# FCC PART 15C
# TEST REPORT
## No. I19Z62263-IOT01

**for**

**Shenzhen Tinno Mobile Technology Corp.**

**Smart Phone**

**Model Name: Wiko U520AS**

**FCC ID: XD6U520AS**

**with**

**Hardware Version: V1.0**

**Software Version: U520ASV01.10.10**

**Issued Date: 2020-3-13**

**Note:**

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# REPORT HISTORY

| Report Number | Revision | Description | Issue Date |
|---|---|---|---|
| I19Z62263-IOT01 | Rev.0 | 1st edition | 2020-3-13 |

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# CONTENTS


**1. TEST LABORATORY ..... 5**

1.1. INTRODUCTION &ACCREDITATION ..... 5
1.2. TESTING LOCATION ..... 5
1.3. TESTING ENVIRONMENT ..... 6
1.4. PROJECT DATA ..... 6
1.5. SIGNATURE ..... 6

**2. CLIENT INFORMATION ..... 7**

2.1. APPLICANT INFORMATION ..... 7
2.2. MANUFACTURER INFORMATION ..... 7

**3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) ..... 8**

3.1. ABOUT EUT ..... 8
3.2. INTERNAL IDENTIFICATION OF EUT ..... 8
3.3. INTERNAL IDENTIFICATION OF AE ..... 8
3.4. NORMAL ACCESSORY SETTING ..... 9
3.5. GENERAL DESCRIPTION ..... 9

**4. REFERENCE DOCUMENTS ..... 10**

4.1. DOCUMENTS SUPPLIED BY APPLICANT ..... 10
4.2. REFERENCE DOCUMENTS FOR TESTING ..... 10

**5. TEST RESULTS ..... 11**

5.1. SUMMARY OF TEST RESULTS ..... 11
5.2. STATEMENTS ..... 11

**6. TEST FACILITIES UTILIZED ..... 12**

**7. MEASUREMENT UNCERTAINTY ..... 13**

7.1. PEAK OUTPUT POWER - CONDUCTED ..... 13
7.2. FREQUENCY BAND EDGES - CONDUCTED ..... 13
7.3. FREQUENCY BAND EDGES - RADIATED ..... 13
7.4. TRANSMITTER SPURIOUS EMISSION - CONDUCTED ..... 13
7.5. TRANSMITTER SPURIOUS EMISSION - RADIATED ..... 13
7.6. TIME OF OCCUPANCY (DWELL TIME) ..... 13
7.7. 20DB BANDWIDTH ..... 14
7.8. CARRIER FREQUENCY SEPARATION ..... 14
7.9. AC POWERLINE CONDUCTED EMISSION ..... 14

**ANNEX A: DETAILED TEST RESULTS ..... 15**

A.1. MEASUREMENT METHOD ..... 15
A.2. PEAK OUTPUT POWER – CONDUCTED ..... 17
A.3. FREQUENCY BAND EDGES – CONDUCTED ..... 18


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A.4. FREQUENCY BAND EDGES –RADIATED.....25
A.5. TRANSMITTER SPURIOUS EMISSION - CONDUCTED.....31
A.6. TRANSMITTER SPURIOUS EMISSION - RADIATED.....56
A.7. TIME OF OCCUPANCY (DWELL TIME).....65
A.8. 20DB BANDWIDTH.....76
A.9. CARRIER FREQUENCY SEPARATION.....82
A.10. NUMBER OF HOPPING CHANNELS.....85
A.11. AC POWERLINE CONDUCTED EMISSION.....89

**ANNEX B: ACCREDITATION CERTIFICATE.....93**

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# 1. Test Laboratory

## 1.1. Introduction &Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP)with lab code600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

## 1.2. 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

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## 1.3. Testing Environment

Normal Temperature: 15-35℃

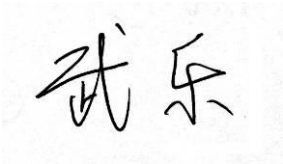
Relative Humidity: 20-75%

## 1.4. Project data

Testing Start Date: 2019-12-20

Testing End Date: 2020-2-28

## 1.5. Signature



**Wu Le**

**(Prepared this test report)**

**Sun Zhenyu**

**(Reviewed this test report)**

**Li Zhuofang**

**(Approved this test report)**

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# 2. Client Information

## 2.1. Applicant Information

| | |
|---|---|
| Company Name: | Shenzhen Tinno Mobile Technology Corp. |
| Address /Post: | 4/F, H-3 Building,OCT Eastern Industrial Park. NO.1 XiangShan East Road, Nan Shan District,Shenzhen, P.R.China |
| City: | Shenzhen |
| Postal Code: | / |
| Country: | China |
| Telephone: | 0755-86095550 |
| Fax: | / |

## 2.2. Manufacturer Information

| | |
|---|---|
| Company Name: | Shenzhen Tinno Mobile Technology Corp. |
| Address /Post: | 4/F, H-3 Building,OCT Eastern Industrial Park. NO.1 XiangShan East Road, Nan Shan District,Shenzhen, P.R.China |
| City: | Shenzhen |
| Postal Code: | / |
| Country: | China |
| Telephone: | 0755-86095550 |
| Fax: | / |

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

## 3.1. About EUT

| | |
|---|---|
| Description | Smart Phone |
| Model Name | Wiko U520AS |
| FCC ID | XD6U520AS |
| 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 | 860055040007604 | V1.0 | U520ASV01.10.10 |
| EUT2 | 860055040006119 | V1.0 | U520ASV01.10.10 |

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

## 3.3. Internal Identification of AE

| AE ID* | Description | SN | Remarks |
|---|---|---|---|
| AE1 | Battery | / | / |
| AE2 | Charger | / | / |
| AE3 | USB Cable | / | / |
| AE4 | USB Cable | / | / |
| AE5 | USB Cable | / | No test |
| AE6 | USB Cable | / | No test |
| AE7 | USB Cable | / | No test |
| AE8 | USB Cable | / | No test |

AE1

| | |
|---|---|
| Model | LT25H446077J |
| Manufacturer | Ningbo Veken Battery Co., Ltd. No.2, Area 0212, West Zone, Free Trade Zone, Ningbo, Zhejiang Province, China |
| Capacitance | 2500 mAh |
| Nominal voltage | 3.8V |

AE2

| | |
|---|---|
| Model | TN-050100U6 |
| Manufacturer | Guangdong Beicom Electronics Co.,Ltd |
| Length of cable | / |

AE3

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| | |
|---|---|
| Model | 336189 |
| SN | P103-BFT132-010 |
| Manufacturer | / |
| Length of cable | / |
| AE4 | |
| Model | T365-004 |
| SN | P103-BL4130-000 |
| Manufacturer | / |
| Length of cable | / |
| AE5 | |
| Model | 336189 |
| SN | P103-ASH130-000 |
| Manufacturer | / |
| Length of cable | / |
| AE6 | |
| Model | 336189 |
| SN | P103-BFT131-010 |
| Manufacturer | / |
| Length of cable | / |
| AE7 | |
| Model | T365-004 |
| SN | P103-BMX131-000 |
| Manufacturer | / |
| Length of cable | / |
| AE8 | |
| Model | T365-004 |
| SN | P103-BL4132-000 |
| Manufacturer | / |
| Length of 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 Smart Phone 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.

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# 4. Reference Documents

## 4.1. Documents supplied by applicant

EUT feature information is supplied by the client 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:<br>15.205 Restricted bands of operation;<br>15.209 Radiated emission limits, general requirements;<br>15.247 Operation within the bands 902–928MHz, 2400–2483.5 MHz, and 5725–5850 MHz. | 2018 |
| ANSI C63.10 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices | June,2013 |

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# 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- Conducted | 15.247 (d) | **P** |
| Frequency Band Edges- Radiated | 15.247, 15.205, 15.209 | **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

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## 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 | 2020-11-29 |
| 2 | Bluetooth Tester | CBT32 | 100649 | Rohde & Schwarz | 1 year | 2020-11-29 |
| 3 | LISN | ENV216 | 101200 | Rohde & Schwarz | 1 year | 2020-04-27 |
| 4 | Test Receiver | ESCI | 100344 | Rohde & Schwarz | 1 year | 2020-03-14 |
| 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 | 2020-10-30 |
| 2 | BiLog Antenna | VULB9163 | 01176 | Schwarzbeck | 1 year | 2020-03-14 |
| 3 | Dual-Ridge Waveguide Horn Antenna | 3117 | 00139065 | ETS-Lindgren | 1 year | 2020-11-10 |
| 4 | Dual-Ridge Waveguide Horn Antenna | 3116 | 2663 | ETS-Lindgren | 1 year | 2020-6-18 |
| 5 | Vector Signal Analyzer | FSV | 101047 | Rohde & Schwarz | 1 year | 2020-05-16 |
| 6 | Bluetooth Tester | CBT | 101042 | Rohde & Schwarz | 1 year | 2021-01-01 |

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# 7. Measurement Uncertainty

## 7.1. Peak Output Power - Conducted

**Measurement Uncertainty:**

| | |
|---|---|
| Measurement Uncertainty (k=2) | 0.66dB |

## 7.2. Frequency Band Edges - Conducted

**Measurement Uncertainty:**

| | |
|---|---|
| Measurement Uncertainty (k=2) | 0.66dB |

## 7.3. Frequency Band Edges - Radiated

**Measurement Uncertainty:**

| | |
|---|---|
| Measurement Uncertainty (k=2) | 4.32dB |

## 7.4. 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 |

## 7.5. Transmitter Spurious Emission - Radiated

**Measurement Uncertainty:**

| Frequency Range | Uncertainty(dBm) (k=2) |
|---|---|
| 9kHz-30MHz | / |
| 30MHz ≤ f ≤ 1GHz | 5.40 |
| 1GHz ≤ f ≤18GHz | 4.32 |
| 18GHz ≤ f ≤40GHz | 5.26 |

## 7.6. Time of Occupancy (Dwell Time)

**Measurement Uncertainty:**

| | |
|---|---|
| Measurement Uncertainty (k=2) | 0.88ms |

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## 7.7. 20dB Bandwidth

**Measurement Uncertainty:**

| | |
|---|---|
| Measurement Uncertainty (k=2) | 61.936Hz |

## 7.8. Carrier Frequency Separation

**Measurement Uncertainty:**

| | |
|---|---|
| Measurement Uncertainty (k=2) | 61.936Hz |

## 7.9. 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.

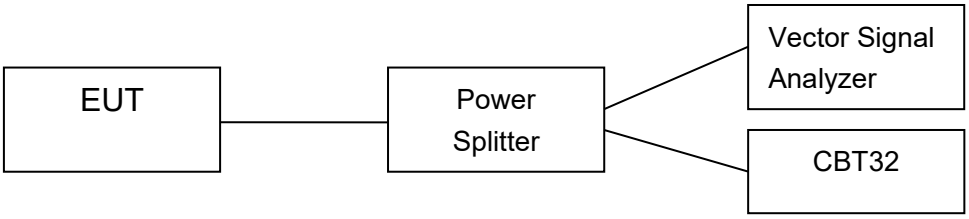
2). Set the EUT to the required work mode (Transmitter, receiver or transmitter & receiver).

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;

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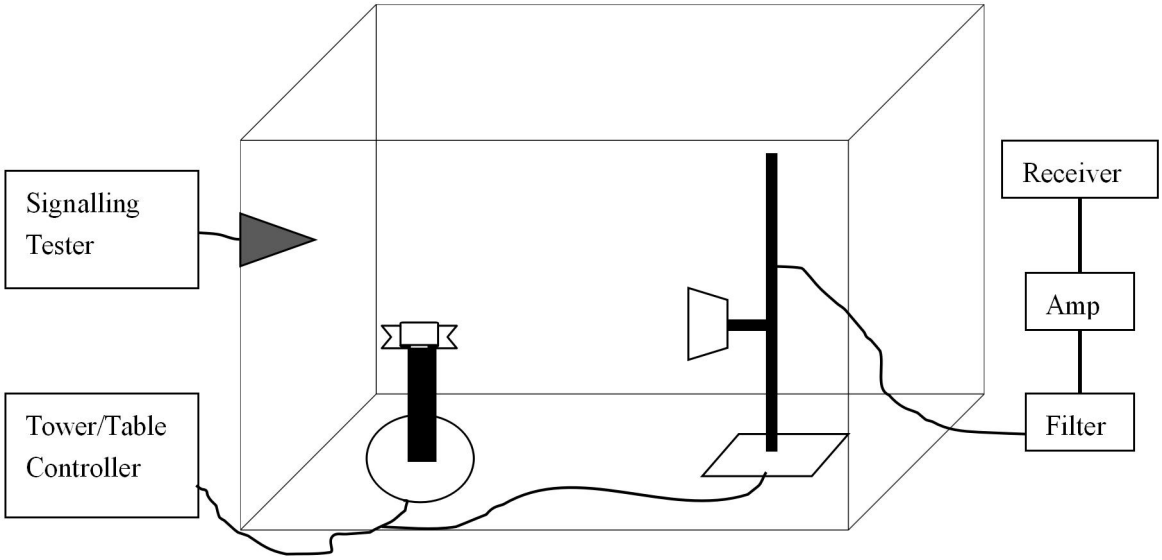


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## A.2. Peak Output Power – Conducted

**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 | Limits | |
|---|---|---|
| FCC Part 15.247 (b)(1) | Bandwidth≤1MHz | 30dBm (1W) |
| | Bandwidth＞1MHz | 21dBm (125mW) |

**Measurement Results:**

**For GFSK**

| Channel | Ch 0<br>2402 MHz | Ch 39<br>2441 MHz | Ch 78<br>2480 MHz | Conclusion |
|---|---|---|---|---|
| Peak Conducted Output Power (dBm) | 5.29 | 5.65 | 5.53 | P |

**For π/4 DQPSK**

| Channel | Ch 0<br>2402 MHz | Ch 39<br>2441 MHz | Ch 78<br>2480 MHz | Conclusion |
|---|---|---|---|---|
| Peak Conducted Output Power (dBm) | 4.54 | 4.75 | 4.67 | P |

**For 8DPSK**

| Channel | Ch 0<br>2402 MHz | Ch 39<br>2441 MHz | Ch 78<br>2480 MHz | Conclusion |
|---|---|---|---|---|
| Peak Conducted Output Power (dBm) | 4.52 | 4.77 | 4.69 | P |

**Conclusion: PASS**

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## 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 | -60.39 | P |
| | Hopping ON | Fig.2 | -62.90 | P |
| 78 | Hopping OFF | Fig.3 | -63.07 | P |
| | Hopping ON | Fig.4 | -64.44 | P |

**For π/4 DQPSK**

| Channel | Hopping | Band Edge Power ( dBc) | | Conclusion |
|---|---|---|---|---|
| 0 | Hopping OFF | Fig.5 | -59.70 | P |
| | Hopping ON | Fig.6 | -63.81 | P |
| 78 | Hopping OFF | Fig.7 | -62.19 | P |
| | Hopping ON | Fig.8 | -62.99 | P |

**For 8DPSK**

| Channel | Hopping | Band Edge Power ( dBc) | | Conclusion |
|---|---|---|---|---|
| 0 | Hopping OFF | Fig.9 | -58.80 | P |
| | Hopping ON | Fig.10 | -63.19 | P |
| 78 | Hopping OFF | Fig.11 | -62.59 | P |

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| | | | | |
|---|---|---|---|---|
| | Hopping ON | Fig.12 | -64.27 | P |

**Conclusion: PASS**

**Test graphs as below**

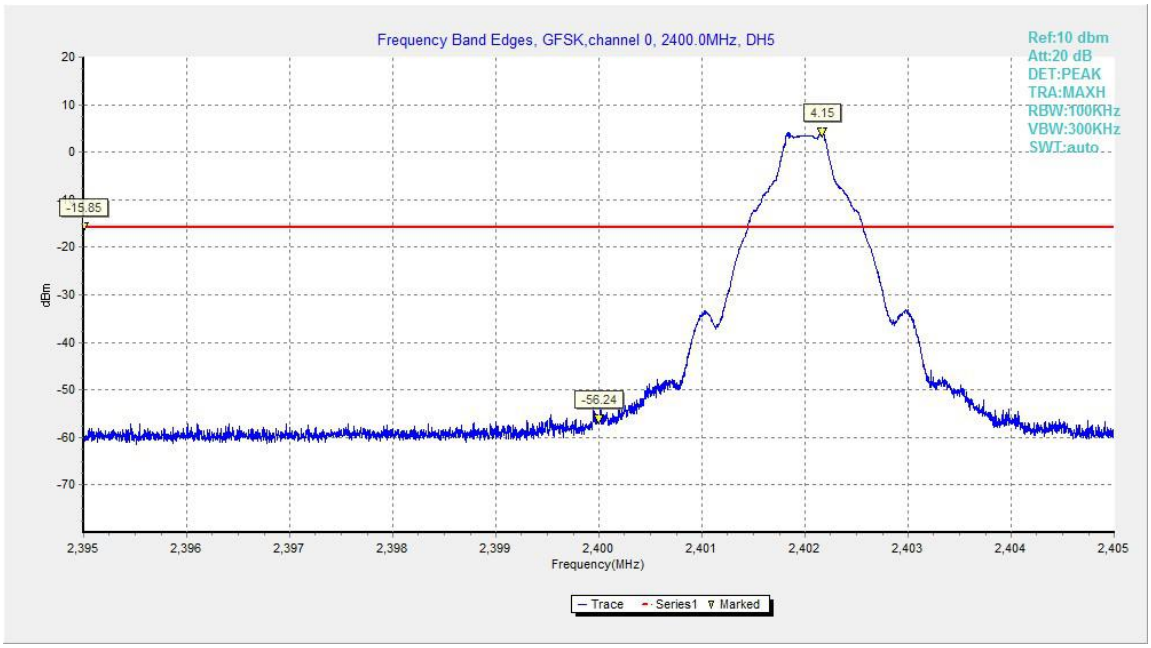


Fig.1. Frequency Band Edges: GFSK, Channel 0, Hopping Off

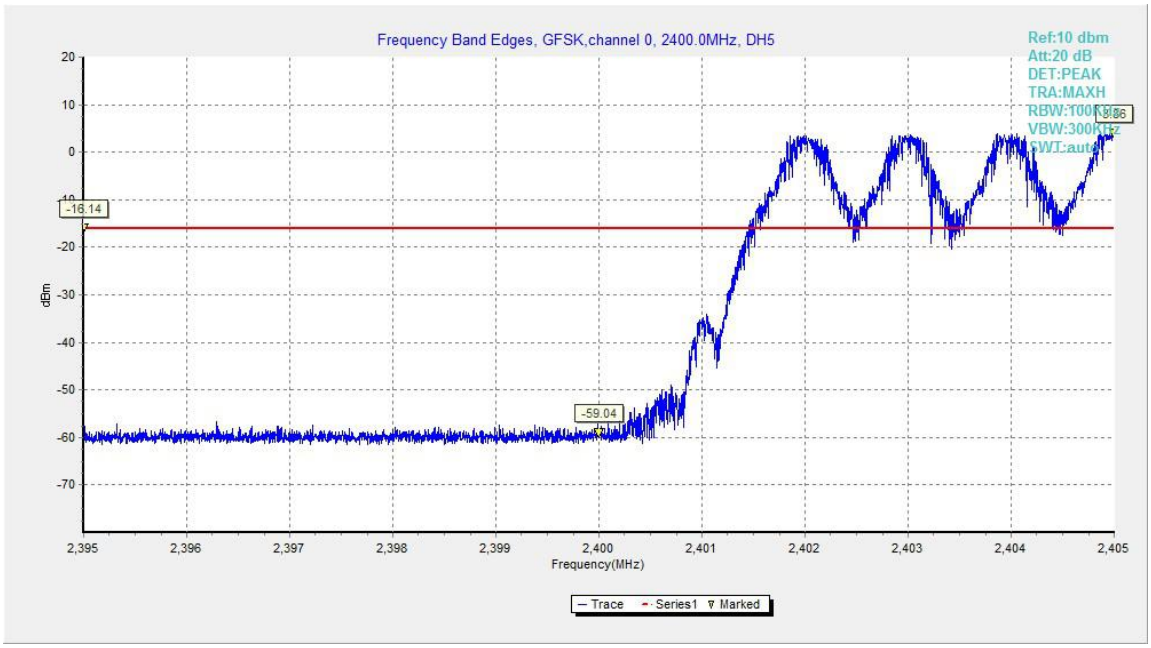


Fig.2. Frequency Band Edges: GFSK, Channel 0, Hopping On

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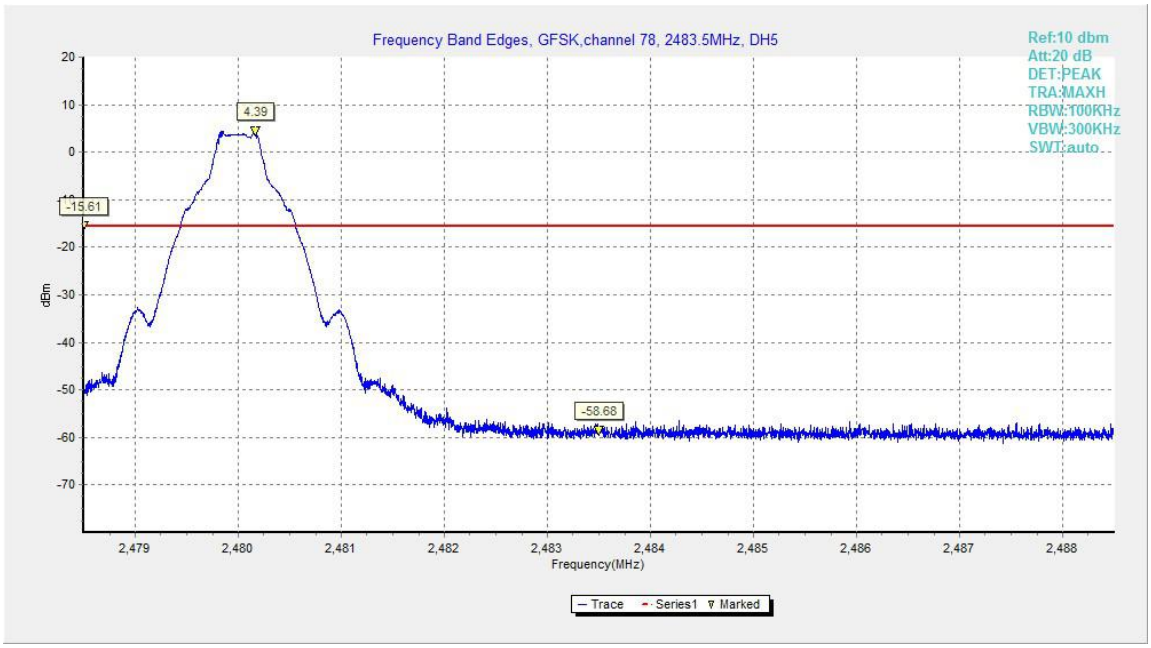


Fig.3. Frequency Band Edges: GFSK, Channel 78, Hopping Off

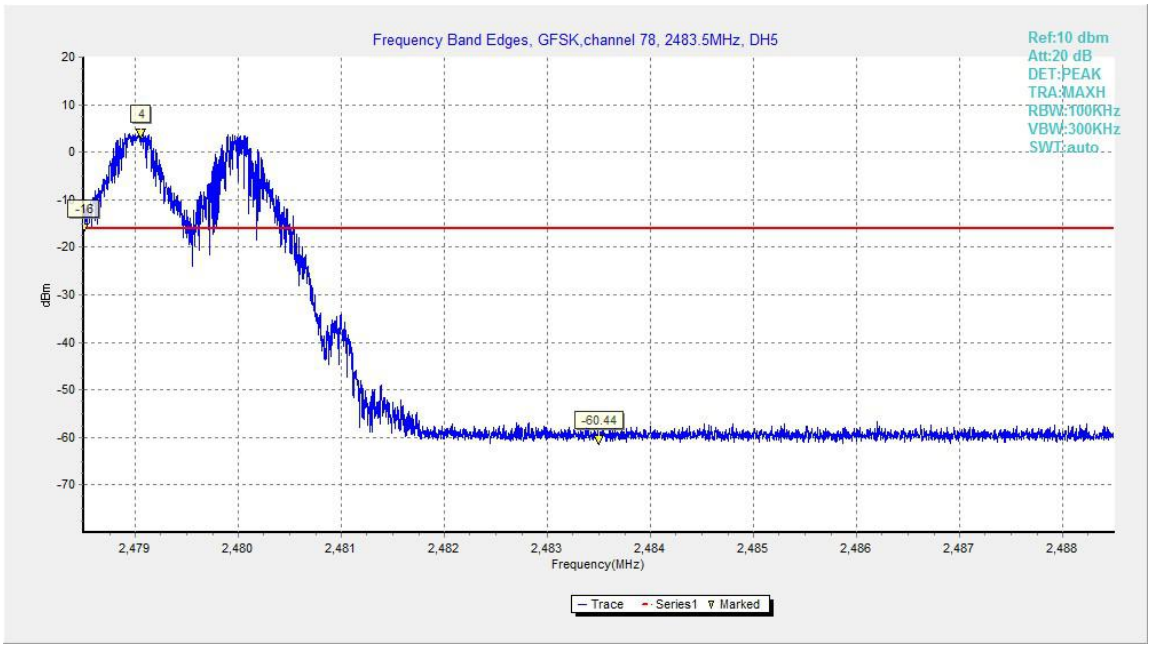


Fig.4. Frequency Band Edges: GFSK, Channel 78, Hopping On

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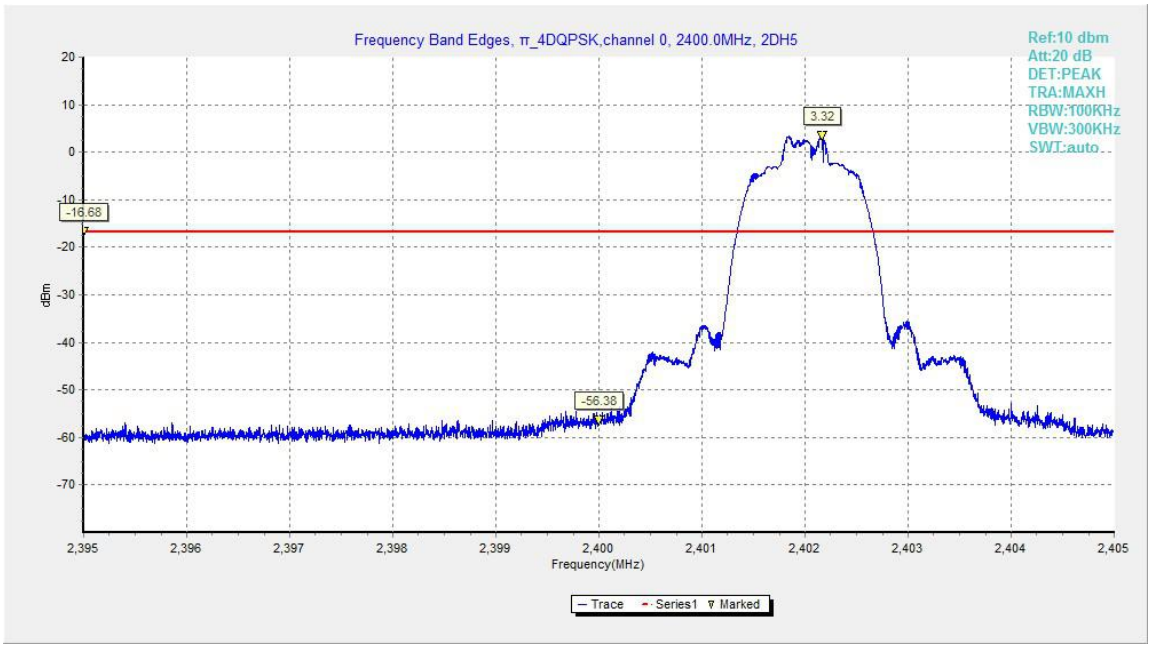


