



FCC Part 15C&RSS-247 TEST REPORT

FCC ID:2AD4XBANG

IC:12714A-BANG

Prepared for : LOUD AUDIO, LLC
Address : 19820 North Creek Parkway, #201, Bothell, Washington 98011-8227, United States

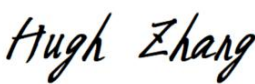
Trade Name : 
E.U.T : POWERED LOUDSPEAKERS
Model Number : THUMP12v4, THUMP15v4

Prepared by : Keyway Testing Technology(Guangdong) Co., Ltd.
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Report No. : 2025121938953803-00
Date of Test: : Nov. 02 ~ Dec. 18, 2025
Date of Report : Dec. 19, 2025



Applicant:	LOUD AUDIO, LLC	
Address:	19820 North Creek Parkway, #201, Bothell, Washington 98011-8227, United States	
Manufacturer:	LOUD AUDIO, LLC	
Address:	19820 North Creek Parkway, #201, Bothell, Washington 98011-8227, United States	
E.U.T:	POWERED LOUDSPEAKERS	
Model Number:	THUMP12v4, THUMP15v4	
Trade Name:		
Date of Receipt:	Nov. 01, 2025	
Date of Test:	Nov. 02 ~ Dec. 18, 2025	
Test Specification :	FCC CFR47 Part 15 Section 15.247 RSS-247 Issue 4: July 24, 2025 ANSI C63.10-2020/Cor1-2023 RSS-GEN Issue5, Amendment 2, February,2021	
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.	
Issue Date: Dec. 19, 2025		
Tested by:	Reviewed by:	Authorized by:
		
Hugh Zhang / Engineer	Billy Zeng / Supervisor	Cherry Chen / Manager
Abbreviations: OK/P=passed fail/F=failed N/A=not applicable E.U.T=equipment under tested		
This device described above has been tested by Keyway, 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 Keyway, this document may be altered or revised by Keyway, personal only, and shall be noted in the revision of the document.		



Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2025.12.19		Original



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1 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions and Restricted Bandedge	15.205(a) 15.209 15.247(d) RSS-Gen 6.13 RSS-Gen 8.10	PASS
Conducted Unwanted emissions and Band edge	15.247(d) 15.205(a) RSS-247 6.6	PASS
Conduct Emission	15.207 RSS-Gen 8.8	PASS
20dB Bandwidth & 99% OCB	15.247(a)(1) RSS-247 6.2.3.1(a) RSS-Gen 6.7	PASS
Maximum Peak Output Power Test (EIRP)	15.247(b)(1) RSS-247 6.2.3.2	PASS
Carrier Frequency Separation	15.247(a)(1)(iii) RSS-247 6.2.3.1(a)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii) RSS-247 6.2.3.1(b)	PASS
Dwell time	15.247(a)(1)(iii) RSS-247 6.2.3.1(b)	PASS
Antenna Requirement	FCC part 15.203/15.247 (b)(4) RSS-Gen 6.8	PASS

Remark:

1. "N/A" denotes test is not applicable in this Test Report.



2 TEST FACILITY

Lab Qualifications	: Certificated by Nemko Registration No.: ELA 814 Date of registration: September 25, 2024 Certificated by CMA China Registration No.: 202319016955 Date of registration: July 23, 2024 Certificated by A2LA Certificate Number: 7404.01 Valid To: March 31, 2027 Accredited by Innovation, Science and Economic Development Canada, May 08, 2025 The Conformity Assessment Body Identifier is CN0186 Company Number: 33959
Name of Firm	: Keyway Testing Technology(Guangdong) Co., Ltd.
Site Location	: Room 2102, Building 6, Dongyi Intelligent Equipment New Energy Vehicle Park, No.30 of Tangxia District, Dongshen Road, Tangxia Town,Dongguan, 523710, People's Republic of China



3 General Information

3.1 General Description of E.U.T.

Product Name	:	POWERED LOUDSPEAKERS
Model Name	:	THUMP12v4, THUMP15v4
Sample ID	:	33000257420, 33000257419
Sample(s) Status:	:	Engineer sample
Additional model	:	N/A
Model difference	:	The two models are the same except for the size and Weight of the subwoofer, Power supply and the model name.
Operating frequency	:	2402-2480MHz
Numbers of Channel	:	79 channels
Antenna Type	:	PCB Antenna
Antenna Gain	:	2.00dBi
Type of Modulation	:	GFSK, $\pi/4$ DQPSK, 8DPSK
Power supply	:	100-240V~50-60Hz THUMP15v4: 350W Max. THUMP12v4: 300W Max.
Hardware Version	:	N/A
Software Version	:	N/A
Remark: the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.		

3.2 Channel List

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 C63.10-2020/Cor1-2023 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.

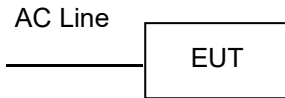
Channel List:

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	-	-

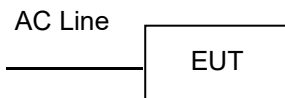
Channel	Frequency(MHz)
0	2402
39	2441
78	2480

3.3 Test Setup Configuration

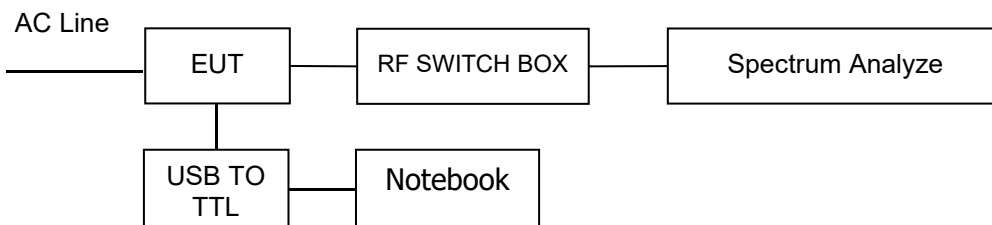
Conducted Emission



Radiated Emission



RF Conducted



3.4 Test Mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. For battery operated equipment, the equipment tests shall be performed using a new battery. So the report just shows that condition's data.	

Test Software	InstallBlueSuiteCda_3_1_1_491.exe	Version number	3.1.1.491
Power level setup	10dBm		



4 Equipment During Test

4.1 Equipments List

Equipment	Manufacturer	Model No.	Serial No.	Date of Cal.	Valid until
For conducted emission at the mains terminals and signal port test 944 Shielded Room					
Test Software	FARAD	EZ-EMC Ver.FARAD-3A1+	KWET-089	/	/
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr 14, 25	Apr 13, 26
ArtificialMains Network	Rohde&Schwarz	ENV216	101314	Mar 05, 25	Mar 04, 26
RF Cable	FUJIKURA	3D-2W	KWET-030	Apr 14, 25	Apr 13, 26
Socket	Gongniu	KWET-003A1	KWET-003A1	Feb 21, 25	Feb 20, 26
For radiated emission test (Below 1GHz)966 Chamber 2					
Test Software	FARAD	EZ-EMC Ver.FARAD-3A1+	KWET-087	/	/
EMI Test Receiver	Rohde&Schwarz	ESCI	101178	Apr 14, 25	Apr 13, 26
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00829	May 10, 25	May 09, 26
3m Semi-anechoic Chamber	YIHENDIANZI	966	YH-KW-966-02	Mar 07, 26	Mar 06, 29
RF Cable	EMC Instruments	EMCCFD400-NM-NM-2000	240307	Apr 14, 25	Apr 13, 26
RF Cable	EMC Instruments	EMCCFD400-NM-NM-9000	240309	Apr 14, 25	Apr 13, 26
Loop Antenna	Schwarzbeck	1519B	00006	May 10, 25	May 09, 26
For radiated emission test (Above 1GHz)966 Chamber 2					
Test Software	FARAD	EZ-EMC Ver.FARAD-3A1+	KWET-087	/	/
EMI Test Receiver	Rohde&Schwarz	ESCI	101178	Apr 14, 25	Apr 13, 26
Spectrum Analyzer	Agilent	N9020A	MY56070279	Apr 14, 25	Apr 13, 26



Spectrum analyzer	R&S	FSV 40	101059	Nov 06, 25	Nov 05, 26
Horn Antenna	DAZE	ZN30701	11003	Jul 27, 25	Jul 26, 26
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	1368	May 16, 25	May 15, 26
Signal Amplifier	WCS Technology	DLNA-18000-40000	KWET-138	Apr 19, 25	Apr 18, 26
3m anechoic Chamber	YIHENDIANZI	966	YH-KW-966-02	Mar 07, 25	Mar 06, 29
RF Cable(1G-18GHz)	EMC Instruments	EMC105-SM-SM-1000	240301	Apr 14, 25	Apr 13, 26
RF Cable(1G-18GHz)	EMC Instruments	EMC105-SM-SM-2000	240302	Apr 14, 25	Apr 13, 26
RF Cable(1G-18GHz)	EMC Instruments	EMC105-SM-SM-9000	240303	Apr 14, 25	Apr 13, 26
RF Cable(18G-40GHz)	WCS Technology	CA360P-29M29M-1M	W2415130001	Apr 14, 25	Apr 13, 26
RF Cable(18G-40GHz)	WCS Technology	CA360P-29M29M-9M	W2415110001	Apr 14, 25	Apr 13, 26
High Pass Filter 3GHz	Micro-Ironics	HPM17544	KWET-179	May 15, 24	May 14, 26
For conducted emission test (RF)					
MXG Signal Analyzer	Agilent	N9020A	MY56070279	Apr 14, 25	Apr 13, 26
RF SWITCH BOX	CSKJ	SMU-1003	KWET-047	Apr 14, 25	Apr 13, 26
Attenuator	R&S	ESH3-Z2	102696	Apr 14, 25	Apr 13, 26
Power meter	YOKOKAWA	WY210	27D528405	Apr 14, 25	Apr 13, 26
RF sma cable	Keysight	ULC-1m-SMSM+	1623	May 15, 25	May 14, 26
RF sma cable	Keysight	ULC-1m-SMSM+	1623	May 15, 25	May 14, 26
RF sma cable	Keysight	ULC-1.5FT-SMSM+	1623	May 15, 25	May 14, 26
RF sma cable	Keysight	ULC-1.5FT-SMSM+	1623	May 15, 25	May 14, 26
Coupler	Keysight	ZHDC-10-63-S+	SF331801603	May 15, 25	May 14, 26
Test Software	CSKJ	CS-305X	KWET-149	/	/



4.2 Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

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	$\pm 1.5 \times 10^{-6}$
Duty Cycle	$\pm 2\%$
Spurious emissions, conducted	$\pm 0.21\text{dB}$
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)	$\pm 4.51\text{dB}$
Radiated Emission(30MHz~1GHz)	$\pm 5.03\text{dB}$
Radiated Emission(1GHz~25GHz)	$\pm 4.74\text{dB}$
Radiated Emission(25GHz~40GHz)	$\pm 3.38\text{dB}$

4.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	POWERED LOUDSPEAKERS		THUMP12v4, THUMP15v4	33000257419, 33000257420	EUT
E-2	iPad	N/A	2010DJ5070	C3VG912KDCP7	Auxiliary
E-3	Notebook	lenovo	B40-80	MP07F6JD	Auxiliary

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

5 Conducted Emission

Test Requirement:	: FCC CFR 47 Part 15 Section 15.207 & RSS-Gen [8.8]
Test Method:	: ANSI C63.10-2020/Cor1-2023
Test Result:	: PASS
Frequency Range:	: 150kHz to 30MHz
Class/Severity:	: Class B
Detector:	: Peak for pre-scan (9kHz Resolution Bandwidth)

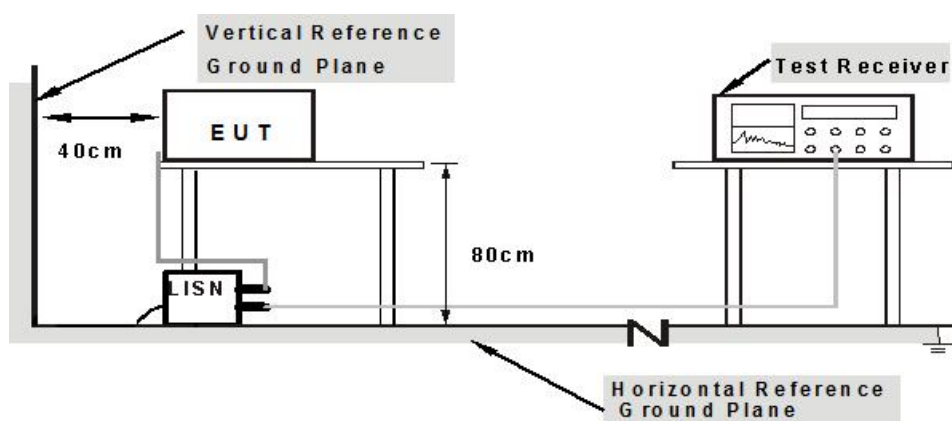
5.1 E.U.T. Operation

Operating Environment :

Temperature:	: 23.5°C
Humidity:	: 54 % RH
Atmospheric Pressure:	: 101.12 kPa
Test Voltage	: AC 120V/60Hz

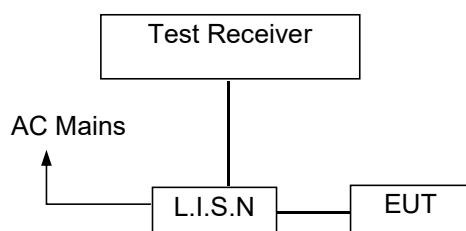
5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10-2020/Cor1-2023



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

5.3 Test SET-UP (Block Diagram of Configuration)



5.4 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.

