



FCC TEST REPORT

FCC ID: 2A77A-JTFLAP12W24K

Product Name	:	Wireless Bluetooth Music Bulb
Model Name	:	JTFLAP-12W-24K ; JTFL-A31-2121 ; JTFL-A31-212 ; JTFL-A31-212APP ; JTFL-A32-212 ; JTFL-A30-212 ; JTFL-A30-212APP ; JTFL-A30-2121 ; JTFL-A30-2121 ; JTFL-A30-2122 ; JTFL-A30-2123 ; JTFL-A30-2124 ; JTFL-E27-6W-01 ; JTFL-E27-6W-02 ; JTFL-E27-3W-01 ; JTFL-E27-3W-02 ; JTFL-E27-6W ; JTFL-A27-218 ; JTFL-A28-236 ; JTFL-A29-254 ; JTFL-A23-241 ; JTFL-A23-24 ; JTFL-A24-24 ; JTFL-A25-24 ; JTFL-A44-23 ; JTFL-A40-53 ; JTFL-A40-531 ; JTFL-A40-532 ; JTFL-A6-54 ; JTFL-A8-541 ; JTFL-A8-54 ; JTFL-A8-114 ; JTFL-A7-54 ; JTFL-A9-56 ; JTFL-A10-215 ; JTFL-A11-215 ; JTFL-A10-2151 ; JTFL-A10-2152 ; JTFL-A15-26 ; JTFL-A14-26 ; JTFL-A14-262 ; JTFL-A14-261 ; JTFL-a17-26 ; JTFL-A18-26 ; JTFL-A12-215 ; JTFL-A12-515 ; JTFL-A13-212 ; JTFL-A13-512 ; JTFL-A19-29 ; JTFL-A19-291 ; JTFL-A20-29 ; JTFL-A20-291 ; JTFL-A20-292 ; JTFL-A20-293 ; JTFL-A16-26 ; JTFL-A16-261 ; JTFL-A26-261 ; JTFL-A26-26 ; JTFL-A42-510 ; JTFL-A43-510 ; JTFL-A22-224 ; JTFL-A21-224 ; JTFL-KX-1688 ; JTFL-A47-58 ; JTFL-4Y-XK-01 ; JTFL-4Y-XK-02 ; JTFL-4Y-SJ-01 ; JTFL-4Y-SJ-02 ; JTFL-4Y-TASJ-01 ; JTFL-4Y-TASJ-02 ; JTFL-4Y-48W ; JTFL-4Y-36W ; JTFL-3Y-SJ-01 ; JTFL-3Y-SJ-02 ; JTFL-3Y-XK-01 ; JTFL-3Y-XK-02 ; JTFL-12W-24K ; JTFL-FXP-PM ; JTFL-3Y-24K ; JTFL-LY-SJ ; JTFL-LY-LHFD ; JTFL-LY-WXSJ ; JTFL-LY-WXXK ; JTFL-4Y-4-1 ; JTFL-3Y-3-1 ; JTFL-4Y-4-1PC ; JTFL-4Y-4-1ABS ; JTFL-LY-XFD-01 ; JTFL-LY-XFD-02 ; JTFL-LY-MNXFD-01 ; JTFL-LY-MNXFD-02 ; JTFL-LY-MNXFD-03 ; JTFL-LY-CDFD-TA ; JTFL-LY-CDFD-XK ; JTFL-LY-ZS-RGB ; JTFL-LY-XFD ; JTFL-LY-CDDMQ-01 ; JTFL-LY-CDDMQ-02 ; JTFL-LY-CDDMQ-03 ; JTFL-QCFSD-60W
Report No.	:	PTC22060201101E-FC02
Sample ID	:	PTC22060201101E-FC02#



Report No.: PTC22060201101E-FC02

Prepared for
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Room 506,Building 8,Baoshan Industrial Zone,Mizhi Street,Longhua New District,Shenzhen,Guangdong,China
Prepared by
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1TEST RESULT CERTIFICATION

Applicant's name : shen zhen shi jie teng song ke ji you xian gong si

Address : Room 506,Building 8,Baoshan Industrial Zone,Mizhi Street,Longhua New District,Shenzhen,Guangdong,China

Manufacture's name : shen zhen shi jie teng song ke ji you xian gong si

Address : Room 506,Building 8,Baoshan Industrial Zone,Mizhi Street,Longhua New District,Shenzhen,Guangdong,China

Product name : Wireless Bluetooth Music Bulb

Model name : JTFLAP-12W-24K ; JTFL-A31-2121 ; JTFL-A31-212 ; JTFL-A31-212APP ; JTFL-A32-212 ; JTFL-A30-212 ; JTFL-A30-212APP ; JTFL-A30-2121 ; JTFL-A30-2121 ; JTFL-A30-2122 ; JTFL-A30-2123 ; JTFL-A30-2124 ; JTFL-E27-6W-01 ; JTFL-E27-6W-02 ; JTFL-E27-3W-01 ; JTFL-E27-3W-02 ; JTFL-E27-6W ; JTFL-A27-218 ; JTFL-A28-236 ; JTFL-A29-254 ; JTFL-A23-241 ; JTFL-A23-24 ; JTFL-A24-24 ; JTFL-A25-24 ; JTFL-A44-23 ; JTFL-A40-53 ; JTFL-A40-531 ; JTFL-A40-532 ; JTFL-A6-54 ; JTFL-A8-541 ; JTFL-A8-54 ; JTFL-A8-114 ; JTFL-A7-54 ; JTFL-A9-56 ; JTFL-A10-215 ; JTFL-A11-215 ; JTFL-A10-2151 ; JTFL-A10-2152 ; JTFL-A15-26 ; JTFL-A14-26 ; JTFL-A14-262 ; JTFL-A14-261 ; JTFL-a17-26 ; JTFL-A18-26 ; JTFL-A12-215 ; JTFL-A12-515 ; JTFL-A13-212 ; JTFL-A13-512 ; JTFL-A19-29 ; JTFL-A19-291 ; JTFL-A20-29 ; JTFL-A20-291 ; JTFL-A20-292 ; JTFL-A20-293 ; JTFL-A16-26 ; JTFL-A16-261 ; JTFL-A26-261 ; JTFL-A26-26 ; JTFL-A42-510 ; JTFL-A43-510 ; JTFL-A22-224 ; JTFL-A21-224 ; JTFL-KX-1688 ; JTFL-A47-58 ; JTFL-4Y-XK-01 ; JTFL-4Y-XK-02 ; JTFL-4Y-SJ-01 ; JTFL-4Y-SJ-02 ; JTFL-4Y-TASJ-01 ; JTFL-4Y-TASJ-02 ; JTFL-4Y-48W ; JTFL-4Y-36W ; JTFL-3Y-SJ-01 ; JTFL-3Y-SJ-02 ; JTFL-3Y-XK-01 ; JTFL-3Y-XK-02 ; JTFL-12W-24K ; JTFL-FXP-PM ; JTFL-3Y-24K ; JTFL-LY-SJ ; JTFL-LY-LHFD ; JTFL-LY-WXSJ ; JTFL-LY-WXXK ; JTFL-4Y-4-1 ; JTFL-3Y-3-1 ; JTFL-4Y-4-1PC ; JTFL-4Y-4-1ABS ; JTFL-LY-XFD-01 ; JTFL-LY-XFD-02 ; JTFL-LY-MNXFD-01 ; JTFL-LY-MNXFD-02 ; JTFL-LY-MNXFD-03 ; JTFL-LY-CDFD-TA ; JTFL-LY-CDFD-XK ; JTFL-LY-ZS-RGB ; JTFL-LY-XFD ; JTFL-LY-CDDMQ-01 ; JTFL-LY-CDDMQ-02 ; JTFL-LY-CDDMQ-03 ; JTFL-QCFSD-60W

Standards : FCC CFR47 Part 15 Section 15.247

Test procedure : ANSI C63.10:2013

Test Date : Jul. 05, 2022 to Jul. 15, 2022



Report No.: PTC22060201101E-FC02

Date of Issue : Jul. 18, 2022

Test Result : Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of PTC, this document may be altered or revised by PTC, personal only, and shall be noted in the revision of the document.

