Emissions
Test Report

EUT Name: Luxury Audio Integrated Amplifier

Model No.: No5805 & No5802

CFR 47 Part 15.247:2018 and RSS-247:2017

Prepared for:

Harman International Industries, Inc
50 Waterview Drive, Suite 240
Shelton, CT 06484 U.S.A.

Prepared by:

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

Report/Issue Date:	August 30, 2018
Report Number:	31863803.001
Project Number:	0000157063
Revision Number	2

Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	08/30/2018	Original Document	
1	12/11/2018	Corrected equipment calibration date	KC
2	03/19/2019	Corrected standard references and added hopping mode band-edge conducted emissions	KC

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Applicant:	Harman International Industries, Inc 50 Waterview Drive, Suite 240 Shelton, CT 06484
Requester / Applicant:	John Garay
Name of Equipment:	Luxury Audio Integrated Amplifier
Model No.	No5805 & No5802
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.247:2018 and RSS-247:2017
Test Dates:	August 22, 2018 to August 29, 2018

Guidance Documents:

Emissions: ANSI C63.10-2013, KDB 558074 D01 15.247 Measurement Guidance v05

Test Methods:

Emissions: ANSI C63.10-2013, KDB 558074 D01 15.247 Measurement Guidance v05

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	March 25, 2019	Jeremy Luong	March 25, 2019
Test Engineer	Date	Laboratory Signature	Date

INDUSTRY CANADA

Testing Cert #3331.02 **US1131** **2932M-1**

Table of Contents

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.247:2018 and RSS-247:2017 based on the results of testing performed on August 22, 2018 to August 29, 2018 on the Luxury Audio Integrated Amplifier Model No5805 & No5802 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 were 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 2.4 GHz radio characteristics for the No5805 & No5802.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.10:2013	Test Parameters	Measured Value	Result
2402 MHz to 2480 MHz Band				
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.247 (d), RSS-GEN Sect.8.9	Class B	-8.4 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	-9.86 dB (Margin)	Complied
Occupied Bandwidth	CFR47 15.247 (a1), RSS GEN Sect.6.7	N/A	20dB BW = 1.252 MHz 99% BW = 1.179 MHz	Complied
Channel Separation	CFR47 15.247 (a1), RSS 247 Sect. 5.1 (b)	>25 kHz	1023 kHz	Complied
Number of Hopping Channels	CFR47 15.247 (a1)(iii), RSS 247 Sect. 5.1(d)	>15	79 Channels	Complied
Average time occupancy of Channel	CFR47 15.247 (a1), RSS 247 Sect. 5.1(d)	< 0.4 sec	324.06ms	Complied
Maximum Transmitted Power	CFR47 15.247 (a1), RSS 247 Sect. 5.1 (b)	<125 mWatts	5.408 mW	Complied
Out of Band Emission	CFR47 15.247 (d), RSS 247 Sect. 5.5	< -20 dBr	- 18.37 dBr (-35.90 dBm at 2400 MHz)	Complied

Note: 1. Meet 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 (US1131). 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 (Testing Cert #3331.02). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited 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 (File Number 2932M-1). This reference number is the indication to the Certification Officers that the site meets the requirements. 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-0268

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.

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 ± 2.9%.	Per IEC 61000-4-8

Thermo KeyTek EMC Pro

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

3 Product Information

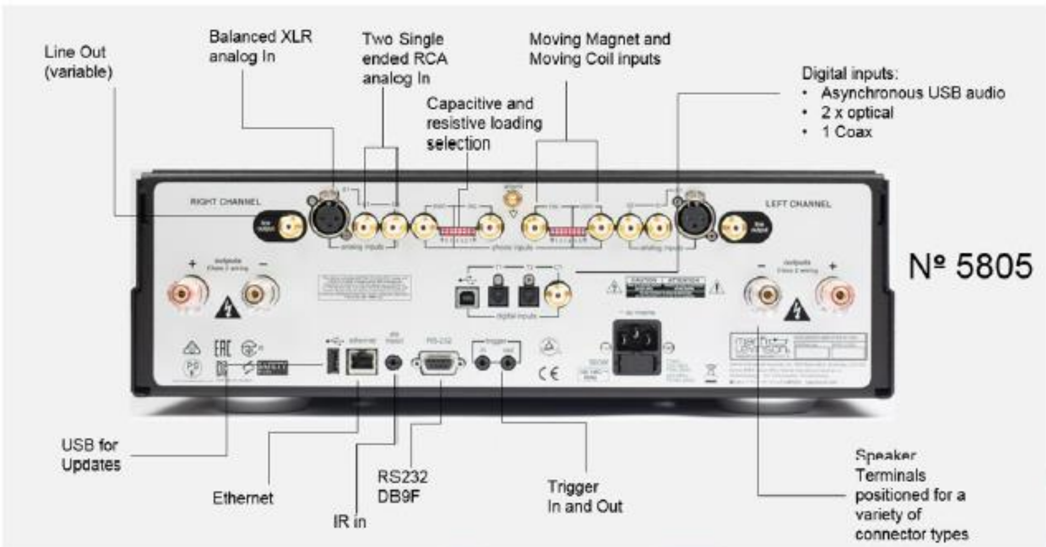
3.1 Product Description

The Model No5805 & No5802 is Mark Levinson Luxury Audio Integrated Amplifier. It has wireless capability, Bluetooth, operating in the band 2.4 GHz.

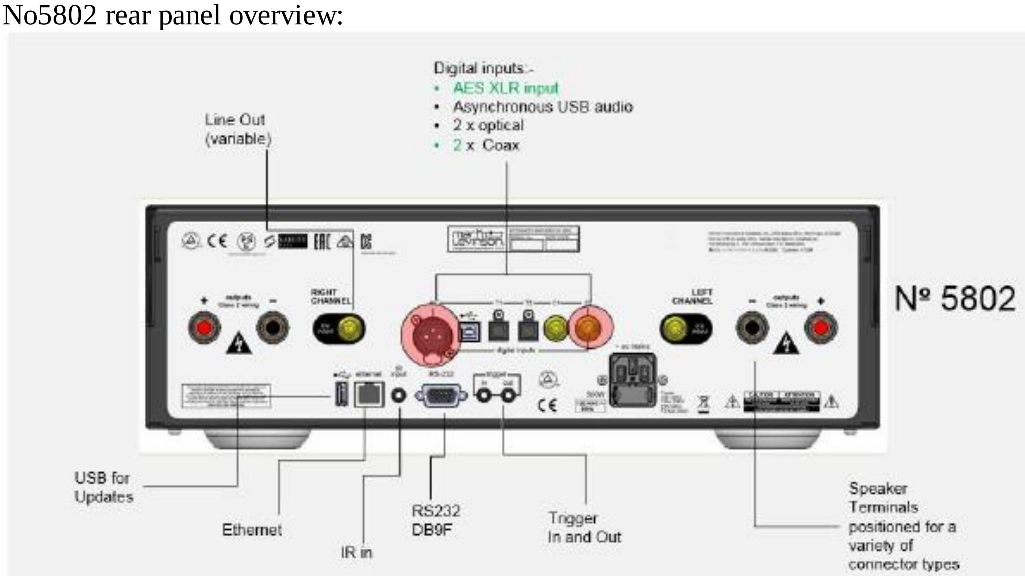
Model differences are:
No5805 – connect to analog and digital audio sources.
No5802 – interfaces with digital sources only.

The Model No5805 was used for final evaluation.

No5805 rear panel overview:



No5802 rear panel overview:



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 No5805 & No5802 uses the permanently attached chip antenna inside the device. Refer to EUT Photo for details. There is no external antenna connection available.

4 EUT Duty Cycle

All measurements are to be performed with the EUT transmitting at least 98% duty cycle. If the continuous transmission (or at least 98% duty cycle) cannot be achieved, the following additions to the measurement are required.

4.1 Test Method

The conducted method was used to measure the duty cycle factor according to ANSI C63.10: 2013 Sect. 11.6.

Duty cycle correction factor = 10 log (1 / D); where D is the duty cycle.

4.2 Result

Mode	**On Time (ms)**	**Period (ms)**	**Duty Cycle (%)**	**Duty Factor (dB)**
Standard	100	0	100	0
Note: All measurements used 100% duty cycle.				

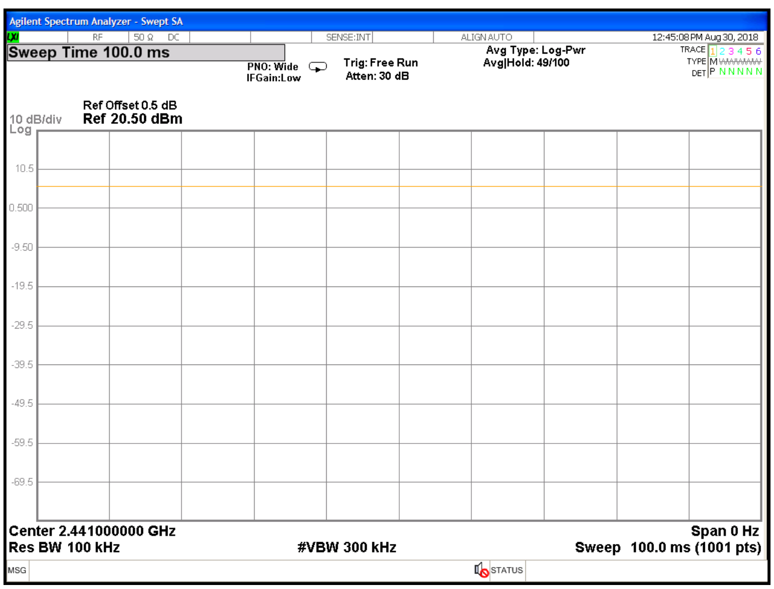


Figure 1: Maximum Transmitted Power, 2402 MHz

5 Emission

Testing was performed in accordance with CFR 47 Part 15.247:2018 and RSS-247:2017. 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.

5.1 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.

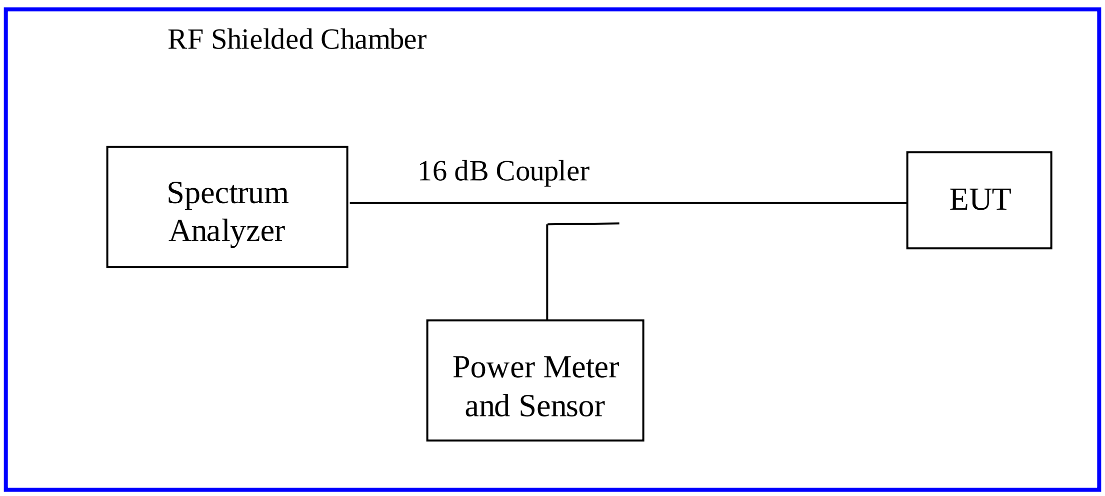
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (a)(1) and RSS 247 Sect. 5.1(b)

Frequency hopping systems in the 2400-2483.5 MHz band: 125 mW.

5.1.1 **Test Method**

The conducted method was used to measure the channel power output according to ANSI C63.10:2013 Section 7.8.5. The measurement was performed with modulation per CFR47 Part 15.247 (a)(1) and RSS-247 Sect. 5.1. This test was conducted on 3 channels on No5805 & No5802. The worst mode result indicated below.

Test Setup:



5.1.2 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, Hopping OFF		**Date**: August 23, 2018		
Antenna Type: Chip		**Power Setting:** fixed at 50		
Max. Antenna Gain: 1.7 dBi		**Signal State:** Modulated		
Duty Cycle: 100 %		**Data Rate:** BDR and EDR		
Ambient Temp.: 23° C		**Relative Humidity:** 37 %RH		
802.15.1 Mode				
Packet	**Operating Channel**	**Limit [dBm]**	**Peak Power [dBm]**	**Margin [dB]**
DH1	2402 MHz	30.00	5.28	-15.72
	2441 MHz	30.00	6.57	-14.43
	2480 MHz	30.00	7.33	-13.67
DH3	2402 MHz	30.00	5.25	-15.75
	2441 MHz	30.00	6.52	-14.48
	2480 MHz	30.00	7.29	-13.71
DH5	2402 MHz	30.00	5.24	-15.76
	2441 MHz	30.00	6.5	-14.5
	2480 MHz	30.00	7.27	-13.73
2-DH1	2402 MHz	30.00	3.56	-17.44
	2441 MHz	30.00	5.22	-15.78
	2480 MHz	30.00	6.06	-14.94
2-DH3	2402 MHz	30.00	3.57	-17.43
	2441 MHz	30.00	5.27	-15.73
	2480 MHz	30.00	6.03	-14.97
2-DH5	2402 MHz	30.00	3.58	-17.42
	2441 MHz	30.00	5.28	-15.72
	2480 MHz	30.00	6.02	-14.98
3-DH1	2402 MHz	30.00	3.59	-17.41

	2441 MHz	30.00	5.35	-15.65
	2480 MHz	30.00	6.09	-14.91
3-DH3	2402 MHz	30.00	3.66	-17.34
	2441 MHz	30.00	5.4	-15.6
	2480 MHz	30.00	6.14	-14.86
3-DH5	2402 MHz	30.00	3.63	-17.37
	2441 MHz	30.00	5.38	-15.62
	2480 MHz	30.00	6.15	-14.85
Note: The EUT is capable to transmit at both BDR and EDR. The worst case at low, middle, and high frequencies are shown below.				

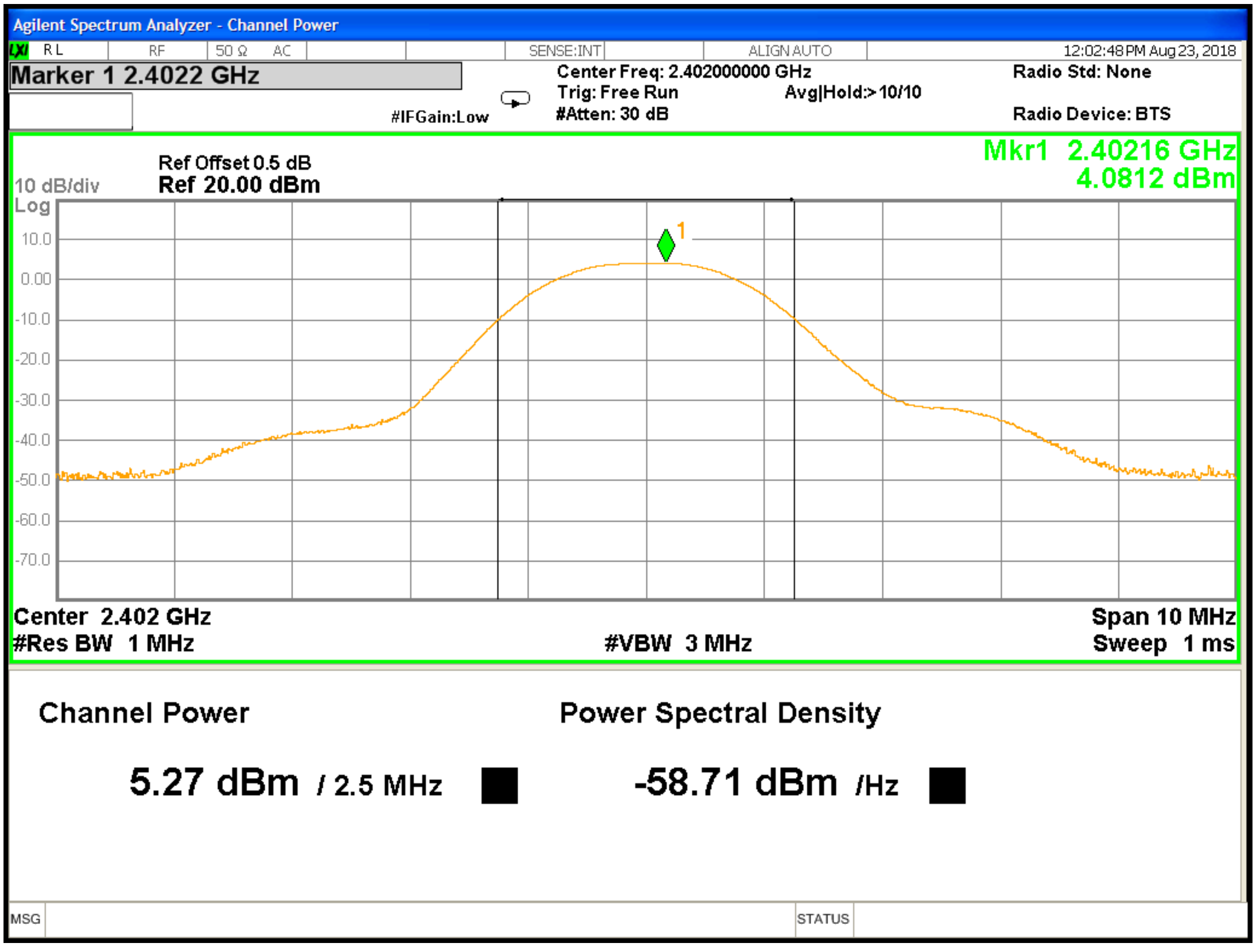


Figure 2: Maximum Transmitted Power, 2402 MHz (DH1)

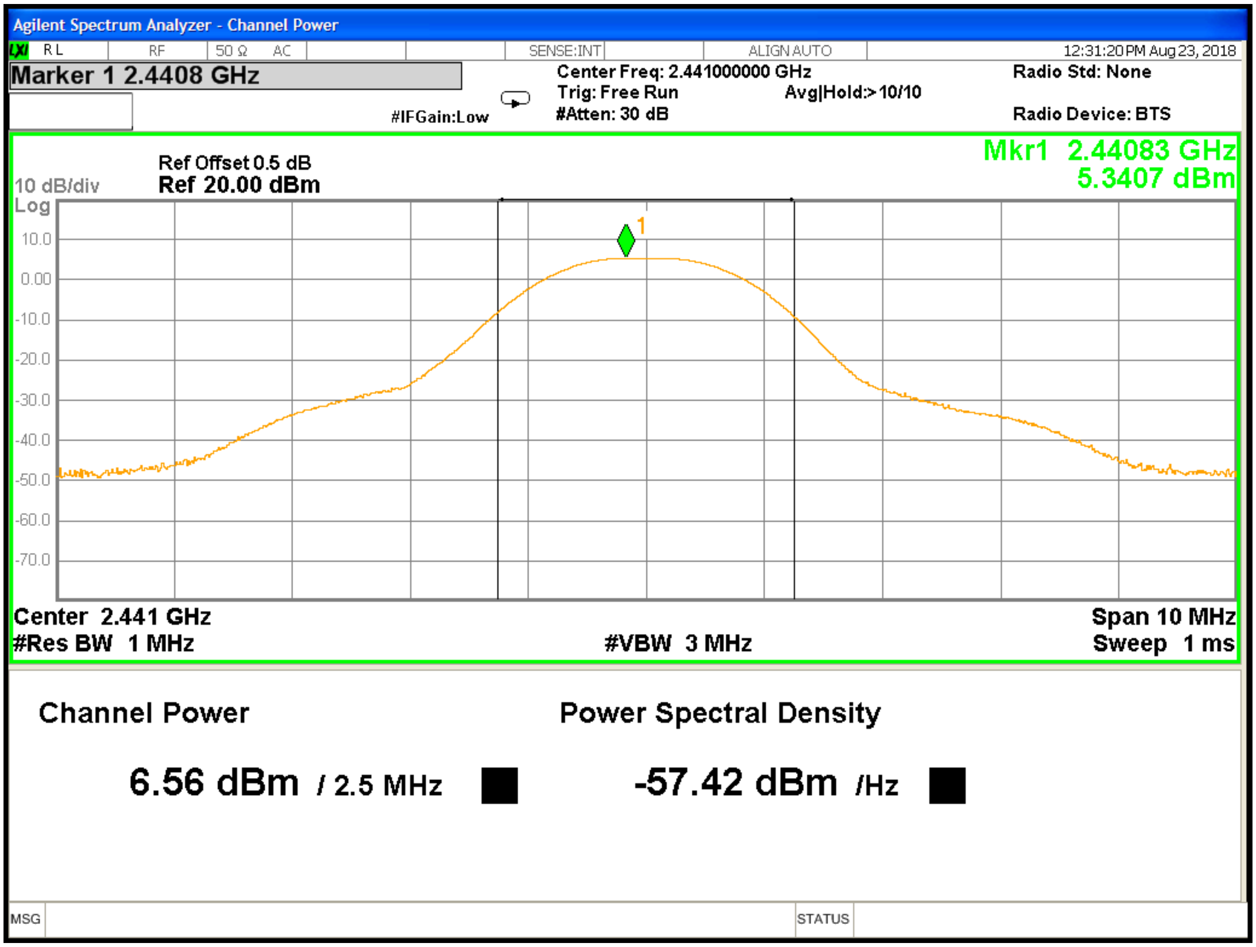


Figure 3: Maximum Transmitted Power, 2441 MHz (DH1)

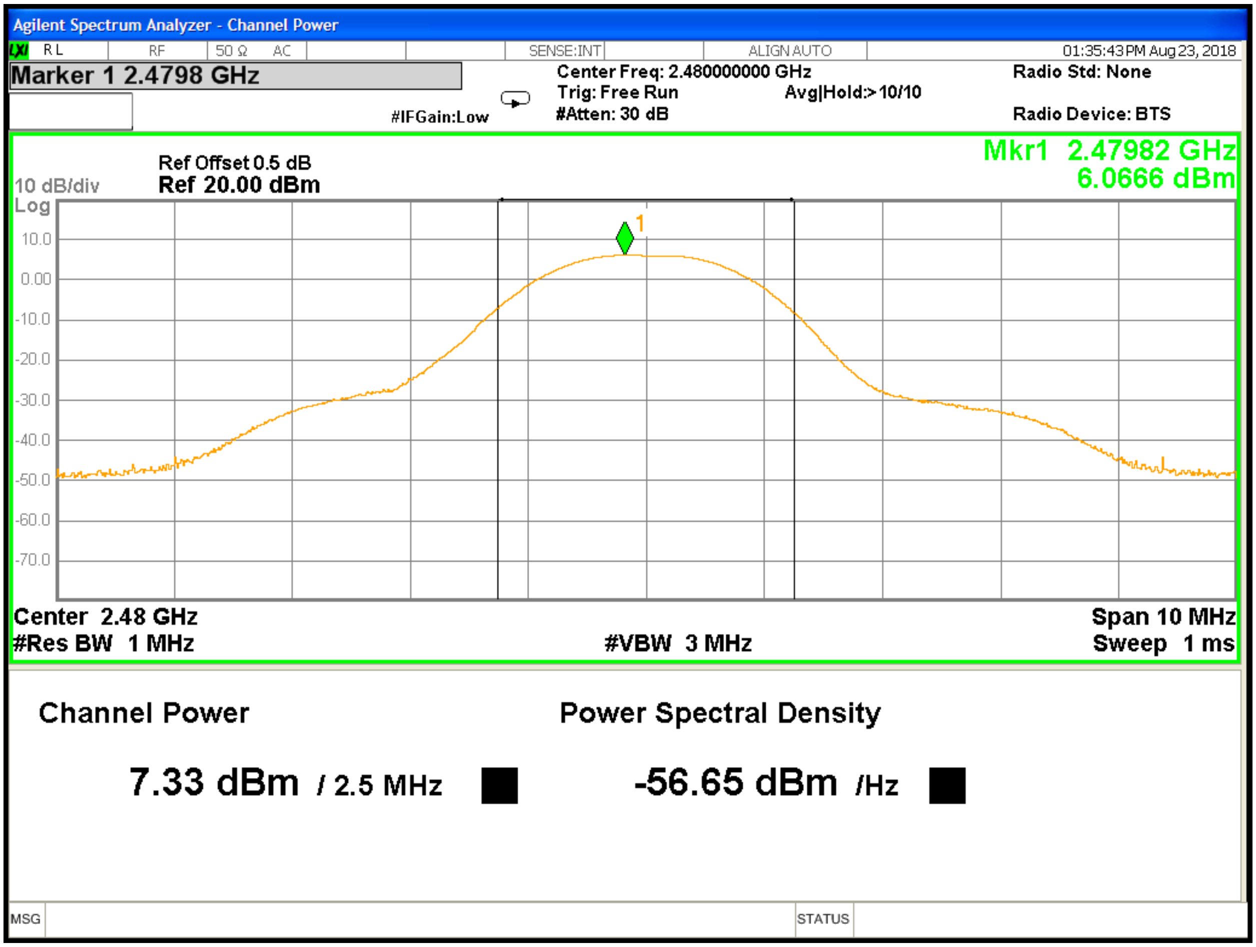


Figure 4: Maximum Transmitted Power, 2480 MHz (DH1)

5.2 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.

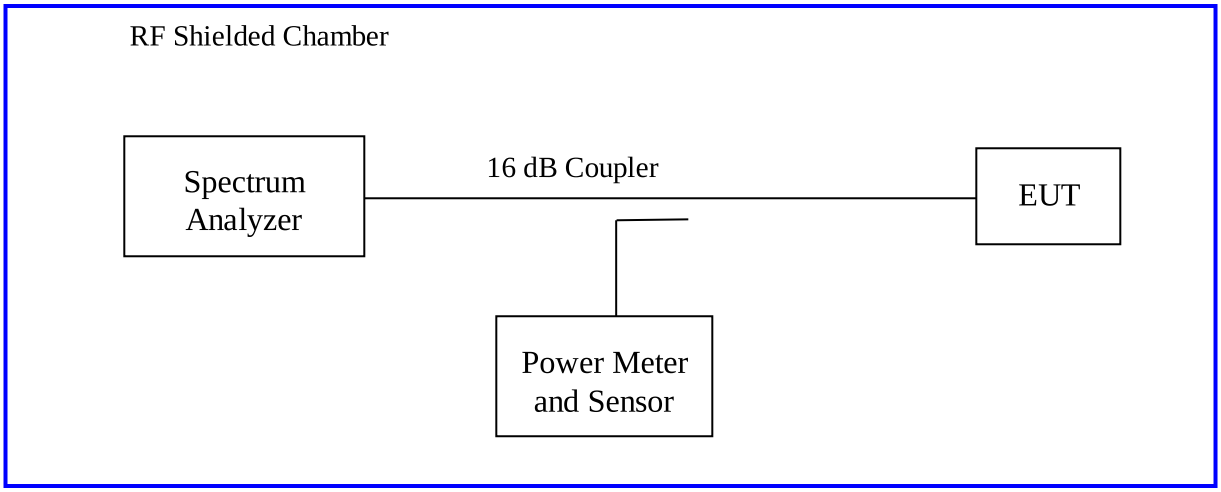
The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

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

5.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.247 (a)(1) and RSS GEN Sect. 6.7. This test was conducted on 3 channels on No5805 & No5802. The worst sample result indicated below.

Test Setup:



5.2.2 Results

These measurements were used for information only

Table 3: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Hopping OFF		**Date**: August 28, 2018	
Antenna Type: Chip		**Power Setting:** fixed at 50	
Max. Antenna Gain: 1.7 dBi		**Signal State:** Modulated	
Duty Cycle: 100 %		**Data Rate:** BDR and EDR	
Ambient Temp.: 23° C		**Relative Humidity:** 35 %RH	
Bandwidth (MHz)			
Packet	**Freq. (MHz)**	**20dB Bandwidth MHz**	**99% Bandwidth MHz**
DH1	2402	0.926	0.851
	2441	0.926	0.843
	2480	0.927	0.842
DH3	2402	0.930	0.860
	2441	0.919	0.843
	2480	0.926	0.841
DH5	2402	0.936	0.870
	2441	0.935	0.863
	2480	0.935	0.865
2-DH1	2402	1.209	1.158
	2441	1.213	1.158
	2480	1.210	1.161
2-DH3	2402	1.232	1.167
	2441	1.247	1.175
	2480	1.250	1.174
2-DH5	2402	1.235	1.171
	2441	1.235	1.174

	2480	1.248	1.173
3-DH1	2402	1.201	1.144
	2441	1.199	1.146
	2480	1.198	1.148
3-DH3	2402	1.250	1.175
	2441	1.252	1.179
	2480	1.250	1.179
3-DH5	2402	1.249	1.170
	2441	1.250	1.174
	2480	1.252	1.176
Note: Worst case for Occupied Bandwidth are shown below.			

