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# Phillips Lifeline TEST REPORT

## SCOPE OF WORK

EMC TESTING – MHB 3.0

## REPORT NUMBER

104038541LEX-001

## ISSUE DATE

6/1/2021

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**EMC TEST REPORT**  
(FULL COMPLIANCE)

**Report Number:** 104038541LEX-001

**Project Number:** G104038541

**Report Issue Date:** 9/4/2020

**Report Revised Date:** 6/1/2021

**Model(s) Tested:** MHB 3.0

**Standards:** Title 47 CFR Part 15.247

RSS-247 Issue 2

RSS-Gen Issue 5

**Tested by:**  
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**Client:**  
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## 1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

## 2 Test Summary

Section	Test full name	Result
6	Receiver Spurious Emissions (ANSI C63.4: 2014)	Pass
7	Transmitter Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5)	Pass
8	Output Power (FCC Part 15.247(b)(3), RSS-247 Issue 2 § 5.4(d))	Pass
9	Occupied Bandwidth (FCC Part 15.247, RSS-247 Issue 2 § 5.2(a))	Pass
10	Power Spectral Density (FCC Part 15.247(e), RSS-247 Issue 2 § 5.2(b))	Pass
11	Conducted Spurious Emissions (FCC Part 15.247(d), RSS-247 Issue 2 § 5.5)	Pass
12	Number of Hopping Channels, Channel Separation, and Time of Occupancy (FCC Part 15.247(a), RSS-247 Issue 2 § 5.1)	Pass
13	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5 § 6.8)	Pass
14	Conducted Emissions (ANSI C63.4: 2014)	Pass



### 3 Client Information

This product was tested at the request of the following:

Client Information	
<b>Client Name:</b>	Phillips Lifeline
<b>Address:</b>	11 Lawrence St Framingham, MA 01702 USA
<b>Contact:</b>	Bill Bekdash
<b>Email:</b>	Bill.bekdash@phillips.com
Manufacturer Information	
<b>Manufacturer Name:</b>	Phillips Lifeline
<b>Manufacturer Address:</b>	11 Lawrence St Framingham, MA 01702 USA



#### 4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	MHB 3.0
Model Numbers	7250MHB
Receive Date	12/15/2020
Test Start Date	1/24/2021
Test End Date	3/30/2021
Device Received Condition	Good
Test Sample Type	Production
Input Rating	3.7V, 0.5A Battery: 3.7V, 2.5AH
Frequency Band(s)	2400-2483.5MHz
Transmission Mode(s)	Bluetooth (FHSS) Bluetooth Low Energy (BLE, DTS) Wi-Fi: 802.11b, 802.11g, 802.11n, 802.11nHT40 (DTS)
Test Channel(s)	Bluetooth: 0 (2402MHz), 38 (2440MHz), 78 (2480MHz) BLE: 37 (2402MHz), 17 (2440MHz), 39 (2480MHz) 802.11b, 802.11g, 802.11n: 1 (2412MHz), 6 (2437MHz), 11 (2462MHz) 802.11nHT40: 3 (2422MHz), 7 (2442MHz), 11 (2462MHz)
Description of Equipment Under Test (provided by client)	
<p>The 7250MHB Mobile Help Buttons is a wearable PERS (Personal Emergency Response System) device. The 7250MHB device provides cellular telephone speakerphone technology for communication with a PERS call center when the user requires assistance. The 7250MHB is configured to use 4G LTE cellular communication. The 7250MHB device provides automatic fall detection, allow the user to manually signal for assistance, and use GPS and Wi-Fi technology to automatically establish the user's location.</p>	

##### 4.1 Variant Models:

There were no variants covered by this evaluation.



## 5 System Setup and Method

### 5.1 Method:

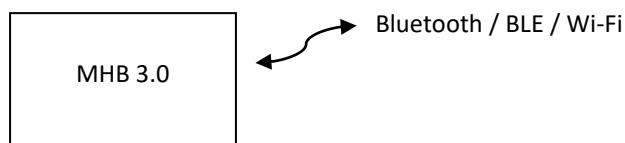
Configuration as required by ANSI C63.4: 2014 and ANSI C63.10:2013

No.	Descriptions of EUT Exercising
1	Transmitting a Bluetooth signal on low, middle, or high channel
2	Transmitting a Bluetooth Low Energy (BLE) signal on low, middle, or high channel
3	Transmitting an 802.11b signal on low, middle, or high channel
4	Transmitting an 802.11g signal on low, middle, or high channel
5	Transmitting an 802.11n signal on low, middle, or high channel
6	Transmitting an 802.11nHT40 signal on low, middle, or high channel
7	Transmitting an 802.11a signal on, middle, or high channel
8	Idle, not transmitting.

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
	None used				

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
Laptop	HP	-	-

### 5.2 EUT Block Diagram:





## 6 Receiver Spurious Emissions

### 6.1 Test Method

Tests are performed in accordance with ANSI C63.4: 2014

**TEST SITE:** 10m ALSE

**Site Designation:** 10m Chamber

#### Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	5.5 dB

As shown in the table above our radiated emissions  $U_{lab}$  is less than the corresponding  $U_{CISPR}$  reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required.





## 6.2 Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where

- FS = Field Strength in dB $\mu$ V/m
- RA = Receiver Amplitude (including preamplifier) in dB $\mu$ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB $\mu$ V  
AF = 7.4 dB/m  
CF = 1.6 dB  
AG = 29.0 dB  
FS = 32 dB $\mu$ V/m

To convert from dB $\mu$ V to  $\mu$ V or mV the following was used:

$$UF = 10^{(NF / 20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$
$$NF = \text{Net Reading in dB}\mu\text{V}$$

### Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$
$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$



### 6.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	10/5/2020	10/5/2021
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	9/4/2020	9/4/2021
Horn Antenna (1-18GHz)	3780	ETS	3117	6/18/2020	6/18/2021
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			12/21/2020	12/21/2021
Preamplifier	3918	Rhode&Schwarz	TS-PR18	12/21/2021	12/21/2021
Coaxial Cable	2588			12/21/2020	12/21/2021
Coaxial Cable	2593			12/21/2020	12/21/2021
Coaxial Cable	2592			12/21/2020	12/21/2021
Coaxial Cable	3339			12/21/2020	12/21/2021

### 6.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

### 6.5 Test Results

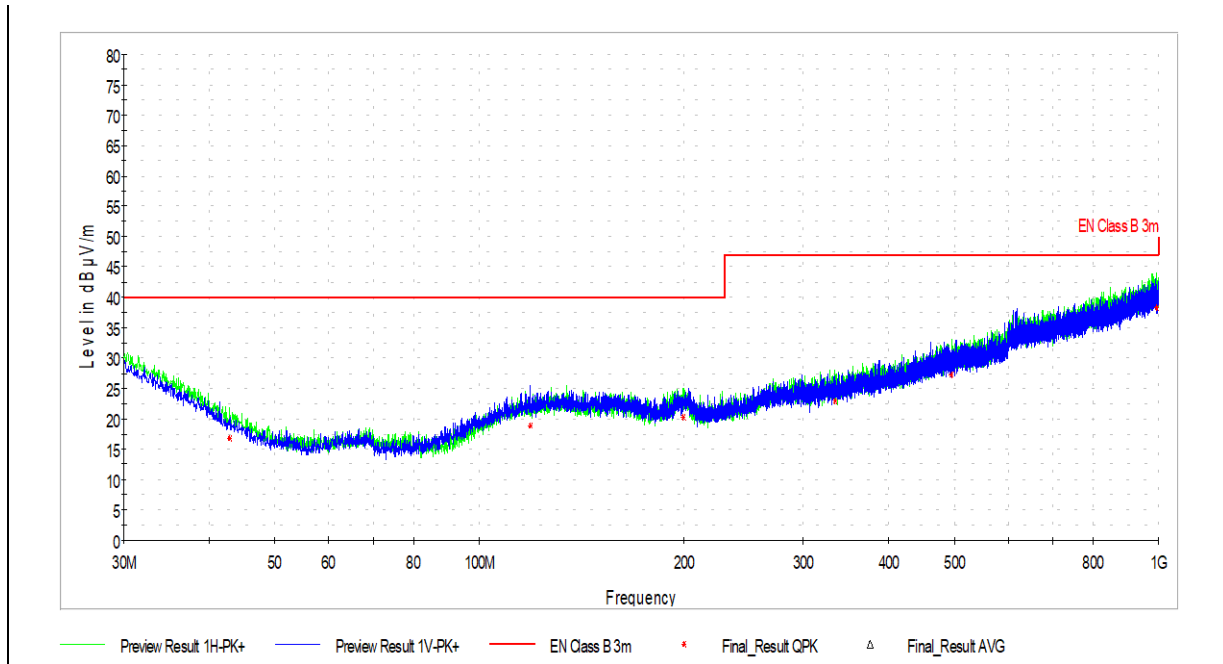
The sample tested was found to be **compliant**.

### 6.6 Test Conditions

Test Personnel:	<u>Brandon Norris</u>	Test Date:	<u>2/9/2021</u>
Supervising/Reviewing Engineer:	<u>NA</u>		<u>FCC Part 15.209 /</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Limit Applied:	<u>FCC Part 15.109 Class B</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Ambient Temperature:	<u>22.6C</u>
Input Voltage:	<u>Battery</u>	Relative Humidity:	<u>63.0%</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>Yes</u>	Atmospheric Pressure:	<u>983.0mbar</u>



6.7 Test Data: 30MHz – 1GHz

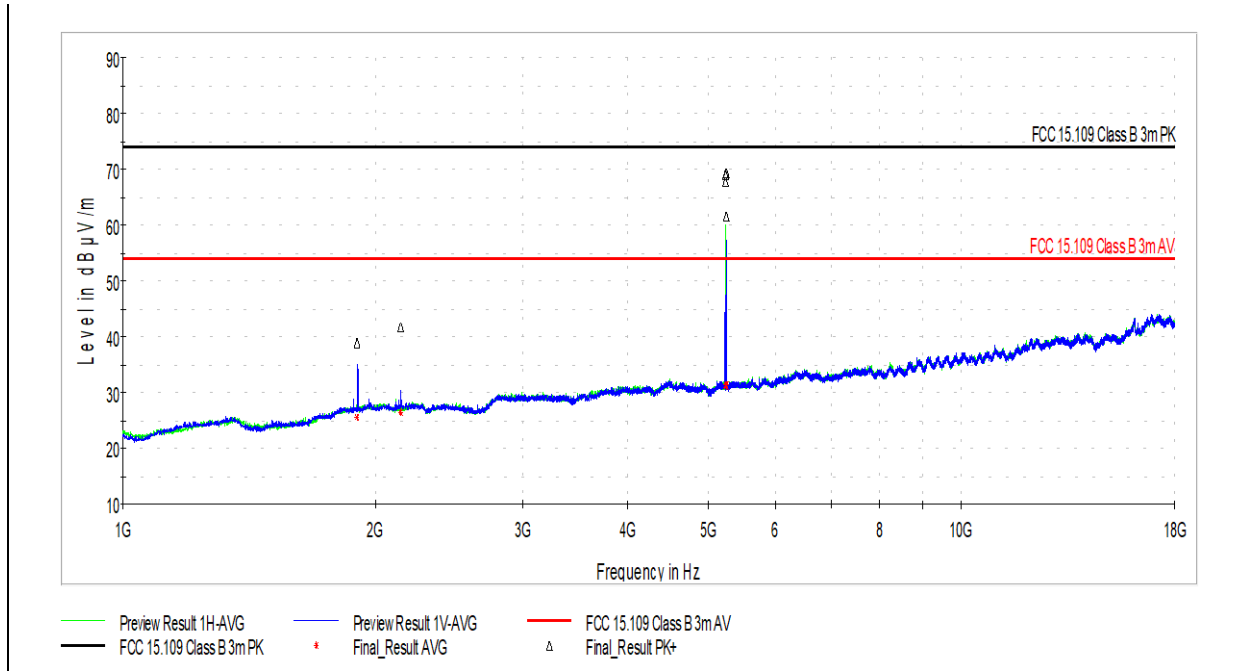


Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
42.879445	16.69	40.00	23.31	120.000	131.1	H	0.0	19.5
118.808889	18.94	40.00	21.06	120.000	142.1	V	27.0	21.8
199.318889	20.34	40.00	19.66	120.000	224.9	H	56.0	22.0
334.202778	22.85	47.00	24.15	120.000	314.6	H	320.0	24.8
495.222778	27.33	47.00	19.67	120.000	320.0	H	31.0	29.0
992.293889	38.34	47.00	8.66	120.000	118.7	H	109.0	38.2

Deviations, Additions, or Exclusions: None



6.8 Test Data: 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1901.000000	38.78	73.98	35.20	1000.000	176.0	V	331.0	3.9
2145.000000	41.76	73.98	32.22	1000.000	152.0	V	13.0	3.9
5231.500000	69.07	73.98	4.91	1000.000	410.0	V	308.0	9.9
5234.000000	67.81	73.98	6.17	1000.000	186.0	H	340.0	9.8
5242.500000	61.59	73.98	12.39	1000.000	372.0	V	235.0	9.9
5248.000000	69.42	73.98	4.56	1000.000	410.0	V	333.0	9.9

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1901.000000	25.48	53.98	28.50	1000.000	176.0	V	331.0	3.9
2145.000000	26.41	53.98	27.57	1000.000	152.0	V	13.0	3.9
5231.500000	31.44	53.98	22.54	1000.000	410.0	V	308.0	9.9
5234.000000	31.27	53.98	22.71	1000.000	186.0	H	340.0	9.8
5242.500000	31.09	53.98	22.89	1000.000	372.0	V	235.0	9.9
5248.000000	31.35	53.98	22.63	1000.000	410.0	V	333.0	9.9

Deviations, Additions, or Exclusions: None



## 7 Transmitter Spurious Emissions

### 7.1 Test Limits

#### FCC Part 15.247(d):

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

#### RSS-247 Issue 2 § 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 7.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.12.1 Radiated emission measurements.



### 7.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	10/5/2020	10/5/2021
Magnetic Loop Antenna	2366	ETS	6502	7/17/2020	7/17/2021
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	9/4/2020	9/4/2021
Horn Antenna (1-18GHz)	3780	ETS	3117	6/18/2020	6/18/2021
Horn Antenna (18-40GHz)	3779	ETS	3116c	7/23/2020	7/23/2021
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
Coaxial Cable	3074			12/21/2020	12/21/2021
Preamplifier	3918	Rhode & Schwarz	TS-PR18	12/21/2021	12/21/2021
Coaxial Cable	2588			12/21/2020	12/21/2021
Coaxial Cable	2593			12/21/2020	12/21/2021
Coaxial Cable	2592			12/21/2020	12/21/2021
Coaxial Cable	3339			12/21/2020	12/21/2021
Preamplifier (18-40GHz)	3921	Rohde & Schwarz	TS-PR40	12/21/2021	12/21/2021
Coaxial Cable (40GHz)	7020			12/21/2020	12/21/2021
Coaxial Cable (40GHz)	7021			12/21/2020	12/21/2021

### 7.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

### 7.5 Test Results

The sample tested was found to be **compliant**. The data presented represents the worst case emissions with the device positioned in three orthogonal positions. All observed emissions outside of the band of operation were attenuated by at least 20dB. Test results shown are worst case with the device positioned in 3 orthogonal orientations.

### 7.6 Test Conditions

Test Personnel:	<u>Brandon Norris</u>	Test Date:	<u>3/22/2021</u>
Supervising/Reviewing Engineer: (Where Applicable)	<u>NA</u>	Limit Applied:	<u>FCC Part 15.209 in Restricted Bands from FCC Part 15.205</u>
Product Standard:	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>24.3C</u>
Input Voltage:	<u>Battery</u>	Relative Humidity:	<u>45.7%</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>Yes</u>	Atmospheric Pressure:	<u>982.7mbar</u>

**7.7 Spurious Emissions (9kHz – 30MHz)**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
0.496787	48.67	73.68	25.01	9.000	315.0	12.0
2.178044	33.51	69.54	36.03	9.000	0.0	11.7
4.127074	27.97	69.54	41.57	9.000	73.0	11.5
6.216574	24.61	69.54	44.93	9.000	0.0	11.4
8.292904	22.96	69.54	46.58	9.000	331.0	11.3
8.363140	22.05	69.54	47.49	9.000	46.0	11.3
8.385088	22.79	69.54	46.75	9.000	126.0	11.3
12.520191	19.19	69.54	50.35	9.000	170.0	11.2
13.393743	19.61	69.54	49.93	9.000	0.0	11.2
16.422640	19.44	69.54	50.10	9.000	26.0	11.2

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
0.496787	36.25	73.68	37.43	9.000	315.0	12.0
2.178044	21.71	69.54	47.83	9.000	0.0	11.7
4.127074	16.39	69.54	53.15	9.000	73.0	11.5
6.216574	13.24	69.54	56.30	9.000	0.0	11.4
8.292904	11.16	69.54	58.38	9.000	331.0	11.3
8.363140	10.79	69.54	58.75	9.000	46.0	11.3
8.385088	10.82	69.54	58.72	9.000	126.0	11.3
12.520191	8.23	69.54	61.31	9.000	170.0	11.2
13.393743	8.23	69.54	61.31	9.000	0.0	11.2
16.422640	7.15	69.54	62.39	9.000	26.0	11.2

Test Personnel:	<u>Brandon Norris</u>	Test Date:	<u>3/8/2021</u>
Supervising/Reviewing Engineer:	<u>NA</u>	Limit Applied:	<u>FCC Part 15.209 in Restricted Bands from FCC Part 15.205</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>22.8C</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>24.8%</u>
Input Voltage:	<u>Battery</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>Yes</u>		

Note: testing represents the worst case emissions from all modes of operation.

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	10/5/2020	10/5/2021
Magnetic Loop Antenna	2366	ETS	6502	7/17/2020	7/17/2021
Coaxial Cable	3339			12/21/2020	12/21/2021
Coaxial Cable	2593			12/21/2020	12/21/2021
Coaxial Cable	2592			12/21/2020	12/21/2021

**7.8 Bluetooth Low Energy****7.8.1 Low Channel (2402MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2273.000000	42.10	73.98	31.88	1000.000	225.0	H	296.0	4.7
4802.000000	45.72	73.98	28.26	1000.000	410.0	V	184.0	9.3
11259.500000	50.65	73.98	23.33	1000.000	410.0	H	276.0	18.7
12341.000000	52.06	73.98	21.92	1000.000	410.0	H	114.0	20.4
16030.500000	55.43	73.98	18.55	1000.000	410.0	V	220.0	24.1
17929.500000	56.14	73.98	17.84	1000.000	410.0	H	124.0	25.3

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2273.000000	30.77	53.98	23.21	1000.000	225.0	H	296.0	4.7
4802.000000	33.60	53.98	20.38	1000.000	410.0	V	184.0	9.3
11259.500000	36.98	53.98	17.00	1000.000	410.0	H	276.0	18.7
12341.000000	38.84	53.98	15.14	1000.000	410.0	H	114.0	20.4
16030.500000	42.07	53.98	11.91	1000.000	410.0	V	220.0	24.1
17929.500000	42.90	53.98	11.08	1000.000	410.0	H	124.0	25.3

**7.8.2 Mid Channel (2440MHz)**

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
74.081111	25.57	40.00	14.43	120.000	248.4	H	155.0	15.5
74.512222	25.77	40.00	14.23	120.000	248.6	H	156.0	15.5
74.943333	25.26	40.00	14.74	120.000	400.1	H	155.0	15.5
108.085000	32.54	43.52	10.98	120.000	260.6	H	158.0	20.4
610.491111	31.84	46.02	14.18	120.000	142.3	H	227.0	31.6
964.056111	37.81	53.98	16.17	120.000	189.6	H	316.0	37.7

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.500000	51.06	73.98	22.92	1000.000	352.0	V	34.0	0.0
4126.000000	48.48	73.98	25.50	1000.000	390.0	V	32.0	8.2
4790.500000	56.89	73.98	17.09	1000.000	268.0	V	0.0	9.3
4881.000000	45.78	73.98	28.20	1000.000	309.0	H	211.0	10.0
7321.500000	51.67	73.98	22.31	1000.000	100.0	H	302.0	13.4
12100.500000	51.94	73.98	22.04	1000.000	410.0	V	35.0	20.2

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.500000	26.93	53.98	27.05	1000.000	352.0	V	34.0	0.0
4126.000000	31.54	53.98	22.44	1000.000	390.0	V	32.0	8.2
4790.500000	31.26	53.98	22.72	1000.000	268.0	V	0.0	9.3
4881.000000	33.02	53.98	20.96	1000.000	309.0	H	211.0	10.0
7321.500000	40.13	53.98	13.85	1000.000	100.0	H	302.0	13.4
12100.500000	39.01	53.98	14.97	1000.000	410.0	V	35.0	20.2



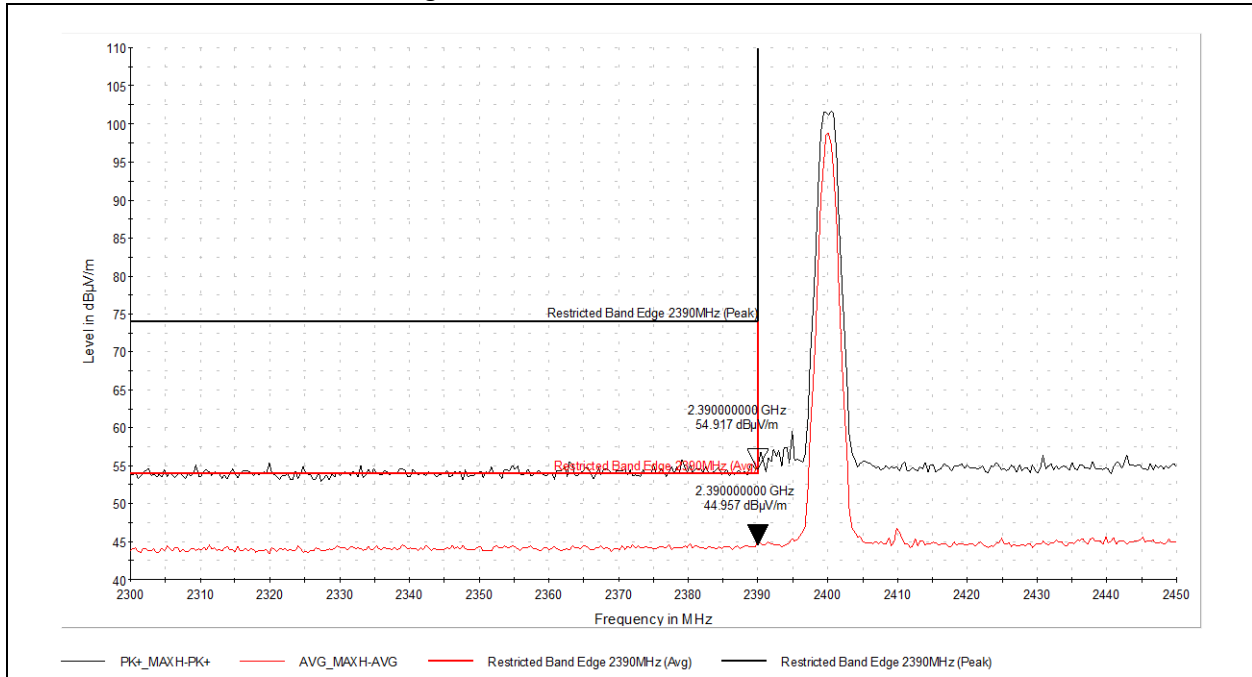
**7.8.3 High Channel (2480MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4120.500000	42.94	73.98	31.04	1000.000	410.0	V	320.0	8.2
4793.500000	49.26	73.98	24.72	1000.000	240.0	V	216.0	9.3
4957.000000	47.54	73.98	26.44	1000.000	271.0	V	188.0	9.8
7321.500000	46.42	73.98	27.56	1000.000	410.0	V	274.0	13.3
7435.500000	52.89	73.98	21.09	1000.000	410.0	H	295.0	13.2
12087.000000	52.12	73.98	21.86	1000.000	410.0	H	251.0	20.0

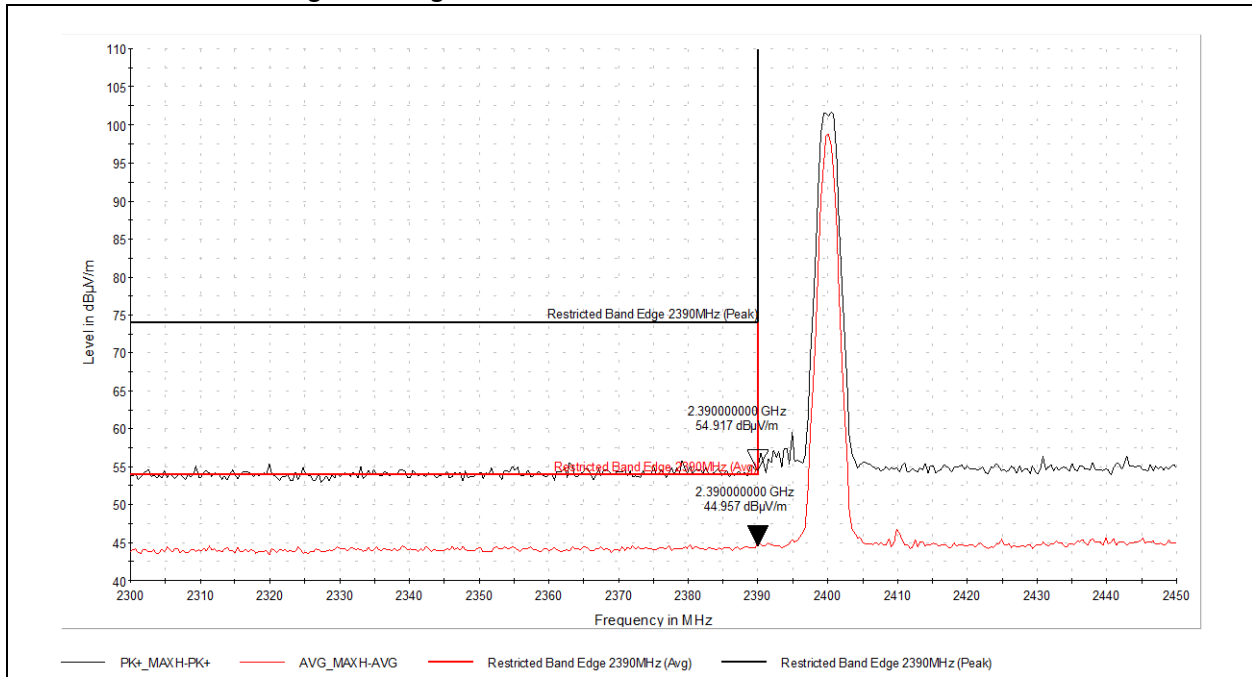
Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4120.500000	29.82	53.98	24.16	1000.000	410.0	V	320.0	8.2
4793.500000	30.89	53.98	23.09	1000.000	240.0	V	216.0	9.3
4957.000000	36.08	53.98	17.90	1000.000	271.0	V	188.0	9.8
7321.500000	33.24	53.98	20.74	1000.000	410.0	V	274.0	13.3
7435.500000	42.14	53.98	11.84	1000.000	410.0	H	295.0	13.2
12087.000000	38.80	53.98	15.18	1000.000	410.0	H	251.0	20.0



### 7.8.4 Emissions at the low band edge



### 7.8.5 Emissions at the high band edge



**7.9 Bluetooth****7.9.1 DH1, Low Channel (2402MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1199.000000	50.02	73.98	23.96	1000.000	352.0	V	20.0	0.1
4072.500000	47.39	73.98	26.59	1000.000	297.0	V	30.0	8.3
4802.000000	45.84	73.98	28.14	1000.000	100.0	H	124.0	9.4
4960.000000	43.31	73.98	30.67	1000.000	410.0	H	185.0	9.8
10970.000000	50.93	73.98	23.05	1000.000	410.0	V	0.0	18.7
16103.500000	56.22	73.98	17.76	1000.000	410.0	V	315.0	25.3

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1199.000000	26.19	53.98	27.79	1000.000	352.0	V	20.0	0.1
4072.500000	30.73	53.98	23.25	1000.000	297.0	V	30.0	8.3
4802.000000	35.76	53.98	18.22	1000.000	100.0	H	124.0	9.4
4960.000000	30.26	53.98	23.72	1000.000	410.0	H	185.0	9.8
10970.000000	37.46	53.98	16.52	1000.000	410.0	V	0.0	18.7
16103.500000	42.92	53.98	11.06	1000.000	410.0	V	315.0	25.3

**7.9.2 DH1, Mid Channel (2440MHz)**

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
74.835556	25.35	40.00	14.65	120.000	400.0	H	160.0	15.5
108.031111	32.55	43.52	10.97	120.000	261.2	H	155.0	20.4
259.997778	33.79	46.02	12.23	120.000	118.3	H	234.0	22.3
263.985556	35.24	46.02	10.78	120.000	106.1	H	202.0	22.8
610.275556	31.68	46.02	14.34	120.000	106.5	H	251.0	31.6
992.994444	38.38	53.98	15.60	120.000	106.1	H	210.0	38.2

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1194.500000	50.43	73.98	23.55	1000.000	349.0	V	25.0	0.0
1366.000000	37.99	73.98	35.99	1000.000	161.0	H	48.0	1.4
4101.500000	43.16	73.98	30.82	1000.000	324.0	V	25.0	8.1
4785.500000	53.72	73.98	20.26	1000.000	279.0	V	0.0	9.3
4880.000000	44.80	73.98	29.18	1000.000	100.0	H	120.0	9.9
7320.000000	54.53	73.98	19.45	1000.000	100.0	V	1.0	13.3
19593.750000	56.37	73.98	17.61	1000.000	100.0	V	212.0	16.4
22743.386364	55.87	73.98	18.11	1000.000	316.0	V	264.0	10.5
23739.818182	57.85	73.98	16.13	1000.000	100.0	H	19.0	11.1

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1194.500000	25.44	53.98	28.54	1000.000	349.0	V	25.0	0.0
1366.000000	23.70	53.98	30.28	1000.000	161.0	H	48.0	1.4
4101.500000	29.64	53.98	24.34	1000.000	324.0	V	25.0	8.1
4785.500000	30.60	53.98	23.38	1000.000	279.0	V	0.0	9.3
4880.000000	33.20	53.98	20.78	1000.000	100.0	H	120.0	9.9
7320.000000	47.24	53.98	6.74	1000.000	100.0	V	1.0	13.3
19593.750000	42.89	53.98	11.09	1000.000	100.0	V	212.0	16.4
22743.386364	42.79	53.98	11.19	1000.000	316.0	V	264.0	10.5
23739.818182	44.37	53.98	9.61	1000.000	100.0	H	19.0	11.1

**7.9.3 DH1, High Channel (2480MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	50.07	73.98	23.91	1000.000	339.0	V	36.0	0.1
4101.500000	45.14	73.98	28.84	1000.000	410.0	V	100.0	8.1
4781.500000	55.56	73.98	18.42	1000.000	254.0	V	0.0	9.4
4958.000000	47.62	73.98	26.36	1000.000	295.0	V	194.0	9.7
7437.500000	55.02	73.98	18.96	1000.000	303.0	V	48.0	13.1

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	26.65	53.98	27.33	1000.000	339.0	V	36.0	0.1
4101.500000	29.86	53.98	24.12	1000.000	410.0	V	100.0	8.1
4781.500000	30.88	53.98	23.10	1000.000	254.0	V	0.0	9.4
4958.000000	39.52	53.98	14.46	1000.000	295.0	V	194.0	9.7
7437.500000	46.40	53.98	7.58	1000.000	303.0	V	48.0	13.1

**7.9.4 DH3, Low Channel (2402MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7499.500000	46.83	73.98	27.15	1000.000	410.0	V	306.0	13.3
8188.000000	47.30	73.98	26.68	1000.000	410.0	H	332.0	14.7
10777.000000	50.15	73.98	23.83	1000.000	410.0	H	186.0	18.9
11957.500000	51.38	73.98	22.60	1000.000	410.0	V	25.0	19.4
16093.000000	56.15	73.98	17.83	1000.000	410.0	H	0.0	25.2
17771.000000	56.09	73.98	17.89	1000.000	410.0	H	252.0	25.3

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7499.500000	33.47	53.98	20.51	1000.000	410.0	V	306.0	13.3
8188.000000	34.32	53.98	19.66	1000.000	410.0	H	332.0	14.7
10777.000000	37.11	53.98	16.87	1000.000	410.0	H	186.0	18.9
11957.500000	38.30	53.98	15.68	1000.000	410.0	V	25.0	19.4
16093.000000	42.99	53.98	10.99	1000.000	410.0	H	0.0	25.2
17771.000000	43.12	53.98	10.86	1000.000	410.0	H	252.0	25.3

