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RF Test Report

Test Report Number	EEI-22061661-LG-FCC-IRXPO-BLE
FCC ID	2ANAC-IRXPO
Applicant	Essex Electronics, Inc.
Applicant Address	1130 Mark Ave. Carpinteria, CA 93013
Product Name	iRox RFID Turnstile Reader
Model Name	IRXPO-2S
Date of Receipt	12/07/2022
Date of Test	12/07/2022 – 03/02/2023
Report Issue Date	03/02/2023
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

Devin Tai (Test Engineer)

David Zhang (Technical Manager)

REVISION HISTORY

Report Number	Version	Description	Issued Date
EEI-22061661-LG-FCC-IRXPO-BLE	01	Initial report	03/02/2023

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1 Test Summary

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DTS (6 dB) Channel Bandwidth	47 CFR Part 15.247	ANSI C63.10 (2013)	Pass
Conducted Maximum Output Power	47 CFR Part 15.247	ANSI C63.10 (2013)	Pass
Power Spectral Density	47 CFR Part 15.247	ANSI C63.10 (2013)	Pass
Conducted Band-Edge & Unwanted Emissions	47 CFR Part 15.247	ANSI C63.10 (2013)	Pass
Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	47 CFR Part 15.247	ANSI C63.10 (2013)	Pass
AC Power Line Conducted Emissions	47 CFR Part 15.247	ANSI C63.10 (2013)	Pass

2 General Information

2.1 Applicant

Applicant	Essex Electronics, Inc.
Applicant address	1130 Mark Ave. Carpinteria, CA 93013
Manufacturer	Essex Electronics, Inc.
Manufacturer Address	1130 Mark Ave. Carpinteria, CA 93013

2.2 Product information

Product Name	iRox RFID Turnstile Reader
Model Number	IRXPO-2S
Family Models	N/A
Serial Number	N/A
Frequency Band	RFID: 125KHz, 13.56MHz Bluetooth BLE: 2402-2480MHz
Type of modulation	RFID: ASK Bluetooth BLE: GFSK
Equipment Class	DCD, DXX, DTS
Antenna Information	125KHz: Internal coil antenna 13.56MHz: Internal PCB trace coil antenna BLE: Chip antenna, 0.5 dBi peak gain
Type of modulation	RFID: ASK Bluetooth BLE: GFSK
Clock Frequencies	N/A
Port/Connectors	Wire connection port
Input Power	5V DC +/10% or 12 VDC +/-10%, 250mA, Max (3W)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	RFID and BLE can transmit simultaneously. The simultaneous transmission has been evaluated in the testing. The RFID remains active during the operation with BLE.
Additional Info	Input voltage is 12VDC during testing

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	23.5°C	61.3%	1002 mbar
Radiated Emission Testing	23.5°C	61.3%	1002 mbar

4 Modification of EUT / Deviations from Standards

N/A

5 Test Configuration and Operation

5.1 EUT Test Configuration

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

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 #
AC/DC Adapter	Dell	DA130PE1-00	JU012
Test Laptop	Dell	Latitude E6510	3RZC1M1
12VDC battery	DURACELL	DURDC12-5F	840821062487
DC power supply	WERKER	WK12V1000	NA

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:

For RFID, that antenna type is on PCB board coil or PCB trace coil antenna. There isn't standard antenna connector used.

For BLE, the antenna type is chip antenna. EUT has a u.FL connector with short RF cable to connect to the chip antenna. The u.FL connector is not a standard antenna connector and is considered a unique coupling.

Conclusion:

- EUT complies with antenna requirement in § 15.203.

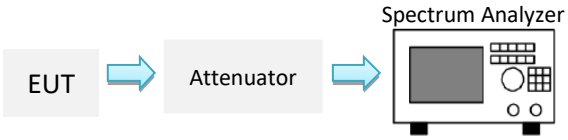
7.2 DTS (6 dB) Bandwidth

7.2.1 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.

7.2.2 Test Setup



7.2.3 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:

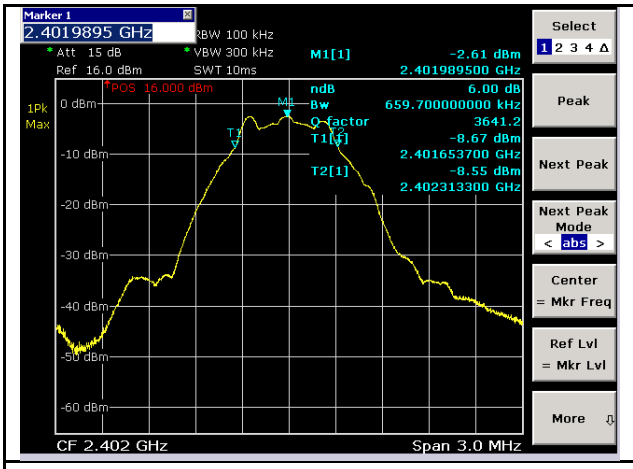
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this 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.

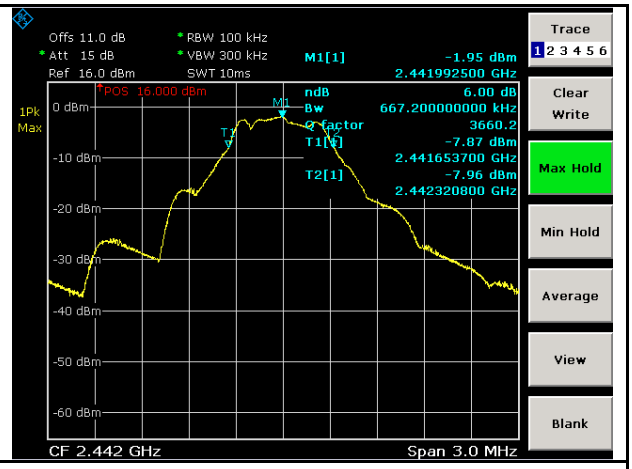
7.2.4 Test Result

Mode	Data rate	Frequency (MHz)	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
BLE	1Mbps	2402	659.7	500	Pass
		2442	667.2	500	Pass
		2480	649.2	500	Pass

