

## COMPLIANCE For FCC PART 15 Subpart C

<b>Applicant Name:</b>	<b>Date of Testing</b>
CanTops	January 29, 2015 to March 12, 2015
	<b>Test Site/Location</b>
<b>Address:</b>	#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea
A-1208 Digital Empire, 16, Deogyong-daero 1556 beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-702, South Korea	<b>Test Report No.:</b> BWS-15-RF-0002
	<b>BWS FRN:</b> 0009936881
<b>FCC ID: RMNCTS-ICOM</b>	

<b>Model(s):</b>	CTS-ICOM-AA00-05-T-250, CTS-ICOM-AA01-05-T-030 CTS-ICOM-AA01-05-T-150, CTS-ICOM-AA01-05-T-250 CTS-ICOM-AB00-05-F-250, CTS-ICOM-AB01-05-F-045 CTS-ICOM-AB02-05-F-060
<b>EUT Type:</b>	IR PIO
<b>Frequency Range:</b>	2403-2480 MHz
<b>Modulation Type</b>	GFSK
<b>FCC Classification:</b>	Digital Transmission System (DTS)
<b>FCC Rule Part(s):</b>	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.

#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do  
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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** : CanTops
- **Company Address** : A-1208 Digital Empire,16, Deogyong-daero 1556 beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-702, South Korea
- **Phone/Fax** : Tel No. : +82-31-303-5234 Fax No. : +82-31-303-5233

### 1.2 Manufacturer

- **Company Name** : CanTops
- **Company Address** : A-1208 Digital Empire,16, Deogyong-daero 1556 beon-gil, Yeongtong-gu, Suwon-si, Gyeonggi-do 443-702, South Korea
- **Phone/Fax** : Tel No. : +82-31-303-5234 Fax No. : +82-31-303-5233

### 1.3 Eut Description

- **EUT Type** : IR PIO
- **Model Name** : CTS-ICOM-AA00-05-T-250, CTS-ICOM-AA01-05-T-030  
CTS-ICOM-AA01-05-T-150, CTS-ICOM-AA01-05-T-250  
CTS-ICOM-AB00-05-F-250, CTS-ICOM-AB01-05-F-045  
CTS-ICOM-AB02-05-F-060
- **S/N** : Prototype
- **Freq. Range** : 2403-2480 MHz
- **Number of Channels** : 78
- **Modulation Method** : GFSK
- **Input Voltage** : DC 24 V  $\pm$ 10%
- **Antenna Peak Gain** : 3 dBi

### 1.4 Other Information

- **FCC Rule Part(s)** : Part 15 Subpart C §15.247
- **FCC ID** : RMNCTS-ICOM
- **Test Procedure** : ANSI C63.10-2013  
KDB 558074 D01 DTS Meas Guidance v03r02
- **Date of Test** : January 07, 2015 to March 12, 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

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### Site Description

<b>Test Lab.</b>	:	    	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
<b>Name of Firm</b>	:	BWS TECH Inc.	
<b>Site Location</b>	:	#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
<sup>1</sup> 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	( <sup>2</sup> )
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 (2403MHz), Mid (2442MHz) and High (2480MHz), these were chosen for full testing.

## 4. Summary of Test Results

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 Edge 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

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)

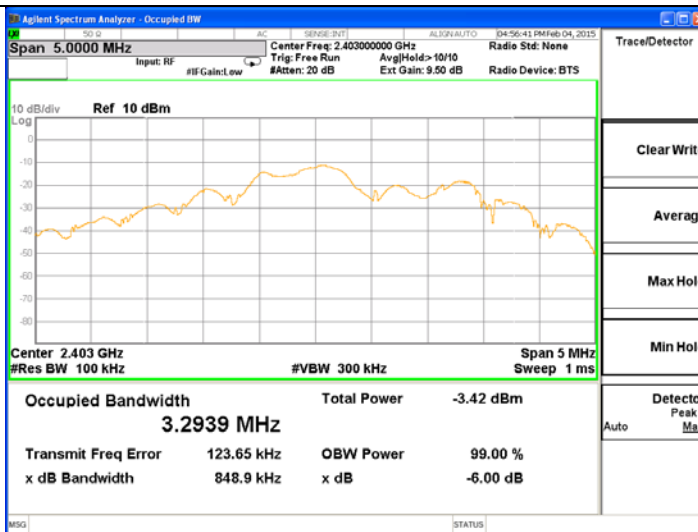


#### 5.1.5 Test Result

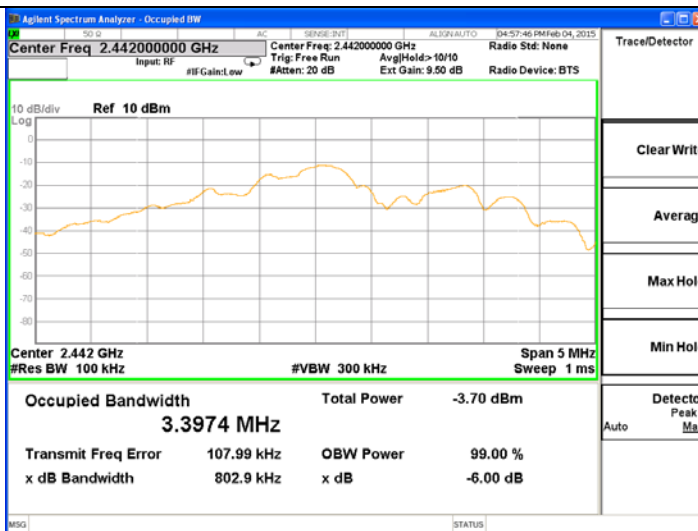
Modulation	Frequency (MHz)	Test Result (MHz)	Limit (MHz)
GFSK	2403	0.85	≥ 0.5
	2442	0.80	≥ 0.5
	2480	0.60	≥ 0.5

## 6dB Bandwidth

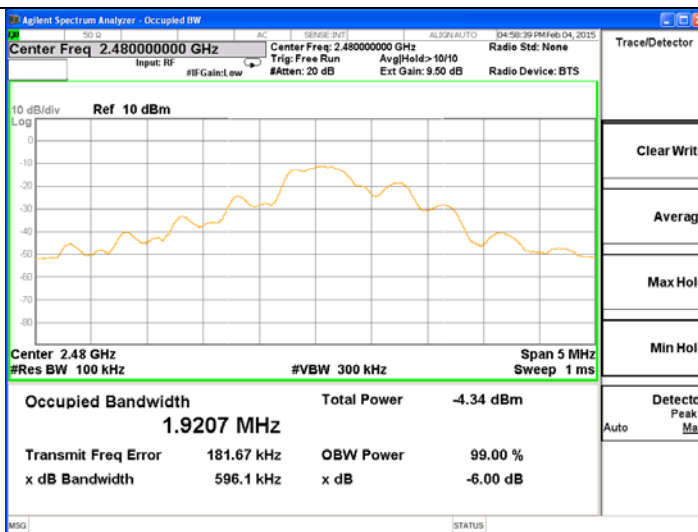
**GFSK - 2403  
MHz(Low Channel)**



**GFSK - 2442  
MHz(Middle Channel)**



**GFSK - 2480  
MHz(High Channel)**



## 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

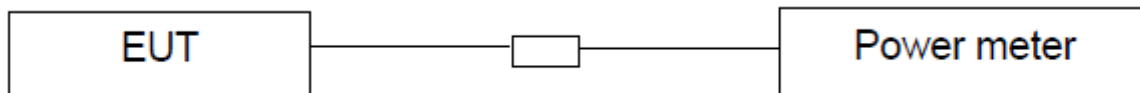
The maximum peak power shall be less than 1 Watt (30dBm).

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

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 attenuator. 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.

### 5.2.4 Test SET-UP (Block Diagram of Configuration)



### 5.2.5 Test Result

Modulation	Frequency(MHz)	Test Result(dBm)	Limit(dBm)
<b>GFSK</b>	2403	-1.2	≤ 30
	2442	-1.3	≤ 30
	2480	-1.2	≤ 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

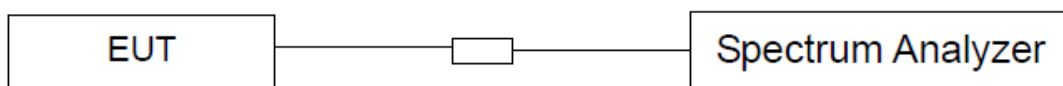
### 5.3.2 Test Limit

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

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

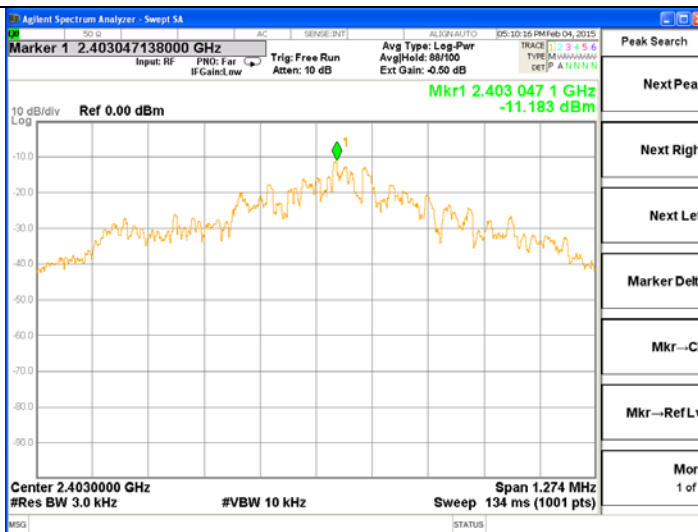


### 5.3.5 Test Result

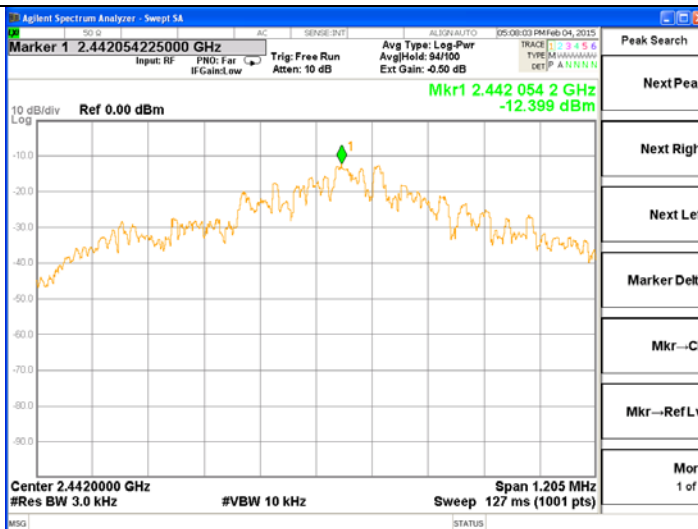
Modulation	Frequency(MHz)	Test Result (dBm/3kHz)	Limit(dBm/3kHz )
GFSK	2403	-11.18	≤ 8
	2442	-12.40	≤ 8
	2480	-12.09	≤ 8

## Power Spectral Density

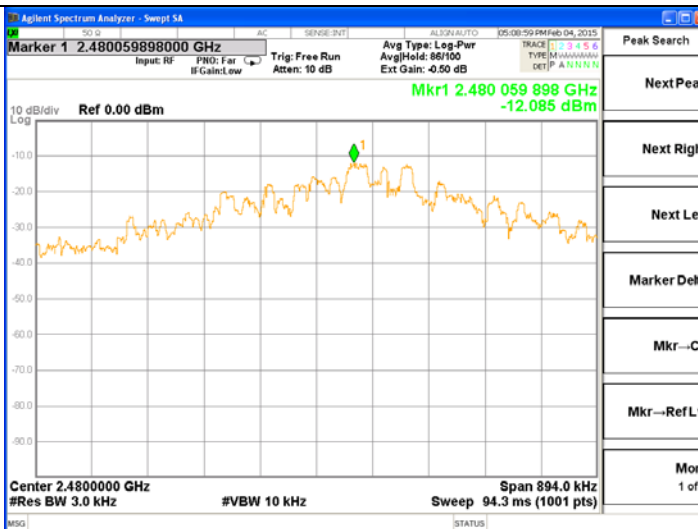
**GFSK - 2403  
MHz(Low Channel)**



**GFSK - 2442  
MHz(Middle Channel)**



**GFSK - 2480  
MHz(High Channel)**



## 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.

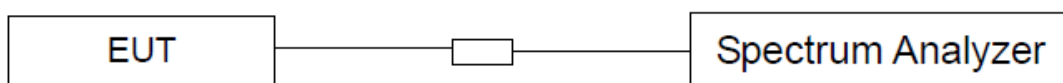
**Note:** Wireless charger configuration was evaluated.

