COMPLIANCE
For FCC PART 15 Subpart C

Applicant Name:	**Date of Testing**
Seers Technology Co., Ltd.	January 07, 2015 to March 12, 2015
	Test Site/Location
Address:	#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea
#1210 Tech Center, SKⓝTechnopark, 124, Sagimakgol-ro, Jungwon-gu, Seongnam-si,Gyeonggi-do, South Korea	**Test Report No.:** BWS-15-RF-0003
	BWS FRN: 0009936881
FCC ID:	**QN8HH-800**

Model(s):	HH-800
EUT Type:	HICARE HUB
Frequency Range:	2402-2480 MHz
Modulation Type	BLE(GFSK)
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	FCC Part 15 Subpart C §15.247

The product was received on January 07, 2015 and testing was completed on March 12, 2015. We, BWS TECH Inc. would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of BWS TECH Inc. the test report shall not be reproduced except in full.

(Date) 03/13/2015

Tested by **Hyun-Yong, Seol**

(Date)03/13/2015

Reviewed by **Bang-Hyun, Nam**

BWS TECH INC.

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FCC TEST REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

1. General Information

1.1 Applicant

- **Company Name** : Seers Technology Co., Ltd.
- **Company Address** : #1210 Tech Center, SKⓝTechnopark, 124, Sagimakgol-ro, Jungwon-gu,Seongnam-si, Gyeonggi-do, South Korea
- **Phone/Fax** : Tel No. : +82-31-776-3036~8 Fax No. : +82-31-776-3039

1.2 Manufacturer

- **Company Name** : Seers Technology Co., Ltd.
- **Company Address** : #1210 Tech Center, SKⓝTechnopark, 124, Sagimakgol-ro, Jungwon-gu,Seongnam-si, Gyeonggi-do, South Korea
- **Phone/Fax** : Tel No. : +82-31-776-3036~8 Fax No. : +82-31-776-3039

1.3 EUT Description

- **EUT Type** : HICARE HUB
- **Model Name** : HH-800(Basic),
  HH-801 : a Model without BP Module from Basic Model
- **S/N** : Prototype
- **Freq. Range** : 2402-2480 MHz
- **Number of Channels** : BLE(40 Channel)
- **Modulation Method** : BLE(GFSK)
- **Power source** : AC Input: 100-240 V 50/60 Hz, DC Output: 12 V, 2.5-3 A
- **Battery** : 7.4 A, 1350 mAh
- **Antenna Peak Gain** : 1.99 dBi

1.4 Other Information

- **FCC Rule Part(s)** : Part 15 Subpart C §15.247
- **Test Procedure** : ANSI C63.10-2013,
  KDB 558074 D01 DTS Meas Guidance v03r02
- **FCC ID** : QN8HH-800
- **Date of Test** :January 07, 2015 to January 27, 2015
- **Place of Test** : BWS TECH Inc.(FCC Registration Number : 287786)
  #23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon,
  Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea
  TEL: +82 31 333 5997 FAX: +82 31 333 0017

2. Description of Test Facility

Site Description

Test Lab. :

Accredited by Industry Canada, February 27, 2012
The Certificate Registration Number is 4963A-2.

Accredited by FCC, September 03, 2013
The Certificate Registration Number is 287786.

Accredited by VCCI, July 10, 2012
The Certificate Registration Number is C-4326

Accredited by RRA(EMC,RF, SAR), November 27, 2014
The Certificate Registration Number is KR0017

Accredited by KOLAS(KS Q ISO/IEC 17025), October 7, 2014
The Certificate Registration Number is KT174

Name of Firm : BWS TECH Inc.

Site Location : #23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea

3. Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application

3.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 FCC Part 15.205 Restricted Bands Of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

1 Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
2 Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions.
The provisions in Section 15.35 apply to these measurements.

3.4 Description Of Test Modes

The EUT has been tested under operating condition.
After verification, all tests were carried out with the worst case test modes as shown below GFSK(1Mbps) Channel Low (2402MHz), Mid (2440MHz) and High (2480MHz), these were chosen for full testing

4. Summary of Test Results

Digital Transmission System (DTS)				
Clause	**TEST Description**	**Standard Section**	**Requirements**	**Result**
5.1	**6dB Bandwidth**	§15.247(a)(2)	≥500kHz	Pass
5.2	**Maximum Peak Conducted Output Power**	§15.247(b)(3)	≤30dBm	Pass
5.3	**Power Spectral Density**	§15.247(e)	≤8dBm/3kHz	Pass
5.4	**Conducted Spurious Emission**	§15.247(d)	≥20dBc/100kHz	Pass
5.5	**Radiated Spurious Emission**	§15.247(d), §15.209(a), §15.35(b)	§15.209, §15.247(d)	Pass
5.6	**Band Edges Measurement**	§15.247(d)	§15.205(a), §15.209(a)	Pass
5.7	**AC Power Conducted Emission**	§15.207	§15.207(a)	Pass
5.8	**Antenna Application**	§15.247(b), §15.203	§15.247(b), §15.203	Pass

5. Test Data

5.1 6dB Bandwidth

5.1.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	15/09/11
RF Cable_2m	Test No.1	Hubersunhner	N/A	16/01/14
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.1.2 Test Limit

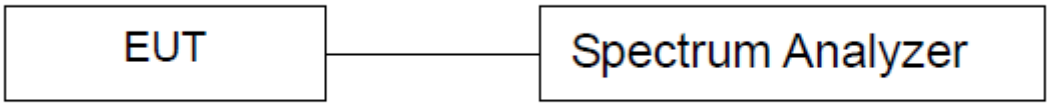
The minimum 6dB bandwidth shall be at least 500 kHz.

5.1.3 Measurement Procedure

The EUT has been operated and followed in the IEEE 802.11b/g/n mode, and could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

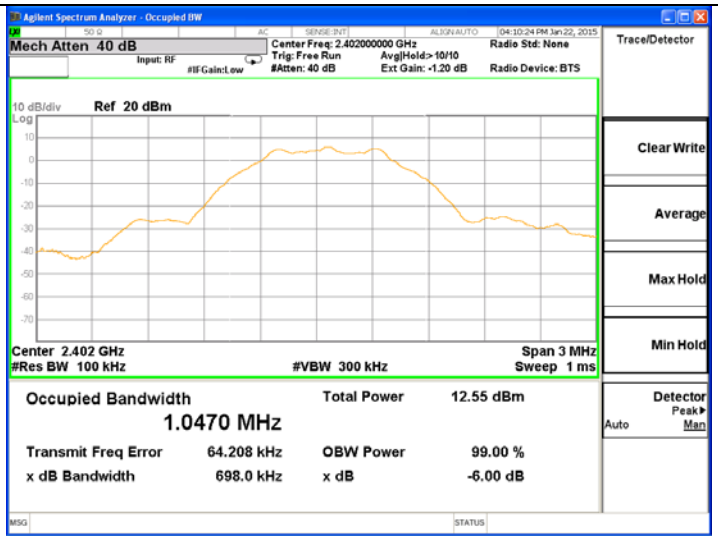
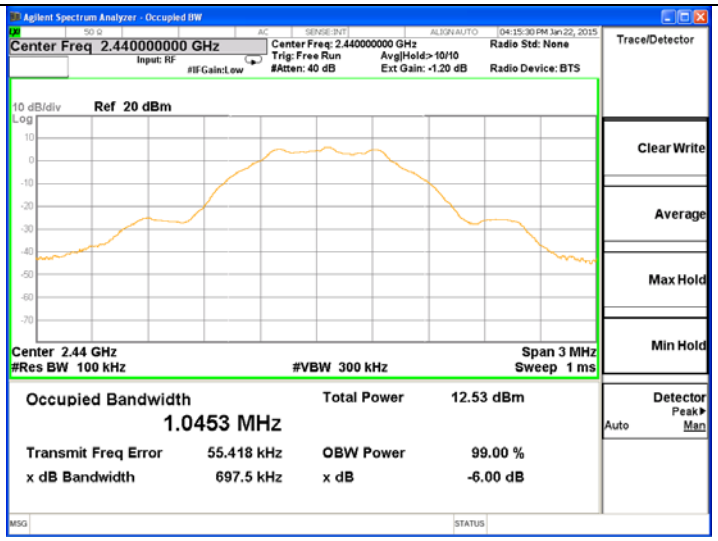
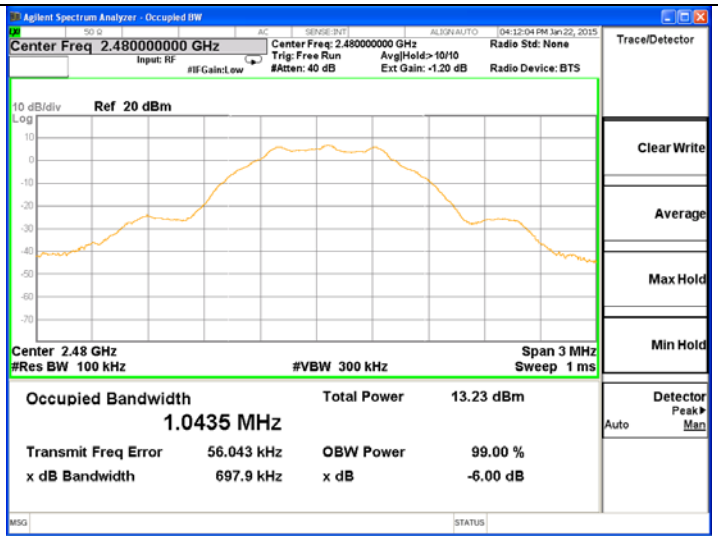
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously
4. Set (RBW = 100 kHz, VBW = 300 kHz, Detector = Peak, Trace mode = Max Hold, Sweep = Auto)
5. Measure and record the results in the test report.

5.1.4 Test SET-UP (Block Diagram of Configuration)



5.1.5 Test Result

Modulation	Frequency (MHz)	Test Result (MHz)	Limit (MHz)
BLE(GFSK)	2402	1.05	≥ 0.5
	2440	1.05	≥ 0.5
	2480	1.04	≥ 0.5

6dB Bandwidth - BLE(GFSK)	
2402MHz	
2440MHz	
2480MHz	

5.2 Maximum Peak Conducted Output Power

5.2.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Power Meter	RPR3006W	D.A.R.E!! Insrtuments	14I00048SNO09	15/04/29
RF Cable_2m	Test No.1	Hubersunhner	N/A	16/01/14
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.2.2 Test Limit

The maximum peak power shall be less than 1 Watt (30dBm).

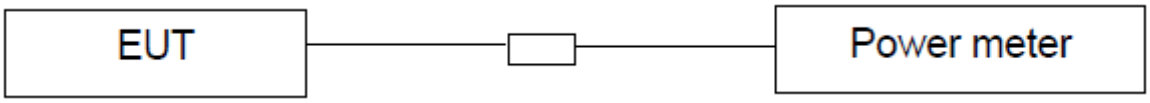
Note: If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the direction gain of the antenna exceeds 6dBi, In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

5.2.3 Measurement Procedure

The EUT has been operated and followed in the IEEE 802.11b/g/n mode, and could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The RF output of EUT was connected to the power meter by RF cable and attnuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum output power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the report.