Fig.5. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping Off

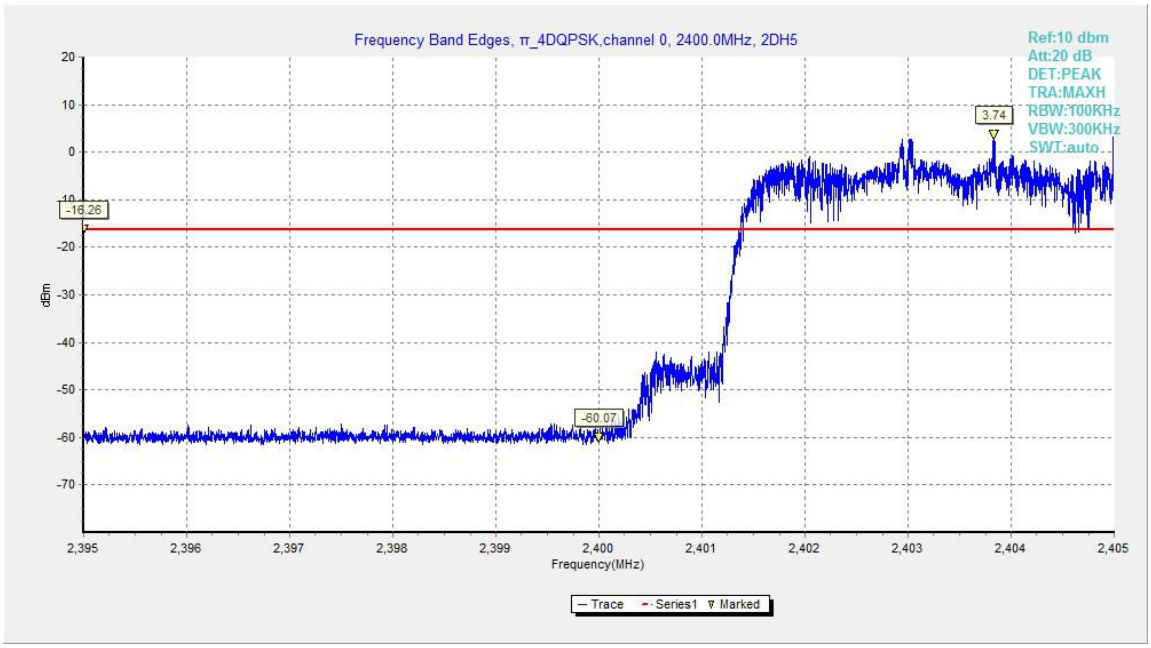


Fig.6. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping On

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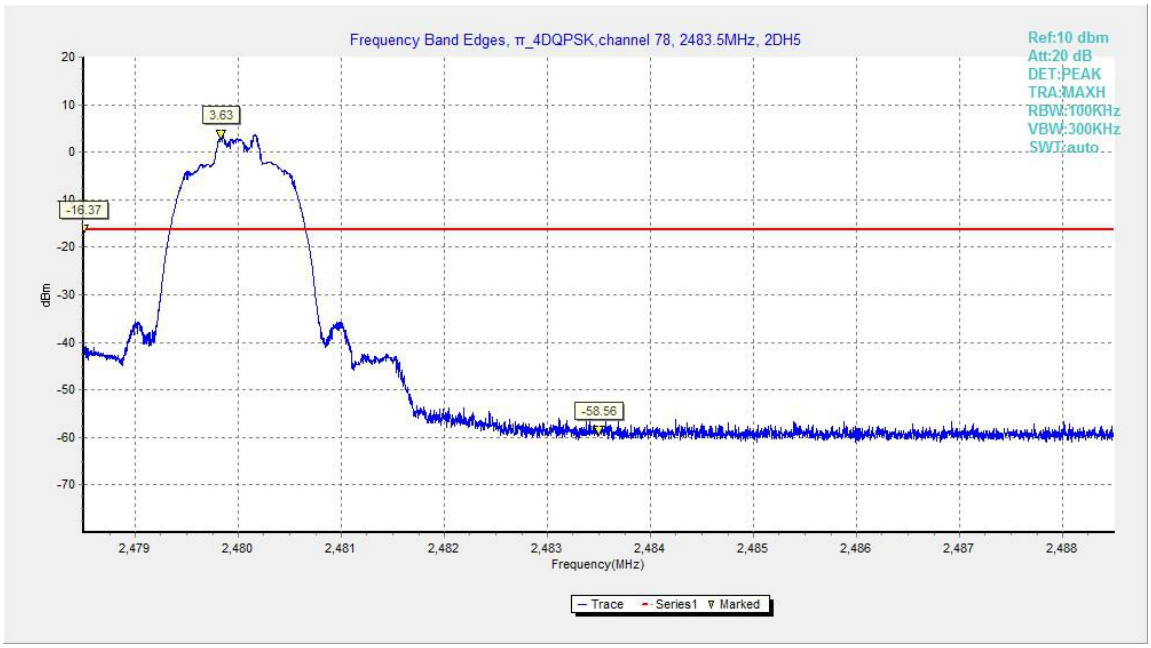


Fig.7. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping Off

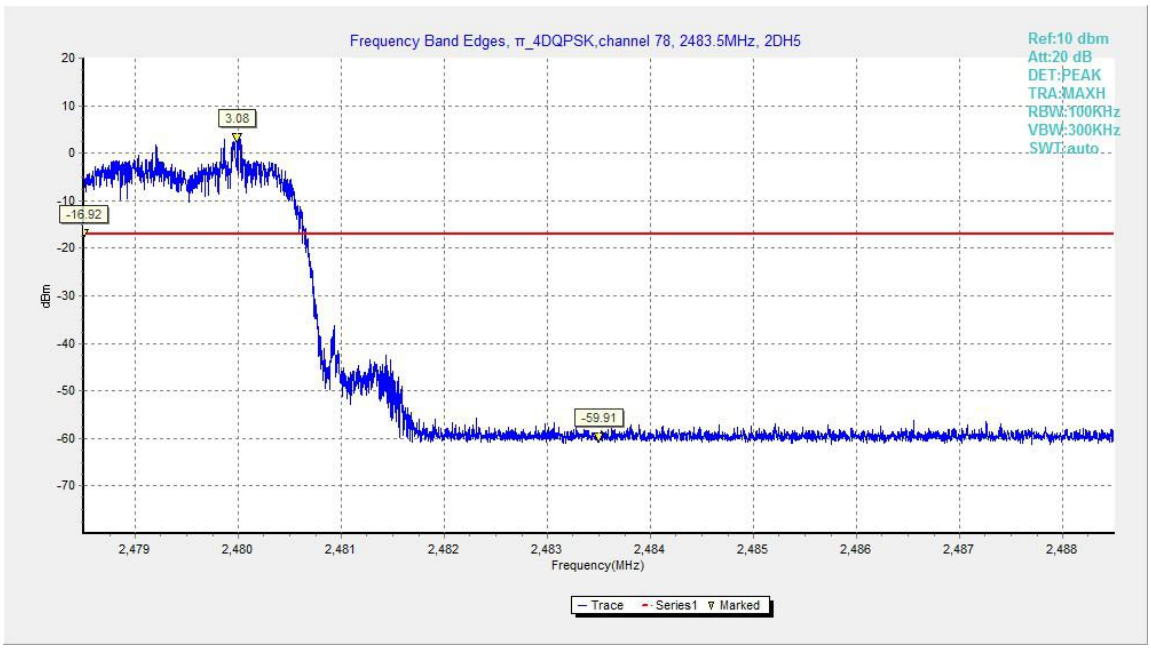


Fig.8. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping On

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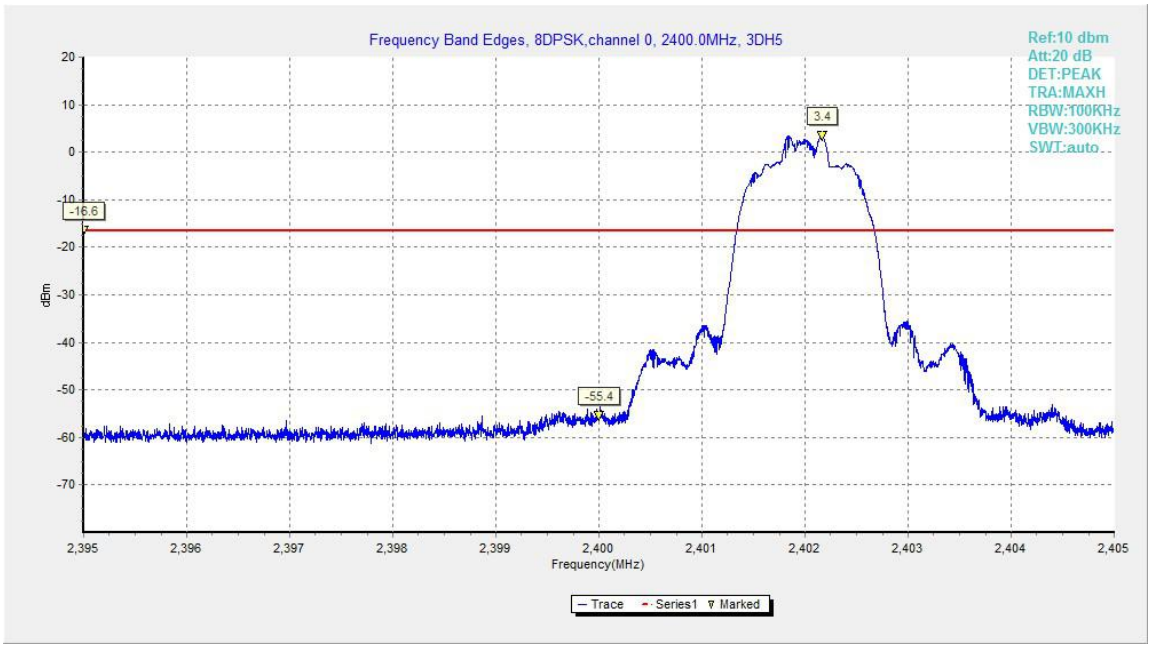


Fig.9. Frequency Band Edges: 8DPSK, Channel 0, Hopping Off

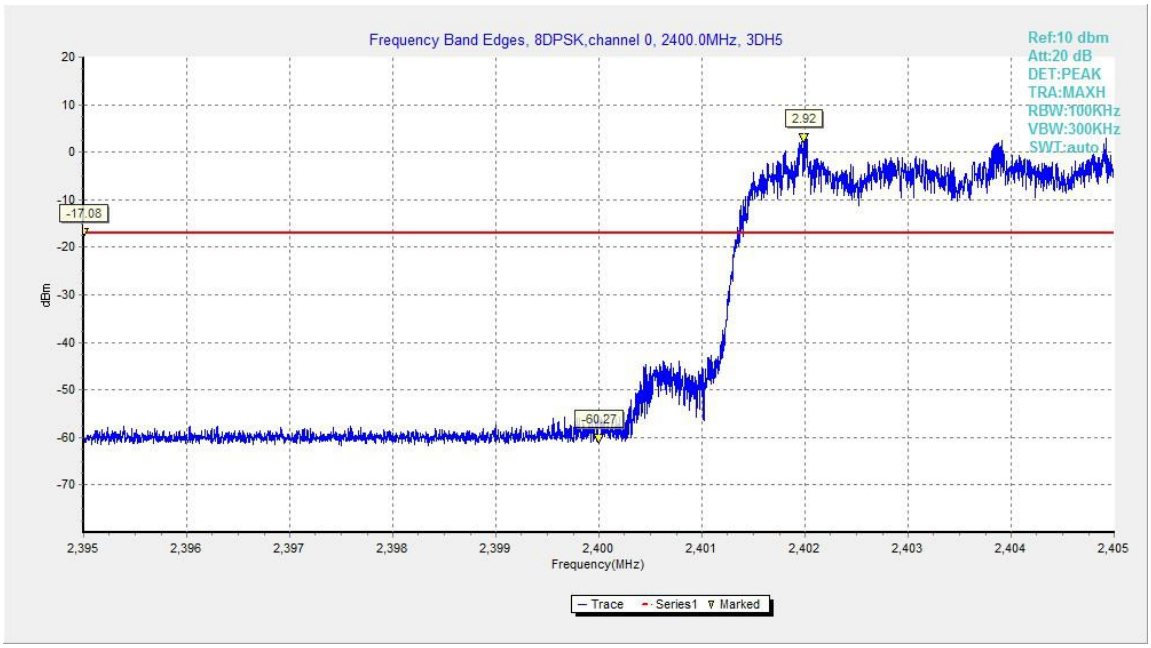


Fig.10. Frequency Band Edges: 8DPSK, Channel 0, Hopping On

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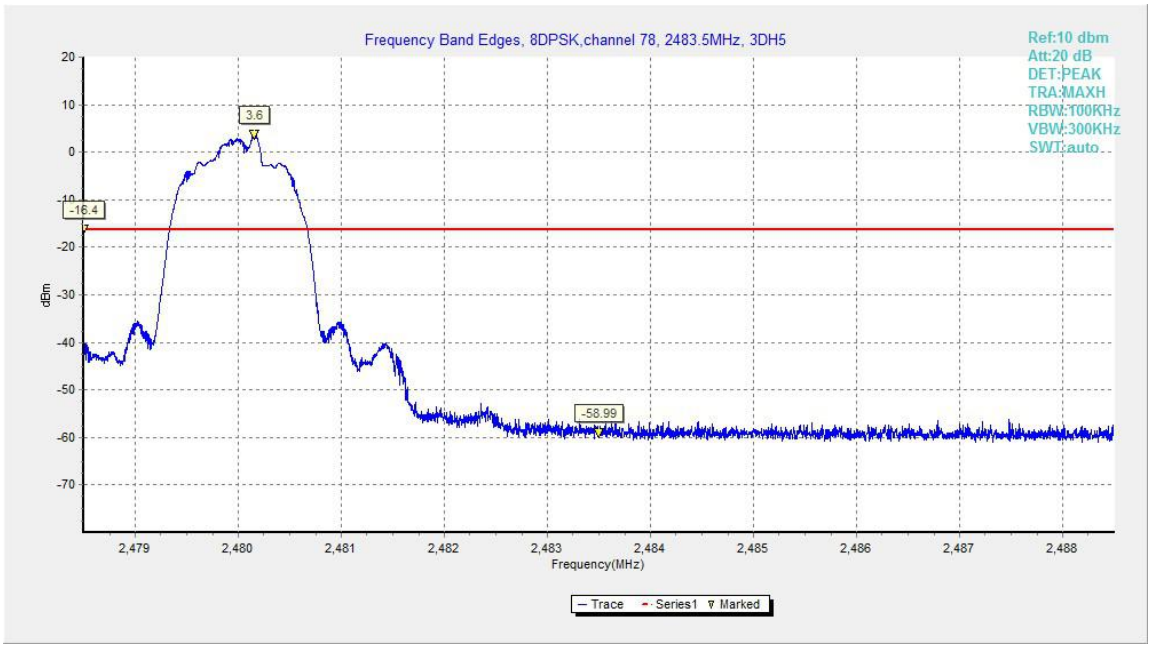


Fig.11. Frequency Band Edges: 8DPSK, Channel 78, Hopping Off

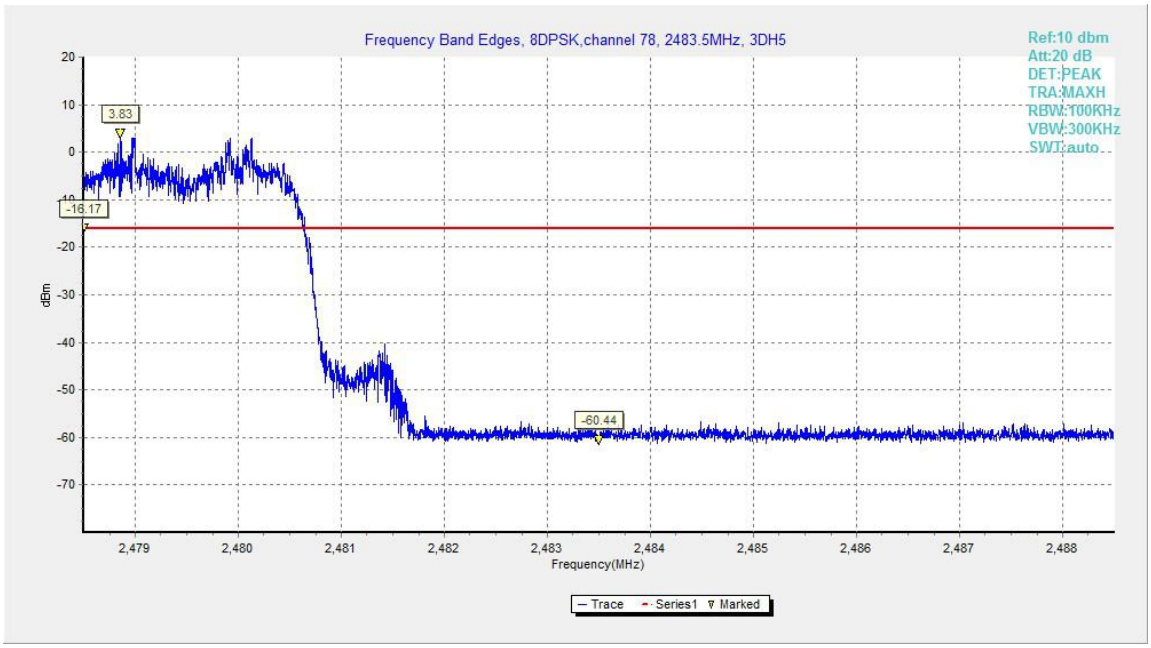


Fig.12. Frequency Band Edges: 8DPSK, Channel 78, Hopping On

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## A.4. Frequency Band Edges –Radiated

**Method of Measurement: See ANSI C63.10-2013-clause 6.4 &6.5 & 6.6**

**Measurement Limit:**

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

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)).

**Limit in restricted band:**

| Frequency (MHz) | Field strength(μV/m) | Measurement distance (m) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |

| 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 |

**Set up:**

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m and the table height shall be 1.5 m.

The EUT and transmitting antenna shall be centered on the turntable.

**Test Condition**

The EUT shall be tested 1 near top, 1 near middle, and 1 near bottom. Set the unlicensed wireless device to operate in continuous transmit mode. For unlicensed wireless devices unable to be configured for 100% duty cycle even in test mode, configure the system for the maximum duty cycle supported.

When required for unlicensed wireless devices, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

**Exploratory radiated emissions measurements**

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. The frequencies of maximum emission may be determined by manually positioning the antenna close to the EUT, and then moving the antenna over all sides of the EUT while observing a spectral

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display. It is advantageous to have prior knowledge of the frequencies of emissions, although this may be determined from such a near-field scan. The near-field scan shall only be used to determine the frequency but not the amplitude of the emissions. Where exploratory measurements are not adequate to determine the worst-case operating modes and are used only to identify the frequencies of the highest emissions, additional preliminary tests can be required.
For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.
Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of test. If either antenna height or EUT azimuth are not fully measured during exploratory testing, then complete testing can be required at the OATS or semi-anechoic chamber when the final full spectrum testing is performed.

**Final radiated emissions measurements**
The final measurements are using the orientation and equipment arrangement of the EUT based on the measurement results found during the preliminary (exploratory) measurements, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement.
For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. Final measurements for the EUT require a measurement antenna height scan of 1 m to 4 m and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.
For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable), as well as the frequency and amplitude of the six highest spurious emissions relative to the limit. Emissions more than 20 dB below the limit do not need to be reported.
This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

**The receiver references:**

| Frequency of emission (MHz) | RBW/VBW | Sweep Time(s) |
|---|---|---|
| 30-1000 | 100KHz/300KHz | 5 |
| 1000-4000 | 1MHz/3MHz | 15 |
| 4000-18000 | 1MHz/3MHz | 40 |
| 18000-26500 | 1MHz/3MHz | 20 |

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**EUT ID: EUT1**

**Measurement Results:**

| Mode | Channel | Frequency Range | Test Results | Conclusion |
|---|---|---|---|---|
| GFSK | 0 | 2.38GHz ~2.45GHz | Fig.13 | P |
| | 78 | 2.45GHz ~2.5GHz | Fig.14 | P |

| Mode | Channel | Frequency Range | Test Results | Conclusion |
|---|---|---|---|---|
| π/4 DQPSK | 0 | 2.38GHz ~2.43GHz | Fig.15 | P |
| | 78 | 2.45GHz ~2.5GHz | Fig.16 | P |

| Mode | Channel | Frequency Range | Test Results | Conclusion |
|---|---|---|---|---|
| 8DPSK | 0 | 2.38GHz ~2.45GHz | Fig.17 | P |
| | 78 | 2.45GHz ~2.5GHz | Fig.18 | P |

**Conclusion: PASS**

**Test graphs as below**

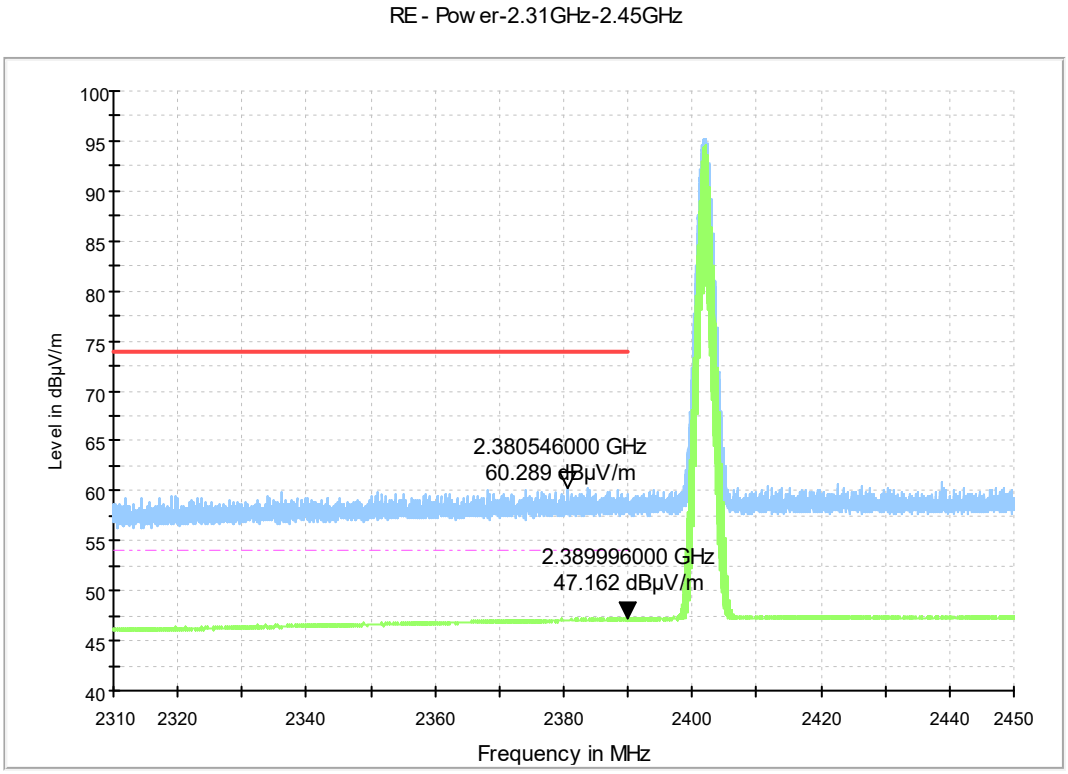


**Fig.13. Frequency Band Edges: GFSK, Channel 0, Hopping Off, 2.38 GHz – 2.45GHz**

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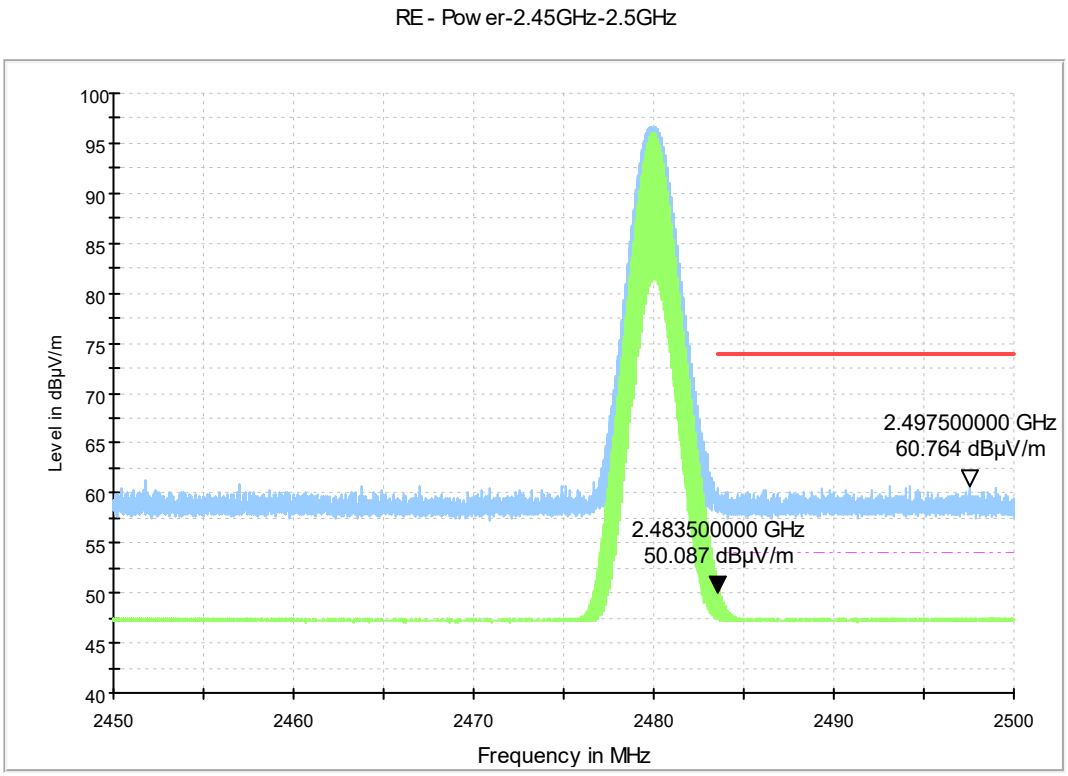


