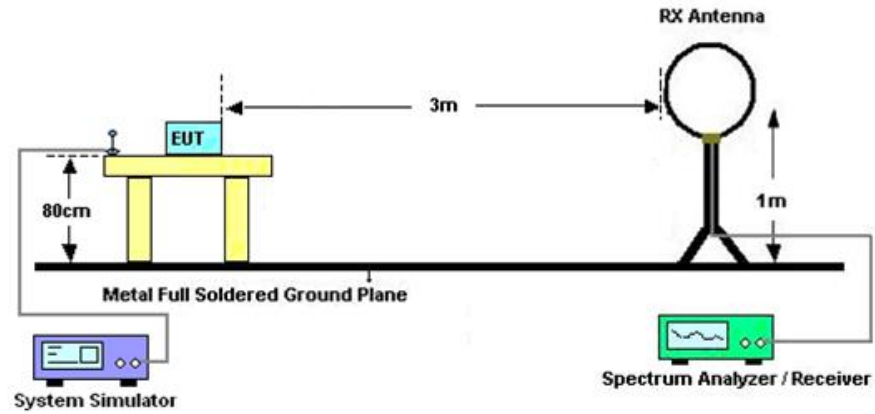
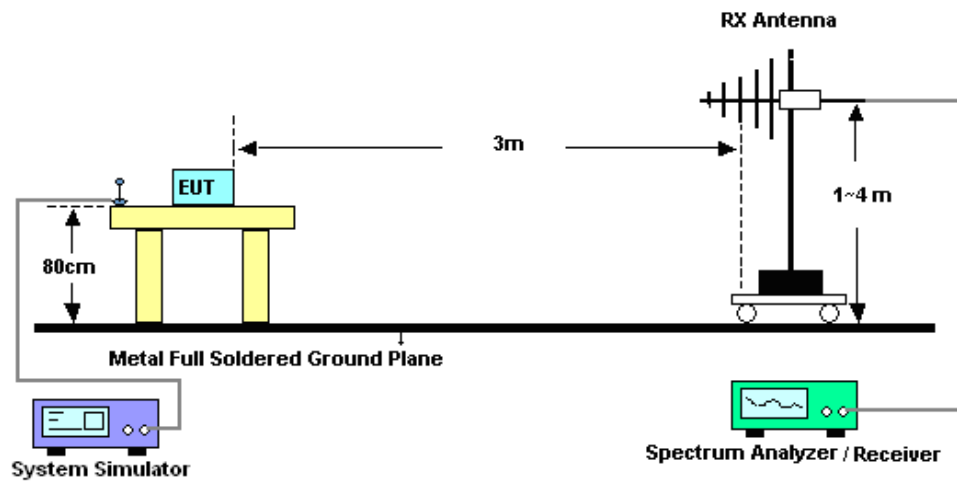


3.8.4 Test Setup

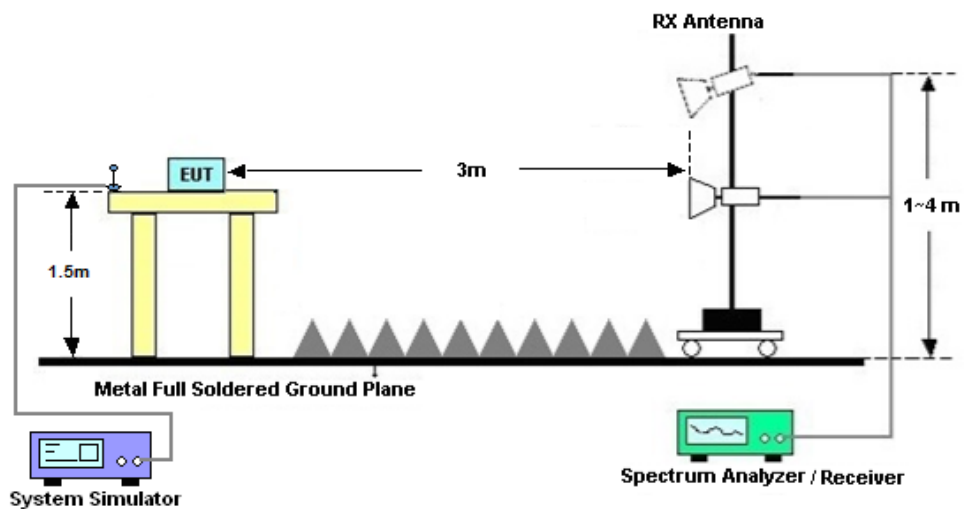
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