Test Engineer:

A handwritten signature in black ink that reads 'Leo Yang'.

Leo Yang / Engineer

Technical Manager:

A handwritten signature in black ink that appears to read 'Ronnie Liu'.

Ronnie Liu / Manager



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2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conduct Emission	15.207	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Antenna Requirement	15.203	PASS

Remark:

1. The EUT is powered by full-charged battery during the test.



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3 TEST FACILITY

Precise Testing & Certification Co., Ltd.

Address: Building 1, No.6 Tongxin Road, Dongcheng Street, Dongguan, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

Designation Number: CN1219



4 General Information

4.1 General Description of E.U.T.

Product Name	:	Wireless Bluetooth Music Bulb
Model Name	:	JTFLAP-12W-24K ; JTFL-A31-2121 ; JTFL-A31-212 ; JTFL-A31-212APP ; JTFL-A32-212 ; JTFL-A30-212 ; JTFL-A30-212APP ; JTFL-A30-2121 ; JTFL-A30-2121 ; JTFL-A30-2122 ; JTFL-A30-2123 ; JTFL-A30-2124 ; JTFL-E27-6W-01 ; JTFL-E27-6W-02 ; JTFL-E27-3W-01 ; JTFL-E27-3W-02 ; JTFL-E27-6W ; JTFL-A27-218 ; JTFL-A28-236 ; JTFL-A29-254 ; JTFL-A23-241 ; JTFL-A23-24 ; JTFL-A24-24 ; JTFL-A25-24 ; JTFL-A44-23 ; JTFL-A40-53 ; JTFL-A40-531 ; JTFL-A40-532 ; JTFL-A6-54 ; JTFL-A8-541 ; JTFL-A8-54 ; JTFL-A8-114 ; JTFL-A7-54 ; JTFL-A9-56 ; JTFL-A10-215 ; JTFL-A11-215 ; JTFL-A10-2151 ; JTFL-A10-2152 ; JTFL-A15-26 ; JTFL-A14-26 ; JTFL-A14-262 ; JTFL-A14-261 ; JTFL-a17-26 ; JTFL-A18-26 ; JTFL-A12-215 ; JTFL-A12-515 ; JTFL-A13-212 ; JTFL-A13-512 ; JTFL-A19-29 ; JTFL-A19-291 ; JTFL-A20-29 ; JTFL-A20-291 ; JTFL-A20-292 ; JTFL-A20-293 ; JTFL-A16-26 ; JTFL-A16-261 ; JTFL-A26-261 ; JTFL-A26-26 ; JTFL-A42-510 ; JTFL-A43-510 ; JTFL-A22-224 ; JTFL-A21-224 ; JTFL-KX-1688 ; JTFL-A47-58 ; JTFL-4Y-XK-01 ; JTFL-4Y-XK-02 ; JTFL-4Y-SJ-01 ; JTFL-4Y-SJ-02 ; JTFL-4Y-TASJ-01 ; JTFL-4Y-TASJ-02 ; JTFL-4Y-48W ; JTFL-4Y-36W ; JTFL-3Y-SJ-01 ; JTFL-3Y-SJ-02 ; JTFL-3Y-XK-01 ; JTFL-3Y-XK-02 ; JTFL-12W-24K ; JTFL-FXP-PM ; JTFL-3Y-24K ; JTFL-LY-SJ ; JTFL-LY-LHFD ; JTFL-LY-WXSJ ; JTFL-LY-WXXK ; JTFL-4Y-4-1 ; JTFL-3Y-3-1 ; JTFL-4Y-4-1PC ; JTFL-4Y-4-1ABS ; JTFL-LY-XFD-01 ; JTFL-LY-XFD-02 ; JTFL-LY-MNXFD-01 ; JTFL-LY-MNXFD-02 ; JTFL-LY-MNXFD-03 ; JTFL-LY-CDFD-TA ; JTFL-LY-CDFD-XK ; JTFL-LY-ZS-RGB ; JTFL-LY-XFD ; JTFL-LY-CDDMQ-01 ; JTFL-LY-CDDMQ-02 ; JTFL-LY-CDDMQ-03 ; JTFL-QCFSD-60W(Note: The samples are the same except appearance and model number. So JTFLAP-12W-24K was selected for full tested.)
Bluetooth Version	:	5.1 BT
Operating frequency	:	2402-2480MHz
Numbers of Channel	:	79 channels
Antenna Type	:	Internal PCB Antenna
Antenna Gain	:	0dBi
Type of Modulation	:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Power supply	:	AC 85-265V 60Hz
Hardware Version	:	V1.0



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Software Version	:	V1.0
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4.2 Test Mode

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK, $\pi/4$ -DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel List:

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

EUT was tested with channel 0, 39, 78.



5 Equipment During Test

5.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Last calibration	Calibration Due	Calibration period
MXA Signal Analyzer	Agilent	N9020A	MY56070279	Aug. 21, 2021	Aug. 20, 2022	1 year
Coaxial Cable	CDS	79254	46107086	Aug. 21, 2021	Aug. 20, 2022	1 year
Power Meter	Anritsu	ML2495A	0949003	Aug. 21, 2021	Aug. 20, 2022	1 year
Power Sensor	Anritsu	MA2411B	0917017	Aug. 21, 2021	Aug. 20, 2022	1 year
Spectrum Analyzer	Rohde&Schwarz	FSU26	1166.1660.26	Aug. 21, 2021	Aug. 20, 2022	1 year

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Last calibration	Calibration Due	Calibration period
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	Aug. 21, 2021	Aug. 20, 2022	1 year
Loop Antenna	Schwarzbeck	FMZB 1519	012	Aug. 21, 2021	Aug. 20, 2022	1 year
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	Aug. 21, 2021	Aug. 20, 2022	1 year
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	Aug. 21, 2021	Aug. 20, 2022	1 year
Cable	Schwarzbeck	PLF-100	549489	Aug. 21, 2021	Aug. 20, 2022	1 year
Spectrum Analyzer	Agilent	E4407B	MY45109572	Aug. 21, 2021	Aug. 20, 2022	1 year
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	Aug. 21, 2021	Aug. 20, 2022	1 year
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	Aug. 21, 2021	Aug. 20, 2022	1 year
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	Aug. 21, 2021	Aug. 20, 2022	1 year
Amplifier	SCHWARZBECK	BBV 9721	9721-205	Aug. 21, 2021	Aug. 20, 2022	1 year
Cable	H+S	CBL-26	N/A	Aug. 21, 2021	Aug. 20, 2022	1 year
RF Cable	R&S	R204	R21X	Aug. 21, 2021	Aug. 20, 2022	1 year



Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Last calibration	Calibration Due	Calibration period
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	Aug. 21, 2021	Aug. 20, 2022	1 year
Artificial Mains Network	Rohde&Schwarz	L2-16B	000WX31025	Aug. 21, 2021	Aug. 20, 2022	1 year
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	Aug. 21, 2021	Aug. 20, 2022	1 year



5.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	$\pm 1.0\text{dB}$
Power Spectral Density, conducted	$\pm 2.2\text{dB}$
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
Time	$\pm 2\%$
Duty Cycle	$\pm 2\%$
Temperature	$\pm 1^\circ\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 3\%$
Conducted Emissions (150kHz~30MHz)	$\pm 3.64\text{dB}$
Radiated Emission(9kHz~30MHz)	$\pm 2.54\text{dB}$
Radiated Emission(30MHz~1GHz)	$\pm 5.03\text{dB}$
Radiated Emission(1GHz~25GHz)	$\pm 4.74\text{dB}$
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	



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5.3 Description of Support Units

Equipment	Model No.	Series No.
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6 Conducted Emission

Test Requirement:	: FCC CFR 47 Part 15 Section 15.207
Test Method:	: ANSI C63.10:2013
Test Result:	: PASS
Frequency Range:	: 150kHz to 30MHz
Class/Severity:	: Class B
Detector:	: Peak for pre-scan (9kHz Resolution Bandwidth)

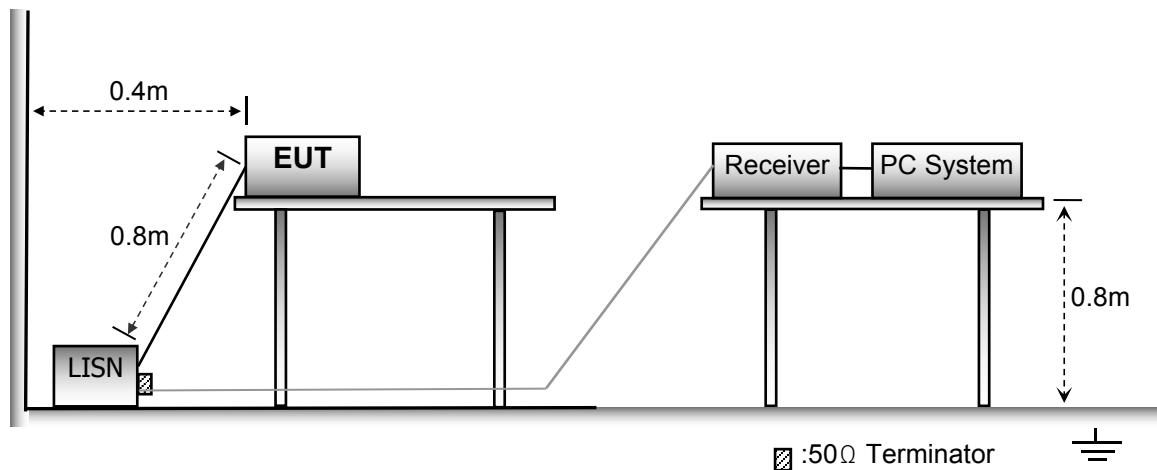
6.1 E.U.T. Operation

Operating Environment :

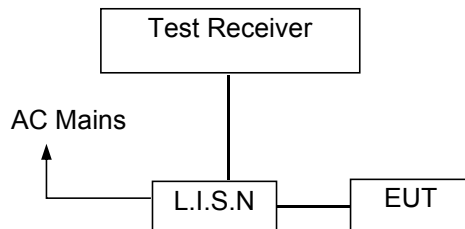
Temperature:	: 25.5 °C
Humidity:	: 51 % RH
Atmospheric Pressure:	: 101.2kPa
Test Voltage	: AC 120V/60Hz

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10: 2013



6.3 Test SET-UP (Block Diagram of Configuration)



6.4 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

6.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

6.6 Measurement Description

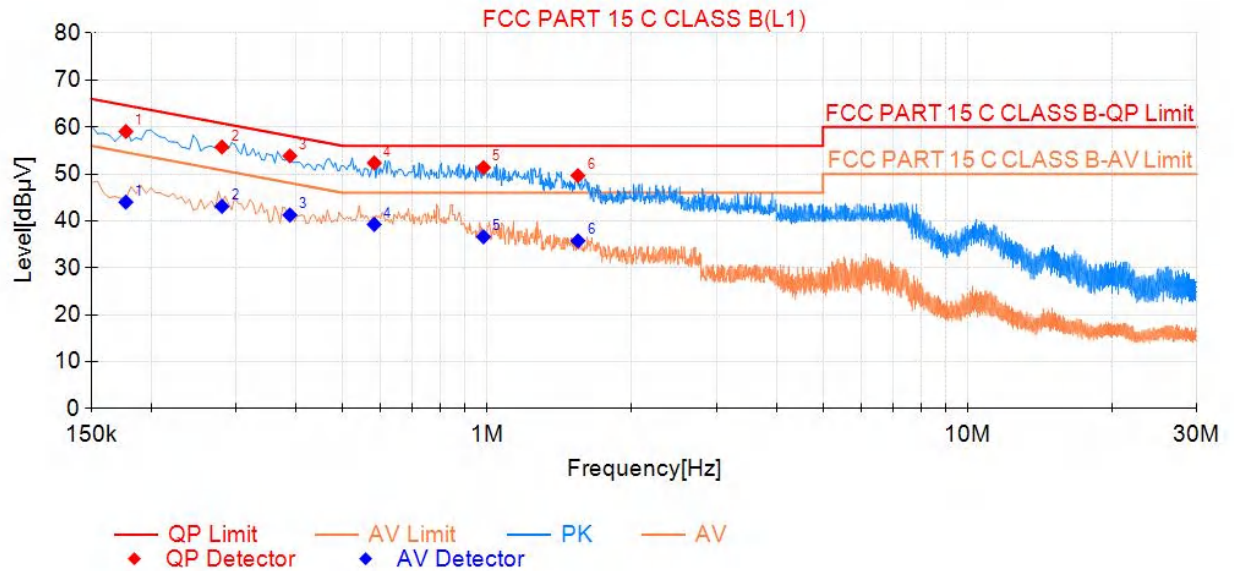
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7 Conducted Emission Test Result

Pass.

