

Intertek
731 Enterprise Drive
Lexington, KY 40510

Tel 859 226 1000
Fax 859 226 1040

www.intertek.com

Ethicon Endo-Surgery Inc TEST REPORT

SCOPE OF WORK

EMC TESTING – ECHELON

REPORT NUMBER

104871091LEX-001.2

ISSUE DATE

3/4/2022

REVISION DATE

10/3/2022

PAGES

36

DOCUMENT CONTROL NUMBER

Non-Specific EMC Report Shell Rev. December 2017
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EMC TEST REPORT (FULL COMPLIANCE)

Report Number: 104871091LEX-001.2

Project Number: G104871091

Report Issue Date: 3/4/2022

Report Revised Date: 10/3/2022

Model(s) Tested: ECH300060L

Standards: Title 47 CFR Part 15.247
RSS-247 Issue 2
RSS-Gen Issue 5

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Dr.
Lexington, KY 40510
USA

Client:
Ethicon Endo-Surgery Inc
4545 Creek Rd.
Cincinnati, OH 45242
USA

Report prepared by



Brian Lackey, Team Leader

Report reviewed by



James Sudduth, Senior Staff Engineer

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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	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 5 § 6.8)	Pass

General Notes: The lowest internal operating frequency was 24MHz.



3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Ethicon Endo-Surgery Inc
Address:	4545 Creek Rd. Cincinnati, OH 45242 USA
Contact:	Matt Cowperthwait
Email:	Mcowper1@its.jnj.com
Manufacturer Information	
Manufacturer Name:	Ethicon Endo-Surgery Inc
Manufacturer Address:	4545 Creek Rd. Cincinnati, OH 45242 USA



4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	Echelon™
Model Name	ECH300060L
Serial Number	U95V3Z
Receive Date	1/17/2022
Test Start Date	1/24/2022
Test End Date	2/24/2022
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	12VDC
Frequency Band(s)	2400-2483.5MHz
Modulation Type(s)	GFSK
Test Channel(s)	2402MHz, 2440MHz, 2480MHz
Maximum Antenna Gain (dBi)	0.5dBi (Antenna AMCA31-2R450G-S1F-T3)
Description of Equipment Under Test (provided by client)	
The Ethicon Echelon™ 3000 60mm Staplers - designed to deliver reliable performance across a wide range of tissue types and thicknesses on a one-handed, easy to use platform.	

4.1 Variant Models:

There were no variant models covered by this evaluation.



5 System Setup and Method

5.1 Method:

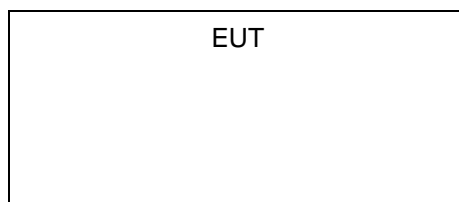
Configuration as required by ANSI C63.4: 2014 and ANSI C63.10:2013

No.	Descriptions of EUT Exercising
1	Transmitting a Bluetooth Low Energy (BLE) signal or low, middle, or high channel
2	Idle, not transmitting. External AC/DC supply used in lieu of battery for testing.

Cables					
Qty	Description	Length (m)	Shielding	Ferrites	Termination

Support Equipment			
Description	Manufacturer	Model Number	Serial Number

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)	U _{CISPR}
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 μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ 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 μ 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 μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ 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	8181	Rohde&Schwarz	ESW44	11/16/2021	11/16/2022
Bilog Antenna (30MHz-1GHz)	3133	ETS	3142C	8/26/2021	8/26/2022
Horn Antenna (1-18GHz)	3780	ETS	3117	6/28/2021	6/28/2022
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			1/13/2022	1/13/2023
Preamplifier	3918	TS-PR18	122005	1/13/2022	1/13/2023
Coaxial Cable	2588			1/13/2022	1/13/2023
Coaxial Cable	2593			1/13/2022	1/13/2023
Coaxial Cable	2592			1/13/2022	1/13/2023
Coaxial Cable	3339			1/13/2022	1/13/2023

6.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

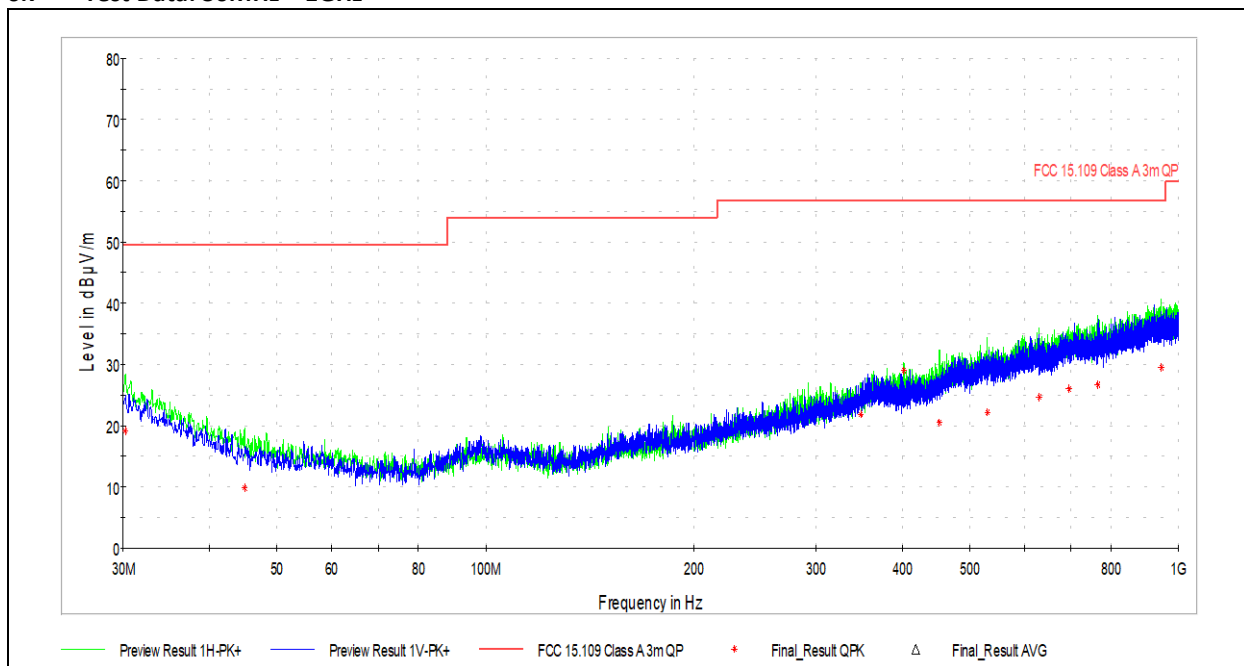
6.5 Test Results

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

6.6 Test Conditions

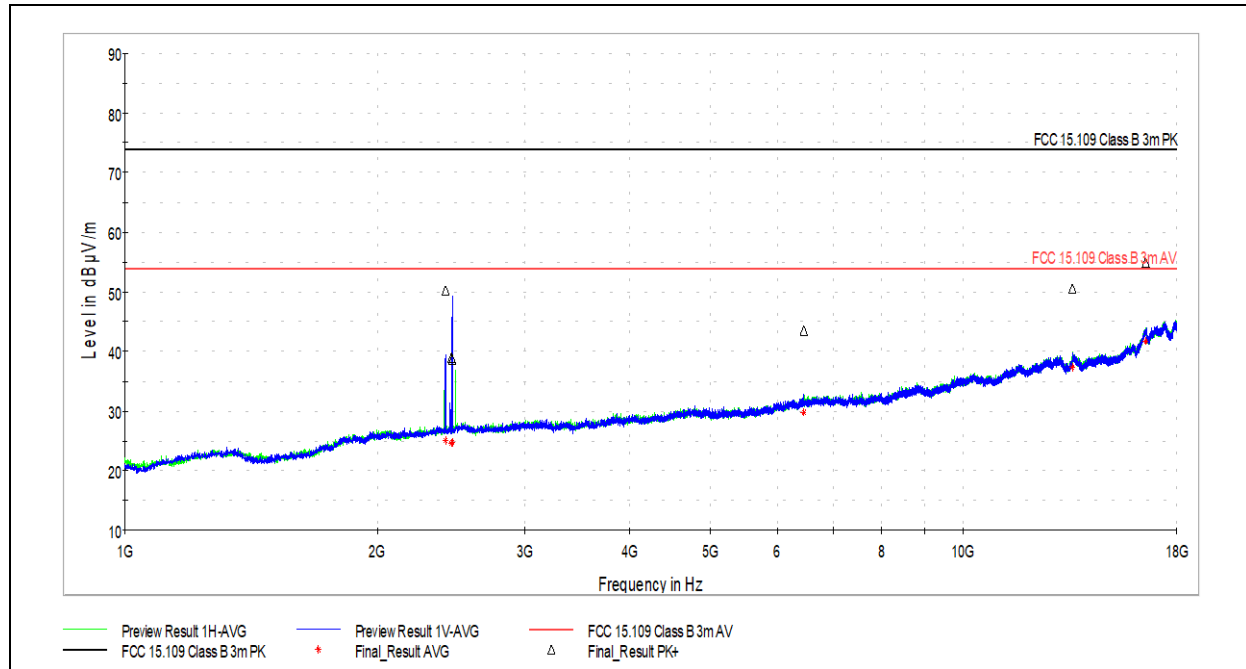
Test Personnel: Brandon Norris
Supervising/Reviewing Engineer:
(Where Applicable) NA
FCC Part 15.247
Product Standard: RSS-247 Issue 2
Input Voltage: 12VDC
Pretest Verification w / Ambient
Signals or BB Source: Yes