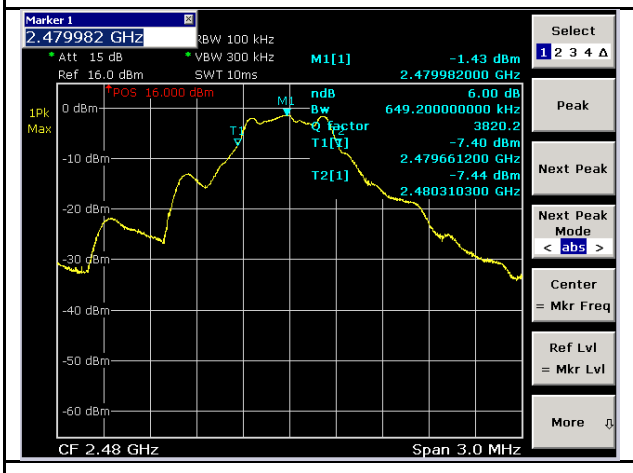
7.2.5 Test Plots



BLE-DTS BW-Low



BLE-DTS BW-Mid



BLE-DTS BW-High

7.4 Maximum Output Power

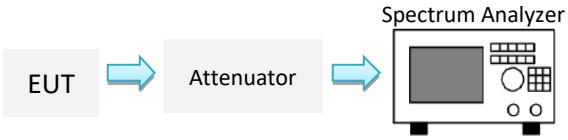
7.4.1 Requirement

§ 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

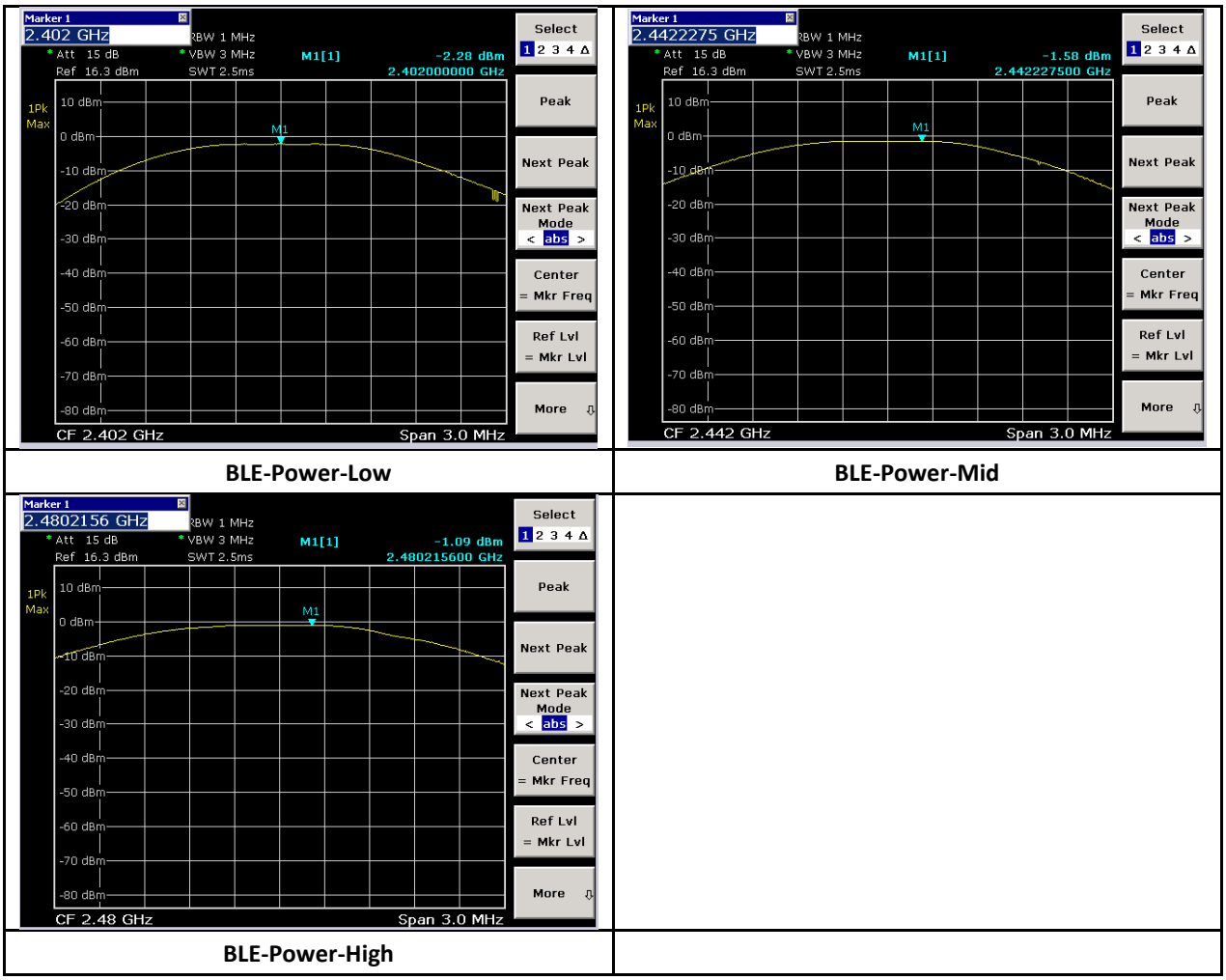
For BLE, power measurement is according to subclause 11.9.1.1 of ANSI C63.10-2013:

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	Data rate	Frequency (MHz)	Measured Output Power (dBm)	Max Output Power (dBm)	Result
BLE	1Mbps	2402	-2.28	30	Pass
		2442	-1.58	30	Pass
		2480	-1.09	30	Pass

7.4.5 Test Plots



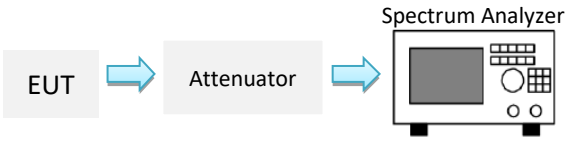
7.5 Power Spectral Density

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

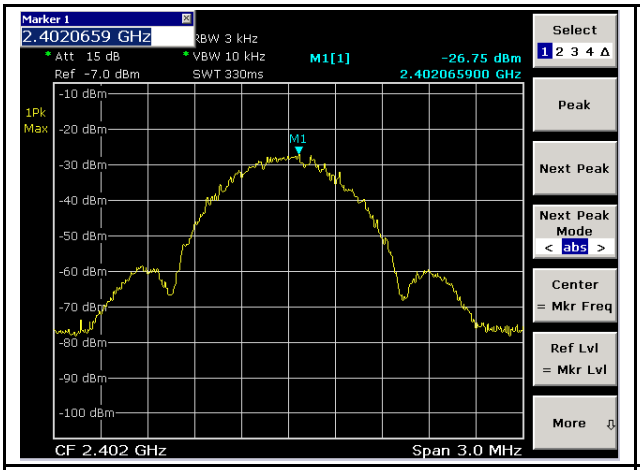
According to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.10.2 PKPSD of ANSI C63.10-2013:

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.

