

TEST REPORT  
On behalf of

Hisense Electric Co., Ltd.

Product Name: REMOTE CONTROL

Model No.: ERF2\*60, ERF2\*60\*

FCC ID: W9HBRCB0009

Prepared For: Hisense Electric Co., Ltd.  
No.218 Qianwangang Road, Economy & Technology  
Development Zone, Qingdao, China

Prepared By: Audix Technology (Shanghai) Co., Ltd.  
3F and 4F, 34Bldg, 680 Guiping Rd.,  
Caohejing Hi-Tech Park,  
Shanghai 200233, China

Tel: +86-21-64955500  
Fax: +86-21-64955491



File No. : C1D1901027  
Report No. : ACI-F19026  
Date of Test : 2019.01.17-20  
Date of Report : 2018.01.22

The statement is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.  
The 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.

## TABLE OF CONTENTS

	Page
<b>1 SUMMARY OF STANDARDS AND RESULTS.....</b>	<b>5</b>
1.1 Description of Standards and Results.....	5
<b>2 GENERAL INFORMATION.....</b>	<b>6</b>
2.1 Description of Equipment Under Test.....	6
2.2 Description of Test Facility.....	7
2.3 Measurement Uncertainty .....	7
<b>3 RADIATED EMISSION TEST.....</b>	<b>8</b>
3.1 Test Equipment.....	8
3.2 Block Diagram of Test Setup .....	8
3.3 Radiated Emission Limit [FCC Part 15 Subpart C 15.209] .....	9
3.4 Test Configuration.....	9
3.5 Operating Condition of EUT .....	10
3.6 Test Procedures .....	10
3.7 Test Results .....	11
<b>4 6 dB BANDWIDTH MEASUREMENT.....</b>	<b>18</b>
4.1 Test Equipment.....	18
4.2 Block Diagram of Test Setup .....	18
4.3 Specification Limits (§15.247(a)(2)).....	18
4.4 Operating Condition of EUT .....	18
4.5 Test Procedure .....	18
4.6 Test Results .....	19
<b>5 MAXIMUM PEAK OUTPUT POWER MEASUREMENT.....</b>	<b>22</b>
5.1 Test Equipment.....	22
5.2 Block Diagram of Test Setup .....	22
5.3 Specification Limits ((§15.247(b)(3)).....	22
5.4 Operating Condition of EUT .....	22
5.5 Test Procedure .....	22
5.6 Test Results .....	23
<b>6 EMISSION LIMITATIONS MEASUREMENT.....</b>	<b>26</b>
6.1 Test Equipment.....	26
6.2 Block Diagram of Test Setup .....	26
6.3 Specification Limits (§15.247(d)).....	26
6.4 Operating Condition of EUT .....	26
6.5 Test Procedure .....	26
6.6 Test Results .....	28
<b>7 BAND EDGES MEASUREMENT .....</b>	<b>35</b>
7.1 Test Equipment.....	35
7.2 Block Diagram of Test Setup .....	35
7.3 Specification Limits (§15.247(d)).....	35
7.4 Operating Condition of EUT .....	35
7.5 Test Procedure .....	35
7.6 Test Results .....	36
<b>8 POWER SPECTRAL DENSITY MEASUREMENT.....</b>	<b>38</b>
8.1 Test Equipment.....	38

8.2	Block Diagram of Test Setup .....	38
8.3	Specification Limits (§15.247(e)) .....	38
8.4	Operating Condition of EUT .....	38
8.5	Test Procedure .....	38
8.6	Test Results .....	39
<b>9</b>	<b>DEVIATION TO TEST SPECIFICATIONS .....</b>	<b>42</b>

## TEST REPORT

Applicant : Hisense Electric Co., Ltd.  
EUT Description : REMOTE CONTROL  
(A) Model No. : Refer to Sec.2.1  
(B) Power Supply : DC 3V  
(C) Test Voltage : DC 3V

## Test Procedure Used:

*FCC RULES AND REGULATIONS PART 15 SUBPART C  
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 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.

Date of Test : 2019.01.17-20 Date of Report : 2019.01.22

Producer : Jarey Lu  
JAREY LU / Supervisor

Reviewer : Byron Wu  
BYRON WU / Deputy Assistant Manager

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

Signatory : Byron Kwo  
Authorized Signature(s) 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 AND ANSI C63.10:2013	N/A	15.207
Radiated Emission	FCC RULES AND REGULATIONS PART 15 SUBPART C 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 AND ANSI C63.10:2013	Pass	15.247(a)(2)
Maximum Peak Output Power Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(b)(3)
Emission Limitations Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(d)
Band Edge Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C AND ANSI C63.10:2013	Pass	15.247(d)
Power Spectral Density Measurement	FCC RULES AND REGULATIONS PART 15 SUBPART C 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 : REMOTE CONTROL

Type of EUT :  Production  Pre-product  Pro-type

Model Number : ERF2\*60, ERF2\*60\*

Note : The different of Models are as follows:

M/N	Difference	
ERF2*60	“*” represents “0” ~ “9” or blank or “A” ~ “Z”, for different sales area and customer.	different printed word of keys
ERF2*60*		

Test Model : ERF2A60

Radio Tech : Bluetooth v4.2 BLE

Channel Freq. : 2402MHz-2480MHz

Tested Freq. : 2402MHz, 2442MHz, 2480MHz

Modulation : GFSK

Antenna Info. : Antenna Type: PCB Antenna  
Antenna Gain: 1.21 dBi  
The Antenna is permanently attached to the intentional radiator that is comply with 15.203 requirement.

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

Applicant : Hisense Electric Co., Ltd.  
No.218 Qianwangang Road, Economy & Technology Development Zone, Qingdao, China

Manufacturer : same as Applicant

Factory : same as Applicant

## 2.2 Description of Test Facility

Name of Firm : Audix Technology (Shanghai) Co., Ltd.

Site Location : 3F and 4F, 34Bldg, 680 Guiping Rd.,  
Caohejing Hi-Tech Park,  
Shanghai 200233, China.

Accredited by NVLAP, Lab Code : 200371-0

FCC Designation Number : CN5027

Test Firm Registration Number : 954668

## 2.3 Measurement Uncertainty

Radiated Emission Expanded Uncertainty (30-1000MHz):

U = 3.99dB

Radiated Emission Expanded Uncertainty (1000M-26.5GHz):

