MHz, and 2480 MHz at DH5.

4.6.1.3 Deviations

None.

Test Setup:



4.6.2 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. 8.9: 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 20 dB below the in-band emission.

4.6.3 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 8: Transmit Spurious Emission at Restricted Band Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature								
Antenna Type: Custom Integrated				**Power Setting:** See test plan				
Max. Directional Gain: + 2.51 dBi								
Signal State: Modulated at 100%.								
Ambient Temp.: 20° C				**Relative Humidity:**47%				
Band-Edge Results								
Freq. (MHz)	Level (dBuV/m)	Pol. (H/V)	Limit (dBuV/m)	Margin (dB)	Det.	Table Deg.	Tower (cm)	Note
2382.78	57.61	V	74.00	-16.39	Pk	128	126	Figure 21: DH5-2402MHz
2390.00	43.28	V	54.00	-10.72	Ave	128	126	Figure 22: DH5-2402MHz
2379.98	57.40	H	74.00	-16.60	Pk	322	122	Figure 23: DH5-2402MHz
2388.39	43.27	H	54.00	-10.73	Ave	322	122	Figure 24: DH5-2402MHz
2486.71	57.66	H	74.00	-16.34	Pk	326	134	Figure 25: DH5-2480MHz
2486.21	42.74	H	54.00	-11.26	Ave	326	134	Figure 26: DH5-2480MHz
2486.21	57.15	V	74.00	-16.85	Pk	139	177	Figure 27: DH5-2480MHz
2487.31	42.74	V	54.00	-11.26	Ave	139	177	Figure 28: DH5-2480MHz
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.								

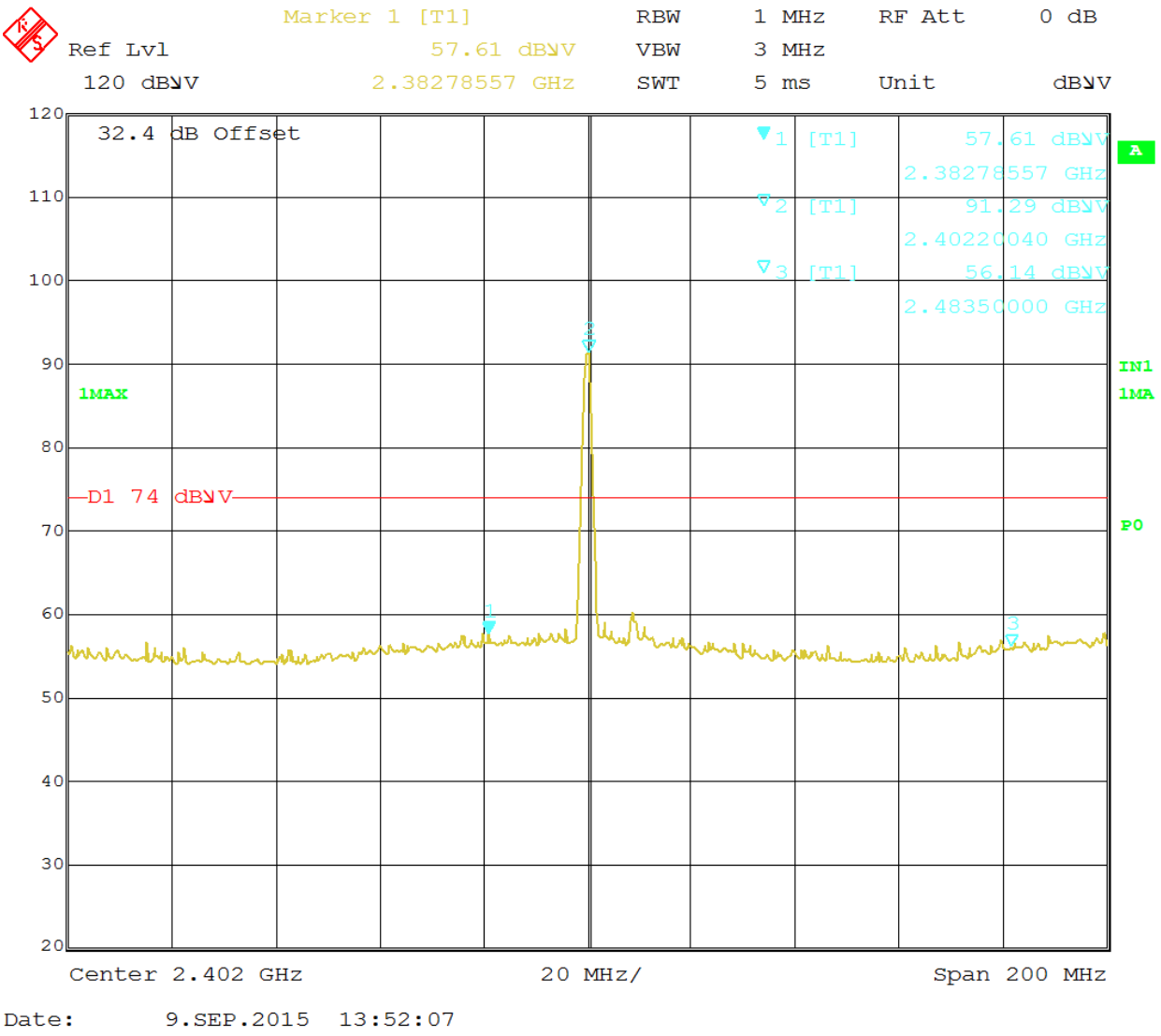


Figure 21: Radiated Emission at the 2390MHz Edge for Channel 2402MHz at DH5 – Vertical (Pk)

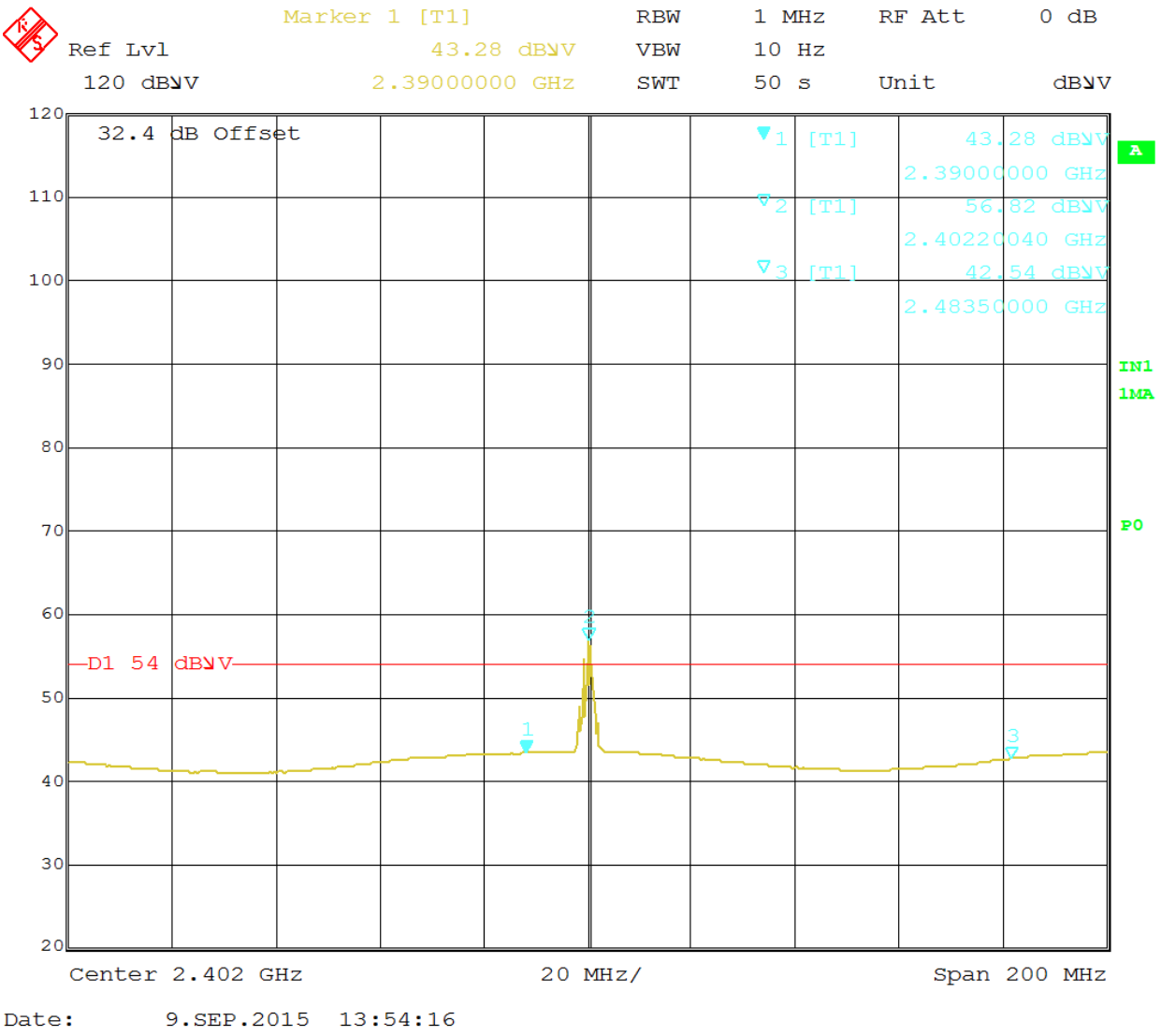


Figure 22: Radiated Emission at the 2390MHz Edge for Channel 2402MHz at DH5 – Vertical (Avg)

