

Application for FCC Certification  
On behalf of

Philips Lighting (China) Investment Co., Ltd.

Product Name: LED MODULE;

Model No.: Hue Engine V1.0

FCC ID: 2AGBW9290012630X

Prepared For: Philips Lighting (China) Investment Co., Ltd.  
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# TEST REPORT FOR FCC CERTIFICATE

Applicant : Philips Lighting (China) Investment Co., Ltd.  
 EUT Description : LED MODULE;  
 (A) Model No. : Hue Engine V1.0  
 (B) Power Supply : DC 3.3V

Test Procedure Used:

*FCC RULES AND REGULATIONS PART 15 SUBPART C OCTOBER 2015  
 AND ANSI C63.10-2013*

The device described above is tested by Audix Technology (Shanghai) Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C limits.

The test results are contained in this test report and Audix Technology (Shanghai) Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. This report also shows that the EUT (M/N: Refer to Sec2.1), which was tested on Mar. 10 – 14, 2016 is technically compliance with the FCC limits.


This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Audix Technology (Shanghai) Co., Ltd.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Date of Test : Mar. 10 – 14, 2016 Date of Report : Mar. 16, 2016

Producer : *Alan He*  
 ALAN HE / Assistant

Review : *Wenqiang Fang for*  
 SAMMY CHEN / Manager

 For and on behalf of  
 Audix Technology (Shanghai) Co., Ltd.

Signatory : *Byron Kwo*  
 Authorized Signature EMC BYRON KWO/Assistant General Manager

# 1 SUMMARY OF STANDARDS AND RESULTS

## 1.1 Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Description / Test Item	Test Standard	Results	Meets Limit
<b>EMISSION</b>			
Conducted Emission	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	N/A	15.207
Radiated Emission	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	Pass	15.209(a) 15.205(a)(c)
6 dB Bandwidth Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	Pass	15.247(a)(2)
Maximum Peak Output Power Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	Pass	15.247(b)(3)
Emission Limitations Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	Pass	15.247(d)
Band Edge Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	Pass	15.247(d)
Power Spectral Density Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C October 2015 AND ANSI C63.10:2013	Pass	15.247(e)
N/A is an abbreviation for Not Applicable.			

## 2 GENERAL INFORMATION

### 2.1 Description of Equipment Under Test

Description : LED MODULE;

Type of EUT  Production  Pre-product  Pro-type

Model Number : Hue Engine V1.0

Radio Tech : Zigbee

Channel Freq. : 2405MHz, 2425MHz, 2450MHz, 2475MHz

Tested Freq. : 2405MHz, 2450MHz, 2475MHz

Modulation : O-QPSK

Antenna Gain : 0 dBi

Test Mode : The EUT was set at continuous TX with duty cycle 100% during all the test in the report

Applicant : Philips Lighting (China) Investment Co., Ltd.  
Building 9#, Lane 888, Tianlin Road, Minhang District,  
Shanghai 200233, China

## 2.2 Description of Test Facility

Site Description (Semi-Anechoic Chamber)	: Sept. 17, 1998 file on Jan. 15, 2015 Renewed Federal Communications Commission FCC Engineering Laboratory 7435 Oakland Mills Road Columbia, MD 21046, USA
Name of Firm	: Audix Technology (Shanghai) Co., Ltd.
Site Location	: 3F 34 Bldg 680 Guiping Rd., Caohejing Hi-Tech Park, Shanghai 200233, China
FCC registration Number	: 91789
Accredited by NVLAP, Lab Code	: 200371-0

## 2.3 Measurement Uncertainty

Radiated Emission Expanded Uncertainty (30-200MHz):	U = 4.3dB (Horizontal) U = 4.6dB (Vertical)
Radiated Emission Expanded Uncertainty (200M-1GHz):	U = 4.5dB (Horizontal) U = 5.4dB (Vertical)
Radiated Emission Expanded Uncertainty (Above 1GHz):	U = 5.1 dB
6 dB Bandwidth Expanded Uncertainty	: U = $\pm 1 \times 10^{-8}$ MHz
Maximum Peak Output Power Expanded Uncertainty:	U = $\pm 1.56$ dB
Emission Limitations Expanded Uncertainty	: U = $\pm 1.20$ dB
Band Edge Expanded Uncertainty	: U = $\pm 1.20$ dB
Power Spectral Density Expanded Uncertainty	: U = $\pm 1.20$ dB

### 3 RADIATED EMISSION TEST

#### 3.1 Test Equipment

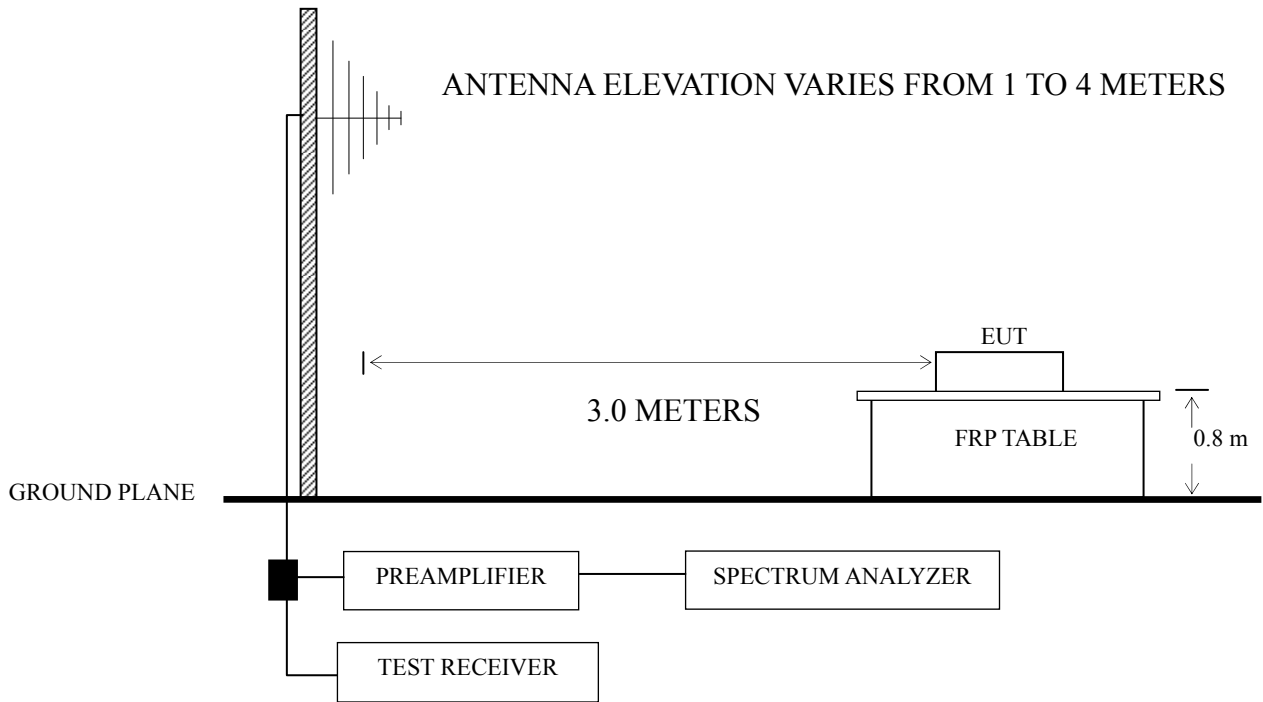
The following test equipment are used during the radiated emission test in a semi-anechoic chamber:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Pre-Amplifier	Agilent	8447D	2944A10548	Sep 18, 2015	Mar 17, 2016
2.	Pre-Amplifier	Agilent	8449B	3008A00864	Mar 20, 2015	Mar 19, 2016
3.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2015	Jun 11, 2016
4.	Test Receiver	R&S	ESCI	101302	Apr 27, 2015	Apr 26, 2016
5.	Bi-log Antenna	TESEQ	CBL6112D	23193	May 15, 2015	May 14, 2016
6.	Horn Antenna	EMCO	3115	9607-4878	Jun 03, 2015	Jun 02, 2016
7.	Horn Antenna	EMCO	3116	00062643	Sep 08, 2015	Sep 08, 2017
8.	50 $\Omega$ Coaxial Switch	Anritsu	MP59B	6200426390	Sep 18, 2015	Mar 17, 2016
9.	Software	Audix	E3	SET00200 9912M295-2	--	--



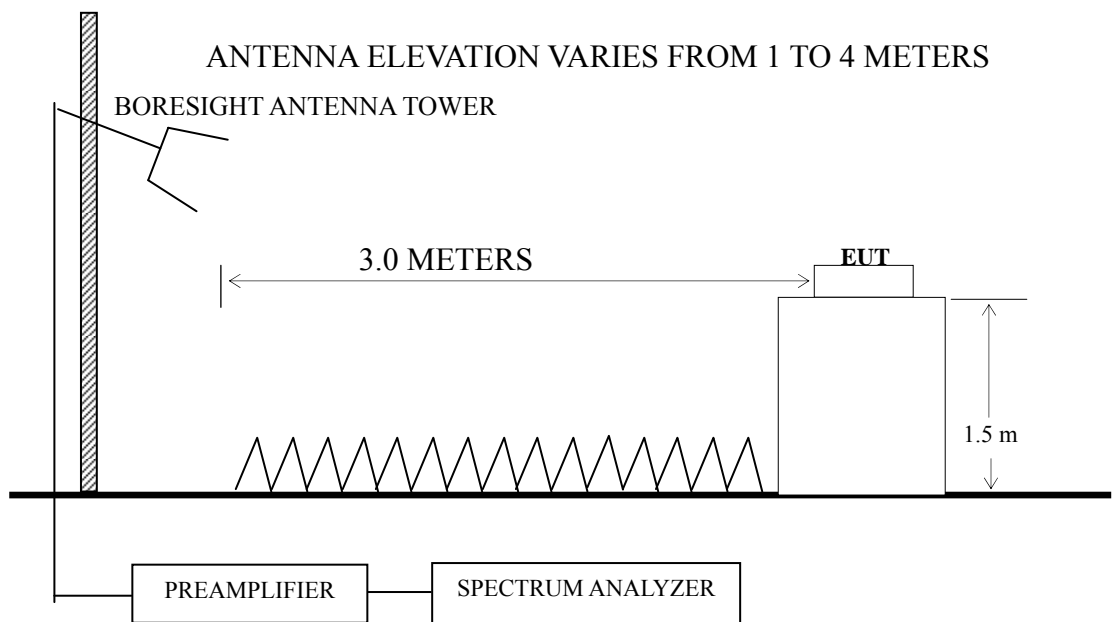
### 3.2 Block Diagram of Test Setup

#### 3.2.1 Below 1GHz



■ : 50 ohm Coaxial Switch

#### 3.2.2 Above 1GHz



### 3.3 Radiated Emission Limit [FCC Part 15 Subpart C 15.209]

Frequency (MHz)	Distance (m)	Field strength limits ( $\mu\text{V/m}$ )	
		( $\mu\text{V/m}$ )	dB( $\mu\text{V/m}$ )
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0

NOTE 1 - Emission Level dB ( $\mu\text{V/m}$ ) = 20 log Emission Level ( $\mu\text{V/m}$ )

NOTE 2 - The tighter limit applies at the band edges.

NOTE 3 - Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

NOTE 4 - The limits shown are based on Quasi-peak value detector below or equal to 1GHz and Average value detector above 1GHz.

NOTE 5 - Above 1 GHz, the limit on peak emission is 20 dB above the maximum permitted average emission limit applicable to the EUT

### 3.4 Test Configuration

The EUT (listed in Sec.2.1) and the simulators (listed in Sec.2.2) were installed as shown on Sec.3.2 to meet FCC requirements and operating in a manner that tends to maximize its emission level in a normal application.

### 3.5 Operating Condition of EUT

3.5.1 Setup the EUT as shown in Sec. 3.2.

3.5.2 Turn on the power of all equipment.

3.5.3 Turn the EUT on the test mode, and then test.

### 3.6 Test Procedures

Radiated emission test applies to harmonics/spurs that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209. A pre-amp is necessary for this measurement. For measurement above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

The EUT was placed on a turntable. Below 1 GHz, the table height is 80 cm above the reference ground plane. Above 1 GHz, the table height is 1.5 m. The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna, which was mounted on an antenna tower. The antenna moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (Calibrated Bilog Antenna) or Horn antenna was used as receiving antenna. Both horizontal and vertical polarizations of the antenna were set on measurement. In order to find the maximum emission, all of the interference cables were manipulated according to ANSI C63.10: 2013 requirements during radiated emission test.

The bandwidth of Test Receiver R&S ESCI was set at 120 kHz from 30MHz to 1000MHz.

