FCC BT TEST REPORT

No. GCCT16CFR01-BT

For

OBI Connect FZE

Product Name: Mobile Phone

Model Name: Obi Worldphone SF1

Trade Name: OBI

Issued Date: 2016-04-07

Test Laboratory:

GCCT, *Guangdong Telecommunications Terminal Products Quality Supervision and Testing Center*

Keji Road, High-tech Zone, He Yuan, Guang Dong, PR China 517001

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GENERAL SUMMARY

Product Name	Mobile Phone
Model Name	Obi Worldphone SF1
Trade Name	OBI
Applicant	OBI Connect FZE
Manufacturer	CK Telecom Limited
Test Laboratory	GCCT, Guangdong Telecommunications Terminal Products Quality Supervision and Testing Center
Reference Standards	FCC CFR 47 Part 15C:"Radio Frequency Devices Sub-Part C: intentional Radiators" ANSI C63.10-2013, "American National Standard for Testing Unlicensed Wireless Devices" FCC Public Notice DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"
Test Conclusion	This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in annex B of this test report are below limits specified in the relevant standards. General Judgment: Pass Date of issue: 2016.04.07
Comment	The test results in this report apply only to the tested sample of the stated device/equipment.

Approved by:	*Reviewed by:*	*Tested by:*
Luo Jian	Dong Xiaobo	Gao Xiaoqing
Manager	Deputy Manager	Test Engineer

1. Test Laboratory

1.1 Testing Location

Company Name	GCCT, Guangdong Telecommunications Terminal Products Quality Supervision and Testing Center
Address	Keji Road, High-tech Zone, Heyuan, Guangdong Province, PR.China
CNAS Registration No.	L4992
FCC Registration No.	303878
Postal Code	517001
Telephone	+86-762-3607221
Fax	+86-762-3603336

1.2 Testing Environment

Environment Data	Temperature(℃)	Humidity(%)
Maximum Ambient	22.3	51
Minimum Ambient	17.8	44

EUT is under testing environment.

1.3 Project Data

Project Leader	Dong Xiaobo
Testing Start Date	2016-03-15
Testing End Date	2016-04-07

2. Client Information

2.1 Applicant Information

Company Name	OBI Connect FZE
Address	B-21,Dubai Airport Free zone, PO BOX 371475, United Arab Emirates
City	Dubai
Postal Code	/
Country	United Arab Emirates

2.2 Manufacturer Information

Company Name	CK Telecom Limited
Address	Keji Road.High-Tech Development Zone. Heyuan, Guangdong,P.R.China.
City	Heyuan
Postal Code	/
Country	China

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1 About EUT

Model Name	Obi Worldphone SF1
FCC ID	2AGBLSF1
Tx Frequency	GSM850:824 ~ 848 MHz PCS1900 : 1850 ~ 1909MHz WCDMA Band II: 1852 ~ 1908MHz WCDMA Band V: 826 ~ 846MHz Bluetooth& BLE: 2402 ~ 2480MHz WIFI(802.11b/g/n-20): 2412 ~ 2462MHz WIFI(802.11n-40): 2422 ~ 2452MHz
Rx Frequency	GSM850: 869 ~ 893MHz GSM1900: 1930 ~ 1989MHz WCDMA Band II: 1932 ~ 1987MHz WCDMA Band V: 871 ~ 891MHz Bluetooth& BLE: 2402 ~ 2480MHz WIFI(802.11b/g/n-20): 2412 ~ 2462MHz WIFI(802.11n-40): 2422 ~ 2452MHz GPS:1575MHz
Number of Channels	GSM850 :25 GSM1900 : 60 WCDMA Band II: 60 WCDMA Band V: 25 Bluetooth:79 BLE:40 WIFI(802.11b/g/n-20):11 WIFI(802.11n-40):7
Modulation	GSM:GMSK WCDMA:BPSK/QPSK BLE:GFSK Bluetooth: GFSK&π/4-DQPSK&8DPSK WIFI:CCK/OFDM
Antenna Type	PIFA(GSM/DCS/WCDMA); MONOPOLE (Bluetooth/WIFI)

Antenna Gain	GSM850&1900:-0.5dBi GSM900&1800:-0.5dBi WCDMA Band II&V: -1dBi Bluetooth&BLE&WIFI: -1dBi GPS: -1dBi
Normal Voltage	3.8V
Extreme Low Voltage	3.6V
Extreme High Voltage	4.2V
Extreme Low Temperature	0℃
Extreme High Temperature	40℃

Note: Photographs of EUT are shown in ANNEX A of this test report.

Note: high and low voltage values in extreme condition test are given by manufacturer

3.2 Internal Identification of EUT

EUT ID *	IMEI	HW Version	SW Version
GCCT16CFR01-M01	/	MIRAGE03-V1.0	/
GCCT16CFR01-M03	/	MIRAGE03-V1.0	/

*EUT ID: is used to identify the test sample in the lab internally.GCCT16CFR01-M01 and GCCT16CFR01-M03 are the same mobile phone.

3.3 Internal Identification of AE

AE ID *	Description	Model	Manufacturer
GCCT16CFR01-B01	Battery	OB3000CK	DONG GUAN DRN NEW ENERGY CO.,LTD.
GCCT16CFR01-C01	Adapter	AOD2A5V	DONGGUAN AOHAI POWER TECHNOLOGY CO,LTD.
GCCT16CFR01-B03	Battery	OB3000CK	DONG GUAN DRN NEW ENERGY CO.,LTD.
GCCT16CFR01-C03	Adapter	AOD2A5V	DONGGUAN AOHAI POWER TECHNOLOGY CO,LTD.

*AE ID: is used to identify the test sample in the lab internally.GCCT16CFR01-B01 and GCCT16CFR01-B03 are the same accessories, GCCT16CFR01-C01 and GCCT16CFR01-C03 are the same accessories.

4. Test Results

4.1 Summary of Test Results

No	Test cases	Sample	Verdict
1	Maximum transmit power	M01	Pass
2	20dB Bandwidth	M01	Pass
3	Band Edge Compliance	M01	Pass
4	Carrier Frequency Separation	M01	Pass
5	Time Of Occupancy (Dwell Time)	M01	Pass
6	Number Of Channel Hopping	M01	Pass
7	Conducted Spurious Emissions	M01	Pass
8	AC Conducted Emission	M03	Pass
9	Radiated Emissions	M03	Pass
10	Antenna Requirements	M01	Pass

Note: please refer to Annex B in this test report for the detailed test results.

4.2 Statements

GCCT has evaluated the test cases requested by the applicant/manufacturer as listed in section 4.1 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in general summary.

5. Test Equipment Utilized

Table 1. Measurement Equipment

Hardware						
No.	**Name**	**Model**	**SN**	**Manufacture**	**Cal. Date**	**Cal. Due Date**
1	Signal Tester	MT8852B	1307002	Anritsu	2015.08.21	2016.08.20
2	Spectrum Analyzer	N9020A	MY52091261	Agilent	2015.08.21	2016.08.20
3	Switch Unit	/	E0112	/	2015.08.21	2016.08.20
Software						
Tech BT		v1.0.3				

Table 2. Radiated emission test system

No.	Name	Model	SN	Manufacture	Cal. date	Cal. Due Date
1	Spectrum Analyzer	E4440A	MY48250641	Agilent	2015.08.21	2016.08.20
2	BiCoNilog Antenna	3142E	00142015	ETS-Lindgren	2015.09.15	2017.09.14
3	Horn Antenna	3117	129169	ETS-Lindgren	2015.09.15	2017.09.14
4	Signal Generator	N5183A-532	MY49060563	Agilent	2015.08.21	2016.08.20
5	Universal Radio Communication Tester	E5515C	MY48367105	Agilent	2015.08.21	2016.08.20
6	RF Preselector	N9039A	MY48260024	Agilent	/	/
7	Loop Antenna	HFH2	860015/00	R&S	2015.08.21	2016.08.20

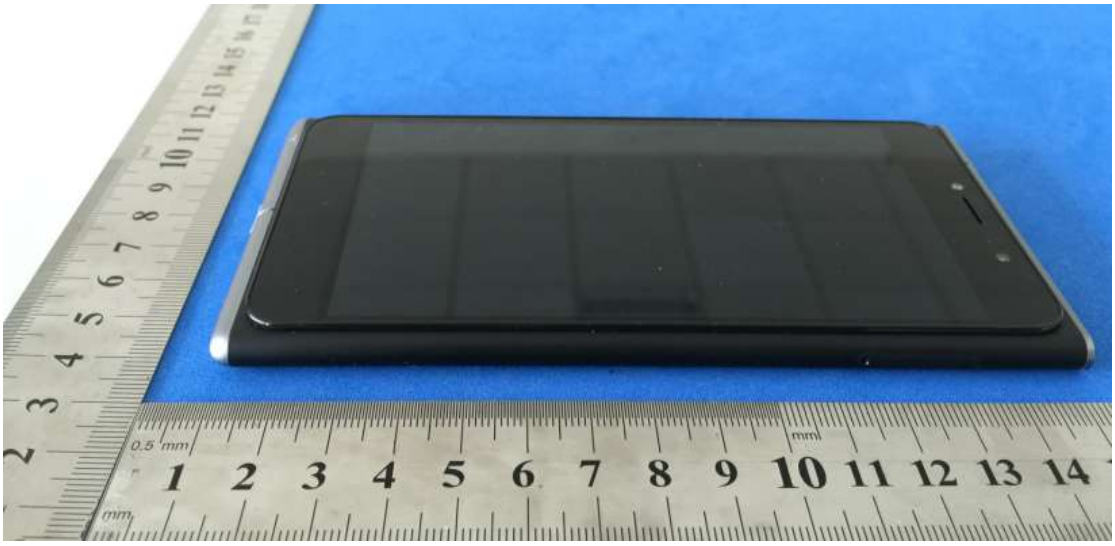
ANNEX A: EUT Photograph

EUT Front View

EUT behind View

EUT Left View

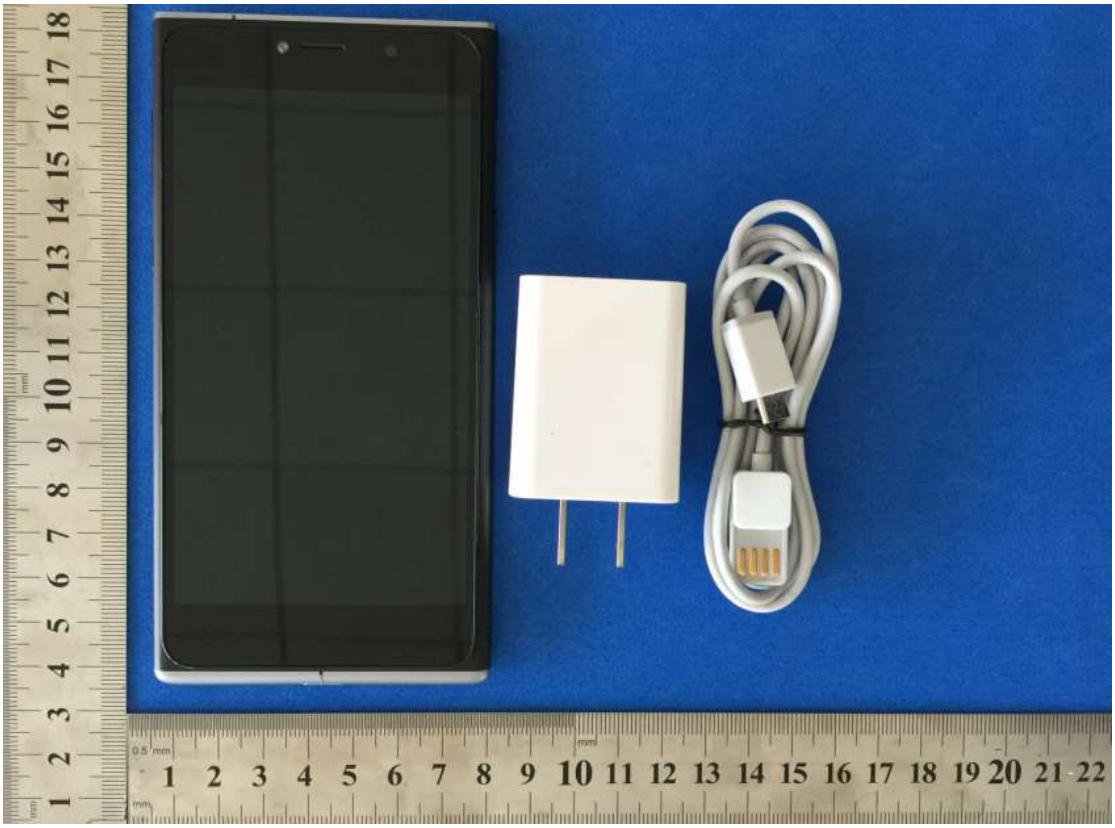
EUT Right View



EUT Top View

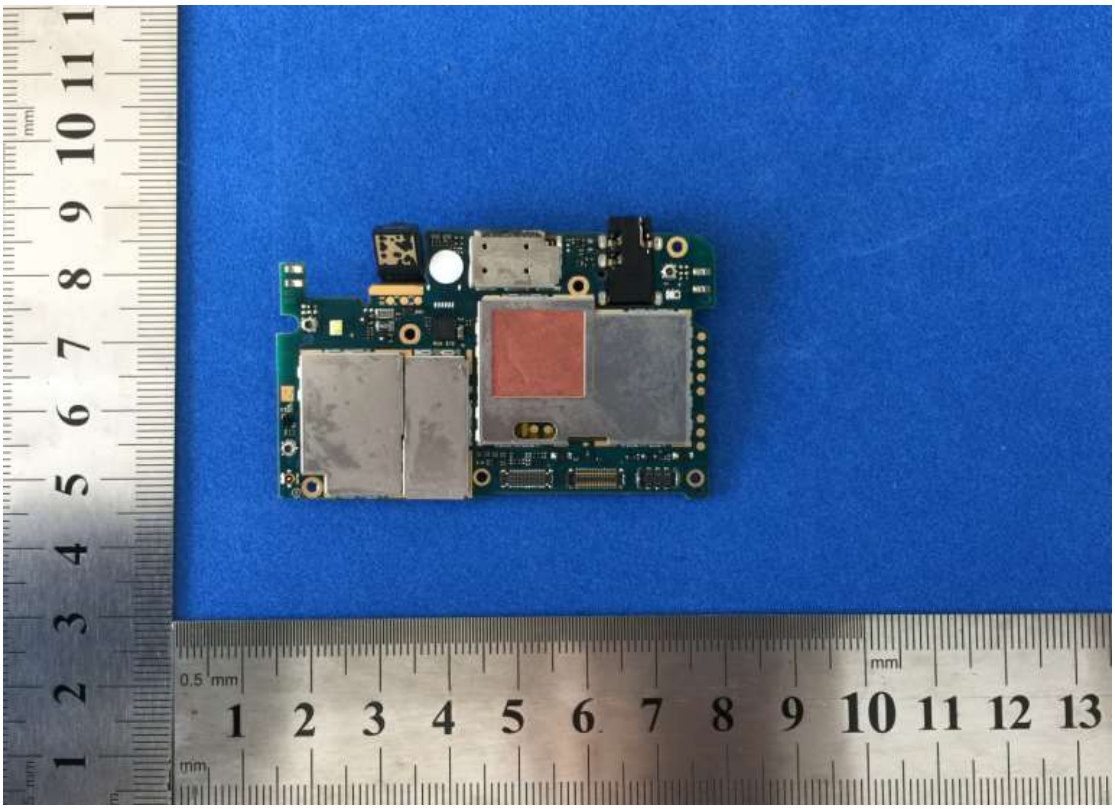
EUT Rear View

All

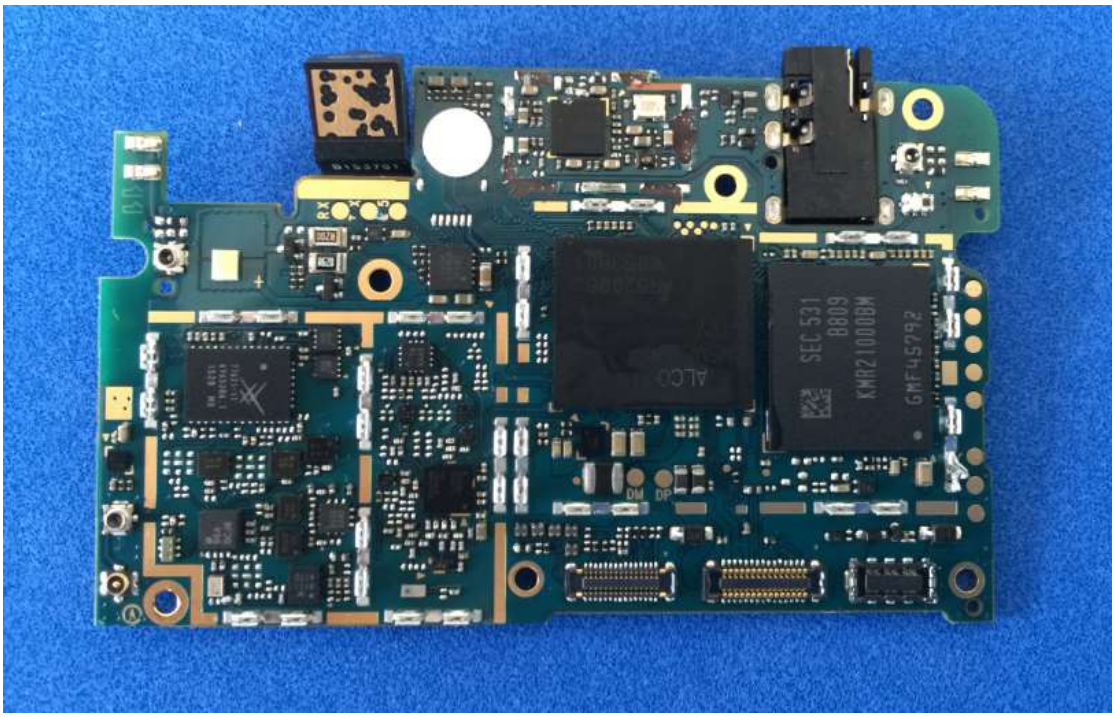


Cover off

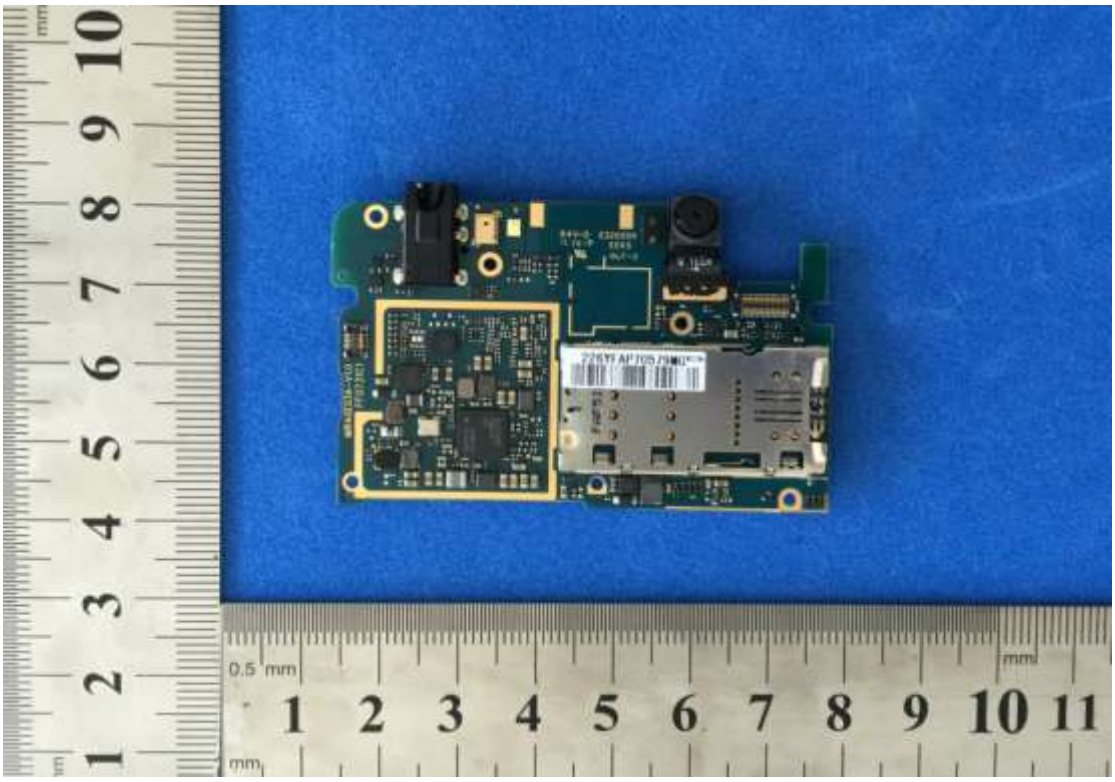
Main board with shielding Front View



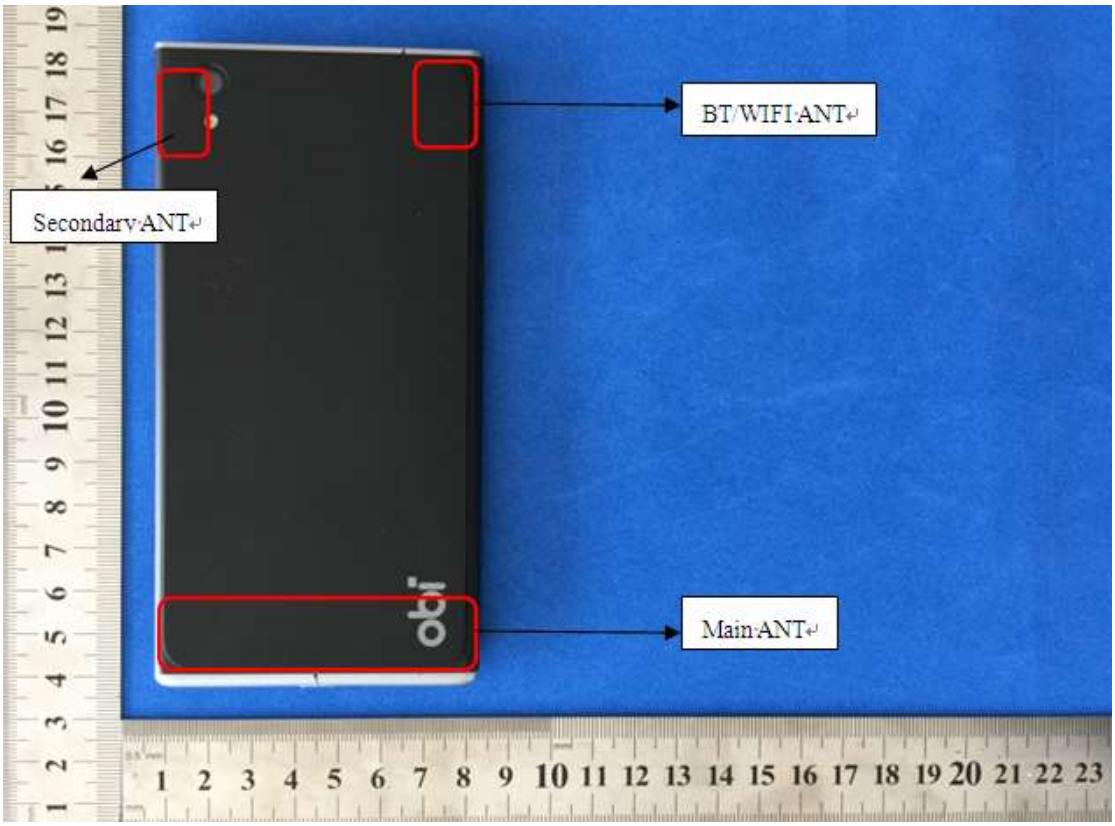
Main board without shielding Front View



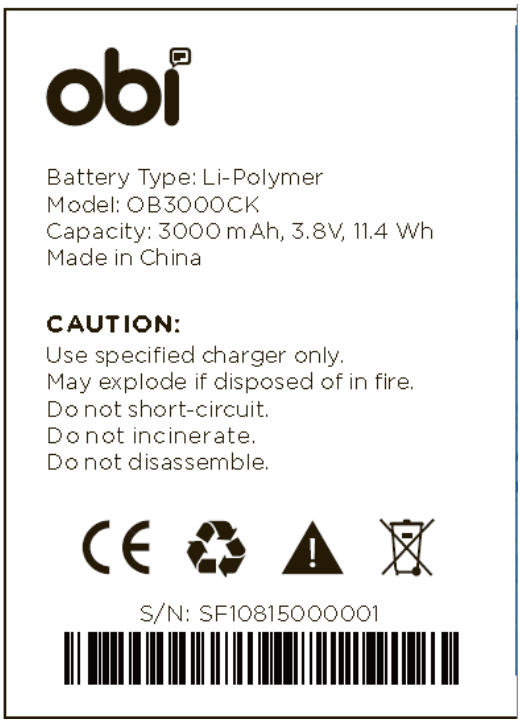
Main board Rear View



Antenna View

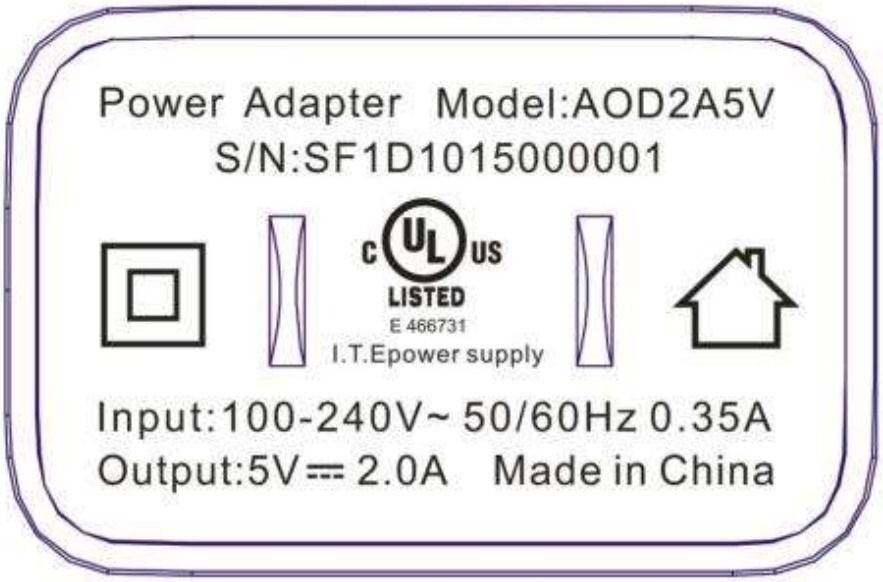


Battery label View

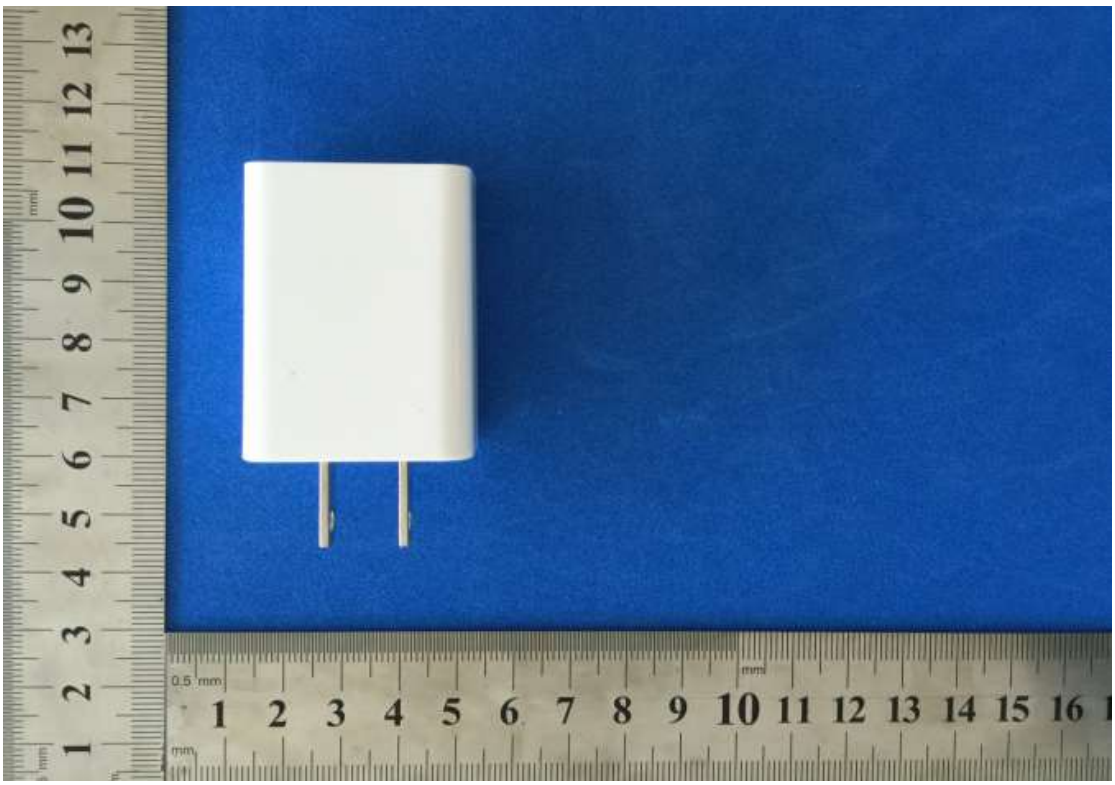


Battery View

Adapter label view

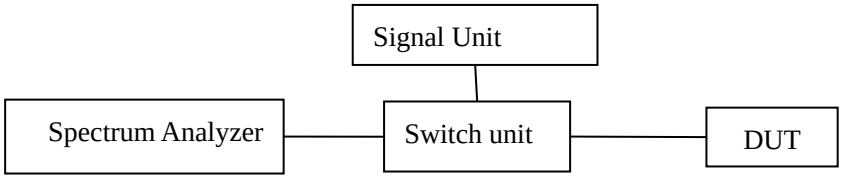


Adapter view



ANNEX B: Detailed Test Results

The radiated test setup is shown in each radiated test case section. The conducted test setup is shown as following:



All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

B.1 Maximum Transmit Power

B.1.1 Description

According to §15.247(b)(1),

The maximum Peak Output power shall be equal to or less than125mW≈21dBm

B.1.2Test procedures

Conducted Measurement

EUT was set for low, mid, high channel with modulated mode and highest RF output power
The spectrum analyzer was connected to the antenna terminal.

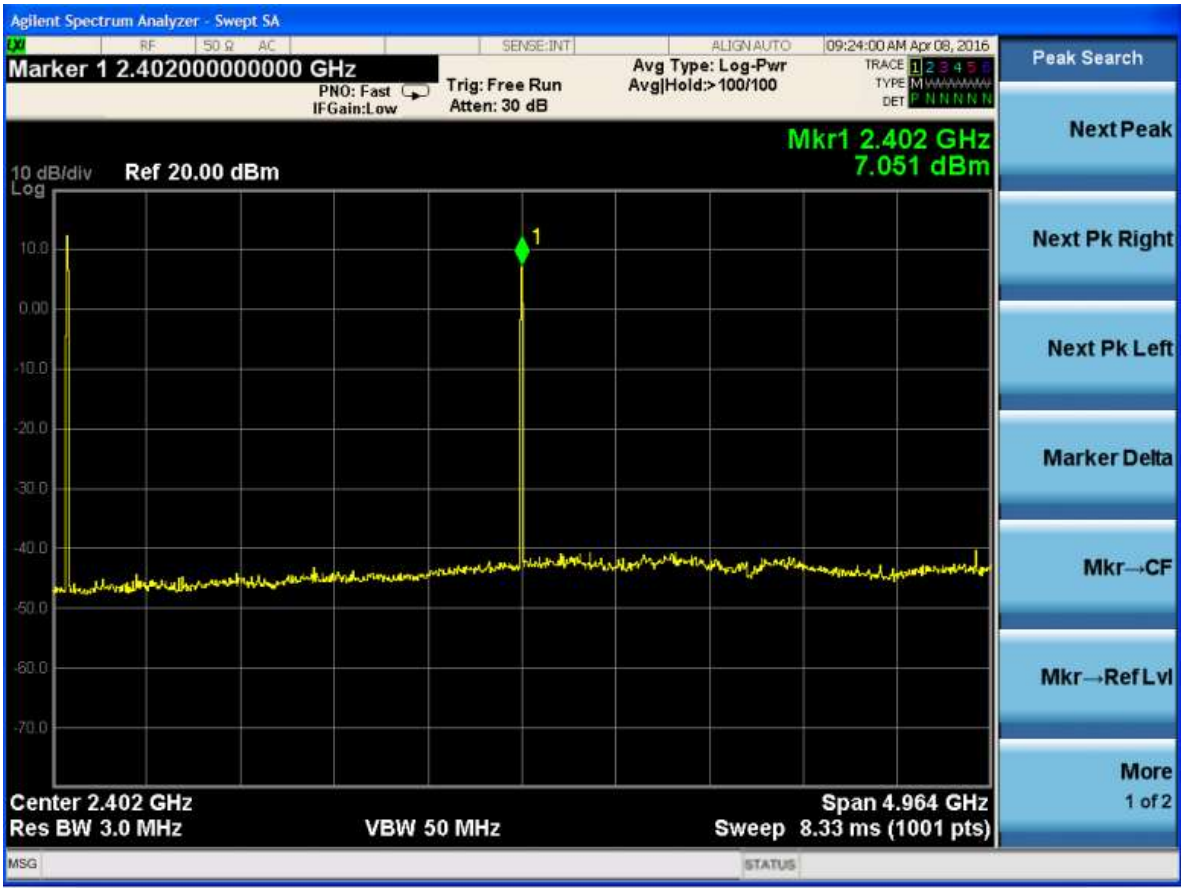
Procedures:

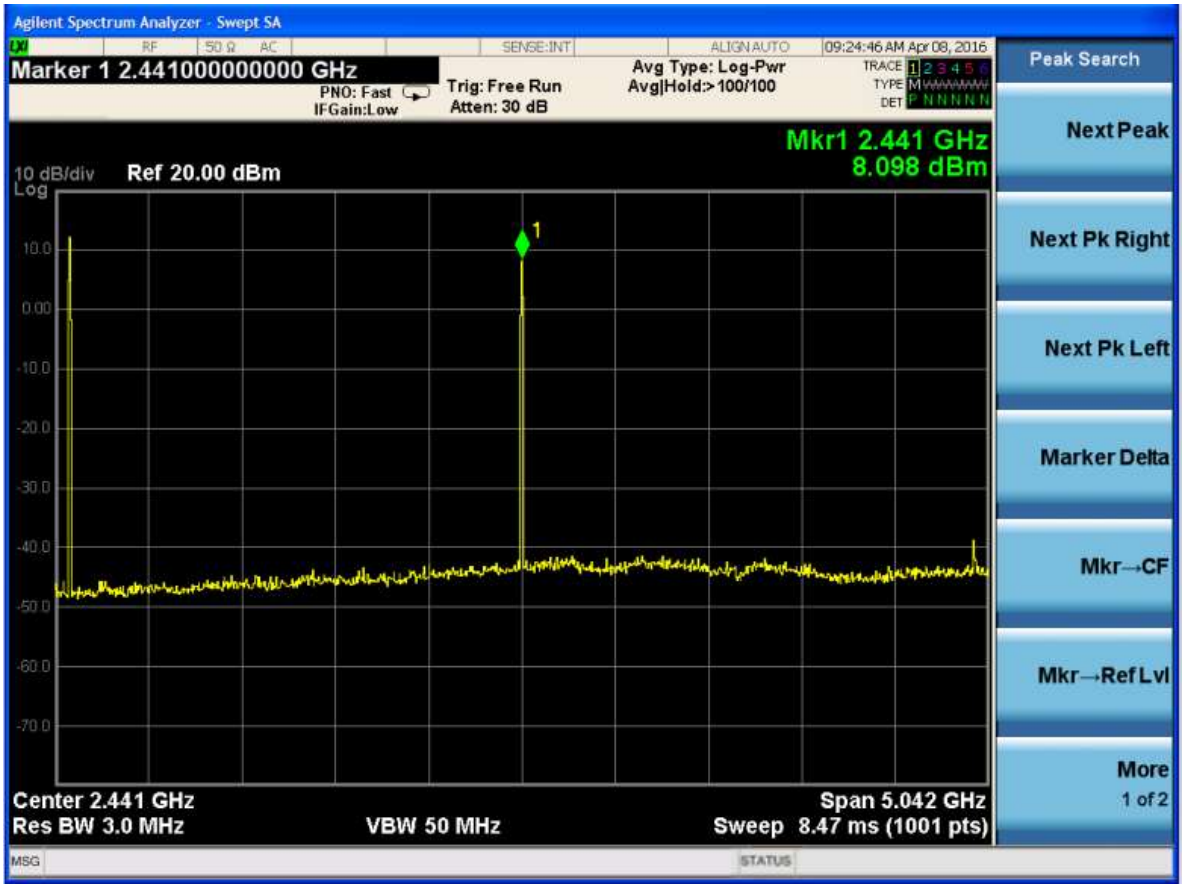
a) Place the EUT on the table and set it in transiting mode.
b) RF output of EUT was connected to SA by a low loss cable.
c) SA settings as follow:Span= approximately 5 times the 20 dB bandwidth, centered on a hopping channel, RBW≥the 20 dB bandwidth of the emission being measured,, VBW≥ RBW, Sweep time= auto, Detector function= Peak, Trace= Max hold
d) Then set the EUT to transmit at low, middle and high frequency and measure the conducted output power separately

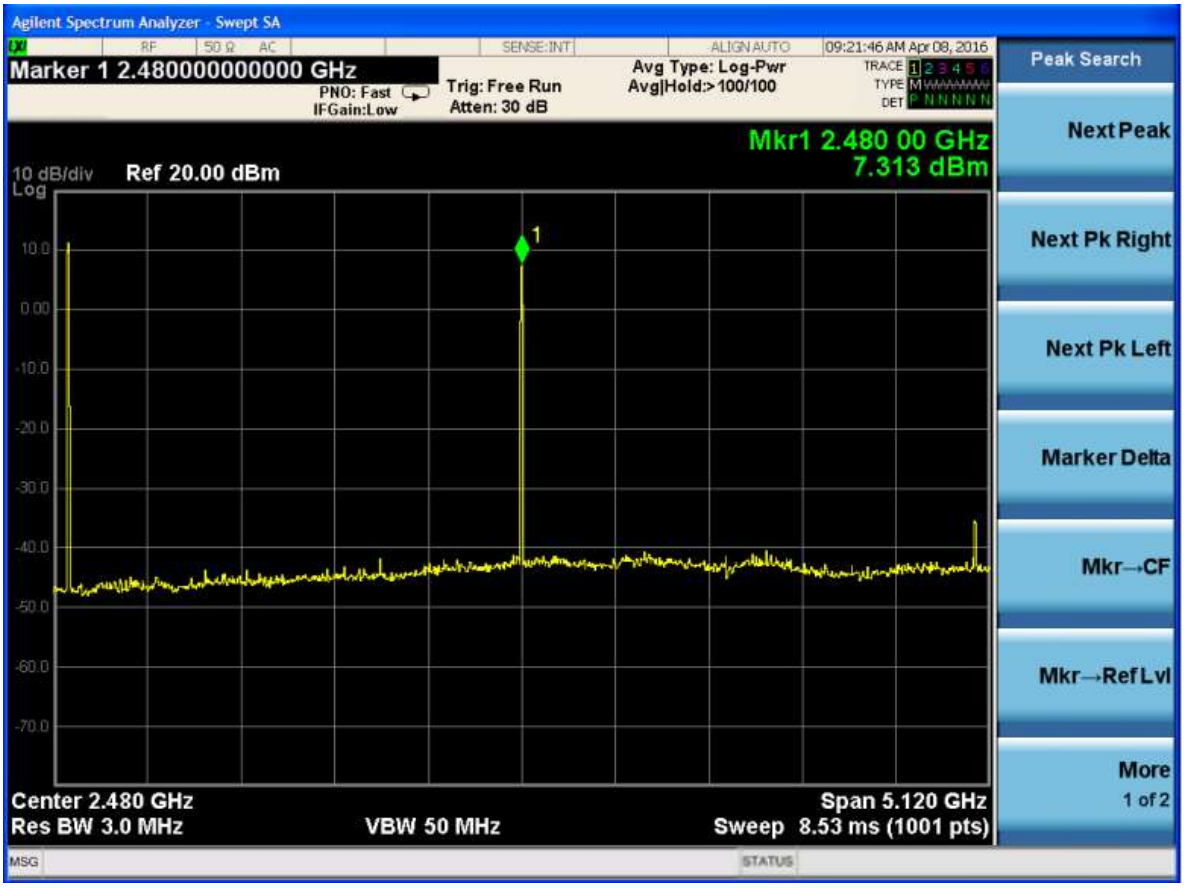
B.1.3 Test Results

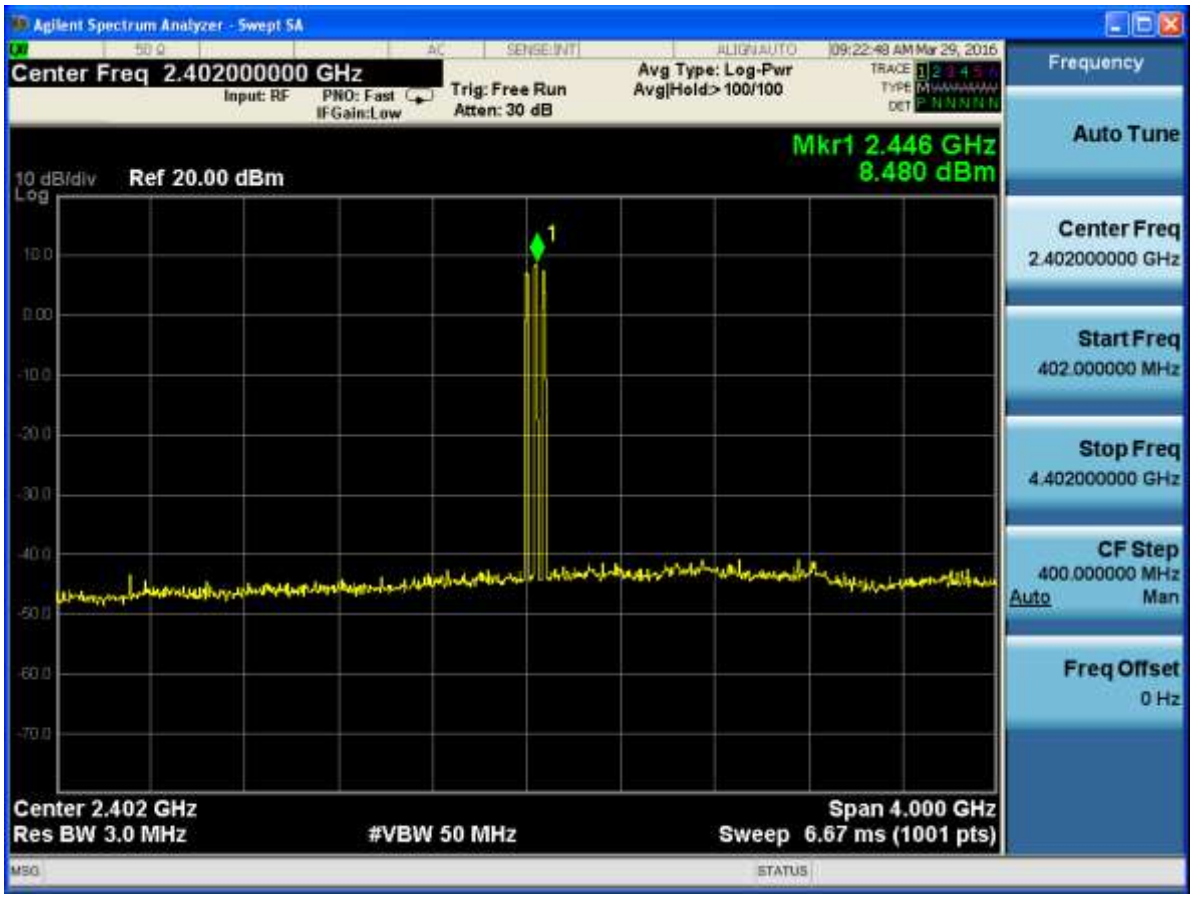
Date rate (Mbps)	Maximum peak output power(dBm)			Verdict
	2402MHz	2441MHz	2480MHz	
1	7.051	8.098	7.313	Pass
2	8.480	8.124	8.362	Pass

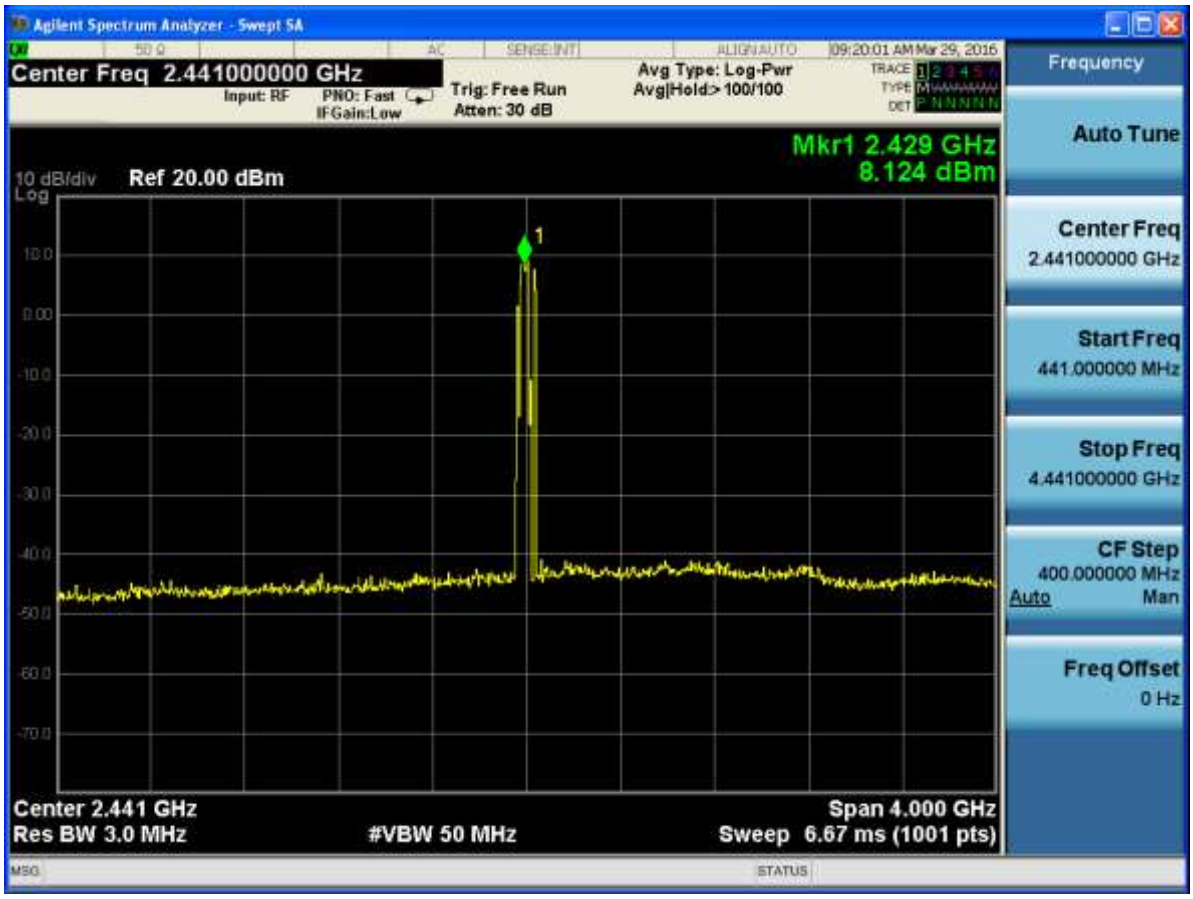
3	8.822	7.837	7.592	Pass

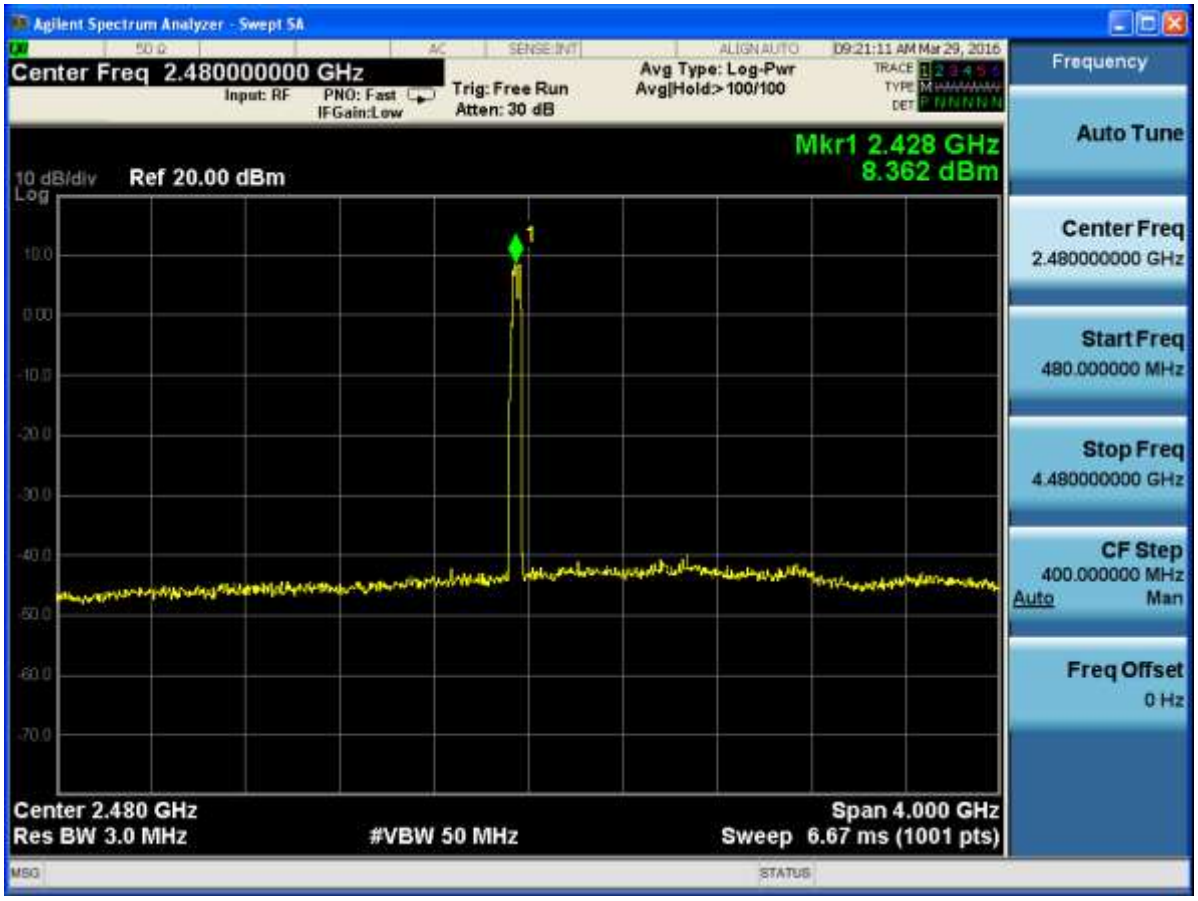



Agilent Spectrum Analyzer - Swept SA
Marker 1 2.441000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:24:46 AM Apr 08, 2016
Mkr1 2.441 GHz
8.098 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.441 GHz
Res BW 3.0 MHz
VBW 50 MHz
Span 5.042 GHz
Sweep 8.47 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

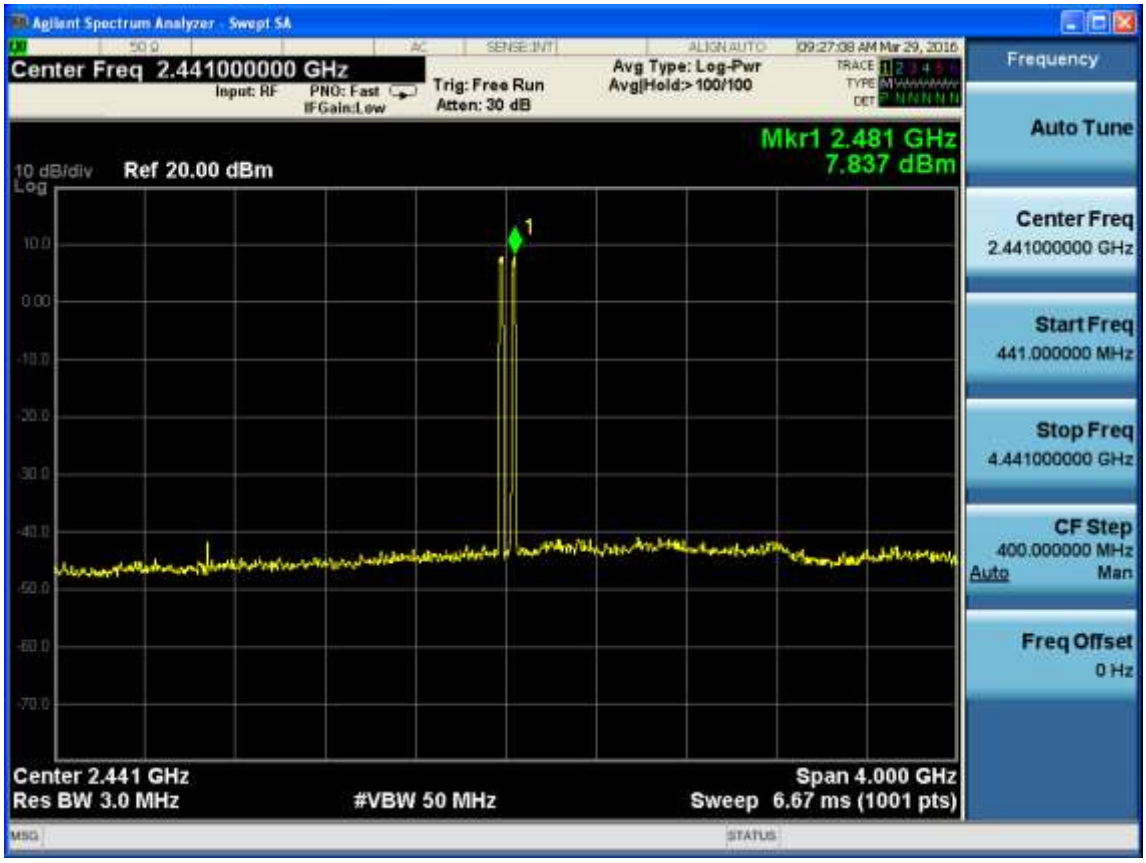

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.480000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:21:46 AM Apr 08, 2016
Mkr1 2.480 00 GHz
7.313 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.480 GHz
Res BW 3.0 MHz
VBW 50 MHz
Span 5.120 GHz
Sweep 8.53 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

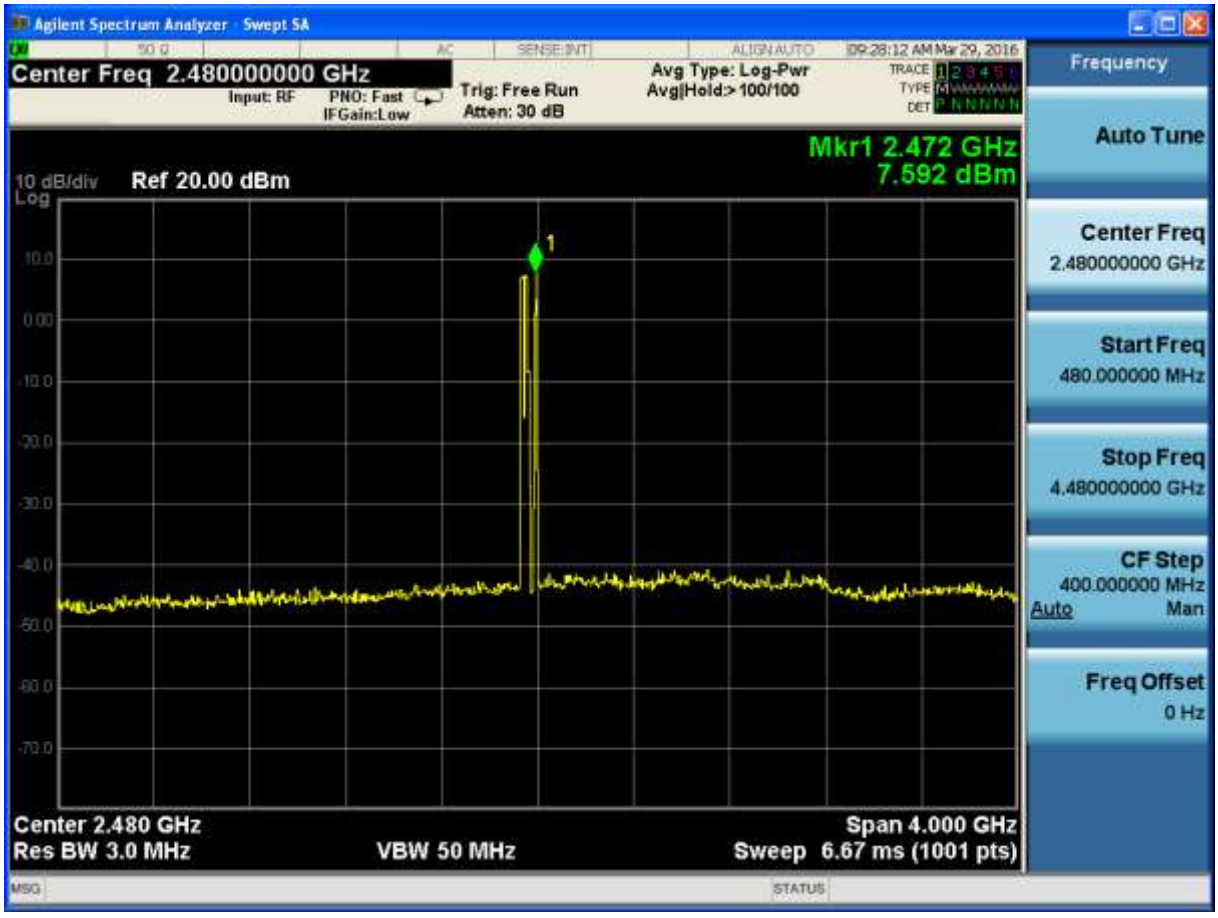

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.402000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:22:49 AM Mar 29, 2016
Mkr1 2.446 GHz
8.480 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.402 GHz
Res BW 3.0 MHz
#VBW 50 MHz
Span 4.000 GHz
Sweep 6.67 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.402000000 GHz
Start Freq
402.000000 MHz
Stop Freq
4.402000000 GHz
CF Step
400.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:20:01 AM Mar 29, 2016
Mkr1 2.429 GHz
8.124 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.441 GHz
Res BW 3.0 MHz
#VBW 50 MHz
Span 4.000 GHz
Sweep 6.67 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
441.000000 MHz
Stop Freq
4.441000000 GHz
CF Step
400.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:21:11 AM Mar 29, 2016
Mkr1 2.428 GHz
8.362 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.480 GHz
Res BW 3.0 MHz
#VBW 50 MHz
Span 4.000 GHz
Sweep 6.67 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
480.000000 MHz
Stop Freq
4.480000000 GHz
CF Step
400.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.402000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:25:23 AM Mar 29, 2016
Mkr1 2.462 GHz
8.822 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.402 GHz
Res BW 3.0 MHz
#VBW 50 MHz
Span 4.000 GHz
Sweep 6.67 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.402000000 GHz
Start Freq
402.000000 MHz
Stop Freq
4.402000000 GHz
CF Step
400.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:27:08 AM Mar 29, 2016
Mkr1 2.481 GHz
7.837 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.441 GHz
Res BW 3.0 MHz
#VBW 50 MHz
Span 4.000 GHz
Sweep 6.67 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
441.000000 MHz
Stop Freq
4.441000000 GHz
CF Step
400.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
Input: RF
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:28:12 AM Mar 29, 2016
Mkr1 2.472 GHz
7.592 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.480 GHz
Res BW 3.0 MHz
VBW 50 MHz
Span 4.000 GHz
Sweep 6.67 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
480.000000 MHz
Stop Freq
4.480000000 GHz
CF Step
400.000000 MHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

B.2 20dB Bandwidth

B.2.1Description

According to §15.247(a)(1)(iii)

The bandwidth at 20 dBm down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receiver antenna while the EUT is operating in transmission mode at the appropriate frequencies.

B.2.2 Test procedures

a) Testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
b) RF output of EUT was connected to SA by a low loss cable.
c) SA settings as follow:Span= approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel, RBW≥1% of 20 dB bandwidth, VBW≥ RBW, Sweep time= auto, Detector function= Peak, Trace= Max hold
d) Set the measured low, middle and high frequency and test 20dB bandwidth with spectrum analyzer

B.2.3 Test Results

GFSK Modulation

Date rate (Mbps)	Frequency(MHz)	Test Result(MHz)		Verdict
1	2402	1.116	Fig.1	Pass
	2441	1.118	Fig.2	Pass
	2480	1.117	Fig.3	Pass

Test plot 1	2401.436523	-19.830000
Test plot 2	2402.552490	-19.830000

Fig1. 20dB Bandwidth in 2402MHz,1Mbps

Test plot 1	2440.437012	-18.469999
Test plot 2	2441.554443	-18.520000

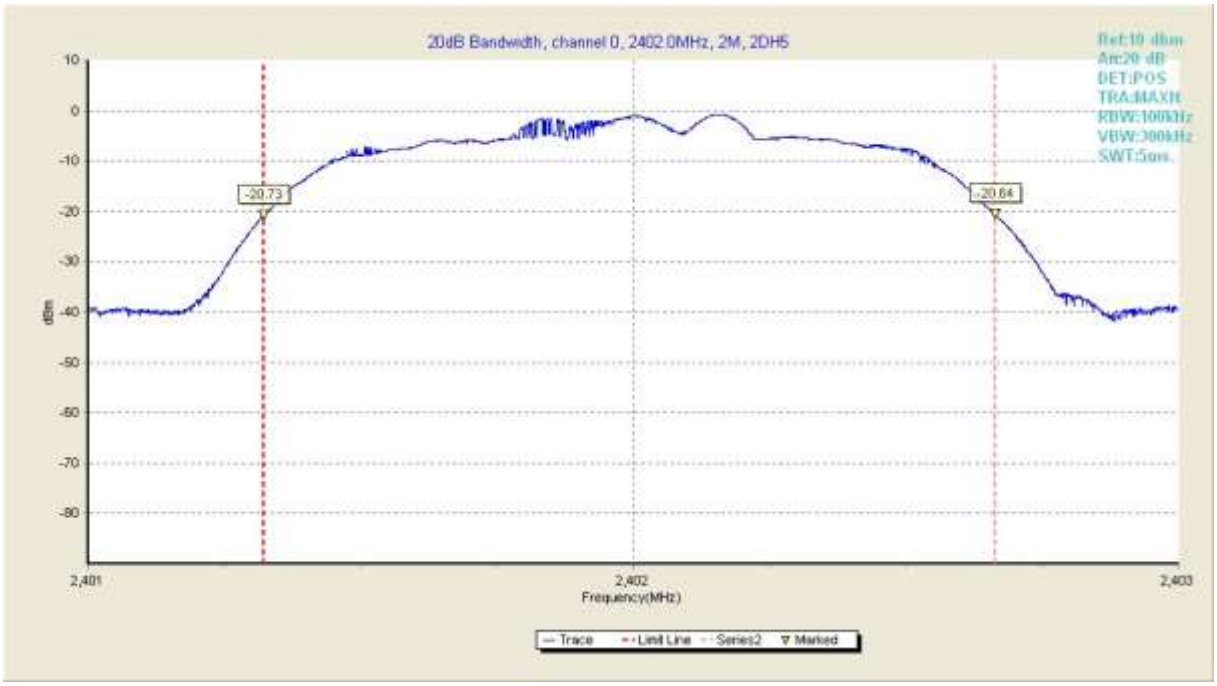
Fig2. 20 dB Bandwidth in 2441MHz,1Mbps

Test plot 1	2479.437988	-18.809999
Test plot 2	2480.554443	-18.549999

Fig3. 20 dB Bandwidth in 2480MHz,1Mbps

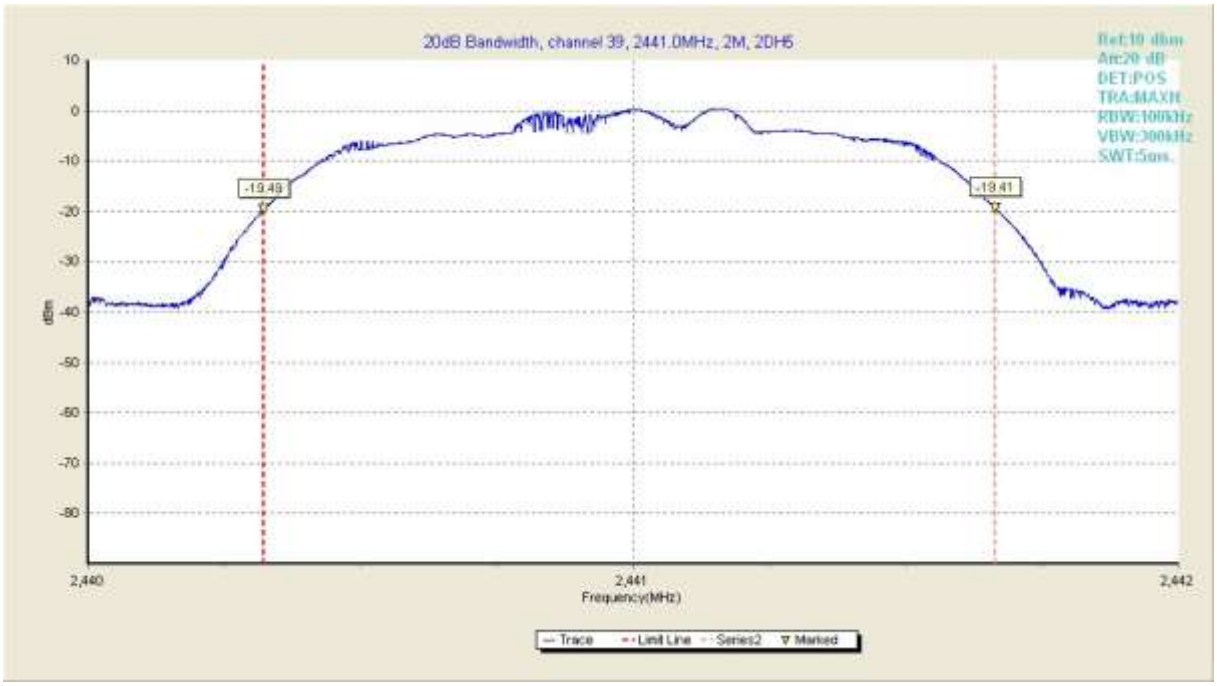
π/4-DQPSK Modulation

Date rate (Mbps)	Frequency(MHz)	Test Result(MHz)		Verdict
2	2402	1.342	Fig.4	Pass
	2441	1.343	Fig.5	Pass
	2480	1.339	Fig.6	Pass



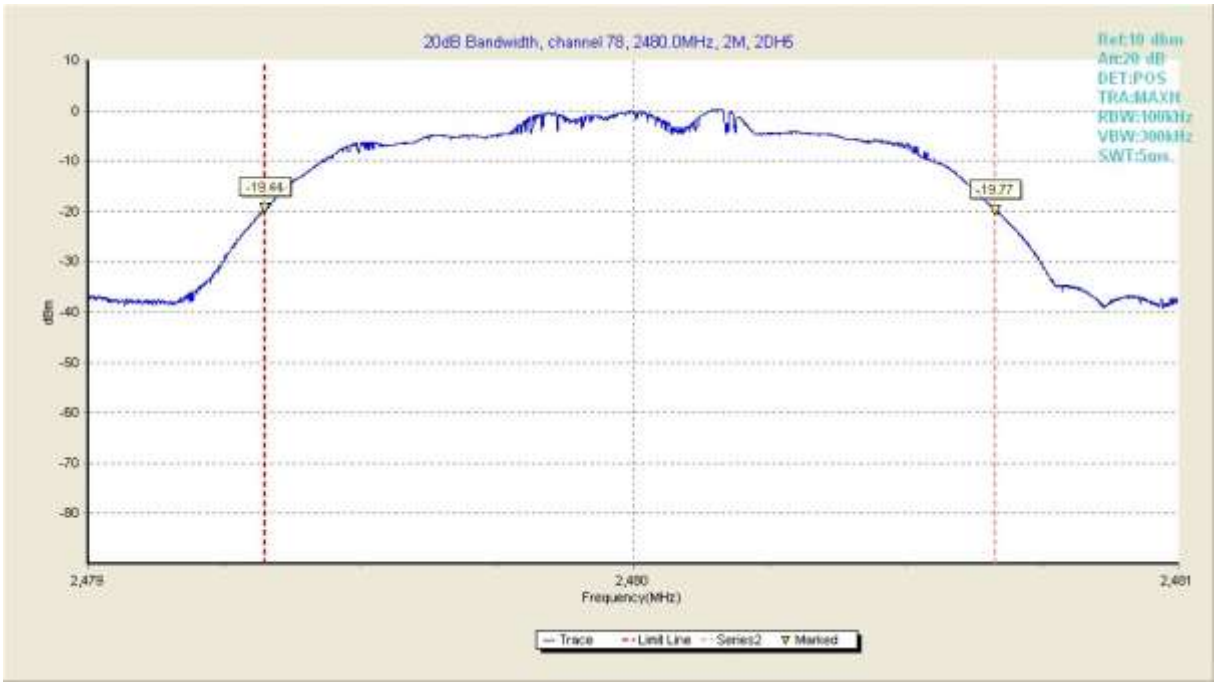
Test plot 1	2401.322021	-20.730000
Test plot 2	2402.664063	-20.639999

Fig4. 20dB Bandwidth in 2402MHz,2Mbps



Test plot 1	2440.322021	-19.490000
Test plot 2	2441.664551	-19.410000

Fig5. 20 dB Bandwidth in 2441MHz,2Mbps

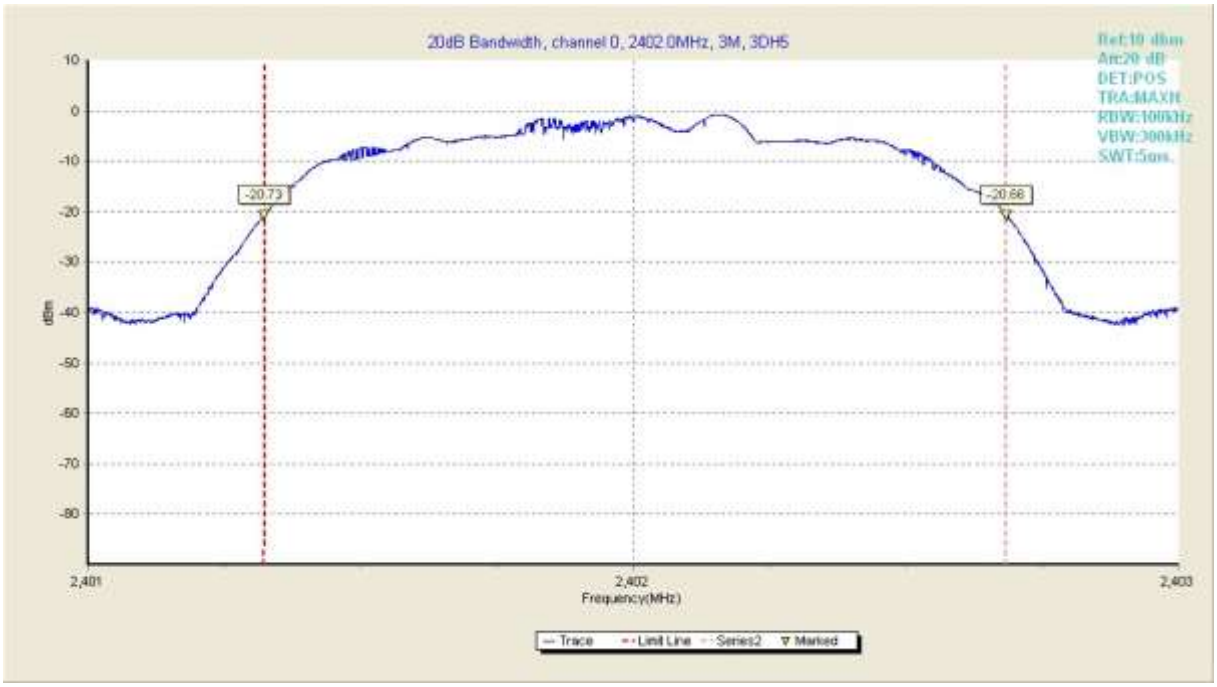


Test plot 1	2479.324463	-19.440001
Test plot 2	2480.664063	-19.770000

Fig6. 20 dB Bandwidth in 2480MHz,2Mbps

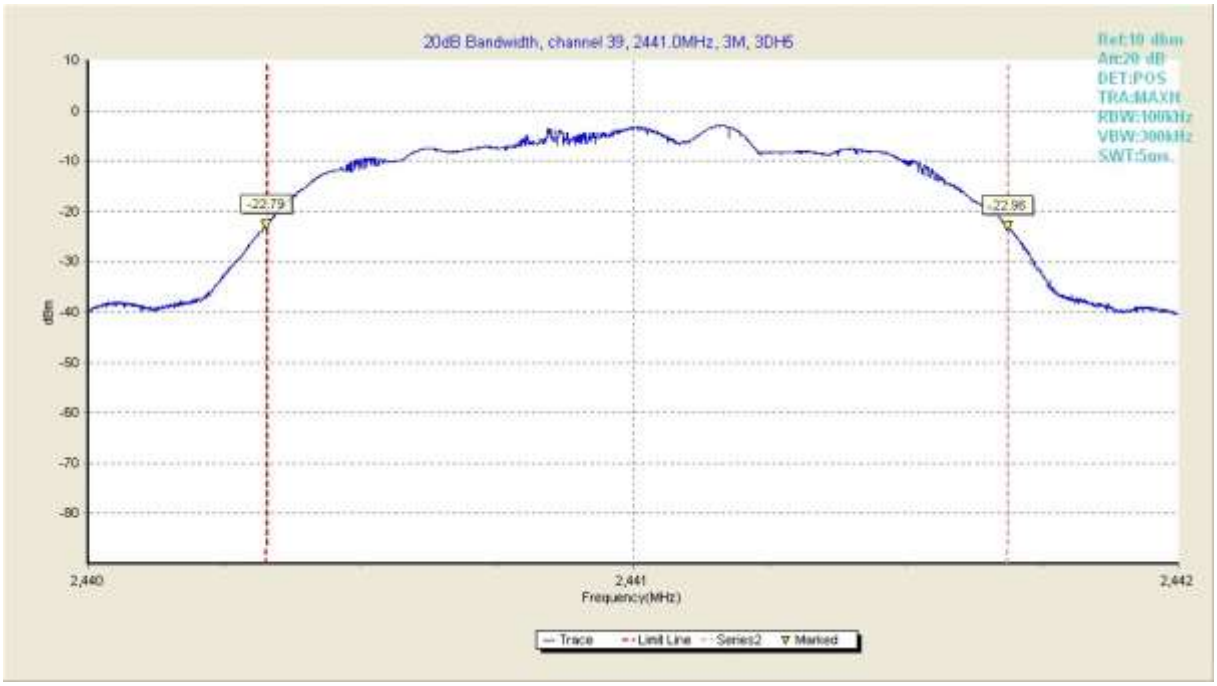
8DPSK Modulation

Date rate (Mbps)	Frequency(MHz)	Test Result(MHz)		Verdict
3	2402	1.362	Fig.7	Pass
	2441	1.362	Fig.8	Pass
	2480	1.365	Fig.9	Pass



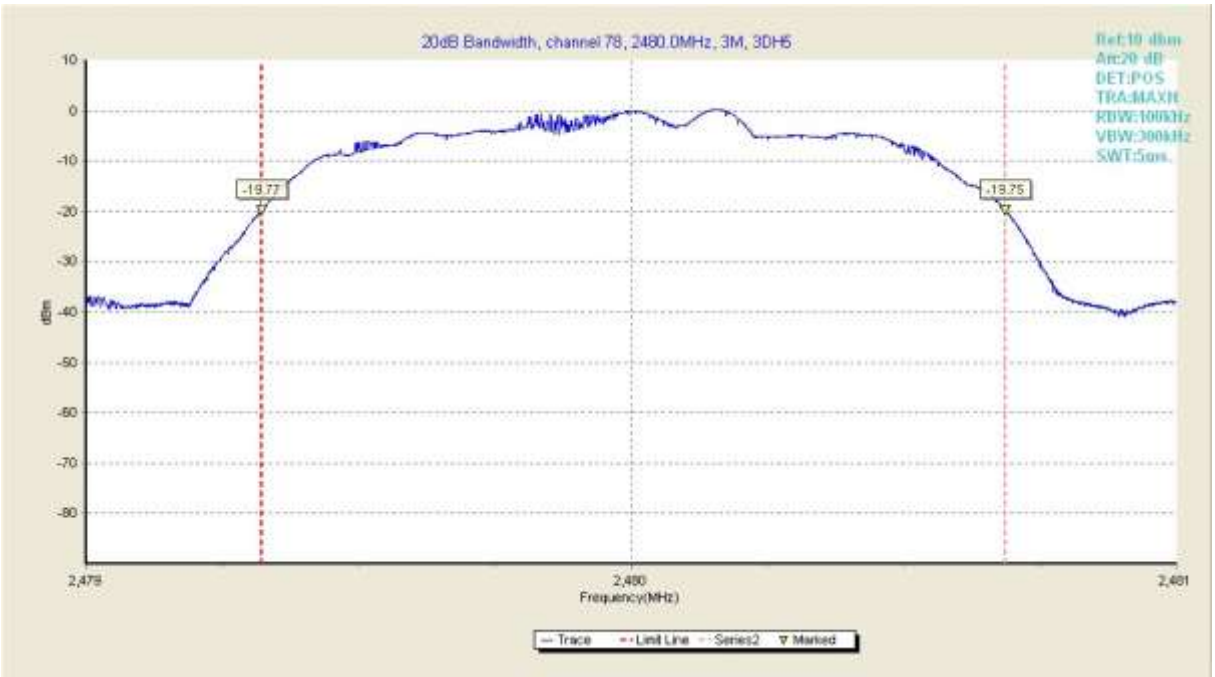
Test plot 1	2401.322998	-20.730000
Test plot 2	2402.684570	-20.660000

Fig7. 20dB Bandwidth in 2402MHz,3Mbps



Test plot 1	2440.324951	-19.430000
Test plot 2	2441.687012	-19.500000

Fig8. 20 dB Bandwidth in 2441MHz,3Mbps



Test plot 1	2479.322021	-19.770000
Test plot 2	2480.686523	-19.750000

Fig9. 20 dB Bandwidth in 2480MHz, 3Mbps

B.3 Band Edge Compliance

B.3.1 Conducted Measurement

B.3.1.1 Description

According to §15.247(d), the Band Edges Compliance shall be equal to or less than -20 dB.

B.3.1.2Test procedures

Conducted Measurement

EUT was set for low, mid, high channel with modulated mode and highest RF output power
The spectrum analyzer was connected to the antenna terminal.

Standard Requirement

Emissions within 2 MHz of an authorized band edge may be measured using either the marker-delta method (for peak or average emissions) or the integration method (for average emissions only), described below, provided that the OBW edge falls within 2 MHz of the band edge. Otherwise, all unwanted emissions measurements shall be performed using the standard methods.

Procedures

Peak Detection

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

a) Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).
b) Set span to 2 MHz
c) RBW = 100 kHz.
d) VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto.
g) Trace mode = max hold.
h) Allow sweep to continue until the trace stabilizes (required measurement time mayincrease for low duty cycle applications)
i) Compute the power by integrating the spectrum over 1 MHz using the analyzer's bandpower measurement function with band limits set equal to the emission frequency ($f_{emission}$) ± 0.5 MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by $f_{emission}$ ± 0.5 MHz.

B.3.1.3 Test Results

GFSK Modulation

Date rate (Mbps)	Frequency(MHz)	Limit (dB)	Test Result(dB)		Verdict
1	2400	-20	-41.11	Fig.10	Pass
			-45.46	Fig.11	
	2483.5		-58.78	Fig.12	Pass
			-63.23	Fig.13	

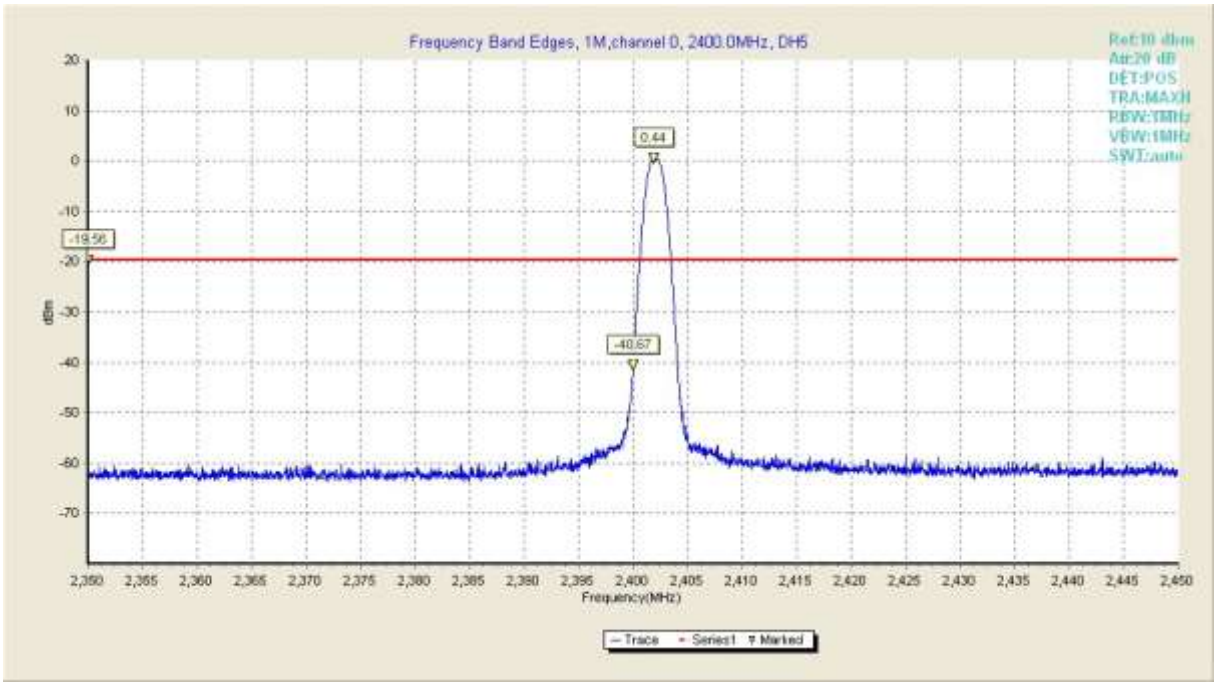


Fig10. Frequency Band Edges in CH0,1Mbps,Hopping off

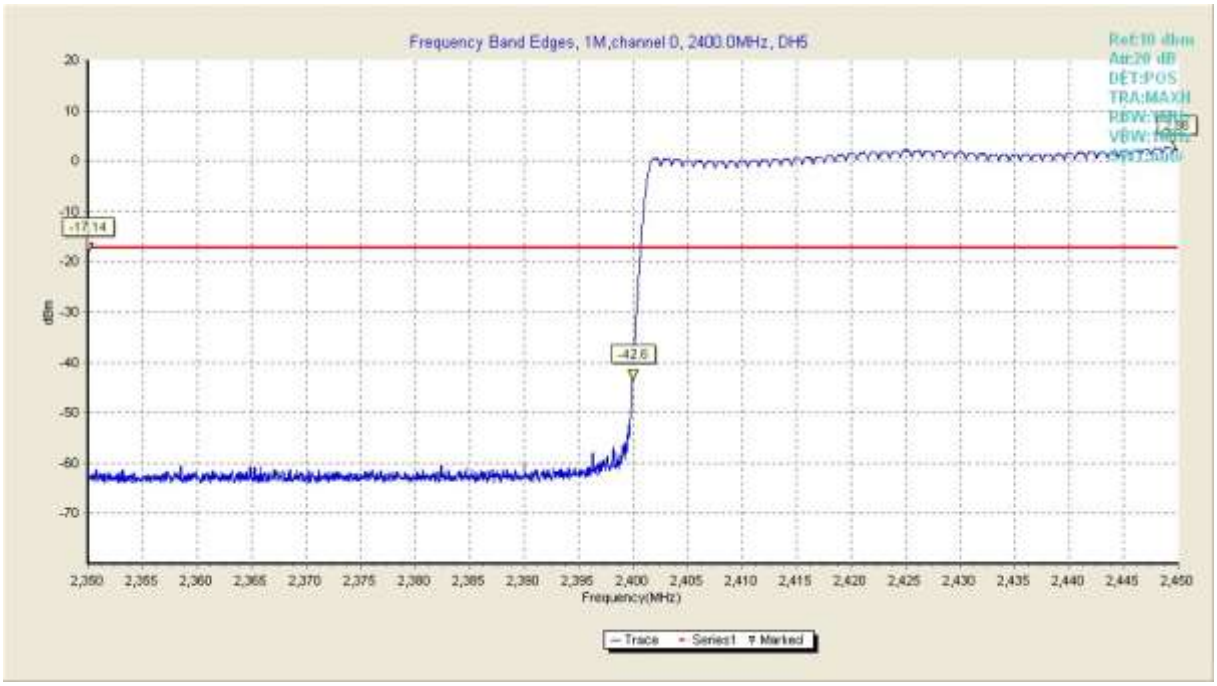


Fig11. Frequency Band Edges in CH0,1Mbps,Hopping on

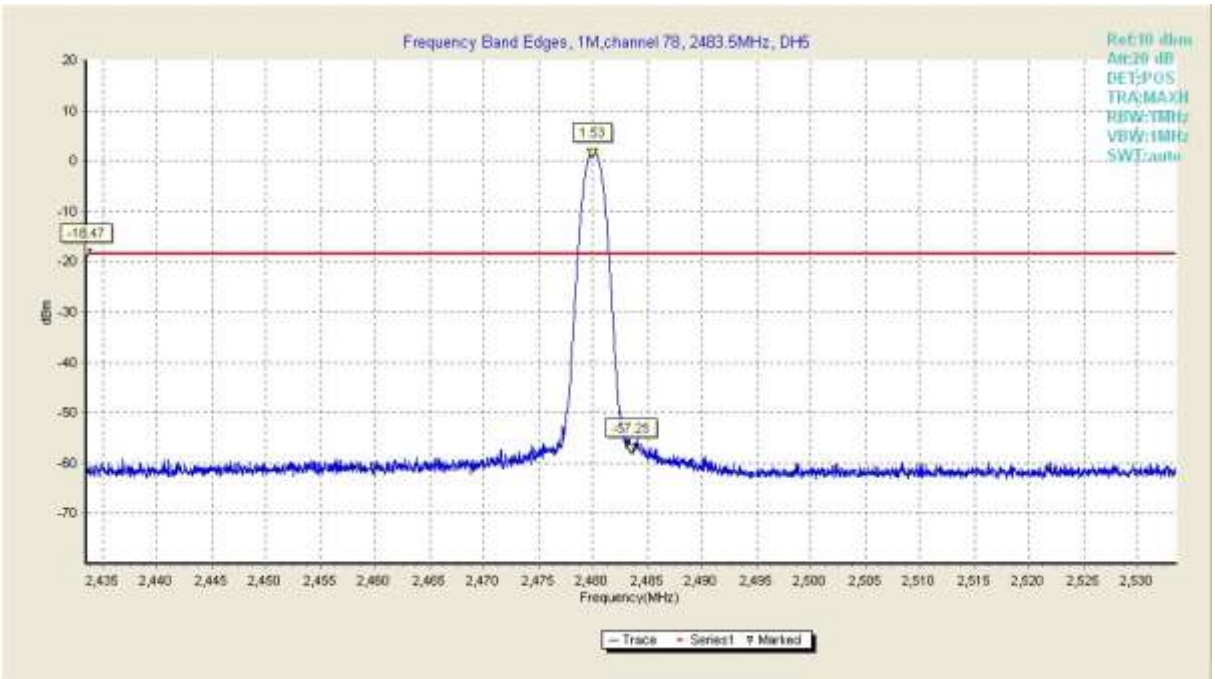


Fig12. Frequency Band Edges in CH78,1Mbps, Hopping off

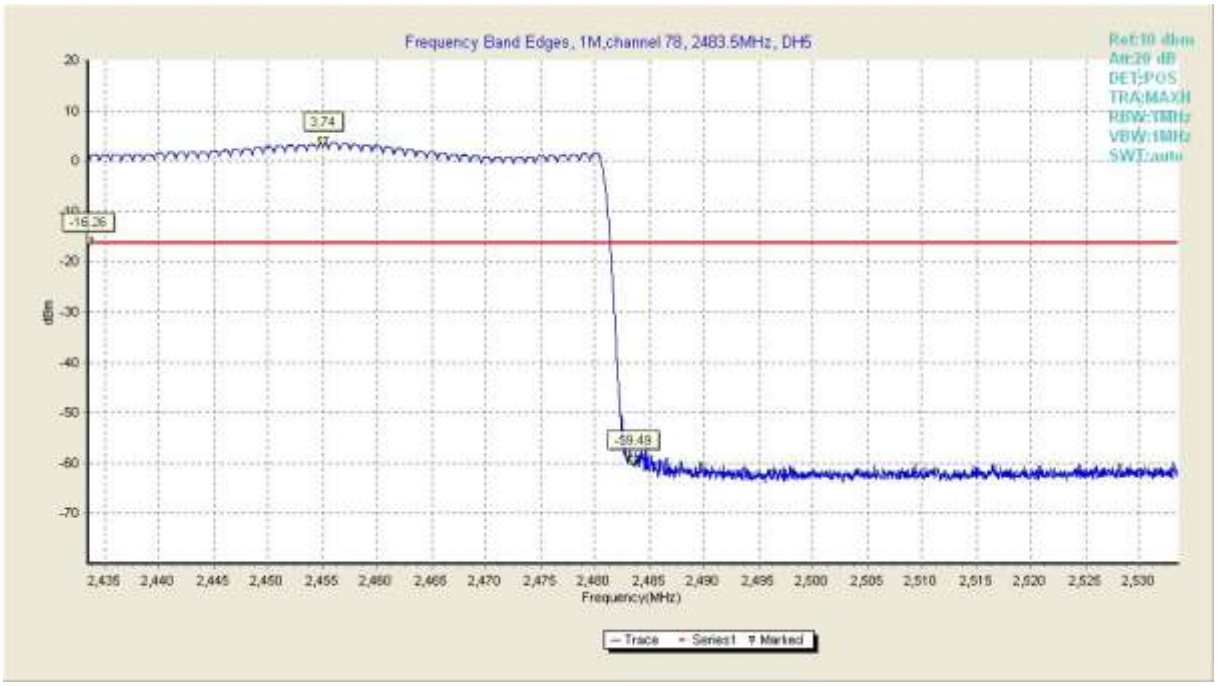


Fig13. Frequency Band Edges in CH78,1Mbps, Hopping on

π/4-DQPSK Modulation

Date rate (Mbps)	Frequency(MHz)	Limit (dB)	Test Result(dB)		Verdict
2	2400	-20	-31.54	Fig.14	Pass
			-37.40	Fig.15	
	2483.5		-51.77	Fig.16	Pass
			-59.22	Fig.17	

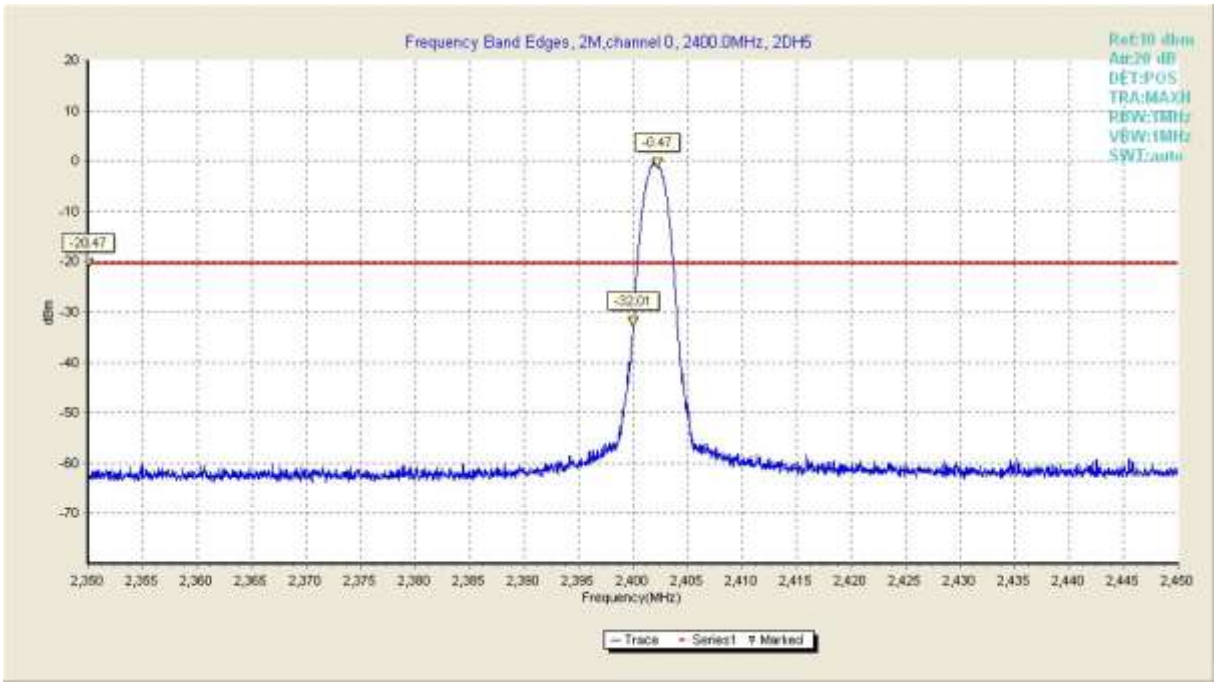


Fig14. Frequency Band Edges in CH 0, 2Mbps,Hopping off

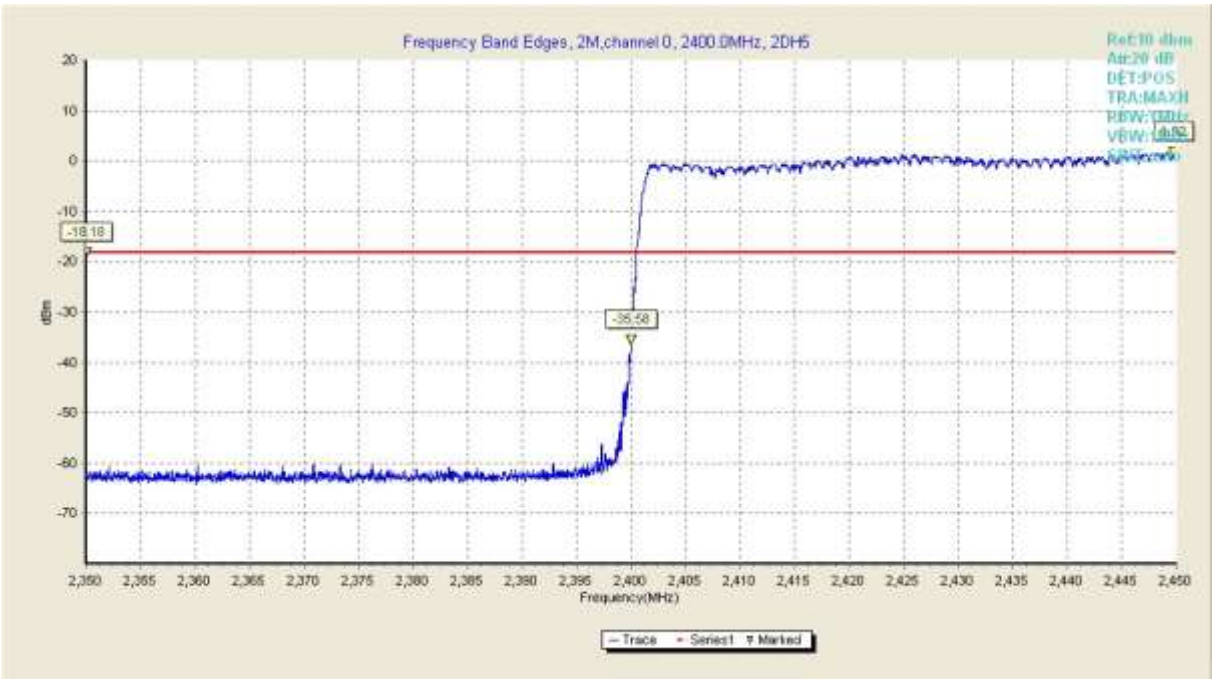


Fig15. Frequency Band Edges in CH 0, 2Mbps,Hopping on

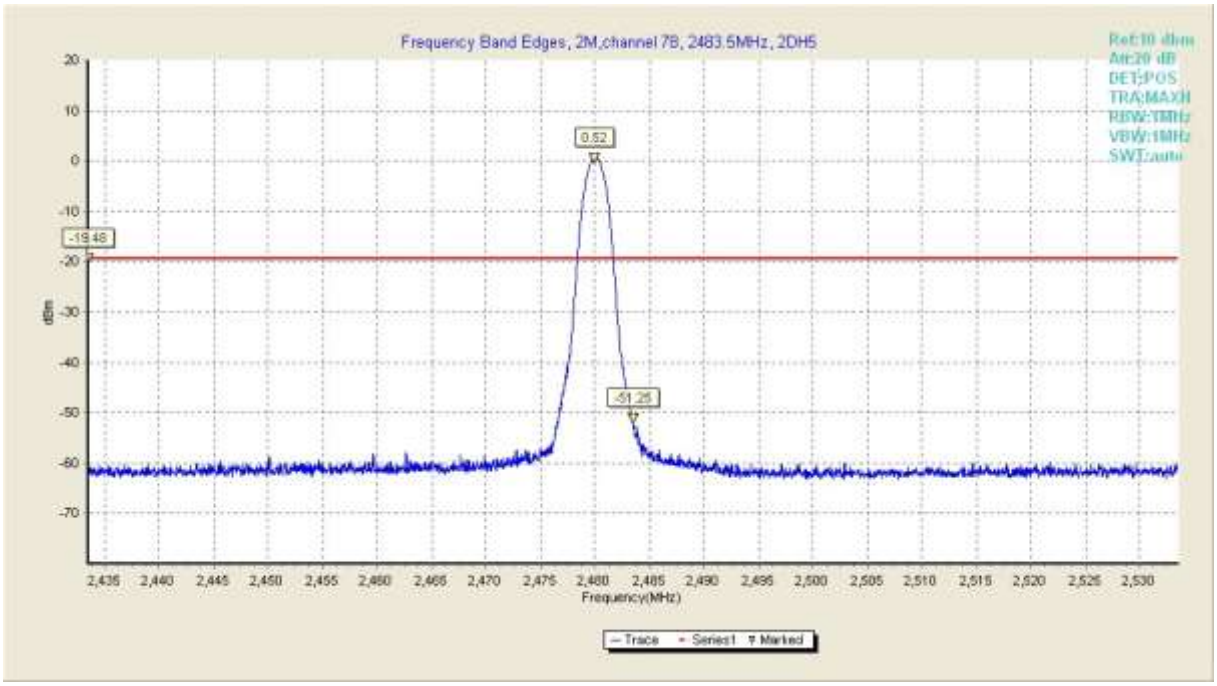


Fig16. Frequency Band Edges in CH 78, 2Mbps, Hopping off

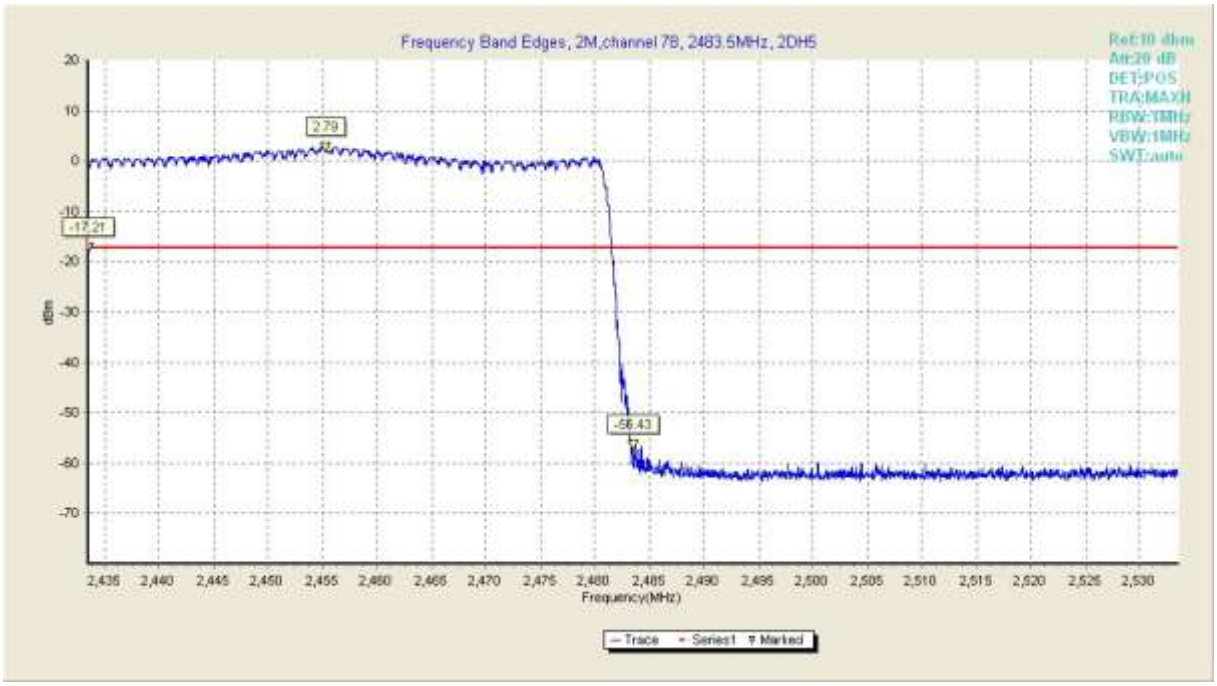


Fig17. Frequency Band Edges in CH 78, 2Mbps,Hopping on

8DPSK Modulation

Date rate (Mbps)	Frequency(MHz)	Limit (dB)	Test Result(dB)		Verdict
3	2400	-20	-32.21	Fig.18	Pass
			-36.33	Fig.19	
	2483.5		-51.87	Fig.20	Pass

			-63.73	Fig.21	

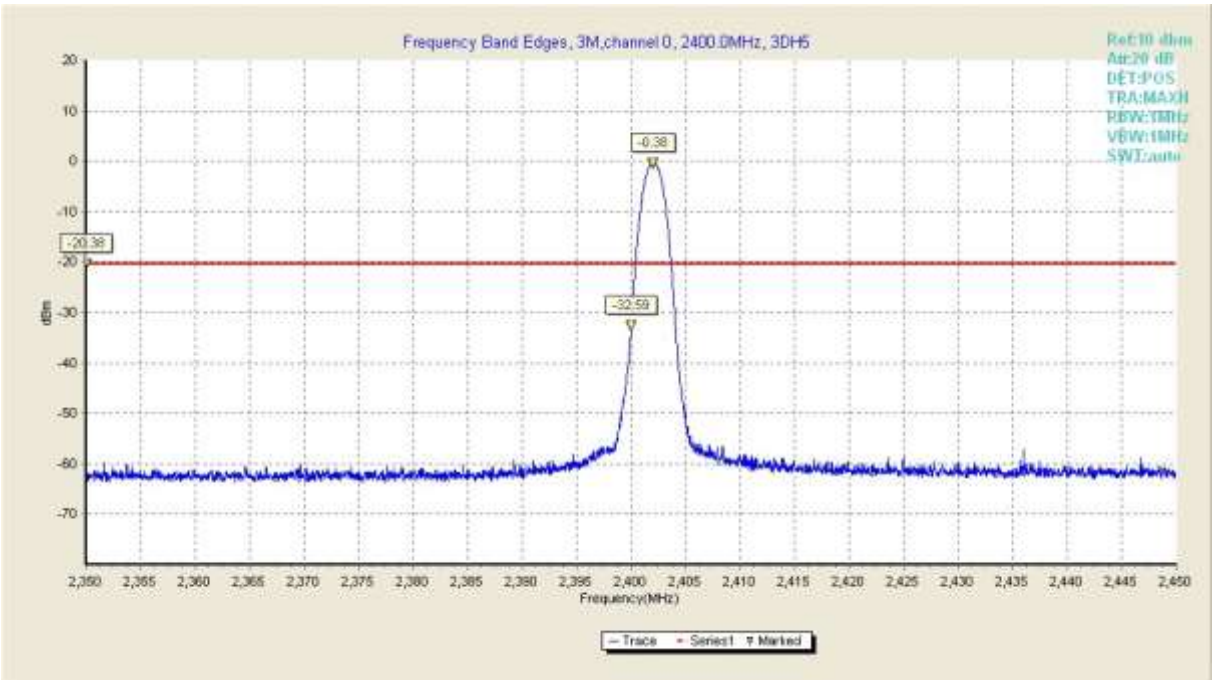


Fig18. Frequency Band Edges in CH0 , 3Mbps,Hopping off

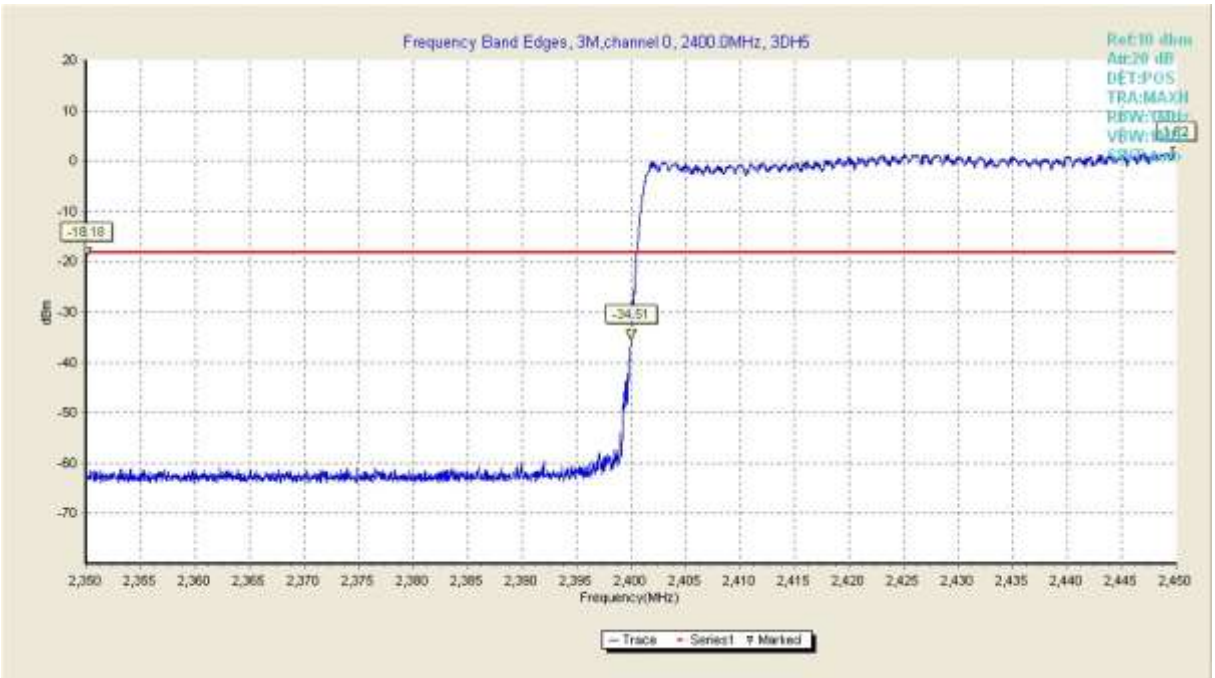


Fig19. Frequency Band Edges in CH0 , 3Mbps,Hopping on

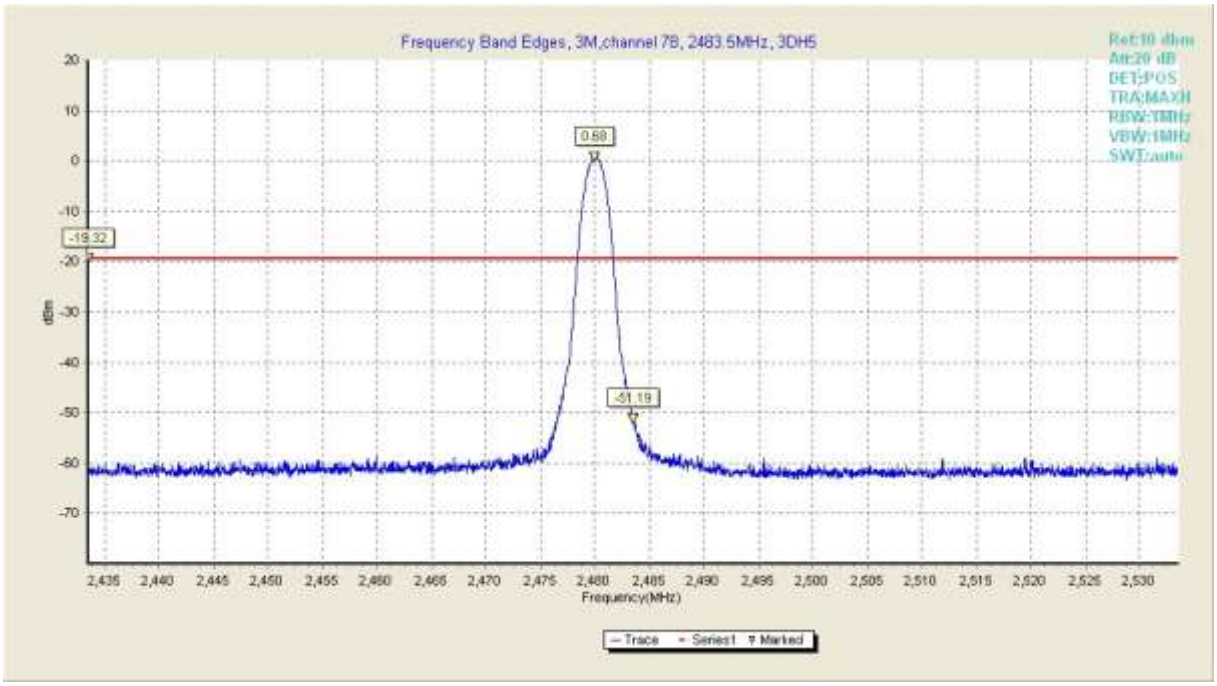


Fig20. Frequency Band Edges in CH 78, 3Mbps,Hopping off

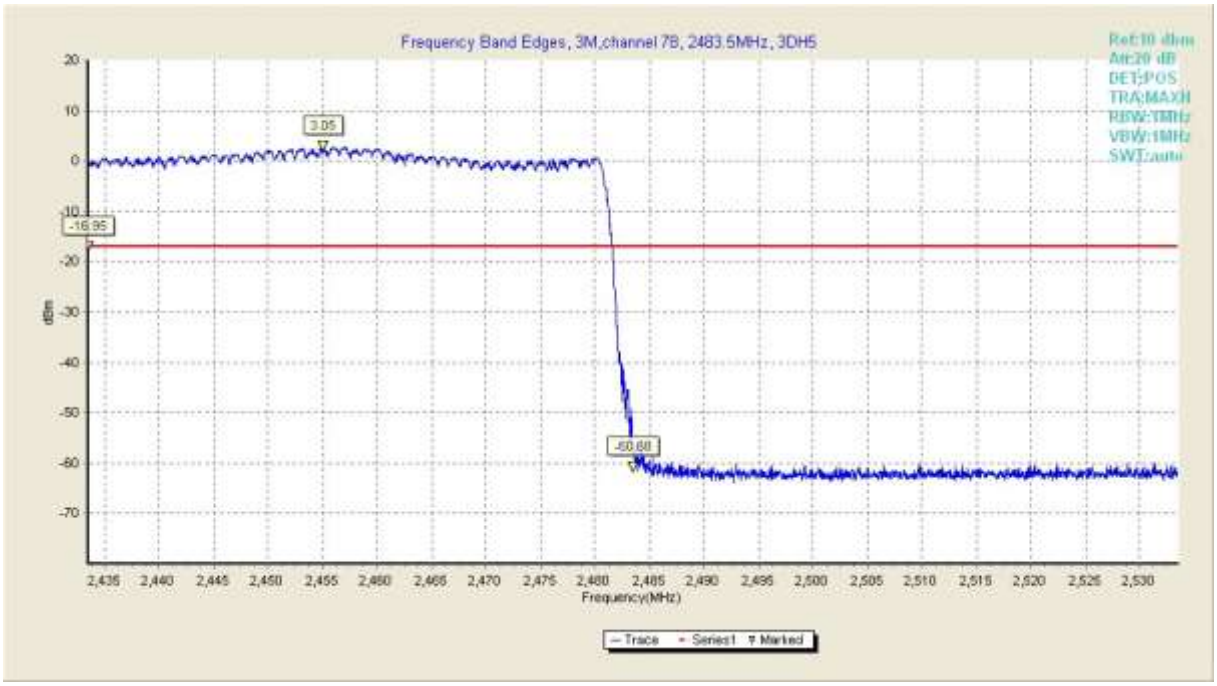


Fig21. Frequency Band Edges in CH 78, 3Mbps,Hopping on

B.3.2Radiated measurement

B.3.2.1 Procedures:

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b) Position the EUT on the rotated table inside the anechoic chamber without connection to measurement instrument. 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. Repeat above procedures until all measured frequencies were complete.

c) Set band RBW=1MHz,VBW=3MHz with a convenient frequency span from band edge.

d) Find the highest point in edge frequency,and then calculated results.

e) Repeat above procedures until all measured frequencies were complete.

B.3.2.2 Test Results

Only the GFSK worst case were reported.

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2400MHz									
175.68	21.63	QP	88	1.4	H	10.52	32.15	43.50	-11.35
175.68	21.12	QP	46	1.3	V	10.52	31.64	43.50	-11.86
4804.00	51.76	PK	254	1.3	V	-1.05	50.71	74.00	-23.29
4804.00	42.77	Ave	254	1.3	V	-1.05	41.72	54.00	-12.28
7206.00	52.96	PK	304	1.6	H	1.33	54.29	74.00	-19.71
7206.00	40.32	Ave	304	1.6	H	1.33	41.65	54.00	-12.35
2326.45	47.67	PK	142	1.9	V	-13.19	34.48	74.00	-39.52
2326.45	38.96	Ave	142	1.9	V	-13.19	25.77	54.00	-28.23
2368.48	43.74	PK	55	1.3	H	-13.15	30.59	74.00	-43.41
2368.48	38.55	Ave	55	1.3	H	-13.15	25.4	54.00	-28.6
2400	**43.12**	**PK**	**274**	**1.2**	**V**	**-13.12**	**30**	**74.00**	**-44**
2400	**41.74**	**Ave**	**274**	**1.2**	**V**	**-13.12**	**28.62**	**54.00**	**-25.38**
2496.27	43.23	PK	99	2.0	V	-13.08	30.15	74.00	-43.85
2496.27	38.11	Ave	99	2.0	V	-13.08	25.03	54.00	-28.97
2483.5MHz									
175.68	19.29	QP	245	1.6	H	10.52	29.81	43.50	-13.69
175.68	20.34	QP	277	1.9	V	10.52	30.86	43.50	-12.64
4960.00	51.67	PK	87	1.9	V	-0.24	51.43	74.00	-22.57
4960.00	44.82	Ave	87	1.9	V	-0.24	44.58	54.00	-9.42
7440.00	52.31	PK	27	1.5	H	2.85	55.16	74.00	-18.84

7440.00	42.97	Ave	27	1.5	H	2.85	45.82	54.00	-8.18
2348.63	44.66	PK	63	1.6	V	-13.19	31.47	74.00	-42.53
2348.63	37.33	Ave	63	1.6	V	-13.19	24.14	54.00	-29.86
2365.85	42.91	PK	196	1.7	H	-13.15	29.76	74.00	-44.24
2365.85	35.63	Ave	196	1.7	H	-13.15	22.48	54.00	-31.52
2483.5	**42.87**	**PK**	**344**	**1.6**	**V**	**-13.11**	**29.76**	**74.00**	**-44.24**
2483.5	**39.35**	**Ave**	**344**	**1.6**	**V**	**-13.11**	**26.24**	**54.00**	**-27.76**
2492.34	42.92	PK	78	1.6	V	-13.08	29.84	74.00	-44.16
2492.34	39.22	Ave	78	1.6	V	-13.08	26.14	54.00	-27.86

B.4Carrier Frequency Separation

B.4.1 Description

According to §15.247(a)(1),Carrier Frequency Separation should be more than two-thirds of the 20 dB bandwidth of the hopping channel

B.4.2 Test Procedures

a) Testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.

b) Place the EUT on the table and set it in hopping mode

c) EUT was connected to SA by a low loss cable.

d) Set center frequency of spectrum analyzer=middle of hopping channel.

e) SA setting: Span= wide enough to capture the peaks of two adjacent channels; Set RBW≥1% of span, VBW≥ RBW, sweep time- auto, detector function= peak, trace= max hold.

f) Max hold, mark 2 perks of hopping channel and record the 2 peaks frequency.

B.4.2 Test Results

The Worst case is 1M and only 1M results are present

Worst case data rate: 1M

GFSK Modulation

Channel	Frequency(MHz)	Limit (MHz)	Test Result(MHz)		Verdict
Low Channel	2402	0.745	1.336	Fig.22	Pass
Adjacency Channel	2403				
Low Channel	2441	0.747	0.992	Fig.23	Pass
Adjacency Channel	2442				
Low Channel	2479	0.746	0.986	Fig.24	Pass
Adjacency Channel	2480				

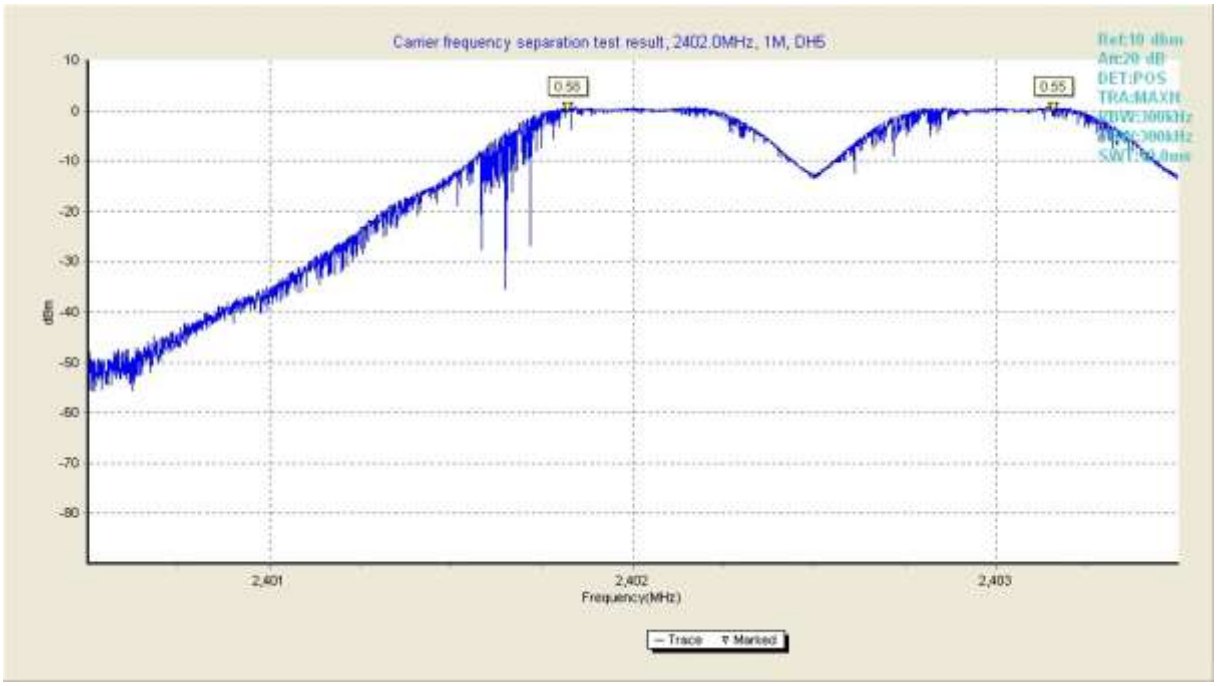


Fig 22. Carrier Frequency Separation in Low channel,1Mbps

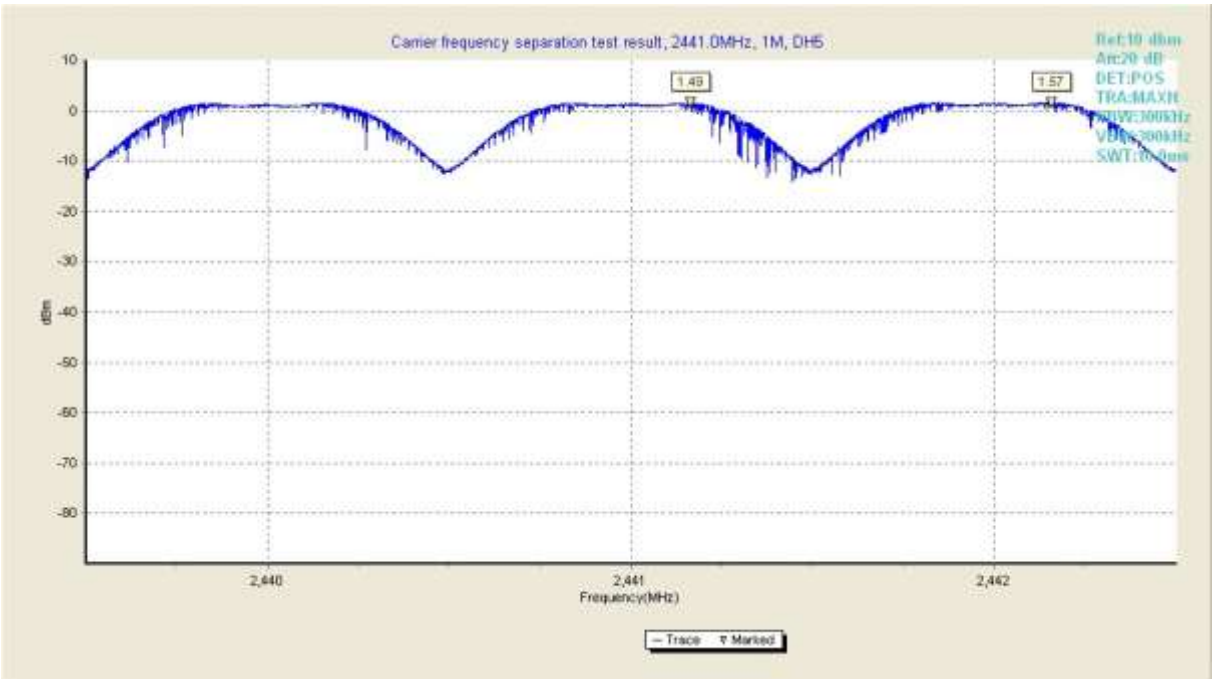


Fig 23. Carrier Frequency Separation in Middle channel,1Mbps

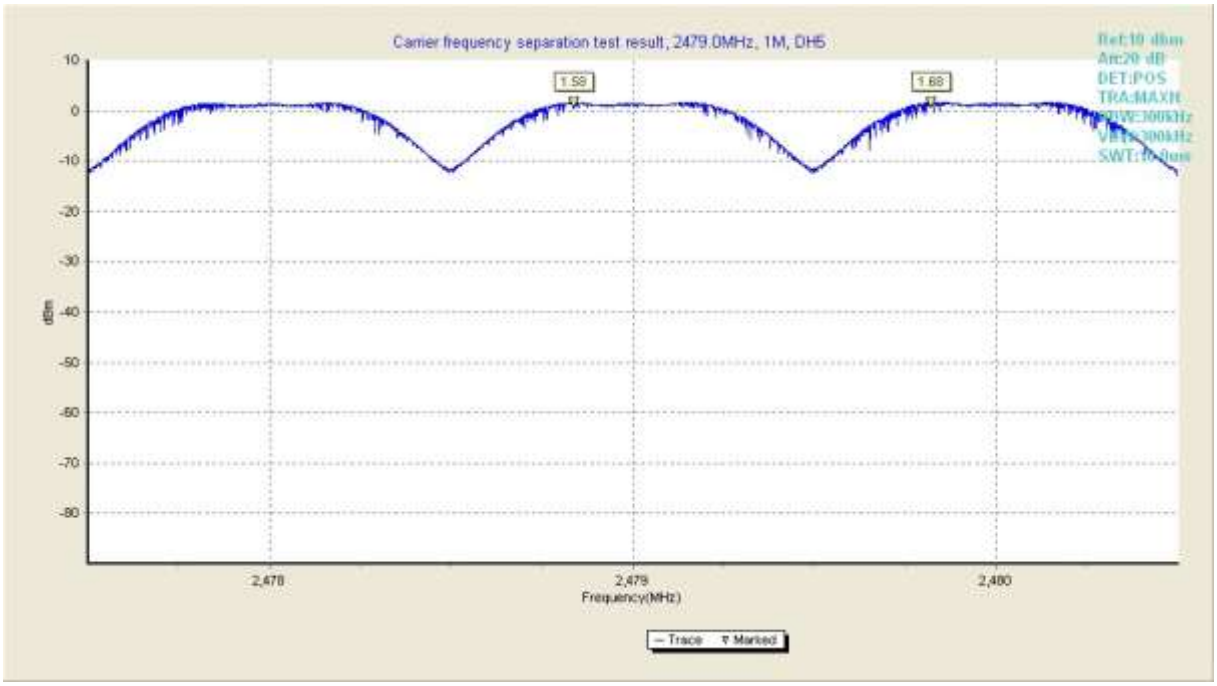


Fig 24. Carrier Frequency Separation in High channel,1Mbps

B.5 Time Of Occupancy (Dwell Time)

B.5.1 Description

According to §15.247(a)(1)(iii)

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.

B.5.2 Test Procedures

Conducted Measurement

EUT was set for low, mid, high channel with modulated mode and highest RF output power

The spectrum analyzer was connected to the antenna terminal.

Procedures

a) Place the EUT on the table and set it in transmitting mode and switch on frequency hopping function.

b) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

c) Set the spectrum analyzer as Span=zero span, centered on a hopping channel, RBW=1MHz, VBW≥RBW, Sweep=as necessary to capture the entire dwell time per hopping channel, Detector function=peak, Trace=max hold.

d) Calculate the time of occupancy in a period with time occupancy of a burst and quantity of bursts.

B.5.3 Test Results

GFSK Modulation

Date rate (Mbps)	Frequency(MHz)	Limit (ms)	Test Result(ms)		Verdict
1	2402	400	306.46	Fig.25	Pass
	2441		306.46	Fig.26	Pass
	2480		306.46	Fig.27	Pass

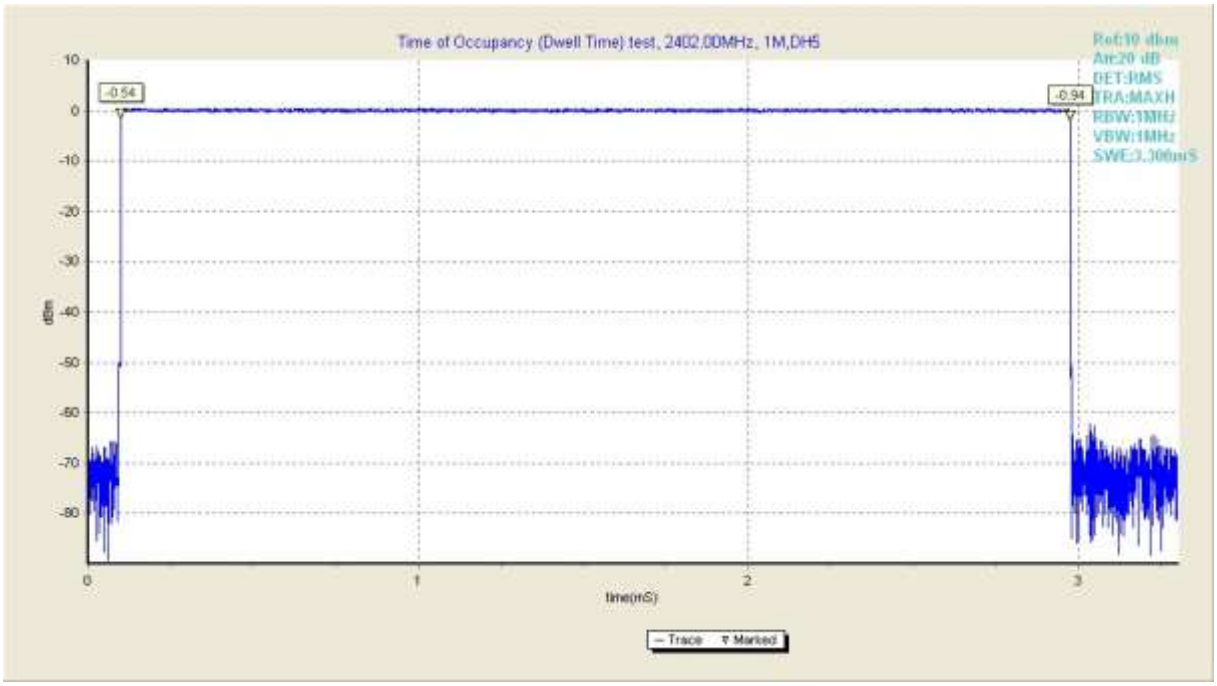


Fig25. Dwell Time in 2402MHz,1Mbps

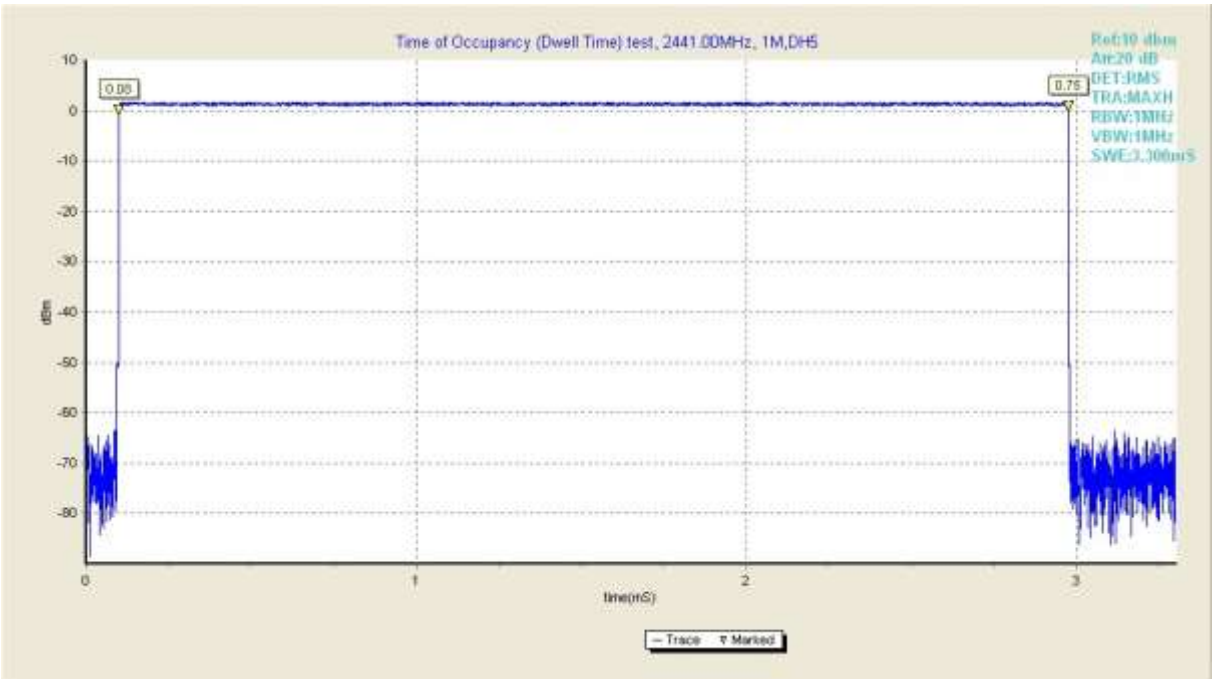


Fig26. Dwell Time in 2441MHz,1Mbps

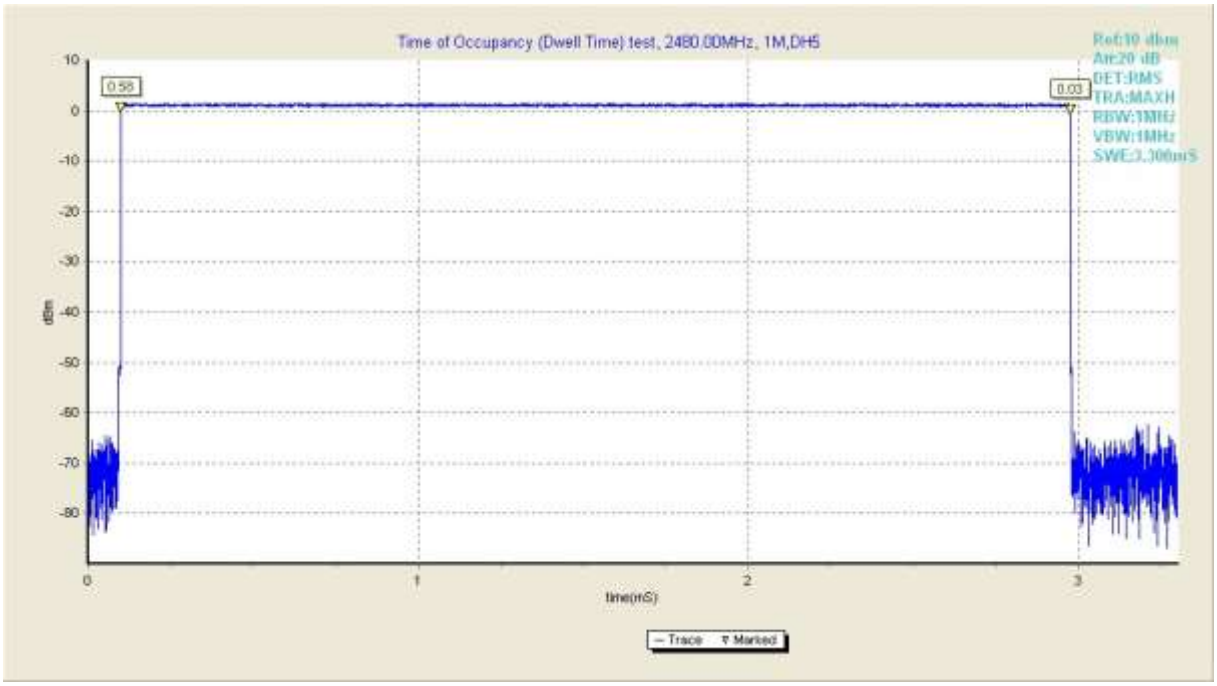


Fig27. Dwell Time in 2480MHz,1Mbps

π/4-DQPSK Modulation

Date rate (Mbps)	Frequency(MHz)	Limit (ms)	Test Result(ms)		Verdict
2	2402	400	306.81	Fig.28	Pass
	2441		306.81	Fig.29	Pass
	2480		306.81	Fig.30	Pass

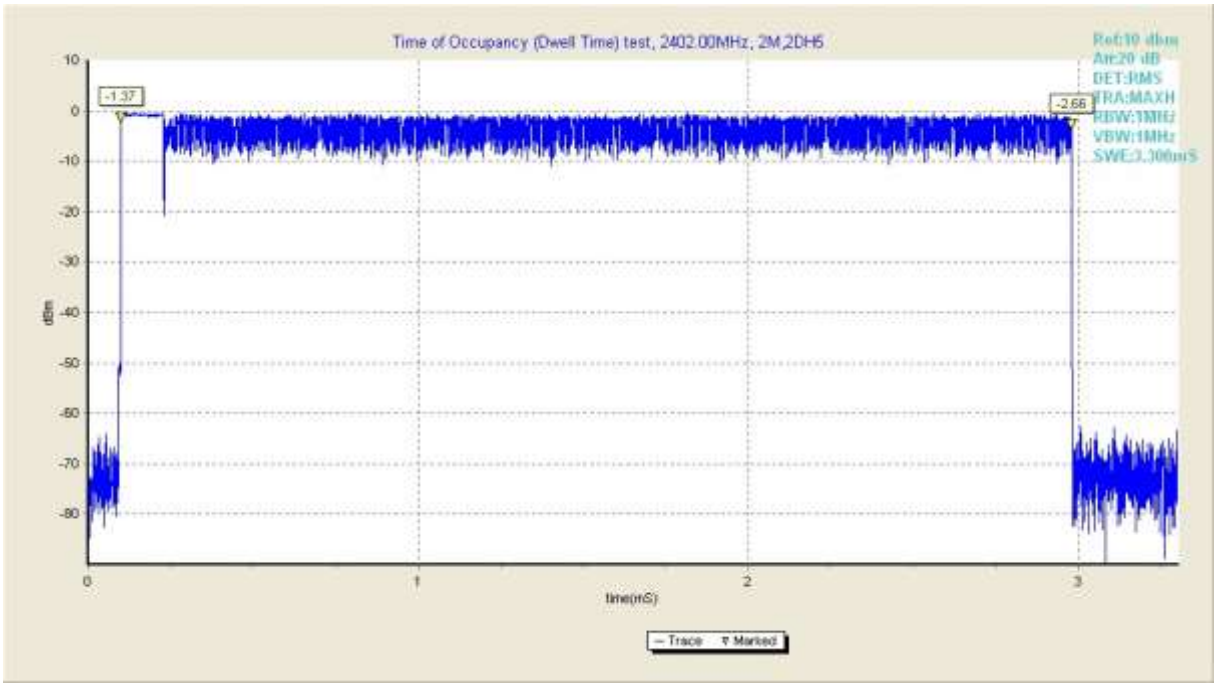


Fig28. Dwell Time in 2402MHz,2Mbps

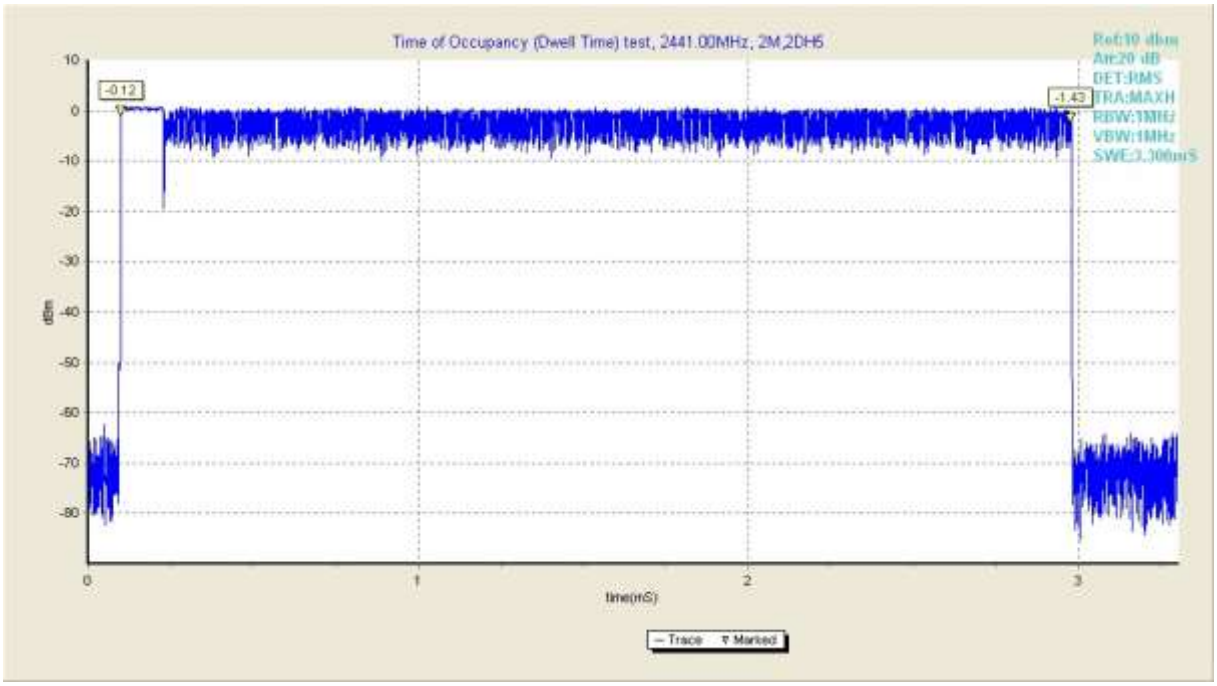


Fig29. Dwell Time in 2441MHz,2Mbps

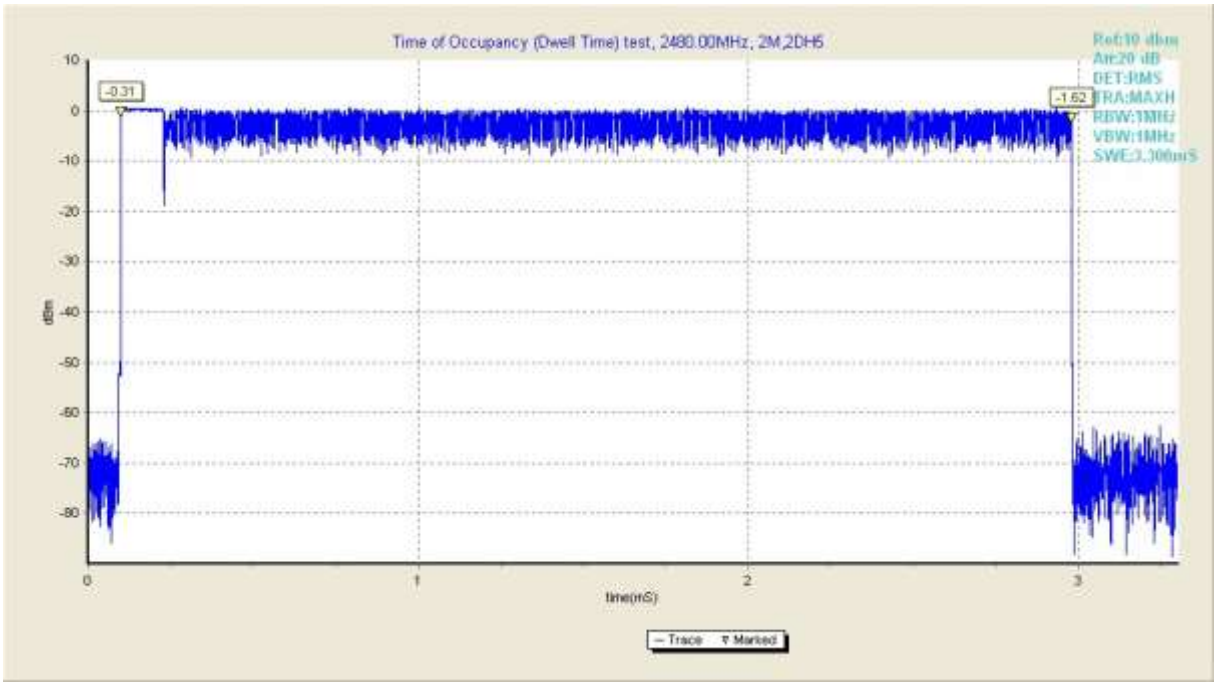


Fig30. Dwell Time in 2480MHz,2Mbps

8DPSK Modulation

Date rate (Mbps)	Frequency(MHz)	Limit (ms)	Test Result(ms)		Verdict
3	2402	400	307.03	Fig.31	Pass

	2441		307.03	Fig.32	Pass
	2480		307.03	Fig.33	Pass

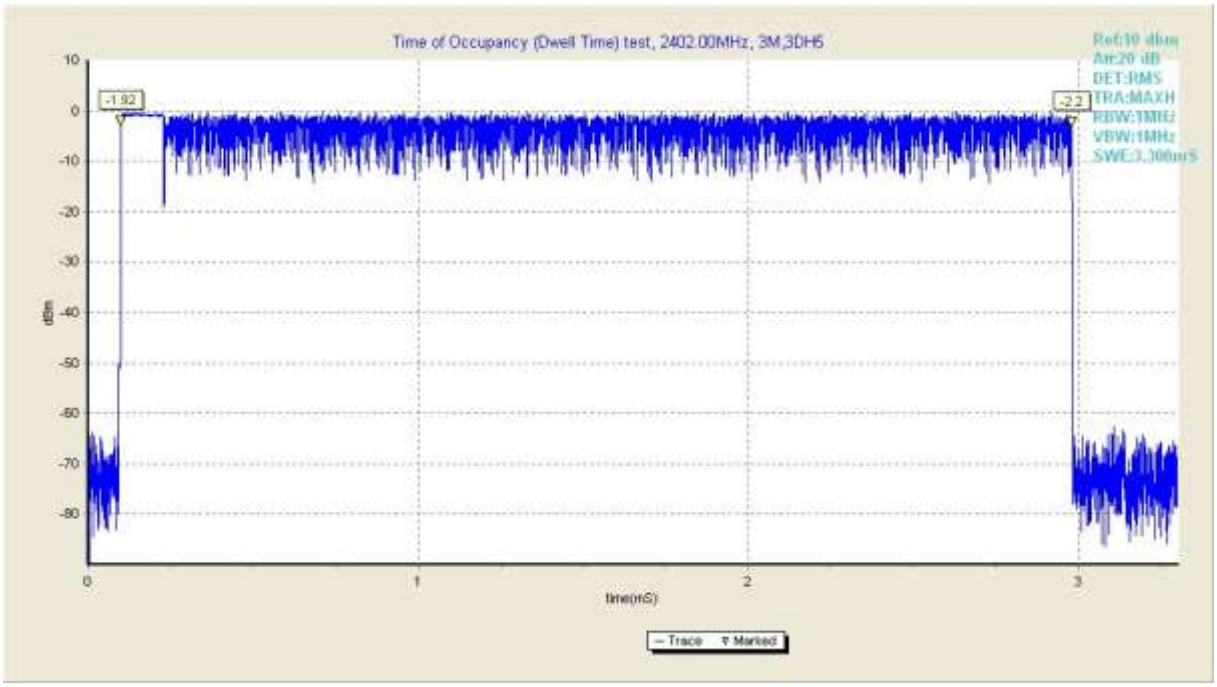


Fig31 Dwell Time in 2402MHz,3Mbps

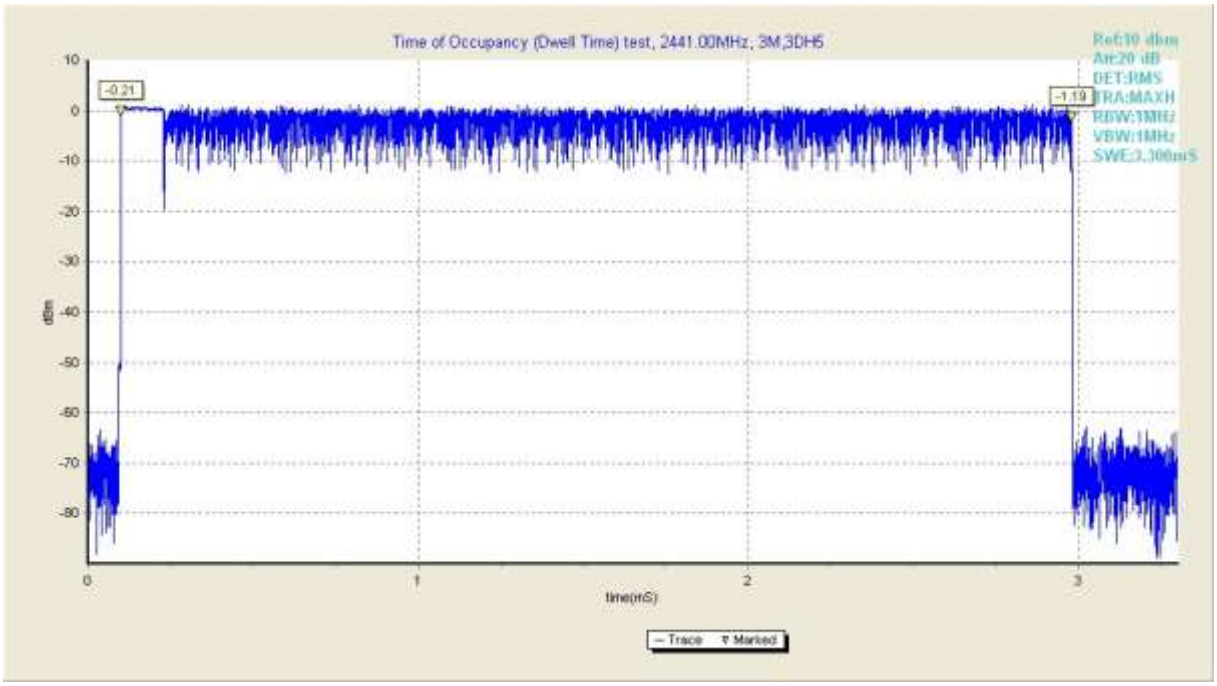


Fig32. Dwell Time in 2441MHz,3Mbps

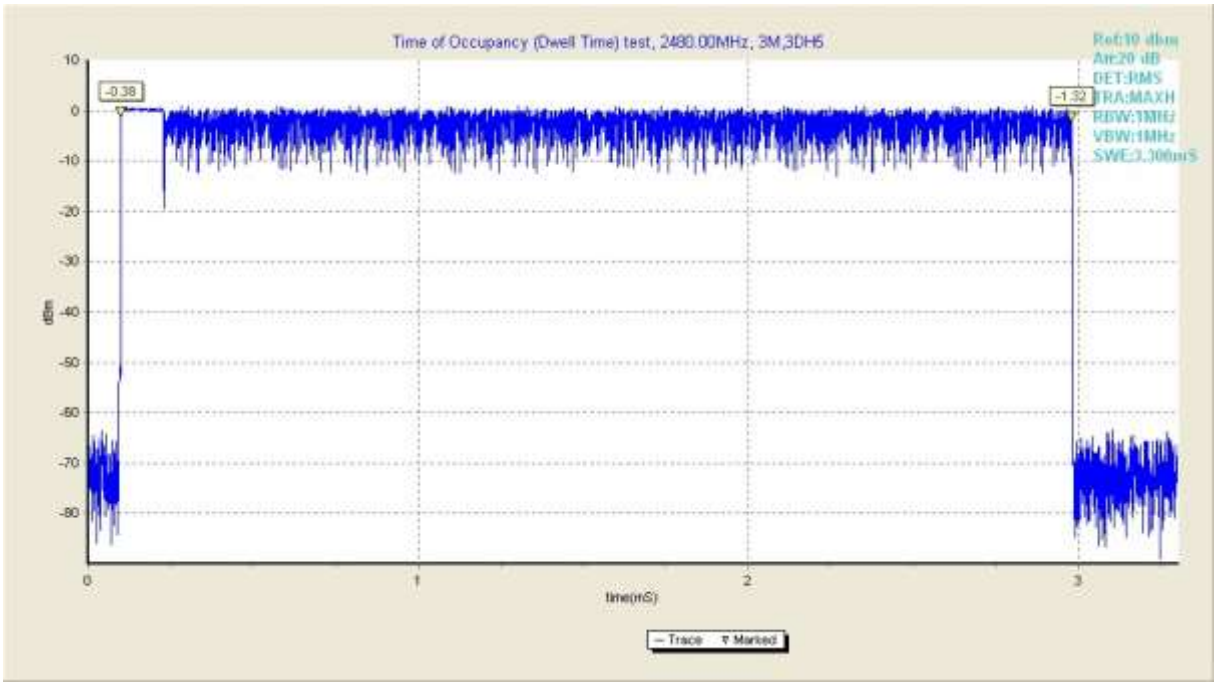


Fig33. Dwell Time in 2480MHz,3Mbps

B.6Number of Channel Hopping

B.6.1 Description

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

B.6.2 Test Procedures

Conducted Measurement

EUT was set for low, mid, high channel with modulated mode and highest RF output power
The spectrum analyzer was connected to the antenna terminal.

Procedures

e) Place the EUT on the table and set it in transmitting mode and switch on frequency hopping function.

f) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

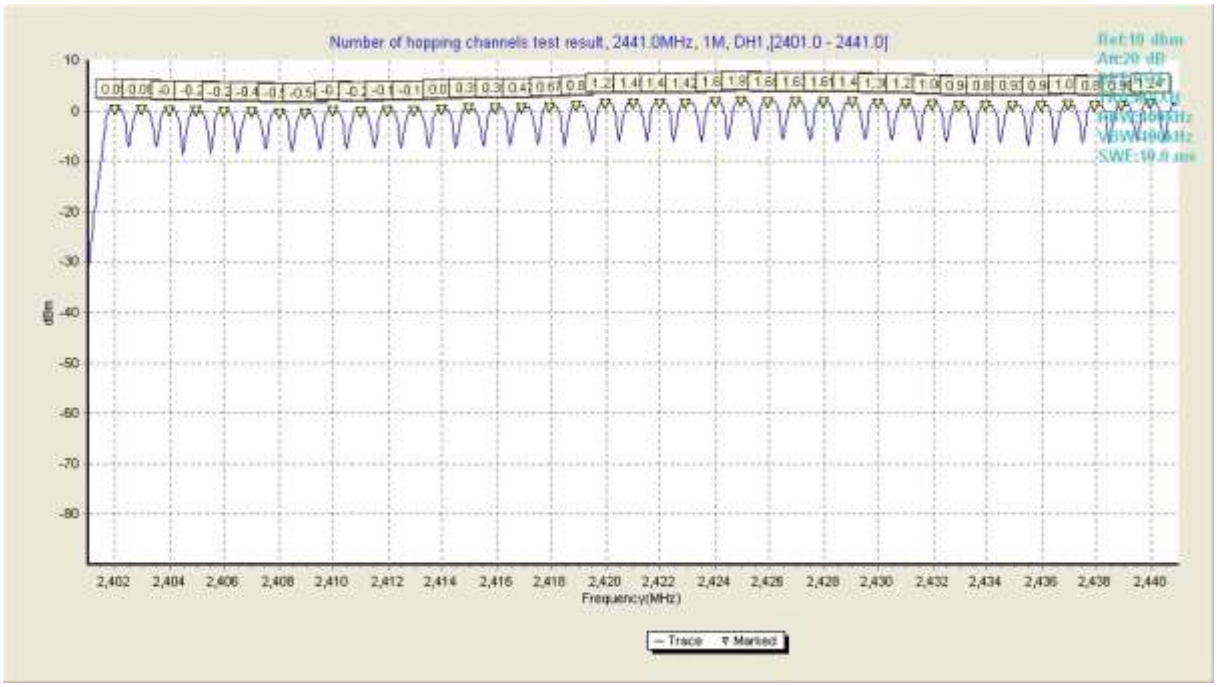
g) Set the spectrum analyzer as Start=2400MHz, Stop=2483.5MHz, Span=the frequency band of operation, RBW≥1% of the span, VBW≥RBW, Sweep=auto, Detector function=peak, Trace=max hold.

h) Count the quantity of peaks to get the number of hopping channels.

B.6.3 Test Results

GFSK Modulation

Hopping Channel Frequency Range(MHz)	Limits(Channel)	Number of hopping Channel	Test Results	Verdict
2402~2480	15	79	Fig.34	Pass



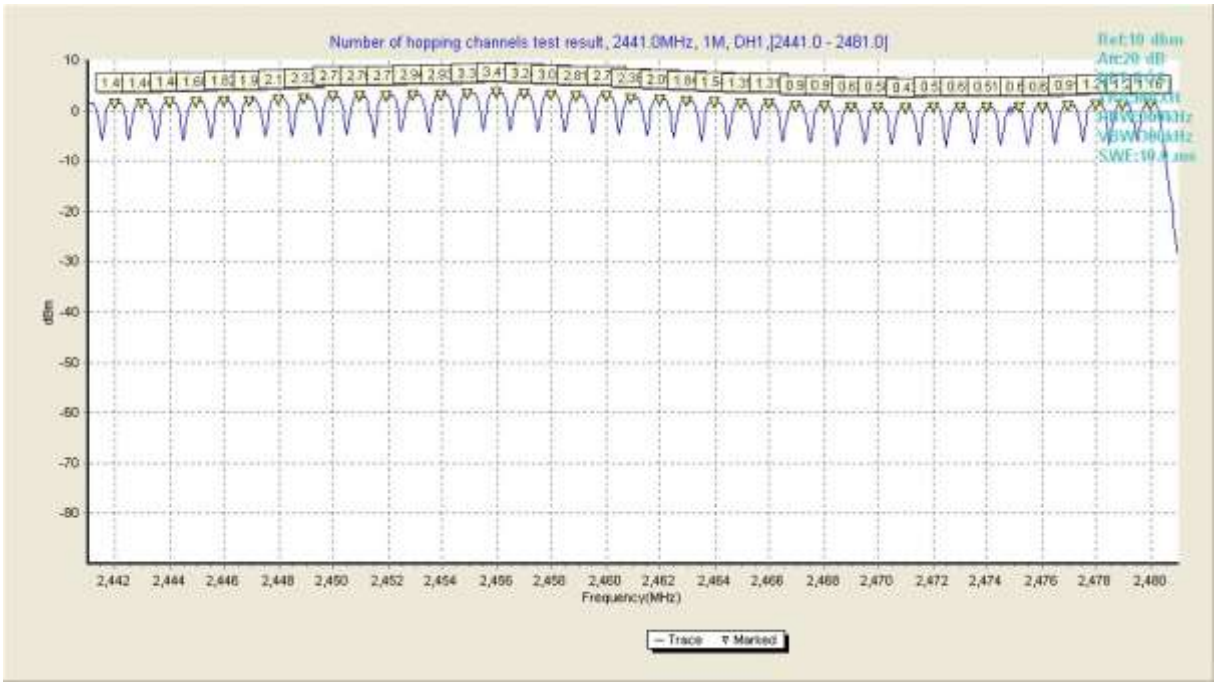
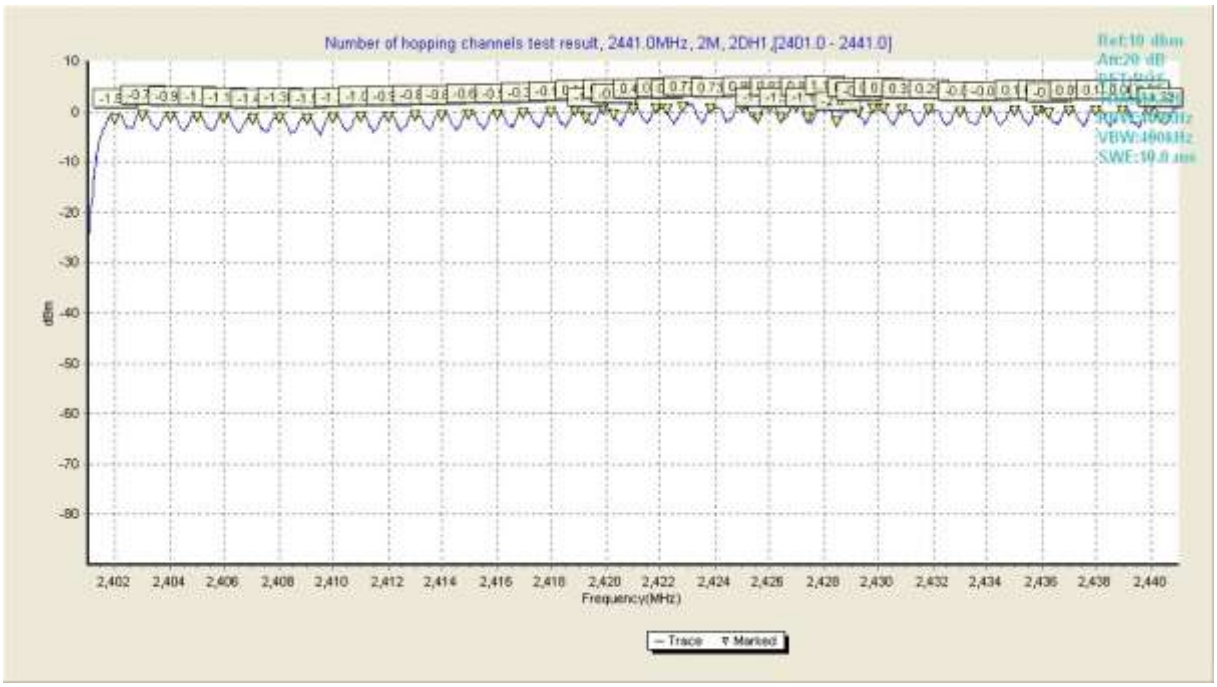


Fig34. Dwell Time in 1Mbps

π/4-DQPSK Modulation

Hopping Channel Frequency Range(MHz)	Limits(Channel)	Number of hopping Channel	Test Results	Verdict
2402~2480	15	79	Fig.35	Pass



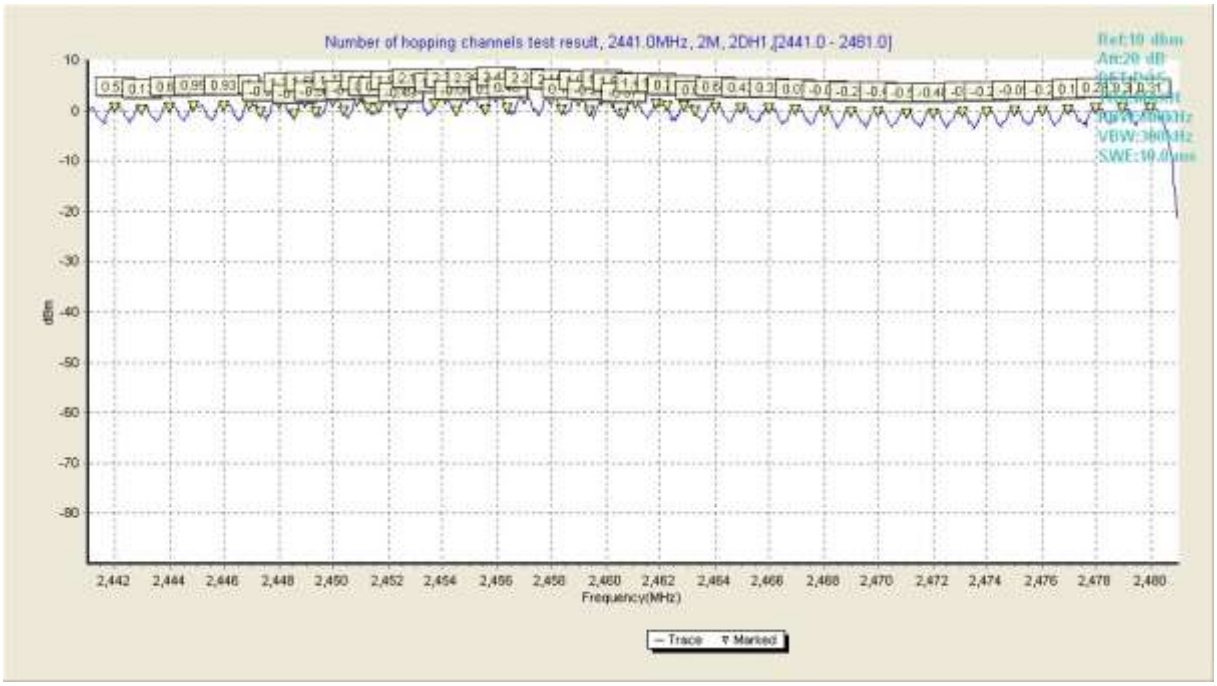


Fig35. Dwell Time in 2Mbps

8DPSK Modulation

Hopping Channel Frequency Range(MHz)	Limits(Channel)	Number of hopping Channel	Test Results	Verdict
2402~2480	15	79	Fig.36	Pass

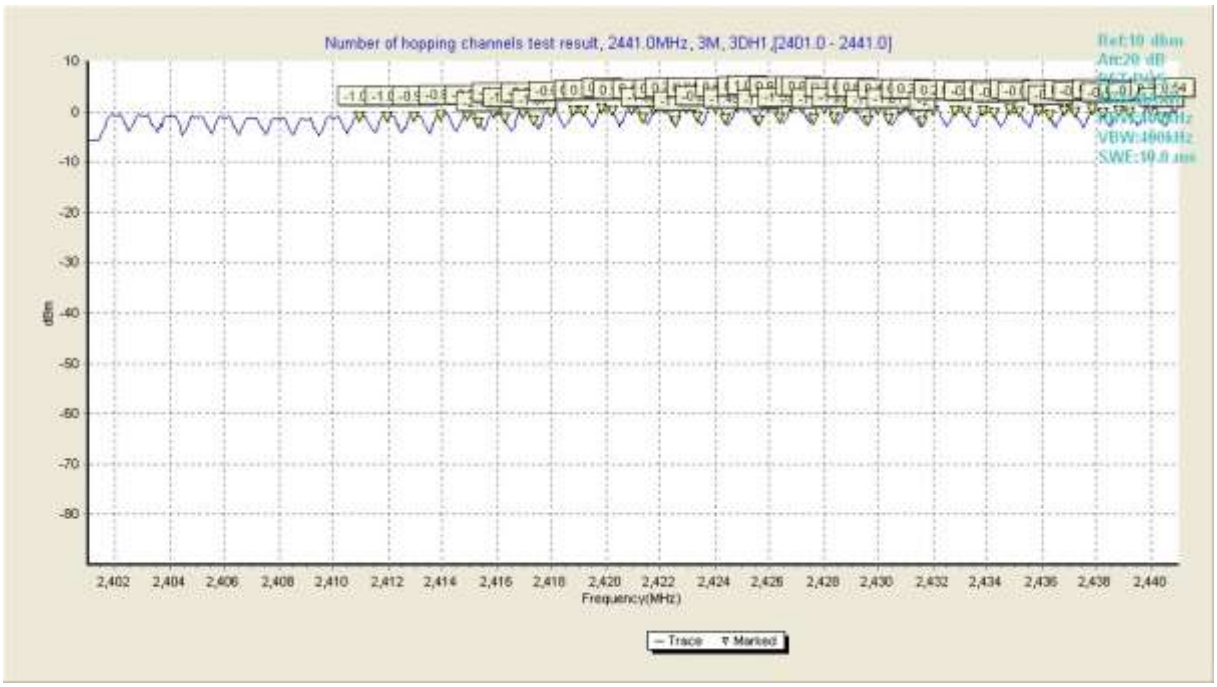


Fig36. Dwell Time in 3Mbps

B.7ConductedSpurious Emissions

B.7.1 Description

According to §15.247(d),

All harmonics/spurious must be at least 20 dB down from the highest emissionlevel within the authorized band.

B.7.2Test Procedures

Conducted Measurement

EUT was set for low, mid, high channel with modulated mode and highest RF output power

The spectrum analyzer was connected to the antenna terminal.

Procedures

a) The EUT was connected to SA by a low loss cable.

b) Set RBW=100 kHz, VBW≥ RBW, scan up to 10th harmonics. All harmonics/Spurs emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

B.7.3 Test Result

GFSK Modulation

Channel	Frequency Range	Test Results	Verdict
0	30MHz ~ 1GHz	Fig.37	Pass
	1GHz ~ 10GHz	Fig.38	Pass
	10GHz ~ 26GHz	Fig.38	Pass
39	30MHz ~ 1GHz	Fig.39	Pass
	1GHz ~ 10GHz	Fig.40	Pass
	10GHz ~ 26GHz	Fig.41	Pass
78	30MHz ~ 1GHz	Fig.42	Pass
	1GHz ~ 10GHz	Fig.43	Pass
	10GHz ~ 26GHz	Fig.44	Pass

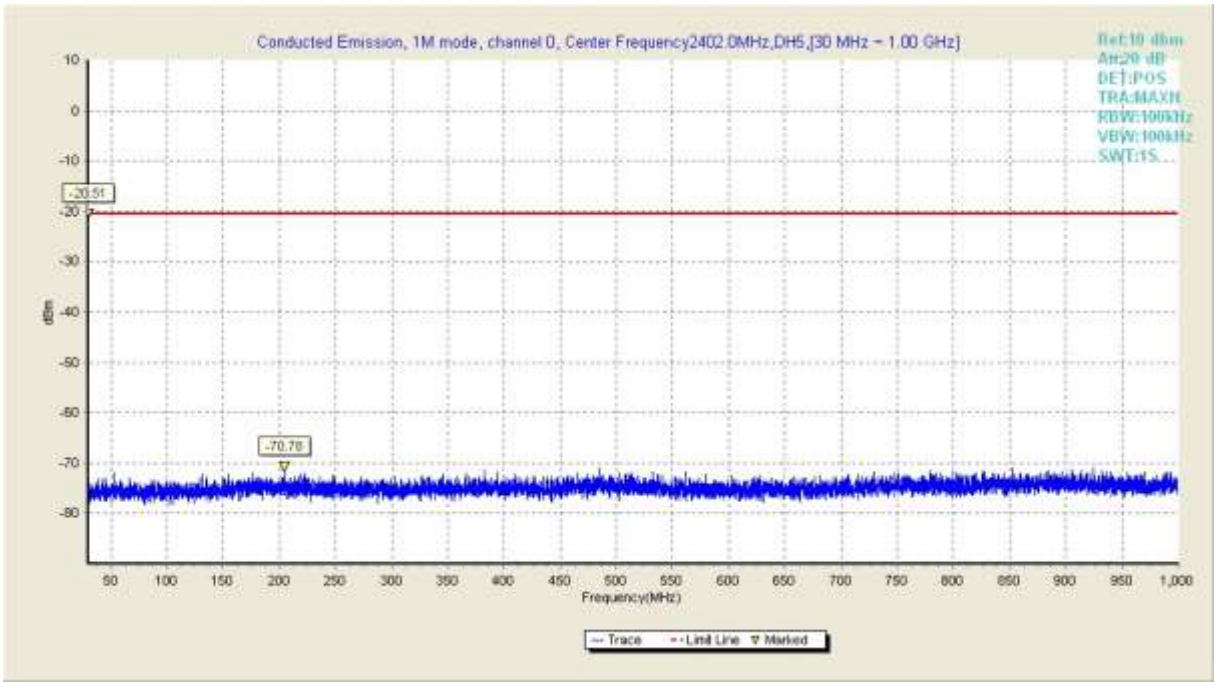


Fig.37 Conducted Emission in 1M mode ,channel 0, (30 MHz ~ 1 GHz)

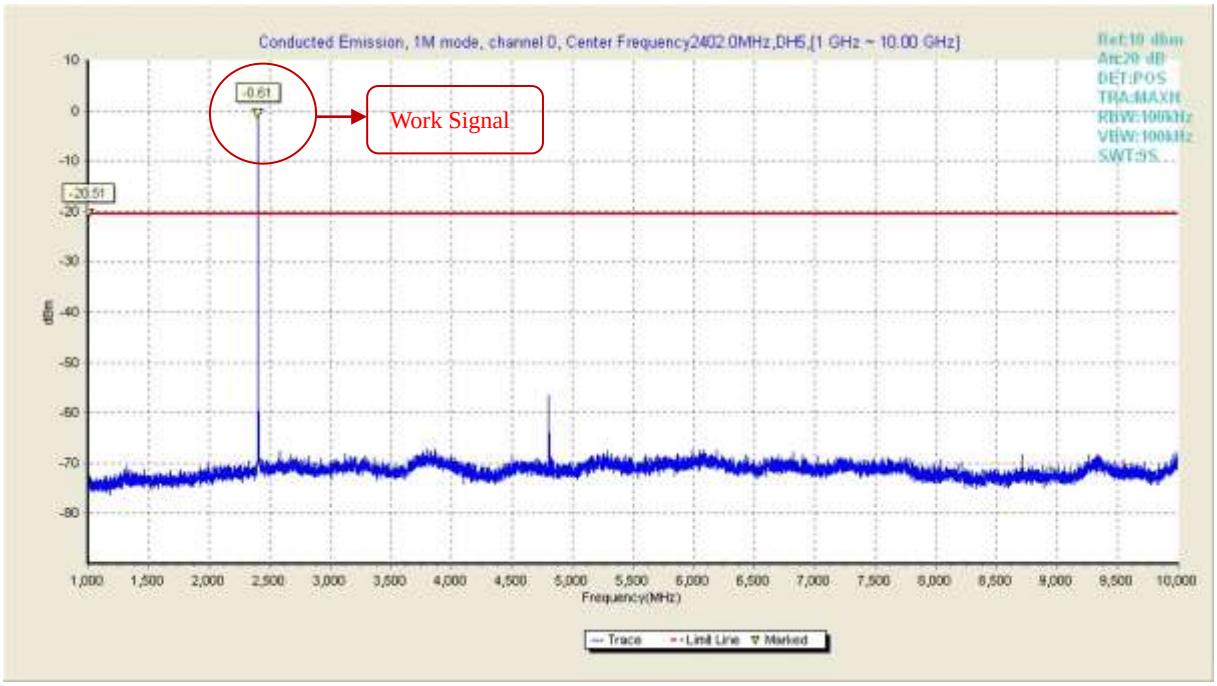


Fig.38 Conducted Emission in 1M mode ,channel 0, (1 GHz ~ 10 GHz)

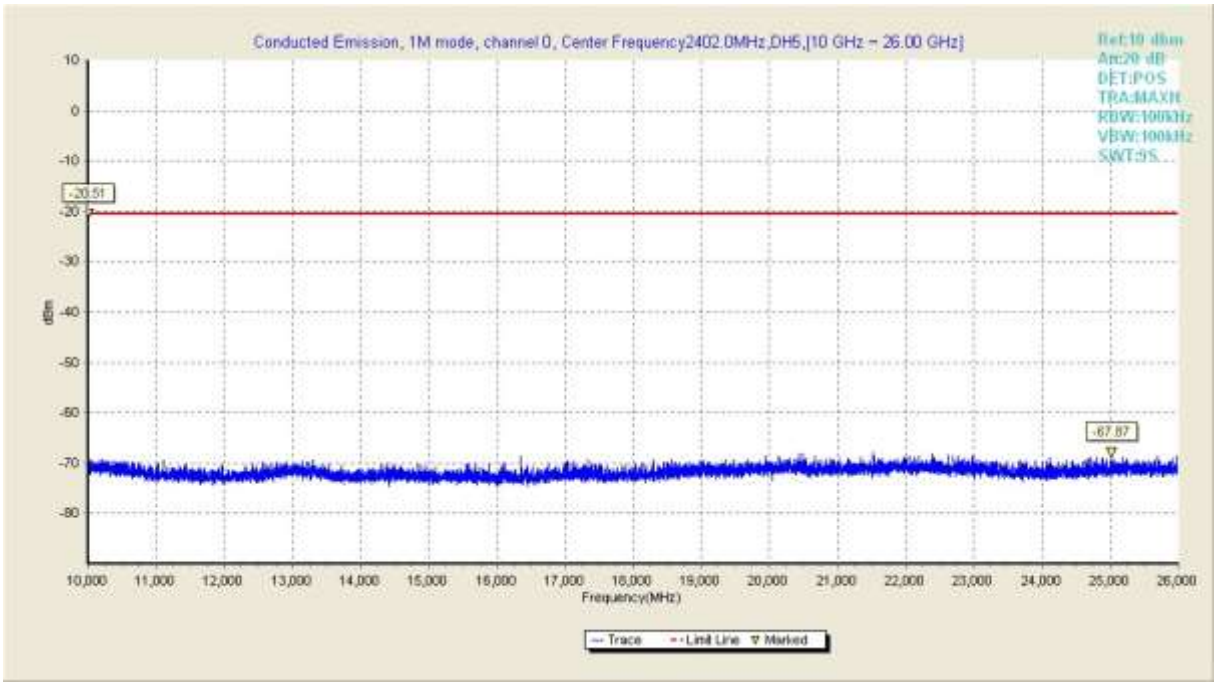


Fig.39 Conducted Emission in 1M mode ,channel 0, (10 GHz ~ 26 GHz)

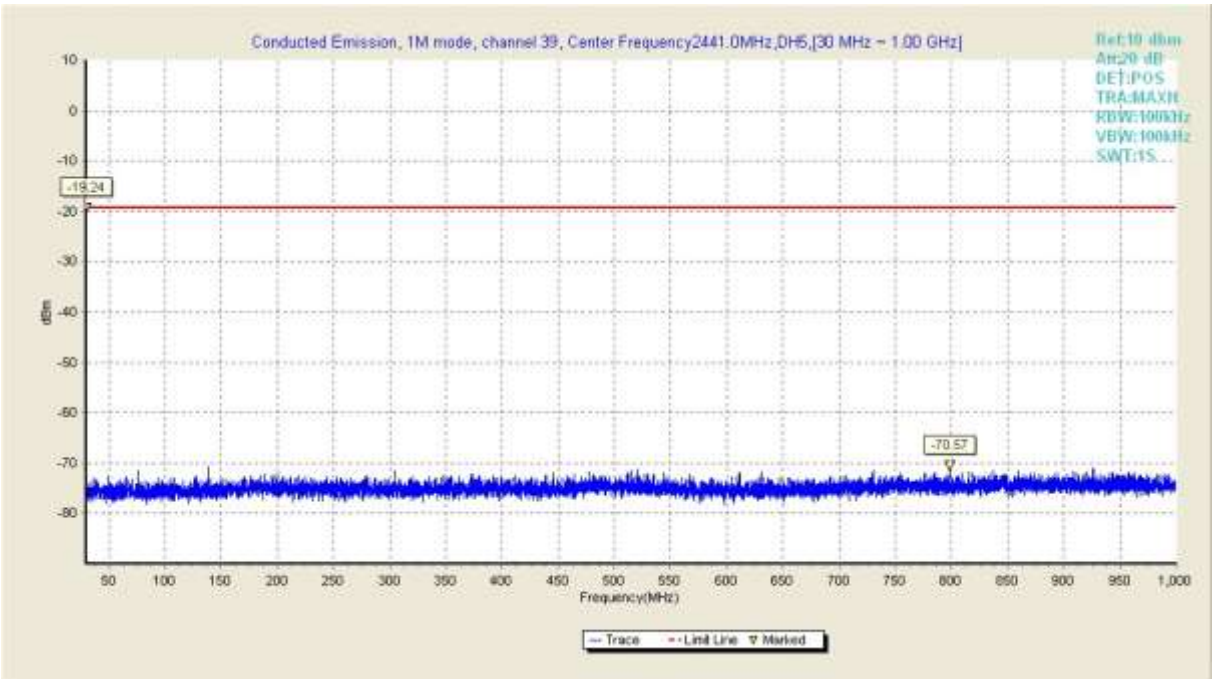


Fig.40 Conducted Emission in 1M mode ,channel 39, (30 MHz ~ 1 GHz)

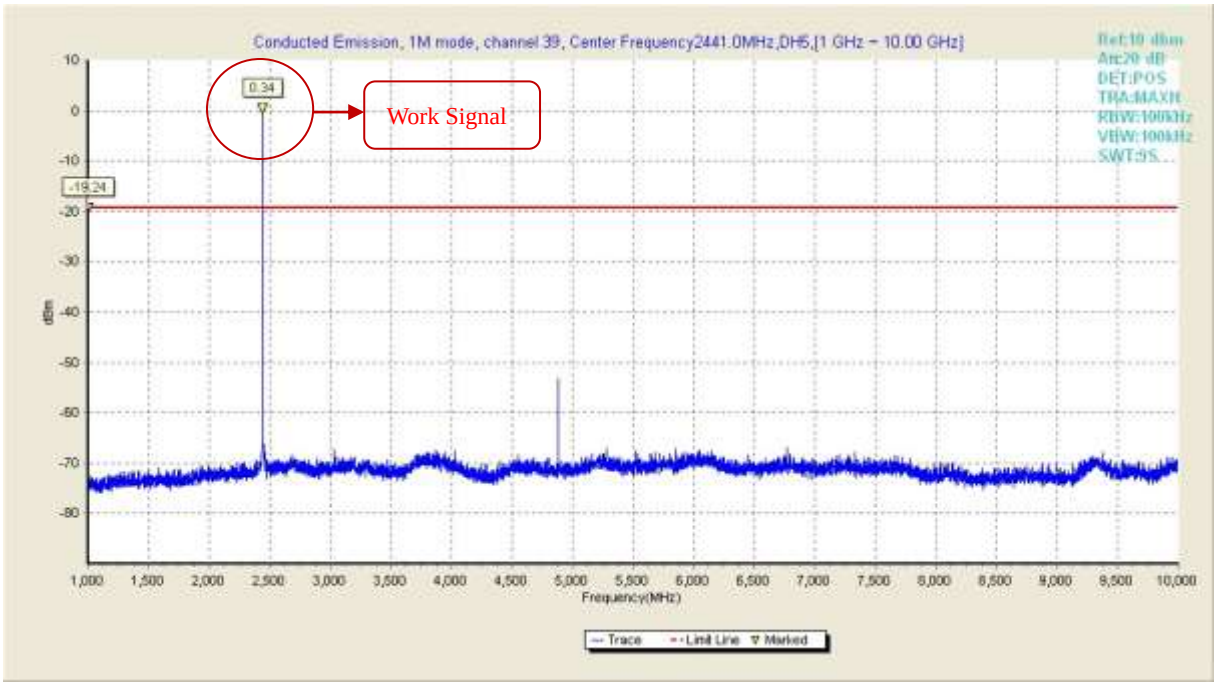


Fig.41 Conducted Emission in 1M mode ,channel 39, (1 GHz ~ 10 GHz)

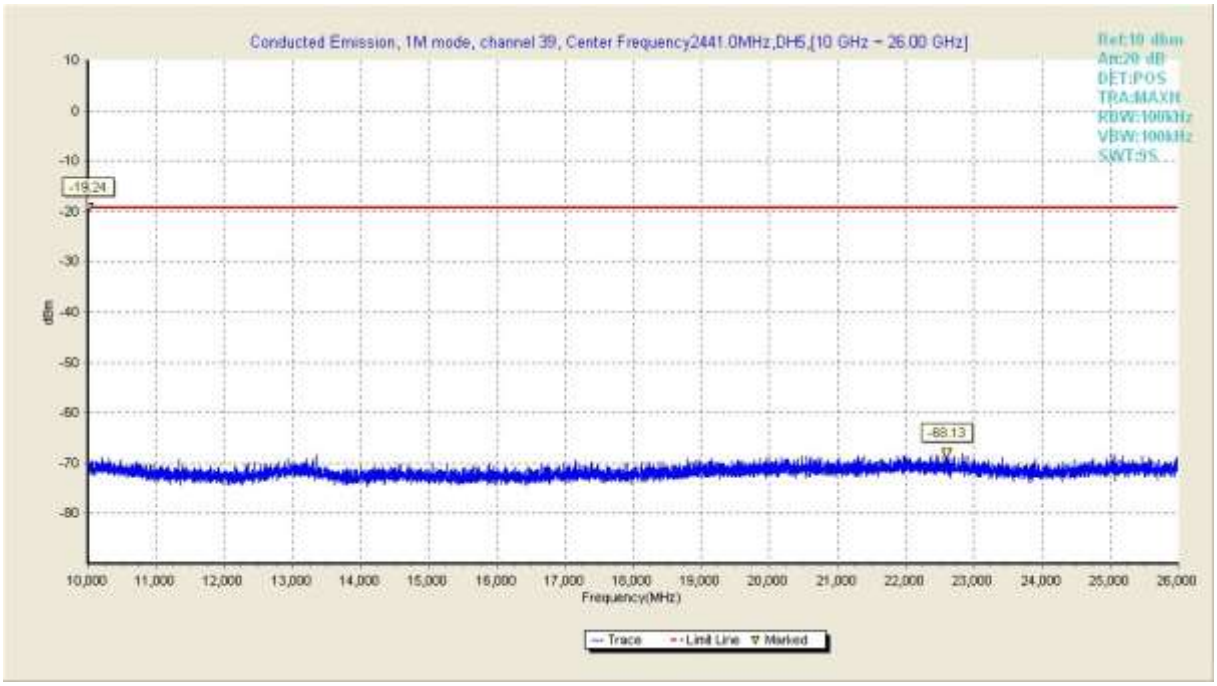


Fig.42 Conducted Emission in 1M mode ,channel 39, (10 GHz ~ 26 GHz)

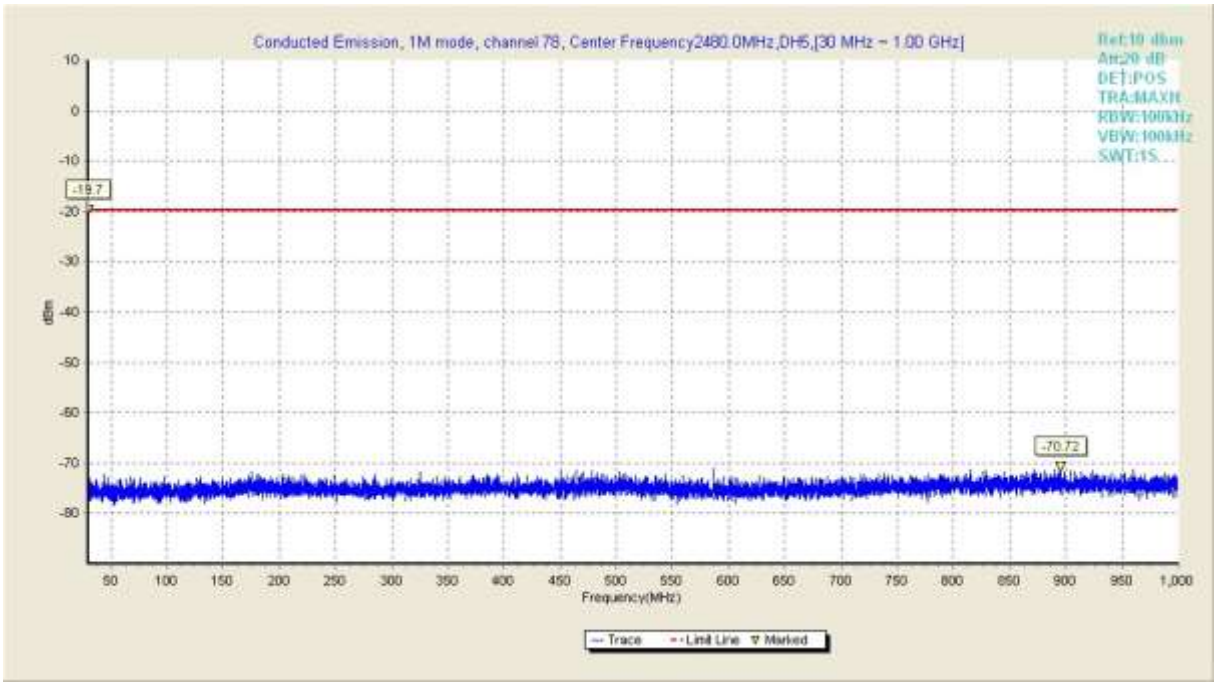


Fig.43 Conducted Emission in 1M mode ,channel 78, (30 MHz ~ 1 GHz)

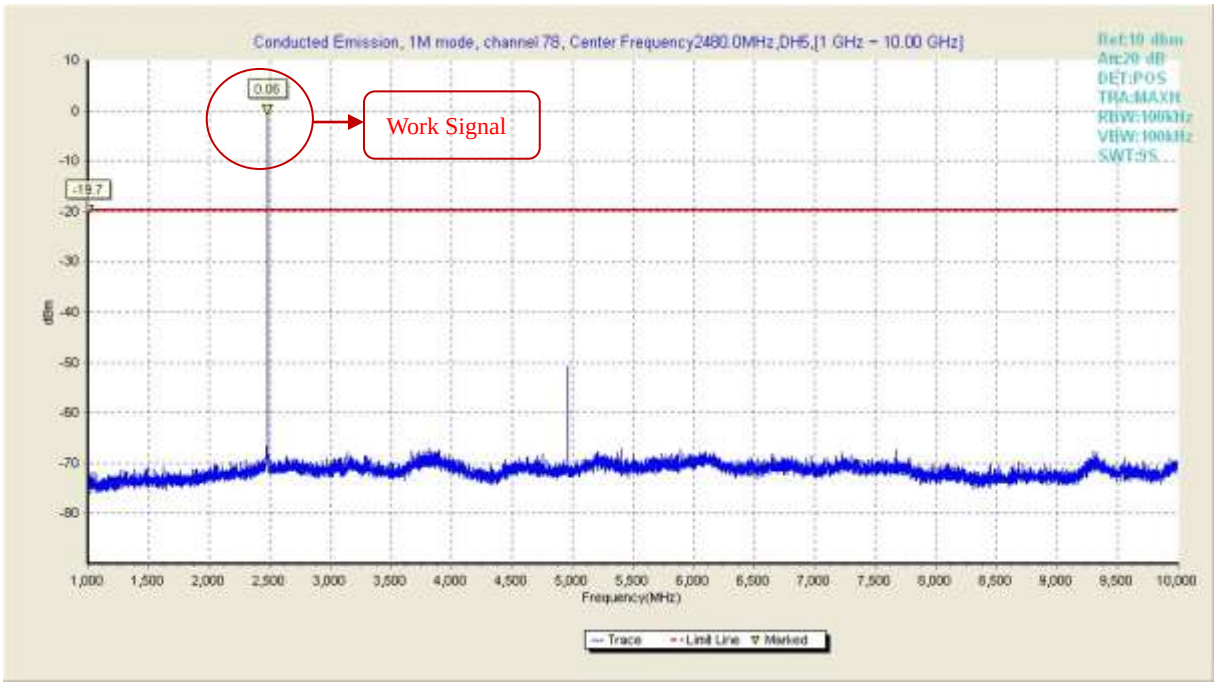


Fig.44 Conducted Emission in 1M mode ,channel 78, (1 GHz ~ 10 GHz)

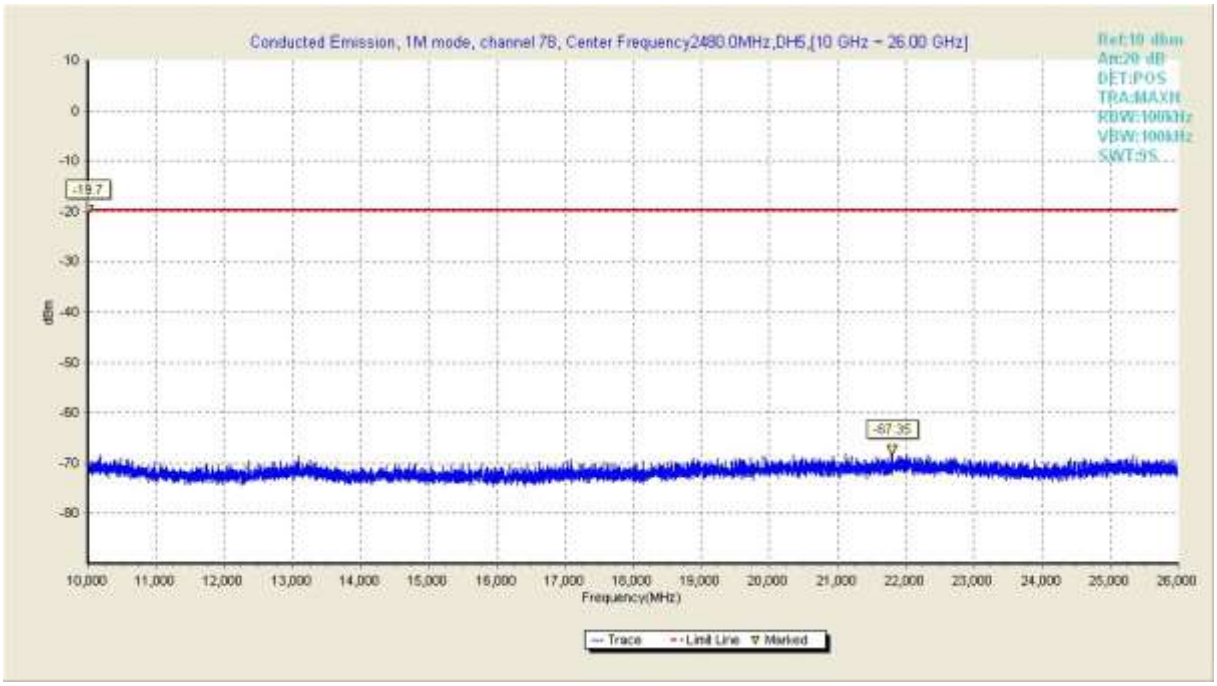


Fig.45 Conducted Emission in 1M mode ,channel 78, (10 GHz ~ 26 GHz)

π/4-DQPSK Modulation

Channel	Frequency Range	Test Results	Verdict
0	30MHz ~ 1GHz	Fig.46	Pass
	1GHz ~ 10GHz	Fig.47	Pass
	10GHz ~ 26GHz	Fig.48	Pass
39	30MHz ~ 1GHz	Fig.49	Pass
	1GHz ~ 10GHz	Fig.50	Pass
	10GHz ~ 26GHz	Fig.51	Pass
78	30MHz ~ 1GHz	Fig.52	Pass
	1GHz ~ 10GHz	Fig.53	Pass
	10GHz ~ 26GHz	Fig.54	Pass

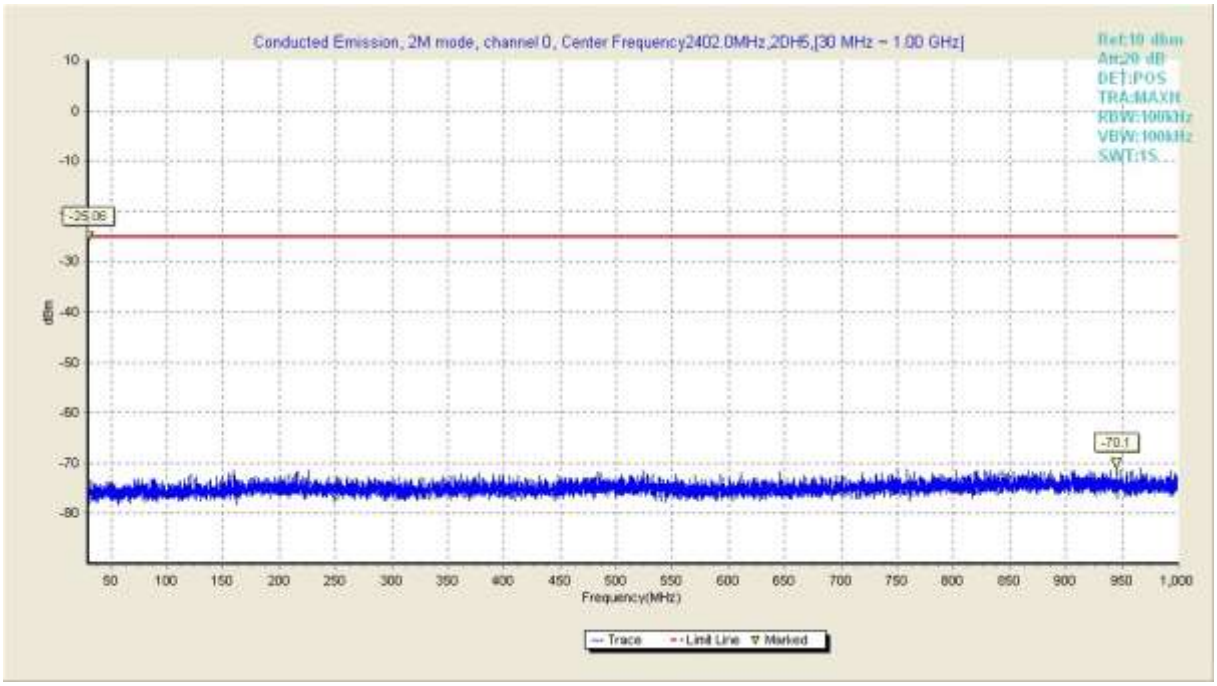


Fig.46 Conducted Emission in 2M mode ,channel 0, (30 MHz ~ 1 GHz)

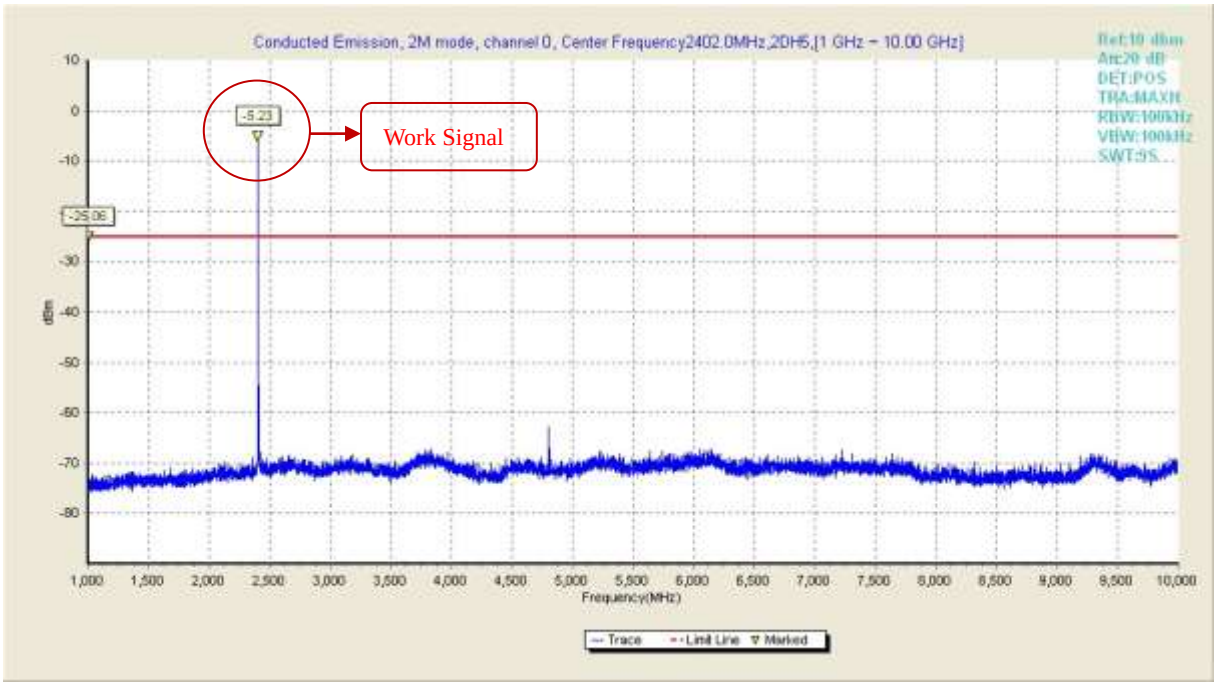


Fig.47 Conducted Emission in 2M mode ,channel 0, (1 GHz ~ 10 GHz)

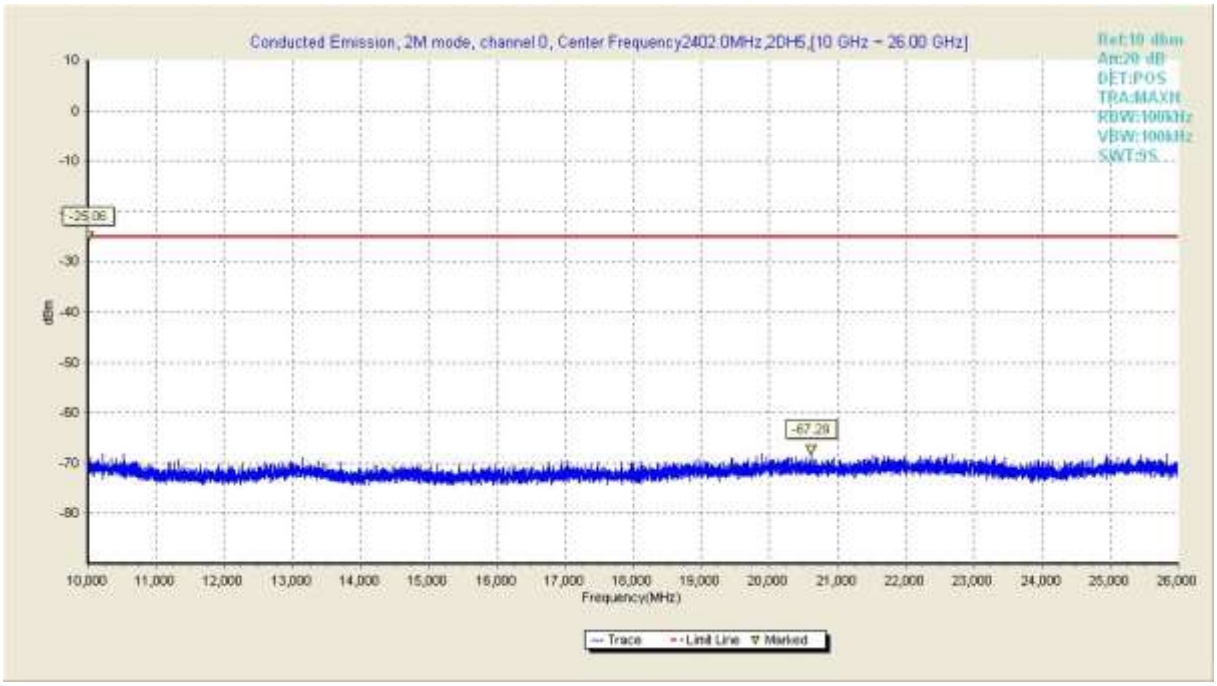


Fig.48Conducted Emission in 2M mode ,channel 0, (10 GHz ~ 26 GHz)

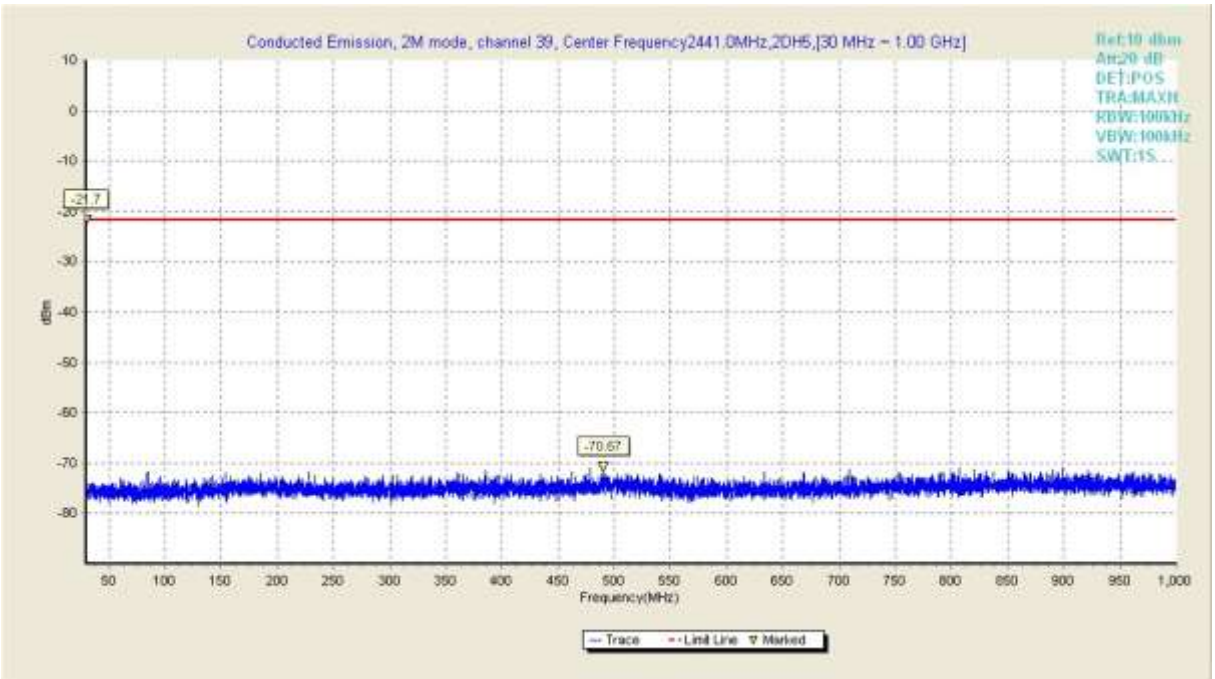


Fig.49 Conducted Emission in 2M mode ,channel 39, (30 MHz ~ 1 GHz)

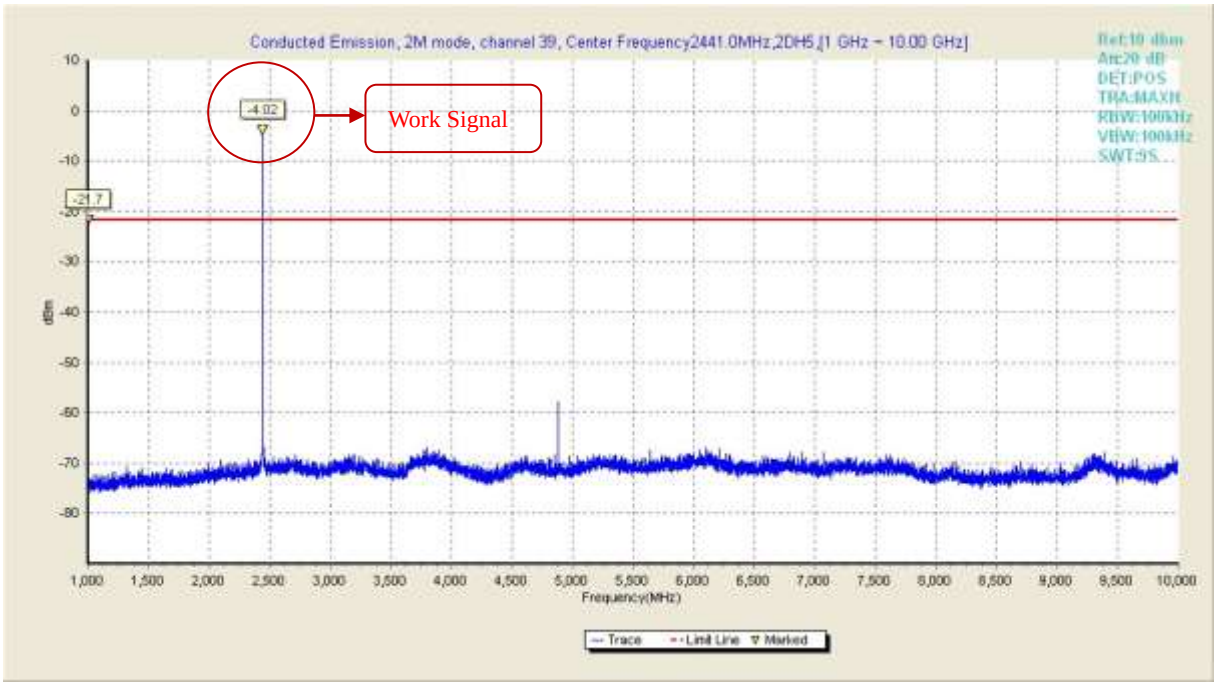


Fig.50 Conducted Emission in 2M mode ,channel 39, (1 GHz ~ 10 GHz)

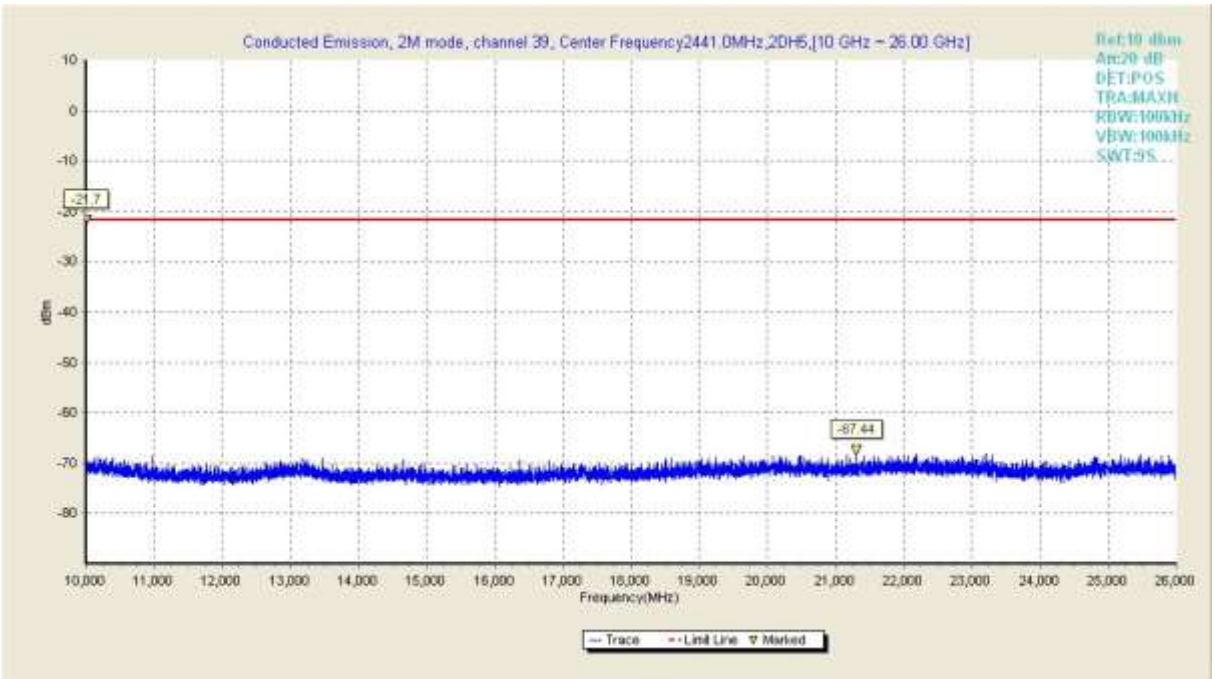


Fig.51 Conducted Emission in 2M mode ,channel 39, (10 GHz ~ 26 GHz)

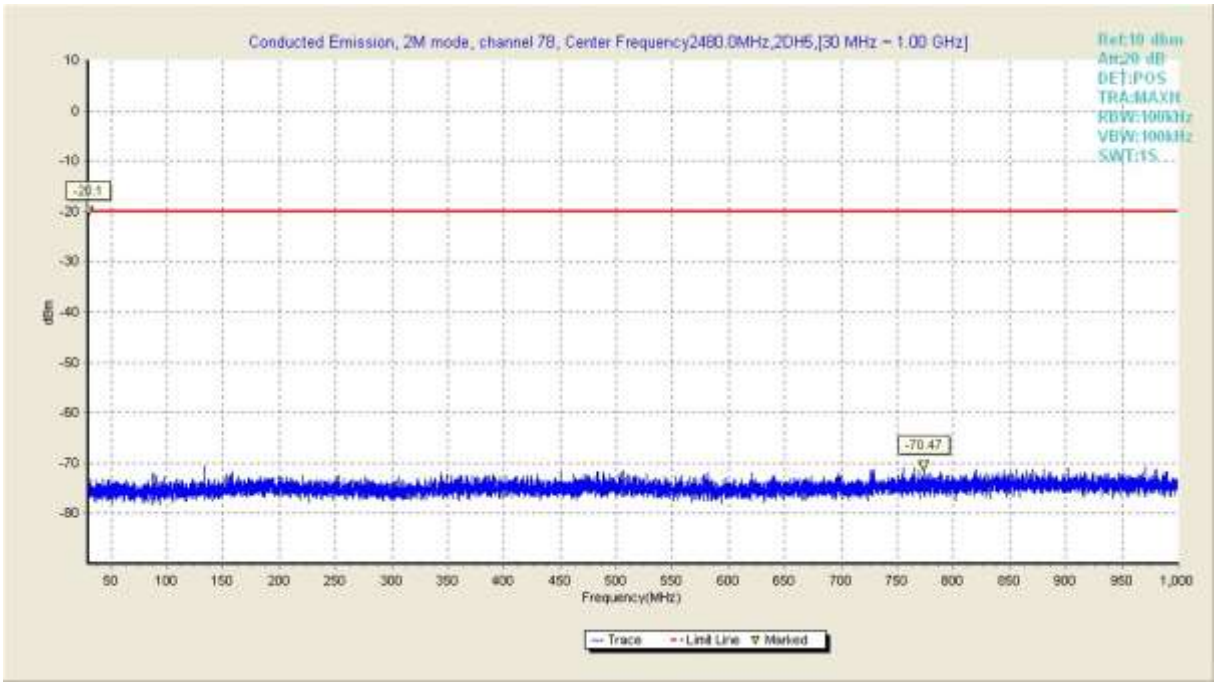


Fig.52 Conducted Emission in 2M mode ,channel 78, (30 MHz ~ 1 GHz)

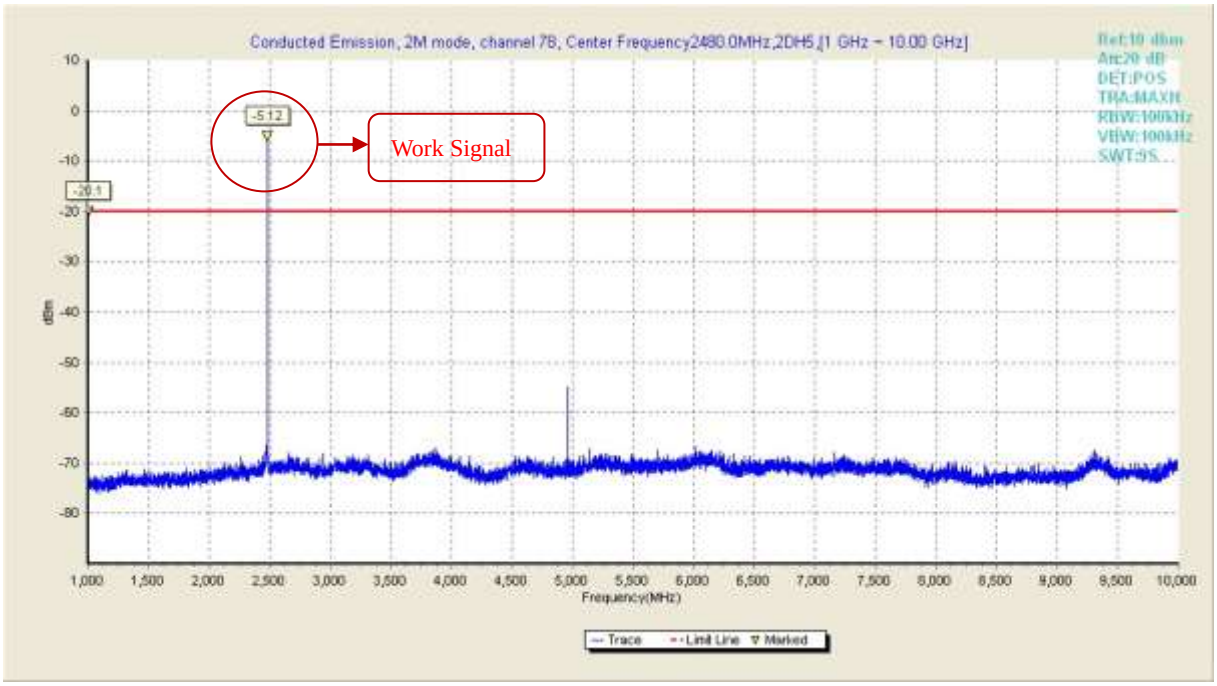


Fig.53 Conducted Emission in 2M mode ,channel 78, (1 GHz ~ 10 GHz)

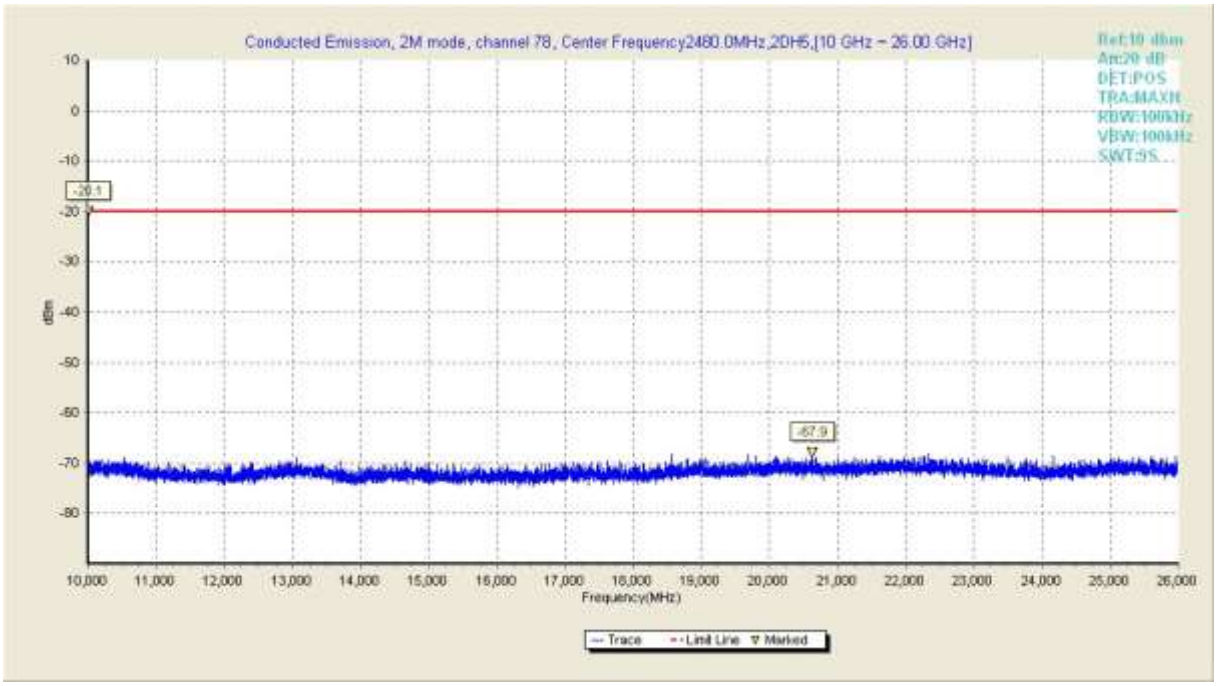


Fig.54 Conducted Emission in 2M mode ,channel 78, (10 GHz ~ 26 GHz)

8DPSK Modulation

Channel	Frequency Range	Test Results	Verdict
0	30MHz ~ 1GHz	Fig.55	Pass
	1GHz ~ 10GHz	Fig.56	Pass
	10GHz ~ 26GHz	Fig.57	Pass
39	30MHz ~ 1GHz	Fig.58	Pass
	1GHz ~ 10GHz	Fig.59	Pass
	10GHz ~ 26GHz	Fig.60	Pass
78	30MHz ~ 1GHz	Fig.61	Pass
	1GHz ~ 10GHz	Fig.62	Pass
	10GHz ~ 26GHz	Fig.63	Pass

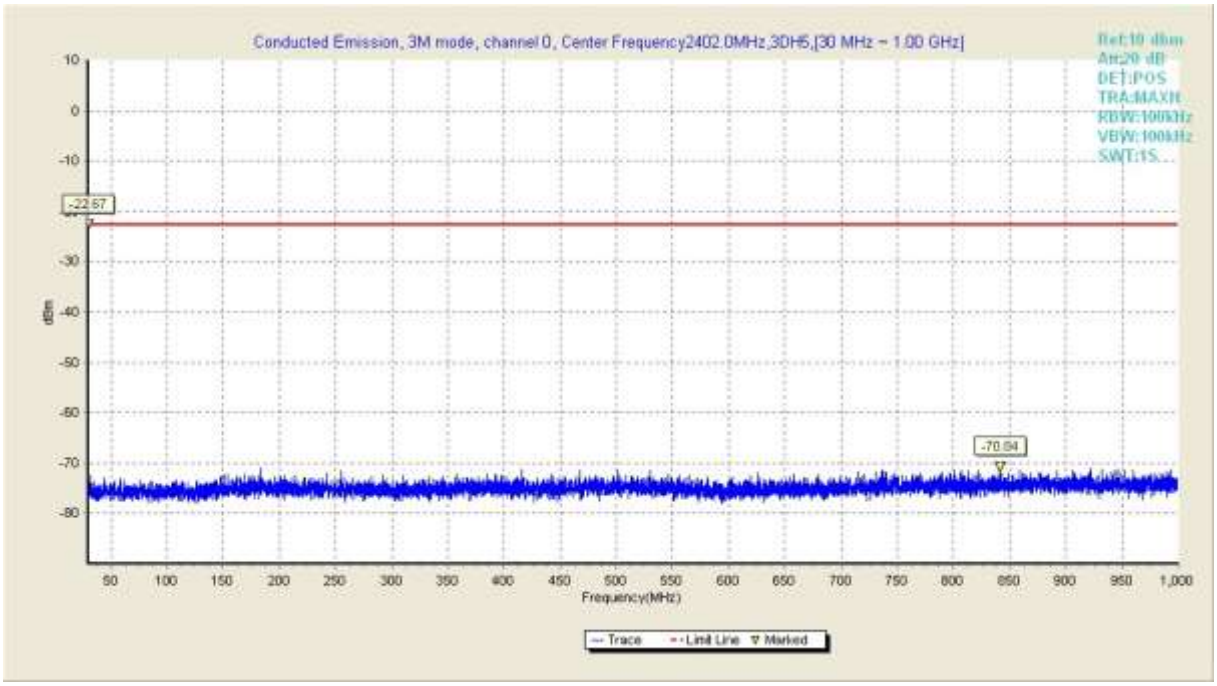


Fig.55 Conducted Emission in 3M mode ,channel 0, (30 MHz ~ 1 GHz)

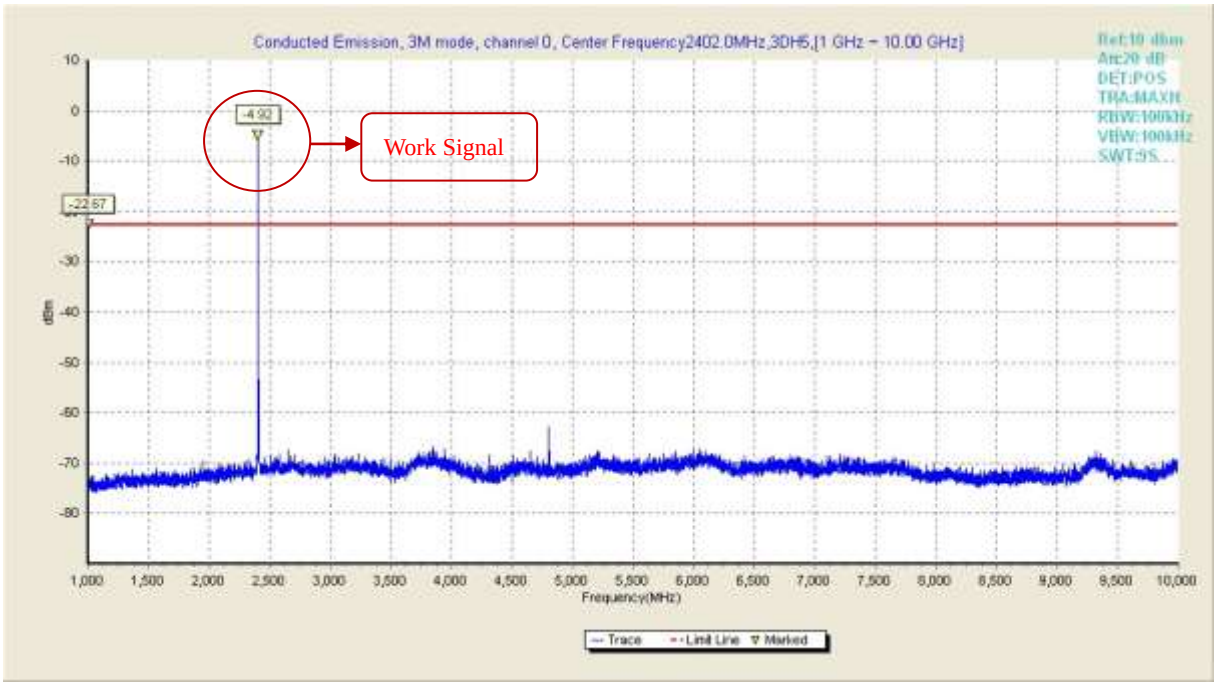


Fig.56 Conducted Emission in 3M mode ,channel 0, (1 GHz ~ 10 GHz)

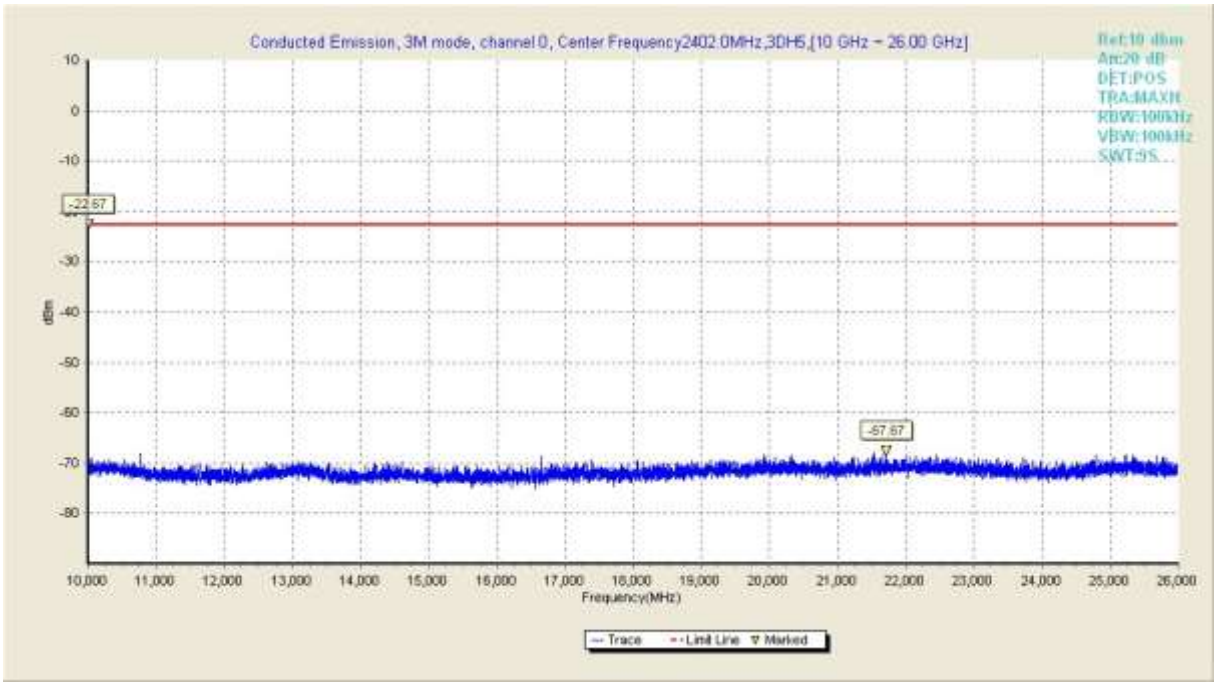


Fig.57 Conducted Emission in 3M mode ,channel 0, (10 GHz ~ 26 GHz)

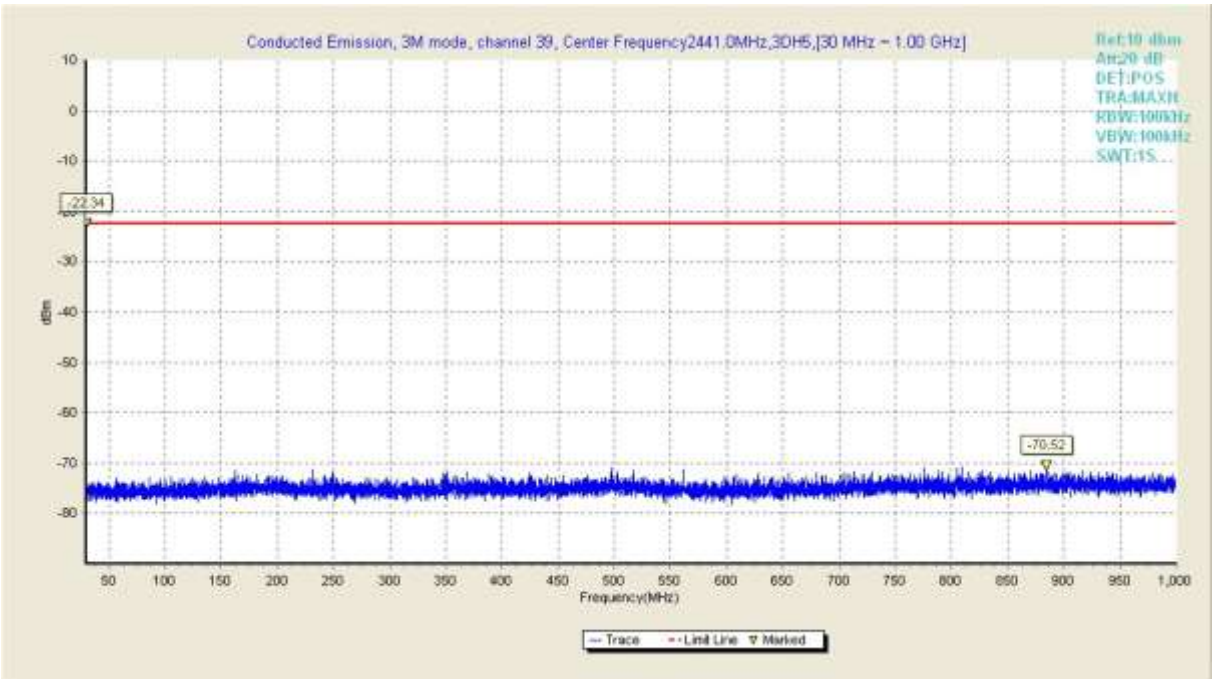


Fig.58Conducted Emission in 3M mode ,channel 39, (30 MHz ~ 1 GHz)

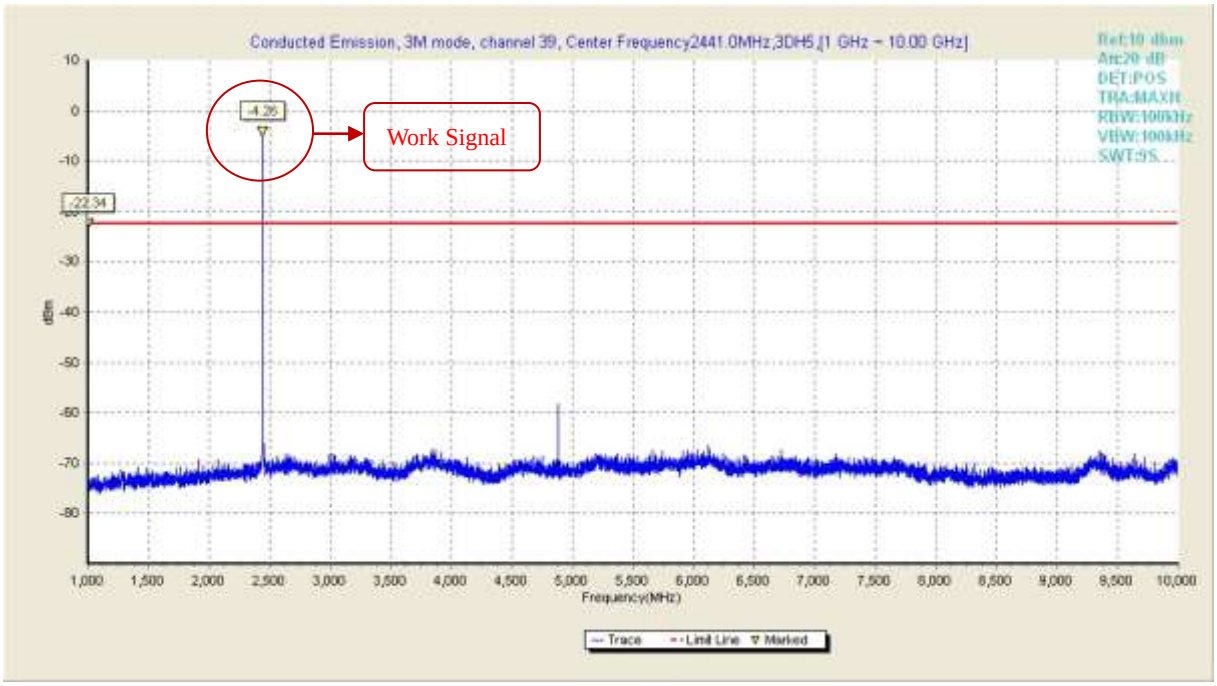


Fig.59 Conducted Emission in 3M mode ,channel 39, (1 GHz ~ 10 GHz)

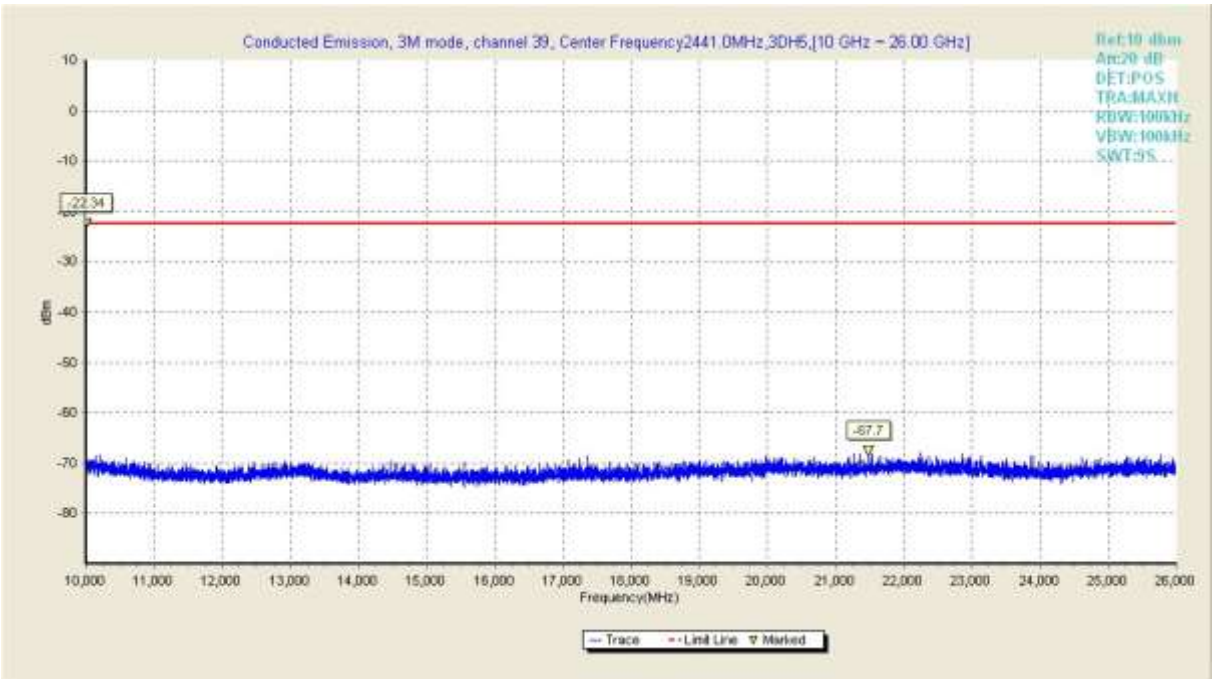


Fig.60 Conducted Emission in 3M mode ,channel 39, (10 GHz ~ 26 GHz)

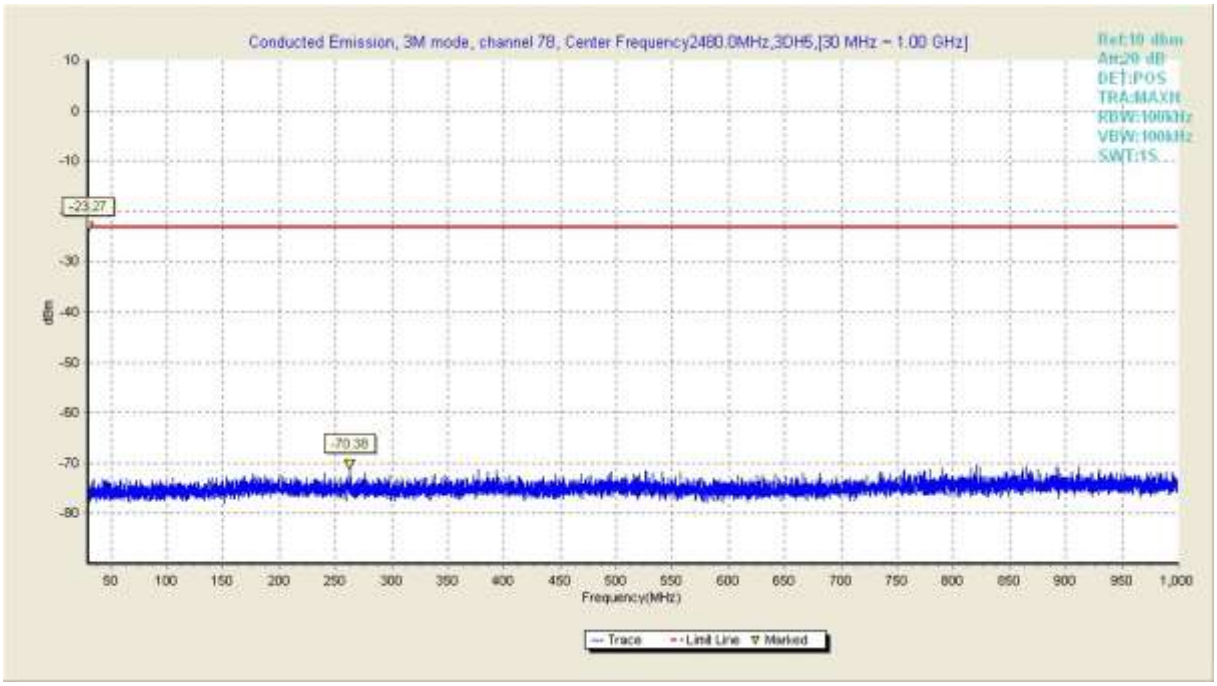


Fig.61 Conducted Emission in 3M mode ,channel 78, (30 MHz ~ 1 GHz)

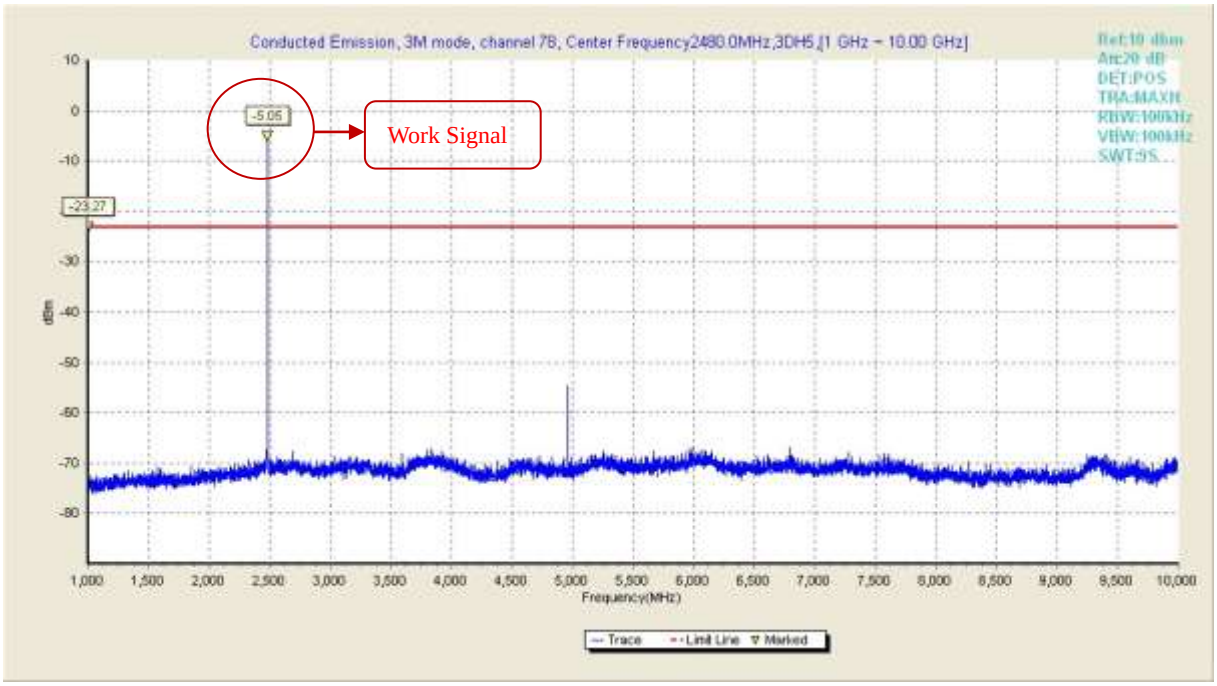


Fig.62 Conducted Emission in 3M mode ,channel 78, (1 GHz ~ 12 GHz)

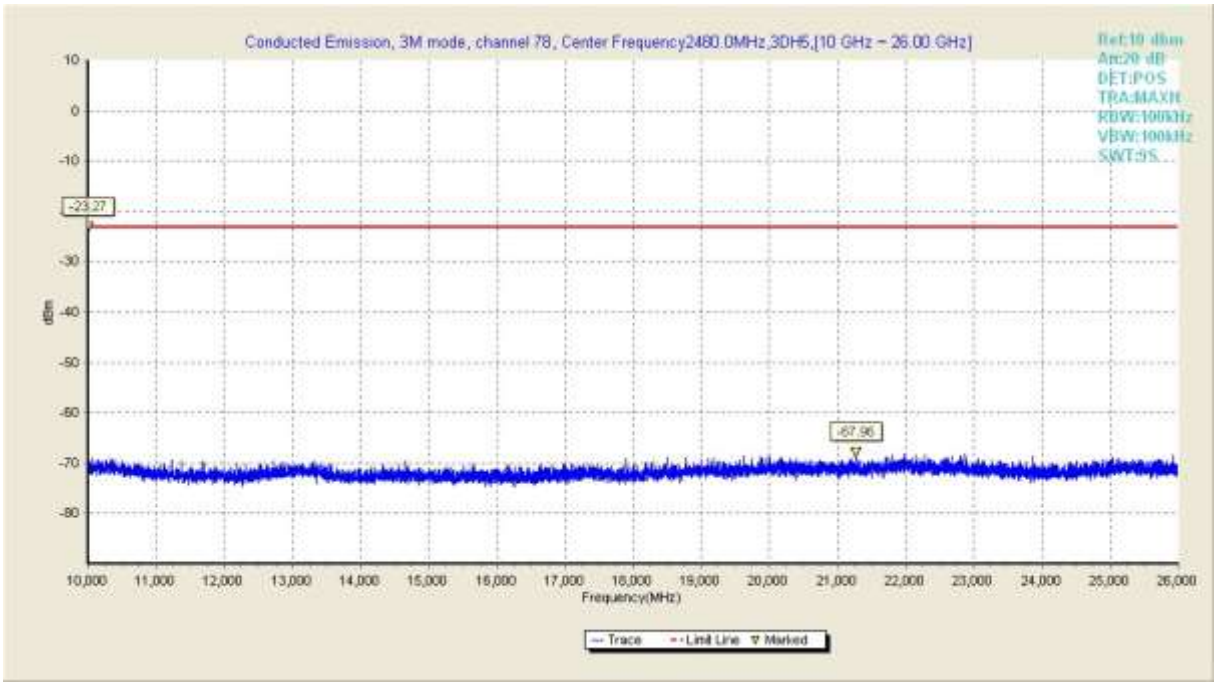


Fig.63 Conducted Emission in 3M mode ,channel 78, (10 GHz ~ 26 GHz)

B.8 AC Conducted Emission

B.8.1 Description

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits

B.8.2 Test Procedure

a) The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.

b) Connect EUT to the power mains through a line impedance stabilization network (LISN).

c) All the support units are connecting to the other LISN.

d) The LISN provides 50 ohm coupling impedance for the measuring instrument.

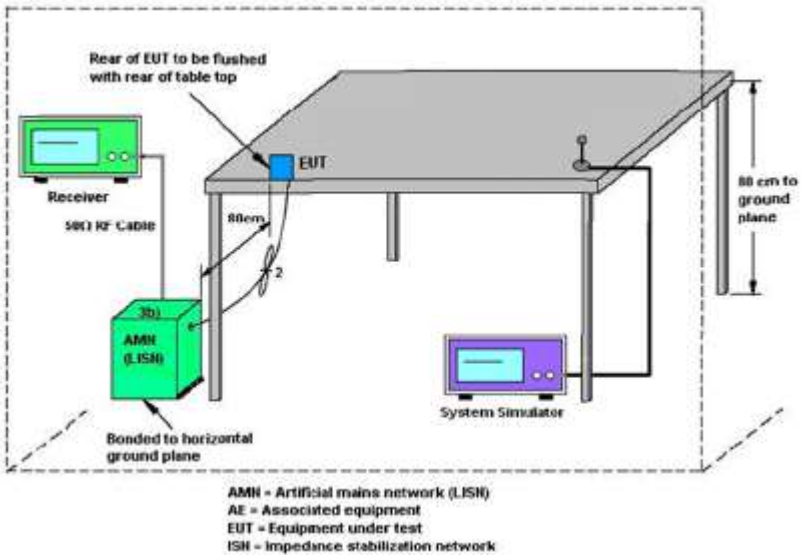
e) The FCC states that a 50 ohm, 50 microhenry LISN should be used.

f) Both sides of AC line were checked for maximum conducted interference.

g) The frequency range from 150 kHz to 30 MHz was searched.

h) Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

B.8.3 Test Setup



B.8.4 Test Results

Limit

Frequency of Emission(MHz)	**Conducted Limit(dBμV)**	
	Quasi –Peak	**Average**
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with logarithm of the frequency		

Line L

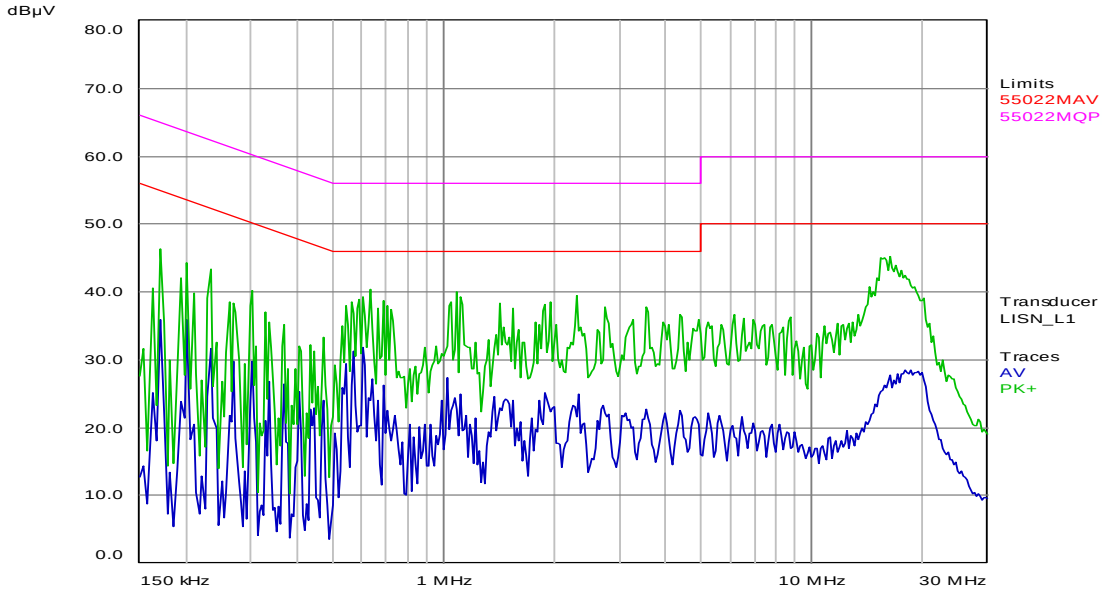
Scan Settings (1 Range)

Frequencies			Receiver Settings			
Start	**Stop**	**Step**	**Res BW**	**M-Time**	**Atten**	**Preamp**
150 kHz	30 MHz	4 kHz	9kHz (6dB)	15 ms	Auto	Off

Final Measurement

Detectors:	AV, QP	Meas Time:	1 s
Peaks:	6	Acc. Margin:	10 dB

Pre-measurement Graph



Final Measurement Results

Trace	Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 AV	0.59	28.35	46.00	-17.65		L1 / on

* = limit exceeded

Line N

Scan Settings (1 Range)

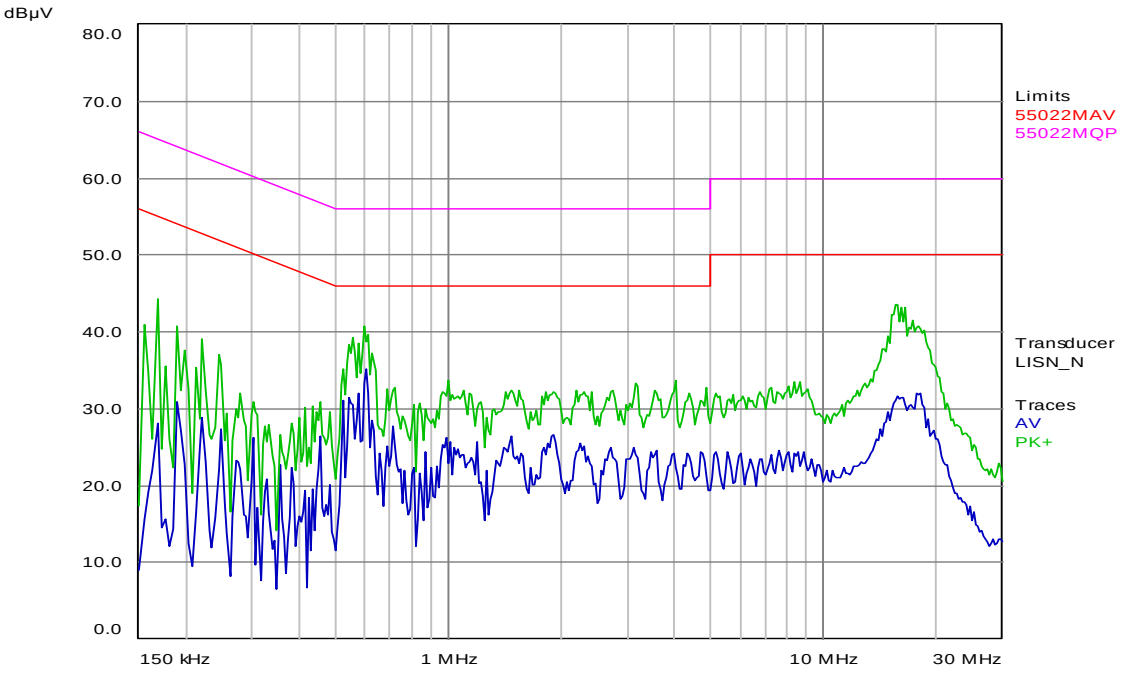
Frequencies			Receiver Settings			
Start	**Stop**	**Step**	**Res BW**	**M-Time**	**Atten**	**Preamp**
150 kHz	30 MHz	4.5 kHz	9 kHz (6dB)	15 ms	Auto	Off

Final Measurement

Detectors:	AV, QP	Meas Time:	1 s

Peaks: 6 Acc. Margin: 10 dB

Pre-measurement Graph



Final Measurement Results

Trace	Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Delta Limit (dB)	Delta Ref (dB)	Comment
1 AV	0.582	33.74	46.00	-12.26		N / on
1 AV	0.6045	33.91	46.00	-12.09		N / on
2 QP	0.6045	42.78	56.00	-13.22		N / on

* = limit exceeded

B.9 Radiated Emission

B.9.1 Limit of Radiated Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below

Frequency(MHz)	Field Strength(microvolts/meters)	Measurement Distance(Meters)
0.009-0.490	2400/F(kHz)	3000
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

30-88	100	3
88-216	150	3
216-960	200	3
above 960	500	3

B.9.2 Test Procedure

a The EUT was placed on a turntable with 1.5meter above ground.

b. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

c. The table was rotated 360 degrees to determine the position of the highest radiation.

d. The height of the antenna is varied between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.

e. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower(from 1 m to 4 m)and turntable(from 0 degree to 360 degrees)to find the maximum reading.

f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode. SA setting: Span= wide enough to fully capture the emission being measured; RBW=1MHz (f ＞ 1GHz), RBW=100kHz (f＜1GHz),VBW≥ RBW, Sweep time=auto, Trace= Max hold. Above 18GHz shall be extrapolated to specified distance using an extrapolation factor 20dB/decade from 3m to 1m.

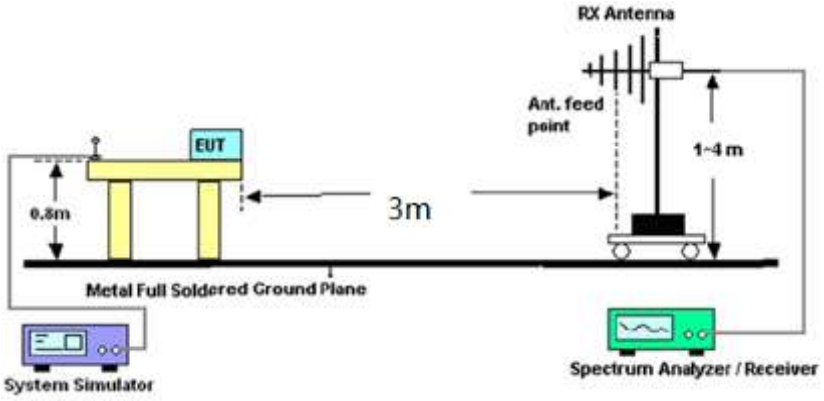
g. If the emission level of the EUT in peak mode was 20dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the quasi-peak method and reported.

h. Emission level (dBμV/m) = 20 log Emission level (μV/m).

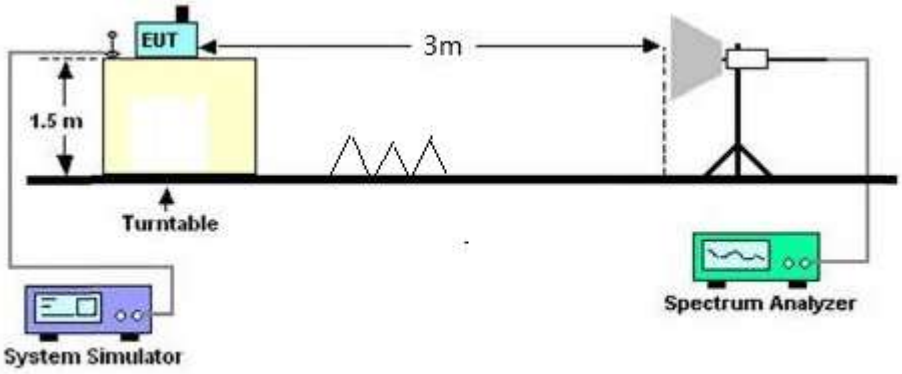
B.9.3 Test Setup

Frequency Band(MHz)	Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	100kHz	100kHz
Above 1000	Peak	1MHz	1MHz
	Average	1MHz	10Hz

Radiated Emissions Frequency: Below 1GHz



Radiated Emissions Frequency: above 1GHz



B.9.4 Test Results

The low frequency, which started from 9kHz to 30MHz and the high frequency, which started from 18GHz

to 26GHz, were pre-scanned and which was 20dB lower than limit line per 15.31(0) were not reported.

Worst case data rate: 1M

Test Mode: Traffic

Verdict: Pass

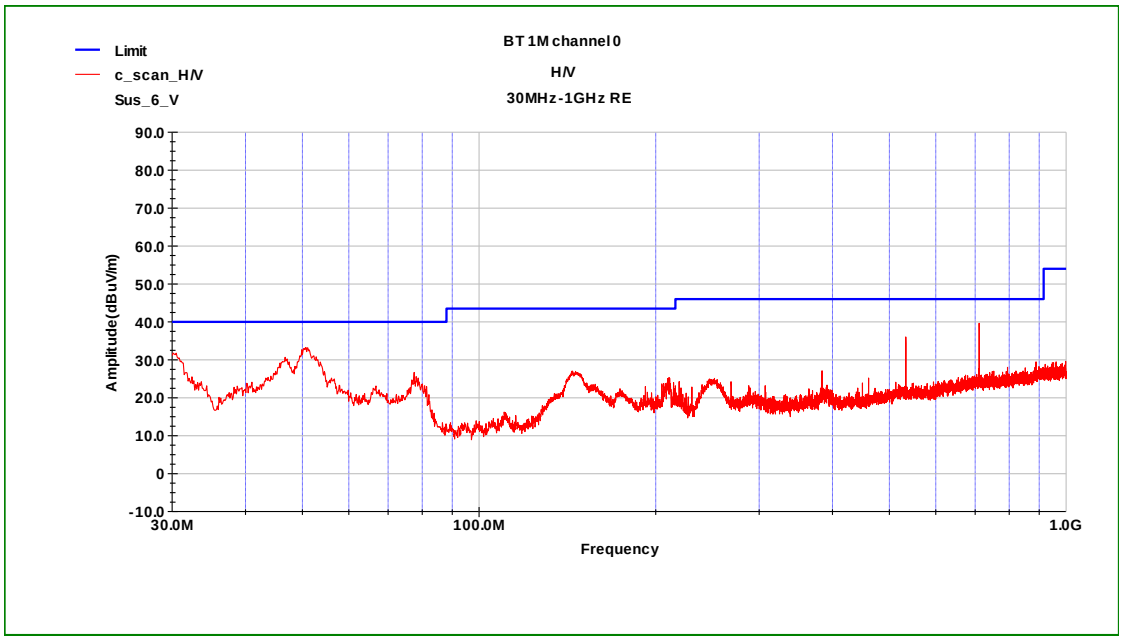


Fig.65Radiated Emission of channel 0 in 30MHz-1GHz

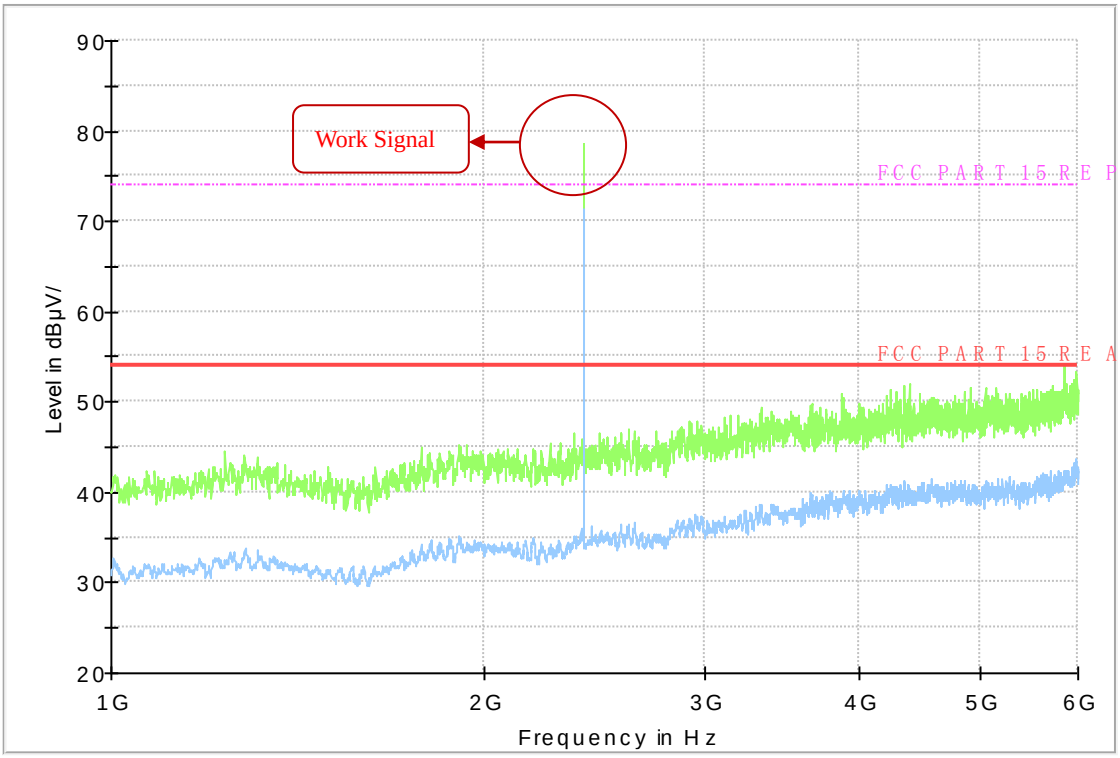


Fig.63 Radiated Emission of channel 0 in 1GHz-6GHz

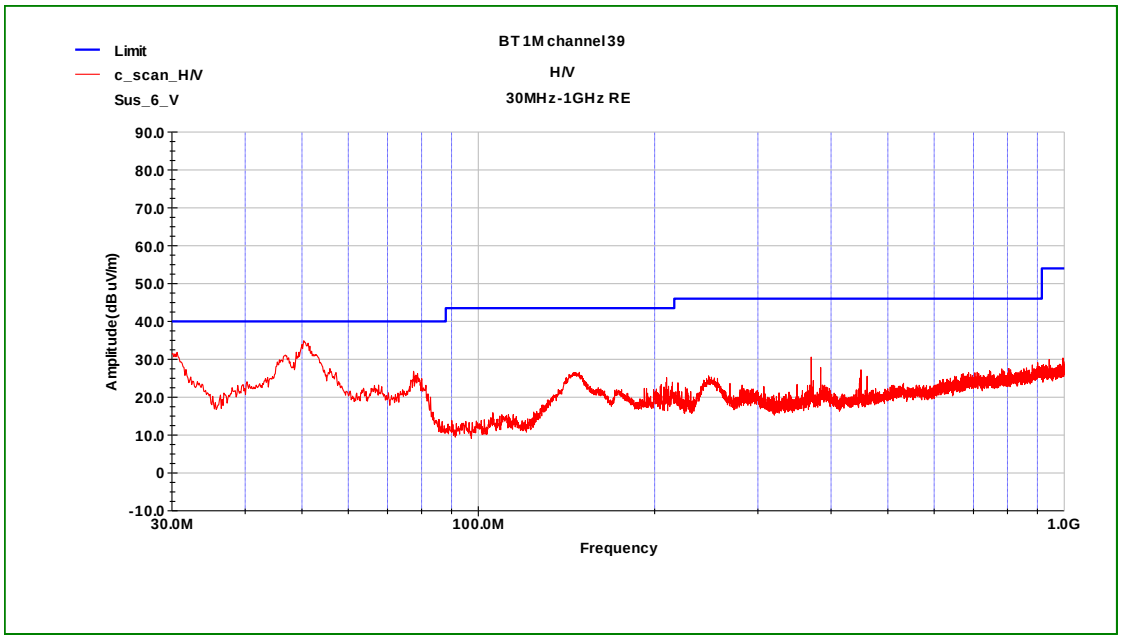


Fig.66 Radiated Emission of channel 39 in 30MHz-1GHz

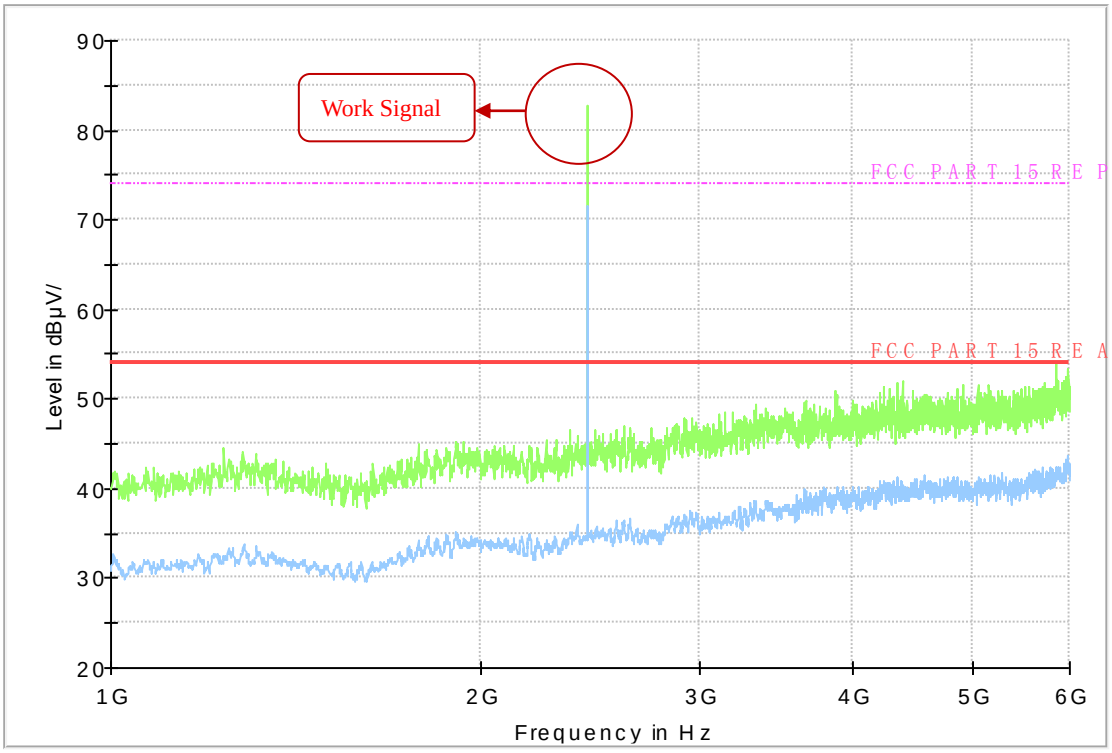


Fig.67 Radiated Emission of channel 39 in 1GHz-6GHz

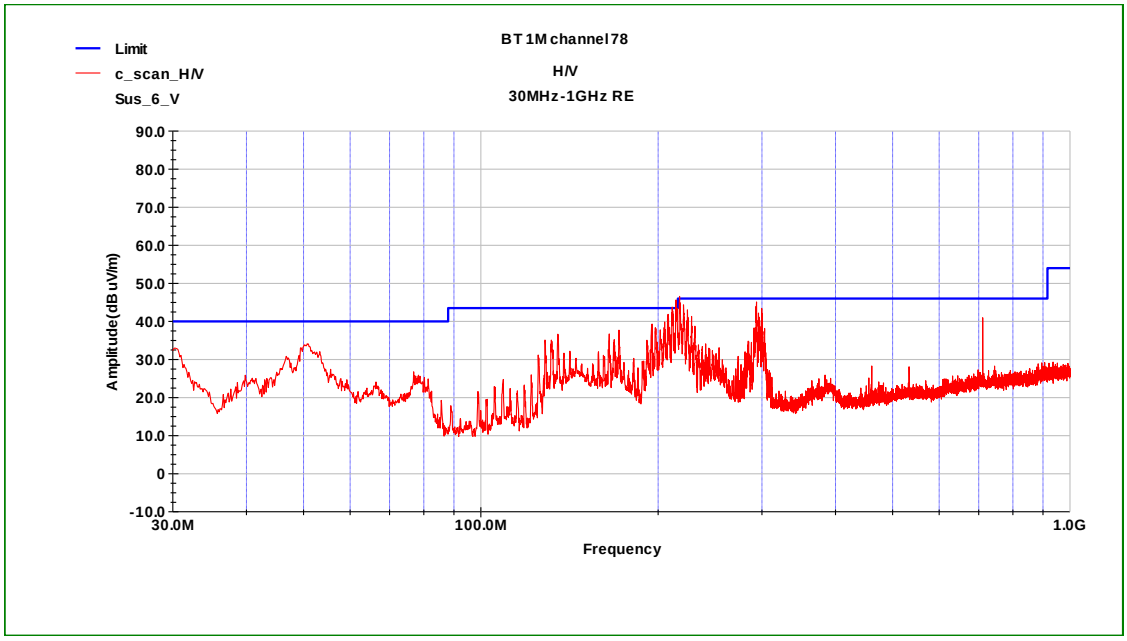


Fig.68 Radiated Emission of channel 78 in 30MHz-1GHz

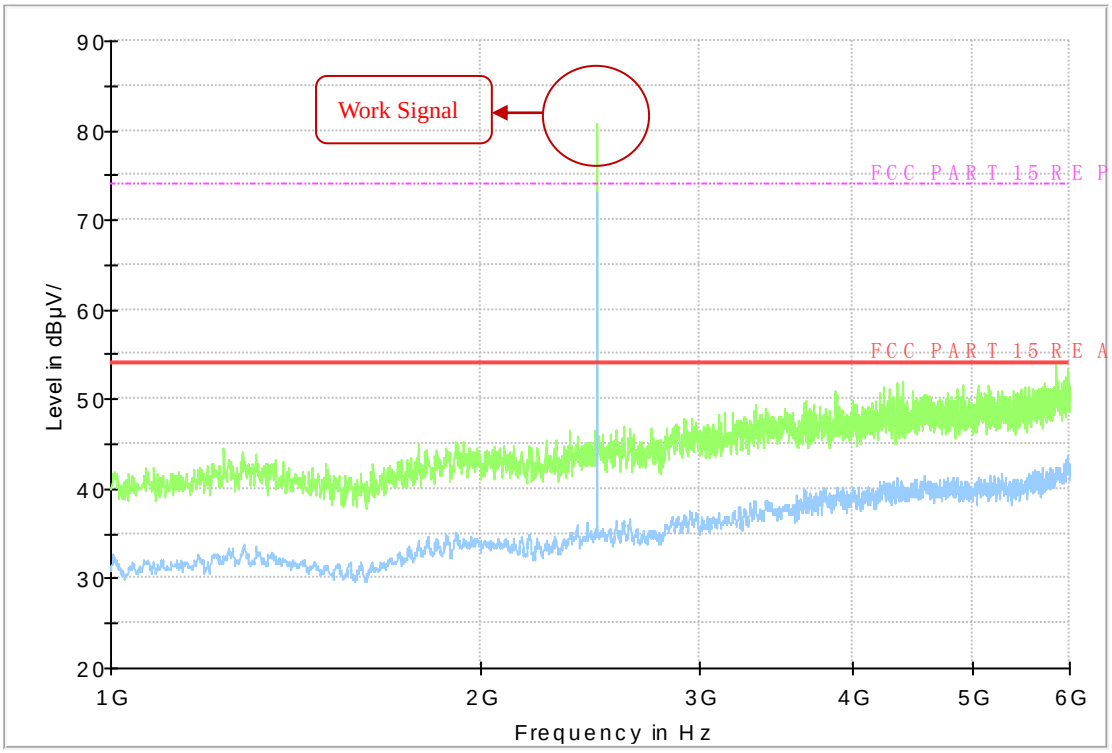


Fig.69 Radiated Emission of channel 78 in 1GHz-6GHz

B.10 Antenna Requirements

B.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an

antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

B.10.2 Antenna Connected construction

The Antenna type used in this product is PIFA Antenna without connector and it is considered to meet antenna requirement.

B.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6dBi, Therefore, it is not necessary to reduced maximum peak output power limit.

ANNEX C: Report Revision History

Report NO.	Report version	Description	Issue Date
GCCT16CFR01-BT	NONE	Original	2016.04.07

END OF REPORT