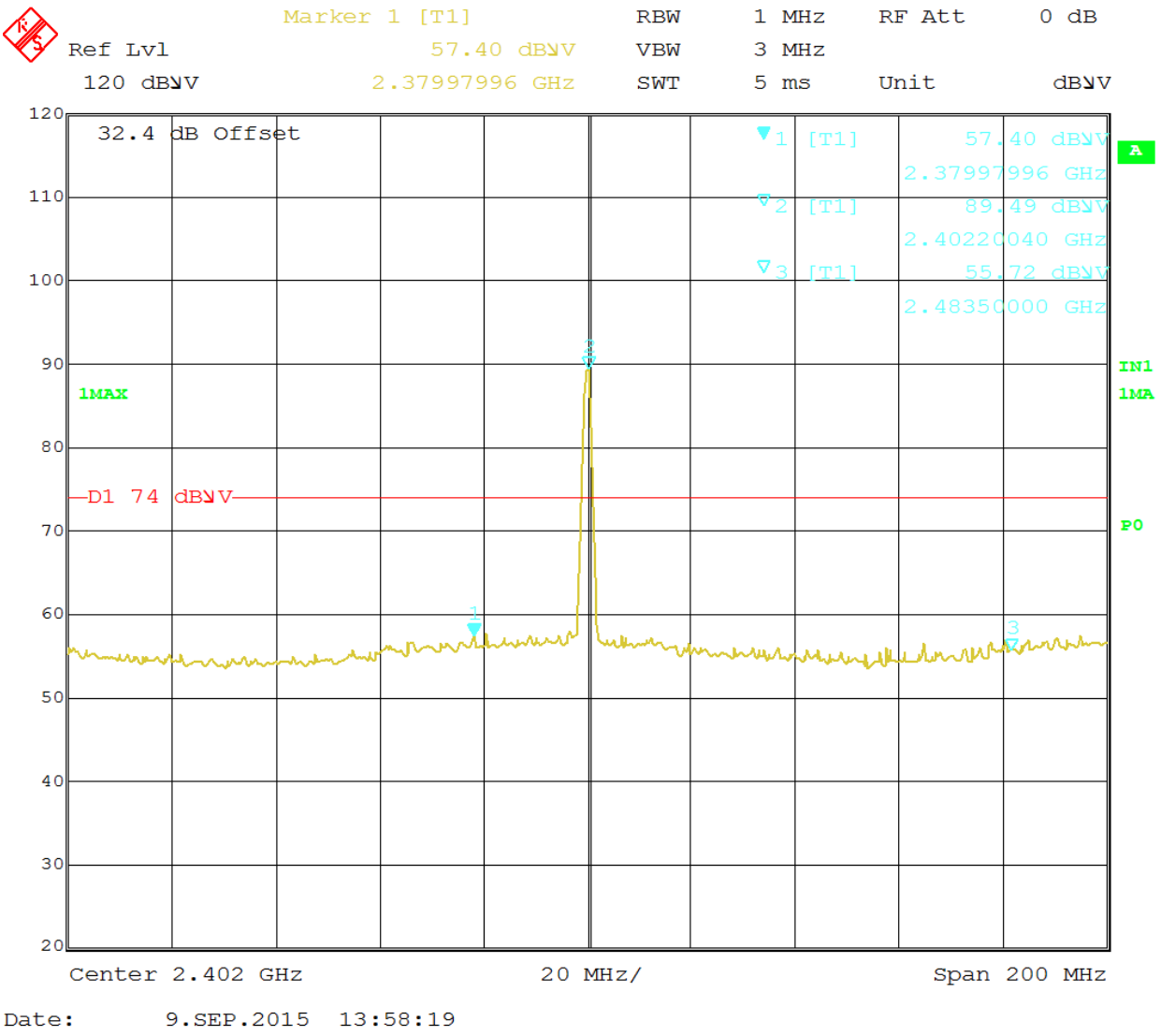


Figure 23: Radiated Emission at the 2390MHz Edge for Channel 2402MHz at DH5 – Horizontal (Pk)

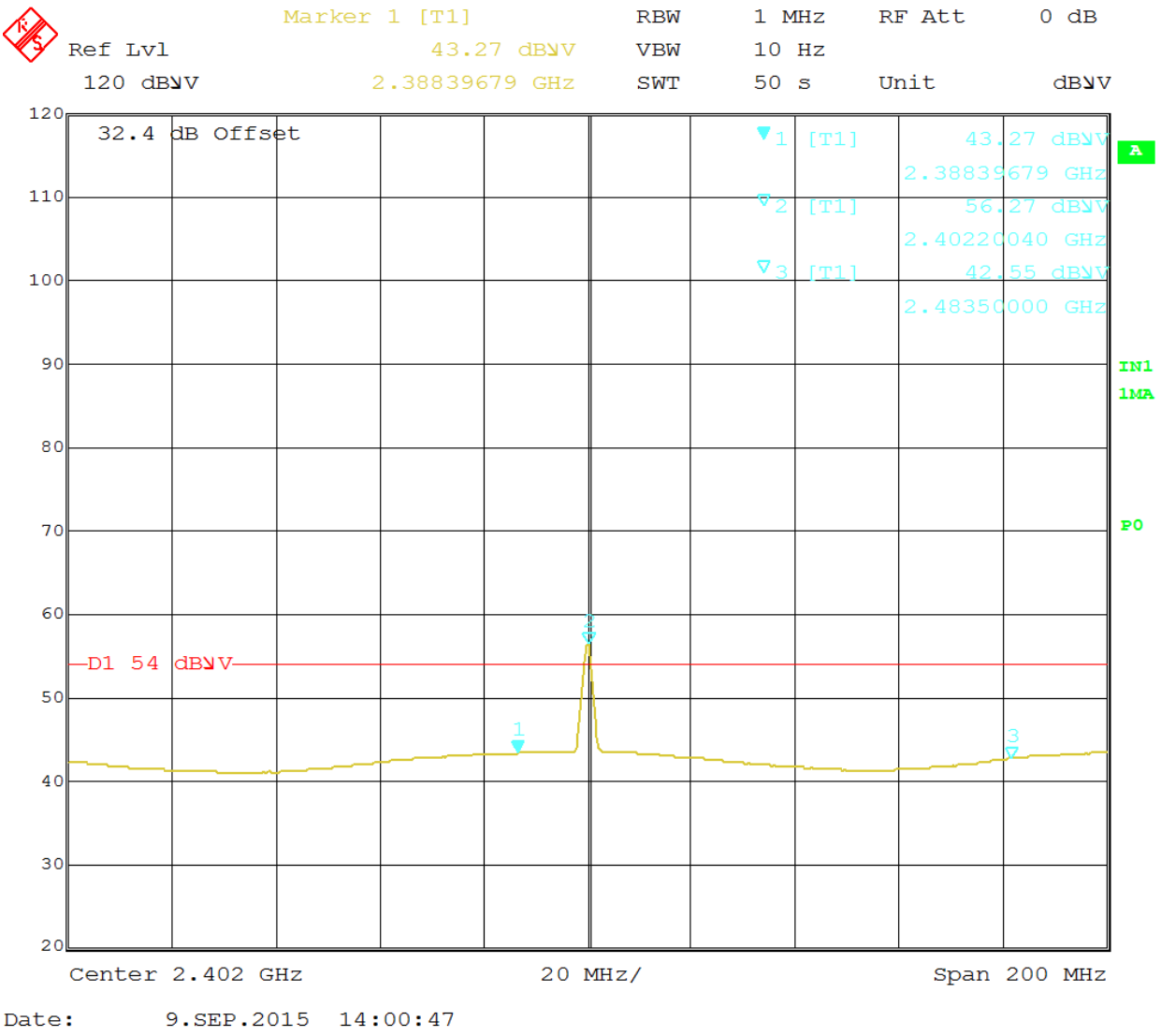


Figure 24: Radiated Emission at the 2390MHz Edge for Channel 2402MHz at DH5 – Horizontal (Avg)