The bandwidth of the VBW was set at 1MHz and RBW was set at 1MHz for peak emission measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emission above 1GHz for Spectrum Agilent N9010A.

The frequency range from 30 MHz to 25 GHz (Up to 10<sup>th</sup> harmonics from fundamental frequency) was checked.

All the test results are listed in Sec.3.7.

### 3.7 Test Results

<PASS>

The frequency and amplitude of the highest radiated emission relative the limit is reported. All the emissions not reported below are too low against the FCC limit.

No.	Operation	Channel	Frequency	Data Page
1.	Transmitting	Worst case emission < 1GHz		P12
2.		11	2405 MHz	P13-14
3.		20	2450 MHz	
4.		25	2475 MHz	
5.	Receiving	--		P17
6.	Transmitting	Cabinet Emission		P18
7.		11	2405 MHz	Restricted Frequency bands
8.		25	2475 MHz	

NOTE 1 – Level = Read Level + Antenna Factor + Cable Loss (<1GHz)

NOTE 2 – Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor (>1GHz)

NOTE 3 – All reading are Quasi-Peak values below or equal to 1GHz, Peak and Average values above 1GHz.

For above 1GHz test, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

**Worst case emission < 1GHz**

EUT : LED MODULE; Temperature : 25°C  
 Model No. : Hue Engine V1.0 Humidity : 45%RH  
 Test Mode : Transmitting Date of Test : Mar. 14, 2014

Polarization	Frequency (MHz)	Meter Reading dB (µV)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission Level dB (µV/m)	Limits dB (µV/m)	Margin (dB)	Remark
Horizontal	30.00	4.02	18.90	0.63	23.55	40.00	16.45	QP
	35.62	2.06	15.30	0.69	18.05	40.00	21.95	
	92.14	3.21	11.00	1.23	15.44	43.50	28.06	
	128.11	2.30	12.90	1.51	16.71	43.50	26.79	
	169.60	2.48	10.96	1.77	15.21	43.50	28.29	
	267.55	3.52	13.25	2.32	19.09	46.00	26.91	
Vertical	30.96	1.36	18.15	0.64	20.15	40.00	19.85	QP
	35.88	1.99	15.10	0.69	17.78	40.00	22.22	
	99.88	1.93	12.25	1.32	15.50	43.50	28.00	
	130.84	3.01	12.76	1.53	17.30	43.50	26.20	
	159.78	4.46	11.11	1.70	17.27	43.50	26.23	
	269.43	4.00	13.30	2.32	19.62	46.00	26.38	

TEST ENGINEER: BILL WU

**Radiated Emission > 1GHz**

EUT : LED MODULE; Temperature : 25°C

Model No. : Hue Engine V1.0 Humidity : 45%RH

Test Mode : Transmitting Date of Test : Mar. 14, 2014

**Ch11 (2405MHz)**

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	1164.509	48.22	24.30	3.75	36.33	40.07	74.00	33.93	Peak
	1415.668	47.25	25.30	3.79	35.91	40.54	74.00	33.46	Peak
	1761.553	47.09	26.66	4.13	35.55	42.52	74.00	31.48	Peak
	2000.528	46.45	27.50	4.47	35.17	43.32	74.00	30.68	Peak
	2275.996	45.94	28.03	4.69	35.13	43.53	74.00	30.47	Peak
	3672.297	45.44	31.97	6.06	35.20	48.90	74.00	25.10	Peak
Vertical	1089.811	47.74	23.95	4.20	36.20	39.56	74.00	34.44	Peak
	1343.987	46.62	25.03	3.69	35.80	39.43	74.00	34.57	Peak
	1604.841	46.19	26.06	4.01	35.36	40.71	74.00	33.29	Peak
	1940.510	45.85	27.29	4.35	35.10	42.32	74.00	31.68	Peak
	2275.996	45.94	28.03	4.69	35.13	43.53	74.00	30.47	Peak
	2999.209	45.96	30.50	5.76	34.57	47.02	74.00	26.98	Peak

**Ch20 (2450MHz)**

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	1307.671	47.51	24.90	3.65	36.40	40.10	74.00	33.90	Peak
	1735.077	47.28	26.57	4.11	35.93	42.57	74.00	31.43	Peak
	2268.911	45.38	28.00	4.69	35.27	42.94	74.00	31.06	Peak
	2997.999	46.03	30.50	5.76	35.13	47.09	74.00	26.91	Peak
	3675.652	44.39	31.97	6.02	35.20	47.81	74.00	26.19	Peak
	4497.116	43.85	33.60	6.79	34.23	50.15	74.00	23.85	Peak
Vertical	1048.989	47.41	23.75	4.55	35.96	39.31	74.00	34.69	Peak
	1329.607	47.42	24.99	3.67	35.39	40.15	74.00	33.85	Peak
	1846.765	46.55	26.97	4.23	35.13	42.48	74.00	31.52	Peak
	2306.971	45.73	28.07	4.72	35.20	43.39	74.00	30.61	Peak
	2960.827	46.10	30.37	5.76	34.57	47.03	74.00	26.97	Peak
	4164.086	43.14	33.08	6.19	34.09	48.18	74.00	25.82	Peak

**Ch25 (2475MHz)**

Polarization	Frequency (MHz)	Meter Reading dB (µV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (µV/m)	Limits dB (µV/m)	Margin (dB)	Remark
Horizontal	1125.839	47.67	24.11	3.98	36.26	39.50	74.00	34.50	Peak
	1484.524	46.62	25.56	3.86	35.70	40.34	74.00	33.66	Peak
	1929.196	46.05	27.25	4.35	35.17	42.48	74.00	31.52	Peak
	2430.073	45.58	28.28	4.83	35.15	43.54	74.00	30.46	Peak
	3067.365	45.28	30.65	5.86	35.13	46.66	74.00	27.34	Peak
	3622.536	45.95	31.83	6.06	34.61	49.23	74.00	24.77	Peak
Vertical	1077.733	47.94	23.89	4.32	36.35	39.80	74.00	34.20	Peak
	1321.338	46.76	24.94	3.67	35.94	39.43	74.00	34.57	Peak
	1609.932	46.59	26.08	4.03	35.54	41.16	74.00	32.84	Peak
	1957.483	45.96	27.35	4.39	35.15	42.55	74.00	31.45	Peak
	2268.911	46.23	28.00	4.69	35.13	43.79	74.00	30.21	Peak
	3080.149	46.39	30.67	5.86	35.12	47.80	74.00	26.20	Peak

TEST ENGINEER: BILL WU

EUT : LED MODULE; Temperature : 25°C

Model No. : Hue Engine V1.0 Humidity : 45%RH

Test Mode : Receiving Date of Test : Mar 14, 2016

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	30.00	0.56	18.90	0.63	--	20.09	40.00	19.91	QP
	35.01	1.58	15.70	0.69	--	17.97	40.00	22.03	
	102.00	1.20	12.37	1.33	--	14.90	43.50	28.60	
	127.22	1.89	12.97	1.51	--	16.37	43.50	27.13	
	142.82	2.41	12.25	1.60	--	16.26	43.50	27.24	
	269.43	3.96	13.30	2.32	--	19.58	46.00	26.42	
	1048.989	47.12	23.75	4.55	36.40	39.02	74.00	34.98	PK
	1386.070	46.00	25.19	3.74	35.84	39.09	74.00	34.91	
	1720.705	45.43	26.51	4.09	35.40	40.63	74.00	33.37	
	2057.653	44.55	27.62	4.53	35.11	41.59	74.00	32.41	
2586.498	44.64	28.80	5.03	35.16	43.31	74.00	30.69		
3264.812	44.18	31.05	6.00	34.93	46.30	74.00	27.70		
Vertical	30.00	4.40	18.90	0.63	--	23.93	40.00	16.07	QP
	32.98	1.14	16.91	0.67	--	18.72	40.00	21.28	
	96.10	1.36	11.84	1.27	--	14.47	43.50	29.03	
	129.92	2.01	12.80	1.52	--	16.33	43.50	27.17	
	287.99	2.94	13.58	2.49	--	19.01	46.00	26.99	
	431.03	2.88	16.82	2.79	--	22.49	46.00	23.51	
	1223.488	46.24	24.55	3.56	36.09	38.26	74.00	35.74	PK
	1525.202	45.17	25.71	3.92	35.65	39.15	74.00	34.85	
	2136.131	44.68	27.77	4.58	35.12	41.91	74.00	32.09	
	2674.001	44.68	29.17	5.25	35.17	43.93	74.00	30.07	
3244.509	43.99	31.01	6.00	34.95	46.05	74.00	27.95		
4121.016	42.76	33.00	6.07	34.25	47.58	74.00	26.42		

TEST ENGINEER: BILL WU

## Emissions in restricted frequency bands Using Antenna-port conducted measurements:

According to the ANSI C63.10-2013 Sec. 11.12.2, antenna-port conducted measurements is also be permitted as an alternative to radiated measurements in the restricted frequency bands.

The transmitter output was connected to the Test Receiver. The EUT was set to transmit continuously ( $\geq 98\%$  duty cycle).

The test procedure is defined in ANSI C63.10-2013 (11.12.2.4 Peak power measurement procedure & the 11.12.2.5 Average power measurement procedures (11.12.2.5.1 Trace averaging with continuous EUT transmission at full power)):

Note1 – The additional radiated test was performed to prove that the cabinet emissions (transmit antenna be replaced with a termination matching the impedance of the antenna) also comply with the applicable limits.

### Cabinet Emission (Radiated with antenna terminated):

Polarization	Frequency (MHz)	Meter Reading dB ( $\mu$ V)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Emission Level dB ( $\mu$ V/m)	Limits dB ( $\mu$ V/m)	Margin (dB)	Remark
Horizontal	2365.319	45.51	28.21	4.81	35.14	43.39	74.00	30.61	Peak
	2388.807	45.96	28.21	4.81	35.14	43.84	74.00	30.16	Peak
	2483.497	47.84	28.38	4.86	35.15	45.93	74.00	28.07	Peak
	2494.319	47.44	28.38	4.89	35.15	45.56	74.00	28.44	Peak
Vertical	2366.634	43.88	28.21	4.81	35.14	41.76	74.00	32.24	Peak
	2389.004	46.75	28.21	4.81	35.14	44.63	74.00	29.37	Peak
	2483.958	47.38	28.38	4.86	35.15	45.47	74.00	28.53	Peak
	2494.719	46.64	28.38	4.89	35.15	44.76	74.00	29.24	Peak

The frequency range 2310-2390MHz & 2483.5-2500MHz were tested, and the maximum emission frequency was recorded above.



Note2 – The antenna gain (0dBi, as 2dBi) and cable loss (2dB) were set as offset ( 4dB ) in the spectrum.

(According to ANSI C63.10-2013 Sec. 11.12.2.6, when determining the EIRP from the measured conducted power, the upper bound on antenna gain for a device with a signal RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. )

Note3 –  $EIRP = E + 20\log D - 104.8$

Where: EIRP = equivalent isotropic radiated power in dBm,

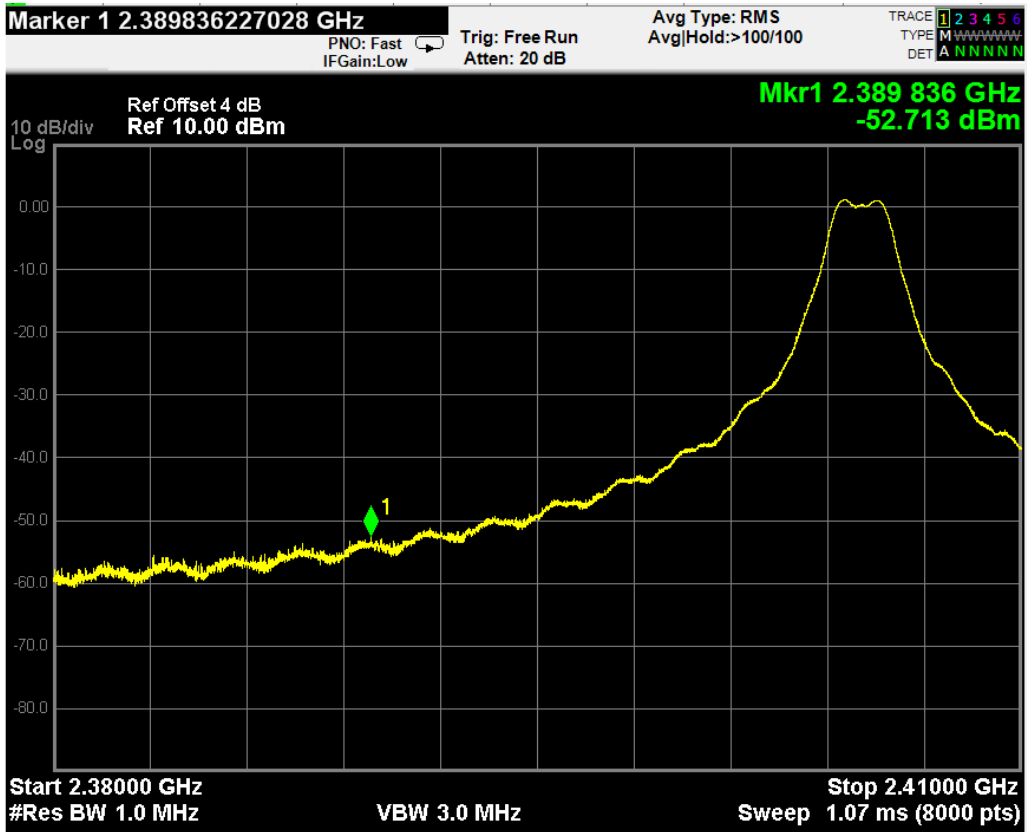
E = electric field strength in  $dB\mu V/m$ ,

D = specified measurement distance in meters.

