

## FCC 47 CFR PART 15 SUBPART C

### RF Test Report

Applicant : Compacta International, Ltd  
Product Type : 2011D  
Trade Name : Smartenit  
Model Number : 2011D  
Test Specification : FCC 47 CFR PART 15 SUBPART C  
ANSI C63.10:2013  
Receive Date : Sep. 23, 2016  
Test Period : Sep. 23 ~ Nov. 02, 2016  
Issue Date : Nov. 07, 2016

#### Issue by

A Test Lab Techno Corp.  
No. 140-1, Changan Street, Bade District,  
Taoyuan City 33465, Taiwan (R.O.C)  
Tel : +886-3-2710188 / Fax : +886-3-2710190



Taiwan Accreditation Foundation accreditation number: 1330

FCC Accredited Test Site Number: 510205

**Note:** This report shall not be reproduced except in full, without the written approval of A Test Lab Techno Corp. This document may be altered or revised by A Test Lab Techno Corp. personnel only, and shall be noted in the revision section of the document. The client should not use it to claim product endorsement by TAF, or any government agencies. The test results in the report only apply to the tested sample.



### **Revision History**

Rev.	Issue Date	Revisions	Revised By
00	Nov. 07, 2016	Initial Issue	Nina Lin

# Verification of Compliance

Issued Date: Nov. 07, 2016

Applicant : Compacta International, Ltd  
Product Type : 2011D  
Trade Name : Smartenit  
Model Number : 2011D  
FCC ID : AFZ-2011D  
EUT Rated Voltage : DC 5V  
Test Voltage : 120 Vac / 60 Hz  
Applicable Standard : FCC 47 CFR PART 15 SUBPART C  
ANSI C63.10:2013  
Test Result : Complied  
Performing Lab. : A Test Lab Techno Corp.  
No. 140-1, Changan Street, Bade District,  
Taoyuan City 33465, Taiwan (R.O.C)  
Tel : +886-3-2710188 / Fax : +886-3-2710190  
Taiwan Accreditation Foundation accreditation number: 1330  
<http://www.atl-lab.com.tw/e-index.htm>

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By  
(Manager)

: Fly Lu  
(Fly Lu)

Reviewed By

(Testing Engineer)

: Eric Ou Yang  
(Eric Ou Yang)

## TABLE OF CONTENTS

<b>1</b>	<b>General Information .....</b>	<b>6</b>
<b>2</b>	<b>EUT Description.....</b>	<b>7</b>
<b>3</b>	<b>Test Methodology.....</b>	<b>8</b>
3.1.	Mode of Operation.....	8
3.2.	EUT Exercise Software .....	8
3.3.	Configuration of Test System Details.....	9
3.4.	Test Site Environment.....	9
<b>4</b>	<b>AC Power Line Conducted Emission Measurement.....</b>	<b>10</b>
4.1.	Limit.....	10
4.2.	Test Instruments .....	10
4.3.	Test Setup .....	10
4.4.	Test Procedure .....	11
4.5.	Test Result.....	12
<b>5</b>	<b>Radiated Emission Measurement .....</b>	<b>14</b>
5.1.	Limit.....	14
5.2.	Test Instruments .....	14
5.3.	Setup .....	15
5.4.	Test Procedure .....	16
5.5.	Test Result.....	18
<b>6</b>	<b>Maximum Conducted Output Power Measurement.....</b>	<b>24</b>
6.1.	Limit.....	24
6.2.	Test Setup .....	24
6.3.	Test Instruments .....	24
6.4.	Test Procedure .....	24
6.5.	Test Result.....	25
<b>7</b>	<b>6dB RF Bandwidth and 99 % Occupied Bandwidth Measurement.....</b>	<b>26</b>
7.1.	Limit.....	26
7.2.	Test Setup .....	26
7.3.	Test Instruments .....	26
7.4.	Test Procedure .....	26
7.5.	Test Result.....	27
7.6.	Test Graphs.....	28

<b>8 Maximum Power Density Measurement .....</b>	<b>29</b>
8.1. Limit.....	29
8.2. Test Setup .....	29
8.3. Test Instruments .....	29
8.4. Test Procedure .....	29
8.5. Test Result.....	30
8.6. Test Graphs .....	31
<b>9 Out of Band Conducted Emissions Measurement .....</b>	<b>32</b>
9.1. Limit.....	32
9.2. Test Setup .....	32
9.3. Test Instruments .....	32
9.4. Test Procedure .....	32
9.5. Test Graphs .....	33
<b>10 Antenna Measurement.....</b>	<b>36</b>
10.1.Limit.....	36
10.2.Antenna Connector Construction .....	36

## 1 General Information

### 1.1 Summary of Test Result

FCC Standard	Item	Result	Remark
15.207	AC Power Conducted Emission	PASS	-----
15.247(d)	Transmitter Radiated Emissions	PASS	-----
15.247(b)(3)	Max. Output Power	PASS	-----
15.247(a)(2)	6dB RF Bandwidth	PASS	-----
15.247(e)	Power Spectral Density	PASS	-----
15.247(c)	Out of Band Conducted Spurious Emission	PASS	-----
15.203	Antenna Requirement	PASS	-----

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

### 1.2 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9kHz ~ 150kHz	2.7
	150kHz ~ 30MHz	2.8
Radiated Emission	9kHz ~ 30MHz	1.457
	30MHz ~ 1000MHz	6.300
	1000MHz ~ 18000MHz	5.474
	18000MHz ~ 26500MHz	5.630
	26500MHz ~ 40000MHz	5.054
Conducted Output Power	+0.27 dB / -0.28 dB	
RF Bandwidth	4.96%	
Power Spectral Density	+0.71 dB / -0.77 dB	

## 2 EUT Description

Applicant	Compacta International, Ltd 31342 Via Las Palmas, San Juan Capistrano, California , United States, 92675 Office:29222 Rancho Viejo Rd., Suite 105 San Juan Capistrano, CA 92675 USA
Manufacturer	Meshreen Technology Ltd. No.11-3, Ln. 162, Mingde Rd., Guishan Township, Taoyuan County 33347, Taiwan
Product Type	2011D
Trade Name	Smartenit
Model Number	2011D
FCC ID	AFZ-2011D
Frequency Range	2405 MHz ~ 2480 MHz
Modulation Type	O-QPSK
Channel Number	16CH
Antenna Type	PCB Antenna
Antenna Gain	1.2 dBi
RF Output Power	0.007 W / 8.57 dBm

### 3 Test Methodology

#### 3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Continuous TX mode
Mode 2: ZigBee mode

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

ZigBee link mode:

Channel Low (2405MHz), Channel Mid (2440MHz) and Channel High (2480MHz) were chosen for full testing.

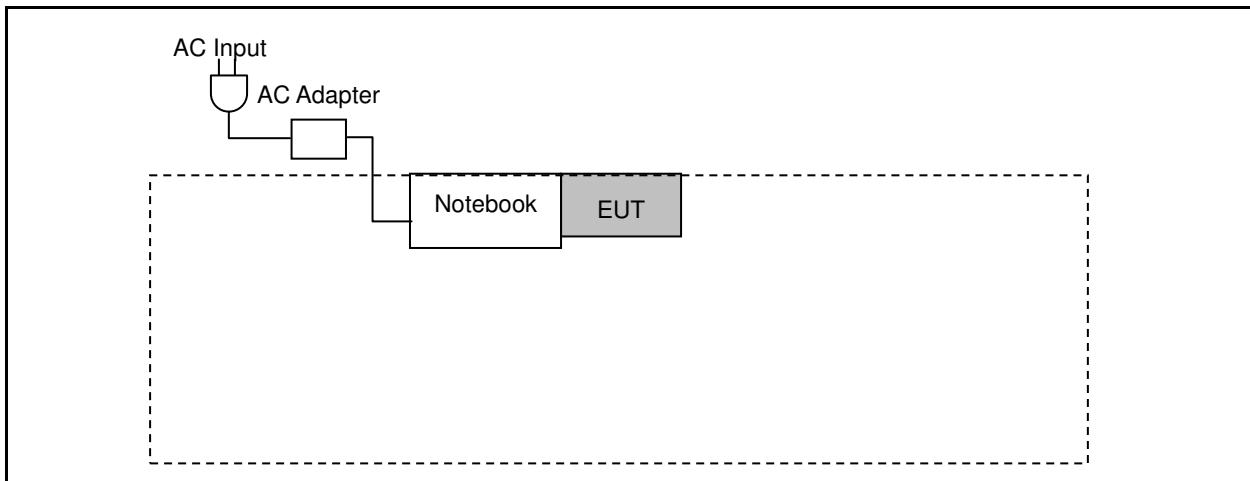
#### 3.2. EUT Exercise Software

1	Setup the EUT shown on 3.3.
2	Turn on the power of all equipment.
3	Turn on Zigbee function link to Notebook and run test program
4	EUT run test program.