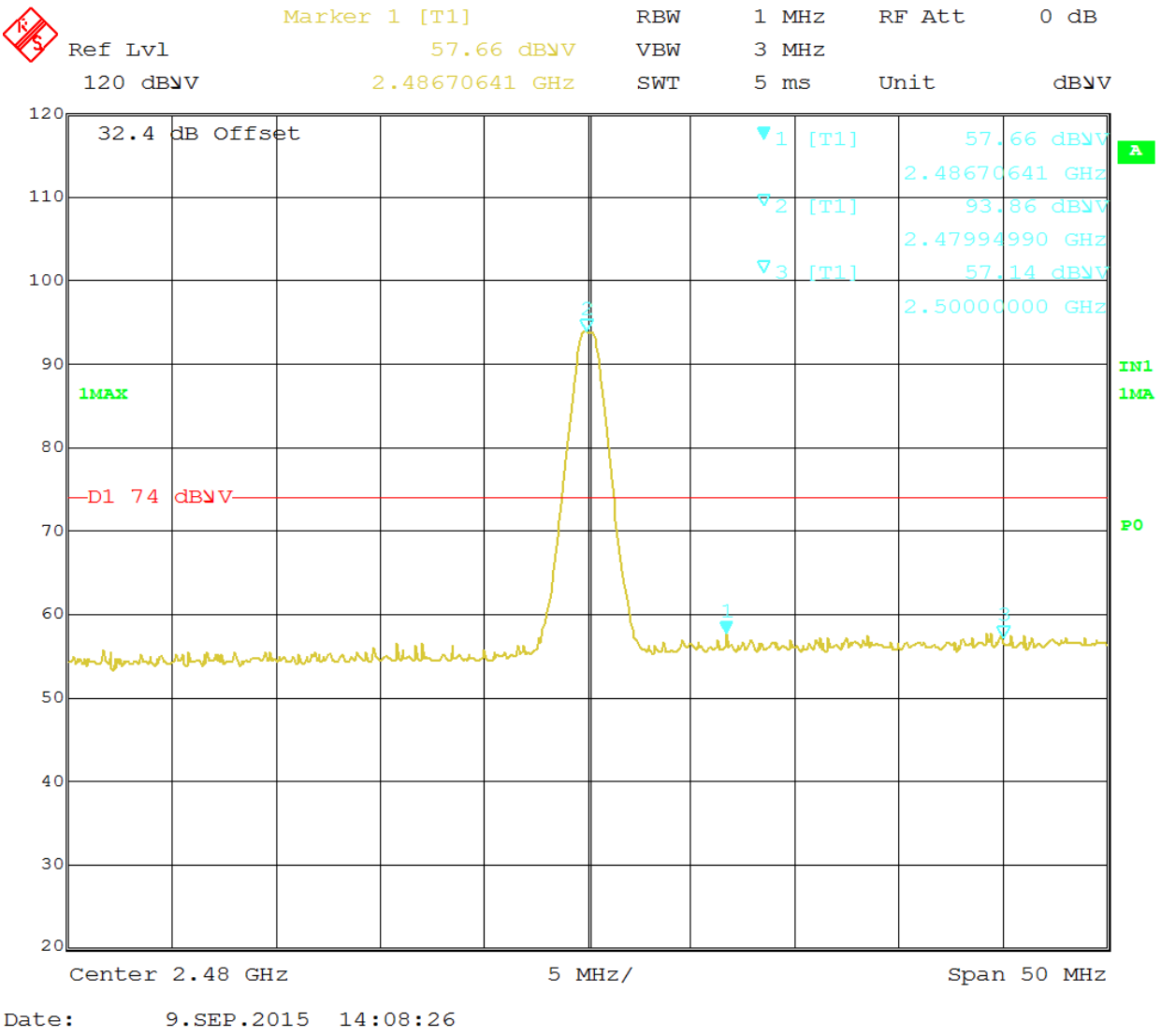


Figure 25: Radiated Emission at the 2483.5MHz Edge for Channel 2480MHz at DH5 – Horizontal (Pk)

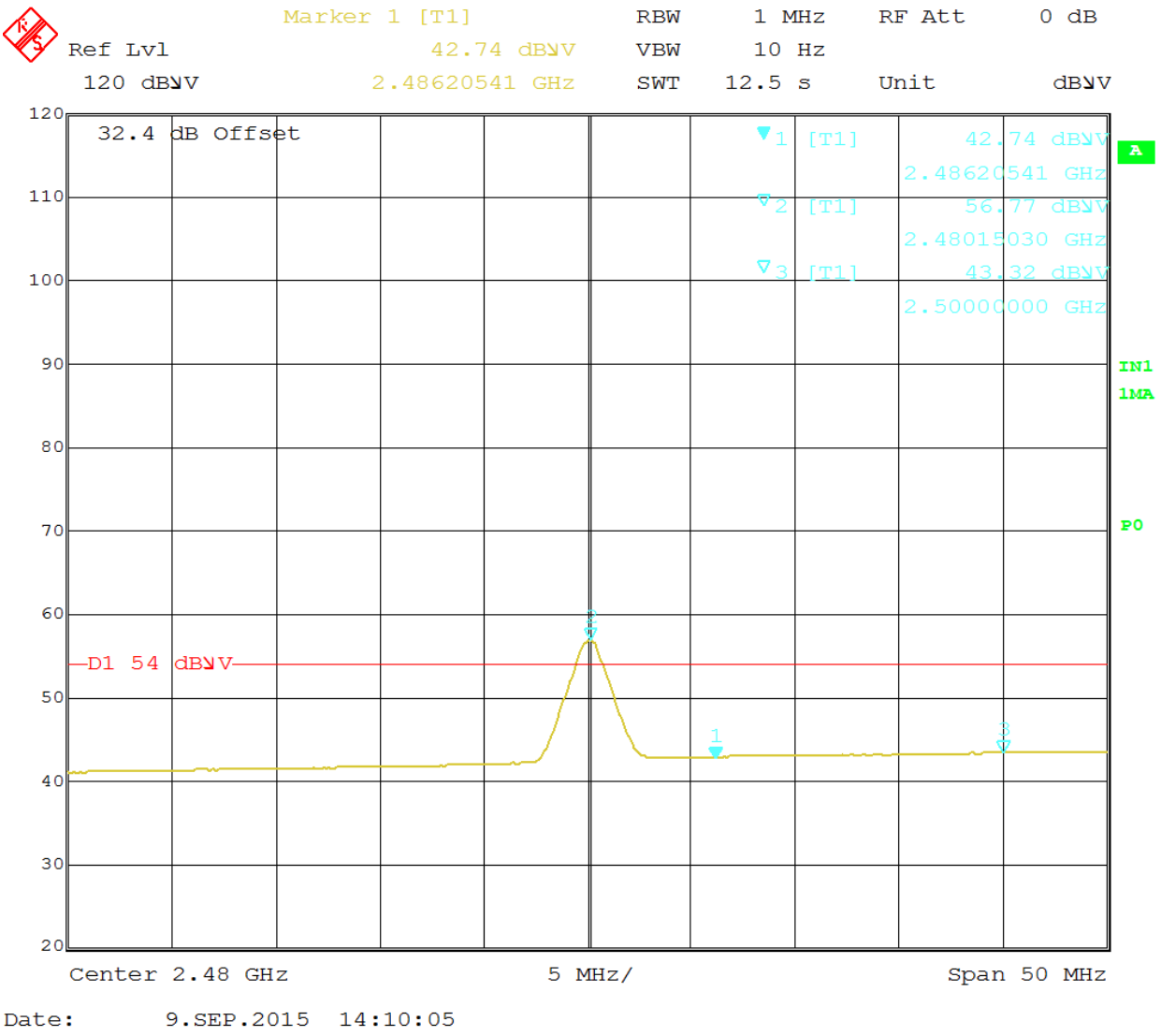


Figure 26: Radiated Emission at the 2483.5MHz Edge for Channel 2480MHz at DH5 – Horizontal (Avg)

