

Ningbo Royalux Lighting Co., Ltd

RF TEST REPORT

Report Type:

FCC Part 15.247 & ISED RSS-247 RF report

Model:

22515

REPORT NUMBER:

180602499SHA-002

ISSUE DATE:

March 15, 2019

DOCUMENT CONTROL NUMBER:

TTRF15.247-02_V1 © 2018 Intertek



Applicant: Ningbo Royalux Lighting Co., Ltd
Xiaobai Industrial Park, Dongwu, Yinzhou, Ningbo, China 315113

Manufacturer: Ningbo Royalux Lighting Co., Ltd
Xiaobai Industrial Park, Dongwu, Yinzhou, Ningbo, China 315113

Factory: Ningbo Royalux Lighting Co., Ltd
Xiaobai Industrial Park, Dongwu, Yinzhou, Ningbo, China 315113

FCC ID: 2APD8-RYL22515

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:

47CFR Part 15 (2018): Radio Frequency Devices (Subpart C)

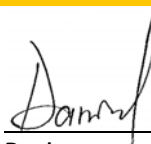
ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-247 Issue 2 (February 2017): Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

RSS-Gen Issue 5 (April 2018): General Requirements for Compliance of Radio Apparatus

PREPARED BY:

Project Engineer
Wade Zhang

REVIEWED BY:

Reviewer
Daniel Zhao

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

TEST REPORT

Content

REVISION HISTORY	5
MEASUREMENT RESULT SUMMARY	6
1 GENERAL INFORMATION	7
1.1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	7
1.2 TECHNICAL SPECIFICATION	7
1.3 DESCRIPTION OF TEST FACILITY	8
2 TEST SPECIFICATIONS	9
2.1 STANDARDS OR SPECIFICATION	9
2.2 MODE OF OPERATION DURING THE TEST	9
2.3 TEST SOFTWARE LIST	10
2.4 TEST PERIPHERALS LIST	10
2.5 TEST ENVIRONMENT CONDITION:	10
2.6 INSTRUMENT LIST	11
2.7 MEASUREMENT UNCERTAINTY	13
3 MINIMUM 6DB BANDWIDTH	14
3.1 LIMIT	14
3.2 MEASUREMENT PROCEDURE	14
3.3 TEST CONFIGURATION	14
3.4 TEST RESULTS OF MINIMUM 6DB BANDWIDTH	14
4 MAXIMUM CONDUCTED OUTPUT POWER AND E.I.R.P.	15
4.1 LIMIT	15
4.2 MEASUREMENT PROCEDURE	15
4.3 TEST CONFIGURATION	15
4.4 TEST RESULTS OF MAXIMUM CONDUCTED OUTPUT POWER	15
5 POWER SPECTRUM DENSITY	16
5.1 LIMIT	16
5.2 MEASUREMENT PROCEDURE	16
5.3 TEST CONFIGURATION	16
5.4 TEST RESULTS OF POWER SPECTRUM DENSITY	16
6 EMISSION OUTSIDE THE FREQUENCY BAND	17
6.1 LIMIT	17
6.2 MEASUREMENT PROCEDURE	17
6.3 TEST CONFIGURATION	18
6.4 THE RESULTS OF EMISSION OUTSIDE THE FREQUENCY BAND	18
7 RADIATED EMISSIONS IN RESTRICTED FREQUENCY BANDS	19
7.1 LIMIT	19
7.2 MEASUREMENT PROCEDURE	19
7.3 TEST CONFIGURATION	21
7.4 TEST RESULTS OF RADIATED EMISSIONS	23
8 POWER LINE CONDUCTED EMISSION	29
8.1 LIMIT	29
8.2 TEST CONFIGURATION	29
8.3 MEASUREMENT PROCEDURE	30
8.4 TEST RESULTS OF POWER LINE CONDUCTED EMISSION	31

TEST REPORT

9	OCCUPIED BANDWIDTH	33
9.1	LIMIT	33
9.2	MEASUREMENT PROCEDURE	33
9.3	TEST CONFIGURATION	33
9.4	THE RESULTS OF OCCUPIED BANDWIDTH.....	33
10	ANTENNA REQUIREMENT	34
	APPENDIX A: TEST RESULTS	35

Revision History

Report No.	Version	Description	Issued Date
180602499SHA-002	Rev. 01	Initial issue of report	March 15, 2019

Measurement result summary

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-247 Issue 2 Clause 5.2	Pass
Maximum conducted output power and e.i.r.p.	15.247(b)(3)	RSS-247 Issue 2 Clause 5.4	Pass
Power spectrum density	15.247(e)	RSS-247 Issue 2 Clause 5.2	Pass
Emission outside the frequency band	15.247(d)	RSS-247 Issue 2 Clause 5.5	Pass
Radiated Emissions in restricted frequency bands	15.247(d), 15.205&15.209	RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207(a)	RSS-Gen Issue 5 Clause 8.8	Pass
Occupied bandwidth	-	RSS-Gen Issue 5 Clause 6.6	Tested
Antenna requirement	15.203	-	Pass

Notes: 1: NA =Not Applicable

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Portable luminaires
Type/Model:	22515
Description of EUT:	The product covered by this report is a portable luminaire for wet location use, with USB output, bluetooth loudspeaker, and has only one model.
Rating:	3.7VDC, 6W; USB: 5Vdc, 1A, Audio: 2W with class II adaptor Adaptor input: 100-240V~, 50/60Hz, 0.6A Max Output: 5VDC, 1.0A
EUT type:	☒ Table top ☐ Floor standing
Software Version:	/
Hardware Version:	/
Sample received date:	June 14, 2018
Date of test:	June 14, 2018~ December 20, 2018

1.2 Technical Specification

Frequency Range:	2400MHz to 2483.5MHz
Support Standards:	Bluetooth Low Energy
Operating Frequency:	2402MHz to 2480MHz
Type of Modulation:	GFSK
Channel Number:	40
Channel Separation:	2MHz
Antenna Information:	PCB antenna, 0dBi max

TEST REPORT

1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN1175
	IC Registration Lab CAB identifier.: CN0051
	VCCI Registration Lab Registration No.: R-14243, G-10845, C-14723, T-12252
	A2LA Accreditation Lab Certificate Number: 3309.02

TEST REPORT

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2018)
ANSI C63.10 (2013)
RSS-247 Issue 2 (February 2017)
RSS-Gen Issue 5 (April 2018)
KDB 558074 (v05)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

Software name	Manufacturer	Version	Supplied by
RTK BT MP TOOL	-	-	Client

The lowest, middle and highest channel were tested as representatives.

Frequency Band (MHz)				2402 ~ 2480			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Data rate and Power setting:

The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

Frequency Band (MHz)	Mode	Worst data rate
2400-2483.5	BLE	1Mbps

Power Setting parameter			
Mode	Channel		
	Lowest	Middle	Highest
BLE	default	default	default

TEST REPORT

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
1	Laptop computer	DELL 5480	-

2.5 Test environment condition:

Test items	Temperature	Humidity
Minimum 6dB Bandwidth	23°C	56%RH
Maximum conducted output power and e.i.r.p.		
Power spectrum density		
Emission outside the frequency band		
Occupied bandwidth		
Radiated Emissions in restricted frequency bands	22°C	56%RH
Power line conducted emission	22°C	54%RH

2.6 Instrument list

Conducted Emission/Disturbance Power/Tri-loop Test/CDN method					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESCS 30	EC 2107	2019-07-15
☒	A.M.N.	R&S	ESH2-Z5	EC 3119	2019-11-30
☐	A.M.N.	R&S	ENV 216	EC 3393	2019-07-04
☐	A.M.N.	R&S	ENV4200	EC 3558	2019-06-10
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESIB 26	EC 3045	2019-09-12
☒	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-06-10
☒	Pre-amplifier	R&S	AFS42-00101800-25-S-42	EC5262	2019-06-10
☒	Horn antenna	R&S	HF 906	EC 3049	2019-11-17
☐	Horn antenna	ETS	3117	EC 4792-1	2020-01-09
☒	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
☐	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2019-03-07
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2019-03-05
☐	Power sensor	Agilent	U2021XA	EC 5338-1	2019-03-05
☐	Vector Signal Generator	Agilent	N5182B	EC 5175	2019-03-05
☐	Spectrum analyzer	R&S	CMW500	EC5944	2019-12-22
☐	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2019-03-05
☐	Mobile Test System	Litepoint	Iqxel	EC 5176	2020-01-08
☐	Test Receiver	R&S	ESCI 7	EC 4501	2019-09-12
Tet Site					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Shielded room	Zhongyu	-	EC 2838	2020-01-14
☐	Shielded room	Zhongyu	-	EC 2839	2020-01-14
☒	Semi-anechoic chamber	Albatross project	-	EC 3048	2019-07-31
☐	Fully-anechoic chamber	Albatross project	-	EC 3047	2019-07-31
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2019-02-28
☐	Therom-	ZJ1-2A	S.M.I.F.	EC 2122	2019-03-11