All the modulation modes were tested on AC 120V 60Hz and AC 230V 60Hz, the data of the worst mode (AC 120V 60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

Line -120V/60Hz:

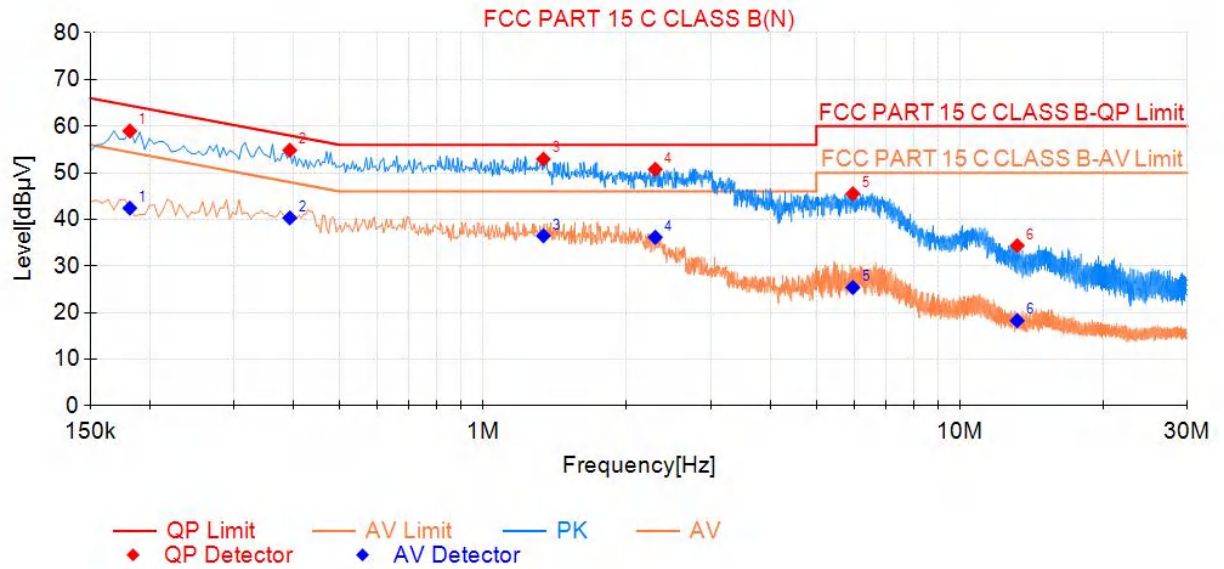


Final Data List

NO.	Freq. [MHz]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.177	59.06	64.63	5.57	44.01	54.63	10.62	PASS
2	0.281	55.75	60.80	5.05	43.11	50.80	7.69	PASS
3	0.389	53.86	58.10	4.24	41.26	48.10	6.84	PASS
4	0.582	52.36	56.00	3.64	39.26	46.00	6.74	PASS
5	0.983	51.36	56.00	4.64	36.62	46.00	9.38	PASS
6	1.545	49.66	56.00	6.34	35.76	46.00	10.24	PASS



Neutral -120V/60Hz:



Final Data List

NO.	Freq. [MHz]	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Verdict
1	0.182	58.95	64.42	5.47	42.42	54.42	12.00	PASS
2	0.393	54.84	58.00	3.16	40.32	48.00	7.68	PASS
3	1.338	52.94	56.00	3.06	36.48	46.00	9.52	PASS
4	2.297	50.75	56.00	5.25	36.17	46.00	9.83	PASS
5	5.964	45.52	60.00	14.48	25.40	50.00	24.60	PASS
6	13.196	34.38	60.00	25.62	18.29	50.00	31.71	PASS



7 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method : ANSI C63.10:2013
 Test Result : PASS
 Measurement Distance : 3m
 Limit : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

7.1 EUT Operation

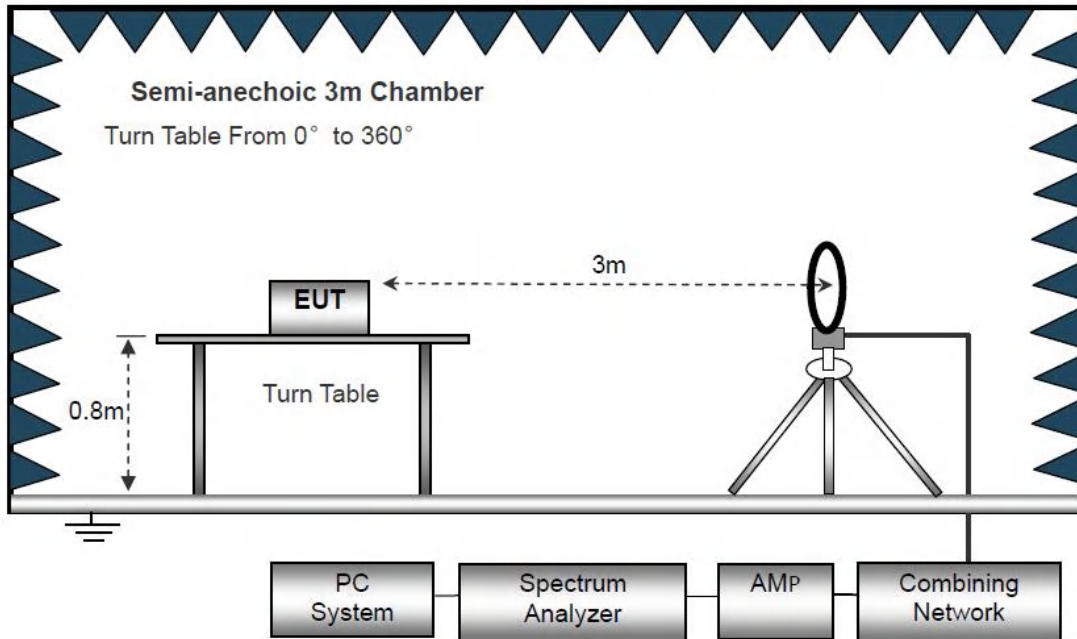
Operating Environment :

Temperature : 23.5 °C
 Humidity : 51.1 % RH
 Atmospheric Pressure : 101.2kPa
 Test Voltage : AC 120V 60Hz

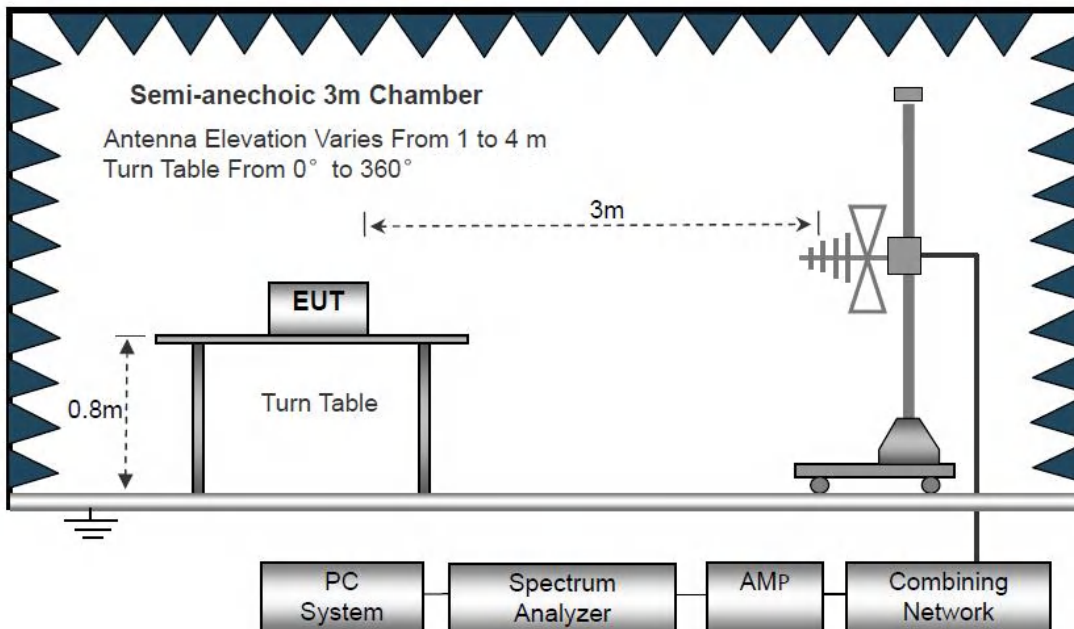
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