Test Date: 1/24/2022
Limit Applied: FCC Part 15.209 /
FCC Part 15.109 Class A
Ambient Temperature: 26.7C
Relative Humidity: 44.2%
Atmospheric Pressure: 982.7mbar

**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/m)
30.215556	19.21	49.54	30.33	120.000	160.0	H	326.0	25
44.873333	9.82	49.54	39.73	120.000	367.0	H	72.0	18
348.537222	21.80	56.90	35.11	120.000	95.0	H	325.0	26
401.995000	29.07	56.90	27.83	120.000	174.0	H	40.0	27
452.435000	20.58	56.90	36.32	120.000	159.0	H	50.0	28
529.819444	22.18	56.90	34.72	120.000	171.0	H	0.0	30
630.376111	24.60	56.90	32.31	120.000	324.0	H	80.0	33
694.557778	26.03	56.90	30.87	120.000	367.0	H	126.0	34
764.290000	26.62	56.90	30.28	120.000	132.0	H	302.0	34
944.979444	29.48	56.90	27.42	120.000	324.0	H	178.0	37

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/m)
2415.000000	50.22	73.979	23.76	1000.000	109.0	V	230.0	4.38
2454.000000	38.96	73.979	35.02	1000.000	100.0	V	118.0	4.50
2457.000000	38.67	73.979	35.31	1000.000	329.0	V	0.0	4.52
6458.500000	43.46	73.979	30.52	1000.000	109.0	V	169.0	11.99
13500.000000	50.63	73.979	23.35	1000.000	100.0	V	24.0	20.97
16541.000000	54.90	73.979	19.08	1000.000	343.0	H	340.0	25.82

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2415.000000	25.05	53.979	28.93	1000.000	109.0	V	230.0	4.38
2454.000000	24.66	53.979	29.32	1000.000	100.0	V	118.0	4.50
2457.000000	24.68	53.979	29.30	1000.000	329.0	V	0.0	4.52
6458.500000	29.80	53.979	24.18	1000.000	109.0	V	169.0	11.99
13500.000000	37.35	53.979	16.63	1000.000	100.0	V	24.0	20.97
16541.000000	41.77	53.979	12.21	1000.000	343.0	H	340.0	25.82

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	8181	Rohde&Schwarz	ESW44	11/16/2021	11/16/2022
Bilog Antenna (30MHz-1GHz)	3133	ETS	3142C	8/26/2021	8/26/2022
Horn Antenna (1-18GHz)	3780	ETS	3117	6/28/2021	6/28/2022
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			1/13/2022	1/13/2023
Preamplifier	3918	TS-PR18	122005	1/13/2022	1/13/2023
Coaxial Cable	2588			1/13/2022	1/13/2023
Coaxial Cable	2593			1/13/2022	1/13/2023
Coaxial Cable	2592			1/13/2022	1/13/2023
Coaxial Cable	3339			1/13/2022	1/13/2023

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.

7.6 Test Conditions

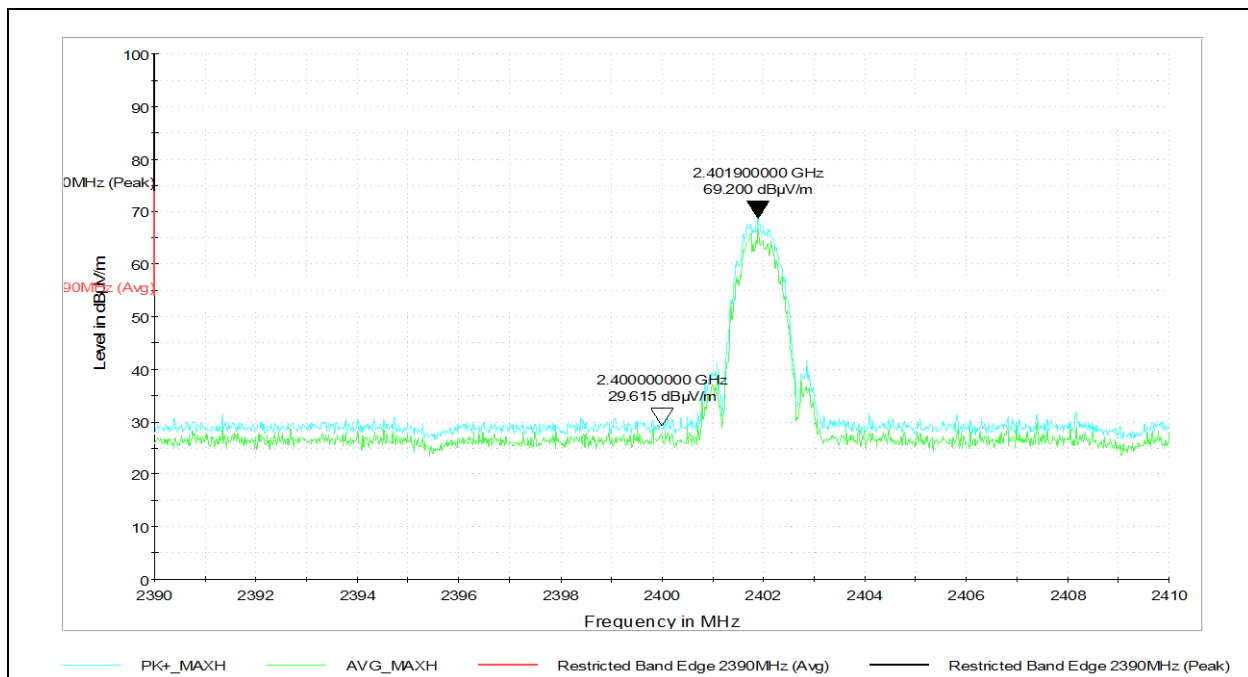
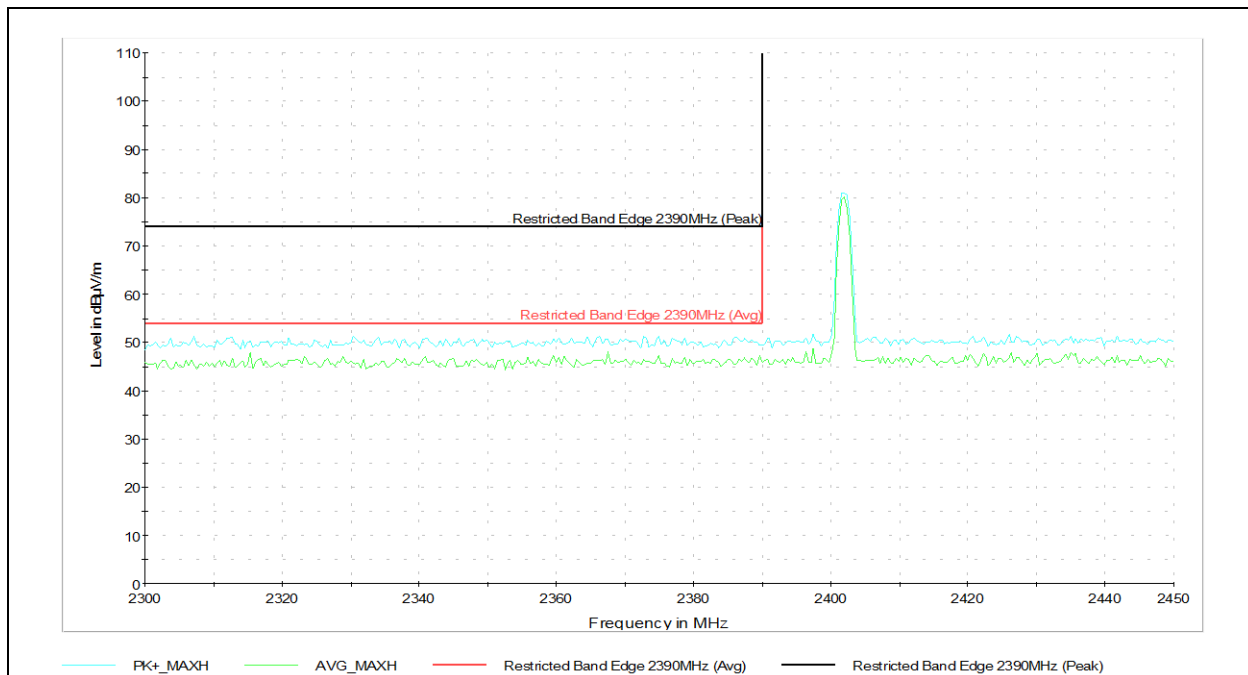
Test Personnel: Brandon Norris
 Supervising/Reviewing Engineer: NA
 (Where Applicable) FCC Part 15.247
 Product Standard: RSS-247 Issue 2
 Input Voltage: 12VDC
 Pretest Verification w / Ambient Signals or BB Source: Yes