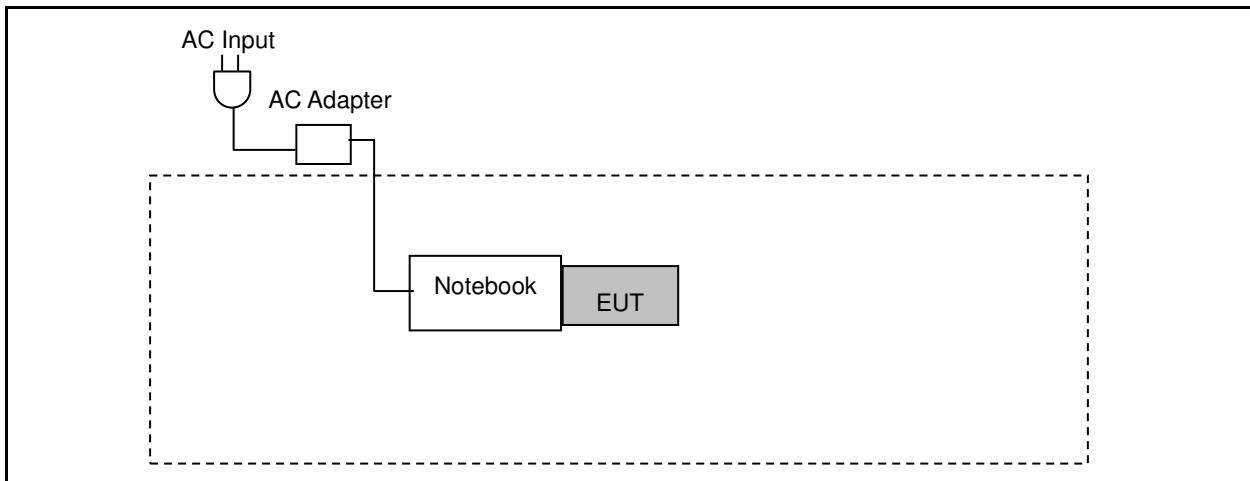
Measurement Software
1 EZ-EMC Ver. ATL-03A1-1
2 EZ-EMC Ver ATL-ITC-3A1-1

### 3.3. Configuration of Test System Details

#### Conducted Emissions



#### Radiated Emissions



### 3.4. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

## 4 AC Power Line Conducted Emission Measurement

### 4.1. Limit

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

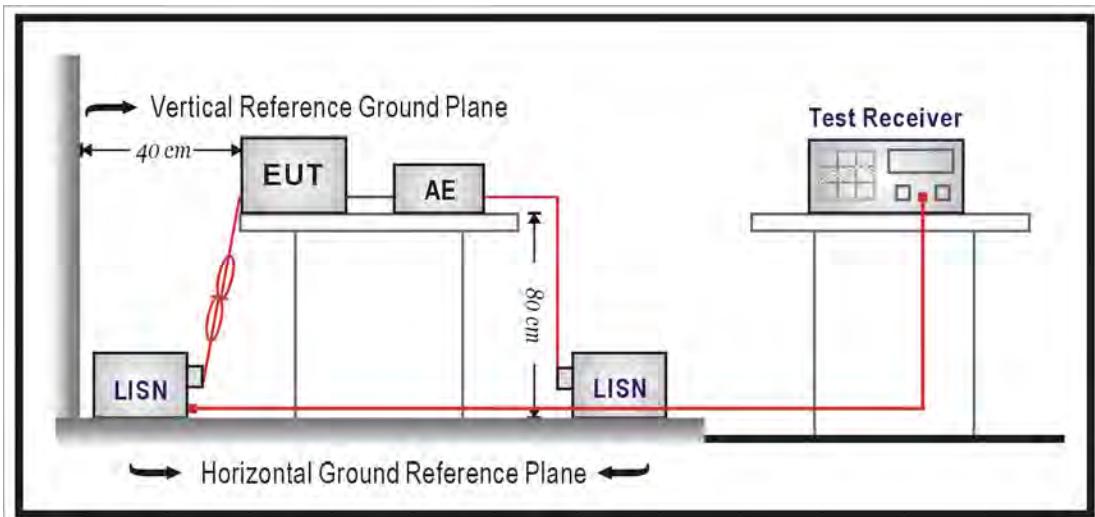
### 4.2. Test Instruments

Describe	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Test Receiver	R&S	ESCI	100367	05/31/2016	(1)
LISN	R&S	ENV216	101040	03/15/2016	(1)
LISN	R&S	ENV216	101041	03/07/2016	(1)
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

Note: N.C.R. = No Calibration Request.

### 4.3. Test Setup



#### 4.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a  $50\Omega$  //  $50\mu\text{H}$  coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a  $50\Omega$  //  $50\mu\text{H}$  coupling impedance with  $50\text{ohm}$  termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12mm insulating material.

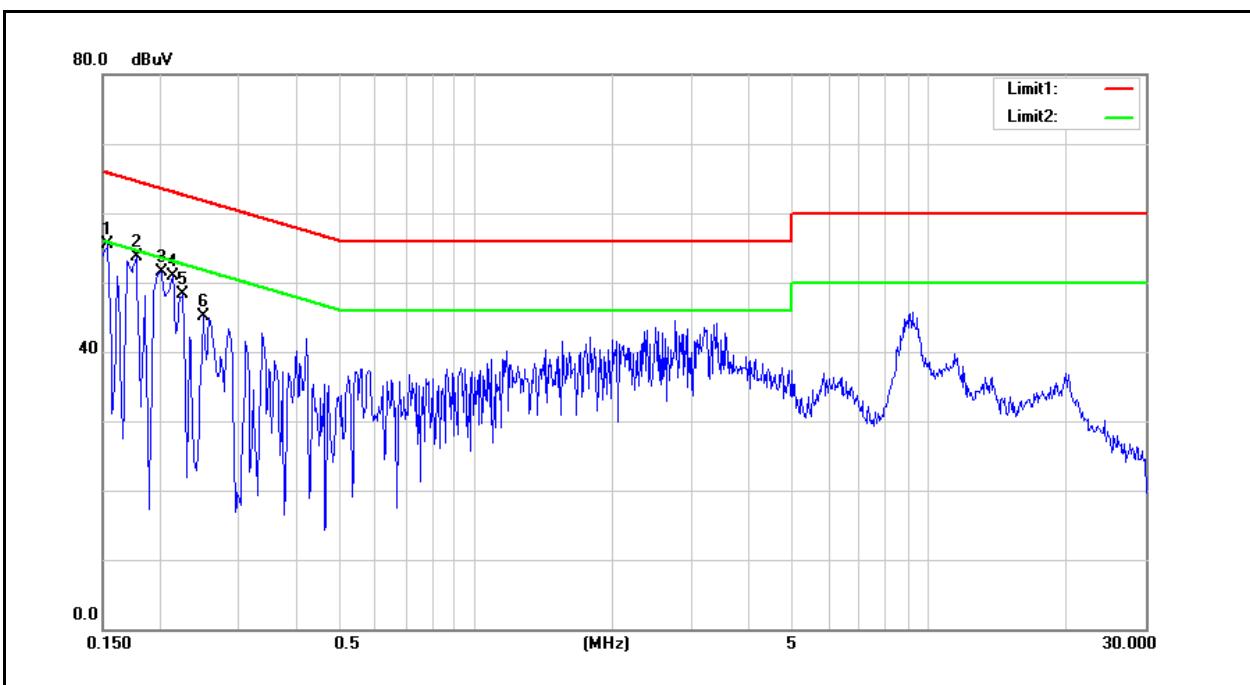
Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150kHz to 30MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0,8 m from the AMN. If the mains power cable is longer than 1m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4m. All of interconnecting cables that hang closer than 40cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1m. All  $50\Omega$  ports of the LISN shall be resistively terminated into  $50\Omega$  loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

