



Test Report No:
22B1055R-RFUIWL2V01-C

TEST REPORT

FCC / ISED Rules&Regulations

Product Name	T-Band
Brand Name	Talitrix
Model No.	TBQC4100OV1
PMN	T-Band
FCC ID	2AOHHTBAND
IC	23465-TBAND
Applicant's Name / Address	Thundercomm Technology Co., Ltd No. 107, Middle Datagu Road, Xiantao Street, Yubei District, Chongqing, China, 401122
Manufacturer's Name / Address	Thundercomm Technology Co., Ltd No. 107, Middle Datagu Road, Xiantao Street, Yubei District, Chongqing, China, 401122
Test Method Requested, Standard	FCC CFR Title 47 Part 15 Subpart C Section 15.247 RSS-247 Issue 2 (Feb. 2017) RSS-Gen Issue 5 (Feb. 2021) ANSI C63.10-2013
Verdict Summary	IN COMPLIANCE
Documented By	<i>Amelia Wu</i> Amelia Wu / Project Specialist
Approved By	<i>Rueyyan Lin</i> Rueyyan Lin / Supervisor
Date of Receipt	Nov. 30, 2022
Date of Issue	Jun. 19, 2023
Report Version	V1.0

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Competences and Guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA.

General Conditions

1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	Jun. 19, 2023

1. General Information

1.1 EUT Description

Product Name	T-Band
Brand Name	Talitrix
Model No.	TBQC4100OV1
PMN	T-Band
EUT Voltage	DC 5V (host equipment) DC 3.85V for battery
Frequency Range	1 Mbps: 2402 ~ 2480 MHz
Channel Number	1 Mbps: 40 Channels
Type of Modulation	GFSK

Antenna Information				
Ant.	Brand Name	Model No.	Type	Gain (dBi)
0	WTT	ANT-1	PIFA	-0.08

EUT Operational Condition	
Testing Voltage	AC 120V/60Hz

GFSK (1 Mbps)

Working Frequency of Each Channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	10	2422 MHz	20	2442 MHz	30	2462 MHz
01	2404 MHz	11	2424 MHz	21	2444 MHz	31	2464 MHz
02	2406 MHz	12	2426 MHz	22	2446 MHz	32	2466 MHz
03	2408 MHz	13	2428 MHz	23	2448 MHz	33	2468 MHz
04	2410 MHz	14	2430 MHz	24	2450 MHz	34	2470 MHz
05	2412 MHz	15	2432 MHz	25	2452 MHz	35	2472 MHz
06	2414 MHz	16	2434 MHz	26	2454 MHz	36	2474 MHz
07	2416MHz	17	2436 MHz	27	2456 MHz	37	2476 MHz
08	2418 MHz	18	2438 MHz	28	2458 MHz	38	2478 MHz
09	2420 MHz	19	2440 MHz	29	2460 MHz	39	2480 MHz

Note:

1. Regards to the frequency band operation; the lowest · middle and highest frequency of channel were selected to perform the test, and then shown on this report.
2. The above EUT information is declared by the manufacturer.

1.2 Test Mode

DEKRA has verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Test Mode	Mode 1: Transmit – power by host equipment Mode 2: Transmit – power by charging
-----------	--

Test Items	Test Mode	Modulation	Channel	Result
AC Power Line Conducted Emission	Mode 1,	GFSK (1 Mbps)	39	Pass
	Mode 2			Pass
Maximum Conducted Output Power	Mode 1	GFSK (1 Mbps)	00/19/39	Pass
				Pass
Radiated Emission Below 1 GHz	Mode 1,	GFSK (1 Mbps)	39	Pass
	Mode 2			Pass
Radiated Emission Above 1 GHz	Mode 1	GFSK (1 Mbps)	00/19/39	Pass
				Pass
Antenna Port Conducted Emission	Mode 1	GFSK (1 Mbps)	00/19/39	Pass
				Pass
Radiated Emission Band Edge	Mode 1	GFSK (1 Mbps)	00/19/39	Pass
				Pass
Occupied Bandwidth & DTS Bandwidth	Mode 1	GFSK (1 Mbps)	00/19/39	Pass
				Pass
Maximum Power Spectral Density	Mode 1	GFSK (1 Mbps)	00/19/39	Pass
				Pass

Note:

- Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- For below 1 GHz radiated emission and AC Power Line Conducted Emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- The EUT was performed at X axis, Y axis and Z axis position for radiated emission and band edge tests. The worst case was found at Z axis, so the measurement will follow this same test configuration.
- The EUT could be applied with WWAN LTE Cat-M1 and Bluetooth LE function and Radiated Emission Co-location (Please refer to Appendix A) test is added for simultaneously transmit between WWAN LTE Cat-M1 and Bluetooth LE function.
- The EUT contains one WWAN module (brand name: Quectel, model: EM9191, FCC ID: XMR201912BG77).

1.3 Comments and Remarks

The product specification and testing instructions for the EUT declared in the report are provided by the manufacturer who will take all responsibilities for the accuracy.

Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system.

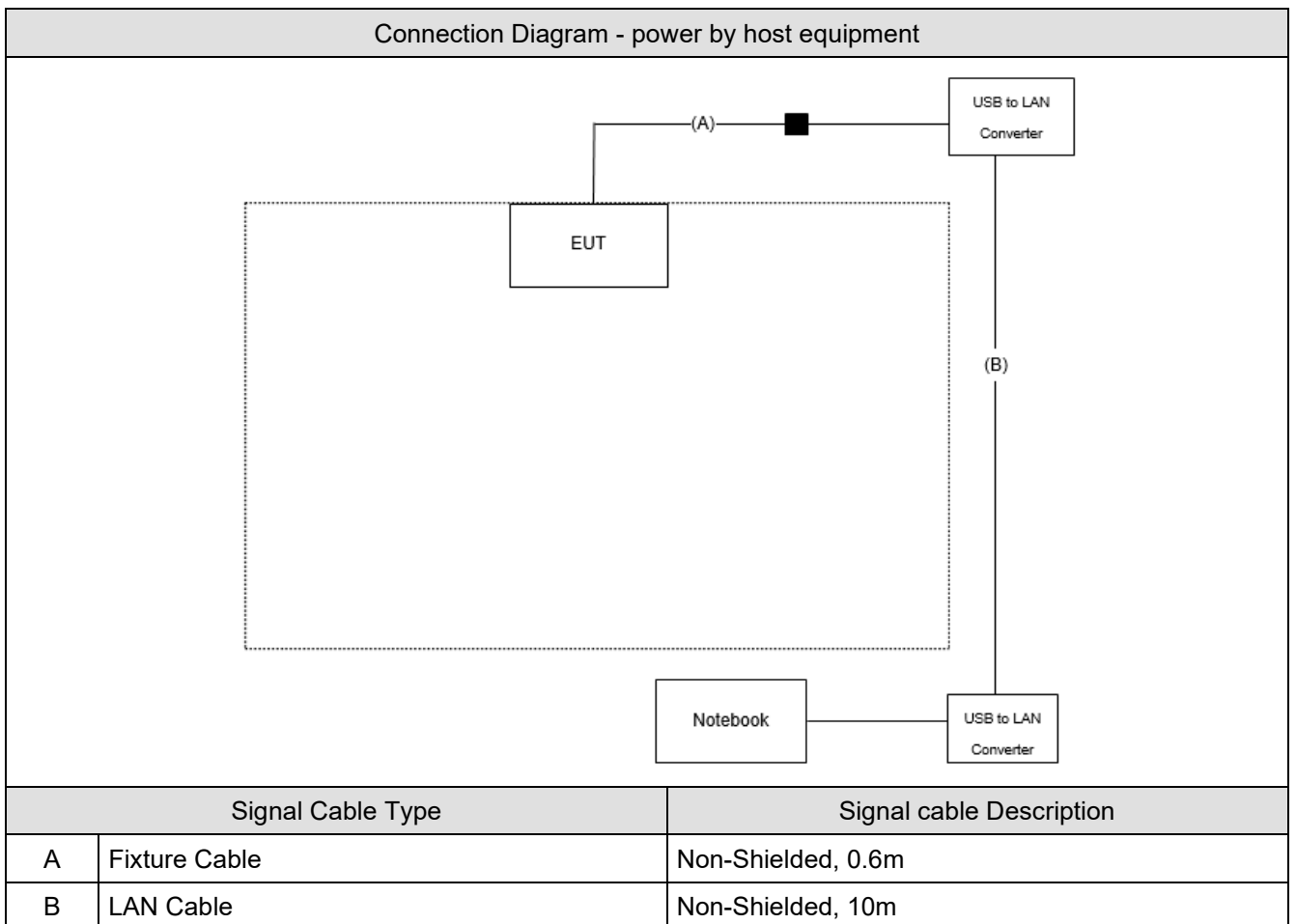
<power by host equipment>

Product		Manufacturer	Model No.	Serial No.
1	Notebook	Lenove	80XL	PF0SXXY1
2	USB to LAN Converter	DEKRA	A29	N/A

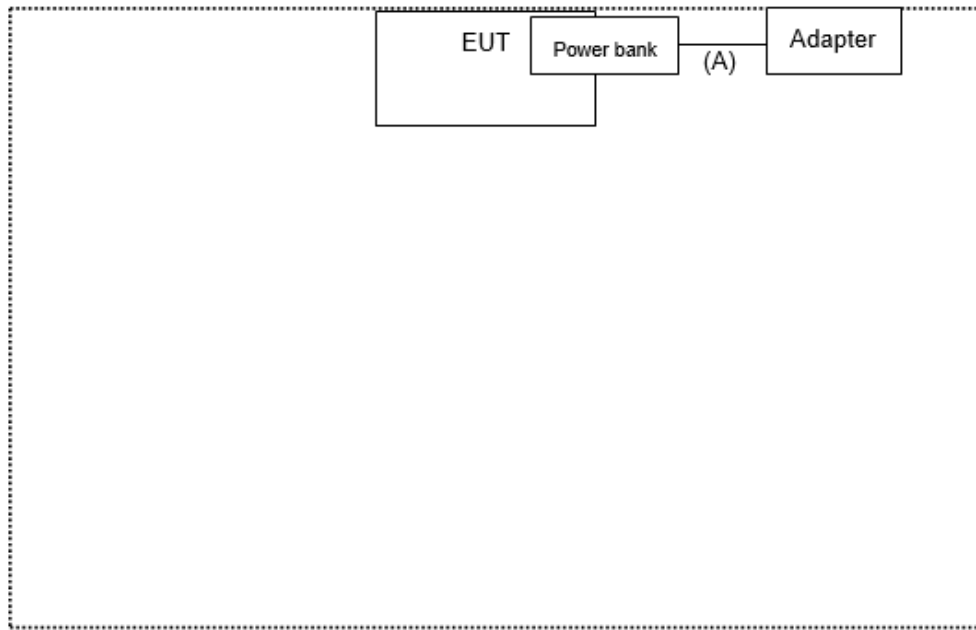
<power by charging>

Product		Manufacturer	Model No.	Serial No.
1	Power bank	Shenzhen Cholipower Technology Co.,LTD	CLP802	N/A
2	Adapter	DONGGUAN SHELL ELECTRONIC LIMITED	S-TR-153B	N/A

1.4 Configuration of tested System



Connection Diagram - power by charging



Signal Cable Type		Signal cable Description
A	USB Cable	Shielded, 1.5m

1. EUT Operation of during Test

1	Execute control command by software "QRCT v4.0.00204.0".
2	Configure the test mode, the test channel, and the data rate.
3	Press "Start TX" to start the continuous transmitting.
4	Verify that the EUT works properly.

1.5 Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Actually	Tested by	Test Date	Test Site
Temperature (°C)	AC power Line Conducted	23	Ling Chen	2023/04/10	HC-SR02
Humidity (%RH)	Emission	59			
Temperature (°C)	Maximum Peak Conducted	20	Clemens Fang	2022/12/20	HC-SR12
Humidity (%RH)	Output Power	67			
Temperature (°C)	Radiated Emission	22.8 ~ 24.4	Ling Chen	2023/03/28 ~ 2323/04/06	HC-CB02
Humidity (%RH)		61 ~ 62			
Temperature (°C)	Antenna Port Conducted	20	Clemens Fang	2022/12/20	HC-SR12
Humidity (%RH)	Emission	67			
Temperature (°C)	Radiated Emission Band Edge	21.6	Ling Chen	2023/03/27	HC-CB02
Humidity (%RH)		61			
Temperature (°C)	Occupied Bandwidth &	20	Clemens Fang	2022/12/20	HC-SR12
Humidity (%RH)	DTS Bandwidth	67			
Temperature (°C)	Maximum Power Spectral	20	Clemens Fang	2022/12/20	HC-SR12
Humidity (%RH)	Density	67			

Note: Test site information refers to Laboratory Information.