**Fig.14. Frequency Band Edges: GFSK, Channel 78, Hopping Off, ch11, 2.45 GHz - 2.50GHz**

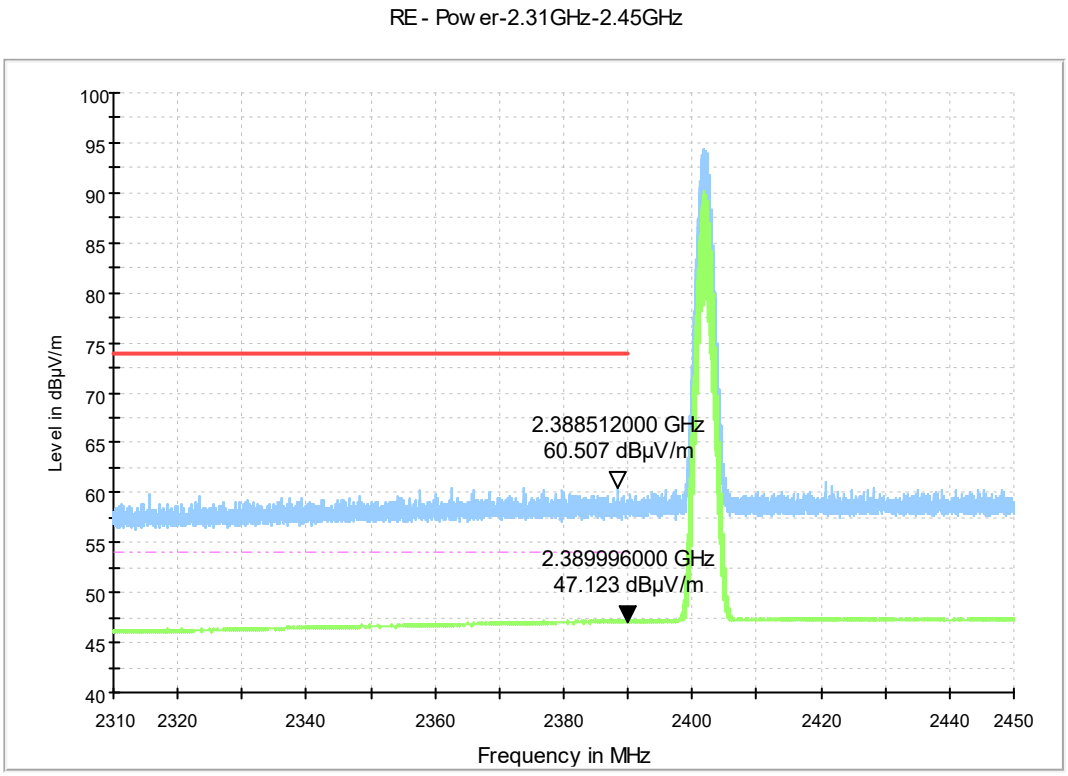


**Fig.15. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping Off, 2.38 GHz - 2.45GHz**

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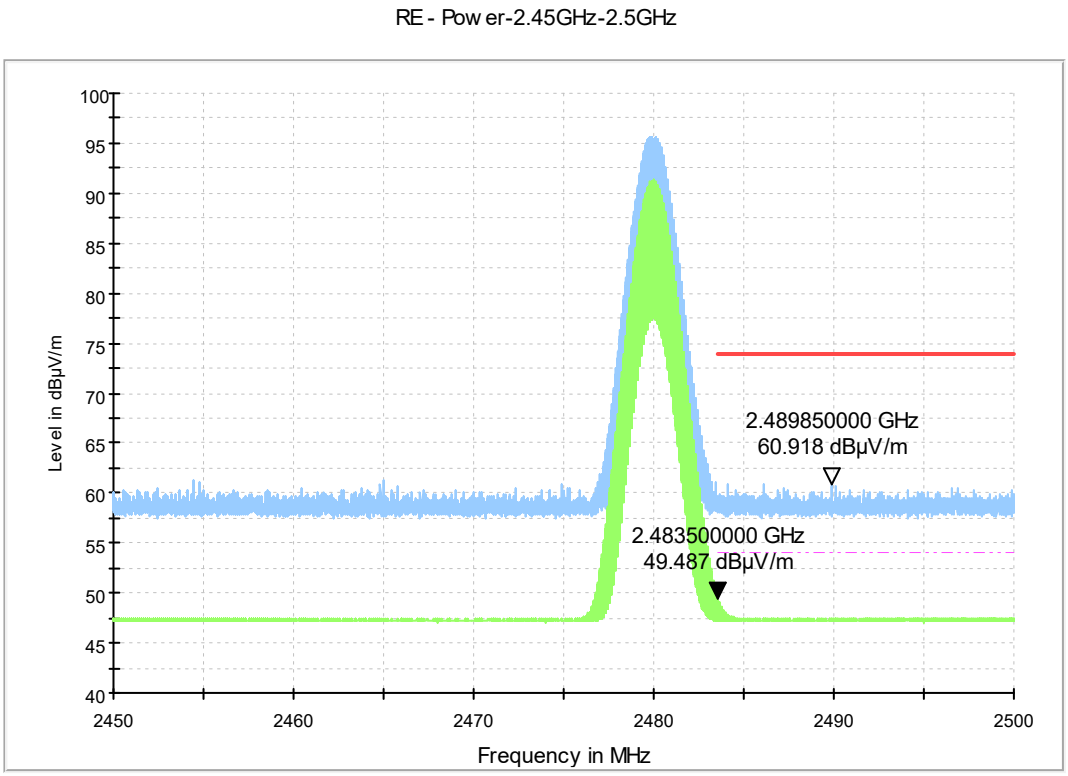


**Fig.16. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping Off, 2.38 GHz - 2.45GHz**

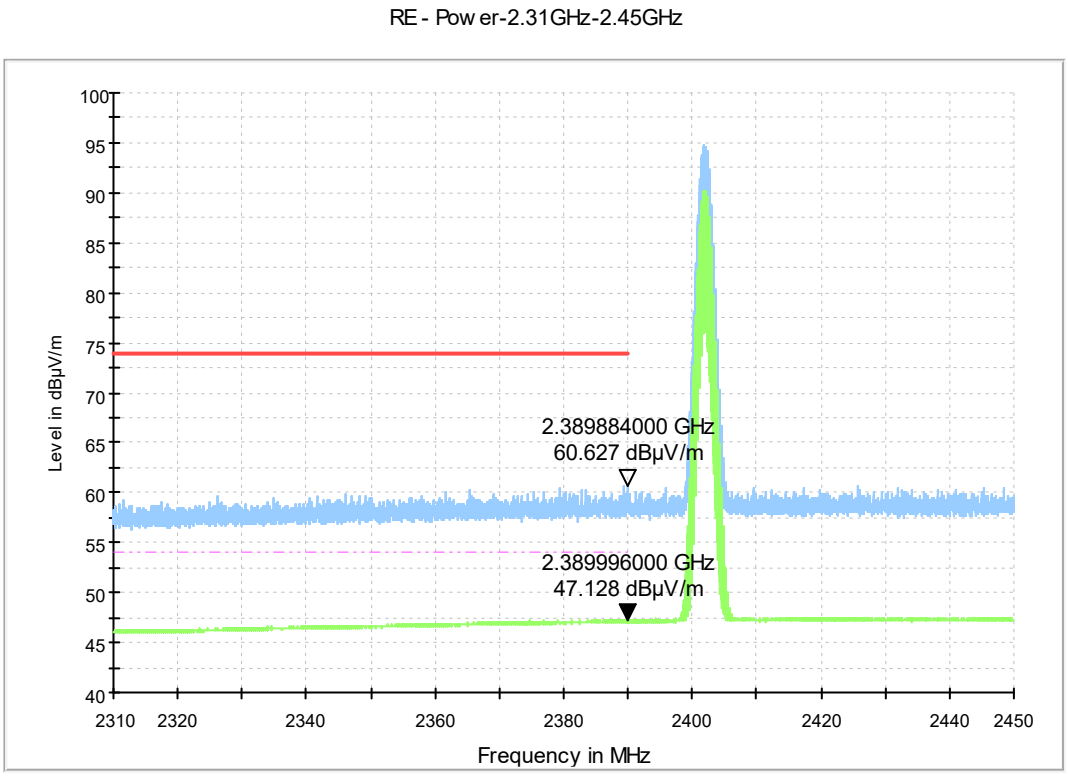


**Fig.17. Frequency Band Edges: 8DPSK, Channel 0, 2.38 GHz - 2.45GHz**

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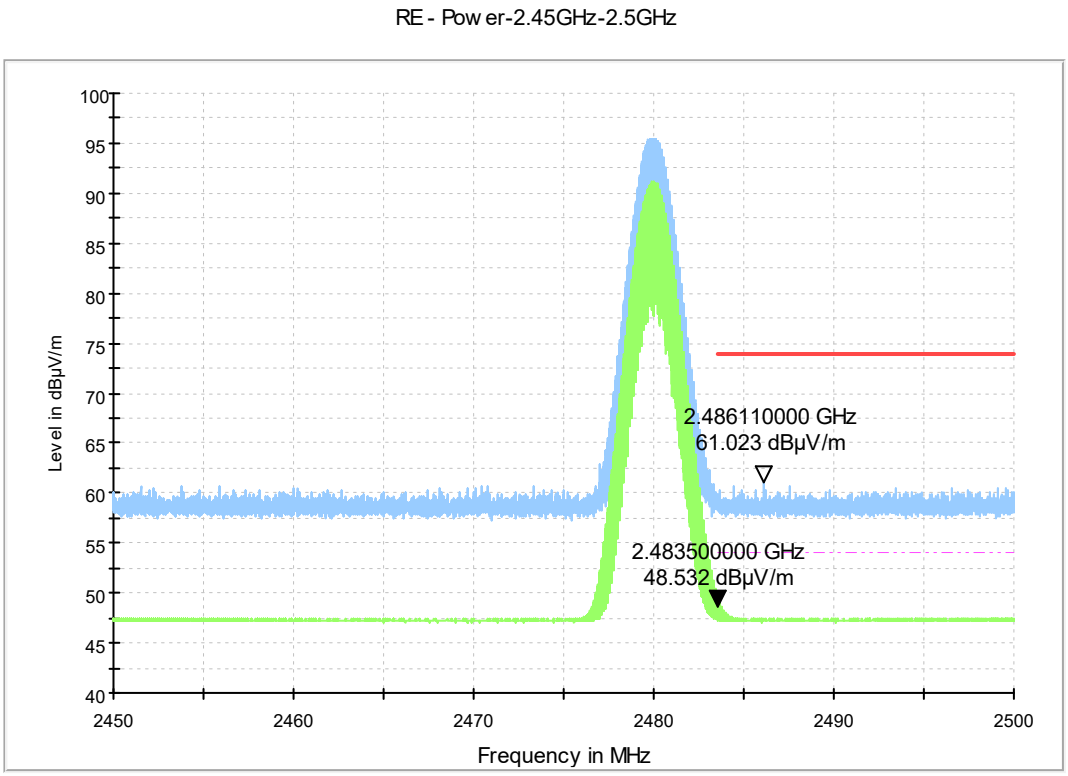


**Fig.18. Frequency Band Edges: 8DPSK, Channel 78, 2.38 GHz - 2.45GHz**

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## A.5. 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.19 | P |

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| | | | |
|---|---|---|---|
| 2402 MHz | 30 MHz ~ 1 GHz | Fig.20 | P |
| | 1 GHz ~ 3 GHz | Fig.21 | P |
| | 3 GHz ~ 10 GHz | Fig.22 | P |
| | 10 GHz ~ 26 GHz | Fig.23 | P |
| Ch 39<br>2441 MHz | Center Frequency | Fig.24 | P |
| | 30 MHz ~ 1 GHz | Fig.25 | P |
| | 1 GHz ~ 3 GHz | Fig.26 | P |
| | 3 GHz ~ 10 GHz | Fig.27 | P |
| | 10 GHz ~ 26 GHz | Fig.28 | P |
| Ch 78<br>2480 MHz | Center Frequency | Fig.29 | P |
| | 30 MHz ~ 1 GHz | Fig.30 | P |
| | 1 GHz ~ 3 GHz | Fig.31 | P |
| | 3 GHz ~ 10 GHz | Fig.32 | P |
| | 10 GHz ~ 26 GHz | Fig.33 | P |

**For π/4 DQPSK**

| Channel | Frequency Range | Test Results | Conclusion |
|---|---|---|---|
| Ch 0<br>2402 MHz | Center Frequency | Fig.34 | P |
| | 30 MHz ~ 1 GHz | Fig.35 | P |
| | 1 GHz ~ 3 GHz | Fig.36 | P |
| | 3 GHz ~ 10 GHz | Fig.37 | P |
| | 10 GHz ~ 26 GHz | Fig.38 | P |
| Ch 39<br>2441 MHz | Center Frequency | Fig.39 | P |
| | 30 MHz ~ 1 GHz | Fig.40 | P |
| | 1 GHz ~ 3 GHz | Fig.41 | P |
| | 3 GHz ~ 10 GHz | Fig.42 | P |
| | 10 GHz ~ 26 GHz | Fig.43 | P |
| Ch 78<br>2480 MHz | Center Frequency | Fig.44 | P |
| | 30 MHz ~ 1 GHz | Fig.45 | P |
| | 1 GHz ~ 3 GHz | Fig.46 | P |
| | 3 GHz ~ 10 GHz | Fig.47 | P |
| | 10 GHz ~ 26 GHz | Fig.48 | P |

**For 8DPSK**

| Channel | Frequency Range | Test Results | Conclusion |
|---|---|---|---|
| Ch 0<br>2402 MHz | Center Frequency | Fig.49 | P |
| | 30 MHz ~ 1 GHz | Fig.50 | P |
| | 1 GHz ~ 3 GHz | Fig.51 | P |
| | 3 GHz ~ 10 GHz | Fig.52 | P |
| | 10 GHz ~ 26 GHz | Fig.53 | P |

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| | | | |
|---|---|---|---|
| Ch 39<br>2441 MHz | Center Frequency | Fig.54 | P |
| | 30 MHz ~ 1 GHz | Fig.55 | P |
| | 1 GHz ~ 3 GHz | Fig.56 | P |
| | 3 GHz ~ 10 GHz | Fig.57 | P |
| | 10 GHz ~ 26 GHz | Fig.58 | P |
| Ch 78<br>2480 MHz | Center Frequency | Fig.59 | P |
| | 30 MHz ~ 1 GHz | Fig.60 | P |
| | 1 GHz ~ 3 GHz | Fig.61 | P |
| | 3 GHz ~ 10 GHz | Fig.62 | P |
| | 10 GHz ~ 26 GHz | Fig.63 | P |

**Conclusion: PASS**

**Test graphs as below**

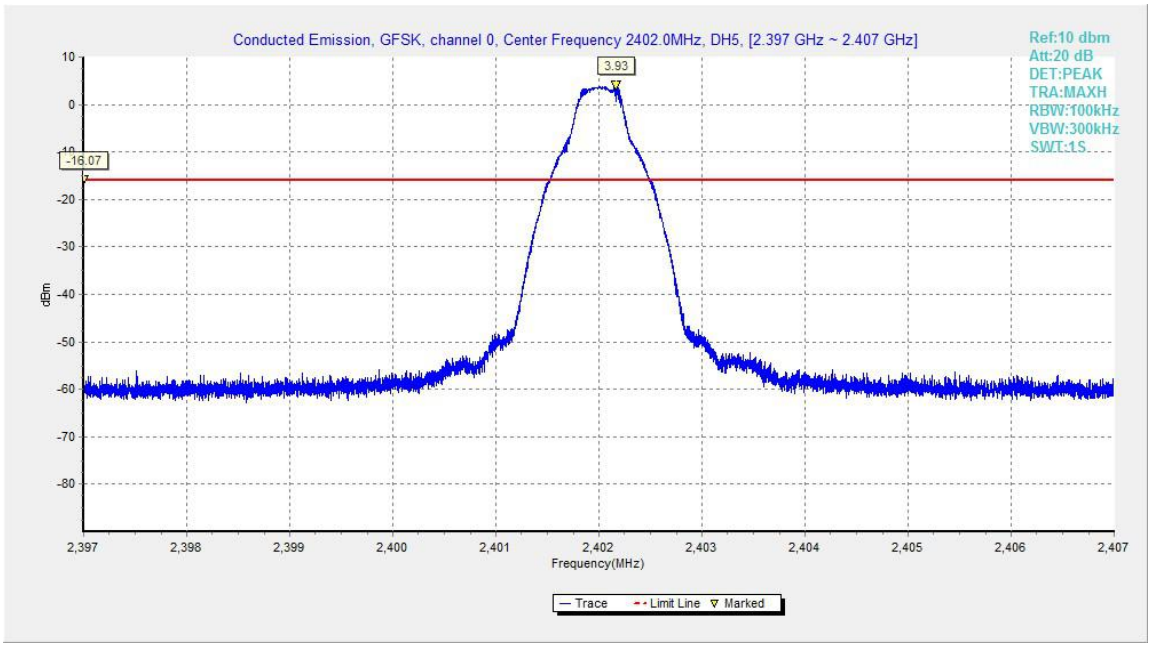


Fig.19. Conducted spurious emission: GFSK, Channel 0,2402MHz

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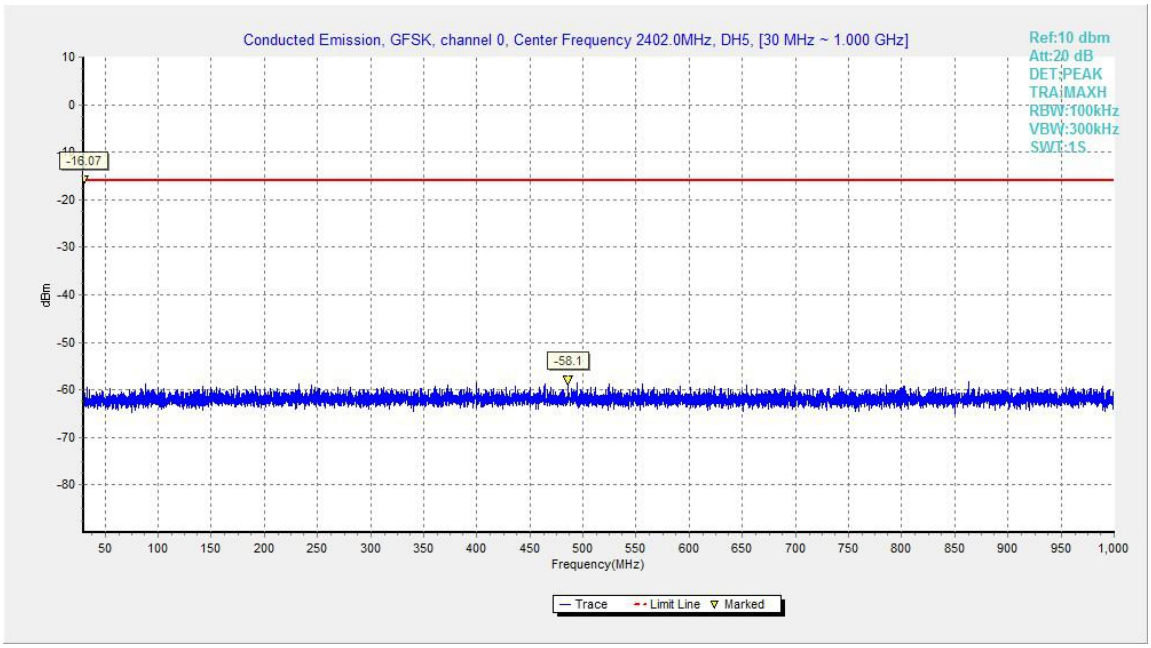


Fig.20. Conducted spurious emission: GFSK, Channel 0, 30MHz - 1GHz

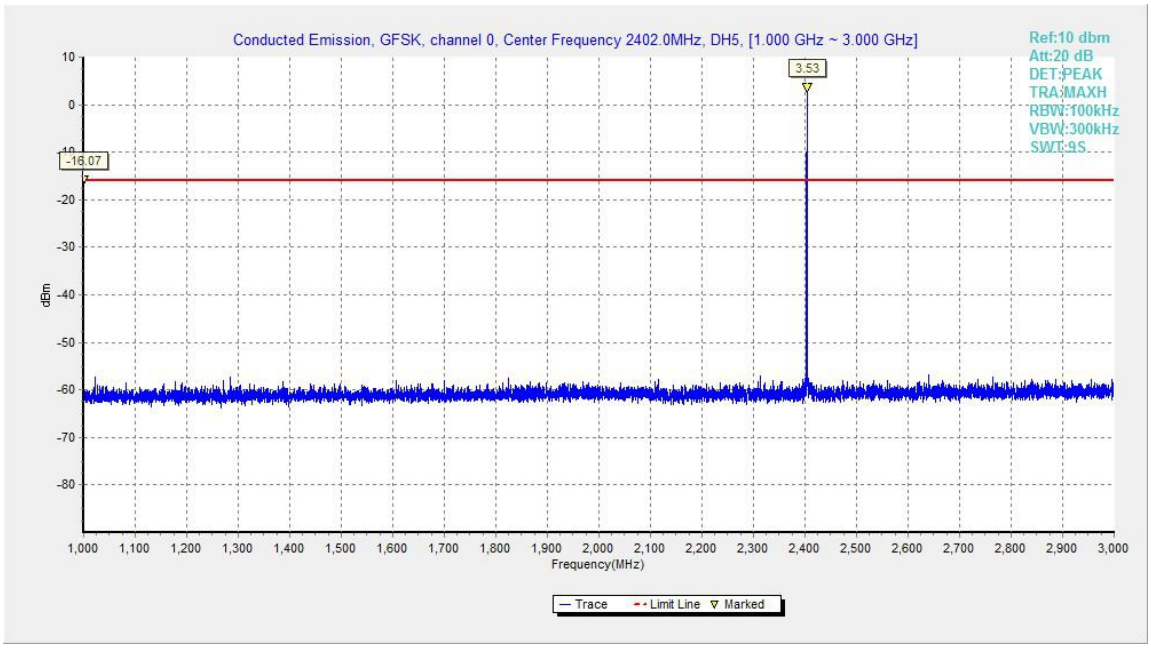


Fig.21. Conducted spurious emission: GFSK, Channel 0, 1GHz - 3GHz

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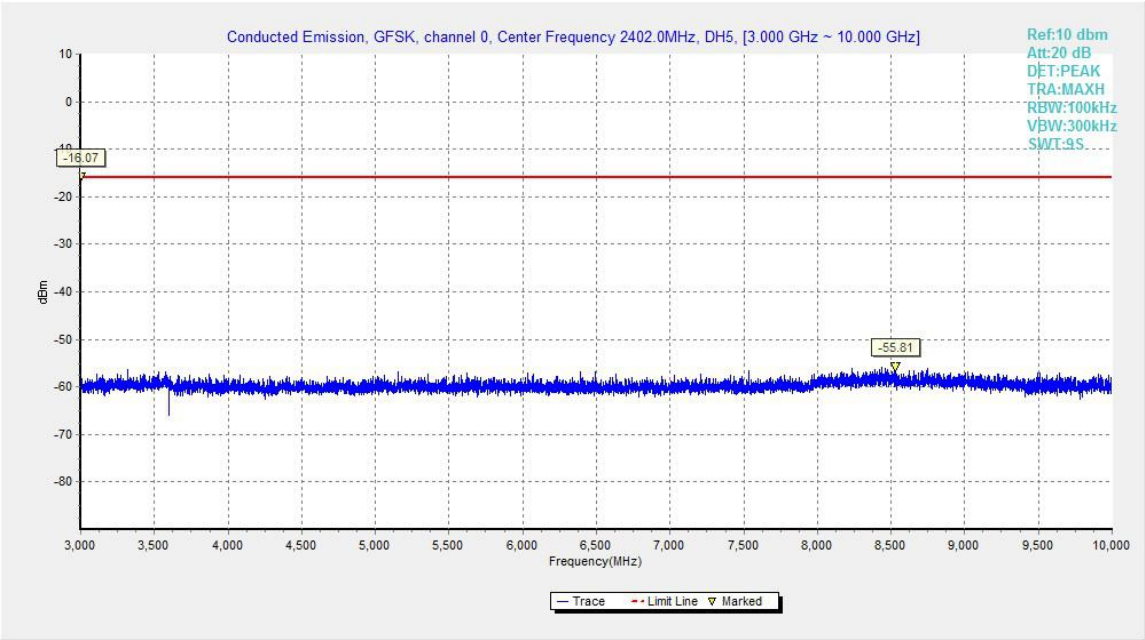