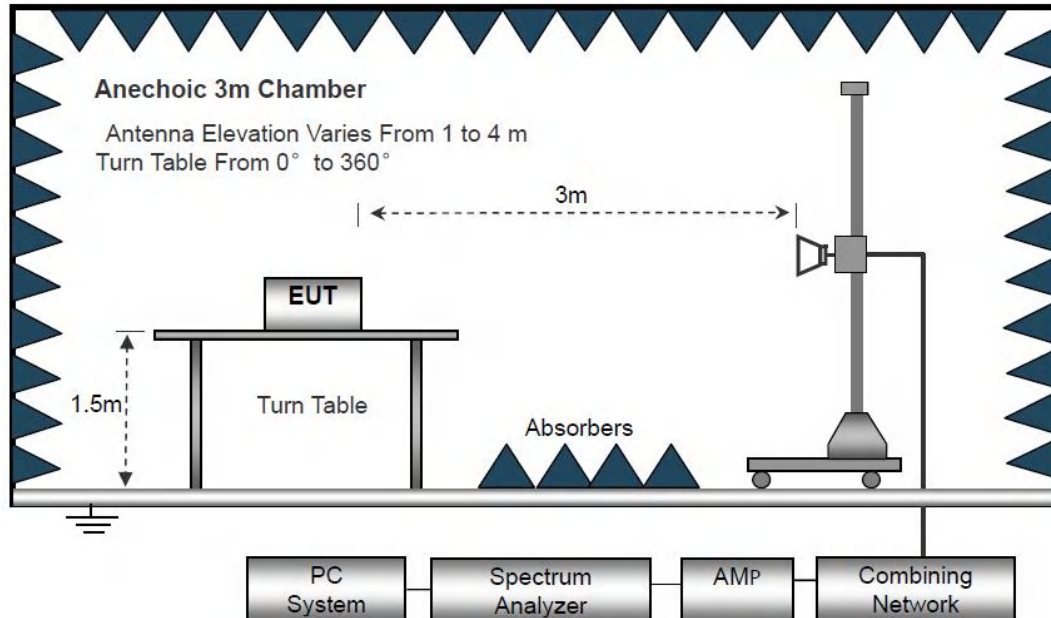
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP



7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.
2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) 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.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
 - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
 - 2) Change the antenna polarization and repeat 1) with vertical polarization.
 - 3) Make a hardcopy of the spectrum.
 - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
 - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
 - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
 - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
 - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



7.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor = $40\log(\text{Specific distance} / \text{test distance})$ (dB);

Limit line = Specific limits (dBuV) + distance extrapolation factor.

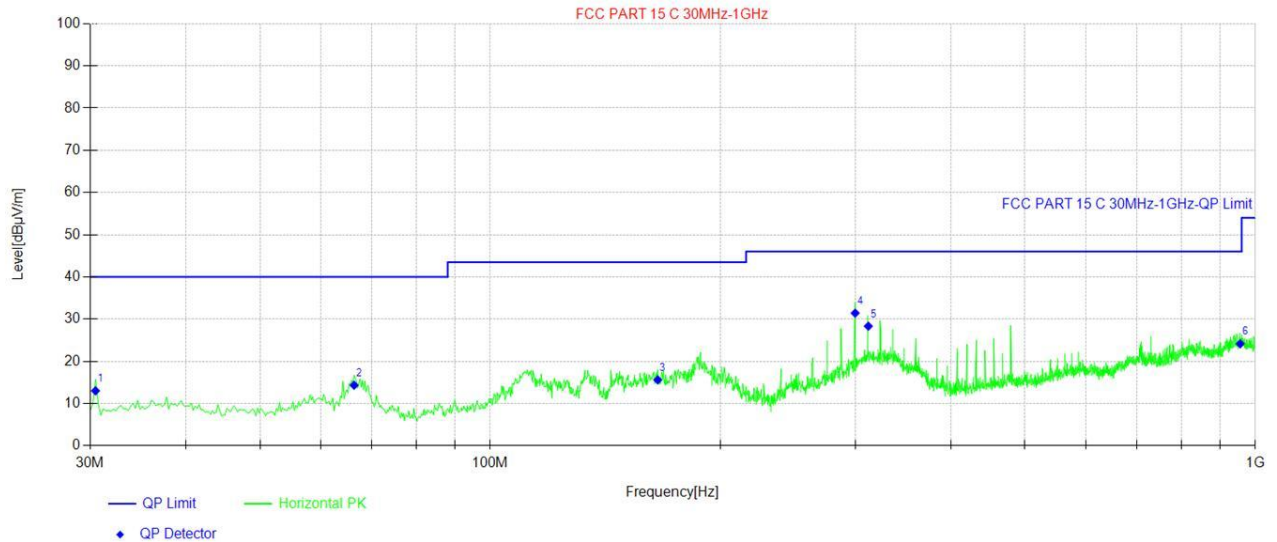
Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots:

All the modulation modes were tested the data of the worst mode (AC 120V 60Hz, GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.



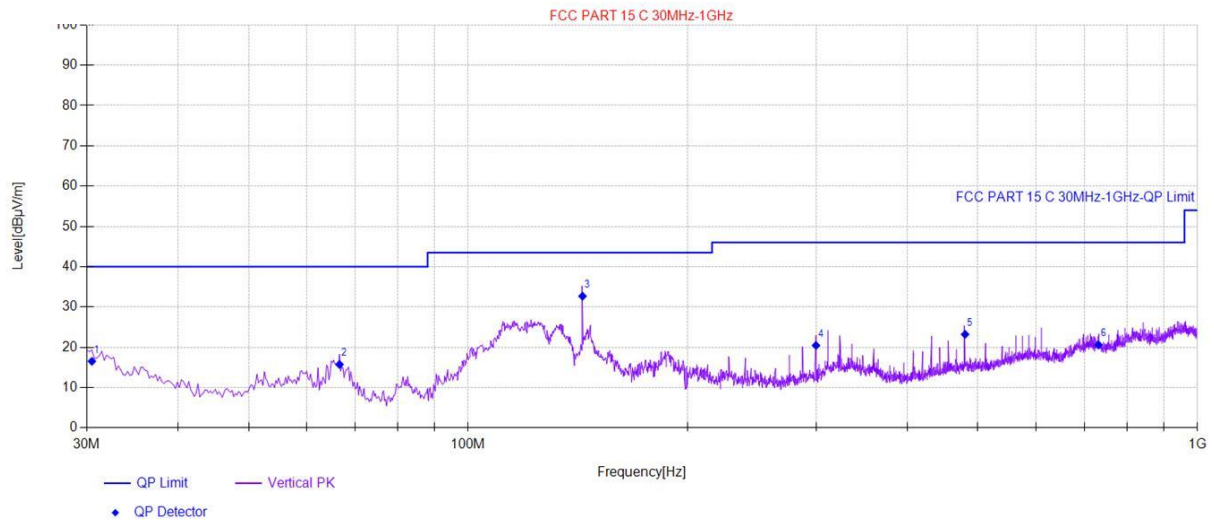
Test plot for Horizontal: GFSK(2402MHz)



