

RF Test Report

Test Report Number	STA-22121361-LCG-FCC-IC-RF-DSS		
FCC ID	ZKP-ZOLLALS0001		
IC ID	9702A-ZOLLALS0001		
Applicant	ZOLL Medical Corporation		
Applicant Address	269 Mill Road, Chelmsford, MA 01824-4105		
Product Name	Zenix Monitor/Defibrillator		
Model (s)	Zenix		
Date of Receipt	08/10/2023		
Date of Test	08/24/2023 – 08/29/2023		
Report Issue Date	03/27/2024		
Test Standards	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023		
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)	
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REVISION HISTORY

Report Number	Version	Description	Issued Date
STA-22121361-LCG-FCC-IC-RF-DSS	01	Initial report	03/27/2024

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1 Test Summary

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15.203	N/A	N/A*
AC Power Line Conducted Emissions	47 CFR Part 15.207 RSS-Gen Issue 5, Feb 2021	ANSI C63.10 (2013) RSS-Gen Issue 5, Feb 2021	N/A*
20 dB Bandwidth	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Occupied Bandwidth	RSS-Gen Issue 5, Feb 2021	RSS-Gen Issue 5, Feb 2021	N/A*
Number of Hopping Channel	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Conducted Maximum Output Power	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Channel Separation	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Time of Occupancy	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Conducted Band-Edge & Unwanted Emissions	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Frequency Hopping System Requirement	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	N/A*
Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023	ANSI C63.10 (2013)	Pass

Note: * The EUT is a host product with FCC/ISED certified BT and WLAN single module integrated (Module model: SX-SDMAC). For more test details, please see FCC ID: N6C-SDMAC and ISED ID: 4908A-SDMAC. The current report is an additional evaluation for the host product with the module integrated.

2 General Information

2.1 Applicant

Applicant	ZOLL Medical Corporation
Applicant address	269 Mill Road, Chelmsford, MA 01824-4105
Manufacturer	ZOLL Medical Corporation
Manufacturer Address	269 Mill Road, Chelmsford, MA 01824-4105

2.2 Product information

Product Name	Zenix Monitor/Defibrillator
Model Number	Zenix
Family Models	N/A
Serial Number	ST22E00204
Frequency Band	BT BDR/EDR: 2402-2480MHz BT BLE: 2402-2480MHz WLAN: 2.4GHz/5GHz 11a/b/g/n/ac
Type of modulation	BT BDR/EDR: GFSK, $\pi/4$ DQPSK, 8DPSK BLE: GFSK 802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM) 802.11a/n/ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Equipment Class	DSS, DTS, U-NII
Antenna Information	2.4/5GHz Flexible Antenna (Model: 1461530100, Brand: molex) Antenna Peak Gain: 2.4G WLAN/BT: 3.0 dBi, 5G WLAN: 4.5 dBi
Clock Frequencies	N/A
Input Power	15Vdc, 8.0A (DC rating for EMS version) 120-240VAC, 50-60Hz, 160VA (AC rating for Hospital version)
Power Adapter Manufacturer/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Additional Info	ZOLL Zenix has two different hardware versions, the Hospital version, and EMS version. The difference is Hospital version has direct connection to AC power mains; the EMS version has DC connector, which can be connected to a external AC/DC power supply for recharging. This difference is not RF related, therefore there is no impact on RF performance. The EUT used for testing is EMS version.

2.3 Test standard and method

Test standard	47 CFR Part 15.247 RSS-247 Issue 3, Aug 2023
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
Radiated Emission Testing	23.5°C	58.2%	996 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 special S/W (includes MyFTM & hcitool) to support the RF TX/RX measurement in different aspects. (S/W version 0.S109.Silex)

The following software was used for testing.