Laboratory Information

USA : FCC Registration Number: TW3024
Canada : CAB identifier : TW3024

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: <http://www.dekra.com.tw>

If you have any comments, please don't hesitate to contact us. Our test sites as below:

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
Address	1. No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C. 2. No.372, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C.
Phone number	1. +886-3-582-8001 2. +886-3-582-8001
Fax number	1. +886-3-582-8958 2. +886-3-582-8958
Email address	info.tw@dekra.com
Website	http://www.dekra.com.tw
Note: Test site number for address 1 includes HC-SR02. Test site number for address 2 includes HC-CB02, HC-CB03, HC-CB04, HC-SR10 and HC-SR12.	

1.6 List of Test Equipment

HC-SR02

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Artificial Mains Network	R&S	ENV4200	848411/010	2022/12/19	2023/12/18
EMI Test Receiver	R&S	ESR3	102608	2022/09/28	2023/09/27
Two-Line V-Network	R&S	ENV216	100096	2022/05/17	2023/05/16
Coaxial Cable(9 m)	Harbour	RG-400	HC-SR02	2022/08/15	2023/08/14
EMI Testing System	AUDIX	e3 210616 dekra V9	HC-SR02	N/A	N/A

HC-SR12

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
High Speed Peak Power Meter Dual Input	Anritsu	ML2496A	1602004	2022/11/02	2023/11/01
Pulse Power Sensor	Anritsu	MA2411B	1531043	2022/11/02	2023/11/01
Pulse Power Sensor	Anritsu	MA2411B	1531044	2022/11/02	2023/11/01
Signal and Spectrum Analyzer	R&S	FSVA40	101435	2022/05/30	2023/05/29

HC-CB02

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal and Spectrum Analyzer	R&S	FSVA40	101435	2022/05/30	2023/05/29
Signal Analyzer	R&S	FSVA40	101455	2022/09/29	2023/09/28
EXA Signal Analyzer	Keysight	N9010A	MY51440132	2022/12/13	2023/12/12
Trilog Broadband Antenna	Schwarzbeck	VULB 9168	1272	2022/05/19	2023/05/18
Horn Antenna	Schwarzbeck	BBHA 9120D	639	2022/05/06	2023/05/05
Double Ridged Horn Antenna	RF SPIN	DRH18-E	211211A18E N	2022/11/15	2023/11/14
Horn Antenna	Schwarzbeck	BBHA 9170	203	2023/02/13	2024/02/12
Pre-Amplifier	EMCI	EMC01820I	980365	2023/04/07	2024/04/06
Pre-Amplifier	EMEC	EM01G18GA	060741	2022/05/06	2023/05/05
Pre-Amplifier	DEKRA	AP-400C	201801231	2022/09/27	2023/09/26
EMI Test Receiver	R&S	ESR7	102260	2022/12/01	2023/11/30
Magnetic Loop Antenna	Teseq	HLA 6121	44287	2022/10/21	2023/10/20
Coaxial Cable(13m)	Suhner	SF104	HC-CB02	2022/08/15	2023/08/14
Coaxial Cable(3m)	Suhner,Rosnol	SF102_UP026 4	HC-CB02_1	2022/08/14	2023/08/13
Radiated Software	AUDIX	e3 V9	HC-CB02_1	N/A	N/A

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

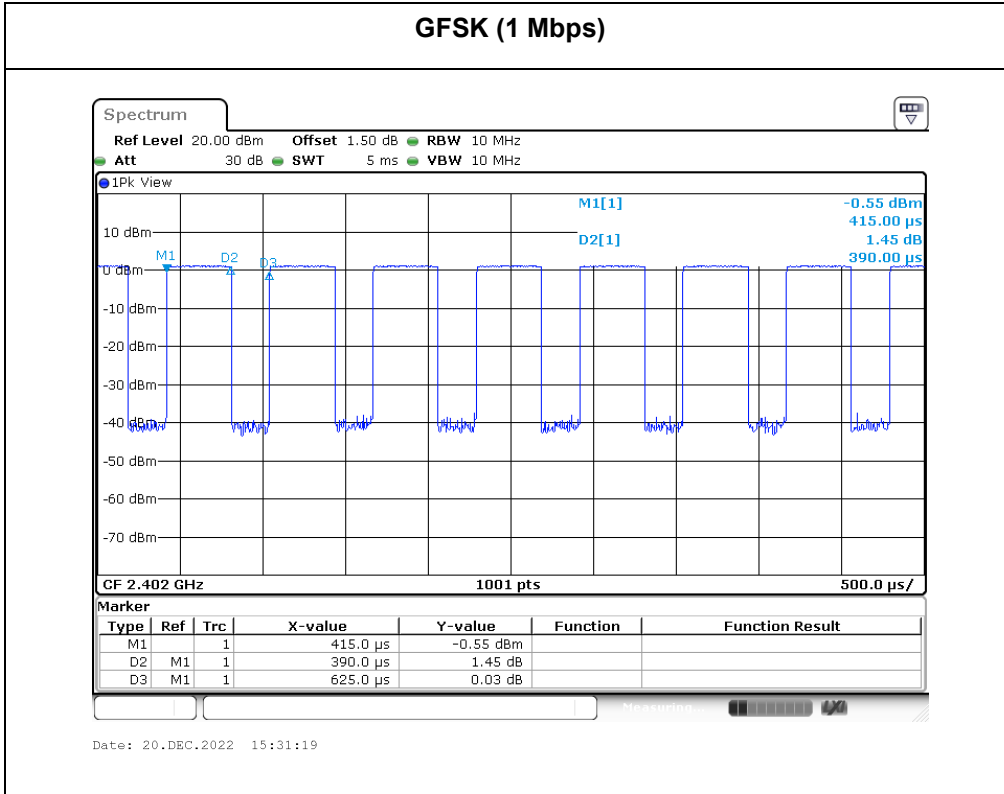
1.7 Measurement Uncertainty

Uncertainties have been calculated according to the DEKRA internal document with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$)).

Test item	Uncertainty
AC Power Line Conducted Emission	± 2.34 dB
Maximum Conducted Output Power	± 1.16 dB
Radiated Emission	± 3.52 dB below 1 GHz ± 3.56 dB above 1 GHz
Antenna Port Conducted Emission	± 2.47 dB
Radiated Emission Band Edge	± 3.56 dB
Occupied Bandwidth & DTS Bandwidth	± 282.55 Hz
Maximum Power Spectral Density	± 2.47 dB

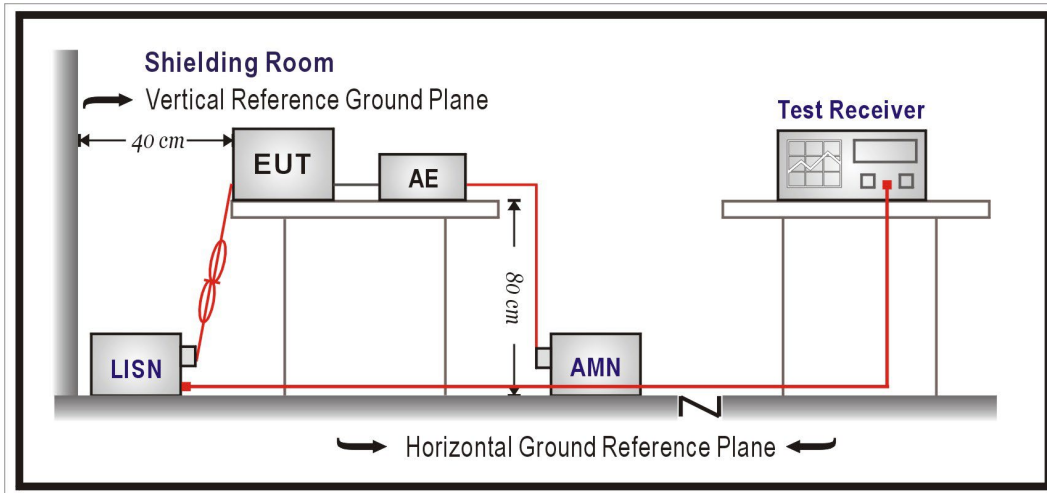
1.8 Duty Cycle

Mode	On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
GFSK (1 Mbps)	0.390	0.625	62.40	2.05	2.564



2. AC Power Line Conducted Emission

2.1 Test Setup



2.2 Test Limit

Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3 Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/50 uH coupling impedance with 50 ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.

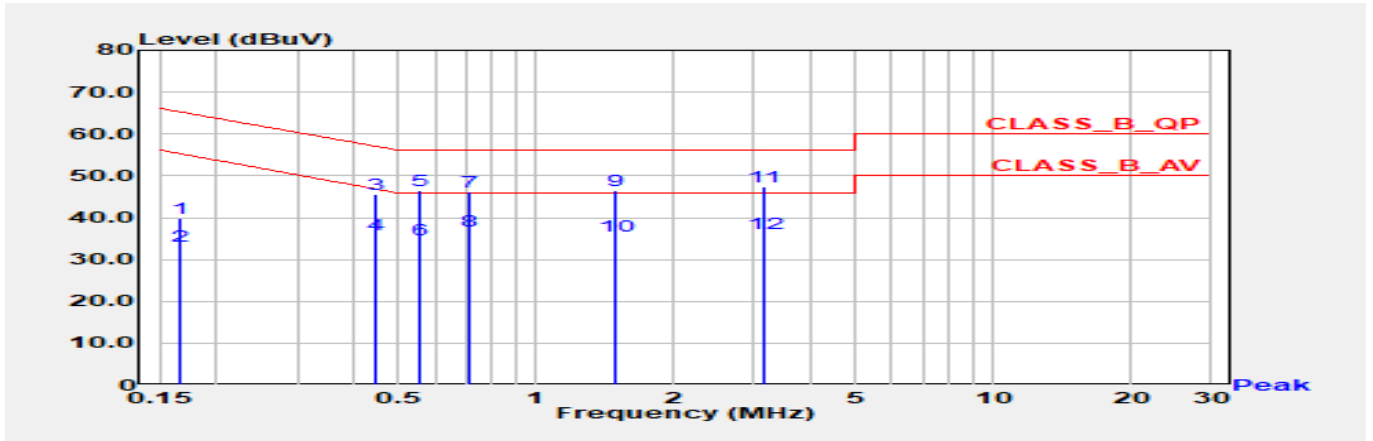
AC Power Line Conducted Emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9 kHz.

2.4 Test Specification

According to FCC Part 15 Subpart C Paragraph 15.207 / IC RSS-Gen Issue 5.

2.5 Test Result of AC Power Line Conducted Emission

Test Mode	Mode 1: Transmit – power by host equipment	Phase	Line
Test Condition	GFSK (1 Mbps) / 2480 MHz		

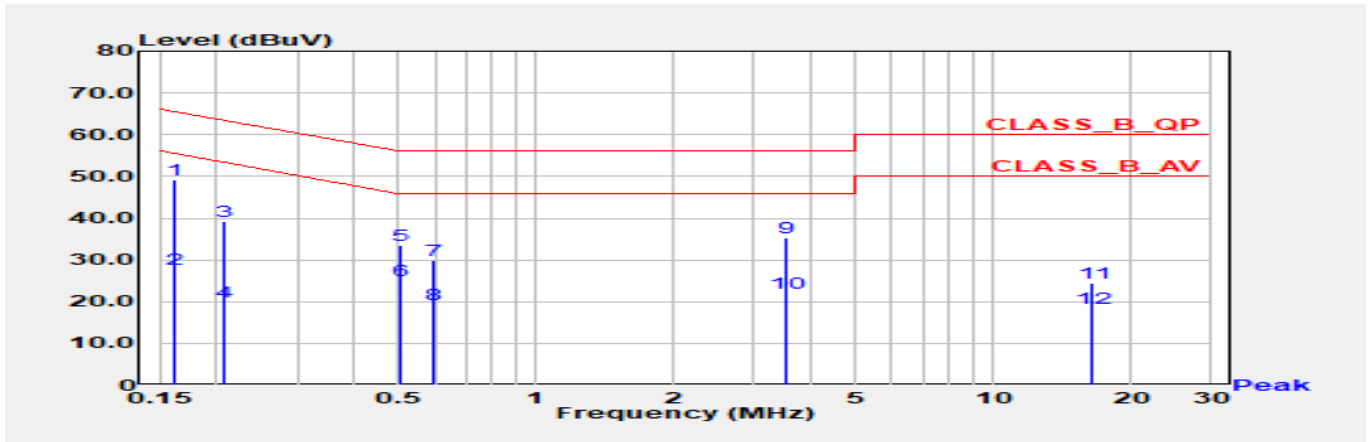


No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
1	0.166	39.85	65.17	-25.33	30.23	9.62	QP
2	0.166	33.30	55.17	-21.87	23.68	9.62	AV
3	0.442	45.53	57.01	-11.48	35.89	9.65	QP
4	0.442	35.86	47.01	-11.16	26.21	9.65	AV
5	0.553	46.39	56.00	-9.61	36.73	9.66	QP
6	0.553	34.57	46.00	-11.43	24.91	9.66	AV
7	0.717	46.11	56.00	-9.89	36.43	9.67	QP
8	0.717	36.86	46.00	-9.14	27.19	9.67	AV
9	1.491	46.43	56.00	-9.57	36.71	9.72	QP
10	1.491	35.62	46.00	-10.38	25.90	9.72	AV
*11	3.147	47.34	56.00	-8.66	37.54	9.80	QP
12	3.147	36.36	46.00	-9.64	26.56	9.80	AV

Remark:

1. "*" means this data is the worst emission level.
2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).
3. Margin = Emission Level - Limit.