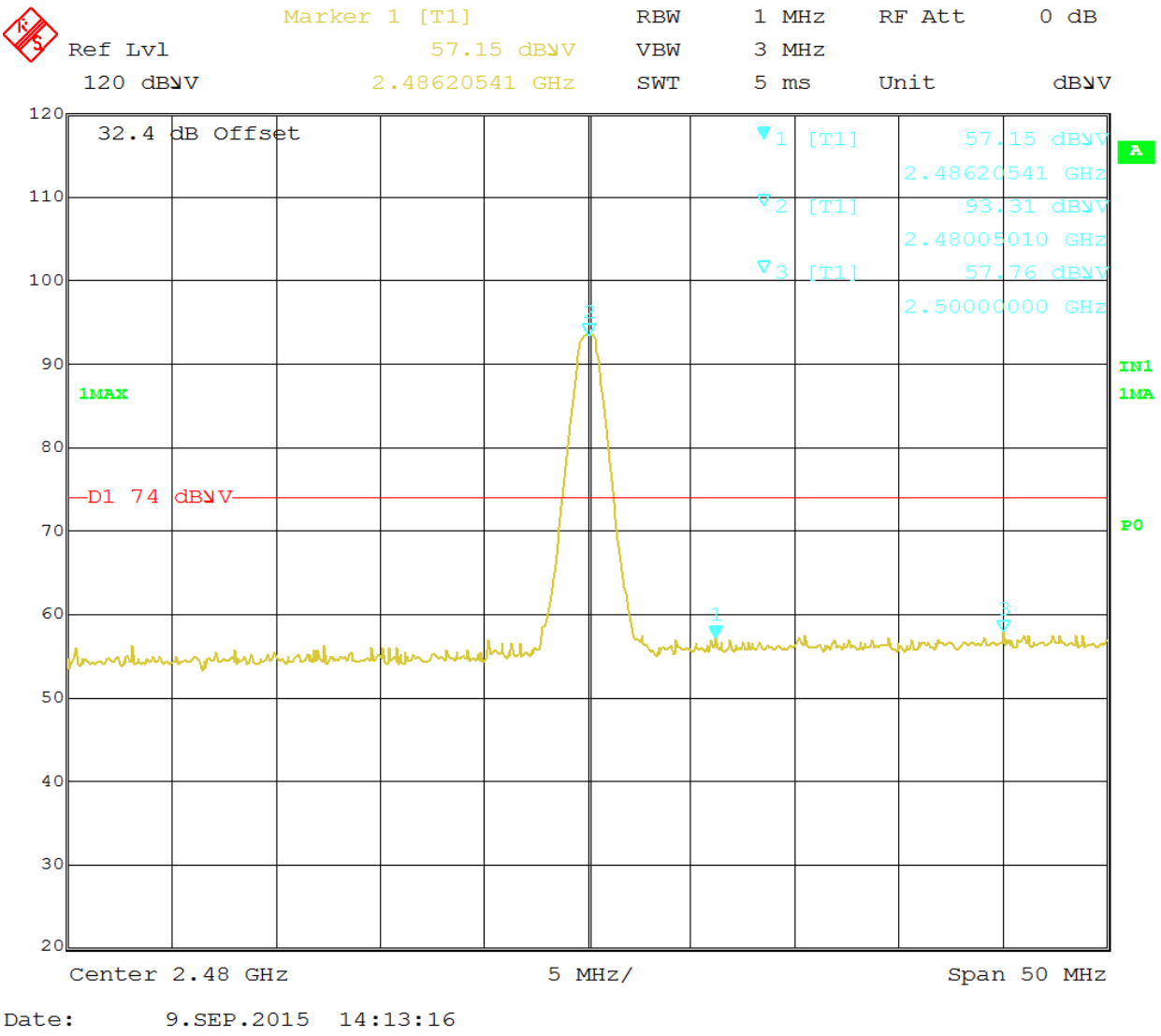


Figure 27: Radiated Emission at the 2483.5MHz Edge for Channel 2480MHz at DH5 – Vertical (Pk)

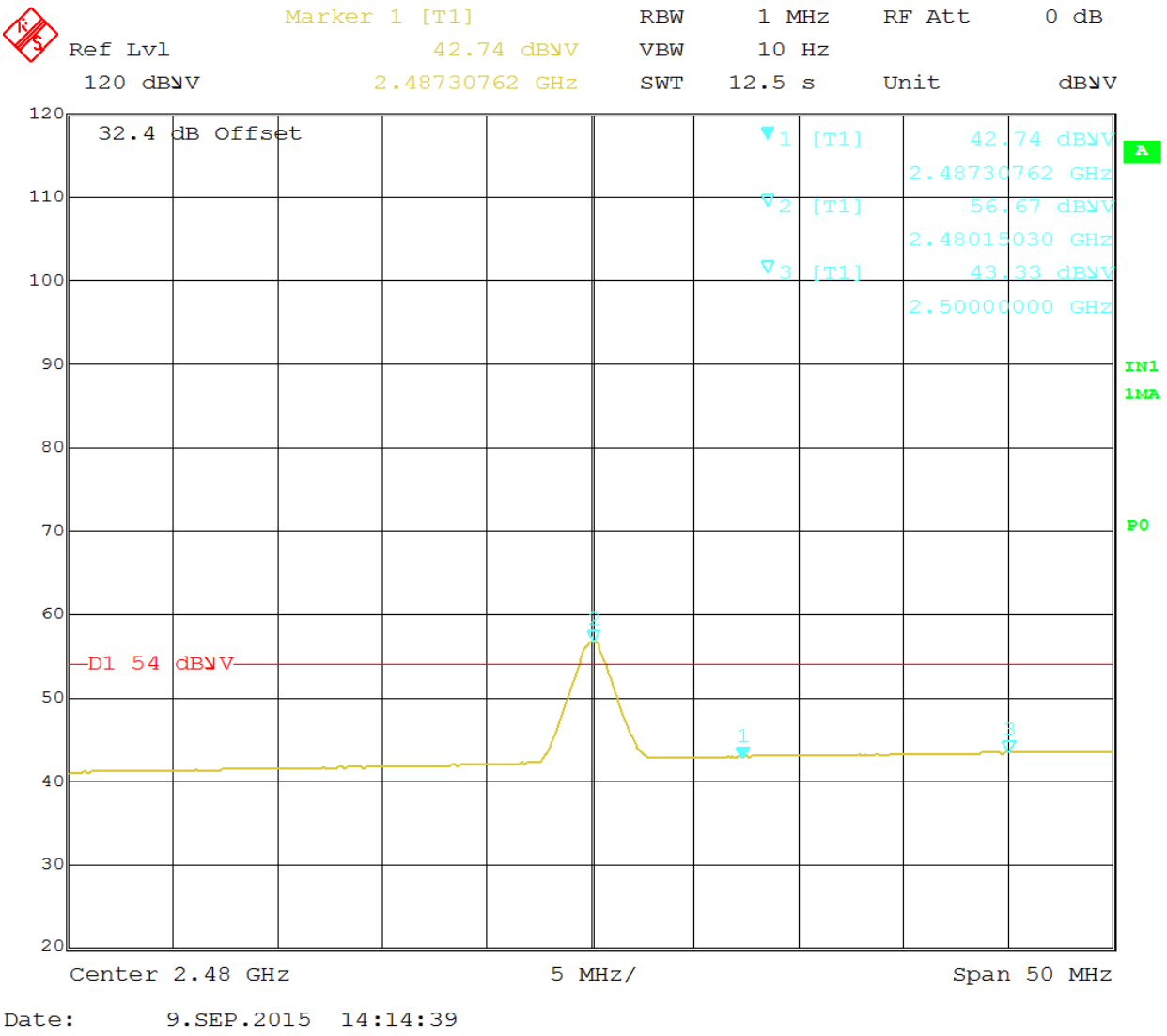


Figure 28: Radiated Emission at the 2483.5MHz Edge for Channel 2480MHz at DH5 – Vertical (Avg)

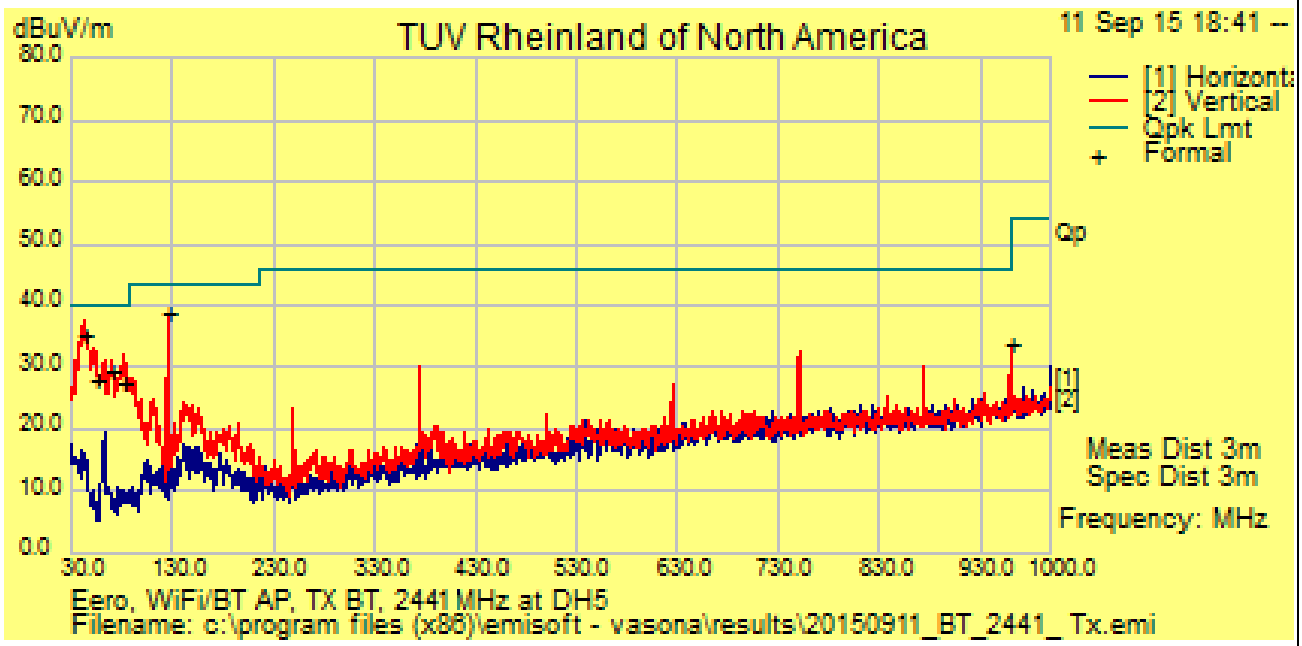
SOP 1 Radiated Emissions

Tracking # 31562963.001 Page 1 of 7

EUT Name	Home Wi-Fi Router	**Date**	September 11, 2015
EUT Model	A010001	**Temp / Hum in**	21° C / 35%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 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**	Chris Byleckie

30 MHz – 1 GHz Transmit at 2441 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
125.010	53.46	3.26	-18.18	38.54	QP	V	258	2	43.50	-4.96
960.023	36.87	5.86	-8.68	34.05	QP	V	166	6	54.00	-19.95
52.000	49.75	2.79	-24.45	28.1	QP	V	180	361	40.00	-11.91
42.682	52.57	2.72	-20.00	35.29	QP	V	115	361	40.00	-4.71
80.778	49.11	3.00	-24.70	27.41	QP	V	104	361	40.00	-12.59
68.704	50.91	2.92	-24.24	29.59	QP	V	112	361	40.00	-10.41



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 DH5 mode.
2. To reduce complexity and bulkiness of the report Worst case Plots is placed in the report.