5.5 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.

5.6 Measurement Description

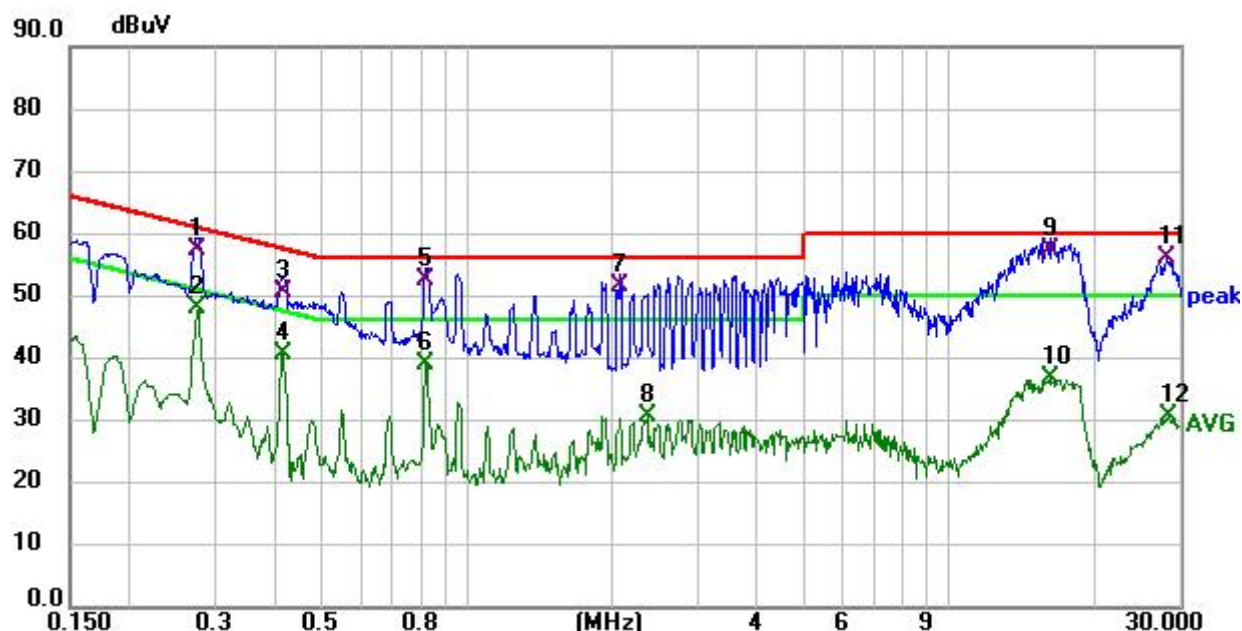
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

Pass

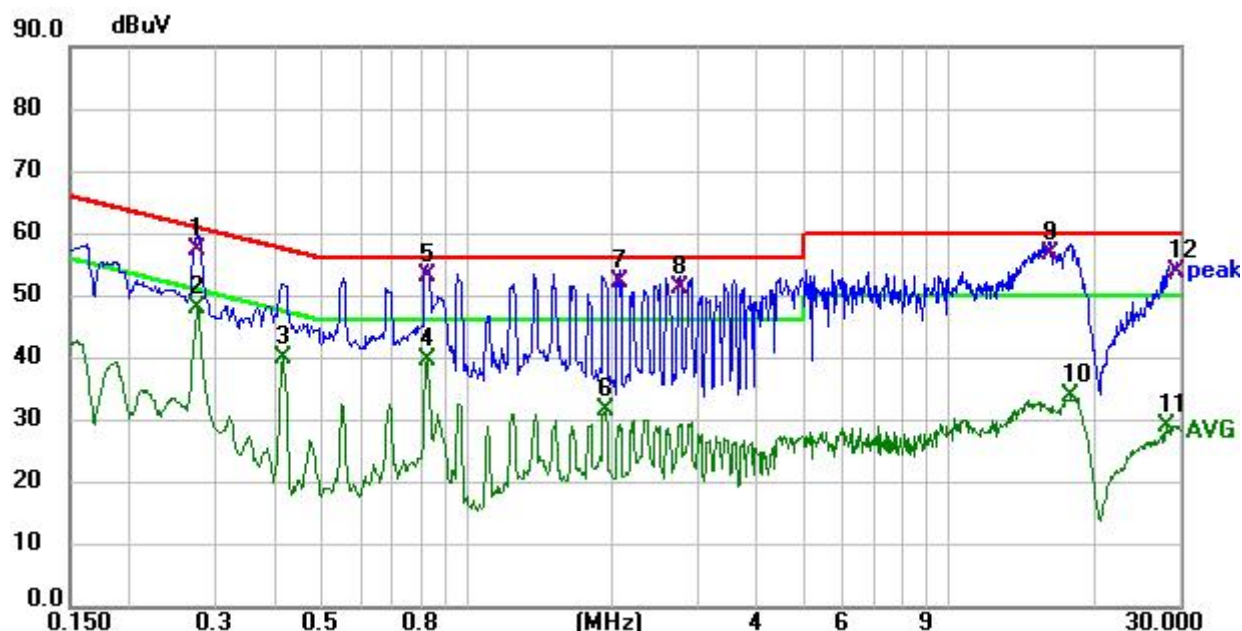
Conducted emission at both 120V & 240V is assessed, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

Channel:	High	Phase :	L
Model:	THUMP12v4		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.276	47.20	10.15	57.35	60.94	-3.59	QP	P	
2	0.276	37.75	10.15	47.90	50.94	-3.04	AVG	P	
3	0.415	40.55	10.23	50.78	57.55	-6.77	QP	P	
4	0.415	30.36	10.23	40.59	47.55	-6.96	AVG	P	
5	0.825	42.48	10.15	52.63	56.00	-3.37	QP	P	
6	0.825	28.90	10.15	39.05	46.00	-6.95	AVG	P	
7	2.080	41.40	10.09	51.49	56.00	-4.51	QP	P	
8	2.359	20.71	10.09	30.80	46.00	-15.20	AVG	P	
9 *	16.150	47.01	10.23	57.24	60.00	-2.76	QP	P	
10	16.150	26.57	10.23	36.80	50.00	-13.20	AVG	P	
11	28.250	45.71	10.24	55.95	60.00	-4.05	QP	P	
12	28.475	20.54	10.24	30.78	50.00	-19.22	AVG	P	

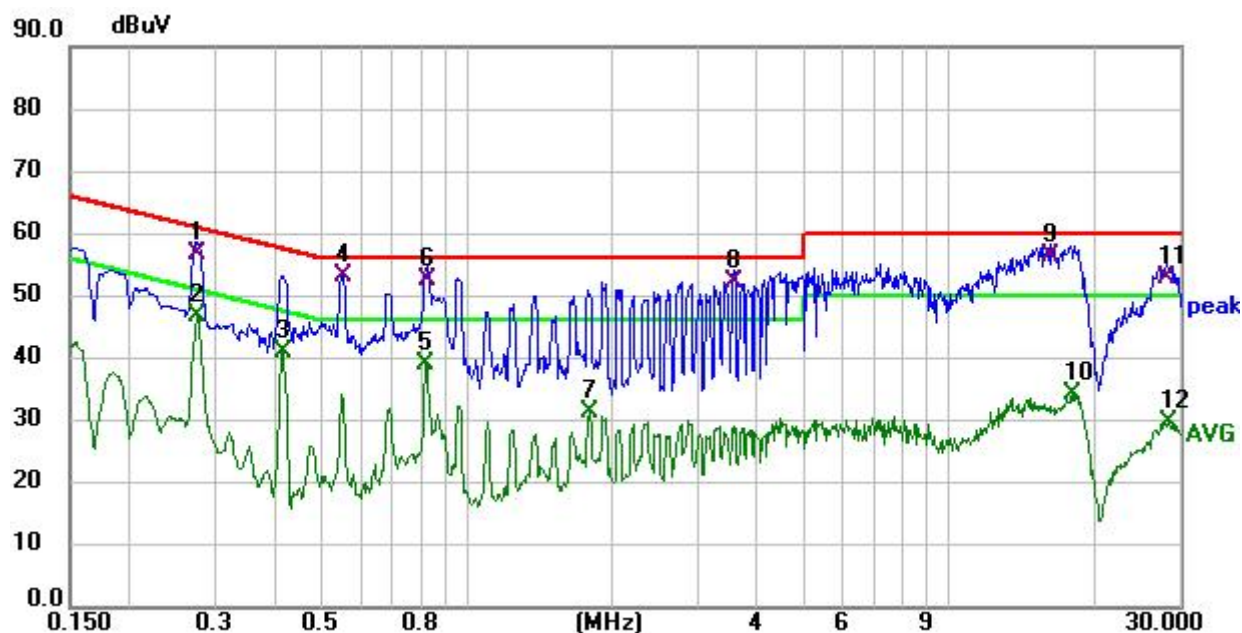
Channel:	High	Phase :	N
Model:	THUMP12v4		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.276	47.42	10.06	57.48	60.94	-3.46	QP	P	
2 *	0.276	38.04	10.06	48.10	50.94	-2.84	AVG	P	
3	0.415	29.74	10.16	39.90	47.55	-7.65	AVG	P	
4	0.830	29.56	10.10	39.66	46.00	-6.34	AVG	P	
5	0.834	43.02	10.10	53.12	56.00	-2.88	QP	P	
6	1.936	21.69	10.02	31.71	46.00	-14.29	AVG	P	
7	2.080	42.17	10.02	52.19	56.00	-3.81	QP	P	
8	2.773	41.08	10.03	51.11	56.00	-4.89	QP	P	
9	16.175	46.62	10.17	56.79	60.00	-3.21	QP	P	
10	17.900	23.75	10.19	33.94	50.00	-16.06	AVG	P	
11	28.250	18.97	10.19	29.16	50.00	-20.84	AVG	P	
12	29.675	43.56	10.19	53.75	60.00	-6.25	QP	P	