Test Mode	Mode 1: Transmit – power by host equipment	Phase	Neutral
Test Condition	GFSK (1 Mbps) / 2480 MHz		

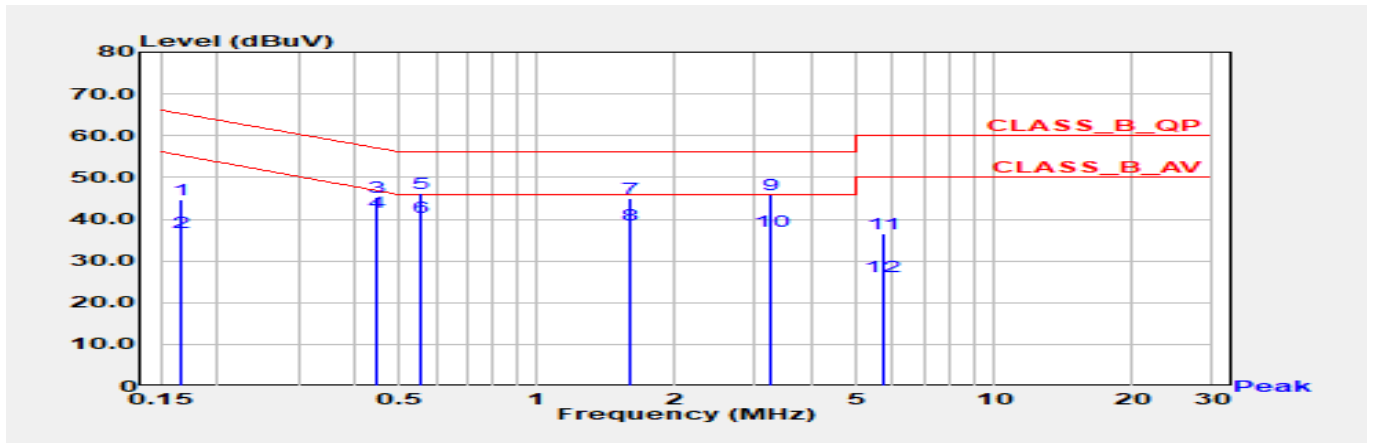


No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
*1	0.161	49.34	65.40	-16.06	39.72	9.62	QP
2	0.161	27.72	55.40	-27.68	18.10	9.62	AV
3	0.206	39.35	63.36	-24.01	29.73	9.61	QP
4	0.206	19.99	53.36	-33.37	10.37	9.61	AV
5	0.505	33.37	56.00	-22.63	23.72	9.64	QP
6	0.505	25.04	46.00	-20.96	15.39	9.64	AV
7	0.598	29.92	56.00	-26.08	20.27	9.65	QP
8	0.598	19.41	46.00	-26.59	9.76	9.65	AV
9	3.534	35.38	56.00	-20.62	25.55	9.83	QP
10	3.534	21.91	46.00	-24.09	12.08	9.83	AV
11	16.539	24.55	60.00	-35.45	14.15	10.40	QP
12	16.539	18.54	50.00	-31.46	8.15	10.40	AV

Remark:

1. "*" means this data is the worst emission level.
2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).
3. Margin = Emission Level - Limit.

Test Mode	Mode 2: Transmit – power by charging	Phase	Line
Test Condition	GFSK (1 Mbps) / 2480 MHz		

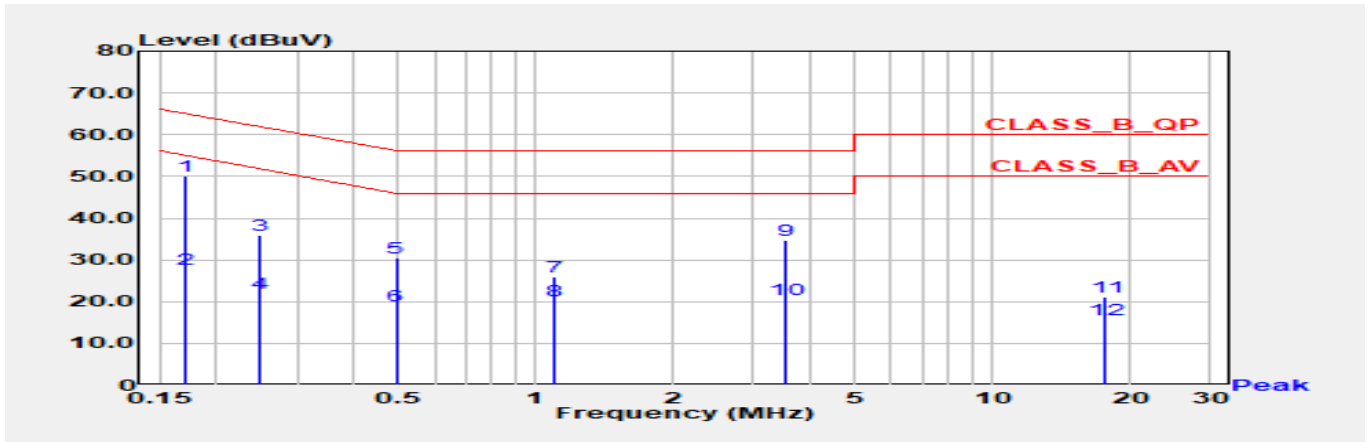


No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
1	0.166	44.83	65.17	-20.34	35.21	9.62	QP
2	0.166	36.75	55.17	-18.42	27.14	9.62	AV
3	0.442	45.19	57.01	-11.83	35.54	9.65	QP
*4	0.442	41.71	47.01	-5.31	32.06	9.65	AV
5	0.553	46.05	56.00	-9.95	36.40	9.66	QP
6	0.553	40.44	46.00	-5.56	30.79	9.66	AV
7	1.603	45.10	56.00	-10.90	35.37	9.73	QP
8	1.603	38.76	46.00	-7.24	29.03	9.73	AV
9	3.259	45.84	56.00	-10.16	36.03	9.81	QP
10	3.259	37.10	46.00	-8.90	27.29	9.81	AV
11	5.689	36.67	60.00	-23.33	26.75	9.92	QP
12	5.689	26.22	50.00	-23.78	16.30	9.92	AV

Remark:

1. "*" means this data is the worst emission level.
2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).
3. Margin = Emission Level - Limit.

Test Mode	Mode 2: Transmit – power by charging	Phase	Neutral
Test Condition	GFSK (1 Mbps) / 2480 MHz		



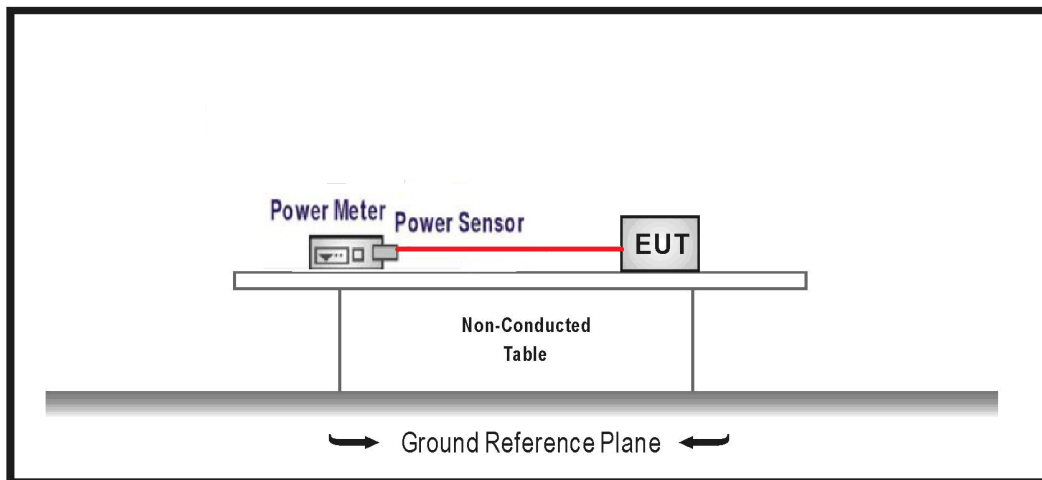
No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
*1	0.170	50.08	64.95	-14.87	40.47	9.62	QP
2	0.170	27.77	54.95	-27.18	18.16	9.62	AV
3	0.249	36.00	61.79	-25.79	26.38	9.62	QP
4	0.249	22.02	51.79	-29.77	12.40	9.62	AV
5	0.494	30.43	56.10	-25.67	20.78	9.64	QP
6	0.494	19.07	46.10	-27.03	9.42	9.64	AV
7	1.104	26.04	56.00	-29.96	16.34	9.71	QP
8	1.104	20.28	46.00	-25.72	10.58	9.71	AV
9	3.534	34.63	56.00	-21.37	24.80	9.83	QP
10	3.534	20.61	46.00	-25.39	10.79	9.83	AV
11	17.713	21.23	60.00	-38.77	10.78	10.45	QP
12	17.713	15.64	50.00	-34.36	5.20	10.45	AV

Remark:

1. "*" means this data is the worst emission level.
2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).
3. Margin = Emission Level - Limit.

3. Maximum Conducted Output Power

3.1 Test Setup



3.2 Test Limit

The Maximum Conducted Output Power shall be less 1 Watt.

3.3 Test procedures

The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB 558074 D01 v05r02 for compliance to FCC 47CFR 15.247 / RSS-247 issue 2 requirements.

3.4 Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247 / IC RSS-247 Issue 2.

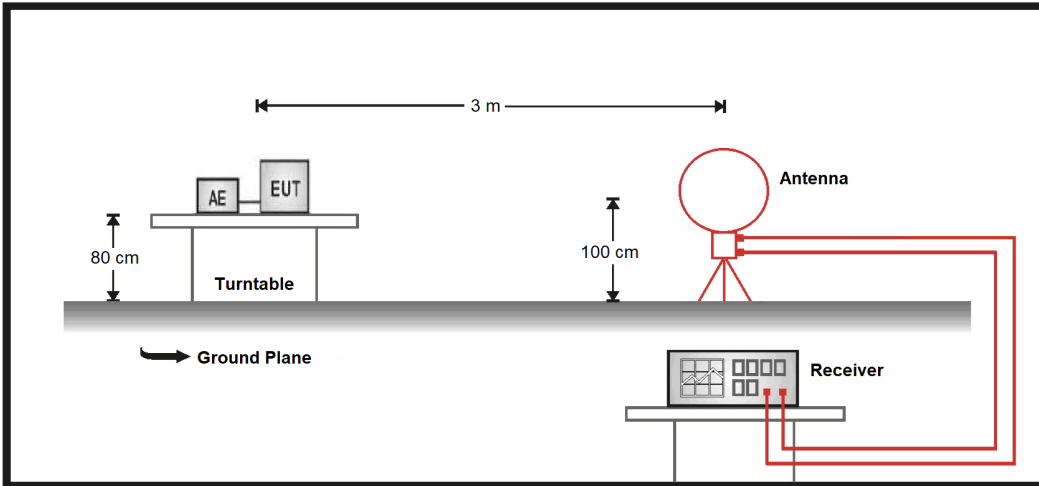
3.5 Test Result of Maximum Conducted Output Power

Modulation	Channel	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
GFSK (1 Mbps)	00	2402	0.48	≤ 30.00	Pass
	19	2440	0.98	≤ 30.00	Pass
	39	2480	0.43	≤ 30.00	Pass