#### 4.5. Test Result

Standard:	FCC Part 15C	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Mode:	1	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Date: 09/23/2016			
Description:			

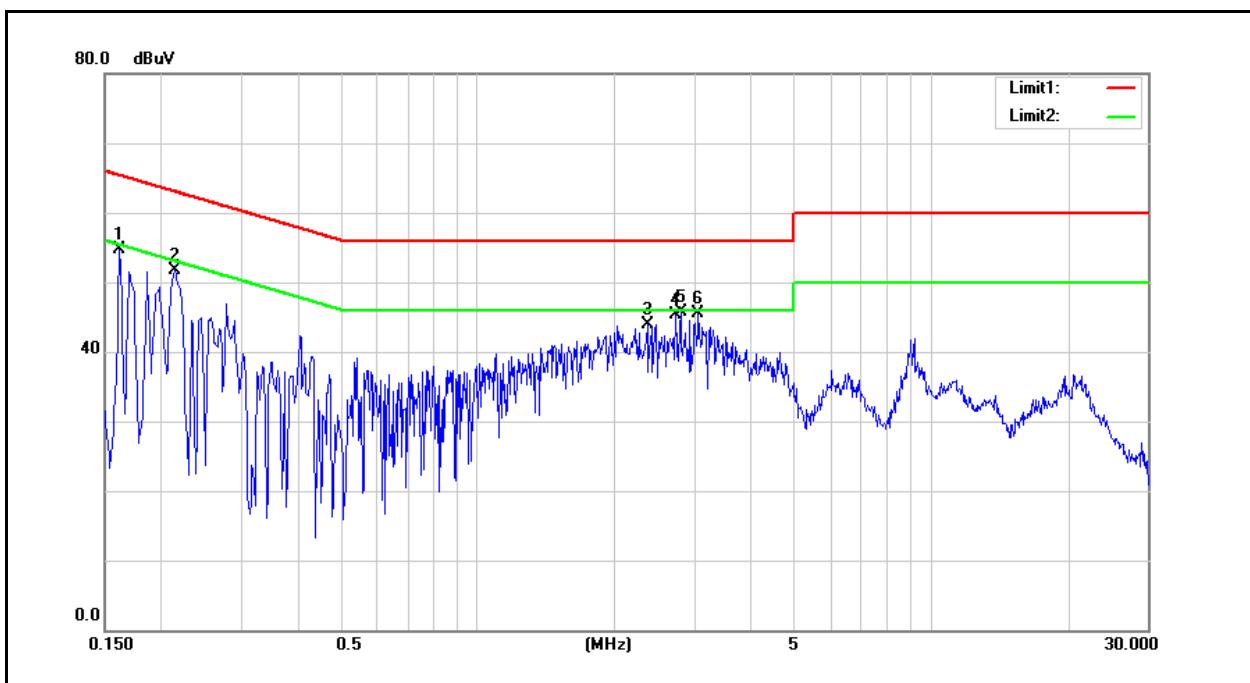


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1540	39.30	13.29	9.60	48.90	22.89	65.78	55.78	-16.88	-32.89	Pass
2	0.1780	35.93	10.56	9.59	45.52	20.15	64.58	54.58	-19.06	-34.43	Pass
3	0.2020	38.08	24.77	9.59	47.67	34.36	63.53	53.53	-15.86	-19.17	Pass
4	0.2140	37.06	24.03	9.59	46.65	33.62	63.05	53.05	-16.40	-19.43	Pass
5	0.2260	30.83	7.98	9.59	40.42	17.57	62.60	52.60	-22.18	-35.03	Pass
6	0.2500	28.95	5.63	9.60	38.55	15.23	61.76	51.76	-23.21	-36.53	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Standard:	FCC Part 15C	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Mode:	1	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Date: 09/23/2016			
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1620	37.87	11.00	9.59	47.46	20.59	65.36	55.36	-17.90	-34.77	Pass
2	0.2140	37.79	23.69	9.58	47.37	33.27	63.05	53.05	-15.68	-19.78	Pass
3	2.3660	30.91	18.82	9.69	40.60	28.51	56.00	46.00	-15.40	-17.49	Pass
4	2.7260	29.55	15.83	9.71	39.26	25.54	56.00	46.00	-16.74	-20.46	Pass
5	2.8020	29.09	14.58	9.71	38.80	24.29	56.00	46.00	-17.20	-21.71	Pass
6	3.0580	30.65	16.45	9.72	40.37	26.17	56.00	46.00	-15.63	-19.83	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

## 5 Radiated Emission Measurement

### 5.1. Limit

According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ( $\mu$ V/m at 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

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

### 5.2. Test Instruments

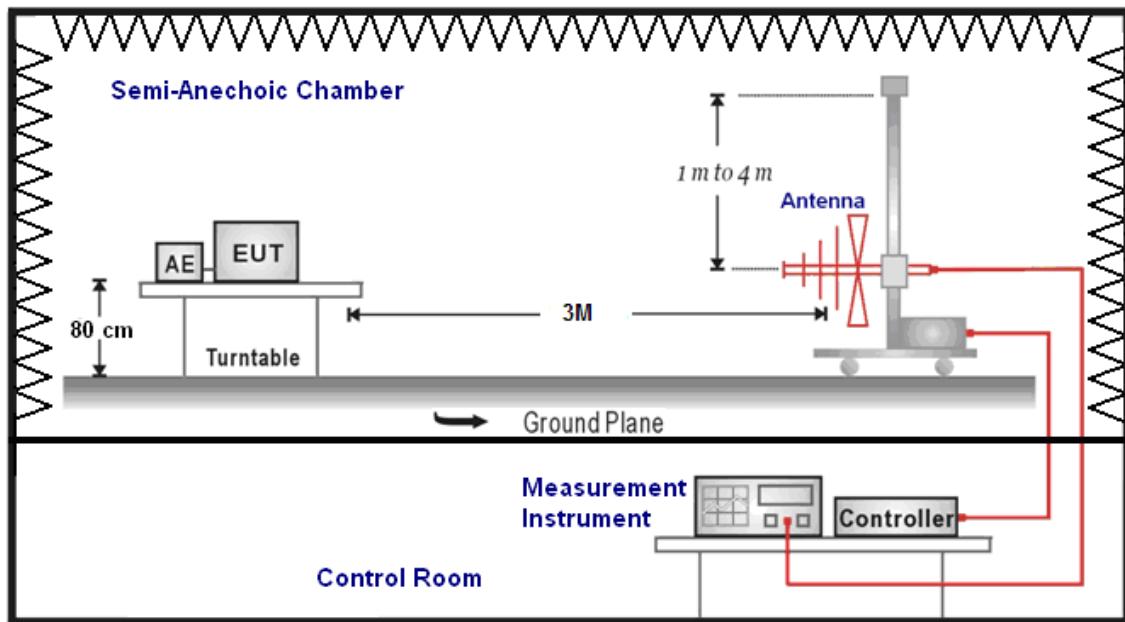
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
RF Pre-selector	Agilent	N9039A	MY46520256	01/08/2016	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/08/2016	(1)
Pre Amplifier	Agilent	8449B	3008A02237	10/07/2015	(1)
Pre Amplifier	Agilent	8447D	2944A11119	01/11/2016	(1)
Broadband Antenna	Schwarzbeck	VULB9168	416	09/26/2016	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/06/2016	(1)
Horn Antenna (18~40GHz)	ETS	3116	86467	09/05/2016	(1)
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	02/01/2016	(1)
Microwave Cable	EMCI	EMC102-KM-KM-14000	151001	10/15/2015	(1)
Microwave Cable	EMCI	EMC-104-SM-SM-14000	140202	10/15/2015	(1)
Microwave Cable	EMCI	EMC104-SM-SM-600	140301	10/15/2015	(1)
Test Site	ATL	TE01	TE01	08/26/2016	(1)