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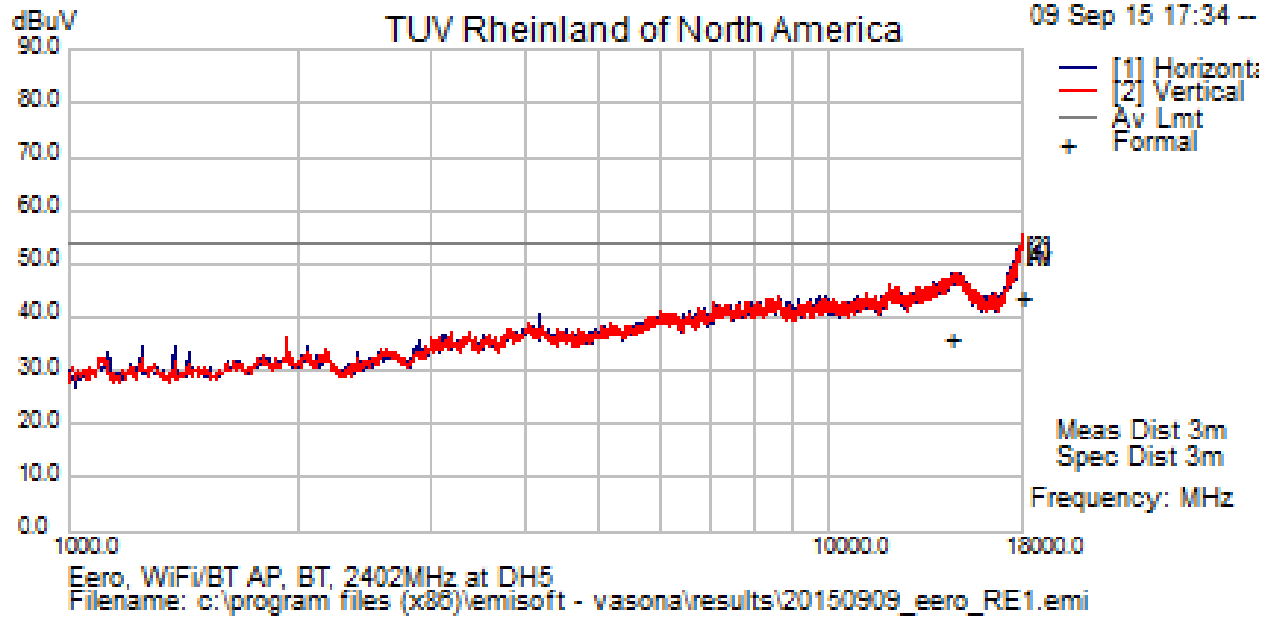
EUT Name	Home Wi-Fi Router	**Date**	Sep 09, 2015
EUT Model	A010001	**Temp / Hum in**	20° C / 38%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	**Performed by**	Chris Byleckie

1 – 18 GHz Transmit at 2402 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
14521.30	39.51	3.41	-7.32	35.61	Average	H	224	168	54.00	-18.39
18000.00	37.29	4.05	2.48	43.82	Average	V	237	352	54.00	-10.19



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

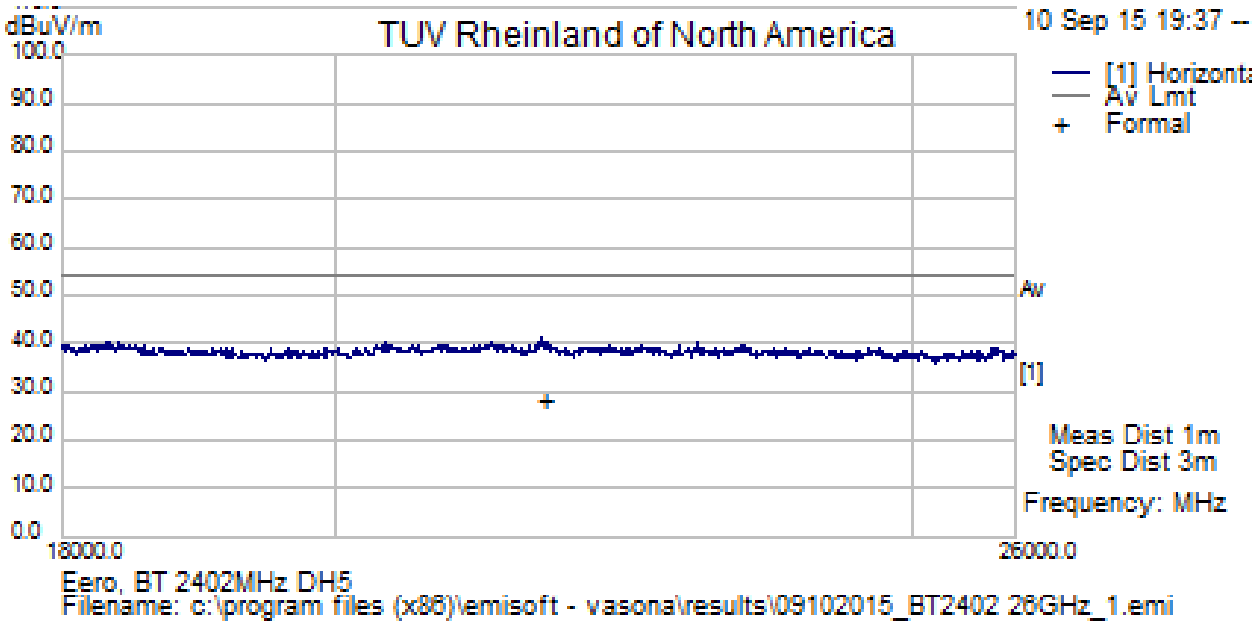
Note: Worst case was observed on DH5

SOP 1 Radiated Emissions — Tracking # 31562963.001 Page 3 of 7

EUT Name	Home Wi-Fi Router	**Date**	Sep 10, 2015
EUT Model	A010001	**Temp / Hum in**	20° C / 37%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 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**	Chris Byleckie

18 – 26 GHz Transmit at 2402 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
21666.05	31.22	7.81	-11.07	27.96	Average	V	148	162	54.00	-26.04



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

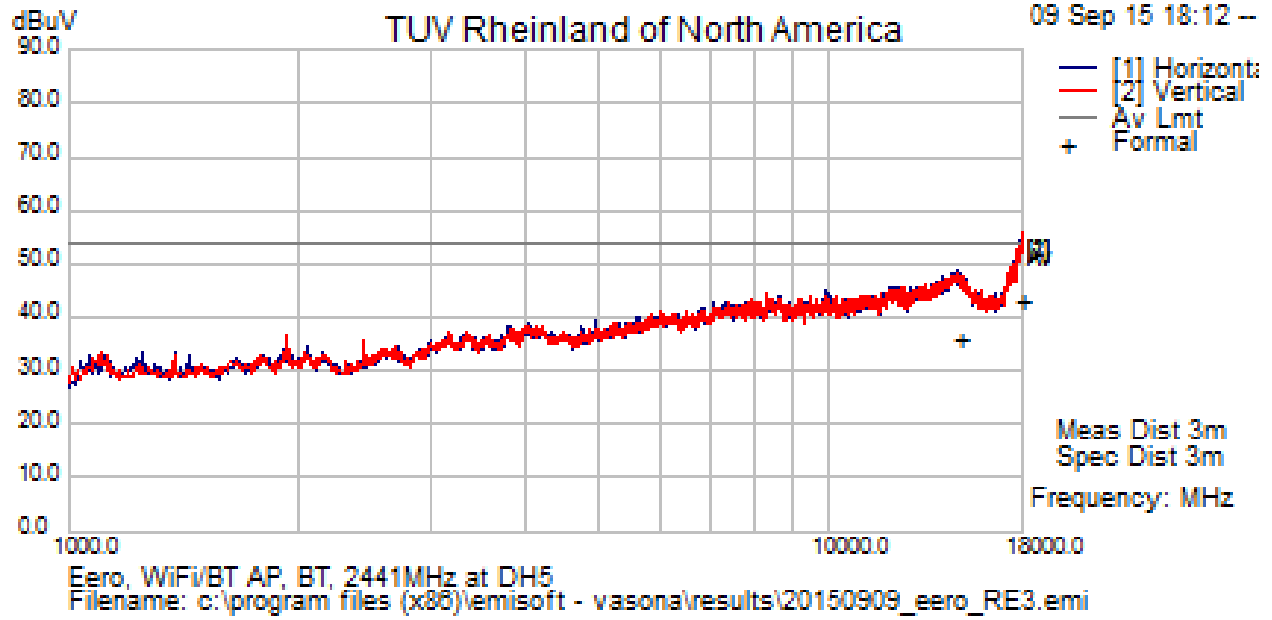
Note: Worst case was observed on DH5.