Fig.22. Conducted spurious emission: GFSK, Channel 0, 3GHz - 10GHz

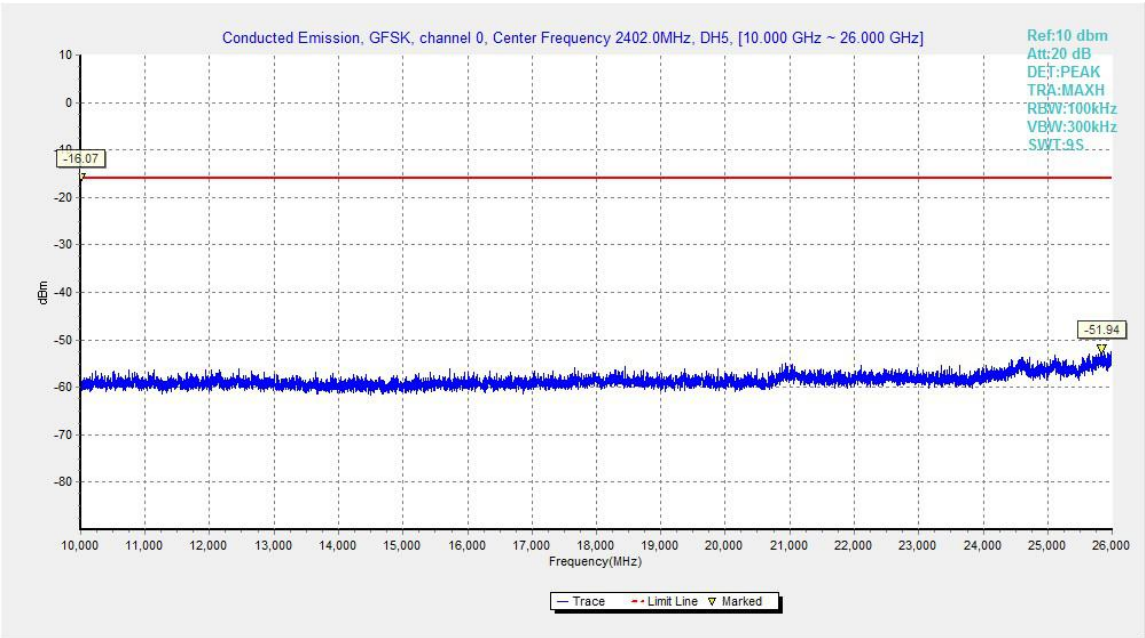


Fig.23. Conducted spurious emission: GFSK, Channel 0,10GHz - 26GHz

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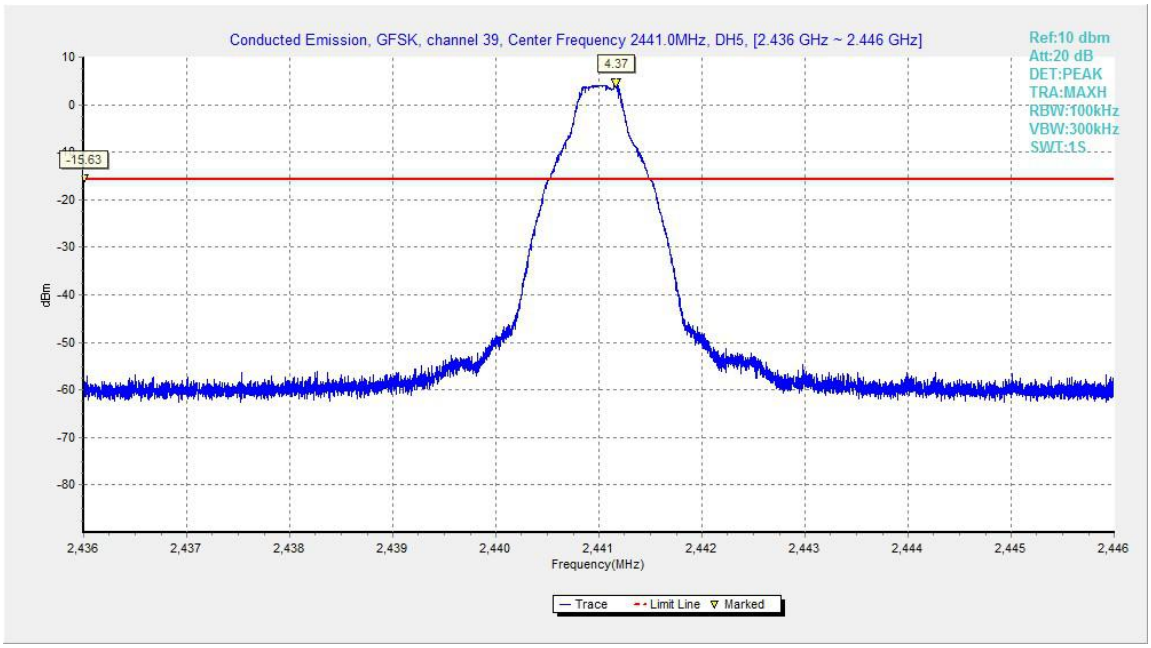


Fig.24. Conducted spurious emission: GFSK, Channel 39, 2441MHz

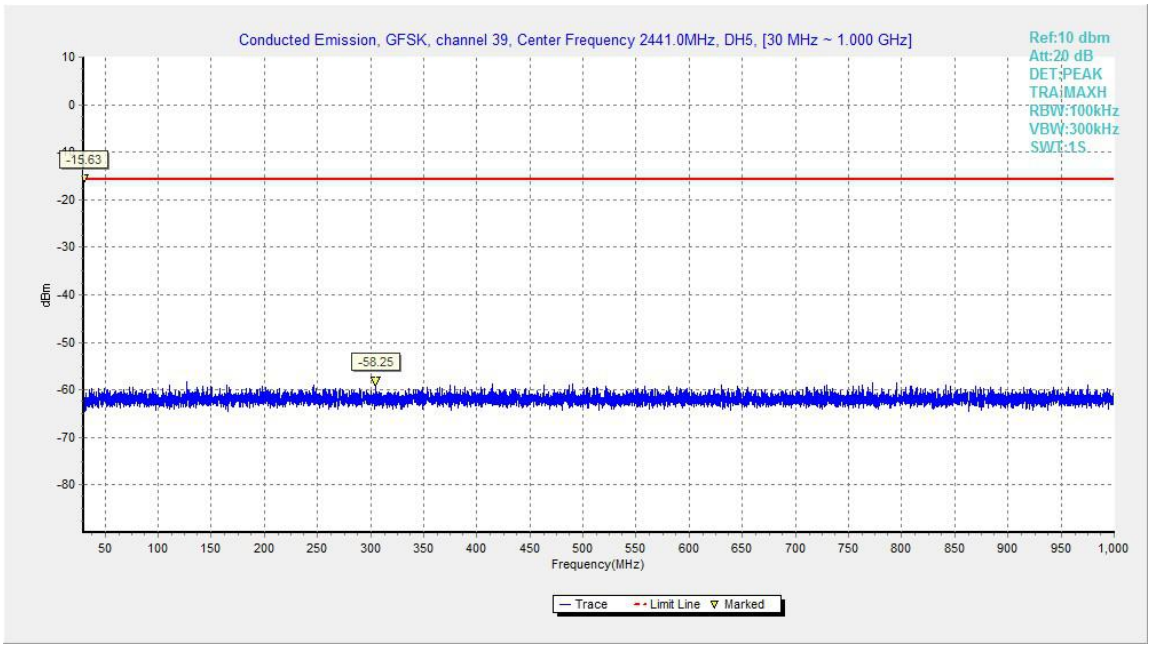


Fig.25. Conducted spurious emission: GFSK, Channel 39, 30MHz - 1GHz

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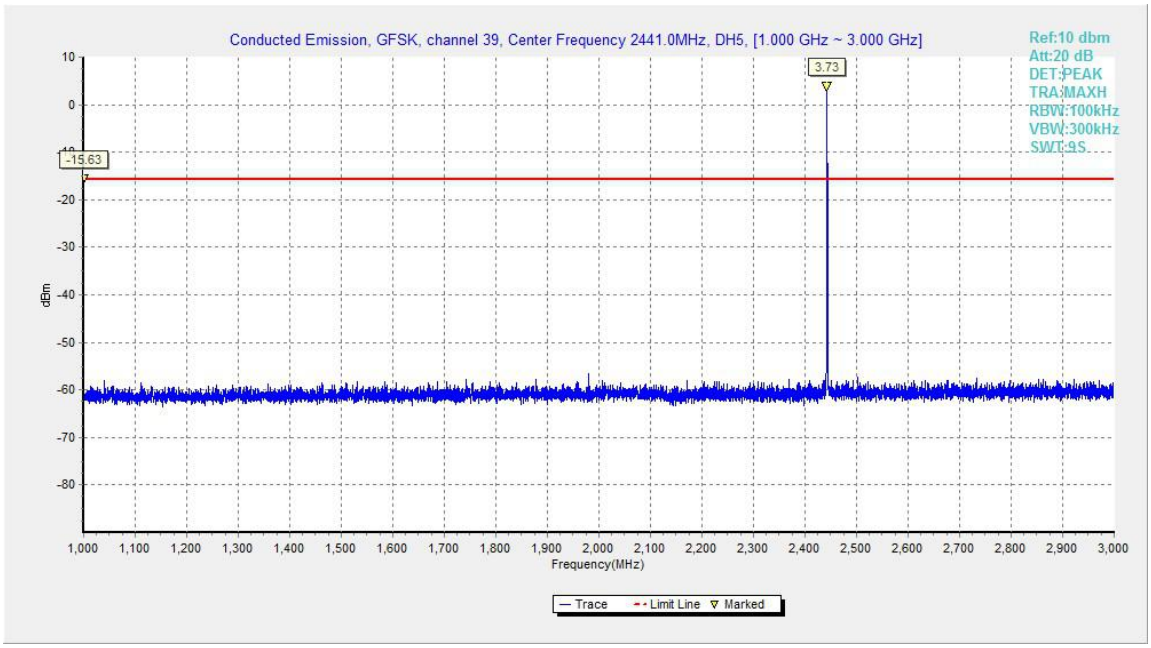


Fig.26. Conducted spurious emission: GFSK, Channel 39, 1GHz – 3GHz

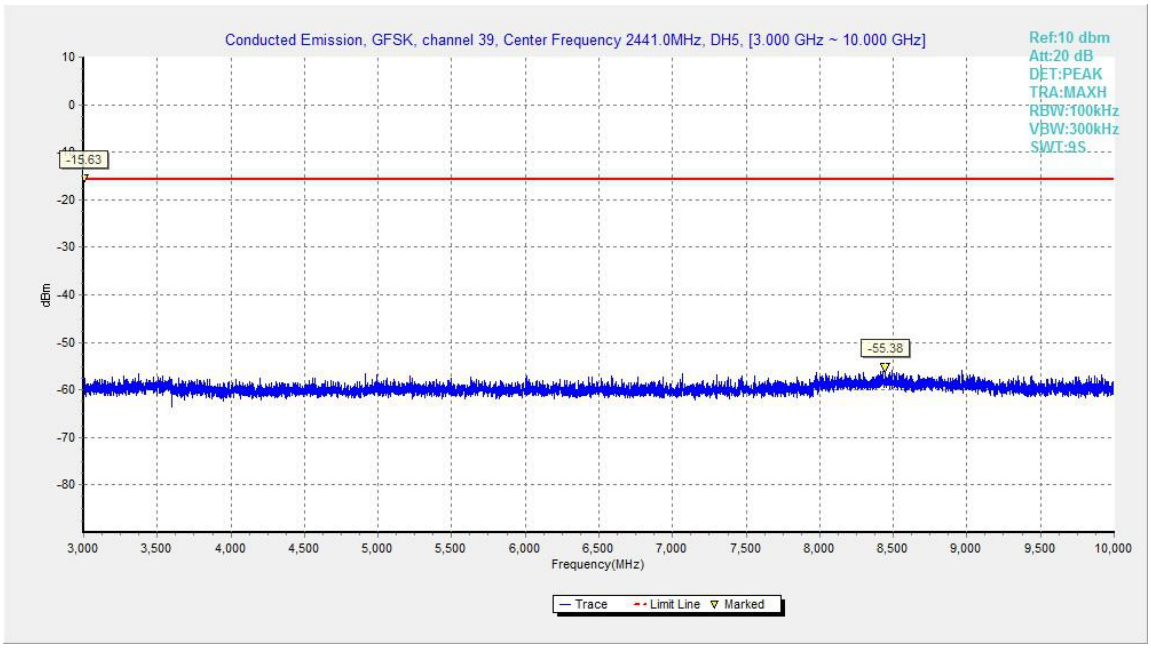


Fig.27. Conducted spurious emission: GFSK, Channel 39, 3GHz – 10GHz

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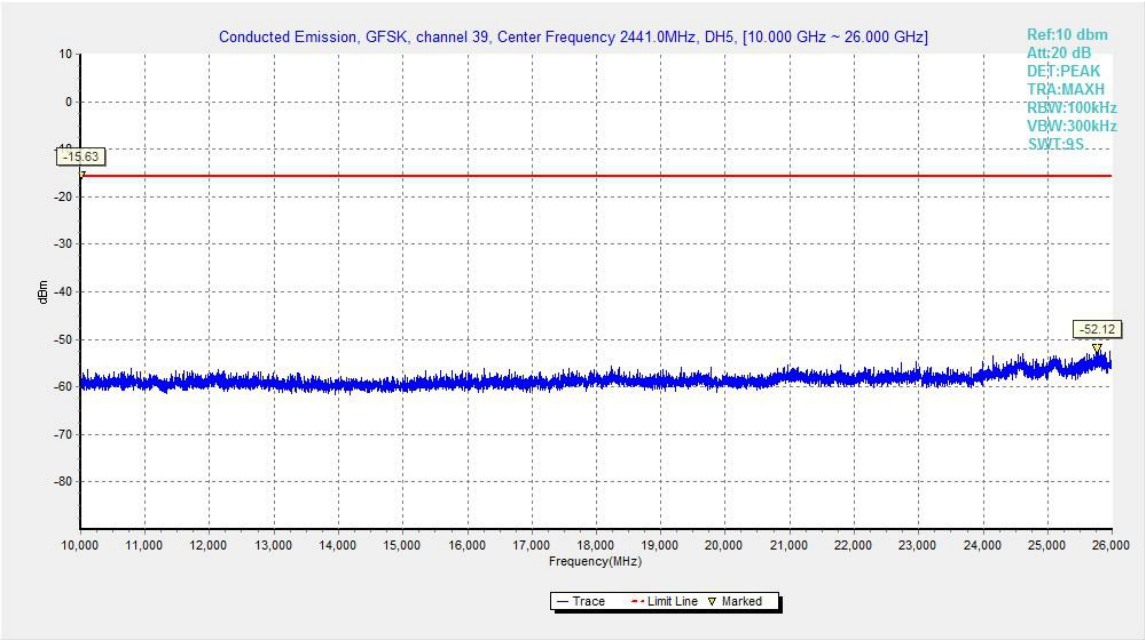


Fig.28. Conducted spurious emission: GFSK, Channel 39, 10GHz – 26GHz

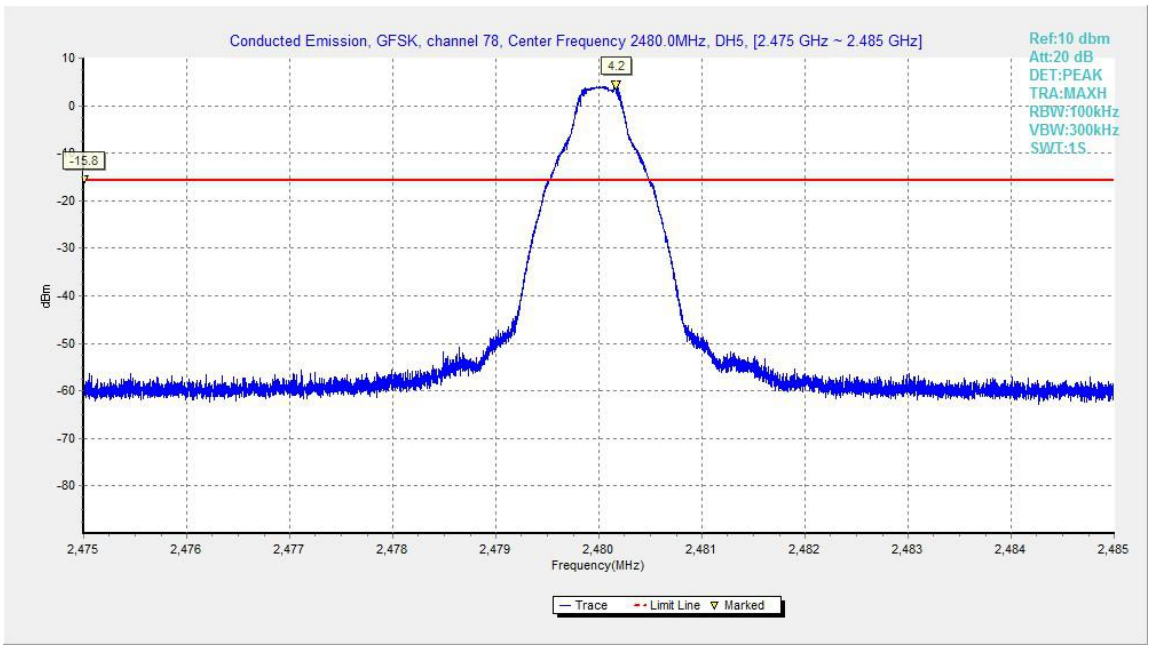


Fig.29. Conducted spurious emission: GFSK, Channel 78, 2480MHz

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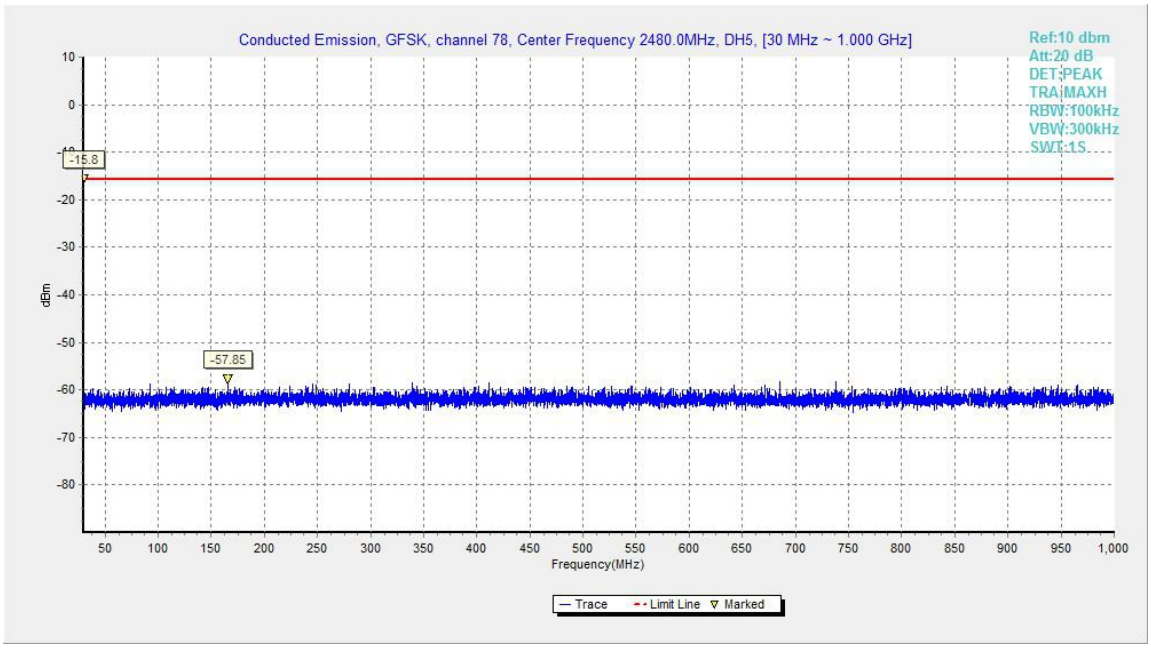


Fig.30. Conducted spurious emission: GFSK, Channel 78, 30MHz - 1GHz

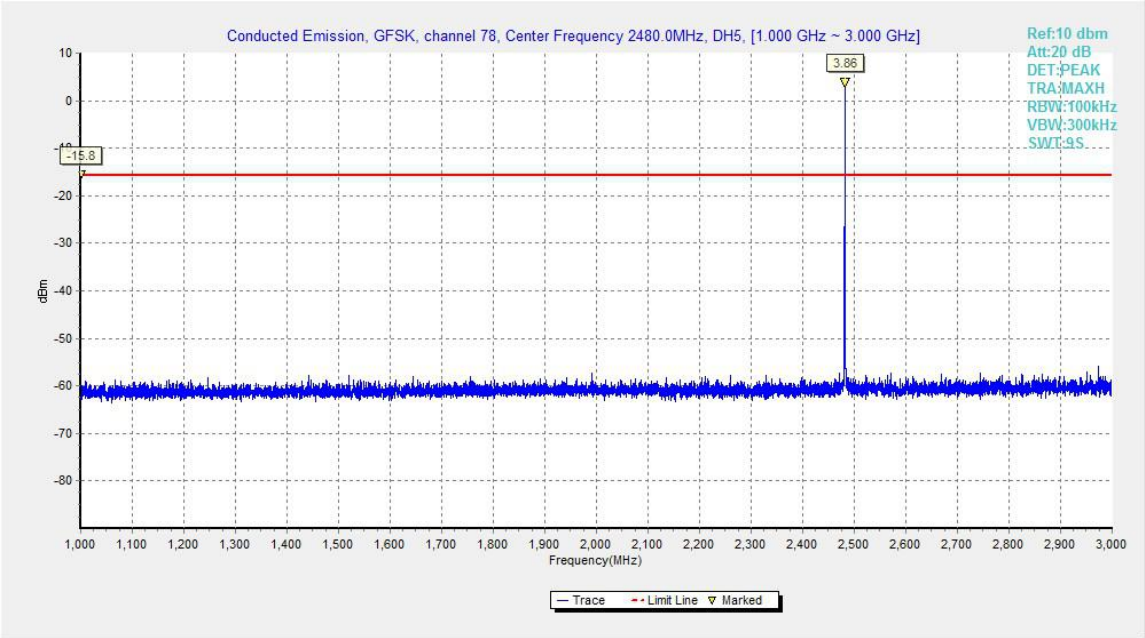


Fig.31. Conducted spurious emission: GFSK, Channel 78, 1GHz - 3GHz

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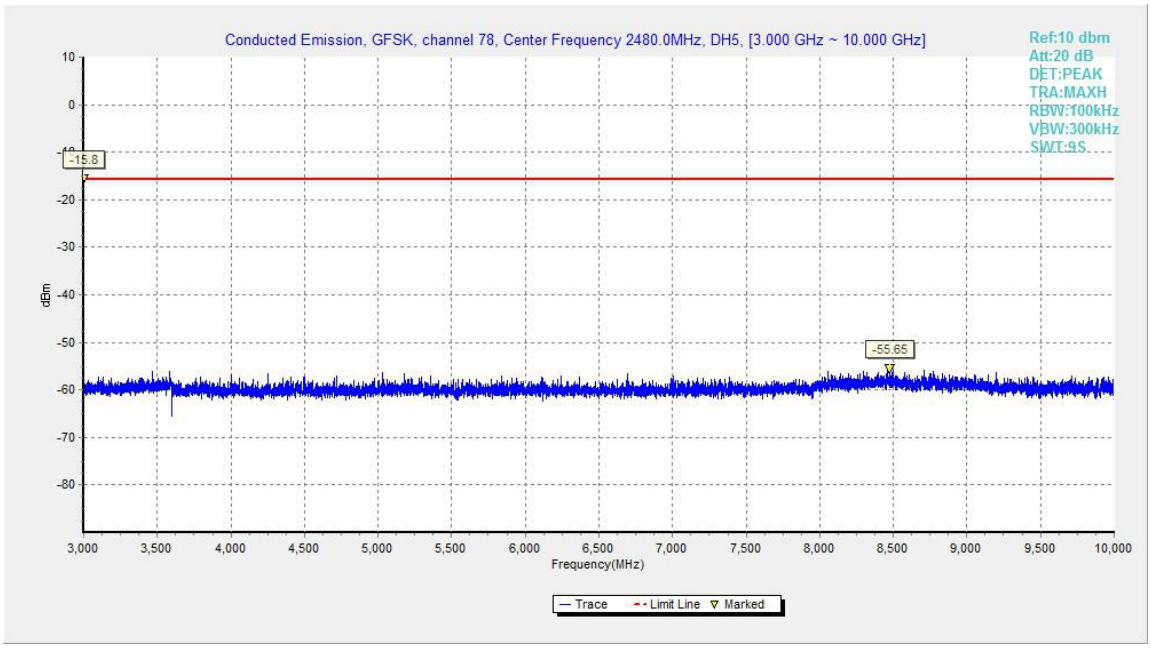