U = 4.98dB

6 dB Bandwidth Expanded Uncertainty : U =  $6 \times 10^{-8}$  MHz

Maximum Peak Output Power Expanded Uncertainty : U = 0.84 dB

Power Spectral Density Expanded Uncertainty : U = 0.38 dB

### 3 RADIATED EMISSION TEST

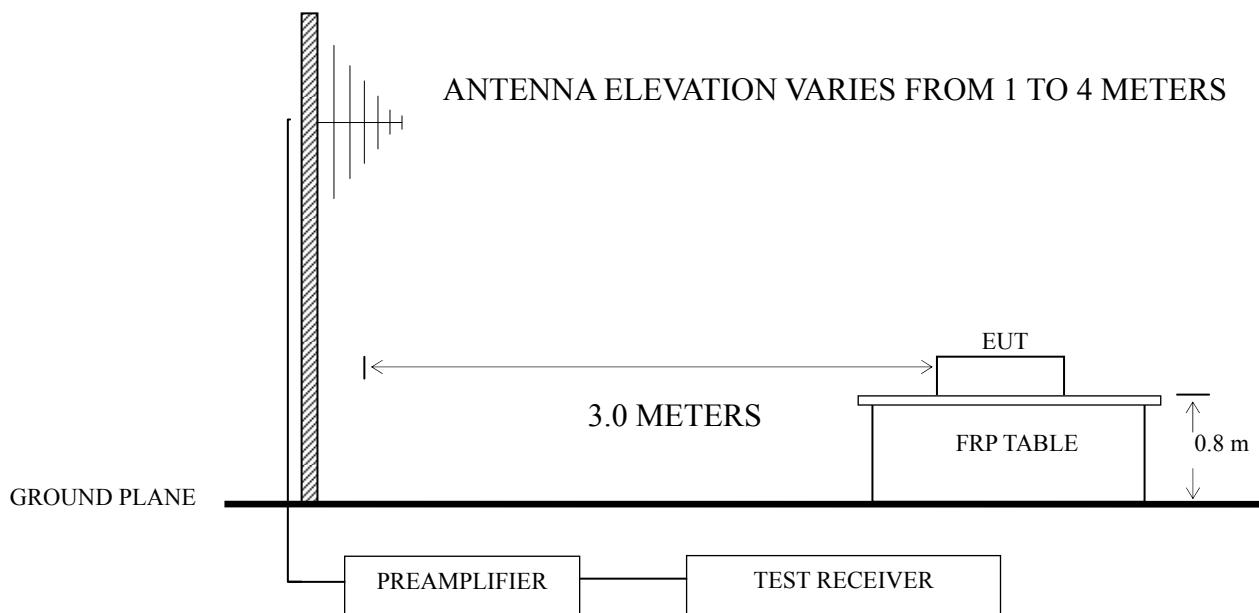
#### 3.1 Test Equipment

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

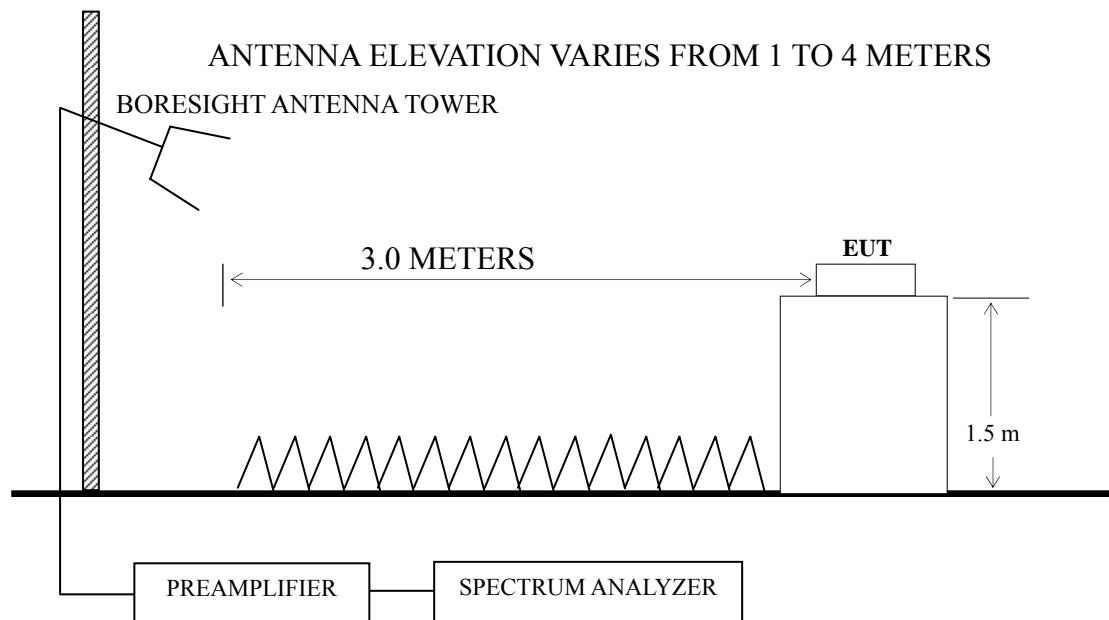
Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Preamplifier	Agilent	8447D	2944A06664	Apr 27, 2018	Apr 26, 2019
2.	Preamplifier	HP	8449B	3008A00864	Mar 8, 2018	Mar 7, 2019
3.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jan 05, 2019	Jan 05, 2020
4.	Test Receiver	R&S	ESCI	101303	May 07, 2018	May 06, 2019
5.	Bi-log Antenna	Schwarz beck	VULB 9168	708	Jul 20, 2018	Jul 19, 2019
6.	Horn Antenna	EMCO	3115	9607-4878	Jun 02, 2018	Jun 01, 2019
7.	Horn Antenna	EMCO	3116	00062643	Sep 08, 2018	Sep 07, 2019
8.	Software	Audix	E3	SET00200 9912M295-2	--	--

#### 3.2 Block Diagram of Test Setup

##### 3.2.1 Below 1GHz



### 3.2.2 Above 1GHz



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

Frequency (MHz)	Distance (m)	Field strength limits ( $\mu$ V/m)	
		( $\mu$ V/m)	dB( $\mu$ 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 ( $\mu$ V/m) = 20 log Emission Level ( $\mu$ 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.

Frequency range: below 1G (Worst case emission)

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	BLE	00	2402 MHz	P12
2.	Receiving	BLE	--	--	P13

Frequency range: above 1G

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	BLE	00	2402 MHz	P14
2.	Transmitting	BLE	20	2442 MHz	P14
3.	Transmitting	BLE	39	2480 MHz	P15
4.	Receiving	BLE	39	2480 MHz	P16

Restricted bands:

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	BLE	Cabinet Emission		P17

NOTE 1 – Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

NOTE 2 – “QP” means “Quasi-Peak” values

NOTE 3 – 0° was the table front facing the antenna. Degree is calculated from 0° clockwise facing the antenna.

NOTE 4 – The emission levels which not reported are too low against the official limit.

NOTE 5 – The emission levels recorded below is data of EUT configured in Lying direction, for Lying direction was the maximum emission direction during the test. The data of Side & Standing direction are too low against the official limit to be reported.

NOTE 6 – 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.

NOTE 7 – The frequency range 2310-2390MHz & 2483.5-2500MHz were tested for Restricted bands.

**Worst case emission < 1GHz**

EUT : REMOTE CONTROL      Temperature : 22°C

Model No. : ERF2A60      Humidity : 51%RH

Test Mode : Transmitting      Date of Test : 2019.01.20

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	43.506	27.62	19	0.72	28.15	19.19	40	20.81	QP
	63.536	26.71	18.75	0.86	28.1	18.22	40	21.78	QP
	157.007	26.3	20.09	1.39	27.56	20.22	43.5	23.28	QP
	287.99	26.08	19.88	1.84	27.06	20.74	46	25.26	QP
	595.133	27.36	25.42	2.65	27.76	27.67	46	18.33	QP
	922.516	26.04	28.6	3.3	26.91	31.03	46	14.97	QP
Vertical	48.843	26.86	18.94	0.76	28.14	18.42	40	21.58	QP
	62.431	26.68	18.65	0.85	28.1	18.08	40	21.92	QP
	154.279	27.34	20.02	1.38	27.58	21.16	43.5	22.34	QP
	462.346	26.57	23.03	2.34	27.86	24.08	46	21.92	QP
	726.805	26.16	27.09	2.92	27.47	28.7	46	17.3	QP
	878.322	25.83	28.5	3.22	27.05	30.5	46	15.5	QP