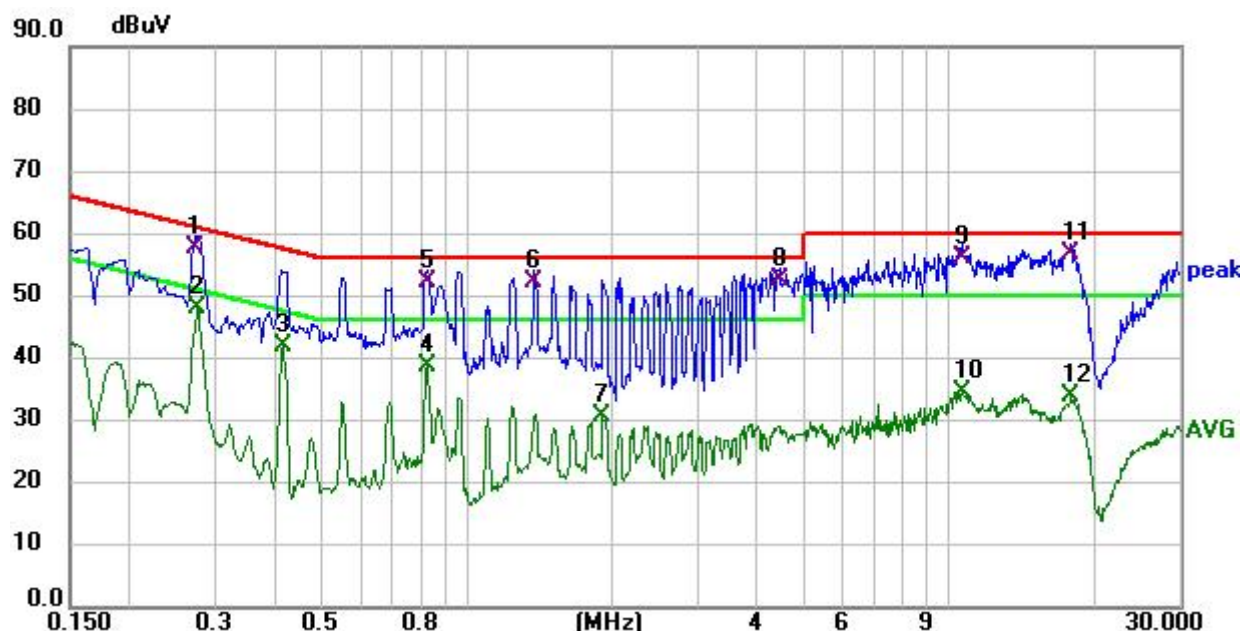


Channel:	High	Phase :	L
Model:	THUMP15v4		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.274	46.52	10.15	56.67	61.00	-4.33	QP	P	
2	0.276	36.75	10.15	46.90	50.94	-4.04	AVG	P	
3	0.415	30.86	10.23	41.09	47.55	-6.46	AVG	P	
4 *	0.555	42.91	10.23	53.14	56.00	-2.86	QP	P	
5	0.825	28.90	10.15	39.05	46.00	-6.95	AVG	P	
6	0.834	42.56	10.15	52.71	56.00	-3.29	QP	P	
7	1.801	21.34	10.09	31.43	46.00	-14.57	AVG	P	
8	3.583	42.18	10.11	52.29	56.00	-3.71	QP	P	
9	16.150	46.03	10.23	56.26	60.00	-3.74	QP	P	
10	17.975	23.93	10.23	34.16	50.00	-15.84	AVG	P	
11	28.250	42.79	10.24	53.03	60.00	-6.97	QP	P	
12	28.475	19.54	10.24	29.78	50.00	-20.22	AVG	P	

Channel:	High	Phase :	N
Model:	THUMP15v4		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.272	47.55	10.07	57.62	61.06	-3.44	QP	P	
2 *	0.276	38.04	10.06	48.10	50.94	-2.84	AVG	P	
3	0.415	31.74	10.16	41.90	47.55	-5.65	AVG	P	
4	0.830	28.56	10.10	38.66	46.00	-7.34	AVG	P	
5	0.834	42.02	10.10	52.12	56.00	-3.88	QP	P	
6	1.378	42.10	10.05	52.15	56.00	-3.85	QP	P	
7	1.918	20.60	10.02	30.62	46.00	-15.38	AVG	P	
8	4.447	42.37	10.04	52.41	56.00	-3.59	QP	P	
9	10.650	46.06	10.13	56.19	60.00	-3.81	QP	P	
10	10.725	24.43	10.13	34.56	50.00	-15.44	AVG	P	
11	17.900	46.52	10.19	56.71	60.00	-3.29	QP	P	
12	17.900	23.75	10.19	33.94	50.00	-16.06	AVG	P	

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Measurement Level = Reading level + Correct Factor



6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247 & RSS-247 [6.6]
 Test Method : ANSI C63.10-2020/Cor1-2023
 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	$20\log^{(500)}$

ISED

Frequency (MHz)	Magnetic field strength (H-Field) ($\mu\text{A/m}$)	Measurement distance (m)
0.009 ~ 0.490	$6.37/F$ (F in kHz)	300
0.490 ~ 1.705	$63.7/F$ (F in kHz)	30
1.705 ~ 30	0.08	30
Frequency (MHz)	Field strength ($\mu\text{V/m}$ at 3 metres)	
30 ~ 88	100	
88 ~ 216	150	
216 ~ 960	200	
Above 960	500	

6.1 EUT Operation

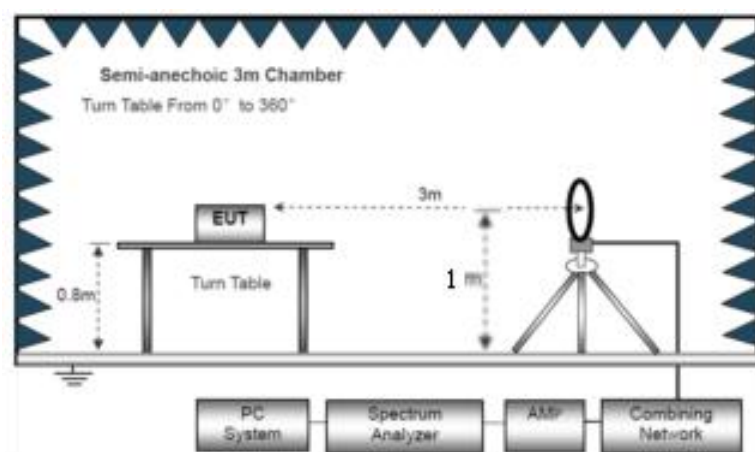
Operating Environment :

Temperature	: 26 °C
Humidity	: 54% RH
Atmospheric Pressure	: 101.3kPa
Test Voltage	: AC 120V60Hz

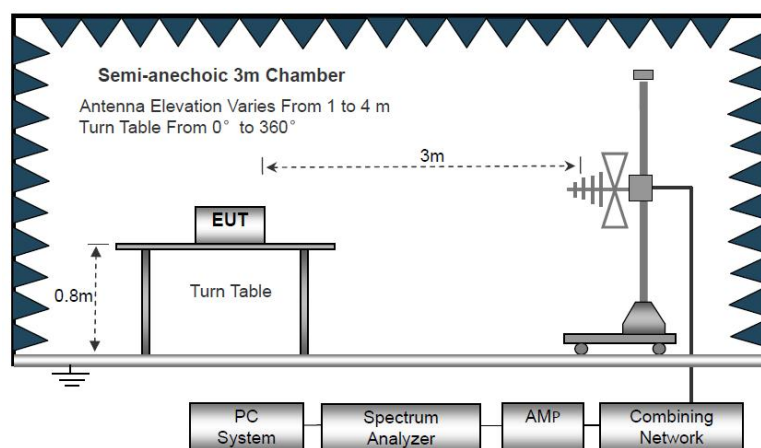
6.2 Test Setup

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

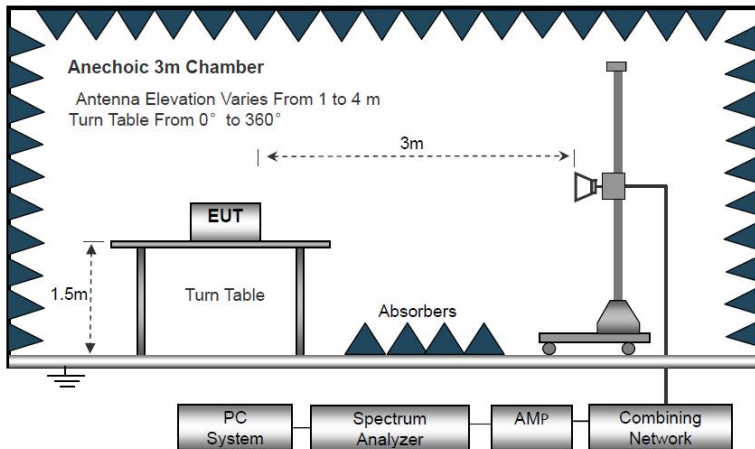
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



6.3 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

6.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2020/Cor1-2023.
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 0.8mm 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.
8. 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.



6.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

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

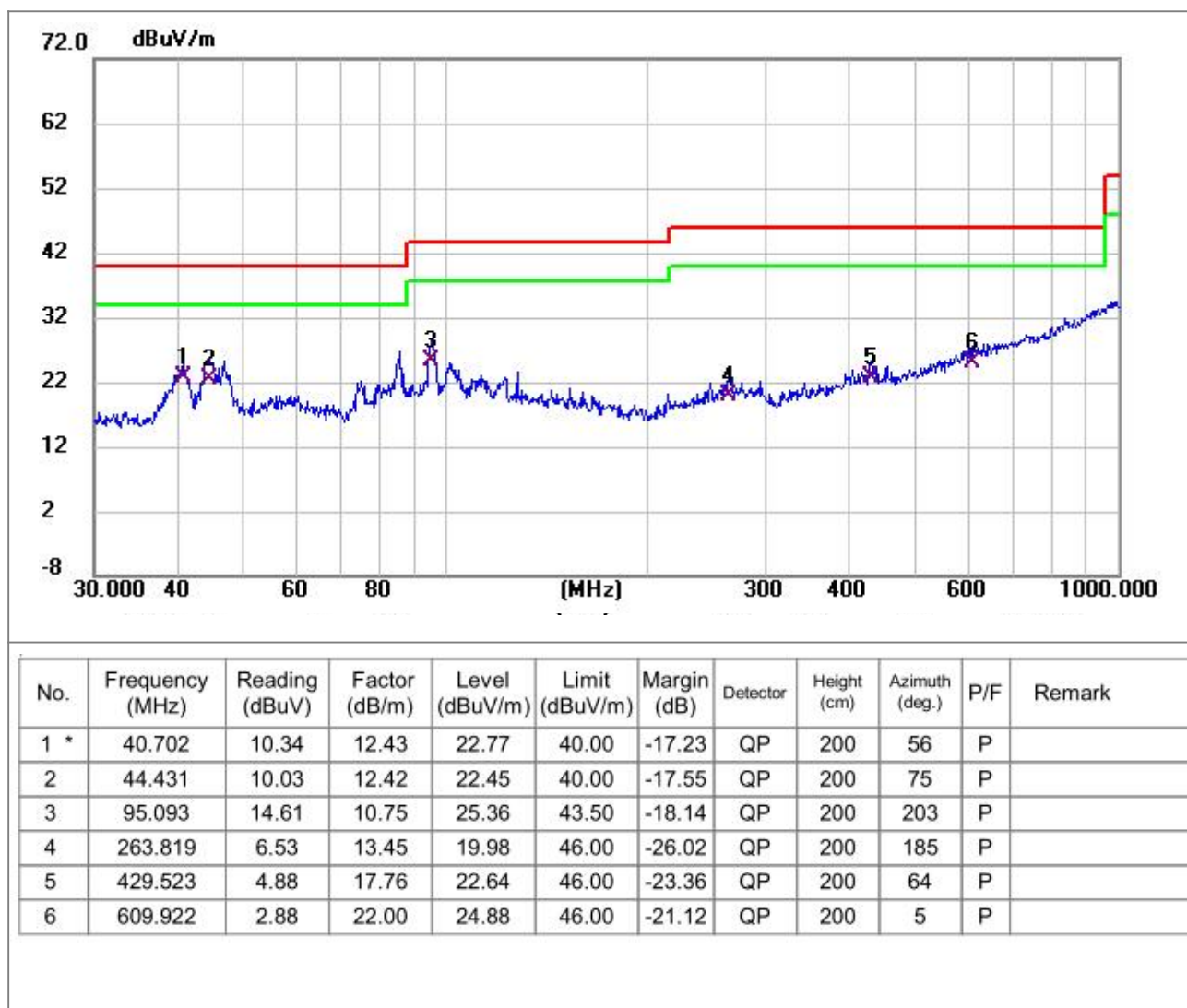
Test Frequency: 30MHz ~ 1GHz

Please refer to the following test plots, High Channel (2480MHz) Worst case GFSK for record:



Model:	THUMP12v4
--------	-----------

Test plot for Horizontal

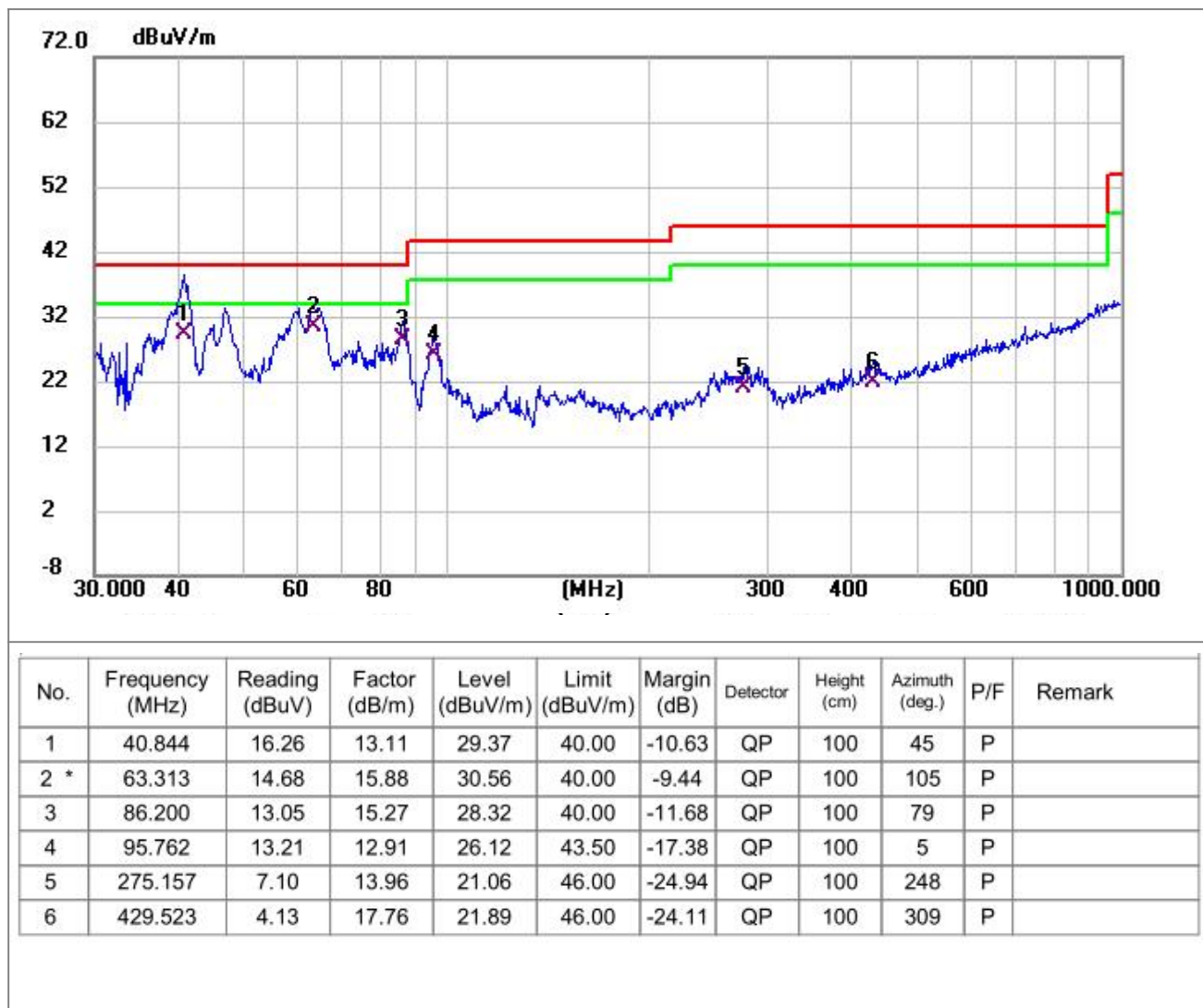


Remark:Emission Level=Reading+ Factor



Model:	THUMP12v4
--------	-----------

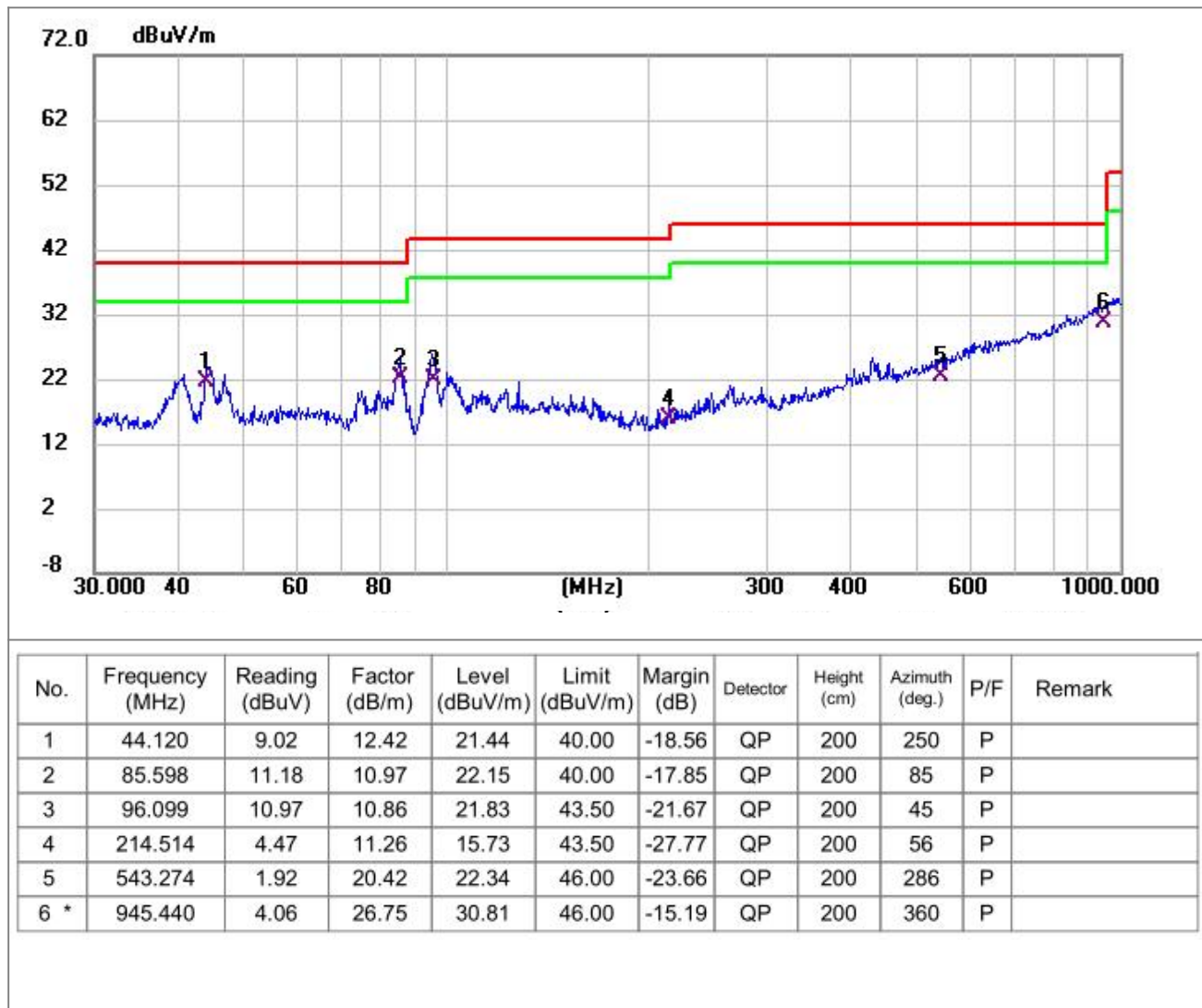
Test plot for Vertical



Remark:Emission Level=Reading+Factor

Model:	THUMP15v4
--------	-----------

Test plot for Horizontal

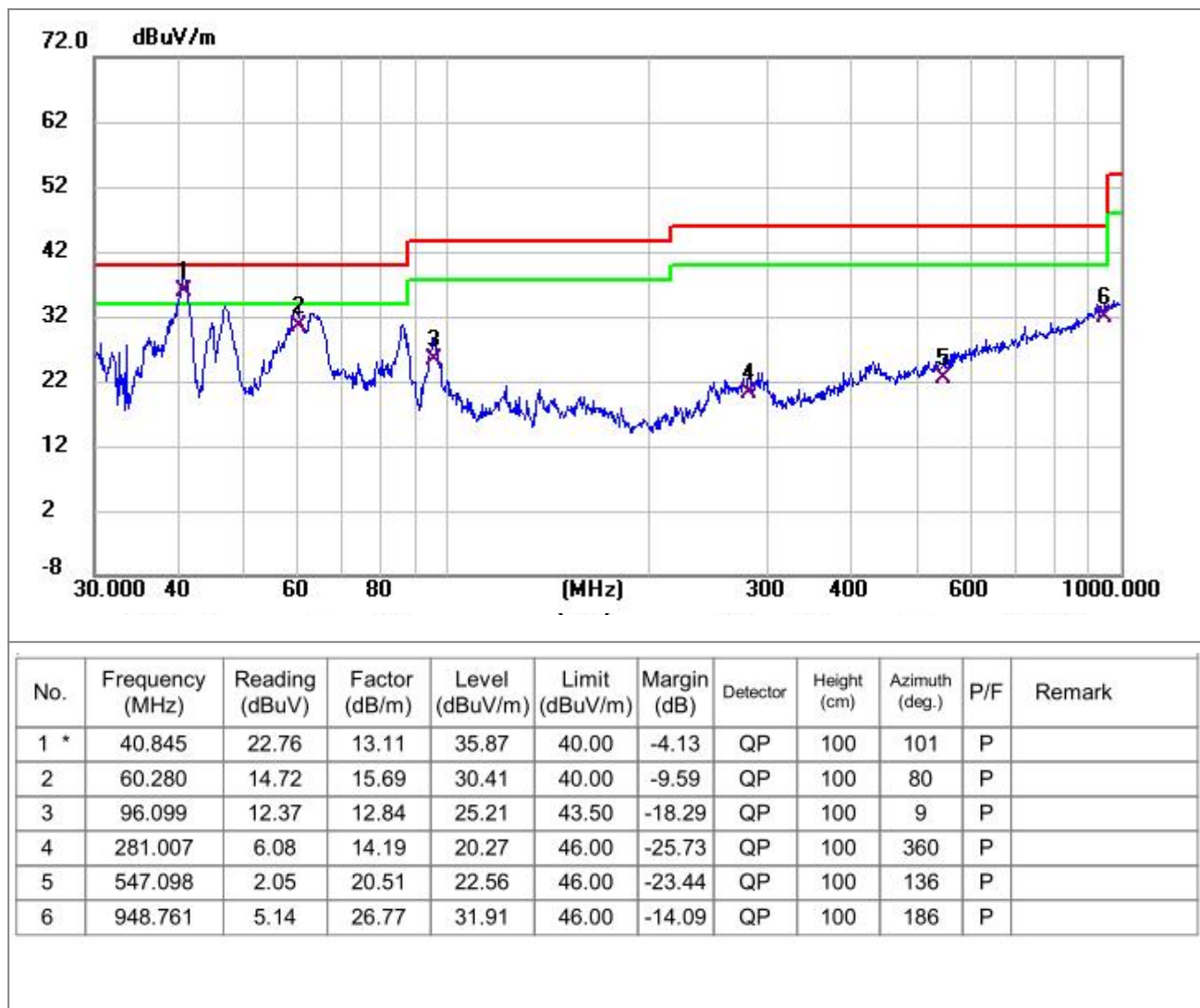


Remark:Emission Level=Reading+ Factor



Model:	THUMP15v4
--------	-----------

Test plot for Vertical



Remark:Emission Level=Reading+Factor

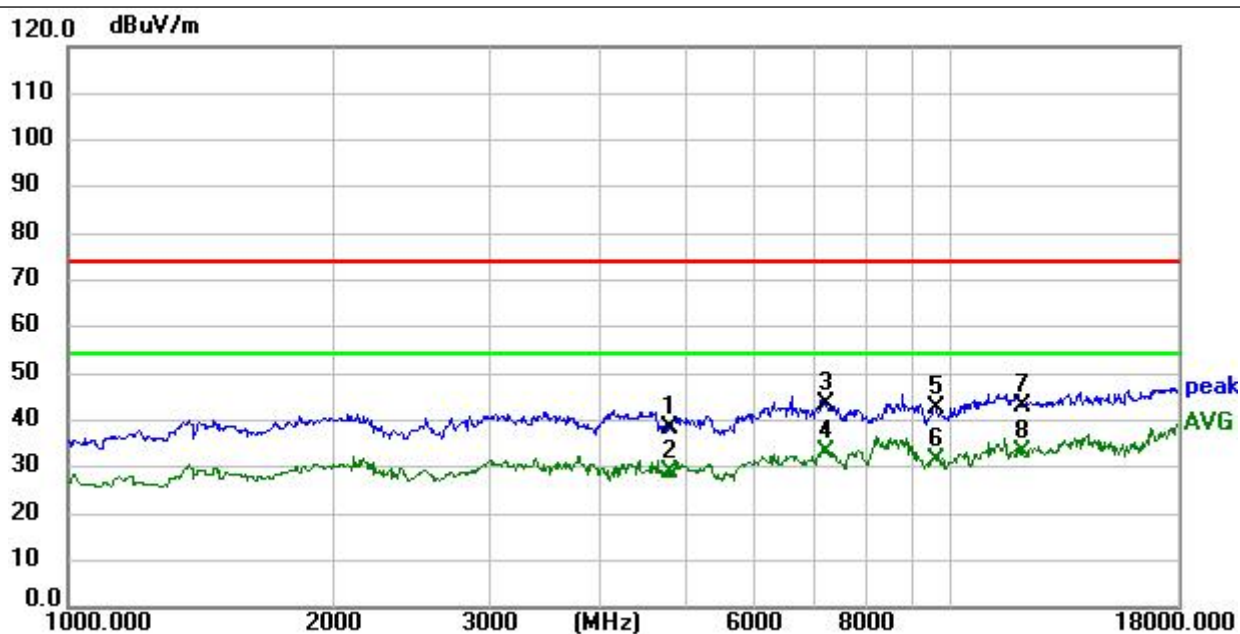
Test Frequency: From 1GHz to 25GHz

Bluetooth (GFSK, $\pi/4$ DQPSK, 8DPSK)mode have been tested, and the worst result(GFSK) was report as below
M/N : THUMP15v4

Operation Mode : TX GFSK Low Channel

Test Voltage : AC 120V/60Hz

Test Specification : Horizontal



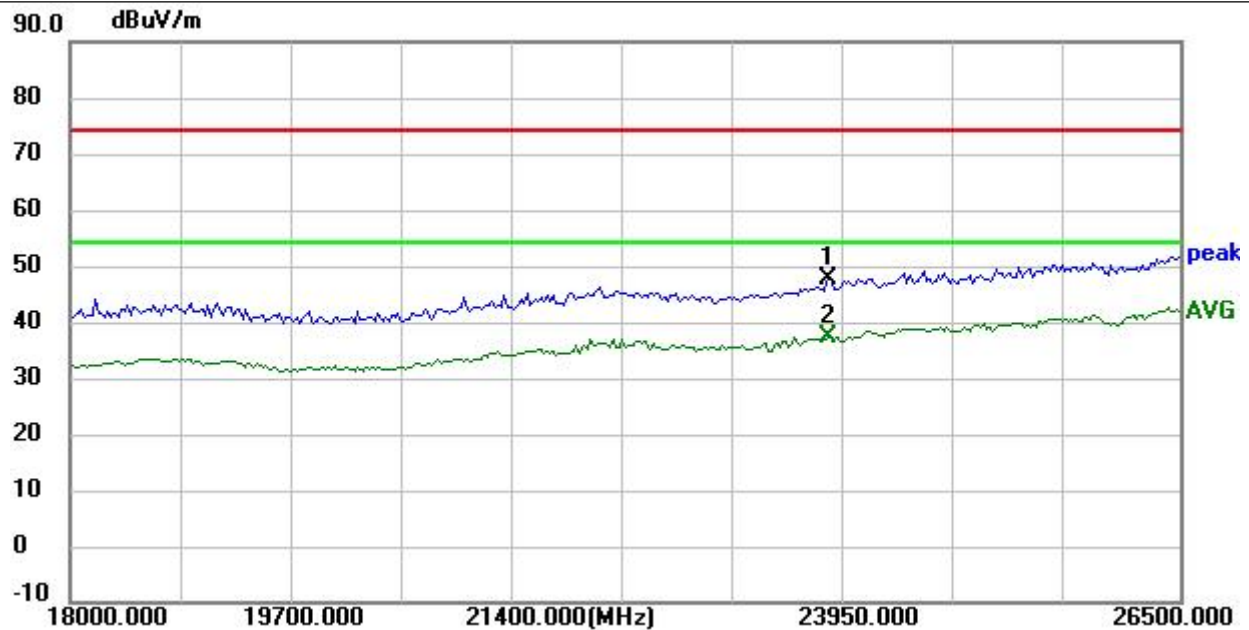
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4804.000	43.45	-4.95	38.50	74.00	-35.50	peak
2	4804.000	33.88	-4.95	28.93	54.00	-25.07	AVG
3	7206.000	43.08	0.24	43.32	74.00	-30.68	peak
4 *	7206.000	32.94	0.24	33.18	54.00	-20.82	AVG