TEST REPORT

	Hygrograph				
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 5198	2020-01-18
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3326	2019-03-28
☐	Pressure meter	YM3	Shanghai Mengde	EC 3320	2019-07-01

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Maximum peak output power	$\pm 0.74\text{dB}$
Radiated Emissions in restricted frequency bands below 1GHz	$\pm 4.90\text{dB}$
Radiated Emissions in restricted frequency bands above 1GHz	$\pm 5.02\text{dB}$
Emission outside the frequency band	$\pm 2.89\text{dB}$
Power line conducted emission	$\pm 3.19\text{dB}$

3 Minimum 6dB bandwidth

Test result: Pass

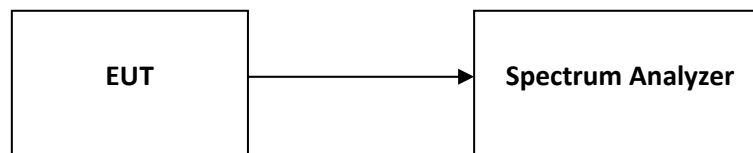
3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Measurement Procedure

- a) Set RBW = 100 kHz.
- b) Set VBW $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

3.3 Test Configuration



3.4 Test Results of Minimum 6dB bandwidth

Please refer to Appendix A

4 Maximum conducted output power and e.i.r.p.

Test result: Pass

4.1 Limit

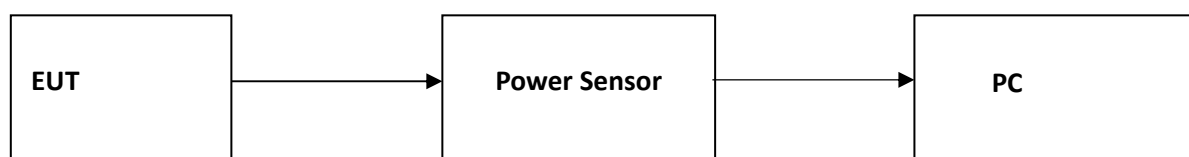
According to FCC part15.247 (b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5MHz, and 5725-5850MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Per RSS247 Issue 2 Section 5.4(d), for DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W.

4.2 Measurement Procedure

Out power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW =50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

4.3 Test Configuration



4.4 Test Results of Maximum conducted output power

Please refer to Appendix A

TEST REPORT

5 Power spectrum density

Test result: Pass

5.1 Limit

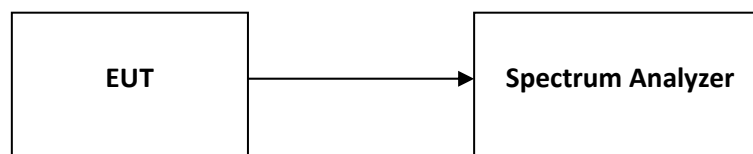
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/MHz and $8 + (6 - \text{antenna gain} - \text{beam forming gain})$.

5.2 Measurement Procedure

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq 3 \times \text{RBW}$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 Test Configuration



5.4 Test Results of Power spectrum density

Please refer to Appendix A

TEST REPORT

6 Emission outside the frequency band

Test result: Pass

6.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

6.2 Measurement Procedure

Reference level measurement

Establish a reference level by using the following procedure:

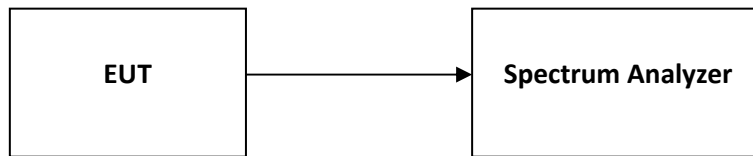
- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to ≥ 1.5 times the DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW $\geq 3 \times$ RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq 3 \times$ RBW.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

6.3 Test Configuration



6.4 The results of Emission outside the frequency band

Please refer to Appendix A

7 Radiated Emissions in restricted frequency bands

Test result: Pass

7.1 Limit

The radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

7.2 Measurement Procedure

For Radiated emission below 30MHz:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Both X and Y axes of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

TEST REPORT**For Radiated emission above 30MHz:**

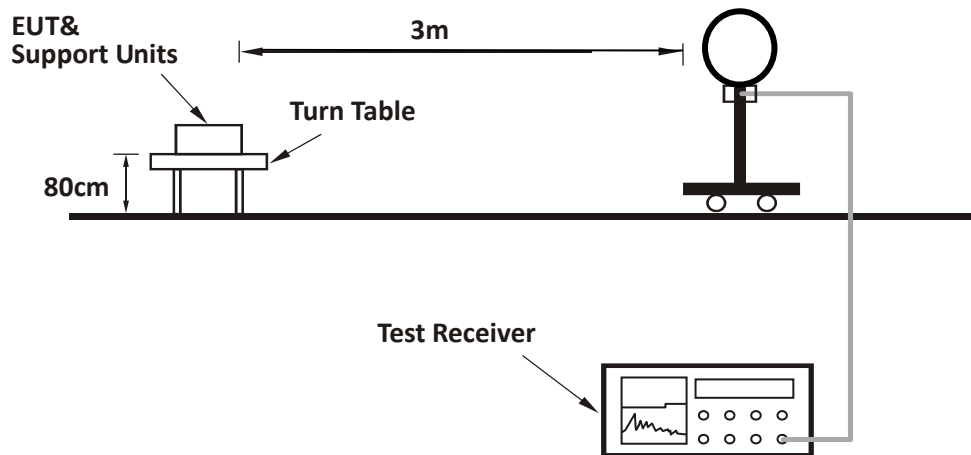
- a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c) The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f) The test-receiver system was set to peak and average detector function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

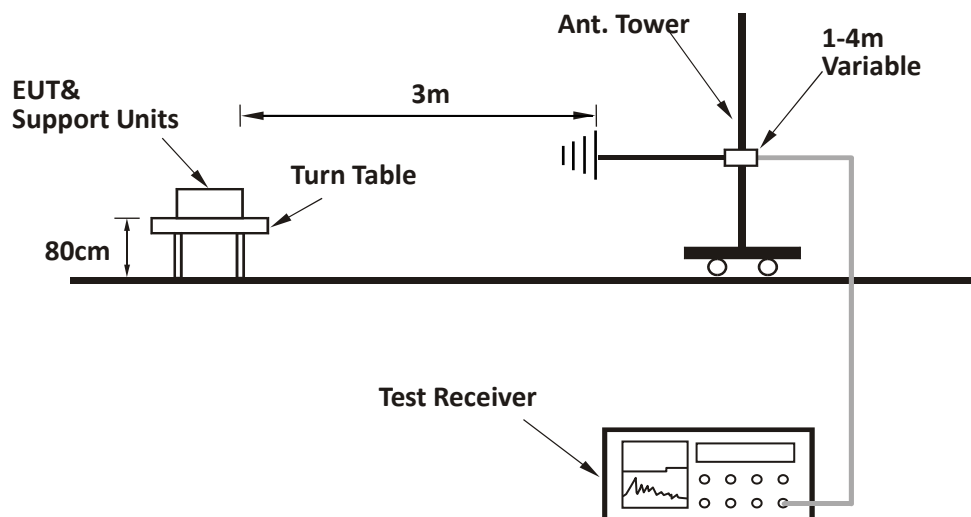
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 3 x RBW (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were and the worst-case emissions were reported.

