



RADIO TEST REPORT

Report No.: STS1901197W01

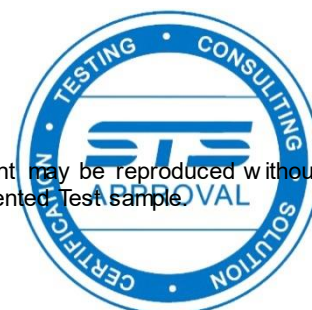
Issued for

Timex Group USA Inc.

555 Christian Road 310 Middlebury Connecticut 06762
United States

Product Name:	Bluetooth Module
Brand Name:	Timex, Guess
Model Name:	M02Q
Series Model:	N/A
FCC ID:	EP9-TMXM02Q
IC ID:	3348A-TMXM02Q
HVIN:	SMA10T
Test Standard:	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 April 2018

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TEST RESULT CERTIFICATION

Applicant's name : **Timex Group USA Inc.**
 Address : 555 Christian Road 310 Middlebury Connecticut 06762 United States
Manufacture's Name : **Timex Group USA Inc.**
 Address : 555 Christian Road 310 Middlebury Connecticut 06762 United States

Product description

Product Name : Bluetooth Module
 Brand Name : Timex, Guess
 Model Name : M02Q
 Series Model..... : N/A

Test Standards : CFR47 FCC Part 15: Subpart C Section 15.247
 CFR47 FCC Part 15: Subpart C Section 15.207
 CFR47 FCC Part 15: Subpart C Section 15.209
 RSS-247 Issue 2 February 2017
 RSS-Gen Issue 5 April 2018

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.

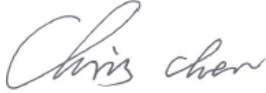
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Date of Test.....:

Date (s) of performance of tests.....: 17 Jan. 2019 - 22 Jan. 2019

Date of Issue.....: 08 Mar. 2019

Test Result.....: **Pass**

Testing Engineer : 
 (Chris Chen)

Technical Manager : 
 (Sunday Hu)


Authorized Signatory : 
 (Vita Li)





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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	08 Mar. 2019	STS1901197W01	ALL	Initial Issue





1 SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

KDB 558074 D01 DTS Meas Guidance v05r01

FCC Part 15, Subpart C RSS-247 Issue 2			
Standard Section	Test Item	Judgment	Remark
FCC Part 15.207(a) RSS-Gen Clause 8.8	Conducted Emission	PASS	
FCC Part 15.247(a)(2) RSS-247 Clause 5.2(a)	6dB Bandwidth	PASS	
RSS-Gen Clause 6.6	99% Bandwidth	PASS	
FCC Part 15.247(b)(3) RSS-247 Clause 5.4(d)	Output Power	PASS	
FCC Part 15.247(d) RSS-247 Clause 3.3	Radiated Spurious Emission	PASS	
FCC Part 15.247(d) RSS-247 Clause 5.5	Conducted Spurious & Band Edge Emission	PASS	
FCC Part 15.247(e) RSS-247 Clause 5.2(b)	Power Spectral Density	PASS	
FCC Part 15.205	Restricted Band Edge Emission	PASS	
FCC Part 15.247(d) & 15.209(a) RSS-247 Clause 5.5	Band Edge Emission	PASS	
FCC Part 15.247(b)(4) & 15.203	Antenna Requirement	PASS	

NOTE:

- 1) 'N/A' denotes test is not applicable in this test report
- 2) All tests were performed according to the procedures in ANSI C63.10: 2013.



1.1 TEST FACTORY

Shenzhen STS Test Services Co., Ltd.

Add.: 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

FCC Registration No.: CN1203

IC Registration No.: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$ · where expanded 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	± 0.71 dB
2	Unwanted Emissions,conducted	± 0.63 dB
3	All emissions,radiated 30-200MHz	± 3.43 dB
4	All emissions,radiated 200MHz-1GHz	± 3.57 dB
5	All emissions,radiated>1G	± 4.13 dB
6	Conducted Emission(9KHz-150KHz)	± 3.18 dB
7	Conducted Emission(150KHz-30MHz)	± 2.70 dB



2 GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product Name	Bluetooth Module	
Trade Name	Timex, Guess	
Model Name	M02Q	
Series Model	N/A	
Model Difference	N/A	
Product Description	The EUT is a Bluetooth Module which supports Bluetooth V5.0 Low Energy technology.	
	Operation Frequency:	2402 - 2480 MHz
	Modulation Type:	GFSK
	Bit Rate of Transmitter:	1 Mbps
	Number Of Channel:	40 channels
	Antenna Designation:	Please see Note 4
	Antenna Gain (dBi):	-1.5dBi
	Duty Cycle:	>98%
Channel List	Please refer to the Note 2.	
Power Rating	Input DC 3.7V	
Hardware version	N/A	
Software version	N/A	
Radio Hardware version	N/A	
Radio Software version	N/A	
Test Software	N/A	



Note:

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

2

RF Channel and Frequency of BLE			
RF Channel	Freq.(MHz)	RF Channel	Freq.(MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2402	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2480
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

3 Note:

- 1) In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test;
- 2) Test frequencies are lowest channel: 2402 MHz, middle channel: 2442 MHz and highest channel: 2480 MHz.

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Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	M02Q	Integral antenna	N/A	-1.5	BLE Antenna



2.2 DESCRIPTION OF TEST MODES

Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

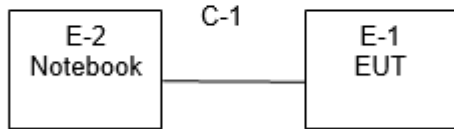
Worst Mode	Description	Data Rate
Mode 1	TX BLE CH00	1 Mbps
Mode 2	TX BLE CH20	1 Mbps
Mode 3	TX BLE CH39	1 Mbps
Mode 4	Normal operating mode	/

Note:

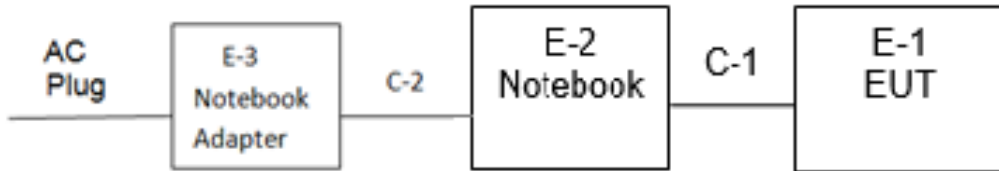
- 1) 2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported
- 3) 4) We have be tested for all availiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/60Hz is shown in the report
- 5) 6) Controlled using a bespoke application on the laptop PC supplied by the customer. The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes as required.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiation Test Set



Conduction Test Set





2.4 DESCRIPTION OF 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.

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Notebook	HP	500-320cx	N/A	N/A
E-3	Notebook Adapter	HP	HSTNN-CA15	N/A	N/A
E-4	Adapter	SZTY	TPA-46050100VU	N/A	N/A
E-5	PHONE	MI	MI6	N/A	N/A

Item	Shielded Type	Ferrite Core	Length	Note
C-1	USB Cable	NO	100cm	N/A
C-2	DC Cable	NO	110cm	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”.



2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test Equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
Signal Analyzer	Agilent	N9020A	MY51110105	2018.03.08	2019.03.07
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 (15G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2019.03.10
Pre-mpifier(0.1M-3GHz)	EM	EM330	060665	2018.10.13	2019.10.12
PreAmplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2018.10.13	2019.10.12
Temperature & Humidity	HH660	Mieo	N/A	2018.10.11	2019.10.10
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
LISN	R&S	ENV216	101242	2018.10.11	2019.10.10
LISN	EMCO	3810/2NM	23625	2018.10.11	2019.10.10
Temperature & Humidity	HH660	Mieo	N/A	2018.10.11	2019.10.10

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2018.10.13	2019.10.12
Signal Analyzer	Agilent	N9020A	MY49100060	2018.10.13	2019.10.12
Temperature & Humidity	HH660	Mieo	N/A	2018.10.11	2019.10.10



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 15. 207(a), 107(a), RSS-Gen Table3 limit in the table below has to be followed.
This item was performed according to the procedures in ANSI C63.10: 2013.

FREQUENCY (MHz)	Conducted Emission limit (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.

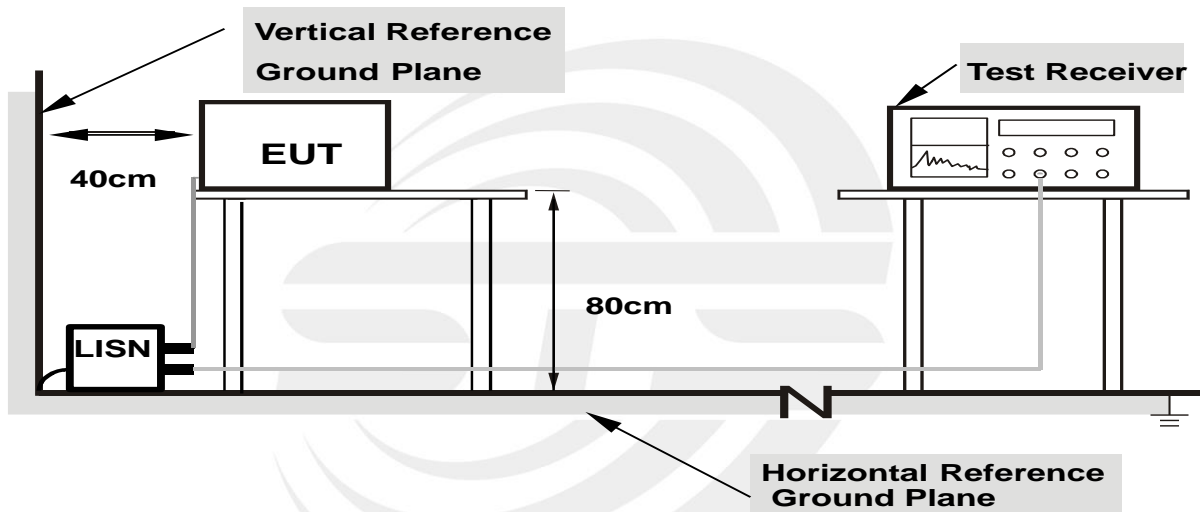
The following table is the setting of the receiver

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 plane with 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**

3.1.4 EUT 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.



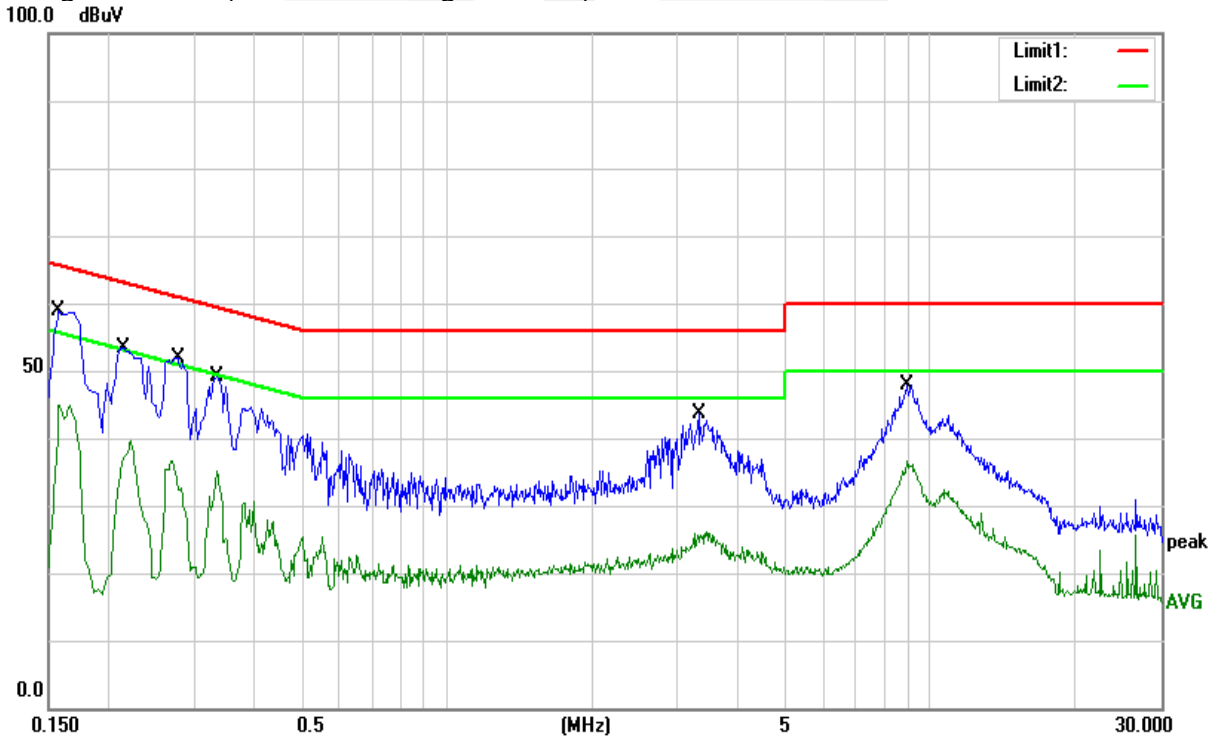
3.1.5 TEST RESULT

Temperature:	21.3 °C	Relative Humidity:	44%
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Date :	2019/1/22	Test Mode:	Mode 1/2/3 (Mode 1 worst case)

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
0.1580	38.61	20.23	58.84	65.57	-6.73	QP
0.1580	24.66	20.23	44.89	55.57	-10.68	AVG
0.2140	33.18	20.30	53.48	63.05	-9.57	QP
0.2140	19.34	20.30	39.64	53.05	-13.41	AVG
0.2780	31.38	20.61	51.99	60.88	-8.89	QP
0.2780	15.98	20.61	36.59	50.88	-14.29	AVG
0.3340	28.36	20.64	49.00	59.35	-10.35	QP
0.3340	14.52	20.64	35.16	49.35	-14.19	AVG
3.3180	23.57	19.97	43.54	56.00	-12.46	QP
3.3180	6.12	19.97	26.09	46.00	-19.91	AVG
8.9620	27.82	20.06	47.88	60.00	-12.12	QP
8.9620	16.54	20.06	36.60	50.00	-13.40	AVG

Remark:

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



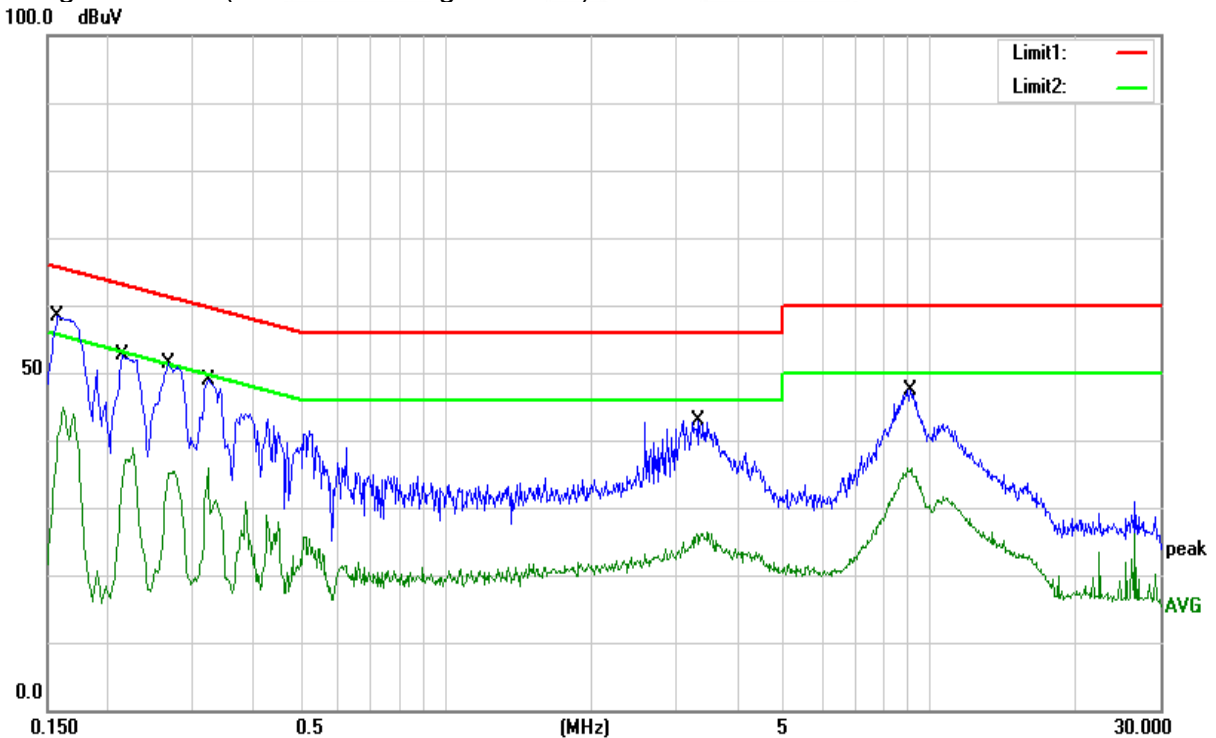


Temperature:	21.3 °C	Relative Humidity:	44%
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Date:	2019/1/22	Test Mode:	Mode 1/2/3 (Mode 1 worst case)

Frequency (MHz)	Reading (dBUV)	Correct Factor(dB)	Result (dBUV)	Limit (dBUV)	Margin (dB)	Remark
0.1580	38.09	20.23	58.32	65.57	-7.25	QP
0.1580	24.67	20.23	44.90	55.57	-10.67	AVG
0.2140	32.21	20.30	52.51	63.05	-10.54	QP
0.2140	18.49	20.30	38.79	53.05	-14.26	AVG
0.2660	30.70	20.56	51.26	61.24	-9.98	QP
0.2660	14.82	20.56	35.38	51.24	-15.86	AVG
0.3220	28.25	20.67	48.92	59.66	-10.74	QP
0.3220	15.19	20.67	35.86	49.66	-13.80	AVG
3.3340	23.02	19.97	42.99	56.00	-13.01	QP
3.3340	6.33	19.97	26.30	46.00	-19.70	AVG
9.0300	27.23	20.07	47.30	60.00	-12.70	QP
9.0300	15.78	20.07	35.85	50.00	-14.15	AVG

Remark:

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





3.2 RADIATED SPURIOUS EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

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 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 (1000MHz-25GHz)

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	1 MHz /3MHz

For Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2300 to 2422 MHz Upper Band Edge: 2452 to 2500 MHz
RB / VB (emission in restricted band)	1 MHz /3MHz



Receiver Parameter	Setting
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

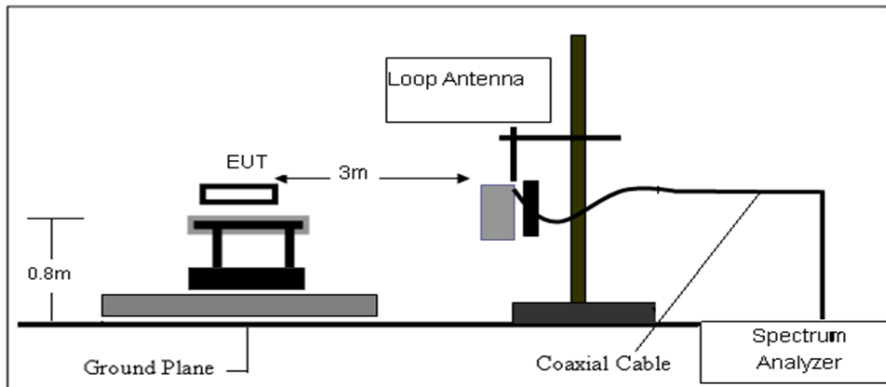
- The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- 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
- 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 Quasi Peak detector mode re-measured.
- 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.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

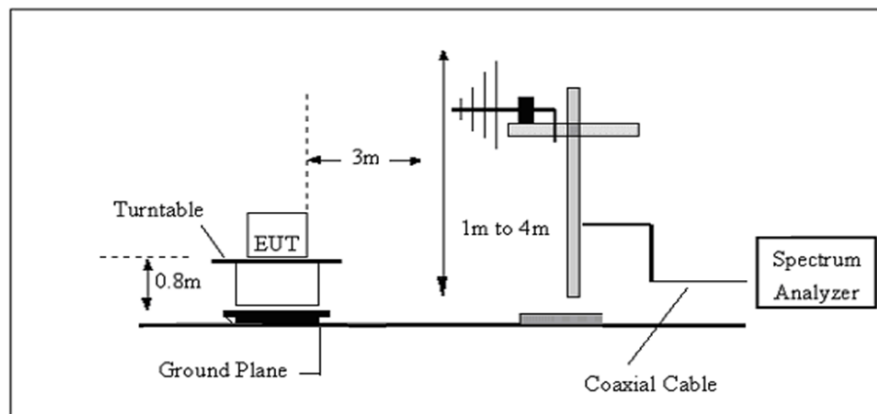
Both horizontal and vertical antenna polarities were tested and performed test to three orthogonal axis. The worst case emissions were reported

3.2.3 TEST SETUP

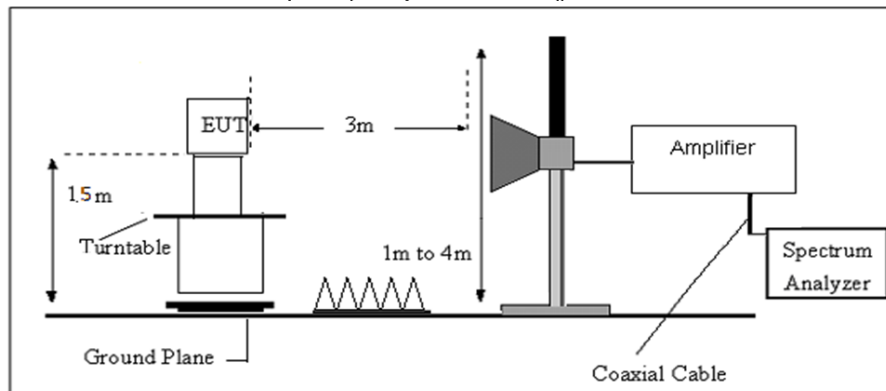
a) Radiated Emission Test-Up Frequency Below 30MHz



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



c) Radiated Emission Test-Up Frequency Above 1GHz



3.2.4 EUT OPERATING 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.



3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier 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 (MHz)	FS (dB μ V/m)	RA (dB μ V/m)	AF (dB)	CL (dB)	AG (dB)	Factor (dB)
300	40	58.1	12.2	1.6	31.9	-18.1

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$

3.2.6 TEST RESULT

9KHz-30MHz

Temperature:	25.8 °C	Relative Humidity:	51%
Test Voltage :	DC 3.7V From Battery	Polarization :	--
Test Mode :	TX Mode		

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F	Test Result
--	--	--	--	--	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 = $40 \log(\text{specific distance}/\text{test distance})(\text{dB})$;

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



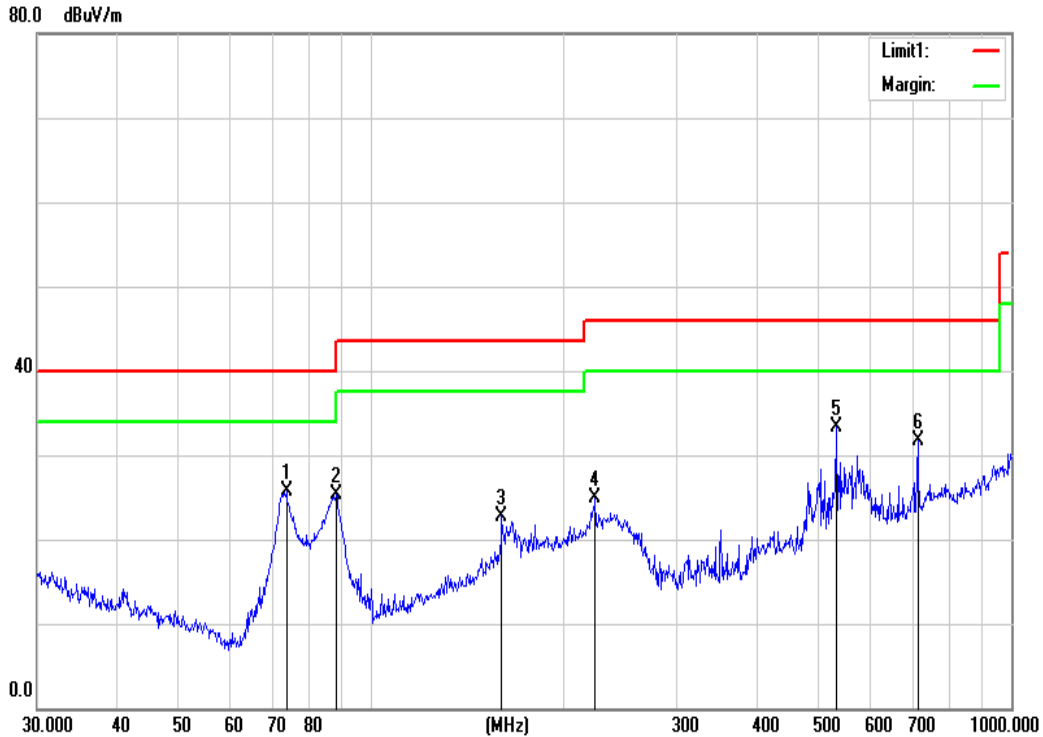
(30MHz - 1000MHz)

Temperature:	25.8 °C	Relative Humidity:	51%
Test Voltage :	DC 3.7V	Polarization :	Horizontal
Test Date:	2019/1/22	Test Mode:	Mode 1/2/3 (Mode 1 worst case)

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
73.6170	49.32	-23.59	25.73	40.00	-14.27	QP
88.0330	45.90	-20.69	25.21	43.50	-18.29	QP
159.7844	41.29	-18.49	22.80	43.50	-20.70	QP
223.7334	43.81	-18.89	24.92	46.00	-21.08	QP
531.9635	40.98	-7.75	33.23	46.00	-12.77	QP
714.1734	36.47	-4.84	31.63	46.00	-14.37	QP

Remark:

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



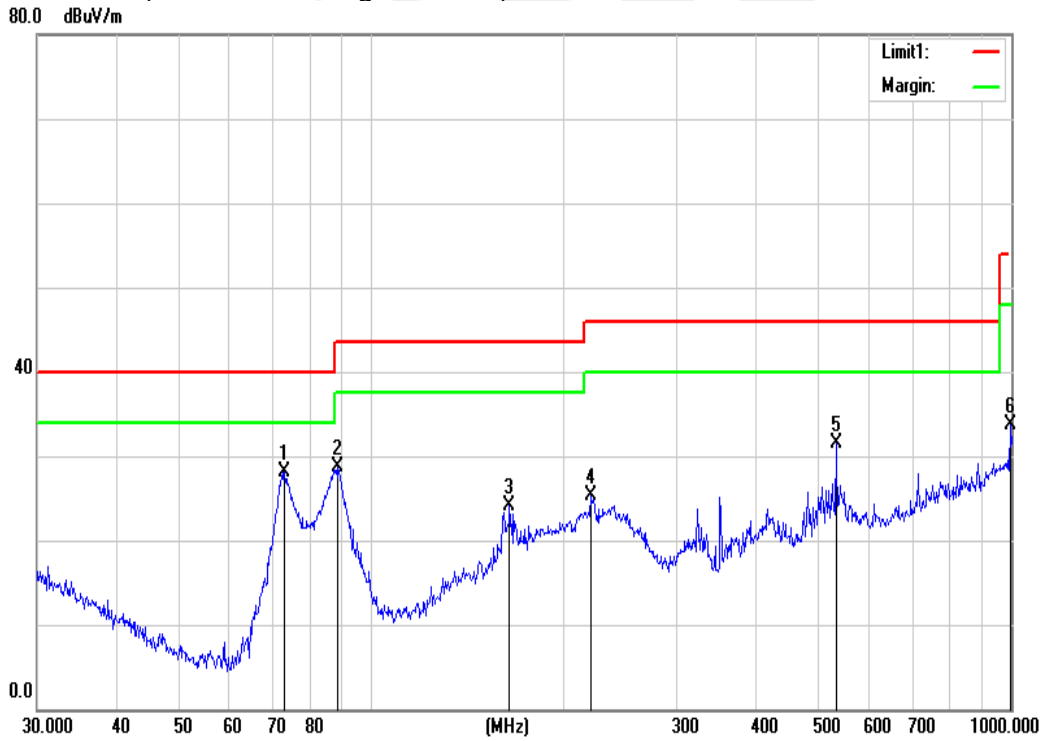


Temperature:	25.8 °C	Relative Humidity:	51%
Test Voltage :	DC 3.7V	Polarization :	Vertical
Test Date:	2019/1/22	Test Mode:	Mode 1/2/3 (Mode 1 worst case)

Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
73.1025	51.82	-23.66	28.16	40.00	-11.84	QP
88.3421	49.37	-20.62	28.75	43.50	-14.75	QP
164.3301	42.98	-18.86	24.12	43.50	-19.38	QP
219.8450	44.47	-19.13	25.34	46.00	-20.66	QP
531.9635	39.17	-7.75	31.42	46.00	-14.58	QP
996.4996	33.76	-0.09	33.67	54.00	-20.33	QP

Remark:.

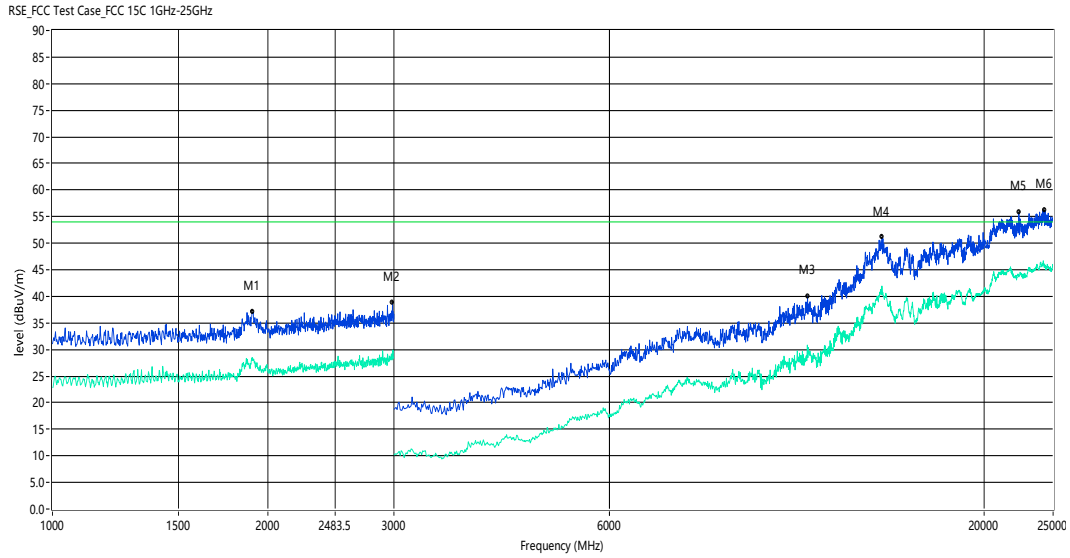
1. Margin = Result (Result =Reading + Factor)–Limit





(1000MHz-25GHz) Restricted band and Spurious emission Requirements

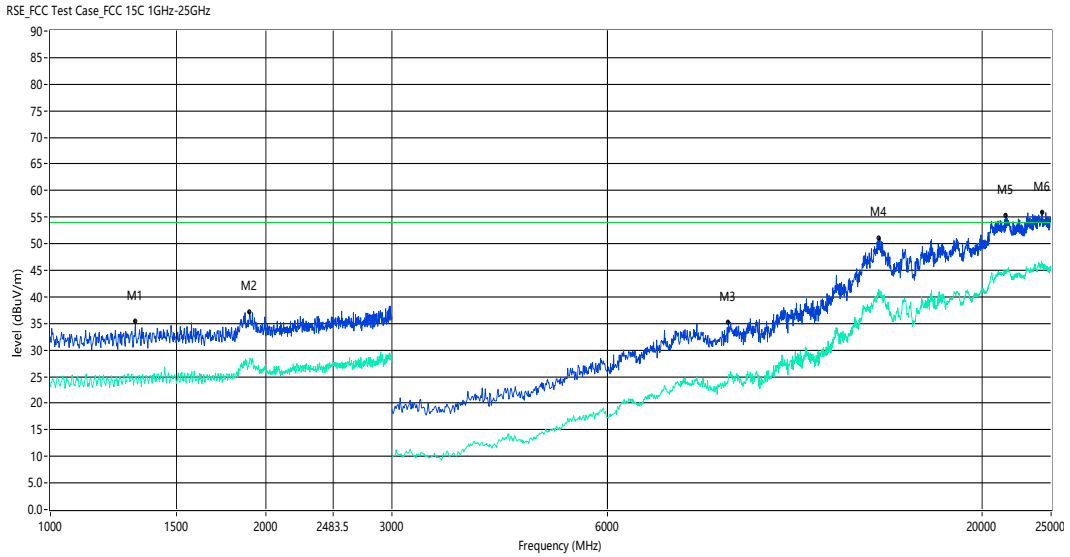
GFSK Low Channel
Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	OverLimit (dB)	Detector	ANT	Verdict
1**	1902.000	28.48	-0.68	54.0	-25.52	AV	H	Pass
1	1902.000	37.02	-0.68	74.0	-36.98	Peak	H	Pass
2**	2986.000	28.87	2.16	54.0	-25.13	AV	H	Pass
2	2986.000	38.84	2.16	74.0	-35.16	Peak	H	Pass
3**	11350.000	29.28	15.68	54.0	-24.72	AV	H	Pass
3	11350.000	40.06	15.68	74.0	-33.94	Peak	H	Pass
4**	14416.000	41.94	25.52	54.0	-12.06	AV	H	Pass
4	14416.000	51.09	25.52	74.0	-22.91	Peak	H	Pass
5**	22396.000	43.65	23.79	54.0	-10.35	AV	H	Pass
5	22396.000	55.74	23.79	74.0	-18.26	Peak	H	Pass
6**	24292.000	45.44	23.21	54.0	-8.56	AV	H	Pass
6	24292.000	56.21	23.21	74.0	-17.79	Peak	H	Pass



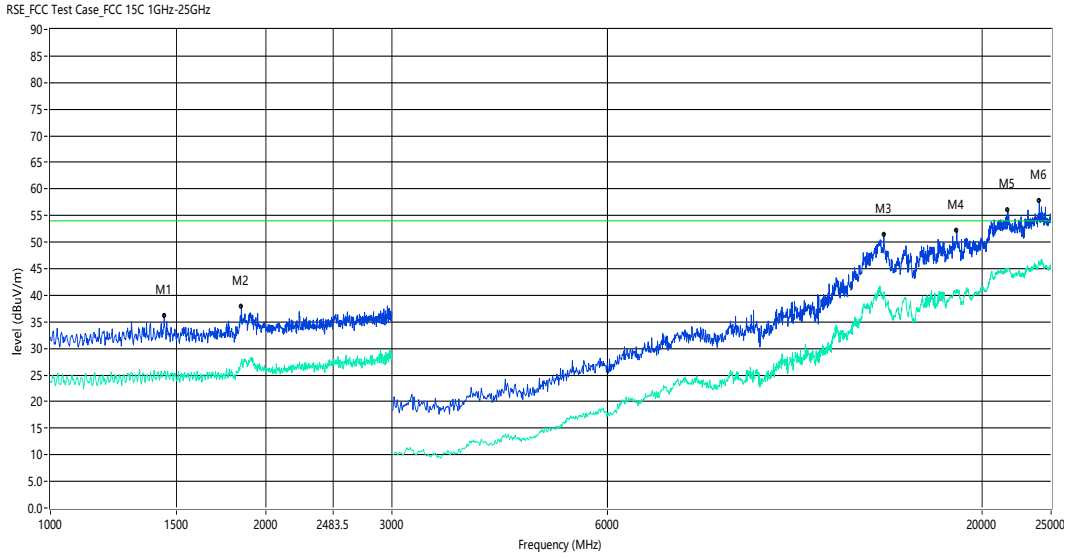
Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1**	1314.000	24.61	-4.64	54.0	-29.39	AV	V	Pass
1	1314.000	35.29	-4.64	74.0	-38.71	Peak	V	Pass
2**	1900.000	28.48	-0.69	54.0	-25.52	AV	V	Pass
2	1900.000	37.09	-0.69	74.0	-36.91	Peak	V	Pass
3**	8860.000	25.23	12.15	54.0	-28.77	AV	V	Pass
3	8860.000	35.20	12.15	74.0	-38.80	Peak	V	Pass
4**	14368.000	41.02	24.92	54.0	-12.98	AV	V	Pass
4	14368.000	51.07	24.92	74.0	-22.93	Peak	V	Pass
5**	21628.000	44.70	23.98	54.0	-9.30	AV	V	Pass
5	21628.000	55.30	23.98	74.0	-18.70	Peak	V	Pass
6**	24292.000	45.40	23.21	54.0	-8.60	AV	V	Pass
6	24292.000	55.91	23.21	74.0	-18.09	Peak	V	Pass



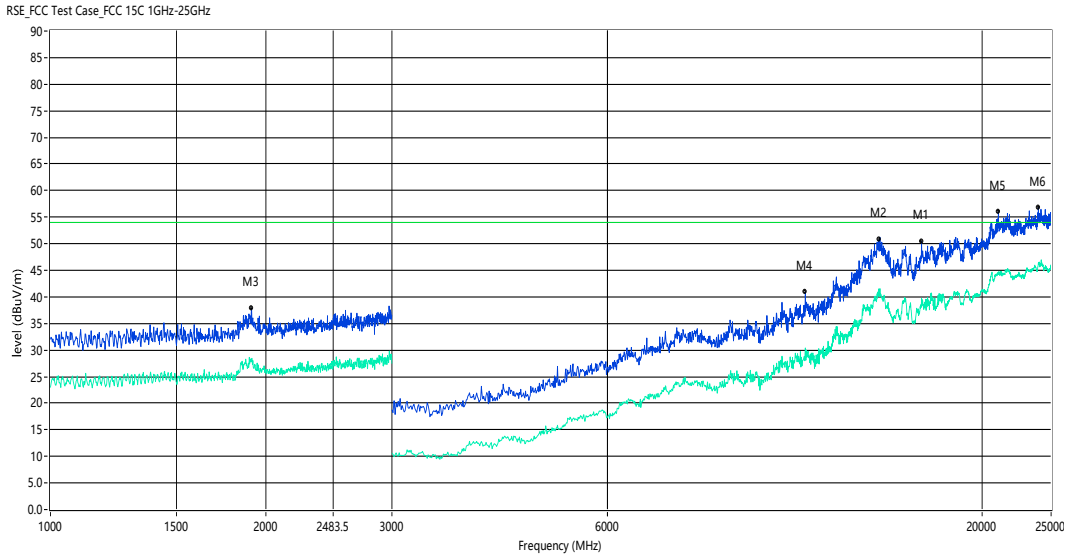
GFSK Mid Channel Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	OverLimit (dB)	Detector	ANT	Verdict
1**	1442.000	25.27	-4.15	54.0	-28.73	AV	H	Pass
1	1442.000	36.11	-4.15	74.0	-37.89	Peak	H	Pass
2**	1848.000	27.11	-1.26	54.0	-26.89	AV	H	Pass
2	1848.000	37.79	-1.26	74.0	-36.21	Peak	H	Pass
3**	14596.000	40.24	24.15	54.0	-13.76	AV	H	Pass
3	14596.000	51.42	24.15	74.0	-22.58	Peak	H	Pass
4**	18460.000	41.07	22.54	54.0	-12.93	AV	H	Pass
4	18460.000	52.10	22.54	74.0	-21.90	Peak	H	Pass
5**	21760.000	44.97	23.94	54.0	-9.03	AV	H	Pass
5	21760.000	55.94	23.94	74.0	-18.06	Peak	H	Pass
6**	24064.000	46.30	23.28	54.0	-7.70	AV	H	Pass
6	24064.000	57.69	23.28	74.0	-16.31	Peak	H	Pass



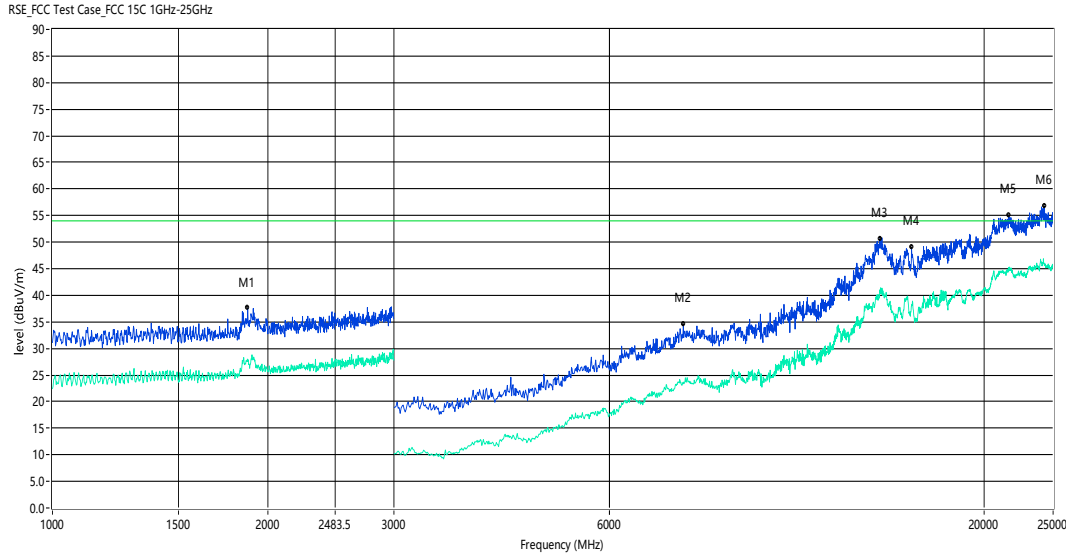
Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1**	16480.000	39.41	22.81	54.0	-14.59	AV	V	Pass
1	16480.000	50.42	22.81	74.0	-23.58	Peak	V	Pass
2**	14368.000	41.00	24.92	54.0	-13.00	AV	V	Pass
2	14368.000	50.71	24.92	74.0	-23.29	Peak	V	Pass
3**	1910.000	28.18	-0.63	54.0	-25.82	AV	V	Pass
3	1910.000	37.87	-0.63	74.0	-36.13	Peak	V	Pass
4**	11340.000	30.39	16.89	54.0	-23.61	AV	V	Pass
4	11340.000	40.96	16.89	74.0	-33.04	Peak	V	Pass
5**	21099.999	44.58	24.11	54.0	-9.42	AV	V	Pass
5	21099.999	56.01	24.11	74.0	-17.99	Peak	V	Pass
6**	23992.001	46.35	23.31	54.0	-7.65	AV	V	Pass
6	23992.001	56.81	23.31	74.0	-17.19	Peak	V	Pass



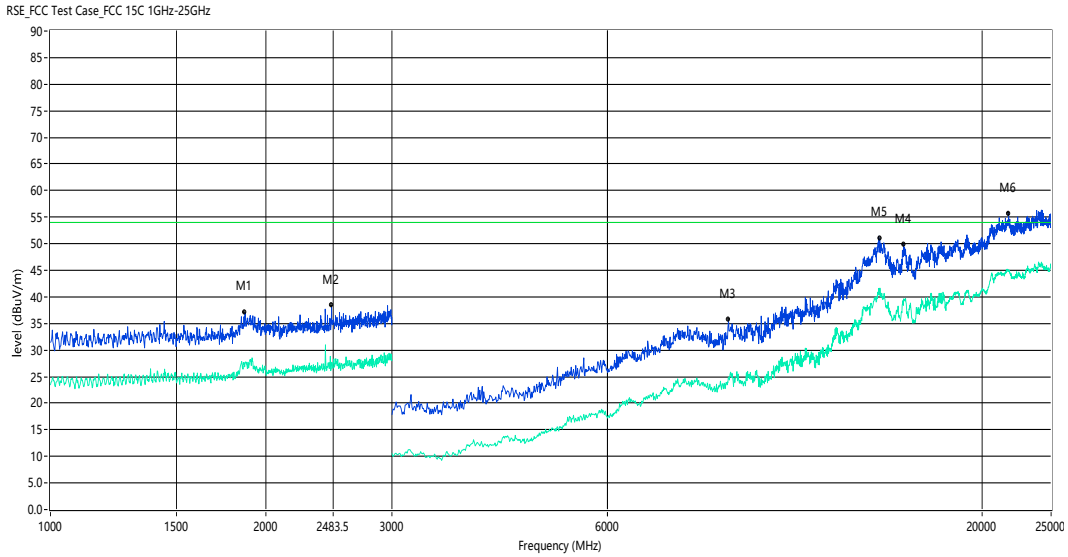
GFSK High Channel Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1**	1874.000	27.57	-0.93	54.0	-26.43	AV	H	Pass
1	1874.000	37.57	-0.93	74.0	-36.43	Peak	H	Pass
2**	7610.000	23.68	10.09	54.0	-30.32	AV	H	Pass
2	7610.000	34.50	10.09	74.0	-39.50	Peak	H	Pass
3**	14320.000	41.04	24.92	54.0	-12.96	AV	H	Pass
3	14320.000	50.28	24.92	74.0	-23.72	Peak	H	Pass
4**	15856.000	38.01	22.10	54.0	-15.99	AV	H	Pass
4	15856.000	49.03	22.10	74.0	-24.97	Peak	H	Pass
5**	21664.000	44.64	23.97	54.0	-9.36	AV	H	Pass
5	21664.000	55.03	23.97	74.0	-18.97	Peak	H	Pass
6**	24316.000	45.76	23.20	54.0	-8.24	AV	H	Pass
6	24316.000	56.73	23.20	74.0	-17.27	Peak	H	Pass



Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	ANT	Verdict
1**	1870.000	27.47	-0.98	54.0	-26.53	AV	V	Pass
1	1870.000	37.07	-0.98	74.0	-36.93	Peak	V	Pass
2**	2470.000	27.22	-0.83	54.0	-26.78	AV	V	Pass
2	2470.000	38.34	-0.83	74.0	-35.66	Peak	V	Pass
3**	8860.000	24.87	12.15	54.0	-29.13	AV	V	Pass
3	8860.000	35.66	12.15	74.0	-38.34	Peak	V	Pass
4**	15556.000	39.64	23.48	54.0	-14.36	AV	V	Pass
4	15556.000	49.83	23.48	74.0	-24.17	Peak	V	Pass
5**	14404.000	40.59	24.76	54.0	-13.41	AV	V	Pass
5	14404.000	50.90	24.76	74.0	-23.10	Peak	V	Pass
6**	21808.001	44.88	23.93	54.0	-9.12	AV	V	Pass
6	21808.001	55.70	23.93	74.0	-18.30	Peak	V	Pass

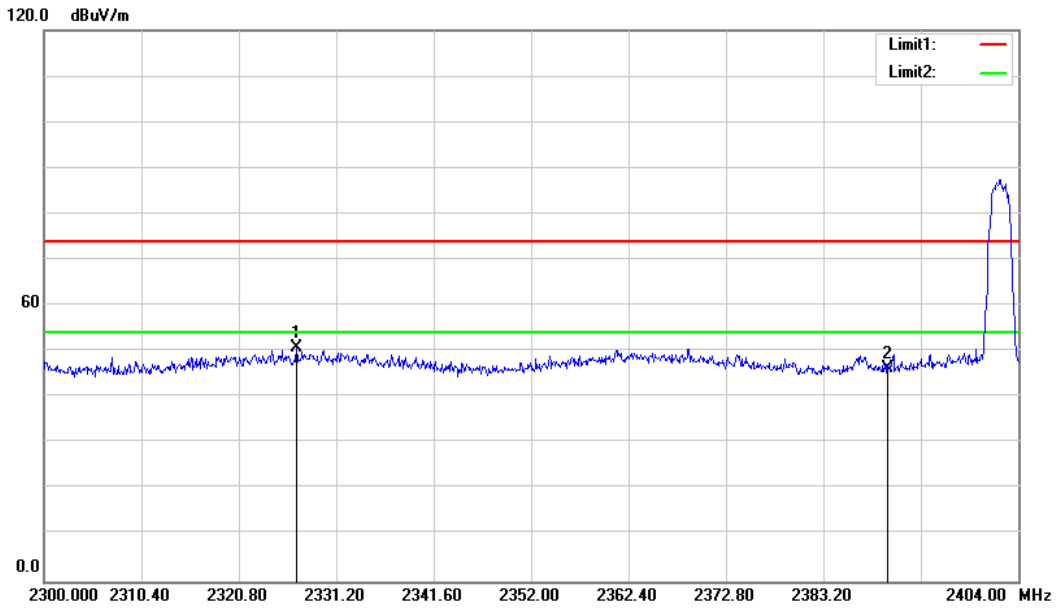
Remark:

- Factor = Antenna Factor + Cable Loss – Pre-amplifier.
- Emission Level = Reading + Factor
Margin = Limit - Emission Level
- 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.



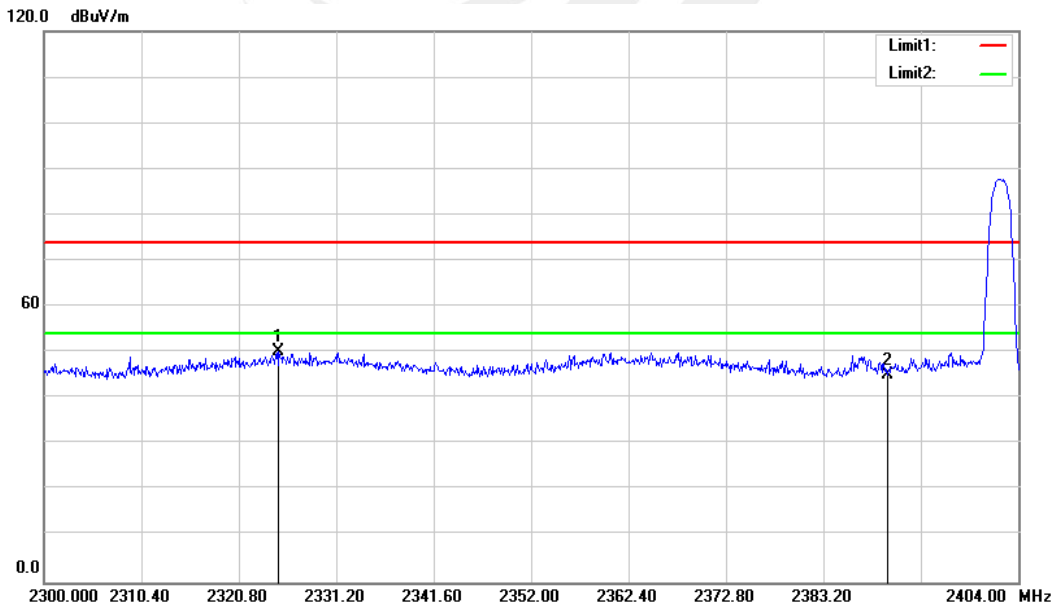
3.2.7 TEST RESULTS (RESTRICTED BAND)

GFSK-Low
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2326.936	61.97	-11.17	50.80	74.00	-23.20	peak
2	2390.000	57.01	-10.75	46.26	74.00	-27.74	peak

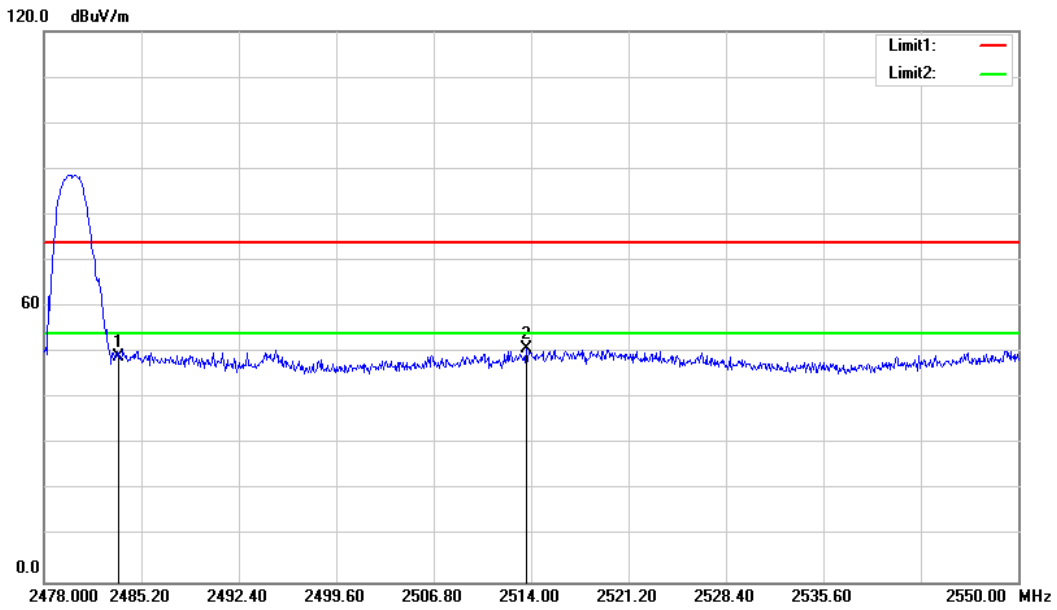
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2325.064	61.33	-11.17	50.16	74.00	-23.84	peak
2	2390.000	55.91	-10.75	45.16	74.00	-28.84	peak

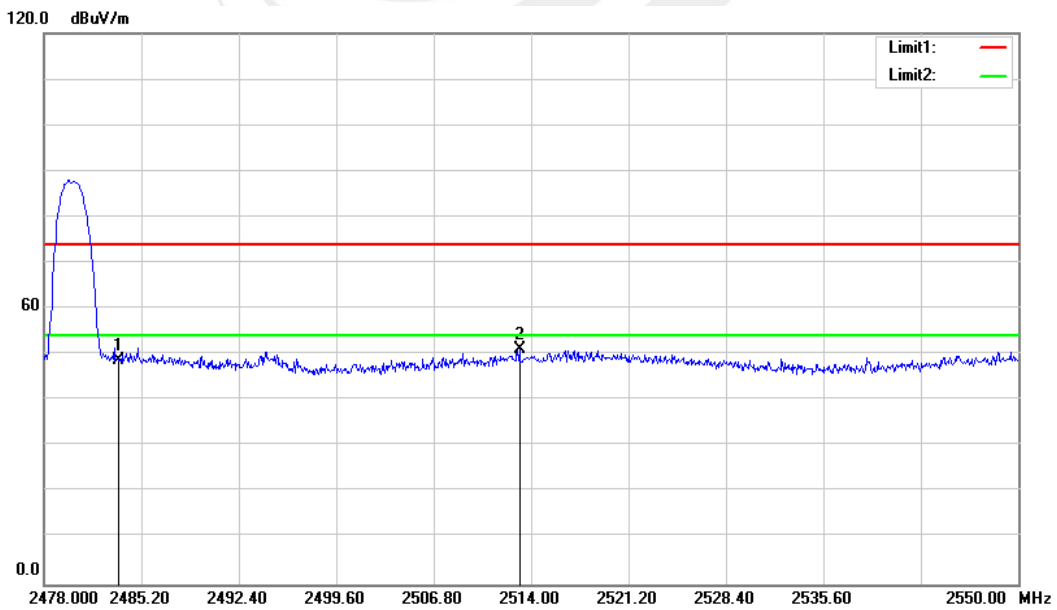


**GFSK-High
Horizontal**



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	59.48	-10.29	49.19	74.00	-24.81	peak
2	2513.640	60.98	-10.17	50.81	74.00	-23.19	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	59.11	-10.29	48.82	74.00	-25.18	peak
2	2513.136	61.31	-10.17	51.14	74.00	-22.86	peak

4 CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 APPLIED PROCEDURES / LIMIT

According to FCC Part 15.247(d) and RSS-247 Clause 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.

4.2 TEST 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

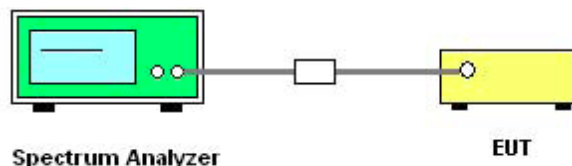
For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 to 2422 MHz Upper Band Edge: 2452 to 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

4.3 DEVIATION FROM STANDARD

No deviation.

4.4 TEST SETUP



The EUT which is powered by the Battery, is coupled 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.

4.5 EUT OPERATION CONDITIONS

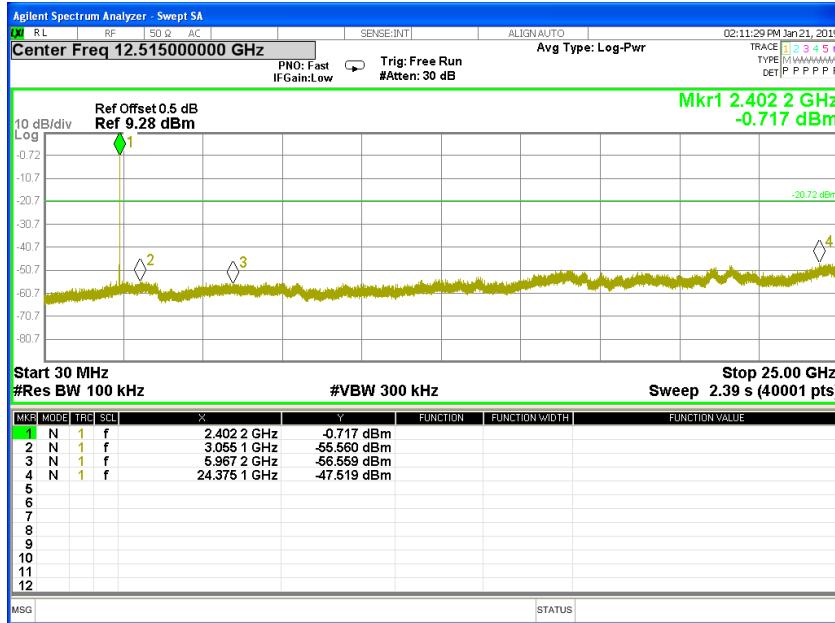
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



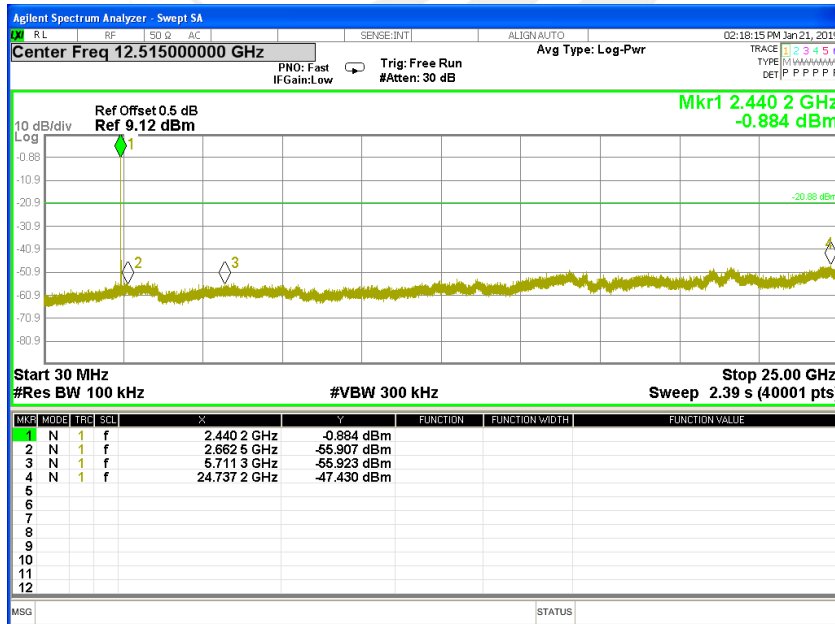
4.6 TEST RESULTS

Temperature :	25 °C	Relative Humidity :	60%
Test Voltage :	DC 3.7V	Test Mode :	TX Mode /CH00, CH20, CH39

CH00

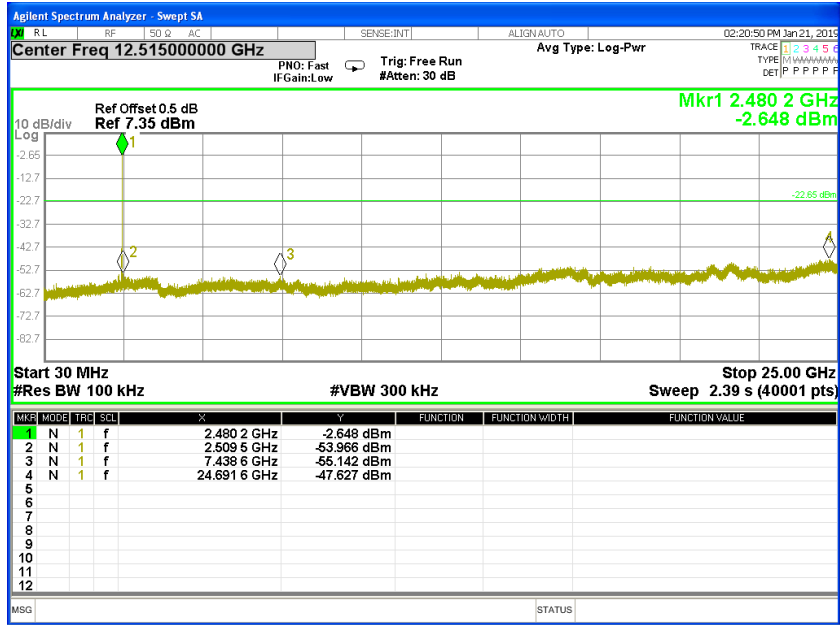


CH20





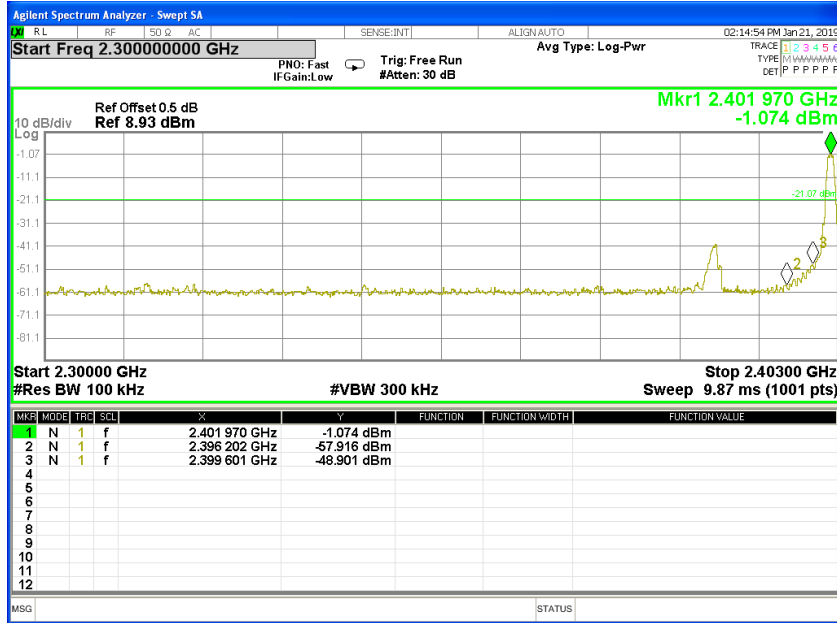
CH39



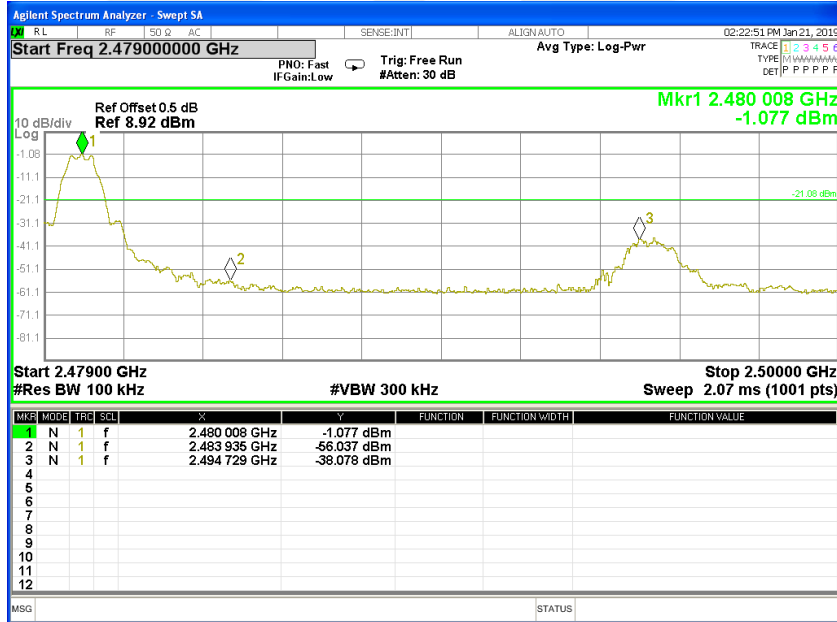


Band edge

CH00



CH39





5 POWER SPECTRAL DENSITY TEST

5.1 APPLIED PROCEDURES / LIMIT

FCC Part 15.247, Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e) RSS-247 Clause 5.2(b)	Power Spectral Density	≤ 8 dBm (RBW ≥ 3 KHz)	2400-2483.5	PASS

5.2 TEST PROCEDURE

- 1) Set analyzer center frequency to DTS channel center frequency.
- 2) Set the span to 1.5 times the DTS channel bandwidth.
- 3) Set the $100 \text{ kHz} \geq \text{RBW} \geq 3 \text{ kHz}$.
- 4) Set the $\text{VBW} \geq 3 \times \text{RBW}$.
- 5) Detector = peak.
- 6) Sweep time = auto couple.
- 7) Trace mode = max hold.
- 8) Allow trace to fully stabilize.
- 9) Use the peak marker function to determine the maximum amplitude level.
- 10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



5.5 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.

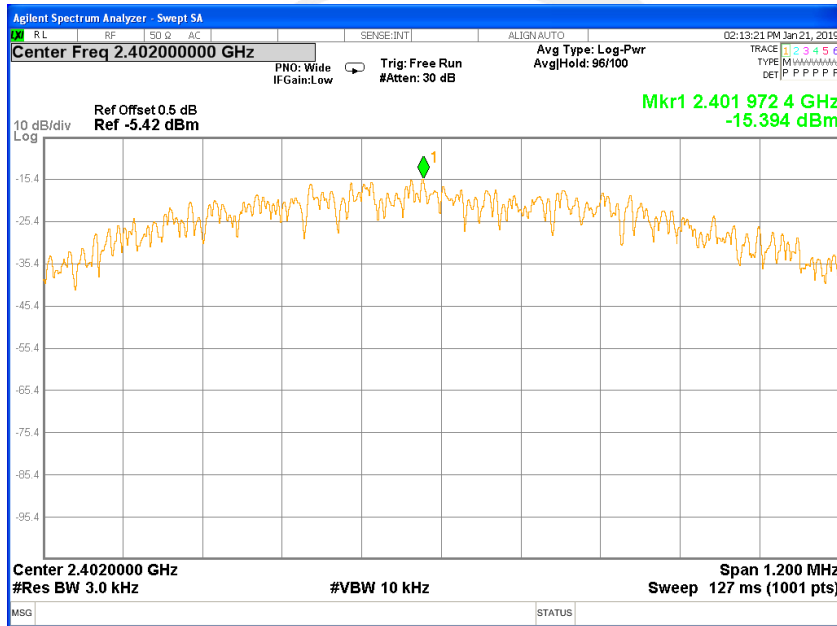


5.6 TEST RESULTS

Temperature:	25 °C	Relative Humidity:	60%
Test Voltage:	DC 3.7V	Test Mode:	TX Mode /CH00, CH20, CH39

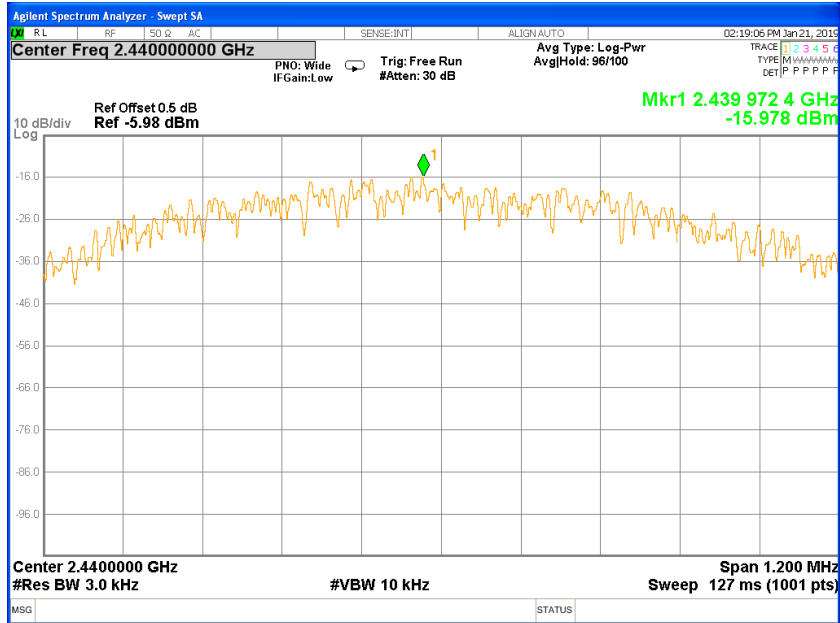
Test Mode	Frequency (MHz)	Power Density (dBm/3kHz)	Limit (dBm/3KHz)	Result
BLE mode (1 Mbps)	2402.00	-15.394	≤ 8.00	PASS
	2440.00	-15.978	≤ 8.00	PASS
	2480.00	-15.531	≤ 8.00	PASS

TX CH00

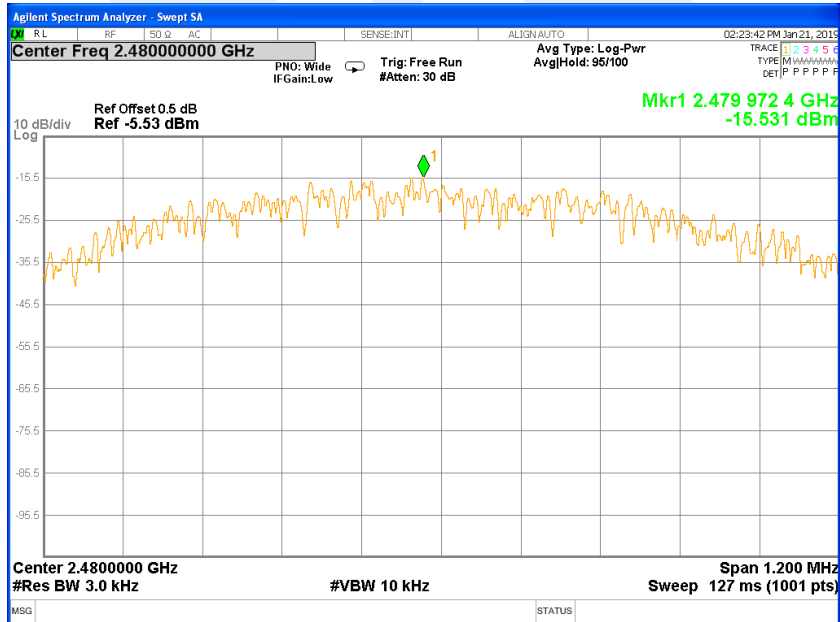




TX CH20



TX CH39





6 BANDWIDTH TEST

6.1 APPLIED PROCEDURES / LIMIT

FCC Part 15.247, Subpart C RSS-247 Issue 2 & RSS-Gen Issue 5				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2) RSS-247 Clause 5.2(b)	6dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5	PASS
RSS-Gen Clause 6.6	99% Bandwidth	-	2400-2483.5	PASS

6.2 TEST PROCEDURE

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW \geq 3RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 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.



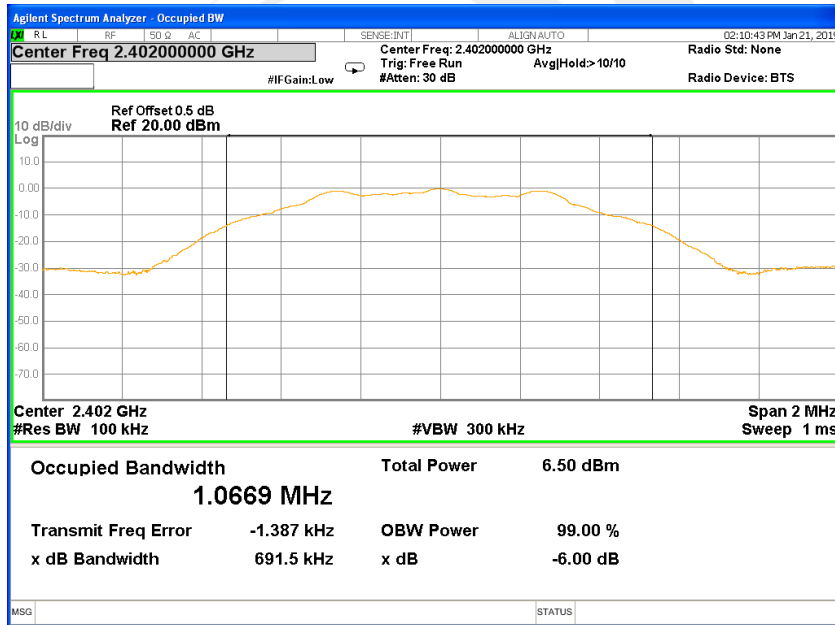
6.6 TEST RESULTS

Temperature:	25 °C	Relative Humidity:	60%
Test Voltage:	DC 3.7V	Test Mode:	TX Mode /CH00, CH20, CH39

Remark: PEAK DETECTOR IS USED

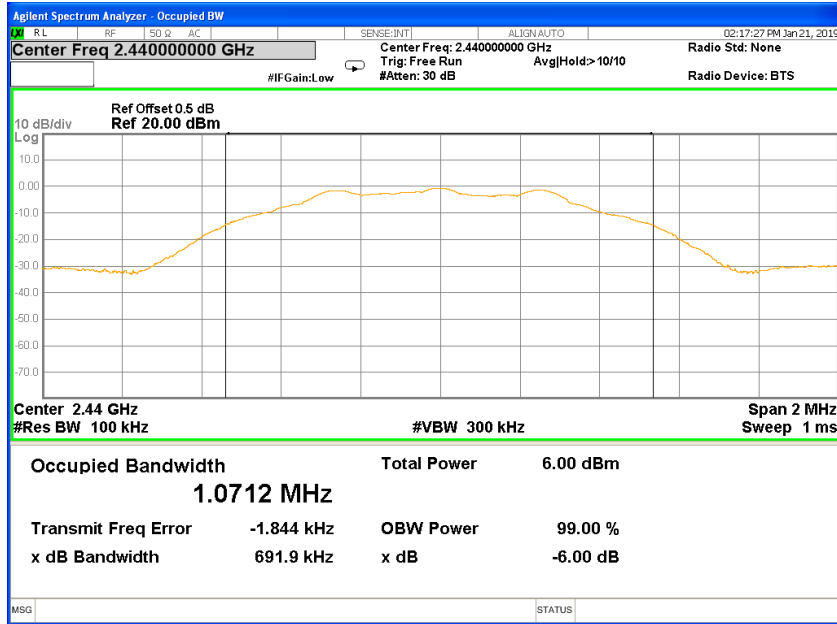
Test Mode	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit of 6dB Bandwidth (MHz)	Result
BLE mode (1 Mbps)	2402.00	0.691	1.052	≥ 0.50	PASS
	2440.00	0.692	1.056	≥ 0.50	PASS
	2480.00	0.694	1.061	≥ 0.50	PASS

6dB Bandwidth
TX CH00

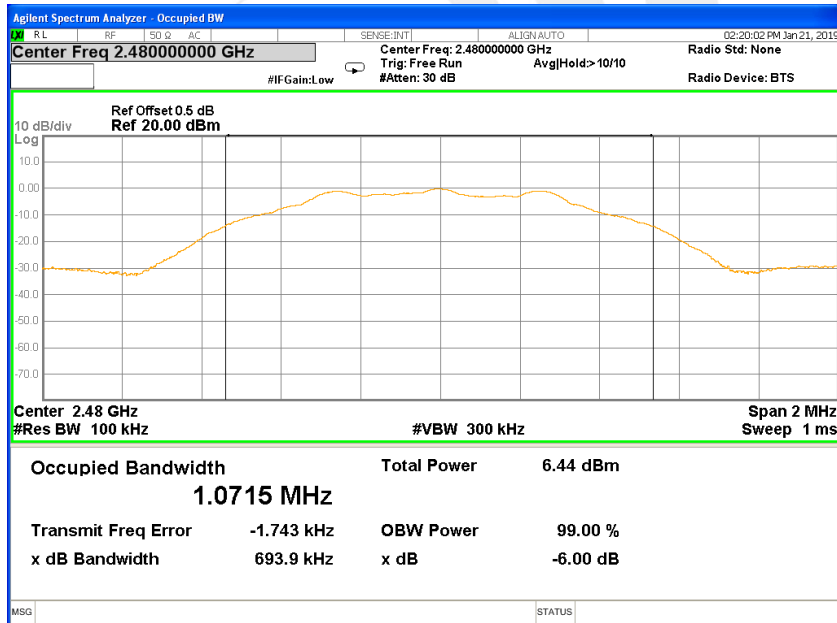




TX CH20

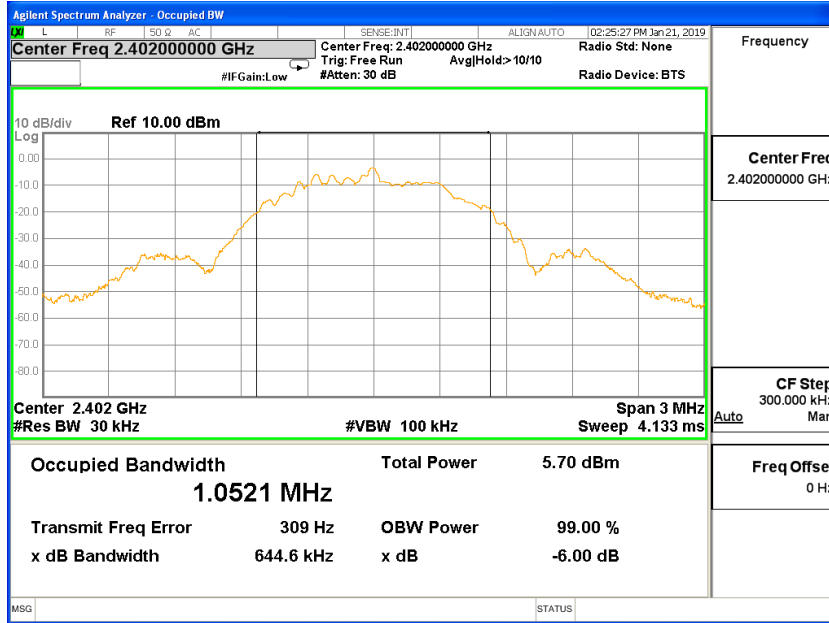


TX CH39

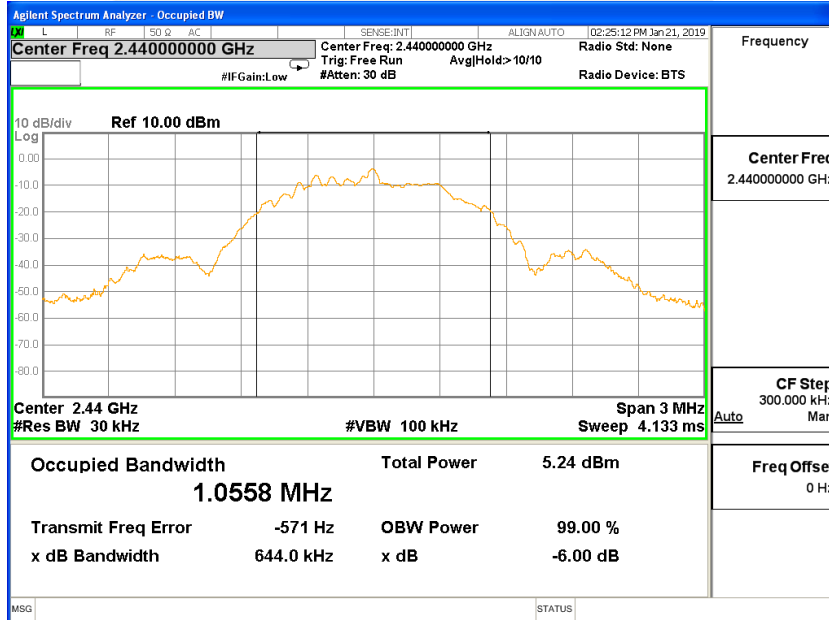




99% Bandwidth TX CH00

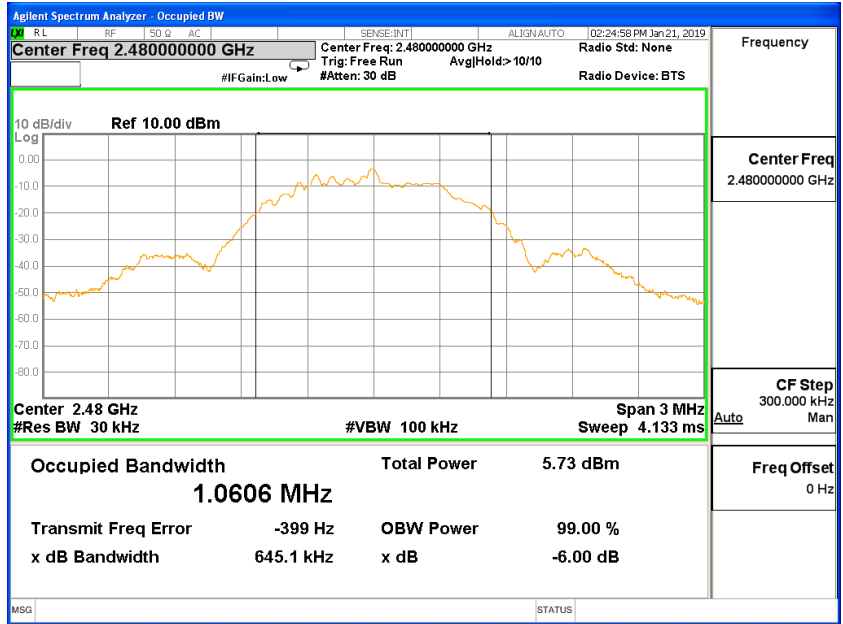


TX CH20





TX CH39





7 PEAK OUTPUT POWER TEST

7.1 APPLIED PROCEDURES / LIMIT

FCC Part 15.247, Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3) RSS-247 Clause 5.4(d)	Output Power	1 watt or 30dBm	2400-2483.5	PASS

7.2 TEST PROCEDURE

- a. The EUT was directly connected to the Power Sensor

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 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.



7.6 TEST RESULTS

Temperature :	25 °C	Relative Humidity :	60%
Test Voltage :	DC 3.7V		

Test Channel	Frequency (MHz)	Conducted Output Power		Limit (dBm)
		Peak(dBm)	AVG(dBm)	
CH00	2402.00	-0.43	-2.52	30.00
CH20	2440.00	-0.53	-2.61	30.00
CH39	2480.00	-0.68	-2.75	30.00

Note:

- 1) The cable loss and antenna gain are taken into account in results.
- 2) Antenna gain(G): -1.5 dBi
- 3) The max. e.i.r.p = conducted power + antenna gain = -4.02 dBm



8 ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

15.203 and RSS-Gen Issue 5 requirement: For intentional device, according to 15.203 and RSS-Gen Issue 5: 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.

8.2 EUT ANTENNA

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