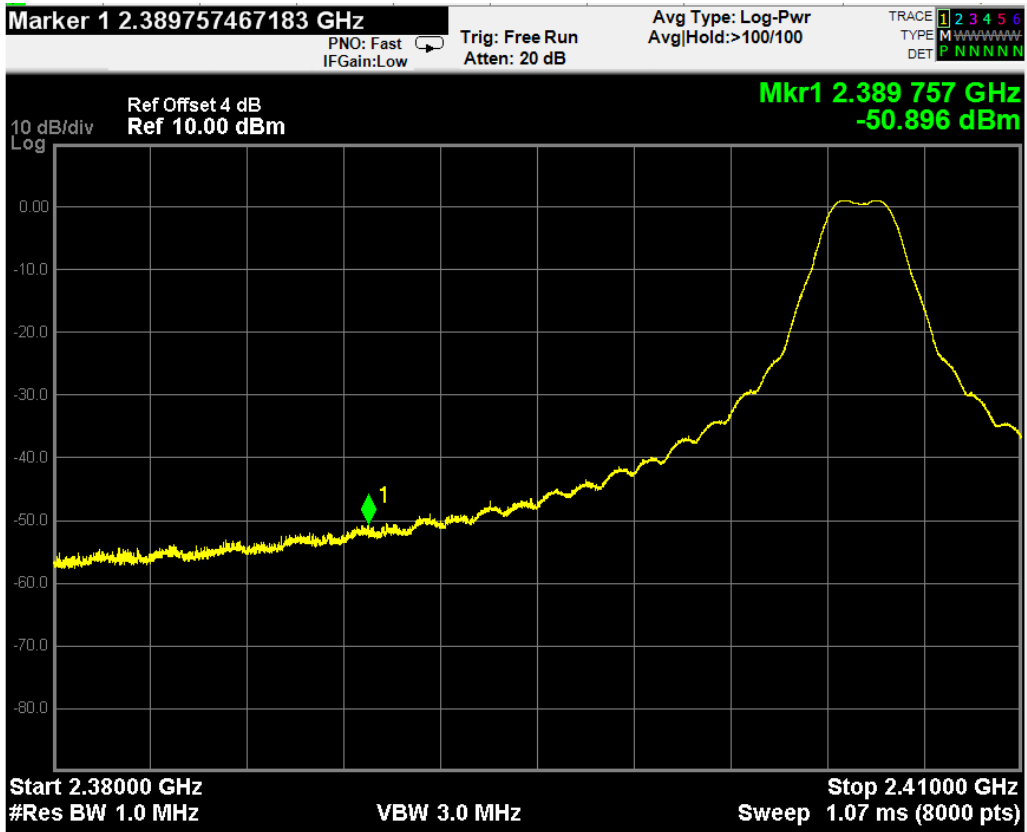
The Average Power limit = -41.2 dBm

The Peak Power limit = -21.2 dBm

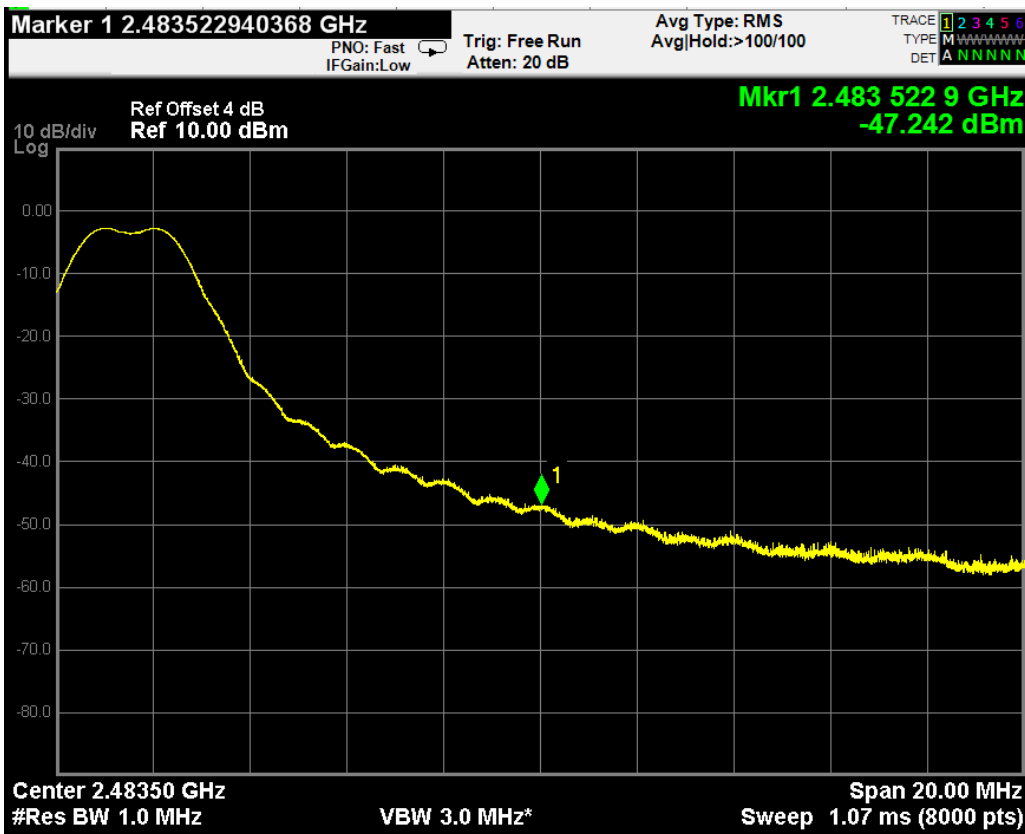
### AV Result on Ch 11



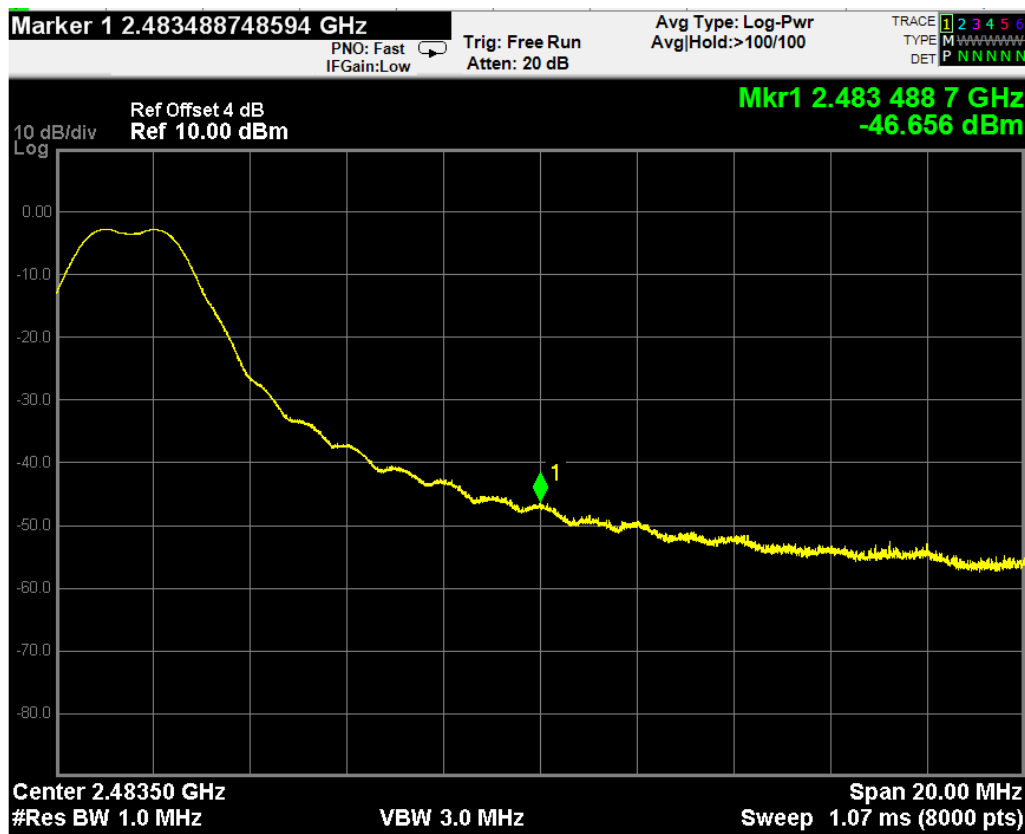
### PK Result on Ch 11



### AV Result on Ch 25



### PK Result on Ch 25



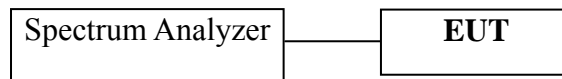
## 4 6 dB BANDWIDTH MEASUREMENT

### 4.1 Test Equipment

The following test equipment was used during the Emission Bandwidth measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2015	Jun 11, 2016

### 4.2 Block Diagram of Test Setup



### 4.3 Specification Limits (§15.247(a)(2))

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

### 4.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

### 4.5 Test Procedure

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 100 kHz RBW / 300 kHz VBW.

The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

The test procedure is defined in ANSI C63.10-2013 (the 11.8.2 Measurement Procedure “Option 2” was used).

### 4.6 Test Results

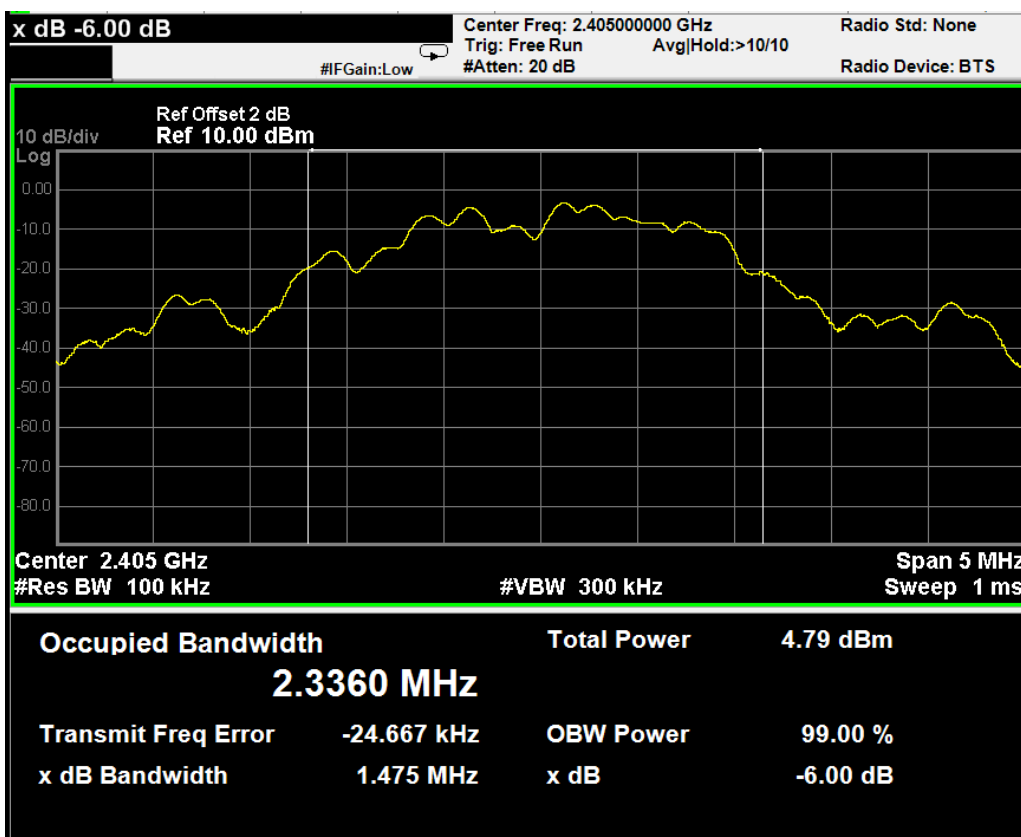
**PASSED.**

All the test results are attached in next pages.

