



FCC Test Report (Bluetooth)

FCC ID : 2AEH4-MI-SPB18

Applicant : Shenzhen Lipon Electronics Co., Ltd.
No.302, 3/F., Bldg 5, Fusen Technology Park, Hangcheng Road,
Xixiang, Bao'an District, Shenzhen, China.

Sample Description

Product Name : Wireless Speaker

Model No. : MI-SPB18, MI-SPB17, HR019, HR036, HR039

Trademark : N/A

Receipt Date : 2015-03-28

Test Date : 2015-03-29 to 2015-04-28

Issue Date : 2015-04-28

Test Standard(s) : FCC CFR Title 47 Part 15 Subpart C Section 15.247

Conclusions : PASSED*

*In the configuration tested, the EUT complied with the standards specified above.

Test/Witness Engineer :

Jason Deng

Approved & Authorized :

Frank Zhang

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.



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1. General Information

1.1. Client Information

Applicant	:	Shenzhen Lipon Electronics Co., Ltd.
Address	:	No.302, 3/F., Bldg 5, Fusen Technology Park, Hangcheng Road, Xixiang, Bao'an District, Shenzhen, China.
Manufacturer	:	Shenzhen Lipon Electronics Co., Ltd.
Address	:	No.302, 3/F., Bldg 5, Fusen Technology Park, Hangcheng Road, Xixiang, Bao'an District, Shenzhen, China.

1.2. General Description of EUT (Equipment Under Test)

Product Name	:	Wireless Speaker
Models No.	:	MI-SPB18, MI-SPB17, HR019, HR036, HR039
Trademark	:	N/A
Remark: All above models are identical in schematic, structure and critical components except for different model number and appearance; We choose MI-SPB18 for test.		
Product Description	Operation Frequency:	2402MHz~2480MHz
	Transfer Rate:	1/2/3 Mbits/s
	Number of Channel:	79 Channels
	Modulation Type:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
	Modulation Technology:	FHSS
	Antenna Type:	Integral PCB Antenna
	Antenna Gain:	0 dBi
Power Supply	:	DC 3.7V from battery or DC 5V from USB port

Note:

- (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
- (2) Channel List:

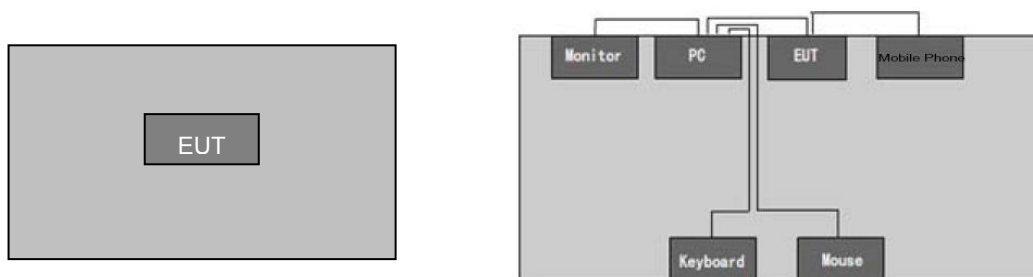
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460



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		

Remark: Channel 0, 39 & 78 selected for GFSK, $\pi/4$ -DQPSK and 8DPSK.

1.3. Block Diagram Showing The Configuration of System Tested





1.4. Description of Support Units

Name	Model	Serial Number	Manufacturer
Mobile Phone	N/A	/	SAMSUNG
LCD Monitor	G205HV	10306738385	ACER
PC	ASPIREM1830	PTSF90C00305005CAC3000	ACER
Keyboard	SK-9625	KBUSB1580500037E0100	ACER
Mouse	MS.11200.014	M-UAY-ACR2	ACER

1.5. External I/O Cable

Cable Description	Length(m)	From/ Port	To
Shielding Detachable USB Cable	1.5	Host PC	Mouse
Shielding Detachable K/B Cable	1.5	Host PC	Keyboard
USB Cable	1.5	Host PC	Mobile Phone
Shielding Detachable VGA Cable	1.5	Host PC	LCD Monitor
Unshielding Detachable USB Cable	0.8	EUT	Host PC
Unshielding Audio Cable	0.6	EUT	Host PC

1.6. Description of Test Mode

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

Test Mode	Description
Transmitting mode	Keep the EUT in Transmitting mode with worst case data rate
Remark	GFSK(1Mbps) is the worst case mode

Remark: The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.



1.7. Test Instruments List

Item	Test Equipment	Manufacturer	Model No.	Cal. Date	Cal. Due date
1	Bilog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	Mar. 28, 2015	Mar. 27, 2016
2	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	Mar. 28, 2015	Mar. 27, 2016
3	Coaxial Cable	N/A	N/A	Mar. 28, 2015	Mar. 27, 2016
4	Coaxial Cable	N/A	N/A	Mar. 28, 2015	Mar. 27, 2016
5	Coaxial cable	N/A	N/A	Mar. 28, 2015	Mar. 27, 2016
6	Coaxial Cable	N/A	N/A	Mar. 28, 2015	Mar. 27, 2016
7	Coaxial Cable	N/A	N/A	Mar. 28, 2015	Mar. 27, 2016
8	Amplifier (10kHz-1.3GHz)	HP	8447D	Mar. 28, 2015	Mar. 27, 2016
9	Amplifier (1GHz-18GHz)	Compliance Direction Systems Inc.	PAP-1G18	Mar. 28, 2015	Mar. 27, 2016
10	Pre-amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	Mar. 28, 2015	Mar. 27, 2016
11	Horn Antenna	ETS-LINDGREN	3160	Mar. 28, 2015	Mar. 27, 2016
12	Positioning Controller	UC	UC3000	N/A	N/A
13	Spectrum analyzer 9kHz-30GHz	Rohde & Schwarz	FSP	Mar. 28, 2015	Mar. 27, 2016
14	EMI Test Receiver	Rohde & Schwarz	ESPI	Mar. 28, 2015	Mar. 27, 2016
15	Loop antenna	Laplace instrument	RF300	Mar. 28, 2015	Mar. 27, 2016
16	Universal radio communication tester	Rhode & Schwarz	CMU200	Mar. 28, 2015	Mar. 27, 2016
17	Signal Analyzer	Rohde & Schwarz	FSIQ3	Mar. 28, 2015	Mar. 27, 2016
18	EMI Test Receiver	Rohde & Schwarz ESCI	ESCI	Mar. 28, 2015	Mar. 27, 2016
19	LISN	CHASE	MN2050D	Mar. 28, 2015	Mar. 27, 2016

1.8. Laboratory Location

Shenzhen TOBY technology Co., Ltd

Address: 1 A/F., Bldg.6, Yusheng Industrial Zone The National Road No.107 Xixiang Section 467,
Xixiang, Bao'an, Shenzhen, Guangdong, 518057, China

At the time of testing, the Laboratory is accredited. It is listed in the United States of American Federal Communications Commission (FCC), and the registration number is 811562 7.

Tel:0086-755-26509301 Fax: 0086-755-26509195



2. Test Summary

Standard Section	Test Item	Judgment
15.203/15.247(c)	Antenna Requirement	PASSED
15.207	Conducted Emission	PASSED
15.247(b)(1)	Conducted Peak Output Power	PASSED
15.247(a)(1)	20dB Occupied Bandwidth	PASSED
15.247(a)(1)	Carrier Frequencies Separation	PASSED
15.247(a)(1)	Hopping Channel Number	PASSED
15.247(a)(1)	Dwell Time	PASSED
15.247(b)(4)&TCB Exclusion List (7 July 2002)	Pseudorandom Frequency Hopping Sequence	PASSED
15.205/15.209	Spurious Emission	PASSED
15.247(d)	Band Edge	PASSED
Remark: "N/A" is an abbreviation for Not Applicable.		



3. Antenna Requirement

3.1. Standard Requirement

3.1.1 Test standard

FCC Part15 Section 15.203 /247(c)

3.1.2 Requirement

1) 15.203 requirement:

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

2) 15.247(c) (1)(i) requirement:

Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.2. Antenna Connected Construction

The bluetooth antenna is an integral antenna which permanently attached, and the best case gain of the antenna is 0 dBi. It complies with the standard requirement.

4. Conducted Emission Test

4.1. Test Standard and Limit

4.1.1 Test Standard

FCC Part15 Section 15.207

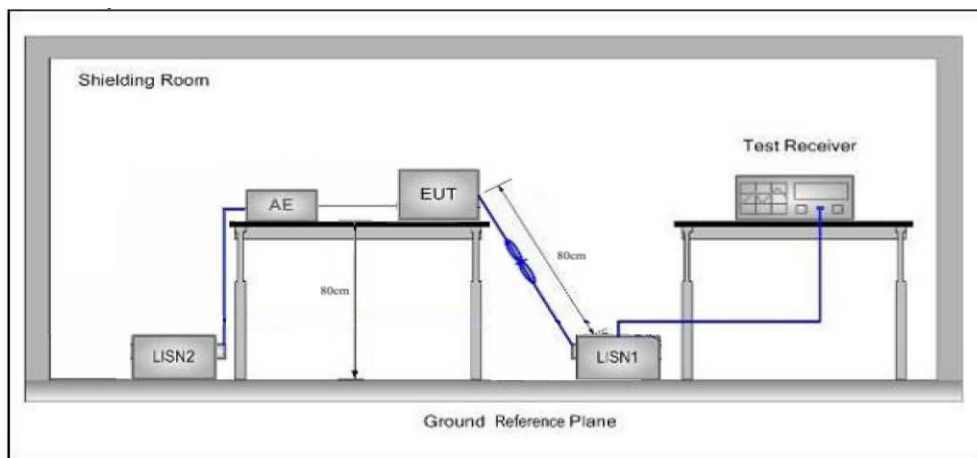
4.1.2 Test Limit

Conducted Emission Test Limit

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

Remark: (1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.

4.2. Test Setup



4.3. Test Procedure

- 1) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50 \Omega / 50 \mu\text{H} + 5 \Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 2) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal



ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.

The Test Receiver setup: RBW=9kHz, VBW=30kHz, Sweep time= auto

4.4. Test Data

Pass



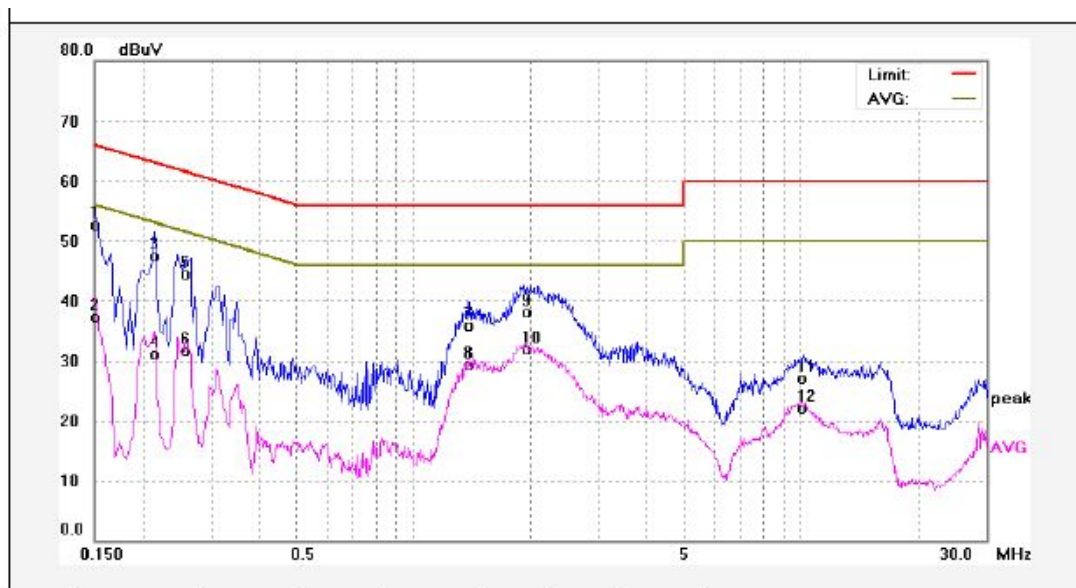
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Conduction Test data

EUT: Wireless Speaker M/N: MI-SPB18
Operating Condition: Charging & Working mode
Test Site: Shielded room
Operator: Jason
Test Specification: AC120V/60Hz
Polarization: Line
Note Tem:25°C Hum:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Remark
1	0.1500	42.85	9.80	52.65	65.99	-13.34	QP	
2	0.1500	27.57	9.80	37.37	55.99	-18.62	AVG	
3	0.2140	37.70	9.84	47.54	63.04	-15.50	QP	
4	0.2140	21.34	9.84	31.18	53.04	-21.86	AVG	
5	0.2580	34.60	9.86	44.46	61.49	-17.03	QP	
6	0.2580	21.77	9.86	31.63	51.49	-19.86	AVG	
7	1.3860	25.90	10.00	35.90	56.00	-20.10	QP	
8	1.3860	19.26	10.00	29.26	46.00	-16.74	AVG	
9	1.9300	28.04	10.00	38.04	56.00	-17.96	QP	
10	1.9300	21.88	10.00	31.88	46.00	-14.12	AVG	
11	10.1340	16.65	10.51	27.16	60.00	-32.84	QP	
12	10.1340	11.52	10.51	22.03	50.00	-27.97	AVG	

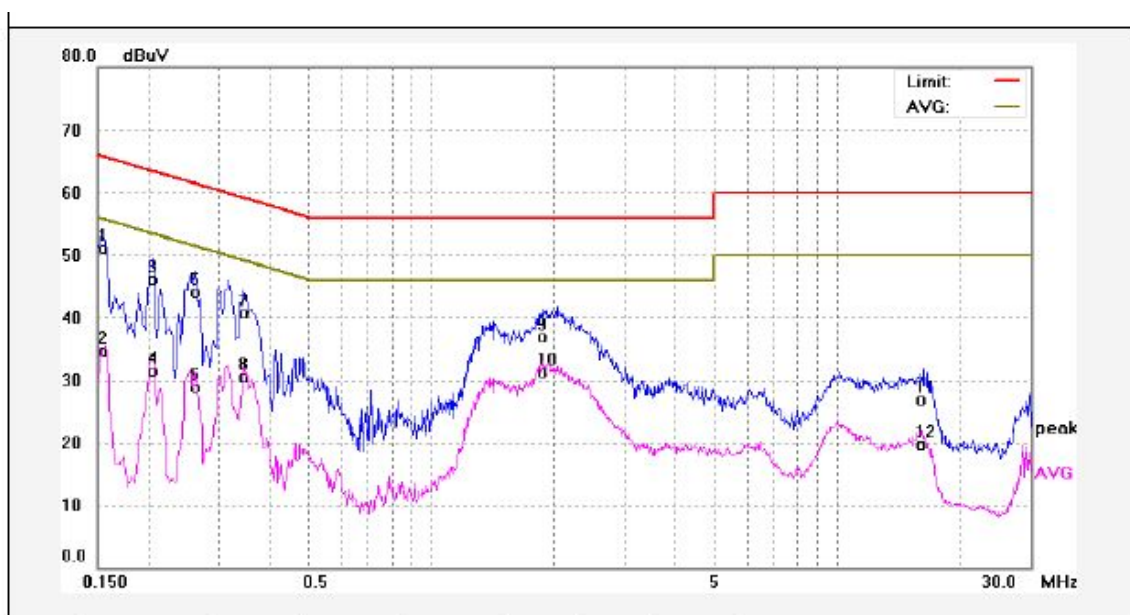


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Conduction Test data

EUT: Wireless Speaker M/N: MI-SPB18
Operating Condition: Charging & Working mode
Test Site: Shielded room
Operator: Jason
Test Specification: AC 120V/60Hz
Polarization: Neutral
Note Tem:25℃ Hum:50%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1539	41.31	9.80	51.11	65.78	-14.67	QP	
2	0.1539	24.97	9.80	34.77	55.78	-21.01	AVG	
3	0.2060	36.31	9.84	46.15	63.36	-17.21	QP	
4	0.2060	21.66	9.84	31.50	53.36	-21.86	AVG	
5	0.2620	34.17	9.86	44.03	61.36	-17.33	QP	
6	0.2620	19.08	9.86	28.94	51.36	-22.42	AVG	
7	0.3460	30.82	9.88	40.70	59.06	-18.36	QP	
8	0.3460	20.53	9.88	30.41	49.06	-18.65	AVG	
9	1.9100	26.89	10.00	36.89	56.00	-19.11	QP	
10	1.9100	21.40	10.00	31.40	46.00	-14.60	AVG	
11	16.3260	16.00	10.98	26.98	60.00	-33.02	QP	
12	16.3260	8.70	10.98	19.68	50.00	-30.32	AVG	



5. Conducted Peak Output Power Test

5.1. Test Standard and Limit

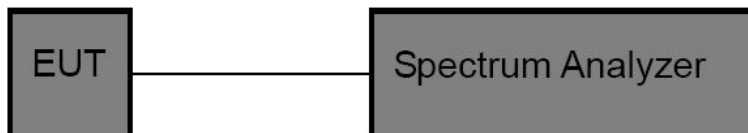
5.1.1 Test Standard

FCC Part15 C Section 15.247 (b)(3)

5.1.2 Test Limit

FCC Part 15 Subpart C(15.247)		
Test Item	Limit	Frequency Range (MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125 mW(21dBm)	2400~2483.5

5.2. Test Setup



5.3. Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
RBW=1MHz, VBW=3MHz, Detector=Peak (If 20dB BW $\leq$ 1 MHz)
RBW=3MHz, VBW=10MHz, Detector=Peak (If 20dB BW > 1 MHz)
- (3) The EUT was set to continuously transmitting in the max power during the test.

5.4. Test Data



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GFSK mode				
Channel Number	Channel Frequency (MHz)	Test Result (dBm)	Limit (30dBm)	Judgment
CH 00	2402	0.310	21	PASSED
CH 39	2441	1.528	21	PASSED
CH 78	2480	1.963	21	PASSED
$\pi/4$ -DQPSK mode				
Channel Number	Channel Frequency (MHz)	Test Result (dBm)	Limit (30dBm)	Judgment
CH 00	2402	-0.193	21	PASSED
CH 39	2441	0.710	21	PASSED
CH 78	2480	0.953	21	PASSED
8DPSK mode				
Channel Number	Channel Frequency (MHz)	Test Result (dBm)	Limit (30dBm)	Judgment
CH 00	2402	-0.189	21	PASSED
CH 39	2441	1.040	21	PASSED
CH 78	2480	1.533	21	PASSED
Remark: Test plot as follows				

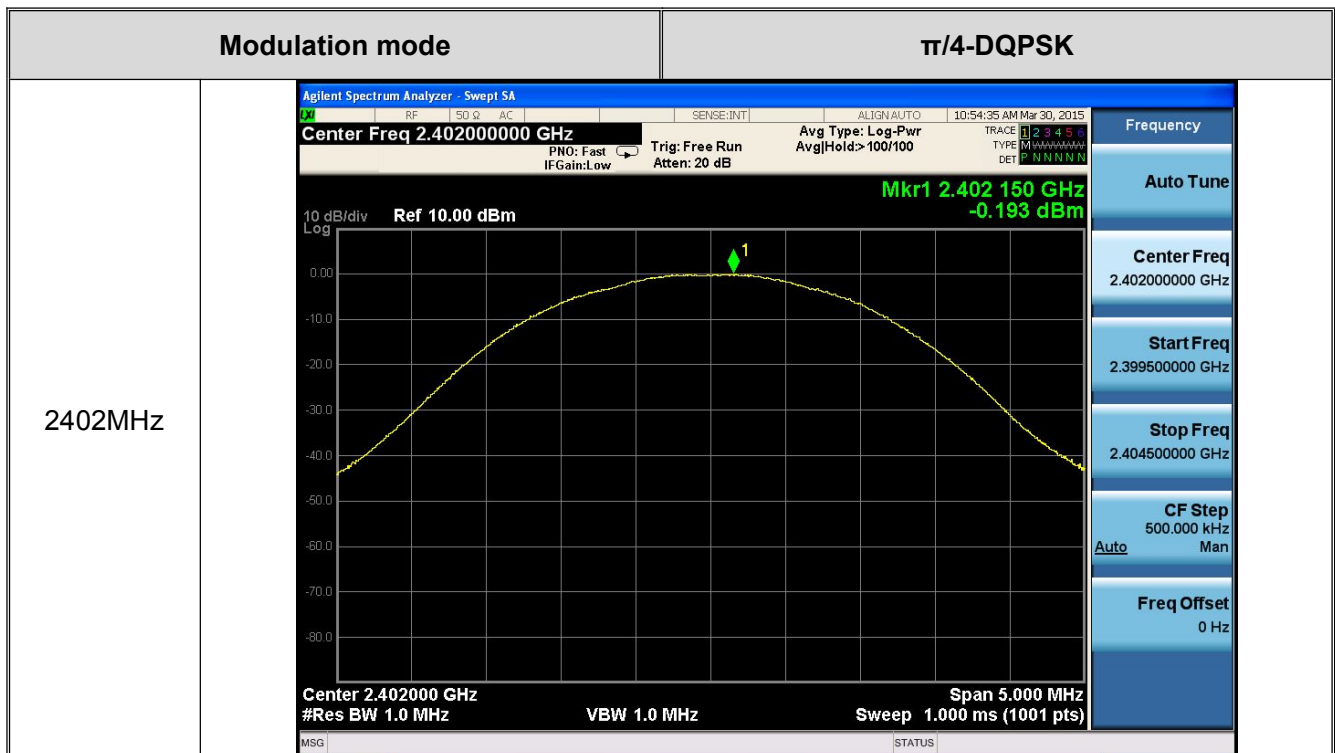
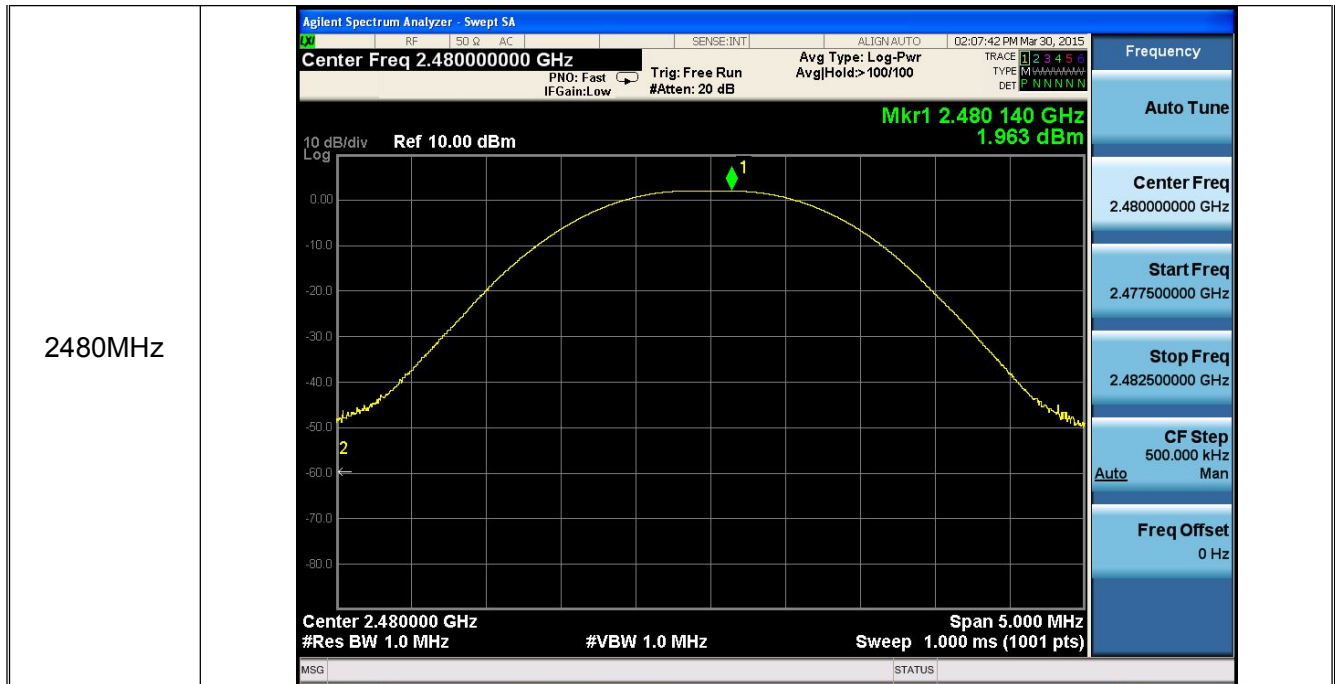


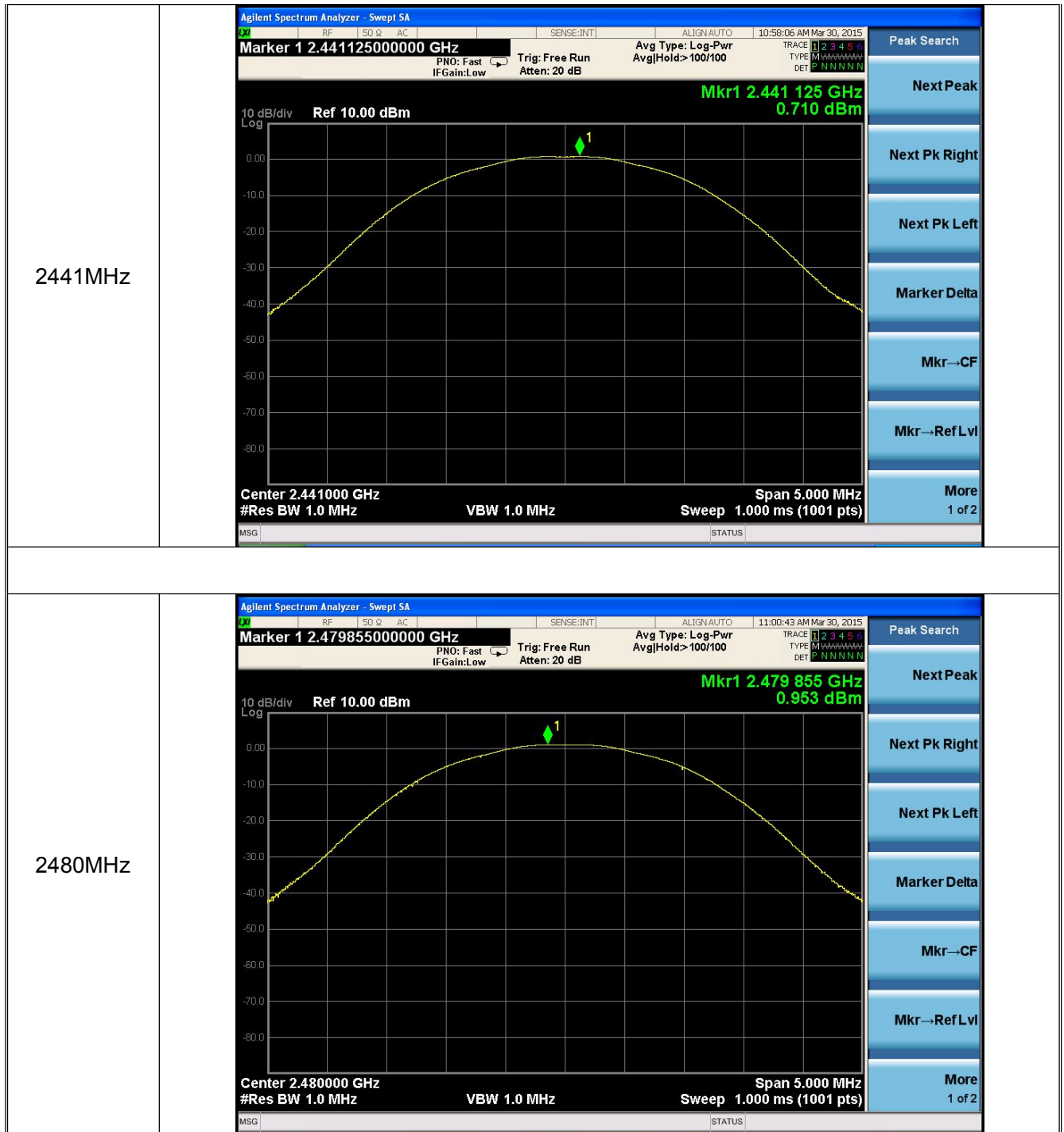


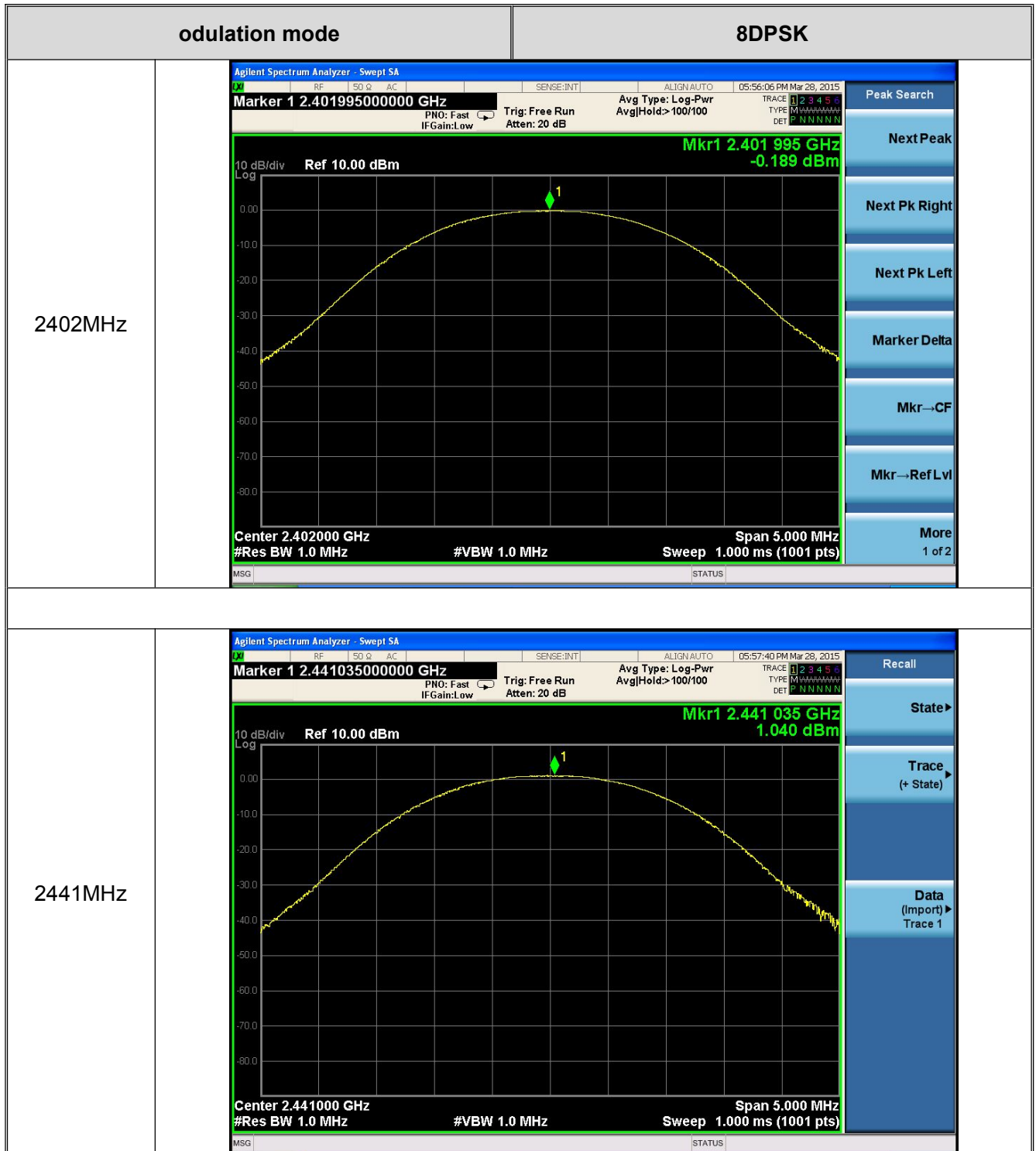
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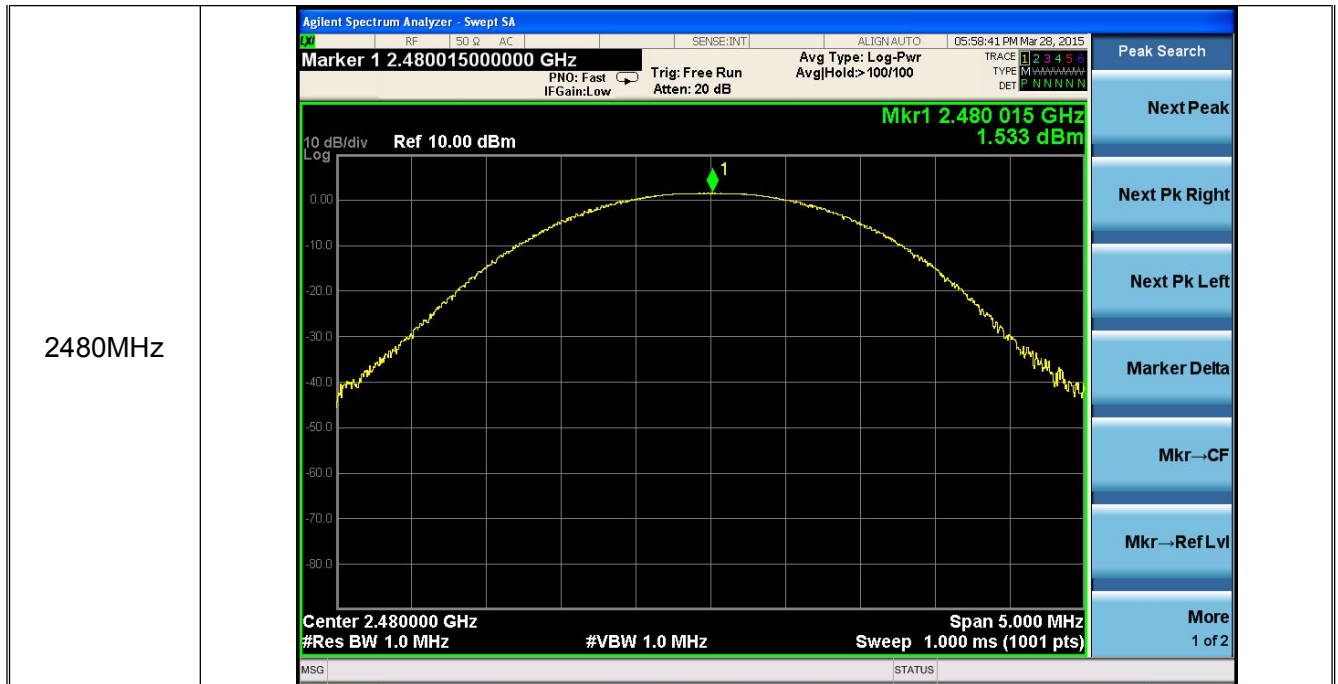




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6. 20dB Occupy Bandwidth Test

6.1. Test Standard and Limit

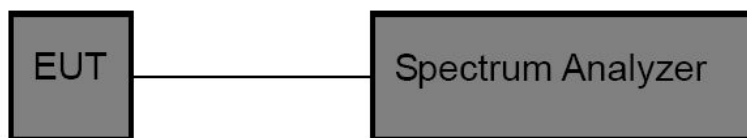
6.1.1 Test Standard

FCC Part15 C Section 15.247 (a)(1)

6.1.2 Test Limit

FCC Part 15 Subpart C(15.247)		
Test Item	Limit	Frequency Range (MHz)
Bandwidth	20dB bandwidth	2400~2483.5

6.2. Test Setup



6.3. Test Procedure

(1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.

(2) Spectrum Setting:

Bandwidth: RBW=30 kHz, VBW=100 kHz, detector= Peak

6.4. Test Data

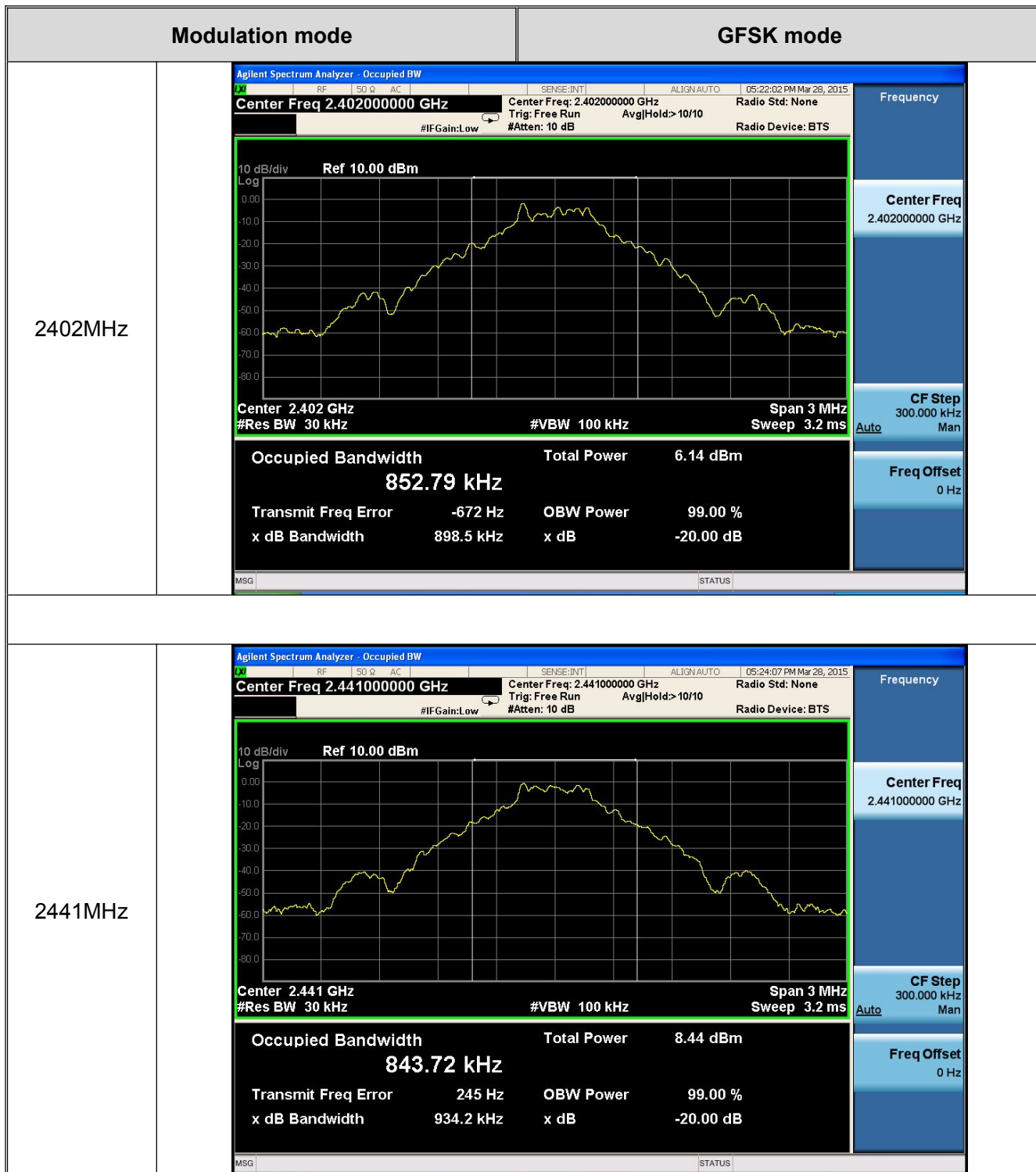
Channel Number	Channel Frequency	20dB Bandwidth (kHz)		
		GFSK	$\pi/4$ -DQPSK	8DPSK
CH 00	2402(MHz)	0.899	1.258	1.263
CH 39	2441(MHz)	0.934	1.259	1.259
CH 78	2480(MHz)	0.923	1.258	1.262
Remark: Test plot as follows				



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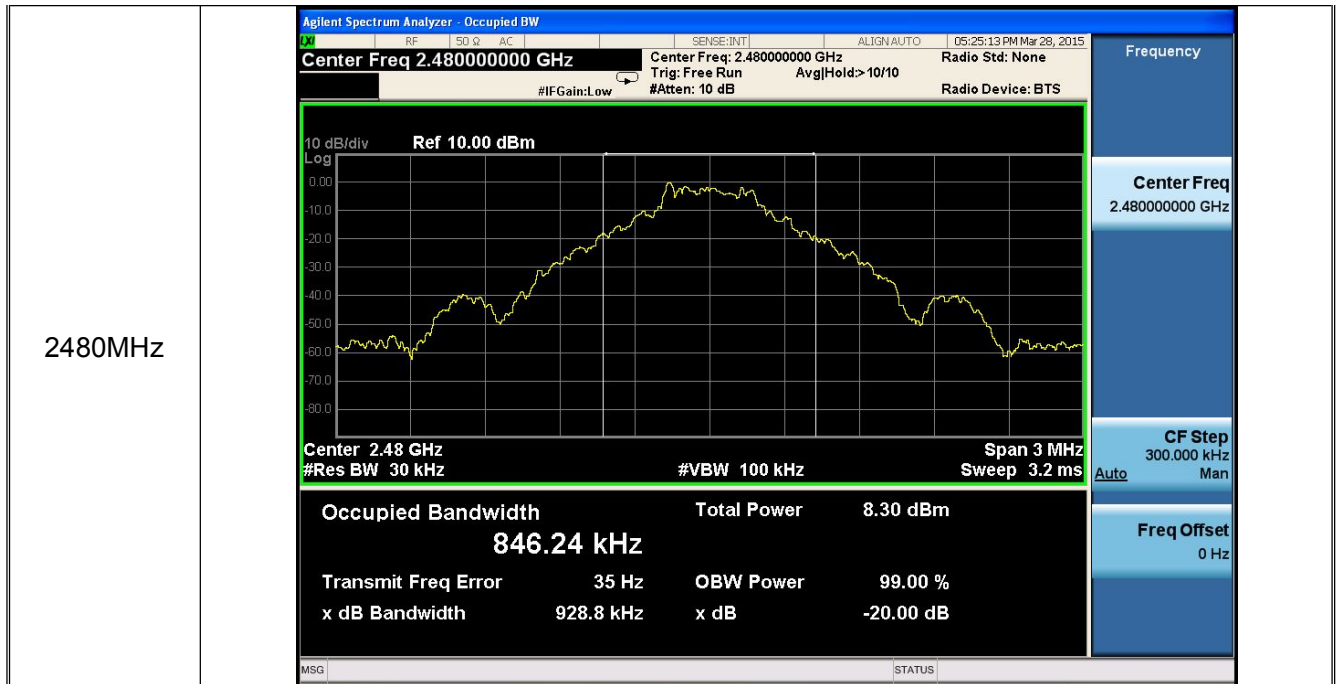




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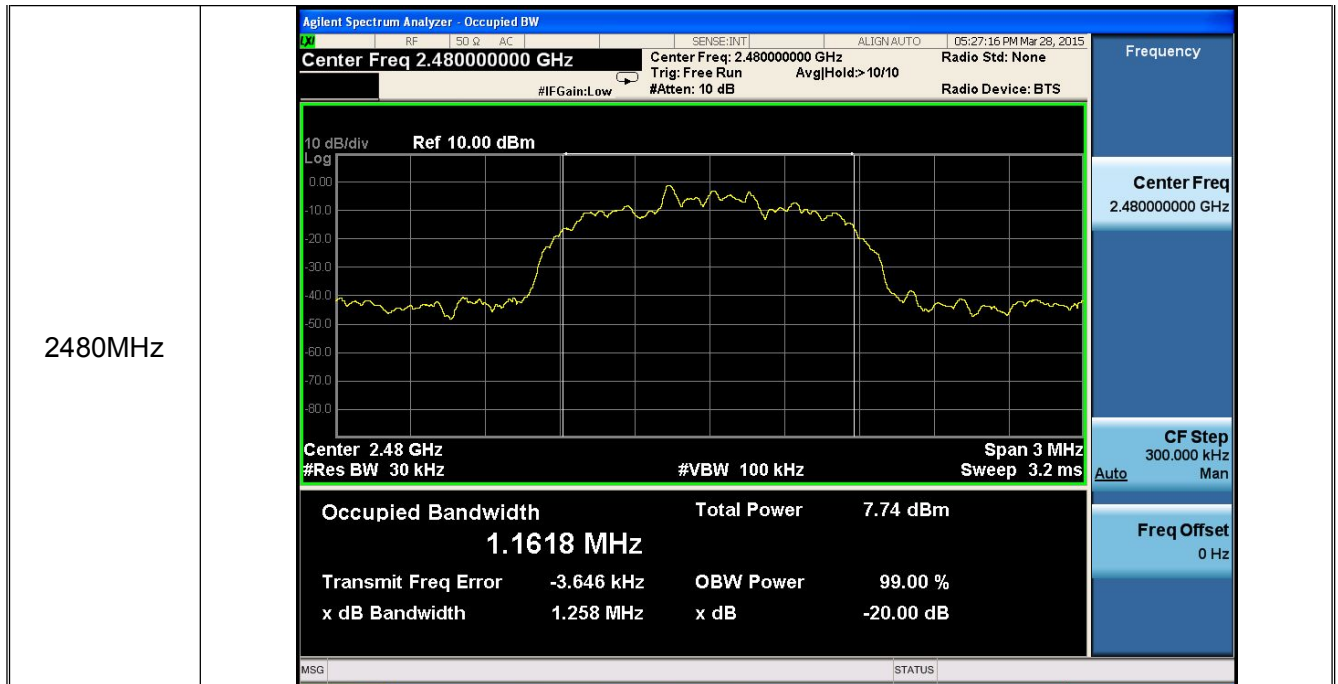




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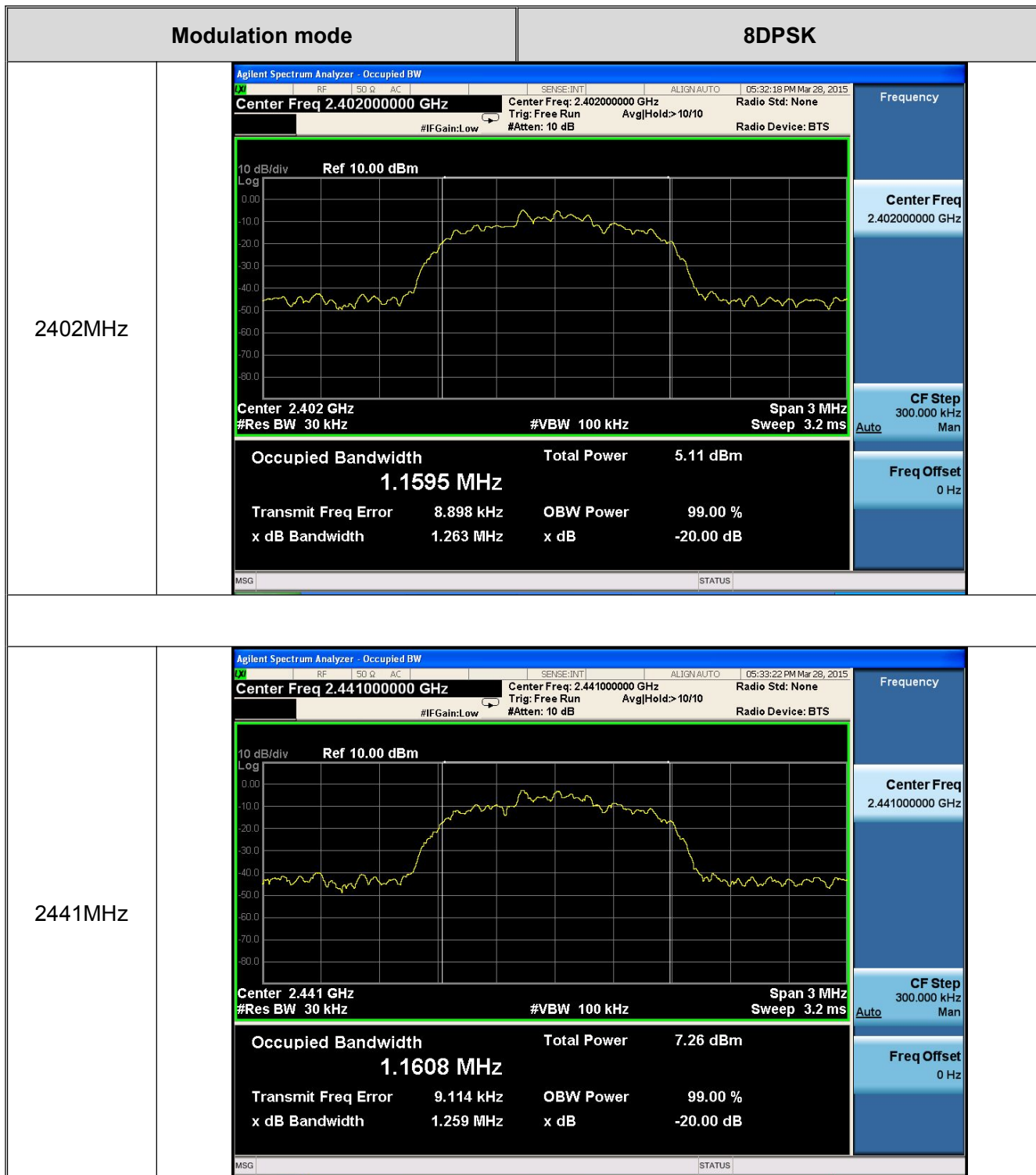


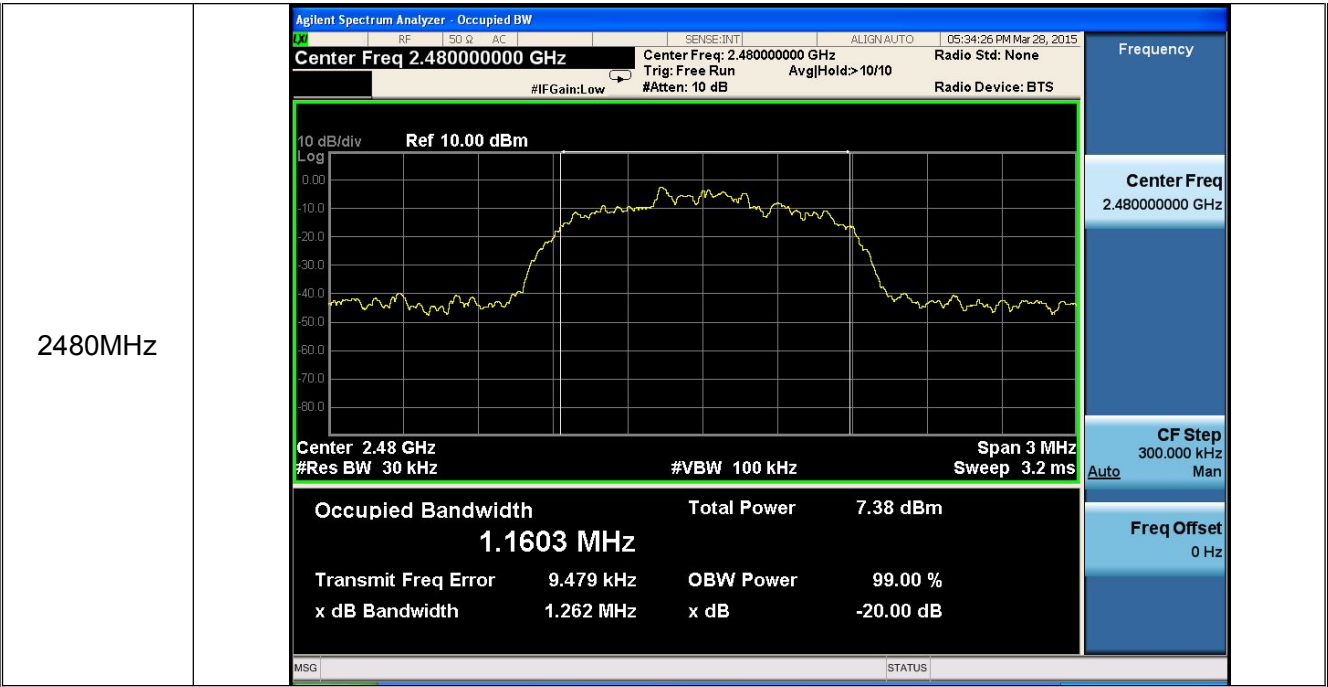


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7. Carrier Frequency Separation Test

7.1. Test Standard and Limit

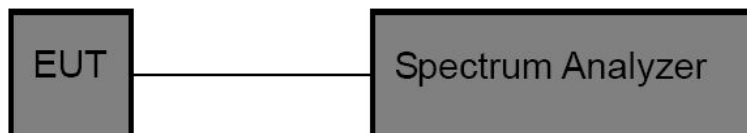
7.1.1 Test Standard

FCC Part15 C Section 15.247 (a)(1)

7.1.2 Test Limit

FCC Part 15 Subpart C(15.247)		
Test Item	Limit	Frequency Range (MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth (Which is greater)	2400~2483.5

7.2. Test Setup



7.3. Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting:
RBW=100 kHz, VBW=300 kHz, detector= Peak, Sweep Time =auto.
- (3) The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Test.

7.4. Test Data



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GFSK mode				
Channel Number	Channel Frequency (MHz)	Test Result (MHz)	Limit (MHz)	Judgment
CH 39	2441	1.005	0.623	PASSED
$\pi/4$ -DQPSK mode				
Channel Number	Channel Frequency (MHz)	Test Result (MHz)	Limit (MHz)	Judgment
CH 39	2441	1.005	0.839	PASSED
8DPSK mode				
Channel Number	Channel Frequency (MHz)	Test Result (MHz)	Limit (MHz)	Judgment
CH 39	2441	1.005	0.839	PASSED
Remark: Test plot as follows				

According to section 6.4

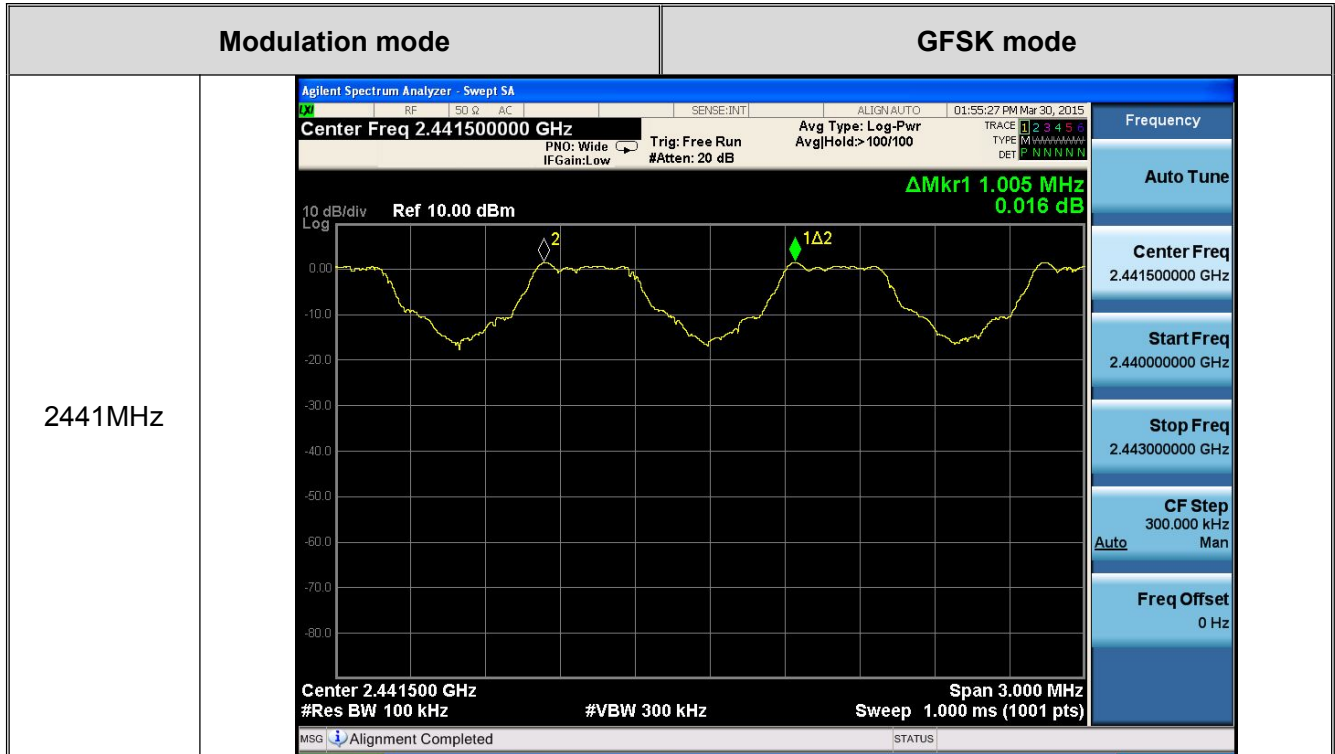
Test Mode	20dB bandwidth (MHz)	Limit (MHz) (Carrier Frequency Separation)
GFSK	1.005	0.623
$\pi/4$ -DQPSK	1.005	0.839
8DPSK	1.005	0.839



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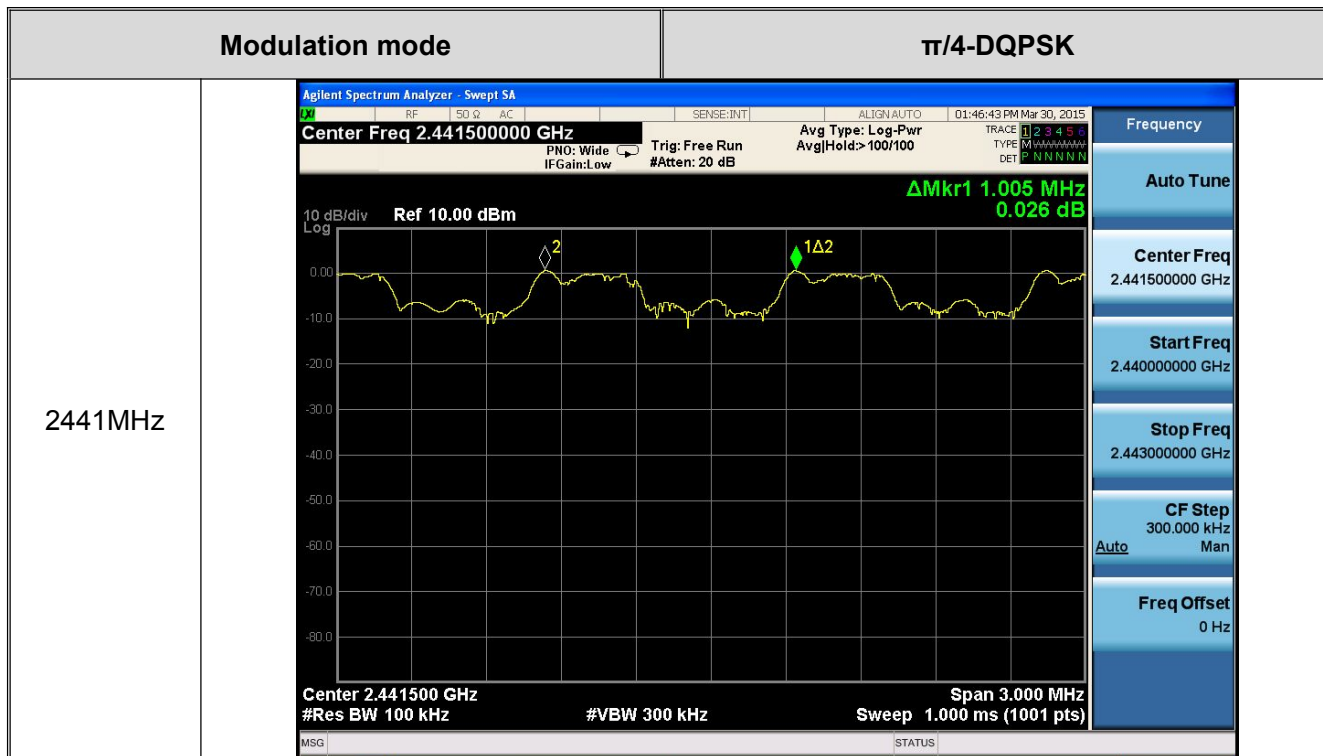
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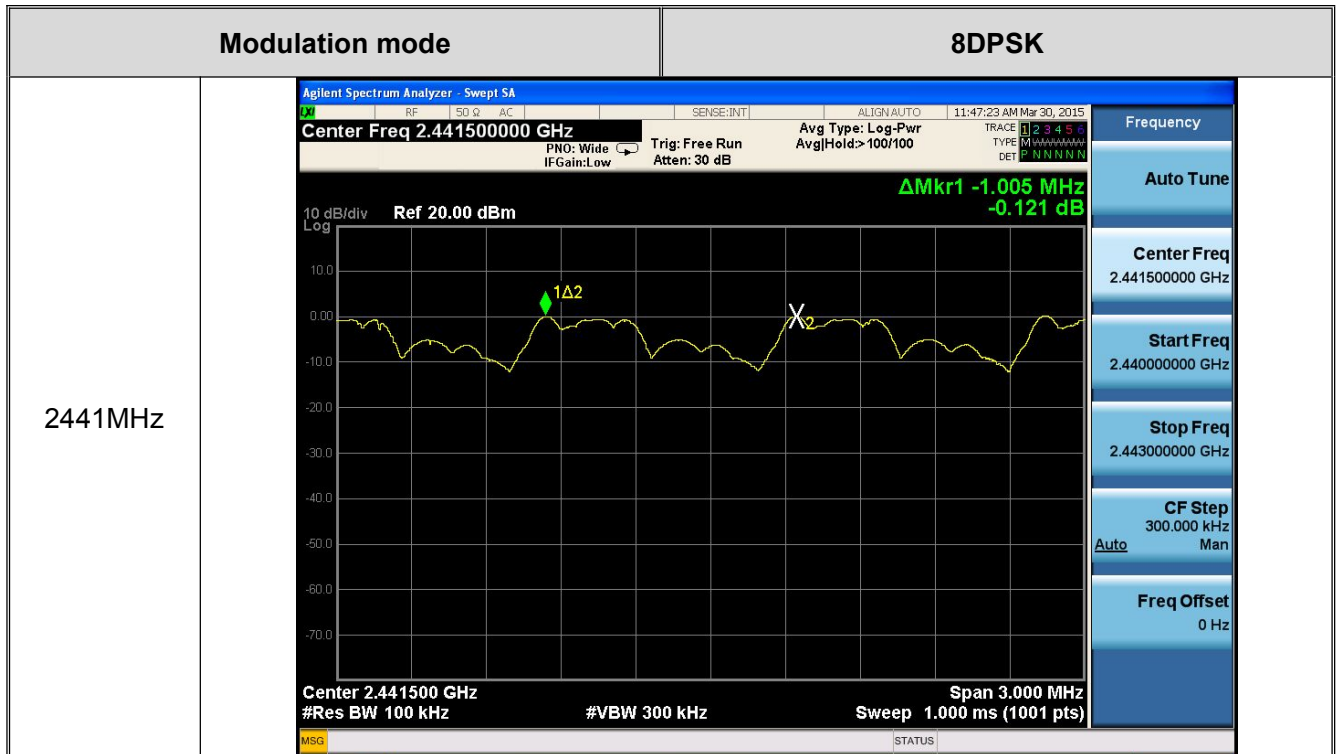




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8. Number of Hopping Channel

8.1. Test Standard and Limit

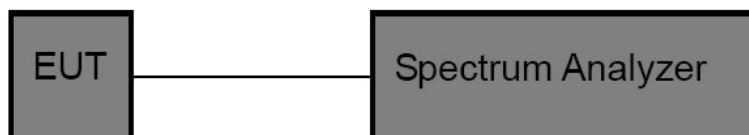
8.1.1 Test Standard

FCC Part15 C Section 15.247 (a)(1)

8.1.2 Test Limit

FCC Part 15 Subpart C (15.247)		
Test Item	Limit	Frequency Range (MHz)
Number of Hopping Channel	>15 channels	2400~2483.5

8.2. Test Setup



8.3. Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=100 kHz, VBW=300 kHz, Detector=Peak, Sweep time= Auto.
- (3) The EUT was set to the Hopping Mode for Channel Separation Test and continuously transmitting for the Test.

8.4. Test Data

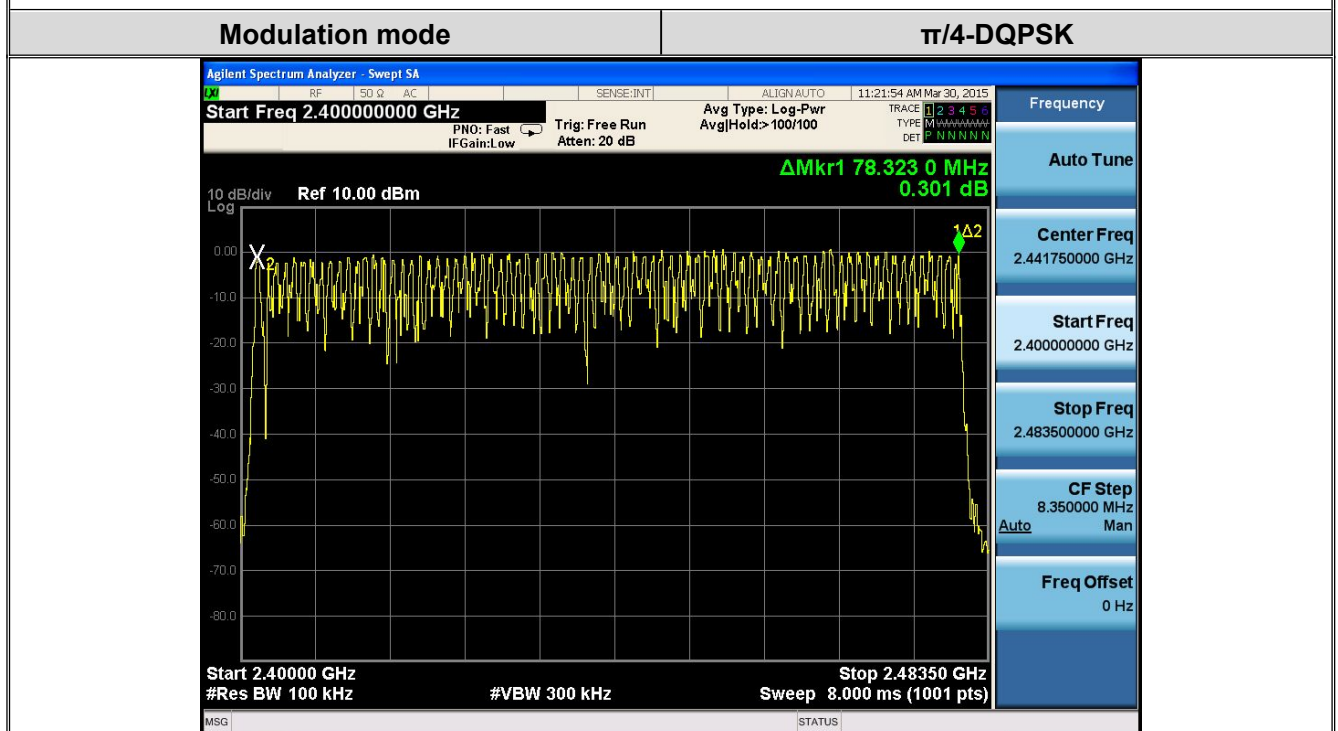
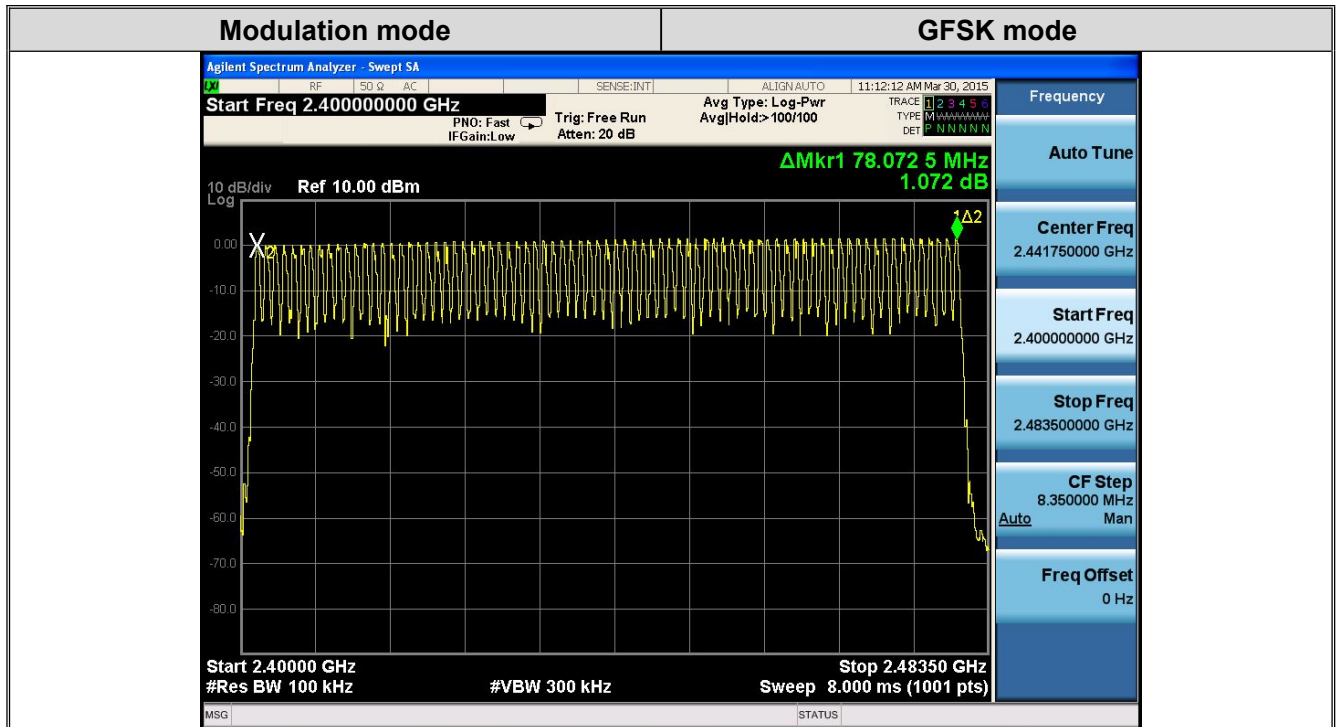
Mode	Quantity of Hopping Channel	Limit	Judgment
GFSK, $\pi/4$ -DQPSK, 8DPSK	79	>15	PASSED



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9. Dwell Time Test

9.1. Test Standard and Limit

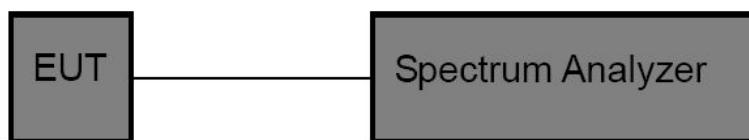
9.1.1 Test Standard

FCC Part15 C Section 15.247 (a)(1)

9.1.2 Test Limit

FCC Part 15 Subpart C(15.247)		
Section	Test Item	Limit
15.247(a)(1)	Dwell time	0.4 sec

9.2. Test Setup



9.3. Test Procedure

- (1) The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- (2) Spectrum Setting: RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
- (3) Use video trigger with the trigger level set to enable triggering only on full pulses.
- (4) Sweep Time is more than once pulse time.
- (5) Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- (6) Measure the maximum time duration of one single pulse.
- (7) Set the EUT for packet transmitting.
- (8) Measure the maximum time duration of one single pulse.
- (9) The EUT was set to the Hopping Mode for Dwell Time Test

9.4. Test Data



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For GFSK, $\pi/4$ -DQPSK and 8DPSK:

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

EUT: Wireless Speaker M/N: MI-SPB18						
Test date: 2015-03-20			Test site: RF site			
Mode	Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limit (s)	Conclusion
GFSK	DH1	2441	0.368	0.236	<0.4	PASS
	DH3	2441	1.617	0.345	<0.4	PASS
	DH5	2441	2.856	0.366	<0.4	PASS
$\pi/4$ -DQPSK	DH1	2441	0.375	0.240	<0.4	PASS
	DH3	2441	1.614	0.344	<0.4	PASS
	DH5	2441	2.856	0.366	<0.4	PASS
8- DQPSK	DH1	2441	0.374	0.239	<0.4	PASS
	DH3	2441	1.617	0.345	<0.4	PASS
	DH5	2441	2.868	0.367	<0.4	PASS
Note: 1 A period time = $0.4 \text{ (s)} \times 79 = 31.6\text{(s)}$ 2 DH1 time slot = Pulse Duration * $(1600/(1 \times 79)) \times \text{A period time}$ DH3 time slot = Pulse Duration * $(1600/(3 \times 79)) \times \text{A period time}$ DH5 time slot = Pulse Duration * $(1600/(5 \times 79)) \times \text{A period time}$						



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