7.3 Test Configuration

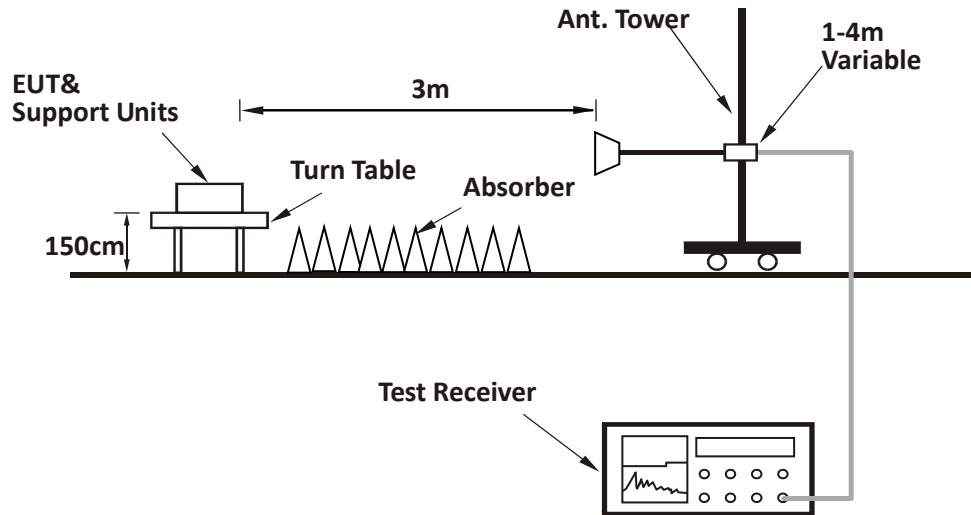
For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



For Radiated emission above 1GHz:

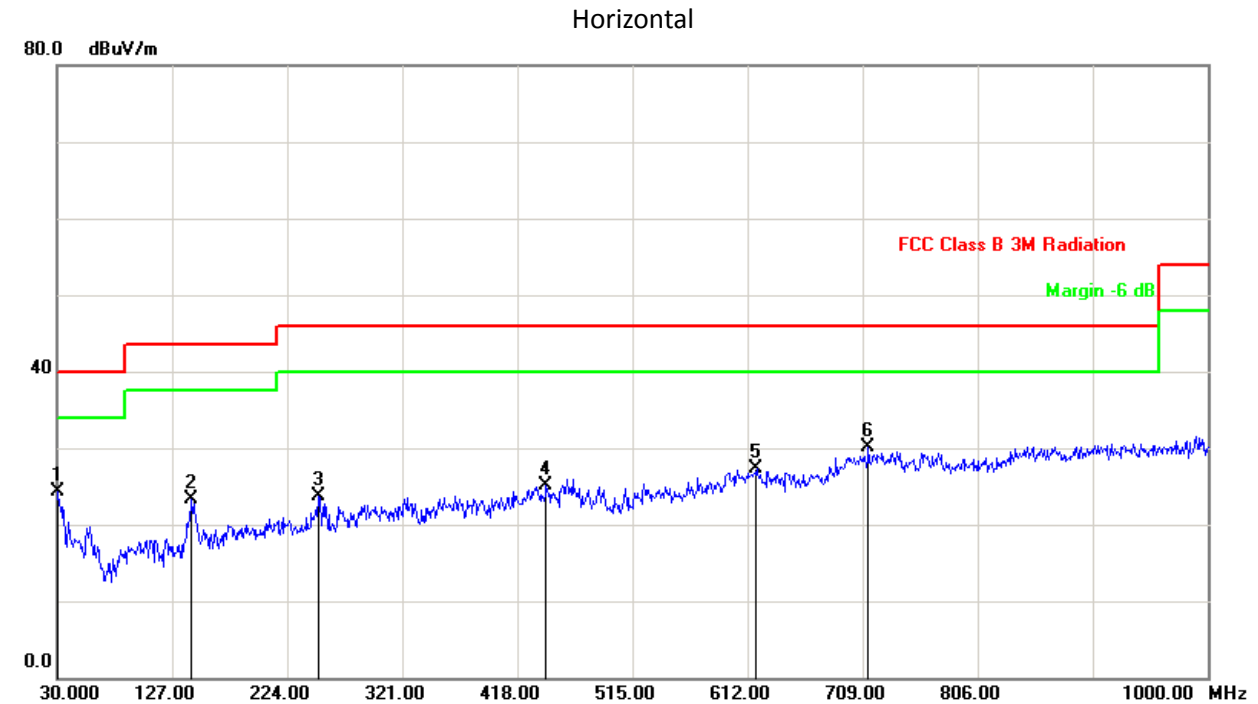


TEST REPORT

7.4 Test Results of Radiated Emissions

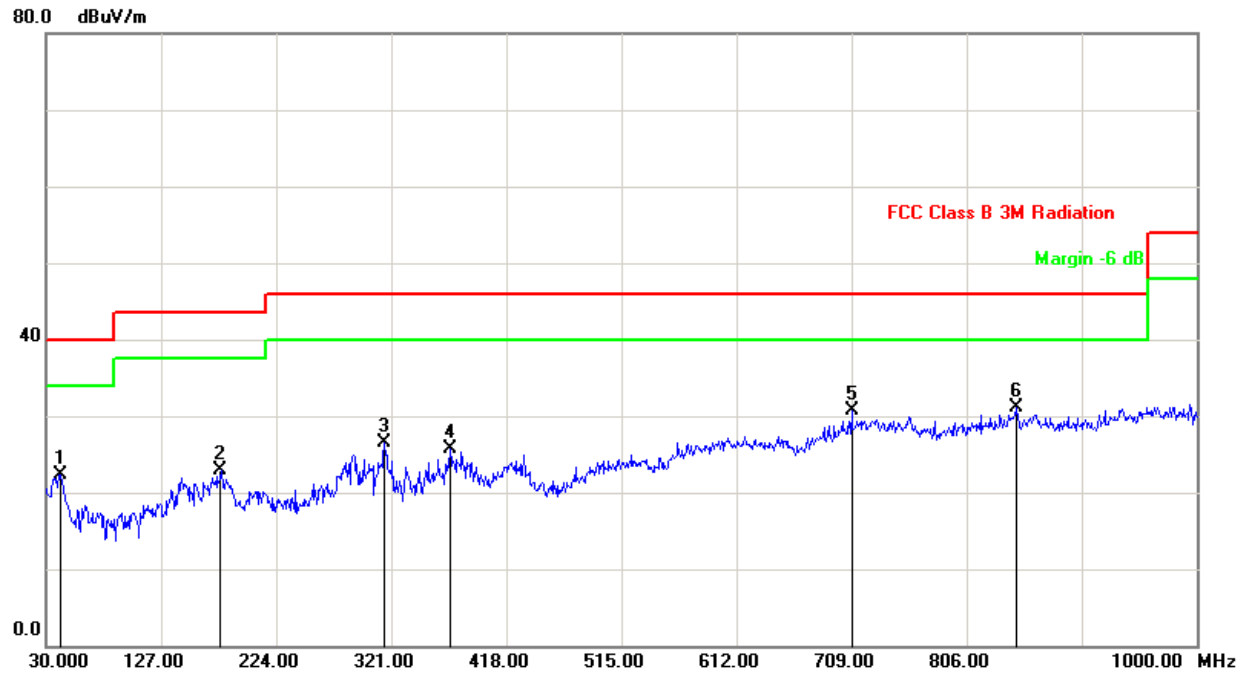
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Test data below 1GHz



Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	30.0000	24.36	2.48	40.00	15.64	PK
H	143.4900	23.26	12.77	43.50	20.24	PK
H	250.1898	23.63	11.02	46.00	22.37	PK
H	442.2500	25.18	5.64	46.00	20.82	PK
H	619.7599	27.32	1.33	46.00	18.68	PK
H	713.8500	30.14	1.31	46.00	15.86	PK