**7.9.5 DH3, Mid Channel (2440MHz)**

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
74.081111	25.28	40.00	14.72	120.000	262.9	H	163.0	15.5
74.566111	24.94	40.00	15.06	120.000	249.1	H	155.0	15.5
74.943333	25.70	40.00	14.30	120.000	264.9	H	156.0	15.5
108.031111	33.28	43.52	10.24	120.000	261.0	H	165.0	20.4
259.836111	34.79	46.02	11.23	120.000	118.7	H	241.0	22.3
263.985556	35.03	46.02	10.99	120.000	104.7	H	192.0	22.8
609.359444	31.68	46.02	14.34	120.000	130.4	H	231.0	31.6
981.570000	37.52	53.98	16.46	120.000	309.3	V	202.0	37.3

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7499.500000	46.83	73.98	27.15	1000.000	410.0	V	306.0	13.3
8188.000000	47.30	73.98	26.68	1000.000	410.0	H	332.0	14.7
10777.000000	50.15	73.98	23.83	1000.000	410.0	H	186.0	18.9
11957.500000	51.38	73.98	22.60	1000.000	410.0	V	25.0	19.4
16093.000000	56.15	73.98	17.83	1000.000	410.0	H	0.0	25.2
17771.000000	56.09	73.98	17.89	1000.000	410.0	H	252.0	25.3
18641.772727	55.47	73.98	18.51	1000.000	158.0	H	238.0	19.0
19840.363636	54.70	73.98	19.28	1000.000	100.0	H	330.0	15.9
20428.363636	54.38	73.98	19.60	1000.000	117.0	V	292.0	13.9
22639.090909	56.37	73.98	17.61	1000.000	244.0	V	0.0	10.5
23767.363636	57.54	73.98	16.44	1000.000	268.0	H	112.0	11.2
23871.090909	57.49	73.98	16.49	1000.000	250.0	H	58.0	11.4

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7499.500000	33.47	53.98	20.51	1000.000	410.0	V	306.0	13.3
8188.000000	34.32	53.98	19.66	1000.000	410.0	H	332.0	14.7
10777.000000	37.11	53.98	16.87	1000.000	410.0	H	186.0	18.9
11957.500000	38.30	53.98	15.68	1000.000	410.0	V	25.0	19.4
16093.000000	42.99	53.98	10.99	1000.000	410.0	H	0.0	25.2
17771.000000	43.12	53.98	10.86	1000.000	410.0	H	252.0	25.3
18641.772727	42.18	53.98	11.80	1000.000	158.0	H	238.0	19.0
19840.363636	40.97	53.98	13.01	1000.000	100.0	H	330.0	15.9
20428.363636	41.31	53.98	12.67	1000.000	117.0	V	292.0	13.9
22639.090909	43.18	53.98	10.80	1000.000	244.0	V	0.0	10.5
23767.363636	44.02	53.98	9.96	1000.000	268.0	H	112.0	11.2
23871.090909	44.13	53.98	9.85	1000.000	250.0	H	58.0	11.4

**7.9.6 DH3, High Channel (2480MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.500000	50.75	73.98	23.23	1000.000	340.0	V	31.0	0.1
1529.500000	42.31	73.98	31.67	1000.000	366.0	V	46.0	0.4
4777.500000	54.66	73.98	19.32	1000.000	281.0	V	0.0	9.4
4958.000000	47.39	73.98	26.59	1000.000	351.0	V	244.0	9.7
7437.000000	50.82	73.98	23.16	1000.000	100.0	V	64.0	13.1
11255.500000	49.92	73.98	24.06	1000.000	410.0	V	316.0	18.6

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.500000	27.09	53.98	26.89	1000.000	340.0	V	31.0	0.1
1529.500000	23.95	53.98	30.03	1000.000	366.0	V	46.0	0.4
4777.500000	30.69	53.98	23.29	1000.000	281.0	V	0.0	9.4
4958.000000	39.15	53.98	14.83	1000.000	351.0	V	244.0	9.7
7437.000000	41.85	53.98	12.13	1000.000	100.0	V	64.0	13.1
11255.500000	36.91	53.98	17.07	1000.000	410.0	V	316.0	18.6



**7.9.7 DH5, Low Channel (2402MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1197.000000	50.23	73.98	23.75	1000.000	288.0	V	47.0	0.1
4802.000000	50.71	73.98	23.27	1000.000	264.0	V	194.0	9.3
4960.000000	44.31	73.98	29.67	1000.000	100.0	H	216.0	9.8
12003.500000	53.39	73.98	20.59	1000.000	346.0	V	85.0	19.4
16084.500000	55.57	73.98	18.41	1000.000	410.0	H	336.0	25.0

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1197.000000	50.23	73.98	23.75	1000.000	288.0	V	47.0	0.1
4802.000000	50.71	73.98	23.27	1000.000	264.0	V	194.0	9.3
4960.000000	44.31	73.98	29.67	1000.000	100.0	H	216.0	9.8
12003.500000	53.39	73.98	20.59	1000.000	346.0	V	85.0	19.4
16084.500000	55.57	73.98	18.41	1000.000	410.0	H	336.0	25.0

**7.9.8 DH5, Mid Channel (2440MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7499.500000	46.83	73.98	27.15	1000.000	410.0	V	306.0	13.3
8188.000000	47.30	73.98	26.68	1000.000	410.0	H	332.0	14.7
10777.000000	50.15	73.98	23.83	1000.000	410.0	H	186.0	18.9
11957.500000	51.38	73.98	22.60	1000.000	410.0	V	25.0	19.4
16093.000000	56.15	73.98	17.83	1000.000	410.0	H	0.0	25.2
17771.000000	56.09	73.98	17.89	1000.000	410.0	H	252.0	25.3

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7499.500000	33.47	53.98	20.51	1000.000	410.0	V	306.0	13.3
8188.000000	34.32	53.98	19.66	1000.000	410.0	H	332.0	14.7
10777.000000	37.11	53.98	16.87	1000.000	410.0	H	186.0	18.9
11957.500000	38.30	53.98	15.68	1000.000	410.0	V	25.0	19.4
16093.000000	42.99	53.98	10.99	1000.000	410.0	H	0.0	25.2
17771.000000	43.12	53.98	10.86	1000.000	410.0	H	252.0	25.3

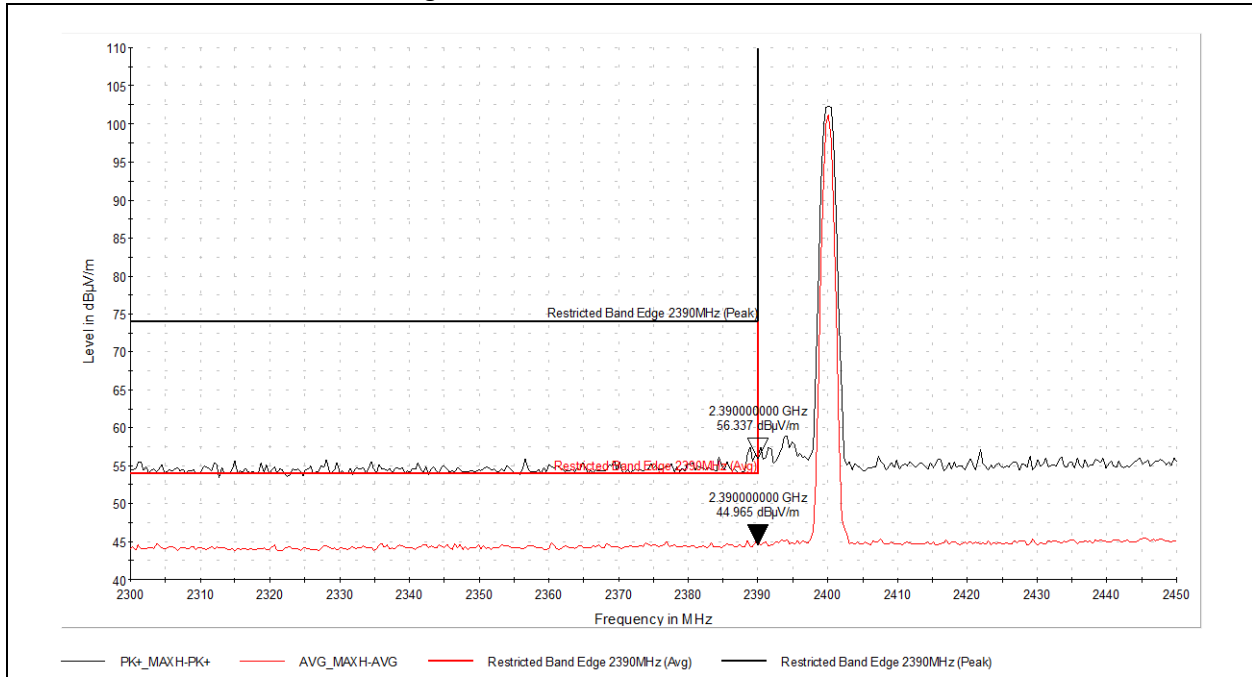
**7.9.9 DH5, Channel 78 (2480MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.500000	50.75	73.98	23.23	1000.000	340.0	V	31.0	0.1
1529.500000	42.31	73.98	31.67	1000.000	366.0	V	46.0	0.4
4777.500000	54.66	73.98	19.32	1000.000	281.0	V	0.0	9.4
4958.000000	47.39	73.98	26.59	1000.000	351.0	V	244.0	9.7
7437.000000	50.82	73.98	23.16	1000.000	100.0	V	64.0	13.1
11255.500000	49.92	73.98	24.06	1000.000	410.0	V	316.0	18.6

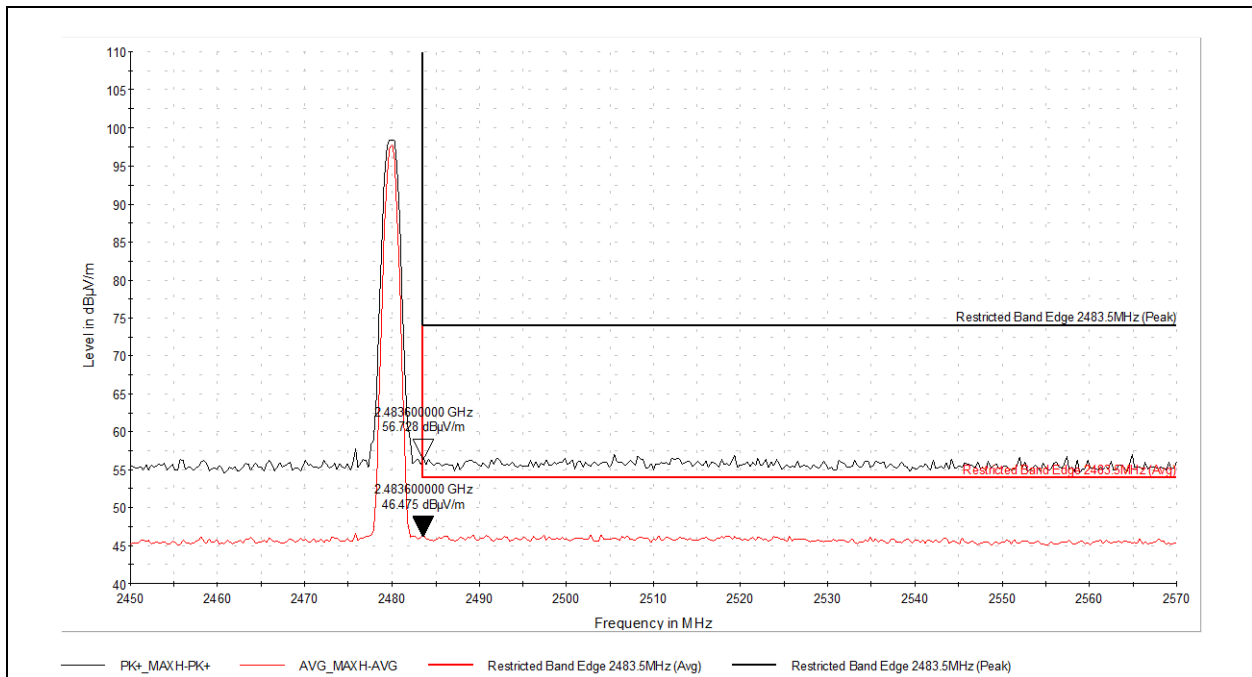
Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.500000	27.09	53.98	26.89	1000.000	340.0	V	31.0	0.1
1529.500000	23.95	53.98	30.03	1000.000	366.0	V	46.0	0.4
4777.500000	30.69	53.98	23.29	1000.000	281.0	V	0.0	9.4
4958.000000	39.15	53.98	14.83	1000.000	351.0	V	244.0	9.7
7437.000000	41.85	53.98	12.13	1000.000	100.0	V	64.0	13.1
11255.500000	36.91	53.98	17.07	1000.000	410.0	V	316.0	18.6



### 7.9.10 Emissions at the low band edge



### 7.9.11 Emissions at the high band edge



**7.10 Wi-Fi, 802.11b****7.10.1 Channel 1 (2412MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	52.10	73.98	21.88	1000.000	331.0	V	37.0	0.1
1440.000000	39.48	73.98	34.50	1000.000	194.0	V	33.0	0.4
1503.000000	42.91	73.98	31.07	1000.000	304.0	V	58.0	0.3
4120.500000	42.51	73.98	31.47	1000.000	169.0	V	0.0	8.2
4793.500000	58.60	73.98	15.38	1000.000	223.0	V	9.0	9.3
16095.500000	56.34	73.98	17.64	1000.000	288.0	H	58.0	25.3

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	29.01	53.98	24.97	1000.000	331.0	V	37.0	0.1
1440.000000	31.89	53.98	22.09	1000.000	194.0	V	33.0	0.4
1503.000000	24.17	53.98	29.81	1000.000	304.0	V	58.0	0.3
4120.500000	29.46	53.98	24.52	1000.000	169.0	V	0.0	8.2
4793.500000	32.16	53.98	21.82	1000.000	223.0	V	9.0	9.3
16095.500000	42.84	53.98	11.14	1000.000	288.0	H	58.0	25.3

**7.10.2 Channel 6 (2437MHz)**

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.760000	20.37	40.00	19.63	120.000	189.0	H	174.0	23.1
163.321111	19.21	43.52	24.31	120.000	400.2	H	8.0	21.5
172.697778	18.93	43.52	24.59	120.000	261.4	V	264.0	21.1
331.292778	22.77	46.02	23.25	120.000	399.9	H	122.0	24.7
613.455000	31.06	46.02	14.96	120.000	320.4	V	312.0	31.1
976.342778	38.05	53.98	15.93	120.000	130.2	H	0.0	37.9

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	52.10	73.98	21.88	1000.000	331.0	V	37.0	0.1
1440.000000	39.48	73.98	34.50	1000.000	194.0	V	33.0	0.4
1503.000000	42.91	73.98	31.07	1000.000	304.0	V	58.0	0.3
4120.500000	42.51	73.98	31.47	1000.000	169.0	V	0.0	8.2
4793.500000	58.60	73.98	15.38	1000.000	223.0	V	9.0	9.3
16095.500000	56.34	73.98	17.64	1000.000	288.0	H	58.0	25.3
19434.045455	55.04	73.98	18.94	1000.000	343.0	V	70.0	16.9
20751.636364	55.38	73.98	18.60	1000.000	212.0	V	270.0	13.1
22506.727273	57.34	73.98	16.64	1000.000	133.0	V	0.0	10.8
23699.590909	57.57	73.98	16.41	1000.000	100.0	H	141.0	11.0



Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1198.000000	29.01	53.98	24.97	1000.000	331.0	V	37.0	0.1
1440.000000	31.89	53.98	22.09	1000.000	194.0	V	33.0	0.4
1503.000000	24.17	53.98	29.81	1000.000	304.0	V	58.0	0.3
4120.500000	29.46	53.98	24.52	1000.000	169.0	V	0.0	8.2
4793.500000	32.16	53.98	21.82	1000.000	223.0	V	9.0	9.3
16095.500000	42.84	53.98	11.14	1000.000	288.0	H	58.0	25.3
19434.045455	42.19	53.98	11.79	1000.000	343.0	V	70.0	16.9
20751.636364	41.64	53.98	12.34	1000.000	212.0	V	270.0	13.1
22506.727273	44.24	53.98	9.74	1000.000	133.0	V	0.0	10.8
23699.590909	44.37	53.98	9.61	1000.000	100.0	H	141.0	11.0

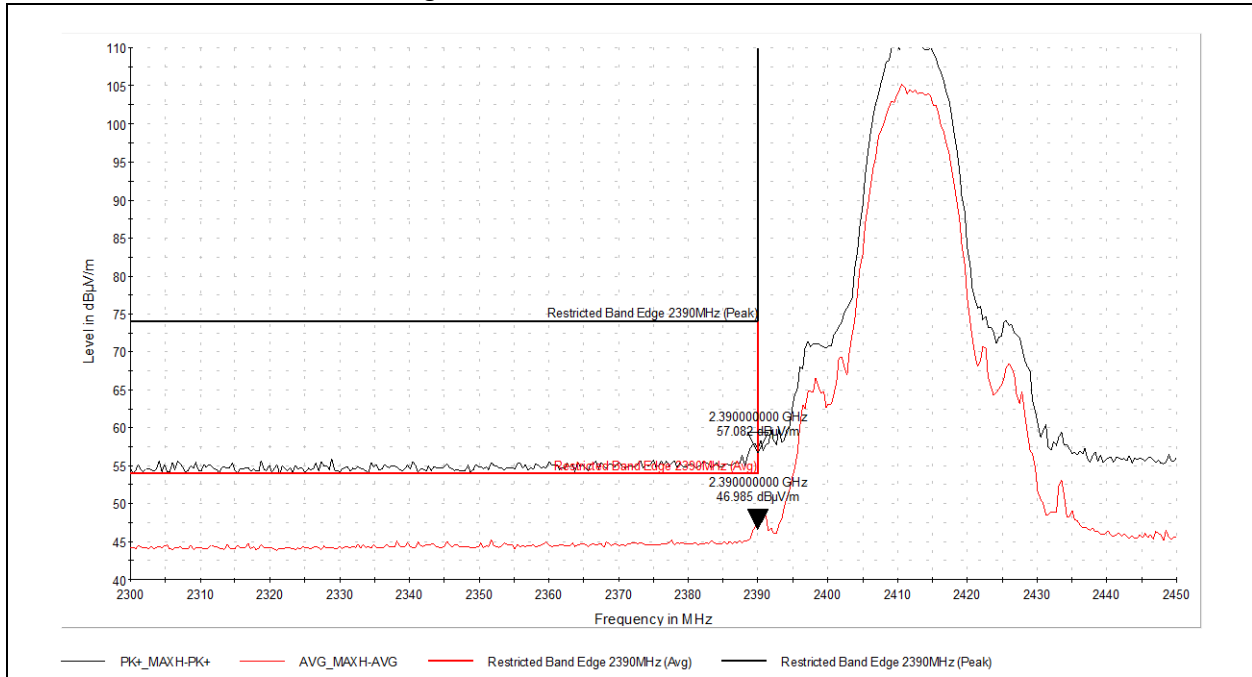
**7.10.3 Channel 11 (2462MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1197.000000	48.65	73.98	25.33	1000.000	381.0	V	255.0	0.1
1340.500000	47.41	73.98	26.57	1000.000	410.0	V	0.0	1.4
3779.500000	43.28	73.98	30.70	1000.000	325.0	V	44.0	8.4
4792.000000	57.55	73.98	16.43	1000.000	223.0	V	1.0	9.3
11624.000000	51.28	73.98	22.70	1000.000	410.0	H	282.0	19.2
12311.000000	52.28	73.98	21.70	1000.000	410.0	V	46.0	20.3

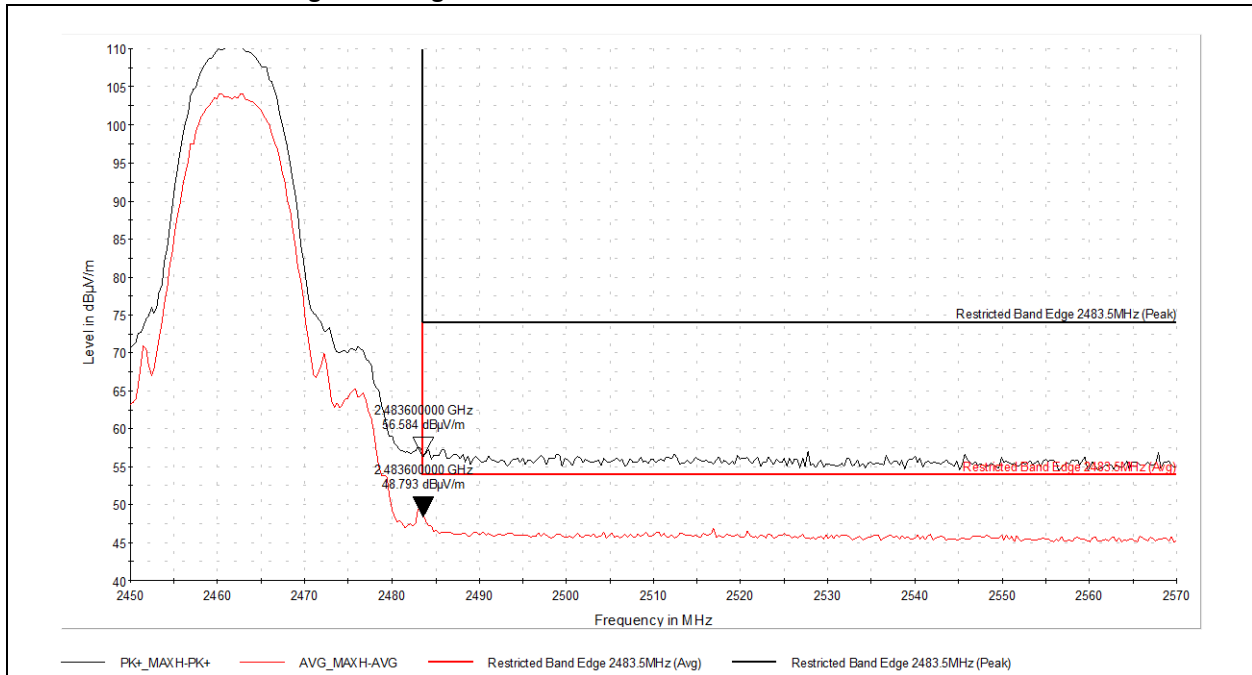
Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1197.000000	27.47	53.98	26.51	1000.000	381.0	V	255.0	0.1
1340.500000	26.91	53.98	27.07	1000.000	410.0	V	0.0	1.4
3779.500000	29.43	53.98	24.55	1000.000	325.0	V	44.0	8.4
4792.000000	31.33	53.98	22.65	1000.000	223.0	V	1.0	9.3
11624.000000	37.76	53.98	16.22	1000.000	410.0	H	282.0	19.2
12311.000000	38.75	53.98	15.23	1000.000	410.0	V	46.0	20.3



### 7.10.4 Emissions at the low band edge



### 7.10.5 Emissions at the high band edge



**7.11 Wi-Fi, 802.11g****7.11.1 Channel 1 (2412MHz)**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.000000	48.26	73.98	25.72	1000.000	302.0	V	260.0	0.0
1533.000000	42.60	73.98	31.38	1000.000	333.0	V	59.0	0.4
3616.500000	48.65	73.98	25.33	1000.000	374.0	H	322.0	7.2
4791.000000	58.18	73.98	15.80	1000.000	236.0	V	7.0	9.3
7250.500000	58.78	73.98	15.20	1000.000	195.0	H	0.0	13.3
12317.000000	51.89	73.98	22.09	1000.000	100.0	V	121.0	20.3

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.000000	26.86	53.98	27.12	1000.000	302.0	V	260.0	0.0
1533.000000	24.40	53.98	29.58	1000.000	333.0	V	59.0	0.4
3616.500000	36.83	53.98	17.15	1000.000	374.0	H	322.0	7.2
4791.000000	31.66	53.98	22.32	1000.000	236.0	V	7.0	9.3
7250.500000	44.07	53.98	9.91	1000.000	195.0	H	0.0	13.3
12317.000000	38.76	53.98	15.22	1000.000	100.0	V	121.0	20.3

**7.11.2 Channel 6 (2437MHz)**

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
119.994445	36.31	43.52	7.21	120.000	105.5	V	145.0	21.8
167.955556	30.43	43.52	13.09	120.000	171.5	H	155.0	21.3
240.867222	31.57	46.02	14.45	120.000	100.3	H	169.0	21.4
335.388333	24.76	46.02	21.26	120.000	104.4	H	114.0	24.8
611.838333	31.56	46.02	14.46	120.000	100.2	H	206.0	31.6
994.934444	38.49	53.98	15.49	120.000	390.2	H	314.0	38.3

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1349.000000	46.32	73.98	27.66	1000.000	410.0	V	0.0	1.5
1513.500000	42.85	73.98	31.13	1000.000	290.0	V	62.0	0.3
3653.000000	47.73	73.98	26.25	1000.000	410.0	H	318.0	7.3
4788.500000	57.00	73.98	16.98	1000.000	233.0	V	1.0	9.3
7310.000000	62.07	73.98	11.91	1000.000	100.0	H	8.0	13.4
12312.500000	51.72	73.98	22.26	1000.000	410.0	H	114.0	20.4
19033.136364	56.20	73.98	17.78	1000.000	344.0	H	153.0	18.4
20681.954546	55.11	73.98	18.87	1000.000	217.0	H	274.0	13.4
22480.636364	57.09	73.98	16.89	1000.000	100.0	H	248.0	10.9

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1349.000000	27.09	53.98	26.89	1000.000	410.0	V	0.0	1.5
1513.500000	24.63	53.98	29.35	1000.000	290.0	V	62.0	0.3
3653.000000	34.84	53.98	19.14	1000.000	410.0	H	318.0	7.3
4788.500000	31.01	53.98	22.97	1000.000	233.0	V	1.0	9.3
7310.000000	49.93	53.98	4.05	1000.000	100.0	H	8.0	13.4
12312.500000	38.87	53.98	15.11	1000.000	410.0	H	114.0	20.4
19033.136364	42.52	53.98	11.46	1000.000	344.0	H	153.0	18.4
20681.954546	42.35	53.98	11.63	1000.000	217.0	H	274.0	13.4
22480.636364	44.00	53.98	9.98	1000.000	100.0	H	248.0	10.9

**7.11.3 Channel 11 (2462MHz)**

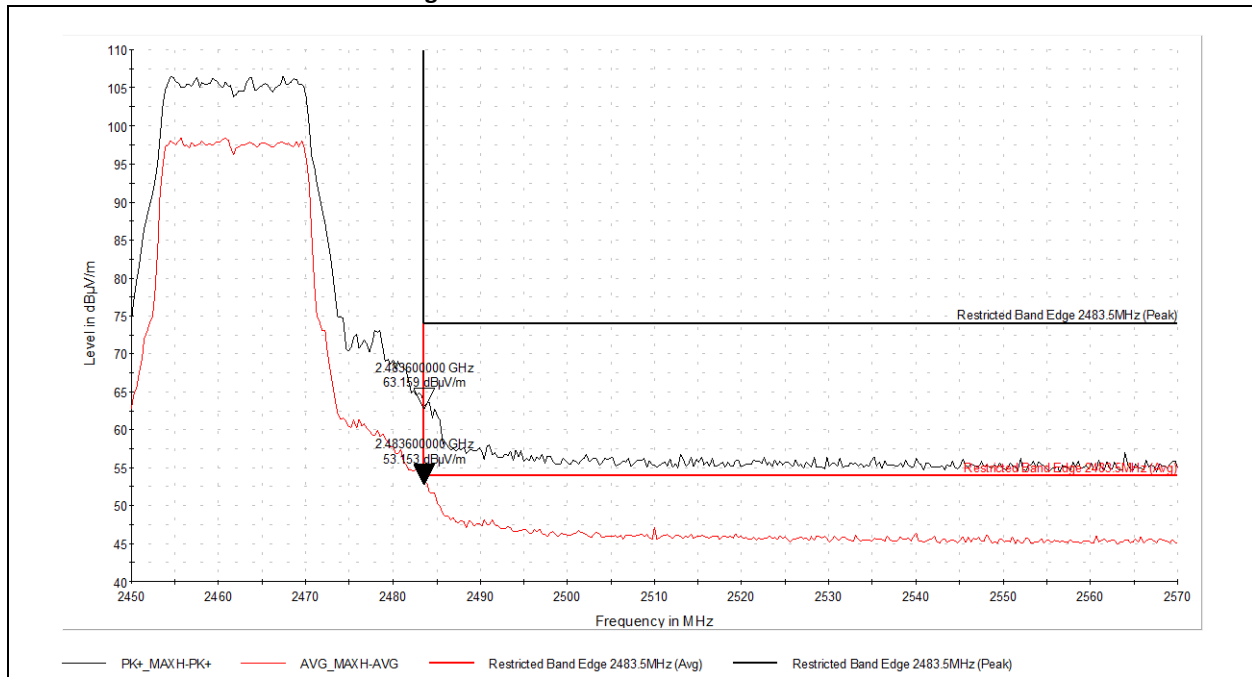
Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.500000	47.21	73.98	26.77	1000.000	301.0	V	253.0	0.0
1527.500000	43.67	73.98	30.31	1000.000	263.0	V	66.0	0.4
3691.000000	42.45	73.98	31.53	1000.000	410.0	H	126.0	7.6
3995.500000	46.53	73.98	27.45	1000.000	360.0	H	0.0	8.5
4799.000000	46.71	73.98	27.27	1000.000	410.0	V	24.0	9.3
7389.000000	45.88	73.98	28.10	1000.000	410.0	H	70.0	13.1

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1195.500000	26.63	53.98	27.35	1000.000	301.0	V	253.0	0.0
1527.500000	24.93	53.98	29.05	1000.000	263.0	V	66.0	0.4
3691.000000	28.95	53.98	25.03	1000.000	410.0	H	126.0	7.6
3995.500000	31.64	53.98	22.34	1000.000	360.0	H	0.0	8.5
4799.000000	29.96	53.98	24.02	1000.000	410.0	V	24.0	9.3
7389.000000	32.76	53.98	21.22	1000.000	410.0	H	70.0	13.1

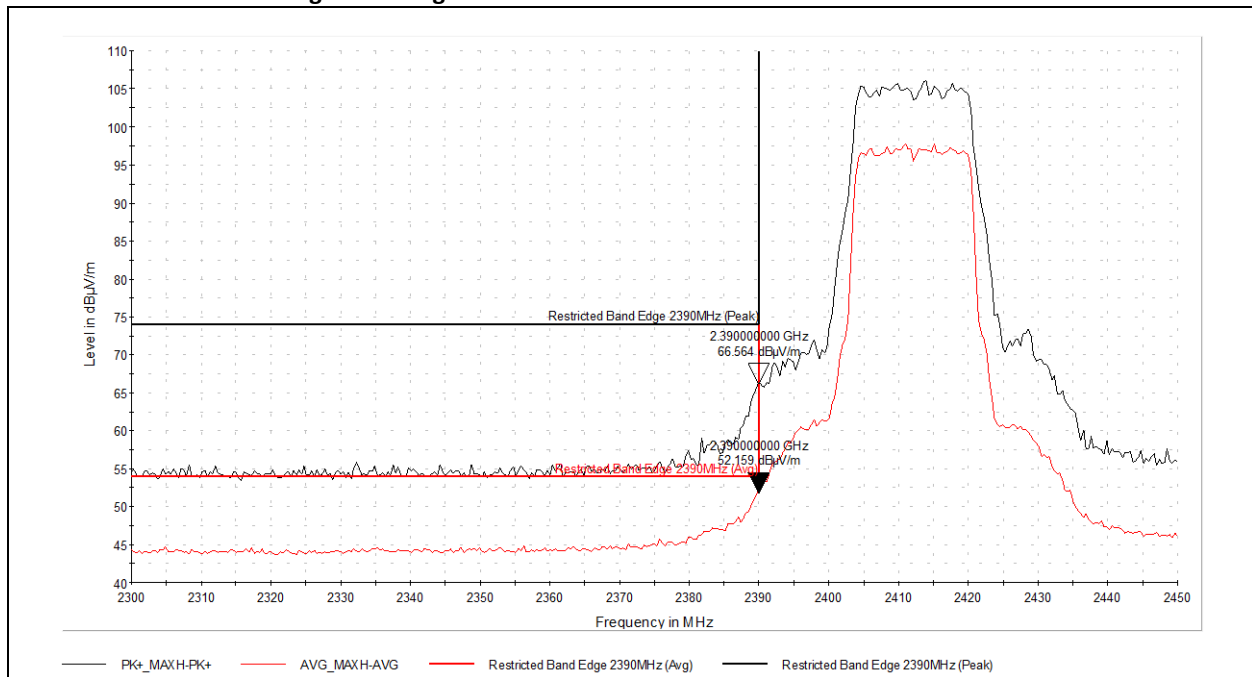




### 7.11.4 Emissions at the low band edge



### 7.11.5 Emissions at the high band edge



**7.12 Wi-Fi, 802.11n****7.12.1 Channel 1 (2412MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1197.000000	46.41	73.98	27.57	1000.000	256.0	H	24.0	-0.2
1365.000000	45.62	73.98	28.36	1000.000	410.0	V	0.0	1.2
1513.500000	41.22	73.98	32.76	1000.000	290.0	V	58.0	0.3
2280.000000	39.39	73.98	34.59	1000.000	410.0	H	286.0	4.7
4782.500000	56.12	73.98	17.86	1000.000	264.0	V	9.0	9.3
7466.000000	46.55	73.98	27.43	1000.000	410.0	H	284.0	13.2

Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1197.000000	25.78	53.98	28.20	1000.000	256.0	H	24.0	-0.2
1365.000000	26.04	53.98	27.94	1000.000	410.0	V	0.0	1.2
1513.500000	23.98	53.98	30.00	1000.000	290.0	V	58.0	0.3
2280.000000	26.24	53.98	27.74	1000.000	410.0	H	286.0	4.7
4782.500000	30.62	53.98	23.36	1000.000	264.0	V	9.0	9.3
7466.000000	33.18	53.98	20.80	1000.000	410.0	H	284.0	13.2

**7.12.2 Channel 6 (2437MHz)**

Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
115.521667	30.06	43.52	13.46	120.000	105.2	V	136.0	21.6
116.276111	29.52	43.52	14.00	120.000	100.2	V	146.0	21.8
119.994445	38.40	43.52	5.12	120.000	99.9	V	138.0	21.8
168.009445	33.70	43.52	9.82	120.000	165.8	H	146.0	21.3
612.269444	31.66	46.02	14.36	120.000	320.3	H	0.0	31.6
975.750000	38.03	53.98	15.95	120.000	308.8	H	0.0	37.9

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.500000	50.50	73.98	23.48	1000.000	100.0	V	13.0	0.1
1535.500000	43.82	73.98	30.16	1000.000	309.0	V	64.0	0.4
3653.000000	49.28	73.98	24.70	1000.000	125.0	H	311.0	7.3
4784.500000	58.35	73.98	15.63	1000.000	233.0	V	7.0	9.3
7311.000000	49.00	73.98	24.98	1000.000	116.0	V	184.0	13.3
12105.500000	52.23	73.98	21.75	1000.000	410.0	H	90.0	20.4
18951.681818	55.06	73.98	18.92	1000.000	318.0	V	324.0	18.5
20052.590909	55.23	73.98	18.75	1000.000	100.0	H	66.0	15.1
22664.227273	56.20	73.98	17.78	1000.000	251.0	V	148.0	10.5
23907.045455	57.88	73.98	16.10	1000.000	100.0	H	76.0	11.4



Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1196.500000	28.45	53.98	25.53	1000.000	100.0	V	13.0	0.1
1535.500000	24.66	53.98	29.32	1000.000	309.0	V	64.0	0.4
3653.000000	36.84	53.98	17.14	1000.000	125.0	H	311.0	7.3
4784.500000	31.79	53.98	22.19	1000.000	233.0	V	7.0	9.3
7311.000000	36.70	53.98	17.28	1000.000	116.0	V	184.0	13.3
12105.500000	39.36	53.98	14.62	1000.000	410.0	H	90.0	20.4
18951.681818	41.84	53.98	12.14	1000.000	318.0	V	324.0	18.5
20052.590909	41.54	53.98	12.44	1000.000	100.0	H	66.0	15.1
22664.227273	43.24	53.98	10.74	1000.000	251.0	V	148.0	10.5
23907.045455	44.27	53.98	9.71	1000.000	100.0	H	76.0	11.4

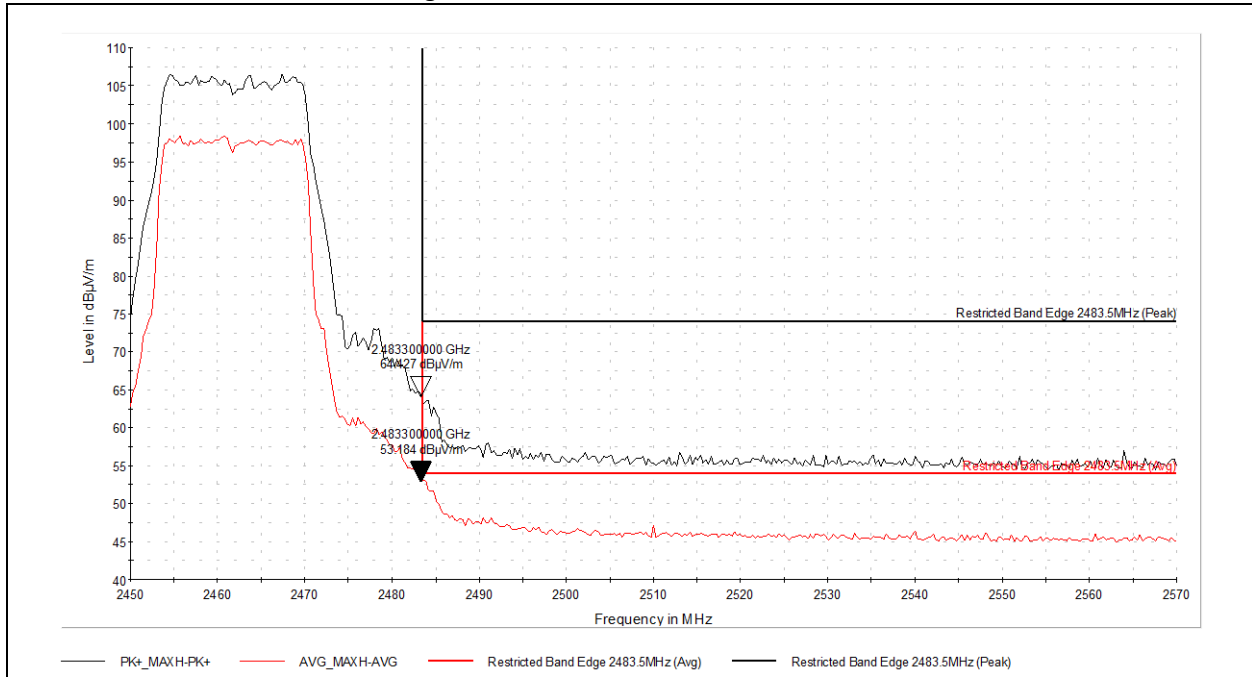
**7.12.3 Channel 11 (2462MHz)**

Frequency (MHz)	MaxPeak (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1194.500000	50.95	73.98	23.03	1000.000	376.0	V	60.0	0.0
1572.500000	39.89	73.98	34.09	1000.000	343.0	V	66.0	0.4
3690.500000	42.77	73.98	31.21	1000.000	410.0	H	92.0	7.6
4785.500000	59.22	73.98	14.76	1000.000	237.0	V	7.0	9.3
7386.000000	49.37	73.98	24.61	1000.000	100.0	V	187.0	13.1
16118.000000	56.40	73.98	17.58	1000.000	410.0	H	182.0	25.3

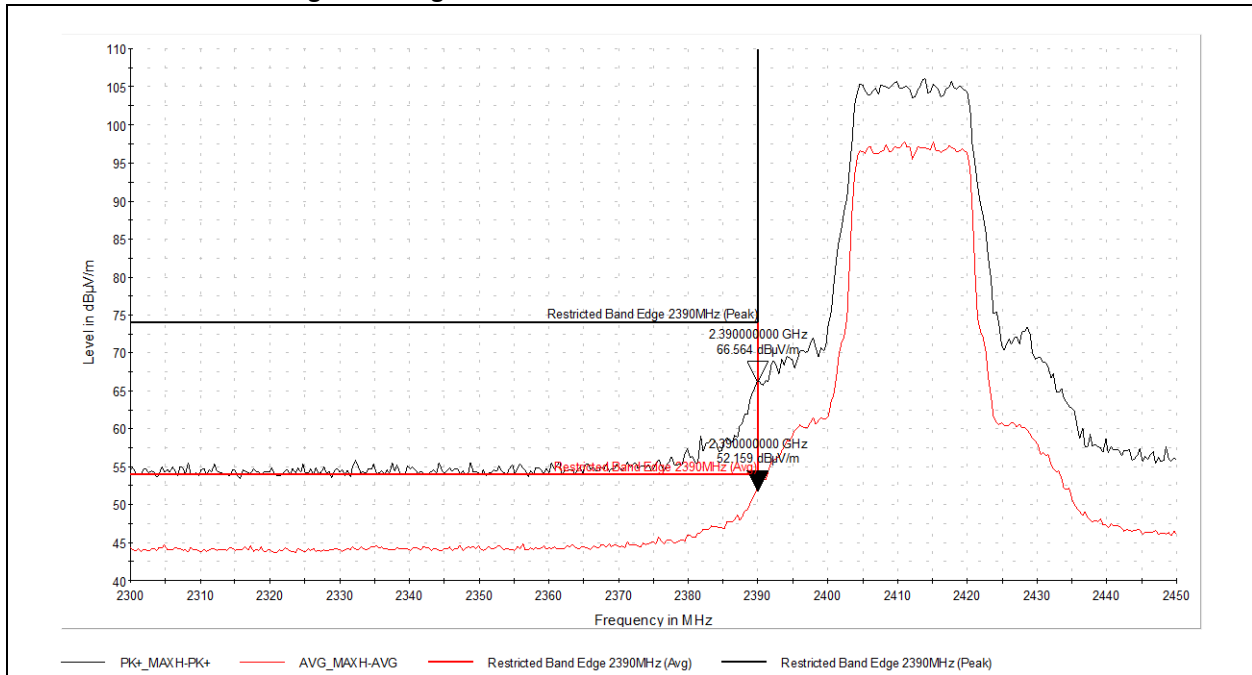
Frequency (MHz)	Average (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1194.500000	27.00	53.98	26.98	1000.000	376.0	V	60.0	0.0
1572.500000	24.03	53.98	29.95	1000.000	343.0	V	66.0	0.4
3690.500000	29.19	53.98	24.79	1000.000	410.0	H	92.0	7.6
4785.500000	32.09	53.98	21.89	1000.000	237.0	V	7.0	9.3
7386.000000	37.63	53.98	16.35	1000.000	100.0	V	187.0	13.1
16118.000000	42.91	53.98	11.07	1000.000	410.0	H	182.0	25.3



### 7.12.4 Emissions at the low band edge



### 7.12.5 Emissions at the high band edge





## 8 Output Power

### 8.1 Test Limits

#### FCC Part 15.247(b)(1):

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

#### FCC Part 15.247(b)(3):

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

#### RSS-247 Issue 2 § 5.4(b):

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

#### RSS-247 Issue 2 § 5.4(d):

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

### 8.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 7.8.5, 11.9.1.1, and 11.9.1.2.



### 8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021

### 8.4 Test Results

The device was found to be **compliant**. The peak output power was less than 1W.

### 8.5 Test Conditions

Test Personnel:	Brandon Norris	Test Date:	3/27/2021
Supervising/Reviewing Engineer:			15.247(b)(1), (3)
(Where Applicable)	NA	Limit Applied:	RSS-247 § 5.4(b), (d)
	FCC Part 15.247		
Product Standard:	RSS-247 Issue 2	Ambient Temperature:	25.6C
Input Voltage:	Battery (5VDC)	Relative Humidity:	52.2%
Pretest Verification w / Ambient			
Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

### 8.6 Test Data

Mode	Channel (Frequency)	Average Output Power (dBm)	Limit (dBm)	Result
Bluetooth	0 (2402MHz)	0.28	30	Pass
	38 (2440MHz)	0.31	30	Pass
	78 (2480MHz)	0.58	30	Pass
Bluetooth Low Energy	37 (2402MHz)	0.22	30	Pass
	17 (2440MHz)	0.25	30	Pass
	39 (2480MHz)	0.48	30	Pass
802.11b	1 (2412MHz)	9.43	30	Pass
	6 (2437MHz)	8.54	30	Pass
	11 (2462MHz)	6.57	30	Pass
802.11g <sup>1</sup>	1 (2412MHz)	5.30	30	Pass
	6 (2437MHz)	4.55	30	Pass
	11 (2462MHz)	4.52	30	Pass
802.11n <sup>1</sup>	1 (2412MHz)	10.86	30	Pass
	6 (2437MHz)	9.84	30	Pass
	11 (2462MHz)	9.06	30	Pass

Deviations, Additions, or Exclusions: None

<sup>1</sup> 802.11g and 802.11n modes were tested with an output attenuation setting of 8 (2dB)



## 9 Occupied Bandwidth

### 9.1 Test Limits

#### FCC Part 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

#### RSS-247 Issue 2 § 5.2(a):

The minimum 6 dB bandwidth shall be 500 kHz.

### 9.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 6.9.2 and 11.8.1.

### 9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021

### 9.4 Test Results

The device was found to be **compliant**. The 6dB bandwidth was at least 500kHz.

### 9.5 Test Conditions

Test Personnel:	<u>Brandon Norris</u>	Test Date:	<u>3/21/2021</u>
Supervising/Reviewing Engineer:	<u>NA</u>	Limit Applied:	<u>See Above</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>25.6C</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>52.2%</u>
Input Voltage:	<u>Battery</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>Yes</u>		

**9.6 Test Data**

Mode	Channel (Frequency)	6dB BW (MHz)	20dB BW (MHz)	99% BW (MHz)
Bluetooth	0 (2402MHz)	-	1.317	1.184
	38 (2440MHz)	-	1.329	1.184
	78 (2480MHz)	-	1.317	1.184
Bluetooth Low Energy	37 (2402MHz)	0.6914	1.226	1.052
	17 (2440MHz)	0.6974	1.220	1.046
	39 (2480MHz)	0.6974	1.214	1.040
802.11b	1 (2412MHz)	8.838	15.21	13.95
	6 (2437MHz)	8.838	15.15	13.89
	11 (2462MHz)	8.838	14.97	13.71
802.11g	1 (2412MHz)	16.75	17.56	16.51
	6 (2437MHz)	16.67	17.56	16.43
	11 (2462MHz)	16.75	17.56	16.51
802.11n	1 (2412MHz)	17.88	18.36	17.56
	6 (2437MHz)	17.88	18.36	17.56
	11 (2462MHz)	17.88	18.36	17.56

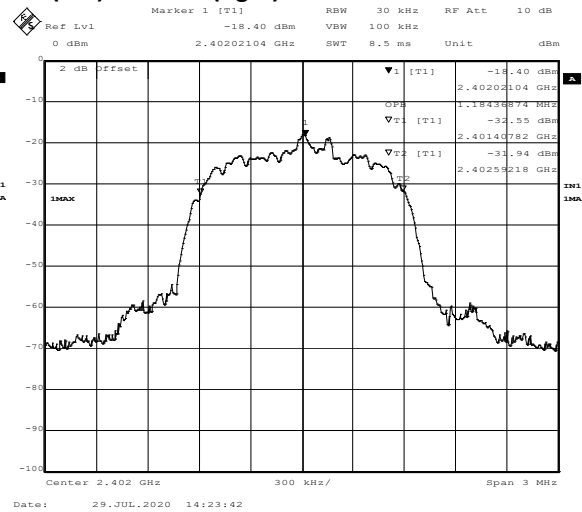
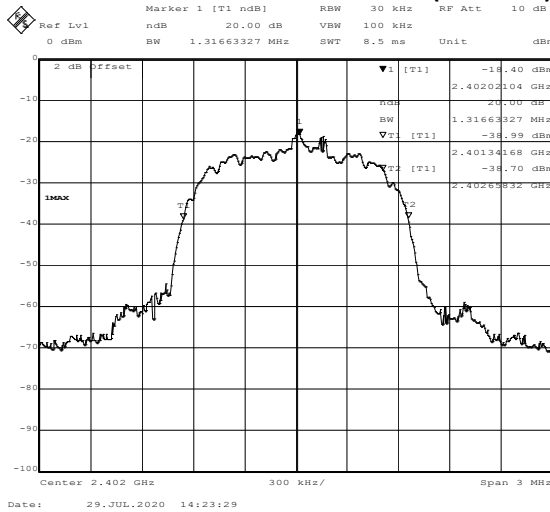
Deviations, Additions, or Exclusions: None.



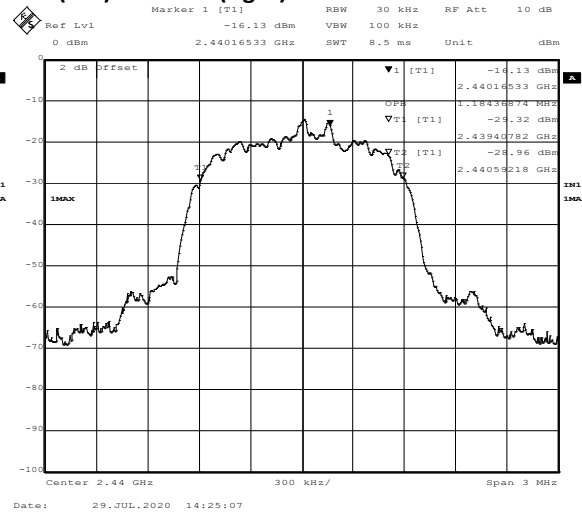
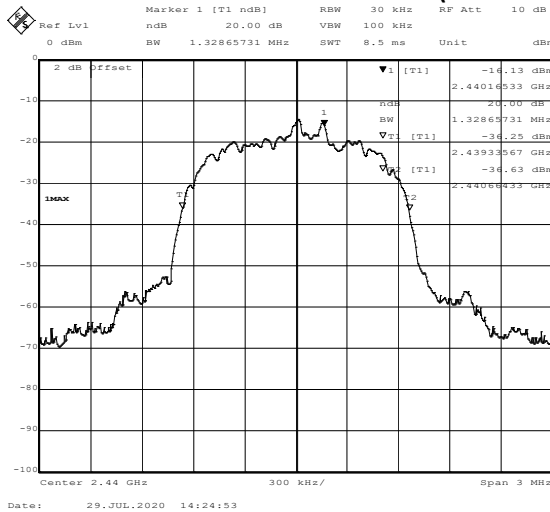


9.6.1 Bluetooth

Channel 0 (2402MHz) 20dB (left) and 99% (right)

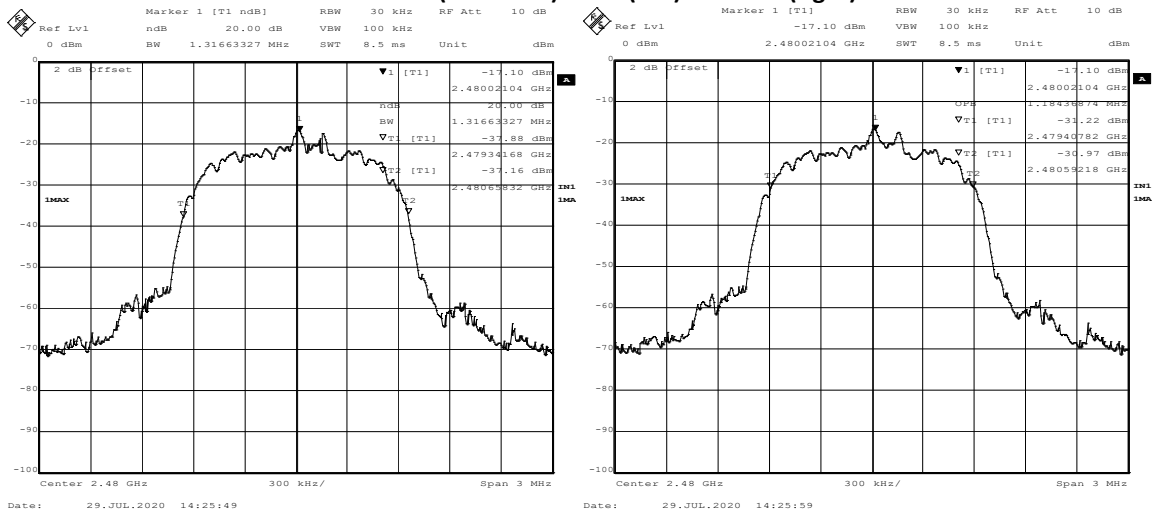


Channel 38 (2440MHz) 20dB (left) and 99% (right)





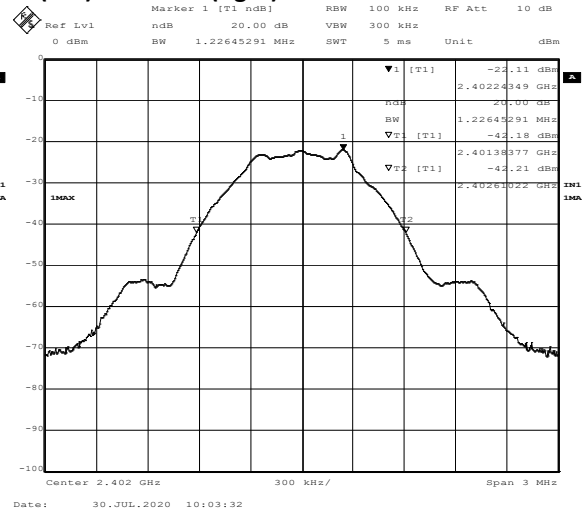
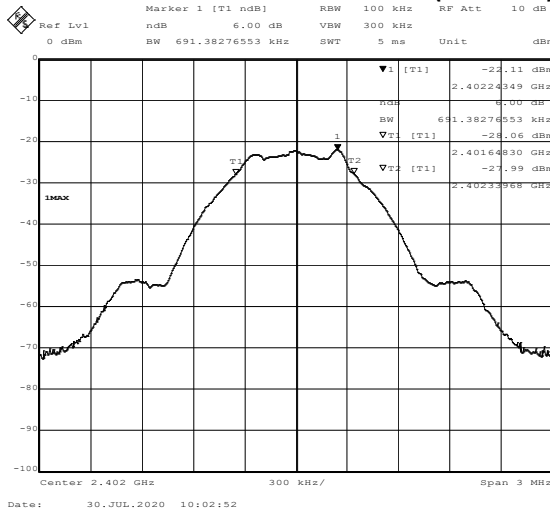
### Channel 78 (2480MHz) 20dB (left) and 99% (right)



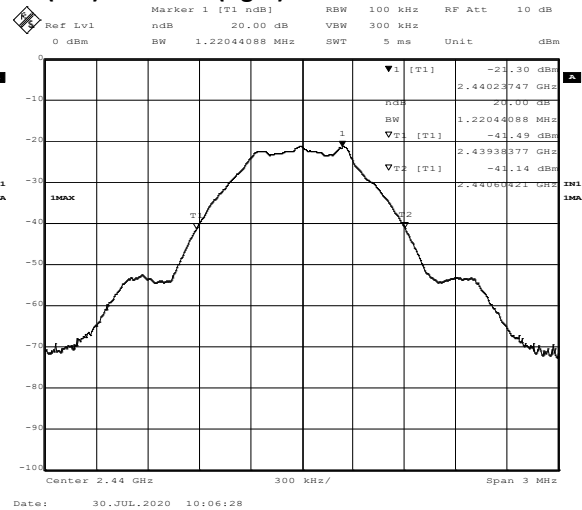
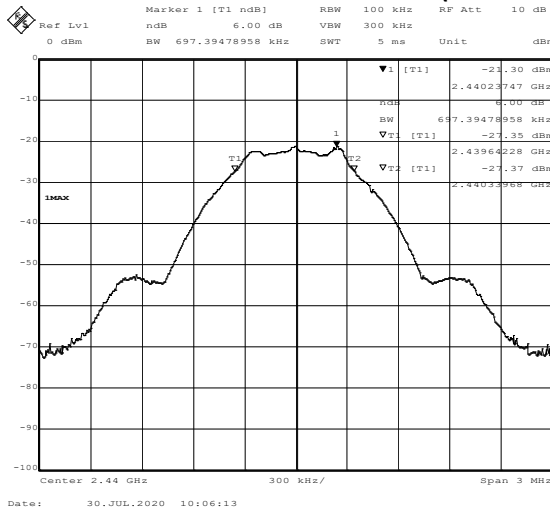


### 9.6.2 Bluetooth Low Energy

#### Channel 0 (2402MHz) 6dB (left) and 20dB (right)

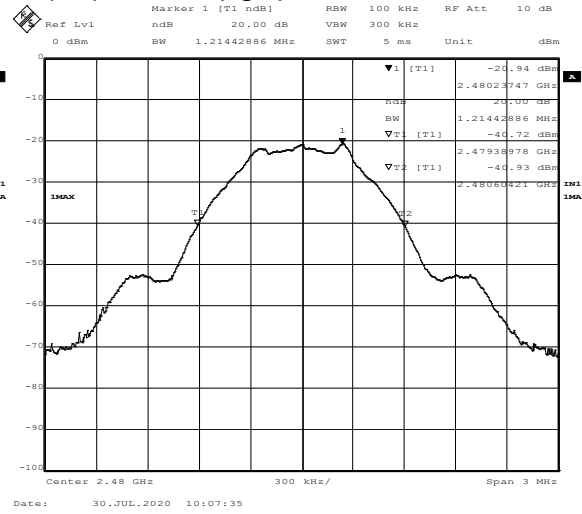
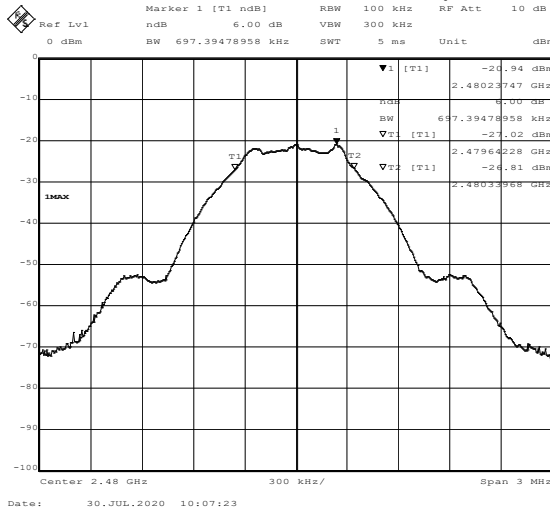


#### Channel 39 (2440MHz) 6dB (left) and 20dB (right)



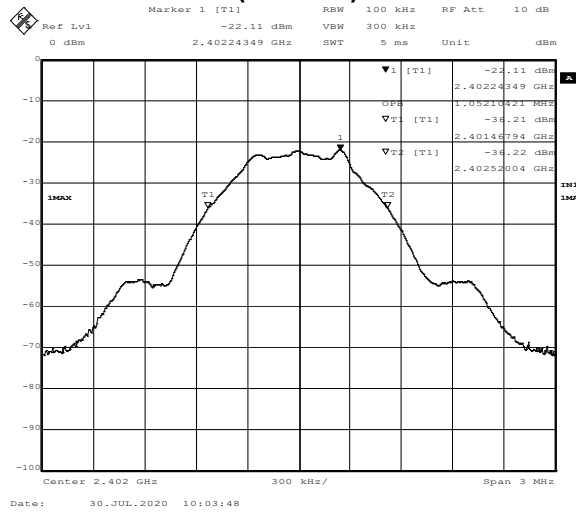


### Channel 78 (2480MHz) 6dB (left) and 20dB (right)

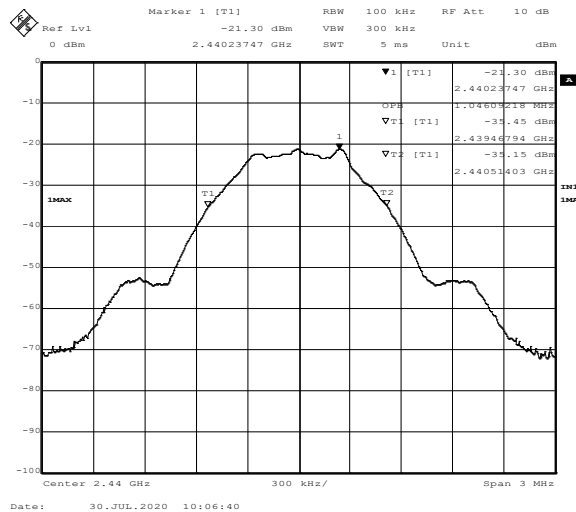




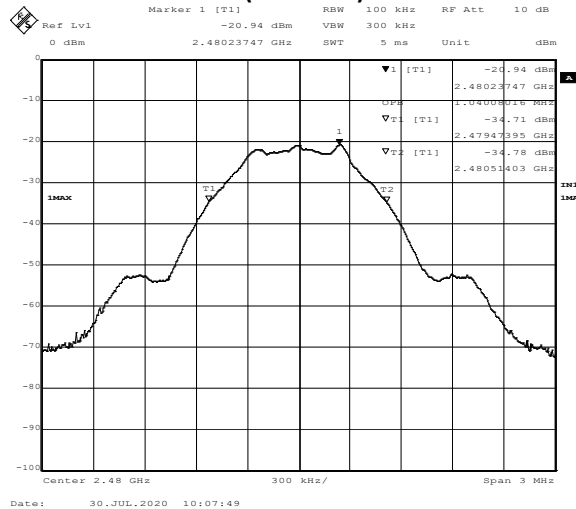
### Channel 0 (2402MHz) 99% OBW



### Channel 39 (2440MHz) 99% OBW



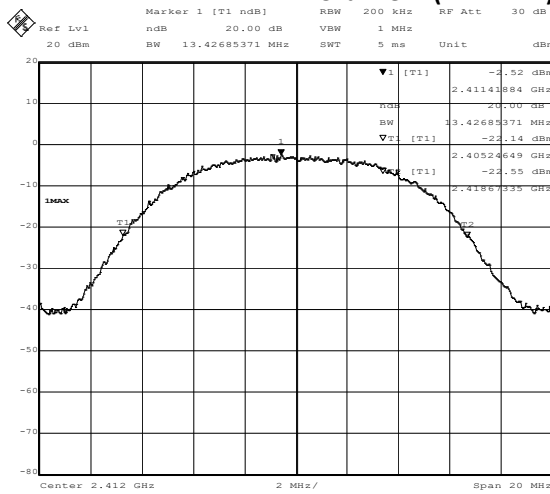
### Channel 78 (2480MHz) 99% OBW



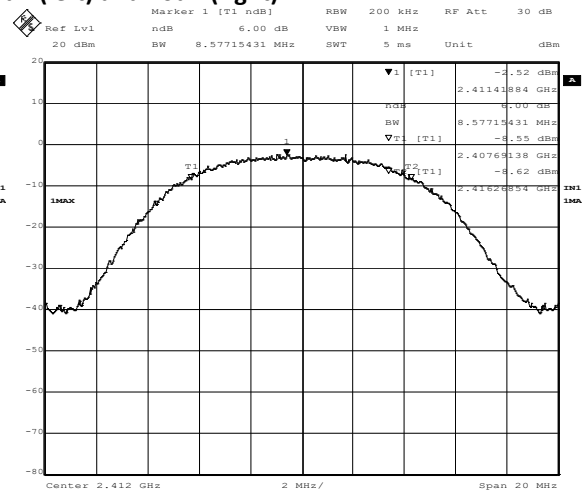


9.6.3 Wi-Fi, 802.11b

Channel 1 (2412MHz) 6dB (left) and 20dB (right)

