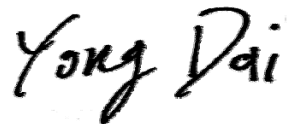




TEST REPORT

Report No.:	EM201500408	Application No.:	ZJ20150201-E-1
Client:	Twin-Star International Inc		
Address:	12/F Taiwanese Trake Association Building, De Aheng Road, ChangAn Town Dongguan City, China.		
Sample Description:	Heater		
Model:	CFI-100-1		
Adding Model:	/		
FCC ID	QCD-CFI-100-1		
Test Specification:	FCC Part 15, Subpart C:2015		
Test Date:	2015-05-20 to 2015-06-08		
Issue Date:	2015-06-08		
Test Result:	Pass.		
Prepared By:	Reviewed By:	Approved By:	
Brian Xiao / Test Engineer	Lynn Xiao / Technical Manager	Yong Dai / Manager	
			
Date: 2015-06-08	Date: 2015-06-08	Date: 2015-06-08	
Other Aspects:			
/			
Abbreviations: ok / P = passed; fail / F = failed; n.a. / N = not applicable			
The test result in this test report refers exclusively to the presented test sample. This report shall not be reproduced except in full, without the written approval of GRGT.			

DIRECTIONS OF TEST

1. This station carries out test task according to the national regulation of verifications which can be traced to National Primary Standards and BIPM.
2. The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.
3. If there is any objection concerning the test, the client should inform the laboratory within 15 days from the date of receiving the test report.

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1. TEST RESULT SUMMARY

Section B of FCC Part 15.247:2015			
Standard	Item	Limit / Severity	Result
FCC Part 15, Subpart C (15.247)	Antenna Requirement	Section 15.247 (c)	PASS
	Occupied Bandwidth	Section 15.247 (a1)	PASS
	Carrier Frequencies Separated	Section 15.247(a)(1)	PASS
	Hopping Channel Number	Section 15.247(a)(1)(iii)	PASS
	Dwell Time	Section 15.247(a)(1)(iii)	PASS
	Maximum Peak Output Power	Section 15.247(b)(1)	PASS
	Conducted Emission	Section 15.207	PASS
	Conducted Spurious Emission (30MHz to 25GHz)	Section 15.209 & 15.247(d)	PASS
	Radiated Spurious Emission (30MHz to 25GHz)	Section 15.209 & 15.247(d)	PASS
	Band Edges Measurement	Section 15.247 (d) & 15.205	PASS

2. GENERAL DESCRIPTION OF EUT

2.1 APPLICANT

Name: Twin-Star International Inc
Address: 12/F Taiwanese Trake Association Building, De Aheng Road, ChangAn Town
Dongguan City, China.

2.2 MANUFACTURER

Name: Twin-Star International Inc
Address: 12/F Taiwanese Trake Association Building, De Aheng Road, ChangAn Town
Dongguan City, China.

2.3 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: Heater
Model No.: CFI-100-1
Trade Name: /
Power supply AC 120V/60Hz
Frequency Range 2402MHz~2480MHz
Type of Modulation GFSK, 8DPSK, Pi/4 QPSK
Channels: Channels with 1MHz step
Antenna Type: PCB Antenna
Antenna Gain: 0 dBi

3. LABORATORY AND ACCREDITATIONS

3.1 LABORATORY

The tests and measurements refer to this report were performed by Guangzhou GRG Metrology and Test CO., LTD.

Add. : 163 Pingyun Rd, West of Huangpu Ave, Guangzhou, 510656, P. R. China

Telephone: +86-20-38699959, 38699960, 38699961

Fax : +86-20-38695185

3.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA	FCC Listed Lab (No. 688188)
Canada	Registration No.:8355A-1

3.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement		Frequency	Uncertainty
Radiated Emission	Horizontal	30MHz~1000MHz	4.2dB
		1GHz~26.5GHz	4.2dB
	Vertical	30MHz~1000MHz	4.4dB
		1GHz~26.5GHz	4.4dB
Conducted Emission		9kHz~30MHz	3.1 dB

This uncertainty represents an expanded uncertainty factor of $k=2$ and the Confidence Level is 95%.

3.4 LIST OF USED TEST EQUIPMENT AT GRGT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
6 dB bandwidth/ carrier frequencies separated/ hopping channel number/ dwell time/ maximum peak output power/100kHz bandwidth of frequency band edge/ Spurious Emissions at Antenna Port/ Restricted Bands				
Receiver	R&S	ESU26	100526	2016-03-08
Conducted Emissions				
EMI Receiver	R&S	ESCI	100529	2016-03-24
L.I.S.N	SCHWARZBECK	NSLK 8127	8127450	2015-08-18
Radiated Spurious Emissions				
Receiver	R&S	ESU26	100526	2016-03-08
Loop antenna	R&S	HFH2-Z2	881058/58	2016-04-17
Biconical Log-periodic Antenna	ETS.LINDGREN	3142C	00075971	2016-04-17
Horn antenna	SCHWARZBECK	BBHA9120D	D752	2017-03-03
Per-Amplifier (0.1-26.5GHz)	Compliance Directions systems Inc.	PAP-0126	25002	2016-01-03

4. TEST RESULTS

4.1 E.U.T. TEST CONDITIONS

Type of antenna: Integral

Temperature: 22.0 °C

Humidity: 54 % RH

Atmospheric Pressure: 1011 mbar

Test frequencies: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

EUT channels and frequencies list:

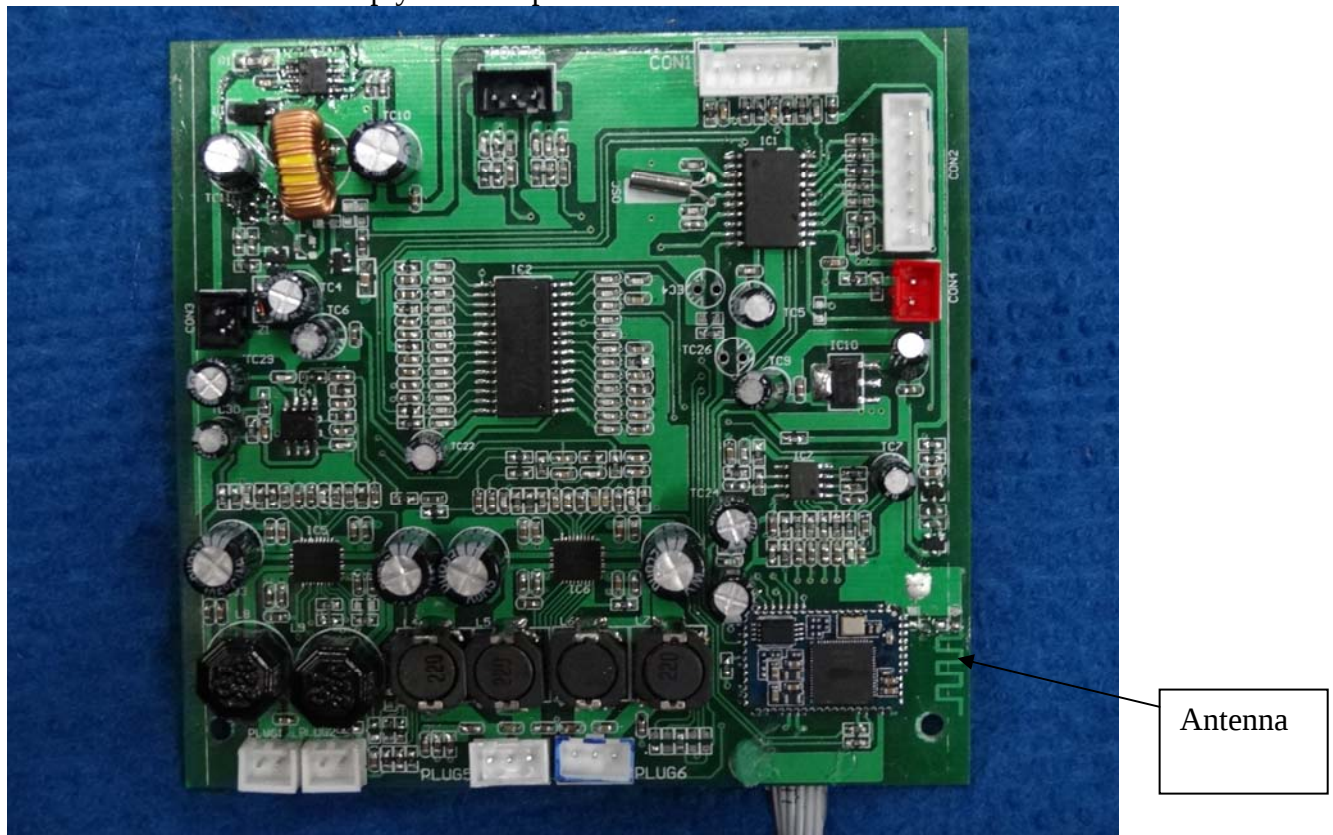
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2416	28	2430
1	2403	15	2417	29	2431
2	2404	16	2418	30	2432
3	2405	17	2419	31	2433
4	2406	18	2420	32	2434
5	2407	19	2421	33	2435
6	2408	20	2422	34	2436
7	2409	21	2423	35	2437
8	2410	22	2424	36	2438
9	2411	23	2425	37	2439
10	2412	24	2426	38	2440
11	2413	25	2427	39	2441
12	2414	26	2428	40	2442
13	2415	27	2429	41	2443

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	2444	55	2457	68	2470
43	2445	56	2458	69	2471
44	2446	57	2459	70	2472
45	2447	58	2460	71	2473
46	2448	59	2461	72	2474
47	2449	60	2462	73	2475
48	2450	61	2463	74	2476
49	2451	62	2464	75	2477
50	2452	63	2465	76	2478
51	2453	64	2466	77	2479
52	2454	65	2467	78	2480
53	2455	66	2468		
54	2456	67	2469		

Test frequency is the lowest channel: 0 channel(2402MHz), middle channel: 39 channel(2441MHz) and highest channel: 78 channel(2480MHz)

4.2 ANTENNA REQUIREMENT

The EUT antenna is ceramic antenna. Antenna gain is 0dBi .which accordance 15.203 is considered sufficient to comply with the provisions of this section.



4.3 OCCUPIED BANDWIDTH

4.3.1 LIMITS

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.

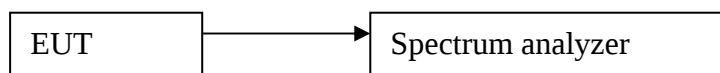
4.3.2 TEST PROCEDURES

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centre on a hopping channel;
3. Set the spectrum analyzer: RBW $\geq$ 1% of the 20dB bandwidth (set 10kHz). VBW $\geq$ RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20dB bandwidth.
5. Bandwidth value is OBW value.

Remark:

Pre-test the 3 modulation to find GFSK and 8DPSK is worse case, so only record GFSK and 8DPSK test data.

4.3.3 TEST SETUP



4.3.4 TEST RESULTS

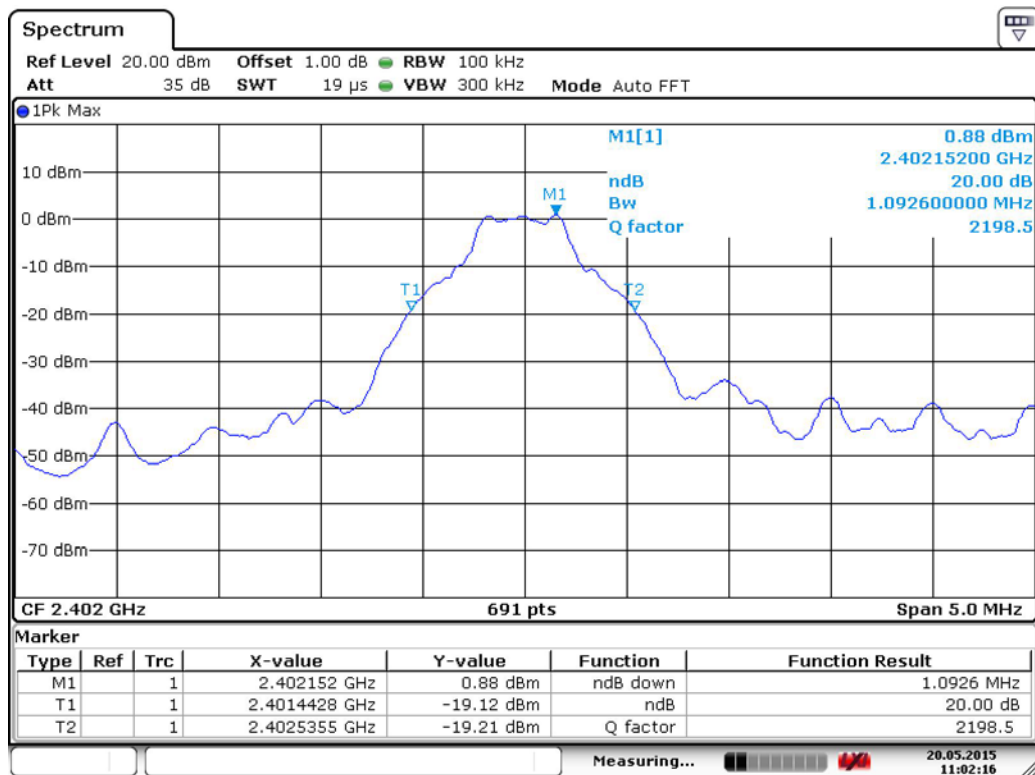
For GFSK

Frequency (GHz)	Test Channel	bandwidth
2.402	Lowest	1.09MHz
2.441	Middle	1.09MHz
2.480	Highest	1.10MHz

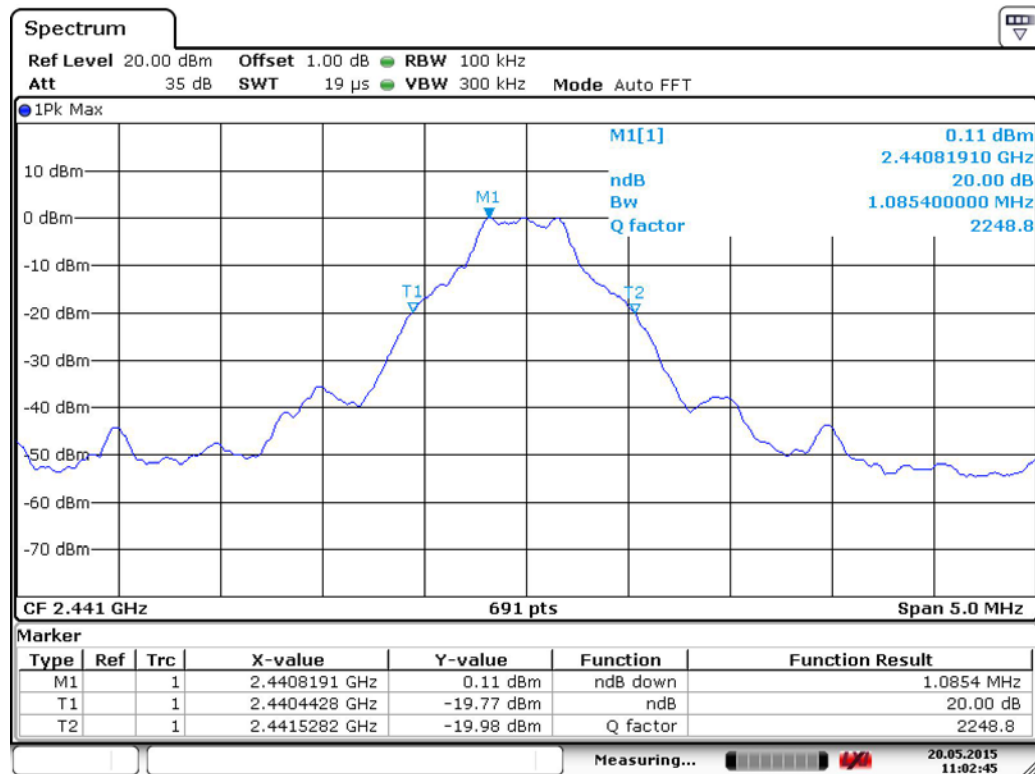
For 8DPSK

Frequency (GHz)	Test Channel	bandwidth
2.402	Lowest	1.31MHz
2.441	Middle	1.31MHz
2.480	Highest	1.32MHz

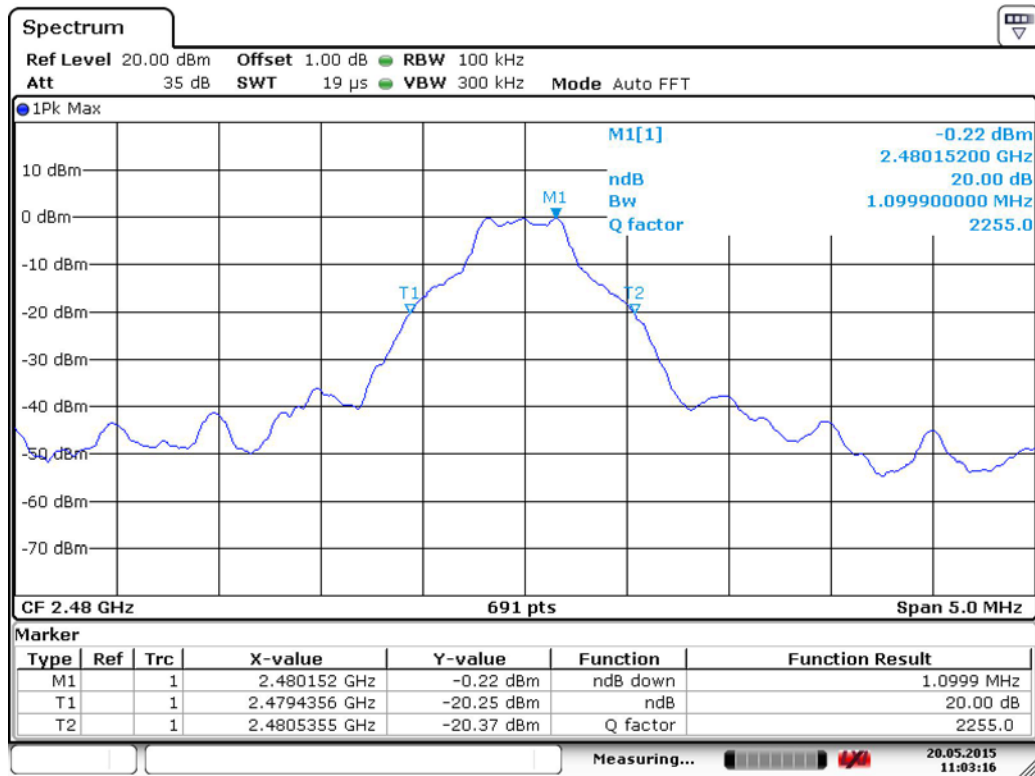
Result plot as follows:

GFSK Lowest Channel:

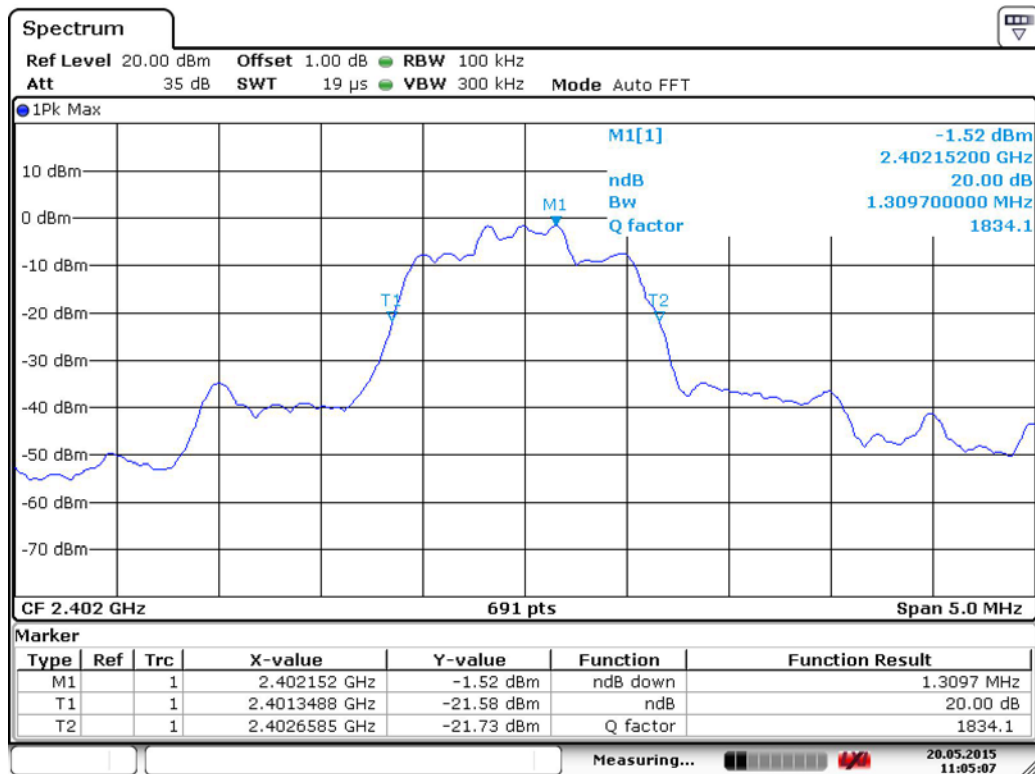
Date: 20.MAY.2015 11:02:16

GFSK Middle Channel:

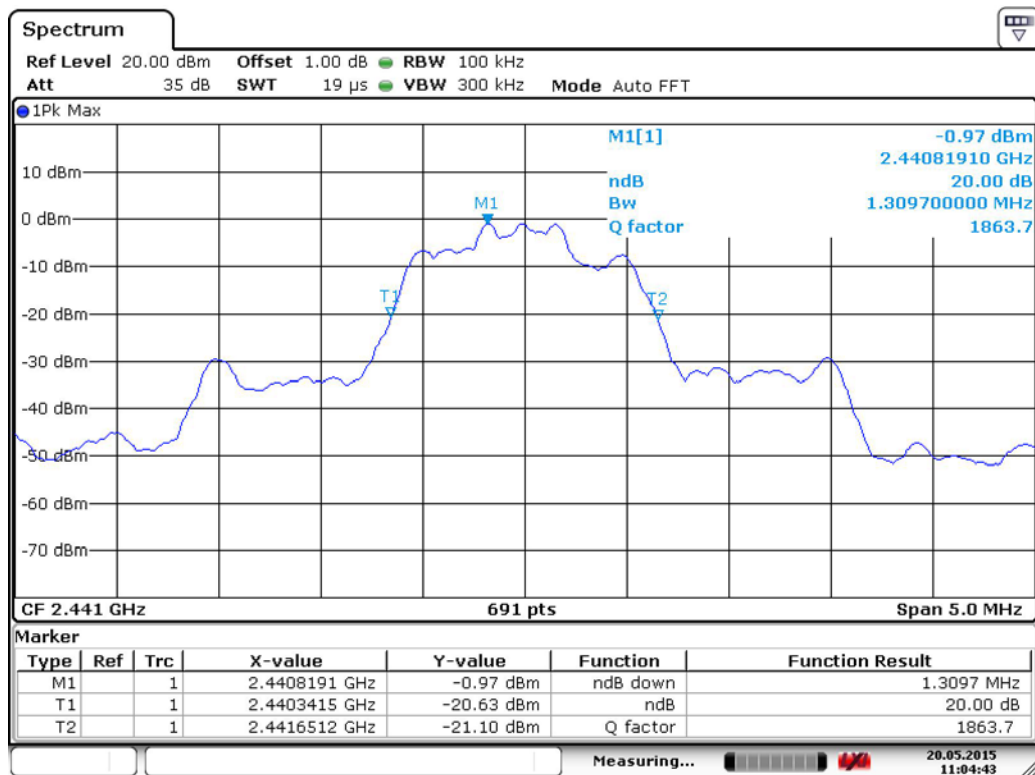
Date: 20.MAY.2015 11:02:45

GFSK Highest Channel:

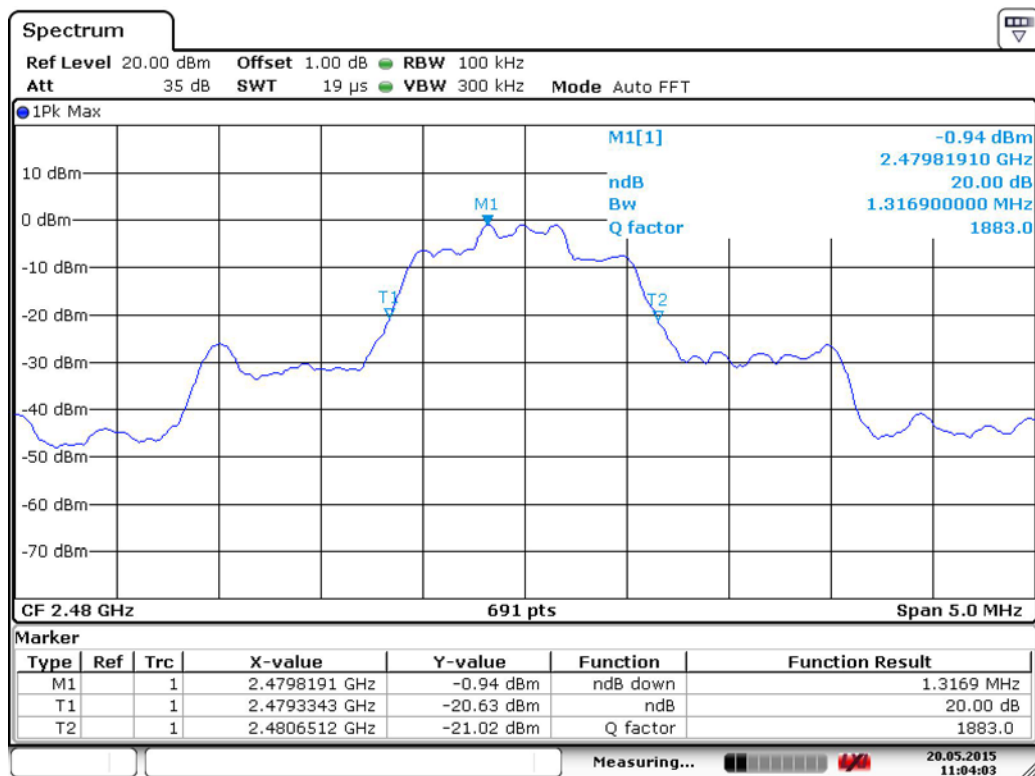
Date: 20.MAY.2015 11:03:16

8DPSK Lowest Channel:

Date: 20.MAY.2015 11:05:08

8DPSK Middle Channel:

Date: 20.MAY.2015 11:04:43

8DPSK Highest Channel:

Date: 20.MAY.2015 11:04:03

4.4 CARRIER FREQUENCIES SEPARATED

4.4.1 LIMITS

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.

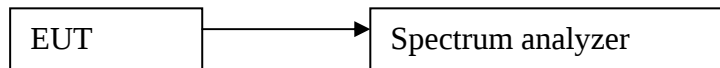
4.4.2 TEST PROCEDURES

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW $\geq$ 1% of the span (set 100 kHz). VBW $\geq$ RBW , Span = 3MHz. Sweep = auto; Detector Function = Peak. Trace = Max,hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Remark :

Pre-test the 3 modulation to find GFSK and 8DPSK is worse case, so only record GFSK and 8DPSK test data.

4.4.3 TEST SETUP

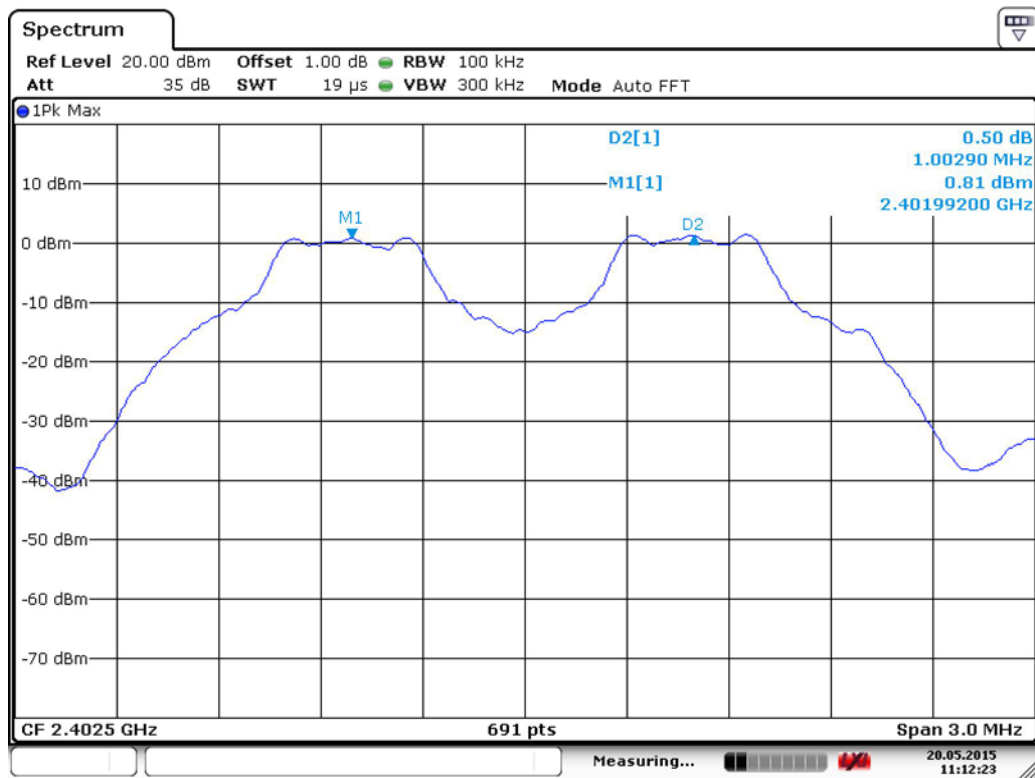


4.4.4 TEST RESULTS

Mode	Test Channel	Carrier Frequencies Separated	2/3 20 dB bandwidth	PASS/FAIL
GFSK	Lower Channels (channel 0 and channel 1)	1.003MHz	0.73MHz	Pass
	Middle Channels (channel 39 and channel 40)	1.003MHz	0.73MHz	Pass
	Upper Channels (channel 77 and channel 78)	1.003MHz	0.73MHz	Pass
8DPSK	Lower Channels (channel 0 and channel 1)	1.004MHz	0.87MHz	Pass
	Middle Channels (channel 39 and channel 40)	1.003MHz	0.87MHz	Pass
	Upper Channels (channel 77 and channel 78)	1.003MHz	0.88MHz	Pass

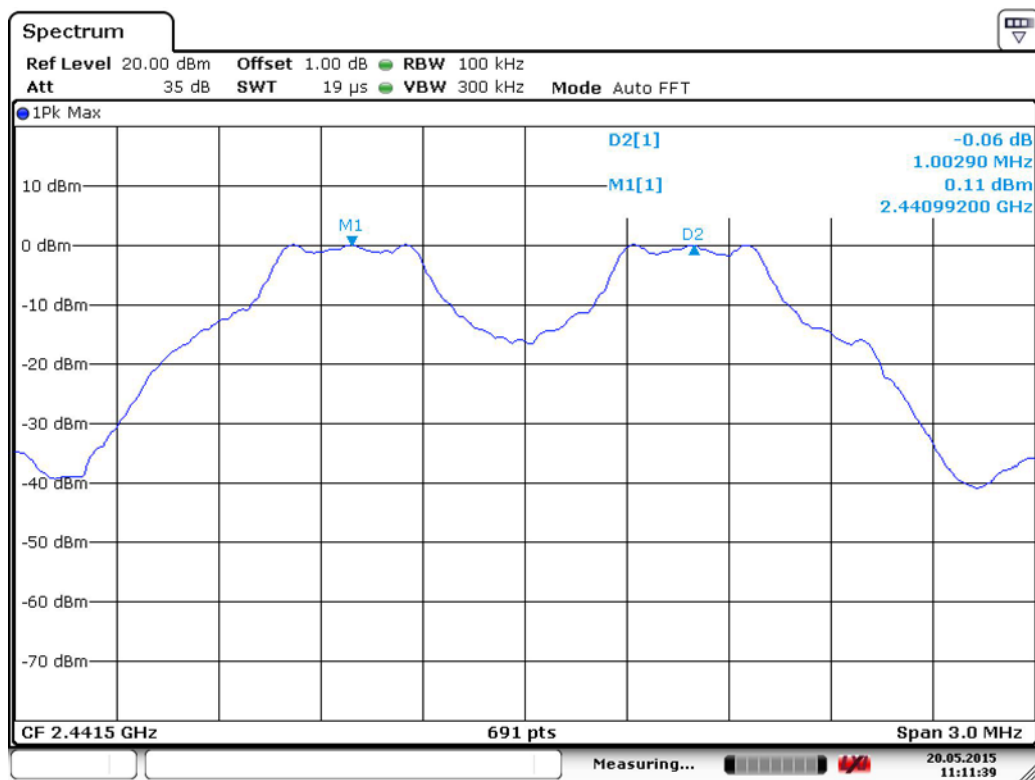
Result plot as follows:

GFSK Lowest Channels:



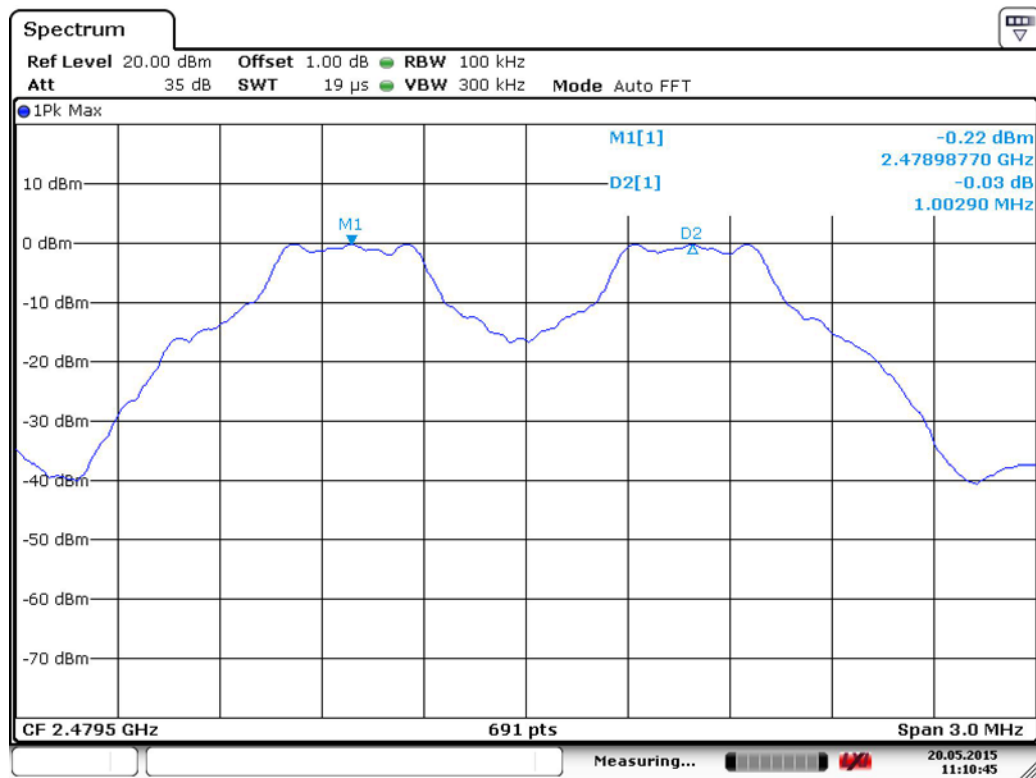
Date: 20.MAY.2015 11:12:23

GFSK Middle Channels:



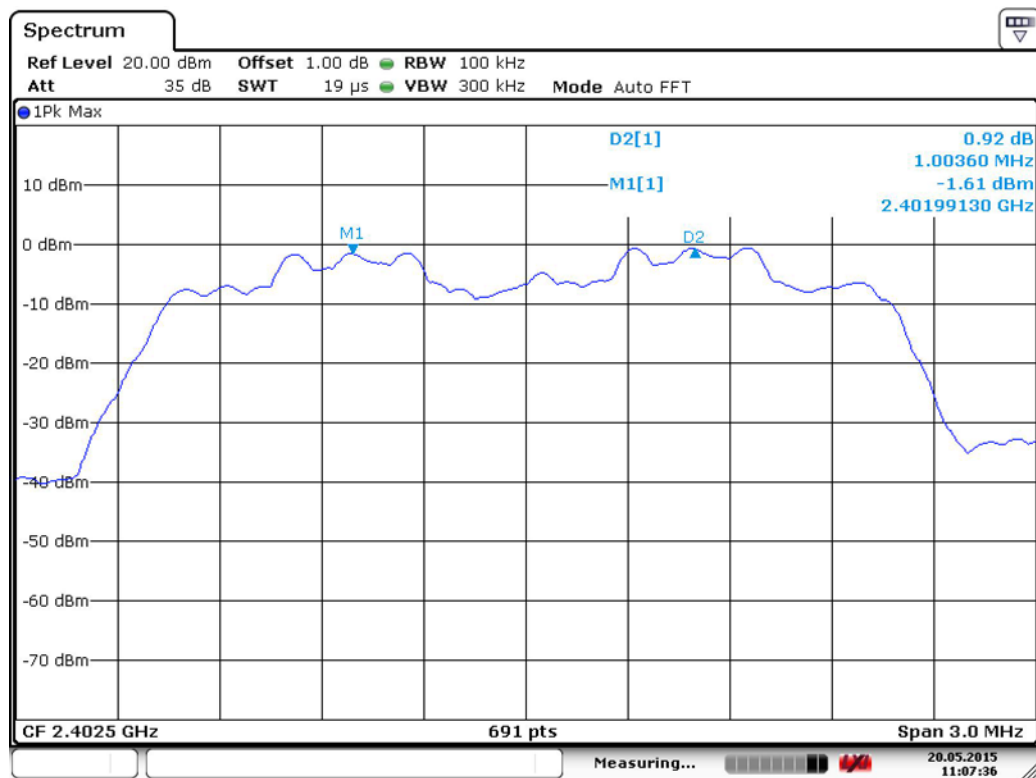
Date: 20.MAY.2015 11:11:39

GFSK Highest Channels:



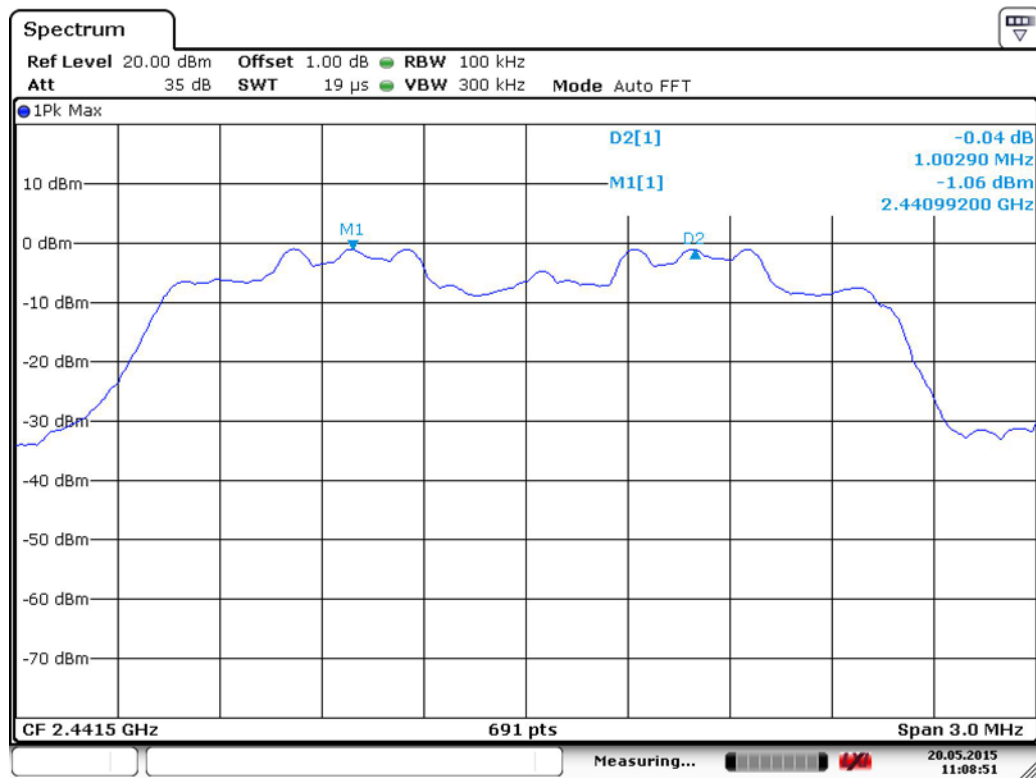
Date: 20.MAY.2015 11:10:45

8DPSK Lowest Channels:



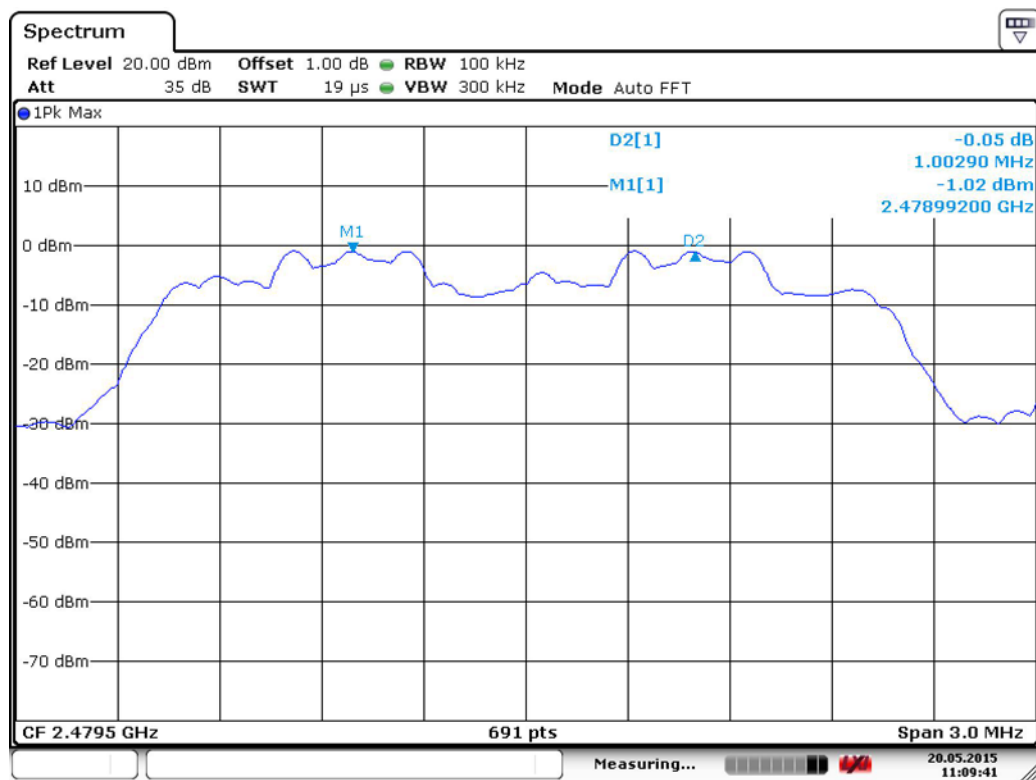
Date: 20.MAY.2015 11:07:36

8DPSK Middle Channels:



Date: 20.MAY.2015 11:08:51

8DPSK Highest Channels:



Date: 20.MAY.2015 11:09:42

Test result: The unit does meet the FCC requirements.

4.5 HOPPING CHANNEL NUMBER

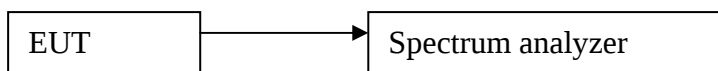
4.5.1 LIMITS

Regulation 15.247 (a) (1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

4.5.2 TEST PROCEDURES

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 2400MHz. stop frequency = 2483.5MHz. Submit the test result graph.

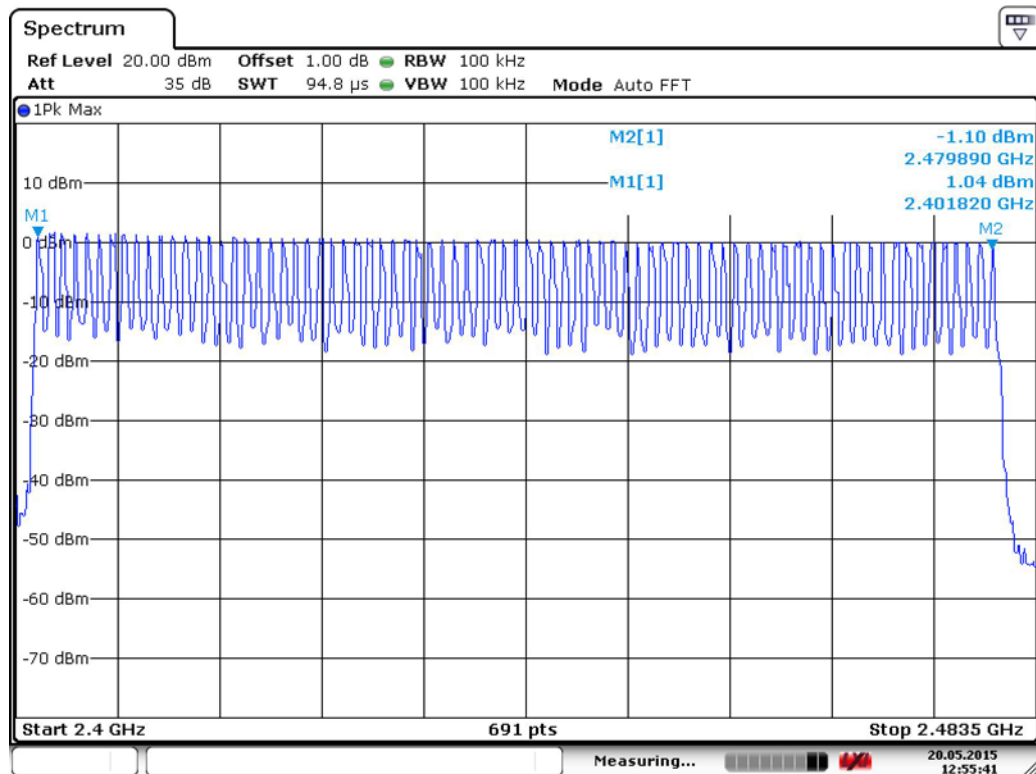
4.5.3 TEST SETUP



4.5.4 TEST RESULTS

Test result: Total channels are 79 channels.

Result plot as follows:



Date: 20.MAY.2015 12:55:41

Test result: The unit does meet the FCC requirements.

4.6 DWELL TIME

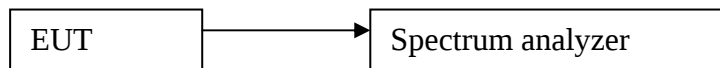
4.6.1 LIMITS

Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

4.6.2 TEST PROCEDURES

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. centered on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = Max hold;
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

4.6.3 TEST SETUP



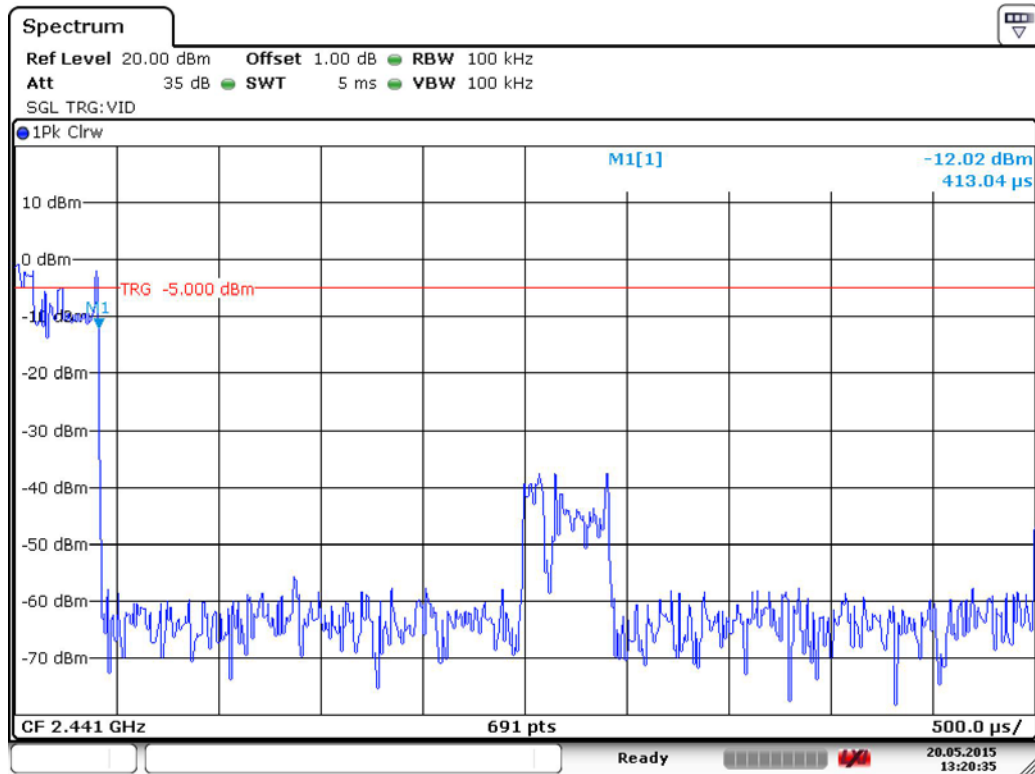
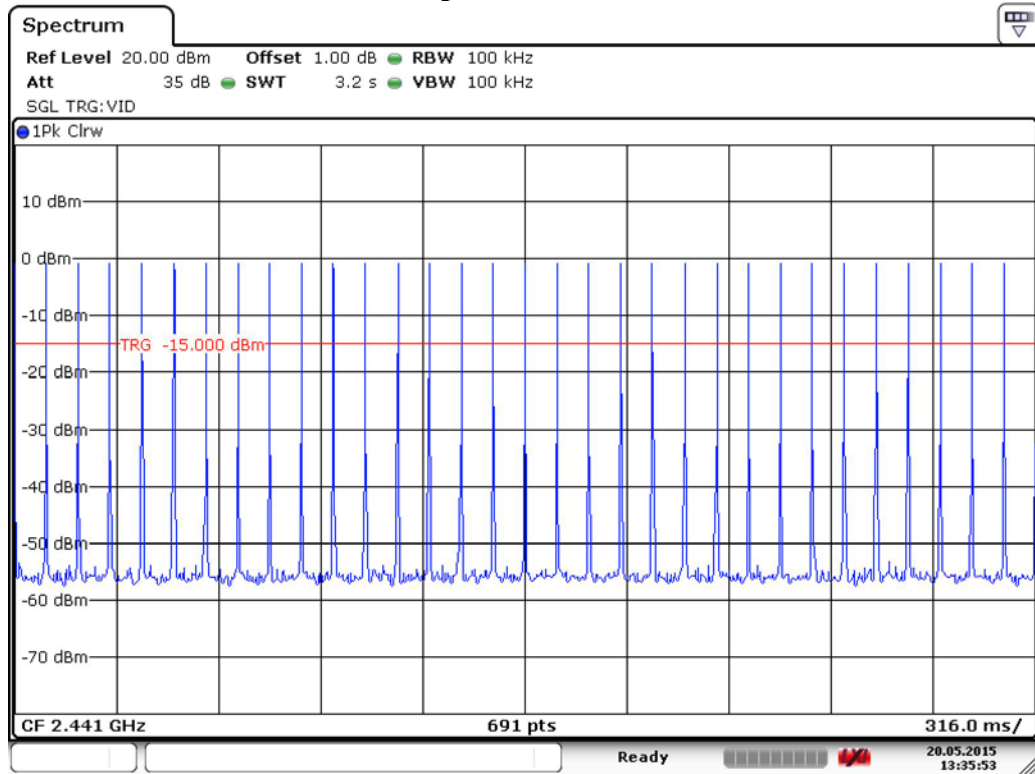
4.6.4 TEST RESULTS

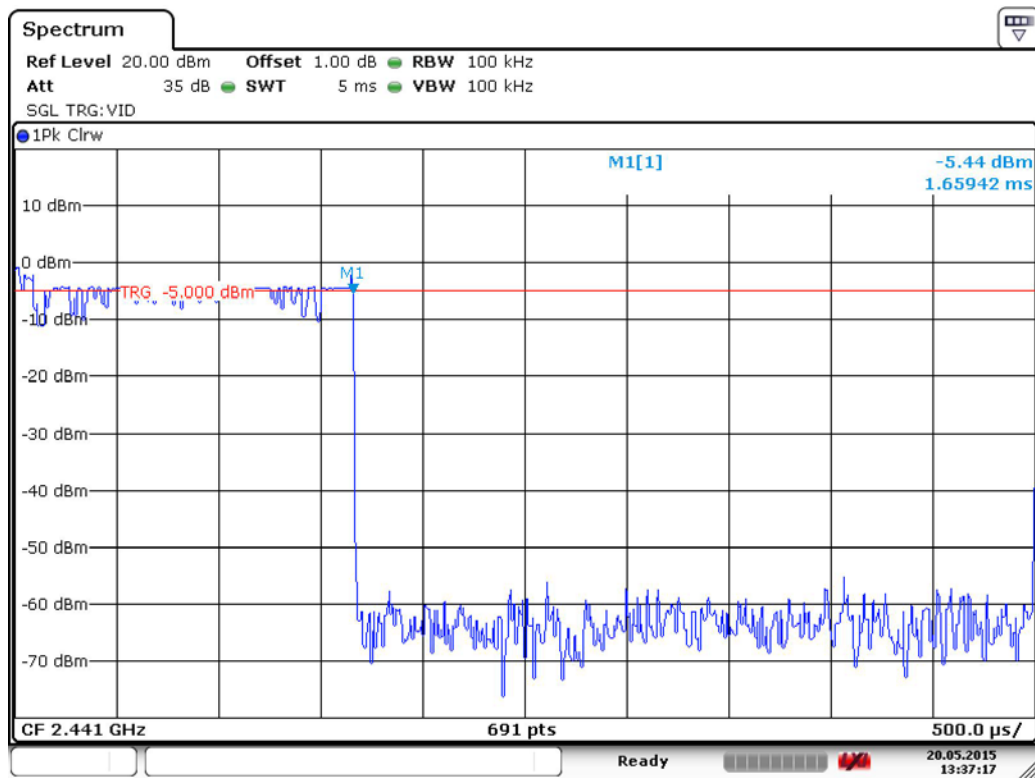
Frequency (MHz)	Modulation	Packet	Dwell Time Per Hop(ms)	Number of Hopping Channel in 31.6s	Maximum Accumulated Dwell Time (s)	Limit (s)	Result
2441	8DPSK	3DH1	0.413	320	0.132	0.4	Pass
		3DH3	1.659	160	0.265	0.4	Pass
		3DH5	2.910	110	0.320	0.4	Pass

Remark: The average time of occupancy in the specified 31.6 second period is equal to pulse width*(time of pulse in observation period)*(test period / observation period)

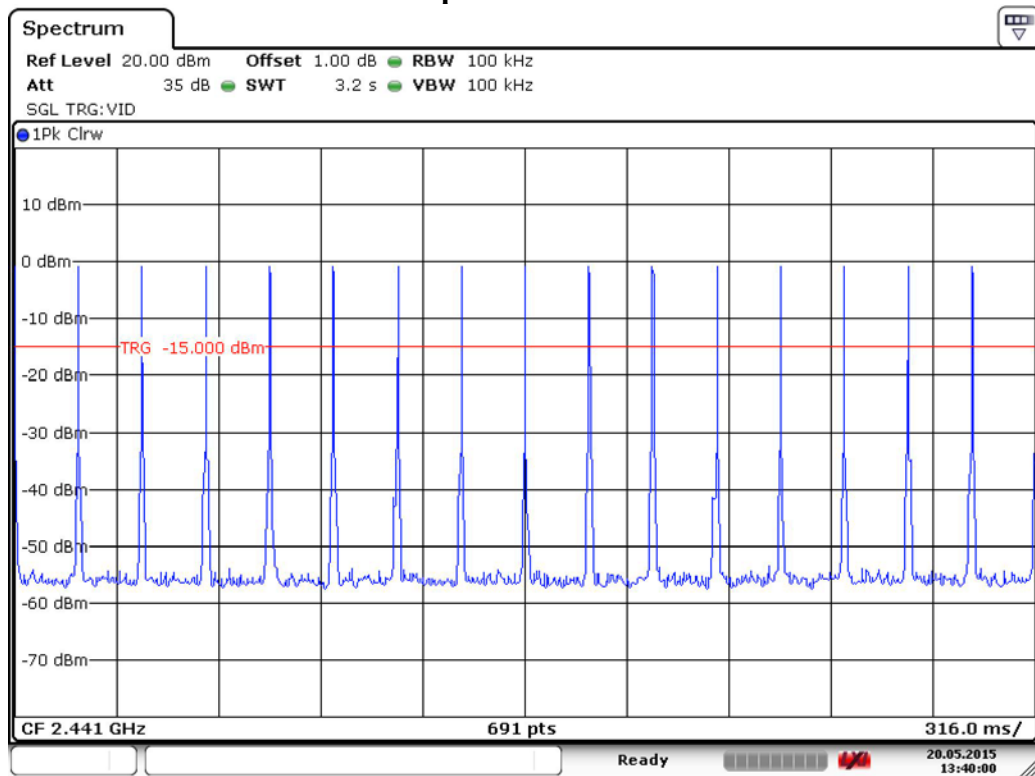
**The results are not greater than 0.4 seconds.
The unit does meet the requirements.**

Please refer the graph as below:

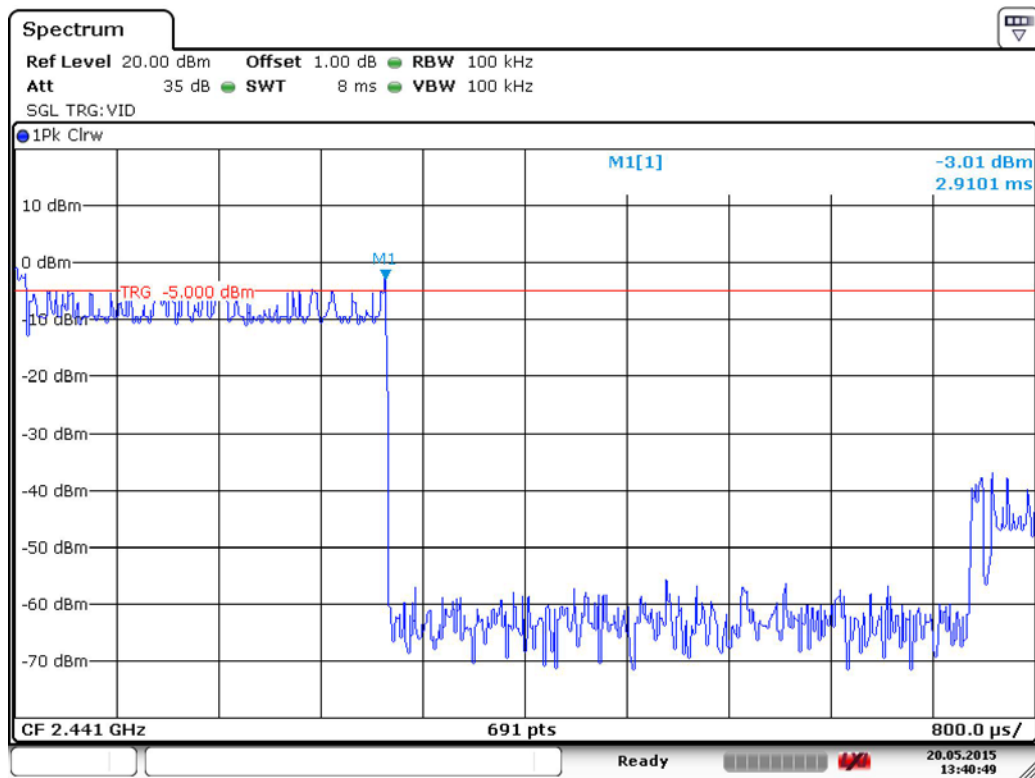
**For 3DH1:
Pulse Width:****Number of Pulses in 31.6 S observation period:**

**For 3DH3:
Pulse Width:**

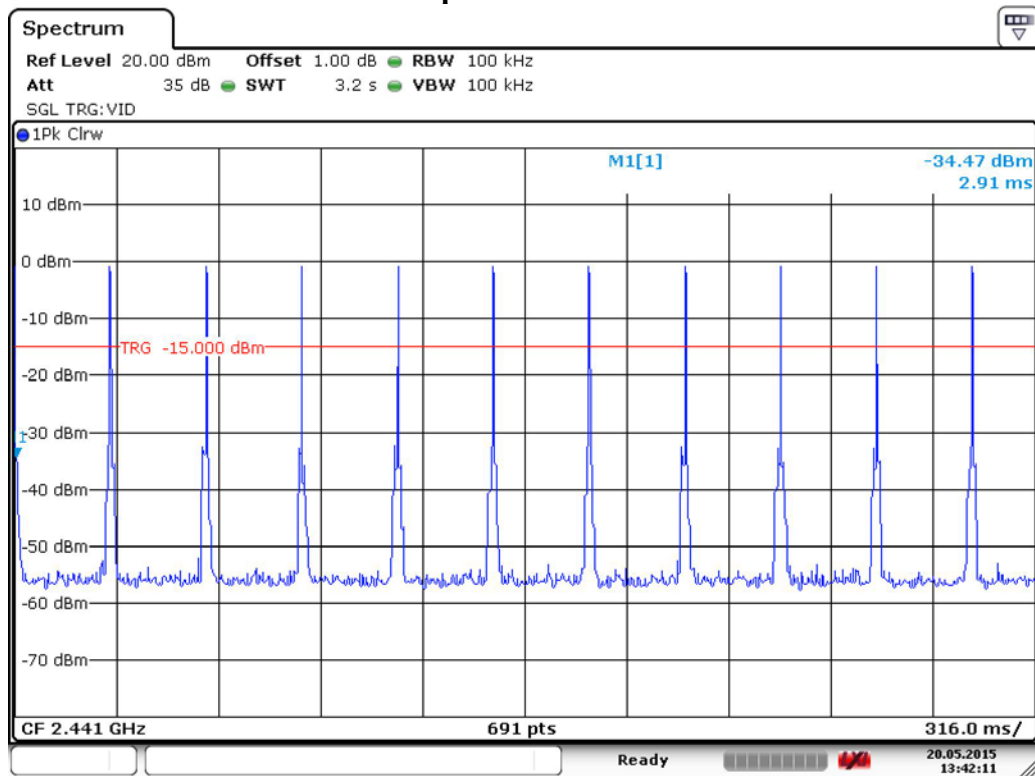
Date: 20.MAY.2015 13:37:17

Number of Pulses in 31.6 S observation period:

Date: 20.MAY.2015 13:40:00

**For 3DH5:
Pulse Width:**

Date: 20.MAY.2015 13:40:49

Number of Pulses in 31.6 S observation period:

Date: 20.MAY.2015 13:42:11

4.7 CONDUCTED EMISSION MEASUREMENT

4.7.1 LIMITS

Frequency range	Limits (dB μ V)	
	Quasi-peak	Average
150kHz $\sim$ 0.5MHz	66 $\sim$ 56	56 $\sim$ 46
0.5 MHz $\sim$ 5 MHz	56	46
5 MHz $\sim$ 30 MHz	60	50

4.7.2 TEST PROCEDURES

Procedure of Preliminary Test

For measurement of the disturbance voltage the equipment under test (EUT) is connected to the power supply mains and any other extended network via one or more artificial network(s). An EUT, whether intended to be grounded or not, and which is to be used on a table is configured as follows:

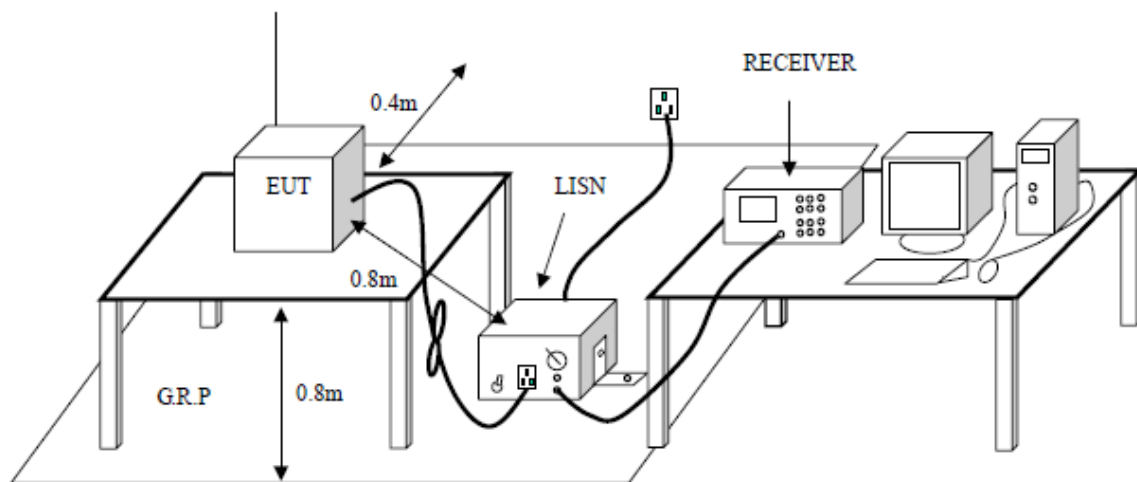
- Either the bottom or the rear of the EUT shall be at a controlled distance of 40 cm from a reference ground plane. This ground plane is normally the wall or floor of a shielded room. It may also be a grounded metal plane of at least 2 m by 2 m. This is physically accomplished as follows:
 - 1) place the EUT on a table of non-conducting material which is at least 80 cm high. Place the EUT so that it is 40 cm from the wall of the shielded room, or
 - 2) place the EUT on a table of non-conducting material which is 40 cm high so that the bottom of the EUT is 40 cm above the ground plane;
- All other conductive surfaces of the EUT shall be at least 80 cm from the reference ground plane;
- The EUT are placed on the floor that one side of the housings is 40 cm from the vertical reference ground plane and other metallic parts;
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth forming a bundle 30 cm to 40 cm long, hanging approximately in the middle between the ground plane and the table.
- I/O cables that are connected to a peripheral shall be bundled in the centre. The end of the cable may be terminated if required using correct terminating impedance. The total length shall not exceed 1 m.

The test mode(s) described in Item 2.4 were scanned during the preliminary test. After the preliminary scan, we found the test mode described in Item 2.4 producing the highest emission level. The EUT configuration and cable configuration of the above highest emission levels were recorded for reference of the final test.

Procedure of Final Test

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test. A scan was taken on both power lines, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. The test data of the worst-case condition(s) was recorded.

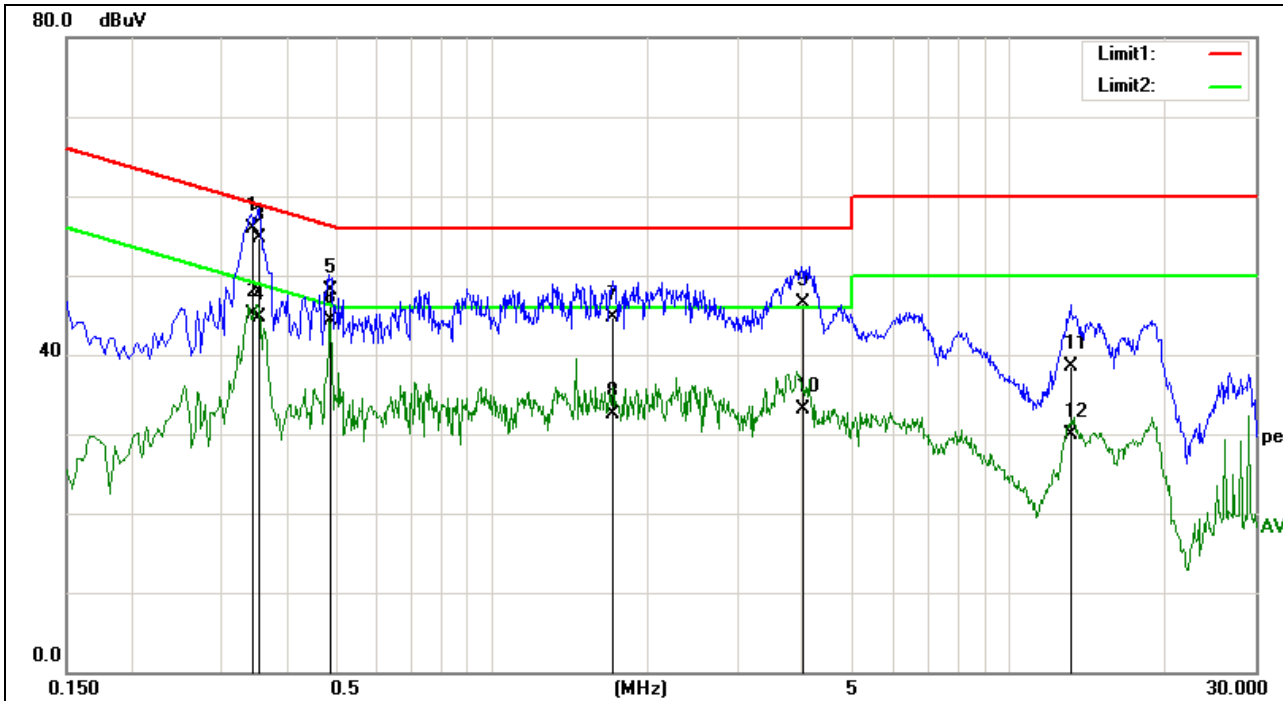
4.7.3 TEST SETUP



4.7.4 TEST RESULTS

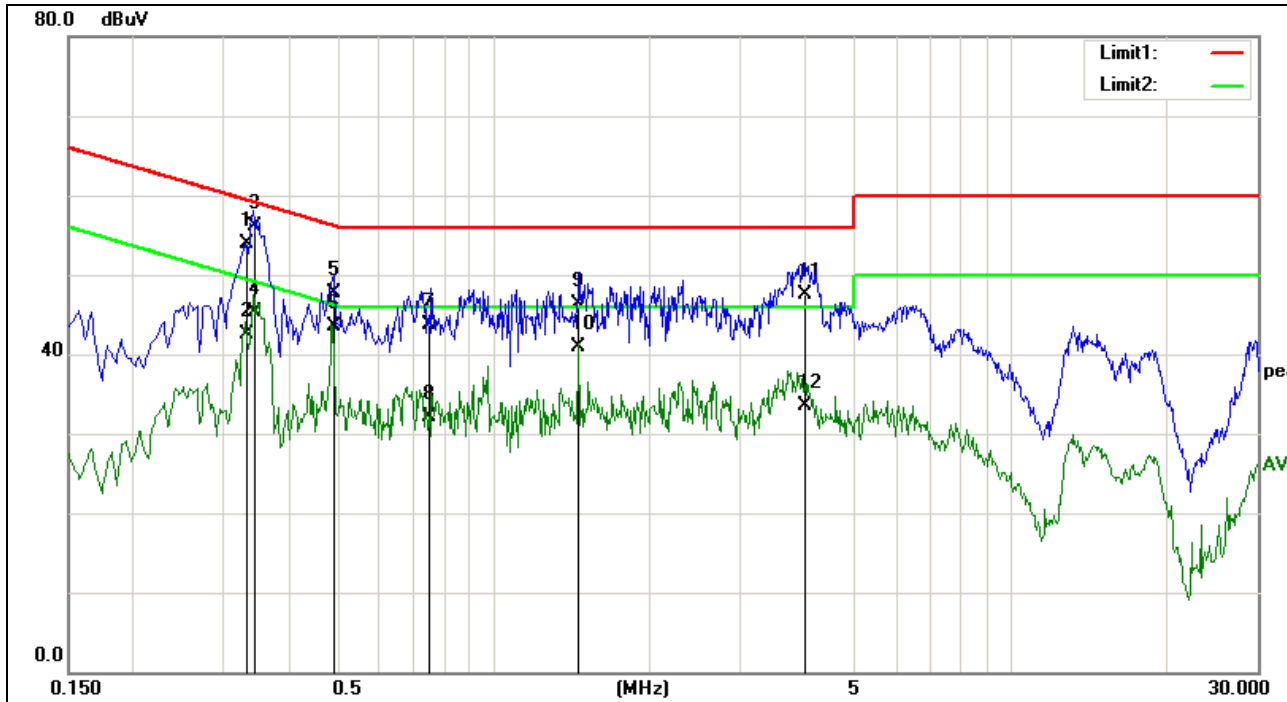
Pre-test the 3 modulation to find 8DPSK 2480 is worse case, so only record 8DPSK 2480 test data.

Project No.:	ZJ20150201-E-1	Probe:	N
Standard:	(CE)FCC PART 15 class B_QP	Power Source:	120V/60Hz
Test item:	Conduction Test	Date:	2015-5-1
Temp./Hum.(%RH):	22.2/53%RH	Time:	16:27:20
EUT:	Heater	Test Result:	Pass
Model:	CFI-100-1		
Note:	8DPSK 2480		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.3437	49.42	6.50	55.92	59.11	-3.19	QP
2	0.3437	38.51	6.50	45.01	49.11	-4.10	AVG
3	0.3526	48.28	6.51	54.79	58.90	-4.11	QP
4	0.3526	38.11	6.51	44.62	48.90	-4.28	AVG
5	0.4863	41.50	6.52	48.02	56.23	-8.21	QP
6	0.4863	37.75	6.52	44.27	46.23	-1.96	AVG
7	1.7173	38.17	6.58	44.75	56.00	-11.25	QP
8	1.7173	25.96	6.58	32.54	46.00	-13.46	AVG
9	4.0100	39.89	6.67	46.56	56.00	-9.44	QP
10	4.0100	26.47	6.67	33.14	46.00	-12.86	AVG
11	13.2030	31.80	6.74	38.54	60.00	-21.46	QP
12	13.2030	23.15	6.74	29.89	50.00	-20.11	AVG

Project No.:	ZJ20150201-E-1	Probe:	L1
Standard:	(CE)FCC PART 15 class B_QP	Power Source:	120V/60Hz
Test item:	Conduction Test	Date:	2015-5-1
Temp./Hum.(%RH):	22.2/53%RH	Time:	16:32:04
EUT:	Heater	Test Result:	Pass
Model:	CFI-100-1		
Note:	8DPSK 2480		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.3336	47.36	6.50	53.86	59.36	-5.50	QP
2	0.3336	35.93	6.50	42.43	49.36	-6.93	AVG
3	0.3454	49.53	6.50	56.03	59.07	-3.04	QP
4	0.3454	38.79	6.50	45.29	49.07	-3.78	AVG
5	0.4868	41.17	6.52	47.69	56.22	-8.53	QP
6	0.4868	36.97	6.52	43.49	46.22	-2.73	AVG
7	0.7498	37.16	6.47	43.63	56.00	-12.37	QP
8	0.7498	25.66	6.47	32.13	46.00	-13.87	AVG
9	1.4559	39.77	6.56	46.33	56.00	-9.67	QP
10	1.4559	34.40	6.56	40.96	46.00	-5.04	AVG
11	4.0063	40.86	6.66	47.52	56.00	-8.48	QP
12	4.0063	26.76	6.66	33.42	46.00	-12.58	AVG