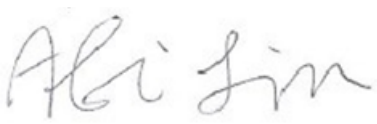
FCC RADIO TEST REPORT

FCC ID	:	**S9GR770**
Equipment	:	**R770 Access Point**
Brand Name	:	**RUCKUS**
Model Name	:	**R770**
Marketing Name	:	**Ruckus R770**
Applicant	:	**Ruckus Wireless, Inc. 350 W. Java Dr., Sunnyvale CA 94089 USA**
Manufacturer	:	**Ruckus Wireless, Inc. 350 W. Java Dr., Sunnyvale CA 94089 USA**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Aug. 17, 2023 and testing was performed from Aug. 21, 2023 to Sep. 27, 2023. 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.



Approved by: Abi Lin

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
FR230524001A	01	Initial issue of report	Nov. 08, 2023

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) 15.247(b)(4)	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	0.39 dB under the limit at 2483.52 MHz
3.6	15.207	AC Conducted Emission	Pass	0.19 dB under the limit at 0.47 MHz
3.7	15.203	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. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs Bluetooth-LE, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax/be, Wi-Fi 5GHz 802.11a/n/ac/ax/be, Wi-Fi 6GHz 802.11a/n/ac/ax/be, ZigBee, and GPS. **Antenna Type** **WLAN:** <Ant. A>: Omni-Directional Antenna <Ant. B>: Omni-Directional Antenna <Ant. C>: Omni-Directional Antenna <Ant. D>: Omni-Directional Antenna <Ant. E>: Omni-Directional Antenna <Ant. F>: Omni-Directional Antenna **Bluetooth-LE / ZigBee:** Omni-Directional Antenna **GPS:** Omni-Directional Antenna

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	1.8

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer 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, 03CH01-CA

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: US1250

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 15.247 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. The TAF code is not including all the FCC KDB listed without accreditation.

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

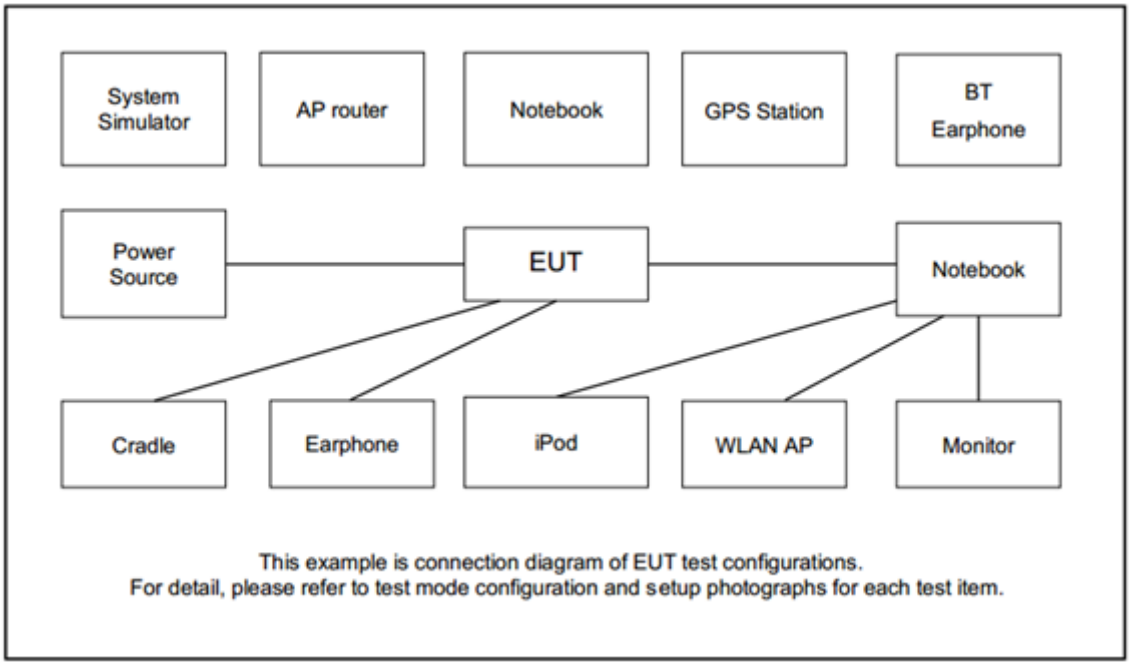
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental 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 only the worst case emissions were reported in this report.

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 CH01_2404 MHz_1Mbps
	Mode 3: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 4: Bluetooth Tx CH38_2478 MHz_1Mbps
	Mode 5: Bluetooth Tx CH39_2480 MHz_1Mbps
Radiated Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps
	Mode 2: Bluetooth Tx CH01_2404 MHz_1Mbps
	Mode 3: Bluetooth Tx CH19_2440 MHz_1Mbps
	Mode 4: Bluetooth Tx CH38_2478 MHz_1Mbps
	Mode 5: Bluetooth Tx CH39_2480 MHz_1Mbps
AC Conducted Emission	Mode 1: WLAN (2.4GHz) Link + WLAN (5GHz) Link + ZigBee Tx + Lan 1 + Lan 2 + PoE Adapter
	Mode 2: WLAN (2.4GHz) Link + WLAN (5GHz) Link + ZigBee Tx + Lan 1 + Lan 2 + AC Adapter
	Mode 3: Bluetooth-LE Tx + Lan 1 + Lan 2 + PoE Adapter
	Mode 4: WLAN (6GHz) Tx + Lan 1 + Lan 2 + PoE Adapter
Remark: 1. The worst case of Conducted Emission is mode 4; only the test data of it was reported. 2. For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.	

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.	PoE Adapter	Ruckus	740-64310-001	NA	N/A	Unshielded, 1.8 m
2.	Laptop	Dell	Latitude E7470	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Laptop	Lenovo	TP00116F	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Adapter	Ruckus	740-64277-001	NA	NA	Unshielded, 1.0m

2.5 EUT Operation Test Setup

The RF test items, utility “Putty (Release 0.62)” 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.

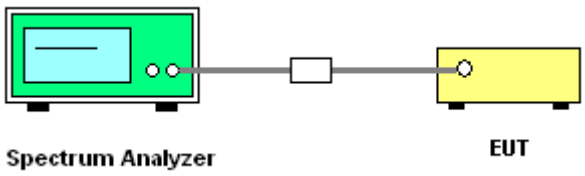
3.1.2 Measuring Instruments

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.

3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

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.

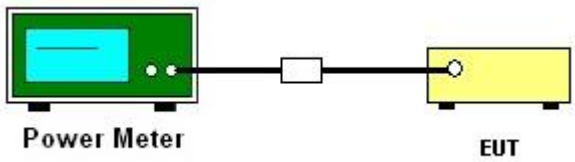
3.2.2 Measuring Instruments

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.

3.4 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 30 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

Please refer to Appendix A.

3.4.6 Test Result of Conducted Spurious Emission Plots

Please refer to Appendix A.

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

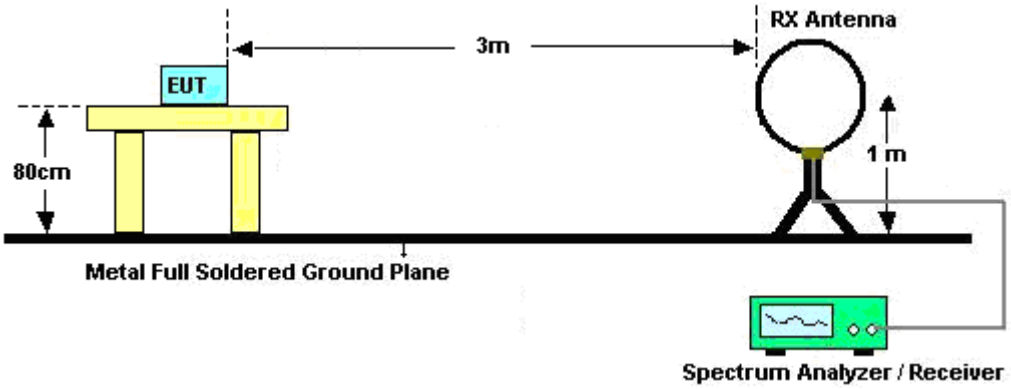
Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

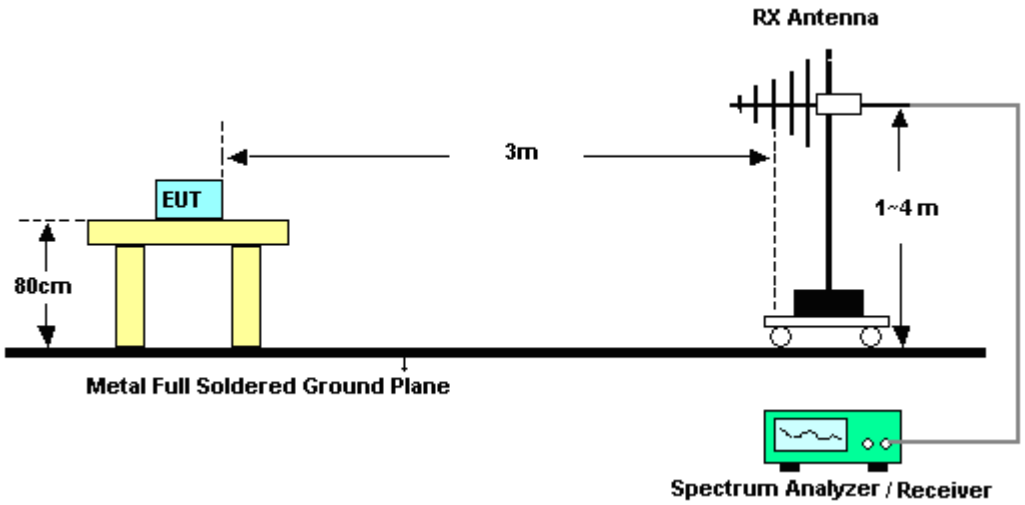
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the 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

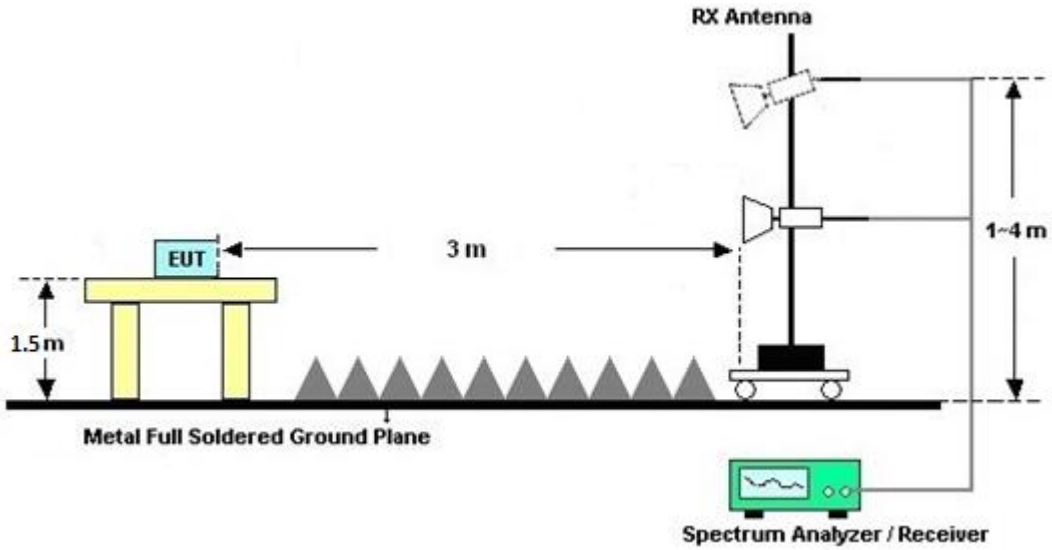
For radiated test below 30MHz



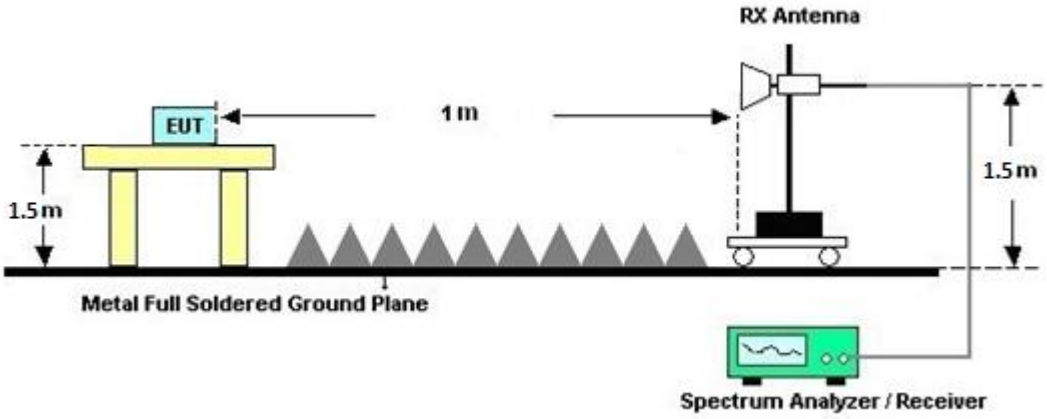
For radiated test from 30MHz to 1GHz



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.