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.

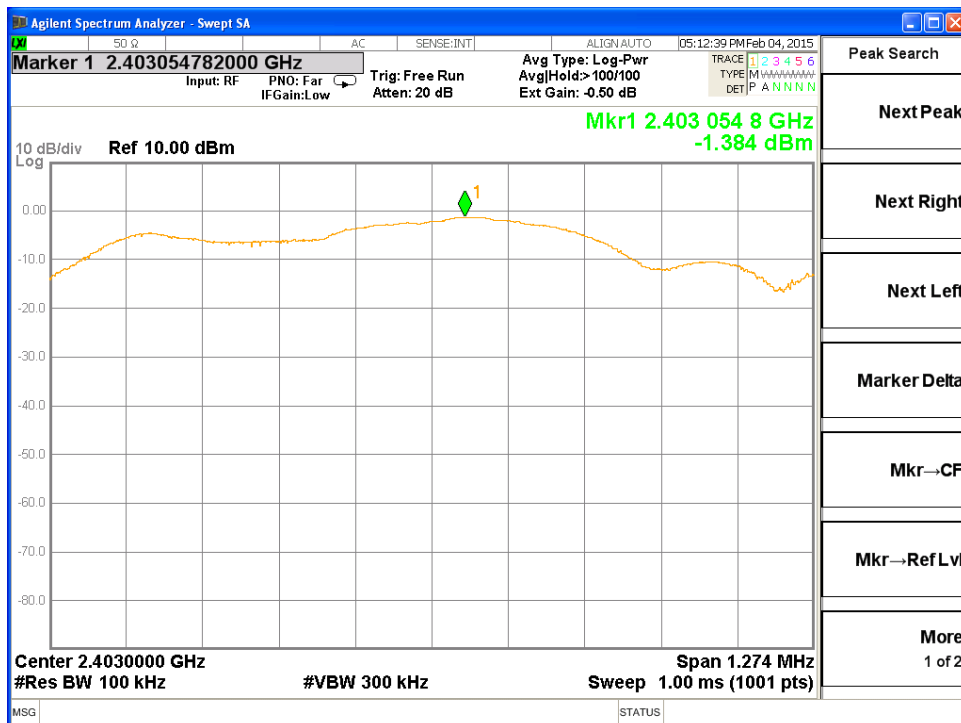
### 5.4.4 Block Diagram of Test setup.