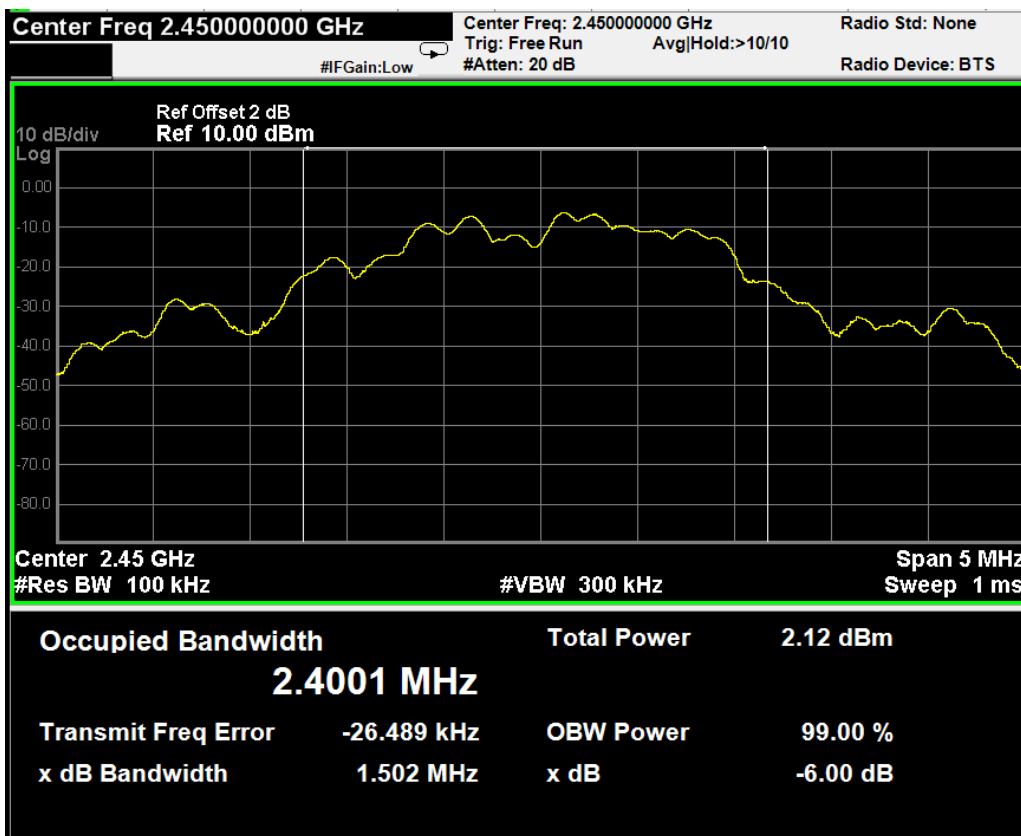
(Test Date: Mar. 10, 2016 Temperature: 20°C Humidity: 44 %)

Channel	Frequency	6dB Bandwidth
11	2405 MHz	<b>1.475 MHz</b>
20	2450 MHz	<b>1.502 MHz</b>
25	2475 MHz	<b>1.514 MHz</b>

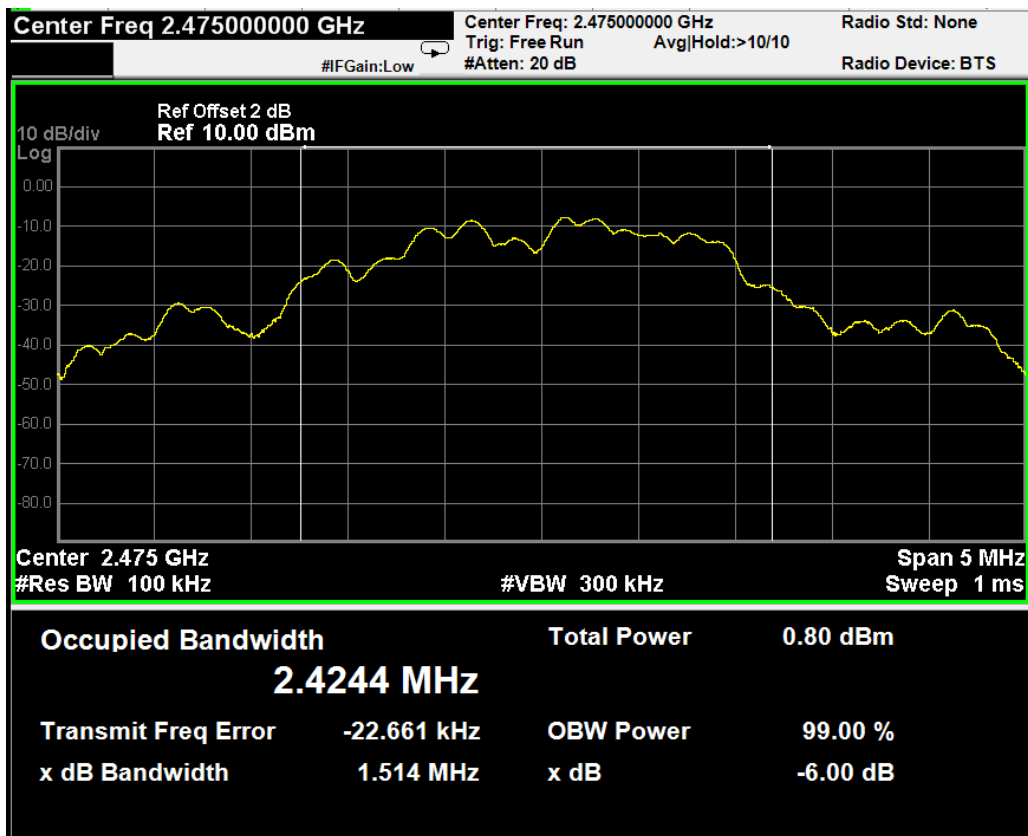
### Ch 11 (2405 MHz)



### Ch 20 (2450 MHz)



### Ch 25 (2475 MHz)



## 5 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

### 5.1 Test Equipment

The following test equipment was used during the maximum peak output power measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2015	Jun 11, 2016

### 5.2 Block Diagram of Test Setup

The same as Section. 4.2.

### 5.3 Specification Limits ((§15.247(b)(3))

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5 MHz is: 1 Watt. (30 dBm)

### 5.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

### 5.5 Test Procedure

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

- a) Set the RBW  $\geq$  DTS bandwidth.
- b) Set VBW  $\geq$   $[3 \times \text{RBW}]$ .
- c) Set span  $\geq$   $[3 \times \text{RBW}]$ .
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

The test procedure is defined in ANSI C63.10-2013 ( 11.9.1.1 Measurement Procedure "RBW  $\geq$  DTS bandwidth" was used).

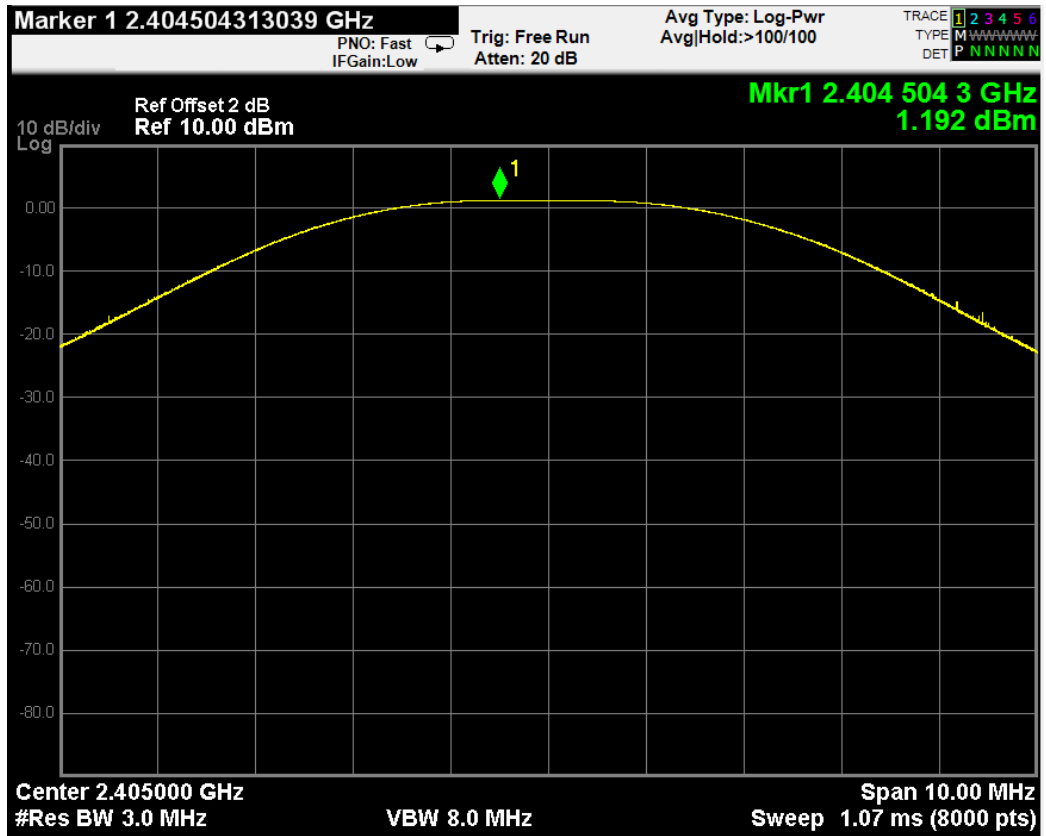
### 5.6 Test Results

**PASSED.** All the test results are listed below.

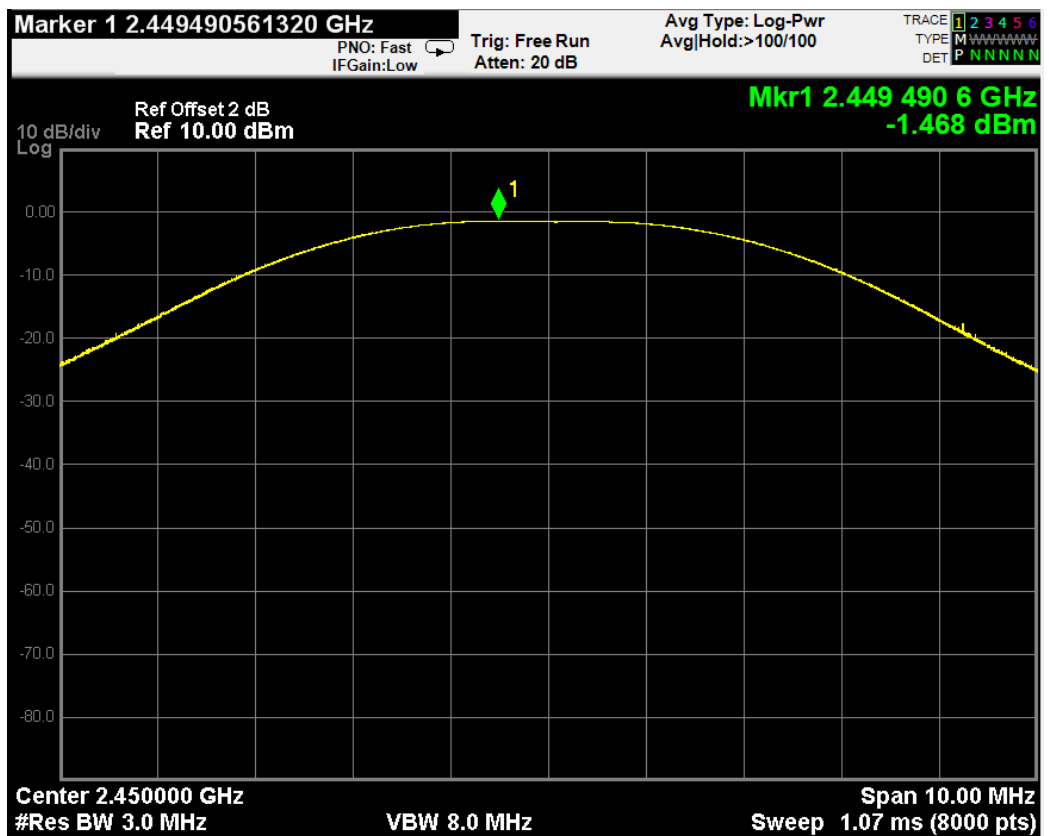
(Test Date: Mar. 10, 2016 Temperature: 20°C Humidity: 44 %)

Channel	Frequency	Peak Output Power	Limit
11	2405 MHz	<b>1.192 dBm</b>	30 dBm
20	2450 MHz	<b>-1.468 dBm</b>	30 dBm
25	2475 MHz	<b>-2.755 dBm</b>	30 dBm

### Ch 11 (2405 MHz)



### Ch 20 (2450 MHz)







## 6 EMISSION LIMITATIONS MEASUREMENT

### 6.1 Test Equipment

The following test equipment was used during the emission limitations test :

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2015	Jun 11, 2016

### 6.2 Block Diagram of Test Setup

The same as Section. 4.2.