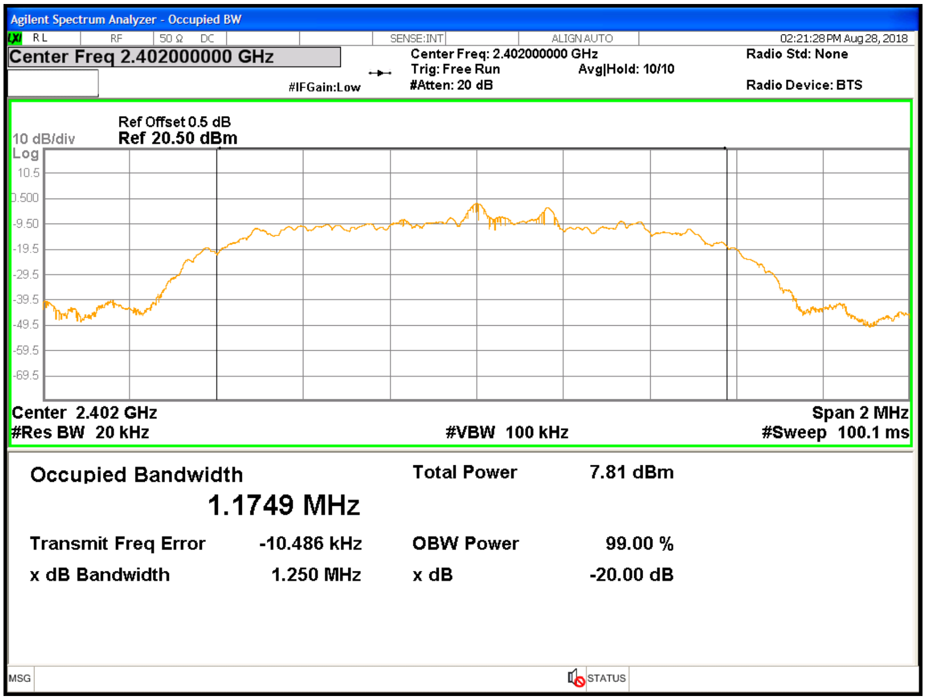


Figure 5: Occupied Bandwidth at 2402 MHz (3-DH3)

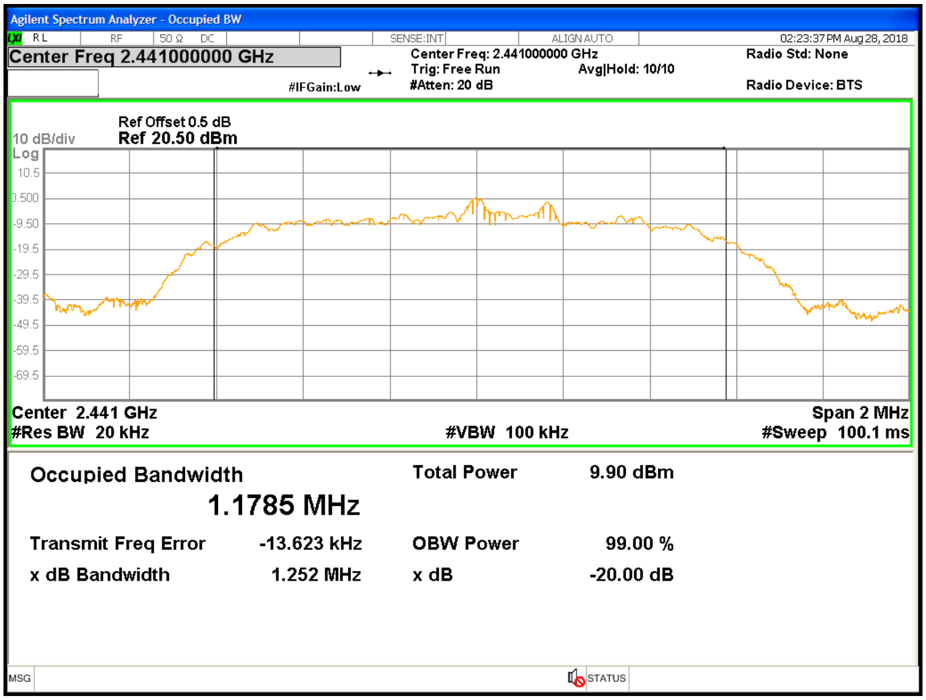


Figure 6: Occupied Bandwidth at 2441 MHz (3-DH3)

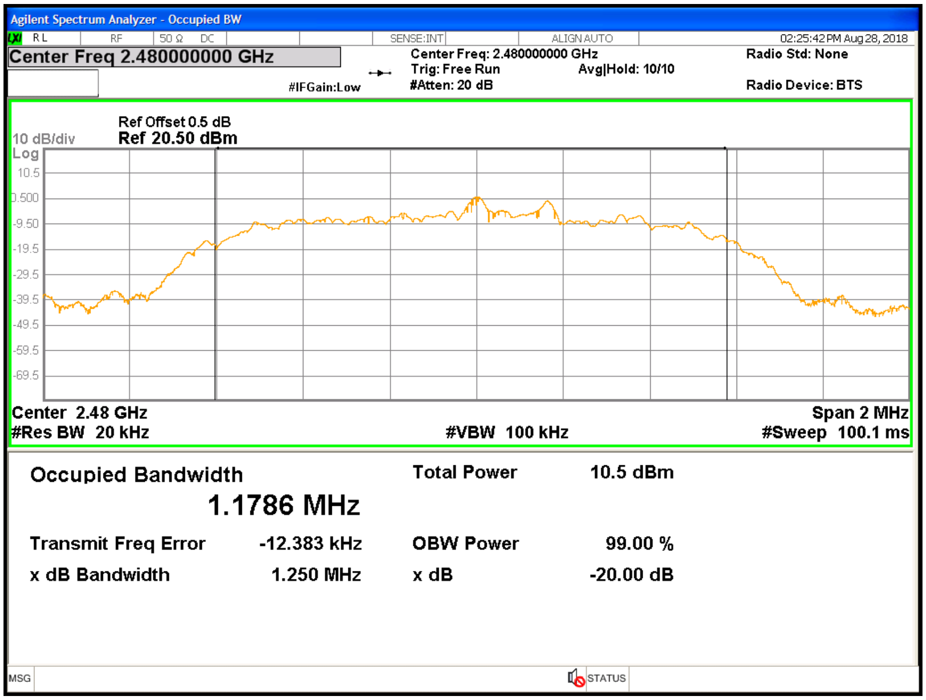


Figure 7: Occupied Bandwidth at 2480 MHz (3-DH3)

5.3 Hopping Frequency Requirements

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

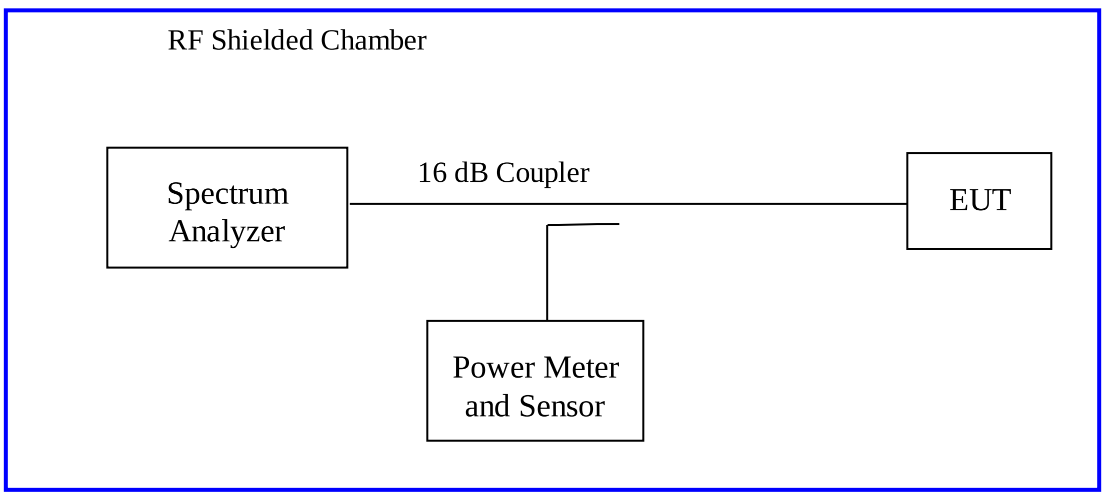
Per CFR47 15.247 (a)(1)(iii), RSS 247 Sect.5.1(b) and 5.1(d), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 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.

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.

5.3.1 **Test Method**

The conducted method were used to measure the carrier frequency separation according to ANSI C63.10:2013 Section 7.8.2, frequency hopping system in Sect. 7.8.3, and time of occupancy in Sect. 7.8.4. The measurement was performed with the EUT set to hop to channel frequencies. Results indicated below.

Test Setup:



5.3.2 Results

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

Table 4: Frequency Hopping Requirements

Test Conditions: Conducted Measurement			**Date:** August 29, 2018		
Antenna Type: Chip			**Power Setting:** fixed at 50		
Max. Antenna Gain: 1.7 dBi			**Signal State:** Modulated		
Duty Cycle: 100 %			**Data Rate:** BDR and EDR		
Ambient Temp.: 22° C			**Relative Humidity:** 38 %RH		
Average Occupancy Time					
Packet	**Pulse Width (ms)**	**# of Pulses (3.16s)**	**Ave. Time (ms)**	**Limit (s)**	**Result**
DH1	0.403	32	128.96	< 0.4	Pass
DH3	1.661	16	265.76	< 0.4	Pass
DH5	2.915	11	320.65	< 0.4	Pass
2-DH1	0.438	32	140.19	< 0.4	Pass
2-DH3	1.691	16	270.56	< 0.4	Pass
2-DH5	2.938	11	323.18	< 0.4	Pass
3-DH1	0.437	32	139.97	< 0.4	Pass
3-DH3	1.683	16	269.28	< 0.4	Pass
3-DH5	2.946	11	324.06	< 0.4	Pass
Note: The dwell time in each channel must be less than 0.4 seconds. The total time for 79 hopping channels is 31.6 seconds. To determine the average dwell time, the frequency 2441MHz was sample in 3.16 second, an 1/10th of the total 79 hopping channels dwell time.					

Minimum Channel Separation			
Package	**Hopping Separation (kHz)**	**Two-Third of 20dB Bandwidth Limit (kHz)**	**Result**
DH1	990.5	> 0.618	Pass
DH3	1005	> 0.620	Pass

DH5	998	> 0.624	Pass
2-DH1	1000.5	> 0.809	Pass
2-DH3	1003	> 0.834	Pass
2-DH5	1000.5	> 0.833	Pass
3-DH1	1000.5	> 0.801	Pass
3-DH3	1000.5	> 0.835	Pass
3-DH5	1023	> 0.835	Pass

Note 1: 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.

Note 2: For 20 dB Occupied Bandwidth plot, refer to Section 5.2 of this test report.

Minimum Number of Channels		
Range (2402MHz -2480MHz)	**Min. Channel Limit**	**Result**
79	15	Pass

Note: Both BDR and EDR used the same number of hopping channels.

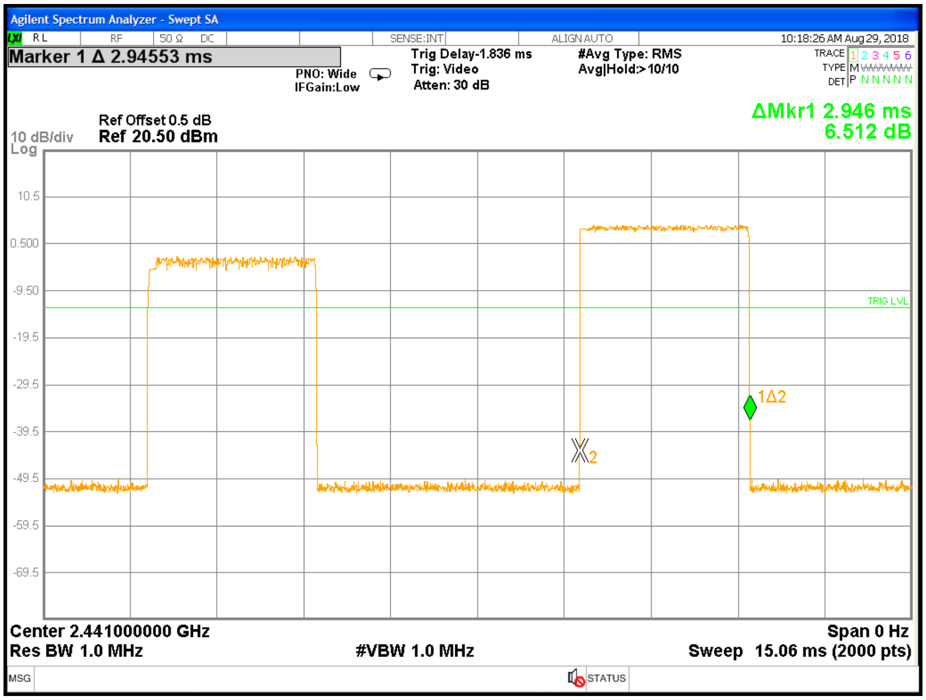


Figure 8: Pulse Width for 3-DH5

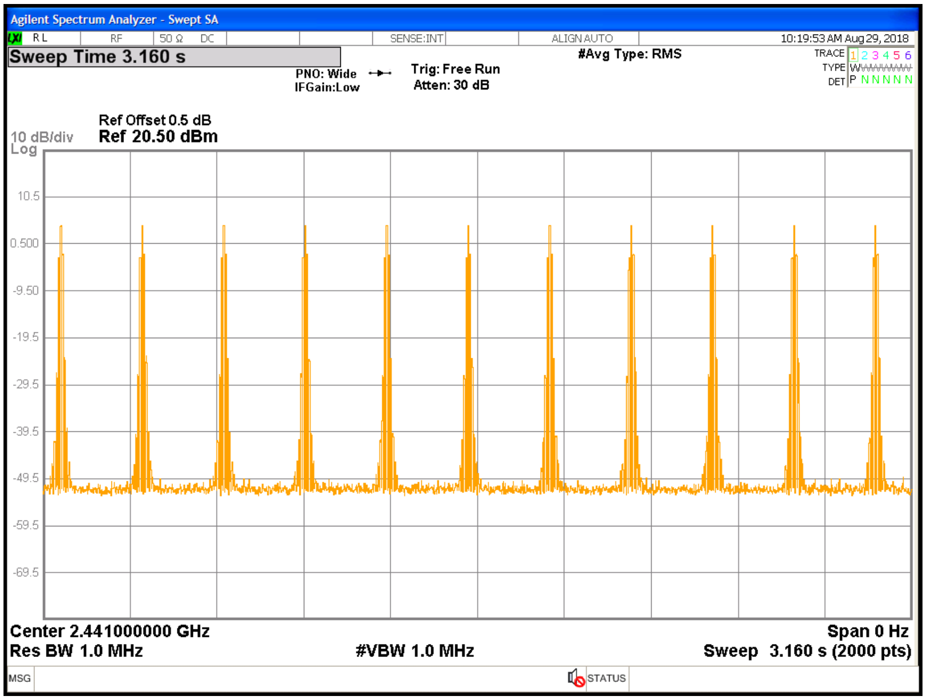


Figure 9: Number of Pulses in 3.16 sec for 3-DH5

Note: There are 11 pulses in 3.16 seconds.

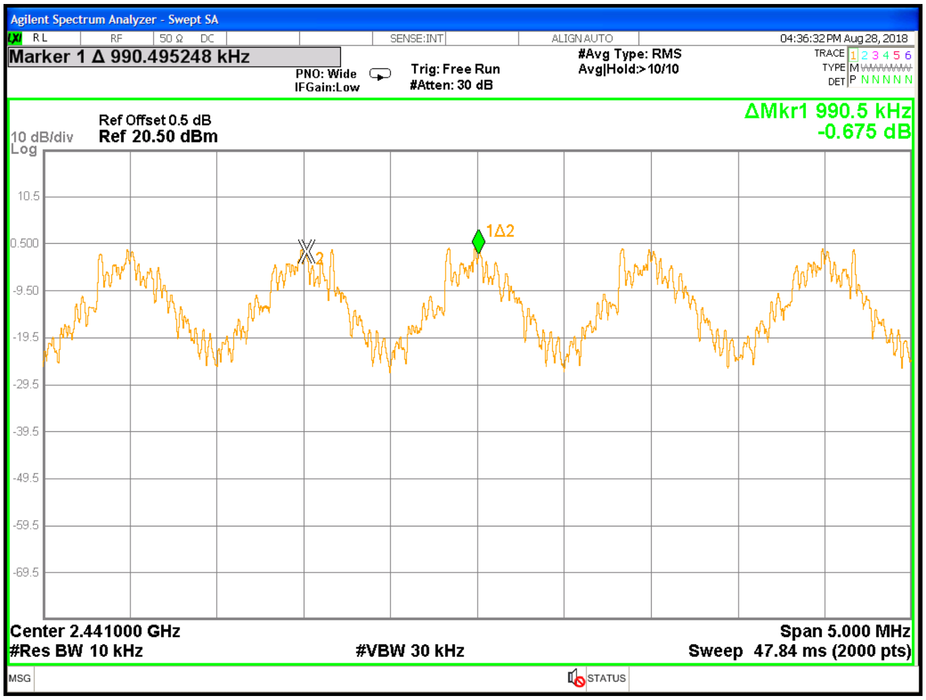


Figure 10: Hopping Separation for DH1

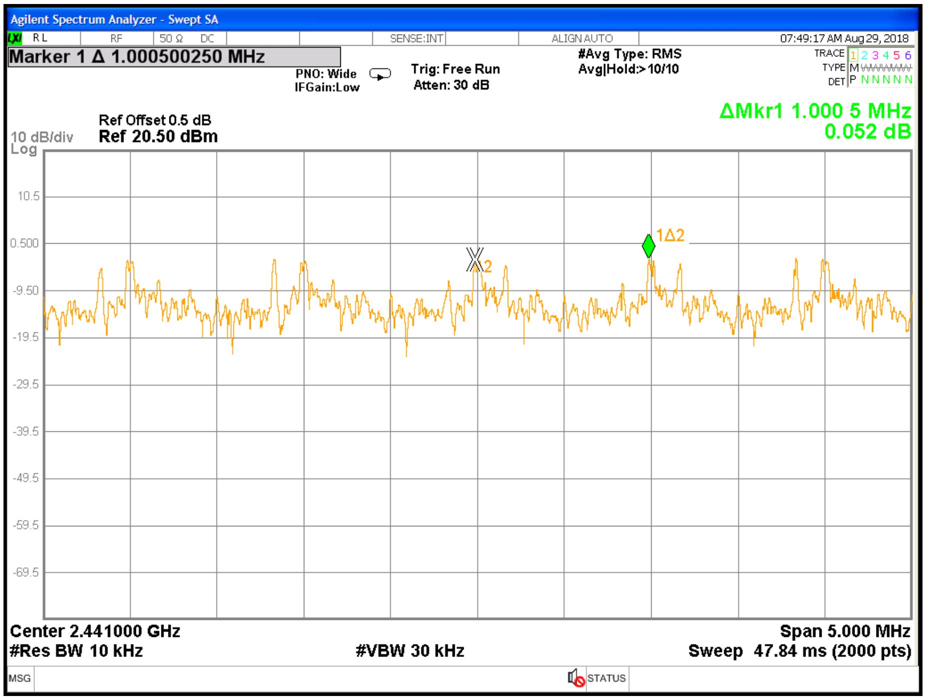


Figure 11: Hopping Separation for 2-DH1

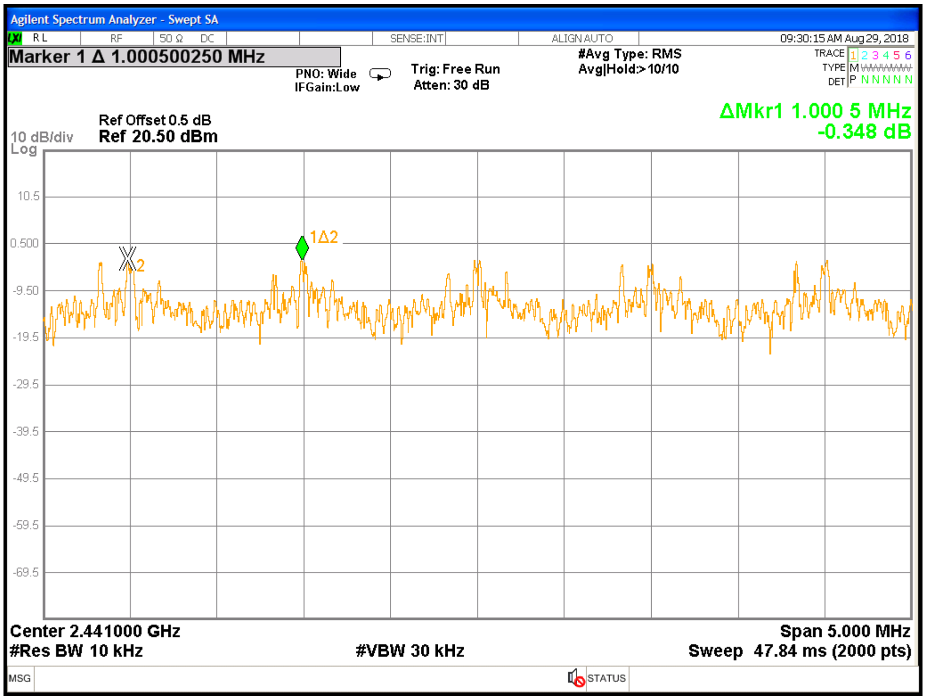


Figure 12: Hopping Separation for 3-DH1

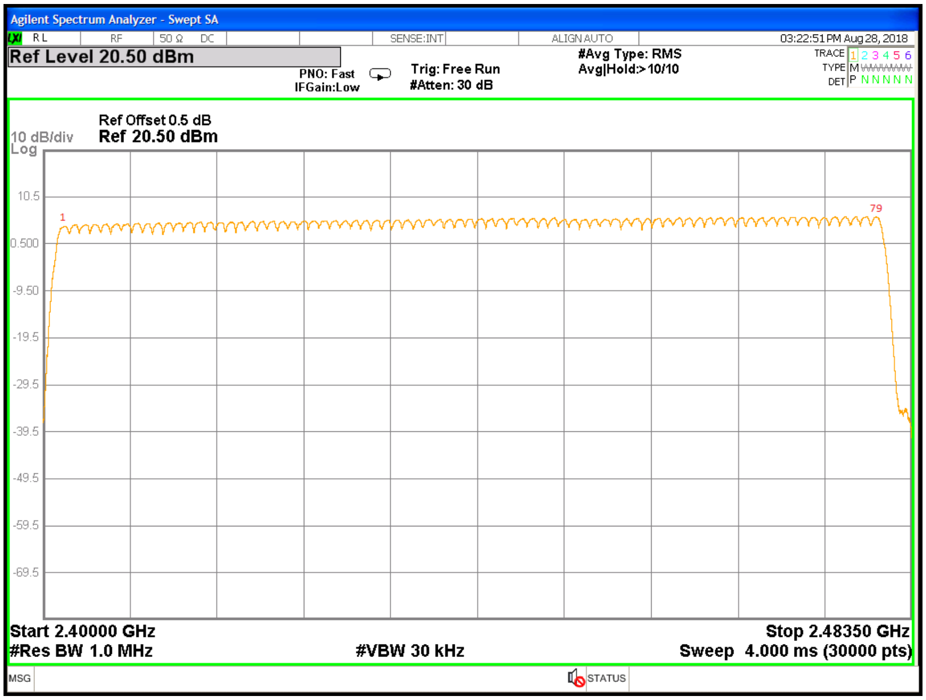


Figure 13: Number of Operating Channels (79)

5.4 Out of Band Emission requirements

Any frequency outside the band of 2400 MHz to 2483.5 MHz, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under the regulation, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. ; CFR 47 Part 15.247(d) and RSS 247 Sect. 5.5.

5.4.1 Test Method

The conducted method was used to measure the channel power output according to ANSI C63.10:2013 Section 7.8.6 and Section 7.8.8. The measurement was performed with modulation per CFR47 Part 15.247 (a)(1) and RSS-247 Sect. 5.1. This test was conducted on 3 channels on No5805 & No5802. The worst mode result indicated below.

5.4.2 Results

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

Table 5: Band Edge Requirements – Test Results

Test Conditions: Conducted Measurement, Hopping OFF		**Date:** August 28, 2018		
Antenna Type: Chip		**Power Setting:** fixed at 50		
Max. Antenna Gain: 1.7 dBi		**Signal State:** Modulated		
Duty Cycle: 100 %		**Data Rate:** See below		
Ambient Temp.: 23° C		**Relative Humidity:** 35 %RH		
-20 dBr Band Edge Results				
Package/ Power	**Operating Freq.**	**Limit (dBm)**	**Measured Value (dBm)**	**Result**
DH1	2402 MHz	-15.97	-38.71	Pass
	2441 MHz	-14.24	-62.62	Pass
	2480 MHz	-13.70	-56.47	Pass
2-DH5	2402 MHz	-18.55	-36.03	Pass
	2441 MHz	-16.56	-61.90	Pass
	2480 MHz	-16.47	-57.61	Pass
3-DH3	2402 MHz	-18.60	-35.63	Pass
	2441 MHz	-16.48	-61.63	Pass

	2480 MHz	-15.94	-55.36	Pass

Note: The stated limits for 20 dBr are relative to each individual output per ANSI C63.10 Method. The worst case of each data rate is recorded.

Out of Band Emission				
Package/ Power	**Operating Freq.**	**Limit (dBm)**	**Measured Value (dBm)**	**Result**
DH1	2402 MHz	-15.97	-47.32 dBm (2.558GHz)	Pass
	2441 MHz	-14.24	-47.16 dBm (2.597GHz)	Pass
	2480 MHz	-13.70	-47.26 dBm (2.6359GHz)	Pass
2-DH5	2402 MHz	-18.55	-49.06 dBm (2.558GHz)	Pass
	2441 MHz	-16.56	-49.75 dBm (2.597GHz)	Pass
	2480 MHz	-16.47	-53.18 dBm (2.6359GHz)	Pass
3-DH3	2402 MHz	-18.60	-52.88 dBm (2.558GHz)	Pass
	2441 MHz	-16.48	-51.65 dBm (2.597GHz)	Pass
	2480 MHz	-15.94	-49.40 dBm (2.6359GHz)	Pass

Note: The stated limits are relative to each individual output per ANSI C63.10 Method.

Table 6: Band Edge Requirements – Test Results

Test Conditions: Conducted Measurement, Hopping ON		**Date:** March 25, 2019		
Antenna Type: Chip		**Power Setting:** fixed at 50		
Max. Antenna Gain: 1.7 dBi		**Signal State:** Modulated		
Duty Cycle: 100 %		**Data Rate:** See below		
Ambient Temp.: 23º C		**Relative Humidity:** 34 %RH		
-20 dBr Band Edge Results				
Package/ Power	**Operating Freq.**	**Limit (dBm)**	**Measured Value (dBm)**	**Result**
DH1	2402 MHz	-13.58	-38.74	Pass
	2480 MHz	-13.47	-60.39	Pass
2-DH5	2402 MHz	-16.01	-45.99	Pass
	2480 MHz	-16.50	-62.07	Pass
3-DH3	2402 MHz	-16.27	-40.81	Pass
	2480 MHz	-15.77	-61.96	Pass
Note: The worst case of each data rate is recorded.				