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

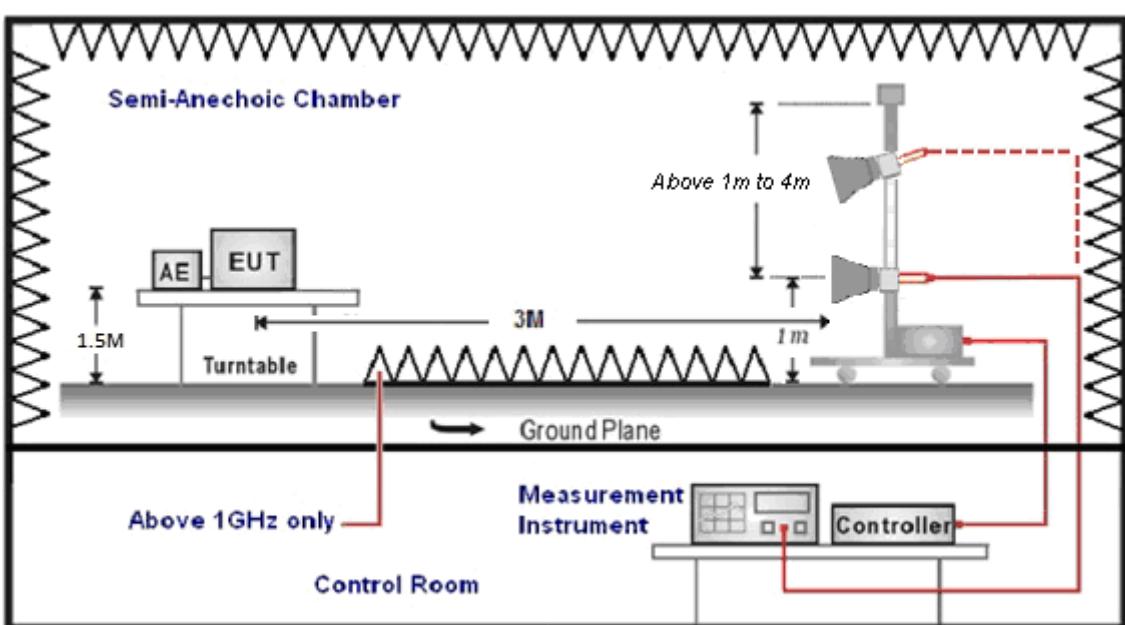
Note: N.C.R. = No Calibration Request.

### 5.3. Setup

Below 1GHz



Above 1GHz



## 5.4. Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height(below 1GHz use 0.8m turntable / above 1GHz use 1.5m turntable), top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 26.5 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna was used in frequencies 1 – 26.5 GHz at a distance of 1 meter. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20dB/decade).

For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts pre meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro colts per meter (dBuV/m).

The actual field intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

- (1) Amplitude (dBuV/m) = FI (dBuV) + AF (dBuV) + CL (dBuV) - Gain (dB)

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

- (2) Actual Amplitude (dBuV/m) = Amplitude (dBuV) - Dis(dB)

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(a) For fundamental frequency : Transmitter Output < +30dBm

(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

## 5.5. Test Result

### Below 1GHz

Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Mode:	1			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
				Date:	10/03/2016		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
173.0000	25.68	-5.68	20.00	43.50	-23.50	QP	H
303.0000	26.94	-3.33	23.61	46.00	-22.39	QP	H
381.0000	25.73	-2.07	23.66	46.00	-22.34	QP	H
558.5000	29.80	1.70	31.50	46.00	-14.50	QP	H
744.0000	26.04	5.87	31.91	46.00	-14.09	QP	H
901.0000	25.32	8.61	33.93	46.00	-12.07	QP	H
162.5000	27.77	-5.19	22.58	43.50	-20.92	QP	V
338.5000	26.30	-2.84	23.46	46.00	-22.54	QP	V
510.0000	27.57	0.88	28.45	46.00	-17.55	QP	V
613.5000	25.70	3.18	28.88	46.00	-17.12	QP	V
783.0000	24.98	6.46	31.44	46.00	-14.56	QP	V
851.5000	24.95	7.59	32.54	46.00	-13.46	QP	V

Note: No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

**Above 1GHz**

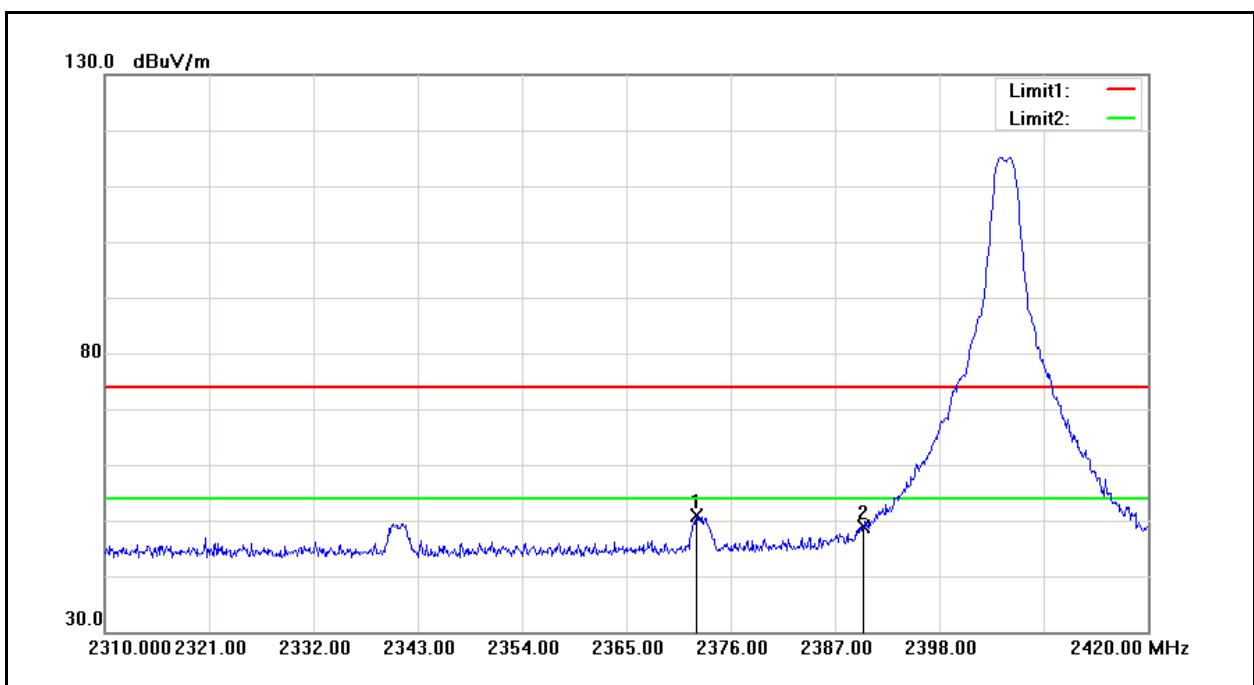
Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Mode:	2			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Frequency:	2405 MHz			Date:	10/03/2016		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4810.000	50.59	-8.00	42.59	74.00	-31.41	peak	H
4810.000	50.52	-8.00	42.52	74.00	-31.48	peak	V

Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Mode:	2			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Frequency:	2440 MHz			Date:	10/03/2016		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4880.000	50.49	-7.77	42.72	74.00	-31.28	peak	H
4880.000	50.62	-7.77	42.85	74.00	-31.15	peak	V

Standard:	FCC Part 15C			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Mode:	2			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Frequency:	2480 MHz			Date:	10/03/2016		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4960.000	51.72	-7.52	44.20	74.00	-29.80	peak	H
4960.000	51.55	-7.52	44.03	74.00	-29.97	peak	V

**Band Edge**

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Mode:	2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Frequency:	2405 MHz	Date:	10/03/2016
Ant.Polar.:	Horizontal		



