FCC RADIO TEST REPORT

FCC ID	:	**TVE-110T17**
Equipment	:	**Bluetooth Low Energy Module**
Brand Name	:	**FORTINET**
Model Name	:	**FBLE-2024TI**
Applicant	:	**Fortinet Inc.** **909 Kifer Rd., Sunnyvale, CA 94086, United States**
Manufacturer	:	**Fortinet Inc.** **909 Kifer Rd., Sunnyvale, CA 94086, United States**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Mar. 22, 2024 and testing was performed from Mar. 29, 2024 to Jun. 28, 2024. We, Sporton International Inc. Wensan Laboratory, 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 variant report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

Table of Contents

History of this test report **3**
Summary of Test Result **4**
1 General Description **5**
1.1 Product Feature of Equipment Under Test 5
1.2 Modification of EUT 5
1.3 Testing Location 6
1.4 Applicable Standards 6
2 Test Configuration of Equipment Under Test **7**
2.1 Carrier Frequency Channel 7
2.2 Test Mode 8
2.3 Connection Diagram of Test System 9
2.4 Support Unit used in test configuration and system 9
2.5 EUT Operation Test Setup 9
3 Test Result **10**
3.1 Output Power Measurement 10
3.2 Radiated Band Edges and Spurious Emission Measurement 11
3.3 AC Conducted Emission Measurement 15
3.4 Antenna Requirements 17
4 List of Measuring Equipment **18**
5 Measurement Uncertainty **19**
Appendix A. Conducted Test Results
Appendix B. AC Conducted Emission Test Result
Appendix C. Radiated Spurious Emission
Appendix D. Duty Cycle Plots
Appendix E. Setup Photographs

History of this test report

Report No.	Version	Description	Issue Date
FR3D0610-01A	01	Initial issue of report	Jun. 21, 2024
FR3D0610-01A	02	Revise Conducted Power, Conducted Band Edge and Radiated Band Edge. This report is an updated version, replacing the report issued on Jun. 21, 2024.	Jul. 31, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.247(a)(2)	6dB Bandwidth	Not Required	-
-	2.1049	99% Occupied Bandwidth	Not Required	-
3.1	15.247(b)(3) 15.247(b)(4)	Output Power	Pass	-
-	15.247(e)	Power Spectral Density	Not Required	-
-	15.247(d)	Conducted Band Edges and Spurious Emission	Not Required	-
3.2	15.247(d)	Radiated Band Edges and Spurious Emission	Pass	6.87 dB under the limit at 32.91 MHz
3.3	15.207	AC Conducted Emission	Pass	14.48 dB under the limit at 0.31 MHz
3.4	15.203	Antenna Requirement	Pass	-

Note:

1. Not required means after assessing, test items are not necessary to carry out.
2. This is a variant report which can be referred Product Equality Declaration. All the test cases were performed on original report which can be referred to Sporton Report Number FR3D0610. Based on the original report, only worst case was verified

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.

Reviewed by: Yun Huang

Report Producer: Mila Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
SKU 1	FWF-50G-5G, FWF-51G-5G, FWF-50G-SFP, FWF-51G-SFP
SKU 2	FG-50G-5G, FG-51G-5G, FG-50G-SFP, FG-51G-SFP
Installed into the Host	Equipment Name: Network Security Gateway Brand Name: FORTINET Model Name: FortiGate 50Gxxxxxxxxxx, FORTIGATE-50Gxxxxxxxxxx, FG-50Gxxxxxxxxxx, FortiGate 51Gxxxxxxxxxx, FORTIGATE-51Gxxxxxxxxxx, FG-51Gxxxxxxxxxx, FortiGate 50G-SFPxxxxxxxxxx, FORTIGATE-50G-SFPxxxxxxxxxx, FG-50G-SFPxxxxxxxxxx, FortiGate 51G-SFPxxxxxxxxxx, FORTIGATE-51G-SFPxxxxxxxxxx, FG-51G-SFPxxxxxxxxxx, FortiWifi 50Gxxxxxxxxxx, FORTIWIFI-50Gxxxxxxxxxx, FWF-50Gxxxxxxxxxx, FortiWifi 51Gxxxxxxxxxx, FORTIWIFI-51Gxxxxxxxxxx, FWF-51Gxxxxxxxxxx, FortiWiFi 50G-SFPxxxxxxxxxx, FORTIWIFI-50G-SFPxxxxxxxxxx, FWF-50G-SFPxxxxxxxxxx, FortiWiFi 51G-SFPxxxxxxxxxx, FORTIWIFI-51G-SFPxxxxxxxxxx, FWF-51G-SFPxxxxxxxxxx (where "x" can be used as "A-Z", or "0-9", or "-", or blank for software purposes or marketing purposes only) Marketing Name: FortiGate 50G, FortiGate 51G, FortiGate 50G-SFP, FortiGate 51G-SFP, FortiWiFi 50G, FortiWiFi 51G, FortiWiFi 50G-SFP, FortiWiFi 51G-SFP
General Specs	Bluetooth-LE
Antenna Type	Monopole

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	1.53

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 Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	CO05-HY (TAF Code: 1190)
Remark	The AC Conducted Emission test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory.

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

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	TH05-HY, 03CH23-HY

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

FCC designation No.: TW1190 and TW3786

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

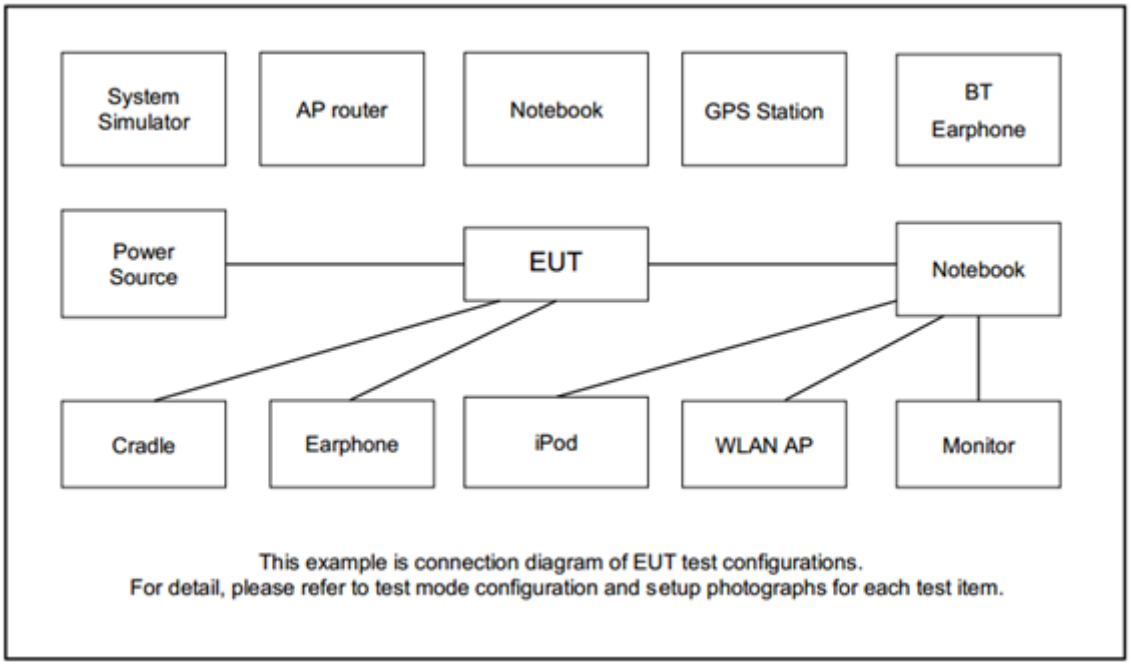
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental 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 two antenna degrees (Ant. degrees 0 and Ant. Degrees 90), 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-LE Tx CH00_2402 MHz_500kbps Mode 2: Bluetooth-LE Tx CH19_2440 MHz_500kbps Mode 3: Bluetooth-LE Tx CH39_2480 MHz_500kbps
Radiated Test Cases	Mode 1: Bluetooth-LE Tx CH00_2402 MHz_500kbps Mode 2: Bluetooth-LE Tx CH19_2440 MHz_500kbps Mode 3: Bluetooth-LE Tx CH39_2480 MHz_500kbps
AC Conducted Emission	Mode 1: Bluetooth-LE Link + AC Adapter for SKU 1

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.	Notebook	Lenovo	MPNXB2A260EX	N/A	N/A	N/A
2.	Phone	Apple	A1586	N/A	N/A	N/A
3.	HD	ADATA	HV620S-1T	FCC DoC	Unshield,1.0m	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “Tera Term Version4.106” 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.