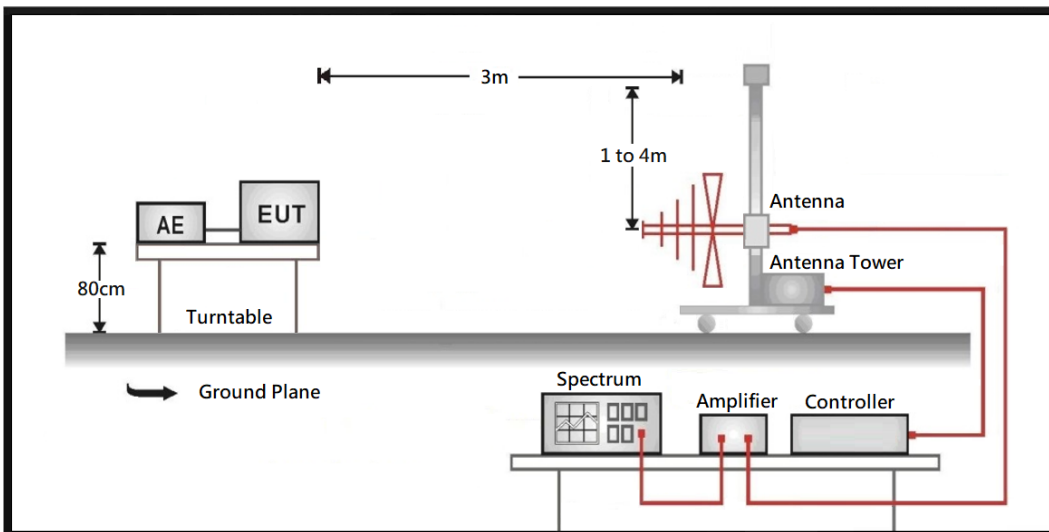
4. Radiated Emission

4.1 Test Setup

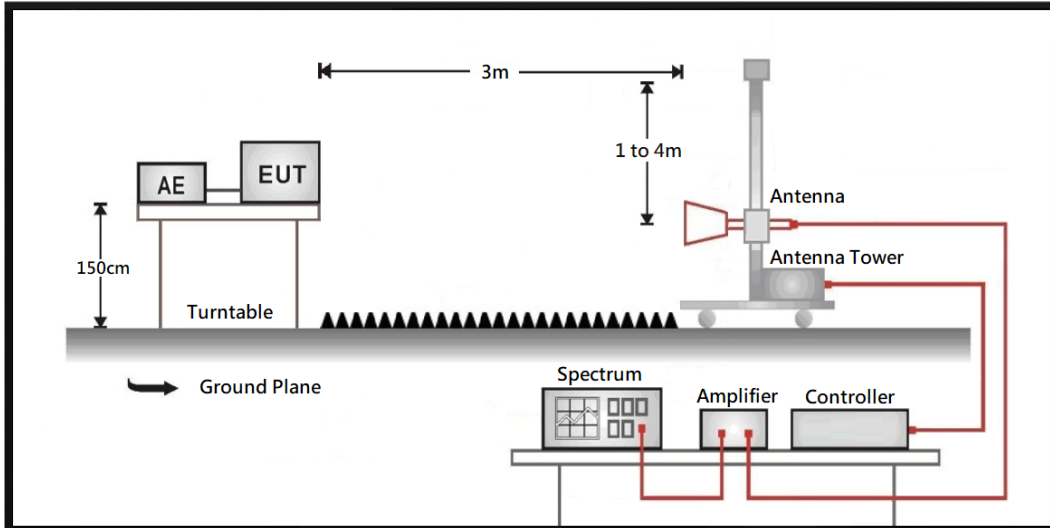
9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



Above 1 GHz



4.2 Test Limit

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limit in paragraph 15.209 / RSS-Gen Issue 5 Section 8.9, whichever is the lesser attenuation.

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	20 log (2400/F(kHz))	300
0.490 – 1.705	24000/F(kHz)	20 log (24000/F(kHz))	30
1.705 - 30	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

4.3 Test Procedure

For FCC:

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB 558074 D01V05r02 for compliance to FCC 47CFR 15.247 requirements.

The EUT and its simulators are placed on a turn table which is 0.8 or 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

On any frequency or frequencies from 9 kHz(include The the lowest oscillator frequency generated within the device up to the 10th harmonic) to 1000 MHz, the limit shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limit shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz and above 1 GHz is 1MHz.

For ISSED:

The EUT and its simulators are placed on a turn table which is 0.8(under 1 GHz) or 1.5(above 1 GHz) meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

On any frequency or frequencies from 9 kHz(include The the lowest oscillator frequency generated within the device up to the 10th harmonic) to 1000 MHz, the limit shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limit shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz and above 1 GHz is 1 MHz.

4.4 Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247 / IC RSS-247 Issue 2.

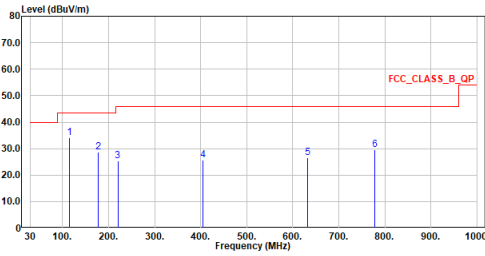
4.5 Test Result of Radiated Emissions (30 MHz ~ 1 GHz)

Mode 1: Transmit – power by host equipment



Mode 2: Transmit – power by charging

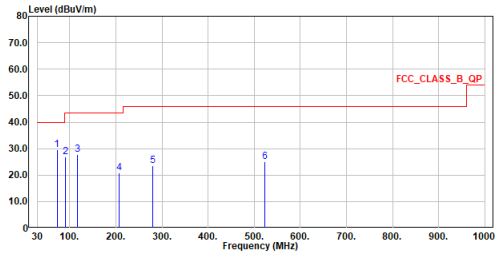
Site :HC-CB02
 Condition :3m Horizontal
 Mode :LF_BLE_1M_TX_2480MHz
 Test by :Ling



No.	Frequency MHz	Level dBuV/m	Limit dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark
1	115.263	33.98	43.50	-9.52	39.13	-5.15	QP
2	177.295	28.70	43.50	-14.80	32.65	-3.95	QP
3	219.878	25.41	46.00	-20.59	31.42	-6.01	QP
4	405.099	25.53	46.00	-20.47	24.79	0.74	QP
5	632.758	26.53	46.00	-19.47	20.32	6.21	QP
6	777.579	29.54	46.00	-16.46	21.09	8.45	QP

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The emission under 30MHz was not included since the emission levels are very low against the limit.
 5. The other emission levels were very low against the limit.

Site :HC-CB02
 Condition :3m Vertical
 Mode :LF_BLE_1M_TX_2480MHz
 Test by :Ling



No.	Frequency MHz	Level dBuV/m	Limit dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark
1	72.292	29.53	40.00	-10.47	34.21	-4.68	QP
2	90.286	26.81	43.50	-16.69	35.34	-8.53	QP
3	116.427	27.92	43.50	-15.58	33.06	-5.14	QP
4	207.462	20.92	43.50	-22.58	27.05	-6.13	QP
5	279.533	23.40	46.00	-22.60	25.74	-2.34	QP
6	522.906	24.98	46.00	-21.02	21.28	3.70	QP

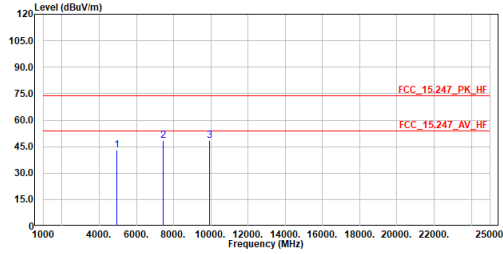
Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The emission under 30MHz was not included since the emission levels are very low against the limit.
 5. The other emission levels were very low against the limit.

4.6 Test Result of Radiated Emissions (1 GHz ~ 10th Harmonic)

Mode 1: Transmit – power by host equipment

<p>Site :HC-CB02 Condition :3m Horizontal Mode :BLE_1M_TX_2402MHz Test by :Ling</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBuV/m</th> <th>Limit Line dBuV/m</th> <th>Over Limit dB</th> <th>Read Level dBuV</th> <th>Factor dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4804.000</td> <td>42.35</td> <td>74.00</td> <td>-31.65</td> <td>55.11</td> <td>-12.76</td> <td>Peak</td> </tr> <tr> <td>2</td> <td>7206.000</td> <td>48.81</td> <td>74.00</td> <td>-25.19</td> <td>54.68</td> <td>-5.87</td> <td>Peak</td> </tr> <tr> <td>3</td> <td>9608.000</td> <td>48.05</td> <td>74.00</td> <td>-25.95</td> <td>51.34</td> <td>-3.29</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit. 5. The other emission levels were very low against the limit.</p>	No.	Frequency MHz	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark	1	4804.000	42.35	74.00	-31.65	55.11	-12.76	Peak	2	7206.000	48.81	74.00	-25.19	54.68	-5.87	Peak	3	9608.000	48.05	74.00	-25.95	51.34	-3.29	Peak	<p>Site :HC-CB02 Condition :3m Vertical Mode :BLE_1M_TX_2402MHz Test by :Ling</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBuV/m</th> <th>Limit Line dBuV/m</th> <th>Over Limit dB</th> <th>Read Level dBuV</th> <th>Factor dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4804.000</td> <td>41.67</td> <td>74.00</td> <td>-32.33</td> <td>54.43</td> <td>-12.76</td> <td>Peak</td> </tr> <tr> <td>2</td> <td>7206.000</td> <td>48.84</td> <td>74.00</td> <td>-25.16</td> <td>54.71</td> <td>-5.87</td> <td>Peak</td> </tr> <tr> <td>3</td> <td>9608.000</td> <td>48.06</td> <td>74.00</td> <td>-25.94</td> <td>51.35</td> <td>-3.29</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit. 5. The other emission levels were very low against the limit.</p>	No.	Frequency MHz	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark	1	4804.000	41.67	74.00	-32.33	54.43	-12.76	Peak	2	7206.000	48.84	74.00	-25.16	54.71	-5.87	Peak	3	9608.000	48.06	74.00	-25.94	51.35	-3.29	Peak
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<p>Site :HC-CB02 Condition :3m Horizontal Mode :BLE_1M_TX_2440MHz Test by :Ling</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBuV/m</th> <th>Limit Line dBuV/m</th> <th>Over Limit dB</th> <th>Read Level dBuV</th> <th>Factor dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4880.000</td> <td>43.56</td> <td>74.00</td> <td>-30.44</td> <td>55.97</td> <td>-12.41</td> <td>Peak</td> </tr> <tr> <td>2</td> <td>7320.000</td> <td>47.97</td> <td>74.00</td> <td>-26.03</td> <td>53.71</td> <td>-5.74</td> <td>Peak</td> </tr> <tr> <td>3</td> <td>9760.000</td> <td>48.44</td> <td>74.00</td> <td>-25.56</td> <td>51.41</td> <td>-2.97</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit. 5. The other emission levels were very low against the limit.</p>	No.	Frequency MHz	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark	1	4880.000	43.56	74.00	-30.44	55.97	-12.41	Peak	2	7320.000	47.97	74.00	-26.03	53.71	-5.74	Peak	3	9760.000	48.44	74.00	-25.56	51.41	-2.97	Peak	<p>Site :HC-CB02 Condition :3m Vertical Mode :BLE_1M_TX_2440MHz Test by :Ling</p> <table border="1"> <thead> <tr> <th>No.</th> <th>Frequency MHz</th> <th>Level dBuV/m</th> <th>Limit Line dBuV/m</th> <th>Over Limit dB</th> <th>Read Level dBuV</th> <th>Factor dB</th> <th>Remark</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4880.000</td> <td>42.60</td> <td>74.00</td> <td>-31.40</td> <td>55.01</td> <td>-12.41</td> <td>Peak</td> </tr> <tr> <td>2</td> <td>7320.000</td> <td>48.14</td> <td>74.00</td> <td>-25.86</td> <td>53.88</td> <td>-5.74</td> <td>Peak</td> </tr> <tr> <td>3</td> <td>9760.000</td> <td>47.79</td> <td>74.00</td> <td>-26.21</td> <td>50.76</td> <td>-2.97</td> <td>Peak</td> </tr> </tbody> </table> <p>Note: 1. Level = Read Level + Factor 2. Factor = Antenna Factor + Cable Loss - Preamp Factor 3. Over Limit = Level - Limit Line 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit. 5. The other emission levels were very low against the limit.</p>	No.	Frequency MHz	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark	1	4880.000	42.60	74.00	-31.40	55.01	-12.41	Peak	2	7320.000	48.14	74.00	-25.86	53.88	-5.74	Peak	3	9760.000	47.79	74.00	-26.21	50.76	-2.97	Peak
No.	Frequency MHz	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Read Level dBuV	Factor dB	Remark																																																										
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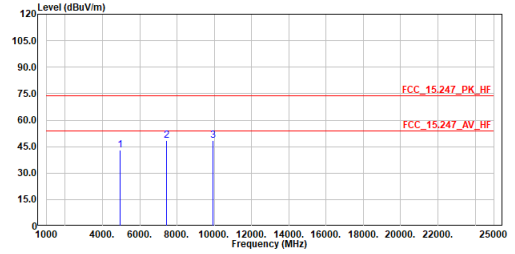
Site :HC-CB02
 Condition :3m Horizontal
 Mode :BLE_1M_TX_2480MHz
 Test by :Ling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	4960.000	43.03	74.00	-30.97	55.06	-12.03	Peak
2	7440.000	48.46	74.00	-25.54	54.09	-5.63	Peak
3	9920.000	48.64	74.00	-25.36	51.26	-2.62	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