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

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

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.8.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.8.8 Duty cycle correction factor for average measurement

Please refer to Appendix D.

3.9 AC Conducted Emission Measurement

3.9.1 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.

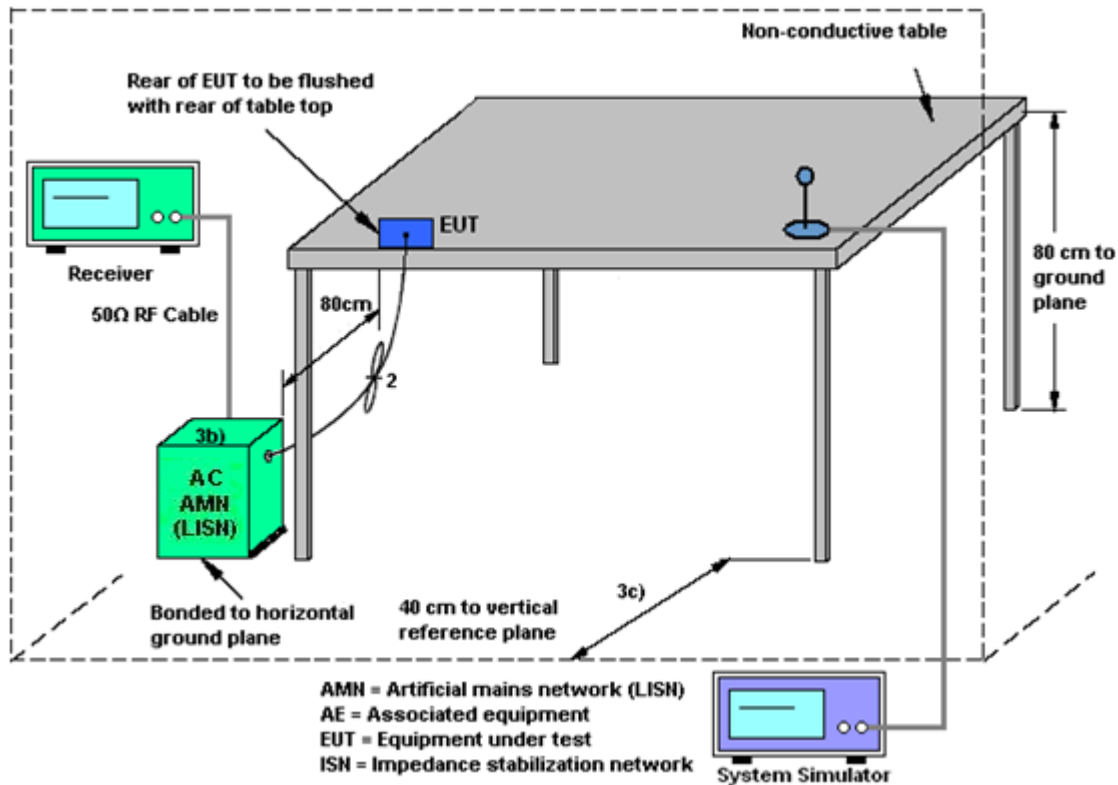
3.9.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was 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 should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