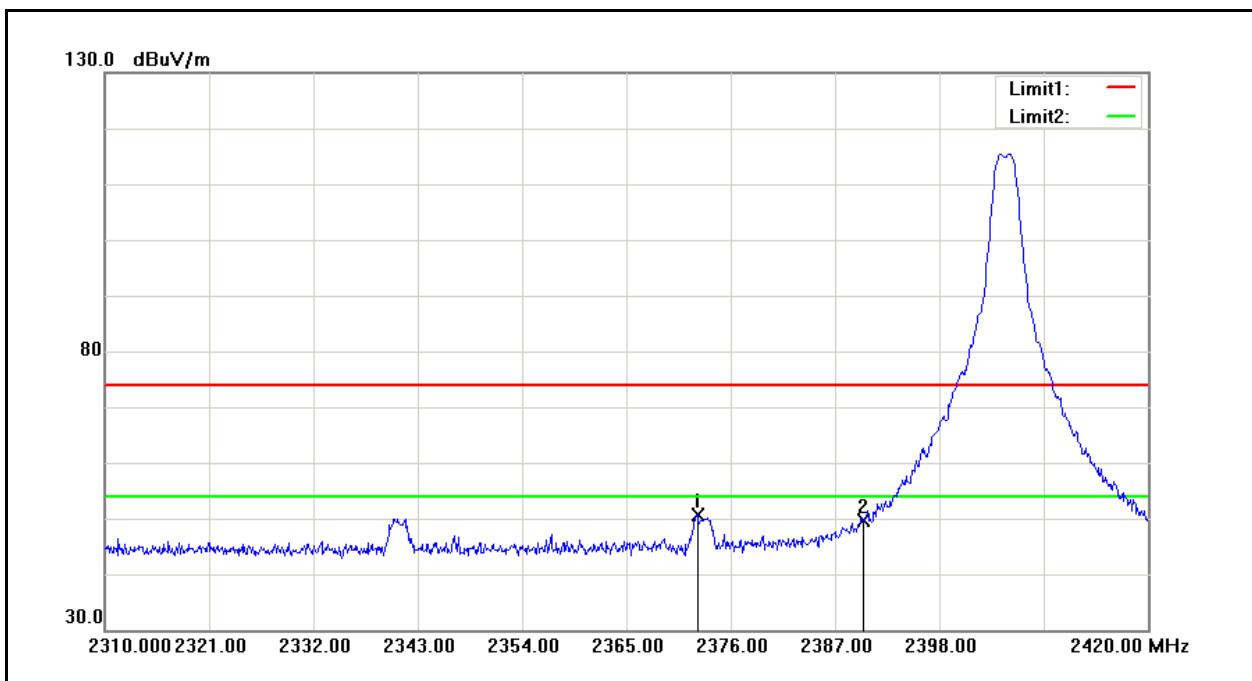
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2372.370	51.19	-0.41	50.78	74.00	-23.22	peak
2	2390.000	49.24	-0.34	48.90	74.00	-25.10	peak

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Mode:	2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Frequency:	2405 MHz	Date:	10/03/2016
Ant.Polar.:	Vertical		



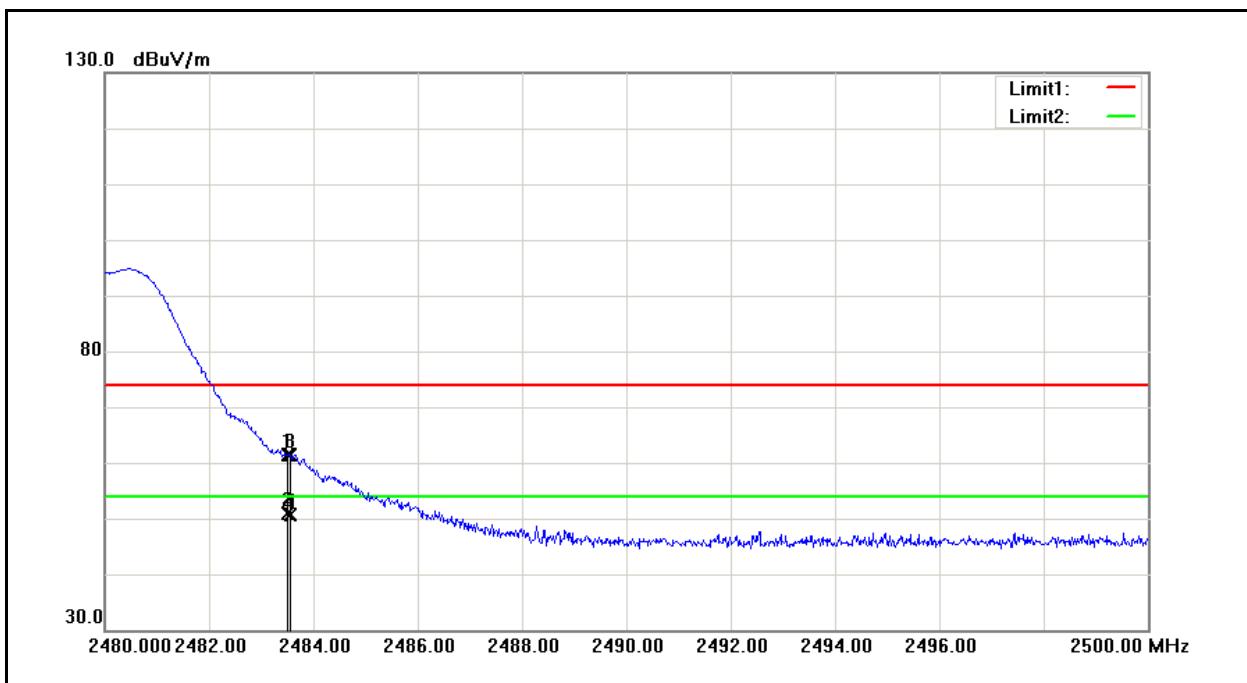
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2372.480	51.08	-0.41	50.67	74.00	-23.33	peak
2	2390.000	49.86	-0.34	49.52	74.00	-24.48	peak

Note: 1. Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Mode:	2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Frequency:	2480 MHz	Date:	10/03/2016
Ant.Polar.:	Horizontal		



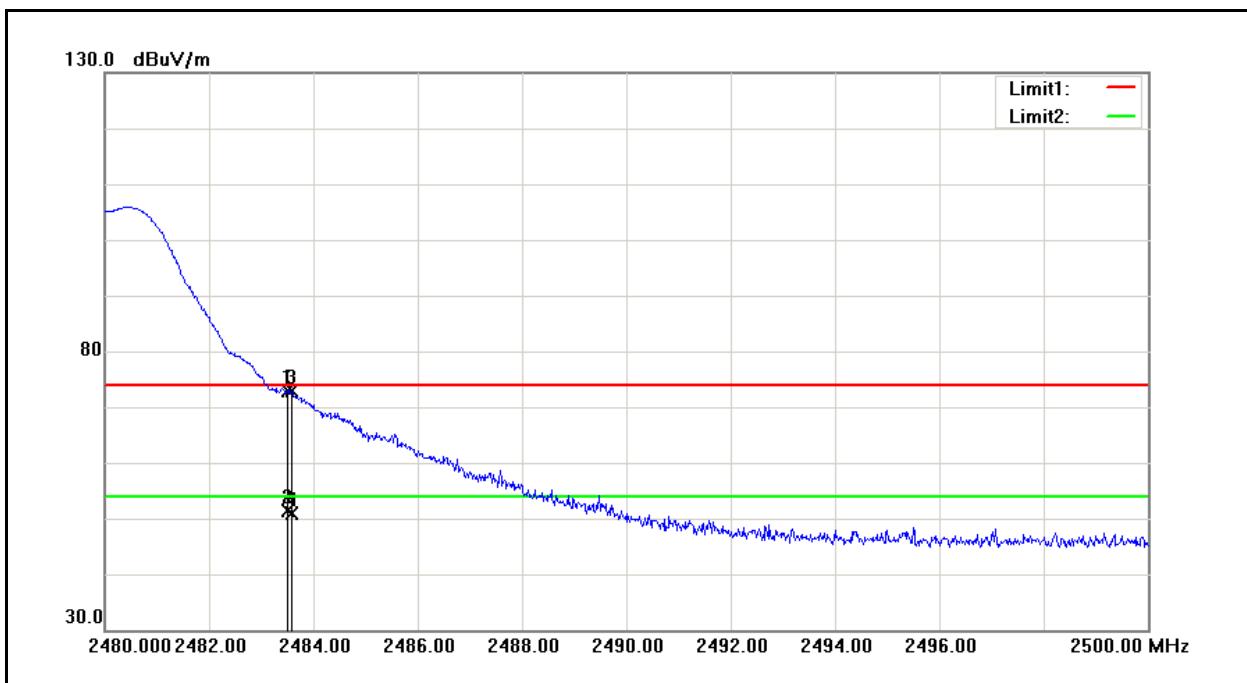
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	61.25	0.03	61.28	74.00	-12.72	peak
2	2483.500	50.94	0.03	50.97	54.00	-3.03	AVG
3	2483.560	61.43	0.03	61.46	74.00	-12.54	peak
4	2483.560	50.51	0.03	50.54	54.00	-3.46	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3. When the peak results are less than average limit, so not need to evaluate the average.