5.2.4 Test SET-UP (Block Diagram of Configuration)



5.2.5 Test Result

Modulation	Frequency(MHz)	Test Result(dBm)	Limit(dBm)
BLE(GFSK)	2402	5.4	≤ 30
	2440	5.5	≤ 30
	2480	5.6	≤ 30

Note: Measurement has been performed with the Power Meter which is compliance with the 9.1.2 of KDB 558074 D01 DTS Meas. Guidance v03r02. (Power Meter Model : RPR 3006W)

5.3 Power Spectral Density

5.3.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	15/09/11
RF Cable_2m	Test No.1	Hubersunhner	N/A	16/01/14
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.3.2 Test Limit

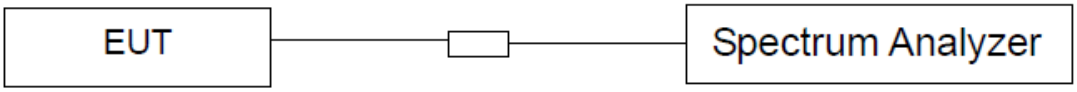
For digitally modulated systems, the power spectral density conducted from the intentional radiated to the Antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

5.3.3 Test Procedures

The EUT has been operated and followed in the IEEE 802.11b/g/n mode, and could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

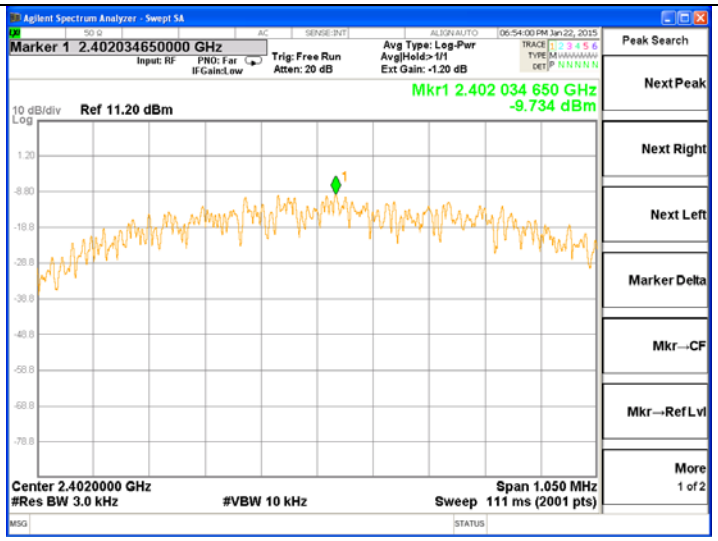
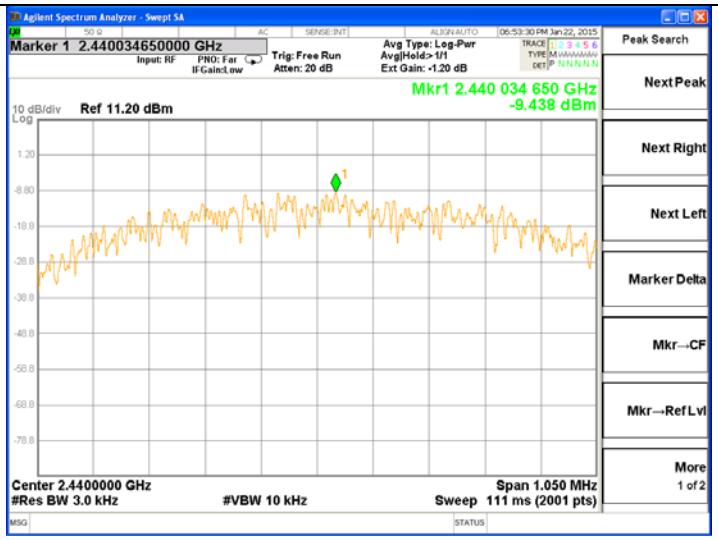
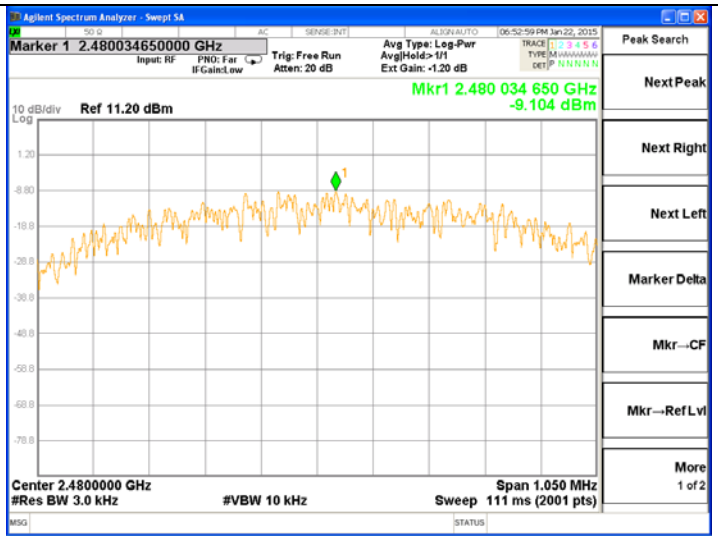
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously
4. Set (RBW = 3 kHz, VBW = 10 kHz, Detector = Peak, Span = 1.5 times DTS Channel Bandwidth, Trace mode = Max Hold, Sweep = Auto)
5. Measure and record the results in the test report.

5.3.4 Block Diagram of Test Setup



5.3.5 Test Result

Modulation	Frequency(MHz)	Test Result(dBm)	Limit(dBm/3kHz)
BLE(GFSK)	2402	-9.7	≤ 8
	2440	-9.4	≤ 8
	2480	-9.1	≤ 8

Power Spectral Density - BLE(GFSK)	
2402MHz	
2440MHz	
2480MHz	

5.4 Conducted Spurious Emission

5.4.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	15/09/11
RF Cable_2m	Test No.1	Hubersunhner	N/A	16/01/14
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.4.2 Test Limit

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

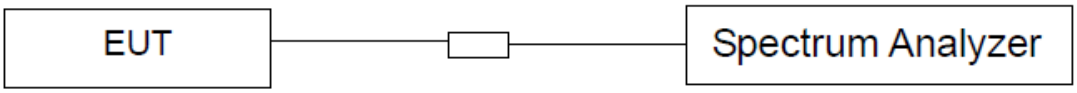
Note: Wireless charger configuration was evaluated.

Frequency (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

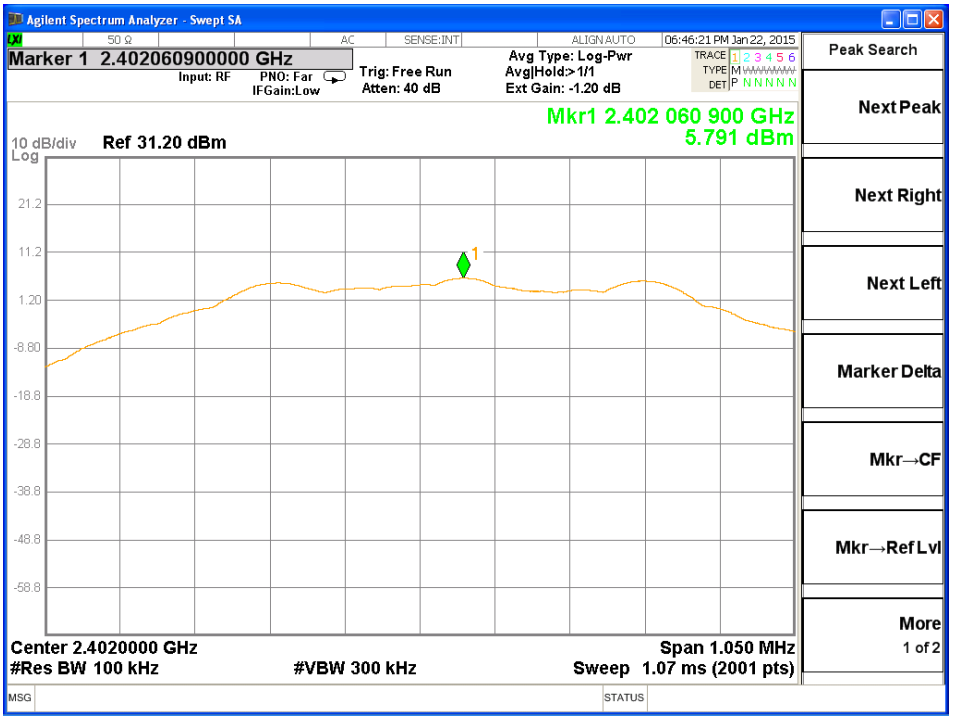
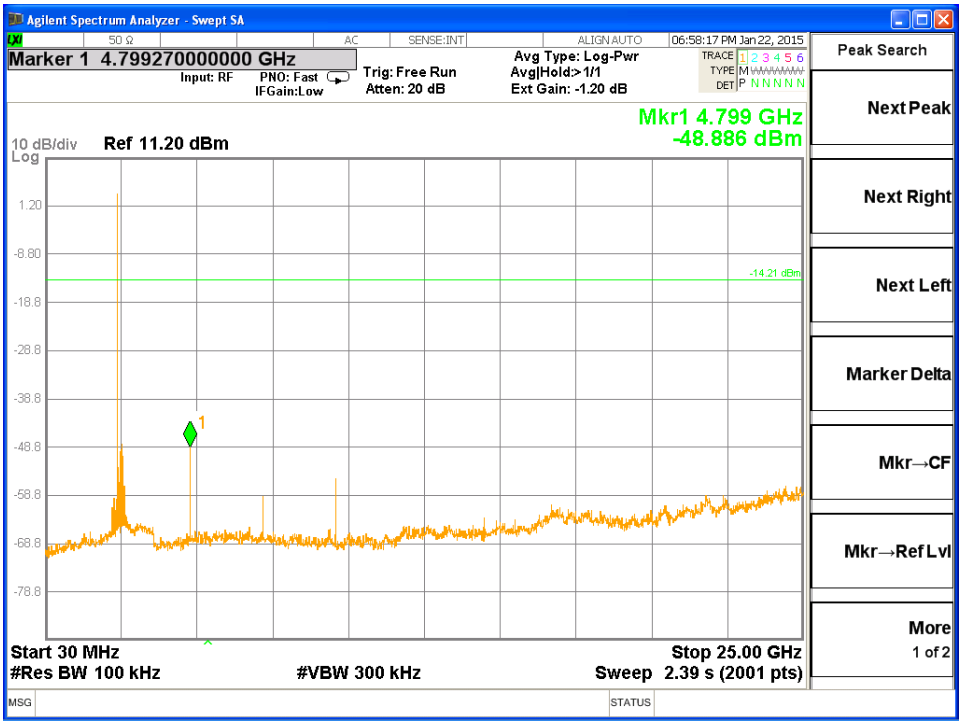
5.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously
4. Set (RBW = 100 kHz, VBW = 300 kHz, Detector = Peak, Trace mode = Max Hold, Sweep = Auto)
5. Measure and record the results in the test report.