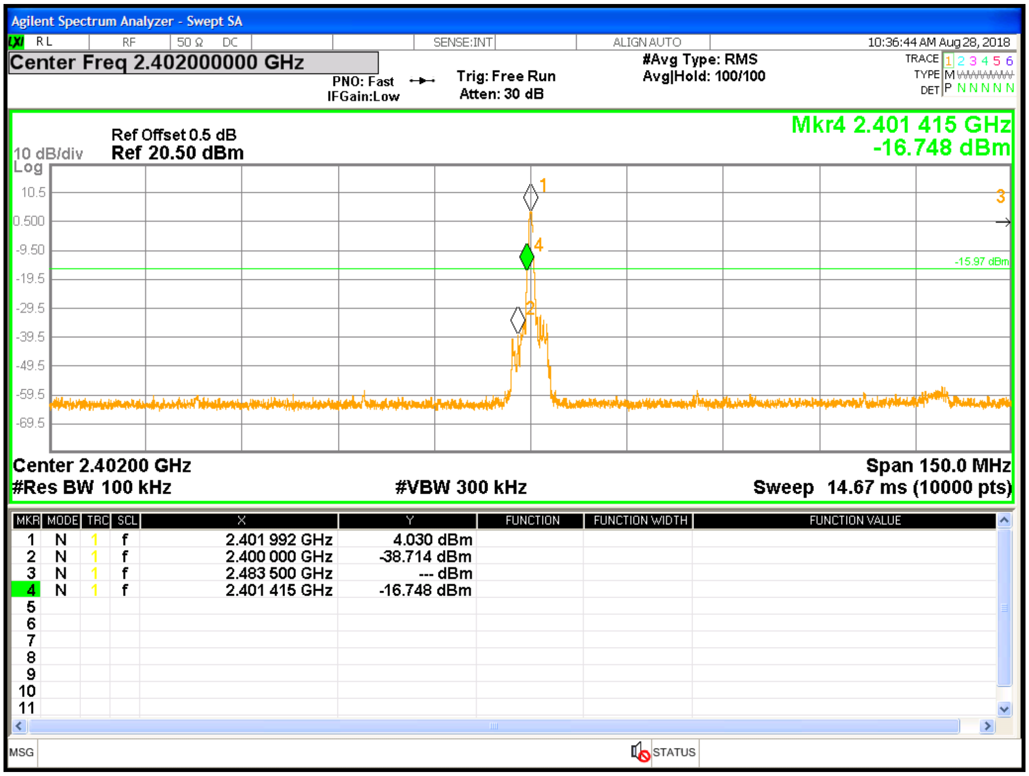


Figure 14: Band Edge Requirements at 2402 MHz – DH1

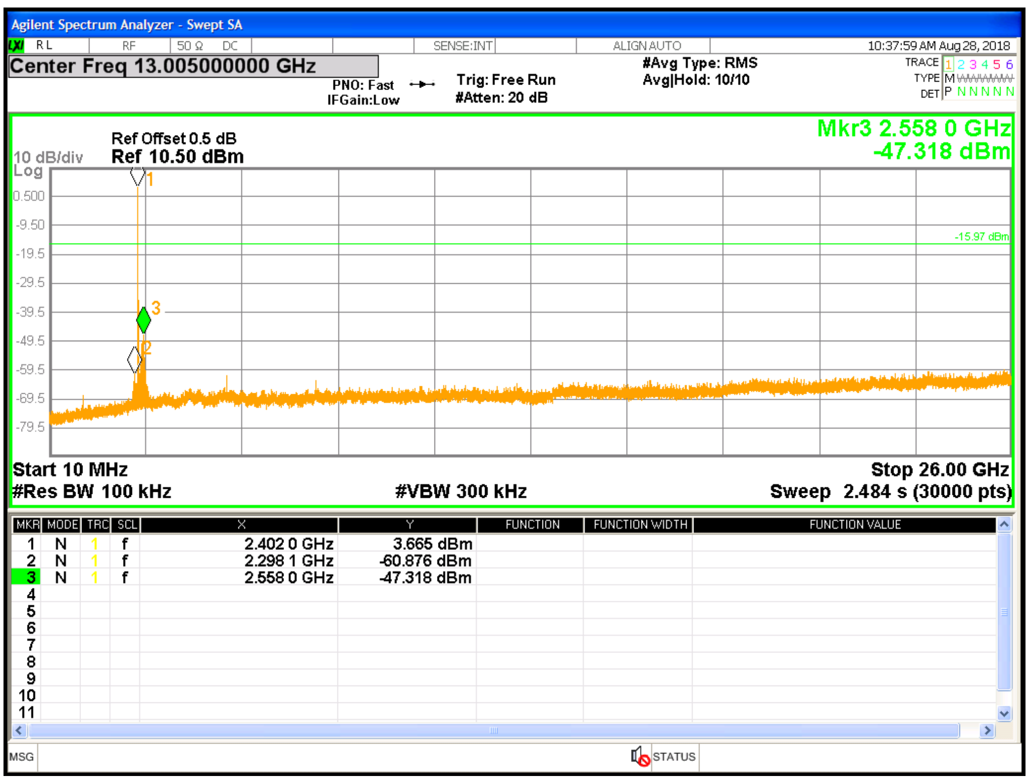


Figure 15: Out of Band Emission Requirements at 2402 MHz – DH1

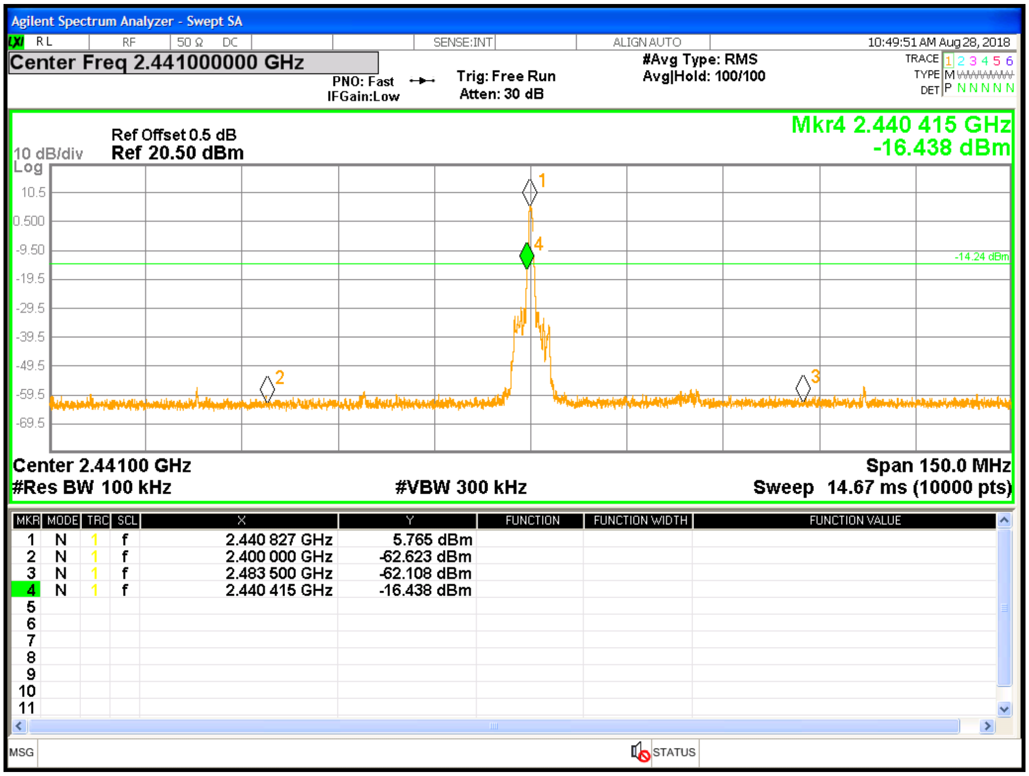


Figure 16: Band Edge Requirements at 2441 MHz – DH1

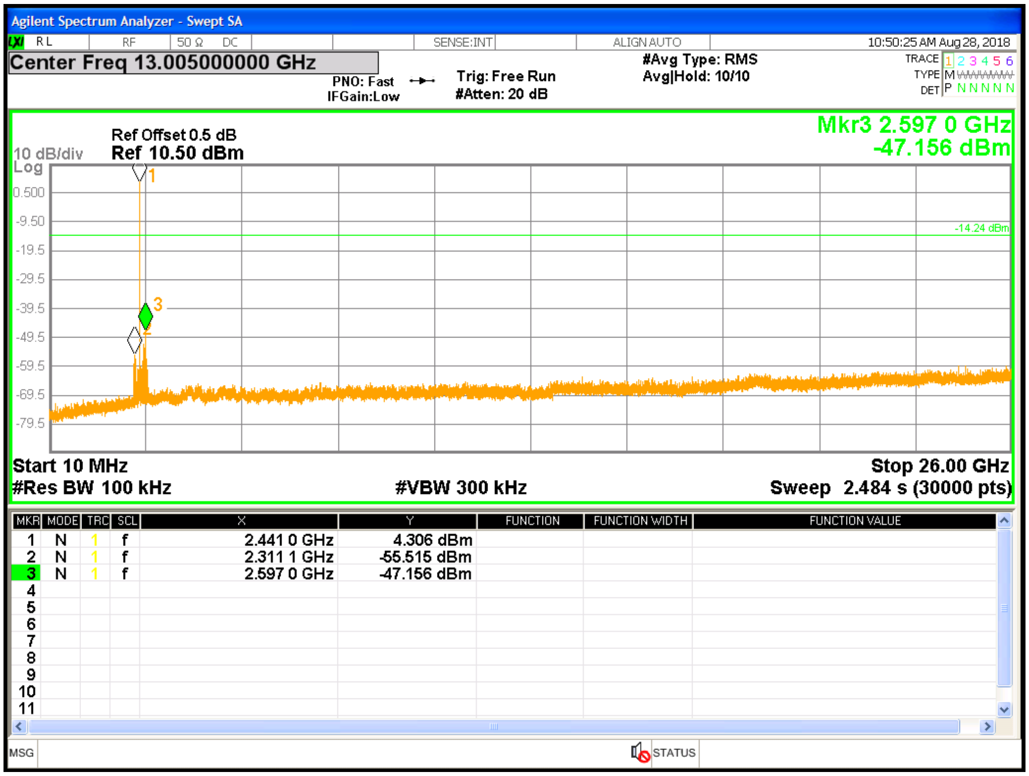


Figure 17: Out of Band Emission Requirements at 2441 MHz – DH1

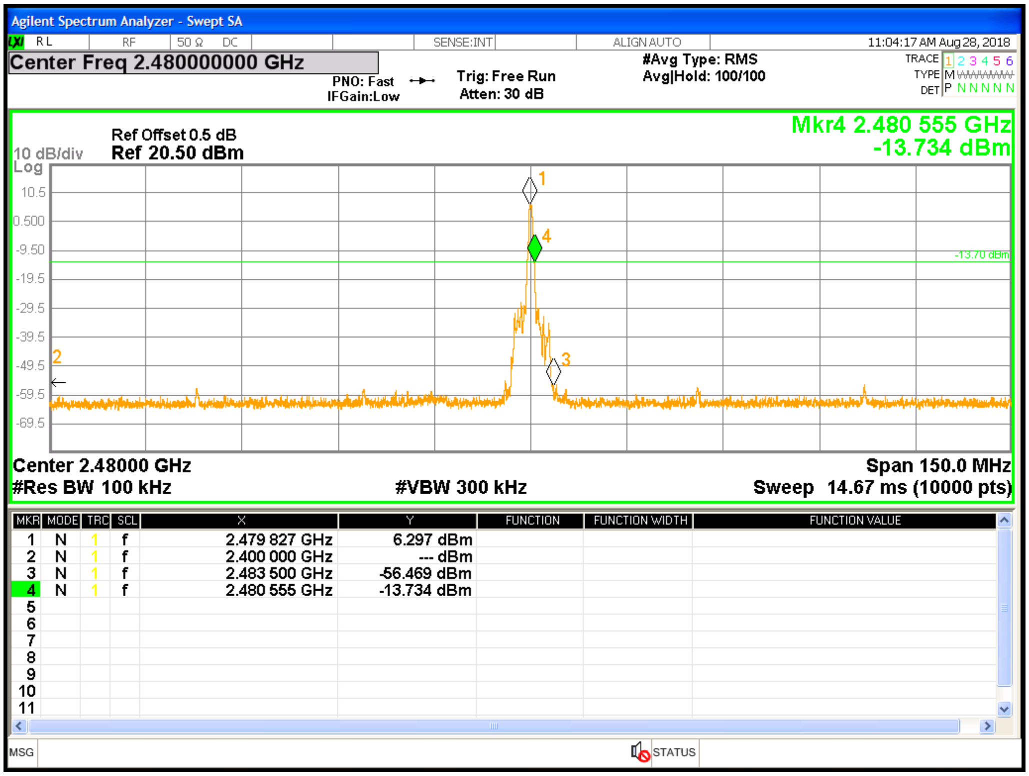


Figure 18: Band Edge Requirements at 2480 MHz – DH1

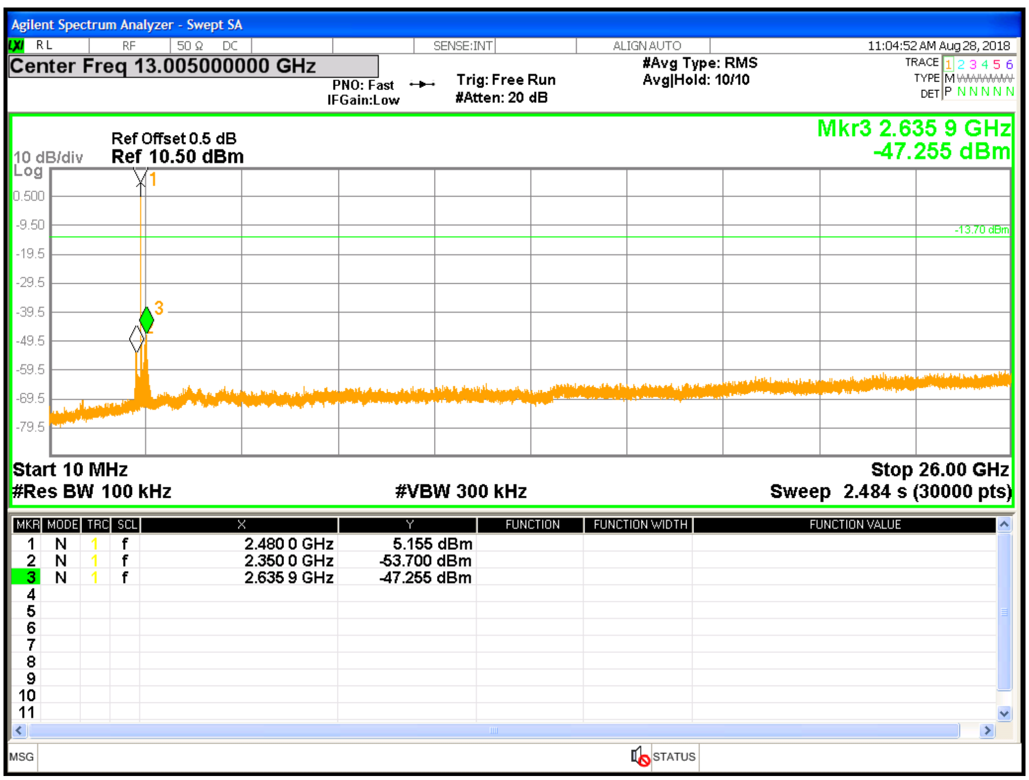


Figure 19: Out of Band Emission Requirements at 2480 MHz – DH1

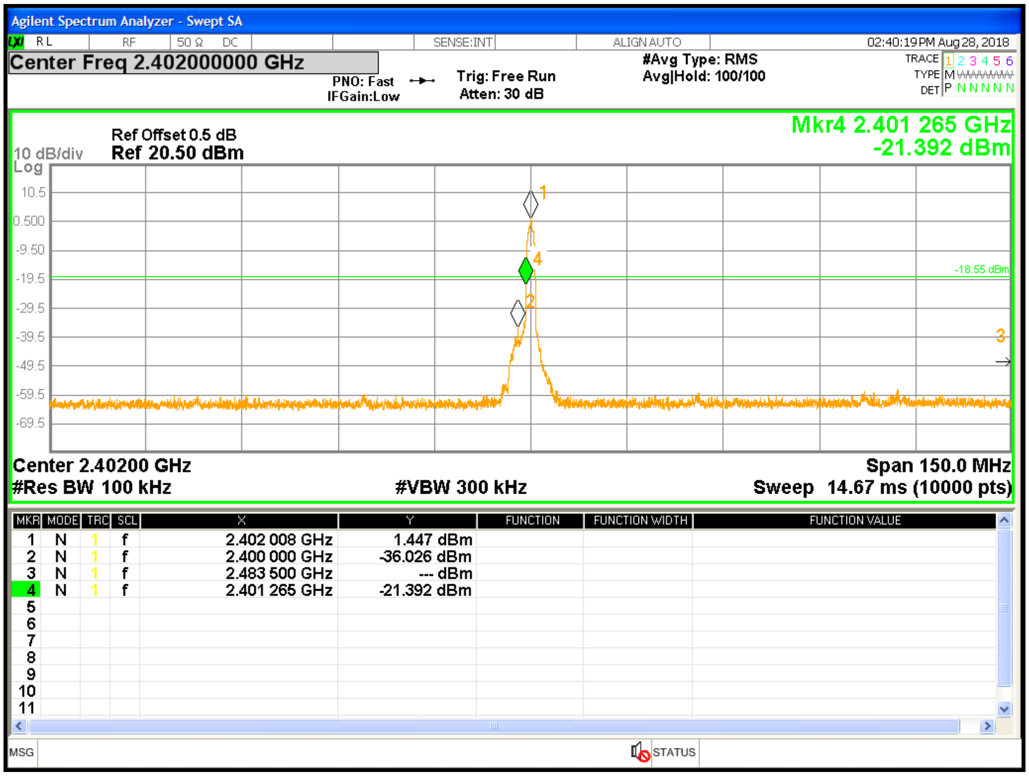


Figure 20: Band Edge Requirements at 2402 MHz – 2-DH5

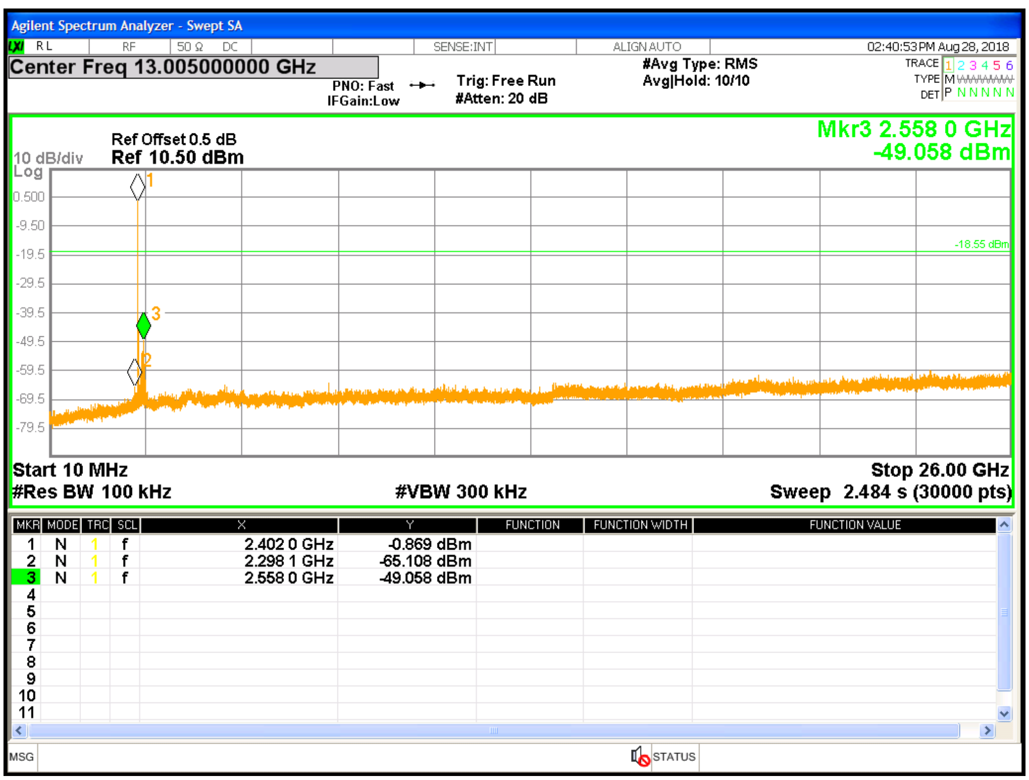


Figure 21: Out of Band Emission Requirements at 2402 MHz – 2-DH5

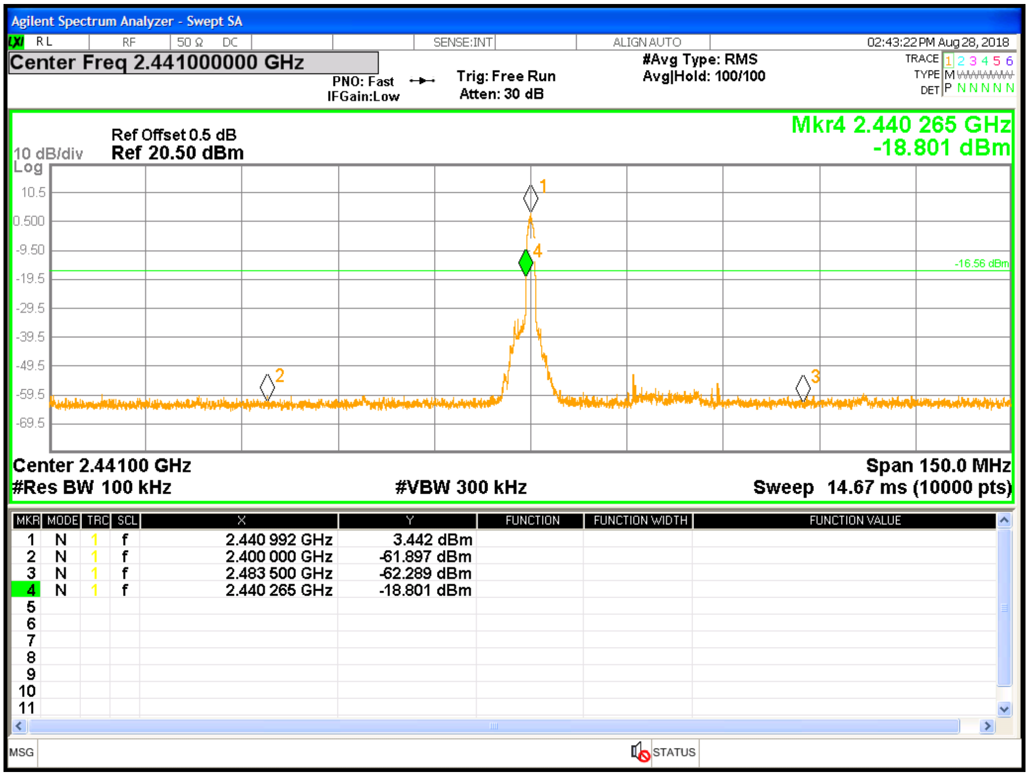


Figure 22: Band Edge Requirements at 2441 MHz – 2-DH5

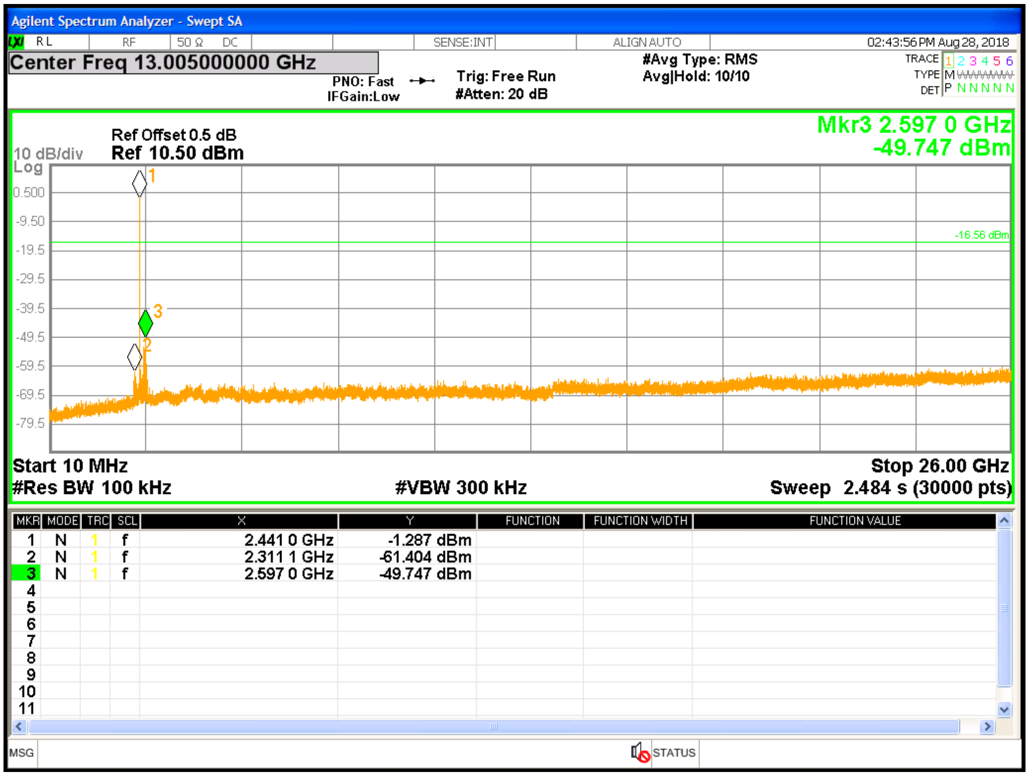


Figure 23: Out of Band Emission Requirements at 2441 MHz – 2-DH5

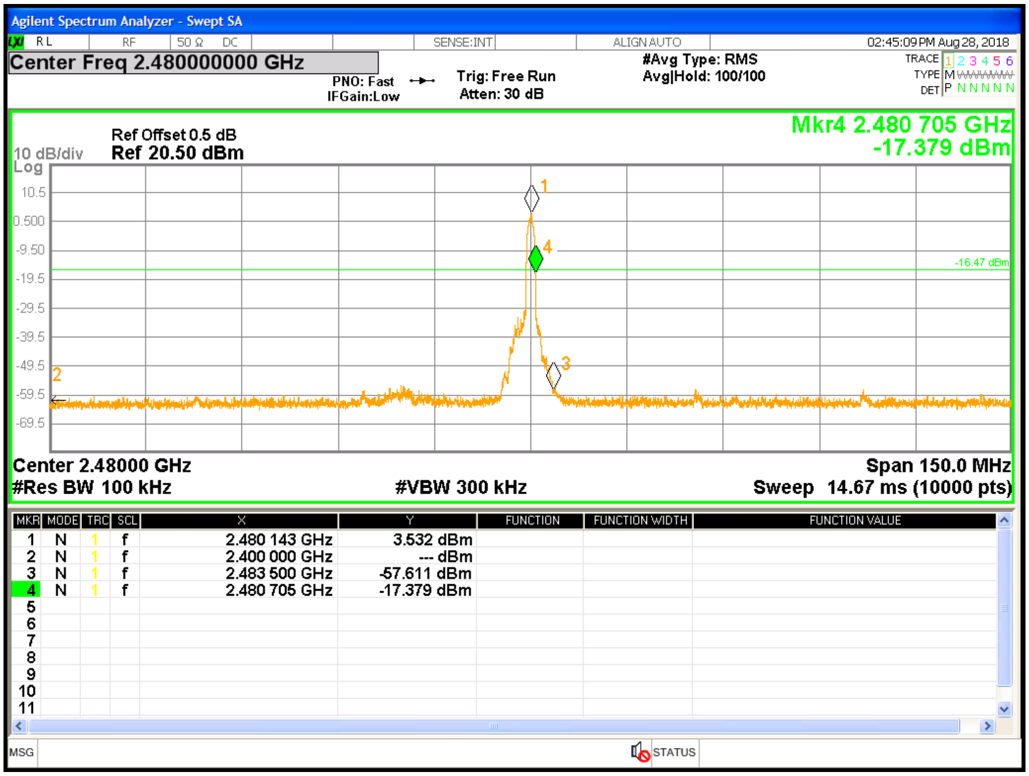


Figure 24: Band Edge Requirements at 2480 MHz – 2-DH5

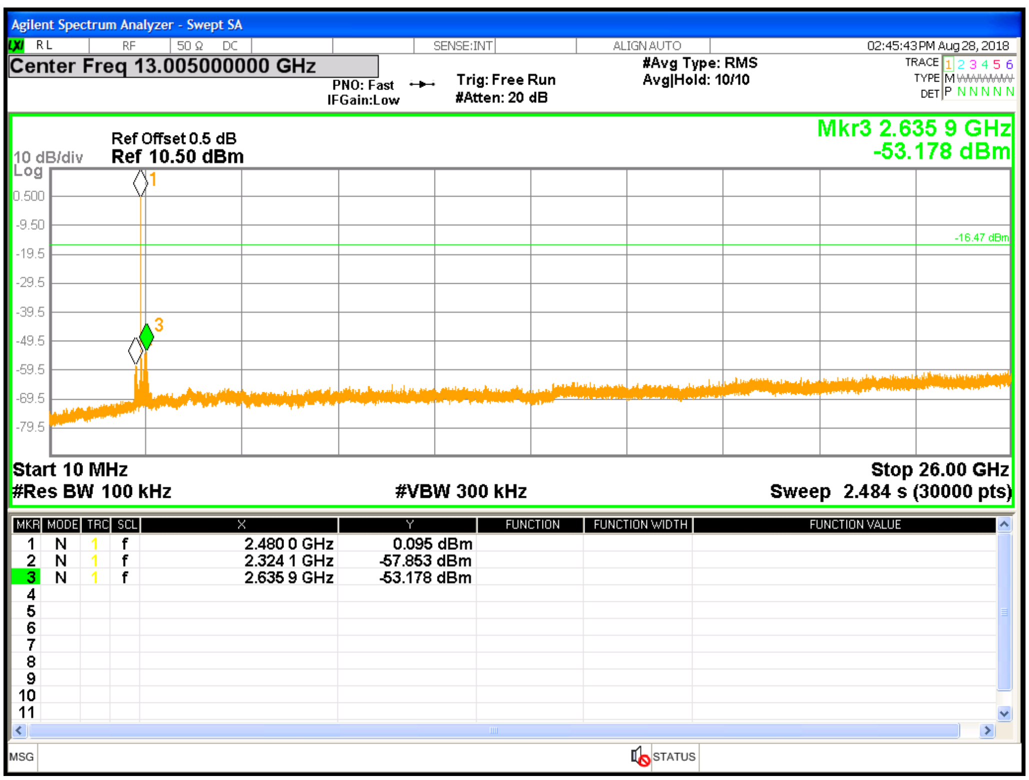


Figure 25: Out of Band Emission Requirements at 2480 MHz – 2-DH5

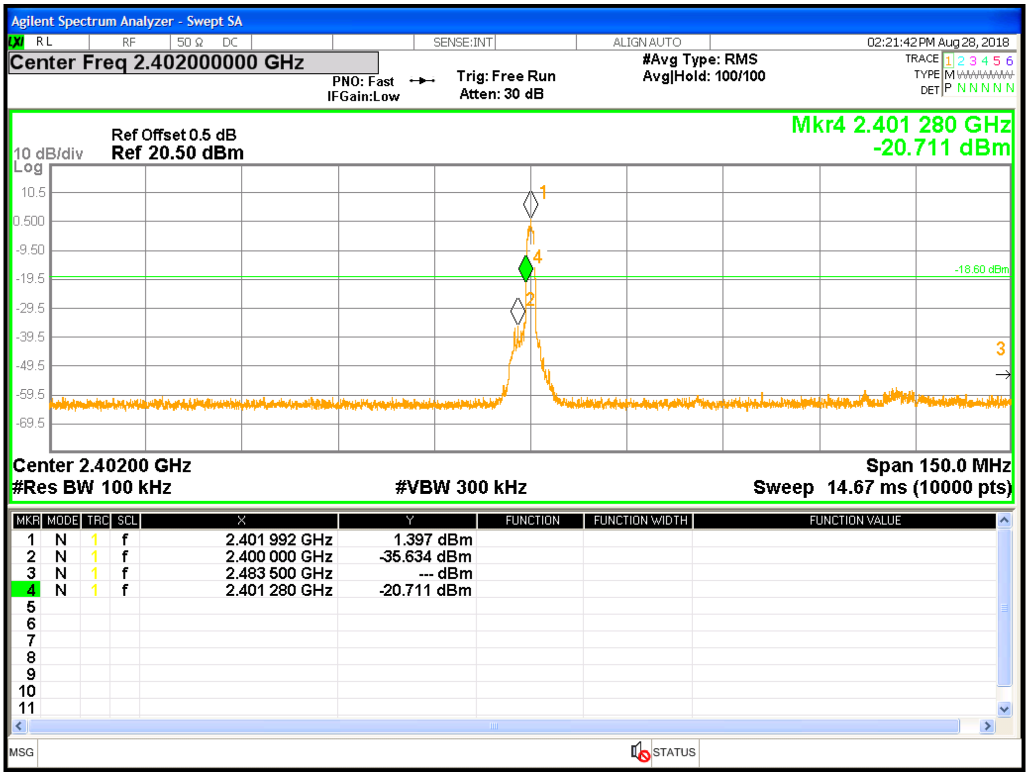