Fig.32. Conducted spurious emission: GFSK, Channel 78, 3GHz - 10GHz

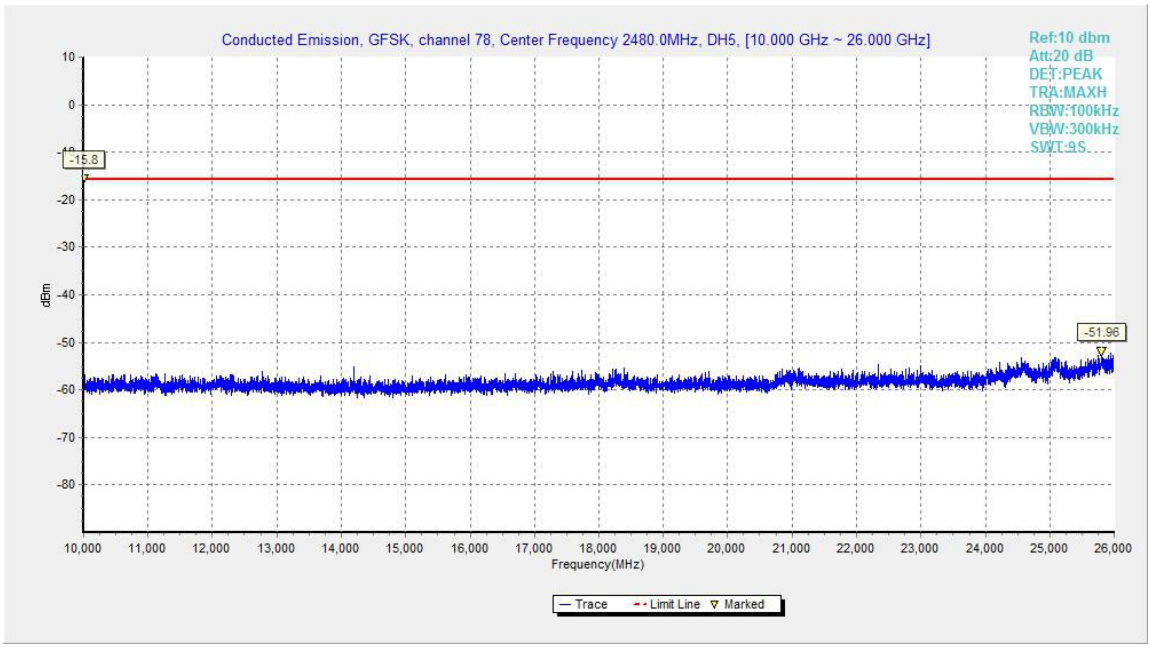


Fig.33. Conducted spurious emission: GFSK, Channel 78, 10GHz - 26GHz

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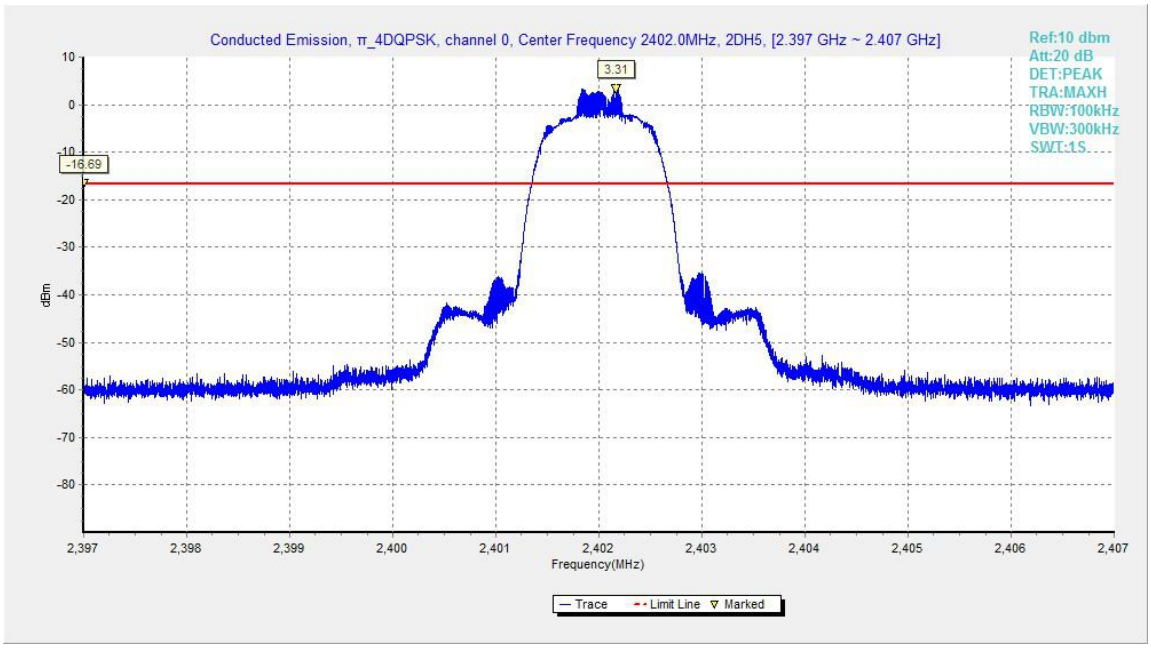


Fig.34. Conducted spurious emission: π/4 DQPSK, Channel 0,2402MHz

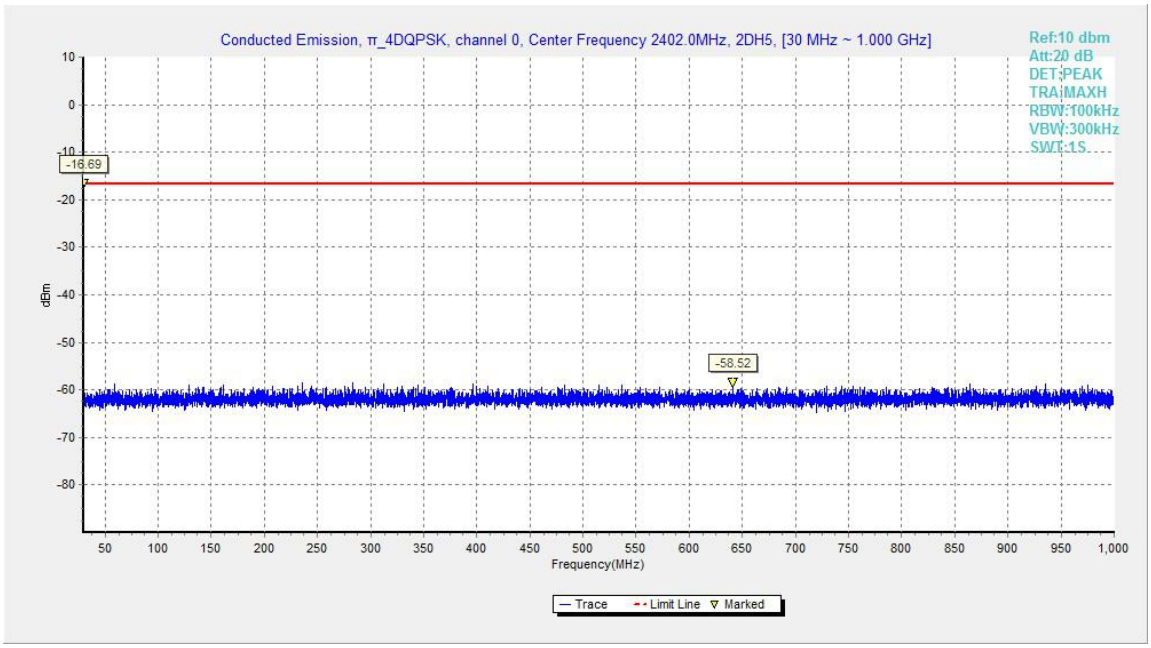


Fig.35. Conducted spurious emission: π/4 DQPSK, Channel 0, 30MHz - 1GHz

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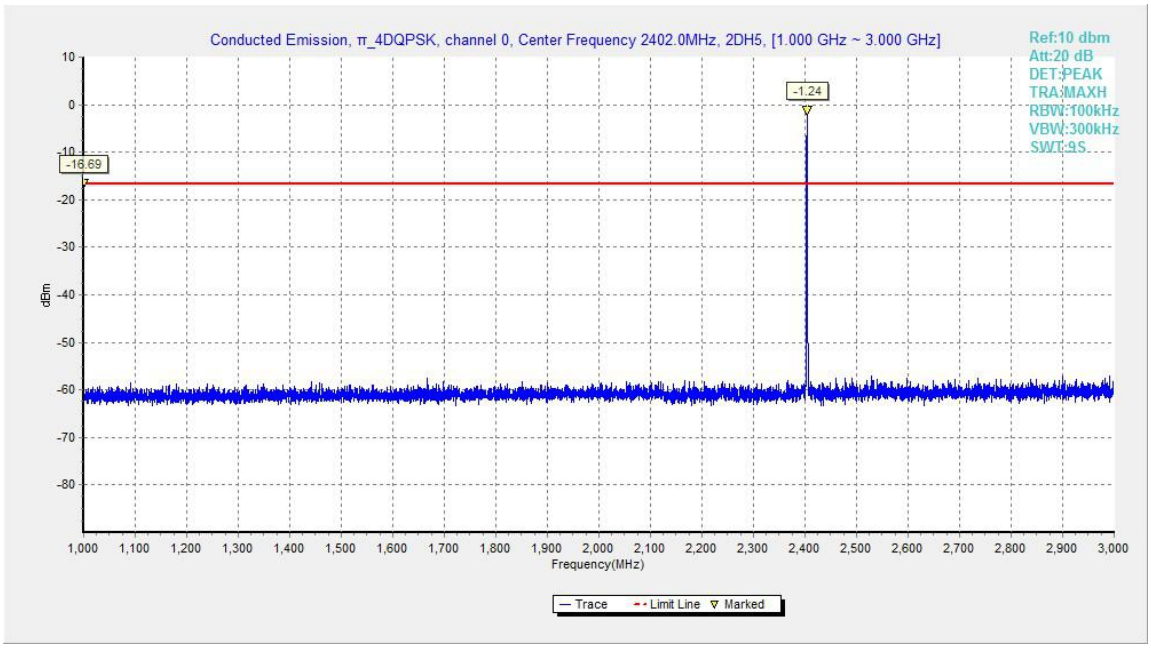


Fig.36. Conducted spurious emission: π/4 DQPSK, Channel 0, 1GHz - 3GHz

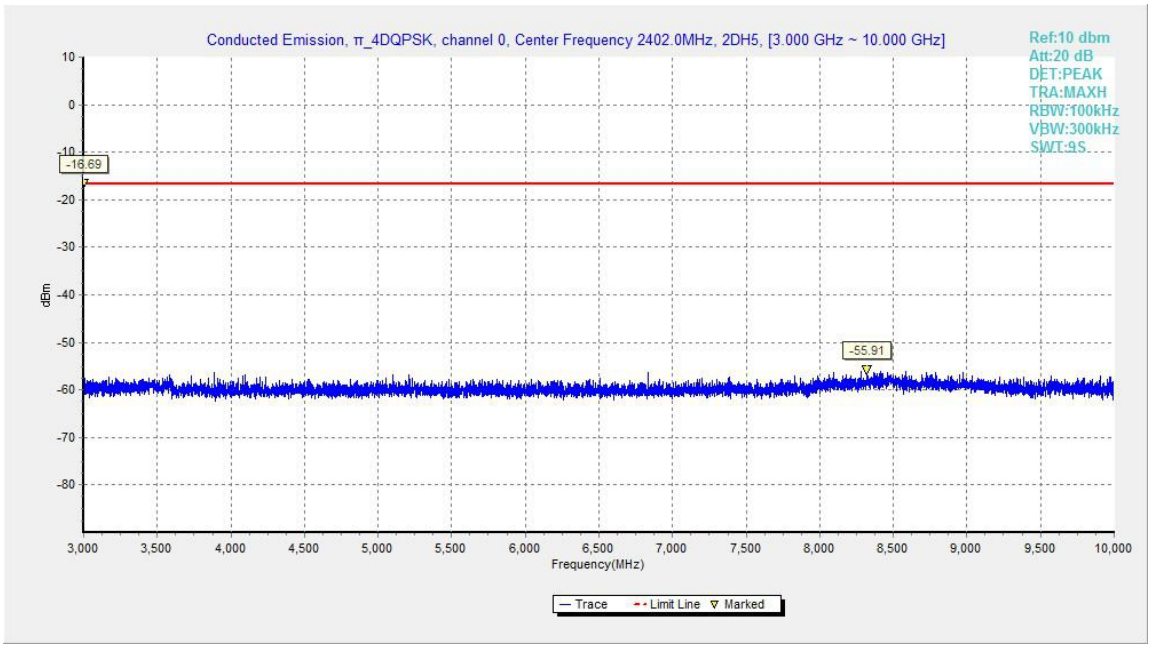


Fig.37. Conducted spurious emission: π/4 DQPSK, Channel 0, 3GHz - 10GHz

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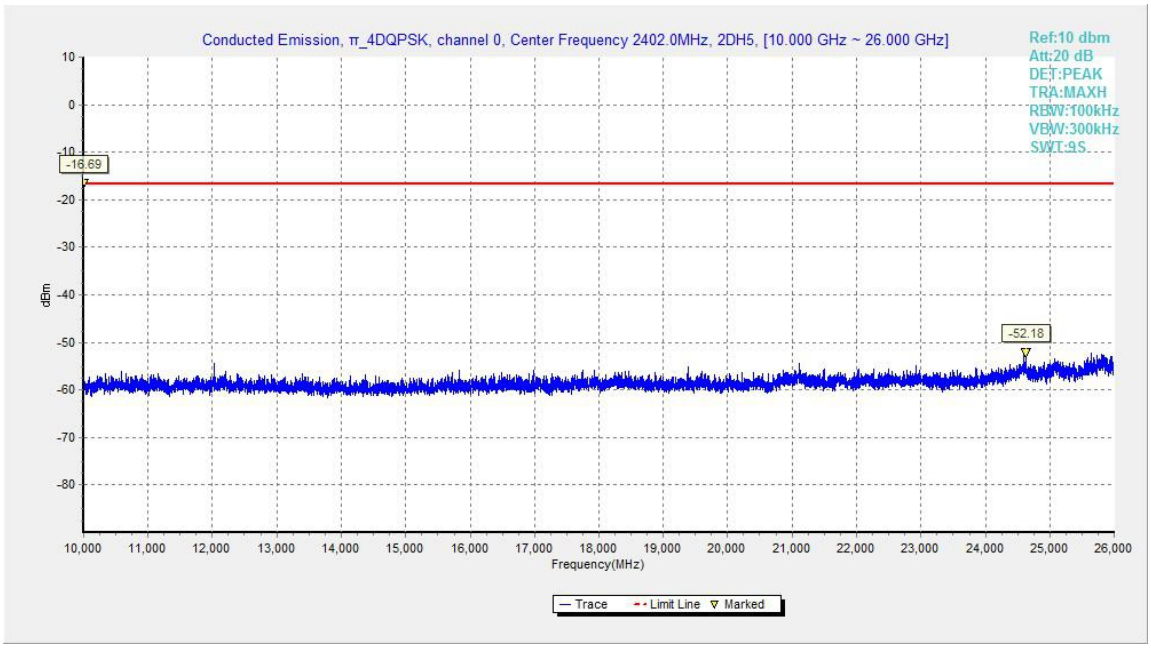


Fig.38. Conducted spurious emission: π/4 DQPSK, Channel 0,10GHz - 26GHz

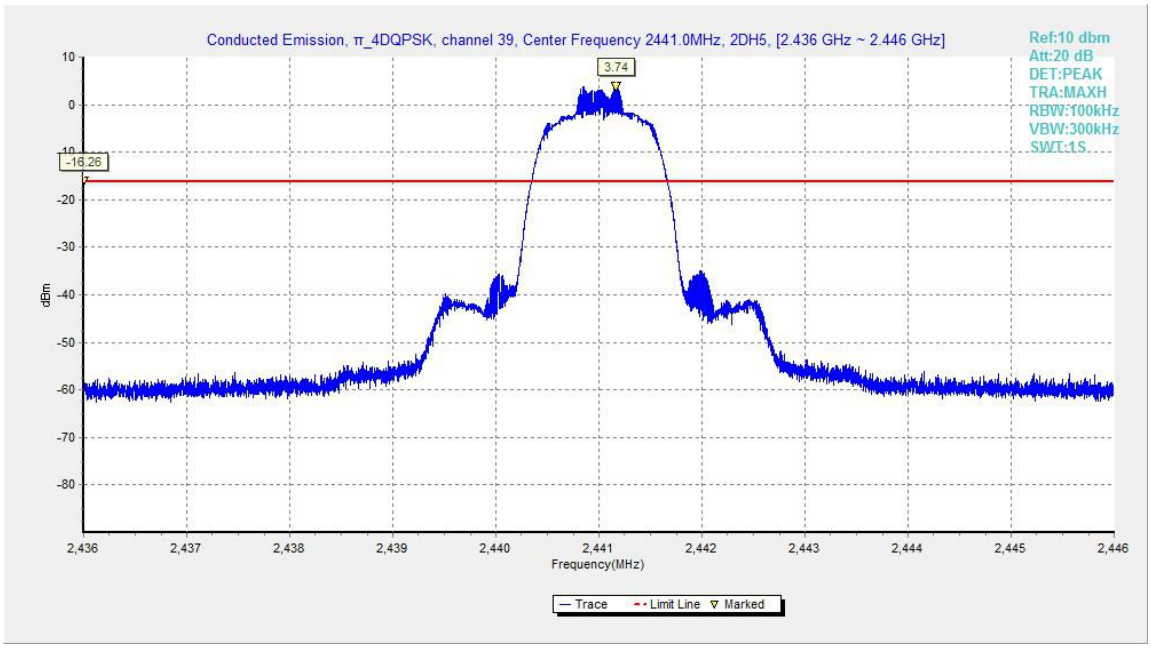


Fig.39. Conducted spurious emission: π/4 DQPSK, Channel 39, 2441MHz

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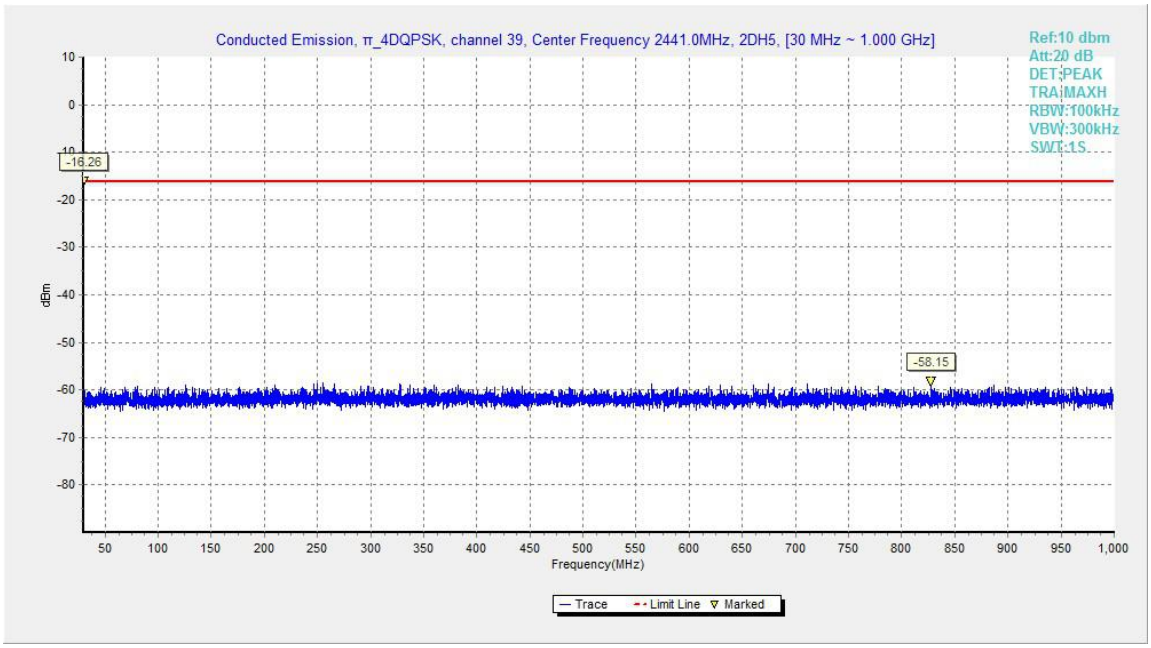


Fig.40. Conducted spurious emission: π/4 DQPSK, Channel 39, 30MHz - 1GHz

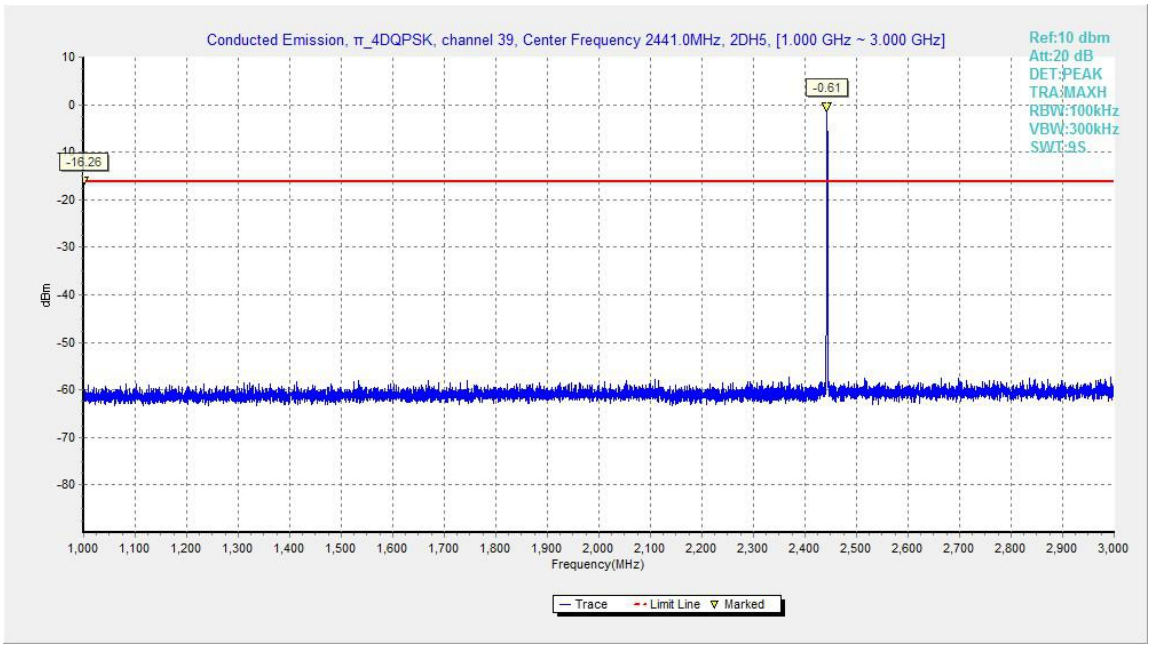


Fig.41. Conducted spurious emission: π/4 DQPSK, Channel 39, 1GHz - 3GHz

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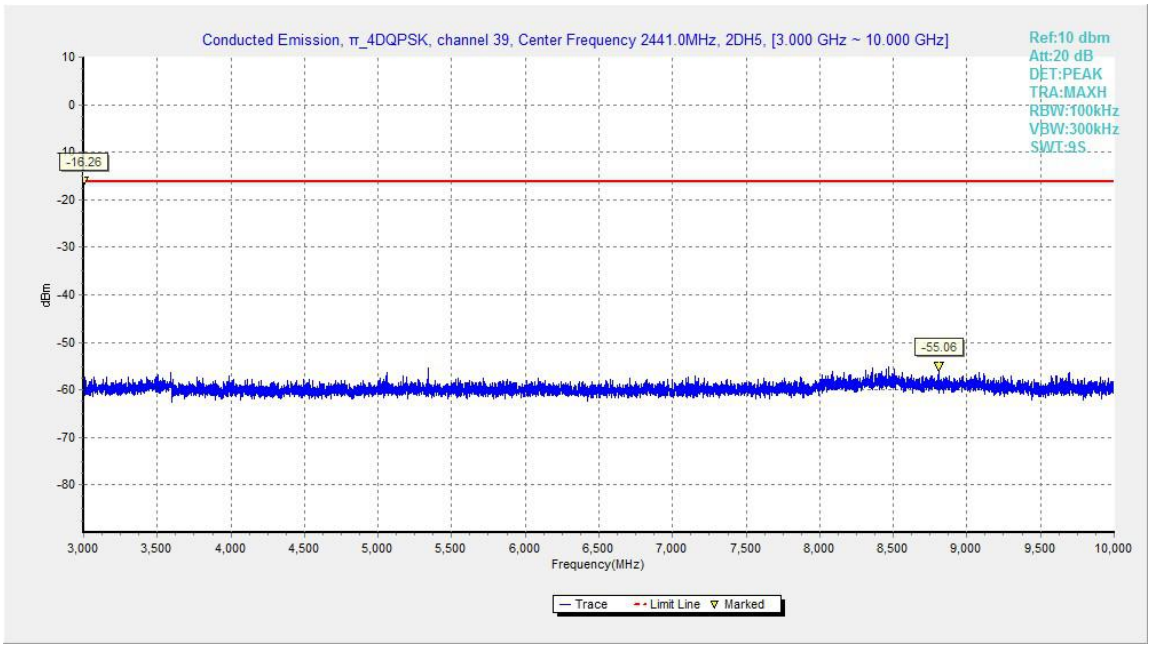