Test Date: 2/24/2022
 Limit Applied: FCC Part 15.209 in Restricted Bands from FCC Part 15.205
 Ambient Temperature: 22.4C
 Relative Humidity: 27.2%
 Atmospheric Pressure: 991.4mbar

**7.7 BLE 2402MHz Spurious Emissions:**

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	57.48	73.979	16.50	1000.000	292.0	H	148.0	9.51
12558.000000	50.62	73.979	23.36	1000.000	100.0	H	174.0	20.76
15713.500000	53.14	73.979	20.84	1000.000	410.0	V	0.0	23.65
17922.000000	56.62	73.979	17.36	1000.000	100.0	H	-1.0	27.89

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	51.81	53.979	2.17	1000.000	292.0	H	148.0	9.51
12558.000000	37.16	53.979	16.82	1000.000	100.0	H	174.0	20.76
15713.500000	39.51	53.979	14.47	1000.000	410.0	V	0.0	23.65
17922.000000	43.28	53.979	10.70	1000.000	100.0	H	-1.0	27.89

**7.8 BLE 2402MHz Band Edge:**

**7.9 BLE 2440MHz Spurious Emissions:**

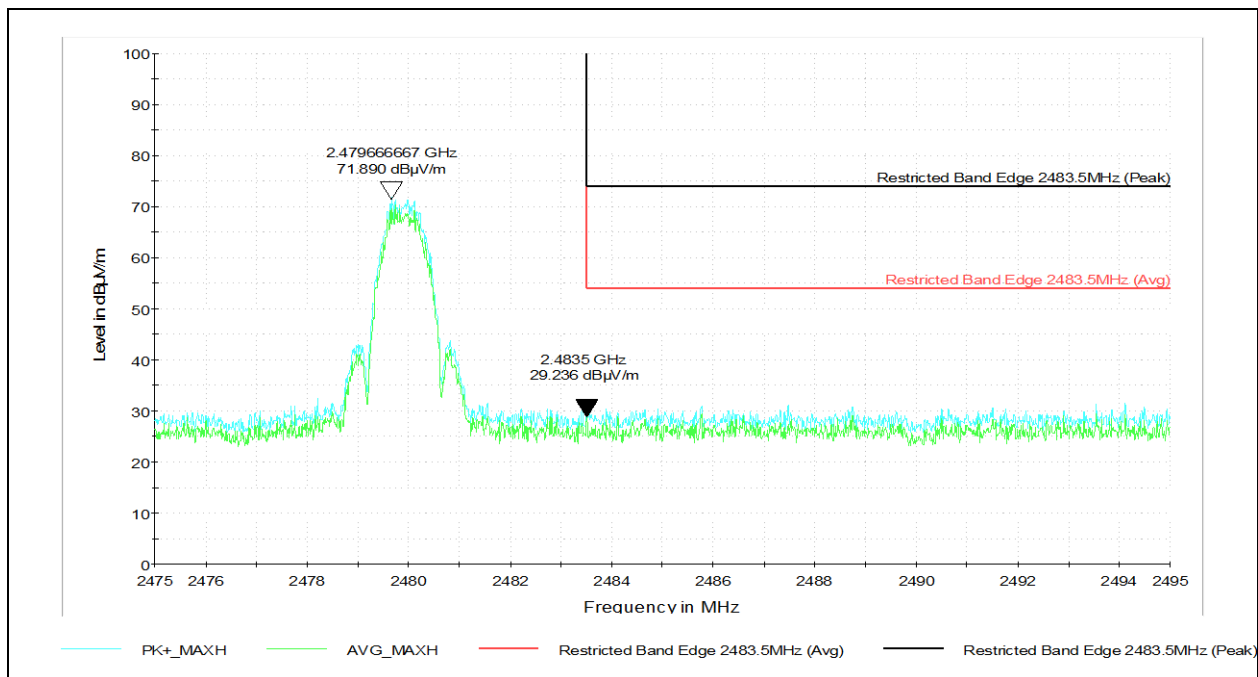
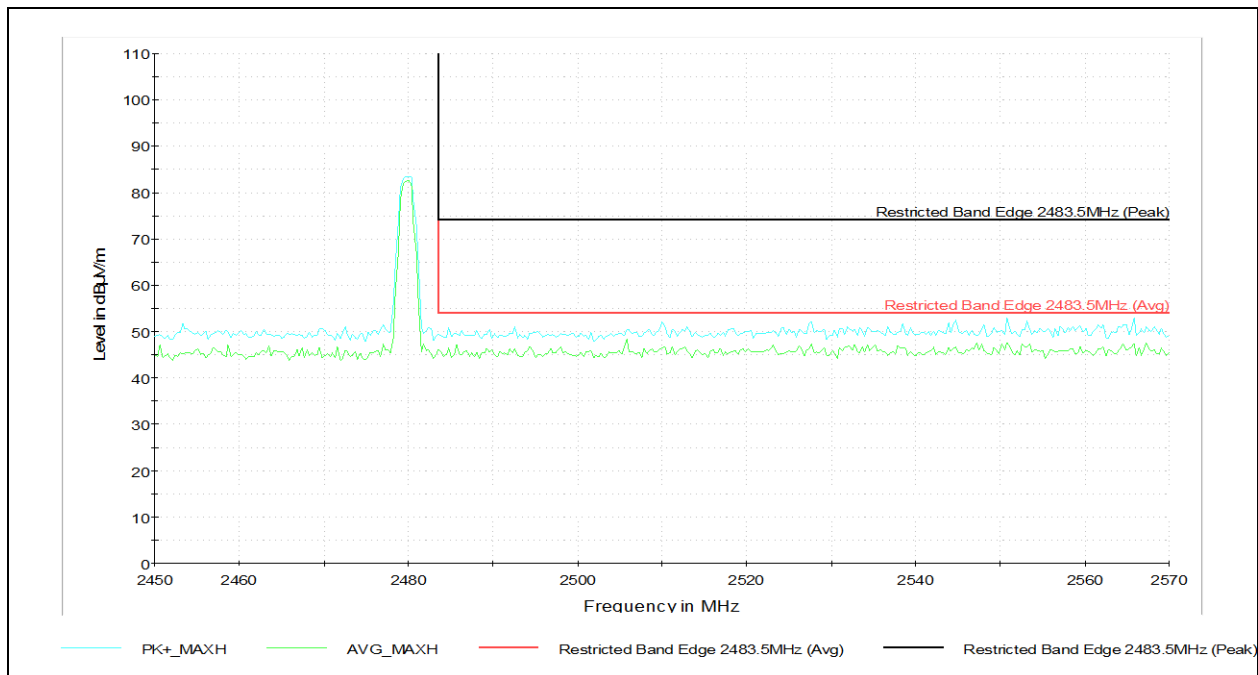
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4871.500000	57.44	73.979	16.54	1000.000	100.0	H	191.0	9.41
7307.000000	52.40	73.979	21.58	1000.000	249.0	V	149.0	12.58
15897.500000	52.78	73.979	21.20	1000.000	410.0	H	299.0	24.05
17935.500000	56.68	73.979	17.30	1000.000	100.0	H	0.0	27.96