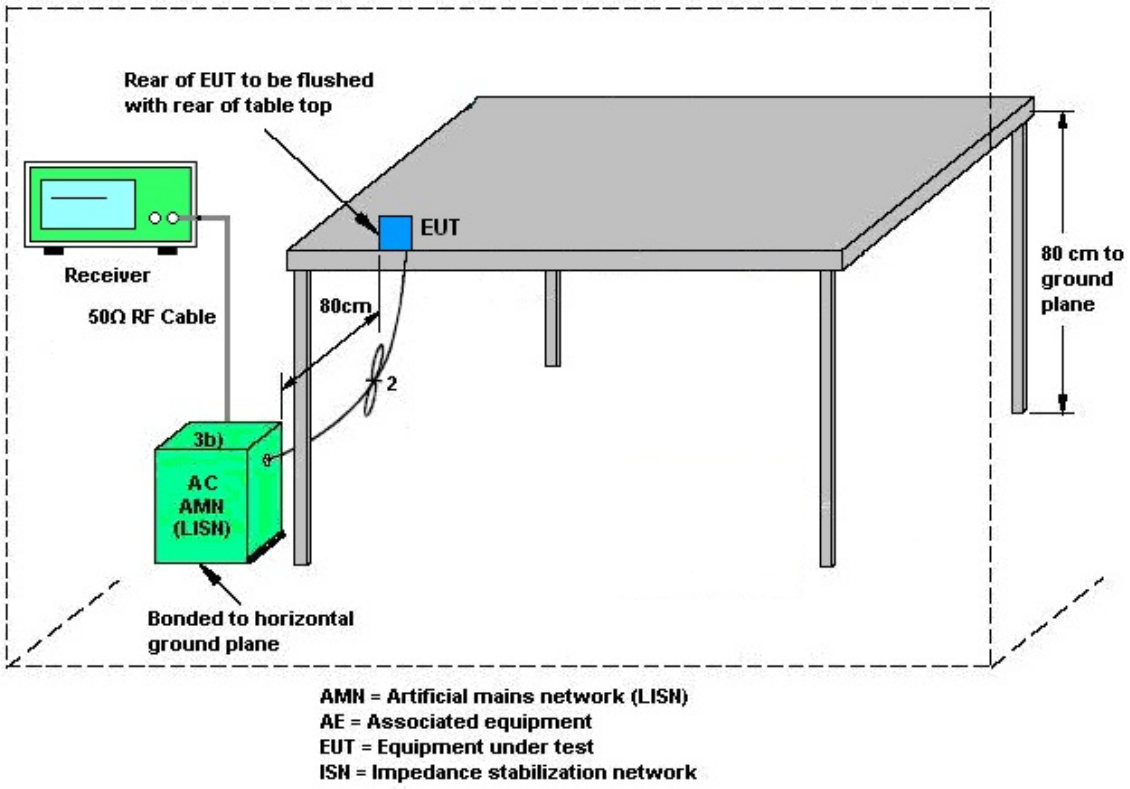
3.6.2 Measuring Instruments

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



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	R&S	HFH2-Z2E	100840	9kHz~30MHz	Jun. 29, 2023	Aug. 21, 2023~ Aug. 28, 2023	Jun. 28, 2024	Radiation (03CH01-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Nov. 01, 2022	Aug. 21, 2023~ Aug. 28, 2023	Oct. 31, 2023	Radiation (03CH01-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02113	1GHz~18GHz	Jun. 27, 2023	Aug. 21, 2023~ Aug. 28, 2023	Jun. 26, 2024	Radiation (03CH01-CA)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00842	18GHz~40GHz	Jul. 17, 2023	Aug. 21, 2023~ Aug. 28, 2023	Jul. 16, 2024	Radiation (03CH01-CA)
Preamplifier	EMEC	EMC18G40G	060725	NA	May 04, 2023	Aug. 21, 2023~ Aug. 28, 2023	May 03, 2024	Radiation (03CH01-CA)
Preamplifier	SONOMA	310N	372240	9kHz~1GHz	May 03, 2023	Aug. 21, 2023~ Aug. 28, 2023	May 02, 2024	Radiation (03CH01-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	NA	Jun 27, 2023	Aug. 21, 2023~ Aug. 28, 2023	Jun. 26, 2024	Radiation (03CH01-CA)
Preamplifier	Keysight	83017A	MY53270321	1GHz~26.5GHz	May 04, 2023	Aug. 21, 2023~ Aug. 28, 2023	May 03, 2024	Radiation (03CH01-CA)
Spectrum Analyzer	Keysight	N9010B	MY63440343	10Hz~44GHz	Jan. 15,2023	Aug. 21, 2023~ Aug. 28, 2023	Jan. 14, 2024	Radiation (03CH01-CA)
EMI Test Receiver	R&S	ESU26	100049	20Hz~26.5GHz	May 02,2023	Aug. 21, 2023~ Aug. 28, 2023	May 01, 2024	Radiation (03CH01-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8015932/2,8015762/2, 804938/2	NA	Mar. 06, 2023	Aug. 21, 2023~ Aug. 28, 2023	Mar. 05, 2024	Radiation (03CH01-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN9	3GHz High Pass Filter	Jun. 05, 2023	Aug. 21, 2023~ Aug. 28, 2023	Jun. 04, 2024	Radiation (03CH01-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN2	1.2GHz Low Pass Filter	Jun. 05, 2023	Aug. 21, 2023~ Aug. 28, 2023	Jun. 04, 2024	Radiation (03CH01-CA
Controller	Chaintek	EM-1000	060881	Control Turn Table & Antenna Mast	N/A	Aug. 21, 2023~ Aug. 28, 2023	N/A	Radiation (03CH01-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Aug. 21, 2023~ Aug. 28, 2023	N/A	Radiation (03CH01-CA)
Test Software	Audix E3	E6.2009-8-24d	PK-002093	N/A	N/A	Aug. 21, 2023~ Aug. 28, 2023	N/A	Radiation (03CH01-CA)
Hygrometer	TESTO	608-H1	45142559	NA	Sep. 12, 2022	Aug. 21, 2023~ Aug. 28, 2023	Sep. 11, 2023	Radiation (03CH01-CA)
LISN	TESEQ	NNB51	47415	N/A	Aug. 04, 2023	Sep. 21, 2023	Aug. 03, 2024	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9kHz~7GHz	May 23, 2023	Sep. 21, 2023	May 22, 2024	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F-N00412	N/A	Jun. 05, 2023	Sep. 21, 2023	Jun. 04, 2024	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Sep. 21, 2023	N/A	Conduction (CO01-CA)
Hygrometer	Testo	608-H1	45141354	N/A	Jul. 26, 2023	Aug. 22, 2023~ Sep. 27, 2023	Jul. 25, 2024	Conducted (TH01-CA)
Power Sensor	DARE!!	RPR3008W	RPR8W-2301002	10MHz-8GHz	Feb. 08, 2023	Aug. 22, 2023~ Sep. 27, 2023	Feb. 07, 2024	Conducted (TH01-CA)
Switch Box	EM Electronics	EMSW26	1090304	N/A	Dec. 05, 2022	Aug. 22, 2023~ Sep. 27, 2023	Dec. 04, 2023	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101545	10Hz-40GHz	May 03, 2023	Aug. 22, 2023~ Sep. 27, 2023	May 02, 2024	Conducted (TH01-CA)

5 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.7 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.6 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.2 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Vincent Lam and Liliana Gonzalez	Temperature:	19.9~24.3	°C
Test Date:	2023/08/22 ~ 2023/09/27	Relative Humidity:	46.8~57.6	%

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	1.033	0.716	0.50	Pass
BLE	1Mbps	1	1	2404	1.023	0.668	0.50	Pass
BLE	1Mbps	1	19	2440	1.033	0.716	0.50	Pass
BLE	1Mbps	1	38	2478	1.023	0.666	0.50	Pass
BLE	1Mbps	1	39	2480	1.031	0.716	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	14.66	30.00	1.80	16.46	36.00	Pass
BLE	1Mbps	1	1	2404	14.66	30.00	1.80	16.46	36.00	Pass
BLE	1Mbps	1	19	2440	20.46	30.00	1.80	22.26	36.00	Pass
BLE	1Mbps	1	38	2478	17.61	30.00	1.80	19.41	36.00	Pass
BLE	1Mbps	1	39	2480	13.16	30.00	1.80	14.96	36.00	Pass

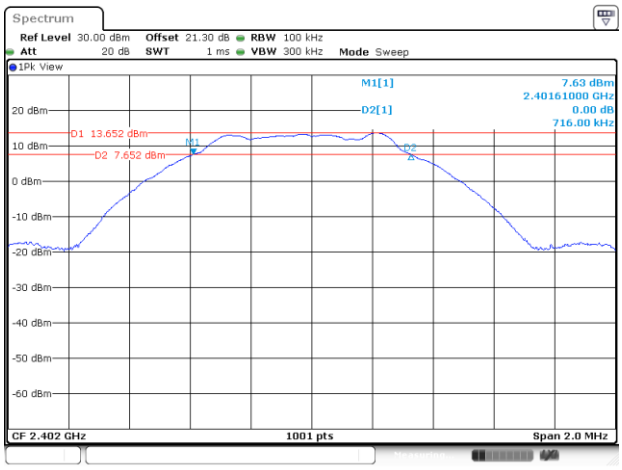
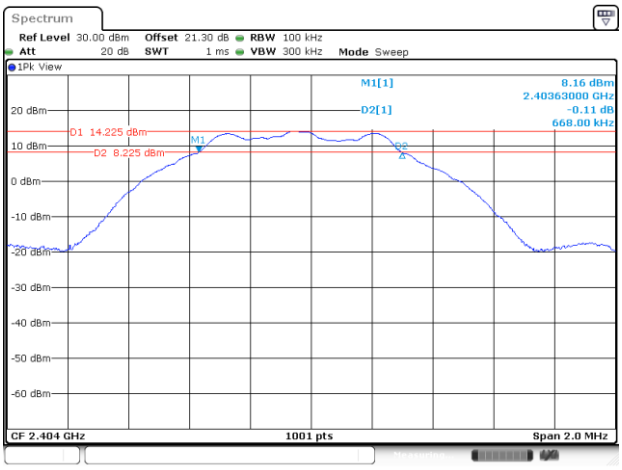
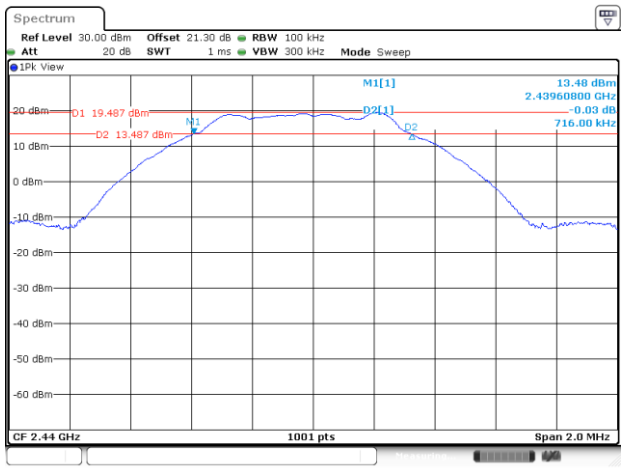
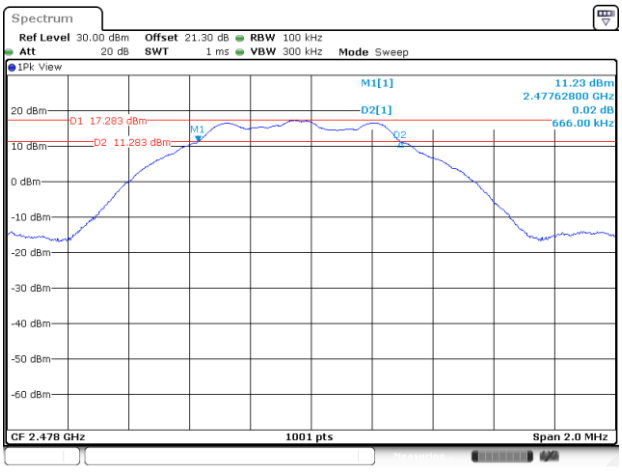
TEST RESULTS DATA
Peak Power Density

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	13.66	-2.29	1.80	8.00	Pass
BLE	1Mbps	1	1	2404	14.23	-0.31	1.80	8.00	Pass
BLE	1Mbps	1	19	2440	19.49	3.56	1.80	8.00	Pass
BLE	1Mbps	1	38	2478	17.29	2.40	1.80	8.00	Pass
BLE	1Mbps	1	39	2480	12.22	-3.72	1.80	8.00	Pass

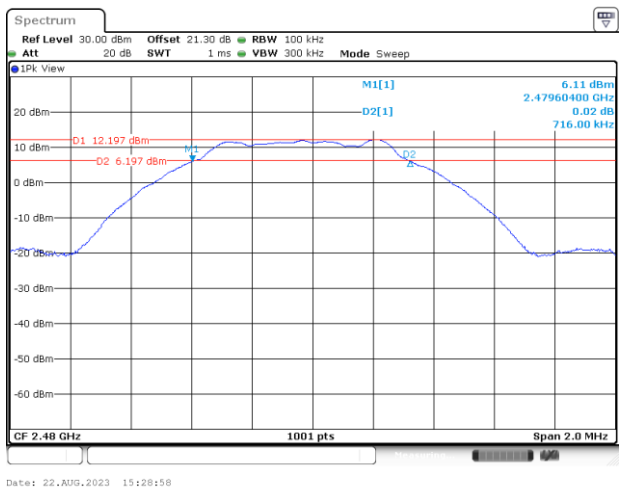
Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