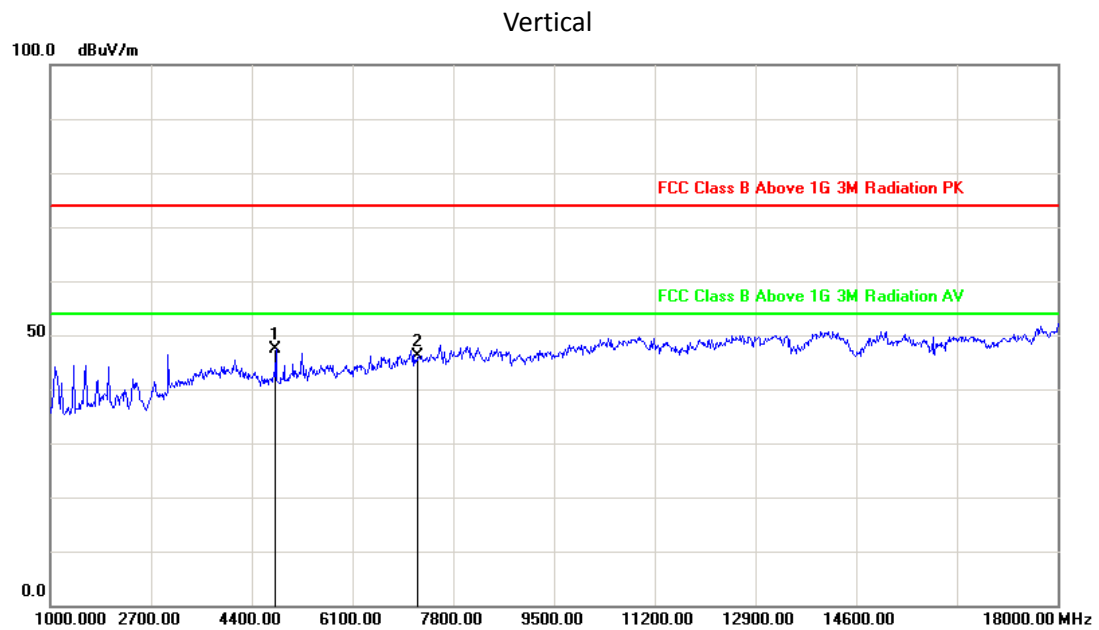
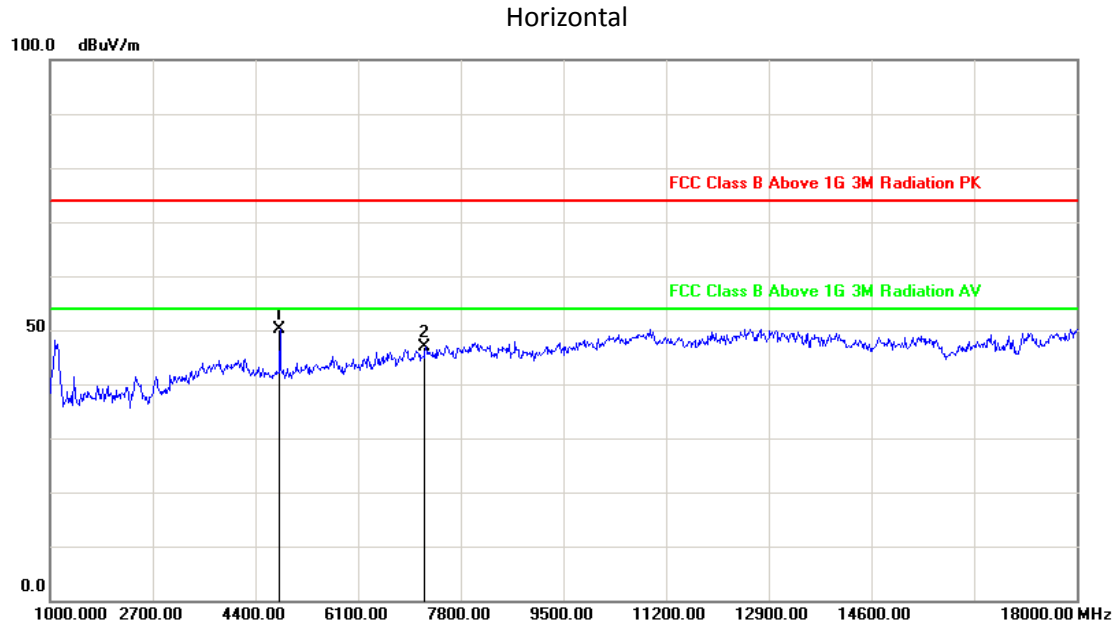
Vertical



Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
V	42.6099	22.38	7.48	40.00	17.62	PK
V	177.4398	22.91	12.64	43.50	20.59	PK
V	315.1800	26.56	6.73	46.00	19.44	PK
V	370.4700	25.64	6.93	46.00	20.36	PK
V	709.0000	30.61	1.24	46.00	15.39	PK
V	847.7100	31.09	1.63	46.00	14.91	PK

TEST REPORT

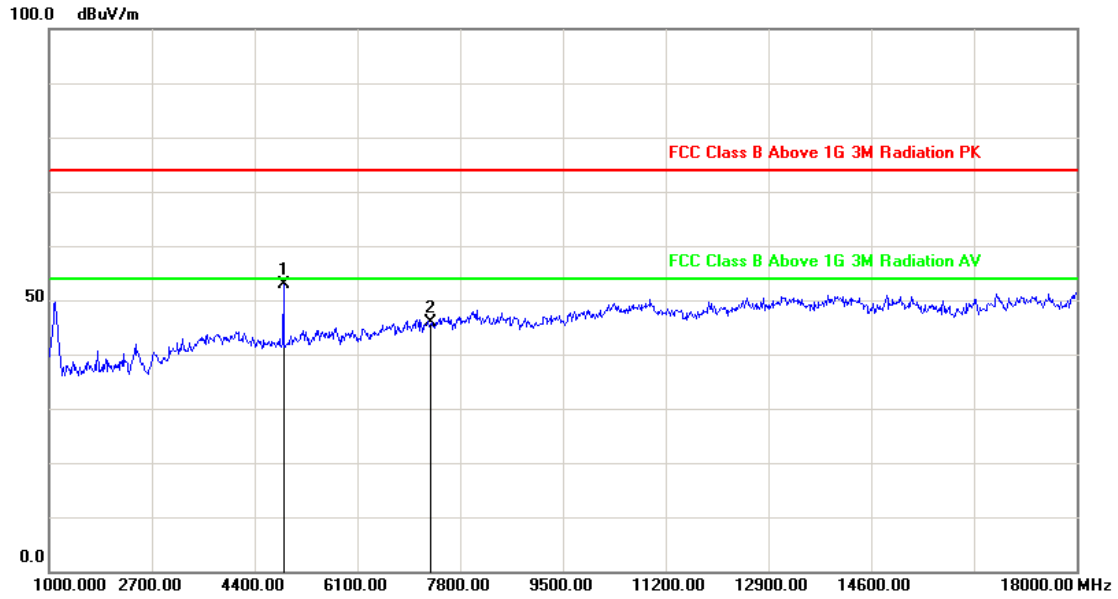
Test result above 1GHz:



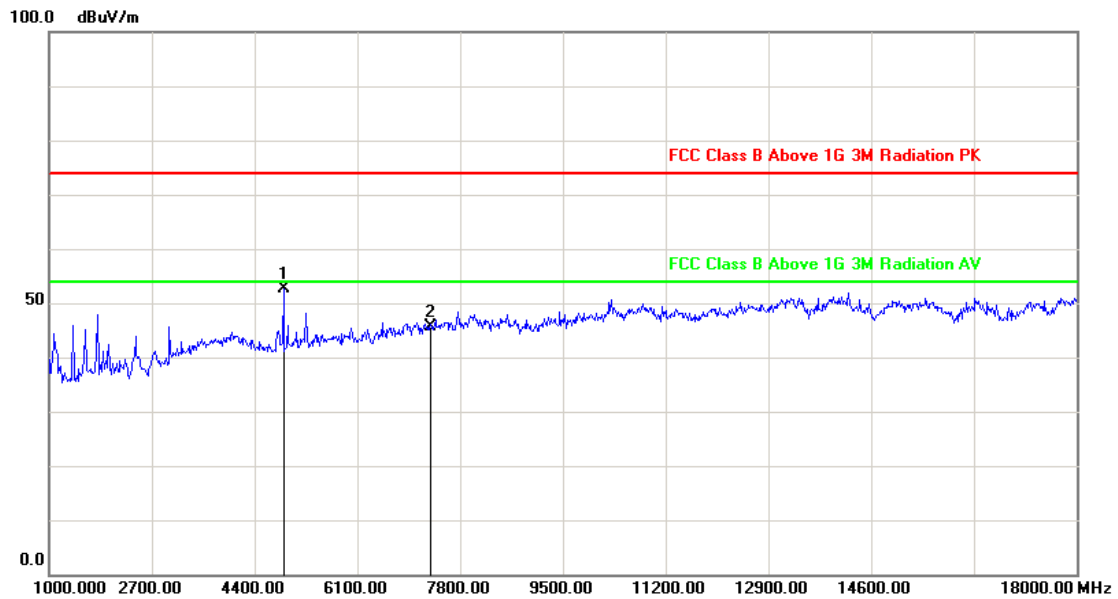
CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
2402MHz	H	4804.000	47.28	3.28	74.00	26.72	PK
	H	7206.000	46.02	8.19	74.00	27.98	PK
	V	4876.000	52.92	3.42	74.00	21.08	PK
	V	7320.000	45.79	8.27	74.00	28.21	PK

