FCC RADIO TEST REPORT

FCC ID	:	**2AVDZCM27**
Equipment	:	**IEEE 802.11 2X2 MIMO a/b/g/n/ac Wireless LAN + Bluetooth + NFC NGFF Module**
Brand Name	:	**LiveU**
Applicant	:	**LiveU, Inc 2 University Plaza Drive Suite 505, Hackensack, New Jersey**
Manufacturer	:	**LiveU Ltd. 5 Hagavish St, Kfar Saba 4442211, Israel**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Jan. 15, 2022 and testing was performed from Jan. 24, 2022 to Jul. 26, 2022. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Neil Kao

Approved by: Neil Kao

Sporton International (USA) Inc.

1175 Montague Expressway, Milpitas, CA 95035

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History of this test report

Report No.	Version	Description	Issue Date
FR220103001A	01	Initial issue of report	Jul. 22, 2022
FR220103001A	02	1. Revise section 3.2.8 2. Revise Appendix B and Appendix C	Aug. 02, 2022

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	15.247(a)(1)	Number of Channels	-	See Note
-	15.247(a)(1)	Hopping Channel Separation	-	See Note
-	15.247(a)(1)	Dwell Time of Each Channel	-	See Note
-	15.247(a)(1)	20dB Bandwidth	-	See Note
-	2.1049	99% Occupied Bandwidth	-	See Note
3.1	15.247(b)(1)	Peak Output Power	Pass	-
-	15.247(d)	Conducted Band Edges	-	See Note
-	15.247(d)	Conducted Spurious Emission	-	See Note
3.2	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	1.72 dB under the limit at 4804.000 MHz for Quasi-Peak
3.3	15.207	AC Conducted Emission	Pass	21.66 dB under the limit at 22.876 MHz
3.4	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Note: The module (FCC ID: 2AVDZCM27) inside the host (Model LU800) makes no significant difference in conducted output power which is a bit lower compared to the original module report after the measurements, hence, the conducted test results can be leveraged from the original module report.

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

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac.

Product Feature	
Installed into the Host	Equipment Name: Live Video Transmission System Brand Name: LiveU Model Name: LU800
Sample 1	Module 0
Sample 2	Module 1
Antenna Type	WLAN: **<Ant. 1>:** PCB Printed Antenna Inverted F **<Ant. 2>:** PCB Printed Antenna Inverted F **<Ant. 3>:** PCB Printed Antenna Inverted F **<Ant. 4>:** PCB Printed Antenna Inverted F Bluetooth: **<Ant. 1>:** PCB Printed Antenna Inverted F **<Ant. 3>:** PCB Printed Antenna Inverted F

Antenna information		
2400 MHz ~ 2483.5 MHz	Peak Gain (dBi)	**<Ant. 1>:** 0.62 dBi
		<Ant. 3>: 4.18 dBi

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

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International (USA) Inc.		
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300		
Test Site No.	**Sporton Site No.**		
	TH01-CA	CO01-CA	03CH02-CA
Test Engineer	LilianaGonzalez	Yuan Lee	Michael Bui, Daniel Lee, Yuan Lee and Fu Chen
Temperature (℃)	15.4~25℃	20~22	20~25
Relative Humidity (%)	31.8~52.6%	40~42	42~50

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

1.4 Applicable Standards

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

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

Remark: All the test items were validated and recorded in accordance with the standards without any modification during the testing.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-

2.2 Test Mode

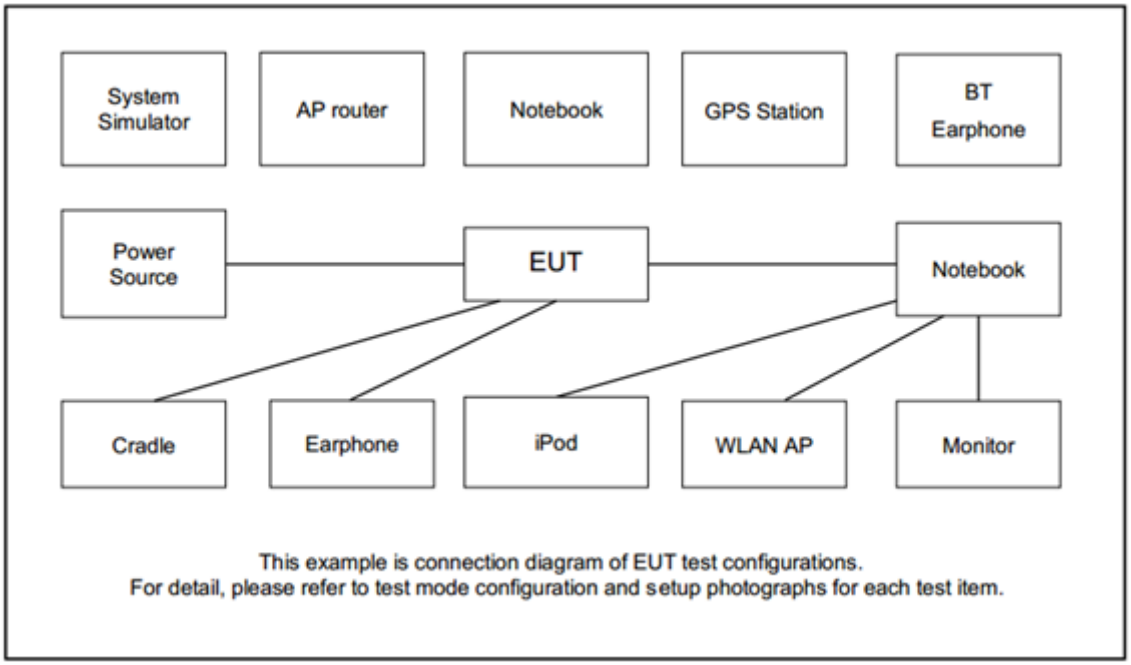
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Y plane as worst plane for Module 0, find X plane as worst plane for Module 1, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded 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 BR 1Mbps GFSK**	**Bluetooth EDR 2Mbps π/4-DQPSK**	**Bluetooth EDR 3Mbps 8-DPSK**
	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz
	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz
Radiated Test Cases	**Bluetooth BR 1Mbps GFSK**		
	Mode 1: CH00_2402 MHz		
	Mode 2: CH39_2441 MHz		
	Mode 3: CH78_2480 MHz		
AC Conducted Emission	Mode 1 :Bluetooth Tx + Charging from Adapter for Sample 1		
	Mode 2 :Bluetooth Tx + Charging from Adapter for Sample 2		
Remark: For Radiated Test Cases, the worst mode data rate 1Mbps was reported only since the highest RF output power in the preliminary tests. The conducted spurious emissions and conducted band edge measurement for other data rates were not worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.			

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.	Laptop	Acer	Altos PS548-G1	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m

2.5 EUT Operation Test Setup

The RF test items, utility “Putty 0.62” was installed in Host 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

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

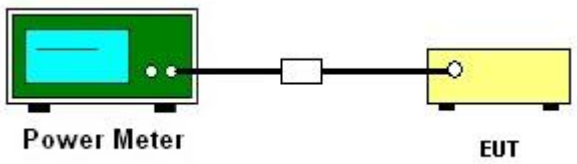
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
1. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
2. Set the maximum power setting and enable the EUT to transmit continuously.
3. Measure the conducted output power with cable loss and record the results in the test report.
4. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of Peak Power

<Sample 1>

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	**6.35**	30.00	Pass
	39	1	6.24	30.00	Pass
	78	1	6.12	30.00	Pass
2DH1	0	1	**6.31**	20.97	Pass
	39	1	6.17	20.97	Pass
	78	1	6.04	20.97	Pass
3DH1	0	1	**6.58**	20.97	Pass
	39	1	6.52	20.97	Pass
	78	1	6.23	20.97	Pass

<Sample 2>

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH1	0	1	**6.59**	20.97	Pass
	39	1	6.38	20.97	Pass
	78	1	6.34	20.97	Pass
2DH1	0	1	**6.23**	20.97	Pass
	39	1	6.03	20.97	Pass
	78	1	5.92	20.97	Pass
3DH1	0	1	**6.54**	20.97	Pass
	39	1	6.18	20.97	Pass
	78	1	6.07	20.97	Pass

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. 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.

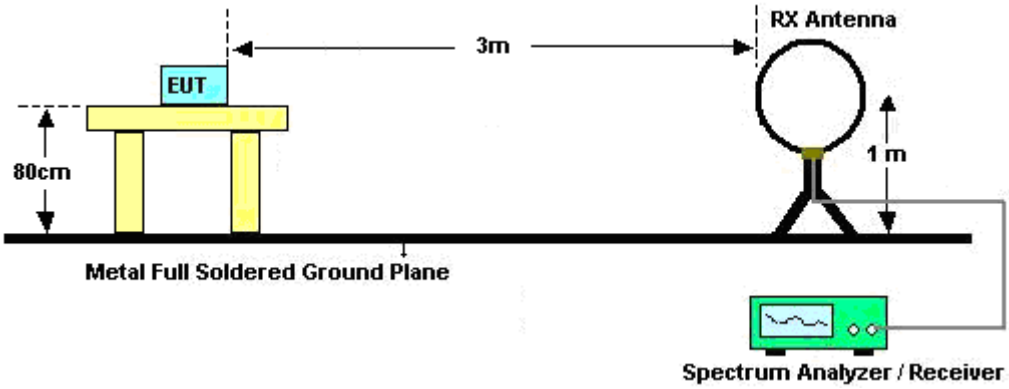
3.2.3 Test Procedures

1. The 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.
2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
3. For each suspected emission, 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 to comply with the guidelines.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. 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, RBW = 1 MHz for f>1 GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log (Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. 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 "-".
8. 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 "-".