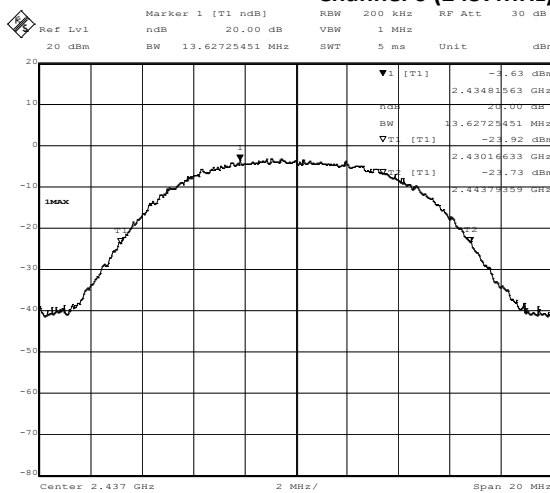


Date: 18.FEB.2021 13:20:52

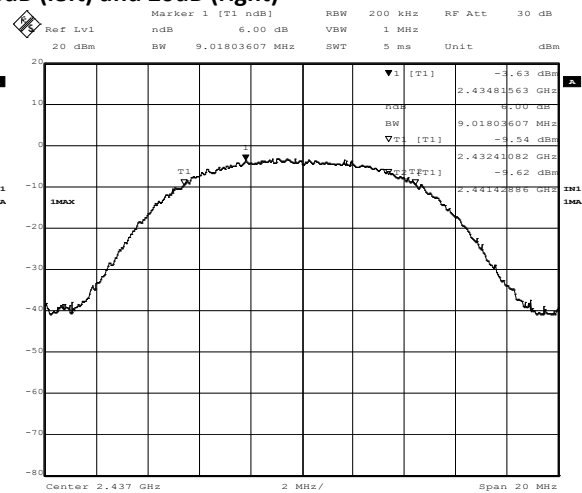


Date: 18.FEB.2021 13:21:17

Channel 6 (2437MHz) 6dB (left) and 20dB (right)



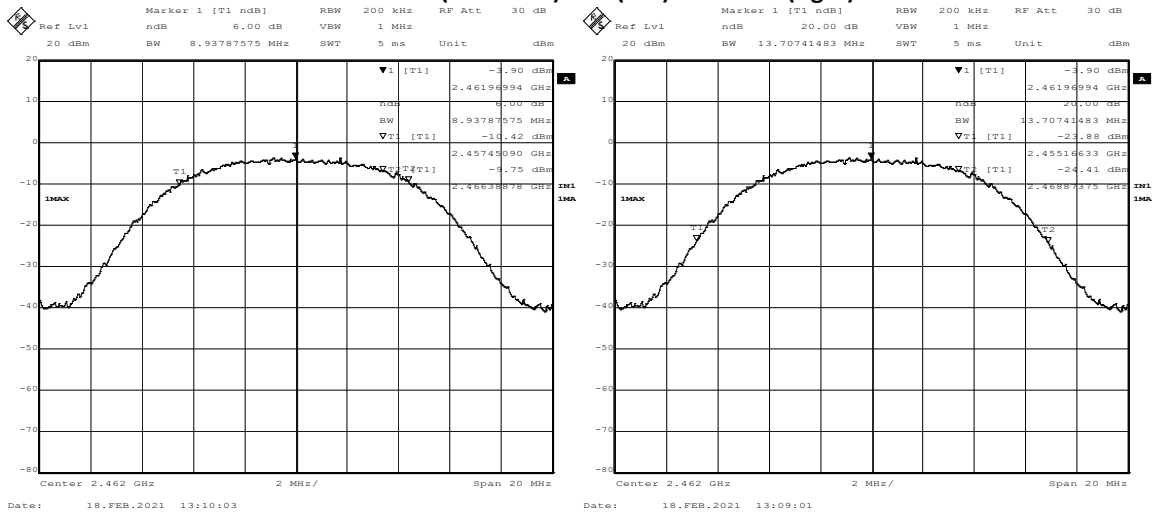
Date: 18.FEB.2021 13:16:23



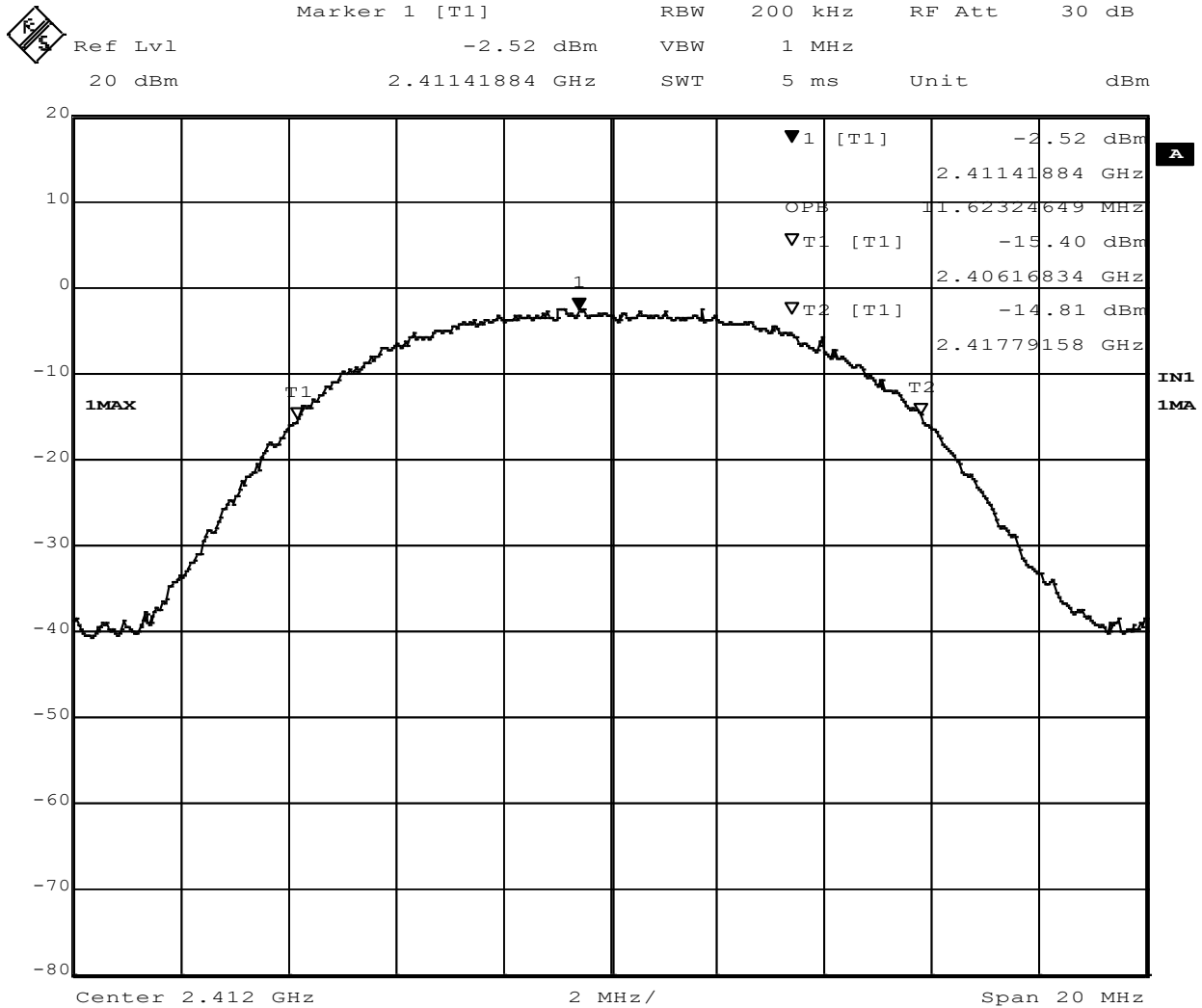
Date: 18.FEB.2021 13:17:11



### Channel 11 (2462MHz) 6dB (left) and 20dB (right)



### Channel 1 (2412MHz) 99% OBW



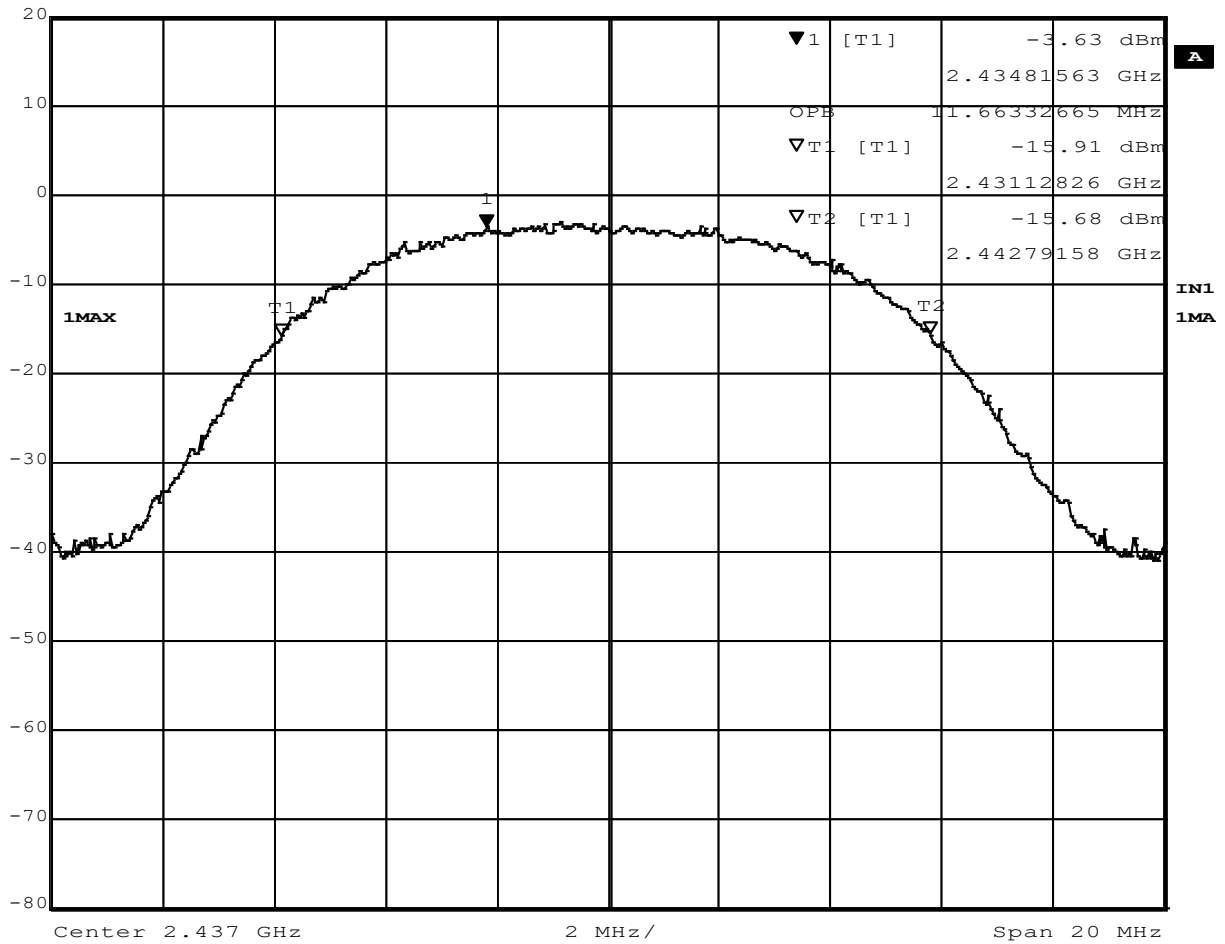
Date: 18.FEB.2021 13:21:56



Channel 6 (2437MHz) 99% OBW



Ref Lvl	Marker 1 [T1]	RBW	200 kHz	RF Att	30 dB
20 dBm	-3.63 dBm	VBW	1 MHz		
	2.43481563 GHz	SWT	5 ms	Unit	dBm



Date: 18.FEB.2021 13:18:16



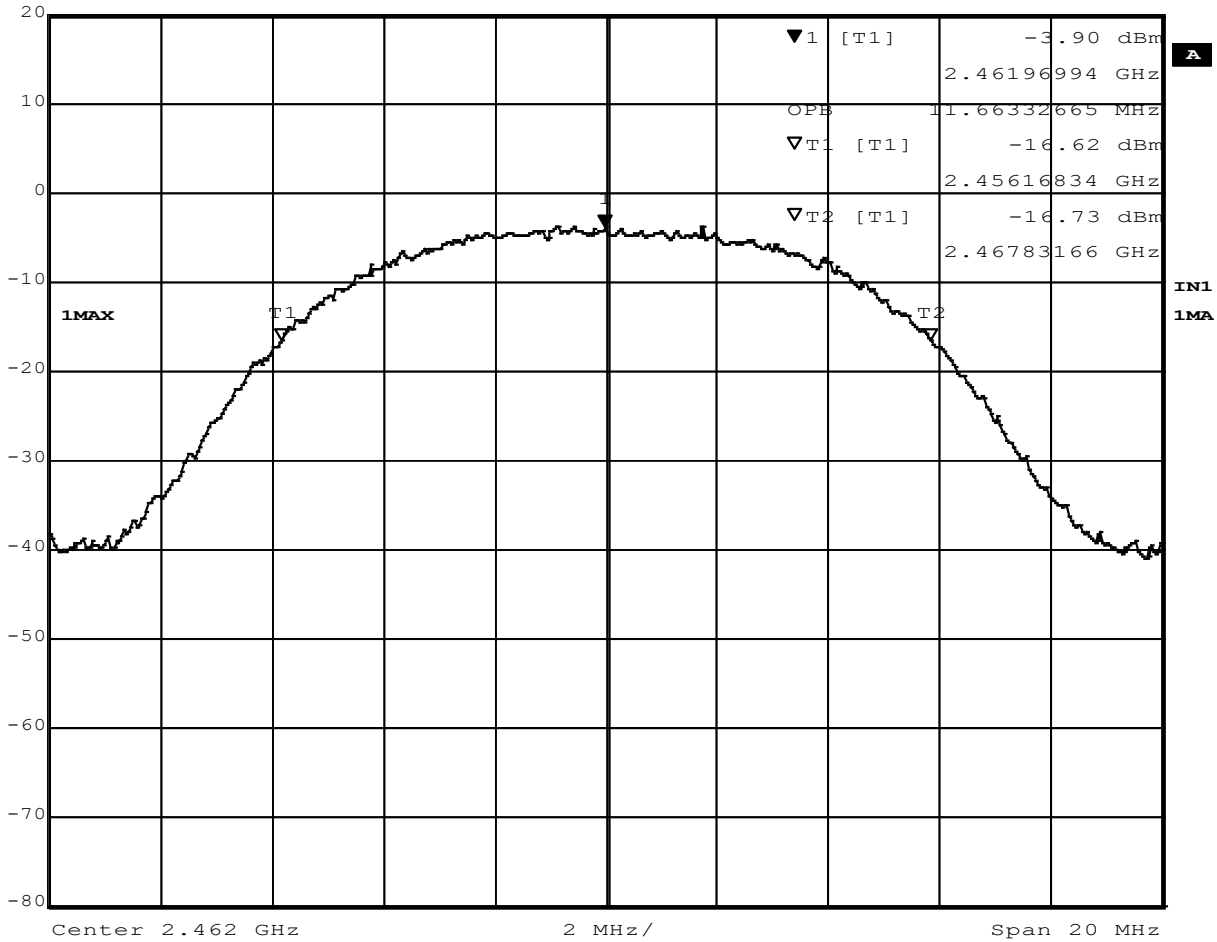


Channel 11 (2462MHz) 99% OBW



Ref Lvl  
20 dBm

Marker 1 [T1]	RBW	200 kHz	RF Att	30 dB
-3.90 dBm	VBW	1 MHz		
2.46196994 GHz	SWT	5 ms	Unit	dBm

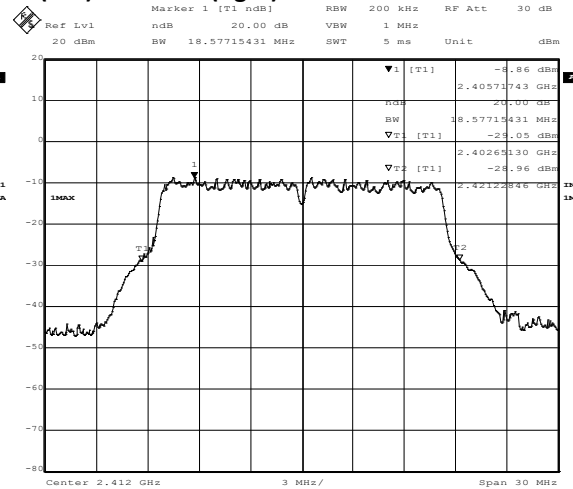
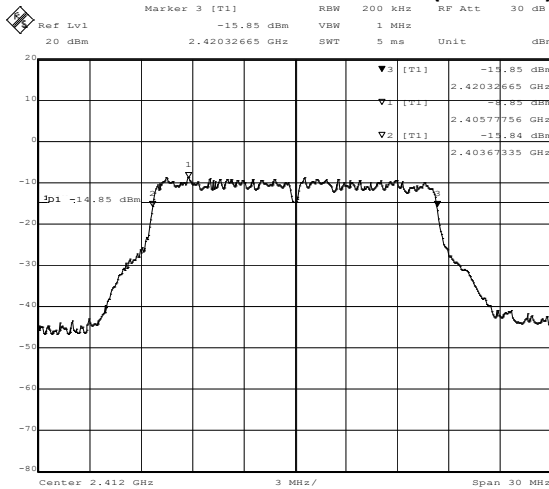


Date: 18.FEB.2021 13:11:30



9.6.4 Wi-Fi, 802.11g

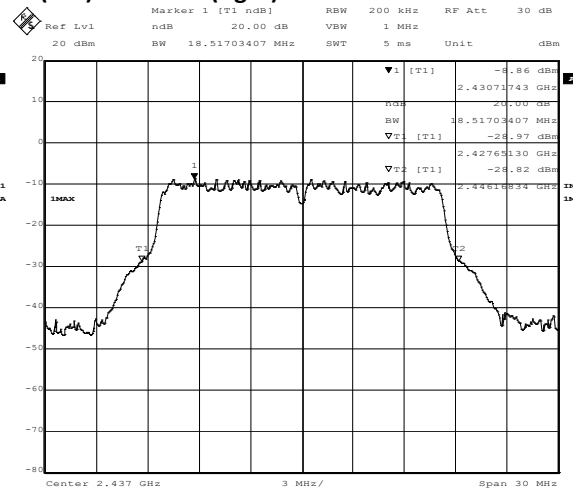
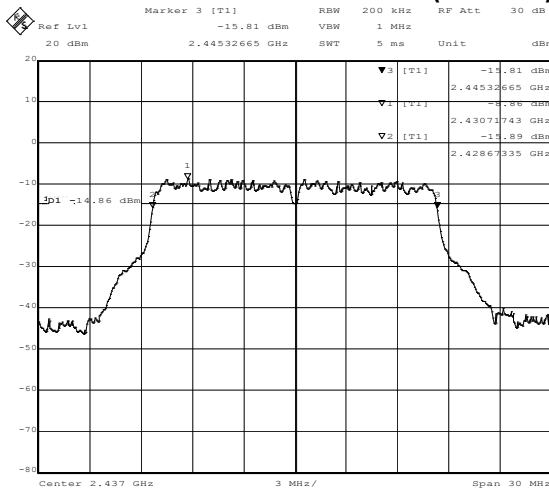
Channel 1 (2412MHz) 6dB (left) and 20dB (right)



Date: 18.FEB.2021 13:52:32

Date: 18.FEB.2021 13:49:42

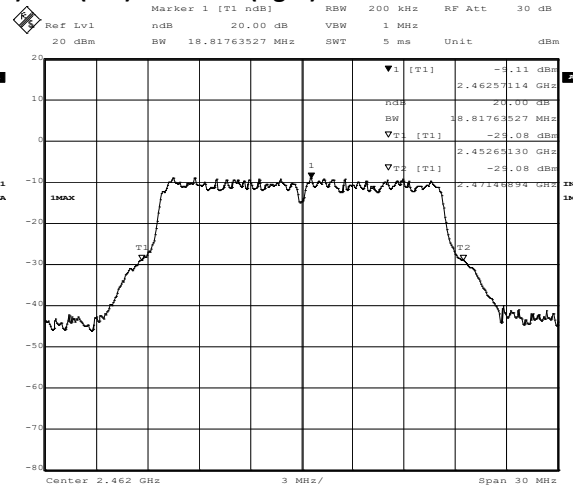
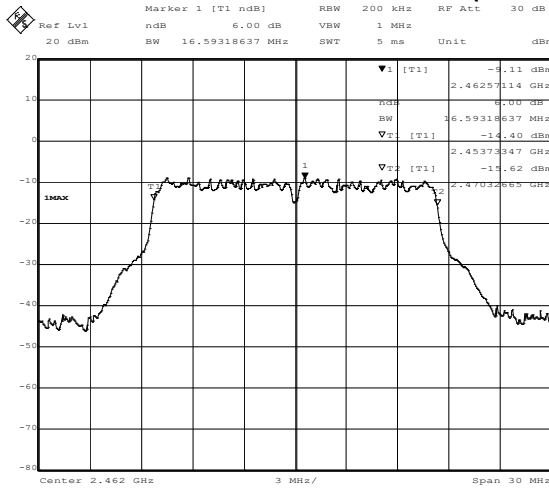
Channel 6 (2437MHz) 6dB (left) and 20dB (right)



Date: 18.FEB.2021 14:00:41

Date: 18.FEB.2021 13:58:30

Channel 11 (2462MHz) 6dB (left) and 20dB (right)



Date: 18.FEB.2021 14:05:48

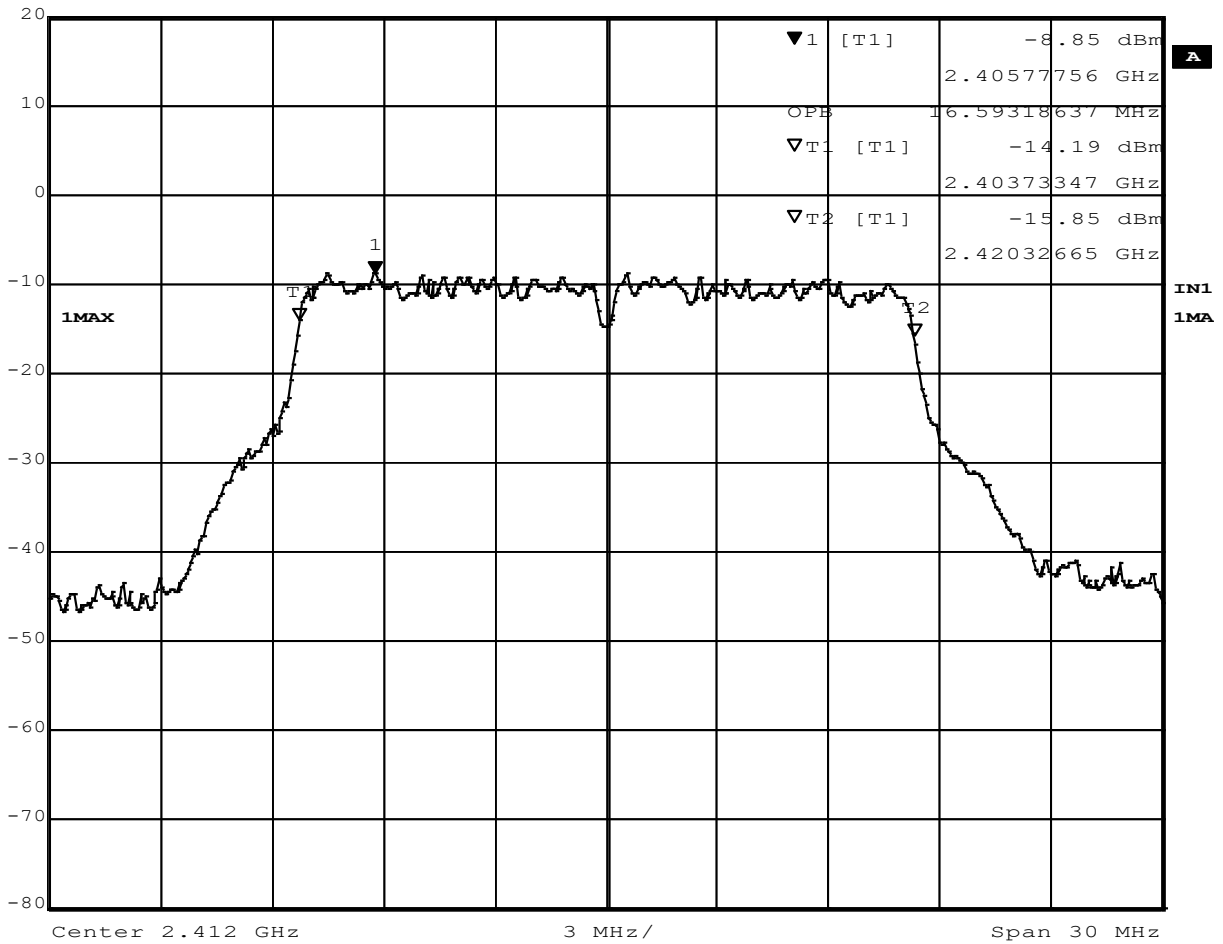
Date: 18.FEB.2021 14:05:17



Channel 1 (2412MHz) 99% OBW



Ref Lvl	Marker 1 [T1]	RBW	200 kHz	RF Att	30 dB
20 dBm	-8.85 dBm	VBW	1 MHz		
	2.40577756 GHz	SWT	5 ms	Unit	dBm



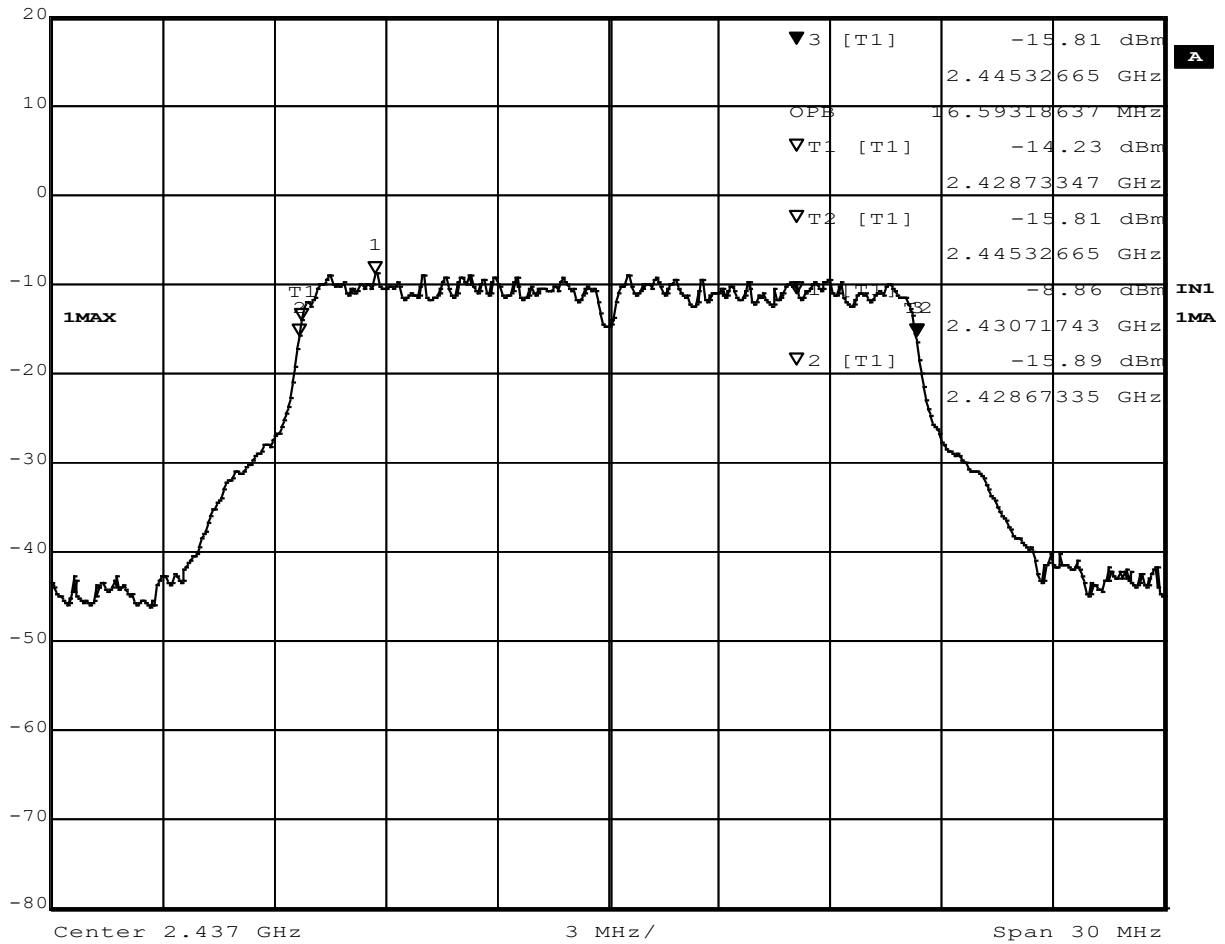
Date: 18.FEB.2021 13:54:16



Channel 6 (2437MHz) 99% OBW



Ref Lvl	20 dBm	Marker 3 [T1]	2.44532665 GHz	RBW	200 kHz	RF Att	30 dB
				VBW	1 MHz		
				SWT	5 ms	Unit	dBm



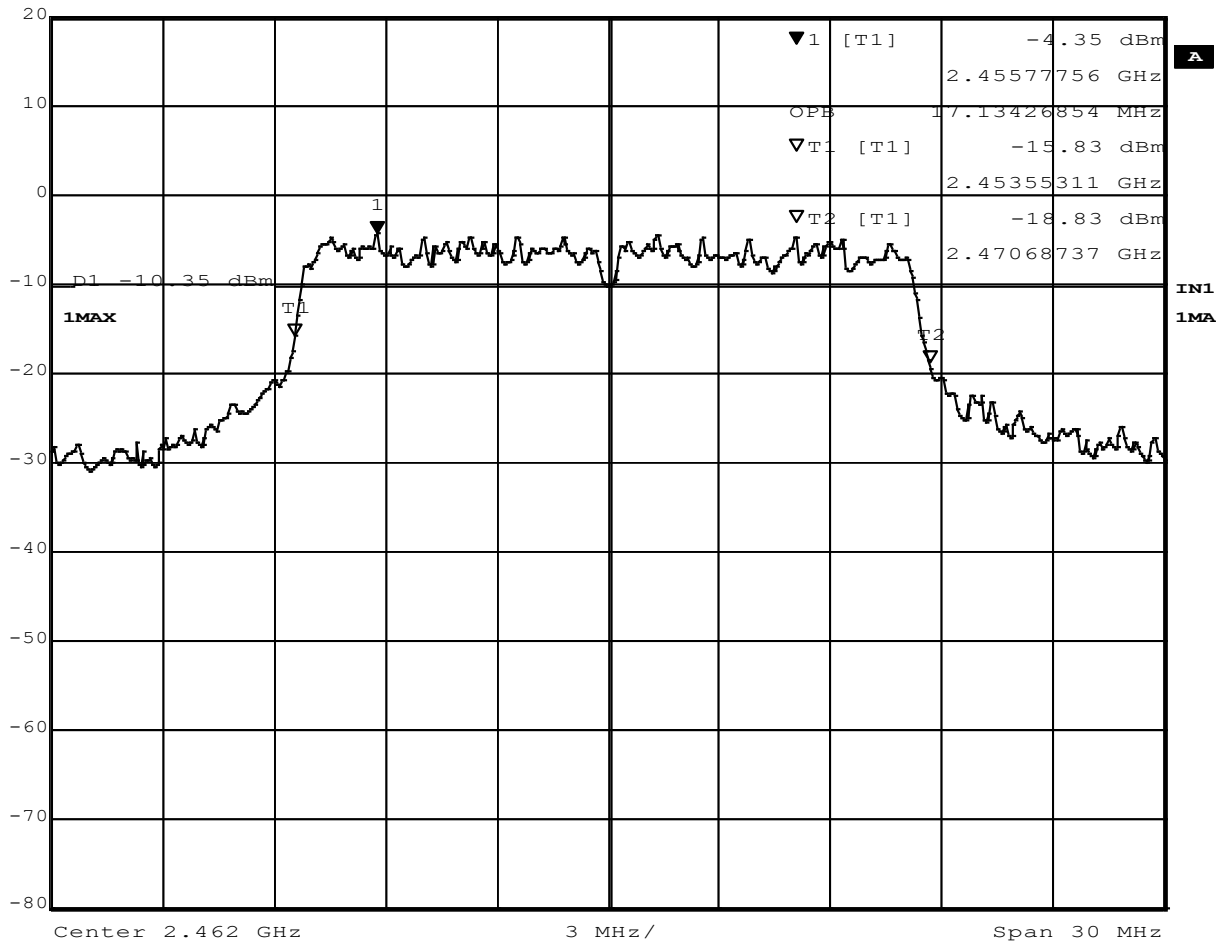
Date: 18.FEB.2021 14:01:56



Channel 11 (2462MHz) 99% OBW



Ref Lvl	Marker 1 [T1]	RBW	200 kHz	RF Att	30 dB
20 dBm	-4.35 dBm	VBW	1 MHz		
	2.45577756 GHz	SWT	5 ms	Unit	dBm