6dB Bandwidth

<1Mbps>

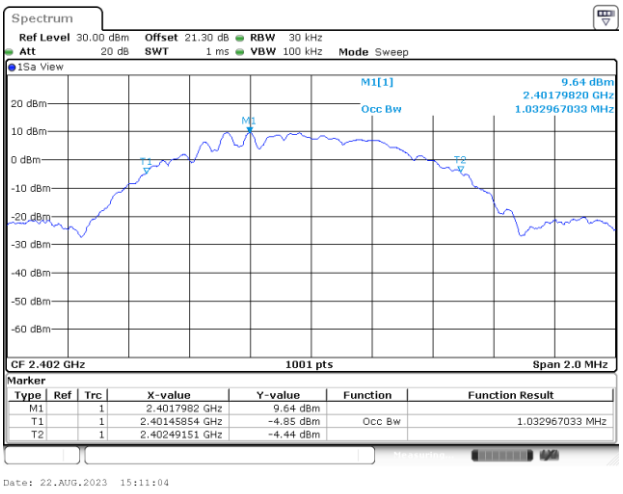
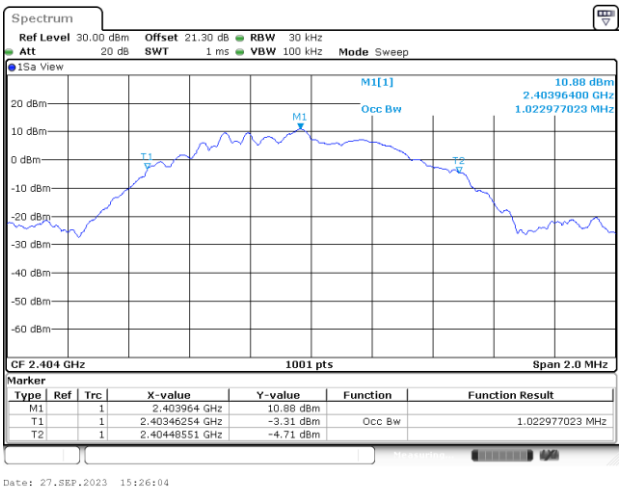
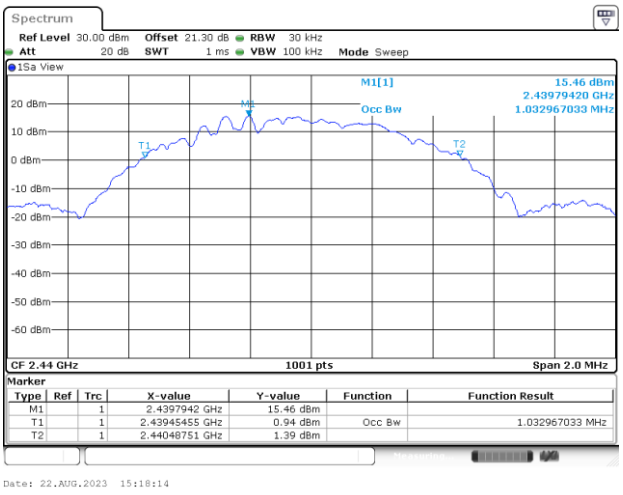
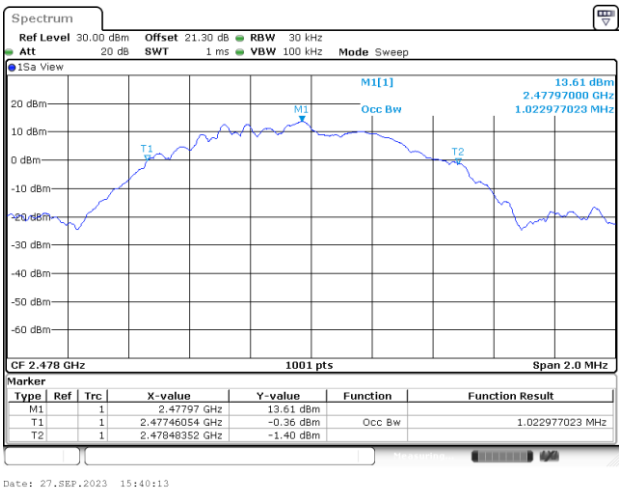
6 dB Bandwidth Plot on Channel 00	6 dB Bandwidth Plot on Channel 01
	
6 dB Bandwidth Plot on Channel 19	**6 dB Bandwidth Plot on Channel 38**
	

6 dB Bandwidth Plot on Channel 39



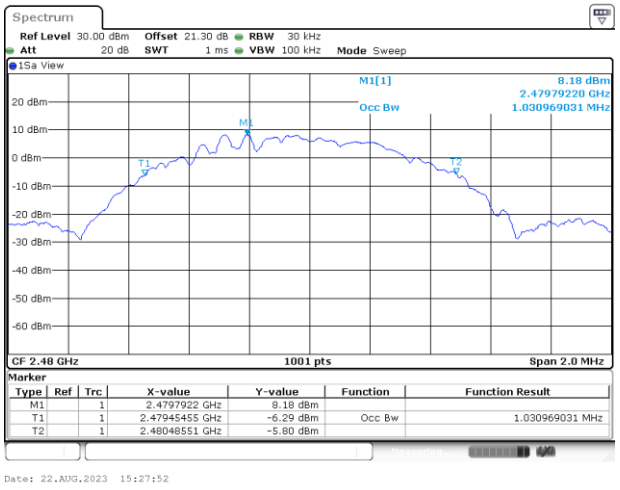
99% Occupied Bandwidth

<1Mbps>

99% Occupied Bandwidth Plot on Channel 00	99% Occupied Plot Bandwidth on Channel 01
	
99% Occupied Bandwidth Plot on Channel 19	**99% Occupied Bandwidth Plot on Channel 38**
	

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

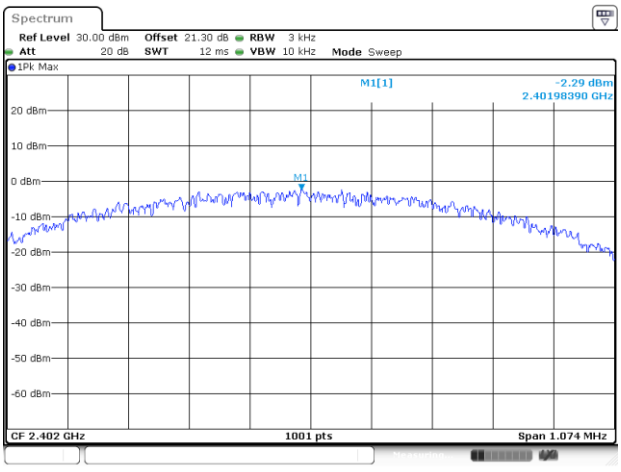
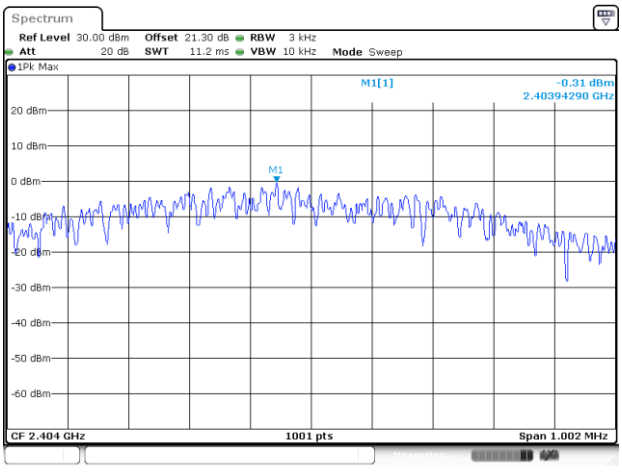
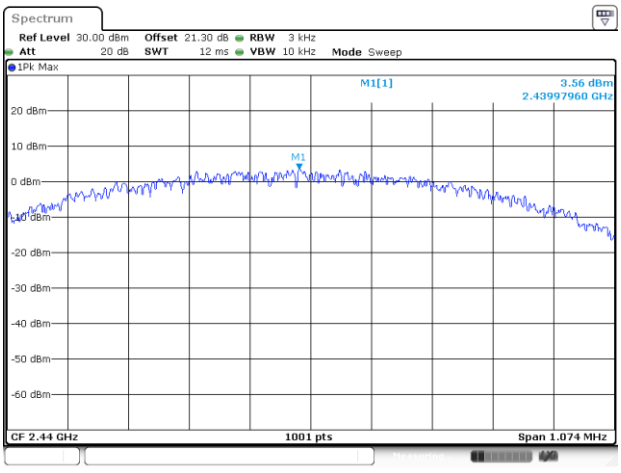
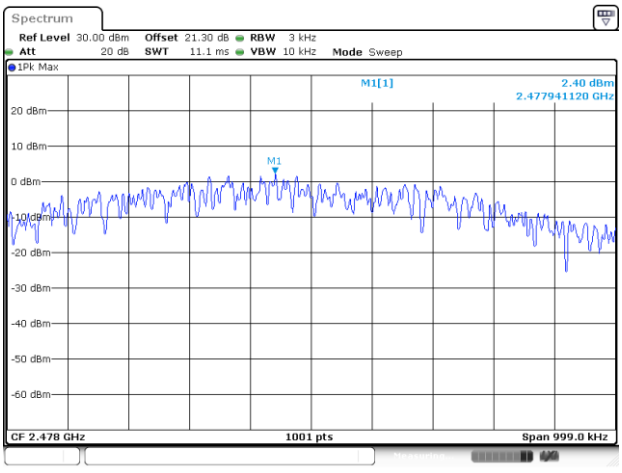
99% Occupied Bandwidth Plot on Channel 39



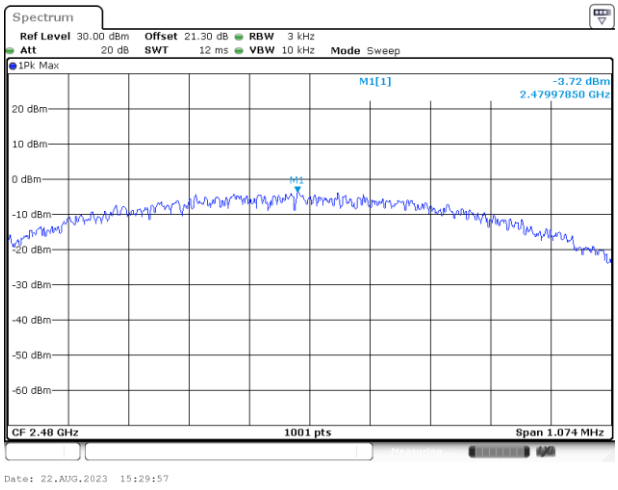
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

Power Spectral Density (dBm/3kHz)