Standard:	FCC Part 15C	Test Distance:	3m
Test item:	Radiated Emission	Power:	AC 120V/60Hz
Mode:	2	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Frequency:	2480 MHz	Date:	10/03/2016
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	72.96	0.03	72.99	74.00	-1.01	peak
2	2483.500	51.40	0.03	51.43	54.00	-2.57	AVG
3	2483.580	72.86	0.03	72.89	74.00	-1.11	peak
4	2483.580	50.90	0.03	50.93	54.00	-3.07	AVG

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading(dBuV).

2.Correct factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

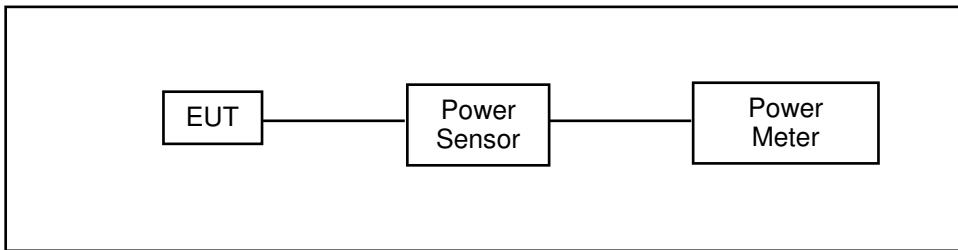
3. When the peak results are less than average limit, so not need to evaluate the average.

## 6 Maximum Conducted Output Power Measurement

### 6.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm.

### 6.2. Test Setup



### 6.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Single Channel PK Power Sensor	Agilent	N1911A	MY45101619	12/11/2015	(1)
Wideband Power Meter	Agilent	N1921A	MY45241957	12/11/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

Note: N.C.R. = No Calibration Request.

### 6.4. Test Procedure

The tests below are run with the EUT's transmitter set at high power in TX mode. The EUT is needed to force selection of output power level and channel number. While testing, EUT was set to transmit continuously. Remove the Subjective device's antenna and connect the RF output port to power sensor. The maximum peak output power shall not exceed 1 watt.

Use a direct connection between the antenna port of transmitter and the power sensor, for prevent the power sensor input attenuation 40-50 dB. Set the RBW Bandwidth of the emission or use a channel power meter mode.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm). For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to  $(GAIN - 6)/3$  dBm.

The antenna port of the EUT was connected to the input of a power sensor. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

## 6.5. Test Result

Test Item	Maximum Conducted Output Power				
Test Mode	Mode 2: ZigBee mode				
Date of Test	11/02/2016				
Frequency (MHz)	Average Power		Peak Power		Limit (dBm)
	(dBm)	(W)	(dBm)	(W)	
2405	<b>8.69</b>	<b>0.007</b>	<b>8.57</b>	<b>0.007</b>	< 30
2440	7.35	0.005	7.23	0.005	< 30
2480	4.89	0.003	4.73	0.003	< 30

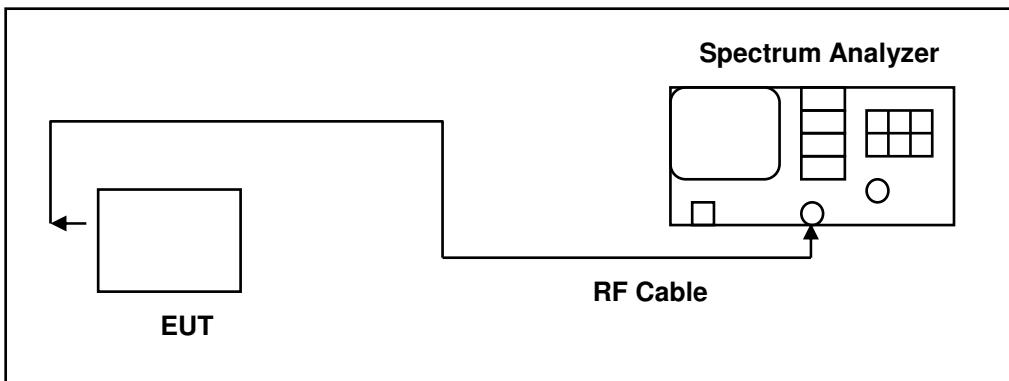
## 7 6dB RF Bandwidth and 99 % Occupied Bandwidth Measurement

### 7.1. Limit

6dB RF Bandwidth: Systems using digital modulation techniques may operate in the 2400–2483.5 MHz bands. The minimum 6 dB band-width shall be at least 500 kHz.

99 % Occupied Bandwidth: N/A

### 7.2. Test Setup



### 7.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

dRemark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

Note: N.C.R. = No Calibration Request.

### 7.4. Test Procedure

The EUT tested to DTS test procedure of KDB558074D01 for compliance to FCC 47CFR 15.247 requirements.

6dB RF Bandwidth: The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A peak output reading was taken, a DISPLAY line was drawn 6 dB lower than peak level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

The test was performed at 3 channels (Channel low, middle, high)

99 % Occupied Bandwidth: The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

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

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%.

The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

## 7.5. Test Result

Test Item	6dB RF Bandwidth and 99 % Occupied Bandwidth		
Test Mode	Mode 2: ZigBee mode		
Date of Test	10/05/2016		
Frequency (MHz)	6dB RF Bandwidth (kHz)	99 % Occupied Bandwidth (MHz)	6dB RF Bandwidth Limit (kHz)
2405	1419.000	2.209	> 500
2440	1537.000	2.246	> 500
2480	1563.000	2.303	> 500

## 7.6. Test Graphs

Mode 2: ZigBee mode

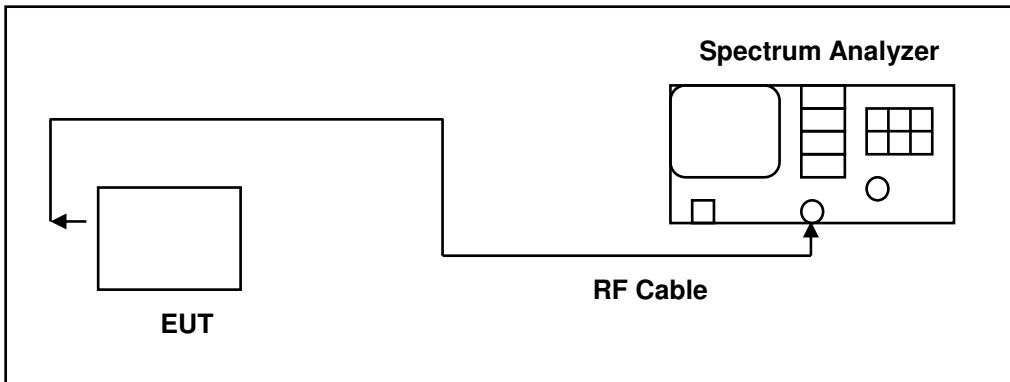


## 8 Maximum Power Density Measurement

### 8.1. Limit

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

### 8.2. Test Setup



### 8.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

Note: N.C.R. = No Calibration Request.

### 8.4. Test Procedure

The EUT tested to DTS test procedure of KDB558074D01D01 for compliance to FCC 47CFR 15.247 requirements.