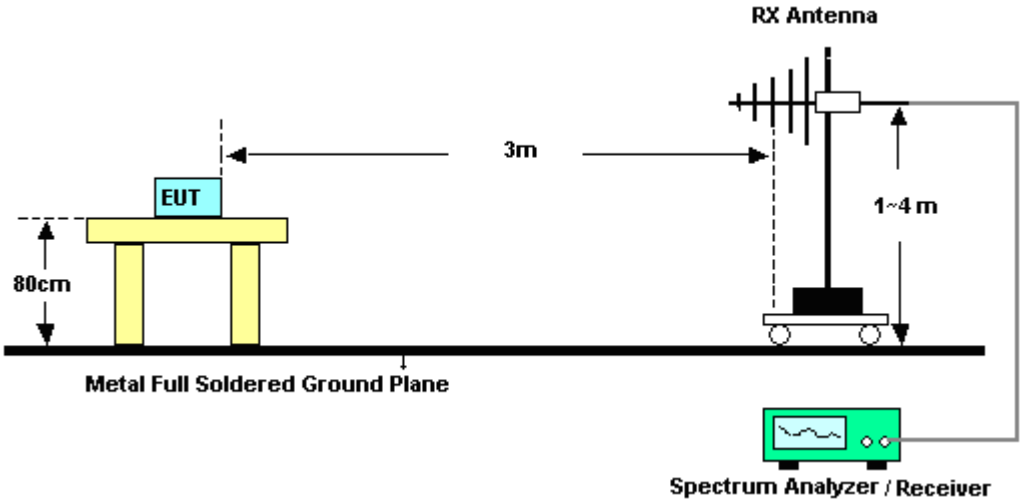
Note: The average levels are calculated from the peak level corrected with duty cycle correction factor (-10.34dB for Module 0 and Module 1) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.2.4 Test Setup

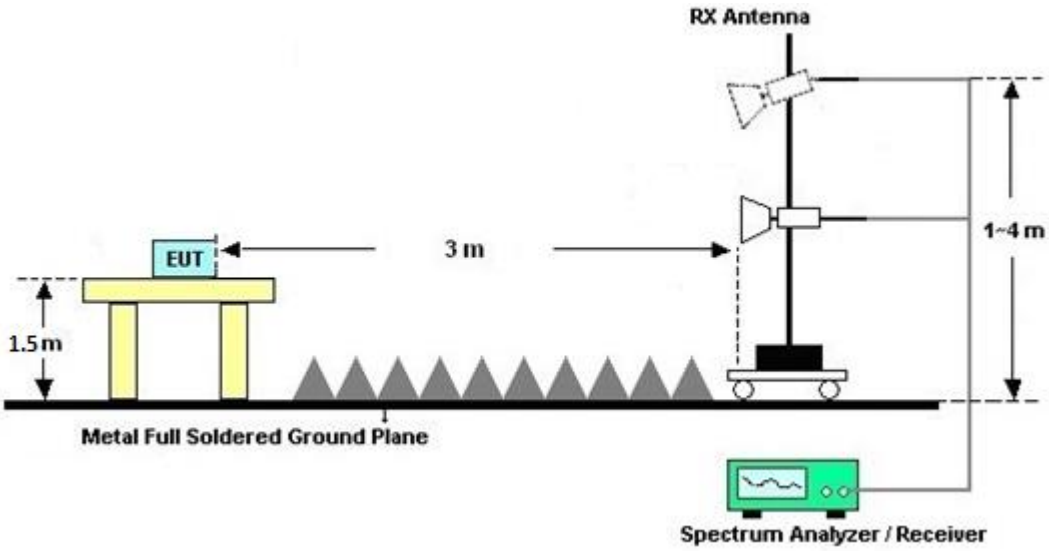
For radiated test below 30MHz



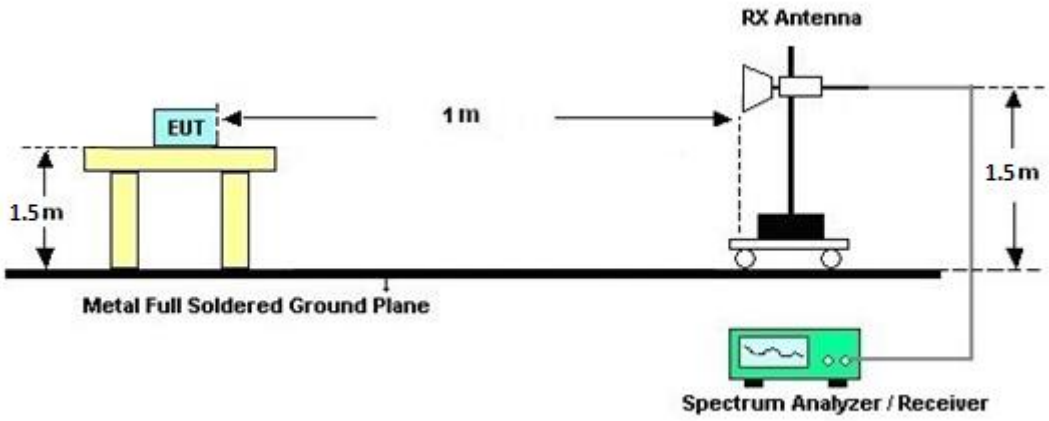
For radiated test from 30MHz to 1GHz



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 B and C.

3.2.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.

Note: When the scan with peak detector exceeds the limit associated with the average detector, additional scan with average detection was performed to show compliance with the average limit. The additional scan plot of the low channel is provided for justification.

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.

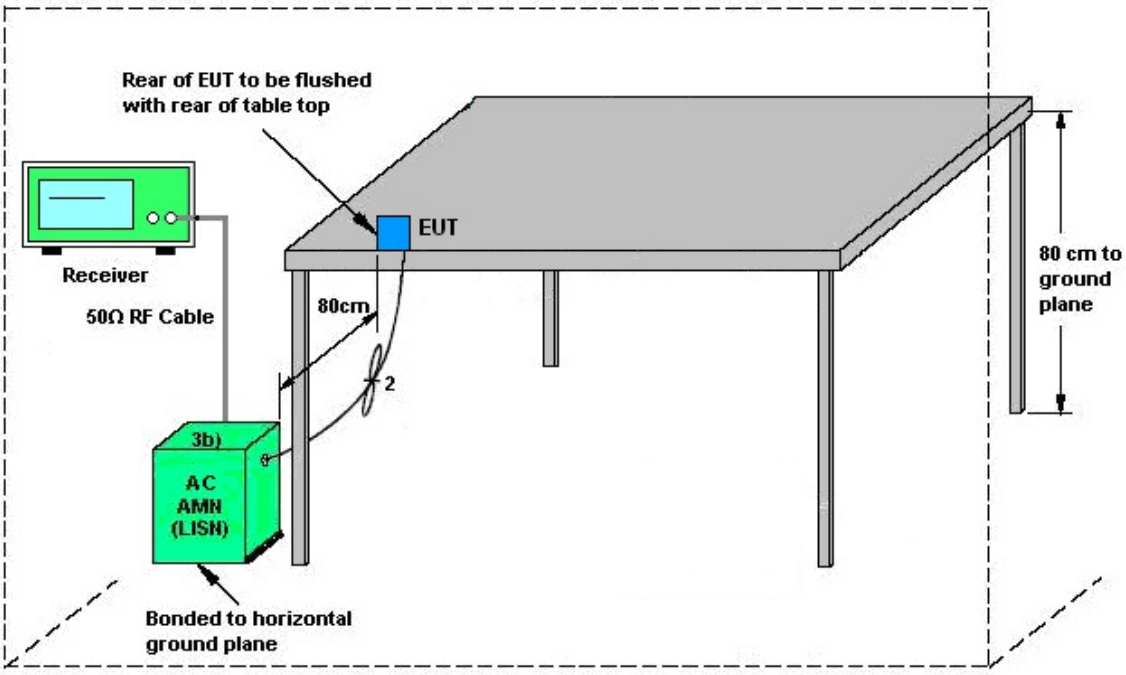
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

9. 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.
10. Connect EUT to the power mains through a line impedance stabilization network (LISN).
11. All the support units are connecting to the other LISN.
12. The LISN provides 50 ohm coupling impedance for the measuring instrument.
13. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
14. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
15. The frequency range from 150 kHz to 30 MHz is scanned.
16. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

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 A.