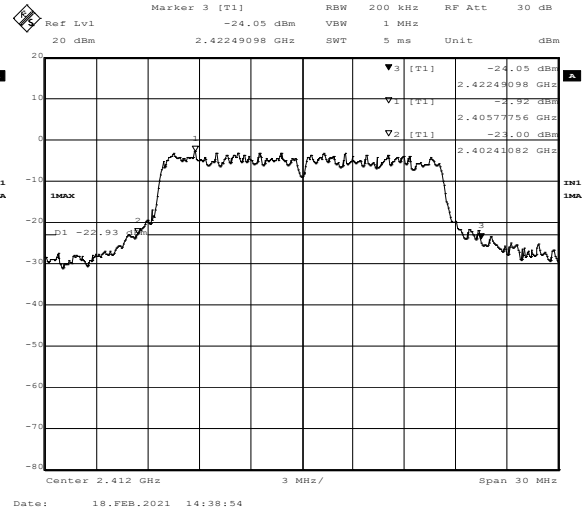
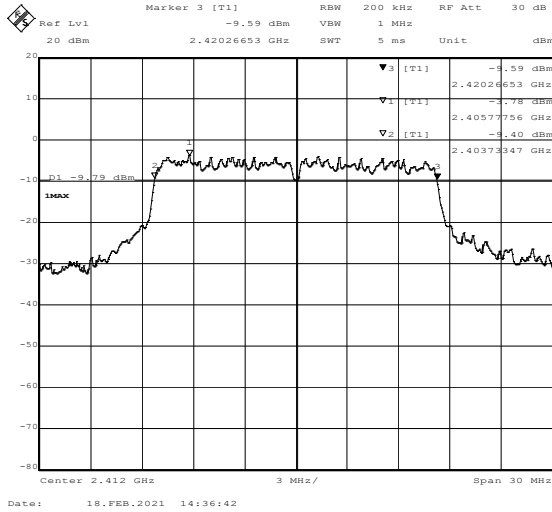


Date: 18.FEB.2021 14:21:34



9.6.5 Wi-Fi, 802.11n

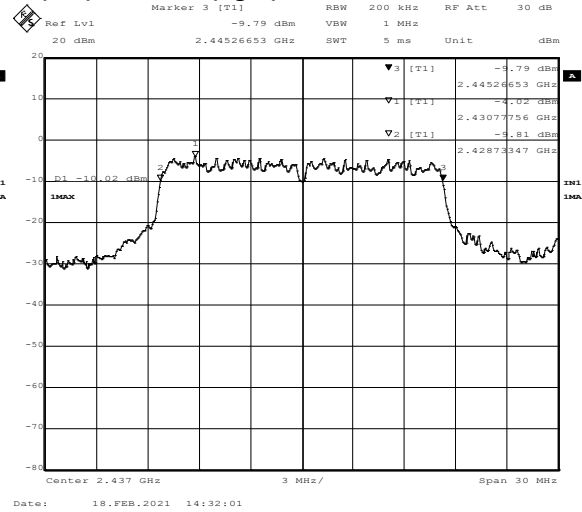
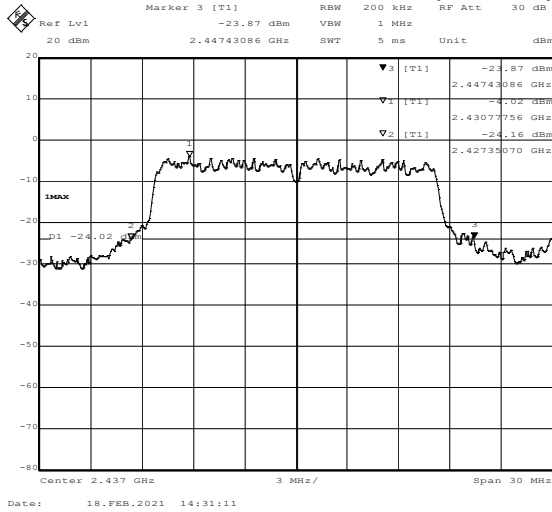
Channel 1 (2412MHz) 6dB (left) and 20dB (right)



Date: 18.FEB.2021 14:36:42

Date: 18.FEB.2021 14:38:54

Channel 6 (2437MHz) 6dB (left) and 20dB (right)

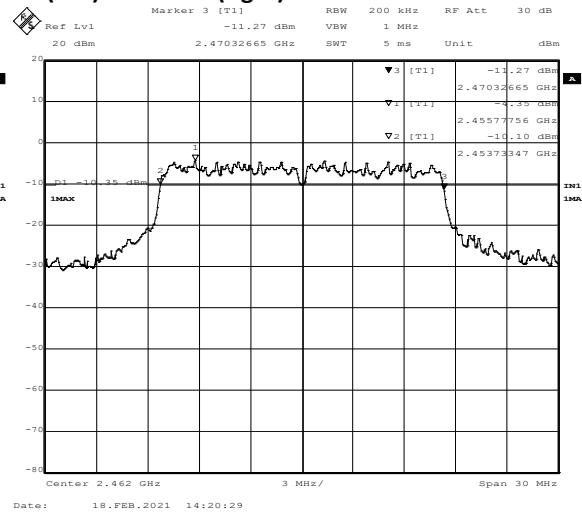
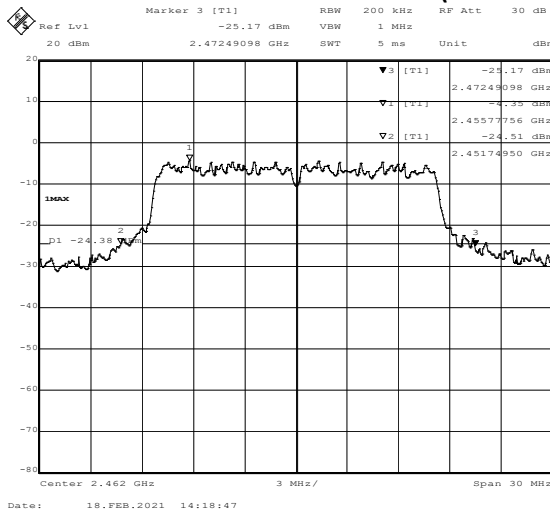


Date: 18.FEB.2021 14:31:11

Date: 18.FEB.2021 14:32:01

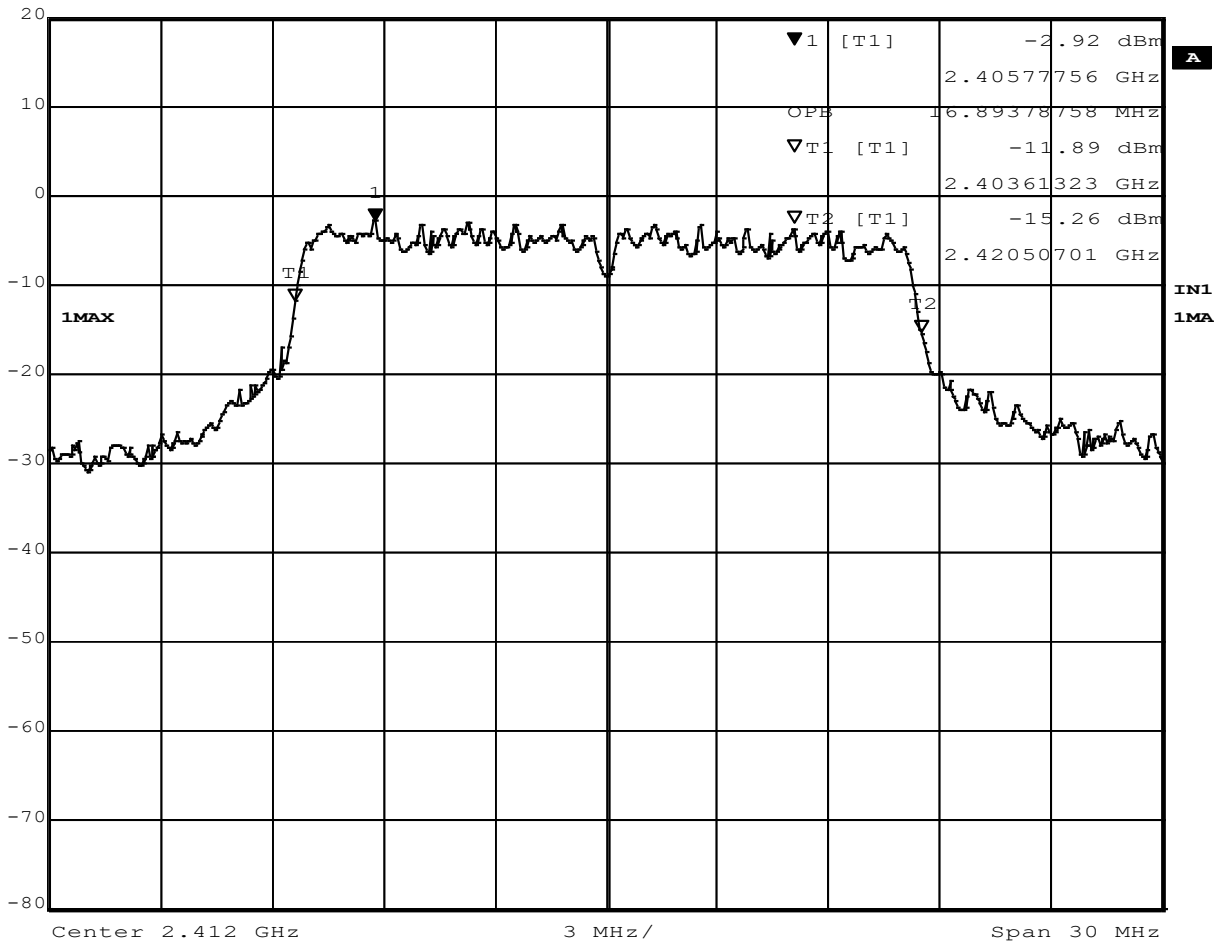


### Channel 11 (2462MHz) 6dB (left) and 20dB (right)



### Channel 1 (2412MHz) 99% OBW

Marker 1 [T1] RBW 200 kHz RF Att 30 dB  
 Ref Lvl -2.92 dBm VBW 1 MHz  
 20 dBm 2.40577756 GHz SWT 5 ms Unit dBm



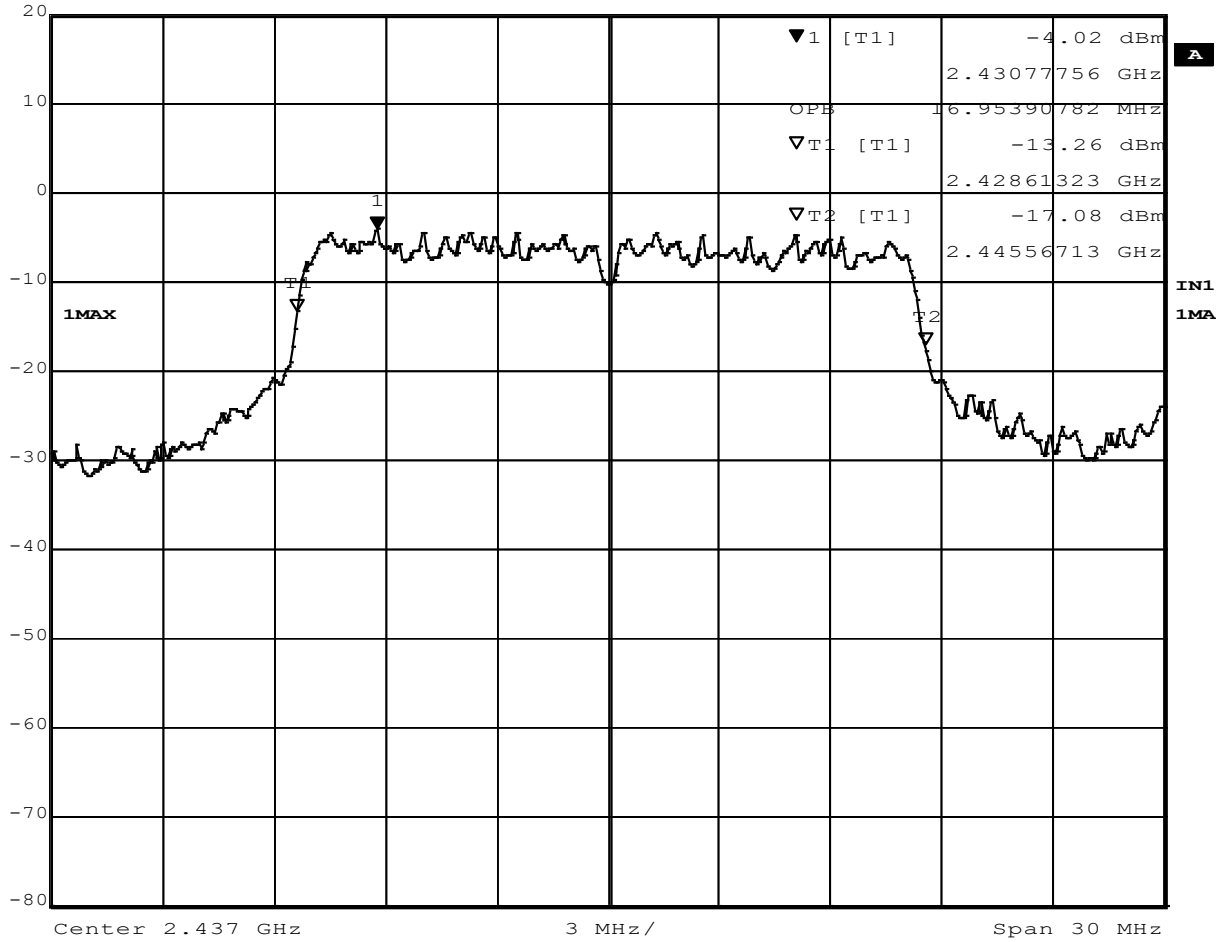


Channel 6 (2437MHz) 99% OBW



Ref Lvl  
20 dBm

Marker 1 [T1]	RBW	200 kHz	RF Att	30 dB
-4.02 dBm	VBW	1 MHz		
2.43077756 GHz	SWT	5 ms	Unit	dBm



Date: 18.FEB.2021 14:28:25

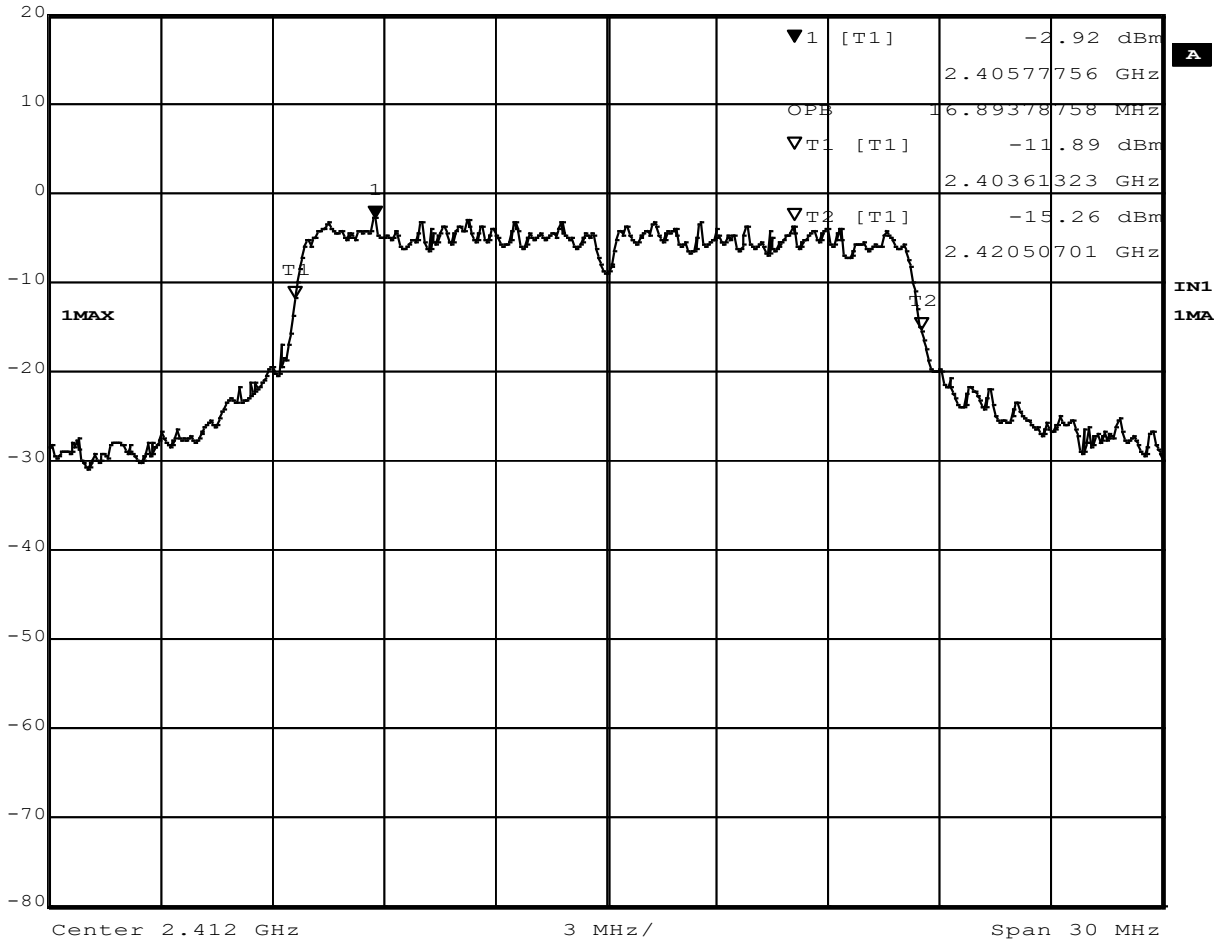




Channel 11 (2462MHz) 99% OBW



Ref Lvl	Marker 1 [T1]	RBW	200 kHz	RF Att	30 dB
20 dBm	-2.92 dBm	VBW	1 MHz		
	2.40577756 GHz	SWT	5 ms	Unit	dBm



Date: 18.FEB.2021 14:41:45



## 10 Power Spectral Density

### 10.1 Test Limits

#### FCC Part 15.247(e):

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

#### RSS-247 Issue 2 § 5.2(b):

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

### 10.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 11.10.2 Method PKPSD (peak PSD).

### 10.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ES126	10/9/2020	10/9/2021

### 10.4 Test Results

The device was found to be **compliant**. The peak power spectral density was less than 8dBm.

### 10.5 Test Conditions

Test Personnel:	<u>Brandon Norris</u>	Test Date:	<u>3/19/2021</u>
Supervising/Reviewing Engineer:	<u>NA</u>	Limit Applied:	<u>See Above</u>
(Where Applicable)	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>25.6C</u>
Product Standard:	<u>RSS-247 Issue 2</u>	Relative Humidity:	<u>52.2%</u>
Input Voltage:	<u>Battery</u>	Atmospheric Pressure:	<u>985.4mbar</u>
Pretest Verification w / Ambient			
Signals or BB Source:	<u>Yes</u>		

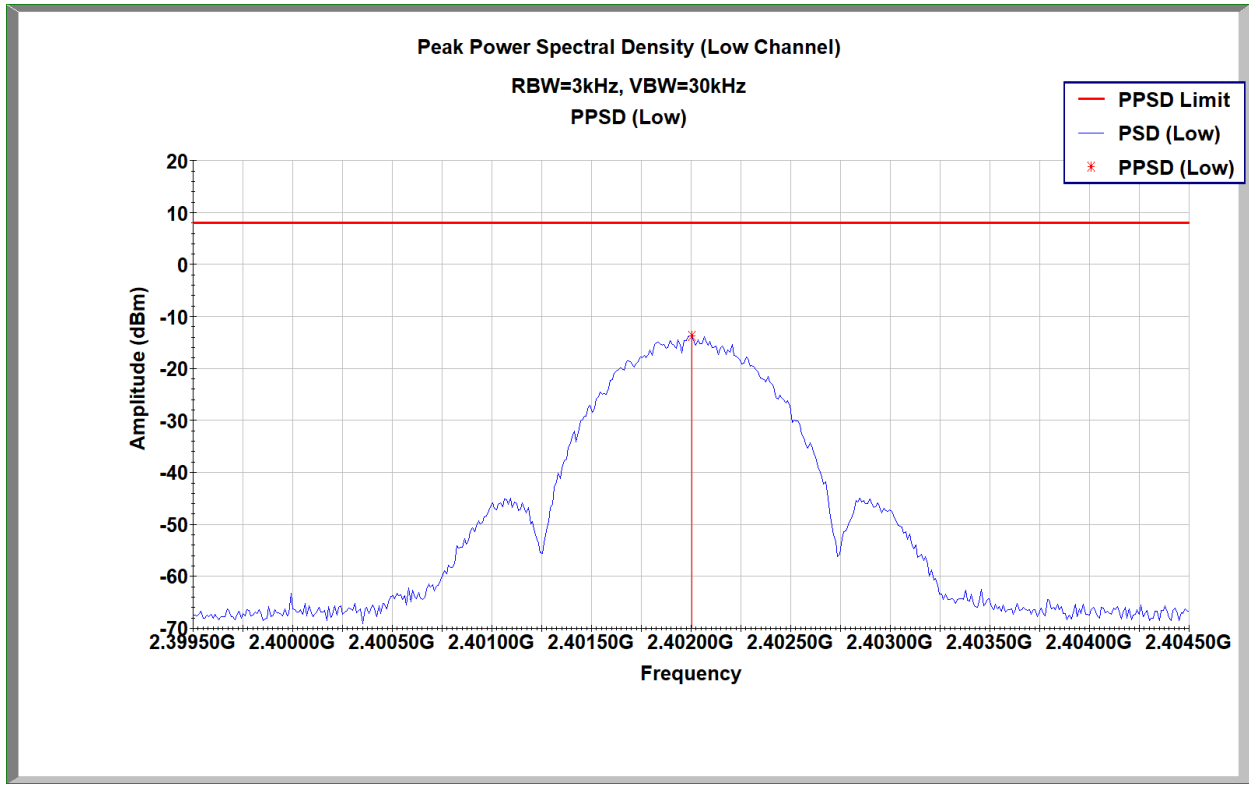
**10.6 Test Data**

Mode	Channel (Frequency)	PPSD (dBm)	Limit (dBm)	Result
Bluetooth Low Energy	37 (2402MHz)	-13.723	8	Pass
	17 (2440MHz)	-12.675	8	Pass
	39 (2480MHz)	-12.447	8	Pass
802.11b	1 (2412MHz)	-16.930	8	Pass
	6 (2437MHz)	-16.698	8	Pass
	11 (2462MHz)	-17.467	8	Pass
802.11g	1 (2412MHz)	-17.775	8	Pass
	6 (2437MHz)	-17.257	8	Pass
	11 (2462MHz)	-17.821	8	Pass
802.11n	1 (2412MHz)	-18.039	8	Pass
	6 (2437MHz)	-17.444	8	Pass
	11 (2462MHz)	-17.866	8	Pass
802.11nHT40	3 (2422MHz)	-20.767	8	Pass
	7 (2442MHz)	-20.389	8	Pass
	11 (2462MHz)	-20.192	8	Pass

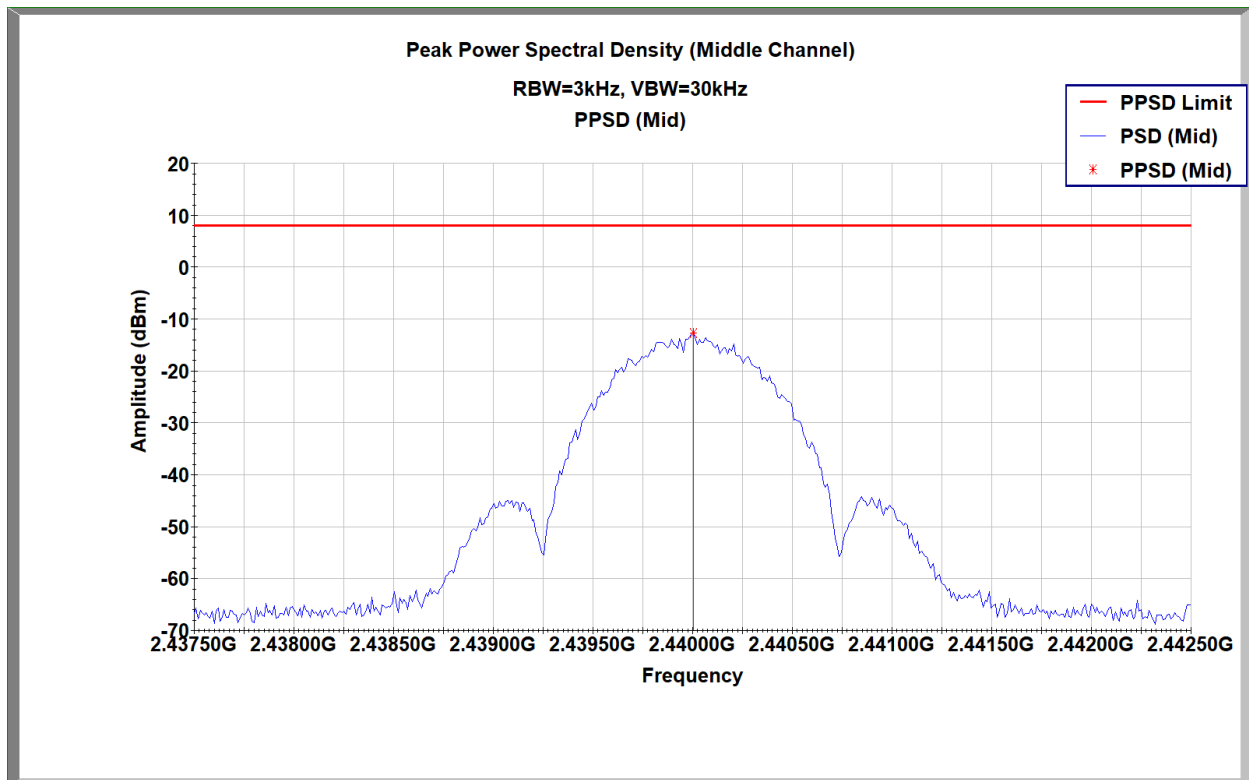
Deviations, Additions, or Exclusions: None.



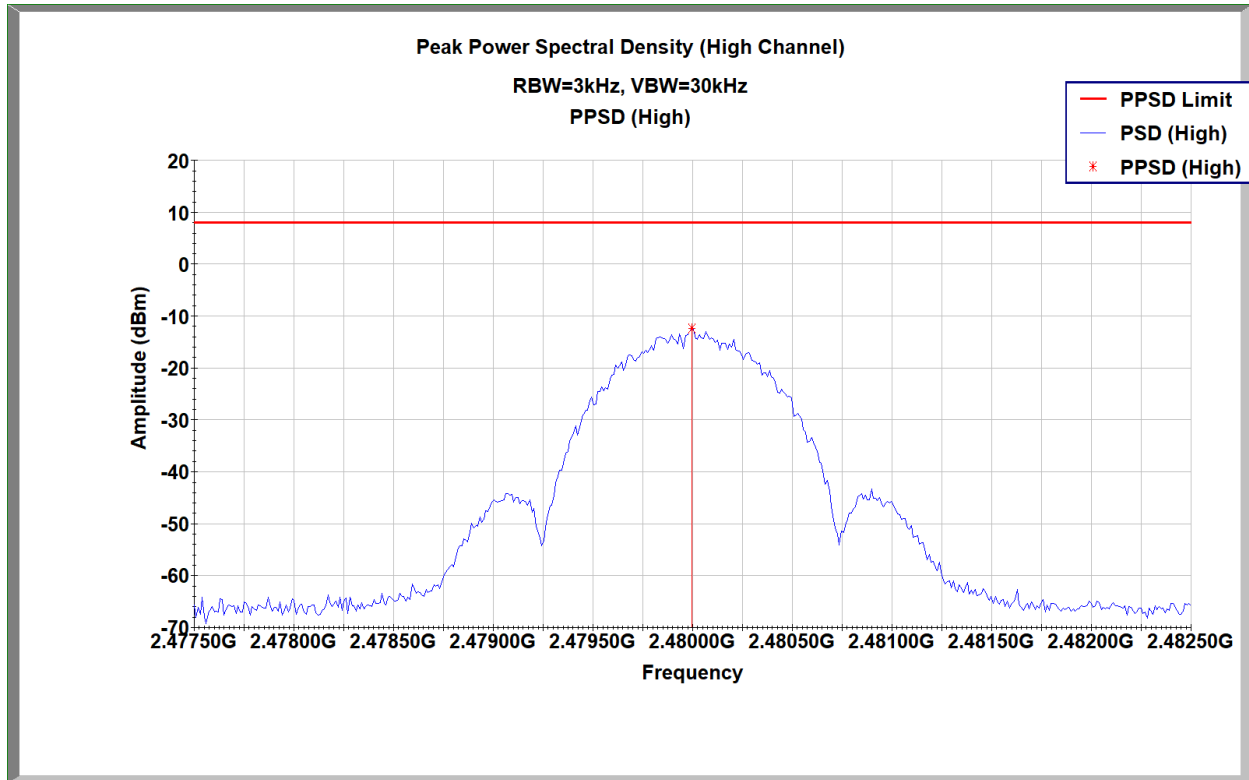
### 10.6.1 Bluetooth Low Energy



Channel 0 (2402MHz) PPSD



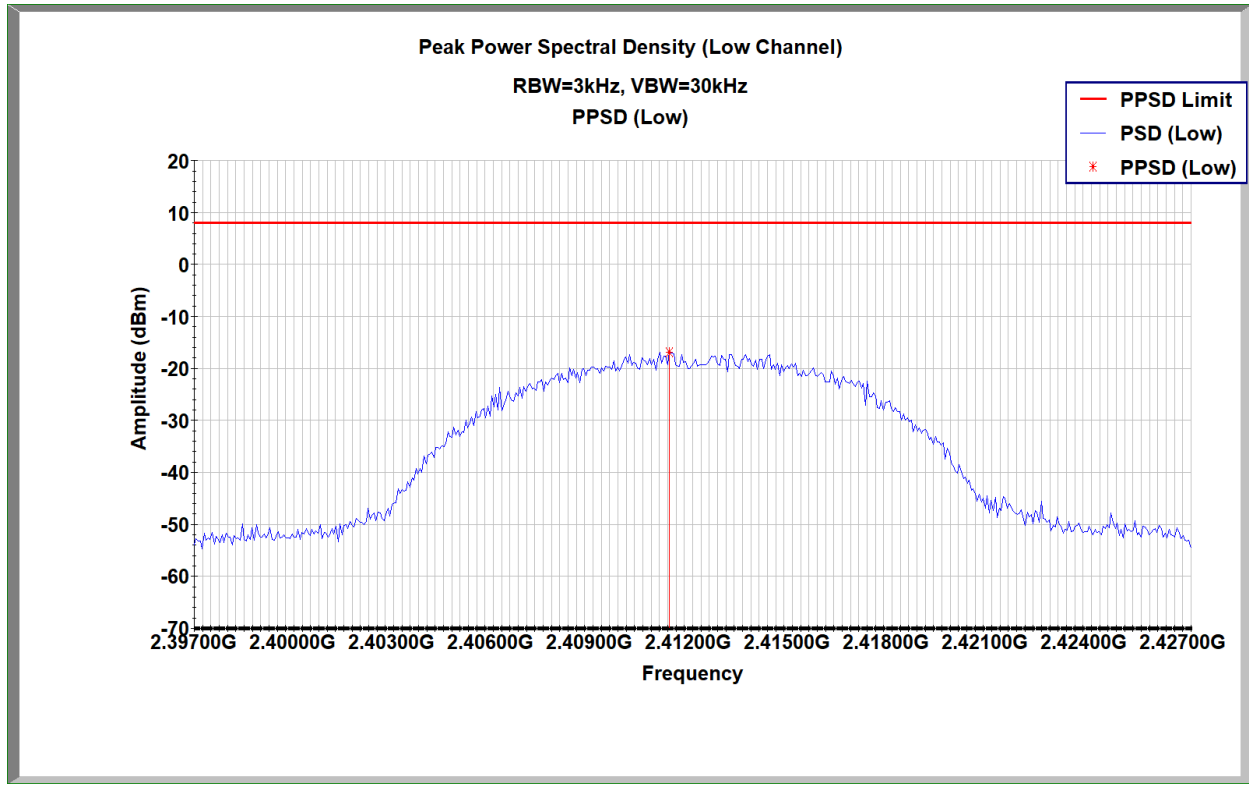
Channel 39 (2440MHz) PPSD



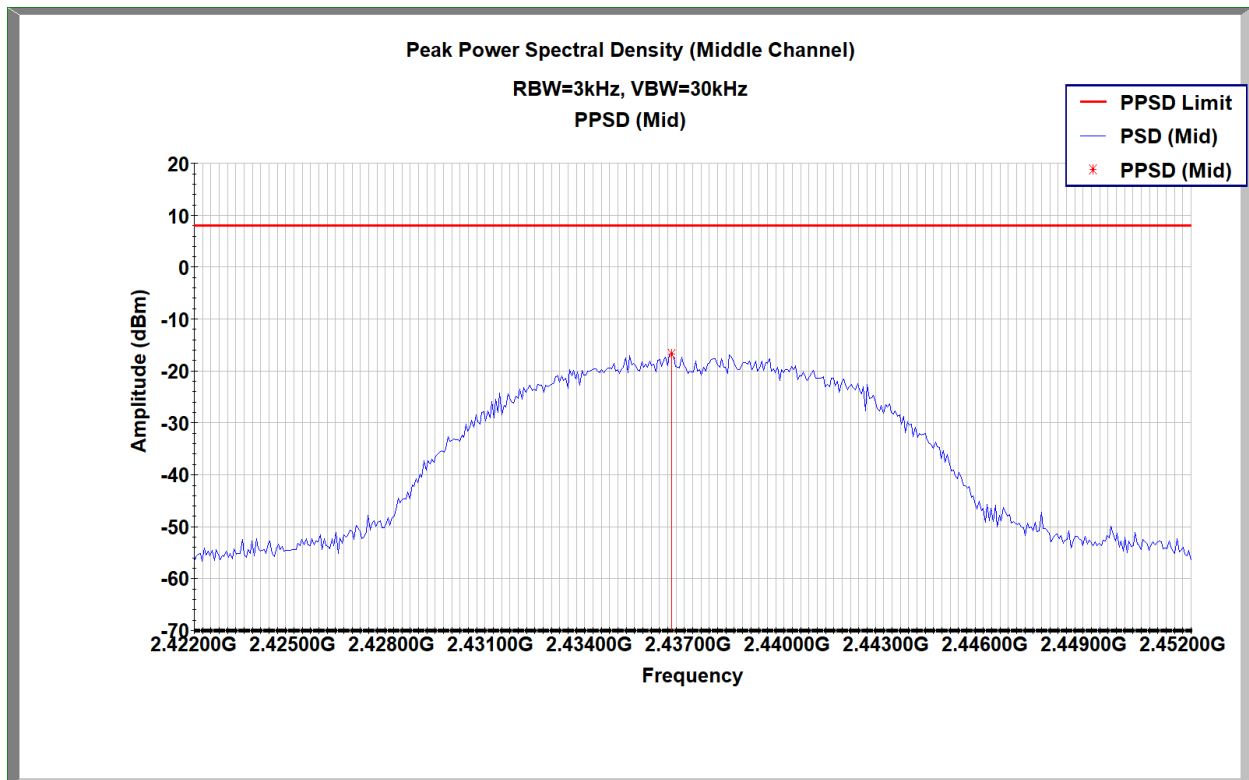
Channel 78 (2480MHz) PPSD



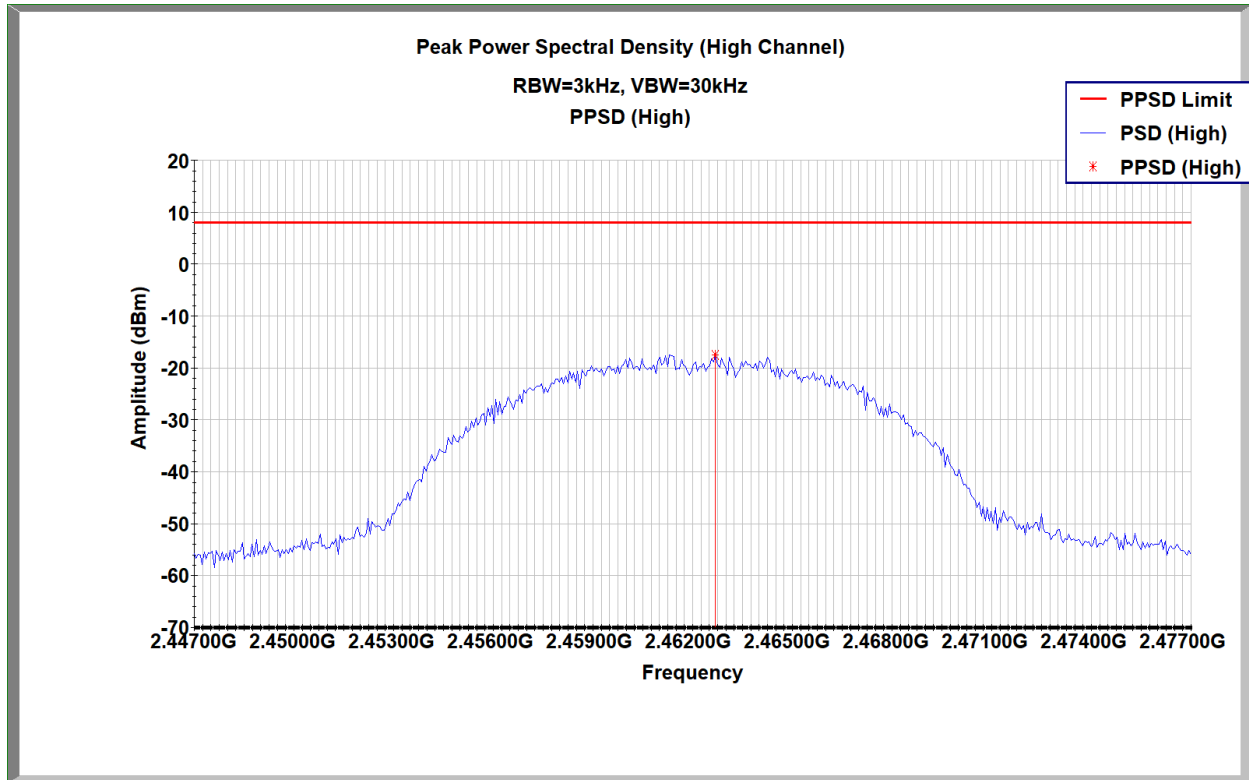
10.6.2 Wi-Fi, 802.11b



Channel 1 (2412MHz) PPSD



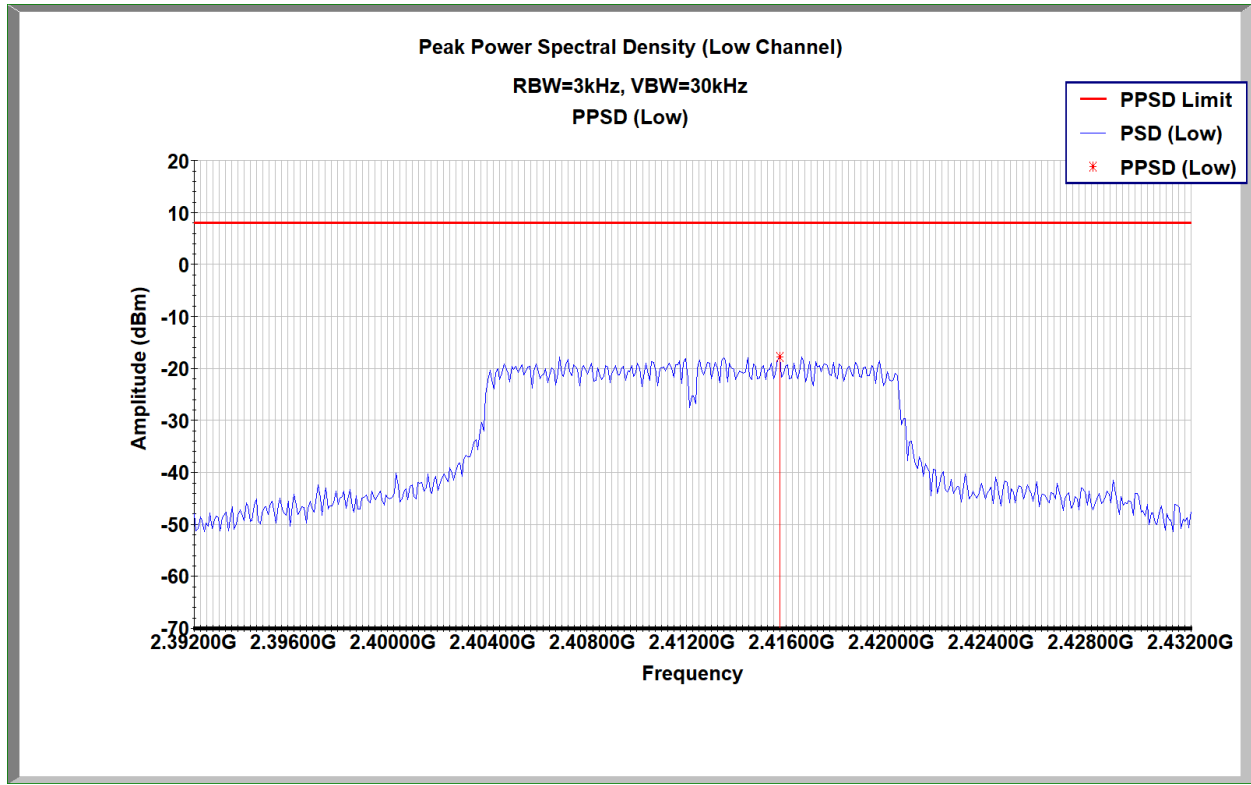
Channel 6 (2437MHz) PPSD



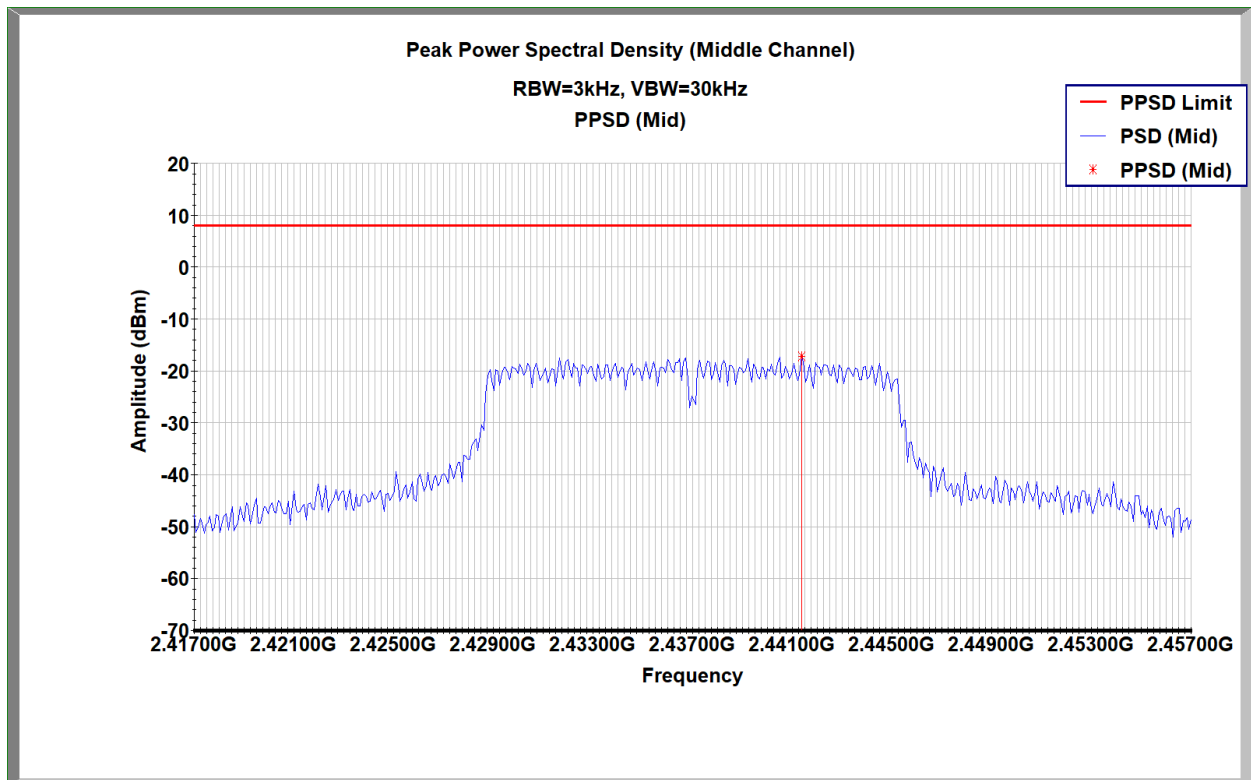
Channel 11 (2462MHz) PPSS



10.6.3 Wi-Fi, 802.11g

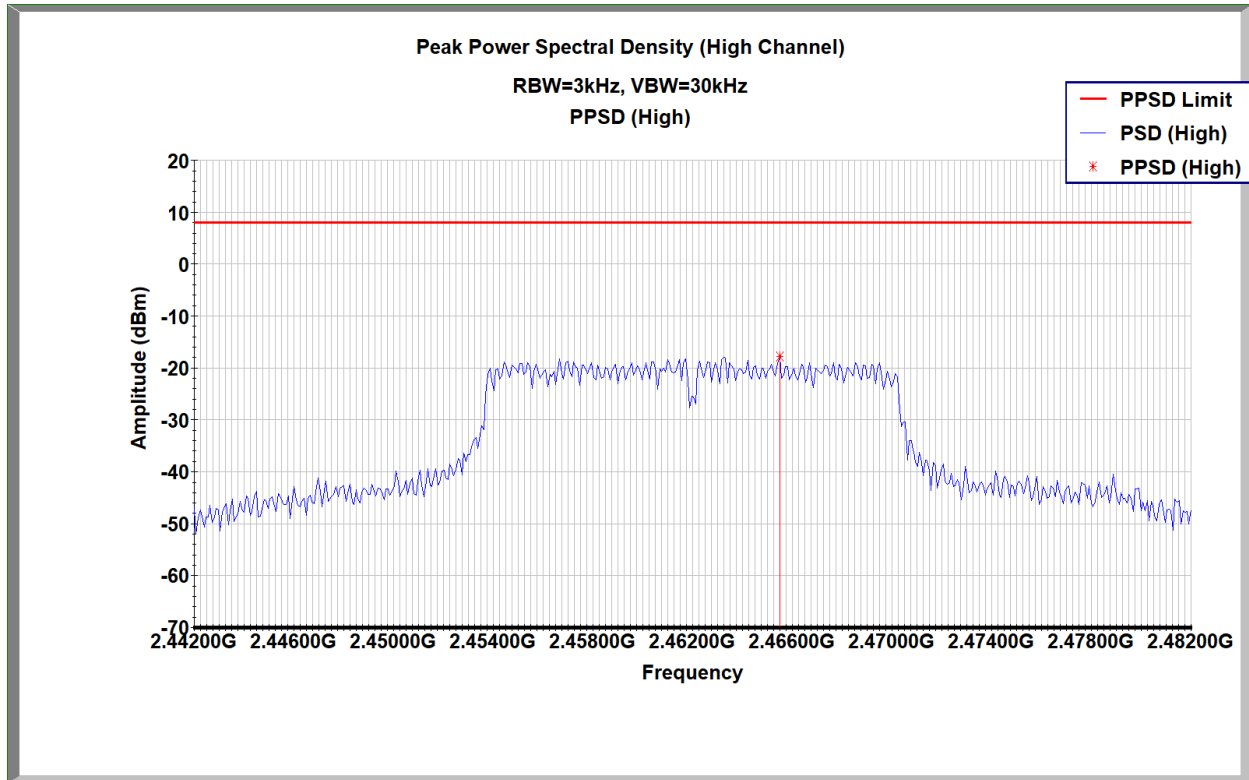


Channel 1 (2412MHz) PPSD



Channel 6 (2437MHz) PPSD

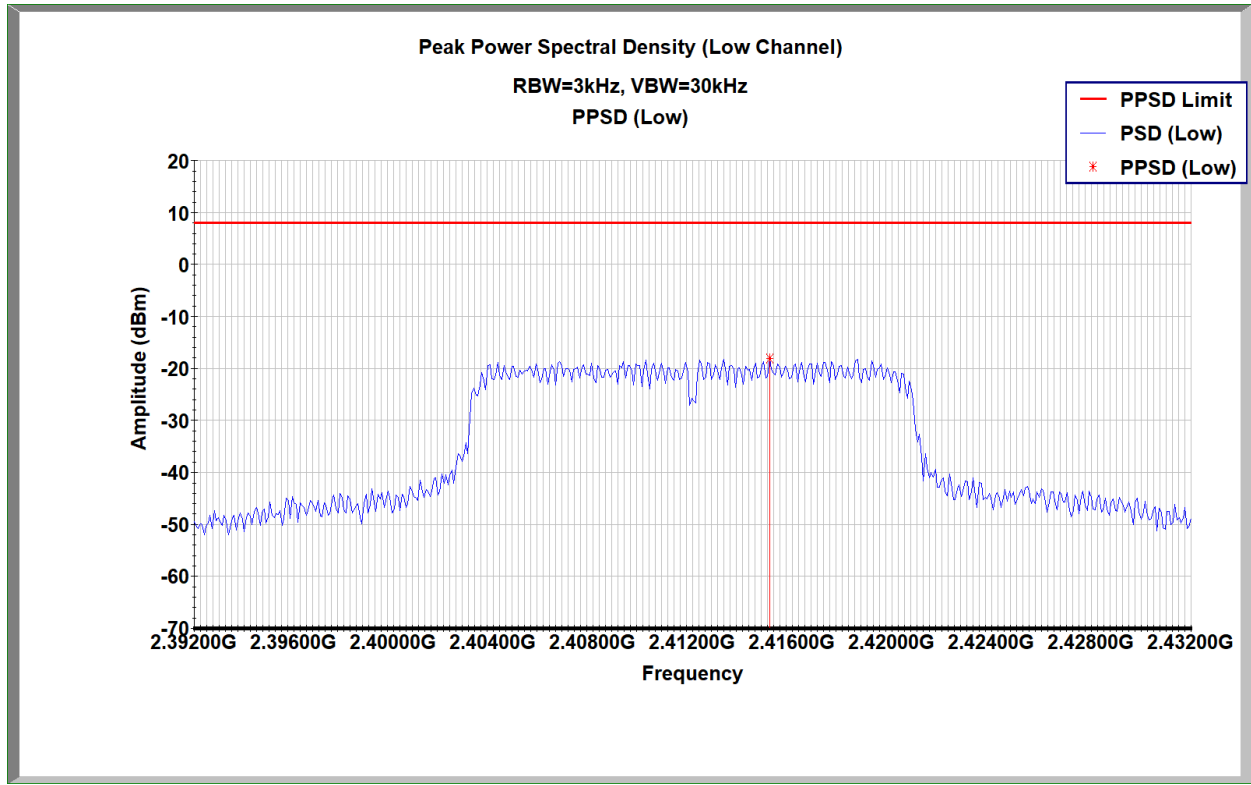




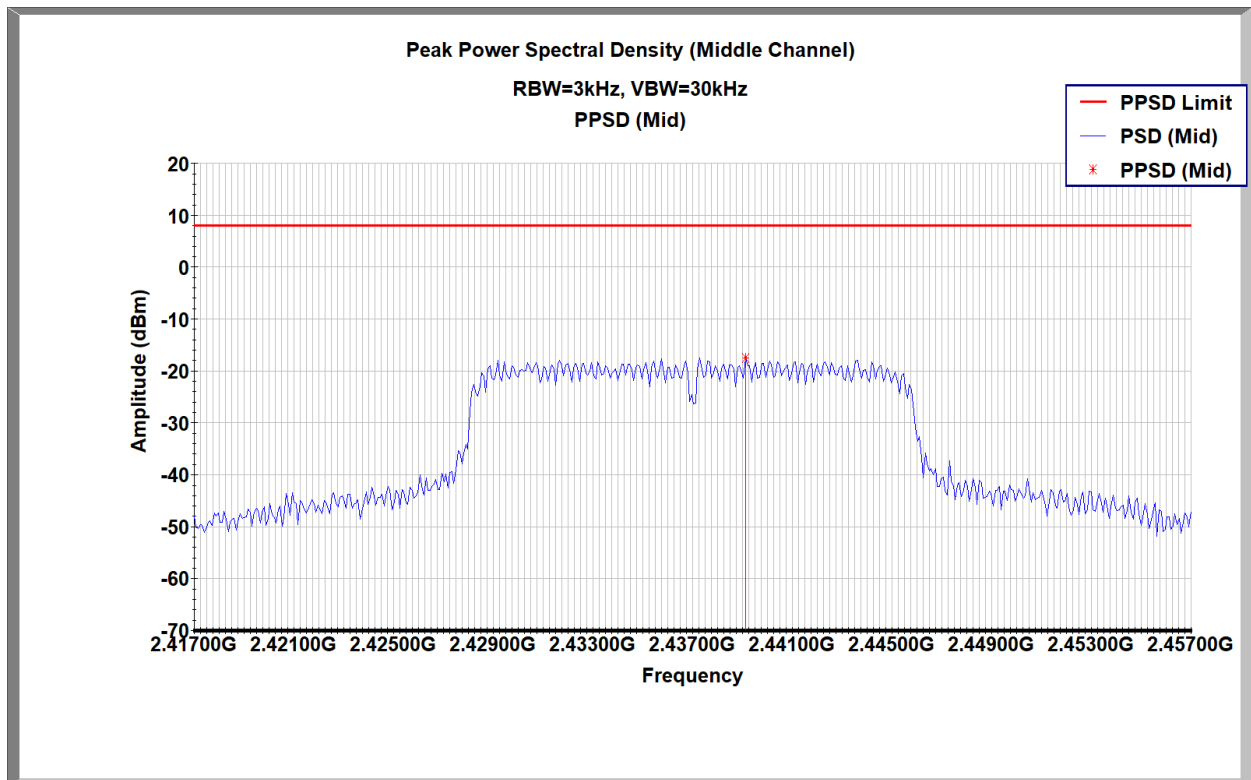
Channel 11 (2462MHz) PPSD



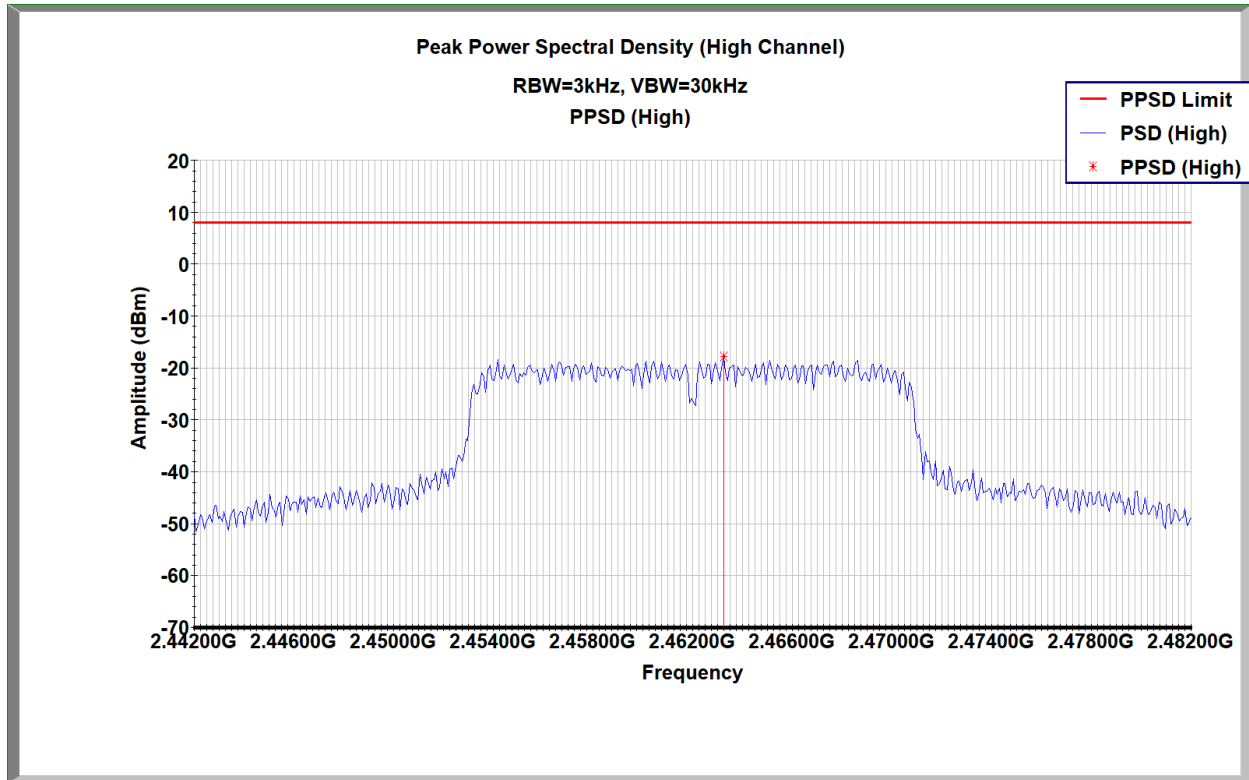
10.6.4 Wi-Fi, 802.11n



Channel 1 (2412MHz) PPSD



Channel 6 (2437MHz) PPSD



Channel 11 (2462MHz) PPSD



## 11 Conducted Spurious Emissions

### 11.1 Test Limits

#### FCC Part 15.247(d):

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

#### RSS-247 Issue 2 § 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 11.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 7.8.8 and 11.11.

### 11.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021

### 11.4 Test Results

The device was found to be **compliant**. All spurious emissions were found to be attenuated more than 20dB below the level of the fundamental.

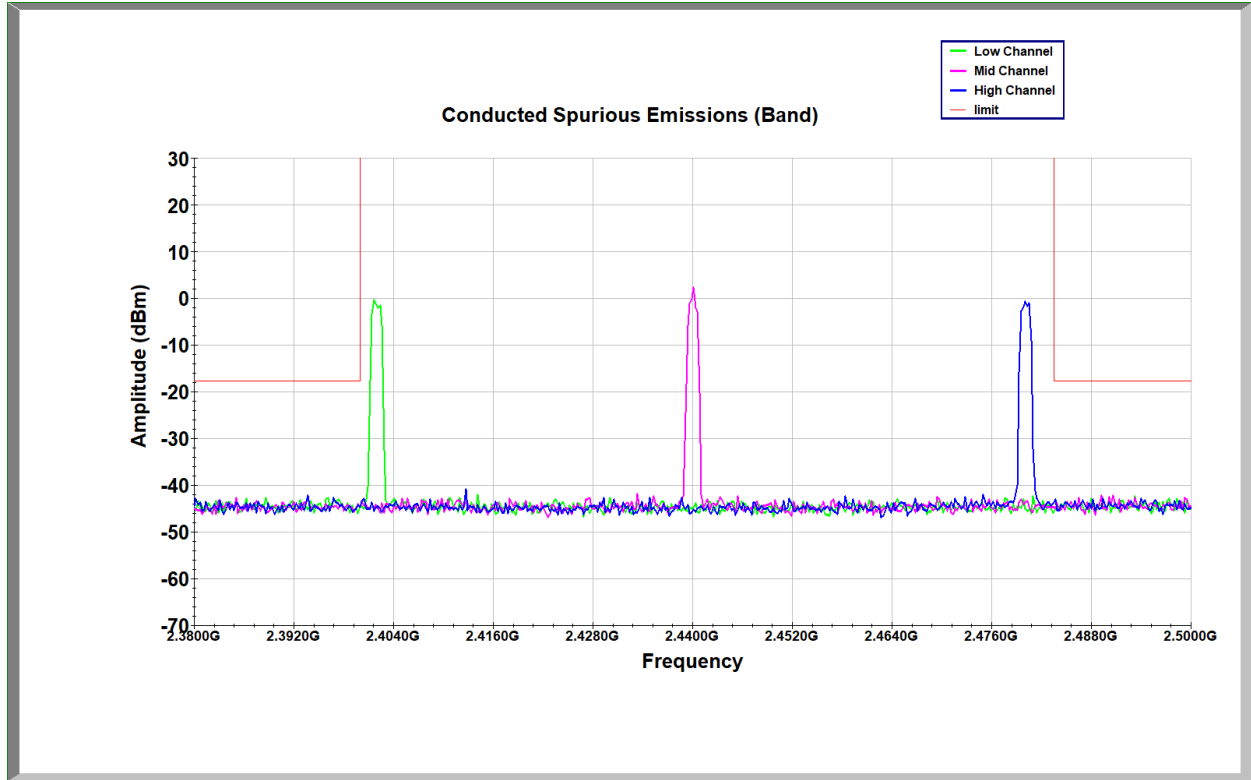
### 11.5 Test Conditions

Test Personnel:	<u>Brandon Norris</u>	Test Date:	<u>3/22/2021</u>
Supervising/Reviewing Engineer: (Where Applicable)	<u>NA</u>	Limit Applied:	<u>See Above</u>
Product Standard:	<u>FCC Part 15.247</u>	Ambient Temperature:	<u>25.6C</u>
Input Voltage:	<u>Battery</u>	Relative Humidity:	<u>52.2%</u>
Pretest Verification w / Ambient Signals or BB Source:	<u>Yes</u>	Atmospheric Pressure:	<u>985.4mbar</u>