### 6.3 Specification Limits (§15.247(d))

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).(※This test result attaching to Section. 4.7)

### 6.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

### 6.5 Test Procedure

The transmitter output was connected to the Test Receiver. Set RBW = 100 kHz, VBW  $\geq$  300 kHz, scan up through 10<sup>th</sup> harmonic. All harmonics/spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

The test procedure is defined in ANSI C63.10-2013 (11.11.2 Reference level measurement and 11.11.3 Emission level measurement was used).

### 6.6 Test Results

**PASSED.**

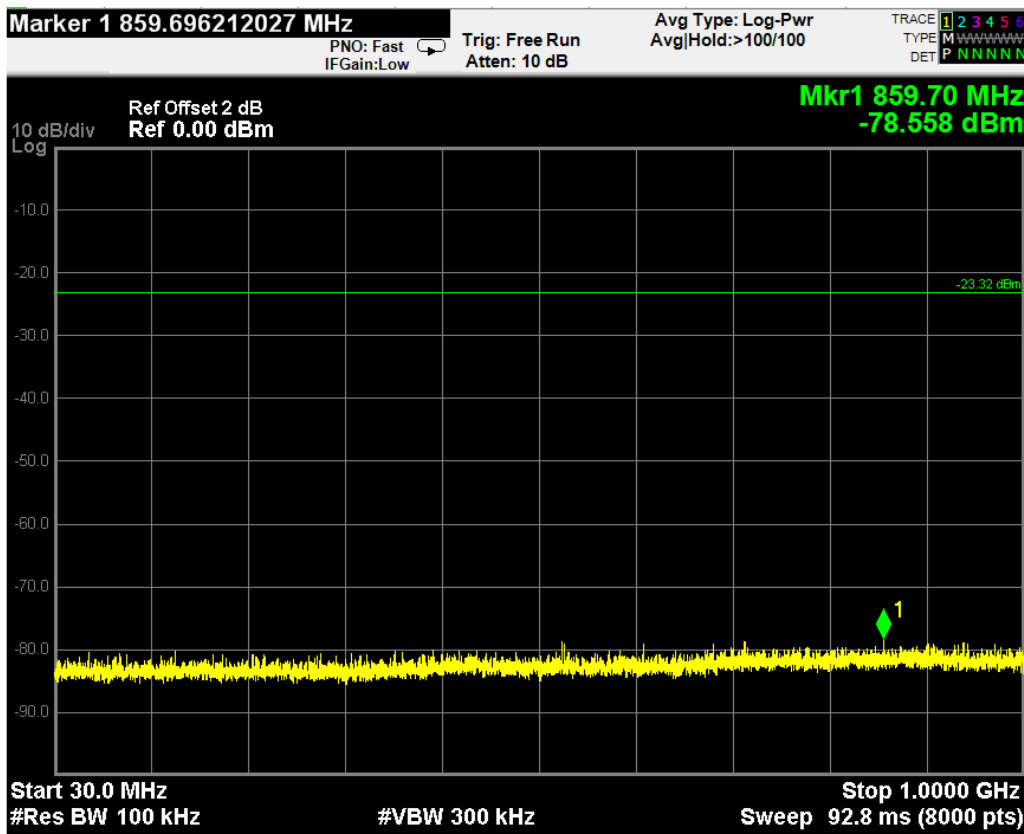
The test data was attached in the next pages.

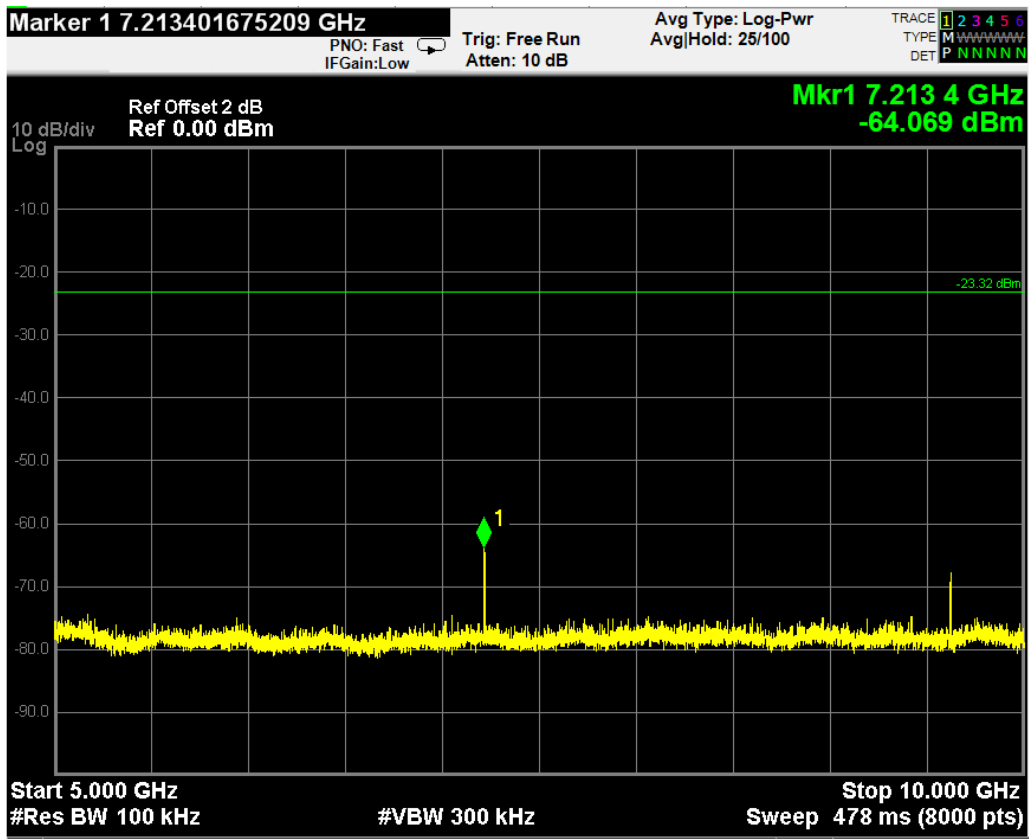
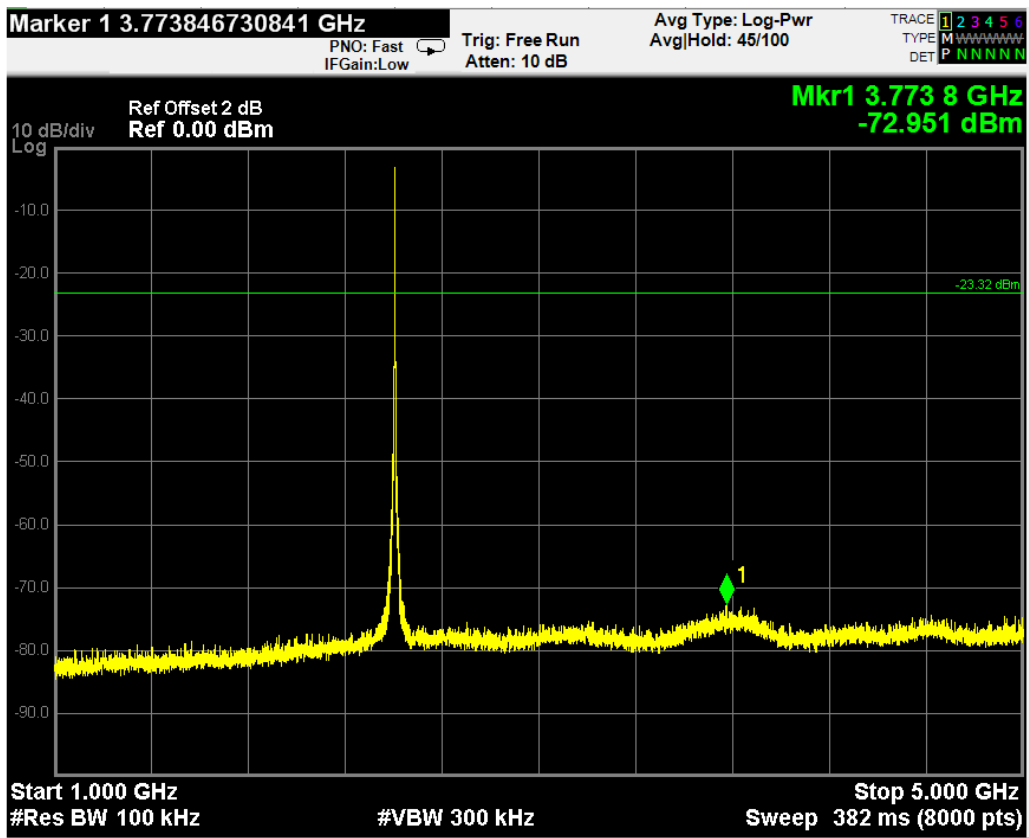
(Test Date: Mar. 10, 2016 Temperature: 20°C Humidity: 44 %)

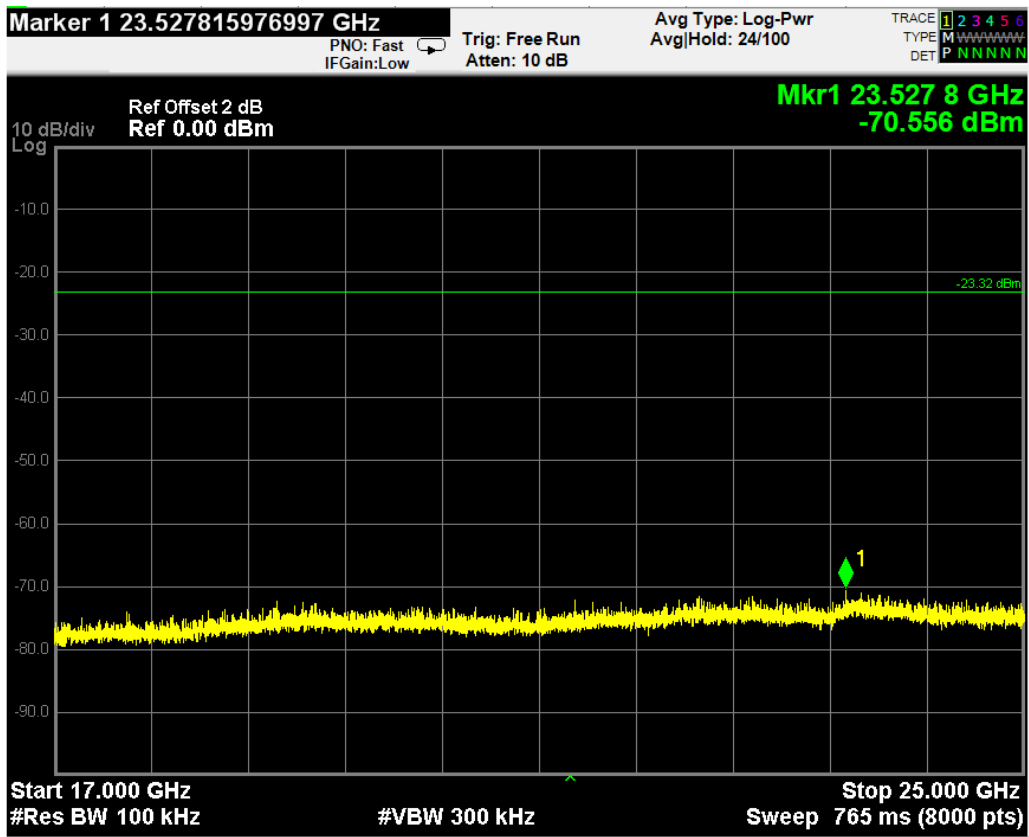
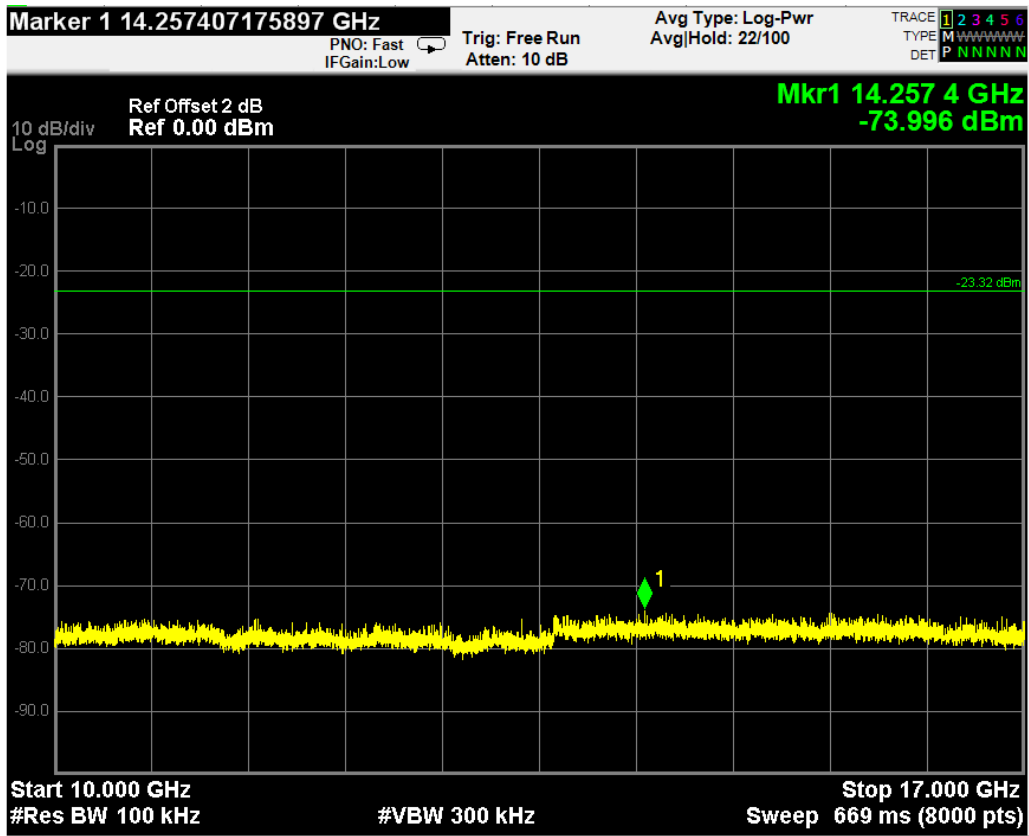
Channel	Data Page
11	P37-39
20	P40-42
25	P43-45

