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FCC RF Test Report

Test Report Number	SUB-21040734-LC-FCC-DTS
FCC ID	2AS4H-BLINC
Applicant	Subeca, Inc.
Applicant Address	4514 Cole Avenue Suite 600, Dallas, TX 75205
Product Name	Subeca BLINC
Model (s)	BLINC
Date of Receipt	05/04/2021
Date of Test	05/04/2021- 06/11/2021
Report Issue Date	06/14/2021
Test Standards	47 CFR Part 15.247
Test Result	**PASS**

Issued by:

Vista Compliance Laboratories
1261 Puerta Del Sol, San Clemente, CA 92673 USA
www.vista-compliance.com

Daniel Bruno (Test Technician)

David Zhang (Technical Manager)

REVISION HISTORY

Report Number	Version	Description	Issued Date
SUB-21040734-LC-FCC-DTS	01	Initial report	06/14/2021

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1 Test Summary

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
AC Power Line Conducted Emissions	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
Occupied Bandwidth	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
DTS (6 dB) Channel Bandwidth	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
Conducted Maximum Output Power	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
Power Spectral Density	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
Conducted Band-Edge & Unwanted Emissions	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass
Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	47 CFR Part 15.247	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02	Pass

2 General Information

2.1 Applicant

Applicant	Subeca, Inc.
Applicant address	4514 Cole Avenue Suite 600, Dallas, TX 75205
Manufacturer	Subeca, Inc.
Manufacturer Address	4514 Cole Avenue Suite 600, Dallas, TX 75205

2.2 Product information

Product Name	Subeca BLINC
Product Description	Subeca BLINC
Model Number	BLINC
Family Models	N/A
Serial Number	#2 (Low F LORA), #7 (MED F LORA), #3 (HIGH F LORA)
Frequency Band	BLE: 2402-2480MHz LoRA: 902.3-914.9MHz
Type of modulation	GFSK (BLE), LoRA
Equipment Class	DTS, DSS
Antenna Information	PCB Antenna WPANT10148-S1A (BLE anenna), peak gain: 2.3 dBi WPANT10144-S2A (LoRA antenna), peak gain: 1.8 dBi WPANT10123-S1B-01A (LoRA antenna), peak gain: 1.4 dBi
Clock Frequencies	N/A
Input Power	DC 3.7V
Power Adapter Manufacturer/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BLE and LoRa can transmit simultaneously
Additional Info	WPANT10144-S2A was used for testing LoRA as worst case.

2.3 Test standard and method

Test standard	47 CFR Part 15.247
Test method	ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02

3 Test Site Information

Lab performing tests	Vista Laboratories, Inc.
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.vista-compliance.com

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.2°C	57.5%	996 mbar
Radiated Emission Testing	23.2°C	57.5%	996 mbar

4 Modification of EUT / Deviations from Standards

The EUT is an engineering test sample loaded with RF testing firmware specifically designed to support the RF TX/RX measurement in different aspects.

5 Test Configuration and Operation

5.1 EUT Test Configuration

The EUT is mounted onto a development board to support testing. EUT is set to different transmission mode in terms of radio mode bandwidth, power level, test channel, etc.

The following software was used for testing and to monitor EUT performance

Software	Description
EMISoft Vasona	EMC/RF Spurious emission test software used during testing

5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
Development board	Subeca	PCB-00017	N/A

6 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

7 Test Results

7.1 Antenna Requirement

7.1.1 Requirement

Per § 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.

7.1.2 Result

Analysis:

- EUT has two removable PCB trace antennas which connect to the main board through unique U.FL RF connectors. One for BLE and one for LoRa.
- Both main board and antenna are equipped with U.FL connector. No standard RF connector is used.

Conclusion:

- EUT complies with antenna requirement in § 15.203.

7.2 Conducted Emissions

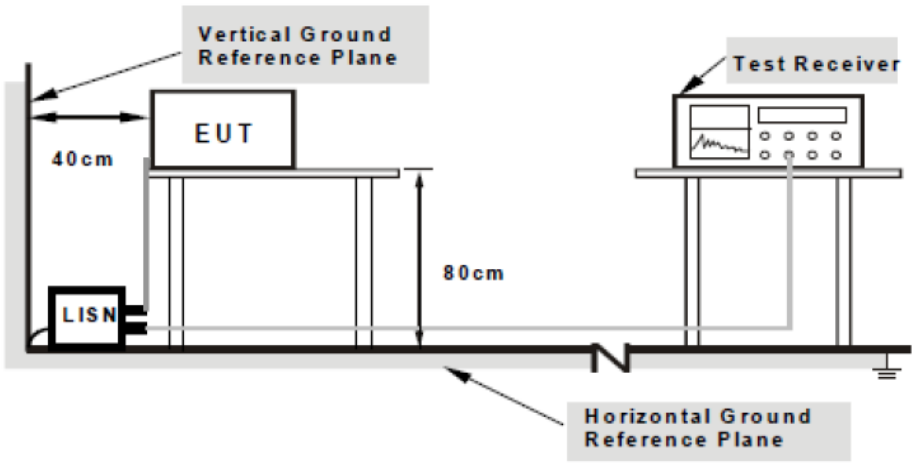
7.2.1 Requirement

Per § 15.207 (a), an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 – 0.5	66 – 56	56 – 46
	0.5 – 5	56	46
	5 - 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies.			