3.10 Antenna Requirements

3.10.1 Standard Applicable

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

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 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	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 07, 2022	Nov. 15, 2022~Dec. 03, 2022	Apr. 08, 2023	Conducted (TH01-SZ)
Pulse Power Sensor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 28, 2021	Nov. 15, 2022~Dec. 03, 2022	Dec. 27, 2022	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1542004	50MHz Bandwidth	Dec. 28, 2021	Nov. 15, 2022~Dec. 03, 2022	Dec. 27, 2022	Conducted (TH01-SZ)
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Dec. 27, 2021	Nov. 23, 2022	Dec. 26, 2022	Radiation (03CH01-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Jul. 07, 2022	Nov. 23, 2022	Jul. 06, 2023	Radiation (03CH01-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jul. 28, 2022	Nov. 23, 2022	Jun. 27, 2023	Radiation (03CH01-SZ)
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz~2GHz	Sep. 28, 2022	Nov. 23, 2022	Sep. 27, 2023	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 07, 2022	Nov. 23, 2022	Jul. 06, 2023	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18GHz~40GHz	Apr. 10, 2022	Nov. 23, 2022	Apr. 09, 2023	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 06, 2022	Nov. 23, 2022	Apr. 05, 2023	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00101800-30-10P-R	1943528	1GHz~18GHz	Oct. 19, 2022	Nov. 23, 2022	Oct. 18, 2023	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270105	0.5GHz~26.5GHz	Oct. 19, 2022	Nov. 23, 2022	Oct. 18, 2023	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35-HG	1871923	18GHz~40GHz	Jul. 06, 2022	Nov. 23, 2022	Jul. 05, 2023	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	Nov. 10, 2022	Nov. 23, 2022	Nov. 09, 2023	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Nov. 23, 2022	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Nov. 23, 2022	NCR	Radiation (03CH01-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Jul. 07, 2022	Nov. 16, 2022	Jul. 06, 2023	Conduction (CO01-SZ)
AC LISN	R&S	ENV216	100063	9kHz~30MHz	Sep. 15, 2022	Nov. 16, 2022	Sep. 14, 2023	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 17, 2022	Nov. 16, 2022	Oct. 16, 2023	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 07, 2022	Nov. 16, 2022	Jul. 06, 2023	Conduction (CO01-SZ)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	± 1.34 dB
Conducted Emissions	± 1.34 dB
Occupied Channel Bandwidth	± 0.13 %

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.2dB
---	-------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.2dB
---	-------

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
---	-------

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

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

----- THE END -----



Appendix A. Conducted Test Results

Test Engineer:	Chen Ran	Temperature:	24~26	°C
Test Date:	2022/11/15~2022/12/3	Relative Humidity:	50~53	%

TEST RESULTS DATA**20dB and 99% Occupied Bandwidth and Hopping Channel Separation**

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.860	0.764	1.003	0.5731	Pass
DH	1Mbps	1	39	2441	0.857	0.761	0.999	0.5711	Pass
DH	1Mbps	1	78	2480	0.860	0.764	0.999	0.5731	Pass
2DH	2Mbps	1	0	2402	1.250	1.143	1.003	0.8336	Pass
2DH	2Mbps	1	39	2441	1.250	1.140	0.999	0.8336	Pass
2DH	2Mbps	1	78	2480	1.250	1.143	0.999	0.8336	Pass
3DH	3Mbps	1	0	2402	1.259	1.146	0.999	0.8393	Pass
3DH	3Mbps	1	39	2441	1.255	1.143	1.003	0.8365	Pass
3DH	3Mbps	1	78	2480	1.259	1.146	0.920	0.8393	Pass

TEST RESULTS DATA**Dwell Time**

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
Nomal	79	106.67	2.8913	0.31	0.4	Pass
AFH	20	53.33	2.8913	0.15	0.4	Pass

TEST RESULTS DATA**Peak Power Table**

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
DH5	0	1	7.60	20.97	Pass
	39	1	8.20	20.97	Pass
	78	1	8.40	20.97	Pass
2DH5	0	1	7.00	20.97	Pass
	39	1	7.40	20.97	Pass
	78	1	7.70	20.97	Pass
3DH5	0	1	7.10	20.97	Pass
	39	1	7.60	20.97	Pass
	78	1	7.80	20.97	Pass