5.4.4 Block Diagram of Test setup.

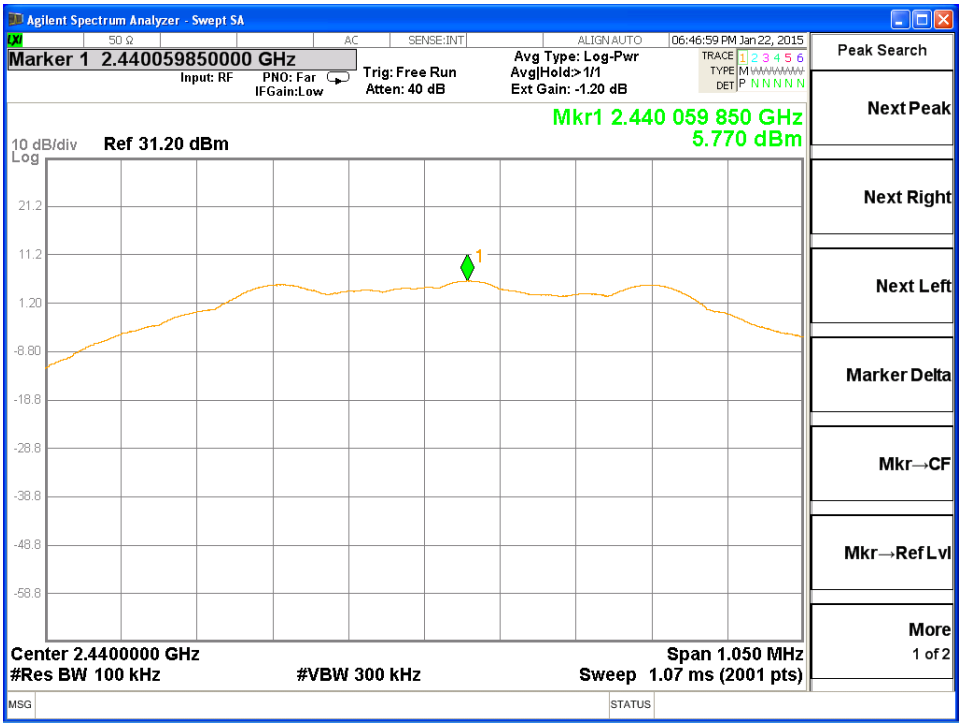


5.4.5 Test Result

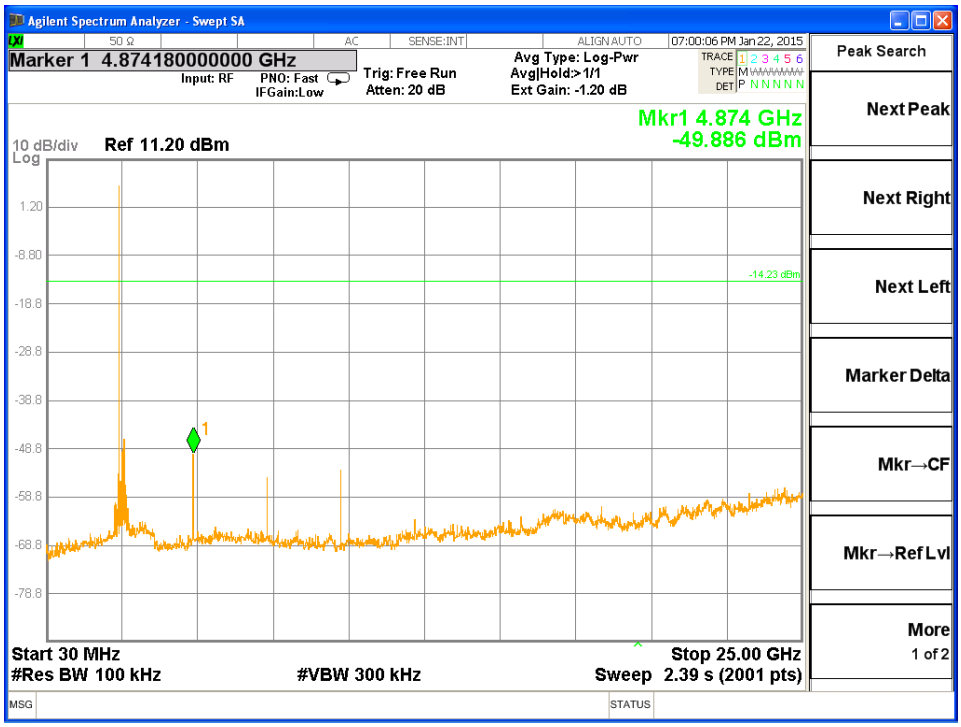
Conducted Spurious Emission (2402MHz)	
PSD Level	
Conducted Spurious Emission	

Conducted Spurious Emission (2440MHz)

PSD Level

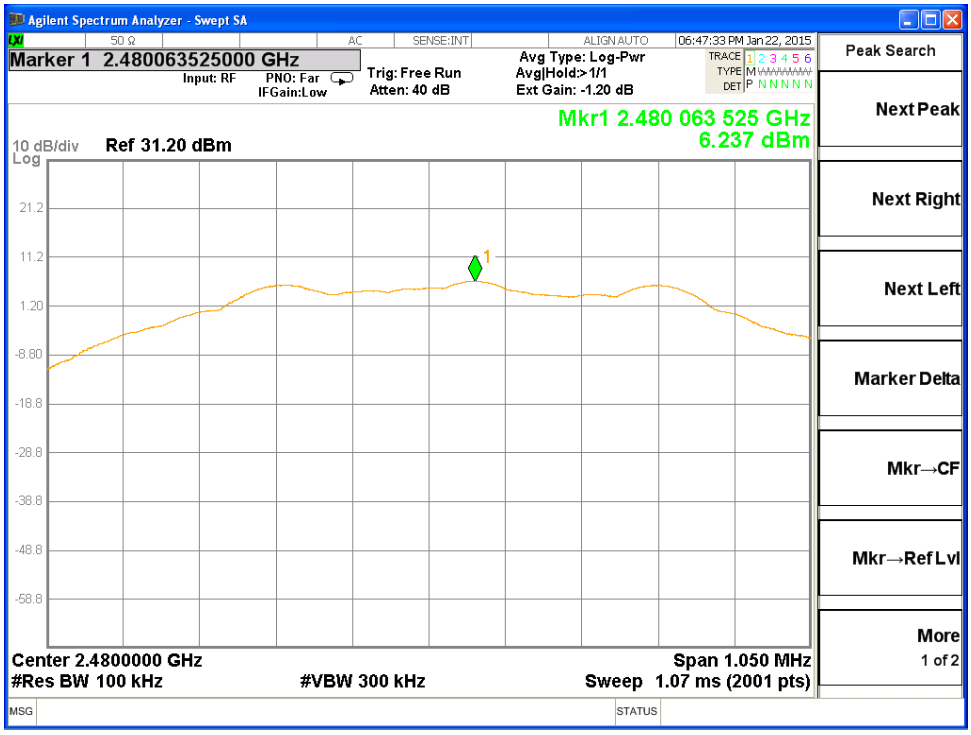


Conducted Spurious Emission

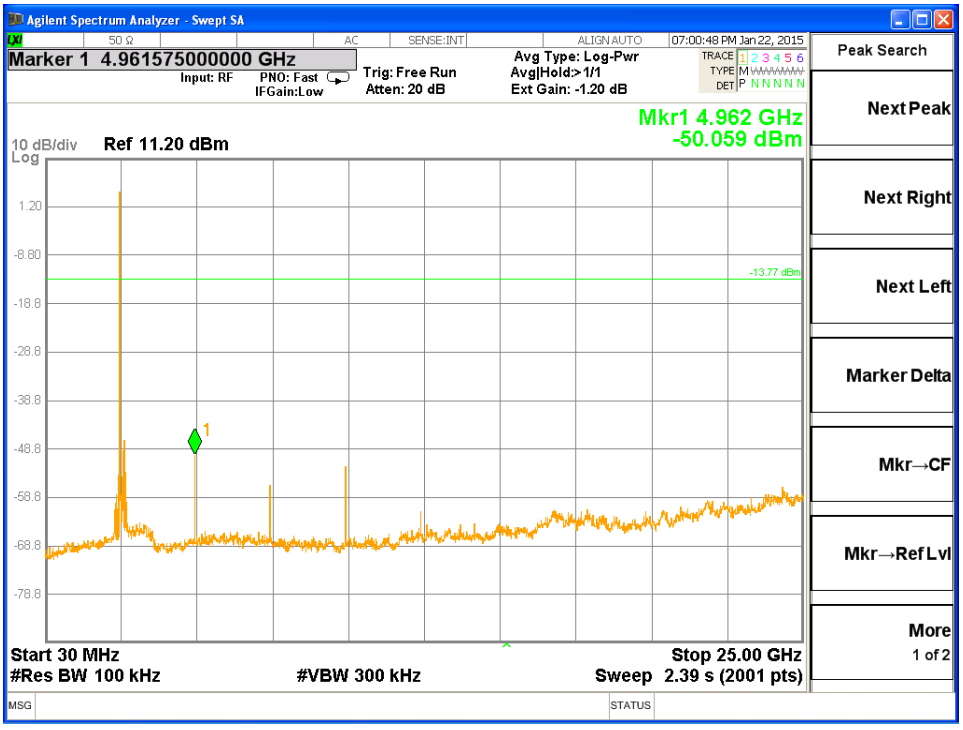


Conducted Spurious Emission (2480MHz)

PSD Level



Conducted Spurious Emission



5.5 Radiated Spurious Emission

5.5.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	FSP13	Rohde & Schwarz	100760	16/02/06
Spectrum analyzer	N9020A	Agilent	US46220101	15/09/11
Bilog Antenna	VULB9160	Schwarzbeck	VULB9160-3122	16/04/02
Antenna Master	JAC-3	DAE IL EMC	N/A	15/05/07
Antenna Turntable Controller	JAC-2	JAEMC	N/A	15/05/07
RF Cable_2m	Test No.1	Hubersunhner	N/A	16/01/14
RF Cable_10m	Test No.2	Hubersunhner	N/A	16/01/14
Loop Antenna	HFH2-Z2	Rohde & Schwarz	881056/6	16/01/06
Horn Antenna	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D 234	15/09/15
Horn Antenna	BBHA 9170	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170157	15/11/14
RF Amplifier	PAM-118A	COM-POWER	551019	15/07/21
Antenna Master	N/A	AUDIX	N/A	15/09/17
Antenna Turntable Controller	ACT	AUDIX	N/A	15/09/17
RE Below 1 GHz CHAMBER	N/A	SY Corp.	N/A	N/A
RE Above 1 GHz CHAMBER	N/A	SY Corp.	N/A	15/09/17
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.5.2 Test Limit

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.
Note: Wireless charger configuration was evaluated.

Frequency (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

5.5.3 Test Procedure

The EUT has been operated and followed in the IEEE 802.11b/g/n mode, and could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Measurements were performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured was complete.