7.2.2 Test setup



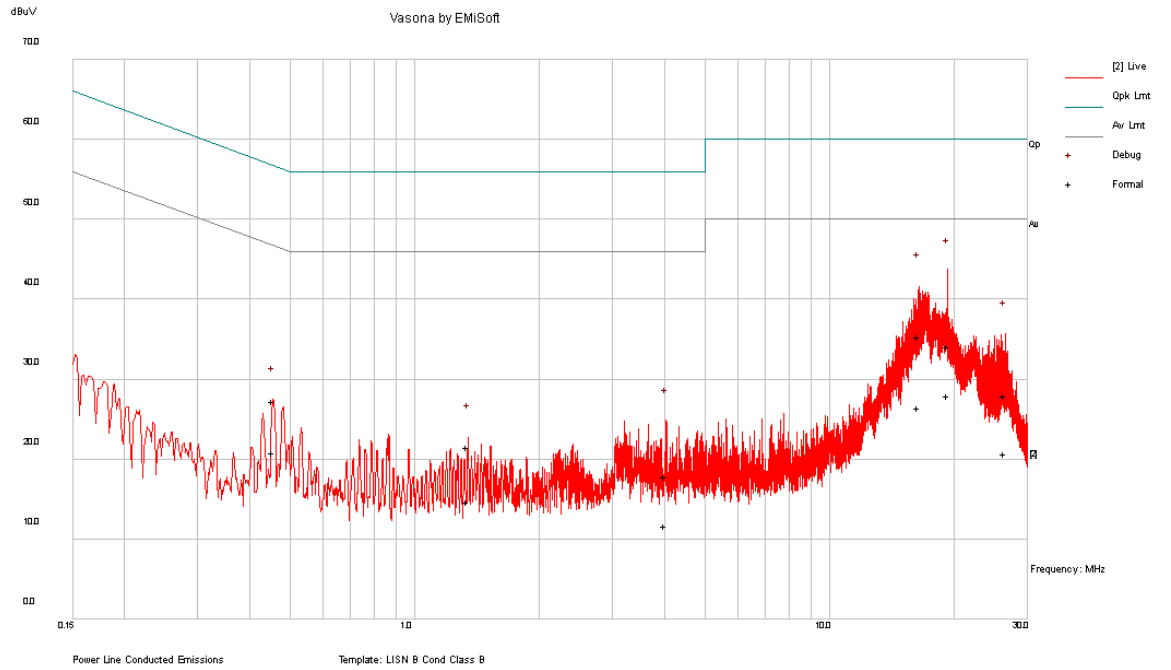
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

7.2.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.

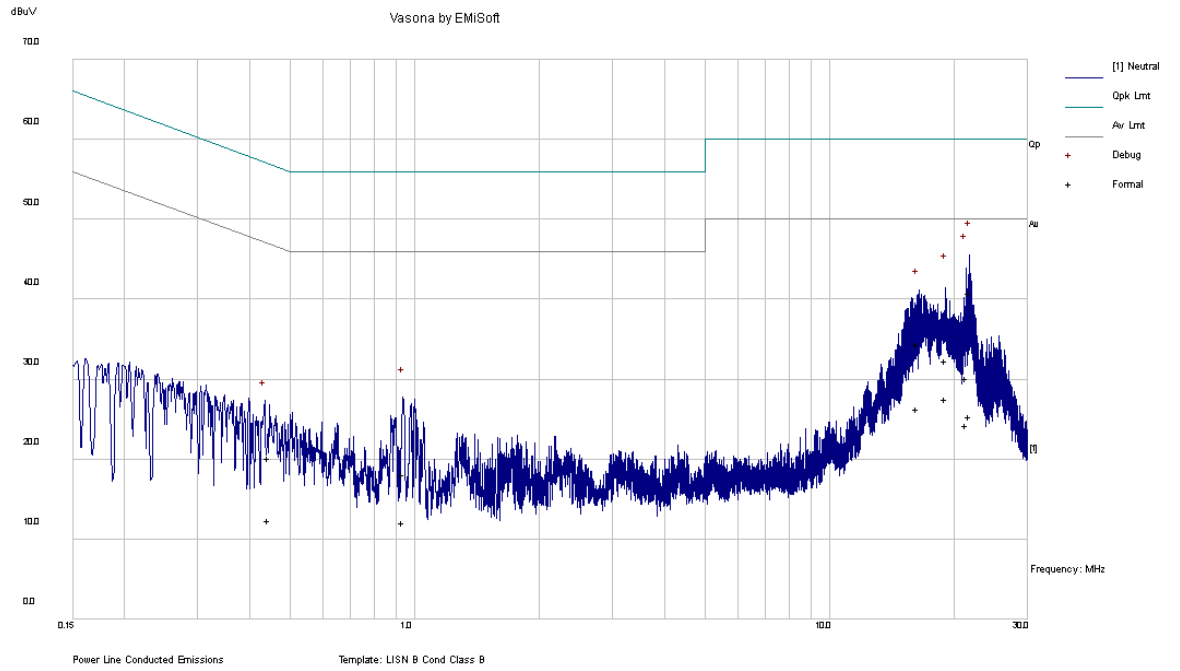
7.2.4 Test Result

Test Standard:	Part 15.207	Mode:	BLE & LoRA, Live
Frequency Range:	0.15-30MHz	Test Date:	05/04/2021- 06/11/2021
Antenna Type/Polarity:	N/A	Test Personnel:	David Zhang
Remark:	Class B, 120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Meas. Ty pe	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.46	16.91	10.11	0.28	27.29	QP	Live	56.77	-29.48	Pass
1.34	10.84	10.18	0.53	21.56	QP	Live	56.00	-34.44	Pass
4.02	5.17	10.34	2.35	17.85	QP	Live	56.00	-38.15	Pass
16.39	10.78	10.69	13.87	35.33	QP	Live	60.00	-24.67	Pass
19.26	7.49	10.76	15.81	34.06	QP	Live	60.00	-25.94	Pass
26.46	2.71	10.87	14.33	27.91	QP	Live	60.00	-32.09	Pass
0.46	10.45	10.11	0.28	20.84	AV	Live	46.77	-25.93	Pass
1.34	4.03	10.18	0.53	14.74	AV	Live	46.00	-31.26	Pass
4.02	-1.02	10.34	2.35	11.67	AV	Live	46.00	-34.33	Pass
16.39	1.83	10.69	13.87	26.39	AV	Live	50.00	-23.61	Pass
19.26	1.33	10.76	15.81	27.90	AV	Live	50.00	-22.10	Pass
26.46	-4.56	10.87	14.33	20.64	AV	Live	50.00	-29.36	Pass