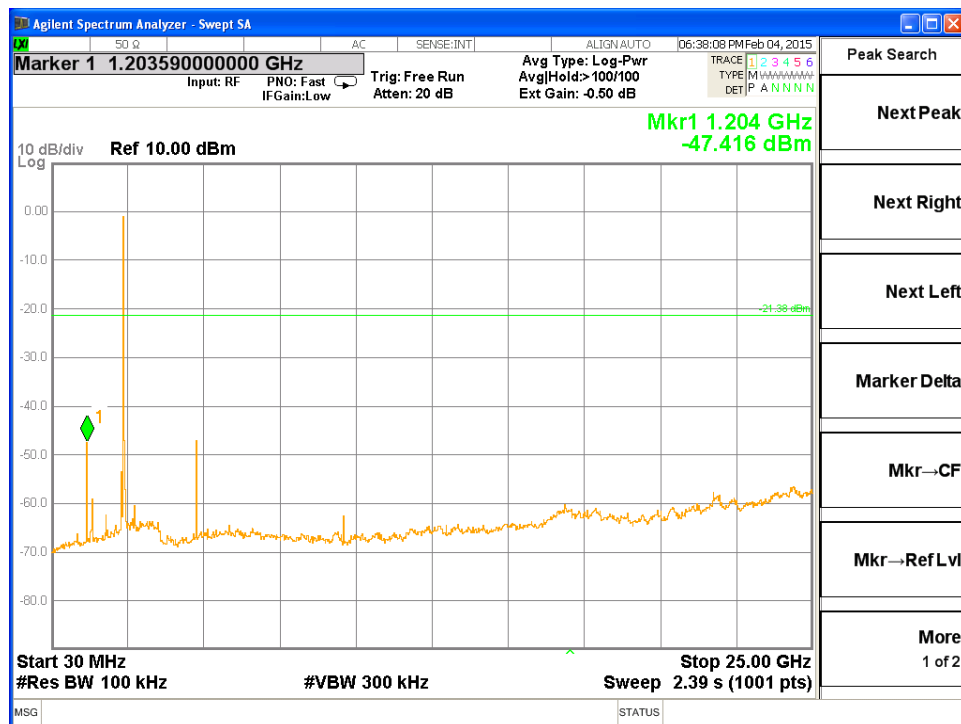
## 5.4.5 Test Result

### Conducted Spurious Emission (2403MHz)

PSD Level

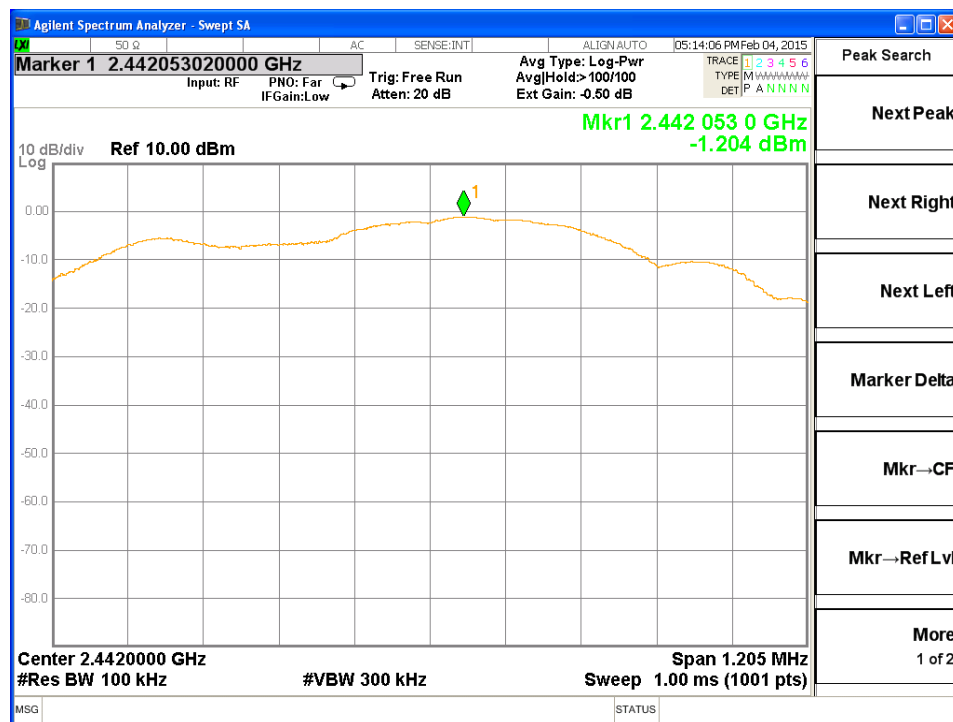


Conducted Spurious Emission

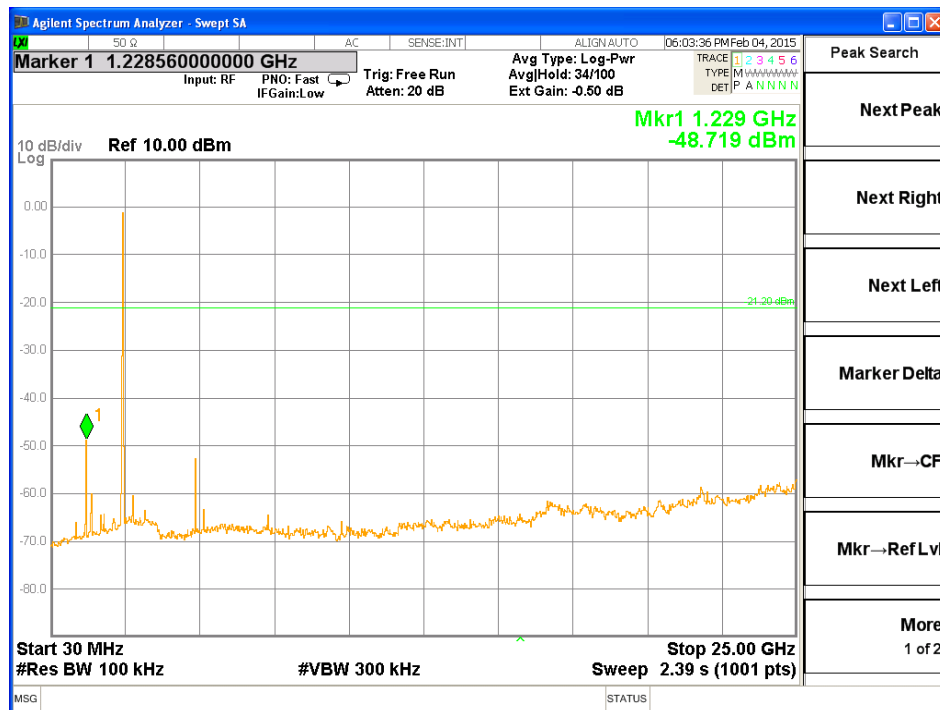


## Conducted Spurious Emission (2442MHz)

PSD Level

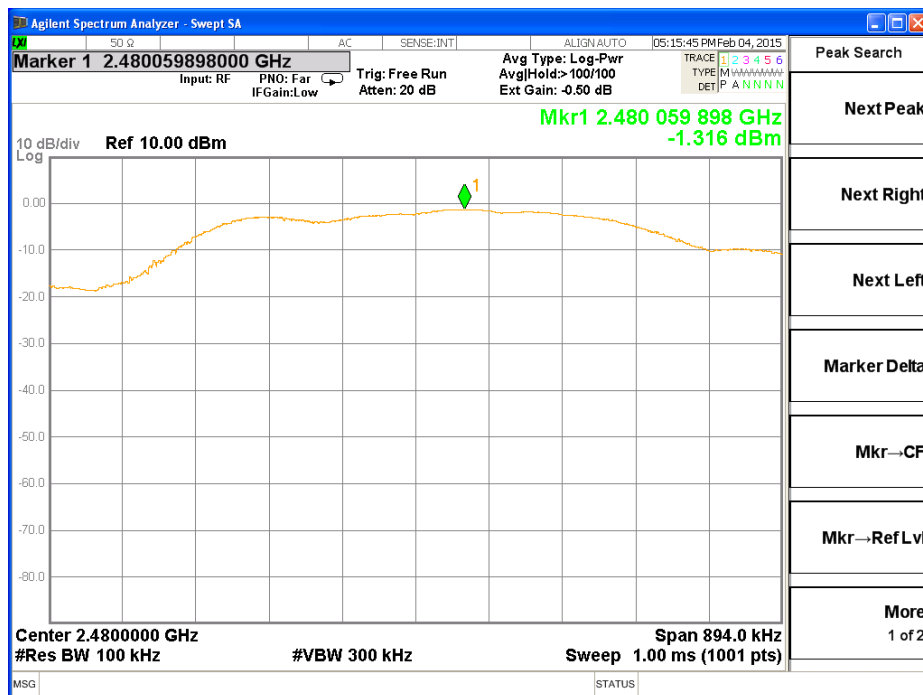


Conducted Spurious Emission

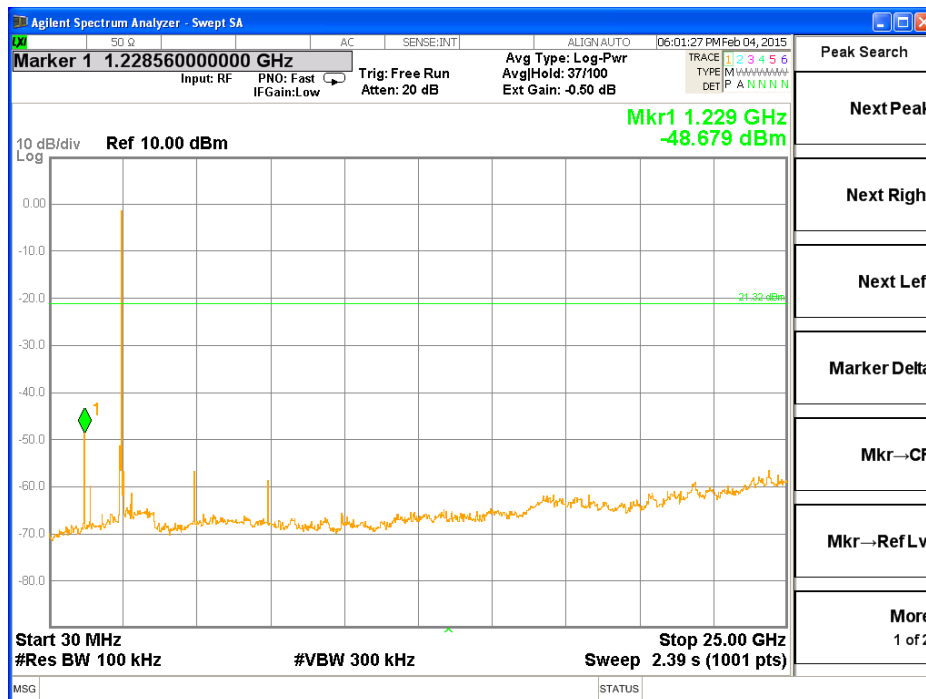


## Conducted Spurious Emission (2480MHz)

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	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

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamplifier Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings and peak emission levels are measured :
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW (9-150kHz : 200Hz, 0.15-30MHz : 9kHz, 30-1000MHz : 120kHz, above 1GHz : 1MHz).
  - (3) VBW  $\geq 3 \times$  RBW ; Sweep = auto; Detector function = peak; Trace = max hold

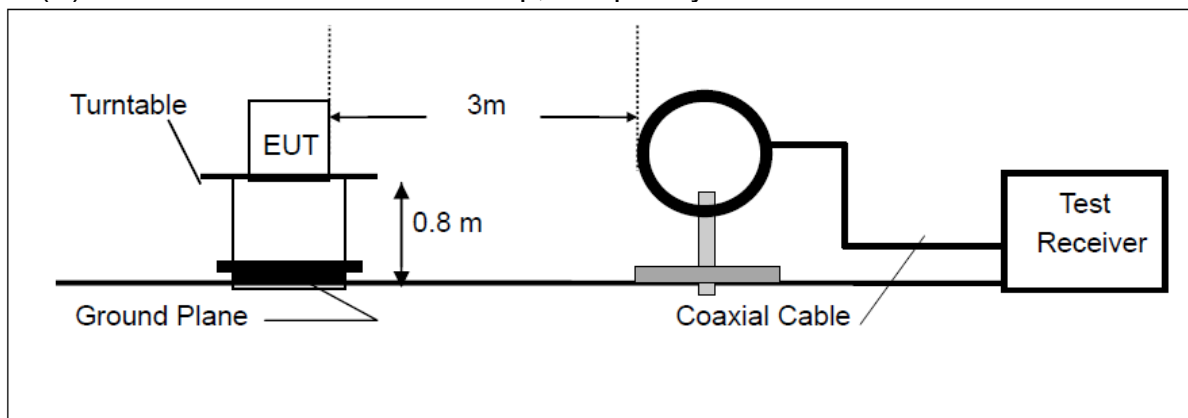
For average measurement:

- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW  $\geq 1/T$ , 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 level for the tested mode of operation.

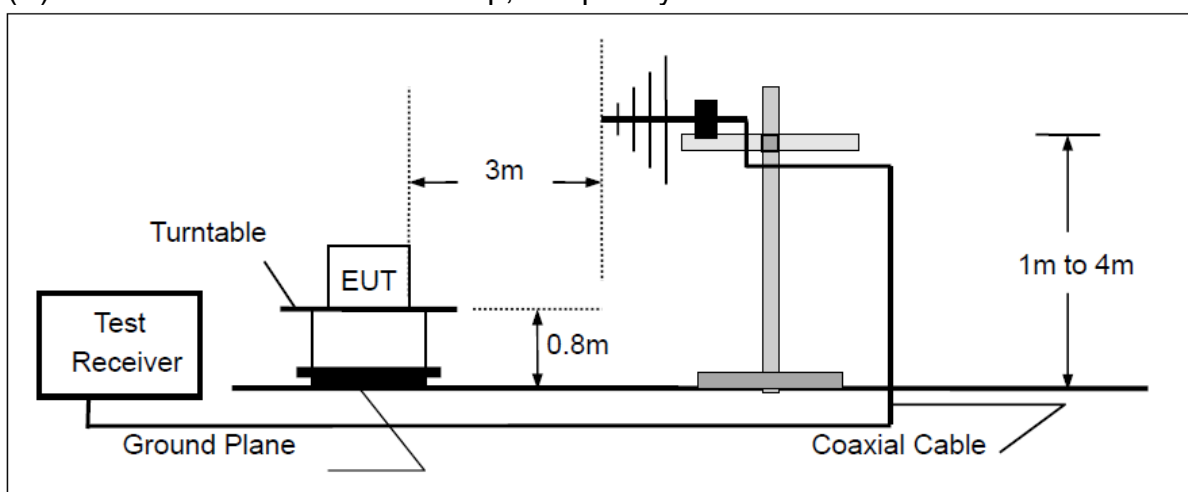
8. Measure and record the results in the test report.

#### 5.5.4 Test SET-UP (Block Diagram of Configuration)

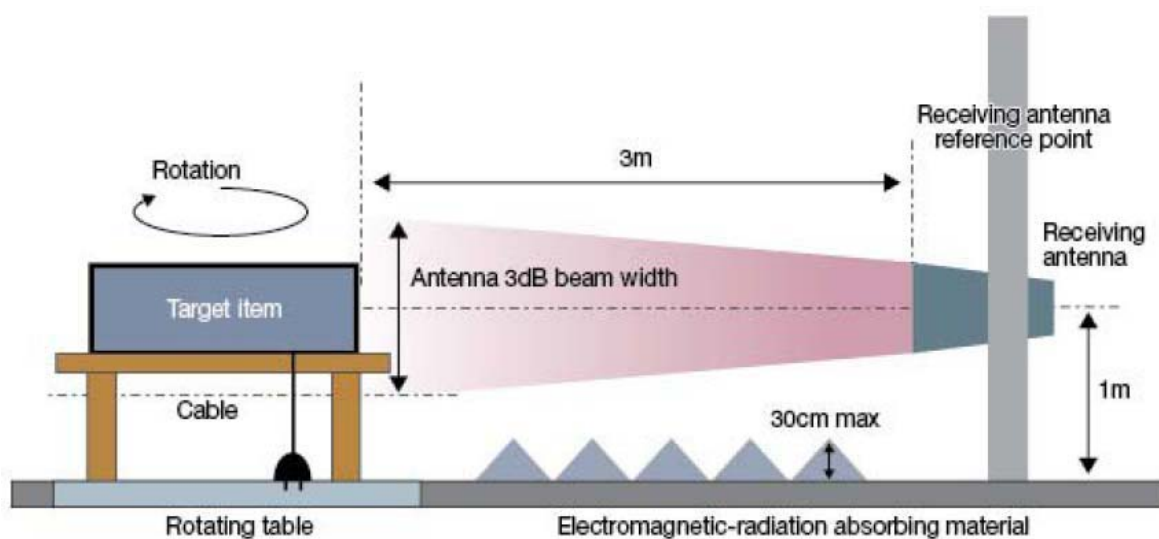
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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

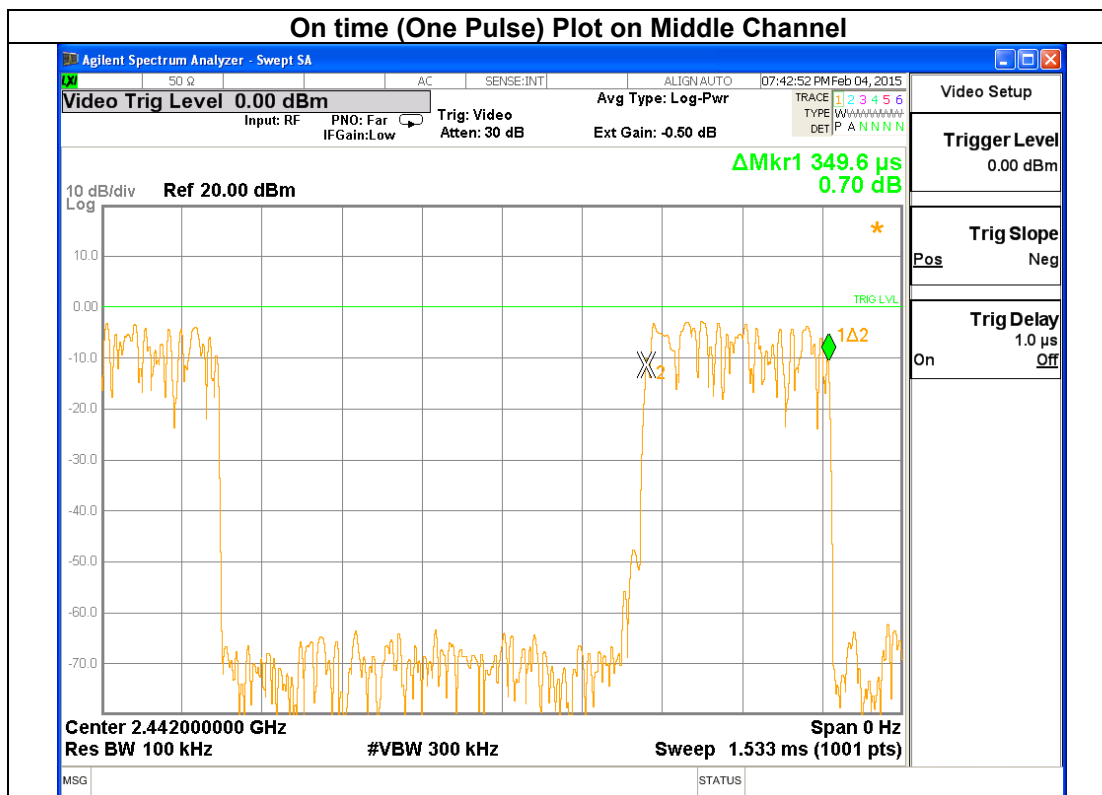


(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



### 5.5.5 Test Result

#### 5.5.5.1 VBW Setting for average measurement



Duty Cycle = 60 %  
T = 350  $\mu$ s  
1/T = 2857 Hz  
VBW Setting 3kHz

### 5.5.5.2 0.009–30 MHz

[illegible]