### Ch 11 (2405 MHz)

Reference level

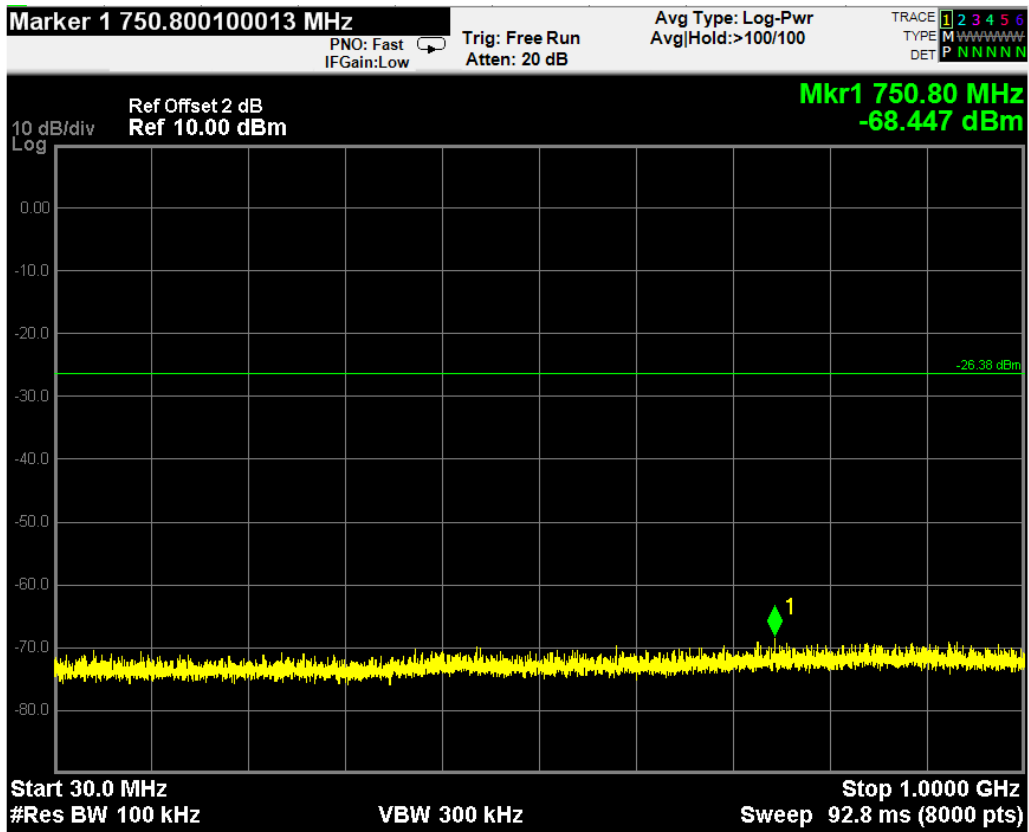


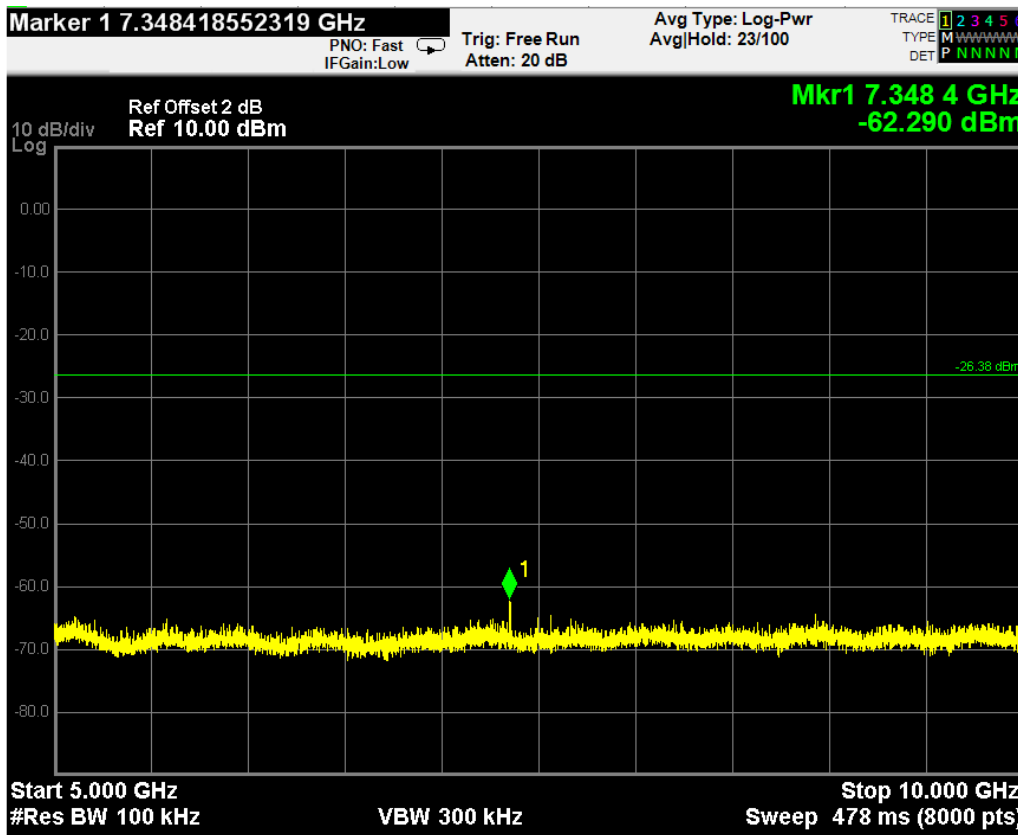
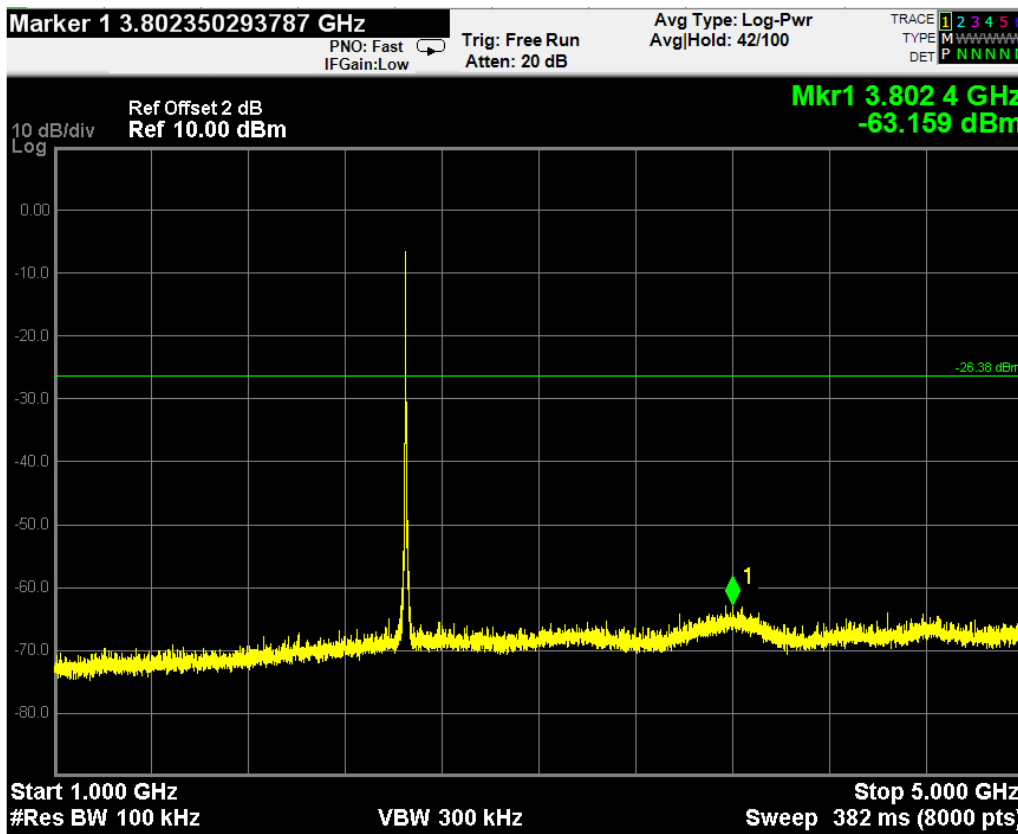