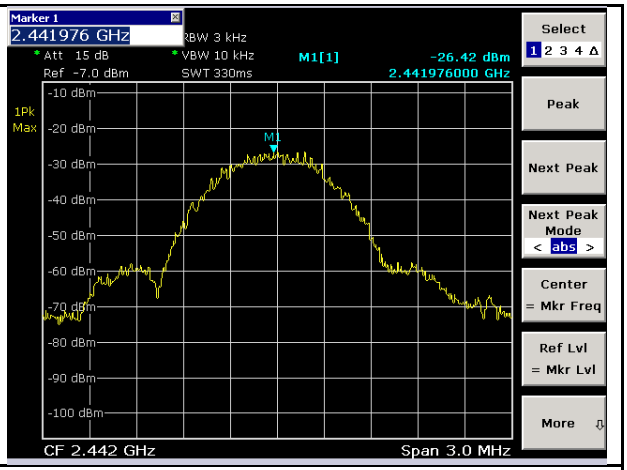
7.5.4 Test Result

Mode	Data rate	Frequency (MHz)	Measured PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
BLE	1Mbps	2402	-26.75	8	Pass
		2442	-26.42	8	Pass
		2480	-24.96	8	Pass

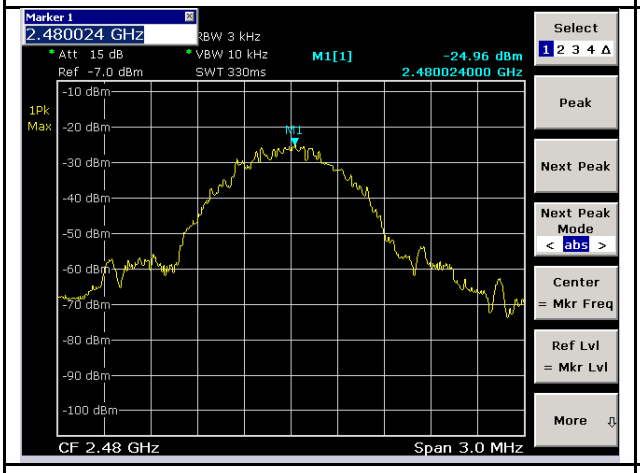
7.5.5 Test Plots



BLE-PSD-Low



BLE-PSD-Mid



BLE-PSD-High

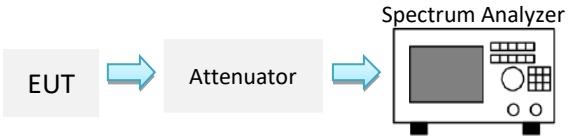
7.6 Conducted Band-Edge & Unwanted Emissions

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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

7.6.2 Test Setup



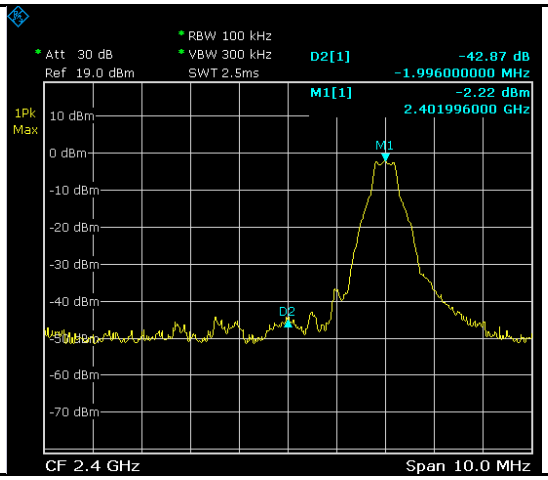
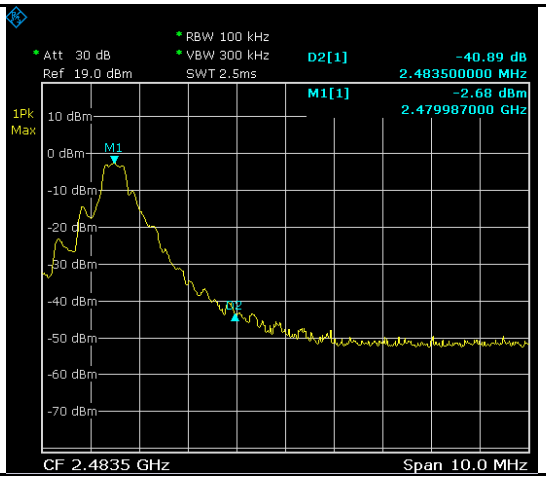
7.6.3 Test Procedure

According to ANSI C63.10-2013 clause 11.13

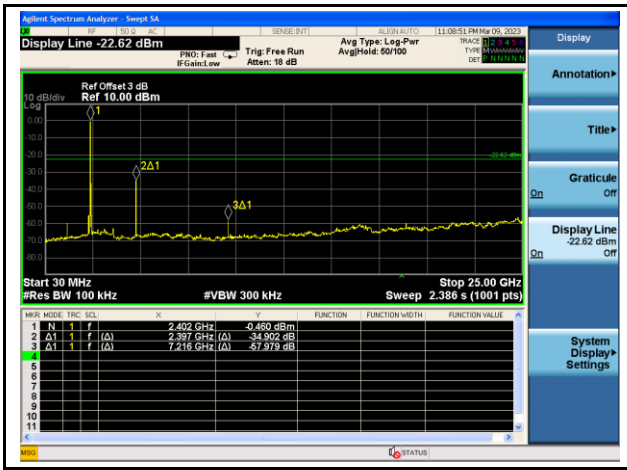
1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW=100 KHZ, VBW=300 KHZ, Peak Detector. Unwanted Emissions measured in any 100 khz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 db relative to the maximum in-band peak PSD level in 100 KHZ when maximum peak conducted output power procedure is used. 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 per 15.247(d).
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete and record the results in the test report.

