FCC RADIO TEST REPORT

FCC ID	:	**2A7ZY-M820-TXR**
Equipment	:	**Minder 820**
Brand Name	:	**Two-Commas**
Model Name	:	**M820**
Applicant	:	**Two Commas llc** **2576 Barona Street, West Sacramento CA 95691**
Manufacturer	:	**Two Commas llc** **2576 Barona Street, West Sacramento CA 95691**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Jul. 08, 2022 and testing was performed from Jul. 13, 2022 to Aug. 05, 2022. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International (USA) Inc. the test report shall not be reproduced except in full.

Neil Kao

Approved by: Neil Kao

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035

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History of this test report

Report No.	Version	Description	Issue Date
FR220715006	01	Initial issue of report	Aug. 11, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Reporting only	-
3.2	15.247(b)(3)	Output Power	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges and Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	1.25 dB under the limit at 4804.000 MHz
3.6	15.207	AC Conducted Emission	Pass	24.07 dB under the limit at 0.585 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Conformity Assessment Condition:
1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. Please refer to the section " Uncertainty of Evaluation " for measurement uncertainty.
Comments and Explanations:
The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth-LE

Product Feature	
Antenna Type	Ceramic Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	0 dBi

Remark: The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International (USA) Inc.		
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300		
Test Site No.	**Sporton Site No.**		
	TH01-CA	CO01-CA	03CH02-CA

Note: The test site complies with ANSI C63.4 2014 requirement.
FCC Designation No.: US 1250

1.4 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	21	2444
	1	2404	22	2446
	2	2406	23	2448
	3	2408	24	2450
	4	2410	25	2452
	5	2412	26	2454
	6	2414	27	2456
	7	2416	28	2458
	8	2418	29	2460
	9	2420	30	2462
	10	2422	31	2464
	11	2424	32	2466
	12	2426	33	2468
	13	2428	34	2470
	14	2430	35	2472
	15	2432	36	2474
	16	2434	37	2476
	17	2436	38	2478
	18	2438	39	2480
	19	2440	-	-
	20	2442	-	-

2.2 Test Mode

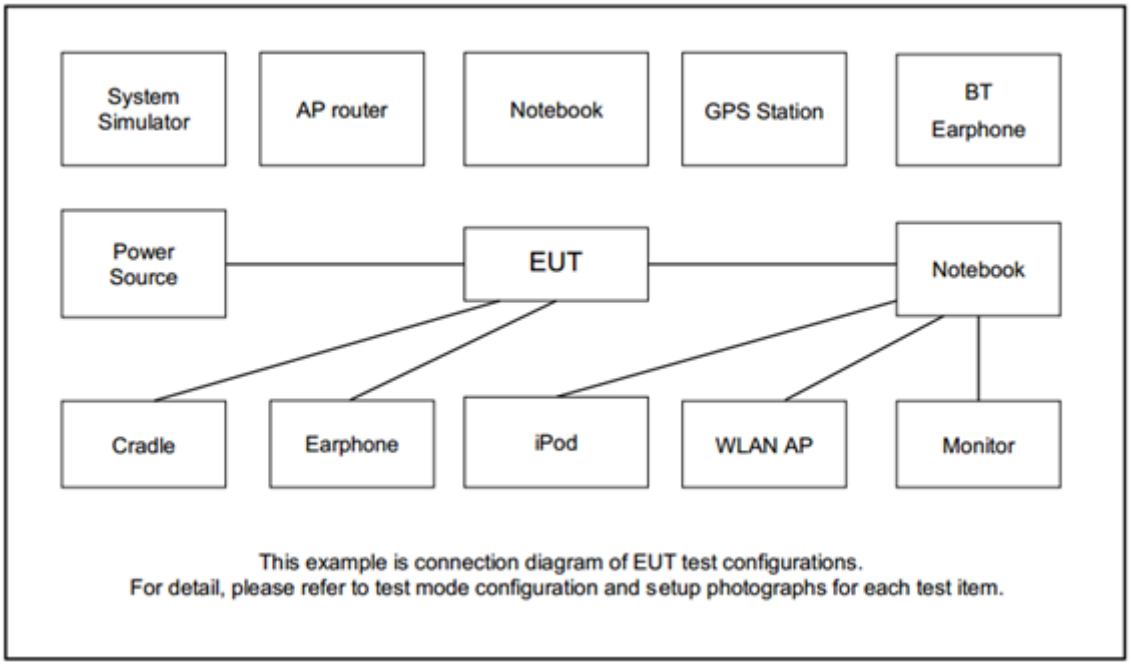
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find X plane as worst plane.

b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**Data Rate / Modulation**
Conducted Test Cases	**Bluetooth – LE / GFSK**
	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: Bluetooth-LE Link + Transceiver with adapter

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Adapter	Motorola	SC-41	FCC DoC	N/A	N/A
2.	Garage Door Minder	Two Commas	M811	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “nRF Connect 3.11.1 Version 3.0.3” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

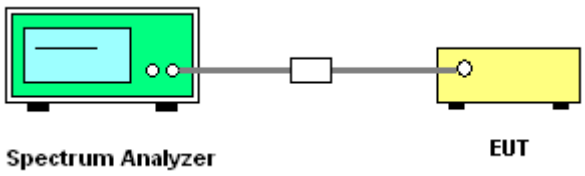
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
6. Measure and record the results in the test report.

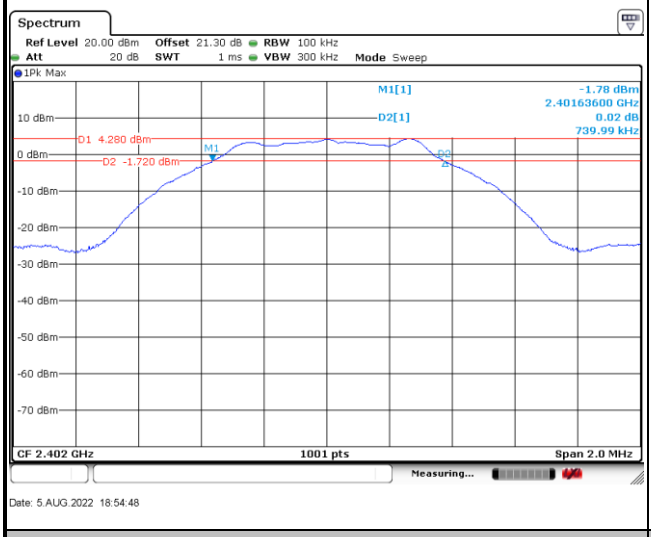
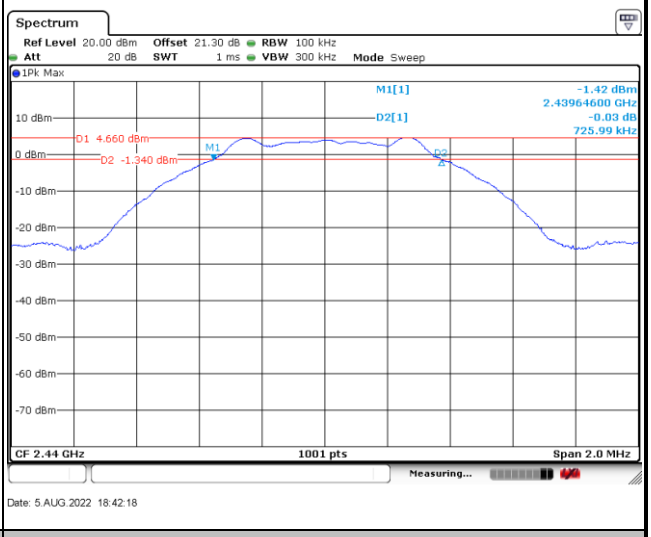
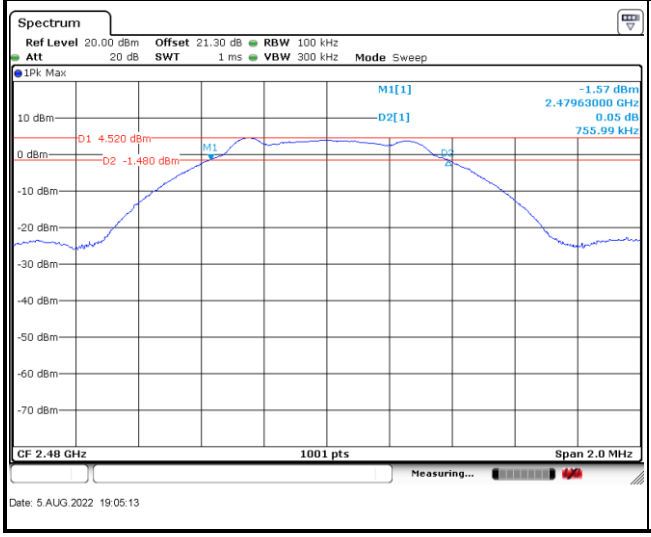
3.1.4 Test Setup