   When spectrum scanned from 0.009 MHz to 30 MHz setting resolution bandwidth 120 kHz and video bandwidth 300kHz.
   EMI Test Receiver Setting (Attenuation: Auto, RBW: 200 Hz, VBW 1 kHz, Detector: QP, Trace: Max hold)

   When spectrum scanned from 30 MHz to 1GHz setting resolution bandwidth 120 kHz and video bandwidth 300kHz.
   EMI Test Receiver Setting (Attenuation: Auto, RBW: 120 kHz, VBW 300 kHz, Detector: QP, Trace: Max hold)

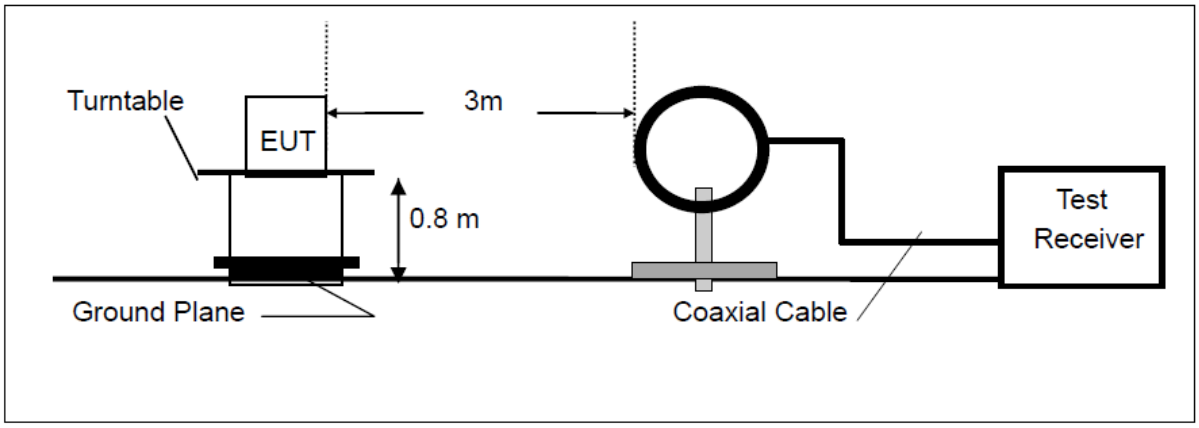
   When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.
   EMI Test Receiver Setting (Attenuation: Auto, RBW: 1 MHz, VBW 3 MHz, Detector: Peak, Trace: Max hold)

   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control l evel for the tested mode of operation.

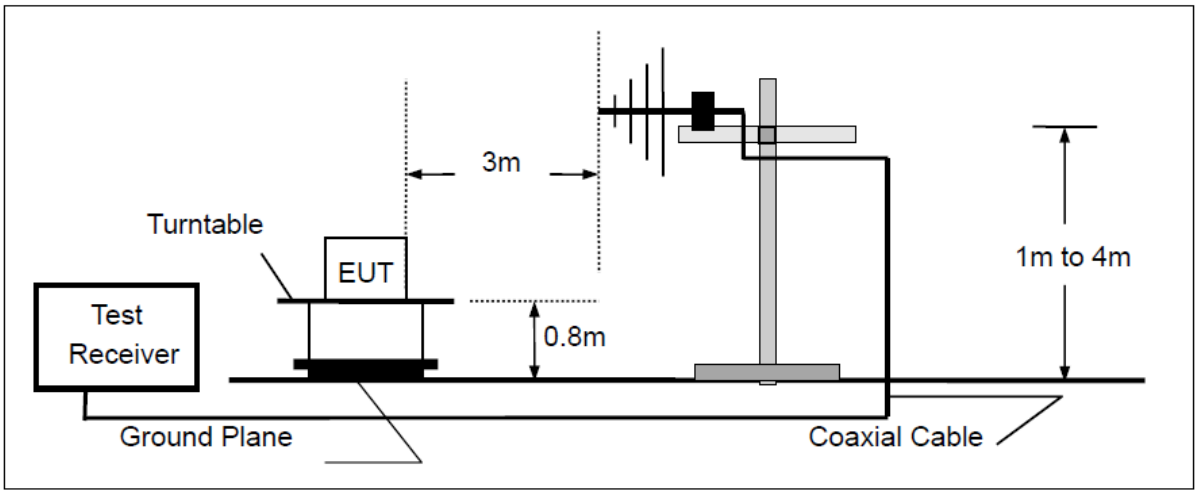
6. Measure and record the results in the test report.

5.5.4 Test SET-UP (Block Diagram of Configuration)

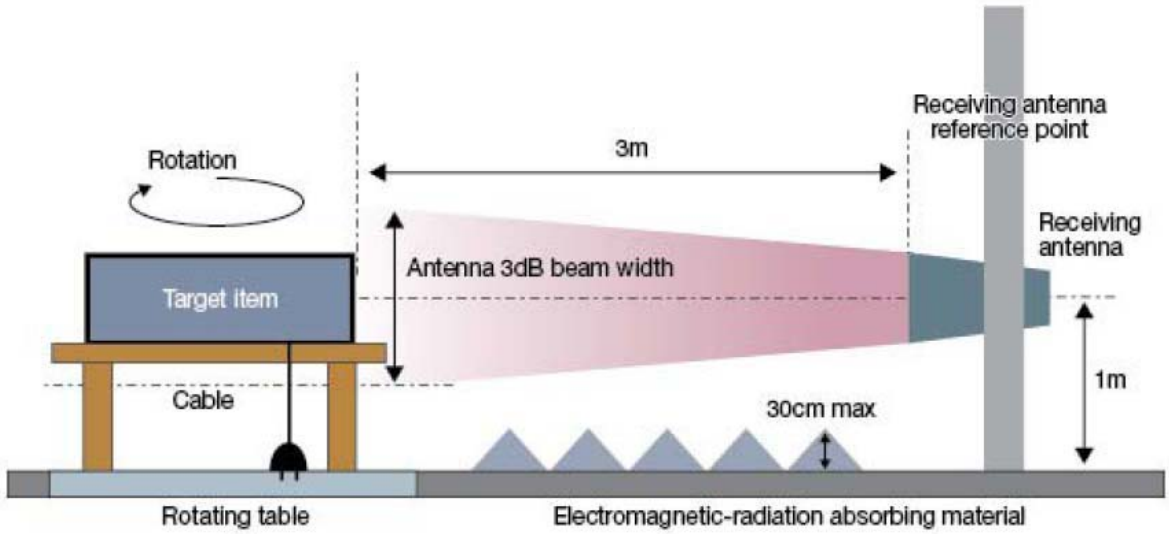
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



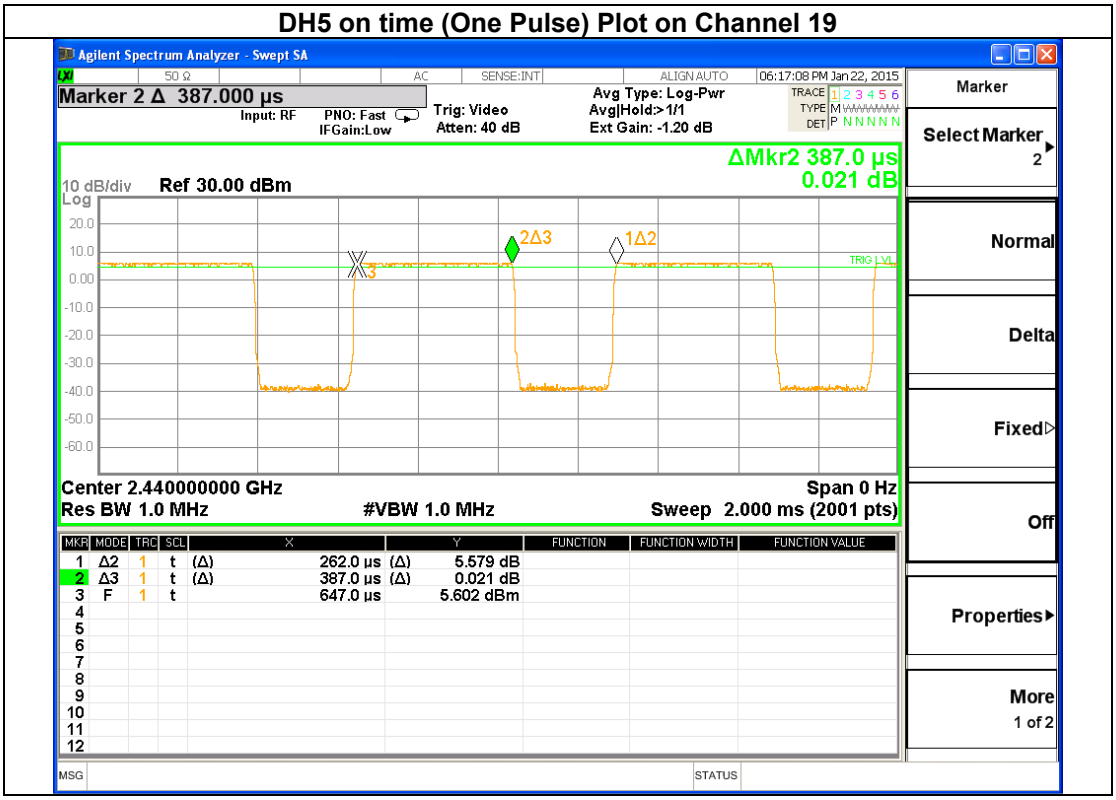
(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



5.5.5 Test Result

5.5.5.1 VBW Setting for average measurement

DH5 on time (One Pulse) Plot on Channel 19



Duty Cycle = 60 %
T = 387 µs
1/T = 2584 Hz
VBW Setting _3kHz

5.5.5.2 0.009–30 MHz

Frequency [MHz]	Reading [dB µV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB µV/m]	Emission Level [dB µV/m]	Margin [dB]	Result
-	-	-	-	-	-	-	-	-	Pass

Note: §15.31(o)_The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

5.5.5.3 30–1000 MHz

BLE(GFSK)- 2402 MHz(Low)

Frequency [MHz]	Reading [dB μV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dB μV/m]	Emission Level [dB μV/m]	Detector
47.99	15.34	V	13.17	0.39	40.00	28.90	Q.P
197.20	19.75	V	10.38	1.07	43.52	31.20	Q.P
207.10	21.17	H	10.32	1.11	43.52	32.60	Q.P
245.90	21.29	H	11.95	1.26	46.02	34.50	Q.P
394.80	18.98	V	15.17	1.55	46.02	35.70	Q.P
478.80	16.31	V	16.71	1.77	46.02	34.80	Q.P

BLE (GFSK)- 2440 MHz(Middle)

Frequency [MHz]	Reading [dB μV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dB μV/m]	Emission Level [dB μV/m]	Detector
46.80	15.61	V	13.11	0.38	40.00	29.10	Q.P
198.50	20.01	V	10.32	1.07	43.52	31.40	Q.P
211.40	21.18	H	10.40	1.13	43.52	32.70	Q.P
359.10	18.63	H	14.82	1.46	46.02	34.90	Q.P
497.20	17.01	V	16.97	1.82	46.02	35.80	Q.P
588.80	13.43	V	18.60	2.07	46.02	34.10	Q.P

BLE (GFSK)- 2480 MHz(High)

Frequency [MHz]	Reading [dB μV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dB μV/m]	Emission Level [dB μV/m]	Detector
46.70	15.72	V	13.10	0.38	40.00	29.20	Q.P
198.40	20.01	V	10.32	1.07	43.52	31.40	Q.P
211.20	21.18	H	10.39	1.12	43.52	32.70	Q.P
359.40	18.52	H	14.82	1.46	46.02	34.80	Q.P
497.20	17.01	V	16.97	1.82	46.02	35.80	Q.P
588.80	13.43	V	18.60	2.07	46.02	34.10	Q.P