3.4 Antenna Requirements

3.4.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 Antenna Gain

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

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9kHz~30MHz	Jan. 07, 2022	Jan. 24, 2022~ Jul. 26, 2022	Jan. 06, 2023	Radiation (03CH02-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Oct. 15, 2021	Jan. 24, 2022~ Jul. 26, 2022	Oct. 14, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 25, 2021	Jan. 24, 2022~ Jul. 26, 2022	Aug. 24, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9170D	00842	18GHz~40GHz	Jul. 20, 2021	Jan. 24, 2022~ Jul. 18, 2022	Jul. 19, 2022	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9170D	00841	18GHz~40GHz	Aug. 26, 2021	Jul. 19, 2022~ Jul. 26, 2022	Aug. 25, 2022	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	Aug. 09, 2021	Jan. 24, 2022~ May 09, 2022	Aug. 08, 2022	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	May 10, 2022	May 10, 2022~ Jul. 26, 2022	May 09, 2023	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	Jul. 27, 2021	Jan. 24, 2022~ May 10, 2022	Jul. 26, 2022	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	May 11, 2022	May. 11, 2022~ Jul. 26, 2022	May 10, 2023	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	1GHz~18GHz	Mar. 30, 2021	Jan. 24, 2022~ Mar. 29, 2022	Mar. 29, 2022	Radiation (03CH02-CA)
Preamplifier	Jet-Power	JPA0118-55-303	1710001800055004	1GHz~18GHz	Jul. 21, 2021	Mar. 29, 2022~ May 09, 2022	Jul. 20, 2022	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	1GHz~18GHz	May 10, 2022	May 10, 2022~ Jul. 26, 2022	May 09, 2023	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz-40GHz	Jul. 21, 2021	Jan. 24, 2022~ May 09, 2022	Jul. 20, 2022	Radiation (03CH02-CA)
Preamplifier	EMEC	EMC18G40G	060725	18GHz-40GHz	May 10, 2022	May 10, 2022~ Jul. 26, 2022	May 09, 2023	Radiation (03CH02-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8024032/2, 8024062/2, 802856/2	N/A	Jun. 23, 2021	Jan. 24, 2022~ Jun. 21, 2022	Jun. 22, 2022	Radiation (03CH02-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	8024032/2, 802406/2, 802875/2	N/A	Jun. 22, 2022	Jun. 22, 2022~ Jul. 26, 2022	Jun. 21, 2023	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 22, 2021	Jan. 24, 2022~ Jul. 26, 2022	Sep. 21, 2022	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN10	3GHz High Pass Filter	Jul. 22, 2021	Jan. 24, 2022~ Jul. 20, 2022	Jul. 21, 2022	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN10	3GHz High Pass Filter	Jul. 21, 2022	Jul. 21, 2022~ Jul. 26, 2022	Jul. 20, 2023	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN1	1.2GHz Low Pass Filter	Jul. 22, 2021	Jan. 24, 2022~ Jul. 20, 2022	Jul. 21, 2022	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN1	1.2GHz Low Pass Filter	Jul. 21, 2022	Jul. 21, 2022~ Jul. 26, 2022	Jul. 20, 2023	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 04, 2021	Jan. 24, 2022~ Jul. 26, 2022	Aug. 03, 2022	Radiation (03CH02-CA)
Controller	ChainTek	EM-1000	060876	NA	N/A	Jan. 24, 2022~ Jul. 26, 2022	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jan. 24, 2022~ Jul. 26, 2022	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jan. 24, 2022~ Jul. 26, 2022	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Jan. 24, 2022~ Jul. 26, 2022	N/A	Radiation (03CH02-CA)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 30, 2021	Jan. 24, 2022~ Jul. 11, 2022	Aug. 29, 2022	Conducted (TH01-CA)
Power Sensor	EM Electronics Corporation	RPR3006W	RPR6W-1901 026	10MHz-6GHz	Jul. 26, 2021	Jan. 24, 2022~ Jul. 11, 2022	Jul. 25, 2022	Conducted (TH01-CA)
Power meter	Anritsu	ML2495A	1804004	N/A	Jul. 22, 2021	Jan. 24, 2022~ Jul. 11, 2022	Jul. 21, 2022	Conducted (TH01-CA)
Power Sensor	Anritsu	MA2411B	1726149	300MHz~40GHz	Jul. 22, 2021	Jan. 24, 2022~ Jul. 11, 2022	Jul. 21, 2022	Conducted (TH01-CA)
Switch Box & RF Cable	EM Electronics	EMSW26	1090304	N/A	Apr. 01, 2021	Jan. 24, 2022~ Mar. 29, 2022	Mar. 31, 2022	Conducted (TH01-CA)
Switch Box & RF Cable	EM Electronics	EMSW26	1090304	N/A	Mar. 30, 2022	Mar. 31, 2022~ Jul. 11, 2022	Mar. 29, 2023	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Jun. 02, 2021	Jan. 24, 2022~ May 31, 2022	Jun. 01, 2022	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Jun. 01, 2022	Jun. 02, 2022~ Jul. 11, 2022	May 31, 2023	Conducted (TH01-CA)
LISN	TESEQ	NNB51	47415	N/A	May 10, 2022	Jul. 13, 2022	May 09, 2023	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	SCHWARZBECK	VTSD 9561-F N	9561-F-N00412	N/A	Jul. 05, 2022	Jul. 13, 2022	Jul. 04, 2023	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	7GHz	May 31, 2022	Jul. 13, 2022	May 30, 2023	Conduction (CO01-CA)
Software	R&S	EMC32	N/A	Version 10.30.00	N/A	Jul. 13, 2022	N/A	Conduction (CO01-CA)

5 Uncertainty of Evaluation

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

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

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

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

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

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

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

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

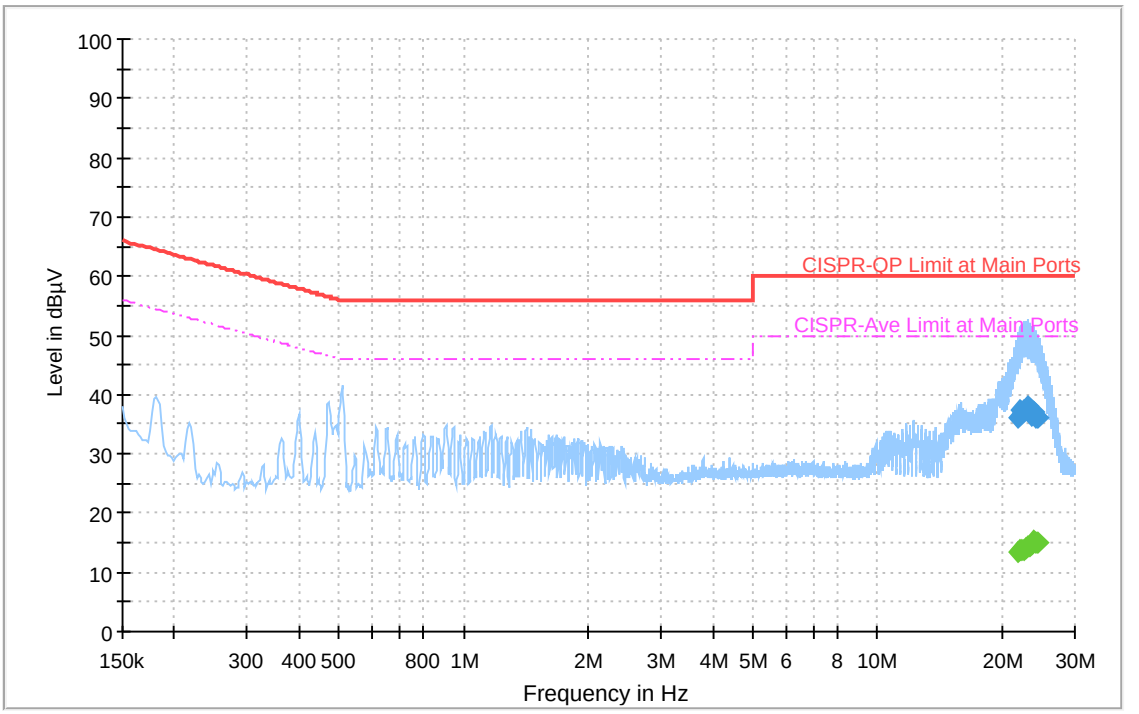
Appendix A. AC Conducted Emission Test Results

<Sample 1>

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Project	220103001

Full Spectrum



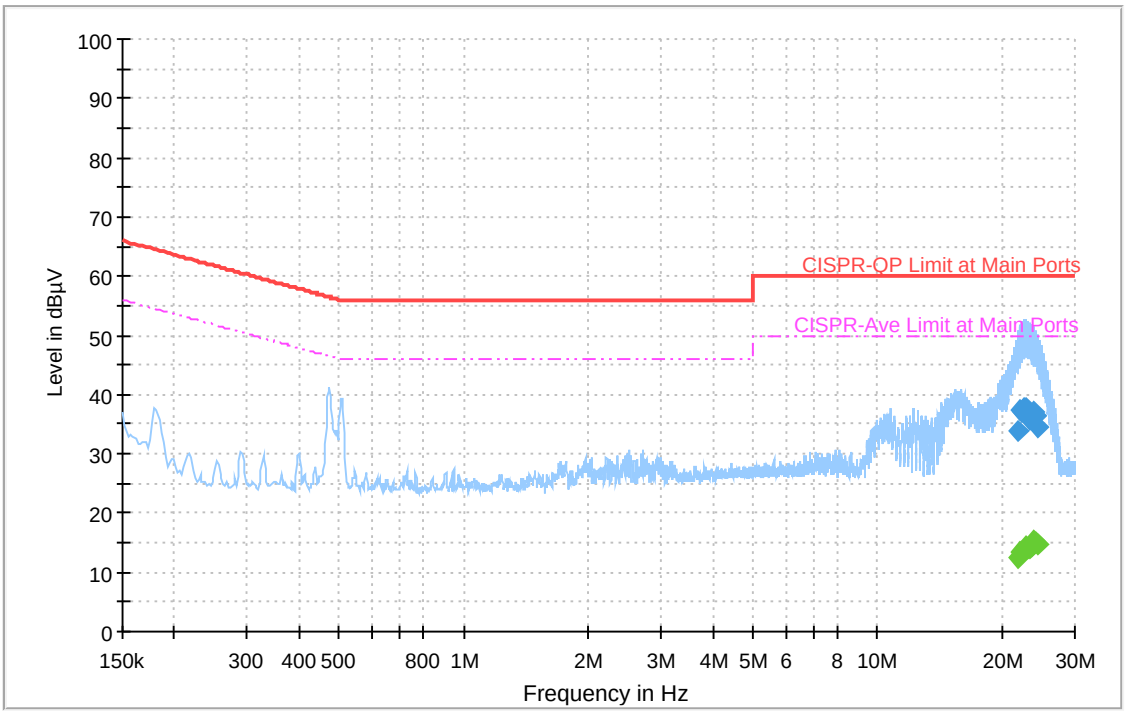
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
21.871680	---	13.40	50.00	36.60	L1	OFF	20.5
21.871680	36.16	---	60.00	23.84	L1	OFF	20.5
22.125723	---	13.82	50.00	36.18	L1	OFF	20.5
22.125723	37.25	---	60.00	22.75	L1	OFF	20.5
22.381197	---	13.64	50.00	36.36	L1	OFF	20.5
22.381197	36.96	---	60.00	23.04	L1	OFF	20.5
22.614765	---	13.61	50.00	36.39	L1	OFF	20.5
22.614765	37.48	---	60.00	22.52	L1	OFF	20.5
22.884963	---	14.08	50.00	35.92	L1	OFF	20.5
22.884963	37.49	---	60.00	22.51	L1	OFF	20.5
23.138934	---	14.44	50.00	35.56	L1	OFF	20.6
23.138934	37.87	---	60.00	22.13	L1	OFF	20.6
23.388270	---	14.34	50.00	35.66	L1	OFF	20.6
23.388270	37.34	---	60.00	22.66	L1	OFF	20.6
23.646921	---	14.65	50.00	35.35	L1	OFF	20.6
23.646921	36.43	---	60.00	23.57	L1	OFF	20.6
23.932212	---	15.20	50.00	34.80	L1	OFF	20.6
23.932212	37.03	---	60.00	22.97	L1	OFF	20.6
24.187542	---	14.95	50.00	35.05	L1	OFF	20.6
24.187542	35.98	---	60.00	24.02	L1	OFF	20.6
24.440460	---	14.89	50.00	35.11	L1	OFF	20.6
24.440460	36.05	---	60.00	23.95	L1	OFF	20.6

