FCC PART 15C
TEST REPORT
No. **I18Z60491-IOT01**

for

LG Electronics MobileComm USA, Inc.

Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN

Model Name: LM-X410FCW,LMX410FCW,X410FCW

FCC ID: ZNFX410FCW

with

Hardware Version: Rev.1.0

Software Version: V09p

Issued Date: 2018-4-17

TESTING
NVLAP LAB CODE 600118-0

Note:

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Test Laboratory:

CTTL, Telecommunication Technology Labs, CAICT

No.52, HuayuanNorth Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512,Fax:+86(0)10-62304633-2504

Email:cttl_terminals@caict.ac.cn, website:www.caict.ac.cn

REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18Z60491-IOT01	Rev.0	1st edition	2018-4-17

CONTENTS

1. Test Laboratory

1.1. Testing Location

Conducted testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China100191

Radiated testing Location: CTTL(Shouxiang)

Address: No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191

1.2. Testing Environment

Normal Temperature: 15-35℃

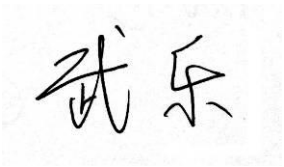
Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2018-3-15

Testing End Date: 2018-4-12

1.4. Signature

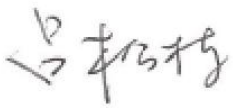


Wu Le

(Prepared this test report)

Sun Zhenyu

(Reviewed this test report)



Lv Songdong

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	LG Electronics MobileComm USA, Inc.
Address /Post:	1000 Sylvan Avenue, Englewood Cliffs NJ 07632
City:	/
Postal Code:	/
Country:	/
Telephone:	/
Fax:	/

2.2. Manufacturer Information

Company Name:	LG Electronics Inc.
Address /Post:	LG Twin Tower 20, Yeouido-dong, Yeongdeungpo-gu Seoul, Korea 150-721
City:	/
Postal Code:	/
Country:	/
Telephone:	/
Fax:	/

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

3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model Name	LM-X410FCW,LMX410FCW ,X410FCW
FCC ID	ZNFX410FCW
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation	GFSK/π/4 DQPSK/8DPSK
Number of Channels	79
Power Supply	3.8V DC by Battery

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	/	Rev.1.0	V09p
EUT2	/	Rev.1.0	V09p

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE

AE ID*	Description
AE1	Battery
AE2	Battery
AE3	Charger
AE4	USB cable

*AE ID: is used to identify the test sample in the lab internally.

3.4. Normal Accessory setting

Fully charged battery should be used during the test.

3.5. General Description

The Equipment Under Test (EUT) is a model of Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfill the test. Samples undergoing test were selected by the Client.

4. Reference Documents

4.1. Documents supplied by applicant

EUT feature information is supplied by the applicant or manufacturer, which is the basis of testing.

4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902–928MHz, 2400–2483.5 MHz, and 5725–5850 MHz.	2016
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	June,2013

5. Test Results

5.1. Summary of Test Results

Abbreviations used in this clause:

P Pass, The EUT complies with the essential requirements in the standard.

F Fail, The EUT does not comply with the essential requirements in the standard

NA Not Applicable, The test was not applicable

NP Not Performed, The test was not performed by CTTL

SUMMARY OF MEASUREMENT RESULTS	Sub-clause	Verdict
Peak Output Power - Conducted	15.247 (b)(1)	**P**
Frequency Band Edges	15.247 (d)	**P**
Transmitter Spurious Emission - Conducted	15.247 (d)	**P**
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	**P**
Time of Occupancy (Dwell Time)	15.247 (a) (1)(iii)	**P**
20dB Bandwidth	15.247 (a)(1)	**NA**
Carrier Frequency Separation	15.247 (a)(1)	**P**
Number of hopping channels	15.247 (a)(b)(iii)	**P**
AC Powerline Conducted Emission	15.107, 15.207	**P**

Please refer to **ANNEX A** for detail.

The measurement is made according to ANSI C63.10.

5.2. Statements

CTTL has evaluated the test cases requested by the applicant /manufacturer as listed in section 5.1 of this report for the EUT specified in section 3 according to the standards or reference documents listed in section 4.2

This model is a variant product which model name is LM-X410HC,LMX410HC,X410HC;LM-X410 RC,LMX410RC,X410RC;all the test result has been derived from test report of LM-X410HC,LMX 410HC,X410HC;LM-X410RC,LMX410RC,X410RC.

6. Test Facilities Utilized

Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ26	200136	Rohde & Schwarz	1 year	2018-09-30
2	Bluetooth Tester	CBT32	100649	Rohde & Schwarz	1 year	2018-09-29
3	LISN	ENV216	101200	Rohde & Schwarz	1 year	2018-08-03
4	Test Receiver	ESCI	100344	Rohde & Schwarz	1 year	2019-02-28
5	Shielding Room	S81	/	ETS-Lindgren	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100376	Rohde & Schwarz	1 year	2018-12-27
2	BiLog Antenna	VULB9163	9163-514	Schwarzbeck	3 years	2020-02-23
3	EMI Antenna	3117	00139065	ETS-Lindgren	3 Years	2020-11-15
4	EMI Antenna	3116	2663	ETS-Lindgren	3 Years	2020-05-31
5	Vector Signal Analyzer	FSV	101047	Rohde & Schwarz	1 year	2018-07-22
6	Station Simulator	CMW500	159408	Rohde & Schwarz	1 year	2019-04-12

7. Measurement Uncertainty

7.1. Peak Output Power - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB

7.2. Frequency Band Edges

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB

7.3. Transmitter Spurious Emission - Conducted

Measurement Uncertainty:

Frequency Range	Uncertainty (k=2)
30 MHz ~ 8 GHz	1.22dB
8 GHz ~ 12.75 GHz	1.51dB
12.7GHz ~ 26 GHz	1.51dB

7.4. Transmitter Spurious Emission - Radiated

Measurement Uncertainty:

Frequency Range	Uncertainty (k=2)
＜ 1 GHz	4.86dB
＞ 1 GHz	5.26dB

7.5. Time of Occupancy (Dwell Time)

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.88ms

7.6. 20dB Bandwidth

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz

7.7. Carrier Frequency Separation

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz

7.8. AC Powerline Conducted Emission

Measurement Uncertainty:

Measurement Uncertainty (k=2)	3.38dB

ANNEX A: Detailed Test Results

A.1. Measurement Method

A.1.1. Conducted Measurements

The measurement is made according to ANSI C63.10.

1). Connect the EUT to the test system correctly.

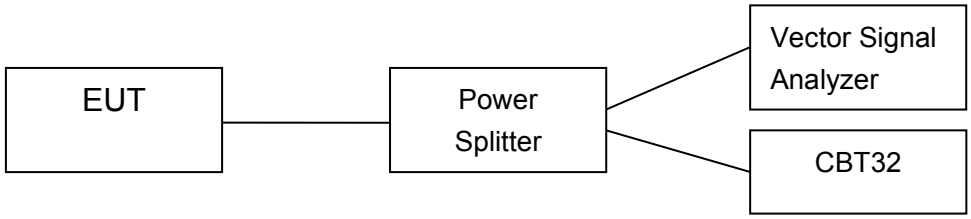
2). Set the EUT to the required work mode (Transmitter, receiver or transmitter & receiver).

3). Set the EUT to the required channel.

4). Set the EUT hopping mode (hopping or hopping off).

5). Set the spectrum analyzer to start measurement.

6). Record the values. Vector Signal Analyzer



A.1.2. Radiated Emission Measurements

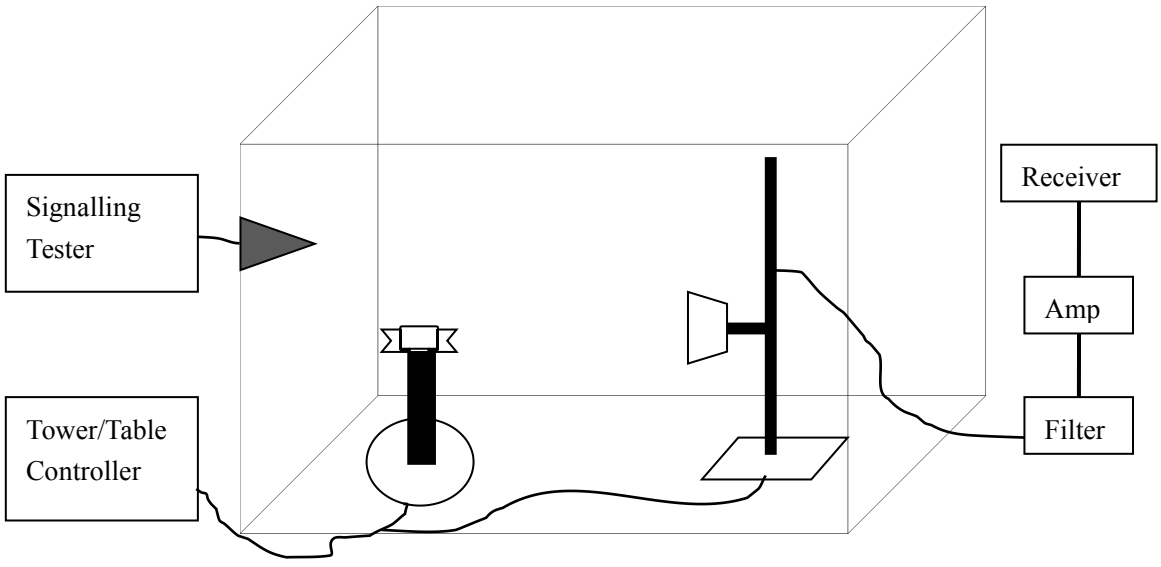
The measurement is made according to ANSI C63.10

The radiated emission test is performed in semi-anechoic chamber. The distance from the EUT to the reference point of measurement antenna is 3m. The test is carried out on both vertical and horizontal polarization and only maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result.

In the case of radiated emission, the used settings are as follows,

Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;

Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 1MHz;



A.2. Peak Output Power – Conducted

Method of Measurement: See ANSI C63.10-clause 7.8.5

a) Use the following spectrum analyzer settings:

- Span: 6MHz
- RBW: 3MHz
- VBW: 3MHz
- Sweep time: 2.5ms
- Detector function: peak
- Trace: max hold

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power.

Measurement Limit:

Standard	Limit (dBm)
FCC Part 15.247(b)(1)	< 30

Measurement Results:

For GFSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.84	7.06	6.85	P

For π/4 DQPSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.63	6.55	6.51	P

For 8DPSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.89	6.83	6.81	P

Conclusion: PASS

A.3. Frequency Band Edges – Conducted

Method of Measurement: See ANSI C63.10-clause 7.8.6

Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described below (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).

– Span: 10 MHz
– Resolution Bandwidth: 100 kHz
– Video Bandwidth: 300 kHz
– Sweep Time:Auto
– Detector: Peak
– Trace: max hold

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel.

Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an absolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.

Measurement Limit:

Standard	Limit (dBc)
FCC 47 CFR Part 15.247 (d)	< -20

Measurement Result:

For GFSK

Channel	Hopping	Band Edge Power (dBc)		Conclusion
0	Hopping OFF	Fig.1	-49.78	P
	Hopping ON	Fig.2	-57.64	P
78	Hopping OFF	Fig.3	-61.98	P
	Hopping ON	Fig.4	-65.12	P

For π/4 DQPSK

Channel	Hopping	Band Edge Power (dBc)		Conclusion
0	Hopping OFF	Fig.5	-53.61	P
	Hopping ON	Fig.6	-61.18	P
78	Hopping OFF	Fig.7	-58.77	P
	Hopping ON	Fig.8	-64.17	P

For 8DPSK

Channel	Hopping	Band Edge Power (dBc)		Conclusion
0	Hopping OFF	Fig.9	-53.13	P
	Hopping ON	Fig.10	-61.05	P

78	Hopping OFF	Fig.11	-63.74	P
	Hopping ON	Fig.12	-64.58	P

Conclusion: PASS

Test graphs as below

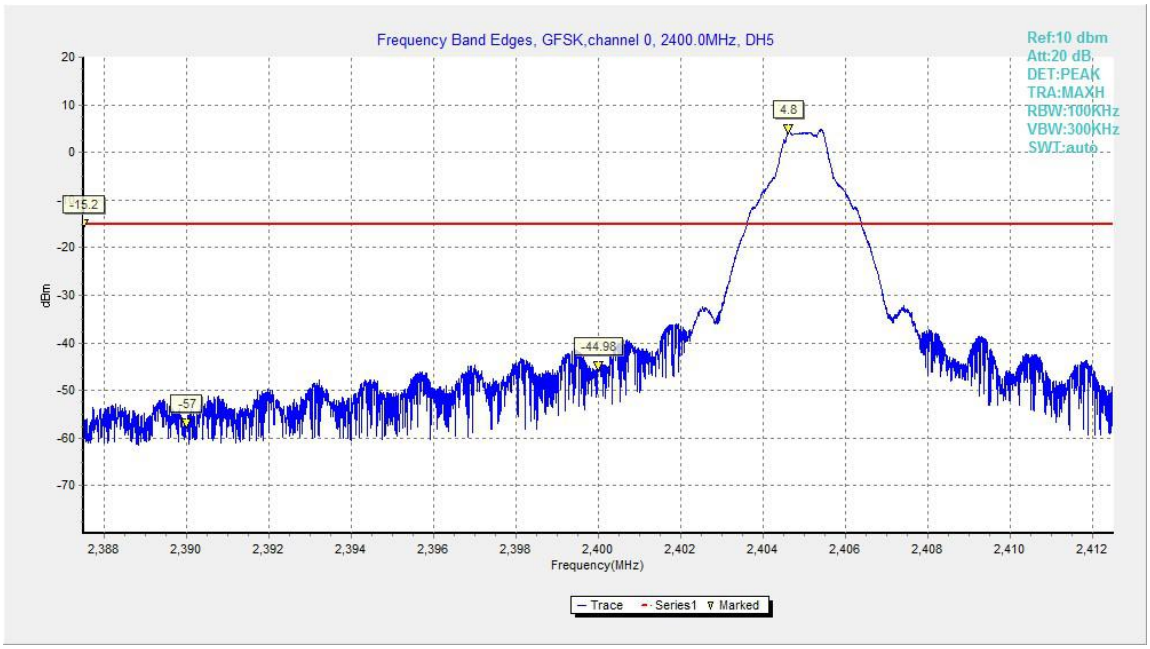


Fig.1. Frequency Band Edges: GFSK, Channel 0, Hopping Off

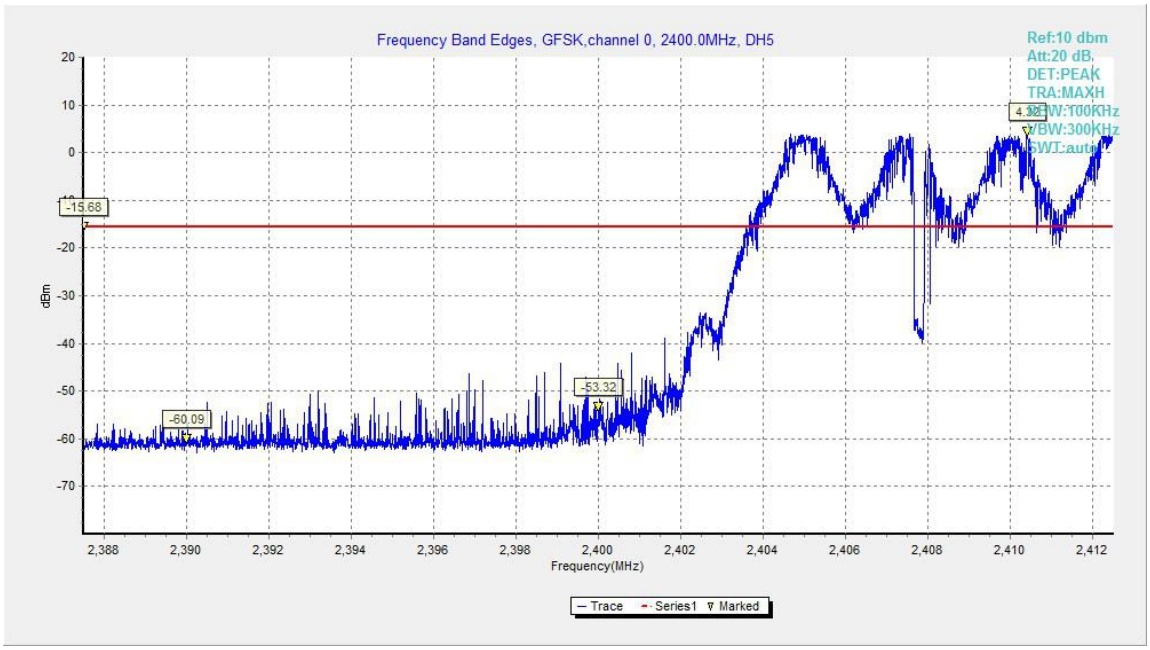


Fig.2. Frequency Band Edges: GFSK, Channel 0, Hopping On

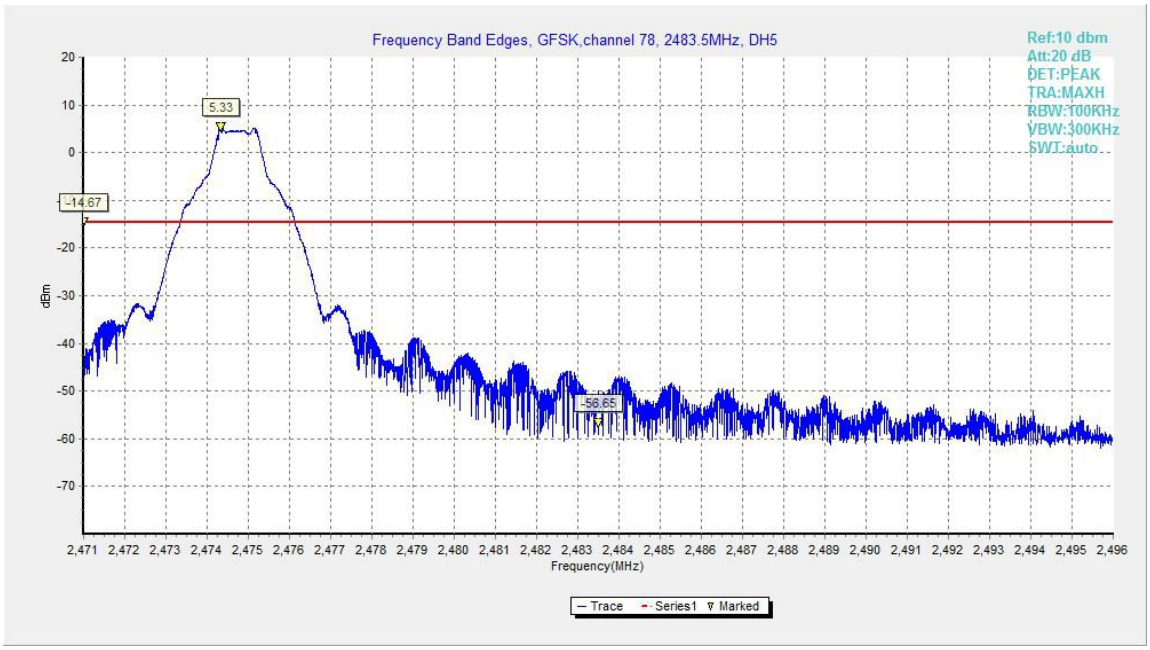


Fig.3. Frequency Band Edges: GFSK, Channel 78, Hopping Off

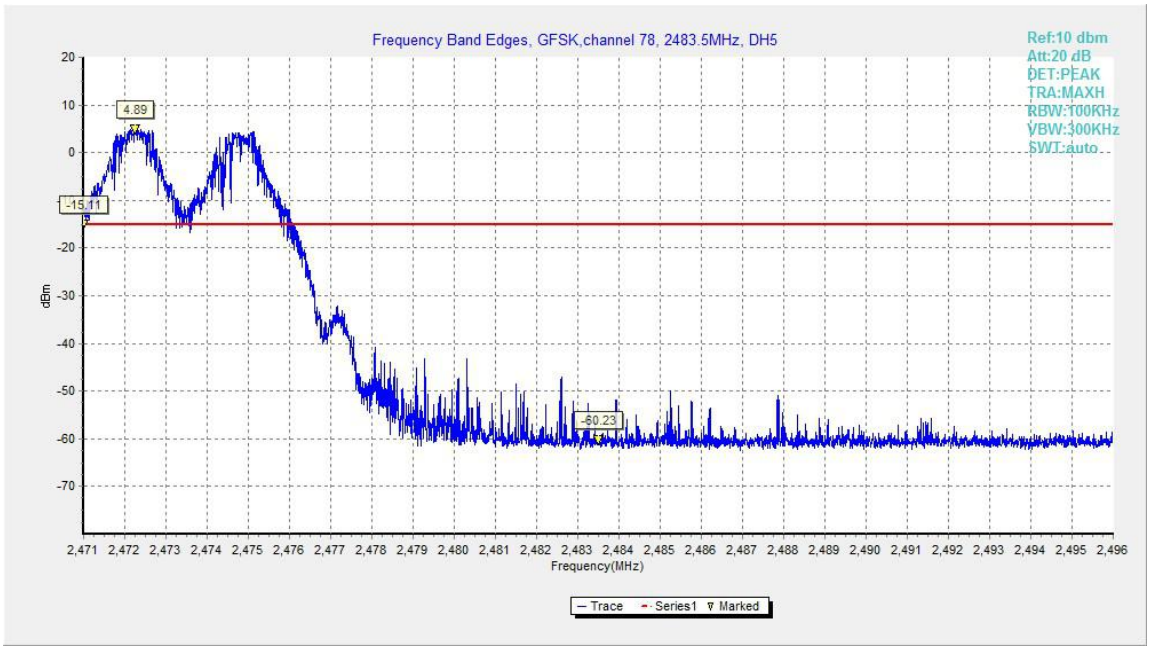


Fig.4. Frequency Band Edges: GFSK, Channel 78, Hopping On

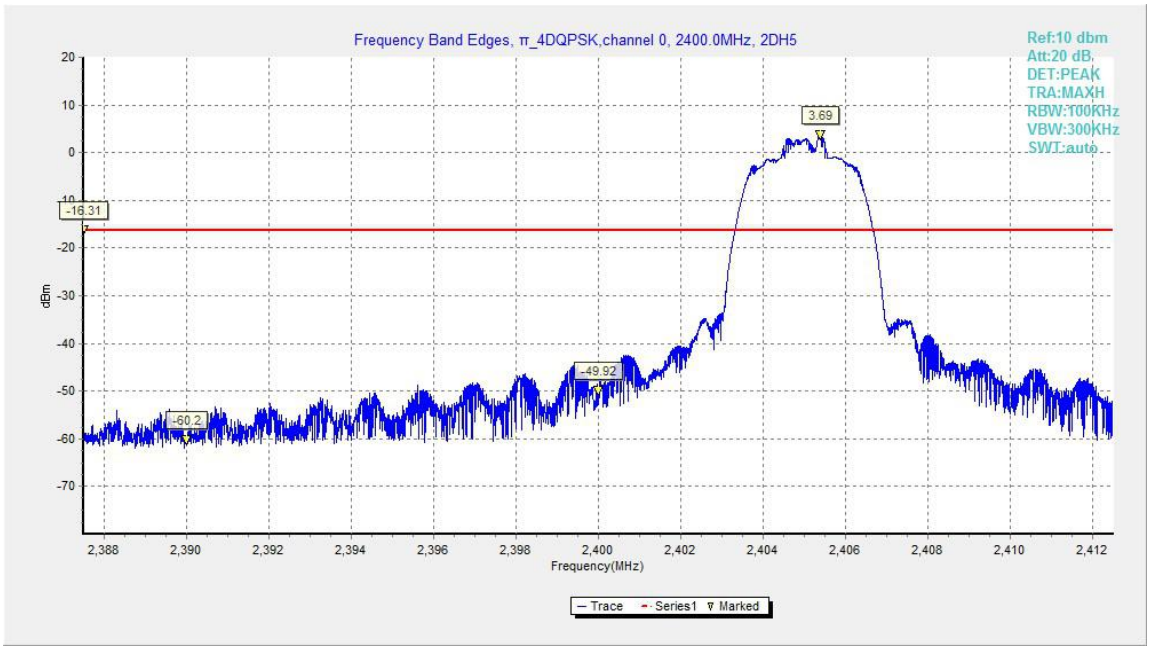


Fig.5. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping Off

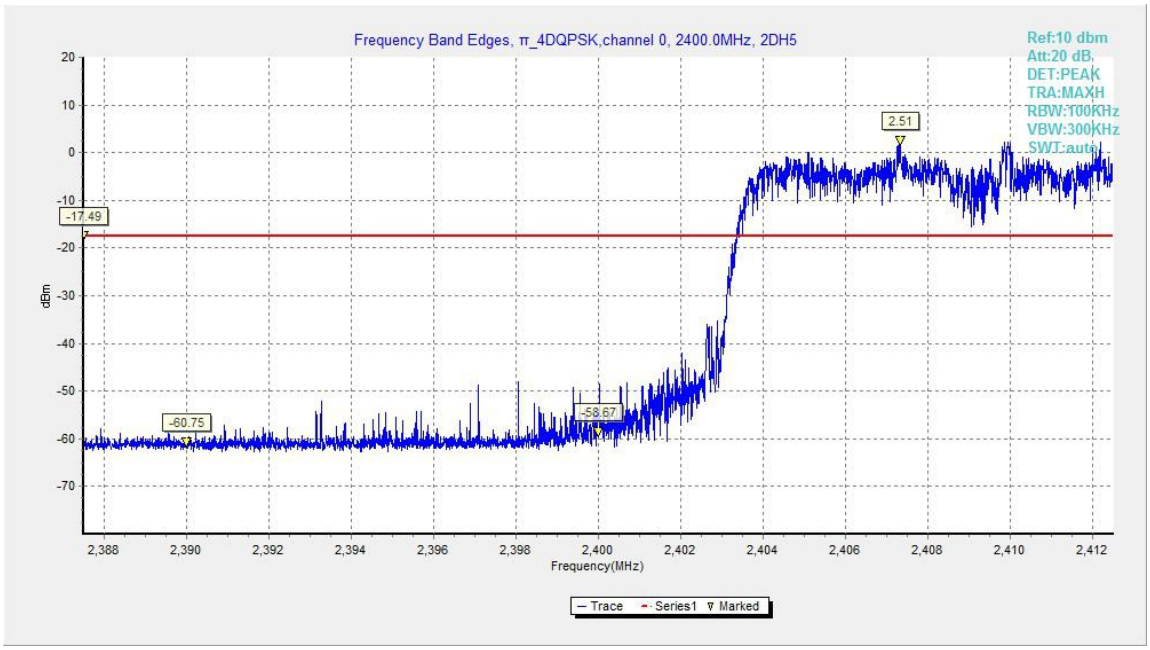


Fig.6. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping On

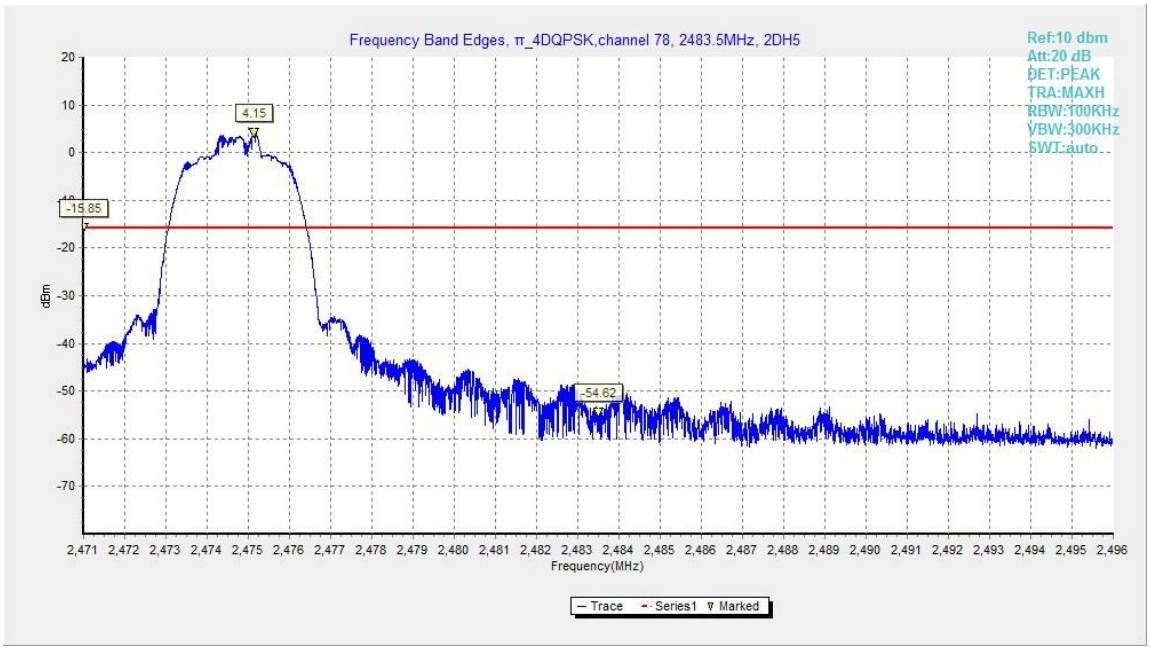


Fig.7. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping Off

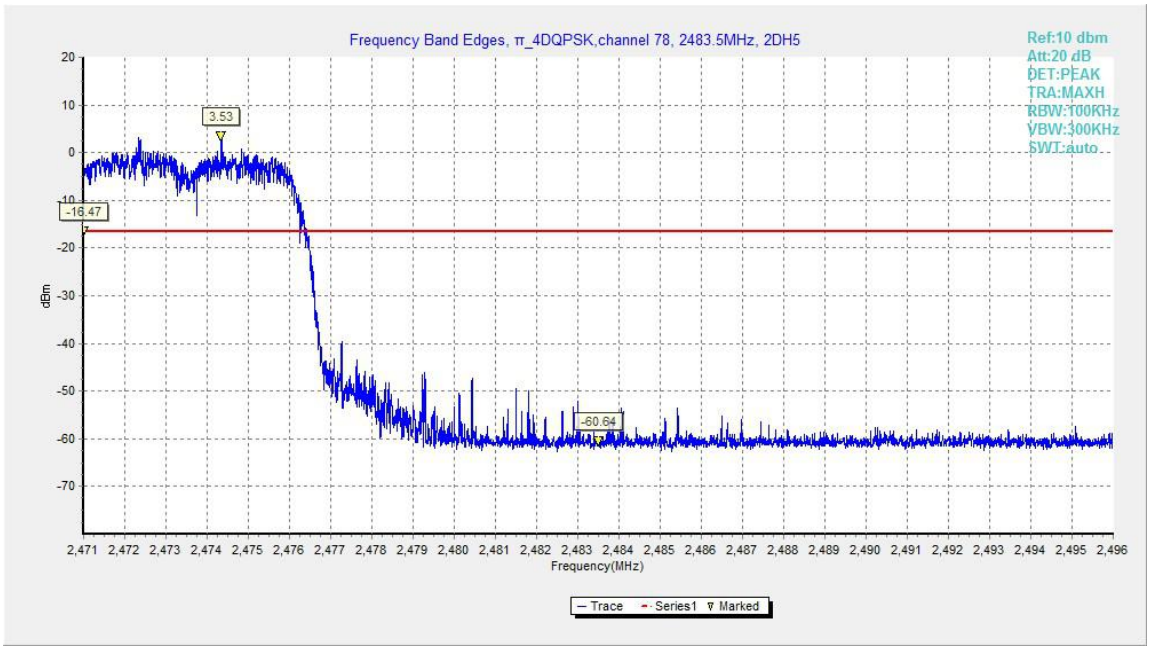


Fig.8. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping On

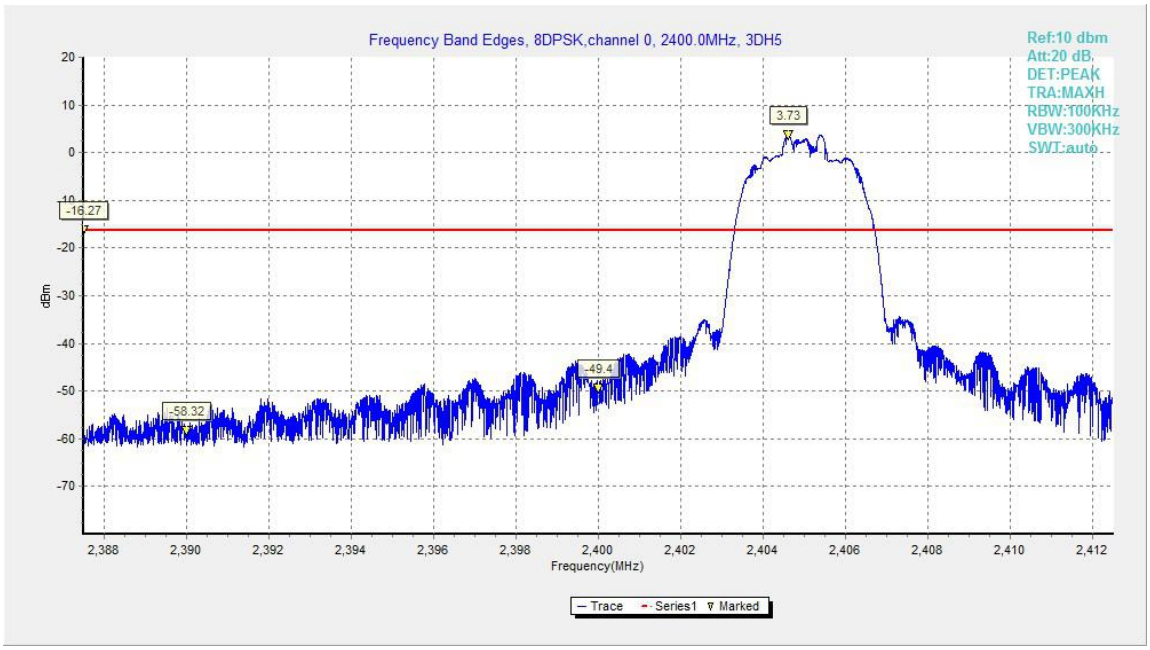


Fig.9. Frequency Band Edges: 8DPSK, Channel 0, Hopping Off

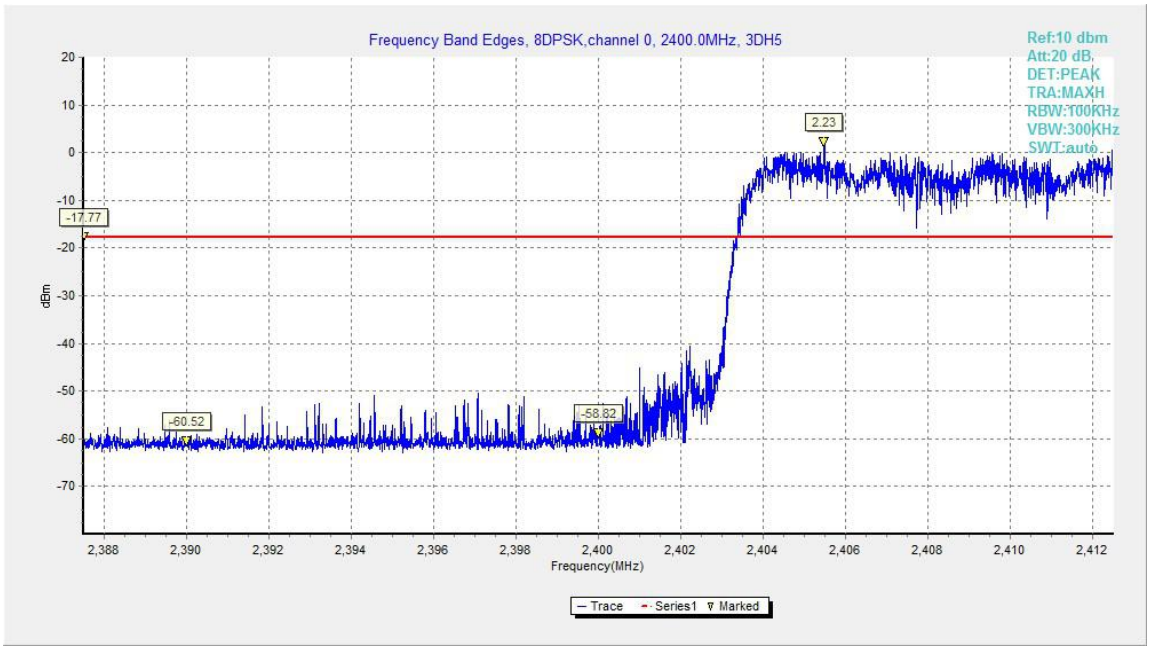


Fig.10. Frequency Band Edges: 8DPSK, Channel 0, Hopping On

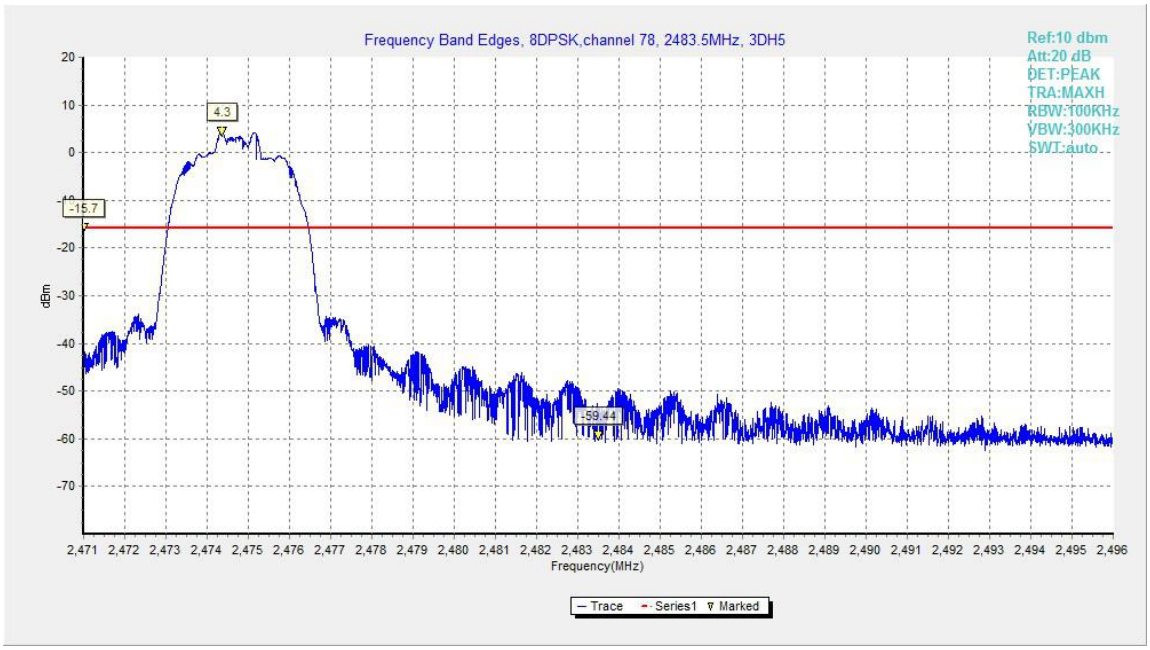


Fig.11. Frequency Band Edges: 8DPSK, Channel 78, Hopping Off

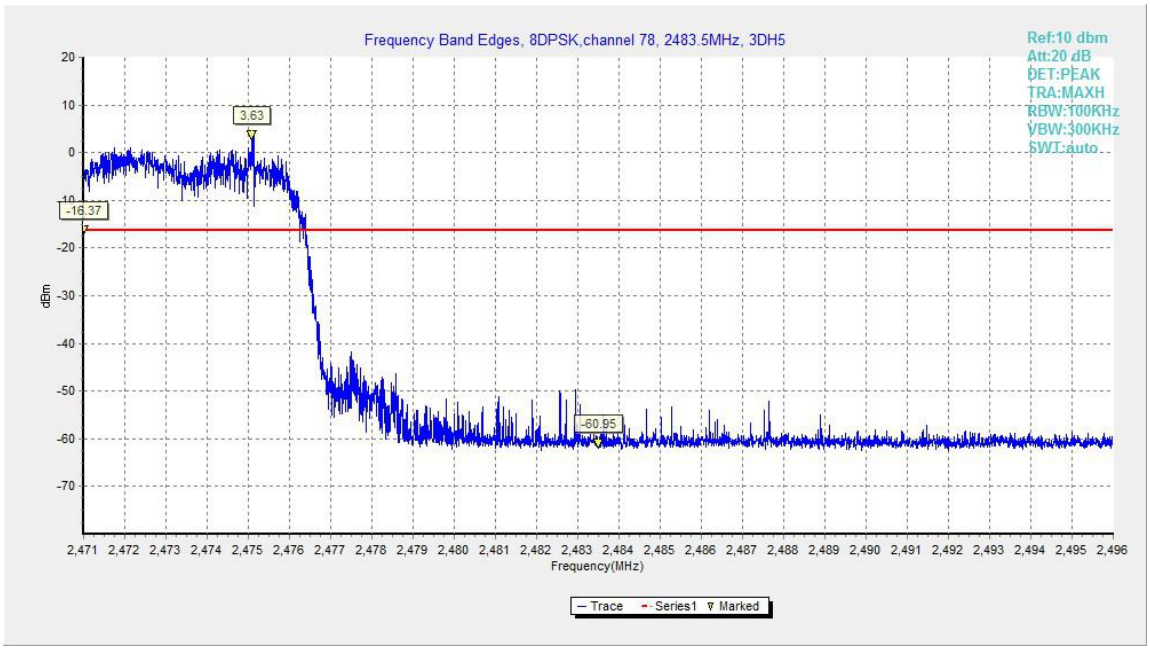


Fig.12. Frequency Band Edges: 8DPSK, Channel 78, Hopping On

A.4. Transmitter Spurious Emission - Conducted

Method of Measurement: See ANSI C63.10-clause 7.8.8

Measurement Procedure – Reference Level

1. Set the RBW = 100 kHz.

2. Set the VBW = 300 kHz.

3. Set the span to 5-30 % greater than the EBW.

4. Detector = peak.

5. Sweep time = auto couple.

6. Trace mode = max hold.

7. Allow trace to fully stabilize.

8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW. Next, determine the power in 100 kHz band segments outside of the authorized frequency band using the following measurement:

Measurement Procedure - Unwanted Emissions

1. Set RBW = 100 kHz.

2. Set VBW = 300 kHz.

3. Set span to encompass the spectrum to be examined.

4. Detector = peak.

5. Trace Mode = max hold.

6. Sweep = auto couple.

7. Allow the trace to stabilize (this may take some time, depending on the extent of the span).

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified above.

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

Measurement Results:

For GFSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0	Center Frequency	Fig.13	P

2402 MHz	30 MHz ~ 1 GHz	Fig.14	P
	1 GHz ~ 3 GHz	Fig.15	P
	3 GHz ~ 10 GHz	Fig.16	P
	10 GHz ~ 26 GHz	Fig.17	P
Ch 39 2441 MHz	Center Frequency	Fig.18	P
	30 MHz ~ 1 GHz	Fig.19	P
	1 GHz ~ 3 GHz	Fig.20	P
	3 GHz ~ 10 GHz	Fig.21	P
	10 GHz ~ 26 GHz	Fig.22	P
Ch 78 2480 MHz	Center Frequency	Fig.23	P
	30 MHz ~ 1 GHz	Fig.24	P
	1 GHz ~ 3 GHz	Fig.25	P
	3 GHz ~ 10 GHz	Fig.26	P
	10 GHz ~ 26 GHz	Fig.27	P

For π/4 DQPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	Center Frequency	Fig.28	P
	30 MHz ~ 1 GHz	Fig.29	P
	1 GHz ~ 3 GHz	Fig.30	P
	3 GHz ~ 10 GHz	Fig.31	P
	10 GHz ~ 26 GHz	Fig.32	P
Ch 39 2441 MHz	Center Frequency	Fig.33	P
	30 MHz ~ 1 GHz	Fig.34	P
	1 GHz ~ 3 GHz	Fig.35	P
	3 GHz ~ 10 GHz	Fig.36	P
	10 GHz ~ 26 GHz	Fig.37	P
Ch 78 2480 MHz	Center Frequency	Fig.38	P
	30 MHz ~ 1 GHz	Fig.39	P
	1 GHz ~ 3 GHz	Fig.40	P
	3 GHz ~ 10 GHz	Fig.41	P
	10 GHz ~ 26 GHz	Fig.42	P

For 8DPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	Center Frequency	Fig.43	P
	30 MHz ~ 1 GHz	Fig.44	P
	1 GHz ~ 3 GHz	Fig.45	P
	3 GHz ~ 10 GHz	Fig.46	P
	10 GHz ~ 26 GHz	Fig.47	P

Ch 39 2441 MHz	Center Frequency	Fig.48	P
	30 MHz ~ 1 GHz	Fig.49	P
	1 GHz ~ 3 GHz	Fig.50	P
	3 GHz ~ 10 GHz	Fig.51	P
	10 GHz ~ 26 GHz	Fig.52	P
Ch 78 2480 MHz	Center Frequency	Fig.53	P
	30 MHz ~ 1 GHz	Fig.54	P
	1 GHz ~ 3 GHz	Fig.55	P
	3 GHz ~ 10 GHz	Fig.56	P
	10 GHz ~ 26 GHz	Fig.57	P

Conclusion: PASS

Test graphs as below

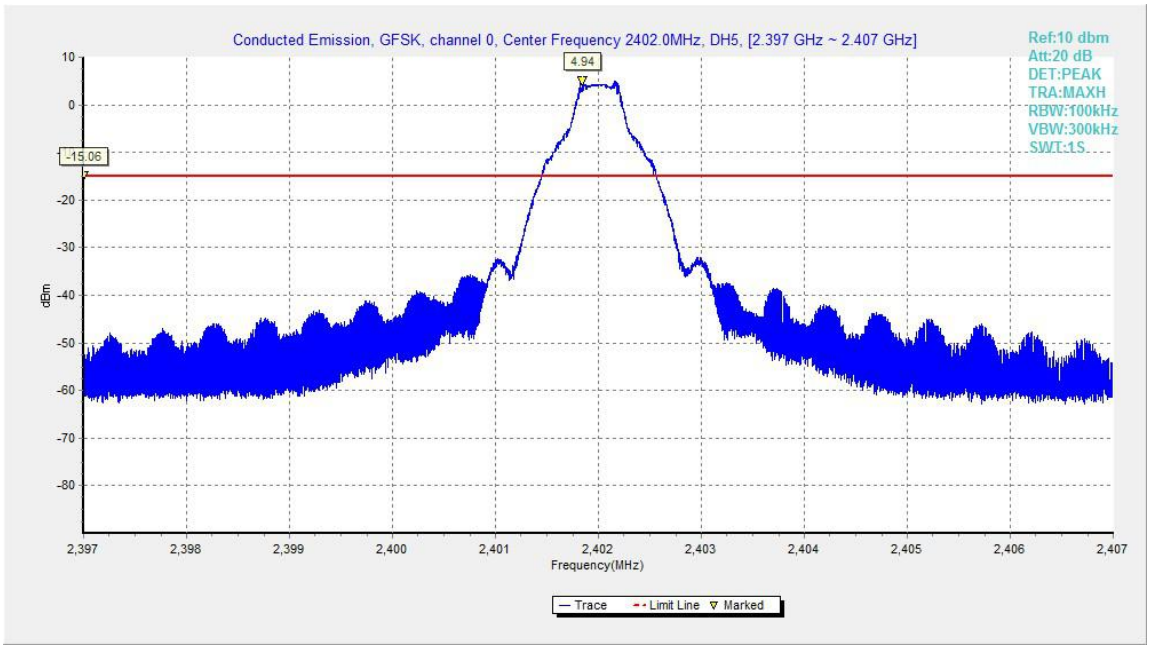


Fig.13. Conducted spurious emission: GFSK, Channel 0,2402MHz

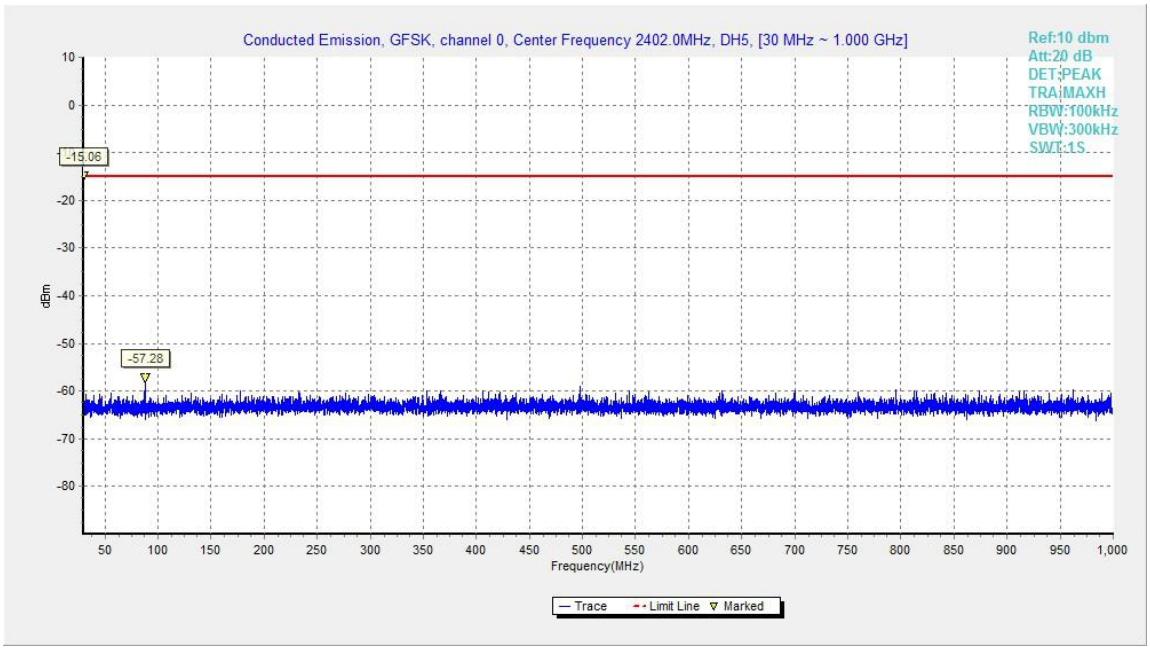


Fig.14. Conducted spurious emission: GFSK, Channel 0, 30MHz - 1GHz

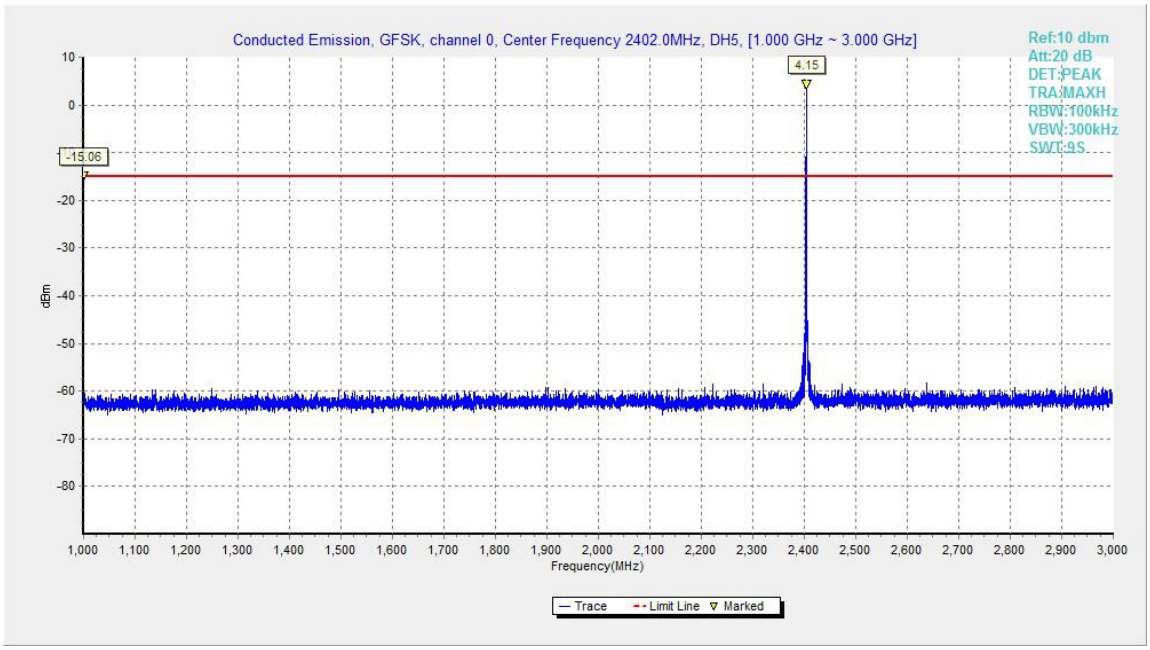


Fig.15. Conducted spurious emission: GFSK, Channel 0, 1GHz - 3GHz

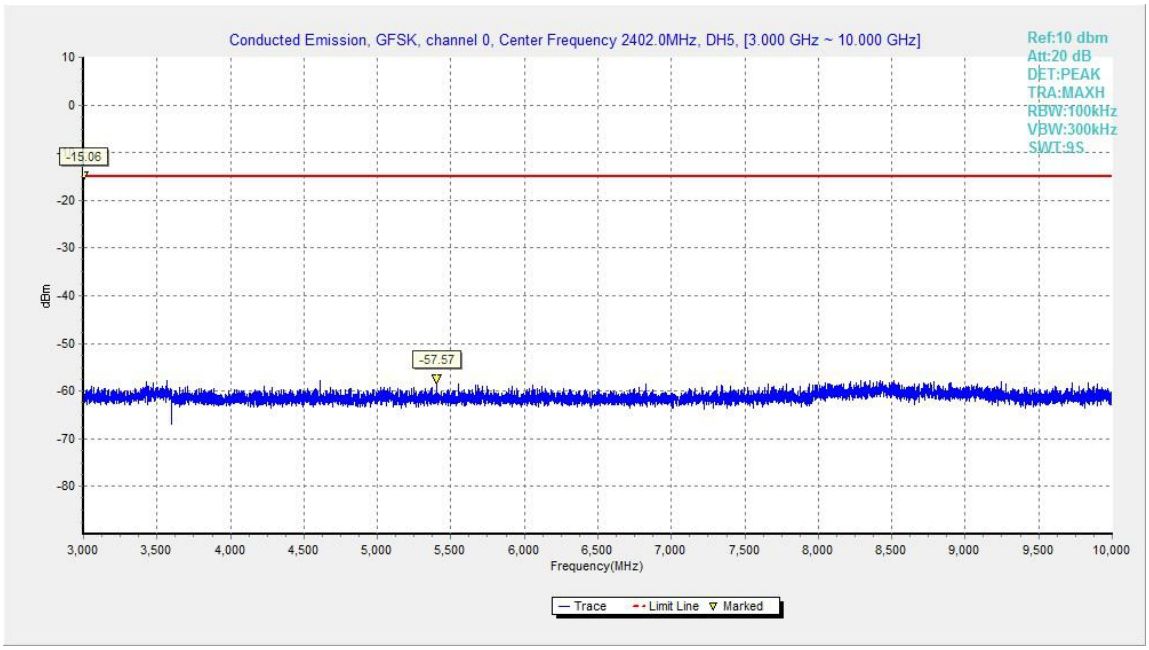


Fig.16. Conducted spurious emission: GFSK, Channel 0, 3GHz - 10GHz

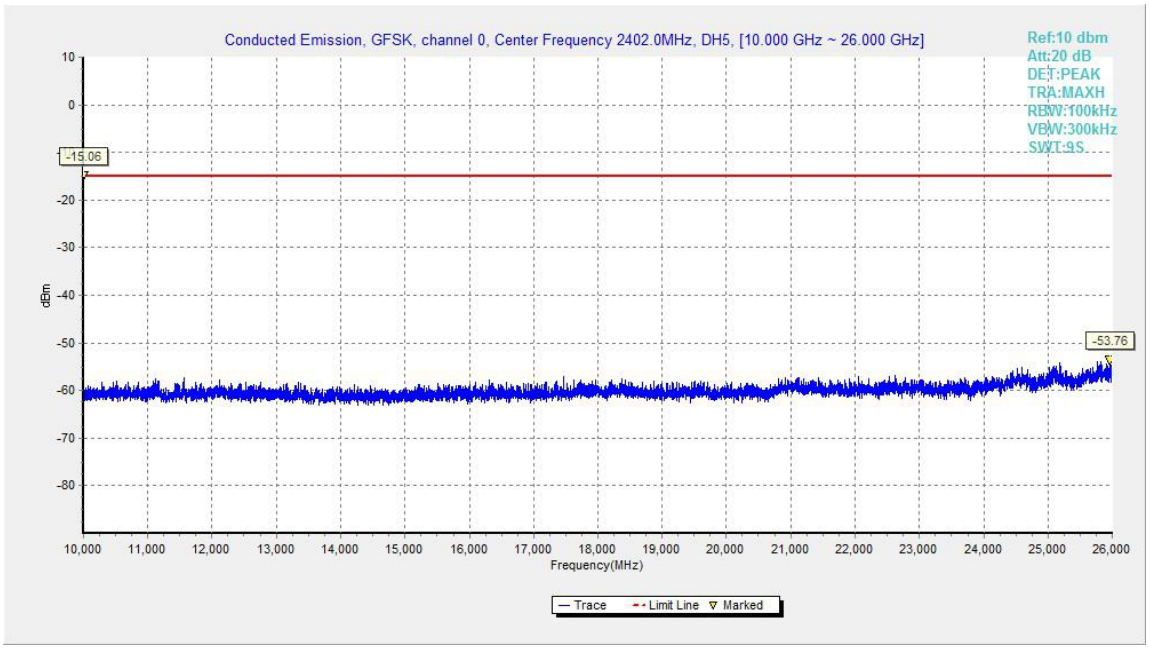


Fig.17. Conducted spurious emission: GFSK, Channel 0,10GHz - 26GHz

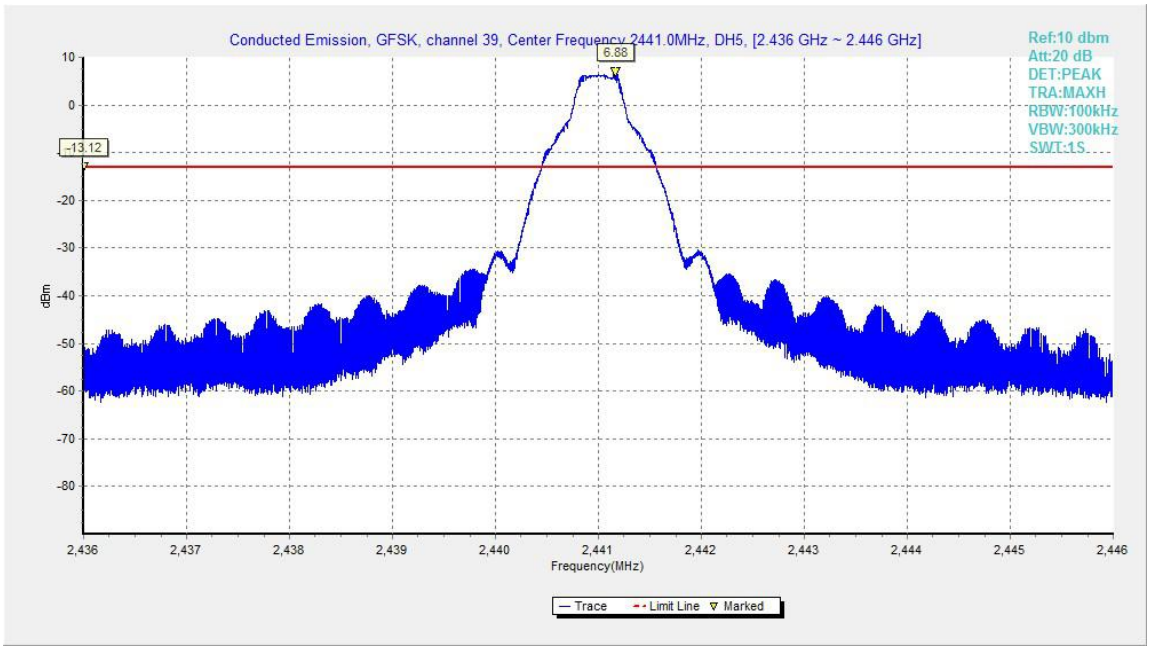


Fig.18. Conducted spurious emission: GFSK, Channel 39, 2441MHz

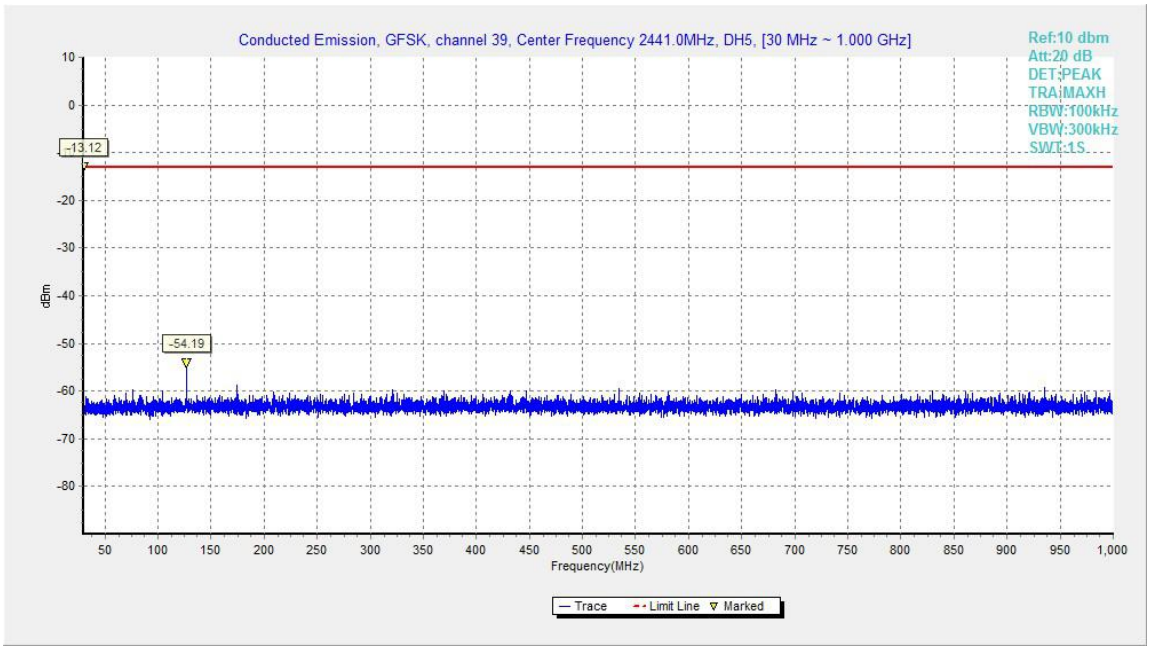


Fig.19. Conducted spurious emission: GFSK, Channel 39, 30MHz - 1GHz

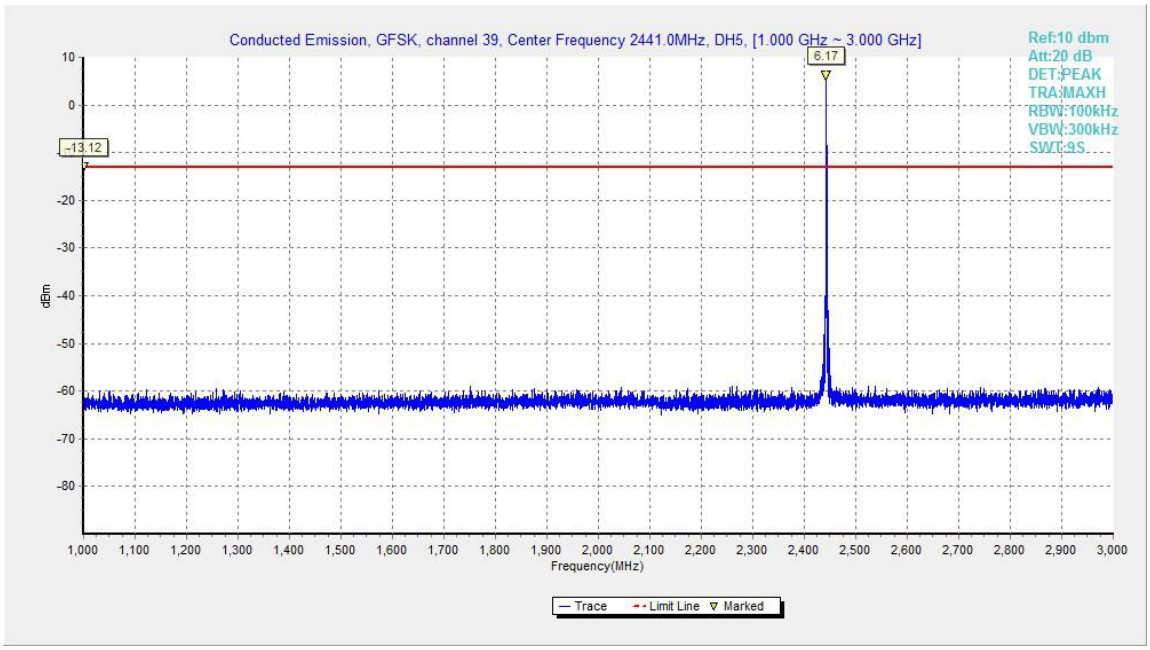


Fig.20. Conducted spurious emission: GFSK, Channel 39, 1GHz – 3GHz

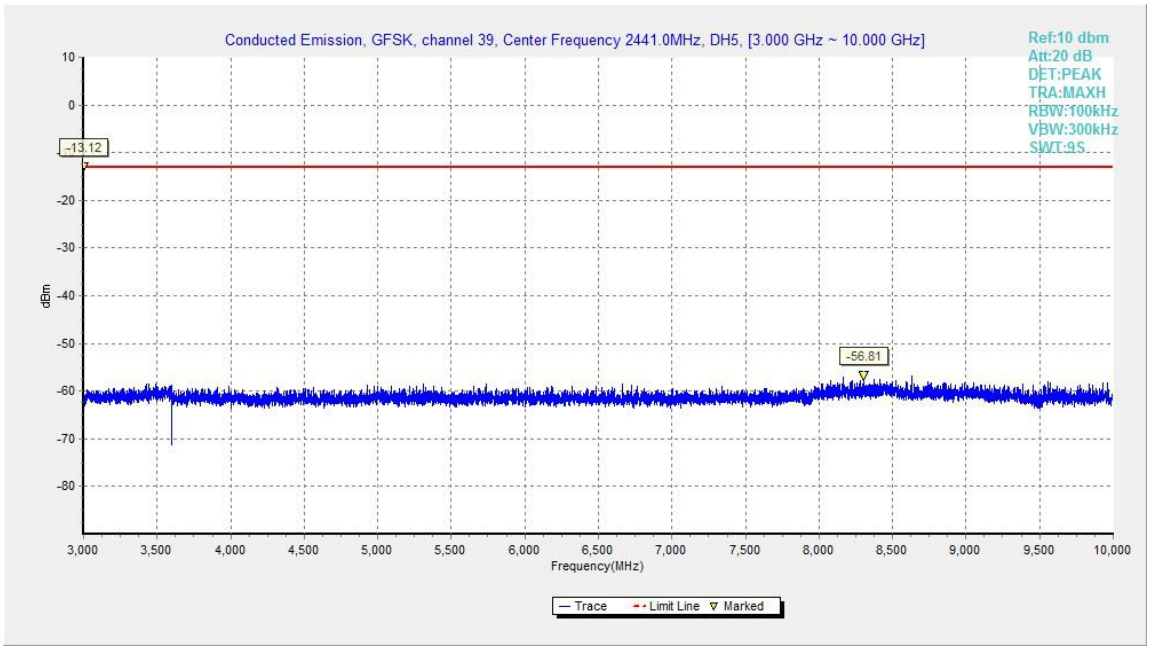


Fig.21. Conducted spurious emission: GFSK, Channel 39, 3GHz – 10GHz

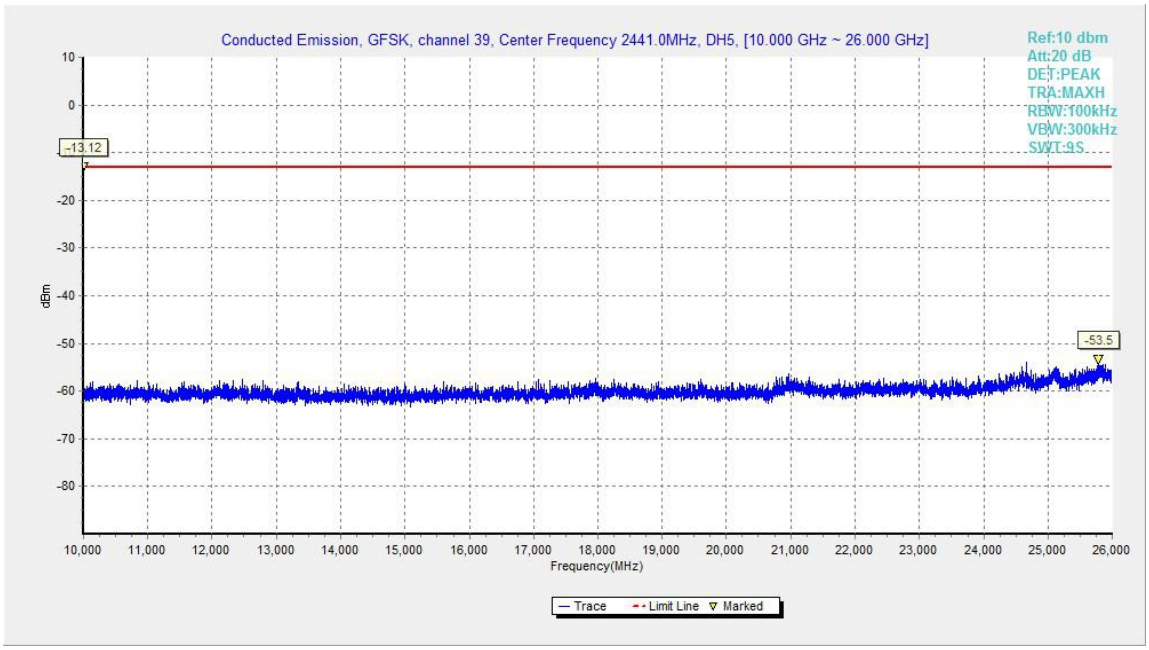


Fig.22. Conducted spurious emission: GFSK, Channel 39, 10GHz – 26GHz

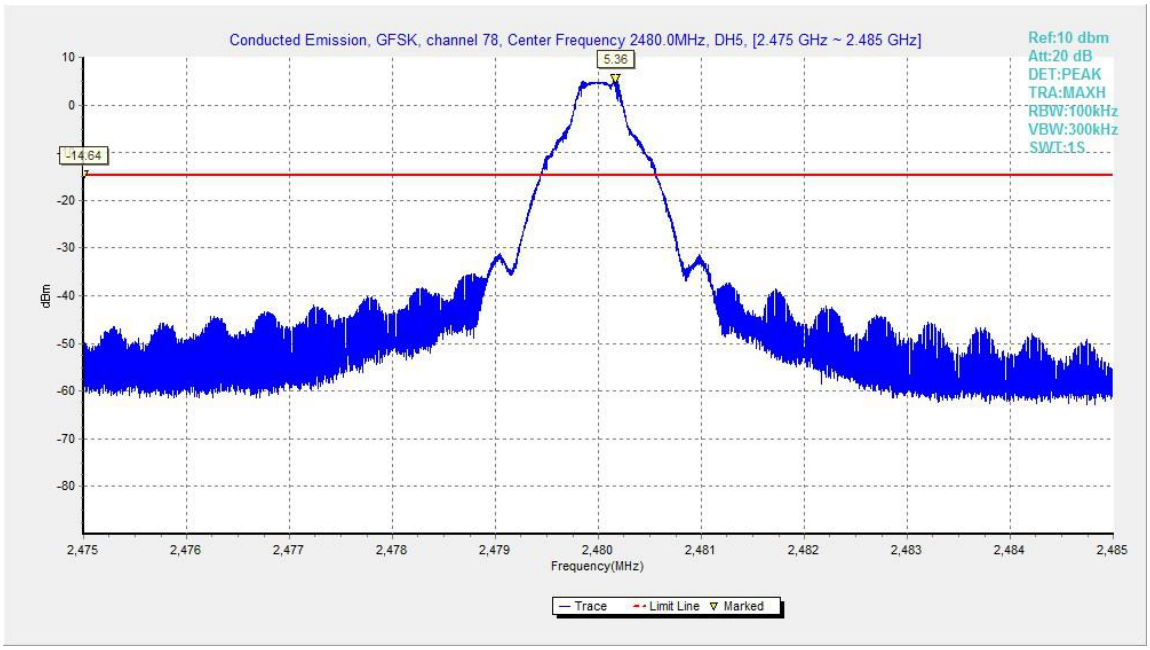


Fig.23. Conducted spurious emission: GFSK, Channel 78, 2480MHz

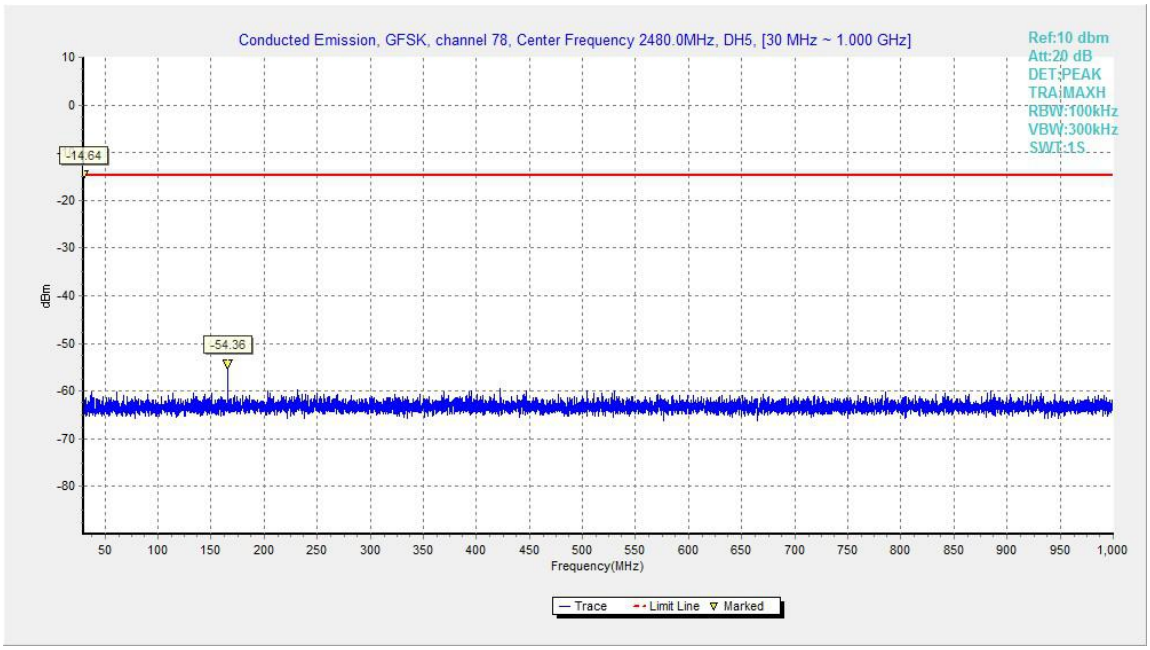


Fig.24. Conducted spurious emission: GFSK, Channel 78, 30MHz - 1GHz

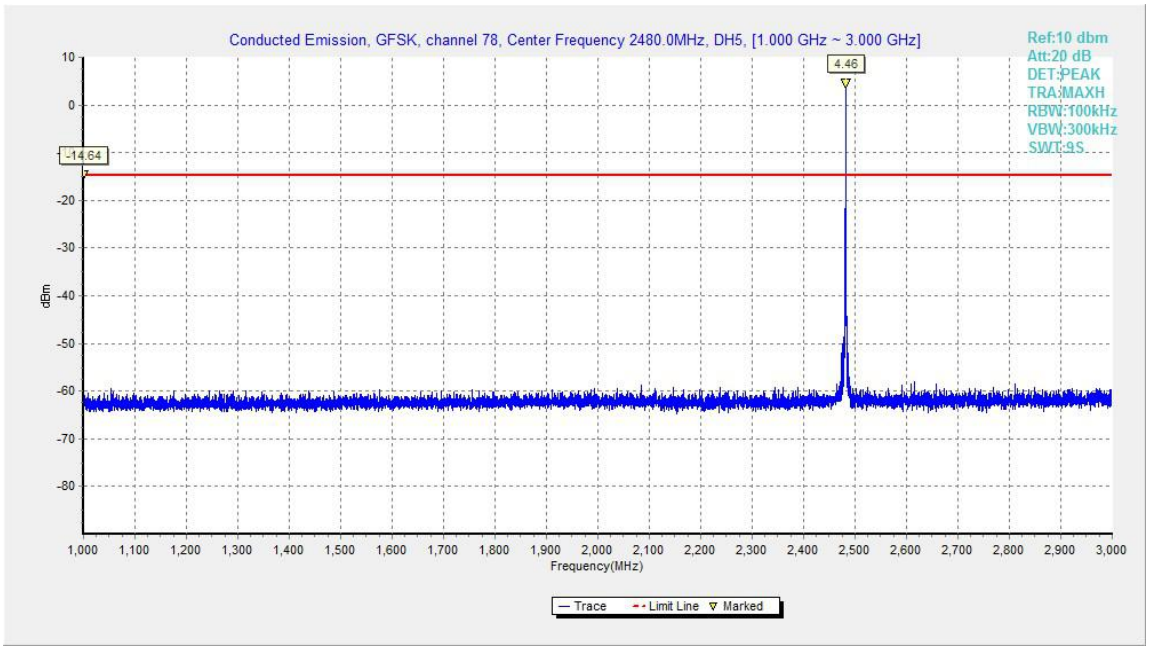


Fig.25. Conducted spurious emission: GFSK, Channel 78, 1GHz - 3GHz

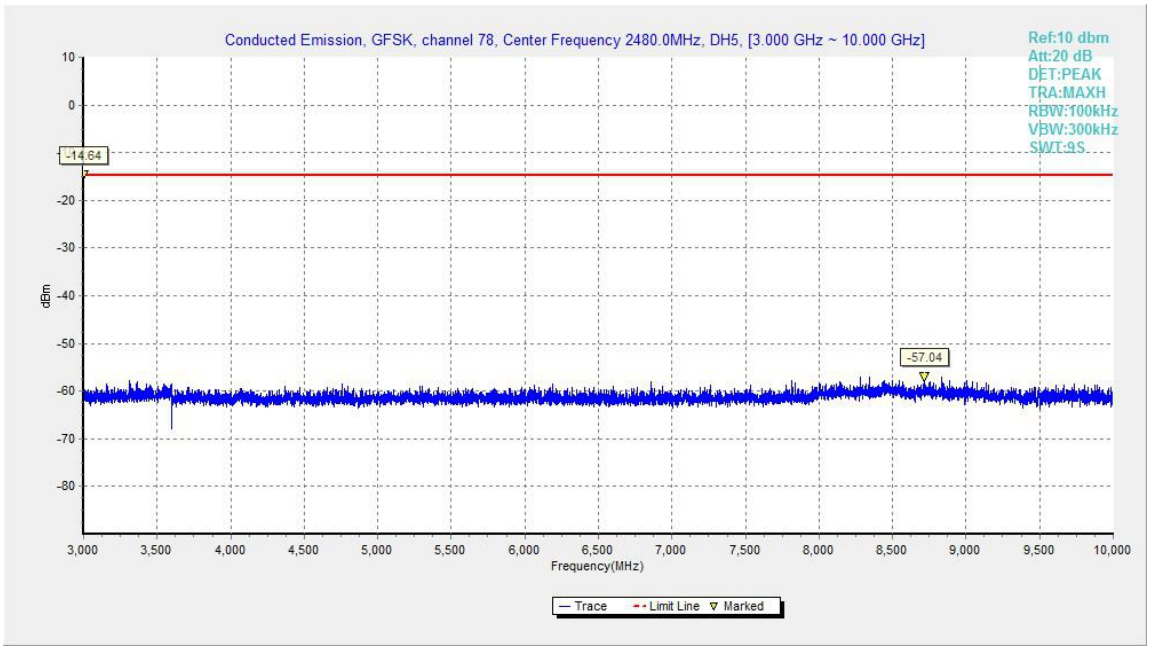


Fig.26. Conducted spurious emission: GFSK, Channel 78, 3GHz - 10GHz

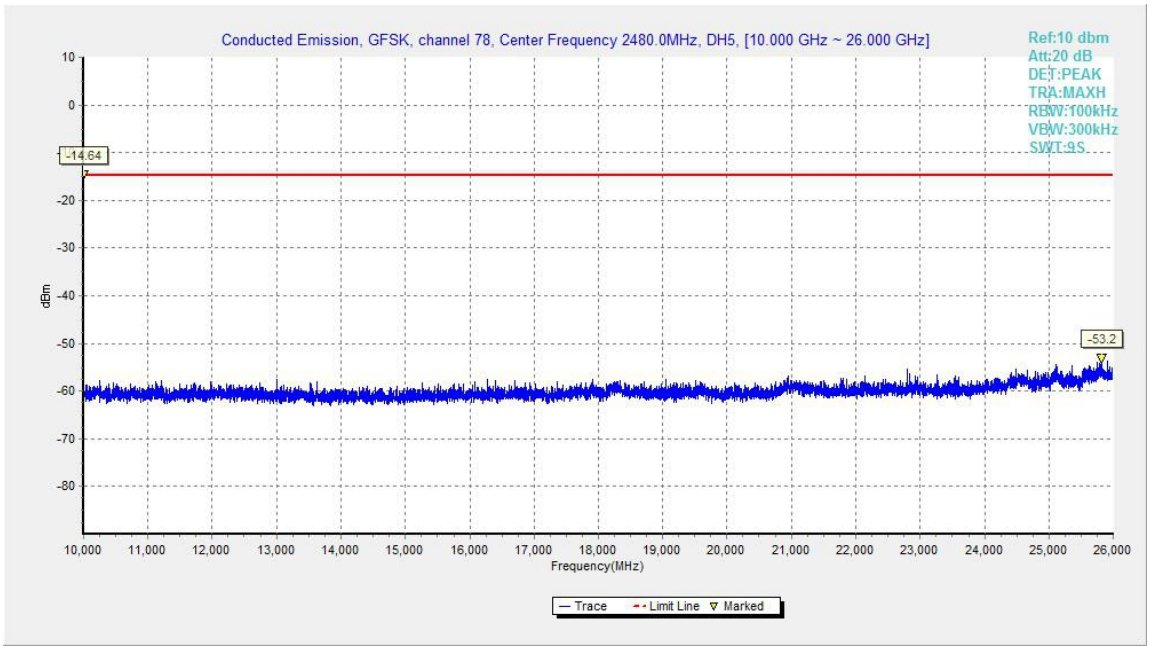


Fig.27. Conducted spurious emission: GFSK, Channel 78, 10GHz - 26GHz

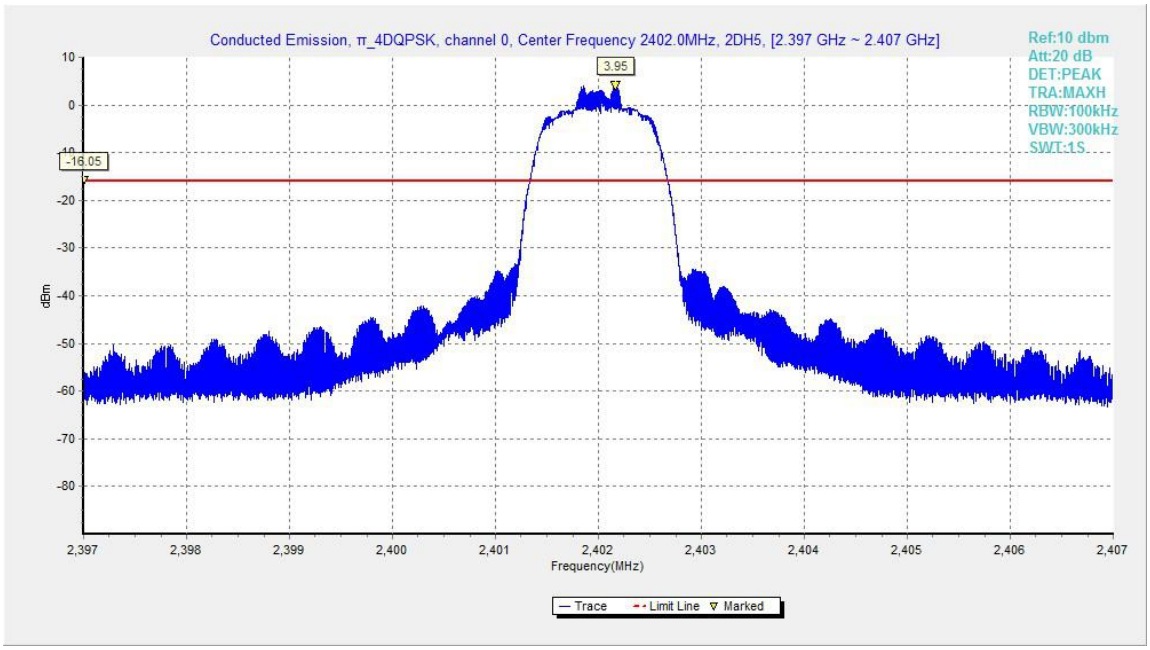


Fig.28. Conducted spurious emission: π/4 DQPSK, Channel 0,2402MHz

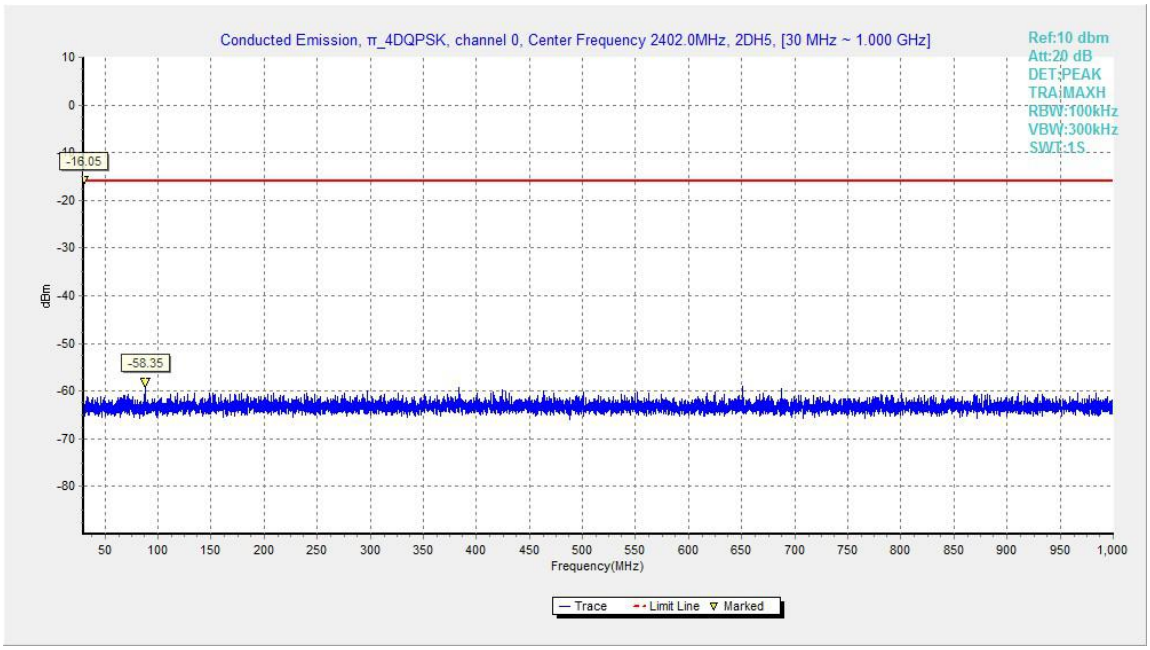


Fig.29. Conducted spurious emission: π/4 DQPSK, Channel 0, 30MHz - 1GHz

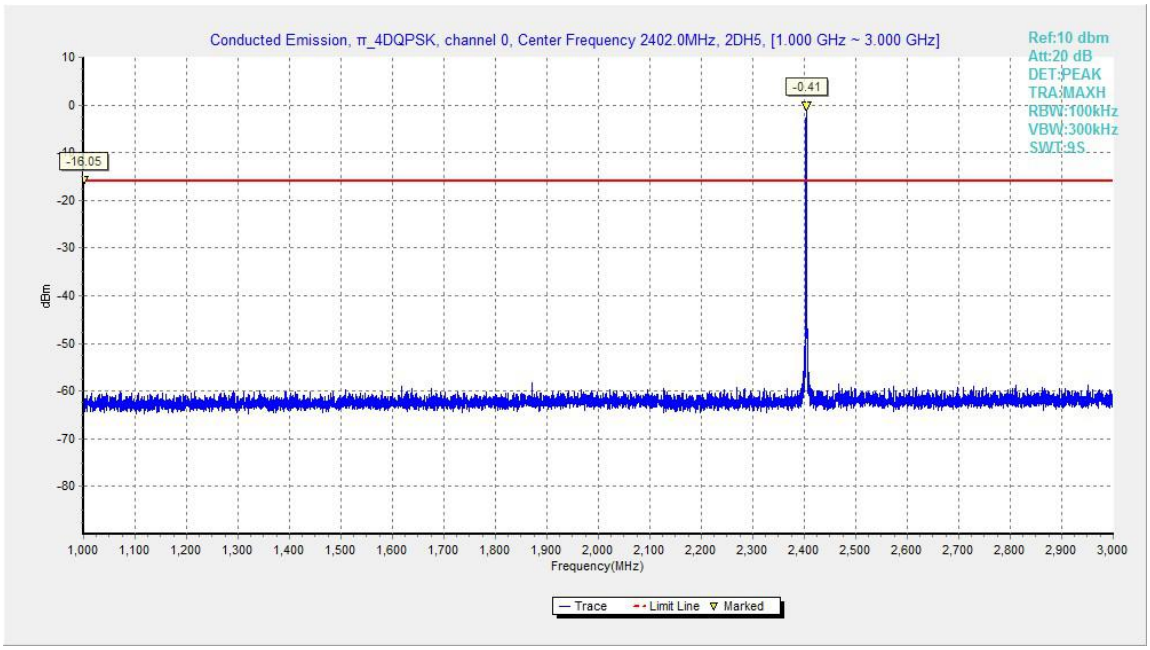


Fig.30. Conducted spurious emission: π/4 DQPSK, Channel 0, 1GHz - 3GHz

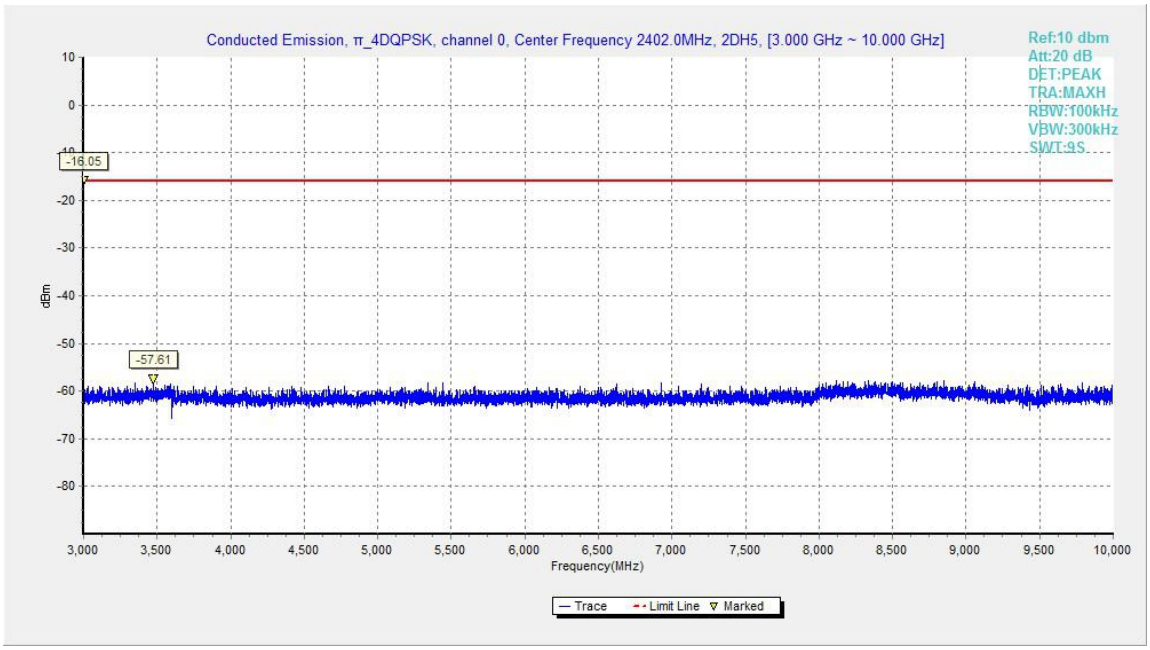


Fig.31. Conducted spurious emission: π/4 DQPSK, Channel 0, 3GHz - 10GHz

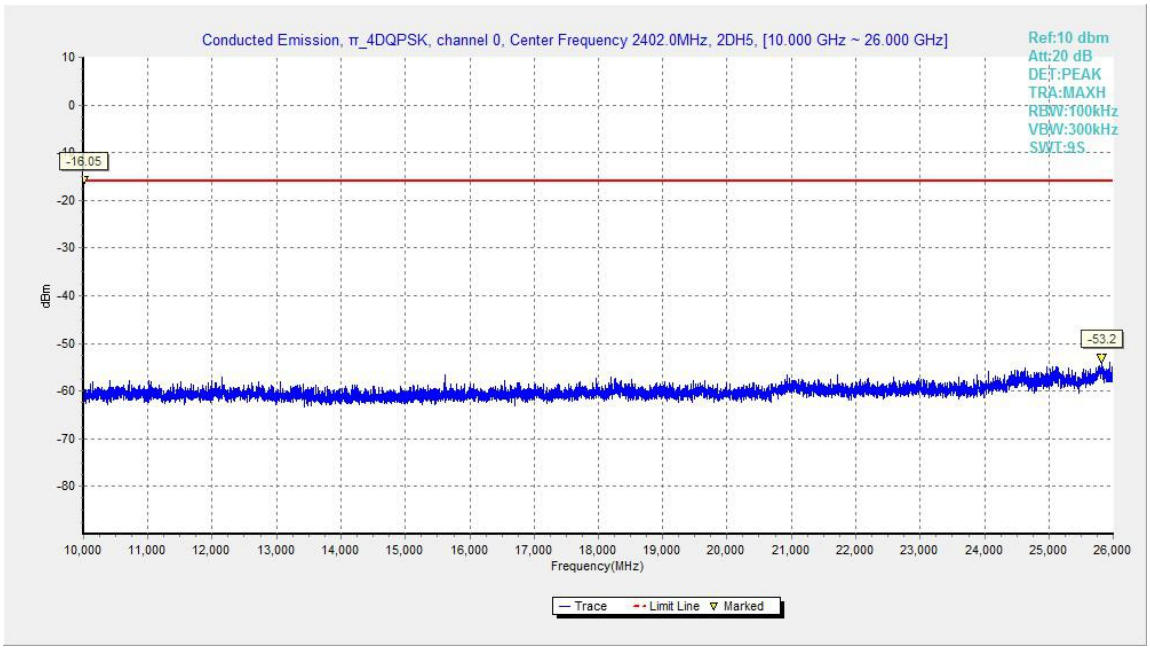


Fig.32. Conducted spurious emission: π/4 DQPSK, Channel 0,10GHz - 26GHz

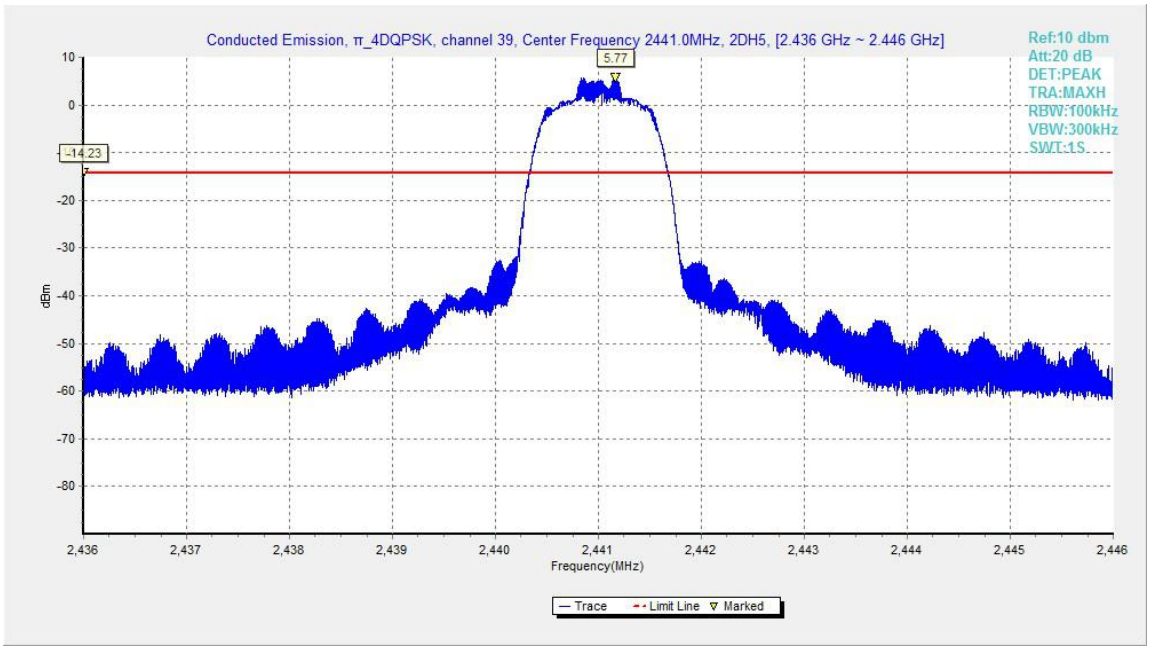


Fig.33. Conducted spurious emission: π/4 DQPSK, Channel 39, 2441MHz

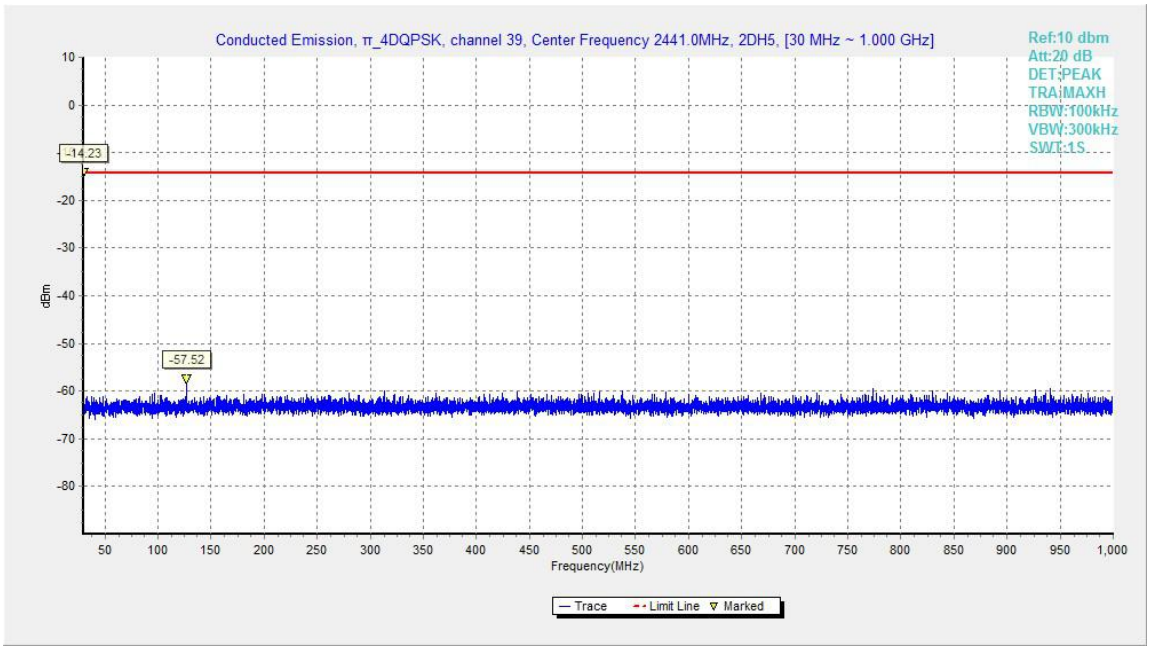


Fig.34. Conducted spurious emission: π/4 DQPSK, Channel 39, 30MHz - 1GHz

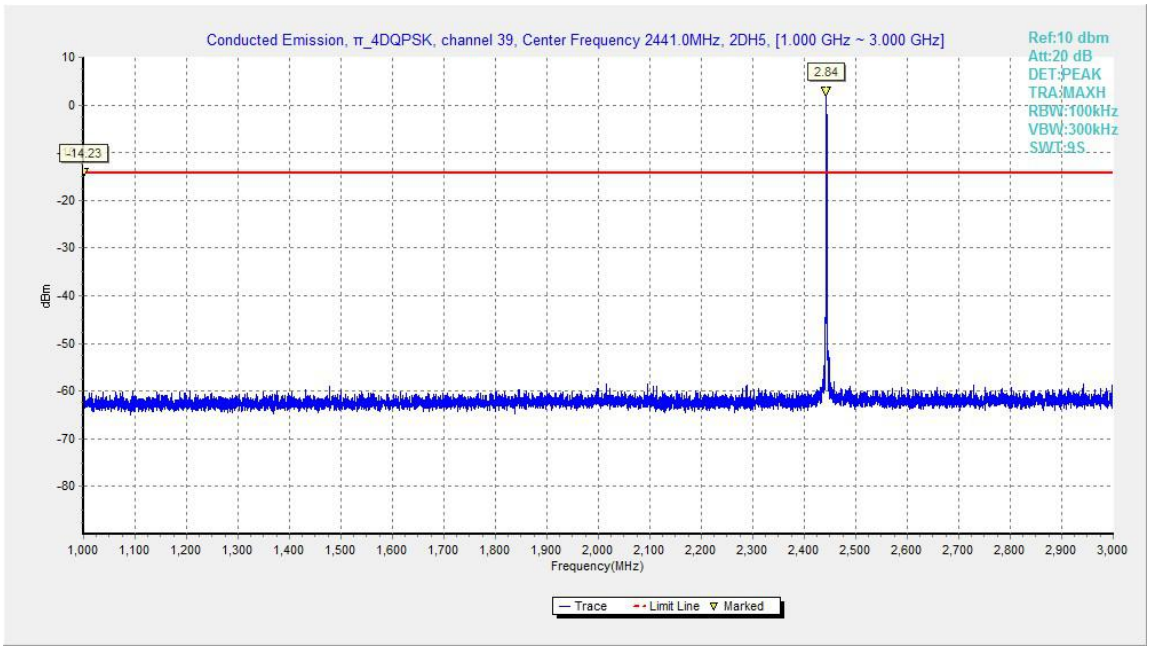


Fig.35. Conducted spurious emission: π/4 DQPSK, Channel 39, 1GHz - 3GHz

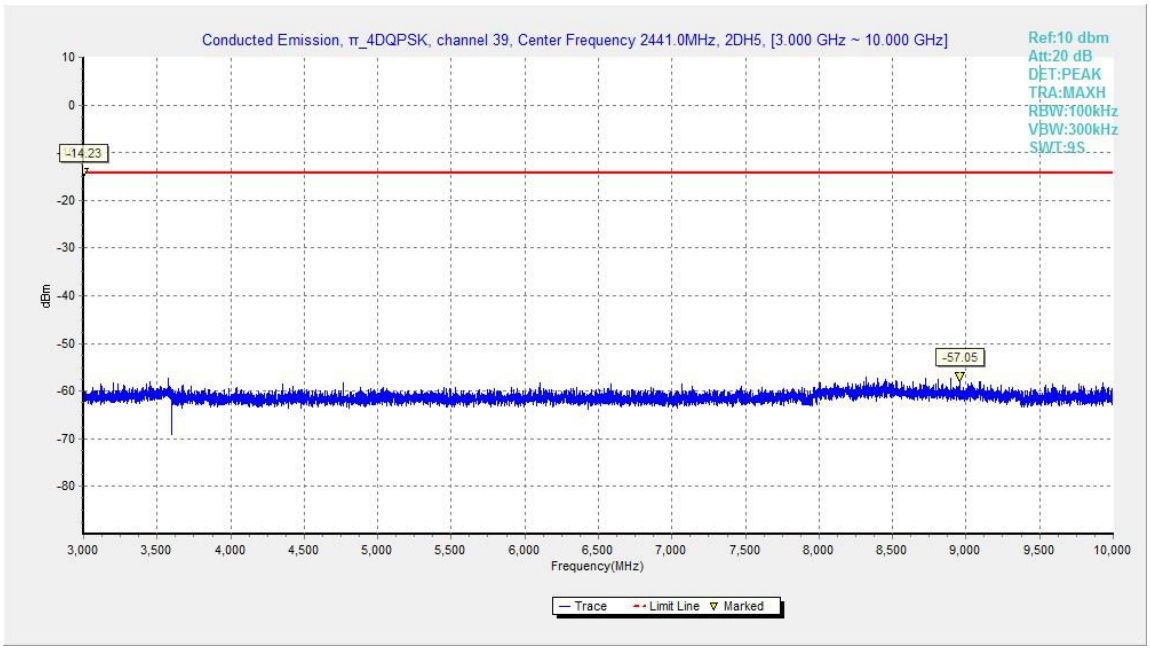


Fig.36. Conducted spurious emission: π/4 DQPSK, Channel 39, 3GHz - 10GHz

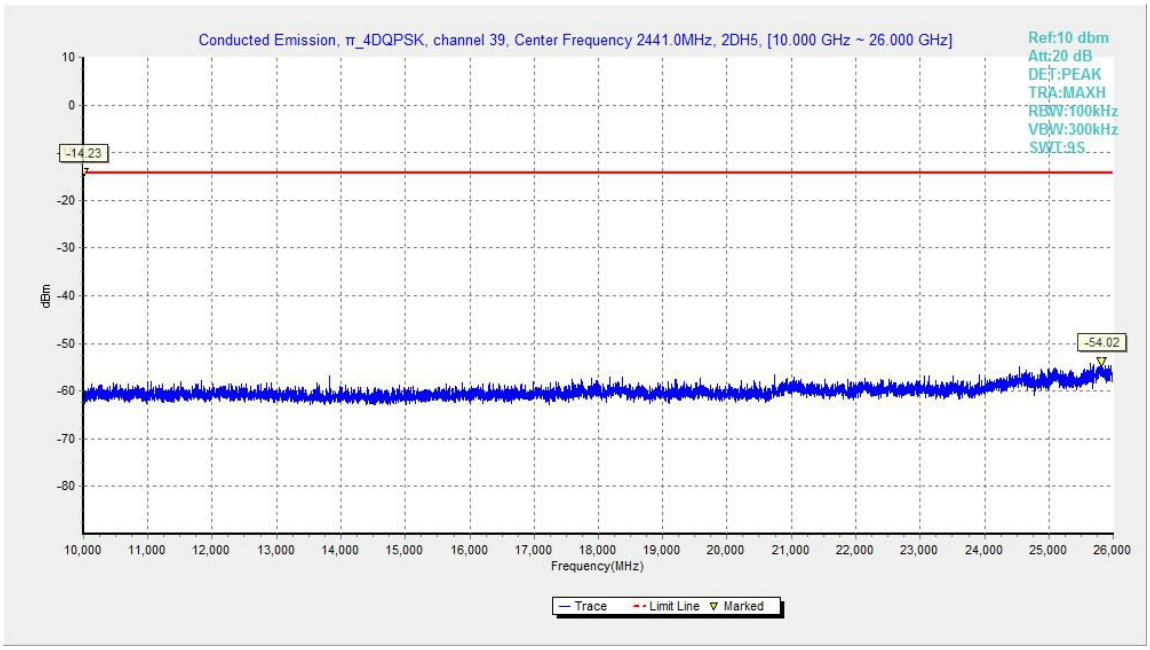


Fig.37. Conducted spurious emission: π/4 DQPSK, Channel 39, 10GHz – 26GHz

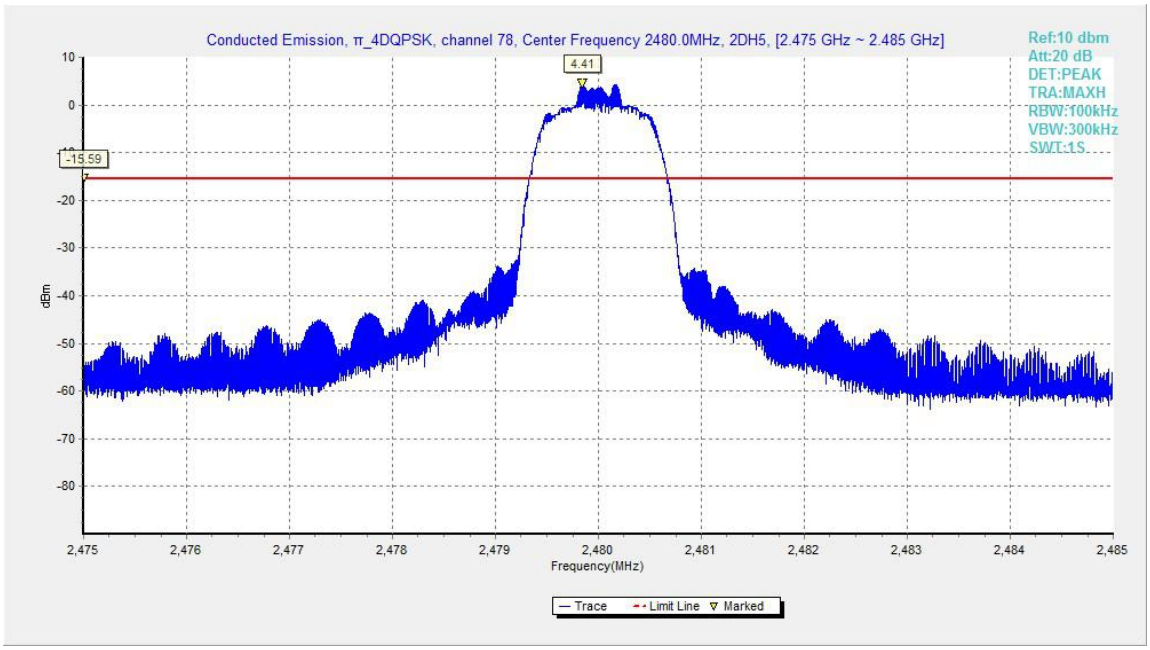


Fig.38. Conducted spurious emission: π/4 DQPSK, Channel 78, 2480MHz

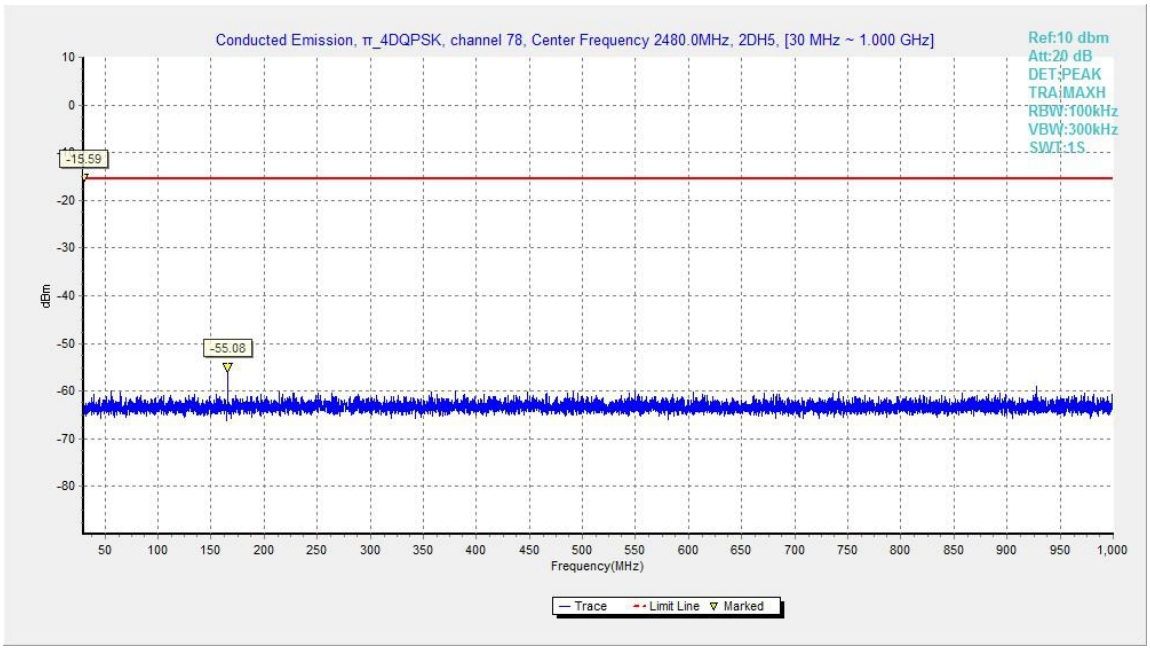


Fig.39. Conducted spurious emission: π/4 DQPSK, Channel 78, 30MHz - 1GHz

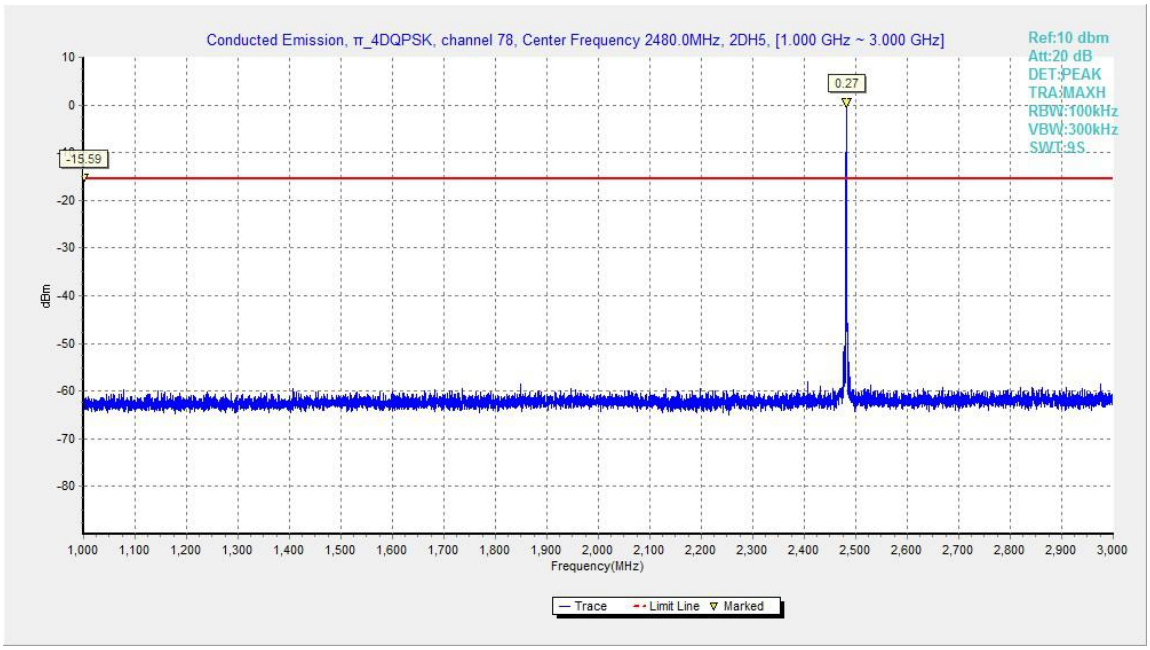


Fig.40. Conducted spurious emission: π/4 DQPSK, Channel 78, 1GHz - 3GHz

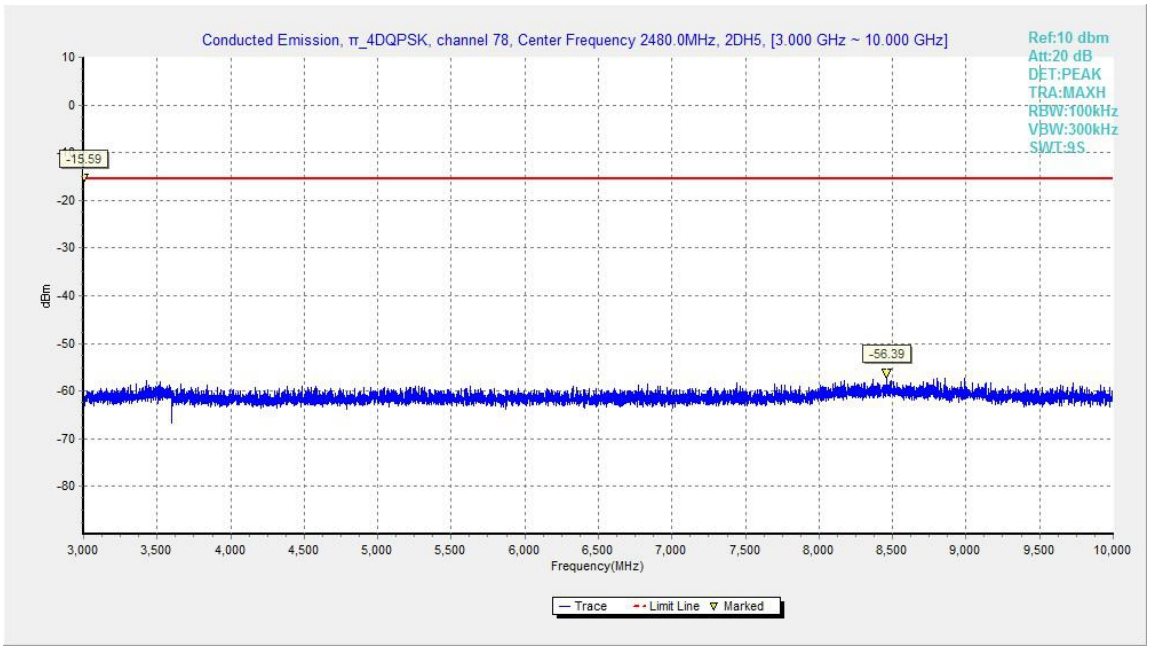


Fig.41. Conducted spurious emission: π/4 DQPSK, Channel 78, 3GHz - 10GHz

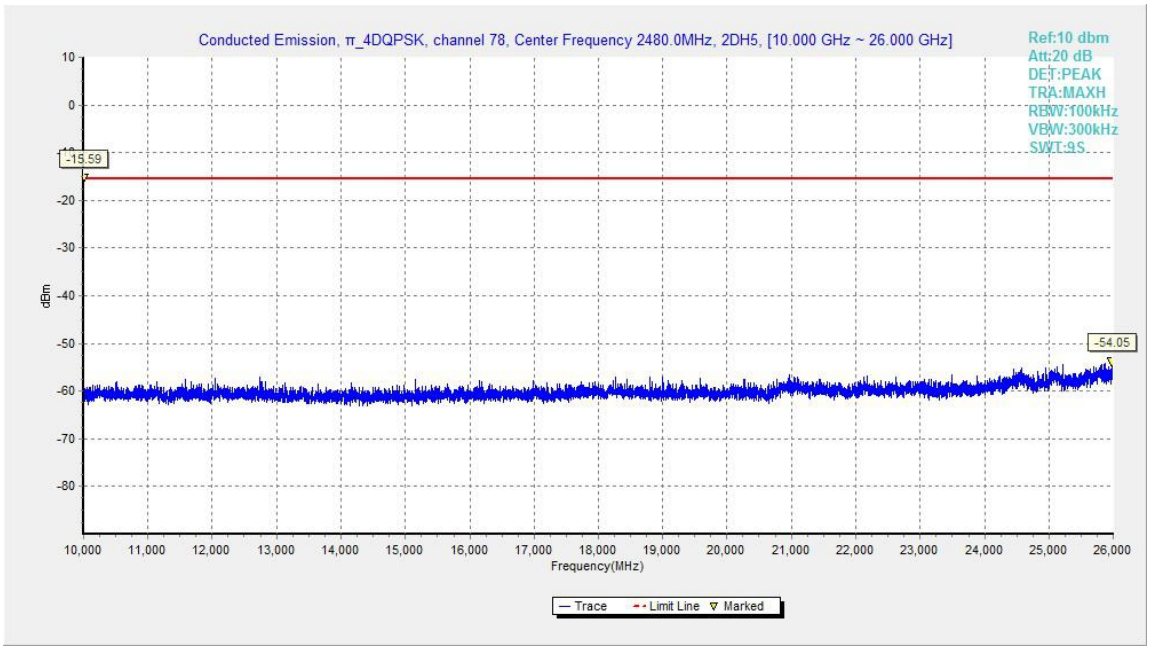


Fig.42. Conducted spurious emission: π/4 DQPSK, Channel 78, 10GHz - 26GHz

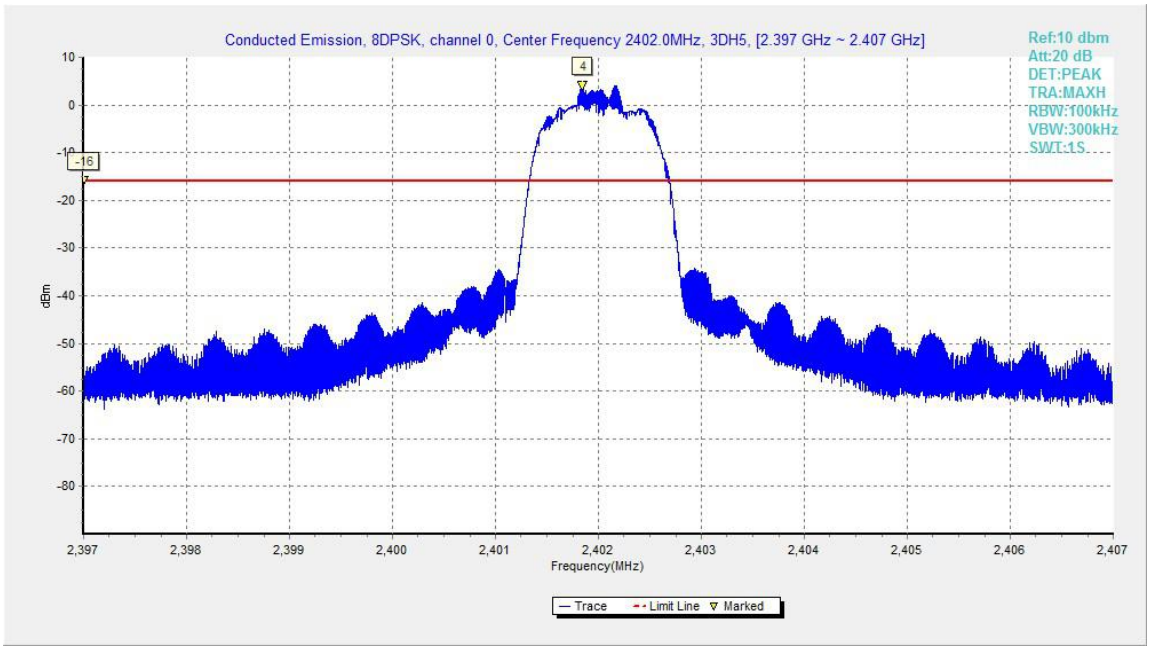


Fig.43. Conducted spurious emission: 8DPSK, Channel 0,2402MHz

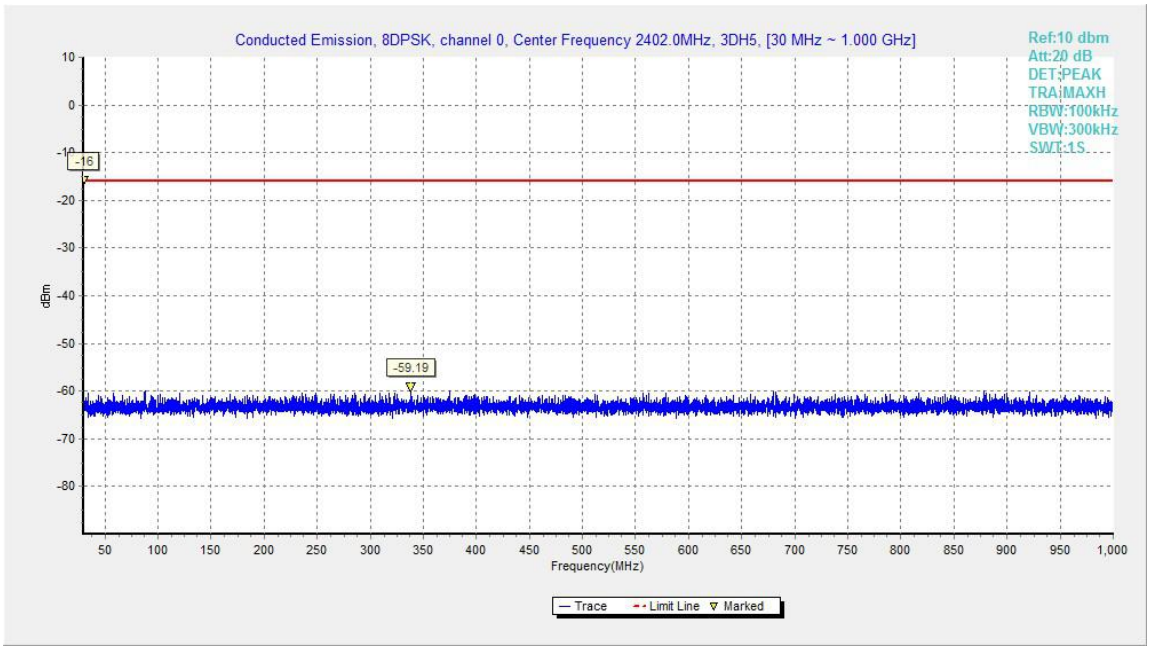


Fig.44. Conducted spurious emission: 8DPSK, Channel 0, 30MHz - 1GHz

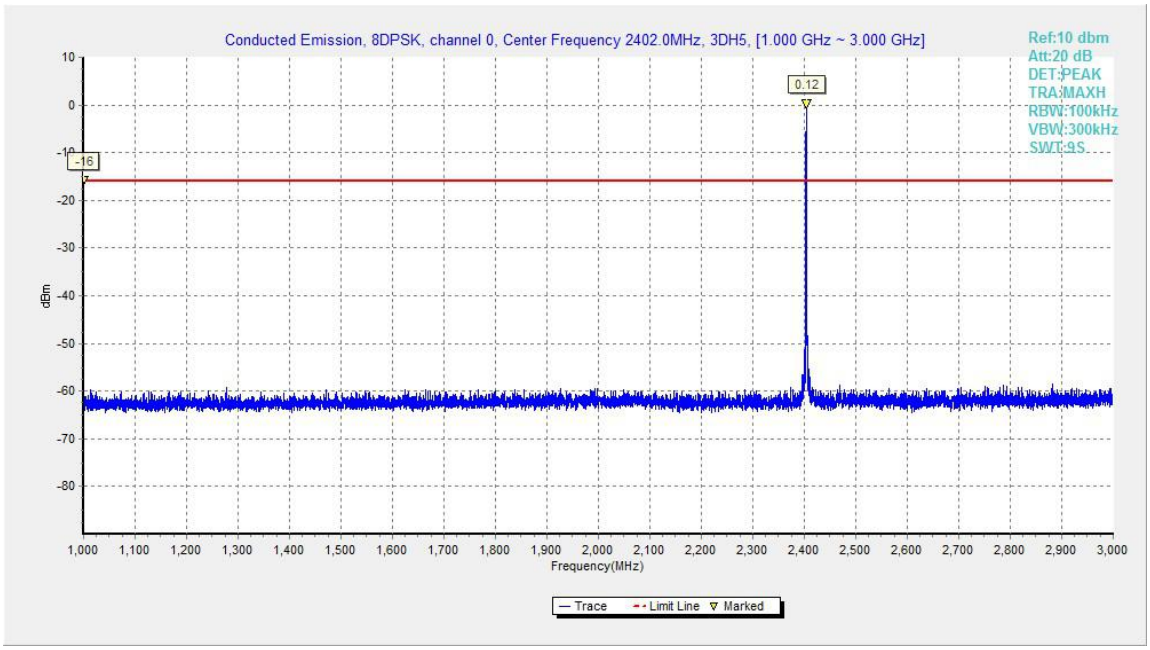


Fig.45. Conducted spurious emission: 8DPSK, Channel 0, 1GHz - 3GHz

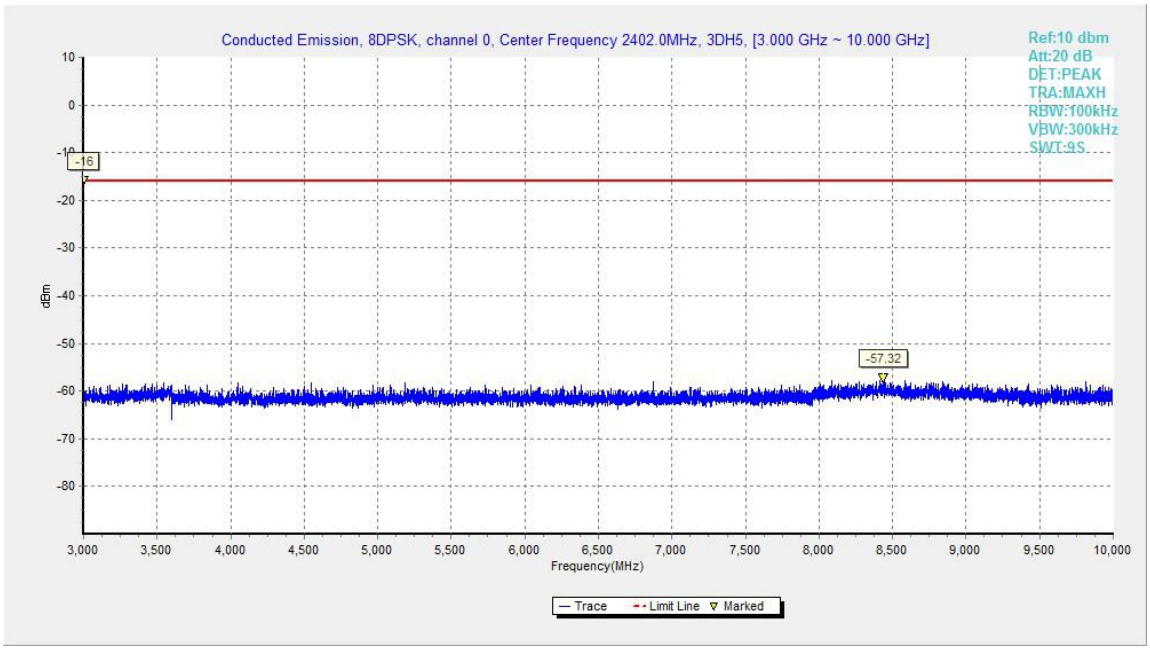


Fig.46. Conducted spurious emission: 8DPSK, Channel 0, 3GHz - 10GHz

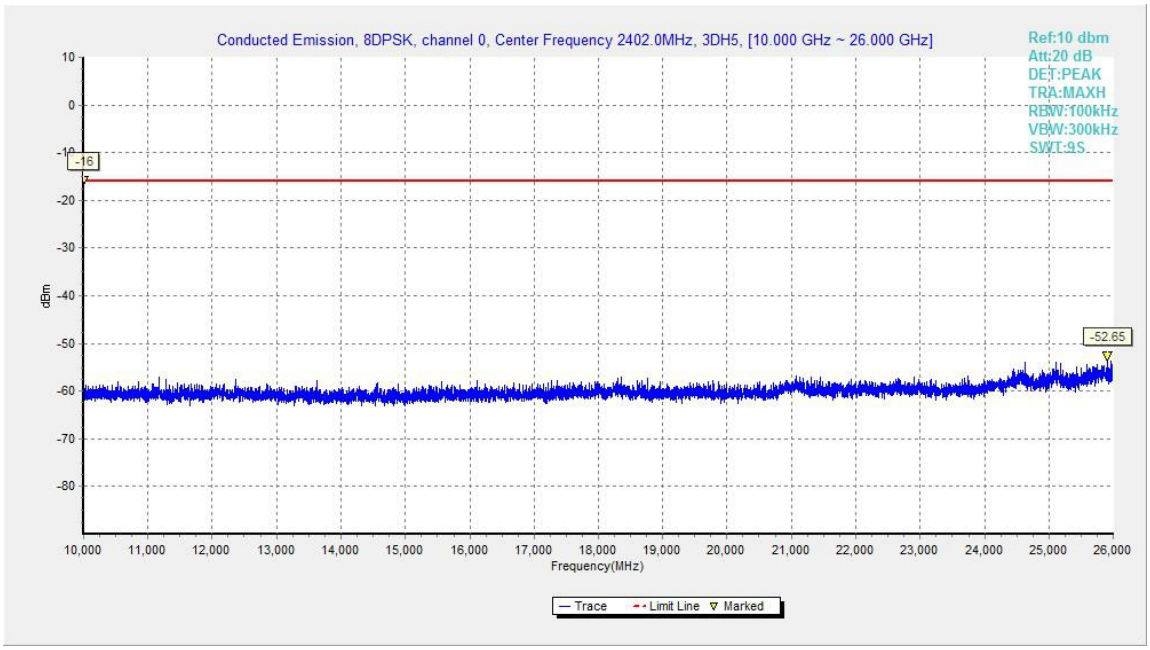


Fig.47. Conducted spurious emission: 8DPSK, Channel 0,10GHz - 26GHz

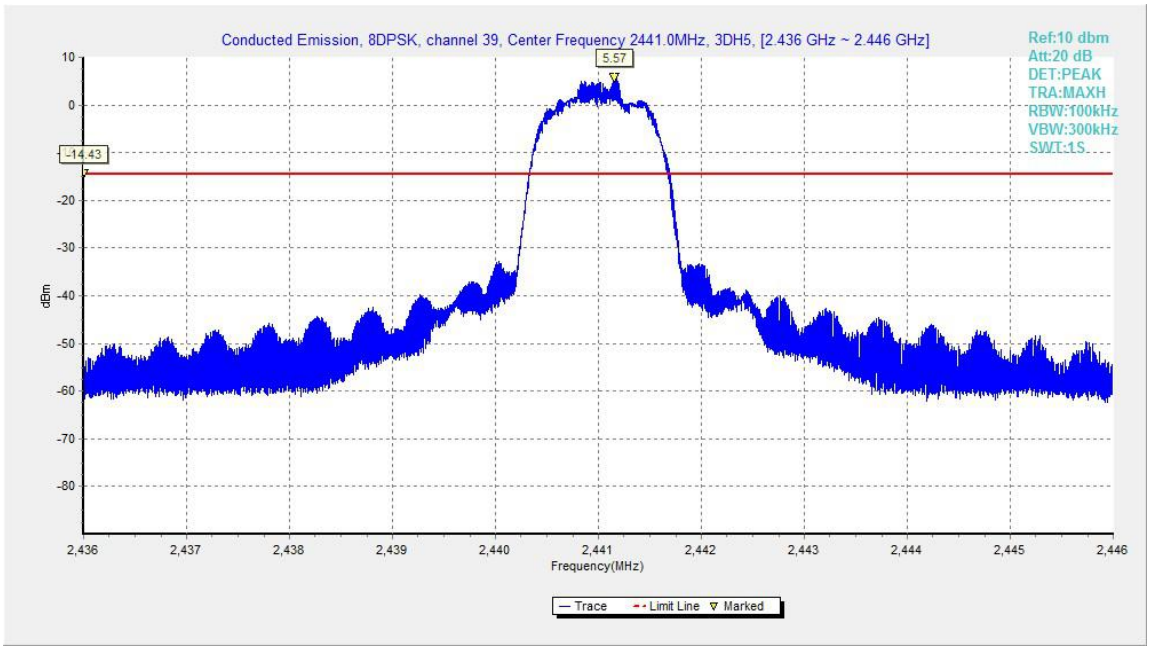


Fig.48. Conducted spurious emission: 8DPSK, Channel 39, 2441MHz

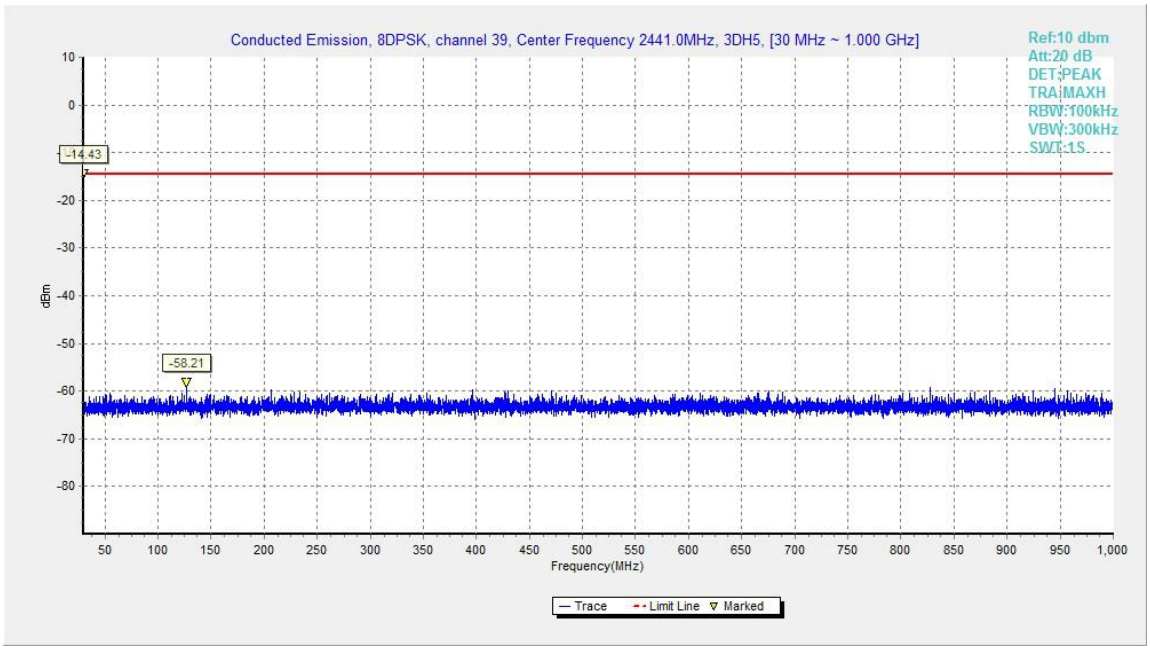


Fig.49. Conducted spurious emission: 8DPSK, Channel 39, 30MHz - 1GHz

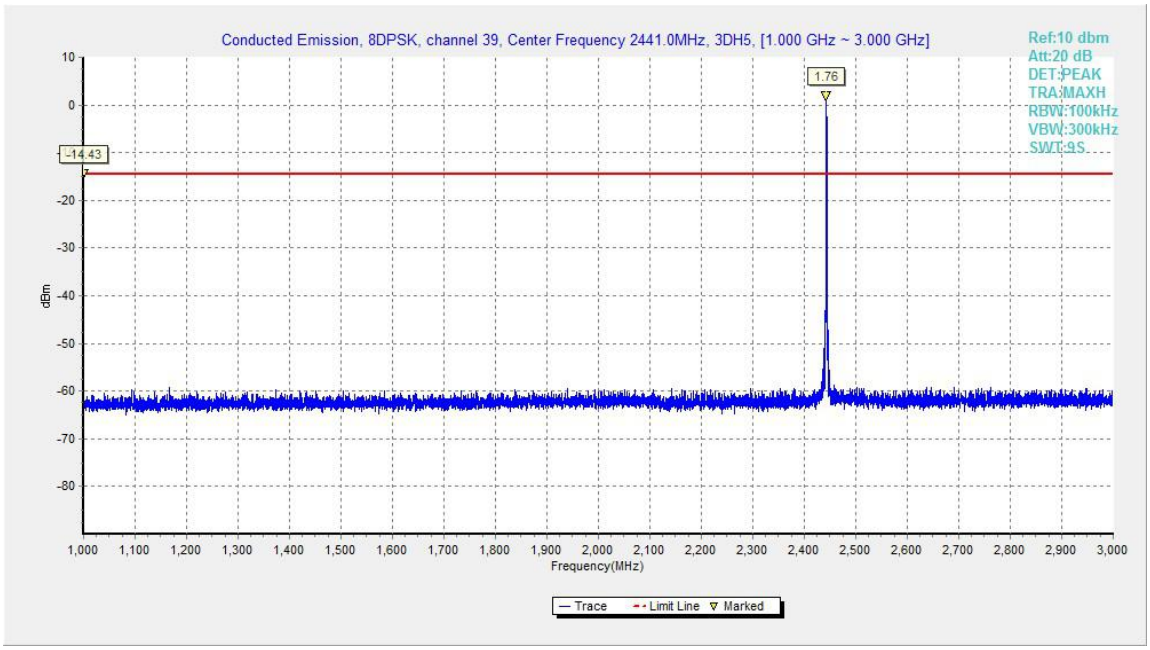


Fig.50. Conducted spurious emission: 8DPSK, Channel 39, 1GHz - 3GHz

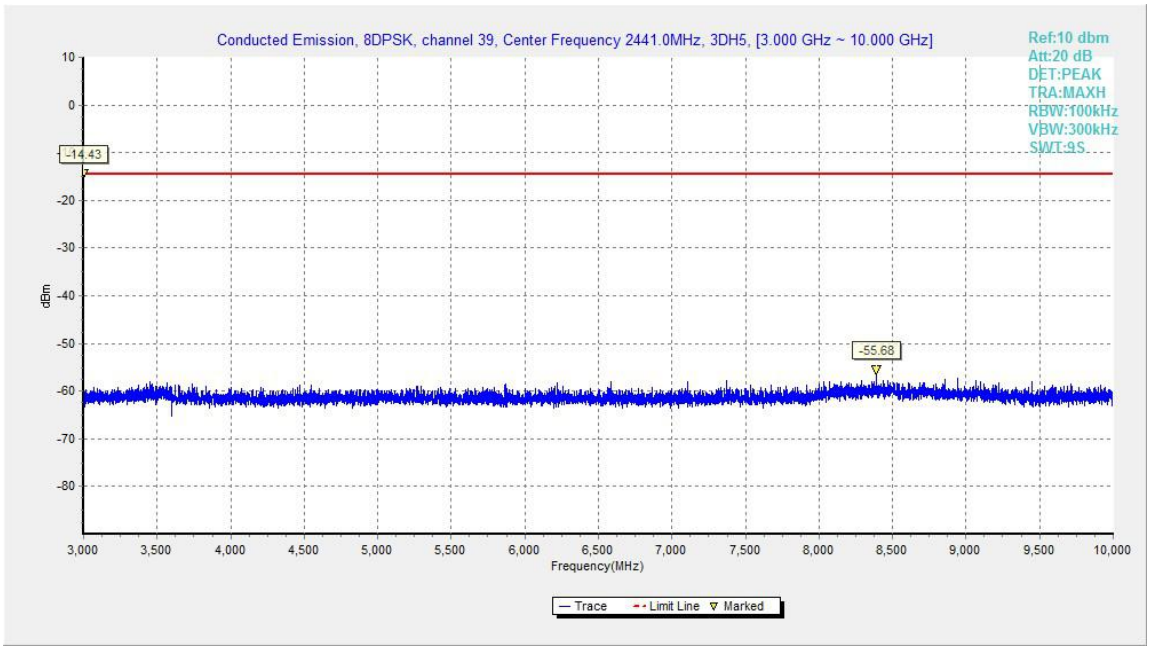


Fig.51. Conducted spurious emission: 8DPSK, Channel 39, 3GHz - 10GHz

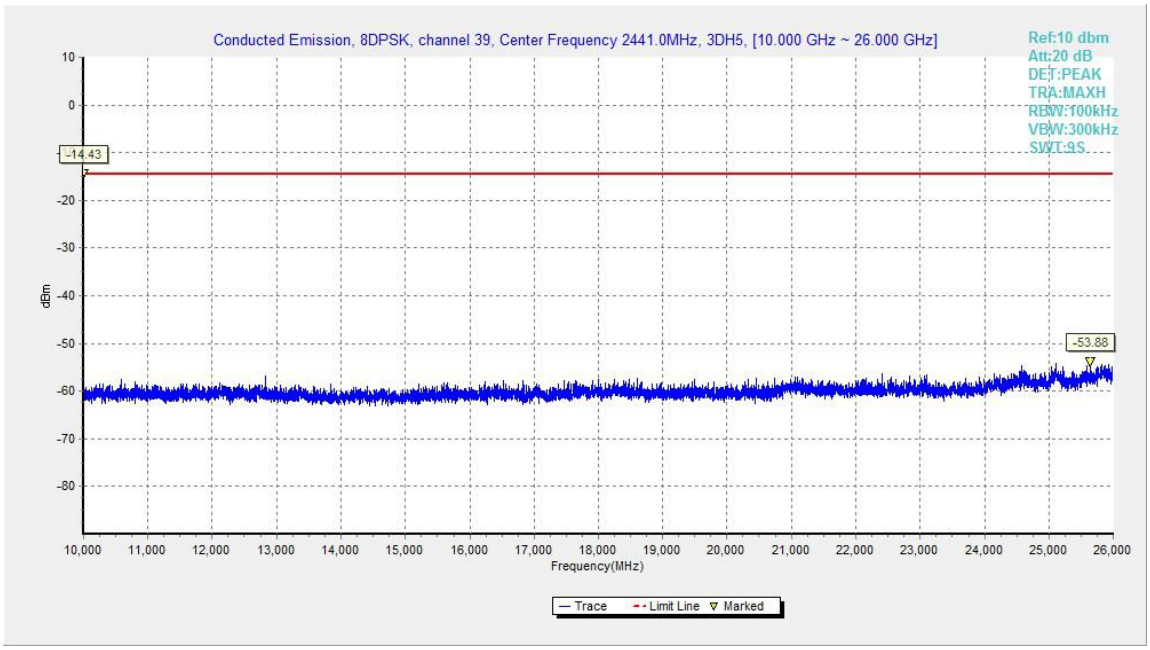


Fig.52. Conducted spurious emission: 8DPSK, Channel 39, 10GHz – 26GHz

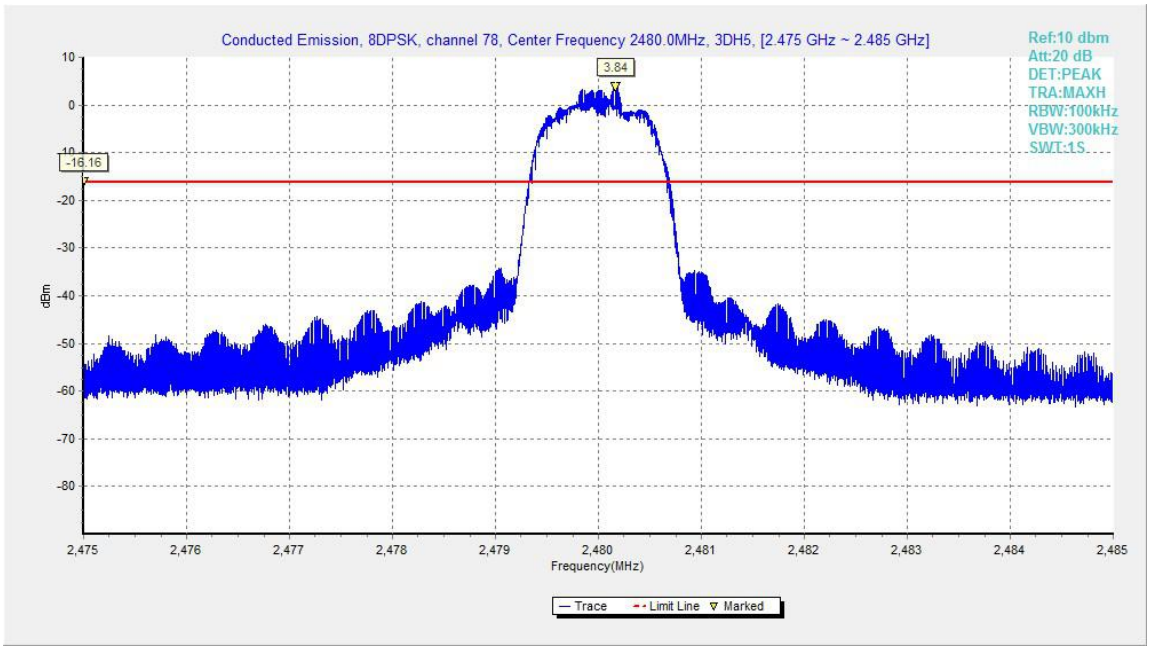


Fig.53. Conducted spurious emission: 8DPSK, Channel 78, 2480MHz

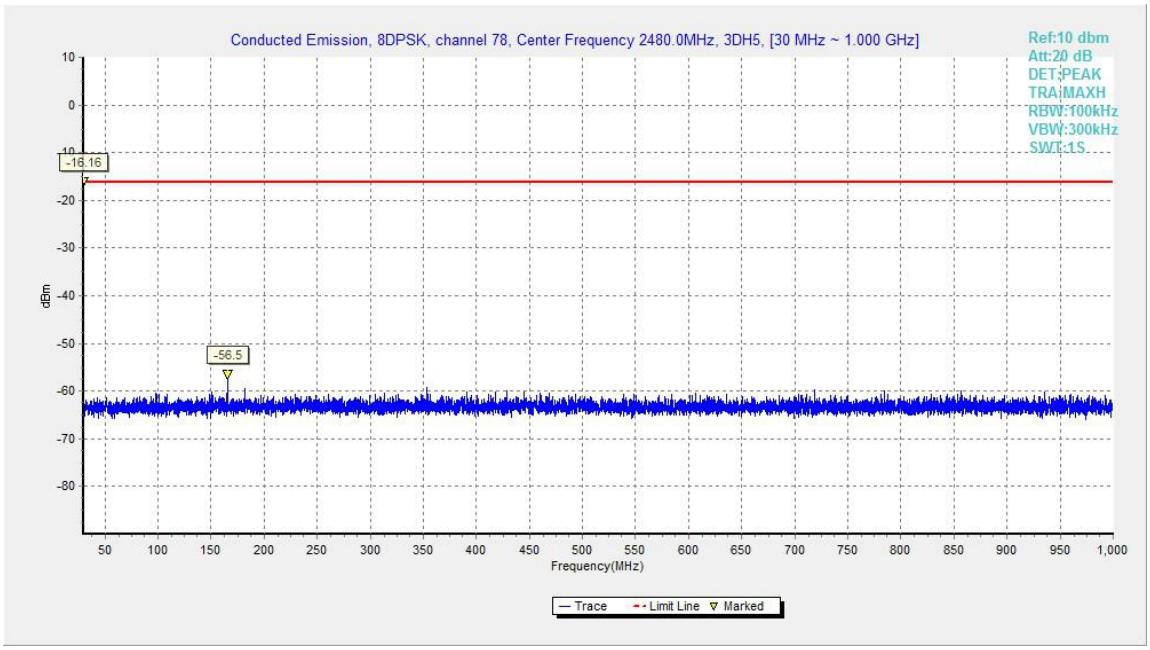


Fig.54. Conducted spurious emission: 8DPSK, Channel 78, 30MHz - 1GHz

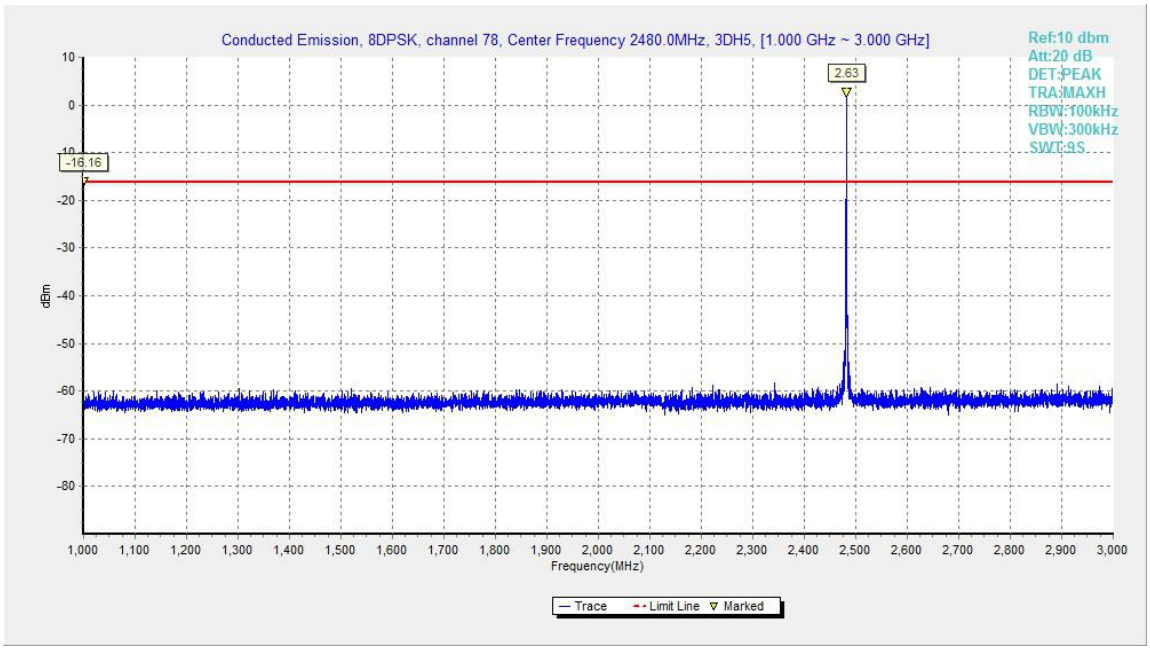


Fig.55. Conducted spurious emission: 8DPSK, Channel 78, 1GHz - 3GHz

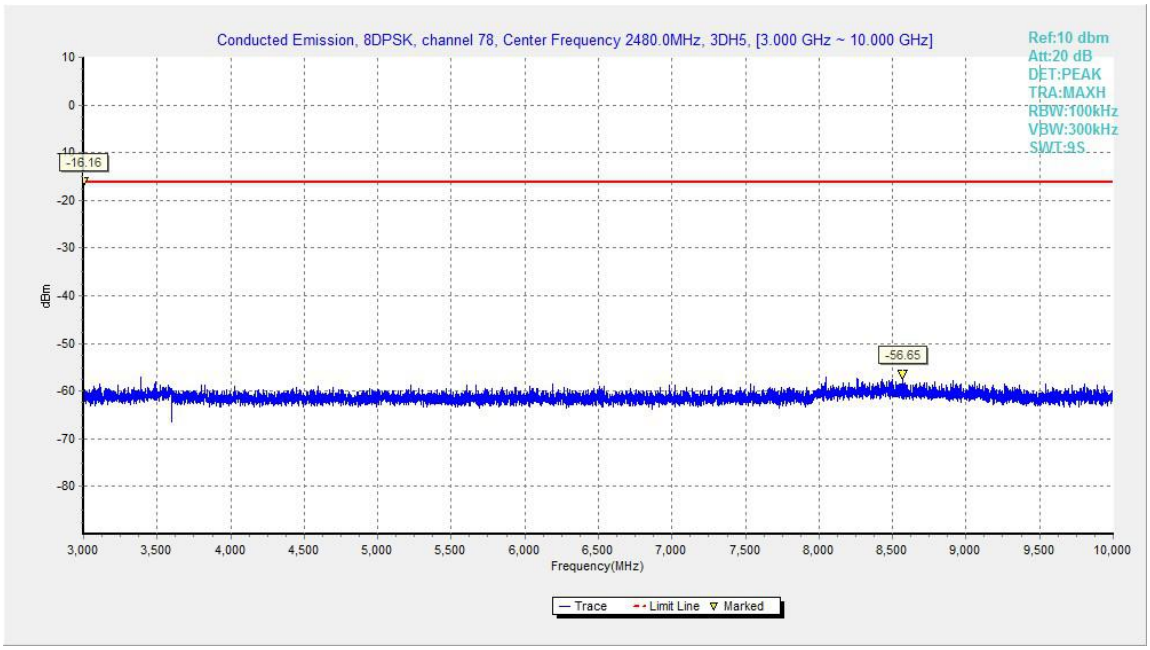


Fig.56. Conducted spurious emission: 8DPSK, Channel 78, 3GHz - 10GHz

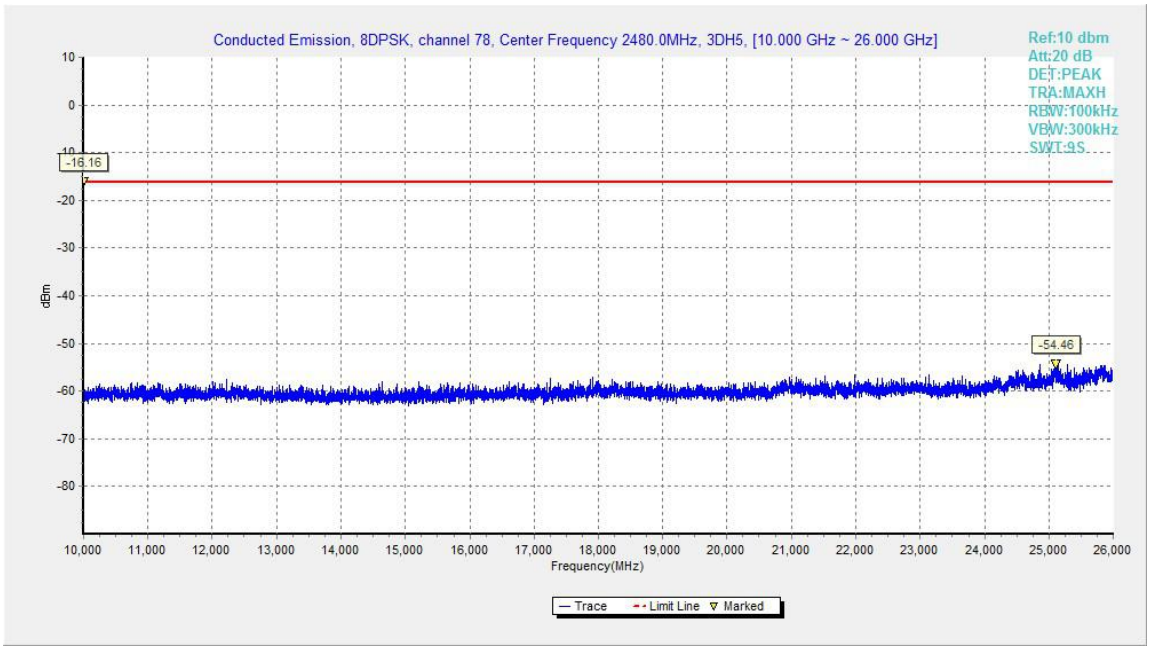


Fig.57. Conducted spurious emission: 8DPSK, Channel 78, 10GHz - 26GHz

A.5. Transmitter Spurious Emission - Radiated

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power

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)).

The measurement is made according to ANSI C63.10

Limit in restricted band:

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Condition

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	100KHz/300KHz	5
1000-4000	1MHz/1MHz	15
4000-18000	1MHz/1MHz	40
18000-26500	1MHz/1MHz	20

Measurement Results:

Result=P_{Mea}+ARPL

For GFSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Ch 39 2441 MHz	9 kHz ~ 30 MHz		P
	30 MHz ~ 1 GHz		P
	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Ch 78 2480 MHz	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Power	2.38GHz~2.4GHz---L	Fig.58	P
Power	2.45GHz~2.5GHz---H	Fig.59	P

For all channels	18 GHz ~ 26 GHz		P

Forπ/4 DQPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Ch 39 2441 MHz	30 MHz ~ 1 GHz		P
	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Ch 78 2480 MHz	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Power	2.38GHz~2.4GHz---L	Fig.60	P
Power	2.45GHz~2.5GHz---H	Fig.61	P
For all channels	18 GHz ~ 26 GHz		P

For 8DPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Ch 39 2441 MHz	30 MHz ~ 1 GHz		P
	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Ch 78 2480 MHz	1 GHz ~ 3 GHz		P
	3 GHz ~ 18 GHz		P
Power	2.38GHz~2.4GHz---L	Fig.62	P
Power	2.45GHz~2.5GHz---H	Fig.63	P
For all channels	18 GHz ~ 26 GHz		P

GFSK Ch 0 - Average

Frequency (MHz)	Measurement Result (dBµV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Limit (dBµV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2384.750	46.28	2.9	32.0	11.41	54.0	7.7	H	155	20
2389.470	46.30	2.9	32.0	11.42	54.0	7.7	H	155	18
4804.000	35.07	-32.2	34.0	33.35	54.0	18.9	H	155	90
7206.000	37.83	-31.2	35.7	33.31	54.0	16.2	H	155	114
9608.000	37.67	-32.6	36.8	33.53	54.0	16.3	H	155	36
12010.000	42.82	-29.8	38.9	33.74	54.0	11.2	H	155	2

GFSK Ch 39 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2381.170	46.28	2.9	32.0	11.40	54.0	7.7	H	155	26
2488.220	46.43	2.9	32.1	11.40	54.0	7.6	H	155	48
4882.000	35.09	-32.5	34.0	33.59	54.0	18.9	H	155	68
7323.000	37.71	-31.4	35.8	33.36	54.0	16.3	H	155	44
9764.000	38.33	-32.1	37.0	33.50	54.0	15.7	H	155	8
12205.000	43.52	-29.2	38.9	33.80	54.0	10.5	H	155	102

GFSK Ch 78 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2483.520	46.91	2.9	32.1	11.89	54.0	7.1	H	155	132
2485.460	46.64	2.9	32.1	11.62	54.0	7.4	H	155	28
4960.000	34.99	-32.6	34.0	33.56	54.0	19.0	H	155	38
7440.000	37.70	-31.4	35.8	33.34	54.0	16.3	H	155	65
9920.000	40.35	-30.2	37.2	33.38	54.0	13.7	H	155	4
12400.000	43.87	-29.3	39.0	34.17	54.0	10.1	H	155	24

π/4 DQPSK Ch 0 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2383.520	46.29	2.9	32.0	11.41	54.0	7.7	H	155	8
2386.803	46.28	2.9	32.0	11.40	54.0	7.7	H	155	56
4804.000	35.02	-32.2	34.0	33.30	54.0	19.0	H	155	139
7206.000	37.80	-31.2	35.7	33.28	54.0	16.2	H	155	108
9608.000	37.60	-32.6	36.8	33.46	54.0	16.4	H	155	78
12010.000	42.66	-29.8	38.9	33.59	54.0	11.3	H	155	36

π/4 DQPSK Ch 39 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2381.640	46.31	2.9	32.0	11.44	54.0	7.7	H	155	268
2483.620	46.30	2.9	32.1	11.28	54.0	7.7	H	155	138
4882.500	35.90	-32.5	34.0	34.40	54.0	18.1	H	155	104
7323.000	37.71	-31.4	35.8	33.36	54.0	16.3	H	155	40
9764.000	38.51	-32.1	37.0	33.68	54.0	15.5	H	155	28
12205.000	43.56	-29.2	38.9	33.84	54.0	10.4	H	155	8

π/4 DQPSK Ch 78 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2483.500	46.93	2.9	32.1	11.91	54.0	7.1	H	155	8
2488.730	46.38	2.9	32.1	11.35	54.0	7.6	H	155	46
4960.000	34.99	-32.6	34.0	33.56	54.0	19.0	H	155	20
7440.000	37.83	-31.4	35.8	33.47	54.0	16.2	H	155	118
9920.000	40.36	-30.2	37.2	33.39	54.0	13.6	H	155	82
12400.000	43.67	-29.3	39.0	33.96	54.0	10.3	H	155	46

8DPSK Ch 0 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2382.790	46.30	2.9	32.0	11.43	54.0	7.7	H	155	16
2388.940	46.37	2.9	32.0	11.49	54.0	7.6	H	155	48
4804.000	35.12	-32.2	34.0	33.40	54.0	18.9	H	155	80
7206.000	37.86	-31.2	35.7	33.34	54.0	16.1	H	155	8
9608.000	37.84	-32.6	36.8	33.71	54.0	16.2	H	155	102
12010.000	42.93	-29.8	38.9	33.85	54.0	11.1	H	155	118

8DPSK Ch 39 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2389.390	46.28	2.9	32.0	11.40	54.0	7.7	H	155	28
2482.330	46.55	2.9	32.1	11.53	54.0	7.5	H	155	46
4881.000	35.02	-32.5	34.0	33.52	54.0	19.0	H	155	8
7323.000	37.92	-31.4	35.8	33.58	54.0	16.1	H	155	6
9764.000	38.19	-32.1	37.0	33.35	54.0	15.8	H	155	24
12205.000	43.51	-29.2	38.9	33.79	54.0	10.5	H	155	185

8DPSK Ch 78 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2483.590	46.85	2.9	32.1	11.83	54.0	7.1	H	155	28
2487.250	46.70	2.9	32.1	11.67	54.0	7.3	H	155	248
4959.000	35.05	-32.6	34.0	33.61	54.0	19.0	H	155	38
7440.000	37.65	-31.4	35.8	33.29	54.0	16.3	H	155	98
9920.000	40.29	-30.2	37.2	33.32	54.0	13.7	H	155	183
12400.000	43.87	-29.3	39.0	34.16	54.0	10.1	H	155	356

GFSK Ch 0 – Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2383.724	59.57	2.9	32.0	24.69	74.0	14.4	H	155	22
2389.002	59.55	2.9	32.0	24.67	74.0	14.4	H	155	22
4804.000	41.57	-32.2	34.0	39.85	74.0	32.4	H	155	88
7206.000	43.63	-31.2	35.7	39.11	74.0	30.4	V	155	110
9608.000	43.20	-32.6	36.8	39.06	74.0	30.8	V	155	44
12010.000	47.57	-29.8	38.9	38.50	74.0	26.4	H	155	0

GFSK Ch 39 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2378.650	49.47	-32.0	32.0	49.50	74.0	24.5	H	155	22
2495.800	48.90	-31.0	32.1	47.80	74.0	25.1	H	155	44
4882.000	41.43	-32.5	34.0	39.93	74.0	32.6	V	155	66
7323.000	43.51	-31.4	35.8	39.17	74.0	30.5	V	155	22
9764.000	44.21	-32.1	37.0	39.38	74.0	29.8	V	155	0
12205.000	48.02	-29.2	38.9	38.30	74.0	26.0	V	155	88

GFSK Ch 78 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2485.510	59.70	2.9	32.1	24.68	74.0	14.3	H	155	110
2490.400	59.91	2.9	32.1	24.88	74.0	14.1	H	155	22
4960.000	41.32	-32.6	34.0	39.89	74.0	32.7	V	155	44
7440.000	42.67	-31.4	35.8	38.31	74.0	31.3	V	155	66
9920.000	45.55	-30.2	37.2	38.58	74.0	28.5	V	155	0
12400.000	48.78	-29.3	39.0	39.07	74.0	25.2	H	155	22

π/4 DQPSK Ch 0 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2386.398	59.57	2.9	32.0	24.69	74.0	14.4	H	155	0
2389.103	59.16	2.9	32.0	24.27	74.0	14.8	H	155	44
4804.000	42.02	-32.2	34.0	40.29	74.0	32.0	H	155	132
7206.000	43.34	-31.2	35.7	38.83	74.0	30.7	V	155	110
9608.000	43.44	-32.6	36.8	39.30	74.0	30.6	H	155	88
12010.000	47.66	-29.8	38.9	38.59	74.0	26.3	H	155	44

π/4 DQPSK Ch 39 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2380.200	50.80	-31.7	32.0	50.52	74.0	23.2	H	155	264
2498.420	49.59	-31.9	32.1	49.37	74.0	24.4	H	155	132
4882.000	40.95	-32.5	34.0	39.45	74.0	33.1	H	155	110
7323.000	43.25	-31.4	35.8	38.90	74.0	30.8	H	155	44
9764.000	42.93	-32.1	37.0	38.09	74.0	31.1	H	155	22
12205.000	48.08	-29.2	38.9	38.36	74.0	25.9	V	155	0

π/4 DQPSK Ch 78 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2486.263	59.85	2.9	32.1	24.83	74.0	14.1	H	155	0
2497.412	60.53	2.9	32.1	25.49	74.0	13.5	H	155	44
4960.000	41.38	-32.6	34.0	39.95	74.0	32.6	V	155	22
7440.000	43.44	-31.4	35.8	39.08	74.0	30.6	H	155	110
9920.000	43.02	-30.2	37.2	36.05	74.0	31.0	H	155	88
12400.000	48.65	-29.3	39.0	38.94	74.0	25.4	H	155	44

8DPSK Ch 0 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2386.034	59.75	2.9	32.0	24.87	74.0	14.2	H	155	22
2384.466	60.21	2.9	32.0	25.33	74.0	13.8	H	155	44
4804.000	41.39	-32.2	34.0	39.67	74.0	32.6	V	155	88
7206.000	43.29	-31.2	35.7	38.78	74.0	30.7	V	155	0
9608.000	43.14	-32.6	36.8	39.00	74.0	30.9	H	155	110
12010.000	47.23	-29.8	38.9	38.16	74.0	26.8	H	155	132

8DPSK Ch 39 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2335.240	47.99	-33.4	32.0	49.39	74.0	26.0	H	155	22
2593.200	49.33	-32.8	32.2	49.86	74.0	24.7	H	155	44
4882.000	41.26	-32.5	34.0	39.76	74.0	32.7	V	155	0
7323.000	43.15	-31.4	35.8	38.81	74.0	30.8	H	155	0
9764.000	43.62	-32.1	37.0	38.79	74.0	30.4	V	155	22
12205.000	47.24	-29.2	38.9	37.52	74.0	26.8	H	155	176

8DPSK Ch 78 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2497.590	59.97	2.9	32.1	24.93	74.0	14.0	H	155	22
2486.470	59.82	2.9	32.1	24.79	74.0	14.2	H	155	242
4960.000	41.39	-32.6	34.0	39.96	74.0	32.6	V	155	44
7440.000	42.93	-31.4	35.8	38.57	74.0	31.1	H	155	88
9920.000	45.83	-30.2	37.2	38.86	74.0	28.2	V	155	176
12400.000	47.69	-29.3	39.0	37.98	74.0	26.3	H	155	0

Conclusion: PASS

Test graphs as below:

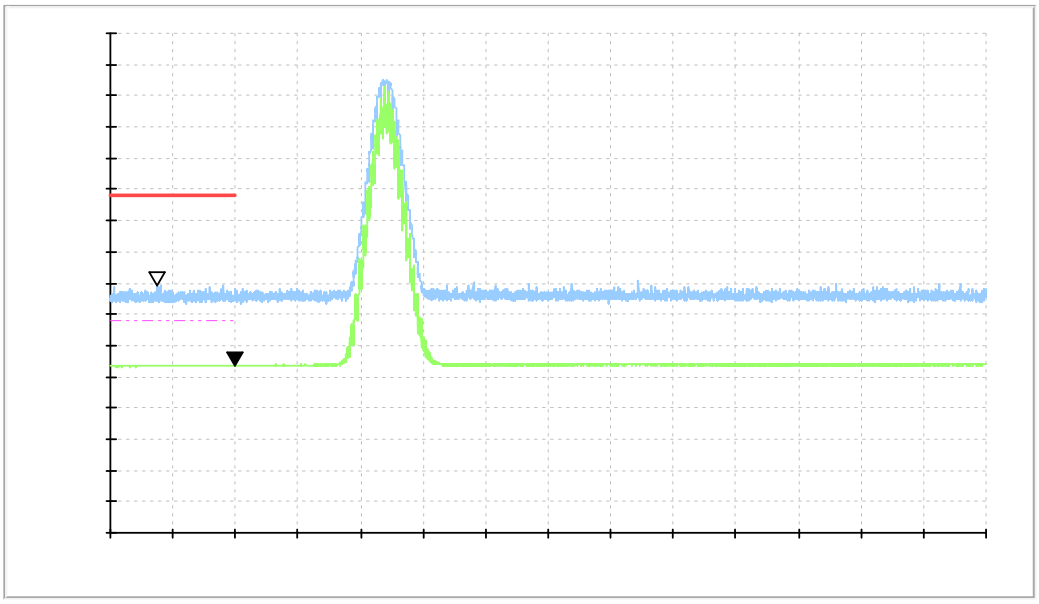


Fig.58. Radiated emission (Power): GFSK, low channel

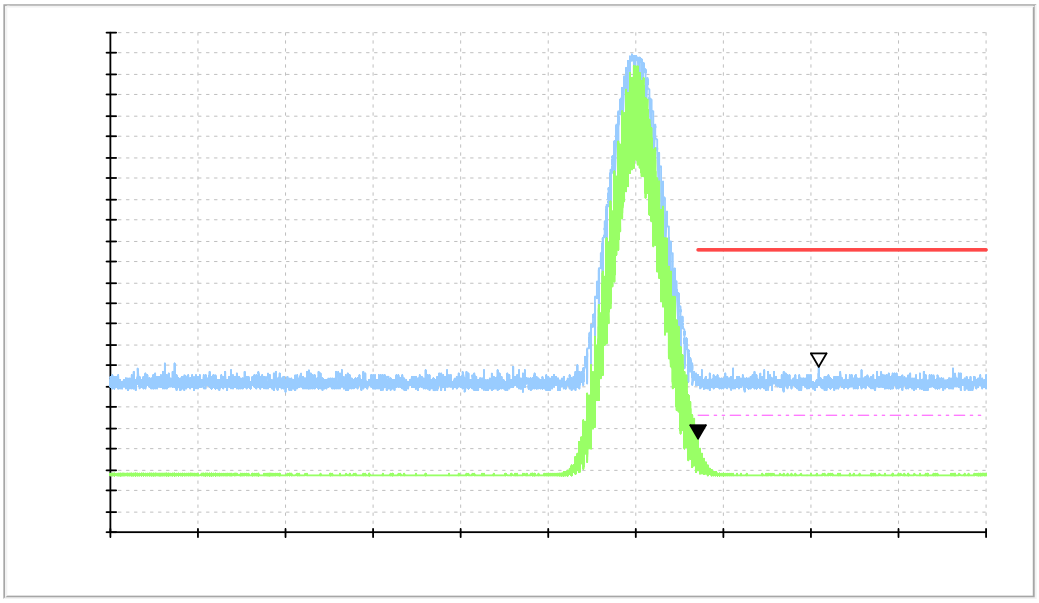


Fig.59. Radiated emission (Power) GFSK, high channel

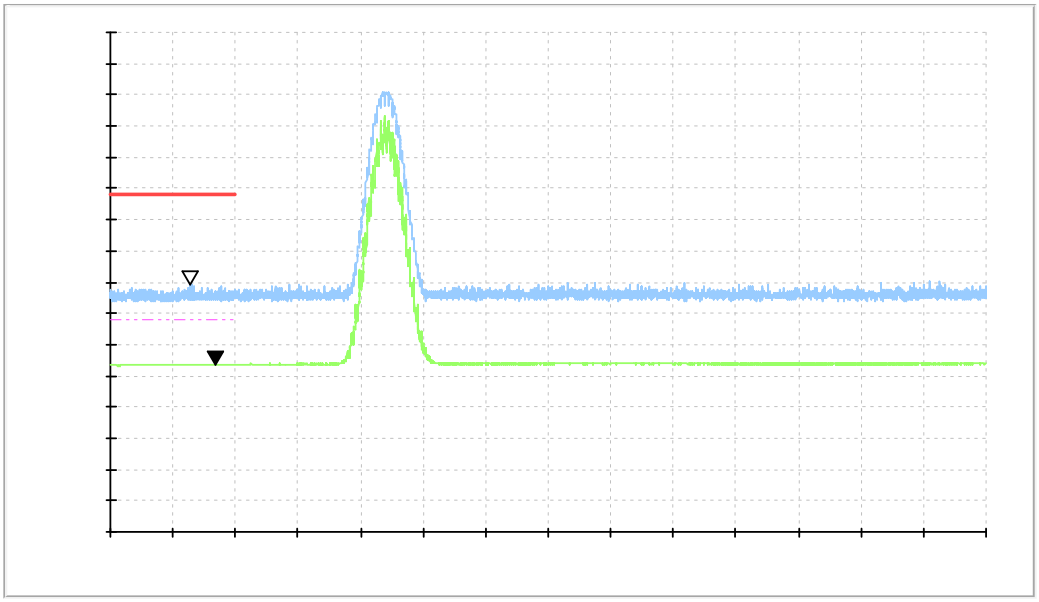


Fig.60. Radiated emission (Power): π/4 DQPSK, low channel

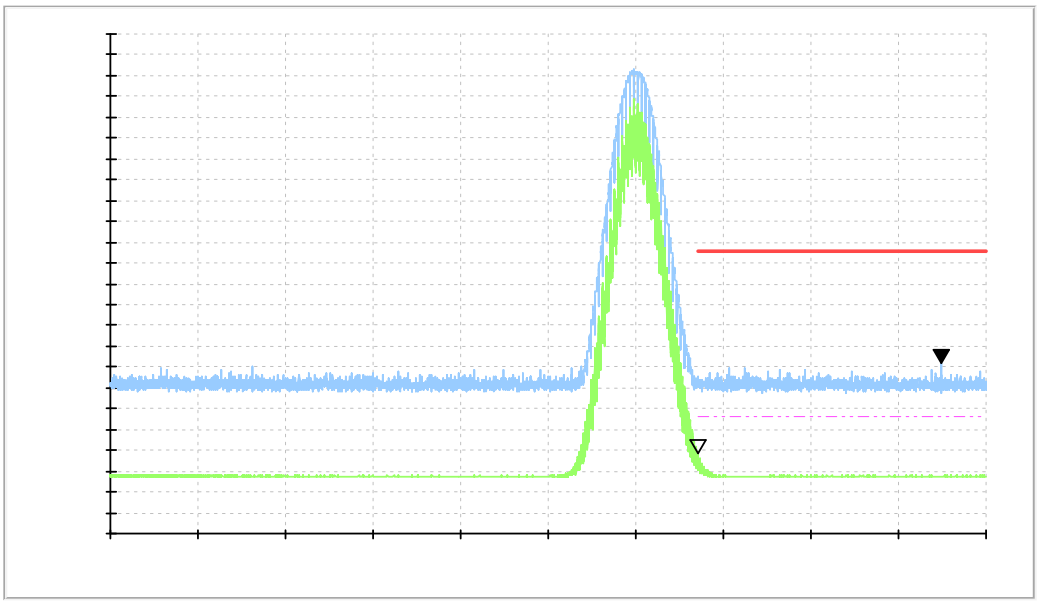


Fig.61. Radiated emission (Power): π/4 DQPSK, high channel

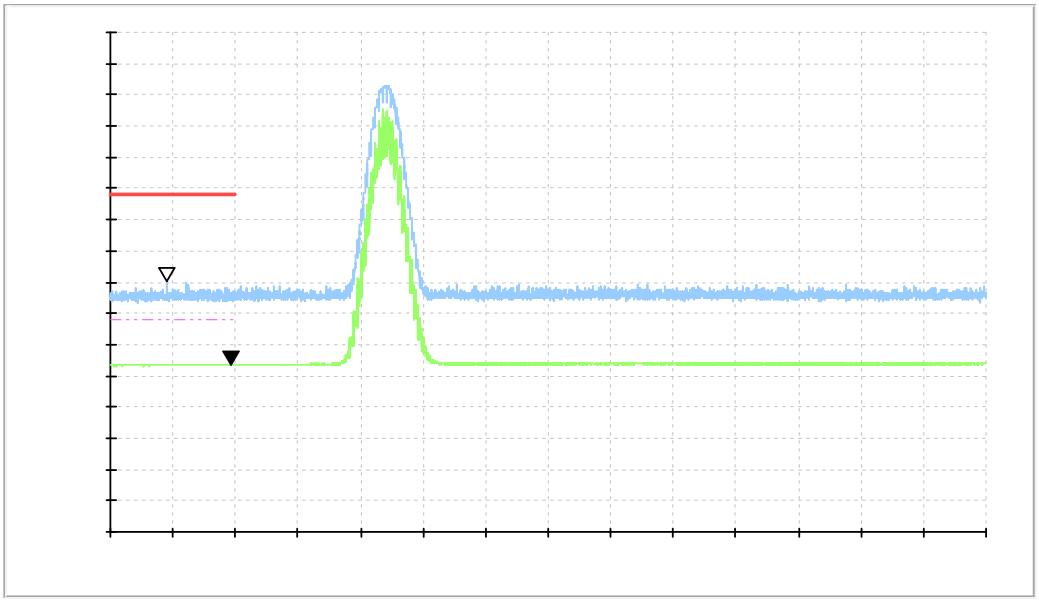


Fig.62. Radiated emission (Power): 8DPSK, low channel

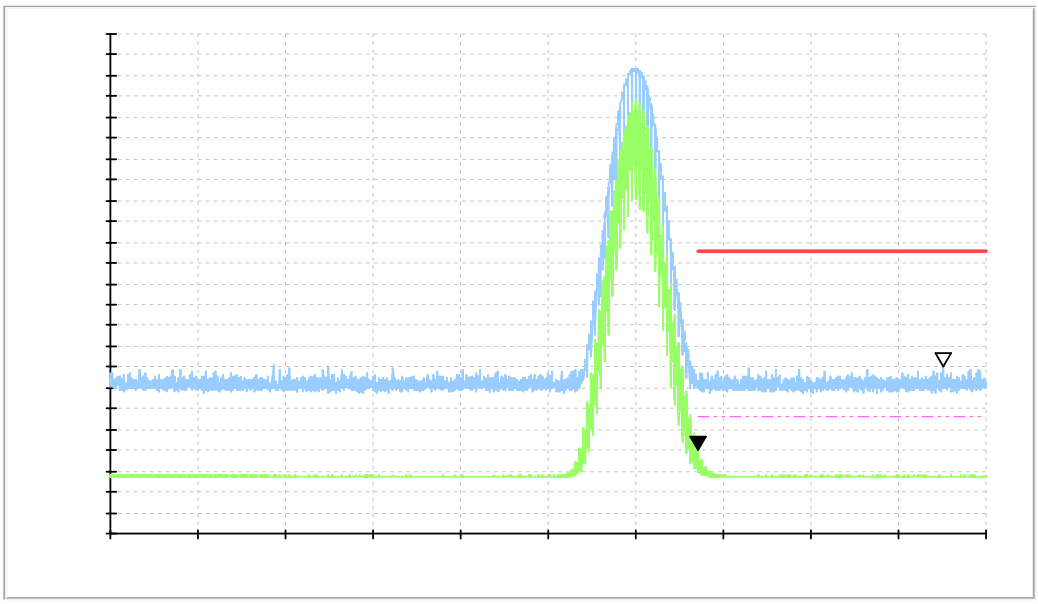


Fig.63. Radiated emission (Power): 8DPSK, high channel

A.6. Time of Occupancy (Dwell Time)

Method of Measurement: See ANSI C63.10-clause 7.8.4

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

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

Measure a pulse time in time domain at middle frequency and then count the hopping number in 31.6s(which equals with 0.4 multiply 79) of middle frequency ,then multiply the pulse time and hopping number and record them.

Measurement Limit:

Standard	Limit (ms)
FCC 47 CFR Part 15.247(a) (1)(iii)	< 400

Measurement Result:

For GFSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.64	117.64	P
		Fig.65		
	DH3	Fig.66	169.11	P
		Fig.67		
	DH5	Fig.68	192.57	P
		Fig.69		

For π/4 DQPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.70	120.32	P
		Fig.71		
	DH3	Fig.72	158.05	P
		Fig.73		
	DH5	Fig.74	210.05	P
		Fig.75		

For 8DPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.76	120.37	P
		Fig.77		
	DH3	Fig.78	182.36	P

		Fig.79		
	DH5	Fig.80	221.32	P
		Fig.81		

Conclusion: PASS

Test graphs as below:

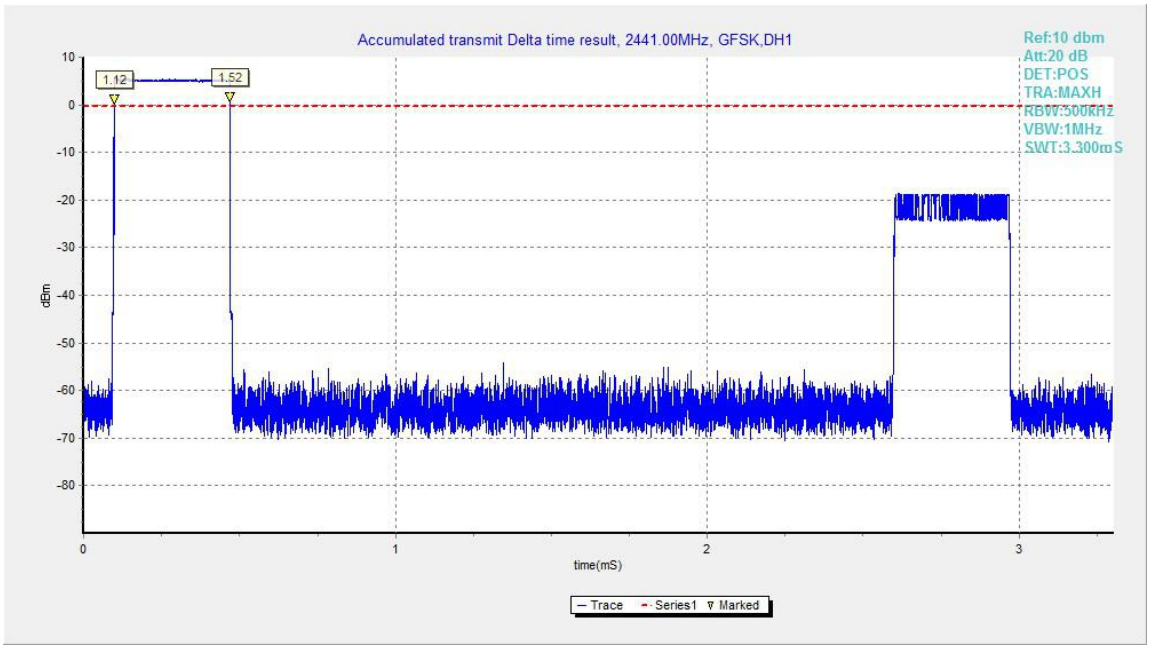


Fig.64. Time of occupancy (Dwell Time): Channel 39, Packet DH1

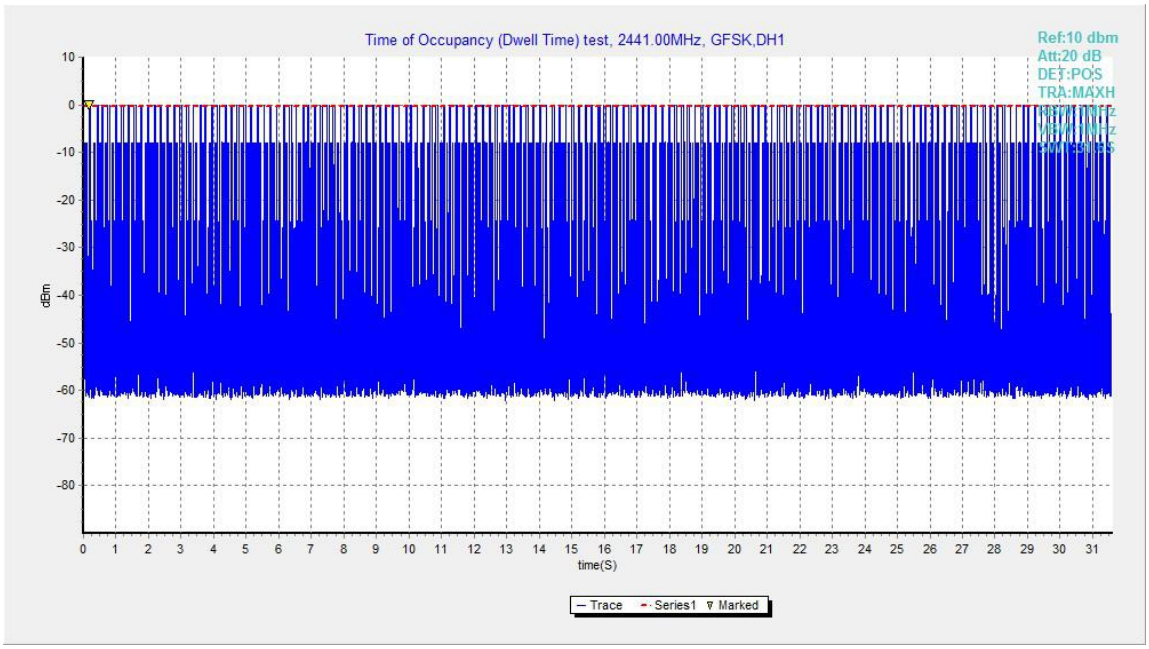


Fig.65. Number of Transmissions Measurement: Channel 39,Packet DH1