<1Mbps>

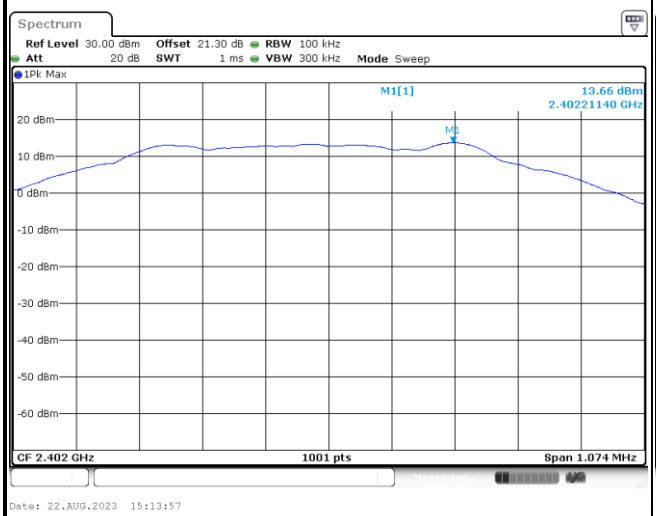
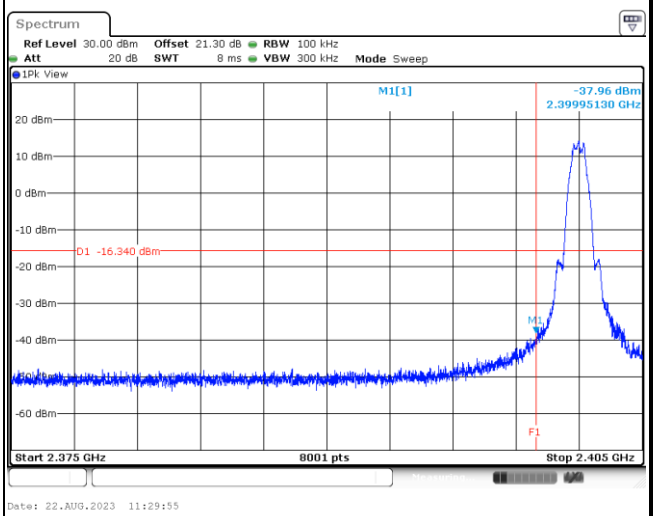
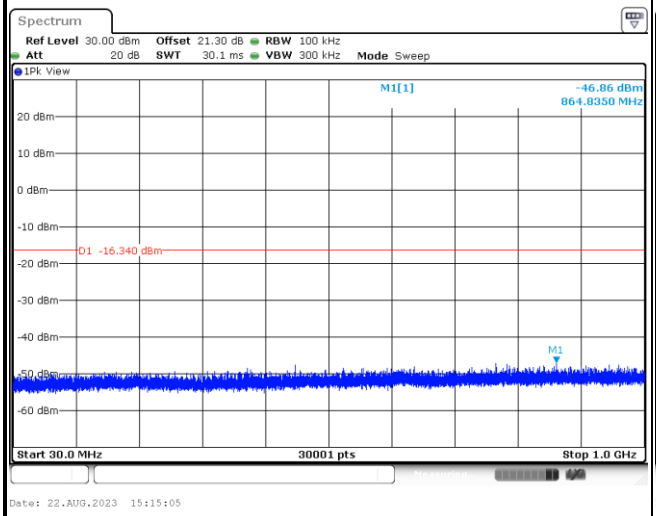
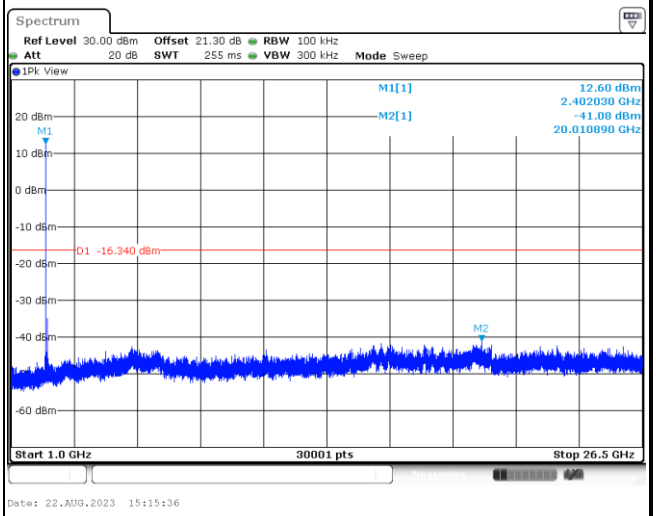
Power Density (dBm/3kHz) Plot Channel 00	Power Density (dBm/3kHz) Plot Channel 01
	
Power Density (dBm/3kHz Plot Channel 19	**Power Density (dBm/3kHz Plot Channel 38**
	

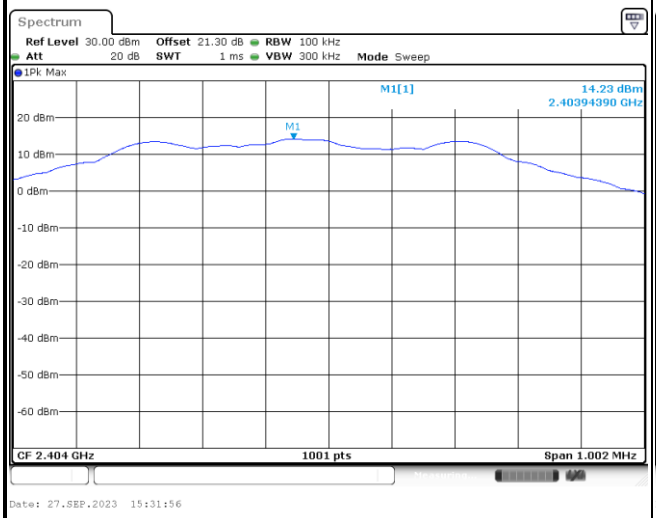
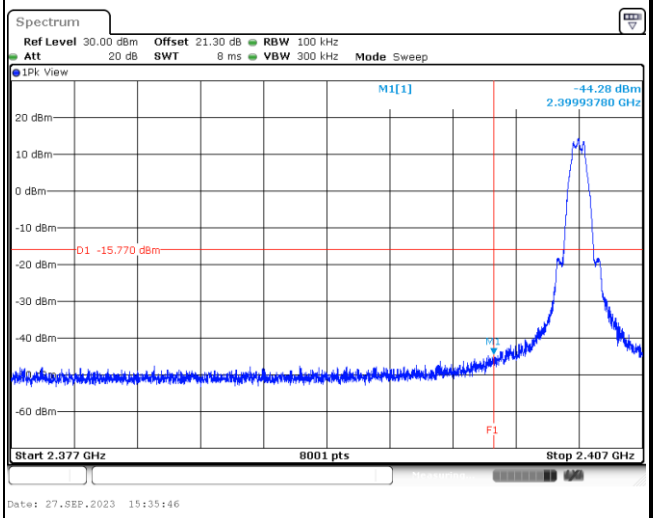
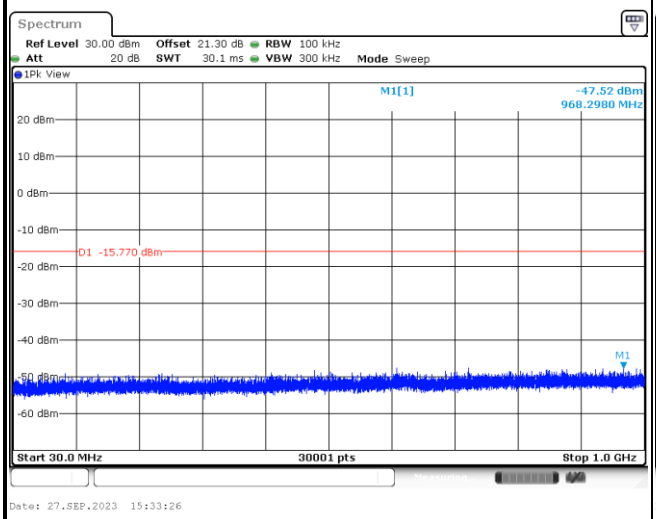
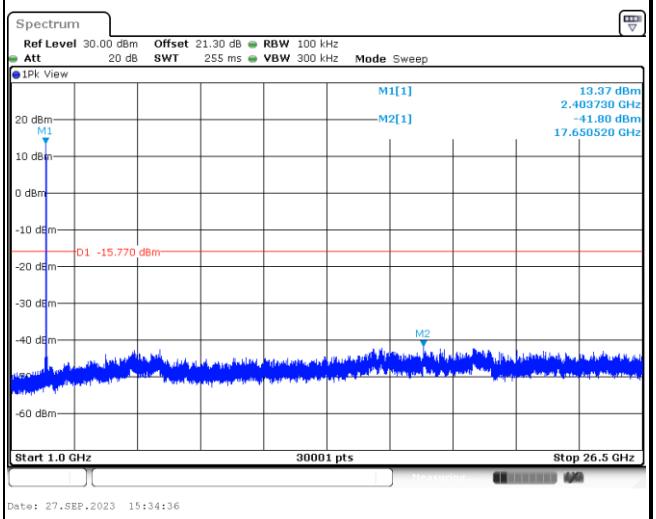
Power Density (dBm/3kHz) Plot Channel 39

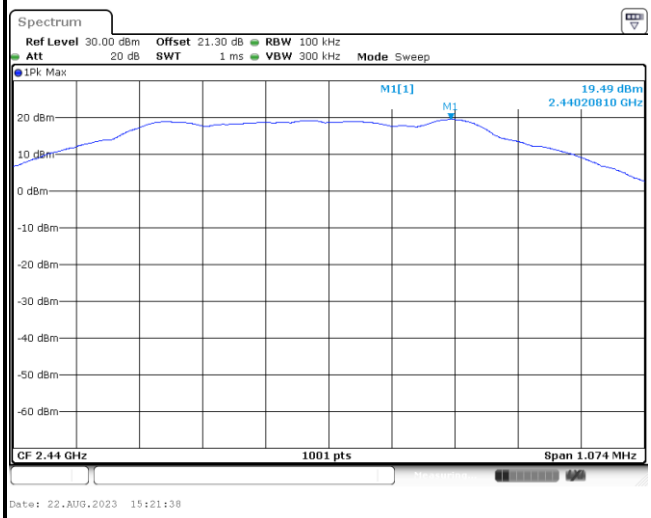
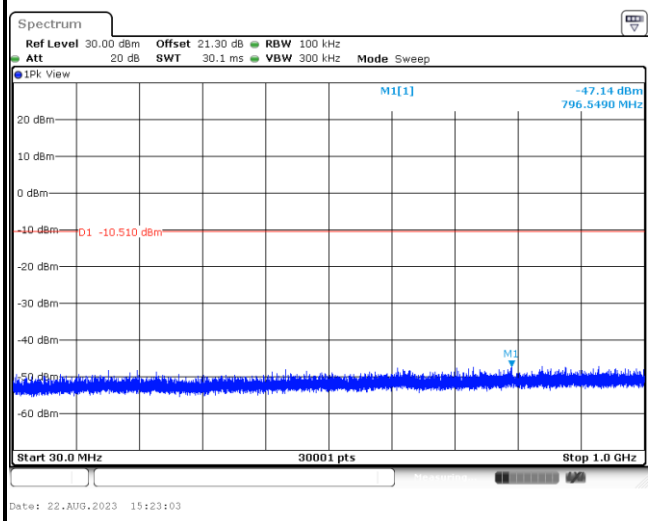
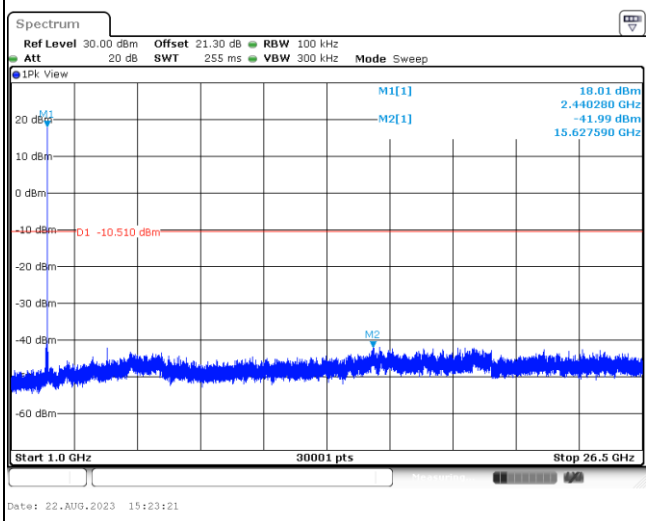


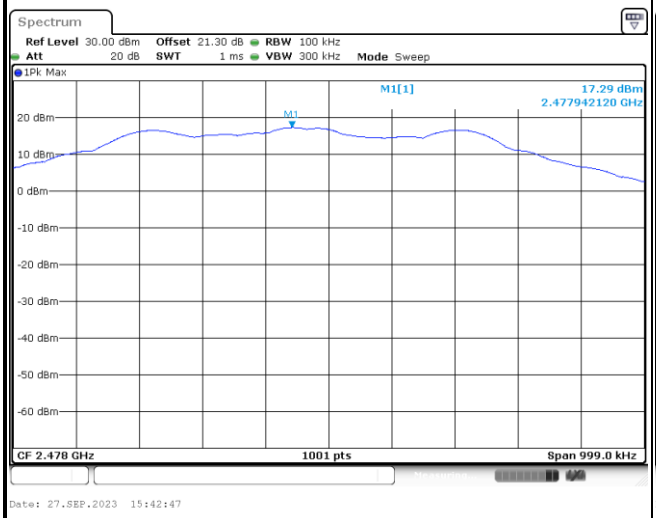
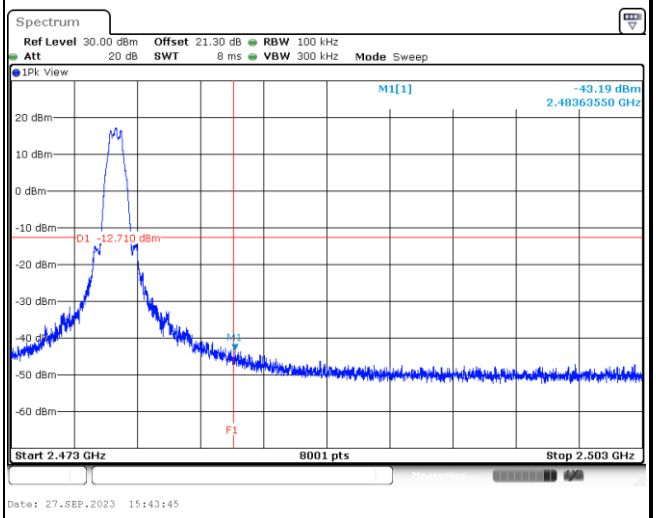
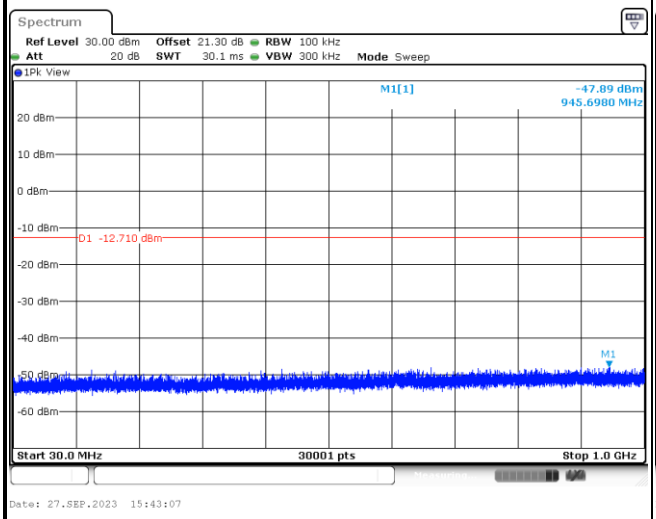
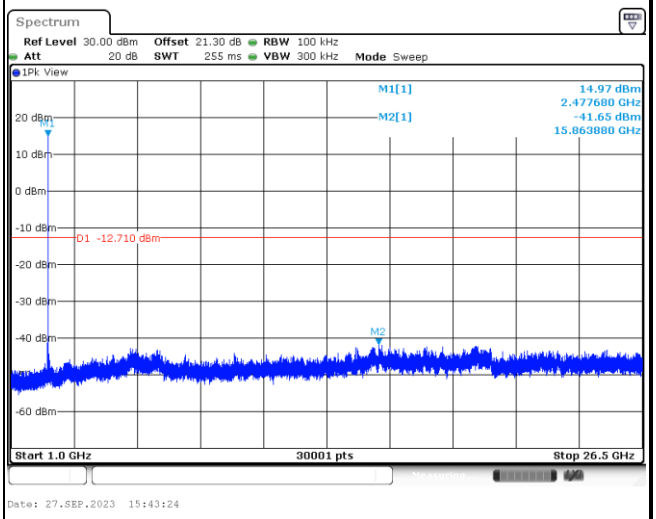
Band Edge and Conducted Spurious Emission

