FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No......:	**A1411096076-EDR**
FCC ID..... :	**2ACWO-HC7-M**
Compiled by (position+printed name+signature)..:	File administrators Tony Li
Supervised by (position+printed name+signature)..:	Technique principal Robin Fang
Approved by (position+printed name+signature)..:	Manager James Wu
Date of issue.....:	Nov,28 2014
Representative Laboratory Name ....:	Shenzhen CTL Electron Technology Co., Ltd.
Address .....:	A0402, Block 1, Kefa Industrial District, Huanguan Nan Rd, Xintian community, Guanlan, Baoan, Shenzhen, China
Testing Laboratory Name.....:	Dongguan Dongdian Testing Service Co.,Ltd
Address .....:	No.17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China
Applicant's name.....:	**AURA TECHNOLOGY LIMTED**
Address .....:	FLAT/RM810, Star House, 3 Salisbury Road, Tsimshatsui, Hong Kong
Test specification .....**:**	
Standard .....:	**FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**
TRF Originator.....:	Shenzhen CTL Electron Technology Co., Ltd.
Master TRF.....:	Dated 2012-06

Test item description .....:	Telpad
Trade Mark .....:	/
Model/Type reference.....:	HC7
Listed Models .....:	/
Manufacturer .....:	**SHENZHEN KWANG SUNG ELECTRONICS CO.,LTD**
Modulation Type .....:	GFSK,Π/4DQPSK,8DPSK
Operation Frequency.....:	From 2402MHz to 2480MHz
Rating .....:	DC 3.70V
Result.....:	**PASS**

T E S T R E P O R T

Test Report No. : A1411096076-EDR	Nov,28 2014 Date of issue

Equipment under Test	:	Telpad
Model /Type	:	HC7
Listed Models	:	/
Applicant	:	**AURA TECHNOLOGY LIMTED**
Address	:	FLAT/RM810, Star House, 3 Salisbury Road, Tsimshatsui, Hong Kong
Manufacturer	:	**SHENZHEN KWANG SUNG ELECTRONICS CO.,LTD**
Address	:	Shitoushan Industrial Zone, Shi Yan Town, Baoan District, Shenzhen, PRC

Test Result:	**PASS**

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.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices

2 . SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Nov 14, 2014
Testing commenced on	:	Nov 14, 2014
Testing concluded on	:	Nov 26, 2014

2.2. Product Description

The **AURA TECHNOLOGY LIMTED**'s Model: HC7 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

Name of EUT	Telpad
Model Number	HC7
FCC ID	2ACWO-HC7-M
WLAN	Supported 802.11b/802.11g/802.11n
Bluetooth	Supported BT 4.0+EDR
Antenna Type	Internal
WLAN FCC Operation frequency	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz IEEE 802.11n HT40: 2422MHz—2452MHz
Bluetooth FCC Operation frequency	2402MHz-2480MHz
WLAN Modulation	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Bluetooth Modulation	EDR(GFSK,8DPSK,π/4DQPSK)/BLE(GFSK)
Android Version	Android 4.2.2

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	120V / 60 Hz	○	115V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 3.70V/DC 5.0V Adapter from AC 120V/60Hz

2.4. Short description of the Equipment under Test (EUT)

2.4GHz (Telpad (M/N: HC7))

For more details, refer to the user's manual of the EUT.

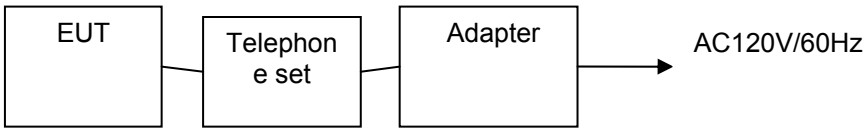
2.5. EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continous transmitting and receiving mode for testing. There are 79 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel .

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

2.6. Block Diagram of Test Setup

Fig. 2-1 Configuration of Tested System



Adapter:

MODEL:SA/18PA/05FUS056300
INPUT:100-240V～50/60Hz 0.3A
OUTPUT: 5.6V DC 3A
Power Cable: 180cm
◇ Shielded ◆ Unshielded

2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2ACWO-HC7-M** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. NOTE

1. The EUT is a Telpad with WLAN and Bluetooth function,The functions of the EUT listed as below:

	Test Standards	Reference Report
WLAN	FCC Part 15 Subpart C	A1411096076-WLAN
Bluetooth-EDR	FCC Part 15 Subpart C	A1411096076-EDR
Bluetooth-BLE	FCC Part 15 Subpart C	A1411096076-BLE
JBP	FCC Part 15 Subpart B	A1411096076-JBP
SAR	FCC Per 47 CFR 2.1093(d)	A1411096076-SAR

2. The frequency bands used in this EUT are listed as follows:

Frequency Band(MHz)	2400-2483.5	5150-5350	5470-5725	5725-5850
EUT	√	—	—	—

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Dongguan Dongdian Testing Service Co.,Ltd

No.17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 10288A-1

The 3m alternate test site of Dongguan Dongdian Testing Service Co.,Ltd EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 10288A-1 on Mar, 2012.

FCC-Registration No.: 270092

Dongguan Dongdian Testing Service Co.,Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 270092, Mar 06, 2012.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Test Description

FCC PART 15 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.109/ 15.205/ 15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS
FCC Part1.1307 (b)	MPE Evaluation	PASS

Remark: The measurement uncertainty is not included in the test result.

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Dongguan Dongdian Testing Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested

may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Dongguan Dongdian Testing Service Co.,Ltd laboratory is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	1.60 dB	(1)
Radiated spurious emission 9KHz-40 GHz	2.20 dB	(1)
Conducted Emission 9KHz-30MHz	3.39 dB	(1)
Radiated Emission 30~1000MHz	4.24 dB	(1)
Radiated Emissio 1~18GHz	5.16 dB	(1)
Radiated Emissio 18-40GHz	5.54 dB	(1)
Occupied Bandwidth	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

Radiated Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	462	2014/11/01
2	EMI TEST Receiver	Rohde&Schwarz	ESU8	100316	2014/11/01
3	EMI TEST Software	Audix	E3	N/A	N/A
4	Horn Anternna	EMCO	3116	00060095	2014/11/02
5	Pre-Amplifer	Rohde&Schwarz	SCU-01	10049	2014/11/01
6	Pre-Amplifer	A.H.	PAM0-0118	360	2014/11/02
7	Pre-Amplifer	A.H.	PAM-1840VH	562	2014/11/02
8	Double Ridged Horn Antenna	Rohde&Schwarz	HF907	100265	2014/11/01
9	Active Loop Antenna	Schwarz beck	FMZB1519	0.38	2014/11/01
10	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2014/10/02
11	TURNTABLE	MATURO	TT2.0	----	N/A
12	ANTENNA MAST	MATURO	TAM-4.0-P	----	N/A
13	Spectrum Analyzer	R&S	FSU26	1166.1660.26	2014/11/01
14	EMI TEST Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A

Maximum Peak Output Power / 20dB Bandwidth / Number of hopping frequency& Time of Occupancy / Band Edge Compliance of RF Emission / Spurious RF Conducted Emission/ Frequency Separation					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Power Sensor	Rohde&Schwarz	NRP-Z81	102638	2014/11/02
2	Spectrum Analyzer	R&S	FSU26	1166.1660.26	2014/11/01
3	Spectrum Analyzer	Aglient	E4407B	MY44210775	2014/11/01

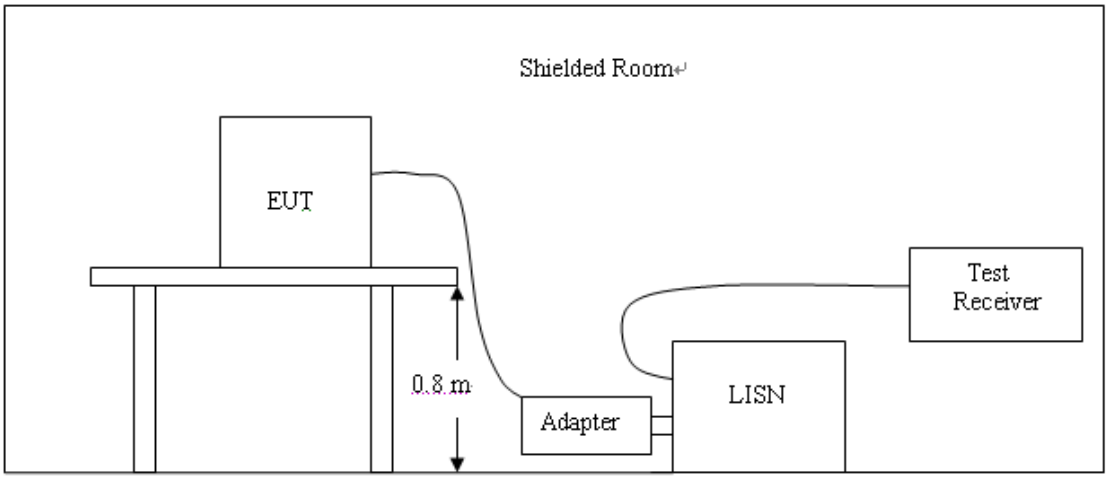
AC Power Conducted Emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ENV216	100316	2014/11/02
2	EMI Test Receiver	Rohde&Schwarz	ESU8	100316	2014/11/02
3	Pulse Limiter	Rohde&Schwarz	ESH3-Z2	101242	2014/11/02
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	N/A	N/A

The Cal.Interval was one year

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2009.
2 Support equipment, if needed, was placed as per ANSI C63.10-2009
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
4 The EUT received DC5V power from PC, the adapter of PC received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

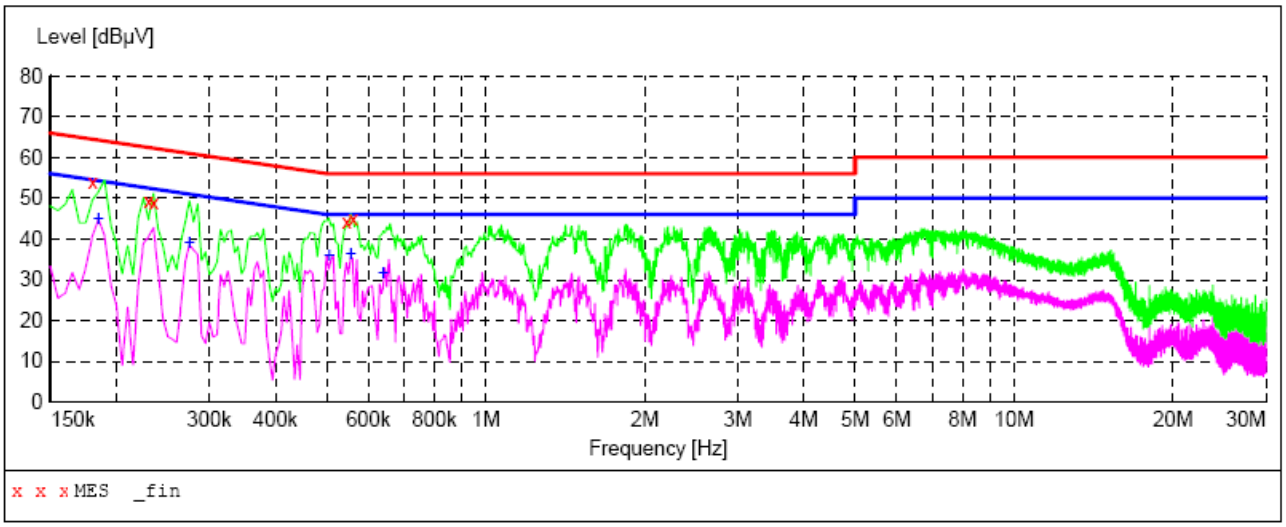
Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

*Note:*We tested Conducted Emission at both TX and RX mode of GFSK,8DPSK and Π/4DQPSK from 0.15KHz to 30MHz and recorded the worst case data at GFSK TX mode.

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



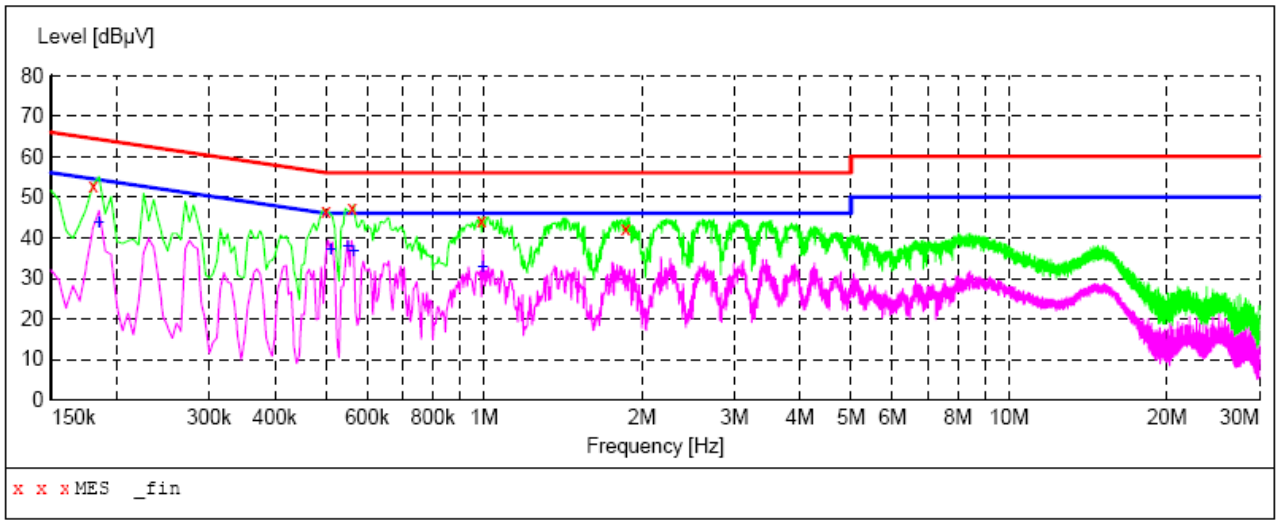
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.180000	54.10	12.1	65	10.4	QP	L1	GND
0.230000	49.30	11.2	62	13.1	QP	L1	GND
0.235000	48.80	11.2	62	13.5	QP	L1	GND
0.545000	44.30	10.5	56	11.7	QP	L1	GND
0.560000	45.10	10.5	56	10.9	QP	L1	GND

MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.185000	44.90	11.9	54	9.4	AV	L1	GND
0.275000	39.20	11.0	51	11.8	AV	L1	GND
0.505000	35.90	10.5	46	10.1	AV	L1	GND
0.555000	36.50	10.5	46	9.5	AV	L1	GND
0.640000	31.70	10.4	46	14.3	AV	L1	GND

SCAN TABLE: "Voltage(150K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.180000	52.70	12.1	65	11.8	QP	N	GND
0.500000	46.70	10.5	56	9.3	QP	N	GND
0.560000	47.50	10.5	56	8.5	QP	N	GND
0.990000	44.10	10.5	56	11.9	QP	N	GND
1.860000	42.40	10.4	56	13.6	QP	N	GND

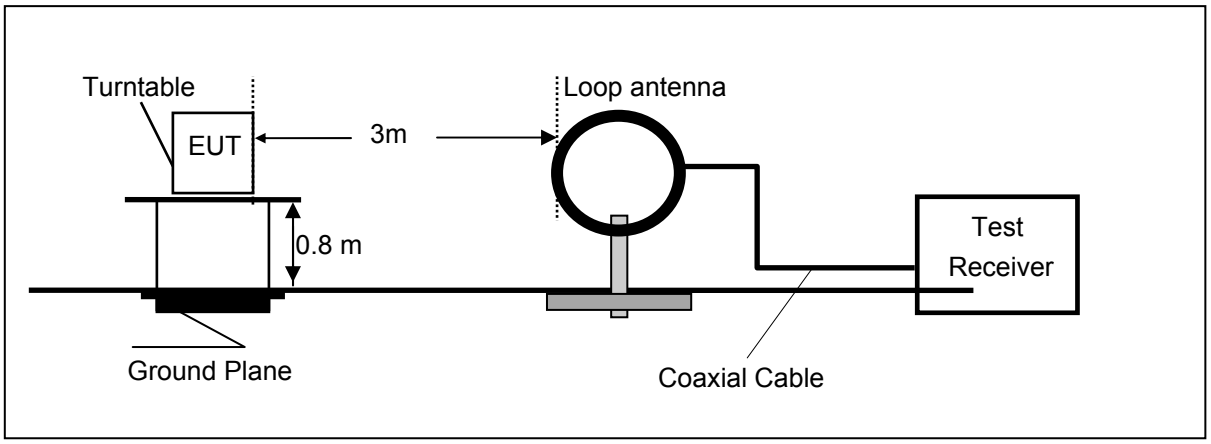
MEASUREMENT RESULT:

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.185000	43.80	11.9	54	10.5	AV	N	GND
0.510000	37.30	10.5	46	8.7	AV	N	GND
0.550000	38.00	10.5	46	8.0	AV	N	GND
0.565000	37.00	10.5	46	9.0	AV	N	GND
0.995000	32.80	10.5	46	13.2	AV	N	GND

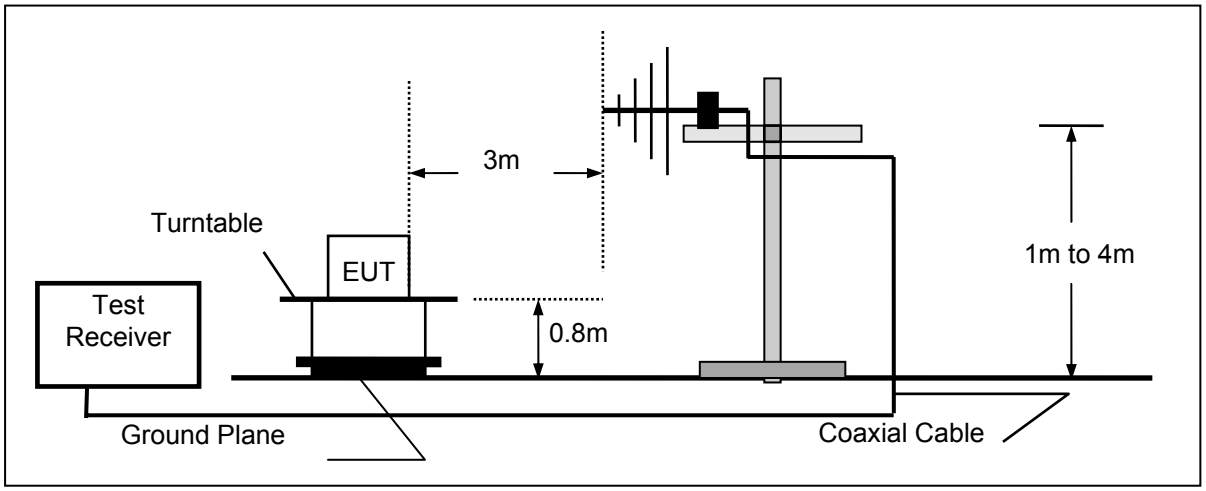
4.2. Radiated Emission

TEST CONFIGURATION

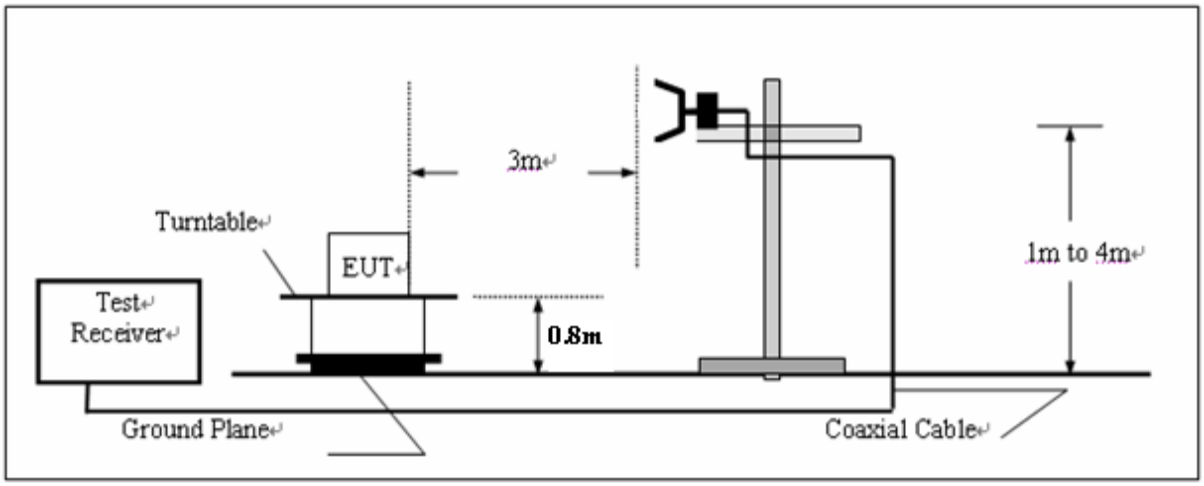
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 22.184MHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.

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 (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The frequency spectrum above 1 GHz for Transmitter was investigated. All emission not reported are much lower than the prescribed limits. Set the RBW=1MHz,VBW=3MHz for Peak Detector while the RBW=1MHz,VBW=10Hz for Average Detector,Readings are both peak and average values. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark: 1. We tested three positions and recorded worst case.

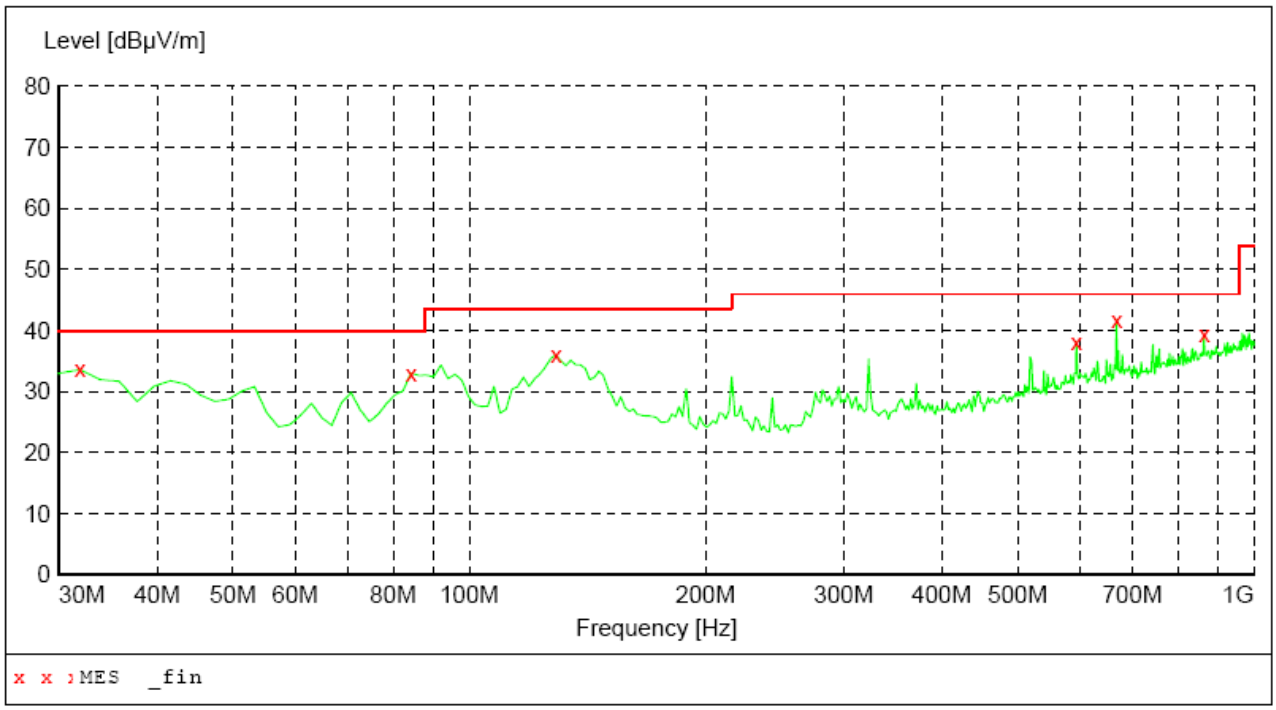
For 9KHz to 30MHz

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
12.00	46.41	69.54	23.13	QP	PASS
26.00	49.82	69.54	19.72	QP	PASS

For 30MHz to 1000MHz

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	VULB9163 NEW

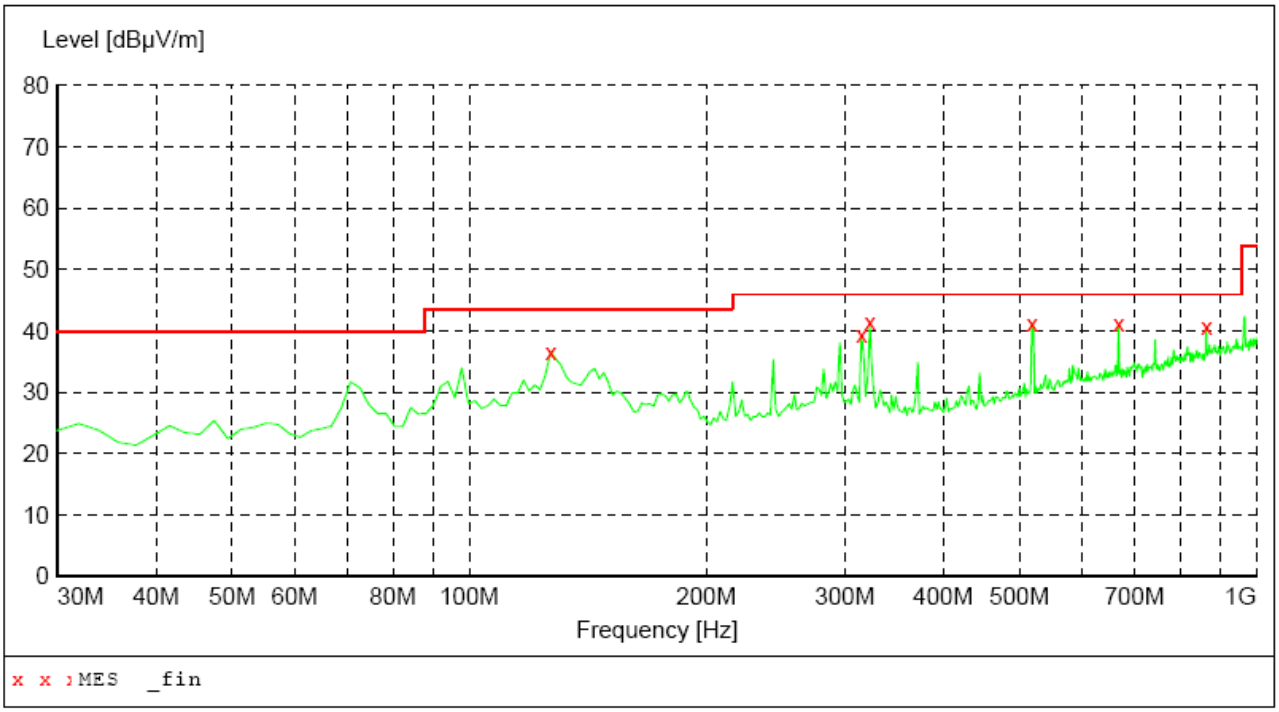


MEASUREMENT RESULT:

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
31.940000	33.60	14.4	40.0	6.4	QP	100.0	15.00	VERTICAL
84.320000	33.00	14.1	40.0	7.0	QP	100.0	124.00	VERTICAL
128.940000	36.00	13.9	43.5	7.5	QP	100.0	60.00	VERTICAL
594.540000	38.20	26.3	46.0	7.8	QP	100.0	238.00	VERTICAL
668.260000	41.80	27.2	46.0	4.2	QP	100.0	325.00	VERTICAL
864.200000	39.30	30.6	46.0	6.7	QP	100.0	75.00	VERTICAL

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	VULB9163 NEW



MEASUREMENT RESULT:

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
127.000000	36.60	14.1	43.5	6.9	QP	300.0	25.00	HORIZONTAL
315.180000	39.40	19.1	46.0	6.6	QP	100.0	30.00	HORIZONTAL
322.940000	41.50	19.3	46.0	4.5	QP	100.0	125.00	HORIZONTAL
518.880000	41.30	24.4	46.0	4.7	QP	100.0	350.00	HORIZONTAL
668.260000	41.20	27.2	46.0	4.8	QP	100.0	272.00	HORIZONTAL
864.200000	40.80	30.6	46.0	5.2	QP	100.0	105.00	HORIZONTAL

For 1GHz to 25GHz

Low Channel @ Channel 00 @ 2402 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4804.00	57.71	PK	74.00	16.29	1.00	202	55.63	31.58	7.00	36.5	2.08
2	4804.00	44.09	AV	54.00	9.91	1.00	202	42.01	31.58	7.00	36.5	2.08
3	7206.00	59.64	PK	74.00	14.36	1.00	279	48.98	37.06	8.90	35.3	10.66
4	7206.00	45.17	AV	54.00	8.83	1.00	279	34.51	37.06	8.90	35.3	10.66

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4804.00	55.22	PK	74.00	18.78	1.00	114	53.14	31.58	7.00	36.5	2.08
2	4804.00	43.46	AV	54.00	10.54	1.00	114	41.38	31.58	7.00	36.5	2.08
3	7206.00	57.78	PK	74.00	16.22	1.00	26	47.12	37.06	8.90	35.3	10.66
4	7206.00	42.94	AV	54.00	11.06	1.00	26	32.28	37.06	8.90	35.3	10.66

Middle Channel @ Channel 39 @ 2441 MHz

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4880.00	59.42	PK	74.00	14.58	1.00	125	57.28	31.04	7.60	36.5	2.14
2	4880.00	47.68	AV	54.00	6.32	1.00	125	45.54	31.04	7.60	36.5	2.14
3	7320.00	60.73	PK	74.00	13.27	1.00	188	49.59	37.84	8.60	35.3	11.14
4	7320.00	46.25	AV	54.00	7.75	1.00	188	34.78	37.84	8.60	35.3	11.47

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4880.00	56.09	PK	74.00	17.91	1.00	323	53.95	31.04	7.60	36.5	2.14
2	4880.00	42.88	AV	54.00	11.12	1.00	323	40.74	31.04	7.60	36.5	2.14
3	7320.00	57.16	PK	74.00	16.84	1.00	246	46.02	37.84	8.60	35.3	11.14
4	7320.00	42.23	AV	54.00	11.77	1.00	246	30.76	37.84	8.60	35.3	11.47

High Channel @ Channel 78 @ 2480 MHz

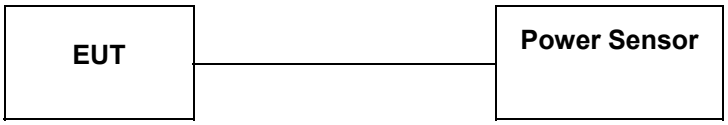
ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4960.00	59.91	PK	74.00	14.09	1.00	100	57.48	31.63	7.00	36.2	2.43
2	4960.00	47.85	AV	54.00	6.15	1.00	100	45.42	31.63	7.00	36.2	2.43
3	7340.00	61.13	PK	74.00	12.87	1.00	250	49.53	38.40	8.50	35.3	11.60
4	7340.00	46.66	AV	54.00	7.34	1.00	250	35.06	38.40	8.50	35.3	11.60

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M												
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	4960.00	56.85	PK	74.00	17.15	1.00	77	54.42	31.63	7.00	-36.2	2.43
2	4960.00	43.14	AV	54.00	10.86	1.00	77	40.71	31.63	7.00	-36.2	2.43
3	7340.00	57.94	PK	74.00	16.06	1.00	142	46.34	38.40	8.50	-35.3	11.60
4	7340.00	42.62	AV	54.00	11.38	1.00	142	31.02	38.40	8.50	35.3	11.60

REMARKS: 1. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. The other emission levels were very low against the limit.
4. Margin value = Limit value- Emission level.
5. The average measurement was not performed when the peak measured data under the limit of average detection.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2009 Maximum peak conducted output power for HFSS devices:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

LIMIT

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

TEST RESULTS

4.3.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	3.36	30	PASS
39	2441	3.48	30	PASS
78	2480	3.33	30	PASS

Note: 1.The test results including the cable lose.

4.3.2 8DPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	2.69	21	PASS
39	2441	2.98	21	PASS
78	2480	2.81	21	PASS

Note: 1.The test results including the cable lose.

4.3.3 π/4DQPSKTest Mode

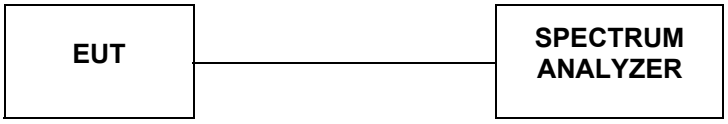
A. Test Verdict

Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limits (dBm)	Verdict
00	2402	2.69	21	PASS
39	2441	2.96	21	PASS
78	2480	2.78	21	PASS

Note: 1.The test results including the cable lose.

4.4. 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30 KHz and VBW=100KHz.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

LIMIT

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwith.

TEST RESULTS

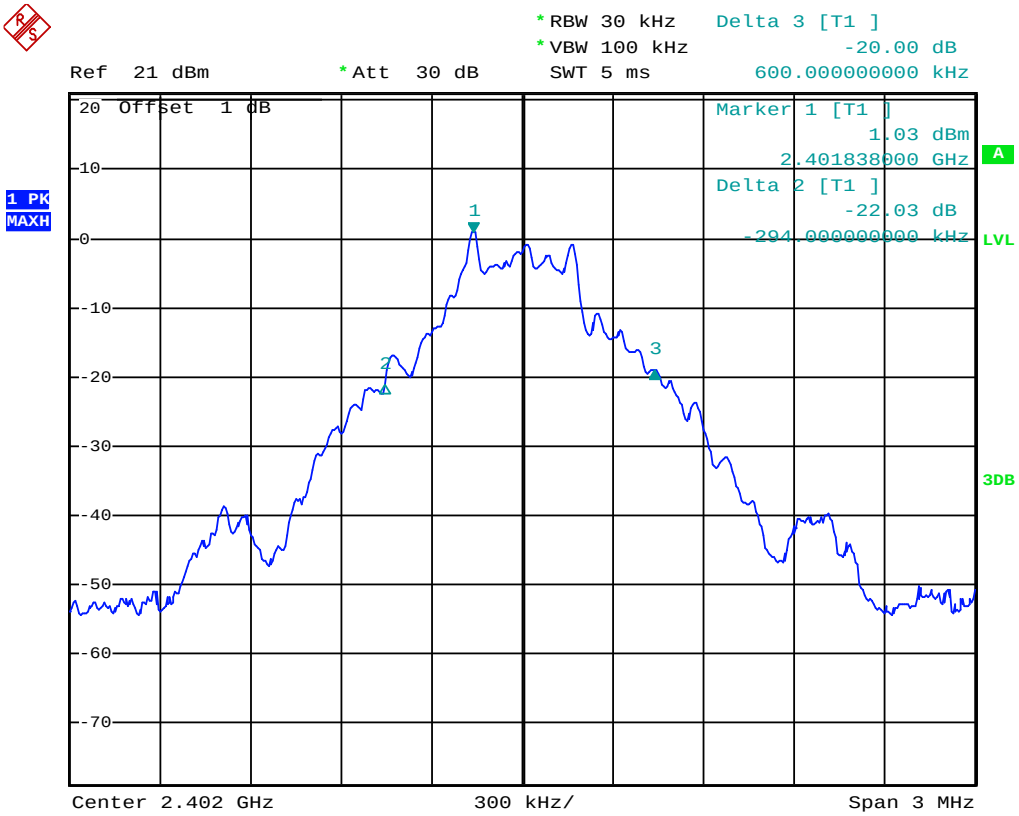
4.4.1 GFSK Test Mode

A. Test Verdict

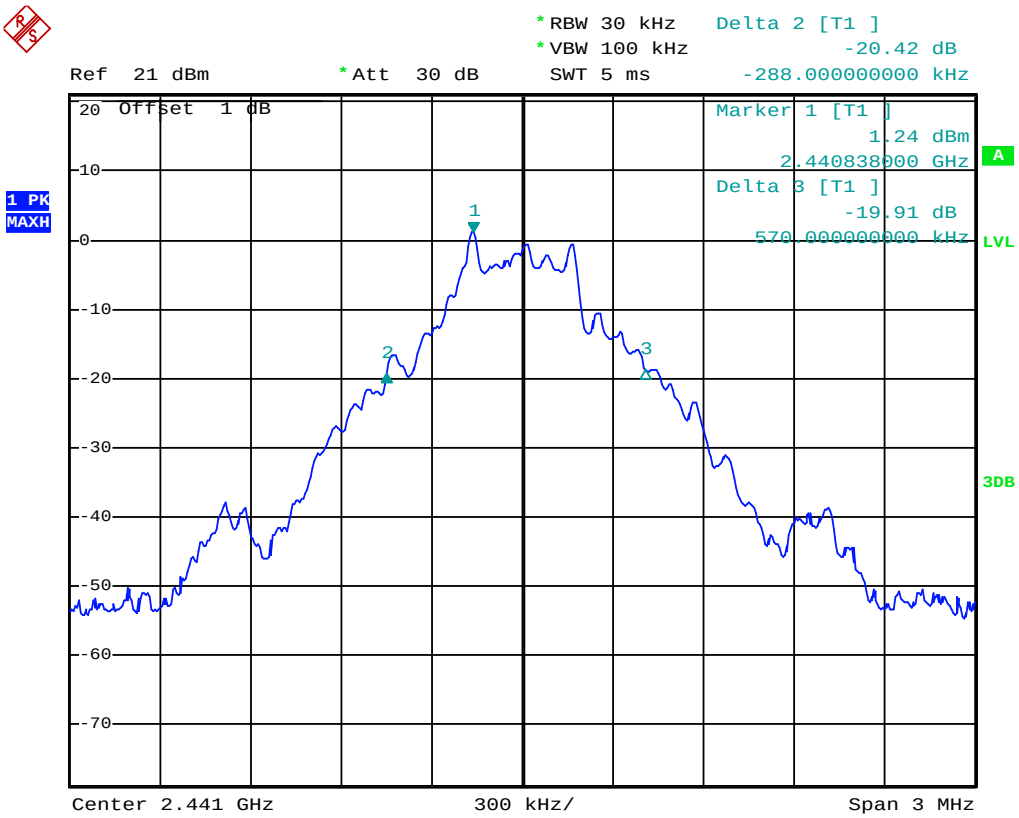
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	0.894	Plot 4.4.1 A	/	PASS
39	2441	0.858	Plot 4.4.1 B	/	PASS
78	2480	0.894	Plot 4.4.1 C	/	PASS

Note: 1.The test results including the cable lose.

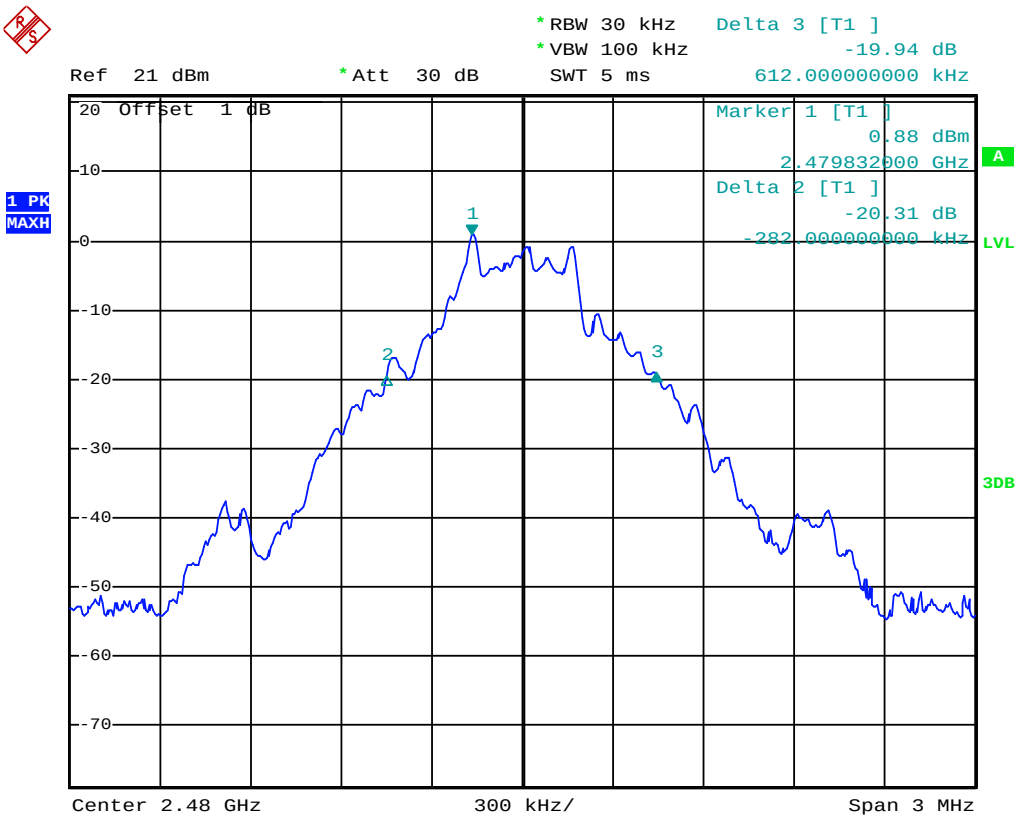
B. Test Plots



(Plot 4.4.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 4.4.1 B: Channel 39: 2441MHz @ GFSK)



(Plot 4.4.1 C: Channel 78: 2480MHz @ GFSK)

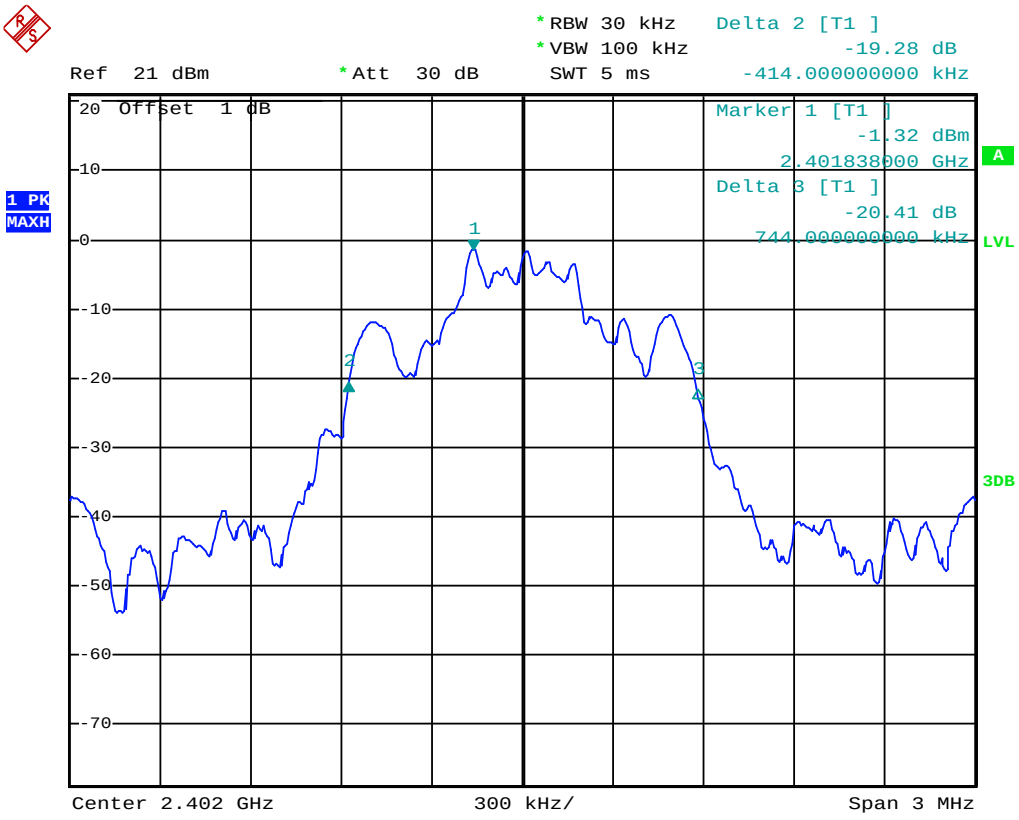
4.4.2 8DPSK Test Mode

A. Test Verdict

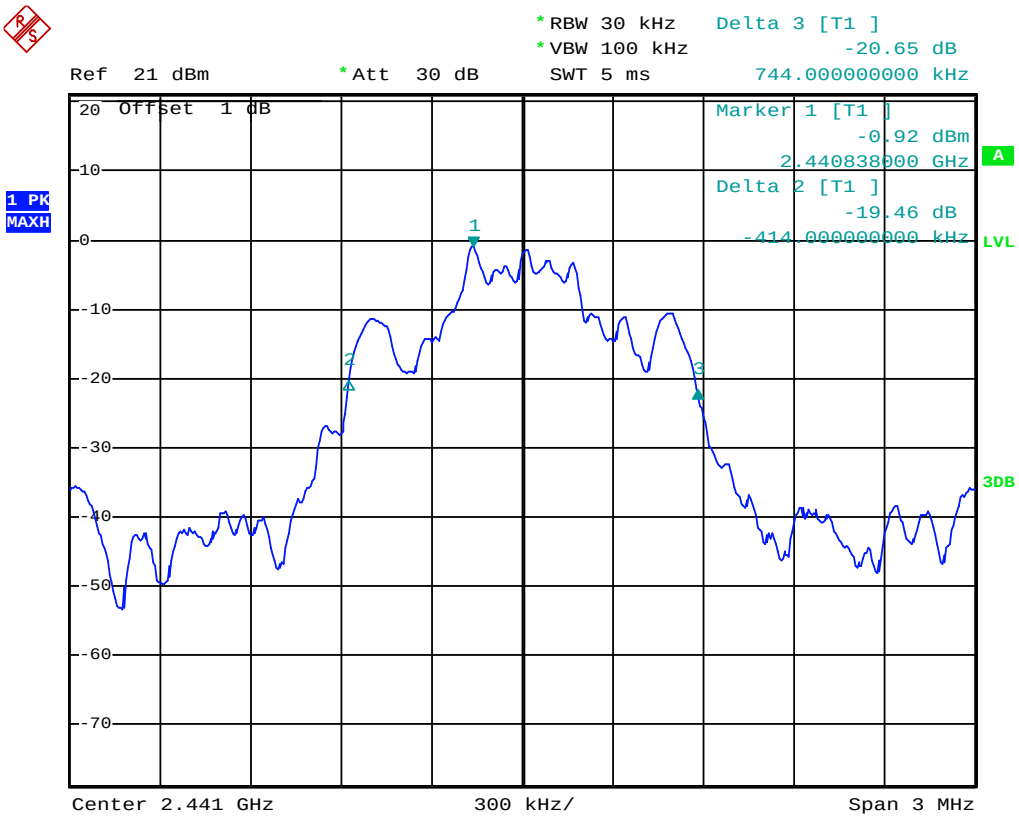
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	1.158	Plot 4.4.2 A	/	PASS
39	2441	1.158	Plot 4.4.2 B	/	PASS
78	2480	1.158	Plot 4.4.2 C	/	PASS

Note: 1.The test results including the cable lose.

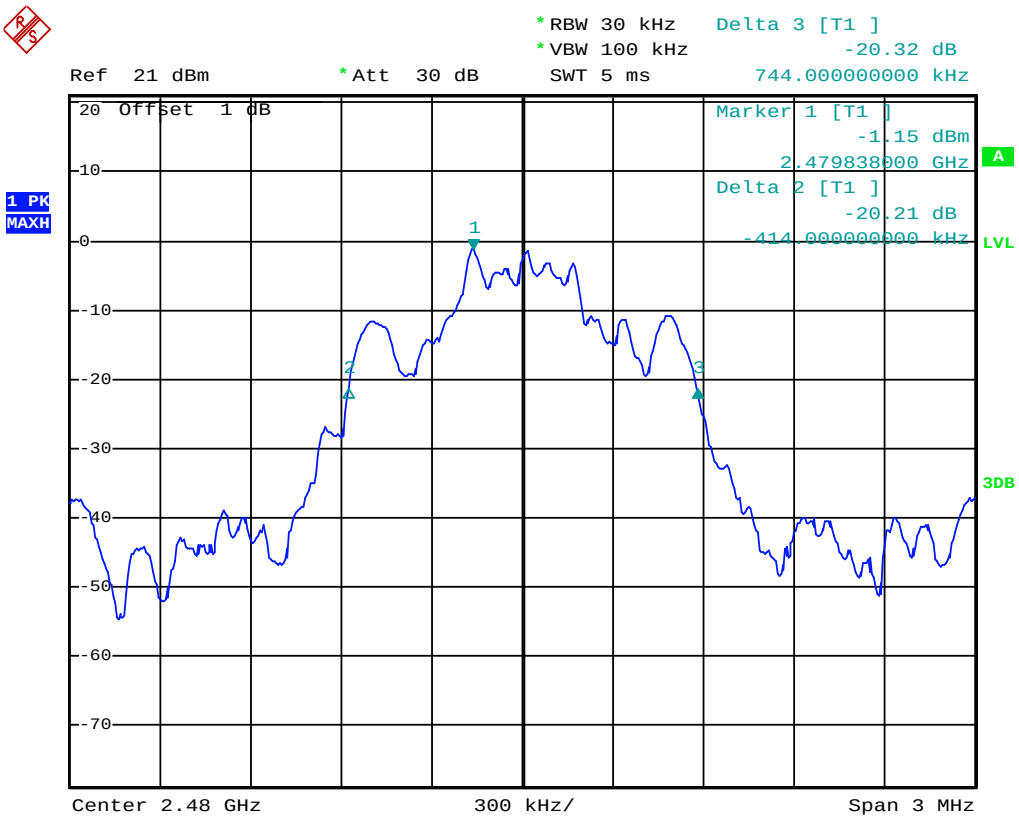
B. Test Plots



(Plot 4.4.2 A: Channel 00: 2402MHz @ 8DPSK)



(Plot 4.4.2 B: Channel 39: 2441MHz @ 8DPSK)



(Plot 4.4.2 C: Channel 78: 2480MHz @ 8DPSK)

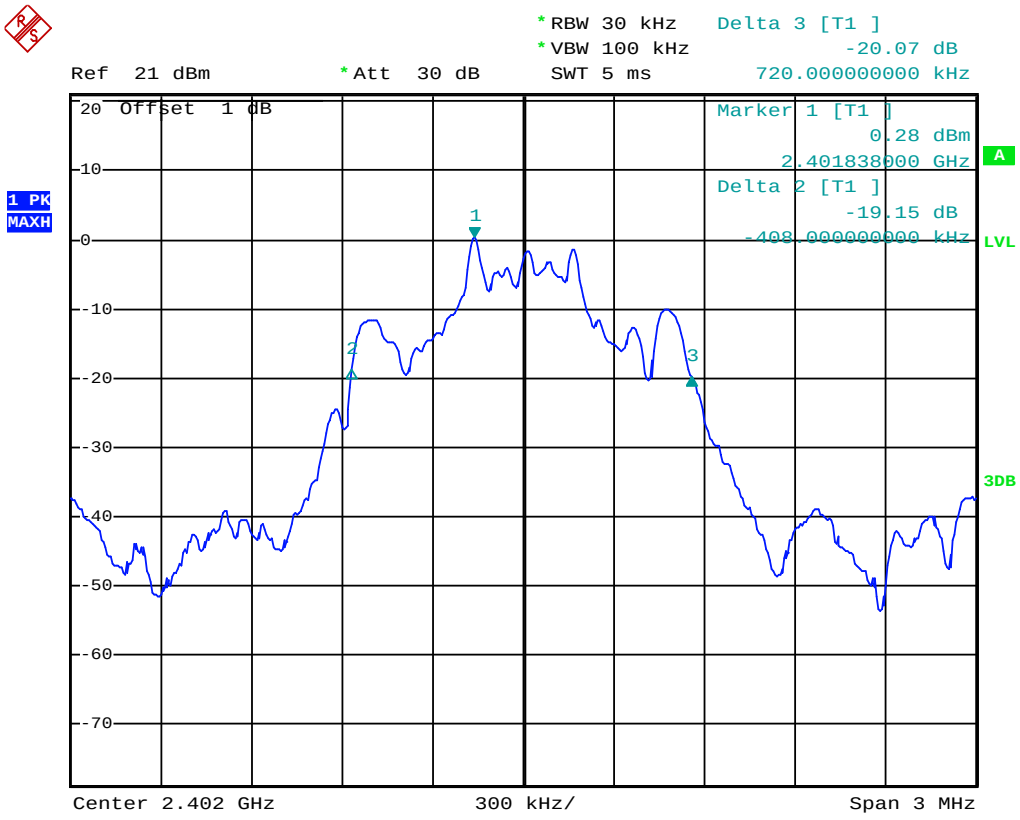
4.4.3 π/4DQPSKTest Mode

A. Test Verdict

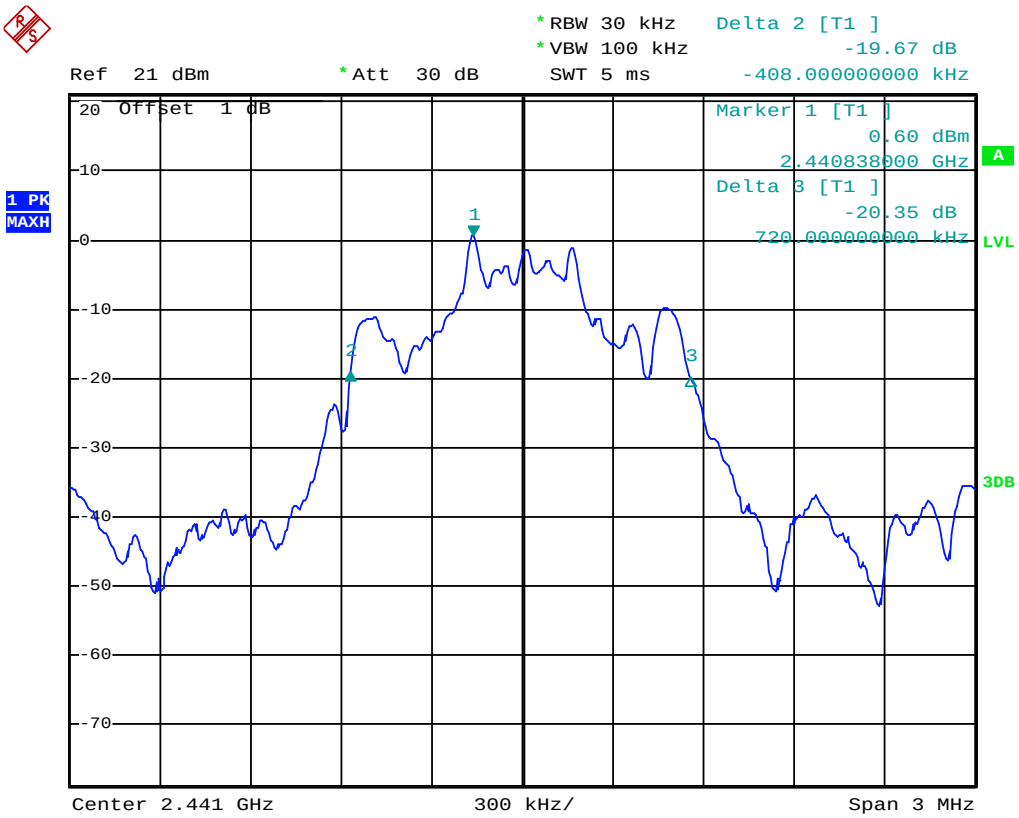
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot	Limits (MHz)	Verdict
00	2402	1.128	Plot 4.4.3 A	/	PASS
39	2441	1.128	Plot 4.4.3 B	/	PASS
78	2480	1.128	Plot 4.4.3 C	/	PASS

Note: 1.The test results including the cable lose.

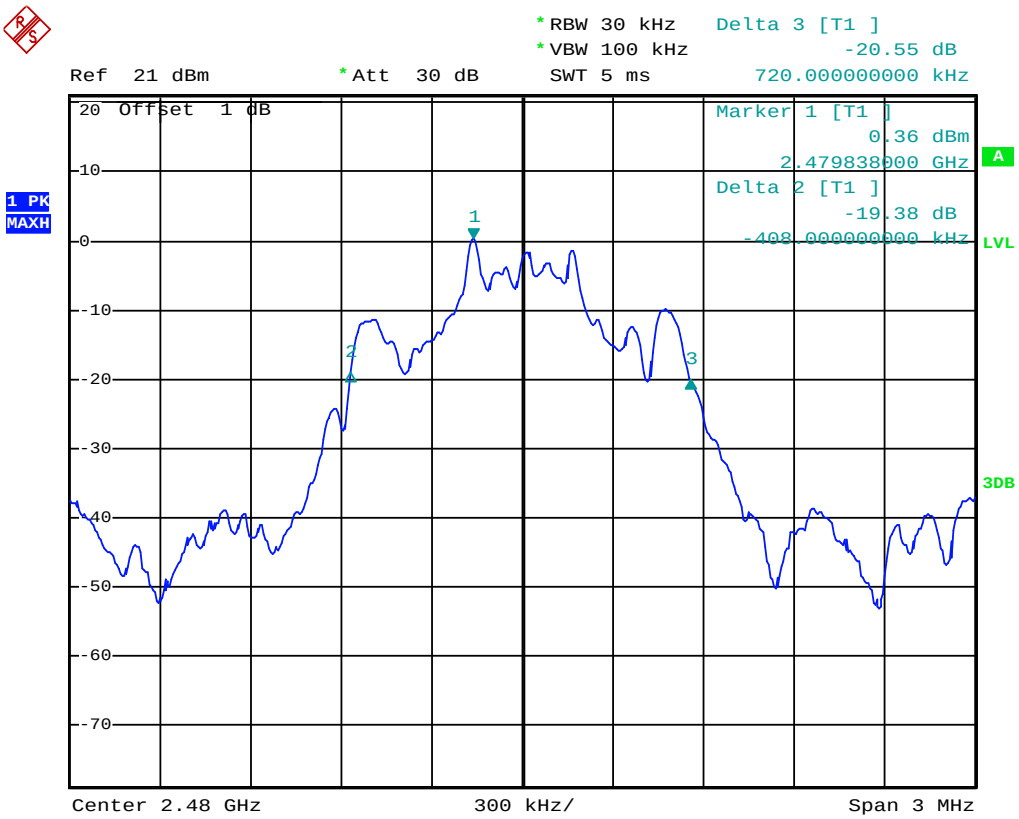
B. Test Plots



(Plot 4.4.3 A: Channel 00: 2402MHz @ π/4DQPSK)



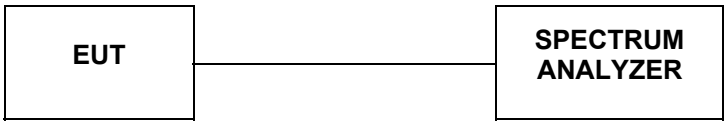
(Plot 4.4.3 B: Channel 39: 2441MHz @π/4DQPSK)



(Plot 4.4.3 C: Channel 78: 2480MHz @π/4DQPSK)

4.5. Frequency Separation

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30 KHz and VBW=100KHz.

LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST RESULTS

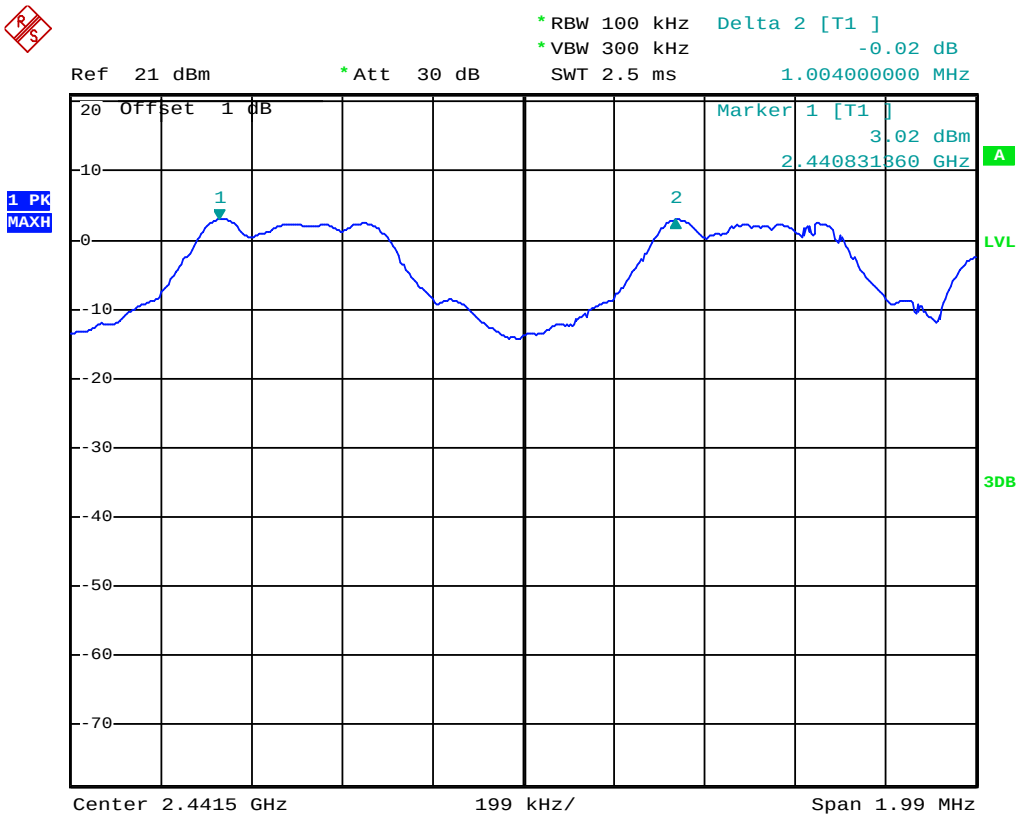
Remark: 1. We test Frequency Separation at difference Packet Type (DH1, DH3 and DH5) and all test channels, recorded worst case at DH5 and middle channel.

4.6.1 GFSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.004	Plot 4.6.1 A	25KHz or 2/3*20dB bandwidth	PASS
39	2441				

B. Test Plots



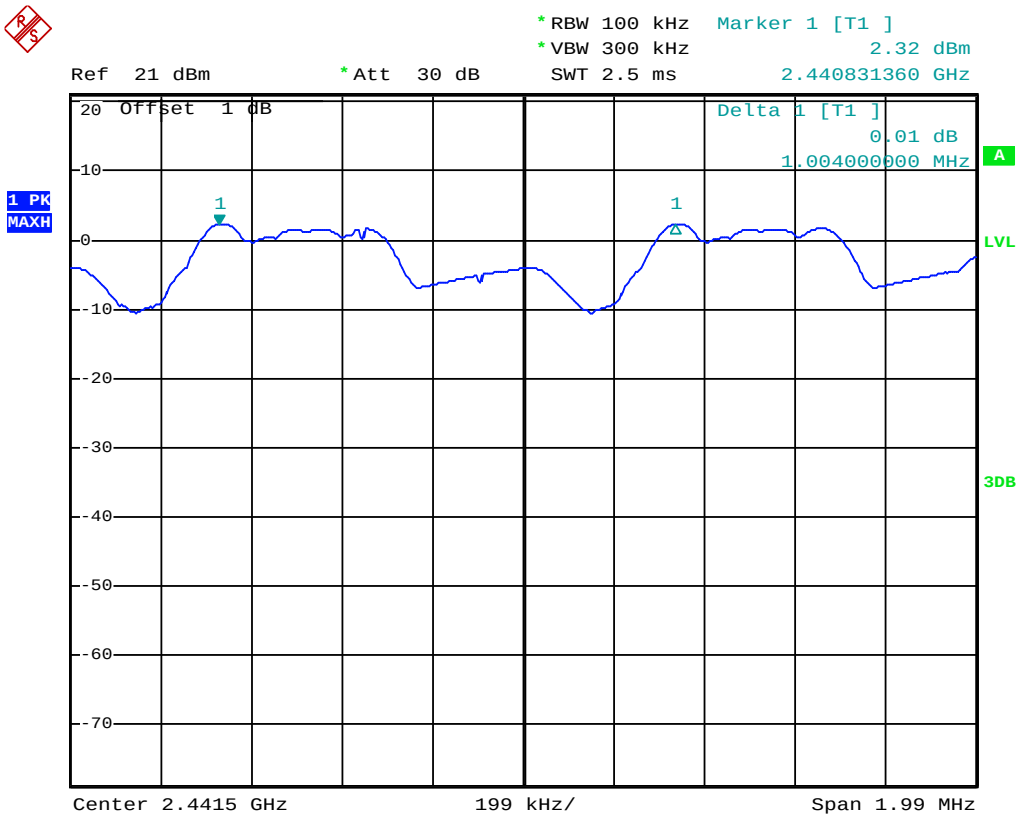
(Plot 4.5.1 A: Channel 39: 2441MHz @ GFSK)

4.6.2 8DPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.004	Plot 4.6.2 A	25KHz or 2/3*20dB bandwidth	PASS
39	2441				

B. Test Plots



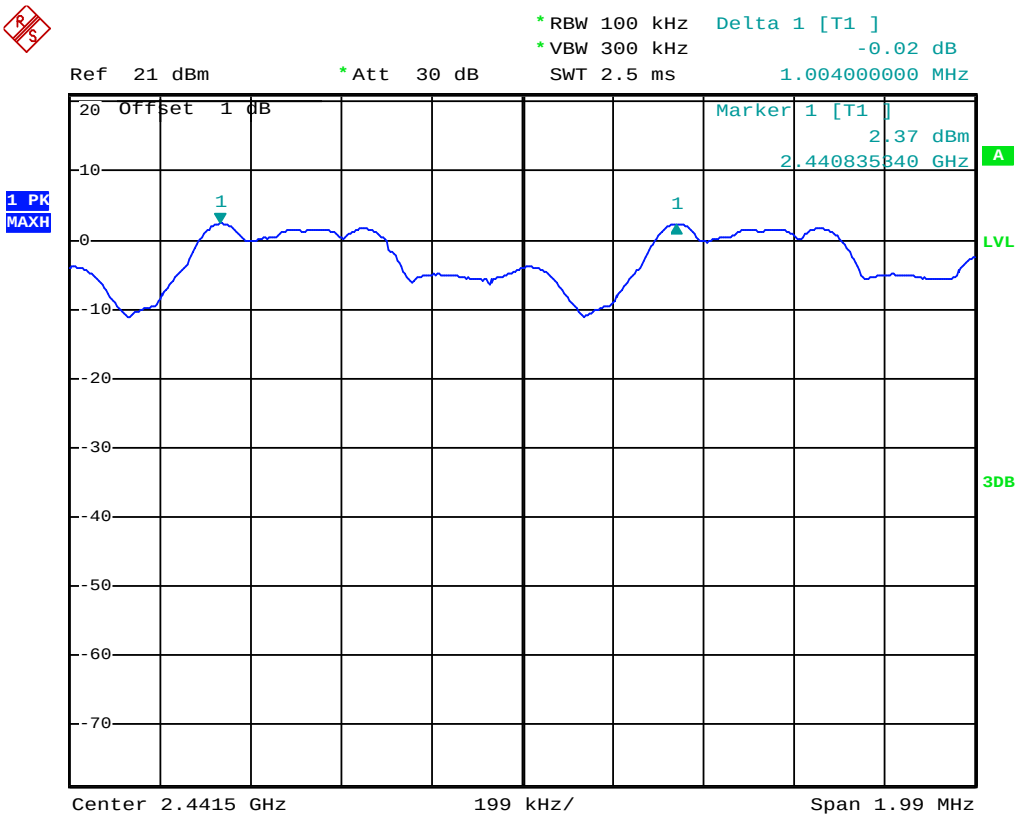
(Plot 4.5.2 A: Channel 39: 2441MHz @ 8DPSK)

4.6.3 π/4DQPSK Test Mode

A. Test Verdict

Channel	Frequency (MHz)	Channel Separation (MHz)	Refer to Plot	Limits (MHz)	Verdict
38	2440	1.004	Plot 4.6.3 A	25KHz or 2/3*20dB bandwidth	PASS
39	2441				

B. Test Plots



(Plot 4.5.3 A: Channel 39: 2441MHz @ π/4DQPSK)

4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for Peak dector while RBW=1MHz,VBW=10Hz for Average dector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

LIMIT

Below -20dB of the highest emission level in operating band.
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

TEST RESULTS

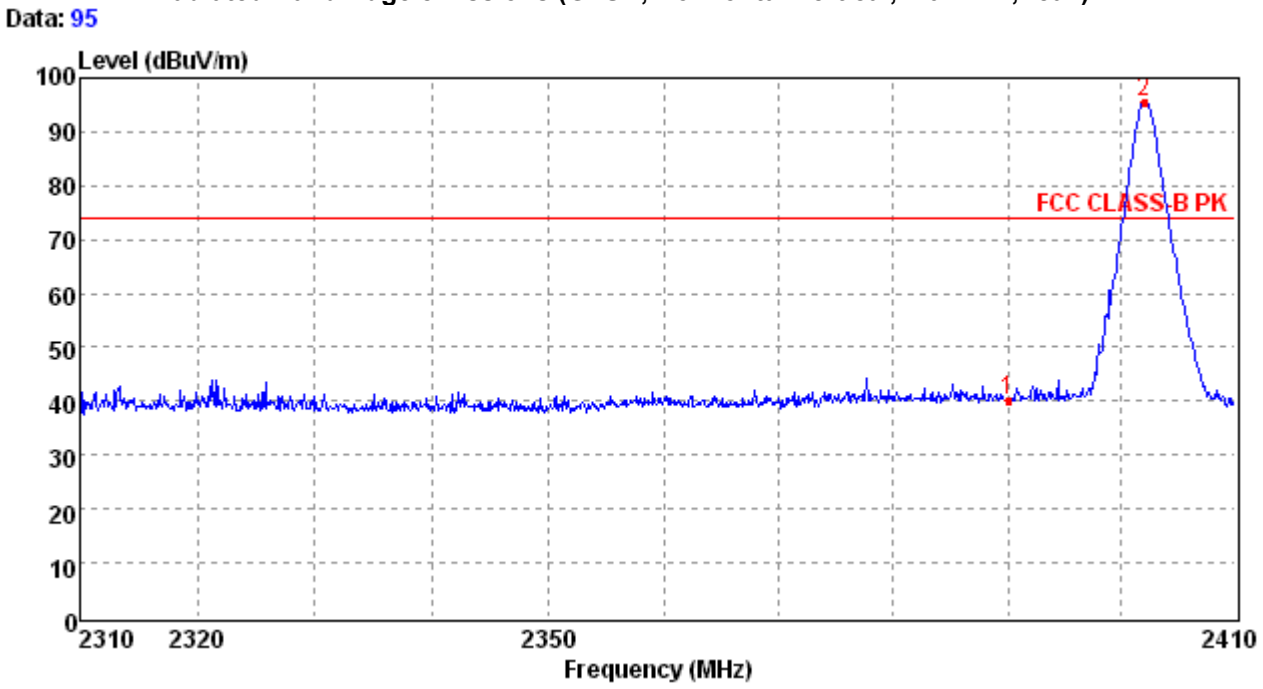
Remark: we measured all conditions(DH1,DH3,DH5) and recorded worst case at DH1

4.6.1 For Radiated Bandedge Measurement

Remark: we tested radiated bandedge at both hopping and no-hopping modes,recorded worst case at no-hopping mode

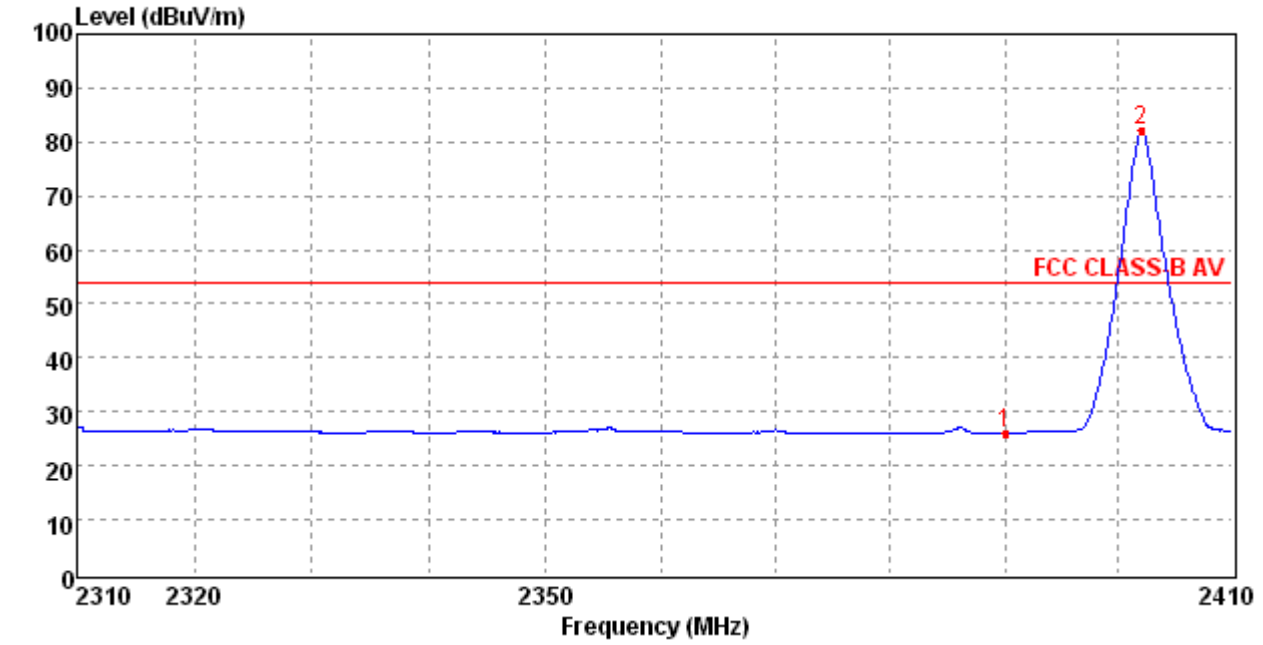
4.6.1.1 GFSK Test Mode

Radiated Band Edge emissions (GFSK, Horizontal/Vertical,2402MHz,Peak)



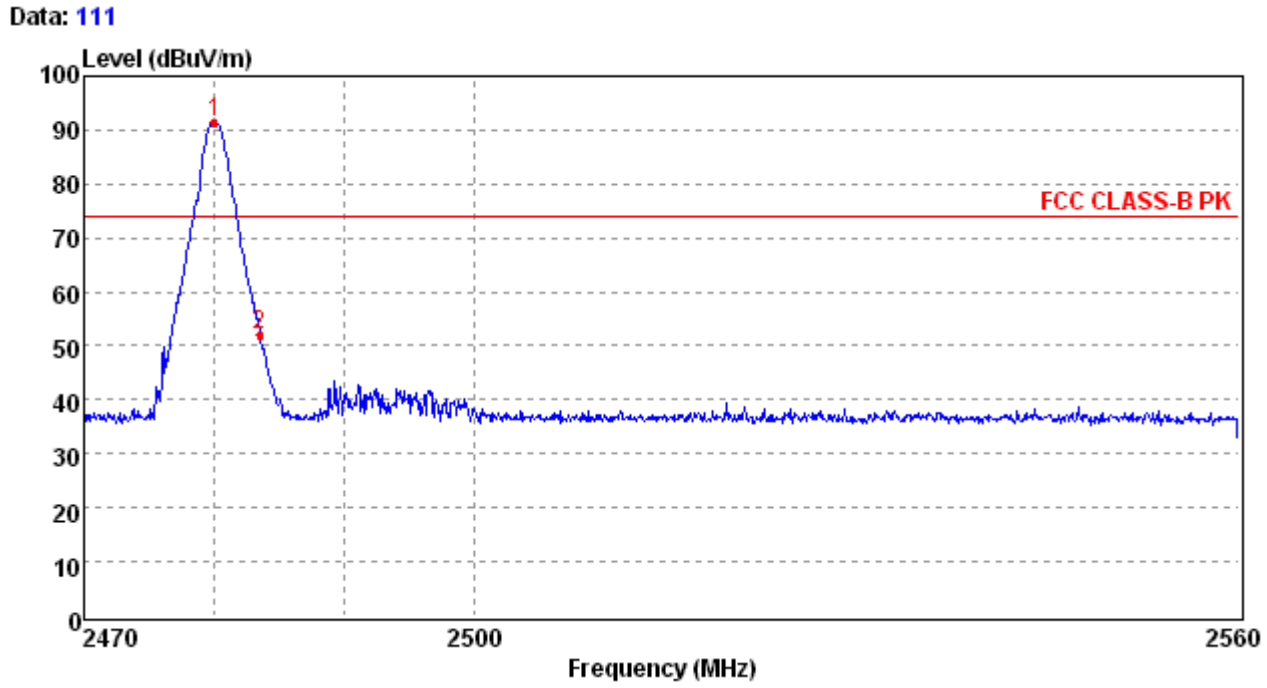
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	40.17	3.32	27.49	36.12	45.45	74.00	33.83	Ver	Peak
2	**2402.00**	**95.59**	**3.32**	**27.49**	**36.12**	**100.90**	**74.00**	**-21.59**	**Hor**	**Peak**

Radiated Band Edge emissions (GFSK, Horizontal/Vertical,2402MHz,Average)



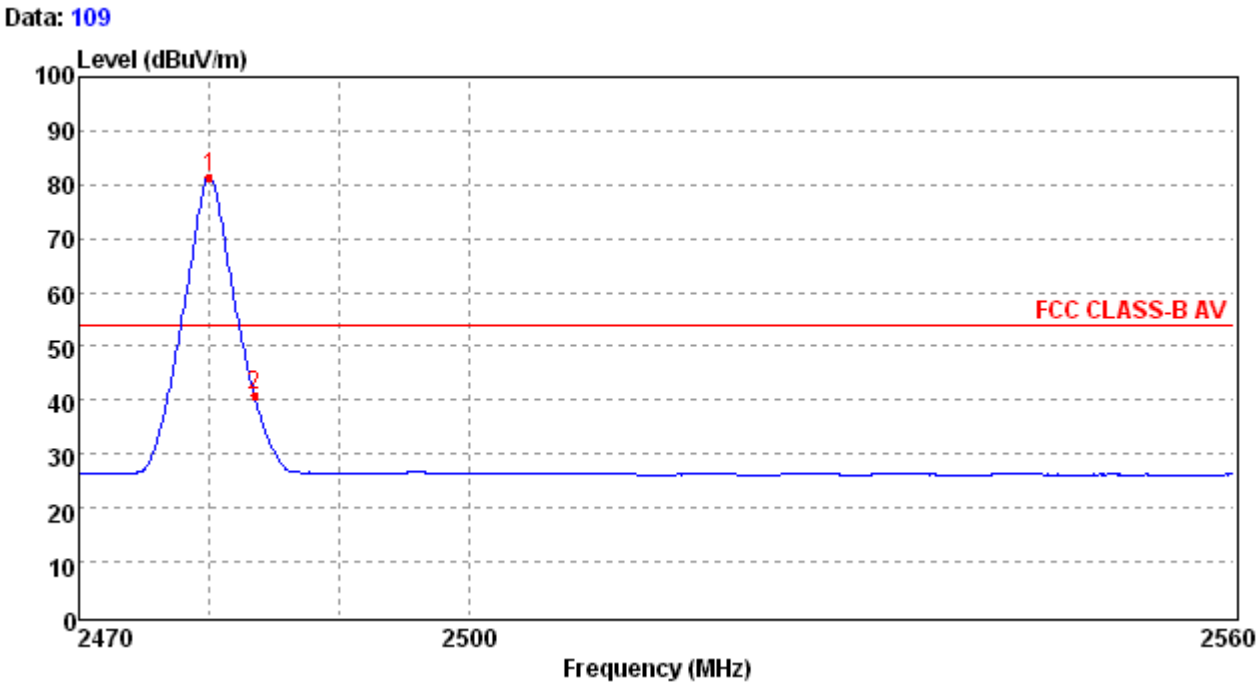
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	26.03	3.32	27.49	36.12	31.31	54.00	27.97	Hor	Average
2	**2402.00**	**82.24**	**3.32**	**27.49**	**36.12**	**57.55**	**54.00**	**-28.24**	**Hor**	Average

Radiated Band Edge emissions (GFSK, Horizontal/Vertical,2480MHz,Peak)



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.00**	**91.38**	**3.88**	**27.45**	**36.55**	**96.60**	**74.00**	**-17.38**	**Hor**	**Peak**
2	2483.50	51.92	3.88	27.45	36.55	57.14	74.00	22.08	Hor	Peak

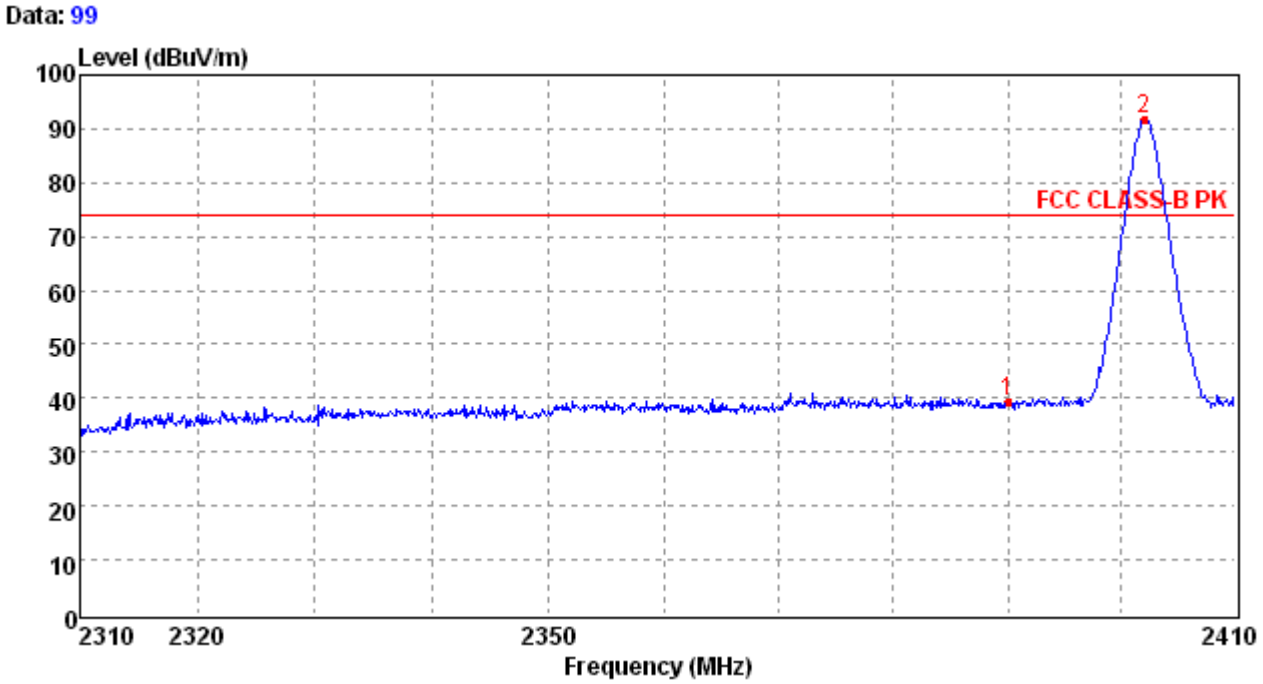
Radiated Band Edge emissions (GFSK, Horizontal/Vertical,2480MHz,Average)



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.01**	**81.58**	**3.88**	**27.45**	**36.55**	**86.80**	**54.00**	**-27.58**	**Hor**	**Average**
2	2483.50	40.96	3.88	27.45	36.55	46.18	54.00	13.04	Hor	Average

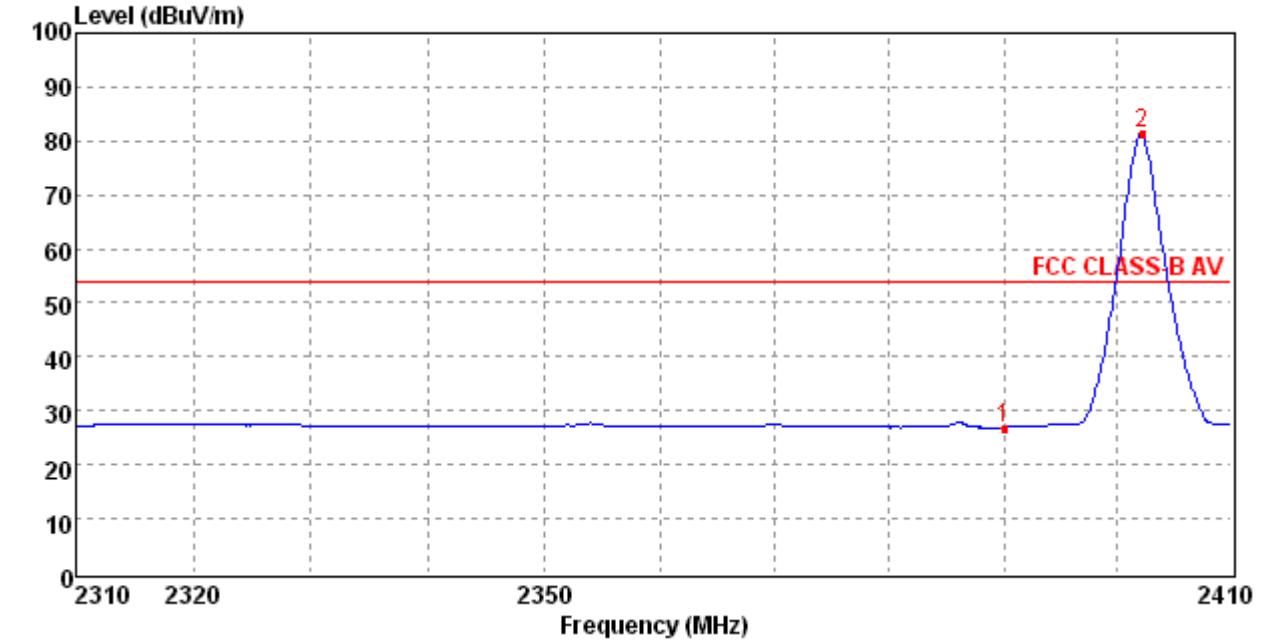
4.6.1.2 8DPSK Test Mode

Radiated Band Edge emissions (8DPSK, Horizontal/Vertical,2402MHz,Peak)



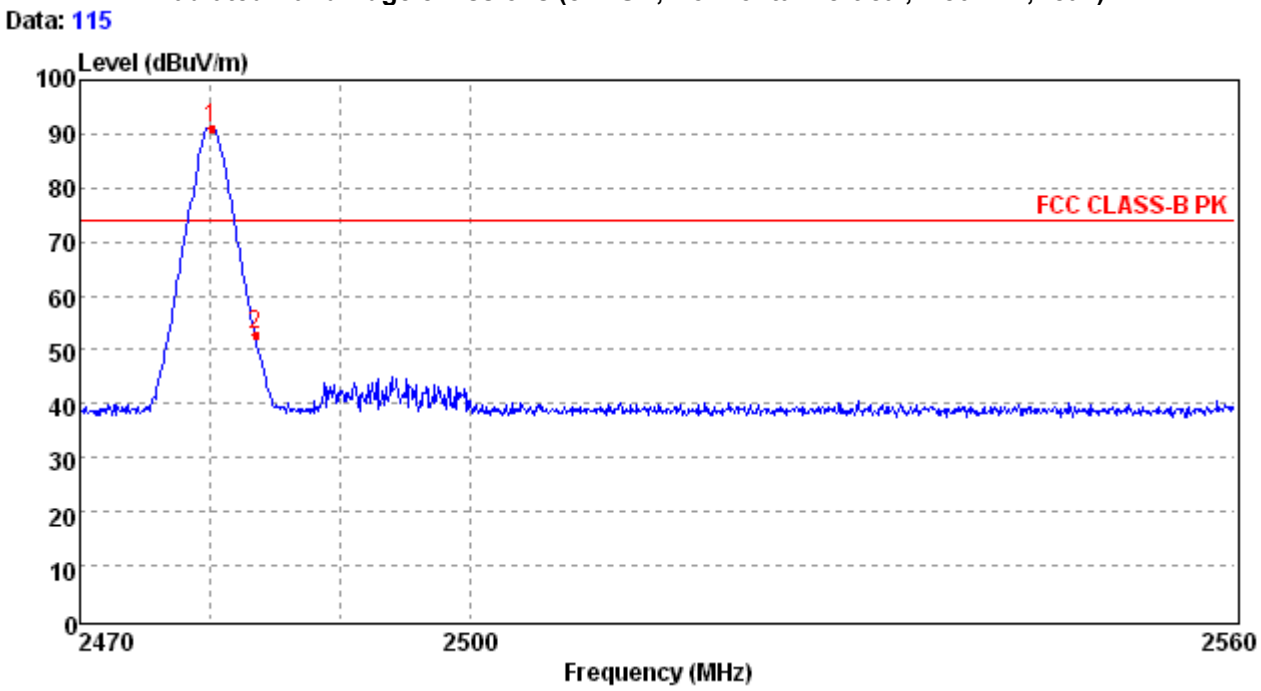
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	39.27	3.32	27.49	36.12	44.55	74.00	34.73	Hor	Peak
2	**2402.10**	**91.77**	**3.32**	**27.49**	**36.12**	**97.08**	**74.00**	**-17.77**	**Hor**	**Peak**

Radiated Band Edge emissions (8DPSK, Horizontal/Vertical,2402MHz,Average)



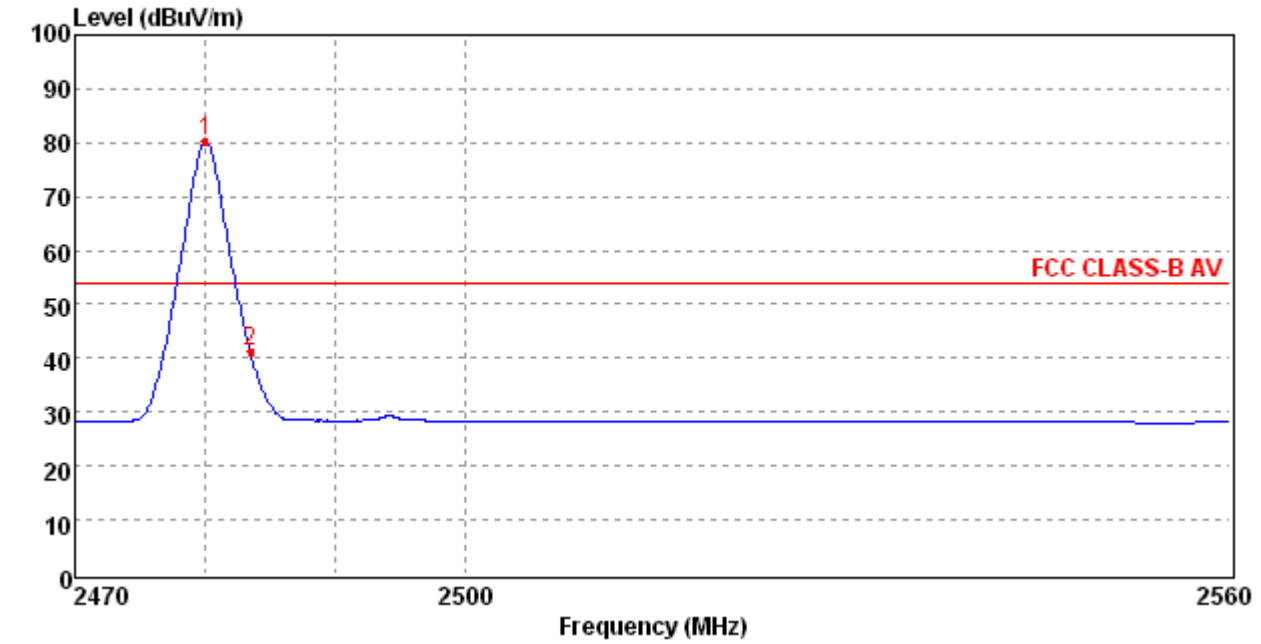
Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	26.94	3.32	27.49	36.12	32.22	54.00	27.06	Hor	Average
2	**2402.05**	**81.43**	**3.32**	**27.49**	**36.12**	**86.74**	**54.00**	**-27.43**	**Hor**	Average

Radiated Band Edge emissions (8DPSK, Horizontal/Vertical,2480MHz,Peak)



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.00**	**91.25**	**3.88**	**27.45**	**36.55**	**96.47**	**74.00**	**-17.25**	**Hor**	**Peak**
2	2483.50	52.74	3.88	27.45	36.55	57.96	74.00	21.26	Hor	Peak

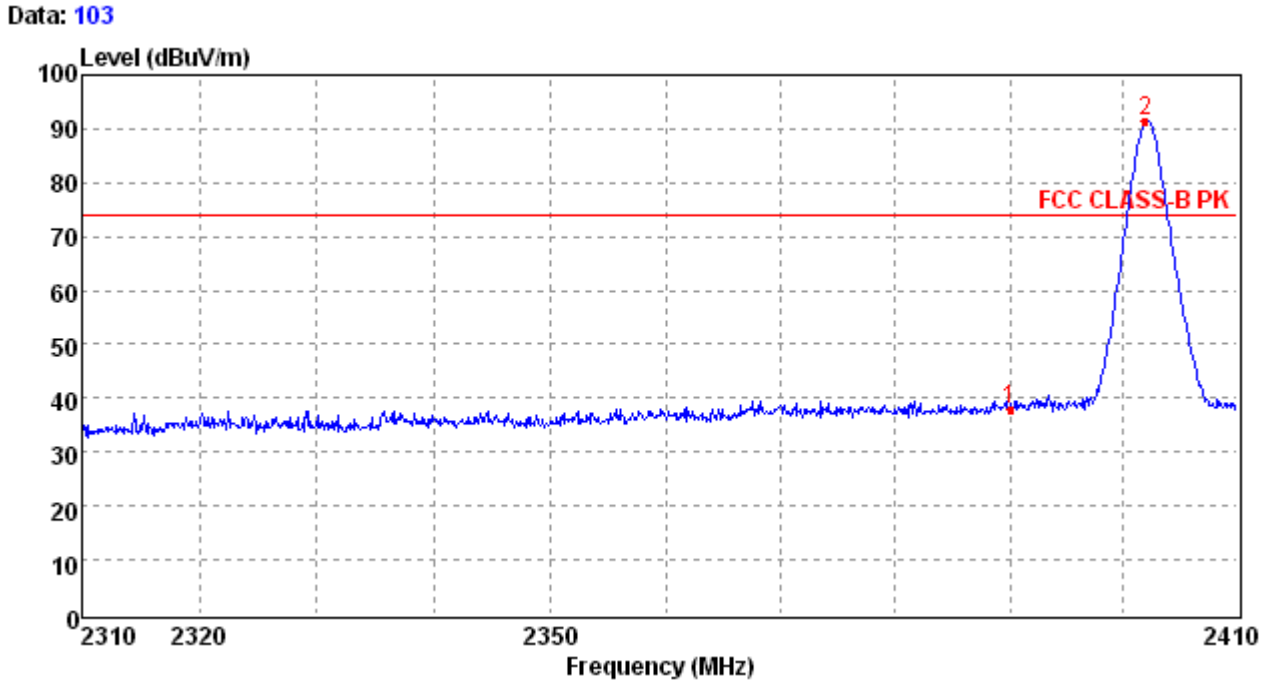
Radiated Band Edge emissions (8DPSK, Horizontal/Vertical,2480MHz,Average)



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.06**	**80.21**	**3.88**	**27.45**	**36.55**	**85.43**	**54.00**	**-26.21**	**Hor**	**Average**
2	2483.50	41.08	3.88	27.45	36.55	46.30	54.00	12.92	Hor	Average

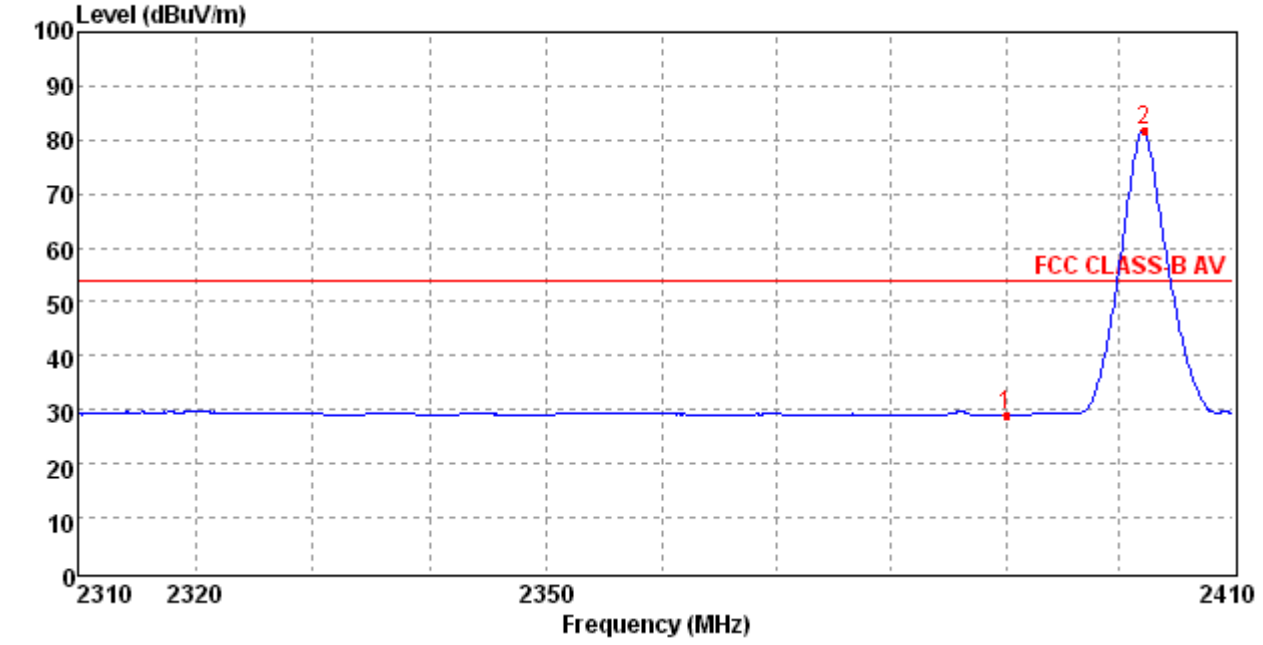
4.6.1.3 π/4DQPSK Test Mode

Radiated Band Edge emissions (π/4DQPSK, Horizontal/Vertical,2402MHz,Peak)



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	38.04	3.32	27.49	36.12	43.32	74.00	35.96	Hor	Peak
2	**2402.00**	**91.63**	**3.32**	**27.49**	**36.12**	**96.94**	**74.00**	**-17.63**	**Hor**	**Peak**

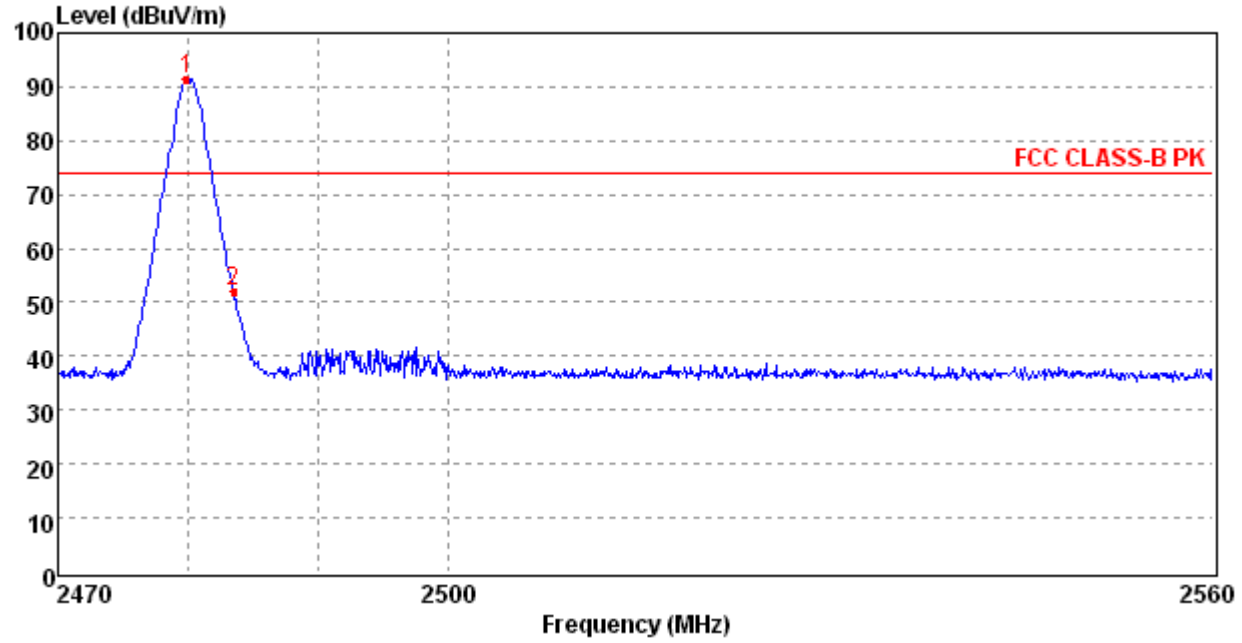
Radiated Band Edge emissions (π/4DQPSK, Horizontal/Vertical,2402MHz,Average)



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	2390.00	28.98	3.32	27.49	36.12	34.26	54.00	25.02	Hor	Average
2	**2402.05**	**81.87**	**3.32**	**27.49**	**36.12**	**87.18**	**54.00**	**-27.87**	**Hor**	Average

Radiated Band Edge emissions (π/4DQPSK, Horizontal/Vertical,2480MHz,Peak)

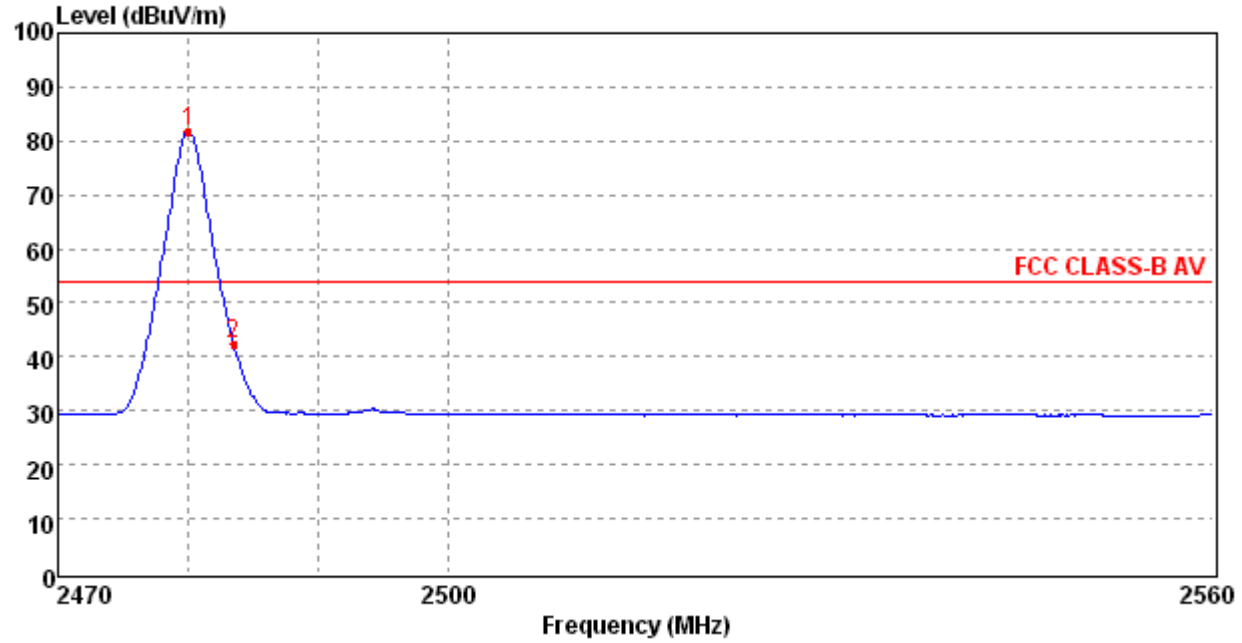
Data: 106



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2479.80**	**91.53**	**3.88**	**27.45**	**36.55**	**96.75**	**74.00**	**-17.53**	**Hor**	**Peak**
2	2483.50	52.14	3.88	27.45	36.55	57.36	74.00	21.86	Hor	Peak

Radiated Band Edge emissions (π/4DQPSK, Horizontal/Vertical,2480MHz,Average)

Data: 105



Mark	Frequency (MHz)	Level (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Reading Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Polarization	Detector
1	**2480.00**	**81.89**	**3.88**	**27.45**	**36.55**	**87.11**	**54.00**	**-27.89**	**Hor**	**Average**
2	2483.50	42.55	3.88	27.45	36.55	42.77	54.00	11.45	Hor	Average

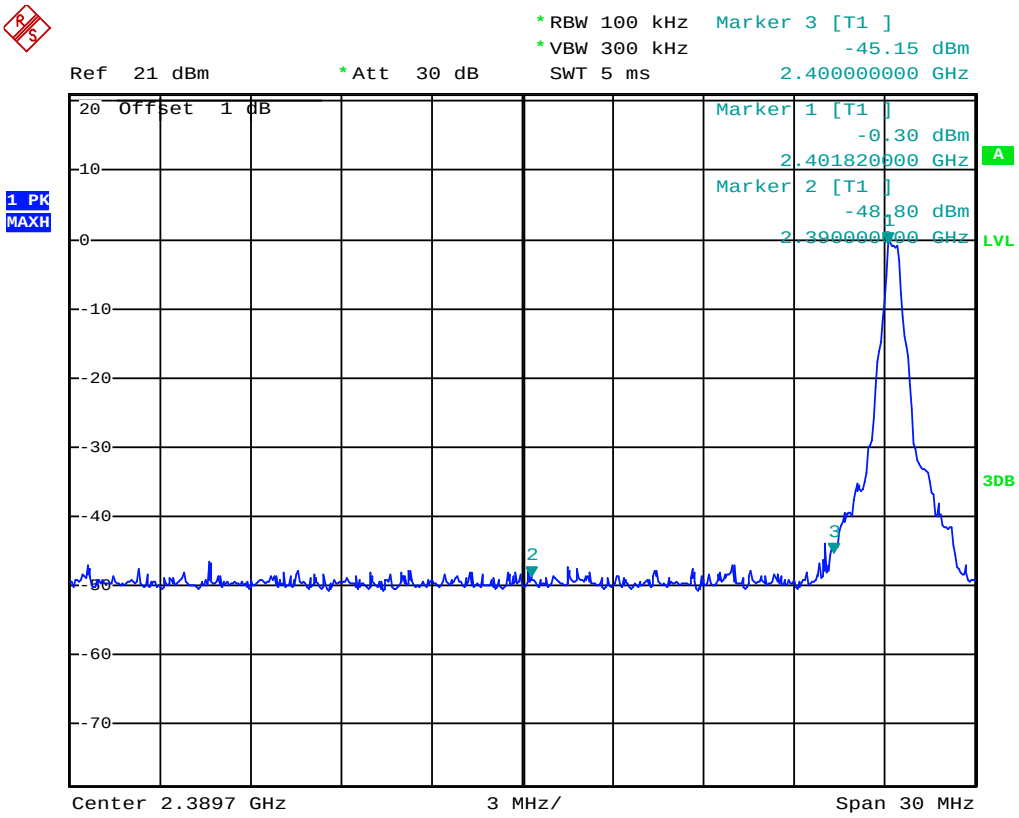
4.6.2 For Conducted Bandedge Measurement

4.6.2.1 GFSK Test Mode

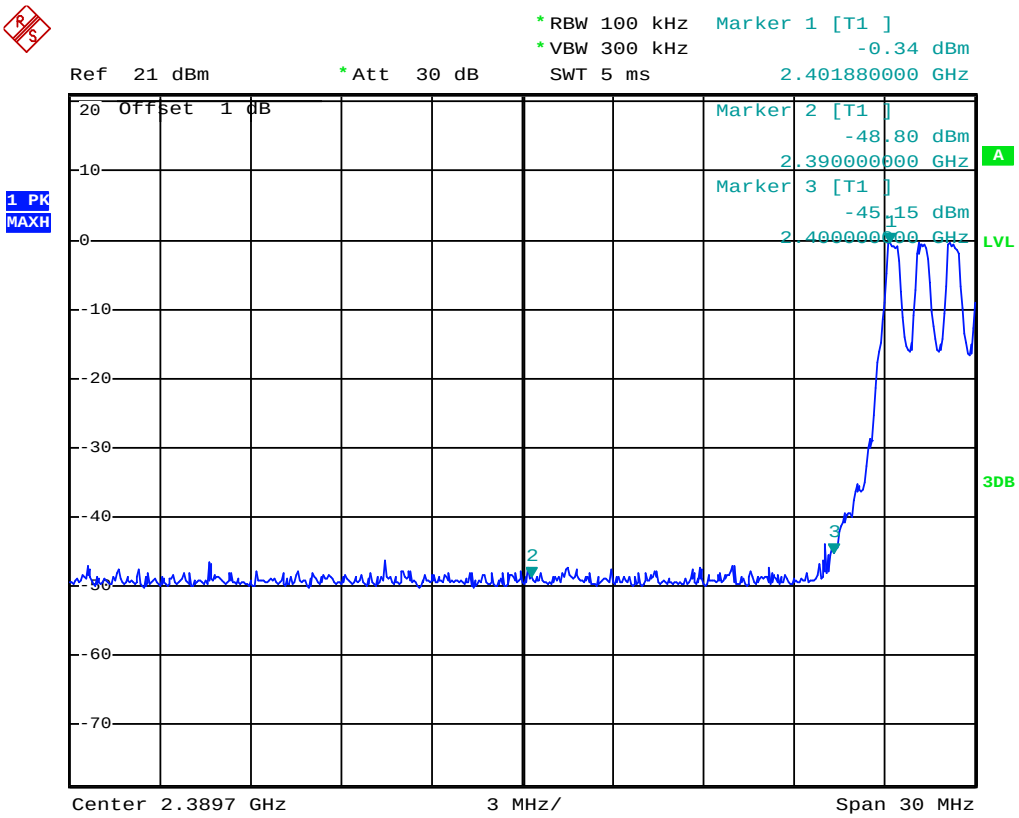
A. Test Verdict

Frequency (MHz)	Delta Peak to Band emission (dBc)	Hoping Mode	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-44.85	OFF	Peak	-20	Plot 4.6.2.1 A	PASS
2400.00	-44.81	ON	Peak	20	Plot 4.6.2.1 B	PASS
2483.50	-50.23	OFF	Peak	20	Plot 4.6.2.1 C	PASS
2483.50	-49.56	ON	Peak	20	Plot 4.6.2.1 D	PASS

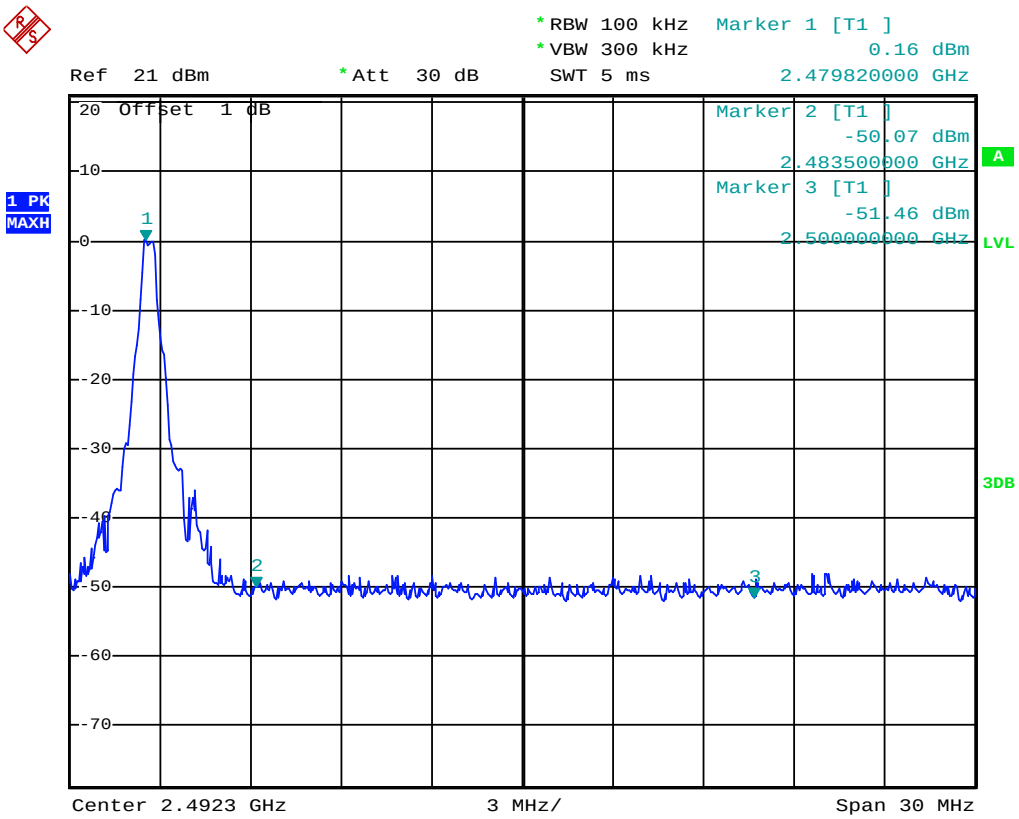
B. Test Plots



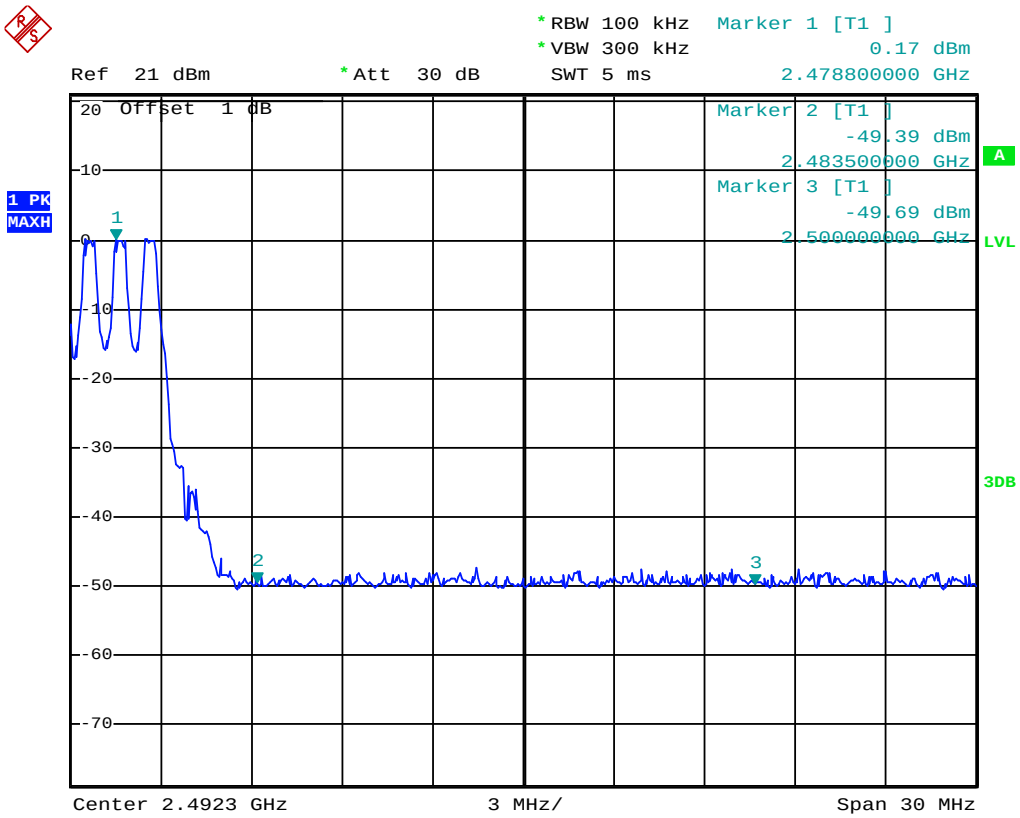
(Plot 4.6.2.1 A: Channel 00: 2402MHz @ GFSK)



(Plot 4.6.2.1 B: Hopping Mode @ GFSK)



(Plot 4.6.2.1 C: Channel 78: 2480MHz @ GFSK)



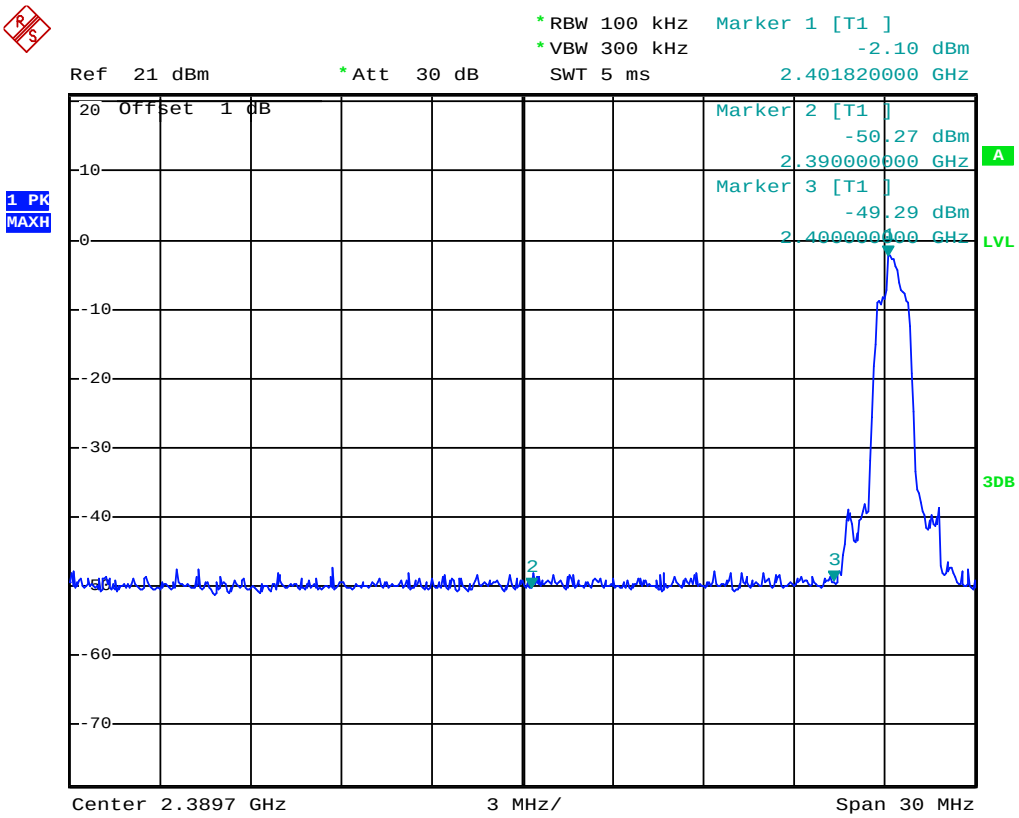
(Plot 4.6.2.1 D: Hopping Mode @ GFSK)

4.6.2.2 8DPSK Test Mode

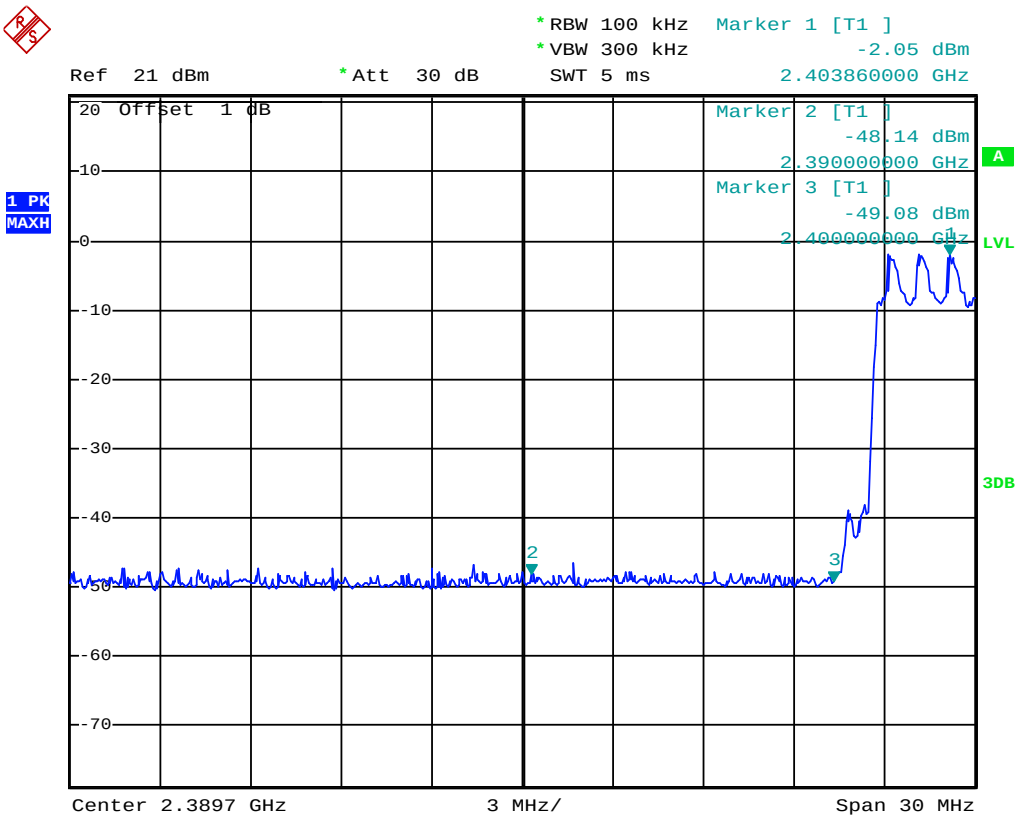
A. Test Verdict

Frequency (MHz)	Delta Peak to Band emission (dBc)	Hoping Mode	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-47.19	OFF	Peak	-20	Plot 4.6.2.2 A	PASS
2400.00	-47.03	ON	Peak	-20	Plot 4.6.2.2 B	PASS
2483.50	-48.67	OFF	Peak	-20	Plot 4.6.2.2 C	PASS
2483.50	-46.69	ON	Peak	-20	Plot 4.6.2.2 D	PASS

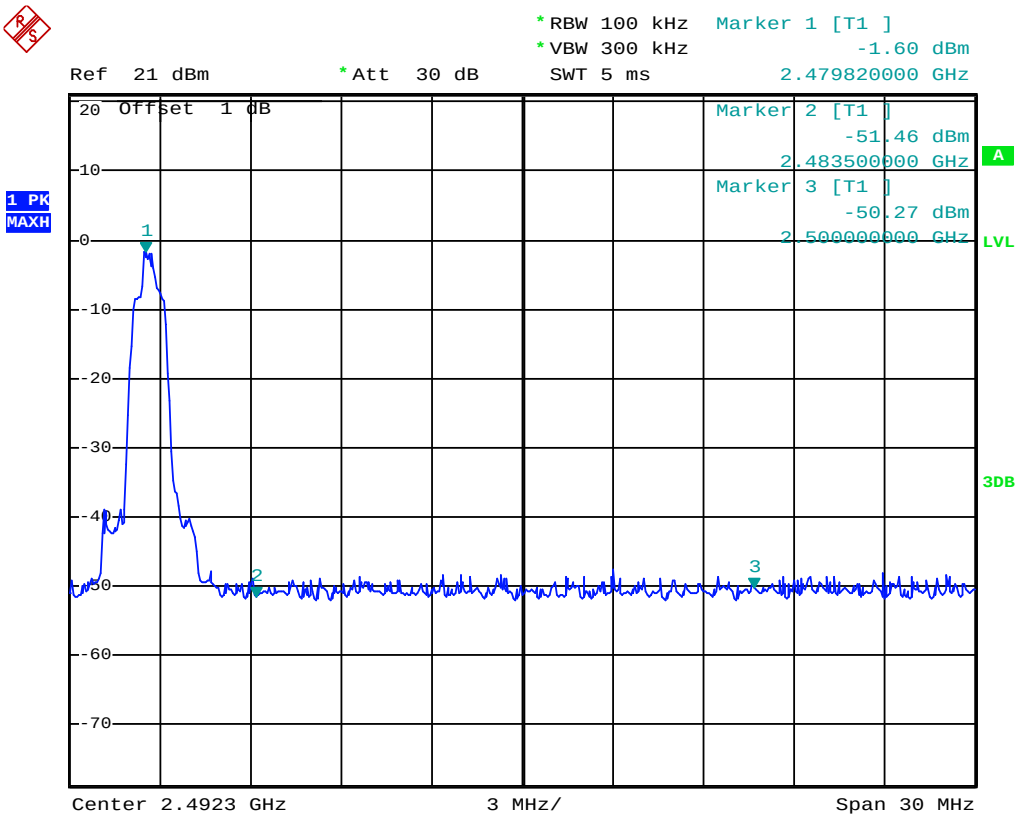
B. Test Plots



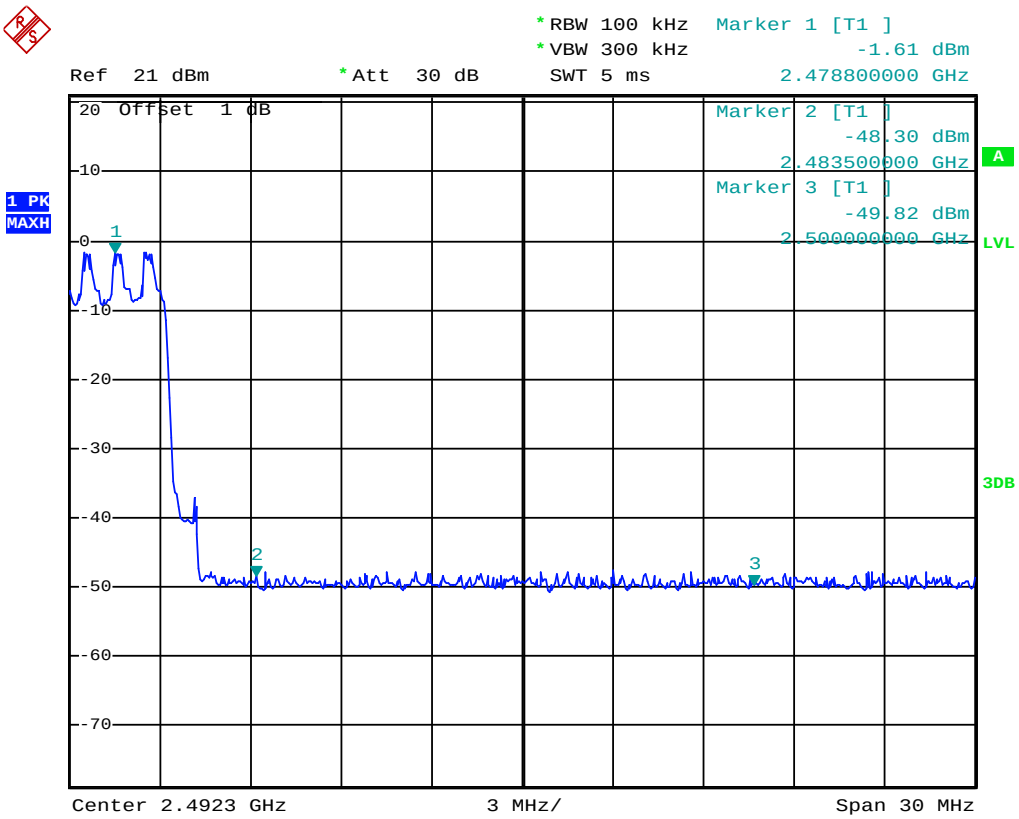
(Plot 4.6.2.2 A: Channel 00: 2402MHz @ 8DPSK)



(Plot 4.6.2.2 B: Hopping Mode @ 8DPSK)



(Plot 4.6.2.2 C: Channel 78: 2480MHz @ 8DPSK)



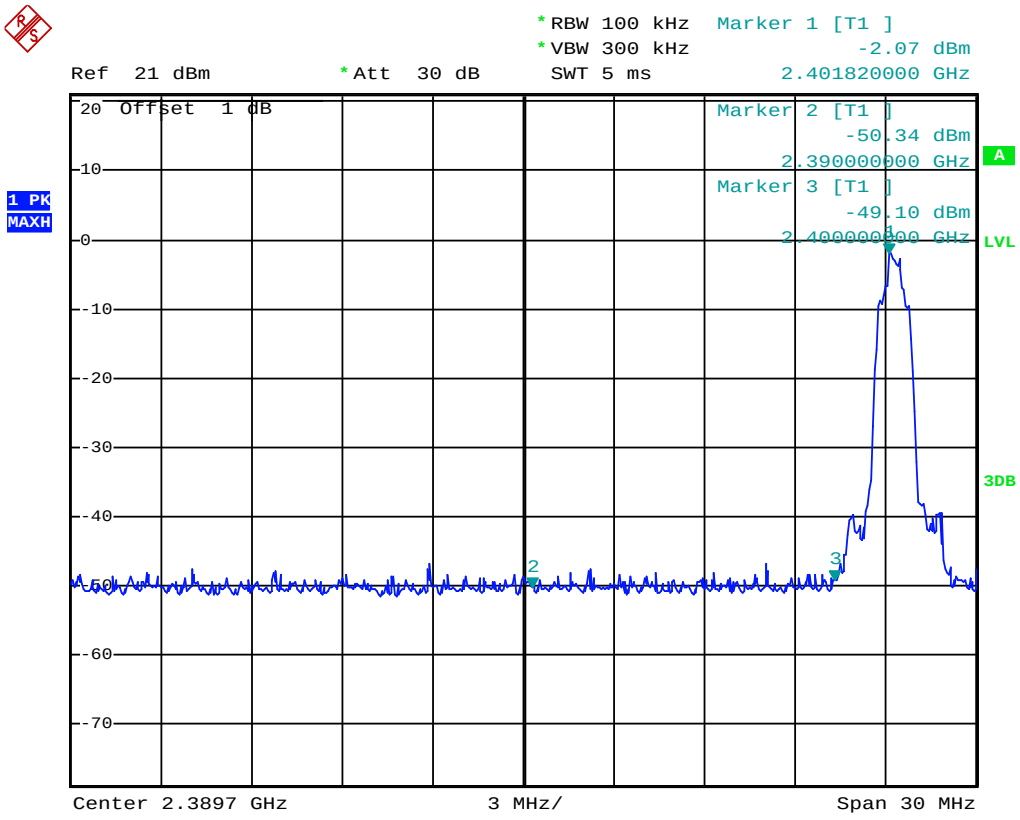
(Plot 4.6.2.2 D: Hopping Mode @ 8DPSK)

4.6.2.3 π/4DQPSK Test Mode

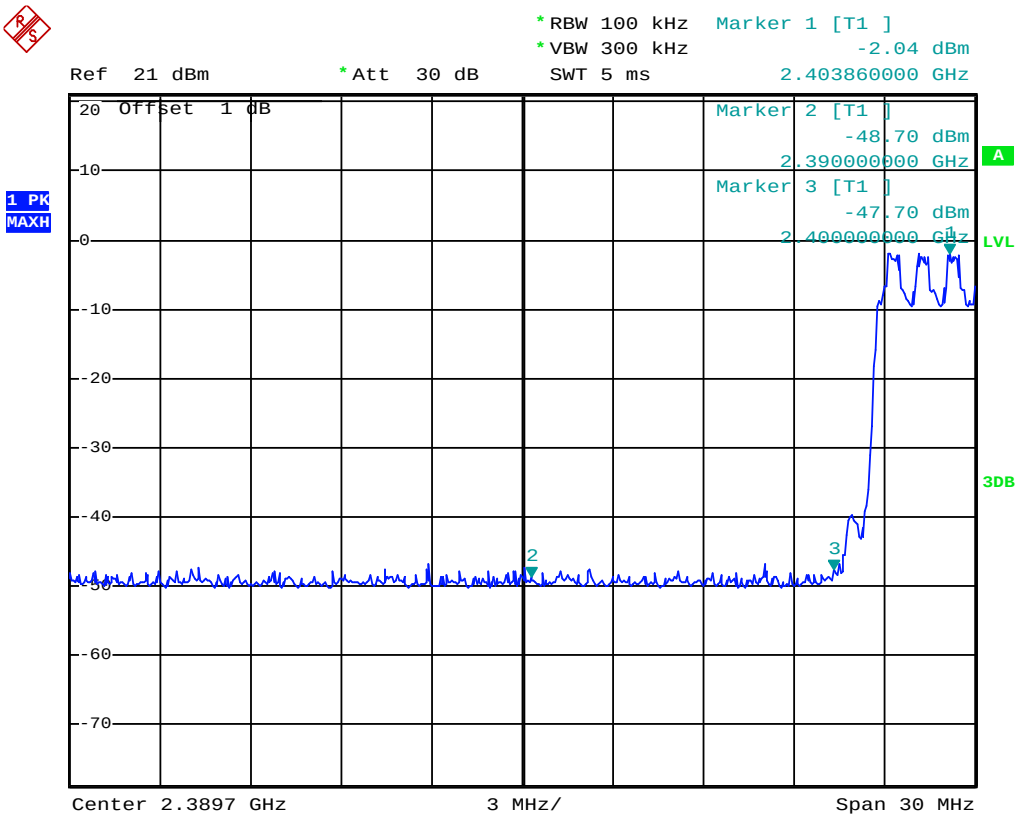
A. Test Verdict

Frequency (MHz)	Delta Peak to Band emission (dBc)	Hoping Mode	Detector	Limit (dBc)	Refer to Plot	Verdict
2400.00	-47.03	OFF	Peak	-20	Plot 4.6.2.3 A	PASS
2400.00	-45.66	ON	Peak	-20	Plot 4.6.2.3 B	PASS
2483.50	-47.66	OFF	Peak	-20	Plot 4.6.2.3 C	PASS
2483.50	-48.17	ON	Peak	-20	Plot 4.6.2.3 D	PASS

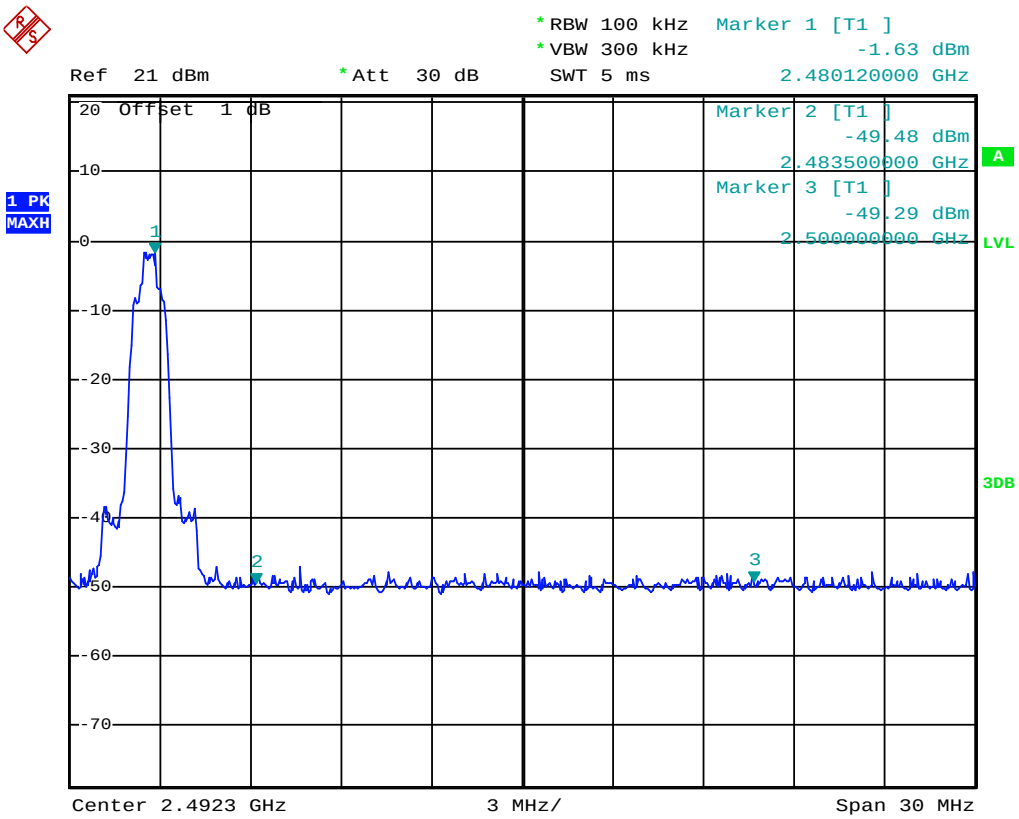
B. Test Plots



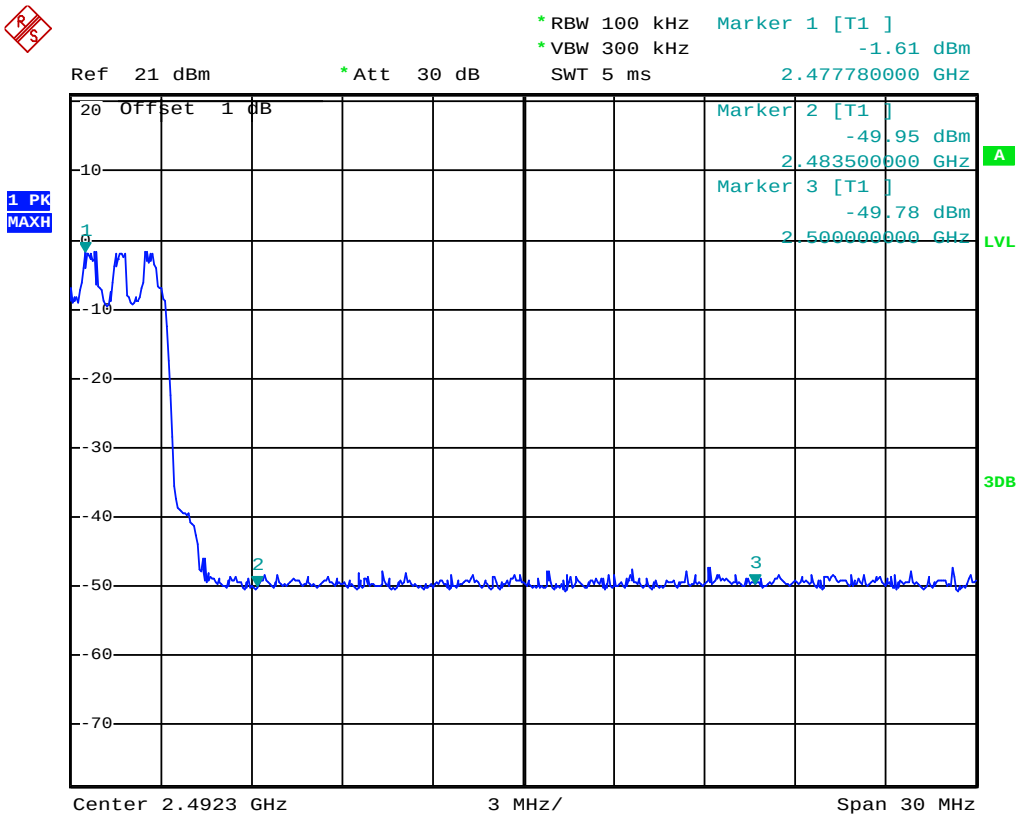
(Plot 4.6.2.3 A: Channel 00: 2402MHz @ π/4DQPSK)



(Plot 4.6.2.3 B: Hopping Mode @π/4DQPSK)



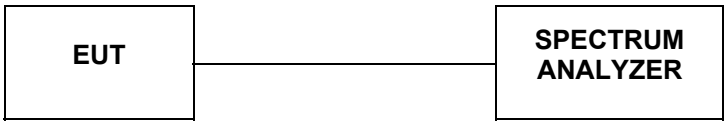
(Plot 4.6.2.3 C: Channel 78: 2480MHz @ π/4DQPSK)



(Plot 4.6.2.3 D: Hopping Mode @π/4DQPSK)

4.7. Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2009 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100kHz and VBM= 300KHz to measure the peak field strength , and mwasure frequeny range from 30MHz to 25GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

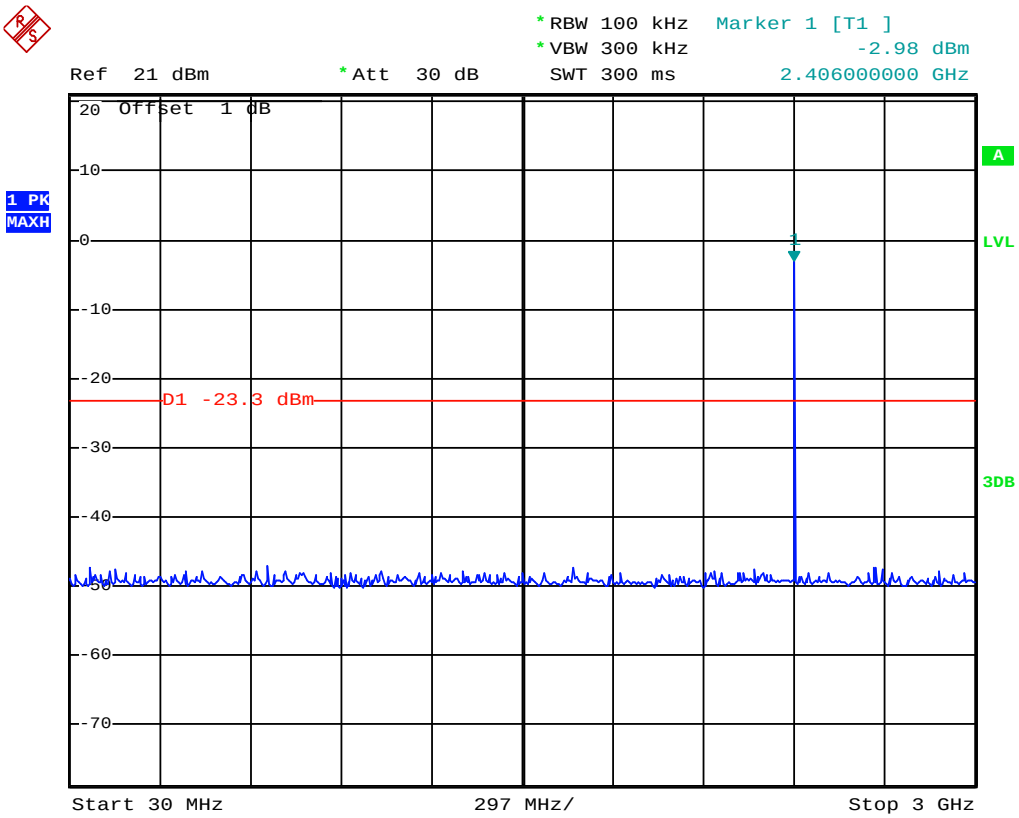
Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

4.7.1 GFSK Test Mode

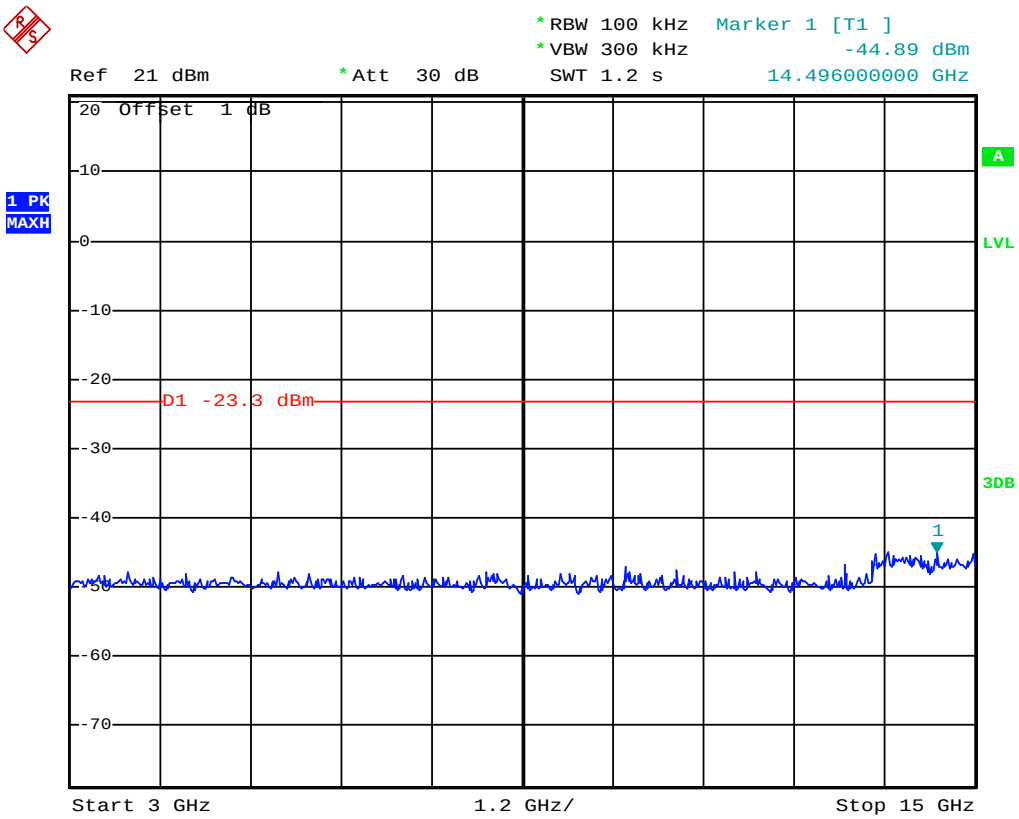
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	30MHz-25GHz	Plot 4.7.1 A1/A2/A3	-20	PASS
39	2441	30MHz-25GHz	Plot 4.7.1 B1/B2/B3	-20	PASS
78	2480	30MHz-25GHz	Plot 4.7.1 C1/C2/C3	-20	PASS

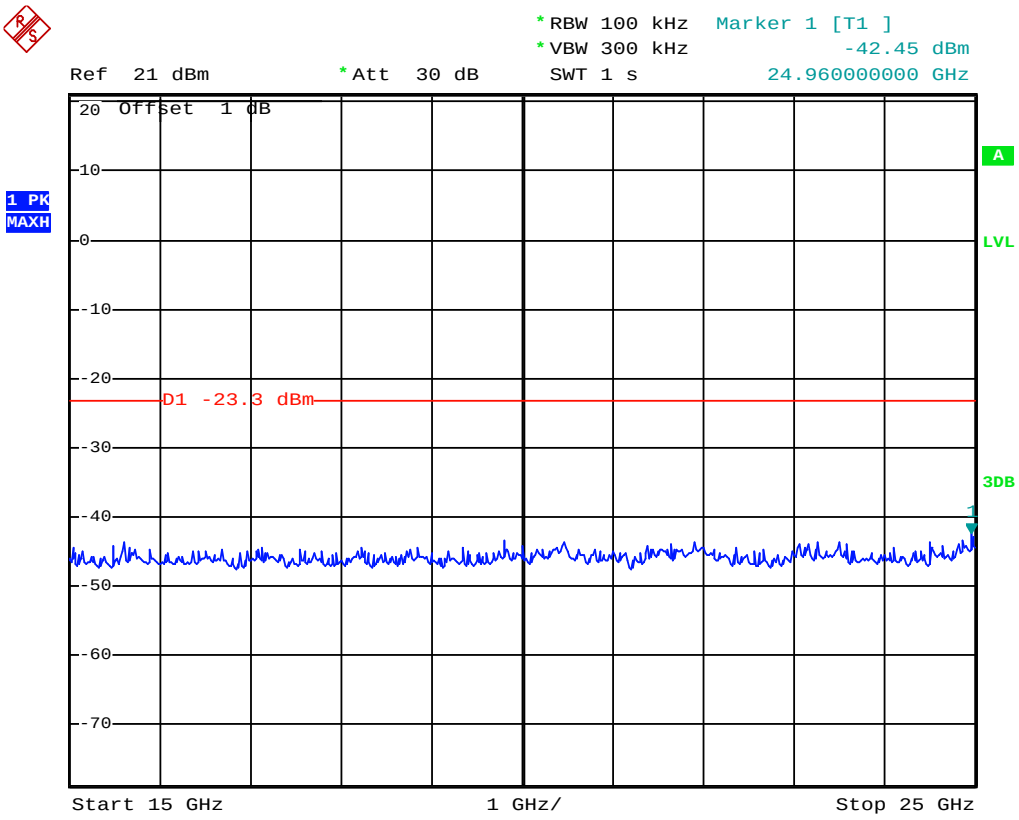
B. Test Plots



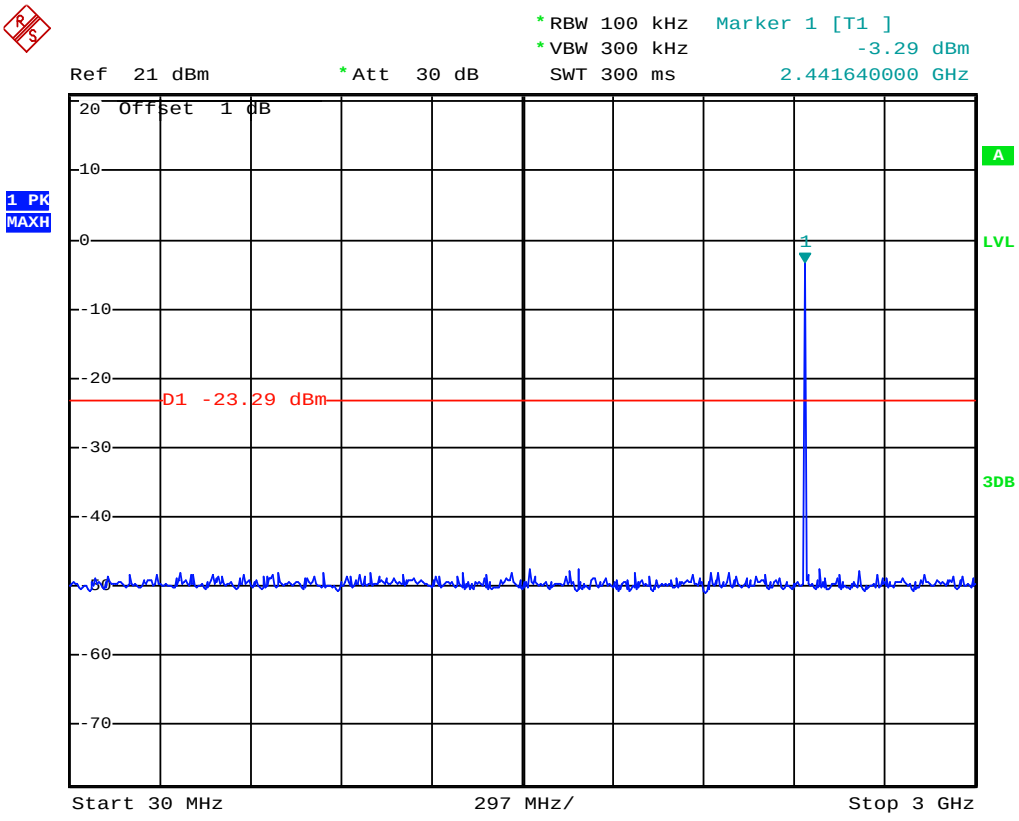
(Plot 4.7.1 A1: Channel 00: 2402MHz @ GFSK)



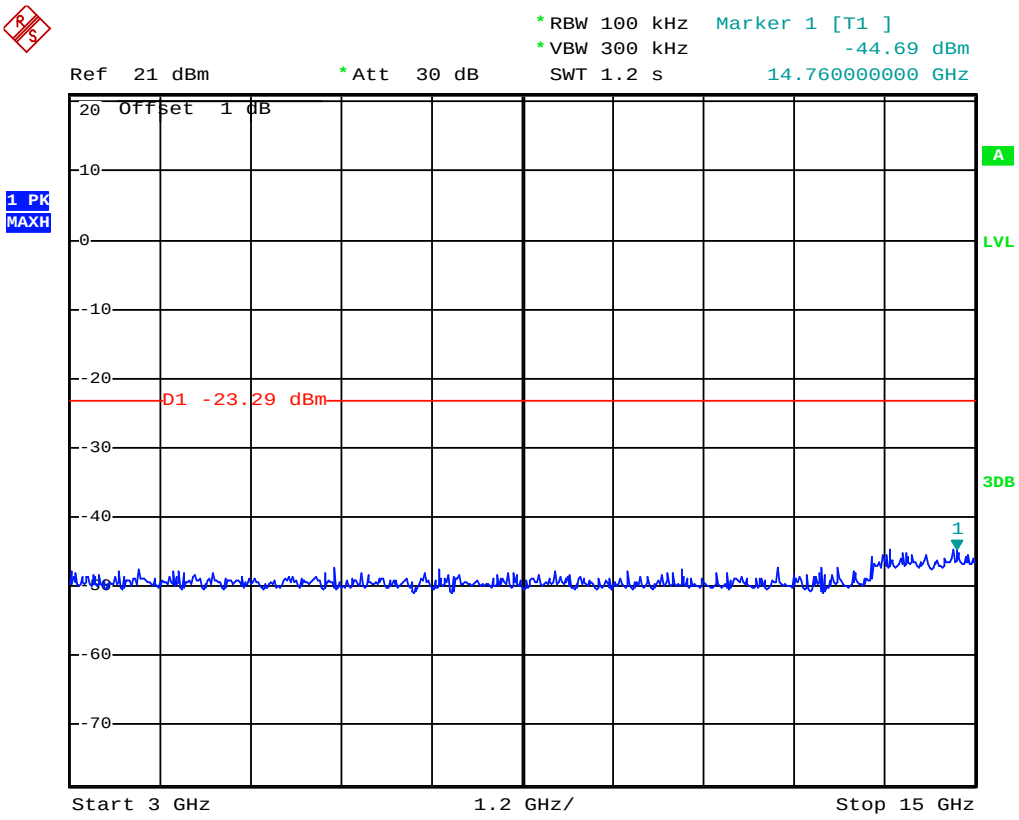
(Plot 4.7.1 A2: Channel 00: 2402MHz @ GFSK)



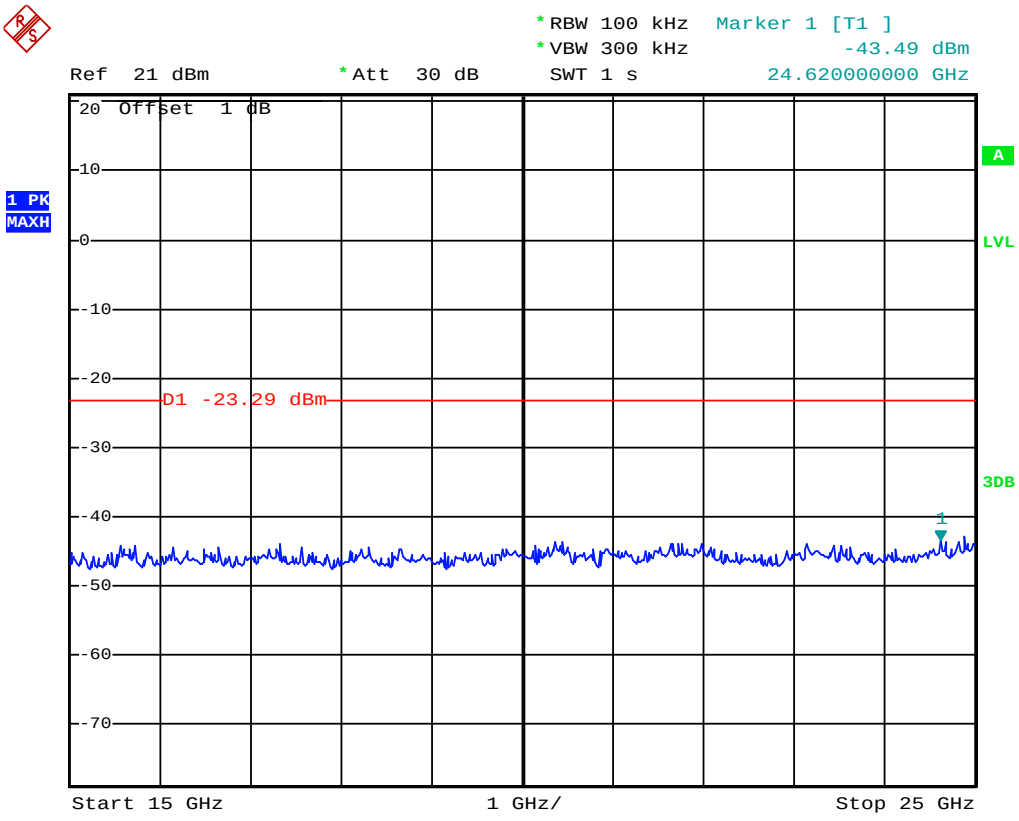
(Plot 4.7.1 A3: Channel 00: 2402MHz @ GFSK)



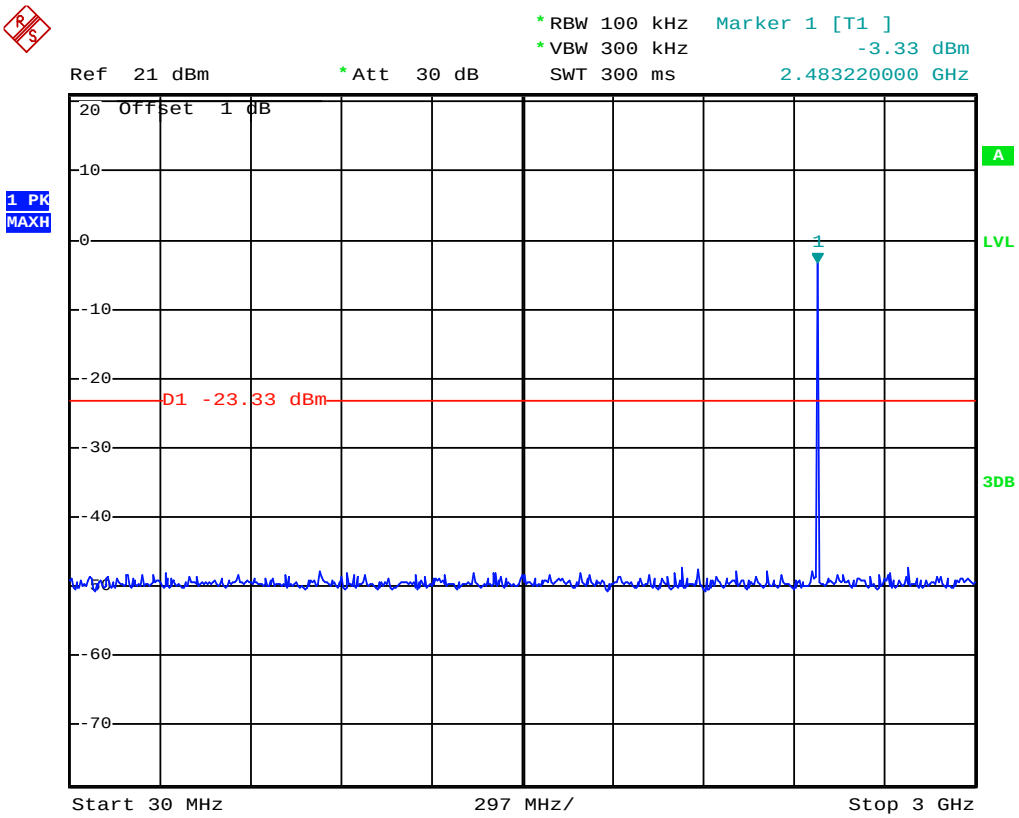
(Plot 4.7.1 B1: Channel 39: 2441MHz @ GFSK)



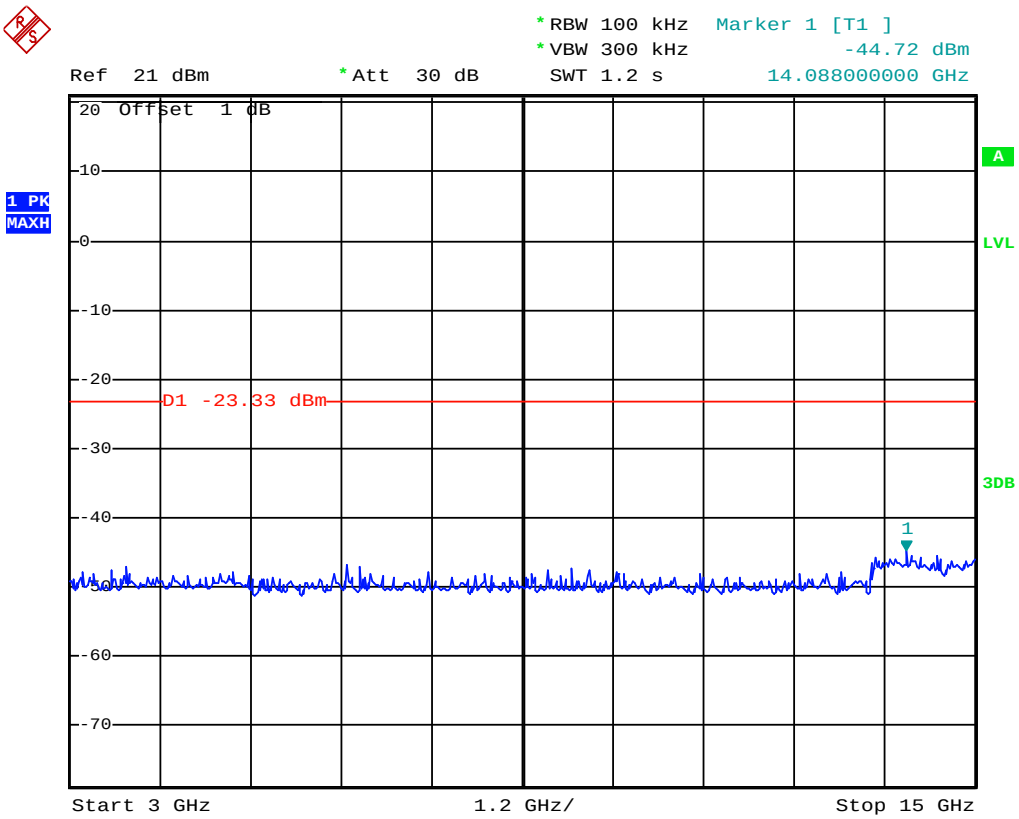
(Plot 4.7.1 B2: Channel 39: 2441MHz @ GFSK)



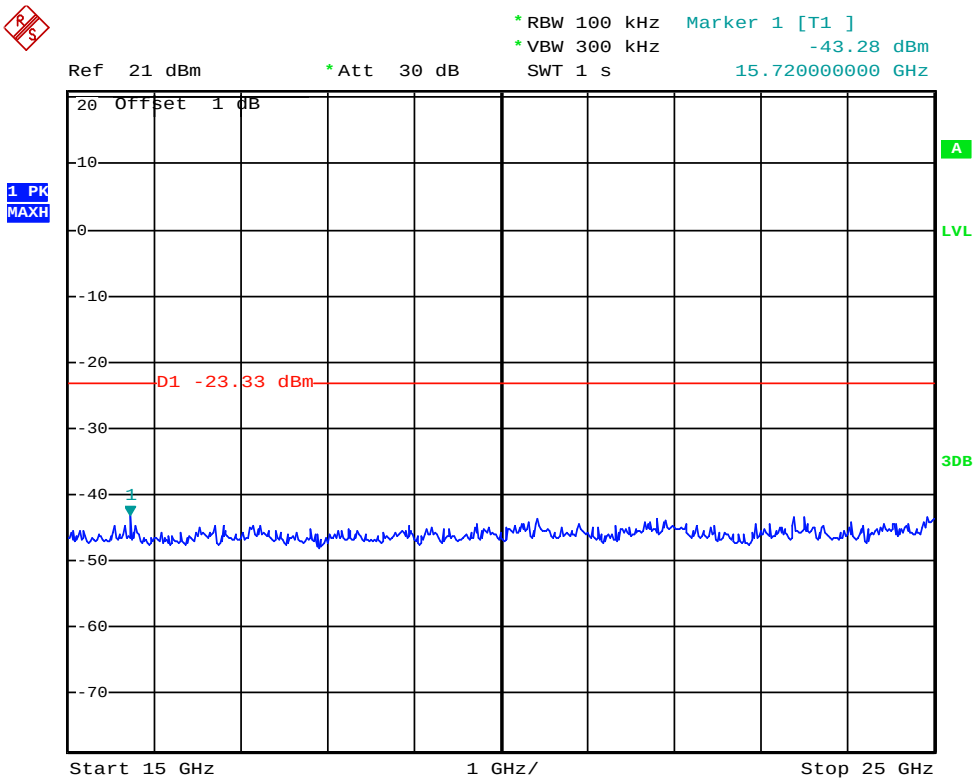
(Plot 4.7.1 B3: Channel 39: 2441MHz @ GFSK)



(Plot 4.7.1 C1: Channel 78: 2480MHz @ GFSK)



(Plot 4.7.1 C2: Channel 78: 2480MHz @ GFSK)



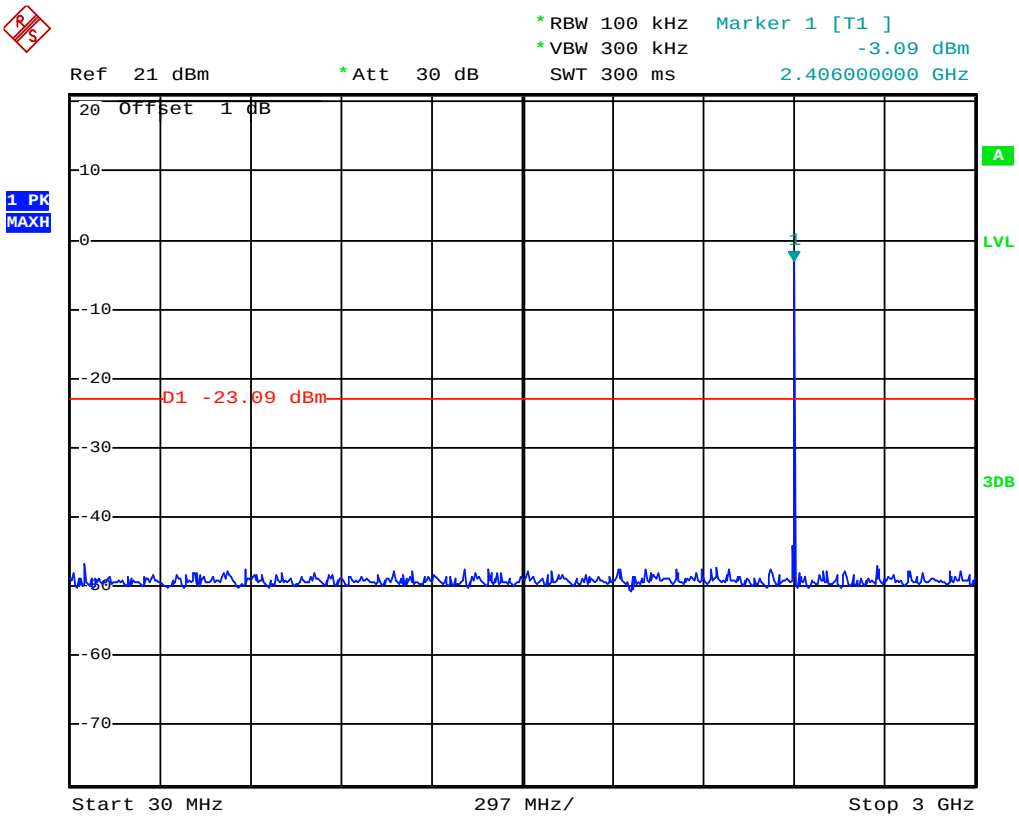
(Plot 4.7.1 C3: Channel 78: 2480MHz @ GFSK)

4.7.2 π/4DQPSK Test Mode

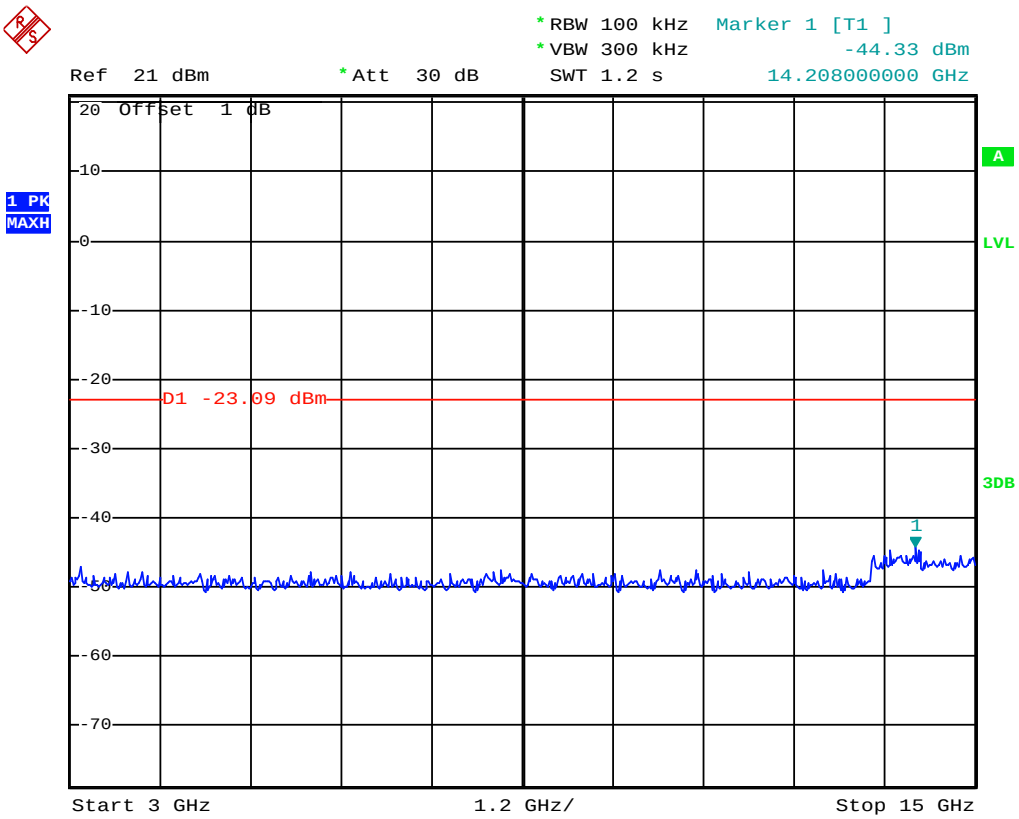
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	30MHz-25GHz	Plot 4.7.2 A1/A2/A3	-20	PASS
39	2441	30MHz-25GHz	Plot 4.7.2 B1/B2/B3	-20	PASS
78	2480	30MHz-25GHz	Plot 4.7.2 C1/C2/C3	-20	PASS

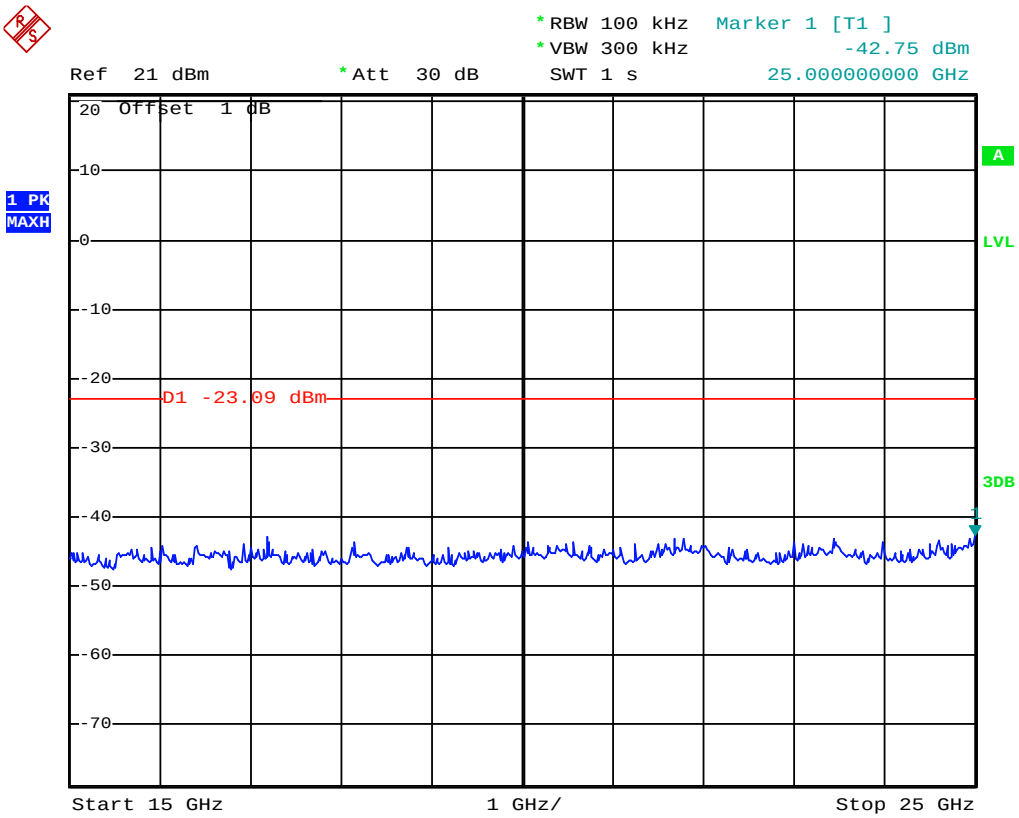
B. Test Plots



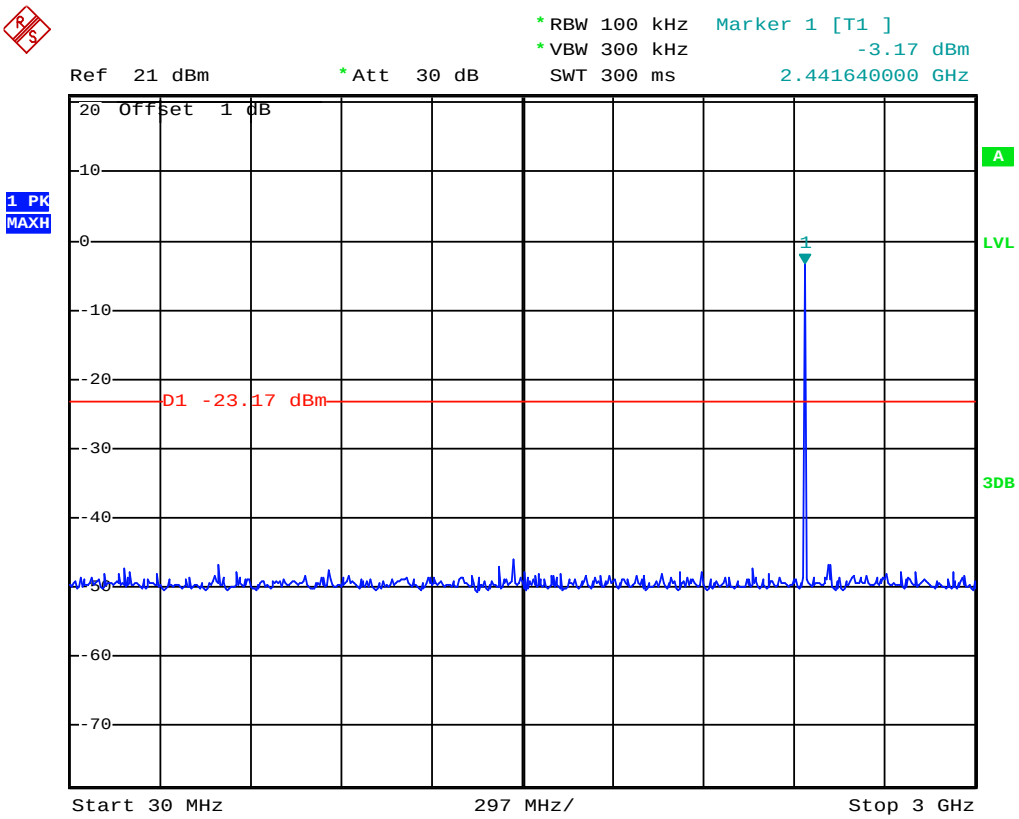
(Plot 4.7.2 A1: Channel 00: 2402MHz @π/4DQPSK)



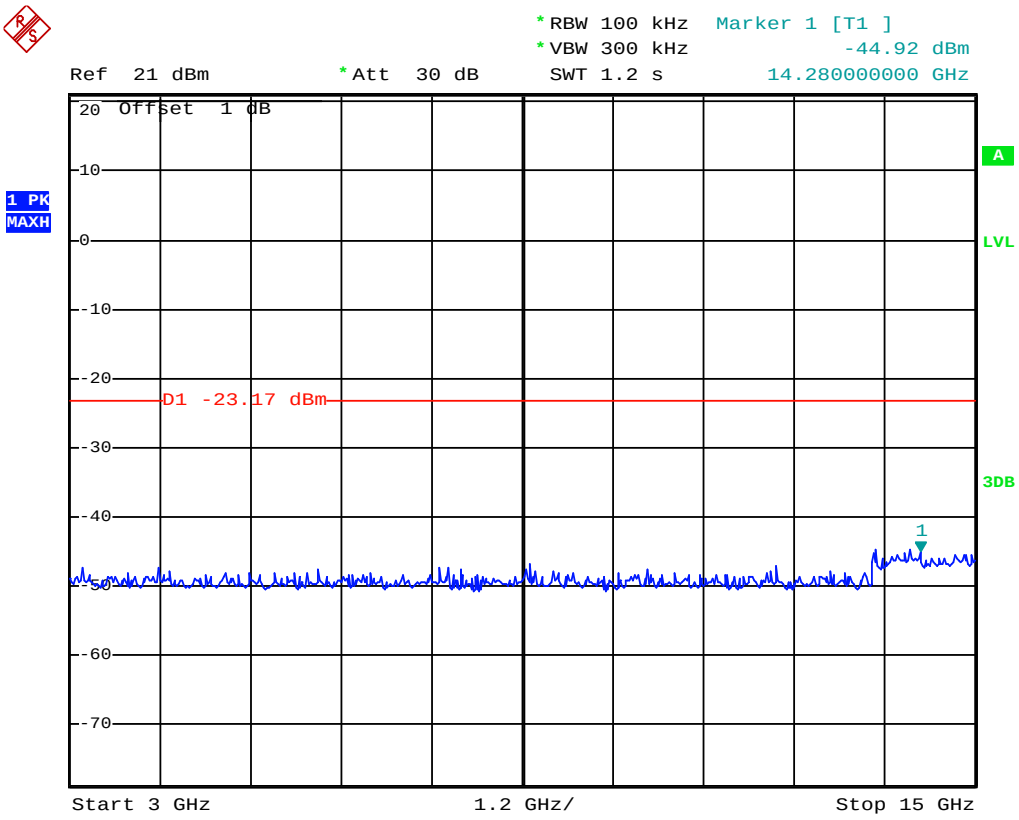
(Plot 4.7.2 A2: Channel 00: 2402MHz @π/4DQPSK)



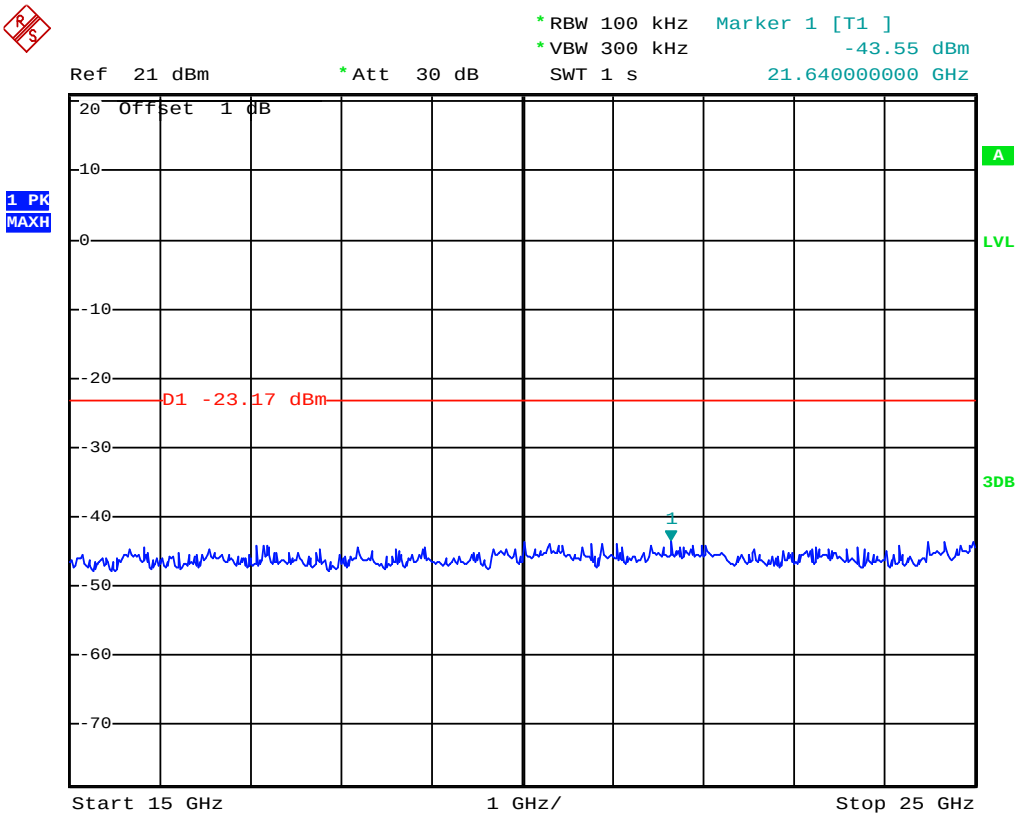
(Plot 4.7.2 A3: Channel 00: 2402MHz @π/4DQPSK)



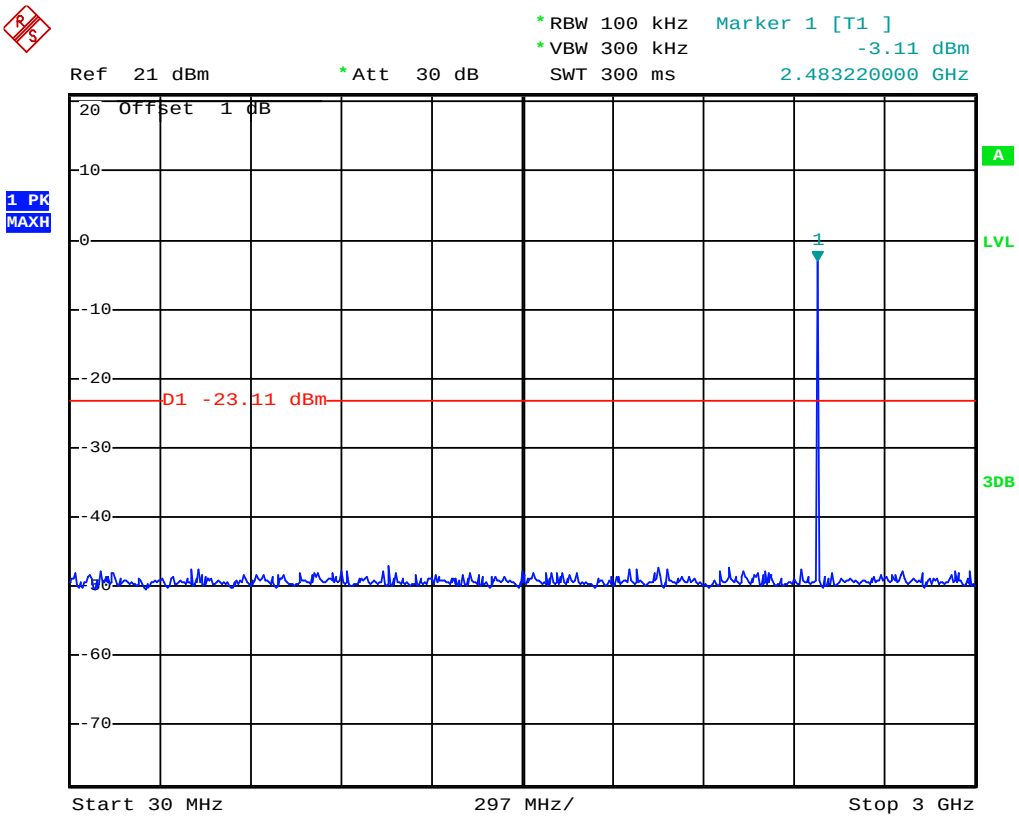
(Plot 4.7.2 B1: Channel 39: 2441MHz @π/4DQPSK)



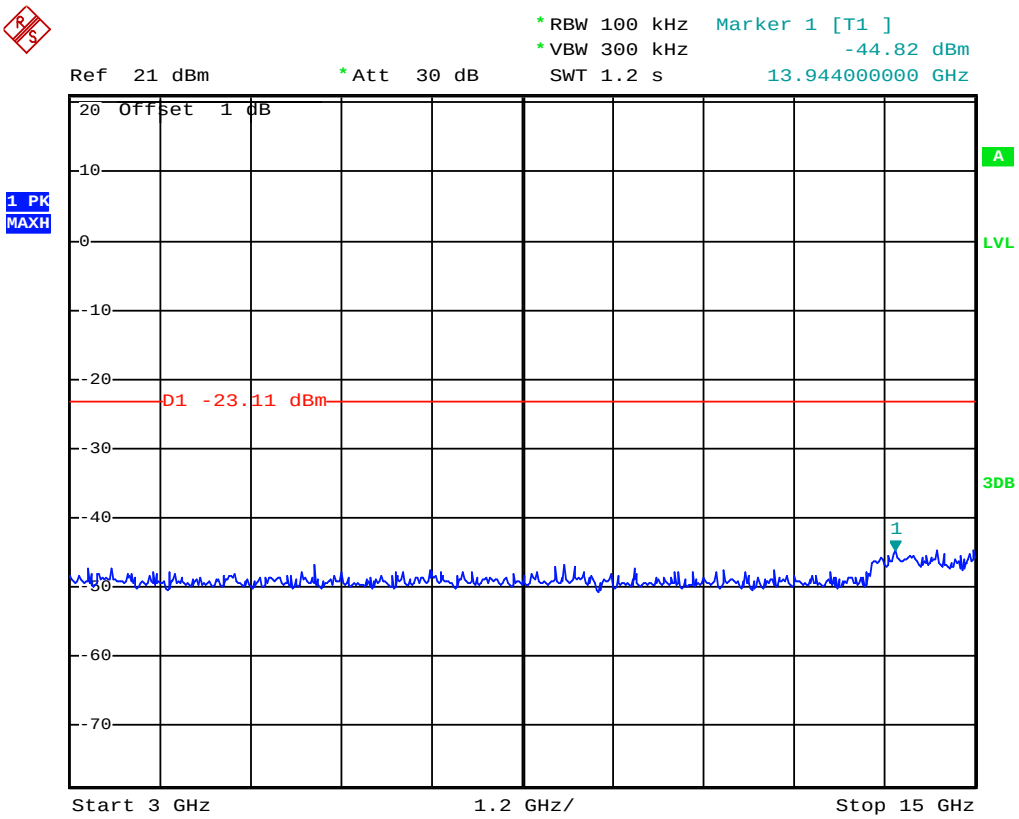
(Plot 4.7.2 B2: Channel 39: 2441MHz @π/4DQPSK)



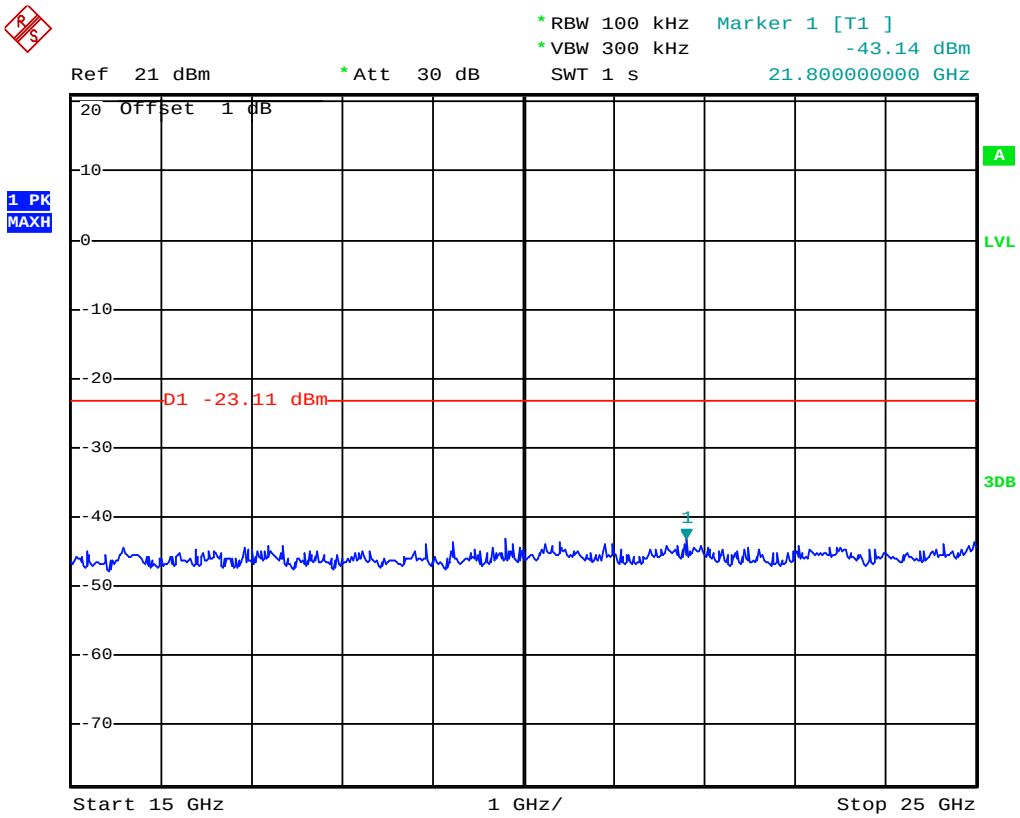
(Plot 4.7.2 B3: Channel 39: 2441MHz @π/4DQPSK)



(Plot 4.7.2 C1: Channel 78: 2480MHz @π/4DQPSK)



(Plot 4.7.2 C2: Channel 78: 2480MHz @π/4DQPSK)



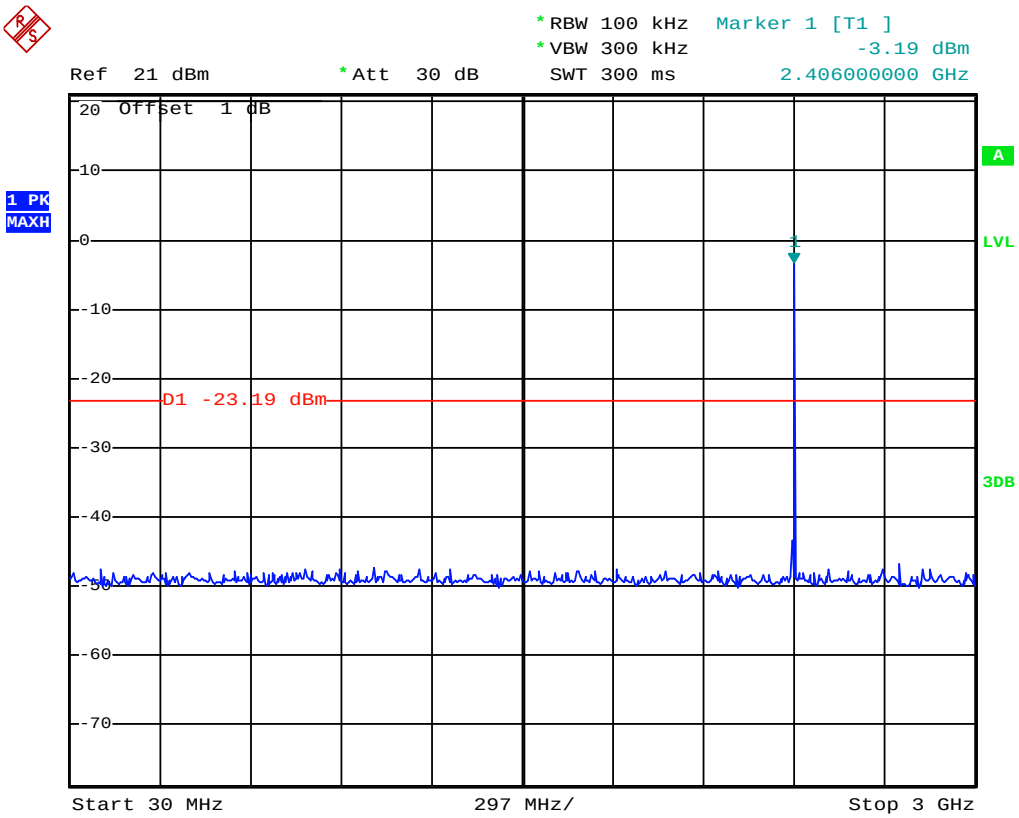
(Plot 4.7.2 C3: Channel 78: 2480MHz @π/4DQPSK)

4.7.3 8DPSK Test Mode

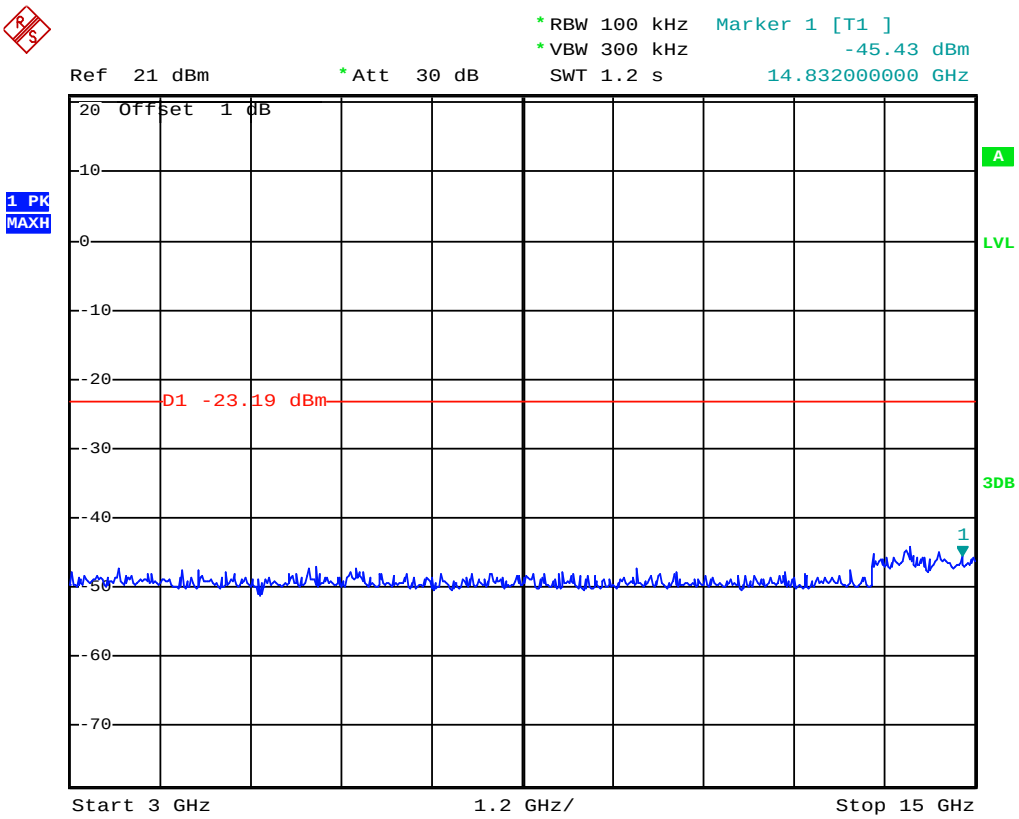
A. Test Verdict

Channel	Frequency (MHz)	Frequency Range	Refer to Plot	Limit (dBc)	Verdict
00	2402	30MHz-25GHz	Plot 4.7.3 A1/A2/A3	-20	PASS
39	2441	30MHz-25GHz	Plot 4.7.3 B1/B2/B3	-20	PASS
78	2480	30MHz-25GHz	Plot 4.7.3 C1/C2/C3	-20	PASS

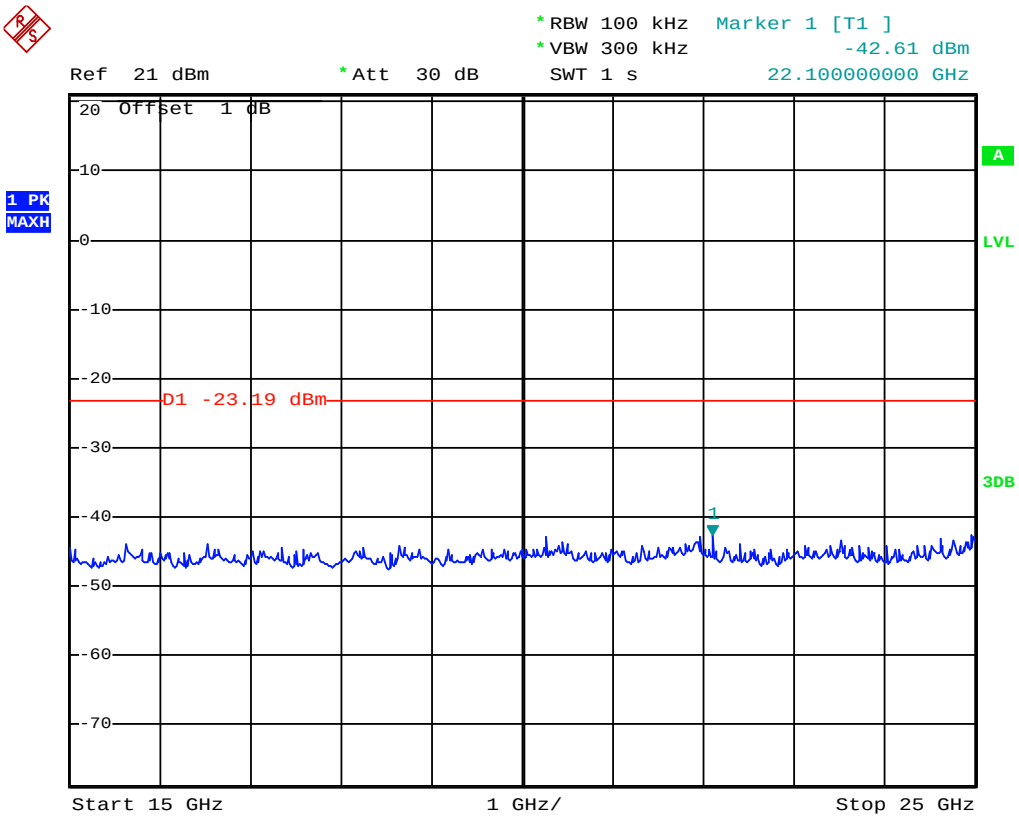
B. Test Plots



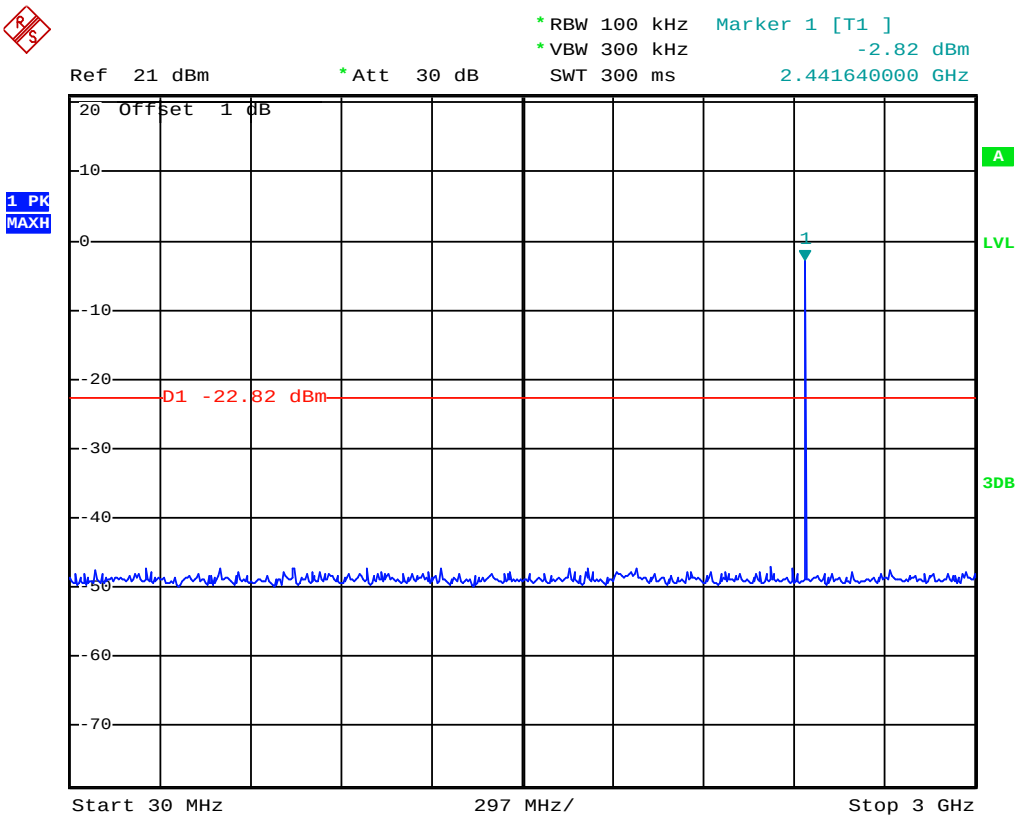
(Plot 4.7.3 A1: Channel 00: 2402MHz @8DPSK)



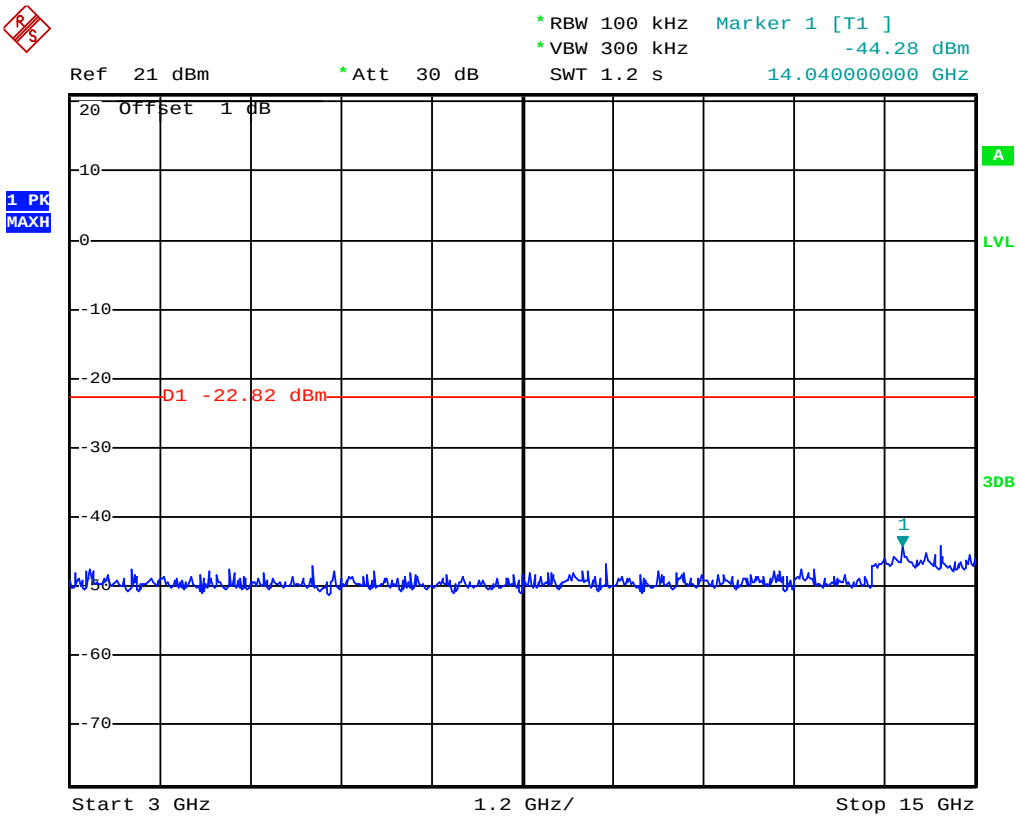
(Plot 4.7.3 A2: Channel 00: 2402MHz @8DPSK)



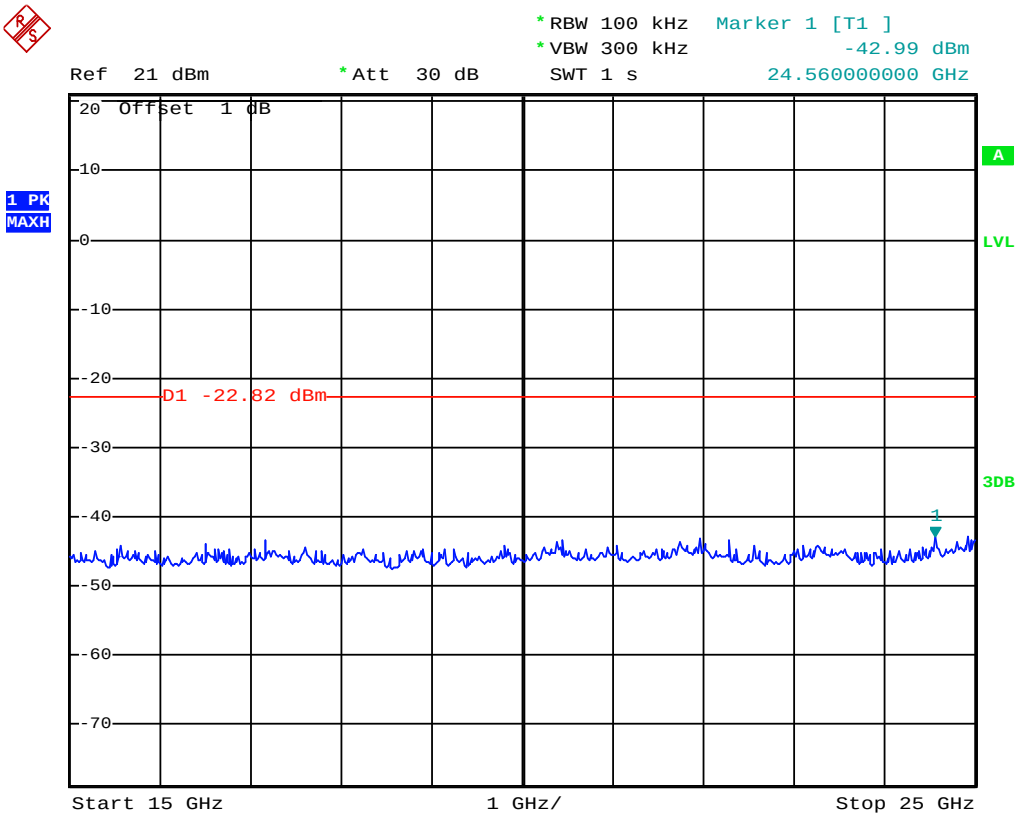
(Plot 4.7.3 A3: Channel 00: 2402MHz @8DPSK)



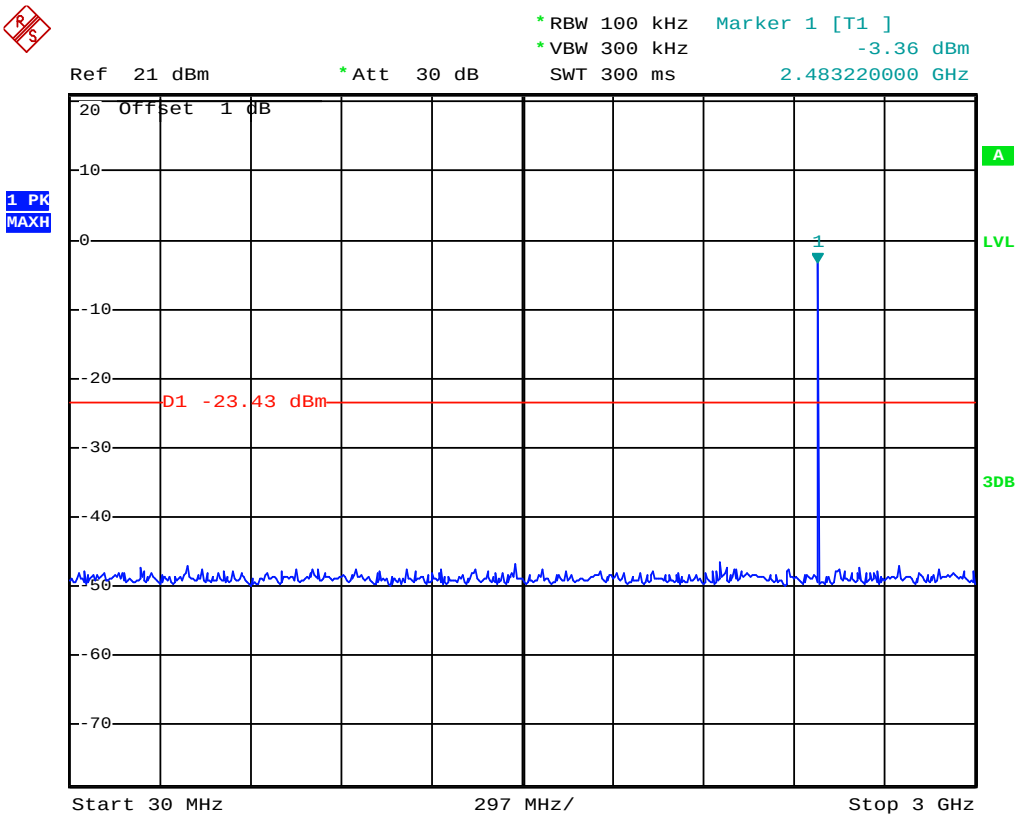
(Plot 4.7.3 B1: Channel 39: 2441MHz @8DPSK)



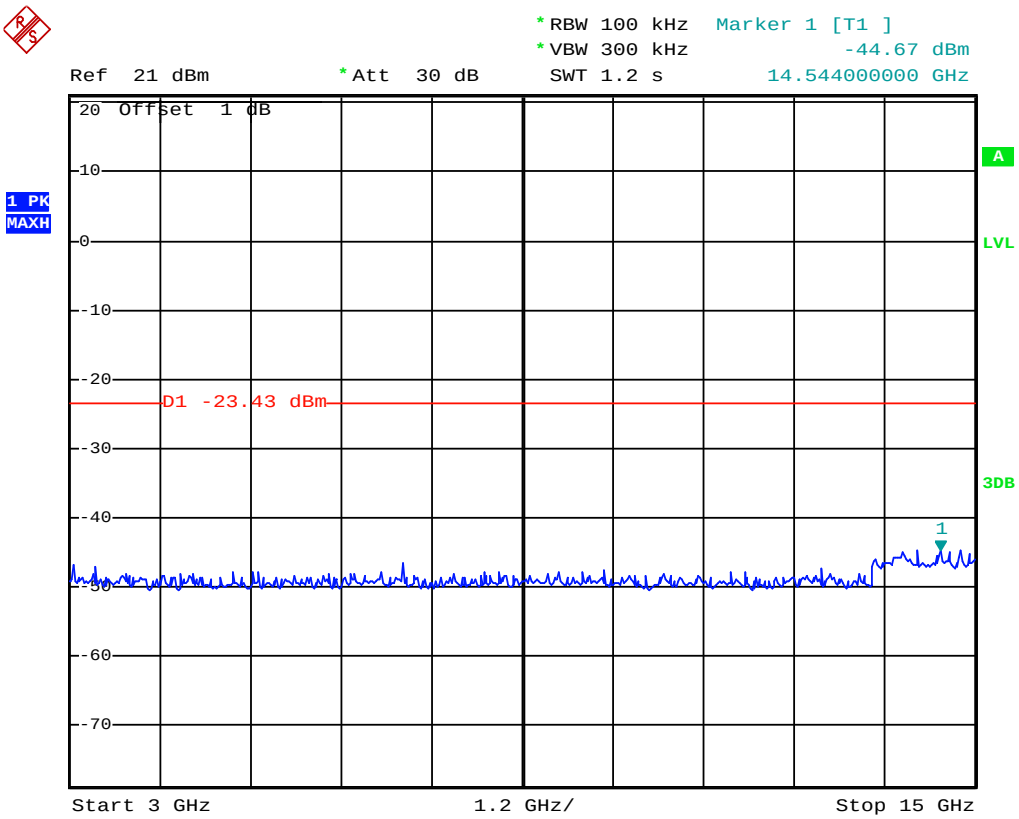
(Plot 4.7.3 B2: Channel 39: 2441MHz @8DPSK)



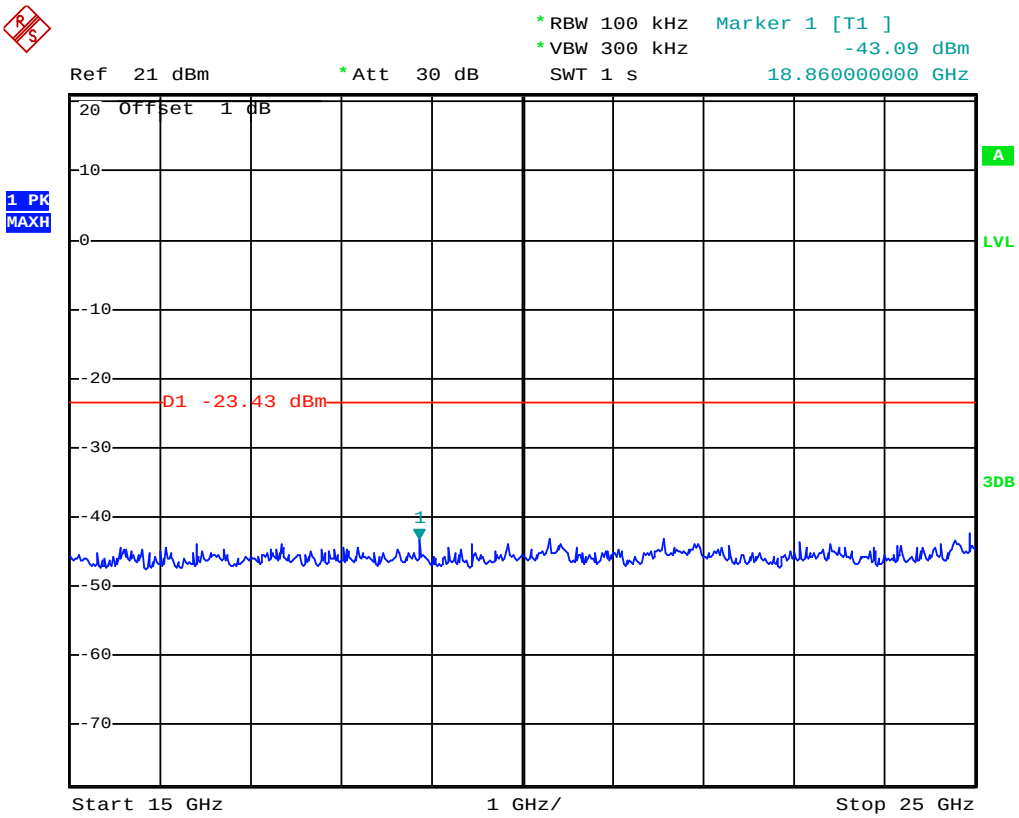
(Plot 4.7.3 B3: Channel 39: 2441MHz @8DPSK)



(Plot 4.7.3 C1: Channel 78: 2480MHz @8DPSK)



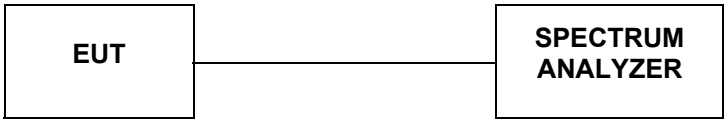
(Plot 4.7.3 C2: Channel 78: 2480MHz @8DPSK)



(Plot 4.7.3 C3: Channel 78: 2480MHz @8DPSK)

4.8. Number of hopping frequency

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=30 KHz and VBW=100KHz.

LIMIT

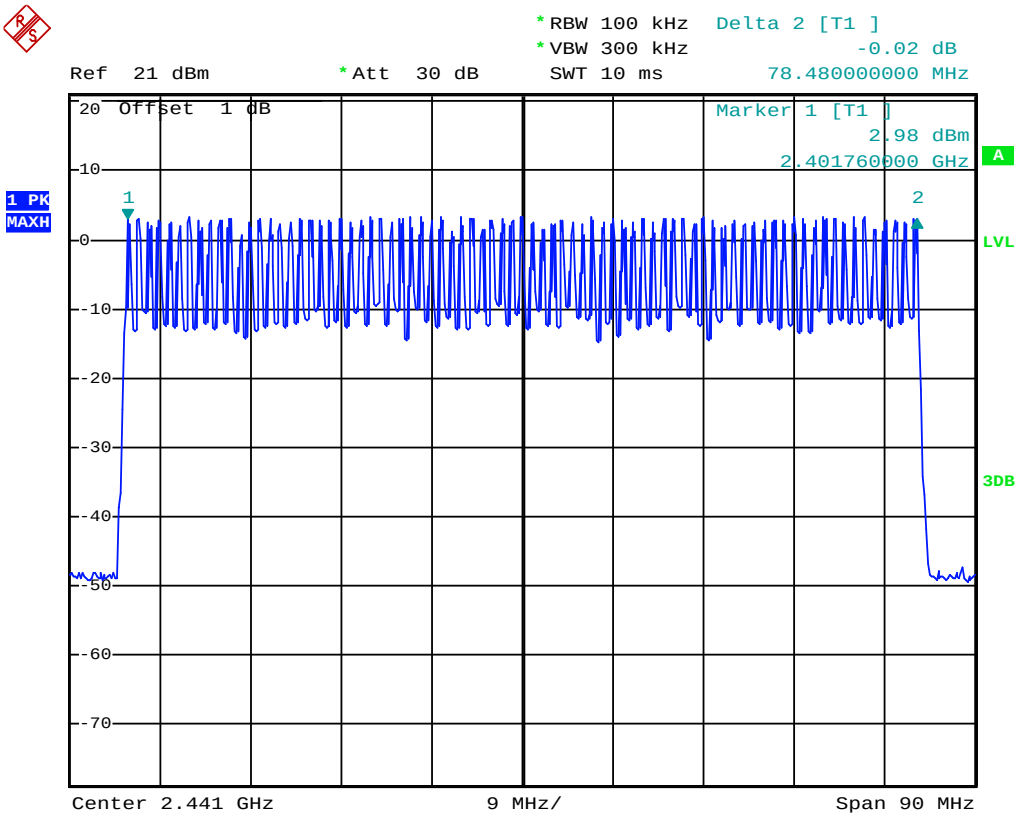
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

4.8.1 GFSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.8.1 A1	≥15	PASS

B. Test Plots



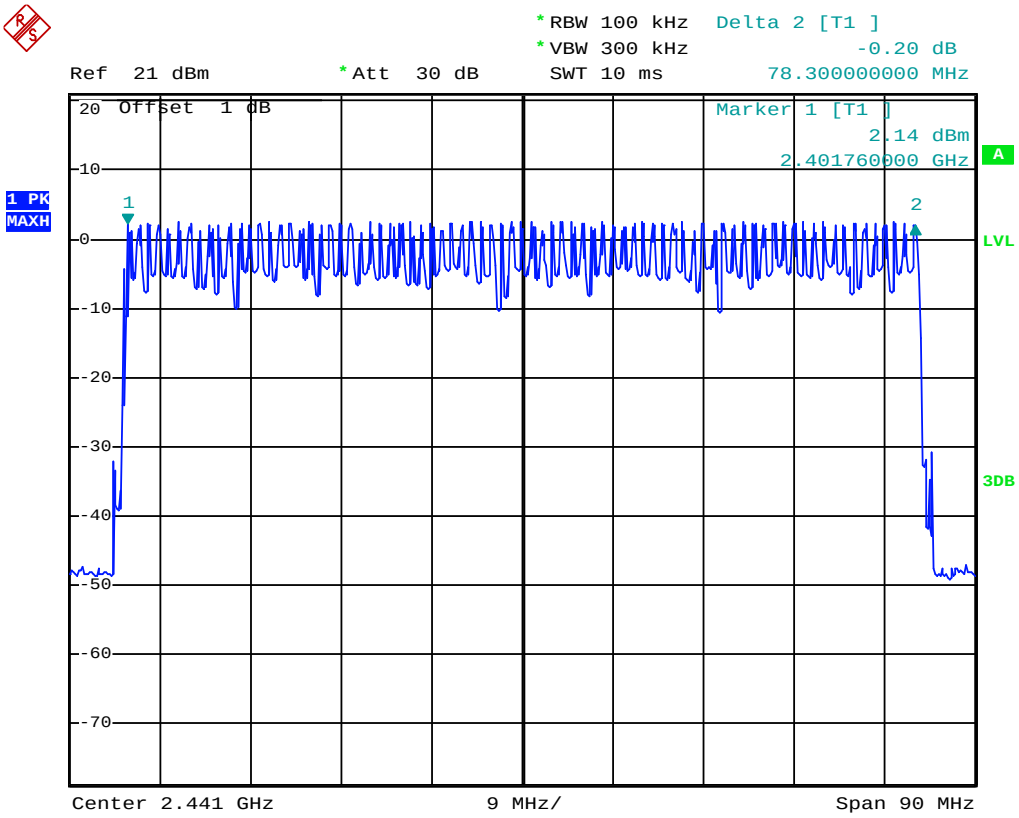
(Plot 4.8.1 A: @ GFSK)

4.8.2 8DPSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.8.2 A1	≥15	PASS

B. Test Plots



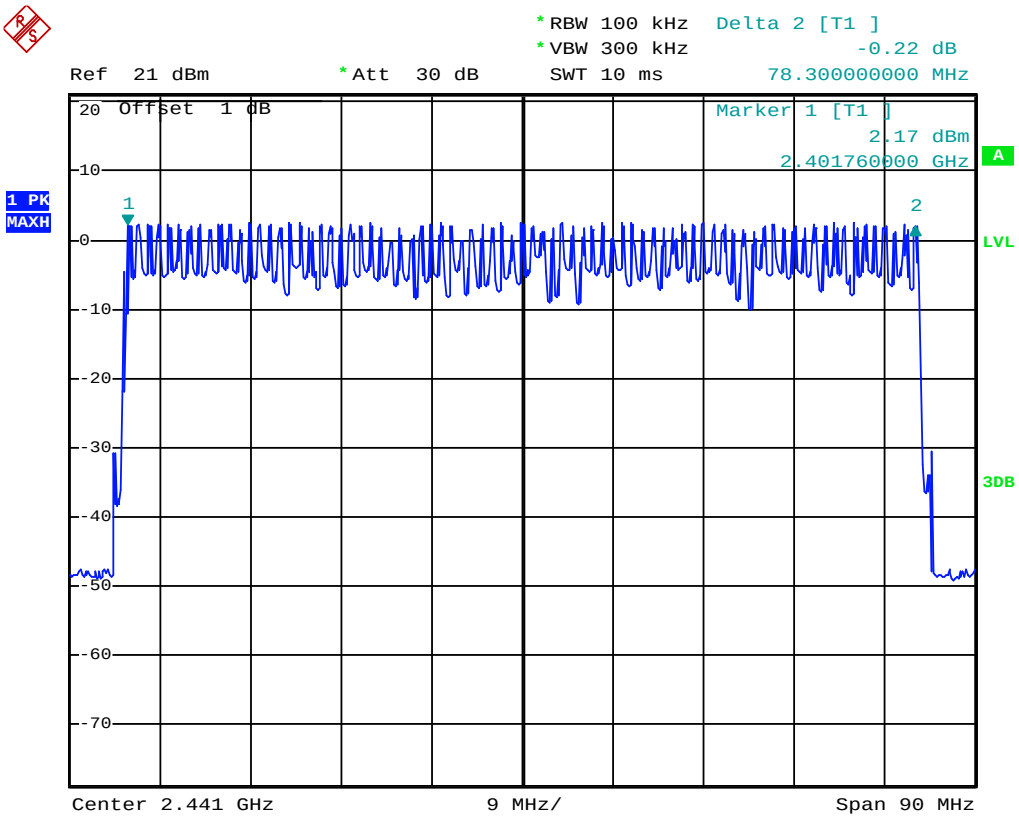
(Plot 4.7.2 A1: @ 8DPSK)

4.8.3 π/4DQPSK Test Mode

A. Test Verdict

Hopping Channel Frequency Range (MHz)	Number of Hopping Channel	Refer to Plot	Limit	Verdict
2400-2483.5	79	Plot 4.8.3 A1	≥15	PASS

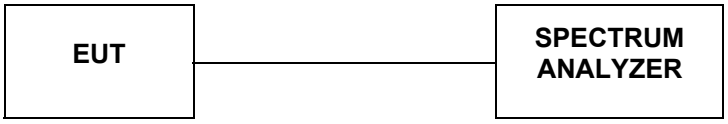
B. Test Plots



(Plot 4.7.3 A1: @ π/4DQPSK)

4.9. Time Of Occupancy(Dwell Time)

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.

LIMIT

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

TEST RESULTS

The Dwell Time=Burst Width*Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation:0.4[s]*hopping number=0.4[s]*79[ch]=31.6[s*ch];
The burst width [ms/hop/ch], which is directly measured, refers to the duration on one channel hop.
The hops per second for all channels: The selected EUT Conf uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600 [ch*hop/s] for all channels. So the final hopping rate for all channels is 1600/6=266.67 [ch*hop/s]
The hops per second on one channel: 266.67 [ch*hops/s]/79 [ch]=3.38 [hop/s];
The total hops for all channels within the dwell time calculation duration: 3.38 [hop/s]*31.6[s*ch]=106.67 [hop*ch];
The dwell time for all channels hopping: 106.67 [hop*ch]*Burst Width [ms/hop/ch].

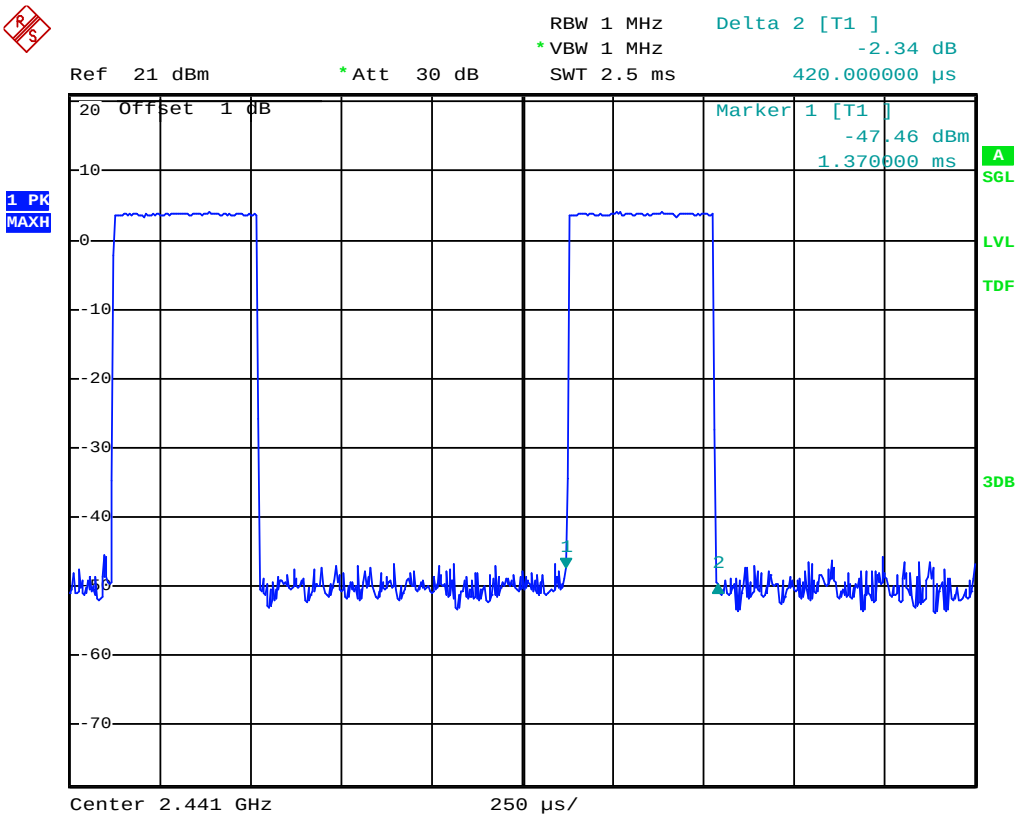
Remark: 1. We test Frequency Separation at all test channels, recorded worst case at middle channel.

4.9.1 GFSK Test Mode

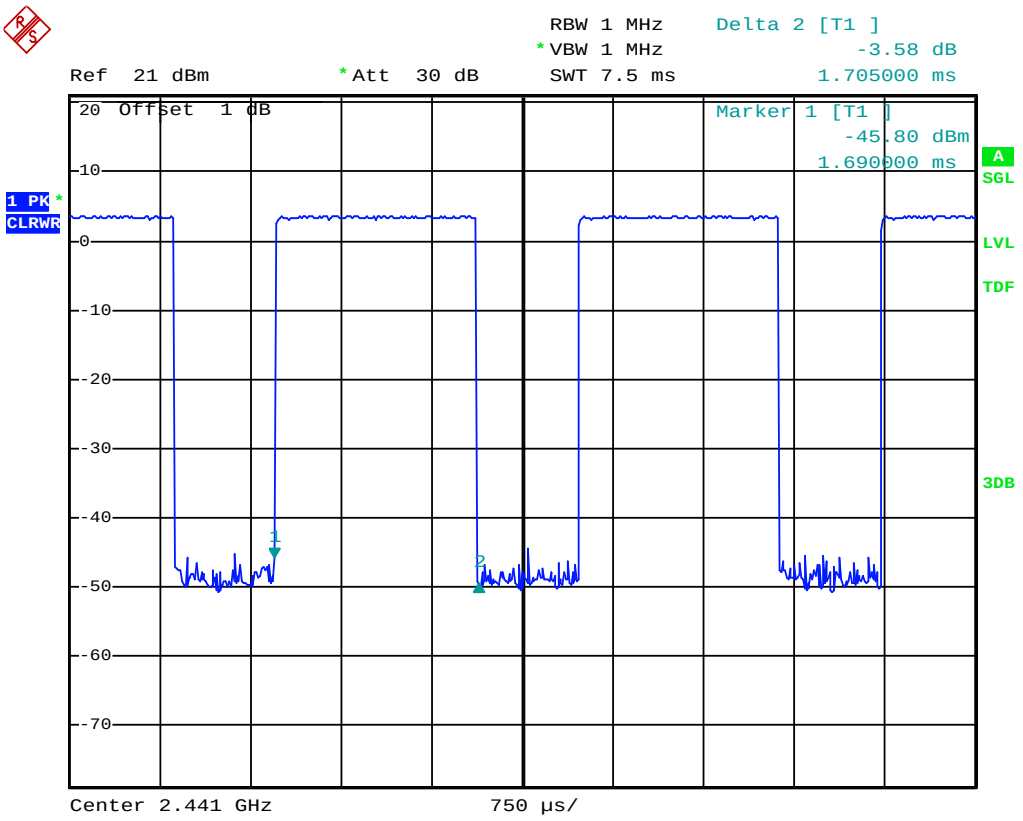
A. Test Verdict

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH 1	2441	0.420	0.1344	0.4	Plot 4.9.1 A1	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second					
DH 3	2441	1.705	0.2728	0.4	Plot 4.9.1 B1	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second					
DH 5	2441	2.960	0.3157	0.4	Plot 4.9.1 C1	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

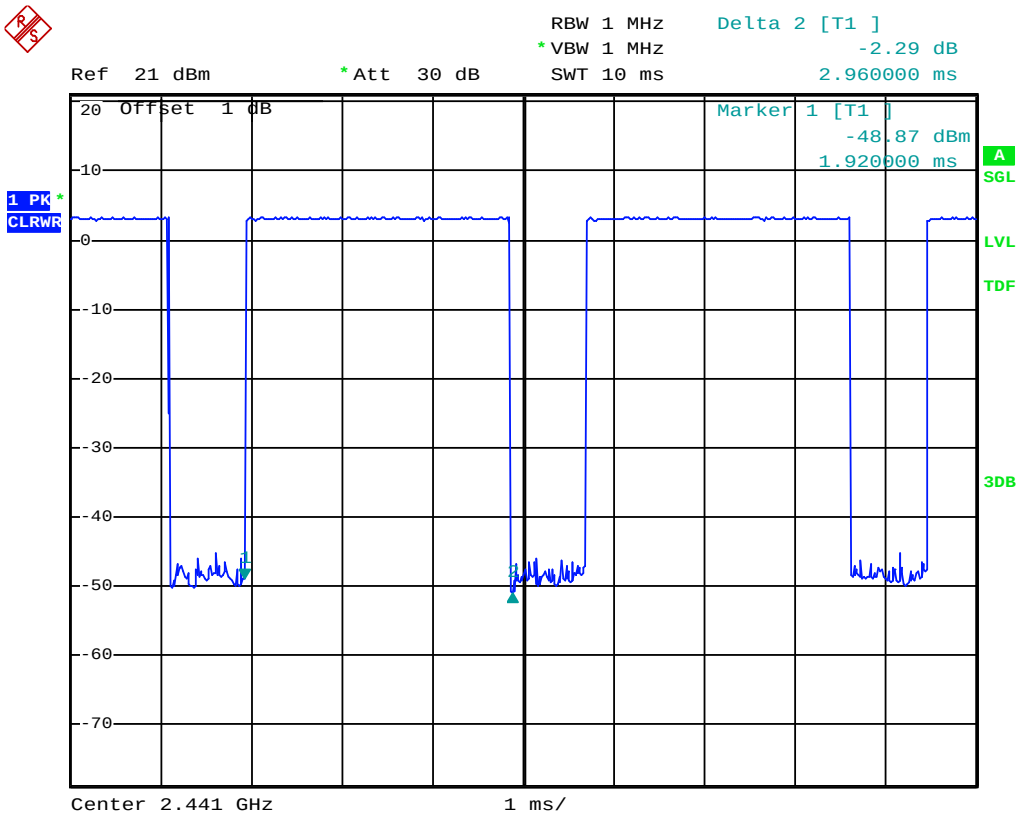
B. Test Plots



(Plot 4.9.1.A1: Channel 39: 2441MHz @ GFSK @ DH1)



(Plot 4.9.1.B1: Channel 39: 2441MHz @ GFSK @ DH3)



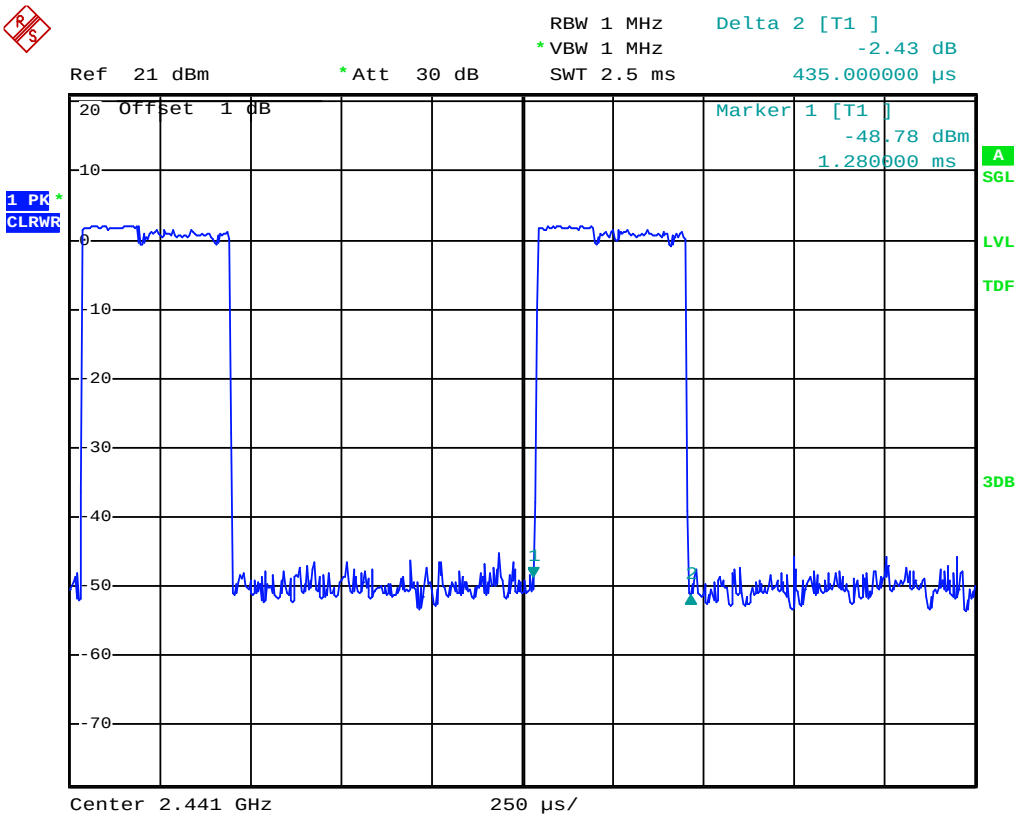
(Plot 4.9.1.C1: Channel 39: 2441MHz @ GFSK @ DH5)

4.8.2 8DPSK Test Mode

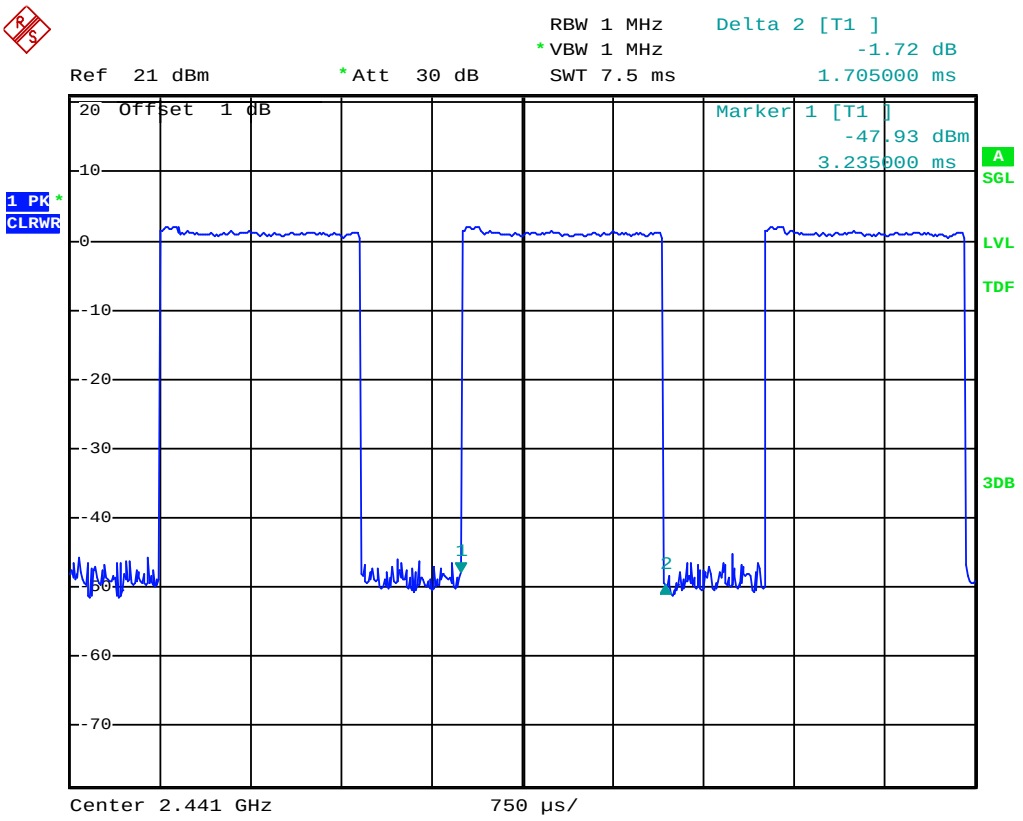
A. Test Verdict

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH 1	2441	0.435	0.1392	0.4	Plot 4.9.2 A1	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second					
DH 3	2441	1.705	0.2728	0.4	Plot 4.9.2 B2	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second					
DH 5	2441	2.960	0.3157	0.4	Plot 4.9.2 C2	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

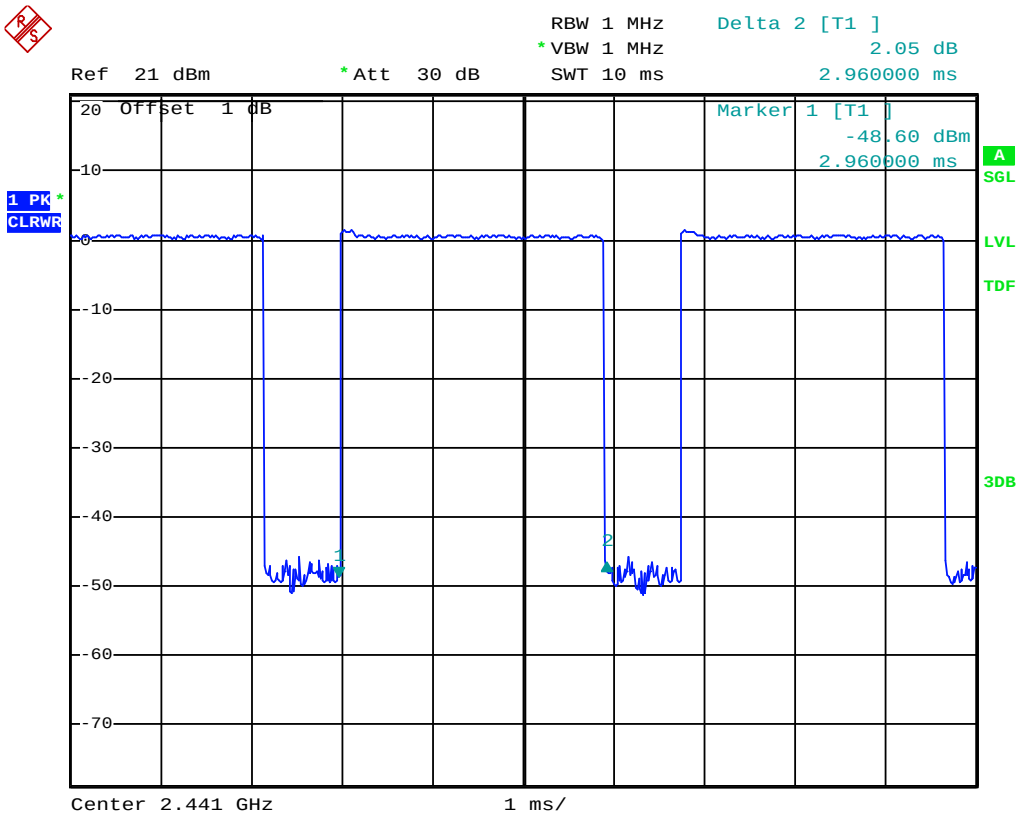
B. Test Plots



(Plot 4.9.2.A1: Channel 39: 2441MHz @ 8DPSK @ DH1)



(Plot 4.9.2.B1: Channel 39: 2441MHz @ 8DPSK @ DH3)



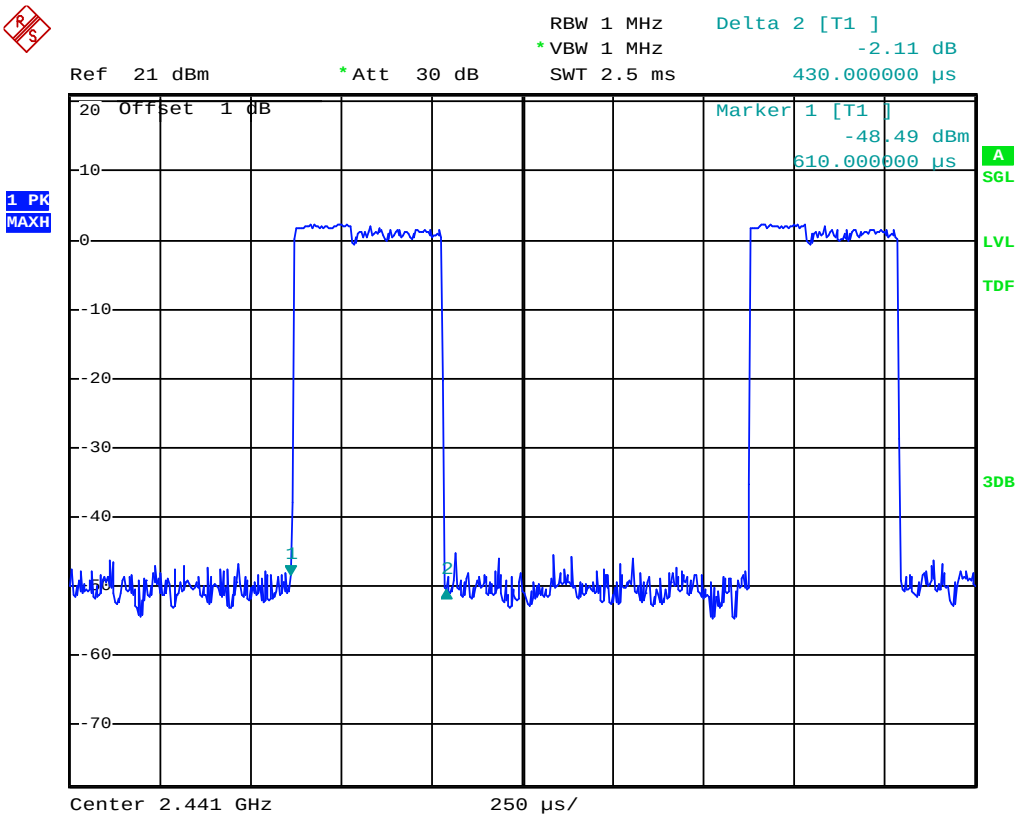
(Plot 4.9.2.C1: Channel 39: 2441MHz @ 8DPSK @ DH5)

4.8.3 π/4DQPSK Test Mode

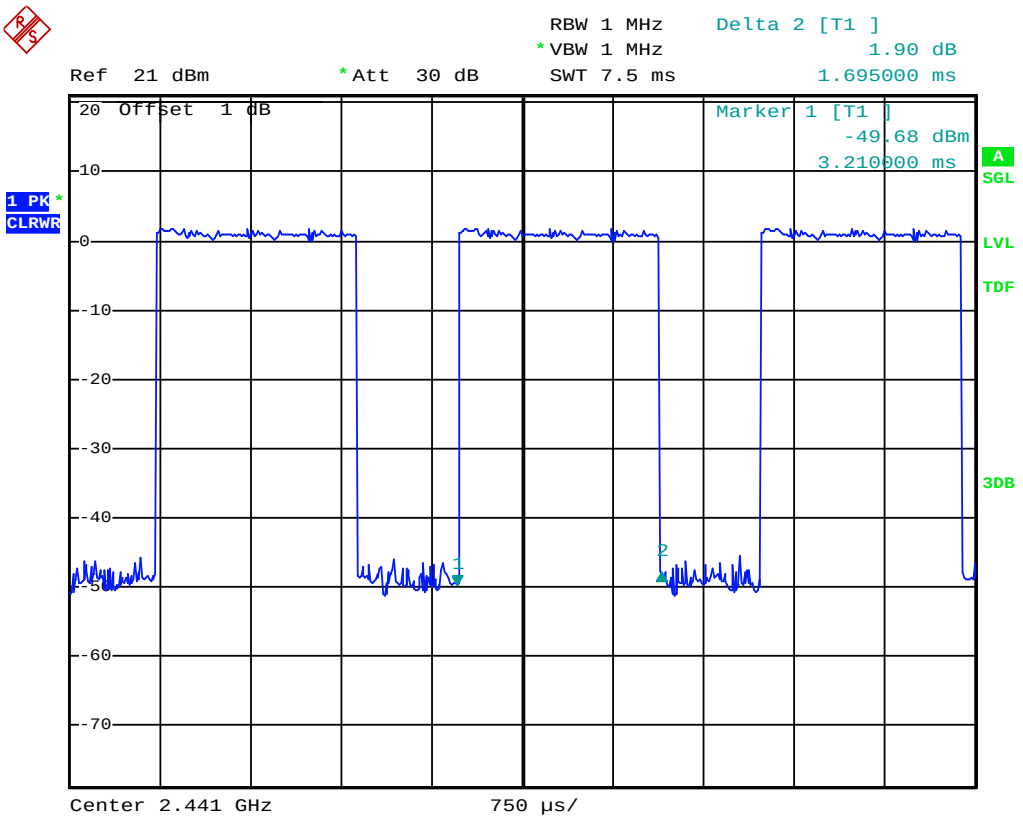
A. Test Verdict

Mode	Frequency (MHz)	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Refer to Plot	Verdict
DH 1	2441	0.430	0.1376	0.4	Plot 4.9.3 A1	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second					
DH 3	2441	1.695	0.2712	0.4	Plot 4.9.3 B1	PASS
	Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second					
DH 5	2441	2.960	0.3157	0.4	Plot 4.9.3 C1	PASS
	Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second					

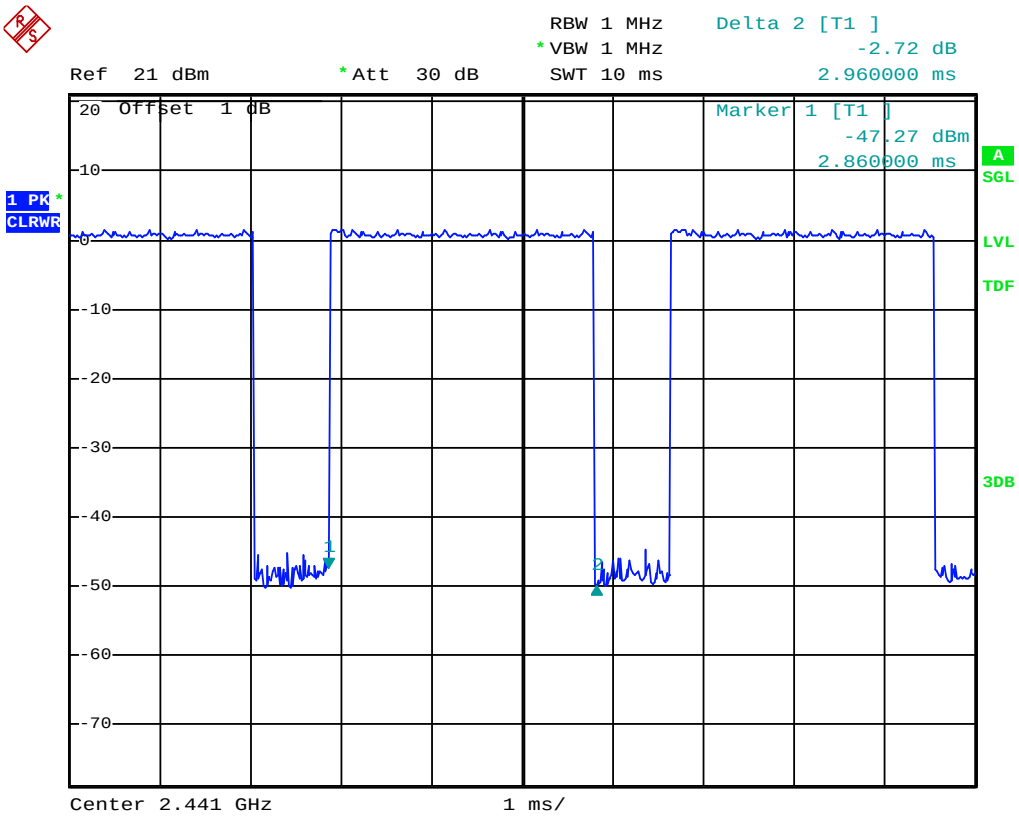
B. Test Plots



(Plot 4.9.3.A1: Channel 39: 2441MHz @ π/4DQPSK @ DH1)



(Plot 4.9.3.B1: Channel 39: 2441MHz @ π/4DQPSK @ DH3)



(Plot 4.9.3.C1: Channel 39: 2441MHz @ π/4DQPSK @ DH5)

4.10. Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

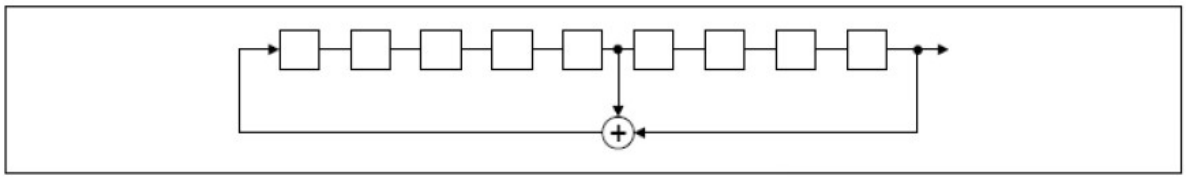
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

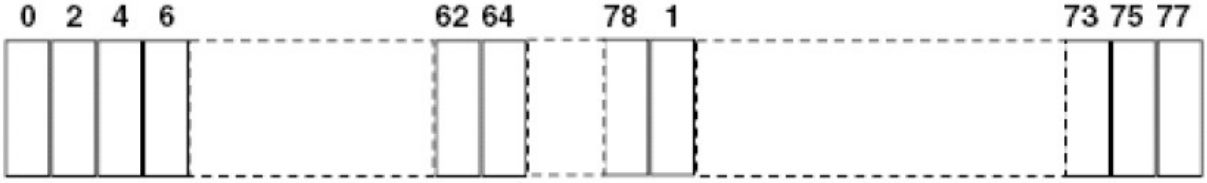
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.11. Antenna Requirement

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.

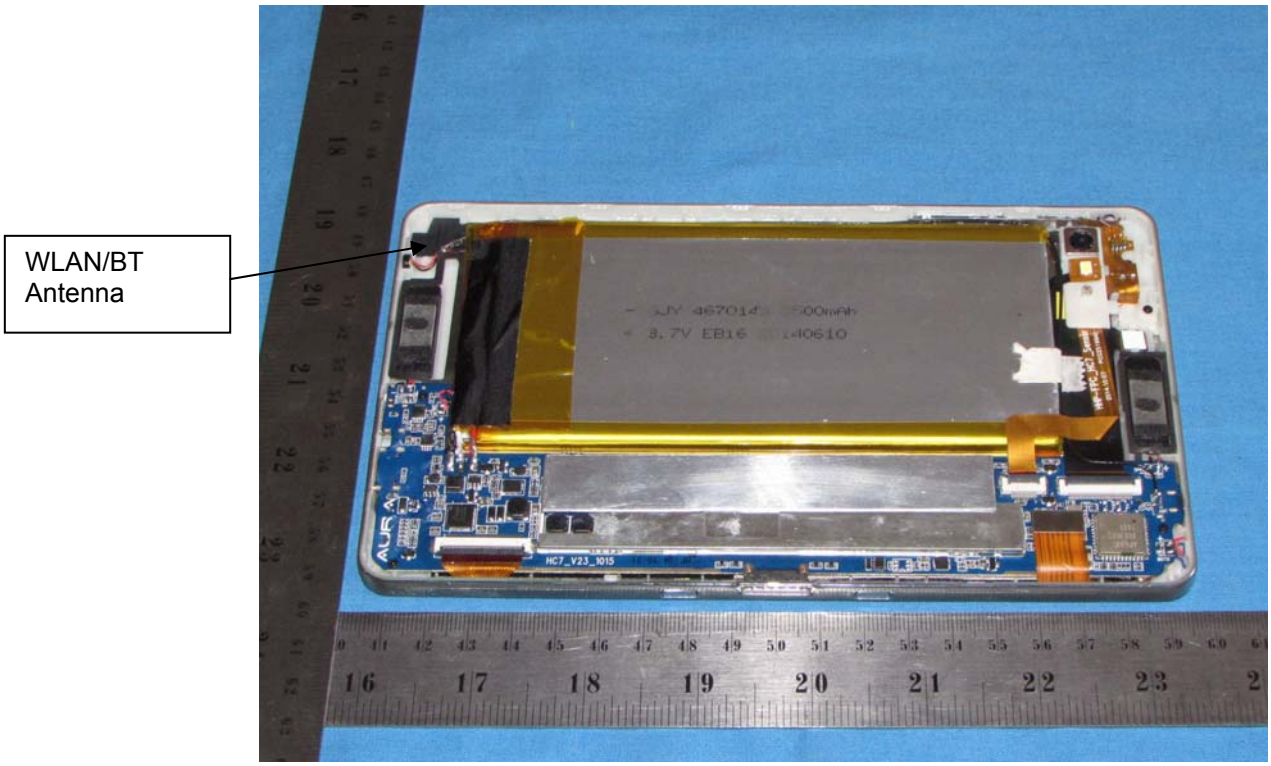
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

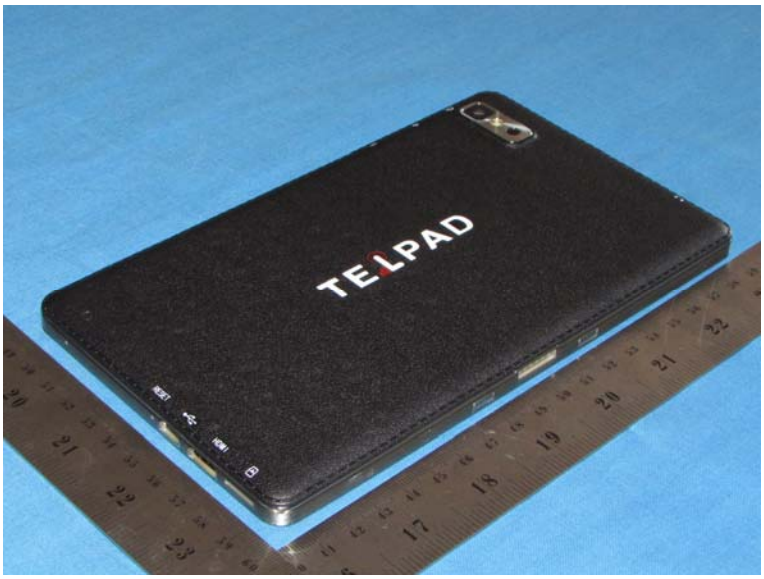
The WLAN and BT share same antenna and the maximum gain of WLAN antenna was 0.00 dBi.

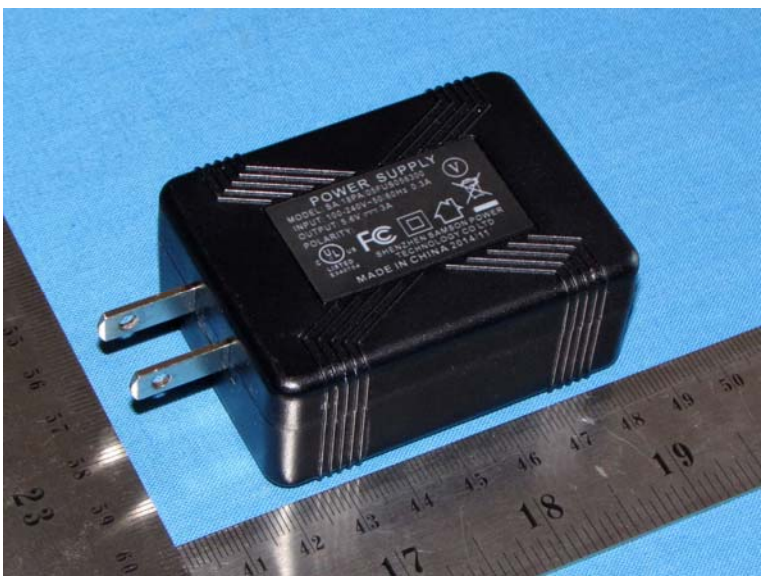


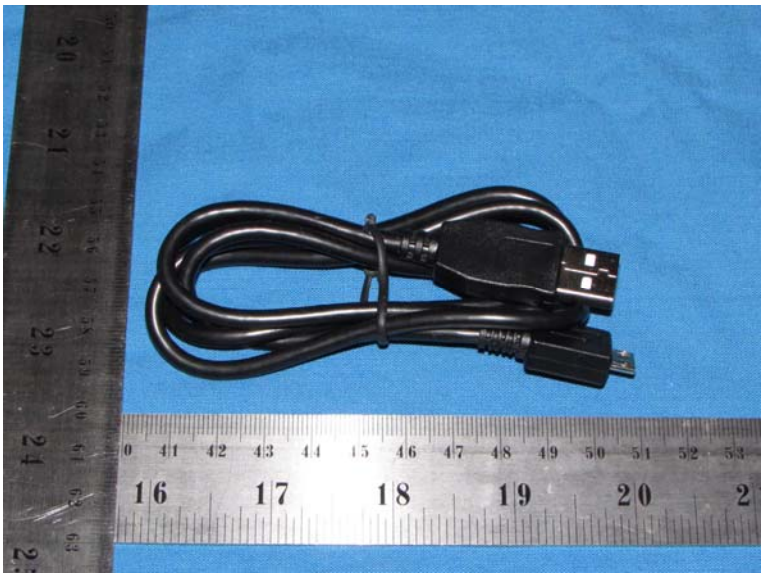
5. Test Setup Photos of the EUT

6. External and Internal Photos of the EUT

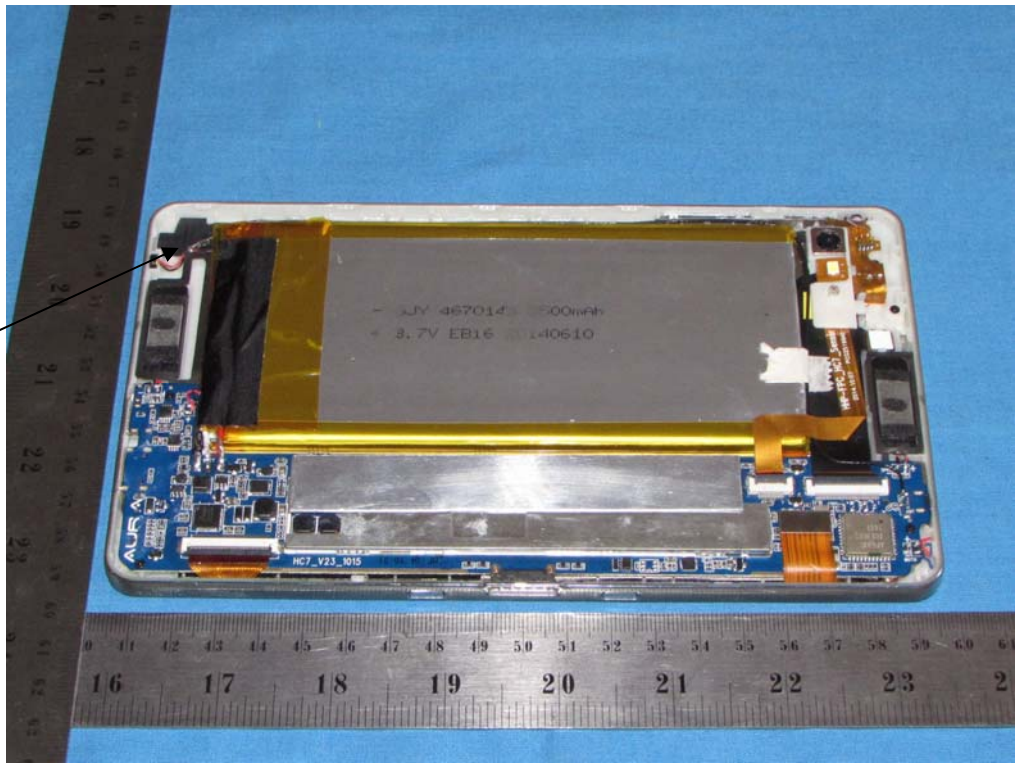
External Photos

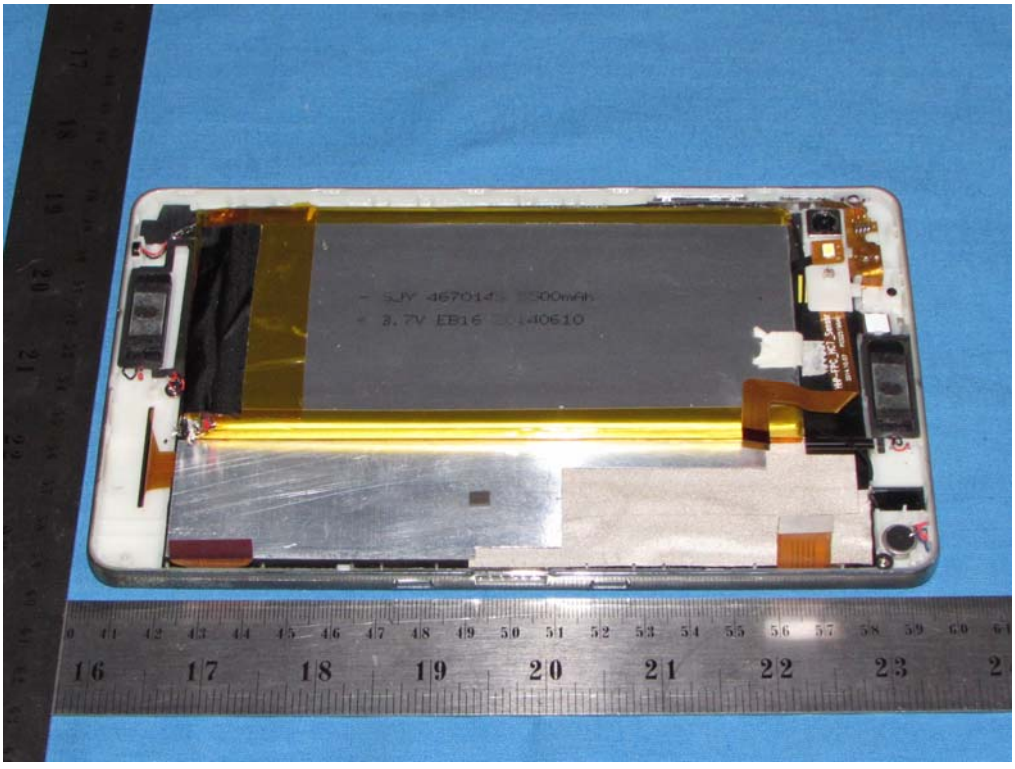


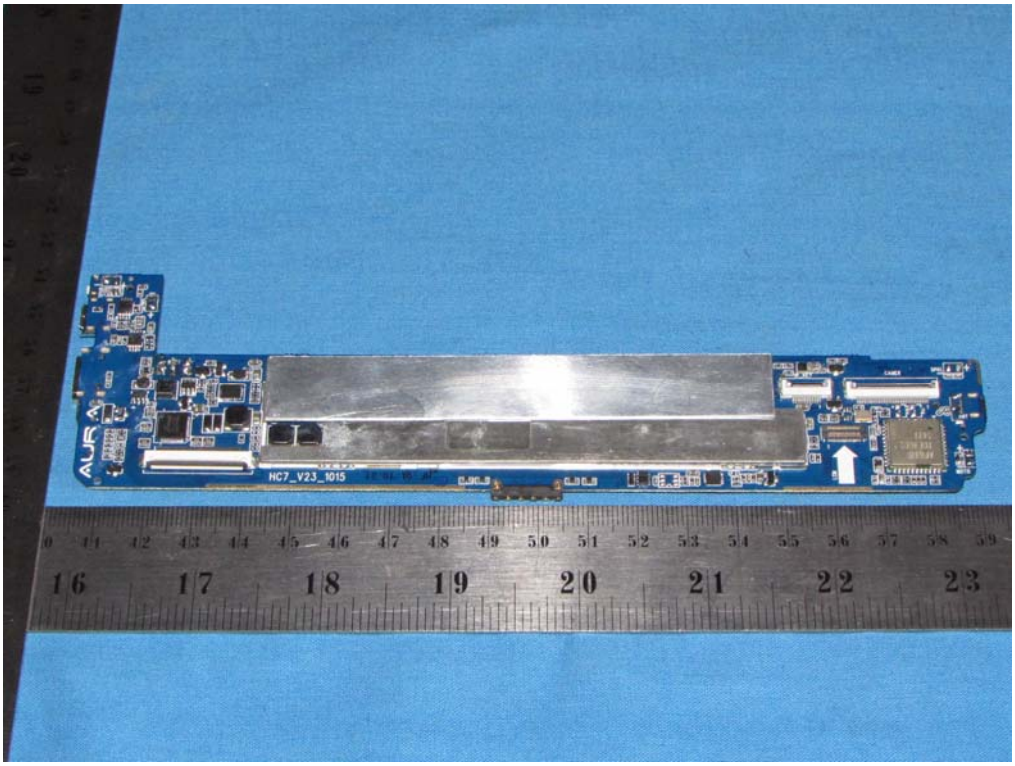


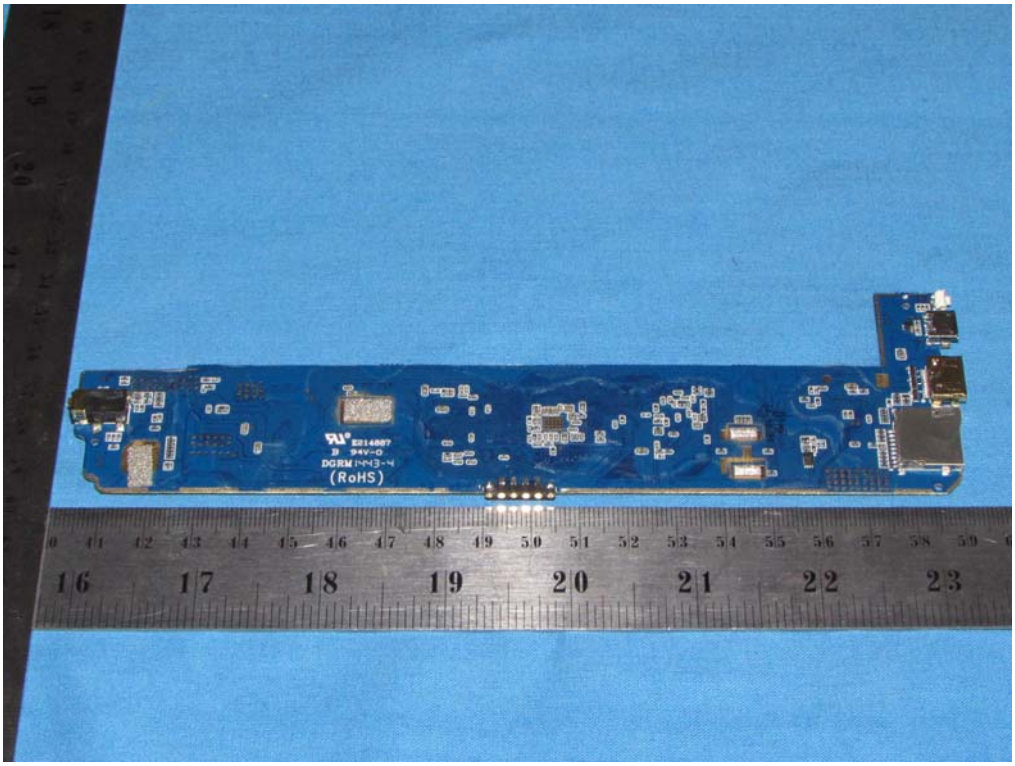

16
17
18
19
20

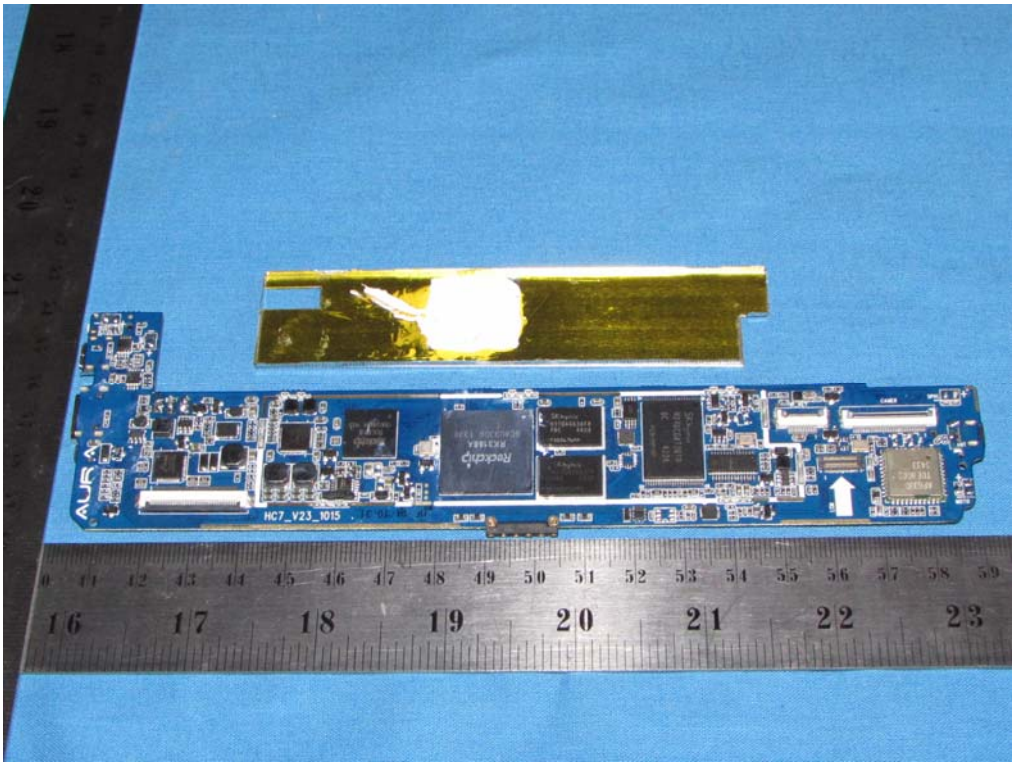
Internal Photos

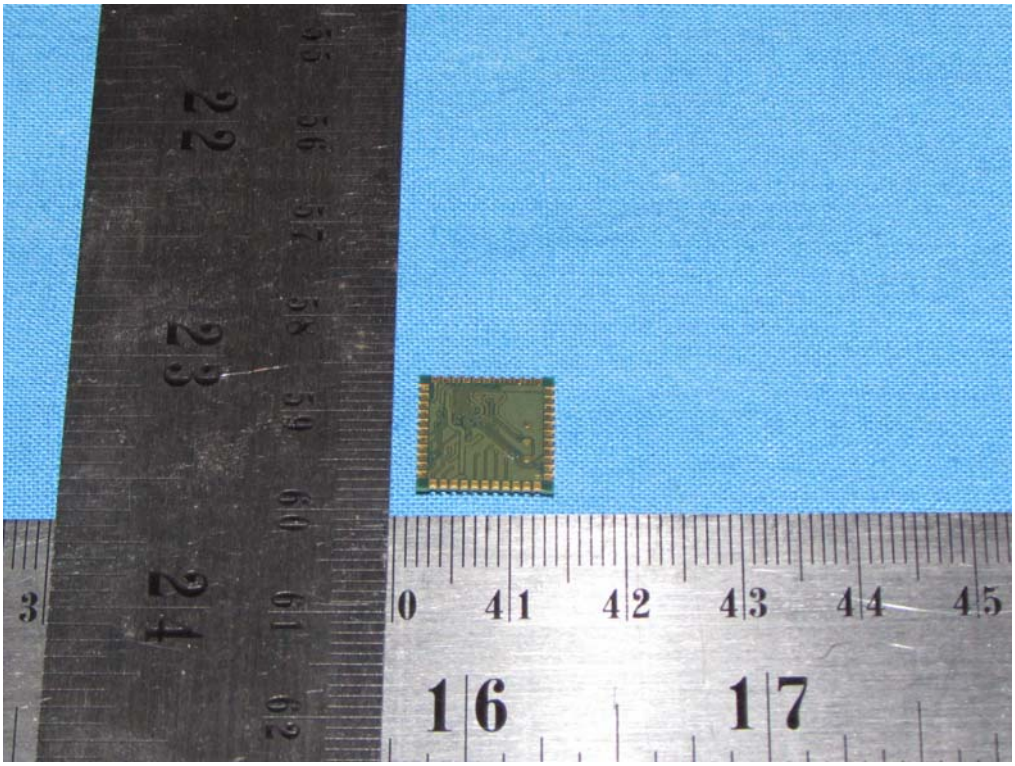


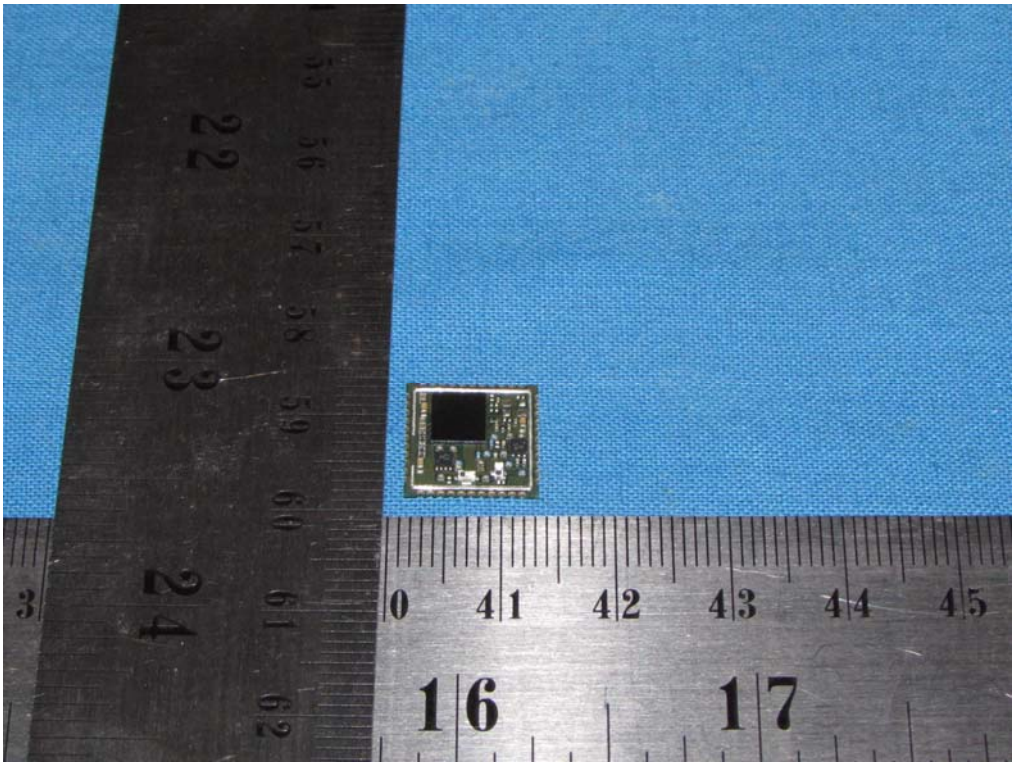



HC7_V23_1015


(RoHS)


HC7_V23_1015
16 17 18 19 20 21 22 23


0 41 42 43 44 45
16 17



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