Site :HC-CB02
 Condition :3m Vertical
 Mode :BLE_1M_TX_2480MHz
 Test by :Ling

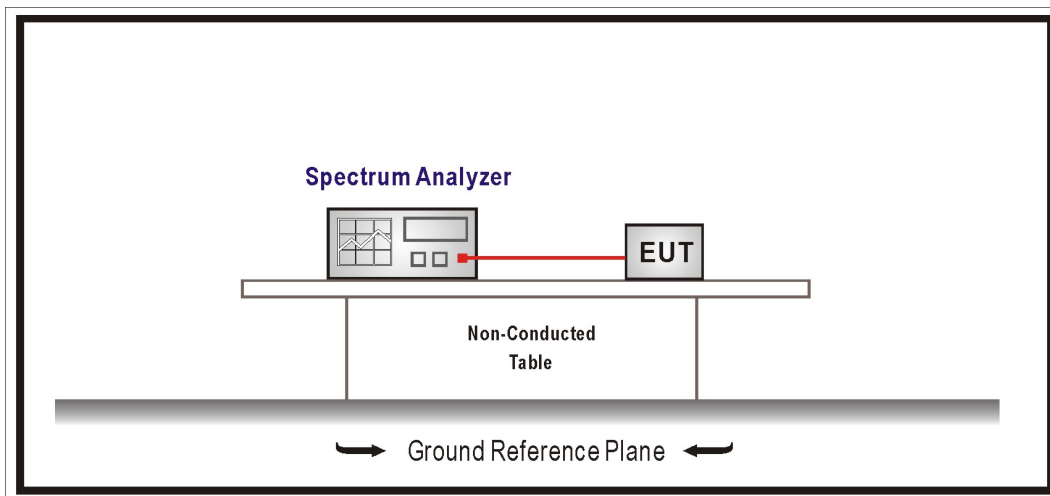


No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	4960.000	42.84	74.00	-31.16	54.87	-12.03	Peak
2	7440.000	48.65	74.00	-25.35	54.28	-5.63	Peak
3	9920.000	48.48	74.00	-25.52	51.10	-2.62	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

5. Antenna Port Conducted Emission

5.1 Test Setup



5.2 Test Limit

For FCC:

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limit. If the transmitter complies with the conducted power limit based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limit specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limit specified in §15.209(a) (see §15.205(c)).

For ISED:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted measurement, provided the transmitter demonstrates compliance with the peak conducted power limit.

5.3 Test Procedure

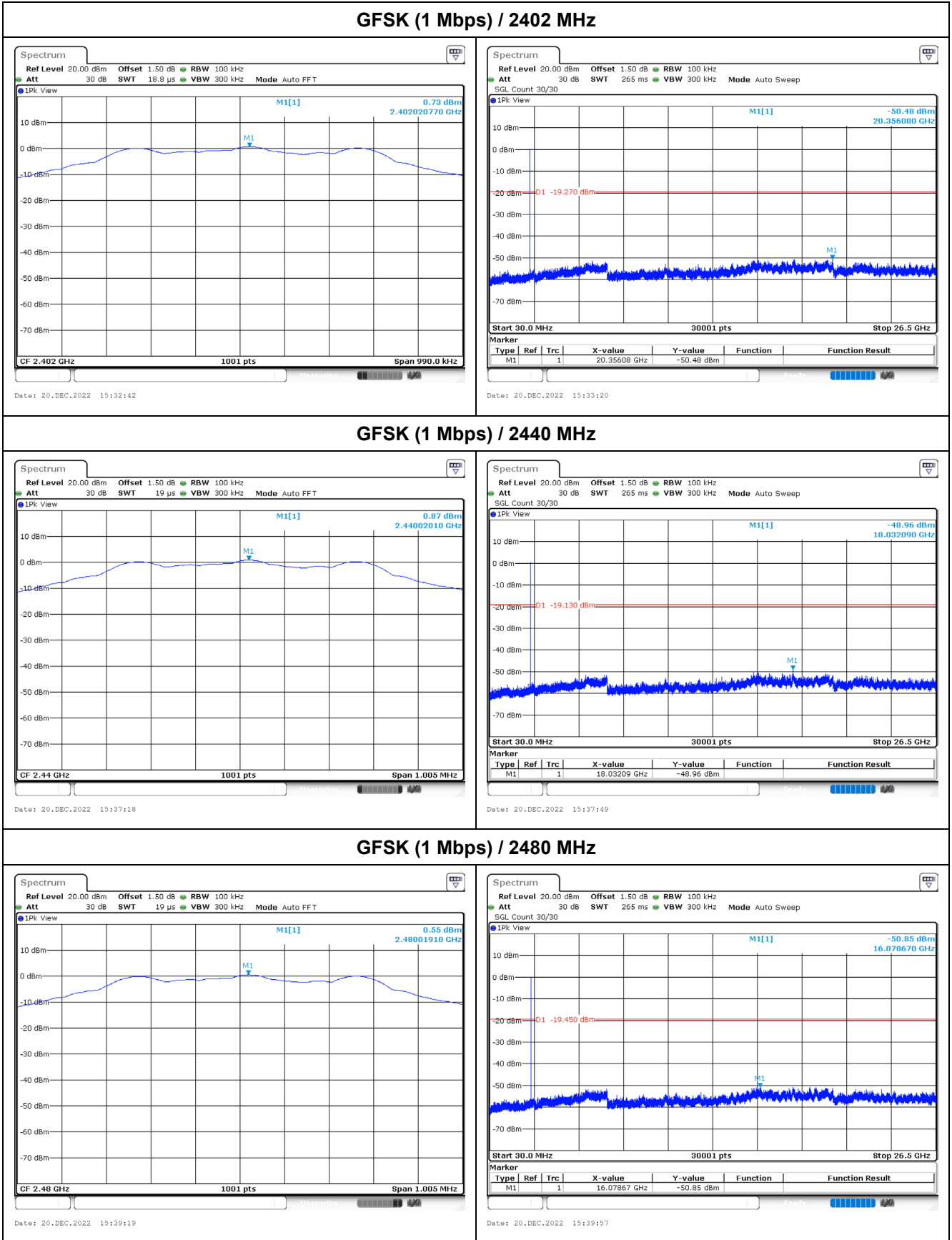
The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB 558074 D01 V05r02 for compliance to FCC 47CFR 15.247 / RSS-247 Issue 2 requirements.

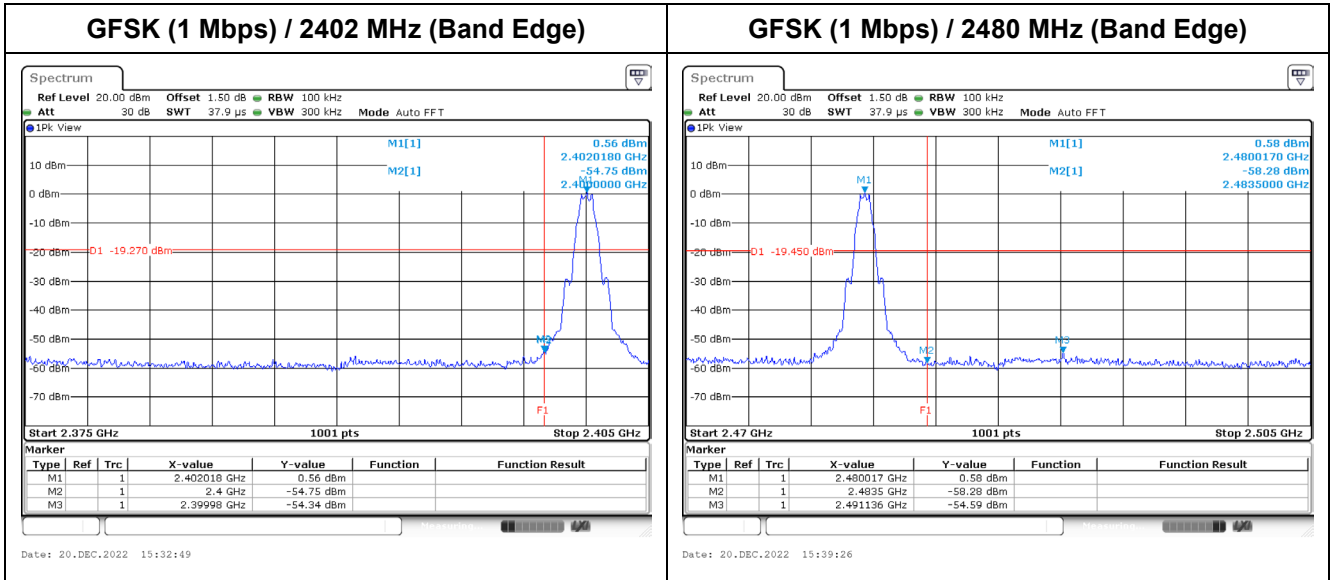
Set RBW = 100 kHz, Set VBW> RBW, scan up through 10th harmonic.

5.4 Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247 / IC RSS-247 Issue 2.

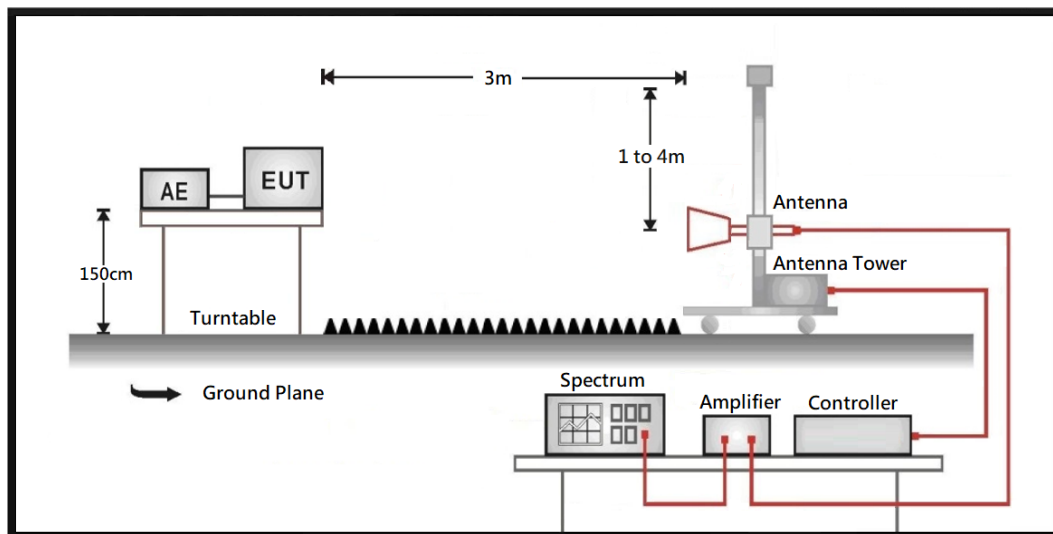
5.5 Test Result of Antenna Port Conducted Emission





6. Radiated Emission Band Edge

6.1 Test Setup



6.2 Test Limit

For FCC:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limit in paragraph 15.209, whichever is the lesser attenuation.

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

For ISSED:

In any 100 kHz bandwidth outside the operating frequency bands, between 30 MHz and 5 times the carrier frequency, the unwanted emission spectral density shall be either at least 20 dB below the inband spectral density, or shall not exceed the levels specified in RSS-Gen Issue 5 Section 8.9, whichever is the less stringent. Note. For frequency hopping systems, the inband density S_i shall be measured with the hopping sequence stopped at lowest channel and highest channel in turn, as with the hopping running normally. The 20 dB shall be with reference to the lowest of the three S_i values.

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

6.3 Test Procedure

For FCC:

The EUT was setup according to ANSI C63.10: 2013 and tested according to the FCC KDB 558074 D01 v05r02 for compliance to FCC 47CFR 15.247 requirements.