TEST REPORT

Horizontal



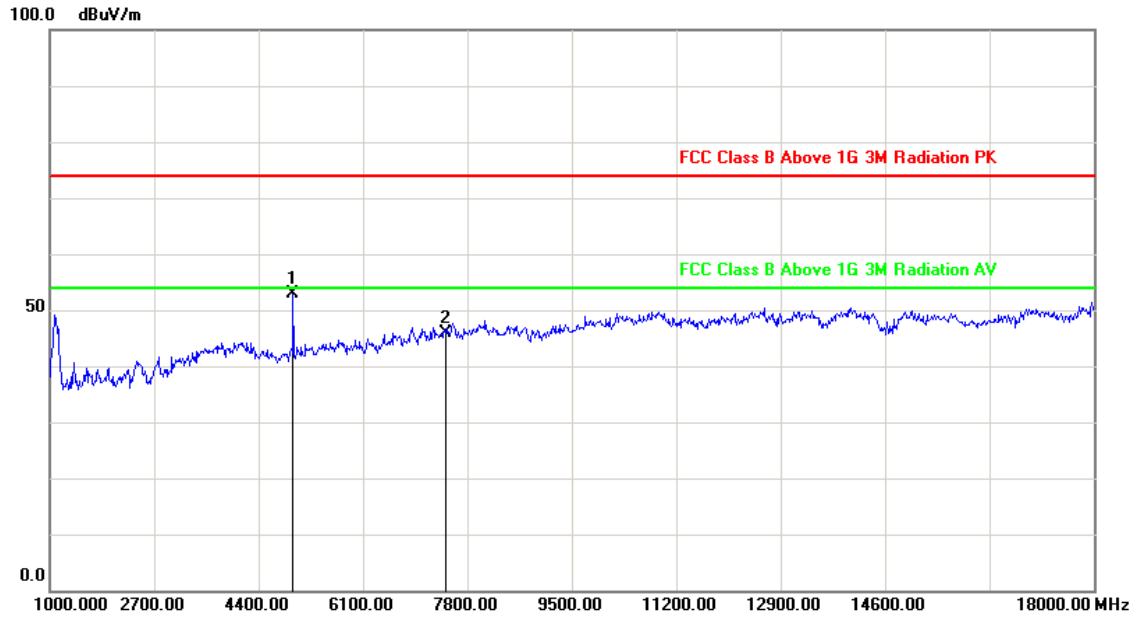
Vertical



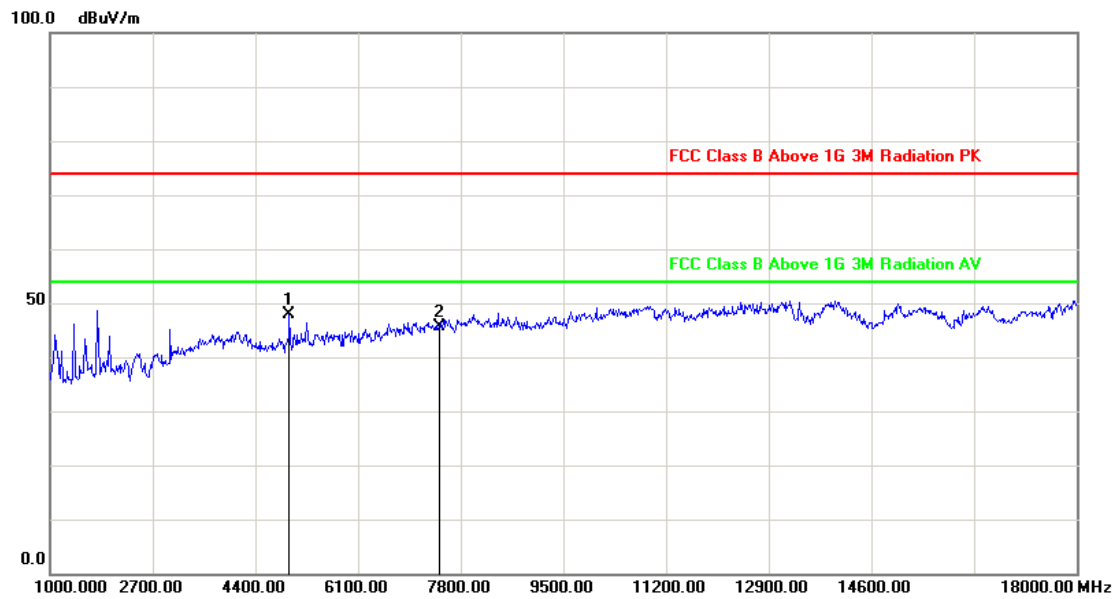
CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
2440MHz	H	4876.000	52.92	3.42	74.00	21.08	PK
	H	7320.000	45.79	8.27	74.00	28.21	PK
	V	4876.000	52.51	3.42	74.00	21.49	PK
	V	7320.000	45.63	8.27	74.00	28.37	PK

TEST REPORT

Horizontal



Vertical



CH	Antenna	Frequency (MHz)	Corrected Reading (dBuV/m)	Correct Factor (dB/m)	Limit (dBuV/m)	Margin (dB)	Detector
2480MHz	H	4960.000	52.78	3.59	74.00	21.22	PK
	H	7440.000	45.81	8.36	74.00	28.19	PK
	V	4960.000	47.99	3.59	74.00	26.01	PK
	V	7440.000	45.58	8.36	74.00	28.42	PK

TEST REPORT

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = $30.20 + 2.00 - 32.00 = 0.20\text{dB/m}$;
Corrected Reading = $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$;
Margin = $40.00\text{dBuV/m} - 10.20\text{dBuV/m} = 29.80\text{dB}$.

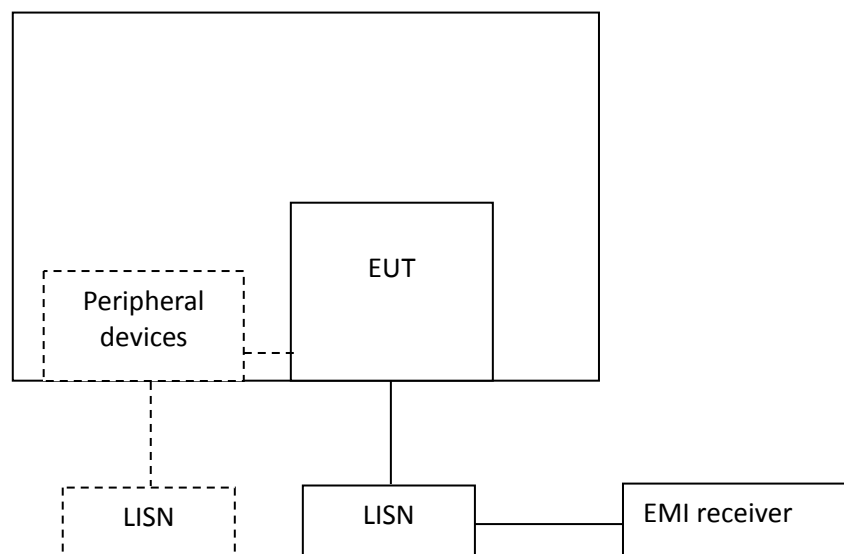
8 Power line conducted emission

Test result: Pass

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

8.2 Test Configuration



TEST REPORT**8.3 Measurement Procedure**

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

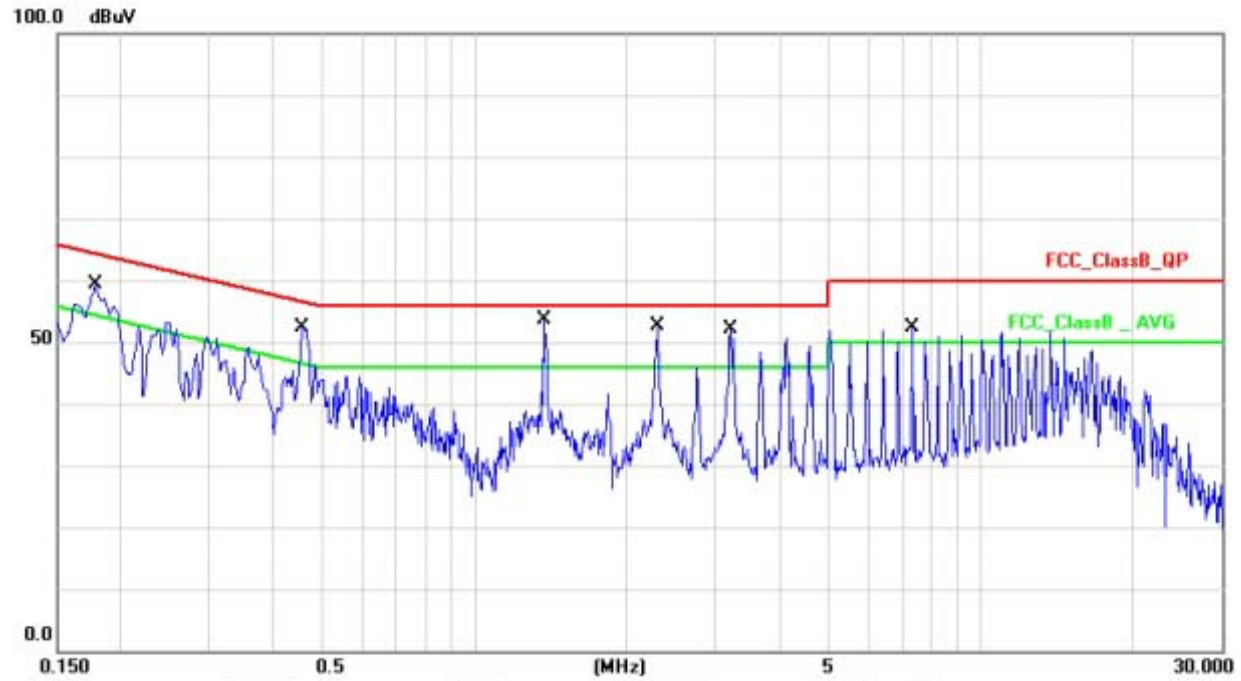
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