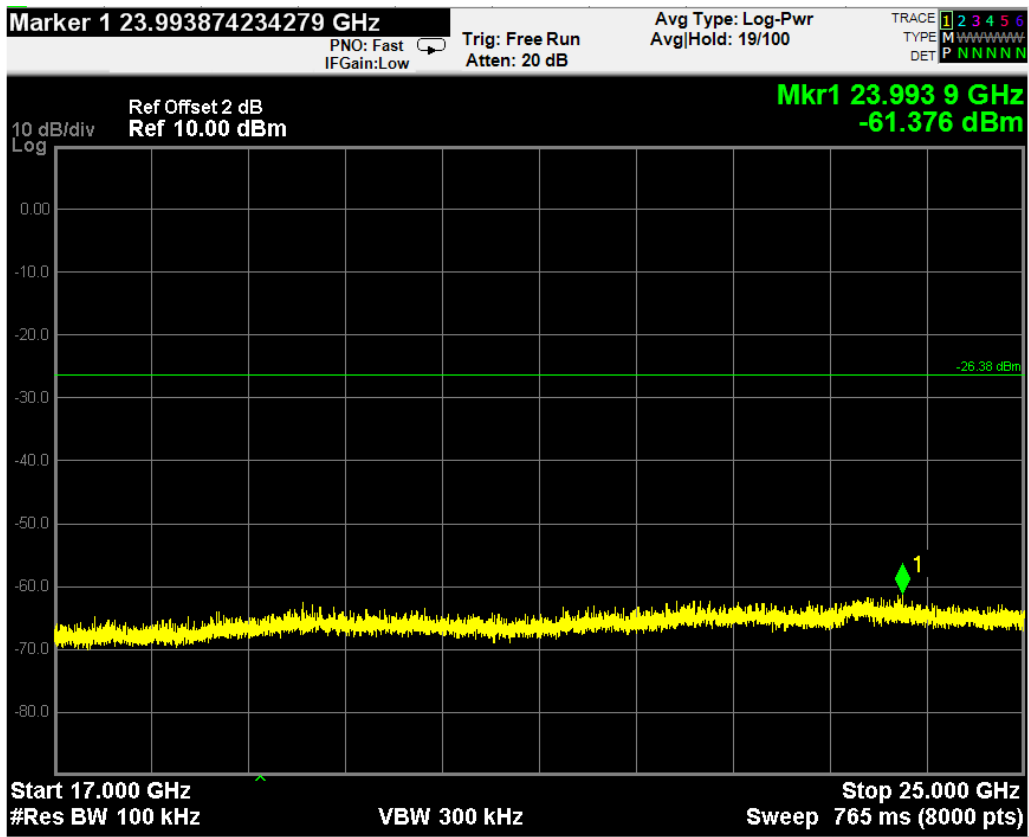
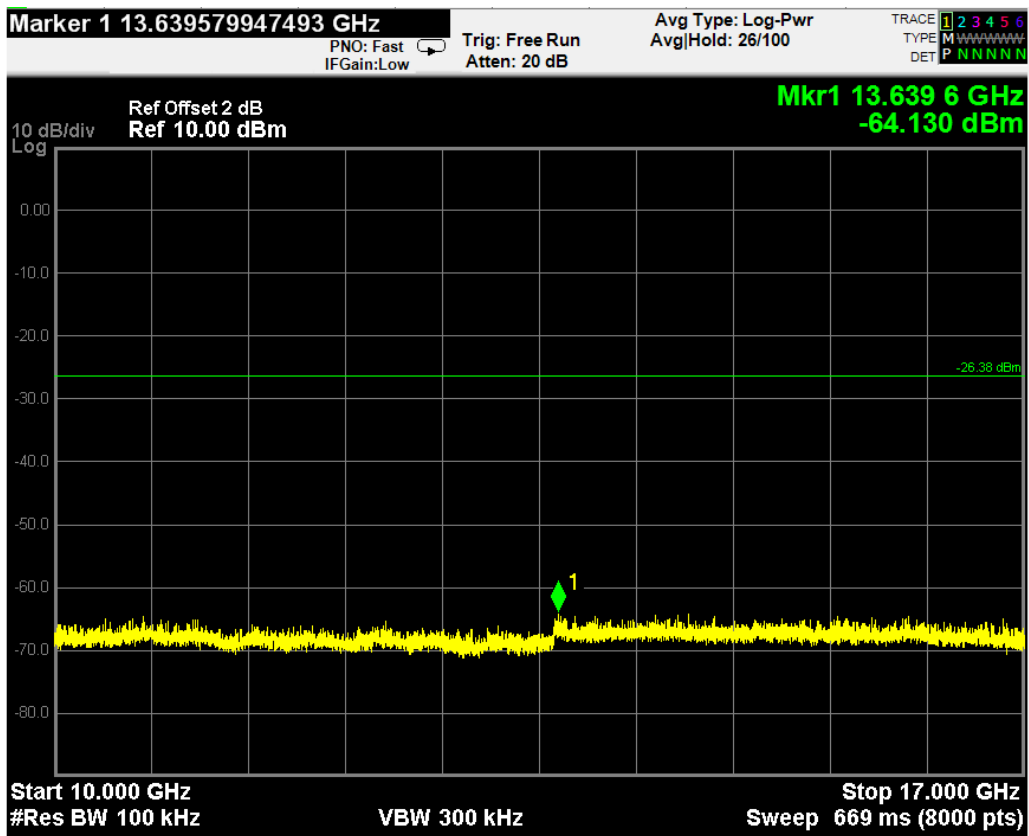


### Ch 20 (2450 MHz)

Reference level



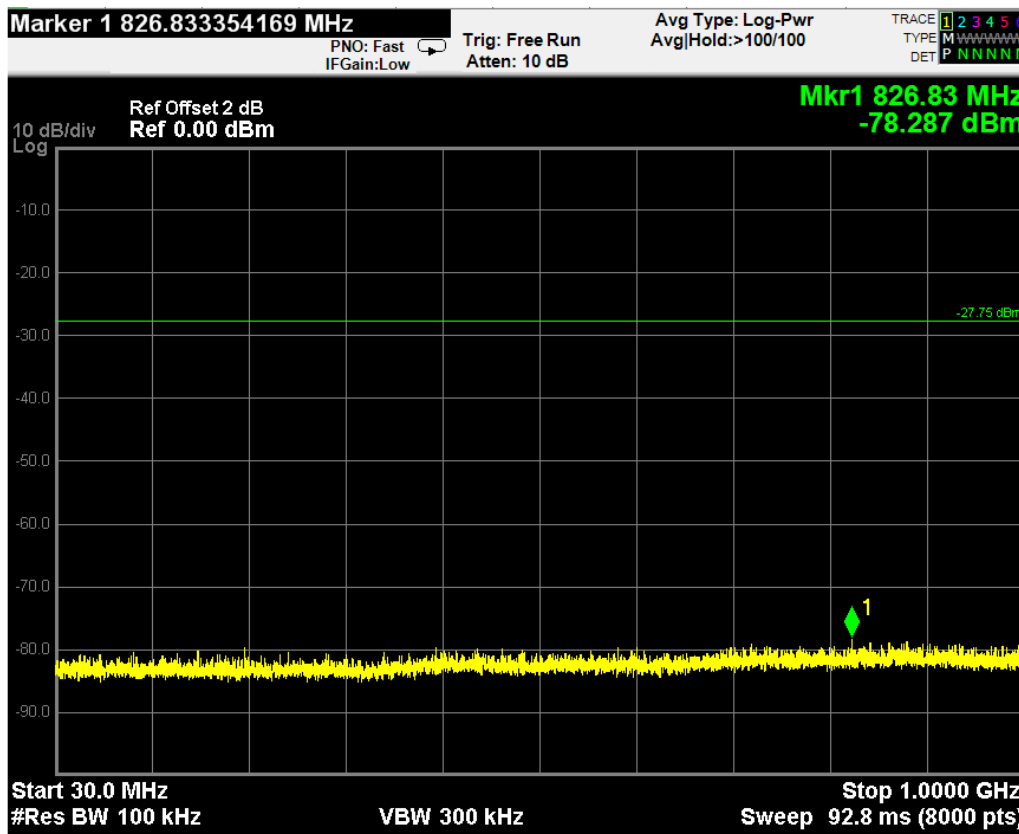


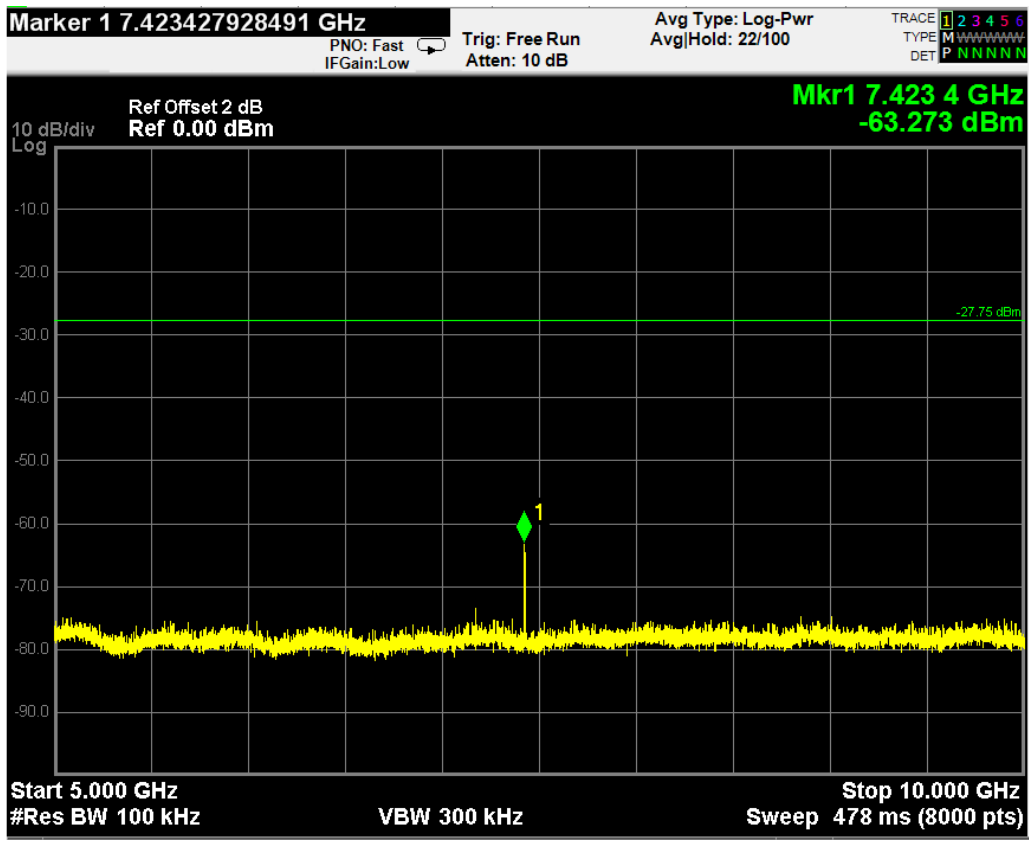
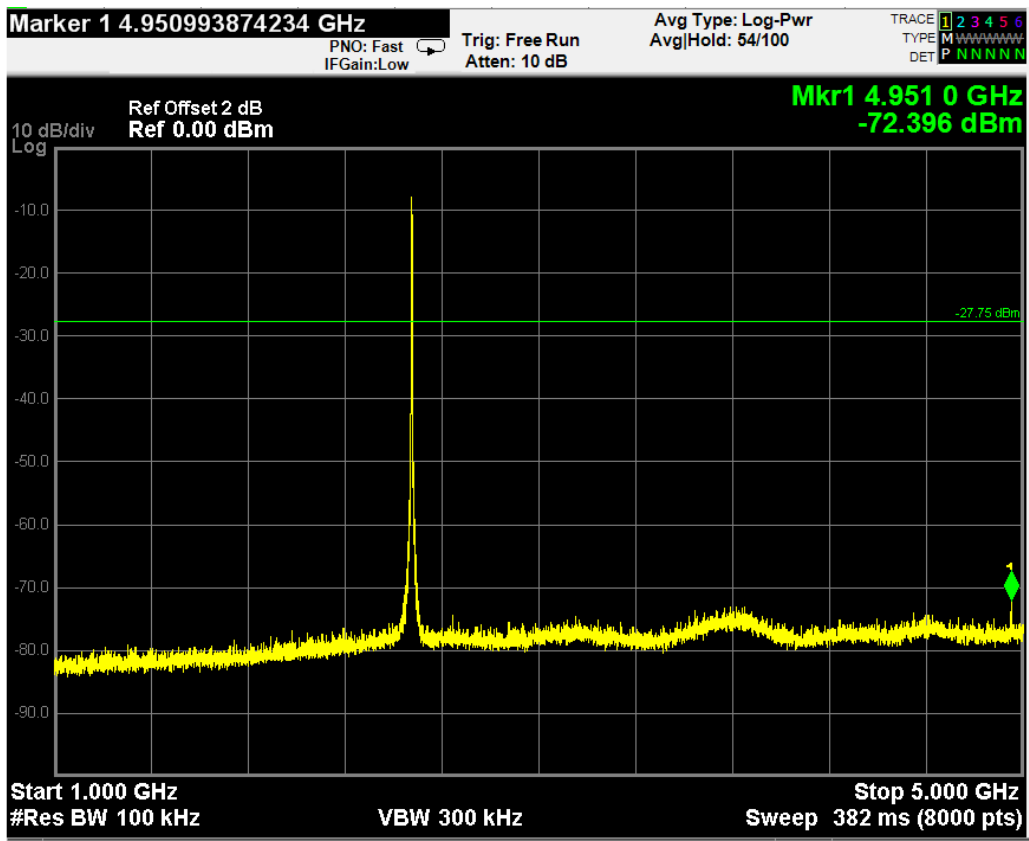