The EUT and its simulators are placed on a turn table which is 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

For ISSED:

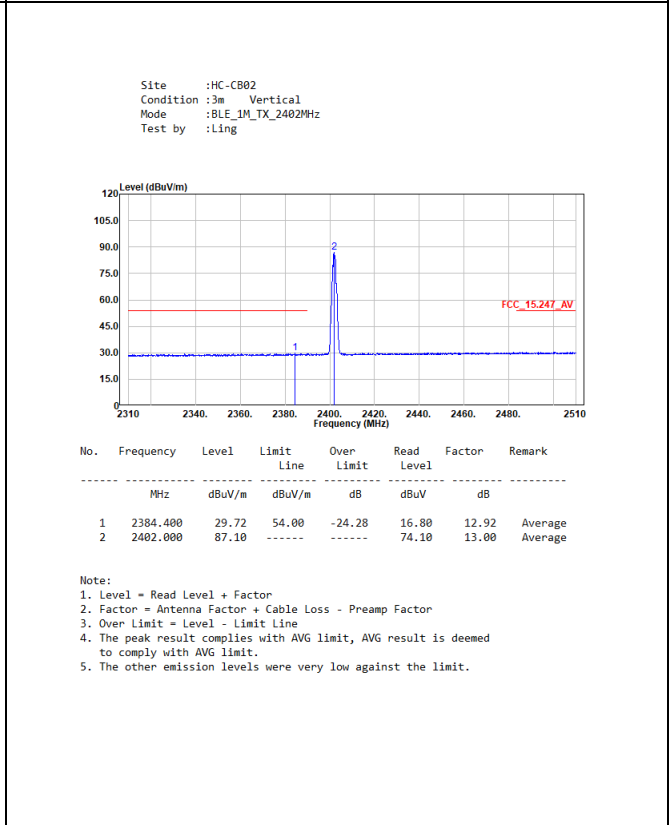
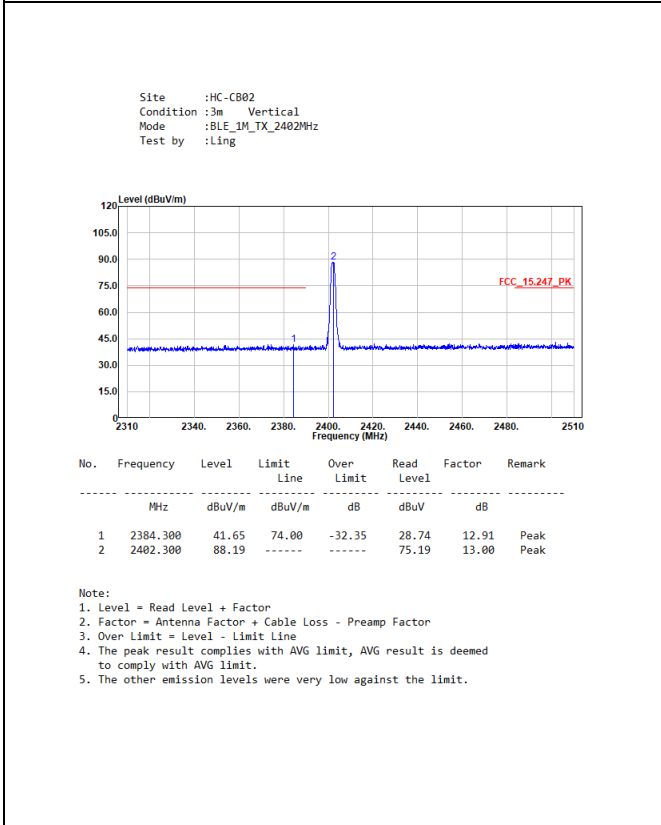
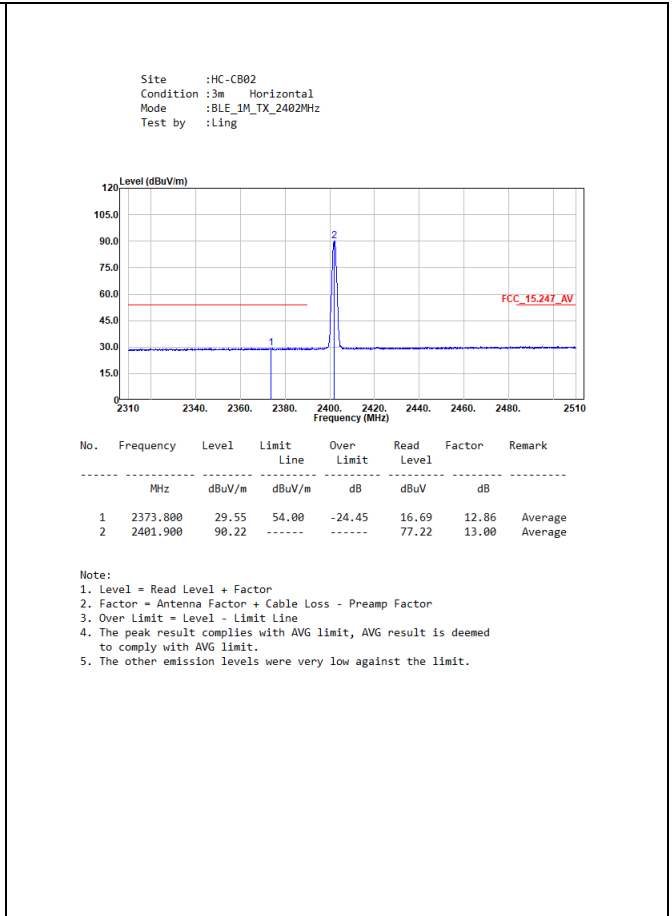
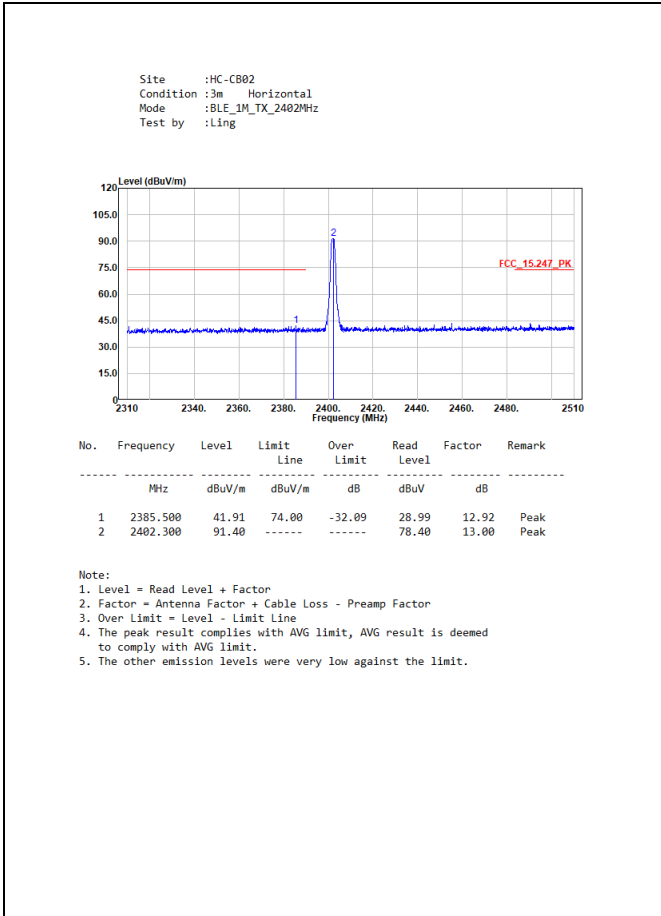
The EUT and its simulators are placed on a turn table which is 1.5 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

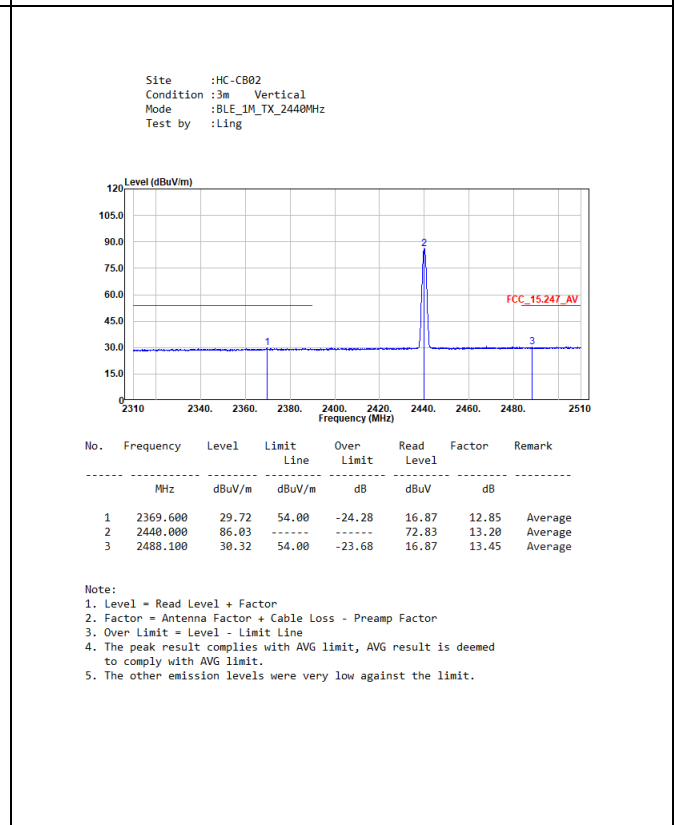
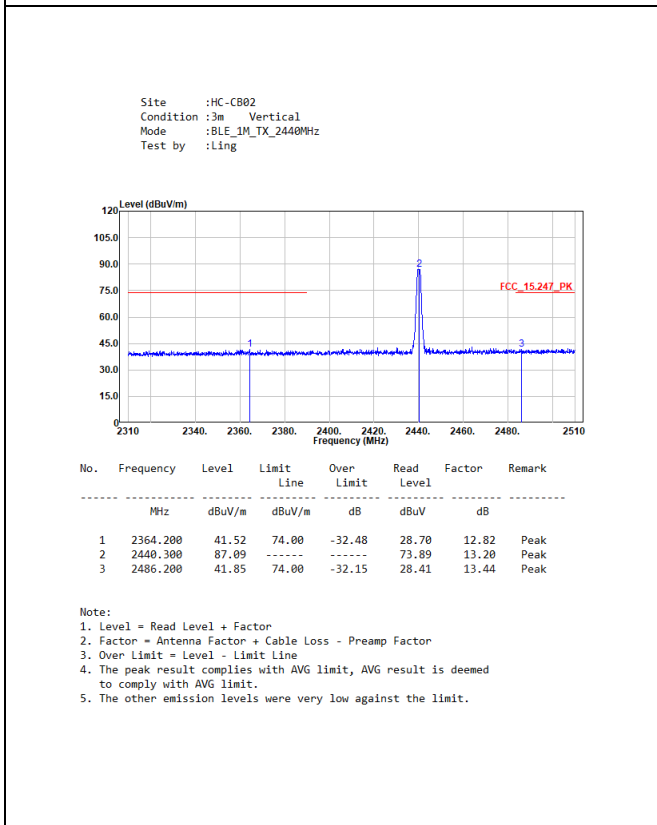
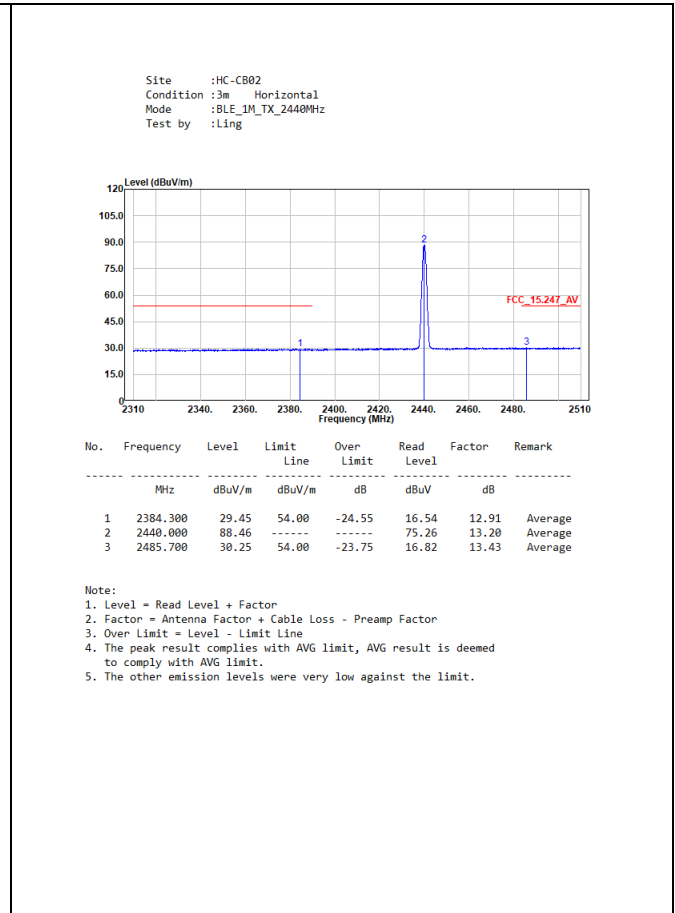
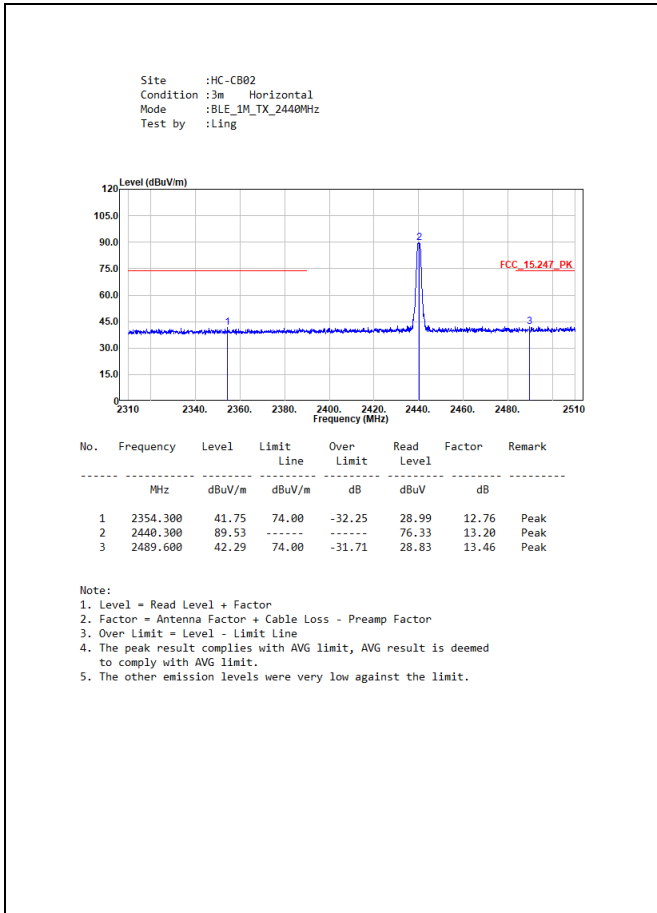
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2013 on radiated measurement.