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	30.49	-18.32	13.03	40.00	26.97	100	359	Horizontal
2	66.38	-18.74	14.35	40.00	25.65	100	359	Horizontal
3	165.56	-15.97	15.62	43.50	27.88	100	135	Horizontal
4	299.90	-15.45	31.42	46.00	14.58	100	135	Horizontal
5	312.03	-15.10	28.34	46.00	17.66	100	182	Horizontal
6	955.38	-2.12	24.17	46.00	21.83	100	268	Horizontal



Test plot for Vertical: GFSK(2402MHz)



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	30.49	-18.32	16.52	40.00	23.48	100	318	Vertical
2	66.62	-18.77	15.74	40.00	24.26	100	222	Vertical
3	143.49	-16.47	32.69	43.50	10.81	100	338	Vertical
4	299.90	-15.45	20.46	46.00	25.54	100	205	Vertical
5	480.08	-11.36	23.22	46.00	22.78	100	299	Vertical
6	731.80	-5.87	20.57	46.00	25.43	100	286	Vertical



Test Frequency 1GHz-18GHz

Low Channel (2402MHz) Worst case GFSK

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4804	29.75	AV	V	8.18	10.46	10.43	37.96	54	-16.04
4804	30.26	AV	H	8.18	10.46	10.43	38.47	54	-15.53
4804	32.14	PK	V	8.18	10.46	10.43	40.35	74	-33.65
4804	35.29	PK	H	8.18	10.46	10.43	43.5	74	-30.5
14412	30.26	AV	V	9.22	11.05	12.36	38.17	54	-15.83
14412	31.47	AV	H	9.22	11.05	12.36	39.38	54	-14.62
14412	34.29	PK	V	9.22	11.05	12.36	42.2	74	-31.8
14412	36.28	PK	H	9.22	11.05	12.36	44.19	74	-29.81

Middle Channel (2441MHz) Worst case GFSK

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882	28.43	AV	V	7.86	9.73	10.75	35.27	54	-18.73
4882	30.12	AV	H	7.86	9.73	10.75	36.96	54	-17.04
4882	32.69	PK	V	7.86	9.73	10.75	39.53	74	-34.47
4882	35.06	PK	H	7.86	9.73	10.75	41.9	74	-32.1
15896	29.43	AV	V	8.25	10.29	11.23	36.74	54	-17.26
15896	30.27	AV	H	8.25	10.29	11.23	37.58	54	-16.42
15896	33.29	PK	V	8.25	10.29	11.23	40.6	74	-33.4
15896	35.74	PK	H	8.25	10.29	11.23	43.05	74	-30.95

High Channel (2480MHz) Worst case GFSK

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	29.35	AV	V	8.23	9.86	11.46	35.98	54	-18.02
4960	30.22	AV	H	8.23	9.86	11.46	36.85	54	-17.15
4960	33.37	PK	V	8.23	9.86	11.46	40	74	-34
4960	36.29	PK	H	8.23	9.86	11.46	42.92	74	-31.08
15483	30.29	AV	V	9.32	10.24	12.09	37.76	54	-16.24
15483	32.48	AV	H	9.32	10.24	12.09	39.95	54	-14.05
15483	35.98	PK	V	9.32	10.24	12.09	43.45	74	-30.55
15483	37.29	PK	H	9.32	10.24	12.09	44.76	74	-29.24

Note: 1. The testing has been conformed to 10*2480MHz=24800MHz.

2. All other emissions more than 30dB below the limit.

3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



Emission Level = Reading + Factor
Margin=Emission Level-Limit

Test Frequency: From 18GHz to 25GHz

The measurements were more than 20dB below the limit and not reported.

Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

TestMod e	Antenn a	ChNa me	Frequenc y[MHz]	Detector	Freq [MHz]	Result [dBm]	Limit [dBm]	Result [dBuV/ m]	Limit [dBuV/ m]	Verdict
DH5	Ant1	Low	2402	AV	2310.000	-54	≤-41.20	41.20	≤54	PASS
				AV	2378.015	-46.02	≤-41.20	49.18	≤54	PASS
				AV	2390.000	-51.03	≤-41.20	44.17	≤54	PASS
				Peak	2310.000	-45.69	≤-21.20	49.51	≤74	PASS
				Peak	2377.700	-39.79	≤-21.20	55.41	≤74	PASS
				Peak	2390.000	-43.06	≤-21.20	52.14	≤74	PASS
		High	2480	AV	2483.500	-46.41	≤-41.20	48.79	≤54	PASS
				AV	2483.520	-46.41	≤-41.20	48.79	≤54	PASS
				AV	2500.000	-50.05	≤-41.20	45.15	≤54	PASS
				Peak	2483.500	-33.41	≤-21.20	61.79	≤74	PASS
				Peak	2483.520	-33.41	≤-21.20	61.79	≤74	PASS
				Peak	2500.000	-41.84	≤-21.20	53.36	≤74	PASS
		Low	Hop_2402	Peak	2310.000	-44.65	≤-21.20	50.55	≤74	PASS
				Peak	2379.275	-40.25	≤-21.20	54.95	≤74	PASS
				Peak	2390.000	-42.51	≤-21.20	52.69	≤74	PASS
		High	Hop_2480	Peak	2483.500	-36.48	≤-21.20	58.72	≤74	PASS
				Peak	2483.600	-34.91	≤-21.20	60.29	≤74	PASS
				Peak	2500.000	-42.34	≤-21.20	52.86	≤74	PASS
2DH5	Ant1	Low	2402	AV	2310.000	-54.09	≤-41.20	41.11	≤54	PASS
				AV	2378.120	-47.13	≤-41.20	48.07	≤54	PASS