Test Standard:	Part 15.207	Mode:	BLE & LoRA, Neutral
Frequency Range:	0.15-30MHz	Test Date:	05/04/2021- 06/11/2021
Antenna Type/Polarity:	N/A	Test Personnel:	David Zhang
Remark:	Class B, 120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Meas. Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.44	9.74	10.11	0.28	20.13	QP	Neutral	57.00	-36.87	Pass
0.93	7.59	10.15	0.39	18.13	QP	Neutral	56.00	-37.87	Pass
16.31	9.91	10.69	13.82	34.41	QP	Neutral	60.00	-25.59	Pass
19.04	5.85	10.76	15.74	32.35	QP	Neutral	60.00	-27.65	Pass
21.30	3.57	10.79	15.82	30.18	QP	Neutral	60.00	-29.82	Pass
21.75	14.18	10.79	15.91	40.88	QP	Neutral	60.00	-19.12	Pass
0.44	1.97	10.11	0.28	12.36	AV	Neutral	47.00	-34.64	Pass
0.93	1.53	10.15	0.39	12.06	AV	Neutral	46.00	-33.94	Pass
16.31	1.78	10.69	13.82	26.28	AV	Neutral	50.00	-23.72	Pass
19.04	1.03	10.76	15.74	27.53	AV	Neutral	50.00	-22.47	Pass

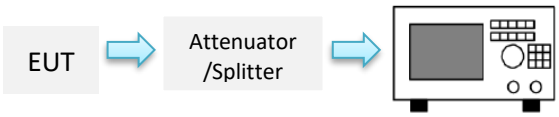
7.3 DTS (6 dB) Bandwidth

7.3.1 Requirement

§ 15.247 (a)(2)

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

7.3.2 Test Setup



7.3.3 Test Procedure

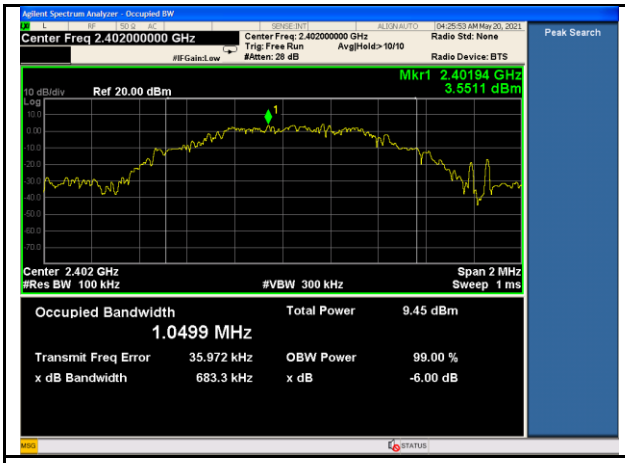
According to section 8.2, option 2, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.8 of ANSI C63.10-2013:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

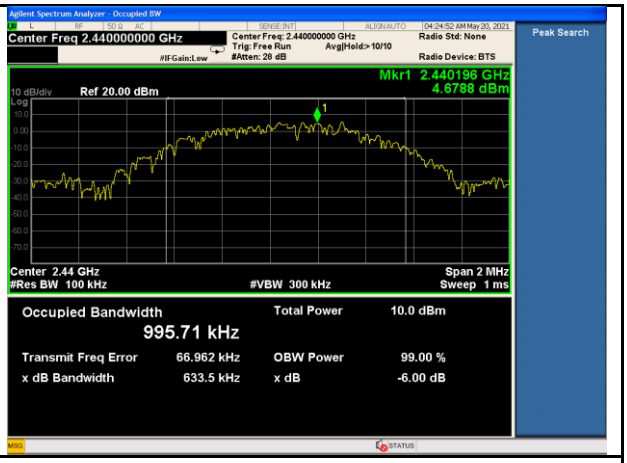
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Use automatic bandwidth measurement capability on instrument to obtain BW result.

7.3.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
BLE	2402	1Mbps	683.3	500	Pass
BLE	2440	1Mbps	633.5	500	Pass
BLE	2480	1Mbps	596.7	500	Pass



BLE-DTS BW-Low-1Mbps



BLE-DTS BW-Mid-1Mbps

BLE-DTS BW-High-1Mbps

7.4 Maximum Output Power

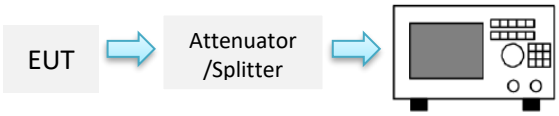
7.4.1 Requirement

§ 15.247 (b)(3), RSS-247 §5.4

or systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: the maximum output power is 1 Watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.4.2 Test Setup



7.4.3 Test Procedure

For BLE, power measurement is according to subclause 11.9.1.1 of ANSI C63.10-2013:

1. Set the RBW ≥ DTS bandwidth
2. Set VBW ≥ 3 X RBW.
2. Set SPAN ≥ 3 X RBW.
3. Sweep time = auto couple.
4. Detector = peak.
5. Trace mode = max hold
6. Allow trace to fully stabilize.
7. Use peak marker function to determine the peak amplitude level.