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

#### GFSK - 2403 MHz(Low)

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Detector
129.01	13.03	H	12.41	1.17	43.52	26.60	Q.P
154.82	11.39	H	13.73	1.28	43.52	26.40	Q.P
180.65	13.14	H	11.97	1.38	43.52	26.50	Q.P
305.98	12.57	V	13.92	1.81	46.02	28.30	Q.P
413.27	13.63	H	15.49	2.08	46.02	31.20	Q.P
595.13	15.08	V	18.68	2.43	46.02	36.20	Q.P

#### GFSK - 2442 MHz(Middle)

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Detector
124.13	13.76	H	12.00	1.15	43.52	26.90	Q.P
151.07	11.11	V	13.72	1.26	43.52	26.10	Q.P
180.65	13.64	V	11.97	1.38	43.52	27.00	Q.P
262.90	12.41	H	12.51	1.67	46.02	26.60	Q.P
348.03	12.24	H	14.64	1.92	46.02	28.80	Q.P
459.11	13.35	H	16.45	2.20	46.02	32.00	Q.P

#### GFSK - 2480 MHz(High)

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Detector
120.28	13.40	H	11.67	1.13	43.52	26.20	Q.P
163.18	11.49	H	13.60	1.31	43.52	26.40	Q.P
181.28	13.13	H	11.89	1.38	43.52	26.40	Q.P
307.83	11.92	H	13.96	1.82	46.02	27.70	Q.P
355.43	11.90	H	14.76	1.94	46.02	28.60	Q.P
449.56	13.92	H	16.31	2.17	46.02	32.40	Q.P

### 5.5.5.4 Above 1 GHz

#### GFSK - 2403 MHz(Low Channel)

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Detector
1345.21	45.81	V	25.42	3.39	-40.41	54	34.21	Peak
2433.49	48.20	V	27.30	4.47	-41.03	54	38.93	Peak
3667.23	47.40	H	28.74	5.67	-41.69	54	40.11	Peak
4800.03	50.08	H	31.07	6.46	-41.29	54	46.32	Peak
5214.43	44.90	V	31.55	6.61	-40.94	54	42.12	Peak
6512.42	41.91	V	33.50	7.58	-40.30	54	42.69	Peak

#### GFSK - 2442 MHz(Middle Channel)

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Detector
1139.25	46.12	V	25.20	3.01	-40.32	54	34.02	Peak
2296.49	47.74	V	26.81	4.37	-40.94	54	37.98	Peak
3560.26	48.63	H	28.56	5.60	-41.66	54	41.13	Peak
4880.03	50.84	H	31.22	6.49	-41.23	54	47.33	Peak
5120.52	44.83	V	31.51	6.57	-41.02	54	41.89	Peak
6216.33	42.15	V	32.83	7.29	-40.33	54	41.94	Peak

#### GFSK - 2480 MHz(High Channel)

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB $\mu$ V/m]	Emission Level [dB $\mu$ V/m]	Detector
1224.67	47.08	V	25.29	3.17	-40.34	54	35.20	Peak
2399.84	48.64	V	27.18	4.44	-41.01	54	39.25	Peak
3468.35	48.76	H	28.44	5.53	-41.64	54	41.10	Peak
4960.02	48.47	H	31.38	6.51	-41.16	54	45.20	Peak
5196.48	44.79	V	31.55	6.60	-40.96	54	41.98	Peak
6254.94	43.27	V	32.92	7.33	-40.32	54	43.19	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 is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. 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 in §15.209(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:

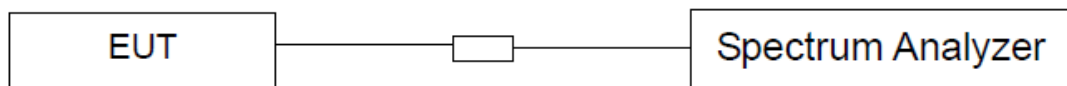
PEAK: RBW=VBW=1MHz / Sweep=AUTO

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

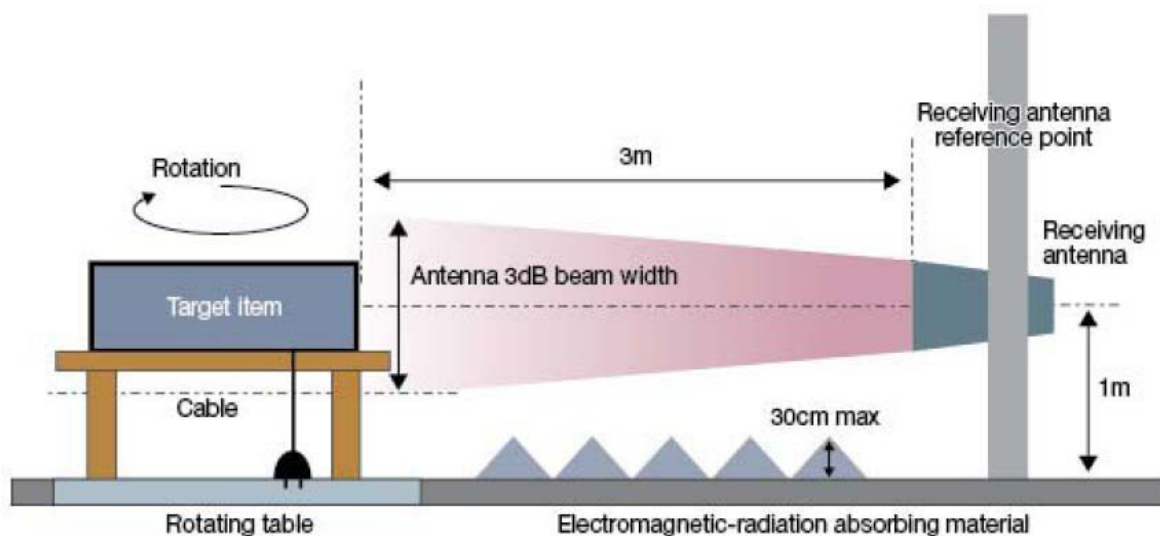
Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

#### 5.6.4 Test SET-UP (Block Diagram of Configuration)

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



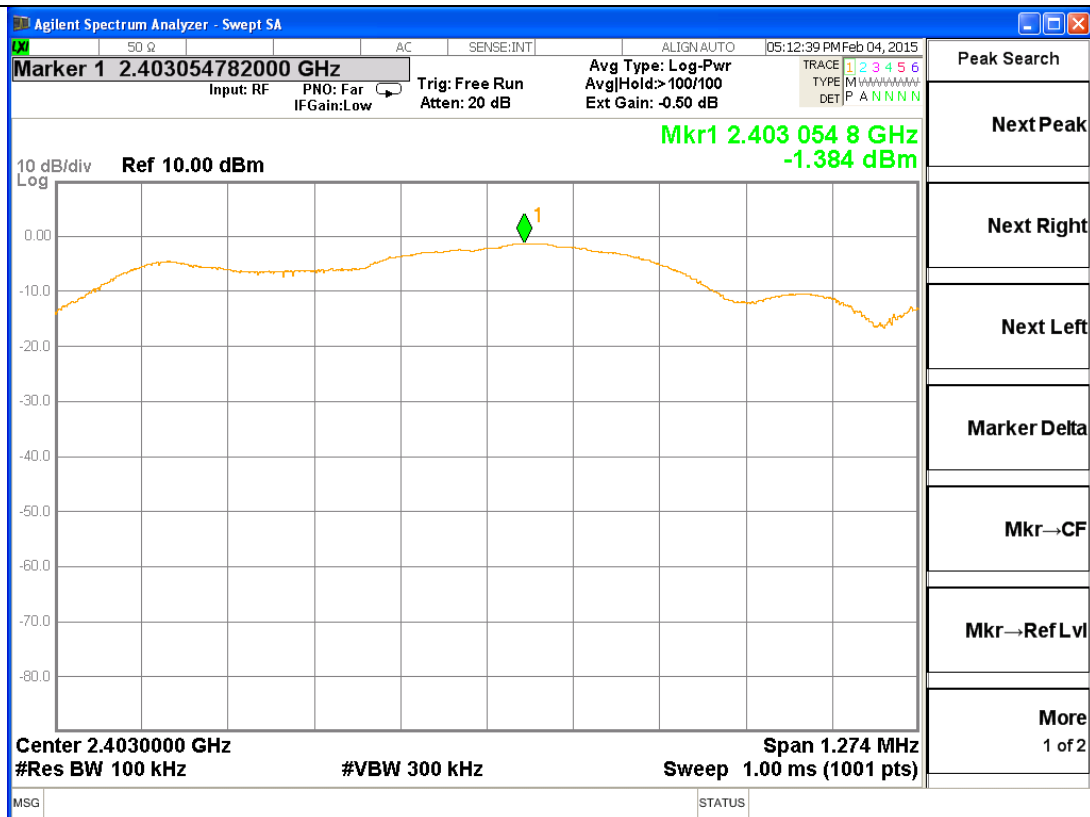
(b) Radiated Emission Test Set-Up, Frequency above 1000MHz