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Project	220103001

Full Spectrum



Final_Result

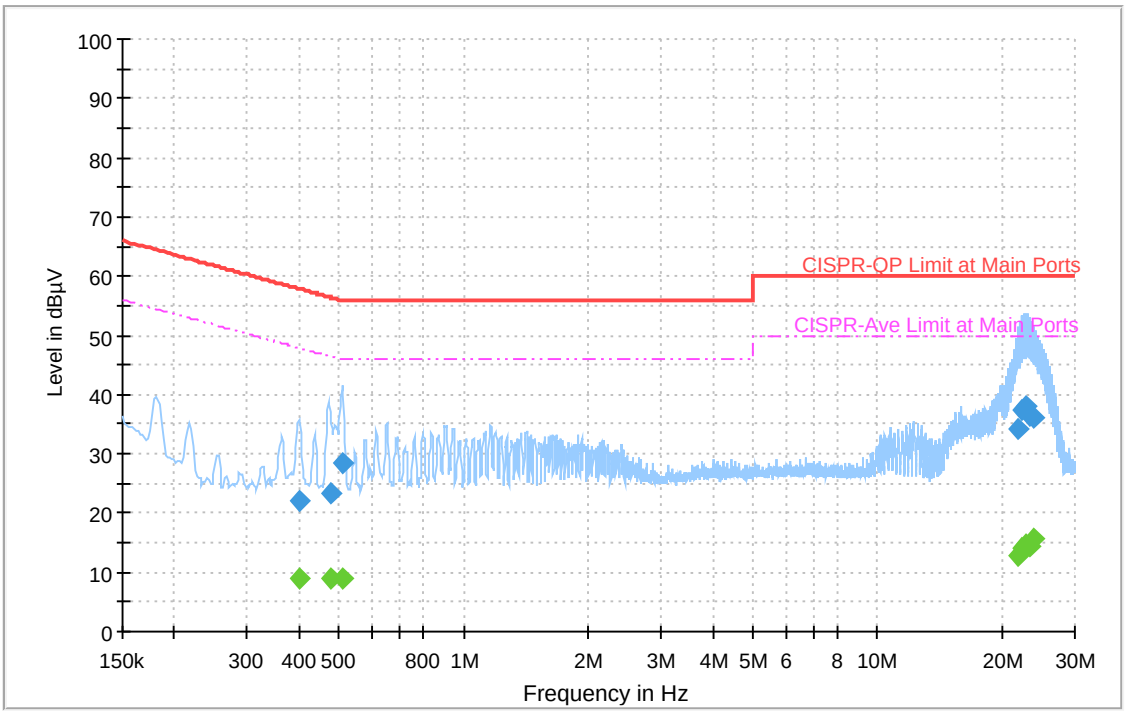
Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
21.840378	---	12.60	50.00	37.40	N	OFF	20.5
21.840378	33.72	---	60.00	26.28	N	OFF	20.5
22.127766	---	13.56	50.00	36.44	N	OFF	20.5
22.127766	37.25	---	60.00	22.75	N	OFF	20.5
22.366572	---	13.37	50.00	36.63	N	OFF	20.5
22.366572	37.12	---	60.00	22.88	N	OFF	20.5
22.631424	---	13.72	50.00	36.28	N	OFF	20.5
22.631424	37.54	---	60.00	22.46	N	OFF	20.5
22.880778	---	14.27	50.00	35.73	N	OFF	20.5
22.880778	37.73	---	60.00	22.27	N	OFF	20.5
23.139024	---	14.16	50.00	35.84	N	OFF	20.5
23.139024	37.15	---	60.00	22.85	N	OFF	20.5
23.393193	---	14.04	50.00	35.96	N	OFF	20.5
23.393193	35.92	---	60.00	24.08	N	OFF	20.5
23.645571	---	14.26	50.00	35.74	N	OFF	20.5
23.645571	35.95	---	60.00	24.05	N	OFF	20.5
23.937189	---	15.23	50.00	34.77	N	OFF	20.5
23.937189	37.17	---	60.00	22.83	N	OFF	20.5
24.189747	---	15.11	50.00	34.89	N	OFF	20.5
24.189747	36.46	---	60.00	23.54	N	OFF	20.5
24.434664	---	14.68	50.00	35.32	N	OFF	20.5
24.434664	34.51	---	60.00	25.49	N	OFF	20.5

<Sample 2>

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Project	220103001

Full Spectrum



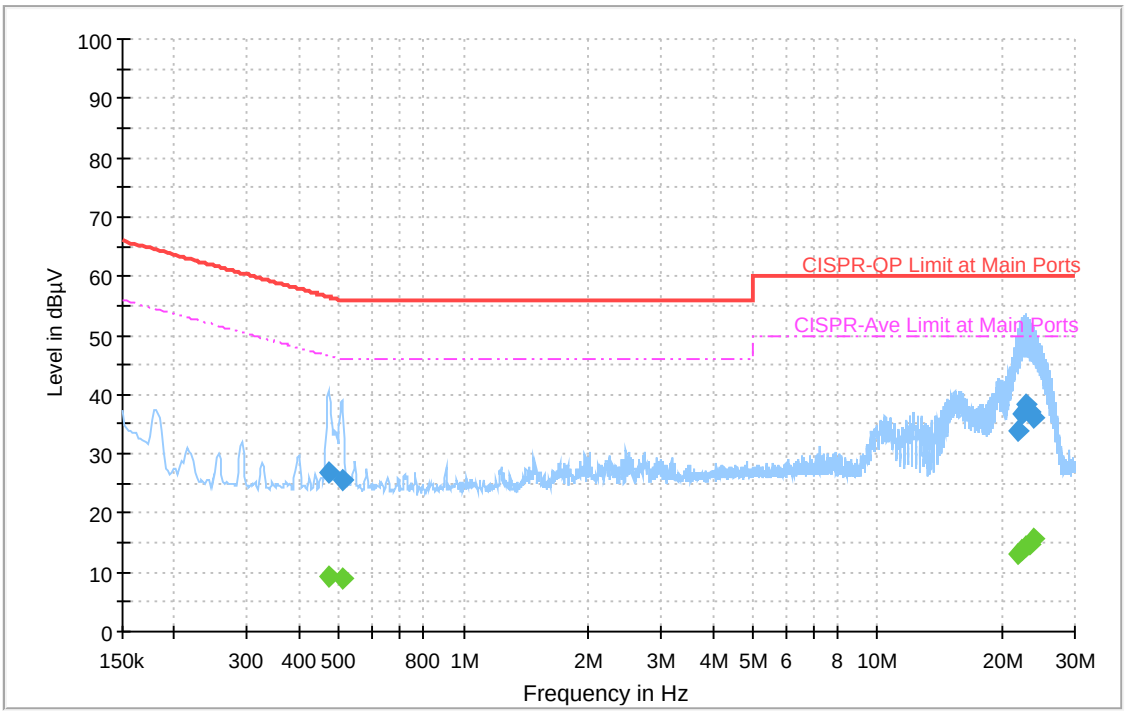
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.400083	---	8.86	47.85	38.99	L1	OFF	20.3
0.400083	22.09	---	57.85	35.76	L1	OFF	20.3
0.475368	---	9.08	46.42	37.34	L1	OFF	20.3
0.475368	23.20	---	56.42	33.22	L1	OFF	20.3
0.509073	---	9.02	46.00	36.98	L1	OFF	20.3
0.509073	28.54	---	56.00	27.46	L1	OFF	20.3
21.832161	---	12.92	50.00	37.08	L1	OFF	20.5
21.832161	34.06	---	60.00	25.94	L1	OFF	20.5
22.375086	---	14.12	50.00	35.88	L1	OFF	20.5
22.375086	37.41	---	60.00	22.59	L1	OFF	20.5
22.881507	---	14.70	50.00	35.30	L1	OFF	20.5
22.881507	38.15	---	60.00	21.85	L1	OFF	20.5
23.379531	---	14.43	50.00	35.57	L1	OFF	20.6
23.379531	36.34	---	60.00	23.66	L1	OFF	20.6
23.923599	---	15.72	50.00	34.28	L1	OFF	20.6
23.923599	36.04	---	60.00	23.96	L1	OFF	20.6

EUT Information

Site:	CO01-CA
Power:	120Vac/60Hz
Project	220103001

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.473118	---	9.17	46.46	37.29	N	OFF	20.3
0.473118	26.93	---	56.46	29.53	N	OFF	20.3
0.508956	---	8.80	46.00	37.20	N	OFF	20.3
0.508956	25.53	---	56.00	30.47	N	OFF	20.3
21.831036	---	13.03	50.00	36.97	N	OFF	20.5
21.831036	33.86	---	60.00	26.14	N	OFF	20.5
22.375059	---	13.85	50.00	36.15	N	OFF	20.5
22.375059	36.74	---	60.00	23.26	N	OFF	20.5
22.876026	---	14.51	50.00	35.49	N	OFF	20.5
22.876026	38.34	---	60.00	21.66	N	OFF	20.5
23.381376	---	14.57	50.00	35.43	N	OFF	20.5
23.381376	37.06	---	60.00	22.94	N	OFF	20.5
23.917533	---	15.55	50.00	34.45	N	OFF	20.5
23.917533	36.15	---	60.00	23.85	N	OFF	20.5

Appendix B. Radiated Spurious Emission

Test Engineer :	Michael Bui, Daniel Lee, Yuan Lee and Fu Chen	Temperature :	20~25°C
		Relative Humidity :	42~50%

<Sample 1>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH00 2402MHz		2371.32	45.74	-28.26	74	42.12	27.73	7.41	31.52	168	113	P	H
		2371.32	3.36	-50.64	54	-	-	-	-	-	-	A	H
	*	2402	98.47	-	-	94.84	27.66	7.46	31.49	168	113	P	H
	*	2402	56.09	-	-	-	-	-	-	-	-	A	H
													H
		2317.035	45.45	-28.55	74	41.74	27.93	7.32	31.54	197	163	P	V
		2317.035	3.07	-50.93	54	-	-	-	-	-	-	A	V
	*	2402	100	-	-	96.29	27.74	7.46	31.49	197	163	P	V
	*	2402	57.62	-	-	-	-	-	-	-	-	A	V
													V
BT CH 39 2441MHz		2333.52	47.69	-26.31	74	43.78	27.86	7.36	31.31	163	115	P	H
		2333.52	5.31	-48.69	54	-	-	-	-	-	-	A	H
	*	2441	98.56	-	-	94.63	27.66	7.53	31.26	163	115	P	H
	*	2441	56.18	-	-	-	-	-	-	-	-	A	H
		2484.81	46.57	-27.43	74	42.6	27.62	7.59	31.24	163	115	P	H
		2484.81	4.19	-49.81	54	-	-	-	-	-	-	A	H
		2333.1	47.76	-26.24	74	43.79	27.92	7.36	31.31	191	148	P	V
		2333.1	5.38	-48.62	54	-	-	-	-	-	-	A	V
	*	2441	100.36	-	-	96.5	27.59	7.53	31.26	191	148	P	V
	*	2441	57.98	-	-	-	-	-	-	-	-	A	V
		2485.72	45.24	-28.76	74	41.38	27.51	7.59	31.24	191	148	P	V
		2485.72	2.86	-51.14	54	-	-	-	-	-	-	A	V