TEST ENGINEER: Jarey

EUT : REMOTE CONTROL Temperature : 22°C

Model No. : ERF2A60 Humidity : 51%RH

Test Mode : Receiving Date of Test : 2019.01.20

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	53.693	27.21	19.64	0.79	28.13	19.51	40	20.49	QP
	62.431	26.6	18.65	0.85	28.1	18	40	22	QP
	154.279	26.2	20.02	1.38	27.58	20.02	43.5	23.48	QP
	346.809	26.73	20.21	2.03	27.32	21.65	46	24.35	QP
	620.71	25.69	26.1	2.71	27.7	26.8	46	19.2	QP
	906.482	25.66	28.53	3.27	26.97	30.49	46	15.51	QP
Vertical	50.409	27.24	19.16	0.77	28.14	19.03	40	20.97	QP
	64.887	26.33	17.4	0.86	28.1	16.49	40	23.51	QP
	156.458	26.41	20.07	1.39	27.57	20.3	43.5	23.2	QP
	475.499	26.29	23.1	2.37	27.92	23.84	46	22.16	QP
	679.96	26.03	26.6	2.83	27.57	27.89	46	18.11	QP
	929.008	25.2	28.68	3.33	26.88	30.33	46	15.67	QP

TEST ENGINEER: Jarey

**Radiated Emission > 1GHz**

EUT : REMOTE CONTROL Temperature : 22°C  
 Model No. : ERF2A60 Humidity : 51%RH  
 Test Mode : Transmitting Date of Test : 2019.01.20

**CH00 (2402MHz)**

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	1200.526	51.74	24.72	3.77	38.17	42.06	74	31.94	Peak
	1745.842	49.65	27.35	4.45	37.31	44.14	74	29.86	Peak
	2215.64	49.19	28.71	4.99	36.87	46.02	74	27.98	Peak
	2914.448	50.09	30.35	5.77	36.77	49.44	74	24.56	Peak
	3987.794	48.63	32.4	6.84	35.78	52.09	74	21.91	Peak
	5645.392	46.29	34.84	8.41	36.82	52.72	74	21.28	Peak
Vertical	1239.876	49.04	24.9	3.85	38.13	39.66	74	34.34	Peak
	1829.098	48.93	27.7	4.53	37.15	44.01	74	29.99	Peak
	2924.911	49.66	30.35	5.77	36.77	49.01	74	24.99	Peak
	3952.228	48.61	32.34	6.84	35.81	51.98	74	22.02	Peak
	4719.315	46.45	33.64	7.48	36.23	51.34	74	22.66	Peak
	5495.685	46.73	34.69	8.23	36.73	52.92	74	21.08	Peak

**CH20 (2442MHz)**

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	1348.812	49.77	25.56	3.81	37.93	41.21	74	32.79	Peak
	1816.036	48.88	27.63	4.43	37.19	43.75	74	30.25	Peak
	2118.583	49.69	28.57	4.8	36.88	46.18	74	27.82	Peak
	2972.46	49.63	30.5	5.71	36.76	49.08	74	24.92	Peak
	3745.394	49.39	31.99	6.52	36.01	51.89	74	22.11	Peak
	5505.541	46.11	34.7	8.11	36.74	52.18	74	21.82	Peak
Vertical	1320.12	49.85	25.37	3.95	37.97	41.2	74	32.8	Peak
	1989.803	49.22	28.33	4.68	36.9	45.33	74	28.67	Peak
	2898.824	50.12	30.3	5.73	36.77	49.38	74	24.62	Peak
	3772.333	49.16	32.04	6.63	35.98	51.85	74	22.15	Peak
	4744.751	46.81	33.68	7.48	36.25	51.72	74	22.28	Peak
	5575.028	45.92	34.77	8.32	36.78	52.23	74	21.77	Peak

**CH39 (2480MHz)**

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	1226.618	48.97	24.81	3.82	38.13	39.47	74	34.53	Peak
	1786.985	47.61	27.49	4.5	37.23	42.37	74	31.63	Peak
	2184.107	48.6	28.67	4.95	36.87	45.35	74	28.65	Peak
	2961.827	48.57	30.45	5.81	36.76	48.07	74	25.93	Peak
	3806.281	48.59	32.1	6.68	35.96	51.41	74	22.59	Peak
	5417.471	46.43	34.63	8.14	36.68	52.52	74	21.48	Peak
Vertical	1303.666	48.06	25.28	3.93	38.01	39.26	74	34.74	Peak
	1889.051	48.52	27.91	4.61	37.06	43.98	74	30.02	Peak
	2977.79	49.29	30.5	5.81	36.76	48.84	74	25.16	Peak
	3711.989	49.02	31.96	6.58	36.06	51.5	74	22.5	Peak
	4770.324	45.52	33.76	7.48	36.27	50.49	74	23.51	Peak
	5625.198	46.45	34.82	8.41	36.81	52.87	74	21.13	Peak

TEST ENGINEER: Jarey

EUT : REMOTE CONTROL      Temperature : 22°C

Model No. : ERF2A60      Humidity : 51%RH

Test Mode : Receiving      Date of Test : 2019.01.20

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	1287.417	48.93	25.18	3.72	38.05	39.78	74	34.22	Peak
	1714.84	48.4	27.21	4.31	37.35	42.57	74	31.43	Peak
	2149.169	48.64	28.62	4.84	36.88	45.22	74	28.78	Peak
	3026.199	48.13	30.63	5.75	36.73	47.78	74	26.22	Peak
	3854.321	48.51	32.18	6.62	35.91	51.4	74	22.6	Peak
	5436.92	46.03	34.65	8.06	36.69	52.05	74	21.95	Peak
Vertical	1271.371	48	25.09	3.88	38.05	38.92	74	35.08	Peak
	1793.401	48.65	27.56	4.5	37.23	43.48	74	30.52	Peak
	3015.374	48.42	30.63	5.85	36.73	48.17	74	25.83	Peak
	3847.421	47.66	32.15	6.74	35.91	50.64	74	23.36	Peak
	4668.852	46.71	33.51	7.42	36.2	51.44	74	22.56	Peak
	5545.141	45.78	34.73	8.32	36.76	52.07	74	21.93	Peak

TEST ENGINEER: Jarey

**Emissions in restricted frequency bands:**

EUT : REMOTE CONTROL      Temperature : 22°C

Model No. : ERF2A60      Humidity : 51%RH

Test Mode : Transmitting      Date of Test : 2019.01.20

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	2326.812	47.34	28.48	5.04	35.26	45.6	74	28.4	Peak
	2326.812	36.22	28.48	5.04	35.26	34.48	54	19.52	Average
	2371.866	47.53	28.57	5.08	35.26	45.92	74	28.08	Peak
	2371.866	36.35	28.57	5.08	35.26	34.74	54	19.26	Average
	2487.109	46.29	28.77	5.23	35.25	45.04	74	28.96	Peak
	2487.109	36.44	28.77	5.23	35.25	35.19	54	18.81	Average
	2496.251	46.17	28.79	5.23	35.25	44.94	74	29.06	Peak
	2496.251	37.13	28.79	5.23	35.25	35.9	54	18.1	Average
Vertical	2331.473	47.66	28.49	5.04	35.26	45.93	74	28.07	Peak
	2331.473	37.24	28.49	5.04	35.26	35.51	54	18.49	Average
	2363.574	47.1	28.55	5.08	35.26	45.47	74	28.53	Peak
	2363.574	36.33	28.55	5.08	35.26	34.7	54	19.3	Average
	2489.807	46.99	28.79	5.23	35.25	45.76	74	28.24	Peak
	2489.807	36.4	28.79	5.23	35.25	35.17	54	18.83	Average
	2498.125	47.23	28.8	5.23	35.25	46.01	74	27.99	Peak
	2498.125	37.13	28.8	5.23	35.25	35.91	54	18.09	Average

TEST ENGINEER: Jarey

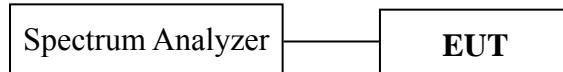
## 4 6 dB BANDWIDTH MEASUREMENT

### 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	Jan 05, 2019	Jan 05, 2020

### 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 measured by spectrum analyzer with settings: RBW = 100kHz, VBW  $\geq 3 \times$  RBW.