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4871.500000	51.99	53.979	1.99	1000.000	100.0	H	191.0	9.41
7307.000000	43.35	53.979	10.63	1000.000	249.0	V	149.0	12.58
15897.500000	39.27	53.979	14.71	1000.000	410.0	H	299.0	24.05
17935.500000	43.41	53.979	10.57	1000.000	100.0	H	0.0	27.96

**7.10 BLE 2480MHz Spurious Emissions:**

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.000000	55.37	73.979	18.61	1000.000	100.0	H	79.0	9.29
7440.500000	52.38	73.979	21.60	1000.000	287.0	V	173.0	12.65
12249.500000	49.11	73.979	24.87	1000.000	100.0	H	0.0	20.34
15990.000000	52.70	73.979	21.28	1000.000	100.0	H	0.0	24.28
17946.500000	56.58	73.979	17.40	1000.000	100.0	H	60.0	28.02

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.000000	50.36	53.979	3.62	1000.000	100.0	H	79.0	9.29
7440.500000	43.25	53.979	10.73	1000.000	287.0	V	173.0	12.65
12249.500000	36.11	53.979	17.87	1000.000	100.0	H	0.0	20.34
15990.000000	39.38	53.979	14.60	1000.000	100.0	H	0.0	24.28
17946.500000	43.36	53.979	10.62	1000.000	100.0	H	60.0	28.02

**7.11 BLE 2480MHz Band Edge:**

**7.12 Spurious Emissions, 30MHz-1GHz:**

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
170.165000	29.70	43.52	13.82	120.000	175.0	H	188.0	18
173.075000	30.71	43.52	12.81	120.000	174.0	H	-1.0	18
400.593889	34.08	46.02	11.94	120.000	211.0	V	83.0	26
401.617778	32.00	46.02	14.02	120.000	199.0	V	72.0	26
402.641667	29.95	46.02	16.08	120.000	196.0	V	62.0	26
403.611667	31.69	46.02	14.34	120.000	196.0	V	102.0	26
404.527778	33.16	46.02	12.86	120.000	196.0	V	83.0	26
408.461667	30.92	46.02	15.10	120.000	212.0	V	82.0	26
409.377778	33.35	46.02	12.67	120.000	194.0	V	83.0	26
611.137778	24.62	46.02	21.40	120.000	113.0	H	302.0	33

Note: results shown represent the worst case of three channels under test

7.13 Spurious Emissions, 18GHz-40GHz:

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
24073.000000	54.65	73.98	19.33	1000.000	126.0	V	216.0	6
33055.500000	57.55	73.98	16.43	1000.000	362.0	V	103.0	11

Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
24073.000000	40.79	53.98	13.19	1000.000	126.0	V	216.0	6
33055.500000	43.73	53.98	10.25	1000.000	362.0	V	103.0	11

Note: results shown represent the worst case of three channels under test.



8 Output Power

8.1 Test Limits

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(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 § 11.9.1.1

8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Power Meter	6111	Rhode & Schwarz	NRP Z-81	09/17/2021	09/17/2022

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:	2/22/2022
Supervising/Reviewing Engineer:		Limit Applied:	See Above
(Where Applicable)	NA		
	FCC Part 15.247		
Product Standard:	RSS-247 Issue 2	Ambient Temperature:	25.6C
Input Voltage:	120V/60Hz to AC/DC supply	Relative Humidity:	52.2%
Pretest Verification w / Ambient			
Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

8.6 Test Data

Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Result
2402	-1.40	30	Pass
2440	-1.54	30	Pass
2480	-2.33	30	Pass

Deviations, Additions, or Exclusions: None



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 § 11.8.1.

9.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3727	Rohde & Schwarz	FSQ	9/17/2021	9/16/2022

9.4 Test Results

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

9.5 Test Conditions

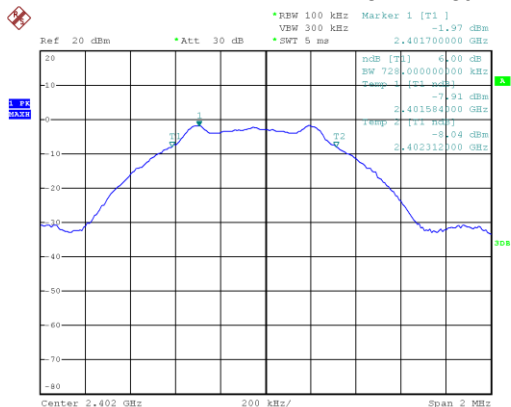
Test Personnel:	Brandon Norris	Test Date:	2/22/2022- 3/4/2022
Supervising/Reviewing Engineer:			
(Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.247	Ambient Temperature:	25.6C
Input Voltage:	RSS-247 Issue 2	Relative Humidity:	52.2%
Pretest Verification w / Ambient	120V/60Hz to AC/DC supply		
Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

9.6 Test Data

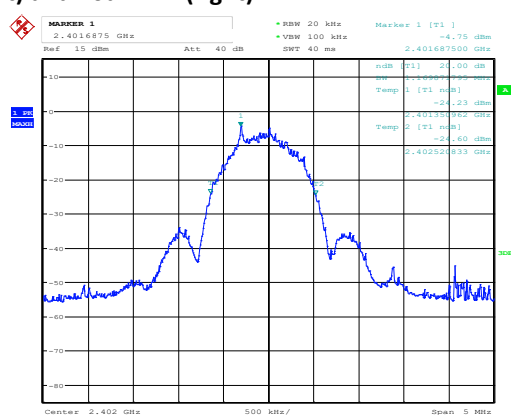
Frequency (MHz)	6dB BW (kHz)	20dB BW (kHz)	99% BW (kHz)
2402	728.0	1169.9	1065.7
2440	736.0	1200.0	1080.0
2480	736.0	1200.0	1073.7



2402MHz 6dB BW (left) and 20dB BW (right)

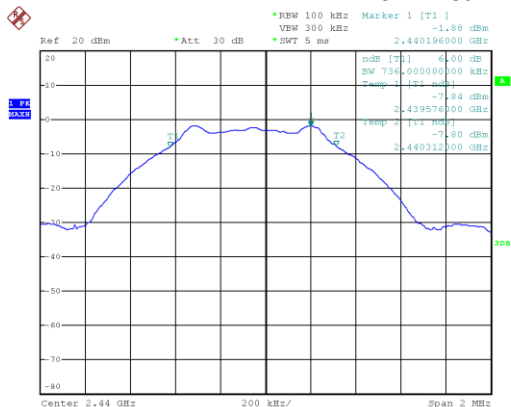


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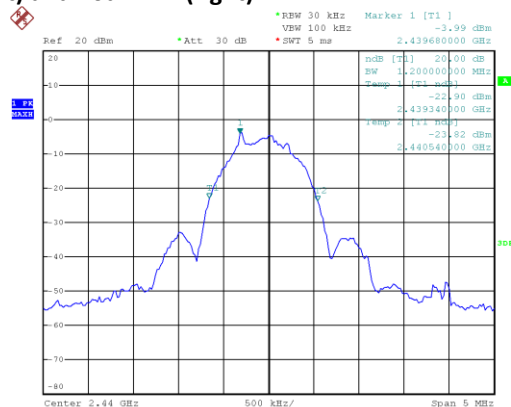


Date: 23.FEB.2022 11:18:02

2440MHz 6dB BW (left) and 20dB BW (right)