5.5.5.4 Above 1 GHz

BLE (GFSK)- 2402 MHz(Low)

Frequency [MHz]	Reading [dB μV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB μV/m]	Emission Level [dB μV/m]	Detector
1595.50	46.69	H	25.69	3.76	40.54	74	35.60	Peak
3331.20	44.81	H	28.20	5.37	41.58	74	36.80	Peak
6284.70	38.13	H	33.73	7.36	40.32	74	38.90	Peak
5123.50	42.78	V	31.07	6.57	41.02	74	39.40	Peak
7566.40	31.92	V	40.61	8.21	40.64	74	40.10	Peak
9122.60	21.93	H	48.96	9.56	40.55	74	39.90	Peak

BLE (GFSK)- 2440 MHz(Middle)

Frequency [MHz]	Reading [dB μV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB μV/m]	Emission Level [dB μV/m]	Detector
1595.50	46.69	H	25.69	3.76	40.54	74	35.60	Peak
3331.20	44.91	H	28.20	5.37	41.58	74	36.90	Peak
6283.80	38.04	H	33.72	7.36	40.32	74	38.80	Peak
5123.40	42.88	V	31.07	6.57	41.02	74	39.50	Peak
7566.30	31.92	V	40.61	8.21	40.64	74	40.10	Peak
9122.60	21.93	H	48.96	9.56	40.55	74	39.90	Peak

BLE (GFSK)- 2480 MHz(High)

Frequency [MHz]	Reading [dB μV]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB μV/m]	Emission Level [dB μV/m]	Detector
1595.50	46.69	H	25.69	3.76	40.54	74	35.60	Peak
3331.20	44.81	H	28.20	5.37	41.58	74	36.80	Peak
6284.10	38.14	H	33.72	7.36	40.32	74	38.90	Peak
5123.30	42.98	V	31.07	6.57	41.02	74	39.60	Peak
7566.30	31.92	V	40.61	8.21	40.64	74	40.10	Peak
9122.60	21.93	H	48.96	9.56	40.55	74	39.90	Peak

5.6 Band Edge Measurement

5.6.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum analyzer	N9020A	Agilent	US46220101	15/09/11
Bilog Antenna	VULB9160	Schwarzbeck	VULB9160-3122	16/04/02
Antenna Master	JAC-3	DAE IL EMC	N/A	15/05/07
Antenna Turntable Controller	JAC-2	JAEMC	N/A	15/05/07
RF Cable_2m	Test No.1	Hubersunhner	N/A	16/01/14
RF Cable_10m	Test No.2	Hubersunhner	N/A	16/01/14
Loop Antenna	HFH2-Z2	Rohde & Schwarz	881056/6	16/01/06
Horn Antenna	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D 234	15/09/15
RF Amplifier	PAM-118A	COM-POWER	551019	15/07/21
Antenna Master	N/A	AUDIX	N/A	15/09/17
Antenna Turntable Controller	ACT	AUDIX	N/A	15/09/17
RE Below 1 GHz CHAMBER	N/A	SY Corp.	N/A	N/A
RE Above 1 GHz CHAMBER	N/A	SY Corp.	N/A	15/09/17
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.6.2 Test Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

5.6.3 Test Procedure

The EUT is placed on a turntable, which is 0.8m above the ground plane.

The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

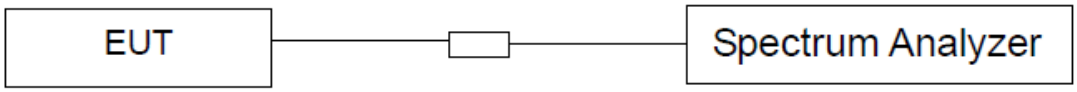
PEAK: RBW=VBW=1MHz / Sweep=AUTO

AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

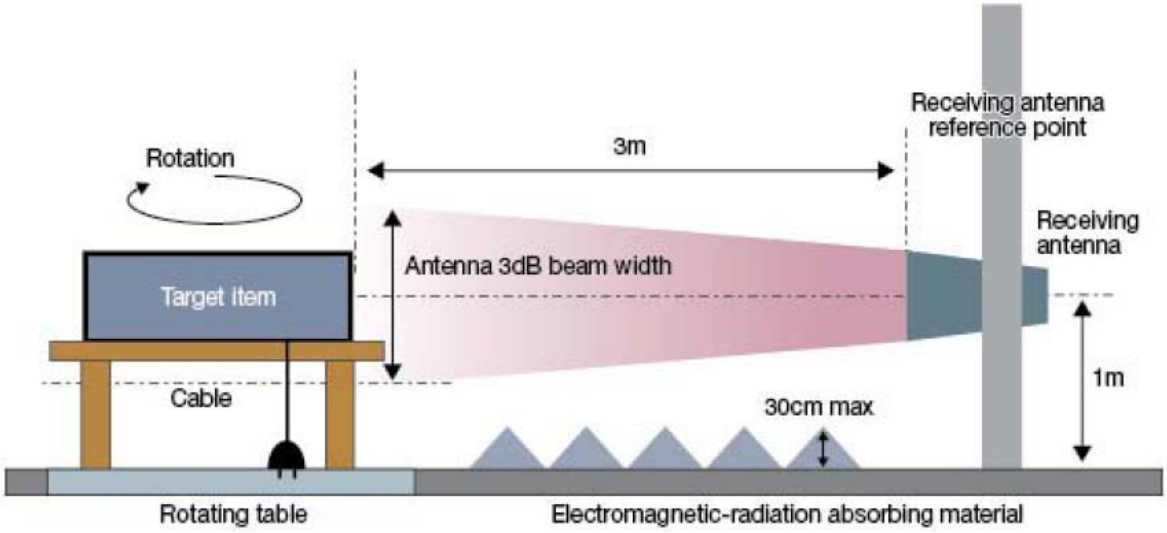
Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

5.6.4 Test SET-UP (Block Diagram of Configuration)

(a) Conducted Emission Test Set-Up, Frequency above 1000MHz



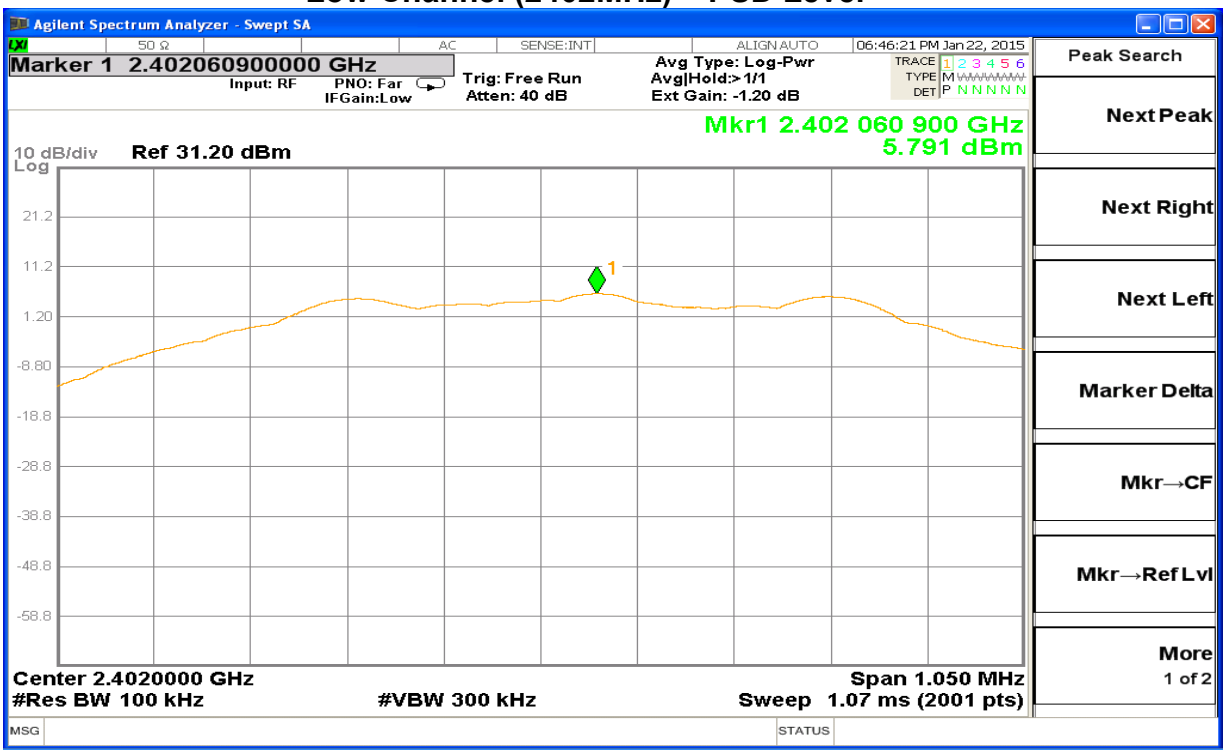
(b)Radiated Emission Test Set-Up, Frequency above 1000MHz