The 6 dB bandwidth is defined as the total spectrum the power of which is lower 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).

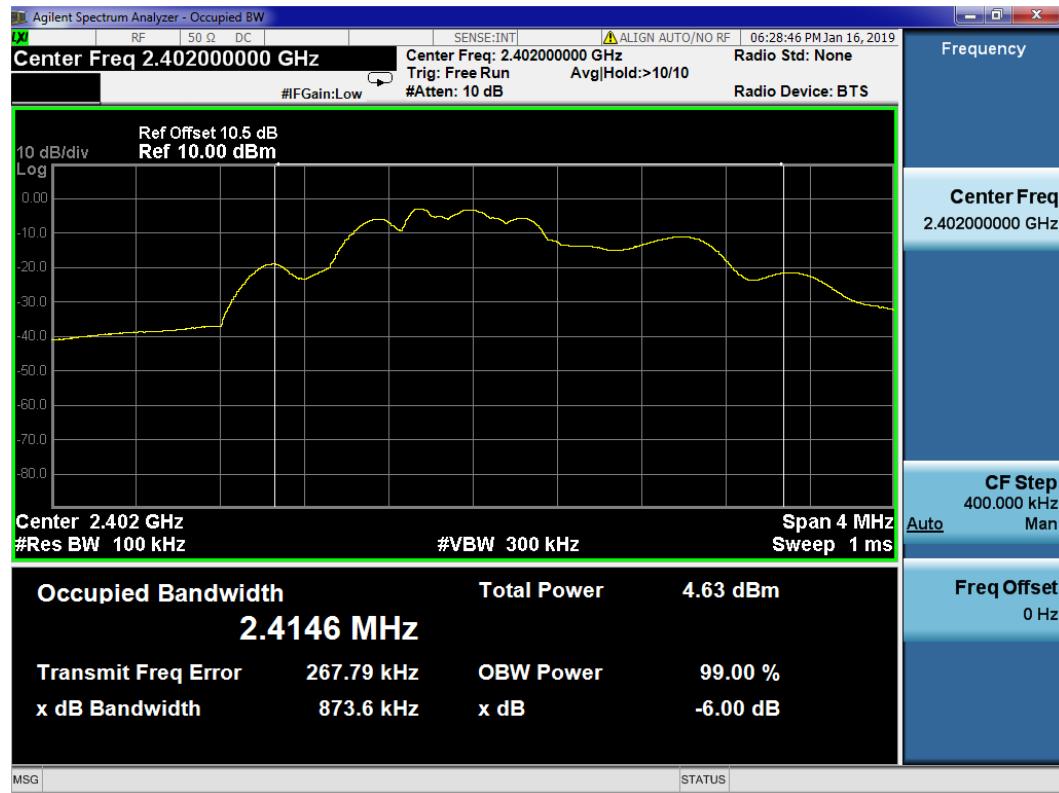
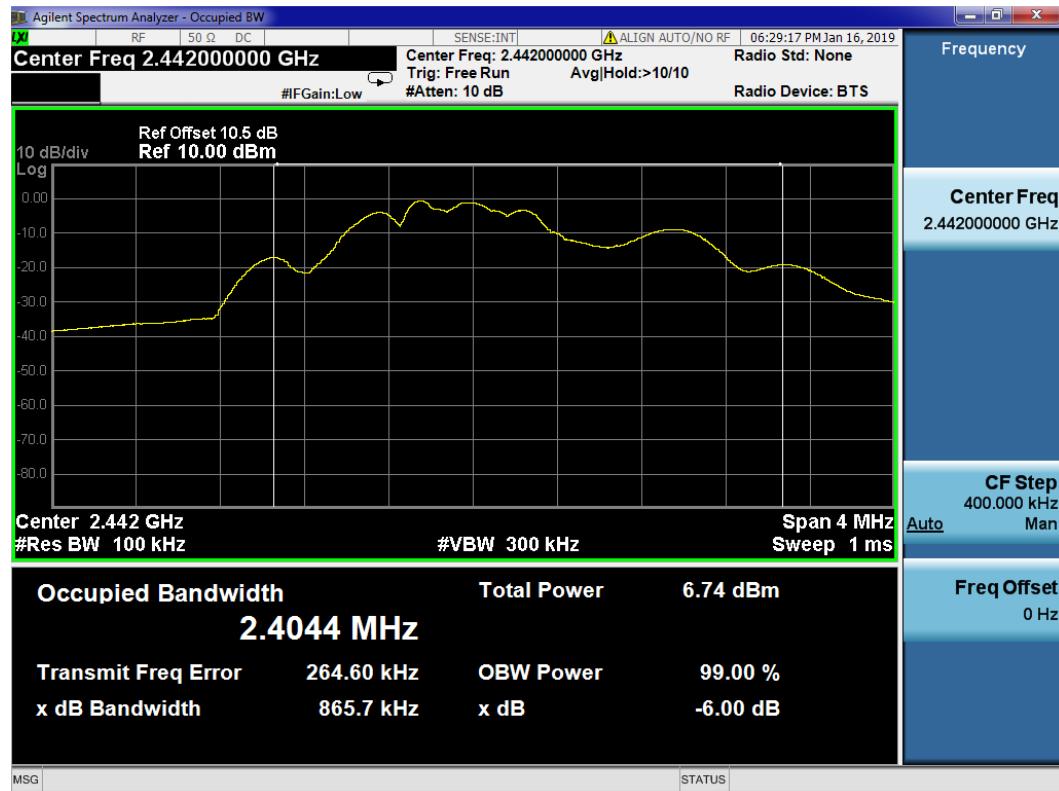
## 4.6 Test Results