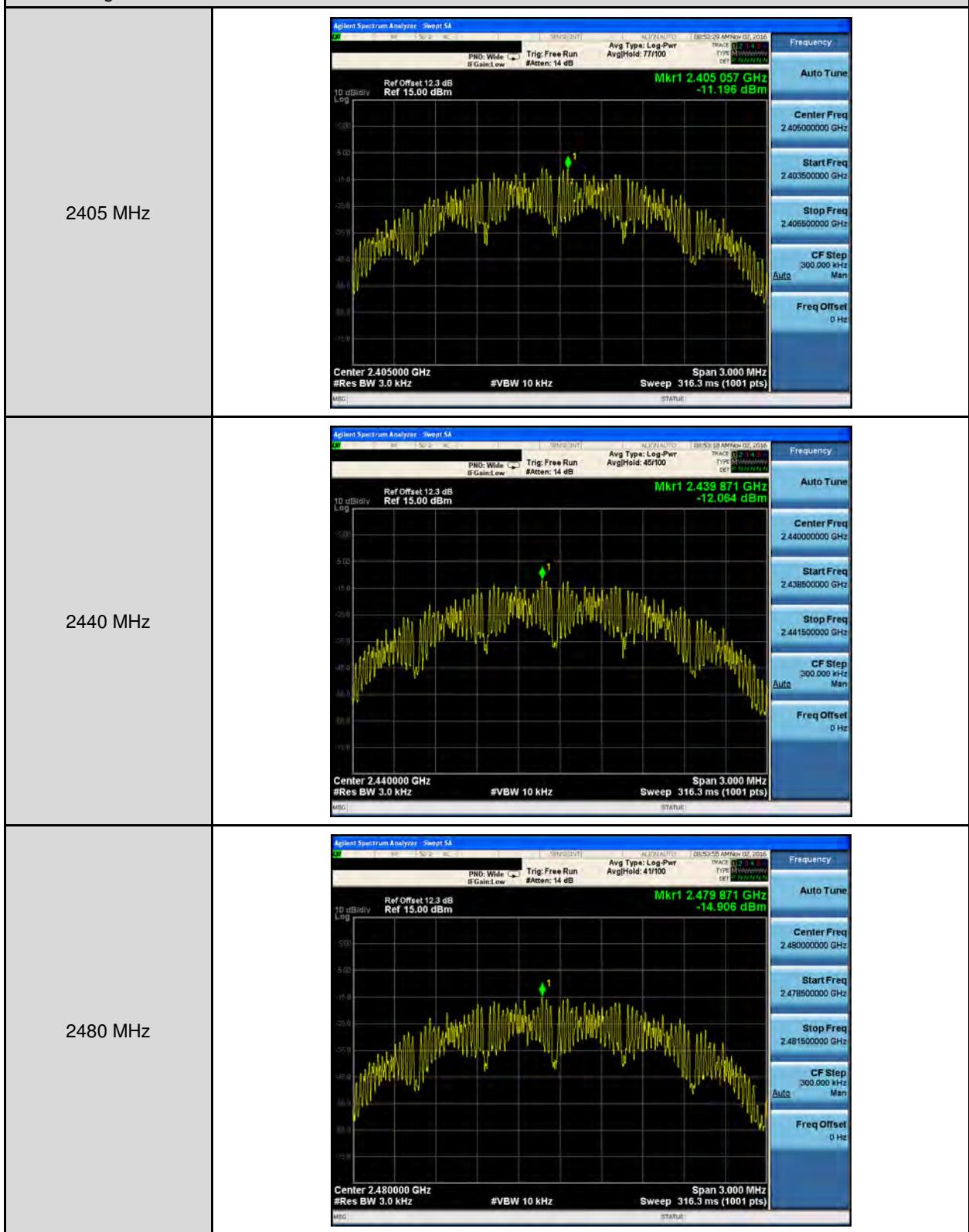
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
4. Set the VBW  $\geq 3 \text{ RBW}$ .
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 8.5. Test Result

Test Item	Maximum Power Density	
Test Mode	Mode 2: ZigBee mode	
Date of Test	11/02/2016	
Frequency (MHz)	Reading (dBm/3KHz)	Limit (dBm)
2405	-11.196	< 8
2440	-12.064	< 8
2480	-14.906	< 8

## 8.6. Test Graphs

Mode 2: ZigBee mode

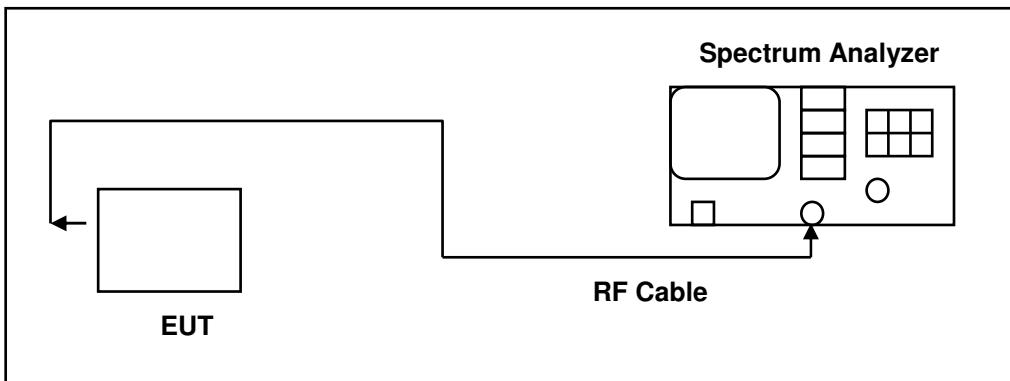


## 9 Out of Band Conducted Emissions Measurement

### 9.1. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

### 9.2. Test Setup



### 9.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	(1)
Spectrum Analyzer	Agilent	E4408B	MY45107753	08/08/2016	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

Note: N.C.R. = No Calibration Request.

### 9.4. Test Procedure

In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the pass band.

The test was performed at 3 channels (Channel low, middle, high)

## 9.5. Test Graphs

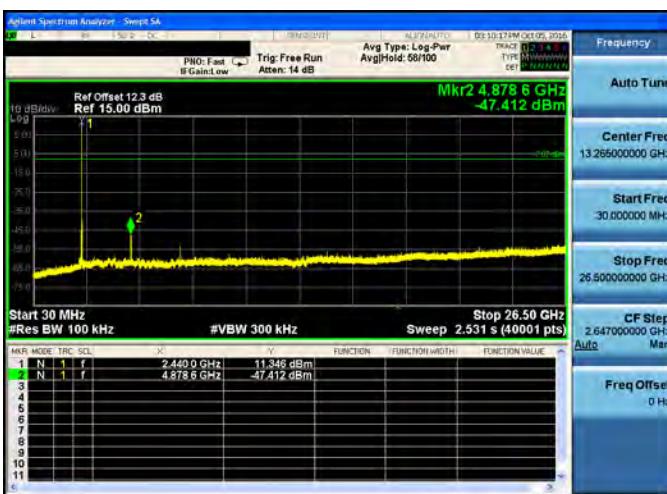
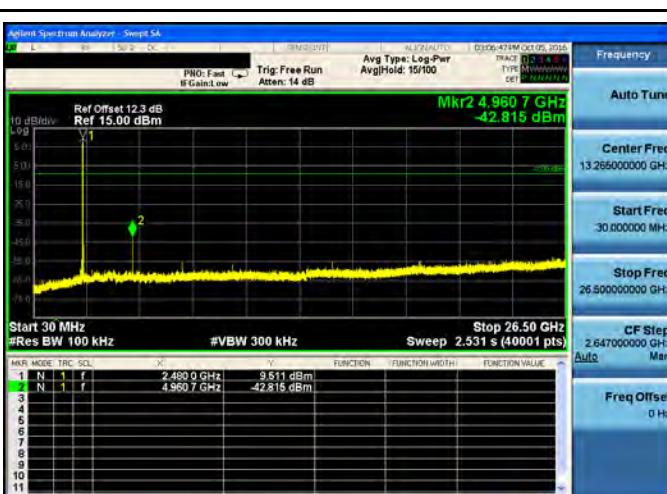
### Reference level