TEST RESULTS DATA**Average Power Table
(Reporting Only)**

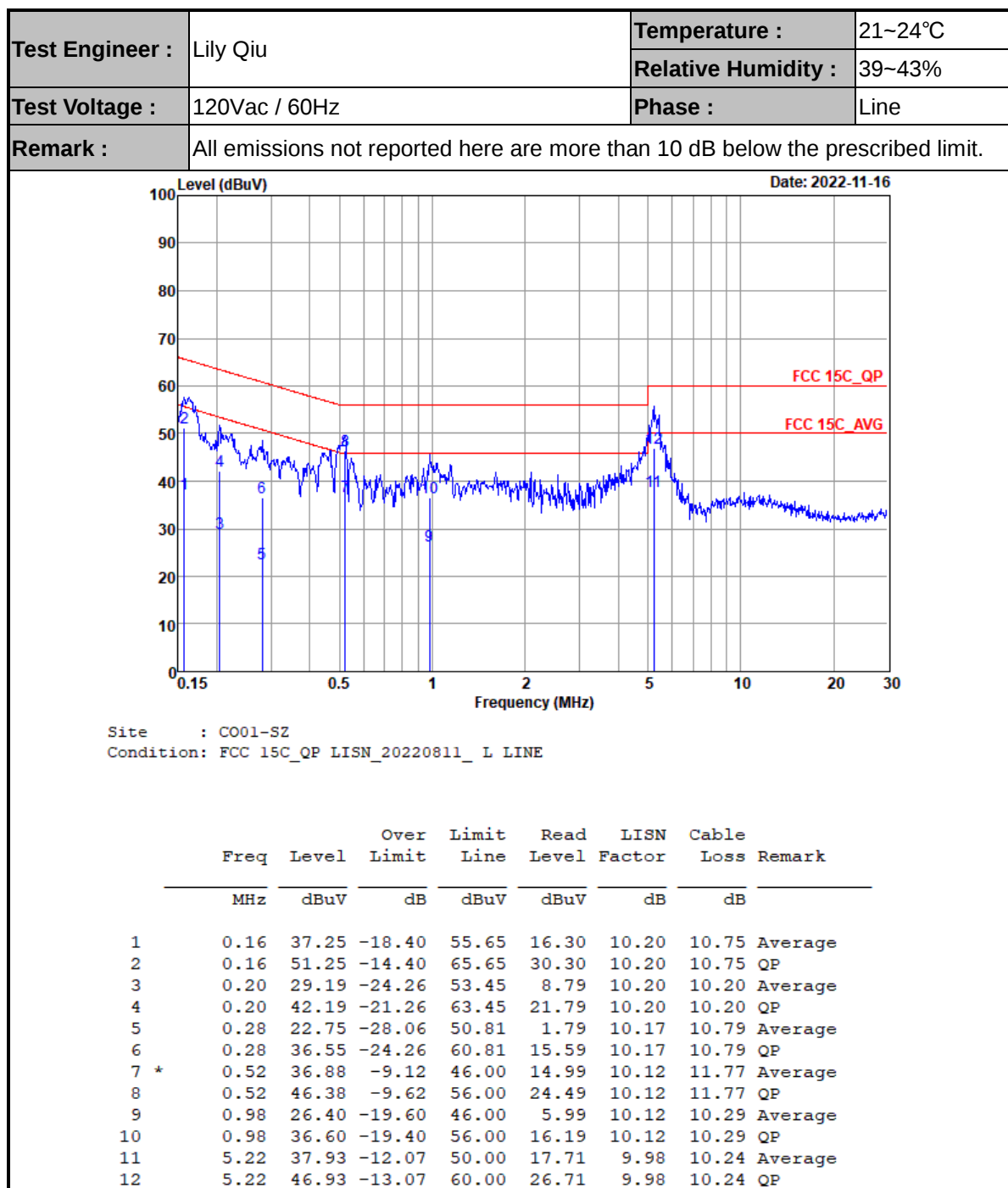
DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH5	0	1	6.90	1.14
	39	1	7.30	1.14
	78	1	7.40	1.14
2DH5	0	1	4.50	1.14
	39	1	4.80	1.14
	78	1	5.10	1.14
3DH5	0	1	4.50	1.16
	39	1	4.80	1.16
	78	1	5.10	1.16