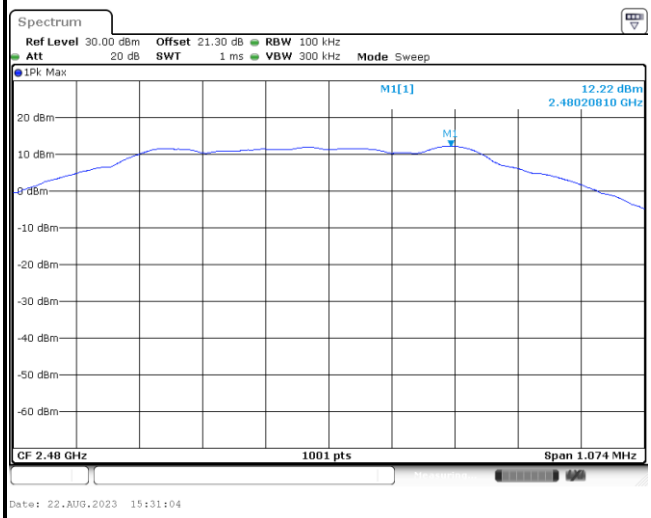
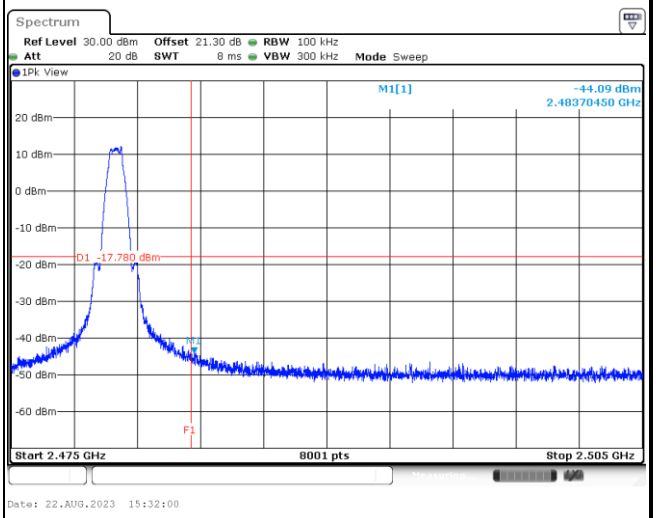
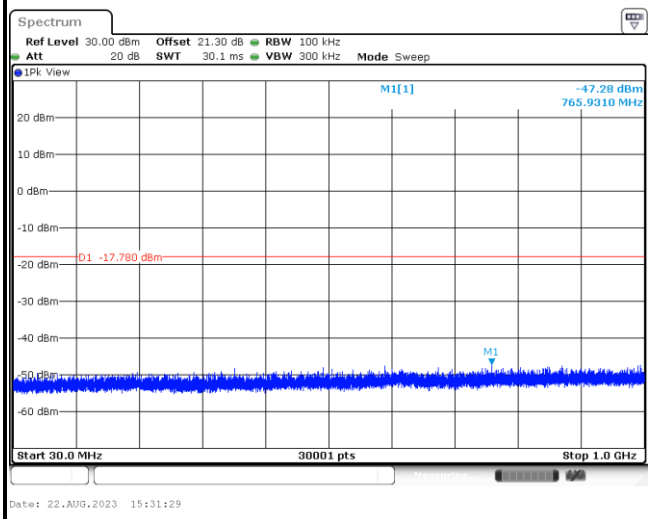
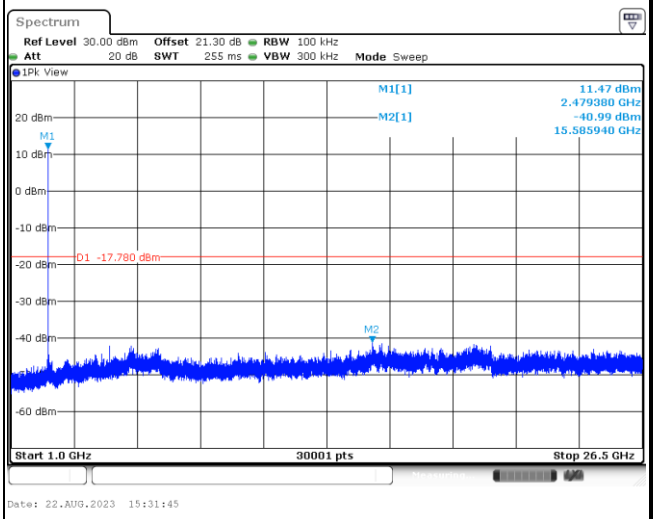
<1Mbps>

Channel 00	
100kHz PSD reference Level Plot	**Low Channel Plot**
	
Spurious Emission 30MHz~1GHz Plot	**Spurious Emission 1GHz~26.5GHz Plot**
	

Channel 01	
100kHz PSD reference Level Plot	**Low Channel Plot**
	
Spurious Emission 30MHz~1GHz Plot	**Spurious Emission 1GHz~26.5GHz Plot**
	

Channel 19	
100kHz PSD reference Level Plot	**Middle Channel Plot**
	
Spurious Emission 30MHz~1GHz Plot	**Spurious Emission 1GHz~26.5GHz Plot**
	

Channel 38	
100kHz PSD reference Level Plot	**High Channel Plot**
	
Spurious Emission 30MHz~1GHz Plot	**Spurious Emission 1GHz~26.5GHz Plot**
	

Channel 39	
100kHz PSD reference Level Plot	**High Channel Plot**
	
Spurious Emission 30MHz~1GHz Plot	**Spurious Emission 1GHz~26.5GHz Plot**
	

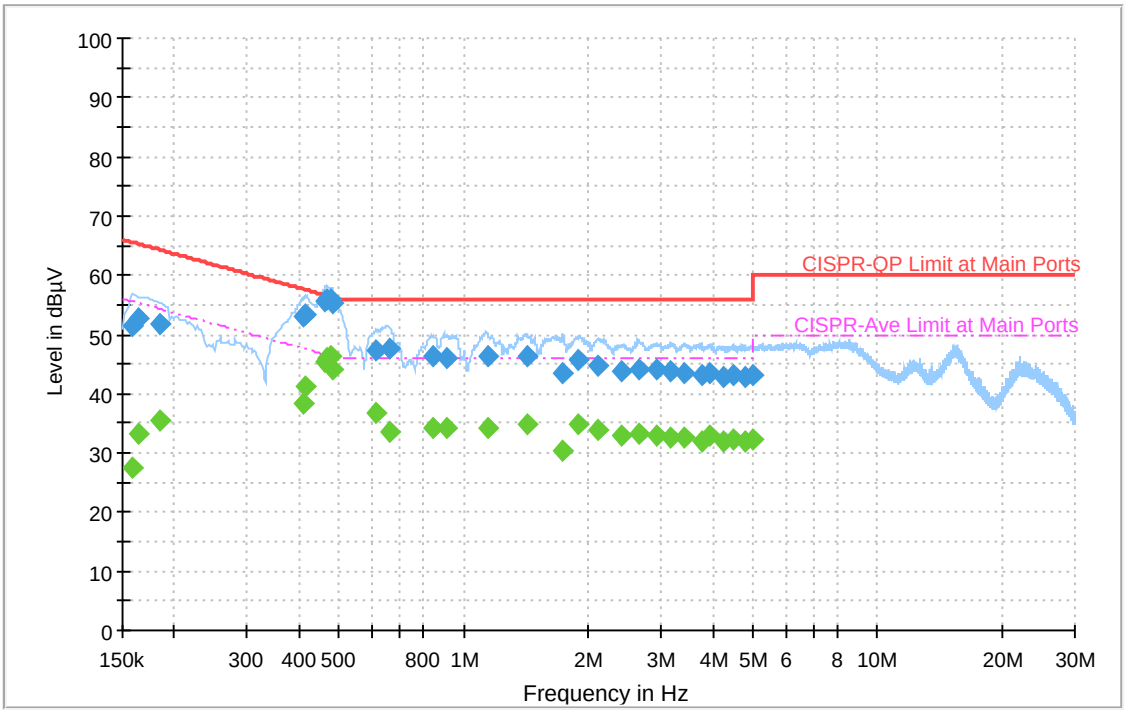
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Fu Chen	**Temperature :**	20.1~24.2℃
		Relative Humidity :	41.2~48.5%

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Project	230524001
	Line

Full Spectrum



Final_Result

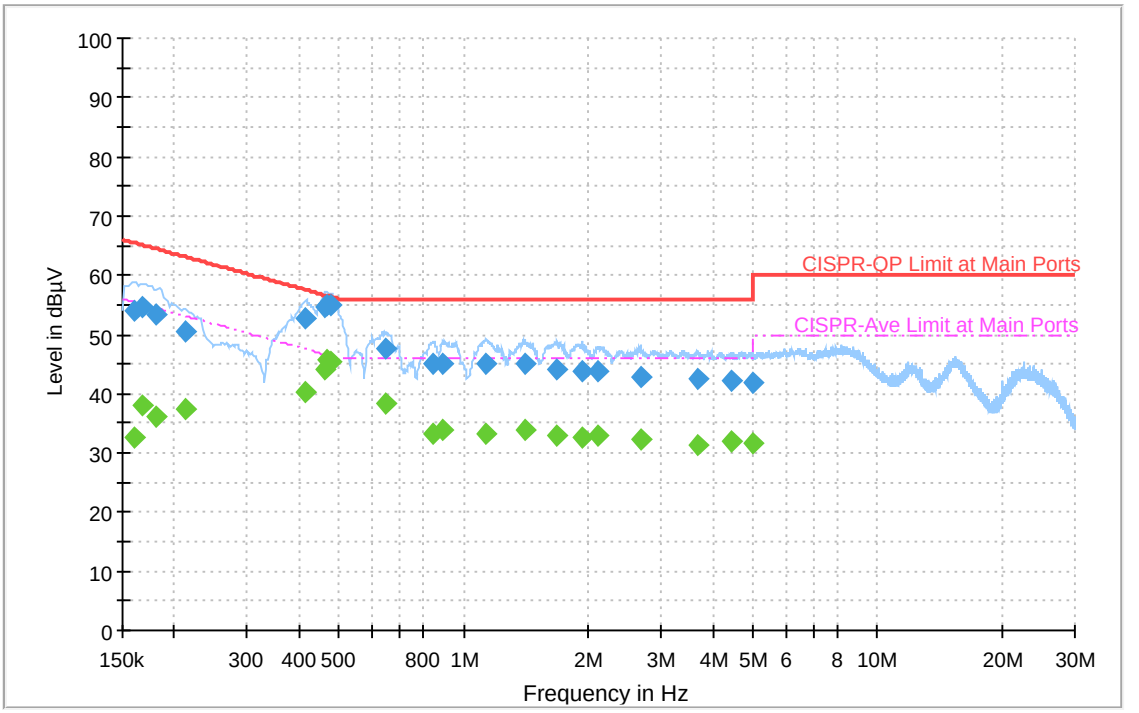
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.158748	---	27.35	55.53	28.18	L1	OFF	20.2
0.158748	51.48	---	65.53	14.05	L1	OFF	20.2
0.163293	---	33.31	55.30	21.98	L1	OFF	20.2
0.163293	52.70	---	65.30	12.59	L1	OFF	20.2
0.183759	---	35.61	54.31	18.70	L1	OFF	20.3
0.183759	51.73	---	64.31	12.58	L1	OFF	20.3
0.407994	---	38.24	47.69	9.45	L1	OFF	20.3
0.407994	52.89	---	57.69	4.80	L1	OFF	20.3
0.414303	53.41	---	57.56	4.15	L1	OFF	20.3
0.414303	---	41.14	47.56	6.42	L1	OFF	20.3
0.463839	---	45.35	46.62	1.27	L1	OFF	20.3
0.463839	55.63	---	56.62	0.99	L1	OFF	20.3
0.466485	---	46.14	46.58	0.44	L1	OFF	20.3
0.466485	55.86	---	56.58	0.72	L1	OFF	20.3
0.474963	55.85	---	56.43	0.58	L1	OFF	20.3
0.474963	---	46.24	46.43	0.19	L1	OFF	20.3
0.480291	55.32	---	56.33	1.01	L1	OFF	20.3
0.480291	---	44.10	46.33	2.23	L1	OFF	20.3
0.611034	---	36.85	46.00	9.15	L1	OFF	20.3
0.611034	47.36	---	56.00	8.64	L1	OFF	20.3
0.664071	---	33.61	46.00	12.39	L1	OFF	20.3