3 Test Result

3.1 Output Power Measurement

3.1.1 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.

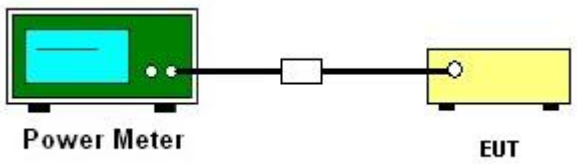
3.1.2 Measuring Instruments

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

3.1.3 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.

3.1.4 Test Setup



3.1.5 Test Result of Average Output Power

Please refer to Appendix A.

3.2 Radiated Band Edges and Spurious Emission Measurement

3.2.1 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

3.2.2 Measuring Instruments

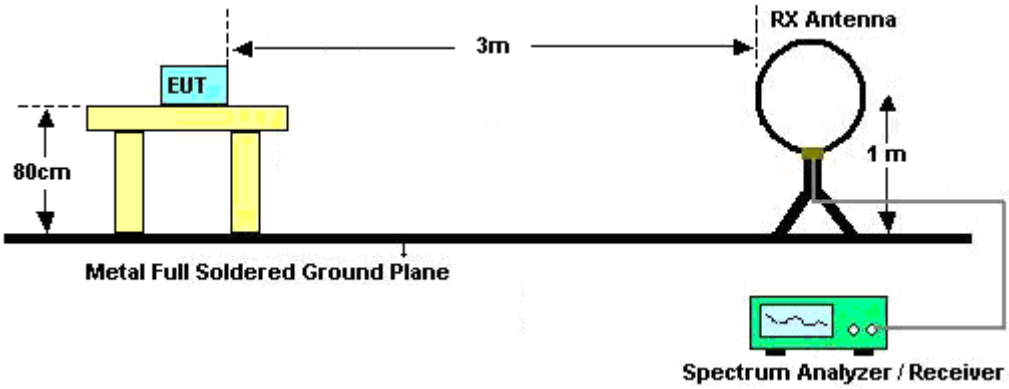
Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

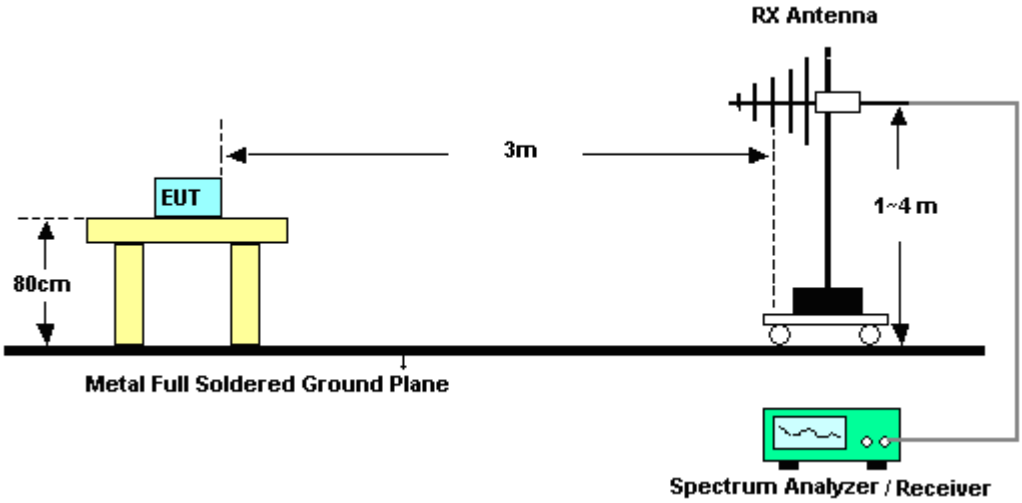
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the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

3.2.4 Test Setup

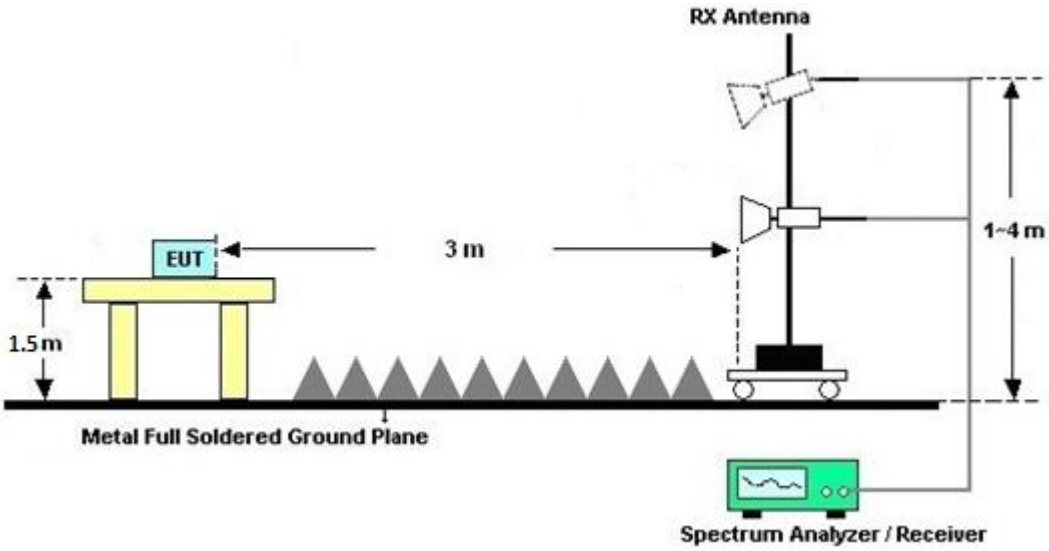
For radiated test below 30MHz



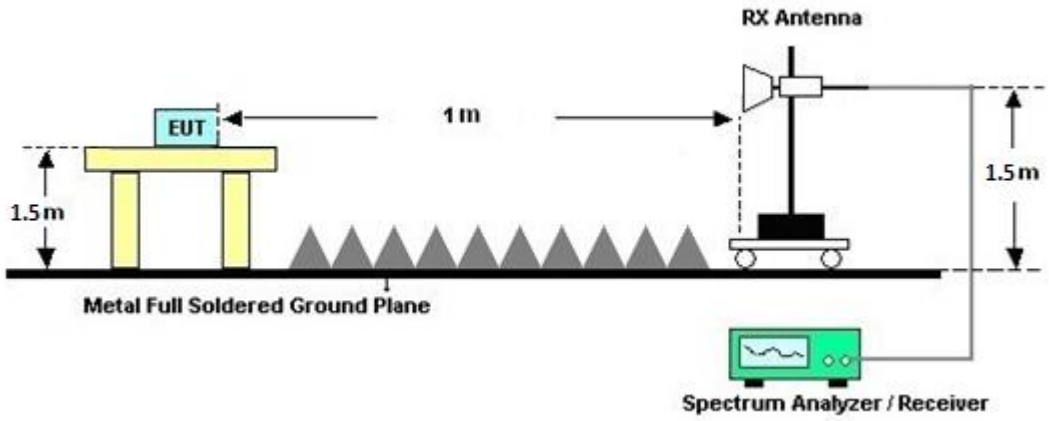
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.2.5 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.

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.2.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix C.

3.3 AC Conducted Emission Measurement

3.3.1 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.