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz	*	2480	98.74	-	-	94.77	27.63	7.58	31.24	161	111	P	H
	*	2480	56.36	-	-	-	-	-	-	-	-	A	H
		2484	52.18	-21.82	74	48.21	27.62	7.59	31.24	161	111	P	H
		2484	9.8	-44.2	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	101.46	-	-	97.61	27.51	7.58	31.24	207	171	P	V
	*	2480	59.08	-	-	-	-	-	-	-	-	A	V
		2483.52	54.39	-19.61	74	50.53	27.51	7.59	31.24	207	171	P	V
		2483.52	12.01	-41.99	54	-	-	-	-	-	-	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 00 2402MHz		4804	37.93	-36.07	74	62.86	31.51	11.44	67.88	-	-	P	H
		4804	-4.45	-58.45	54	-	-	-	-	-	-	A	H
		11355	49.21	-24.79	74	59.88	39.91	17.62	68.2	-	-	P	H
		11355	6.83	-47.17	54	-	-	-	-	-	-	A	H
		14490	52.72	-21.28	74	58.56	41.94	20.2	67.98	-	-	P	H
		14490	10.34	-43.66	54	-	-	-	-	-	-	A	H
		18000	60.32	-13.68	74	59.31	48.82	21.91	69.72	-	-	P	H
		18000	17.94	-36.06	54	-	-	-	-	-	-	A	H
													H
													H
													H
													H
		4804	37.83	-36.17	74	62.73	31.54	11.44	67.88	-	-	P	V
		4804	-4.55	-58.55	54	-	-	-	-	-	-	A	V
		11355	49.39	-24.61	74	60.13	39.84	17.62	68.2	-	-	P	V
		11355	7.01	-46.99	54	-	-	-	-	-	-	A	V
		14490	51.42	-22.58	74	57.26	41.94	20.2	67.98	-	-	P	V
		14490	9.04	-44.96	54	-	-	-	-	-	-	A	V
		17970	60.7	-13.3	74	60.51	48.36	21.9	70.07	-	-	P	V
		17970	18.32	-35.68	54	-	-	-	-	-	-	A	V
													V
													V
													V
													V

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 39 2441MHz		4882	39.04	-34.96	74	64.03	31.45	11.48	67.92	-	-	P	H
		4882	-3.34	-57.34	54	-	-	-	-	-	-	A	H
		7323	44.23	-29.77	74	61.08	36.33	13.92	67.1	-	-	P	H
		7323	1.85	-52.15	54	-	-	-	-	-	-	A	H
		11415	50.23	-23.77	74	60.51	40.04	17.68	68	-	-	P	H
		11415	7.85	-46.15	54	-	-	-	-	-	-	A	H
		14490	51.55	-22.45	74	57.39	41.94	20.2	67.98	-	-	P	H
		14490	9.17	-44.83	54	-	-	-	-	-	-	A	H
		17985	59.5	-14.5	74	59.07	48.43	21.9	69.9	-	-	P	H
		17985	17.12	-36.88	54	-	-	-	-	-	-	A	H
													H
													H
		4882	39.19	-34.81	74	64.26	31.37	11.48	67.92	-	-	P	V
		4882	-3.19	-57.19	54	-	-	-	-	-	-	A	V
		7323	43.8	-30.2	74	60.57	36.41	13.92	67.1	-	-	P	V
		7323	1.42	-52.58	54	-	-	-	-	-	-	A	V
		12150	49.57	-24.43	74	58.94	39.28	18.38	67.03	-	-	P	V
		12150	7.19	-46.81	54	-	-	-	-	-	-	A	V
		14490	51.86	-22.14	74	57.7	41.94	20.2	67.98	-	-	P	V
		14490	9.48	-44.52	54	-	-	-	-	-	-	A	V
		18000	59.25	-14.75	74	58.02	49.04	21.91	69.72	-	-	P	V
		18000	16.87	-37.13	54	-	-	-	-	-	-	A	V
													V
													V

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz		4960	40.22	-33.78	74	65.26	31.51	11.51	68.06	-	-	P	H
		4960	-2.16	-56.16	54	-	-	-	-	-	-	A	H
		7440	43.33	-30.67	74	60	36.49	14.07	67.23	-	-	P	H
		7440	0.95	-53.05	54	-	-	-	-	-	-	A	H
		11475	49.59	-24.41	74	59.49	40.15	17.74	67.79	-	-	P	H
		11475	7.21	-46.79	54	-	-	-	-	-	-	A	H
		14490	51.07	-22.93	74	56.91	41.94	20.2	67.98	-	-	P	H
		14490	8.69	-45.31	54	-	-	-	-	-	-	A	H
		17985	60.77	-13.23	74	60.34	48.43	21.9	69.9	-	-	P	H
		17985	18.39	-35.61	54	-	-	-	-	-	-	A	H
													H
													H
		4960	39.41	-34.59	74	64.5	31.46	11.51	68.06	-	-	P	V
		4960	-2.97	-56.97	54	-	-	-	-	-	-	A	V
		7440	43.8	-30.2	74	60.49	36.47	14.07	67.23	-	-	P	V
		7440	1.42	-52.58	54	-	-	-	-	-	-	A	V
		11055	49.37	-24.63	74	60.19	39.98	17.34	68.14	-	-	P	V
		11055	6.99	-47.01	54	-	-	-	-	-	-	A	V
		14490	51.26	-22.74	74	57.1	41.94	20.2	67.98	-	-	P	V
		14490	8.88	-45.12	54	-	-	-	-	-	-	A	V
		17985	60.22	-13.78	74	59.52	48.7	21.9	69.9	-	-	P	V
		17985	17.84	-36.16	54	-	-	-	-	-	-	A	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.
4. The emission level close to 18GHz is checked that the average emission level is noise floor only.

Emission above 18GHz

2.4GHz BT (SHF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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 BT SHF		23551	40.44	-33.56	74	38.41	38.94	14.99	51.9	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		24216	40.48	-33.52	74	37.84	39	15.43	51.79	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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 BT LF		49.4	29.95	-10.05	40	46.58	14.64	1.16	32.43	-	-	P	H
		145.43	27.94	-15.56	43.5	40.83	17.56	1.95	32.4	-	-	P	H
		375.32	34.75	-11.25	46	42.9	21.21	3.13	32.49	209	118	Q	H
		499.48	38.3	-7.7	46	43.19	24.09	3.61	32.59	-	-	P	H
		624.61	38.62	-7.38	46	41.25	25.98	4	32.61	-	-	P	H
		874.87	35.68	-10.32	46	33.46	29.2	4.81	31.79	183	354	Q	H
		49.4	29.95	-10.05	40	46.58	14.64	1.16	32.43	-	-	P	H
													H
													H
													H
													H
													H
		37.76	34.08	-5.92	40	44.54	20.94	1.03	32.43	101	17	Q	V
		62.98	34	-6	40	53.21	11.9	1.31	32.42	-	-	P	V
		375.32	36.71	-9.29	46	44.86	21.21	3.13	32.49	-	-	P	V
		499.48	37.58	-8.42	46	42.47	24.09	3.61	32.59	-	-	P	V
		624.61	38.4	-7.6	46	41.03	25.98	4	32.61	-	-	P	V
		874.87	39.44	-6.56	46	37.22	29.2	4.81	31.79	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

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

<Sample 2>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Margin Limit	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)
BT CH00 2402MHz		2322.81	45.67	-28.33	74	41.73	27.92	7.34	31.32	110	47	P	H
		2322.81	3.29	-50.71	54	-	-	-	-	-	-	A	H
	*	2402	98.81	-	-	94.95	27.66	7.47	31.27	110	47	P	H
	*	2402	56.43	-	-	-	-	-	-	-	-	A	H
													H
													H
		2385.6	46.28	-27.72	74	42.31	27.8	7.45	31.28	318	297	P	V
		2385.6	3.9	-50.1	54	-	-	-	-	-	-	A	V
	*	2402	100.14	-	-	96.2	27.74	7.47	31.27	318	297	P	V
	*	2402	57.76	-	-	-	-	-	-	-	-	A	V
													V
													V
BT CH 39 2441MHz		2381.68	45.45	-28.55	74	41.6	27.7	7.44	31.29	102	46	P	H
		2381.68	3.07	-50.93	54	-	-	-	-	-	-	A	H
	*	2441	97.73	-	-	93.8	27.66	7.53	31.26	102	46	P	H
	*	2441	55.35	-	-	-	-	-	-	-	-	A	H
		2484.46	45.02	-28.98	74	41.05	27.62	7.59	31.24	102	46	P	H
		2484.46	2.64	-51.36	54	-	-	-	-	-	-	A	H
		2340.8	48.63	-25.37	74	44.65	27.92	7.37	31.31	312	300	P	V
		2340.8	6.25	-47.75	54	-	-	-	-	-	-	A	V
	*	2441	101.15	-	-	97.29	27.59	7.53	31.26	312	300	P	V
	*	2441	58.77	-	-	-	-	-	-	-	-	A	V
		2498.46	45.28	-28.72	74	41.41	27.49	7.61	31.23	312	300	P	V
		2498.46	2.9	-51.1	54	-	-	-	-	-	-	A	V