SOP 1 Radiated Emissions — Tracking # 31562963.001 Page 4 of 7

EUT Name	Home Wi-Fi Router	**Date**	Sep 09, 2015
EUT Model	A010001	**Temp / Hum in**	20° C / 38%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 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**	Chris Byleckie

1 – 18 GHz Transmit at 2441 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
17962.35	37.31	4.02	1.48	42.81	Average	V	184	32	54.00	-11.19
14856.01	38.95	3.36	-6.57	35.74	Average	H	126	276	54.00	-18.26



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

Note: Worst case was observed on DH5

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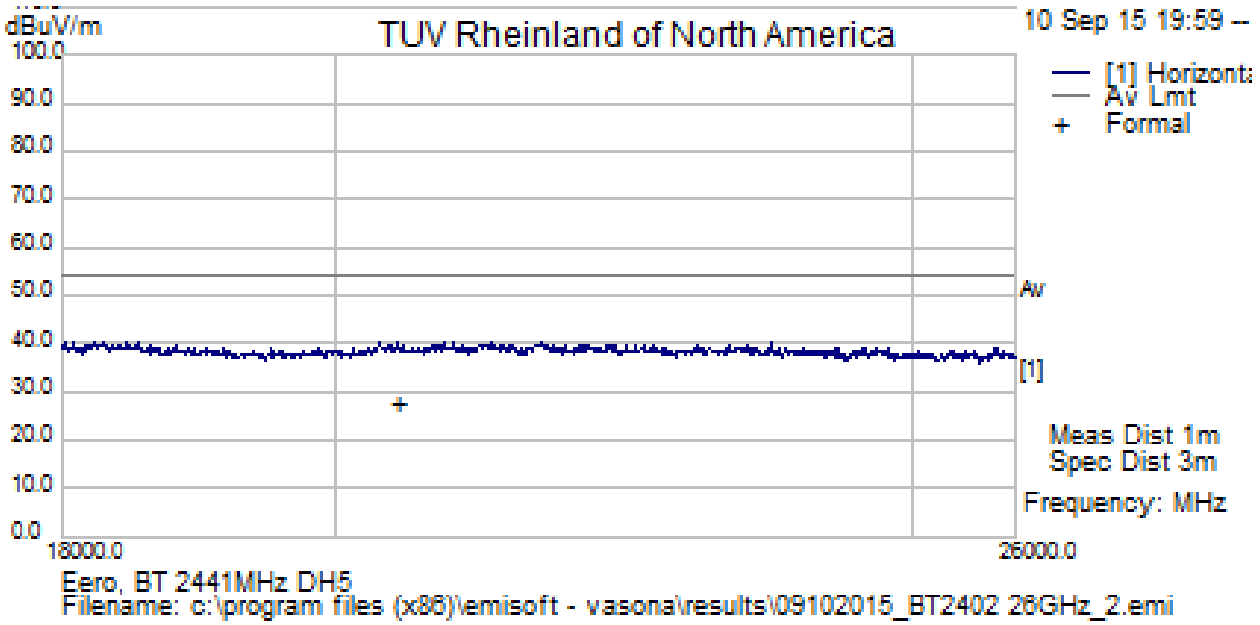
EUT Name	Home Wi-Fi Router	**Date**	Sep 10, 2015
EUT Model	A010001	**Temp / Hum in**	20° C / 37%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	**Performed by**	Chris Byleckie

18 – 26 GHz Transmit at 2441 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
20489.80	29.41	7.58	-9.65	27.34	Average	H	149	148	54	-26.66



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

Note: Worst case was observed on DH5.

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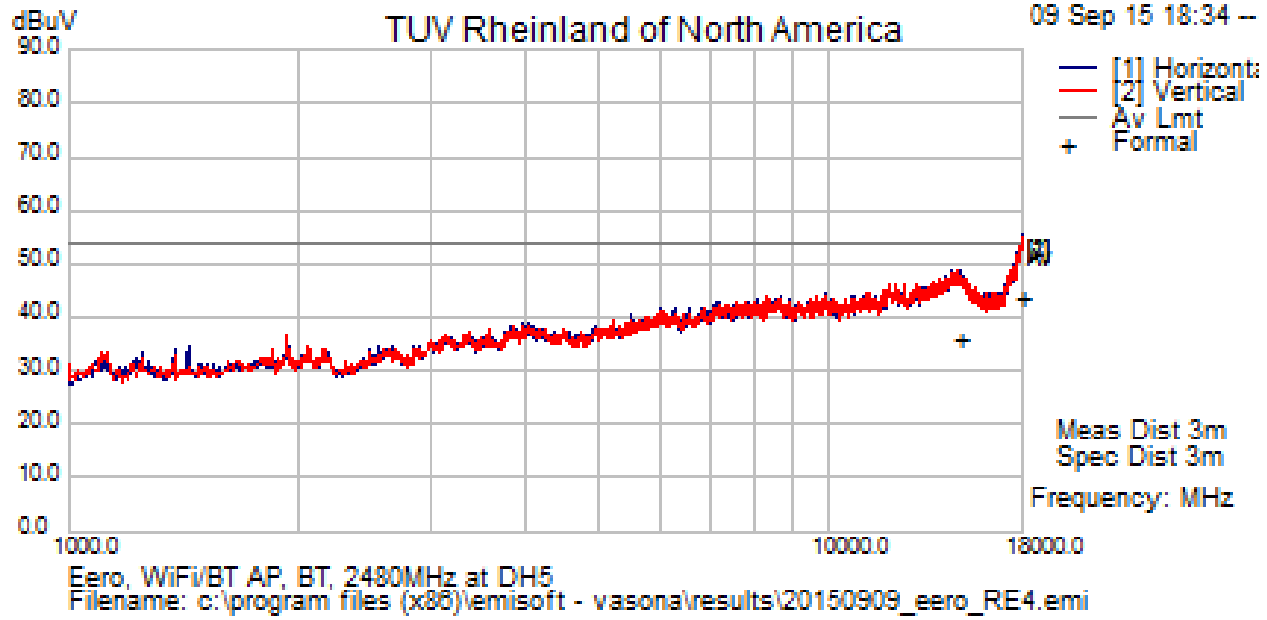
EUT Name	Home Wi-Fi Router	**Date**	Sep 09, 2015
EUT Model	A010001	**Temp / Hum in**	20° C / 38%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	**Performed by**	Chris Byleckie

1 – 18 GHz Transmit at 2480 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
17994.44	36.98	4.04	2.34	43.37	Average	V	141	218	54	-10.64
14859.90	39.02	3.35	-6.62	35.76	Average	V	202	354	54	-18.24



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

Note: Worst case was observed on DH5

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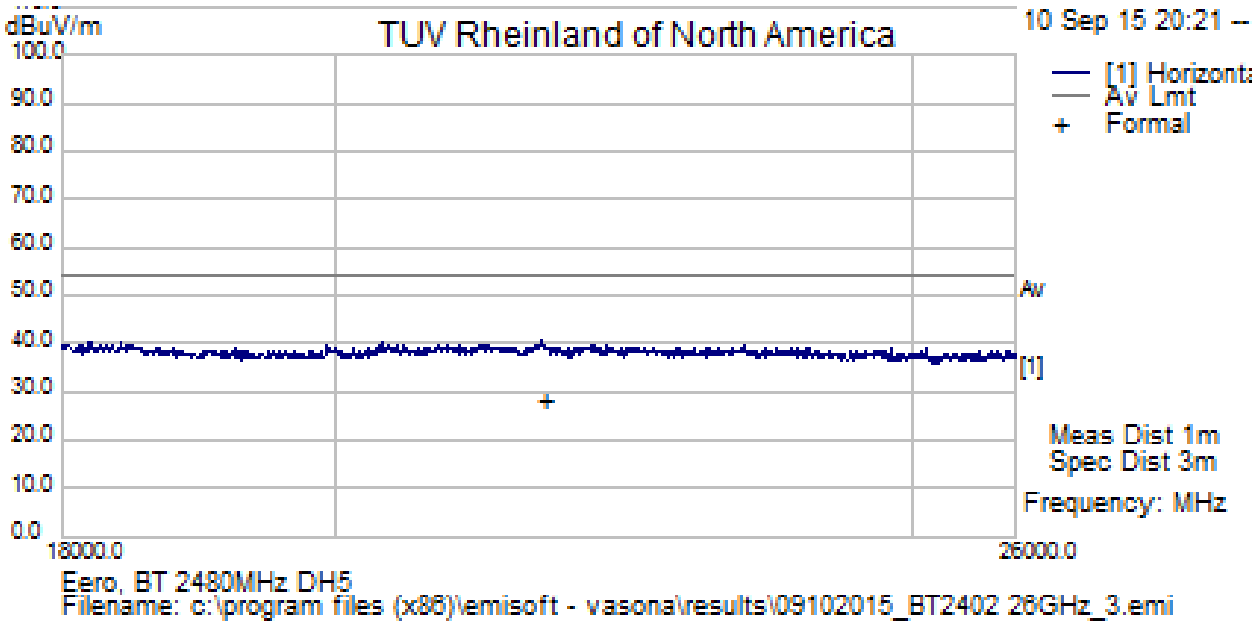
EUT Name	Home Wi-Fi Router	**Date**	Sep 10, 2015
EUT Model	A010001	**Temp / Hum in**	20° C / 37%rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	802.15.1 at DH5	**Line AC / Freq**	120 Vac / 60 Hz
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m – EMCO3115 / 1m – AHA-840	**Performed by**	Chris Byleckie

18 – 26 GHz Transmit at 2480 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
21671.00	31.19	7.81	-11.08	27.92	Average	V	151	355	54	-26.08



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

Note: Worst case was observed on DH5.