5	9608.000	40.67	2.10	42.77	74.00	-31.23	peak
6	9608.000	29.37	2.10	31.47	54.00	-22.53	AVG
7	12010.000	39.26	3.87	43.13	74.00	-30.87	peak
8	12010.000	29.25	3.87	33.12	54.00	-20.88	AVG

Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor

M/N : THUMP15v4
Operation Mode : TX GFSK Low Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	23813.471	39.73	8.01	47.74	74.00	-26.26	peak
2 *	23813.471	29.43	8.01	37.44	54.00	-16.56	AVG

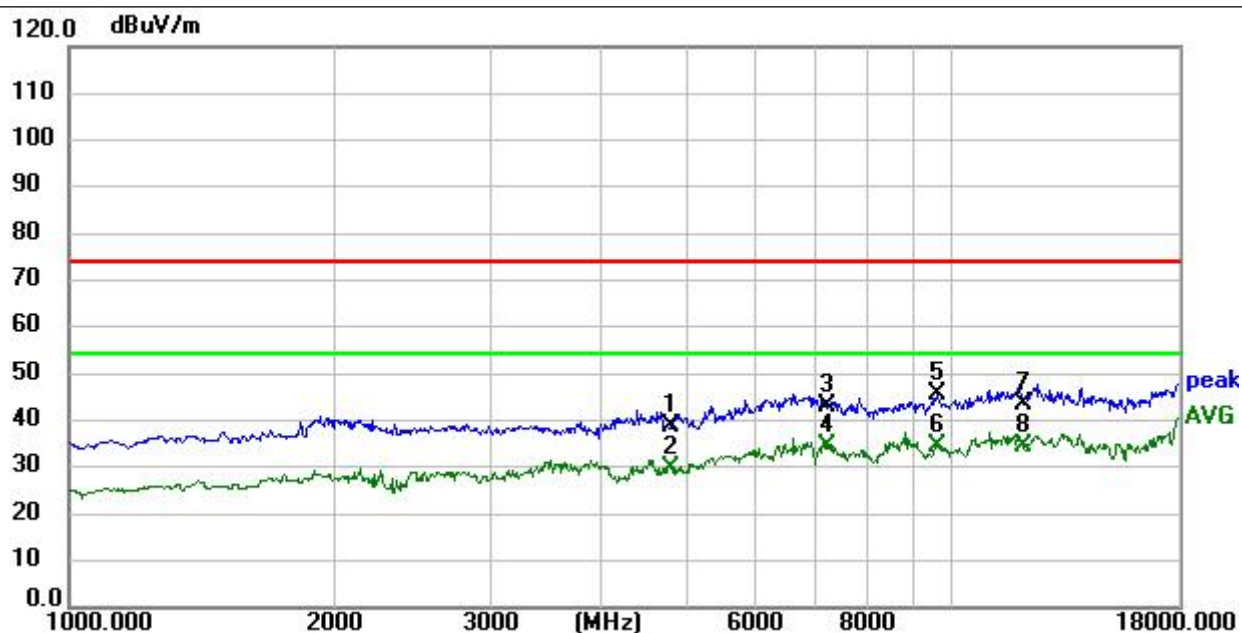
Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor



M/N : THUMP15v4
Operation Mode : TX GFSK Low Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4804.000	43.82	-4.95	38.87	74.00	-35.13	peak
2	4804.000	34.90	-4.95	29.95	54.00	-24.05	AVG
3	7206.000	42.63	0.24	42.87	74.00	-31.13	peak
4	7206.000	34.09	0.24	34.33	54.00	-19.67	AVG
5	9608.000	43.42	2.10	45.52	74.00	-28.48	peak
6 *	9608.000	32.45	2.10	34.55	54.00	-19.45	AVG
7	12010.000	39.56	3.87	43.43	74.00	-30.57	peak
8	12010.000	30.68	3.87	34.55	54.00	-19.45	AVG

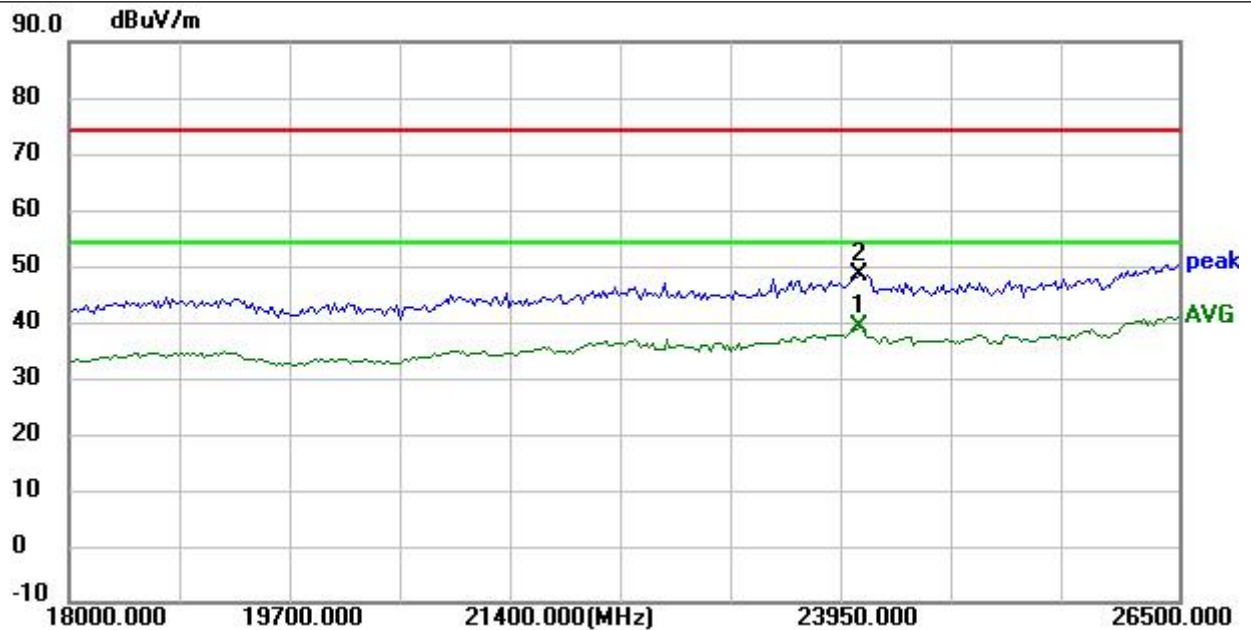
Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor



M/N : THUMP15v4
Operation Mode : TX GFSK Low Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	24077.715	30.38	8.61	38.99	54.00	-15.01	AVG
2	24077.715	39.78	8.61	48.39	74.00	-25.61	peak

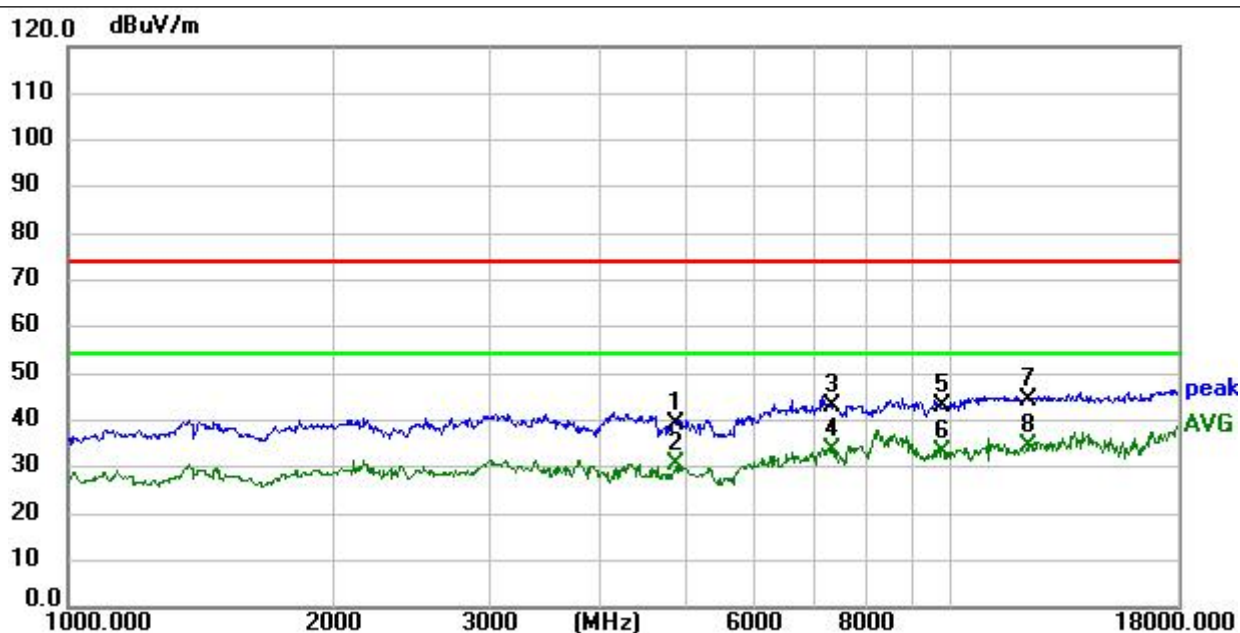
Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor



M/N : THUMP15v4
Operation Mode : TX GFSK Middle Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



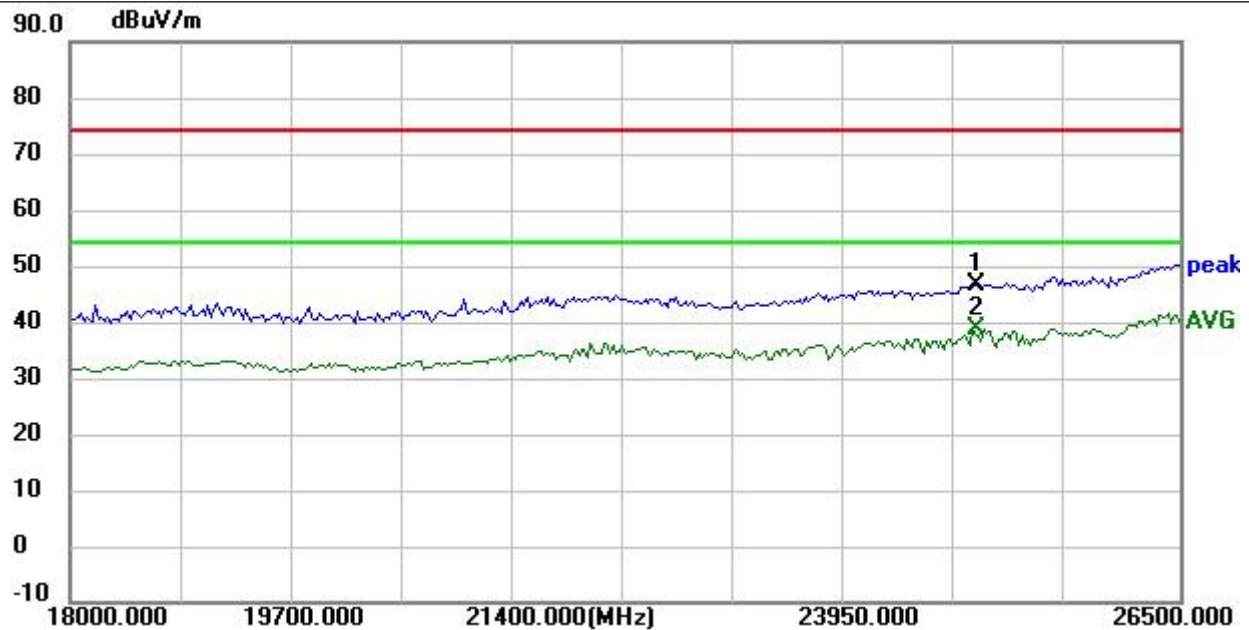
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4882.000	44.01	-4.69	39.32	74.00	-34.68	peak
2	4882.000	35.12	-4.69	30.43	54.00	-23.57	AVG
3	7323.000	42.62	0.51	43.13	74.00	-30.87	peak
4	7323.000	33.08	0.51	33.59	54.00	-20.41	AVG
5	9764.000	41.32	1.76	43.08	74.00	-30.92	peak
6	9764.000	31.66	1.76	33.42	54.00	-20.58	AVG
7	12205.000	39.78	4.64	44.42	74.00	-29.58	peak
8 *	12205.000	29.90	4.64	34.54	54.00	-19.46	AVG

Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamp Factor

M/N : THUMP15v4
Operation Mode : TX GFSK Middle Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	24936.528	36.73	9.97	46.70	74.00	-27.30	peak
2 *	24936.528	28.64	9.97	38.61	54.00	-15.39	AVG

Remark:

Emission Level=Reading+Factor

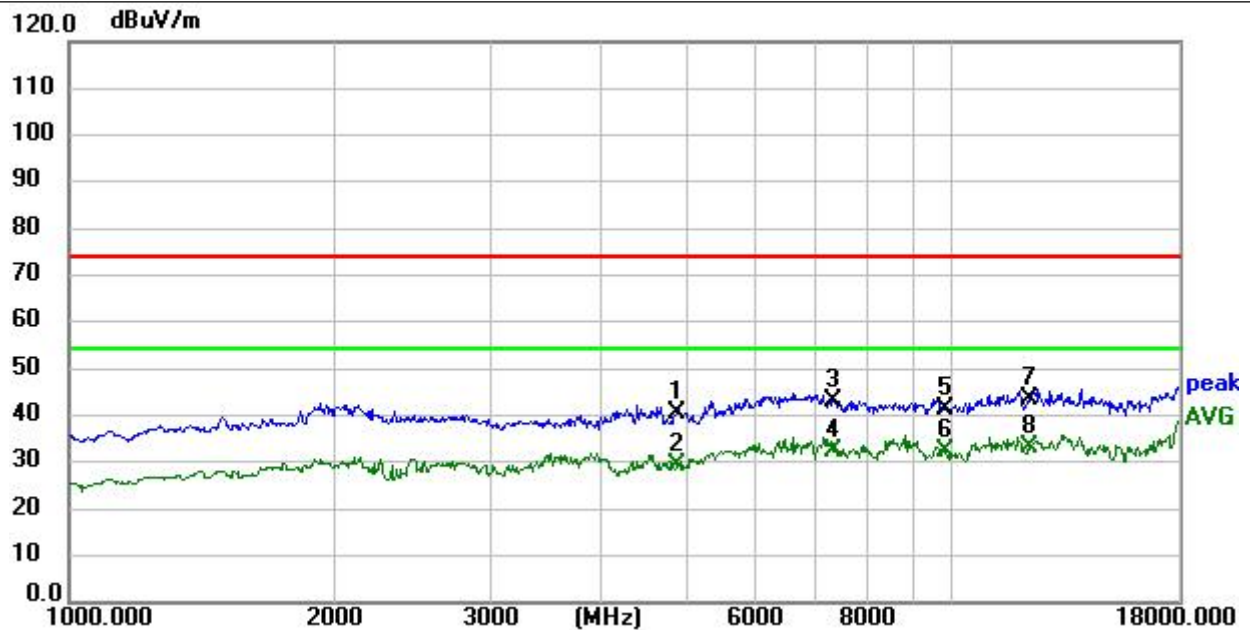
Factor=Cable Loss+ANT Factor-Preamplifier Factor

M/N : THUMP15v4

Operation Mode : TX GFSK Middle Channel

Test Voltage : AC 120V/60Hz

Test Specification : Vertical



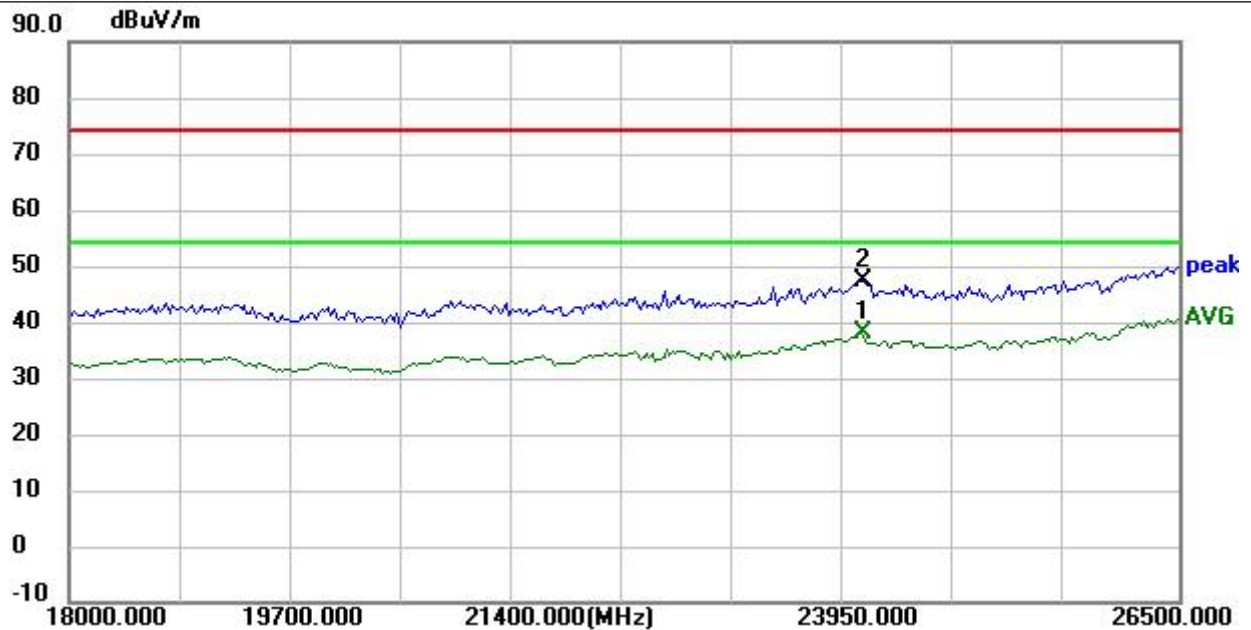
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4882.000	45.32	-4.69	40.63	74.00	-33.37	peak
2	4882.000	34.04	-4.69	29.35	54.00	-24.65	AVG
3	7323.000	42.43	0.51	42.94	74.00	-31.06	peak
4	7323.000	32.06	0.51	32.57	54.00	-21.43	AVG
5	9764.000	39.69	1.76	41.45	74.00	-32.55	peak
6	9764.000	30.43	1.76	32.19	54.00	-21.81	AVG
7	12205.000	39.00	4.64	43.64	74.00	-30.36	peak
8 *	12205.000	28.47	4.64	33.11	54.00	-20.89	AVG

Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor

M/N : THUMP15v4
Operation Mode : TX GFSK Middle Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	24077.720	29.43	8.61	38.04	54.00	-15.96	AVG
2	24077.720	38.78	8.61	47.39	74.00	-26.61	peak

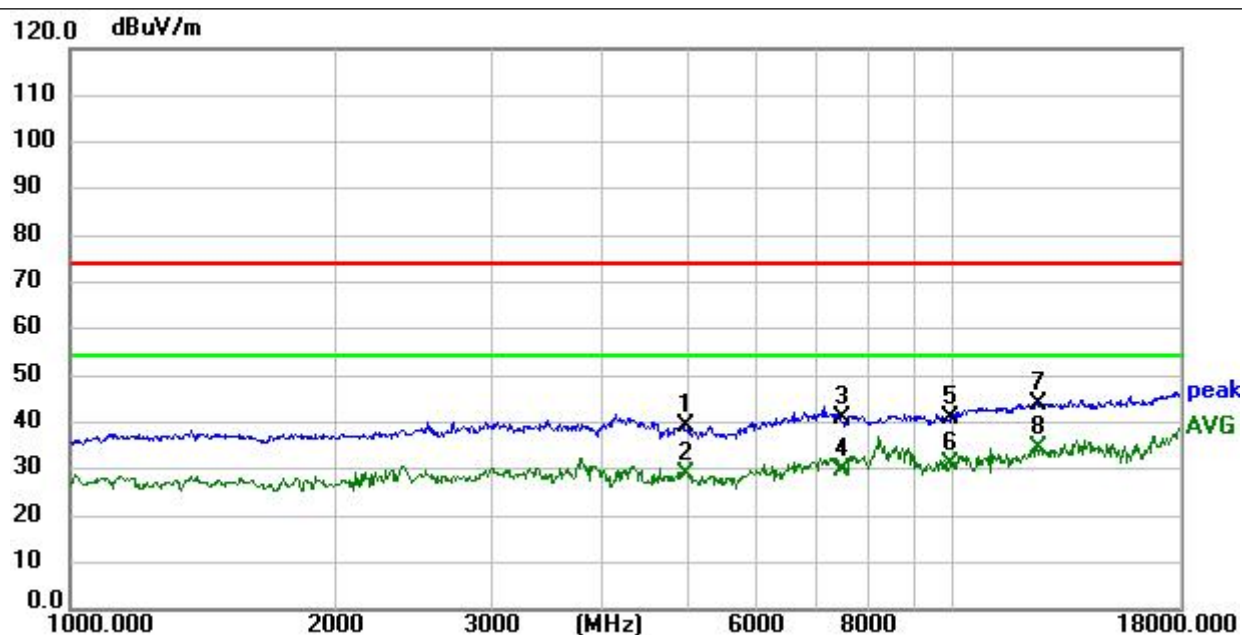
Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor



M/N : THUMP15v4
Operation Mode : TX GFSK High Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4960.000	44.22	-5.15	39.07	74.00	-34.93	peak
2	4960.000	34.22	-5.15	29.07	54.00	-24.93	AVG
3	7440.000	40.15	0.88	41.03	74.00	-32.97	peak
4	7440.000	28.82	0.88	29.70	54.00	-24.30	AVG
5	9920.000	38.95	1.95	40.90	74.00	-33.10	peak
6	9920.000	29.25	1.95	31.20	54.00	-22.80	AVG
7	12400.000	39.42	4.47	43.89	74.00	-30.11	peak
8 *	12400.000	29.99	4.47	34.46	54.00	-19.54	AVG

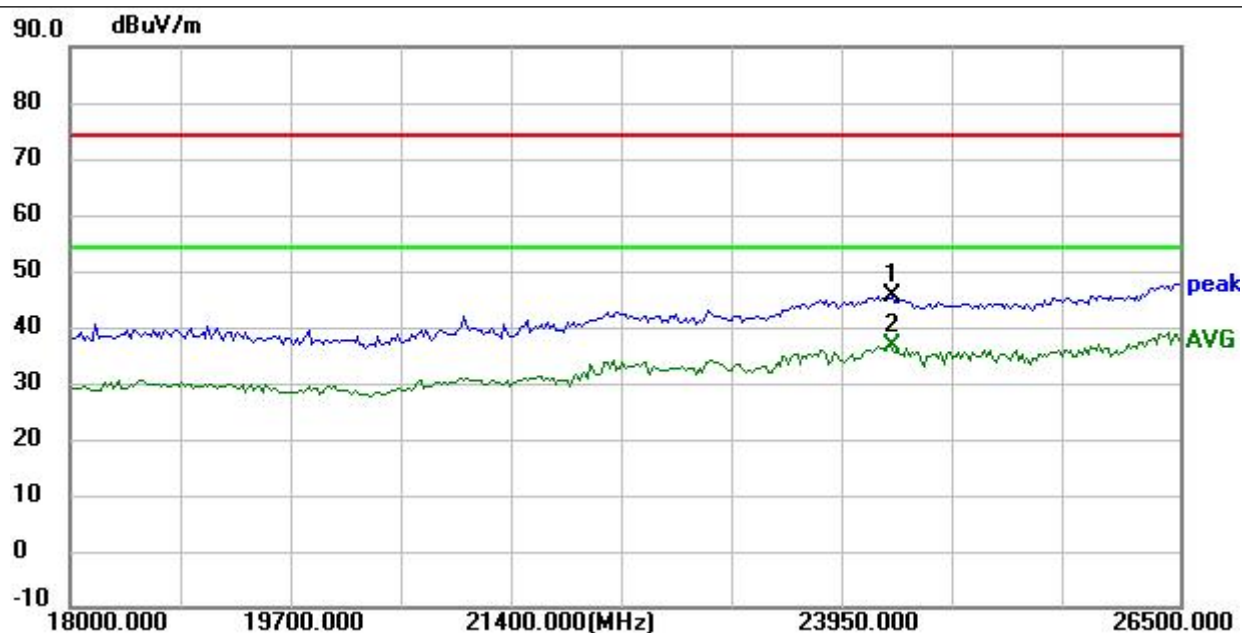
Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamp Factor



M/N : THUMP15v4
Operation Mode : TX GFSK High Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	24297.927	36.39	9.05	45.44	74.00	-28.56	peak
2 *	24297.927	27.50	9.05	36.55	54.00	-17.45	AVG

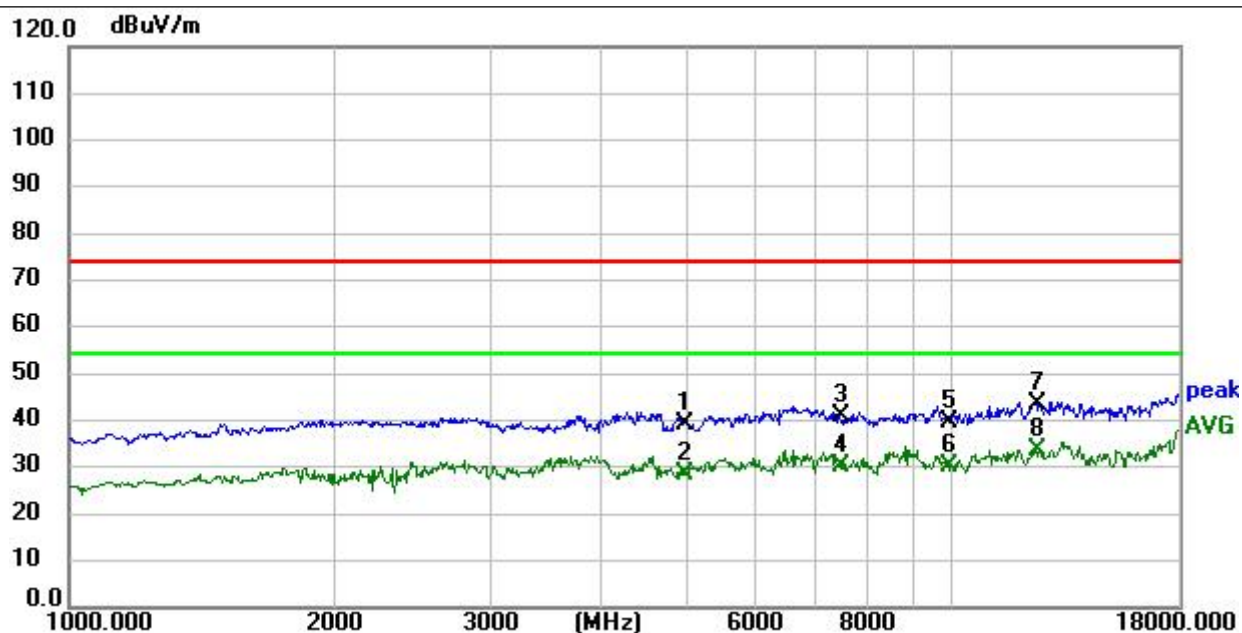
Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor



M/N : THUMP15v4
Operation Mode : TX GFSK High Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical



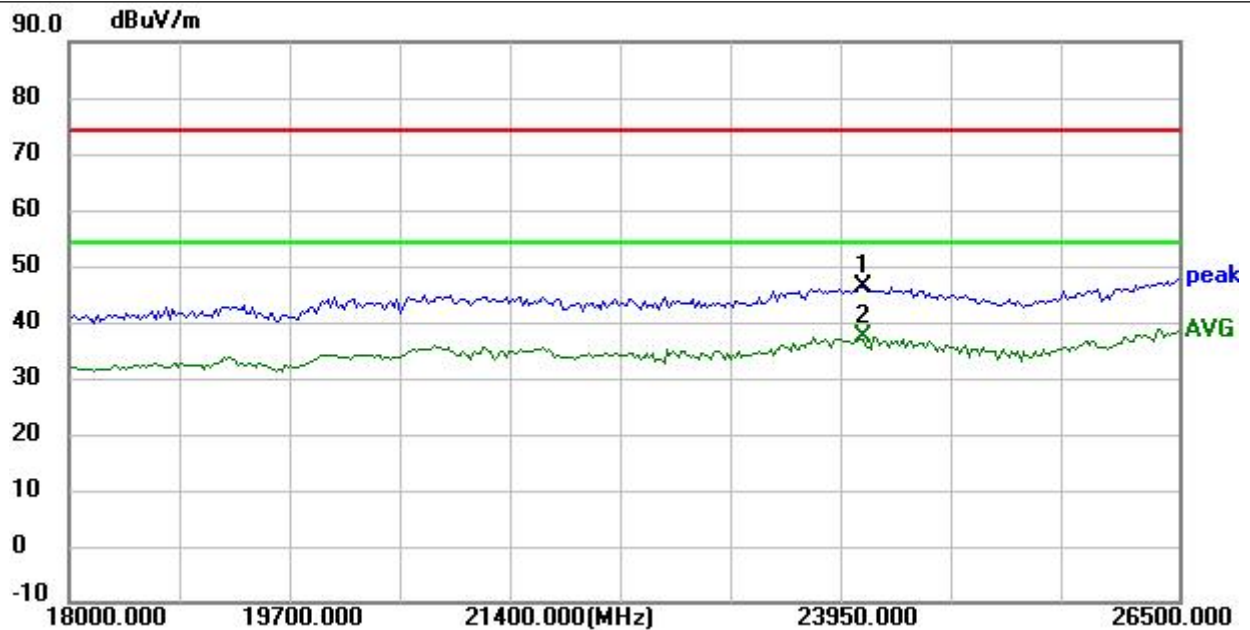
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4960.000	44.34	-5.15	39.19	74.00	-34.81	peak
2	4960.000	33.76	-5.15	28.61	54.00	-25.39	AVG
3	7440.000	40.10	0.88	40.98	74.00	-33.02	peak
4	7440.000	29.46	0.88	30.34	54.00	-23.66	AVG
5	9920.000	37.90	1.95	39.85	74.00	-34.15	peak
6	9920.000	28.12	1.95	30.07	54.00	-23.93	AVG
7	12400.000	39.01	4.47	43.48	74.00	-30.52	peak
8 *	12400.000	29.06	4.47	33.53	54.00	-20.47	AVG

Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamplifier Factor

M/N : THUMP15v4
Operation Mode : TX GFSK High Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical



No.	Frequency (MHz)	Reading (dBUV)	Factor (dB/m)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector
1	24077.720	37.78	8.61	46.39	74.00	-27.61	peak
2 *	24077.720	28.56	8.61	37.17	54.00	-16.83	AVG

Remark:

Emission Level=Reading+Factor

Factor=Cable Loss+ANT Factor-Preamp Factor

Note:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,

Margin= Emission Level - Limit

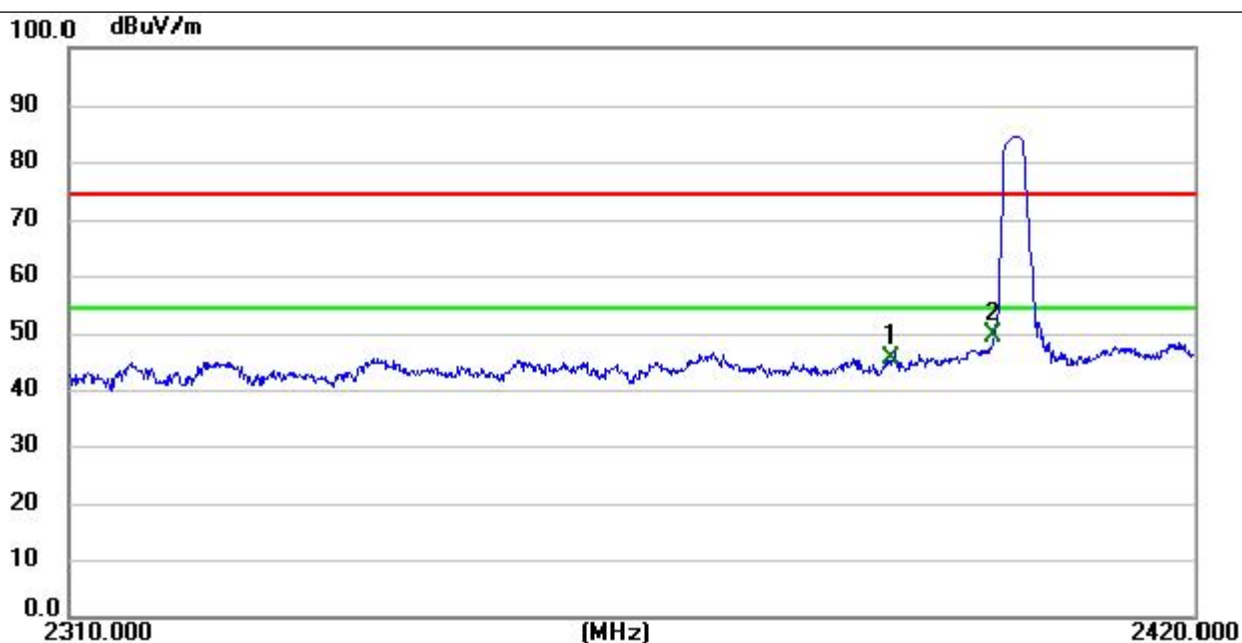
2. If peak below the average limit, the average emission was no test.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Radiated Band Emission Measurement:

Bluetooth (GFSK, $\pi/4$ DQPSK, 8DPSK)mode have been tested, and the worst result(GFSK) was report as below

M/N : THUMP15v4
Operation Mode : TX GFSK Low Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	55.53	-12.67	42.86	54.00	-11.14	AVG
2 *	2400.000	62.33	-12.69	49.64	54.00	-4.36	AVG

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

M/N : THUMP15v4
Operation Mode : TX GFSK Low Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical

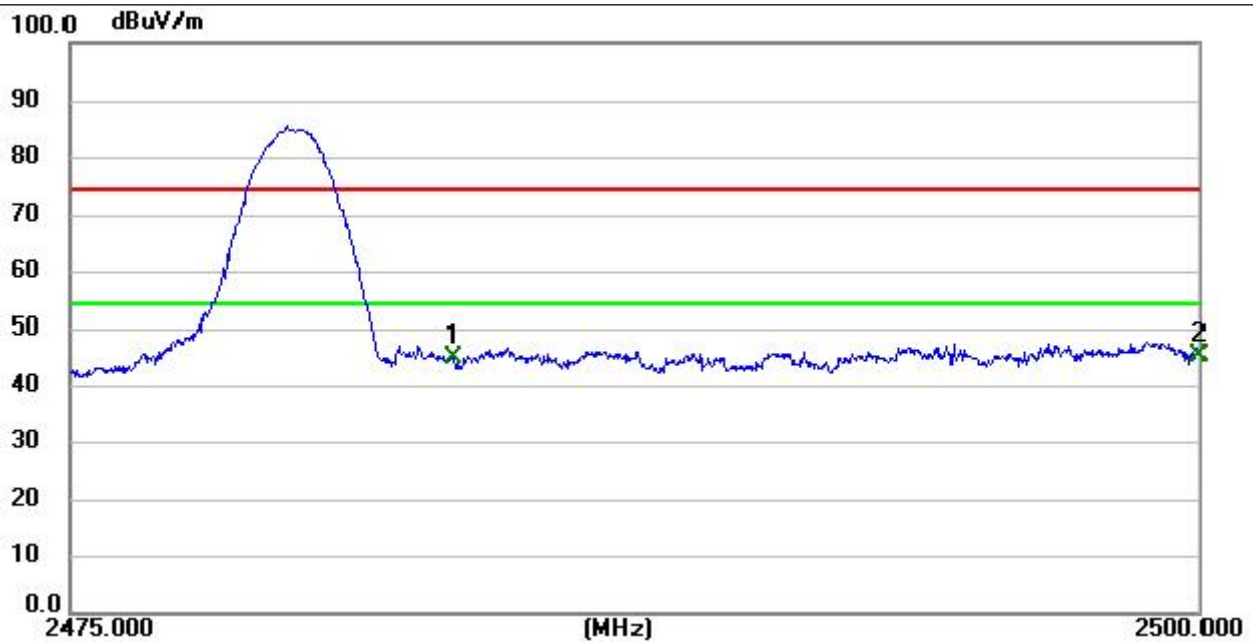


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	58.03	-12.67	45.36	54.00	-8.64	AVG
2 *	2400.000	62.33	-12.69	49.64	54.00	-4.36	AVG

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

M/N : THUMP15v4
Operation Mode : TX GFSK High Channel
Test Voltage : AC 120V/60Hz
Test Specification : Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	57.70	-12.81	44.89	54.00	-9.11	AVG
2 *	2500.000	57.80	-12.63	45.17	54.00	-8.83	AVG

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

M/N : THUMP15v4
Operation Mode : TX GFSK High Channel
Test Voltage : AC 120V/60Hz
Test Specification : Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	56.70	-12.81	43.89	54.00	-10.11	AVG
2 *	2500.000	59.30	-12.63	46.67	54.00	-7.33	AVG

Remark:

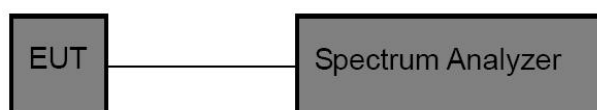
1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

7 Maximum Peak Output Power Test (EIRP)

7.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (b)(1) & RSS-247.6.2.3.2
Test Limit	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. For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W.

7.2 Test Setup



7.3 Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above,
2. Spectrum Setting:
 - RBW > the 20 dB bandwidth of the emission being measured
 - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
 - VBW ≥ RBW
 - Sweep = auto
 - Detector function = peak
 - Trace = max hold

7.4 Test Data

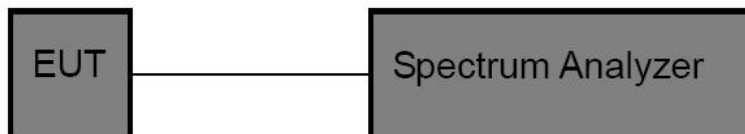
Please see the appendix III Bluetooth_(Class Bluetooth)_Test data.

8 20B Occupy Bandwidth & 99% OCB Test

8.1 Test Standard

Test Standard	FCC Part15 C Section 15.247 (a)(1) RSS-247 6.2.3.1 (a)
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8.2 Test Setup



8.3 Test Procedure

Using the following spectrum analyzer settings:

20dB Occupy Bandwidth:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 30 kHz.
3. Set the VBW = 91 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

99% OCB:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 20 kHz.
3. Set the VBW = 62 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.



6. Trace mode = max hold.

7. Allow trace to fully stabilize.

8.4 Test Data

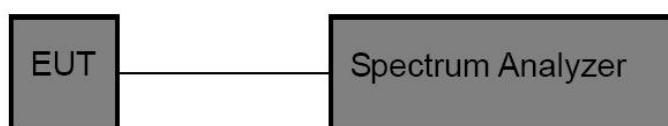
Please see the appendix III Bluetooth_(Class Bluetooth)_Test data.

9 Carrier Frequency Separation Test

9.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1) & RSS-247.6.2.3.1(a)
Test Limit	GFSK: 20dB bandwidth π /4DQPSK & 8DPSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

9.2 Test Setup



9.3 Test Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 100 kHz.
3. Set the VBW = 300 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

9.4 Test Data

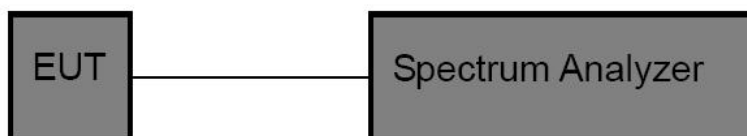
Please see the appendix III Bluetooth_(Class Bluetooth)_Test data.

10 Number of Hopping Channel Test

10.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)(iii) & RSS-247.6.2.3.1(b)
Test Limit	≥15 channels

10.2 Test Setup



10.3 Test Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 100kHz.
3. Set the VBW = 300kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

10.4 Test Data

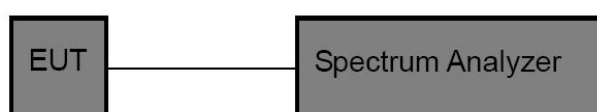
Please see the appendix III Bluetooth_(Class Bluetooth)_Test data.

12 Dwell Time Test

12.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (a)(1)(iii) & RSS-247.6.2.3.1(b)
Test Limit	0.4 sec

12.2 Test Setup



12.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 1 MHz.
3. Set the VBW = 3 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = clear write.
6. Trace mode = normal.
7. Allow trace to fully stabilize.

12.4 Test Data

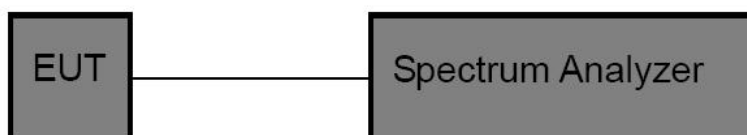
Please see the appendix III Bluetooth_(Class Bluetooth)_Test data.

13 100kHz Bandwidth of Frequency Band Edge Requirement

13.1 Test Standard and Limit

Test Standard	FCC Part15 C Section 15.247 (d) & RSS-247 6.6
Test Limit	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

13.2 Test Setup



13.3 Test Procedure

The EUT must have its hopping/Non-hopping function enabled. Using the following spectrum analyzer setting:

1. Set the RBW = 100kHz.
2. Set the VBW = 300kHz.
3. Sweep time = auto couple.
4. Detector function = peak.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.

13.4 Test Data

Please see the appendix III Bluetooth_(Class Bluetooth)_Test data.

14 Antenna Requirement

14.1 Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203 /247(b)(4) & RSS-Gen 6.8
Requirement	1) 15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 2) 15.247(b) requirement: Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 3) RSS-Gen 6.8 The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list. For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below). When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

14.2 Antenna Connected Construction

The antenna is PCB Antenna which permanently attached, and the best case gain of the antenna is 2.0dBi. It complies with the standard requirement.



15 APPENDIX I -- TEST SETUP PHOTOGRAPH

Please see the attachment for details.



16 APPENDIX II -- EUT PHOTOGRAPH

Please see the attachment for details.

----- End of Report -----