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.664071	47.57	---	56.00	8.43	L1	OFF	20.3
0.845565	---	34.03	46.00	11.97	L1	OFF	20.3
0.845565	46.35	---	56.00	9.65	L1	OFF	20.3
0.914496	---	34.33	46.00	11.67	L1	OFF	20.3
0.914496	46.01	---	56.00	9.99	L1	OFF	20.3
1.141431	---	34.31	46.00	11.69	L1	OFF	20.3
1.141431	46.27	---	56.00	9.73	L1	OFF	20.3
1.416948	---	34.98	46.00	11.02	L1	OFF	20.3
1.416948	46.23	---	56.00	9.77	L1	OFF	20.3
1.738113	---	30.24	46.00	15.76	L1	OFF	20.3
1.738113	43.45	---	56.00	12.55	L1	OFF	20.3
1.895289	---	34.76	46.00	11.24	L1	OFF	20.3
1.895289	45.64	---	56.00	10.36	L1	OFF	20.3
2.116176	---	33.89	46.00	12.11	L1	OFF	20.3
2.116176	44.85	---	56.00	11.15	L1	OFF	20.3
2.398695	---	33.00	46.00	13.00	L1	OFF	20.3
2.398695	43.85	---	56.00	12.15	L1	OFF	20.3
2.642910	---	33.25	46.00	12.75	L1	OFF	20.4
2.642910	44.04	---	56.00	11.96	L1	OFF	20.4
2.935662	---	32.91	46.00	13.09	L1	OFF	20.4
2.935662	43.99	---	56.00	12.01	L1	OFF	20.4
3.174036	---	32.65	46.00	13.35	L1	OFF	20.4
3.174036	43.66	---	56.00	12.34	L1	OFF	20.4
3.423723	---	32.60	46.00	13.40	L1	OFF	20.4
3.423723	43.60	---	56.00	12.40	L1	OFF	20.4
3.749307	---	31.83	46.00	14.17	L1	OFF	20.4
3.749307	43.24	---	56.00	12.76	L1	OFF	20.4
3.922881	---	32.86	46.00	13.14	L1	OFF	20.4
3.922881	43.36	---	56.00	12.64	L1	OFF	20.4
4.256898	---	31.93	46.00	14.07	L1	OFF	20.4
4.256898	42.90	---	56.00	13.10	L1	OFF	20.4
4.460559	---	32.28	46.00	13.72	L1	OFF	20.4
4.460559	43.13	---	56.00	12.87	L1	OFF	20.4
4.762149	---	32.02	46.00	13.98	L1	OFF	20.4
4.762149	42.77	---	56.00	13.23	L1	OFF	20.4
4.977060	---	32.27	46.00	13.73	L1	OFF	20.4
4.977060	43.05	---	56.00	12.95	L1	OFF	20.4

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Project	230524001
	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.160170	---	32.74	55.46	22.72	N	OFF	20.2
0.160170	54.01	---	65.46	11.45	N	OFF	20.2
0.166578	---	38.04	55.13	17.09	N	OFF	20.2
0.166578	54.70	---	65.13	10.43	N	OFF	20.2
0.180267	---	36.00	54.47	18.47	N	OFF	20.2
0.180267	53.29	---	64.47	11.18	N	OFF	20.2
0.212055	---	37.30	53.12	15.82	N	OFF	20.2
0.212055	50.49	---	63.12	12.63	N	OFF	20.2
0.414708	---	40.13	47.55	7.42	N	OFF	20.2
0.414708	52.80	---	57.55	4.75	N	OFF	20.2
0.462093	---	44.06	46.66	2.59	N	OFF	20.2
0.462093	54.66	---	56.66	1.99	N	OFF	20.2
0.465405	---	45.58	46.60	1.02	N	OFF	20.2
0.465405	54.87	---	56.60	1.73	N	OFF	20.2
0.474981	---	45.41	46.43	1.02	N	OFF	20.2
0.474981	54.83	---	56.43	1.60	N	OFF	20.2
0.647412	---	38.35	46.00	7.65	N	OFF	20.2
0.647412	47.71	---	56.00	8.29	N	OFF	20.2
0.845673	---	33.19	46.00	12.81	N	OFF	20.3
0.845673	45.12	---	56.00	10.88	N	OFF	20.3
0.892680	---	33.81	46.00	12.19	N	OFF	20.3

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.892680	45.05	---	56.00	10.95	N	OFF	20.3
1.136499	---	33.31	46.00	12.69	N	OFF	20.3
1.136499	45.15	---	56.00	10.85	N	OFF	20.3
1.409514	---	33.88	46.00	12.12	N	OFF	20.3
1.409514	44.95	---	56.00	11.05	N	OFF	20.3
1.682691	---	33.06	46.00	12.94	N	OFF	20.3
1.682691	44.17	---	56.00	11.83	N	OFF	20.3
1.939407	---	32.52	46.00	13.48	N	OFF	20.3
1.939407	43.64	---	56.00	12.36	N	OFF	20.3
2.110866	---	32.87	46.00	13.13	N	OFF	20.3
2.110866	43.86	---	56.00	12.14	N	OFF	20.3
2.684769	---	32.18	46.00	13.82	N	OFF	20.3
2.684769	42.97	---	56.00	13.03	N	OFF	20.3
3.689403	---	31.42	46.00	14.58	N	OFF	20.4
3.689403	42.40	---	56.00	13.60	N	OFF	20.4
4.428294	---	31.86	46.00	14.14	N	OFF	20.4
4.428294	42.08	---	56.00	13.92	N	OFF	20.4
4.973892	---	31.50	46.00	14.50	N	OFF	20.4
4.973892	41.76	---	56.00	14.24	N	OFF	20.4

Appendix C. Radiated Spurious Emission

Test Engineer :	Fu Chen, Yuan Lee, and Thinh Hoang	Temperature :	20.1~24.2°C
		Relative Humidity :	42.1~52.1%

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 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		2362.605	58.39	-15.61	74	44.37	27.29	17.55	30.82	174	122	P	H
		2363.025	53.28	-0.72	54	39.26	27.29	17.55	30.82	174	122	A	H
	*	2402	112.79	-	-	98.45	27.52	17.6	30.78	174	122	P	H
		2442	58.49	-	-	43.76	27.8	17.67	30.74	174	122	P	H
	*	2402	112.26	-	-	97.92	27.52	17.6	30.78	174	122	A	H
		2442	51.65	-	-	36.92	27.8	17.67	30.74	174	122	A	H
		2362.71	55.74	-18.26	74	41.66	27.35	17.55	30.82	213	181	P	V
		2362.92	47.99	-6.01	54	33.91	27.35	17.55	30.82	213	181	A	V
	*	2402	106.68	-	-	92.42	27.44	17.6	30.78	213	181	P	V
	*	2402	106.15	-	-	91.89	27.44	17.6	30.78	213	181	A	V
		2440	48.81	-	-	34.21	27.68	17.66	30.74	213	181	A	V
BLE CH 01 2404MHz		2365.125	58.89	-15.11	74	44.85	27.3	17.55	30.81	199	126	P	H
		2364.915	53.32	-0.68	54	39.29	27.3	17.55	30.82	199	126	A	H
	*	2404	113.4	-	-	99.03	27.54	17.61	30.78	199	126	P	H
		2444	58.49	-	-	43.75	27.81	17.67	30.74	199	126	P	H
	*	2404	112.86	-	-	98.49	27.54	17.61	30.78	199	126	A	H
		2444	51.80	-	-	37.06	27.81	17.67	30.74	199	126	A	H
		2365.23	56.41	-17.59	74	42.32	27.35	17.55	30.81	266	186	P	V
		2364.915	48.59	-5.41	54	34.51	27.35	17.55	30.82	266	186	A	V
	*	2404	105.84	-	-	91.56	27.45	17.61	30.78	266	186	P	V
	*	2404	105.33	-	-	91.05	27.45	17.61	30.78	266	186	A	V
		2444	48.87	-	-	34.25	27.69	17.67	30.74	266	186	A	V

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 19 2440MHz		2366.8	54.94	-19.06	74	40.89	27.31	17.55	30.81	122	121	P	H
		2362	44.54	-9.46	54	30.53	27.29	17.54	30.82	122	121	A	H
		2402	62.27	-	-	47.93	27.52	17.6	30.78	122	121	P	H
	*	2440	119.87	-	-	105.16	27.79	17.66	30.74	122	121	P	H
		2478	59.93	-	-	44.9	28.01	17.72	30.7	122	121	P	H
		2402	57.04	-	-	42.7	27.52	17.6	30.78	122	121	A	H
	*	2440	119.32	-	-	104.61	27.79	17.66	30.74	122	121	A	H
		2478	54.68	-	-	39.65	28.01	17.72	30.7	122	121	A	H
		2497.76	55.62	-18.38	74	40.51	28.04	17.76	30.69	122	121	P	H
		2488.88	44.77	-9.23	54	29.67	28.05	17.74	30.69	122	121	A	H
		2387.44	54.57	-19.43	74	40.34	27.44	17.58	30.79	195	175	P	V
		2389.52	43.44	-10.56	54	29.19	27.45	17.58	30.78	195	175	A	V
		2402	57.57	-	-	43.31	27.44	17.6	30.78	195	175	P	V
	*	2440	114.62	-	-	100.02	27.68	17.66	30.74	195	175	P	V
		2478	59.27	-	-	44.42	27.82	17.73	30.7	195	175	P	V
		2402	51.08	-	-	36.82	27.44	17.6	30.78	195	175	A	V
	*	2440	114.1	-	-	99.5	27.68	17.66	30.74	195	175	A	V
		2478	50.99	-	-	36.14	27.82	17.73	30.7	195	175	A	V
		2493.04	55.55	-18.45	74	40.62	27.87	17.75	30.69	195	175	P	V
		2499.68	44.23	-9.77	54	29.27	27.89	17.76	30.69	195	175	A	V

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 38 2478MHz		2440	61.05	-	-	46.34	27.79	17.66	30.74	108	127	P	H
	*	2478	116.02	-	-	100.99	28.01	17.72	30.7	108	127	P	H
		2518	60.32	-25.7	86.02	45.14	28.05	17.79	30.66	108	127	P	H
		2440	56.27	-	-	41.58	27.79	17.66	30.74	108	127	A	H
	*	2478	115.5	-	-	100.47	28.01	17.72	30.7	108	127	A	H
		2518	55.21	-	-	40.03	28.05	17.79	30.66	108	127	A	H
		2483.6	62.25	-11.75	74	47.19	28.03	17.73	30.7	108	127	P	H
		2483.52	53.09	-0.91	54	38.03	28.03	17.73	30.7	108	127	A	H
		2440	59.35	-	-	44.75	27.68	17.66	30.74	214	180	P	V
	*	2478	111.43	-	-	96.6	27.81	17.72	30.7	214	180	P	V
		2518	60.5	-25.52	86.02	45.4	27.97	17.79	30.66	214	180	P	V
		2440	51.64	-	-	37.04	27.68	17.66	30.74	214	180	A	V
	*	2478	110.9	-	-	96.07	27.81	17.72	30.7	214	180	A	V
		2518	50.88	-	-	35.78	27.97	17.79	30.66	214	180	A	V
		2484.12	58.97	-15.03	74	44.11	27.83	17.73	30.7	214	180	P	V
		2483.52	49.15	-4.85	54	34.29	27.83	17.73	30.7	214	180	A	V