Figure 26: Band Edge Requirements at 2402 MHz – 3-DH3

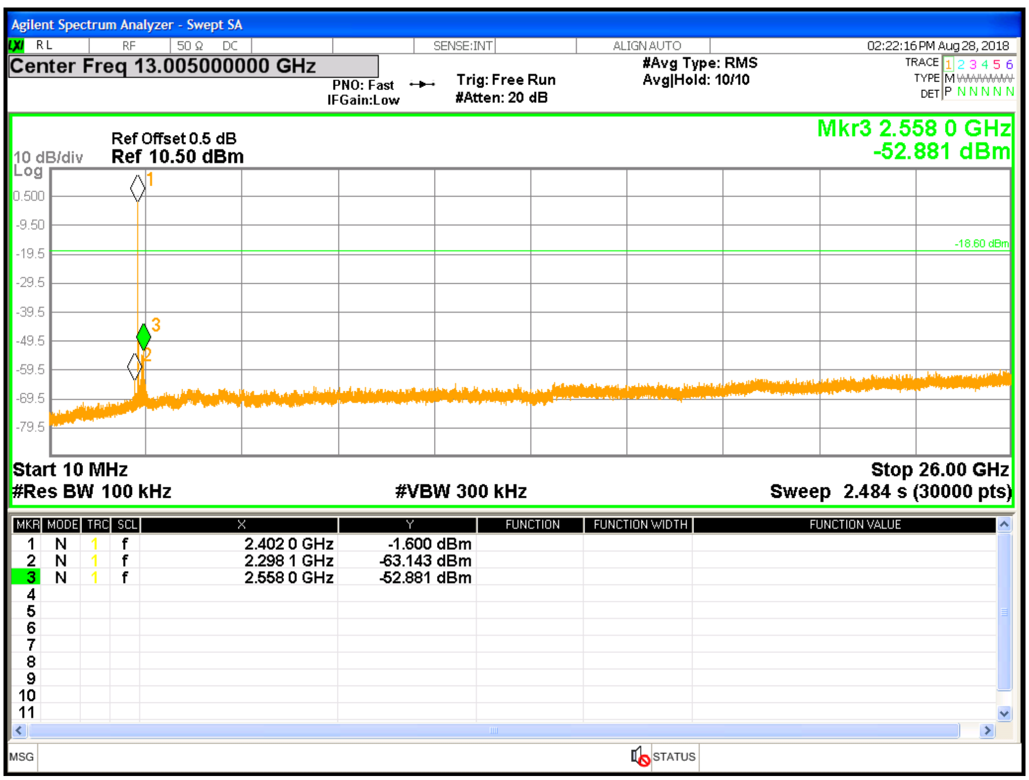


Figure 27: Out of Band Emission Requirements at 2402 MHz – 3-DH3

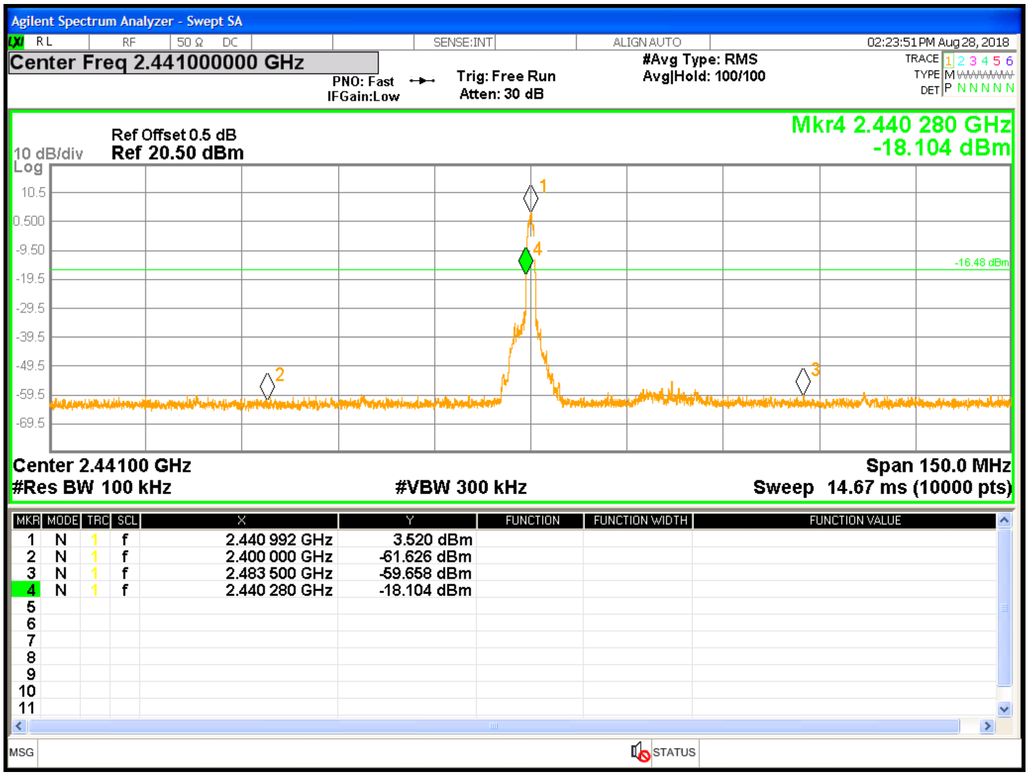


Figure 28: Band Edge Requirements at 2441 MHz – 3-DH3

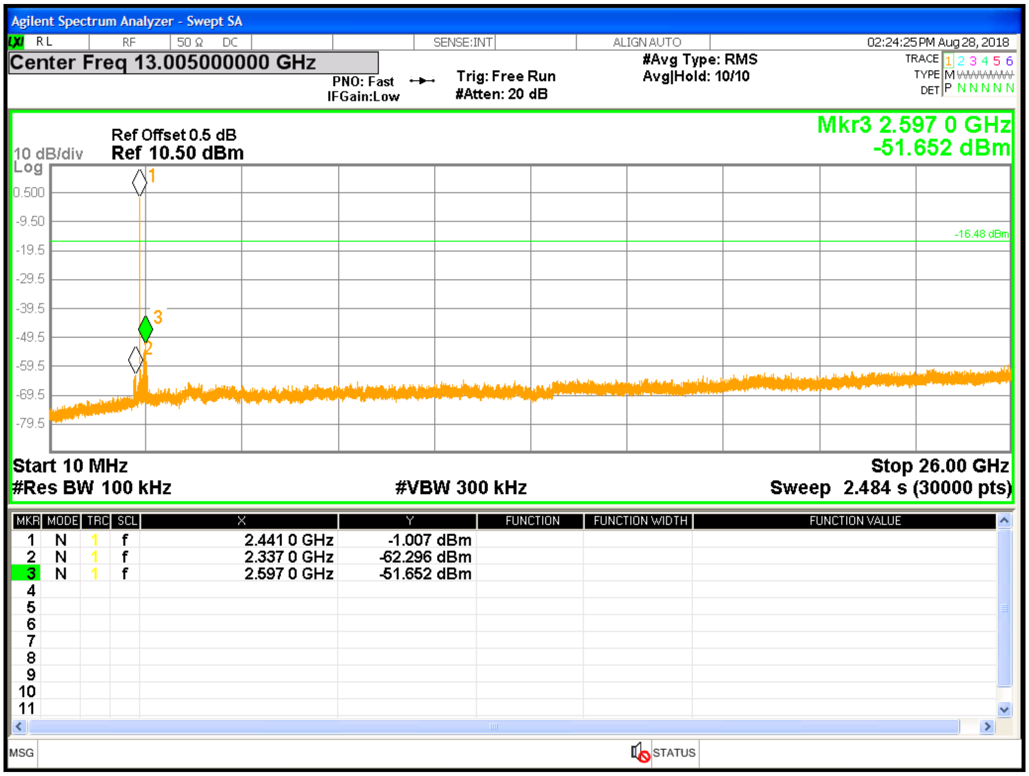


Figure 29: Out of Band Emission Requirements at 2441 MHz – 3-DH3

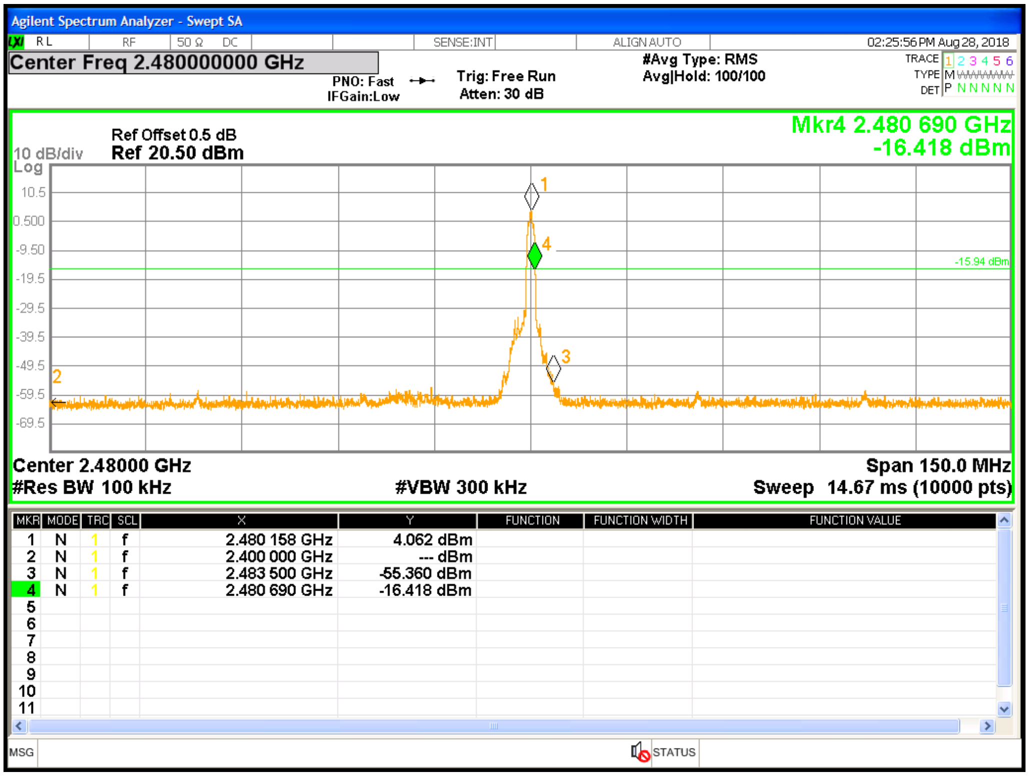


Figure 30: Band Edge Requirements at 2480 MHz – 3-DH3

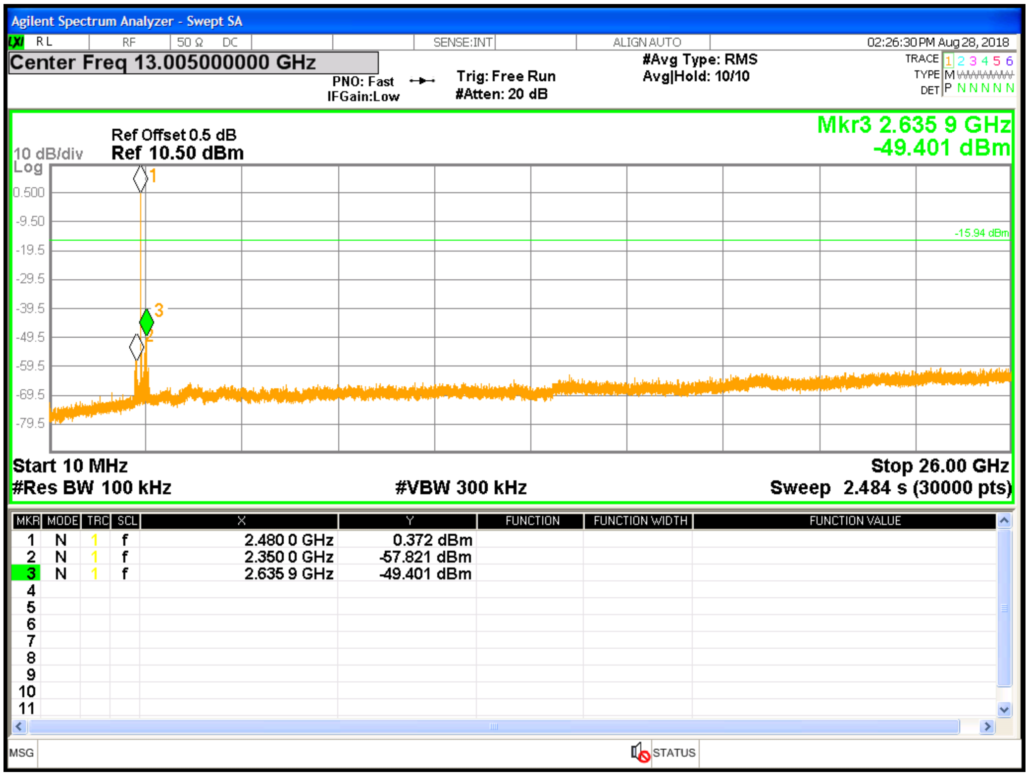


Figure 31: Out of Band Emission Requirements at 2480 MHz – 3-DH3

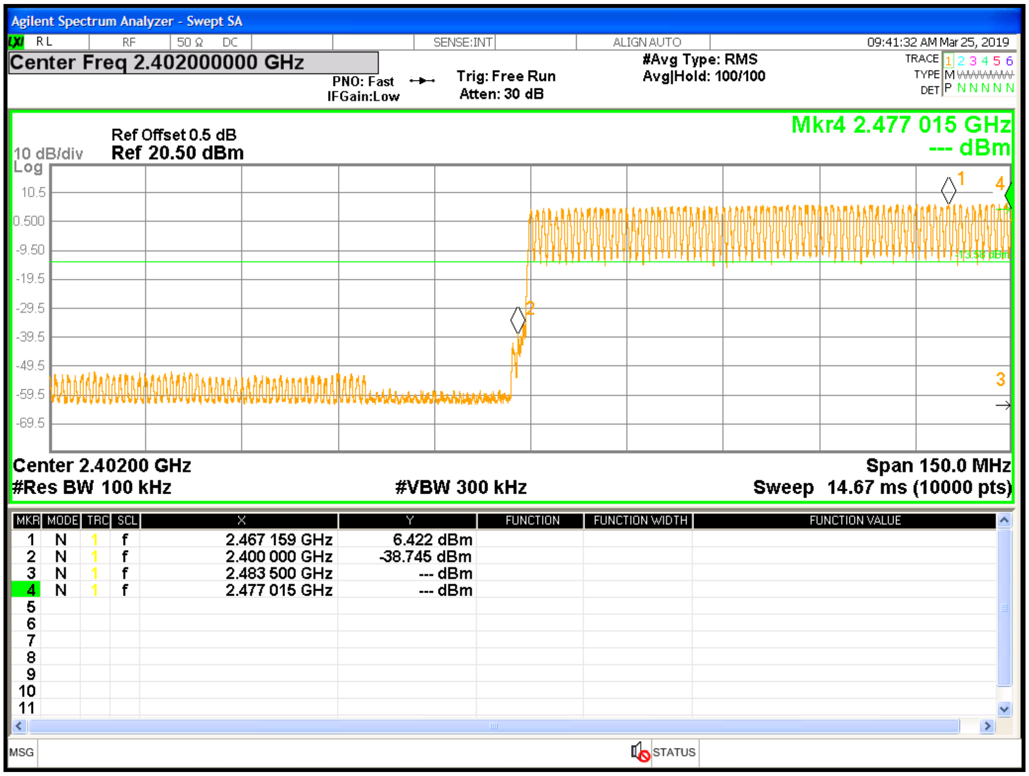


Figure 32: Band Edge Requirements at 2402 MHz – DH1 Hopping Mode

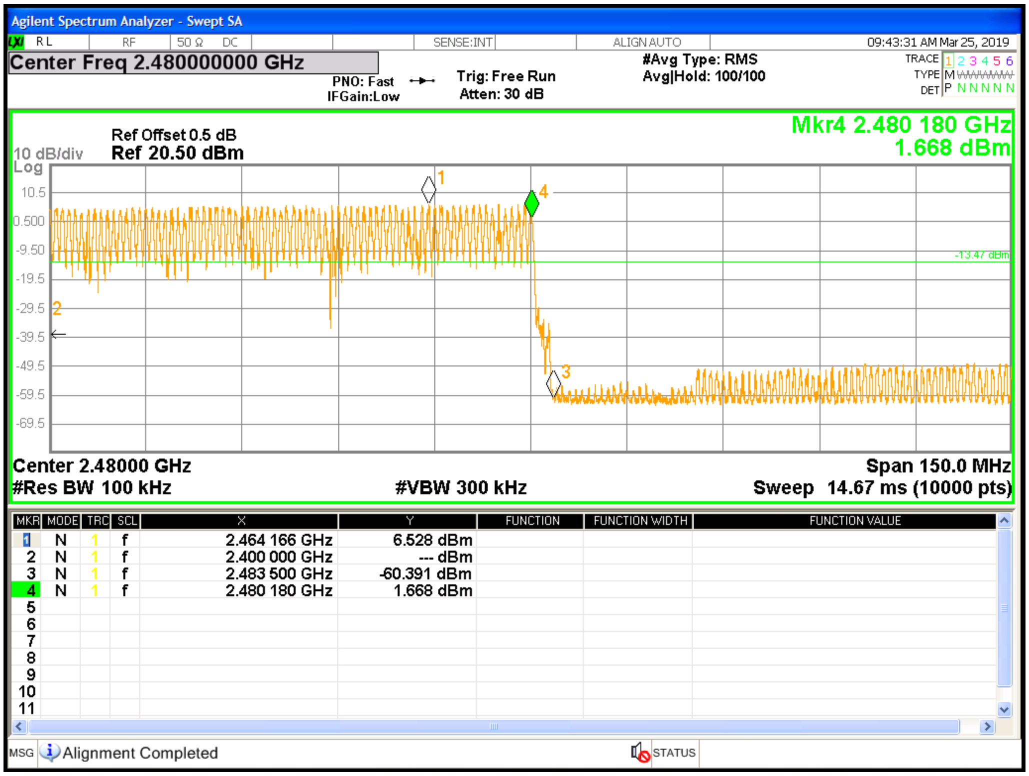


Figure 33: Band Edge Requirements at 2480 MHz – DH1 Hopping Mode

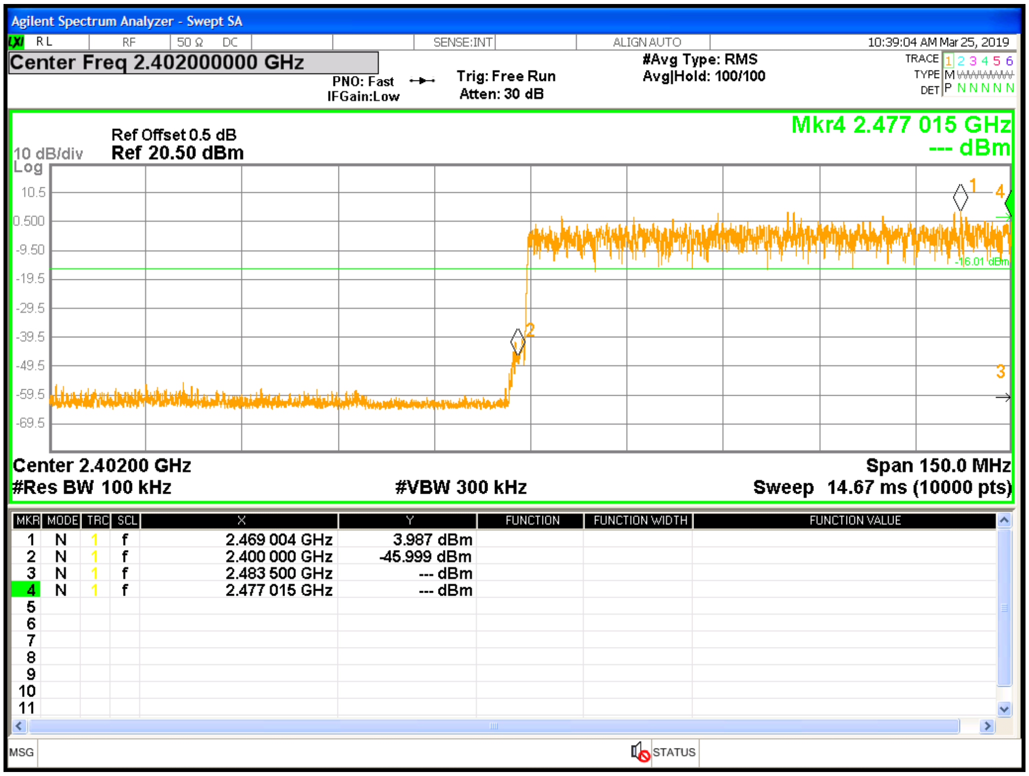


Figure 34: Band Edge Requirements at 2402 MHz – 2-DH5 Hopping Mode

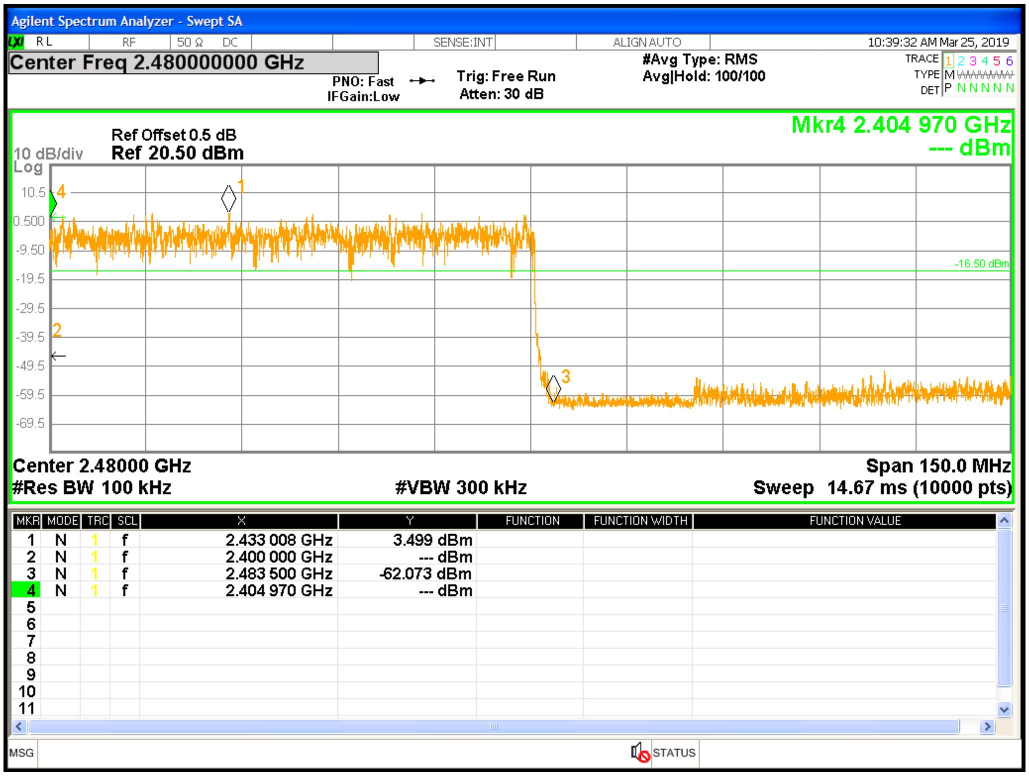


Figure 35: Band Edge Requirements at 2480 MHz – 2-DH5 Hopping Mode

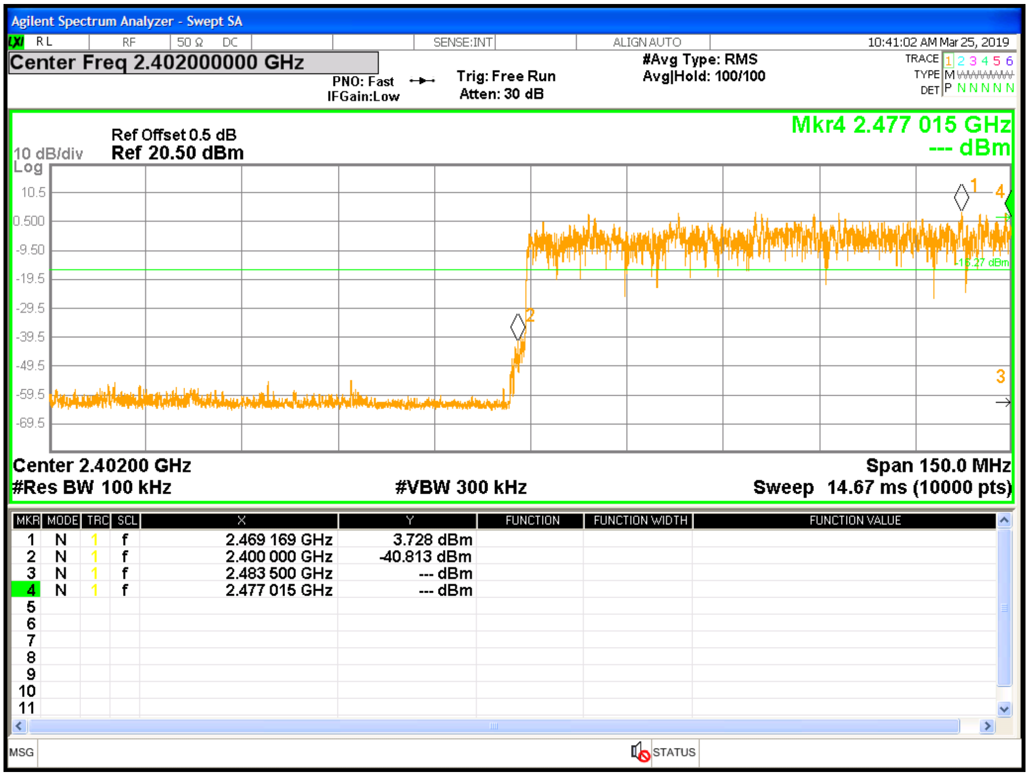


Figure 36: Band Edge Requirements at 2402 MHz – 3-DH3 Hopping Mode

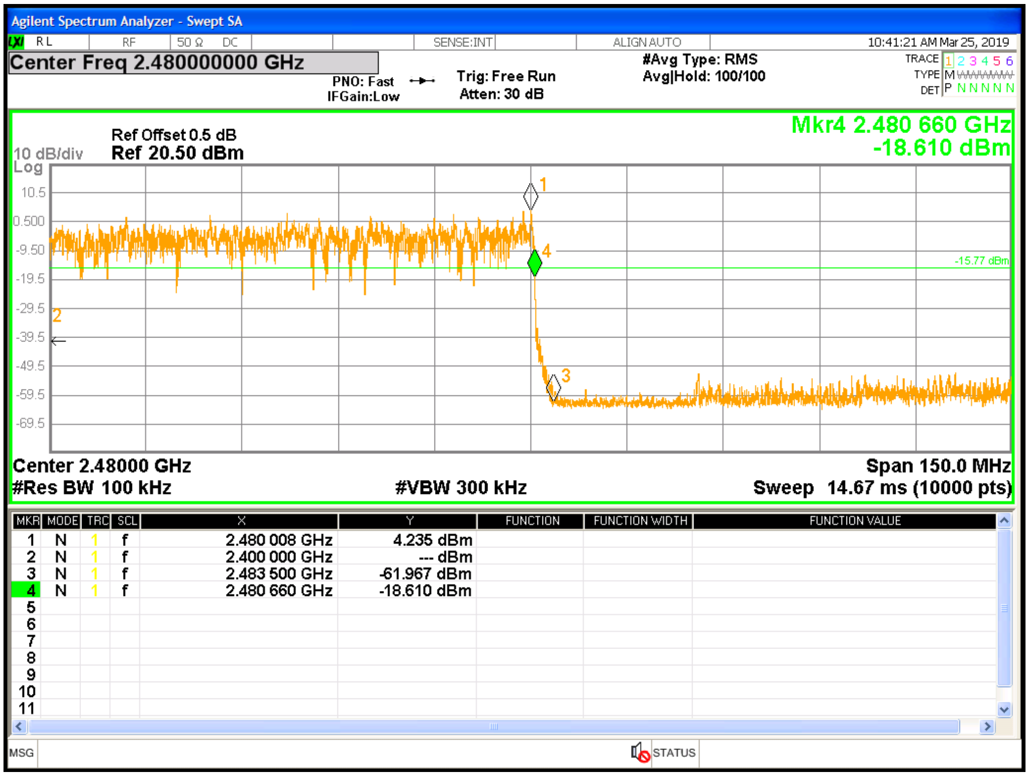


Figure 37: Band Edge Requirements at 2480 MHz – 3-DH3 Hopping Mode

5.5 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 GEN Sect. 8.9 and 8.10.

