RADIO TEST REPORT

Report No: STS1911156W04

Issued for

Saregama Inc

200 Continental Dr, Suite 401, Newark, DE 19713

Product Name:	Carvaan GO
Brand Name:	Carvaan
Model Name:	SCG110
Series Model:	SCG
FCC ID:	2AMX5-SCG110-1
IC:	24402-SCG110
Test Standard:	FCC Part 15.247
	RSS-247 Issue 2, February 2017

Shenzhen STS Test Services Co., Ltd.
1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road,
Fuyong Street, Bao'an District, Shenzhen, Guangdong, China
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TEST RESULT CERTIFICATION

Applicant's Name .....:	Saregama Inc
Address.....:	200 Continental Dr, Suite 401, Newark, DE 19713
Manufacture's Name .....:	Shenzhen HLX Technolygy Co., Ltd.
Address.....:	Floor 4, Building A1, Yangbei Industrial zone, Huangtian, hangcheng Street, Bao'an District, Shenzhen, China

Product Description

Product Name .....:	Carvaan GO
Brand Name.....:	Carvaan
Model Name.....:	SCG110
SeriesModel .....:	SCG
Test Standards .....:	FCC Part15.247
	RSS-247 Issue 2, February 2017
Test Procedure.....:	ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC&IC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test.....:

Date (s) of performance of tests :	02 Nov. 2019 ~ 06 Nov. 2019
Date of Issue .....:	11 Nov. 2019
Test Result .....:	Pass

Testing Engineer : Chris Chen
(ChrisChen)

Technical Manager : Sunday Hu
(Sunday Hu)

Authorized Signatory : Vita Li
(Vita Li)

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	11 Nov. 2019	STS1911156W04	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r01

FCC Part15.247,Subpart C RSS-247Issue 2			
Standard Section	Test Item	Judgment	Remark
15.207 RSS-Gen Issue 5, Amendment 1, March 2019	Conducted Emission	PASS	--
15.247(a)(1) RSS-247 Issue 2, February 2017 (5.1)	Hopping Channel Separation	PASS	--
15.247(a)(1)&(b)(1) RSS-247 Issue 2, February 2017 (5.1)	Output Power	PASS	--
15.247(c) RSS-247 Issue 2, February 2017 (5.5)	Radiated Spurious Emission	PASS	--
15.247(d) RSS-247 Issue 2, February 2017 (5.5)	Conducted Spurious & Band Edge Emission	PASS	--
15.247(a)(iii) RSS-247 Issue 2, February 2017 (5.1)	Number of Hopping Frequency	PASS	--
15.247(a)(iii) RSS-247 Issue 2, February 2017 (5.1)	Dwell Time	PASS	--
15.247(a)(1) RSS-247 Issue 2, February 2017 (5.1)	Bandwidth	PASS	--
15.205	Restricted Band Edge Emission	PASS	--
Part 15.247(d)/part 15.209(a) RSS-247 Issue 2, February 2017 (5.5)	Band Edge Emission	PASS	--
15.203 RSS-Gen Issue 5, Amendment 1, March 2019	Antenna Requirement	PASS	--
RSS-Gen Issue 5, Amendment 1, March 2019	Frequency Stability	PASS	--

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

(2)All tests are according to ANSI C63.10-2013

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District,Bao'an District, Shenzhen, Guang Dong, China
FCC test Firm Registration Number: 625569
IC test Firm Registration Number: 12108A
A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ±**U**,where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**,providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 30-1GHz	±6.7dB
4	All emissions, radiated 1G-6GHz	±5.5dB
5	All emissions, radiated>6G	±5.8dB
6	Conducted Emission (9KHz-150KHz)	±4.43dB
7	Conducted Emission (150KHz-30MHz)	±5dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Carvaan GO
Trade Name	Carvaan
Model Name	SCG110
Series Model	SCG
Model Difference	Only different in model name and size
Channel List	Please refer to the Note 2.
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps)
Bluetooth Version	4.2
Bluetooth Configuration	BR
Power Rating	Input:5V 0.65A
Battery	Rated Voltage: 3.7V Charge Limit: 4.2V Capacity: 800mAh
Hardware version number	GL-725-MB V0.5
Software versionnumber	V4.2
Radio Hardware version	MPLY.LR9.W1444,MD.LWTG.MP.V79.P4
Radio Software version	SC6531_W13.04.05_Release
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.

2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	Carvaan	SCG110	PCB	N/A	-0.58 dBi	BT Antenna

2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX CH00	1Mbps/GFSK
Mode 2	TX CH39	1Mbps/GFSK
Mode 3	TX CH78	1Mbps/GFSK
Mode 4	TX CH00	2 Mbps/π/4-DQPSK
Mode 5	TX CH39	2 Mbps/π/4-DQPSK
Mode 6	TX CH78	2 Mbps/π/4-DQPSK

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

(2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/ 60Hz is shown in the report

For ACConductedEmission

Test Case	
AC Conducted Emission	Mode7 : Keeping BT TX

2.3FREQUENCY HOPPING SYSTEM REQUIREMENTS

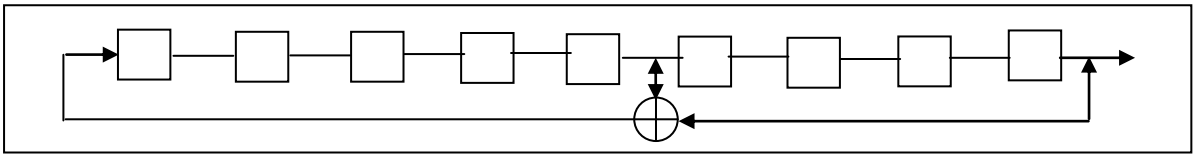
(1)Standard and Limit

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies thatare selected at the system hopping rate from a pseudo randomly ordered list of hoppingfrequencies. Each frequency must be used equally on the average by each transmitter.The system receivers shall have input bandwidths that match the hopping channelbandwidths of their corresponding transmitters and shall shift frequencies insynchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all availablehopping channels during each transmission. However, the system, consisting of both thetransmitter and the receiver, must be designed to comply with all of the regulations inthis section should the transmitter be presented with a continuous data (or information)stream. In addition, a system employing short transmission bursts must comply with thedefinition of a frequency hopping system and must distribute its transmissions over theminimum number of hopping channels specified in this section.

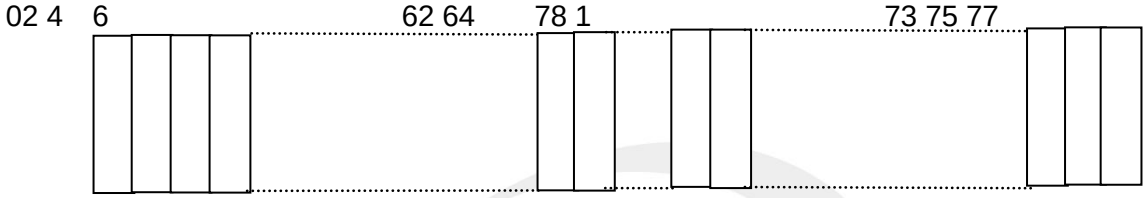
The incorporation of intelligence within a frequency hopping spread spectrum systemthat permits the system to recognize other users within the spectrum band so that itindividually and independently chooses and adapts its hop sets to avoid hopping onoccupied channels is permitted. The coordination of frequency hopping systems in anyother manner for the express purpose of avoiding the simultaneous occupancy ofindividual hopping frequencies by multiple transmitters is not permitted.

(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized with nine ones.
Numver of shift register stages:9
Length of pseudo-random sequence:2^9-1=511bits
Longest sequence of zeros: 8(non-inverted signal)



Liner Feedback Shift Register for Generator of the PRBS sequence

An example of Pseudorandom Frequency Hoppong Sequence as follow:



Each frequency used equally on th average by each transmitter.
The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies ini synchronization with the transmitted signals.

(3)Frequency Hopping System
This transmitter device is frequency hopping device, and complies with FCC part 15.247rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetoothuses a radio technology called frequency-hopping spread spectrum, which chops up thedata being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from2402 to 2480 MHz) in the range 2,400-2,483.5MHz. The transmitter switches hopfrequencies 1,600 times per second to assure a high degree of data security. AllBluetooth devices participating in a given piconet are synchronized to thefrequency-hopping channel for the piconet. The frequency hopping sequence isdetermined by the master's device address and the phase of the hopping sequence (thefrequency to hop at a specific time) is determined by the master's internal clock.Therefore, all slaves in a piconet must know the master's device address and mustsynchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification toprovide an effective way for a Bluetooth radio to counteract normal interference. AFHidentifies "bad" channels, where either other wireless devices are interfering with theBluetooth signal or the Bluetooth signal is interfering with another device. TheAFH-enabled Bluetooth device will then communicate with other devices within itspiconet to share details of any identified bad channels. The devices will then switch toalternative available "good" channels, away from the areas of interference, thus havingno impact on the bandwidth used.

This device was tested with a bluetooth system receiver to check that the devicemaintained hopping synchronization, and the device complied with these requirementsFCC Part 15.247 rule.

2.4 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

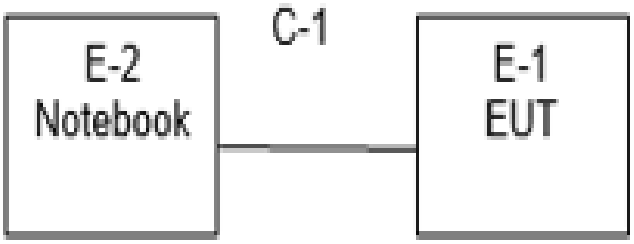
During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

Test software Version	Test program: Bluetooth		
(Power control software) Parameters(1/2Mbps)	Power class: DH1rate:4:27 2DH1rate:20:54	Power class: DH3rate:11:183 2DH3rate:26:367	Power class: DH5rate:15:3392DH 5rate:30:679

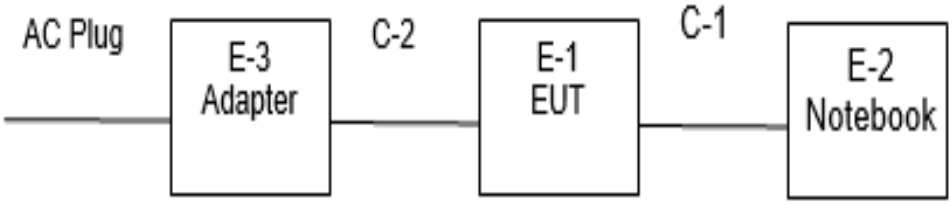
2.5BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

Radiated Spurious EmissionTest



Conducted Emission Test



2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-3	Adapter	N/A	N/A	N/A	N/A
C-2	DC Cable	N/A	110cm	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Notebook	DELL	VOSTRO.3800	N/A	N/A
C-1	USB Cable	N/A	100cm	N/A	N/A

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.7EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.07.29	2020.07.28
Signal Analyzer	Agilent	N9020A	MY51110105	2019.03.02	2020.03.01
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Pre-Amplifier(0.1M-3GHz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.09	2020.10.08
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.07.29	2020.07.28
LISN	R&S	ENV216	101242	2019.10.09	2020.10.08
LISN	EMCO	3810/2NM	23625	2019.10.09	2020.10.08
Temperature &Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY49100060	2019.10.09	2020.10.08
Temperature &Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	LZ-RF /LzRf-3A3			

3.EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

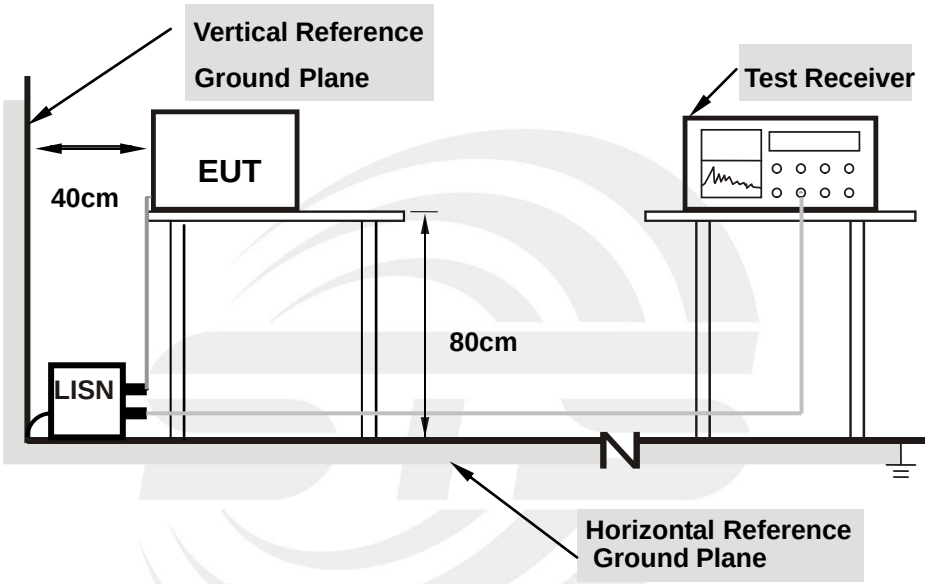
The following table is the setting of the receiver

Receiver Parameters	**Setting**
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground planewith EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.4EUT OPERATING CONDITIONS

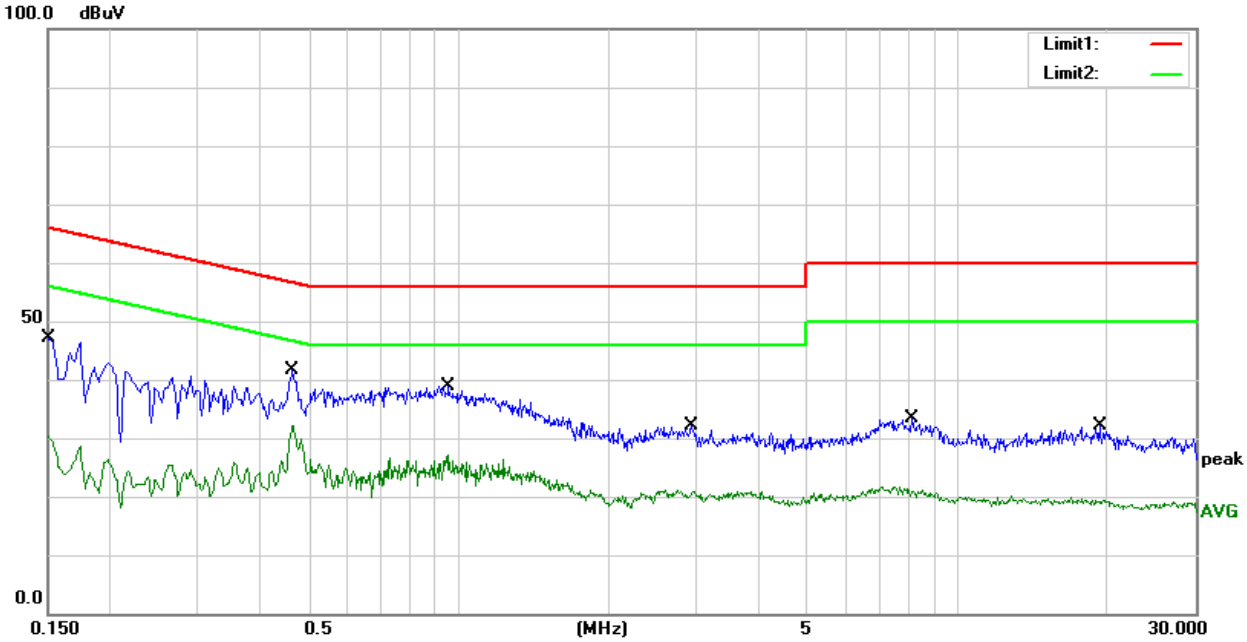
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.5 TEST RESULT

Temperature:	25.2(C)	Relative Humidity:	53%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 7		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1500	26.63	20.54	47.17	66.00	-18.83	QP
2	0.1500	9.79	20.54	30.33	56.00	-25.67	AVG
3	0.4660	21.46	20.10	41.56	56.58	-15.02	QP
4	0.4660	12.12	20.10	32.22	46.58	-14.36	AVG
5	0.9540	18.92	19.99	38.91	56.00	-17.09	QP
6	0.9540	7.08	19.99	27.07	46.00	-18.93	AVG
7	2.9340	12.06	20.15	32.21	56.00	-23.79	QP
8	2.9340	0.92	20.15	21.07	46.00	-24.93	AVG
9	8.1100	13.07	20.42	33.49	60.00	-26.51	QP
10	8.1100	1.30	20.42	21.72	50.00	-28.28	AVG
11	19.3060	10.65	21.37	32.02	60.00	-27.98	QP
12	19.3060	-1.59	21.37	19.78	50.00	-30.22	AVG

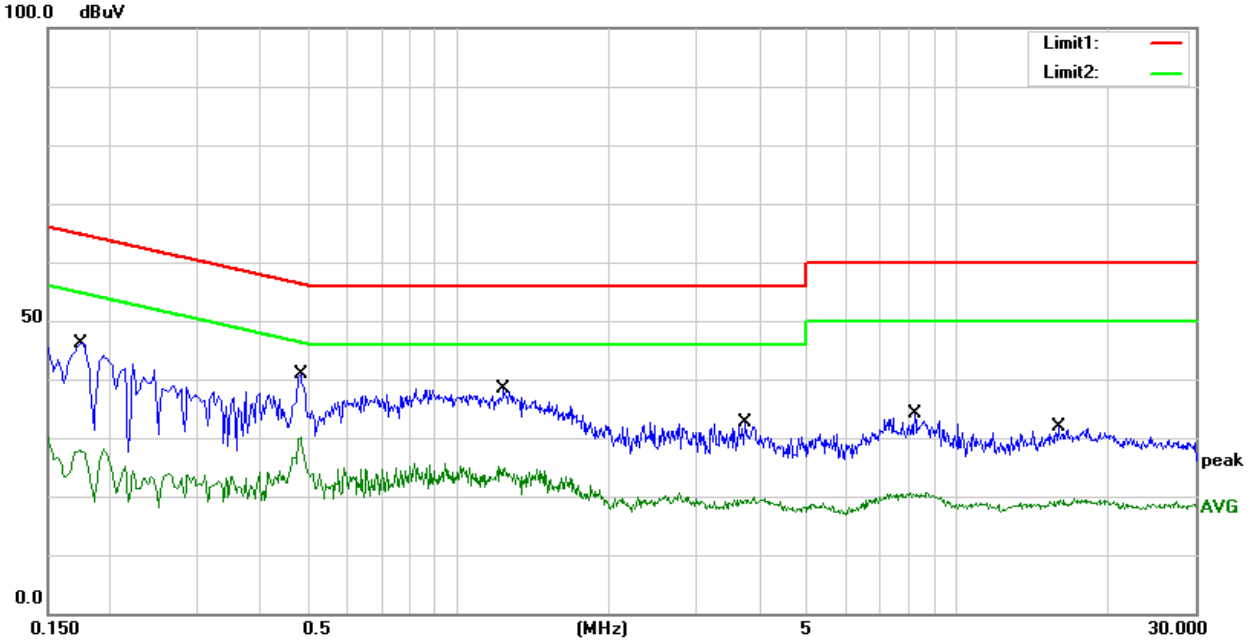
Remark:
1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result =Reading + Factor)–Limit



Temperature:	25.2(C)	Relative Humidity:	53%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 7		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1740	25.60	20.54	46.14	64.77	-18.63	QP
2	0.1740	9.61	20.54	30.15	54.77	-24.62	AVG
3	0.4820	20.83	20.05	40.88	56.30	-15.42	QP
4	0.4820	10.04	20.05	30.09	46.30	-16.21	AVG
5	1.2300	18.75	19.53	38.28	56.00	-17.72	QP
6	1.2300	5.61	19.53	25.14	46.00	-20.86	AVG
7	3.7420	12.33	20.26	32.59	56.00	-23.41	QP
8	3.7420	-0.47	20.26	19.79	46.00	-26.21	AVG
9	8.2340	13.81	20.43	34.24	60.00	-25.76	QP
10	8.2340	0.29	20.43	20.72	50.00	-29.28	AVG
11	15.9380	10.95	20.92	31.87	60.00	-28.13	QP
12	15.9380	-1.41	20.92	19.51	50.00	-30.49	AVG

Remark:
1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result =Reading + Factor)–Limit



3.2 RADIATED EMISSION MEASUREMENT

3.2.1RADIATED EMISSION LIMITS

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) and RSS-247 Issue 2, February 2017 (5.5) limit in the table and according to ANSI C63.10-2013 below has to be followed

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	PK=1MHz / 1MHz, AV=1 MHz /10 Hz

For Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2300 to 2403 MHz Upper Band Edge: 2479to 2500 MHz
RB / VB (emission in restricted band)	PK=1MHz/1MHz, AV=1 MHz /10 Hz

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz,and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 meters(above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

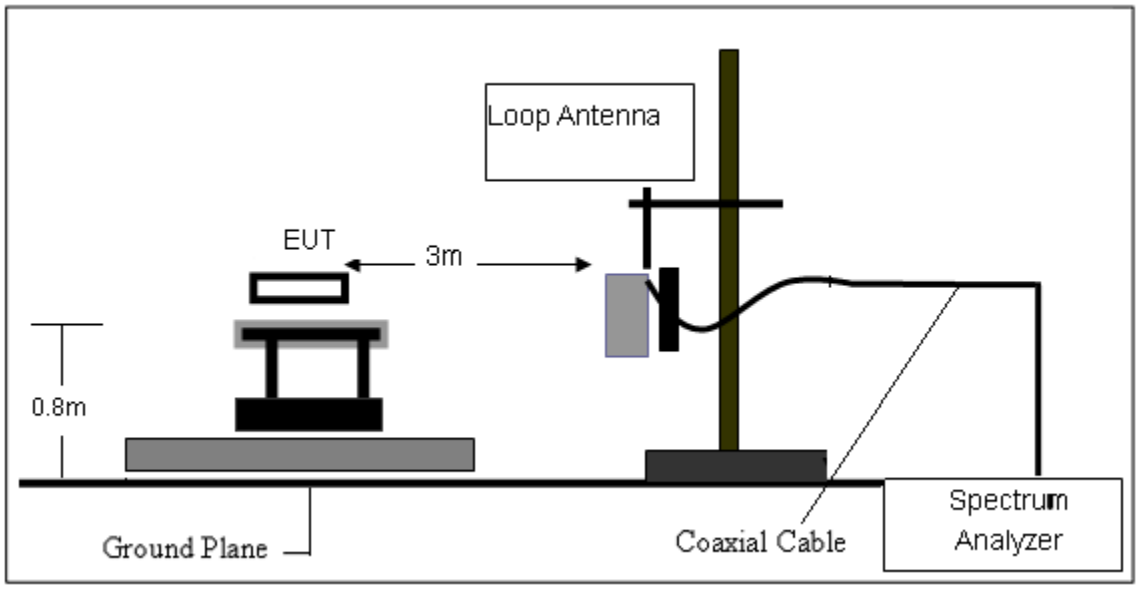
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

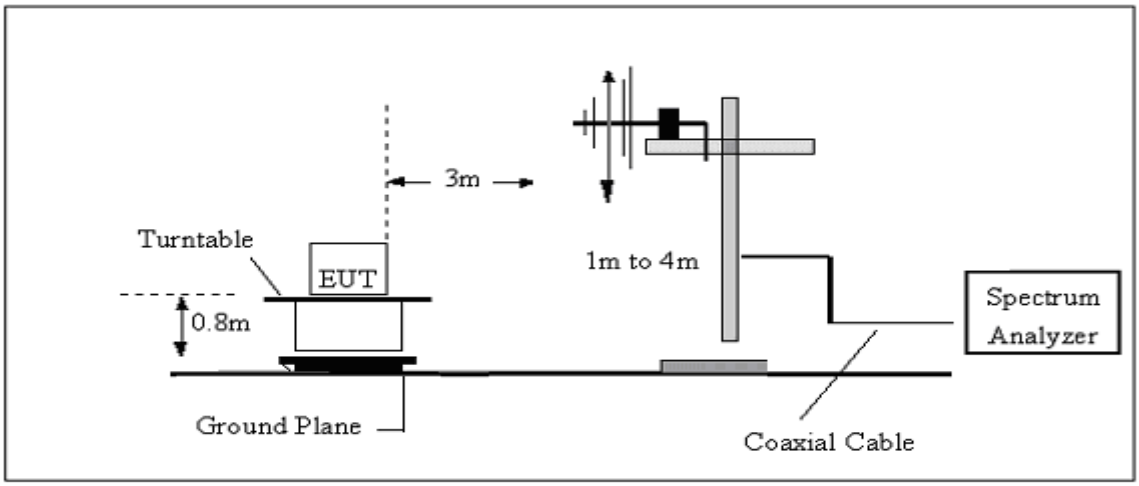
No deviation

3.2.4 TESTSETUP

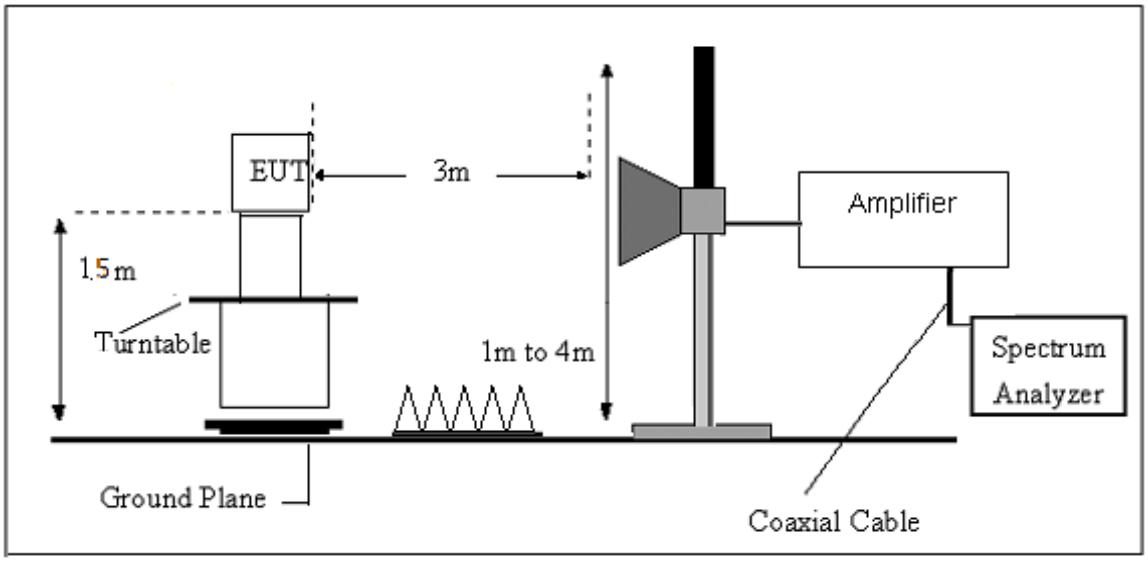
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



3.2.5EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.6 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting theAmplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

3.2.7TEST RESULTS

(9KHz-30MHz)

Temperature:	24.5(C)	Relative Humidity:	58%RH
Test Voltage:	DC 3.7V from battery	Test Mode:	TX Mode

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

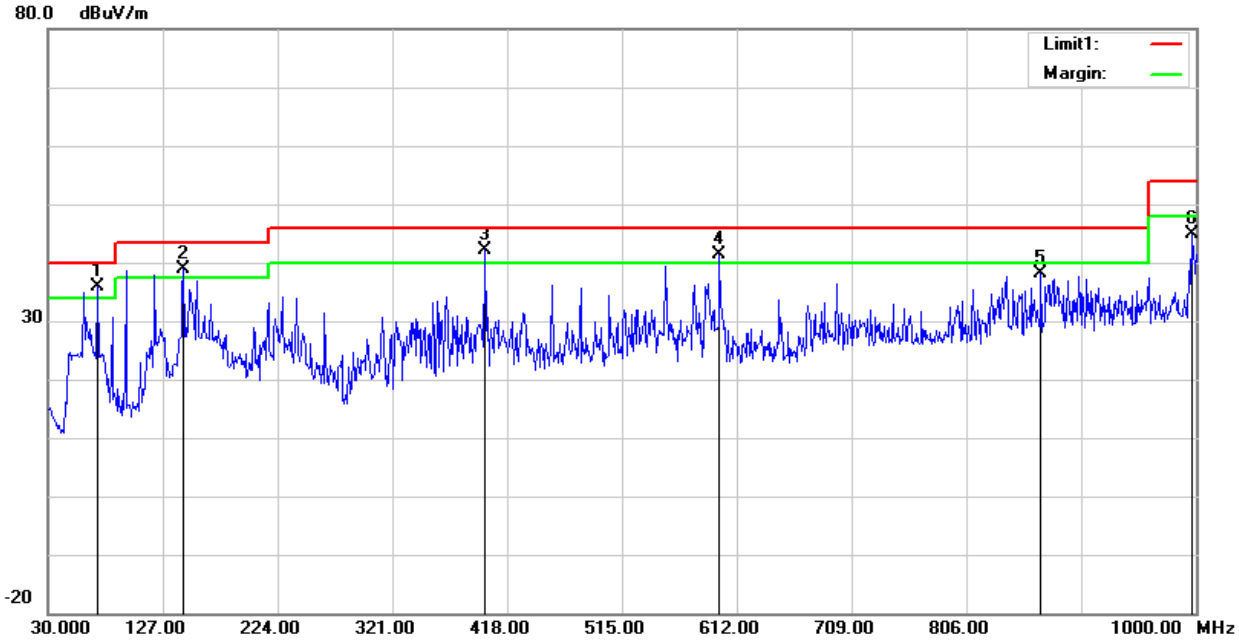
Limit line = specific limits(dBuv) + distance extrapolation factor.

(30MHz-1000MHz)

Temperature:	24.5(C)	Relative Humidity:	58%RH
Test Voltage:	DC 3.7V from battery	Phase:	Horizontal
Test Mode:	Mode 1/2/3/4/5/6 (Mode 6 worst mode)		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	71.7100	60.55	-24.56	35.99	40.00	-4.01	QP
2	144.4600	57.15	-18.29	38.86	43.50	-4.64	QP
3	399.5700	53.24	-11.16	42.08	46.00	-3.92	QP
4	597.4500	47.26	-5.85	41.41	46.00	-4.59	QP
5	869.0500	38.60	-0.52	38.08	46.00	-7.92	QP
6	996.1200	42.94	2.04	44.98	54.00	-9.02	QP

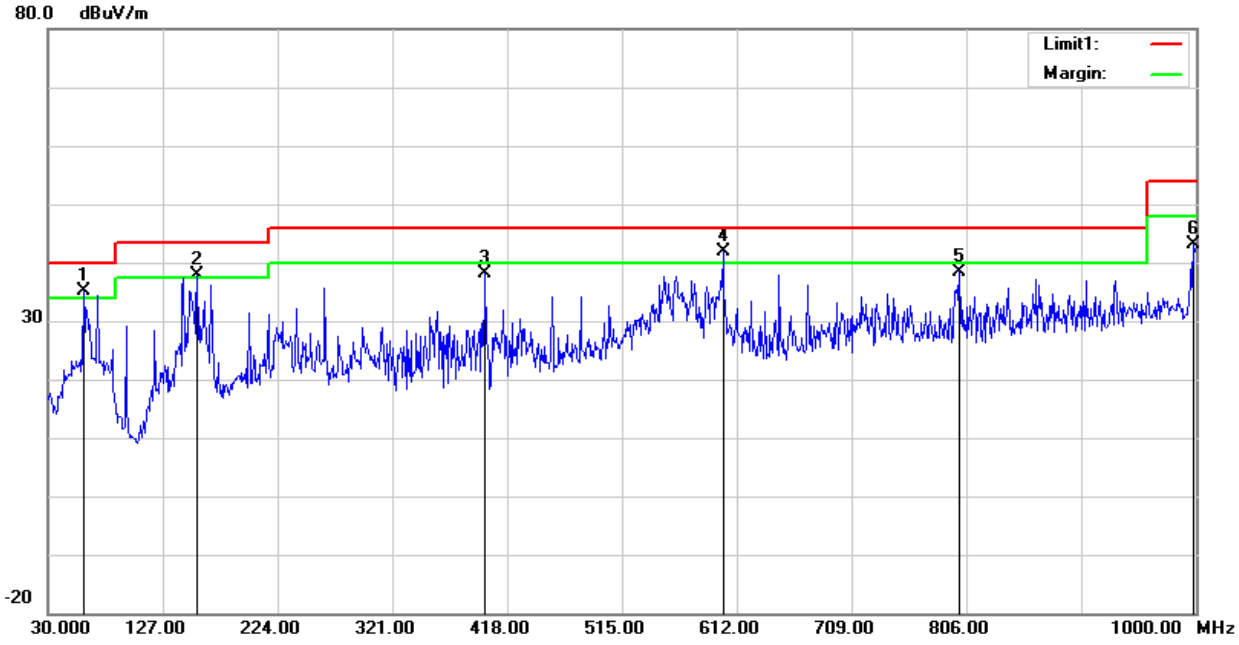
Remark:
1. Margin = Result (Result =Reading + Factor)–Limit



Temperature:	24.5(C)	Relative Humidity:	58%RH
Test Voltage:	DC 3.7V from battery	Phase:	Vertical
Test Mode:	Mode 1/2/3/4/5/6 (Mode 6 worst mode)		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	60.0700	60.95	-25.86	35.09	40.00	-4.91	QP
2	156.1000	56.54	-18.66	37.88	43.50	-5.62	QP
3	399.5700	49.24	-11.16	38.08	46.00	-7.92	QP
4	600.3600	47.75	-5.84	41.91	46.00	-4.09	QP
5	800.1800	40.55	-2.05	38.50	46.00	-7.50	QP
6	998.0600	41.12	2.04	43.16	54.00	-10.84	QP

Remark:
1. Margin = Result (Result =Reading + Factor)–Limit



(1GHz~25GHz)Restricted band and Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Orrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	（dB）	（dB）	（dB/m）	（dB）	(dBμV/m)	(dBμV/m)	(dB)	Type	
Low Channel (Q/2402 MHz)										
3264.68	61.06	44.70	6.70	28.20	-9.80	51.26	74.00	-22.74	PK	Vertical
3264.68	51.55	44.70	6.70	28.20	-9.80	41.75	54.00	-12.25	AV	Vertical
3264.72	62.21	44.70	6.70	28.20	-9.80	52.41	74.00	-21.59	PK	Horizontal
3264.72	51.04	44.70	6.70	28.20	-9.80	41.24	54.00	-12.76	AV	Horizontal
4804.34	59.07	44.20	9.04	31.60	-3.56	55.51	74.00	-18.49	PK	Vertical
4804.34	50.57	44.20	9.04	31.60	-3.56	47.01	54.00	-6.99	AV	Vertical
4804.39	58.85	44.20	9.04	31.60	-3.56	55.29	74.00	-18.71	PK	Horizontal
4804.39	50.56	44.20	9.04	31.60	-3.56	47.00	54.00	-7.00	AV	Horizontal
5359.67	48.16	44.20	9.86	32.00	-2.34	45.82	74.00	-28.18	PK	Vertical
5359.67	39.08	44.20	9.86	32.00	-2.34	36.74	54.00	-17.26	AV	Vertical
5359.76	48.20	44.20	9.86	32.00	-2.34	45.86	74.00	-28.14	PK	Horizontal
5359.76	39.51	44.20	9.86	32.00	-2.34	37.17	54.00	-16.83	AV	Horizontal
7205.91	53.70	43.50	11.40	35.50	3.40	57.10	74.00	-16.90	PK	Vertical
7205.91	44.49	43.50	11.40	35.50	3.40	47.89	54.00	-6.11	AV	Vertical
7205.85	54.91	43.50	11.40	35.50	3.40	58.31	74.00	-15.69	PK	Horizontal
7205.85	44.27	43.50	11.40	35.50	3.40	47.67	54.00	-6.33	AV	Horizontal
Middle Channel (Q/2441 MHz)										
3264.81	61.96	44.70	6.70	28.20	-9.80	52.16	74.00	-21.84	PK	Vertical
3264.81	50.95	44.70	6.70	28.20	-9.80	41.15	54.00	-12.85	AV	Vertical
3264.62	61.46	44.70	6.70	28.20	-9.80	51.66	74.00	-22.34	PK	Horizontal
3264.62	50.08	44.70	6.70	28.20	-9.80	40.28	54.00	-13.72	AV	Horizontal
4882.57	59.44	44.20	9.04	31.60	-3.56	55.88	74.00	-18.12	PK	Vertical
4882.57	50.55	44.20	9.04	31.60	-3.56	46.99	54.00	-7.01	AV	Vertical
4882.46	58.29	44.20	9.04	31.60	-3.56	54.73	74.00	-19.27	PK	Horizontal
4882.46	49.25	44.20	9.04	31.60	-3.56	45.69	54.00	-8.31	AV	Horizontal
5359.75	48.19	44.20	9.86	32.00	-2.34	45.85	74.00	-28.15	PK	Vertical
5359.75	39.35	44.20	9.86	32.00	-2.34	37.01	54.00	-16.99	AV	Vertical
5359.83	47.37	44.20	9.86	32.00	-2.34	45.03	74.00	-28.97	PK	Horizontal
5359.83	38.82	44.20	9.86	32.00	-2.34	36.48	54.00	-17.52	AV	Horizontal
7323.85	54.24	43.50	11.40	35.50	3.40	57.64	74.00	-16.36	PK	Vertical
7323.85	43.50	43.50	11.40	35.50	3.40	46.90	54.00	-7.10	AV	Vertical
7323.72	53.85	43.50	11.40	35.50	3.40	57.25	74.00	-16.75	PK	Horizontal
7323.72	44.83	43.50	11.40	35.50	3.40	48.23	54.00	-5.77	AV	Horizontal

High Channel (Q/2480 MHz)										
3264.71	61.38	44.70	6.70	28.20	-9.80	51.58	74.00	-22.42	PK	Vertical
3264.71	50.73	44.70	6.70	28.20	-9.80	40.93	54.00	-13.07	AV	Vertical
3264.79	61.79	44.70	6.70	28.20	-9.80	51.99	74.00	-22.01	PK	Horizontal
3264.79	50.29	44.70	6.70	28.20	-9.80	40.49	54.00	-13.51	AV	Horizontal
4960.47	58.95	44.20	9.04	31.60	-3.56	55.39	74.00	-18.61	PK	Vertical
4960.47	50.19	44.20	9.04	31.60	-3.56	46.63	54.00	-7.37	AV	Vertical
4960.41	59.36	44.20	9.04	31.60	-3.56	55.80	74.00	-18.20	PK	Horizontal
4960.41	50.02	44.20	9.04	31.60	-3.56	46.46	54.00	-7.54	AV	Horizontal
5359.86	48.15	44.20	9.86	32.00	-2.34	45.81	74.00	-28.19	PK	Vertical
5359.86	39.36	44.20	9.86	32.00	-2.34	37.02	54.00	-16.98	AV	Vertical
5359.58	48.11	44.20	9.86	32.00	-2.34	45.77	74.00	-28.23	PK	Horizontal
5359.58	38.82	44.20	9.86	32.00	-2.34	36.48	54.00	-17.52	AV	Horizontal
7439.93	53.77	43.50	11.40	35.50	3.40	57.17	74.00	-16.83	PK	Vertical
7439.93	44.54	43.50	11.40	35.50	3.40	47.94	54.00	-6.06	AV	Vertical
7439.68	54.64	43.50	11.40	35.50	3.40	58.04	74.00	-15.96	PK	Horizontal
7439.68	44.61	43.50	11.40	35.50	3.40	48.01	54.00	-5.99	AV	Horizontal

Note:

1) Scan with GFSK, π/4-DQPSK,the worst case is GFSK Mode

2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

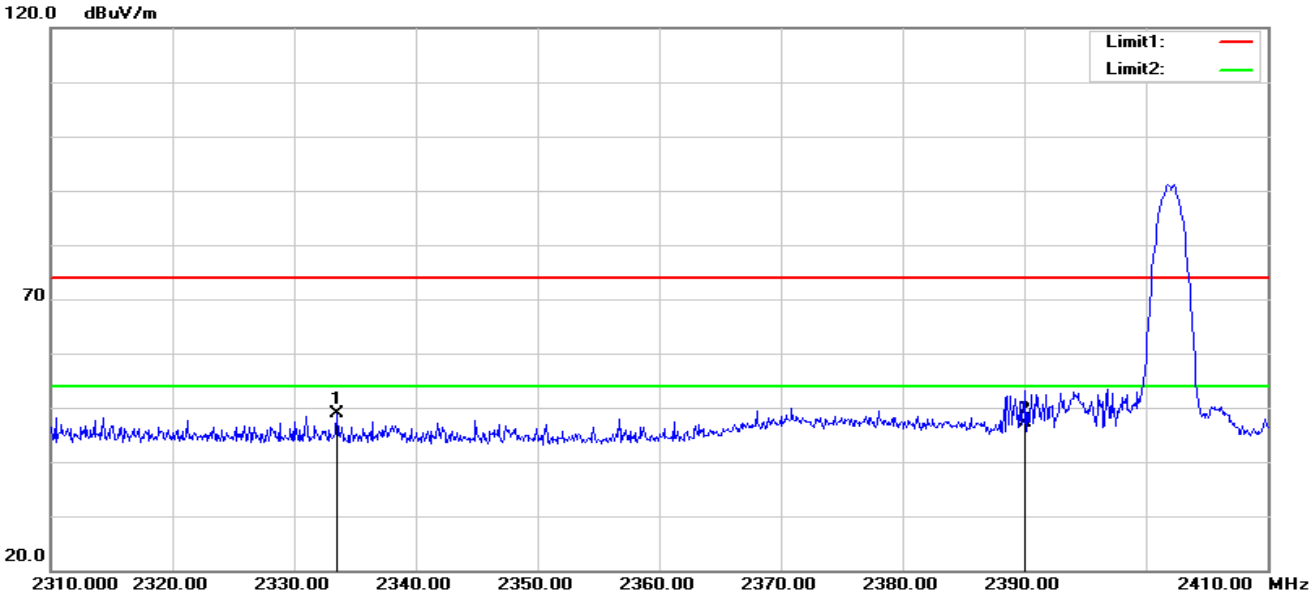
Emission Level = Reading + Factor

3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

Restricted bandRequirements

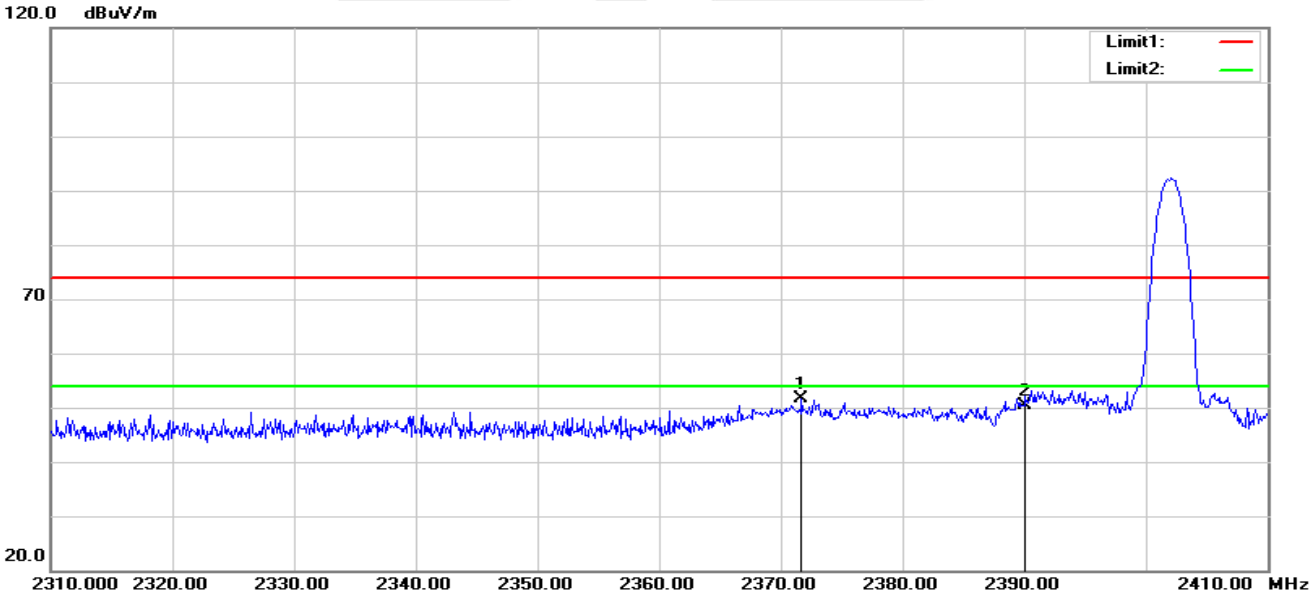
GFSK-Low

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2333.500	45.28	3.65	48.93	74.00	-25.07	peak
2	2390.000	42.73	4.34	47.07	74.00	-26.93	peak

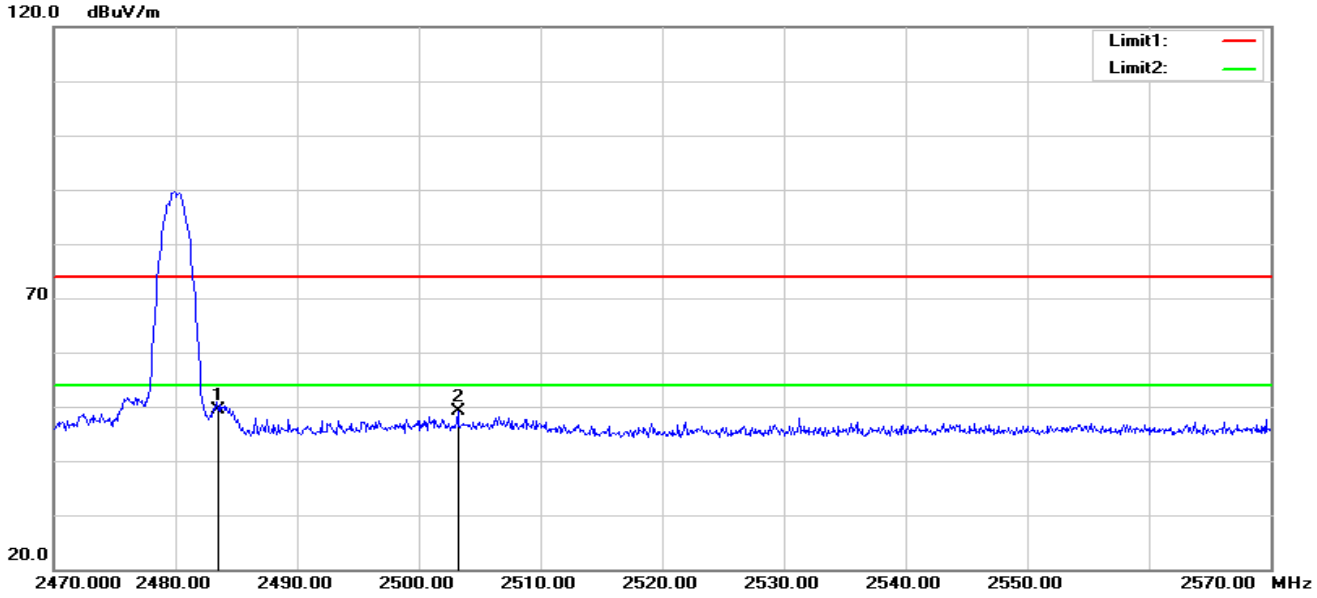
Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2371.700	47.67	4.06	51.73	74.00	-22.27	peak
2	2390.000	45.93	4.34	50.27	74.00	-23.73	peak

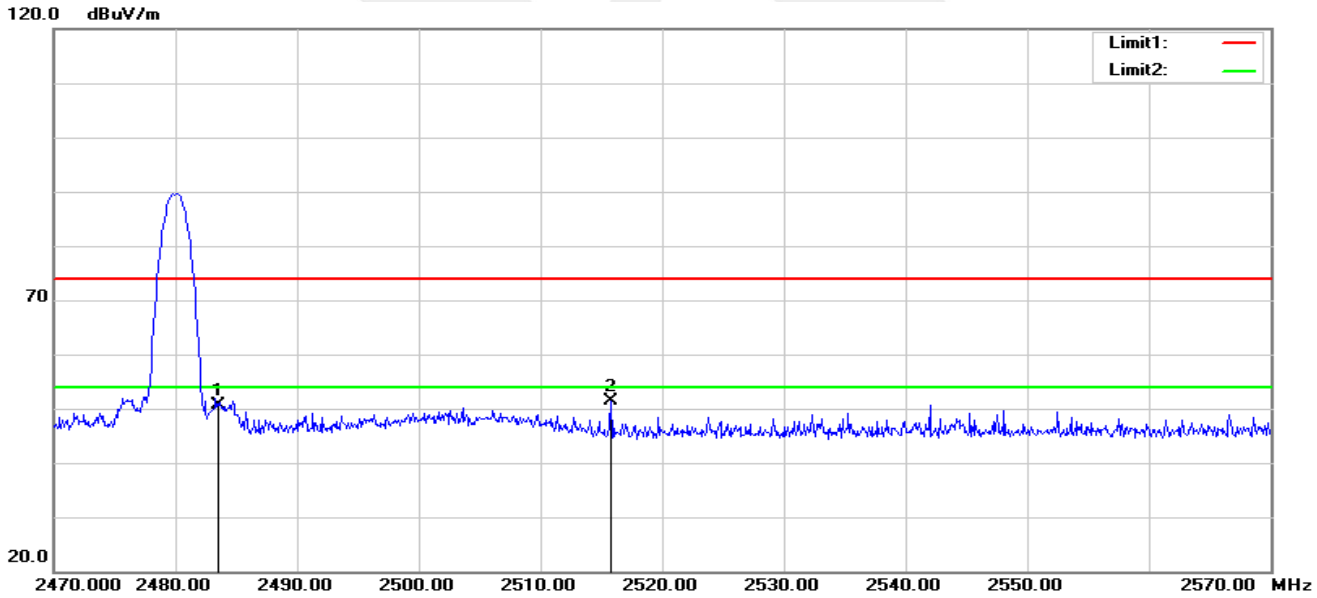
GFSK-High

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	44.90	4.60	49.50	74.00	-24.50	peak
2	2503.200	44.56	4.67	49.23	74.00	-24.77	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	46.10	4.60	50.70	74.00	-23.30	peak
2	2515.800	46.59	4.76	51.35	74.00	-22.65	peak

Note:GFSK, π/4-DQPSK of the nohopping and hopping mode all have been test, the worst case is GFSK of the nohopping mode,this report only show the worst case.

4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d)and RSS-247 Issue 2, February 2017 (5.5), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

4.2TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

.

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300– 2407 MHz Upper Band Edge: 2475 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

Remark : Hopping on and Hopping off mode all have been tested,only worst case hopping off is reported.

4.3 TEST SETUP

The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

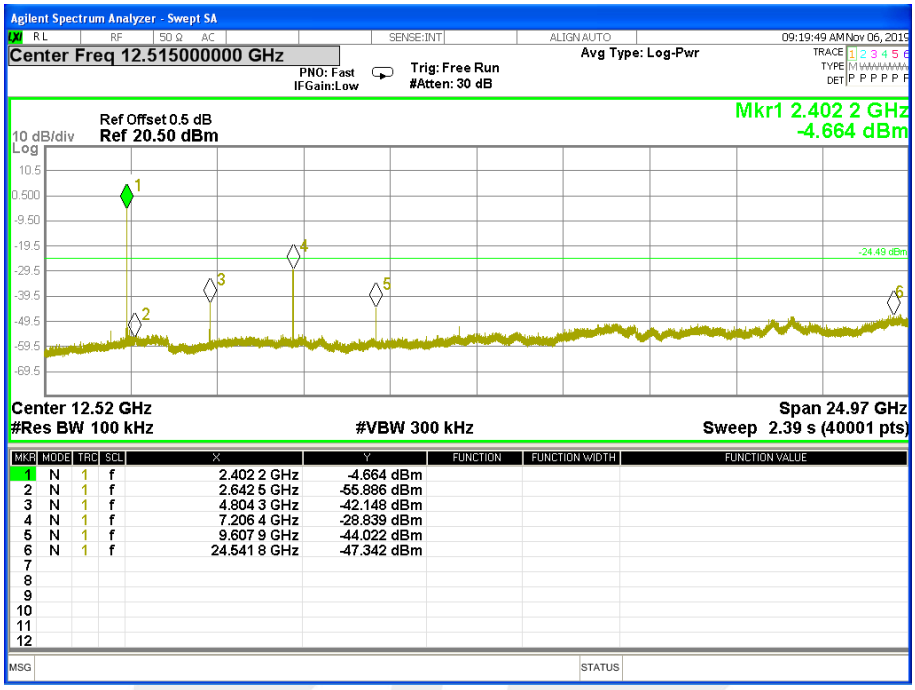
4.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

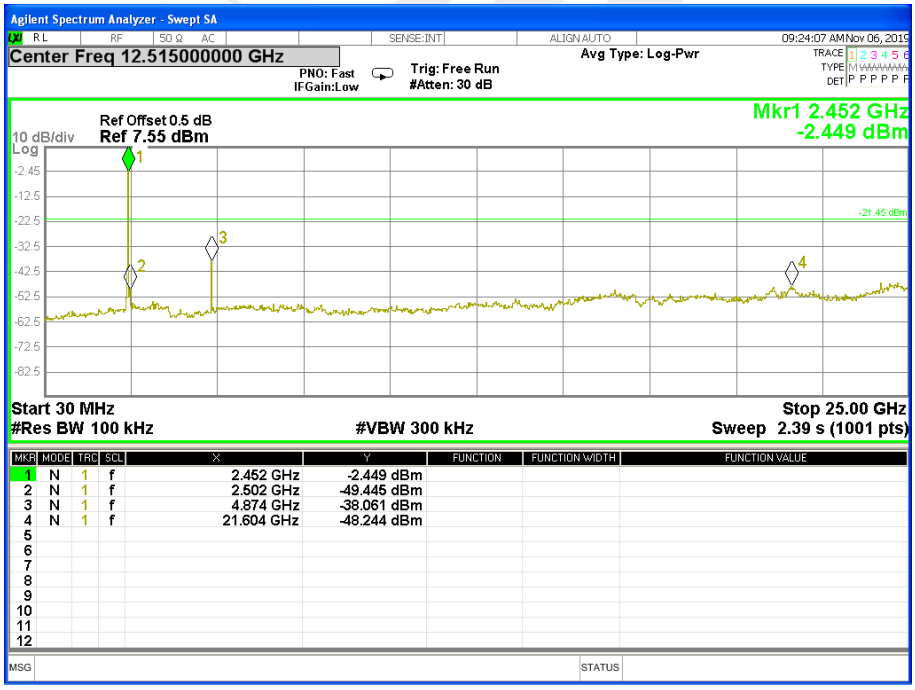
4.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-00/39/78 CH	Test Voltage:	DC 3.7V from battery

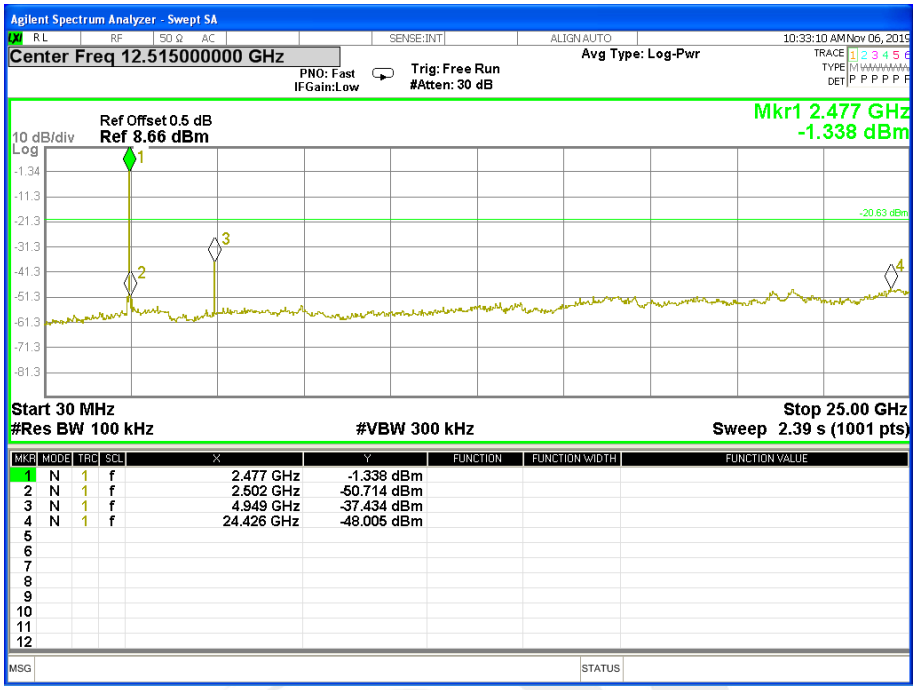
00 CH



39 CH

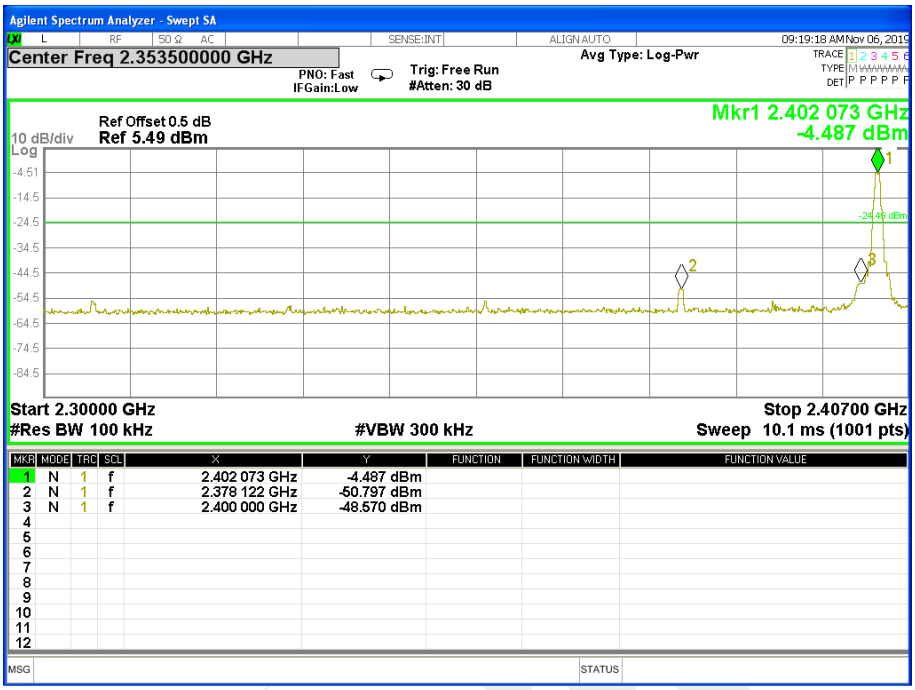


78 CH

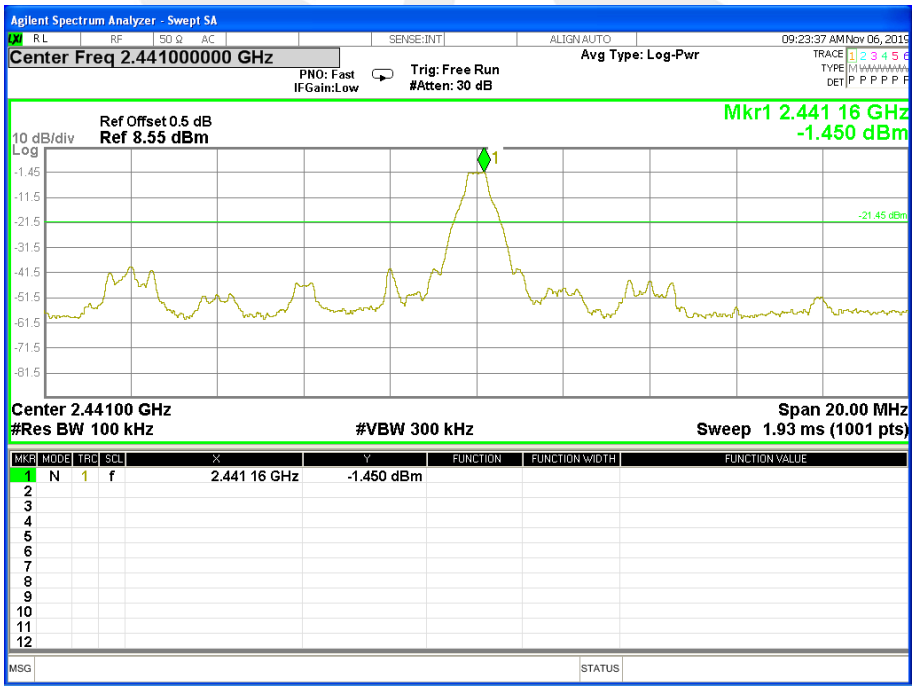

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:33:10 AM Nov 06, 2019
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M
DET P P P P P
Ref Offset 0.5 dB
10 dB/div
Log
Ref 8.66 dBm
Mkr1 2.477 GHz
-1.338 dBm
-20.63 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.39 s (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.477 GHz -1.338 dBm
2 N 1 f 2.502 GHz -50.714 dBm
3 N 1 f 4.949 GHz -37.434 dBm
4 N 1 f 24.426 GHz -48.005 dBm
MSG
STATUS

For Band edge

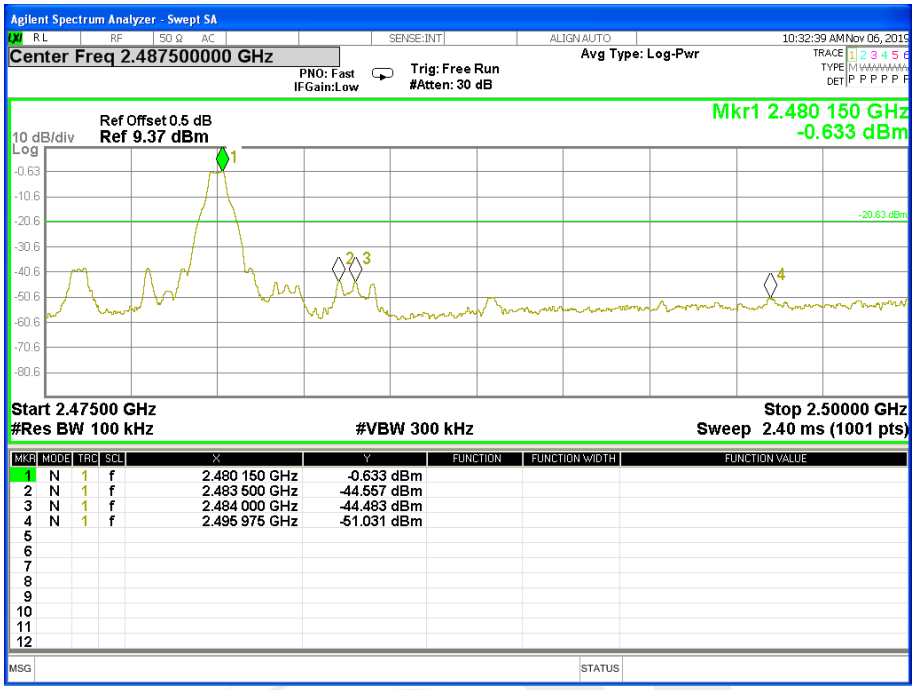
00 CH



39 CH

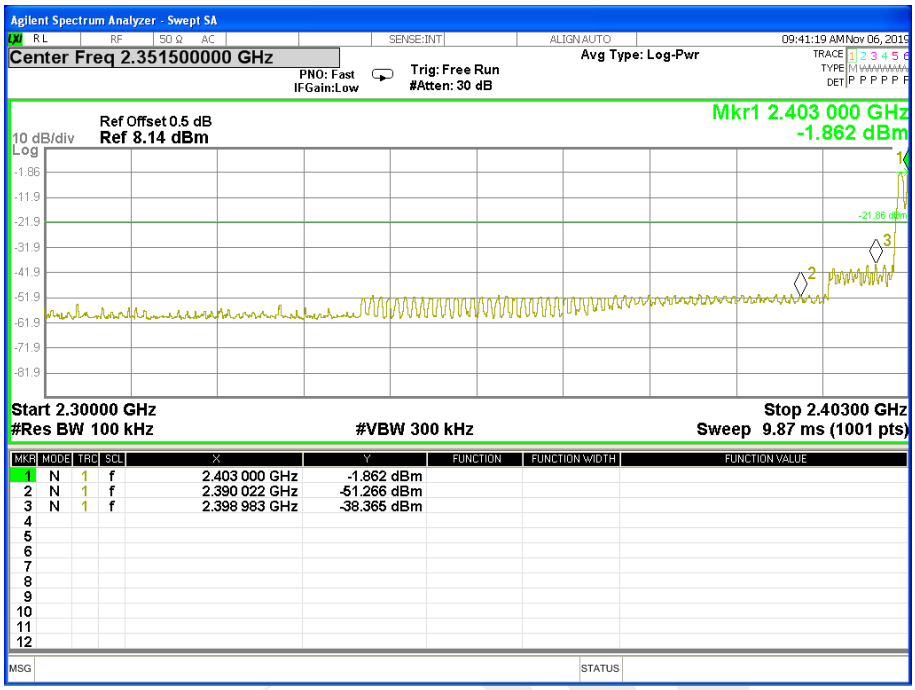


78 CH

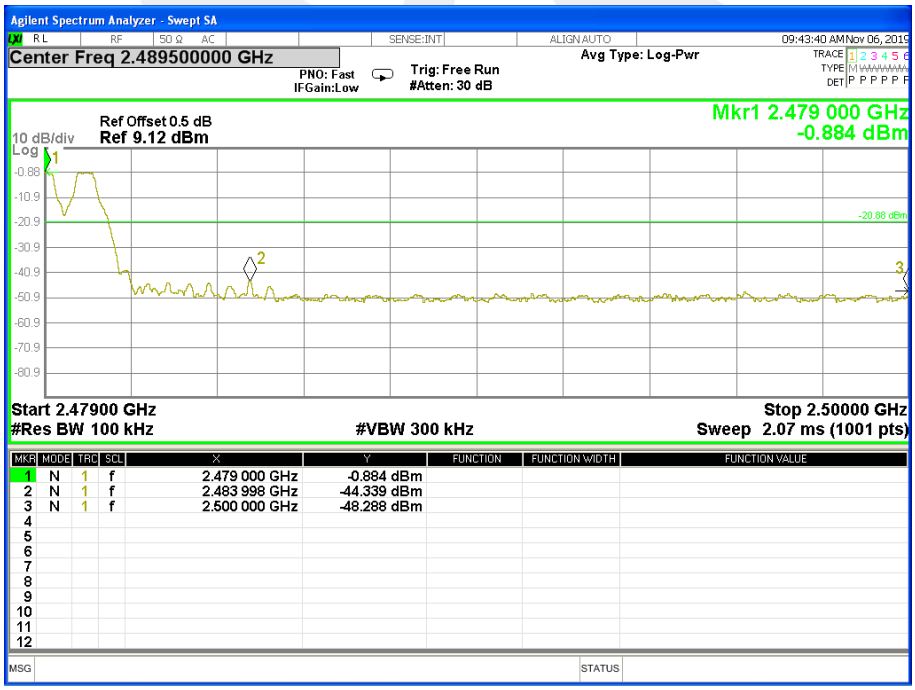

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.487500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
10:32:39 AM Nov 06, 2019
Ref Offset 0.5 dB
10 dB/div
Ref 9.37 dBm
Log
Mkr1 2.480 150 GHz
-0.633 dBm
-20.63 dBm
Start 2.47500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.40 ms (1001 pts)
1 N 1 f 2.480 150 GHz -0.633 dBm
2 N 1 f 2.483 500 GHz -44.557 dBm
3 N 1 f 2.484 000 GHz -44.483 dBm
4 N 1 f 2.495 975 GHz -51.031 dBm

For Hopping Band edge

00 CH

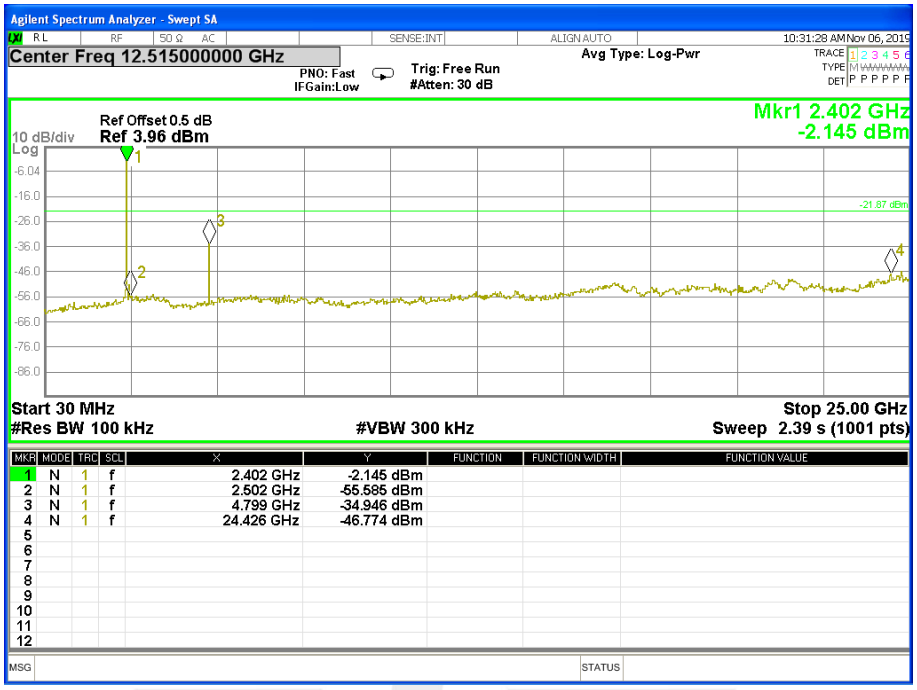


78 CH

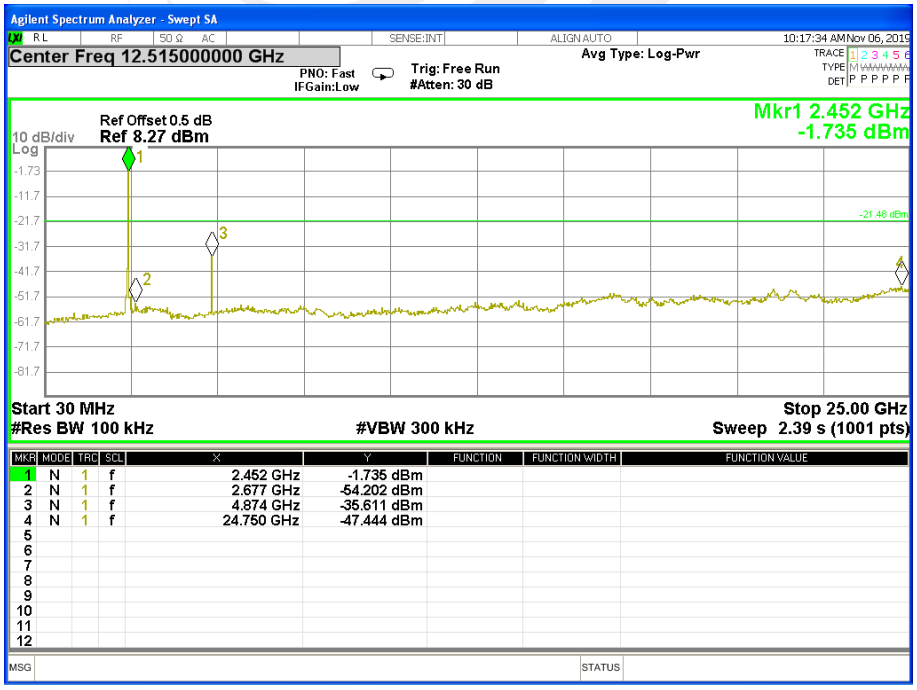


Temperature:	25℃	Relative Humidity:	50%
Test Mode:	π/4-DQPSK(2Mbps)–00/39/78 CH	Test Voltage:	DC 3.7V from battery

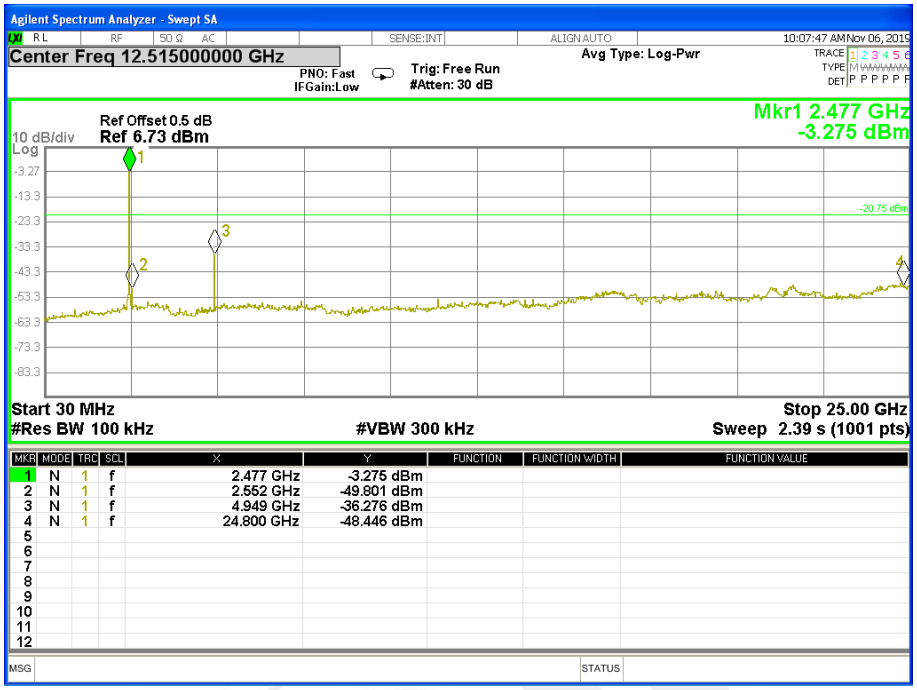
00 CH



39 CH

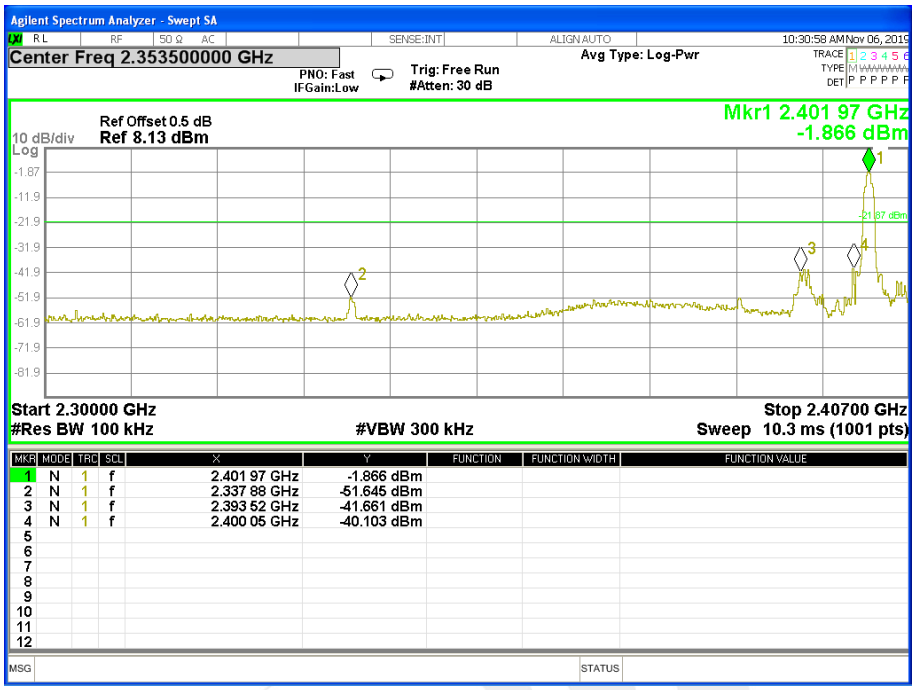


78 CH

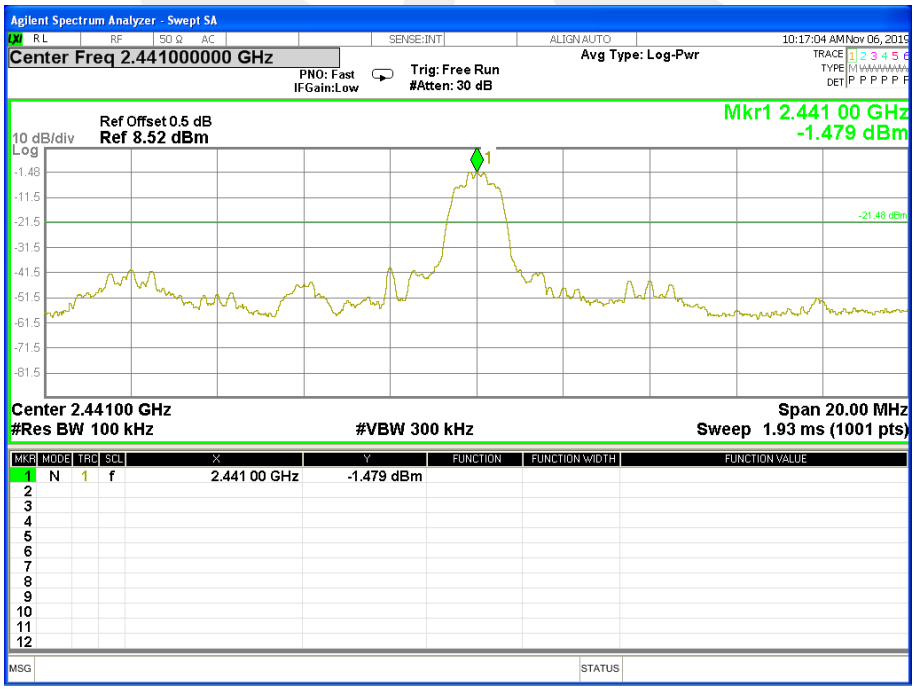

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:07:47 AM Nov 06, 2019
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M
DET P P P P P
Ref Offset 0.5 dB
10 dB/div
Log
Ref 6.73 dBm
Mkr1 2.477 GHz
-3.275 dBm
-3.27
-13.3
-23.3
-33.3
-43.3
-53.3
-63.3
-73.3
-83.3
-20.75 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.39 s (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.477 GHz -3.275 dBm
2 N 1 f 2.552 GHz -49.801 dBm
3 N 1 f 4.949 GHz -36.276 dBm
4 N 1 f 24.800 GHz -48.446 dBm
MSG
STATUS

For Band edge

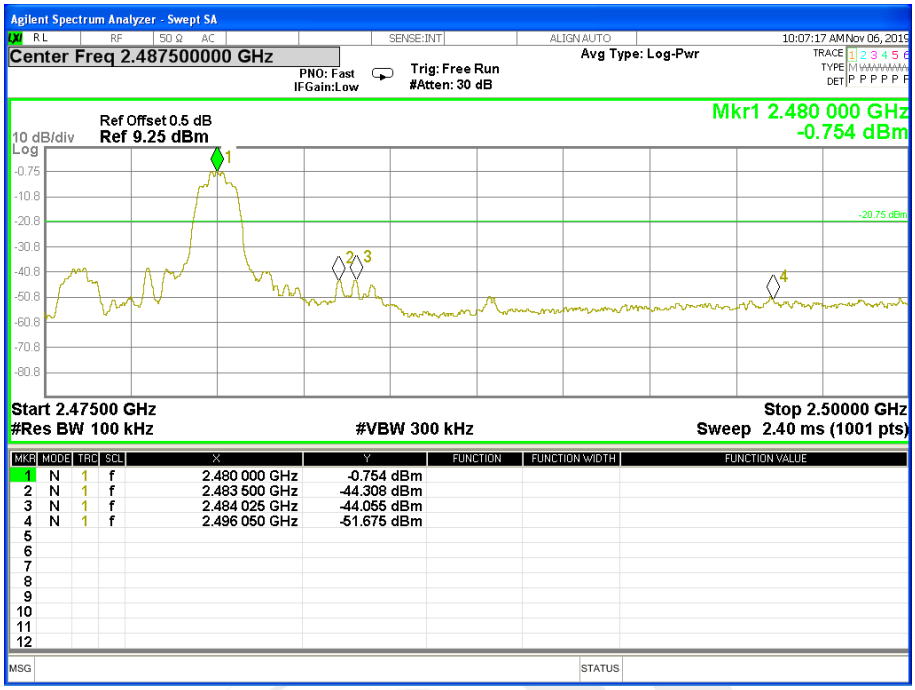
00 CH



39 CH

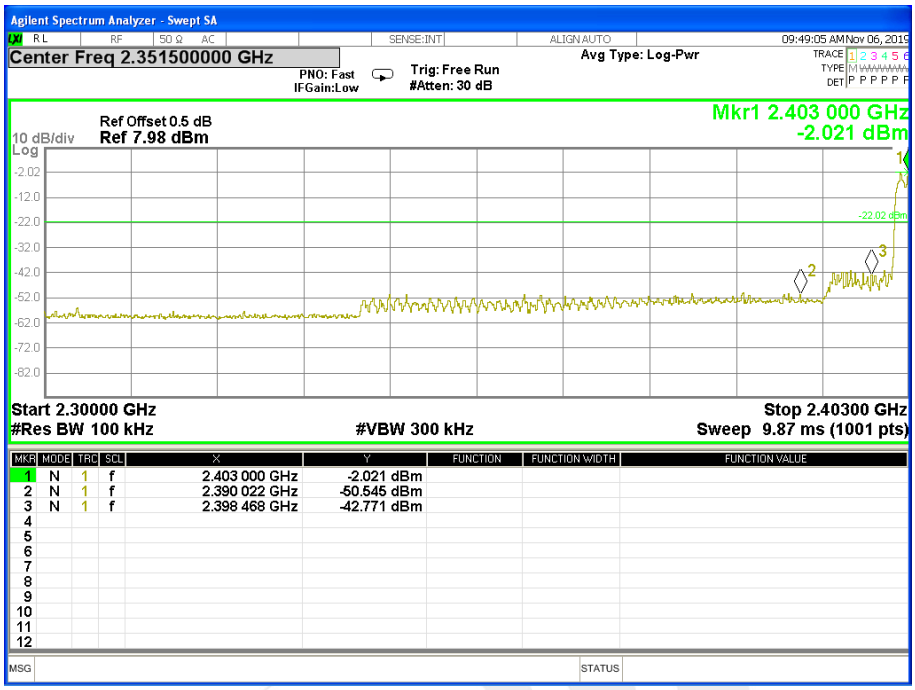


78 CH

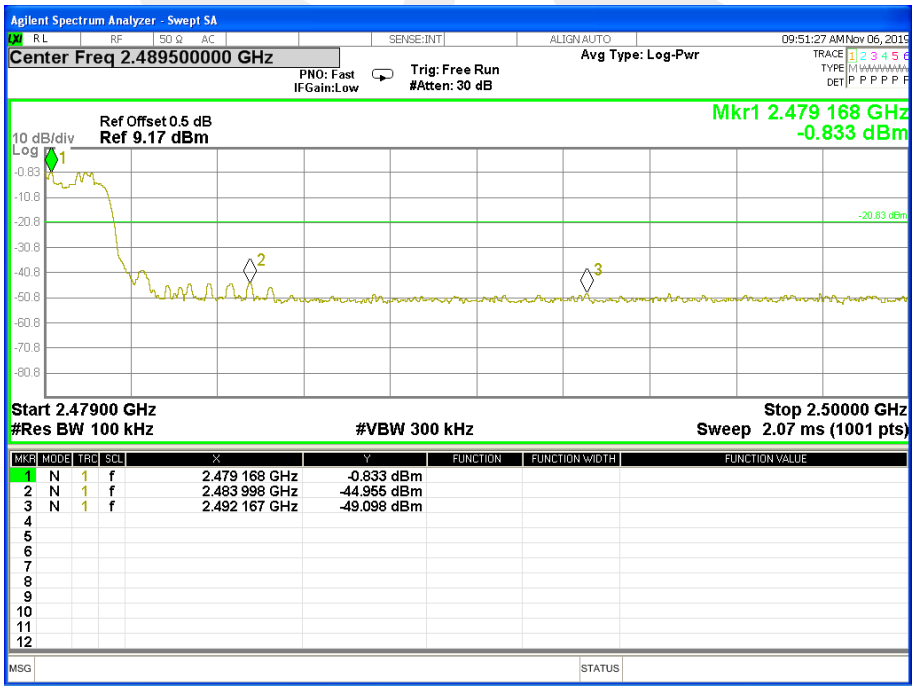

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.487500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
10:07:17 AM Nov 06, 2019
Ref Offset 0.5 dB
10 dB/div
Ref 9.25 dBm
Log
Mkr1 2.480 000 GHz
-0.754 dBm
-20.75 dBm
Start 2.47500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 2.40 ms (1001 pts)
1 N 1 f 2.480 000 GHz -0.754 dBm
2 N 1 f 2.483 500 GHz -44.308 dBm
3 N 1 f 2.484 025 GHz -44.055 dBm
4 N 1 f 2.496 050 GHz -51.675 dBm

For Hopping Band edge

00 CH



78 CH



5. NUMBER OF HOPPING CHANNEL

5.1LIMIT

FCC Part 15.247,Subpart C RSS-247Issue 2				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247(a)(1)(iii) RSS-247	Number of Hopping Channel	≥15	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	300KHz
VB	300KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting: RBW= 300KHz, VBW=300KHz, Sweep time = Auto.

5.3 TEST SETUP

5.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.5TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	DC 3.7V from battery

Number of Hopping Channel 79

Hopping channel

6. AVERAGE TIME OF OCCUPANCY

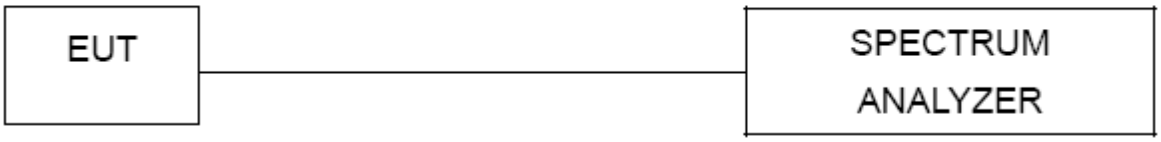
6.1 APPLIED PROCEDURES / LIMIT

FCC Part 15.247,Subpart C RSS-247Issue 2				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247(a)(1)(iii) RSS-247	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

6.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer
b. Set RBW =1MHz/VBW =3MHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is more than once pulse time.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
h. Measure the maximum time duration of one single pulse.
i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). Sothe dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds.
j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). Sothe dwell time is the time duration of the pulse times 5.06 x 31.6 = 160 within 31.6 seconds.
k. DH1 Packet permit maximum 1600 / 79 /2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the dwell time is the time duration of the pulse times 10.12 x 31.6 = 320 within 31.6 seconds.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

6.5TEST RESULTS

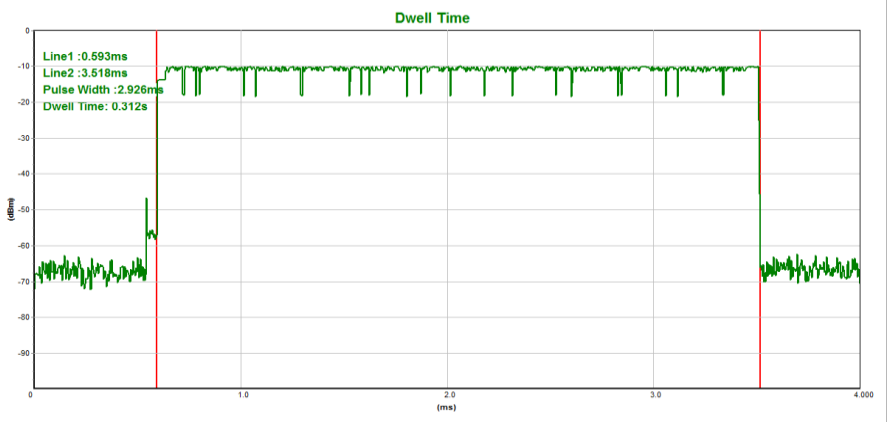
Temperature:	25℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-DH1/DH3/DH5	Test Voltage:	DC 3.7V from battery

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.412	0.132	0.4
DH3	middle	1.673	0.268	0.4
DH5	middle	2.926	0.312	0.4

CH39-DH1

CH39-DH3

CH39-DH5

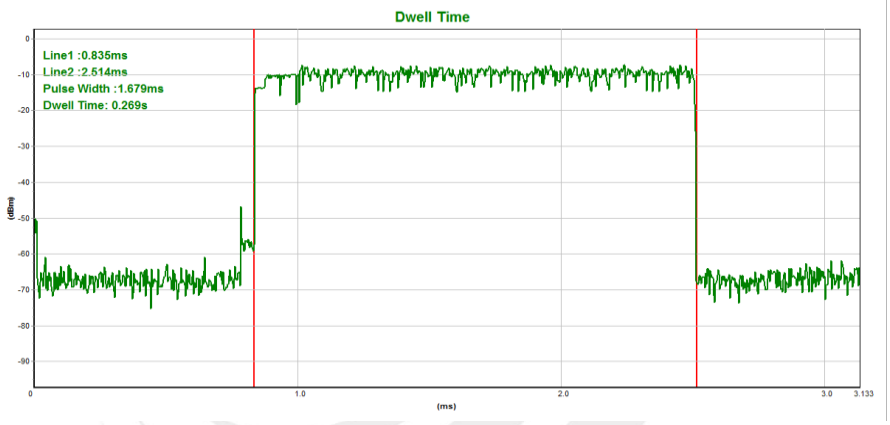


Temperature:	25℃	Relative Humidity:	50%
Test Mode:	π/4-DQPSK(2Mbps)–2DH1/2DH3/2DH5	Test Voltage:	DC 3.7V from battery

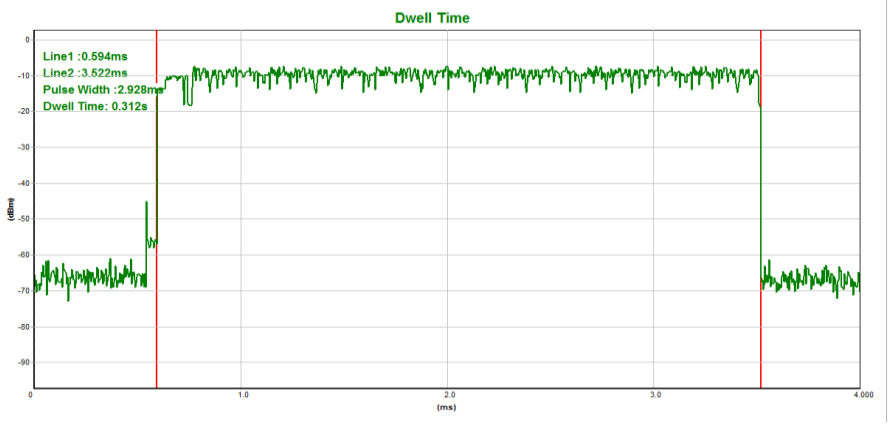
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.421	0.135	0.4
2DH3	middle	1.679	0.269	0.4
2DH5	middle	2.928	0.312	0.4

CH39-2DH1

CH39-2DH3



CH39-2DH5



7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

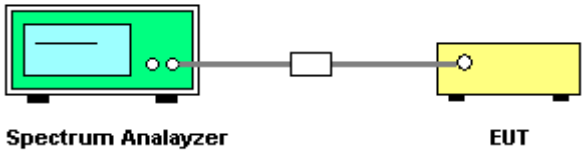
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 20 dB Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

7.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
b. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
c. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for channel separation measurement.

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

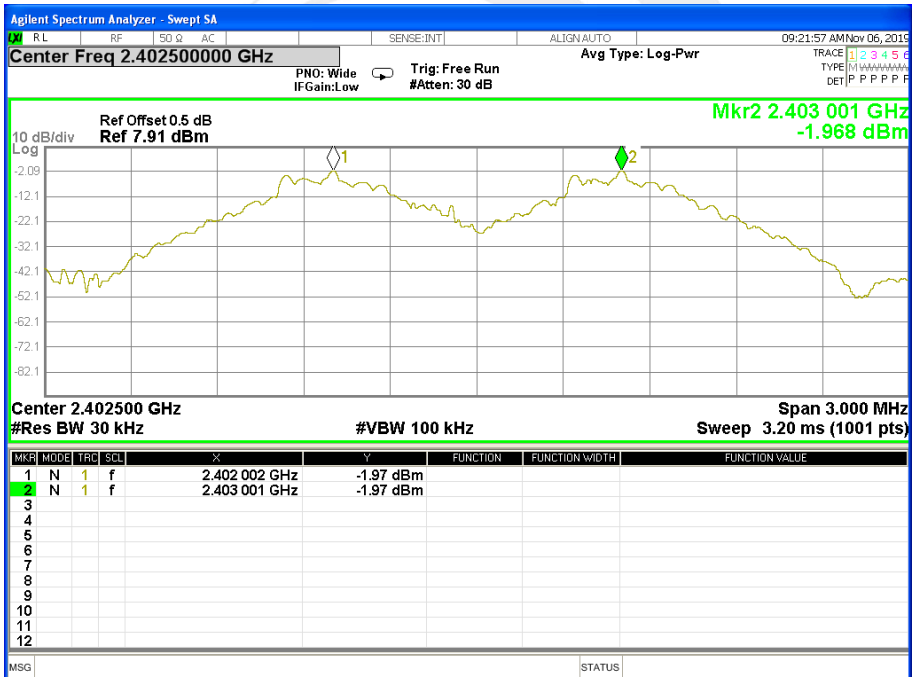
7.5TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	DC 3.7V from battery

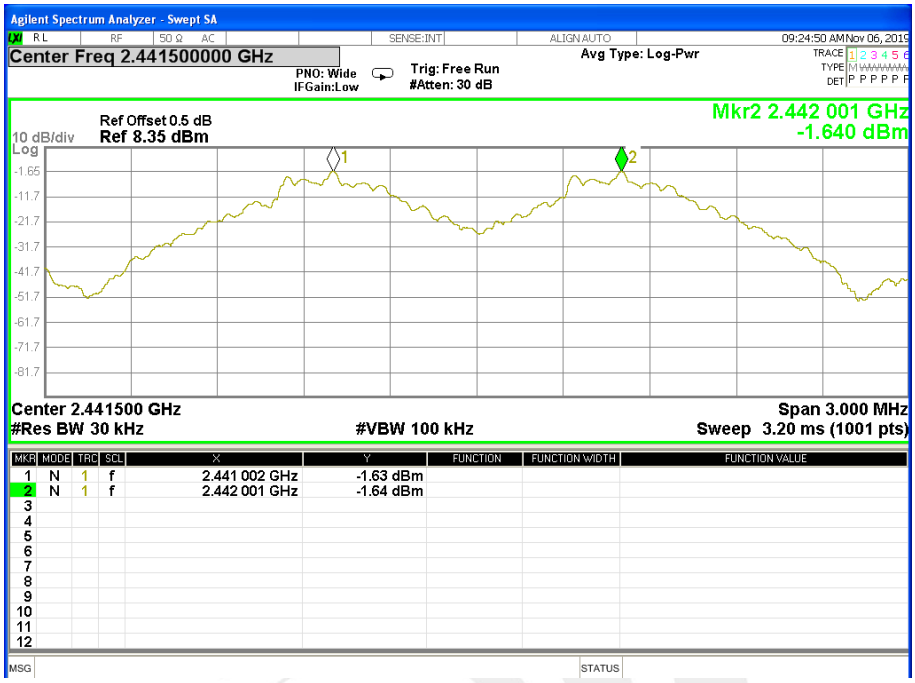
Frequency	Mark1 Frequency （MHz）	Mark2 Frequency （MHz）	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.002	2403.001	0.999	0.848	Complies
2441 MHz	2441.002	2442.001	0.999	0.836	Complies
2480 MHz	2479.002	2480.004	1.002	0.838	Complies

For GFSK: Ch. Separation Limits: > 20dB bandwidth

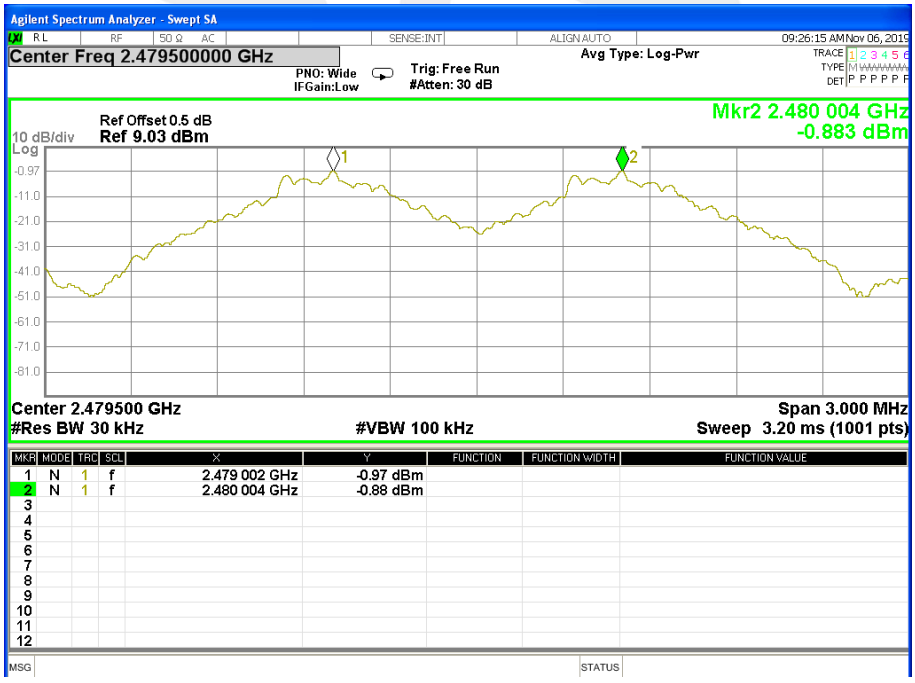
CH00 -1Mbps



CH39 -1Mbps



CH78 -1Mbps

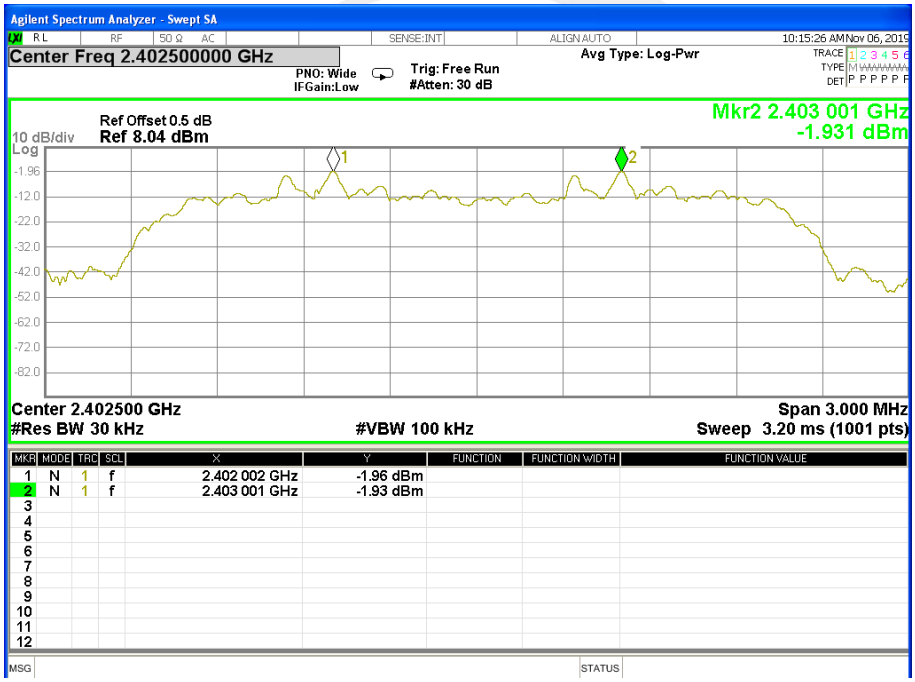


Temperature:	25℃	Relative Humidity:	50%
Test Mode:	CH00 / CH39 /CH78 (π/4-DQPSK(2Mbps) Mode)	Test Voltage:	DC 3.7V from battery

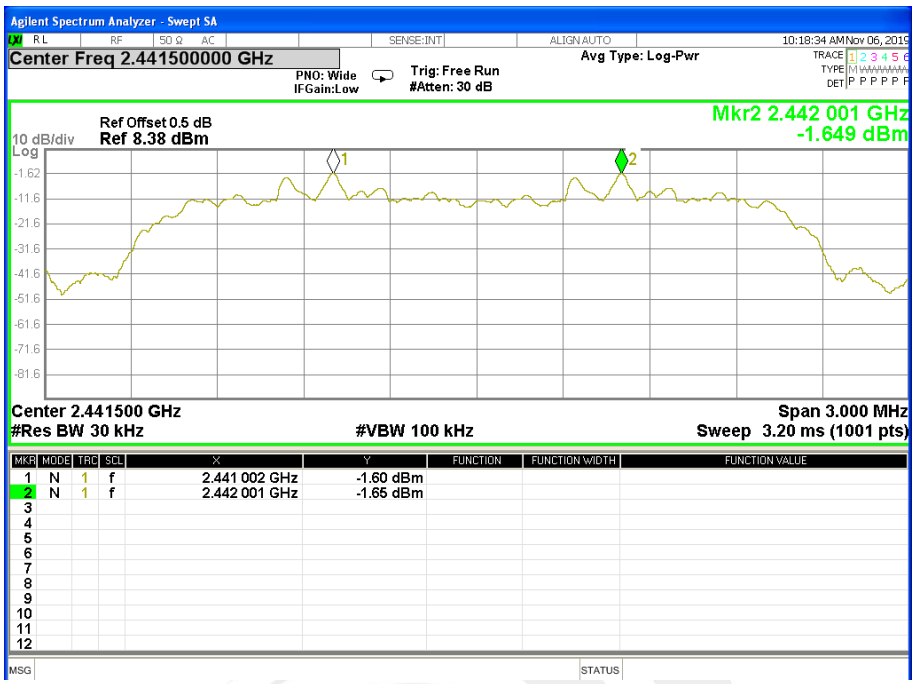
Frequency	Mark1 Frequency （MHz）	Mark2 Frequency （MHz）	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.002	2403.001	0.999	0.809	Complies
2441 MHz	2441.002	2442.001	0.999	0.809	Complies
2480 MHz	2479.002	2480.004	1.002	0.807	Complies

For π/4-DQPSK(2Mbps): Ch. Separation Limits: > two-thirds 20dB bandwidth

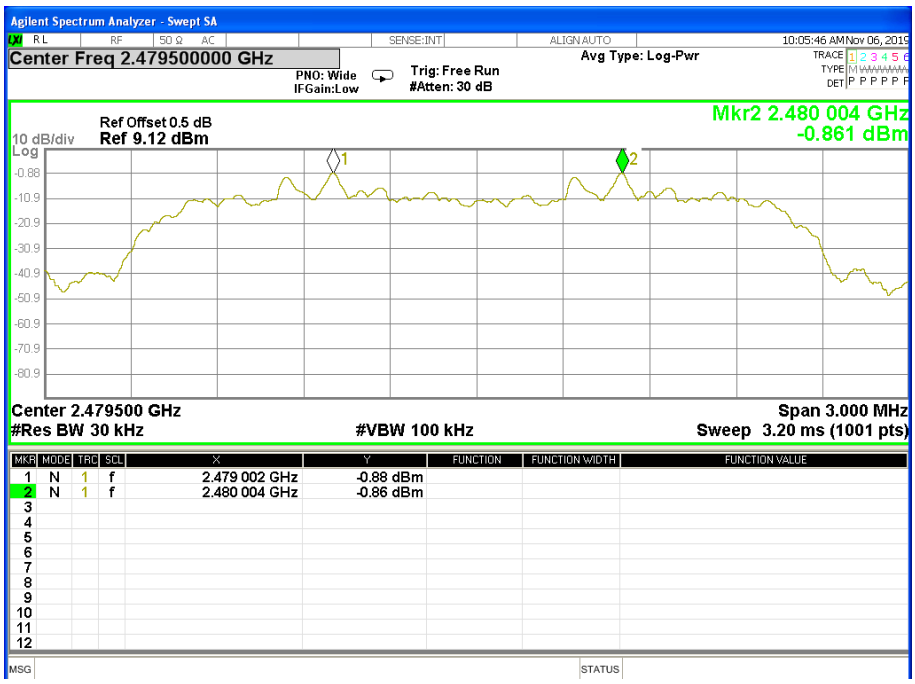
CH00 -2Mbps



CH39 -2Mbps



CH78 -2Mbps



8. BANDWIDTH TEST

8.1LIMIT

FCC Part1515.247,Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247(a)(1) RSS-247	Bandwidth	(20dB bandwidth)	2400-2483.5	PASS

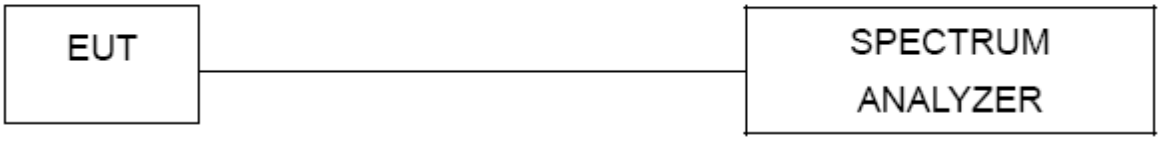
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,

b. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

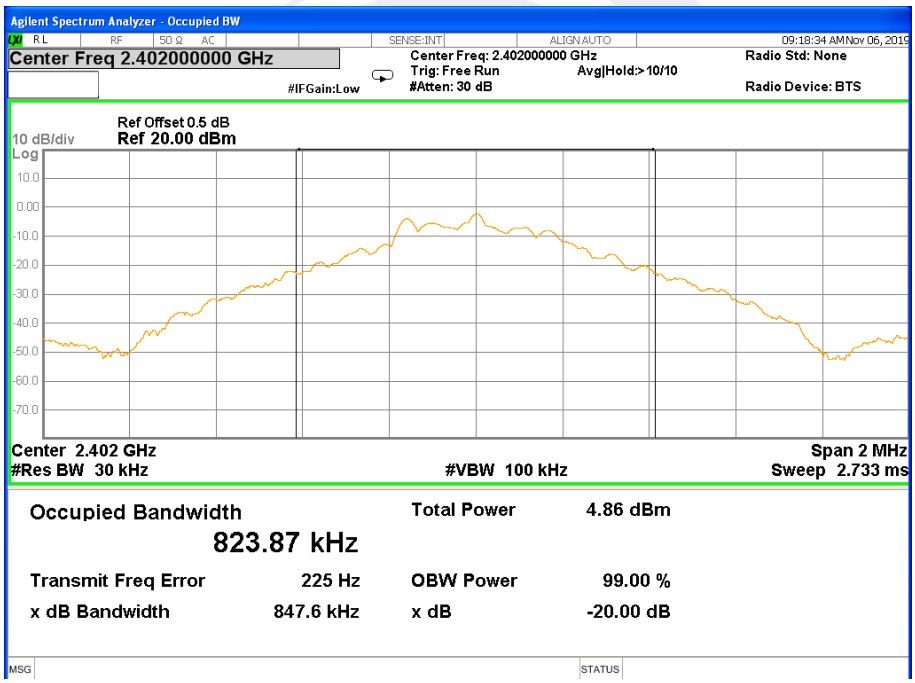
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

8.5TEST RESULTS

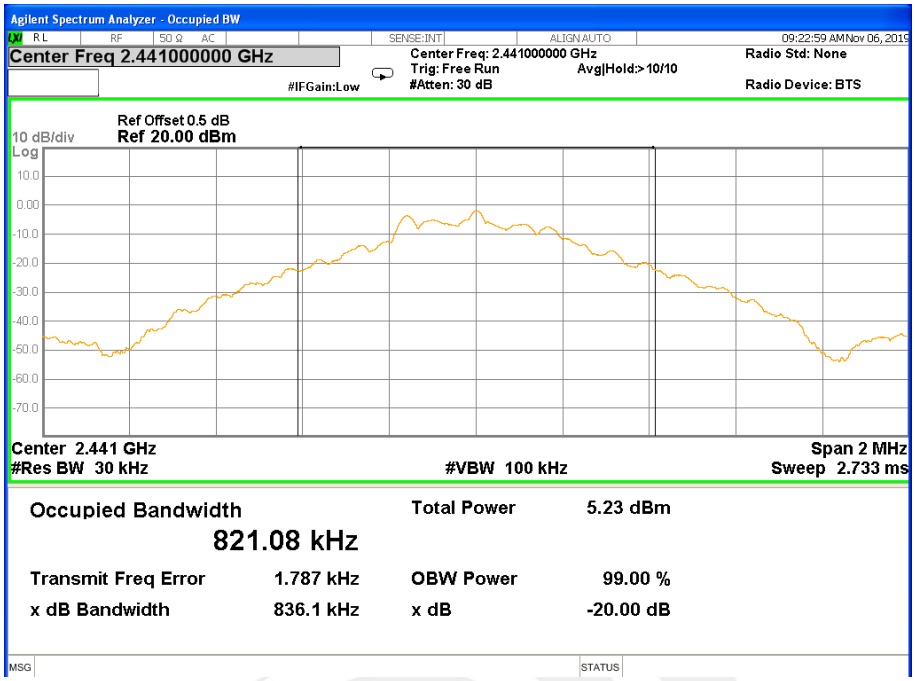
Temperature:	25℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps) CH00 / CH39 /C78	Test Voltage:	DC 3.7V from battery

Frequency	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2402 MHz	0.848	0.824	PASS
2441 MHz	0.836	0.821	PASS
2480 MHz	0.838	0.822	PASS

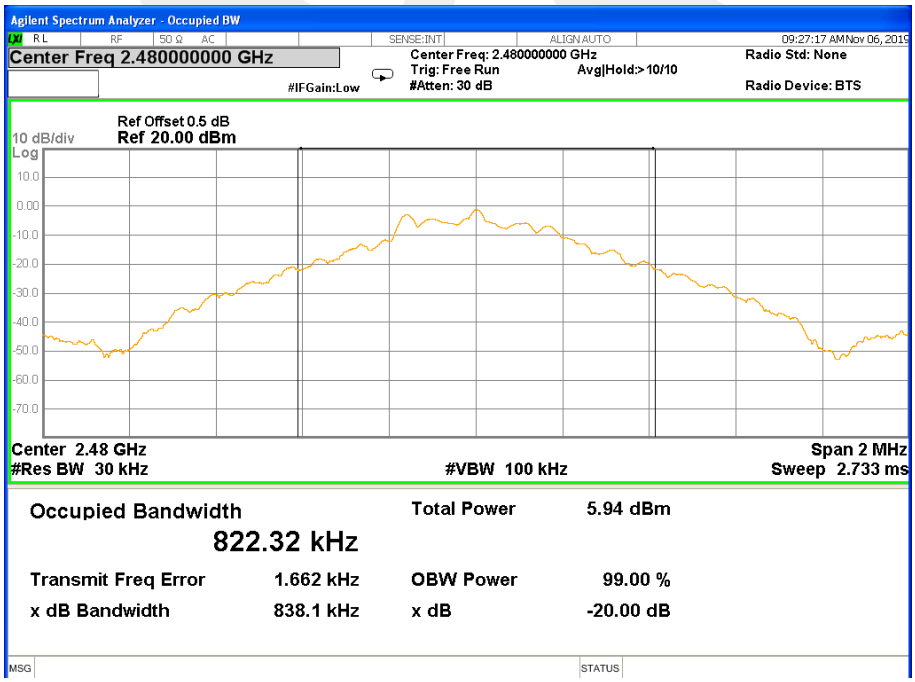
CH00 -1Mbps



CH39 -1Mbps



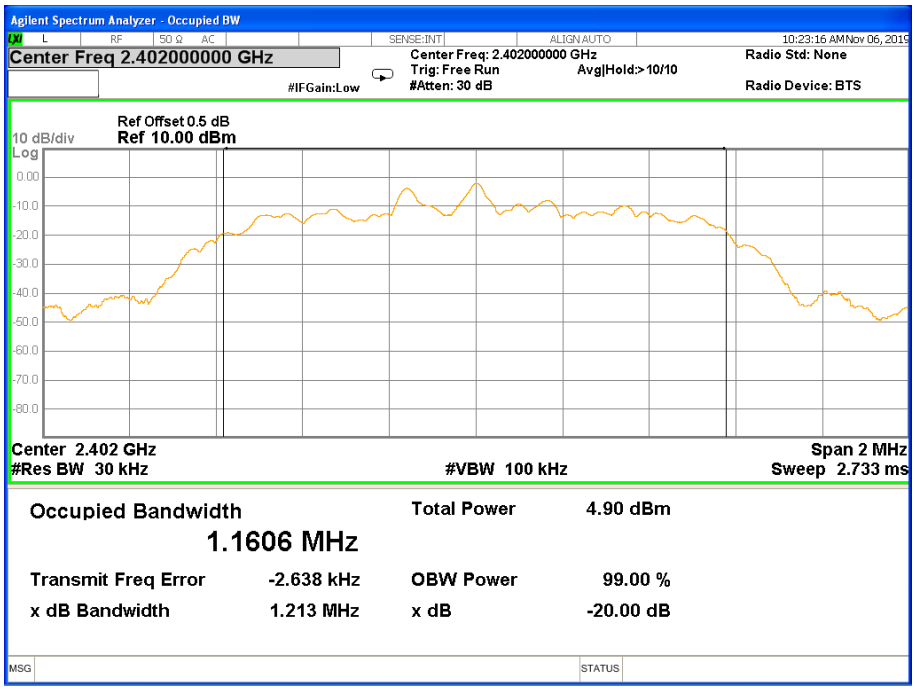
CH78 -1Mbps



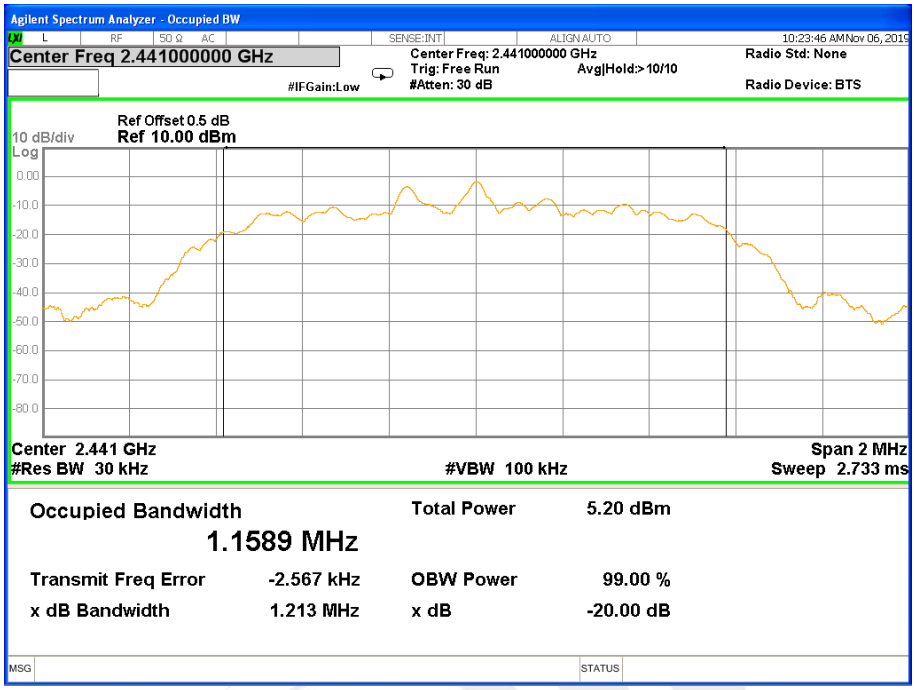
Temperature:	25℃	Relative Humidity:	50%
Test Mode:	π/4-DQPSK(2Mbps) CH00 / CH39 /C78	Test Voltage:	DC 3.7V from battery

Frequency	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2402 MHz	1.213	1.161	PASS
2441 MHz	1.213	1.159	PASS
2480 MHz	1.21	1.158	PASS

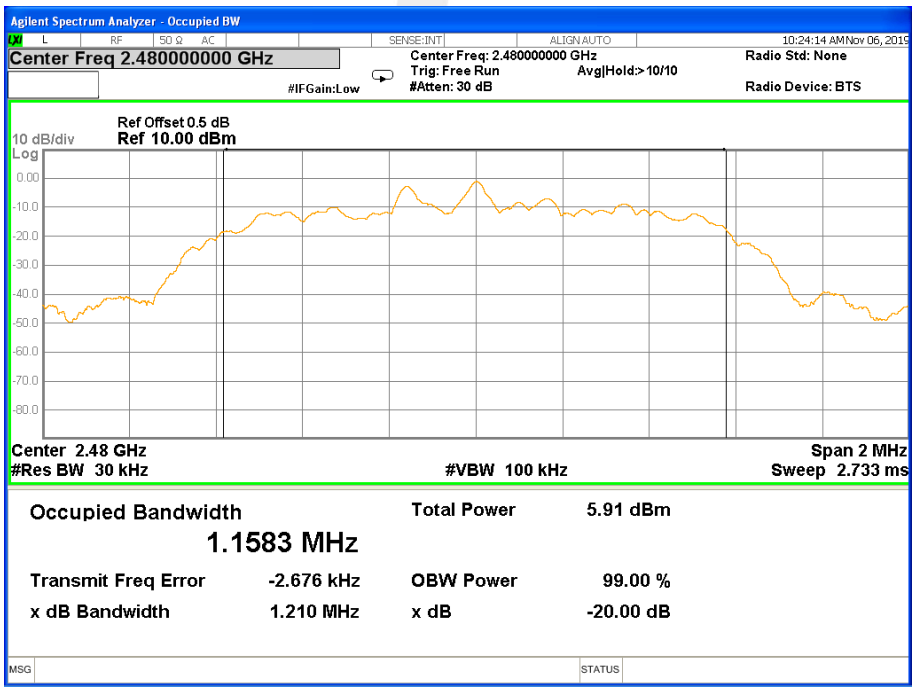
CH00 -2Mbps



CH39 -2Mbps



CH78 -2Mbps



9. OUTPUT POWER TEST

9.1 LIMIT

Fcc Part 15.247,Subpart C
Rss-247 Issue 2

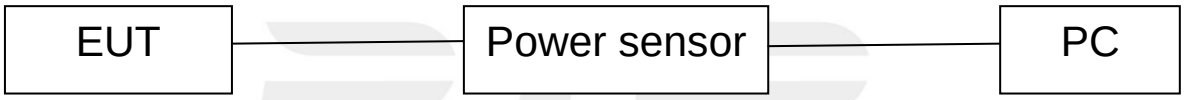
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247(a)(1)&(b)(1) RSS-247	Output Power	1 W or 0.125W if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5	PASS

9.2 TEST PROCEDURE

a. The EUT was directly connected to the Power Sensor&PC

9.2 TEST PROCEDURE
a. The EUT was directly connected to the Power Sensor&PC

9.3 TEST SETUP



9.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

9.5TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 3.7V from battery		

Mode	Channel Number	Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)	Limit (dBm)
GFSK(1M)	0	2402	-1.11	-2.52	30.00
	39	2441	-0.76	-2.16	30.00
	78	2480	-0.60	-2.04	30.00

Note:the channel separation >20dB bandwidth

Mode	Channel Number	Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)	Limit (dBm)
π/4-DQPSK(2M)	0	2402	0.29	-3.85	20.97
	39	2441	0.64	-3.49	20.97
	78	2480	0.72	-3.46	20.97

Note:the channel separation >2/3 20dB bandwidth

10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

10.2 EUT ANTENNA

The EUT antenna is PCBAntenna. It comply with the standard requirement.

11. FREQUENCY STABILITY

11.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within +/-0.02% of the operating frequency over a temperature variation of -30 degrees to 50 degrees C at normal supply voltage,and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees.

11.2 TEST PROCEDURE

1.The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2.Turn the EUT on and couple its output to spectrum analyzer.
3.Turn the EUT off and set the chamber to the highest temperature specified.
4.Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize,turn the EUT on and measure the operating frequency after 2,5,and 10 minutes.
5.Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6.The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes.The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

11.3 TEST RESULT

Channel 39 (2441MHz)

Voltage vs. Frequency Stability

Voltage vs. Frequency Stability Voltage(V)	Measurement Frequency(MHz)
4.255	2441.0028
3.7	2441.0023
3.145	2441.0027
Max.Deviation(MHz)	0.0028
Max.Deviation(ppm)	1.15

Rated working voltage:DC 3.7V from battery

Temperature vs. Frequency Stability

Temperature(℃)	Measurement Frequency(MHz)
-30	2441.0036
-20	2441.0026
-10	2441.0032
0	2441.0033
10	2441.0028
20	2441.0027
30	2441.0033
40	2441.0035
50	2441.0034
Max.Deviation(MHz)	0.0036
Max.Deviation(ppm)	1.47

APPENDIX-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※