7.6.4 Test Result

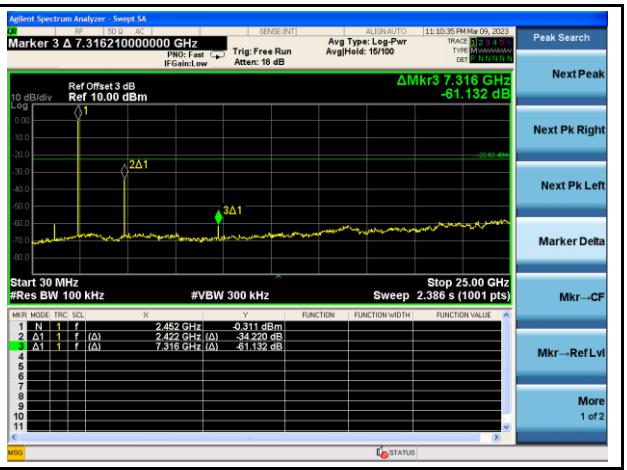
Conducted Band edge

	
BLE-Band Edge-Low CH	**BLE-Band Edge -High CH**

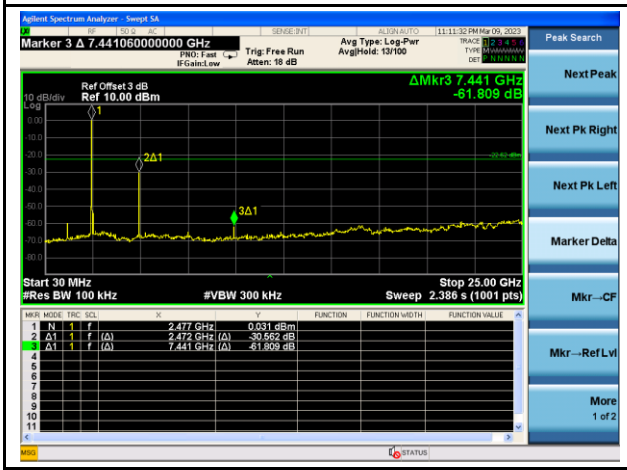
Conducted Spurious emission



BLE-CSE-Low



BLE-CSE-Mid



BLE-CSE-High

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

7.7.1 Requirement

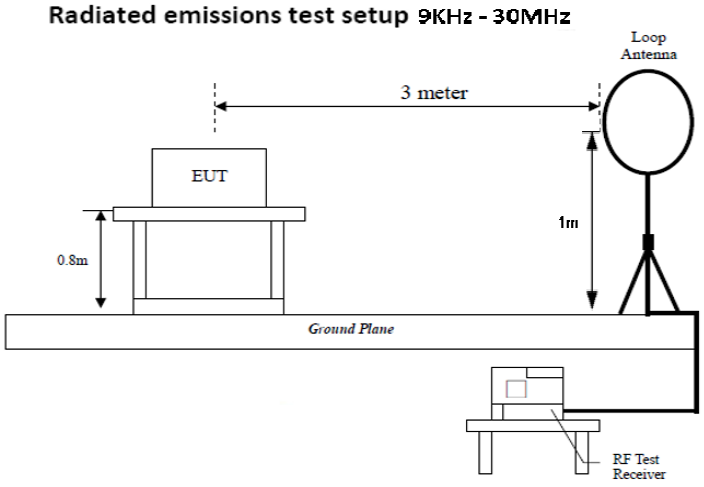
§ 15.247 (d), RSS-247 §5.5

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.

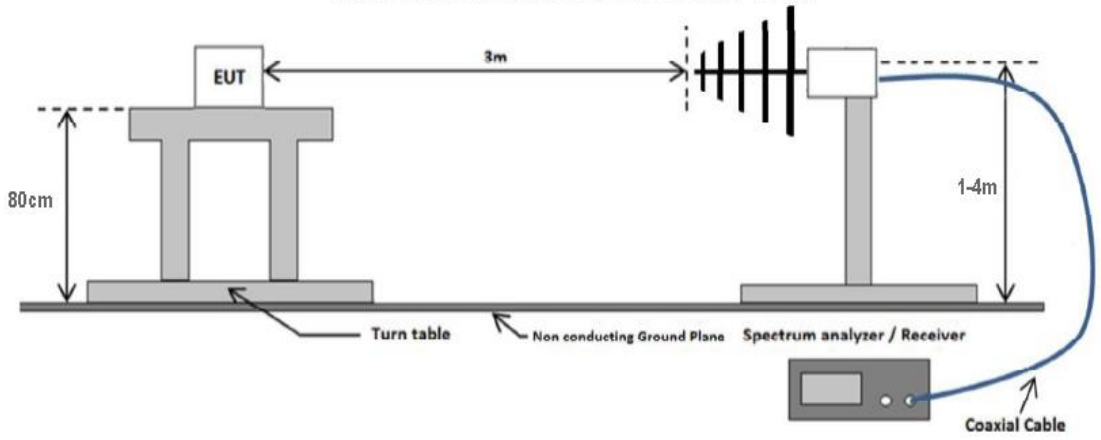
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

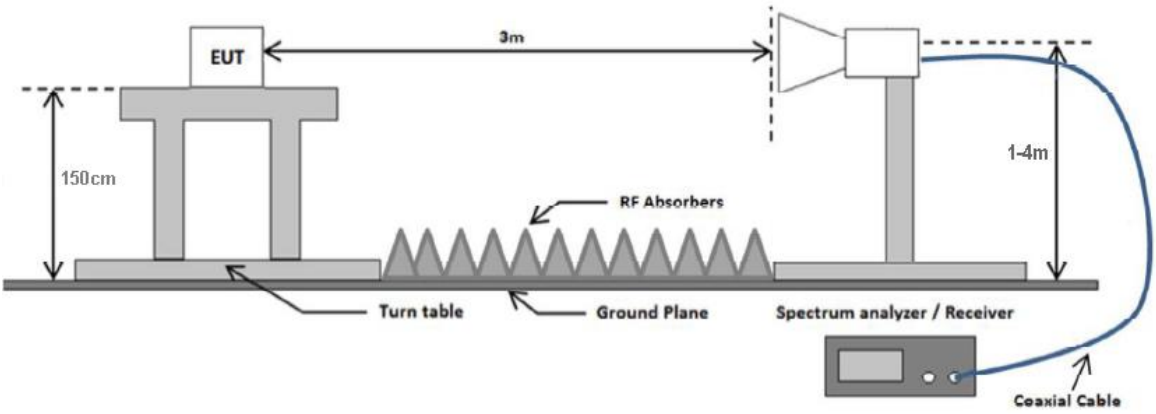
7.7.2 Test Setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



7.7.3 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 C63.10-2013 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.