5.5.1 Test Methodology

5.5.1.1 *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 height of 1 – 4m. Measurement equipment was located outside of the chamber < 1GHz frequency range.

5.5.1.2 *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.

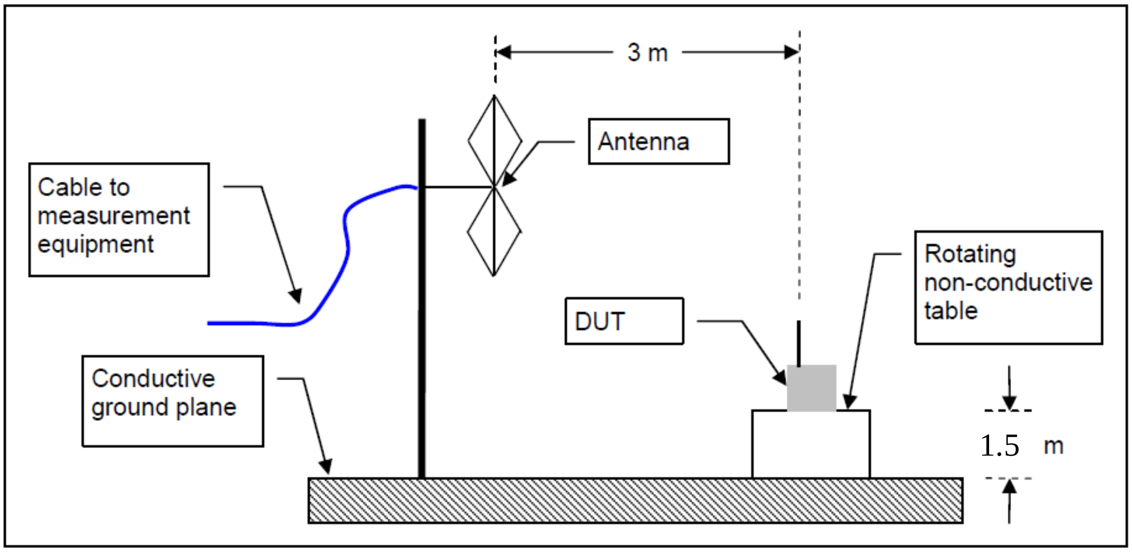
Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final scans performed on the highest power measured, for three operating channels: 2402 MHz, 2441 MHz, and 2480 MHz at DH1.

5.5.1.3 *Deviations*

None.

Test Setup:



5.5.2 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2018 and RSS Gen Sect. 8.9, 8.10: 2018.

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.

5.5.3 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)

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

5.5.4 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 7: Transmit Spurious Emission at Restricted Band Edge Requirements

Test Conditions: Radiated Measurement at 3 meters, Hopping OFF				**Date:** August 24, 2018			
Antenna Type: Chip				**Power Setting:** fixed at 50			
Max. Antenna Gain: +1.7 dBi				**Signal State:** Modulated			
Duty Cycle: 100 %				**Data Rate:** see below			
Ambient Temp.: 23º C				**Relative Humidity:** 37 %RH			
Band Edge Results								

Freq. MHz	Level dBuV/m	Pol. V/H	15.209/15.247 Limit	Margin	Detector Pk/Avg	Azimuth degrees	Height meters	Comments
2390.0	55.76	V	74.00	-18.24	Pk	208	106	BT-2402MHz, DH1
2390.0	56.88	V	74.00	-17.12	Pk	208	106	BT-2402MHz, DH1, 2MHz Span
2390.0	43.38	V	54.00	-10.62	Avg	208	106	BT-2402MHz, DH1
2390.0	43.38	V	54.00	-10.62	Avg	208	106	BT-2402MHz, DH1, 2MHz Span
2390.0	55.19	H	74.00	-18.81	Pk	149	207	BT-2402MHz, DH1
2390.0	55.35	H	74.00	-18.65	Pk	149	207	BT-2402MHz, DH1, 2MHz Span
2390.0	43.38	H	54.00	-10.62	Avg	149	207	BT-2402MHz, DH1
2390.0	43.38	H	54.00	-10.62	Avg	149	207	BT-2402MHz, DH1, 2MHz Span
2483.5	57.98	V	74.00	-16.02	Pk	188	103	BT-2480MHz, DH1
2483.6	59.06	V	74.00	-14.94	Pk	188	103	BT-2480MHz, DH1, 2MHz Span
2483.5	43.38	V	54.00	-10.62	Avg	188	103	BT-2480MHz, DH1
2483.5	43.38	V	54.00	-10.62	Avg	188	103	BT-2480MHz, DH1, 2MHz Span
2483.5	58.96	H	74.00	-15.04	Pk	144	193	BT-2480MHz, DH1
2483.5	59.76	H	74.00	-14.24	Pk	144	193	BT-2480MHz, DH1, 2MHz Span
2483.5	45.31	H	54.00	-8.69	Avg	144	193	BT-2480MHz, DH1
2483.5	43.38	H	54.00	-10.62	Avg	144	193	BT-2480MHz, DH1, 2MHz Span

Band Edge Results (Hopping Mode)								
Freq. MHz	Level dBuV/m	Pol. V/H	15.209/15.247 Limit	Margin	Detector Pk/Avg	Azimuth degrees	Height meters	Comments
2389.9	56.15	V	74.00	-17.85	Pk	208	106	BT-Hopping, DH1
2389.3	57.51	V	74.00	-16.49	Pk	208	106	BT-Hopping, DH1, 2MHz Span
2389.9	40.88	V	54.00	-13.12	Avg	208	106	BT-Hopping, DH1
2390.0	43.38	V	54.00	-10.62	Avg	208	106	BT-Hopping, DH1, 2MHz Span
2390.0	55.44	H	74.00	-18.56	Pk	149	207	BT-Hopping, DH1
2389.9	56.29	H	74.00	-17.71	Pk	149	207	BT-Hopping, DH1, 2MHz Span
2390.0	43.38	H	54.00	-10.62	Avg	149	207	BT-Hopping, DH1
2390.0	43.38	H	54.00	-10.62	Avg	149	207	BT-Hopping, DH1, 2MHz Span
2483.5	57.27	V	74.00	-16.73	Pk	188	103	BT-Hopping, DH1
2483.5	56.93	V	74.00	-17.07	Pk	188	103	BT-Hopping, DH1, 2MHz Span
2483.5	43.38	V	54.00	-10.62	Avg	188	103	BT-Hopping, DH1
2483.5	43.38	V	54.00	-10.62	Avg	188	103	BT-Hopping, DH1, 2MHz Span
2483.5	57.92	H	74.00	-16.08	Pk	144	193	BT-Hopping, DH1
2483.6	58.73	H	74.00	-15.27	Pk	144	193	BT-Hopping, DH1, 2MHz Span
2483.5	43.38	H	54.00	-10.62	Avg	144	193	BT-Hopping, DH1
2483.5	43.38	H	54.00	-10.62	Avg	144	193	BT-Hopping, DH1, 2MHz Span
Note: Band Edge measurement were made on the highest power level (DH1).								

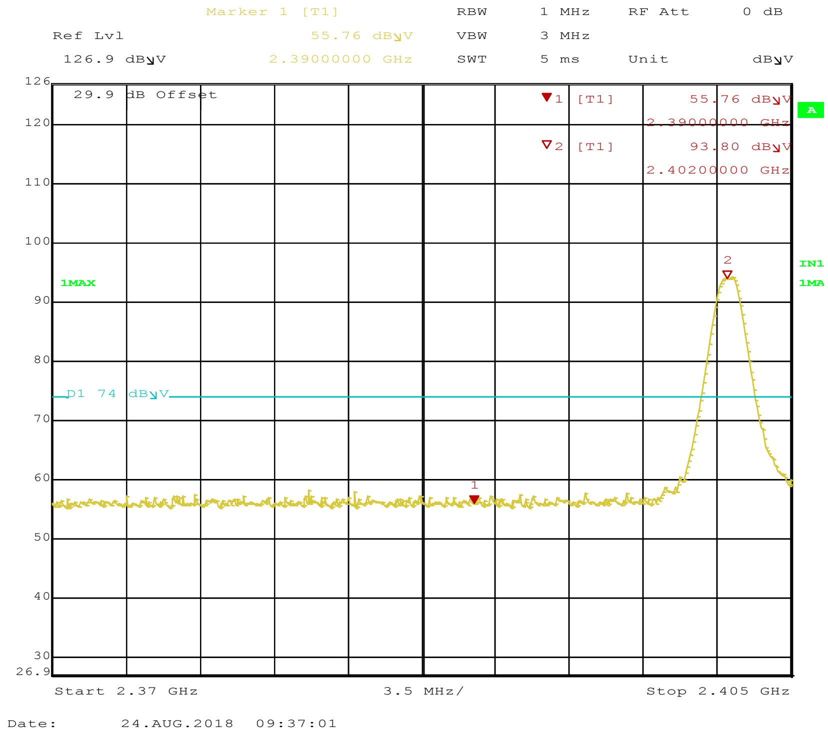


Figure 38: Radiated Emission at 2390 MHz Edge for Channel 2402 MHz at DH1 – Vertical (Pk)

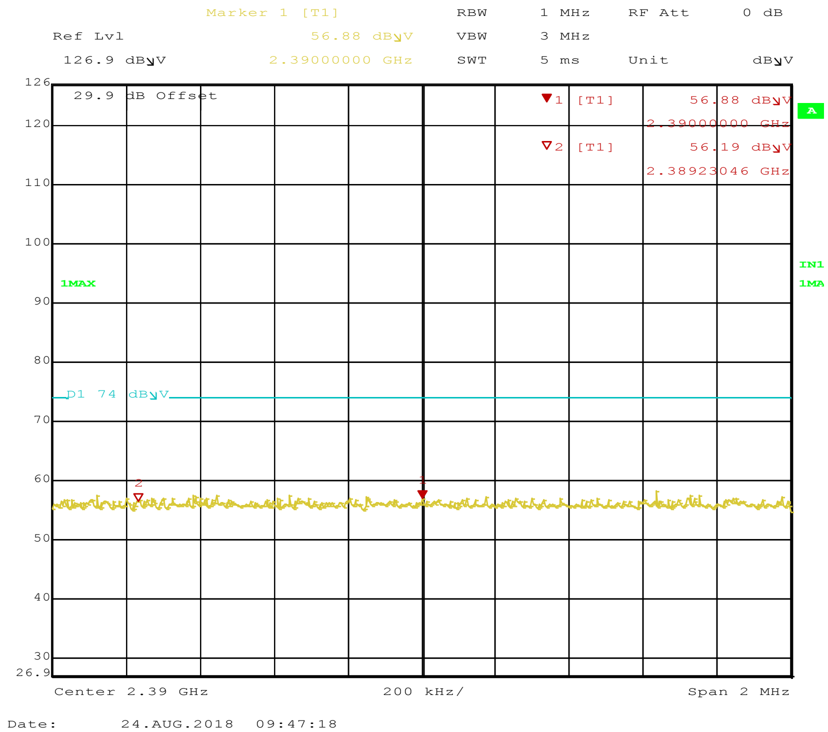


Figure 39: Radiated Emission at 2390 MHz, 2 MHz Span, for Channel 2402 MHz at DH1 – Vertical (Pk)

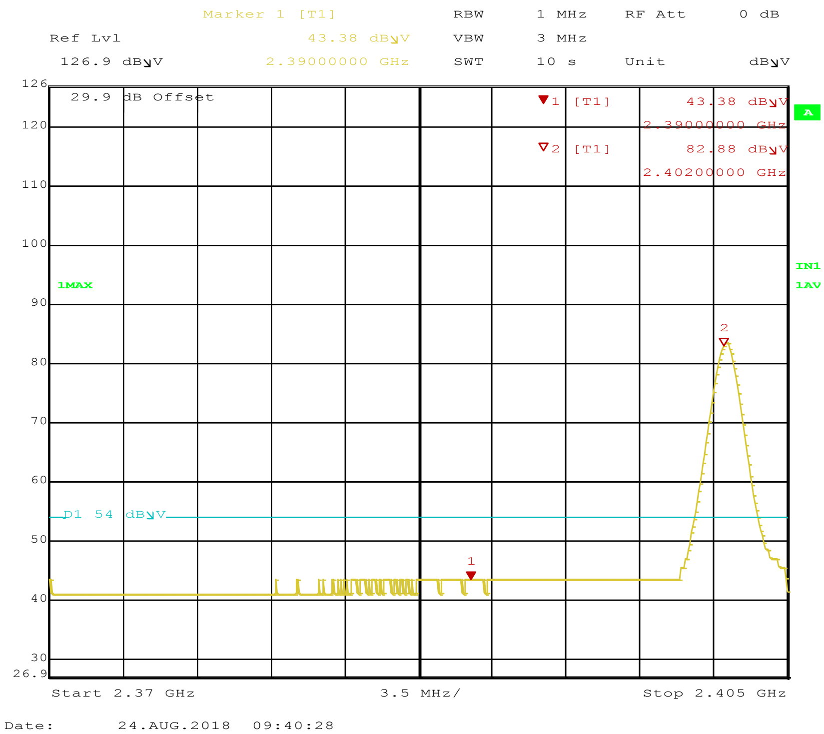


Figure 40: Radiated Emission at the 2390 MHz Edge for Channel 2402 MHz at DH1 – Vertical (Avg)

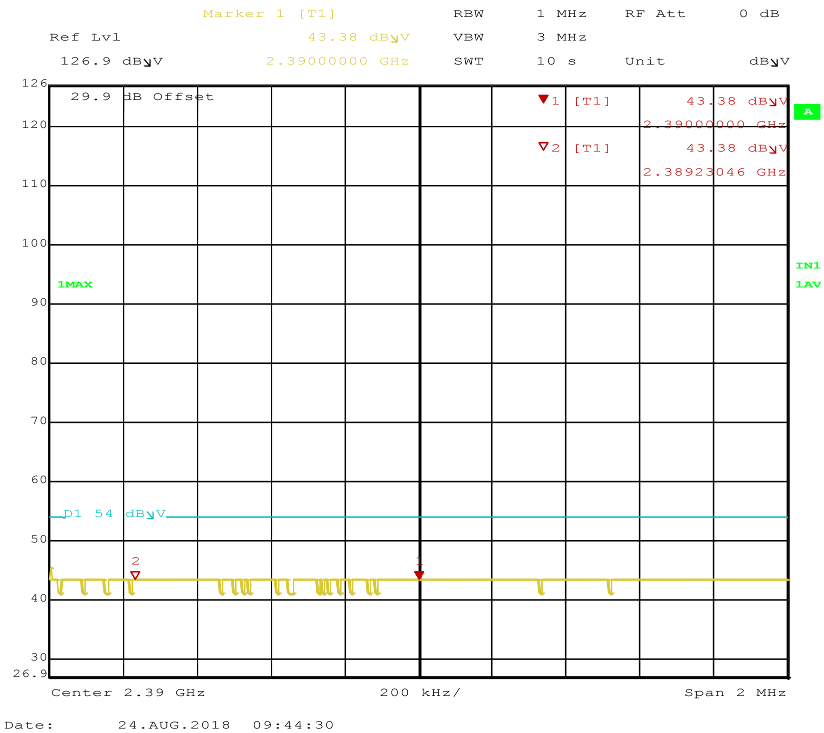


Figure 41: Radiated Emission at 2390 MHz, 2 MHz Span, for Channel 2402 MHz at DH1 – Vertical (Avg)

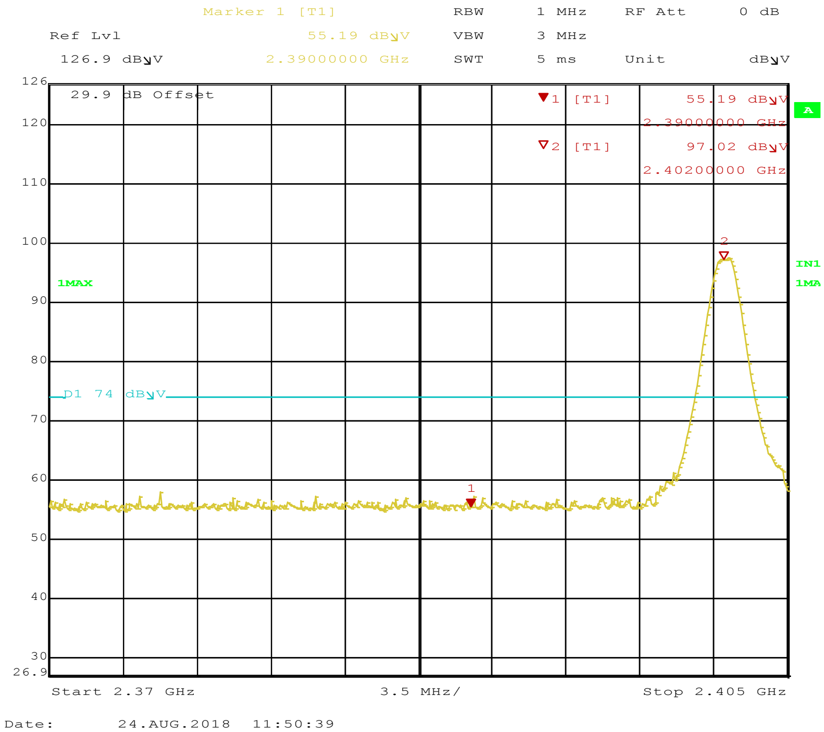


Figure 42: Radiated Emission at the 2390 MHz Edge for Channel 2402 MHz at DH1 – Horizontal (Pk)

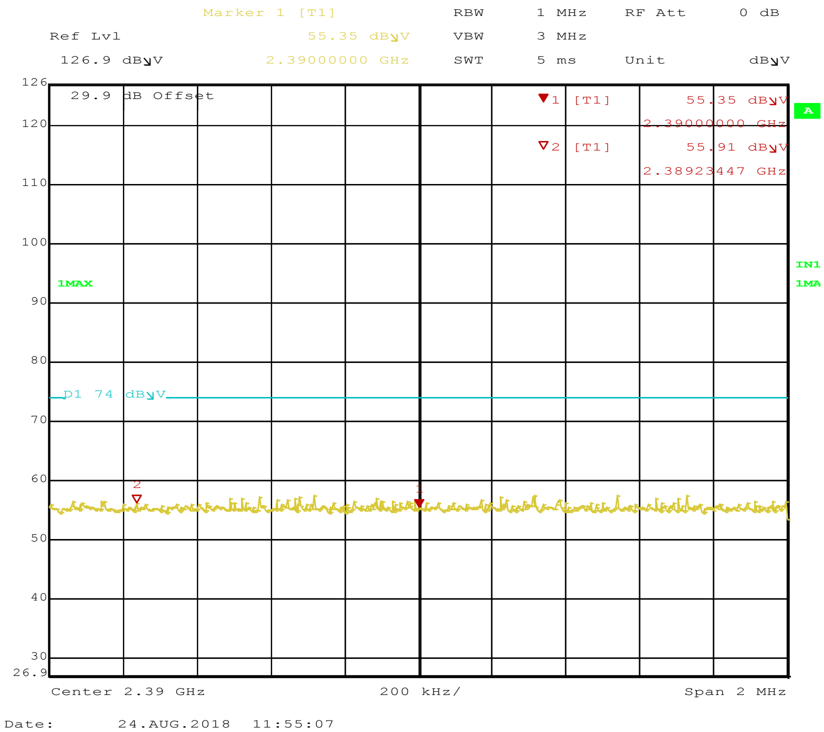


Figure 43: Radiated Emission at 2390 MHz, 2 MHz Span, for Channel 2402 MHz at DH1 – Horizontal (Pk)

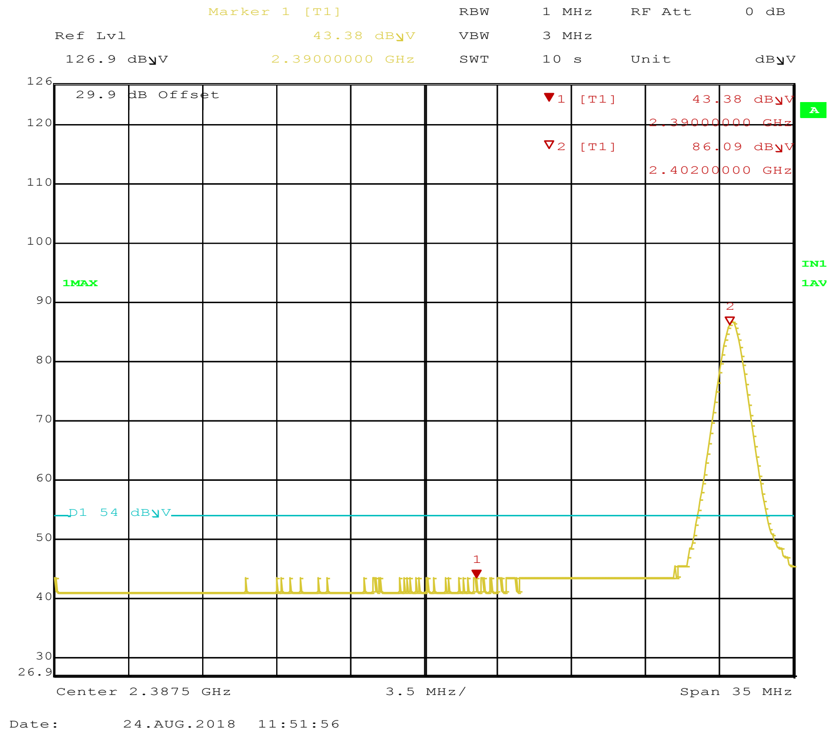


Figure 44: Radiated Emission at the 2390 MHz Edge for Channel 2402 MHz at DH1 – Horizontal (Avg)

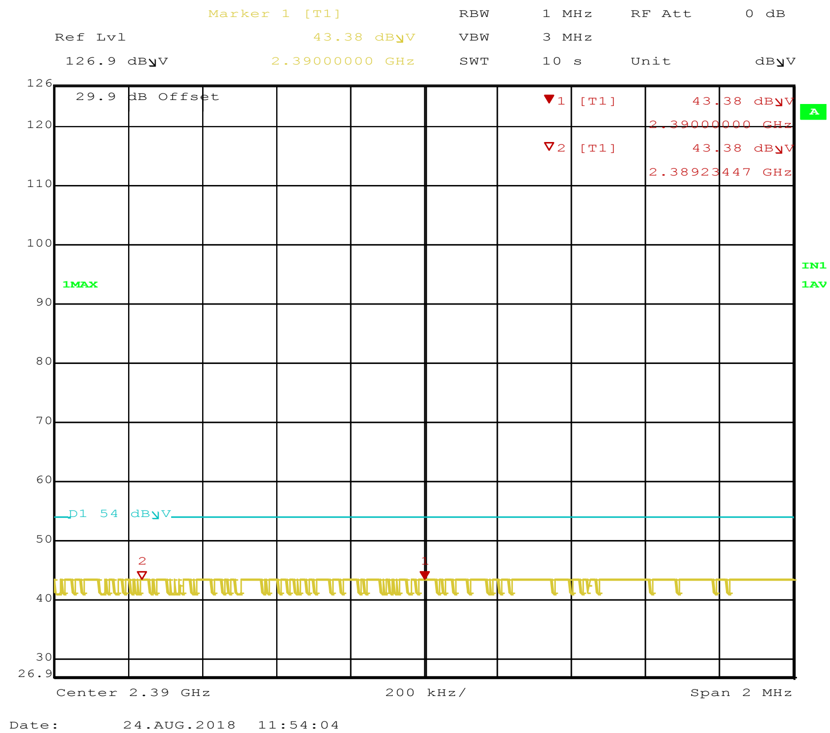


Figure 45: Radiated Emission at 2390 MHz, 2 MHz Span, for Channel 2402 MHz at DH1 – Horizontal (Avg)

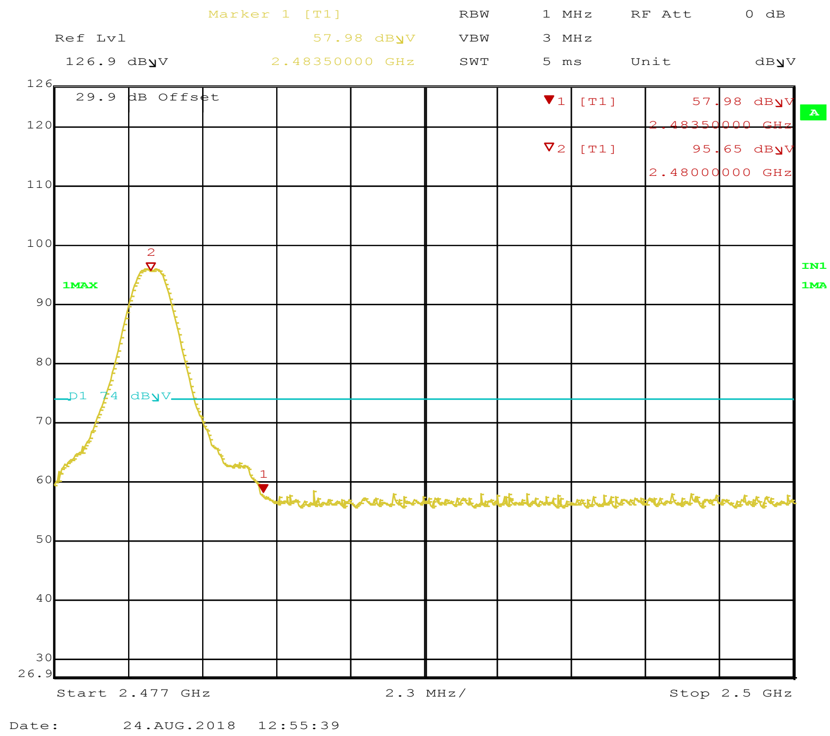


Figure 46: Radiated Emission at the 2483.5 MHz Edge for Channel 2480 MHz at DH1 – Vertical (Pk)