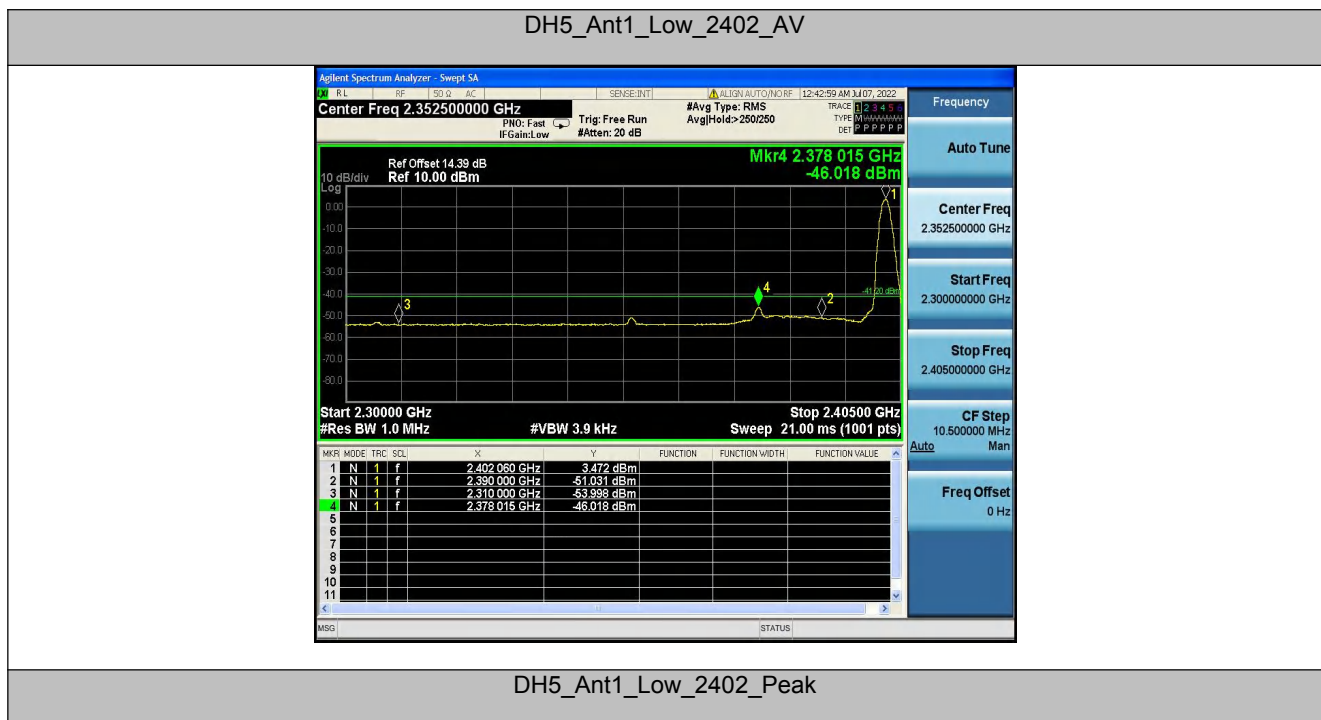
				AV	2390.000	-50.48	≤-41.20	44.72	≤54	PASS
				Peak	2310.000	-45.3	≤-21.20	49.90	≤74	PASS
				Peak	2378.120	-39.52	≤-21.20	55.68	≤74	PASS
				Peak	2390.000	-42.02	≤-21.20	53.18	≤74	PASS
		High	2480	AV	2483.500	-53.55	≤-41.20	41.65	≤54	PASS
				AV	2496.400	-53.52	≤-41.20	41.68	≤54	PASS
				AV	2500.000	-53.58	≤-41.20	41.62	≤54	PASS
				Peak	2483.500	-37.94	≤-21.20	57.26	≤74	PASS
				Peak	2483.680	-36.5	≤-21.20	58.70	≤74	PASS
				Peak	2500.000	-42.35	≤-21.20	52.85	≤74	PASS
		Low	Hop_2402	Peak	2310.000	-44.73	≤-21.20	50.47	≤74	PASS
				Peak	2382.635	-40.86	≤-21.20	54.34	≤74	PASS
				Peak	2390.000	-42.41	≤-21.20	52.79	≤74	PASS
		High	Hop_2480	Peak	2483.500	-39.66	≤-21.20	55.54	≤74	PASS
				Peak	2500.000	-42	≤-21.20	53.20	≤74	PASS
3DH5	Ant1	Low	2402	AV	2310.000	-53.97	≤-41.20	41.23	≤54	PASS
				AV	2378.015	-46.93	≤-41.20	48.27	≤54	PASS
				AV	2390.000	-50.82	≤-41.20	44.38	≤54	PASS
				Peak	2310.000	-44.77	≤-21.20	50.43	≤74	PASS
				Peak	2384.315	-39.99	≤-21.20	55.21	≤74	PASS
				Peak	2390.000	-43.08	≤-21.20	52.12	≤74	PASS
		High	2480	AV	2483.500	-53.64	≤-41.20	41.56	≤54	PASS
				AV	2499.600	-53.54	≤-41.20	41.66	≤54	PASS
				AV	2500.000	-53.57	≤-41.20	41.63	≤54	PASS
				Peak	2483.500	-40.32	≤-21.20	54.88	≤74	PASS
				Peak	2492.800	-40.26	≤-21.20	54.94	≤74	PASS
				Peak	2500.000	-42.94	≤-21.20	52.26	≤74	PASS
		Low	Hop_2402	Peak	2310.000	-45.46	≤-21.20	49.74	≤74	PASS
				Peak	2381.480	-41	≤-21.20	54.20	≤74	PASS



				Peak	2390.000	-42.11	≤-21.20	53.09	≤74	PASS
		High	Hop_2480	Peak	2483.500	-41.17	≤-21.20	54.03	≤74	PASS
				Peak	2497.440	-40.69	≤-21.20	54.51	≤74	PASS
				Peak	2500.000	-43.3	≤-21.20	51.90	≤74	PASS

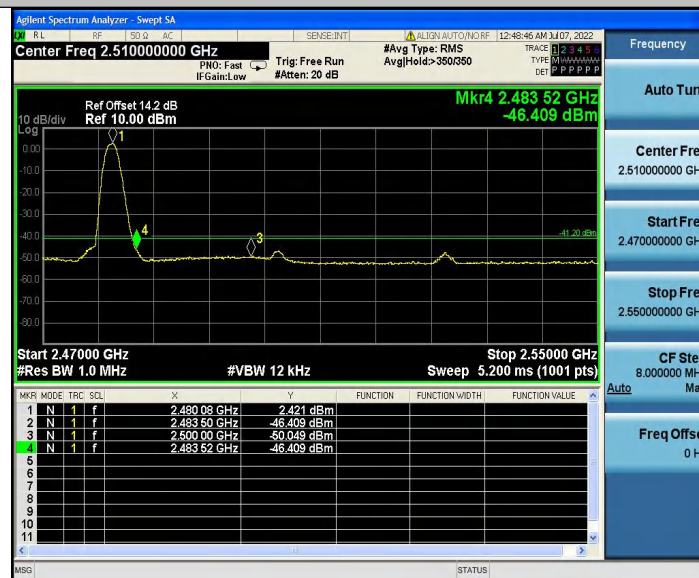
Note :