**PASSED.**

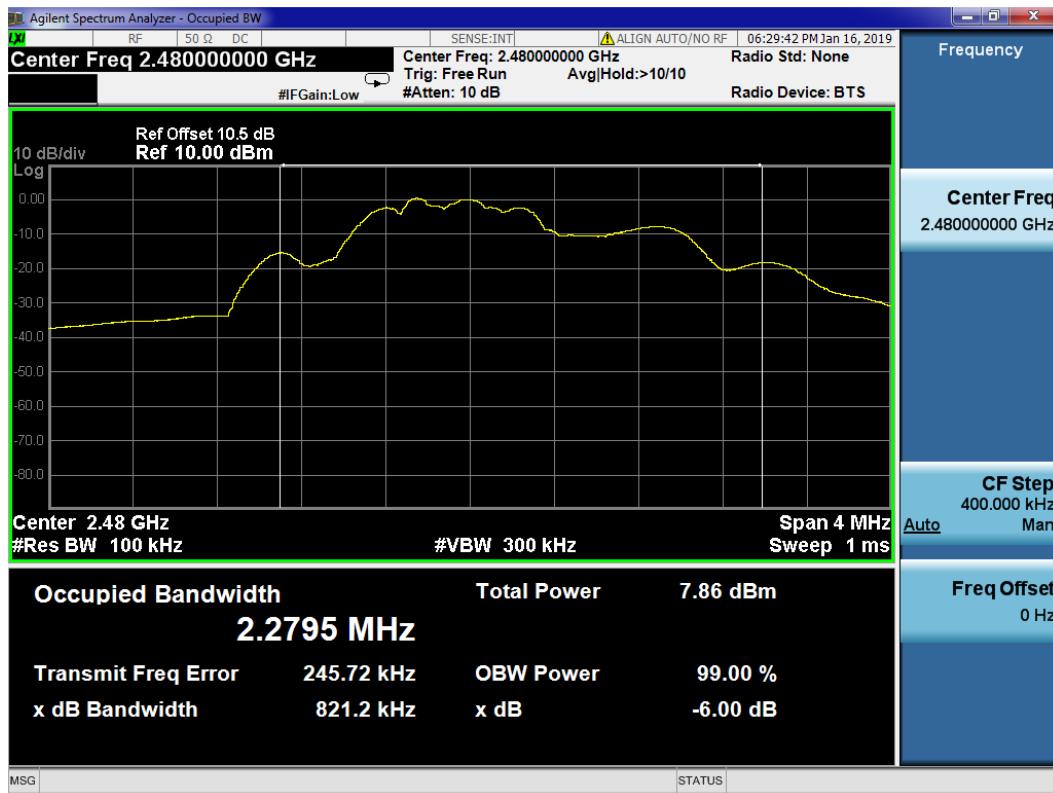
All the test results are attached in next pages.

(Test Date: 2019.01.16 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Limit
BLE	00	2402	<b>873.6</b>	500 kHz
	20	2442	<b>865.7</b>	500 kHz
	39	2480	<b>821.2</b>	500 kHz

**CH00 (2402 MHz)****CH20 (2442 MHz)**

## CH39 (2480 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	Jan 05, 2019	Jan 05, 2020

### 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 transmitter output was connected to the spectrum analyzer.

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)  $RBW \geq DTS$  Bandwidth.
- b)  $VBW \geq [3 \times RBW]$ .
- c)  $Span \geq [3 \times RBW]$ .
- d) Sweep time = auto.
- 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

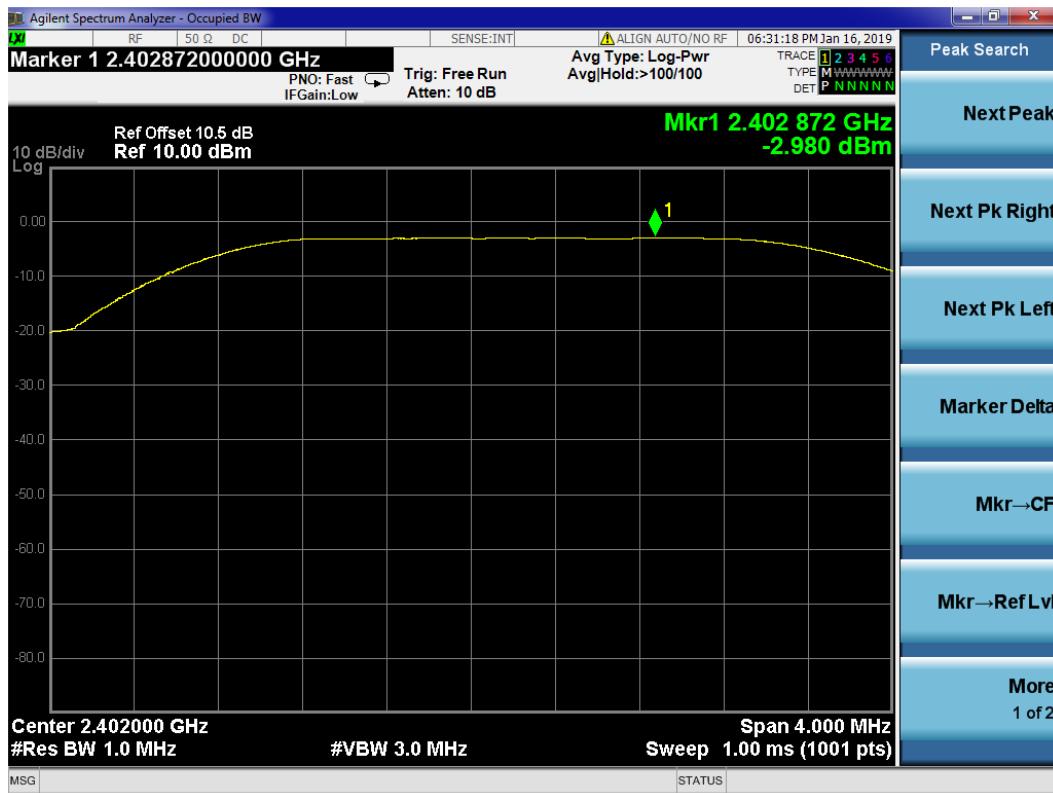
**PASSED.**

All the test results are listed below.

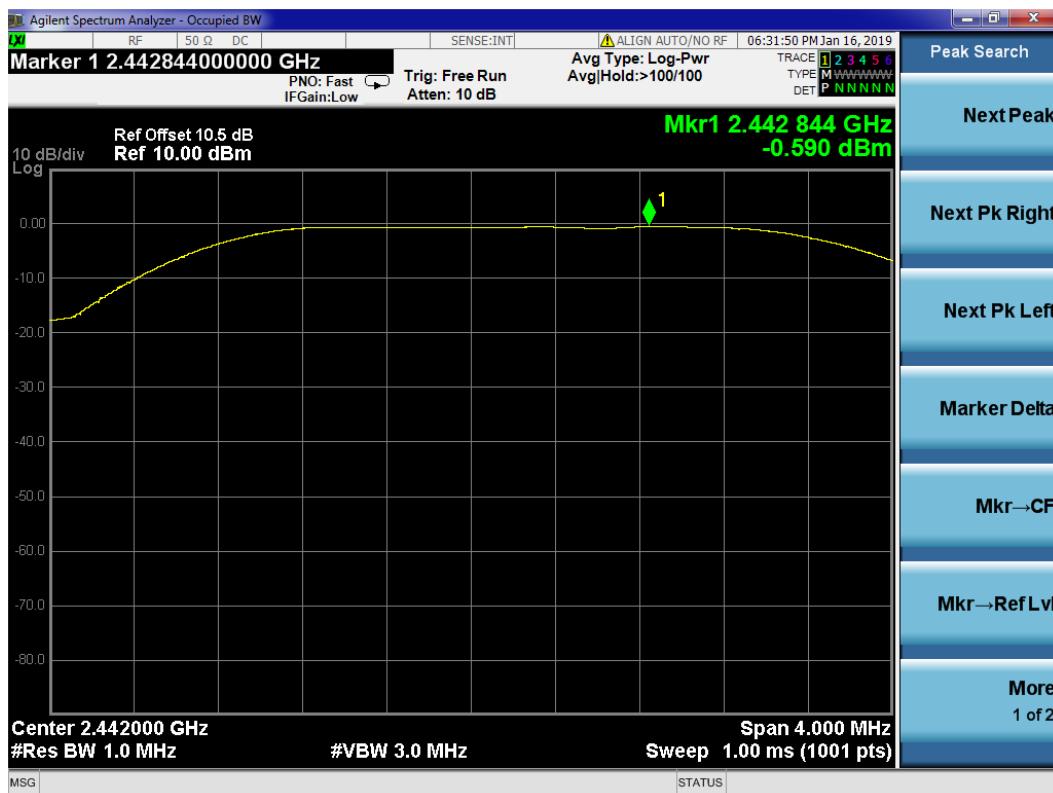
(Test Date: 2019.01.16 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit
BLE	00	2402 MHz	<b>-2.980</b>	30 dBm
	20	2442 MHz	<b>-0.590</b>	30 dBm
	39	2480 MHz	<b>0.468</b>	30 dBm

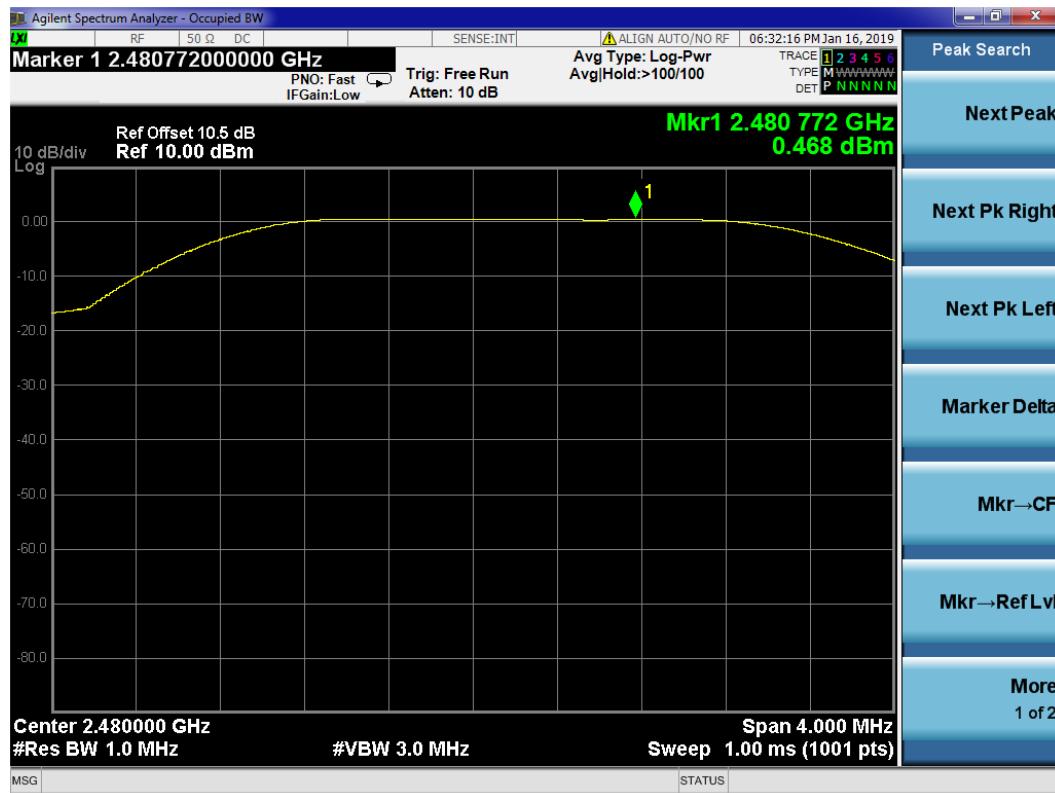
## CH00 (2402 MHz)



## CH20 (2442 MHz)



## CH39 (2480 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	Jan 05, 2019	Jan 05, 2020

### 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

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) (see §15.205(c)). (※This test result attaching to Section. 3.7)

### 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 spectrum analyzer.

Establish a reference level by using the following procedure:

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

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

Establish an emission level by using the following procedure:

- a) Set the center frequency and span to encompass frequency range to be measured.

- b) Set the RBW = 100 kHz.
- c) Set the VBW  $\geq [3 \times \text{RBW}]$ .
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.  
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in 11.11. Report the three highest emissions relative to the limit.

Scan up through 10<sup>th</sup> harmonic.

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: 2019.01.16 Temperature: 23°C Humidity: 51 %)

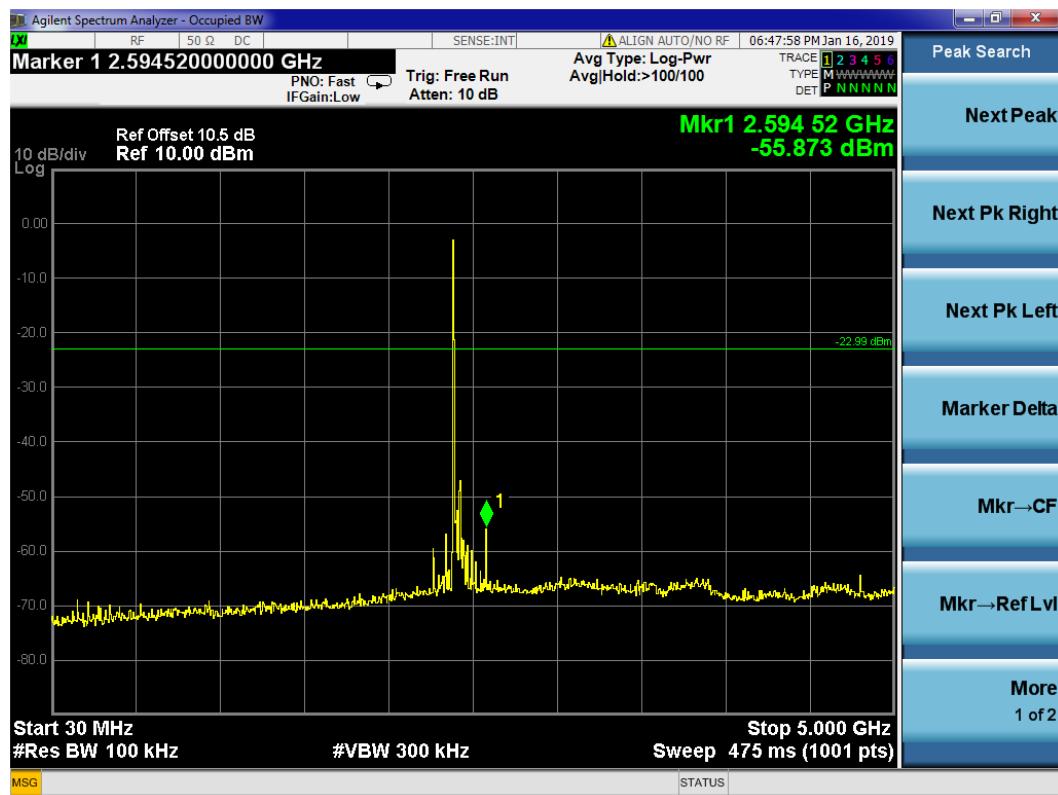
Modulation	Channel	Frequency (MHz)	Data Page
BLE	00	2402 MHz	P29-30
	20	2442 MHz	P31-32
	39	2480 MHz	P33-34