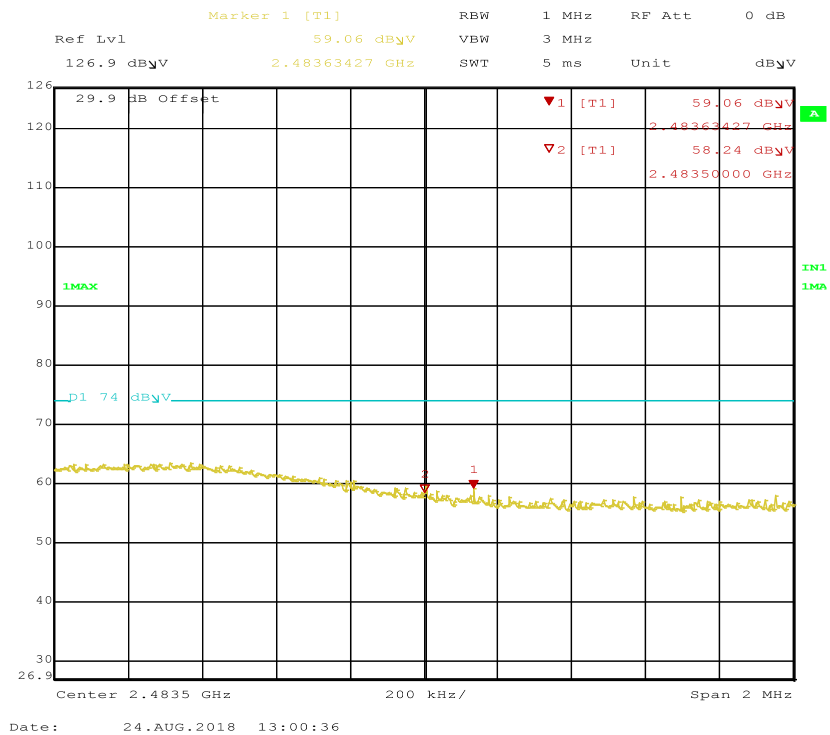


Figure 47: Radiated Emission at 2483.5 MHz, 2 MHz Span, for Channel 2480 MHz at DH1 – Vertical (Pk)

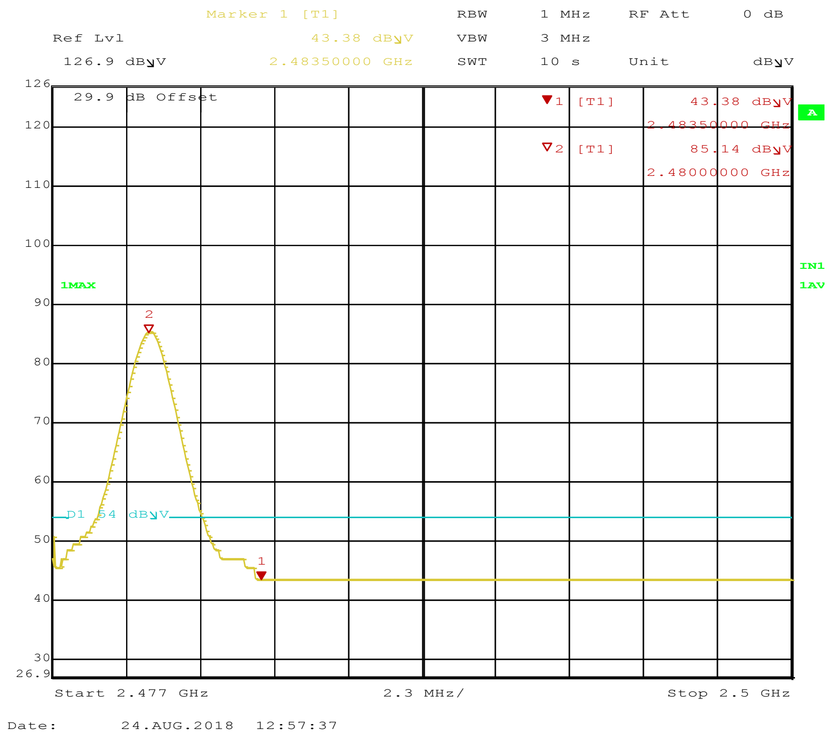


Figure 48: Radiated Emission at the 2483.5 MHz Edge for Channel 2480 MHz at DH1 – Vertical (Avg)

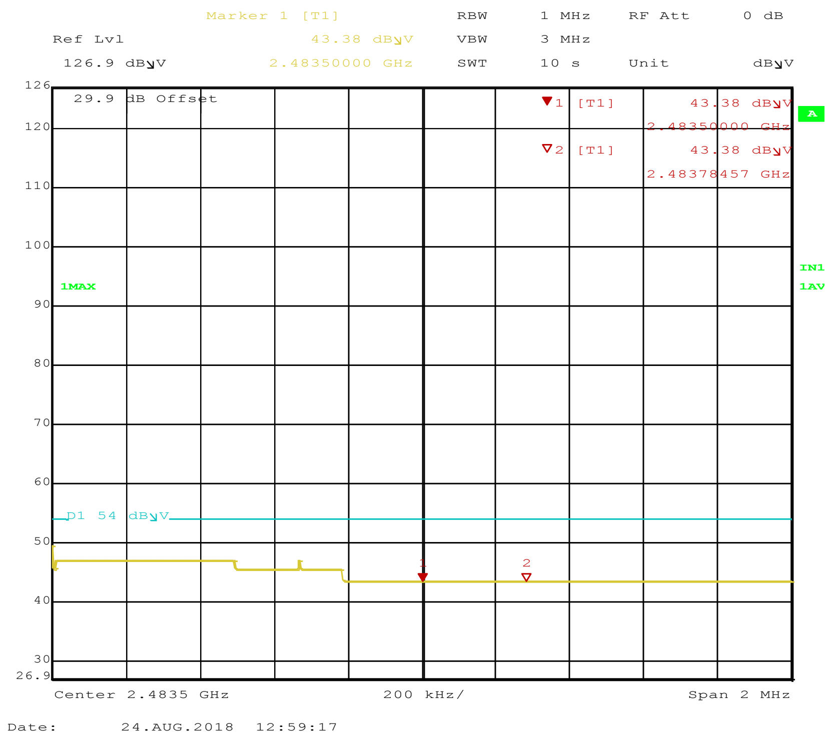


Figure 49: Radiated Emission at 2483.5 MHz, 2 MHz Span, for Channel 2480 MHz at DH1 – Vertical (Avg)

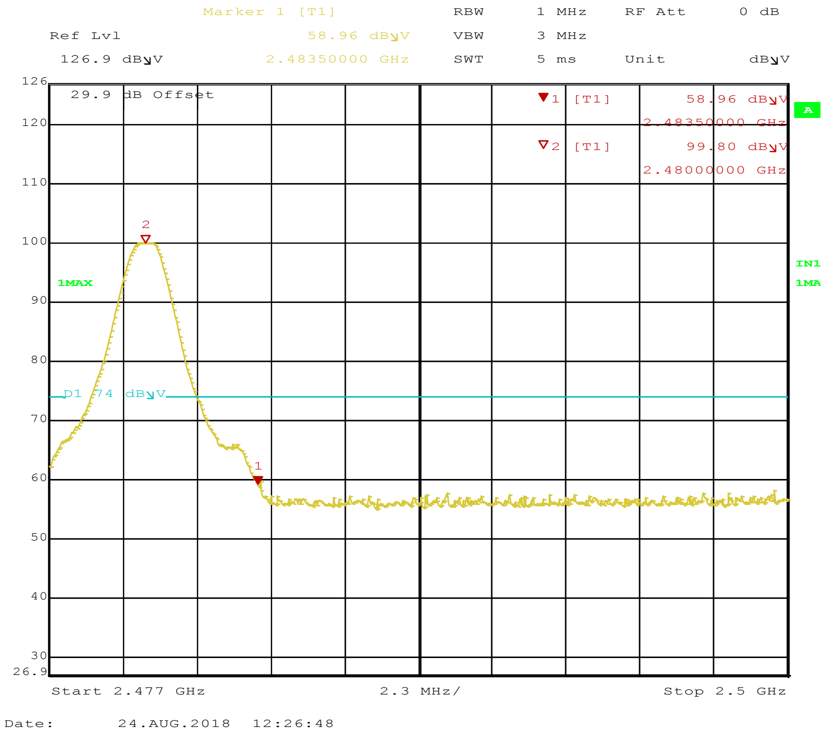


Figure 50: Radiated Emission at the 2483.5 MHz Edge for Channel 2480 MHz at DH1 – Horizontal (Pk)

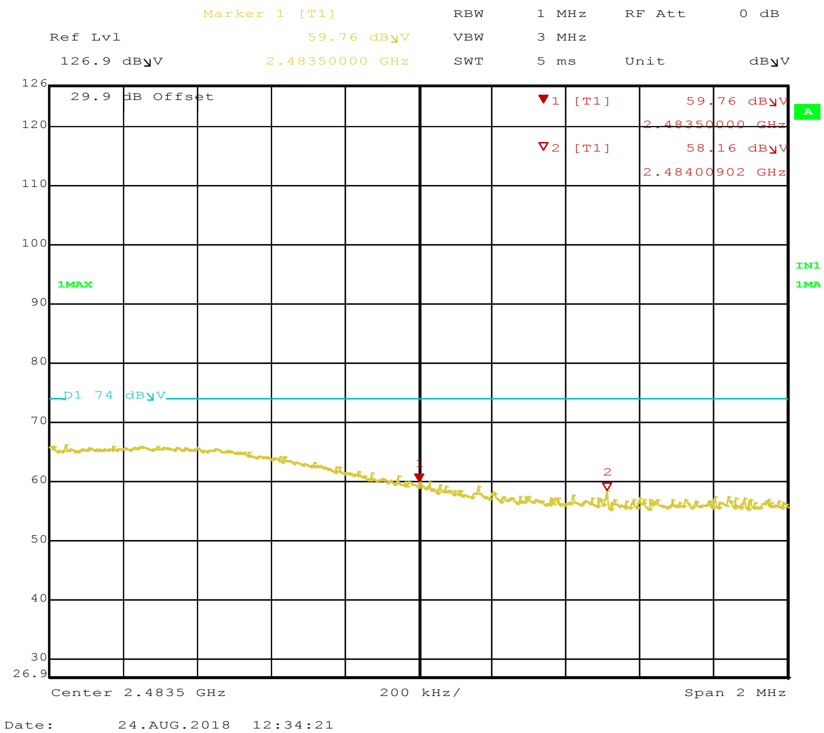


Figure 51: Radiated Emission at 2483.5 MHz, 2 MHz Span, for Channel 2480 MHz at DH1 – Horizontal (Pk)

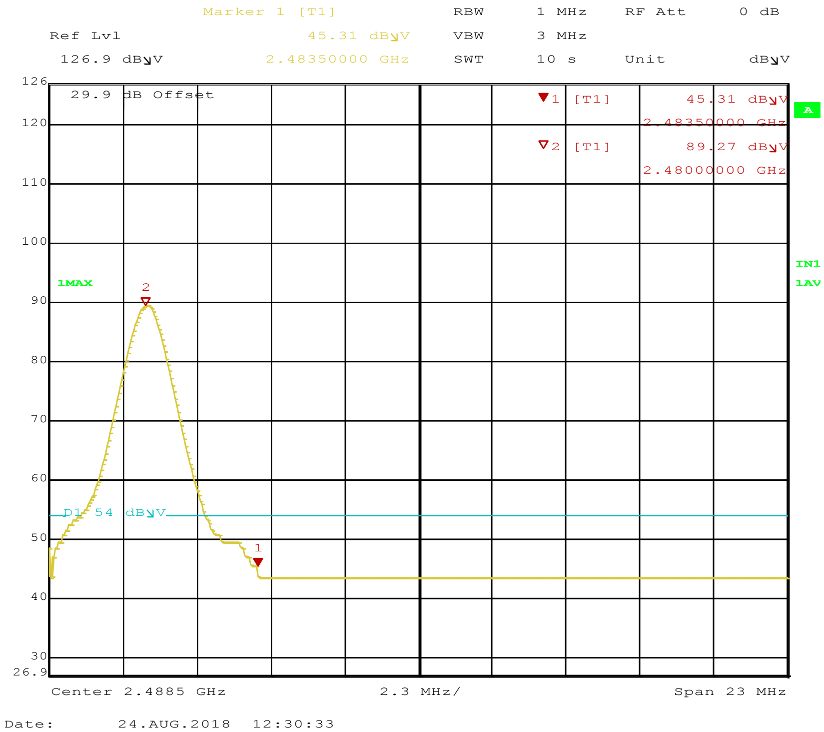


Figure 52: Radiated Emission at the 2483.5 MHz Edge for Channel 2480 MHz at DH1 – Horizontal (Avg)

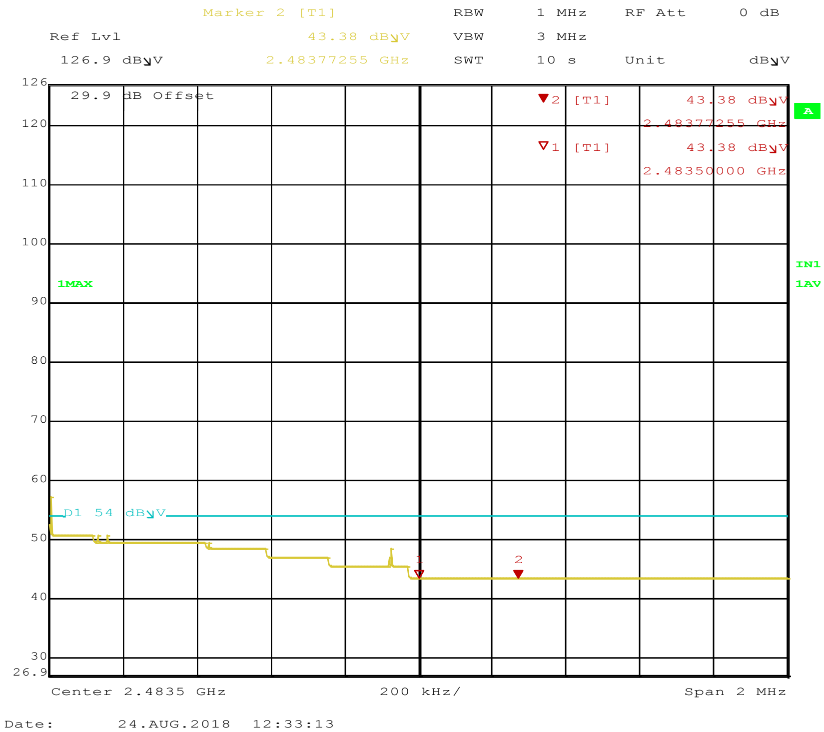


Figure 53: Radiated Emission at 2483.5 MHz, 2 MHz Span, for Channel 2480 MHz at DH1 – Horizontal (Avg)

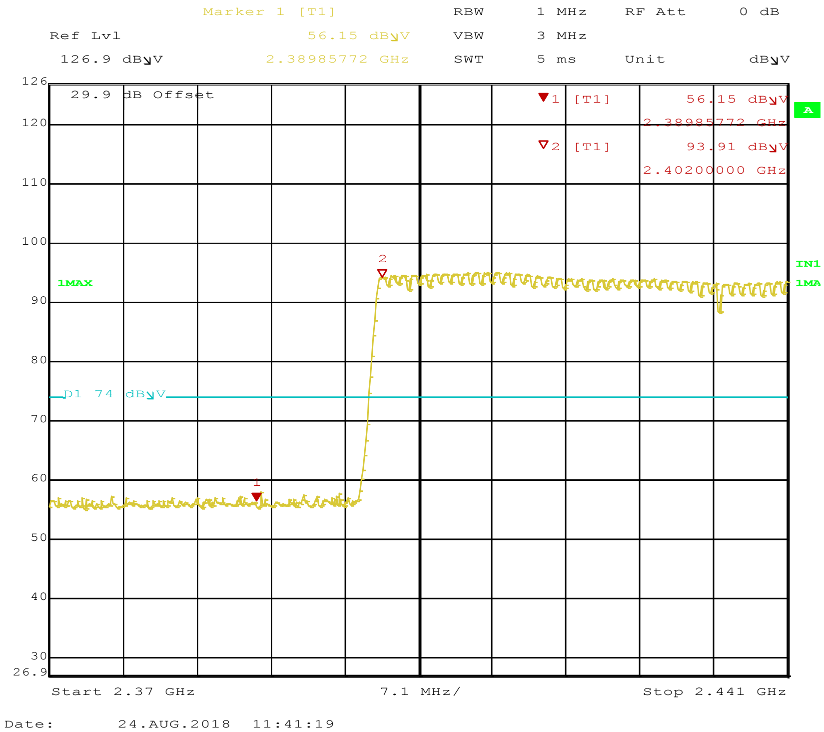


Figure 54: Radiated Emission at the 2390 MHz Edge for Hopping Channel at DH1 – Vertical (Pk)

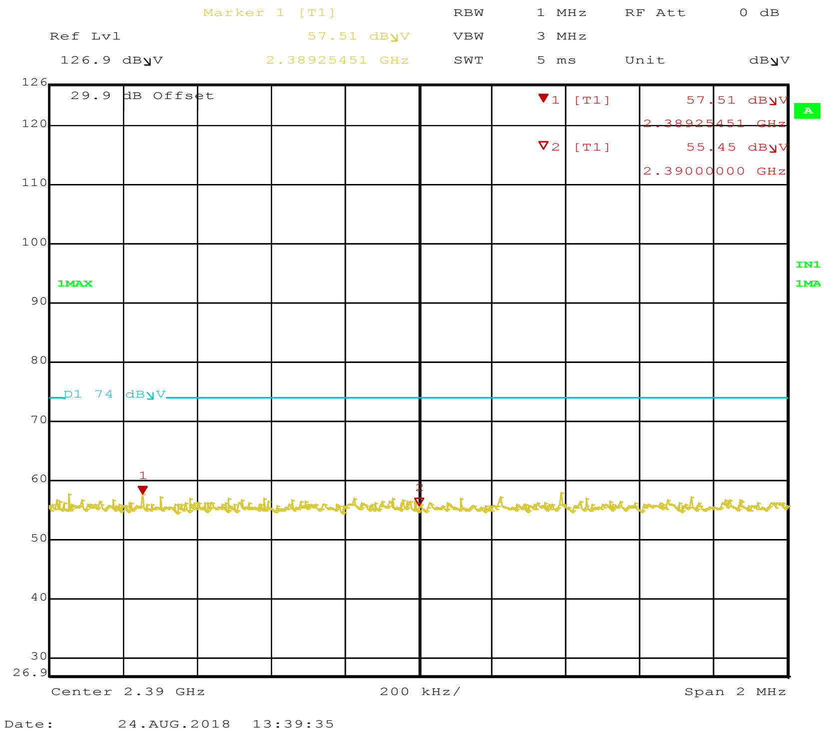


Figure 55: Radiated Emission at the 2390 MHz, 2 MHz Span, for Hopping Channel at DH1 – Vertical (Pk)

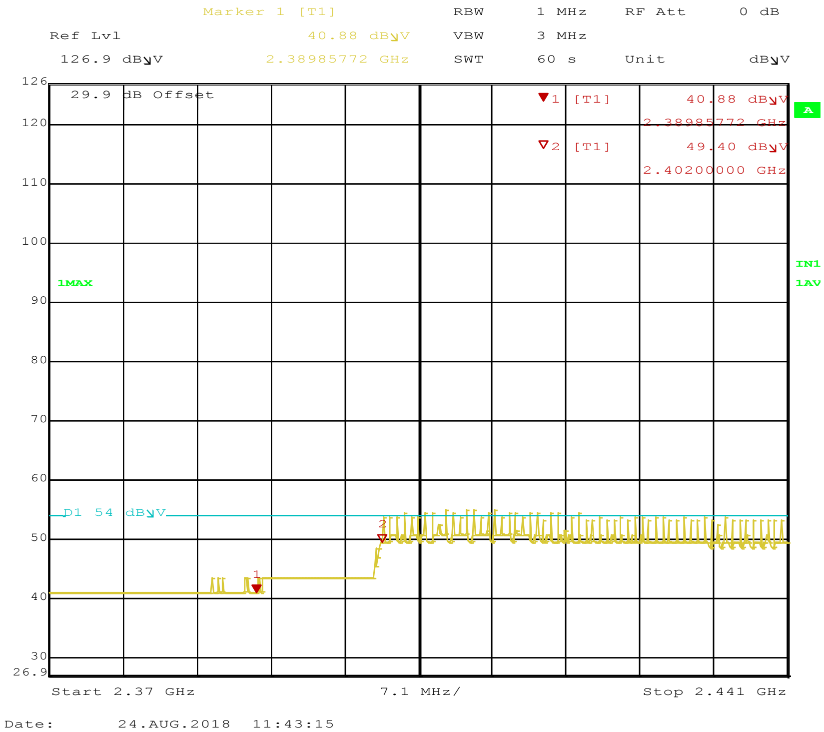


Figure 56: Radiated Emission at the 2390 MHz Edge for Hopping Channel at DH1 – Vertical (Avg)

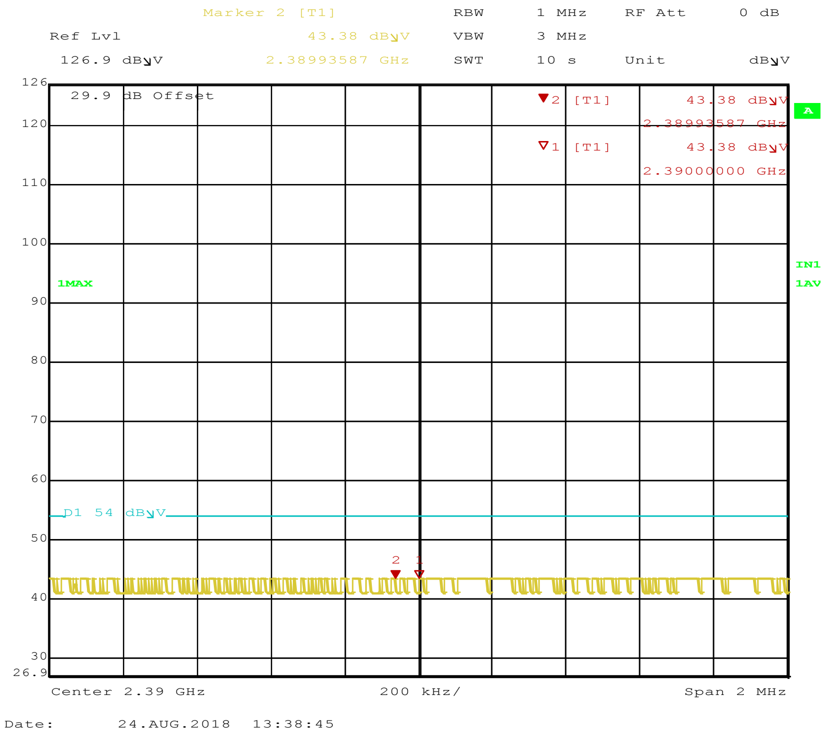


Figure 57: Radiated Emission at the 2390 MHz, 2 MHz Span, for Hopping Channel at DH1 – Vertical (Avg)

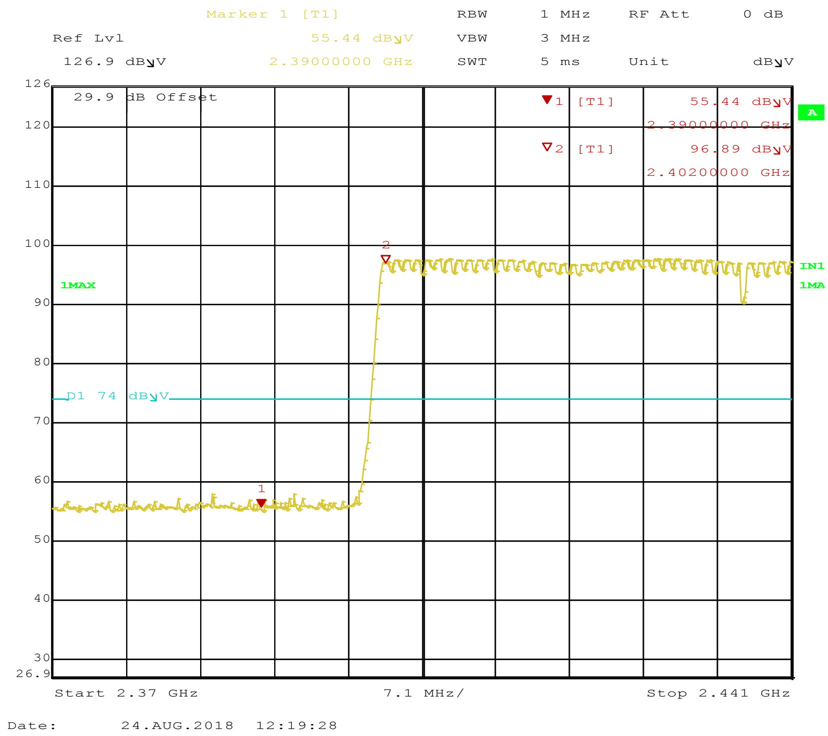


Figure 58: Radiated Emission at the 2390 MHz Edge for Hopping Channel at DH1 – Horizontal (Pk)

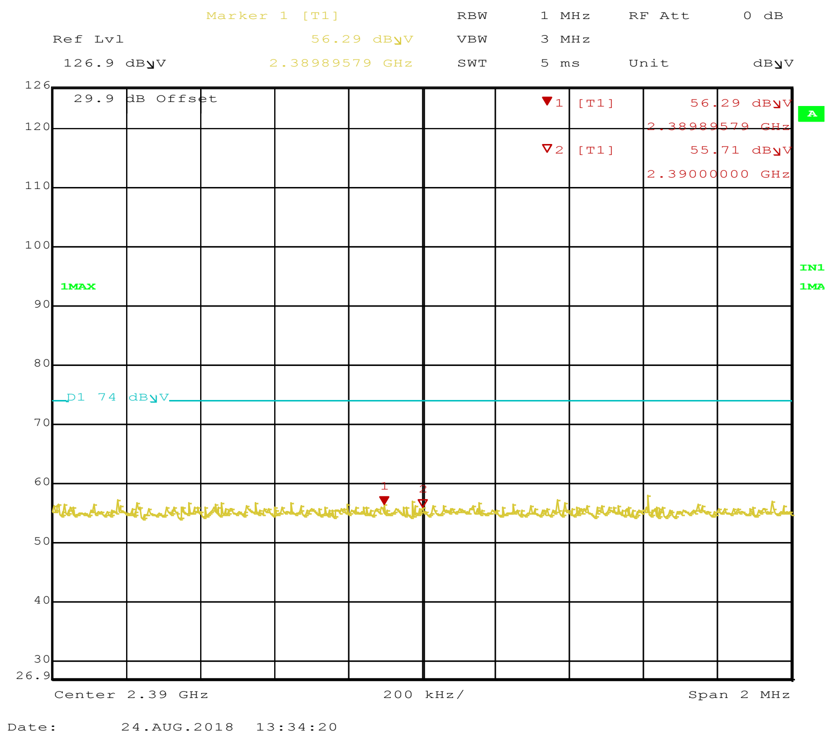


Figure 59: Radiated Emission at the 2390 MHz, 2 MHz Span, for Hopping Channel at DH1 – Horizontal (Pk)

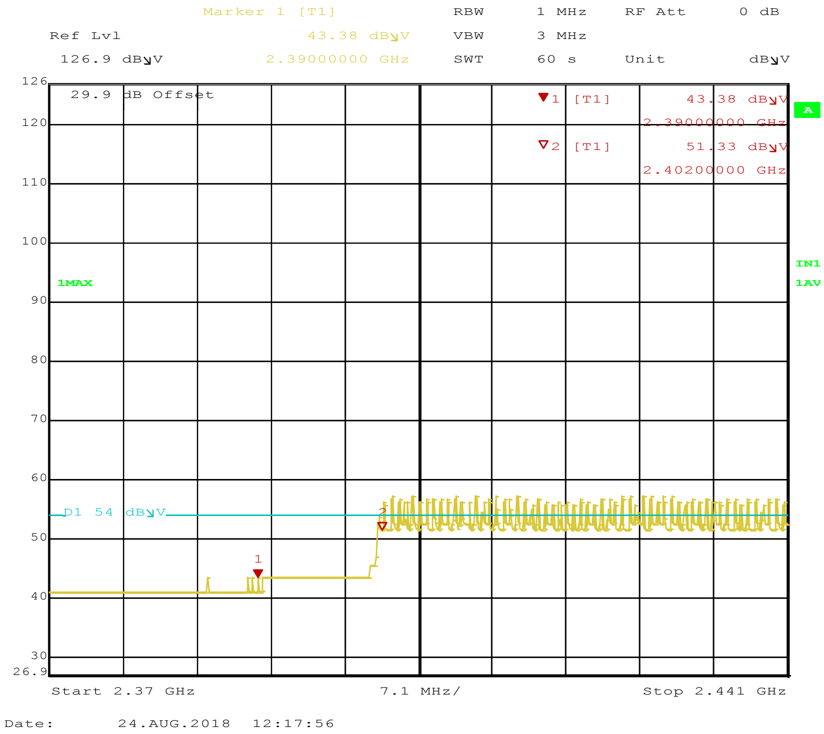


Figure 60: Radiated Emission at the 2390 MHz Edge for Hopping Channel at DH1 – Horizontal (Avg)