4.6.4 Sample Calculation

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:

Field Strength (dBμV/m) = FIM - AMP + CBL + ACF

Where:

FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

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

4.2 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: 2013 and RSS-Gen. Sect. 8.8: 2014.

4.2.1 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 either performed in 5m Chamber. 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.

4.2.1.1 Deviations

There were no deviations from this test methodology.

4.2.2 Test Results

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

Table 9: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only		
Antenna Type: Custom Integrated	**Power Level:** See Test Plan	
AC Power: 120 Vac/60 Hz	**Configuration:** Tabletop	
Ambient Temperature: 22° C	**Relative Humidity:** 37% 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 # 31562963.001 Page 1 of 4

EUT Name	Home Wi-Fi Router	**Date**	September 15, 2015
EUT Model	A010001	**Temp / Hum in**	22° C / 37% rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC / Freq**	120Vac / 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**	Chris Byleckie

Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.152	35.96	9.94	0.23	46.13	QP	Live	65.90	-19.77	Pass
0.152	23.32	9.94	0.23	33.48	Ave	Live	55.90	-22.42	Pass
0.292	30.88	9.96	0.12	40.96	QP	Live	60.47	-19.50	Pass
0.292	22.65	9.96	0.12	32.73	Ave	Live	50.47	-17.73	Pass
0.413	39.75	9.96	0.09	49.80	QP	Live	57.60	-7.80	Pass
0.413	36.14	9.96	0.09	46.19	Ave	Live	47.60	-1.41	Pass
0.661	21.05	9.98	0.07	31.10	QP	Live	56.00	-24.90	Pass
0.661	12.55	9.98	0.07	22.60	Ave	Live	46.00	-23.40	Pass
1.165	22.75	9.99	0.06	32.80	QP	Live	56.00	-23.20	Pass
1.165	9.29	9.99	0.06	19.34	Ave	Live	46.00	-26.66	Pass
1.545	21.93	10.00	0.06	31.99	QP	Live	56.00	-24.01	Pass
1.545	10.73	10.00	0.06	20.79	Ave	Live	46.00	-25.21	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

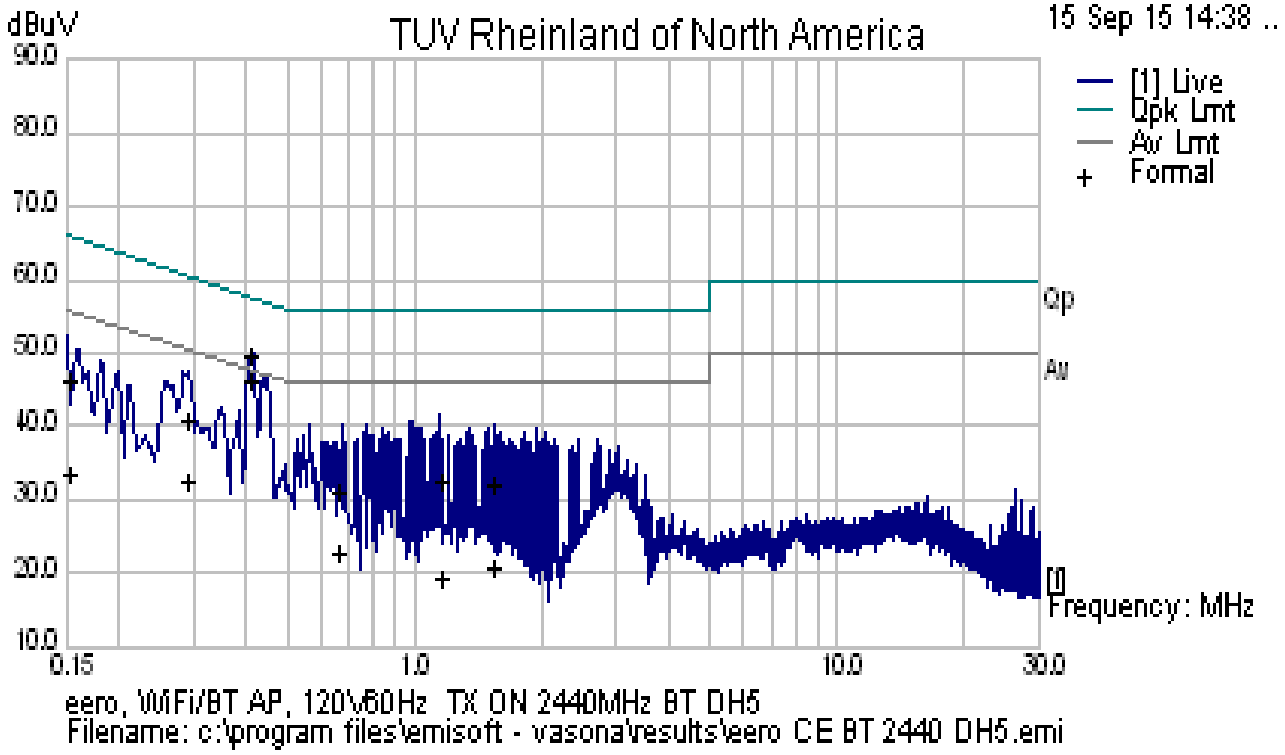
Notes: EUT was setup as table top equipment and transmitted at 2441 MHz in 802.15.1 at DH5

SOP 2 Conducted Emissions

Tracking # 31562963.001 Page 2 of 4

EUT Name	Home Wi-Fi Router	**Date**	September 15, 2015
EUT Model	A010001	**Temp / Hum in**	22° C / 37% rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC**	120Vac / 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**	Chris Byleckie

150 kHz to 30 MHz Plot for Line 1 (Hot)



Note: Met FCC Class B limit.

SOP 2 Conducted Emissions

Tracking # 31562963.001 Page 3 of 4

EUT Name	Home Wi-Fi Router	**Date**	September 15, 2015
EUT Model	A010001	**Temp / Hum in**	22° C / 37% rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC / Freq**	120Vac / 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**	Chris Byleckie

Frequency	Raw	Limiter	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB	
0.285	35.12	9.96	0.12	45.20	QP	Neutral	60.66	-15.46	Pass
0.285	29.84	9.96	0.12	39.92	Ave	Neutral	50.66	-10.74	Pass
0.417	35.23	9.96	0.09	45.28	QP	Neutral	57.52	-12.23	Pass
0.417	28.53	9.96	0.09	38.58	Ave	Neutral	47.52	-8.93	Pass
0.562	27.44	9.98	0.08	37.50	QP	Neutral	56.00	-18.50	Pass
0.562	20.75	9.98	0.08	30.81	Ave	Neutral	46.00	-15.19	Pass
0.735	26.42	9.98	0.07	36.47	QP	Neutral	56.00	-19.53	Pass
0.735	19.35	9.98	0.07	29.40	Ave	Neutral	46.00	-16.60	Pass
0.807	25.16	9.98	0.07	35.22	QP	Neutral	56.00	-20.78	Pass
0.807	10.47	9.98	0.07	20.52	Ave	Neutral	46.00	-25.48	Pass
1.530	23.29	10.00	0.06	33.35	QP	Neutral	56.00	-22.65	Pass
1.530	9.28	10.00	0.06	19.34	Ave	Neutral	46.00	-26.66	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

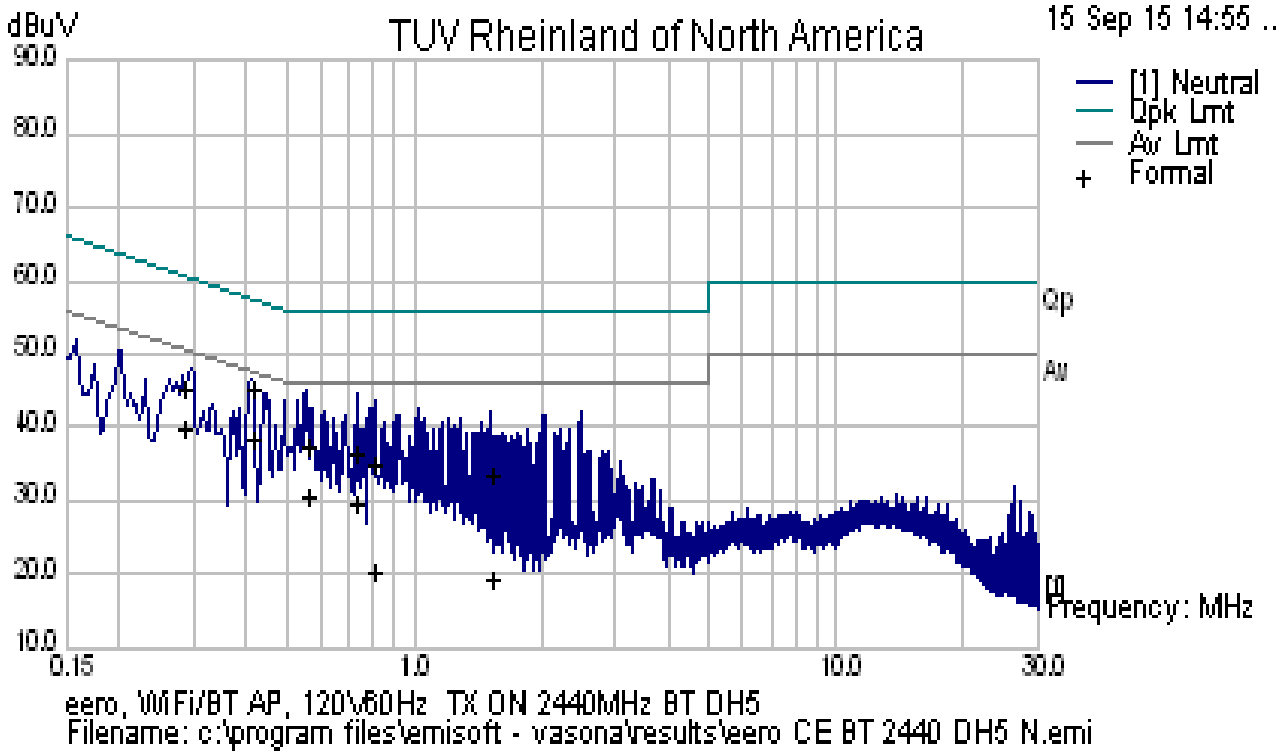
Notes: EUT was setup as table top equipment and transmitted at 2441 MHz in 802.15.1 at DH5

SOP 2 Conducted Emissions

Tracking # 31562963.001 Page 4 of 4

EUT Name	Home Wi-Fi Router	**Date**	September 15, 2015
EUT Model	A010001	**Temp / Hum in**	22° C / 37% rh
EUT Serial	E58V-0034-H6W8-7MJX	**Temp / Hum out**	N/A
EUT Config.	TX mode	**Line AC**	120Vac / 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**	Chris Byleckie

150 kHz to 30 MHz Plot for Line 2 (Neutral)



Note: Met FCC Class B Limit.

4.3 Maximum Permissible Exposure

4.3.1 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.

4.3.2 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

4.3.3 EUT Operating Condition

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

4.3.4 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 2.402 GHz RF Exposure at a distance of 20cm.

4.3.5 Test Results

4.3.5.1 Antenna Gain

The 2.412 GHz transmitting maximum antenna gain is +2.51 dBi or 1.78 (numeric).

4.3.5.2 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/cm^2

The highest measured total power is -4.15 dBm (0.385 mW)

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

$Pd = (0.385*1.78) / (1600\pi) = 0.00014$ mW/cm^2, which is 0.9999mW/cm^2 (0.0999W/m^2) below to the limit.

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

4.3.6 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
Pout = 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).

6 Test Equipment Use List

6.1 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	02/10/2016
Antenna (18-40 GHz)	Com-Power	AHA-840	105005	07/08/2015	07/08/2016
Spectrum Analyzer	Rohde & Schwarz	FSL6	100169	01/13/2015	01/13/2016
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/12/2015	01/12/2016
Spectrum Analyzer	Agilent	N9030A	MY51380689	01/19/2015	01/19/2016
Spectrum Analyzer	Rohde Schwarz	ESIB	832427/002	01/13/2015	01/13/2016
Spectrum Analyzer	Rohde Schwarz	FSV40	1321.3008K40	11/01/2015	11/01/2016
Amplifier	Sonoma Instruments	310	213221	09/30/2014	09/30/2015
Amplifier	Miteq	TTA1800-30-4G	1842452	01/13/2015	01/13/2016
Amplifier	Rohde & Schwarz	TS-PR26	100011	07/24/2015	07/24/2016
Amplifier	Rohde & Schwarz	TS-PR40	100012	02/21/2015	02/21/2016
Power Meter	Agilent	E4418B	MY45103902	01/15/2015	01/15/2016
Power Sensor	Hewlett Packard	8482A	US37295801	01/15/2015	01/15/2016
Thermometer	Fluke	52II	96480032	07/15/2015	07/15/2016
Thermo Chamber	Espec	BTZ-133	0613436	03/16/2015	03/16/2016
DC Power Supply	Agilent	E3634A	MY400004331	01/12/2015	01/12/2016
Notch Filter	Micro-Tronics	BRM50716	003	01/30/2015	01/30/2016
Signal Generator	Anritsu	MG3694A	42803	01/13/2015	01/13/2016
Signal Generator	Rohde & Schwarz	SMF100A	1167.0000K02	10/14/2014	10/14/2015
Signal Generator	Rohde & Schwarz	SMBV100A	1407.6004K02	12/04/2014	12/04/2015
Power Sensors	Rohde & Schwarz	OSP120	1520.9010.02	12/19/2014	12/14/2015

* 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.

7 EMC Test Plan

7.1 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.

7.2 Customer

Table 10: Customer Information

Company Name	eero inc
Address	933 20th Street
City, State, Zip	San Francisco, CA 94107
Country	U.S.A.

Table 11: Technical Contact Information

Name	Clifford Clarke
E-mail	compliance@eero.com
Phone	(415) 738-7972

7.3 Equipment Under Test (EUT)

Table 12: EUT Specifications

EUT Specifications	
Dimensions	W: 4.75in (121mm) x D: 4.75in (121mm) x H: 0.85-1.26in (22-33mm)
AC Input	100-240V AC, 50 – 60 Hz
Environment	Indoor
Operating Temperature Range:	0 to 35 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	01A
Part Number	830-00001-14
RF Software Version	v1.0.0
802.11-radio modules	
Operating Mode	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	Qty 7 – 2 custom antennas at 2.4GHz. See Table 13 for details
Antenna Gain	Antenna 1 = +1.5 dBi, Antenna 2 = -0.75 dBi
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☐ Other describe: 16QAM and 64 QAM
Data Rate	802.11g: 2 Spatial Streams: 6, 9, 12, 18, 24, 36, 48, 54 Mbps 802.11n HT20: 2 Spatial Streams: 13, 26, 39, 52, 78, 104, 117, 130 /156 Mbps (LGI) 802.11n HT40: 2 Spatial Streams: 27, 54, 81, 108, 162, 216, 243, 270 / 324, 370 Mbps (LGI)
TX/RX Chain (s)	MIMO (2x2); no beam forming
Directional Gain Type	☒ Correlated ☐ Beam-Forming ☐ Other describe:
Type of Equipment	☒ Table Top ☒ Wall-mount ☐ Floor standing cabinet ☐ Other:

EUT Specifications
Note: All 2 chains will be on / transmitted at all time.

Table 13: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
Antenna 1	Stamped metal Planar Inverted F antenna(PIFA)	2.4 GHz Wi-Fi Chain 2	1.50
Antenna 2	Stamped metal PIFA	2.4 GHz Wi-Fi Chain 1	-0.75
Antenna 3	Stamped metal PIFA	Bluetooth	2.51
Antenna 5	Monopole	5 GHz Wi-Fi U-NII-1 Band, Chain 1	1.11
Antenna 6	Monopole	5 GHz Wi-Fi U-NII-1 Band, Chain 2	2.13
Antenna 7	Monopole	5 GHz Wi-Fi U-NII-3 Band, Chain 1	-1.01
Antenna 8	Monopole	5 GHz Wi-Fi U-NII-3 Band, Chain 2	2.24

Table 14: EUT Channel Power Specifications

Max Power

Frequency (MHz)	Target Power Value (dBm)									
	DH1	DH3	DH5	2-DH1	2-DH3	2-DH5	3-DH1	3-DH3	3-DH5	BLE
2402	-9.04	-9.80	-9.86	-8.68	-9.95	-11.73	-8.66	-11.13	-12.91	-7.07
2441	-7.42	-6.41	-8.51	-7.12	-8.54	-10.19	-7.14	-9.64	-11.42	
2442										-5.22
2480	-6.38	-6.48	-7.19	-6.10	-7.43	-9.16	-6.08	-8.60	-10.36	-4.15

Note: 1. The adjusted power target values are updated at the evaluated frequencies.
2. TP setting = automatically set to 7 for all channels.

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?
Ehternet	RJ45	☒ No	☒ Metric: 2 m	☐ N/A

Table 16: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	Latitude	35521341769	Setup EUT operating channel
Note: None.				

Table 17: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
Access Point	E58V-0034-H6W8-7MJX	Custom Integrated Antenna	TX Emission, AC Conducted Emission
		Direct Connection	Peak Transmit Power, Peak Power Spectral Density, Occupied Bandwidth Band-Edge Out-of-Band Emission

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)
Access Point	Custom Integrated	Transmit	EUT laid flat.	N/A	N/A
Note: N/A.					

7.4 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