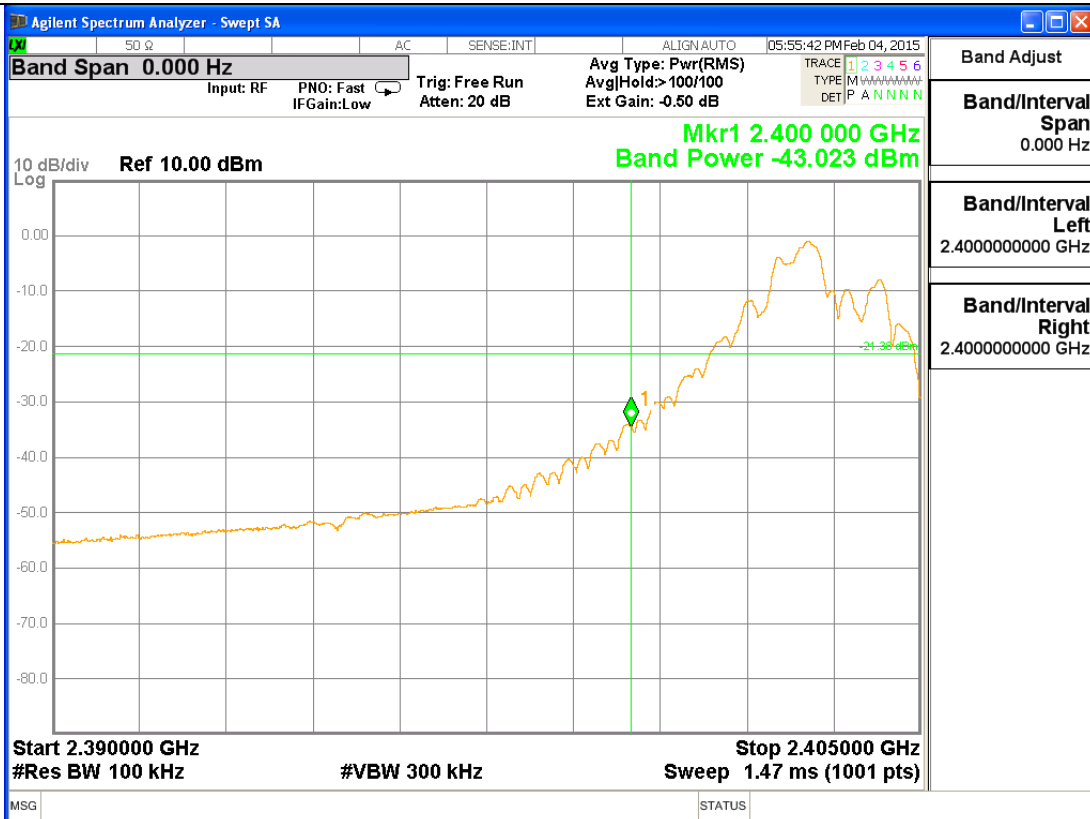
## 5.6.5 Test Result

### Conducted Band Edges (2403MHz)

PSD Level

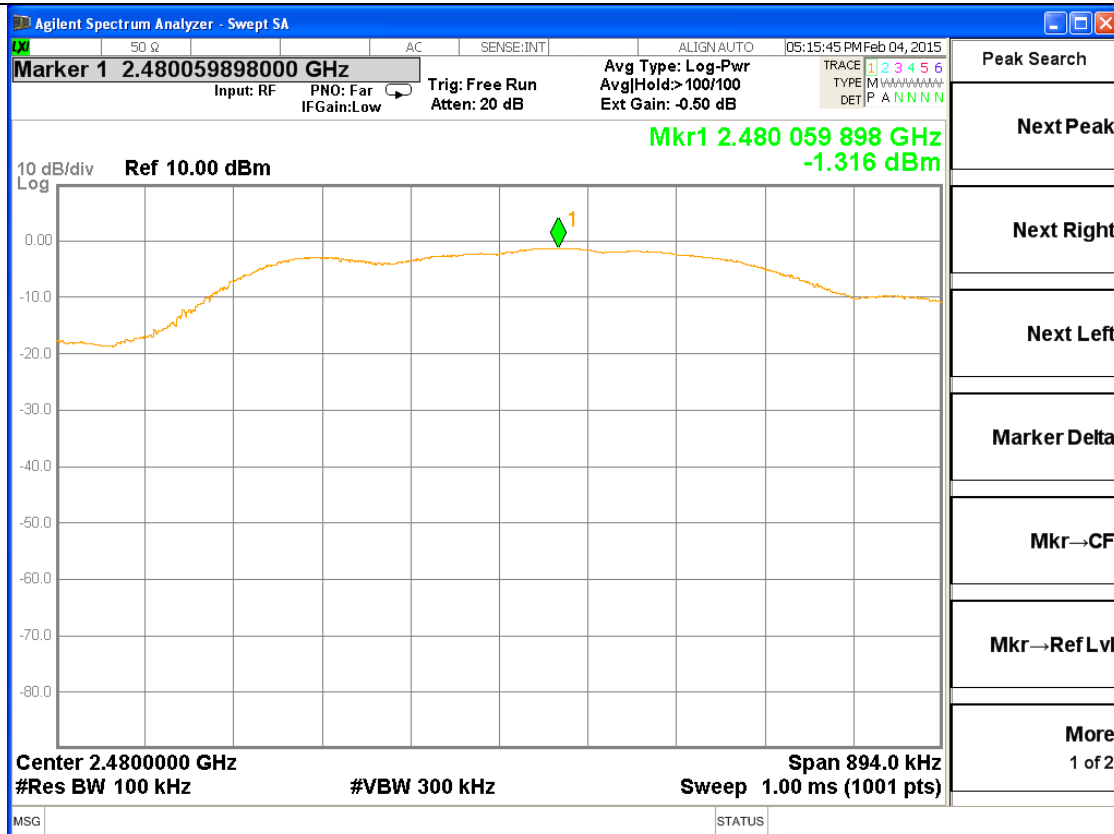


Band Edge

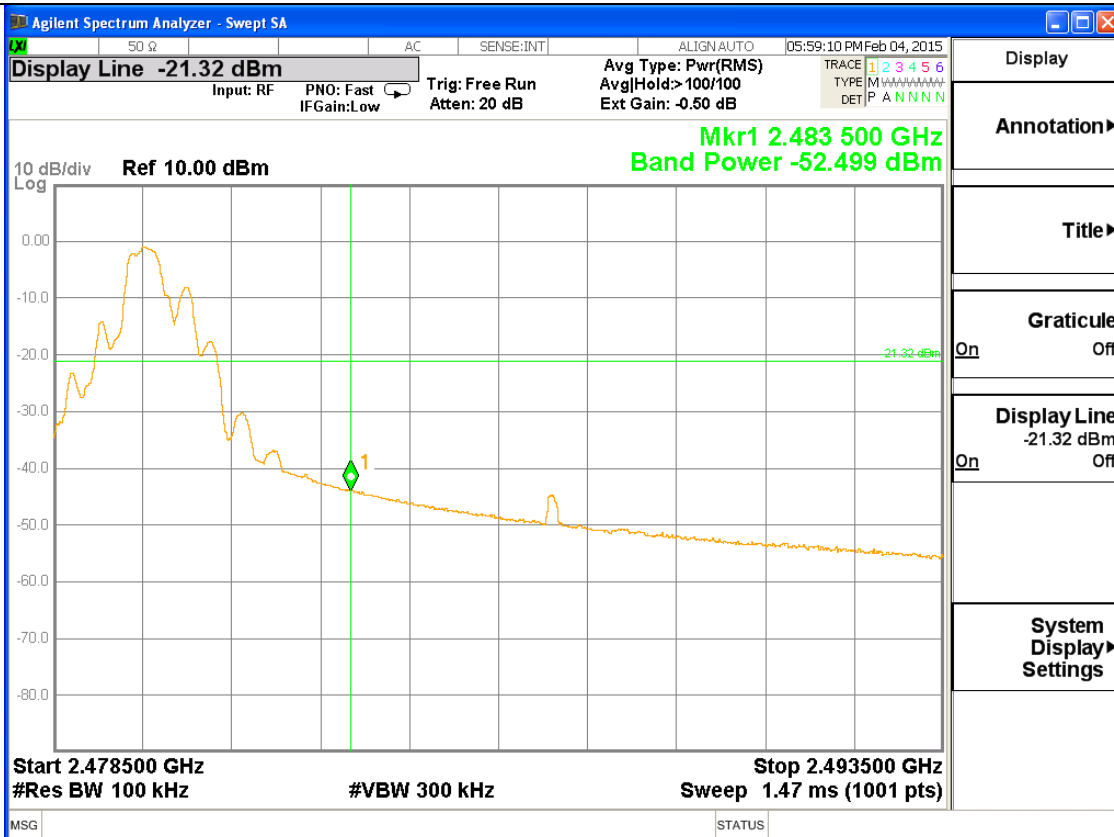


## Conducted Band Edges (2480MHz)

PSD Level



Band Edge



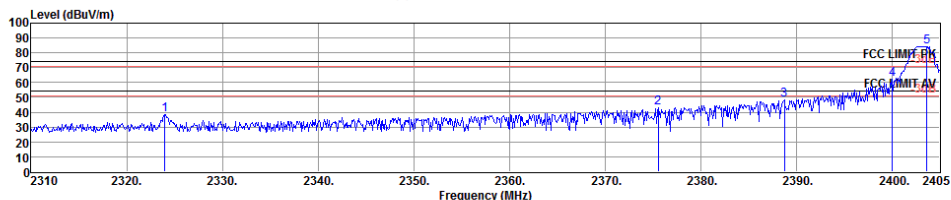
## Radiated Band Edges

**2403MHz  
Peak  
Horizontal**



BWS TECH INC

Data: 1 File: D:\방사데이터\설\ICANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT PK 3m BBHA9120D517\_2014 HORIZONTAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 3  
memo :

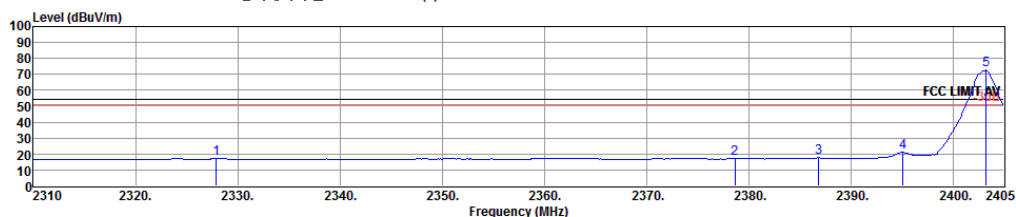
	Freq	ReadAntenna Level	Preamp Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2323.97	48.24	26.65	40.96	4.39	38.32	74.00	-35.68 Peak
2	2375.55	53.08	26.72	41.00	4.43	43.23	74.00	-30.77 Peak
3	2388.76	58.31	26.74	41.01	4.44	48.48	74.00	-25.52 Peak
4	2400.06	71.81	26.75	41.01	4.44	61.99	74.00	-12.01 Peak
5 *	2403.67	94.16	26.76	41.02	4.45	84.35	74.00	10.35 Peak

**2403MHz  
Average  
Horizontal**



BWS TECH INC

Data: 2 File: D:\방사데이터\설\ICANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT AV 3m BBHA9120D517\_2014 HORIZONTAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 3  
memo :

	ReadAntenna	Preamp	Cable	Limit	Over			
Freq	Level	Factor	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
2327.86	27.12	26.66	40.96	4.39	17.21	54.00	-36.79	Average
2378.69	26.98	26.73	41.00	4.43	17.14	54.00	-36.86	Average
2386.86	27.48	26.74	41.01	4.43	17.64	54.00	-36.36	Average
2395.12	31.18	26.75	41.01	4.44	21.36	54.00	-32.64	Average
2403.29	82.41	26.76	41.02	4.45	72.60	54.00	18.60	Average

## Radiated Band Edges

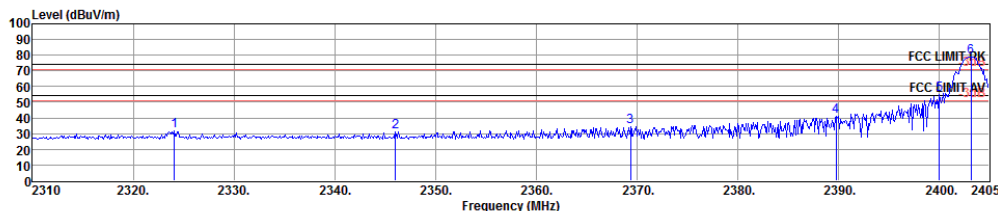
2403MHz

Peak  
Vertical



BWS TECH INC

Data: 3 File: D:\방사대이터\설\ICANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT PK 3m BBHA9120D517\_2014 VERTICAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 3  
memo :

		ReadAntenna	Preamp	Cable		Limit	Over	
	Freq	Level	Factor	Loss	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2324.06	41.49	26.65	40.96	4.39	31.57	74.00	-42.43 Peak
2	2346.01	41.16	26.68	40.98	4.40	31.26	74.00	-42.74 Peak
3	2369.38	44.49	26.71	40.99	4.42	34.63	74.00	-39.37 Peak
4	2389.80	50.72	26.74	41.01	4.44	40.89	74.00	-33.11 Peak
5	2400.06	65.07	26.75	41.01	4.44	55.25	74.00	-18.75 Peak
6 *	2403.20	88.62	26.76	41.02	4.45	78.81	74.00	4.81 Peak

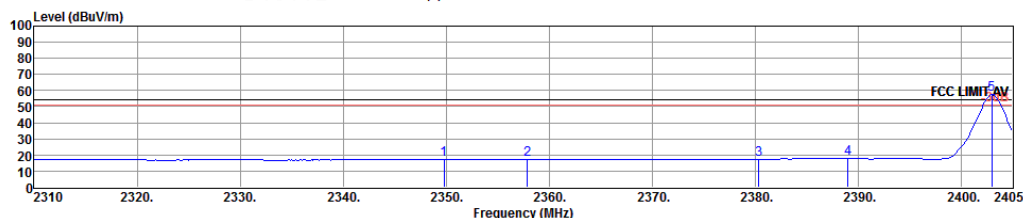
2403MHz

Average  
Vertical



BWS TECH INC

Data: 4 File: D:\방사대이터\설\ICANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT AV 3m BBHA9120D517\_2014 VERTICAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 3  
memo :