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 39 2480MHz		2442	60.13	-	-	45.4	27.8	17.67	30.74	100	123	P	H
	*	2480	112.47	-	-	97.42	28.02	17.73	30.7	100	123	P	H
		2520	58.24	-24.23	82.47	43.06	28.05	17.79	30.66	100	123	P	H
		2442	54.44	-	-	39.71	27.8	17.67	30.74	100	123	A	H
	*	2480	111.97	-	-	96.92	28.02	17.73	30.7	100	123	A	H
		2520	52.08	-	-	36.9	28.05	17.79	30.66	100	123	A	H
		2483.52	63.18	-10.82	74	48.12	28.03	17.73	30.7	100	123	P	H
		2483.52	53.61	-0.39	54	38.55	28.03	17.73	30.7	100	123	A	H
		2442	58.71	-	-	44.1	27.68	17.67	30.74	194	174	P	V
	*	2480	107.28	-	-	92.43	27.82	17.73	30.7	194	174	P	V
		2520	57.38	-25.09	82.47	42.29	27.96	17.79	30.66	194	174	P	V
		2442	50.65	-	-	36.04	27.68	17.67	30.74	194	174	A	V
	*	2480	106.8	-	-	91.95	27.82	17.73	30.7	194	174	A	V
		2520	49.22	-	-	34.13	27.96	17.79	30.66	194	174	A	V
		2483.76	59.24	-14.76	74	44.38	27.83	17.73	30.7	194	174	P	V
		2483.52	49.52	-4.48	54	34.66	27.83	17.73	30.7	194	174	A	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 (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		4804	49.51	-24.49	74	71.7	32.59	11.47	66.25	170	164	P	H
		4804	43.76	-10.24	54	65.95	32.59	11.47	66.25	170	164	A	H
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		4804	50.92	-23.08	74	73.1	32.6	11.47	66.25	162	179	P	V
		4804	46.47	-7.53	54	68.65	32.6	11.47	66.25	162	179	A	V
													V
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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 19 2440MHz		4880	53.8	-20.2	74	75.5	32.88	11.54	66.12	160	163	P	H
		4880	49.9	-4.1	54	71.6	32.88	11.54	66.12	160	163	A	H
		7320	46.02	-27.98	74	61.49	36.75	13.77	65.99	-	-	P	H
													H
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		4880	56.32	-17.68	74	78.11	32.79	11.54	66.12	154	178	P	V
		4880	52.92	-1.08	54	74.71	32.79	11.54	66.12	154	178	A	V
		7320	46.04	-27.96	74	61.43	36.83	13.77	65.99	-	-	P	V
													V
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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 39 2480MHz		4960	49.27	-24.73	74	70.5	33.14	11.6	65.97	166	160	P	H
		4960	41.77	-12.23	54	63	33.14	11.6	65.97	166	160	A	H
		7440	45.33	-28.67	74	61.1	36.4	13.89	66.06	-	-	P	H
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		4960	50.87	-23.13	74	72.1	33.14	11.6	65.97	153	176	P	V
		4960	44.27	-9.73	54	65.5	33.14	11.6	65.97	153	176	A	V
		7440	45.48	-28.52	74	61.23	36.42	13.89	66.06	-	-	P	V
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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 with sufficient margin against limit line or noise floor only.

Emission above 18GHz

2.4GHz BLE (SHF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BLE SHF		24811.56	43.33	-30.67	74	37.78	38.85	15.71	49.01	-	-	P	H
													H
													H
													H
													H
													H
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													H
													H
													H
													H
		22631.14	43.68	-30.32	74	38.94	38.43	14.97	48.66	-	-	P	V
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Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Emission below 1GHz

2.4GHz BLE (LF)

BLE	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/Q)	(H/V)
2.4GHz BLE LF		85.29	33.65	-6.35	50.27	40	14.13	1.71	32.46	-	-	P	H
		165.8	31.35	-12.15	45.56	43.5	15.9	2.28	32.39	-	-	P	H
		214.3	35.99	-7.51	51.13	43.5	14.83	2.52	32.49	-	-	P	H
		672.14	33.08	-12.92	34.59	46	26.4	4.5	32.41	-	-	P	H
		746.83	33.46	-12.54	32.83	46	28	4.91	32.28	-	-	P	H
		950.53	34.37	-11.63	28.83	46	31.3	5.31	31.07	-	-	P	H
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		31.94	28.59	-11.41	36.4	40	23.72	0.93	32.46	100	0	QP	V
		66.86	32.66	-7.34	51.5	40	12.09	1.5	32.43	100	0	QP	V
		110.51	39.67	-3.83	52.99	43.5	17.2	1.96	32.48	100	360	QP	V
		132.82	35.47	-8.03	48.45	43.5	17.4	2.08	32.46	-	-	P	V
		246.31	33.05	-12.95	44.68	46	18.16	2.67	32.46	-	-	P	V
		957.32	34.28	-11.72	28.59	46	31.35	5.34	31	-	-	P	V
													V
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													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is 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 **Margin** 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	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(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. Margin(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. Margin(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. Margin(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

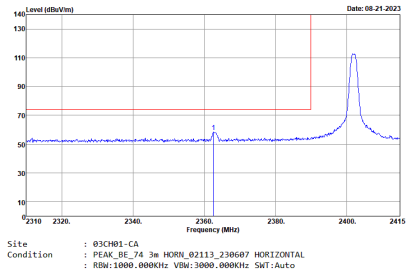
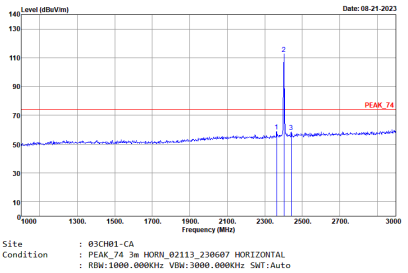
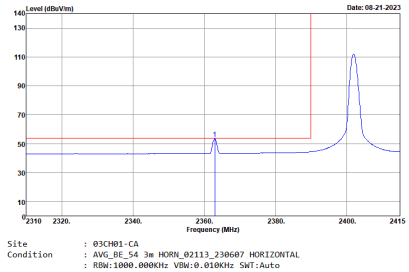
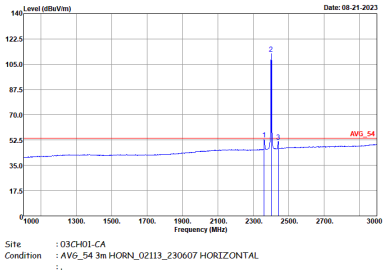
Test Engineer :	Fu Chen, Yuan Lee, and Thinh Hoang	**Temperature :**	20.1~24.2°C
		Relative Humidity :	42.1~52.1%

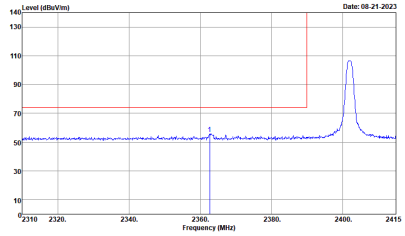
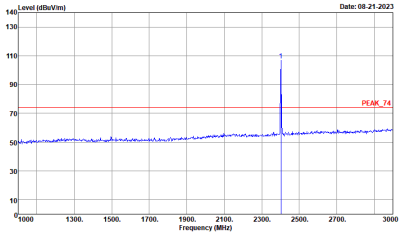
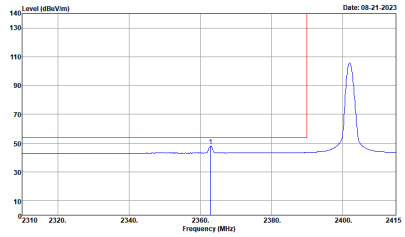
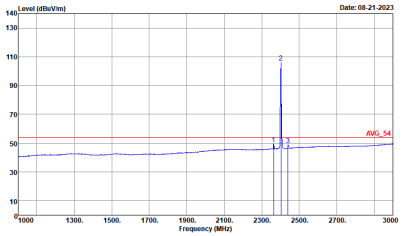
Note symbol

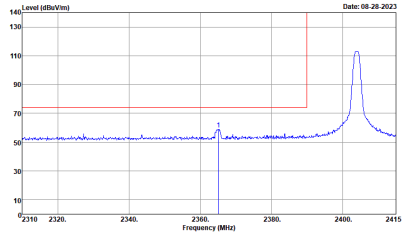
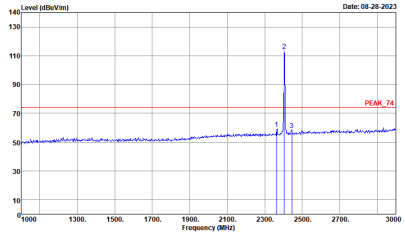
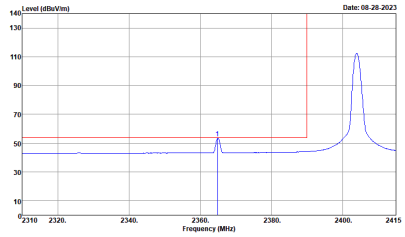
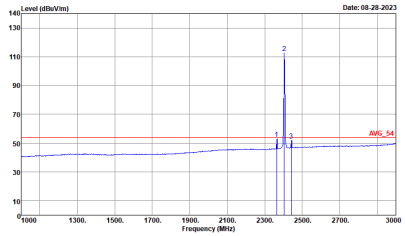
-L	**Low channel location**
-R	**High channel location**

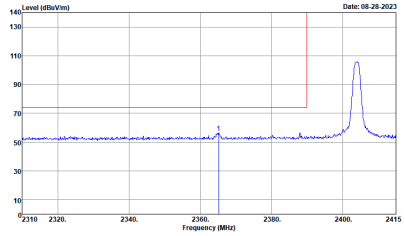
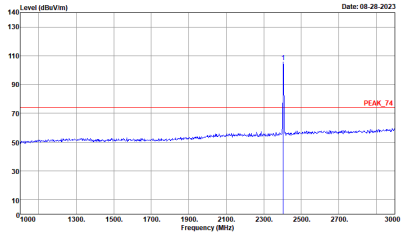
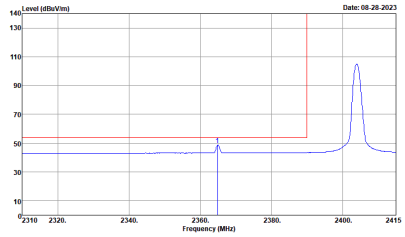
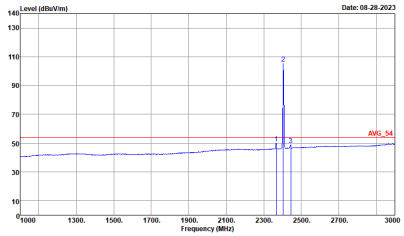
2.4GHz 2400~2483.5MHz

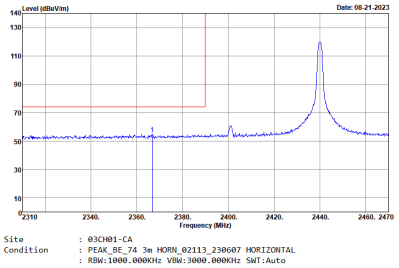
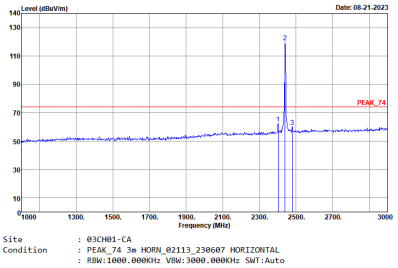
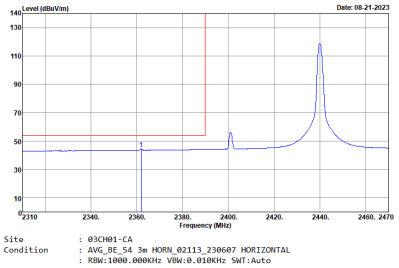
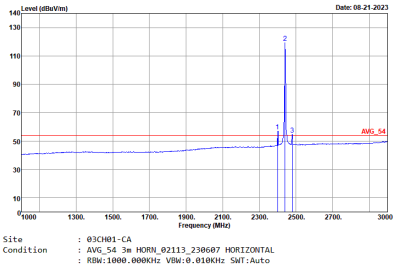
BLE (Band Edge @ 3m)

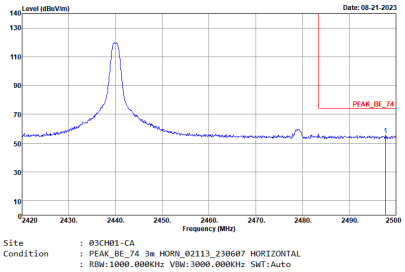
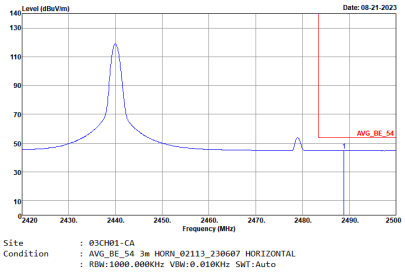
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 HORIZONTAL :.

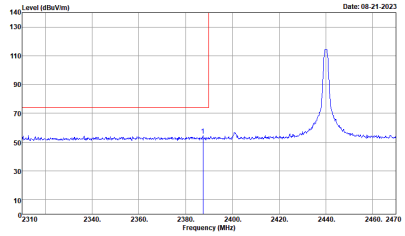
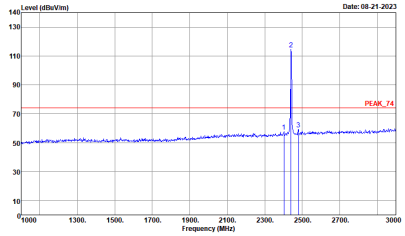
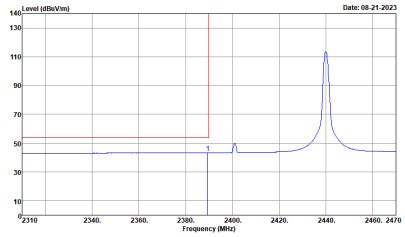
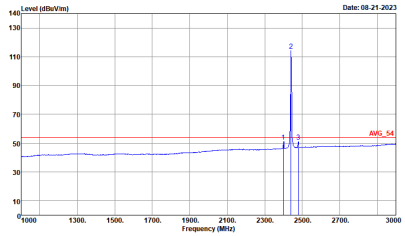
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH00 2402MHz	
	Vertical	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

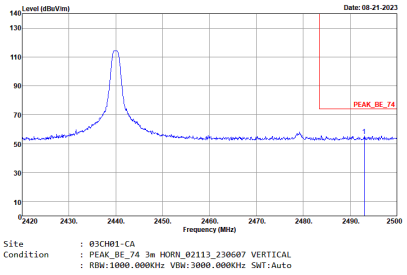
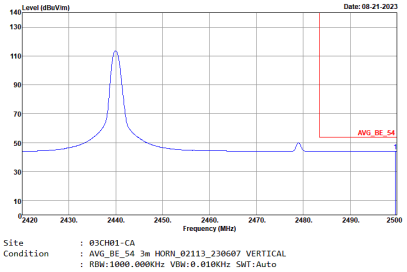
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH01 2404MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 HORIZONTAL : .
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 HORIZONTAL : .