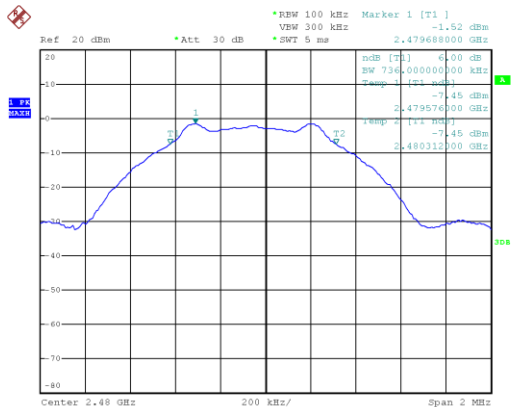


Date: 4.MAR.2022 09:24:43

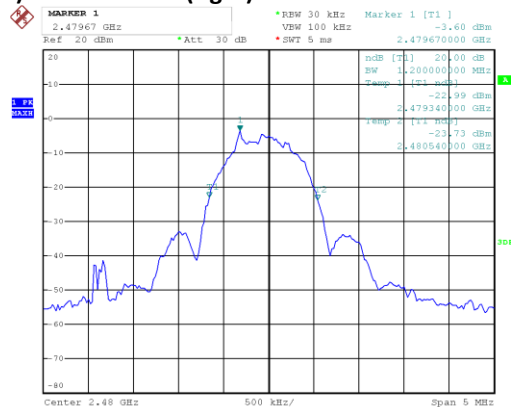


Date: 4.MAR.2022 10:03:31

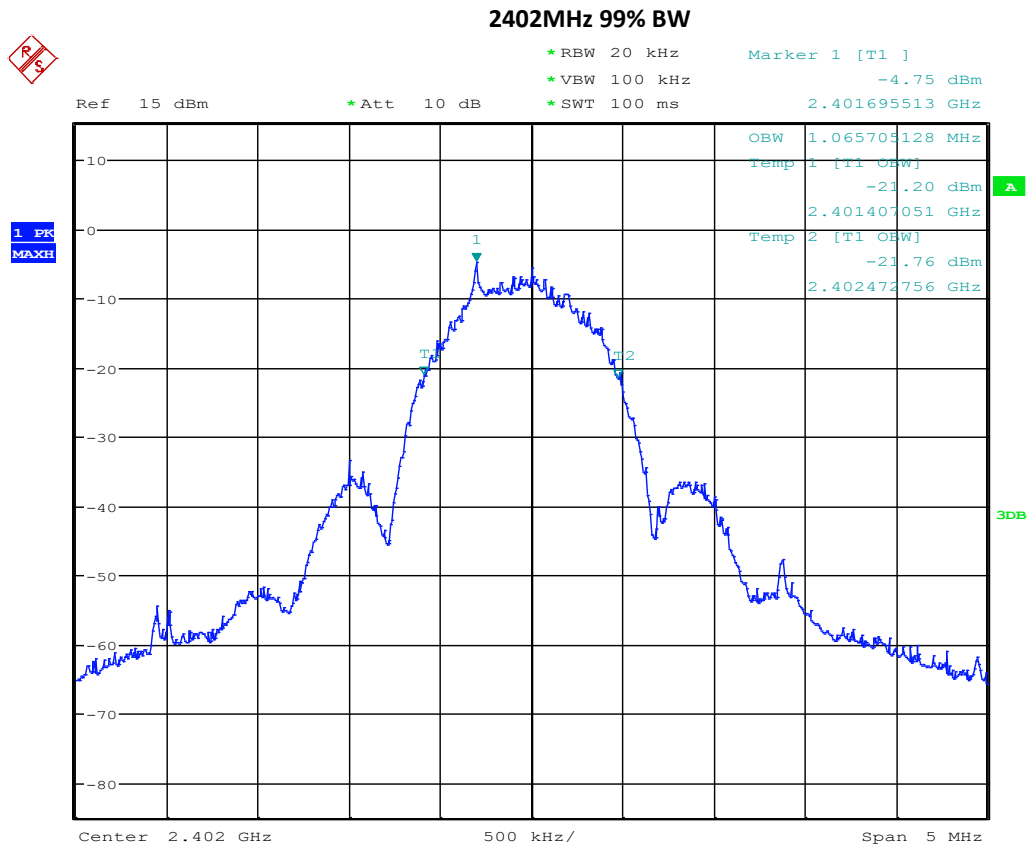
2480MHz 6dB BW (left) and 20dB BW (right)