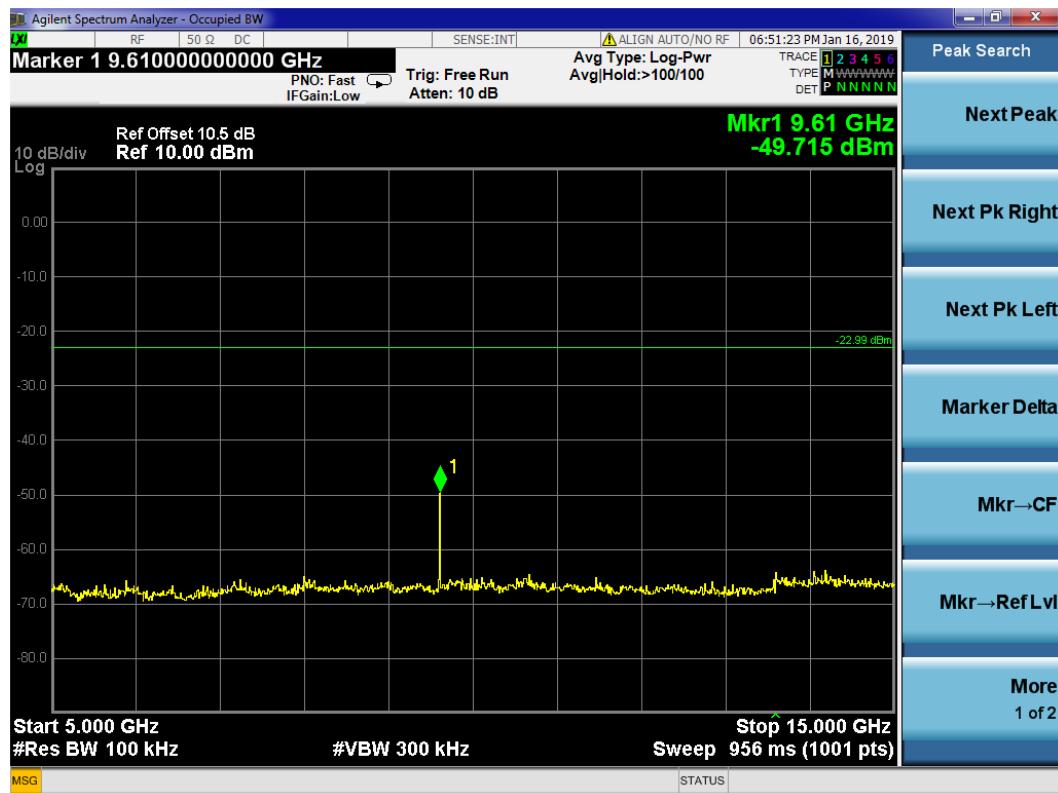
## CH00 (2402 MHz)

## Reference level



## Emission level



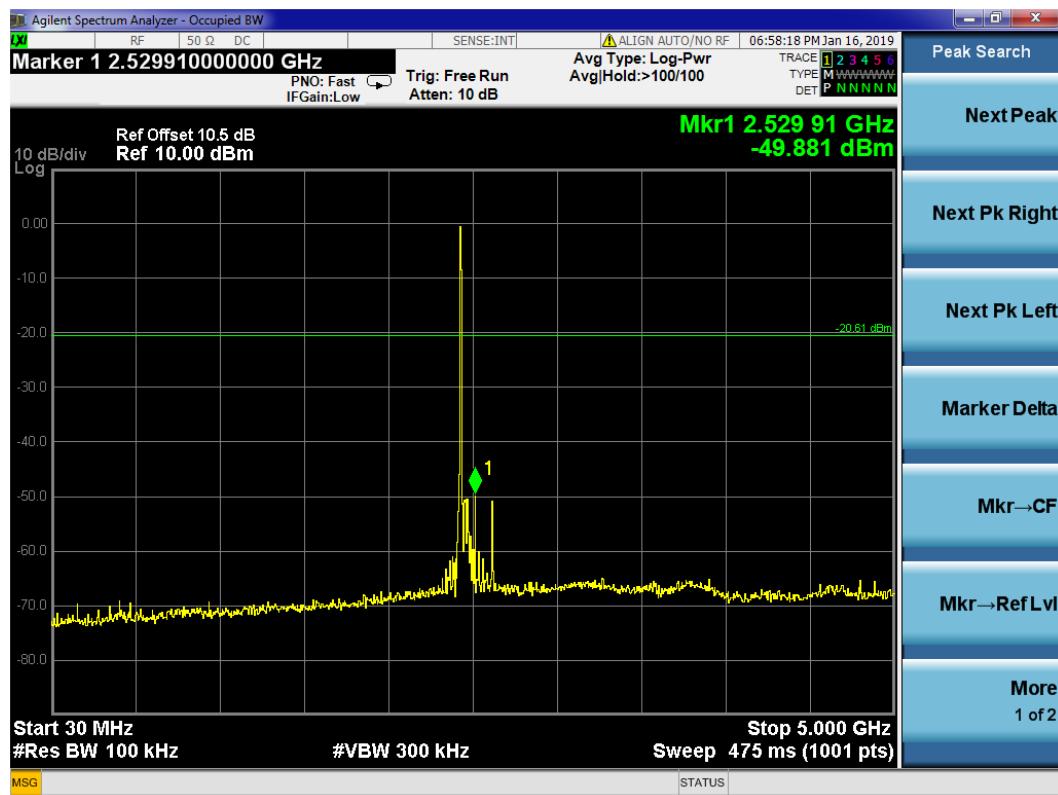


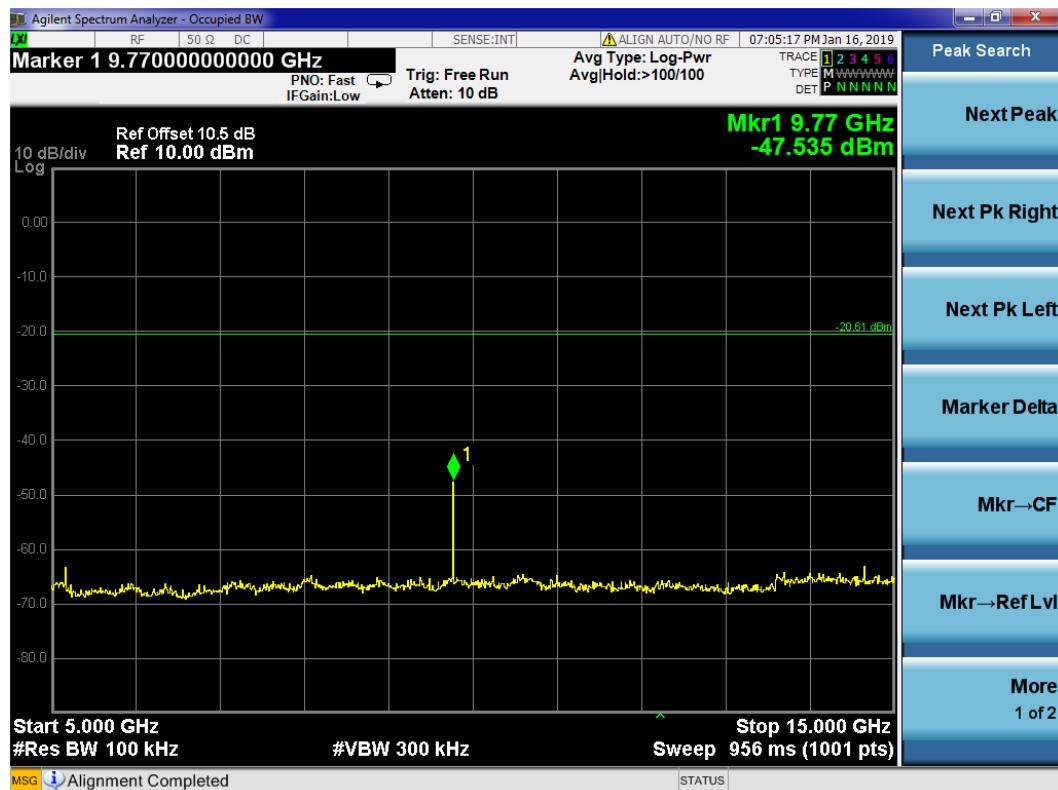
## CH20 (2442 MHz)