7.4.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Max Output Power (dBm)	Result
BLE	2402	1Mbps	6.22	30	Pass
BLE	2440	1Mbps	6.31	30	Pass
BLE	2480	1Mbps	6.34	30	Pass

7.4.5 Test Plots

<table>
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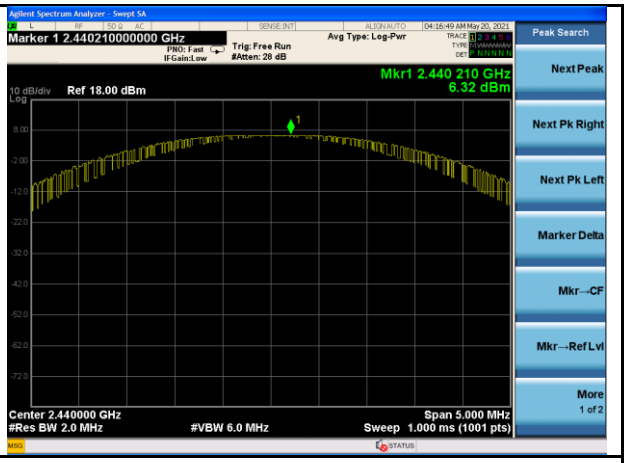
</td><td> 
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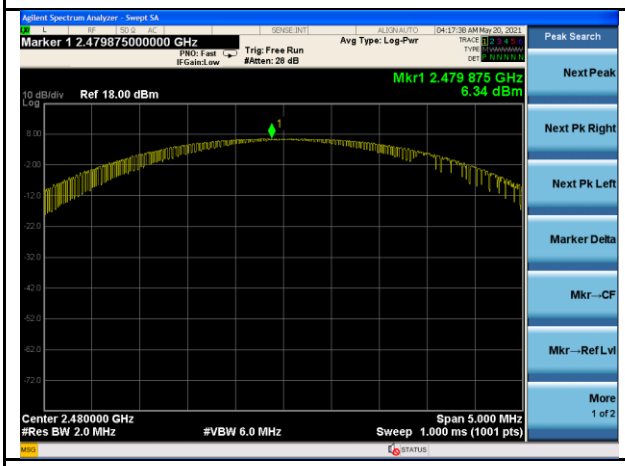
<tr><td> 
</td><td></td></tr>
<tr><td>BLE-Power-High-1Mbps</td><td></td></tr>
</table>

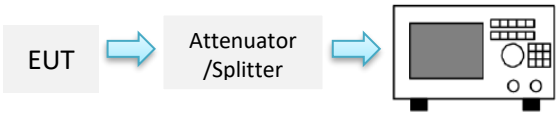
7.5 Power Spectral Density

7.5.1 Requirement

§ 15.247 (e), RSS-247 §5.2

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 is used to determine the power spectral density.

7.5.2 Test Setup



7.5.3 Test Procedure

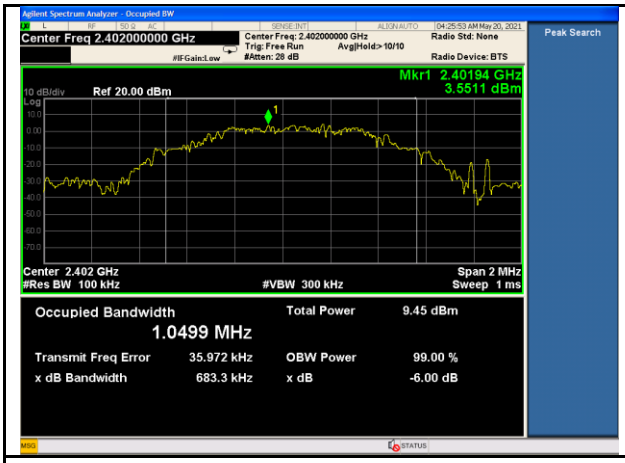
According to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.10.2 PKPSD of ANSI C63.10-2013:

1. Set analyser centre frequency to DTS channel centre frequency.
2. Set the span to 1.5 X DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

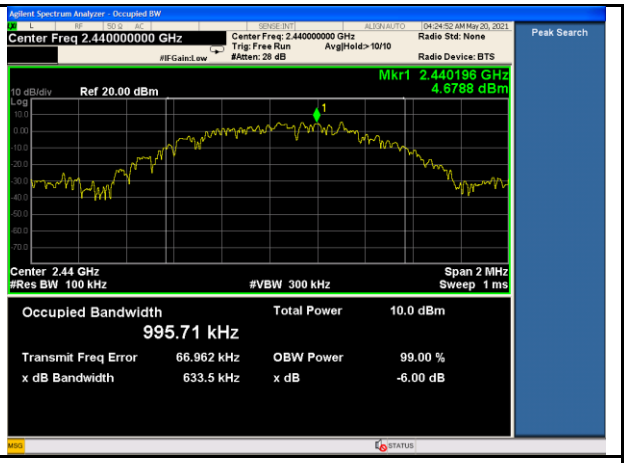
7.5.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
BLE	2402	1Mbps	3.551	8	Pass
BLE	2440	1Mbps	4.679	8	Pass
BLE	2480	1Mbps	5.636	8	Pass

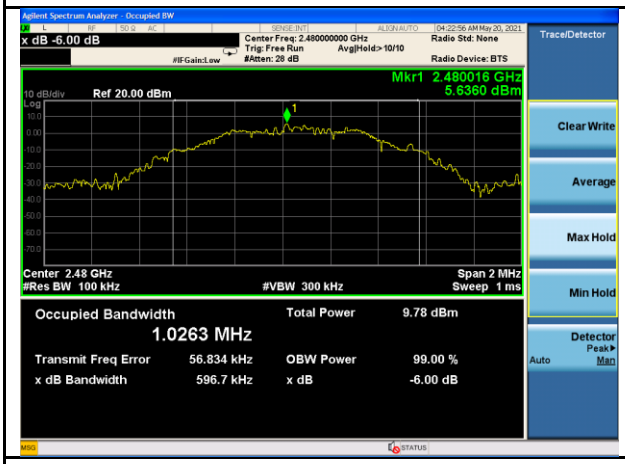
7.5.5 Test Plots



BLE-PSD-Low-1Mbps



BLE-PSD-Mid-1Mbps



BLE-PSD-High-1Mbps

7.6 Radiated Band-Edge & Spurious Emissions into Restricted Frequency Bands

7.6.1 Requirement

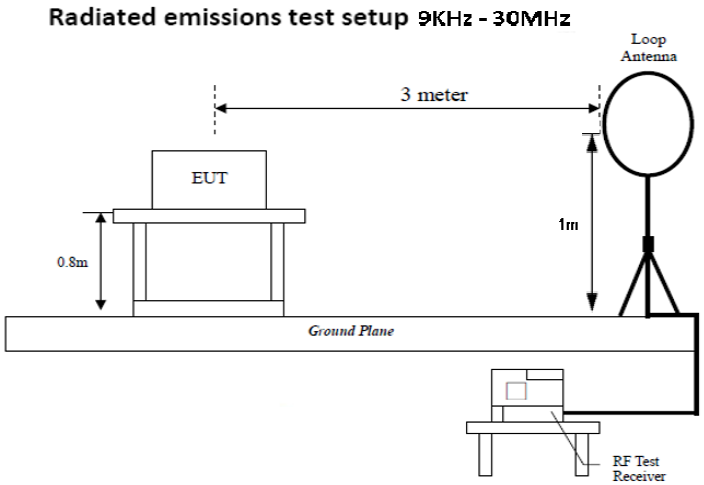
§ 15.247 (d), RSS-247 §5.5

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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

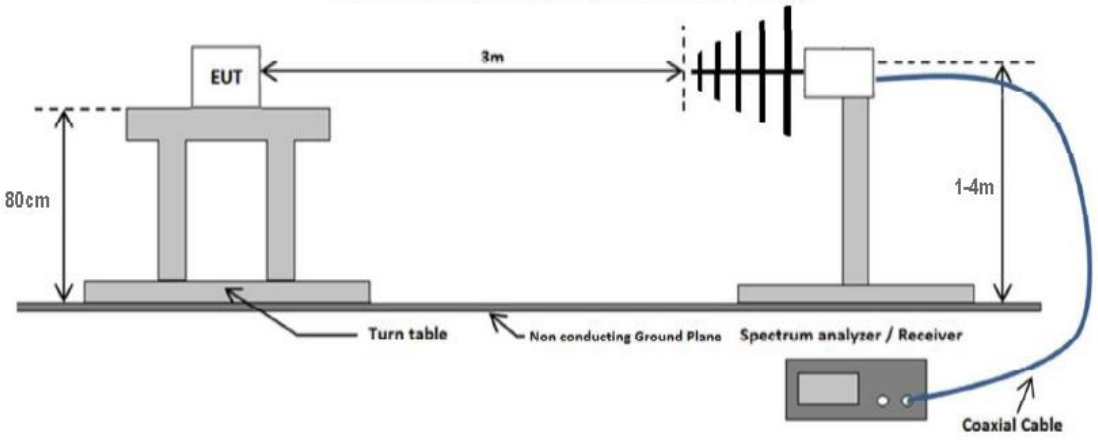
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency Range (MHZ)	Field Strength (μV/m)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

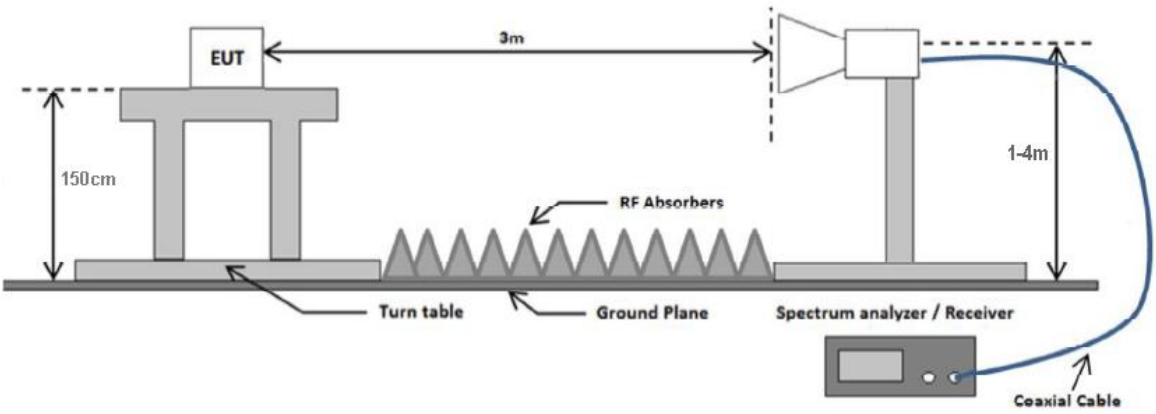
7.6.2 Test Setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



7.6.3 Test Procedure

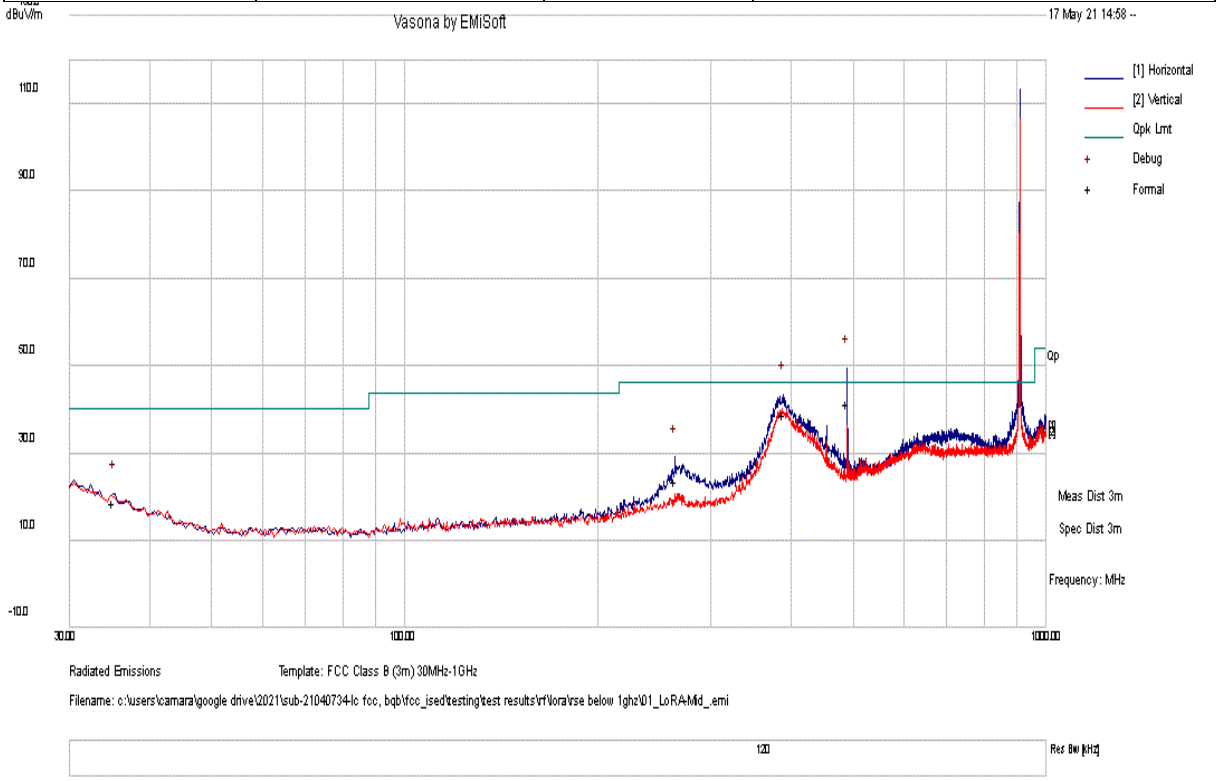
According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

7.6.4 Test Result

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	15.247, 15.209	Mode:	BLE & LoRA
Frequency Range:	30 MHz - 1 GHz	Test Date:	05/21/2021
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

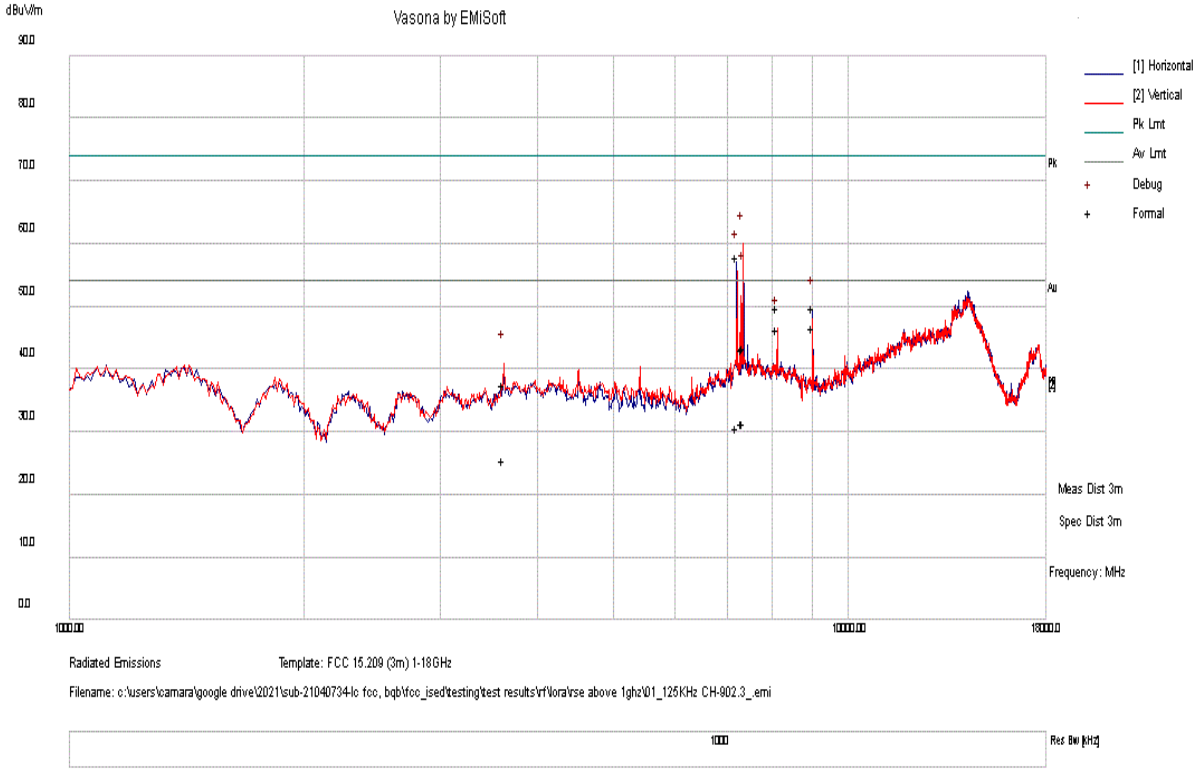


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
489.517	44.00	6.1	-8.6	41.5	Quasi Max	H	139.00	0	46	-4.5	Pass
389.261	41.10	6.3	-8.5	38.9	Quasi Max	H	100.00	91	46	-7.1	Pass
263.744	33.00	5.4	-14.5	23.8	Quasi Max	H	127.00	22	46	-22.2	Pass
35.077	30.60	2.4	-14.3	18.7	Quasi Max	H	400.00	143	40	-21.3	Pass

Note: Emission at around 900MHz is LoRA fundamental emission.

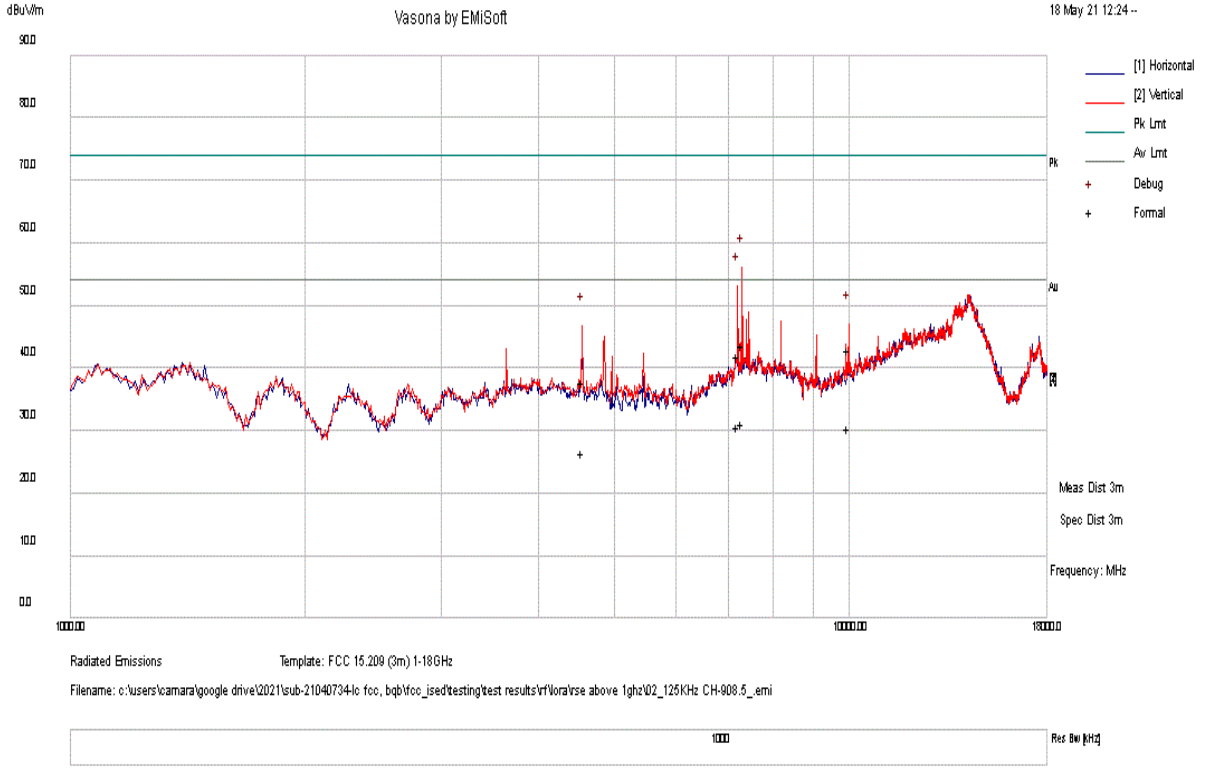
RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	15.247, 15.209	Mode:	BLE & LoRA Low CH
Frequency Range:	1 GHz – 18 GHz	Test Date:	05/21/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



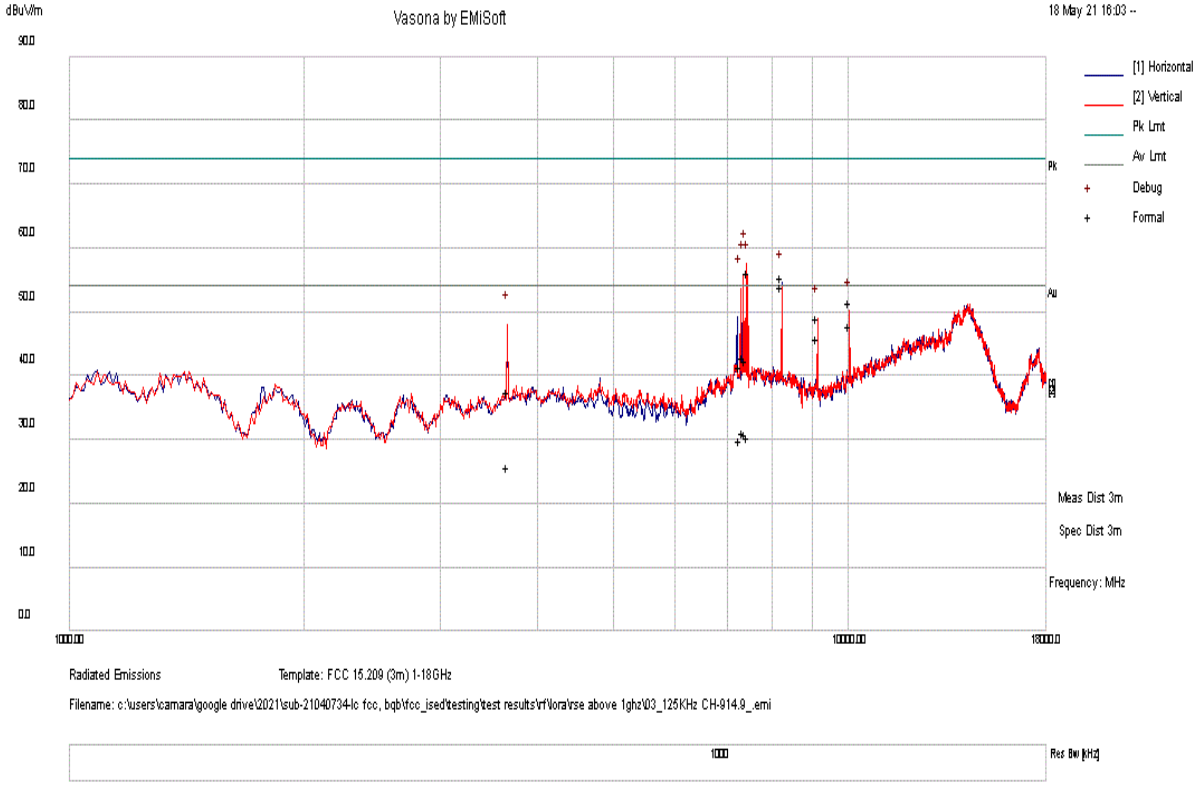
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
2390.000	60.4	13.8	-5.7	68.5	Peak Max	H	120	0	74	-5.5	Pass
7330.858	21.3	20.7	1.2	43.2	Peak Max	V	148	0	74	-30.8	Pass
7206.905	36.3	20.5	1.2	58	Peak Max	H	244	0	74	-16	Pass
7354.683	21.6	20.7	1.2	43.5	Peak Max	H	200	27	74	-30.5	Pass
9022.87	28.4	21.1	0.3	49.7	Peak Max	H	169	38	74	-24.3	Pass
8120.708	28.1	21.2	0.4	49.7	Peak Max	V	206	350	74	-24.3	Pass
3611.99	26.3	16.1	-4.9	37.5	Peak Max	V	257	33	74	-36.5	Pass
2390.000	41.4	13.8	-5.7	49.5	Average Max	H	120	0	54	-4.5	Pass
7330.858	9.4	20.7	1.2	31.3	Average Max	V	148	0	54	-22.7	Pass
7206.905	9	20.5	1.2	30.7	Average Max	H	244	0	54	-23.3	Pass
7354.683	9.5	20.7	1.2	31.4	Average Max	H	200	27	54	-22.6	Pass
9022.87	25.4	21.1	0.3	46.8	Average Max	H	169	38	54	-7.2	Pass
8120.708	24.7	21.2	0.4	46.3	Average Max	V	206	350	54	-7.7	Pass
3611.99	14.3	16.1	-4.9	25.5	Average Max	V	257	33	54	-28.5	Pass

Test Standard:	15.247, 15.209	Mode:	BLE & LoRA Mid CH
Frequency Range:	1 GHz – 18 GHz	Test Date:	05/21/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
7300.803	21.8	20.6	1.2	43.6	Peak Max	V	215	6	74	-30.4	Pass
7203.22	20.4	20.4	1.2	42	Peak Max	V	347	0	74	-32	Pass
9998.553	19.6	22.4	0.9	42.9	Peak Max	V	269	277	74	-31.1	Pass
4547.295	23.9	17.3	-3.3	37.9	Peak Max	V	337	56	74	-36.1	Pass
7300.803	9.3	20.6	1.2	31.1	Average Max	V	215	6	54	-22.9	Pass
7203.22	8.9	20.4	1.2	30.6	Average Max	V	347	0	54	-23.4	Pass
9998.553	7.2	22.4	0.9	30.5	Average Max	V	269	277	54	-23.5	Pass
4547.295	12.4	17.3	-3.3	26.4	Average Max	V	337	56	54	-27.6	Pass

Test Standard:	15.247, 15.209	Mode:	BLE & LoRA High CH
Frequency Range:	1 GHz – 18 GHz	Test Date:	05/21/2021
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
2483.500	61.8	14.0	-5.6	70.2	Peak Max	H	120	0	74	-12.2	Pass
7407.405	20.5	20.8	1.1	42.4	Peak Max	V	259	318	74	-31.6	Pass
7439.505	34.4	20.9	1	56.2	Peak Max	V	192	336	74	-17.8	Pass
7343.01	21.1	20.7	1.2	43	Peak Max	V	290	314	74	-31	Pass
8234.115	33.8	21.2	0.5	55.6	Peak Max	H	212	0	74	-18.4	Pass
7280.615	19.6	20.6	1.2	41.4	Peak Max	V	247	109	74	-32.6	Pass
10063.785	28	22.5	1.1	51.6	Peak Max	V	101	0	74	-22.4	Pass
9149.06	27.7	21.3	0.1	49.1	Peak Max	V	186	173	74	-24.9	Pass
3657.945	26.3	16.2	-4.8	37.6	Peak Max	V	158	257	74	-36.4	Pass
2483.500	53.2	14.0	-5.6	61.6	Average Max	H	120	0	74	-0.8	Pass
7407.405	9.1	20.8	1.1	31	Average Max	V	259	318	54	-23	Pass
7439.505	8.6	20.9	1	30.5	Average Max	V	192	336	54	-23.5	Pass
7343.01	9.2	20.7	1.2	31.1	Average Max	V	290	314	54	-22.9	Pass
8234.115	32.2	21.2	0.5	53.9	Average Max	H	212	0	54	-0.1	Pass
7280.615	8.2	20.6	1.2	30	Average Max	V	247	109	54	-24	Pass
10063.785	24.2	22.5	1.1	47.8	Average Max	V	101	0	54	-6.2	Pass
9149.06	24.4	21.3	0.1	45.8	Average Max	V	186	173	54	-8.2	Pass
3657.945	14.4	16.2	-4.8	25.7	Average Max	V	158	257	54	-28.3	Pass

Radiated Emission between 9KHz – 30MHz test result

Note: no substantial emission is found other than the noise floor. Different modes have been verified.

Radiated Emission between 18GHz – 40GHz test result

Note: no substantial emission is found other than the noise floor. Different modes have been verified.

8 EUT and Test Setup Photos

See FCC exhibits

9 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/19	10/18/21
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	6/17/20	6/17/21
EMC Test Receiver	R&S	ESL6	100230	6/14/20	6/14/21
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/21	5/4/22
LISN (9KHz – 30MHz)	Com-Power	LI-550C	20140050	01/29/2021	01/29/2022
LISN (9KHz – 30MHz)	Com-Power	LI-550C	20140051	01/29/2021	01/29/2022
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2020	11/15/2021
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/14/2021	5/14/2022
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	6/24/20	6/24/21
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	7/16/2020	7/16/2021
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/5/2021	5/5/2022
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/15/2021	5/15/2022
RF Attenuator	Pasternack	PE7005-3	VL061	7/16/2020	7/16/2021
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	7/16/2020	7/16/2021
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/16/21	5/16/22
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	7/16/2020	7/16/2021
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	7/16/2020	7/16/2021
RE test cable (>18GHz)	Sucoflex	104	344903/4	7/16/2020	7/16/2021
Pulse limiter	Com-Power	LIT-930A	531727	7/16/2020	7/16/2021
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	7/16/2020	7/16/2021
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	7/16/2020	7/16/2021
Vector Signal Generator	Keysight	N5182A	US47080548	6/17/20	6/17/21
RF Power Amplifier (80-1000MHz)	Ophir	5226FE	1013/1815	N/A	N/A
RF Power Amplifier (700-6000MHz)	Ophir	5293FE	1063/1815	N/A	N/A
Horn Antenna (1-18GHz)	FT-RF	HA-07M18G-NF	180010HA	N/A	N/A