Software	Description
EMISoft Vasona	EMC/RF Spurious emission test software used during testing
Tera Term	To set Bluetooth BDR/EDR into different channel, modulation

5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
Wideband radio communication tester	Rohde & Schwarz	CMW500	147508
Laptop	DELL	Latitude E6510	3RZC1M1
Zenix AC-DC external power supply	ZOLL	TR9WG4000A00G3228R6B	880488123-23

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 Radiated Spurious Emissions into Restricted Frequency Bands

7.1.1 Requirement

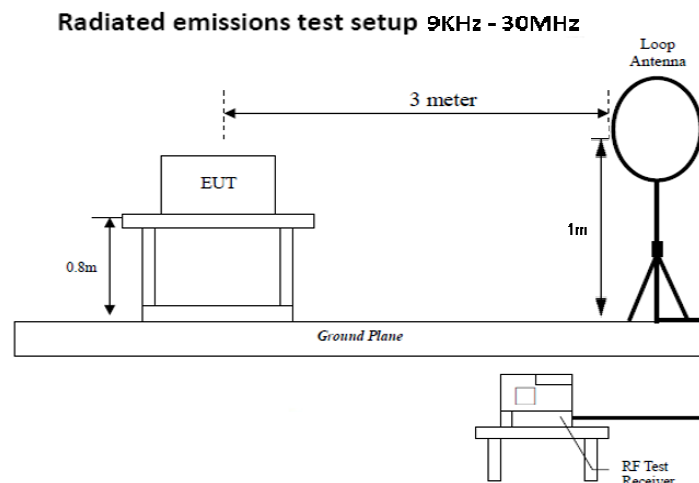
§ 15.247 (d)

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

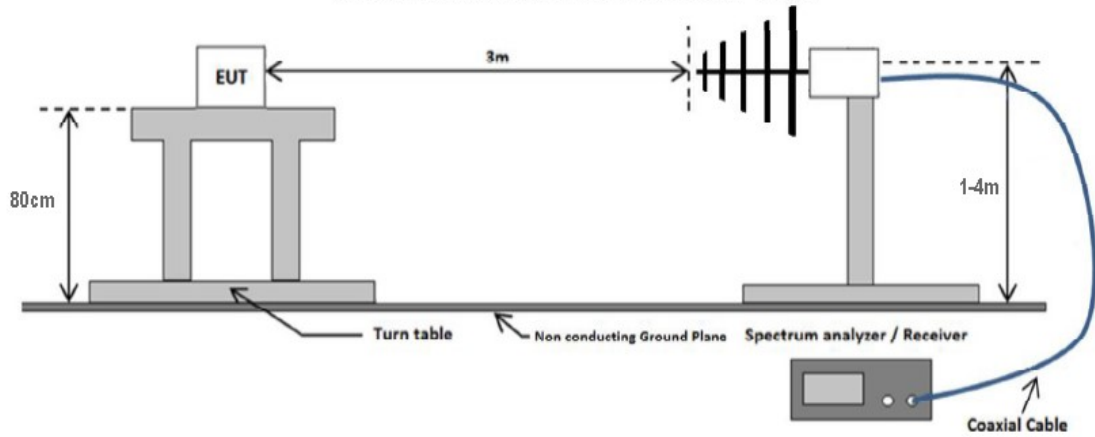
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

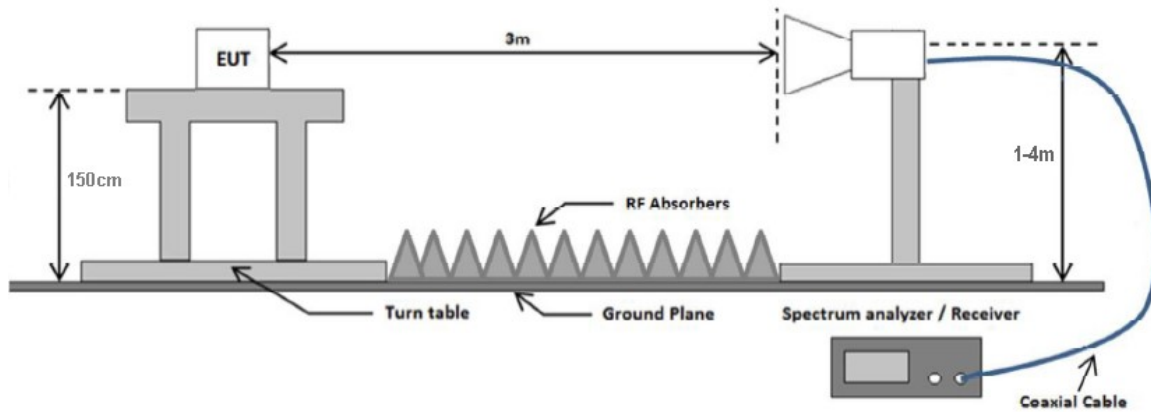
7.1.2 Test Setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



7.1.3 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.