Fig.42. Conducted spurious emission: π/4 DQPSK, Channel 39, 3GHz - 10GHz

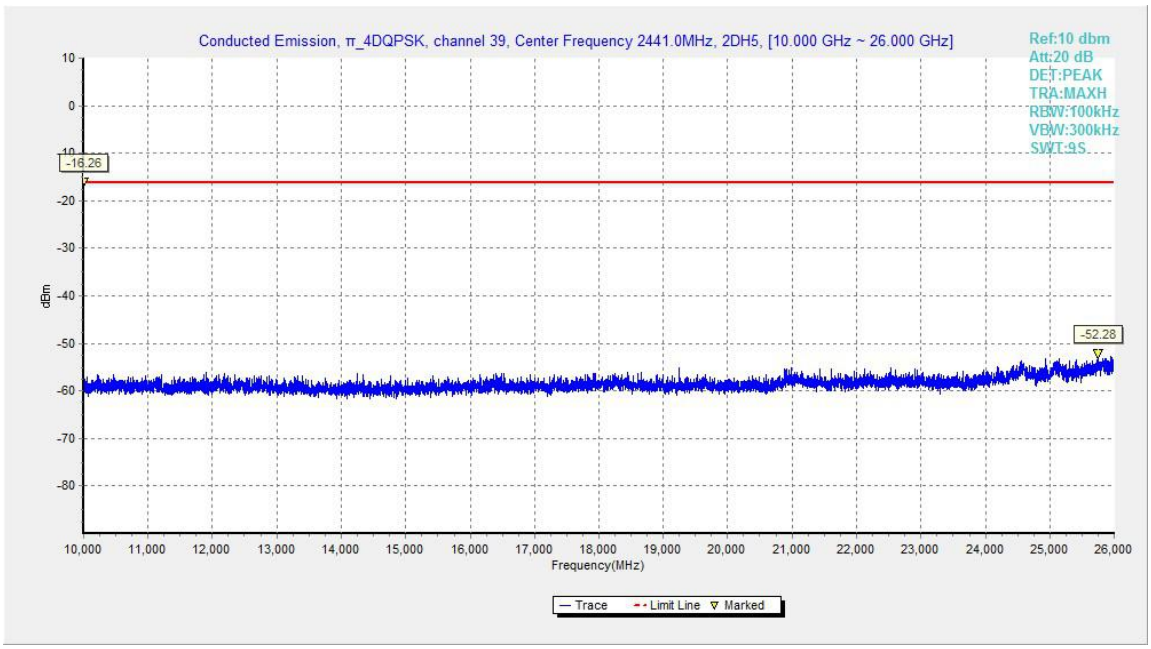


Fig.43. Conducted spurious emission: π/4 DQPSK, Channel 39, 10GHz – 26GHz

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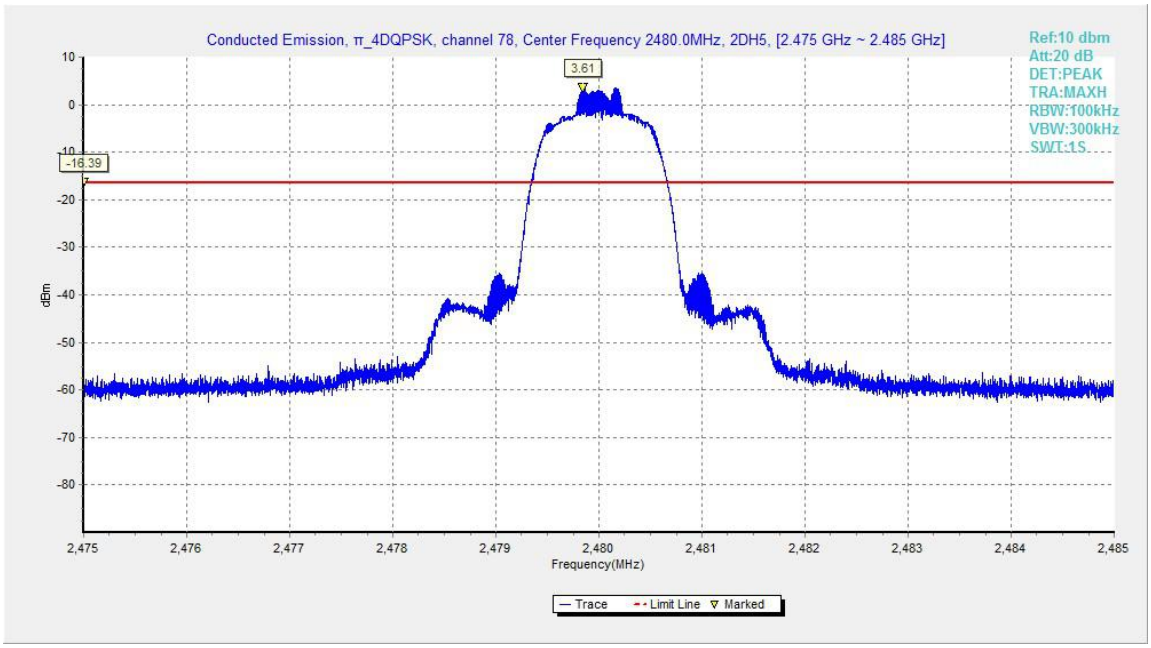


Fig.44. Conducted spurious emission: π/4 DQPSK, Channel 78, 2480MHz

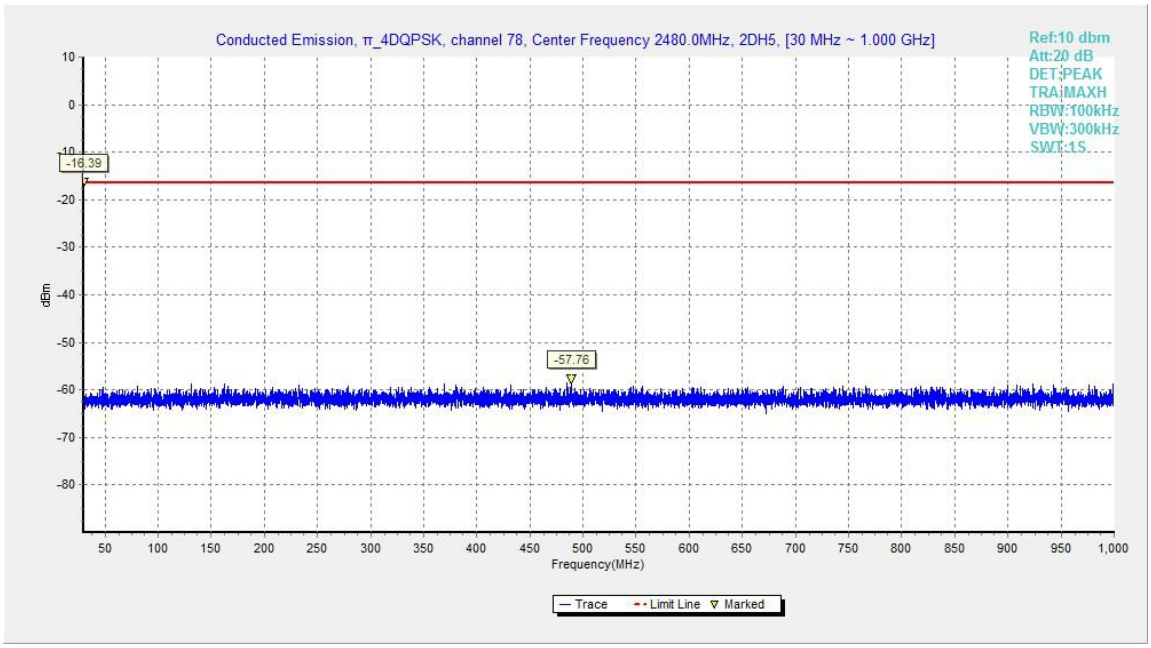


Fig.45. Conducted spurious emission: π/4 DQPSK, Channel 78, 30MHz - 1GHz

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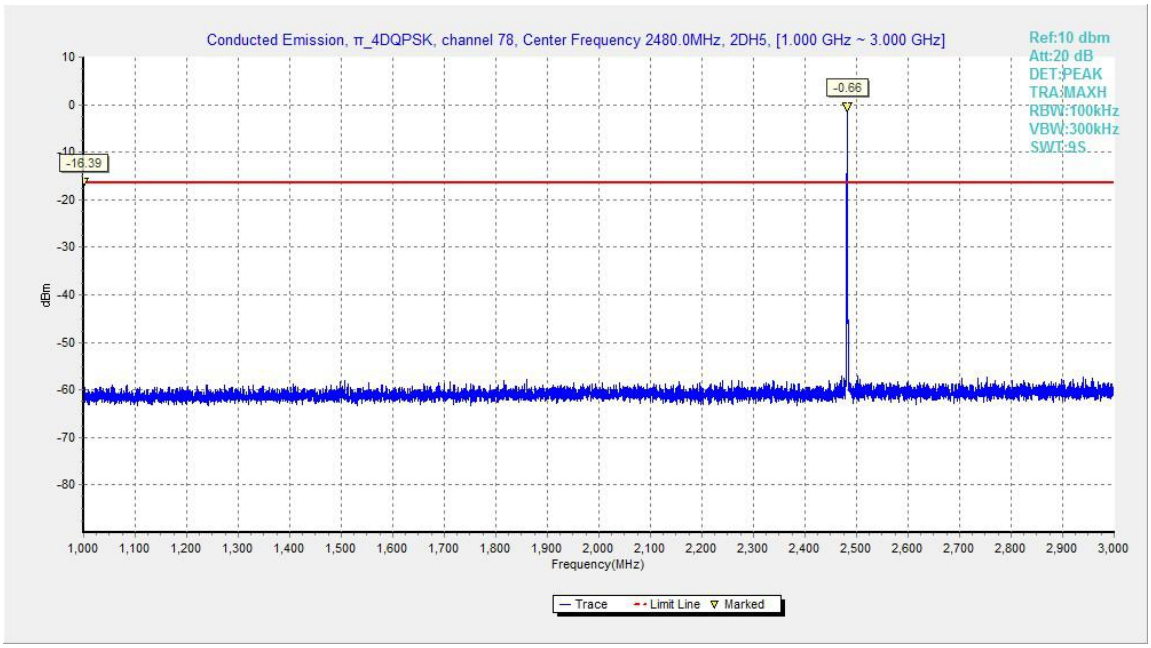


Fig.46. Conducted spurious emission: π/4 DQPSK, Channel 78, 1GHz - 3GHz

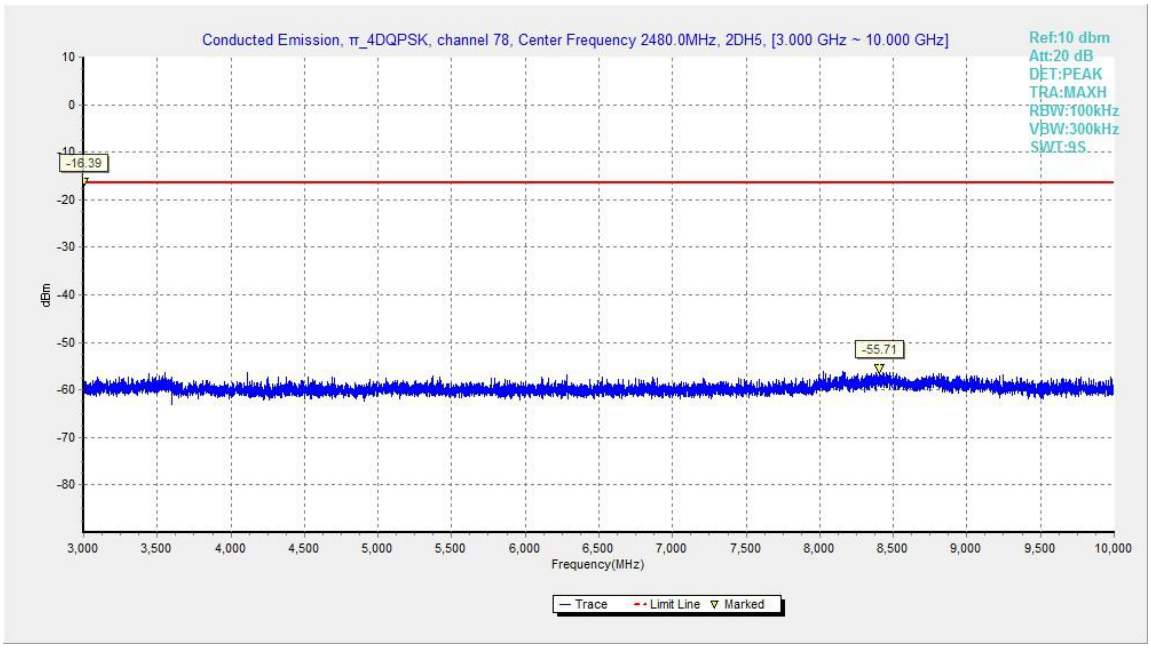


Fig.47. Conducted spurious emission: π/4 DQPSK, Channel 78, 3GHz - 10GHz

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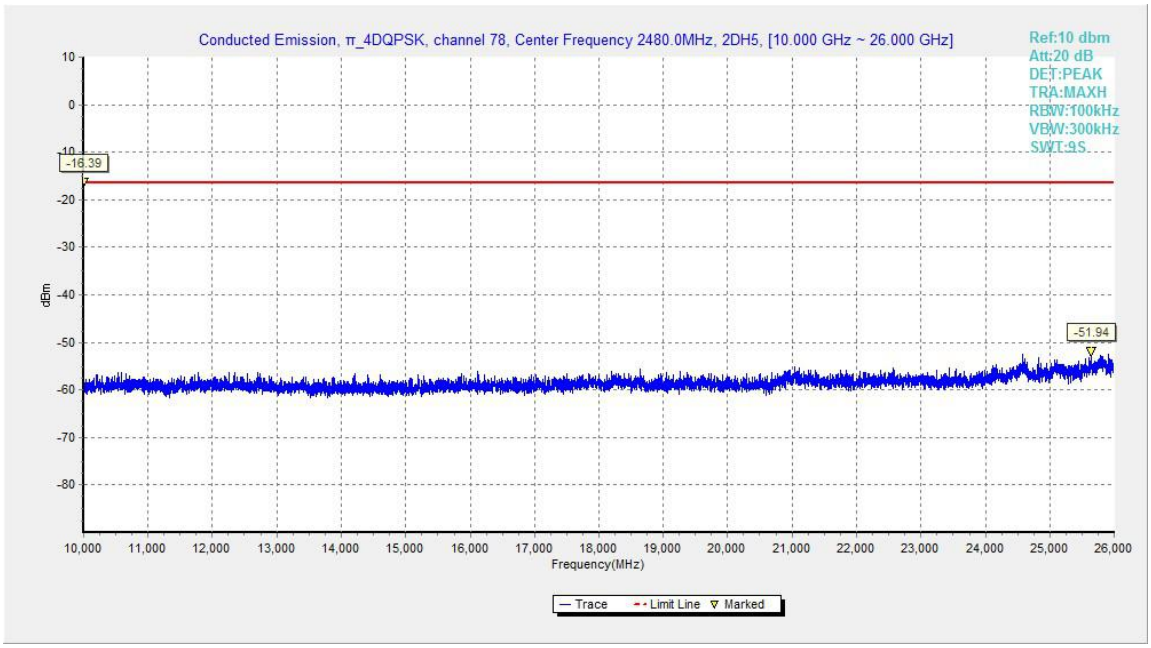


Fig.48. Conducted spurious emission: π/4 DQPSK, Channel 78, 10GHz - 26GHz

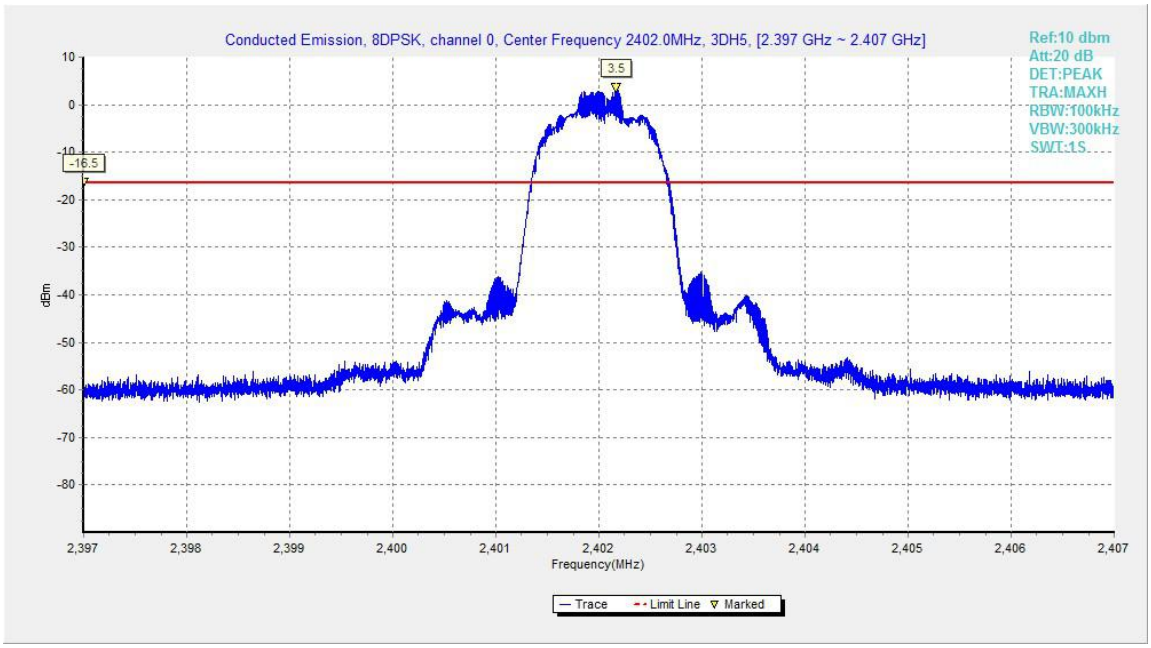


Fig.49. Conducted spurious emission: 8DPSK, Channel 0,2402MHz

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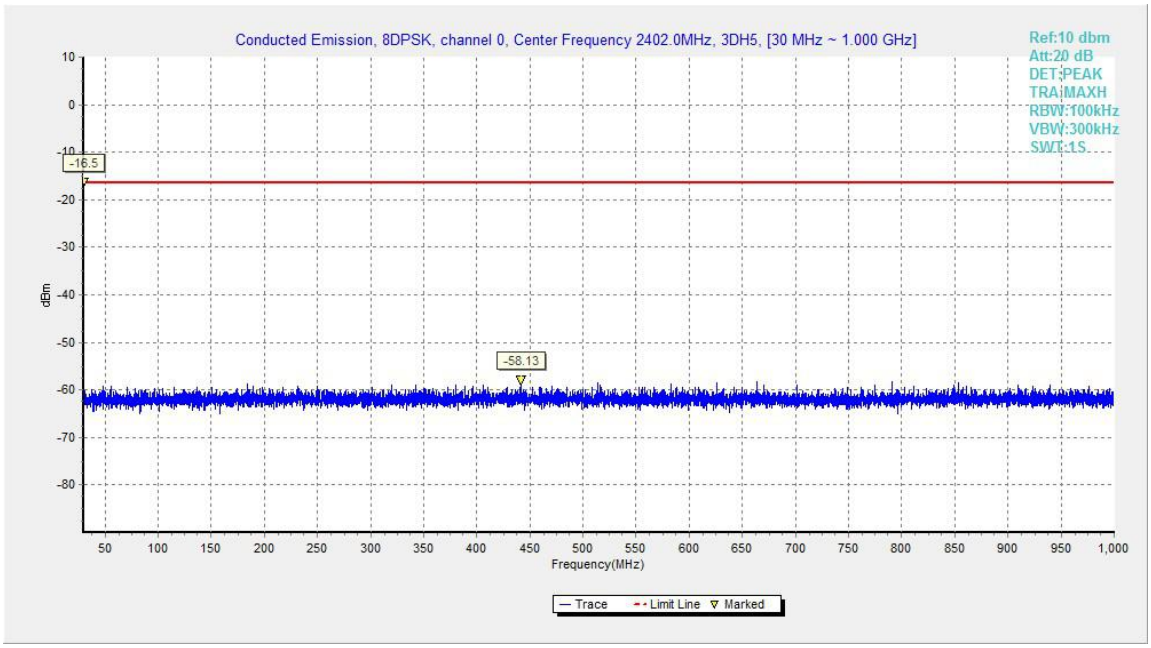


Fig.50. Conducted spurious emission: 8DPSK, Channel 0, 30MHz - 1GHz

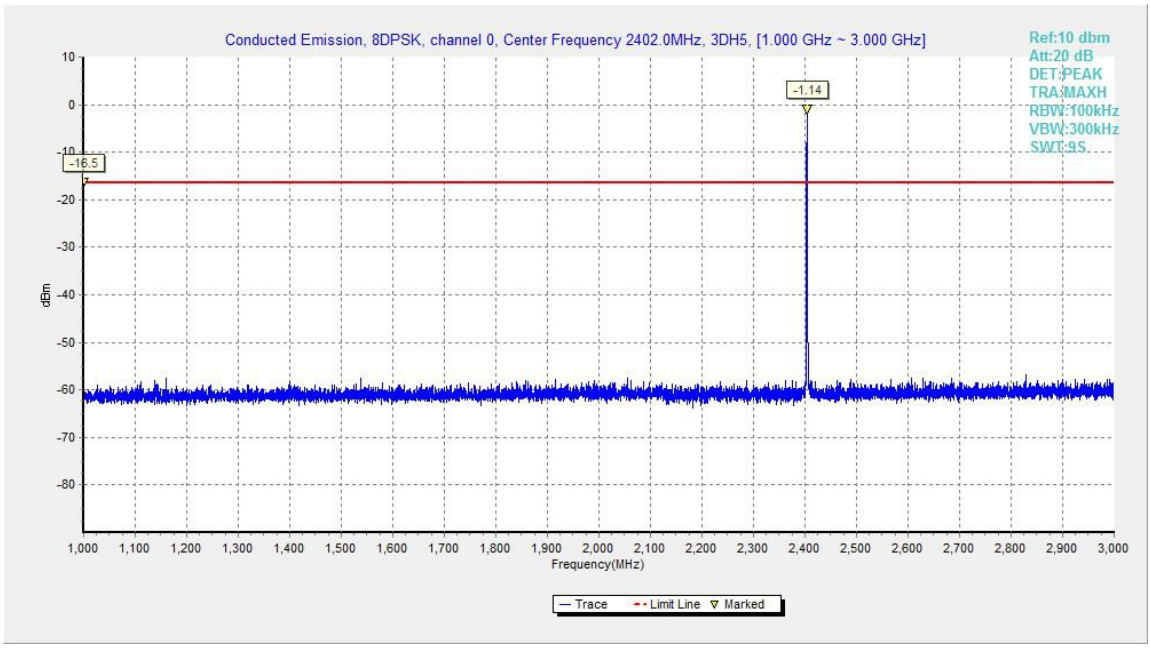


Fig.51. Conducted spurious emission: 8DPSK, Channel 0, 1GHz - 3GHz

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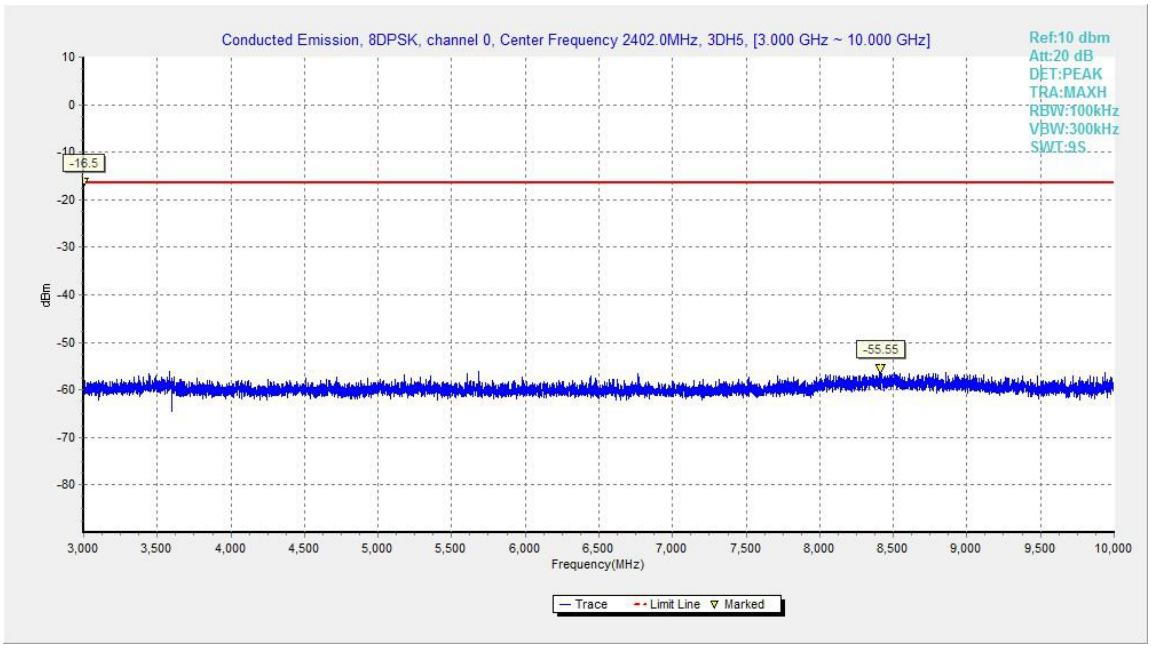