TEST RESULTS DATA**Number of Hopping Frequency**

Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass

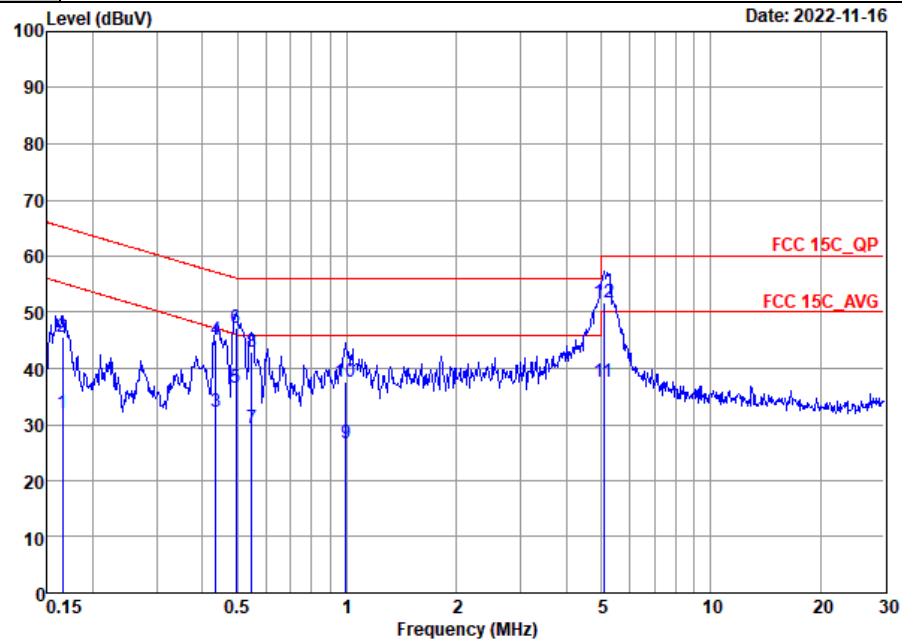


Appendix B. AC Conducted Emission Test Results





Test Engineer :	Lily Qiu	Temperature :	21~24°C
		Relative Humidity :	39~43%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-SZ
Condition: FCC 15C_QP LISN_20220811_N NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.17	32.02	-23.19	55.21	11.10	10.31	10.61	Average
2	0.17	45.72	-19.49	65.21	24.80	10.31	10.61	QP
3	0.44	32.19	-14.96	47.15	10.40	10.19	11.60	Average
4	0.44	45.09	-12.06	57.15	23.30	10.19	11.60	QP
5	0.49	36.53	-9.57	46.10	14.50	10.19	11.84	Average
6	0.49	47.23	-8.87	56.10	25.20	10.19	11.84	QP
7	0.55	29.27	-16.73	46.00	7.41	10.21	11.65	Average
8	0.55	43.07	-12.93	56.00	21.21	10.21	11.65	QP
9	0.99	26.56	-19.44	46.00	6.10	10.21	10.25	Average
10	0.99	37.56	-18.44	56.00	17.10	10.21	10.25	QP
11	5.08	37.57	-12.43	50.00	17.21	10.12	10.24	Average
12 *	5.08	51.67	-8.33	60.00	31.31	10.12	10.24	QP

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)



