SIMBEX LLC

TEST REPORT

SCOPE OF WORK
EMISSIONS TESTING – INSITE NXT PLAYER UNIT

REPORT NUMBER
104955058ATL-001a

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June 09, 2022

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

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 104955058ATL-001a
Project Number: G104955058

Report Issue Date: May 20, 2022
Report Revision Date: June 09, 2022

Model(s) Tested: INSITE NXT PLAYER UNIT

Standards: CFR47 FCC Part 15.247 Subpart C: 2022,
CFR47 FCC Part 15 Subpart C: 2022,
RSS-247 Issue 2 February 2017,
ICES-003 Issue 6 Published: 2020,
RSS-Gen Issue 5 April 2018,
Issue 5 March 2015 +A1: 2021

Tested by:
Intertek Testing Services NA, Inc.
1950 Evergreen Blvd., Suite 100
Duluth, GA 30096
USA

Client:
Simbex LLC
10 Water Street Suite 410
Lebanon, NH 03766
USA

Report prepared by Dan Alvarez

Dan Alvarez / EMC Engineer

Report reviewed by Kouma Sinn

Kouma Sinn / EMC Engineering Supervisor

Table of Contents

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
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	---
6	Maximum Peak Output CFR47 FCC Part 15 Subpart B:2019, Section 15.247 (b)(3) RSS-247 Issue 2 February 2017, Issue 5 March 2015	Pass
7	6 dB Bandwidth and Occupied Bandwidth CFR47 FCC Part 15 Subpart C:2019, Section 15.247 (a)(2) RSS-247 Issue 2 February 2017	Pass
8	Maximum Power Spectral Density CFR47 FCC Part 15 Subpart C:2019, Section 15.247 (e) RSS-247 Issue 2 February 2017	Pass
9	Band Edge Compliance CFR47 FCC Part 15 Subpart C:2019, Section 15.247 (d) RSS-247 Issue 2: 02/2017)	Pass
10	Transmitter spurious emissions CFR47 FCC Part 15 Subpart C:2019, Section 15.247 (d) RSS-247 Issue 2 February 2017	Pass
11	Revision History	--

Notes: The EUT is powered by 1.5 VDC Battery. No AC Conducted Emissions test is required.

3 Client Information

This EUT was tested at the request of:

Client: Simbex LLC
10 Water Street Suite 410
Lebanon, NH 03766
USA
Contact: Evart Fairman
Telephone: +1 (603) 448 2367
Fax: None
Email: ef01@simbex.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Simbex LLC
10 Water Street Suite 410
Lebanon, NH 03766
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
INSITE NXT PLAYER UNIT (No Shield)	Simbex, LLC	016-N-1003 Rev.A	Test Unit 5
INSITE NXT PLAYER UNIT (No Shield with Coax on antenna port)	Simbex, LLC	016-N-1003 Rev.A	Test Unit 7

Receive Date:	04/25/2022
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The InSite NXT Player Unit is a battery-powered device that is designed to be built into football helmets worn by players. The device detects and measures head impact events and transmits event data to the paired smart phone using the IEEE 802.15.1 -2006 Bluetooth Low Energy protocol.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Power	Rated Frequency	Number of Phases
1.5 VDC Battery	-	-	-

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Continuously transmitting

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	2400-2480 MHz
Modulation Type(s)	Direct-sequence Spread Spectrum, 40 channels, GFSK
Data Rates	800 kbps
Power Setting During Test	Max
Maximum Output Power	Low Channel (2402.2 MHz): + 15.13 dBm (Conducted) Mid Channel (2441.4 MHz): + 14.78 dBm (Conducted) High Channel (2480.1 MHz): + 14.19 dBm (Conducted)
Test Channels	Low Channel (2402 MHz) Mid Channel (2442 MHz) High Channel (2480 MHz)
Occupied Bandwidth	Low Channel (2401.7 MHz): 1.058 MHz Mid Channel (2441.7 MHz): 1.067 MHz High Channel (2479.7 MHz): 1.065 MHz
6 dB Bandwidth	Low Channel (2401.7 MHz): 0.649 MHz Mid Channel (2441.7 MHz): 0.632 MHz High Channel (2479.7 MHz): 0.674 MHz
20 dB Bandwidth	Low Channel (2401.7 MHz): 1.191 MHz Mid Channel (2441.7 MHz): 1.199 MHz High Channel (2479.7 MHz): 1.192 MHz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	1
Equipment Type	Standalone
Antenna Type and Gain	PCB, +3.3 dBi

Antenna Requirement – FCC: Section 15.203
The PCB antenna is a mounted antenna and the antenna is permanently attached to the board. This satisfies the requirements of Section 15.203.

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

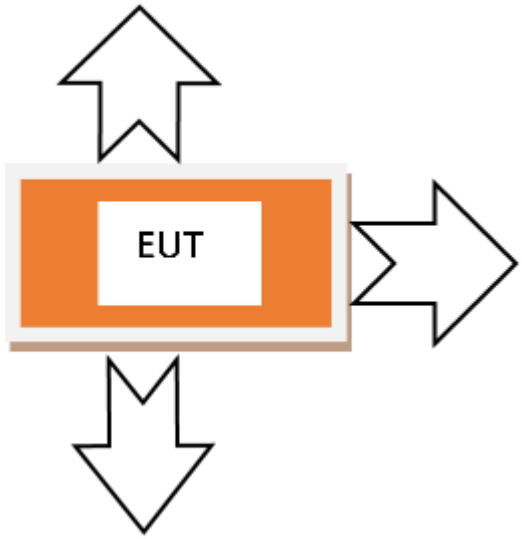
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	None	N/A	N/A	N/A	N/A

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	N/A	N/A	N/A

5.1 Method:

Configuration as required by Configuration as required by FCC Part 15 Subpart C 15.247:2022, FCC Part 15 Subpart B:2022, RSS 247 Issue 2: 02/2017, ICES 003 Issue 7:2020, RSS-Gen Issue 5 April 2018, Issue 5:2015 +A1:2021, ANSI C 63.10: 2013, ANSI C 63.4: 2014, ANSI C63.10:2013, and KBD 558074 D01 15.247 Meas Guidance v05r02:2019

5.2 EUT Block Diagram:



6 Maximum Peak Output Power

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, ANSI C63.10, and KBD 558074.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.9 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.6 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.8 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.9 dB	6.3 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, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

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

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200005'	Attenuator, 03 dB, <18GHz	Weinschel Corp	2	BK7890	05/27/2021	05/27/2022
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/13/2021	10/13/2022
212104'	Barometric Pressure/Humidity/Temperature Datalogger	Extech	SD700	A.074980	05/25/2021	05/25/2022

Software Utilized:

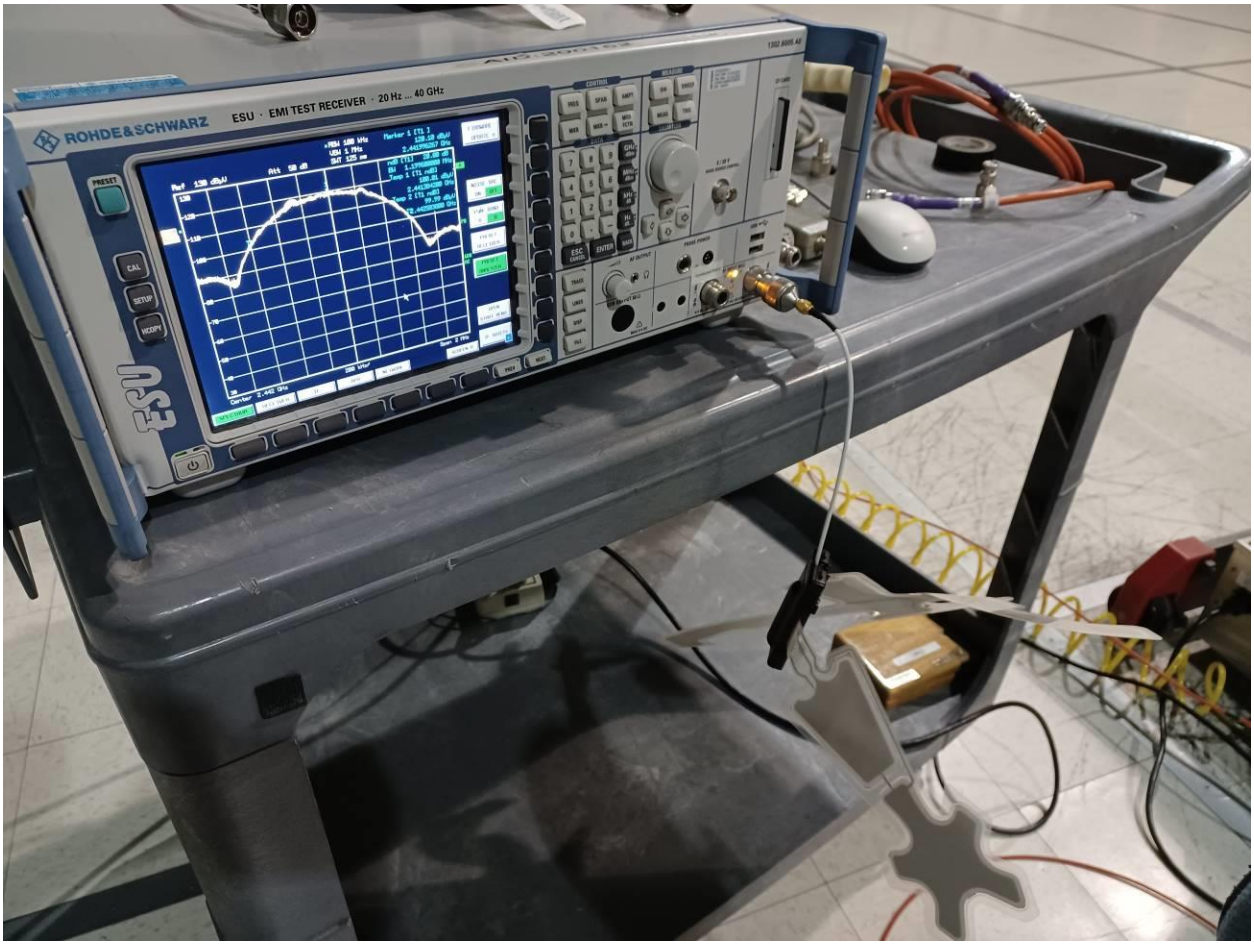
Name	Manufacturer	Version
BAT-EMC	Nexio	3.19.1.18

6.3 Results:

The sample tested was found to Comply.

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 or + 30 dBm.

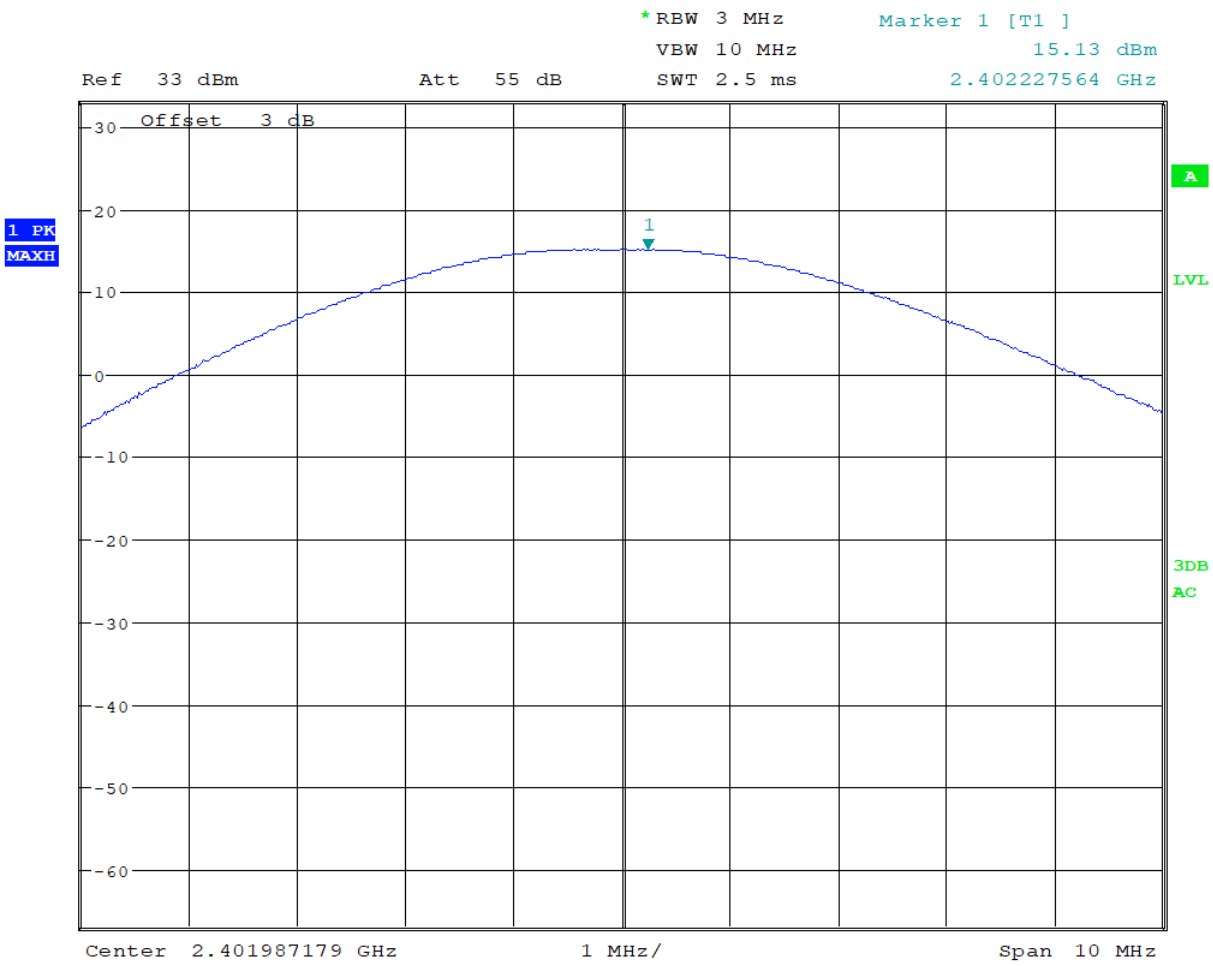
6.4 Setup Photograph:



6.5 Plots/Data:

Frequency (MHz)	Conducted Power (dBm)
2402.2	15.13
2441.4	14.78
2480.1	14.19

Low Channel Conducted Power



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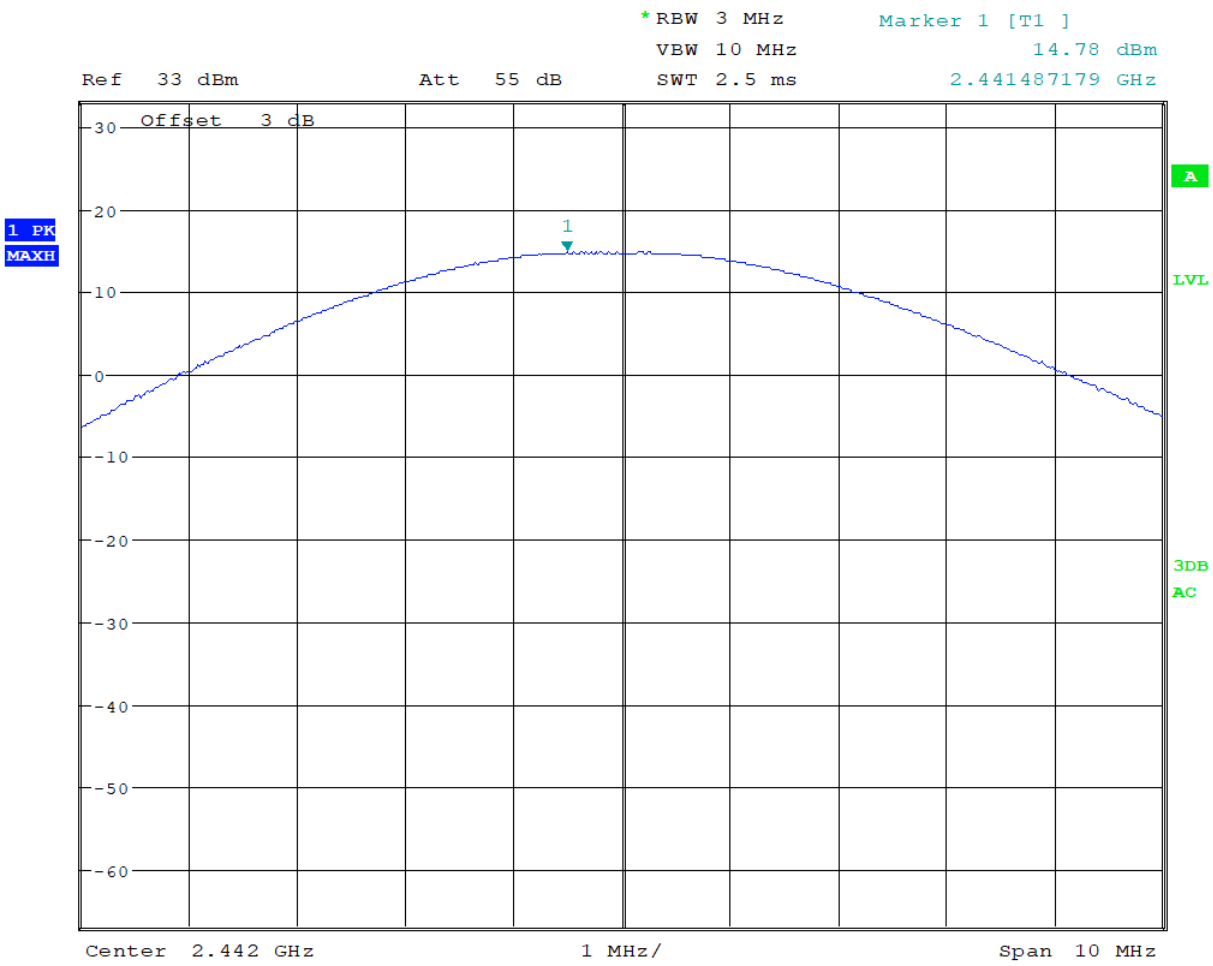
Mid Channel Conducted Power



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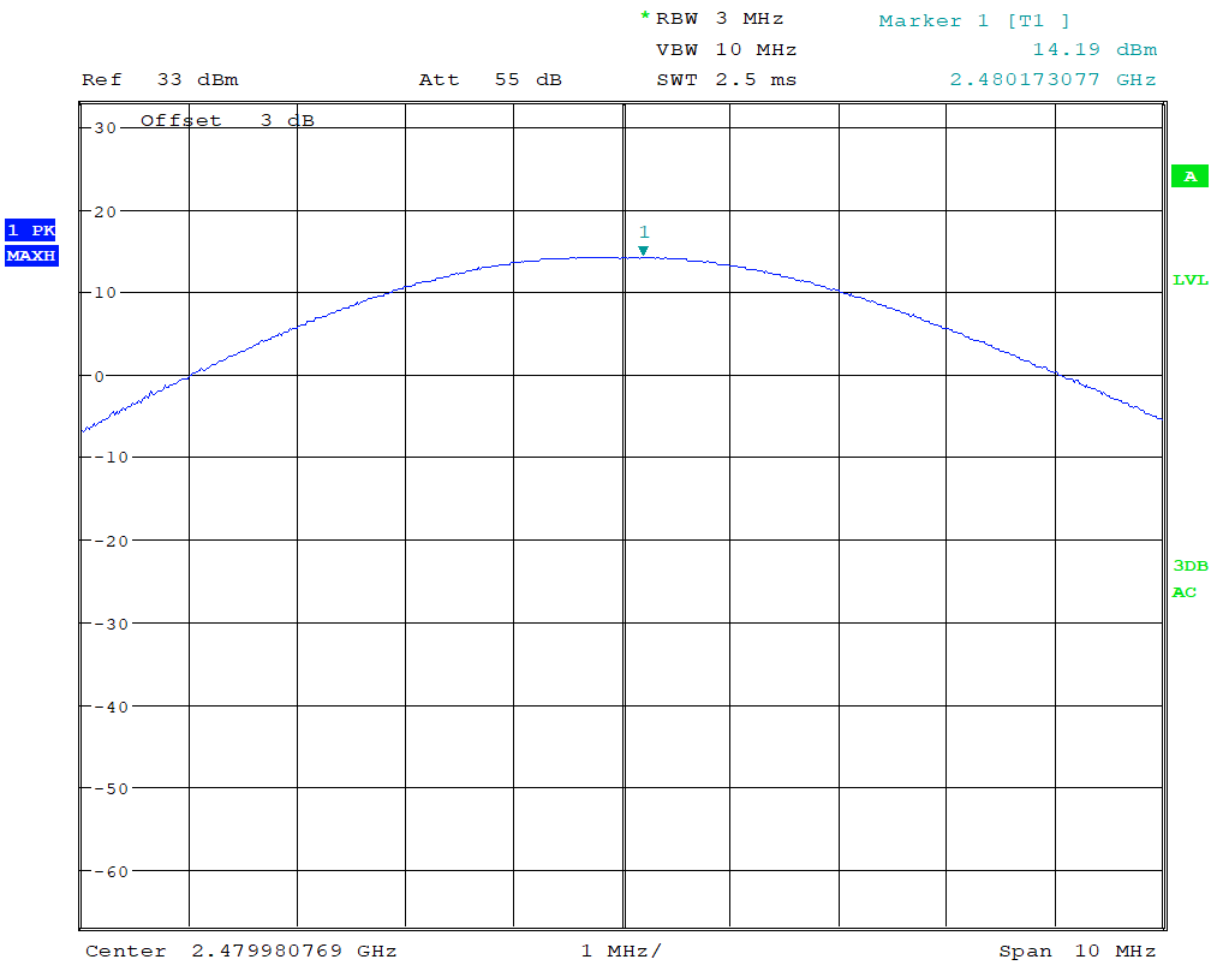
High Channel Conducted Power



Test Personnel:	Dan Alvarez	Test Date:	05/19/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247,	Limit Applied:	See report section 6.3
Input Voltage:	Battery Powered	Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	**N/A**	Relative Humidity:	43 %
		Atmospheric Pressure:	986 mbars

Deviations, Additions, or Exclusions: None

7 6 dB Bandwidth and Occupied Bandwidth

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/13/2021	10/13/2022
212104'	Barometric Pressure/Humidity/Temperature Datalogger	Extech	SD700	A.074980	05/25/2021	05/25/2022

Software Utilized:

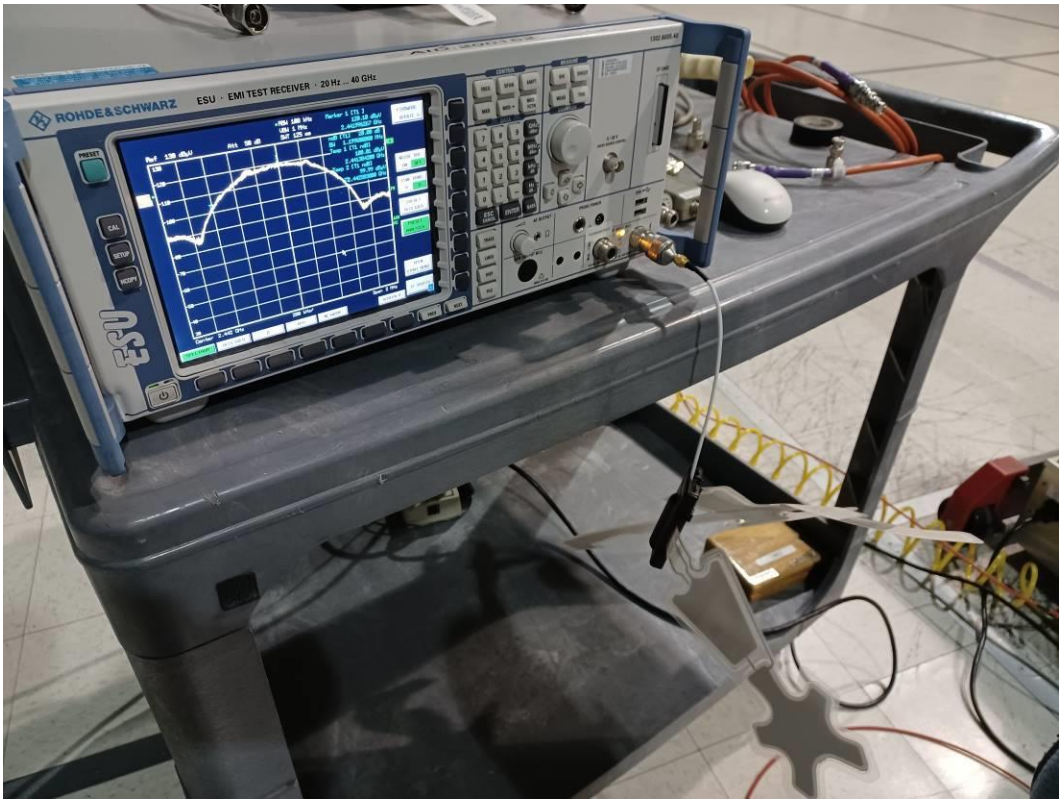
Name	Manufacturer	Version
None	N/A	N/A

7.3 Results:

The sample tested was found to Comply.

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.

7.4 Setup Photograph:



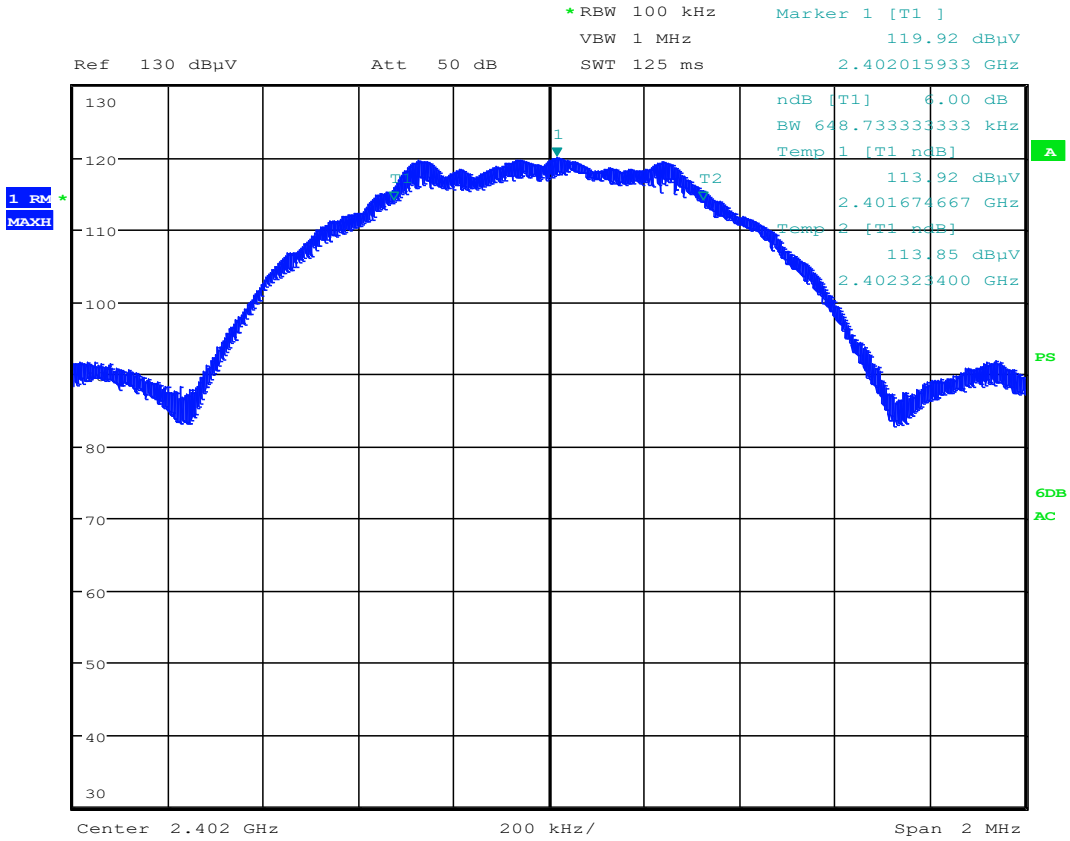
7.5 Plots/Data:

DTS Bandwidths

Frequency	6 dB DTS Bandwidth	Bandwidth Limit	Results
2401.7 MHz	649 kHz	> 500 kHz	Pass
2441.7 MHz	632 kHz	> 500 kHz	Pass
2479.7 MHz	674 kHz	> 500 kHz	Pass

Notes: Measurement was performed using conducted method.

Low Channel 6 dB DTS Bandwidth



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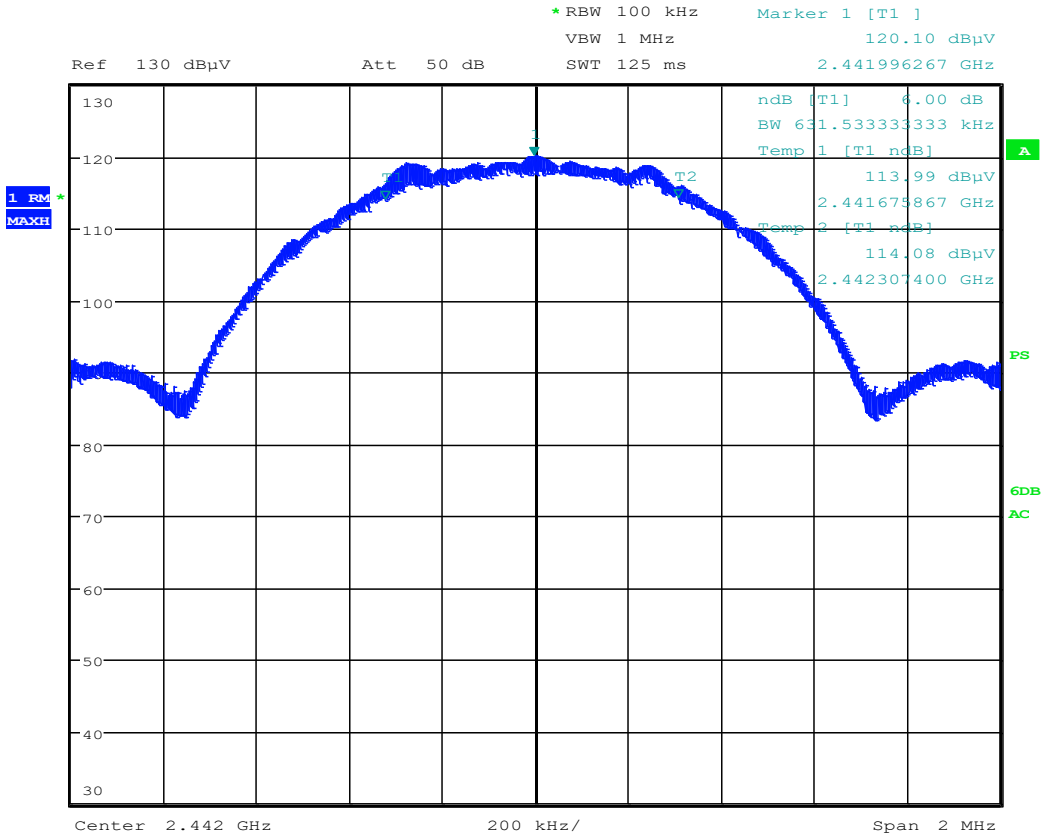
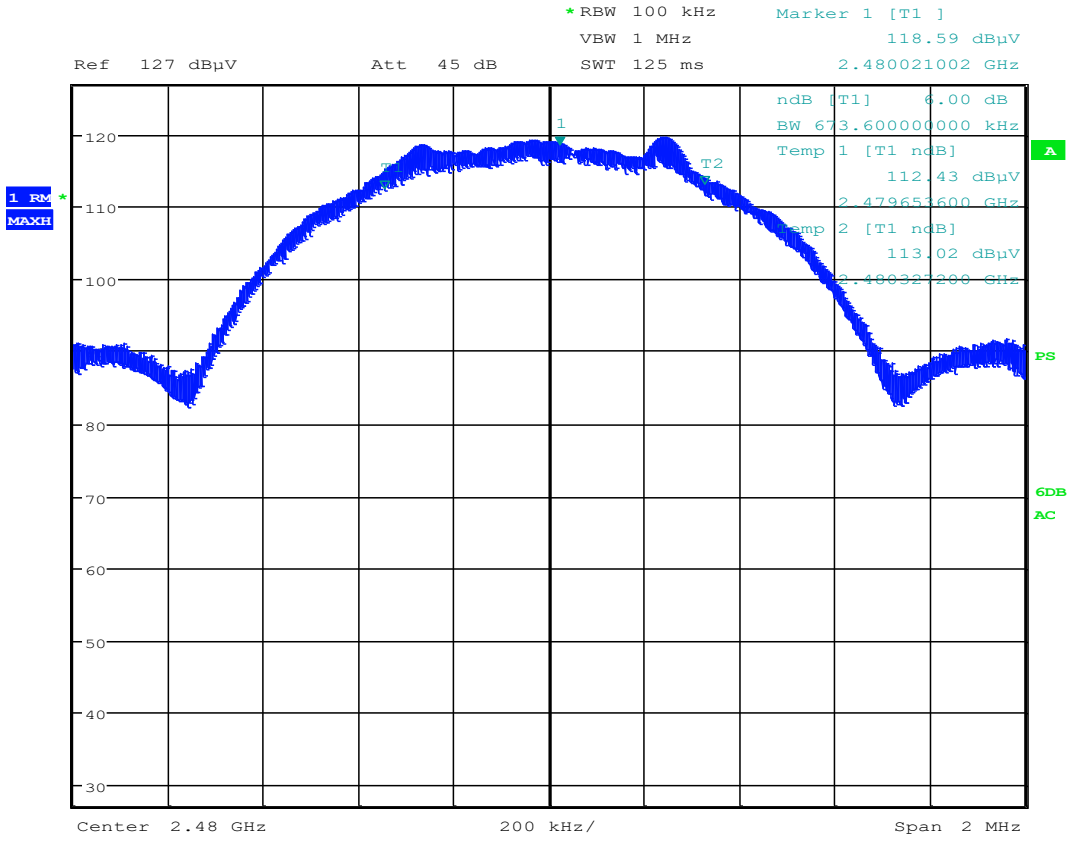
Mid Channel 6 dB DTS Bandwidth



Date: 27.APR.2022 14:59:24

High Channel 6 dB DTS Bandwidth

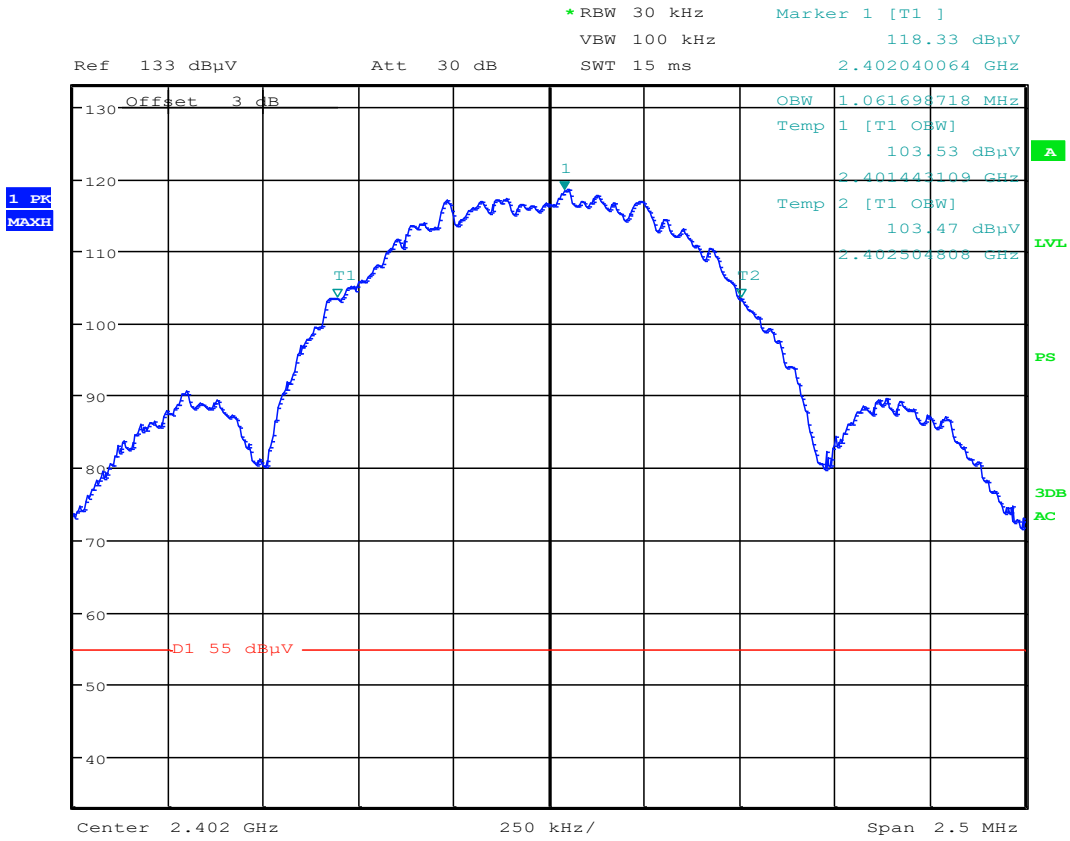


Occupied Bandwidths

Frequency	99% Occupied Bandwidth	Bandwidth Limit	Result
2401.7 MHz	1.062 MHz	Upper and Lower edge within assigned band	Pass
2441.7 MHz	1.066 MHz	Upper and Lower edge within assigned band	Pass
2479.7 MHz	1.070 MHz	Upper and Lower edge within assigned band	Pass

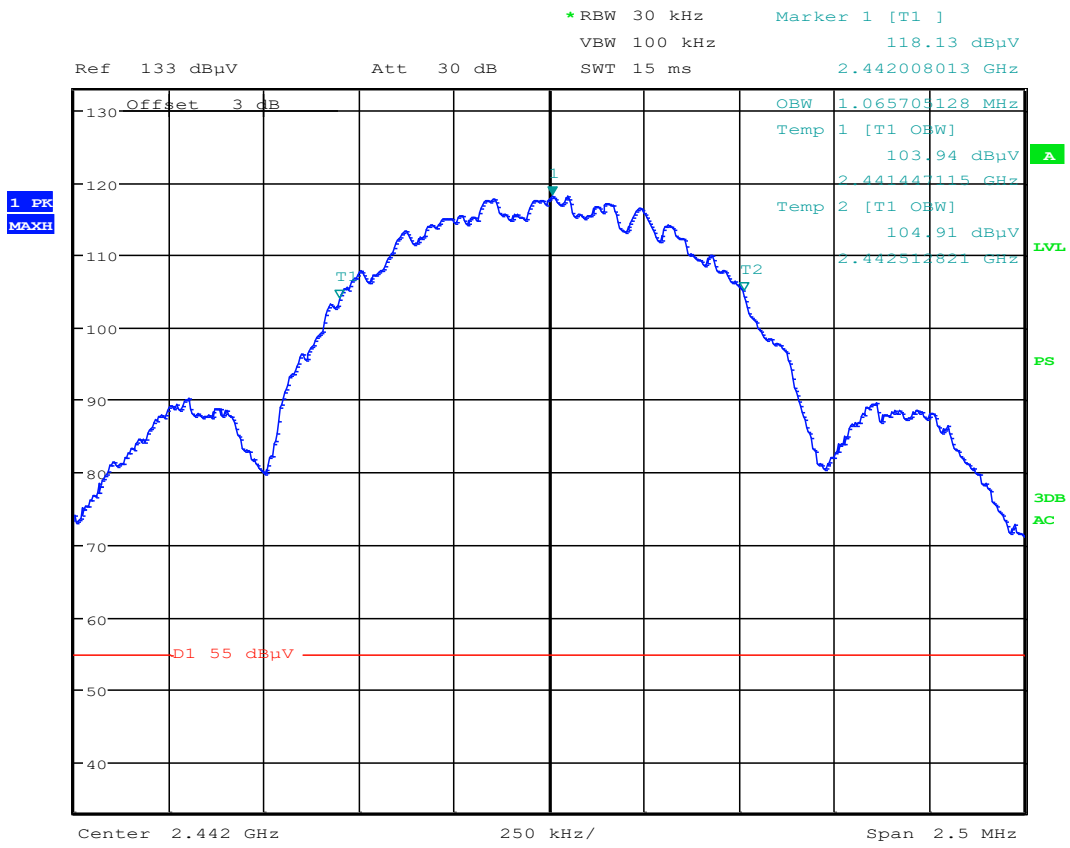
Notes: Measurement was performed using conducted method.

Low Channel 99% Power Occupied Bandwidth



Date: 13.MAY.2022 13:26:14

Mid Channel 99% Power Occupied Bandwidth



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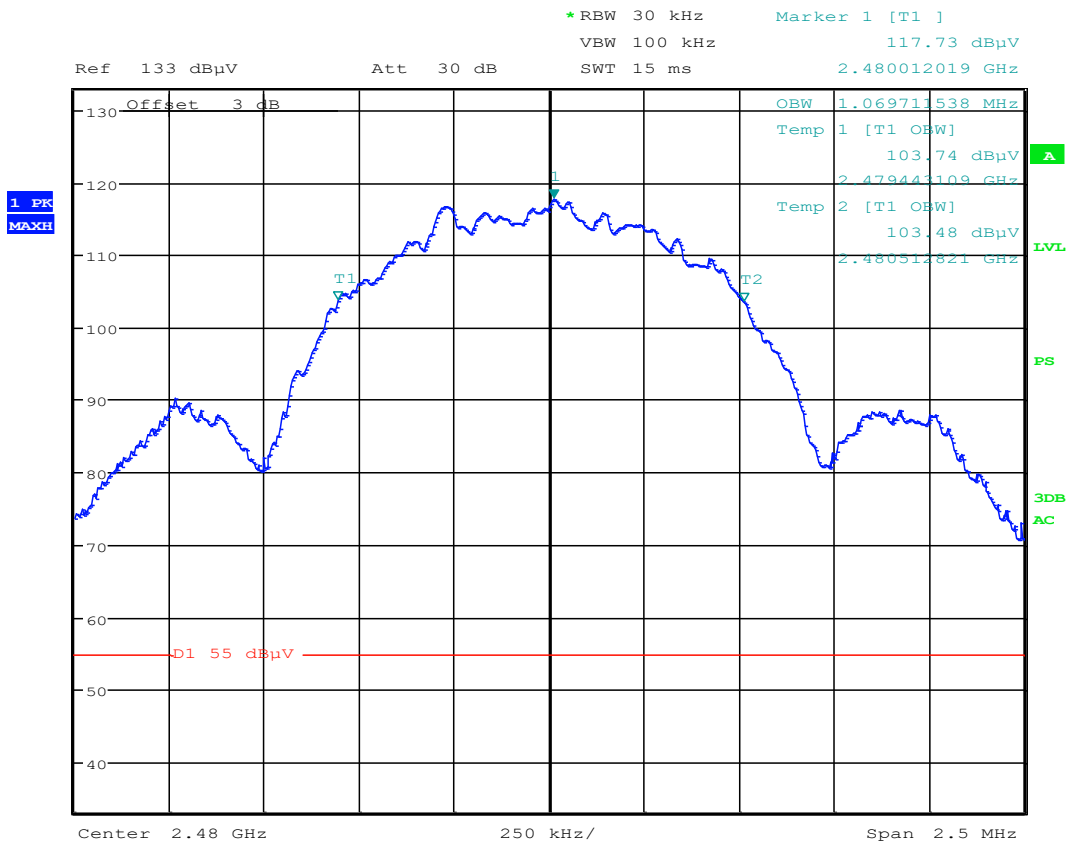
High Channel 99% Power Occupied Bandwidth



Date: 13.MAY.2022 13:25:43

Test Personnel:	Dan Alvarez	Test Date:	04/27/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247, RSS-247	Limit Applied:	See report section 7.3
Input Voltage:	Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	**N/A**	Ambient Temperature:	23 ºC
		Relative Humidity:	40.2 %
		Atmospheric Pressure:	987 mbars

Deviations, Additions, or Exclusions: None

8 Maximum Power Spectral Density

8.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10.

TEST SITE: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/13/2021	10/13/2022
212104'	Barometric Pressure/Humidity/Temperature Datalogger	Extech	SD700	A.074980	05/25/2021	05/25/2022

Software Utilized:

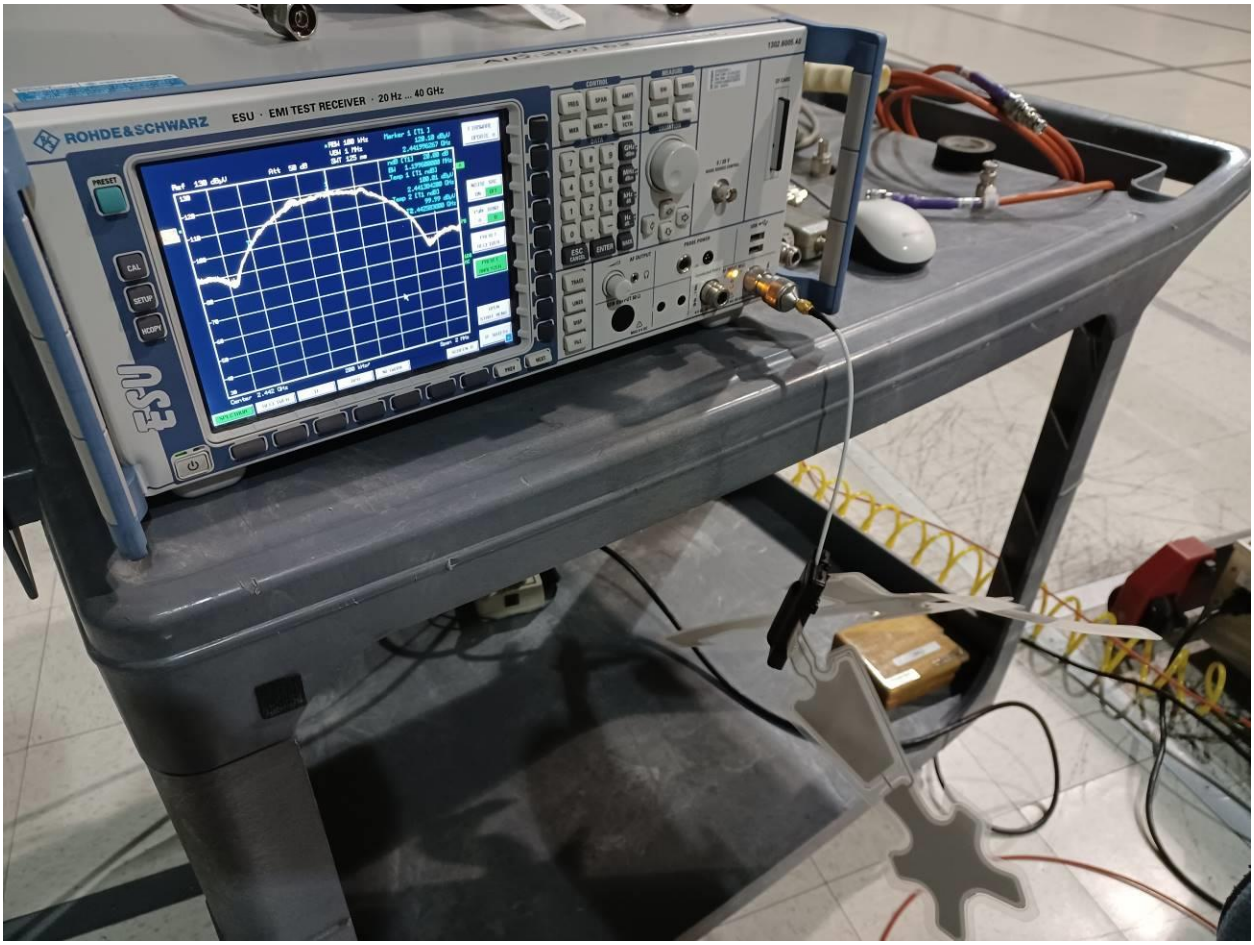
Name	Manufacturer	Version
None	N/A	N/A

8.3 Results:

The sample tested was found to Comply.

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.

8.4 Setup Photograph:



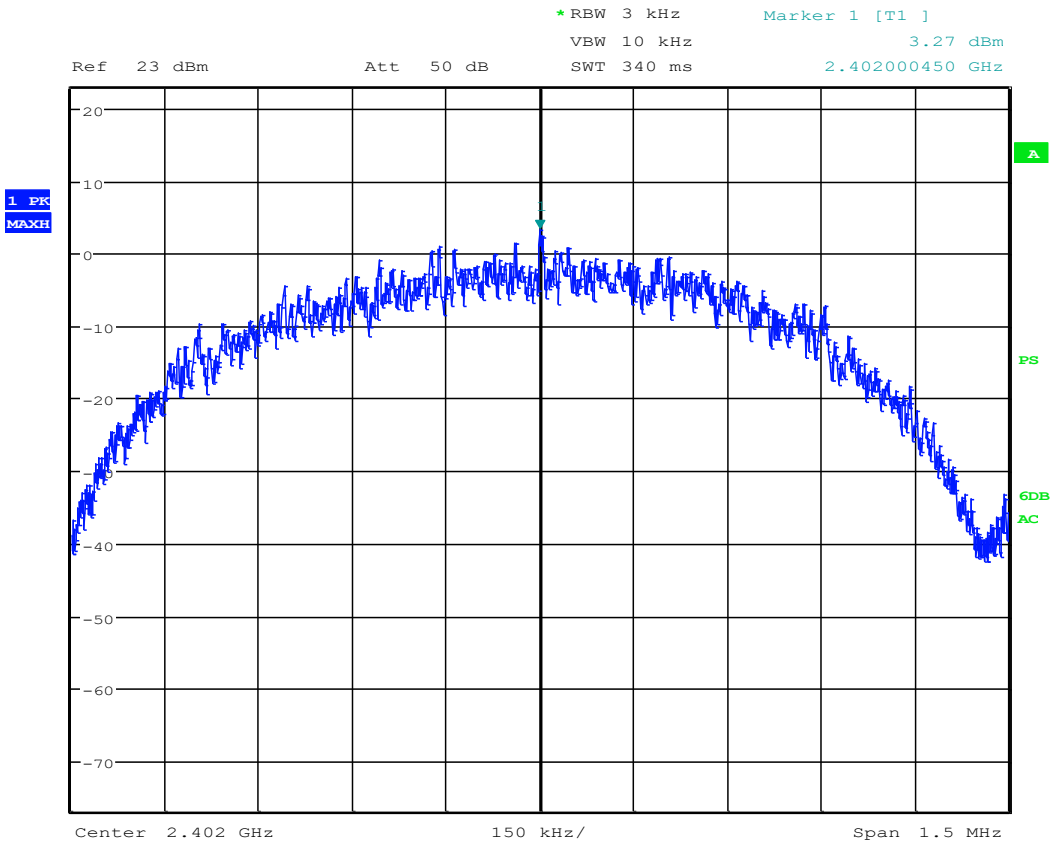
8.5 Plots/Data:

Power Spectral Density

Frequency (MHz)	PSD RBW (kHz)	Power Spectral Density (dBm)	Limit (dBm)	Margin (dB)	Result
2401.7	3	3.27	8	-4.73	Pass
2441.7	3	1.63	8	-6.37	Pass
2479.7	3	0.86	8	-7.14	Pass

Notes: Measurement was performed using conducted method.

Low Channel Power Spectral Density



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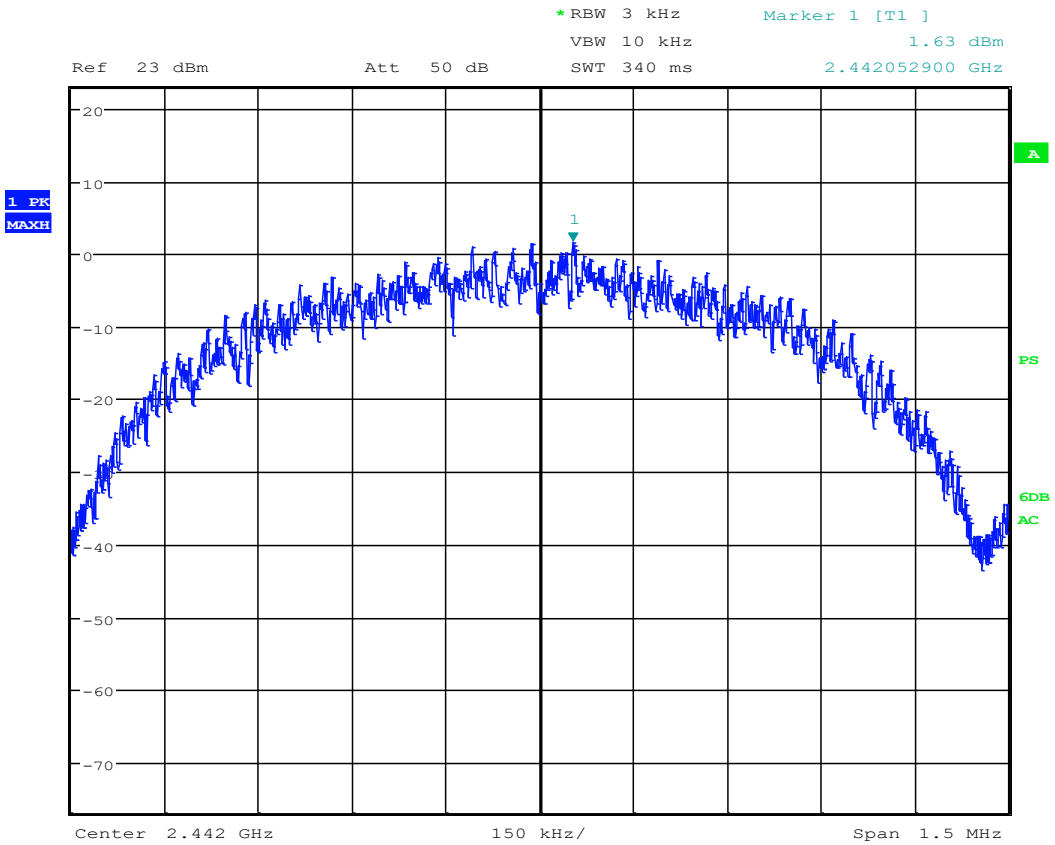
Mid Channel Power Spectral Density



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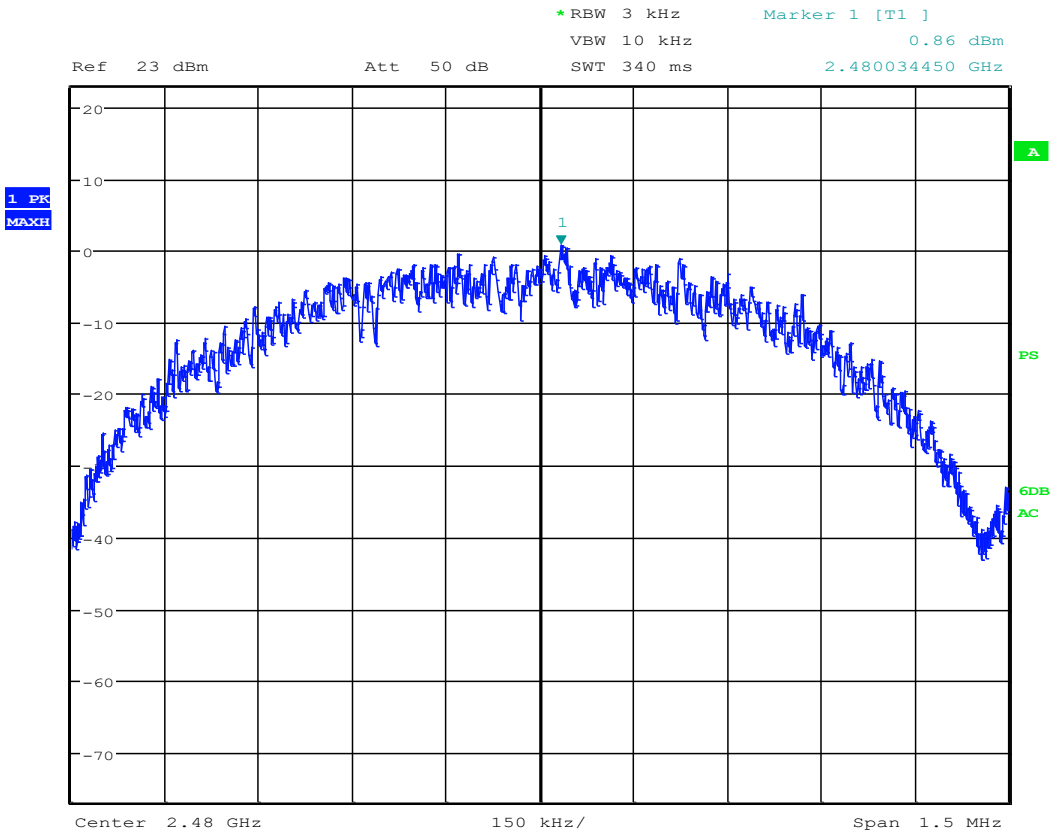
High Channel Power Spectral Density



Test Personnel:	Dan Alvarez	Test Date:	04/27/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247, RSS-247	Limit Applied:	See report section 8.3
Input Voltage:	Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	23 ºC
		Relative Humidity:	43 %
		Atmospheric Pressure:	986 mbars

Deviations, Additions, or Exclusions: None

9 Band Edge Compliance

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247 RSS 247, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.9 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.6 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.8 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.9 dB	6.3 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, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

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

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200005'	Attenuator, 03 dB, <18GHz	Weinschel Corp	2	BK7890	05/27/2021	05/27/2022
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/13/2021	10/13/2022
MM3'	RF Coax Cable 10KHz-18GHz	Maury Microwave	UC-N-MM36	769548	05/28/2021	05/28/2022
212104'	Barometric Pressure/Humidity/Temperature Datalogger	Extech	SD700	A.074980	05/25/2021	05/25/2022
MM8	RF Coax Cable 9KHz-18GHz	Maury Microwave	UC-N-MM-267	1635289	10/13/2021	10/13/2022
213453'	Preamplifier 500MHz-18GHz	Com-Power	PAM-118A	18040030	10/13/2021	10/13/2022
213058a'	Antenna, Horn, <18 GHz	A.H. Systems	SAS-200/571	246	02/08/2022	02/08/2023

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.19.1.18

9.3 Results:

The sample tested was found to Comply.

Limit – 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))

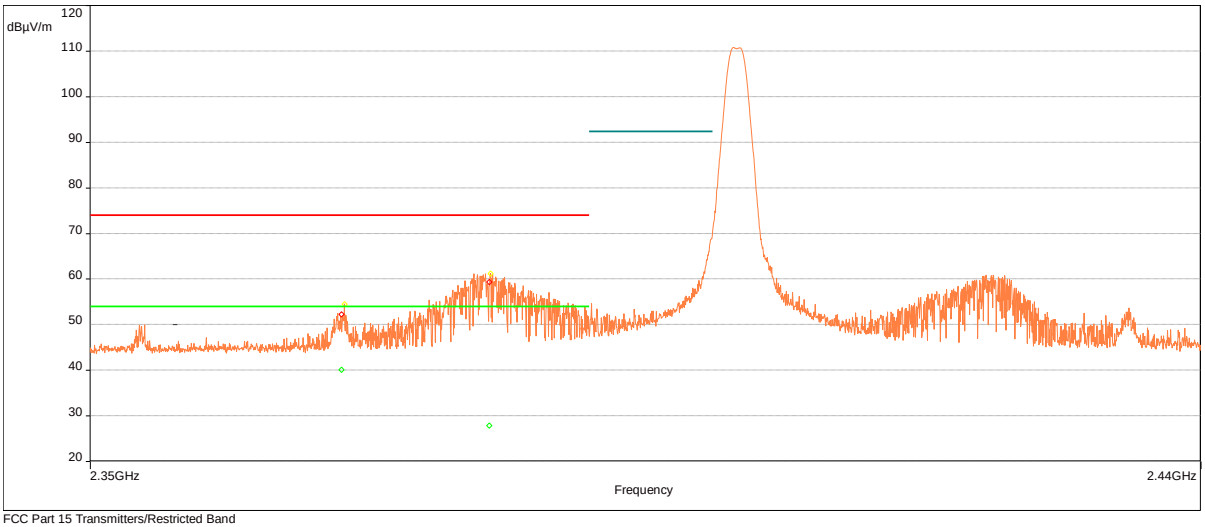
Note: Emissions were highest in the Z-Axis.

9.4 Setup Photograph:

Z-Axis Orientation

9.5 Plots/Data:

Restricted Band- Class 2.35GHz-2.44GHz.
InSite NXT Player Unit _RE_Z-Axis_Low-Channel_Band Edge
Emissions Graph:



FCC Part 15 Transmitters/Restricted Band
4/27/2022 9:53:32 AM

Data Results:

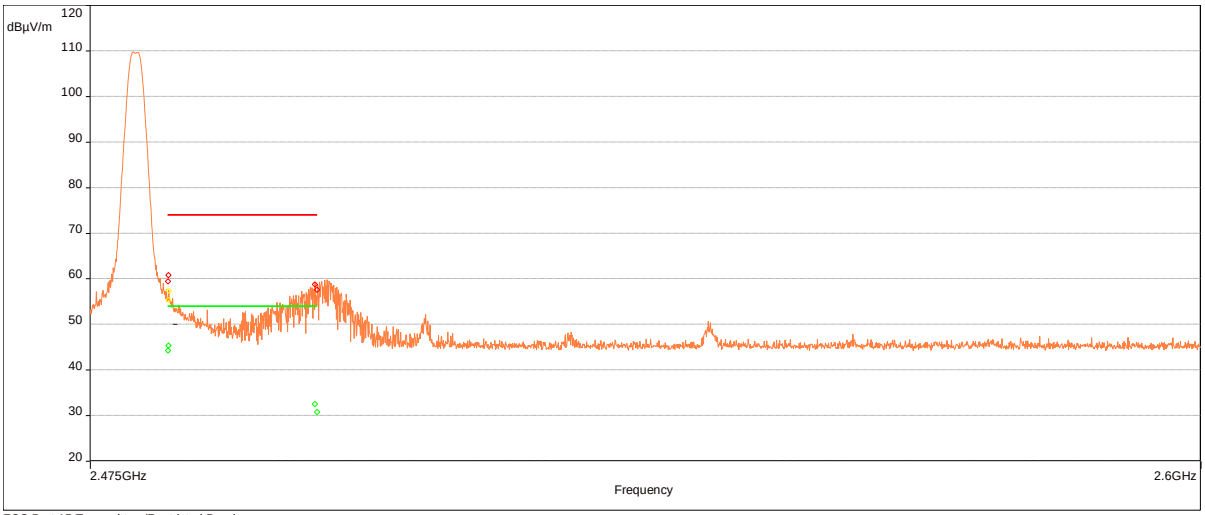
Avg (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	(RBW) (MHz)	Correction (dB)
2370.057	40.08	54.00	-13.92	177.00	3.61	Horizontal	1.00	-5.71
2381.93	27.90	54.00	-26.10	311.00	2.57	Horizontal	1.00	-5.70

Peak (PASS) (2)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	(RBW) (MHz)	Correction (dB)
2370.057	52.24	74.00	-21.76	177.00	3.61	Horizontal	1.00	-5.71
2381.93	59.34	74.00	-14.66	311.00	2.57	Horizontal	1.00	-5.70

Restricted Band- Class 2.475GHz-2.6GHz.
InSite NXT Player Unit _RE_Z-Axis_High-Channel_Band Edge Emissions Graph:



FCC Part 15 Transmitters/Restricted Band
4/27/2022 10:49:40 AM

Data Results:

Avg (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	(RBW) (MHz)	Correction (dB)
2483.563141	44.32	54.00	-9.68	288.00	2.20	Horizontal	1.00	-5.55
2499.799167	32.59	54.00	-21.41	316.00	1.66	Horizontal	1.00	-5.49
2500.032659	30.82	92.4	-61.58	316.00	1.66	Horizontal	1.00	-5.49

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	(RBW) (MHz)	Correction (dB)
2483.563141	59.45	74.00	-14.55	288.00	2.20	Horizontal	1.00	-5.55
2499.799167	58.82	74.00	-15.18	316.00	1.66	Horizontal	1.00	-5.49
2500.032659	57.58	92.4	-34.82	316.00	1.66	Horizontal	1.00	-5.49

Note: Measurement at 2500.032659 was checked to make sure that it met the 15.209 requirement. This frequency did not fall under the restricted band.

Test Personnel:	Dan Alvarez	Test Date:	04/27/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247, RSS-247	Limit Applied:	See report section 9.3
Input Voltage:	Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	23 ºC
		Relative Humidity:	43 %
		Atmospheric Pressure:	986 mbars

Deviations, Additions, or Exclusions: None

10 Transmitter spurious emissions

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC Part 15 Subpart B, RSS 247, ICES 003, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.9 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.6 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.6 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.8 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.9 dB	6.3 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, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

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

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
200005'	Attenuator, 03 dB, <18GHz	Weinschel Corp	2	BK7890	05/27/2021	05/27/2022
MM13'	RF Coax Cable 9KHz-18GHz	Fairview Microwave	SCE18110505-600CM	MM13	09/09/2021	09/09/2022
TW4 211413'	RF Low loss cable 9KHz-18GHz	Fairview Microwave	FMCA1282-472	TW4	05/28/2021	05/28/2022
200074'	Preamplifier, 10 MHz to 2000 MHz, 37 dB gain	Mini-Circuits	ZKL-2	D052005	12/13/2021	12/13/2022
211386'	Antenna, BiLog, 20-2000MHz	Chase	CBL6112B	2622	05/11/2021	05/11/2022
213451'	(20Mhz step5GHz) Omni -directional Comb Generator	Com-Power	CGO-520	281266	VBU	Verified
200162'	EMI Receiver (20Hz-40GHz)	Rohde & Schwarz	ESU 40	100314	10/13/2021	10/13/2022
E211'	RF Coax Cable	Megaphase	TM18-N1N1-120	15055601001	09/09/2021	09/09/2022
MM3'	RF Coax Cable 10KHz-18GHz	Maury Microwave	UC-N-MM36	769548	05/28/2021	05/28/2022
212104'	Barometric Pressure/Humidity/Temperature Datalogger	Extech	SD700	A.074980	05/25/2021	05/25/2022
213462'	Band reject Filter 2.4-2.5GHz	Micro Tronics	BRM50702	G357	02/07/2022	02/07/2023
213453'	Preamplifier 500MHz-18GHz	Com-Power	PAM-118A	18040030	10/13/2021	10/13/2022
213058a'	Antenna, Horn, <18 GHz	A.H. Systems	SAS-200/571	246	02/08/2022	02/08/2023
E402'	Cable E402, 40 GHz, 2.9, 9"	Megaphase	TM40 K1K1 9	E402	10/13/2021	10/13/2022
E405'	Cable E405, 40 GHz, 2.9, 2m	Megaphase	TM40 K1K1 80	E405	10/13/2021	10/13/2022
213023'	Antenna, Horn, 18-40 GHz	EMCO	3116	9310-2222	03/30/2022	03/30/2023
200080'	Preamplifier, 18-40GHz, 29 dB Gain	Miteq	JS41800400-30-5P-S	818197	10/12/2021	10/12/2022

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.19.1.18

10.3 Results:

The sample tested was found to Comply.

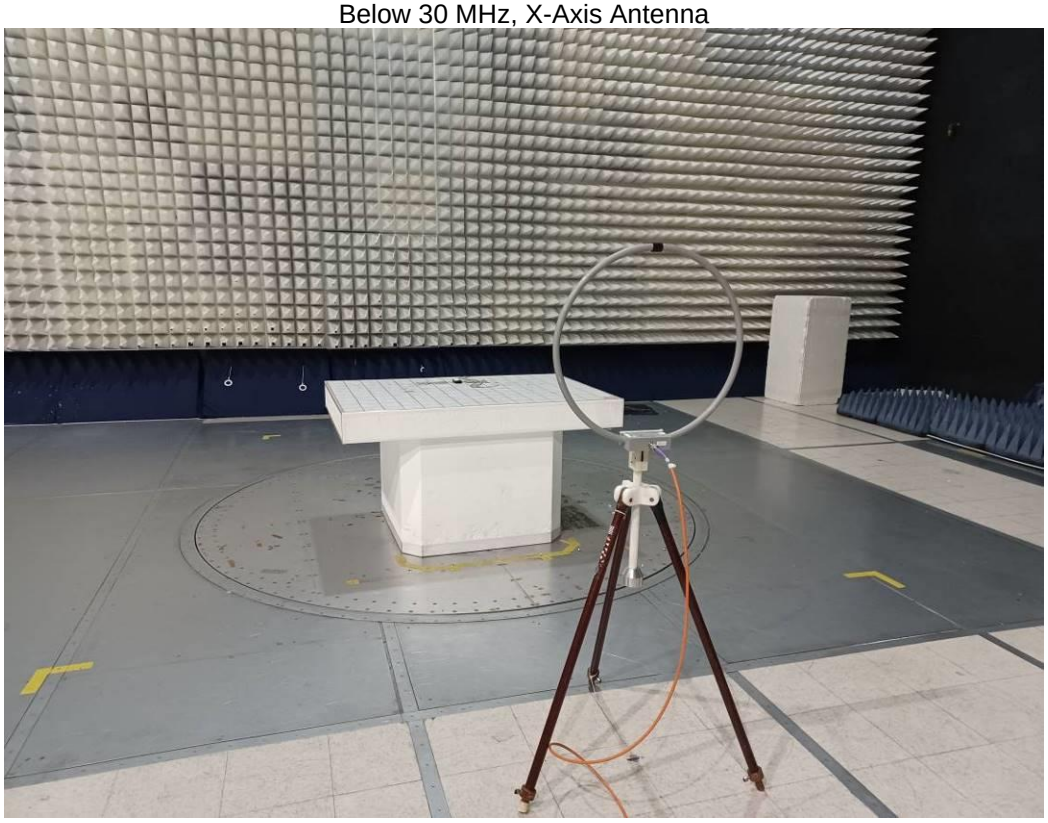
Limit – FCC Part §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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))

Note: Emissions were highest in the Z-Axis

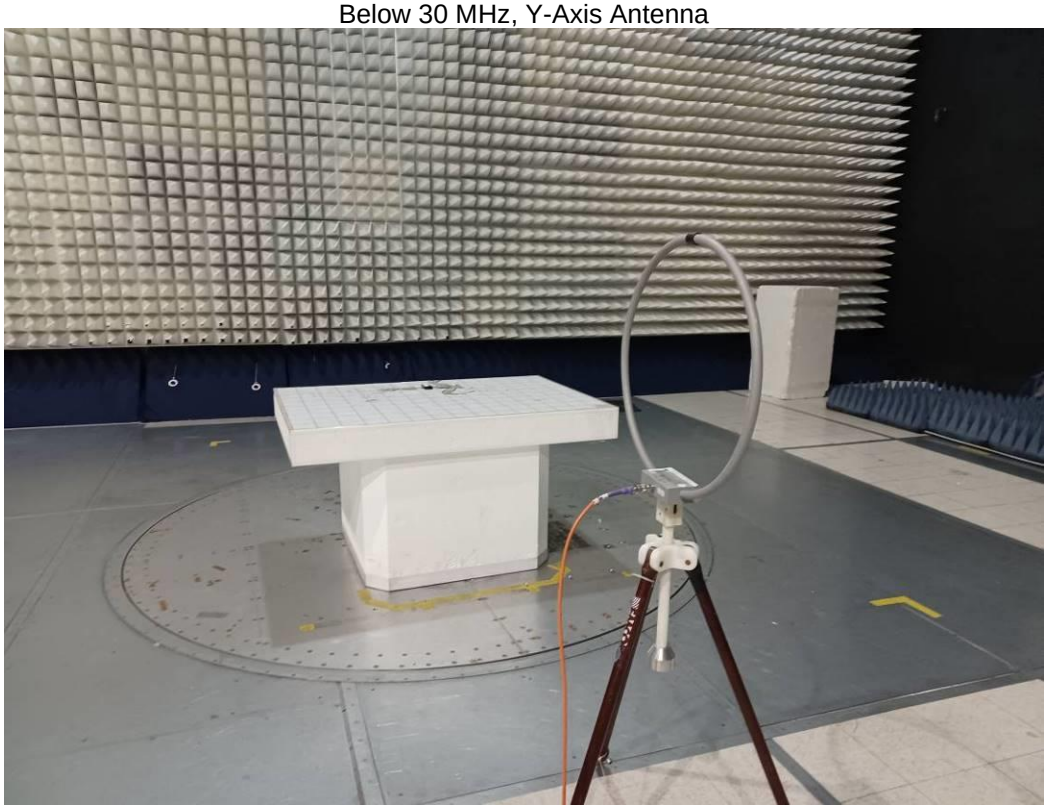
The EUT has a worst-case duty cycle of 30% during normal operation. The duty cycle factor of -10.5 was used.

10.4 Setup Photographs:

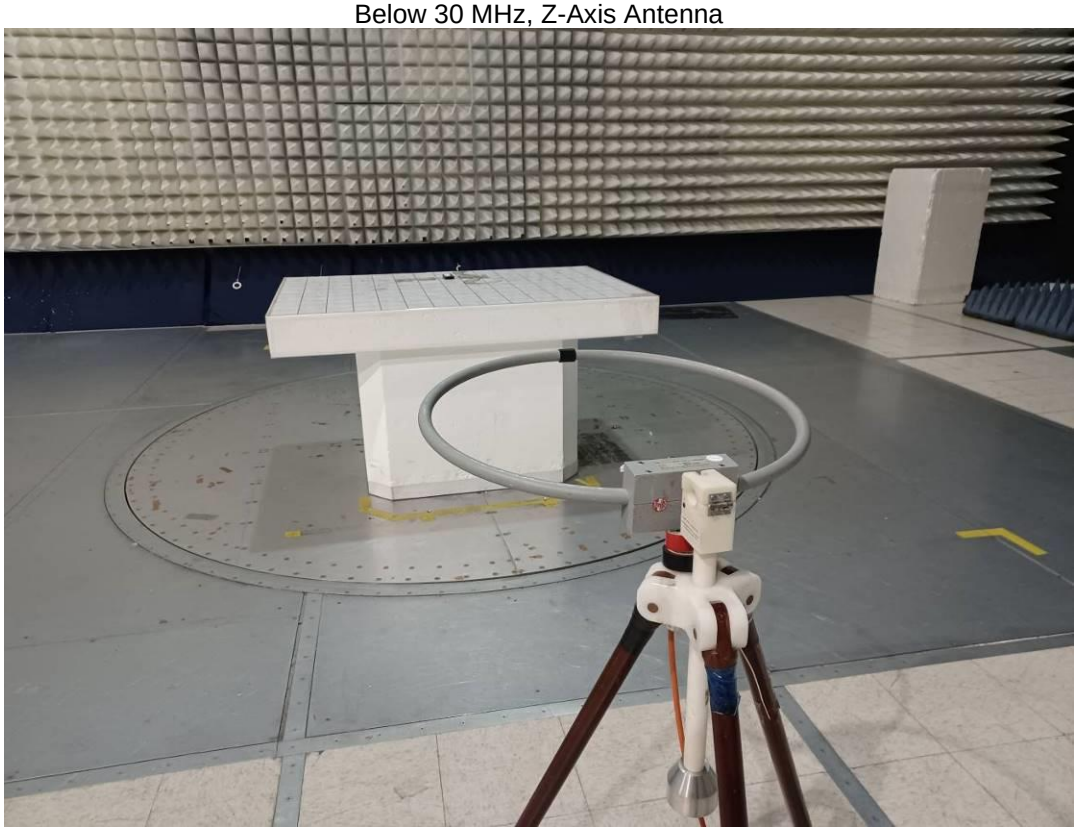
Below 30 MHz, X-Axis Antenna



Below 30 MHz, Y-Axis Antenna



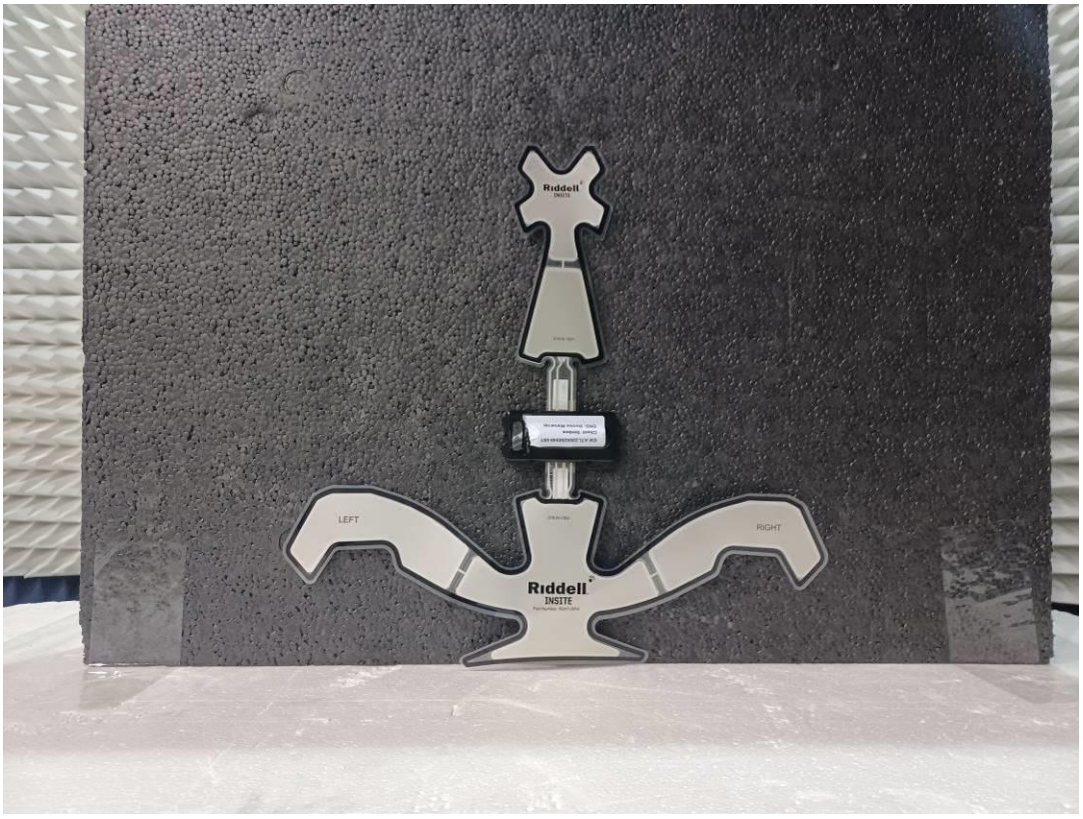
Below 30 MHz, Z-Axis Antenna



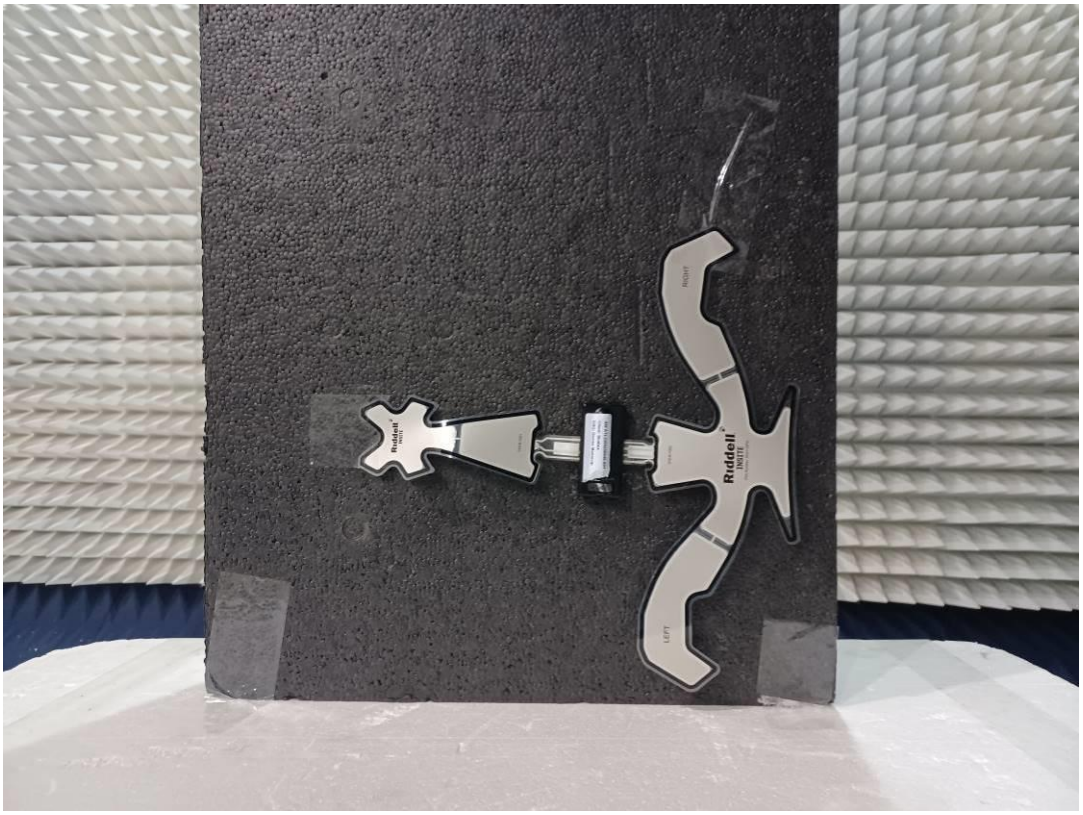
30-1000 MHz

Above 1 GHz

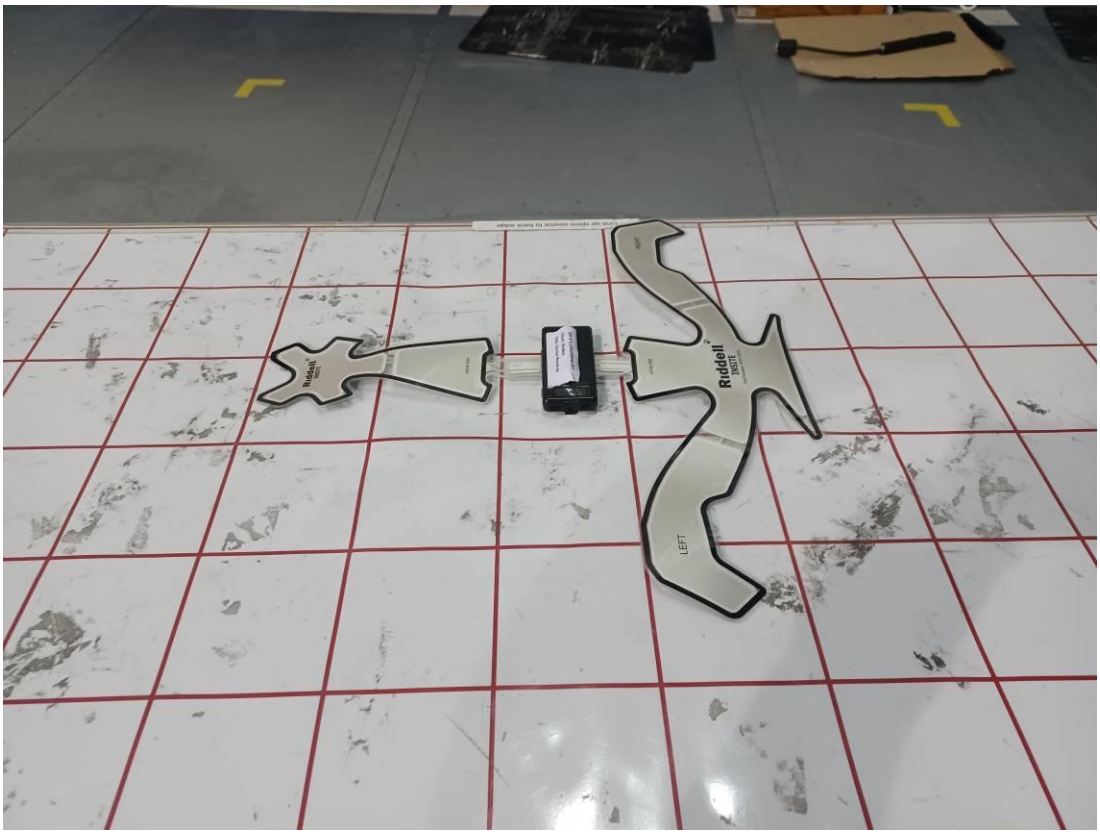
EUT X- Axis



EUT Y-Axis

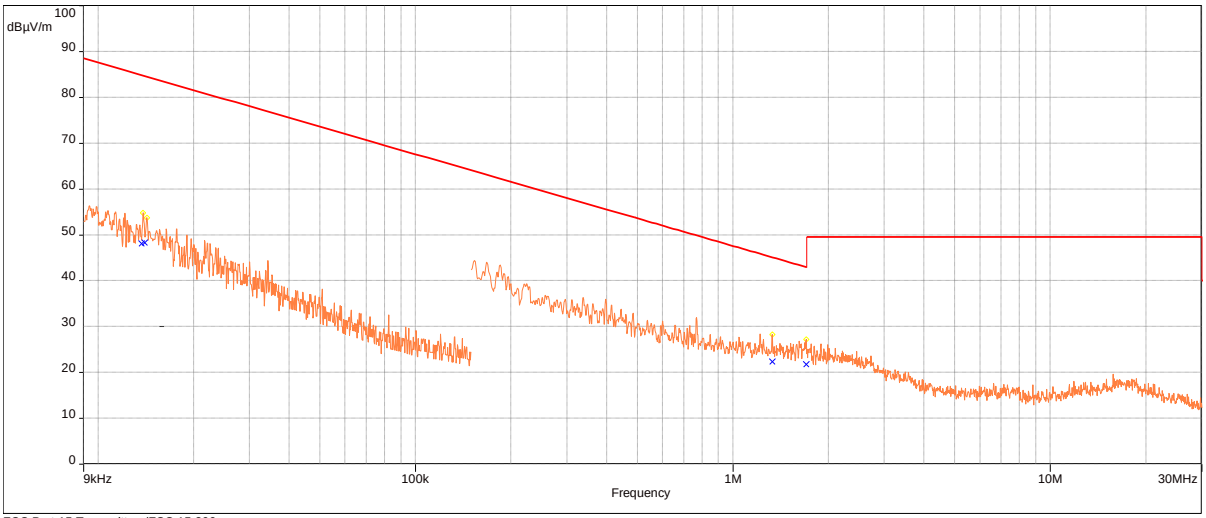


EUT Z-Axis


Riddell
LEFT

10.5 Plots/Data:

FCC 15.209- Class 9kHz-30MHz.
Insite Player_Mid-Channel_Z-Axis_RE_9kHz-30MHz_Antenna in Z-Axis
Emissions Graph:



FCC Part 15 Transmitters/FCC 15.209
4/26/2022 1:06:12 PM

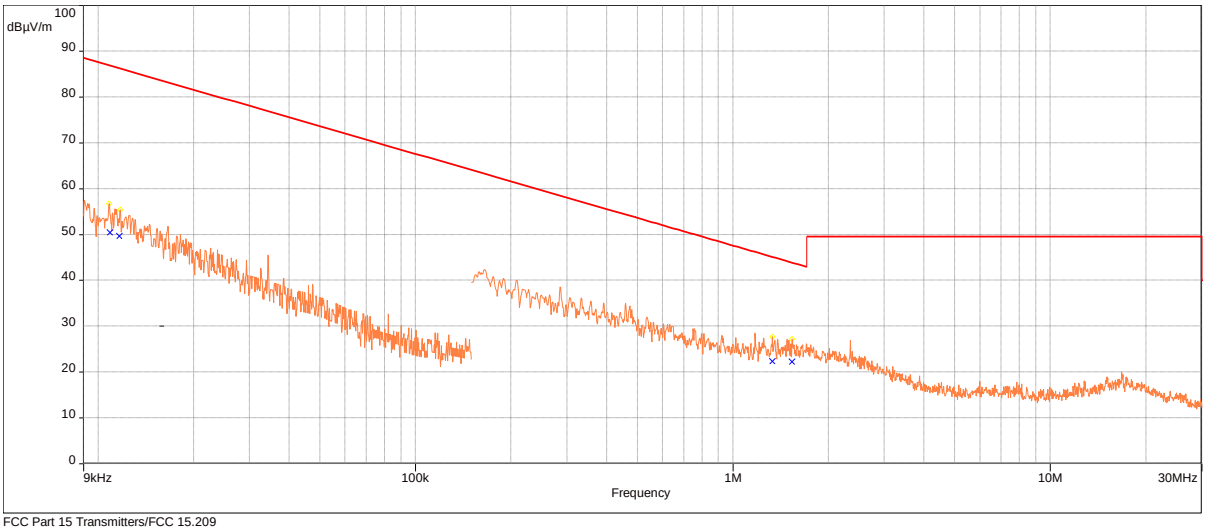
Data Results:

QuasiPeak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	(RBW) (kHz)	Correction (dB)
0.01371257949	48.09	84.86	-36.77	48.00	0.00	0.20	57.22
0.01402917692	48.30	84.66	-36.37	153.00	0.00	0.20	57.08
1.328658333	22.36	45.13	-22.77	129.00	0.00	9.00	18.59
1.699536923	21.80	43.00	-21.20	256.00	0.00	9.00	16.74

Notes: Worst-case output power channel was used for testing.

FCC 15.209- Class 9kHz-30MHz.
Insite Player_Mid-Channel_Z-Axis_RE_9kHz-30MHz_Antenna in X-Axis
Emissions Graph:



FCC Part 15 Transmitters/FCC 15.209
4/26/2022 1:18:16 PM

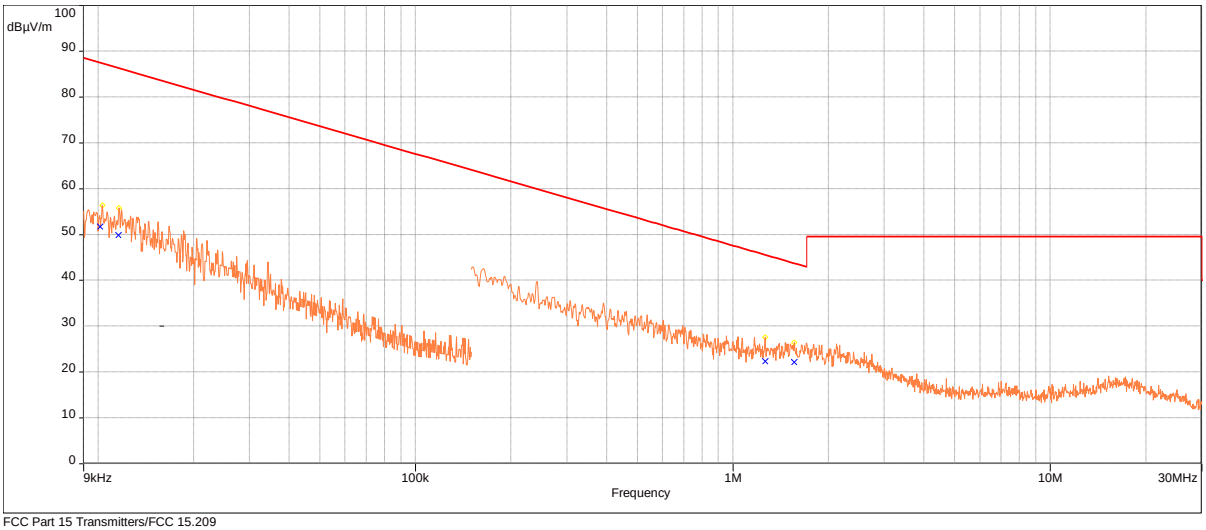
Data Results:

QuasiPeak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	(RBW) (kHz)	Correction (dB)
0.01088770256	50.48	86.86	-36.39	58.00	0.00	0.20	58.45
0.01167140513	49.64	86.26	-36.62	334.00	0.00	0.20	58.12
1.330358462	22.36	45.13	-22.77	67.00	0.00	9.00	18.58
1.535281795	22.25	43.88	-21.63	248.00	0.00	9.00	17.61

Notes: Worst-case output power channel was used for testing.

FCC 15.209- Class 9kHz-30MHz.
Insite Player_Mid-Channel_Z-Axis_RE_9kHz-30MHz_Antenna in Y-Axis
Emissions Graph:



FCC Part 15 Transmitters/FCC 15.209
4/26/2022 1:29:01 PM

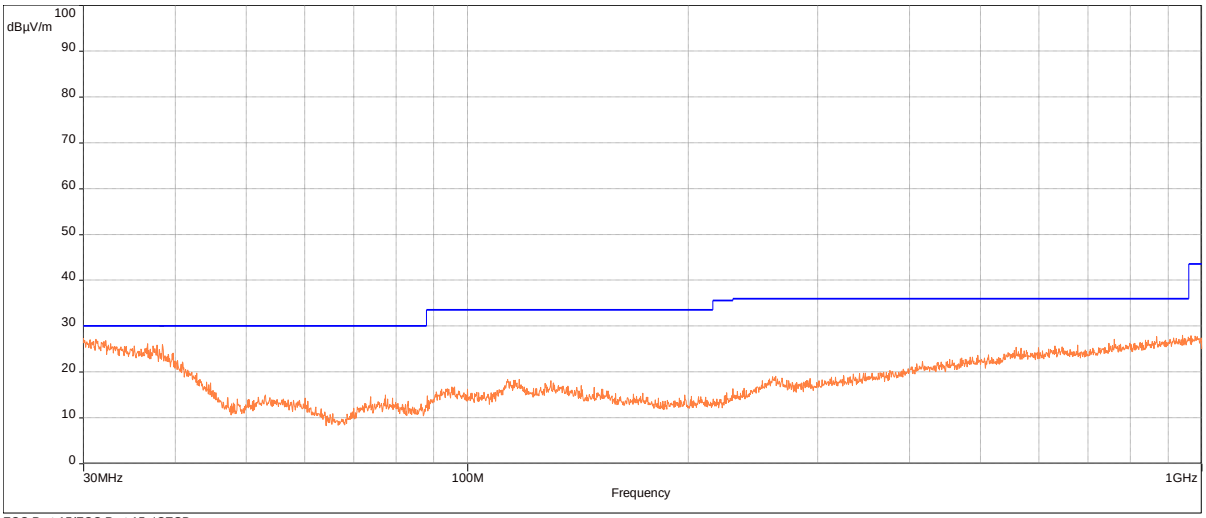
Data Results:

QuasiPeak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Pol.	(RBW) (kHz)	Correction (dB)
0.01014175128	51.72	87.48	-35.76	351.00	0.00	0.20	58.75
0.01158584872	49.89	86.33	-36.44	18.00	0.00	0.20	58.15
1.263531795	22.41	45.57	-23.17	89.00	0.00	9.00	18.88
1.559499744	22.16	43.74	-21.58	275.00	0.00	9.00	17.49

Notes: Worst-case output power channel was used for testing.

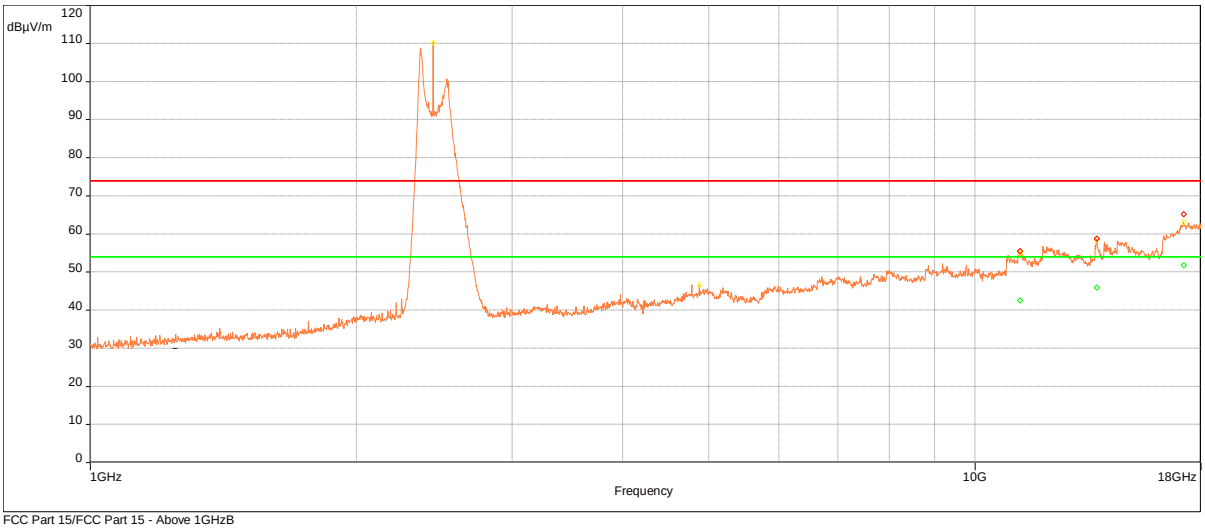
FCC Part 15 & ICES- Class B 30MHz-1GHz.
Insite Player_Battery_Mid-Channel_Z-Axis_RE 30MHz-1GHz
Emissions Graph:



FCC Part 15/FCC Part 15 _ICESB

Notes: Worst-case output power channel was used for testing.

FCC Part 15 - Above 1GHz- Class B 1GHz-18GHz.
Insite Player_Band Pass Filter_Z-Axis_Mid-Channel_RE_1GHz-18GHz
Emissions Graph:



FCC Part 15/FCC Part 15 - Above 1GHzB
4/25/2022 1:34:18 PM

Data Results:

Avg (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	(RBW) (MHz)	Correction (dB)
11236.06058	42.52	54.00	-11.48	290.00	2.29	Vertical	1.00	11.51
13723.492	45.96	54.00	-8.04	331.00	2.08	Vertical	1.00	14.14
17214.62724	51.82	54.00	-2.18	355.00	3.63	Horizontal	1.00	21.31

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	(RBW) (MHz)	Correction (dB)
11236.06058	55.57	74.00	-18.43	290.00	2.29	Vertical	1.00	11.51
13723.492	58.83	74.00	-15.17	331.00	2.08	Vertical	1.00	14.14
17214.62724	65.19	74.00	-8.81	355.00	3.63	Horizontal	1.00	21.31

Notes: Worst-case output power channel was used for testing. A bandpass filter used between 2.3 GHz to 2.6 GHz.

Product was hand scanned from 18 GHz to 26 GHz. No discernable emissions were detected above 18 GHz.

Test Personnel:	Dan Alvarez	Test Date:	04/25/2022
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	FCC Part 15 Subpart C, ICES-003	Limit Applied:	FCC Part 15.209, FCC Part 15.205
Input Voltage:	Battery Powered		
		Ambient Temperature:	23 ºC
Pretest Verification w/ Ambient Signals or BB Source:	Yes	Relative Humidity:	43 %
		Atmospheric Pressure:	986 mbars

Deviations, Additions, or Exclusions: None

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	05/20/2022	104550058ATL-001	DH	KPS KPS	Original Issue
1	06/09/2022	104955058ATL-001a	DH	KPS KPS	TCB Corrections issued 06/06/2022