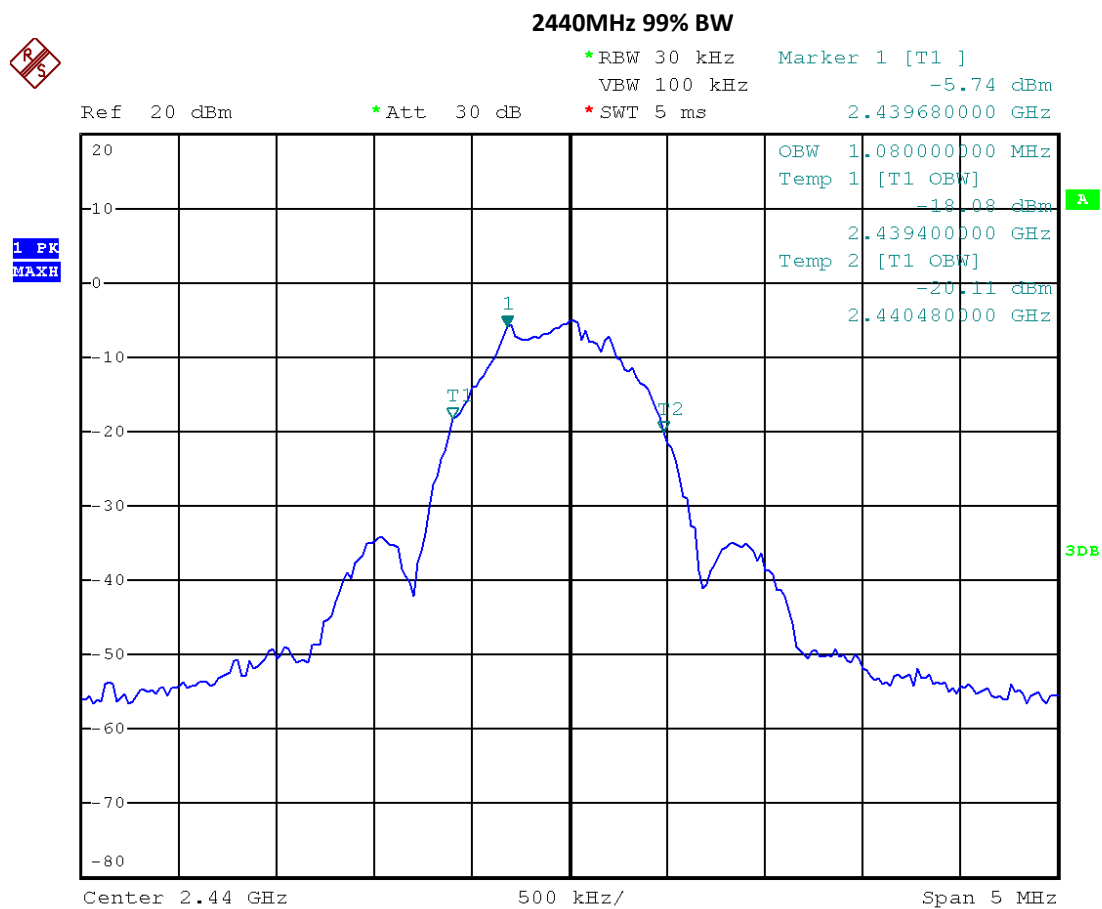
Date: 4.MAR.2022 09:26:43



Date: 4.MAR.2022 10:10:33



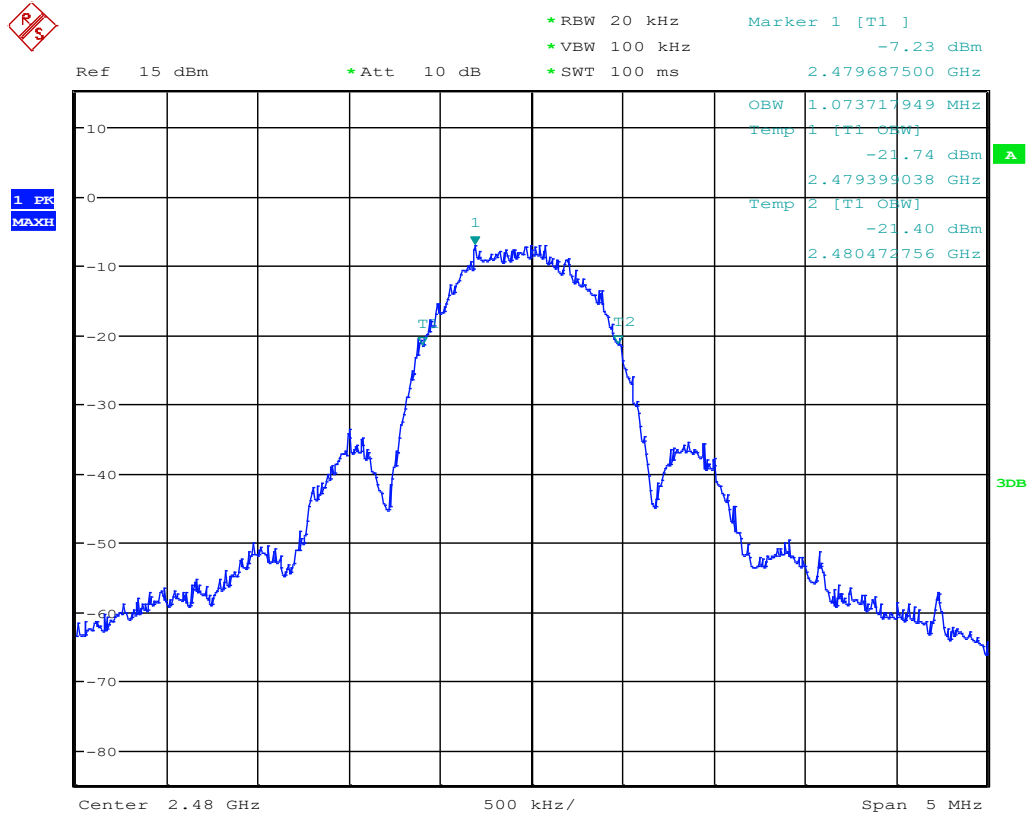
Date: 22.FEB.2022 11:46:43



Date: 4.MAR.2022 10:08:35



2480MHz 99% BW



Date: 22.FEB.2022 12:18:15

Deviations, Additions, or Exclusions: None



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	8181	Rohde & Schwarz	ESW44	11/16/2021	11/16/2022

10.4 Test Results

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

10.5 Test Conditions

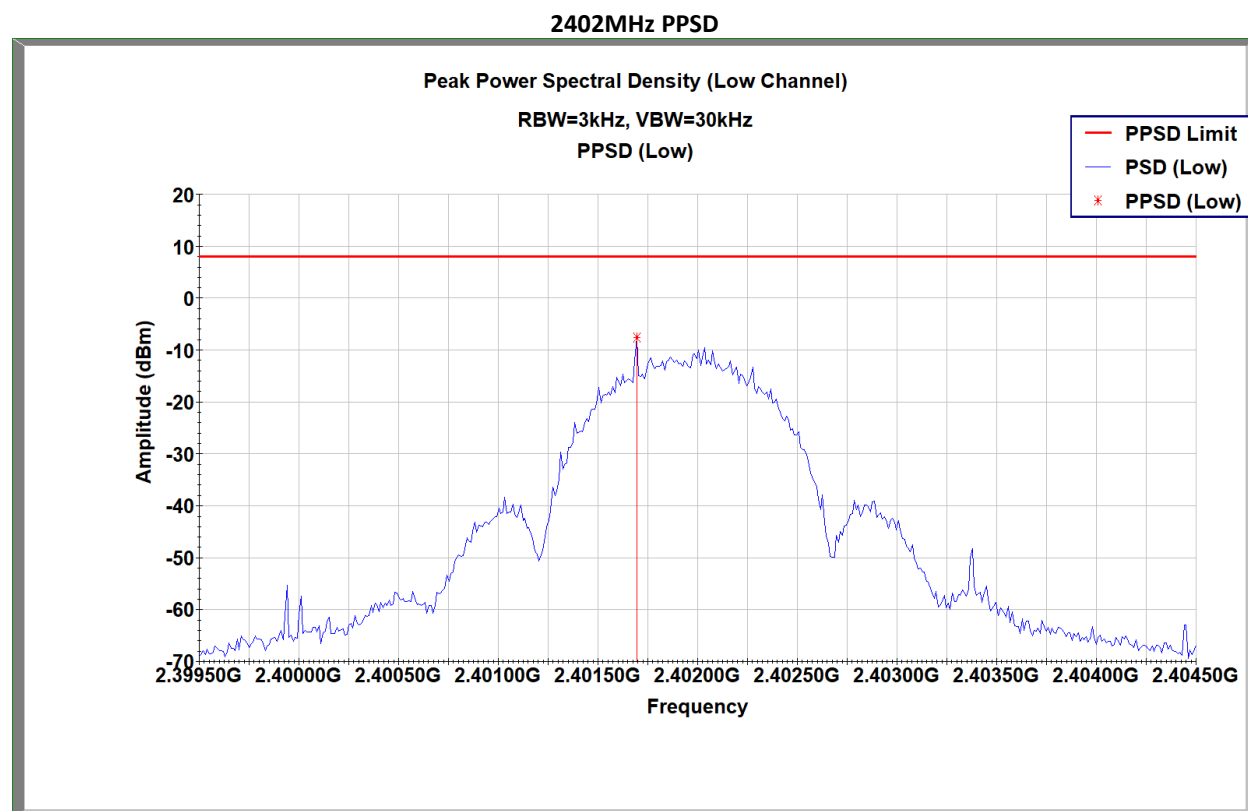
Test Personnel:	Brandon Norris	Test Date:	2/25/2022
Supervising/Reviewing Engineer:		Limit Applied:	See Above
(Where Applicable)	NA	Ambient Temperature:	25.6C
Product Standard:	FCC Part 15.247	Relative Humidity:	52.2%
Input Voltage:	RSS-247 Issue 2	Atmospheric Pressure:	985.4mbar
Pretest Verification w / Ambient	Battery		
Signals or BB Source:	Yes		

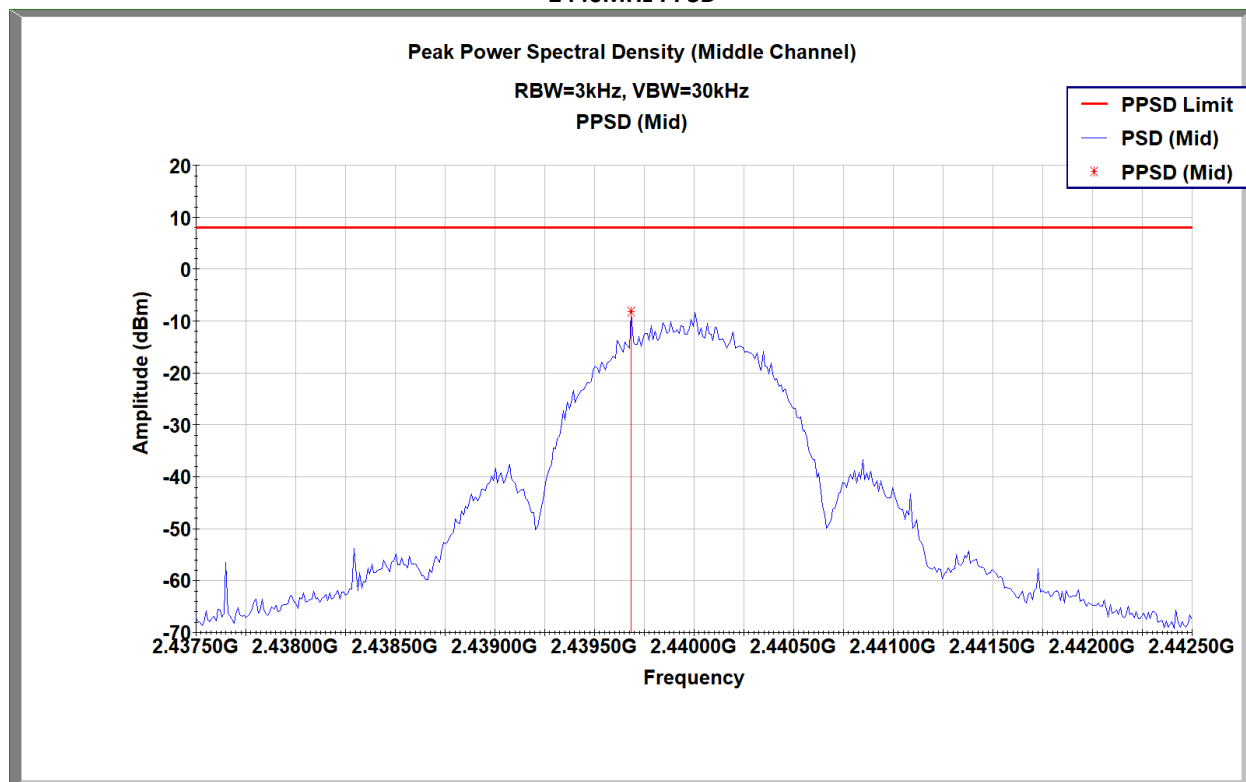
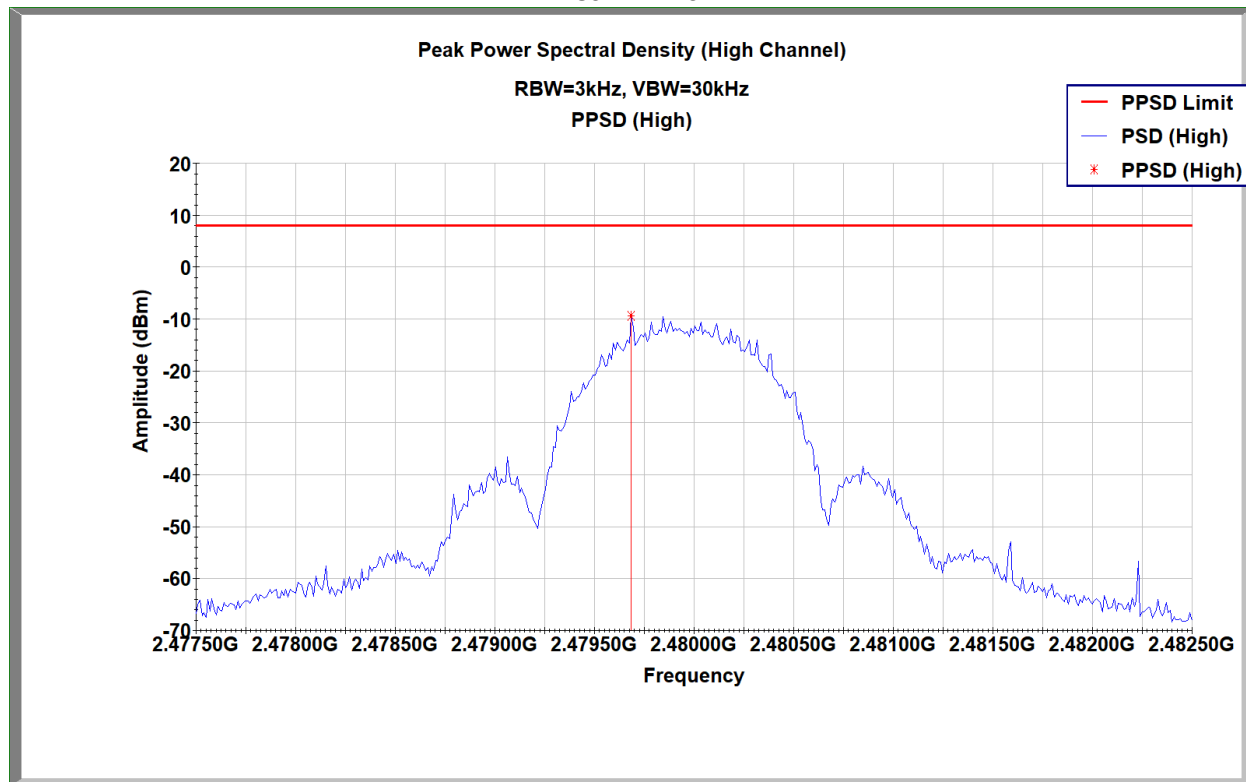