		ReadAntenna	Preamp	Cable		Limit	Over	
	Freq	Level	Factor	Loss	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	2349.81	27.29	26.69	40.98	4.41	17.41	54.00	-36.59 Average
2	2357.88	27.14	26.70	40.99	4.41	17.26	54.00	-36.74 Average
3	2380.40	27.23	26.73	41.00	4.43	17.39	54.00	-36.61 Average
4	2389.04	27.69	26.74	41.01	4.44	17.86	54.00	-36.14 Average
5 *	2403.01	67.29	26.76	41.02	4.45	57.48	54.00	3.48 Average

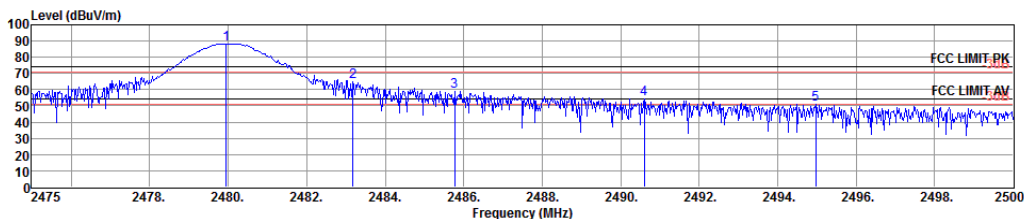
## Radiated Band Edges

**2480MHz**  
**Peak**  
**Horizontal**



BWS TECH INC

Data: 5 File: D:\방사대이터설\ICANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT PK 3m BBHA9120D517\_2014 HORIZONTAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 80  
memo :

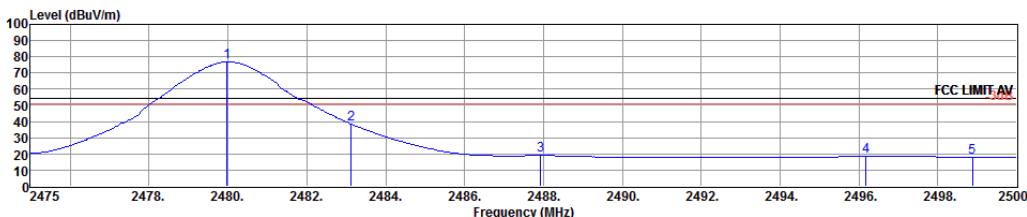
	ReadAntenna	Preamp	Cable	Limit	Over	
Freq	Level	Factor	Loss	Level	Line	Limit Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB
1 *	2479.95	97.94	26.86	41.07	4.50	88.23 74.00 14.23 Peak
2	2483.18	74.75	26.86	41.07	4.51	65.05 74.00 -8.95 Peak
3	2485.78	68.57	26.86	41.07	4.51	58.87 74.00 -15.13 Peak
4	2490.60	63.70	26.87	41.07	4.51	54.01 74.00 -19.99 Peak
5	2494.98	60.51	26.87	41.08	4.52	50.82 74.00 -23.18 Peak

**2480MHz**  
**Average**  
**Horizontal**



BWS TECH INC

Data: 6 File: D:\방사대이터설\ICANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT AV 3m BBHA9120D517\_2014 HORIZONTAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 80  
memo :

	ReadAntenna	Preamp	Cable	Limit	Over	
Freq	Level	Factor	Loss	Level	Line	Limit Remark
MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB
1 *	2479.98	86.74	26.86	41.07	4.50	77.03 54.00 23.03 Average
2	2483.13	48.02	26.86	41.07	4.51	38.32 54.00 -15.68 Average
3	2487.93	28.76	26.87	41.07	4.51	19.07 54.00 -34.93 Average
4	2496.18	28.53	26.88	41.08	4.52	18.85 54.00 -35.15 Average
5	2498.88	27.42	26.88	41.08	4.52	17.74 54.00 -36.26 Average

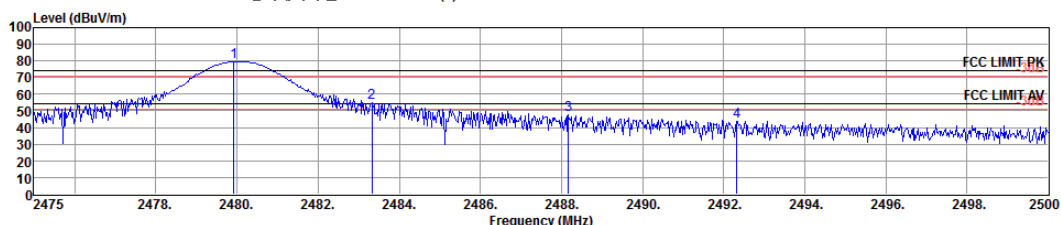
## Radiated Band Edges

**2480MHz**  
**Peak**  
**Vertical**



BWS TECH

Data: 7 File: D:\방사대이터\설\CANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT PK 3m BBHA9120D517\_2014 VERTICAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 80  
memo :

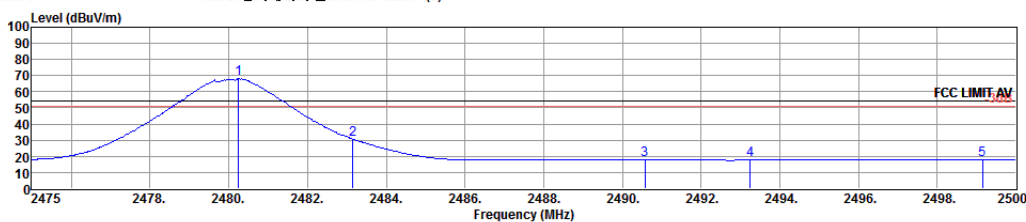
		ReadAntenna	Preamp	Cable		Limit	Over	
	Freq	Level	Factor	Factor	Loss	Level	Line	Limit Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1 *	2479.93	89.05	26.86	41.07	4.50	79.34	74.00	5.34 Peak
2	2483.33	64.37	26.86	41.07	4.51	54.67	74.00	-19.33 Peak
3	2488.18	57.40	26.87	41.07	4.51	47.71	74.00	-26.29 Peak
4	2492.33	53.69	26.87	41.08	4.51	43.99	74.00	-30.01 Peak

**2480MHz**  
**Average**  
**Vertical**



BWS TECH IN

Data: 8 File: D:\방사대이터\설\CANTOPS.EM6 (8)



Site : SVSWR Chamber  
Condition: FCC LIMIT AV 3m BBHA9120D517\_2014 VERTICAL  
eut : CanTops- CTS-ICOM  
mode : GFSK Channel 80  
memo :

		ReadAntenna	Preamp	Cable		Limit	Over	
	Freq	Level	Factor	Factor	Loss	Level	Line	Limit Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1 *	2480.25	77.98	26.86	41.07	4.50	68.27	54.00	14.27 Average
2	2483.15	40.47	26.86	41.07	4.51	30.77	54.00	-23.23 Average
3	2490.58	27.82	26.87	41.07	4.51	18.13	54.00	-35.87 Average
4	2493.25	27.39	26.87	41.08	4.51	17.69	54.00	-36.31 Average
5	2499.15	27.75	26.88	41.08	4.52	18.07	54.00	-35.93 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.

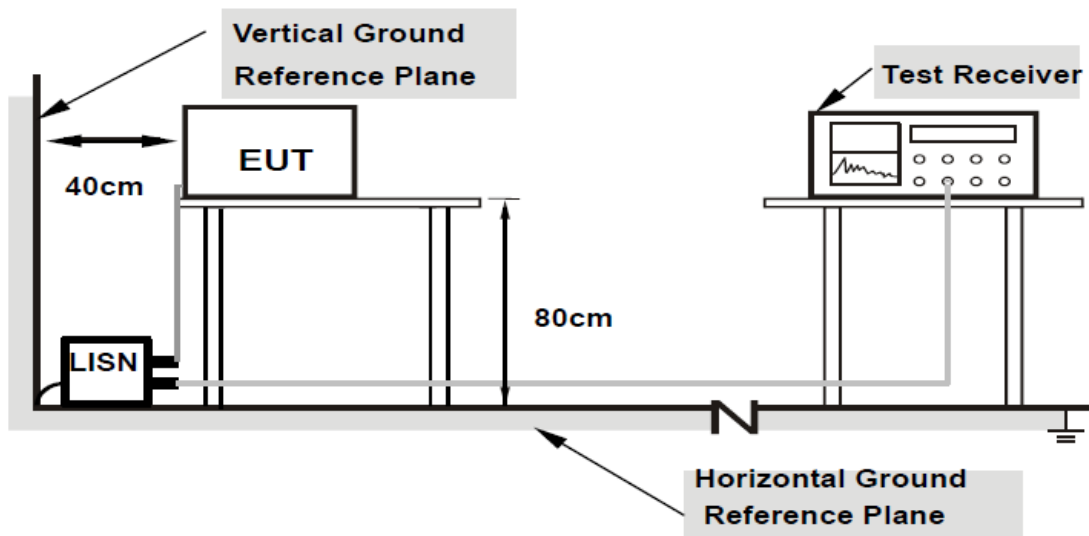
Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

### 5.7.3 Test Procedures

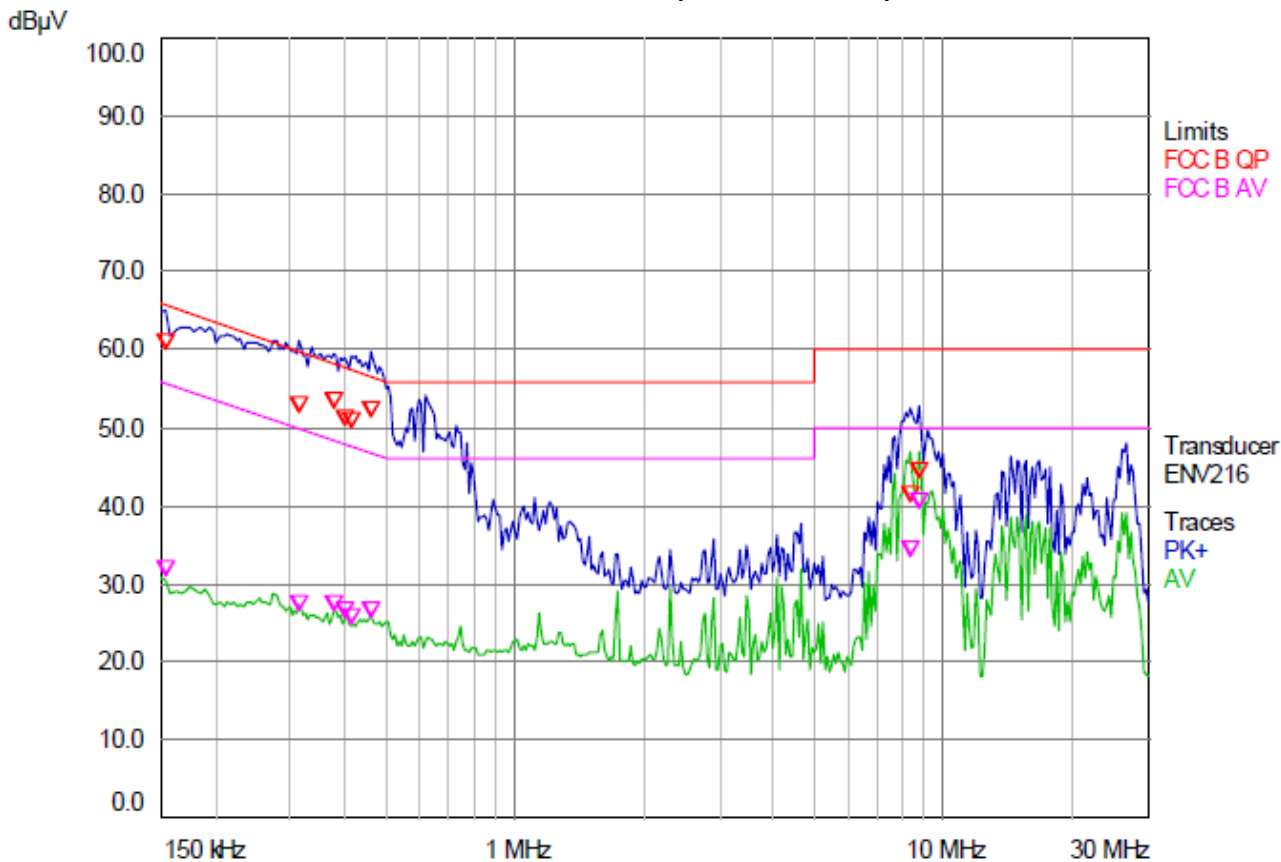
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room and was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network(LISN).
3. All the support units are connecting to the other 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



