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Zerv, Inc.
TEST REPORT

SCOPE OF WORK
EMC TESTING – ZERVERB

REPORT NUMBER
104685025LEX-001.2

ISSUE DATE **REVISED DATE**
8/23/2021 10/12/2021

PAGES
55

DOCUMENT CONTROL NUMBER
Non-Specific EMC Report Shell Rev. December 2017

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 104685025LEX-001.2
Project Number: G104685025

Report Issue Date: 8/23/2021
Report Revised Date: 10/12/2021

Model(s) Tested: ZerverB

Standards: FCC Part 15 Subpart B
FCC Part 15.247
ICES-003 Issue 7
RSS-247 Issue 2

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

Client:
Zerv, Inc.
965 W Chicago Ave.
Chicago, IL 60642
USA

Report prepared by

Brian Lackey, Staff Engineer

Report reviewed by

Bryan Taylor, Team Leader

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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	FCC Reference	ISED Reference	Result
6	Radiated Emissions (ANSI C63.4:2014)	FCC Part 15.109	ICES-003 Issue 7 § 3.2.2	Pass
7	Occupied Bandwidth (ANSI C63.10:2020 § 6.9, 11.8)	FCC Part 15.247(a)(2)	RSS-247 Issue 2 § 5.2(a)	Pass
8	Output Power (ANSI C63.10:2020 § 11.9.1.1, 11.9.2.2.2)	FCC Part 15.247(b)(3)	RSS-247 Issue 2 § 5.4(d)	Pass
9	Power Spectral Density (ANSI C63.10:2020 § 11.10.3)	FCC Part 15.247(e)	RSS-247 Issue 2 § 5.2(b)	Pass
10	Unwanted Emissions in the Spurious Domain (ANSI C63.10:2020 § 6.10, 11.11, 11.12)	FCC Part 15.247(d), 15.209	RSS-247 Issue 2 § 5.5 RSS-Gen Issue 5 §8.9	Pass
11	Antenna Requirement	FCC Part 15.203	RSS-Gen Issue 5 § 6.8	Pass
-	Conducted Emissions (ANSI C63.4:2014)	FCC Part 15.107, 15.207	ICES-003 Issue 7 § 3.2.1 RSS-Gen Issue 5 § 8.8	NA[1]

[1] The test was not applicable since the ZerverB does not connect directly or indirectly to AC mains.

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Zerv, Inc.
Address:	965 W Chicago Ave. Chicago, IL 60642 USA
Contact:	Frank Annerino
Telephone:	+1 (847) 302-2906
Email:	Frank.annerino@zervinc.com
Manufacturer Information	
Manufacturer Name:	Zerv, Inc.
Manufacturer Address:	965 W Chicago Ave. Chicago, IL 60642 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	ZerverB
Model Number	Zerv0001
Serial Number	06472B78-DB4C0D42
Receive Date	7/27/2021
Test Start Date	7/27/2021
Test End Date	8/18/2021
Device Received Condition	Good
Test Sample Type	Production
Input Rating	5-24VDC 50mA
Software Used By EUT	V0.0.0.21
Embedded Modules	LoRa: Semtech Corporation SX1262IMLTRT BLE: Nordic Semi NRF52840-QIAA-R
Antennas Used by the EUT (provided by client)	LoRa: Yageo ANTX150P118B09153, 1.9dBi gain BLE External Antenna: Yageo ANTX100P001B24003, 4.4dBi gain BLE Internal Antenna: Johanson Technology Inc 2450AT18B100E, 0.5dBi gain
Test Channels	LoRa: 903.0MHz, 908.5MHz, 914.9MHz BLE: 2402MHz, 2440MHz, 2480MHz

Description of Equipment Under Test (provided by client)
The Zerver B is an access control device that allows users to utilize their mobile phones, via Bluetooth, to enter secured doors that are controlled by an RFID reader.

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 System Setup and Method

5.1 Method:

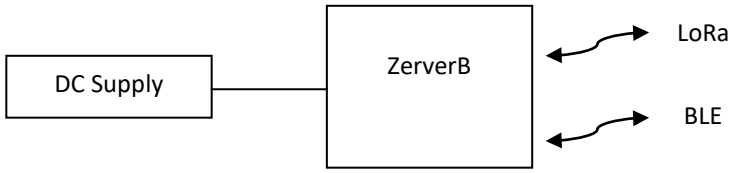
Configuration as required by ANSI C63.4:2014 and ANSI C63.10:2020

No.	Descriptions of EUT Exercising
1	The EUT was powered by 12VDC. Both radios were idle.
2	The EUT was powered by 12VDC. The LoRa radio was configured to transmit on a low, middle, or high channel. The BLE radio was idle.
3	The EUT was powered by 12VDC. The BLE radio was configured to transmit on a low, middle, or high channel. The LoRa radio was idle.

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
1	UART	0.2	No	No	Header
2	DC Supply	0.2	No	No	DC Supply

Support Equipment			
Description	Manufacturer	Model Number	Serial Number

5.2 EUT Block Diagram:



6 Radiated Emissions

6.1 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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
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 dBμV 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 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/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	4001	ETS	3117	1/26/2021	1/26/2022
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			12/21/2020	12/21/2021
Preamplifier	3918	Rohde & Schwarz	TS-PR18	12/21/2020	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	7019	Rohde & Schwarz	TS-PR3	12/21/2020	12/21/2021
Coaxial Cable	3172			12/21/2020	12/21/2021
Coaxial Cable	2590			12/21/2020	12/21/2021
Coaxial Cable	2589			12/21/2020	12/21/2021

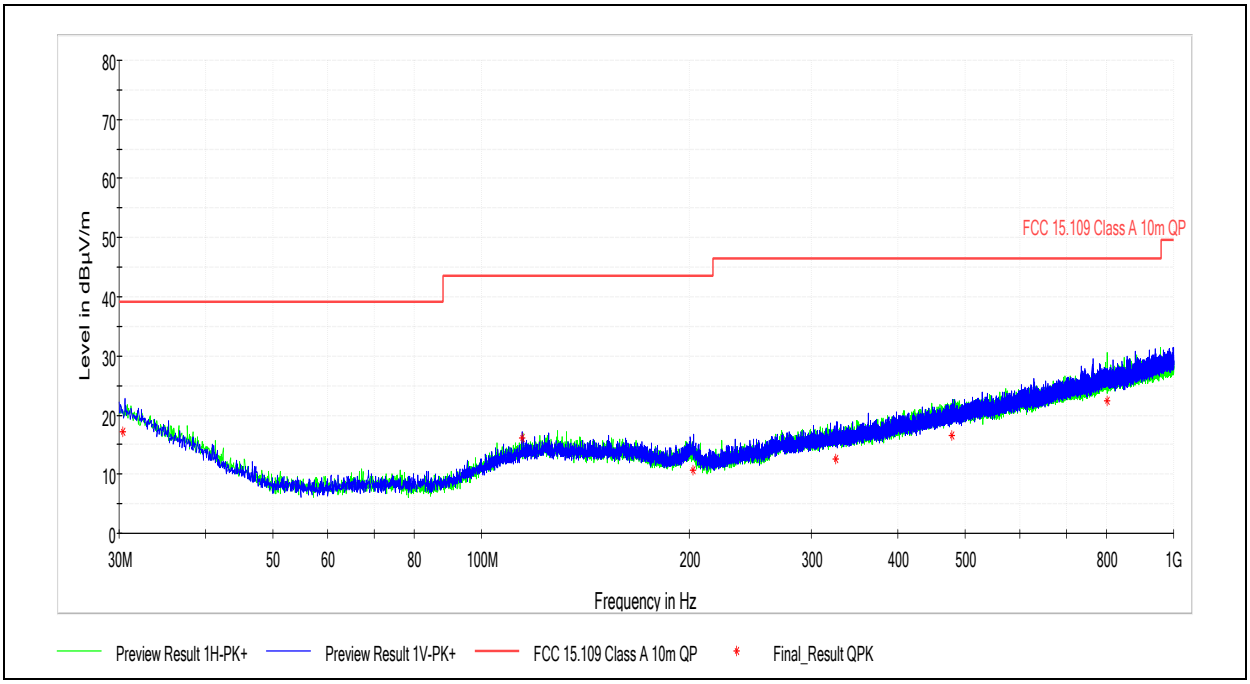
6.4 Software Utilized:

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

6.5 Results:

The sample tested was found to Comply.

6.6 Plots/Data: Radiated Emissions, 30MHz – 1GHz



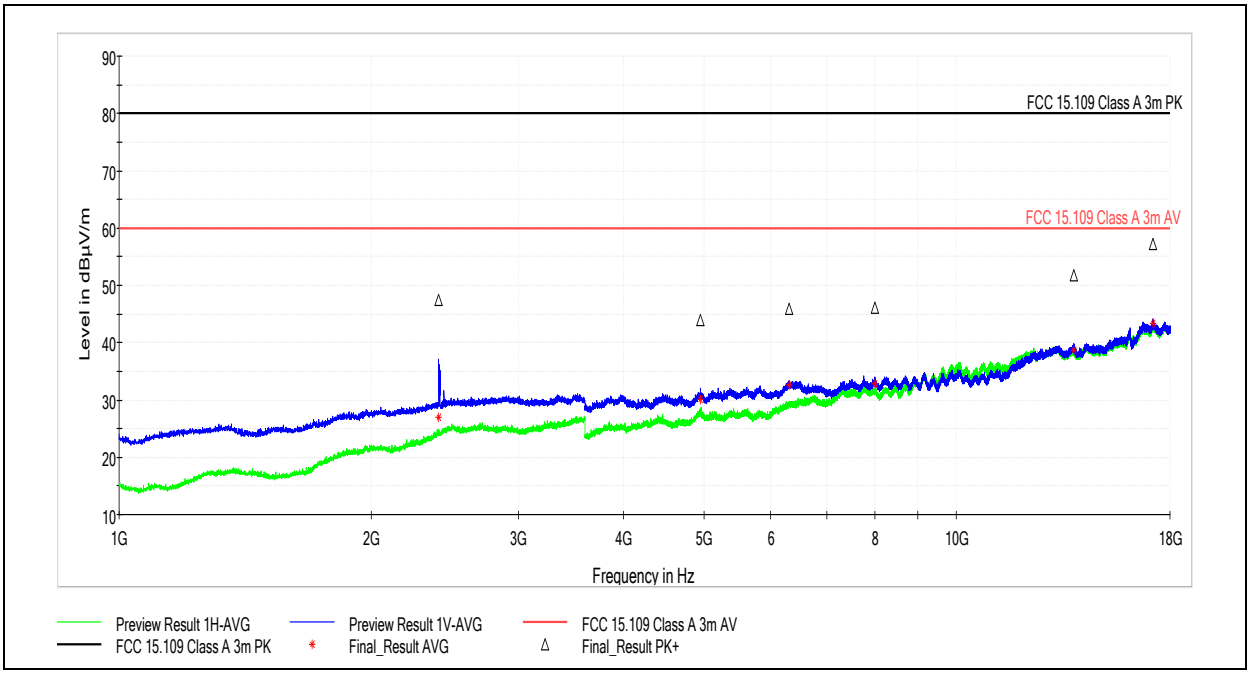
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.340000	17.16	39.09	21.92	120.000	267.0	V	333.0	-3
114.551667	16.16	43.52	27.37	120.000	395.0	V	272.0	-9
202.153889	10.73	43.52	32.79	120.000	134.0	V	163.0	-8
325.376667	12.61	46.44	33.84	120.000	395.0	V	232.0	-6
478.622222	16.47	46.44	29.97	120.000	190.0	V	244.0	-2
801.820556	22.45	46.44	23.99	120.000	191.0	H	119.0	4

Test Personnel:	Brian Lackey	Test Date:	8/4/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class A
Product Standard:	FCC Part 15.109 ICES-003	Ambient Temperature:	22.2C
Input Voltage:	12VDC	Relative Humidity:	56.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	989.2mbar

Deviations, Additions, or Exclusions: None

Note: the limits used above are for FCC Part 15B and are more restrictive than the ICES-003 Issue 7 limits.

6.7 Plots/Data: Radiated Emissions, 1GHz – 18GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2409.000000	47.52	80.00	32.48	1000.000	296.0	V	0.0	5
4943.000000	43.89	80.00	36.11	1000.000	349.0	V	0.0	10
6308.500000	45.93	80.00	34.07	1000.000	100.0	V	152.0	13
7999.000000	46.03	80.00	33.97	1000.000	100.0	V	0.0	14
13829.500000	51.72	80.00	28.28	1000.000	326.0	V	85.0	21
17165.000000	57.13	80.00	22.87	1000.000	410.0	V	0.0	26

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2409.000000	26.94	60.00	33.06	1000.000	296.0	V	0.0	5
4943.000000	30.03	60.00	29.97	1000.000	349.0	V	0.0	10
6308.500000	32.59	60.00	27.41	1000.000	100.0	V	152.0	13
7999.000000	32.87	60.00	27.13	1000.000	100.0	V	0.0	14
13829.500000	38.75	60.00	21.25	1000.000	326.0	V	85.0	21
17165.000000	43.37	60.00	16.63	1000.000	410.0	V	0.0	26

Test Personnel:	Brian Lackey	Test Date:	8/4/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class A
Product Standard:	FCC Part 15.109 ICES-003	Ambient Temperature:	22.2C
Input Voltage:	12VDC	Relative Humidity:	56.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	989.2mbar

Deviations, Additions, or Exclusions: None

7 Occupied Bandwidth

7.1 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.

7.2 Test Method

Tests are performed in accordance with ANSI C63.10:2020 § 6.9, 11.8

7.3 Test Equipment

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

7.4 Test Software

Name	Manufacturer	Version
GPIBShot	Rohde & Schwarz	Version 2.7 BETA 2

7.5 Test Results

The sample tested was found to Comply. The 6 dB bandwidth was at least 500 kHz.