TEST REPORT

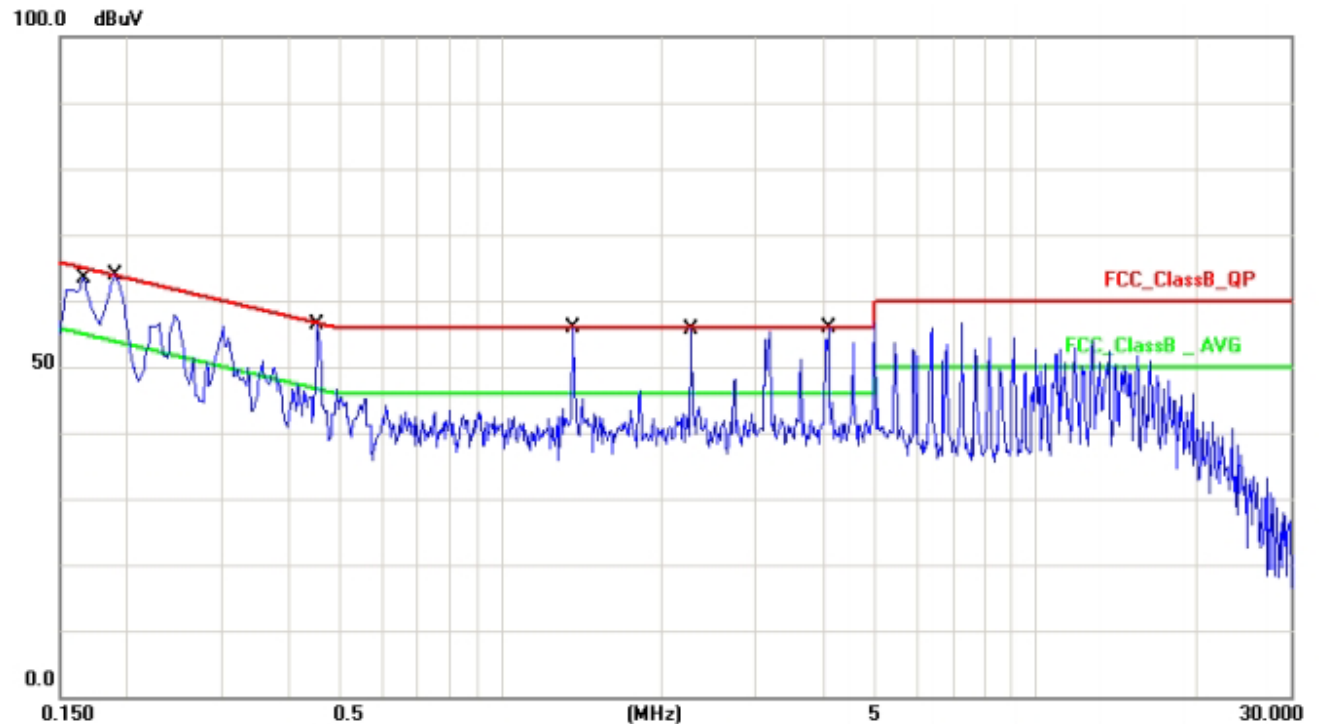
8.4 Test Results of Power line conducted emission

L Line



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1780	10.12	42.67	52.79	64.57	-11.78	QP
2	0.1780	10.12	23.94	34.06	54.57	-20.51	AVG
3	0.4580	10.16	38.04	48.20	56.73	-8.53	QP
4	0.4580	10.16	30.62	40.78	46.73	-5.95	AVG
5	1.3779	10.16	31.11	41.27	56.00	-14.73	QP
6	1.3779	10.16	18.46	28.62	46.00	-17.38	AVG
7	2.2980	10.17	34.44	44.61	56.00	-11.39	QP
8	2.2980	10.17	18.94	29.11	46.00	-16.89	AVG
9	3.2180	10.19	32.30	42.49	56.00	-13.51	QP
10	3.2180	10.19	16.21	26.40	46.00	-19.60	AVG
11	7.3460	10.26	24.75	35.01	60.00	-24.99	QP
12	7.3460	10.26	11.18	21.44	50.00	-28.56	AVG

N Line



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1660	10.13	43.53	53.66	65.15	-11.49	QP
2	0.1660	10.13	26.93	37.06	55.15	-18.09	AVG
3	0.1900	10.13	43.91	54.04	64.03	-9.99	QP
4	0.1900	10.13	26.64	36.77	54.03	-17.26	AVG
5	0.4540	10.15	42.31	52.46	56.80	-4.34	QP
6	0.4540	10.15	34.68	44.83	46.80	-1.97	AVG
7	1.3660	10.18	34.73	44.91	56.00	-11.09	QP
8	1.3660	10.18	20.37	30.55	46.00	-15.45	AVG
9	2.2780	10.19	38.44	48.63	56.00	-7.37	QP
10	2.2780	10.19	19.37	29.56	46.00	-16.44	AVG
11	4.1020	10.22	36.49	46.71	56.00	-9.29	QP
12	4.1020	10.22	18.58	28.80	46.00	-17.20	AVG

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

9 Occupied Bandwidth

Test result: Tested

9.1 Limit

None

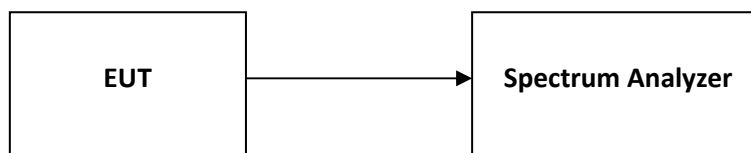
9.2 Measurement Procedure

The occupied bandwidth per RSS-Gen was measured using the Spectrum Analyzer.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

9.3 Test Configuration



9.4 The results of Occupied Bandwidth

Please refer to Appendix A

10 Antenna requirement

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 shall be considered sufficient to comply with the provisions of this section.

Result:

EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

Appendix A: Test results

1. Conducted Output Power

1.1 Test Data

BLE Maximum Output Power		
Test Frequency	Power(dBm)	Result
2402	2.37	Pass
2440	1.82	Pass
2480	1.85	Pass

BLE EIRP		
Max power (dBm)	Max EIRP (W)	Result
2.37	0.002	Pass

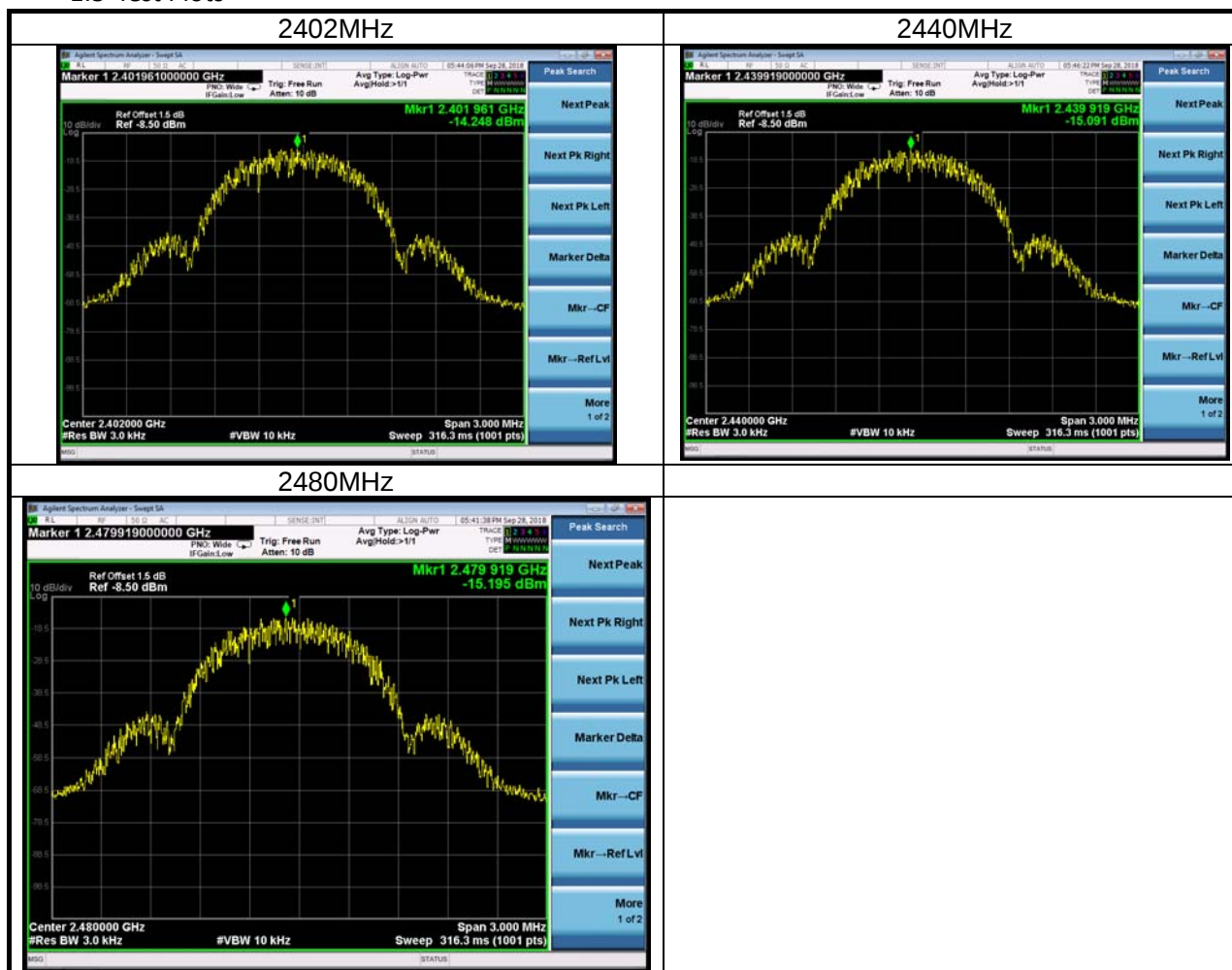
TEST REPORT

2. Power Spectral Density

1.2 Test Data

BLE Peak Power Spectral Density		
Test Frequency	PSD(dBm/3kHz)	Result
2402	-14.248	Pass
2440	-15.091	Pass
2480	-15.195	Pass

1.3 Test Plots

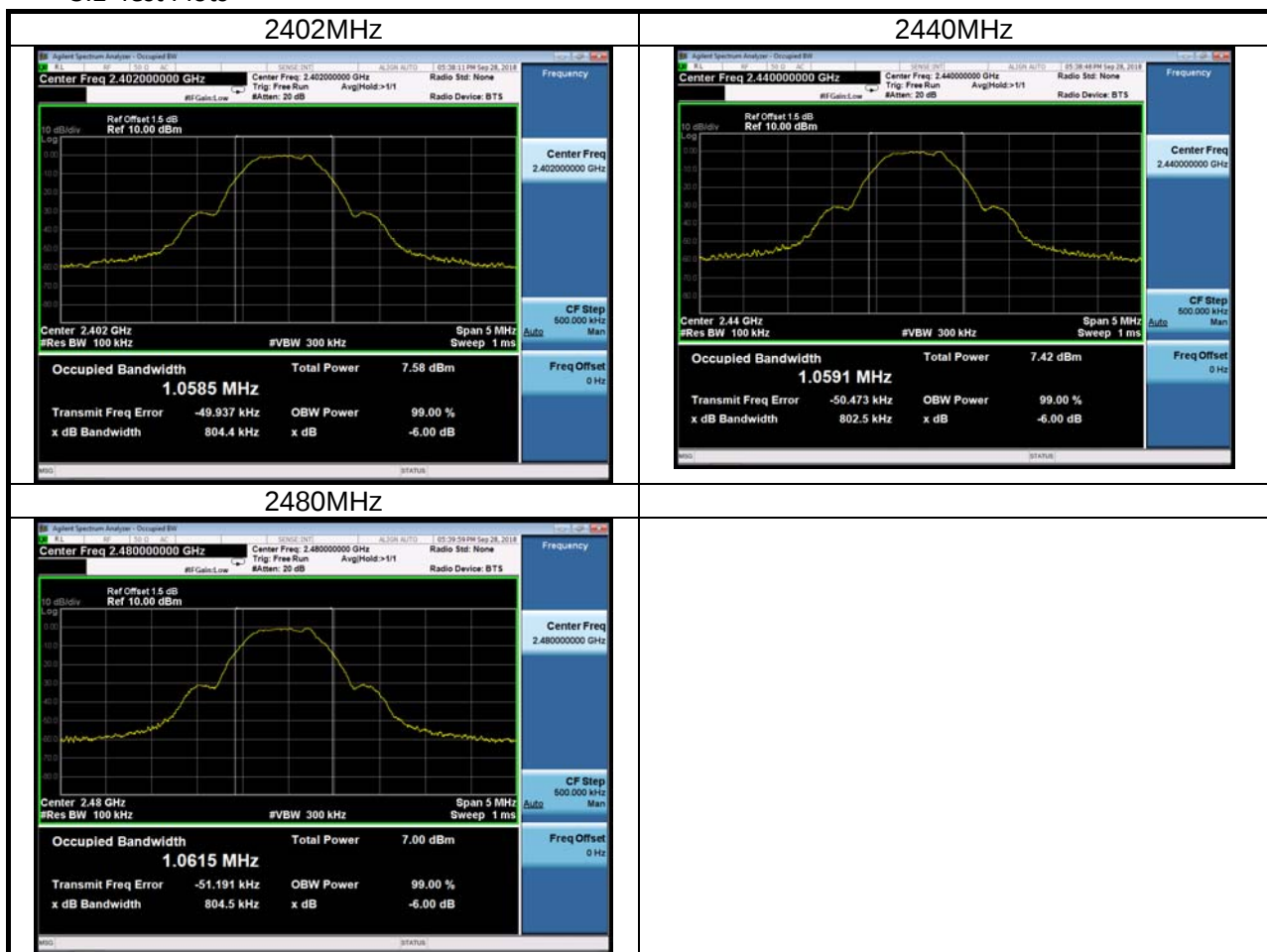


3. Minimum 6dB bandwidth

3.1 Test Data

BLE Occupied 6dB Bandwidth			
Test Frequency (MHz)	Occupied Bandwidth (kHz)	Min Limit (kHz)	Result
2402	804.4	500	Pass
2440	802.5	500	Pass
2480	804.5	500	Pass

3.2 Test Plots



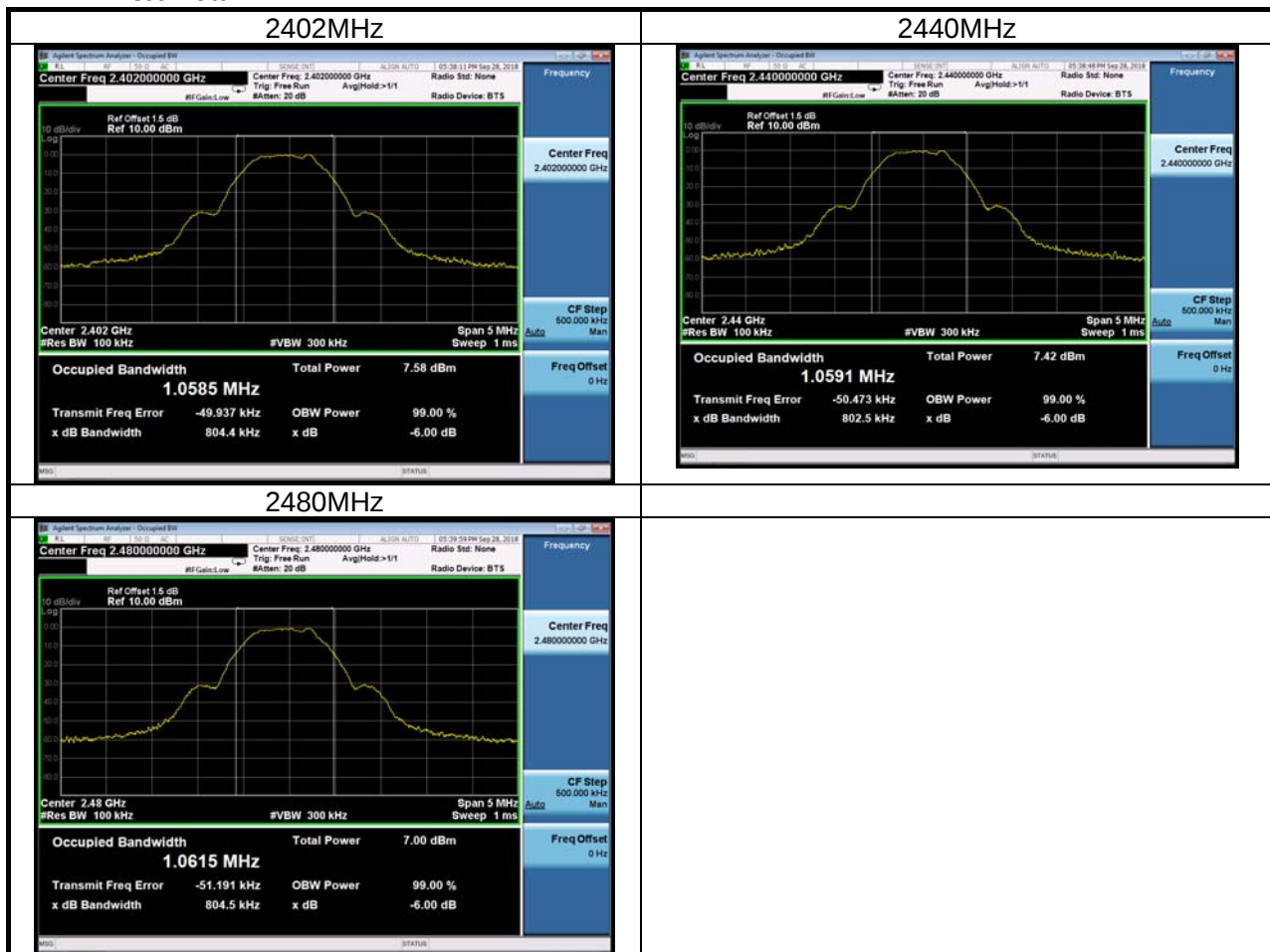
TEST REPORT

4. Occupied Bandwidth

4.1 Test Data

BLE 99% Occupied Bandwidth		
Test Frequency (MHz)	99% Occupied Bandwidth (MHz)	Result
2402	1.0585	Pass
2440	1.0591	Pass
2480	1.0615	Pass

4.2 Test Plots



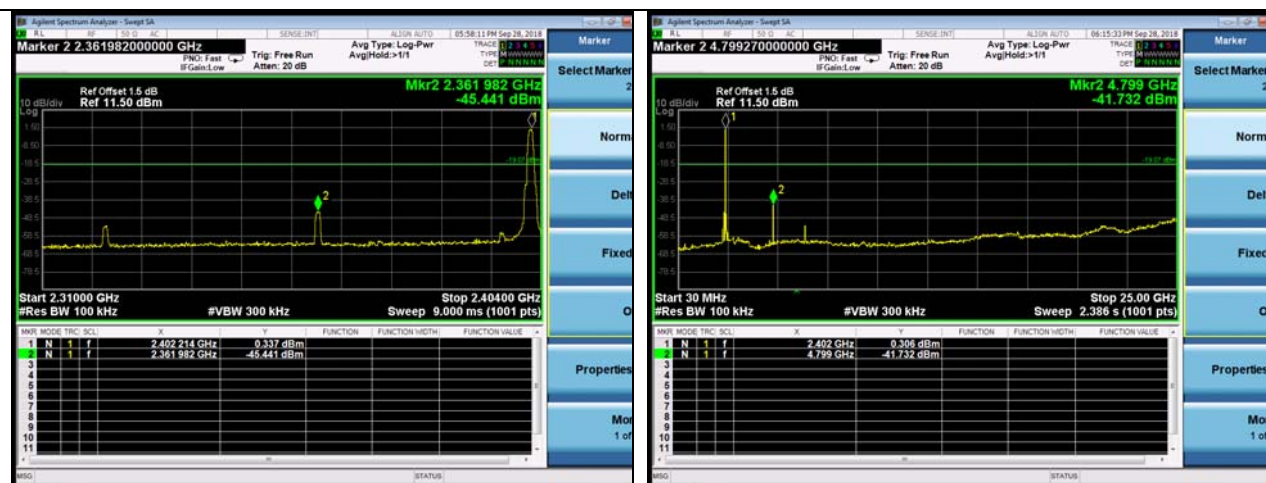
5. Emission outside the frequency band

5.1 Test Data

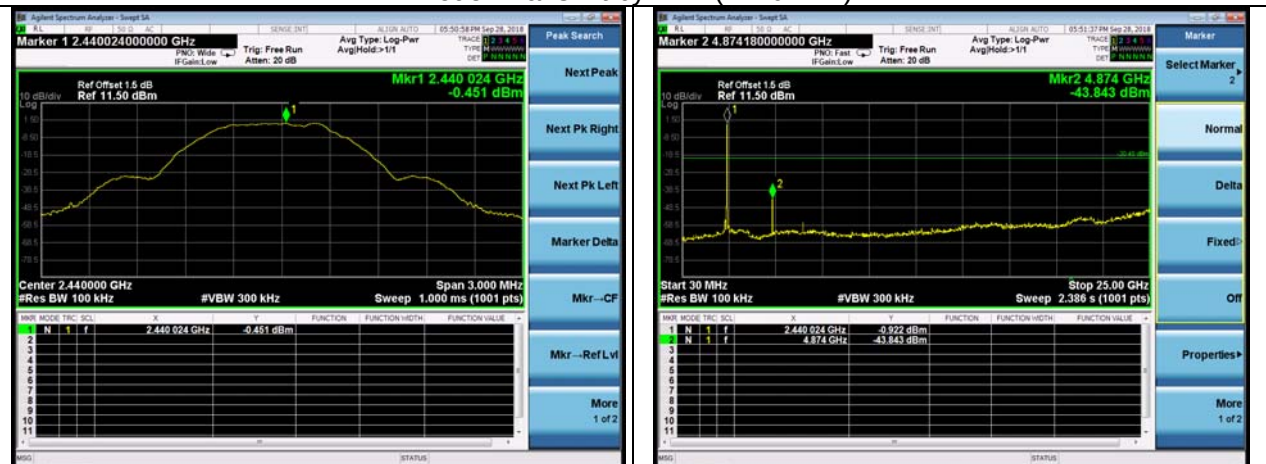
Test Frequency (MHz)	Limit	Result
2402	20dBc	Pass
2440	20dBc	Pass
2480	20dBc	Pass

5.2 Test Plots

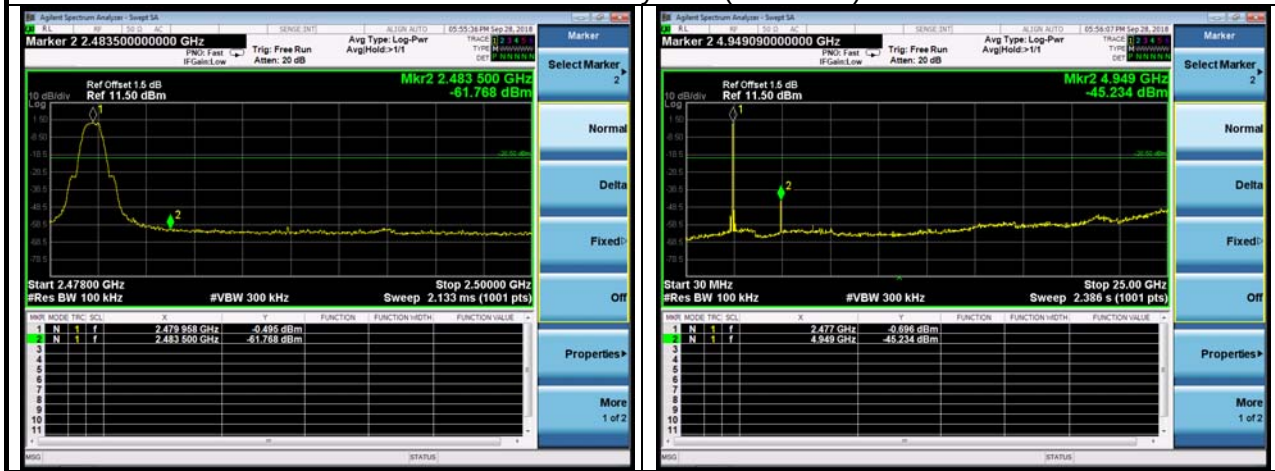
Mode: Transmit by BLE (2402MHz)



Mode: Transmit by BLE (2440MHz)



Mode: Transmit by BLE (2480MHz)



***** END *****