3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

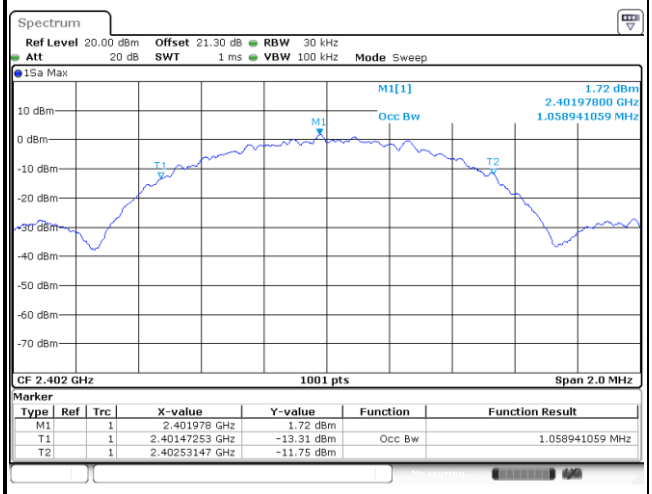
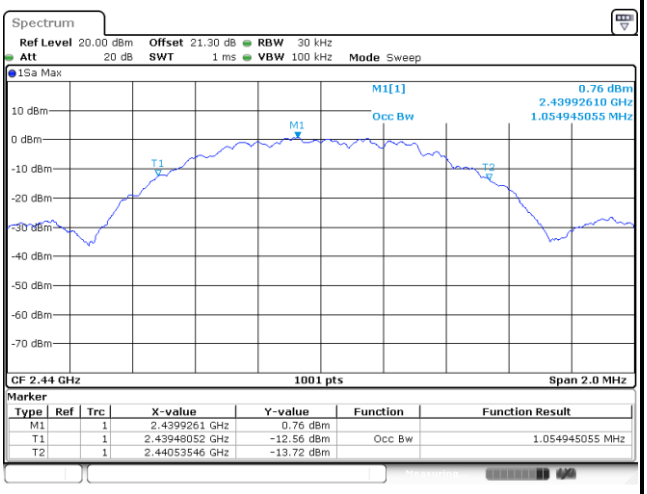
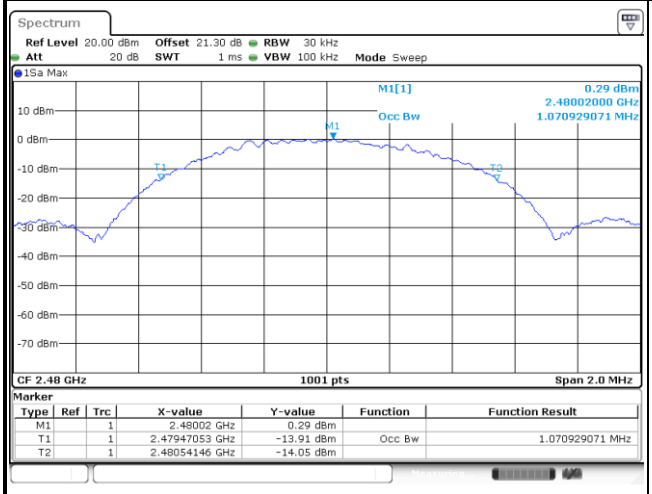
<1Mbps>

6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 19
	
6 dB Bandwidth Plot on Channel 39	**N/A**
	

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

<1Mbps>

99% Bandwidth Plot on Channel 00	99% Occupied Bandwidth Plot on Channel 19
	
99% Occupied Bandwidth Plot on Channel 39	**N/A**
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

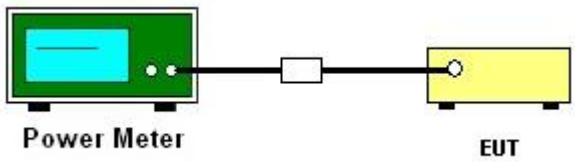
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT is connected to the power meter by RF cable and attenuator.
3. The path loss is compensated to the results for each measurement.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth (VBW) = 10 kHz. In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6 dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100 kHz is a reference level and is used as 20 dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

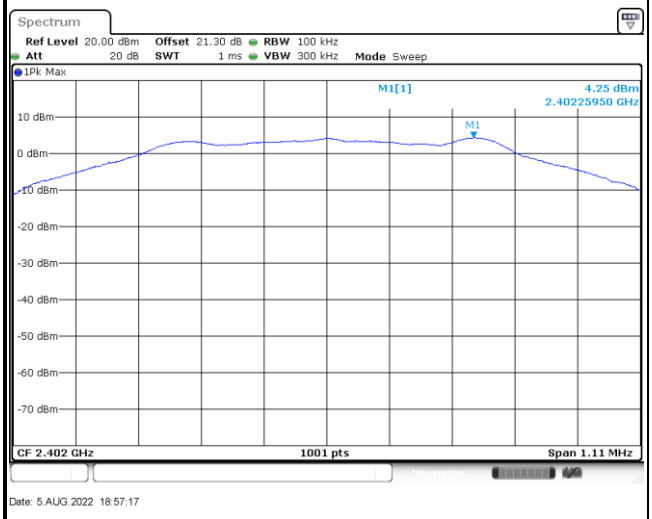
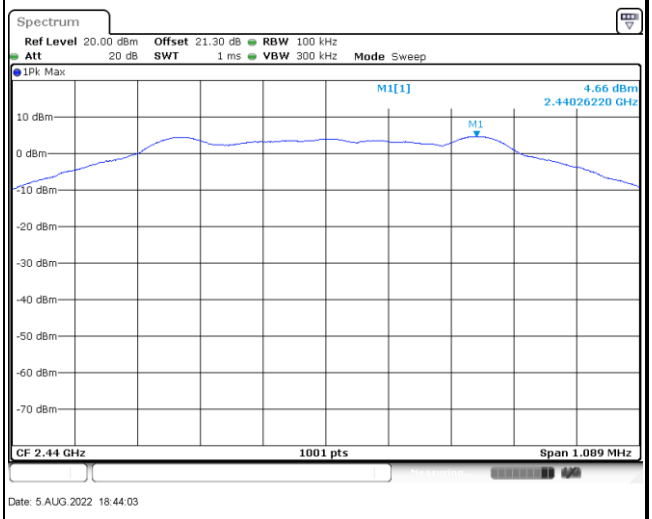
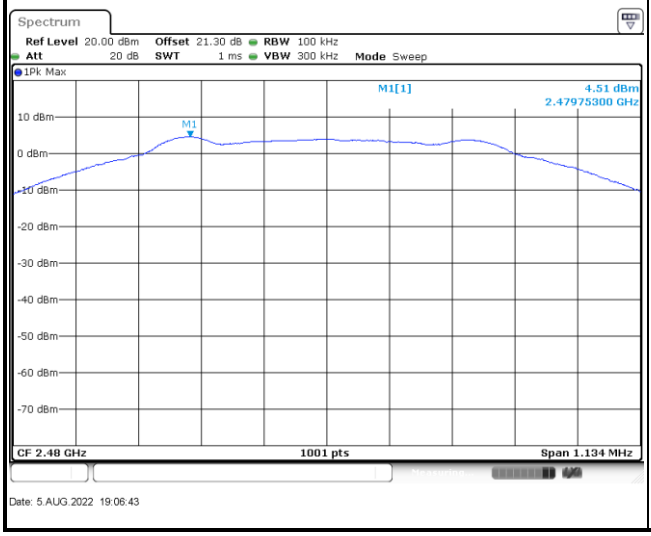
3.3.4 Test Setup

3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

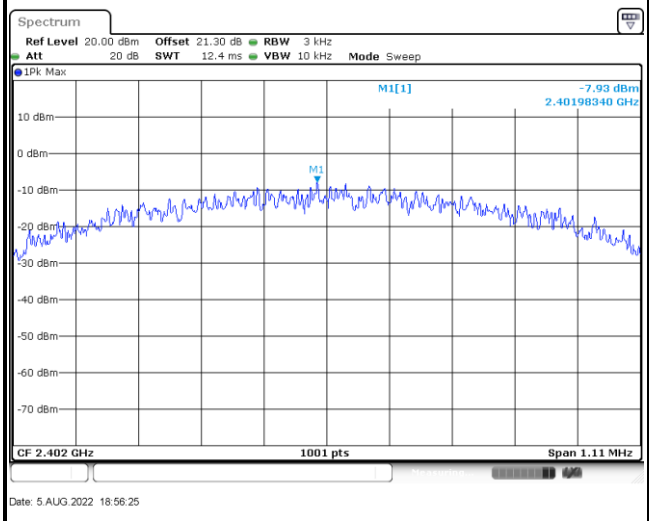
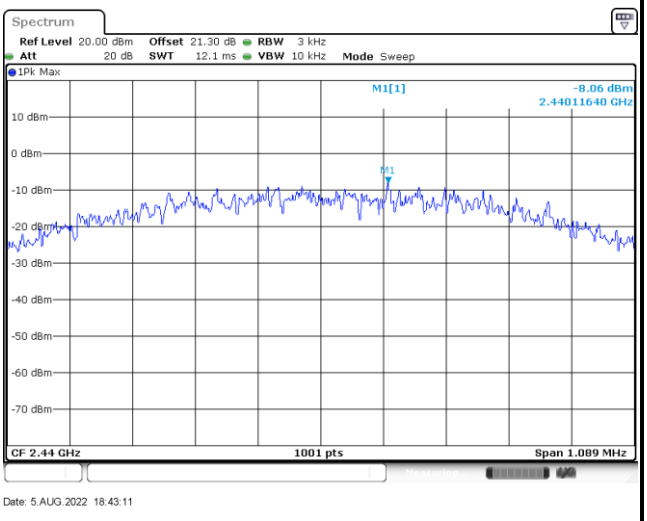
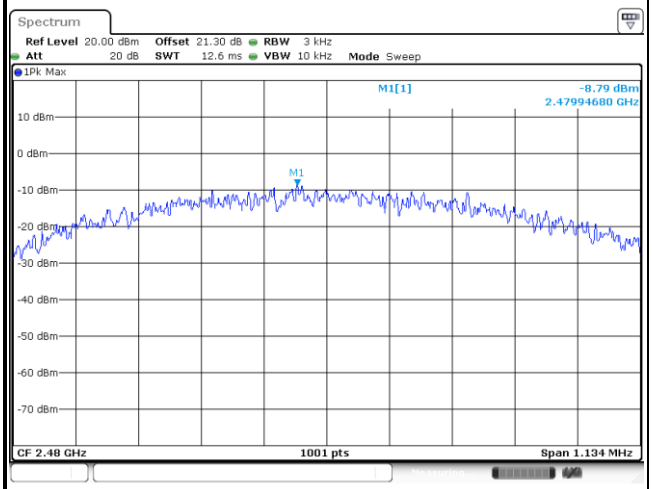
3.3.6 Test Result of Power Spectral Density Plots (100kHz)

<1Mbps>

PSD 100kHz Plot on Channel 00	PSD 100kHz Plot on Channel 19
	
PSD 100kHz Plot on Channel 39	**N/A**
	

3.3.7 Test Result of Power Spectral Density Plots (3kHz)

<1Mbps>

PSD 3kHz Plot on Channel 00	PSD 3kHz Plot on Channel 19
	
PSD 3kHz Plot on Channel 39	**N/A**
	

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

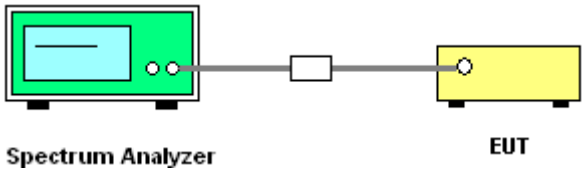
3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedure

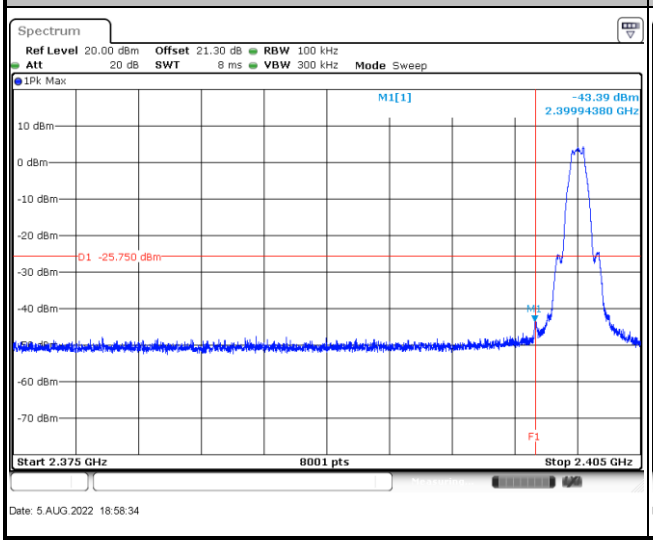
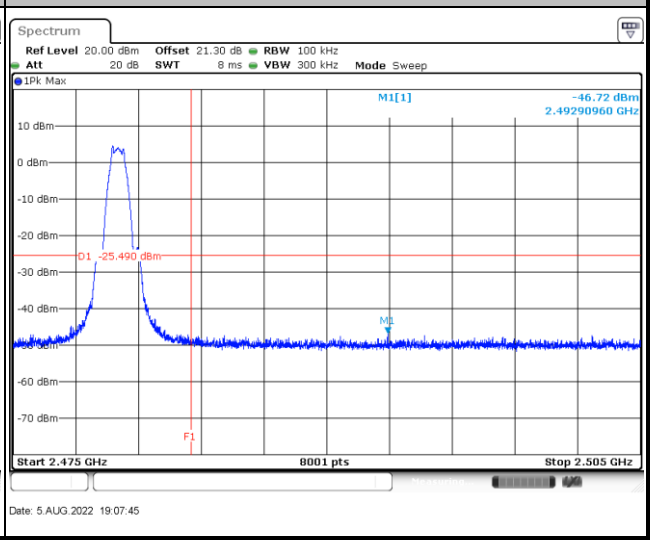
1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. 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.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



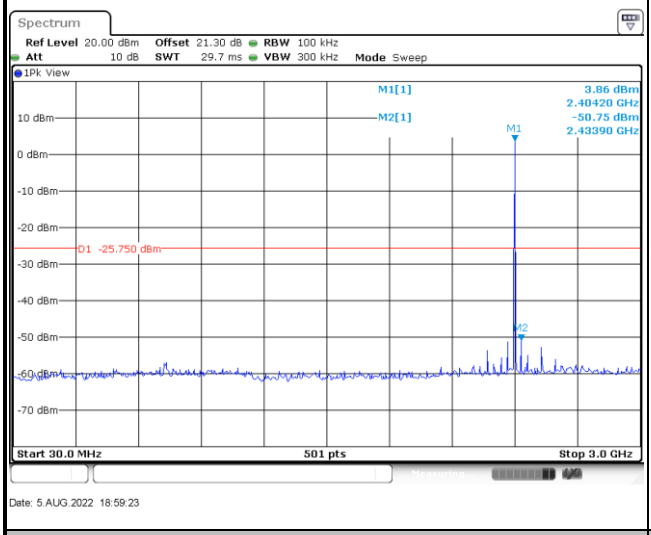
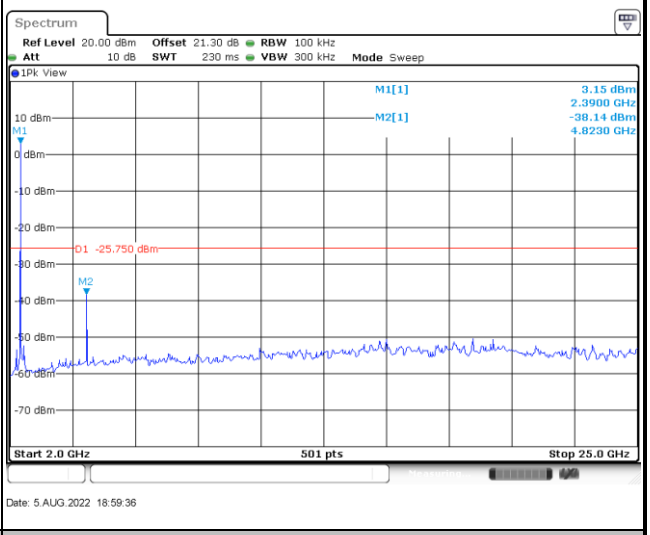
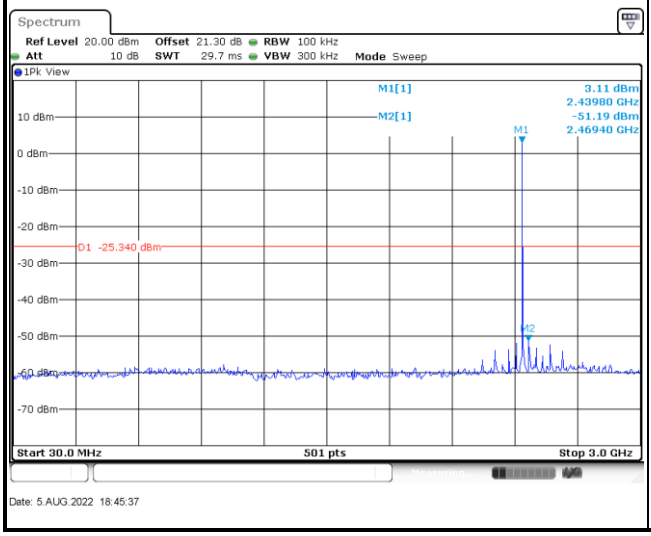
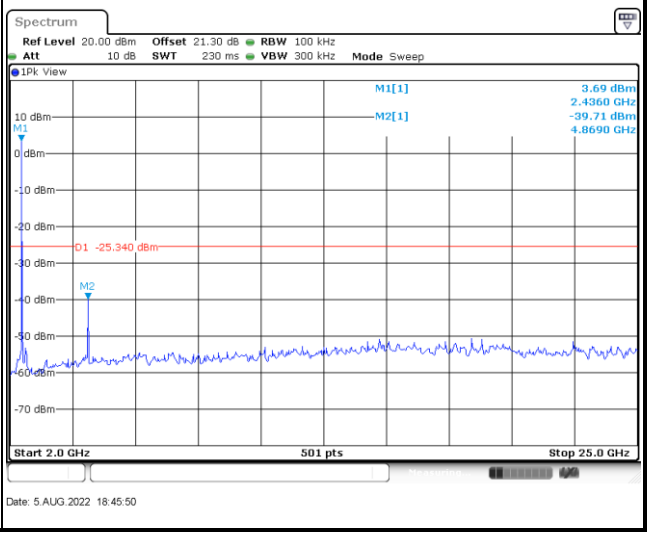
3.4.5 Test Result of Conducted Band Edges Plots

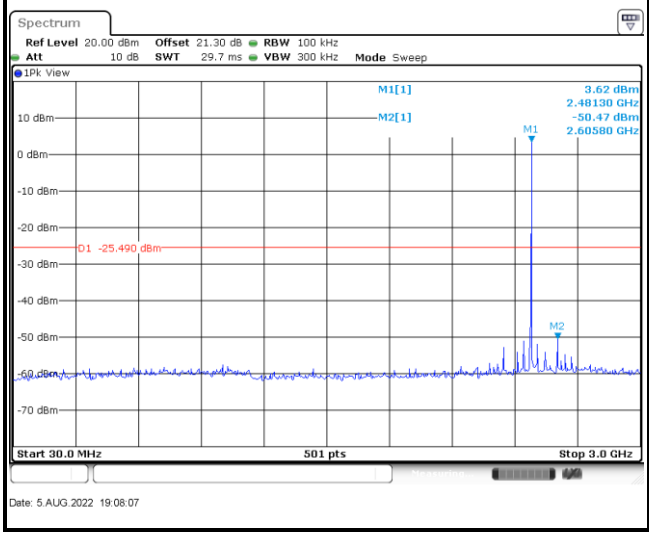
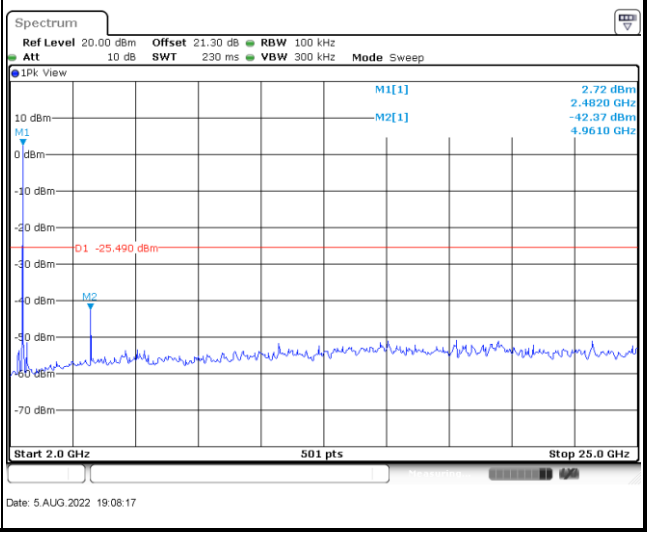
<1Mbps>

Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 39
	

3.4.6 Test Result of Conducted Spurious Emission Plots

<1Mbps>

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 00
	
Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19	**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 19**
	

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39	Conducted Spurious Emission Plot on Bluetooth LE 1Mbps GFSK Channel 39
	

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

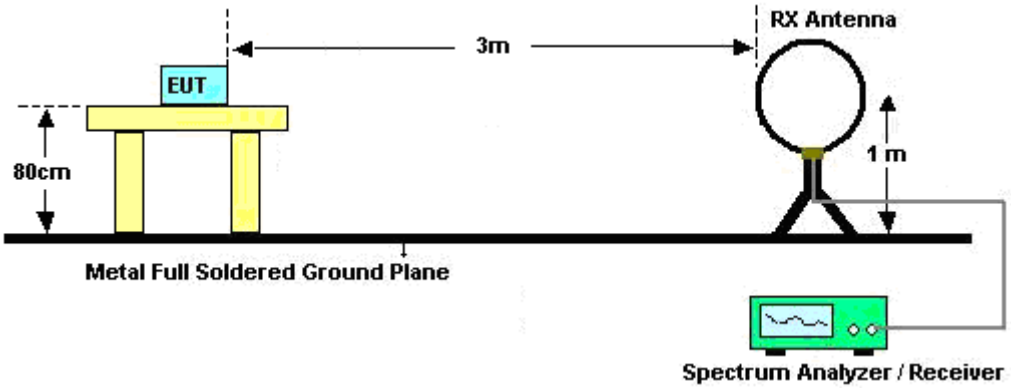
3.5.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-“.

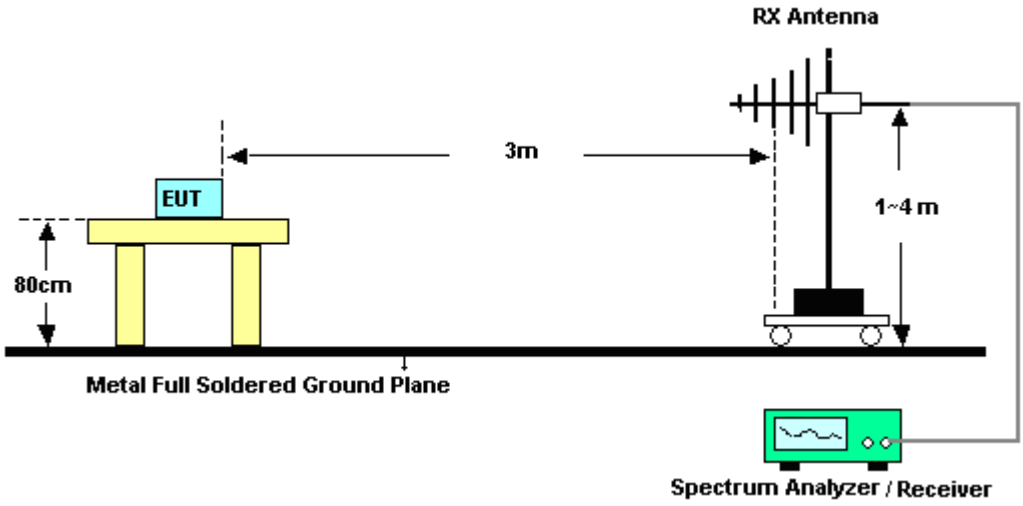
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW = 3 MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

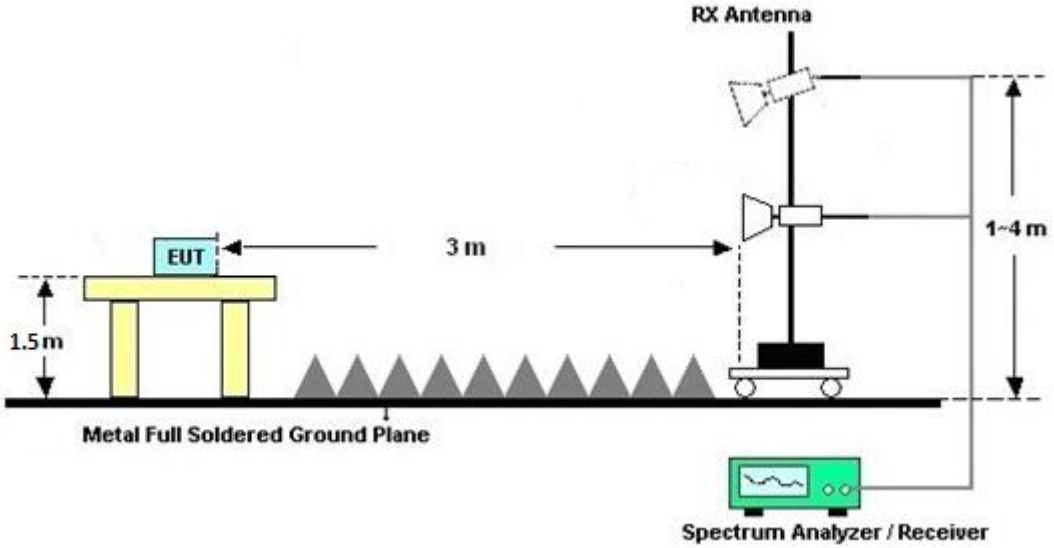
For radiated test below 30MHz



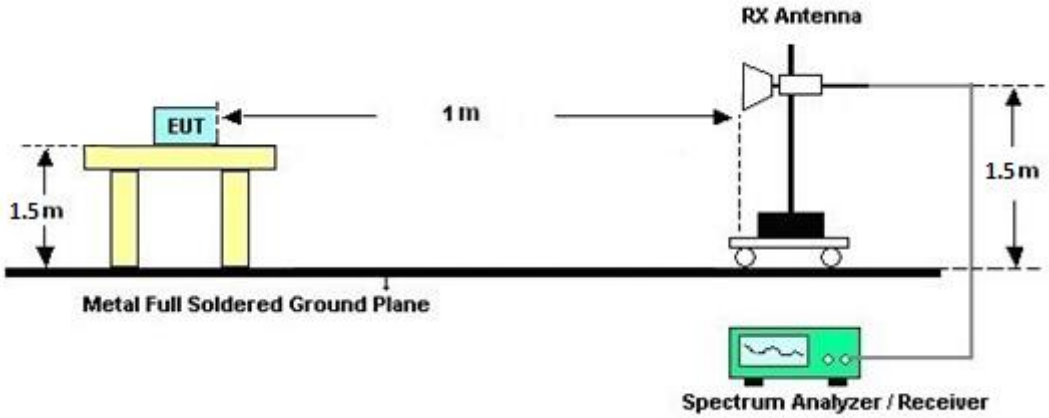
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30 MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment 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.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

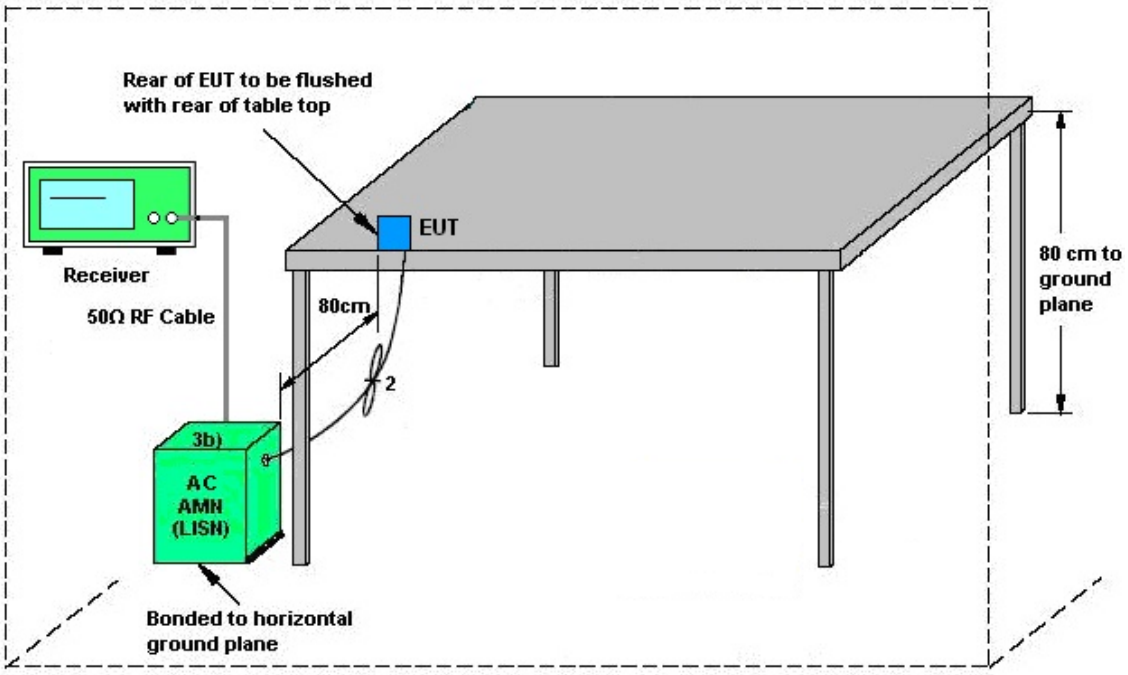
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. 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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2E	100840	9kHz~30MHz	Jul. 05, 2022	Aug. 04, 2022~ Aug. 05, 2022	Jul. 04, 2023	Radiation (03CH02-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Oct. 15, 2021	Aug. 04, 2022~ Aug. 05, 2022	Oct. 14, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 25, 2021	Aug. 04, 2022~ Aug. 05, 2022	Aug. 24, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9170D	00841	18GHz~40GHz	Aug. 26, 2021	Aug. 04, 2022~ Aug. 05, 2022	Aug. 25, 2022	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	May 10, 2022	Aug. 04, 2022~ Aug. 05, 2022	May 09, 2023	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	May 11, 2022	Aug. 04, 2022~ Aug. 05, 2022	May 10, 2023	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	1GHz~18GHz	May 10, 2022	Aug. 04, 2022~ Aug. 05, 2022	May 09, 2023	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz-40GHz	May 10, 2022	Aug. 04, 2022~ Aug. 05, 2022	May 09, 2023	Radiation (03CH02-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8024032/2, 802406/2, 802875/2	N/A	Jun. 22, 2022	Aug. 04, 2022~ Aug. 05, 2022	Jun. 21, 2023	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 22, 2021	Aug. 04, 2022~ Aug. 05, 2022	Sep. 21, 2022	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN10	3GHz High Pass Filter	Jul. 21, 2022	Aug. 04, 2022~ Aug. 05, 2022	Jul. 20, 2023	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN1	1.2GHz Low Pass Filter	Jul. 21, 2022	Aug. 04, 2022~ Aug. 05, 2022	Jul. 20, 2023	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 30, 2021	Aug. 04, 2022~ Aug. 05, 2022	Aug. 29, 2022	Radiation (03CH02-CA)
Controller	ChainTek	EM-1000	060876	NA	N/A	Aug. 04, 2022~ Aug. 05, 2022	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Aug. 04, 2022~ Aug. 05, 2022	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Aug. 04, 2022~ Aug. 05, 2022	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Aug. 04, 2022~ Aug. 05, 2022	N/A	Radiation (03CH02-CA)
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 30, 2021	Aug. 05, 2022	Aug. 29, 2022	Conducted (TH01-CA)
Power Sensor	EM Electronics Corporation	RPR3006W	RPR6W-1901026	10MHz-6GHz	May 10, 2022	Aug. 05, 2022	May 09, 2023	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Jun. 01, 2022	Aug. 05, 2022	May 31, 2023	Conducted (TH01-CA)
Switch Box & RF Cable	EM Electronics	EMSW26	1090304	N/A	Mar. 30, 2022	Aug. 05, 2022	Mar. 29, 2023	Conducted (TH01-CA)
LISN	TESEQ	NNB51	47415	N/A	May 10, 2022	Jul. 13, 2022	May 09, 2023	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	SCHWARZBECK	VTSD 9561-F N	9561-F-N00412	N/A	Jul. 05, 2022	Jul. 13, 2022	Jul. 04, 2023	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	7GHz	May 31, 2022	Jul. 13, 2022	May 30, 2023	Conduction (CO01-CA)
Software	R&S	EMC32	N/A	Version 10.30.00	N/A	Jul. 13, 2022	N/A	Conduction (CO01-CA)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.0 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.70 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.20 dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.40 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Liliana Gonzalez	Temperature:	23.4~24	°C
Test Date:	2022/8/5	Relative Humidity:	48~49	%

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)	6dB BW (MHz)	6dB BW Limit (MHz)	Pass/Fail
BLE	1Mbps	1	0	2402	1.059	0.740	0.50	Pass
BLE	1Mbps	1	19	2440	1.055	0.726	0.50	Pass
BLE	1Mbps	1	39	2480	1.071	0.756	0.50	Pass

TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	1Mbps	1	0	2402	5.64	30.00	0.00	5.64	36.00	Pass
BLE	1Mbps	1	19	2440	6.09	30.00	0.00	6.09	36.00	Pass
BLE	1Mbps	1	39	2480	6.35	30.00	0.00	6.35	36.00	Pass

TEST RESULTS DATA
Peak Power Density

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm /100kHz)	Peak PSD (dBm /3kHz)	DG (dBi)	Peak PSD Limit (dBm /3kHz)	Pass/Fail
BLE	1Mbps	1	0	2402	4.25	-7.93	0.00	8.00	Pass
BLE	1Mbps	1	19	2440	4.66	-8.06	0.00	8.00	Pass
BLE	1Mbps	1	39	2480	4.51	-8.79	0.00	8.00	Pass

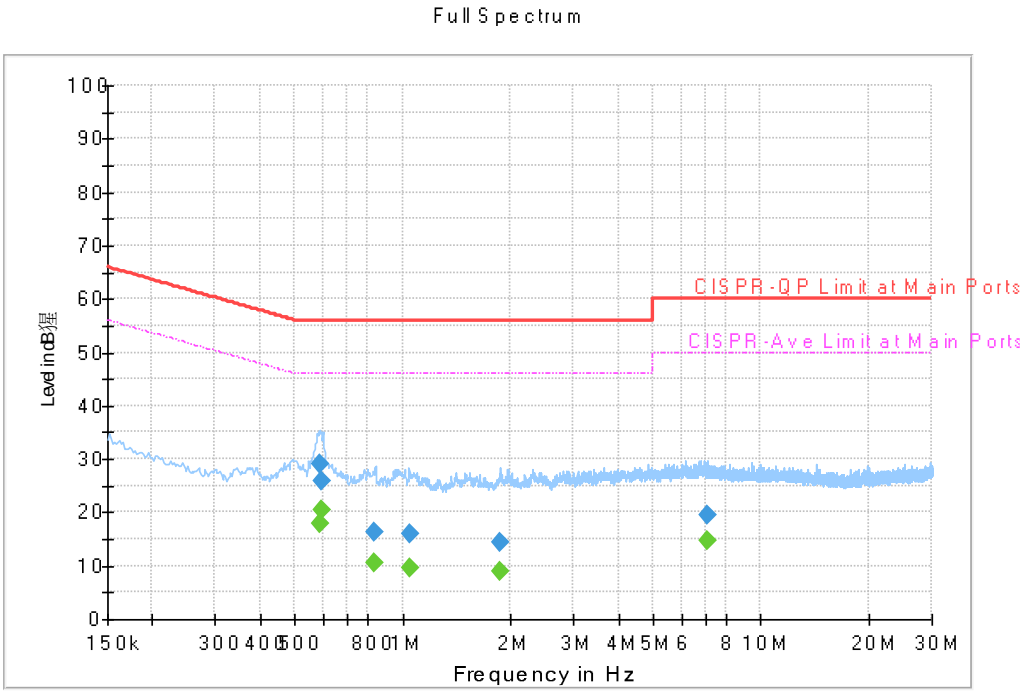
Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Yuan Lee	**Temperature :**	21~23℃
		Relative Humidity :	42~45%

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Mode:	1

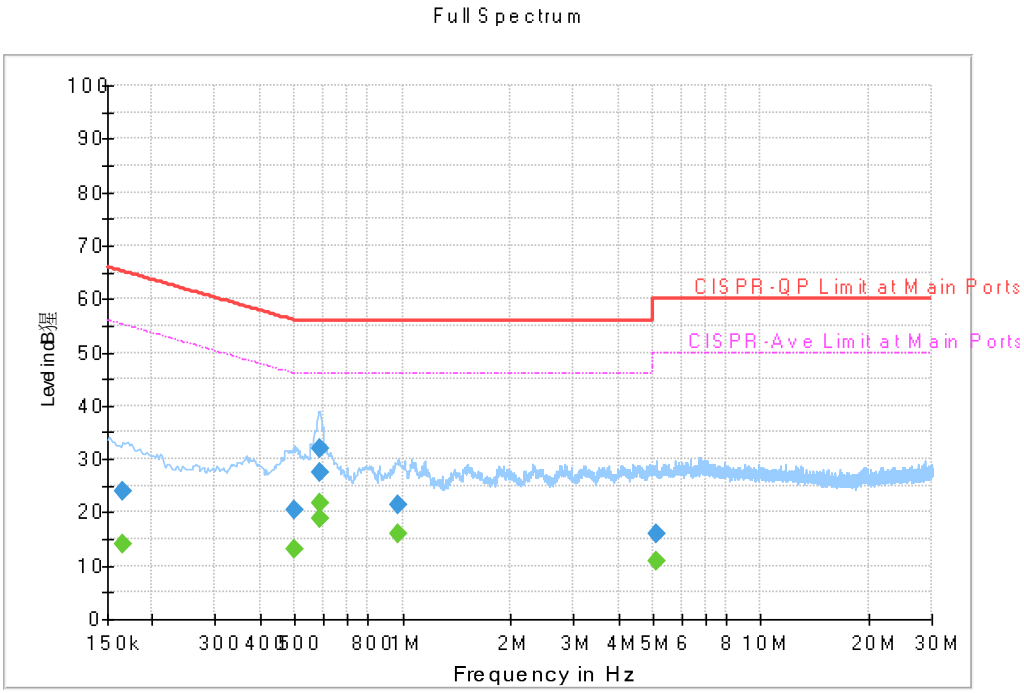


Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.585636	---	17.82	46.00	28.18	L1	OFF	20.3
0.585636	28.94	---	56.00	27.06	L1	OFF	20.3
0.594492	---	20.32	46.00	25.68	L1	OFF	20.3
0.594492	25.96	---	56.00	30.04	L1	OFF	20.3
0.834774	---	10.66	46.00	35.34	L1	OFF	20.3
0.834774	16.23	---	56.00	39.77	L1	OFF	20.3
1.044492	---	9.60	46.00	36.40	L1	OFF	20.3
1.044492	15.93	---	56.00	40.07	L1	OFF	20.3
1.871520	---	9.01	46.00	36.99	L1	OFF	20.3
1.871520	14.43	---	56.00	41.57	L1	OFF	20.3
7.066257	---	14.79	50.00	35.21	L1	OFF	20.4
7.066257	19.59	---	60.00	40.41	L1	OFF	20.4

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Mode:	1



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.165174	---	14.09	55.20	41.11	N	OFF	20.3
0.165174	23.95	---	65.20	41.25	N	OFF	20.3
0.498165	---	13.01	46.03	33.02	N	OFF	20.3
0.498165	20.34	---	56.03	35.69	N	OFF	20.3
0.585141	---	21.70	46.00	24.30	N	OFF	20.3
0.585141	31.93	---	56.00	24.07	N	OFF	20.3
0.587328	---	18.80	46.00	27.20	N	OFF	20.3
0.587328	27.44	---	56.00	28.56	N	OFF	20.3
0.969819	---	15.90	46.00	30.10	N	OFF	20.3
0.969819	21.26	---	56.00	34.74	N	OFF	20.3
5.102430	---	11.00	50.00	39.00	N	OFF	20.4
5.102430	16.07	---	60.00	43.93	N	OFF	20.4

Appendix C. Radiated Spurious Emission

Test Engineer :	Fu Chen	Temperature :	20~25°C
		Relative Humidity :	42~50%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

BLE	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		2325.54	56.17	-17.83	74	42.49	27.9	17.31	31.53	114	127	P	H
		2369.955	49.03	-4.97	54	35.43	27.73	17.39	31.52	114	127	A	H
	*	2402	104.31	-	-	90.7	27.66	17.44	31.49	114	127	P	H
	*	2402	104.09	-	-	90.48	27.66	17.44	31.49	114	127	A	H
													H
													H
		2369.745	55.69	-18.31	74	41.97	27.85	17.39	31.52	368	87	P	V
		2369.85	47.56	-6.44	54	33.84	27.85	17.39	31.52	368	87	A	V
	*	2402	102.93	-	-	89.24	27.74	17.44	31.49	368	87	P	V
	*	2402	102.61	-	-	88.92	27.74	17.44	31.49	368	87	A	V
													V
													V
BLE CH 19 2440MHz		2376.4	54.63	-19.37	74	41.04	27.71	17.4	31.52	111	126	P	H
		2376.24	47.48	-6.52	54	33.89	27.71	17.4	31.52	111	126	A	H
	*	2440	105.5	-	-	91.81	27.66	17.5	31.47	111	126	P	H
	*	2440	105.29	-	-	91.6	27.66	17.5	31.47	111	126	A	H
		2484.32	55.82	-18.18	74	42.08	27.62	17.58	31.46	111	126	P	H
		2487.28	45.87	-8.13	54	32.12	27.62	17.59	31.46	111	126	A	H
		2347.92	55.54	-18.46	74	41.81	27.91	17.34	31.52	400	89	P	V
		2375.76	46.48	-7.52	54	32.77	27.83	17.4	31.52	400	89	A	V
	*	2440	103.05	-	-	89.43	27.59	17.5	31.47	400	89	P	V
	*	2440	102.8	-	-	89.18	27.59	17.5	31.47	400	89	A	V
		2495.44	54.95	-19.05	74	41.31	27.49	17.6	31.45	400	89	P	V
		2498.32	45.69	-8.31	54	32.04	27.49	17.61	31.45	400	89	A	V

BLE CH 39 2480MHz	*	2480	105.33	-	-	91.58	27.63	17.58	31.46	107	122	P	H
	*	2480	105.04	-	-	91.29	27.63	17.58	31.46	107	122	A	H
		2483.6	56.54	-17.46	74	42.8	27.62	17.58	31.46	107	122	P	H
		2483.52	47.6	-6.4	54	33.86	27.62	17.58	31.46	107	122	A	H
													H
													H
	*	2480	103.68	-	-	90.05	27.51	17.58	31.46	393	91	P	V
	*	2480	103.35	-	-	89.72	27.51	17.58	31.46	393	91	A	V
		2483.88	56.63	-17.37	74	43	27.51	17.58	31.46	393	91	P	V
		2483.6	47.46	-6.54	54	33.83	27.51	17.58	31.46	393	91	A	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

BLE	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 00 2402MHz		4804	55.42	-18.58	74	80.22	31.51	11.57	67.88	301	336	P	H
		4804	52.75	-1.25	54	77.55	31.51	11.57	67.88	301	336	A	H
		7206	53.89	-20.11	74	69.7	36.17	13.97	65.95	121	73	P	H
		9608	51.47	-22.53	74	66.25	38.32	15.94	69.04	282	137	P	H
		11250	50.1	-23.9	74	61.11	39.72	17.6	68.33	-	-	P	H
		11250	39.21	-14.79	54	50.22	39.72	17.6	68.33	-	-	A	H
		12010	54.9	-19.1	74	65.07	39.17	18.36	67.7	231	209	P	H
		12010	48.21	-5.79	54	58.38	39.17	18.36	67.7	231	209	A	H
		14490	51.25	-22.75	74	57.1	41.94	20.19	67.98	-	-	P	H
		14490	43.07	-10.93	54	48.92	41.94	20.19	67.98	-	-	A	H
		18000	58.18	-15.82	74	57.16	48.82	21.92	69.72	-	-	P	H
		18000	50.46	-3.54	54	49.44	48.82	21.92	69.72	-	-	A	H
		4804	52.8	-21.2	74	77.57	31.54	11.57	67.88	366	100	P	V
		4804	49.85	-4.15	54	74.62	31.54	11.57	67.88	366	100	A	V
		7206	53.57	-20.43	74	69.38	36.17	13.97	65.95	267	100	P	V
		9608	55.2	-18.8	74	70.04	38.26	15.94	69.04	362	267	P	V
		10950	50.06	-23.94	74	61.02	40.13	17.31	68.4	-	-	P	V
		10950	38.19	-15.81	54	49.15	40.13	17.31	68.4	-	-	A	V
		12010	53.4	-20.6	74	63.59	39.15	18.36	67.7	225	283	P	V
		12010	45.16	-8.84	54	55.35	39.15	18.36	67.7	225	283	A	V
		14490	50.99	-23.01	74	56.84	41.94	20.19	67.98	-	-	P	V
		14490	43.14	-10.86	54	48.99	41.94	20.19	67.98	-	-	A	V
		18000	58.17	-15.83	74	56.93	49.04	21.92	69.72	-	-	P	V
		18000	50.8	-3.2	54	49.56	49.04	21.92	69.72	-	-	A	V

BLE	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 19 2440MHz		4880	54.57	-19.43	74	79.47	31.45	11.57	67.92	100	172	P	H
		4880	51.96	-2.04	54	76.86	31.45	11.57	67.92	100	172	A	H
		7320	54.07	-19.93	74	70.71	36.33	14.1	67.07	109	73	P	H
		7320	49.59	-4.41	54	66.23	36.33	14.1	67.07	109	73	A	H
		9760	53.82	-20.18	74	68.1	38.79	16.14	69.21	252	185	P	H
		11100	49.85	-24.15	74	60.6	39.92	17.45	68.12	-	-	P	H
		11100	38.48	-15.52	54	49.23	39.92	17.45	68.12	-	-	A	H
		12200	54.75	-19.25	74	64.02	39.26	18.51	67.04	222	210	P	H
		12200	48.28	-5.72	54	57.55	39.26	18.51	67.04	222	210	A	H
		14490	50.48	-23.52	74	56.33	41.94	20.19	67.98	-	-	P	H
		14490	43.03	-10.97	54	48.88	41.94	20.19	67.98	-	-	A	H
		18000	58.97	-15.03	74	57.95	48.82	21.92	69.72	-	-	P	H
		18000	50.68	-3.32	54	49.66	48.82	21.92	69.72	-	-	A	H
		4880	52.24	-21.76	74	77.21	31.38	11.57	67.92	400	216	P	V
		4880	49.05	-4.95	54	74.02	31.38	11.57	67.92	400	216	A	V
		7320	53.85	-20.15	74	70.42	36.4	14.1	67.07	253	102	P	V
		7320	48.79	-5.21	54	65.36	36.4	14.1	67.07	253	102	A	V
		9760	54.17	-19.83	74	68.42	38.82	16.14	69.21	215	97	P	V
		11355	49.53	-24.47	74	60.18	39.84	17.71	68.2	-	-	P	V
		11355	38.51	-15.49	54	49.16	39.84	17.71	68.2	-	-	A	V
		12200	54.28	-19.72	74	63.54	39.27	18.51	67.04	380	275	P	V
		12200	46.77	-7.23	54	56.03	39.27	18.51	67.04	380	275	A	V
		14490	51.28	-22.72	74	57.13	41.94	20.19	67.98	-	-	P	V
		14490	43.17	-10.83	54	49.02	41.94	20.19	67.98	-	-	A	V
		18000	58.23	-15.77	74	56.99	49.04	21.92	69.72	-	-	P	V
		18000	50.58	-3.42	54	49.34	49.04	21.92	69.72	-	-	A	V

BLE	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BLE CH 39 2480MHz		4960	53.36	-20.64	74	78.33	31.51	11.58	68.06	282	313	P	H
		4960	50.58	-3.42	54	75.55	31.51	11.58	68.06	282	313	A	H
		7440	54.59	-19.41	74	71.13	36.49	14.2	67.23	117	71	P	H
		7440	50.18	-3.82	54	66.72	36.49	14.2	67.23	117	71	A	H
		9920	53.01	-20.99	74	67.04	38.88	16.29	69.2	248	228	P	H
		11565	49.76	-24.24	74	59.43	40.04	17.92	67.63	-	-	P	H
		11565	39.56	-14.44	54	49.23	40.04	17.92	67.63	-	-	A	H
		12400	54.82	-19.18	74	65.11	38.56	18.68	67.53	224	329	P	H
		12400	48.5	-5.5	54	58.79	38.56	18.68	67.53	224	329	A	H
		14490	50.67	-23.33	74	56.52	41.94	20.19	67.98	-	-	P	H
		14490	42.96	-11.04	54	48.81	41.94	20.19	67.98	-	-	A	H
		18000	58.91	-15.09	74	57.89	48.82	21.92	69.72	-	-	P	H
		18000	50.45	-3.55	54	49.43	48.82	21.92	69.72	-	-	A	H
		4960	48.86	-25.14	74	73.88	31.46	11.58	68.06	400	323	P	V
		4960	44.67	-9.33	54	69.69	31.46	11.58	68.06	400	323	A	V
		7440	54.5	-19.5	74	71.06	36.47	14.2	67.23	260	103	P	V
		7440	49.64	-4.36	54	66.2	36.47	14.2	67.23	260	103	A	V
		9920	52.36	-21.64	74	66.39	38.88	16.29	69.2	218	97	P	V
		11430	49.6	-24.4	74	59.76	40.01	17.78	67.95	-	-	P	V
		11430	38.86	-15.14	54	49.02	40.01	17.78	67.95	-	-	A	V
		12400	53.34	-20.66	74	63.57	38.62	18.68	67.53	344	253	P	V
		12400	46.05	-7.95	54	56.28	38.62	18.68	67.53	344	253	A	V
		14490	50.92	-23.08	74	56.77	41.94	20.19	67.98	-	-	P	V
		14490	42.97	-11.03	54	48.82	41.94	20.19	67.98	-	-	A	V
		17985	59.3	-14.7	74	58.59	48.7	21.91	69.9	-	-	P	V
		17985	50.01	-3.99	54	49.3	48.7	21.91	69.9	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or noise floor only. 4. The emission level close to 18GHz is checked that the average emission level is noise floor only.												

Emission above 18GHz

2.4GHz BLE (SHF)

BT	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz BLE SHF		23082	38.39	-35.61	74	36.79	38.87	14.65	51.92	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		23103	38.51	-35.49	74	36.96	38.81	14.66	51.92	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found and emission level has at least 6dB margin against limit or noise floor only.

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz BLE LF		74.62	13.51	-26.49	40	31.23	13.16	1.54	32.42	-	-	P	H
		123.12	16.45	-27.05	43.5	29.57	17.5	1.79	32.41	-	-	P	H
		261.83	20.18	-25.82	46	29.75	20.2	2.64	32.41	-	-	P	H
		634.31	27.78	-18.22	46	29.91	26.37	4.11	32.61	-	-	P	H
		753.62	33.44	-12.56	46	33.04	28.17	4.63	32.4	-	-	P	H
		957.32	33.99	-12.01	46	28.57	31.45	5.12	31.15	-	-	P	H
													H
													H
													H
													H
													H
													H
		74.62	14.12	-25.88	40	31.84	13.16	1.54	32.42	-	-	P	V
		137.67	16.23	-27.27	43.5	29.12	17.6	1.92	32.41	-	-	P	V
		254.07	20.42	-25.58	46	31.05	19.17	2.61	32.41	-	-	P	V
		600.36	27.29	-18.71	46	29.95	26	3.97	32.63	-	-	P	V
		747.8	34.08	-11.92	46	33.77	28.1	4.62	32.41	-	-	P	V
		955.38	34.26	-11.74	46	28.93	31.41	5.1	31.18	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found and emission level has at least 6dB margin against limit or noise floor only.

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

BLE	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BLE CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Radiated Spurious Emission Plots

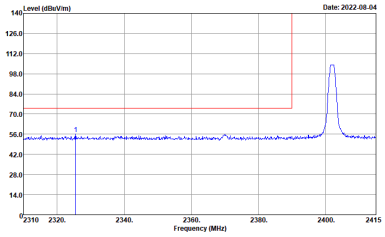
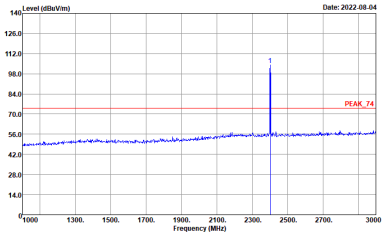
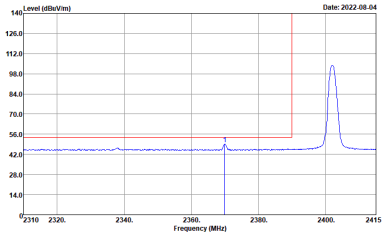
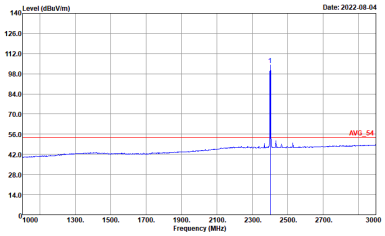
Test Engineer :	Fu Chen	**Temperature :**	20~25°C
		Relative Humidity :	42~50%

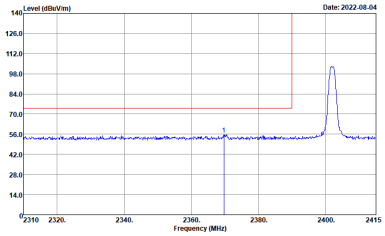
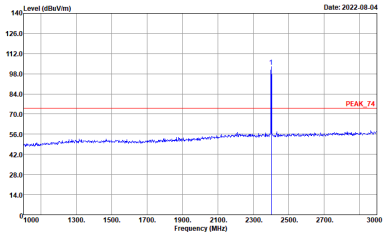
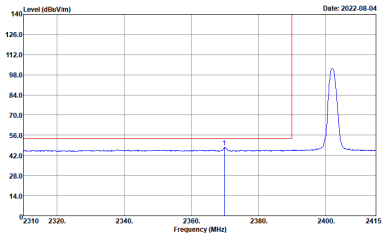
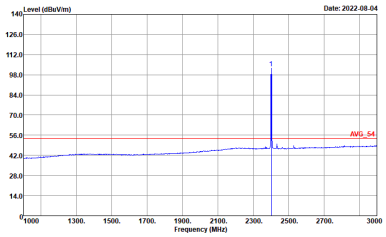
Note symbol

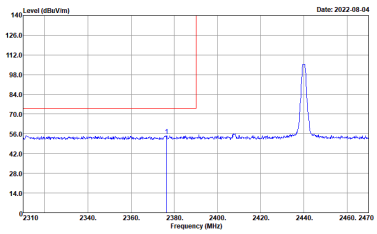
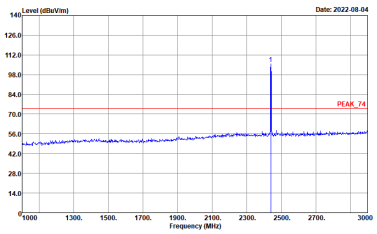
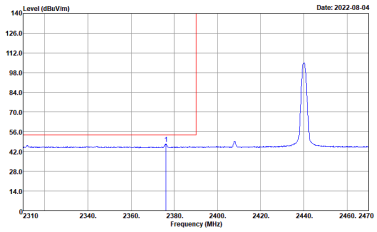
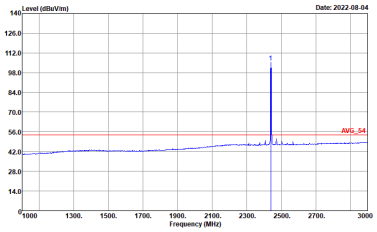
-L	**Low channel location**
-R	**High channel location**

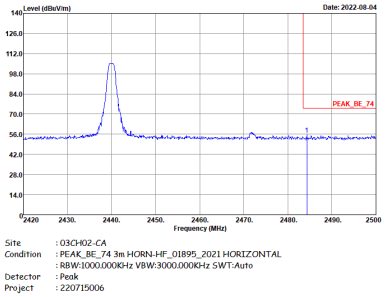
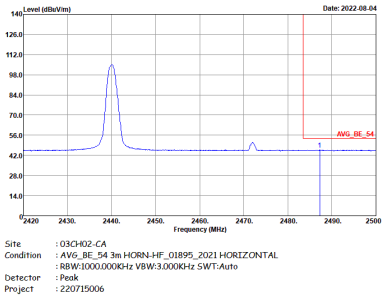
2.4GHz 2400~2483.5MHz

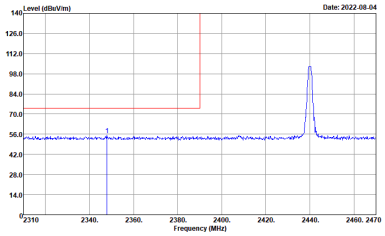
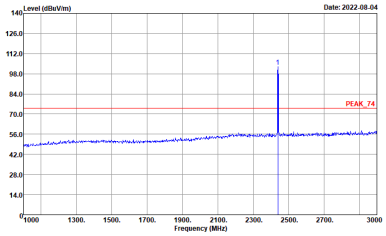
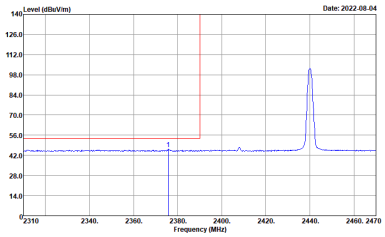
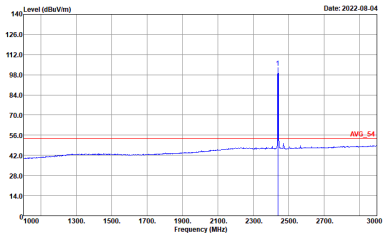
BLE (Band Edge @ 3m)

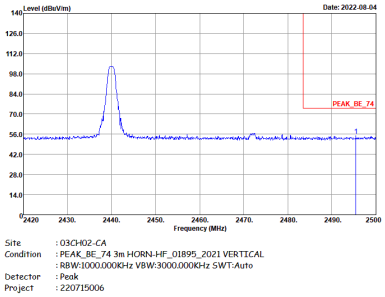
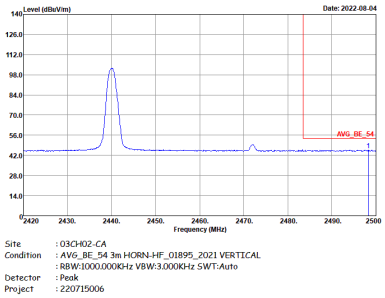
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Fundamental
Peak		
Avg.		

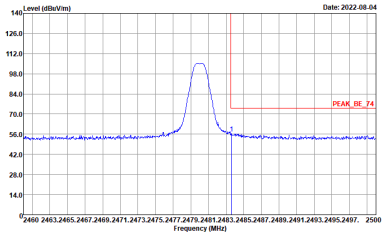
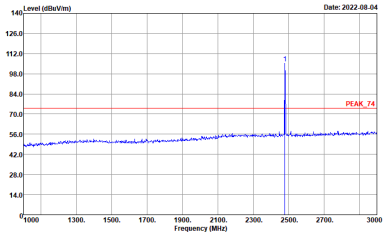
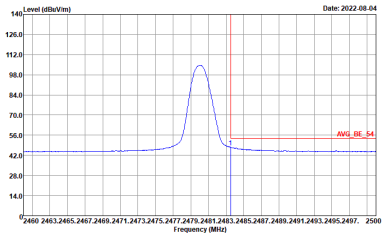
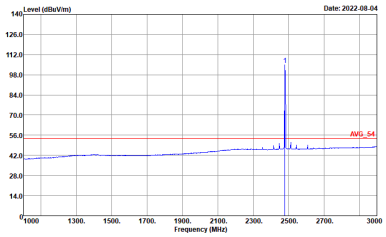
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006
Avg	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006

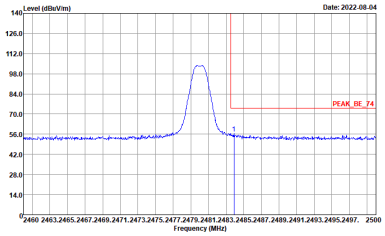
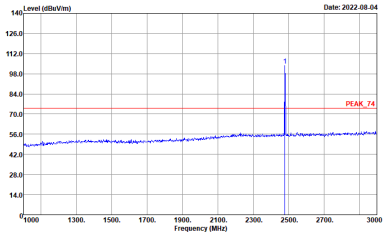
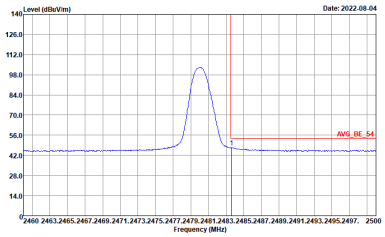
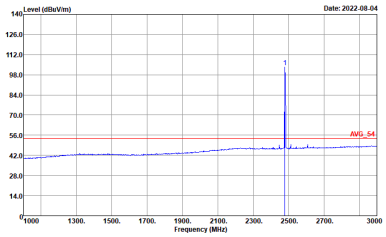
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	Left blank
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006	Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006

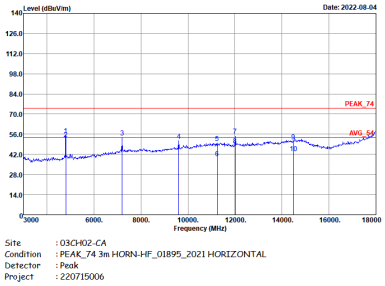
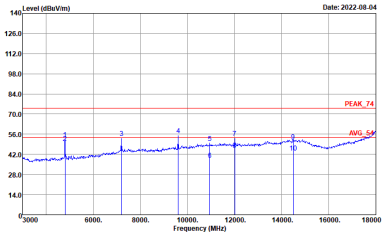
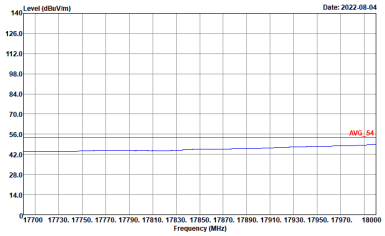
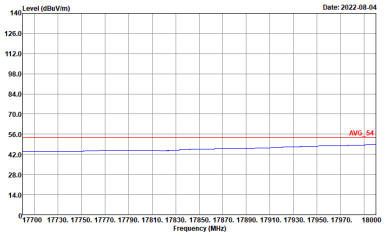
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	Left blank
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006	Left blank

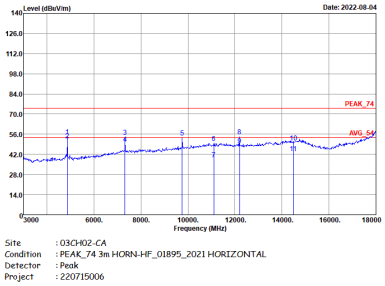
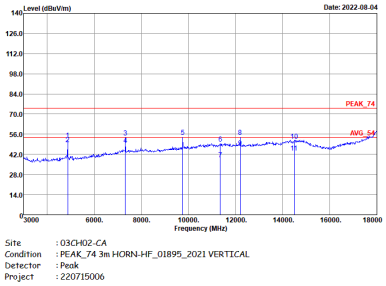
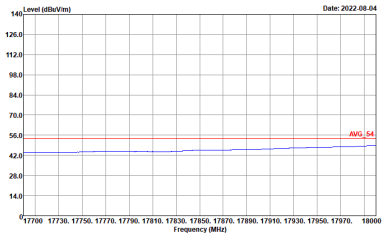
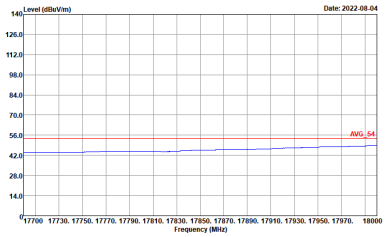
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:1.000KHz SWT:Auto Detector : Peak Project : 220715006

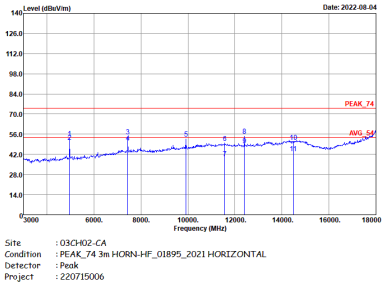
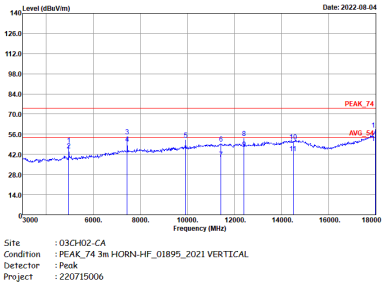
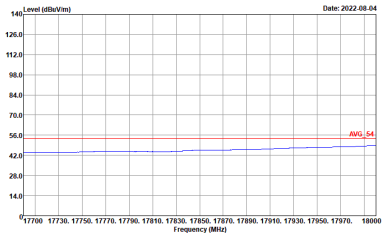
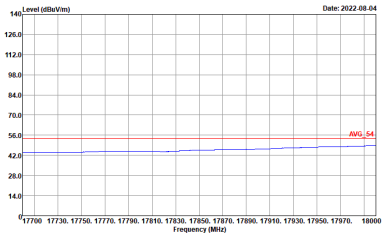
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_BE_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Detector : Peak Project : 220715006

2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

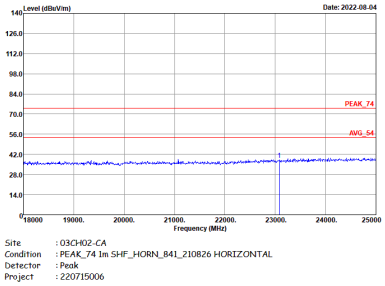
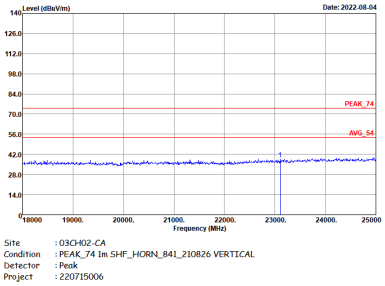
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL Detector : Peak Project : 220715006

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL Detector : Peak Project : 220715006

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 VERTICAL Detector : Peak Project : 220715006
Avg.	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 HORIZONTAL Detector : Peak Project : 220715006	 Site : 03CH02-CA Condition : AVG_54 3m HORN-HF_01895_2021 VERTICAL Detector : Peak Project : 220715006

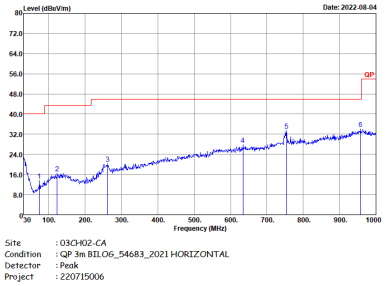
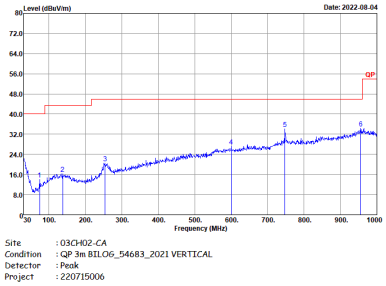
Emission above 18GHz

2.4GHz BLE (SHF @ 1m)

BLE	2.4GHz 2400~2483.5MHz	
	BLE SHF	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

2.4GHz BLE (LF)

BLE	2.4GHz 2400~2483.5MHz	
	BLE LF	
	Horizontal	Vertical
QP / Peak		

Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth –LE	2.10	350	2.86	3kHz

Bluetooth – LE