Mode 2: ZigBee mode



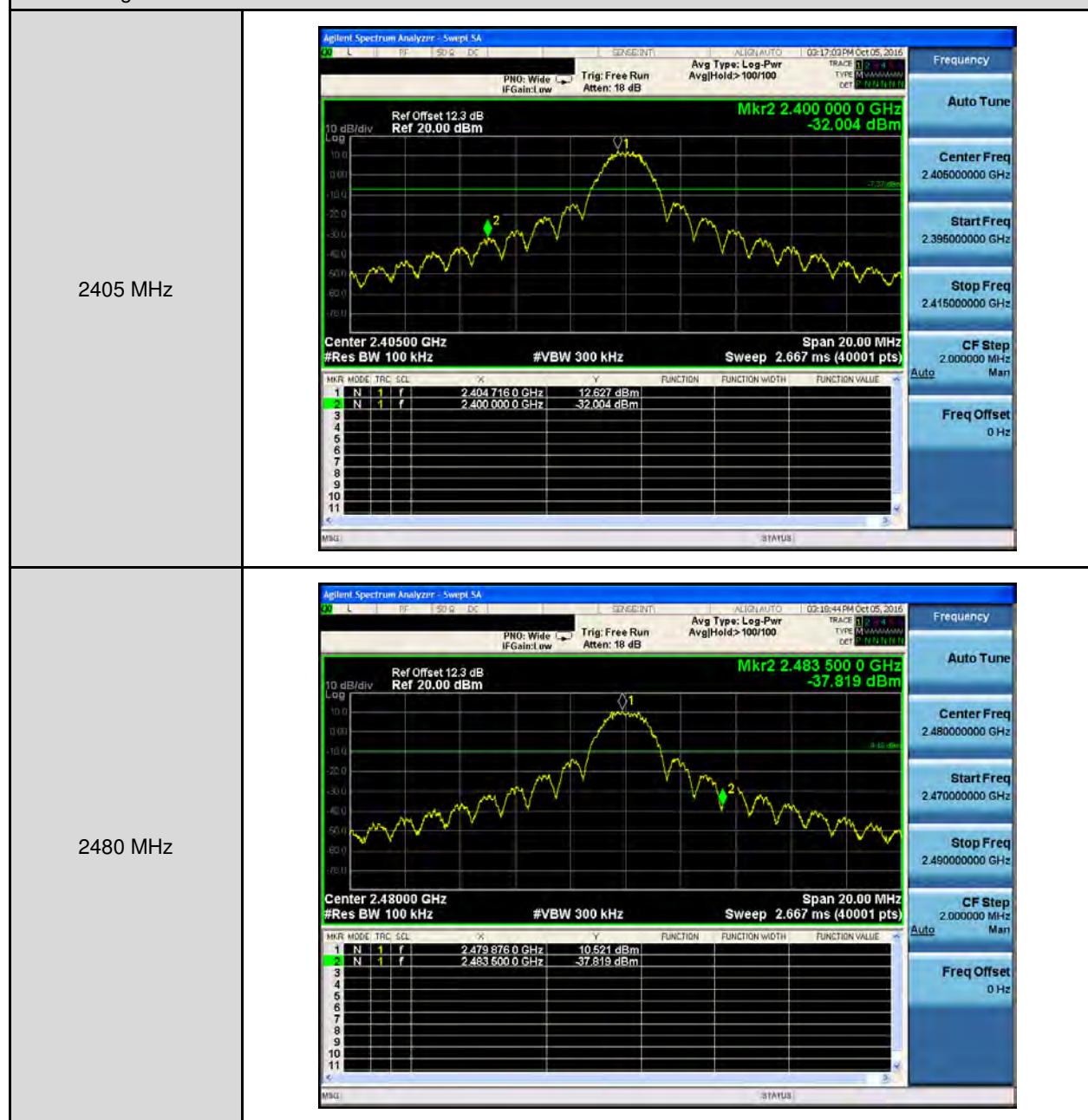
### Out of Band Conducted Emissions

Mode 2: ZigBee mode

2405 MHz	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Ref Offset 12.3 dB Ref 15.00 dBm</p> <p>Start 30 MHz Stop 26.50 GHz #VBW 300 kHz Sweep 2.531 s (40001 pts)</p> <table border="1"> <tr> <td>MFR MODE</td> <td>TRC</td> <td>SCL</td> <td>X</td> <td>Y</td> <td>FUNCTION</td> <td>FUNCTION WIDTH</td> <td>FUNCTION VALUE</td> </tr> <tr> <td>1</td> <td>N</td> <td>1</td> <td>f</td> <td>2405.0 GHz</td> <td>-11.896 dBm</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>N</td> <td>1</td> <td>f</td> <td>7213.3 GHz</td> <td>-52.912 dBm</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>12</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>MIG Alignment Completed</p>	MFR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2405.0 GHz	-11.896 dBm			2	N	1	f	7213.3 GHz	-52.912 dBm			3								4								5								6								7								8								9								10								11								12							
MFR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																																																																																																		
1	N	1	f	2405.0 GHz	-11.896 dBm																																																																																																				
2	N	1	f	7213.3 GHz	-52.912 dBm																																																																																																				
3																																																																																																									
4																																																																																																									
5																																																																																																									
6																																																																																																									
7																																																																																																									
8																																																																																																									
9																																																																																																									
10																																																																																																									
11																																																																																																									
12																																																																																																									
2440 MHz	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Ref Offset 12.3 dB Ref 15.00 dBm</p> <p>Start 30 MHz Stop 26.50 GHz #VBW 300 kHz Sweep 2.531 s (40001 pts)</p> <table border="1"> <tr> <td>MFR MODE</td> <td>TRC</td> <td>SCL</td> <td>X</td> <td>Y</td> <td>FUNCTION</td> <td>FUNCTION WIDTH</td> <td>FUNCTION VALUE</td> </tr> <tr> <td>1</td> <td>N</td> <td>1</td> <td>f</td> <td>2440.0 GHz</td> <td>-11.346 dBm</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>N</td> <td>1</td> <td>f</td> <td>4878.6 GHz</td> <td>-47.412 dBm</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>12</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>MIG Alignment Completed</p>	MFR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2440.0 GHz	-11.346 dBm			2	N	1	f	4878.6 GHz	-47.412 dBm			3								4								5								6								7								8								9								10								11								12							
MFR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																																																																																																		
1	N	1	f	2440.0 GHz	-11.346 dBm																																																																																																				
2	N	1	f	4878.6 GHz	-47.412 dBm																																																																																																				
3																																																																																																									
4																																																																																																									
5																																																																																																									
6																																																																																																									
7																																																																																																									
8																																																																																																									
9																																																																																																									
10																																																																																																									
11																																																																																																									
12																																																																																																									
2480 MHz	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Ref Offset 12.3 dB Ref 15.00 dBm</p> <p>Start 30 MHz Stop 26.50 GHz #VBW 300 kHz Sweep 2.531 s (40001 pts)</p> <table border="1"> <tr> <td>MFR MODE</td> <td>TRC</td> <td>SCL</td> <td>X</td> <td>Y</td> <td>FUNCTION</td> <td>FUNCTION WIDTH</td> <td>FUNCTION VALUE</td> </tr> <tr> <td>1</td> <td>N</td> <td>1</td> <td>f</td> <td>2480.0 GHz</td> <td>-9.511 dBm</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>N</td> <td>1</td> <td>f</td> <td>4960.0 GHz</td> <td>-42.815 dBm</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>12</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> <p>MIG Alignment Completed</p>	MFR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2480.0 GHz	-9.511 dBm			2	N	1	f	4960.0 GHz	-42.815 dBm			3								4								5								6								7								8								9								10								11								12							
MFR MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																																																																																																		
1	N	1	f	2480.0 GHz	-9.511 dBm																																																																																																				
2	N	1	f	4960.0 GHz	-42.815 dBm																																																																																																				
3																																																																																																									
4																																																																																																									
5																																																																																																									
6																																																																																																									
7																																																																																																									
8																																																																																																									
9																																																																																																									
10																																																																																																									
11																																																																																																									
12																																																																																																									

## Conducted Band Edge

Mode 2: ZigBee mode



## 10 Antenna Measurement

### 10.1. Limit

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

### 10.2. Antenna Connector Construction

See section 2 – antenna information.