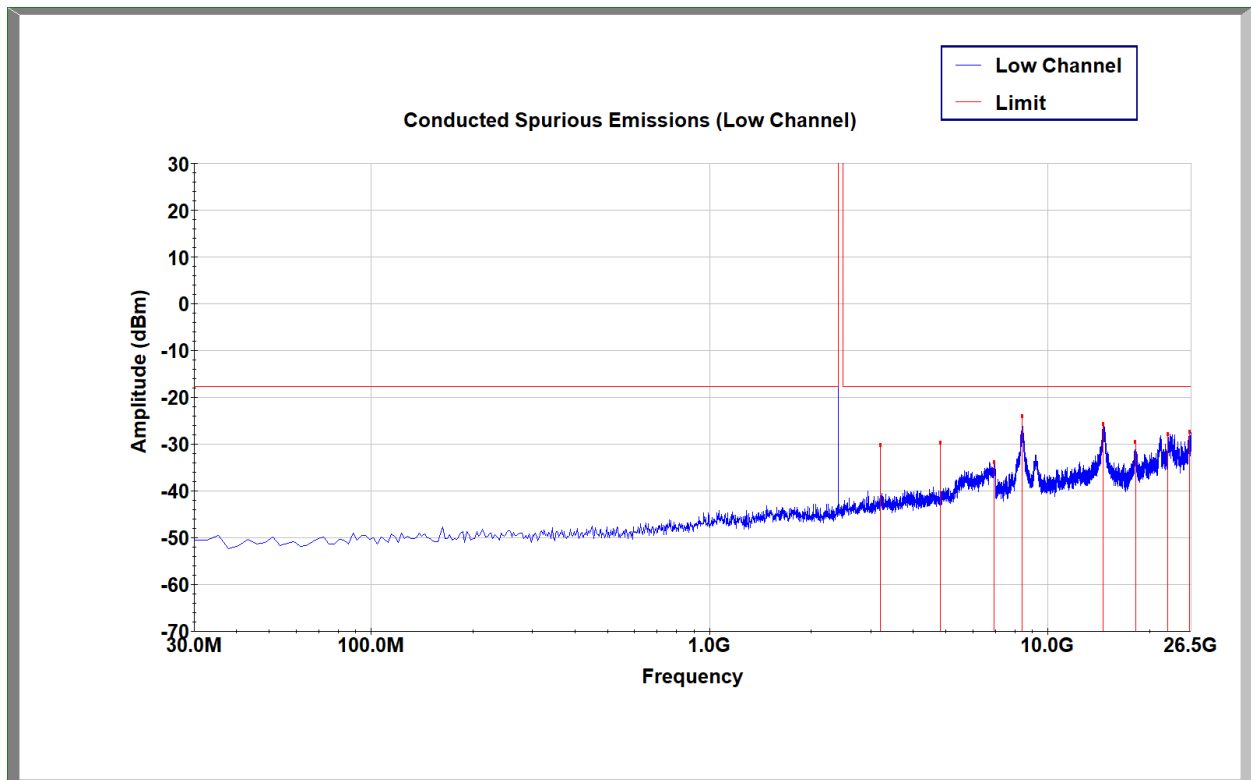


### 11.6 Test Data

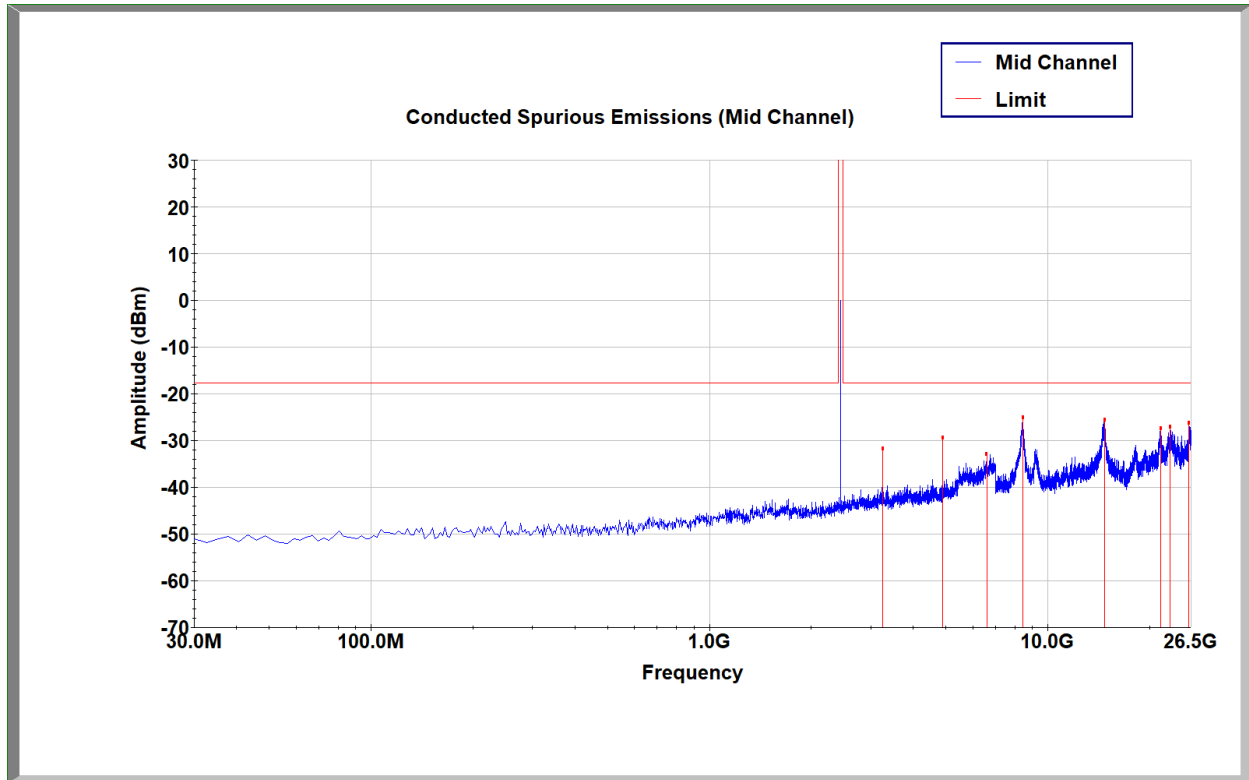
#### 11.6.1 Bluetooth



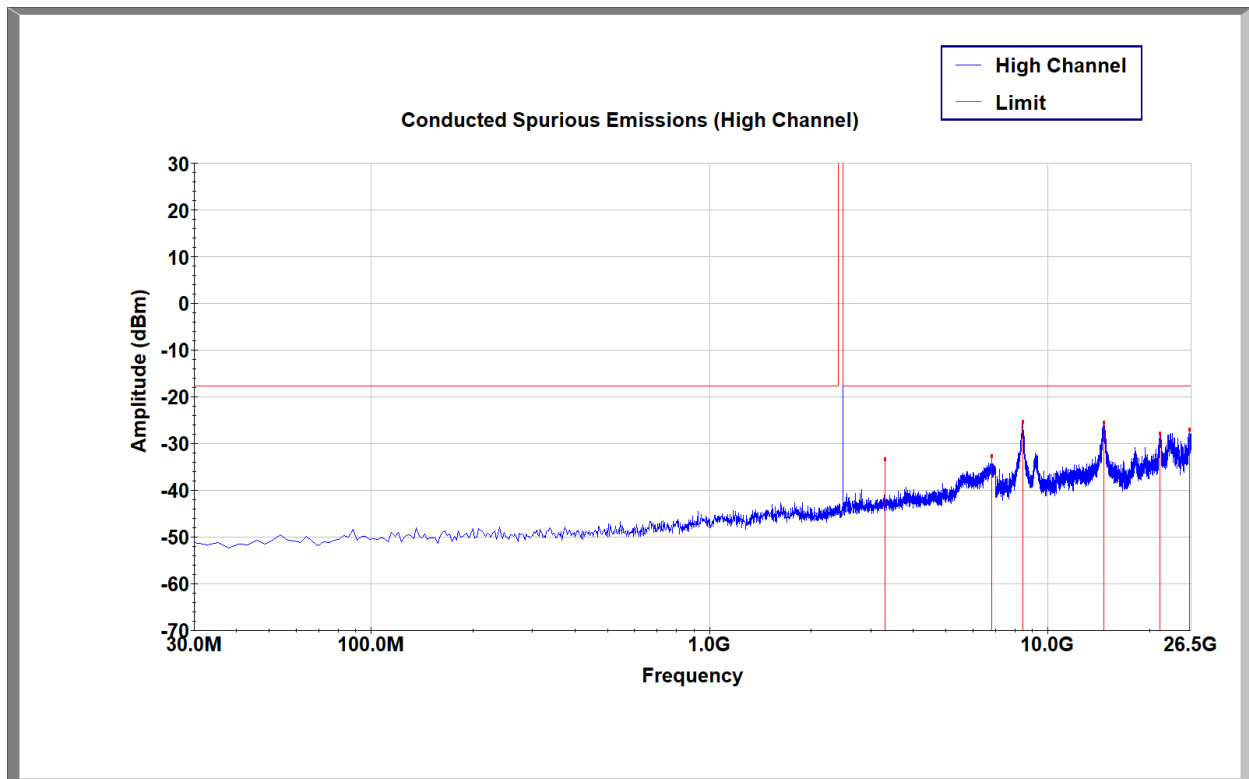
Conducted Spurious Emissions (Band)



Channel 0 (2402MHz) Conducted Spurious Emissions



Channel 38 (2440MHz) Conducted Spurious Emissions

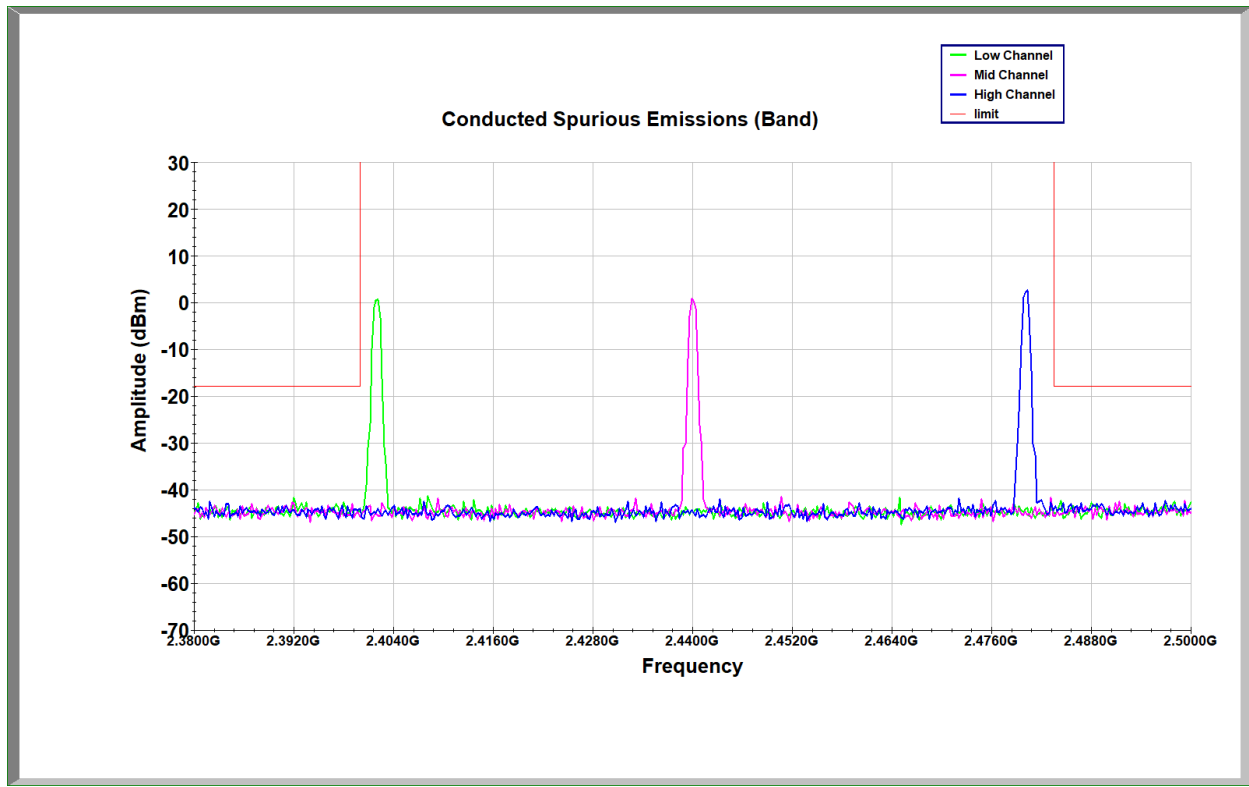


Channel 78 (2480MHz) Conducted Spurious Emissions

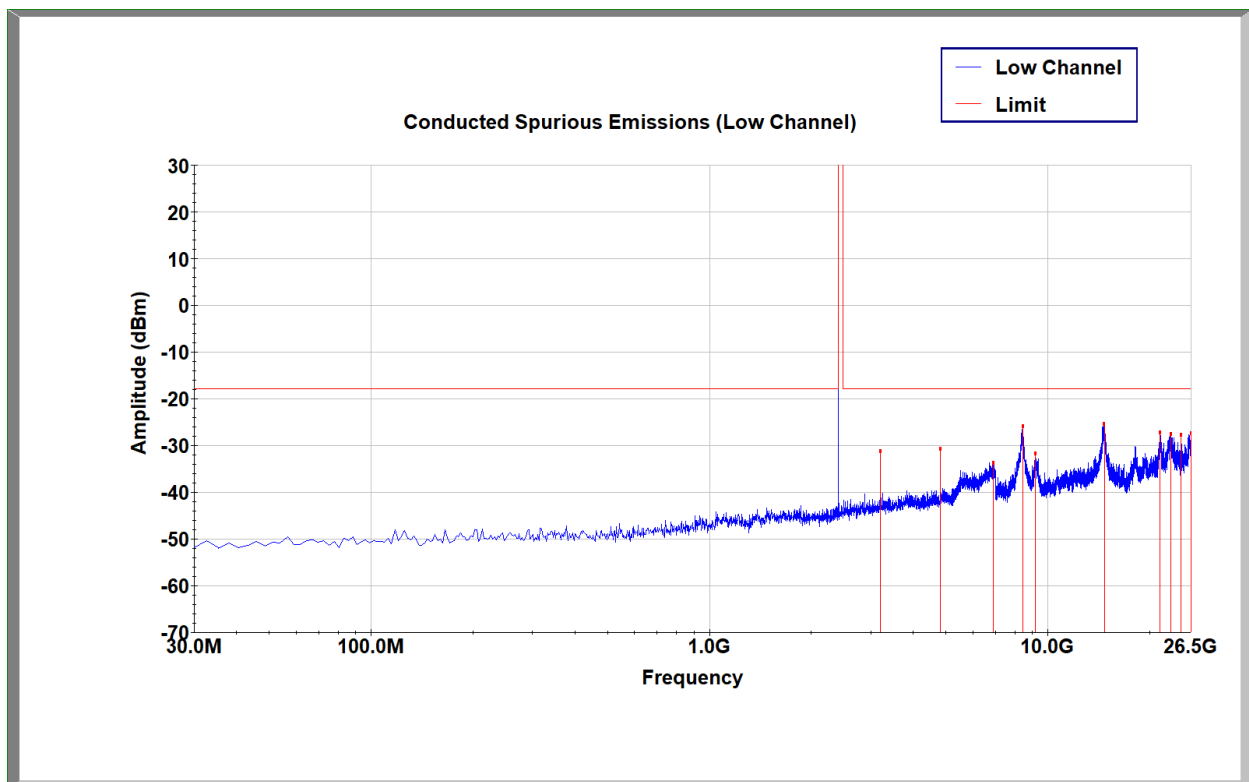
Deviations, Additions, or Exclusions: None.



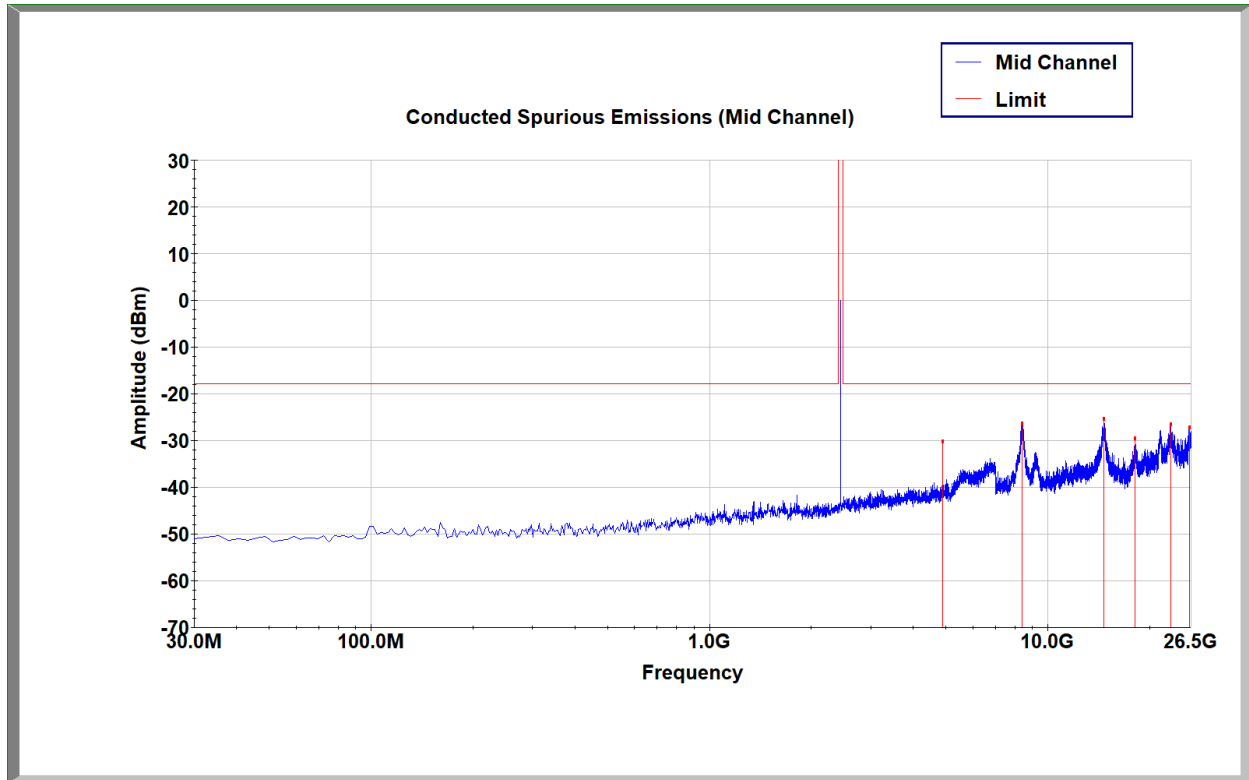
### 11.6.2 Bluetooth Low Energy



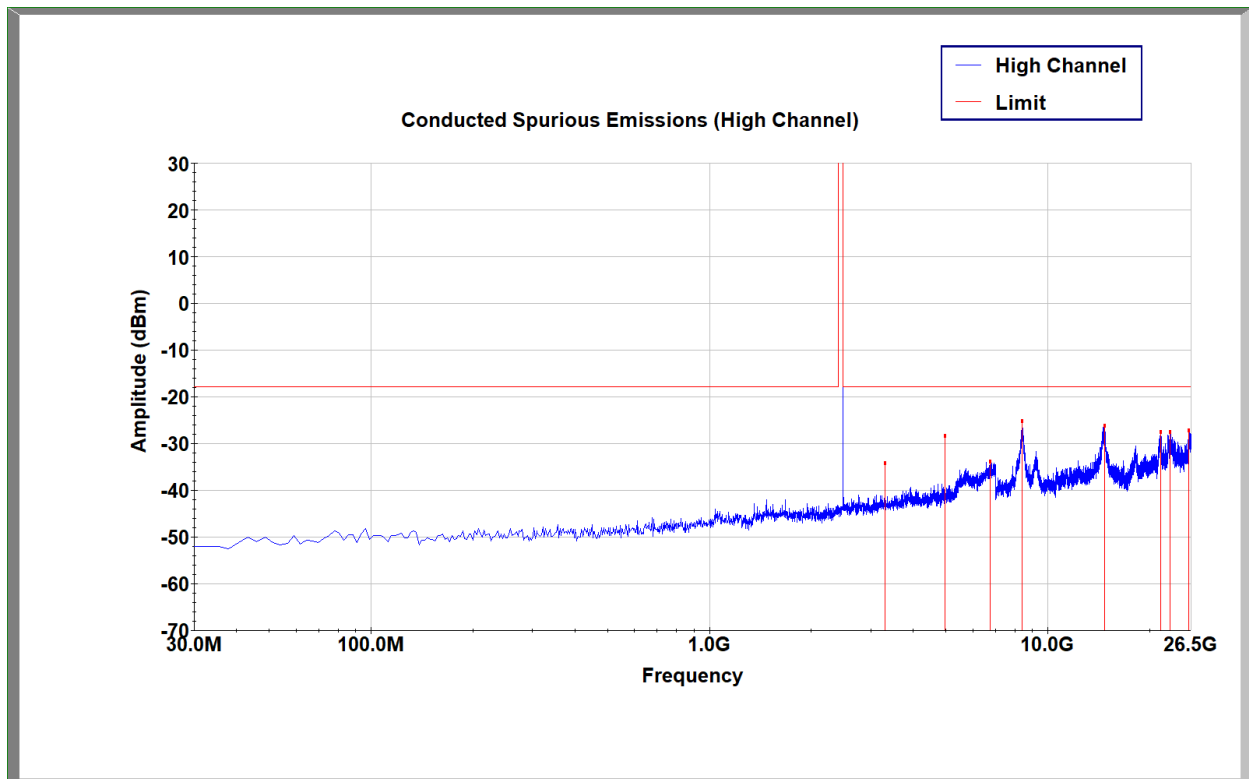
Conducted Spurious Emissions (Band)



Channel 0 (2402MHz) Conducted Spurious Emissions



Channel 39 (2440MHz) Conducted Spurious Emissions



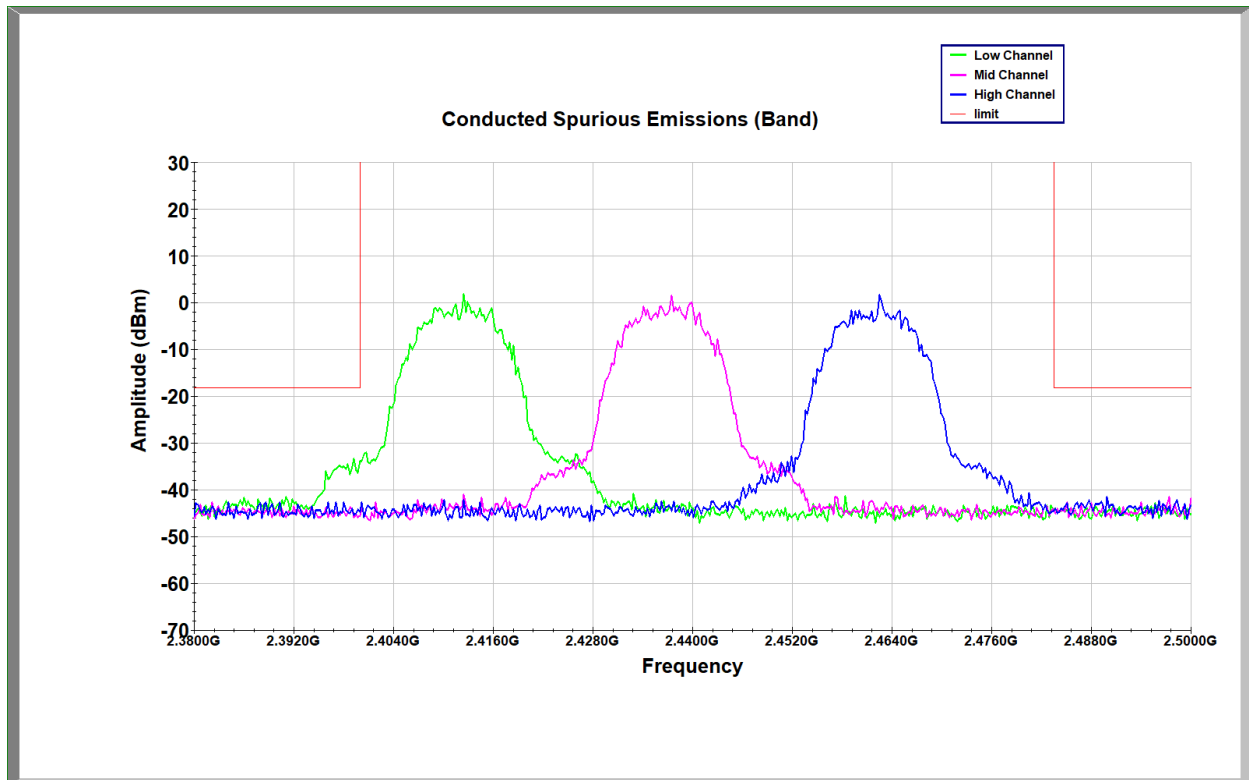
Channel 80 (2480MHz) Conducted Spurious Emissions

Deviations, Additions, or Exclusions: None.

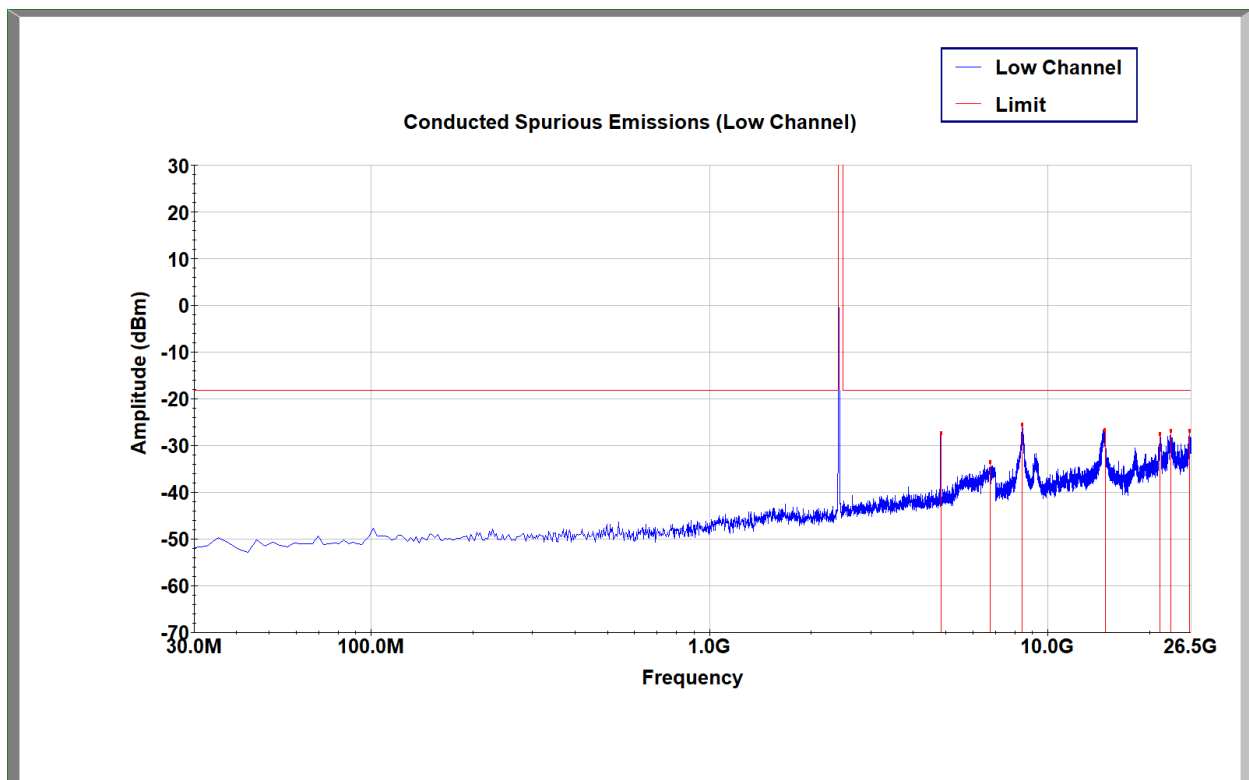




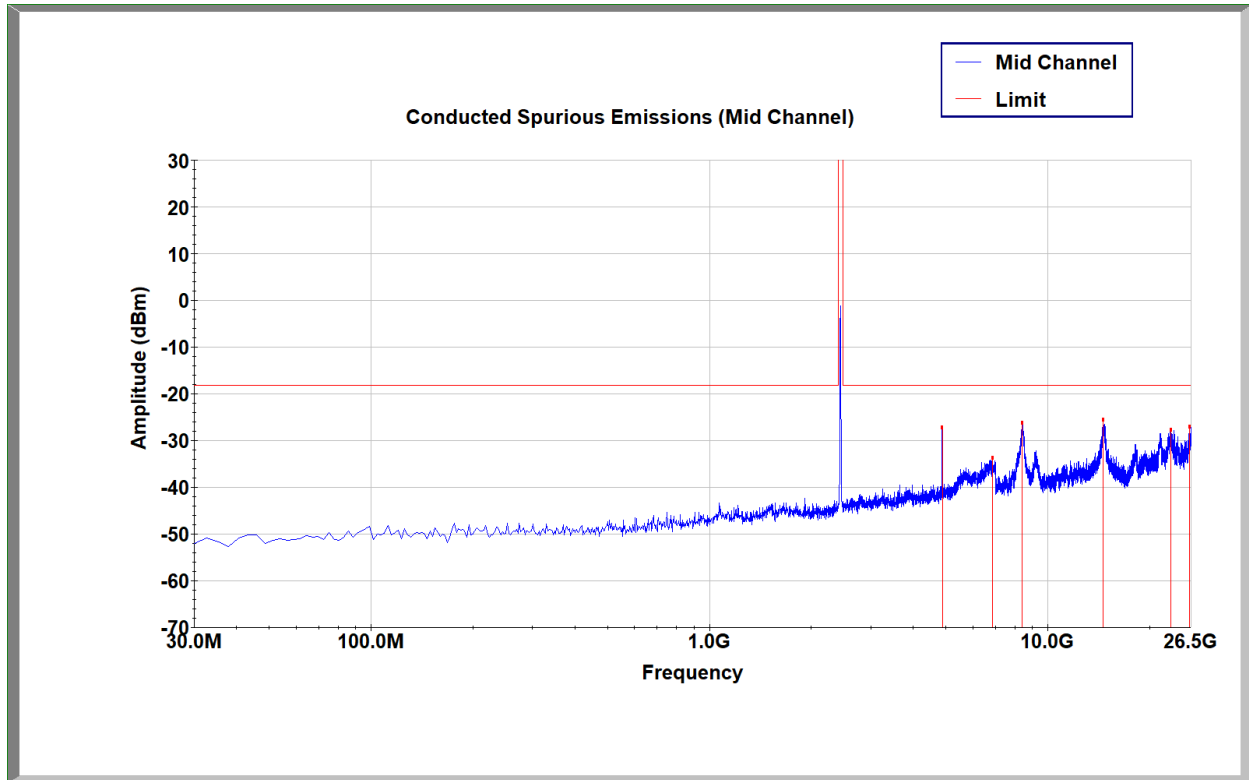
11.6.3 Wi-Fi, 802.11b



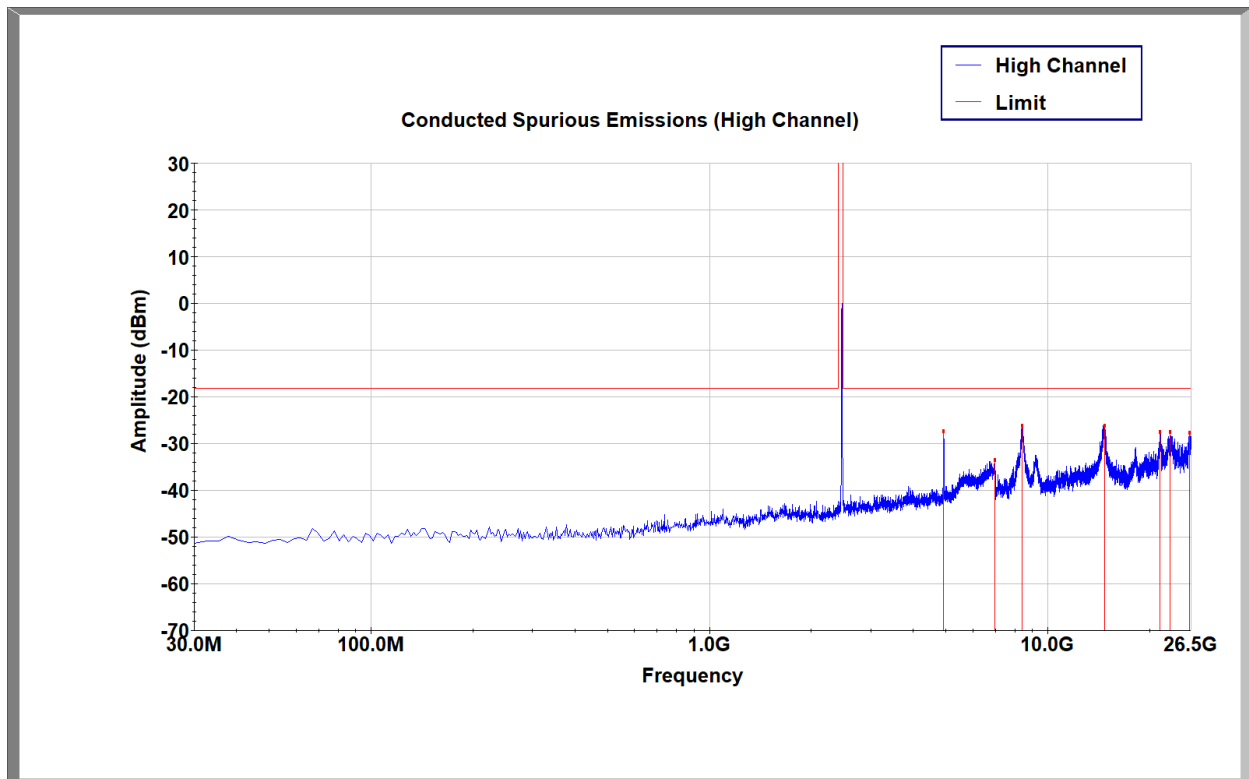
Conducted Spurious Emissions (Band)