Appendix C. Radiated Spurious Emission

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2349.27	47.74	-26.26	74	40.58	32.17	7.69	32.7	100	239	P	H
		2349.27	22.95	-31.05	54	-	-	-	-	-	-	A	H
	*	2402	101.49	-	-	94.11	32.28	7.8	32.7	100	239	P	H
	*	2402	76.7	-	-	-	-	-	-	-	-	A	H
		2353.575	48.14	-25.86	74	40.97	32.18	7.69	32.7	100	247	P	V
		2353.575	23.35	-30.65	54	-	-	-	-			A	V
	*	2402	105.1	-	-	97.72	32.28	7.8	32.7	100	247	P	V
	*	2402	80.31	-	-	-	-	-	-	-	-	A	V
BT CH 78 2480MHz	*	2480	99.43	-	-	91.79	32.46	7.88	32.7	100	228	P	H
	*	2480	74.64	-	-	-	-	-	-	-	-	A	H
		2497	48.05	-25.95	74	40.38	32.49	7.88	32.7	100	228	P	H
		2497	23.26	-30.74	54	-	-	-	-	-	-	A	H
	*	2480	102.84	-	-	95.2	32.46	7.88	32.7	138	256	P	V
	*	2480	78.05	-	-	-	-	-	-	-	-	A	V
		2486.04	48	-26	74	40.35	32.47	7.88	32.7	138	256	P	V
		2486.04	23.21	-30.79	54	-	-	-	-	-	-	A	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 (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	44.72	-29.28	74	50.97	34.82	11.08	52.15	-	-	P	H
		4804	19.93	-34.07	54	-	-	-	-	-	-	A	H
		4804	45.61	-28.39	74	51.86	34.82	11.08	52.15	-	-	P	V
		4804	20.82	-33.18	54	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		4882	43.06	-30.94	74	49.2	34.85	11.11	52.1	-	-	P	H
		4882	18.27	-35.73	54	-	-	-	-	-	-	A	H
		7323	47.14	-26.86	74	49.5	36.33	13.08	51.77	-	-	P	H
		7323	22.35	-31.65	54	-	-	-	-	-	-	A	H
		4882	43.62	-30.38	74	49.76	34.85	11.11	52.1	-	-	P	V
		4882	18.83	-35.17	54	-	-	-	-	-	-	A	V
		7323	47.53	-26.47	74	49.89	36.33	13.08	51.77	-	-	P	V
		7323	22.74	-31.26	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	43.88	-30.12	74	49.89	34.88	11.14	52.03	-	-	P	H
		4960	19.09	-34.91	54	-	-	-	-	-	-	A	H
		7440	46.04	-27.96	74	48.32	36.38	12.99	51.65	-	-	P	H
		7440	21.25	-32.75	54	-	-	-	-	-	-	A	H
		4960	44.77	-29.23	74	50.78	34.88	11.14	52.03	-	-	P	V
		4960	19.98	-34.02	54	-	-	-	-	-	-	A	V
		7440	46.63	-27.37	74	48.91	36.38	12.99	51.65	-	-	P	V
		7440	21.84	-32.16	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BT LF		49.4	21.23	-18.77	40	34.96	19.63	1.63	34.99	-	-	P	H
		94.02	23.39	-20.11	43.5	41.97	14.18	2.04	34.8	-	-	P	H
		292.87	31.42	-14.58	46	43.94	18.91	3.18	34.61	-	-	P	H
		373.38	24.19	-21.81	46	34.58	20.78	3.38	34.55	-	-	P	H
		632.37	25.79	-20.21	46	30.5	26.19	3.64	34.54	-	-	P	H
		819.58	28.55	-17.45	46	30.24	28.22	4.39	34.3	-	-	P	H
		48.43	33.53	-6.47	40	47.26	19.62	1.63	34.98	-	-	P	V
		87.23	34.23	-5.77	40	52.94	14.09	1.97	34.77	-	-	P	V
		174.53	20.57	-22.93	43.5	35.29	17.51	2.47	34.7	-	-	P	V
		298.69	27.66	-18.34	46	39.96	19.09	3.21	34.6	-	-	P	V
		484.93	24.09	-21.91	46	32.01	23.17	3.41	34.5	-	-	P	V
		702.21	27.95	-18.05	46	31.49	27.12	3.74	34.4	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												