## Reference level



## Emission level





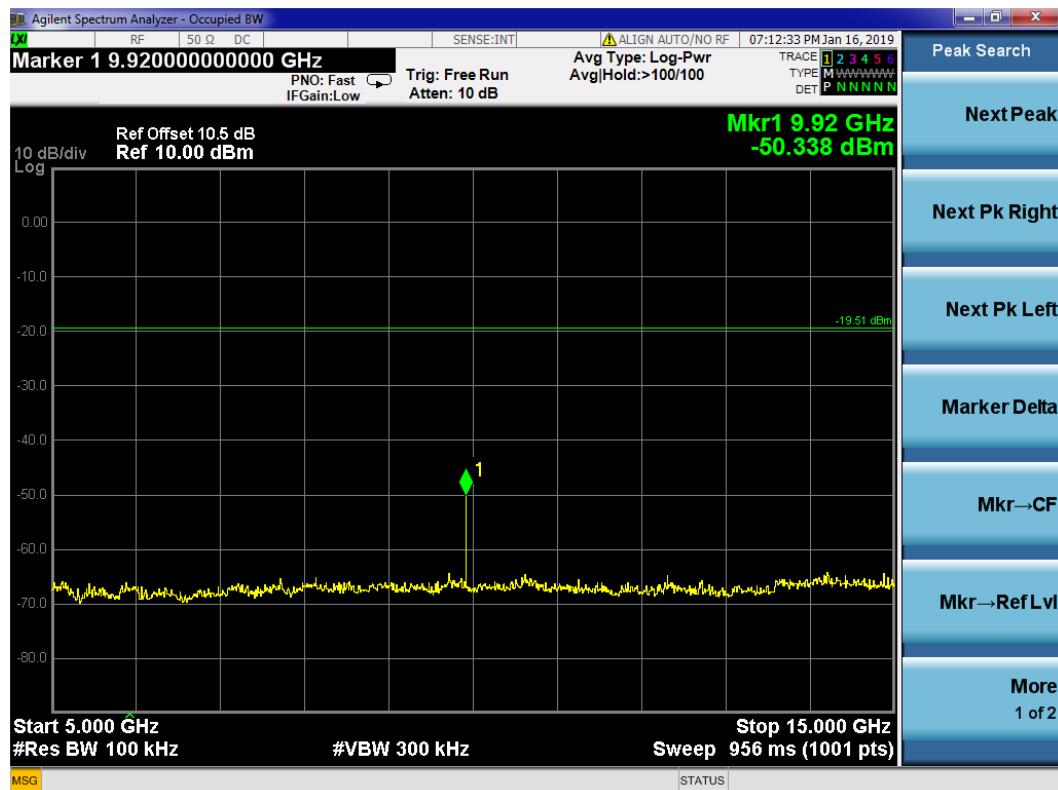
## CH39 (2480 MHz)

## Reference level



## Emission 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	Jan 05, 2019	Jan 05, 2020

### 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

### 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 spectrum analyzer. 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

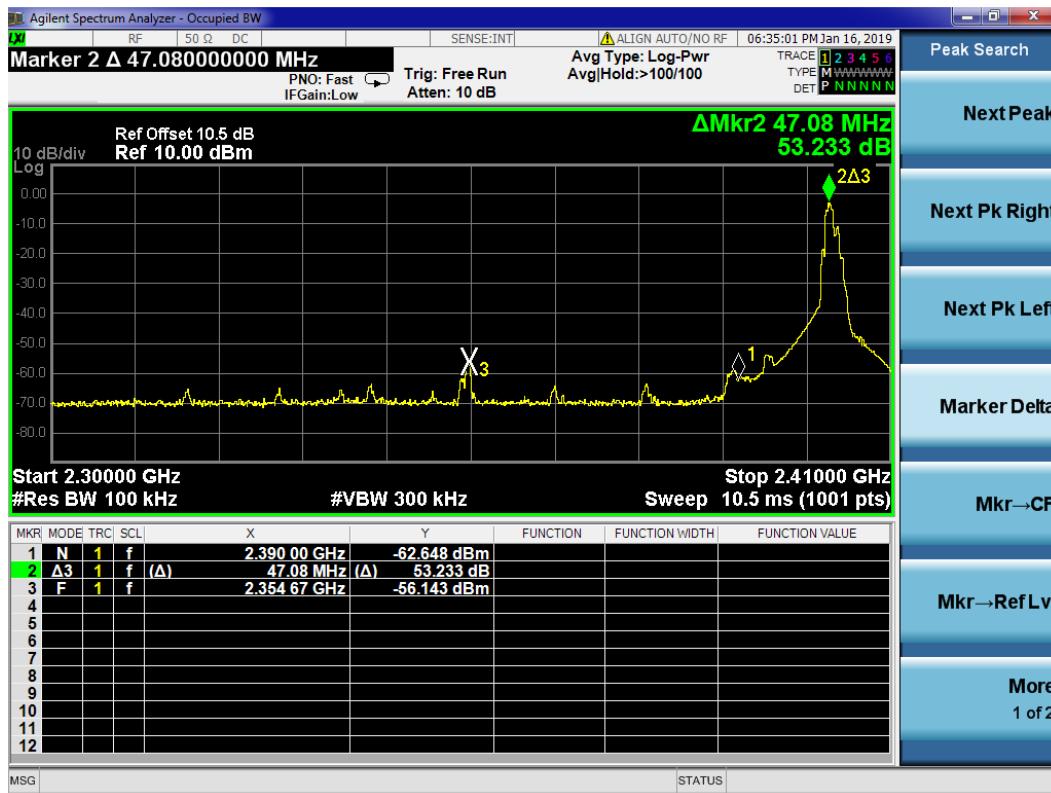
**PASSED.**

All the test results are attached in next pages.

(Test Date: 2019.01.16 Temperature: 23°C Humidity: 51 %)

Modulation	Location	Channel	Frequency (MHz)	Delta Marker (dB)	Result
BLE	Below Band Edge	00	2402	<b>53.233</b>	More than <b>20 dB</b> below the highest level of the desired power
	Upper Band Edge	39	2480	<b>45.178</b>	

## CH00 2402MHz (Below Edge 2390 MHz)



## CH39 2480MHz (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	Jan 05, 2019	Jan 05, 2020

### 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 spectrum analyzer.

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

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: 2019.01.16 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit
BLE	00	2402	<b>-2.993</b>	8 dBm
	20	2442	<b>-0.612</b>	8 dBm
	39	2480	<b>0.485</b>	8 dBm

## CH00 2402 MHz



## CH20 2442 MHz



## CH39 2480 MHz



## 9 DEVIATION TO TEST SPECIFICATIONS

None.