10.6 Test Data

Frequency (MHz)	RBW (kHz)	PPSD (dBm)	Limit (dBm)	Result
2402	3	-7.664	8	Pass
2440	3	-8.137	8	Pass
2480	3	-9.349	8	Pass

Deviations, Additions, or Exclusions: None.



**2440MHz PPSPD****2480MHz PPSPD**



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 § 11.11 Emissions in nonrestricted frequency bands.

11.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	8181	Rohde & Schwarz	ESW44	11/16/2021	11/16/2022

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.

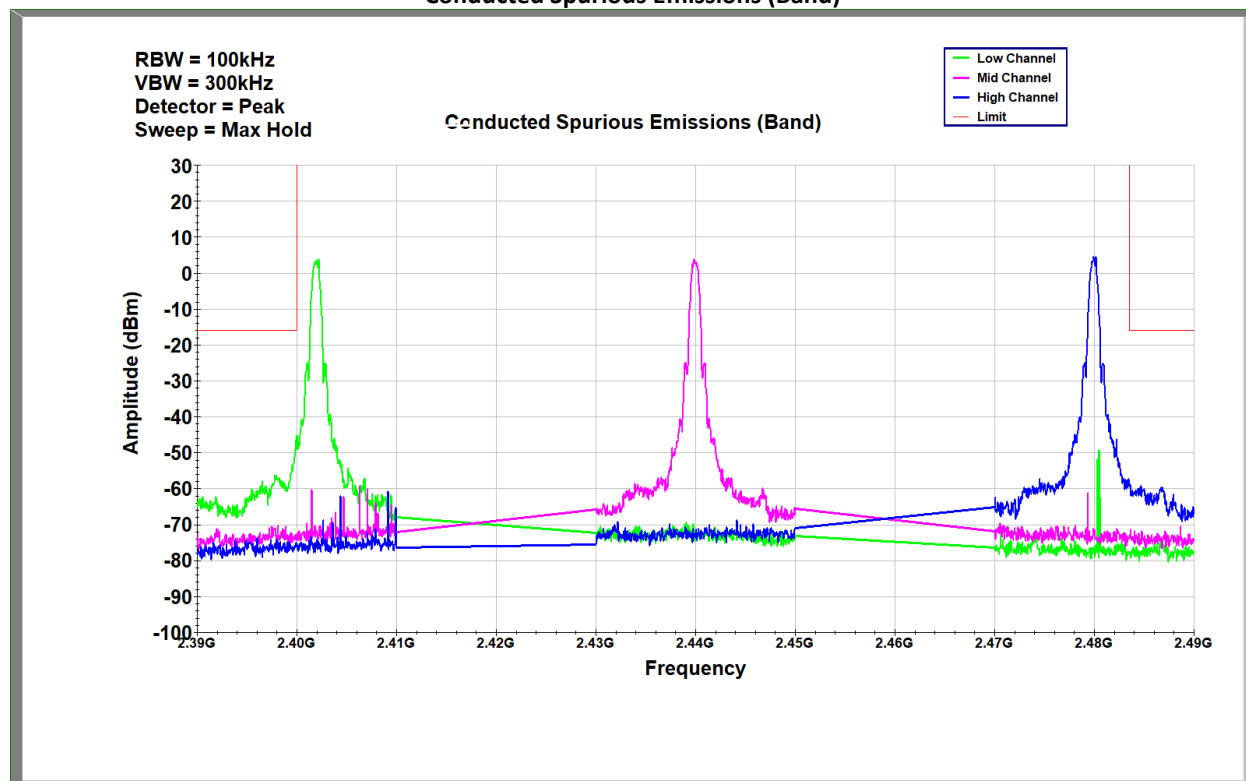
11.5 Test Conditions

Test Personnel:	Brandon Norris	Test Date:	2/24/2022
Supervising/Reviewing Engineer:		Limit Applied:	See Above
(Where Applicable)	NA		
Product Standard:	FCC Part 15.247	Ambient Temperature:	22.4C
Input Voltage:	RSS-247 Issue 2	Relative Humidity:	27.2%
Pretest Verification w / Ambient	Battery 12VDC		
Signals or BB Source:	Yes	Atmospheric Pressure:	991.4mbar



