TEST REPORT
On behalf of

Signify (China) Investment Co., Ltd

Product Name: Miscellaneous Controls

Model No.: SC1500/05, SC1500/10, SC1500/15

FCC ID: 2AGBW-SC1500

Prepared For: Signify (China) Investment Co., Ltd
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TESTING
NVLAP LAB CODE 200371-0

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Report No. : ACI-F19372
Date of Test : 2019.12.03-25
Date of Report : 2019.12.28

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

1 SUMMARY OF STANDARDS AND RESULTS 5
1.1 Description of Standards and Results 5
2 GENERAL INFORMATION 6
2.1 Description of Equipment Under Test 6
2.2 EUT Specifications Assessed in Current Report 7
2.3 Test Information 7
2.4 Supported equipment 7
2.5 Description of Test Facility 7
3 CONDUCTED EMISSION TEST 8
3.1 Test Equipment 8
3.2 Block Diagram of Test Setup 8
3.3 Conducted Emission Limits (§15.207) 9
3.4 Test Configuration 9
3.5 Operating Condition of EUT 9
3.6 Test Procedures 9
3.7 Test Results 10
4 RADIATED EMISSION TEST 12
4.1 Test Equipment 12
4.2 Block Diagram of Test Setup 12
4.3 Radiated Emission Limit (§15.209) 13
4.4 Test Configuration 13
4.5 Operating Condition of EUT 14
4.6 Test Procedures 14
4.7 Test Results 15
5 6 DB BANDWIDTH MEASUREMENT 22
5.1 Test Equipment 22
5.2 Block Diagram of Test Setup 22
5.3 Specification Limits (§15.247(a)(2)) 22
5.4 Operating Condition of EUT 22
5.5 Test Procedure 22
5.6 Test Results 23
6 MAXIMUM PEAK OUTPUT POWER MEASUREMENT 26
6.1 Test Equipment 26
6.2 Block Diagram of Test Setup 26
6.3 Specification Limits ((§15.247(b)(3)) 26
6.4 Operating Condition of EUT 26
6.5 Test Procedure 26
6.6 Test Results 27
7 EMISSION LIMITATIONS MEASUREMENT 30
7.1 Test Equipment 30
7.2 Block Diagram of Test Setup 30
7.3 Specification Limits (§15.247(d)) 30
7.4 Operating Condition of EUT 30
7.5 Test Procedure 30

7.6 Test Results 32
8 BAND EDGES MEASUREMENT 39
8.1 Test Equipment 39
8.2 Block Diagram of Test Setup 39
8.3 Specification Limits (§15.247(d)) 39
8.4 Operating Condition of EUT 39
8.5 Test Procedure 39
8.6 Test Results 40
9 POWER SPECTRAL DENSITY MEASUREMENT 42
9.1 Test Equipment 42
9.2 Block Diagram of Test Setup 42
9.3 Specification Limits (§15.247(e)) 42
9.4 Operating Condition of EUT 42
9.5 Test Procedure 42
9.6 Test Results 43
10 DEVIATION TO TEST SPECIFICATIONS 46
11 MEASUREMENT UNCERTAINTY LIST 47

TEST REPORT

Applicant	:	Signify (China) Investment Co., Ltd
EUT Description	:	Miscellaneous Controls
	(A) Model No.	: Refer to Sec.2.1
	(B) Power Supply	: 12-20.5V; 25mA
	(C) Test Voltage	: DC16V

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 : 2019.12.03-25 Date of Report : 2019.12.28

Producer : _____
JAREY LU / Supervisor

Reviewer : _____
BYRON WU / Deputy Assistant Manager

AUDIX® 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	:	Miscellaneous Controls
Type of EUT	:	☑ Production ☐ Pre-product ☐ Pro-type
Model Number	:	SC1500/05, SC1500/10, SC1500/15
Note	:	SC1500/05, SC1500/10, SC1500/15 are identical with each other, except the color of the front cover is different. /05 is white, /10 is grey and /15 is black.
Tested Model	:	SC1500/05
Radio Tech	:	Bluetooth v4.2 BLE Zigbee
Channel Freq.	:	BLE: 2402MHz-2480MHz; Zigbee: 2405MHz-2480MHz.
Modulation	:	BLE: GFSK Zigbee: OQPSK
Antenna Info.	:	Antenna Type: PCB Antenna Antenna Gain: 2.35 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 during all the test in the report.
Applicant	:	Signify (China) Investment Co., Ltd Building no.9, Lane 888, Tianlin Road, Minhang District, Shanghai 200233, China
Manufacturer	:	same as Applicant
Factory	:	Fideltronik Poland Sp.z.o.o. UL. Beniowskiego 1 34-200, Sucha Beskidzka Poland Postcode/Zip Code: 34-200

2.2 EUT Specifications Assessed in Current Report

Mode	Modulation	Data Rate(kbps)
Zigbee	OQPSK	250

Channel List			
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
11	2405	19	2445
12	2410	20	2450
13	2415	21	2455
14	2420	22	2460
15	2425	23	2465
16	2430	24	2470
17	2435	25	2475
18	2440	26	2480

2.3 Test Information

The test software "Philips MultiOne" was used to control EUT work in TX mode, and select test channel.

Modulation	data rate (kbps)	Test Channel		Frequency (MHz)
Zigbee	250	Low:	11	2405
		Middle:	18	2440
		High:	26	2480

2.4 Supported equipment

Model Name : LED Electronic Driver
Model Number : XI040C119V054VPT1

2.5 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

3 CONDUCTED EMISSION TEST

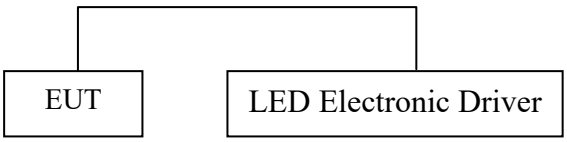
3.1 Test Equipment

The following test equipments are used during the conducted emission test in a shielded room:

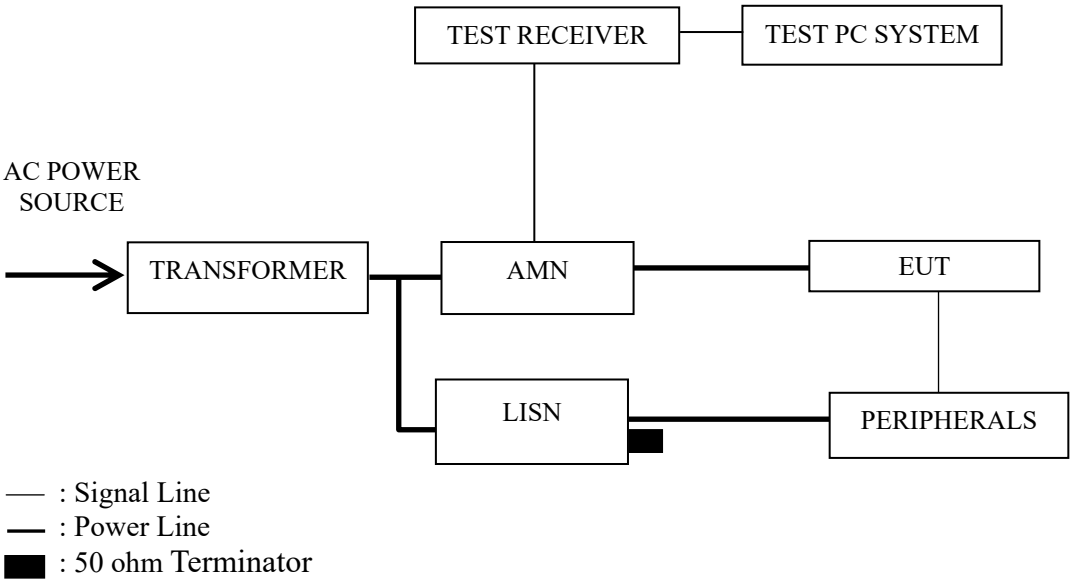
Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Test Receiver	R&S	ESCI	101302	Apr 27, 2019	Apr 26, 2020
2.	Artificial Mains Network (AMN)	R&S	ENV4200	100125	Jun 24, 2019	Jun 23, 2020
3.	Software	Audix	E3	6.2009-1-15	--	--

3.2 Block Diagram of Test Setup

3.2.1 EUT & Peripherals



3.2.2 Conducted Disturbance Test Setup



3.3 Conducted Emission Limits (§15.207)

Frequency Range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 ~ 0.5	66~56	56~46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE 1 – The lower limit shall apply at the transition frequencies.

NOTE 2 – The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz~0.50 MHz

3.4 Test Configuration

The EUT (listed in Sec.2.1) was installed as shown on Sec.3.2 to meet FCC requirement and operating in a manner which 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

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)

The test modes were done on conducted disturbance test and all the test results are listed in Sec. 3.7

3.7 Test Results

< PASS >

The frequency and amplitude of the highest conducted 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 (MHz)	Data Page
1.	Normal	Zigbee	--	--	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	:	Miscellaneous Controls	Temperature :	22℃
Model No.	:	SC1500/05	Humidity :	51%RH
Test Mode	:	Normal	Date of Test :	2019.12.25

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	0.22437	29.83	10.43	0.04	40.3	62.66	22.36	QP
	0.22437	27.9	10.43	0.04	38.37	52.66	14.29	Average
	0.55226	20.8	10.33	0.04	31.17	56	24.83	QP
	0.55226	17.9	10.33	0.04	28.27	46	17.73	Average
	0.73519	11.92	10.32	0.05	22.29	56	33.71	QP
	0.73519	5.79	10.32	0.05	16.16	46	29.84	Average
	2.358	8.59	10.3	0.06	18.95	56	37.05	QP
	2.358	3.6	10.3	0.06	13.96	46	32.04	Average
	11.807	22.88	10.27	0.07	33.22	60	26.78	QP
	11.807	16.9	10.27	0.07	27.24	50	22.76	Average
	28.302	19.62	10.32	0.09	30.03	60	29.97	QP
	28.302	12.71	10.32	0.09	23.12	50	26.88	Average
Neutral	0.2304	23.34	10.42	0.04	33.8	62.44	28.64	QP
	0.2304	20.39	10.42	0.04	30.85	52.44	21.59	Average
	0.54644	19.07	10.32	0.04	29.43	56	26.57	QP
	0.54644	13.1	10.32	0.04	23.46	46	22.54	Average
	0.73519	15.81	10.32	0.05	26.18	56	29.82	QP
	0.73519	7.89	10.32	0.05	18.26	46	27.74	Average
	1.082	11.71	10.32	0.05	22.08	56	33.92	QP
	1.082	2.8	10.32	0.05	13.17	46	32.83	Average
	12.06	22.67	10.31	0.07	33.05	60	26.95	QP
	12.06	16.7	10.31	0.07	27.08	50	22.92	Average
	28.302	18.08	10.33	0.09	28.5	60	31.5	QP
	28.302	12.1	10.33	0.09	22.52	50	27.48	Average

TEST ENGINEER: Jarey

4 RADIATED EMISSION TEST

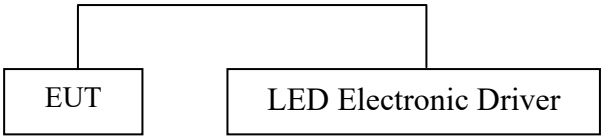
4.1 Test Equipment

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

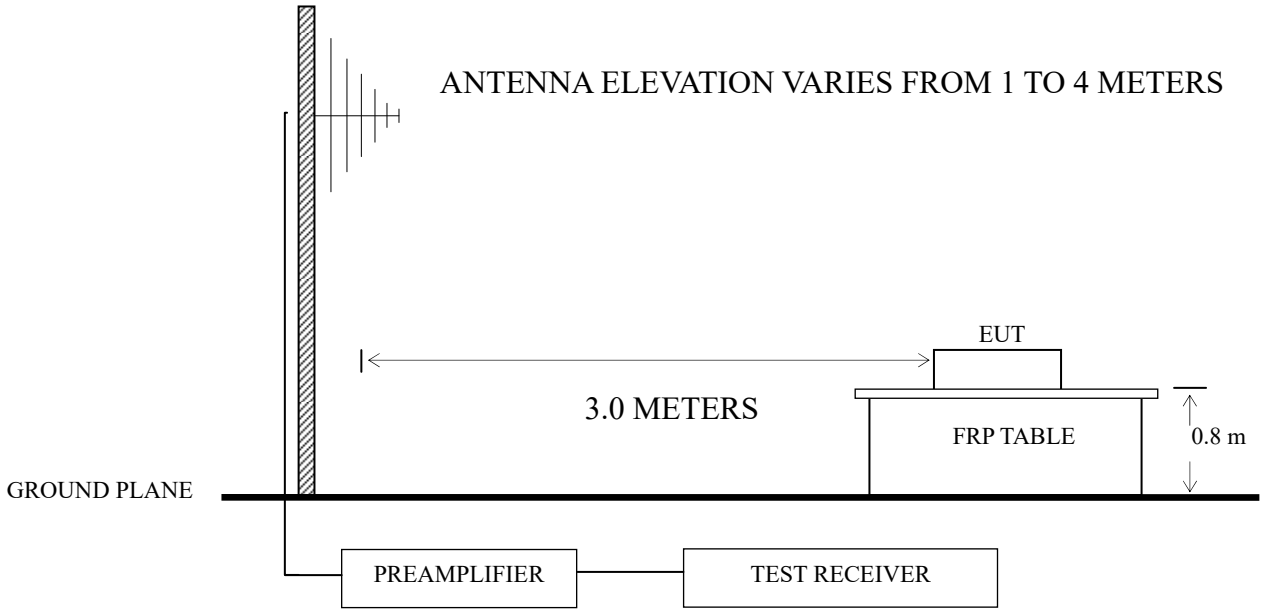
Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Preamplifier	Agilent	8447D	2944A06664	Apr 27, 2019	Apr 26, 2020
2.	Preamplifier	HP	8449B	3008A00864	Mar 08, 2019	Mar 07, 2020
3.	Spectrum Analyzer	Agilent	N9010A	MY52221182	Jan 05, 2019	Jan 05, 2020
4.	Test Receiver	R&S	ESCI	101303	May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

4.2 Block Diagram of Test Setup

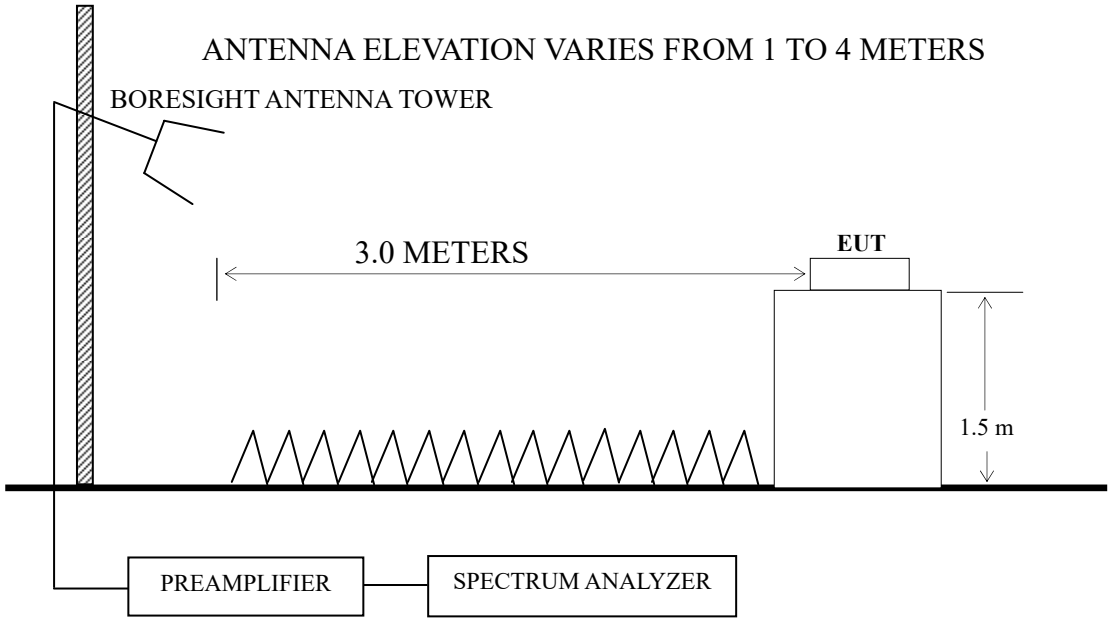
4.2.1 EUT & Peripherals



4.2.2 Below 1GHz



4.2.3 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 10^{th} harmonics from fundamental frequency) was checked.

All the test results are listed in Sec.4.7.

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	Zigbee	11	2405 MHz	P16
2.	Receiving	Zigbee	26	2480 MHz	P17

Frequency range: above 1G

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	Zigbee	11	2405 MHz	P18
2.	Transmitting	Zigbee	18	2440 MHz	P18
3.	Transmitting	Zigbee	26	2480 MHz	P19
4.	Receiving	Zigbee	26	2480 MHz	P20

Restricted bands:

No.	Operation	Modulation	Channel	Frequency	Data Page
1.	Transmitting	Zigbee	Cabinet Emission		P21

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	:	Miscellaneous Controls	Temperature :	22℃
Model No.	:	SC1500/05	Humidity :	51%RH
Test Mode	:	Transmitting	Date of Test :	2019.12.22

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	55.805	28.92	18.5	0.85	27.6	20.67	40	19.33	QP
	120.7	36.99	17.49	1.23	27.44	28.27	43.5	15.23	QP
	140.34	41.85	19.6	1.33	27.3	35.48	43.5	8.02	QP
	298.27	27.35	20.1	1.95	26.8	22.6	46	23.4	QP
	574.63	25.76	24.98	2.65	28	25.39	46	20.61	QP
	755.39	25.63	28.19	2.99	27.99	28.82	46	17.18	QP
Vertical	46.995	37.01	17.53	0.78	27.6	27.72	40	12.28	QP
	55.805	36.09	18.5	0.85	27.6	27.84	40	12.16	QP
	128.56	41.52	18.05	1.27	27.38	33.46	43.5	10.04	QP
	140.34	39.32	19.6	1.33	27.3	32.95	43.5	10.55	QP
	317.7	25.43	21.02	2.02	26.94	21.53	46	24.47	QP
	815.97	25.26	28.19	3.1	27.83	28.72	46	17.28	QP

TEST ENGINEER: Jarey

EUT	:	Miscellaneous Controls	Temperature :	22℃
Model No.	:	SC1500/05	Humidity :	51%RH
Test Mode	:	Receiving	Date of Test :	2019.12.22

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	48.43	30.85	17.45	0.79	27.6	21.49	40	18.51	QP
	121.18	36.86	17.48	1.23	27.43	28.14	43.5	15.36	QP
	141.55	41.29	19.7	1.34	27.3	35.03	43.5	8.47	QP
	301.6	26.21	20.26	1.96	26.82	21.61	46	24.39	QP
	600.36	24.65	25.7	2.71	28	25.06	46	20.94	QP
	891.36	24.89	28.53	3.22	27.53	29.11	46	16.89	QP
Vertical	41.64	35.89	17.78	0.75	27.61	26.81	40	13.19	QP
	56.19	35.31	18.33	0.85	27.6	26.89	40	13.11	QP
	127.97	42.23	17.89	1.27	27.39	34	43.5	9.5	QP
	141.55	41.29	19.7	1.34	27.3	35.03	43.5	8.47	QP
	315.18	25.24	20.95	2	26.91	21.28	46	24.72	QP
	912.7	25.26	28.87	3.24	27.46	29.91	46	16.09	QP

TEST ENGINEER: Jarey

Radiated Emission > 1GHz

EUT	:	Miscellaneous Controls	Temperature :	22℃
Model No.	:	SC1500/05	Humidity :	51%RH
Test Mode	:	Transmitting	Date of Test :	2019.12.22

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	1828	45.22	27.39	4.57	37.11	40.07	74	33.93	Peak
	3763	42.97	32.1	6.64	36.52	45.19	74	28.81	Peak
	5131	42.27	33.62	7.82	36.51	47.2	74	26.8	Peak
	6418	40.5	35.33	9.23	36.9	48.16	74	25.84	Peak
	7642	41.4	36.16	10	37.04	50.52	74	23.48	Peak
	9037	40.45	36.83	10.55	35.29	52.54	74	21.46	Peak
Vertical	1837	44.78	27.41	4.6	37.1	39.69	74	34.31	Peak
	3835	43.03	32.32	6.69	36.51	45.53	74	28.47	Peak
	5356	40.74	33.98	8.08	36.54	46.26	74	27.74	Peak
	6931	40.86	35.75	9.67	37.26	49.02	74	24.98	Peak
	8164	42.1	36.33	10.2	36.63	52	74	22	Peak
	9217	40.45	36.93	10.65	35.25	52.78	74	21.22	Peak

CH18 (2440MHz)

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	1810	49.61	27.3	4.57	37.12	44.36	74	29.64	Peak
	3592	43.94	31.59	6.48	36.54	45.47	74	28.53	Peak
	5095	42.18	33.55	7.82	36.51	47.04	74	26.96	Peak
	6373	40.97	35.3	9.14	36.87	48.54	74	25.46	Peak
	7633	41.3	36.15	10	37.05	50.4	74	23.6	Peak
	8695	40.41	36.56	10.37	35.76	51.58	74	22.42	Peak
Vertical	1837	45.29	27.41	4.6	37.1	40.2	74	33.8	Peak
	3817	42.94	32.26	6.69	36.52	45.37	74	28.63	Peak
	5059	41.66	33.5	7.82	36.51	46.47	74	27.53	Peak
	5914	40.43	34.87	8.7	36.59	47.41	74	26.59	Peak
	7714	40.81	36.19	10.04	37.02	50.02	74	23.98	Peak
	9064	39.86	36.85	10.55	35.28	51.98	74	22.02	Peak

CH26 (2480MHz)

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	2008	44.38	28.12	4.78	37	40.28	74	33.72	Peak
	3745	43.15	32.07	6.64	36.52	45.34	74	28.66	Peak
	5518	41.13	34.23	8.35	36.55	47.16	74	26.84	Peak
	6895	40.42	35.72	9.67	37.23	48.58	74	25.42	Peak
	8137	41.21	36.33	10.16	36.67	51.03	74	22.97	Peak
	9406	39.97	37.04	10.75	35.22	52.54	74	21.46	Peak
Vertical	1846	44.75	27.46	4.6	37.09	39.72	74	34.28	Peak
	3808	42.86	32.26	6.69	36.52	45.29	74	28.71	Peak
	5104	41.21	33.57	7.82	36.51	46.09	74	27.91	Peak
	6265	40.75	35.21	9.05	36.79	48.22	74	25.78	Peak
	7822	40.56	36.24	10.08	36.97	49.91	74	24.09	Peak
	8848	40.11	36.68	10.41	35.53	51.67	74	22.33	Peak

TEST ENGINEER: Jarey

EUT	:	Miscellaneous Controls	Temperature :	22℃
Model No.	:	SC1500/05	Humidity :	51%RH
Test Mode	:	Receiving	Date of Test :	2019.12.22

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	2629	43.67	29.73	5.48	36.73	42.15	74	31.85	Peak
	3817	42.78	32.26	6.69	36.52	45.21	74	28.79	Peak
	5077	40.7	33.52	7.82	36.51	45.53	74	28.47	Peak
	6094	40	35.07	8.88	36.66	47.29	74	26.71	Peak
	7372	41.23	36.02	9.88	37.14	49.99	74	24.01	Peak
	8875	40.49	36.7	10.41	35.48	52.12	74	21.88	Peak
Vertical	2854	43.02	29.97	5.71	36.65	42.05	74	31.95	Peak
	4024	41.17	32.79	6.9	36.5	44.36	74	29.64	Peak
	5086	41.91	33.55	7.82	36.51	46.77	74	27.23	Peak
	6301	41.48	35.24	9.14	36.82	49.04	74	24.96	Peak
	7363	41.01	36.02	9.88	37.15	49.76	74	24.24	Peak
	8560	41.34	36.46	10.33	35.99	52.14	74	21.86	Peak

TEST ENGINEER: Jarey

Emissions in restricted frequency bands:

EUT	:	Miscellaneous Controls	Temperature :	22℃
Model No.	:	SC1500/05	Humidity :	51%RH
Test Mode	:	Transmitting	Date of Test :	2019.12.22

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	2340.6	45.13	29.15	5.17	36.85	42.6	74	31.4	Peak
	2340.6	32.38	29.15	5.17	36.85	29.85	54	24.15	Average
	2378.1	43.81	29.27	5.21	36.83	41.46	74	32.54	Peak
	2378.1	31.62	29.27	5.21	36.83	29.27	54	24.73	Average
	2484.8	48.39	29.56	5.36	36.79	46.52	74	27.48	Peak
	2484.8	33.53	29.56	5.36	36.79	31.66	54	22.34	Average
	2492.8	44.39	29.58	5.36	36.78	42.55	74	31.45	Peak
	2492.8	30.13	29.58	5.36	36.78	28.29	54	25.71	Average
Vertical	2340.7	44.44	29.15	5.17	36.84	41.92	74	32.08	Peak
	2340.7	32.14	29.15	5.17	36.84	29.62	54	24.38	Average
	2379.1	44.09	29.27	5.25	36.83	41.78	74	32.22	Peak
	2379.1	32.31	29.27	5.25	36.83	30	54	24	Average
	2484.3	46.38	29.56	5.36	36.79	44.51	74	29.49	Peak
	2484.3	33.22	29.56	5.36	36.79	31.35	54	22.65	Average
	2492.9	43.72	29.58	5.36	36.78	41.88	74	32.12	Peak
	2492.9	29.42	29.58	5.36	36.78	27.58	54	26.42	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	Jan 05, 2019	Jan 05, 2020

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 ≥ 3 × 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

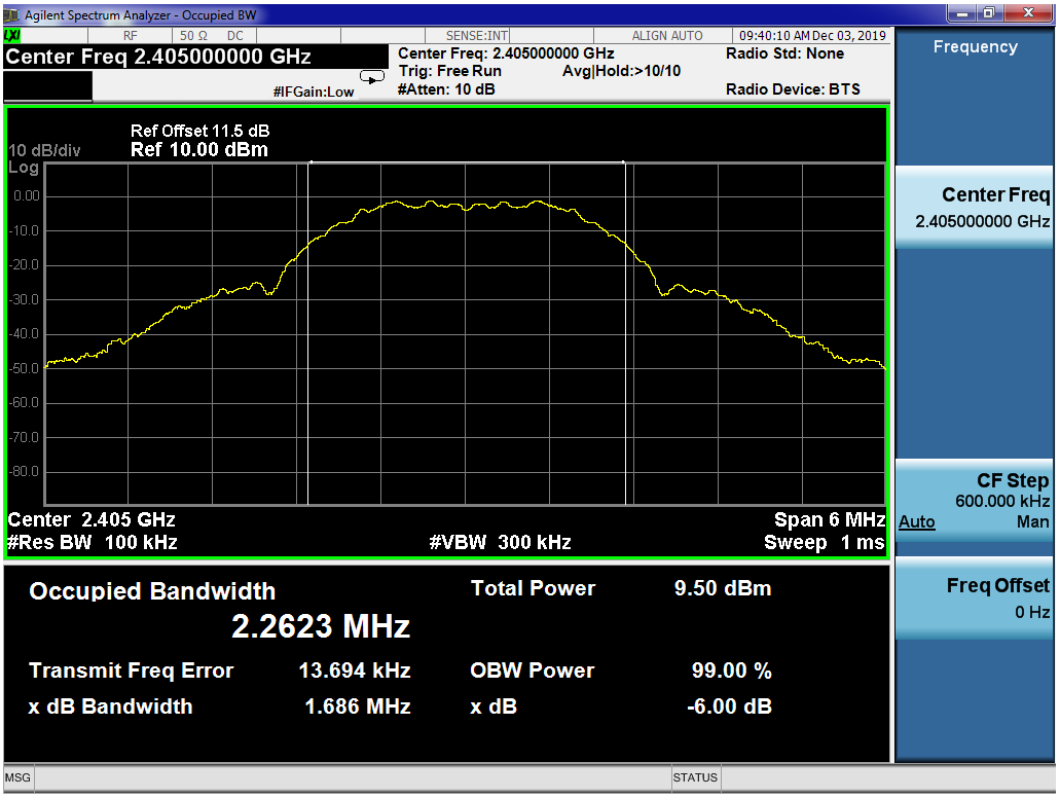
PASSED.

All the test results are attached in next pages.

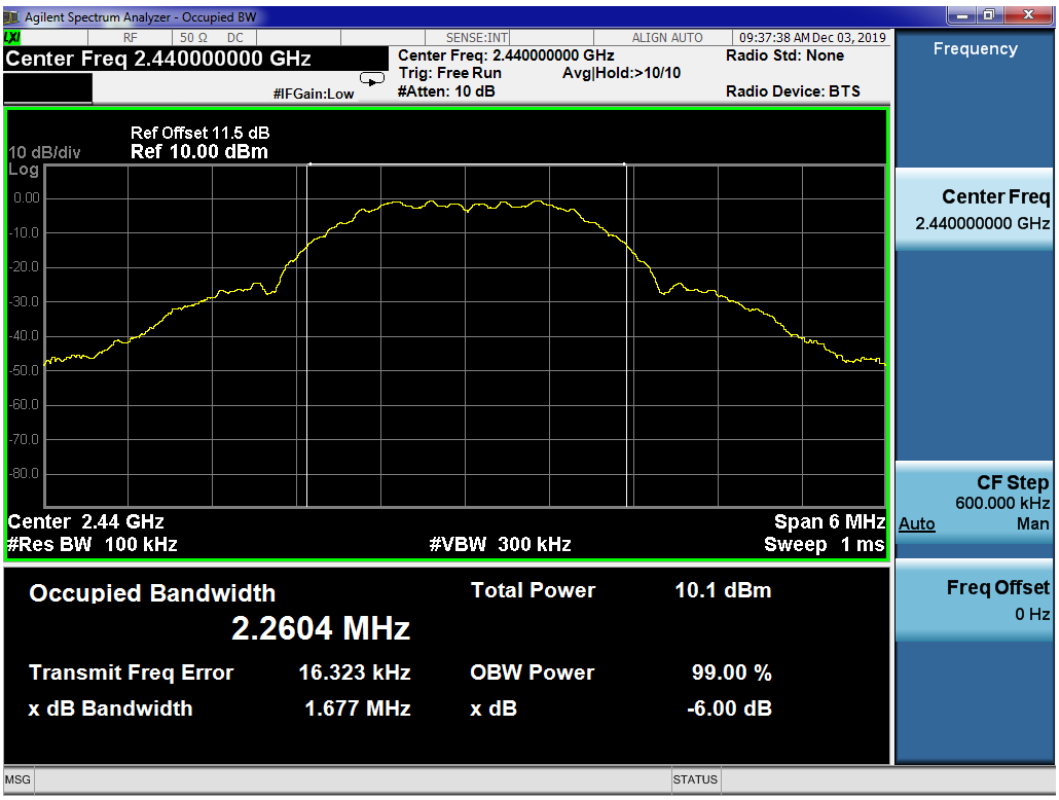
(Test Date: 2019.12.03 Temperature: 23℃ Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	**6dB Bandwidth (MHz)**	Limit
Zigbee	11	2405	**1.686**	500 kHz
	18	2440	**1.677**	500 kHz
	26	2480	**1.664**	500 kHz

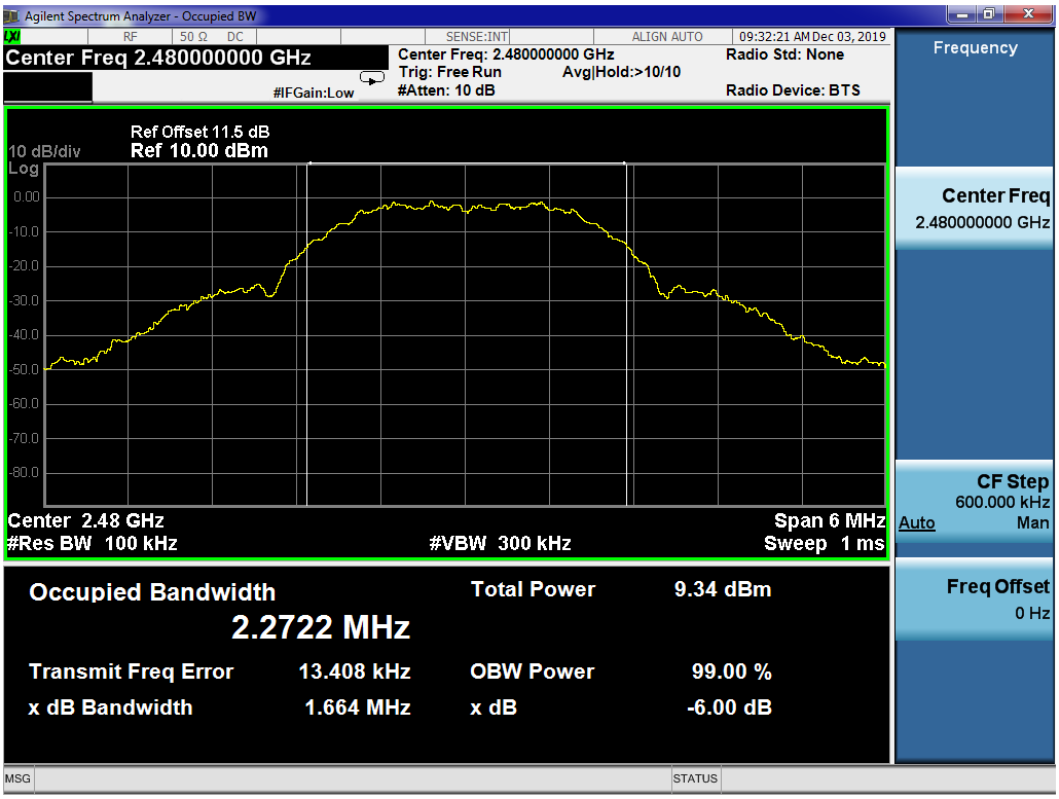
CH11 (2405 MHz)



CH18 (2440 MHz)



CH26 (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	Jan 05, 2019	Jan 05, 2020

6.2 Block Diagram of Test Setup

The Same as Section. 5.2.

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 ≥ DTS Bandwidth.
b) VBW ≥ [3 × RBW].
c) Span ≥ [3 × 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 ≥ DTS bandwidth" was used).

6.6 Test Results

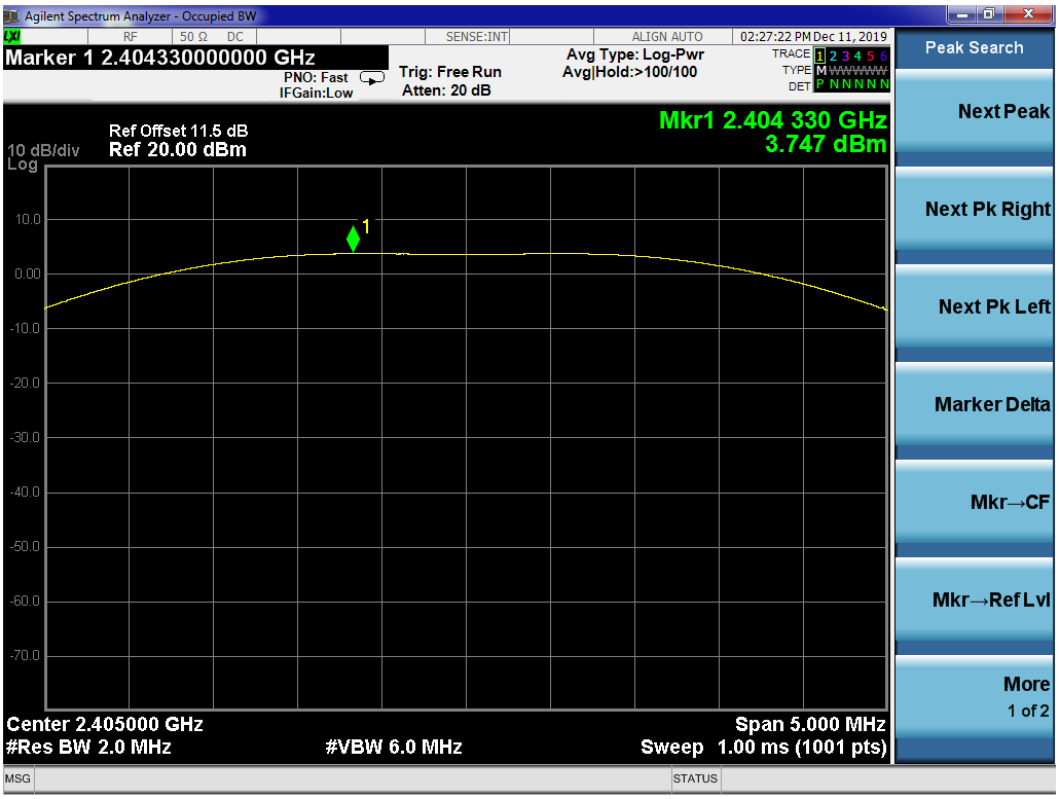
PASSED.

All the test results are listed below.

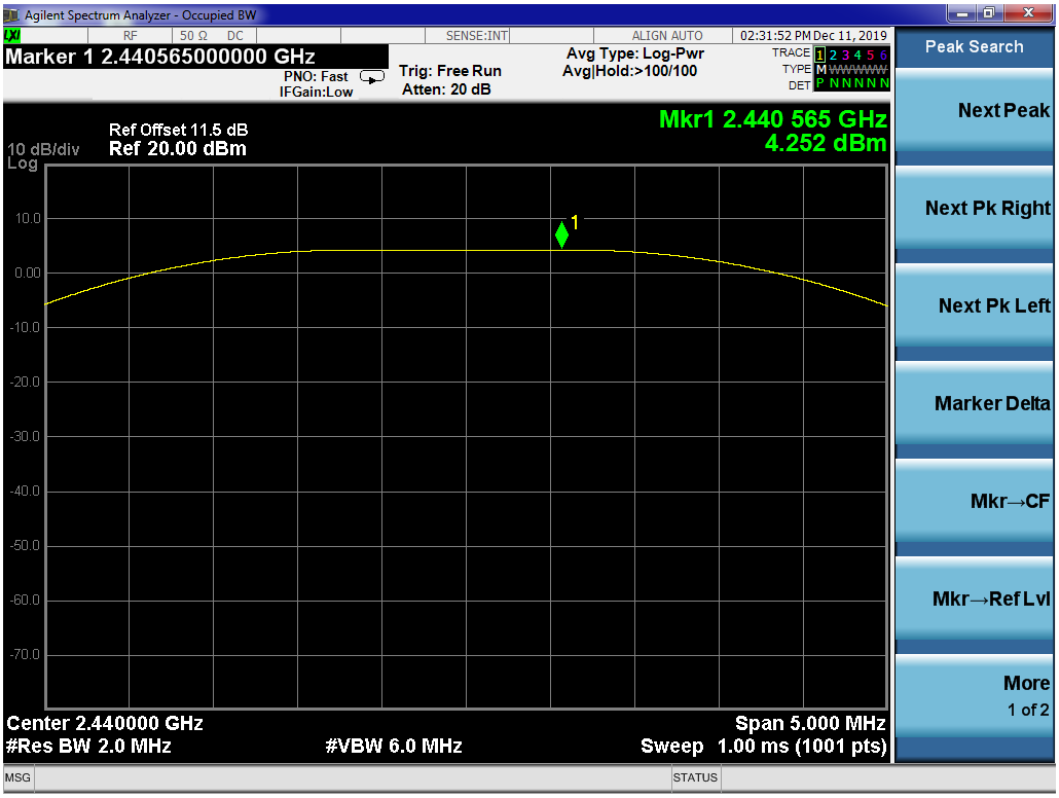
(Test Date: 2019.12.11 Temperature: 23℃ Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	**Peak Output Power (dBm)**	Limit
Zigbee	11	2405	**3.747**	30 dBm
	18	2440	**4.252**	30 dBm
	26	2480	**3.756**	30 dBm

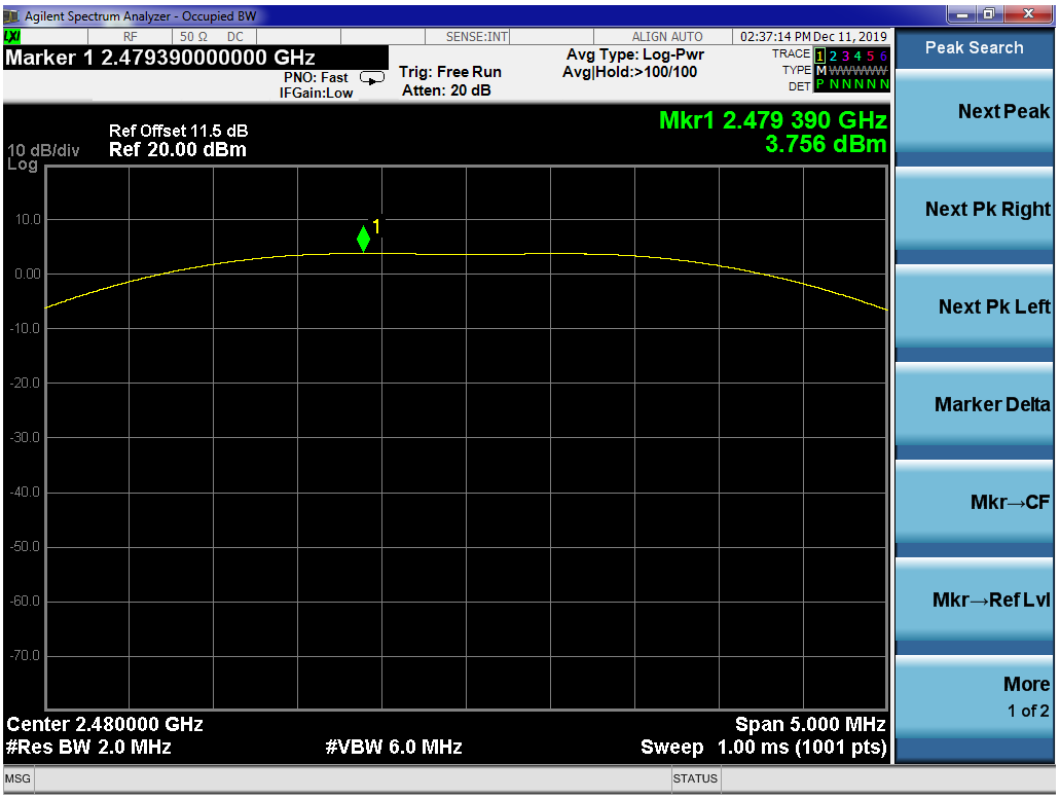
CH11 (2405 MHz)



CH18 (2440 MHz)



CH26 (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	Jan 05, 2019	Jan 05, 2020

7.2 Block Diagram of Test Setup

The Same as Section. 5.2.

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.
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. 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.

Establish a reference level by using the following procedure:
a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 times the DTS bandwidth.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ [3 × 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 ≥ [3 × 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^{th} 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).

7.6 Test Results

PASSED.

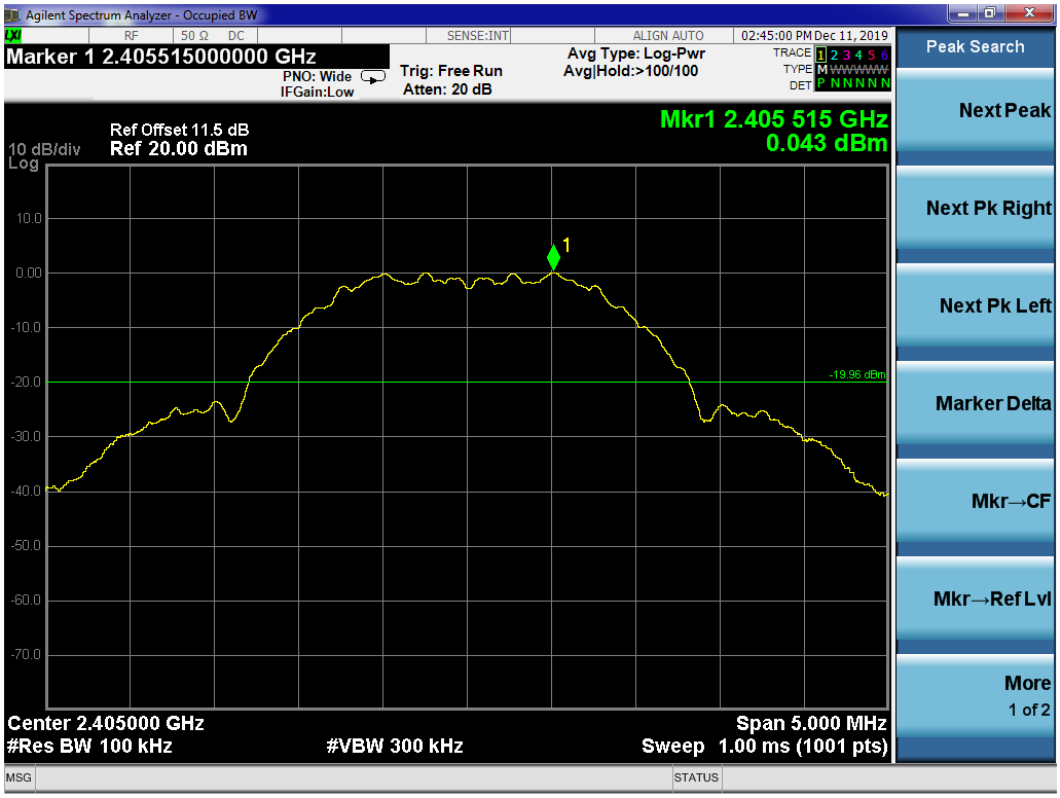
The test data was attached in the next pages.

(Test Date: 2019.12.11 Temperature: 23℃ Humidity: 51 %)

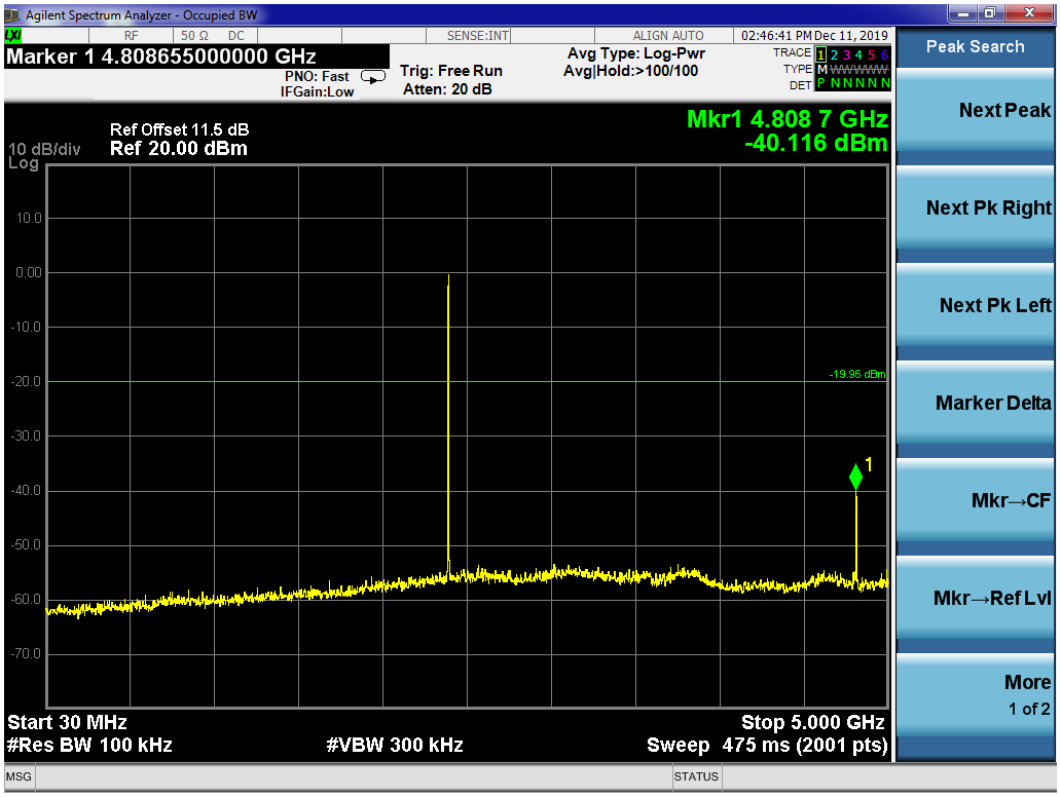
Modulation	Channel	Frequency (MHz)	Data Page
Zigbee	11	2405	P33-34
	18	2440	P35-36
	26	2480	P37-38

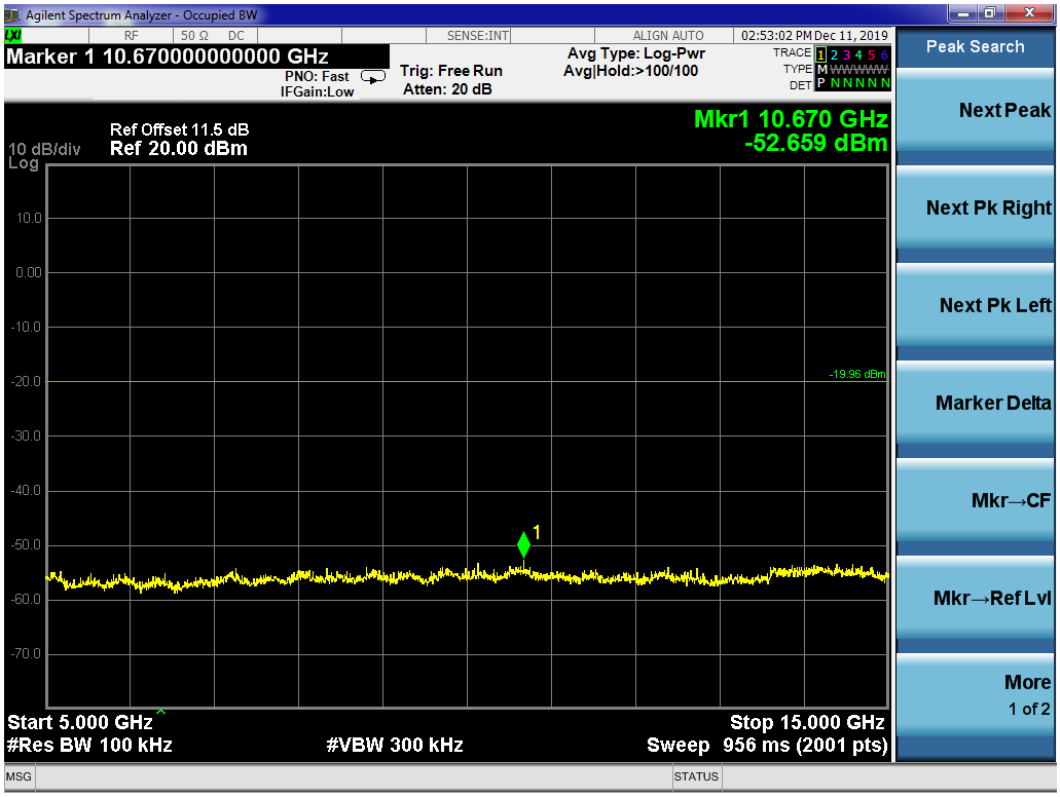
CH11 (2405 MHz)

Reference level



Emission level

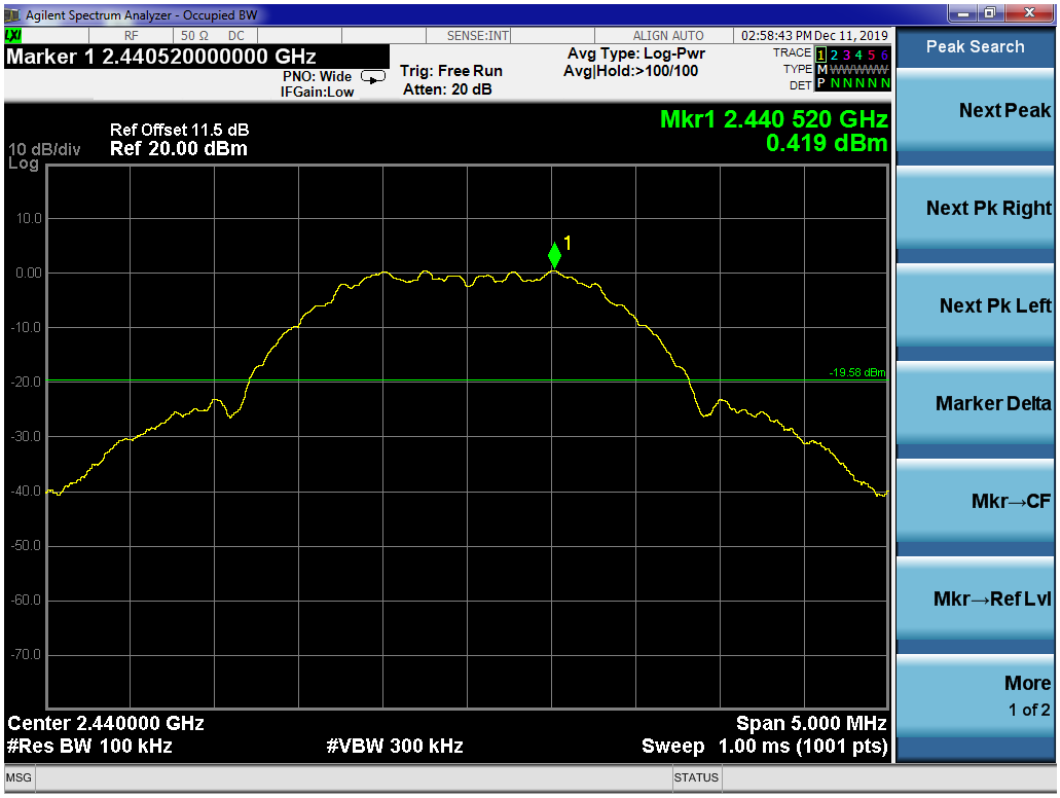



Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
02:53:02 PM Dec 11, 2019
Marker 1 10.670000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 11.5 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 10.670 GHz
-52.659 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-19.96 dBm
1
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 15.000 GHz
Sweep 956 ms (2001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

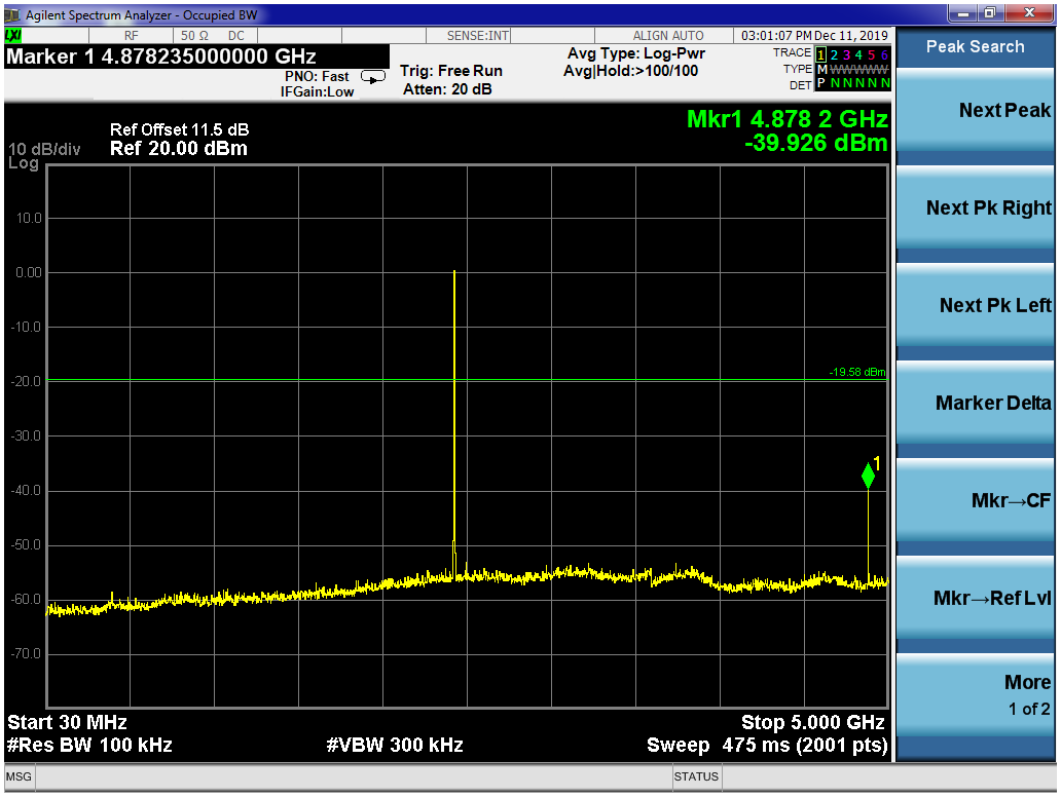
Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
02:56:20 PM Dec 11, 2019
Marker 1 23.515000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 11.5 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 23.515 GHz
-49.418 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-19.96 dBm
1
Start 15.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 956 ms (2001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

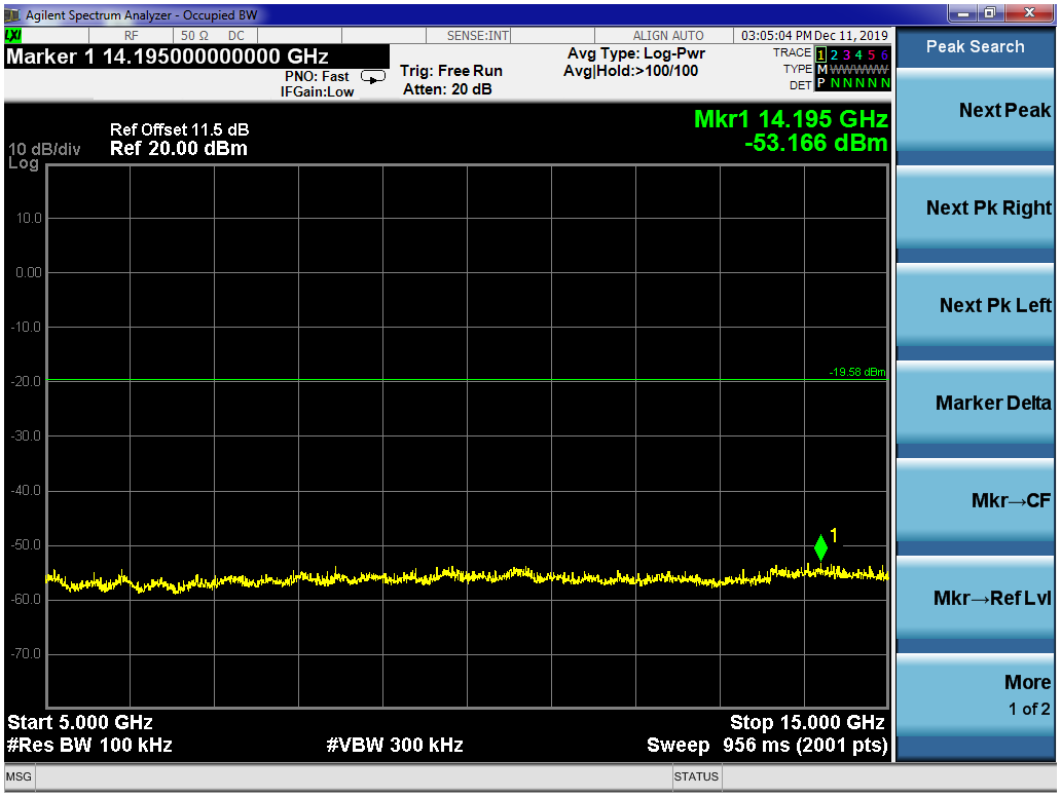
CH18 (2440 MHz)

Reference level



Emission level

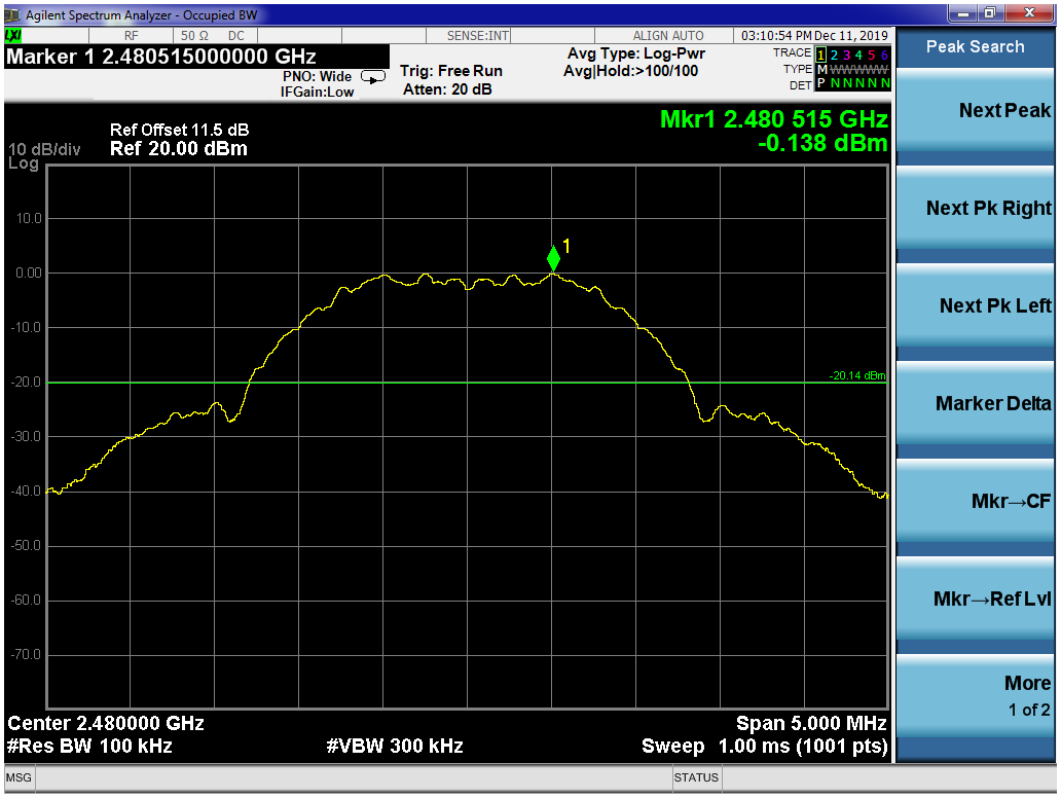



Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
03:05:04 PM Dec 11, 2019
Marker 1 14.195000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 11.5 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 14.195 GHz
-53.166 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-19.58 dBm
1
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 15.000 GHz
Sweep 956 ms (2001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

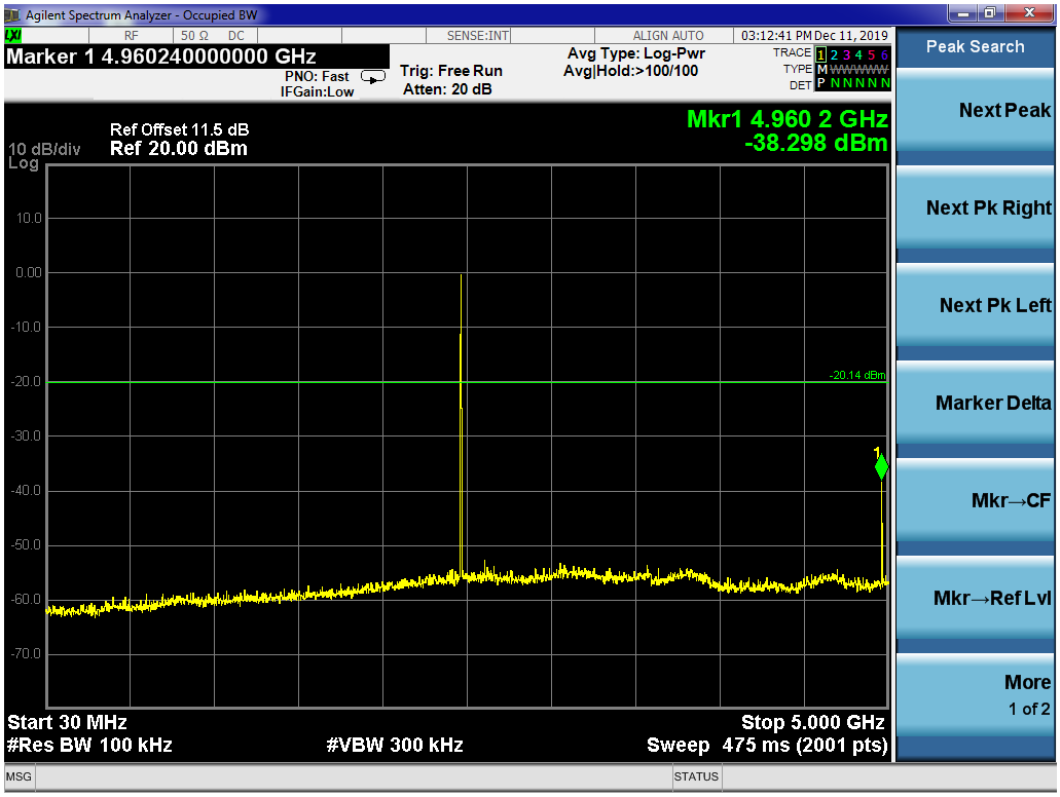
Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
03:08:08 PM Dec 11, 2019
Marker 1 23.655000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 11.5 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 23.655 GHz
-49.417 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-19.58 dBm
1
Start 15.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 956 ms (2001 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

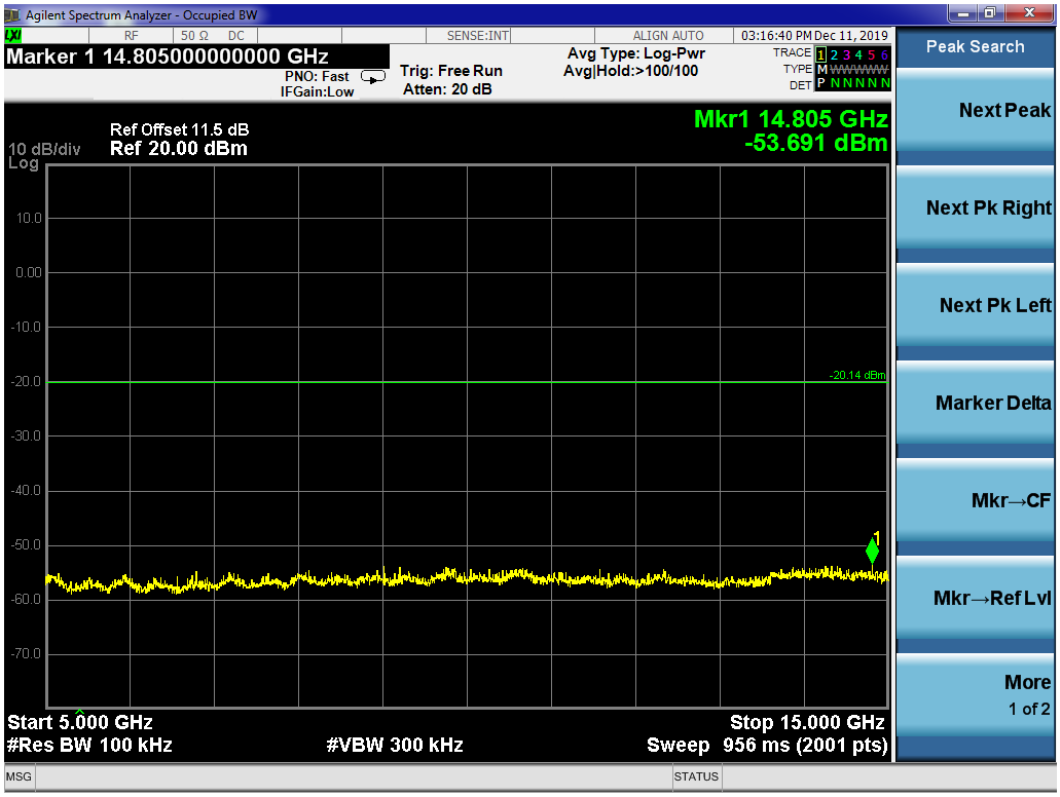
CH26 (2480 MHz)

Reference level



Emission level




Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
03:16:40 PM Dec 11, 2019
Marker 1 14.805000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Ref Offset 11.5 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 14.805 GHz
-53.691 dBm
-20.14 dBm
Start 5.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 15.000 GHz
Sweep 956 ms (2001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

Agilent Spectrum Analyzer - Occupied BW
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
03:28:21 PM Dec 11, 2019
Marker 1 23.665000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Ref Offset 11.5 dB
10 dB/div
Log
Ref 20.00 dBm
Mkr1 23.665 GHz
-49.470 dBm
-20.14 dBm
Start 15.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 956 ms (2001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

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	Jan 05, 2019	Jan 05, 2020

8.2 Block Diagram of Test Setup

The Same as section. 5.2.

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. 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.

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

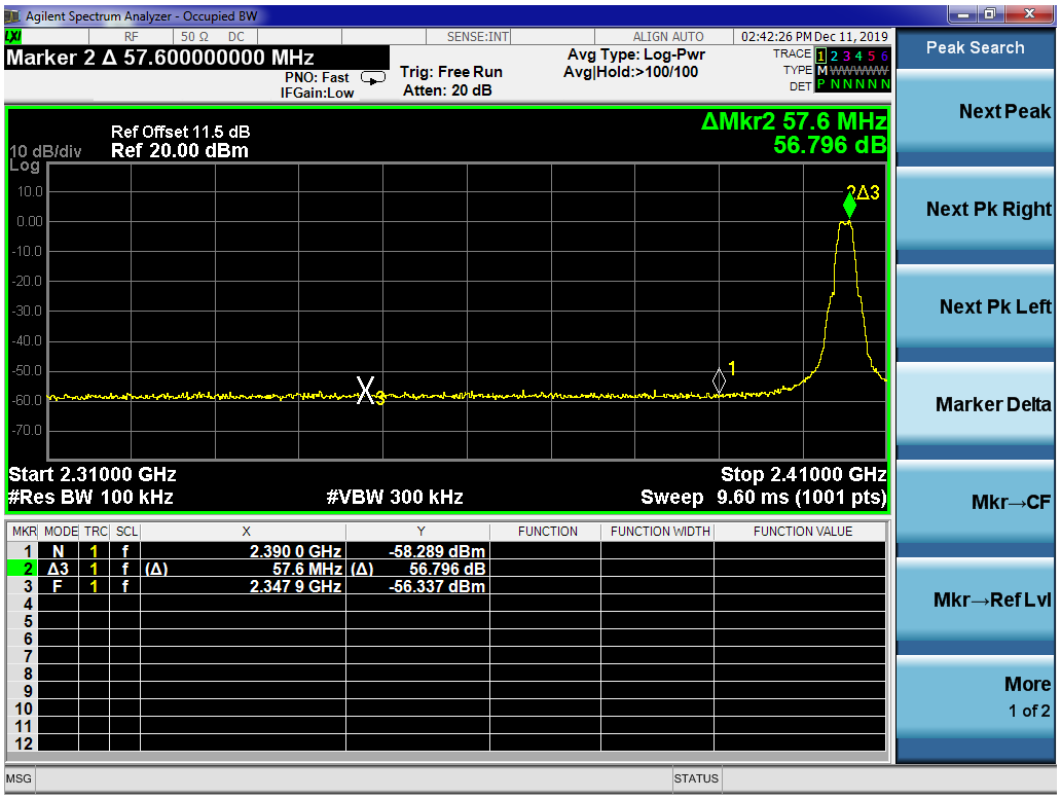
PASSED.

All the test results are attached in next pages.

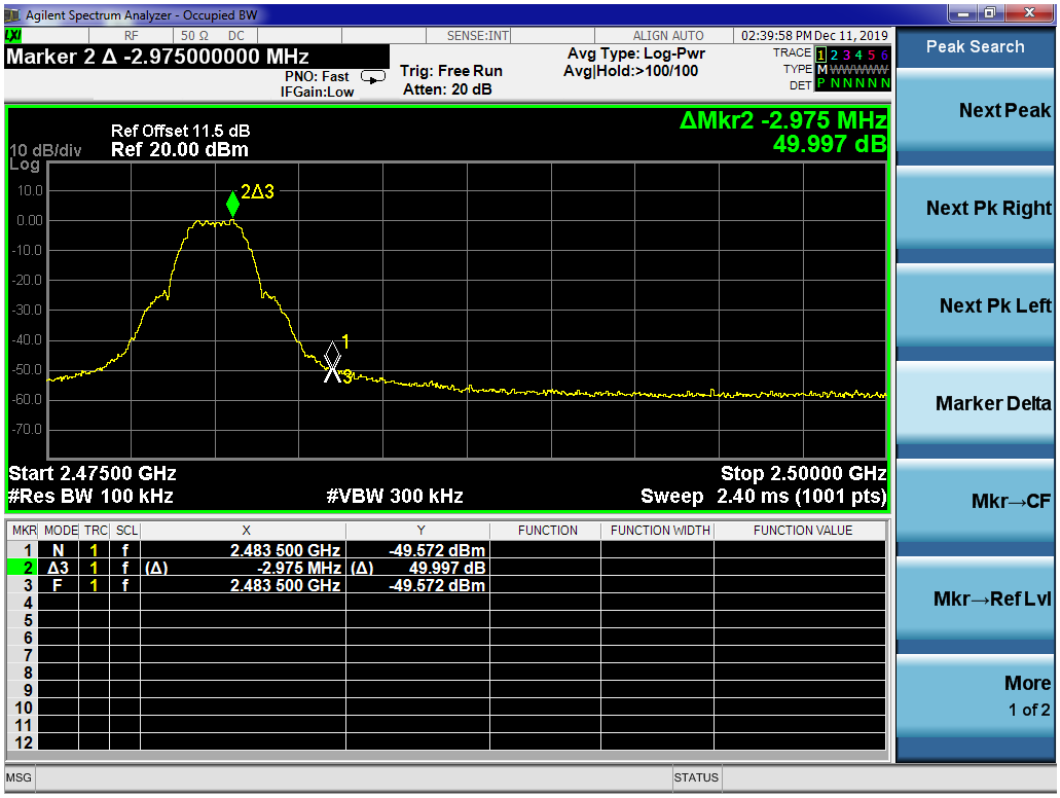
(Test Date: 2019.12.11 Temperature: 23℃ Humidity: 51 %)

Modulation	Location	Channel	Frequency (MHz)	**Delta Marker (dB)**	Result
Zigbee	Below Band Edge	11	2405	**56.796**	More than **20 dB** below the highest level of the desired power
	Upper Band Edge	26	2480	**49.997**	

CH11 2405MHz (Below Edge 2390 MHz)



CH26 2480MHz (Upper Edge 2483.5 MHz)



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	Jan 05, 2019	Jan 05, 2020

9.2 Block Diagram of Test Setup

The Same as section 5.2.

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.

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 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ [3 × 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).

9.6 Test Results

PASSED.

All the test results are attached in next pages.

(Test Date: 2019.12.11 Temperature: 23℃ Humidity: 51 %)

Modulation	Channel	Frequency (MHz)	**Power Spectral Density (dBm)**	Limit
Zigbee	11	2405	**0.043**	8 dBm
	18	2440	**0.419**	8 dBm
	26	2480	**-0.138**	8 dBm

CH11 2405 MHz

CH18 2440 MHz

CH26 2480 MHz

10 DEVIATION TO TEST SPECIFICATIONS

None.

11 MEASUREMENT UNCERTAINTY LIST

The measurement uncertainty was estimated for test on the EUT according to CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage of K=2.
The uncertainties value is not used in determining the PASS/FAIL results.

Test Items/Facilities	Frequency/Equipment/Unit	Uncertainty
Conducted Emission No.1 Shielded Room	9kHz~150kHz	±3.8dB
	150kHz~30MHz	±3.4dB
Conducted Emission No.3 Shielded Room	150kHz~30MHz	±3.4dB
Radiated Emission	30MHz~200MHz, Horizontal	±4.5dB
	30MHz~200MHz, Vertical	±4.5dB
	200MHz~1000MHz, Horizontal	±4.6dB
	200MHz~1000MHz, Vertical	±5.7dB
	1GHz~6GHz	±6.0dB
	6GHz~18GHz	±5.7dB
Output Power Test	50MHz~18GHz	0.77dB
Power Density Test	9kHz~6GHz	1.08dB
RF Frequency Test	9kHz~40GHz	$6*10^{-4}$
Bandwidth Test	9kHz~6GHz	$1.5*10^{-3}$
RF Radiated Power Test	30MHz~1000MHz	3.06dB
Conducted Output Power Test	50MHz~18GHz	0.83dB
AC Voltage(<10kHz) Test	120V~230V	0.04%
DC Power Test	0V~30V	0.4%
Temperature	-40℃~+100℃	0.52℃
Humidity	30%~95%	2.6%