Fig.52. Conducted spurious emission: 8DPSK, Channel 0, 3GHz - 10GHz

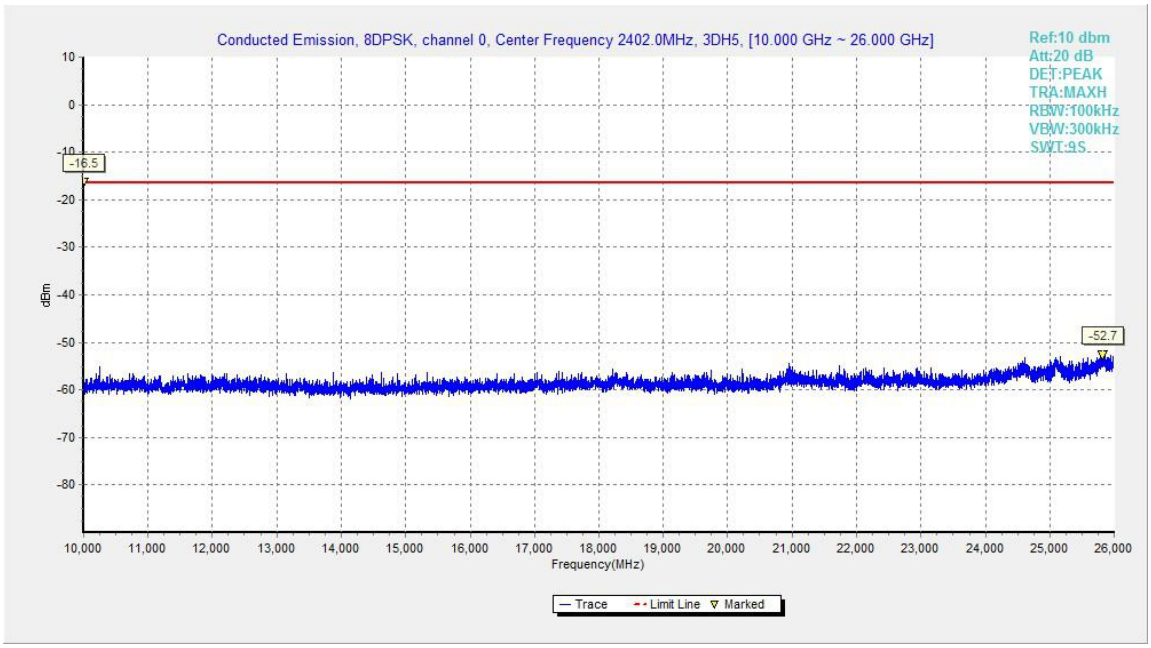


Fig.53. Conducted spurious emission: 8DPSK, Channel 0,10GHz - 26GHz

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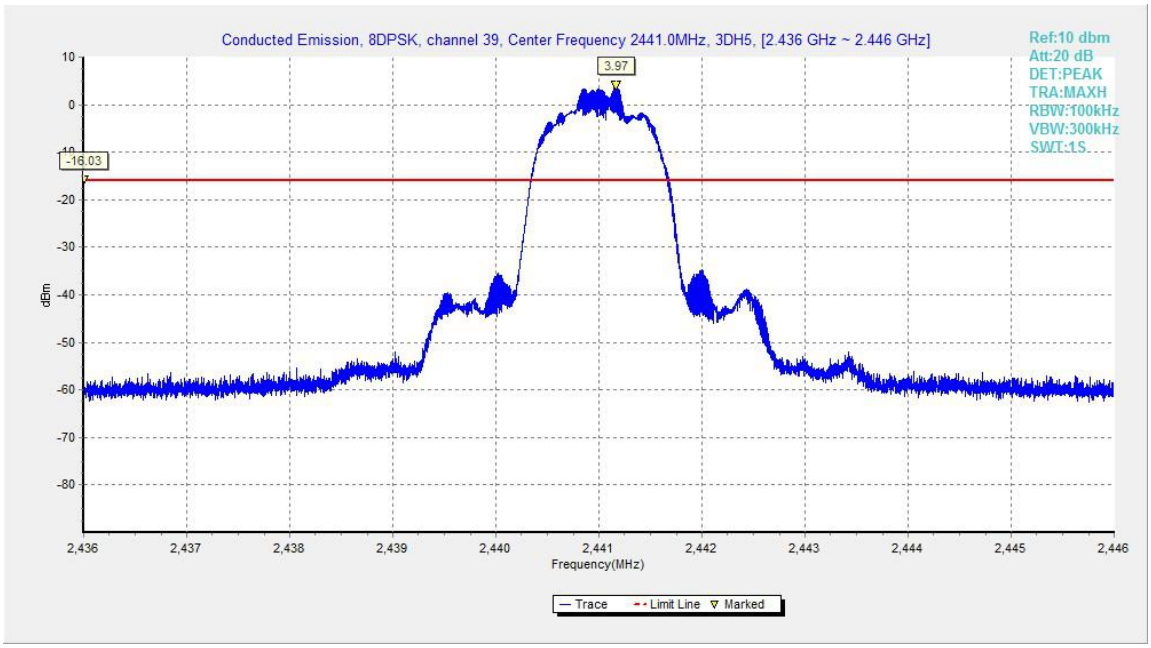


Fig.54. Conducted spurious emission: 8DPSK, Channel 39, 2441MHz

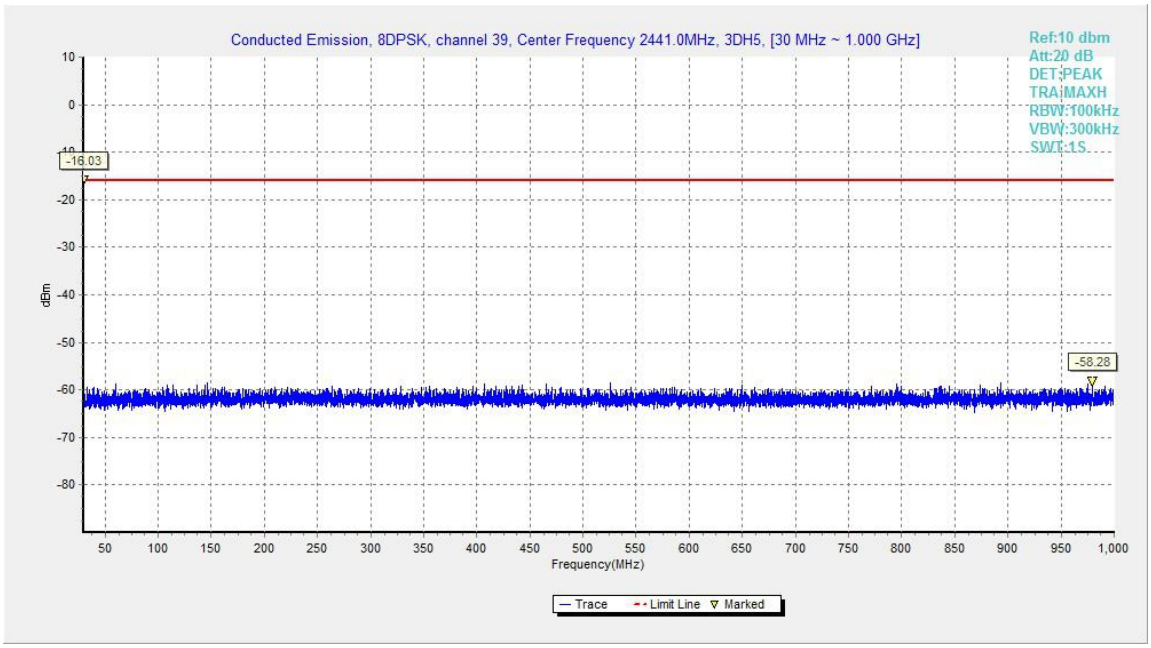


Fig.55. Conducted spurious emission: 8DPSK, Channel 39, 30MHz - 1GHz

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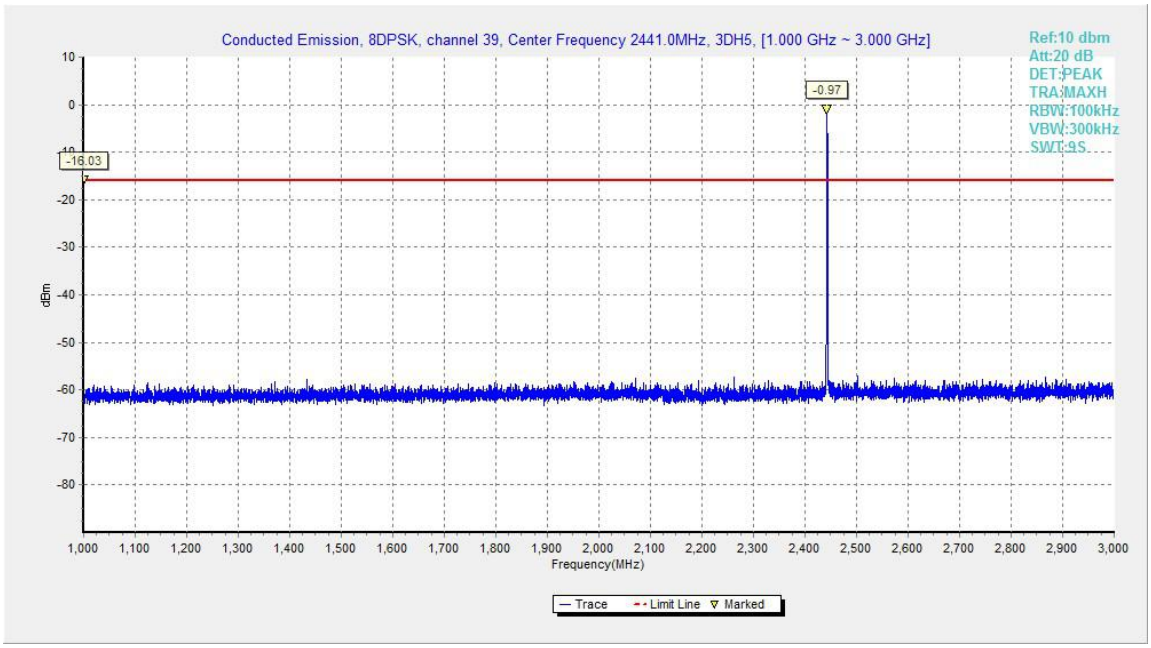


Fig.56. Conducted spurious emission: 8DPSK, Channel 39, 1GHz - 3GHz

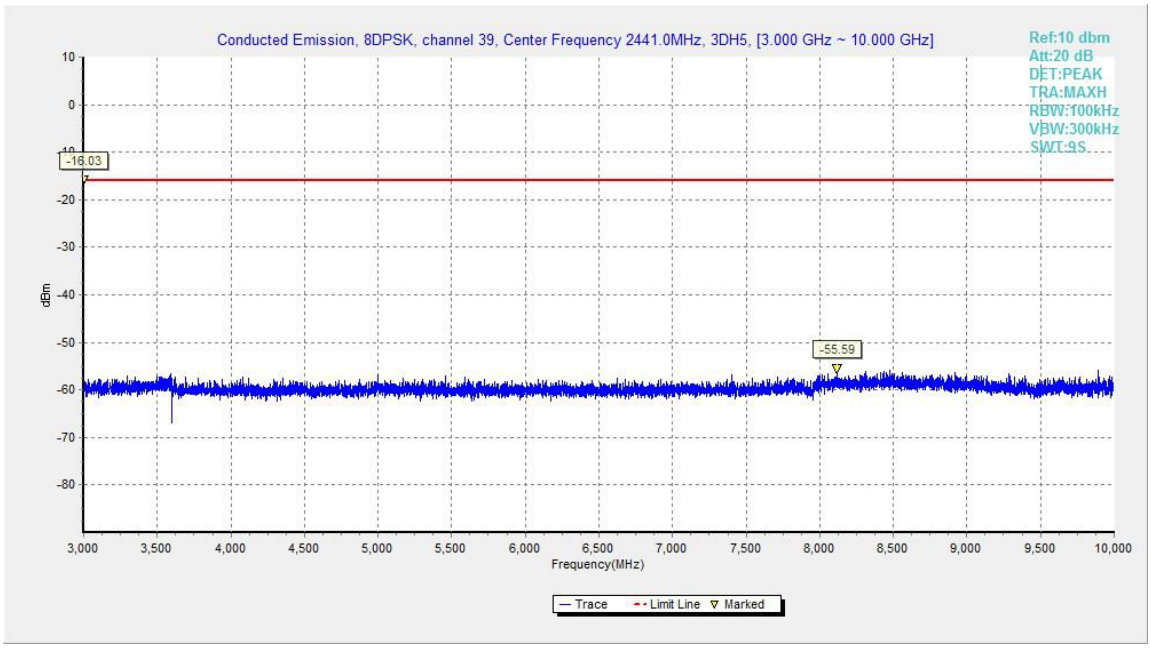


Fig.57. Conducted spurious emission: 8DPSK, Channel 39, 3GHz - 10GHz

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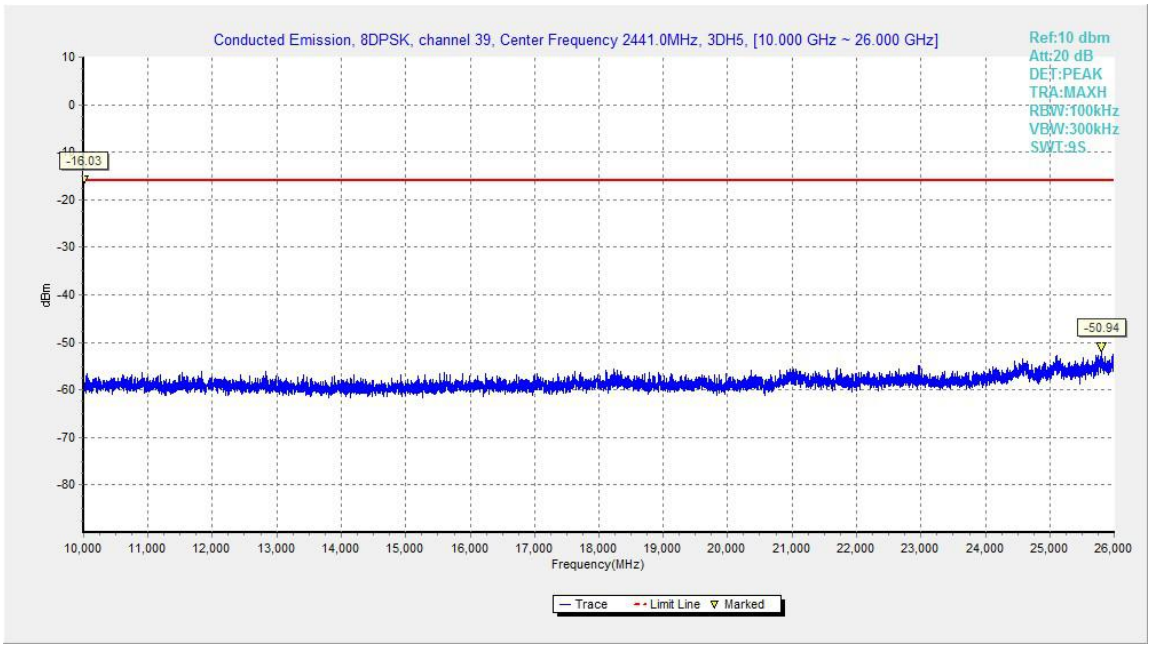


Fig.58. Conducted spurious emission: 8DPSK, Channel 39, 10GHz – 26GHz

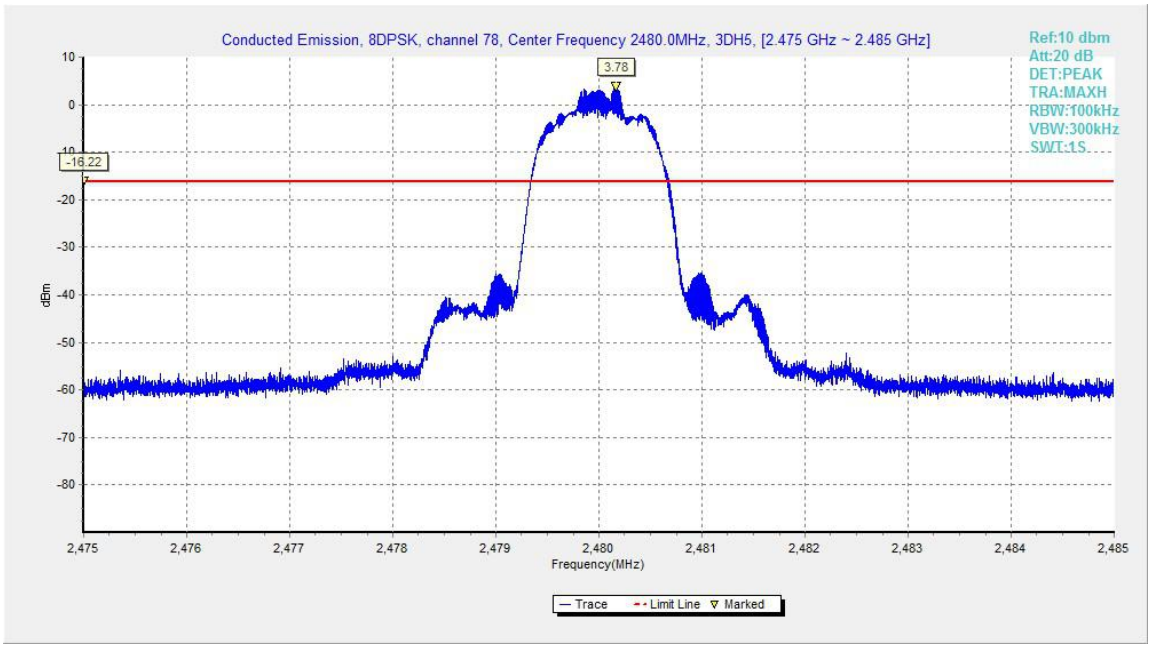


Fig.59. Conducted spurious emission: 8DPSK, Channel 78, 2480MHz

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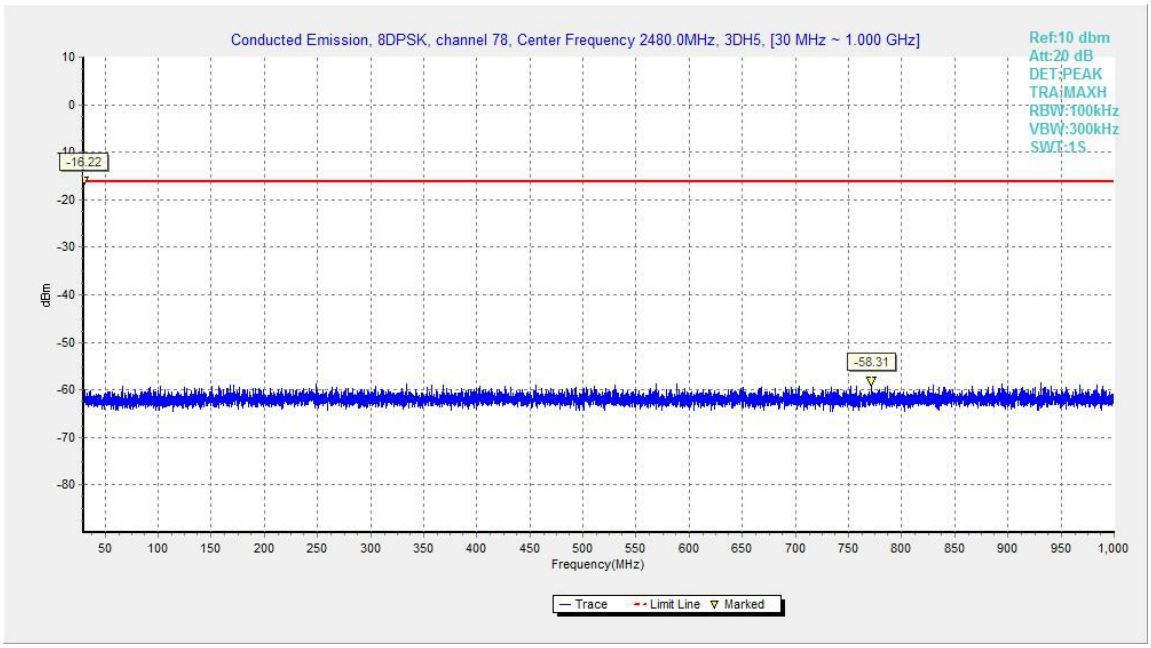


Fig.60. Conducted spurious emission: 8DPSK, Channel 78, 30MHz - 1GHz

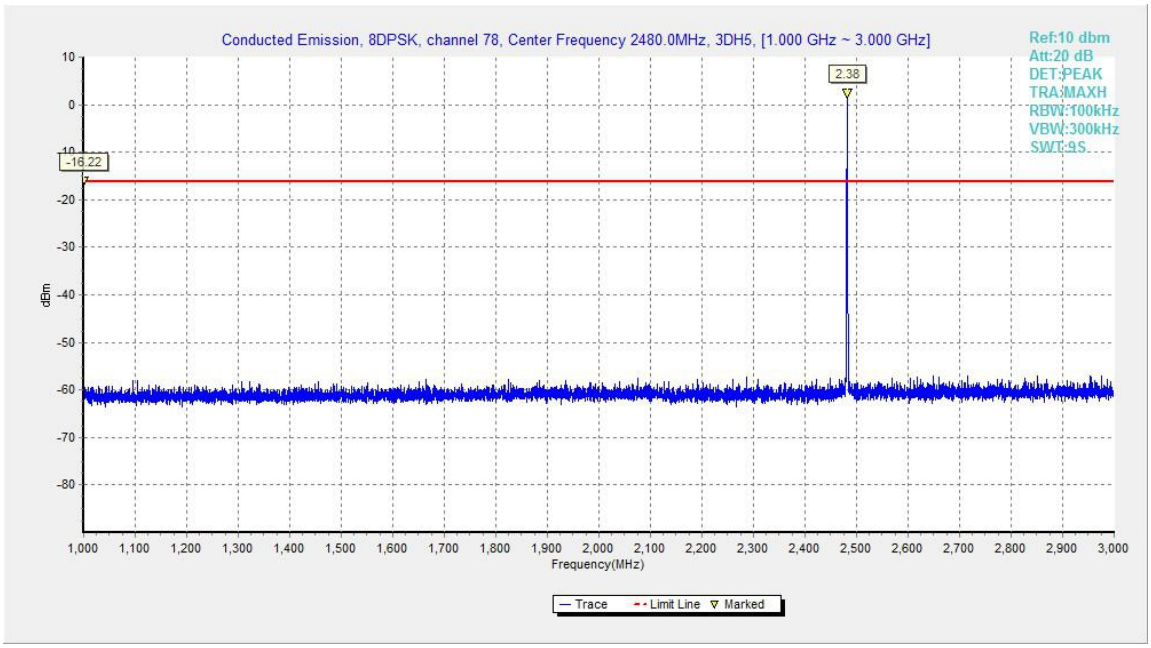


Fig.61. Conducted spurious emission: 8DPSK, Channel 78, 1GHz - 3GHz

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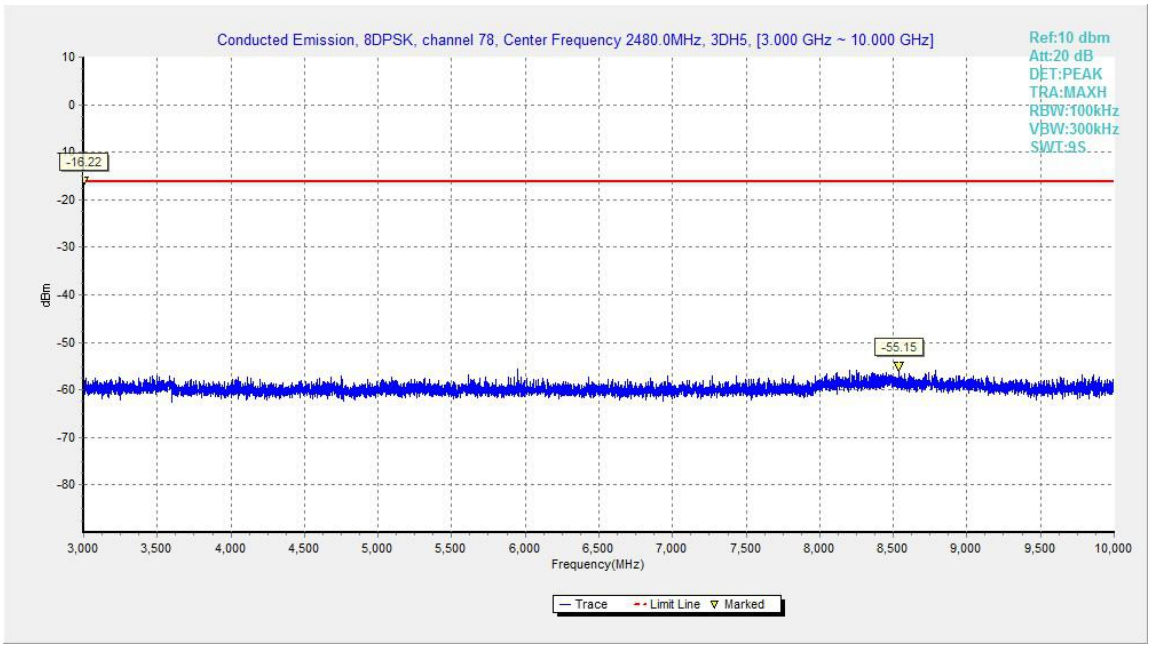


Fig.62. Conducted spurious emission: 8DPSK, Channel 78, 3GHz - 10GHz

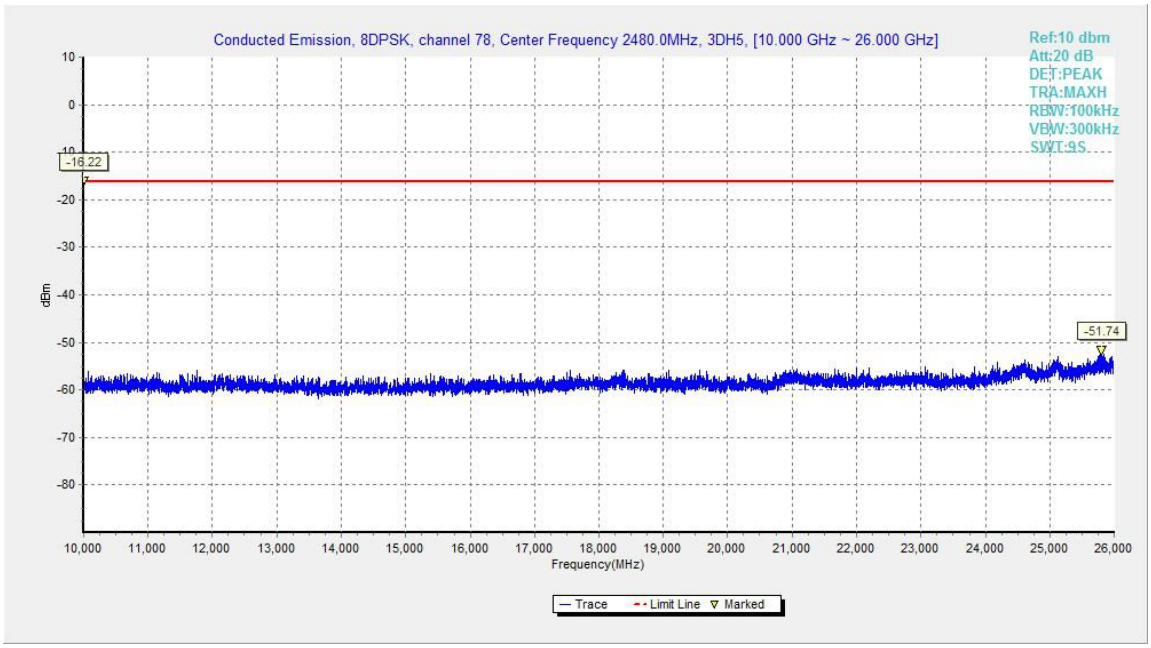


Fig.63. Conducted spurious emission: 8DPSK, Channel 78, 10GHz - 26GHz

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## A.6. Transmitter Spurious Emission - Radiated

**Method of Measurement: See ANSI C63.10-2013-clause 6.4 &6.5 & 6.6**

**Measurement Limit:**

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

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)).