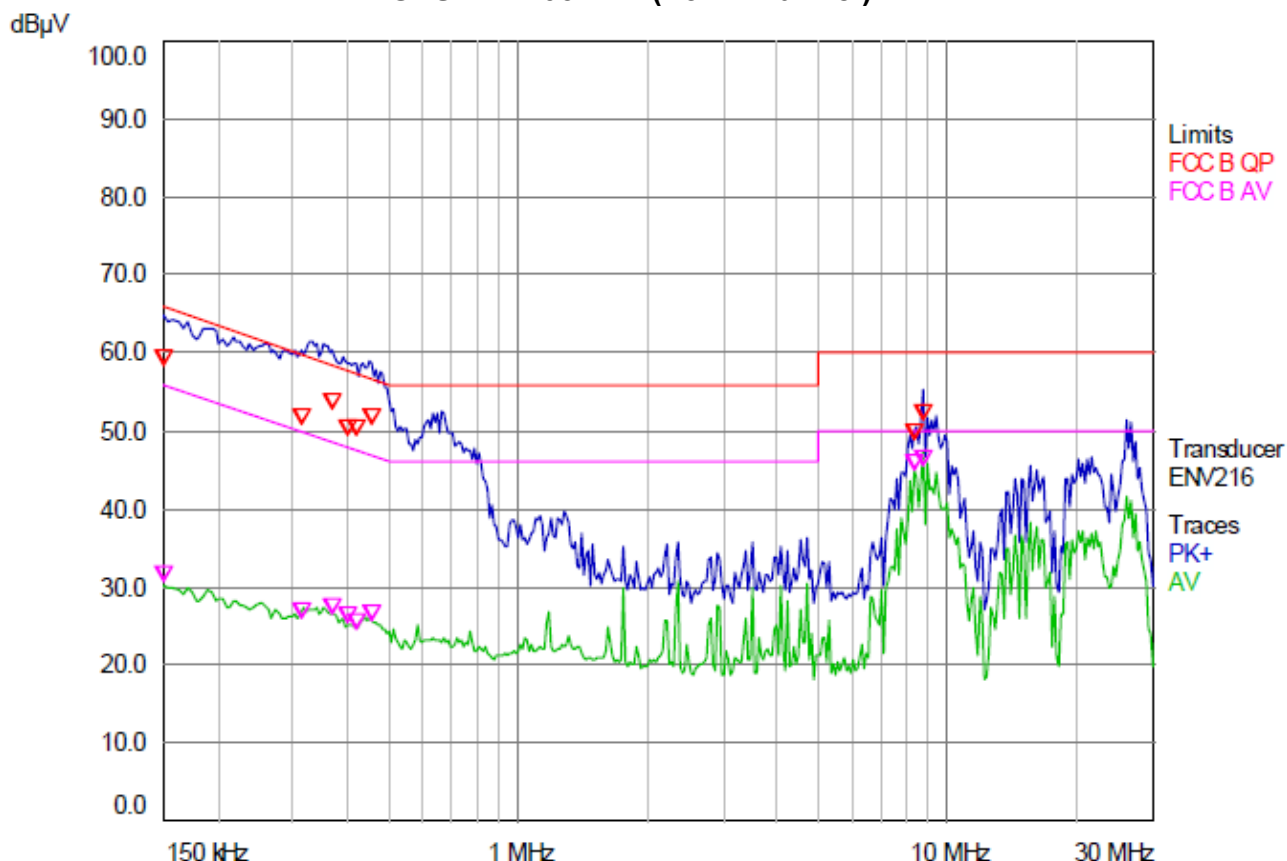
## 5.7.5 Test Result

### GFSK - 2403 MHz(Low Channel)-H



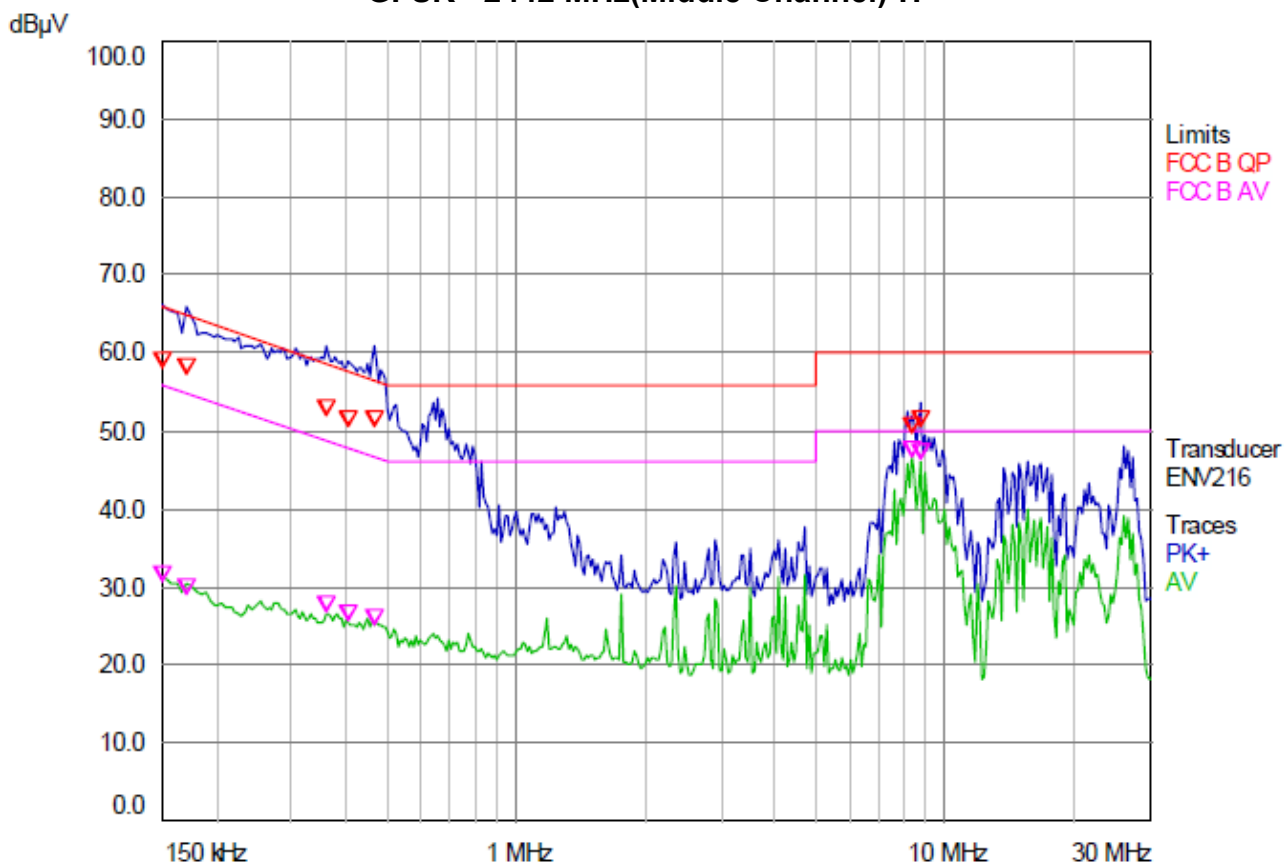
Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.154	60.11	65.78	-5.67		
2 AV	0.154	31.14	55.78	-24.64		
1 QP	0.314	52.00	59.86	-7.86		
2 AV	0.314	26.64	49.86	-23.22		
1 QP	0.378	52.54	58.32	-5.78		
2 AV	0.378	26.57	48.32	-21.75		
1 QP	0.402	50.36	57.81	-7.45		
2 AV	0.402	25.57	47.81	-22.24		
1 QP	0.418	50.08	57.49	-7.41		
2 AV	0.418	24.87	47.49	-22.62		
1 QP	0.462	51.52	56.66	-5.14		
2 AV	0.462	25.82	46.66	-20.84		
1 QP	8.312	40.59	60.00	-19.41		
2 AV	8.312	33.41	50.00	-16.59		
1 QP	8.756	43.54	60.00	-16.46		
2 AV	8.764	39.70	50.00	-10.30		

### GFSK - 2403 MHz(Low Channel)-N



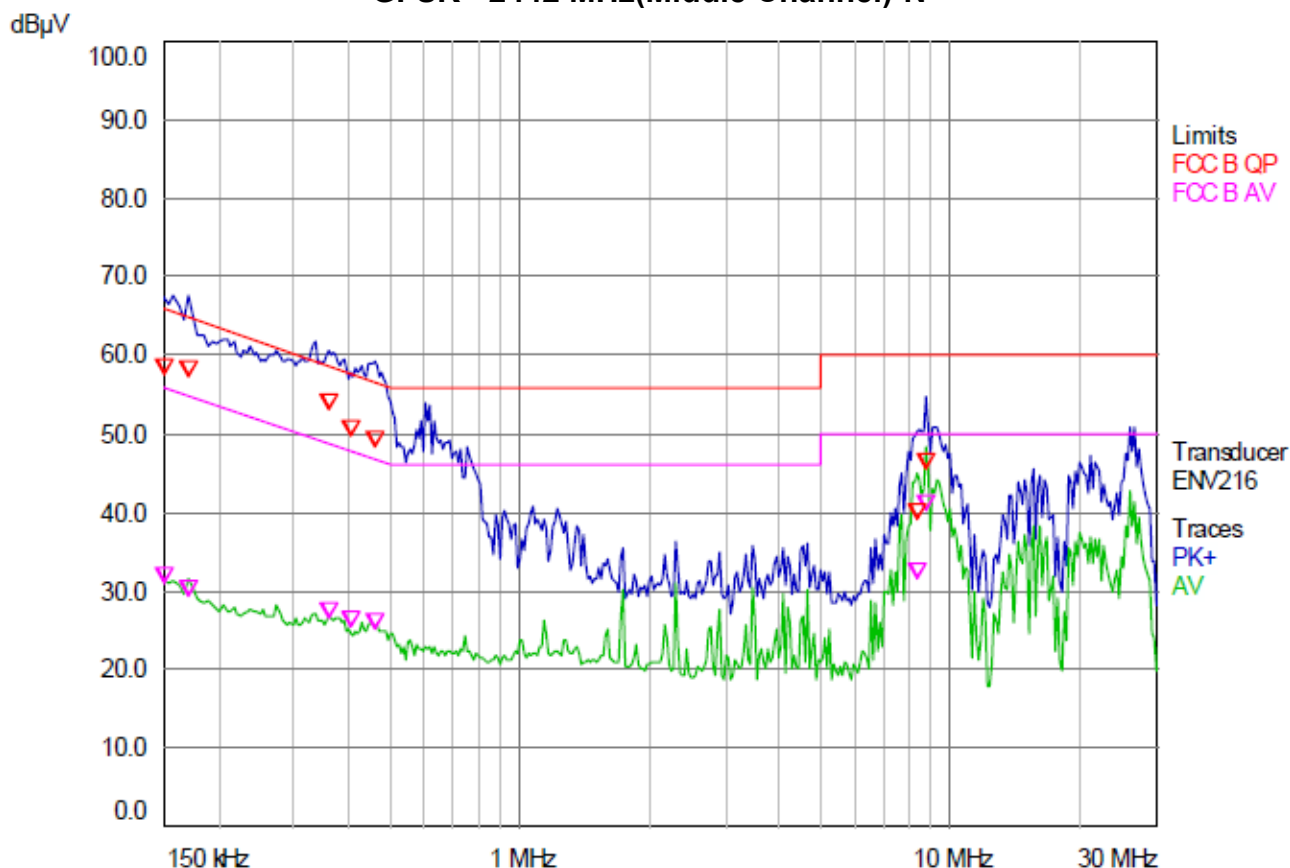
Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.15	58.35	66.00	-7.65		
2 AV	0.15	30.81	56.00	-25.19		
1 QP	0.314	50.90	59.86	-8.96		
2 AV	0.314	25.96	49.86	-23.90		
1 QP	0.37	52.83	58.50	-5.67		
2 AV	0.37	26.47	48.50	-22.03		
1 QP	0.402	49.53	57.81	-8.28		
2 AV	0.402	25.32	47.81	-22.49		
1 QP	0.422	49.41	57.41	-8.00		
2 AV	0.422	24.46	47.41	-22.95		
1 QP	0.458	50.86	56.73	-5.87		
2 AV	0.458	25.79	46.73	-20.94		
1 QP	8.344	48.88	60.00	-11.12		
2 AV	8.344	44.93	50.00	-5.07		
1 QP	8.784	51.46	60.00	-8.54		
2 AV	8.784	45.61	50.00	-4.39		