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz	*	2480	97.44	-	-	93.68	27.63	7.59	31.46	106	44	P	H
	*	2480	55.06	-	-	-	-	-	-	-	-	A	H
		2483.68	46.77	-27.23	74	43.02	27.62	7.59	31.46	106	44	P	H
		2483.68	4.39	-49.61	54	-	-	-	-	-	-	A	H
													H
													H
	*	2480	100.99	-	-	97.35	27.51	7.59	31.46	312	301	P	V
	*	2480	58.61	-	-	-	-	-	-	-	-	A	V
		2483.52	48.99	-25.01	74	45.35	27.51	7.59	31.46	312	301	P	V
		2483.52	6.61	-47.39	54	-	-	-	-	-	-	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 00 2402MHz		4804	39.85	-34.15	74	64.78	31.51	11.44	67.88	-	-	P	H
		4804	-2.53	-56.53	54	-	-	-	-	-	-	A	H
		10890	50.79	-23.21	74	62.06	40.16	17.18	68.61	-	-	P	H
		10890	8.41	-45.59	54	-	-	-	-	-	-	A	H
		14490	51.29	-22.71	74	57.13	41.94	20.2	67.98	-	-	P	H
		14490	8.91	-45.09	54	-	-	-	-	-	-	A	H
		18000	59.8	-14.2	74	58.79	48.82	21.91	69.72	-	-	P	H
		18000	17.42	-36.58	54	-	-	-	-	-	-	A	H
													H
													H
													H
													H
		4804	40.66	-33.34	74	65.56	31.54	11.44	67.88	-	-	P	V
		4804	-1.72	-55.72	54	-	-	-	-	-	-	A	V
		11115	49.4	-24.6	74	60.32	39.83	17.39	68.14	-	-	P	V
		11115	7.02	-46.98	54	-	-	-	-	-	-	A	V
		14490	51.88	-22.12	74	57.72	41.94	20.2	67.98	-	-	P	V
		14490	9.5	-44.5	54	-	-	-	-	-	-	A	V
		17955	59.84	-14.16	74	60.18	48.02	21.89	70.25	-	-	P	V
		17955	17.46	-36.54	54	-	-	-	-	-	-	A	V
													V
													V
													V
													V

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 39 2441MHz		4882	39.49	-34.51	74	64.48	31.45	11.48	67.92	-	-	P	H
		4882	-2.89	-56.89	54	-	-	-	-	-	-	A	H
		7323	43.61	-30.39	74	60.46	36.33	13.92	67.1	-	-	P	H
		7323	1.23	-52.77	54	-	-	-	-	-	-	A	H
		11625	49.92	-24.08	74	59.74	39.87	17.89	67.58	-	-	P	H
		11625	7.54	-46.46	54	-	-	-	-	-	-	A	H
		14490	51.83	-22.17	74	57.67	41.94	20.2	67.98	-	-	P	H
		14490	9.45	-44.55	54	-	-	-	-	-	-	A	H
		17970	59.84	-14.16	74	59.97	48.04	21.9	70.07	-	-	P	H
		17970	17.46	-36.54	54	-	-	-	-	-	-	A	H
													H
													H
		4882	39.27	-34.73	74	64.46	31.37	11.36	67.92	-	-	P	V
		4882	-3.11	-57.11	54	-	-	-	-	-	-	A	V
		7323	43.35	-30.65	74	60.26	36.41	13.78	67.1	-	-	P	V
		7323	0.97	-53.03	54	-	-	-	-	-	-	A	V
		11340	48.63	-25.37	74	59.94	39.81	17.12	68.24	-	-	P	V
		11340	6.25	-47.75	54	-	-	-	-	-	-	A	V
		14490	50.44	-23.56	74	56.88	41.94	19.6	67.98	-	-	P	V
		14490	8.06	-45.94	54	-	-	-	-	-	-	A	V
		18000	59.92	-14.08	74	58.16	49.04	22.44	69.72	-	-	P	V
		18000	17.54	-36.46	54	-	-	-	-	-	-	A	V
													V
													V

BT	Note	Frequency (MHz)	Level (dBμV/m)	Margin Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
BT CH 78 2480MHz		4960	39.68	-34.32	74	64.72	31.51	11.51	68.06	-	-	P	H
		4960	-2.7	-56.7	54	-	-	-	-	-	-	A	H
		7440	45.41	-28.59	74	62.08	36.49	14.07	67.23	-	-	P	H
		7440	3.03	-50.97	54	-	-	-	-	-	-	A	H
		11115	49.42	-24.58	74	60.29	39.88	17.39	68.14	-	-	P	H
		11115	7.04	-46.96	54	-	-	-	-	-	-	A	H
		14490	50.89	-23.11	74	56.73	41.94	20.2	67.98	-	-	P	H
		14490	8.51	-45.49	54	-	-	-	-	-	-	A	H
		17985	58.13	-15.87	74	57.7	48.43	21.9	69.9	-	-	P	H
		17985	15.75	-38.25	54	-	-	-	-	-	-	A	H
													H
													H
		4960	40.09	-33.91	74	65.18	31.46	11.51	68.06	-	-	P	V
		4960	-2.29	-56.29	54	-	-	-	-	-	-	A	V
		7440	43.35	-30.65	74	60.04	36.47	14.07	67.23	-	-	P	V
		7440	0.97	-53.03	54	-	-	-	-	-	-	A	V
		11025	49.86	-24.14	74	60.7	40.04	17.31	68.19	-	-	P	V
		11025	7.48	-46.52	54	-	-	-	-	-	-	A	V
		14490	51.8	-22.2	74	57.64	41.94	20.2	67.98	-	-	P	V
		14490	9.42	-44.58	54	-	-	-	-	-	-	A	V
		17985	58.94	-15.06	74	58.24	48.7	21.9	69.9	-	-	P	V
		17985	16.56	-37.44	54	-	-	-	-	-	-	A	V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.
4. The emission level close to 18GHz is checked that the average emission level is noise floor only.

Emission above 18GHz

2.4GHz BT (SHF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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 BT SHF		24230	42.12	-31.88	74	39.39	39.08	15.44	51.79	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		24797	41.42	-32.58	74	38.25	39.36	15.73	51.92	-	-	P	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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 BT LF		49.4	29.34	-10.66	40	45.97	14.64	1.16	32.43	-	-	P	H
		144.46	27.97	-15.53	43.5	40.83	17.6	1.94	32.4	-	-	P	H
		375.32	34.69	-11.31	46	42.84	21.21	3.13	32.49	205	119	Q	H
		499.48	38.45	-7.55	46	43.34	24.09	3.61	32.59	-	-	P	H
		624.61	39.09	-6.91	46	41.72	25.98	4	32.61	-	-	P	H
		874.87	36.55	-9.45	46	34.33	29.2	4.81	31.79	201	360	Q	H
													H
													H
													H
													H
													H
													H
		33.88	32.62	-7.38	40	40.92	23.17	0.97	32.44	100	348	Q	V
		62.98	27.61	-12.39	40	46.82	11.9	1.31	32.42	112	329	Q	V
		105.66	32.27	-11.23	43.5	46.14	16.77	1.77	32.41	-	-	P	V
		188.11	30.67	-12.83	43.5	45.87	15	2.2	32.4	-	-	P	V
		499.48	36.59	-9.41	46	41.48	24.09	3.61	32.59	-	-	P	V
		874.87	39.34	-6.66	46	37.12	29.2	4.81	31.79	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or noise floor only.												

Note symbol

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

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

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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)
BT 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 Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Margin Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

Peak measured complies with the limit line, so test result is “PASS”.

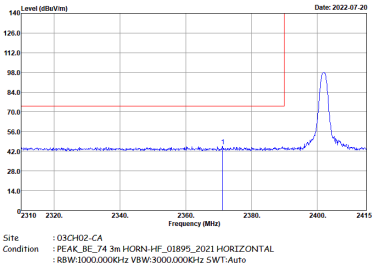
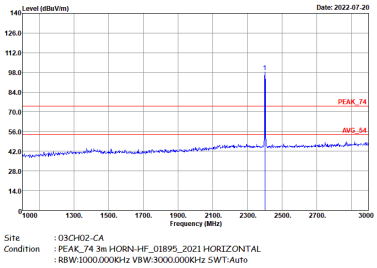
Appendix C. Radiated Spurious Emission Plots

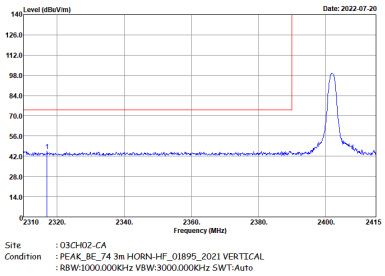
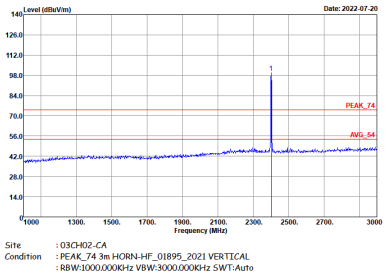
Test Engineer :	Michael Bui, Daniel Lee, Yuan Lee and Fu Chen	Temperature :	20~25°C
		Relative Humidity :	42~50%

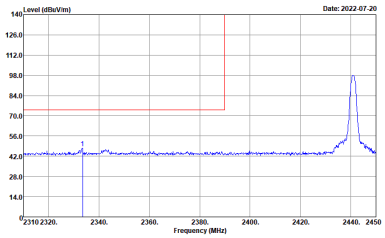
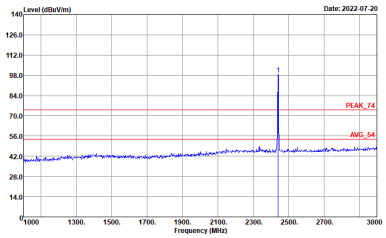
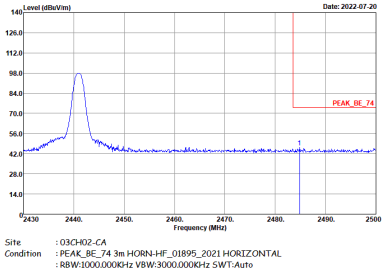
<Sample 1>