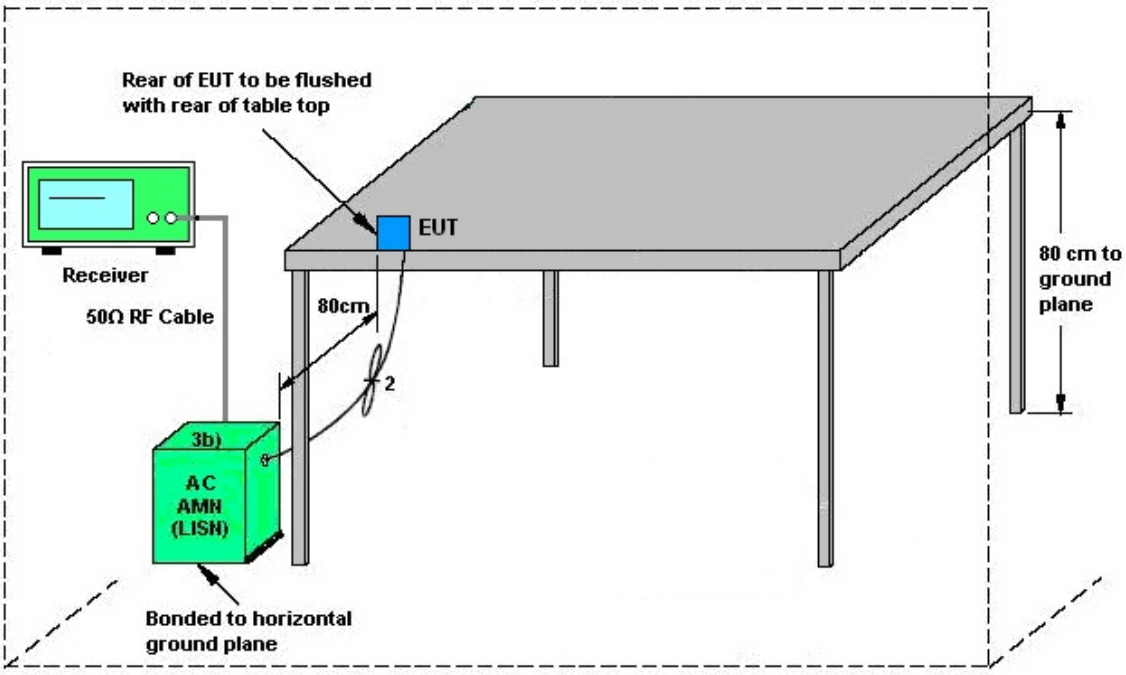
3.3.2 Measuring Instruments

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

3.3.3 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.

3.3.4 Test Setup



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

3.3.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.4 Antenna Requirements

3.4.1 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.

3.4.2 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
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 07, 2023	Mar. 29, 2024~ Jun. 28, 2024	Nov. 06, 2024	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	15I00041SNO 10 (NO:248)	10MHz~6GHz	Jan. 10, 2024	Mar. 29, 2024~ Jun. 28, 2024	Jan. 09, 2025	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 23, 2023	Mar. 29, 2024~ Jun. 28, 2024	Aug. 22, 2024	Conducted (TH05-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	Apr. 01, 2024~ Jun. 28, 2024	Sep. 11, 2024	Radiation (03CH23-HY)
Bilog Antenna with 6dB pad	TESEQ & WOKEN	CBL 6111D & 00802N1D-06	62028 & 003	N/A	Oct. 15, 2023	Apr. 01, 2024~ Jun. 28, 2024	Oct. 14, 2024	Radiation (03CH23-HY)
Amplifier	SONOMA	310N	421582	N/A	Jul. 15, 2023	Apr. 01, 2024~ Jun. 28, 2024	Jul. 14, 2024	Radiation (03CH23-HY)
Double Ridged Guide Horn Antenna	RFSPIN	DRH18-E	LE2C05A18E N	1GHz~18GHz	Jul. 12, 2023	Apr. 01, 2024~ Jun. 28, 2024	Jul. 11, 2024	Radiation (03CH23-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	1223	18GHz-40GHz	Jul. 10, 2023	Apr. 01, 2024~ Jun. 28, 2024	Jul. 09, 2024	Radiation (03CH23-HY)
Amplifier	EMEC	EM01G18GA	060878	N/A	Sep. 28, 2023	Apr. 01, 2024~ Jun. 28, 2024	Sep. 27, 2024	Radiation (03CH23-HY)
Preamplifier	EMEC	EM18G40G	060871	18-40GHz	Sep. 06, 2023	Apr. 01, 2024~ Jun. 28, 2024	Sep. 05, 2024	Radiation (03CH23-HY)
Signal Analyzer	Keysight	N9010B	MY62170337	N/A	Aug. 17, 2023	Apr. 01, 2024~ Jun. 28, 2024	Aug. 16, 2024	Radiation (03CH23-HY)
Hygrometer	TECPEL	DTM-303B	TP211542	N/A	Oct. 30, 2023	Apr. 01, 2024~ Jun. 28, 2024	Oct. 29, 2024	Radiation (03CH23-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Apr. 01, 2024~ Jun. 28, 2024	N/A	Radiation (03CH23-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Apr. 01, 2024~ Jun. 28, 2024	N/A	Radiation (03CH23-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Apr. 01, 2024~ Jun. 28, 2024	N/A	Radiation (03CH23-HY)
Software	Audix	E3 6.09824_2019 122	RK-002348	N/A	N/A	Apr. 01, 2024~ Jun. 28, 2024	N/A	Radiation (03CH23-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9kHz~30MHz	Mar. 06, 2024	Apr. 01, 2024~ Jun. 28, 2024	Mar. 05, 2025	Radiation (03CH23-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804395/2	N/A	Nov. 27, 2023	Apr. 01, 2024~ Jun. 28, 2024	Nov. 26, 2024	Radiation (03CH23-HY)
RF Cable	EMC	EMC101Y	231115/23111 9/231122	N/A	Nov. 27, 2023	Apr. 01, 2024~ Jun. 28, 2024	Nov. 26, 2024	Radiation (03CH23-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Apr. 03, 2024	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 06, 2023	Apr. 03, 2024	Dec. 05, 2024	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Oct. 26, 2023	Apr. 03, 2024	Oct. 25, 2024	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 22, 2023	Apr. 03, 2024	Nov. 21, 2024	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Apr. 03, 2024	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBE CK	VTSD 9561-F N	00691	N/A	Jul. 28, 2023	Apr. 03, 2024	Jul. 27, 2024	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 28, 2023	Apr. 03, 2024	Dec. 27, 2024	Conduction (CO05-HY)

5 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.5 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.8 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.4 dB

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.3 dB

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

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

Appendix A. Test Result of Conducted Test Items

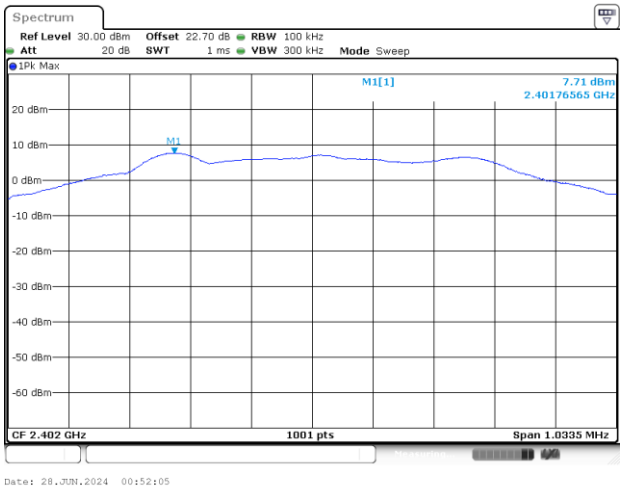
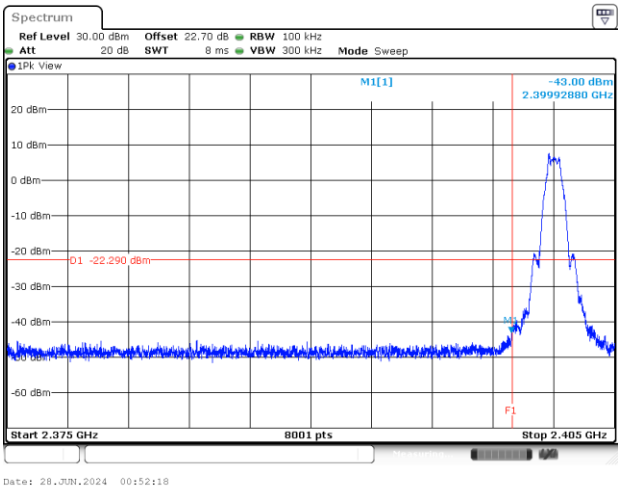
Test Engineer:	Junyu Jhou	Temperature:	21~25	°C
Test Date:	2024/3/29~2024/6/28	Relative Humidity:	51~54	%

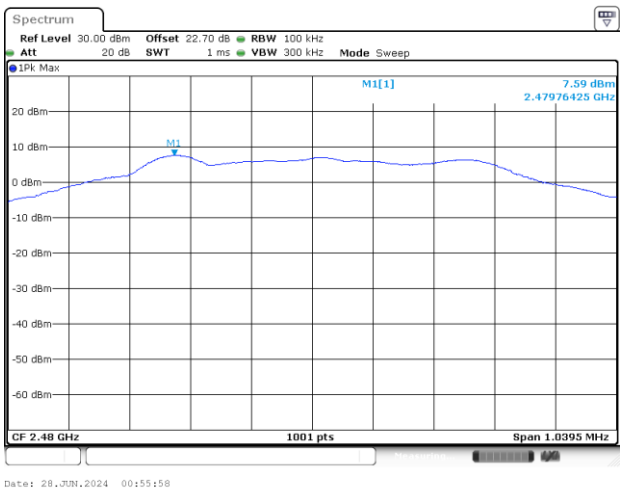
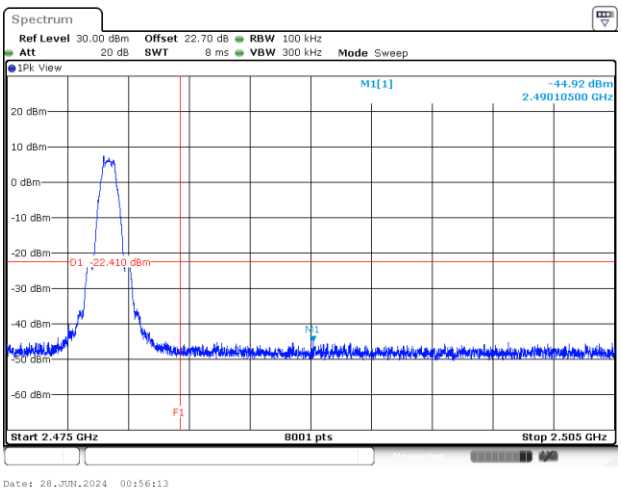
TEST RESULTS DATA
Average Power Table

Mod.	Data Rate	N_{TX}	CH.	Freq. (MHz)	Average Conducted Power (dBm)	Conducted Power Limit (dBm)	DG (dBi)	EIRP Power (dBm)	EIRP Power Limit (dBm)	Pass /Fail
BLE	500kbps	1	0	2402	7.50	30.00	1.53	9.03	36.00	Pass
BLE	500kbps	1	19	2440	7.50	30.00	1.53	9.03	36.00	Pass
BLE	500kbps	1	39	2480	7.40	30.00	1.53	8.93	36.00	Pass

Band Edge and Conducted Spurious Emission

<500kbps>

Channel 00	
100kHz PSD reference Level Plot	**Low Channel Plot**
	

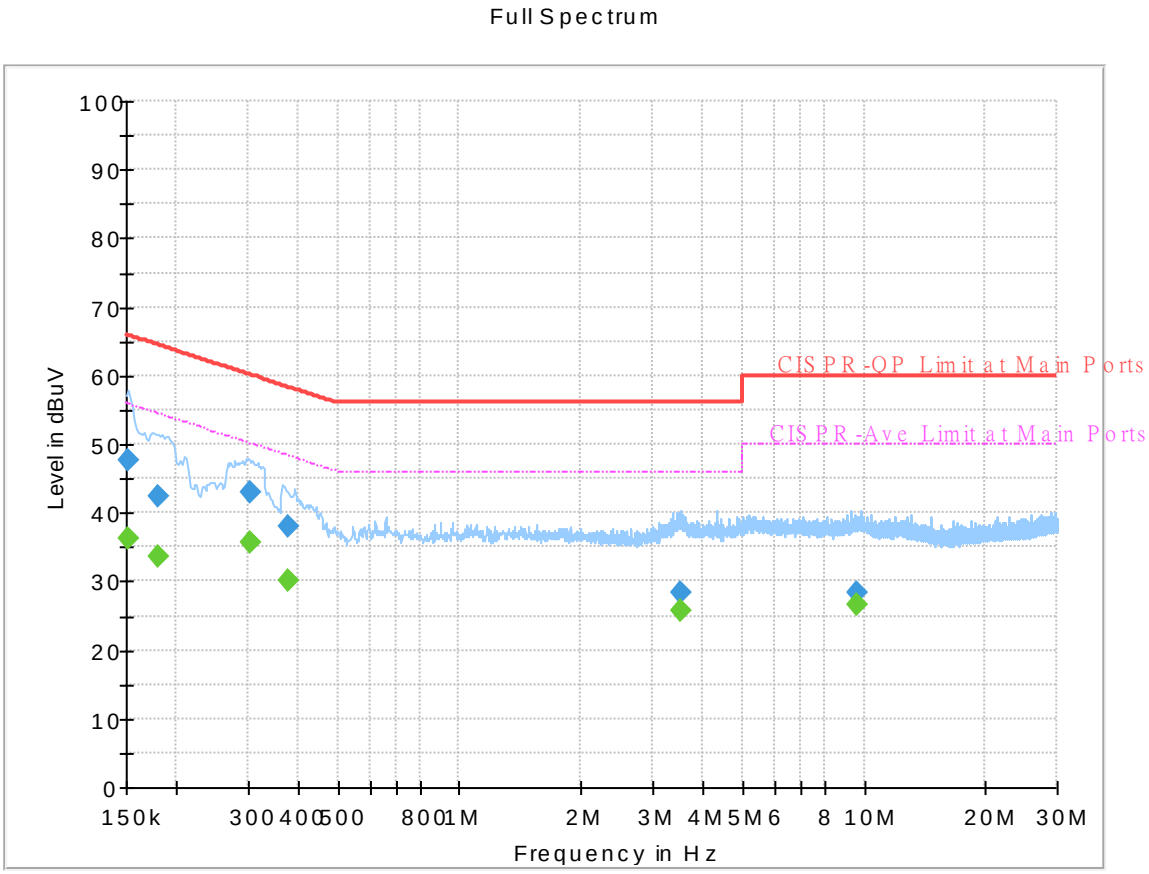
Channel 39	
100kHz PSD reference Level Plot	**High Channel Plot**
	

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Calvin Wang	**Temperature :**	23~26℃
		Relative Humidity :	45~55%

EUT Information

Report NO :	3D0610-01
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line



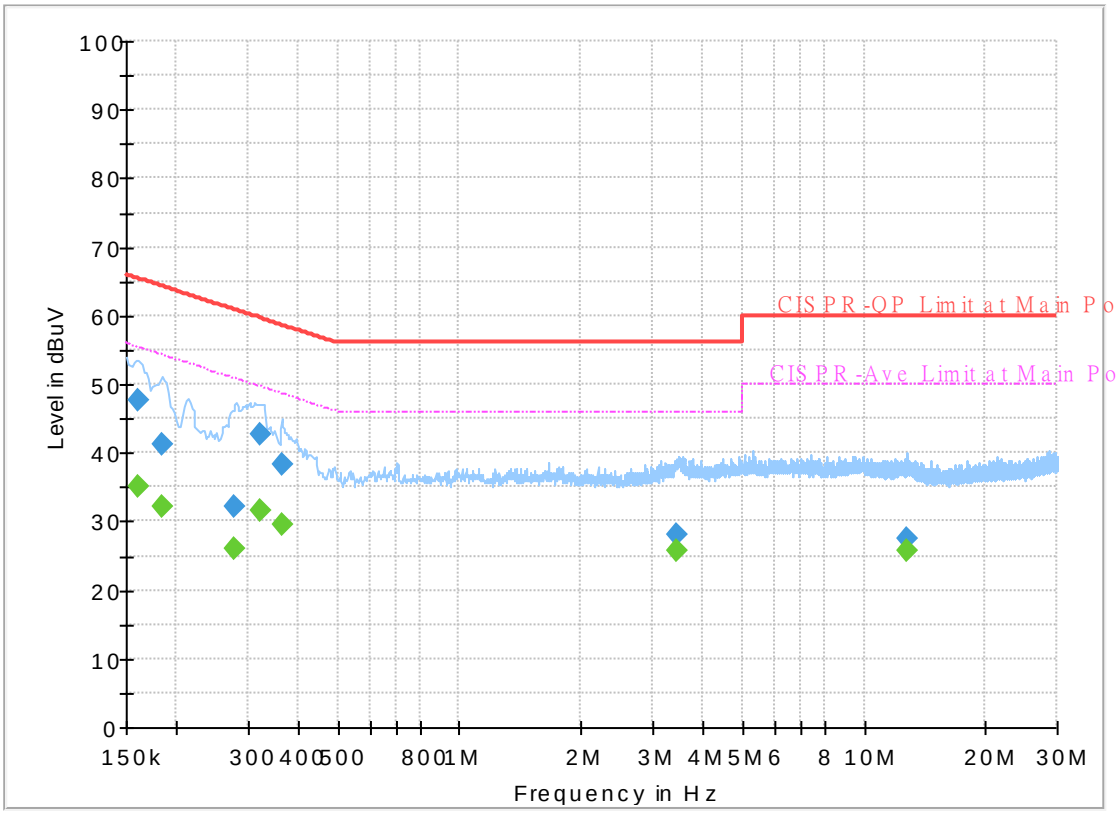
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152250	---	36.37	55.88	19.51	L1	OFF	19.8
0.152250	47.54	---	65.88	18.34	L1	OFF	19.8
0.179250	---	33.65	54.52	20.87	L1	OFF	19.8
0.179250	42.48	---	64.52	22.04	L1	OFF	19.8
0.305250	---	35.62	50.10	14.48	L1	OFF	19.8
0.305250	43.10	---	60.10	17.00	L1	OFF	19.8
0.377250	---	29.98	48.34	18.36	L1	OFF	19.8
0.377250	37.89	---	58.34	20.45	L1	OFF	19.8
3.518250	---	25.80	46.00	20.20	L1	OFF	19.9
3.518250	28.27	---	56.00	27.73	L1	OFF	19.9
9.654000	---	26.49	50.00	23.51	L1	OFF	20.1
9.654000	28.45	---	60.00	31.55	L1	OFF	20.1

EUT Information

Report NO :	3D0610-01
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.161250	---	35.22	55.40	20.18	N	OFF	19.8
0.161250	47.77	---	65.40	17.63	N	OFF	19.8
0.183750	---	32.08	54.31	22.23	N	OFF	19.8
0.183750	41.30	---	64.31	23.01	N	OFF	19.8
0.278250	---	26.12	50.87	24.75	N	OFF	19.8
0.278250	32.14	---	60.87	28.73	N	OFF	19.8
0.323250	---	31.53	49.62	18.09	N	OFF	19.8
0.323250	42.62	---	59.62	17.00	N	OFF	19.8
0.363750	---	29.40	48.64	19.24	N	OFF	19.8
0.363750	38.41	---	58.64	20.23	N	OFF	19.8
3.455250	---	25.70	46.00	20.30	N	OFF	19.9
3.455250	28.13	---	56.00	27.87	N	OFF	19.9
12.792750	---	25.78	50.00	24.22	N	OFF	20.3
12.792750	27.35	---	60.00	32.65	N	OFF	20.3

Appendix C. Radiated Spurious Emission Test Data

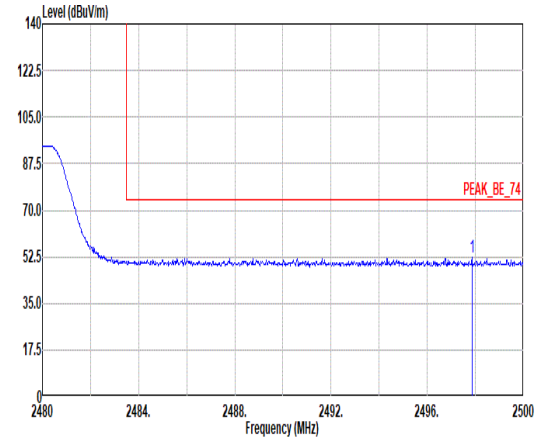
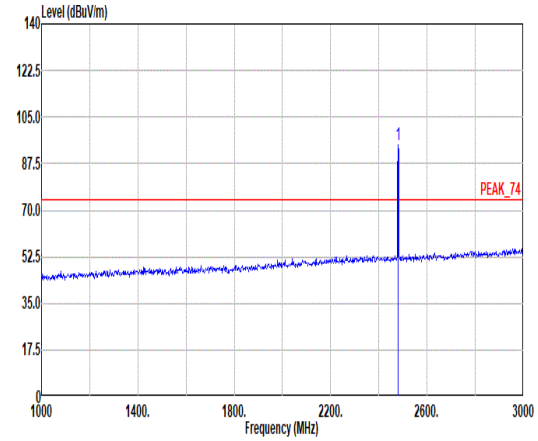
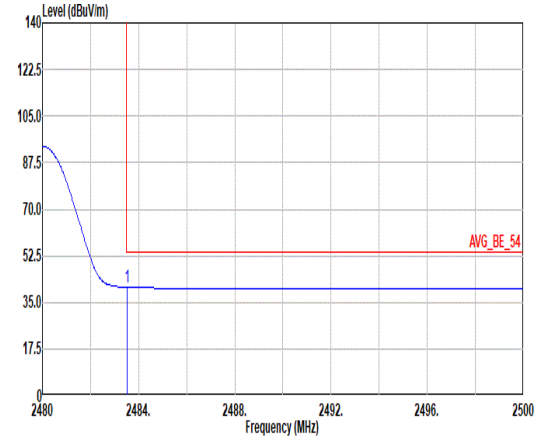
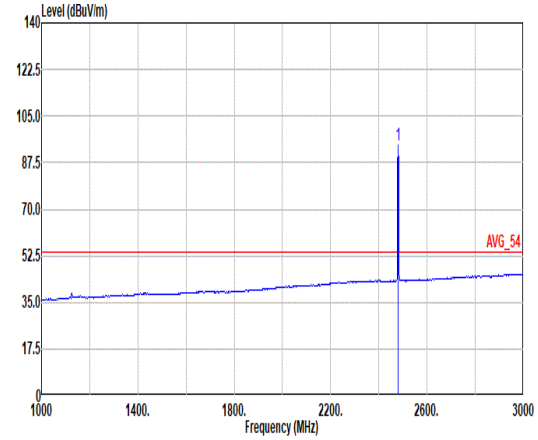
Test Engineer :	Leo Li and Lucifer Jiang	**Relative Humidity :**	51~57%
		Temperature :	21.7~22.5℃

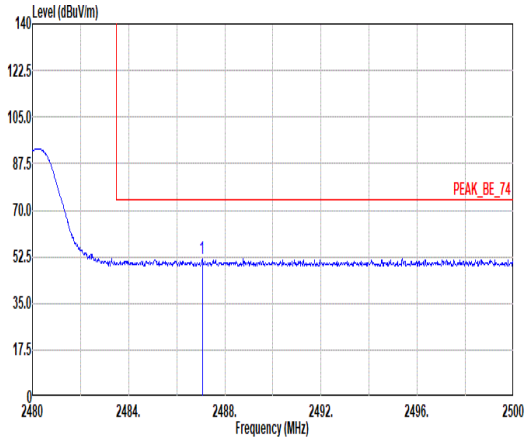
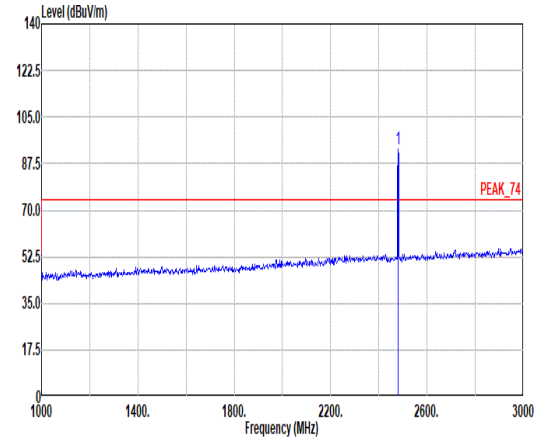
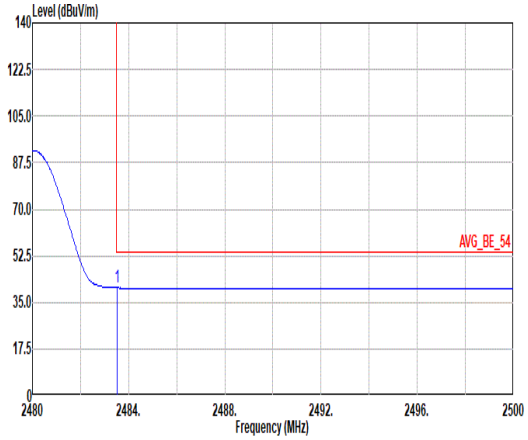
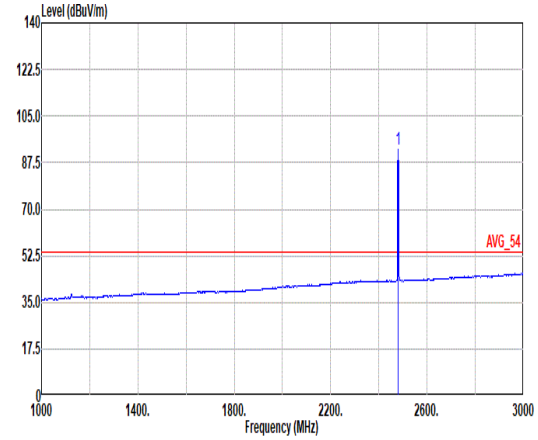
C1-1. Radiated Spurious Emission Test Modes

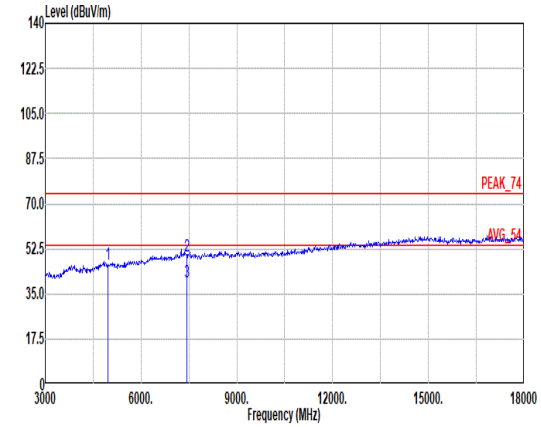
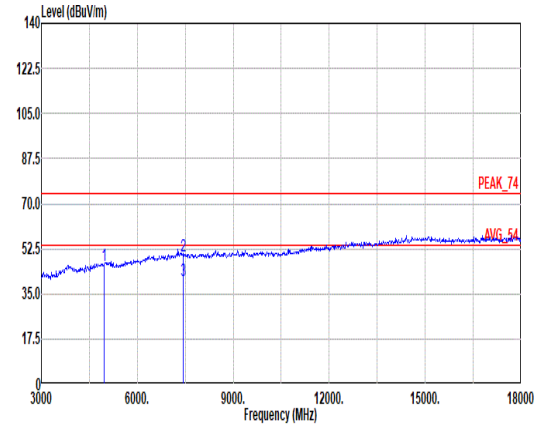
Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	2400-2483.5	SISO	Bluetooth-LE_GSFK	39	2480	500kbps	-	-
Mode 2	2400-2483.5	SISO	Bluetooth-LE_GSFK	39	2480	500kbps	-	SHF
Mode 3	2400-2483.5	SISO	Bluetooth-LE_GSFK	39	2480	500kbps	-	LF
Mode 4	2400-2483.5	SISO	Bluetooth-LE_GSFK	0	2402	500kbps	-	-

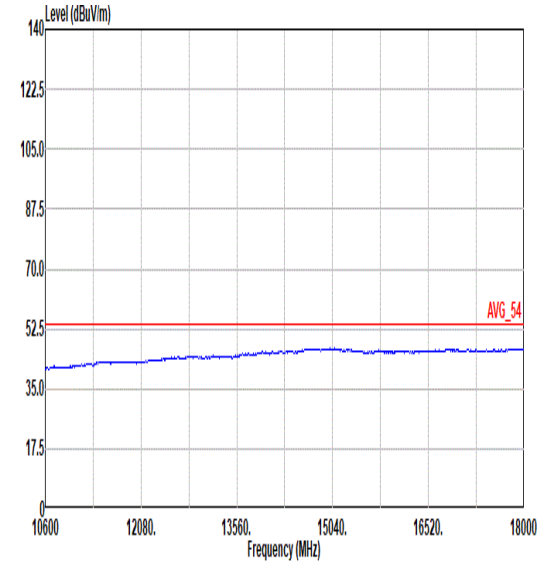
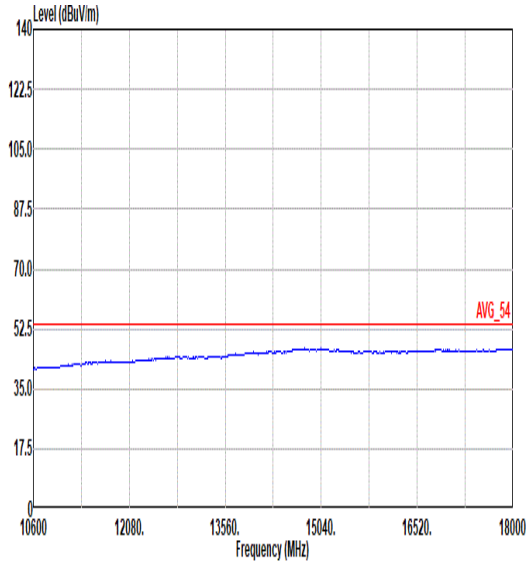
C1-2. Summary of each worse mode

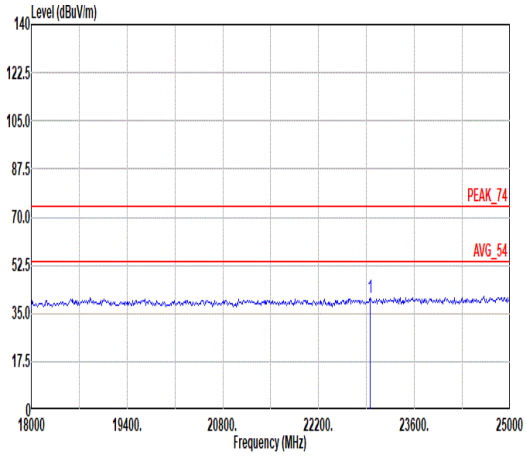
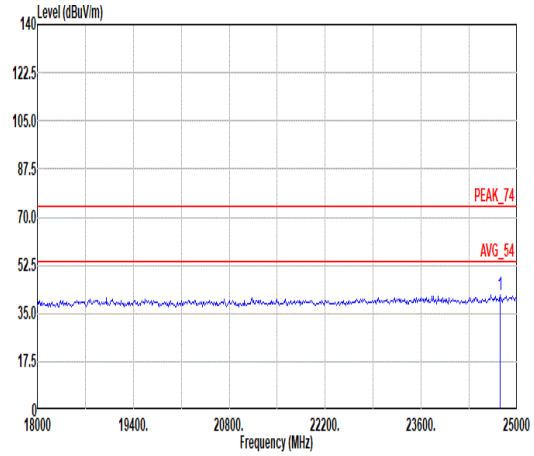
Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	RU	Remark
1	Bluetooth-LE_GSFK	39	2483.52	40.61	54.00	-13.39	H	Avg.	Pass	-	Band Edge
	Bluetooth-LE_GSFK	39	7440.00	40.01	54.00	-13.99	V	Avg.	Pass	-	Harmonic
2	SHF	39	24754.00	41.62	74.00	-32.38	V	Peak	Pass	-	SHF
3	LF	39	32.91	33.13	40.00	-6.87	V	Peak	Pass	-	LF
4	Bluetooth-LE_GSFK	0	2388.48	40.55	54.00	-13.45	H	Avg.	Pass	-	Band Edge