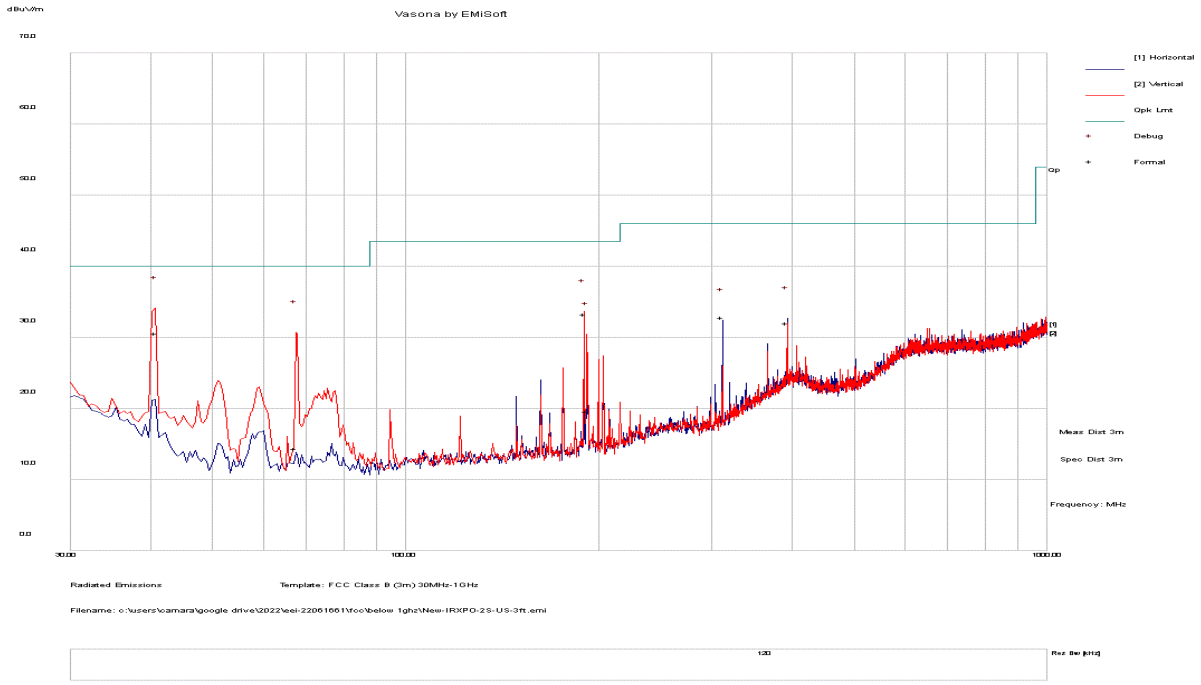
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting 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.

7.7.4 Test Result

Radiated Emission between 9KHz – 30MHz test result

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

Test Standard:	FCC15.247, 15.209	Mode:	BLE middle channel
Frequency Range:	30 MHz - 1 GHz	Test Date:	02/24/2023
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Zach Peng
Remark:	N/A	Test Result:	Pass



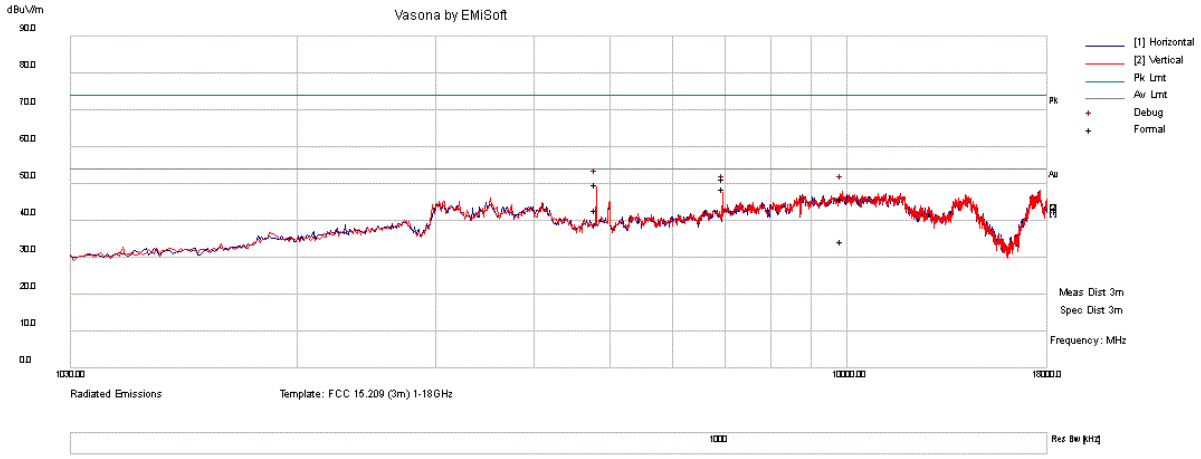
Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
40.678	45.4	2.6	-17.3	30.7	Quasi Max	V	125	250	40	-9.3	Pass
67.208	31.5	3.1	-20.2	14.4	Quasi Max	V	178	261	40	-25.6	Pass
189.809	45.9	4.6	-17.1	33.4	Quasi Max	V	112	278	43.5	-10.1	Pass
191.753	32.1	4.7	-17.1	19.7	Quasi Max	V	123	255	43.5	-23.8	Pass
393.22	34	6.3	-8.3	32.1	Quasi Max	H	122	243	46	-13.9	Pass
311.868	40.6	5.8	-13.4	32.9	Quasi Max	H	108	284	46	-13.1	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB/m) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	FCC15.247, 15.209	Mode:	BLE, low channel
Frequency Range:	1 GHz – 18 GHz	Test Date:	02/24/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Zach Peng
Remark:	IRXPO-2S	Test Result:	Pass