BLE:

Frequency (MHz)	DTS BW (kHz)	6dB BW (kHz)	20dB BW (kHz)	99% OPB (kHz)
2402	741.4	556.1	1202	1107
2440	751.5	556.1	1202	1117
2480	746.5	616.2	1182	1127

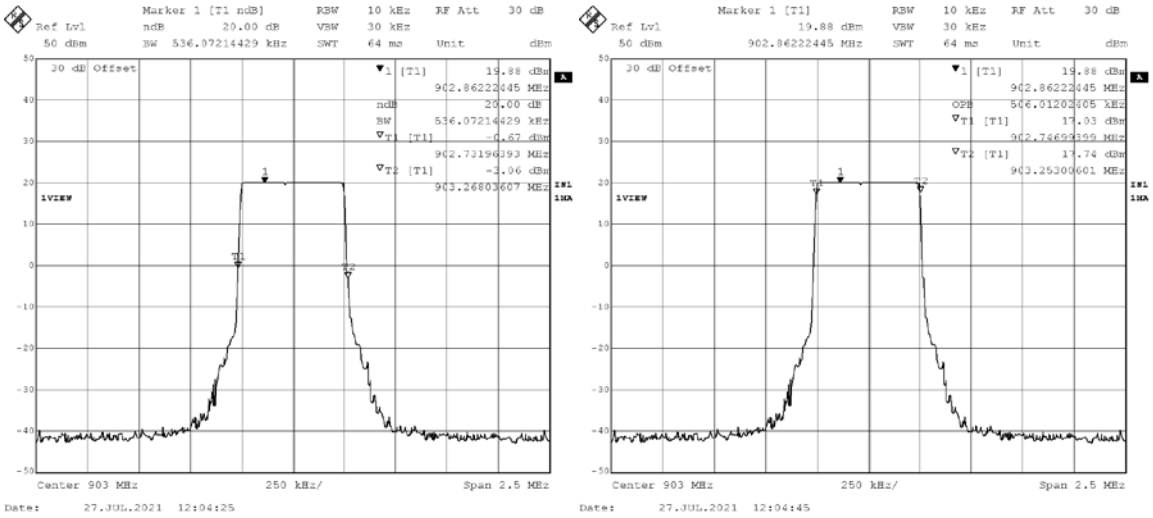
LoRa:

Frequency (MHz)	DTS BW (kHz)	6dB BW (kHz)	20dB BW (kHz)	99% OPB (kHz)
903.0	649.3	516.0	536.1	506.0
908.5	643.3	516.0	531.1	506.0
914.9	646.3	516.0	536.1	506.0

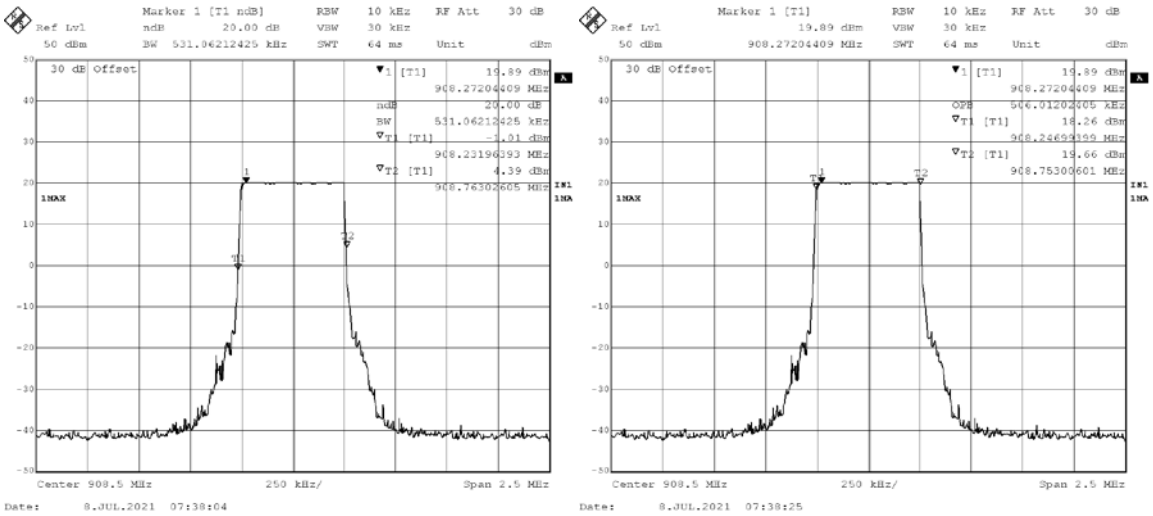
7.6 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	7/27/2021, 9/9/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	500 kHz
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.1C
Input Voltage:	12VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

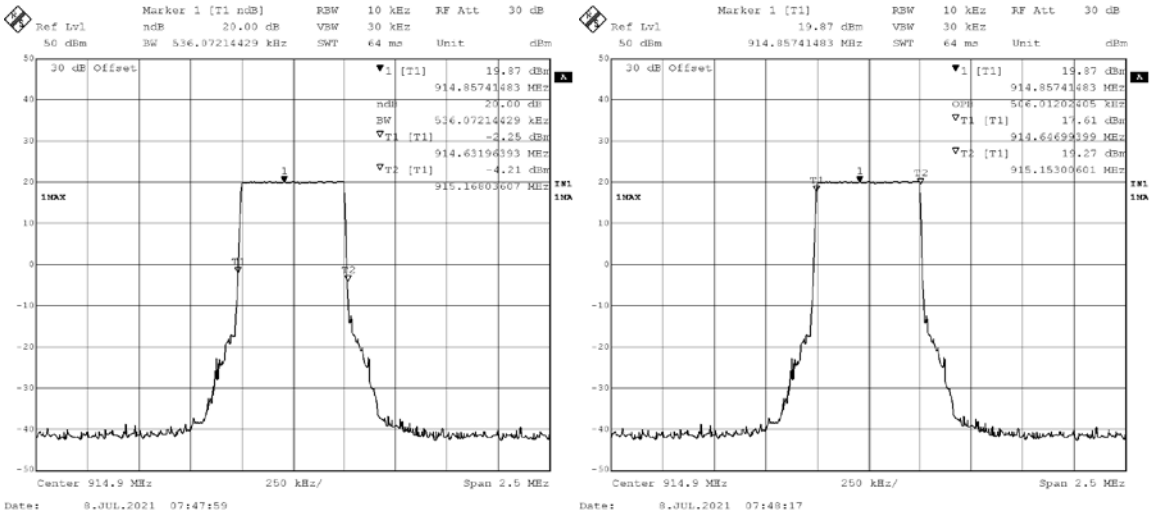
7.7 Test Data (LoRa)



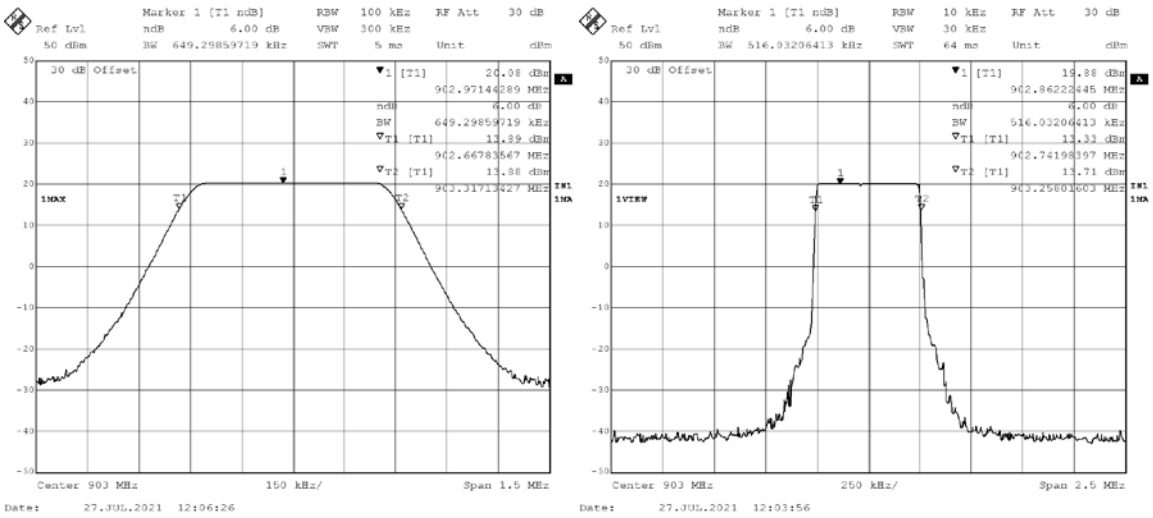
903.0MHz 20dB BW (left) and 99% OPB (right)



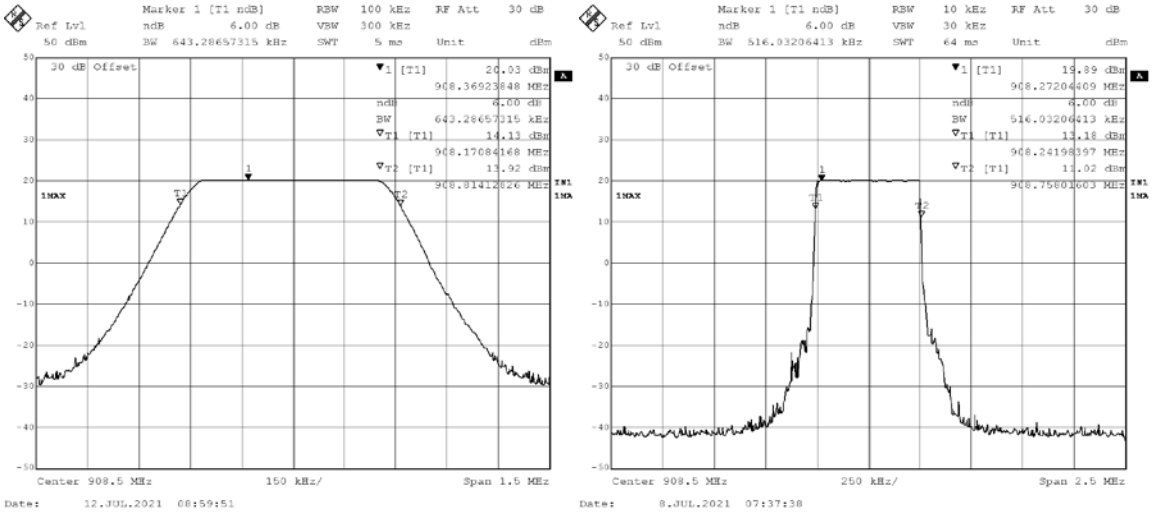
908.5MHz 20dB BW (left) and 99% OPB (right)



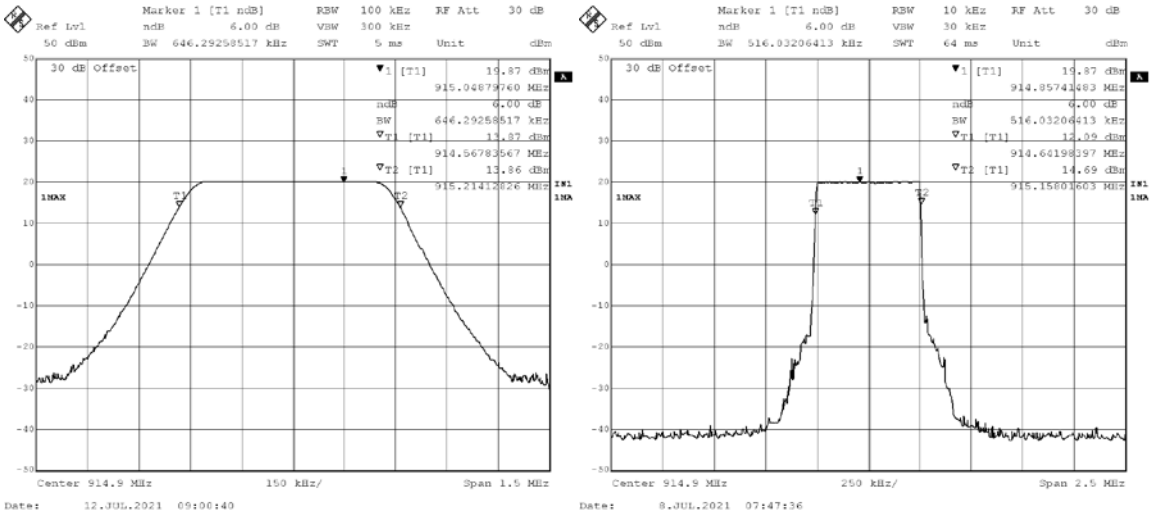
914.9MHz 20dB BW (left) and 99% OPB (right)



903.0MHz DTS BW (left) and 6dB BW (right)

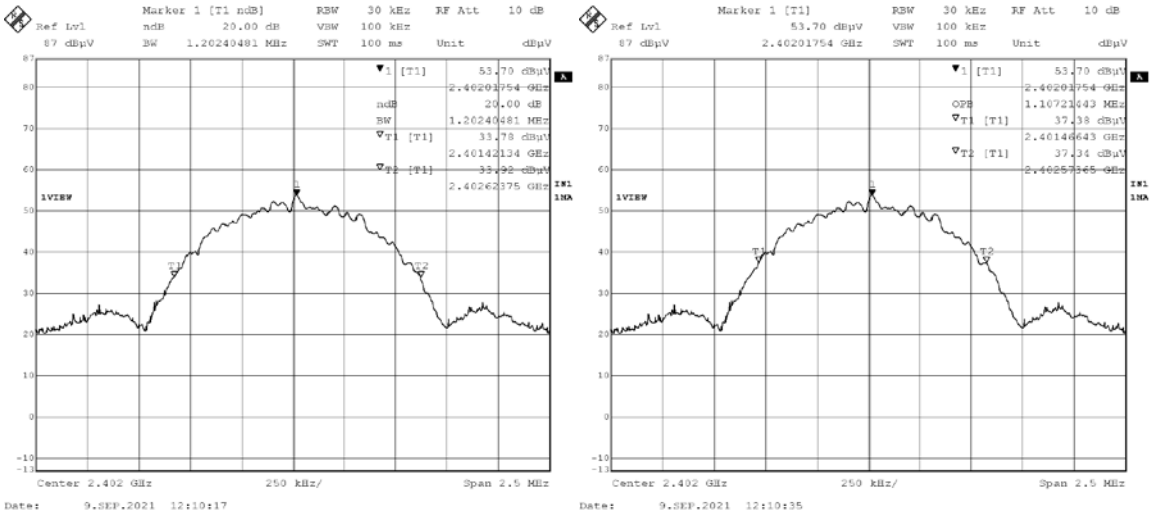


908.5MHz DTS BW (left) and 6dB BW (right)

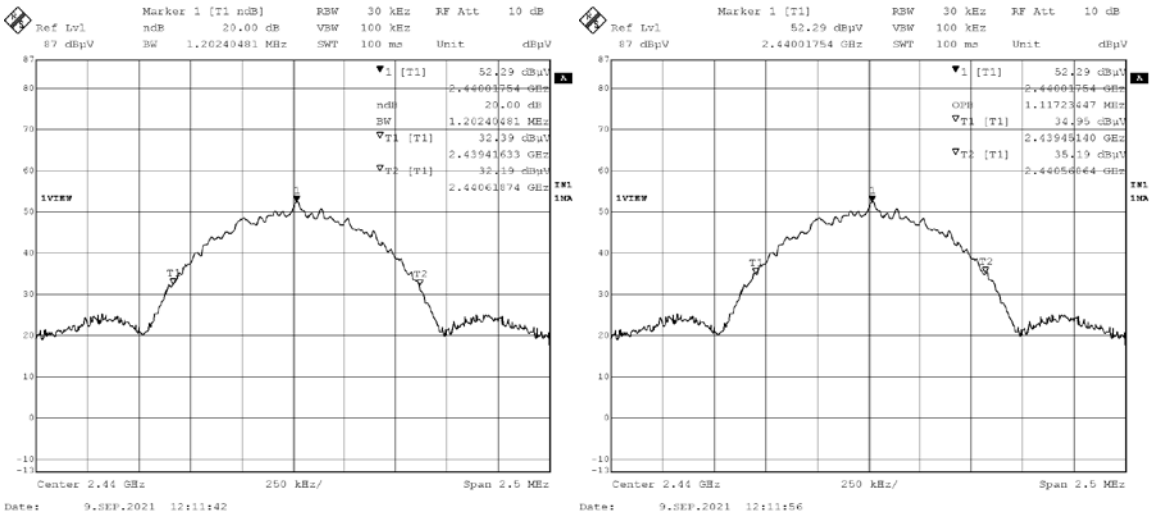


914.9MHz DTS BW (left) and 6dB BW (right)

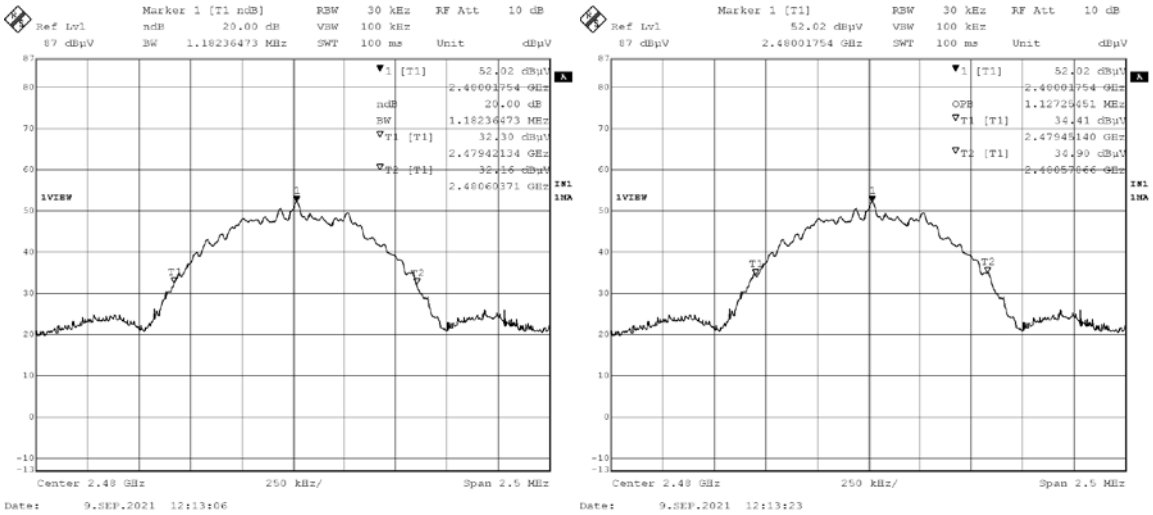
7.8 Test Data (BLE)