1. The Antenna Gain is compensated in the graph.
2. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.





DH5_Ant1_High_2480_AV



DH5_Ant1_High_2480_Peak



DH5_Ant1_Low_Hop_2402_Peak



DH5_Ant1_High_Hop_2480_Peak



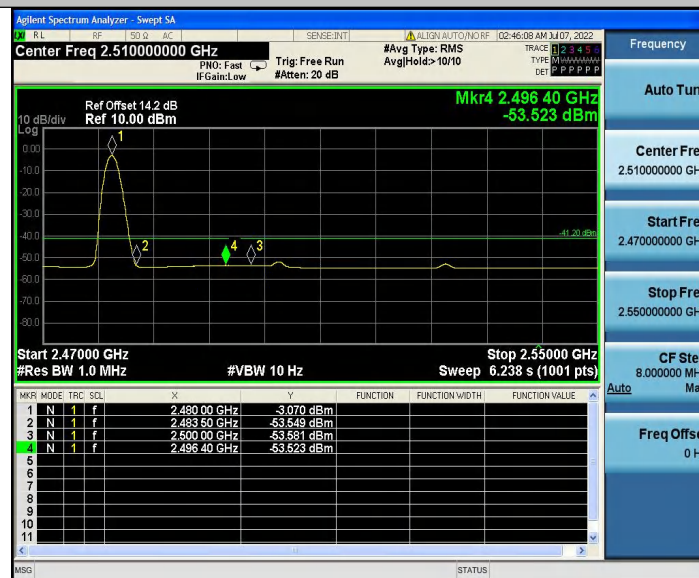
2DH5_Ant1_Low_2402_AV



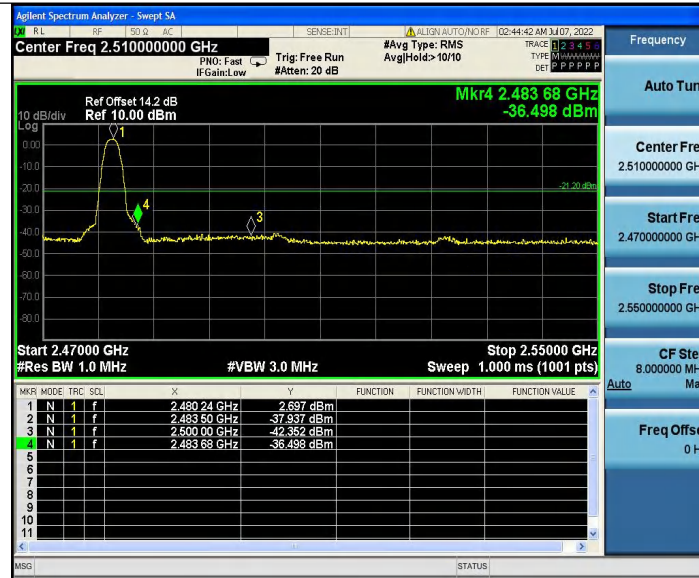
2DH5_Ant1_Low_2402_Peak



2DH5_Ant1_High_2480_AV



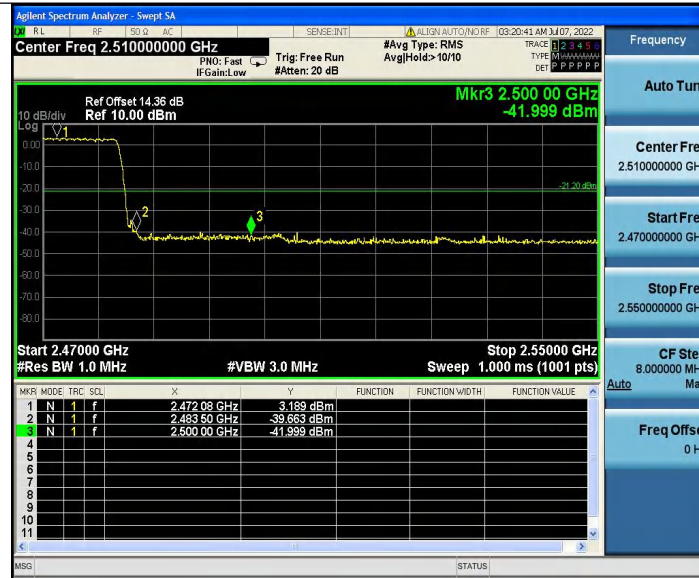
2DH5_Ant1_High_2480_Peak



2DH5_Ant1_Low_Hop_2402_Peak



2DH5_Ant1_High_Hop_2480_Peak



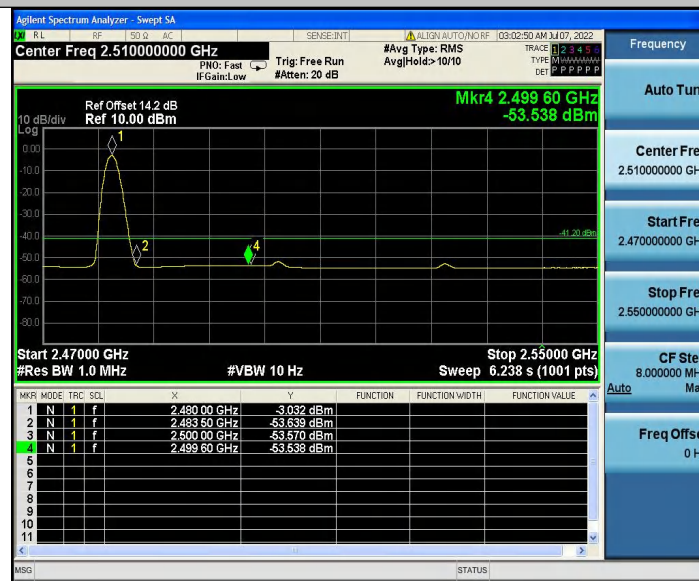
3DH5_Ant1_Low_2402_AV



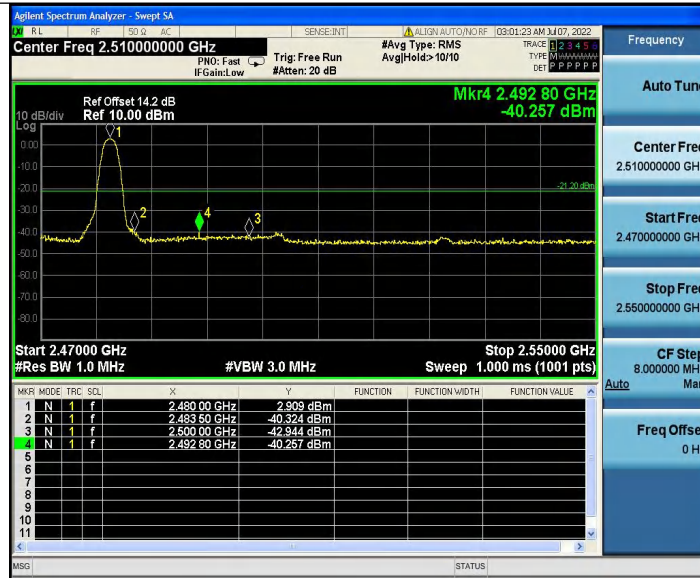
3DH5_Ant1_Low_2402_Peak



3DH5_Ant1_High_2480_AV



3DH5_Ant1_High_2480_Peak



3DH5_Ant1_Low_Hop_2402_Peak



3DH5_Ant1_High_Hop_2480_Peak





8 CONDUCTED BAND EDGE EMISSION

8.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

8.2 TEST PROCEDURE

For Conducted Test

1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

For Radiated emission Test

The EUT was placed on a styrofoam table which is 1.5m above ground plane.

The measurement procedure at the band edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were encompassed by the span. After trace stabilization, the maximum peak was determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20dB below the first, marks the limit for the emissions in the unrestricted band. A maximum-peak-detector marks the highest emission in the unrestricted band next to the band edge.



The measurements were performed at the lower end of the 2.4GHz band.

Use the following spectrum analyzer settings:

For Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	3MHz
Detector	Peak
Trace	Max hold

For Non-Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 100KHz, video bandwidth 300KHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold