

TEST REPORT

On behalf of

Mettler Toledo (Changzhou) Measurement Technology Ltd.

Product Name: Bluetooth Module ACW520

Model No.: ACW520-BT

FCC ID: 2ALAI2018MT102

Prepared For: Mettler Toledo (Changzhou) Measurement Technology Ltd.
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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.

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TEST REPORT

Applicant : Mettler Toledo (Changzhou) Measurement Technology Ltd.
EUT Description : Refer to Sec.2.1
(A) Model No. : Refer to Sec.2.1
(B) Power Supply : DC (3.3~12) V
(C) Test Voltage : DC 5V

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 to be technically compliance with the FCC limits.

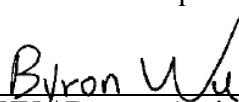
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Date of Test : 2018.03.06 – 05.15 Date of Report : 2018.05.15

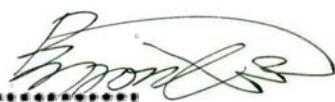
Producer :


JAREY LU / Supervisor

Reviewer :


BYRON WU / Deputy Assistant Manager

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

Signatory : 
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
EMISSION			
Conducted Emission	FCC Rules And Regulations Part 15 Subpart C And ANSI C63.10:2013	Pass	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 : Bluetooth Module ACW520

Type of EUT : ☒ Production ☐ Pre-product ☐ Pro-type

Model Number : ACW520-BT

Radio Tech : BT 5.0 (Compatible 4.1, 4.2)

Note : High Speed Mode of BT5.0 not supported.

Channel Freq. : 2402MHz - 2480MHz

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

Modulation : GFSK

Antenna Gain : 3 dBi

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

Applicant : Mettler Toledo (Changzhou) Measurement Technology Ltd.
111 West Taihu Road, Changzhou, Jiangsu, 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

Conducted Disturbance Expanded Uncertainty (0.15-30MHz):

U = 3.4dB

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 = 6×10^{-8} MHz

Maximum Peak Output Power Expanded Uncertainty

: U = 0.84 dB

Power Spectral Density Expanded Uncertainty

: U = 0.38 dB

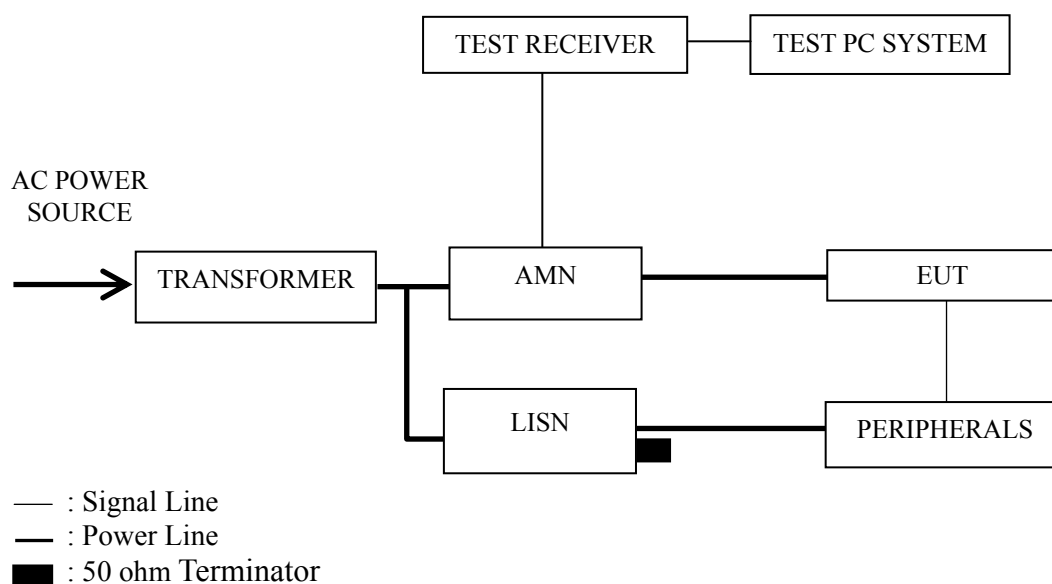
3 CONDUCTED EMISSION

3.1 Test Equipment

The following test equipment are used during the conducted emission test in a shielded room.

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Test Receiver	R&S	ESCI	101302	Apr 27, 2018	Apr 26, 2019
2.	Artificial Mains Network (AMN)	R&S	ENV4200	100125	Jun 24, 2017	Jun 23, 2018
3.	Software	Audix	E3	6.2009-1-15	--	--

3.2 Block Diagram of Test Setup



3.3 Conducted Emission Limits (§15.207)

Frequency (MHz)	Field strength limits (μV/m)	
	(μV/m)	dB(μV/m)
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE 1 - *Decreases with the logarithm of the frequency.
 NOTE 2 - Emission Level dB (μV/m) = 20 log Emission Level (μV/m)
 NOTE 3 - The tighter limit applies at the band edges.

3.4 Operating Condition of EUT

3.4.1 Setup the EUT as shown in Sec. 3.2.

3.4.2 Turn on the power of all equipment.

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

3.5 Test Procedures

The EUT was placed upon a non-metallic table, which is 0.8 m above the horizontal conducting ground plane and 0.4 m from a vertical reference plane. The EUT was connected to the power mains through an Artificial Mains Network (AMN) to provide a 50 Ω coupling impedance for the measuring equipment. Both sides of AC line (Line & Neutral) were checked to find out the maximum conducted emission according to FCC Part 15 Subpart C and ANSI C63.10: 2013 requirements during conducted disturbance test.

The I.F. bandwidth of Test Receiver ESCI was set at 9 kHz.

The frequency range from 150 kHz to 30 MHz was checked.

Test with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. (According to KDB 174176 D01 Line Conducted FAQ)

3.6 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.

Worst case emission:

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	BLE	--	--	P10
2.	Receiving	BLE	--	--	P11

NOTE 1 – Level = Read Level + AMN Factor + Cable Loss

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

NOTE 3 – The emission levels which not reported are too low against the official limit.

Worst case emission

EUT	:	Bluetooth Module ACW520	Temperature :	22℃
Model No.	:	ACW520-BT	Humidity :	51%RH
Test Mode	:	Transmitting	Date of Test :	2018.05.11

BLE:

Polarization	Frequency (MHz)	Meter Reading dB (μV)	AMN Factor (dB/m)	Cable Loss (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Line	0.1625	34.29	10.55	0.04	44.88	65.34	20.46	QP
	0.1625	19.29	10.55	0.04	29.88	55.34	25.46	Average
	0.4354	17.1	10.35	0.05	27.5	57.15	29.65	QP
	0.4354	5.1	10.35	0.05	15.5	47.15	31.65	Average
	1.986	11.5	10.32	0.09	21.91	56	34.09	QP
	1.986	7.3	10.32	0.09	17.71	46	28.29	Average
	3.148	10.6	10.32	0.11	21.03	56	34.97	QP
	3.148	5.9	10.32	0.11	16.33	46	29.67	Average
	4.62	13.5	10.33	0.13	23.96	56	32.04	QP
	4.62	4.4	10.33	0.13	14.86	46	31.14	Average
	20.43	14.7	10.14	0.27	25.11	60	34.89	QP
	20.43	9.9	10.14	0.27	20.31	50	29.69	Average
Neutral	0.1539	35.6	10.49	0.03	46.12	65.79	19.67	QP
	0.1539	21.2	10.49	0.03	31.72	55.79	24.07	Average
	0.4357	18.6	10.34	0.05	28.99	57.14	28.15	QP
	0.4357	7.3	10.34	0.05	17.69	47.14	29.45	Average
	1.234	10.7	10.32	0.08	21.1	56	34.9	QP
	1.234	6.4	10.32	0.08	16.8	46	29.2	Average
	1.913	11.4	10.33	0.09	21.82	56	34.18	QP
	1.913	7.1	10.33	0.09	17.52	46	28.48	Average
	4.113	9.6	10.34	0.12	20.06	56	35.94	QP
	4.113	2.9	10.34	0.12	13.36	46	32.64	Average
	20.3	14.3	10.21	0.27	24.78	60	35.22	QP
	20.3	9.5	10.21	0.27	19.98	50	30.02	Average

TEST ENGINEER: Jarey

EUT	:	Bluetooth Module ACW520	Temperature :	22℃
Model No.	:	ACW520-BT	Humidity :	51%RH
Test Mode	:	Receiving	Date of Test :	2018.05.11

BLE:

Polarization	Frequency (MHz)	Meter Reading dB (μV)	AMN Factor (dB/m)	Cable Loss (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Line	0.16501	33.46	10.54	0.04	44.04	65.21	21.17	QP
	0.16501	21.46	10.54	0.04	32.04	55.21	23.17	Average
	0.43052	16.67	10.35	0.05	27.07	57.24	30.17	QP
	0.43052	6.67	10.35	0.05	17.07	47.24	30.17	Average
	2.11	11.43	10.32	0.09	21.84	56	34.16	QP
	2.11	7.43	10.32	0.09	17.84	46	28.16	Average
	3.19	10.41	10.33	0.11	20.85	56	35.15	QP
	3.19	5.41	10.33	0.11	15.85	46	30.15	Average
	4.361	12.8	10.33	0.12	23.25	56	32.75	QP
	4.361	3.8	10.33	0.12	14.25	46	31.75	Average
	20.377	14.72	10.14	0.27	25.13	60	34.87	QP
	20.377	9.72	10.14	0.27	20.13	50	29.87	Average
Neutral	0.15816	35.53	10.48	0.03	46.04	65.56	19.52	QP
	0.15816	22.53	10.48	0.03	33.04	55.56	22.52	Average
	0.44443	18.19	10.34	0.05	28.58	56.98	28.4	QP
	0.44443	9.19	10.34	0.05	19.58	46.98	27.4	Average
	1.449	11.05	10.33	0.08	21.46	56	34.54	QP
	1.449	7.05	10.33	0.08	17.46	46	28.54	Average
	2.066	11.89	10.33	0.09	22.31	56	33.69	QP
	2.066	7.89	10.33	0.09	18.31	46	27.69	Average
	3.901	10.16	10.34	0.12	20.62	56	35.38	QP
	3.901	5.16	10.34	0.12	15.62	46	30.38	Average
	20.162	15.96	10.21	0.27	26.44	60	33.56	QP
	20.162	8.96	10.21	0.27	19.44	50	30.56	Average

TEST ENGINEER: Jarey

4 RADIATED EMISSION TEST

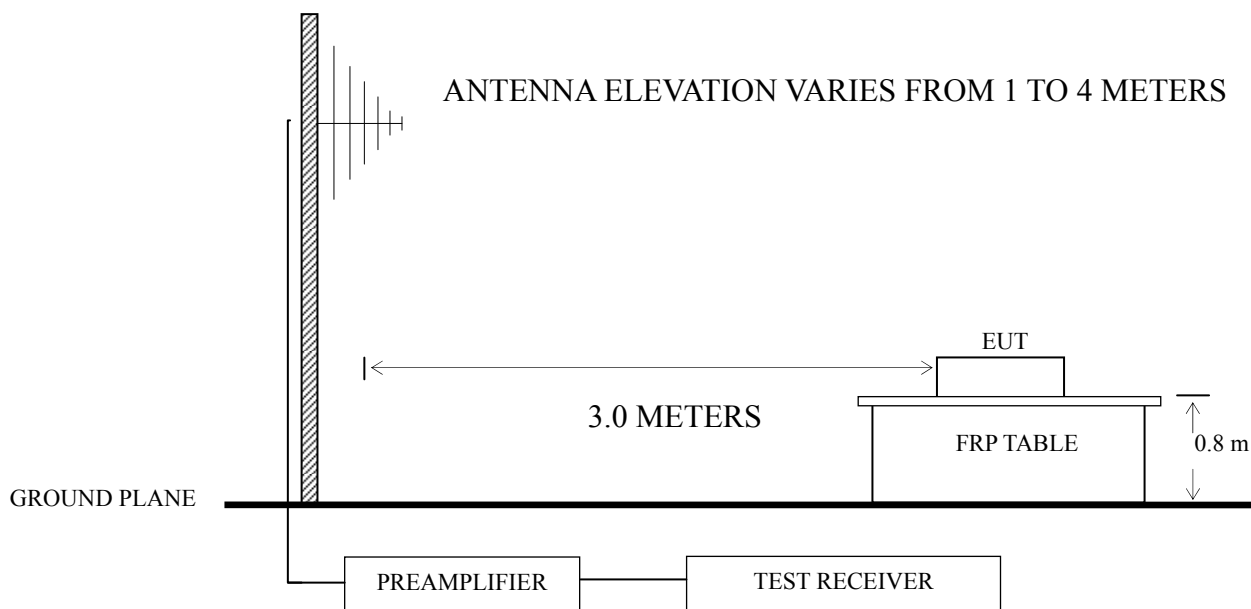
4.1 Test Equipment

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

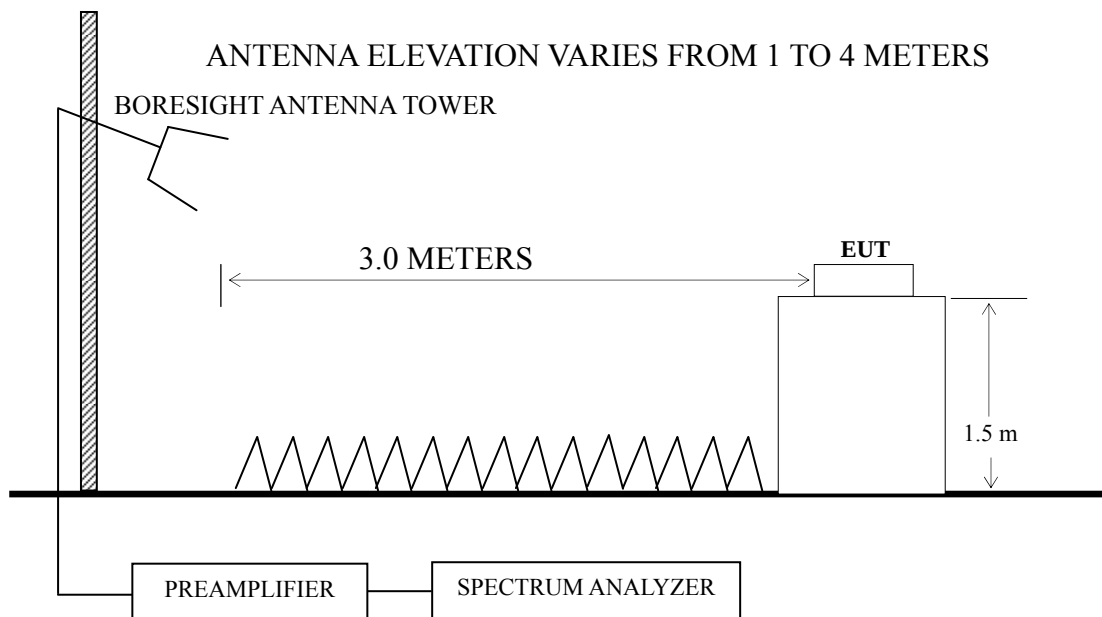
Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Preamplifier	Agilent	8447D	2944A06664	Apr 27, 2017	Apr 26, 2018
2.	Preamplifier	HP	8449B	3008A00864	Mar 8, 2018	Mar 7, 2019
3.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jun 12, 2017	Jun 11, 2018
4.	Test Receiver	R&S	ESCI	101303	May 07, 2017	May 06, 2018
5.	Bi-log Antenna	Schwarz beck	VULB 9168	708	Jul 20, 2017	Jul 19, 2018
6.	Horn Antenna	EMCO	3115	9607-4878	Jun 02, 2017	Jun 01, 2018
7.	Horn Antenna	EMCO	3116	00062643	Sep 08, 2017	Sep 07, 2018
8.	Software	Audix	E3	SET00200 9912M295-2	--	--

4.2 Block Diagram of Test Setup

4.2.1 Below 1GHz



4.2.2 Above 1GHz



4.3 Radiated Emission Limit (§15.209)

Frequency (MHz)	Distance (m)	Field strength limits (μV/m)	
		(μV/m)	dB(μV/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 (μV/m) = 20 log Emission Level (μV/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

4.4 Test Configuration

The EUT (listed in Sec.2.1) and the simulators (listed in Sec.2.2) were installed as shown on Sec.4.2 to meet FCC requirements and operating in a manner that tends to maximize its emission level in a normal application.

4.5 Operating Condition of EUT

4.5.1 Setup the EUT as shown in Sec. 4.2.

4.5.2 Turn on the power of all equipment.

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

4.6 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 10th harmonics from fundamental frequency) was checked.

4.7 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	BT	00	2402 MHz	P12
2.	Receiving	BT	--	--	P13

Frequency range: above 1G

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

Restricted bands:

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	BT	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 : Bluetooth Module Temperature : 22°C
ACW520

Model No. : ACW520-BT Humidity : 51%RH

Test Mode : Transmitting Date of Test : 2018.03.06

BT:

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	30.745	26.57	18.36	0.56	27.93	17.56	40	22.44	QP
	35.128	26.95	15.92	0.6	27.92	15.55	40	24.45	QP
	95.093	38.97	11.97	0.97	27.71	24.2	43.5	19.3	QP
	100.934	37.15	12.82	1.01	27.69	23.29	43.5	20.21	QP
	114.515	36.21	12.98	1.09	27.54	22.74	43.5	20.76	QP
	287.99	37.3	13.77	1.74	26.81	26	46	20	QP
Vertical	30.424	34.55	18.58	0.55	27.93	25.75	40	14.25	QP
	48.502	39.25	9.1	0.71	27.9	21.16	40	18.84	QP
	88.342	46.01	10.62	0.93	27.74	29.82	43.5	13.68	QP
	95.093	44.57	11.97	0.97	27.71	29.8	43.5	13.7	QP
	121.123	40.88	13.14	1.13	27.48	27.67	43.5	15.83	QP
	545.183	31	18.66	2.39	28.09	23.96	46	22.04	QP

TEST ENGINEER: Jarey

EUT	:	<u>Bluetooth Module ACW520</u>	Temperature :	<u>22°C</u>
Model No.	:	<u>ACW520-BT</u>	Humidity :	<u>51%RH</u>
Test Mode	:	<u>Receiving</u>	Date of Test :	<u>2018.03.06</u>

BT:

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	30.853	28.33	18.29	0.56	27.93	19.25	40	20.75	QP
	95.093	32.69	11.97	0.97	27.71	17.92	43.5	25.58	QP
	114.515	33.88	12.98	1.09	27.54	20.41	43.5	23.09	QP
	120.277	32.71	13.17	1.13	27.48	19.53	43.5	23.97	QP
	159.784	35.4	10.61	1.32	27.15	20.18	43.5	23.32	QP
	501.179	31.02	18.4	2.29	28	23.71	46	22.29	QP
Vertical	30.317	34.56	18.58	0.55	27.93	25.76	40	14.24	QP
	47.492	39.42	9.54	0.71	27.9	21.77	40	18.23	QP
	88.342	44.63	10.62	0.93	27.74	28.44	43.5	15.06	QP
	95.093	42.2	11.97	0.97	27.71	27.43	43.5	16.07	QP
	121.123	40.52	13.14	1.13	27.48	27.31	43.5	16.19	QP
	431.032	33.07	17.32	2.14	27.51	25.02	46	20.98	QP

TEST ENGINEER: Jarey

Radiated Emission > 1GHz

EUT	:	Bluetooth Module ACW520	Temperature :	22°C
Model No.	:	ACW520-BT	Humidity :	51%RH
Test Mode	:	Transmitting	Date of Test :	2018.03.06

BT CH00 (2402 MHz):

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	2062.401	38.18	27.93	4.72	35.29	35.54	74	38.46	Peak
	2961.827	39.7	30.39	5.71	35.2	40.6	74	33.4	Peak
	3424.443	38.95	31.54	6.21	34.73	41.97	74	32.03	Peak
	3752.111	39.76	32.21	6.52	34.43	44.06	74	29.94	Peak
	4440.397	37.86	33.69	7.26	34.06	44.75	74	29.25	Peak
	5635.286	36.64	34.91	8.22	34.1	45.67	74	28.33	Peak
Vertical	2062.401	39.6	27.93	4.72	35.29	36.96	74	37.04	Peak
	2776.81	41.01	29.77	5.51	35.22	41.07	74	32.93	Peak
	3436.736	40.14	31.56	6.21	34.72	43.19	74	30.81	Peak
	3738.689	41.17	32.19	6.52	34.44	45.44	74	28.56	Peak
	4448.361	39.49	33.69	7.26	34.06	46.38	74	27.62	Peak
	5515.415	38.43	34.81	8.11	34.06	47.29	74	26.71	Peak

BT CH20 (2442 MHz):

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	2207.714	37.77	28.24	4.88	35.28	35.61	74	38.39	Peak
	2951.232	38.25	30.34	5.67	35.2	39.06	74	34.94	Peak
	3412.193	37.77	31.52	6.16	34.75	40.7	74	33.3	Peak
	3711.989	39.46	32.15	6.46	34.46	43.61	74	30.39	Peak
	4424.514	37.13	33.66	7.19	34.06	43.92	74	30.08	Peak
	5605.076	35.95	34.88	8.22	34.09	44.96	74	29.04	Peak
Vertical	2095.928	38.99	28.01	4.76	35.29	36.47	74	37.53	Peak
	2904.023	40	30.2	5.63	35.21	40.62	74	33.38	Peak
	3412.193	39.89	31.52	6.16	34.75	42.82	74	31.18	Peak
	3731.996	40.95	32.19	6.52	34.44	45.22	74	28.78	Peak
	4208.015	40.14	33.17	6.99	34.13	46.17	74	27.83	Peak
	5595.042	38.21	34.88	8.16	34.08	47.17	74	26.83	Peak

BT CH39 (2480 MHz):

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2114.79	37.49	28.05	4.76	35.29	35.01	74	38.99	Peak
	2988.48	38.02	30.47	5.71	35.2	39	74	35	Peak
	3449.074	37.06	31.59	6.21	34.71	40.15	74	33.85	Peak
	3698.711	39.2	32.13	6.46	34.47	43.32	74	30.68	Peak
	4408.687	37.62	33.61	7.19	34.07	44.35	74	29.65	Peak
	5665.659	34.31	34.93	8.22	34.1	43.36	74	30.64	Peak
Vertical	2172.398	38.76	28.16	4.84	35.28	36.48	74	37.52	Peak
	2951.232	40.12	30.34	5.67	35.2	40.93	74	33.07	Peak
	3449.074	39.15	31.59	6.21	34.71	42.24	74	31.76	Peak
	3705.344	40.81	32.13	6.46	34.46	44.94	74	29.06	Peak
	4464.33	39.38	33.74	7.26	34.05	46.33	74	27.67	Peak
	5555.085	37.27	34.84	8.16	34.07	46.2	74	27.8	Peak

TEST ENGINEER: Jarey

EUT : Bluetooth Module Temperature : 22°C
 : ACW520

Model No. : ACW520-BT Humidity : 51%RH

Test Mode : Receiving Date of Test : 2018.03.06

BT:

Polarization	Frequency (MHz)	Meter Reading dB (μV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Emission Level dB (μV/m)	Limits dB (μV/m)	Margin (dB)	Remark
Horizontal	2073.517	37.76	27.96	4.72	35.29	35.15	74	-38.85	Peak
	2883.284	38.41	30.12	5.63	35.21	38.95	74	-35.05	Peak
	3369.664	36.53	31.41	6.16	34.79	39.31	74	-34.69	Peak
	3799.467	38.77	32.32	6.57	34.38	43.28	74	-30.72	Peak
	4512.583	37.26	33.81	7.32	34.04	44.35	74	-29.65	Peak
	5436.92	36.73	34.73	8.06	34.04	45.48	74	-28.52	Peak
Vertical	1975.593	38.77	27.72	4.61	35.32	35.78	74	-38.22	Peak
	2837.161	39	29.99	5.59	35.21	39.37	74	-34.63	Peak
	3511.43	38.12	31.74	6.26	34.65	41.47	74	-32.53	Peak
	3813.107	40.42	32.34	6.57	34.37	44.96	74	-29.04	Peak
	4238.283	39.95	33.25	6.99	34.12	46.07	74	-27.93	Peak
	5427.187	36.91	34.71	8.06	34.03	45.65	74	-28.35	Peak

TEST ENGINEER: Jarey

Emissions in restricted frequency bands:

EUT : Bluetooth Module
ACW520

Temperature : 22°C

Model No. : ACW520-BT

Humidity : 51%RH

Test Mode : Transmitting

Date of Test : 2018.03.06

BT:

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	2322.354	38.78	28.48	5.04	35.26	37.04	74	36.96	Peak
	2322.354	24.23	28.48	5.04	35.26	22.49	54	31.51	Average
	2345.121	38.99	28.51	5.08	35.26	37.32	74	36.68	Peak
	2345.121	24.23	28.51	5.08	35.26	22.56	54	31.44	Average
	2488.354	38.76	28.77	5.23	35.25	37.51	74	36.49	Peak
	2488.354	24.44	28.77	5.23	35.25	23.19	54	30.81	Average
	2495.21	38.34	28.79	5.23	35.25	37.11	74	36.89	Peak
Vertical	2495.21	24.63	28.79	5.23	35.25	23.4	54	30.6	Average
	2332.056	39.26	28.49	5.04	35.26	37.53	74	36.47	Peak
	2332.056	25.34	28.49	5.04	35.26	23.61	54	30.39	Average
	2362.983	38.61	28.55	5.08	35.26	36.98	74	37.02	Peak
	2362.983	24.42	28.55	5.08	35.26	22.79	54	31.21	Average
	2489.184	38.76	28.79	5.23	35.25	37.53	74	36.47	Peak
	2489.184	24.43	28.79	5.23	35.25	23.2	54	30.8	Average
	2495.626	38.73	28.79	5.23	35.25	37.5	74	36.5	Peak
	2495.626	24.15	28.79	5.23	35.25	22.92	54	31.08	Average

TEST ENGINEER: Jarey

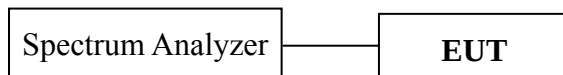
5 6 dB BANDWIDTH MEASUREMENT

5.1 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, 2017	Jun 11, 2018

5.2 Block Diagram of Test Setup



5.3 Specification Limits (§15.247(a)(2))

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

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 bandwidth of the fundamental frequency was measure 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).

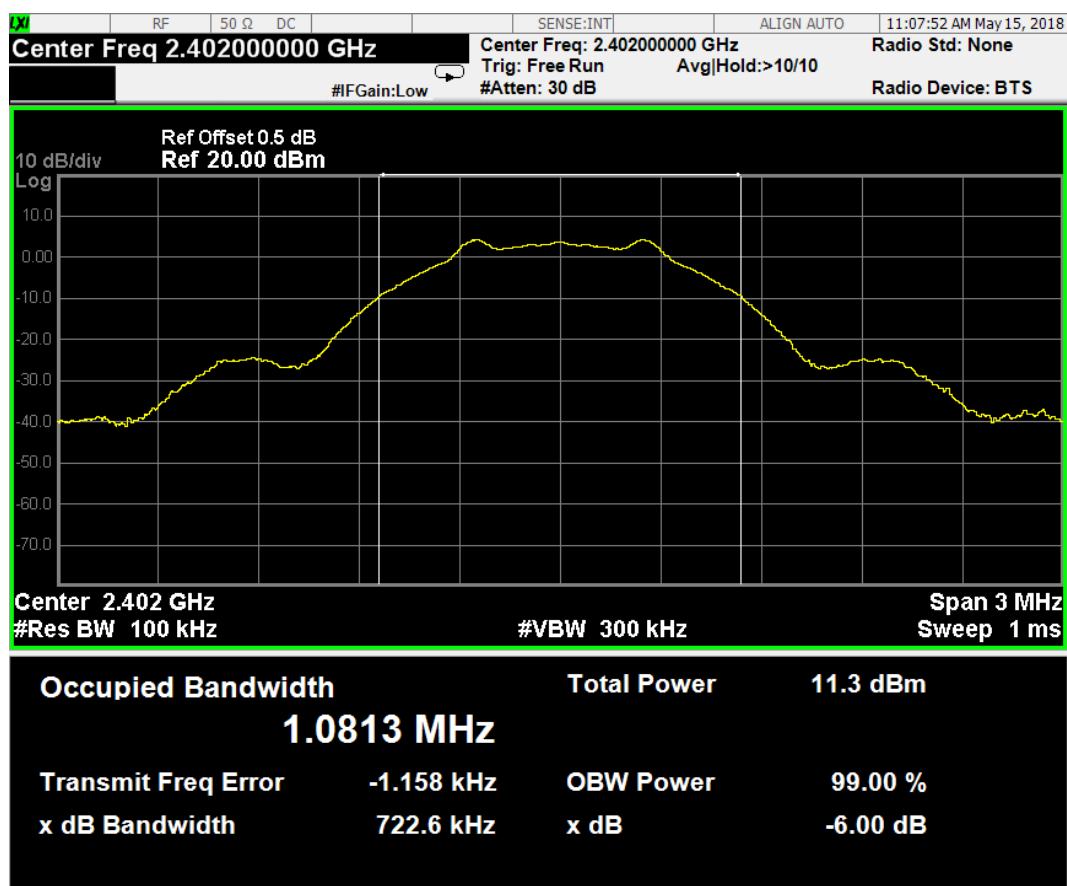
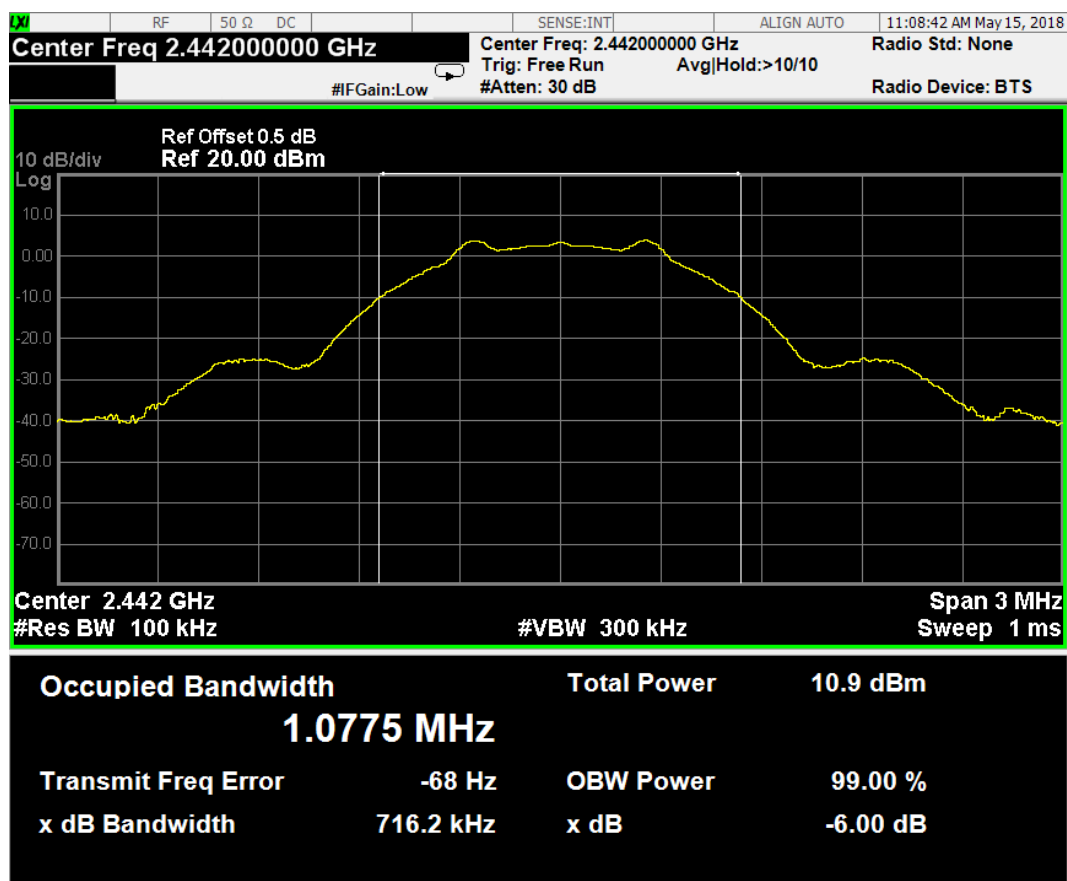
5.6 Test Results

PASSED.

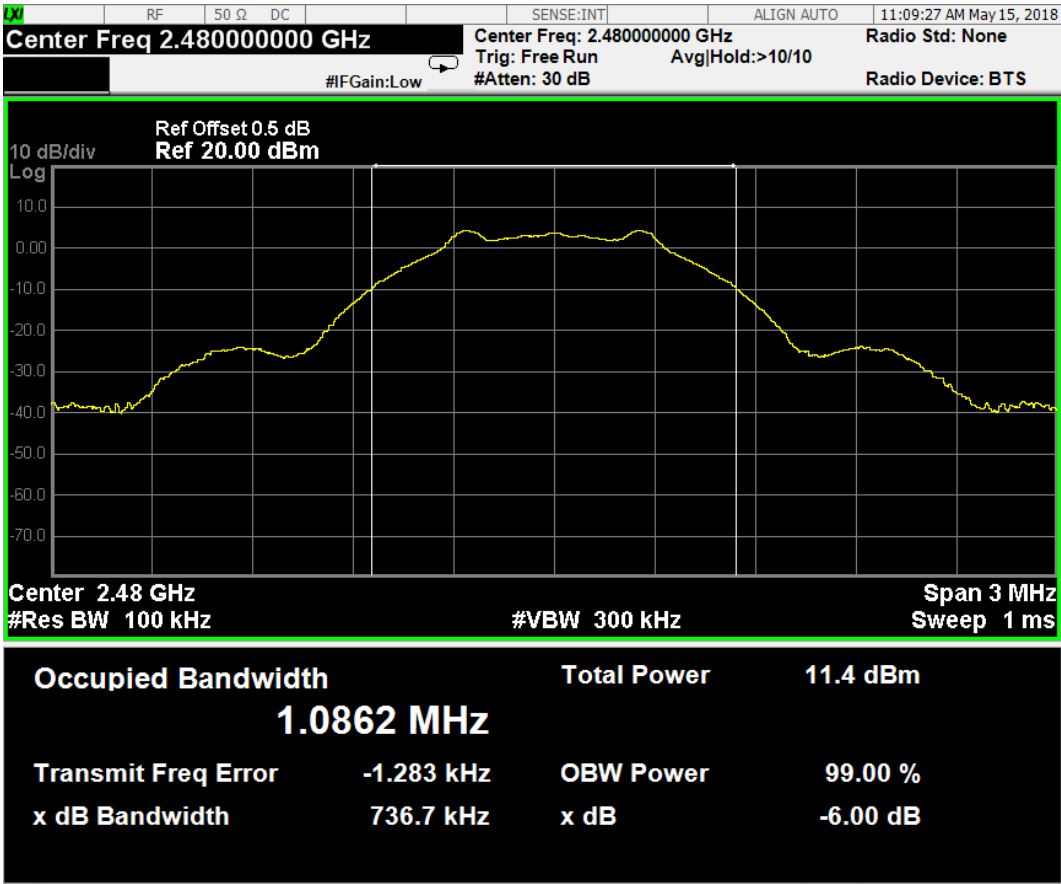
All the test results are attached in next pages.

(Test Date: 2018.05.15 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Limit
BT	00	2402	722.6	500 kHz
	20	2442	716.2	500 kHz
	40	2480	736.7	500 kHz

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

BT: CH39 (2480 MHz)



6 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

6.1 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, 2017	Jun 11, 2018

6.2 Block Diagram of Test Setup

The Same as Section. 4.2.

6.3 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)

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.

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) $RBW \geq DTS \text{ Bandwidth}$.
- 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.

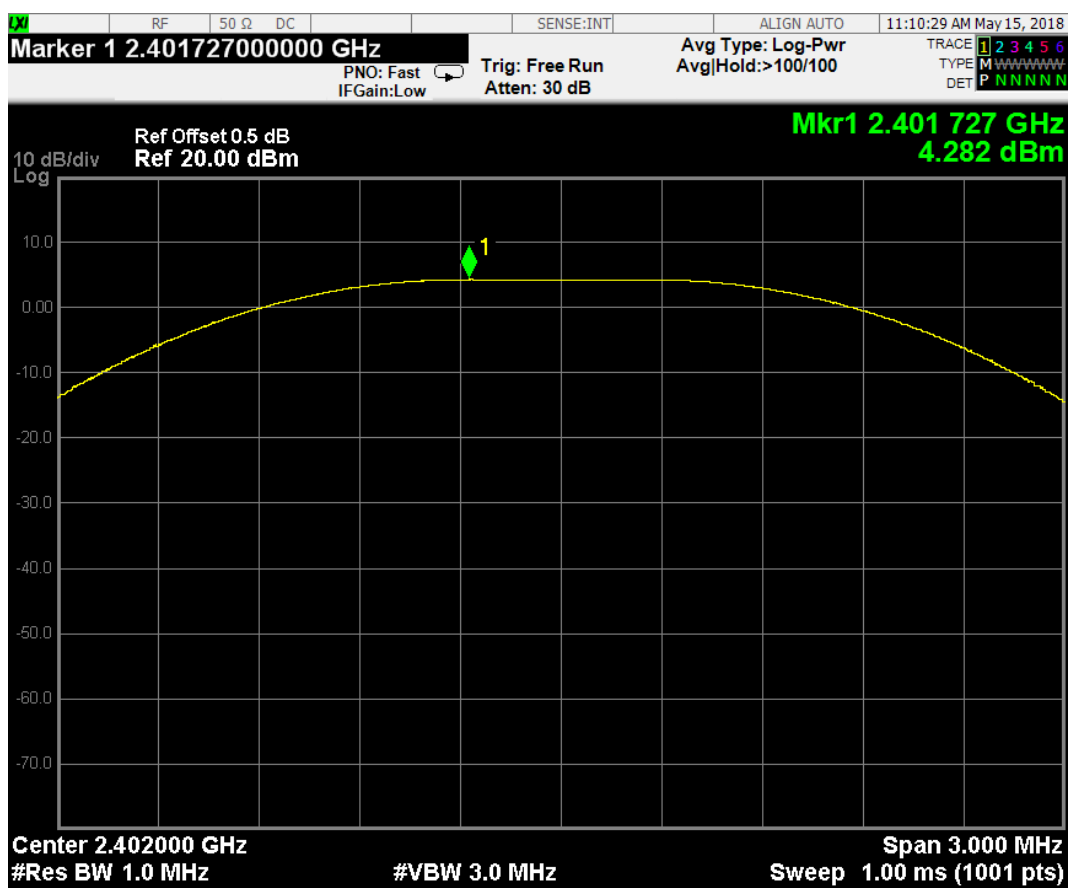
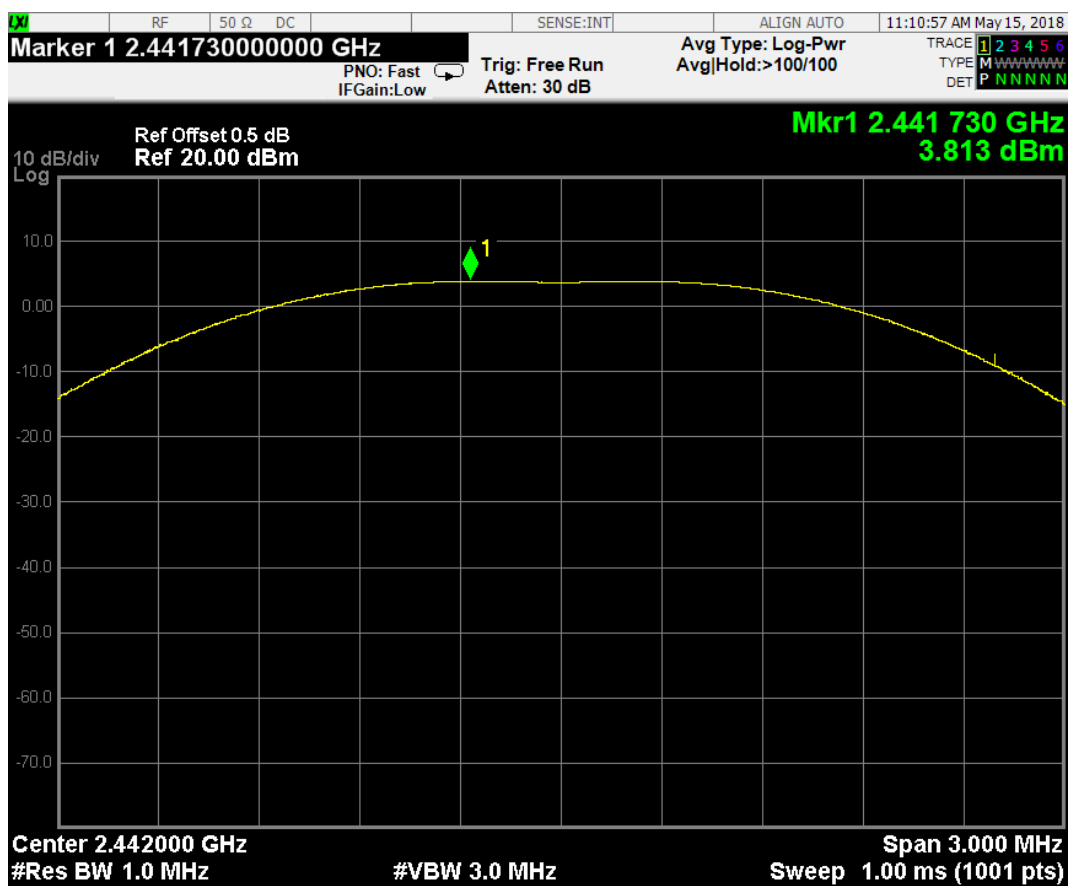
The test procedure is defined in ANSI C63.10-2013 (11.9.1.1 Measurement Procedure “ $RBW \geq DTS \text{ bandwidth}$ ” was used).

6.6 Test Results

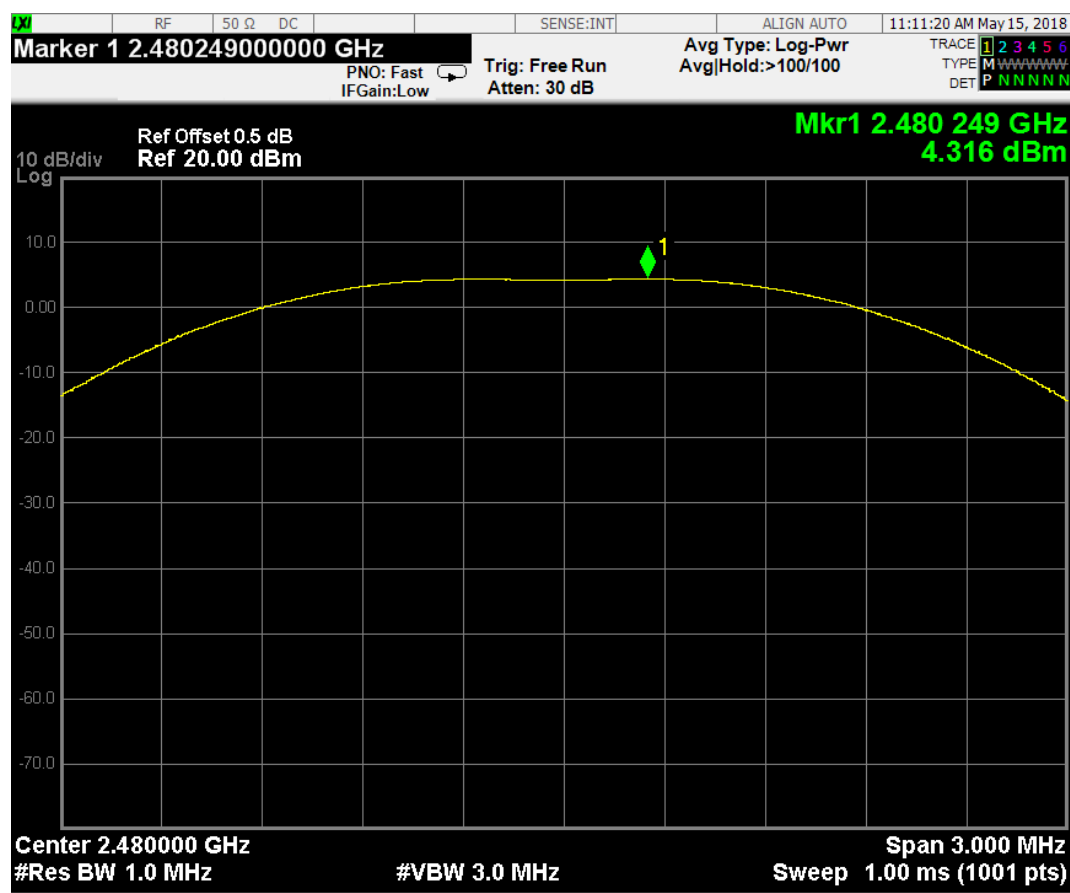
PASSED. All the test results are listed below.

(Test Date: 2018.05.15 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	Peak Output Power (dBm)	Limit
BT	00	2402	4.282	30 dBm
	20	2442	3.813	30 dBm
	40	2480	4.316	30 dBm

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

BT: CH39 (2480 MHz)



7 EMISSION LIMITATIONS MEASUREMENT

7.1 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, 2017	Jun 11, 2018

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. 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)

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 = 100 kHz, VBW $\geq$ 300 kHz, scan up through 10th harmonic.

When maximum conducted (average) output power was used to determine compliance as described in 11.9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz.

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).

7.6 Test Results

PASSED.

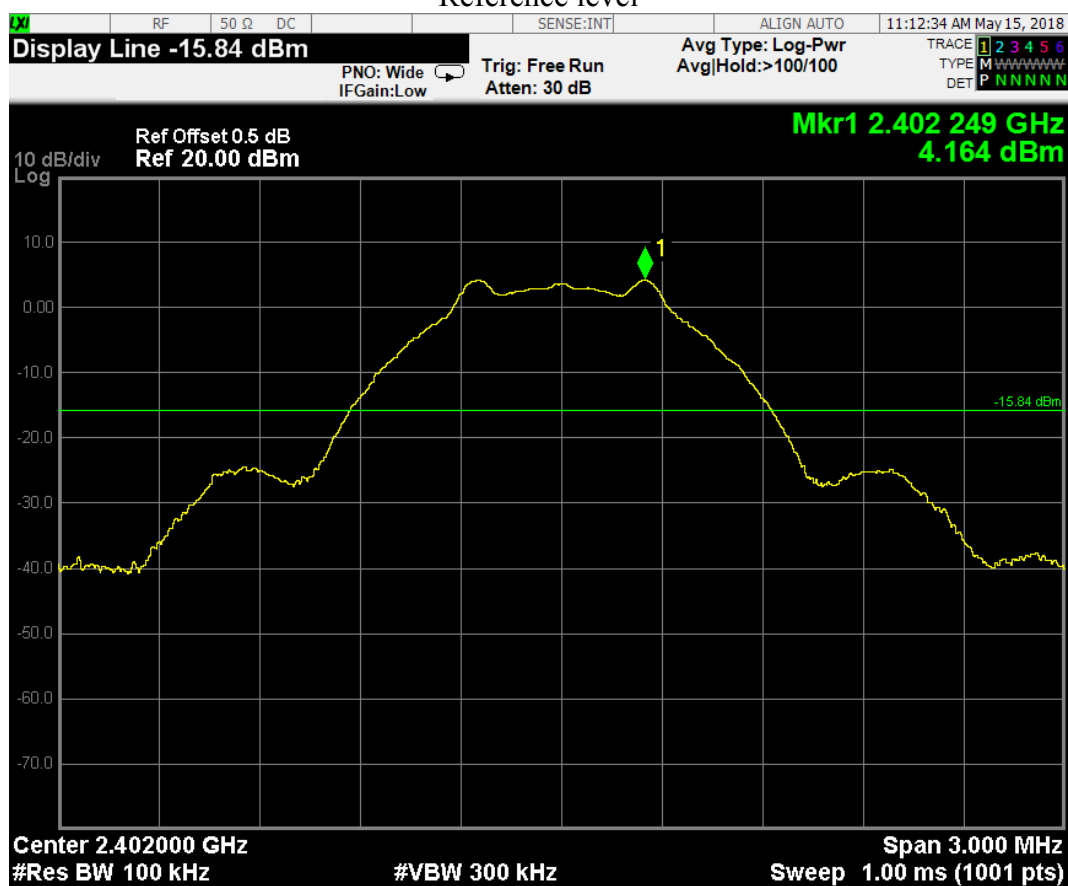
The test data was attached in the next pages.

(Test Date: 2018.05.15 Temperature: 23°C Humidity: 51 %)

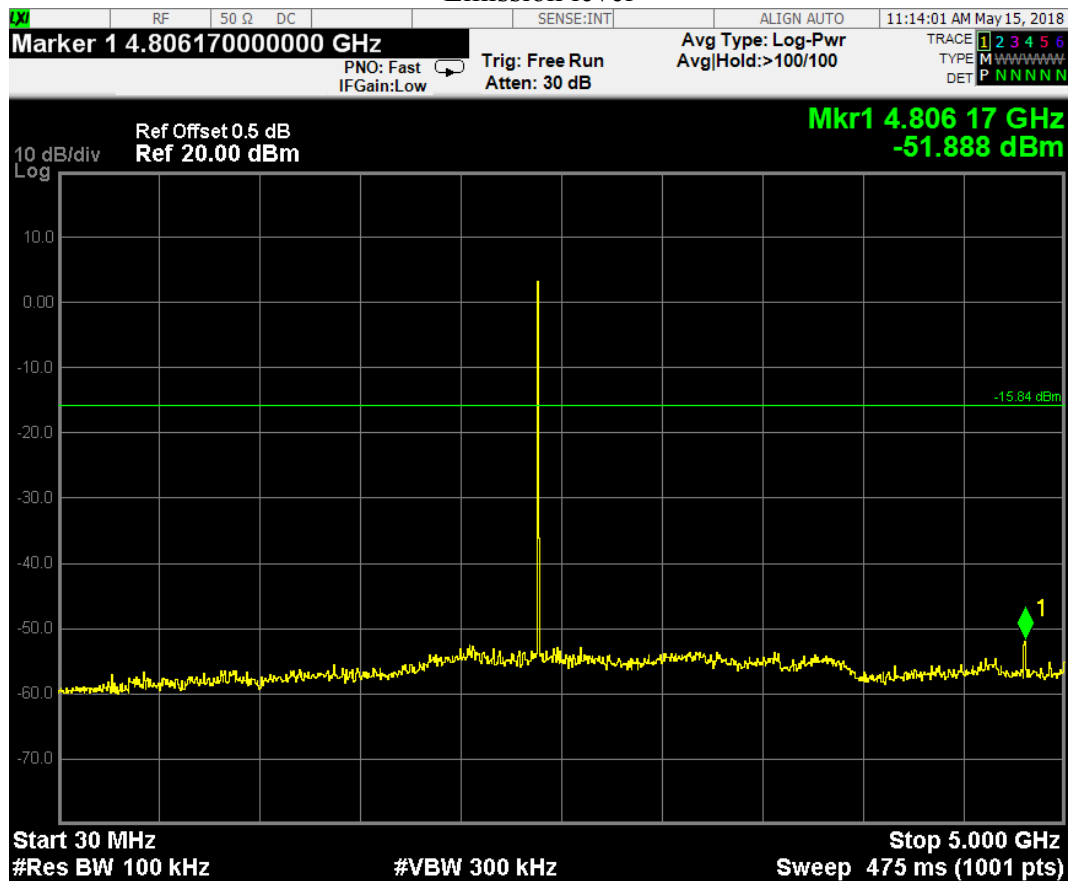
Modulation	Channel	Frequency (MHz)	Data Page
BT	00	2402	P32-33
	20	2442	P34-35
	40	2480	P36-37

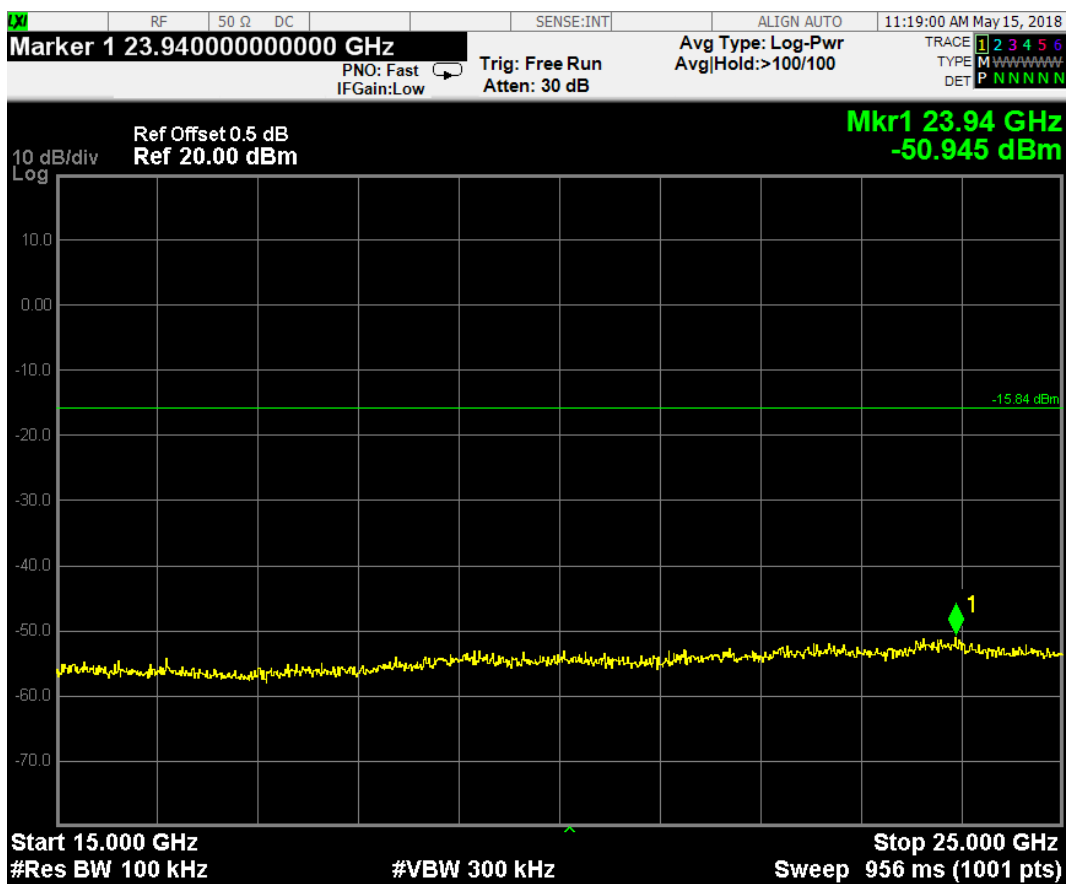
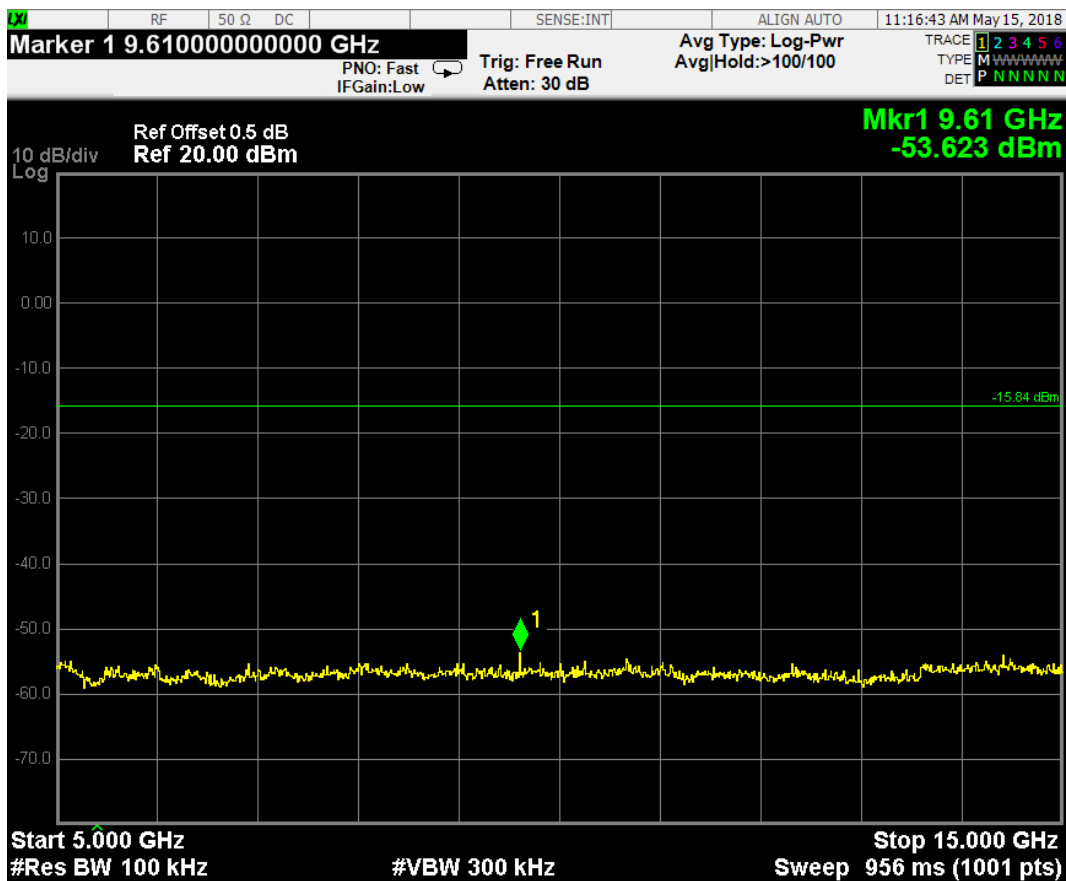
BT: CH00 (2402 MHz)

Reference level



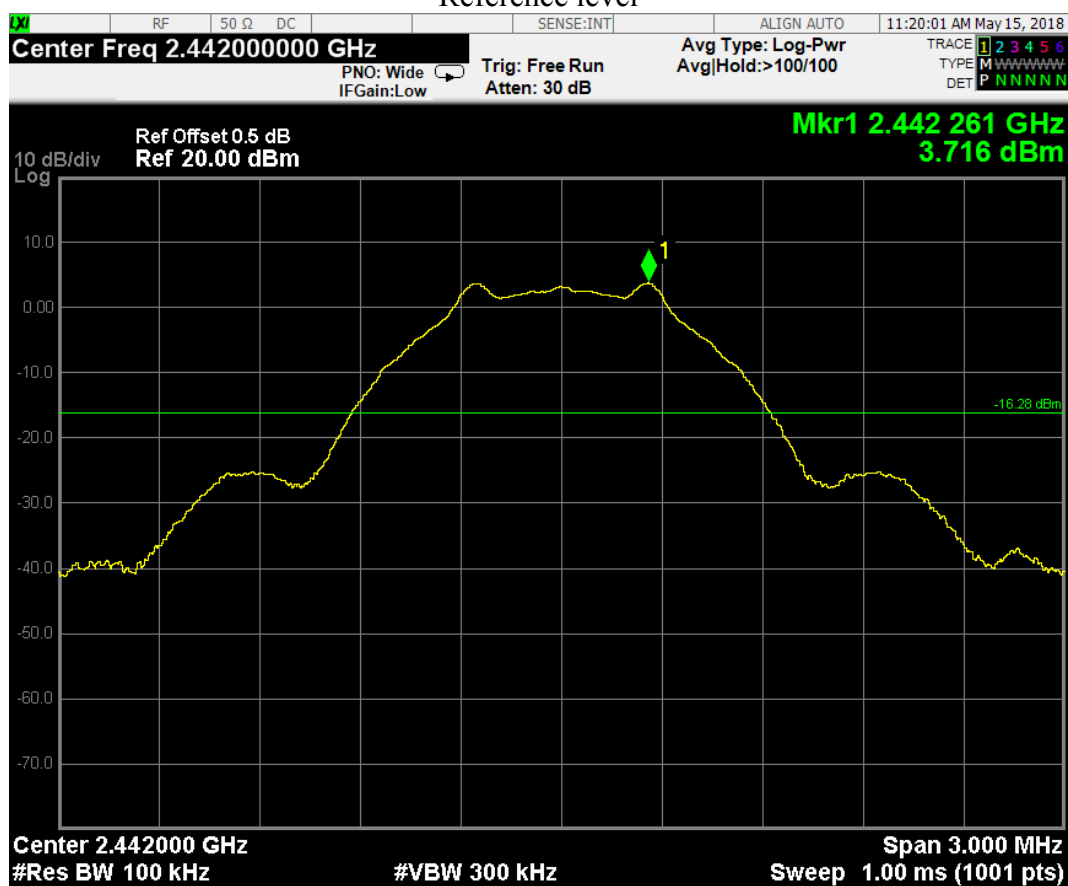
Emission level



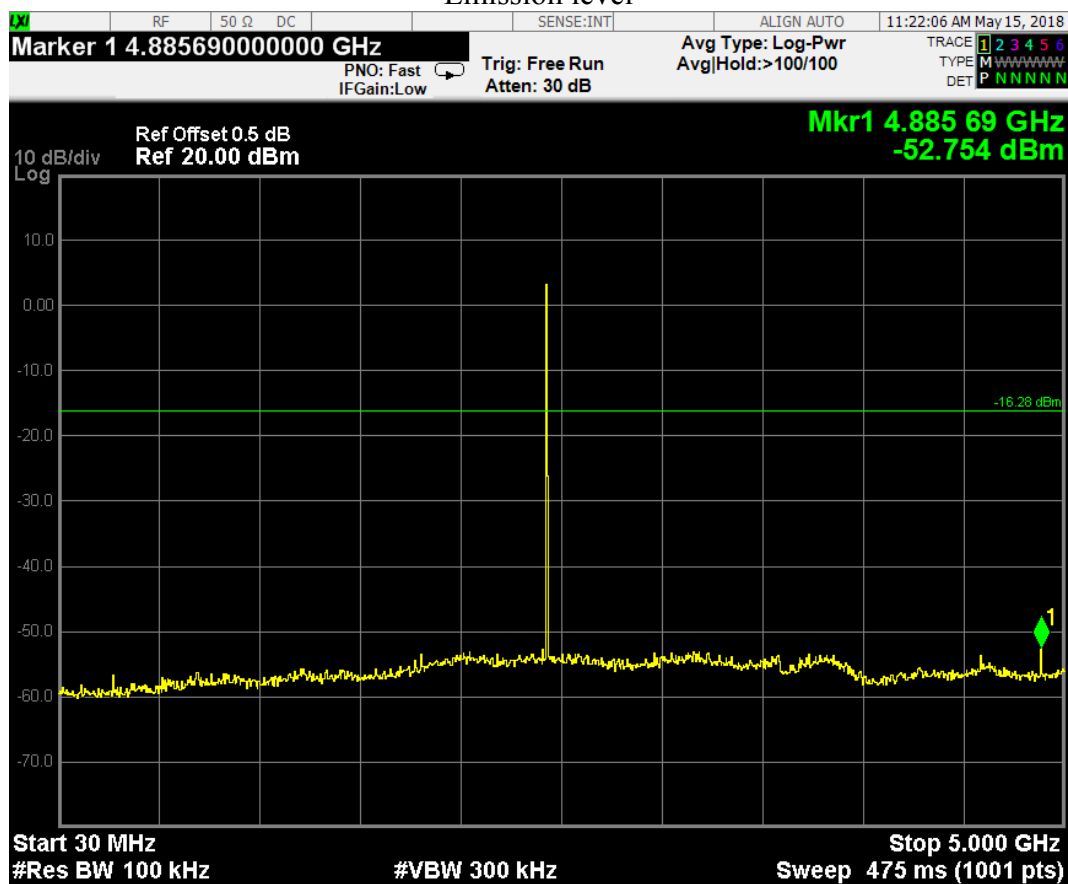


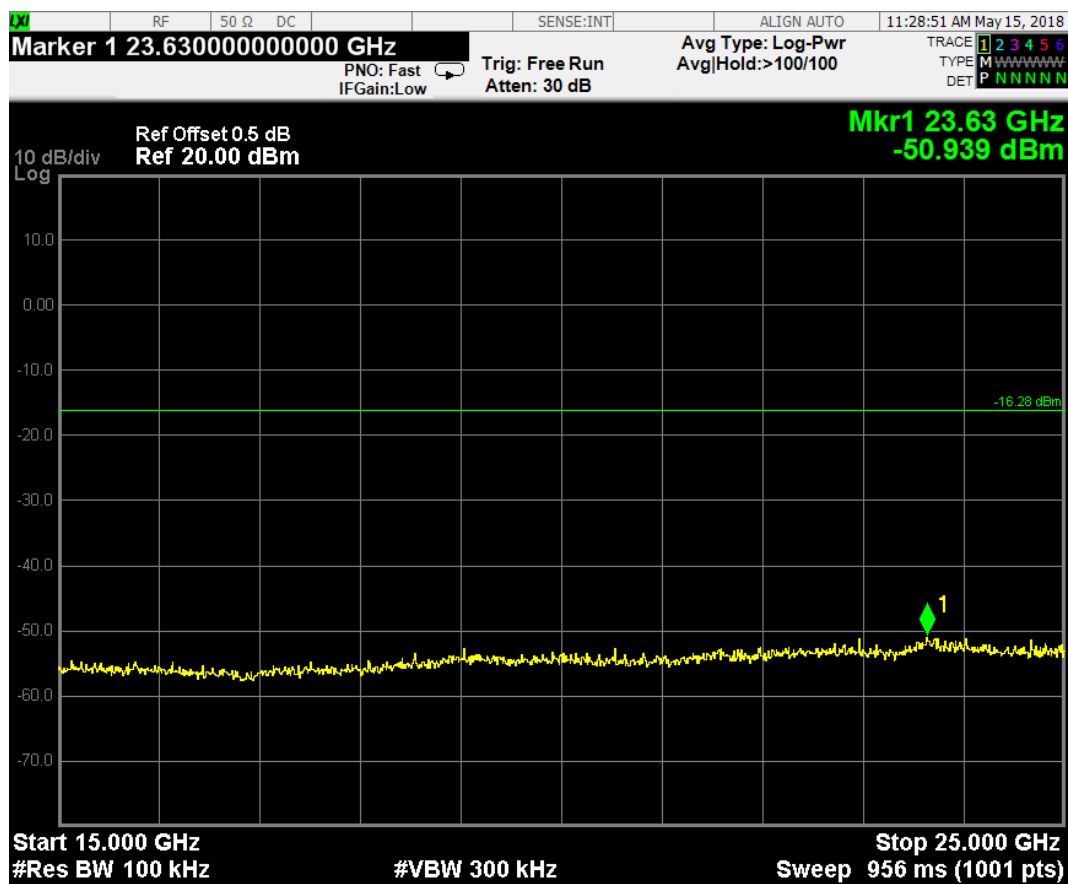
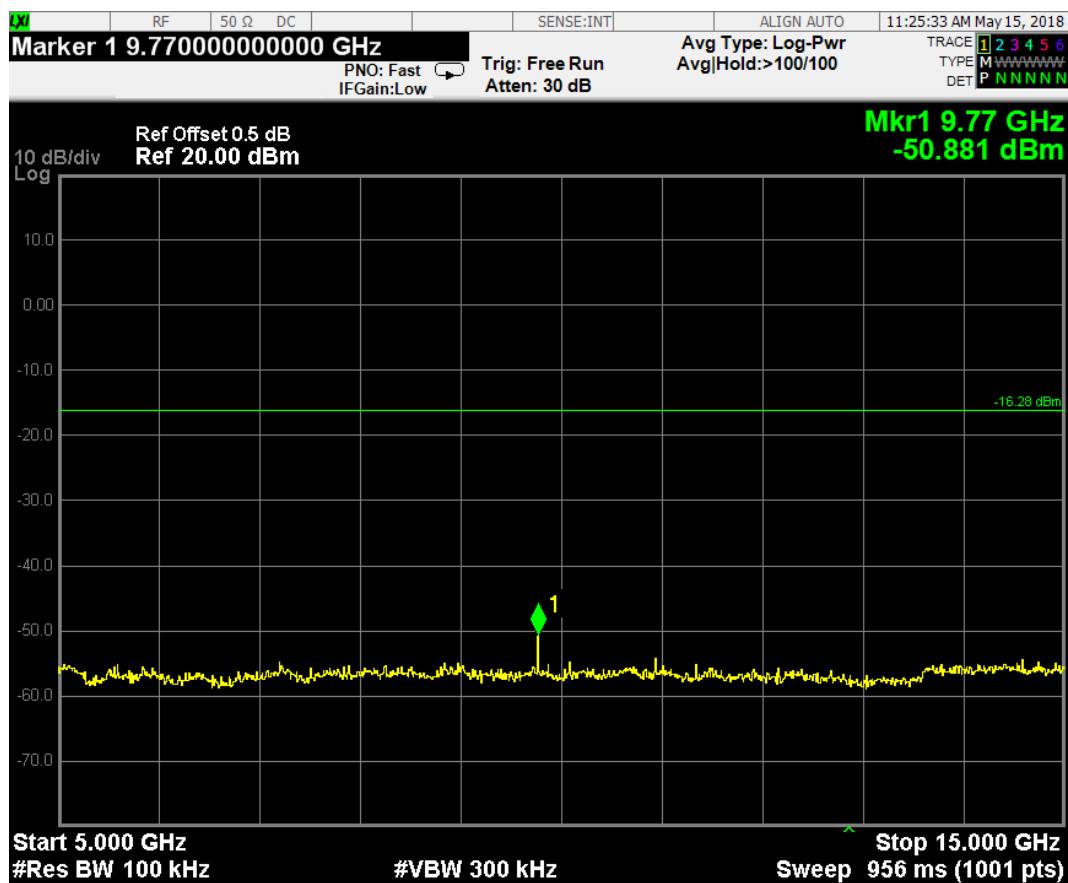
BT: CH20 (2442 MHz)

Reference level



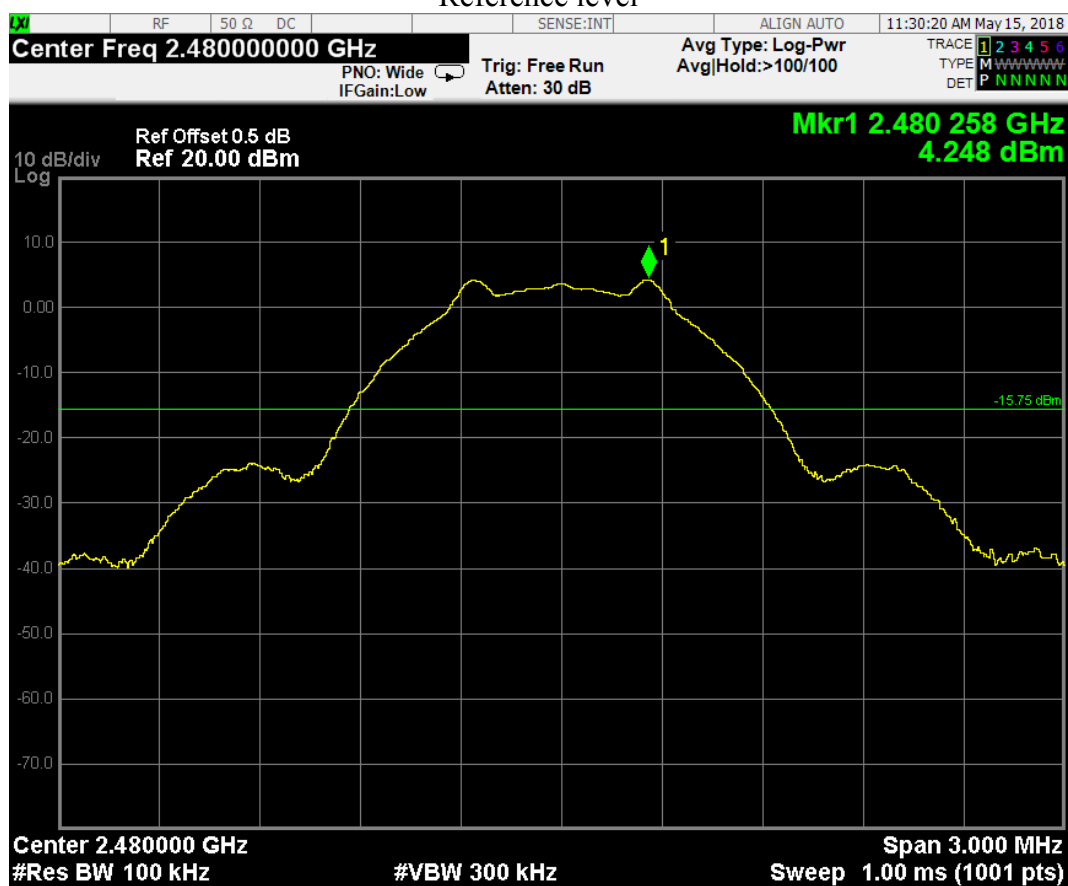
Emission level



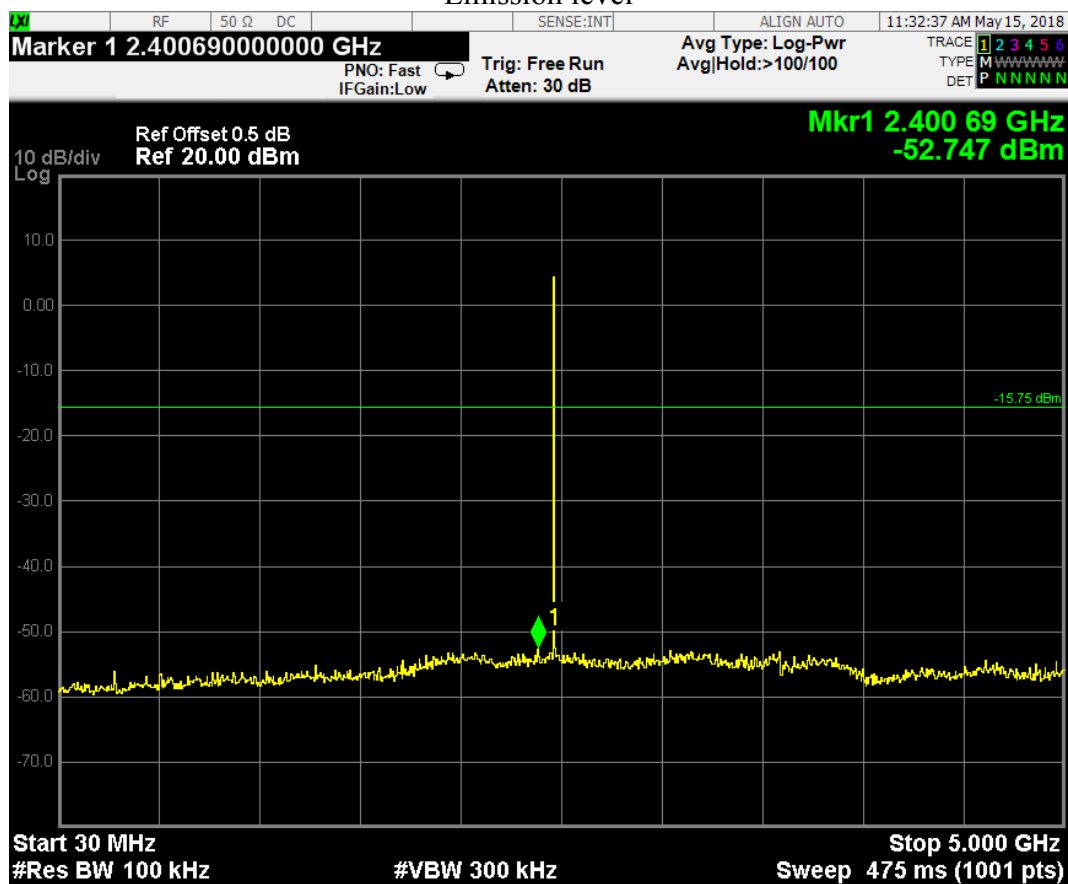


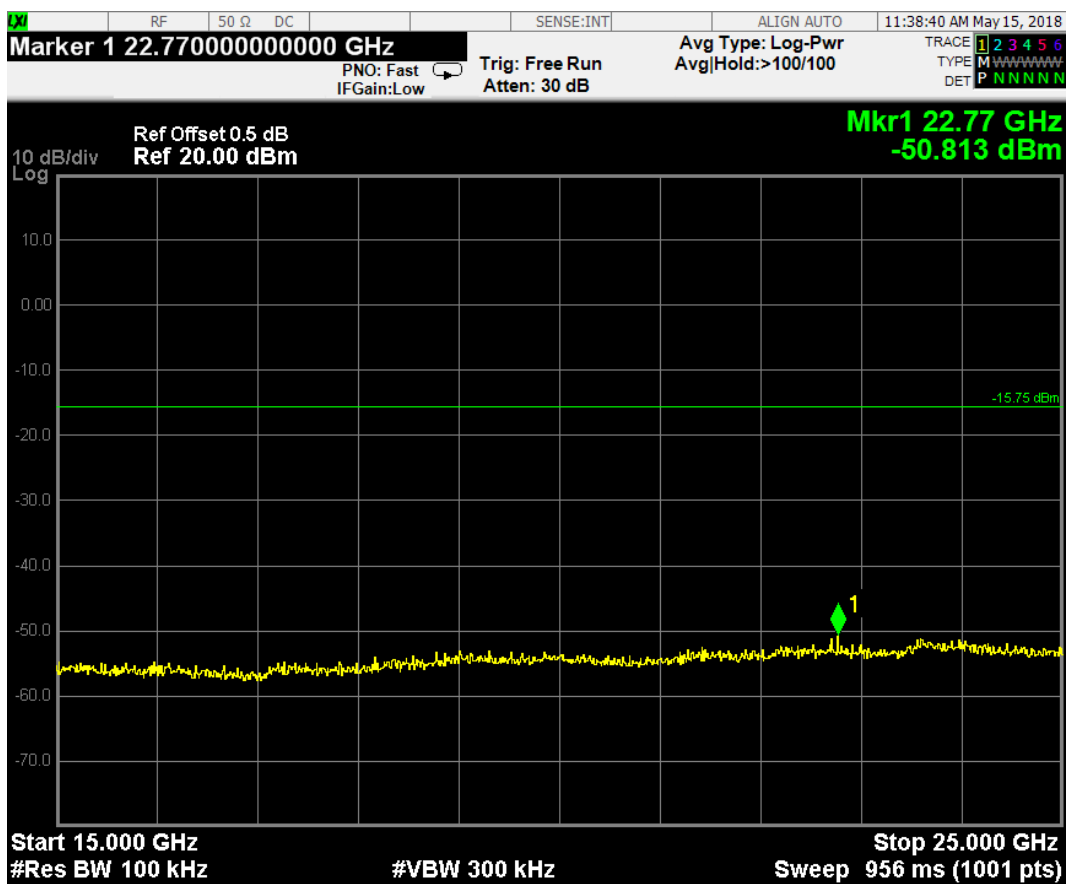
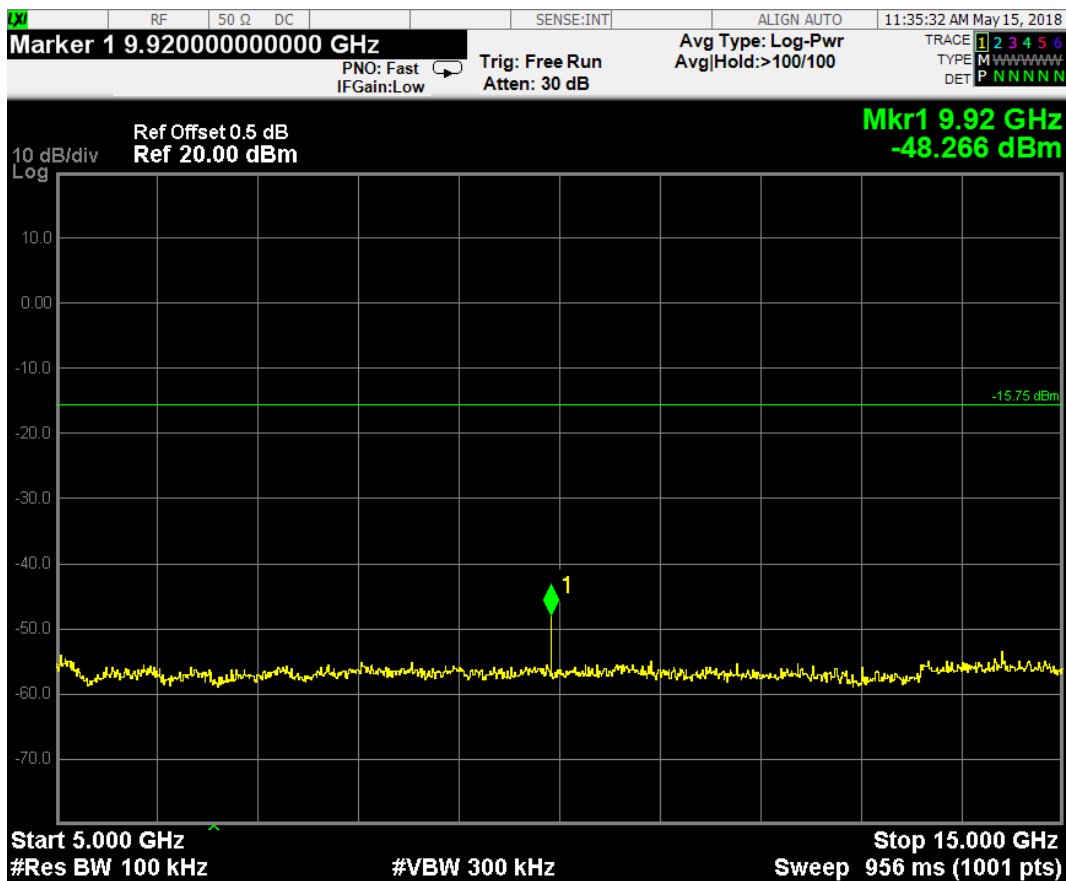
BT: CH39 (2480 MHz)

Reference level



Emission level





8 BAND EDGES MEASUREMENT

8.1 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, 2017	Jun 11, 2018

8.2 Block Diagram of Test Setup

The Same as section.4.2.

8.3 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.

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. 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).

8.6 Test Results

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

(Test Date: 2018.03.23 Temperature: 23°C Humidity: 51 %)

Modulation	Location	Channel	Frequency (MHz)	Delta Marker (dB)	Result
BT	Below Band Edge	00	2402	59.669	More than 20 dB below the highest level of the desired power
	Upper Band Edge	20	2480	57.725	

[illegible][illegible]

9 POWER SPECTRAL DENSITY MEASUREMENT

9.1 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, 2017	Jun 11, 2018

9.2 Block Diagram of Test Setup

The Same as section 4.2.

9.3 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.

9.4 Operating Condition of EUT

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

9.5 Test Procedure

The transmitter output was connected to the spectrum analyzer. 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).

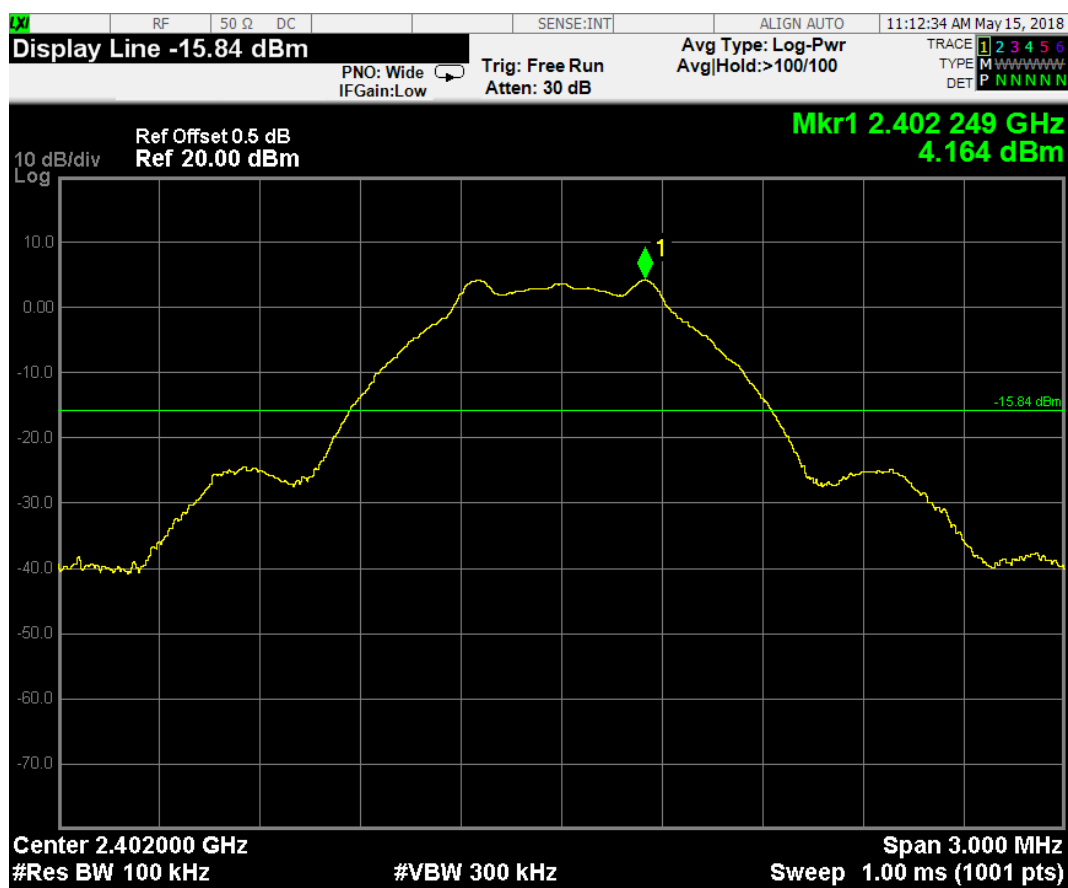
9.6 Test Results

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

(Test Date: 2018.03.23 Temperature: 23°C Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit
BT	00	2402	4.164	8 dBm
	20	2442	3.716	8 dBm
	40	2480	4.248	8 dBm

BT: CH00 2402 MHz



BT: CH20 2442 MHz



BT: CH39 2480 MHz



10 DEVIATION TO TEST SPECIFICATIONS

None.