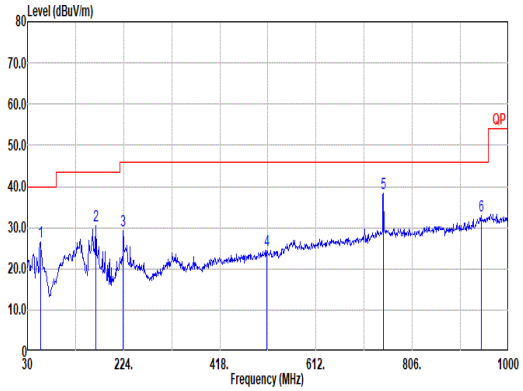
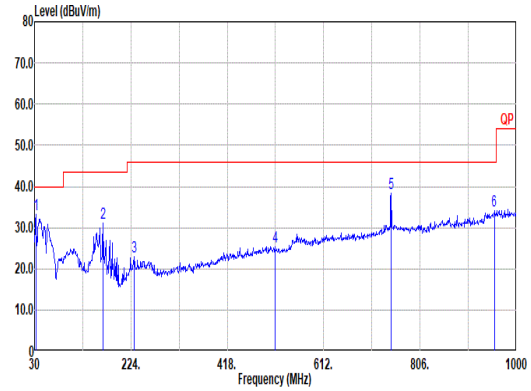
Mode	1	
	Band Edge	
	2400-2483.5_Bluetooth-LE_GSFK_CH39_2480MHz	
ANT	SISO	
Pol.	Horizontal	Fundamental
Peak	 Site : 03CH23-HY Condition: PEAK_BE_74 3m DRH18-E_LE2C05A18EN_230712 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2497.86 52.16 74.00 -21.84 39.09 26.90 7.49 31.80 10.48 100 333 PEAK	 Site : 03CH23-HY Condition: PEAK_74 3m DRH18-E_LE2C05A18EN_230712 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2480.00 94.54 ------ ------ 81.58 26.80 7.47 31.79 10.48 100 333 PEAK
Avg.	 Site : 03CH23-HY Condition: AVG_BE_54 3m DRH18-E_LE2C05A18EN_230712 HORIZONTAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2483.52 40.61 54.00 -13.39 27.61 26.84 7.47 31.79 10.48 100 333 AVERAGE	 Site : 03CH23-HY Condition: AVG_54 3m DRH18-E_LE2C05A18EN_230712 HORIZONTAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2480.00 93.96 ------ ------ 81.00 26.80 7.47 31.79 10.48 100 333 AVERAGE

Mode	1	
	Band Edge	
	2400-2483.5_Bluetooth-LE_GSFK_CH39_2480MHz	
ANT	SISO	
Pol.	Vertical	Fundamental
Peak	 Site : 03CH23-HY Condition: PEAK_BE_74 3m DRH18-E_LE2C05A18EN_230712 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2487.06 51.53 74.00 -22.47 38.49 26.87 7.48 31.79 10.48 368 23 PEAK	 Site : 03CH23-HY Condition: PEAK_74 3m DRH18-E_LE2C05A18EN_230712 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2480.00 93.16 ------ ------ 80.20 26.80 7.47 31.79 10.48 368 23 PEAK
Avg.	 Site : 03CH23-HY Condition: AVG_BE_54 3m DRH18-E_LE2C05A18EN_230712 VERTICAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2483.52 40.47 54.00 -13.53 27.47 26.84 7.47 31.79 10.48 368 23 AVERAGE	 Site : 03CH23-HY Condition: AVG_54 3m DRH18-E_LE2C05A18EN_230712 VERTICAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2480.00 92.59 ------ ------ 79.63 26.80 7.47 31.79 10.48 368 23 AVERAGE

Mode	1	
	Harmonic	
	2400-2483.5_Bluetooth-LE_GSFK_CH39_2480MHz	
ANT	SISO	
Pol.	Horizontal	Vertical
Peak Avg.	 Site : 03CH23-HY Condition: PEAK_74 3m DRH18-E_LE2C05A18EN_230712 HORIZONTAL Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 4960.00 46.52 74.00 -27.48 34.48 32.78 10.48 32.98 1.76 -- -- PEAK 2 7440.00 49.58 74.00 -24.42 33.32 37.10 12.82 35.65 1.99 -- -- PEAK 3 7440.00 39.64 54.00 -14.36 23.38 37.10 12.82 35.65 1.99 -- -- AVERAGE	 Site : 03CH23-HY Condition: PEAK_74 3m DRH18-E_LE2C05A18EN_230712 VERTICAL Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 4960.00 46.19 74.00 -27.81 34.15 32.78 10.48 32.98 1.76 -- -- PEAK 2 7440.00 49.60 74.00 -24.40 33.34 37.10 12.82 35.65 1.99 -- -- PEAK 3 7440.00 40.01 54.00 -13.99 23.75 37.10 12.82 35.65 1.99 -- -- AVERAGE

Mode	1	
	Harmonic	
	2400-2483.5_Bluetooth-LE_GSFK_CH39_2480MHz	
ANT	SISO	
Pol.	Horizontal	Vertical
10.6G ~18G Avg.	 Site : 03CH23-HY Condition: AVG_54 3m DRH18-E_LE2C05A18EN_230712 HORIZONTAL	 Site : 03CH23-HY Condition: AVG_54 3m DRH18-E_LE2C05A18EN_230712 VERTICAL

Mode	2	
	SHF	
	2400-2483.5_Bluetooth-LE_GSFK_CH39_2480MHz	
ANT	SISO	
Pol.	Horizontal	Vertical
Peak	 Site : 03CH23-HY Condition: PEAK_74 1m BBHA9170_1225_230710 HORIZONTAL Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 22950.00 40.76 74.00 -33.24 51.68 39.20 19.73 60.31 -9.54 -- -- Peak	 Site : 03CH23-HY Condition: PEAK_74 1m BBHA9170_1225_230710 VERTICAL Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 24754.00 41.62 74.00 -32.38 51.14 39.59 20.78 60.35 -9.54 -- -- Peak

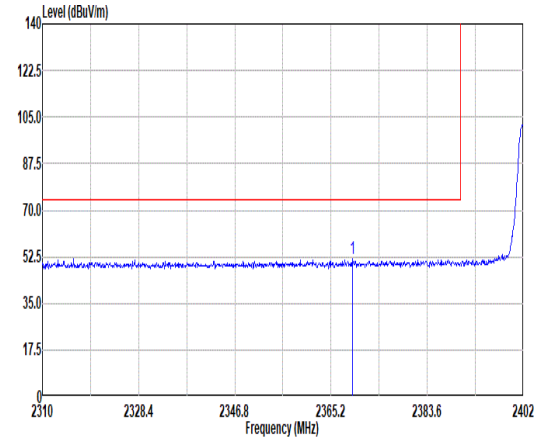
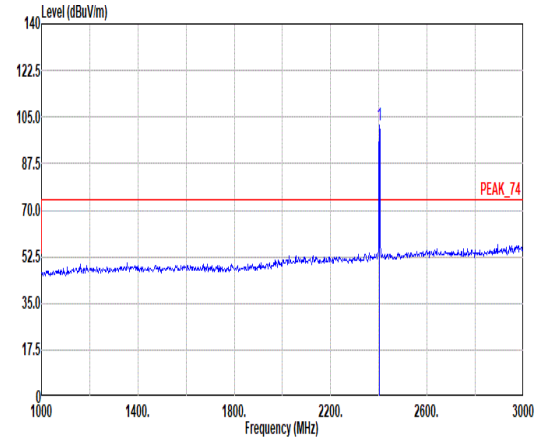
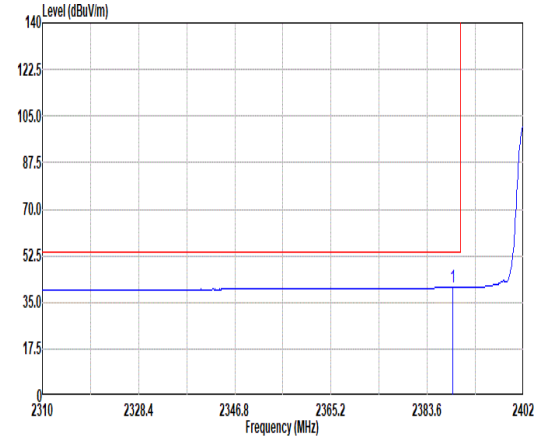
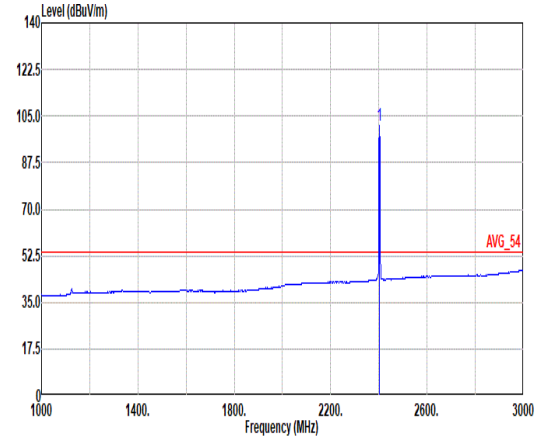
Mode	3	
	LF	
	2400-2483.5_Bluetooth-LE_GSFK_CH39_2480MHz	
ANT	SISO	
Pol.	Horizontal	Vertical
QP/ Peak		