**Limit in restricted band:**

| Frequency (MHz) | Field strength(μV/m) | Measurement distance (m) |
|---|---|---|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |

| 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 |

**Set up:**

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m

The EUT and transmitting antenna shall be centered on the turntable.

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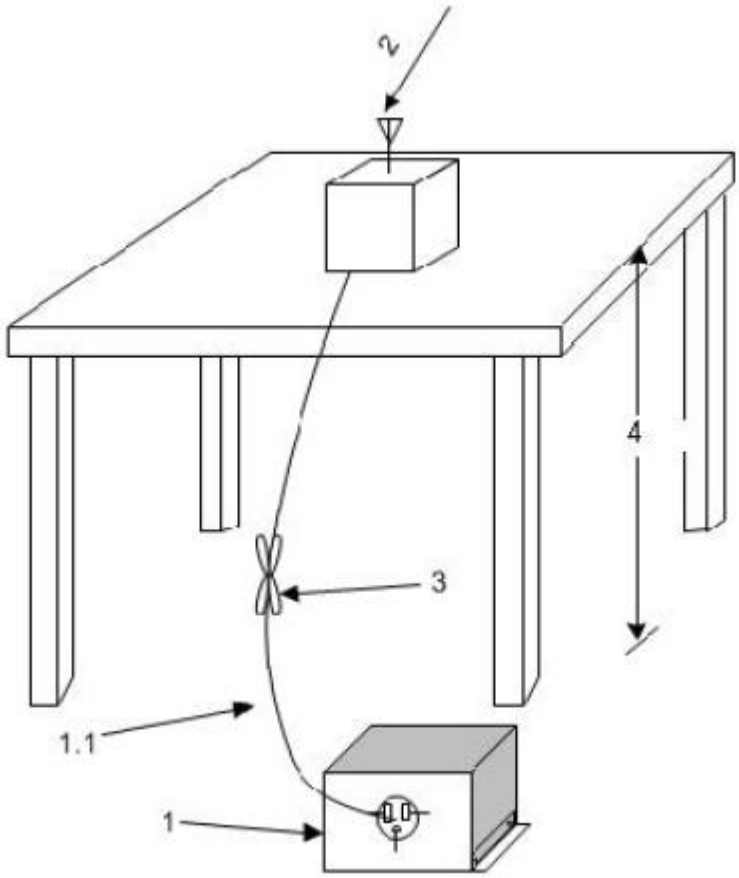


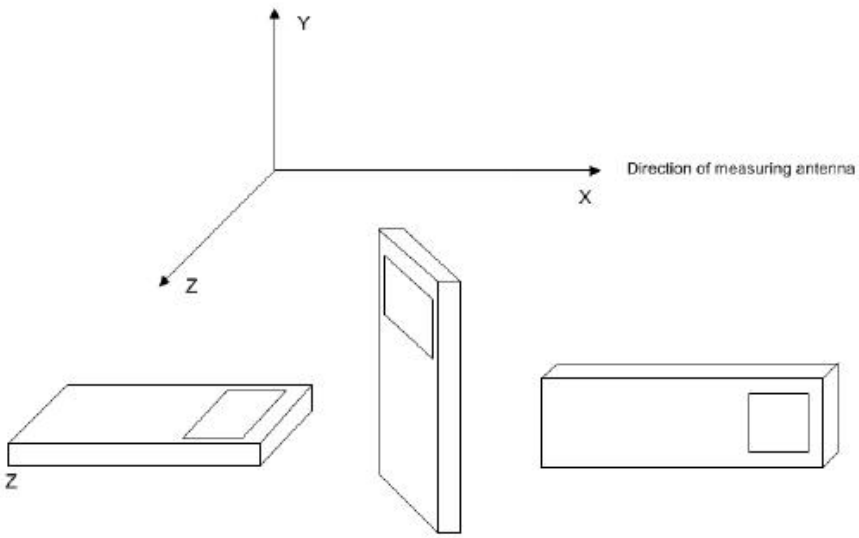


**Test Condition**

The EUT shall be tested 1 near top, 1 near middle, and 1 near bottom. Set the unlicensed wireless device to operate in continuous transmit mode. For unlicensed wireless devices unable to be configured for 100% duty cycle even in test mode, configure the system for the maximum duty cycle supported.

When required for unlicensed wireless devices, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the

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nominal rated supply voltage.

**Exploratory radiated emissions measurements**

Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT and, if applicable, the EUT configuration that produces the maximum level of emissions. The frequencies of maximum emission may be determined by manually positioning the antenna close to the EUT, and then moving the antenna over all sides of the EUT while observing a spectral display. It is advantageous to have prior knowledge of the frequencies of emissions, although this may be determined from such a near-field scan. The near-field scan shall only be used to determine the frequency but not the amplitude of the emissions. Where exploratory measurements are not adequate to determine the worst-case operating modes and are used only to identify the frequencies of the highest emissions, additional preliminary tests can be required.

For emissions from the EUT, the maximum level shall be determined by rotating the EUT and its antenna through 0° to 360°. For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored.

Broadband antennas and a spectrum analyzer or a radio-noise meter with a panoramic display are often useful in this type of test. If either antenna height or EUT azimuth are not fully measured during exploratory testing, then complete testing can be required at the OATS or semi-anechoic chamber when the final full spectrum testing is performed.

**Final radiated emissions measurements**

The final measurements are using the orientation and equipment arrangement of the EUT based on the measurement results found during the preliminary (exploratory) measurements, the EUT arrangement, appropriate modulation, and modes of operation that produce the emissions that have the highest amplitude relative to the limit shall be selected for the final measurement.

For each mode of operation required to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.

For each mode selected, record the frequency and amplitude of the highest fundamental emission (if applicable), as well as the frequency and amplitude of the six highest spurious emissions relative to the limit. Emissions more than 20 dB below the limit do not need to be reported.

This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

**The receiver references:**

| Frequency of emission (MHz) | RBW/VBW | Sweep Time(s) |
|---|---|---|
| 30-1000 | 100KHz/300KHz | 5 |
| 1000-4000 | 1MHz/3MHz | 15 |
| 4000-18000 | 1MHz/3MHz | 40 |
| 18000-26500 | 1MHz/3MHz | 20 |

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$P_{Mea}$ is the field strength recorded from the instrument.

The measurement results are obtained as described below:

Result= $P_{Mea}$ + Cable Loss + Antenna Factor

Where:

$P_{Mea}$ field strength recorded from the instrument

**Average Measurement results**

**EUT ID: EUT1**

**GFSK Ch 0**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2376.800 | 46.47 | 2.9 | 32.0 | 11.65 | 54.0 | 7.5 | H | 155 | 170 |
| 2386.200 | 46.54 | 2.9 | 32.0 | 11.72 | 54.0 | 7.5 | H | 155 | 150 |
| 4804.000 | 30.39 | -35.0 | 34.1 | 31.33 | 54.0 | 23.6 | H | 155 | 20 |
| 7206.400 | 33.99 | -32.4 | 35.8 | 30.58 | 54.0 | 20.0 | H | 155 | 180 |
| 9607.700 | 39.98 | -29.7 | 36.7 | 32.92 | 54.0 | 14.0 | H | 155 | 202 |
| 12010.100 | 37.80 | -30.5 | 38.9 | 29.39 | 54.0 | 16.2 | H | 155 | 8 |

**GFSK Ch 39**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2388.600 | 46.63 | 2.9 | 32.0 | 11.80 | 54.0 | 7.4 | H | 155 | 25 |
| 2483.800 | 46.77 | 2.9 | 32.0 | 11.85 | 54.0 | 7.2 | H | 155 | 49 |
| 4882.100 | 31.12 | -35.5 | 34.1 | 32.56 | 54.0 | 22.9 | H | 155 | 4 |
| 7323.000 | 35.83 | -31.3 | 35.8 | 31.34 | 54.0 | 18.2 | H | 155 | 6 |
| 9763.900 | 38.10 | -31.4 | 36.9 | 32.58 | 54.0 | 15.9 | H | 155 | 25 |
| 12204.800 | 37.52 | -28.8 | 39.0 | 27.38 | 54.0 | 16.5 | H | 155 | 186 |

**GFSK Ch 78**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2483.600 | 50.55 | 2.9 | 32.0 | 15.63 | 54.0 | 3.4 | H | 155 | 25 |
| 2484.200 | 47.38 | 2.9 | 32.0 | 12.46 | 54.0 | 6.6 | H | 155 | 49 |
| 4960.200 | 31.38 | -34.9 | 34.1 | 32.17 | 54.0 | 22.6 | H | 155 | 4 |
| 7439.600 | 35.90 | -32.2 | 35.8 | 32.26 | 54.0 | 18.1 | H | 155 | 6 |
| 9920.100 | 36.95 | -29.7 | 37.1 | 29.51 | 54.0 | 17.0 | H | 155 | 25 |
| 12399.500 | 38.90 | -30.0 | 39.1 | 29.88 | 54.0 | 15.1 | H | 155 | 186 |

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**π/4 DQPSK Ch 0**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2385.000 | 46.54 | 2.9 | 32.0 | 11.72 | 54.0 | 7.5 | H | 155 | 20 |
| 2388.800 | 46.55 | 2.9 | 32.0 | 11.72 | 54.0 | 7.5 | H | 155 | 45 |
| 4804.000 | 30.36 | -35.0 | 34.1 | 31.30 | 54.0 | 23.6 | H | 155 | 240 |
| 7206.400 | 34.00 | -32.4 | 35.8 | 30.60 | 54.0 | 20.0 | H | 155 | 180 |
| 9607.700 | 39.99 | -29.7 | 36.7 | 32.93 | 54.0 | 14.0 | H | 155 | 85 |
| 12010.100 | 37.79 | -30.5 | 38.9 | 29.38 | 54.0 | 16.2 | H | 155 | 25 |

**π/4 DQPSK Ch 39**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2387.600 | 46.60 | 2.9 | 32.0 | 11.78 | 54.0 | 7.4 | H | 155 | 92 |
| 2488.200 | 46.76 | 2.9 | 32.0 | 11.83 | 54.0 | 7.2 | H | 155 | 115 |
| 4882.100 | 31.10 | -35.5 | 34.1 | 32.54 | 54.0 | 22.9 | H | 155 | 135 |
| 7323.000 | 35.84 | -31.3 | 35.8 | 31.35 | 54.0 | 18.2 | H | 155 | 168 |
| 9763.900 | 38.02 | -31.4 | 36.9 | 32.51 | 54.0 | 16.0 | H | 155 | 184 |
| 12204.800 | 37.50 | -28.8 | 39.0 | 27.36 | 54.0 | 16.5 | H | 155 | 202 |

**π/4 DQPSK Ch 78**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2483.600 | 48.95 | 2.9 | 32.0 | 14.02 | 54.0 | 5.1 | H | 155 | 180 |
| 2484.400 | 47.01 | 2.9 | 32.0 | 12.08 | 54.0 | 7.0 | H | 155 | 204 |
| 4960.200 | 31.25 | -34.9 | 34.1 | 32.04 | 54.0 | 22.7 | H | 155 | 222 |
| 7439.600 | 35.96 | -32.2 | 35.8 | 32.33 | 54.0 | 18.0 | H | 155 | 245 |
| 9920.100 | 36.89 | -29.7 | 37.1 | 29.44 | 54.0 | 17.1 | H | 155 | 72 |
| 12399.500 | 39.01 | -30.0 | 39.1 | 30.00 | 54.0 | 15.0 | H | 155 | 94 |

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**8DPSK Ch 0**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2383.400 | 46.60 | 2.9 | 32.0 | 11.78 | 54.0 | 7.4 | H | 155 | 48 |
| 2389.600 | 46.58 | 2.9 | 32.0 | 11.75 | 54.0 | 7.4 | H | 155 | 70 |
| 4804.000 | 30.31 | -35.0 | 34.1 | 31.24 | 54.0 | 23.7 | H | 155 | 92 |
| 7206.400 | 33.99 | -32.4 | 35.8 | 30.58 | 54.0 | 20.0 | H | 155 | 112 |
| 9607.700 | 39.95 | -29.7 | 36.7 | 32.89 | 54.0 | 14.1 | H | 155 | 136 |
| 12010.100 | 37.70 | -30.5 | 38.9 | 29.29 | 54.0 | 16.3 | H | 155 | 156 |

**8DPSK Ch 39**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2388.000 | 46.61 | 2.9 | 32.0 | 11.78 | 54.0 | 7.4 | H | 155 | 8 |
| 2487.200 | 46.81 | 2.9 | 32.0 | 11.88 | 54.0 | 7.2 | H | 155 | 26 |
| 4882.100 | 31.11 | -35.5 | 34.1 | 32.56 | 54.0 | 22.9 | H | 155 | 72 |
| 7323.000 | 35.86 | -31.3 | 35.8 | 31.37 | 54.0 | 18.1 | H | 155 | 136 |
| 9763.900 | 38.05 | -31.4 | 36.9 | 32.53 | 54.0 | 16.0 | H | 155 | 94 |
| 12204.800 | 37.45 | -28.8 | 39.0 | 27.30 | 54.0 | 16.6 | H | 155 | 48 |

**8DPSK Ch 78**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2483.600 | 48.51 | 2.9 | 32.0 | 13.58 | 54.0 | 5.5 | H | 155 | 46 |
| 2492.400 | 46.81 | 2.9 | 32.0 | 11.87 | 54.0 | 7.2 | H | 155 | 70 |
| 4960.200 | 31.23 | -34.9 | 34.1 | 32.02 | 54.0 | 22.8 | H | 155 | 92 |
| 7439.600 | 35.87 | -32.2 | 35.8 | 32.24 | 54.0 | 18.1 | H | 155 | 268 |
| 9920.100 | 36.91 | -29.7 | 37.1 | 29.46 | 54.0 | 17.1 | H | 155 | 292 |
| 12399.500 | 38.90 | -30.0 | 39.1 | 29.89 | 54.0 | 15.1 | H | 155 | 316 |

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**Peak Measurement results**

**GFSK Ch 0**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2380.546 | 60.29 | 2.9 | 32.0 | 25.47 | 74.0 | 13.7 | H | 155 | 176 |
| 2383.710 | 60.23 | 2.9 | 32.0 | 25.42 | 74.0 | 13.8 | V | 155 | 154 |
| 4804.000 | 40.80 | -35.0 | 34.1 | 41.74 | 74.0 | 33.2 | H | 155 | 22 |
| 7206.000 | 45.05 | -32.4 | 35.8 | 41.64 | 74.0 | 29.0 | H | 155 | 176 |
| 9608.000 | 49.36 | -29.7 | 36.7 | 42.29 | 74.0 | 24.6 | V | 155 | 198 |
| 12010.000 | 47.88 | -30.5 | 38.9 | 39.47 | 74.0 | 26.1 | V | 155 | 0 |

**GFSK Ch 39**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2340.600 | 48.22 | 2.8 | 31.9 | 13.44 | 74.0 | 25.8 | H | 155 | 22 |
| 2522.000 | 48.92 | 3.0 | 32.0 | 13.93 | 74.0 | 25.1 | H | 155 | 44 |
| 4882.000 | 42.26 | -35.5 | 34.1 | 43.70 | 74.0 | 31.7 | V | 155 | 0 |
| 7323.000 | 45.47 | -31.3 | 35.8 | 40.98 | 74.0 | 28.5 | V | 155 | 0 |
| 9764.000 | 47.36 | -31.4 | 36.9 | 41.84 | 74.0 | 26.6 | V | 155 | 22 |
| 12205.000 | 47.42 | -28.8 | 39.0 | 37.28 | 74.0 | 26.6 | H | 155 | 176 |

**GFSK Ch 78**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2494.245 | 60.63 | 2.9 | 32.0 | 25.69 | 74.0 | 13.4 | H | 155 | 22 |
| 2497.500 | 60.76 | 2.9 | 32.0 | 25.82 | 74.0 | 13.2 | H | 155 | 44 |
| 4960.000 | 40.89 | -34.9 | 34.1 | 41.67 | 74.0 | 33.1 | H | 155 | 0 |
| 7440.000 | 46.09 | -32.2 | 35.8 | 42.47 | 74.0 | 27.9 | V | 155 | 0 |
| 9920.000 | 47.13 | -29.7 | 37.1 | 39.69 | 74.0 | 26.9 | H | 155 | 22 |
| 12400.000 | 47.69 | -30.0 | 39.1 | 38.67 | 74.0 | 26.3 | V | 155 | 176 |

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**π/4 DQPSK Ch 0**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2362.542 | 60.48 | 2.8 | 31.9 | 25.69 | 74.0 | 13.5 | H | 155 | 22 |
| 2388.512 | 60.51 | 2.9 | 32.0 | 25.68 | 74.0 | 13.5 | H | 155 | 44 |
| 4804.000 | 41.07 | -35.0 | 34.1 | 42.01 | 74.0 | 32.9 | H | 155 | 242 |
| 7206.000 | 43.24 | -32.4 | 35.8 | 39.83 | 74.0 | 30.8 | V | 155 | 176 |
| 9608.000 | 49.64 | -29.7 | 36.7 | 42.57 | 74.0 | 24.4 | V | 155 | 88 |
| 12010.000 | 46.96 | -30.5 | 38.9 | 38.55 | 74.0 | 27.0 | H | 155 | 22 |

**π/4 DQPSK Ch 39**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2344.800 | 48.00 | 2.8 | 31.9 | 13.22 | 74.0 | 26.0 | V | 155 | 88 |
| 2506.600 | 49.07 | 2.9 | 32.0 | 14.11 | 74.0 | 24.9 | V | 155 | 110 |
| 4882.000 | 40.60 | -35.5 | 34.1 | 42.04 | 74.0 | 33.4 | H | 155 | 132 |
| 7323.000 | 45.32 | -31.3 | 35.8 | 40.83 | 74.0 | 28.7 | H | 155 | 154 |
| 9764.000 | 46.53 | -31.4 | 36.9 | 41.02 | 74.0 | 27.5 | H | 155 | 176 |
| 12205.000 | 46.90 | -28.8 | 39.0 | 36.76 | 74.0 | 27.1 | H | 155 | 198 |

**π/4 DQPSK Ch 78**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2486.095 | 60.81 | 2.9 | 32.0 | 25.88 | 74.0 | 13.2 | V | 155 | 176 |
| 2489.850 | 60.92 | 2.9 | 32.0 | 25.99 | 74.0 | 13.1 | V | 155 | 198 |
| 4960.000 | 42.29 | -34.9 | 34.1 | 43.07 | 74.0 | 31.7 | H | 155 | 220 |
| 7440.000 | 45.72 | -32.2 | 35.8 | 42.09 | 74.0 | 28.3 | V | 155 | 242 |
| 9920.000 | 47.17 | -29.7 | 37.1 | 39.73 | 74.0 | 26.8 | H | 155 | 66 |
| 12400.000 | 48.97 | -30.0 | 39.1 | 39.94 | 74.0 | 25.0 | V | 155 | 88 |

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**8DPSK Ch 0**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2379.440 | 60.38 | 2.9 | 32.0 | 25.57 | 74.0 | 13.6 | H | 155 | 44 |
| 2389.884 | 60.63 | 2.9 | 32.0 | 25.80 | 74.0 | 13.4 | V | 155 | 66 |
| 4804.000 | 41.49 | -35.0 | 34.1 | 42.42 | 74.0 | 32.5 | H | 155 | 88 |
| 7206.000 | 44.43 | -32.4 | 35.8 | 41.02 | 74.0 | 29.6 | V | 155 | 110 |
| 9608.000 | 50.25 | -29.7 | 36.7 | 43.18 | 74.0 | 23.8 | V | 155 | 132 |
| 12010.000 | 46.71 | -30.5 | 38.9 | 38.30 | 74.0 | 27.3 | V | 155 | 154 |

**8DPSK Ch 39**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2362.200 | 47.06 | 2.8 | 31.9 | 12.27 | 74.0 | 26.9 | V | 155 | 0 |
| 2540.400 | 48.83 | 3.0 | 32.1 | 13.81 | 74.0 | 25.2 | H | 155 | 22 |
| 4882.000 | 40.21 | -35.5 | 34.1 | 41.66 | 74.0 | 33.8 | V | 155 | 66 |
| 7323.000 | 45.12 | -31.3 | 35.8 | 40.63 | 74.0 | 28.9 | H | 155 | 132 |
| 9764.000 | 48.60 | -31.4 | 36.9 | 43.08 | 74.0 | 25.4 | H | 155 | 88 |
| 12205.000 | 46.12 | -28.8 | 39.0 | 35.98 | 74.0 | 27.9 | V | 155 | 44 |

**8DPSK Ch 78**

| 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) |
|---|---|---|---|---|---|---|---|---|---|
| 2484.420 | 60.77 | 2.9 | 32.0 | 25.84 | 74.0 | 13.2 | H | 155 | 44 |
| 2486.110 | 61.02 | 2.9 | 32.0 | 26.09 | 74.0 | 13.0 | V | 155 | 66 |
| 4960.000 | 41.87 | -34.9 | 34.1 | 42.66 | 74.0 | 32.1 | V | 155 | 88 |
| 7440.000 | 45.05 | -32.2 | 35.8 | 41.43 | 74.0 | 28.9 | V | 155 | 264 |
| 9920.000 | 50.06 | -29.7 | 37.1 | 42.62 | 74.0 | 23.9 | V | 155 | 286 |
| 12400.000 | 48.67 | -30.0 | 39.1 | 39.64 | 74.0 | 25.3 | H | 155 | 308 |

Sample:

2484.420MHz

Result (60.77 dBμV/m)= $P_{Mea}$(25.84 dBμV/m)+ Cable Loss(2.9 dB) + Antenna Factor(32.0 dB/m)

**Conclusion: PASS**

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## A.7. 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 | Pulse time (ms) | | Number of Transmissions | | Dwell Time (ms) | Conclusion |
|---|---|---|---|---|---|---|---|
| 39 | DH1 | Fig.64 | 0.38 | Fig.65 | 319 | 121.22 | P |
| | DH3 | Fig.66 | 1.63 | Fig.67 | 106 | 172.78 | P |
| | DH5 | Fig.68 | 2.88 | Fig.69 | 67 | 192.96 | P |

**For π/4 DQPSK**

| Channel | Packet | Pulse time (ms) | | Number of Transmissions | | Dwell Time (ms) | Conclusion |
|---|---|---|---|---|---|---|---|
| 39 | 2DH1 | Fig.70 | 0.38 | Fig.71 | 319 | 121.22 | P |
| | 2DH3 | Fig.72 | 1.64 | Fig.73 | 107 | 175.48 | P |
| | 2DH5 | Fig.74 | 2.88 | Fig.75 | 72 | 207.36 | P |

**For 8DPSK**

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