6.4 Test Specification

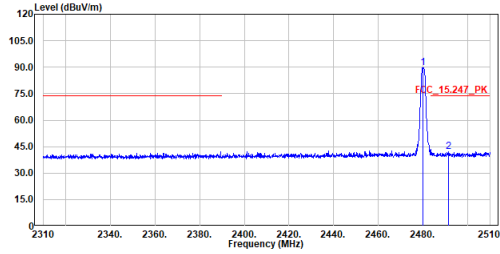
According to FCC Part 15 Subpart C Paragraph 15.247 / IC RSS-247 Issue 2.

6.5 Test Result of Radiated Emission Band Edge





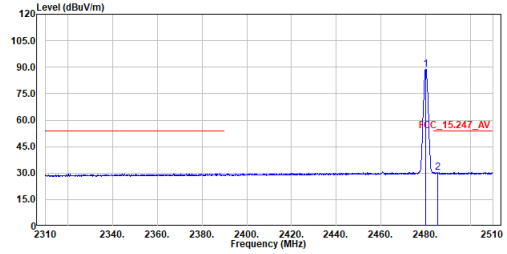
Site :HC-CB02
 Condition :3m Horizontal
 Mode :BLE_IM_TX_2480MHz
 Test by :Ling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	2480.100	89.84	-----	-----	76.44	13.40	Peak
2	2491.600	41.92	74.00	-32.08	28.46	13.46	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

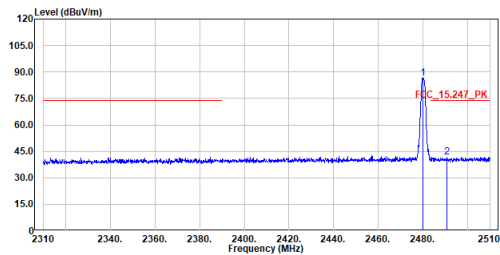
Site :HC-CB02
 Condition :3m Horizontal
 Mode :BLE_IM_TX_2480MHz
 Test by :Ling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	2480.000	88.80	-----	-----	75.40	13.40	Average
2	2485.300	30.32	54.00	-23.68	16.89	13.43	Average

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

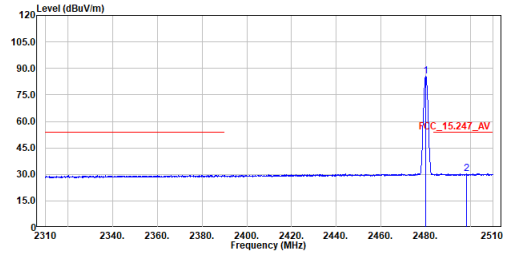
Site :HC-CB02
 Condition :3m Vertical
 Mode :BLE_IM_TX_2480MHz
 Test by :Ling



No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	2480.100	86.41	-----	-----	73.01	13.40	Peak
2	2490.800	41.81	74.00	-32.19	28.35	13.46	Peak

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

Site :HC-CB02
 Condition :3m Vertical
 Mode :BLE_IM_TX_2480MHz
 Test by :Ling

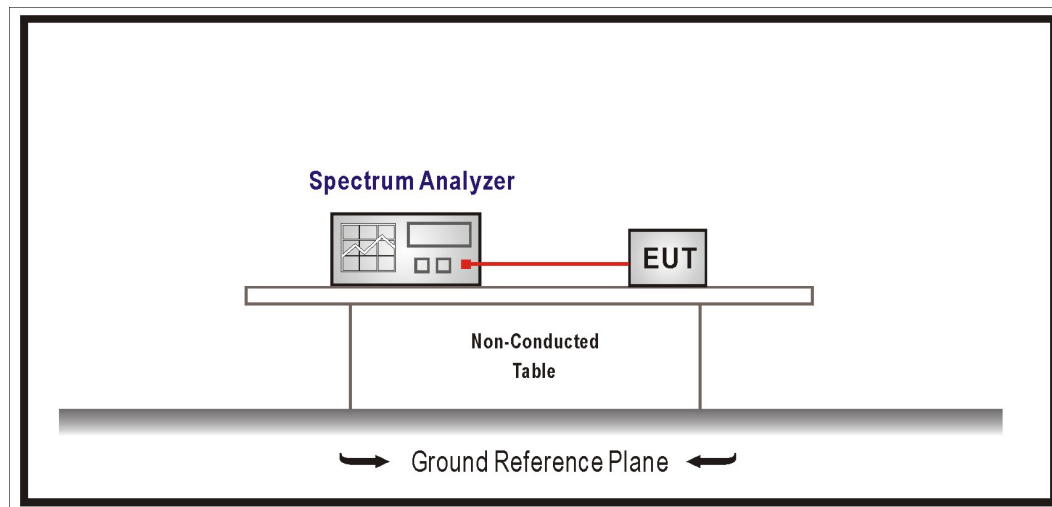


No.	Frequency	Level	Limit	Over	Read	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	2480.000	85.38	-----	-----	71.98	13.40	Average
2	2498.200	30.54	54.00	-23.46	17.03	13.51	Average

Note:
 1. Level = Read Level + Factor
 2. Factor = Antenna Factor + Cable Loss - Preamp Factor
 3. Over Limit = Level - Limit Line
 4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
 5. The other emission levels were very low against the limit.

7. Occupied Bandwidth & DTS Bandwidth

7.1 Test Setup



7.2 Test Limit

The 6 dB bandwidth: ≥ 500 kHz.

Occupied Bandwidth: NA

7.3 Test Procedures

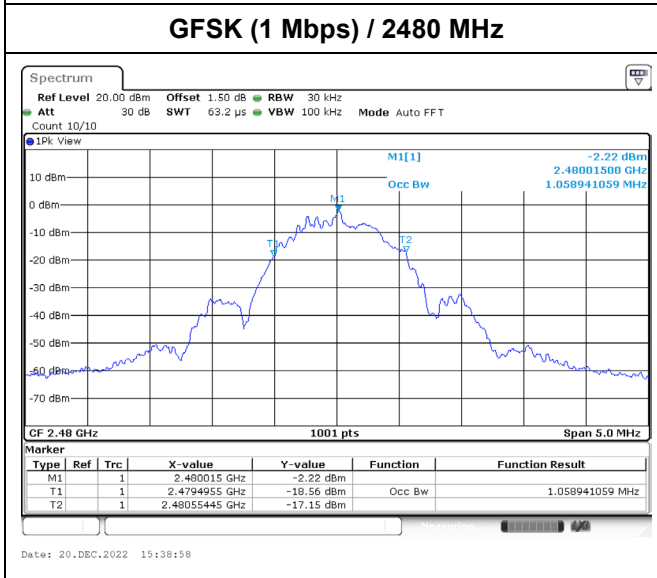
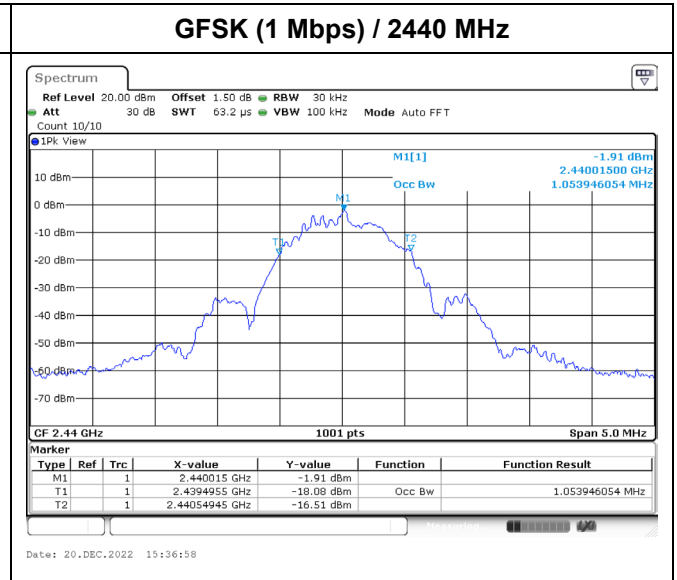
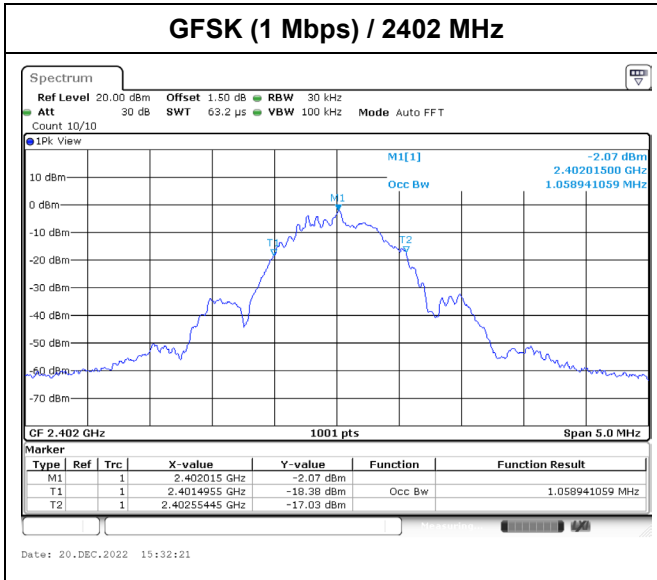
The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB 558074 D01 V05r02 for compliance to FCC 47CFR 15.247 / RSS-247 Issue 2 requirements.

7.4 Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247 / IC RSS-247 Issue 2.