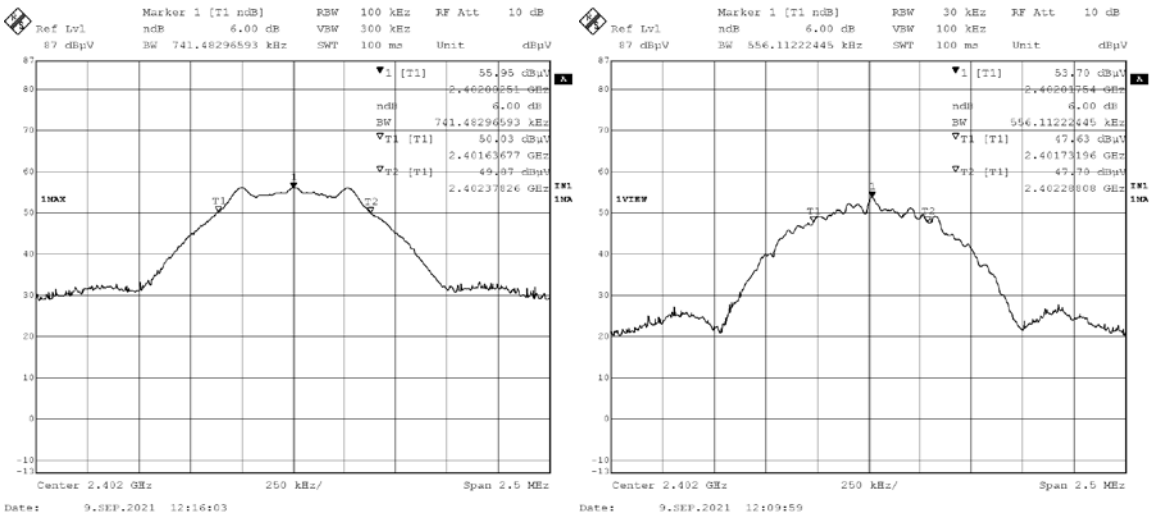
2402MHz 20dB BW (left) and 99% OPB (right)



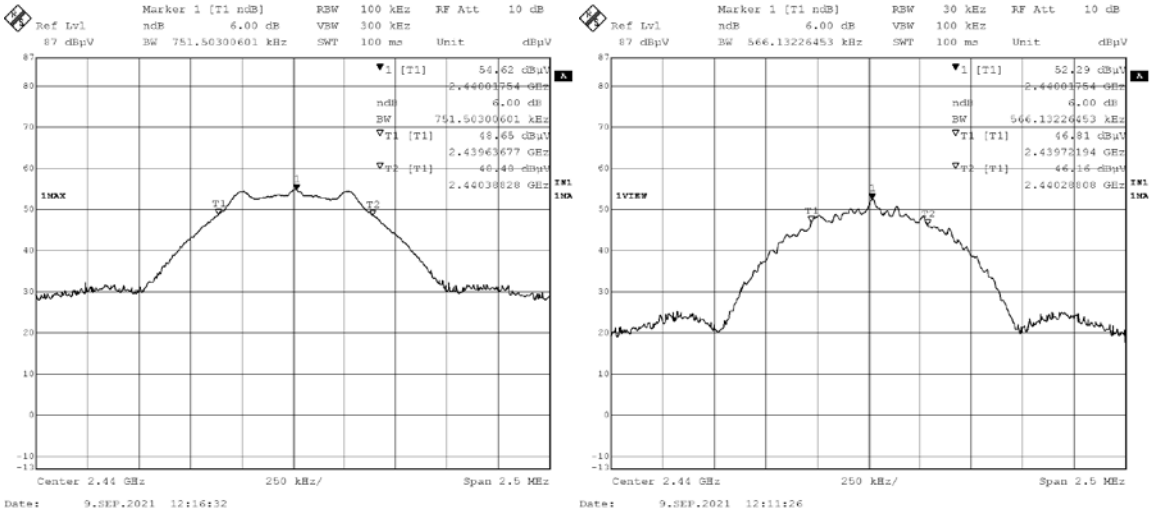
2440MHz 20dB BW (left) and 99% OPB (right)



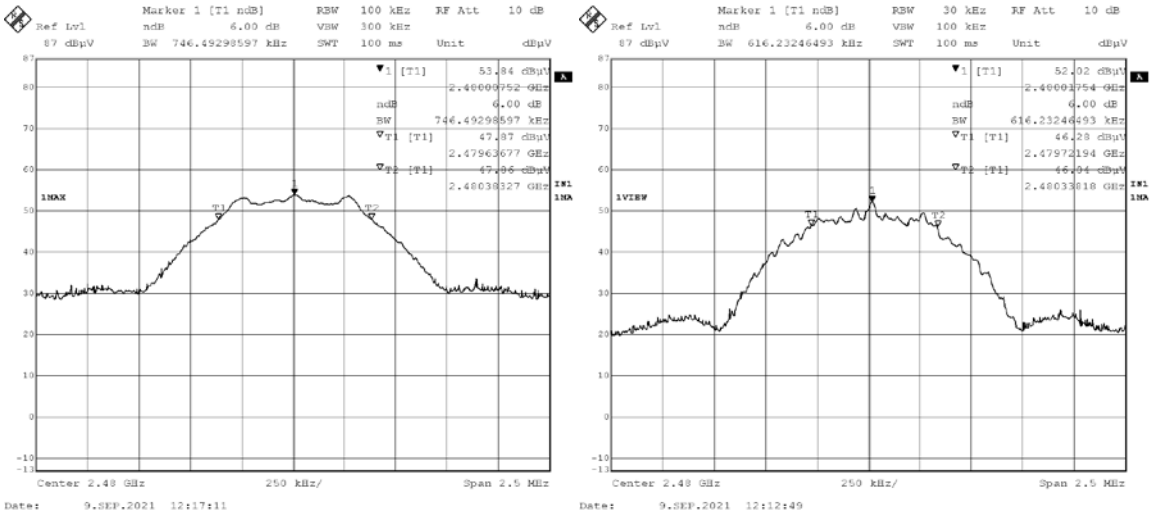
2480MHz 20dB BW (left) and 99% OPB (right)



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



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



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

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.

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).

8.2 Test Method

Tests are performed in accordance with ANSI C63.10:2020 § 11.9.1.1, 11.9.2.2.2

8.3 Test Equipment

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

8.4 Test Software

Name	Manufacturer	Version
GPIBShot	Rohde & Schwarz	Version 2.7 BETA 2

8.5 Test Results

The sample tested was found to Comply. The output power was less than 1 Watt. The EIRP was less than 4 Watts.

BLE:

Frequency (MHz)	Maximum Peak Conducted Power (dBm)	Maximum Antenna Gain (dBi)	EIRP (dBm)
2402	-4.57	4.4	-0.17
2440	-4.81	4.4	-0.41
2480	-4.57	4.4	-0.17

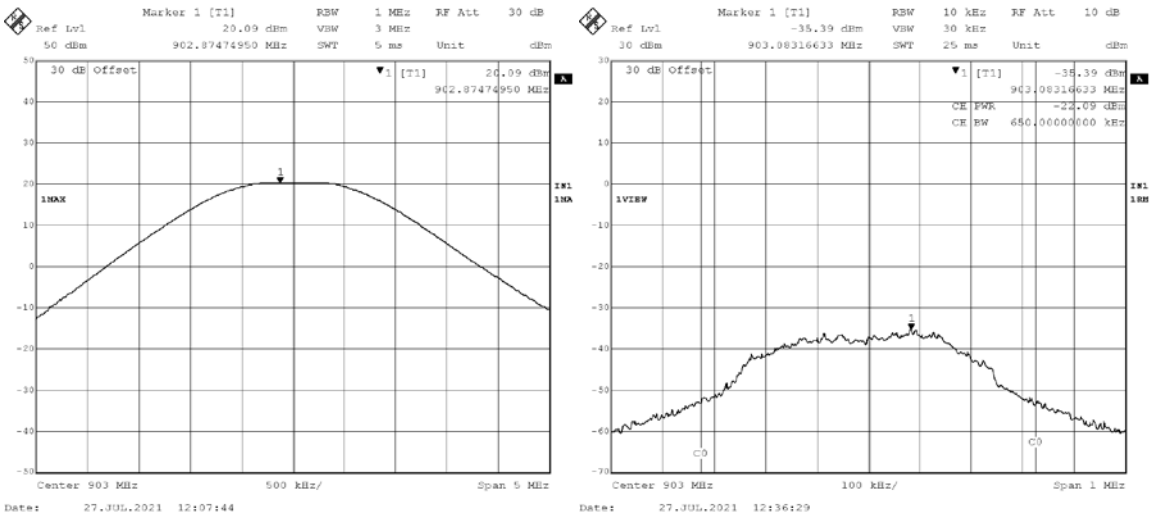
LoRa:

Frequency (MHz)	Maximum Peak Conducted Power (dBm)	Maximum Conducted (Average) Power (dBm)	EIRP (dBm)
903.0	20.09	-22.09	21.99
908.5	20.08	-19.24	21.98
914.9	19.95	-21.56	21.85

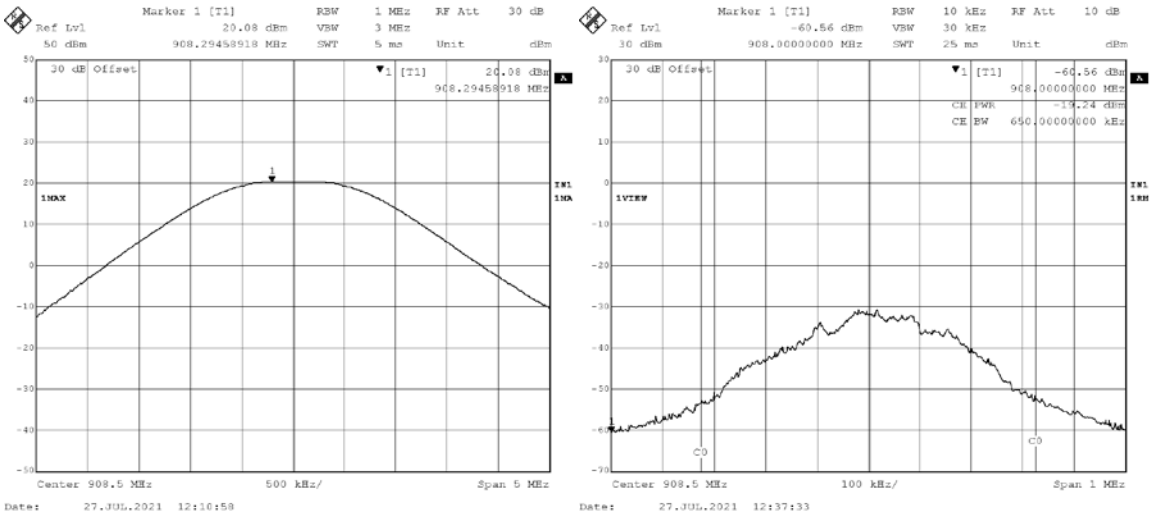
8.6 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	7/27/2021, 9/9/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	1W Conducted / 4W EIRP
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.1C
Input Voltage:	12VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

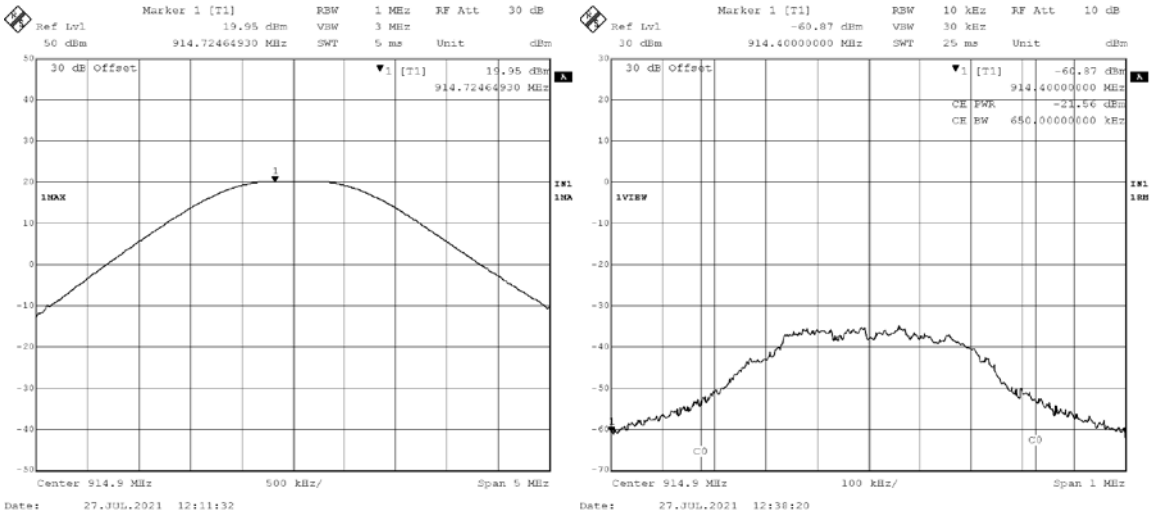
8.7 Test Data (LoRa)



903.0MHz Peak Power (left) and Average Power (right)

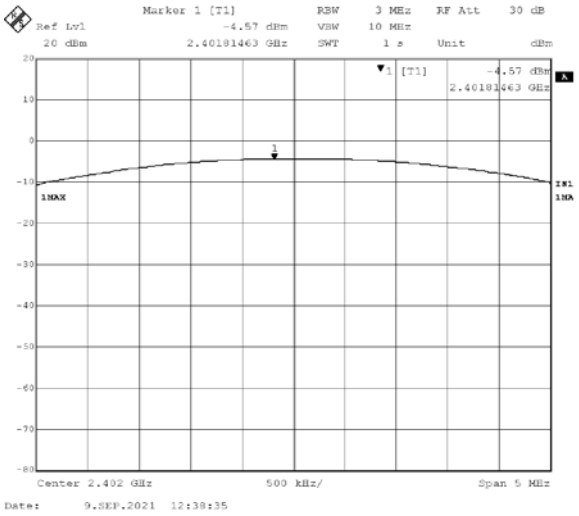


908.5MHz Peak Power (left) and Average Power (right)

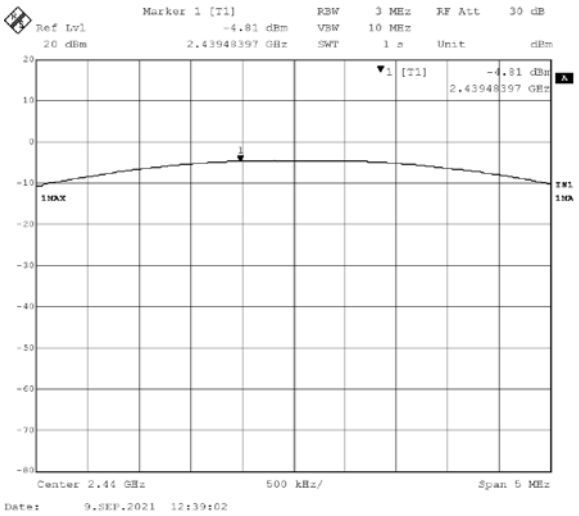


914.9MHz Peak Power (left) and Average Power (right)

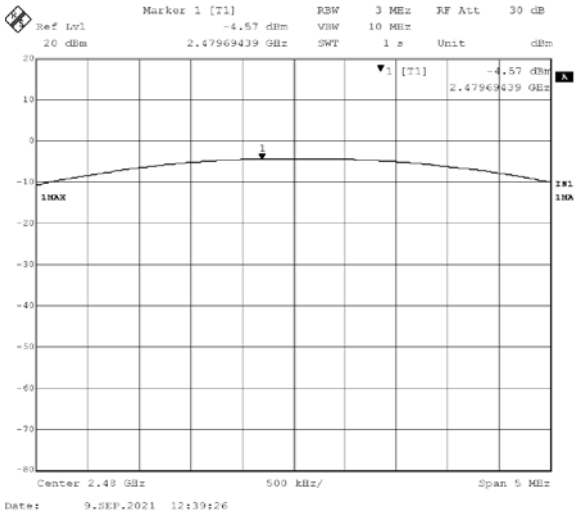
8.8 Test Data (BLE)



2402MHz Peak Output Power



2440MHz Peak Output Power



2480MHz Peak Output Power

9 Power Spectral Density

9.1 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).

9.2 Test Method

Tests are performed in accordance with ANSI C63.10:2020 § 11.10.3

9.3 Test Equipment

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

9.4 Test Software

Name	Manufacturer	Version
GPIBShot	Rohde & Schwarz	Version 2.7 BETA 2

9.5 Test Results

The sample tested was found to Comply. The power spectral density was less than 8dBm/3kHz. For the LoRa transmitter, a correction factor of 10 · log(3kHz / 100kHz) = -15.23dB was applied to measurements performed with an RBW of 100kHz per method AVGPSD-1 of ANSI C63.10:2020.

BLE:

Frequency (MHz)	PKPSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
2402	-14.174	8.000	22.174
2440	-13.780	8.000	21.780
2480	-13.590	8.000	21.590

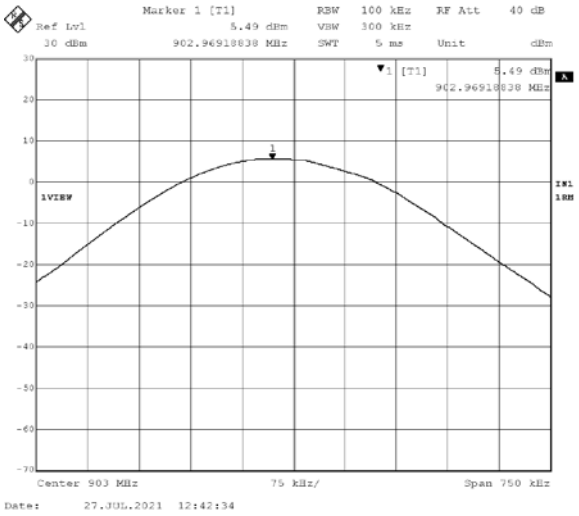
LoRa:

Frequency (MHz)	AVGPSD (dBm/100kHz)	AVGPSD (dBm/3kHz)	Limit (dBm/3kHz)
903.0	5.49	-9.73	8.00
908.5	4.67	-10.56	8.00
914.9	5.59	-9.64	8.00

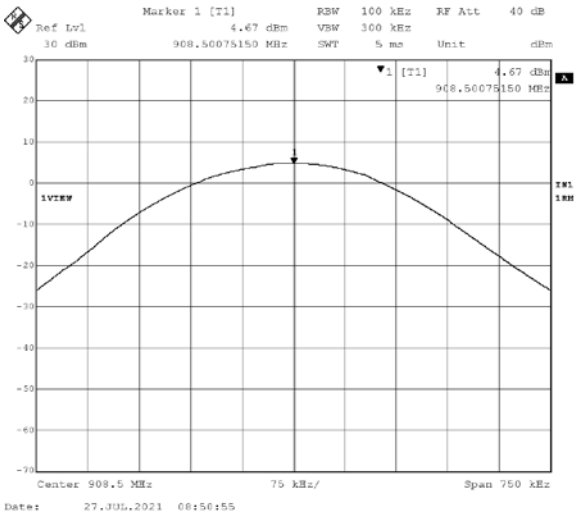
9.6 Test Conditions

Test Personnel:	Brian Lackey	Test Date:	7/27/2021, 9/9/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	8dBm/3kHz
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.1C
Input Voltage:	12VDC	Relative Humidity:	62.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.4mbar

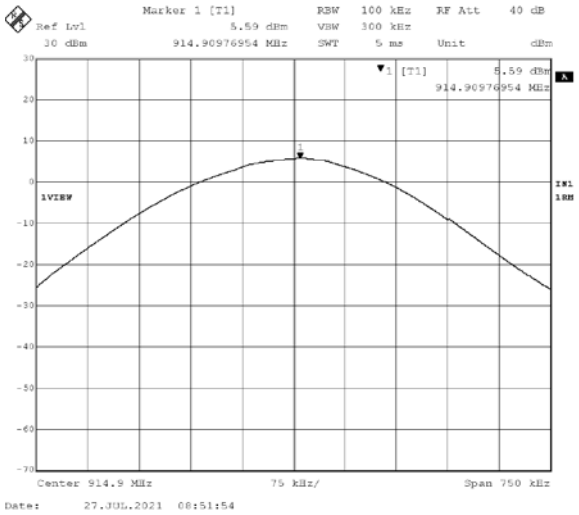
9.7 Test Data (LoRa)



903.0MHz Power Spectral Density

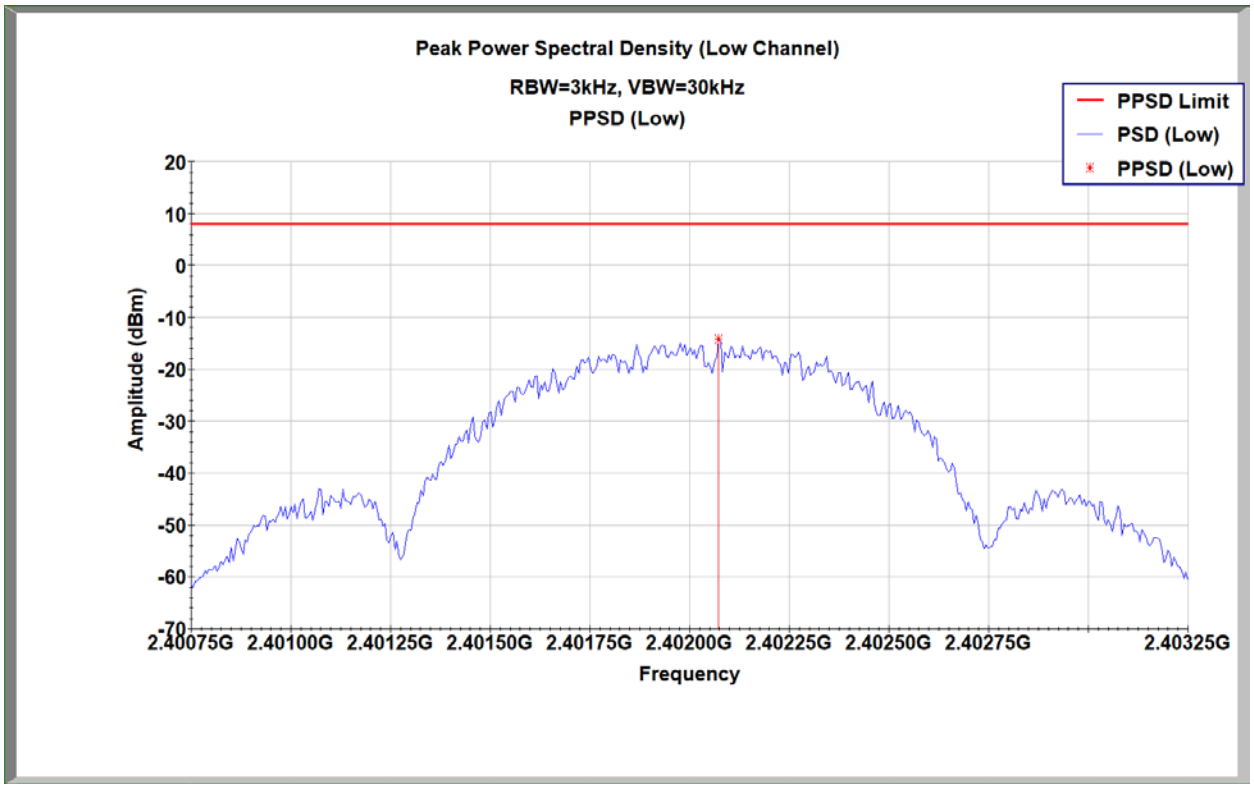


908.5MHz Power Spectral Density

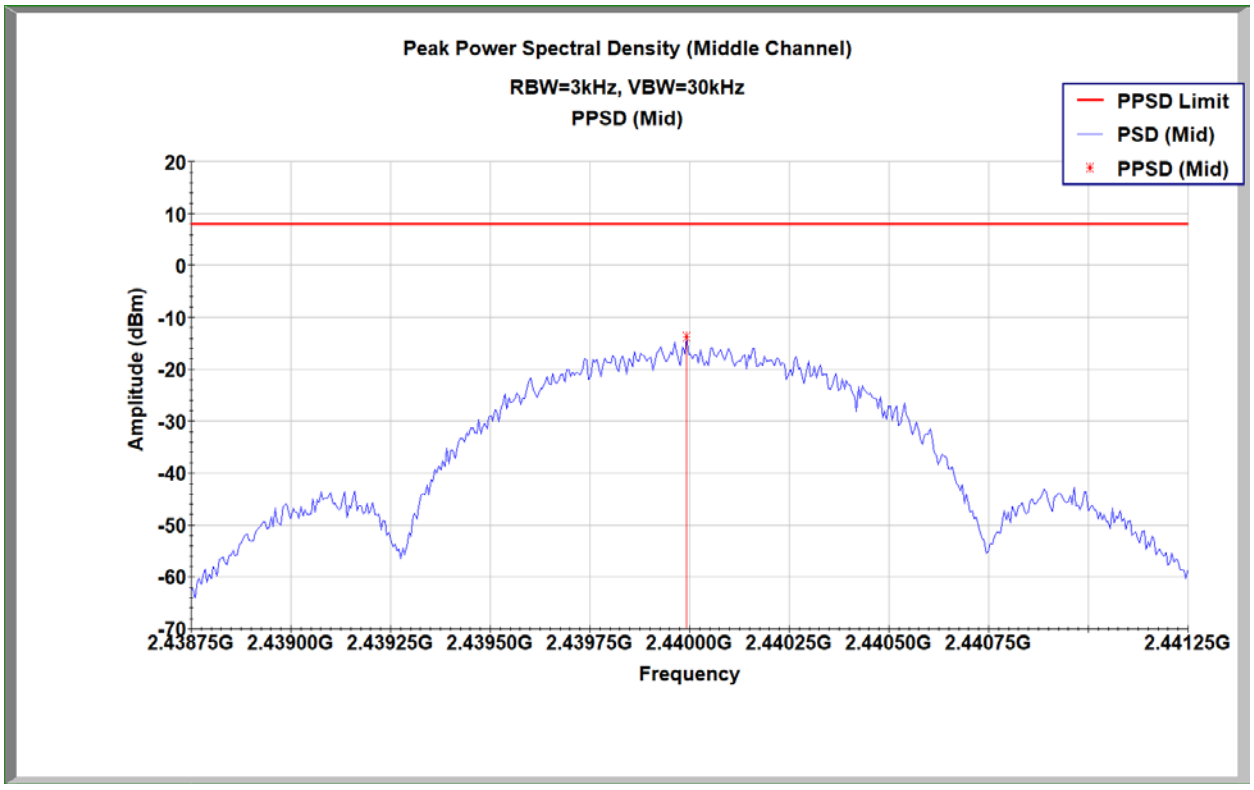


914.9MHz Power Spectral Density

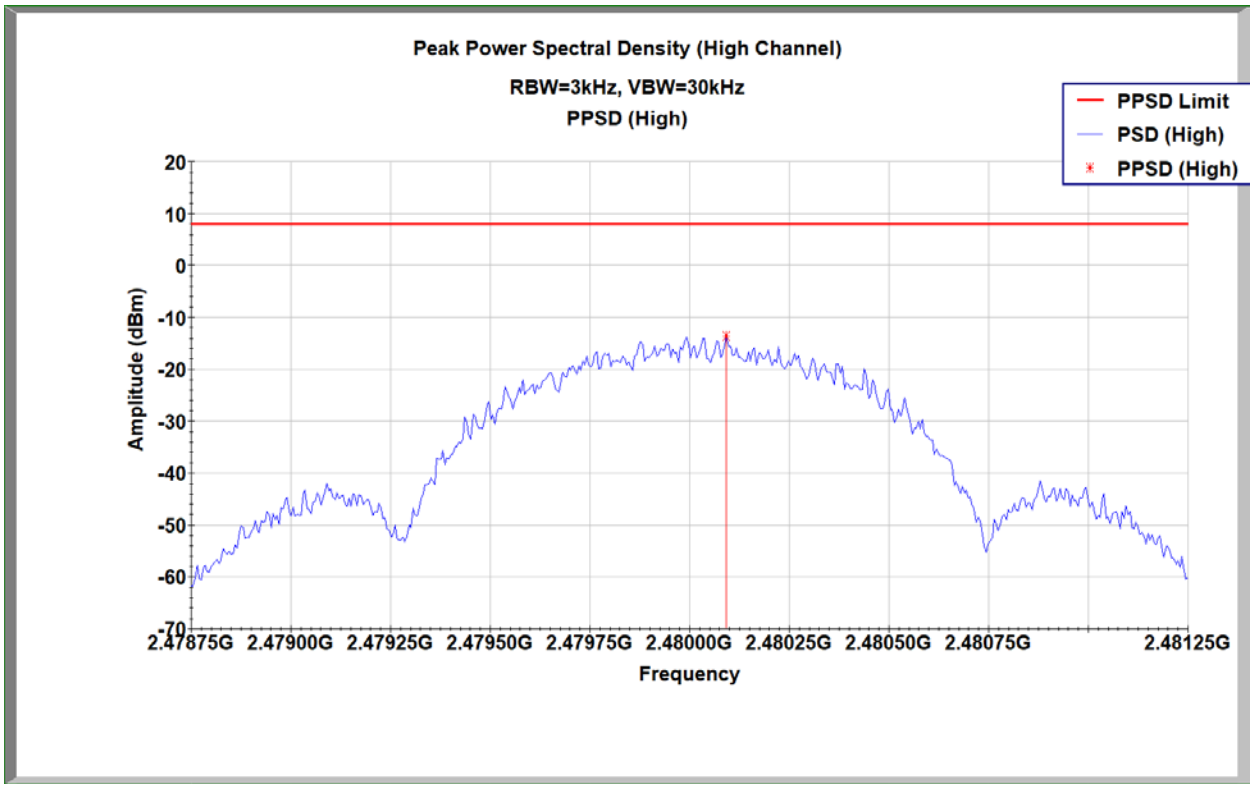
9.8 Test Data (BLE)



2402MHz Power Spectral Density



2440MHz Power Spectral Density



2480MHz Power Spectral Density

10 Unwanted Emissions in the Spurious Domain

10.1 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.

10.2 Test Method

Tests are performed in accordance with ANSI C63.10:2020 § 6.10, 11.11, 11.12

10.3 Test Equipment

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde & Schwarz	ESU40	10/5/2020	10/5/2021
EMI Test Receiver	2327	Rohde & Schwarz	ESI26	10/9/2020	10/9/2021
Magnetic Loop Antenna	2366	ETS	6502	7/30/2021	7/30/2022
Bilog Antenna (30MHz-1GHz)	7085	SunAR	JB6	9/4/2020	9/4/2021
Horn Antenna	4001	ETS	3117	1/26/2021	1/26/2022
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			12/21/2020	12/21/2021
Preamplifier	3918	Rohde & Schwarz	TS-PR18	12/21/2020	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	7019	Rohde & Schwarz	TS-PR3	12/21/2020	12/21/2021
Coaxial Cable	3172			12/21/2020	12/21/2021
Coaxial Cable	2590			12/21/2020	12/21/2021
Coaxial Cable	2589			12/21/2020	12/21/2021

10.4 Test Software

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

10.5 Test Results

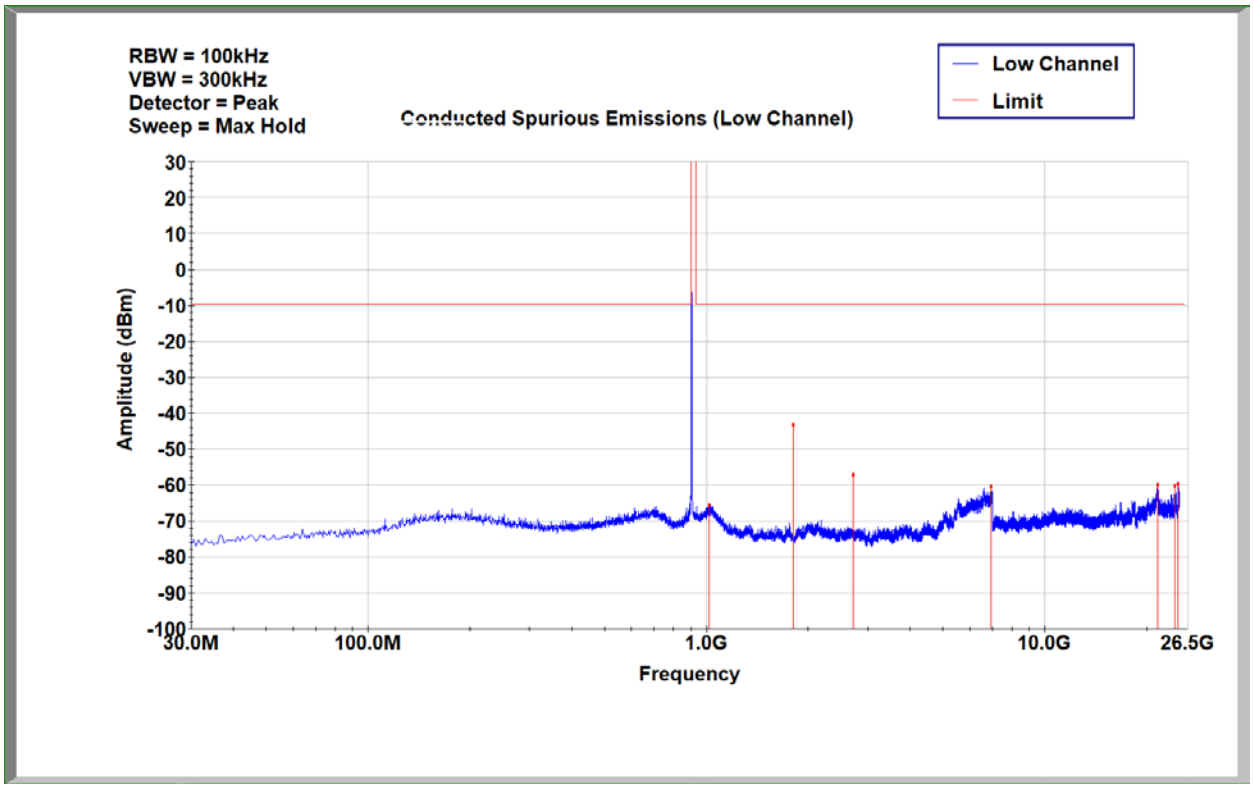
The sample tested was found to Comply. All emissions outside of the authorized band were suitably attenuated. A metallic shield (Harwin EMI P/N S02-20150300) was installed over the RF circuitry during radiated testing.

10.6 Test Conditions

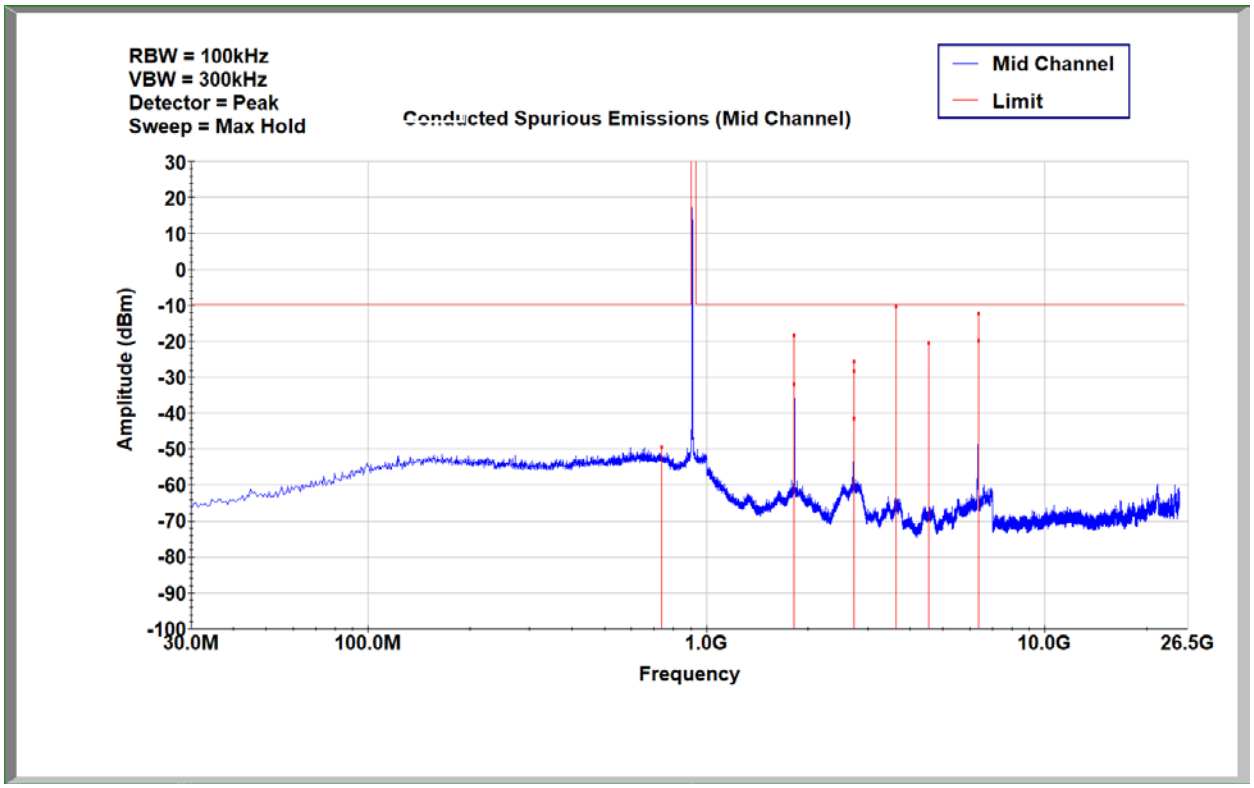
Test Personnel:	Brian Lackey	Test Date:	8/5/2021 – 8/18/2021, 9/9/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See clause 10.1
Product Standard:	FCC Part 15.247 RSS-247 Issue 2	Ambient Temperature:	24.0C
Input Voltage:	12VDC	Relative Humidity:	62.7%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	987.8mbar

10.7 Test Data (LoRa)

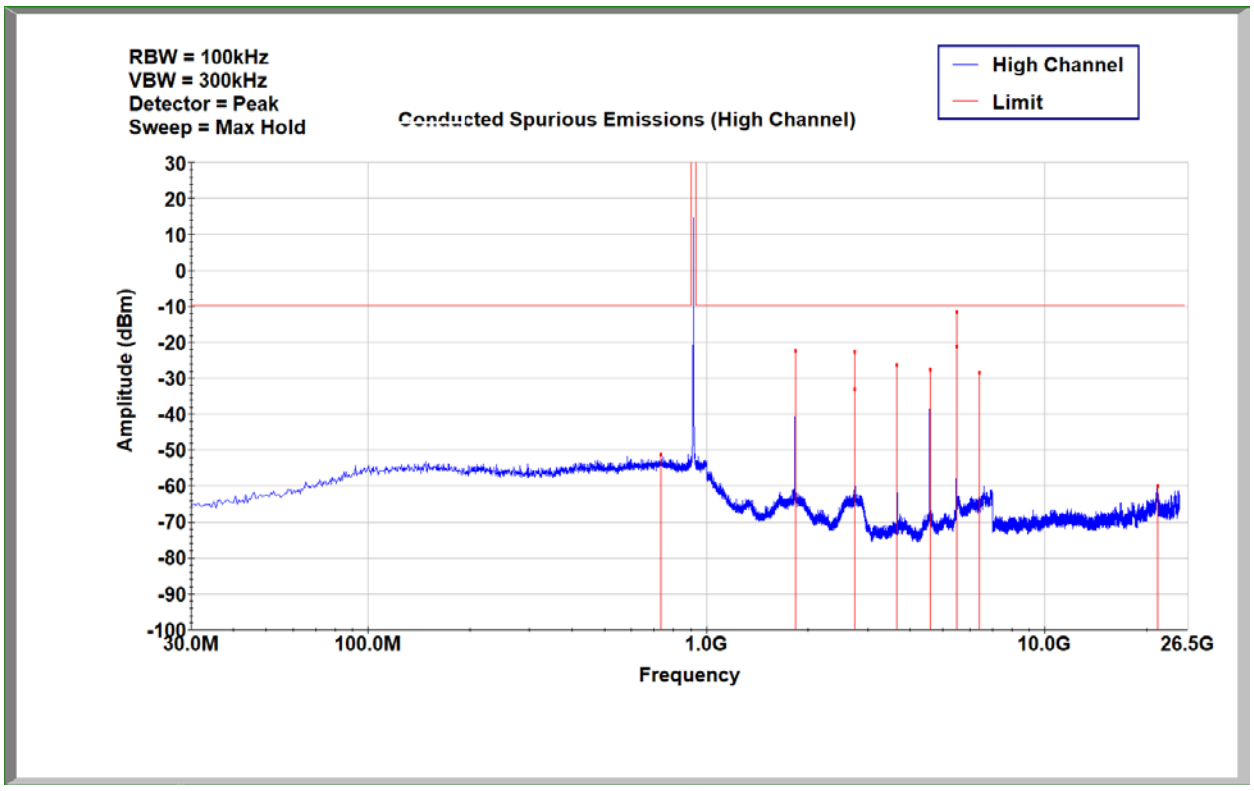
10.7.1 Conducted Spurious Emissions, Transmitting at 903.0MHz



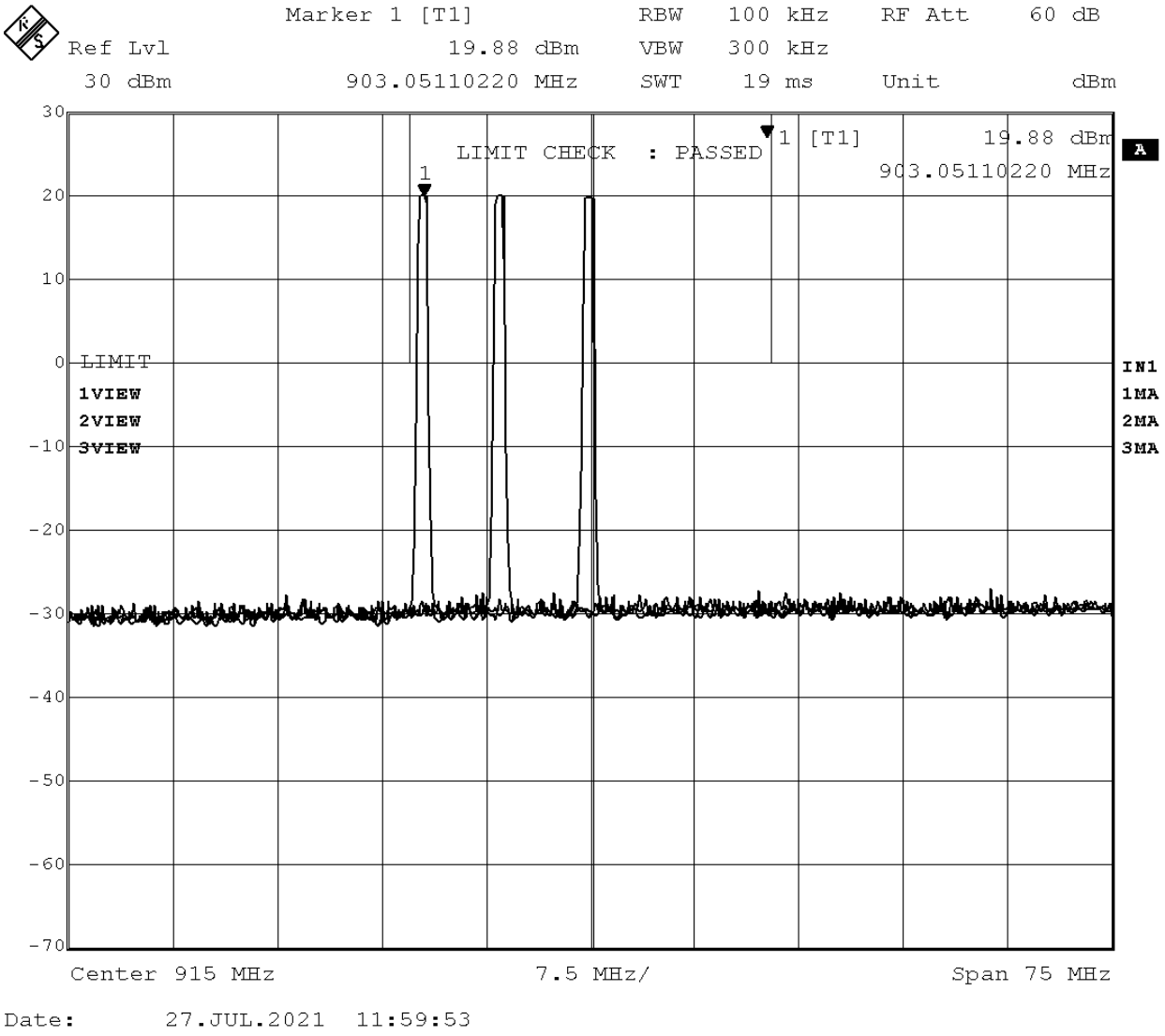
10.7.2 Conducted Spurious Emissions, Transmitting at 908.5MHz



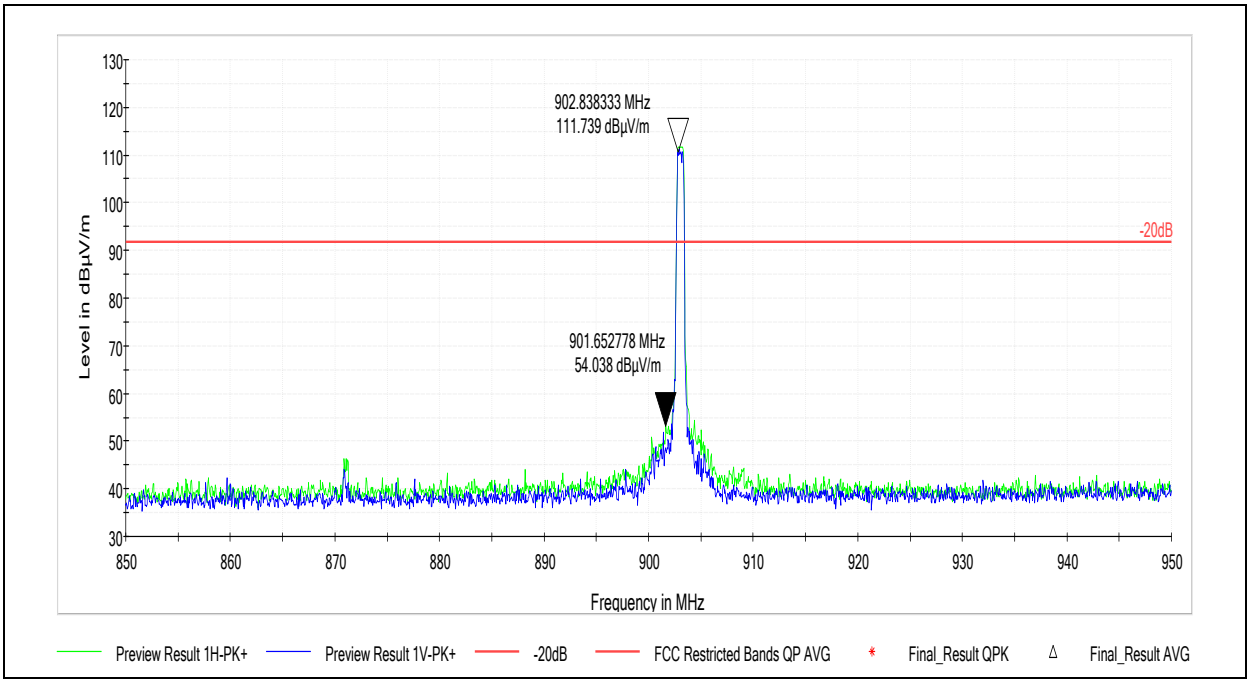
10.7.3 Conducted Spurious Emissions, Transmitting at 914.9MHz



10.7.4 Conducted Spurious Emissions at the Authorized Band Edge



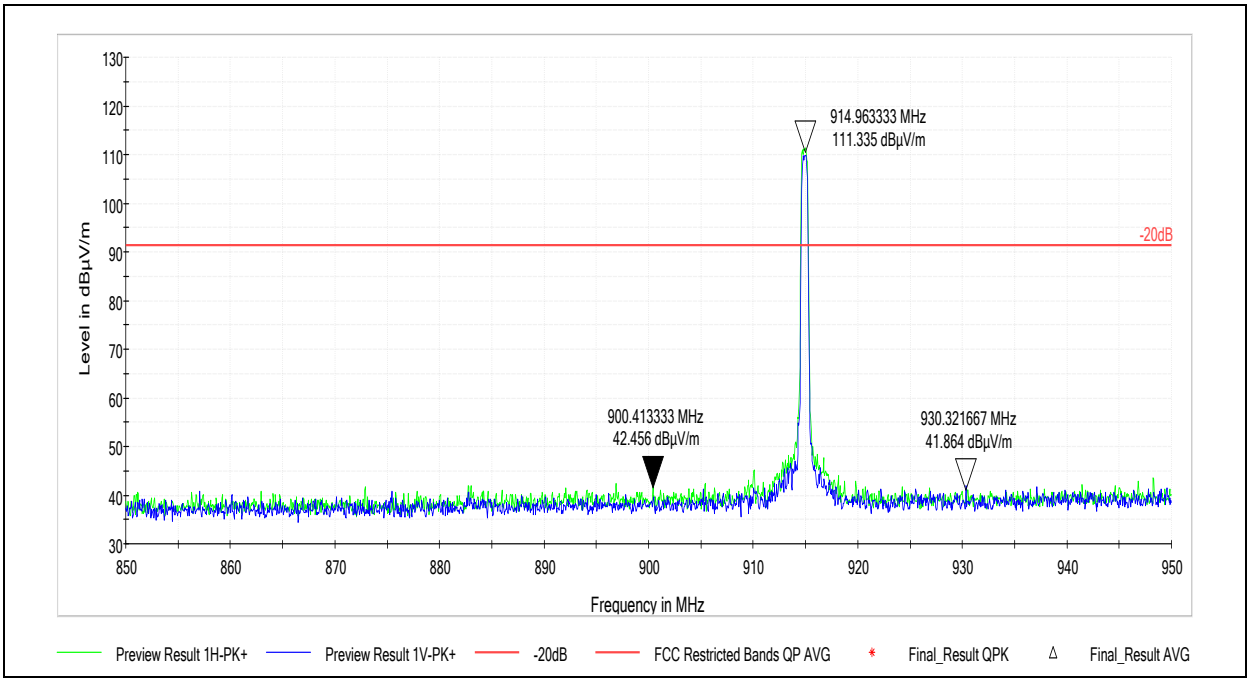
10.7.5 Radiated Emissions at the Low Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Highest Wanted Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Corr. (dB/m)
901.652778	54.04	111.74	81.74	27.70	38

Note: although the device complies with the peak conducted output power requirements, the device meets the more stringent 30dB attenuation criteria.

10.7.6 Radiated Emissions at the High Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Highest Wanted Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Corr. (dB/m)
900.413333	42.46	111.33	81.34	38.88	38
930.321667	41.86	111.33	81.34	39.48	38

Note: although the device complies with the peak conducted output power requirements, the device meets the more stringent 30dB attenuation criteria.

10.7.7 Radiated Spurious Emissions below 1 GHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
74.512222	34.52	40.00	5.48	120.000	100.0	V	110.0	15
74.997222	31.58	40.00	8.42	120.000	100.0	V	135.0	15
108.085000	33.64	43.52	9.88	120.000	100.0	V	164.0	21
119.994444	32.73	43.52	10.79	120.000	100.0	V	164.0	22
168.009444	37.40	43.52	6.12	120.000	100.0	V	253.0	21
168.763889	32.38	43.52	11.15	120.000	100.0	V	274.0	21
170.434444	32.81	43.52	10.71	120.000	100.0	V	234.0	21
171.350556	34.86	43.52	8.67	120.000	99.0	V	212.0	21
172.967222	31.30	43.52	12.23	120.000	100.0	V	225.0	21
613.993889	32.19	46.02	13.83	120.000	119.0	H	-1.0	32

Note: results represent the worst case of all transmission modes with the device oriented in three orthogonal directions.

10.7.8 Radiated Spurious Emissions above 1 GHz, Transmitting at 903.0MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2709.500000	36.34	73.98	37.64	1000.000	341.0	H	60.0	6
4514.500000	43.34	73.98	30.64	1000.000	250.0	V	238.0	9
8126.500000	45.10	73.98	28.88	1000.000	398.0	H	56.0	14

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2709.500000	24.50	53.98	29.48	1000.000	341.0	H	60.0	6
4514.500000	31.79	53.98	22.19	1000.000	250.0	V	238.0	9
8126.500000	31.36	53.98	22.62	1000.000	398.0	H	56.0	14

10.7.9 Radiated Spurious Emissions above 1 GHz, Transmitting at 908.5MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1099.000000	43.28	73.98	30.70	1000.000	200.0	H	44.0	-1
2725.000000	47.77	73.98	26.21	1000.000	285.0	H	79.0	6
4543.500000	45.31	73.98	28.67	1000.000	391.0	H	293.0	9
7267.000000	50.28	73.98	23.70	1000.000	339.0	V	234.0	14

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1099.000000	30.50	53.98	23.48	1000.000	200.0	H	44.0	-1
2725.000000	38.27	53.98	15.71	1000.000	285.0	H	79.0	6
4543.500000	32.64	53.98	21.34	1000.000	391.0	H	293.0	9
7267.000000	36.97	53.98	17.01	1000.000	339.0	V	234.0	14

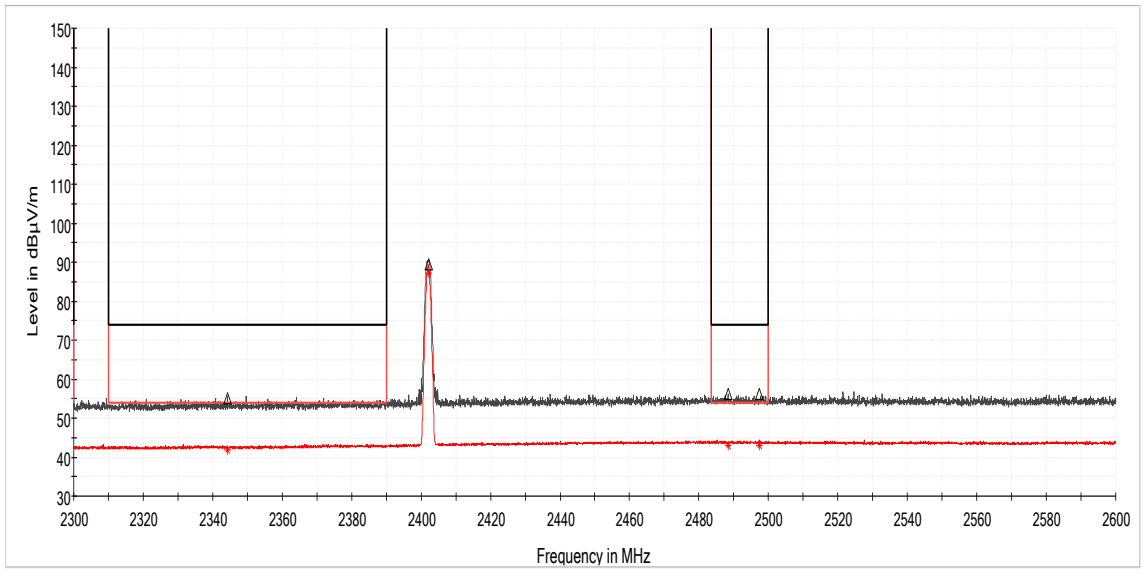
10.7.10 Radiated Spurious Emissions above 1 GHz, Transmitting at 914.9MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1102.000000	47.09	73.98	26.89	1000.000	339.0	H	280.0	-1
2744.500000	46.76	73.98	27.22	1000.000	349.0	H	54.0	6
4575.000000	48.48	73.98	25.50	1000.000	301.0	H	232.0	9
7320.500000	51.57	73.98	22.41	1000.000	410.0	V	256.0	13

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1102.000000	33.92	53.98	20.06	1000.000	339.0	H	280.0	-1
2744.500000	36.74	53.98	17.24	1000.000	349.0	H	54.0	6
4575.000000	33.43	53.98	20.55	1000.000	301.0	H	232.0	9
7320.500000	38.15	53.98	15.83	1000.000	410.0	V	256.0	13

10.8 Test Data (BLE, Internal Antenna)

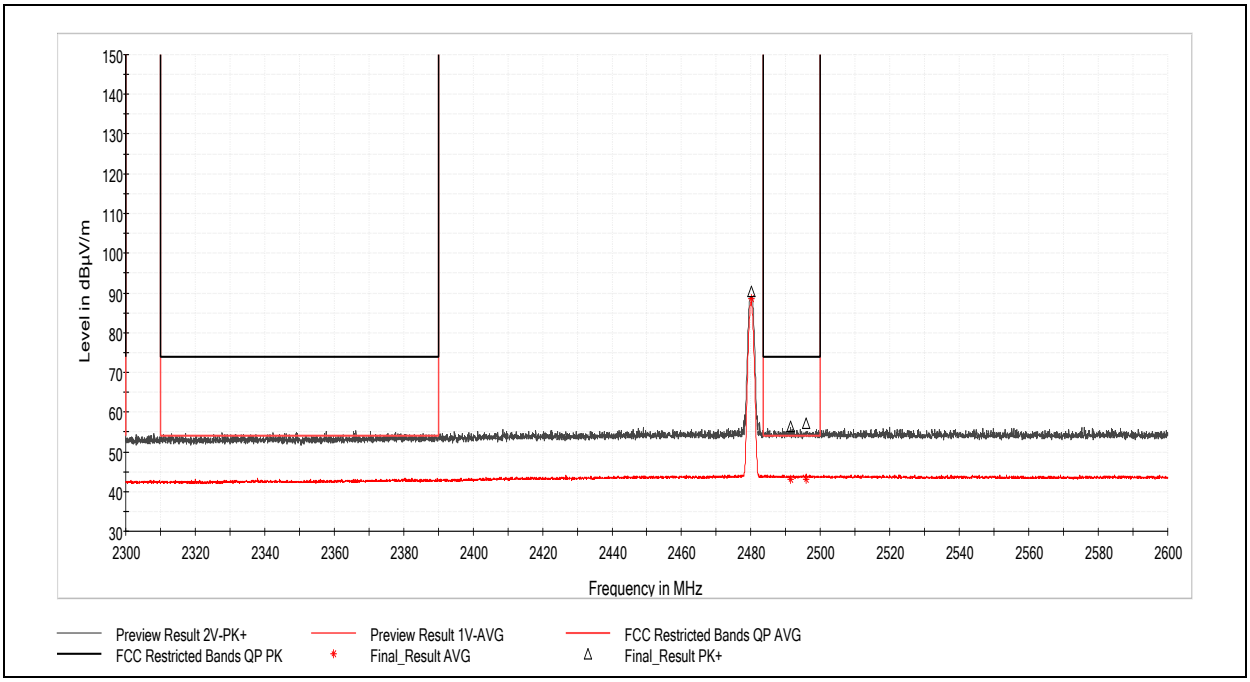
10.8.1 Radiated Emissions at the Low Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2344.192308	55.18	73.98	18.80	1000.000	155.0	V	86.0	39
2402.230769	89.56	-	-	1000.000	272.0	V	345.0	39
2488.365385	56.29	73.98	17.69	1000.000	270.0	V	45.0	39
2497.365385	56.24	73.98	17.74	1000.000	294.0	V	92.0	39

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2344.192308	41.87	53.98	12.11	1000.000	155.0	V	86.0	39
2402.230769	87.24	-	-	1000.000	272.0	V	345.0	39
2488.365385	43.08	53.98	10.90	1000.000	270.0	V	45.0	39
2497.365385	43.05	53.98	10.93	1000.000	294.0	V	92.0	39

10.8.2 Radiated Emissions at the High Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2480.115385	90.31	-	-	1000.000	215.0	V	347.0	39
2491.365385	56.35	73.98	17.63	1000.000	398.0	V	22.0	39
2495.865385	57.24	73.98	16.74	1000.000	179.0	V	0.0	39

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2480.115385	88.66	-	-	1000.000	215.0	V	347.0	39
2491.365385	43.05	53.98	10.93	1000.000	398.0	V	22.0	39
2495.865385	43.03	53.98	10.95	1000.000	179.0	V	0.0	39

10.8.3 Radiated Spurious Emissions below 1 GHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
73.596111	28.26	40.00	11.74	120.000	101.0	V	88.0	15
74.566111	34.12	40.00	5.88	120.000	100.0	V	121.0	15
75.158889	32.32	40.00	7.68	120.000	101.0	V	111.0	15
108.031111	33.58	43.52	9.94	120.000	101.0	V	164.0	21
168.009444	39.60	43.52	3.92	120.000	101.0	V	216.0	21
168.763889	32.19	43.52	11.33	120.000	101.0	V	217.0	21

Note: results represent the worst case of all transmission modes with the device oriented in three orthogonal directions.

10.8.4 Radiated Spurious Emissions above 1 GHz, Transmitting at 2402MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4924.500000	44.45	73.98	29.53	1000.000	100.0	V	35.0	10
8225.000000	49.49	73.98	24.49	1000.000	100.0	H	237.0	15
12359.500000	52.52	73.98	21.46	1000.000	100.0	H	0.0	21

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4924.500000	31.12	53.98	22.86	1000.000	100.0	V	35.0	10
8225.000000	34.86	53.98	19.12	1000.000	100.0	H	237.0	15
12359.500000	39.21	53.98	14.77	1000.000	100.0	H	0.0	21

10.8.5 Radiated Spurious Emissions above 1 GHz, Transmitting at 2440MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4227.500000	44.69	73.98	29.29	1000.000	100.0	V	98.0	9
8286.500000	47.61	73.98	26.37	1000.000	100.0	V	318.0	15
12392.000000	52.81	73.98	21.17	1000.000	100.0	V	185.0	20

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4227.500000	30.73	53.98	23.25	1000.000	100.0	V	98.0	9
8286.500000	34.41	53.98	19.57	1000.000	100.0	V	318.0	15
12392.000000	39.04	53.98	14.94	1000.000	100.0	V	185.0	20

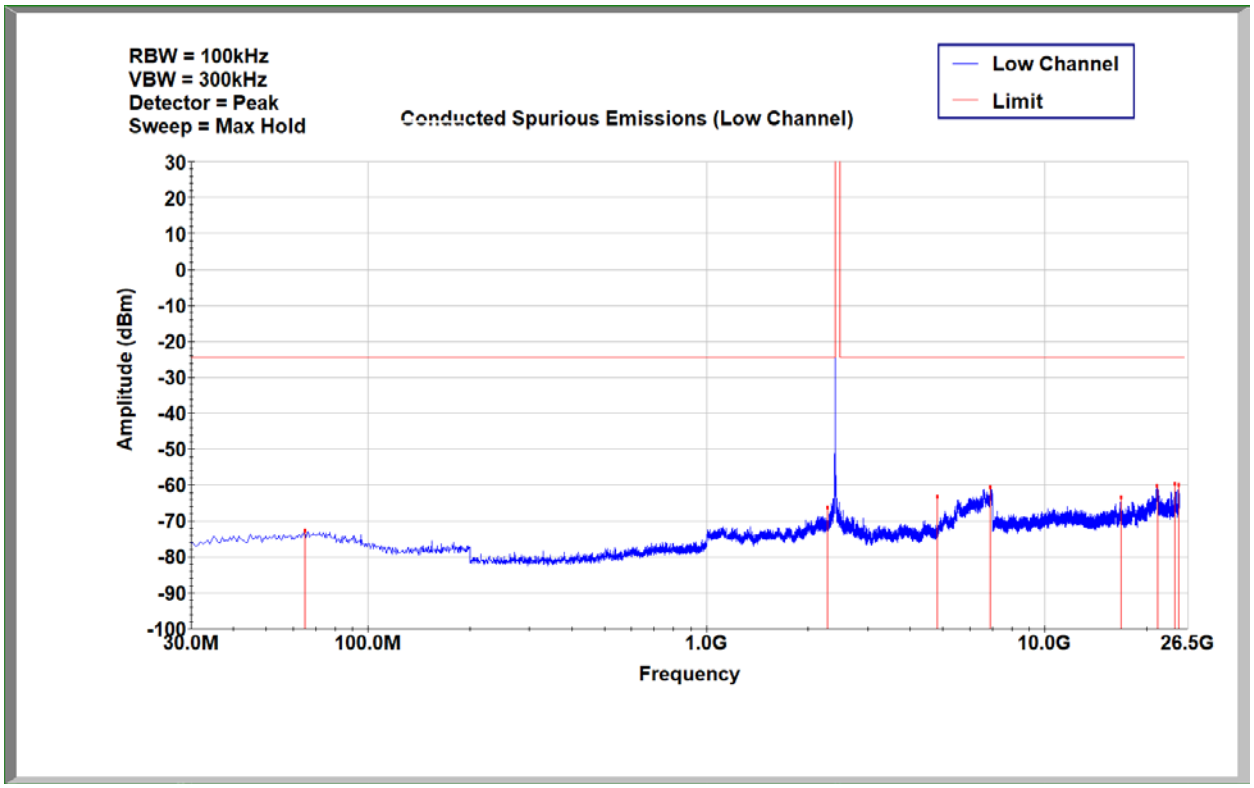
10.8.6 Radiated Spurious Emissions above 1 GHz, Transmitting at 2480MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3820.500000	44.77	73.98	29.21	1000.000	100.0	V	59.0	8
7440.000000	47.91	73.98	26.07	1000.000	410.0	H	203.0	13
10991.000000	51.64	73.98	22.34	1000.000	100.0	H	0.0	19

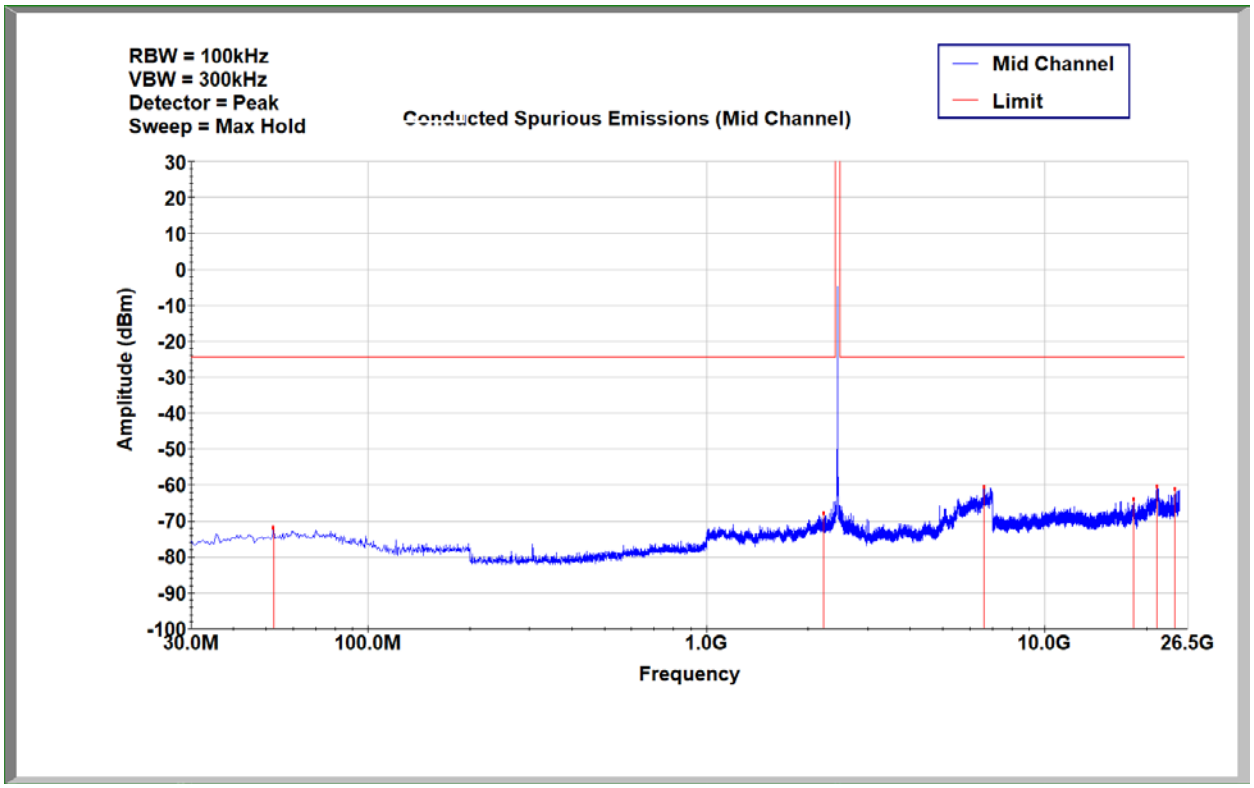
Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3820.500000	30.34	53.98	23.64	1000.000	100.0	V	59.0	8
7440.000000	34.48	53.98	19.50	1000.000	410.0	H	203.0	13
10991.000000	38.53	53.98	15.45	1000.000	100.0	H	0.0	19

10.9 Test Data (BLE, External Antenna)

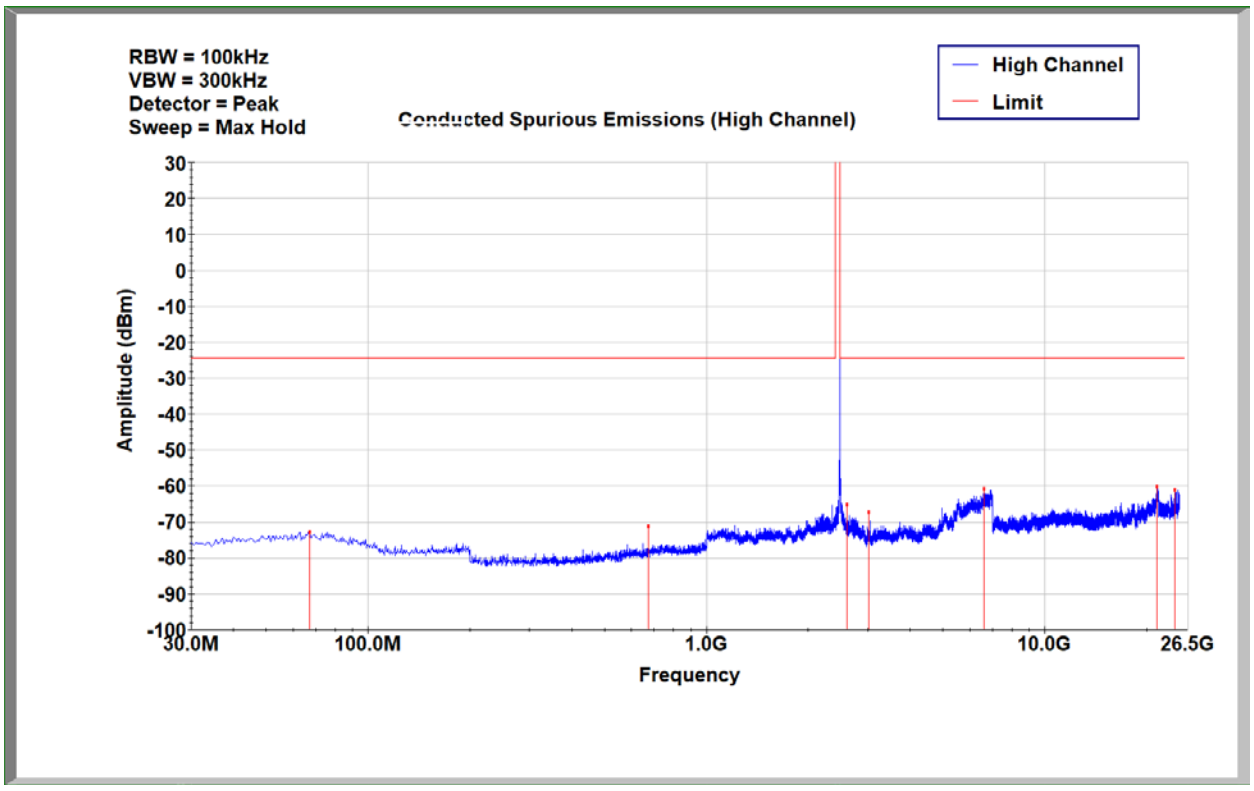
10.9.1 Conducted Spurious Emissions, Transmitting at 2402MHz



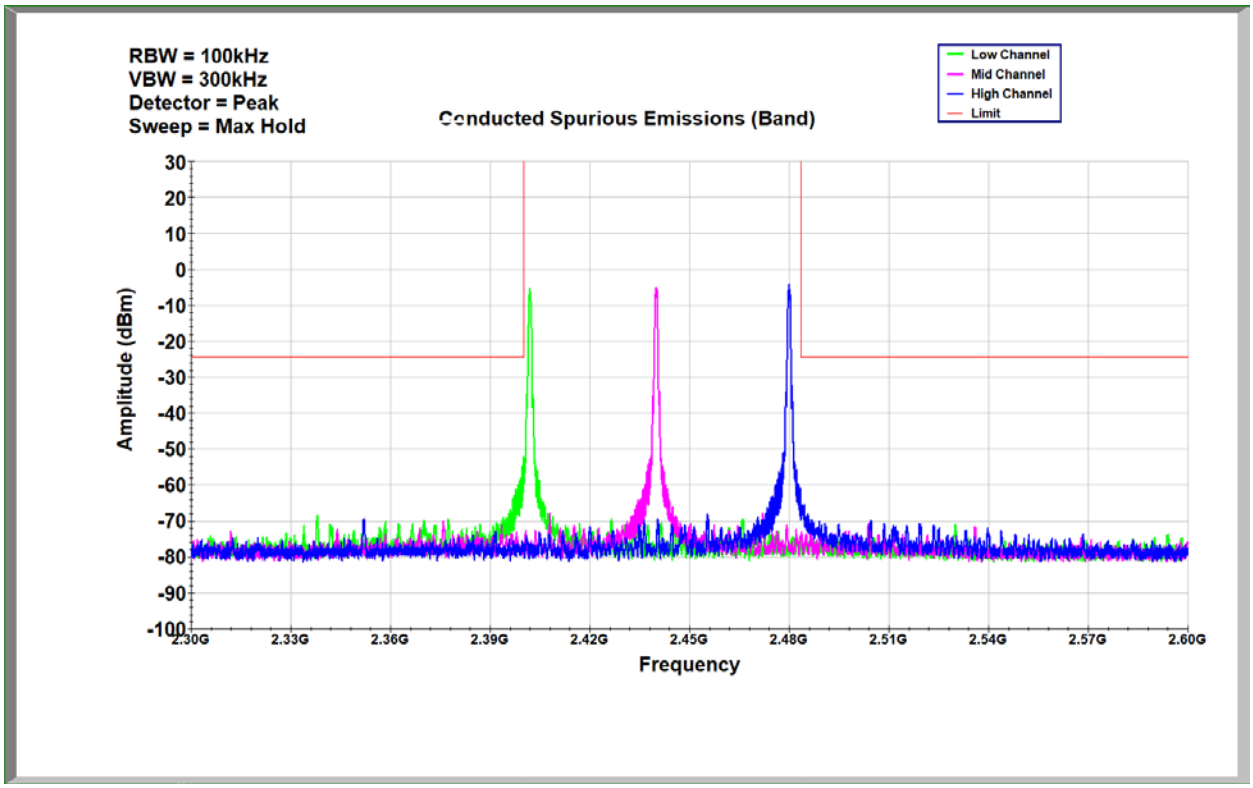
10.9.2 Conducted Spurious Emissions, Transmitting at 2440MHz



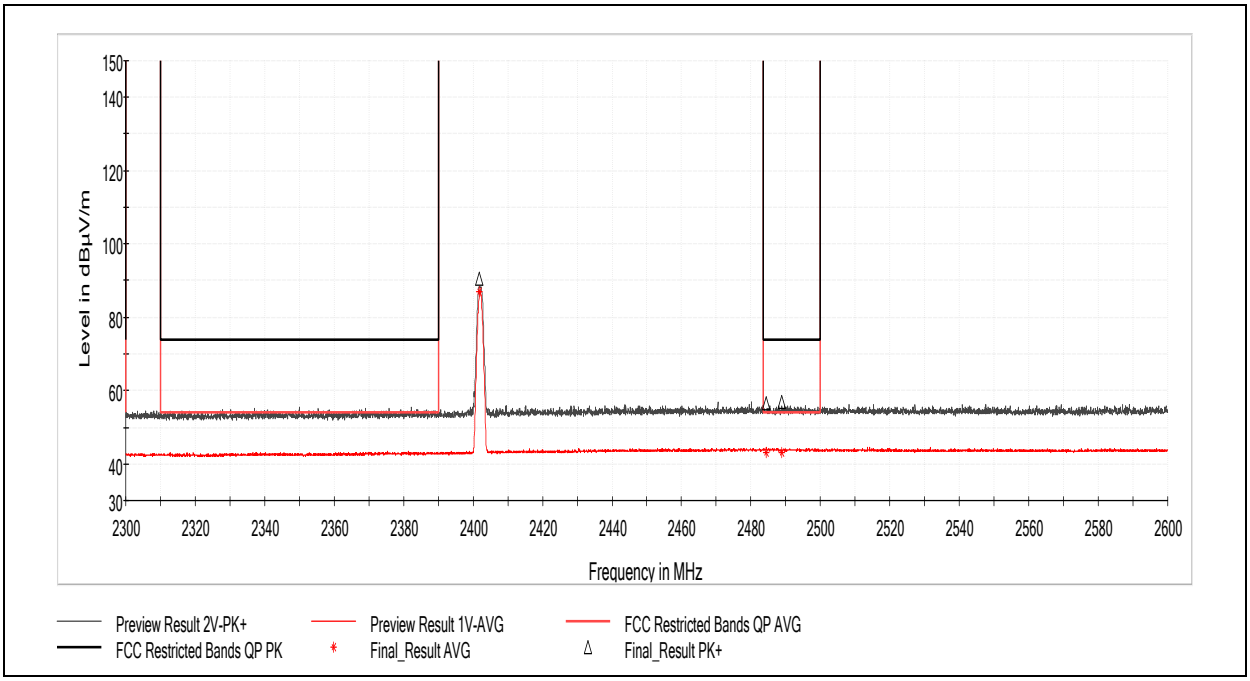
10.9.3 Conducted Spurious Emissions, Transmitting at 2480MHz



10.9.4 Conducted Spurious Emissions at the Authorized Band Edge



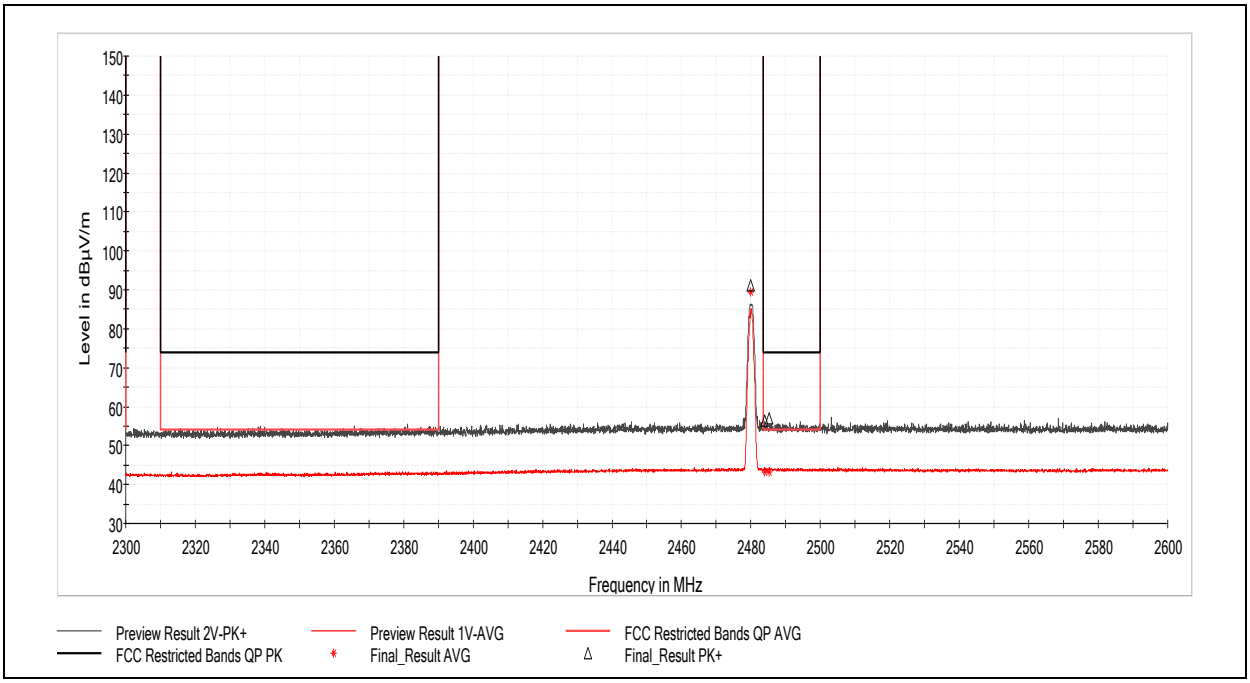
10.9.5 Radiated Emissions at the Low Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2401.711539	90.55	1000.00	909.45	1000.000	310.0	V	330.0	39
2484.442308	56.66	73.98	17.32	1000.000	204.0	V	12.0	39
2488.942308	56.81	73.98	17.17	1000.000	410.0	V	11.0	39

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2401.711539	87.09	1000.00	912.91	1000.000	310.0	V	330.0	39
2484.442308	43.15	53.98	10.83	1000.000	204.0	V	12.0	39
2488.942308	43.11	53.98	10.87	1000.000	410.0	V	11.0	39

10.9.6 Radiated Emissions at the High Band Edge



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2479.884615	91.27	1000.00	908.73	1000.000	359.0	V	330.0	39
2483.923077	56.35	73.98	17.63	1000.000	325.0	V	340.0	39
2485.192308	56.91	73.98	17.07	1000.000	200.0	V	303.0	39

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2479.884615	89.51	1000.00	910.49	1000.000	359.0	V	330.0	39
2483.923077	43.26	53.98	10.72	1000.000	325.0	V	340.0	39
2485.192308	43.12	53.98	10.86	1000.000	200.0	V	303.0	39

10.9.7 Radiated Spurious Emissions below 1 GHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
73.596111	28.26	40.00	11.74	120.000	101.0	V	88.0	15
74.566111	34.12	40.00	5.88	120.000	100.0	V	121.0	15
75.158889	32.32	40.00	7.68	120.000	101.0	V	111.0	15
108.031111	33.58	43.52	9.94	120.000	101.0	V	164.0	21
168.009444	39.60	43.52	3.92	120.000	101.0	V	216.0	21
168.763889	32.19	43.52	11.33	120.000	101.0	V	217.0	21

Note: results represent the worst case of all transmission modes with the device oriented in three orthogonal directions.

10.9.8 Radiated Spurious Emissions above 1 GHz, Transmitting at 2402MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4400.500000	44.68	1000.00	955.32	1000.000	100.0	V	0.0	9
4922.000000	44.96	73.98	29.02	1000.000	100.0	H	94.0	10
7766.500000	46.88	1000.00	953.12	1000.000	100.0	V	24.0	14
12099.500000	52.65	73.98	21.33	1000.000	100.0	H	325.0	20

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4400.500000	30.98	1000.00	969.02	1000.000	100.0	V	0.0	9
4922.000000	31.28	53.98	22.70	1000.000	100.0	H	94.0	10
7766.500000	33.97	1000.00	966.03	1000.000	100.0	V	24.0	14
12099.500000	39.49	53.98	14.49	1000.000	100.0	H	325.0	20

10.9.9 Radiated Spurious Emissions above 1 GHz, Transmitting at 2440MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4942.000000	44.77	73.98	29.21	1000.000	100.0	H	332.0	10
10990.000000	52.10	73.98	21.88	1000.000	100.0	V	0.0	19
16113.000000	56.65	73.98	17.33	1000.000	100.0	H	158.0	25

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4942.000000	31.47	53.98	22.51	1000.000	100.0	H	332.0	10
10990.000000	38.20	53.98	15.78	1000.000	100.0	V	0.0	19
16113.000000	42.70	53.98	11.28	1000.000	100.0	H	158.0	25

10.9.10 Radiated Spurious Emissions above 1 GHz, Transmitting at 2480MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4397.000000	44.39	73.98	29.59	1000.000	100.0	V	154.0	9
4893.000000	44.29	73.98	29.69	1000.000	100.0	V	-1.0	10
7752.000000	47.60	1000.00	952.40	1000.000	100.0	V	276.0	14

Frequency (MHz)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4397.000000	31.00	53.98	22.98	1000.000	100.0	V	154.0	9
4893.000000	31.19	53.98	22.79	1000.000	100.0	V	-1.0	10
7752.000000	34.10	1000.00	965.90	1000.000	100.0	V	276.0	14

11 Antenna Requirement

11.1 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 shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

> This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

11.2 Test Results

The sample tested was found to Comply. The EUT has an antenna inside the enclosure that can only be accessed by disassembly of the transmitter where such disassembly is not normally required, allowable per KDB 353028 D01 Antennas Part 15 Transmitters v01 Clause II(A)(2)(b)(ii)(3).

12 Conducted Emissions

12.1 Method

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

TEST SITE: Ground Plane

Site Designation: Ground Plane

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Power Line Conducted Emissions	150 kHz - 30 MHz	3.1dB	3.4dB

As shown in the table above our conducted 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.

12.2 Sample Calculations

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF
Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN or ISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(49.1\ dB\mu V / 20)}$ = 285.1 μV/m

12.3 Test Equipment Used:

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	103006	Rohde & Schwarz	ESW26	6/14/2021	6/14/2022
LISN	2508	Fischer Custom Communication	FCC-LISN-50-50-2M	6/22/2021	6/22/2022
Coaxial Cable	6026			12/21/2020	12/21/2021

12.4 Software Utilized:

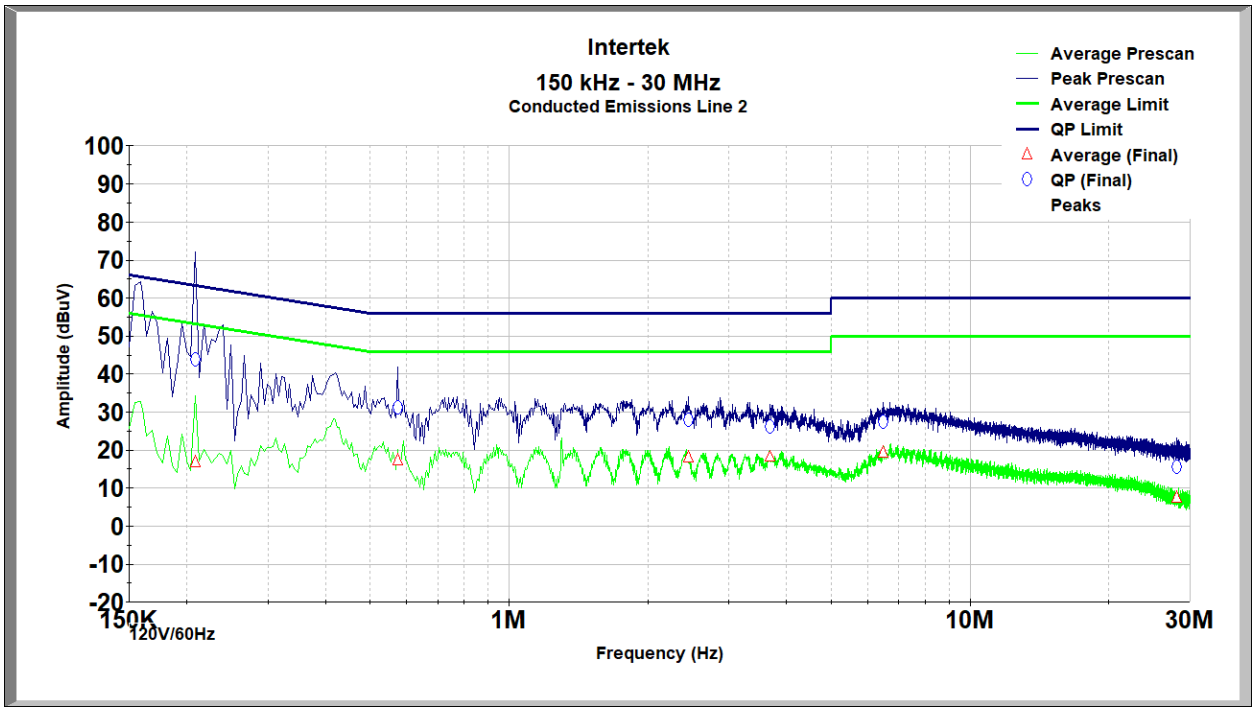
Name	Manufacturer	Version
TILE	ETS Lindgren	V7.0.6.545

12.5 Results:

The sample tested was found to Comply.

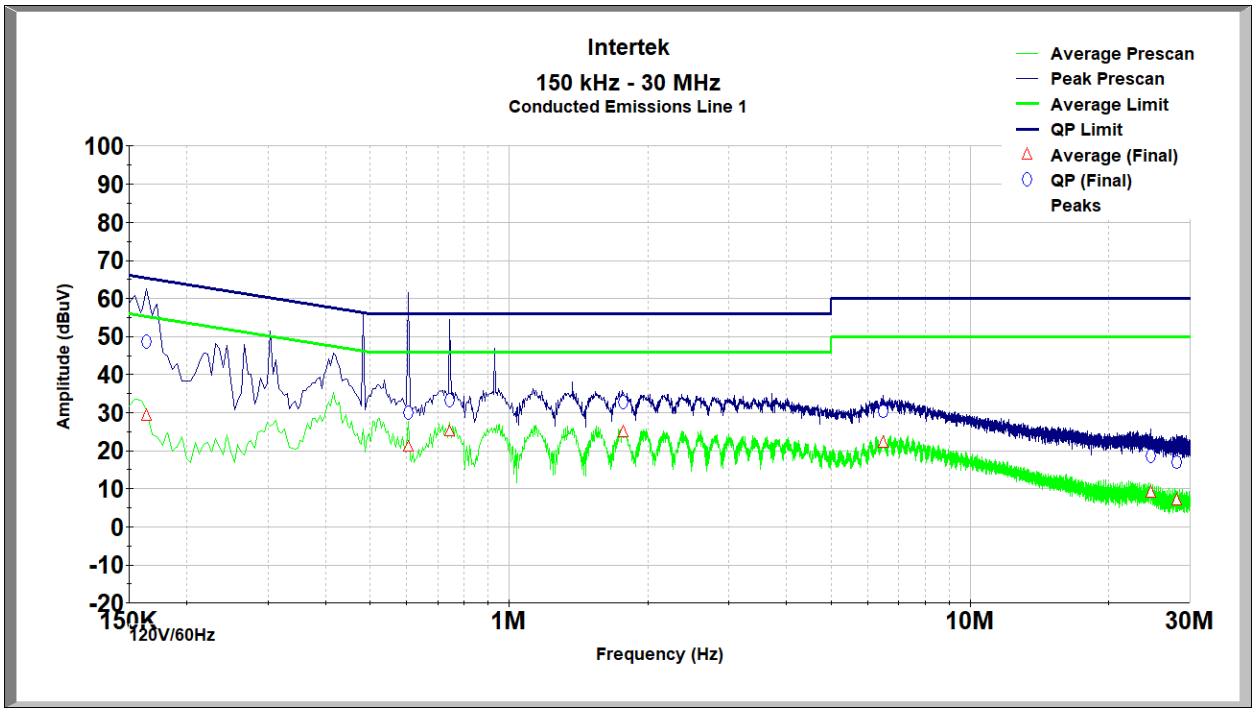
12.6 Setup Photographs: Conducted Emissions

12.7 Plots/Data: Conducted Emissions



Line

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.164	48.679	65.614	16.936	29.289	55.614	26.325
0.605	29.874	56.000	26.126	21.071	46.000	24.929
0.744	33.356	56.000	22.644	25.238	46.000	20.762
1.770	32.817	56.000	23.183	24.839	46.000	21.161
6.480	30.382	60.000	29.618	22.067	50.000	27.933
24.665	18.531	60.000	41.469	9.049	50.000	40.951
28.064	17.190	60.000	42.810	6.978	50.000	43.022



Neutral

Frequency (MHz)	Quasi-Peak (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)	Average (dBuV)	Average Limit (dBuV)	Average Margin (dB)
0.208	43.940	64.329	20.389	16.815	54.329	37.513
0.573	31.282	56.000	24.718	17.333	46.000	28.667
2.450	27.914	56.000	28.086	18.014	46.000	27.986
3.688	26.180	56.000	29.820	18.241	46.000	27.759
6.484	27.359	60.000	32.641	19.474	50.000	30.526
28.108	15.576	60.000	44.424	7.479	50.000	42.521

Test Personnel:	Brian Lackey	Test Date:	10/12/2021
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	Class B
Product Standard:	FCC Part 15B ICES-003 Issue 7	Ambient Temperature:	22.0C
Input Voltage:	120V/60Hz	Relative Humidity:	66.2%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	985.0mbar

Deviations, Additions, or Exclusions: None

13 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	8/23/2021	104685025LEX-001	BL	BCT	Original Issue
1	9/9/2021	104685025LEX-001.1	BL	BCT	Added additional BLE data
2	10/12/2021	104685025LEX-001.2	BL	BCT	Added conducted emissions data.