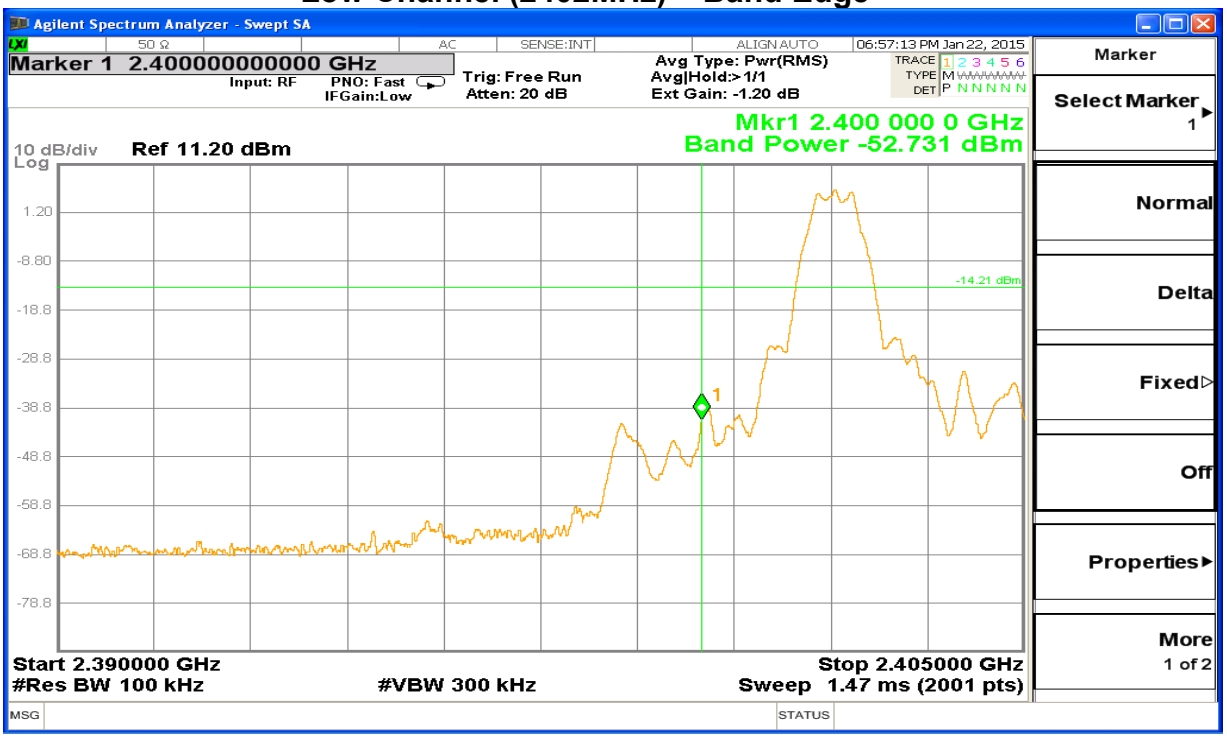
5.6.5 Test Result

5.6.5.1 Conducted Band Edges

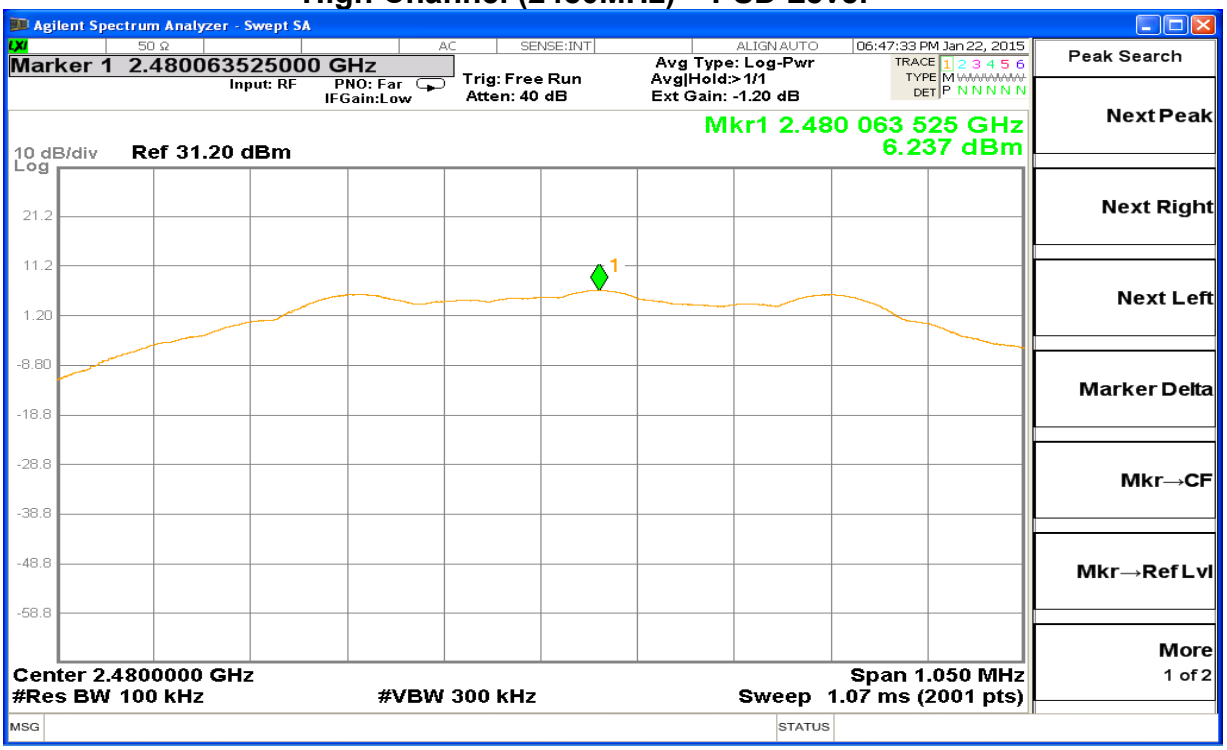
Low Channel (2402MHz) – PSD Level



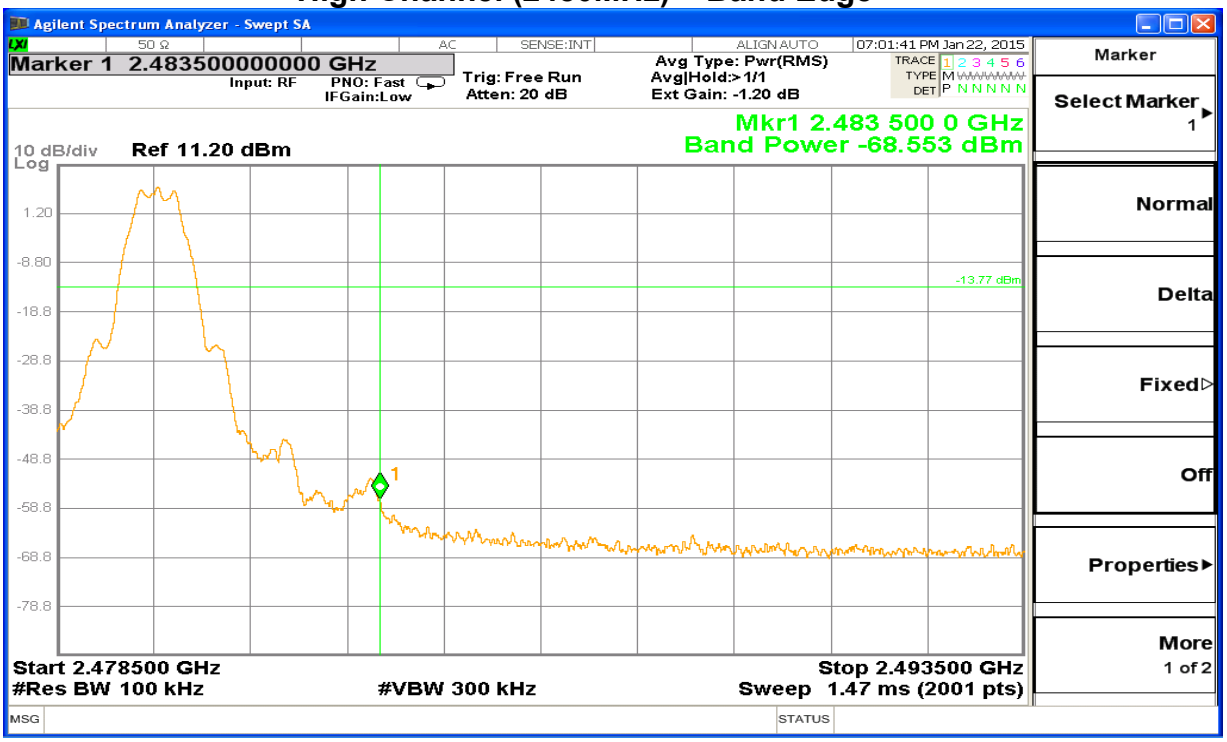
Low Channel (2402MHz) – Band Edge



High Channel (2480MHz) – PSD Level



High Channel (2480MHz) – Band Edge



5.6.5.2 Radiated Band Edges

Low Channel (2402 MHz) – Horizontal

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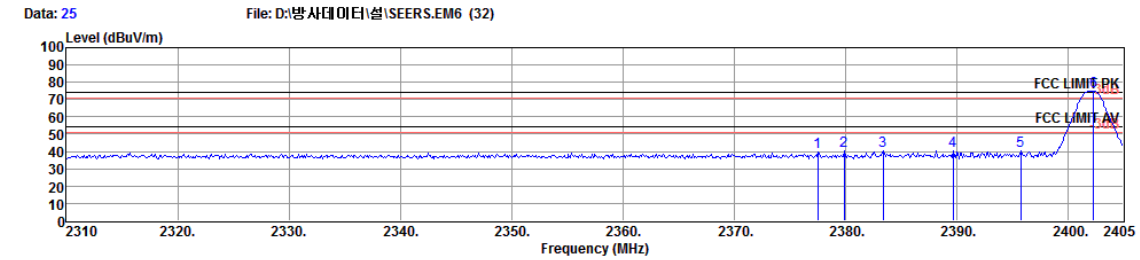

Site : SVSWR Chamber
Condition: FCC LIMIT PK 3m BBHA9120D517_2014 HORIZONTAL
eut : HH-800
mode : GFSK(BLE) Channel 0
memo :

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	2377.55	49.61	26.72	41.00	4.43	39.76	74.00	-34.24	---	---	Peak
2	2379.92	50.09	26.73	41.00	4.43	40.25	74.00	-33.75	---	---	Peak
3	2383.44	50.46	26.73	41.00	4.43	40.62	74.00	-33.38	---	---	Peak
4	2389.71	50.25	26.74	41.01	4.44	40.42	74.00	-33.58	---	---	Peak
5	2395.79	49.89	26.75	41.01	4.44	40.07	74.00	-33.93	---	---	Peak
6 *	2402.34	84.78	26.76	41.02	4.45	74.97	74.00	0.97	---	---	Peak

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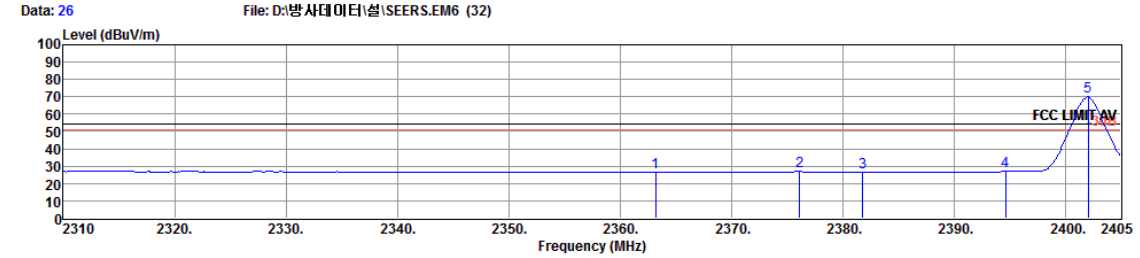

Site : SVSWR Chamber
Condition: FCC LIMIT AV 3m BBHA9120D517_2014 HORIZONTAL
eut : HH-800
mode : GFSK(BLE) Channel 0
memo :

	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	2363.20	36.63	26.71	40.99	4.42	26.77	54.00	-27.23	---	---	Average
2	2376.12	36.78	26.72	41.00	4.43	26.93	54.00	-27.07	---	---	Average
3	2381.82	36.52	26.73	41.00	4.43	26.68	54.00	-27.32	---	---	Average
4	2394.65	36.76	26.75	41.01	4.44	26.94	54.00	-27.06	---	---	Average
5 *	2402.06	79.77	26.76	41.02	4.45	69.96	54.00	15.96	---	---	Average

Low Channel (2402 MHz) – Vertical

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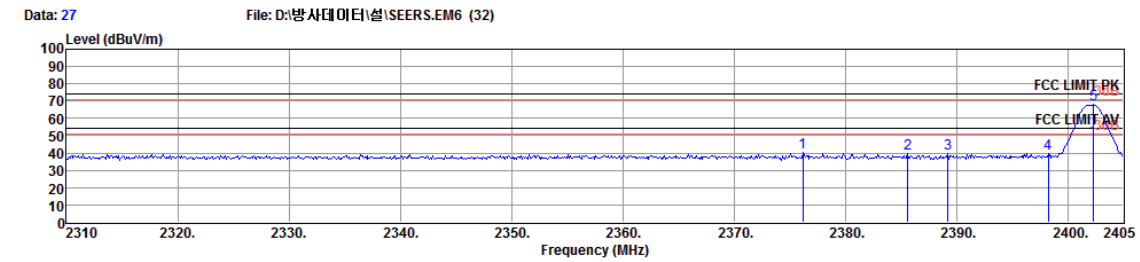