Channel 1 (2412MHz) Conducted Spurious Emissions



**Channel 6 (2437MHz) Conducted Spurious Emissions**

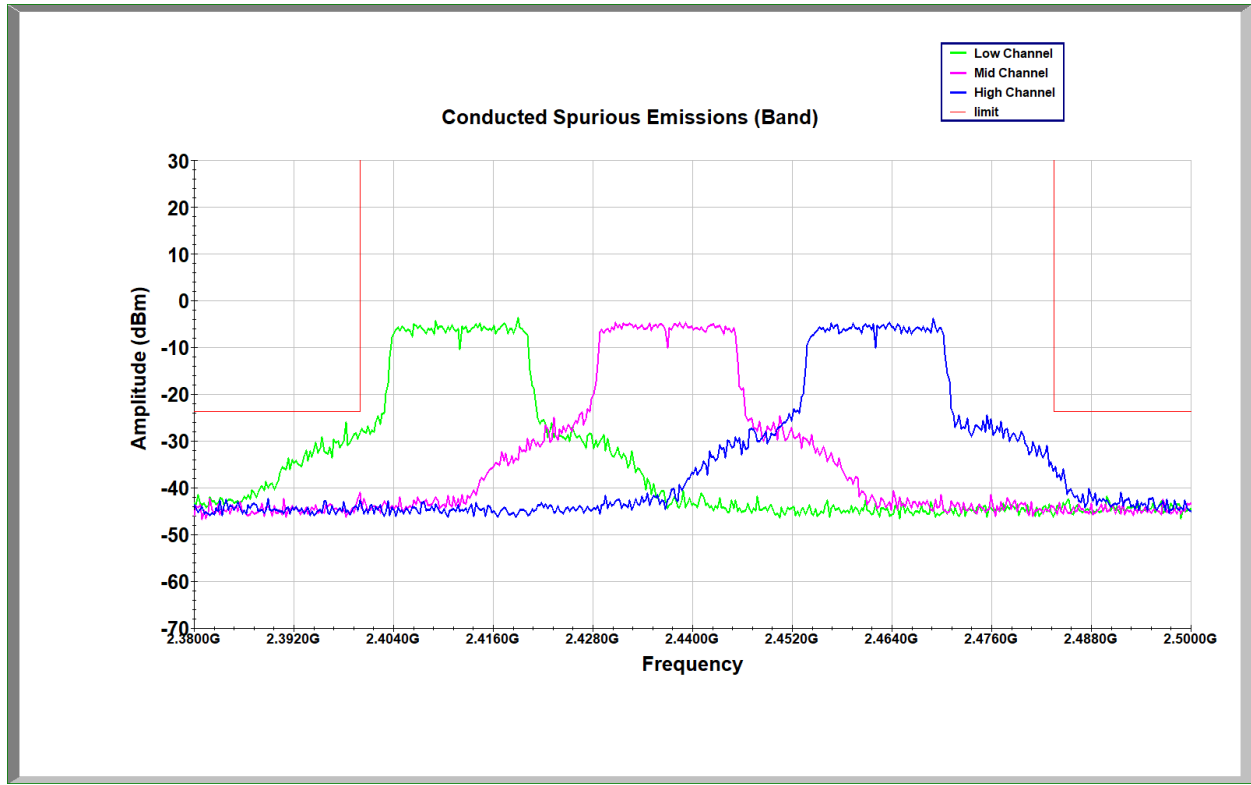


**Channel 11 (2462MHz) Conducted Spurious Emissions**

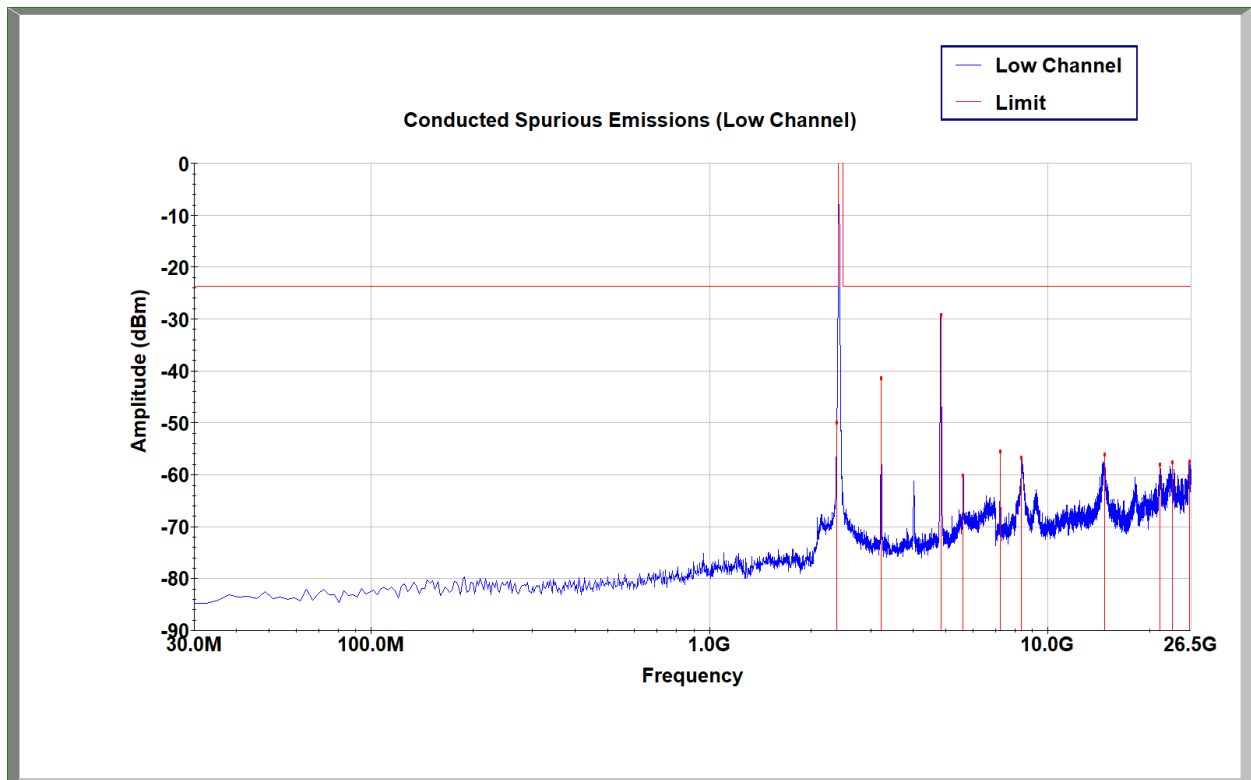
Deviations, Additions, or Exclusions: None.



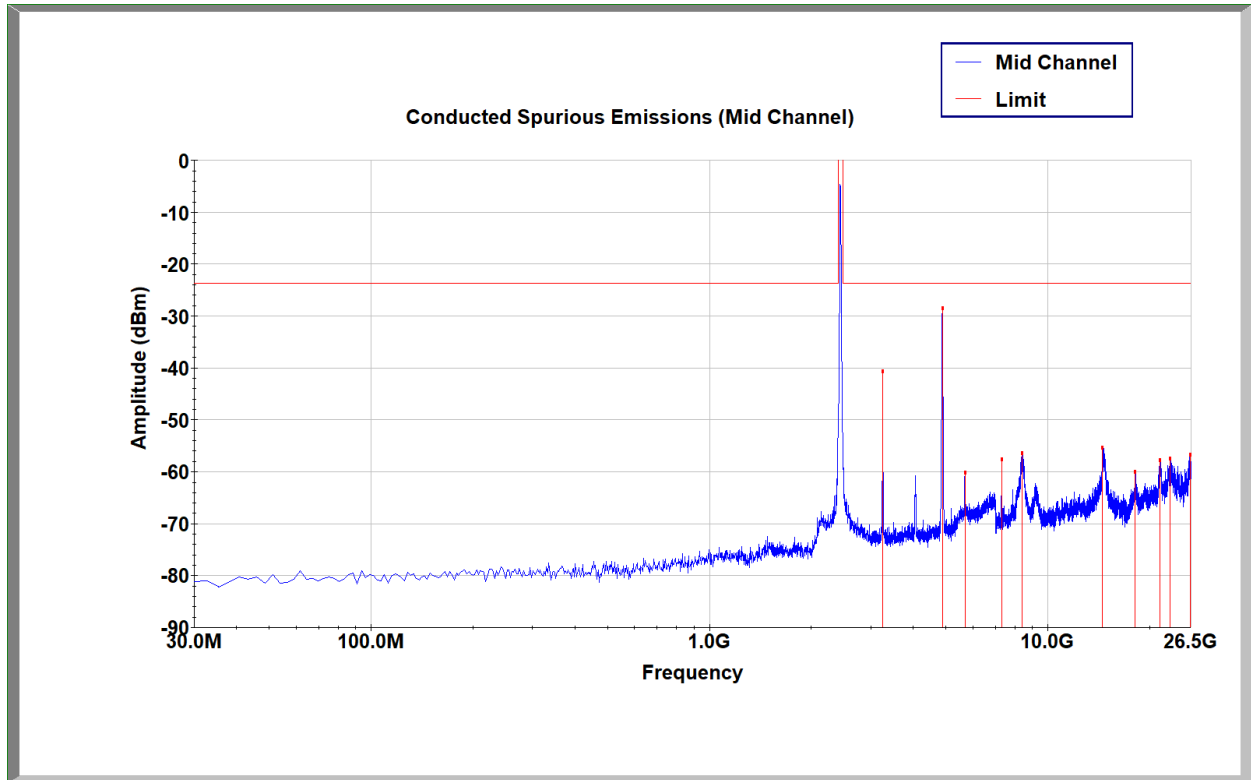
11.6.4 Wi-Fi, 802.11g



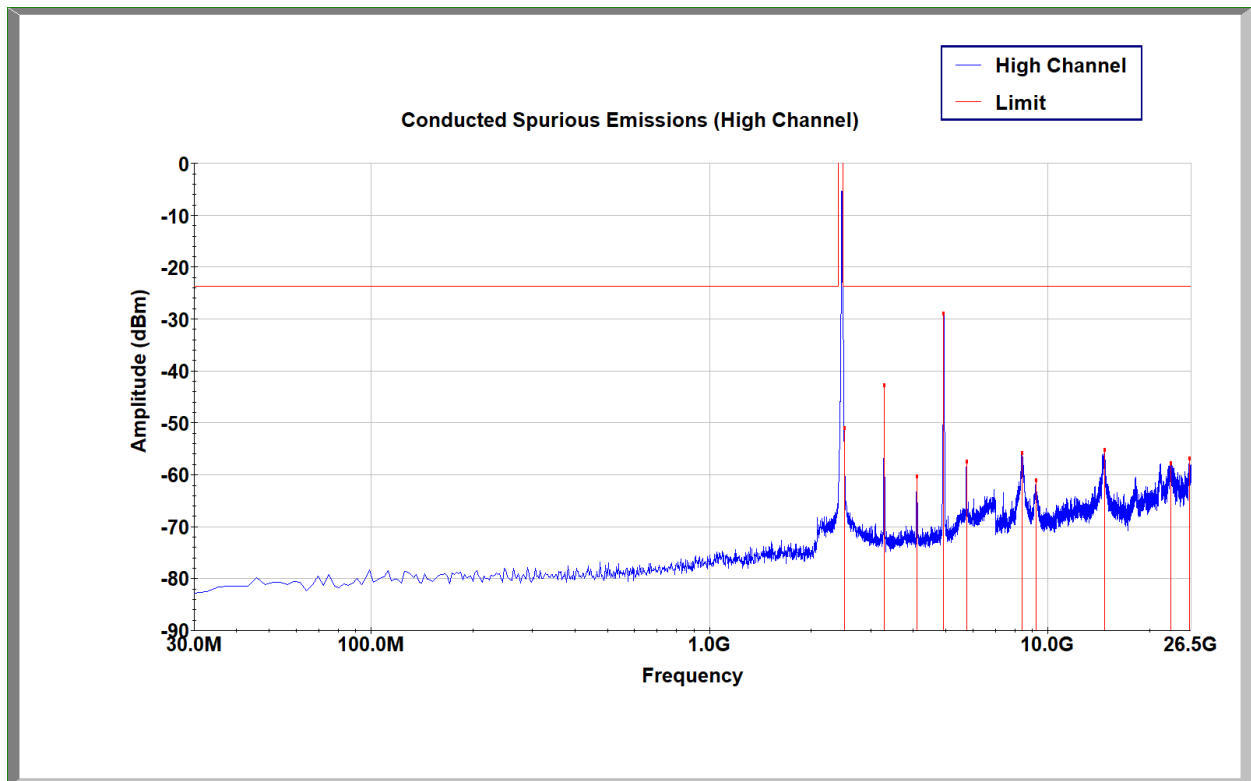
Conducted Spurious Emissions (Band)



Channel 1 (2412MHz) Conducted Spurious Emissions



Channel 6 (2437MHz) Conducted Spurious Emissions

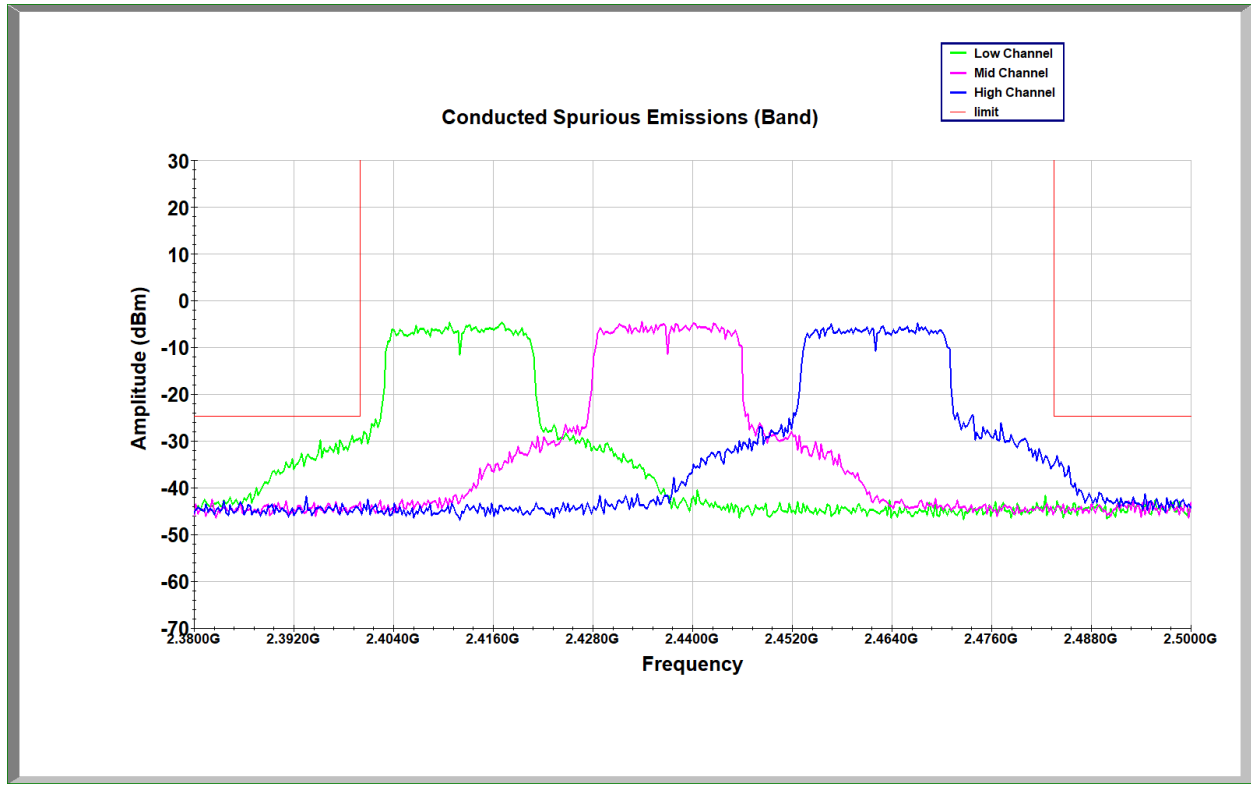


Channel 11 (2462MHz) Conducted Spurious Emissions

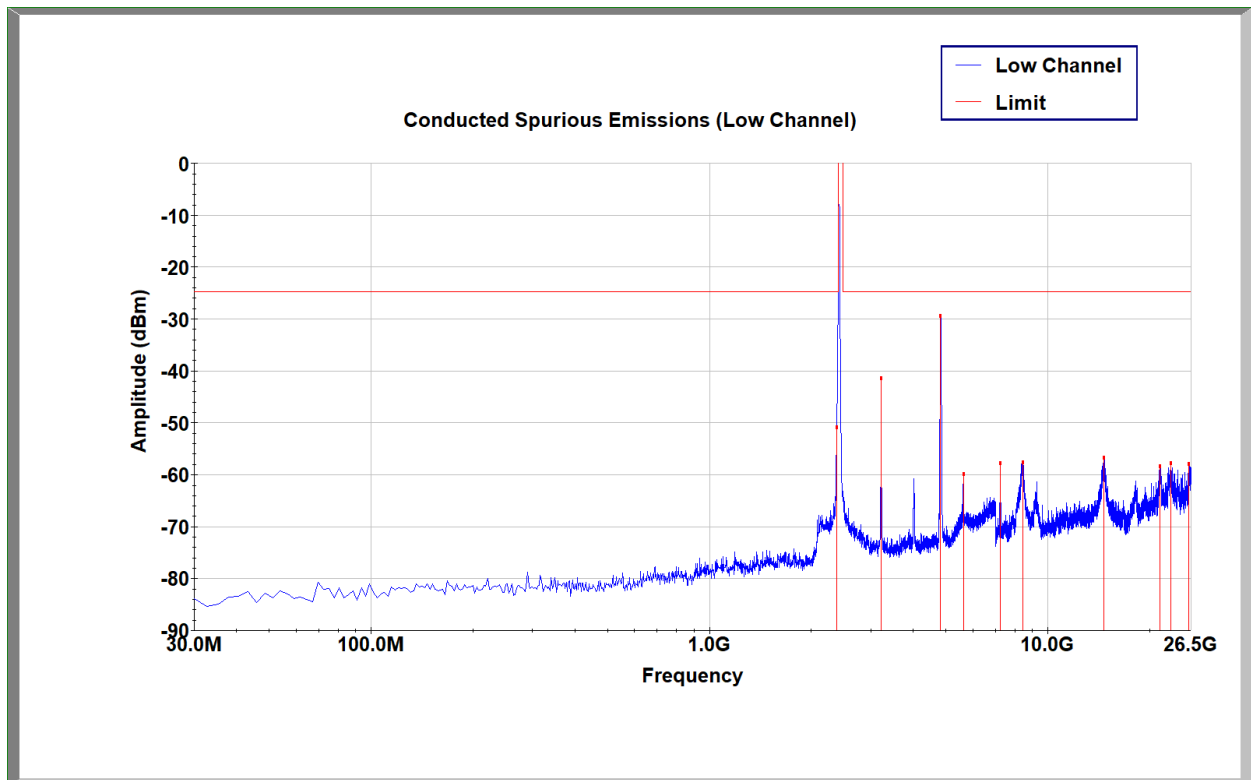
Deviations, Additions, or Exclusions: The output attenuation setting was set to 8 (2dB) for this test.



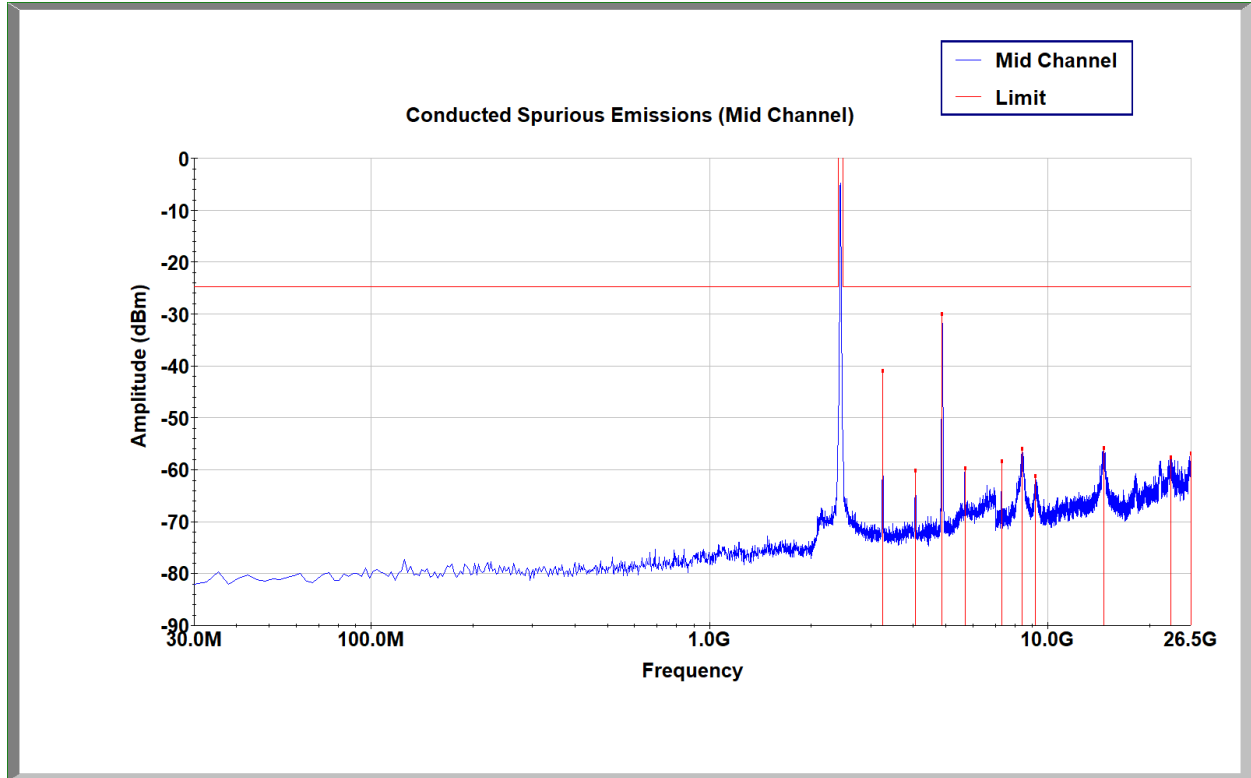
11.6.5 Wi-Fi, 802.11n



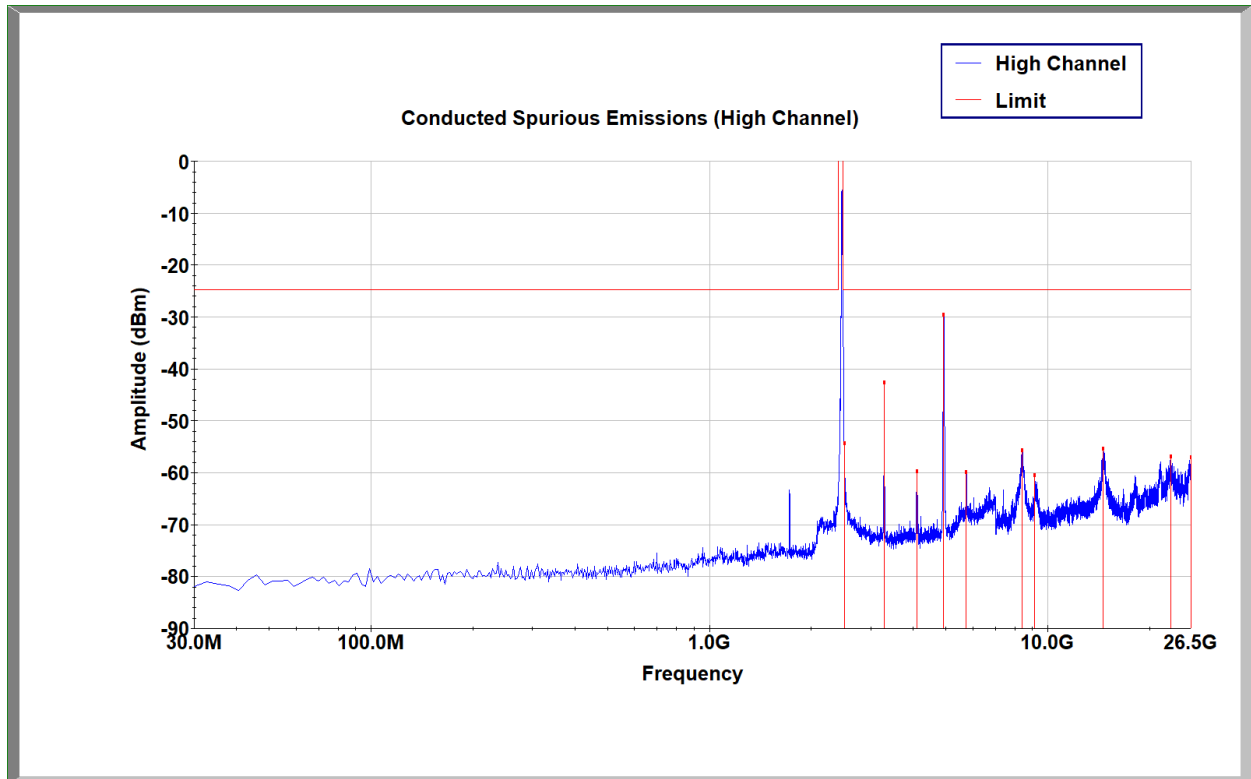
Conducted Spurious Emissions (Band)



Channel 1 (2412MHz) Conducted Spurious Emissions



**Channel 6 (2437MHz) Conducted Spurious Emissions**



**Channel 11 (2462MHz) Conducted Spurious Emissions**

Deviations, Additions, or Exclusions: The output attenuation setting was set to 8 (2dB) for this test.



## 12 Number of Hopping Channels, Channel Separation, and Time of Occupancy

### 12.1 Test Limits

#### FCC Part 15.247(a)(1):

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 system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

#### FCC Part 15.247(a)(1)(iii):

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 may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

#### RSS-247 Issue 2 § 5.1(b):

FHSs 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

#### RSS-247 Issue 2 § 5.1(d):

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

### 12.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013 § 7.8.2, 7.8.3, 7.8.4



### 12.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021

### 12.4 Test Results

The device was found to be **compliant**. The Bluetooth radio used 79 hopping channels separated by 1MHz, greater than 2/3 of the measured 20dB bandwidth of 1.329MHz (see section 9 of this report). The total time of occupancy was 0.198s in a 31.6s period.

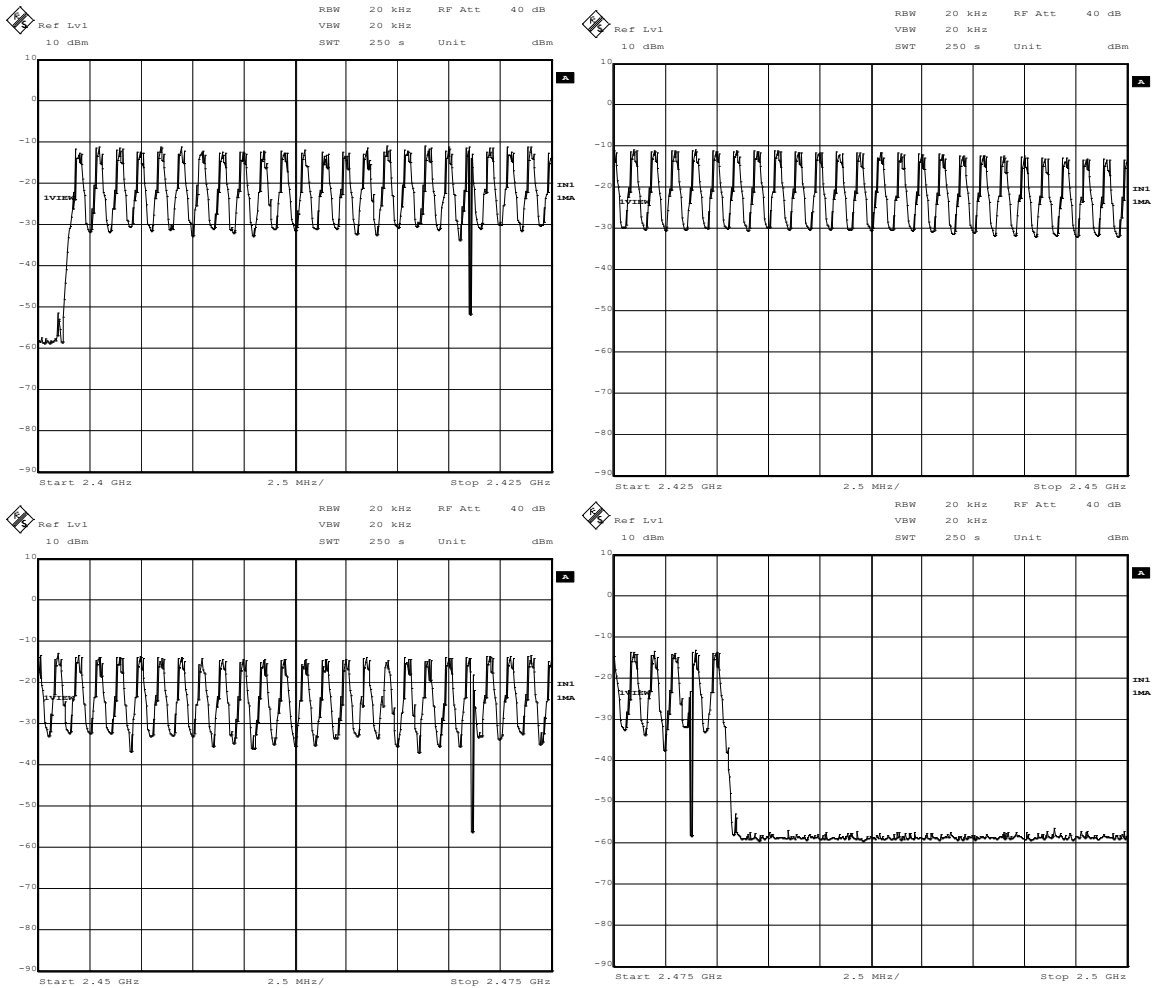
### 12.5 Test Conditions

Test Personnel:	Brandon Norris	Test Date:	3/22/2021
Supervising/Reviewing Engineer:			15.247(a)(1), (1)(iii)
(Where Applicable)	NA	Limit Applied:	RSS-247 Issue 2 § 5.1(b), (d)
	FCC Part 15.247		
Product Standard:	RSS-247 Issue 2	Ambient Temperature:	25.6C
Input Voltage:	Battery	Relative Humidity:	52.2%
Pretest Verification w / Ambient			
Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

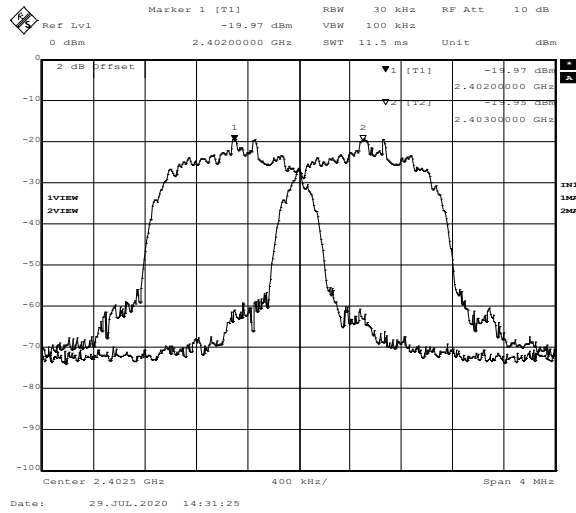




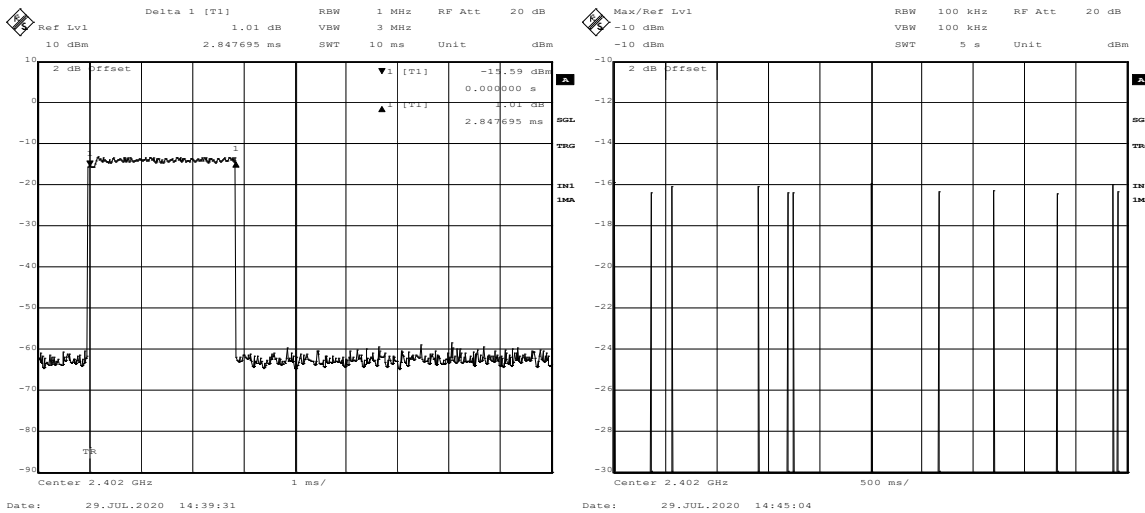
### 12.6 Test Data



Total Number of Hopping Channels Observed = 79



Channel Separation



Time of single occupancy of 2.848ms (left) and 11 occupancies observed in 5s (right)

Period of observation = 0.4s x 79 = 31.6s

Total time of occupancy = 0.002848s x 11 x (31.6s / 5s) = 0.198s

Deviations, Additions, or Exclusions: None



## 13 Antenna Requirement

### 13.1 Test Limits

#### FCC Part 15.203:

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 §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### RSS-Gen Issue 5 § 6.8:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

*This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

### 13.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna.



**14 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	9/4/2020	104038541LEX-001	BN	BCT	Original Issue