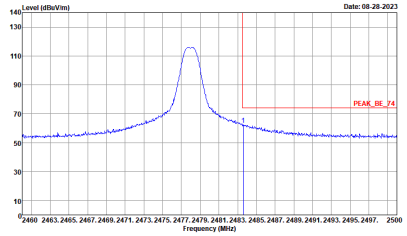
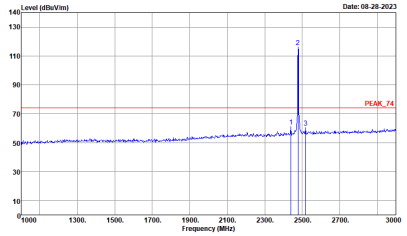
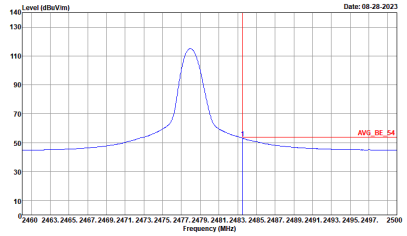
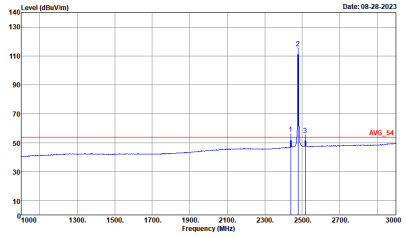
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH01 2404MHz	
	Vertical	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 VERTICAL : .

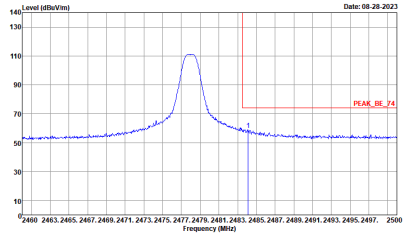
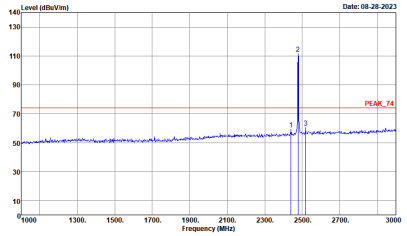
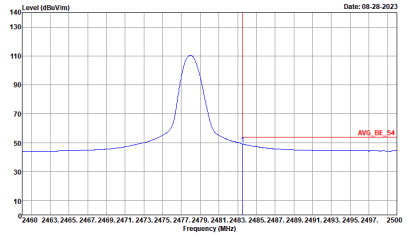
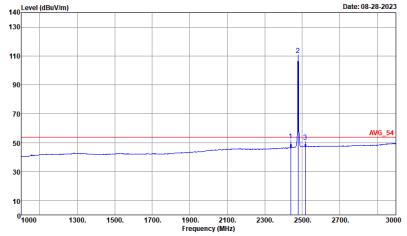
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Horizontal	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

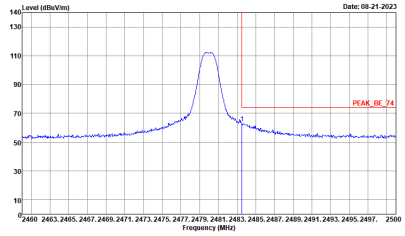
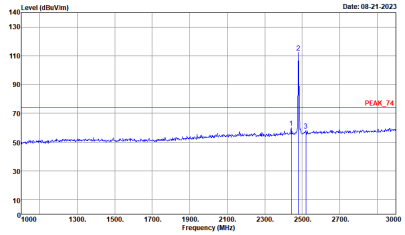
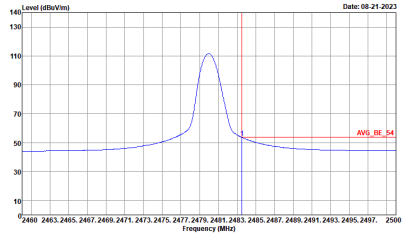
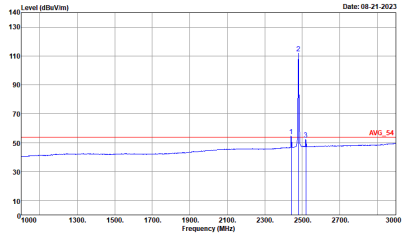
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

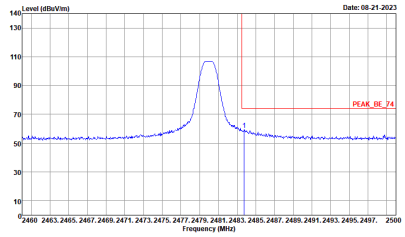
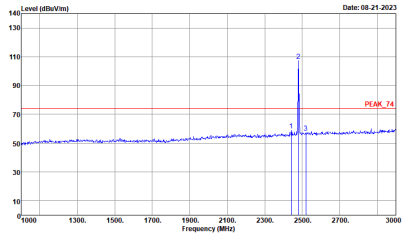
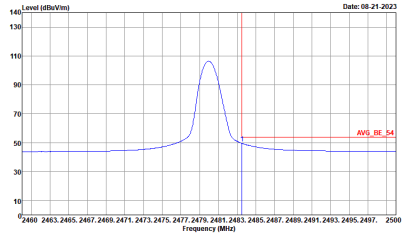
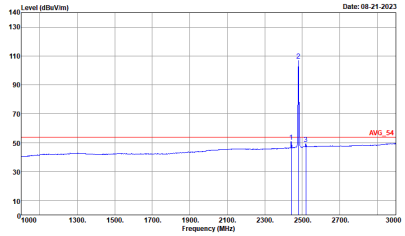
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - L	
	Vertical	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH19 2440MHz - R	
	Vertical	Fundamental
Peak		Left blank
Avg.		Left blank

BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH38 2478MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

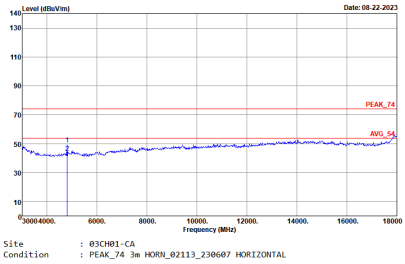
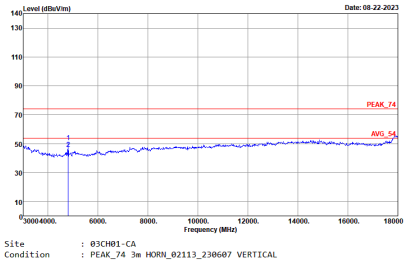
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH38 2478MHz	
	Vertical	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

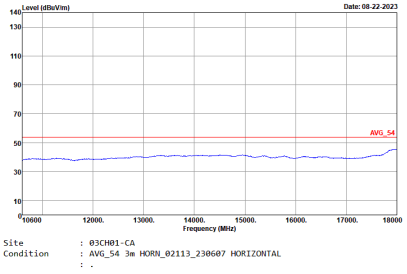
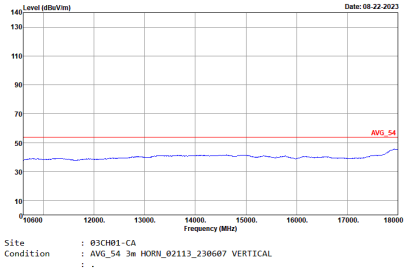
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

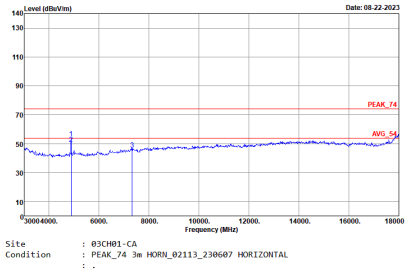
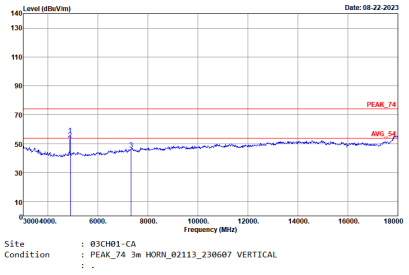
BLE	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BLE CH39 2480MHz	
	Vertical	Fundamental
Peak	 Site : 03CH01-CA Condition : PEAK_BE_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH01-CA Condition : PEAK_74 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Avg.	 Site : 03CH01-CA Condition : AVG_BE_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto	 Site : 03CH01-CA Condition : AVG_54 3m HORN_02113_230607 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto

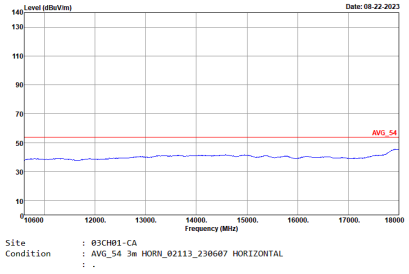
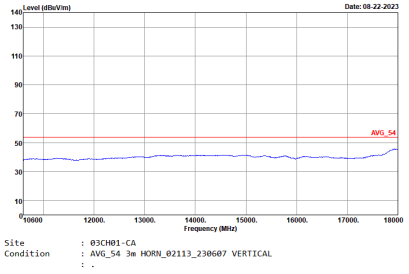
2.4GHz 2400~2483.5MHz

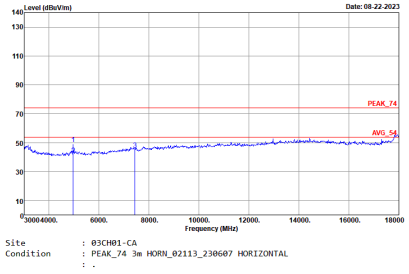
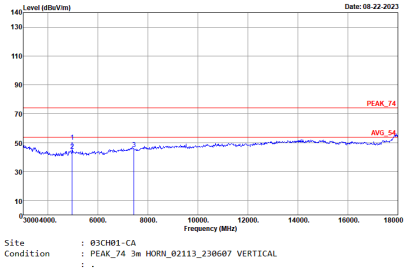
BLE (Harmonic @ 3m)

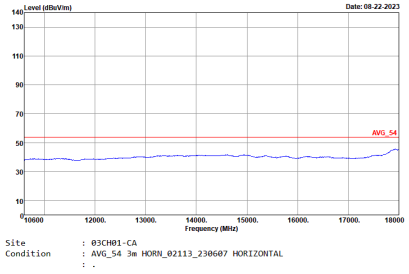
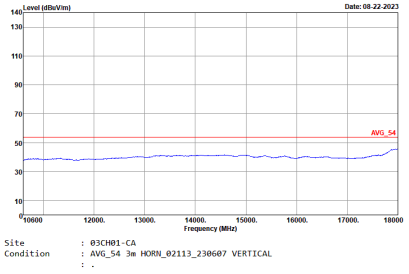
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH00 2402MHz	
	Horizontal	Vertical
10.6G ~18G Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
Peak Avg.		

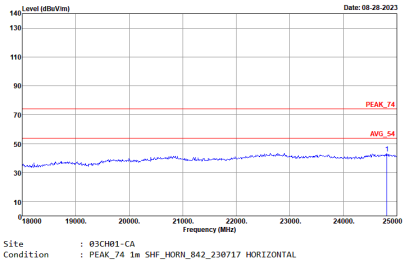
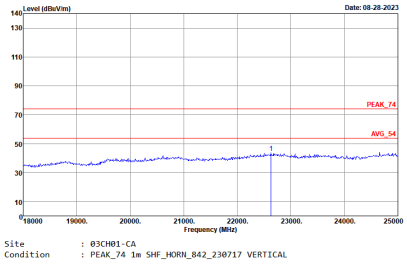
BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH19 2440MHz	
	Horizontal	Vertical
10.6G ~18G Avg.		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
Peak		

BLE	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BLE CH39 2480MHz	
	Horizontal	Vertical
10.6G ~18G Avg.		

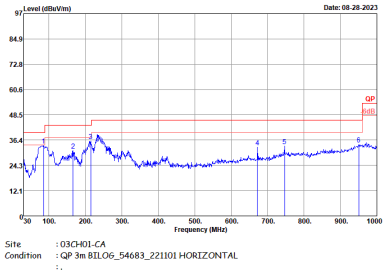
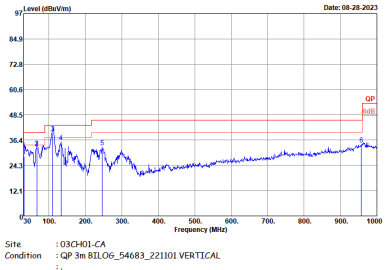
Emission above 18GHz

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 for 1Mbps	100.00	-	-	10Hz

Bluetooth – LE for 1 Mbps