Site : SVSWR Chamber
Condition: FCC LIMIT PK 3m BBHA9120D517_2014 VERTICAL
eut : HH-800
mode : GFSK(BLE) Channel 0
memo :

	Freq	ReadLevel	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	2376.22	50.52	26.72	41.00	4.43	40.67	74.00	-33.33	---	---	Peak
2	2385.62	49.57	26.74	41.00	4.43	39.74	74.00	-34.26	---	---	Peak
3	2389.23	49.46	26.74	41.01	4.44	39.63	74.00	-34.37	---	---	Peak
4	2398.26	49.64	26.75	41.01	4.44	39.82	74.00	-34.18	---	---	Peak
5	2402.34	77.83	26.76	41.02	4.45	68.02	74.00	-5.98	---	---	Peak

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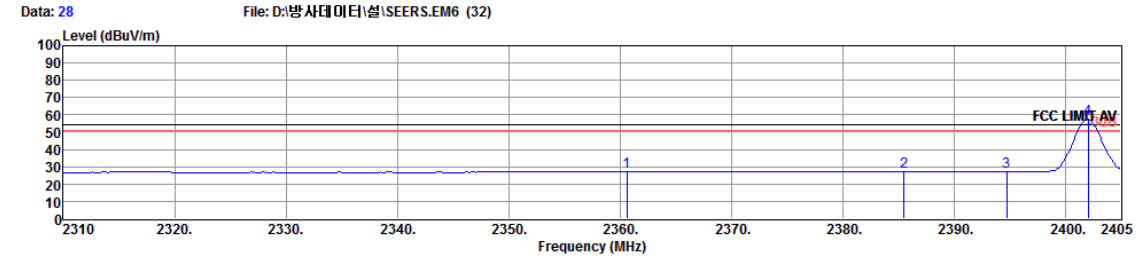

Site : SVSWR Chamber
Condition: FCC LIMIT AV 3m BBHA9120D517_2014 VERTICAL
eut : HH-800
mode : GFSK(BLE) Channel 0
memo :

	Freq	ReadLevel	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	2360.64	37.25	26.70	40.99	4.41	27.37	54.00	-26.63	---	---	Average
2	2385.53	36.86	26.74	41.00	4.43	27.03	54.00	-26.97	---	---	Average
3	2394.74	37.06	26.75	41.01	4.44	27.24	54.00	-26.76	---	---	Average
4 *	2402.06	67.44	26.76	41.02	4.45	57.63	54.00	3.63	---	---	Average

High Channel (2480 MHz) – Horizontal

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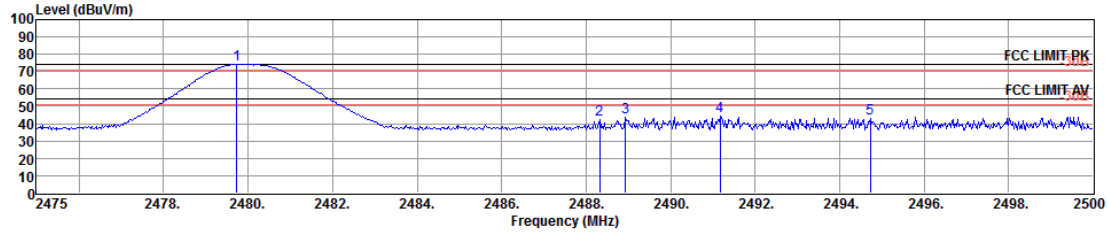
Data: 29 File: D:\방사데이터\설\SEERS.EM6 (32)



Site : SVSWR Chamber
Condition: FCC LIMIT PK 3m BBHA9120D517_2014 HORIZONTAL
eut : HH-800
mode : GFSK(BLE) Channel 39
memo :

	Freq	ReadAntenna Level	Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1 *	2479.73	83.96	26.85	41.07	4.50	74.24	74.00	0.24	---	---	Peak
2	2488.33	52.35	26.87	41.07	4.51	42.66	74.00	-31.34	---	---	Peak
3	2488.93	53.51	26.87	41.07	4.51	43.82	74.00	-30.18	---	---	Peak
4	2491.18	54.09	26.87	41.07	4.51	44.40	74.00	-29.60	---	---	Peak
5	2494.73	52.73	26.87	41.08	4.52	43.04	74.00	-30.96	---	---	Peak

BWS Testing Laboratory

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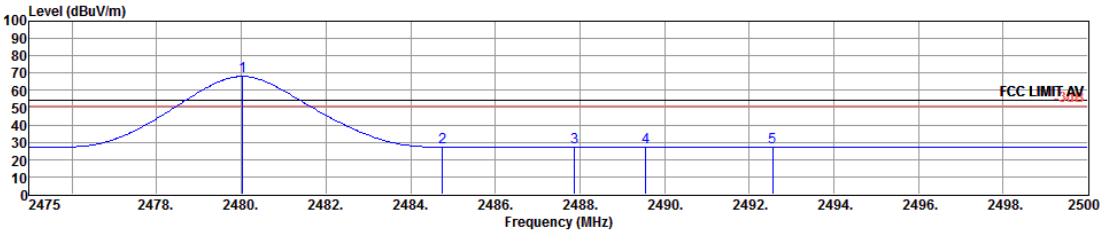
Data: 30 File: D:\방사데이터\설\SEERS.EM6 (32)



Site : SVSWR Chamber
Condition: FCC LIMIT AV 3m BBHA9120D517_2014 HORIZONTAL
eut : HH-800
mode : GFSK(BLE) Channel 39
memo :

	Freq	ReadAntenna Level	Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1 *	2480.03	77.83	26.86	41.07	4.50	68.12	54.00	14.12	---	---	Average
2	2484.75	36.79	26.86	41.07	4.51	27.09	54.00	-26.91	---	---	Average
3	2487.88	36.74	26.86	41.07	4.51	27.04	54.00	-26.96	---	---	Average
4	2489.55	36.75	26.87	41.07	4.51	27.06	54.00	-26.94	---	---	Average
5	2492.55	36.72	26.87	41.08	4.51	27.02	54.00	-26.98	---	---	Average

High Channel (2480 MHz) – Vertical

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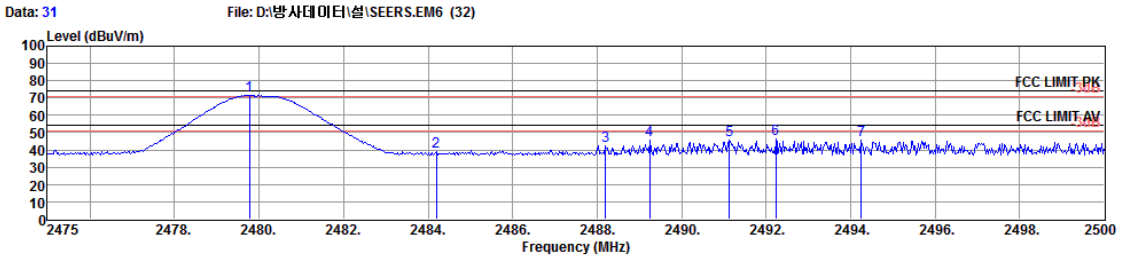

Site : SVSWR Chamber
Condition: FCC LIMIT PK 3m BBHA9120D517_2014 VERTICAL
eut : HH-800
mode : GFSK(BLE) Channel 39
memo :

		Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	!	2479.78	81.13	26.85	41.07	4.50	71.41	74.00	-2.59	---	---	Peak
2		2484.20	48.56	26.86	41.07	4.51	38.86	74.00	-35.14	---	---	Peak
3		2488.20	52.02	26.87	41.07	4.51	42.33	74.00	-31.67	---	---	Peak
4		2489.25	55.10	26.87	41.07	4.51	45.41	74.00	-28.59	---	---	Peak
5		2491.13	55.42	26.87	41.07	4.51	45.73	74.00	-28.27	---	---	Peak
6		2492.23	56.30	26.87	41.07	4.51	46.61	74.00	-27.39	---	---	Peak
7		2494.25	55.35	26.87	41.08	4.52	45.66	74.00	-28.34	---	---	Peak

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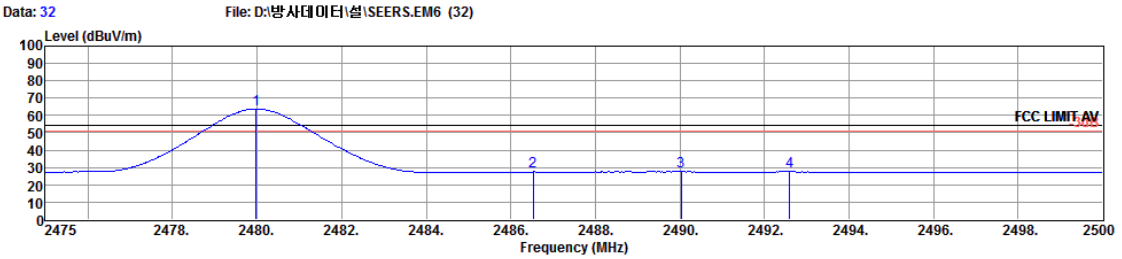


Site : SVSWR Chamber
Condition: FCC LIMIT AV 3m BBHA9120D517_2014 VERTICAL
eut : HH-800
mode : GFSK(BLE) Channel 39
memo :

		Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
		MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg	
1	*	2479.98	73.52	26.86	41.07	4.50	63.81	54.00	9.81	---	---	Average
2		2486.53	37.19	26.86	41.07	4.51	27.49	54.00	-26.51	---	---	Average
3		2490.03	37.23	26.87	41.07	4.51	27.54	54.00	-26.46	---	---	Average
4		2492.60	37.21	26.87	41.08	4.51	27.51	54.00	-26.49	---	---	Average

5.7 AC Power Conducted Emission

5.7.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
LISN	ENV216	ROHDE & SCHWARZ	100324	16/01/12
LISN	FCC-LISN-50-50-2-02	FCC	03074	16/01/12
#2 Conducted Cable_2.7m	N/A	N/A	N/A	16/01/14
Test Receiver	ESPI	ROHDE & SCHWARZ	100063	16/01/12
CE CHAMBER	N/A	SY Corp.	N/A	15/09/17
AC Power Source	15001ix-CTS	California Instruments	56255/56256/56257	16/01/13