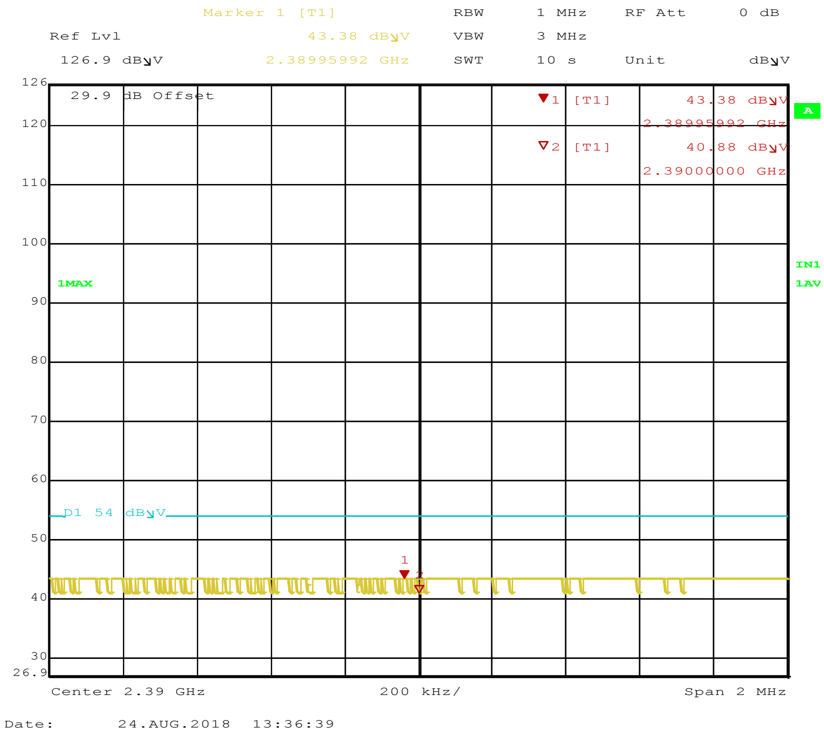


Figure 61: Radiated Emission at the 2390 MHz, 2 MHz Span, for Hopping Channel at DH1 – Horizontal (Avg)

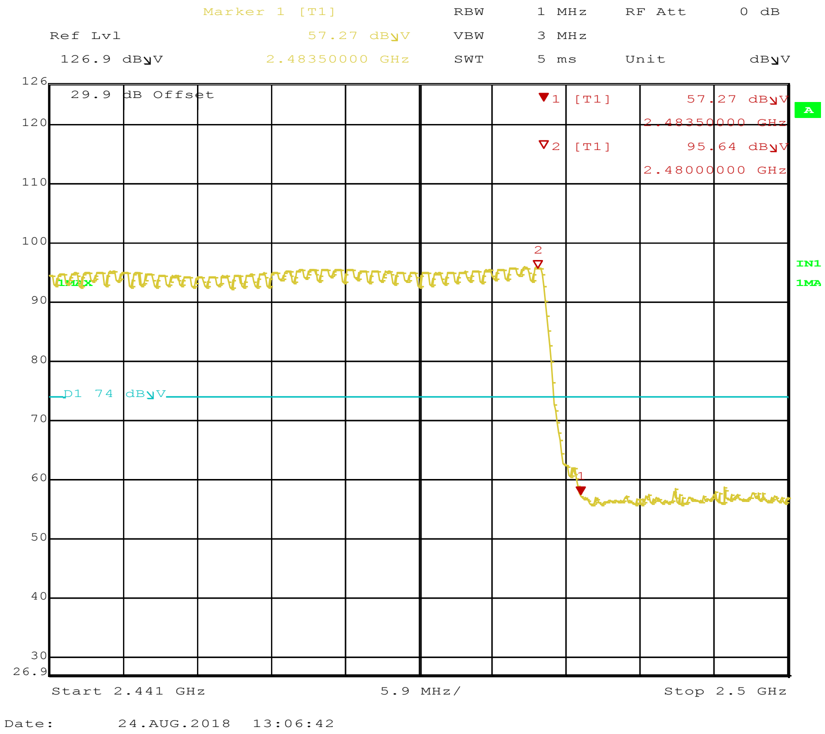


Figure 62: Radiated Emission at the 2483.5 MHz Edge for Hopping Channel at DH1 – Vertical (Pk)

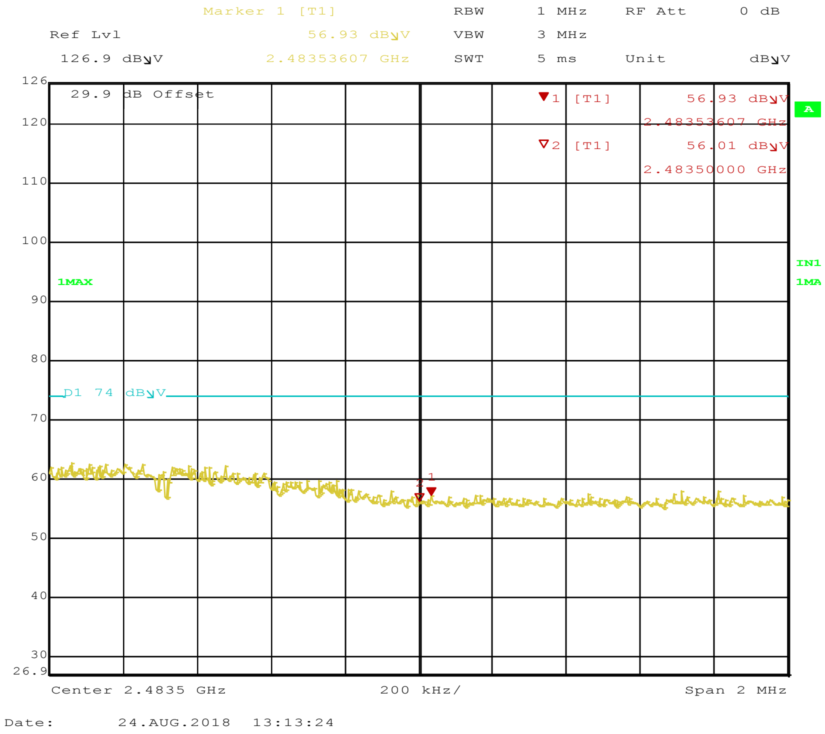


Figure 63: Radiated Emission at the 2483.5 MHz, 2 MHz Span, for Hopping Channel at DH1 – Vertical (Pk)

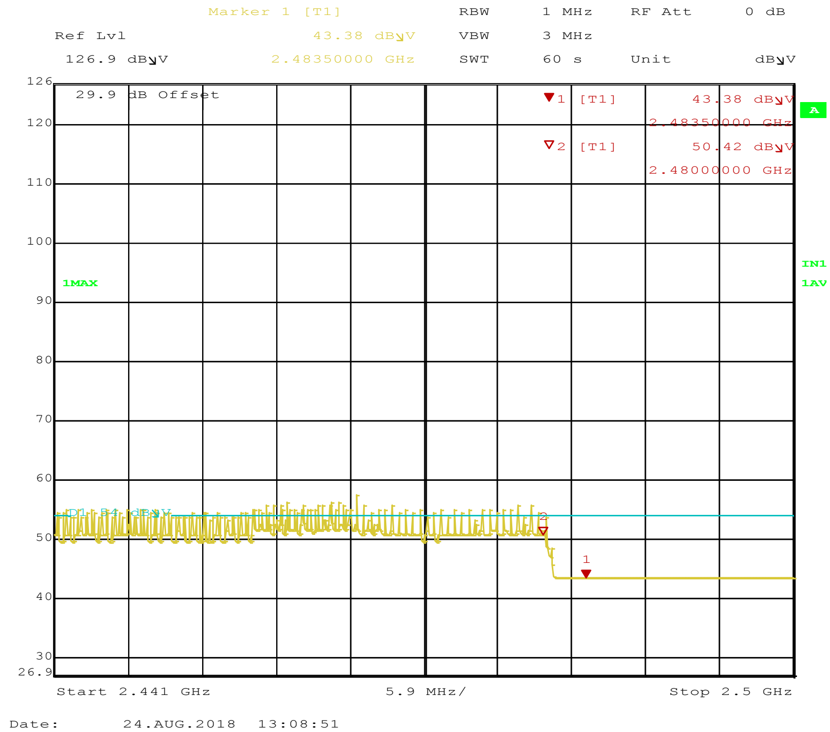


Figure 64: Radiated Emission at the 2483.5 MHz Edge for Hopping Channel at DH1 – Vertical (Avg)

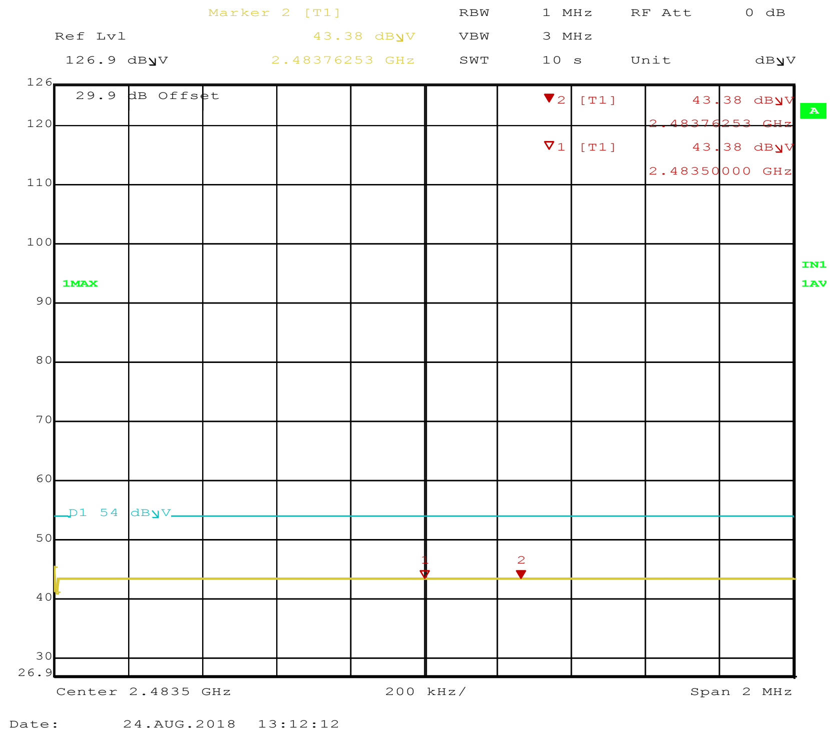


Figure 65: Radiated Emission at the 2483.5 MHz, 2 MHz Span, for Hopping Channel at DH1 – Vertical (Avg)

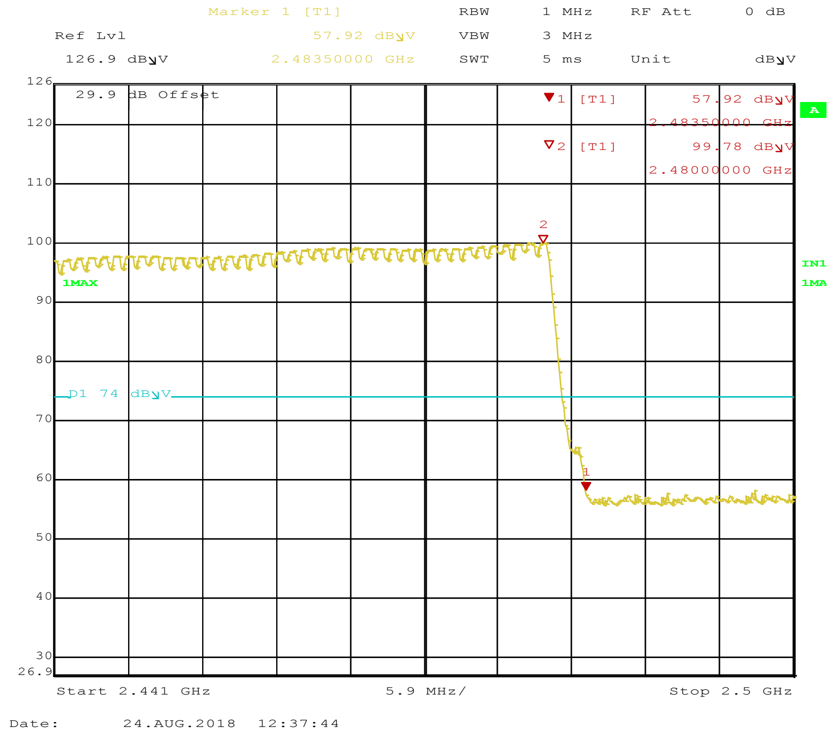


Figure 66: Radiated Emission at the 2483.5 MHz Edge for Hopping Channel at DH1 – Horizontal (Pk)

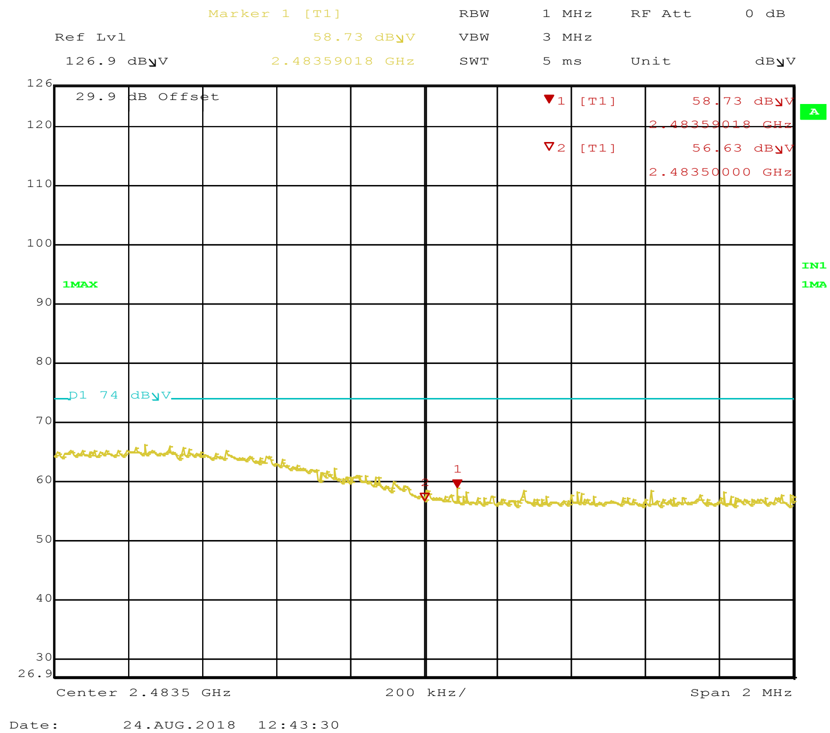


Figure 67: Radiated Emission at the 2483.5 MHz, 2 MHz Span, for Hopping Channel at DH1 – Horizontal (Pk)

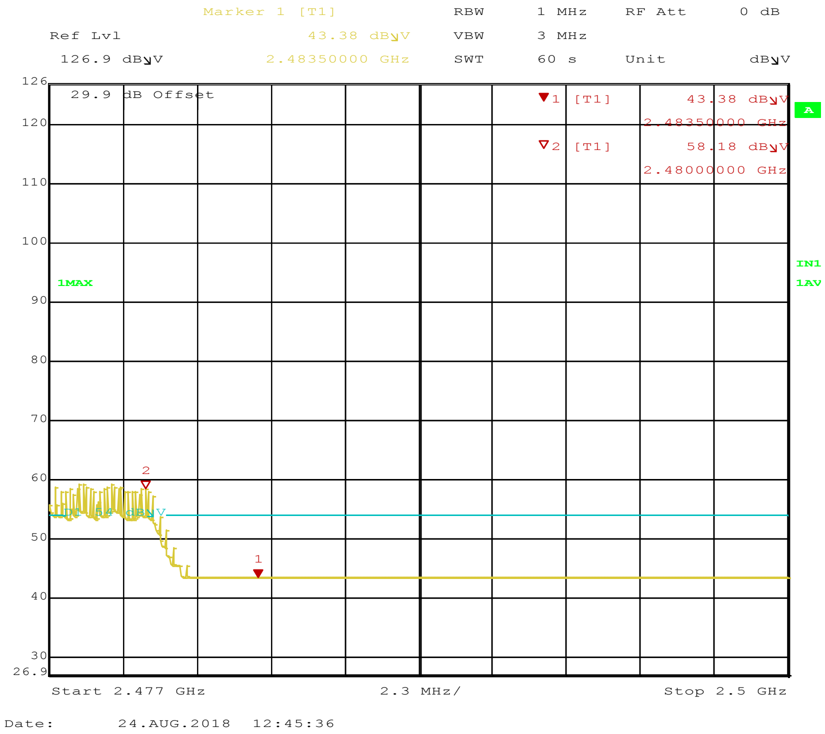


Figure 68: Radiated Emission at the 2483.5 MHz Edge for Hopping Channel at DH1 – Horizontal (Avg)

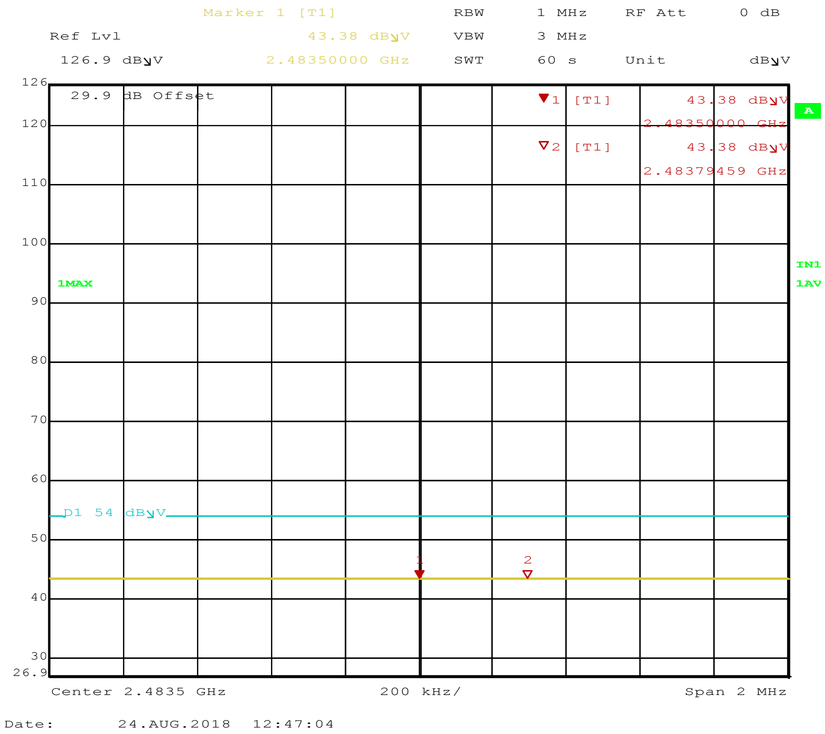


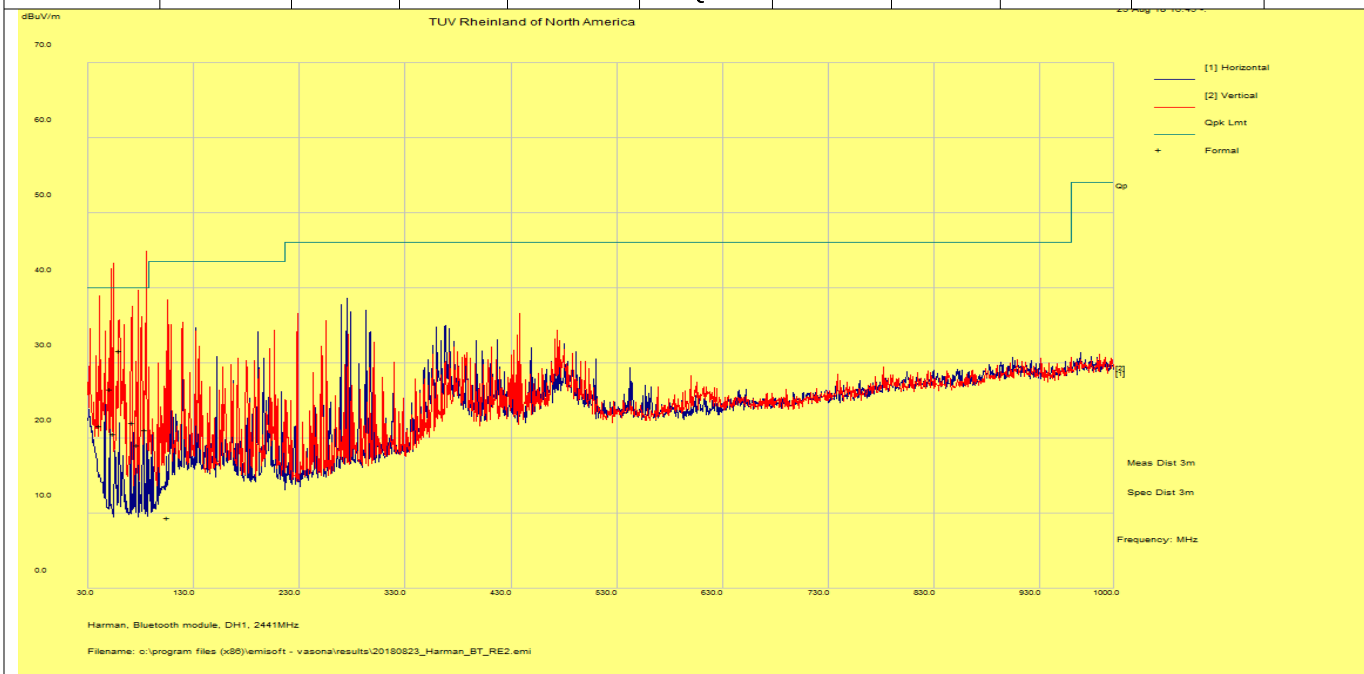
Figure 69: Radiated Emission at the 2483.5 MHz, 2 MHz Span, for Hopping Channel at DH1 – Horizontal (Avg)

SOP 1 Radiated Emissions — Tracking # 31863803.001 Page 1 of 7

EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 23, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 39%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
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 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
41.01	33.99	2.58	-14.98	21.59	QP	V	126	346	40.00	-18.41
51.65	43.82	2.64	-20.00	26.47	QP	V	103	246	40.00	-13.54
54.35	38.10	2.66	-20.21	20.56	QP	V	313	40	40.00	-19.45
59.95	49.53	2.68	-20.61	31.60	QP	V	129	360	40.00	-8.40
72.00	39.37	2.76	-20.04	22.08	QP	V	110	234	40.00	-17.92
77.45	36.57	2.77	-20.28	19.06	QP	V	167	314	40.00	-20.94
85.27	38.65	2.81	-20.38	21.07	QP	V	186	144	40.00	-18.93
105.92	23.00	2.90	-16.50	9.40	QP	V	351	242	43.50	-34.10



Spec Margin = Level - Limit, Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

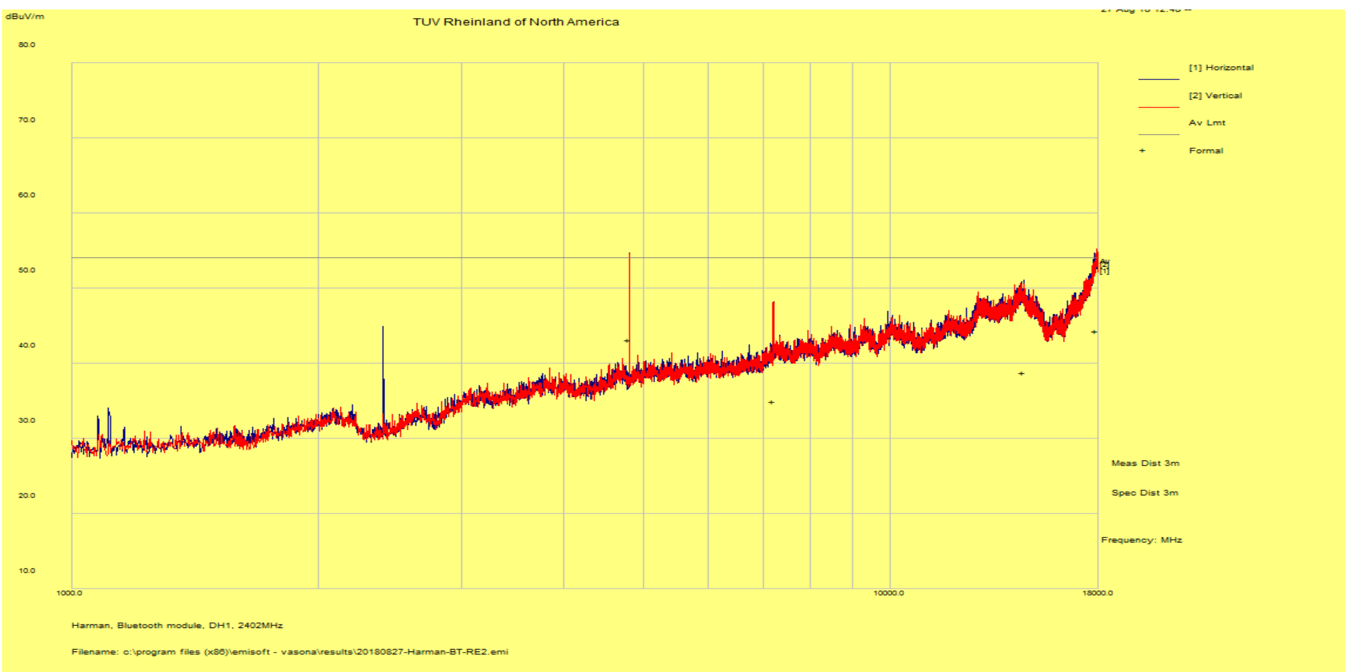
Combined Standard Uncertainty $u_c(y)$ = ± 4.52 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Note: 1. Radiated Spurious Emissions measurement were made on the highest power level (DH1). The worst case was observed at mid channel of DH1.
2. No significant emission was observed below 30 MHz.

SOP 1 Radiated Emissions		Tracking # 31863803.001 Page 2 of 7	
EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 27, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 36%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / DRH-118 & 1m / AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 2402 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
4804.26	41.34	2.14	-0.38	43.10	Average	H	154	144	54.00	-10.90
7206.39	29.16	2.64	3.12	34.92	Average	H	238	4	54.00	-19.08
14580.57	23.39	3.85	11.52	38.76	Average	H	182	34	54.00	-15.24
17905.71	24.83	4.20	15.24	44.27	Average	V	166	128	54.00	-9.73



Spec Margin = Level - Limit, Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

Combined Standard Uncertainty $u_c(y) = \pm 4.52$ dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

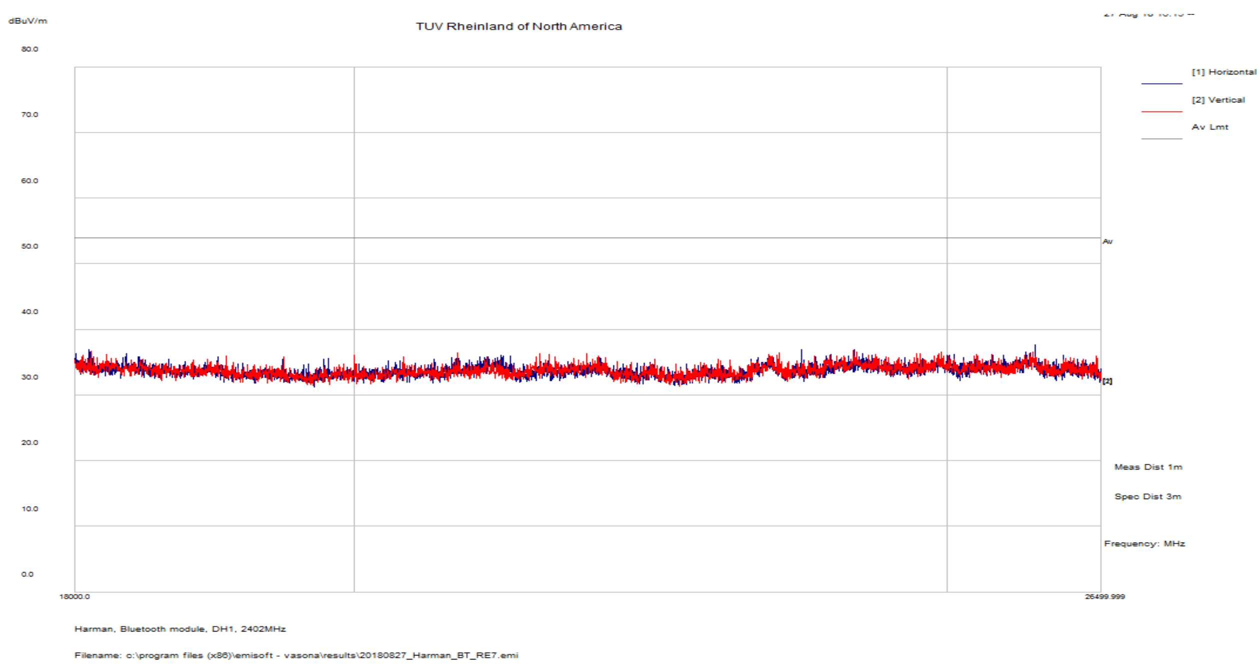
Note: Radiated Spurious Emissions measurement were made on the highest power level (DH1).