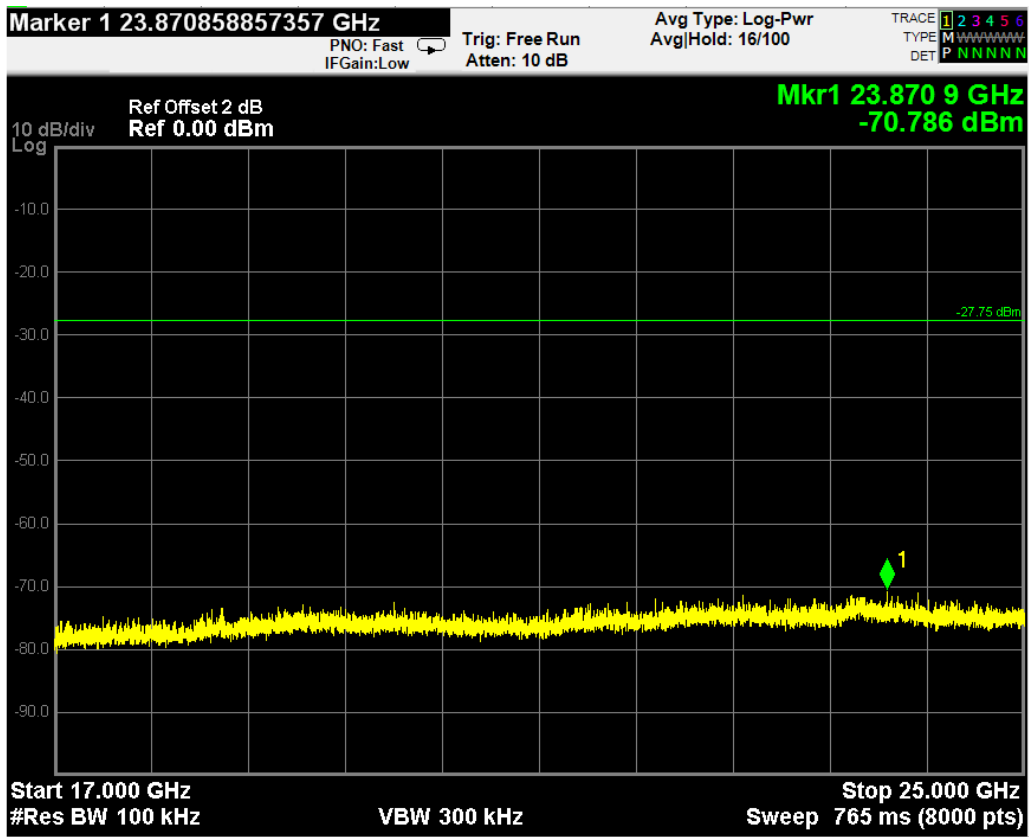
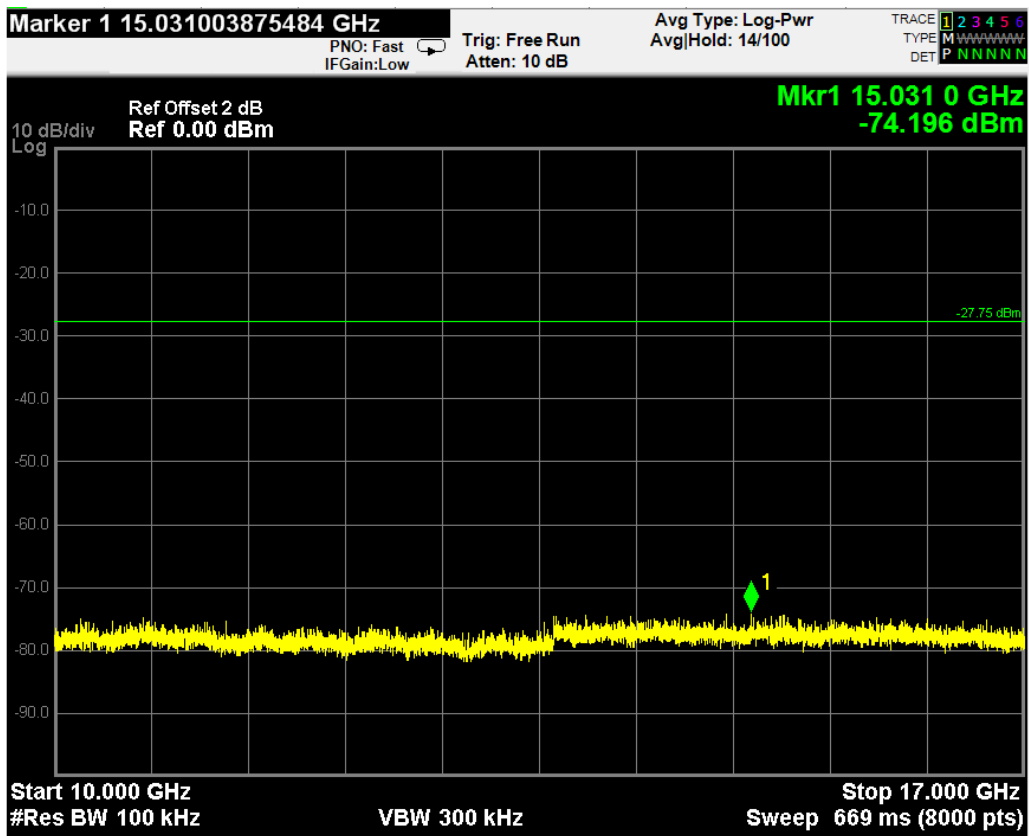


### Ch 25 (2475 MHz)

Reference level







## 7 BAND EDGES MEASUREMENT

### 7.1 Test Equipment

The following test equipment was used during the band edges measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2015	Jun 11, 2016

### 7.2 Block Diagram of Test Setup

The same as section.4.2.

### 7.3 Specification Limits (§15.247(d))

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

### 7.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

### 7.5 Test Procedure

The transmitter output was connected to the Test Receiver. Set RBW of Test Receiver to 100kHz and VBW to 300kHz with suitable frequency span including 100kHz bandwidth from band edge.

The test procedure is defined in ANSI C63.10-2013 (11.11.3 Emission level measurement was used).

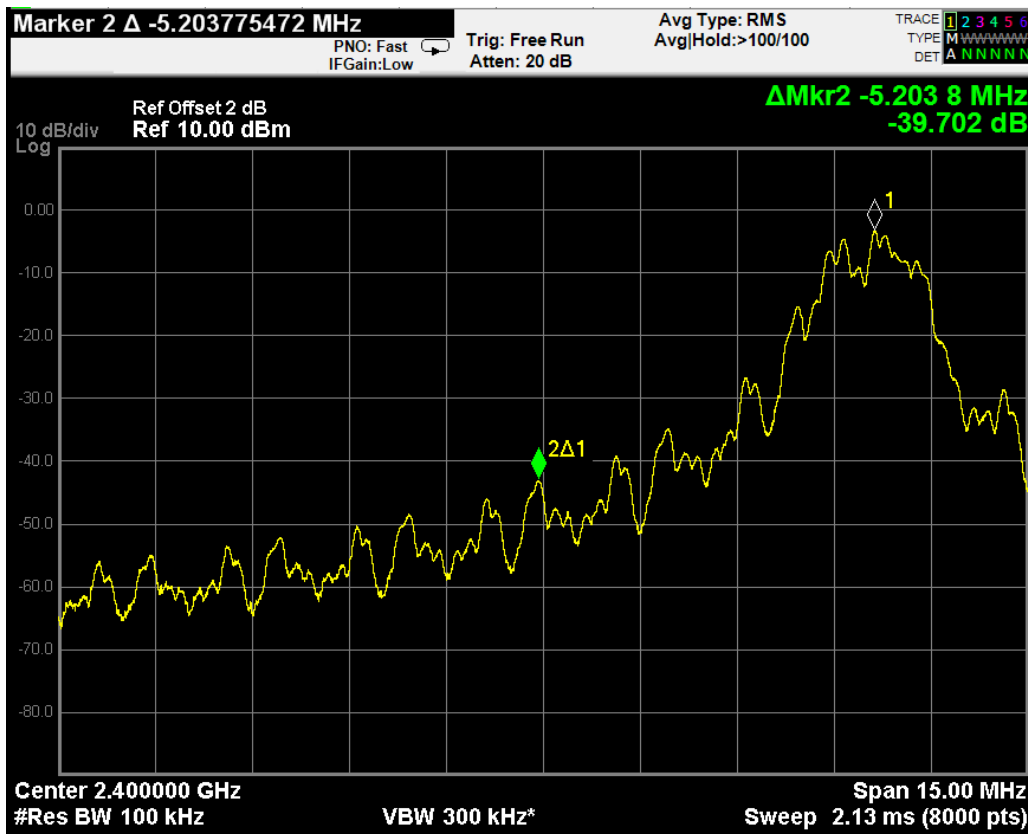
### 7.6 Test Results

**PASSED.** All the test results are attached in next pages.

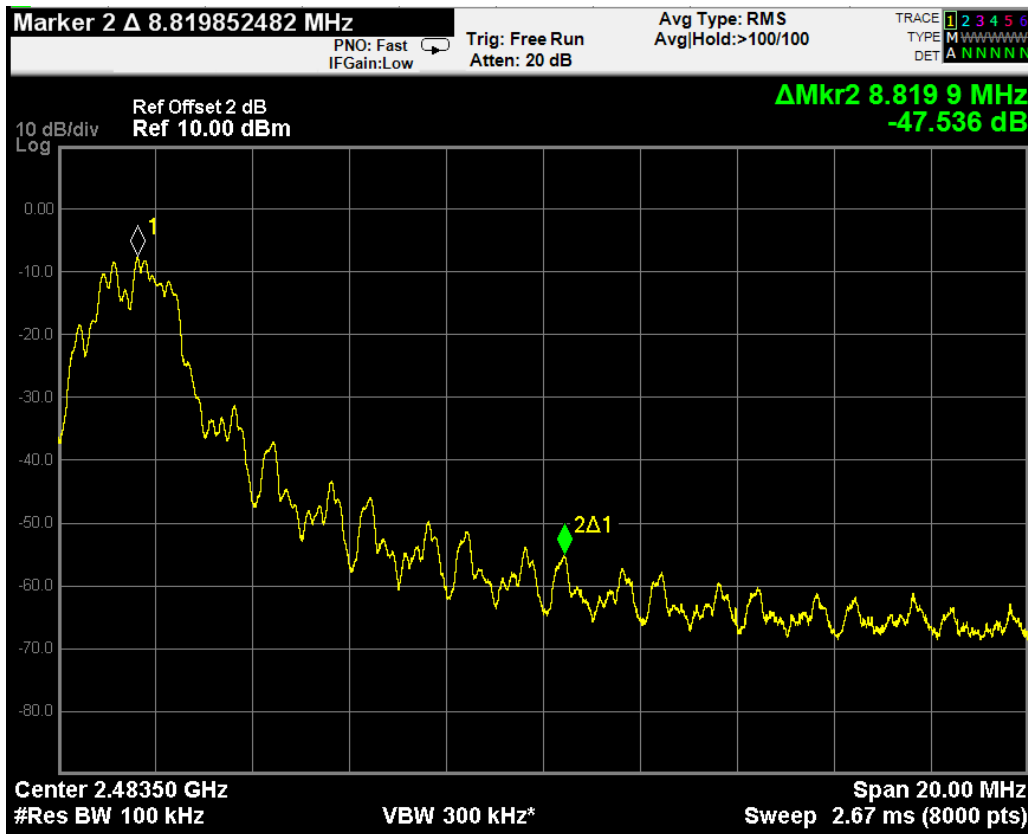
(Test Date: Mar. 10, 2016 Temperature: 20°C Humidity: 44 %)

Location	Channel	Frequency	Delta Marker	Result
Below Band Edge	11	2405 MHz	<b>39.702 dB</b>	More than <b>20 dB</b> below the highest level of the desired power
Upper Band Edge	25	2475 MHz	<b>40.488 dB</b>	

### Ch11 2405MHz (Below Edge 2400 MHz)



### Ch25 2475MHz (Upper Edge 2483.5 MHz)



## 8 POWER SPECTRAL DENSITY MEASUREMENT

### 8.1 Test Equipment

The following test equipment was used during the power spectral density measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2015	Jun 11, 2016

### 8.2 Block Diagram of Test Setup

The same as section.4.2.

### 8.3 Specification Limits (§15.247(e))

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band.

### 8.4 Operating Condition of EUT

The switch ON/OFF was used to enable the EUT to change the channel one by one.

### 8.5 Test Procedure

The transmitter output was connected to the Test Receiver. The Test Receiver was set as  $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$ ,  $\text{VBW} \geq 3 \times \text{RBW}$ , span = 1.5 times the DTS channel bandwidth.

The test procedure is defined in ANSI C63.10-2013 ( 11.10.2 Measurement Procedure “Method PKPSD (peak PSD)” was used).

### 8.6 Test Results

**PASSED.** All the test results are attached in next pages.

(Test Date: Mar. 10, 2016 Temperature: 20°C Humidity: 44 %)

Channel	Frequency	Power Spectral Density	Limit
11	2405 MHz	-3.318 dBm	8dBm
20	2450 MHz	-6.375 dBm	8dBm
25	2475 MHz	-7.751 dBm	8dBm

### Ch11 2405 MHz



### Ch20 2450 MHz



### Ch25 2475 MHz





## **9 DEVIATION TO TEST SPECIFICATIONS**

None.