

FCC PART 15C TEST REPORT FOR CERTIFICATION

On Behalf of

Hangzhou LMenergysolution lighting co.,ltd

FCC ID: 2AX48LMICBT

Report Type:

Original report

Product Type:

Bluetooth module

Test Engineer: Clint Chen



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Reviewed By: Lion Li

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The device described above is tested by Standard-Tech Co., Ltd. Testing Center. to confirm comply with all the FCC Part 15 Subpart C requirements. The test results are contained in this test report and Standard-Tech Co., Ltd. Testing Center is assumed full responsibility for the accuracy and completeness of these tests. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements. This Report is made under FCC Part 2.1074. No modifications were required during testing to bring this product into compliance. This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Standard-Tech Co., Ltd. Testing Center.

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1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT has been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	Standard	Results
Power Line Conducted Emission	FCC Part 15: 15.207	N/A
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.205	PASS
Band Edge Compliance	FCC Part 15: 15.247(d)	PASS
Conducted spurious emissions	FCC Part 15: 15.247(d)	PASS
6dB Bandwidth Test	FCC Part 15: 15.247(a)	PASS
Peak Output Power	FCC Part 15: 15.247(b)	PASS
Power Spectral Density	FCC Part 15: 15.247(e)	PASS
Antenna requirement	FCC Part 15: 15.203	PASS

2. GENERAL INFORMATION

2.1. Description of Equipment Under Test

Applicant	Hangzhou LMenergysolution lighting co.,ltd
Manufacturer	Hangzhou LMenergysolution lighting co.,ltd
Factory	Hangzhou LMenergysolution lighting co.,ltd
Product	Bluetooth module
Model No.	CSIG-BT50
Power Adapter	3.3V
Sample Type	Prototype production
Date of Receipt	2020/09/20
Date of Test	2020/09/28-2020/10/20

2.2.Feature of Equipment Under Test

Product Feature & Specification	
BLE	
Hardware version	BT_nRF_V1.0
Software version	V1.21.2
Modulation Type	QPSK
Operating Frequency Range	The frequency range used is 2402MHz-2480MHz(40)channels, at intervals of 1/2MHz)
Bluetooth Version	Bluetooth LE

Antenna System

BLE	
Type of Antenna	PCB Antenna
Antenna number	1
Antenna Peak Gain	Peak Gain: 0dBi

2.3.Tested Supporting System Details

RF Test Tool: nRFgo Studio

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Notebook	X220i	428632C
Lenovo	Adapter	42T4420	N322

External I/O Cable

Cable Description	Length (m)	From Port	To
Data Cable	0.1	EUT	Debug Board

2.4. Test Information

Frequency band(MHz)				2400-2480			
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

2.5. Equipments Used during the Test

Conducted Emissions

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Shielding Room	AUDIX	N/A	N/A	2018/07/28	3 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESR7	101487	2020/07/29	2 Year
3.	V-LISN	Rohde & Schwarz	NNLK 8122	8122-00128	2019/07/20	2 Year
4.	RF Cable	YuanDao	RG223	N/A	2020/05/25	1 Year
5.	Test Software	AUDIX	e3	N/A	N/A	N/A

Note: N/A means Not applicable.

For frequency range 30MHz~1000MHz (In 3m Anechoic Chamber)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Semi-anechoic chamber	AUDIX	N/A	N/A	2018/11/18	3 Year
2.	EMI Test Receiver	R&S	ESR7	101487	2020/07/29	2 Year
3.	Biconical Logarithmic Antenna	SCHWARDZBECK	VULB 9162	9162-104	2019/01/06	2 Year
4.	Cable Line	PEWC	CFD400NL	N/A	2020/05/25	1 Year
5.	Loop Antenna	Beijing Daze	ZN30900C	1062	2019/12/20	1 Year
6.	Test Software	AUDIX	e3	N/A	N/A	1 Year

Note: N/A means Not applicable.

For frequency range above 1GHz (In 3m Anechoic Chamber)

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Semi-anechoic chamber	AUDIX	N/A	N/A	2018/11/18	3 Year
2	Spectrum Analyzer	R&S	FSP	100615	2019/12/11	1 Year
3	Horn Antenna	SCHWARDZBECK	BBHA 9170	895	2019/12/14	2 Year
4	Horn Antenna	SCHWARDZBECK	BBHA 9120 D	9120D-1515	2019/12/14	2 Year
5	Broadband Preamplifier	SCHWARDZBECK	BBV9718	9718-269	2019/12/19	2 Year
6	Broadband Preamplifier	SKET	LNPA-1840	SK2019121201	2019/12/16	2 Year
7	RF Cable	SKET	RC-40G-K-M /K-M-0.6M	N/A	2019/12/16	1 Year
8	RF Cable	SKET	RC-40G-K-M /K-M-0.6M	N/A	2019/12/16	1 Year
9	Test Software	AUDIX	e3	N/A	N/A	N/A

Note: N/A means Not applicable.

RF Conducted Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analyzer	R&S	FSP	100615	2019/12/11	1 Year
2.	RF Cable	STD	/	/	/	/

2.6. Test Facility

Site Description

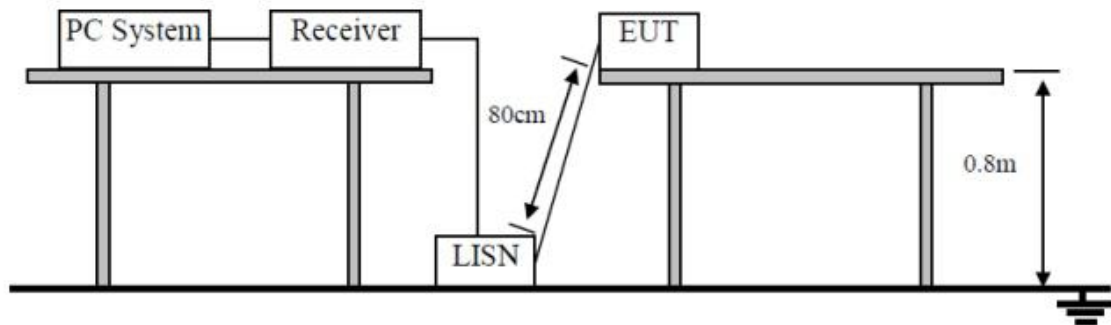
Name of Firm	:	Standard-Tech Co., Ltd. Testing Center Standard-Tech Building, No. 6 Guanhong Road, Guangzhou Science City, Guangzhou 510663, China
EMC Lab.	:	Certificated by Industry Canada Registration Number: 20901 Valid Date: 2020/02/28 Certificated by FCC USA. Designation No.: CN1222 Valid Date: 2020/02/28

2.7.Measurement Uncertainty (95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Conduction emission test in No. 1 Conduction	2.42dB(150KHz to 30MHz)
Uncertainty for Radiation Emission test in 3m chamber	3.94dB(30M~1GHz, Distance: 3m)
Uncertainty for Radiation Emission test in 3m chamber(1GHz-25GHz)	4.92dB(1~6GHz, Distance: 3m)
	5.24dB(6~40GHz, Distance: 3m)
Uncertainty for Output power test	0.67dB
Uncertainty for Bandwidth test	83kHz

3. POWER LINE CONDUCTED EMISSION TEST

3.1. Block Diagram of Test Setup



3.2. Power Line Conducted Emission Test Limits

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μ V)	Average Level dB(μ V)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

3.3. Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power Via PC connected to the power mains through a line impedance stabilization network (V-LISN). This provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs). The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Test.

The bandwidth of test receiver (R & S ESR7) is set at 9kHz.

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

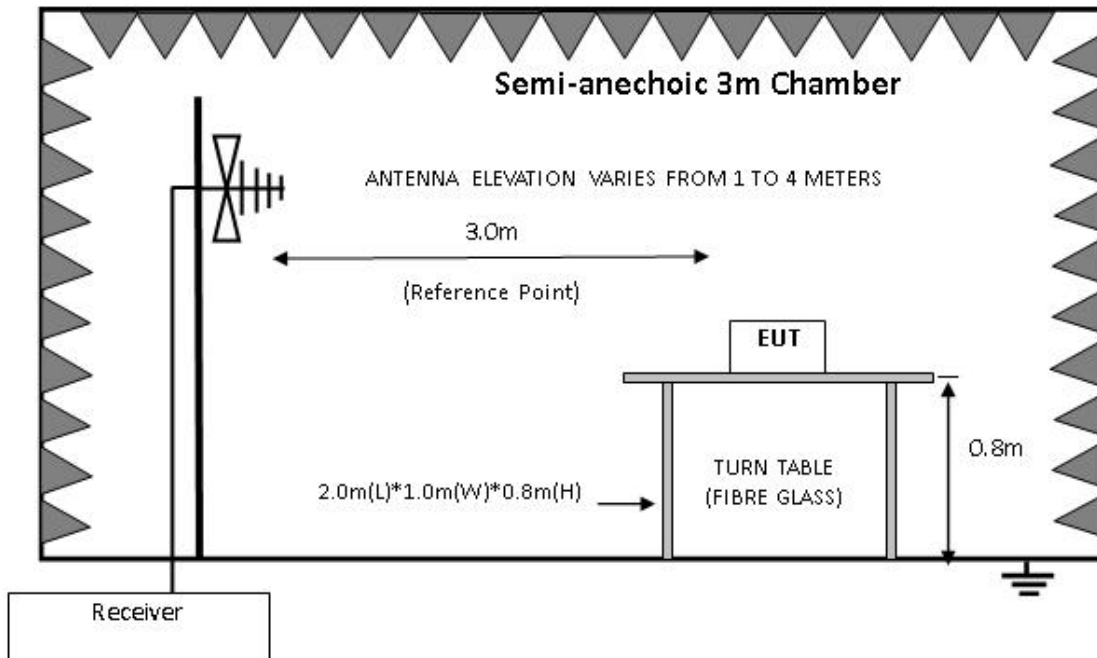
3.4. Power Line Conducted Emission Test Result

N/A

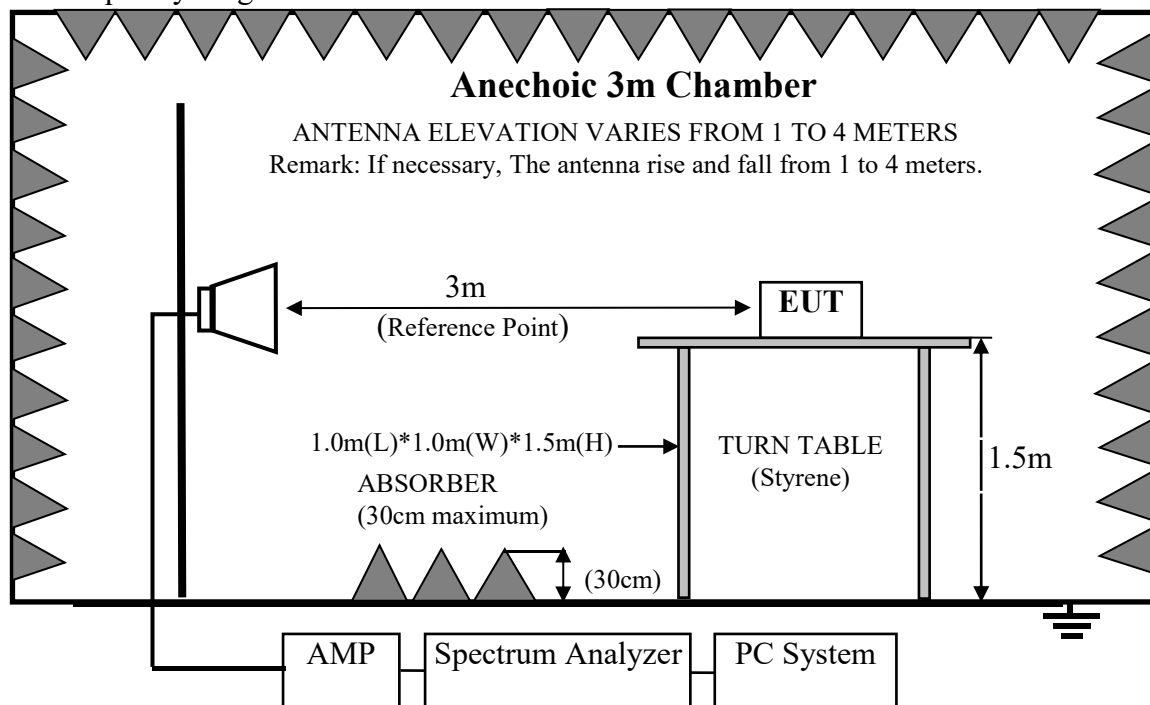
4. RADIATED EMISSION TEST

4.1. Block Diagram of Test Setup

For frequency range 30MHz-1000MHz



For frequency range above 1GHz



4.2.Radiated Emission Limit

15.247&209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V/m}$	$\text{dB}(\mu\text{V})/\text{m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average)	

- Remark: (1) Emission level $\text{dB}\mu\text{V} = 20 \log$ Emission level $\mu\text{V/m}$
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

15.205 Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

4.3.Test Procedure

Frequency below 30MHz:

The EUT setup on the turn table which has 0.8m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

EUT and its simulators are placed on a turn table, which is 0.8 meter high above ground for frequency 30MHz~1000MHz, 1.5 meter high above ground for frequency above 1GHz and put the absorbing with 2.4m(L)*2.4m(W)*0.3m(H) on the ground . The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it.EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna

(calibrated bilog antenna) is used as receiving antenna for frequency 30MHz~1000MHz, and the Horn antenna is used as receiving antenna for frequency above 1GHz. Both horizontal and vertical polarization of the antenna is set on Test. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.10-2013 on radiated emission Test.

The bandwidth of the EMI test receiver (R&S ESR7) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz

4.4. Radiated Emission Test Results

PASS.

Note 1: Final Level= Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

Note 2: The emissions (9kHz~30MHz) not reported for there is no emission be found.

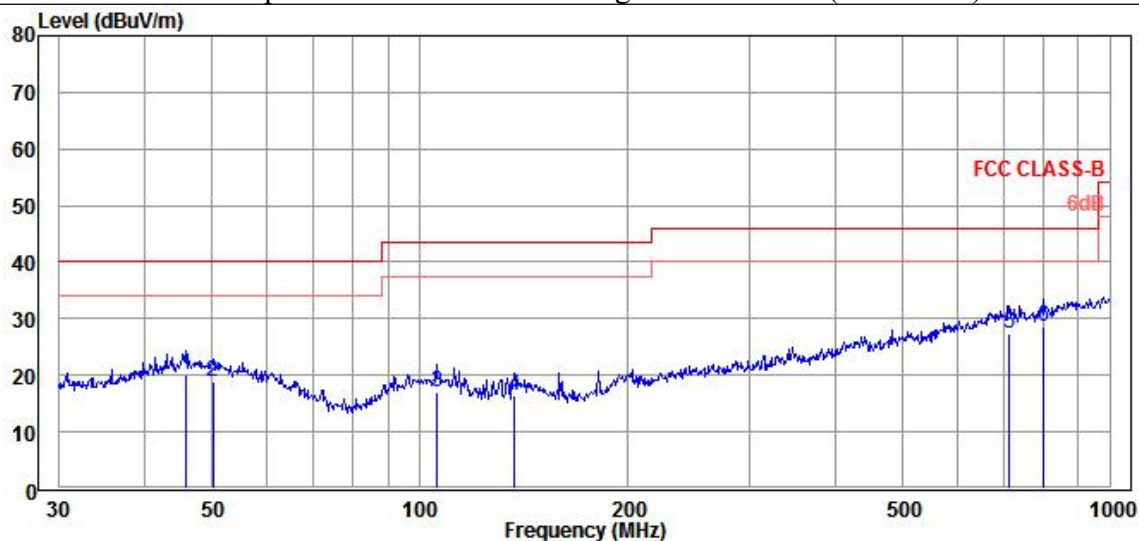
Note 3: The emission levels of other frequencies(test frequency bang is above 1GHz) are very lower than the limit and not show in test report.

Frequency: 30MHz~1GHz

Polarization:

Horizontal(A19-9.5-T/B1BJ/14D/XTY)

EUT operation mode: Transmitting in low channel(worst case)

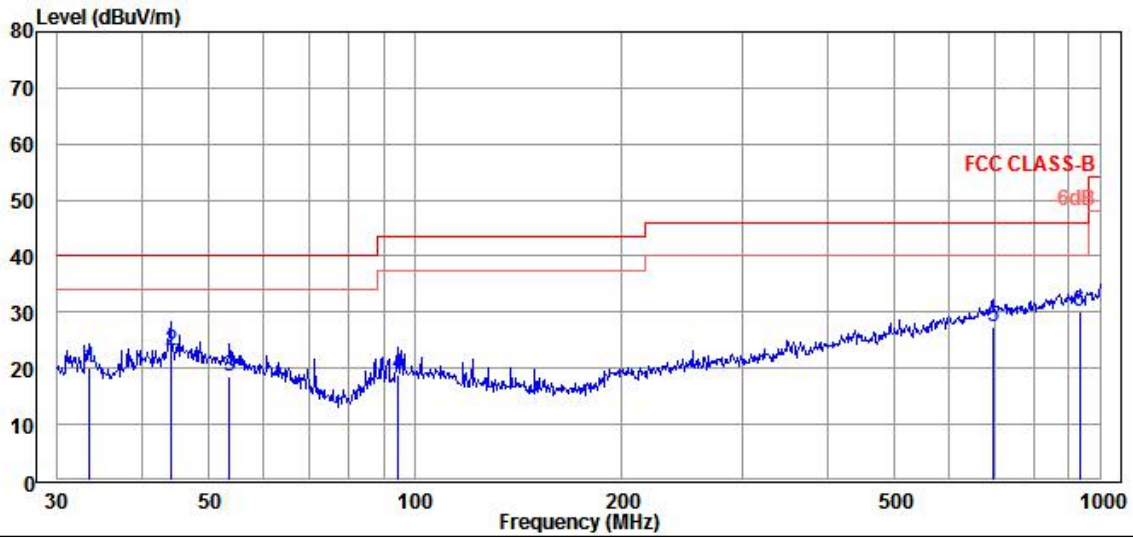


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	45.69	20.19	-2.66	22.85	40.00	-19.81	Horizontal	QP
2	50.06	18.80	-4.09	22.89	40.00	-21.20	Horizontal	QP
3	105.64	16.90	-3.68	20.58	43.50	-26.60	Horizontal	QP
4	136.94	16.28	-0.80	17.08	43.50	-27.22	Horizontal	QP
5	714.17	27.34	-2.75	30.09	46.00	-18.66	Horizontal	QP
6	798.98	28.56	-2.68	31.24	46.00	-17.44	Horizontal	QP

Polarization:

Vertical(A19-9.5-T/B1BJ/14D/XTY)

EUT operation mode: Transmitting in low channel(worst case)



	Freq	Level	Read	Limit	Over		
	MHz	dBuV/m	Level	Factor	Line	Limit	Pol/Phase
			dBuV	dB/m	dBuV/m	dB	Remark
1	33.33	20.20	0.77	19.43	40.00	-19.80	Vertical QP
2	43.97	23.24	0.61	22.63	40.00	-16.76	Vertical QP
3	53.51	18.41	-3.81	22.22	40.00	-21.59	Vertical QP
4	94.10	18.76	-0.77	19.53	43.50	-24.74	Vertical QP
5	696.86	27.32	-2.64	29.96	46.00	-18.68	Vertical QP
6	932.27	30.04	-2.65	32.69	46.00	-15.96	Vertical QP

Frequency: 1GHz~25GHz

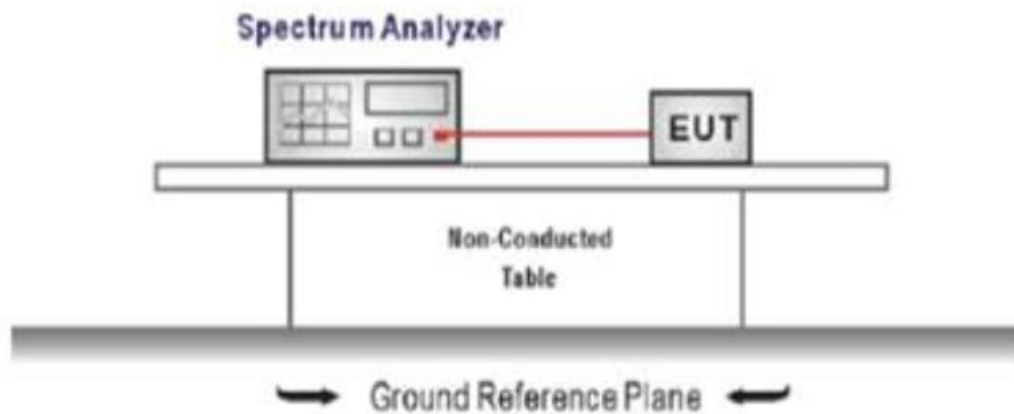
QPSK					CH00			
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3312.00	36.94	38.95	-2.01	74.00	-37.06	Horizontal	Peak
2	4910.00	48.20	46.41	1.79	74.00	-25.80	Horizontal	Peak
3	7800.00	45.69	35.72	9.97	74.00	-28.31	Horizontal	Peak
4	10826.00	51.45	35.87	15.58	74.00	-22.55	Horizontal	Peak
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	1918.00	22.84	27.38	-4.54	54.00	-31.16	Horizontal	Average
2	3006.00	25.08	27.24	-2.16	54.00	-28.92	Horizontal	Average
3	8242.00	33.97	23.58	10.39	54.00	-20.03	Horizontal	Average
4	11166.00	38.93	22.81	16.12	54.00	-15.07	Horizontal	Average
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3006.00	36.87	39.03	-2.16	74.00	-37.13	Vertical	Peak
2	4808.00	41.81	40.31	1.50	74.00	-32.19	Vertical	Peak
3	8208.00	46.58	36.20	10.38	74.00	-27.42	Vertical	Peak
4	10928.00	50.96	35.14	15.82	74.00	-23.04	Vertical	Peak
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	1816.00	23.47	28.35	-4.88	54.00	-30.53	Vertical	Average
2	4978.00	26.34	24.35	1.99	54.00	-27.66	Vertical	Average
3	8242.00	33.95	23.56	10.39	54.00	-20.05	Vertical	Average
4	11540.00	38.91	22.58	16.33	54.00	-15.09	Vertical	Average

QPSK					CH19			
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2020.00	43.28	47.49	-4.21	74.00	-30.72	Horizontal	Peak
2	4876.00	46.34	44.64	1.70	74.00	-27.66	Horizontal	Peak
3	8718.00	47.45	36.60	10.85	74.00	-26.55	Horizontal	Peak
4	9364.00	50.00	37.53	12.47	74.00	-24.00	Horizontal	Peak
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3006.00	25.15	27.31	-2.16	54.00	-28.85	Horizontal	Average
2	4876.00	27.12	25.42	1.70	54.00	-26.88	Horizontal	Average
3	8208.00	34.17	23.79	10.38	54.00	-19.83	Horizontal	Average
4	11166.00	39.09	22.97	16.12	54.00	-14.91	Horizontal	Average
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2088.00	44.78	48.88	-4.10	74.00	-29.22	Vertical	Peak
2	3720.00	40.68	42.13	-1.45	74.00	-33.32	Vertical	Peak
3	7052.00	45.02	37.52	7.50	74.00	-28.98	Vertical	Peak
4	10962.00	50.76	34.86	15.90	74.00	-23.24	Vertical	Peak
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3006.00	25.04	27.20	-2.16	54.00	-28.96	Vertical	Average
2	4876.00	26.83	25.13	1.70	54.00	-27.17	Vertical	Average
3	8242.00	34.16	23.77	10.39	54.00	-19.84	Vertical	Average
4	11200.00	38.88	22.74	16.14	54.00	-15.12	Vertical	Average

QPSK					CH39			
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	2122.00	42.77	46.80	-4.03	74.00	-31.23	Horizontal	Peak
2	4944.00	42.37	40.48	1.89	74.00	-31.63	Horizontal	Peak
3	8242.00	46.75	36.36	10.39	74.00	-27.25	Horizontal	Peak
4	10928.00	51.21	35.39	15.82	74.00	-22.79	Horizontal	Peak
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3006.00	25.01	27.17	-2.16	54.00	-28.99	Horizontal	Average
2	6712.00	29.81	23.31	6.50	54.00	-24.19	Horizontal	Average
3	8242.00	33.97	23.58	10.39	54.00	-20.03	Horizontal	Average
4	11200.00	38.99	22.85	16.14	54.00	-15.01	Horizontal	Average
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3006.00	39.58	41.74	-2.16	74.00	-34.42	Vertical	Peak
2	4944.00	40.34	38.45	1.89	74.00	-33.66	Vertical	Peak
3	7868.00	46.09	35.97	10.12	74.00	-27.91	Vertical	Peak
4	11574.00	51.06	34.77	16.29	74.00	-22.94	Vertical	Peak
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
1	3006.00	25.05	27.21	-2.16	54.00	-28.95	Vertical	Average
2	4128.00	24.94	25.42	-0.48	54.00	-29.06	Vertical	Average
3	8242.00	34.04	23.65	10.39	54.00	-19.96	Vertical	Average
4	11166.00	39.12	23.00	16.12	54.00	-14.88	Vertical	Average

5. CONDUCTED SPURIOUS EMISSIONS

5.1. Block Diagram of Test Setup



5.2. Limit

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum 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.

5.3. Test Procedure

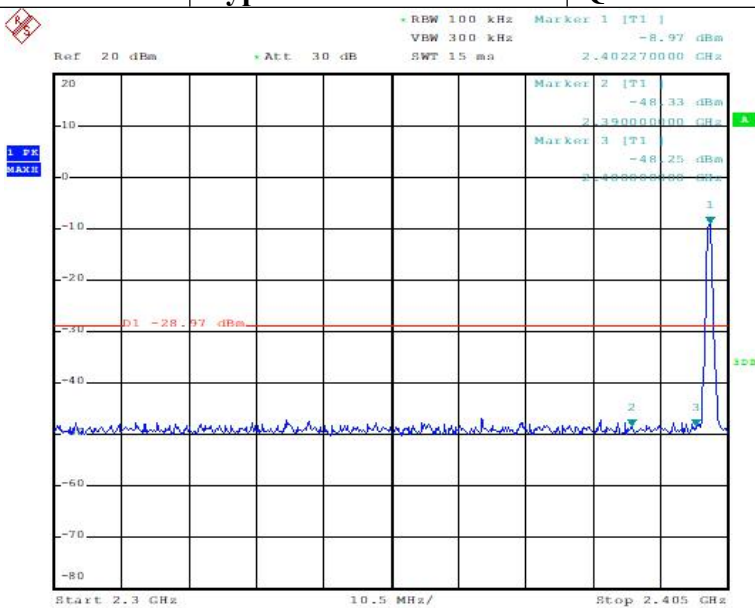
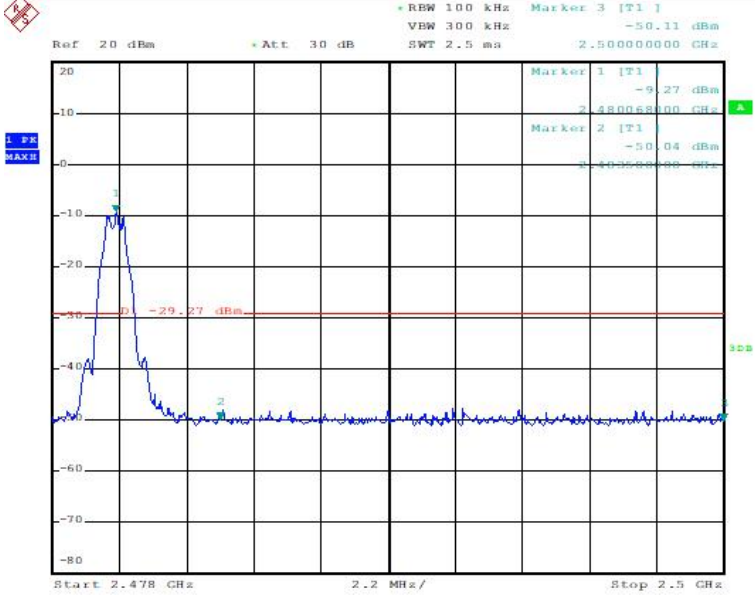
Use the test method described in ANSI C63.10:

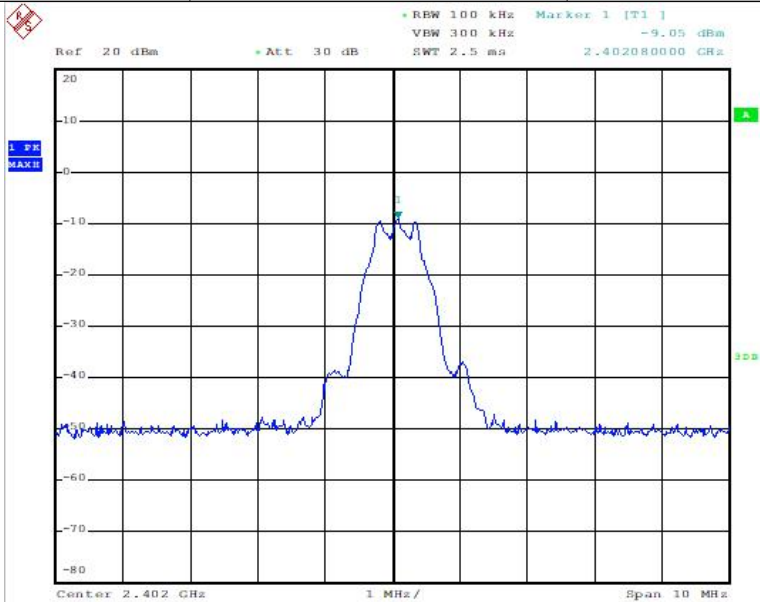
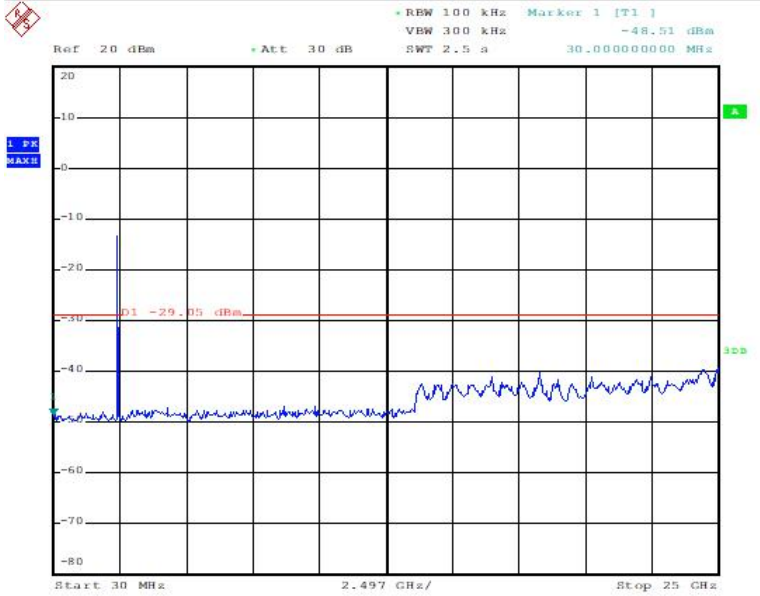
The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz and measure all the emissions with peak detector.

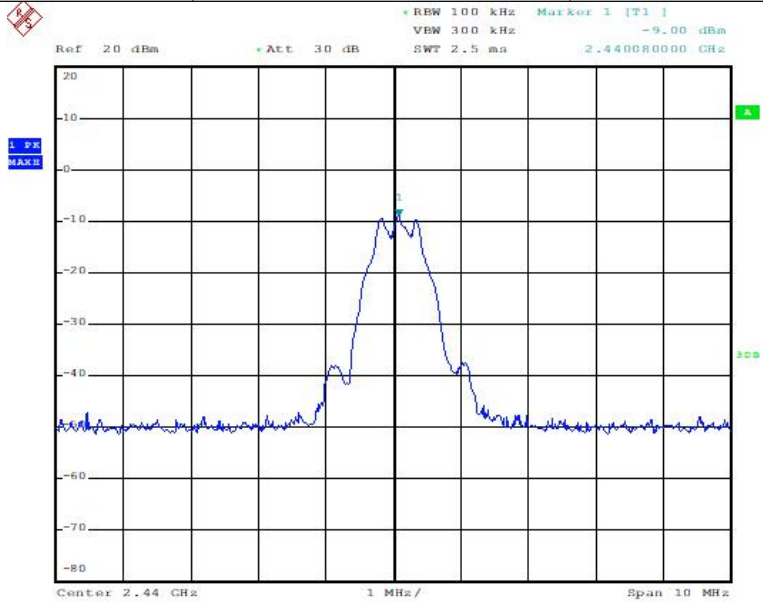
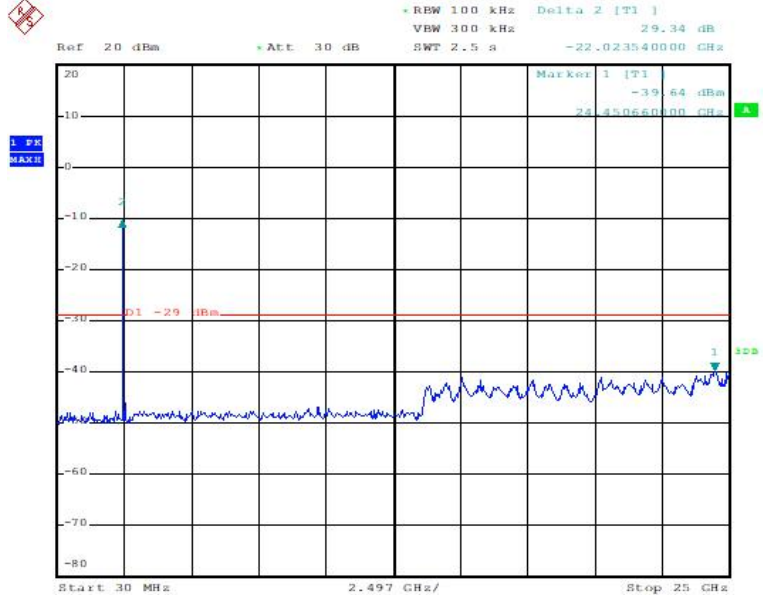
Note: The cable loss and attenuator loss were offset into spectrum analyzer as an amplitude offset.

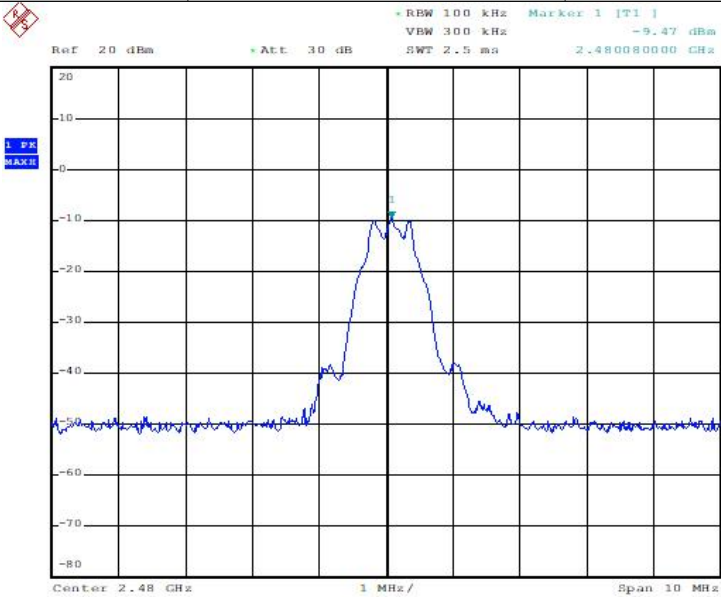
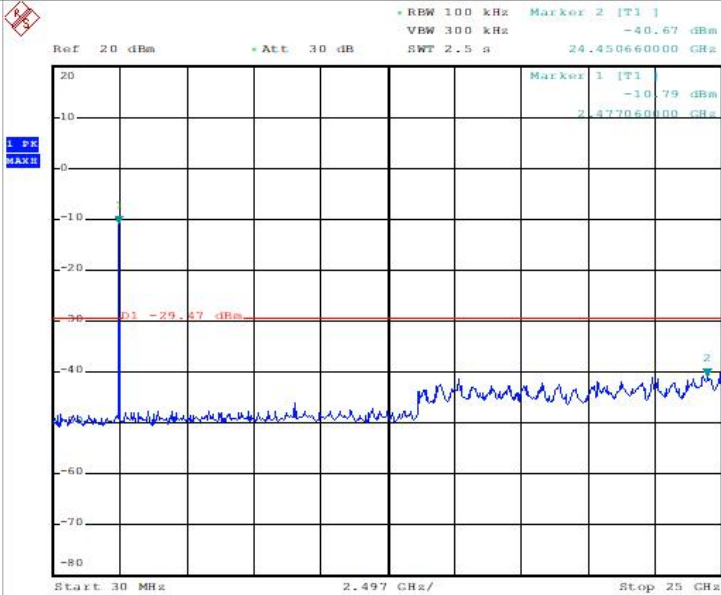
5.4. Test result

PASS (The testing data was attached in the next pages.)

Test Item:	Bandedge	Type:	QPSK
CH00	 Ref: 20 dBm Att: 30 dB SWT: 15 ms Marker 1 [T1] -8.97 dBm Marker 2 [T1] -48.33 dBm Marker 3 [T1] -48.25 dBm Start 2.3 GHz 10.5 MHz/ Stop 2.405 GHz		
CH39	 Ref: 20 dBm Att: 30 dB SWT: 2.5 ms Marker 1 [T1] -9.27 dBm Marker 2 [T1] -50.04 dBm Start 2.478 GHz 2.2 MHz/ Stop 2.5 GHz		

Test Item:	SE	Type:	QPSK
CH00 Reference level		 Ref: 20 dBm Att: 30 dB RBW: 100 kHz VBW: 300 kHz SWT: 2.5 ms Marker 1 [T1] -9.05 dBm 2.40280000 GHz Center: 2.402 GHz 1 MHz/ Span: 10 MHz	
CH00 30MHz-25GMHz		 Ref: 20 dBm Att: 30 dB RBW: 100 kHz VBW: 300 kHz SWT: 2.5 ms Marker 1 [T1] -48.51 dBm 30.00000000 MHz Start: 30 MHz 2.497 GHz/ Stop: 25 GHz	

Test Item:	SE	Type:	QPSK
CH19 Reference level	 Ref 20 dBm Att 30 dB VSWR 300 kHz SWT 2.5 ms 2.440080000 GHz Center 2.44 GHz 1 MHz/ Span 10 MHz		
CH19 30MHz-25GMHz	 Ref 20 dBm Att 30 dB VSWR 300 kHz SWT 2.5 s -22.023540000 GHz Start 30 MHz 2.497 GHz/ Stop 25 GHz		

Test Item:	SE	Type:	QPSK
CH39 Reference level			
CH39 30MHz-25GMHz			

6. BAND EDGE COMPLIANCE TEST

6.1.Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

6.2.Test Procedure

Use the test method described in ANSI C63.10 clause 6.10:

1. The EUT is placed on a turntable, which is 1.5m above the ground plane and worked at highest radiated power.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz; VBW=3MHz; Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz; VBW=10Hz; Sweep=AUTO

6.3.Test Results

Pass (The testing data was attached in the next pages.)

QPSK				CH00					
Horizontal		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2310.00	32.23	35.90	-3.67	74.00	-41.77	Horizontal	Peak
	2	2390.00	32.00	35.52	-3.52	74.00	-42.00	Horizontal	Peak
		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2310.00	23.19	26.86	-3.67	54.00	-30.81	Horizontal	Average
	2	2390.00	21.74	25.26	-3.52	54.00	-32.26	Horizontal	Average

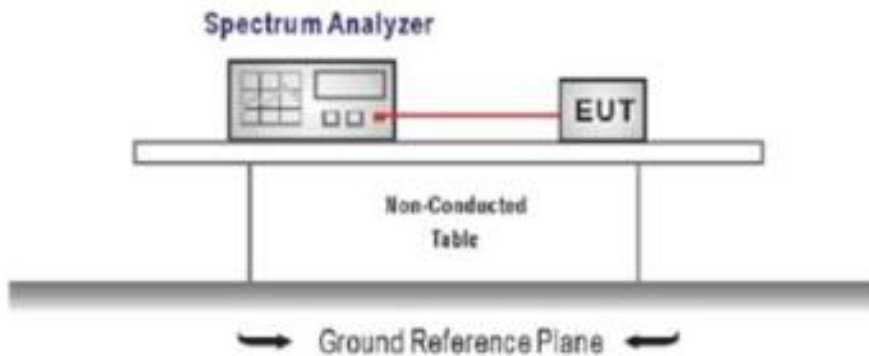
QPSK				CH00					
Vertical		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2310.00	32.74	36.41	-3.67	74.00	-41.26	Vertical	Peak
	2	2390.00	31.59	35.11	-3.52	74.00	-42.41	Vertical	Peak
		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2310.00	19.58	23.25	-3.67	54.00	-34.42	Vertical	Average
	2	2390.00	20.41	23.93	-3.52	54.00	-33.59	Vertical	Average

QPSK				CH39					
Horizontal		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2483.50	41.57	44.91	-3.34	74.00	-32.43	Horizontal	Peak
	2	2500.00	37.15	40.46	-3.31	74.00	-36.85	Horizontal	Peak
		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2483.50	19.25	22.59	-3.34	54.00	-34.75	Horizontal	Average
	2	2500.00	21.02	24.33	-3.31	54.00	-32.98	Horizontal	Average

QPSK				CH39					
Vertical		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2483.50	38.72	42.06	-3.34	74.00	-35.28	Vertical	Peak
	2	2500.00	33.01	36.32	-3.31	74.00	-40.99	Vertical	Peak
		Freq	Level	Read Level	Factor	Limit Line	Over Limit	Pol/Phase	Remark
		MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB		
	1	2483.50	22.40	25.74	-3.34	54.00	-31.60	Vertical	Average
	2	2500.00	21.18	24.49	-3.31	54.00	-32.82	Vertical	Average

7. 6dB Bandwidth Test

7.1. Block Diagram of Test Setup



7.2. Limit

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

7.3. Test Procedure

Use the test method described in ANSI C63.10 Section 11.8.2:

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

7.4. Test Results

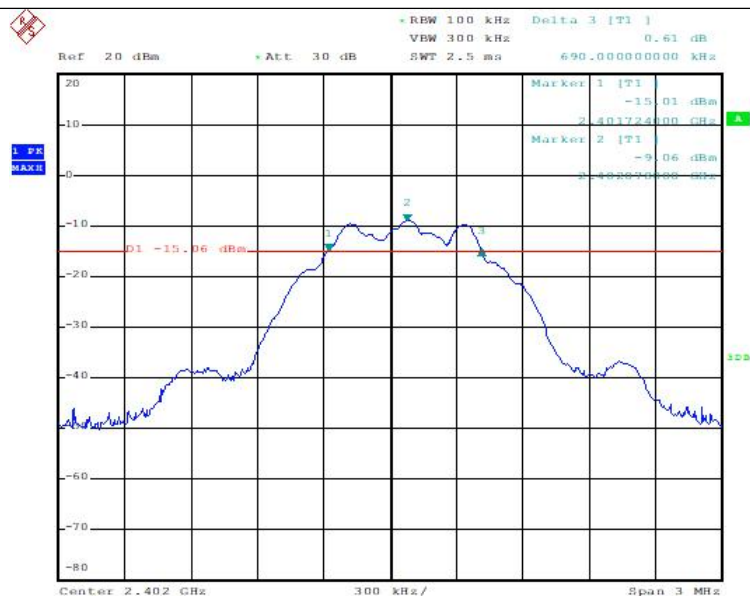
Pass

Test Mode	CH	-6dB bandwidth (MHz)	Limit (KHz)
QPSK	CH00	0.690	≧ 500
	CH19	0.690	
	CH39	0.696	
Conclusion: PASS			

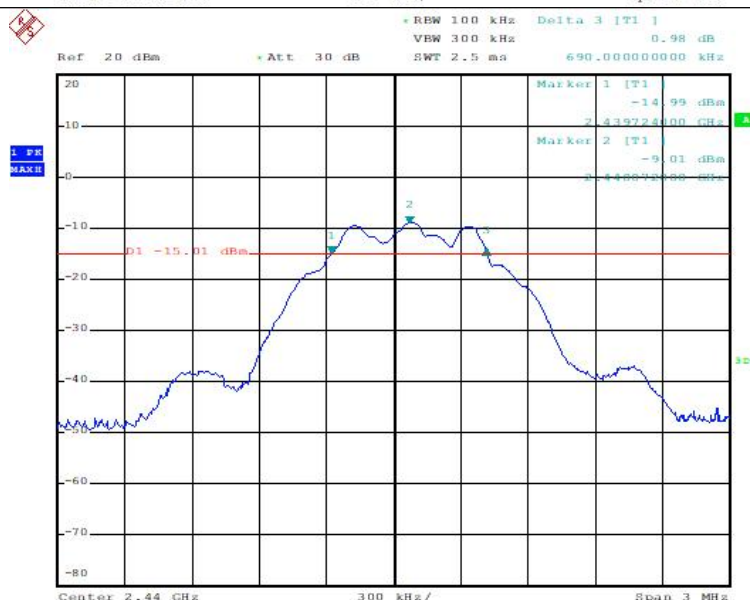
Type:

QPSK

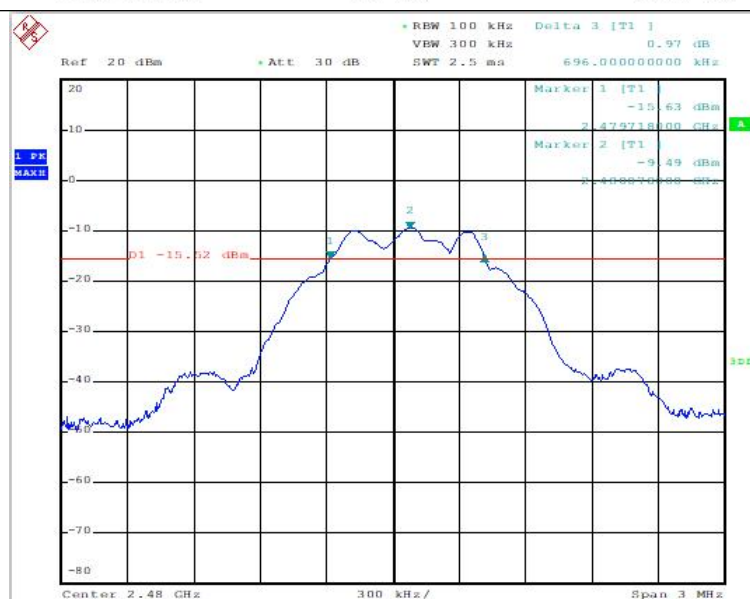
CH00



CH19



CH39



8. OUTPUT POWER TEST

8.1.Limit (FCC Part 15C 15.247 b(3))

For systems using digital modulation in the 2400—2483.5MHz, The Peak output Power shall not exceed 1W(30dBm), As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

8.2.Test Procedure

- 1, Connected the EUT's antenna port to Spectrum Analyzer.
- 2, Use the test method descried in ANSI C63.10:
 - 1) Set span to at least 1.5 times the OBW.
 - 2) Set RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
 - 3) Set VBW $\geq [3 \times \text{RBW}]$.
 - 4) Sweep time = auto.
 - 5) Detector = peak
 - 6) Trace mode = max hold
 - 7) Allow trace to fully stabilize; Use peak marker function to determine the peak amplitude level.

Note: The cable loss needs to be compensated into the data.

8.3.Test Results

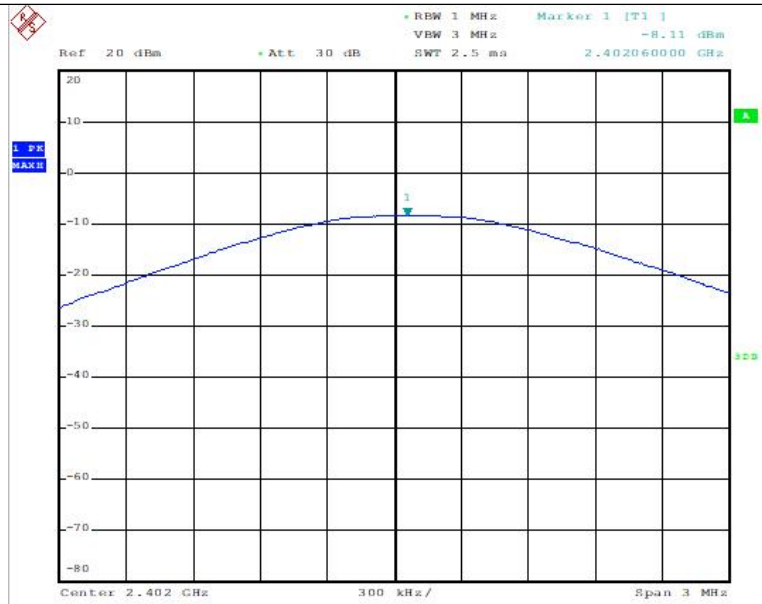
Pass

Channel	Frequency (MHz)	Output power		Limit	
		(dBm)	(W)	(dBm)	(W)
00	2402	-8.11	0.00015	30	1
19	2440	-7.76	0.00017		
39	2480	-9.15	0.00012		

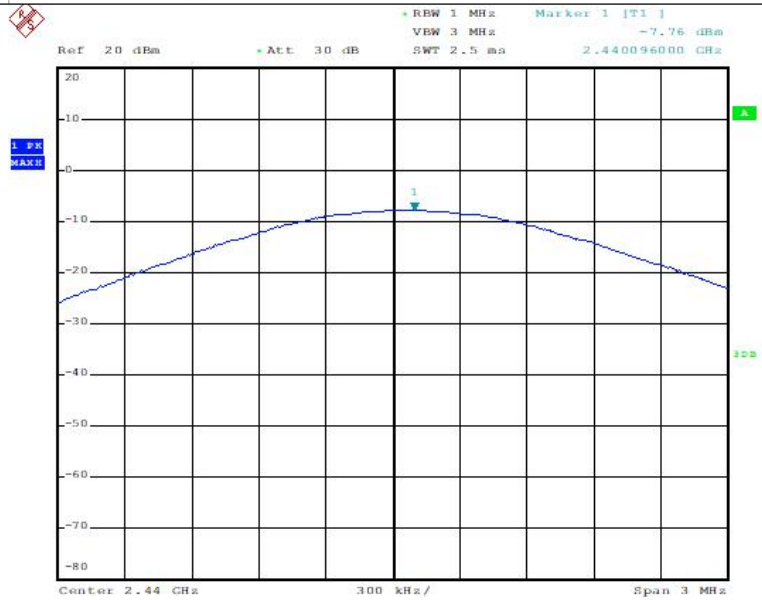
Type:

QPSK

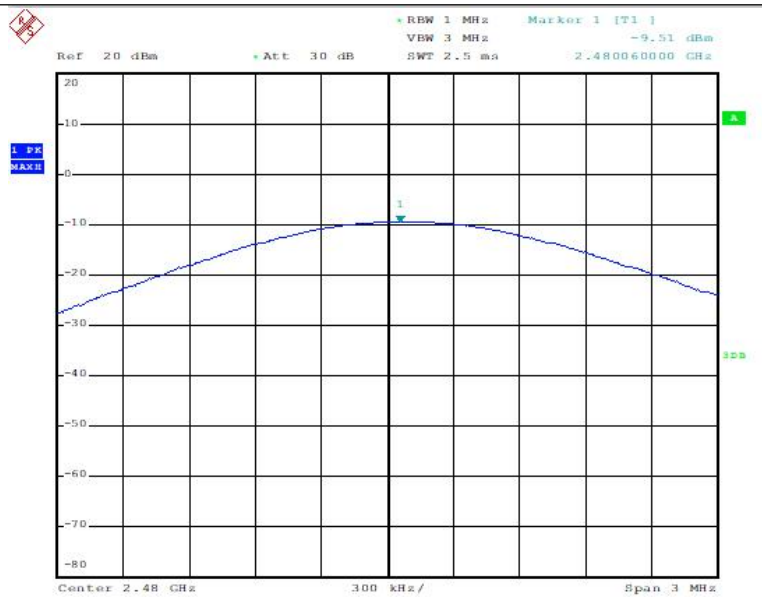
CH00



CH19



CH39



9. POWER SPECTRAL DENSITY TEST

9.1.Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

9.2.Test Procedure

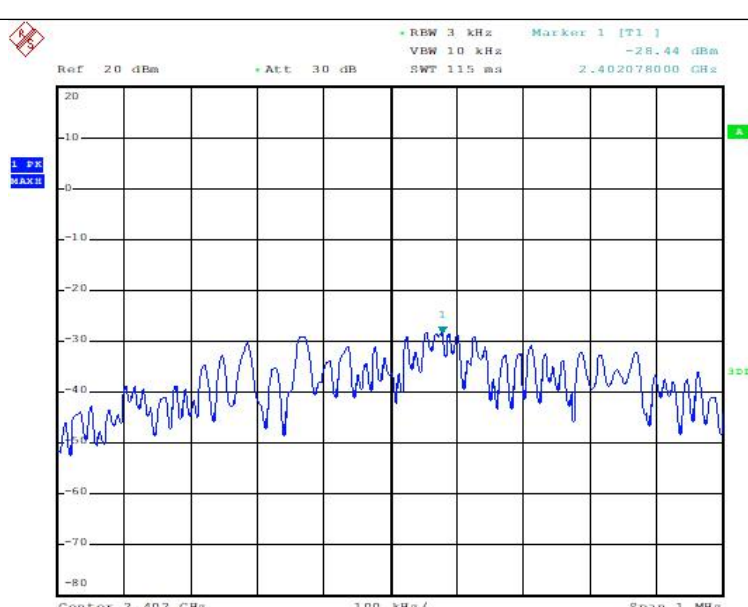
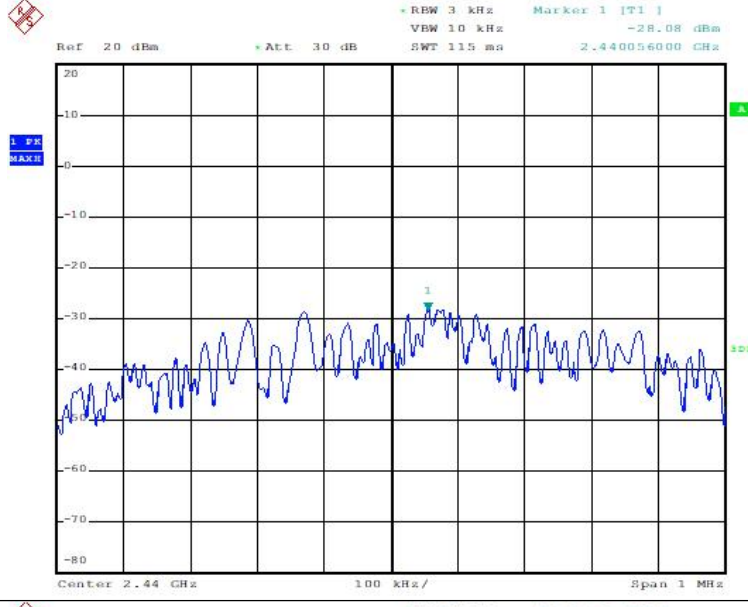
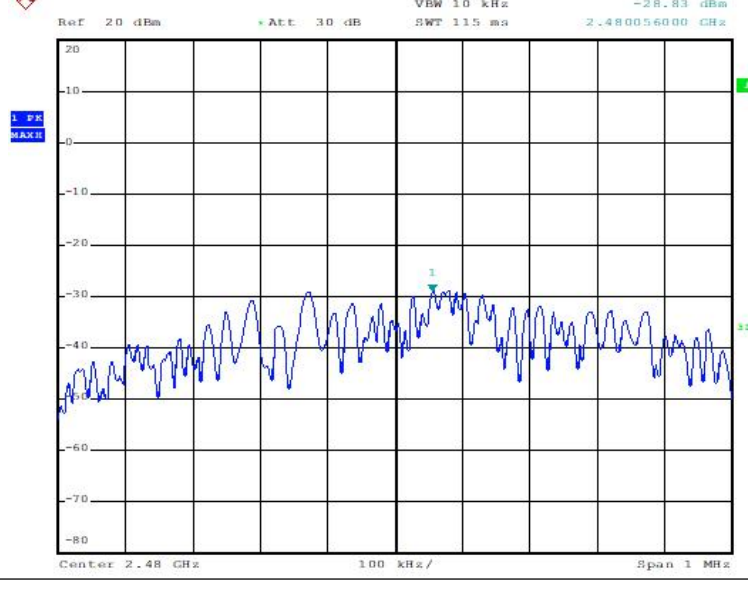
Use the test method described in ANSI C63.10 clause 11.10.2:

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

9.3.Test Results

Pass

Channel	Frequency(MHz)	Power density (dBm/3KHz)	Limit (dBm/3KHz)
CH00	2402	-28.44	8
CH19	2440	-28.08	
CH39	2480	-28.83	
Conclusion: PASS			

Type:	QPSK
CH00	 Ref 20 dBm + Att 30 dB RBW 3 kHz Marker 1 [T1] -28.44 dBm VBW 10 kHz SWT 115 ms 2.402078000 GHz Center 2.402 GHz 100 kHz/ Span 1 MHz
CH19	 Ref 20 dBm + Att 30 dB RBW 3 kHz Marker 1 [T1] -28.08 dBm VBW 10 kHz SWT 115 ms 2.440056000 GHz Center 2.44 GHz 100 kHz/ Span 1 MHz
CH39	 Ref 20 dBm + Att 30 dB RBW 3 kHz Marker 1 [T1] -28.83 dBm VBW 10 kHz SWT 115 ms 2.480056000 GHz Center 2.48 GHz 100 kHz/ Span 1 MHz

10.RADIO FRFREQUENCY EXPOSURE COMPLIANCE

RESULT : PASS

Test standard : FCC KDB Publication 447498 D01 V06

Since maximum peak output power of the transmitter is $<10\text{mW}$, i.e. $0.17\text{mW} < 10\text{mW}$, hence the EUT is excluded from SAR evaluation according to FCC KDB Publication 447498 D01: General RF Exposure Guidance V06.

11.ANTENNA REQUIREMENT

11.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Antenna Connected Construction

The antennas used for this product are PCB antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 0dBi.

.....**End of Report**.....