### GFSK - 2442 MHz(Middle Channel)-H



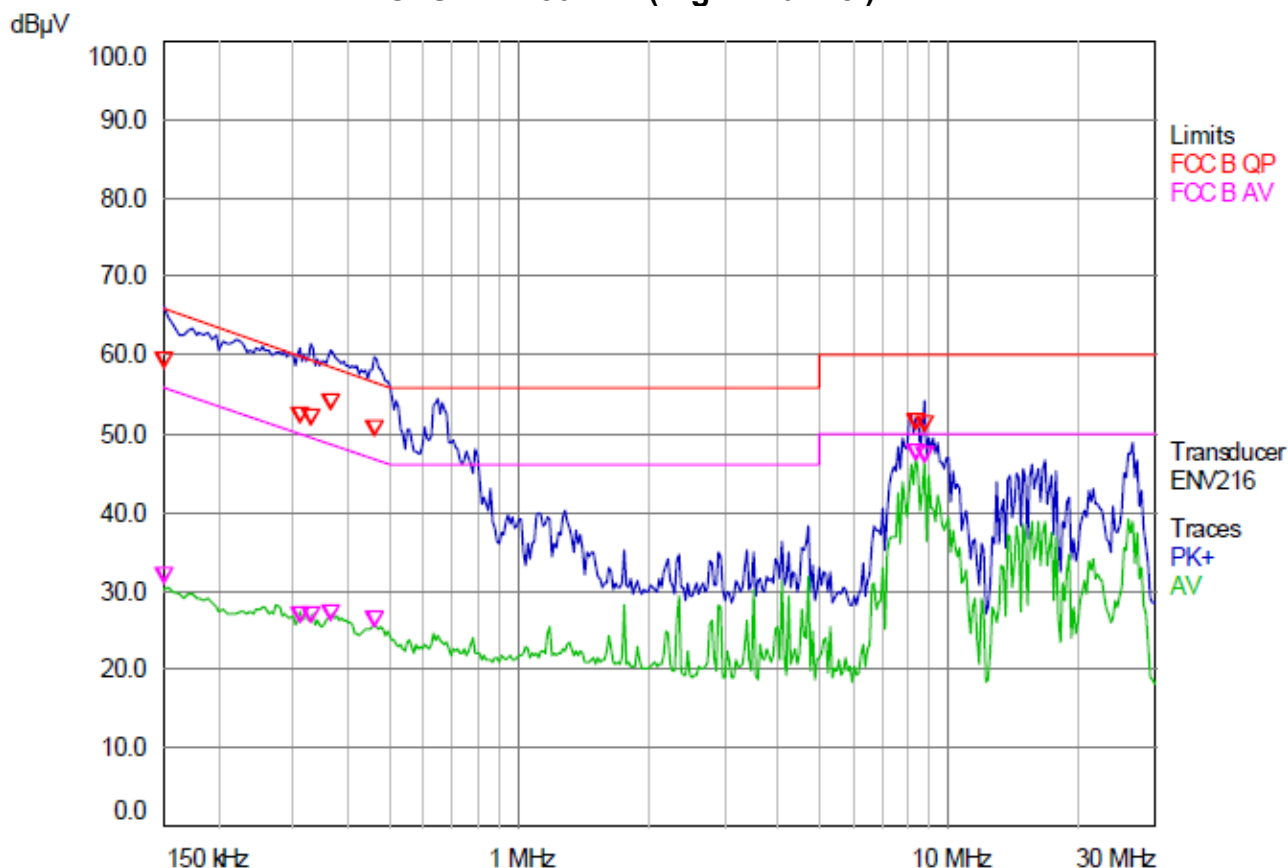
Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.15	58.00	66.00	-8.00		
2 AV	0.15	30.80	56.00	-25.20		
1 QP	0.17	57.26	64.96	-7.70		
2 AV	0.17	28.97	54.96	-25.99		
1 QP	0.362	52.09	58.68	-6.59		
2 AV	0.362	26.81	48.68	-21.87		
1 QP	0.406	50.55	57.73	-7.18		
2 AV	0.406	25.65	47.73	-22.08		
1 QP	0.47	50.58	56.51	-5.93		
2 AV	0.47	25.27	46.51	-21.24		
1 QP	8.34	49.59	60.00	-10.41		
2 AV	8.344	46.72	50.00	-3.28		
1 QP	8.784	50.47	60.00	-9.53		
2 AV	8.796	46.46	50.00	-3.54		

### GFSK - 2442 MHz(Middle Channel)-N



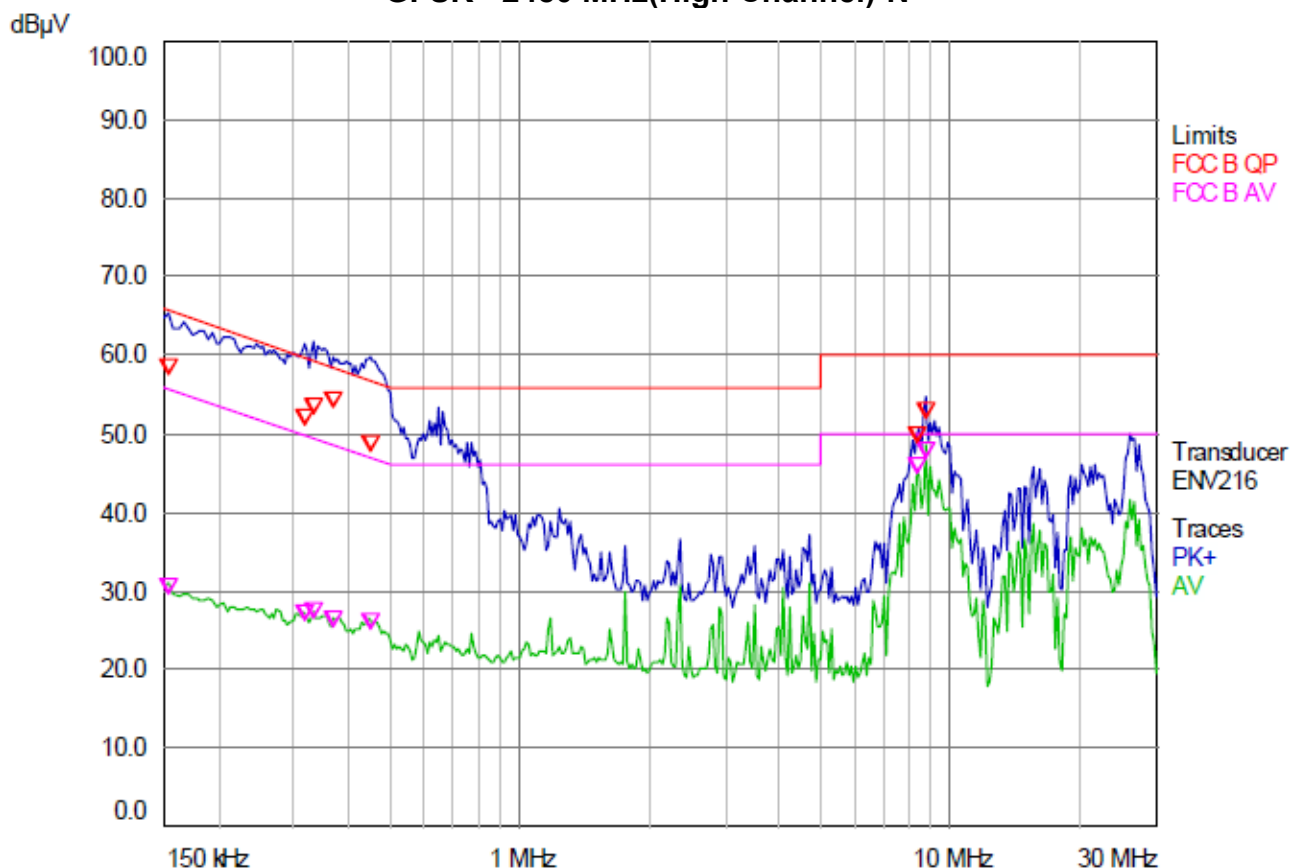
Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.15	57.61	66.00	-8.39		
2 AV	0.15	31.06	56.00	-24.94		
1 QP	0.17	57.13	64.96	-7.83		
2 AV	0.17	29.43	54.96	-25.53		
1 QP	0.362	53.02	58.68	-5.66		
2 AV	0.362	26.67	48.68	-22.01		
1 QP	0.406	49.77	57.73	-7.96		
2 AV	0.406	25.45	47.73	-22.28		
1 QP	0.462	48.38	56.66	-8.28		
2 AV	0.462	25.01	46.66	-21.65		
1 QP	8.312	39.08	60.00	-20.92		
2 AV	8.312	31.69	50.00	-18.31		
1 QP	8.76	45.45	60.00	-14.55		
2 AV	8.76	40.20	50.00	-9.80		

### GFSK - 2480 MHz(High Channel)-H



Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.15	58.45	66.00	-7.55		
2 AV	0.15	31.00	56.00	-25.00		
1 QP	0.31	51.40	59.97	-8.57		
2 AV	0.31	25.87	49.97	-24.10		
1 QP	0.33	51.08	59.45	-8.37		
2 AV	0.33	25.93	49.45	-23.52		
1 QP	0.366	53.08	58.59	-5.51		
2 AV	0.366	26.27	48.59	-22.32		
1 QP	0.462	49.59	56.66	-7.07		
2 AV	0.462	25.31	46.66	-21.35		
1 QP	8.344	50.55	60.00	-9.45		
2 AV	8.344	46.77	50.00	-3.23		
1 QP	8.784	50.40	60.00	-9.60		
2 AV	8.796	46.34	50.00	-3.66		

### GFSK - 2480 MHz(High Channel)-N



Trace	Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 QP	0.154	57.53	65.78	-8.25		
2 AV	0.154	29.72	55.78	-26.06		
1 QP	0.318	51.09	59.76	-8.67		
2 AV	0.318	26.25	49.76	-23.51		
1 QP	0.334	52.41	59.35	-6.94		
2 AV	0.334	26.57	49.35	-22.78		
1 QP	0.37	53.34	58.50	-5.16		
2 AV	0.37	25.52	48.50	-22.98		
1 QP	0.454	47.77	56.80	-9.03		
2 AV	0.454	25.24	46.80	-21.56		
1 QP	8.344	48.99	60.00	-11.01		
2 AV	8.344	44.98	50.00	-5.02		
1 QP	8.789	51.92	60.00	-8.08		
2 AV	8.789	46.98	50.00	-3.02		

## 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	3 dBi	≤6 dBi

### 5.8.2 Result

PASS