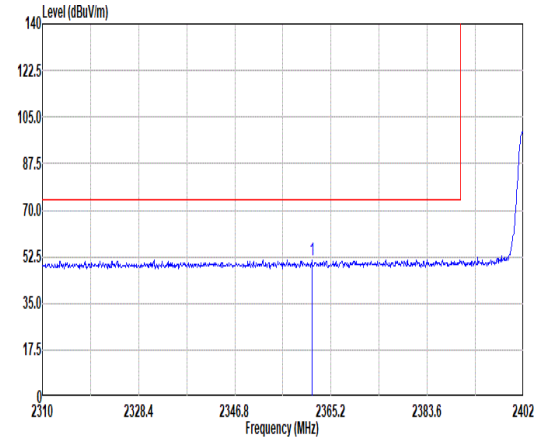
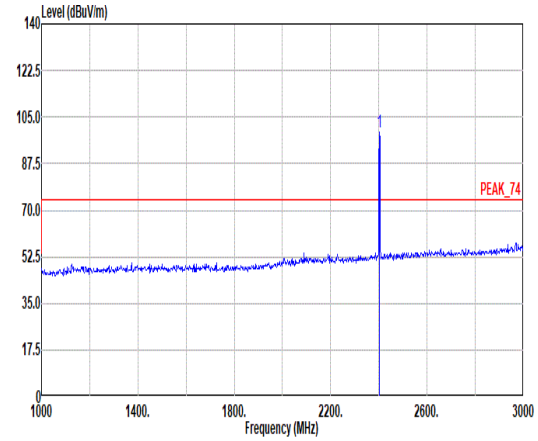
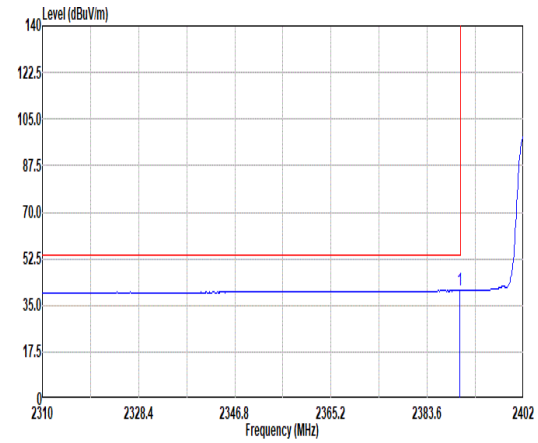
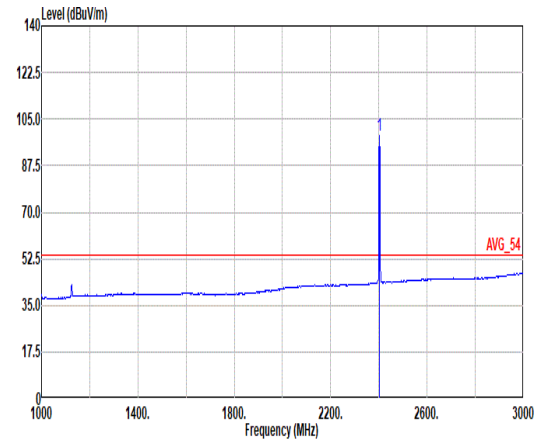
Site : 03CH23-HY
Condition: QP 3m CBL6111D_62028 & 003_231015 HORIZONTAL

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	56.19	26.50	40.00	-13.50	45.45	12.38	1.34	32.71	0.04	--	--	Peak
2	167.74	30.64	43.50	-12.86	45.12	15.98	2.02	32.68	0.20	--	--	Peak
3	223.03	29.19	46.00	-16.81	44.01	15.45	2.24	32.68	0.17	--	--	Peak
4	512.09	24.54	46.00	-21.46	29.87	24.16	3.28	32.92	0.15	--	--	Peak
5	747.80	38.44	46.00	-7.56	38.85	28.26	3.89	32.70	0.14	--	--	Peak
6	944.71	33.05	46.00	-12.95	29.33	30.57	4.29	31.39	0.25	--	--	Peak

Site : 03CH23-HY
Condition: QP 3m CBL6111D_62028 & 003_231015 VERTICAL

	Freq	Level	Limit Line	Margin	Read Level	Ant Factor	Cable Loss	Preamp Factor	Aux Factor	APos	TPos	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	dB	cm	deg	
1	32.91	33.13	40.00	-6.87	41.34	23.46	1.06	32.73	0.00	--	--	Peak
2	167.74	31.08	43.50	-12.42	45.56	15.98	2.02	32.68	0.20	--	--	Peak
3	230.79	22.84	46.00	-23.16	36.87	16.22	2.27	32.69	0.17	--	--	Peak
4	514.03	25.50	46.00	-20.50	30.81	24.17	3.29	32.92	0.15	--	--	Peak
5	747.80	38.44	46.00	-7.56	38.85	28.26	3.89	32.70	0.14	--	--	Peak
6	955.38	34.06	46.00	-11.94	29.79	30.99	4.31	31.29	0.26	--	--	Peak

Mode	4	
	Band Edge	
	2400-2483.5_Bluetooth-LE_GSFK_CH0_2402MHz	
ANT	SISO	
Pol.	Horizontal	Fundamental
Peak	 Site : 03CH23-HY Condition: PEAK_BE_74 3m 9120D_1212_240321 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2369.25 51.63 74.00 -22.37 38.32 27.30 7.30 31.72 10.43 107 118 PEAK	 Site : 03CH23-HY Condition: PEAK_74 3m 9120D_1212_240321 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 102.14 ------ ------ 88.58 27.50 7.36 31.74 10.44 107 118 PEAK
Avg.	 Site : 03CH23-HY Condition: AVG_BE_54 3m 9120D_1212_240321 HORIZONTAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2388.48 40.55 54.00 -13.45 27.12 27.38 7.34 31.73 10.44 107 118 AVERAGE	 Site : 03CH23-HY Condition: AVG_54 3m 9120D_1212_240321 HORIZONTAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 101.60 ------ ------ 88.04 27.50 7.36 31.74 10.44 107 118 AVERAGE

Mode	4	
	Band Edge	
	2400-2483.5_Bluetooth-LE_GSFK_CH0_2402MHz	
ANT	SISO	
Pol.	Vertical	Fundamental
Peak	 Site : 03CH23-HY Condition: PEAK_BE_74 3m 9120D_1212_240321 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2361.52 51.50 74.00 -22.50 38.19 27.30 7.29 31.71 10.43 300 30 PEAK	 Site : 03CH23-HY Condition: PEAK_74 3m 9120D_1212_240321 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 99.41 ------ ------ 85.85 27.50 7.36 31.74 10.44 300 30 PEAK
Avg.	 Site : 03CH23-HY Condition: AVG_BE_54 3m 9120D_1212_240321 VERTICAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2389.76 40.51 54.00 -13.49 27.06 27.40 7.34 31.73 10.44 300 30 AVERAGE	 Site : 03CH23-HY Condition: AVG_54 3m 9120D_1212_240321 VERTICAL : RBW:1000.000kHz VBW:0.010kHz SWT:Auto Freq Level Limit Line Margin Read Level Ant Factor Cable Loss Preamp Factor Aux Factor APos TPos Remark MHz dBuV/m dBuV/m dB dBuV dB/m dB dB dB cm deg 1 2402.00 98.87 ------ ------ 85.31 27.50 7.36 31.74 10.44 300 30 AVERAGE

Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
Bluetooth - LE for 500kbps	100.00	-	-	10Hz

Bluetooth - LE for 500kbps