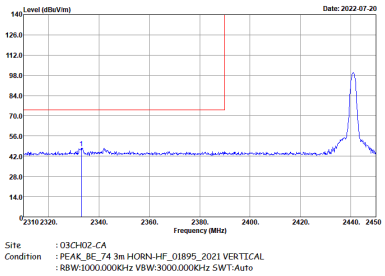
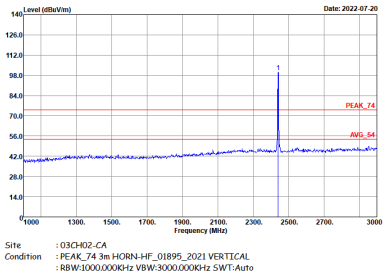
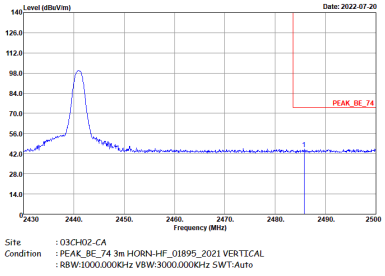
2.4GHz 2400~2483.5MHz

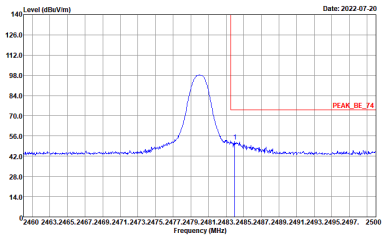
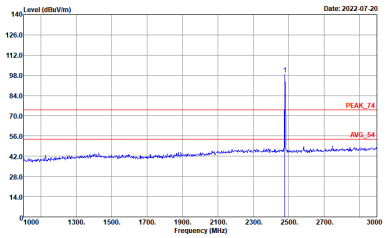
BT (Band Edge @ 3m)

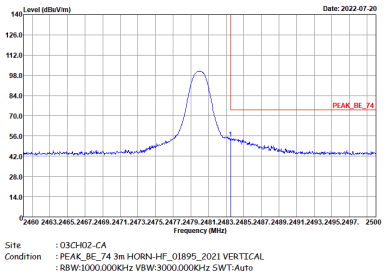
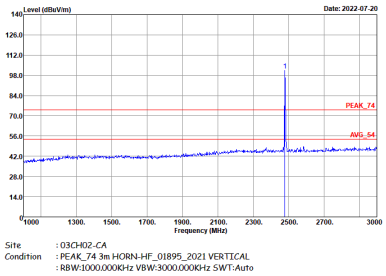
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak		
Peak		Left blank

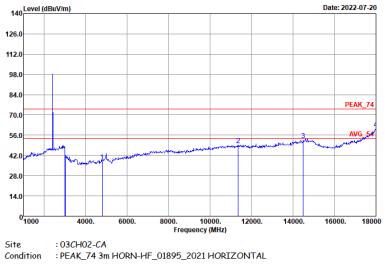
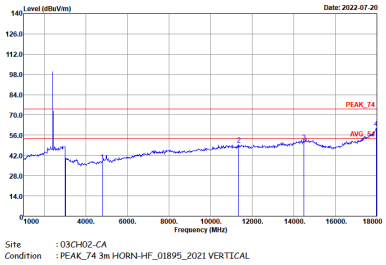
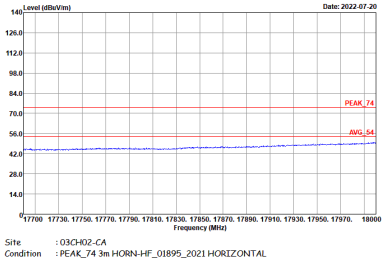
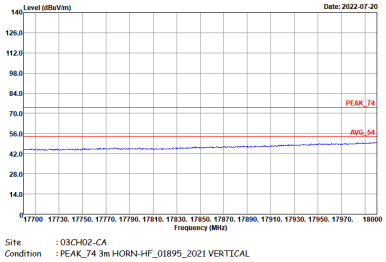
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak		
Peak		Left blank

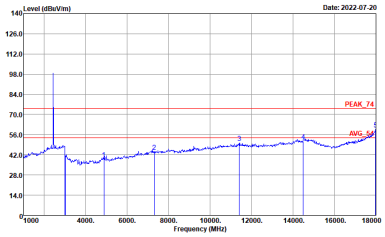
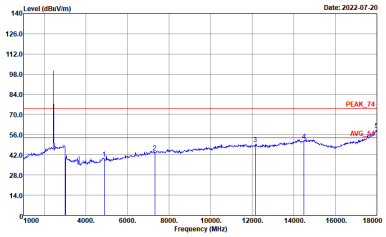
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

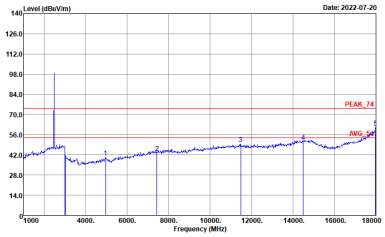
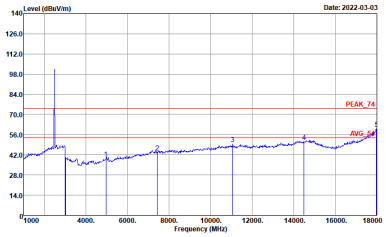
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

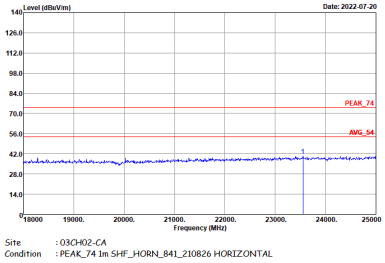
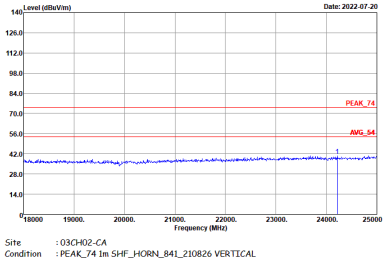
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak		
Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

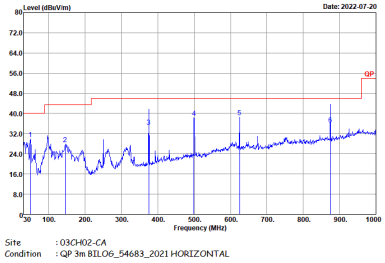
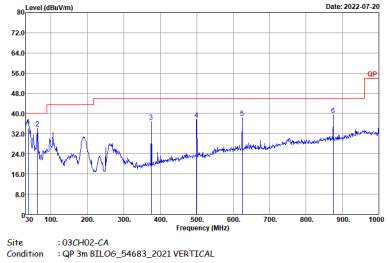
Emission above 18GHz

2.4GHz BT (SHF @ 1m)

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

Emission below 1GHz

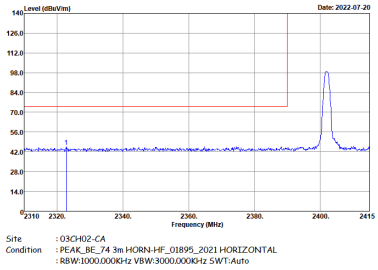
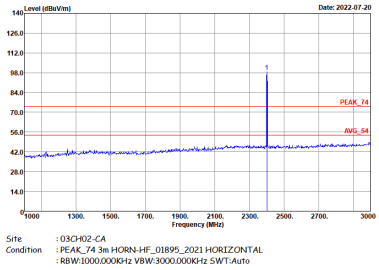
2.4GHz BT (LF)

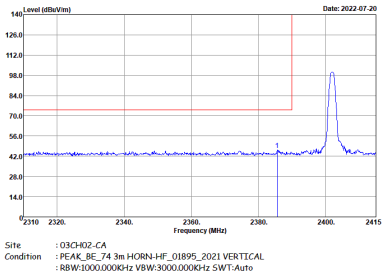
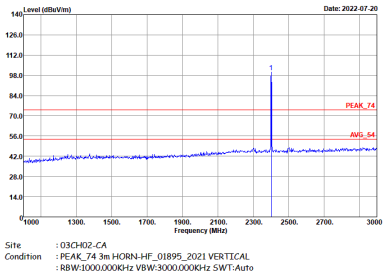
BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

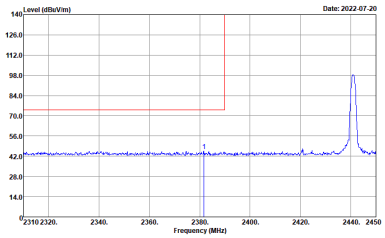
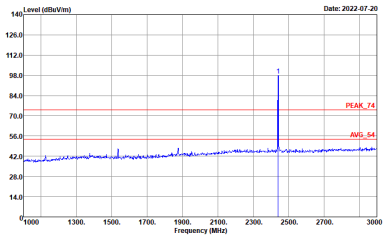
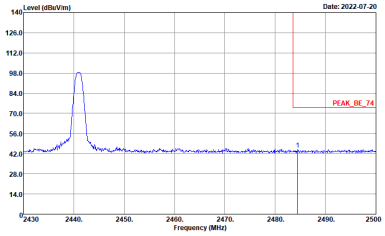
<Sample 2>

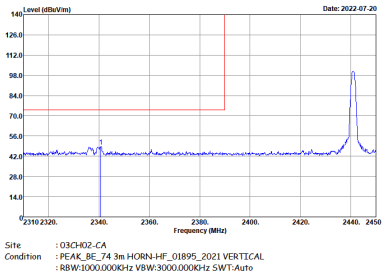
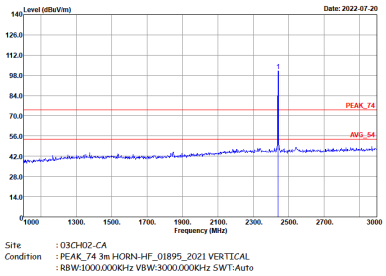
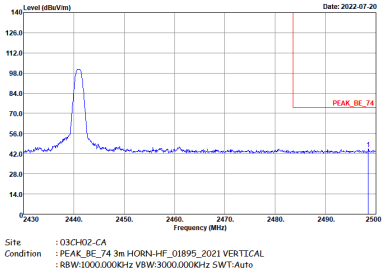
2.4GHz 2400~2483.5MHz

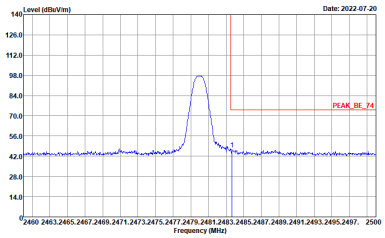
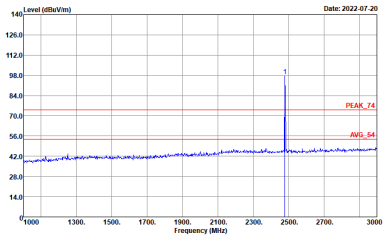
BT (Band Edge @ 3m)