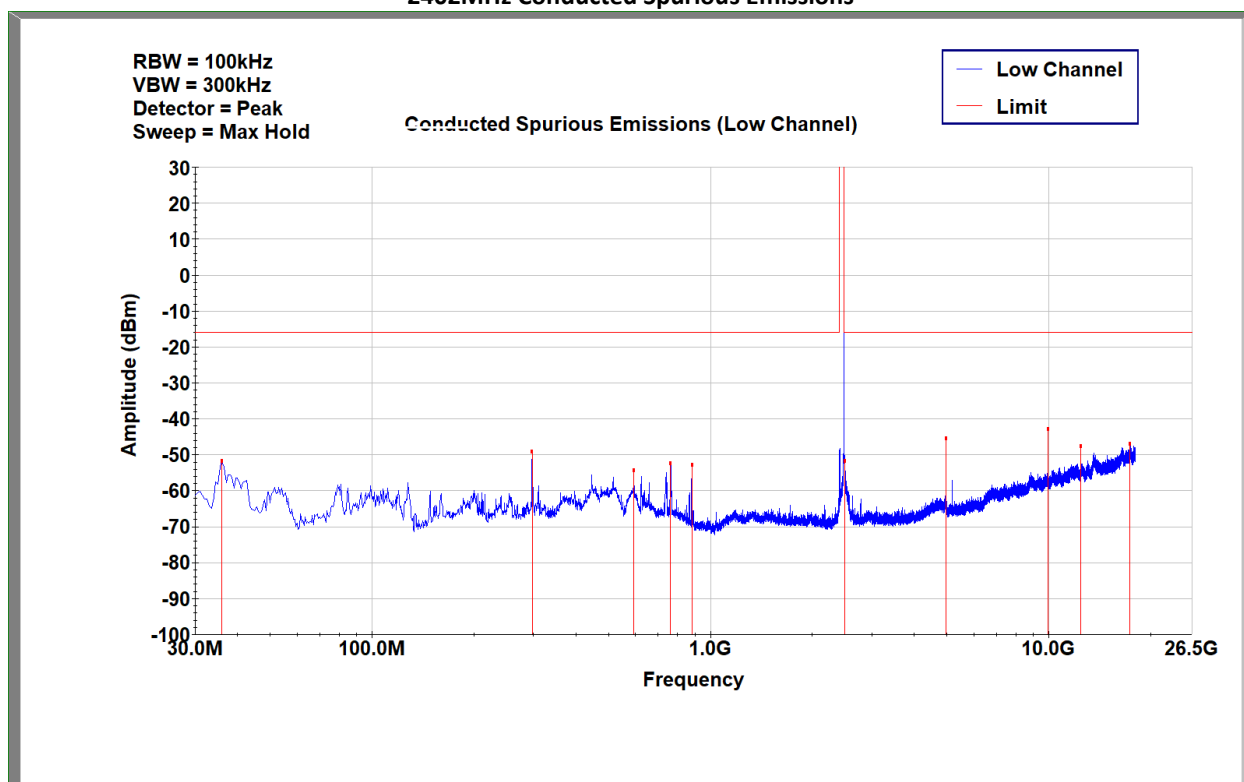
11.6 Test Data

Conducted Spurious Emissions (Band)

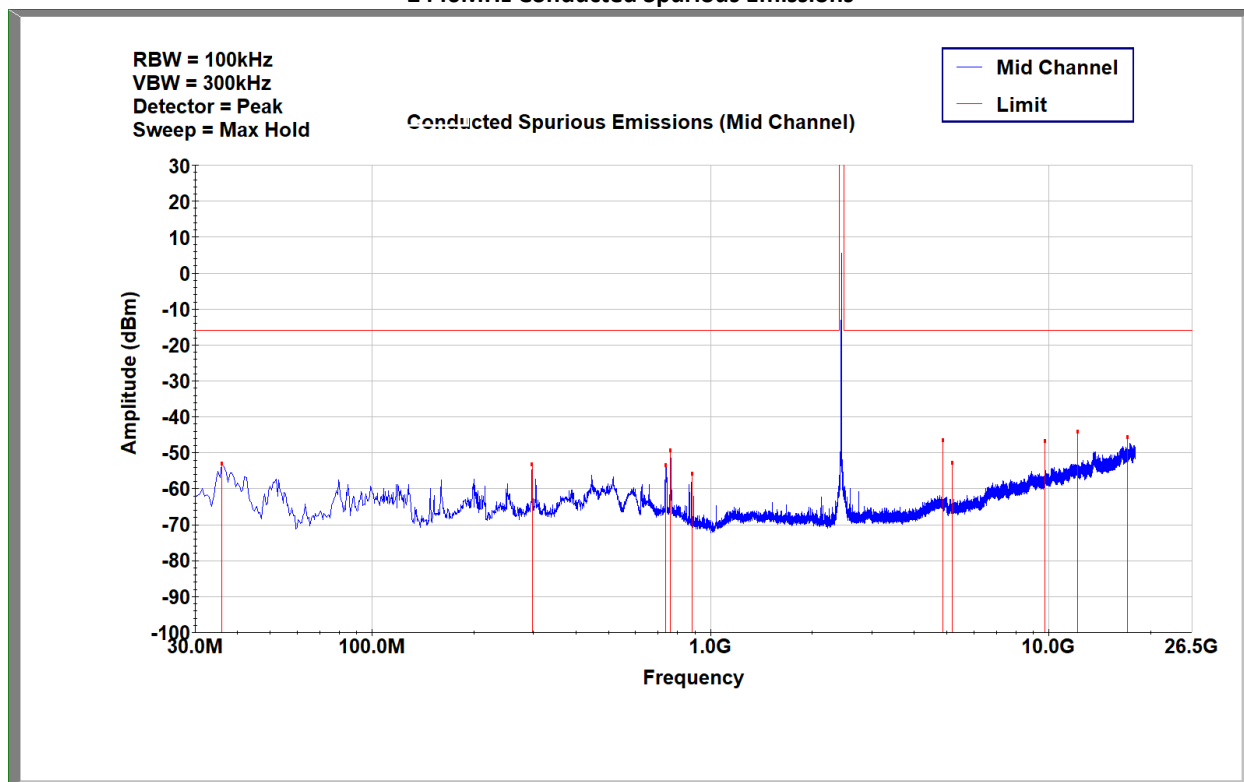




2402MHz Conducted Spurious Emissions

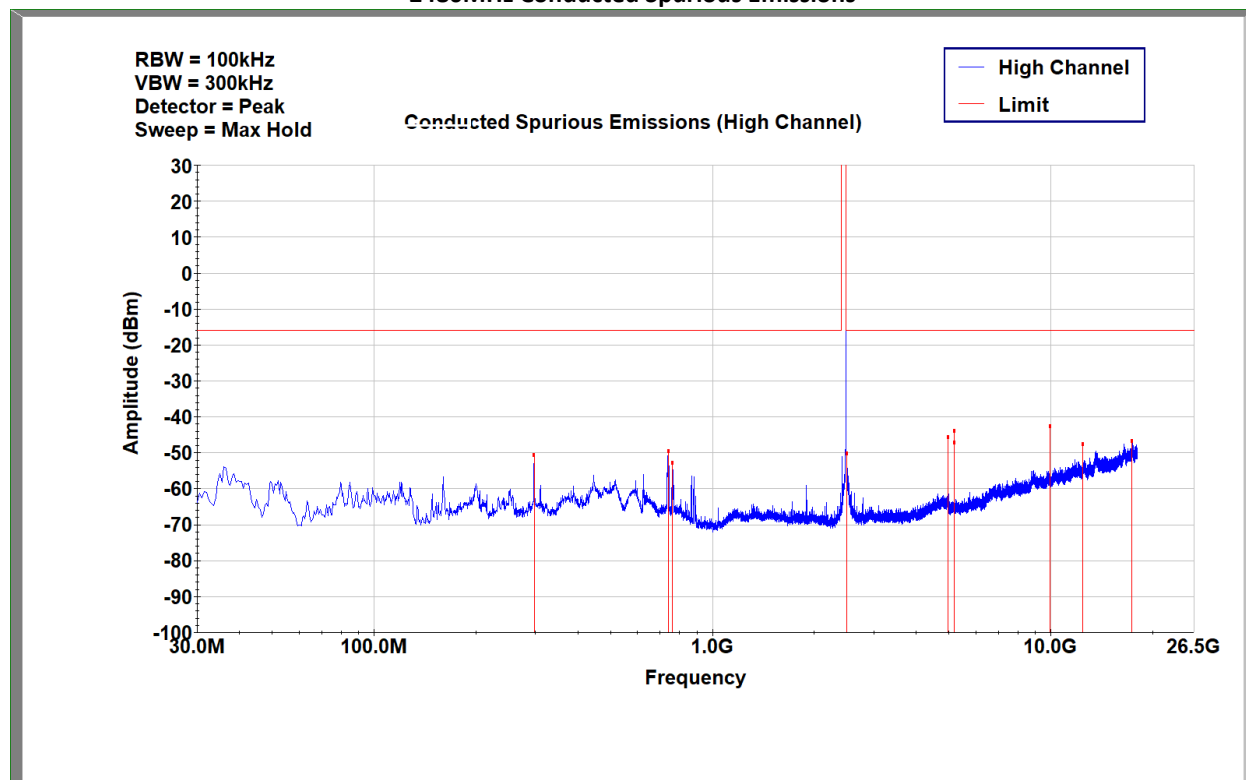


2440MHz Conducted Spurious Emissions





2480MHz Conducted Spurious Emissions





12 Antenna Requirement

12.1 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).

12.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna. The antenna used is AMCA31-2R450G-S1F-T3.

**13 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	3/4/2022	104871091LEX-001	BN	BZ	Original Issue
1	3/30/2022	104871091LEX-001.1	BN	BZ	Included the Model in the report also included antenna gain
2	10/3/2022	104871091LEX-001.2	BZ	JTS	Updated per TCB Reviewer feedback