5.7.2 Test Limit

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

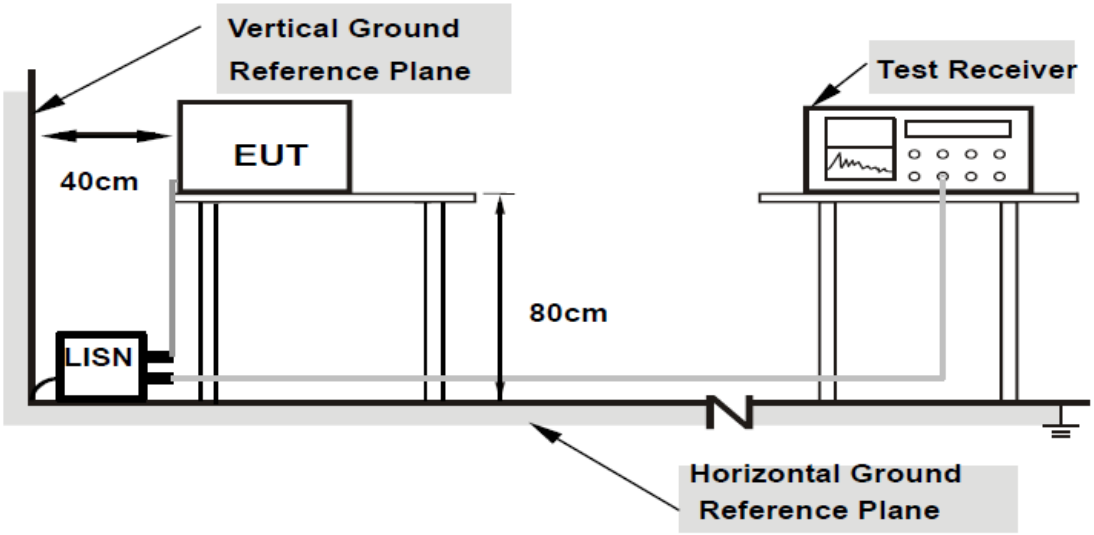
Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

5.7.3 Test Procedures

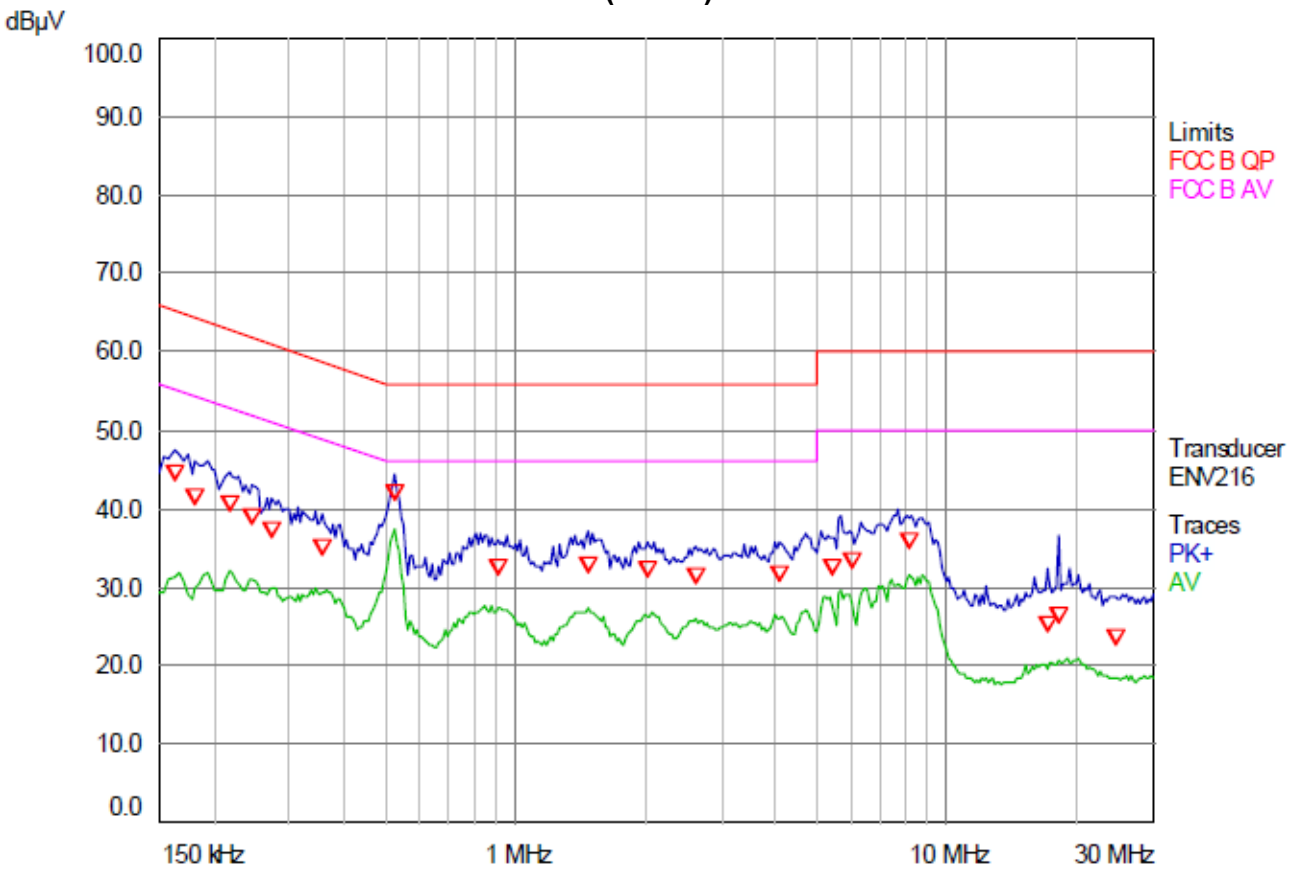
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network(LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

5.7.4 Block Diagram of Test Setup



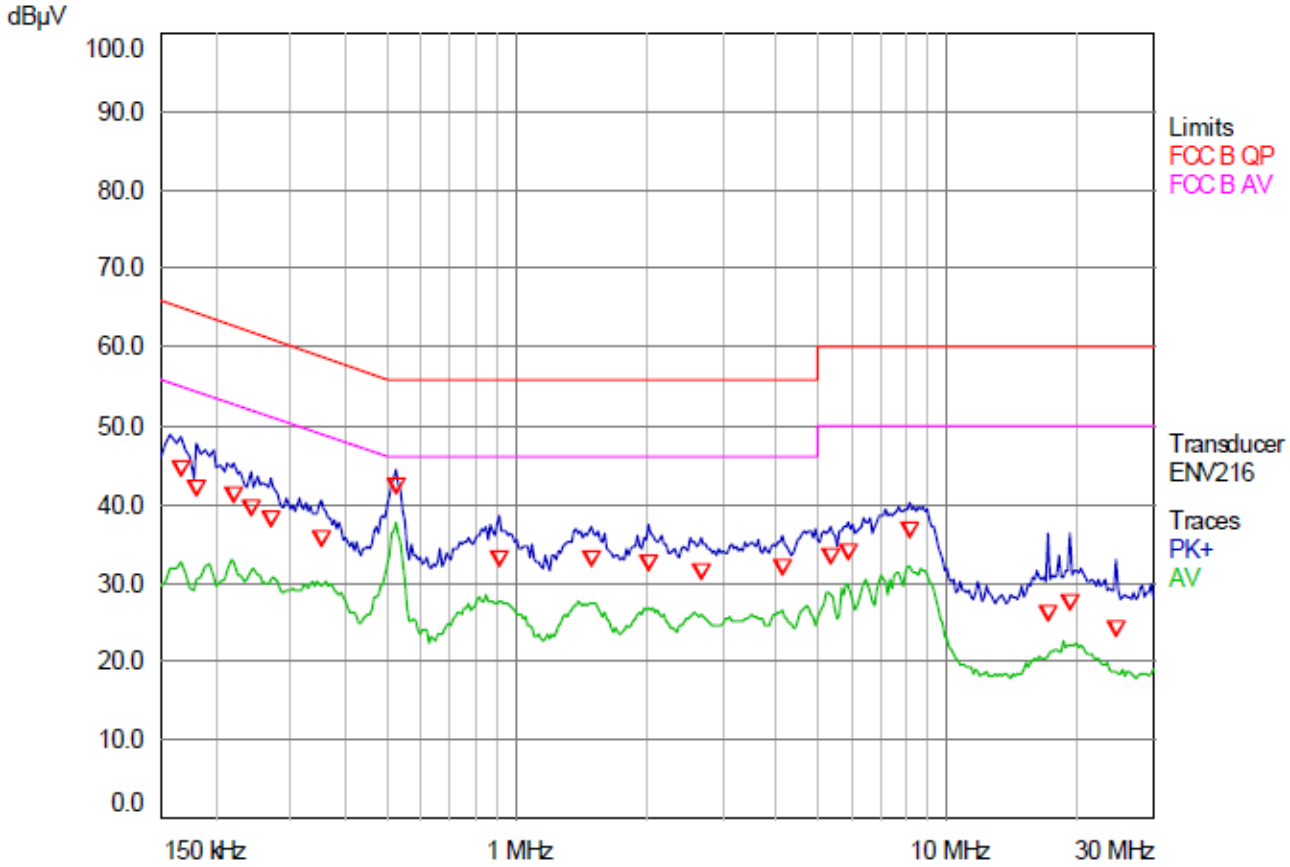
5.7.5 Test Result

BLE(GFSK)-H



Trace	Frequency	Level	Limit	Delta Limit	Delta Ref	Comment
	(MHz)	(dBµV)	(dBµV)	(dB)	(dB)	
1 QP	0.162	43.53	65.36	-21.83		
1 QP	0.182	40.40	64.39	-23.99		
1 QP	0.218	39.72	62.89	-23.17		
1 QP	0.246	37.91	61.89	-23.98		
1 QP	0.274	36.35	61.00	-24.65		
1 QP	0.358	34.18	58.77	-24.59		
1 QP	0.524	41.17	56.00	-14.83		
1 QP	0.916	31.68	56.00	-24.32		
1 QP	1.472	31.89	56.00	-24.11		
1 QP	2.036	31.18	56.00	-24.82		
1 QP	2.628	30.48	56.00	-25.52		
1 QP	4.112	30.69	56.00	-25.31		
1 QP	5.404	31.60	60.00	-28.40		
1 QP	5.992	32.27	60.00	-27.73		
1 QP	8.14	34.97	60.00	-25.03		
1 QP	17.08	24.33	60.00	-35.67		
1 QP	18.144	25.37	60.00	-34.63		
1 QP	24.512	22.70	60.00	-37.30		

BLE(GFSK)-N



Trace	Frequency	Level	Limit	Delta Limit	Delta Ref	Comment
	(MHz)	(dBµV)	(dBµV)	(dB)	(dB)	
1 QP	0.166	43.61	65.16	-21.55		
1 QP	0.182	40.96	64.39	-23.43		
1 QP	0.222	40.23	62.74	-22.51		
1 QP	0.242	38.54	62.03	-23.49		
1 QP	0.27	37.22	61.12	-23.90		
1 QP	0.354	34.65	58.87	-24.22		
1 QP	0.524	41.46	56.00	-14.54		
1 QP	0.912	32.22	56.00	-23.78		
1 QP	1.496	32.21	56.00	-23.79		
1 QP	2.016	31.59	56.00	-24.41		
1 QP	2.672	30.56	56.00	-25.44		
1 QP	4.128	31.07	56.00	-24.93		
1 QP	5.368	32.47	60.00	-27.53		
1 QP	5.916	33.07	60.00	-26.93		
1 QP	8.176	35.67	60.00	-24.33		
1 QP	17.084	25.10	60.00	-34.90		
1 QP	19.22	26.53	60.00	-33.47		
1 QP	24.524	23.23	60.00	-36.77		

5.8 Antenna Application

5.8.1 Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	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. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Antenna Type	Frequency	Antenna Gain	Limit
Chip Antenna	2.4 GHz	1.99 dBi	≤6 dBi

5.8.2 Result

PASS