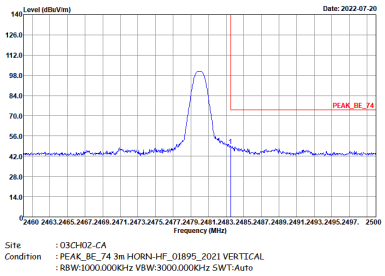
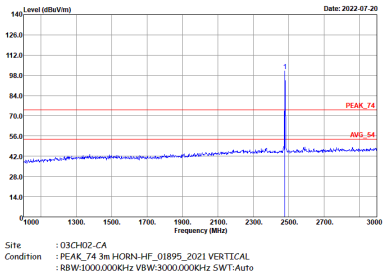
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN-HF_01895_2021 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

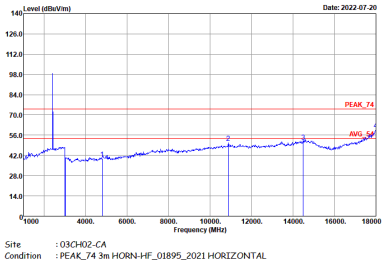
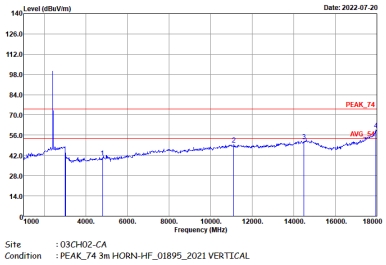
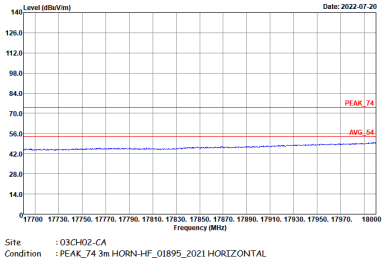
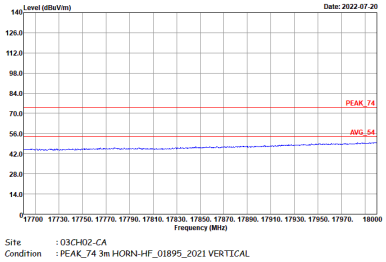
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak		
Peak		Left blank

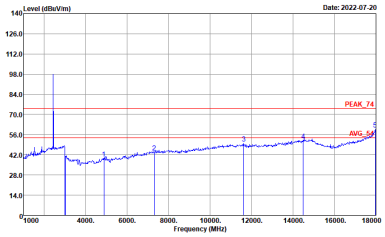
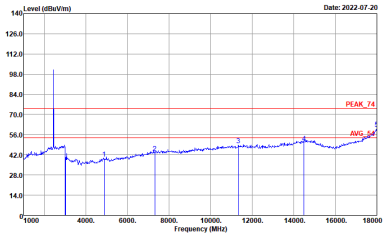
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

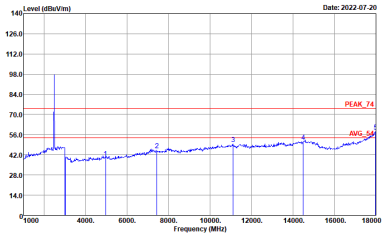
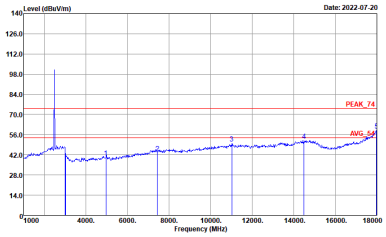
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

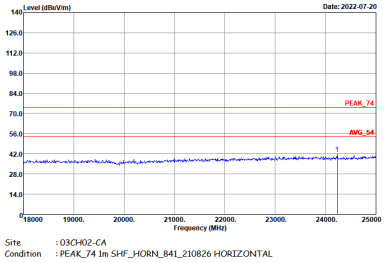
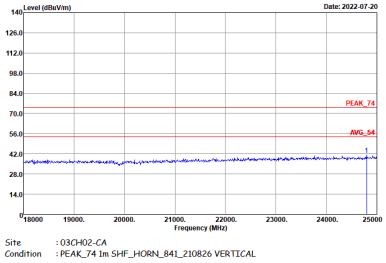
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak		
Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

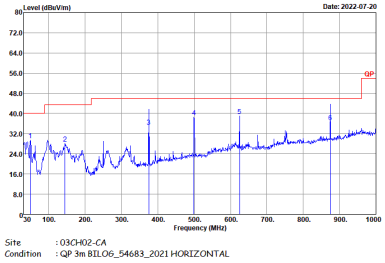
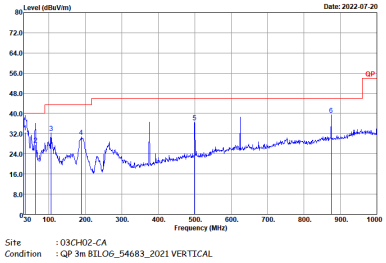
Emission above 18GHz

2.4GHz BT (SHF @ 1m)

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

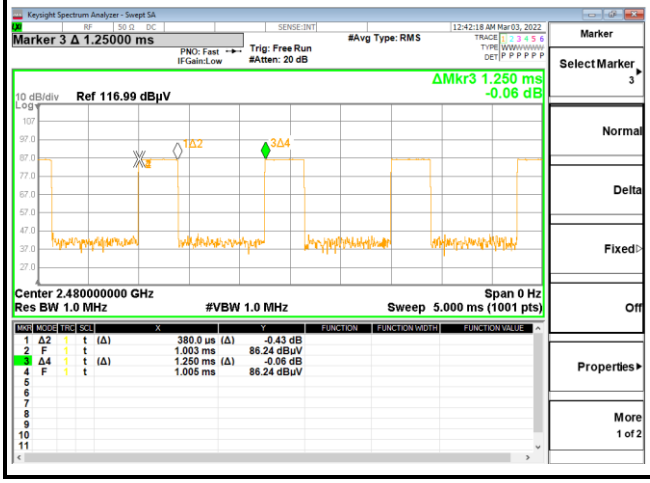
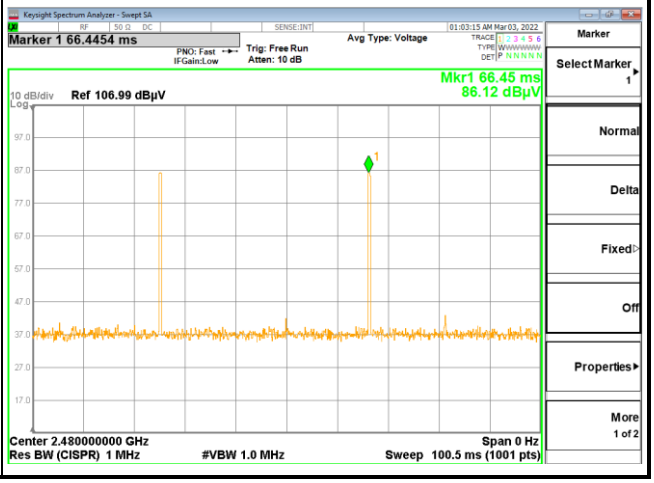
Emission below 1GHz

2.4GHz BT (LF)

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

Appendix D. Duty Cycle Plots

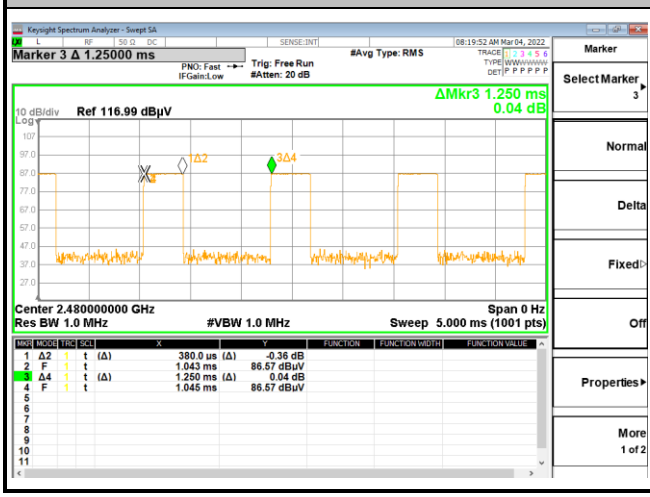
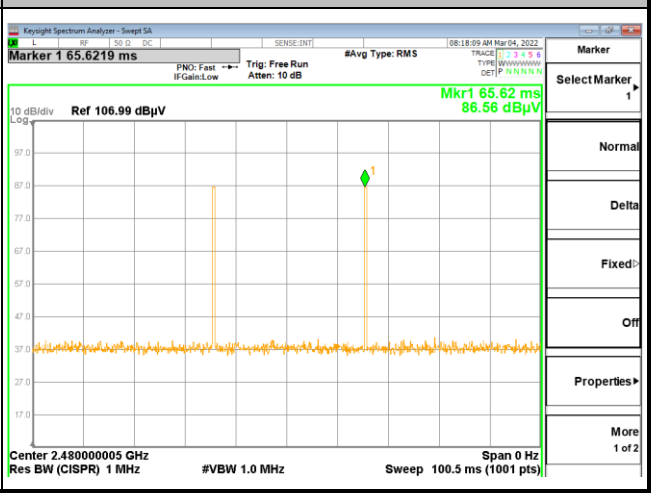
<Sample 1>

DH1 on time (One Pulse) Plot on Channel 78	on time (Count Pulses) Plot on Channel 78
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 0.38 / 100 = 0.76 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -10.34 dB
3. DH1 has the highest duty cycle worst case and is reported.

<Sample 2>

DH1 on time (One Pulse) Plot on Channel 78	on time (Count Pulses) Plot on Channel 78
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 0.38 / 100 = 0.76 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -10.34 dB
3. DH1 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the on time period to have DH5 packet completing one hopping sequence is

0.38 ms x 20 channels = 7.6 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 7.6 ms] = 2 hops

Thus, the maximum possible ON time:

0.38 ms x 2 = 0.76 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(0.76 ms/100 ms) = -10.34 dB