Note symbol

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



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

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
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 (dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 55.45 (dBμV/m)

2. Margin (dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

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

= 43.54 (dBμV/m)

2. Margin (dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

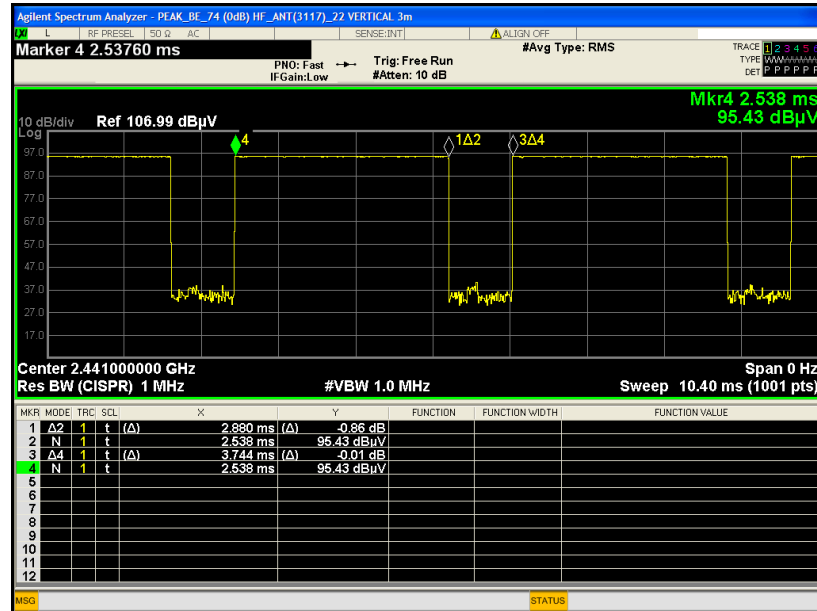
= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

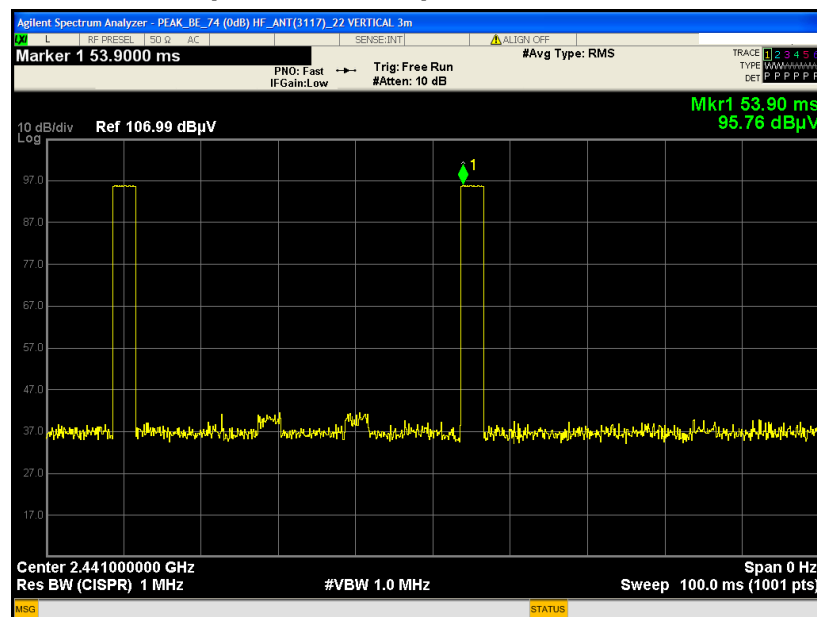
Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Duty Cycle Plots

DH5 on time (One Pulse) Plot on Channel 78



DH5 on time (Count Pulses) Plot on Channel 78



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.88 / 100 = 5.76 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.79 \text{ dB}$
3. DH5 has the highest duty cycle worst case and is reported.