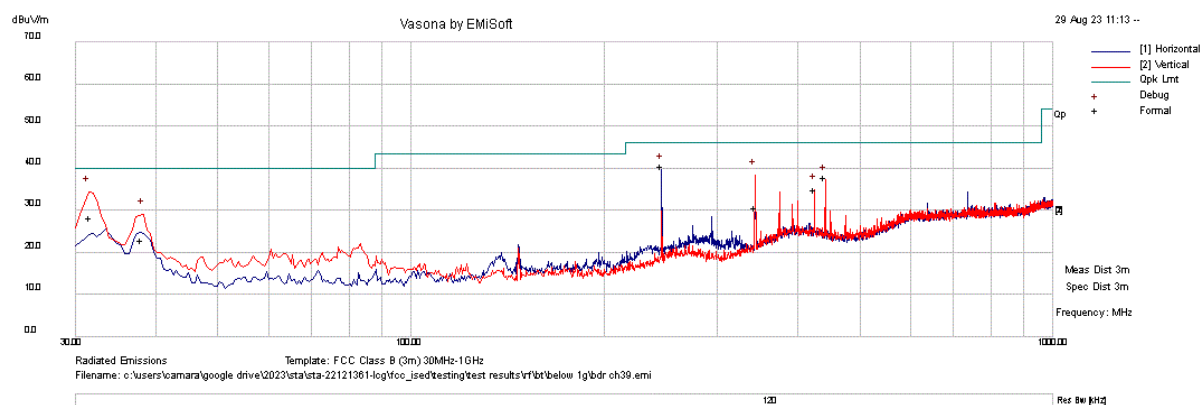
7.1.4 Test Result

Radiated Emission between 9KHz – 30MHz test result

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

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	FCC 15.247, 15.209, RSS-247	Mode:	BDR Mode
Frequency Range:	30 MHz - 1 GHz	Test Date:	08/29/2023
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Devin Tai
Remark:	Mid channel	Test Result:	Pass



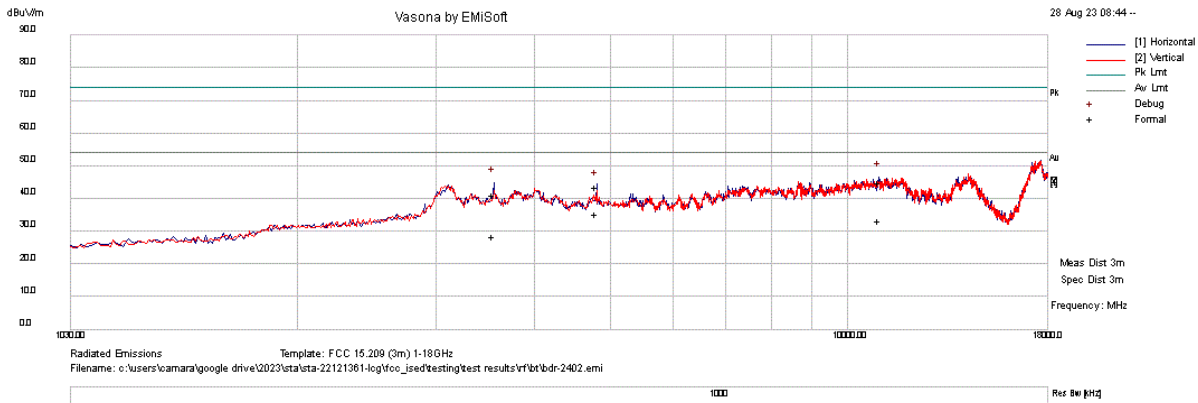
No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	31.704	38.6	2.3	-12.4	28.5	Quasi Max	V	127	130	40	-11.5	Pass
2	245.453	50.3	5.2	-14.8	40.7	Quasi Max	H	130	198	46	-5.3	Pass
3	343.558	36.1	6	-11.4	30.7	Quasi Max	V	100	162	46	-15.3	Pass
4	441.822	40.7	6.2	-9	37.9	Quasi Max	V	0	152	46	-8.1	Pass
5	38.078	36.5	2.5	-16	23	Quasi Max	V	101	0	40	-17	Pass
6	424.988	37.3	6.3	-8.6	35	Quasi Max	V	0	134	46	-11	Pass

Remarks:

1. Level (dBuV/m) = Raw (dBuV) + Cable loss(dB) + AF (dB/m).
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:	FCC 15.247, 15.209, RSS-247	Mode:	BDR Mode
Frequency Range:	1 GHz - 18 GHz	Test Date:	08/24/2023-08/28/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Devin Tai
Remark:	Low Channel	Test Result:	Pass



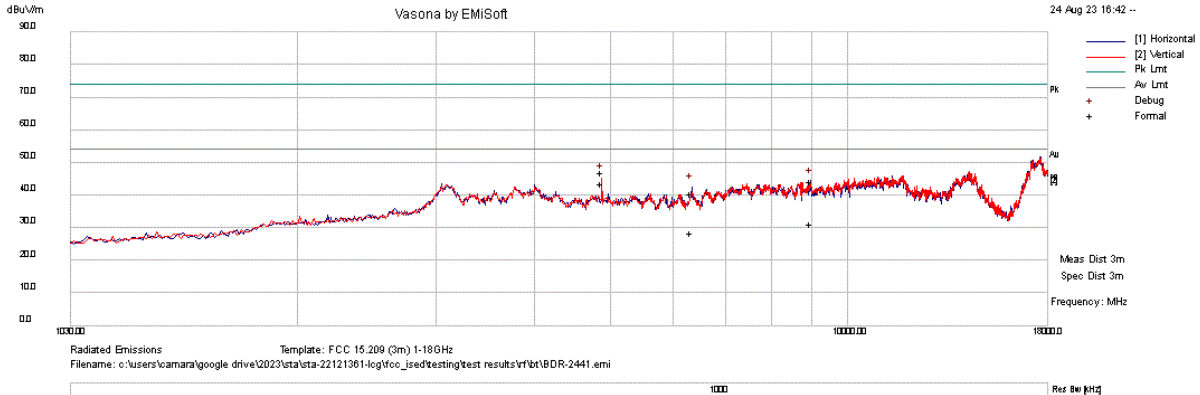
No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	10977.601	32.2	17.2	-4.6	44.8	Peak Max	H	157	282	74	-29.2	Pass
2	3554.993	32.4	8.3	0.6	41.3	Peak Max	H	242	0	74	-32.7	Pass
3	4803.945	38.8	9.1	-4.5	43.4	Peak Max	V	251	332	74	-30.6	Pass
4	10977.601	20.6	17.2	-4.6	33.2	Average Max	H	157	282	54	-20.8	Pass
5	3554.993	19.7	8.3	0.6	28.6	Average Max	H	242	0	54	-25.4	Pass
6	4803.945	30.7	9.1	-4.5	35.3	Average Max	V	251	332	54	-18.7	Pass

Remarks:

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

Report# STA-22121361-LCG-FCC-IC-RF-DSS

Test Standard:	FCC 15.247, 15.209, RSS-247	Mode:	BDR Mode
Frequency Range:	1 GHz – 18 GHz	Test Date:	08/24/2023-08/28/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Devin Tai
Remark:	Mid Channel	Test Result:	Pass



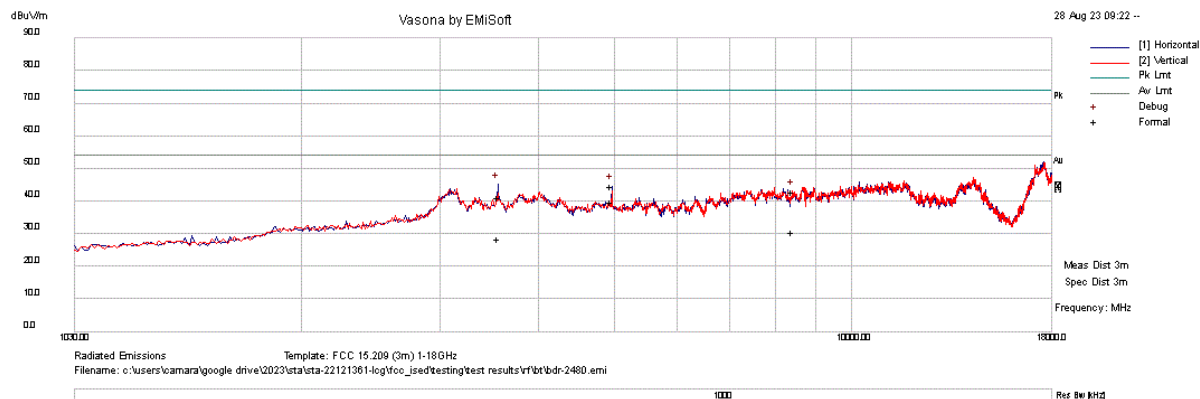
No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	4882.018	43.4	9.3	-5.5	47.2	Peak Max	V	217	0	74	-26.8	Pass
2	8985.777	34.9	15.2	-5.8	44.3	Peak Max	H	103	334	74	-29.7	Pass
3	6344.99	37.2	12	-8.8	40.4	Peak Max	H	168	224	74	-33.6	Pass
4	4882.018	39.8	9.3	-5.5	43.6	Average Max	V	217	0	54	-10.4	Pass
5	8985.777	21.9	15.2	-5.8	31.3	Average Max	H	103	334	54	-22.7	Pass
6	6344.99	25.4	12	-8.8	28.6	Average Max	H	168	224	54	-25.4	Pass

Remarks:

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

Report# STA-22121361-LCG-FCC-IC-RF-DSS

Test Standard:	FCC 15.247, 15.209, RSS-247	Mode:	BDR Mode
Frequency Range:	1 GHz – 18 GHz	Test Date:	08/24/2023-08/28/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Devin Tai
Remark:	High Channel	Test Result:	Pass



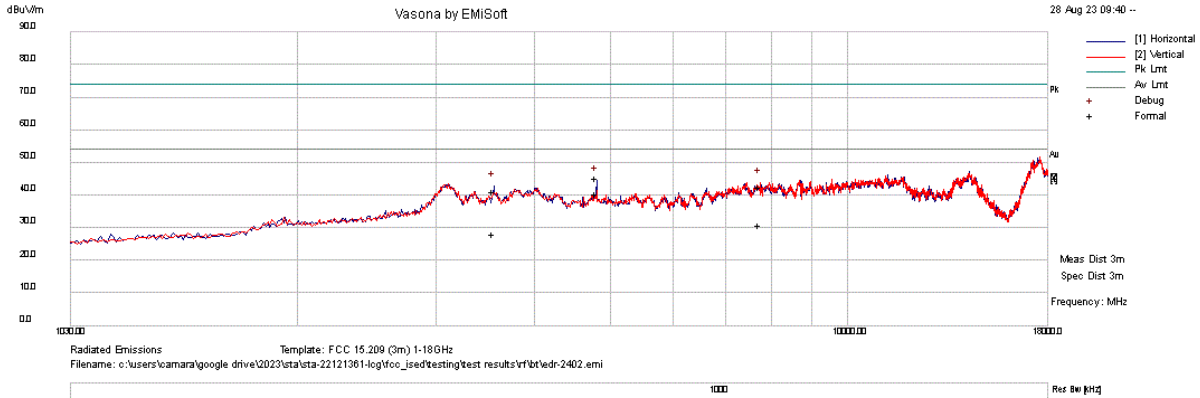
No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	3558.685	32	8.4	0.6	41	Peak Max	H	108	1	74	-33	Pass
2	4960.02	41.9	9.5	-6.6	44.8	Peak Max	V	197	142	74	-29.2	Pass
3	8426.363	34.2	14.2	-5.6	42.8	Peak Max	V	330	93	74	-31.2	Pass
4	3558.685	19.5	8.4	0.6	28.5	Average Max	H	108	1	54	-25.5	Pass
5	4960.02	37	9.5	-6.6	39.9	Average Max	V	197	142	54	-14.1	Pass
6	8426.363	21.9	14.2	-5.6	30.5	Average Max	V	330	93	54	-23.5	Pass

Remarks:

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

Report#	STA-22121361-LCG-FCC-IC-RF-DSS
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Test Standard:	FCC 15.247, 15.209, RSS-247	Mode:	EDR Mode
Frequency Range:	1 GHz – 18 GHz	Test Date:	08/24/2023-08/28/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Devin Tai
Remark:	Low Channel	Test Result:	Pass



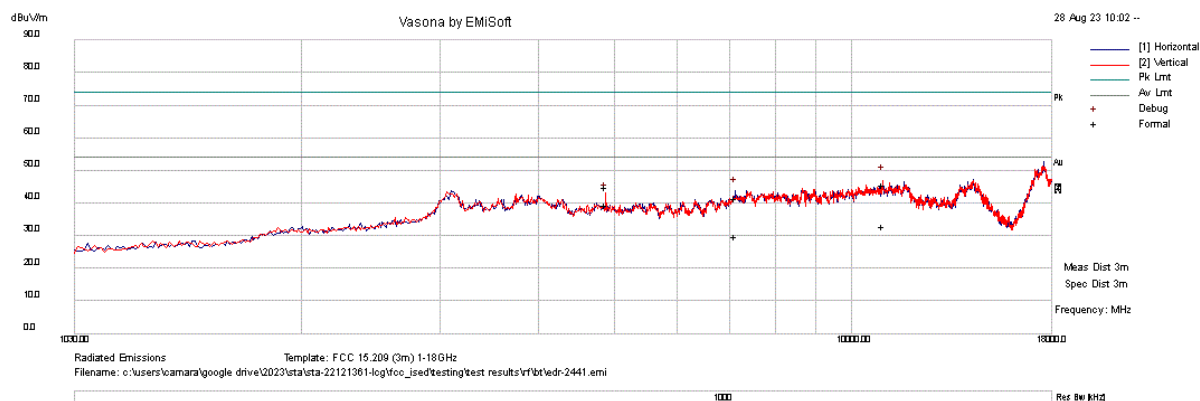
No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	4803.83	40.8	9.1	-4.5	45.4	Peak Max	H	169	232	74	-28.6	Pass
2	7744.469	34.6	13.7	-5.7	42.6	Peak Max	V	179	26	74	-31.4	Pass
3	3554.667	32.3	8.3	0.6	41.2	Peak Max	H	218	8	74	-32.8	Pass
4	4803.83	35.8	9.1	-4.5	40.4	Average Max	H	169	232	54	-13.6	Pass
5	7744.469	22.7	13.7	-5.7	30.7	Average Max	V	179	26	54	-23.3	Pass
6	3554.667	19.4	8.3	0.6	28.3	Average Max	H	218	8	54	-25.7	Pass

Remarks:

1. Level (dBuV/m) = Raw (dBuV) + Cable loss(dB) + AF (dB/m).
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:	FCC 15.247, 15.209, RSS-247	Mode:	EDR Mode
Frequency Range:	1 GHz - 18 GHz	Test Date:	08/24/2023-08/28/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Devin Tai
Remark:	Mid Channel	Test Result:	Pass



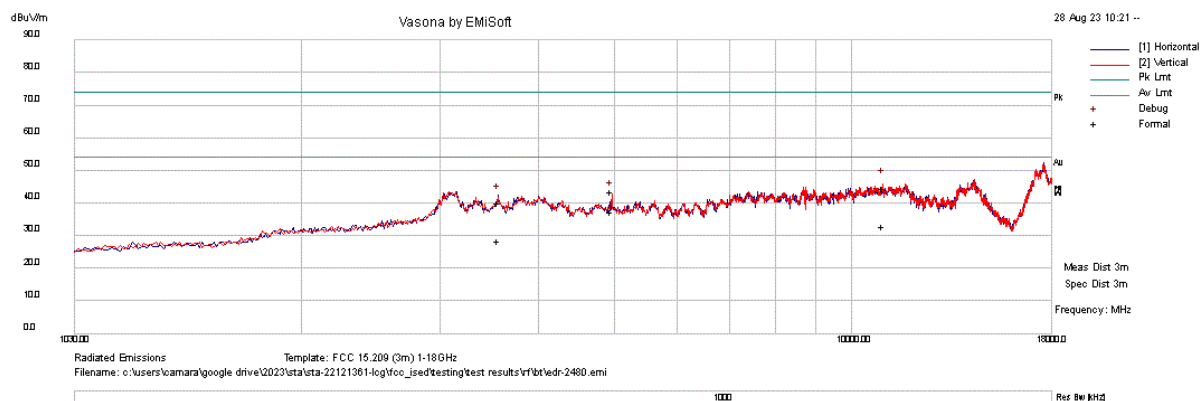
No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	10967.751	33	17.2	-4.6	45.6	Peak Max	V	131	182	74	-28.4	Pass
2	7127.941	34.8	12.7	-5.8	41.7	Peak Max	H	100	114	74	-32.3	Pass
3	4881.945	41.1	9.3	-5.5	44.9	Peak Max	V	213	143	74	-29.1	Pass
4	10967.751	20.4	17.2	-4.6	33	Average Max	V	131	182	54	-21	Pass
5	7127.941	22.9	12.7	-5.8	29.8	Average Max	H	100	114	54	-24.2	Pass
6	4881.945	35.6	9.3	-5.5	39.4	Average Max	V	213	143	54	-14.6	Pass

Remarks:

1. Level (dBuV/m) = Raw (dBuV) + Cable loss(dB) + AF (dB/m).
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:	FCC 15.247, 15.209, RSS-247	Mode:	EDR Mode
Frequency Range:	1 GHz - 18 GHz	Test Date:	08/24/2023-08/28/2023
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Devin Tai
Remark:	High Channel	Test Result:	Pass



No.	Frequency MHz	Raw dBuV	Cable Loss dB	AF dB/m	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
1	10967.681	31.9	17.2	-4.6	44.5	Peak Max	V	216	227	74	-29.5	Pass
2	4960.103	40.8	9.5	-6.6	43.7	Peak Max	V	101	42	74	-30.3	Pass
3	3560.723	31.2	8.4	0.7	40.3	Peak Max	H	117	292	74	-33.7	Pass
4	10967.681	20.4	17.2	-4.6	33	Average Max	V	216	227	54	-21	Pass
5	4960.103	34.5	9.5	-6.6	37.4	Average Max	V	101	42	54	-16.6	Pass
6	3560.723	19.3	8.4	0.7	28.4	Average Max	H	117	292	54	-25.6	Pass

Remarks:

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

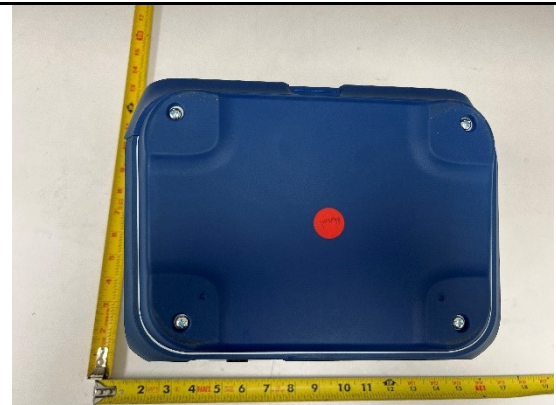
Radiated Emission between 18GHz – 40GHz test result

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

8 EUT and Test Setup Photos



EUT Top View



EUT Bottom View



EUT Front View



EUT Rear View



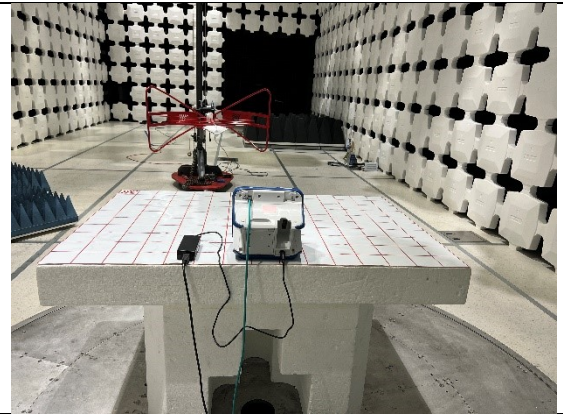
EUT Left View



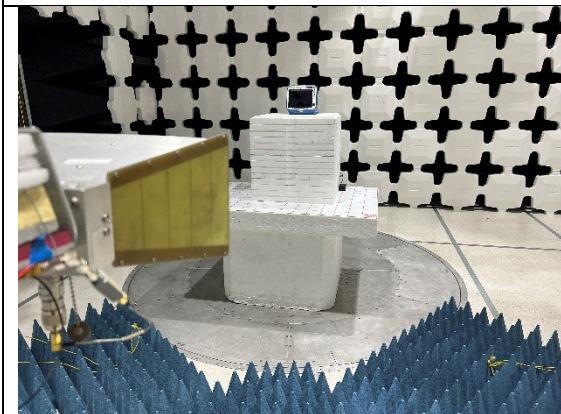
EUT Right View



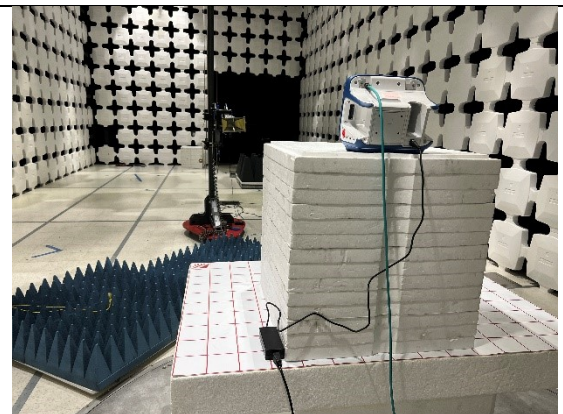
Radiated Emission-Below 1GHz-Front



Radiated Emission-Below 1GHz-Back



Radiated Emission-Above 1GHz-Front



Radiated Emission-Above 1GHz-Back

9 Test Instrument List

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
10m Semi-Anechoic Chamber	ETS-Lingren	10M	VL001	10/18/2022	10/18/2023
Turn Table	ETS-Lingren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lingren	2171B	VL003	N/A	N/A
MXA Signal Analyzer 20Hz to 26.5GHz	Keysight	N9020A	MY50110074	06/17/2023	06/17/2024
MXG Vector Signal Generator	Keysight	N5182A	US47080548	06/17/2023	06/17/2024
EMI Test Receiver (9KHz to 6 GHz)	Rohde & Schwarz	ESL6	100230	06/24/2023	06/24/2024
BICONILOG ANTENNA (30 MHz to 6 GHz)	ETS-Lingren	3142E	217921	08/15/2023	08/15/2024
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	06/09/2023	06/09/2024
Synthesized Signal Generator (10MHz - 40GHz)	Anritsu	68367C A/NV	11625	06/24/2023	06/24/2024
Temperature/Humidity Chamber	Bemco	FBW1.5-100/350	3621-9	06/24/2023	06/24/2024
Power Splitter/Combiner	Mini-Circuits	ZFSC-2-9G+	VL052	N/A	N/A
Power Splitter/Combiner	Mini-Circuits	ZFSC-2-9G+	VL053	N/A	N/A
2 x Attenuator - 10dB (SMA) (DC~18GHz) (2 Watt)	Pasternack	PE7005-10	VL059-1, VL059-2	N/A	N/A
Attenuator - 20dB (SMA) (DC~18GHz) (2 Watt)	Pasternack	PE7005-20	VL060	N/A	N/A
Attenuator - 3dB (SMA) (DC~18GHz) (2 Watt)	Pasternack	PE7005-3	VL061	N/A	N/A
Attenuator - 20dB (N-Type) (DC~6GHz) (50 Watt)	Aeroflex	6N50W-20-048	64671	N/A	N/A
2.4GHz Notch Filter	Micro-Tronics	BRM50702	G332	N/A	N/A
Wideband Radio Communicator	Rohde & Schwarz	CMW500	147508	07/09/2023	07/09/2024
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	05/15/2023	05/15/2024
Broadband RF Power Amplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	N/A	N/A
2 x Attenuator - 6dB (SMA) (DC~18GHz) (2 Watt)	JFW Industries, Inc	50HF-006 SMA	VL084-1, VL084-2	N/A	N/A
Attenuator - 30dB (SMA) (DC~18GHz) (2 Watt)	JFW Industries, Inc	50HF-030 SMA	VL085	N/A	N/A
Directional coupler	KRYTAR	1850	64023	N/A	N/A

Note:

- 1) This equipment is not for measurement purposes and only requires functional verification. Calibration is not required.

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