SOP 1 Radiated Emissions — Tracking # 31863803.001 Page 3 of 7

EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 27, 2017
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 36%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / DRH-118 & 1m / AHA-840	**Performed by**	Kerwinn Corpuz

18 – 25 GHz Transmit at 2402 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
25846.56	42.36	8.15	-12.87	37.64	Peak	H	150	285	54.00	-16.36



Spec Margin = Level - Limit, Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 4.52 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

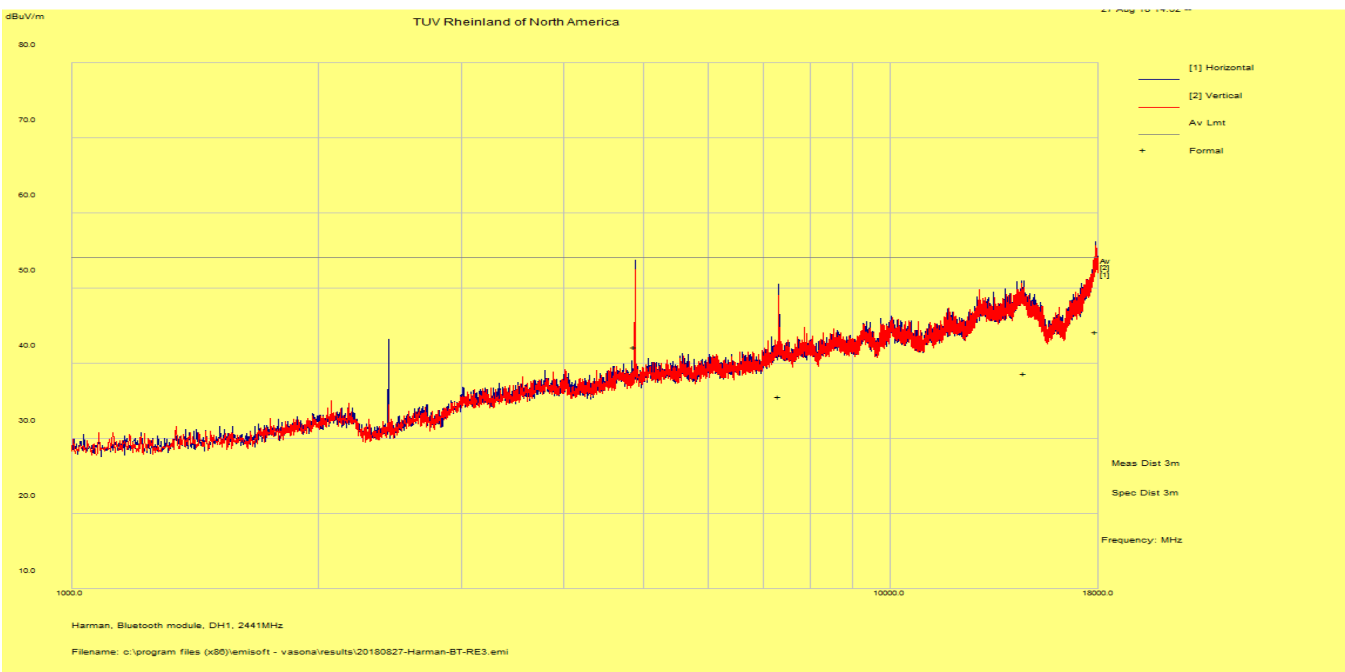
Note: 1. Radiated Spurious Emissions measurement were made on the highest power level (DH1).
2. Detected Noise Floor. No significant emission was observed from 18GHz to 25GHz.

SOP 1 Radiated Emissions — Tracking # 31863803.001 Page 4 of 7

EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 27, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 36%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / DRH-118 & 1m / AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 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
4882.04	40.12	2.25	-0.21	42.16	Average	H	108	134	54.00	-11.85
7322.45	29.65	2.63	3.30	35.58	Average	H	115	22	54.00	-18.42
14590.61	23.25	3.87	11.54	38.66	Average	H	245	254	54.00	-15.34
17885.04	24.80	4.21	15.17	44.18	Average	H	170	286	54.00	-9.82



Spec Margin = Level - Limit, Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

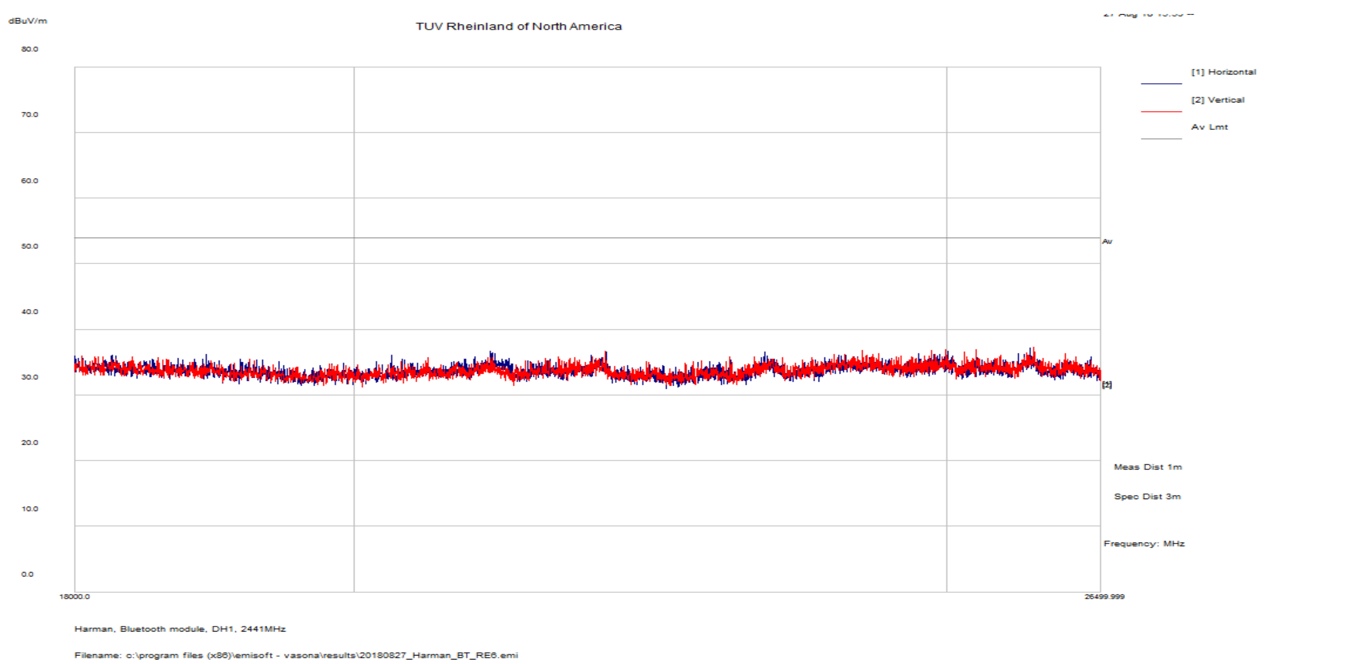
Combined Standard Uncertainty $u_c(y)$ = ± 4.52 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Note: Radiated Spurious Emissions measurement were made on the highest power level (DH1).

SOP 1 Radiated Emissions		Tracking # 31863803.001 Page 5 of 7	
EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 27, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 36%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / DRH-118 & 1m / AHA-840	**Performed by**	Kerwinn Corpuz

18 – 25 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
25841.25	42.06	8.15	-12.87	37.34	Pk	V	150	240	54.00	-16.66



Spec Margin = Level - Limit, Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 4.52 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

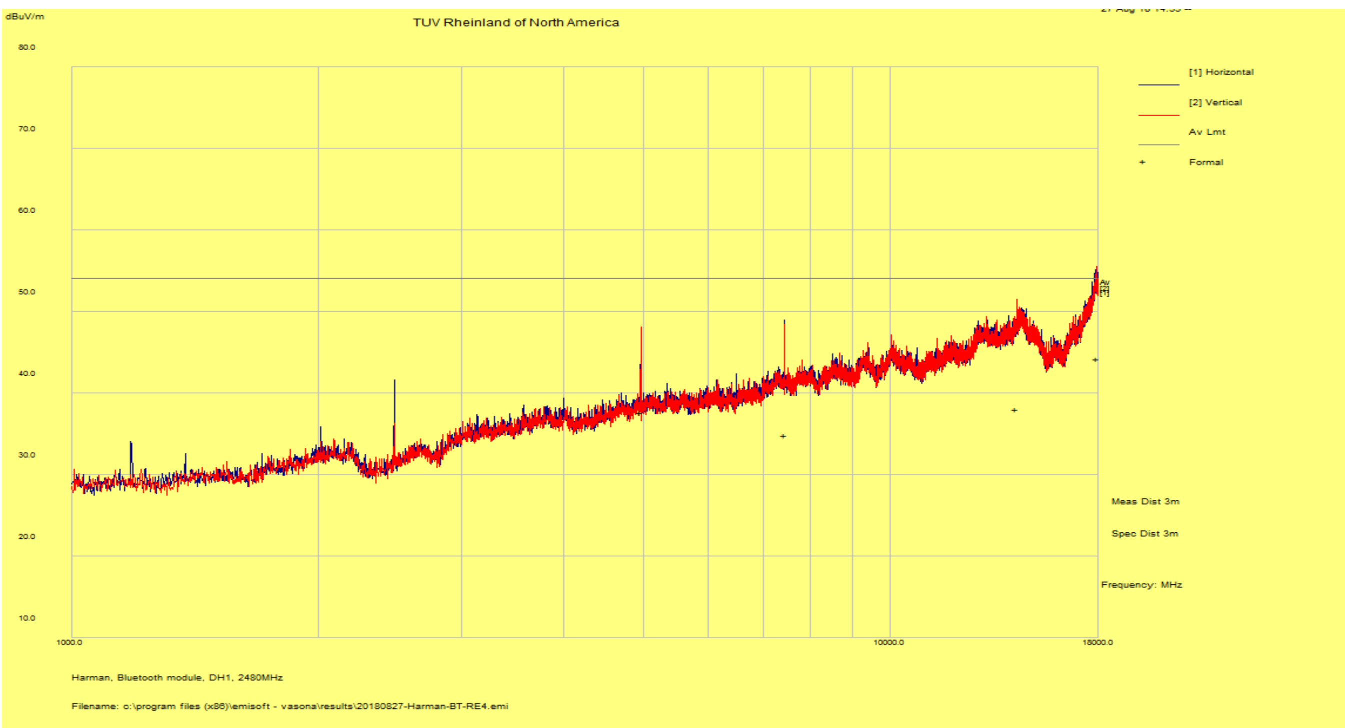
Note: 1. Radiated Spurious Emissions measurement were made on the highest power level (DH1).
2. Detected Noise Floor. No significant emission was observed from 18GHz to 25GHz.

SOP 1 Radiated Emissions — Tracking # 31863803.001 Page 6 of 7

EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 27, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 36%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / DRH-118 & 1m / AHA-840	**Performed by**	Kerwinn Corpuz

1 – 18 GHz Transmit at 2480 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
7440.58	29.16	2.70	2.97	34.83	Average	H	132	14	54.00	-19.17
4959.87	35.67	2.16	-0.23	37.60	Average	V	240	168	54.00	-16.40
14292.63	23.40	3.70	10.88	37.97	Average	V	111	194	54.00	-16.03
17923.70	24.76	4.21	15.14	44.12	Average	V	200	268	54.00	-9.88



Spec Margin = Level - Limit, Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

Combined Standard Uncertainty $u_c(y) = \pm 4.52$ dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

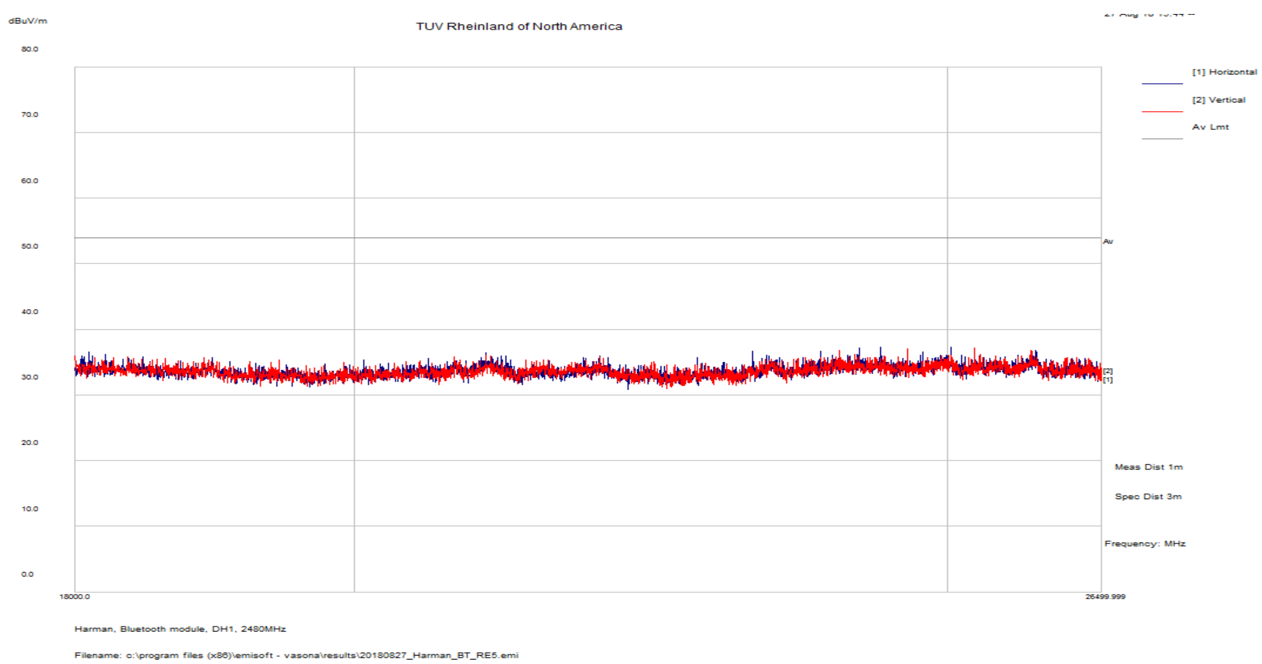
Note: Radiated Spurious Emissions measurement were made on the highest power level (DH1).

SOP 1 Radiated Emissions　　Tracking # 31863803.001 Page 7 of 7

EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 27, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	22° C / 36%rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**Line AC / Freq**	3.3 VDC
Standard	CFR47 Part 15 Subpart C, RSS-247, RSS-GEN	**RBW / VBW**	1 MHz/ 3 MHz
Dist/Ant Used	3m / DRH-118 & 1m / AHA-840	**Performed by**	Kerwinn Corpuz

18 – 25 GHz Transmit at 2480 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
24385.62	41.82	8.10	-12.60	37.32	Peak	H	150	22	54.00	-16.68



Spec Margin = Level - Limit,　Level = Raw+ Cbl+ CF ± Uncertainty
CF= Amp Gain + ANT Factor

Combined Standard Uncertainty $u_c(y) = \pm 4.52$ dB　Expanded Uncertainty $U = ku_c(y)$　$k = 2$ for 95% confidence

Note: 1. Radiated Spurious Emissions measurement were made on the highest power level (DH1).
2. Detected Noise Floor. No significant emission was observed from 18GHz to 25GHz.

5.6 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: 2018 and RSS- GEN Sect. 8.8: 2018.

5.6.1 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 either performed in Lab 2. 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.

5.6.1.1 *Deviations*

There were no deviations from this test methodology.

5.6.2 Test Results

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

Table 8: AC Conducted Emissions – Test Results

Test Conditions: Conducted Emissions	**Test Date:** August 29, 2018	
Antenna Type: Chip	**Power Setting:** fixed at 50	
Max. Antenna Gain: 1.7 dBi	**Signal State:** Modulated	
Ambient Temp.: 23 °C	**Relative Humidity:**39%	
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 # 31863803.001 Page 1 Of 4	
EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 29, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	23° C / 39% rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**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
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB
0.157	34.96	9.82	0.05	44.83	QP	Live	65.60	-20.76
0.157	17.51	9.82	0.05	27.38	Avg	Live	55.60	-28.22
0.202	30.41	9.83	0.04	40.28	QP	Live	63.51	-23.23
0.202	27.45	9.83	0.04	37.32	Avg	Live	53.51	-16.19
0.494	25.71	9.84	0.03	35.58	QP	Live	56.10	-20.52
0.494	26.37	9.84	0.03	36.24	Avg	Live	46.10	-9.86
0.584	22.24	9.85	0.03	32.12	QP	Live	56.00	-23.88
0.584	19.22	9.85	0.03	29.10	Avg	Live	46.00	-16.90
0.711	19.83	9.86	0.03	29.72	QP	Live	56.00	-26.28
0.711	16.17	9.86	0.03	26.06	Avg	Live	46.00	-19.94
0.875	12.60	9.87	0.03	22.50	QP	Live	56.00	-33.50
0.875	13.71	9.87	0.03	23.61	Avg	Live	46.00	-22.39
0.157	34.96	9.82	0.05	44.83	QP	Live	65.60	-20.76
0.157	17.51	9.82	0.05	27.38	Avg	Live	55.60	-28.22
0.202	30.41	9.83	0.04	40.28	QP	Live	63.51	-23.23
0.202	27.45	9.83	0.04	37.32	Avg	Live	53.51	-16.19

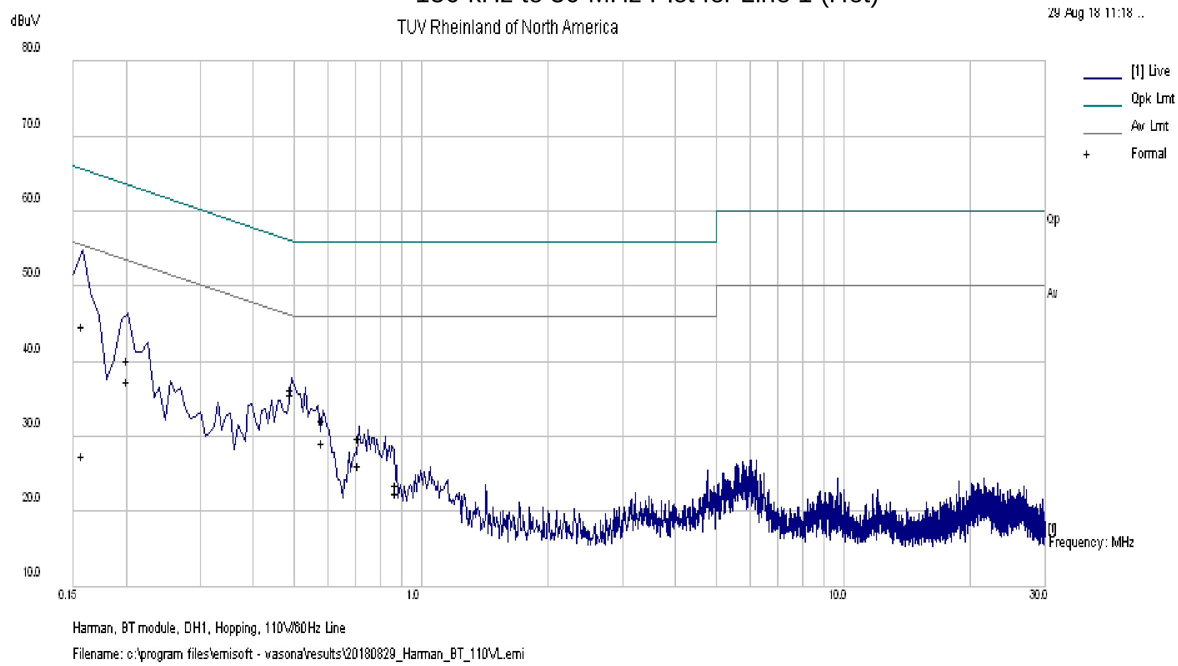
Spec Margin = QP./Ave. - Limit, ± Uncertainty

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

Notes: EUT was setup as table top equipment and transmitted at DH1 Hopping Channel. USB power port were connected to supporting equipment, Laptop.

SOP 2 Conducted Emissions		Tracking # 31863803.001 Page 2 of 4	
EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 29, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	23° C / 39% rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**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

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



Note: Met AC Conducted Emissions Limit.

SOP 2 Conducted Emissions — Tracking # 31863803.001 Page 3 Of 4

EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 29, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	23° C / 39% rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**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
MHz	dBuV	dB	dB	dBuV		Line	dBuV	dB
0.165	31.58	9.82	0.05	41.45	QP	Neutral	65.21	-23.77
0.165	10.17	9.82	0.05	20.04	Avg	Neutral	55.21	-35.17
0.210	26.06	9.83	0.04	35.93	QP	Neutral	63.21	-27.28
0.210	9.11	9.83	0.04	18.98	Avg	Neutral	53.21	-34.23
0.247	20.87	9.83	0.04	30.74	QP	Neutral	61.85	-31.11
0.247	6.06	9.83	0.04	15.93	Avg	Neutral	51.85	-35.92
0.270	19.48	9.83	0.04	29.34	QP	Neutral	61.13	-31.79
0.270	4.01	9.83	0.04	13.88	Avg	Neutral	51.13	-37.25
0.292	17.33	9.83	0.03	27.19	QP	Neutral	60.47	-33.27
0.292	3.10	9.83	0.03	12.96	Avg	Neutral	50.47	-37.50
1.847	9.39	9.88	0.03	19.30	QP	Neutral	56.00	-36.70
1.847	3.37	9.88	0.03	13.28	Avg	Neutral	46.00	-32.72
0.165	31.58	9.82	0.05	41.45	QP	Neutral	65.21	-23.77
0.165	10.17	9.82	0.05	20.04	Avg	Neutral	55.21	-35.17
0.210	26.06	9.83	0.04	35.93	QP	Neutral	63.21	-27.28
0.210	9.11	9.83	0.04	18.98	Avg	Neutral	53.21	-34.23

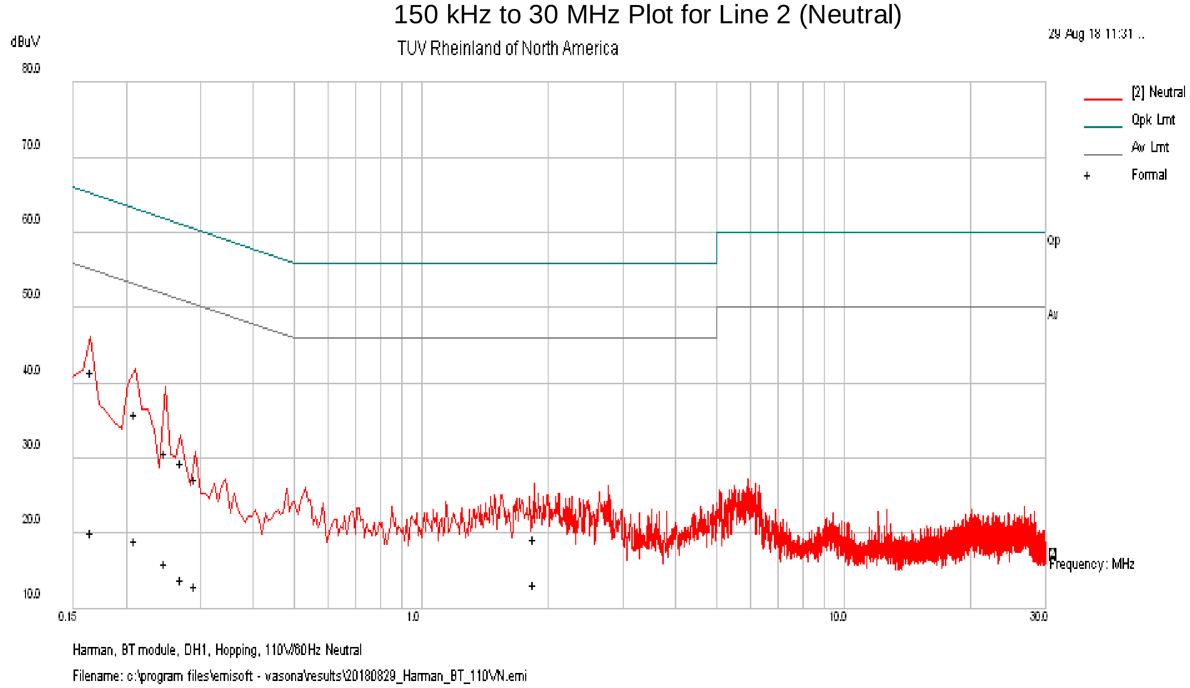
Spec Margin = QP./Ave. - Limit, ± Uncertainty

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 DH1 Hopping Channel. USB power port were connected to supporting equipment, Laptop.

SOP 2 Conducted Emissions		Tracking # 31863803.001 Page 4 of 4	
EUT Name	Luxury Audio Integrated Amplifier	**Date**	August 29, 2018
EUT Model	No5805 & No5802	**Temp / Hum in**	23° C / 39% rh
EUT Serial	0923	**Temp / Hum out**	N/A
EUT Config.	DH1	**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

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



Note: Met AC Conducted Emissions Limit.

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	A020502	03/27/2018	03/27/2019
Horn Antenna	EMCO	3115	9211-3969	05/16/2017	05/16/2019
Horn Antenna	Com-Power	AHA-840	105005	05/26/2017	05/26/2019
Loop Antenna	EMCO	6502	9110-2683	07/20/2017	07/20/2019
LISN	Com-Power	LI-215	12100	01/24/2018	01/24/2019
Spectrum Analyzer	Agilent	N9038A	MY552260210	01/22/2018	01/22/2019
Spectrum Analyzer	Rohde Schwarz	ESIB40	832427/002	01/22/2018	01/22/2019
Spectrum Analyzer	Rohde Schwarz	FSV40	1321.3008K40	09/19/2017	09/19/2018
Amplifier	Sonoma Instruments	310	165516	01/23/2018	01/23/2019
Amplifier	Miteq	TTA1800-30-HG	1842452	01/23/2018	01/23/2019
Power Meter	Agilent	E4418B	MY45103902	01/24/2018	01/24/2019
Power Sensor	Hewlett Packard	8482A	1925A04647	01/24/2018	01/24/2019
Thermo Chamber	Espec	BTZ-133	0613436	05/31/2018	05/31/2019
Multimeter	Fluke	177	92780312	01/22/2018	01/22/2019
DC Power Supply	Agilent	E3634A	MY400004331	01/25/2018	01/25/2019
Notch Filter	Micro-Tronics	BRM50702	037	VBU	VBU
Signal Generator	Anritsu	MG3694A	42803	03/20/2018	03/20/2019
Signal Generator	Rohde & Schwarz	SMF100A	1167.0000K02	09/19/2017	09/19/2018
Signal Generator	Rohde & Schwarz	SMBV100A	1407.6004K02	09/19/2017	09/19/2018
Power Sensors	Rohde & Schwarz	OSP120	1520.9010.02	09/19/2017	09/19/2018
Thermo Chamber	Tenney	T30RS	10.785-19	03/01/2018	03/01/2019

VBU = verify before use.

* 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 9: Customer Information

Company Name	Harman International Industries, Inc
Address	50 Waterview Drive, Suite 240
City, State, Zip	Shelton, CT 06484
Country	U.S.A.

Table 10: Technical Contact Information

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

7.3 Equipment Under Test (EUT)

Table 11: EUT Specifications

EUT Specifications	
Bluetooth Package Dimensions	24.5 mm; 0.96” (L) x 13.5 mm; 0.53” (W) x 2.2 mm; 0.086” (H)
DC Input	3.3 VDC
Environment	Indoor
Operating Temperature Range:	+10 to +40 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Product Marketing Name (PMN)	No5805 or No5802
Hardware Version Identification Number (HVIN)	No5805 or No5802
Firmware Version Identification Number (FVIN)	1.1
Bluetooth Radio	
Operating Mode	BDR and EDR
Transmitter Frequency Band	2402 MHz to 2480 MHz
Operating Bandwidth	1 MHz
Max. Power Output	7.33 dBm
Power Setting	255 / 50 (fixed)
Antenna Type	Chip antenna
Antenna Gain	1.7 dBi
Modulation Type	GFSK, π/4-DQPSK and 8DPSK
Data Rate	1 Mbps, 2Mbps, and 3Mbps
Note: 1. This report only documents the radio characteristics for 2402 - 2480 MHz bands. 2. Refer to Section 3.1 Product Description, in this report, for model differences of No5805 and No5802.	

Table 12: 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?
USB (used for data communication)	USB	☒ No	☒ Metric: 3 m	☒ M
USB (used to power Bluetooth)	USB	☒ No	☒ Metric: 3 m	☒ M
Note: These USB cables were use for test purposes only.				

Table 13: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	LENOVO	E440	PF-063HA6-14/12	Setup EUT operating channel & Conducted Emission Test
DC Power Supply	Agilent	E3634A	MY40004331	Radiated Emission Test
Note: See Section 6 of this test report for DC power supply calibration information.				

Table 14: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
Bluetooth Module	Prototype	Integrated Antenna	Radiated Emissions Conducted Emissions
		Direct via SMA Connection	Transmit Power, Occupied Bandwidth, Out of Band Emission, Hopping Requirement

Table 15: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
Bluetooth Module	Chip	Transmit	N/A	EUT upright	N/A
Note: The Bluetooth Module is located in front panel of an audio system and placed upright. All emission scans performed on the Y-Axis.					

7.4 Test Specifications

Testing requirements

Table 16: Test Specifications

Emissions and Immunity	
Standard	Requirement
CFR 47 Part 15.247: 2018	All
RSS-247 Issue 2, 2017	All

END OF REPORT