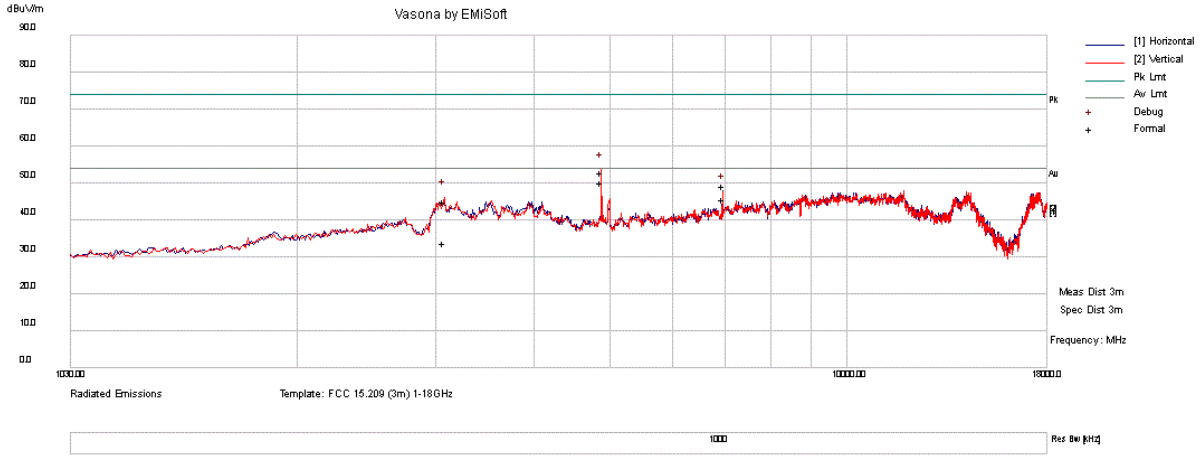
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	4804.125	45.3	9.1	-4.5	49.9	Peak Max	V	146	0	74	-24.1	Pass
2	9864.449	34.7	16.4	-5.2	45.9	Peak Max	V	375	282	74	-28.1	Pass
3	6959.959	45.3	12.5	-6.4	51.4	Peak Max	V	242	69	74	-22.6	Pass
4	4804.125	38.2	9.1	-4.5	42.9	Average Max	V	146	0	54	-11.1	Pass
5	9864.449	23.2	16.4	-5.2	34.4	Average Max	V	375	282	54	-19.6	Pass
6	6959.959	42.5	12.5	-6.4	48.6	Average Max	V	242	69	54	-5.4	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB/m) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	FCC15.247, 15.209	Mode:	BLE, mid channel
Frequency Range:	1 GHz – 18 GHz	Test Date:	02/24/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Zach Peng
Remark:	IRXPO-2S	Test Result:	Pass



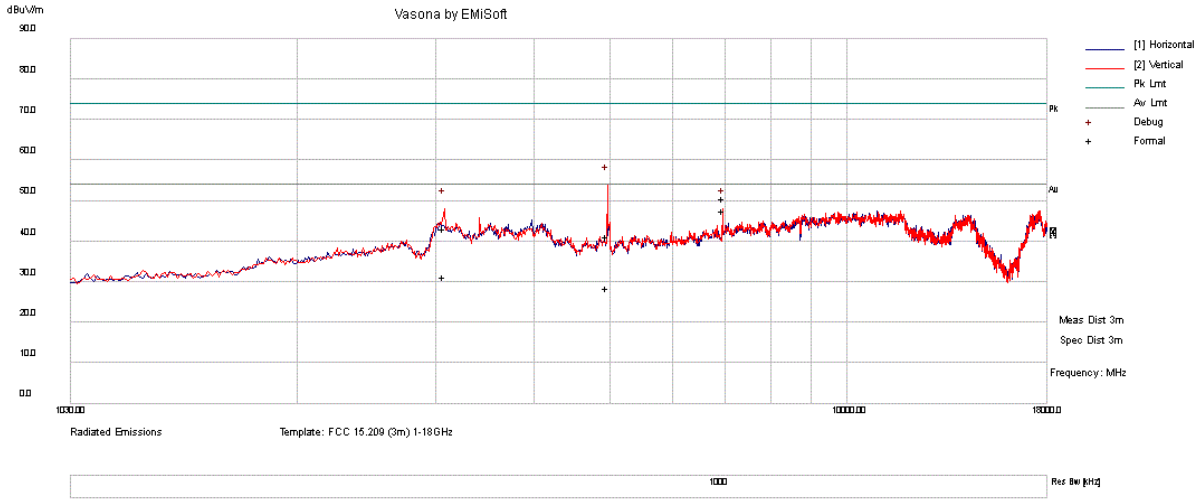
No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	4881.963	48.9	9.3	-5.5	52.7	Peak Max	V	171	132	74	-21.3	Pass
2	6959.976	43.1	12.5	-6.4	49.2	Peak Max	H	184	42	74	-24.8	Pass
3	3077.999	36.9	7.7	0.4	45	Peak Max	V	127	287	74	-29	Pass
4	4881.963	46.2	9.3	-5.5	50	Average Max	V	171	132	54	-4	Pass
5	6959.976	39.4	12.5	-6.4	45.5	Average Max	H	184	42	54	-8.5	Pass
6	3077.999	25.7	7.7	0.4	33.7	Average Max	V	127	287	54	-20.3	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB/m) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

RADIATED EMISSIONS 1 - 18 GHZ

Test Standard:	FCC15.247, 15.209	Mode:	BLE, high channel
Frequency Range:	1 GHz – 18 GHz	Test Date:	02/24/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Zach Peng
Remark:	IRXPO-2S	Test Result:	Pass



No.	Frequency MHz	Raw dBuV	Cable Loss	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	4963.051	38.3	9.5	-6.7	41.1	Peak Max	V	310	316	74	-32.9	Pass
2	3077.386	35.1	7.7	0.4	43.2	Peak Max	V	328	54	74	-30.8	Pass
3	6960.116	44.4	12.5	-6.4	50.6	Peak Max	V	237	63	74	-23.4	Pass
4	4963.051	25.7	9.5	-6.7	28.4	Average Max	V	310	316	54	-25.6	Pass
5	3077.386	23	7.7	0.4	31.2	Average Max	V	328	54	54	-22.8	Pass
6	6960.116	41.5	12.5	-6.4	47.6	Average Max	V	237	63	54	-6.4	Pass

Remarks:e

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + AF (dB).
2. AF(dB/m) = Antenna Factor (dB) – Preamplifier Gain (dB)
3. Margin = Level (dBuV/m) - Limit value(dBuV/m)

Radiated Emission between 18GHz – 40GHz test result

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

7.8 Conducted Emissions

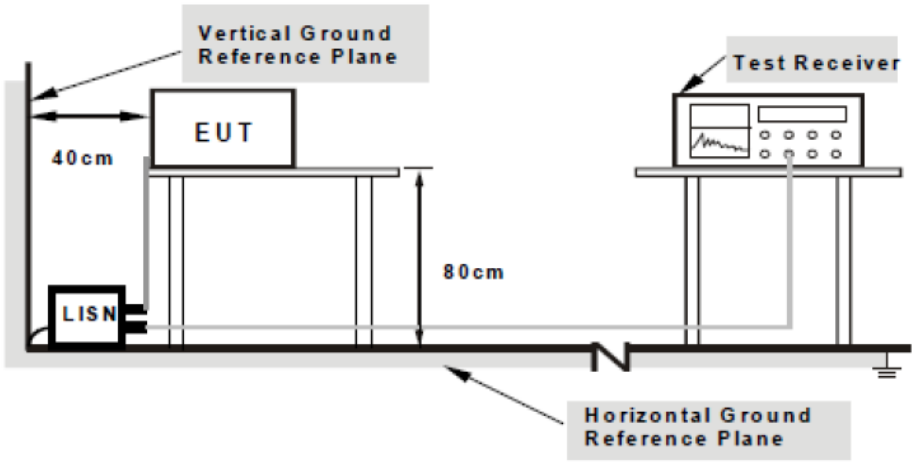
7.8.1 Requirement

Per § 15.207 (a) and RSS-Gen, 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.			

7.8.2 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.

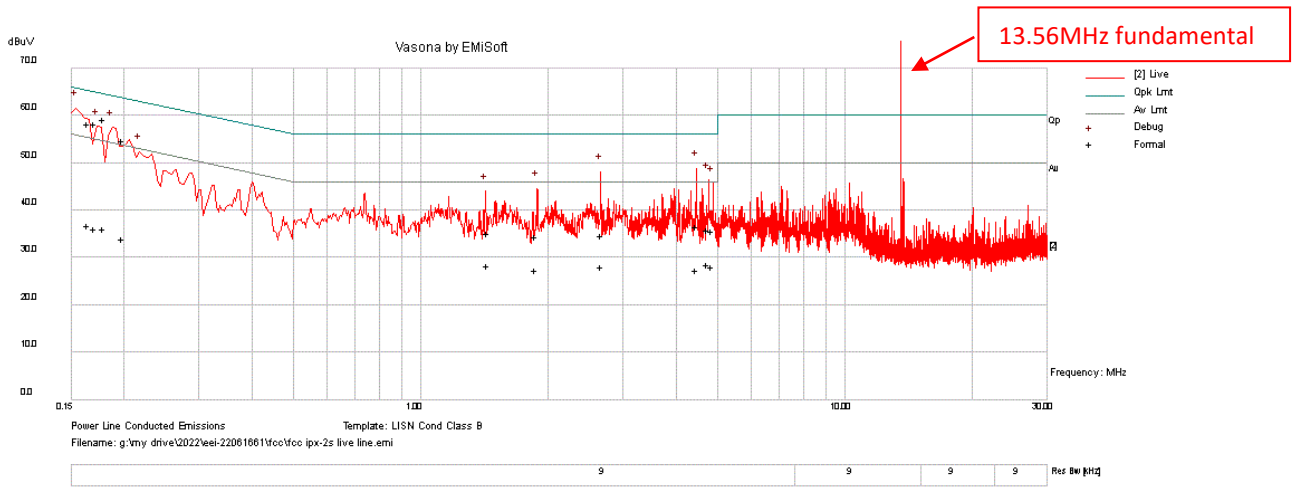
7.8.3 Test Procedure

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; 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.

7.8.4 Test Result

CONDUCTED EMISSIONS

Test Standard:	LISN B Cond Class B	Mode:	Normal operation
Frequency Range:	0.15 - 30MHz	Test Date:	03/02/2023
Line:	Live	Test Personnel:	Zach Peng
Remark:	Tested with supporting power adapter	Test Result:	Pass

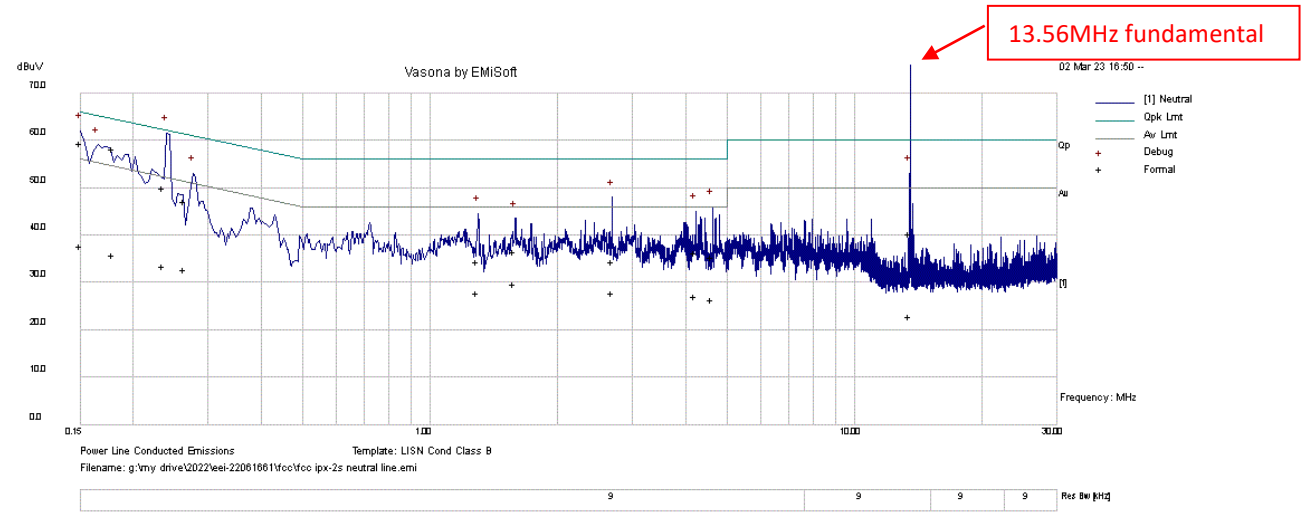


No.	Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass/Fail
1	0.171	48.1	10.1	0.2	58.3	Quasi Peak	Live	64.9	-6.6	Pass
2	0.179	48.8	10.1	0.2	59.1	Quasi Peak	Live	64.5	-5.4	Pass
3	0.165	48	10.1	0.2	58.3	Quasi Peak	Live	65.2	-6.9	Pass
4	4.466	26.1	10.4	0.1	36.6	Quasi Peak	Live	56	-19.4	Pass
5	2.672	24.4	10.3	0.1	34.7	Quasi Peak	Live	56	-21.3	Pass
6	4.754	25.4	10.4	0.1	36	Quasi Peak	Live	56	-20	Pass
7	4.876	25.2	10.4	0.2	35.7	Quasi Peak	Live	56	-20.3	Pass
8	0.199	44.6	10.1	0.2	54.8	Quasi Peak	Live	63.6	-8.8	Pass
9	1.872	24.1	10.2	0.1	34.4	Quasi Peak	Live	56	-21.6	Pass
10	1.438	24.8	10.2	0.1	35.1	Quasi Peak	Live	56	-20.9	Pass
11	0.171	26	10.1	0.2	36.3	Average	Live	54.9	-18.7	Pass
12	0.179	25.8	10.1	0.2	36	Average	Live	54.5	-18.5	Pass
13	0.165	26.5	10.1	0.2	36.8	Average	Live	55.2	-18.4	Pass
14	4.466	17	10.4	0.1	27.5	Average	Live	46	-18.5	Pass
15	2.672	17.7	10.3	0.1	28.1	Average	Live	46	-17.9	Pass
16	4.754	18	10.4	0.1	28.5	Average	Live	46	-17.5	Pass
17	4.876	17.5	10.4	0.2	28.1	Average	Live	46	-17.9	Pass
18	0.199	23.8	10.1	0.2	34.1	Average	Live	53.6	-19.6	Pass
19	1.872	17.2	10.2	0.1	27.5	Average	Live	46	-18.5	Pass
20	1.438	18.1	10.2	0.1	28.4	Average	Live	46	-17.6	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + Factor (dB).
2. Margin = Level (dBuV) - Limit value(dBuV)
3. The emission at 13.56MHz is from the RFID's intentional fundamental emission that operates simultaneously with BLE.

Test Standard:	LISN B Cond Class B	Mode:	Normal operation
Frequency Range:	0.15 - 30MHz	Test Date:	03/02/2023
Line:	Neutral	Test Personnel:	Zach Peng
Remark:	Tested with supporting power adapter	Test Result:	Pass



No.	Frequency MHz	Raw dBuV	Cable Loss dB	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass/Fail
1	0.236	39.9	10.1	0.2	50.1	Quasi Peak	Neutral	62.2	-12.1	Pass
2	0.15	49.2	10.1	0.2	59.5	Quasi Peak	Neutral	66	-6.5	Pass
3	0.179	48	10.1	0.2	58.2	Quasi Peak	Neutral	64.5	-6.3	Pass
4	0.264	37.1	10.1	0.1	47.3	Quasi Peak	Neutral	61.3	-14	Pass
5	2.693	24.1	10.3	0.1	34.5	Quasi Peak	Neutral	56	-21.5	Pass
6	4.626	25	10.4	0.1	35.5	Quasi Peak	Neutral	56	-20.5	Pass
7	4.204	25.9	10.3	0.1	36.3	Quasi Peak	Neutral	56	-19.7	Pass
8	1.294	24.2	10.2	0.1	34.5	Quasi Peak	Neutral	56	-21.5	Pass
9	1.577	26.4	10.2	0.1	36.7	Quasi Peak	Neutral	56	-19.3	Pass
10	0.236	23.2	10.1	0.2	33.5	Average	Neutral	52.2	-18.8	Pass
11	0.15	27.5	10.1	0.2	37.8	Average	Neutral	56	-18.2	Pass
12	0.179	25.7	10.1	0.2	36	Average	Neutral	54.5	-18.5	Pass
13	0.264	22.6	10.1	0.1	32.8	Average	Neutral	51.3	-18.5	Pass
14	2.693	17.5	10.3	0.1	27.9	Average	Neutral	46	-18.1	Pass
15	4.626	15.9	10.4	0.1	26.4	Average	Neutral	46	-19.6	Pass
16	4.204	16.8	10.3	0.1	27.3	Average	Neutral	46	-18.7	Pass
17	1.294	17.5	10.2	0.1	27.8	Average	Neutral	46	-18.2	Pass
18	1.577	19.5	10.2	0.1	29.8	Average	Neutral	46	-16.2	Pass

Remarks:

1. Level (dBuV) = Raw (dBuV) + Cable loss(dB) + Factor (dB).
2. Margin = Level (dBuV) - Limit value(dBuV)
3. The emission at 13.56MHz is from the RFID's intentional fundamental emission that operates simultaneously with BLE.

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	10/18/2022	10/18/2023
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	06/09/2022	06/09/2023
EMC Test Receiver	R&S	ESL6	100230	06/07/2022	06/07/2023
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	07/12/2022	07/12/2023
Bi-Log Antenna	ETS-Lindgren	3142E	217921	07/19/2022	07/19/2023
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	07/21/2022	07/21/2023
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	07/21/2022	07/21/2023
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	07/16/2022	07/16/2023
True RMS Multi-meter	UNI-T	UT181A	C173014829	06/07/2022	06/07/2023
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	06/07/2022	06/07/2023
RF Attenuator	Pasternack	PE7005-3	VL061	07/16/2022	07/16/2023
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	07/16/2022	07/16/2023
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	06/10/2022	06/10/2023
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	07/16/2022	07/16/2023
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	07/16/2022	07/16/2023
RE test cable (>18GHz)	Sucoflex	104	344903/4	07/16/2022	07/16/2023
Pulse limiter	Com-Power	LIT-930A	531727	07/16/2022	07/16/2023
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	07/16/2022	07/16/2023
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	07/16/2022	07/16/2023

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