



**FCC PART 15C  
TEST REPORT  
No. I18Z60435-IOT02**

**for**

**LG Electronics MobileComm USA, Inc.**

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

**Model Name:**

**LM-X410HT,LMX410HT,X410HT ;LM-X410RT,LMX410RT,X410RT**

**FCC ID: ZNFX410HT**

**with**

**Hardware Version: Rev.1.0**

**Software Version: V09p**

**Issued Date: 2018-4-16**



**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I18Z60435-IOT02	Rev.0	1st edition	2018-4-16



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## 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℃

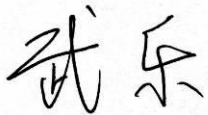
Relative Humidity: 20-75%

### 1.3. Project data

Testing Start Date: 2018-3-20

Testing End Date: 2018-4-16

### 1.4. Signature



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Wu Le

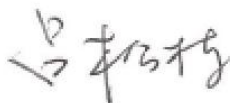
(Prepared this test report)



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Sun Zhenyu

(Reviewed this test report)



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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-X410HT,LMX410HT,X410HT ;LM-X410RT,LMX410RT,X410RT
FCC ID	ZNFX410HT
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation	GFSK/ $\pi/4$ DQPSK/8DPSK
Number of Channels	79
Power Supply	3.8V DC by Battery

#### **3.2. Internal Identification of EUT**

<b>EUT ID*</b>	<b>SN or IMEI</b>	<b>HW Version</b>	<b>SW Version</b>
EUT1	355673090005740	Rev.1.0	V09p
EUT2	355673090002457	Rev.1.0	V09p

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

#### **3.3. Internal Identification of AE**

<b>AE ID*</b>	<b>Description</b>
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.

<b>Reference</b>	<b>Title</b>	<b>Version</b>
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)	<b>P</b>
Frequency Band Edges	15.247 (d)	<b>P</b>
Transmitter Spurious Emission - Conducted	15.247 (d)	<b>P</b>
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	<b>P</b>
Time of Occupancy (Dwell Time)	15.247 (a) (1)(iii)	<b>P</b>
20dB Bandwidth	15.247 (a)(1)	<b>NA</b>
Carrier Frequency Separation	15.247 (a)(1)	<b>P</b>
Number of hopping channels	15.247 (a)(b)(iii)	<b>P</b>
AC Powerline Conducted Emission	15.107, 15.207	<b>P</b>

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

## 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	100235	Rohde & Schwarz	1 year	2019-02-28
2	BiLog Antenna	VULB9163	9163-302	Schwarzbeck	3 years	2020-02-27
3	EMI Antenna	3115	00167250	ETS-Lindgren	3 Years	2020-05-21
4	Dual-Ridge Waveguide Horn Antenna	3116	2661	ETS-Lindgren	3 years	2020-07-27
5	Vector Signal Analyzer	FSV	101047	Rohde & Schwarz	1 year	2018-07-22
6	Bluetooth Tester	CBT	101042	Rohde & Schwarz	1 year	2019-02-28

## 7. Measurement Uncertainty

### 7.1. Peak Output Power - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB
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### 7.2. Frequency Band Edges

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB
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### 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
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### 7.6. 20dB Bandwidth

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz
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### 7.7. Carrier Frequency Separation

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	61.936Hz
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### 7.8. AC Powerline Conducted Emission

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	3.38dB
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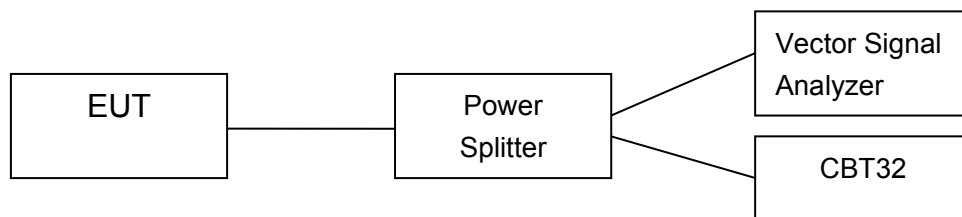
## **ANNEX A: Detailed Test Results**

### **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**

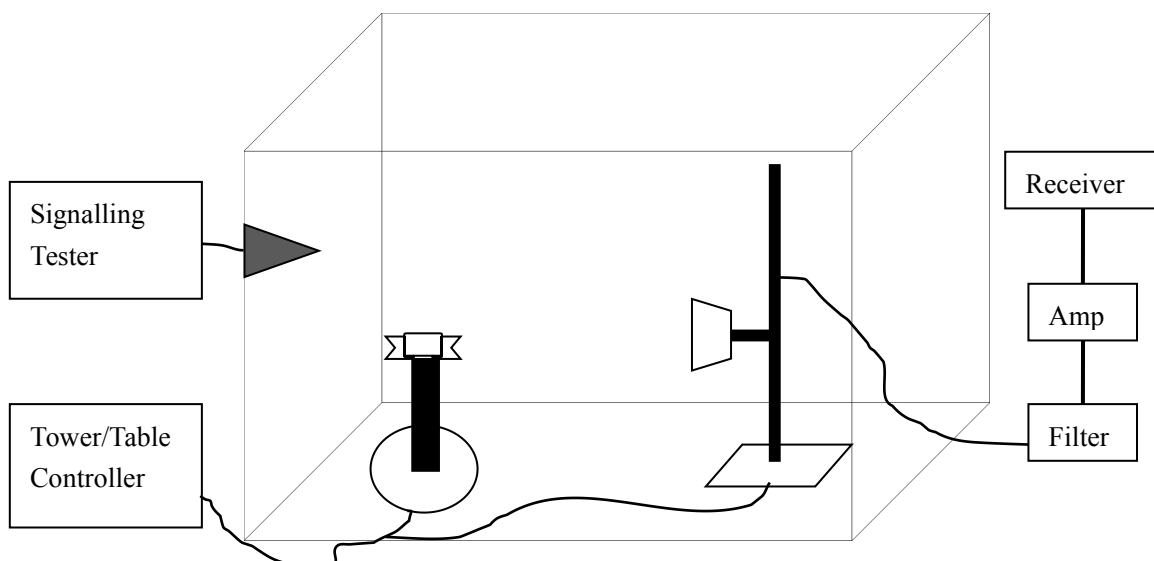
The measurement is made according to ANSI C63.10

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)	4.26	6.44	5.98	P

#### For $\pi/4$ DQPSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.13	6.08	5.27	P

#### For 8DPSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	4.40	6.33	5.63	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	-57.19	P
	Hopping ON	Fig.2	-58.92	P
78	Hopping OFF	Fig.3	-64.48	P
	Hopping ON	Fig.4	-63.96	P

**For  $\pi/4$  DQPSK**

Channel	Hopping	Band Edge Power ( dBc)		Conclusion
0	Hopping OFF	Fig.5	-57.15	P
	Hopping ON	Fig.6	-63.99	P
78	Hopping OFF	Fig.7	-62.85	P
	Hopping ON	Fig.8	-63.60	P

**For 8DPSK**

Channel	Hopping	Band Edge Power ( dBc)		Conclusion
0	Hopping OFF	Fig.9	-58.75	P
	Hopping ON	Fig.10	-58.16	P

78	Hopping OFF	Fig.11	-63.20	P
	Hopping ON	Fig.12	-64.34	P

**Conclusion: PASS**

**Test graphs as below**

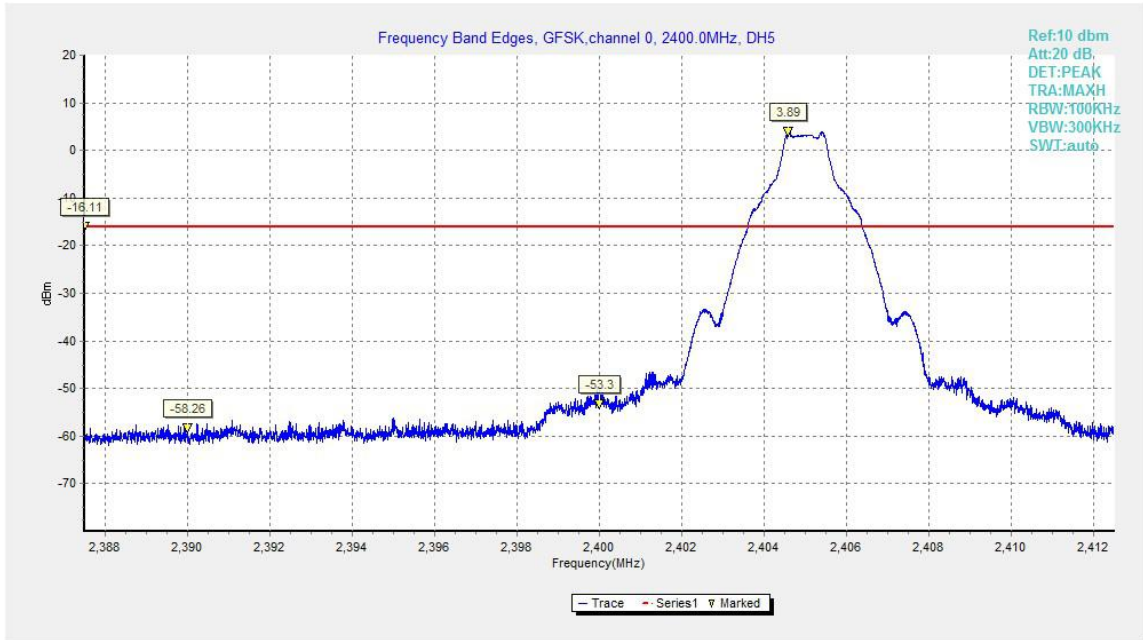


Fig.1. Frequency Band Edges: GFSK, Channel 0, Hopping Off

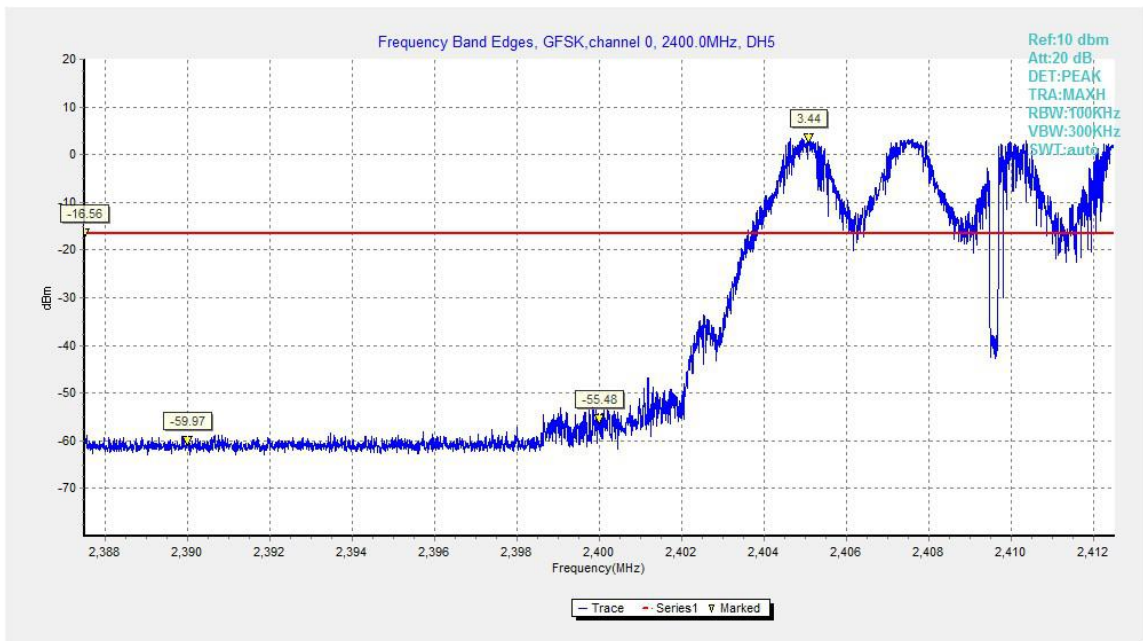


Fig.2. Frequency Band Edges: GFSK, Channel 0, Hopping On



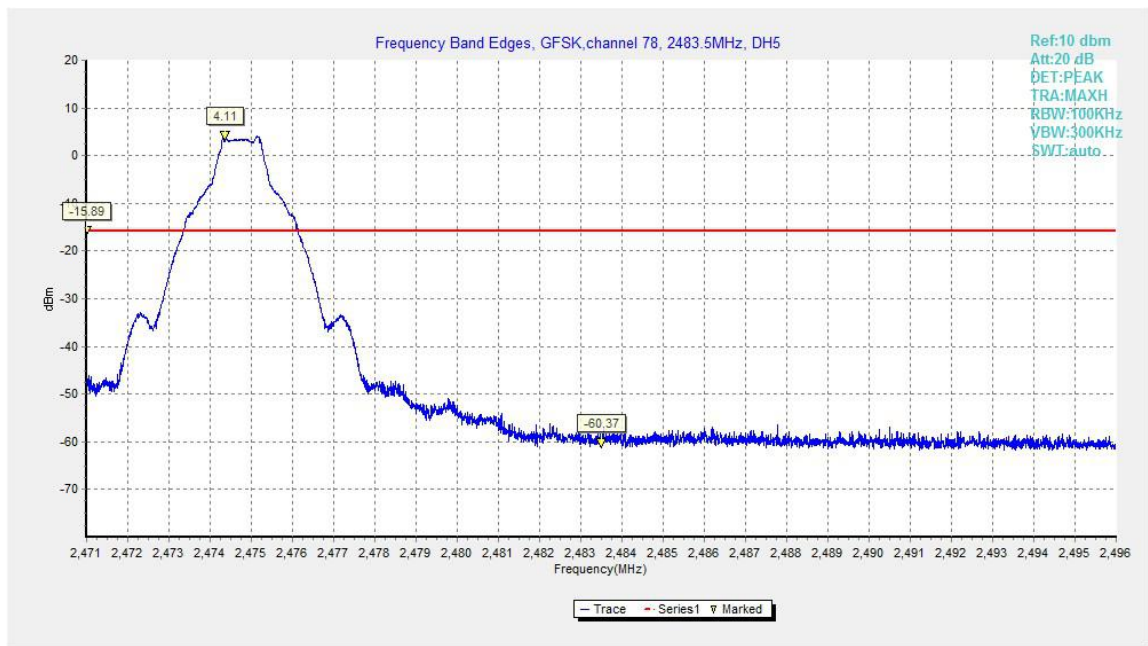


Fig.3. Frequency Band Edges: GFSK, Channel 78, Hopping Off

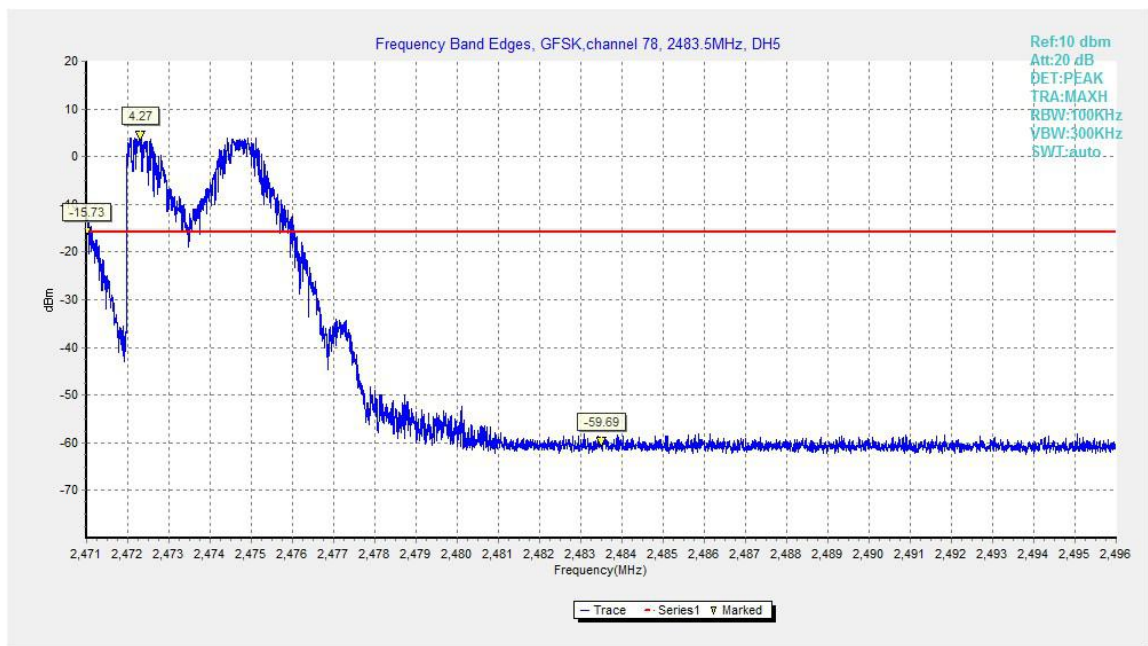


Fig.4. Frequency Band Edges: GFSK, Channel 78, Hopping On

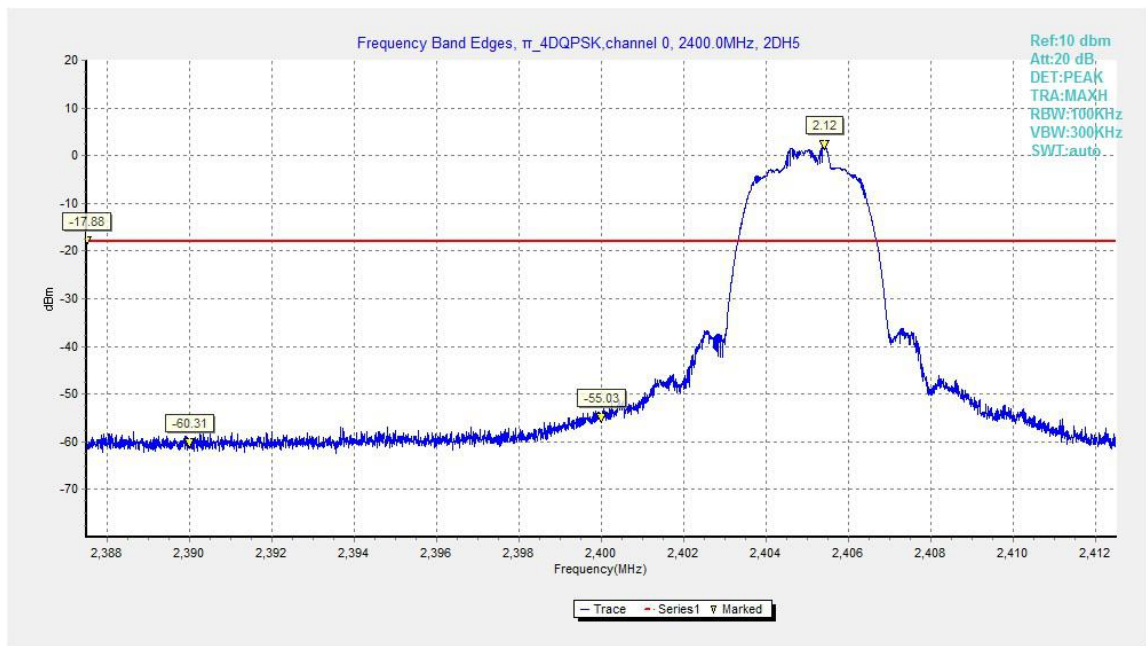


Fig.5. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 0, Hopping Off

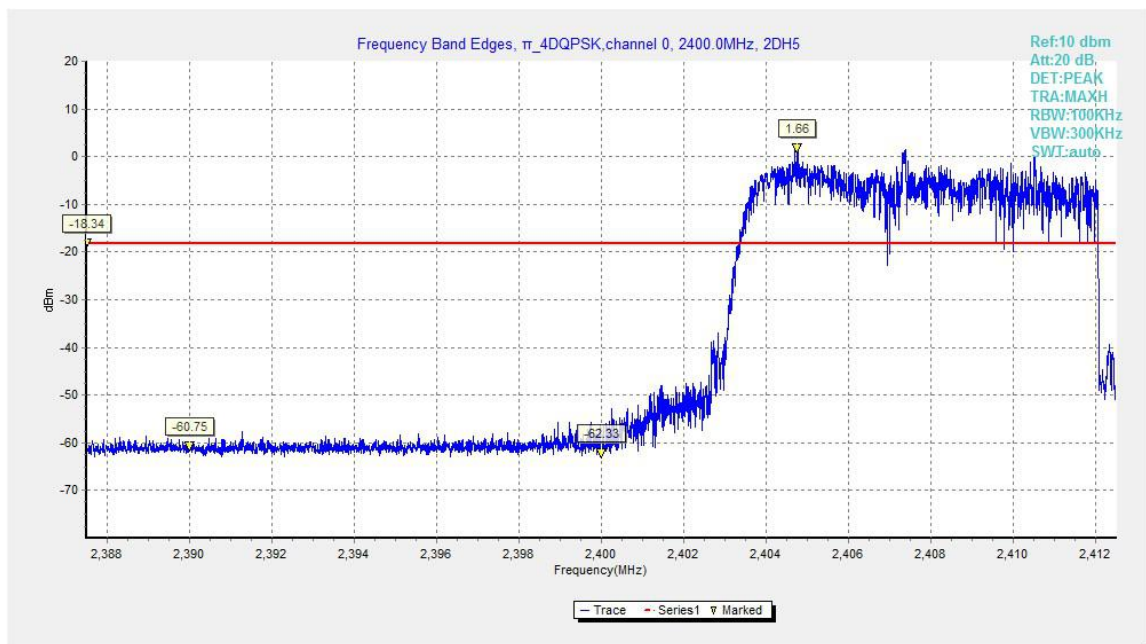


Fig.6. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 0, Hopping On

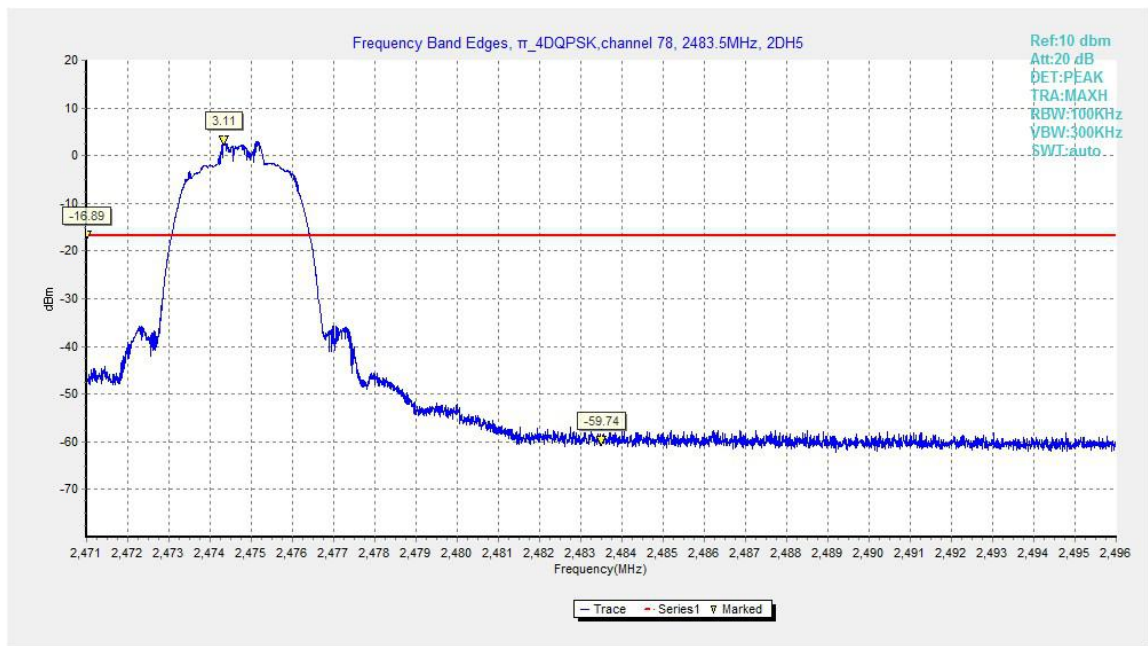


Fig.7. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 78, Hopping Off

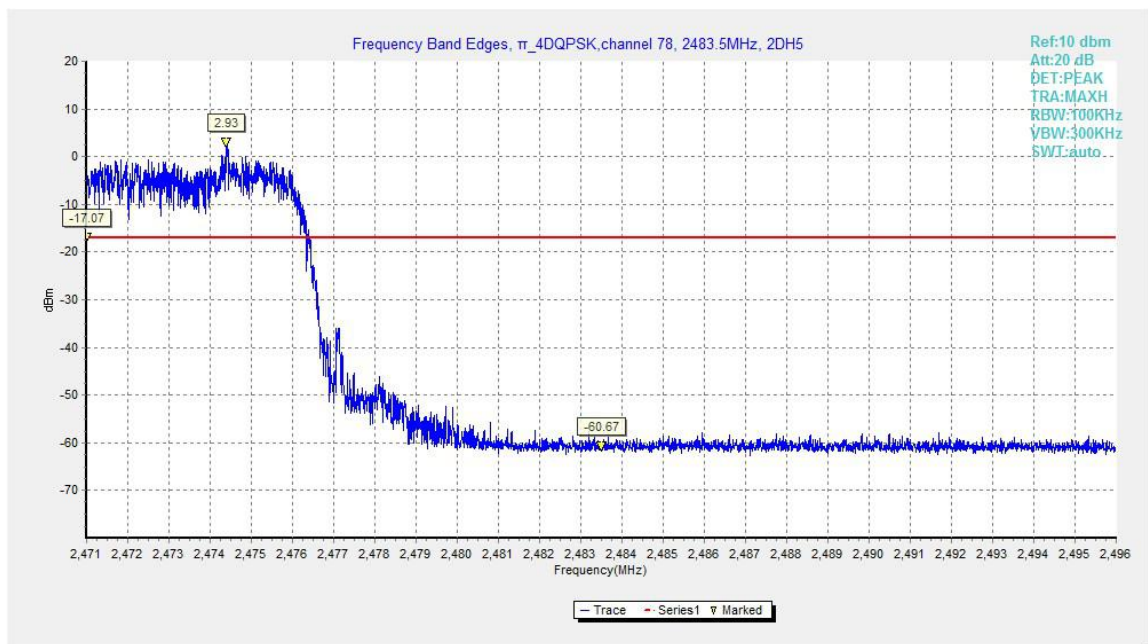


Fig.8. Frequency Band Edges:  $\pi/4$  DQPSK, Channel 78, Hopping On

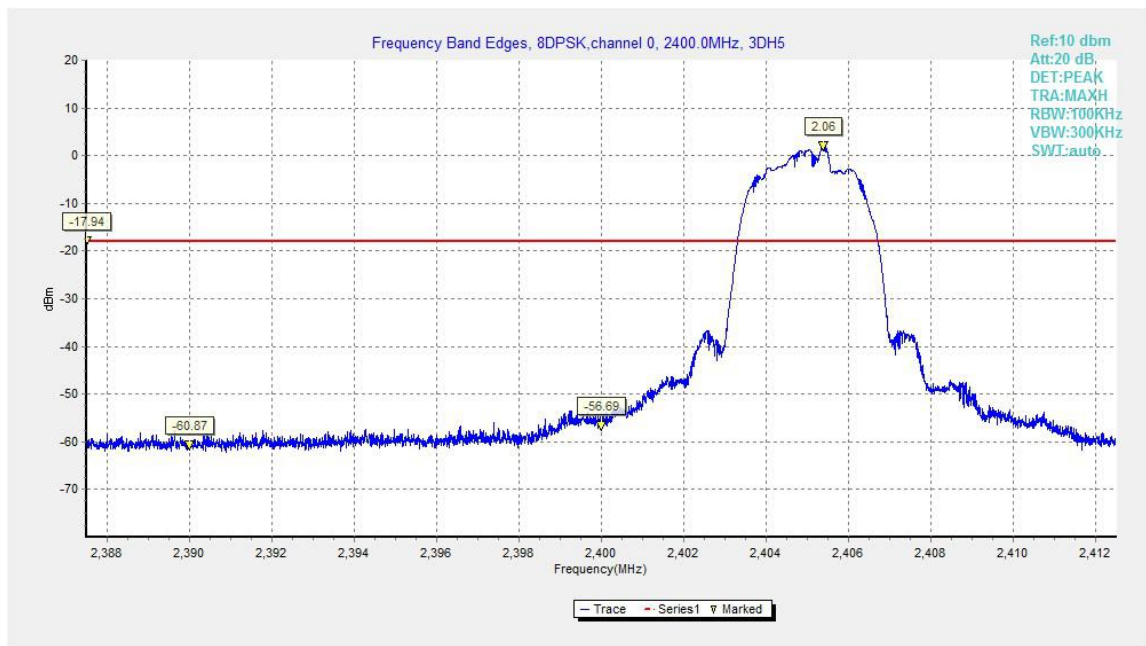


Fig.9. Frequency Band Edges: 8DPSK, Channel 0, Hopping Off

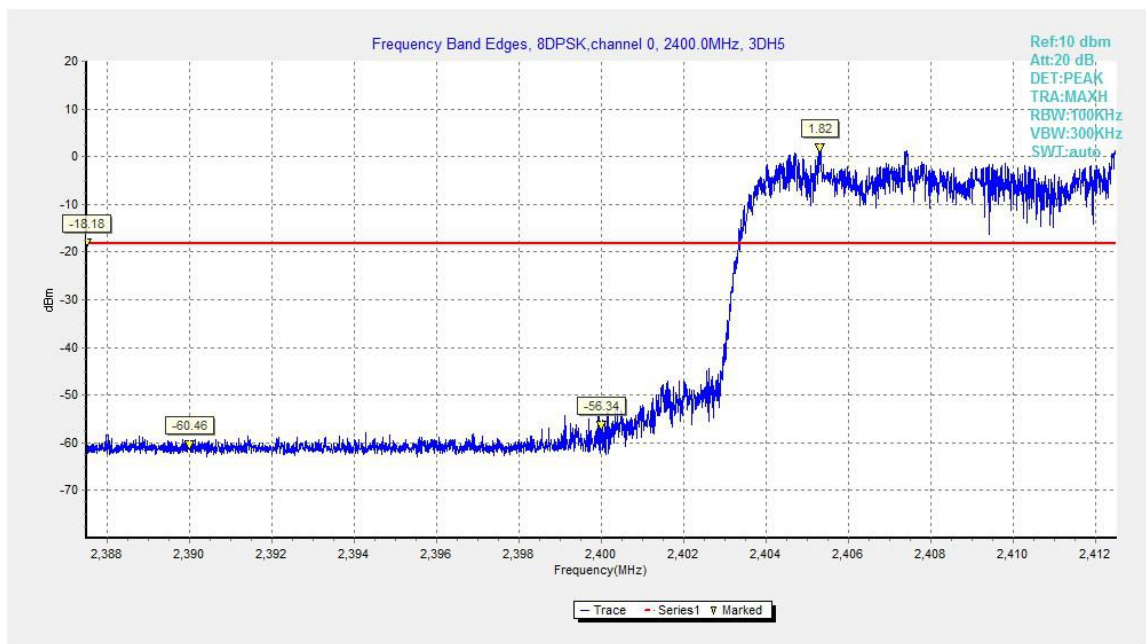


Fig.10. Frequency Band Edges: 8DPSK, Channel 0, Hopping On



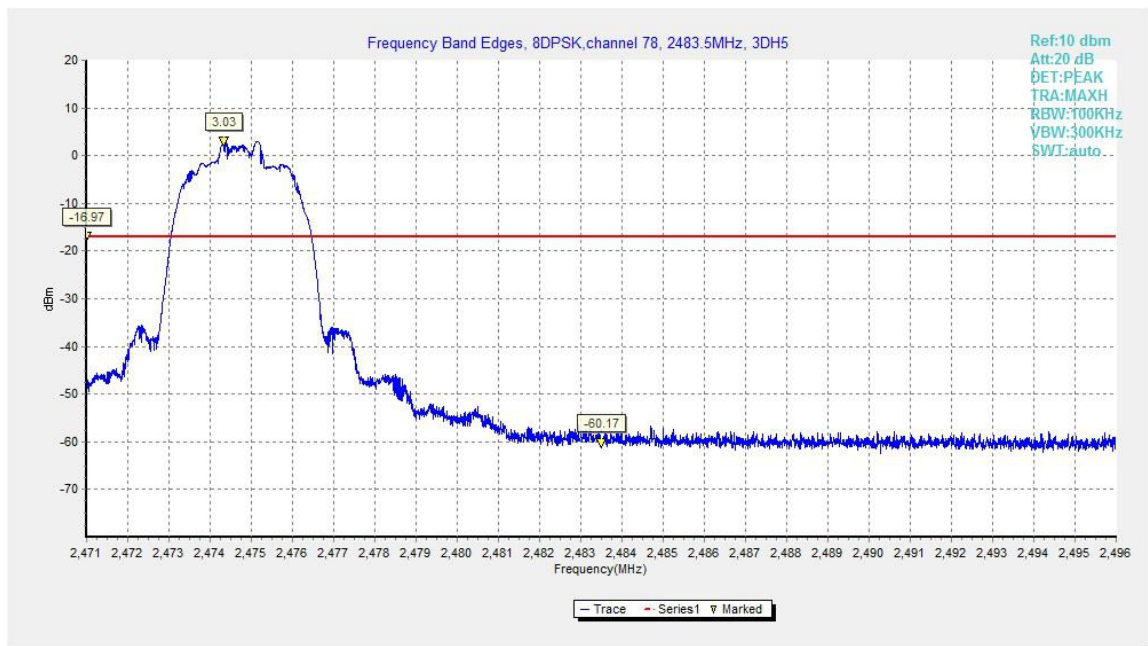


Fig.11. Frequency Band Edges: 8DPSK, Channel 78, Hopping Off

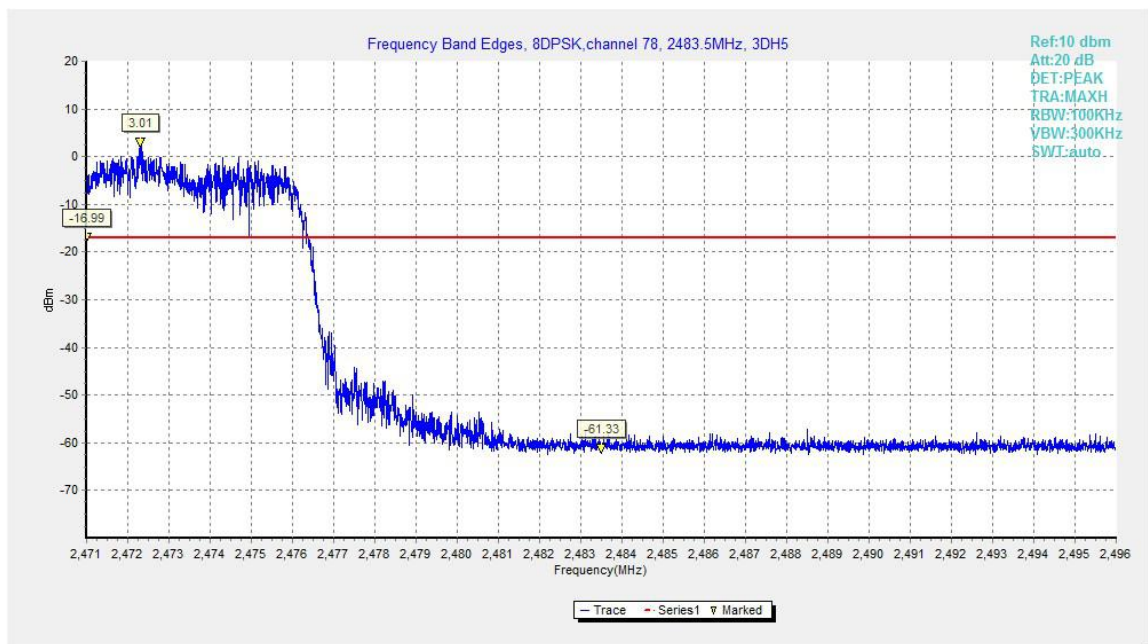


Fig.12. Frequency Band Edges: 8DPSK, Channel 78, Hopping On



#### 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  $\pi/4$  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**

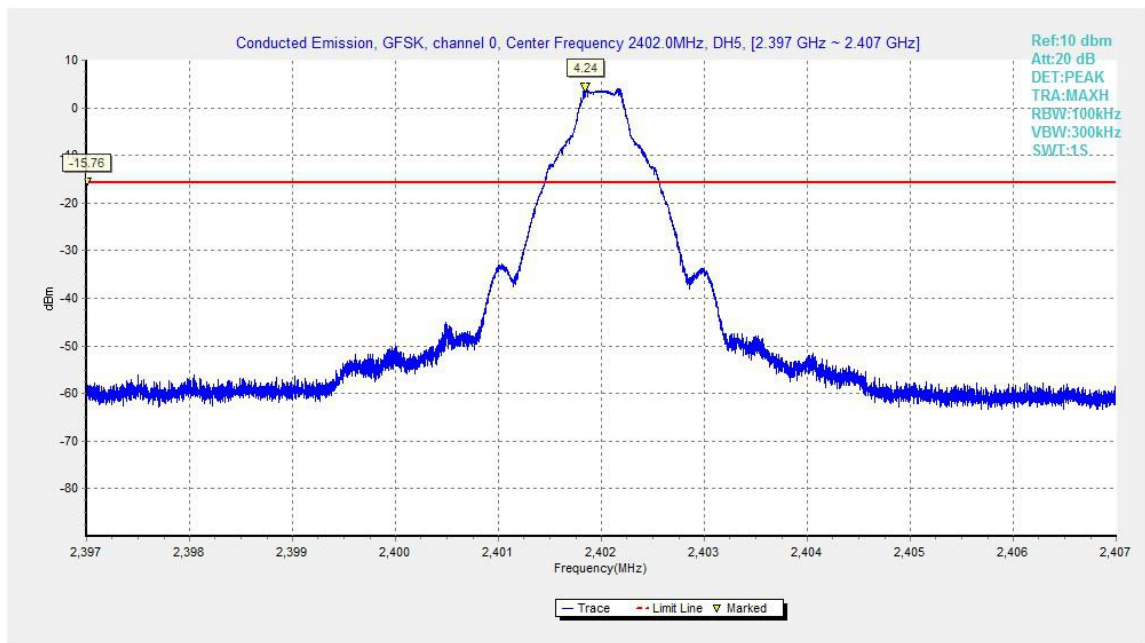


Fig.13. Conducted spurious emission: GFSK, Channel 0,2402MHz



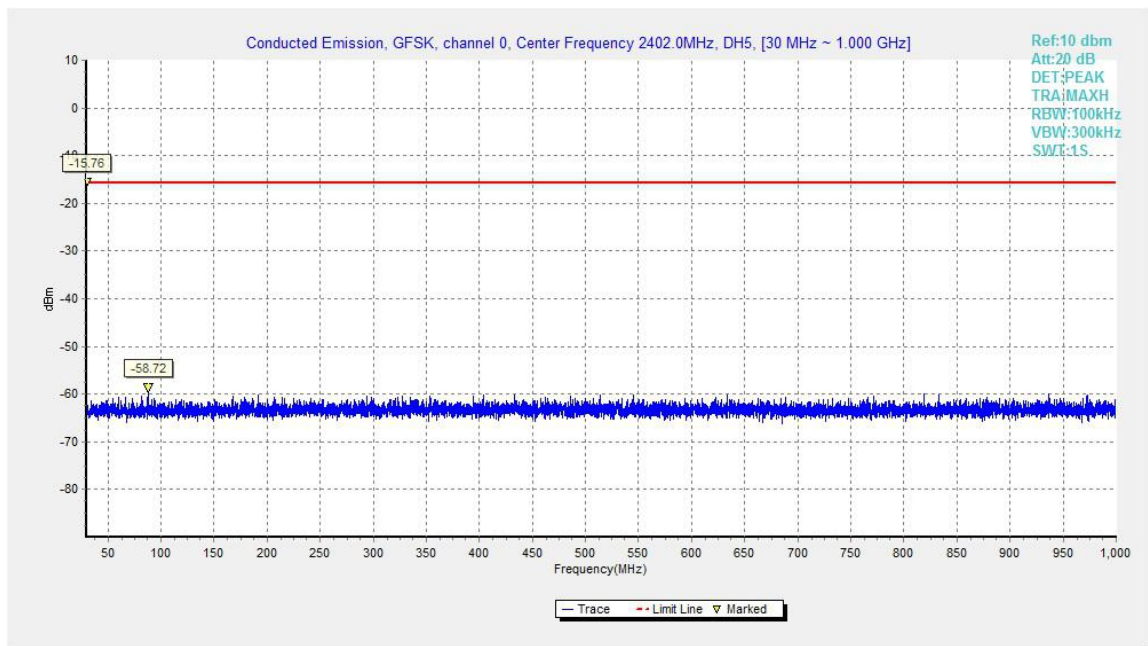


Fig.14. Conducted spurious emission: GFSK, Channel 0, 30MHz - 1GHz

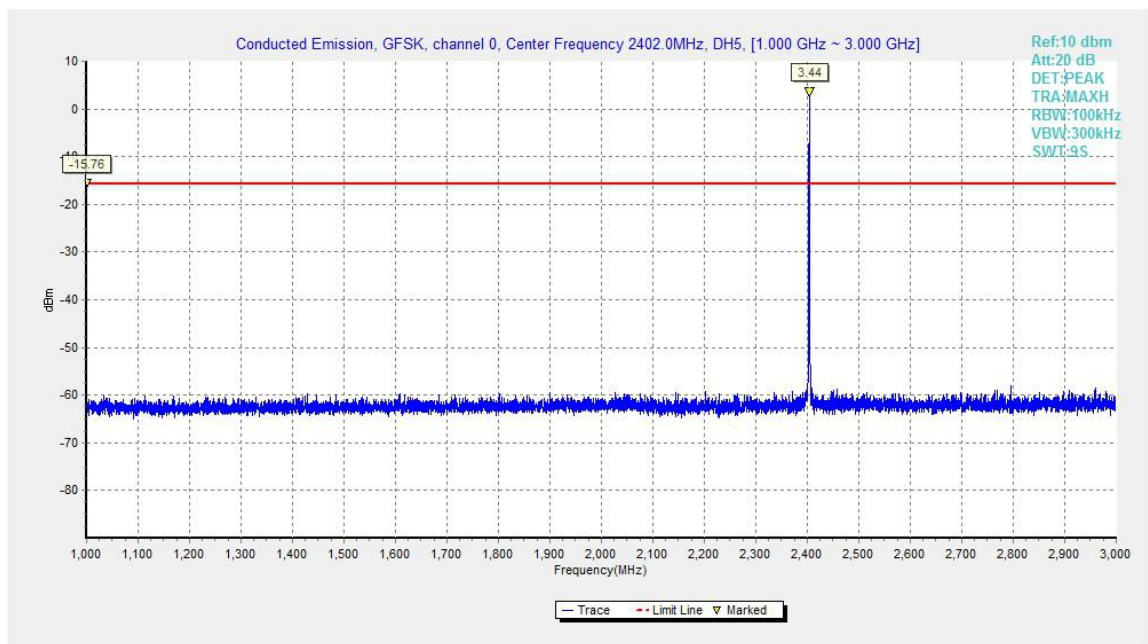


Fig.15. Conducted spurious emission: GFSK, Channel 0, 1GHz - 3GHz

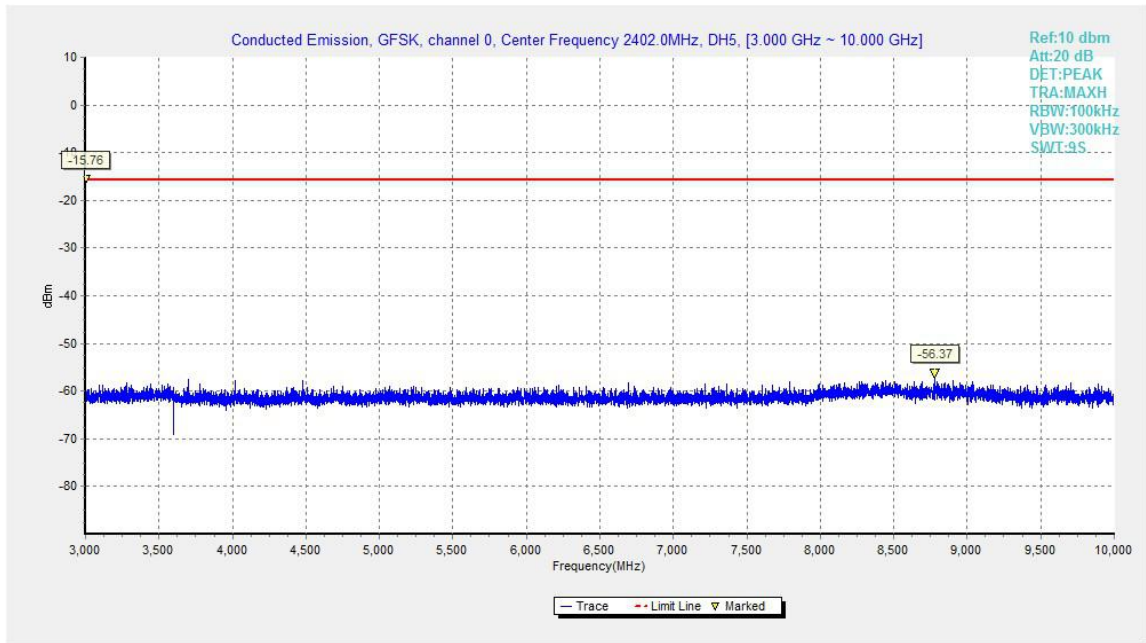


Fig.16. Conducted spurious emission: GFSK, Channel 0, 3GHz - 10GHz

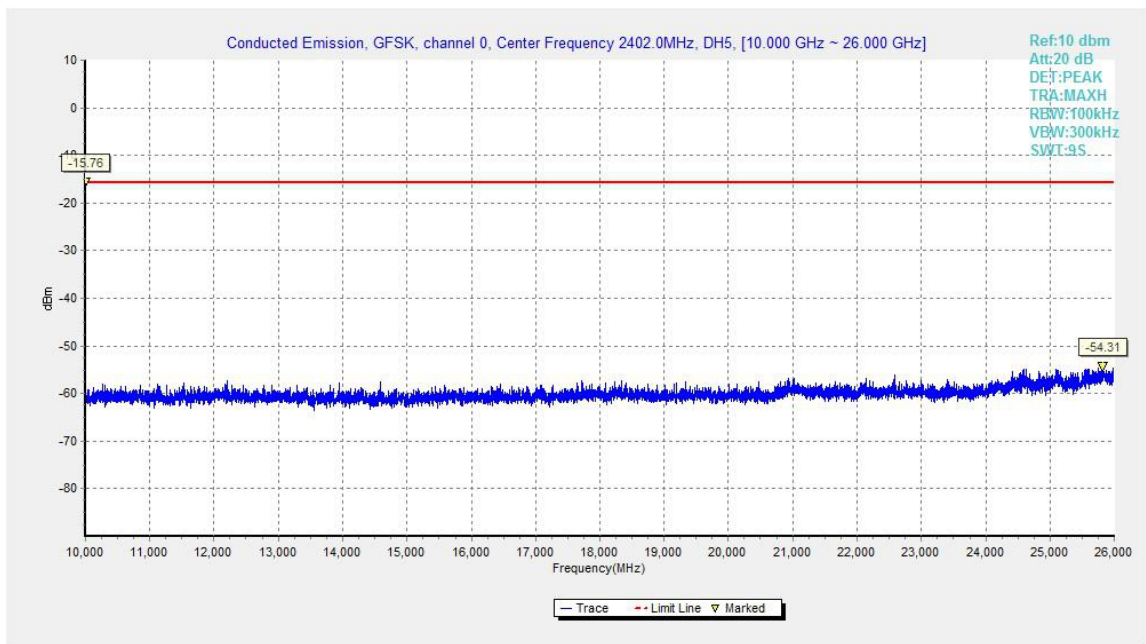


Fig.17. Conducted spurious emission: GFSK, Channel 0, 10GHz - 26GHz

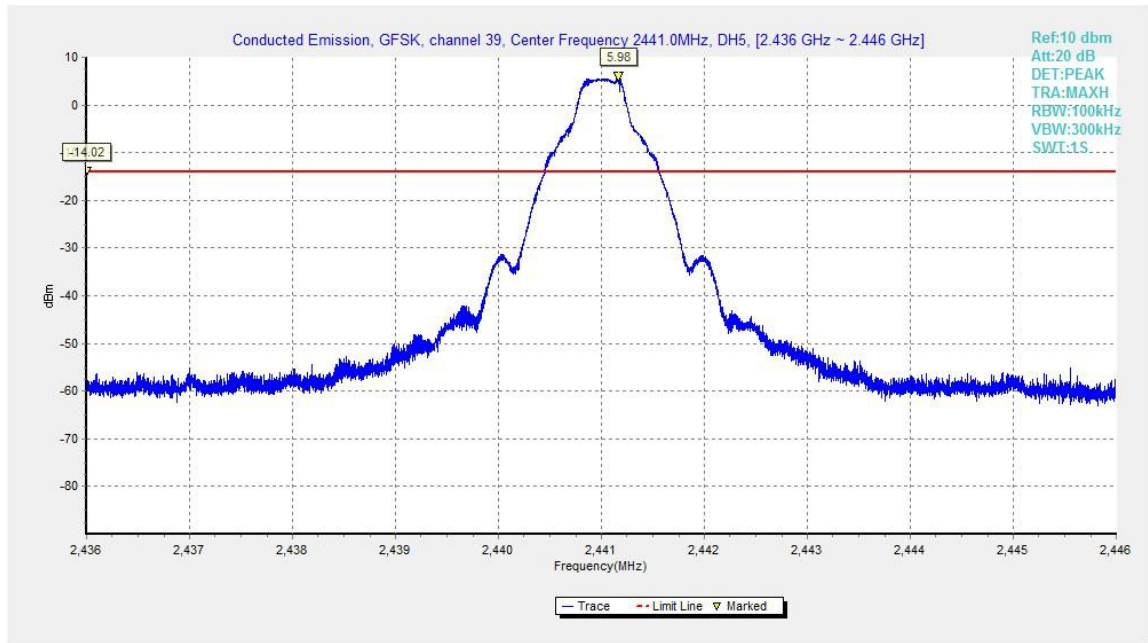


Fig.18. Conducted spurious emission: GFSK, Channel 39, 2441MHz

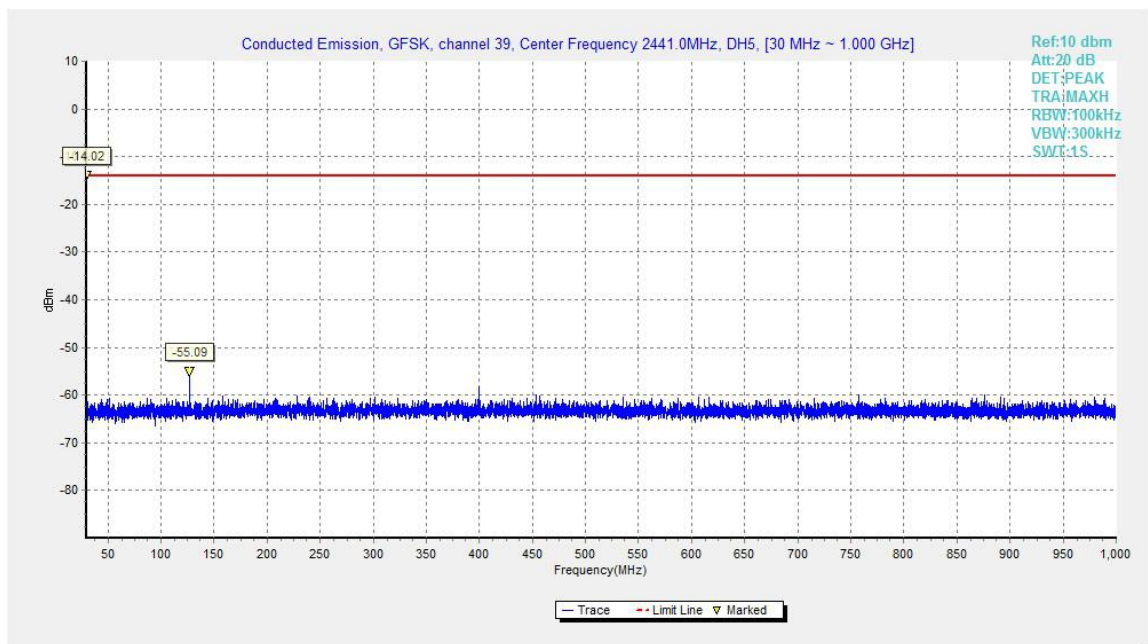


Fig.19. Conducted spurious emission: GFSK, Channel 39, 30MHz - 1GHz

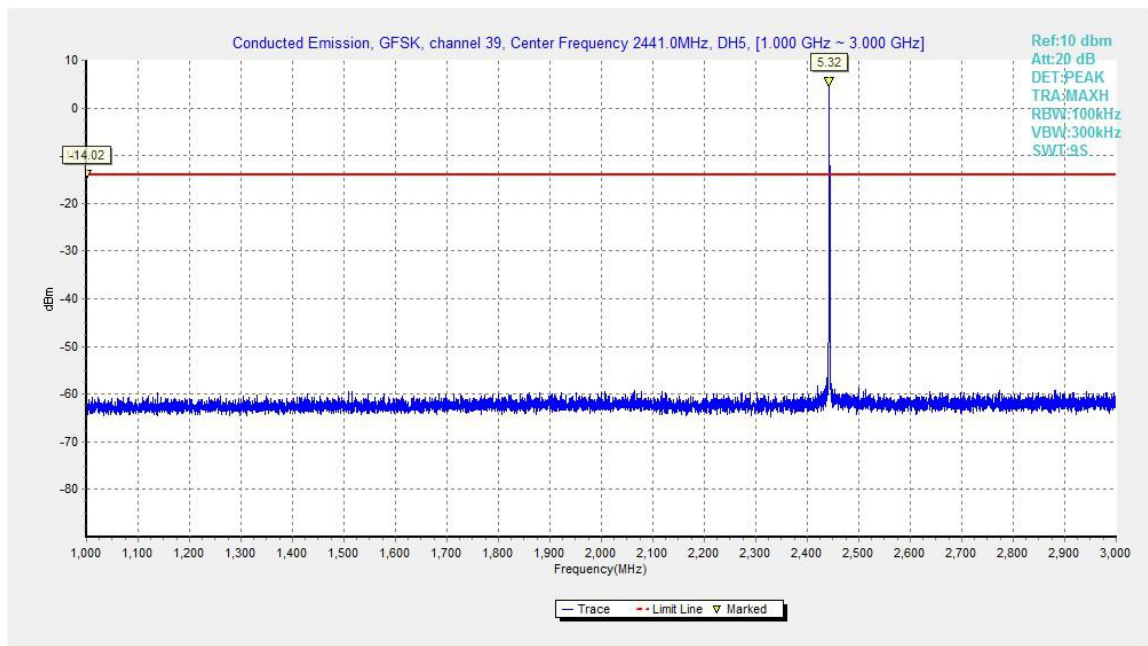


Fig.20. Conducted spurious emission: GFSK, Channel 39, 1GHz – 3GHz

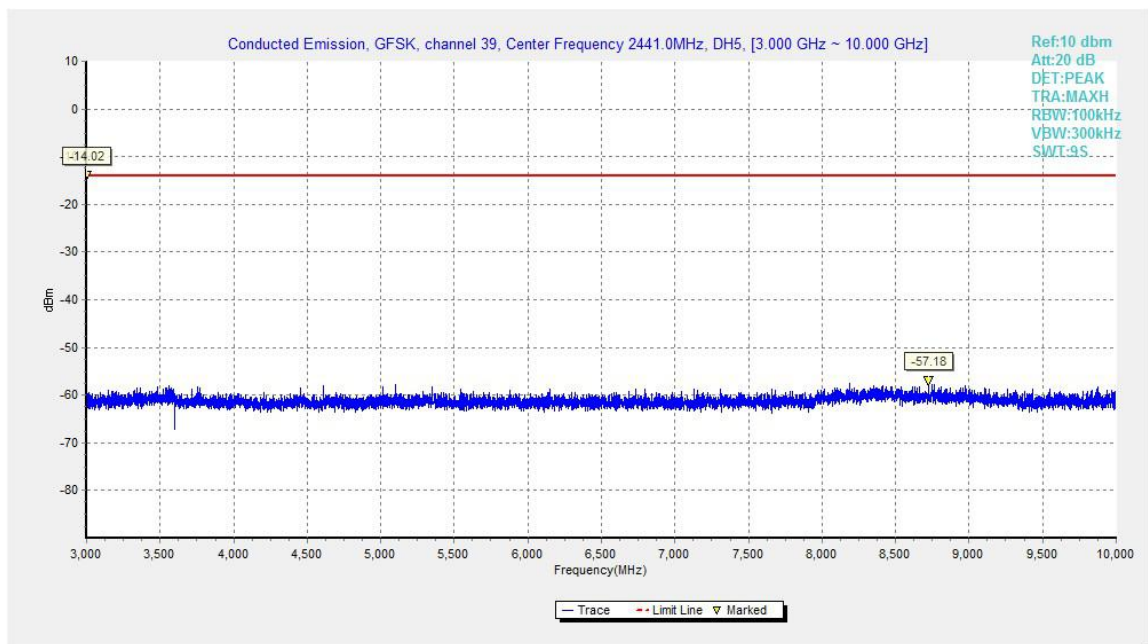


Fig.21. Conducted spurious emission: GFSK, Channel 39, 3GHz – 10GHz



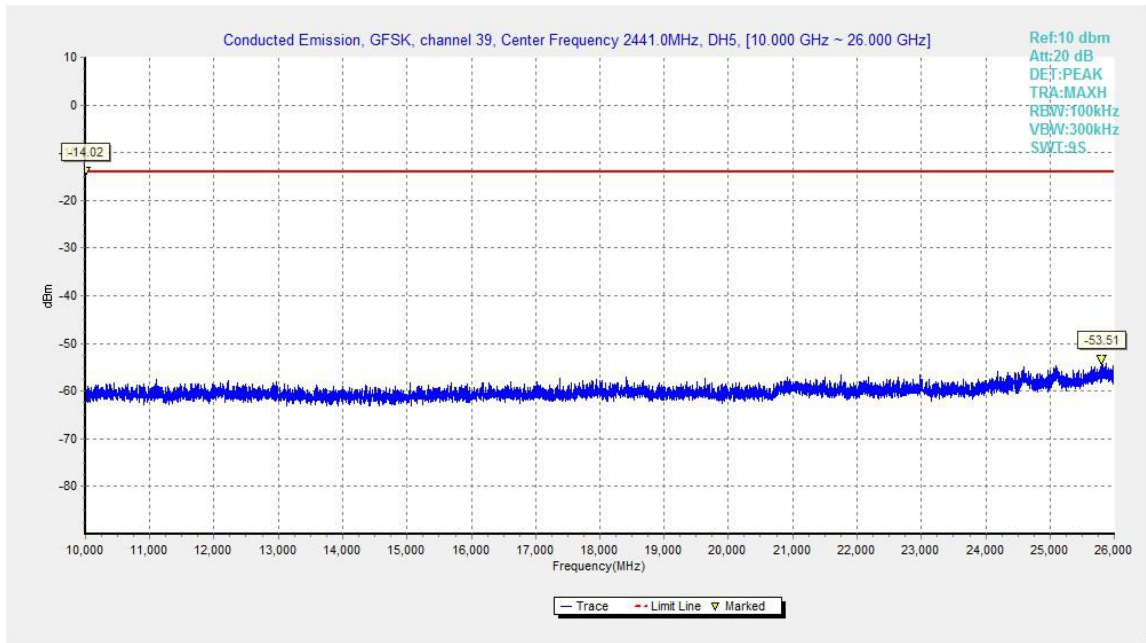


Fig.22. Conducted spurious emission: GFSK, Channel 39, 10GHz – 26GHz

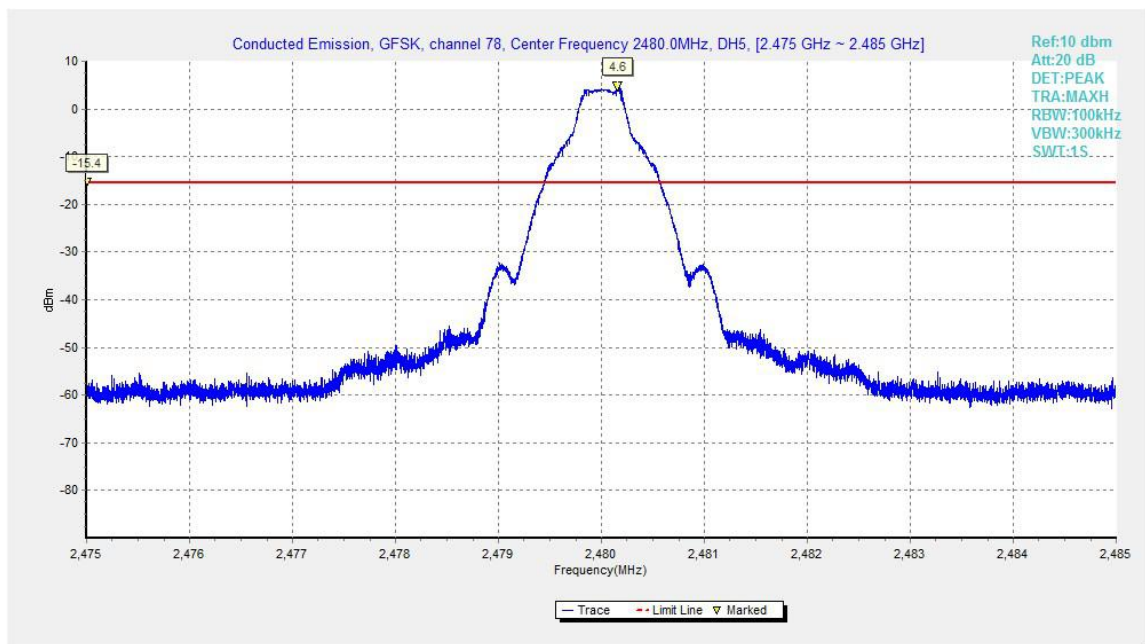


Fig.23. Conducted spurious emission: GFSK, Channel 78, 2480MHz

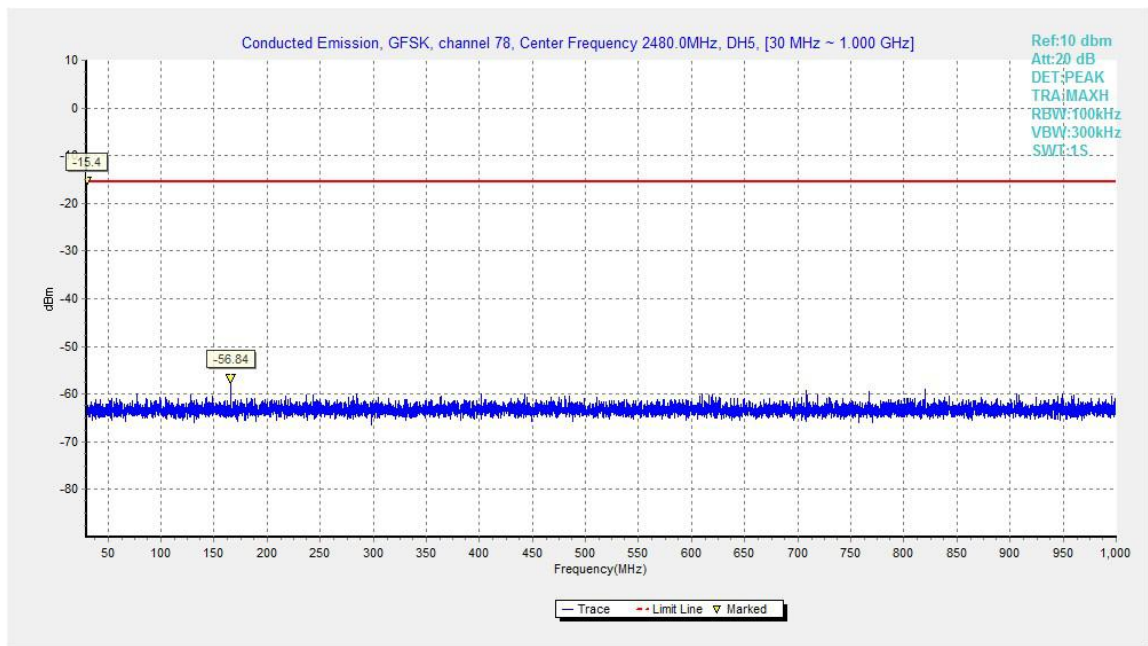


Fig.24. Conducted spurious emission: GFSK, Channel 78, 30MHz - 1GHz

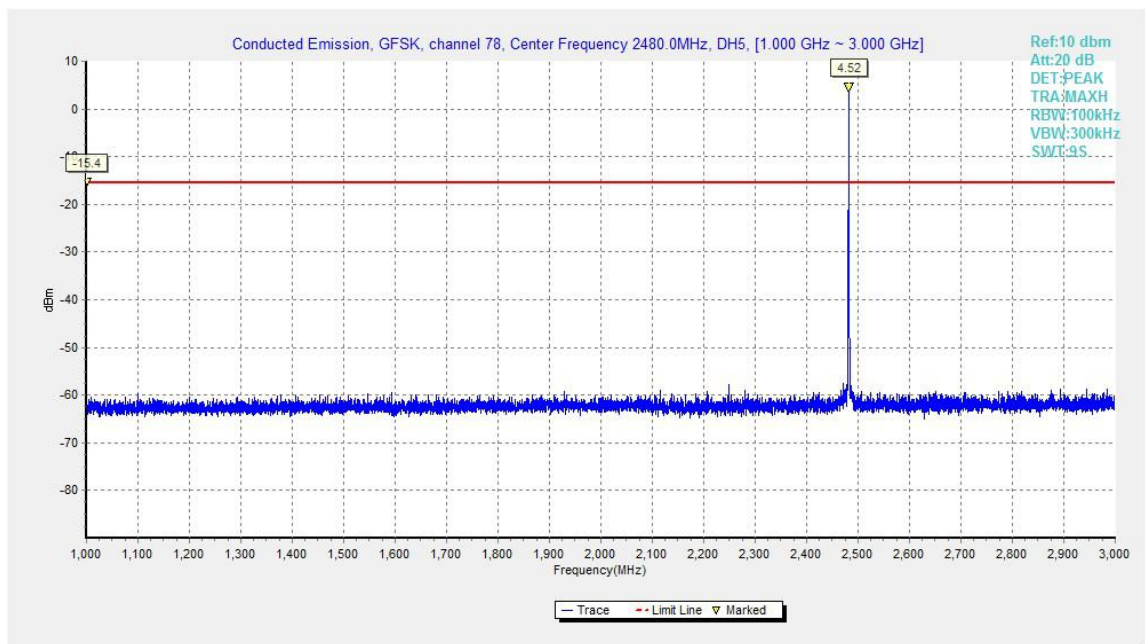


Fig.25. Conducted spurious emission: GFSK, Channel 78, 1GHz - 3GHz

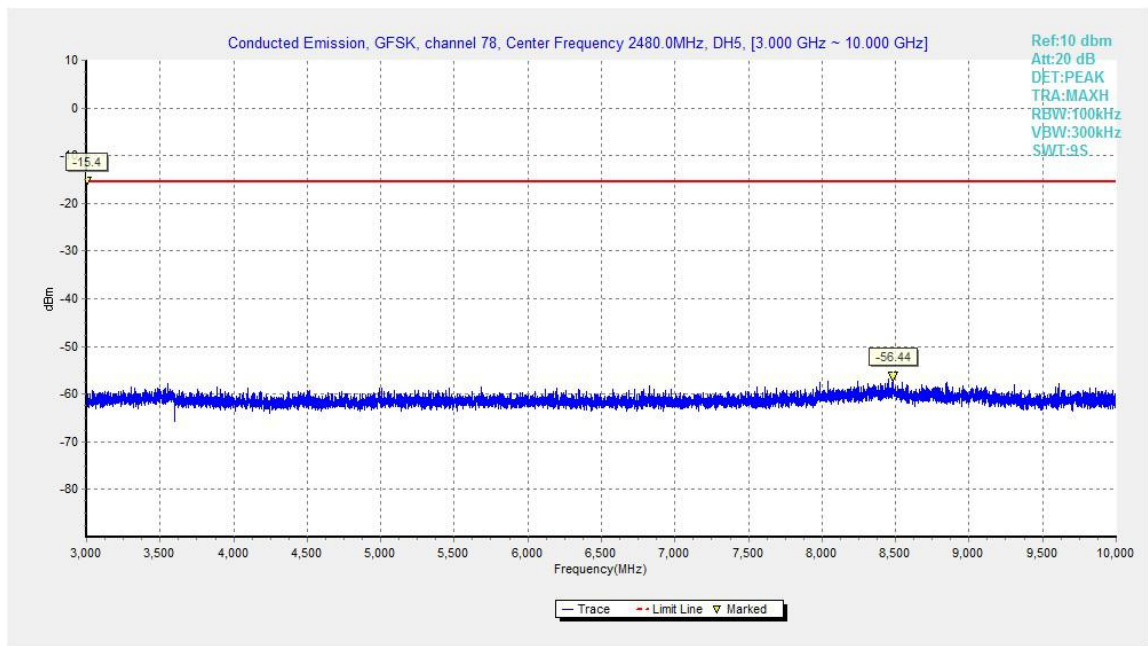


Fig.26. Conducted spurious emission: GFSK, Channel 78, 3GHz - 10GHz

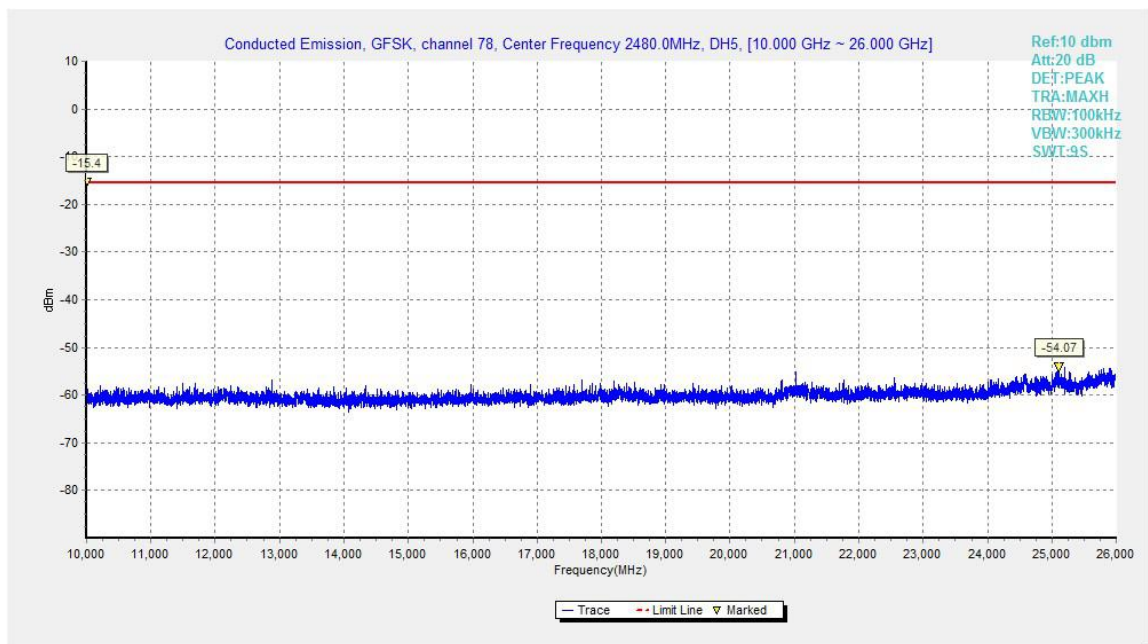


Fig.27. Conducted spurious emission: GFSK, Channel 78, 10GHz - 26GHz

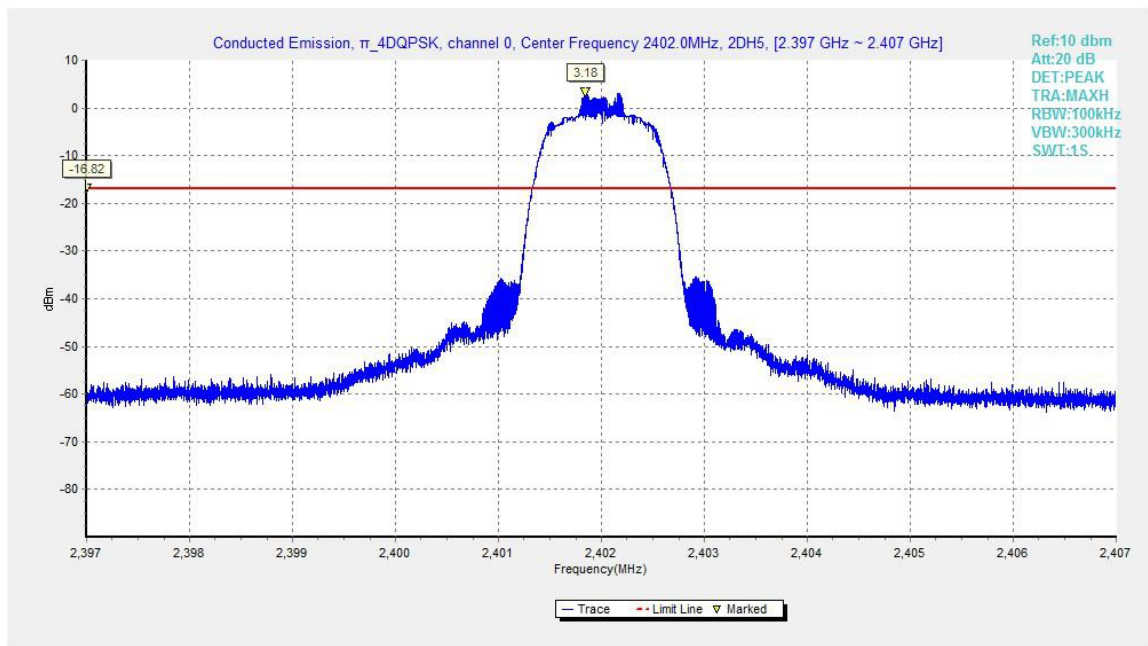


Fig.28. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 0,2402MHz

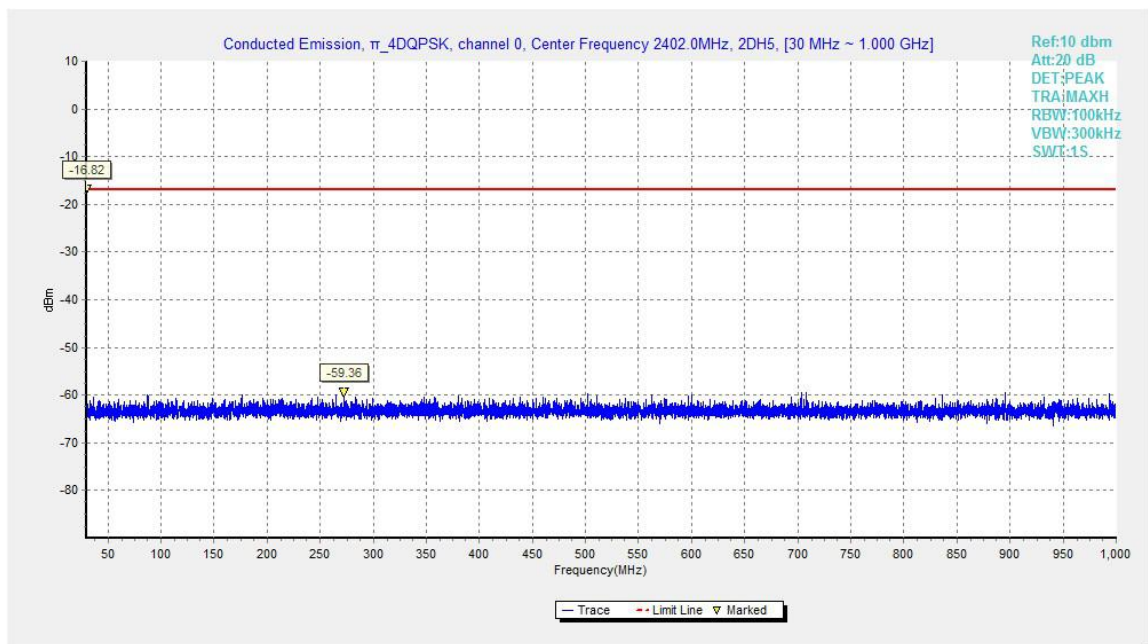


Fig.29. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 0, 30MHz - 1GHz



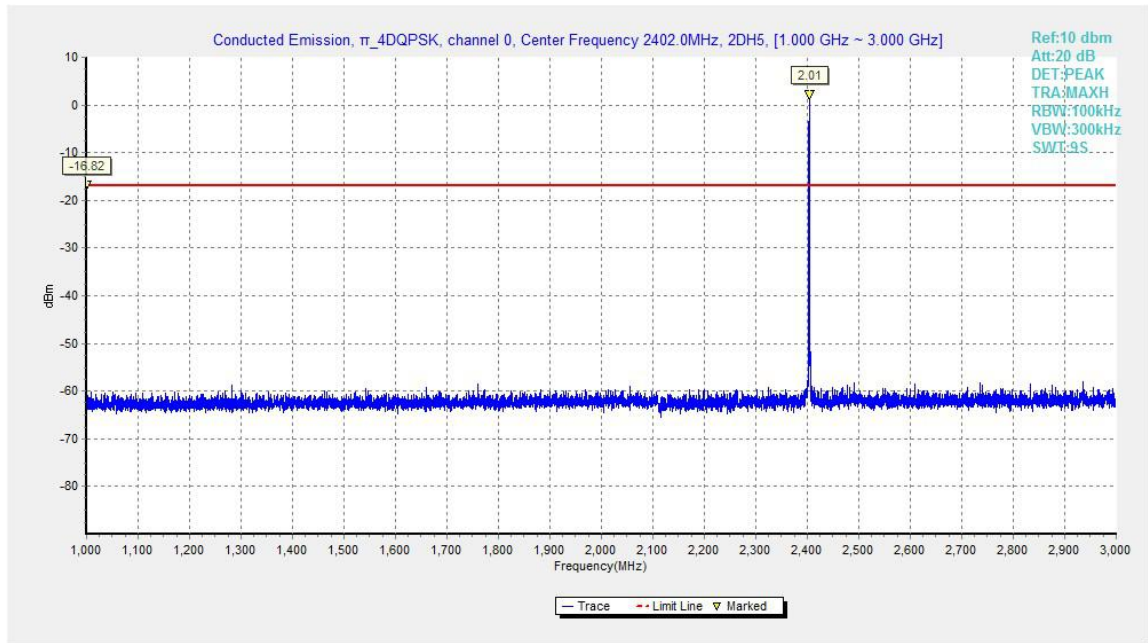


Fig.30. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 0, 1GHz - 3GHz

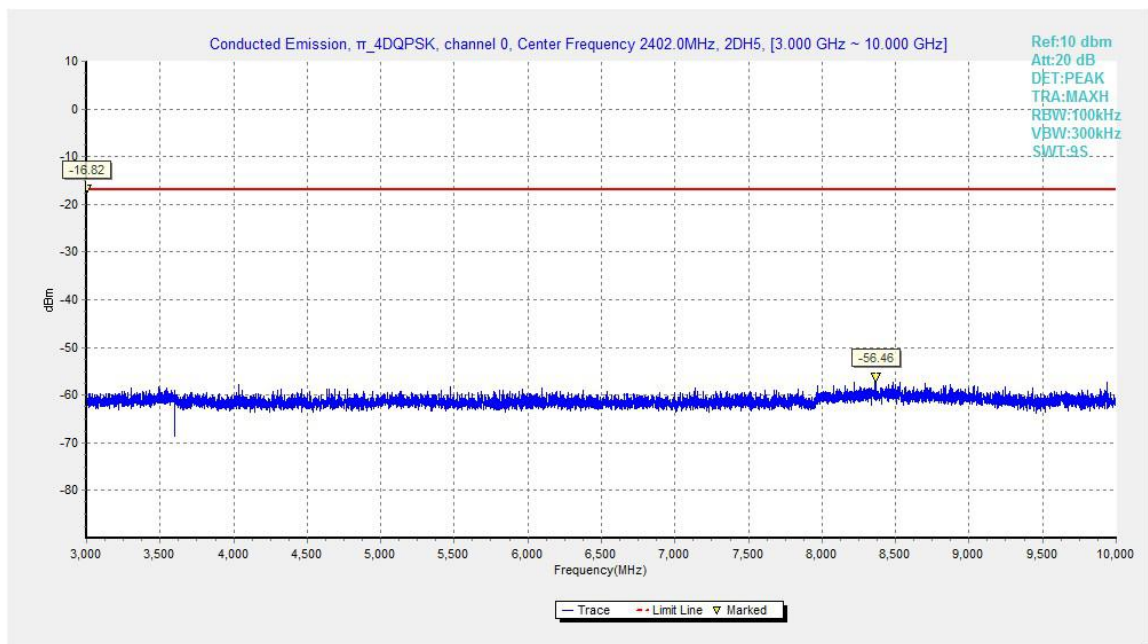


Fig.31. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 0, 3GHz - 10GHz

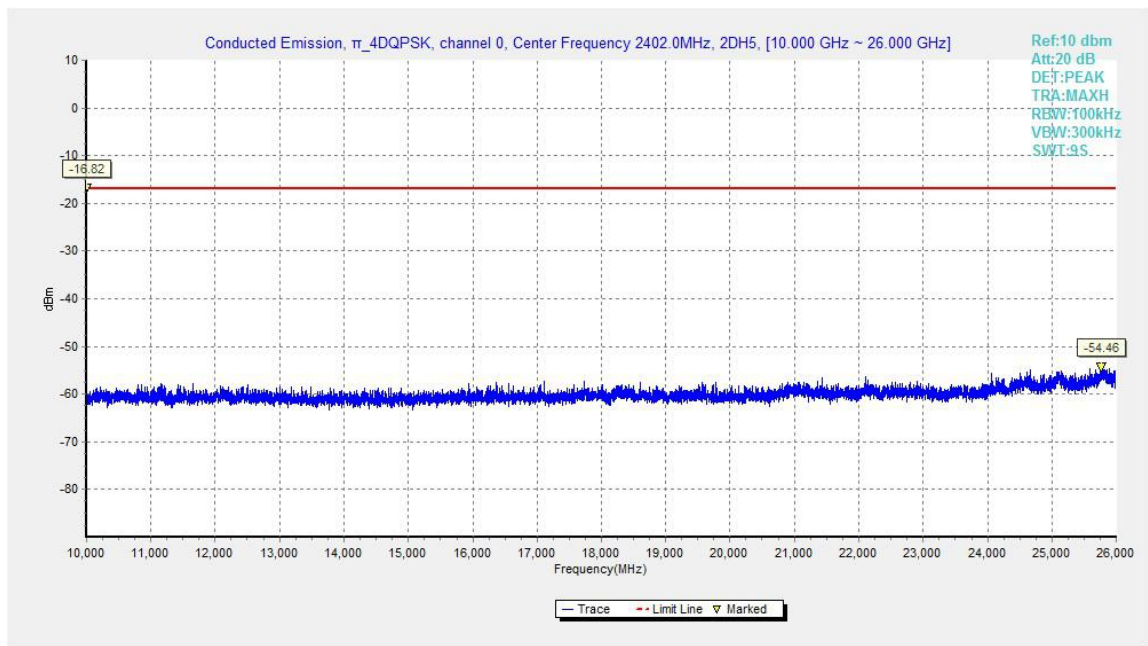


Fig.32. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 0, 10GHz - 26GHz

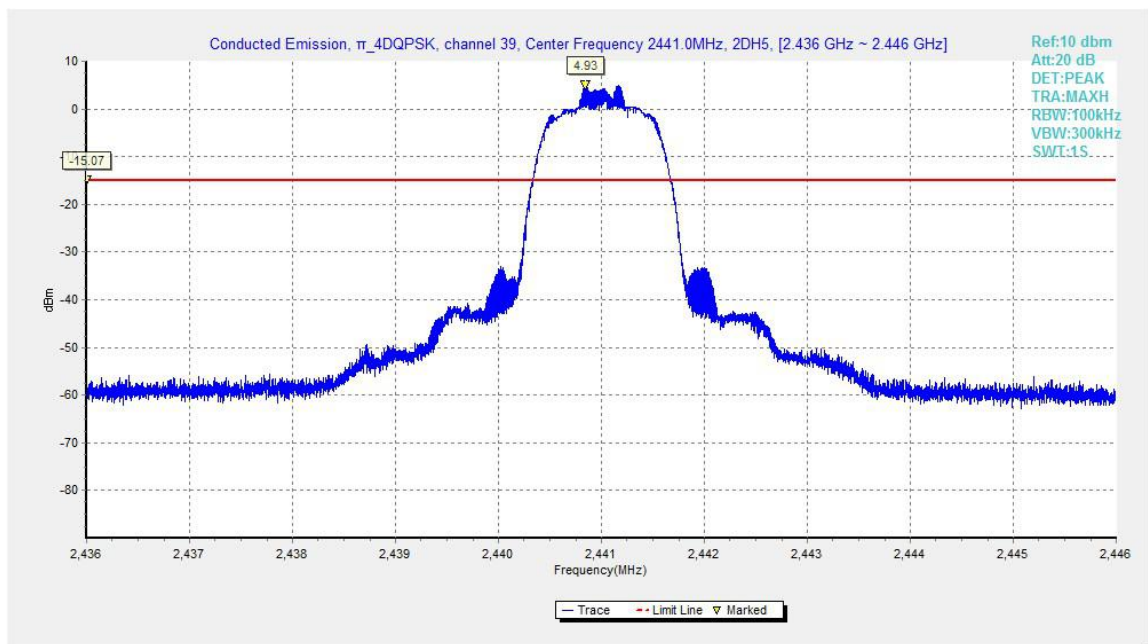


Fig.33. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 39, 2441MHz

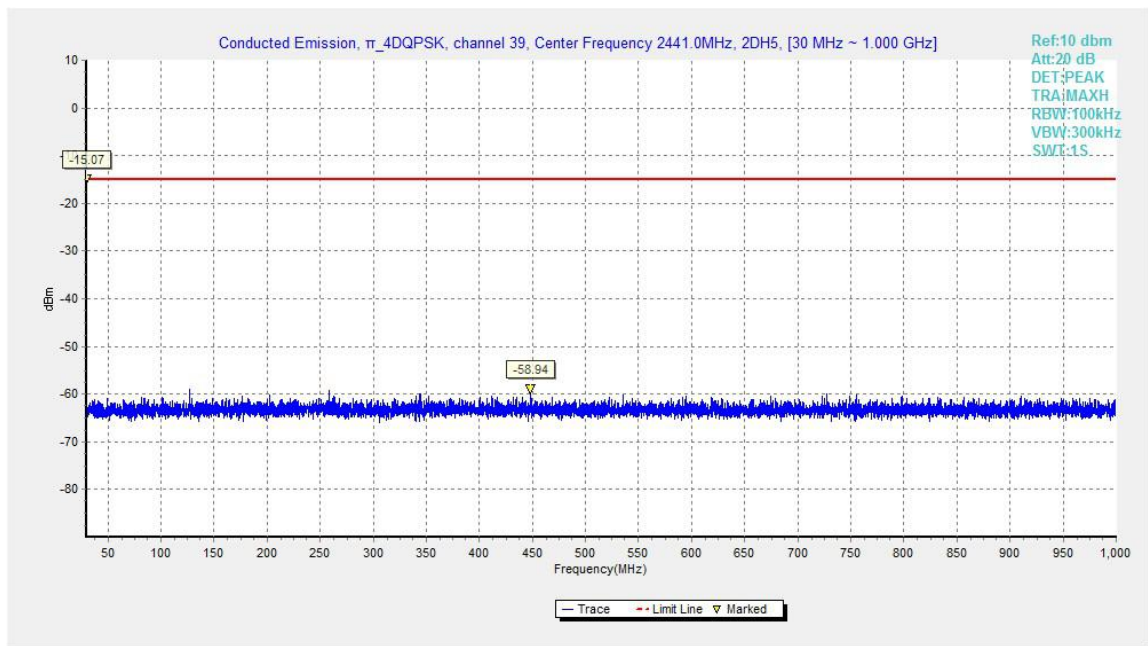


Fig.34. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 39, 30MHz - 1GHz

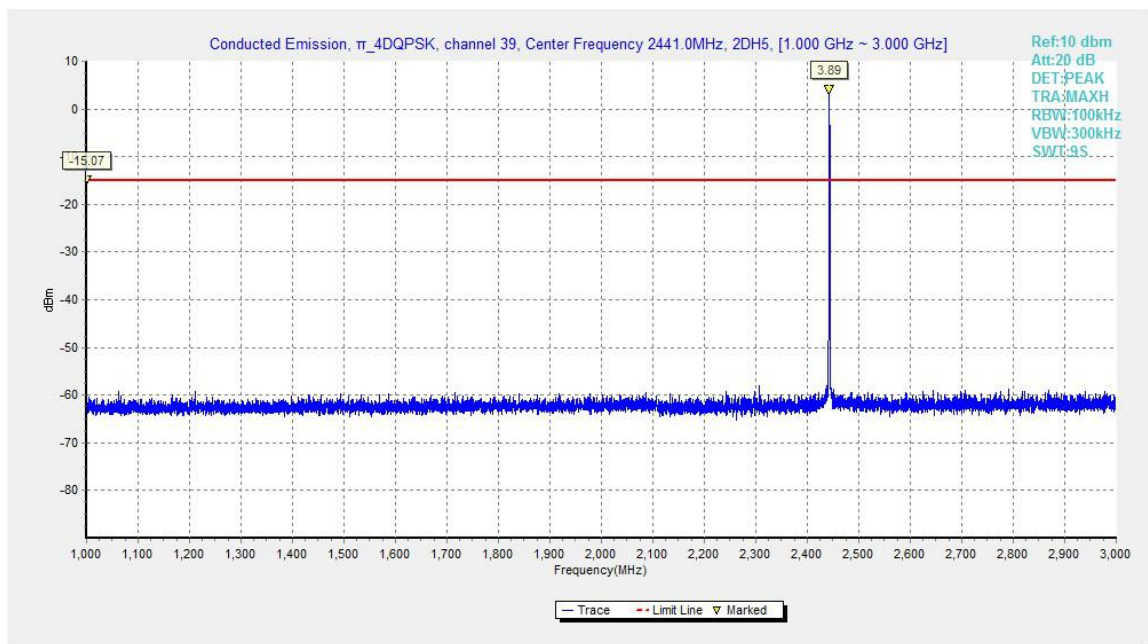


Fig.35. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 39, 1GHz - 3GHz

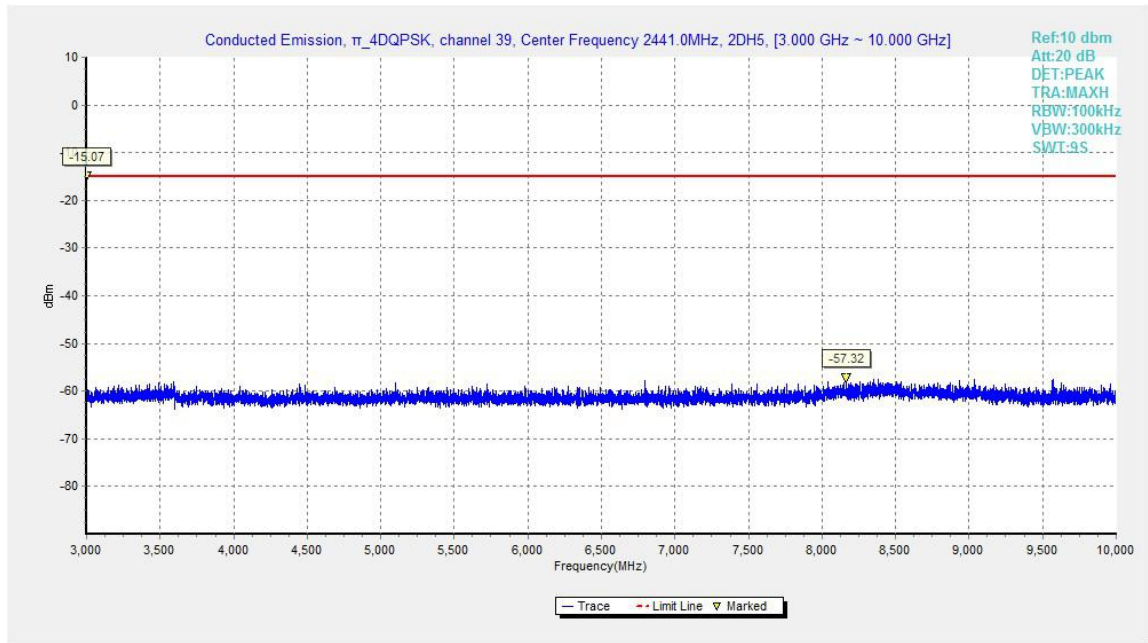


Fig.36. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 39, 3GHz - 10GHz

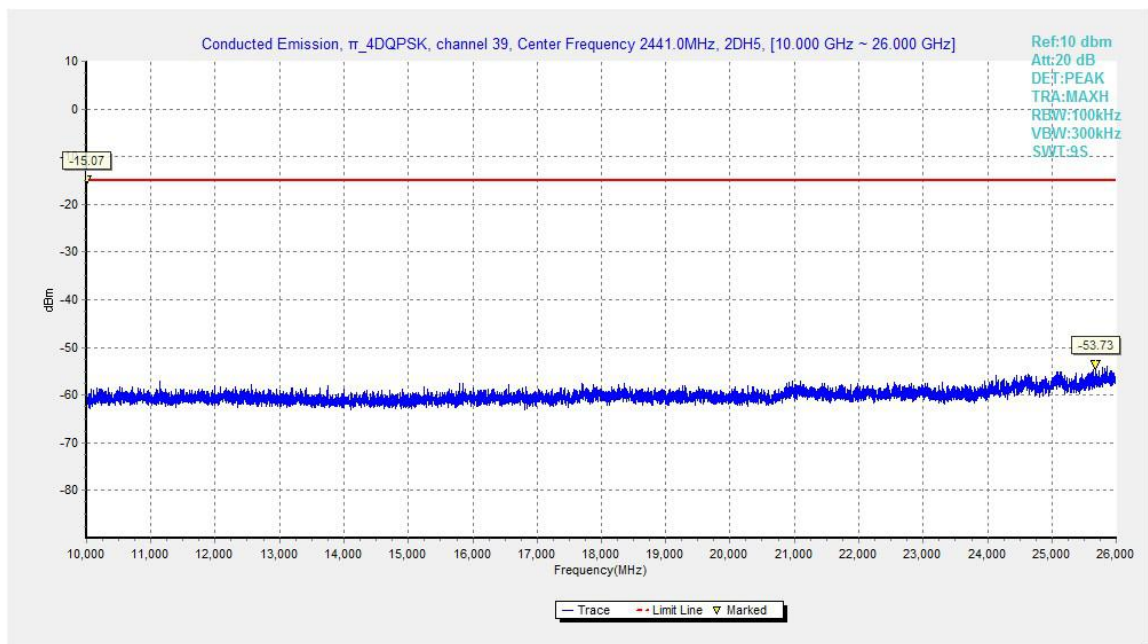


Fig.37. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 39, 10GHz – 26GHz



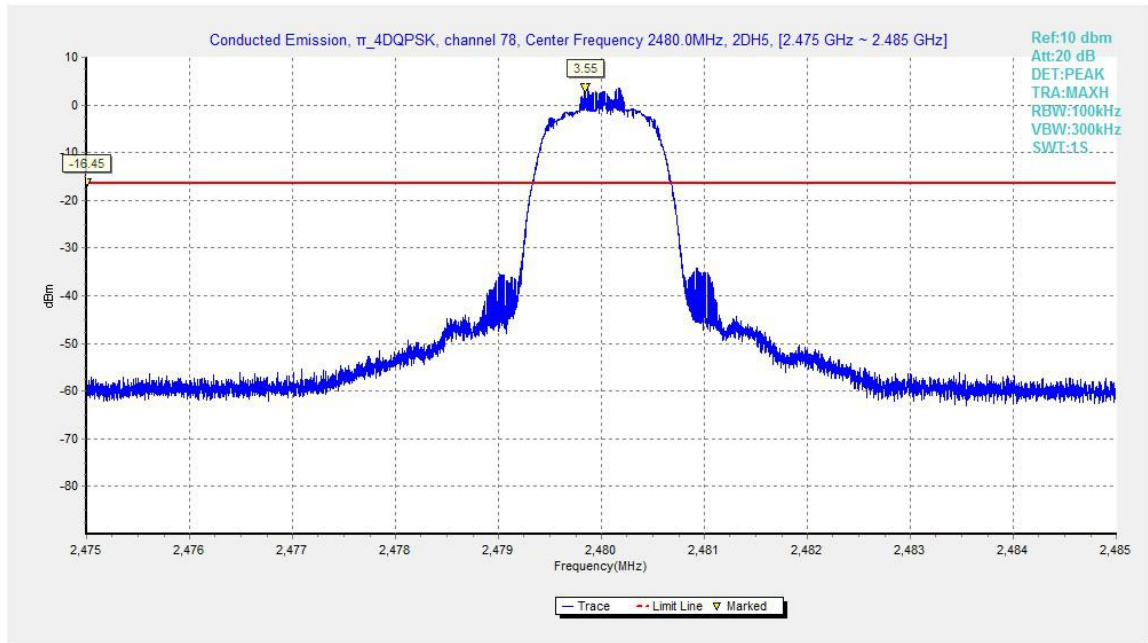


Fig.38. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 78, 2480MHz

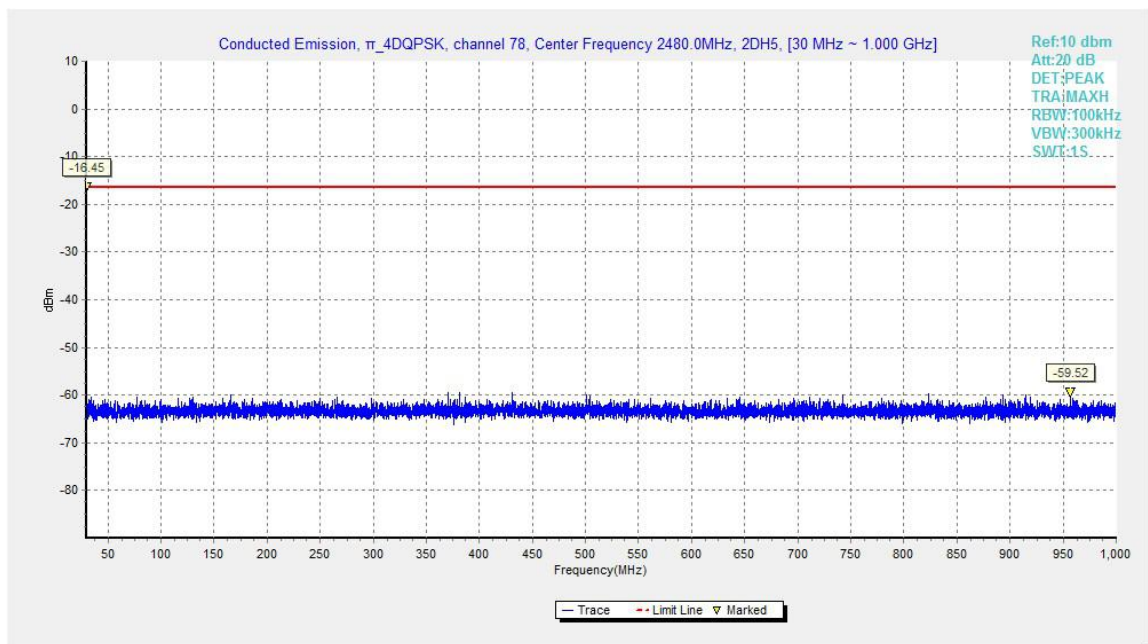


Fig.39. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 78, 30MHz - 1GHz

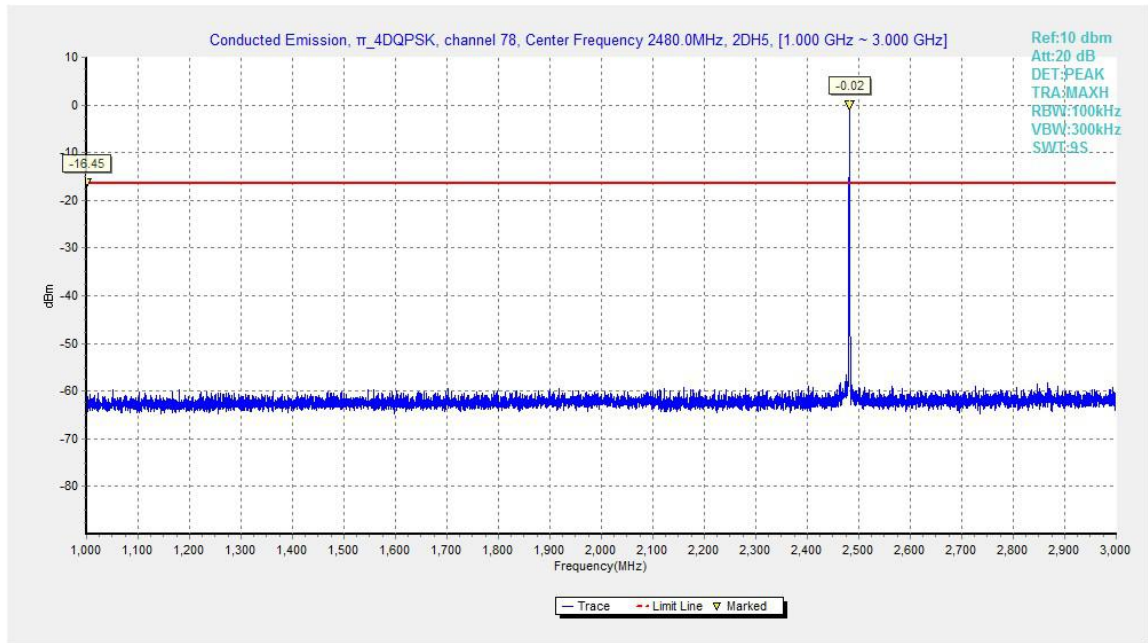


Fig.40. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 78, 1GHz - 3GHz

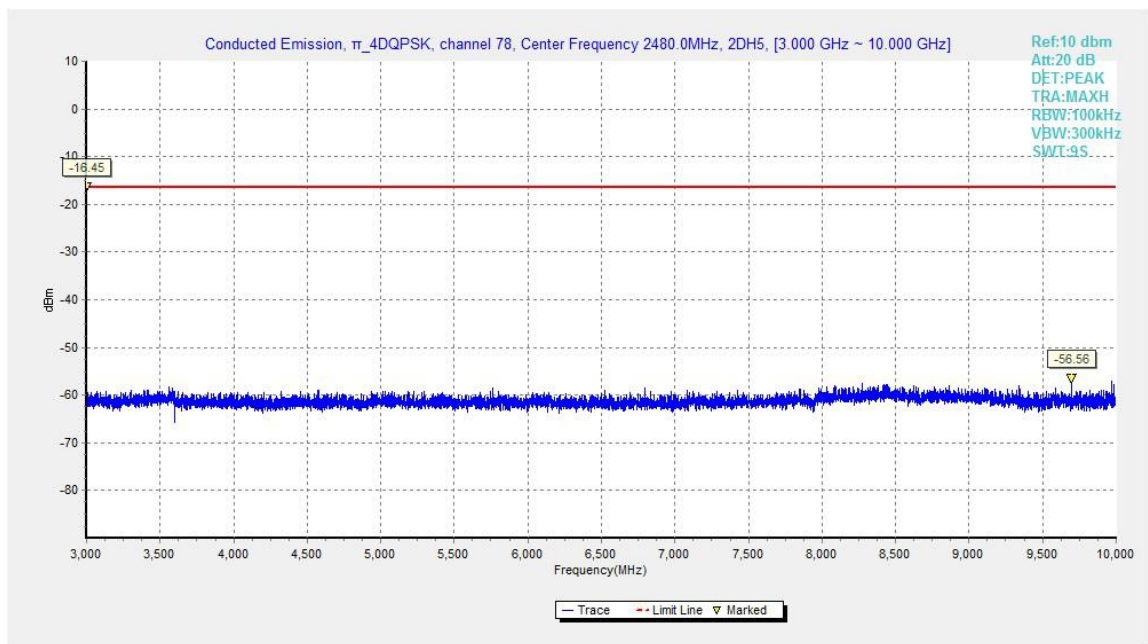


Fig.41. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 78, 3GHz - 10GHz

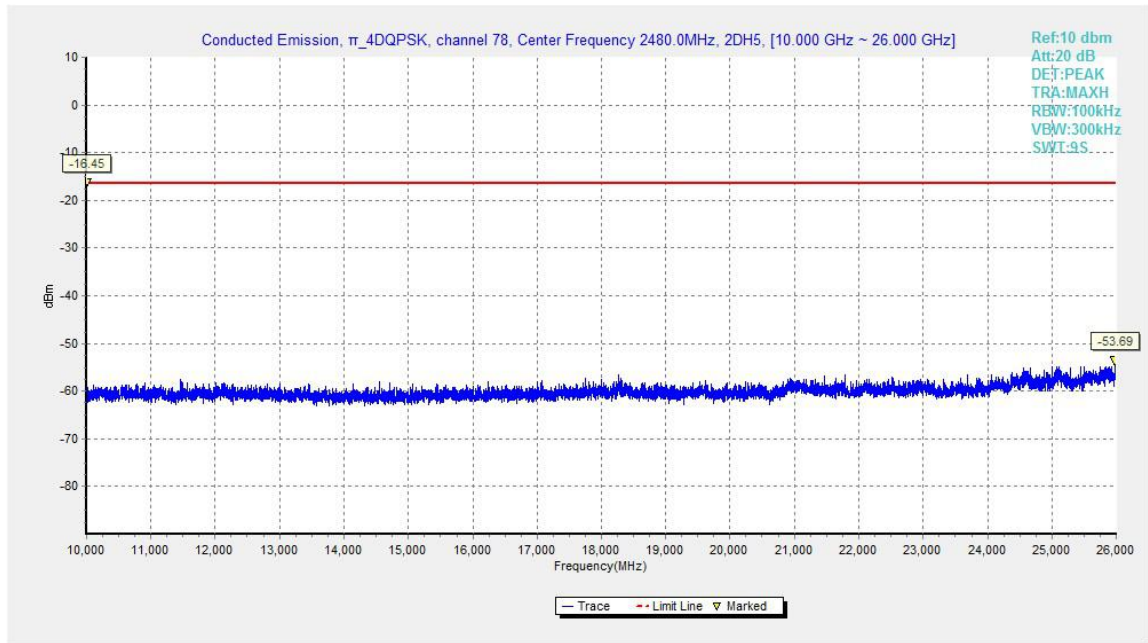


Fig.42. Conducted spurious emission:  $\pi/4$  DQPSK, Channel 78, 10GHz - 26GHz

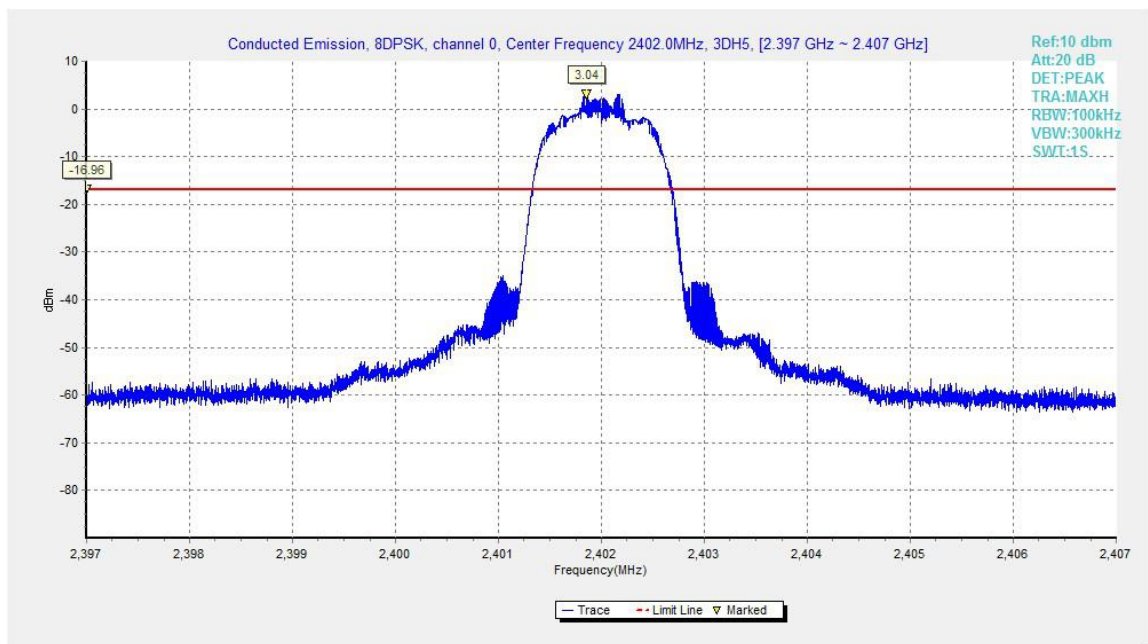


Fig.43. Conducted spurious emission: 8DPSK, Channel 0,2402MHz

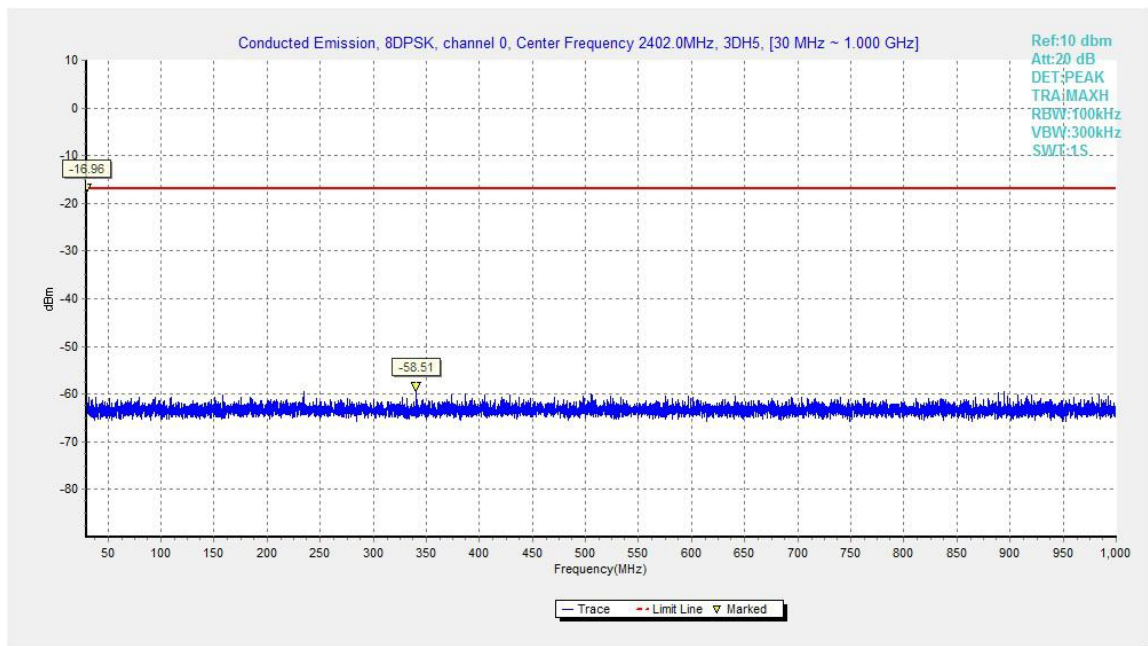


Fig.44. Conducted spurious emission: 8DPSK, Channel 0, 30MHz - 1GHz

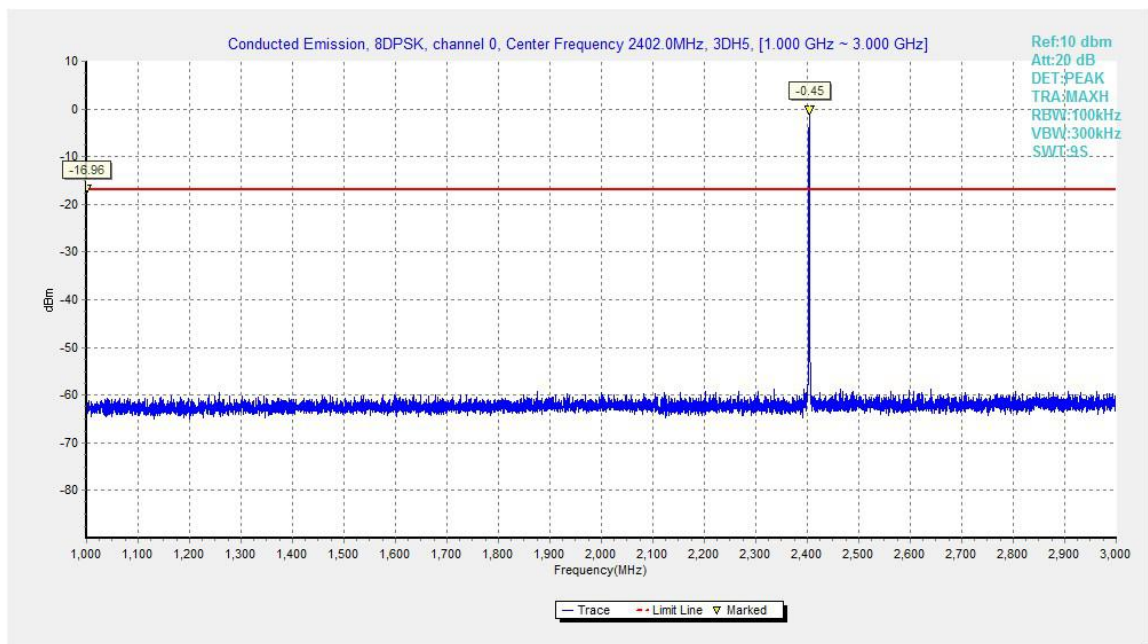


Fig.45. Conducted spurious emission: 8DPSK, Channel 0, 1GHz - 3GHz



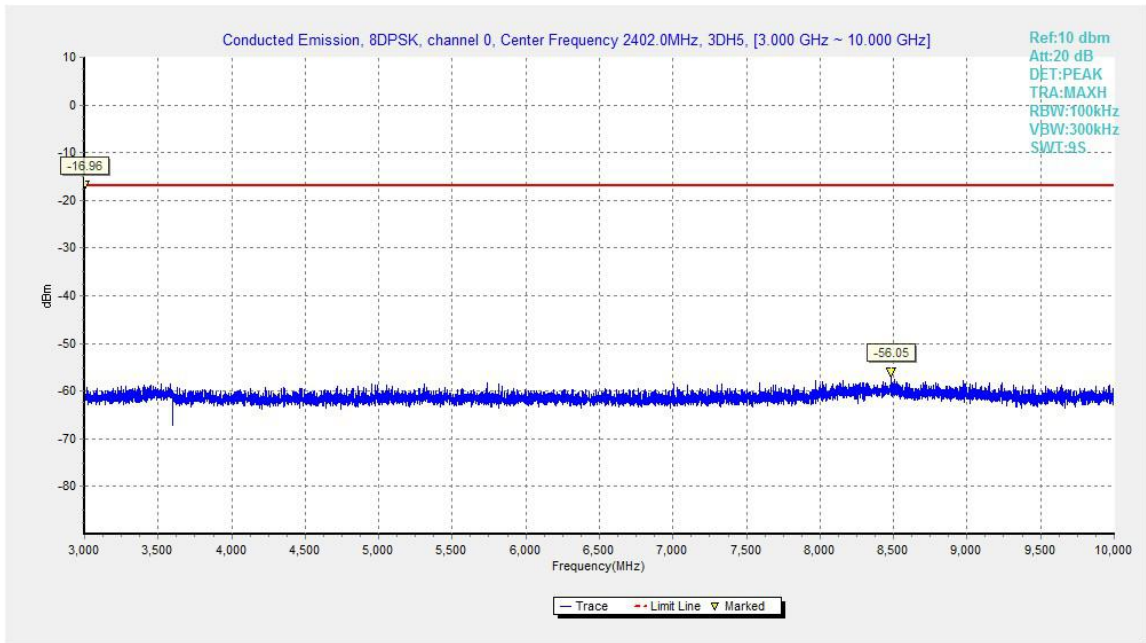


Fig.46. Conducted spurious emission: 8DPSK, Channel 0, 3GHz - 10GHz

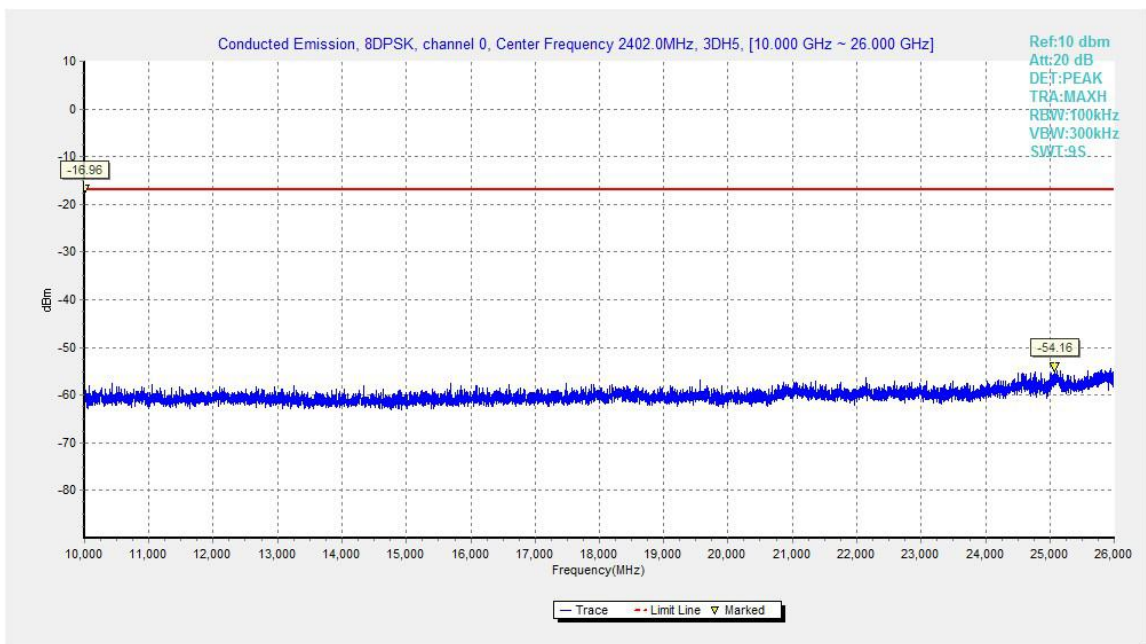


Fig.47. Conducted spurious emission: 8DPSK, Channel 0, 10GHz - 26GHz

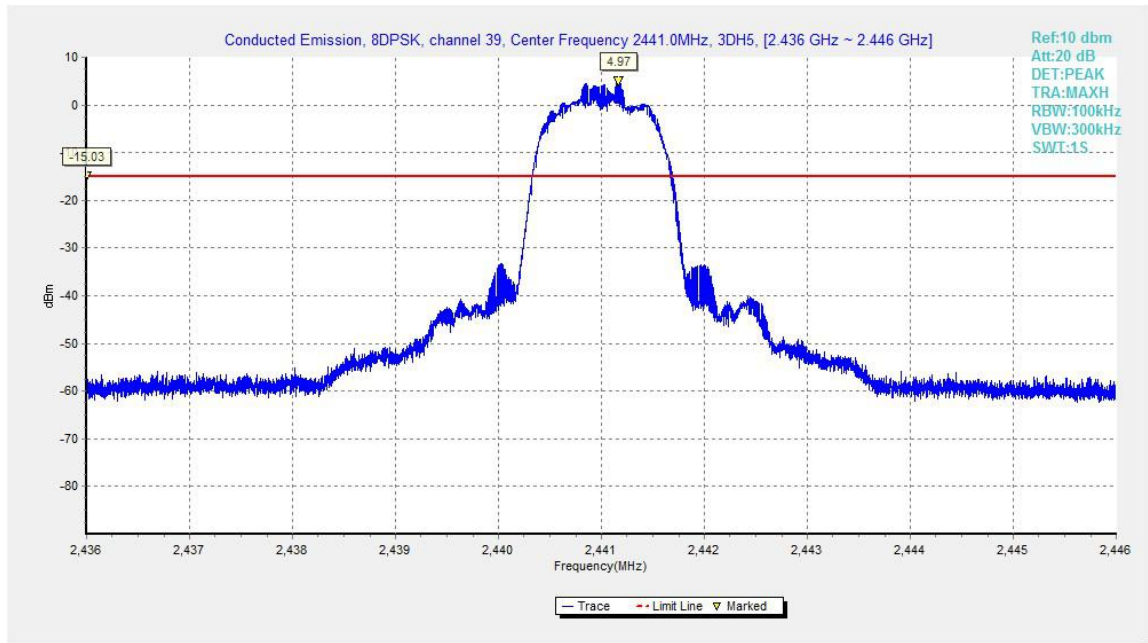


Fig.48. Conducted spurious emission: 8DPSK, Channel 39, 2441MHz

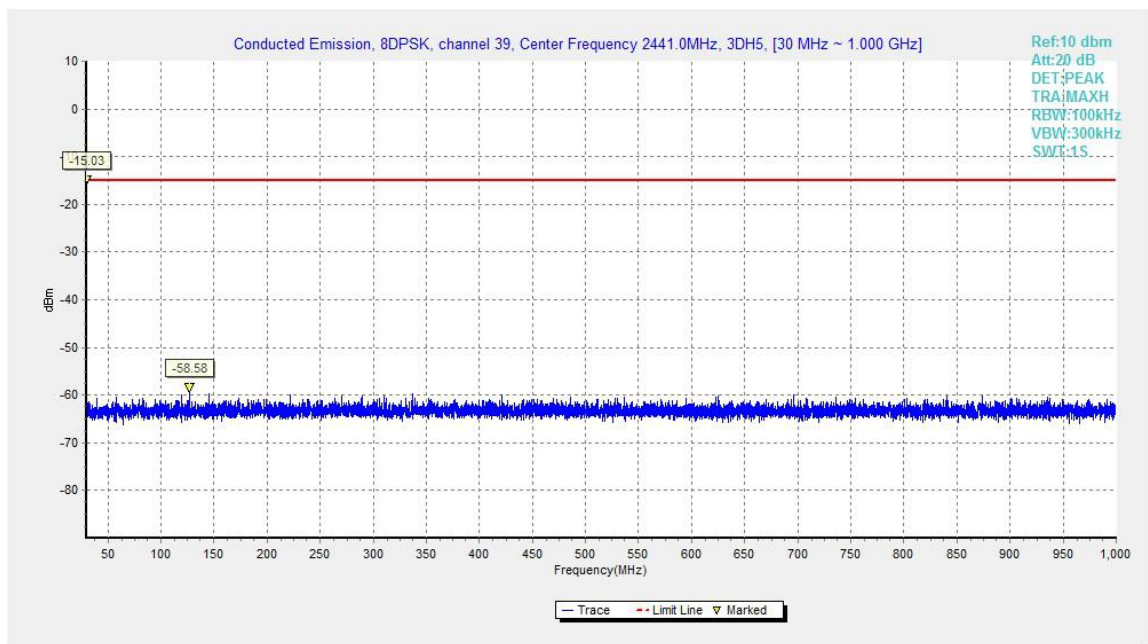


Fig.49. Conducted spurious emission: 8DPSK, Channel 39, 30MHz - 1GHz

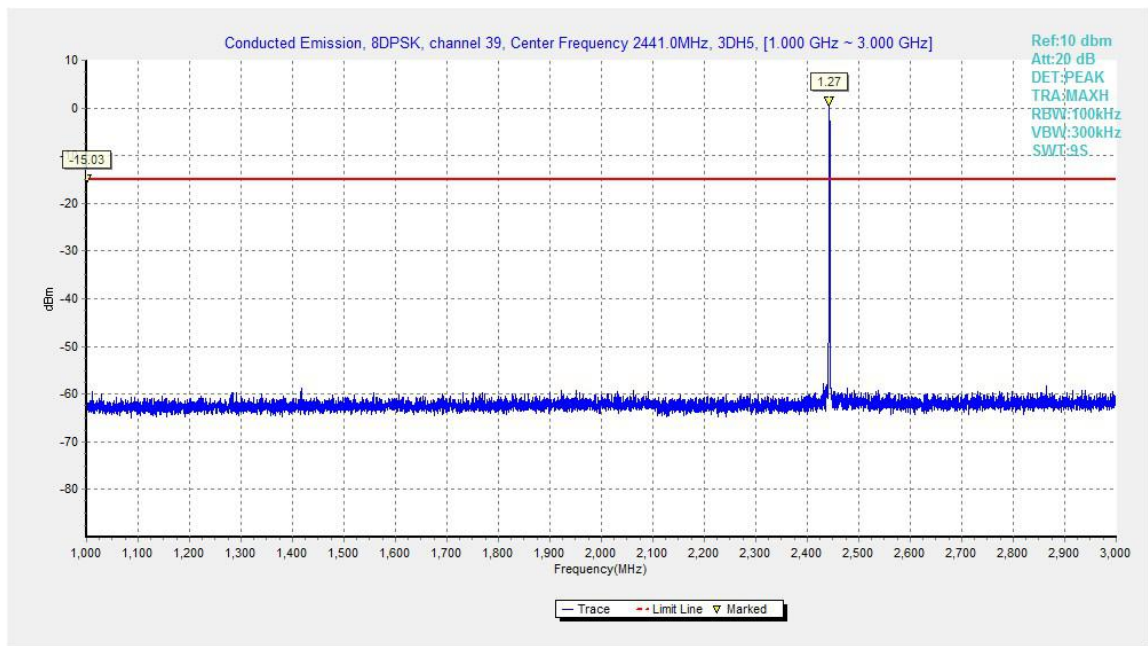


Fig.50. Conducted spurious emission: 8DPSK, Channel 39, 1GHz - 3GHz

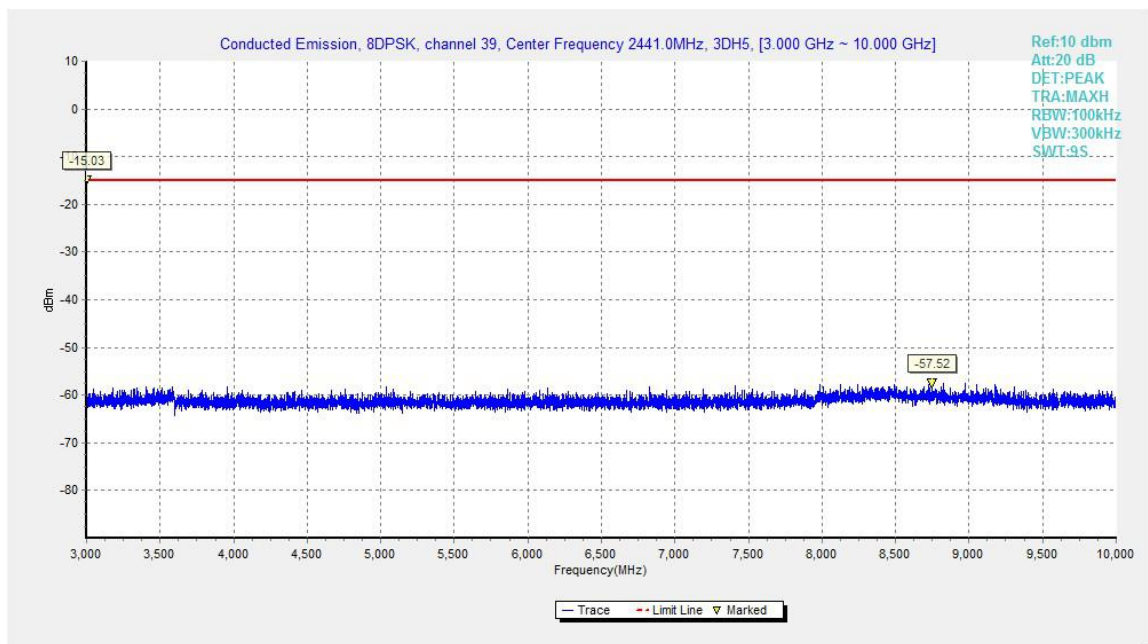


Fig.51. Conducted spurious emission: 8DPSK, Channel 39, 3GHz - 10GHz

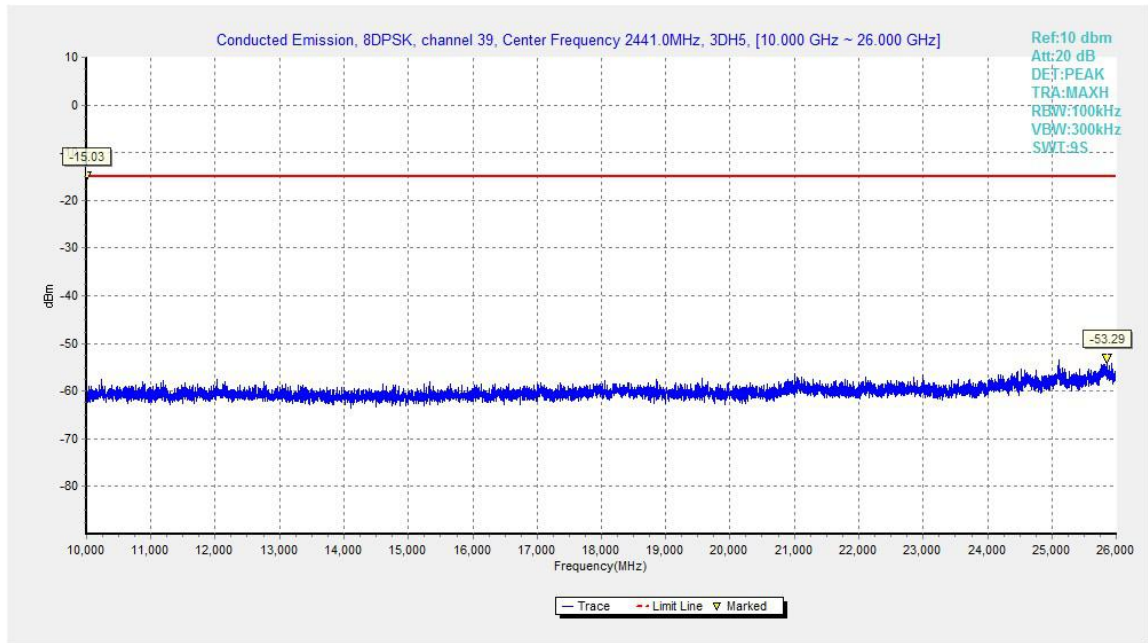


Fig.52. Conducted spurious emission: 8DPSK, Channel 39, 10GHz – 26GHz

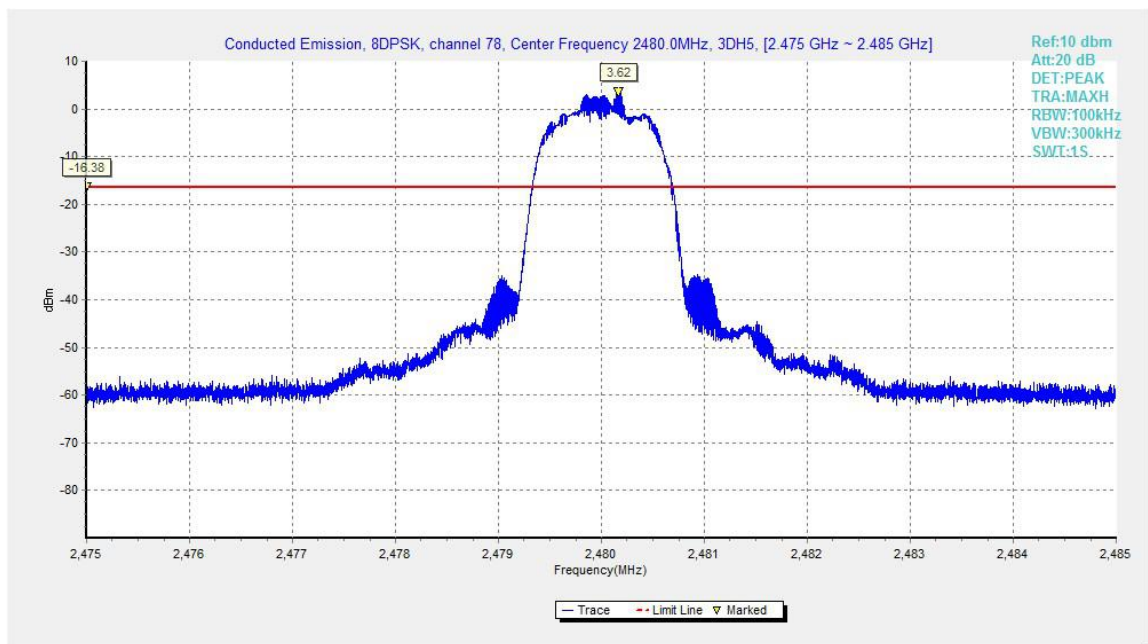


Fig.53. Conducted spurious emission: 8DPSK, Channel 78, 2480MHz



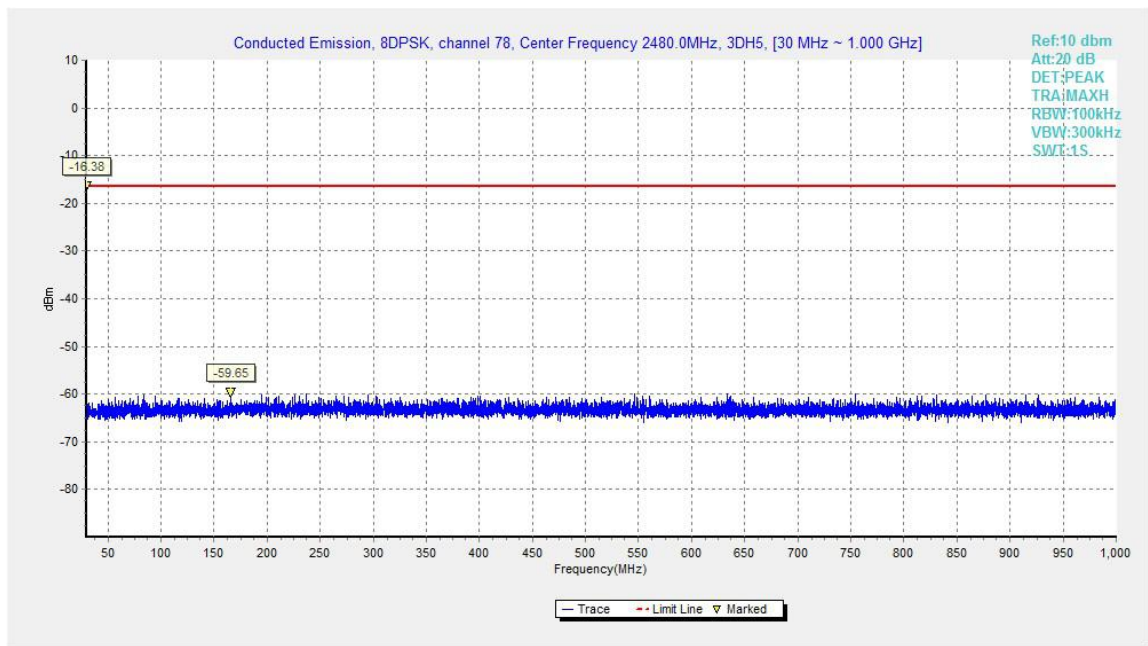


Fig.54. Conducted spurious emission: 8DPSK, Channel 78, 30MHz - 1GHz

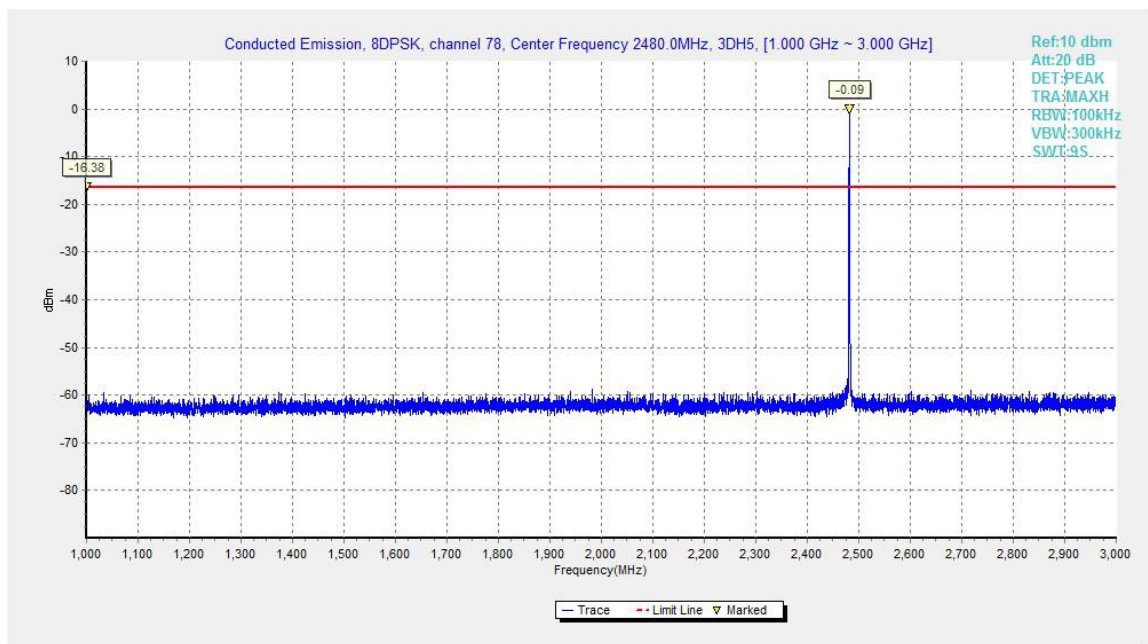


Fig.55. Conducted spurious emission: 8DPSK, Channel 78, 1GHz - 3GHz

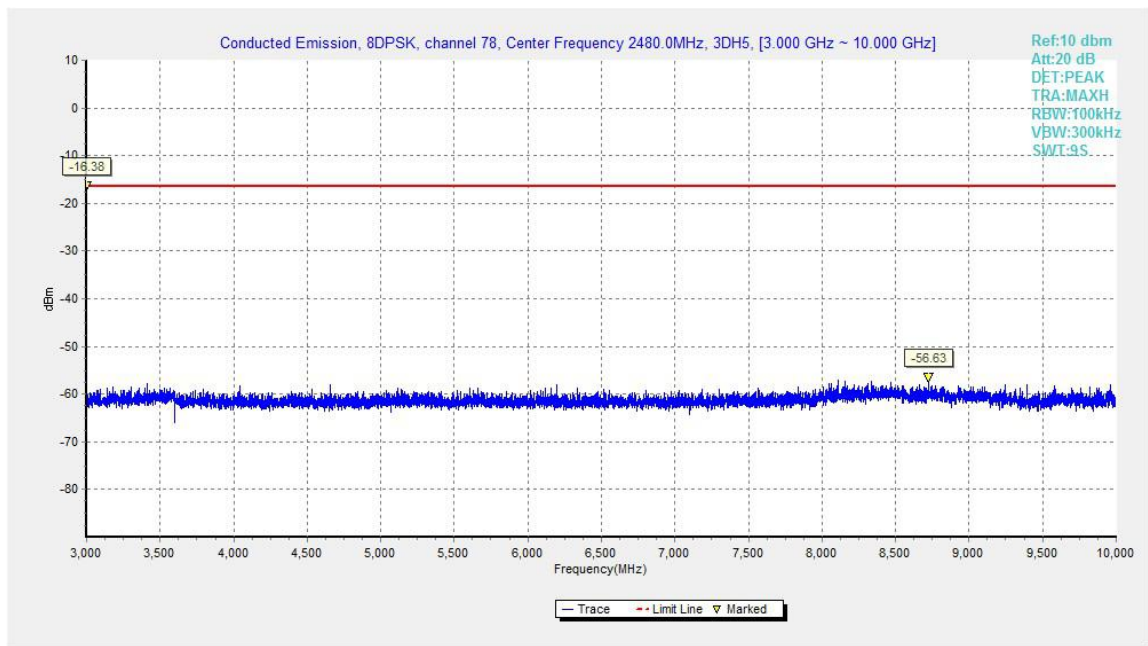


Fig.56. Conducted spurious emission: 8DPSK, Channel 78, 3GHz - 10GHz

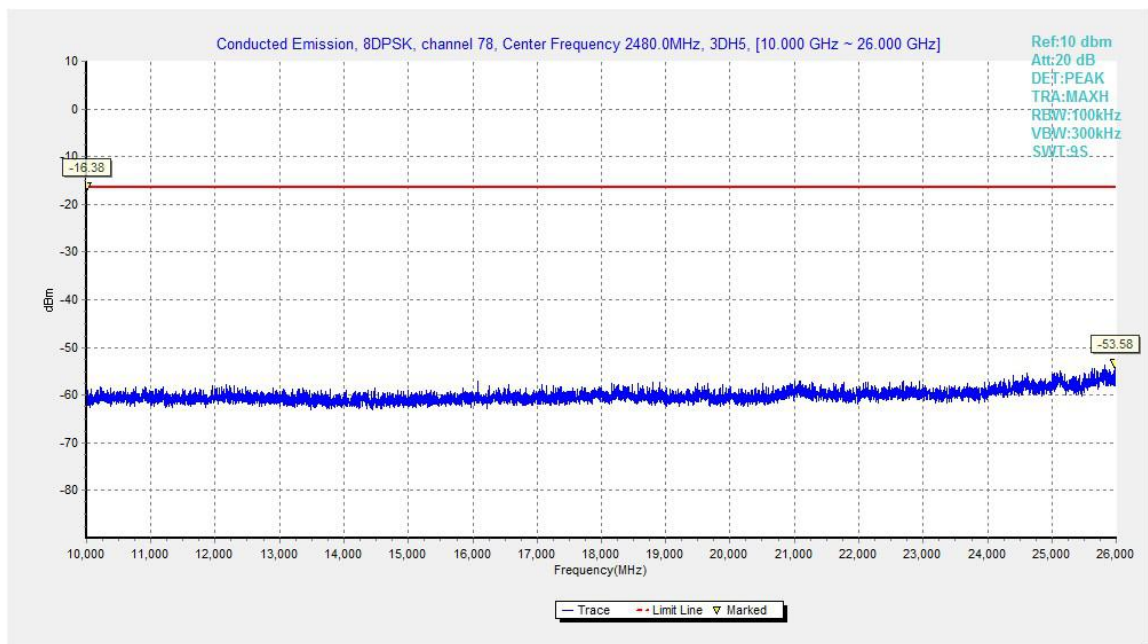


Fig.57. Conducted spurious emission: 8DPSK, Channel 78, 10GHz - 26GHz



### 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
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**For  $\pi/4$  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)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
2386.040	41.1	-38.8	27.7	52.200	H
17898.500	38.2	-18.5	45.6	11.100	H
17841.000	38.1	-18.5	45.6	11.000	V
17907.000	38.1	-18.5	45.6	11.000	H
17874.500	38.1	-18.5	45.6	11.000	H
17829.500	38.0	-18.5	45.6	10.900	H

**GFSK Ch 39 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
17886.000	38.4	-18.5	45.6	11.300	H
17882.500	38.3	-18.5	45.6	11.200	H
17883.000	38.3	-18.5	45.6	11.200	V
17877.000	38.3	-18.5	45.6	11.200	H
17863.000	38.3	-18.5	45.6	11.200	H
17844.000	38.2	-18.5	45.6	11.100	H

**GFSK Ch 78 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
2488.530	41.0	-38.9	27.7	52.2	H
17847.500	38.6	-18.5	45.6	11.5	H
17915.000	38.6	-17.7	45.6	10.7	V
17763.000	38.3	-18.5	45.6	11.2	H
17754.000	38.3	-18.5	45.6	11.2	H
17879.000	38.3	-18.5	45.6	11.2	H

**$\pi/4$  DQPSK Ch 0 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
2382.355	41.4	-38.8	27.7	52.500	H
17847.000	38.6	-18.5	45.6	11.500	H
17916.000	38.6	-17.7	45.6	10.700	V
17869.500	38.5	-18.5	45.6	11.400	H
17855.500	38.5	-18.5	45.6	11.400	H
17876.000	38.4	-18.5	45.6	11.300	H

**$\pi/4$  DQPSK Ch 39 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
17789.000	38.6	-18.5	45.6	11.5	H
17876.500	38.5	-18.5	45.6	11.4	H
17914.000	38.5	-18.5	45.6	11.4	V
17886.500	38.5	-18.5	45.6	11.4	H
17872.500	38.4	-18.5	45.6	11.3	H
17836.000	38.4	-18.5	45.6	11.3	H

**$\pi/4$  DQPSK Ch 78 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
2489.510	41.0	-38.9	27.7	52.2	H
17860.000	38.7	-18.5	45.6	11.6	H
17912.000	38.7	-18.5	45.6	11.6	V
17789.000	38.6	-18.5	45.6	11.5	H
17864.000	38.6	-18.5	45.6	11.5	H
17880.500	38.5	-18.5	45.6	11.4	H

**8DPSK Ch 0 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
2384.830	41.2	-38.8	27.7	52.3	H
17415.500	38.7	-19.2	41.5	16.4	H
17870.500	38.7	-18.5	45.6	11.6	V
17868.000	38.6	-18.5	45.6	11.5	H
17856.000	38.6	-18.5	45.6	11.5	H
17755.500	38.5	-18.5	45.6	11.4	H

**8DPSK Ch 39 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
17863.000	38.7	-18.5	45.6	11.6	H
17762.000	38.6	-18.5	45.6	11.5	H
17765.000	38.6	-18.5	45.6	11.5	V
17881.500	38.6	-18.5	45.6	11.5	H
17888.500	38.6	-18.5	45.6	11.5	H
17876.500	38.5	-18.5	45.6	11.4	H

**8DPSK Ch 78 - Average**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
2489.500	47.0	-38.9	27.7	58.2	H
17868.000	38.7	-18.5	45.6	11.6	H
17440.000	38.6	-19.2	41.5	16.3	V
17852.500	38.6	-18.5	45.6	11.5	H
17882.000	38.6	-18.5	45.6	11.5	H
17895.500	38.5	-18.5	45.6	11.4	H

**GFSK Ch 0 – Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
2386.090	53.8	-38.8	27.7	64.9	H
17843.500	50.2	-18.5	45.6	23.1	H
17876.500	50.1	-18.5	45.6	23.0	V
17928.500	50.0	-17.7	45.6	22.1	H
17790.500	49.8	-18.5	45.6	22.7	H
17450.500	49.8	-19.2	41.5	27.5	H

**GFSK Ch 39 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
17492.000	50.5	-19.2	41.5	28.2	H
17905.000	50.3	-18.5	45.6	23.2	H
17354.500	50.2	-19.5	41.5	28.2	V
17864.500	49.9	-18.5	45.6	22.8	H
17393.500	49.9	-19.2	41.5	27.6	H
17782.000	49.8	-18.5	45.6	22.7	H

**GFSK Ch 78 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
2488.535	53.9	-38.9	27.7	65.1	H
17753.000	50.4	-18.5	45.6	23.3	H
17258.000	50.4	-19.5	41.5	28.4	V
17444.500	50.1	-19.2	41.5	27.8	H
17897.000	49.8	-18.5	45.6	22.7	H
17782.000	49.7	-18.5	45.6	22.6	H

**π/4 DQPSK Ch 0 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
2382.445	53.5	-38.8	27.7	64.600	H
17849.000	50.5	-18.5	45.6	23.400	H
17733.500	50.1	-18.9	45.6	23.400	V
17579.500	50.0	-18.9	45.6	23.300	H
17664.500	50.0	-18.9	45.6	23.300	H
17473.000	49.9	-19.2	41.5	27.600	H

**$\pi/4$  DQPSK Ch 39 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
17909.500	50.4	-18.5	45.6	23.300	H
17486.000	50.2	-19.2	41.5	27.900	H
17896.500	50.0	-18.5	45.6	22.900	V
17879.500	50.0	-18.5	45.6	22.900	H
17803.500	49.9	-18.5	45.6	22.800	H
17774.000	49.9	-18.5	45.6	22.800	H

**$\pi/4$  DQPSK Ch 78 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
2489.490	53.7	-38.9	27.7	64.9	H
17448.500	50.9	-19.2	41.5	28.6	H
17034.000	50.3	-19.9	41.5	28.7	V
17776.000	50.2	-18.5	45.6	23.1	H
17297.000	50.1	-19.5	41.5	28.1	H
17368.500	49.9	-19.5	41.5	27.9	H

**8DPSK Ch 0 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
2384.895	53.9	-38.8	27.7	65.0	H
17905.500	51.0	-18.5	45.6	23.9	H
17747.500	50.7	-18.5	45.6	23.6	V
17875.000	50.7	-18.5	45.6	23.6	H
17817.500	50.6	-18.5	45.6	23.5	H
17623.500	50.4	-18.9	45.6	23.7	H

**8DPSK Ch 39 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dB $\mu$ V)	Polarization
17873.500	50.5	-18.5	45.6	23.4	H
17736.000	50.5	-18.9	45.6	23.8	H
17753.500	50.4	-18.5	45.6	23.3	V
17761.500	50.4	-18.5	45.6	23.3	H
17774.500	50.3	-18.5	45.6	23.2	H
17281.000	50.2	-19.5	41.5	28.2	H



**8DPSK Ch 78 - Peak**

Frequency(MHz)	Result (dBuV/m)	Cable Loss(dB)	Antenna Factor	Receiver Reading (dBμV)	Polarization
2489.500	52.9	-38.9	27.7	64.1	H
17914.000	50.8	-18.5	45.6	23.7	H
17831.000	50.4	-18.5	45.6	23.3	V
17394.500	50.3	-19.2	41.5	28.0	H
17654.500	50.3	-18.9	45.6	23.6	H
17806.500	50.3	-18.5	45.6	23.2	H

**Conclusion: PASS**

**Test graphs as below:**

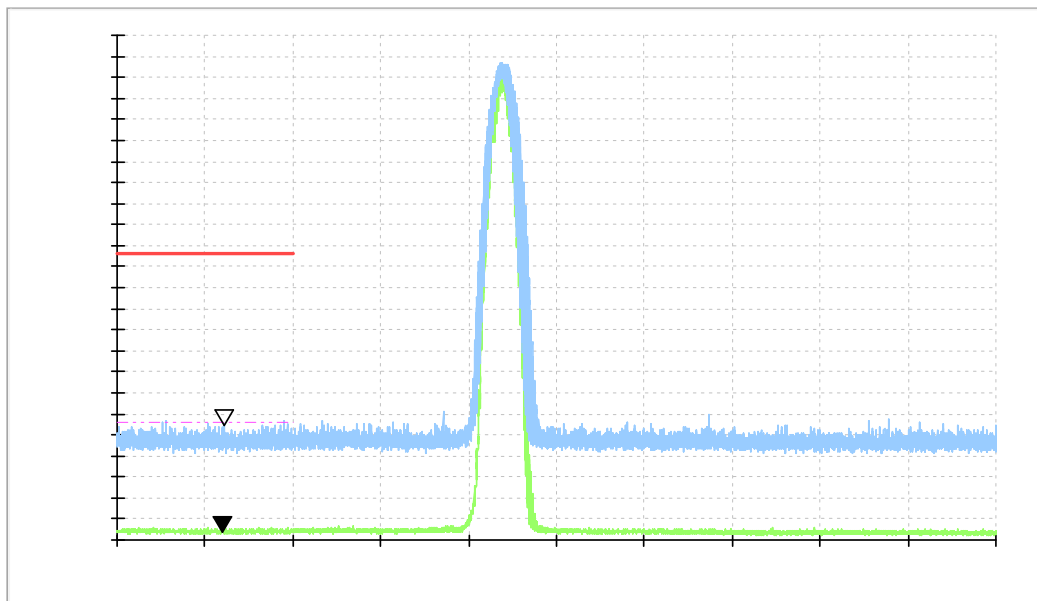


Fig.58. Radiated emission (Power): GFSK, low channel

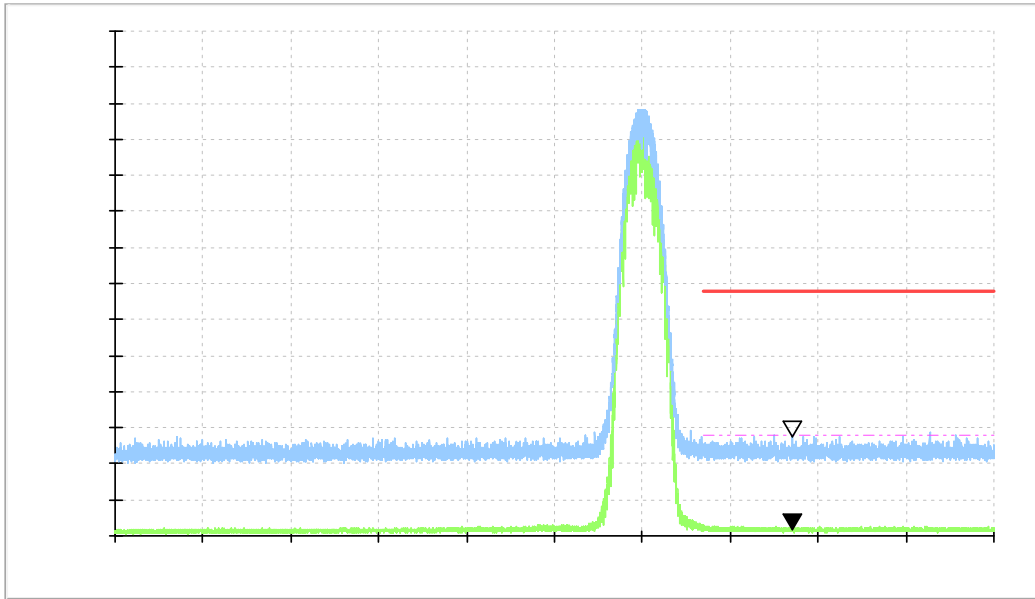


Fig.59. Radiated emission (Power) GFSK, high channel

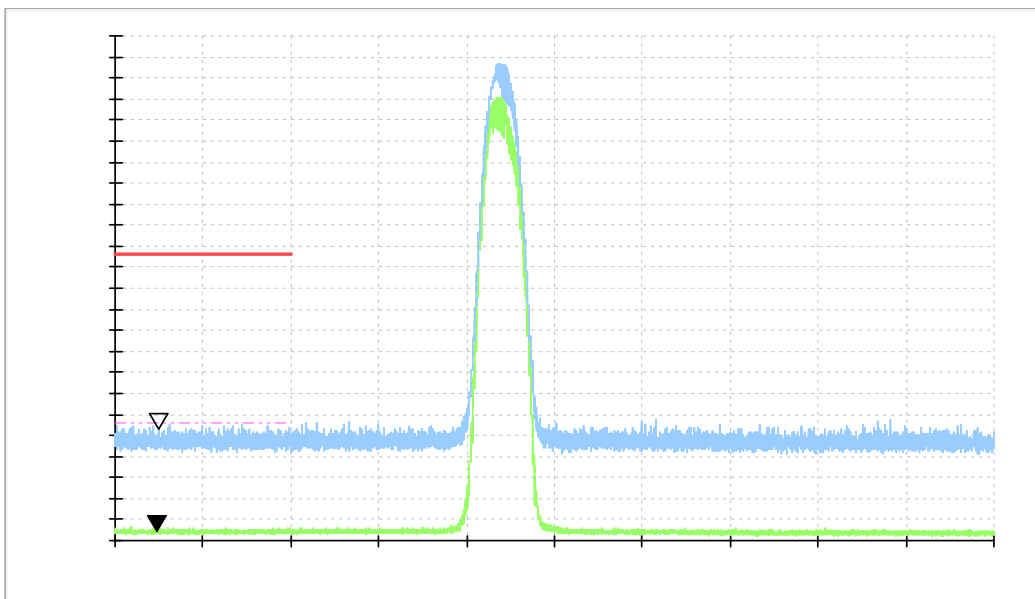


Fig.60. Radiated emission (Power):  $\pi/4$  DQPSK, low channel

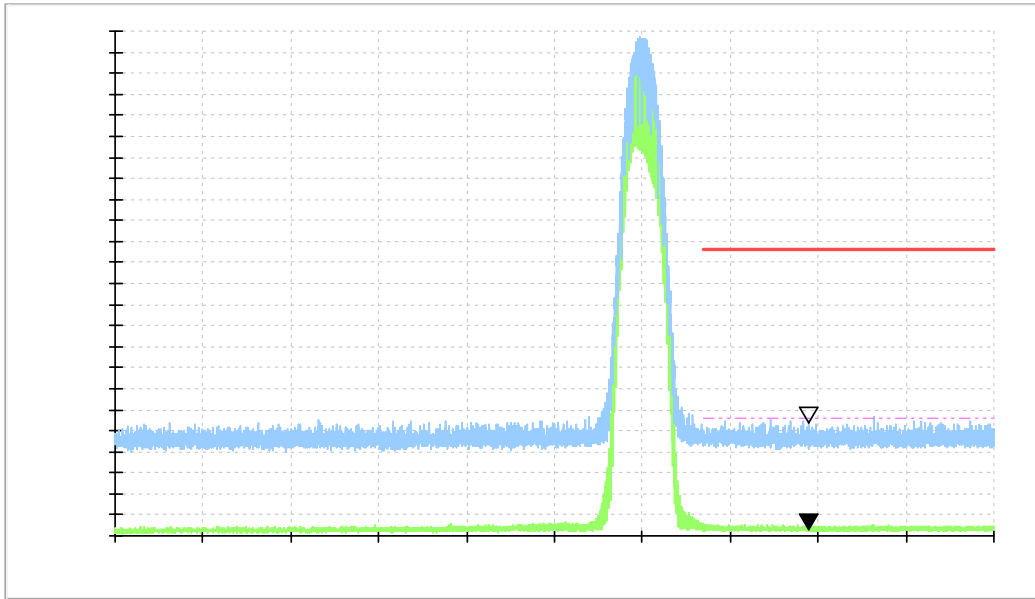


Fig.61. Radiated emission (Power):  $\pi/4$  DQPSK, high channel

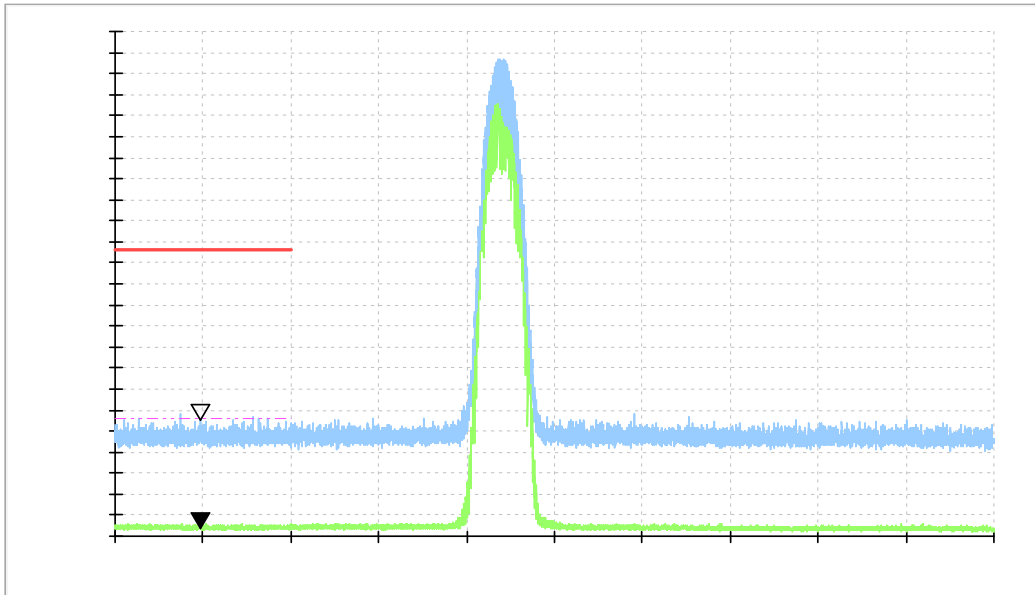


Fig.62. Radiated emission (Power): 8DPSK, low channel

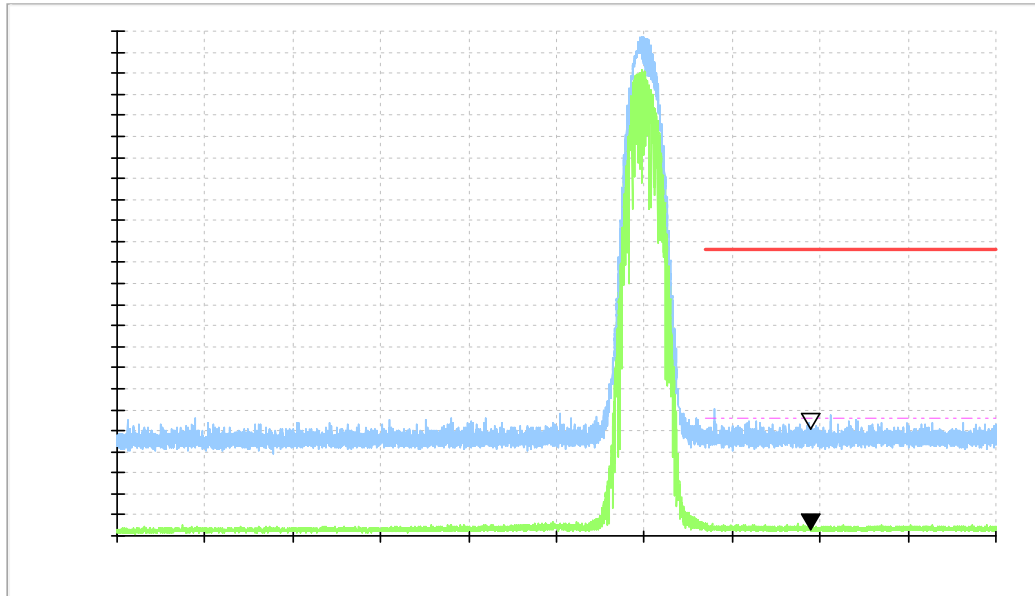


Fig.63. Radiated emission (Power): 8DPSK, high channel

### 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  $\geq$  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	118.01	P
		Fig.65		
	DH3	Fig.66	165.84	P
		Fig.67		
	DH5	Fig.68	195.45	P
		Fig.69		

**For  $\pi/4$  DQPSK**

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.70	120.32	P
		Fig.71		
	DH3	Fig.72	172.70	P
		Fig.73		
	DH5	Fig.74	201.41	P
		Fig.75		

**For 8DPSK**

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.76	121.02	P
		Fig.77		
	DH3	Fig.78	188.87	P

		Fig.79		
	DH5	Fig.80	192.92	P
		Fig.81		

**Conclusion: PASS**

**Test graphs as below:**

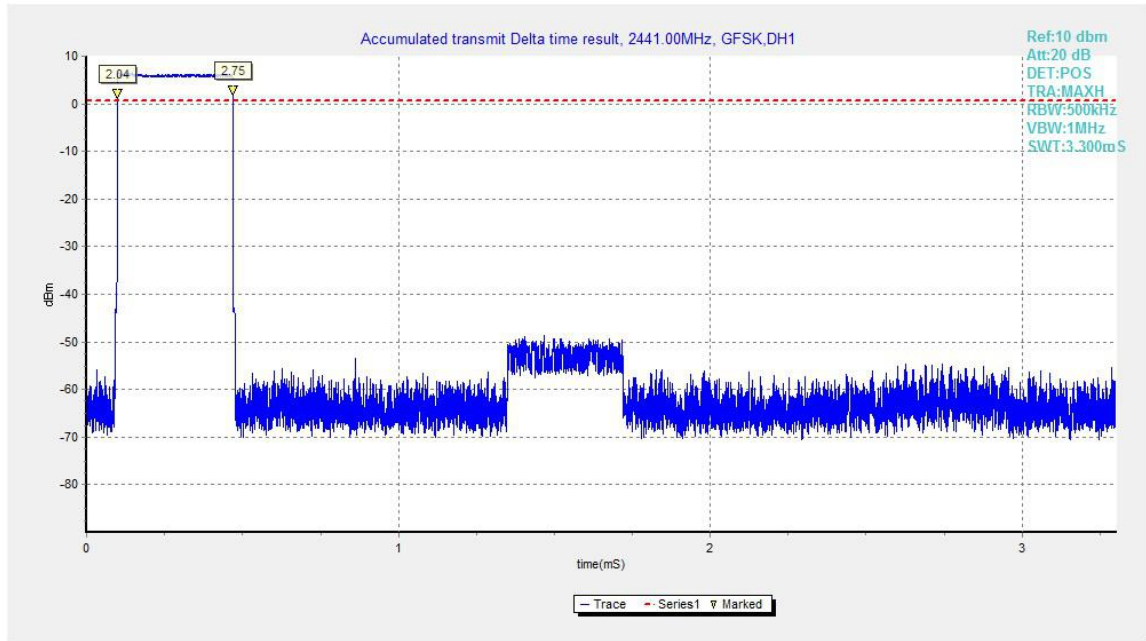


Fig.64. Time of occupancy (Dwell Time): Channel 39, Packet DH1

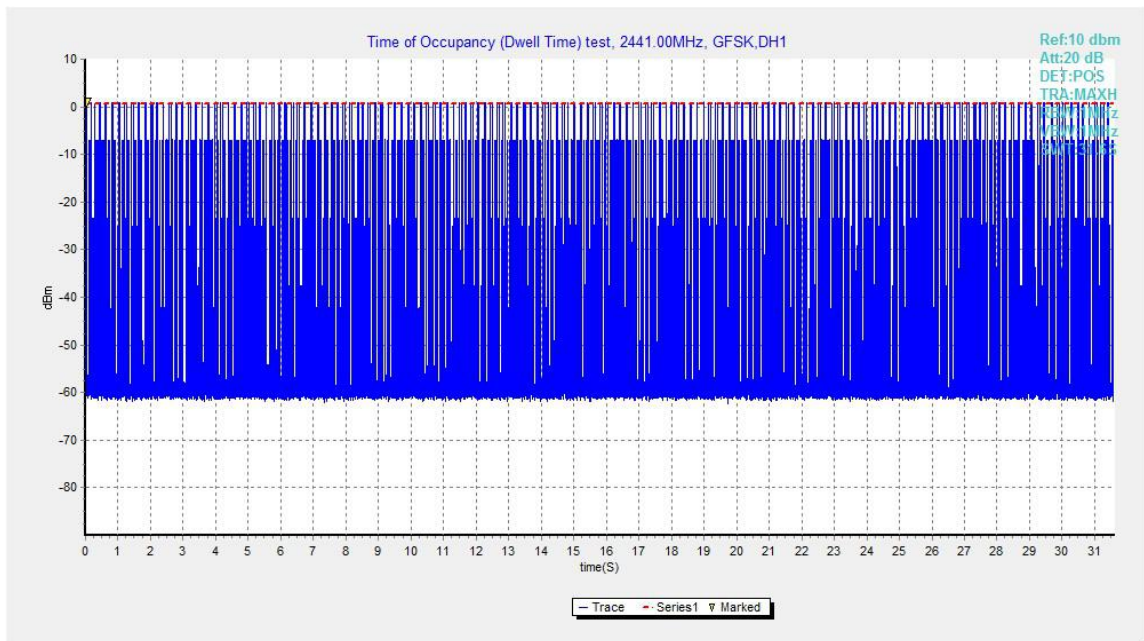


Fig.65. Number of Transmissions Measurement: Channel 39,Packet DH1