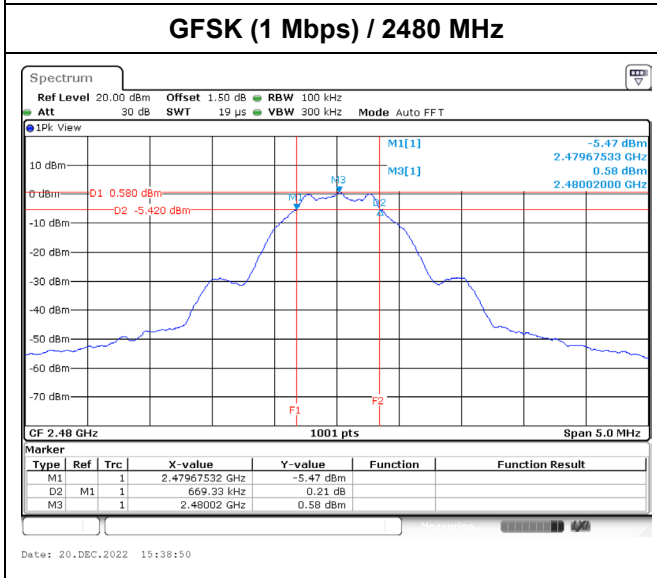
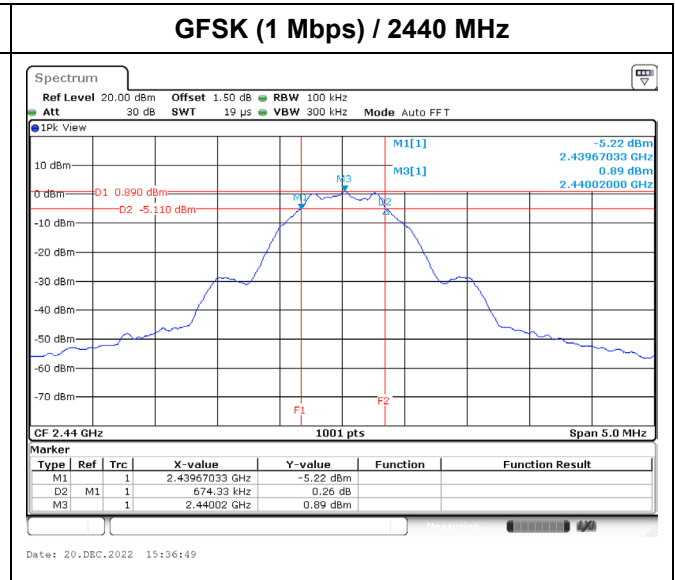
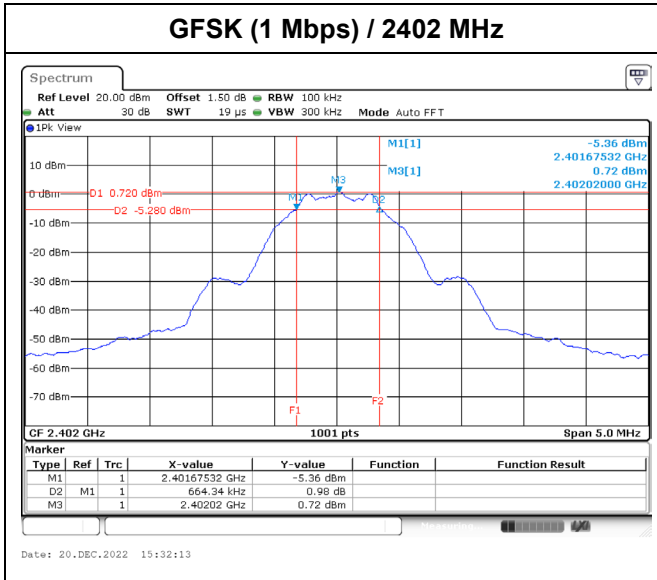
7.5 Test Result of Occupied Bandwidth

Modulation	Channel	Frequency (MHz)	Measure Level (MHz)	Limit (MHz)
GFSK (1 Mbps)	00	2402	1.058	-
	19	2440	1.053	-
	39	2480	1.058	-



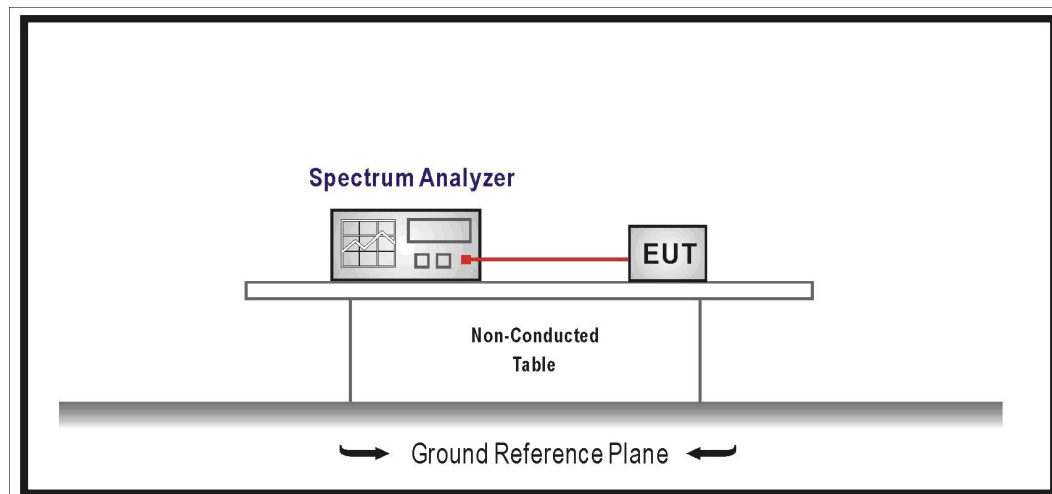
7.6 Test Result of DTS Bandwidth

Modulation	Channel	Frequency (MHz)	Measure Level (MHz)	Limit (MHz)	Result
GFSK (1 Mbps)	00	2402	0.664	≥ 0.500	Pass
	19	2440	0.674	≥ 0.500	Pass
	39	2480	0.669	≥ 0.500	Pass



8. Maximum Power Spectral Density

8.1 Test Setup



8.2 Test Limit

The peak power spectral density conducted from the intentional radiated to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3 Test Procedures

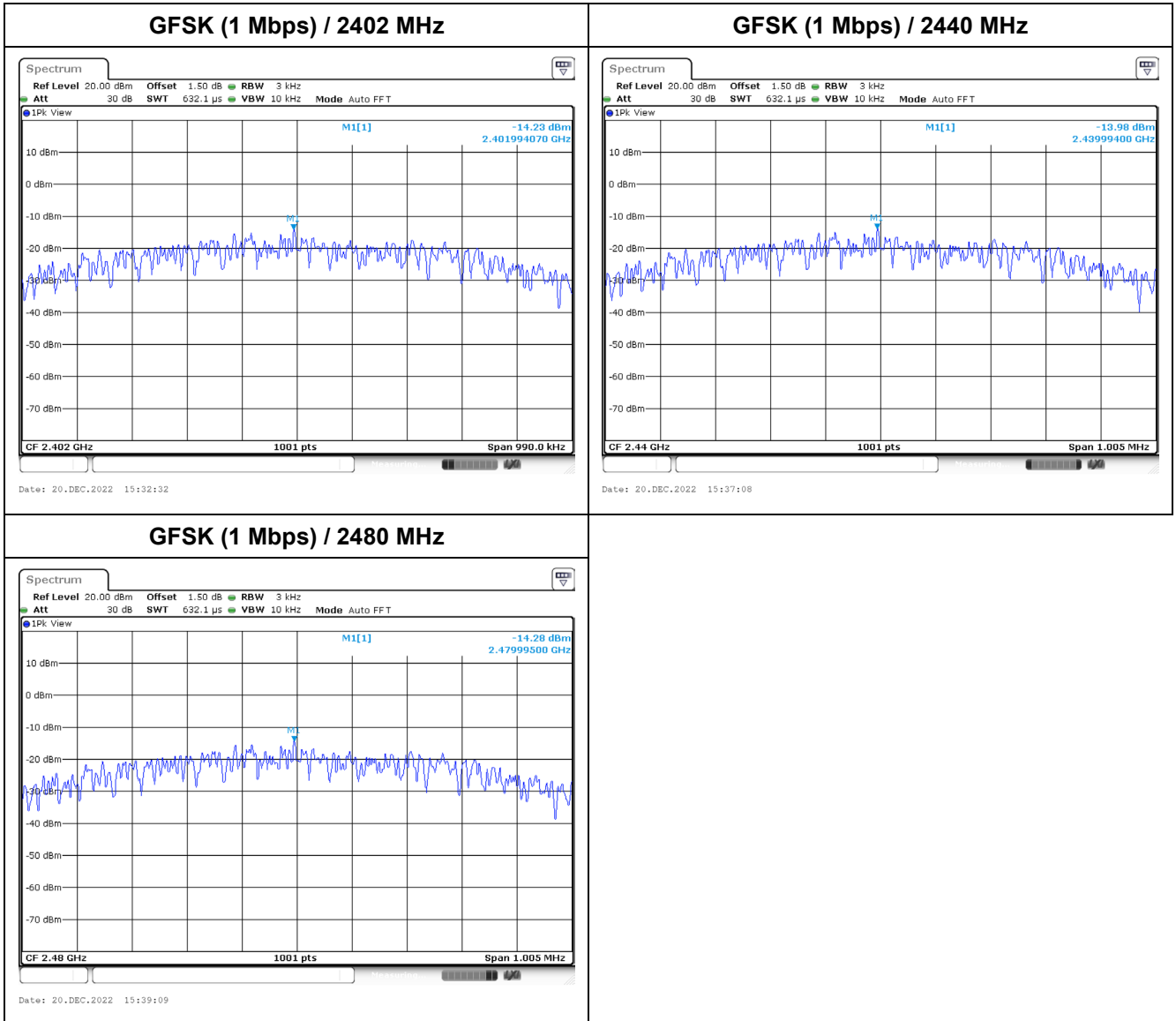
The EUT was setup according to ANSI C63.10: 2013; tested according to DTS test procedure of KDB 558074 D01 V05r02 for compliance to FCC 47CFR 15.247 / RSS-247 Issue 2 requirements.

8.4 Test Specification

According to FCC Part 15 Subpart C Paragraph 15.247 / IC RSS-247 Issue 2.

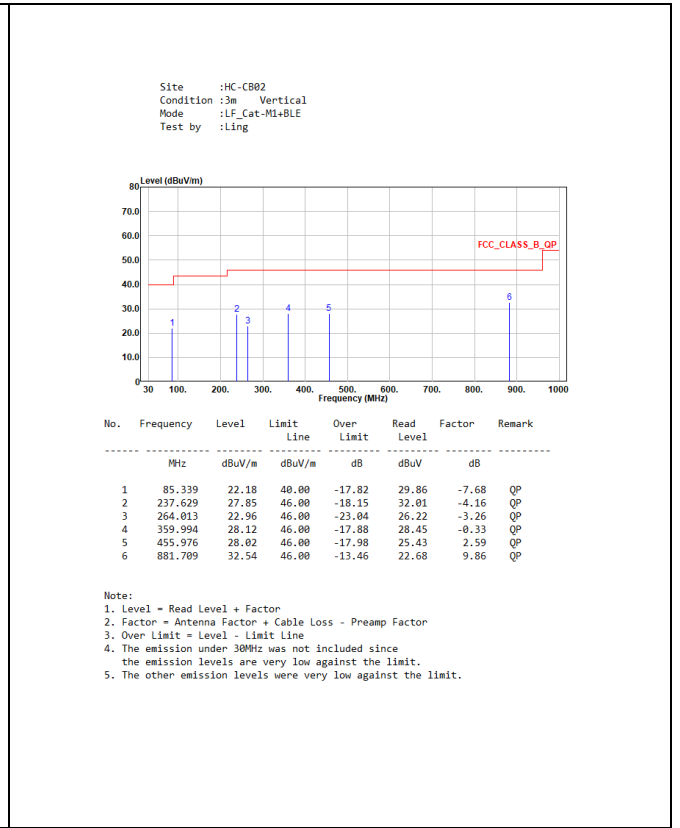
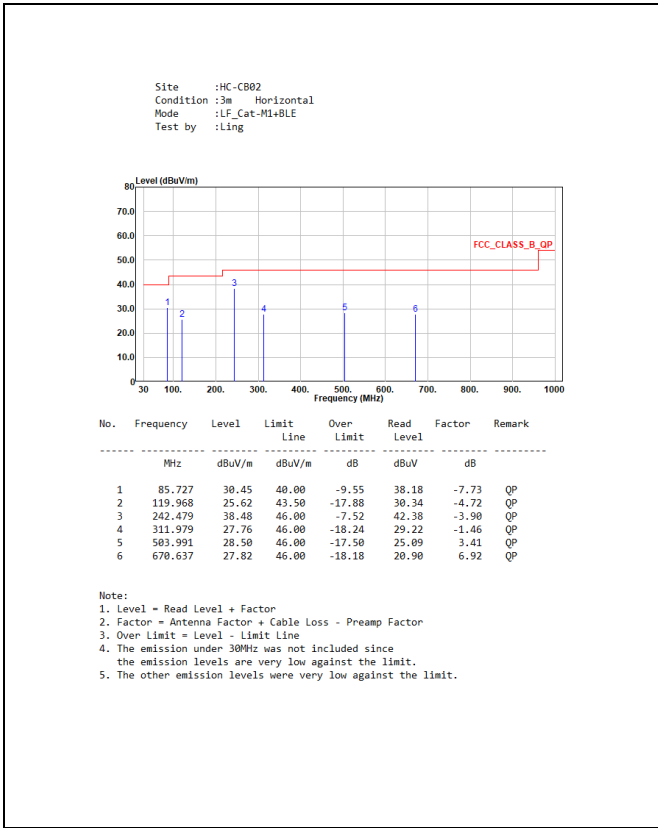
8.5 Test Result of Maximum Power Spectral Density

Modulation	Channel	Frequency (MHz)	Measure Value (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK (1 Mbps)	00	2402	-14.230	≤ 8.000	Pass
	19	2440	-13.980	≤ 8.000	Pass
	39	2480	-14.280	≤ 8.000	Pass



Appendix A

➤ Test Result of Radiated Emissions Co-location WWAN LTE Cat-M1 + Bluetooth LE function 30 MHz ~ 1 GHz:



Above 1 GHz:

