



TEST REPORT

No. I20N02439-BT

TCL Communication Ltd.

LTE/UMTS/GSM Smartphone

Model Name: 4187M

with

Hardware Version: FS180-MB-V0.2A

Software Version: 4187M_LCAR_1SIM_V1.0_20200814_UNLOCK

FCC ID: 2ACCJB118

Issued Date: 2020-09-11

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 SAICT.

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CONTENTS

| | |
|---|-----------|
| 1. SUMMARY OF TEST REPORT | 4 |
| 1.1. TEST ITEMS | 4 |
| 1.2. TEST STANDARDS | 4 |
| 1.3. TEST RESULT | 4 |
| 1.4. TESTING LOCATION | 4 |
| 1.5. PROJECT DATA | 4 |
| 1.6. SIGNATURE | 4 |
| 2. CLIENT INFORMATION | 5 |
| 2.1. APPLICANT INFORMATION | 5 |
| 2.2. MANUFACTURER INFORMATION | 5 |
| 3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) | 6 |
| 3.1. ABOUT EUT | 6 |
| 3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST | 6 |
| 3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST | 6 |
| 3.4. GENERAL DESCRIPTION | 7 |
| 4. REFERENCE DOCUMENTS | 8 |
| 4.1. DOCUMENTS SUPPLIED BY APPLICANT | 8 |
| 4.2. REFERENCE DOCUMENTS FOR TESTING | 8 |
| 5. TEST RESULTS | 9 |
| 5.1. TESTING ENVIRONMENT | 9 |
| 5.2. TEST RESULTS | 9 |
| 5.3. STATEMENTS | 9 |
| 6. TEST EQUIPMENTS UTILIZED | 10 |
| 7. LABORATORY ENVIRONMENT | 11 |
| 8. MEASUREMENT UNCERTAINTY | 12 |
| ANNEX A: DETAILED TEST RESULTS | 13 |
| A.0 ANTENNA REQUIREMENT | 13 |
| A.1 MAXIMUM PEAK OUTPUT POWER | 14 |
| A.2 BAND EDGES COMPLIANCE | 15 |
| A.3 CONDUCTED EMISSION | 22 |
| A.4 RADIATED EMISSION | 38 |
| A.5 20dB BANDWIDTH | 56 |
| A.6 TIME OF OCCUPANCY (DWELL TIME) | 61 |
| A.7 NUMBER OF HOPPING CHANNELS | 65 |
| A.8 CARRIER FREQUENCY SEPARATION | 69 |



A.9 AC POWER LINE CONDUCTED EMISSION 71

1. Summary of Test Report

1.1. Test Items

| | |
|---------------------|-------------------------|
| Description | LTE/UMTS/GSM Smartphone |
| Model Name | 4187M |
| Applicant's name | TCL Communication Ltd. |
| Manufacturer's Name | TCL Communication Ltd. |

1.2. Test Standards

FCC Part15-2019; ANSI C63.10-2013

1.3. Test Result

Pass

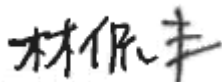
1.4. Testing Location

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China

1.5. Project data

Testing Start Date: 2020-03-20
Testing End Date: 2020-03-27

1.6. Signature



Lin Kanfeng
(Prepared this test report)



Tang Weisheng
(Reviewed this test report)



Zhang Bojun
(Approved this test report)



2. Client Information

2.1. Applicant Information

Company Name: TCL Communication Ltd.
Address: 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact Person: Gong Zhizhou
E-Mail: zhizhou.gong@tcl.com
Telephone: 0086-755-36611722
Fax: 0086-755-36612000-81722

2.2. Manufacturer Information

Company Name: TCL Communication Ltd.
Address: 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong
Contact Person: Gong Zhizhou
E-Mail: zhizhou.gong@tcl.com
Telephone: 0086-755-36611722
Fax: 0086-755-36612000-81722

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

3.1. About EUT

| | |
|------------------------------|------------------------------|
| Description | LTE/UMTS/GSM Smartphone |
| Model Name | 4187M |
| Brand Name | TCL |
| Frequency Band | 2400MHz~2483.5MHz |
| Type of Modulation | GFSK/π /4 DQPSK/8DPSK |
| Number of Channels | 79 |
| Antenna Type | Integrated |
| Antenna Gain | -1.2dBi |
| Power Supply | 3.85V DC by Battery |
| FCC ID | 2ACCJB118 |
| Condition of EUT as received | No abnormality in appearance |

Note1: According to the customer's description, 4187M is a variant product of 5030J, and it only changes memory. All results were from the initial model. The initial model report number is I20N00391-BT.

Note2: Components list, please refer to documents of the manufacturer; it is also included in the original test record of Shenzhen Academy of Information and Communications Technology.

3.2. Internal Identification of EUT used during the test

| EUT ID* | IMEI | HW Version | SW Version | Receive Date |
|----------------|-----------------|--------------------|--|---------------------|
| EUT1 | 354827110000146 | FS180-MB- V0.2A | 4187M_LCAR_1SIM_V1.0_20 200814_UNLOCK | 2020-03-13 |
| EUT2 | 354827110000161 | FS180-MB- V0.2A | 4187M_LCAR_1SIM_V1.0_20 200814_UNLOCK | 2020-03-13 |

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

3.3. Internal Identification of AE used during the test

| AE ID* | Description | SN |
|---------------|--------------------|--------------|
| AE1 | Battery | CAC3860025C7 |
| AE2 | Battery | CAC3860032CA |
| AE3 | Charger | / |
| AE4 | Charger | / |

AE1

| | |
|-----------------|----------|
| Model | TLp038D7 |
| Manufacturer | VENKE |
| Capacity | 4000mAh |
| Nominal Voltage | 3.85v |

AE2



| | |
|-----------------|----------|
| Model | TLp038DA |
| Manufacturer | TIANMAO |
| Capacitance | 4000mAh |
| Nominal Voltage | 3.85v |

AE3

| | |
|--------------|---------------------|
| Model | UC13US/CBA0059AGAC7 |
| Manufacturer | CHENYANG |

AE4

| | |
|--------------|---------------------|
| Model | UC13US/CBA0059AGAC5 |
| Manufacturer | PUAN |

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

3.4. General Description

The Equipment under Test (EUT) is a model of LTE/UMTS/GSM Smartphone with integrated antenna and battery.

It consists of normal options: Lithium Battery, Charger and Headset.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.



4. Reference Documents

4.1. Documents supplied by applicant

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

4.2. Reference Documents for testing

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

| Reference | Title | Version |
|------------------|---|----------------|
| FCC Part 15 | 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 | 2019 |
| ANSI C63.10 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices | 2013 |

5. Test Results

5.1. Testing Environment

Normal Temperature: 15~35°C

Relative Humidity: 20~75%

5.2. Test Results

| No | Test cases | Sub-clause of Part 15C | Verdict |
|----|----------------------------------|------------------------|---------|
| 0 | Antenna Requirement | 15.203 | P |
| 1 | Maximum Peak Output Power | 15.247 (b) | P |
| 2 | Band Edges Compliance | 15.247 (d) | P |
| 3 | Conducted Spurious Emission | 15.247 (d) | P |
| 4 | Radiated Spurious Emission | 15.247,15.205,15.209 | P |
| 5 | Occupied 20dB bandwidth | 15.247(a) | P |
| 6 | Time of Occupancy (Dwell Time) | 15.247(a) | P |
| 7 | Number of Hopping Channel | 15.247(a) | P |
| 8 | Carrier Frequency Separation | 15.247(a) | P |
| 9 | AC Power line Conducted Emission | 15.107,15.207 | P |

See **ANNEX A** for details.

5.3. Statements

SAICT has evaluated the test cases requested by the applicant/manufacture as listed in section 5.2 of this report, for the EUT specified in section 3, according to the standards or reference documents listed in section 4.2.

6. Test Equipments Utilized

Conducted test system

| No. | Equipment | Model | Serial Number | Manufacturer | Calibration Due date | Calibration Period |
|-----|------------------------|---------|---------------|-----------------|----------------------|--------------------|
| 1 | Vector Signal Analyzer | FSV40 | 100903 | Rohde & Schwarz | 2021-01-15 | 1 year |
| 2 | Bluetooth Tester | CBT32 | 100584 | Rohde & Schwarz | 2021-01-01 | 1 year |
| 3 | Power Sensor | U2021XA | MY55430013 | Agilent | 2021-01-15 | 1 year |
| 4 | Data Acquisition | U2531A | TW55443507 | Agilent | / | / |

Radiated emission test system

| No. | Equipment | Model | Serial Number | Manufacturer | Calibration Due date | Calibration Period |
|-----|-------------------|-----------------------|---------------|--------------|----------------------|--------------------|
| 1 | LISN | ESH2-Z5 | 100196 | R&S | 2021-01-02 | 1 year |
| 2 | Test Receiver | ESCI | 100701 | R&S | 2020-08-06 | 1 year |
| 3 | Loop Antenna | HLA6120 | 35779 | TESEQ | 2022-05-01 | 3 year |
| 4 | BiLog Antenna | VULB9163 | 9163 329 | Schwarzbeck | 2021-02-16 | 3 year |
| 5 | Horn Antenna | 3117 | 00066585 | ETS-Lindgren | 2022-03-04 | 3 year |
| 6 | Test Receiver | ESR7 | 101675 | R&S | 2020-07-18 | 1 year |
| 7 | Spectrum Analyzer | FSP 40 | 100378 | R&S | 2020-12-12 | 1 year |
| 8 | Chamber | FACT5-2.0 | 4166 | ETS-Lindgren | 2021-05-12 | 3 year |
| 9 | Antenna | QSH-SL-1 8-26-S-20 | 17013 | Q-par | 2021-01-14 | 3 year |
| 10 | Antenna | QSH-SL-2 6-40-K-20 | 17014 | Q-par | 2021-01-10 | 3 year |

Test software

| No. | Equipment | Manufacturer | Version |
|-----|------------------|-----------------|----------|
| 1 | TechMgr Software | CAICT | 2.1.1 |
| 2 | EMC32 | Rohde & Schwarz | 8.53.0 |
| 3 | EMC32 | Rohde & Schwarz | 10.01.00 |

EUT is engineering software provided by the customer to control the transmitting signal.

The EUT was programmed to be in continuously transmitting mode.

Anechoic chamber

Fully anechoic chamber by ETS-Lindgren

7. Laboratory Environment

Semi-anechoic chambe

| | |
|-----------------------------------|--|
| Temperature | Min. = 15 °C, Max. = 35 °C |
| Relative humidity | Min. = 15 %, Max. = 75 % |
| Shielding effectiveness | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB |
| Electrical insulation | > 2MΩ |
| Ground system resistance | < 4 Ω |
| Normalised site attenuation (NSA) | < ±4 dB, 3 m distance, from 30 to 1000 MHz |

Shielded room

| | |
|--------------------------|--|
| Temperature | Min. = 15 °C, Max. = 35 °C |
| Relative humidity | Min. =20 %, Max. = 75 % |
| Shielding effectiveness | 0.014MHz-1MHz> 60 dB; 1MHz-1000MHz>90 dB |
| Electrical insulation | > 2MΩ |
| Ground system resistance | < 4 Ω |

Fully-anechoic chamber

| | |
|------------------------------------|---|
| Temperature | Min. = 15 °C, Max. = 35 °C |
| Relative humidity | Min. = 15 %, Max. = 75 % |
| Shielding effectiveness | 0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB |
| Electrical insulation | > 2MΩ |
| Ground system resistance | < 4 Ω |
| Voltage Standing Wave Ratio (VSWR) | ≤ 6 dB, from 1 to 18 GHz, 3 m distance |
| Uniformity of field strength | Between 0 and 6 dB, from 80 to 6000 MHz |

8. Measurement Uncertainty

| Test Name | Uncertainty ($k=2$) | |
|--|--|--------|
| 1. RF Output Power - Conducted | 1.32dB | |
| 2. Time of Occupancy - Conducted | 0.58ms | |
| 3. Occupied channel bandwidth - Conducted | 66Hz | |
| 4. Transmitter Spurious Emission - Conducted | $30\text{MHz} \leq f \leq 1\text{GHz}$ | 1.41dB |
| | $1\text{GHz} \leq f \leq 7\text{GHz}$ | 1.92dB |
| | $7\text{GHz} \leq f \leq 13\text{GHz}$ | 2.31dB |
| | $13\text{GHz} \leq f \leq 26\text{GHz}$ | 2.61dB |
| 5. Transmitter Spurious Emission - Radiated | $9\text{kHz} \leq f \leq 30\text{MHz}$ | 1.70dB |
| | $30\text{MHz} \leq f \leq 1\text{GHz}$ | 4.90dB |
| | $1\text{GHz} \leq f \leq 18\text{GHz}$ | 4.60dB |
| | $18\text{GHz} \leq f \leq 40\text{GHz}$ | 4.10dB |
| 6. AC Power line Conducted Emission | $150\text{kHz} \leq f \leq 30\text{MHz}$ | 3.00dB |

ANNEX A: Detailed Test Results

A.0 Antenna requirement

Measurement Limit:

| Standard | Requirement |
|------------------------|--|
| FCC CRF Part 15.203 | An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded. |

Conclusion: The Directional gains of antenna used for transmitting is -1.2dBi. The RF transmitter uses an integrate antenna without connector.



A.1 Maximum Peak Output Power

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

A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

Measurement Limit:

| Standard | Limit (dBm) | E.I.R.P Limit (dBm) |
|-------------------------|-------------|---------------------|
| FCC CRF Part 15.247 (b) | < 30 | < 36 |

Measurement Results:

Conducted transmitter power

| Mode | Peak Conducted Output Power (dBm) | | |
|----------------|-----------------------------------|----------------|----------------|
| | 2402MHz (Ch0) | 2441MHz (Ch39) | 2480MHz (Ch78) |
| GFSK | 5.97 | 4.60 | 4.34 |
| π /4 DQPSK | 4.83 | 3.23 | 3.29 |
| 8DPSK | 5.90 | 4.57 | 4.34 |

E.I.R.P

| Mode | Peak Conducted Output Power (dBm) | | |
|----------------|-----------------------------------|----------------|----------------|
| | 2402MHz (Ch0) | 2441MHz (Ch39) | 2480MHz (Ch78) |
| GFSK | 4.77 | 3.40 | 3.14 |
| π /4 DQPSK | 3.63 | 2.03 | 2.09 |
| 8DPSK | 4.70 | 3.37 | 3.14 |

Note: E.I.R.P value = Conducted values (with conducted samples) + Antenna Gain.

Conclusion: Pass

A.2 Band Edges Compliance

Measurement Limit:

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

Measurement Result:

| Mode | Channel | Hopping | Test Results | Conclusion |
|---------------|---------|---------|--------------|------------|
| GFSK | 0 | ON | Fig.1 | P |
| | 78 | ON | Fig.2 | P |
| $\pi/4$ DQPSK | 0 | ON | Fig.3 | P |
| | 78 | ON | Fig.4 | P |
| 8DPSK | 0 | ON | Fig.5 | P |
| | 78 | ON | Fig.6 | P |

| Mode | Channel | Hopping | Test Results | Conclusion |
|---------------|---------|---------|--------------|------------|
| GFSK | 0 | OFF | Fig.7 | P |
| | 78 | OFF | Fig.8 | P |
| $\pi/4$ DQPSK | 0 | OFF | Fig.9 | P |
| | 78 | OFF | Fig.10 | P |
| 8DPSK | 0 | OFF | Fig.11 | P |
| | 78 | OFF | Fig.12 | P |

See below for test graphs.

Conclusion: Pass

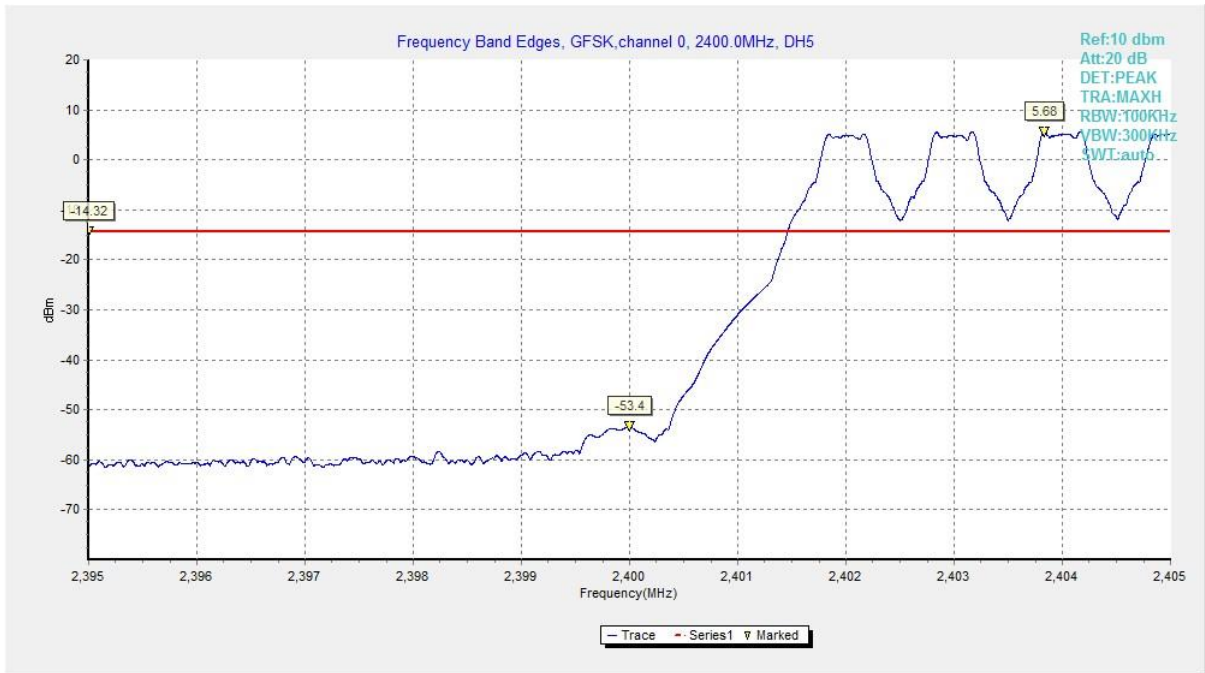


Fig. 1 Band Edges (GFSK, Ch 0, Hopping ON)

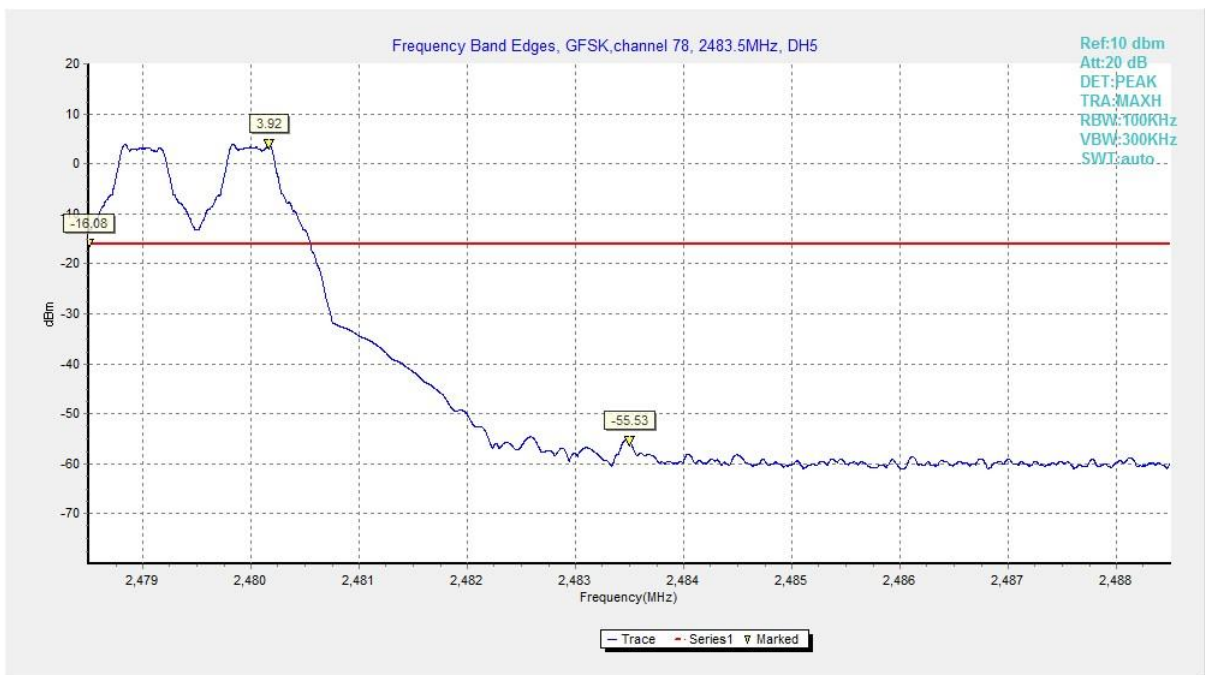


Fig. 2 Band Edges (GFSK, Ch 78, Hopping ON)

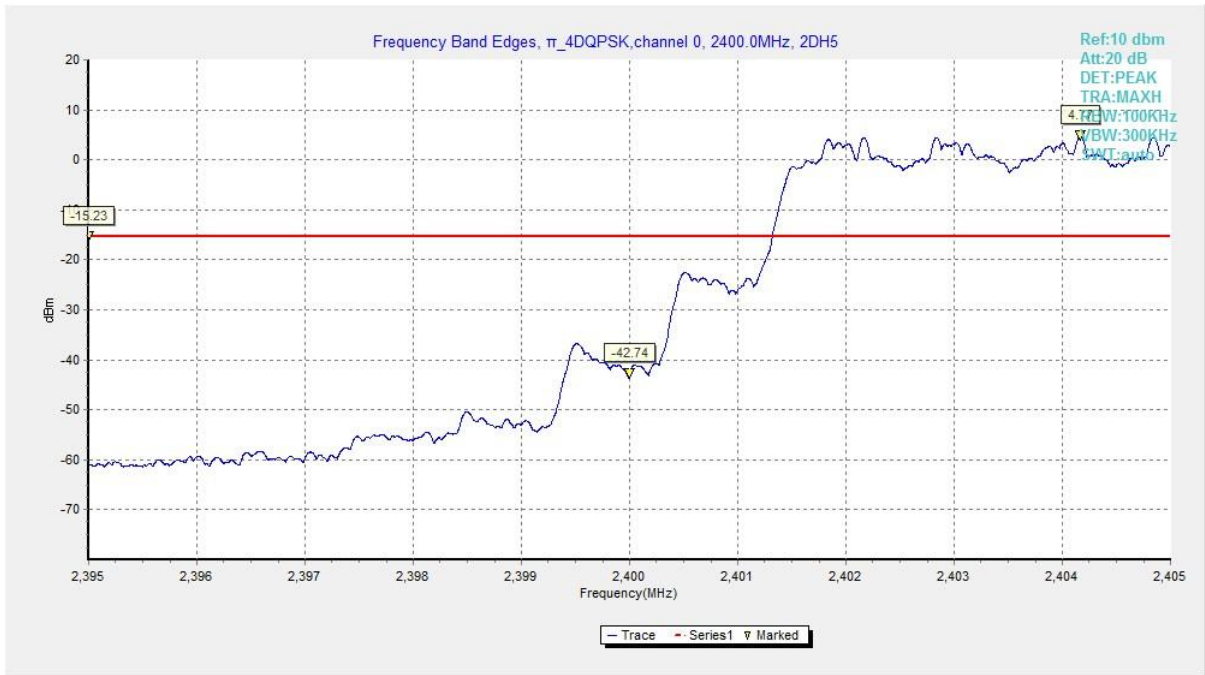


Fig. 3 Band Edges ($\pi/4$ DQPSK, Ch 0, Hopping ON)

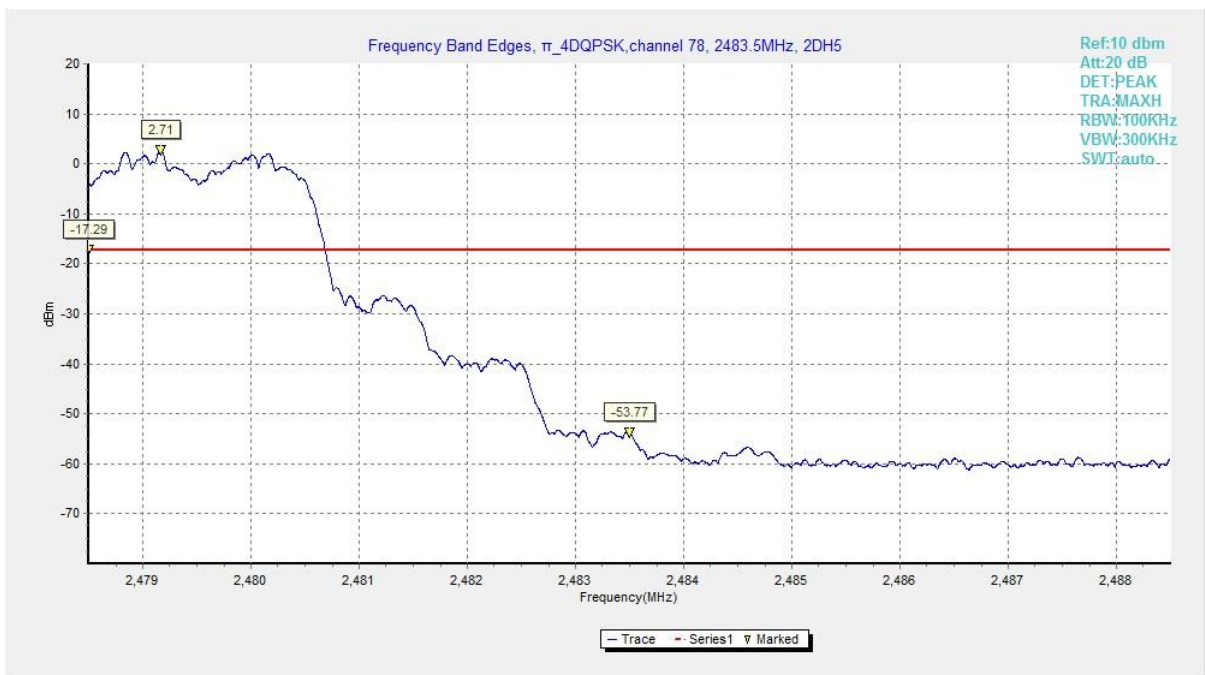


Fig. 4 Band Edges ($\pi/4$ DQPSK, Ch 78, Hopping ON)

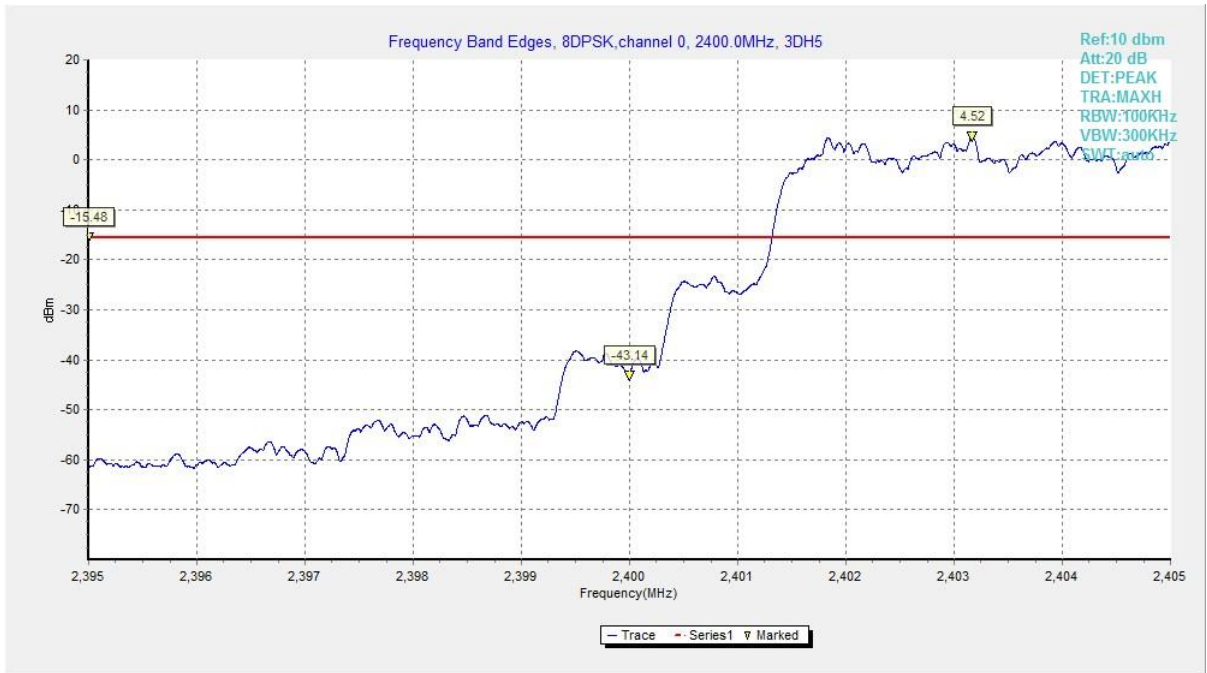


Fig. 5 Band Edges (8DPSK, Ch 0, Hopping ON)

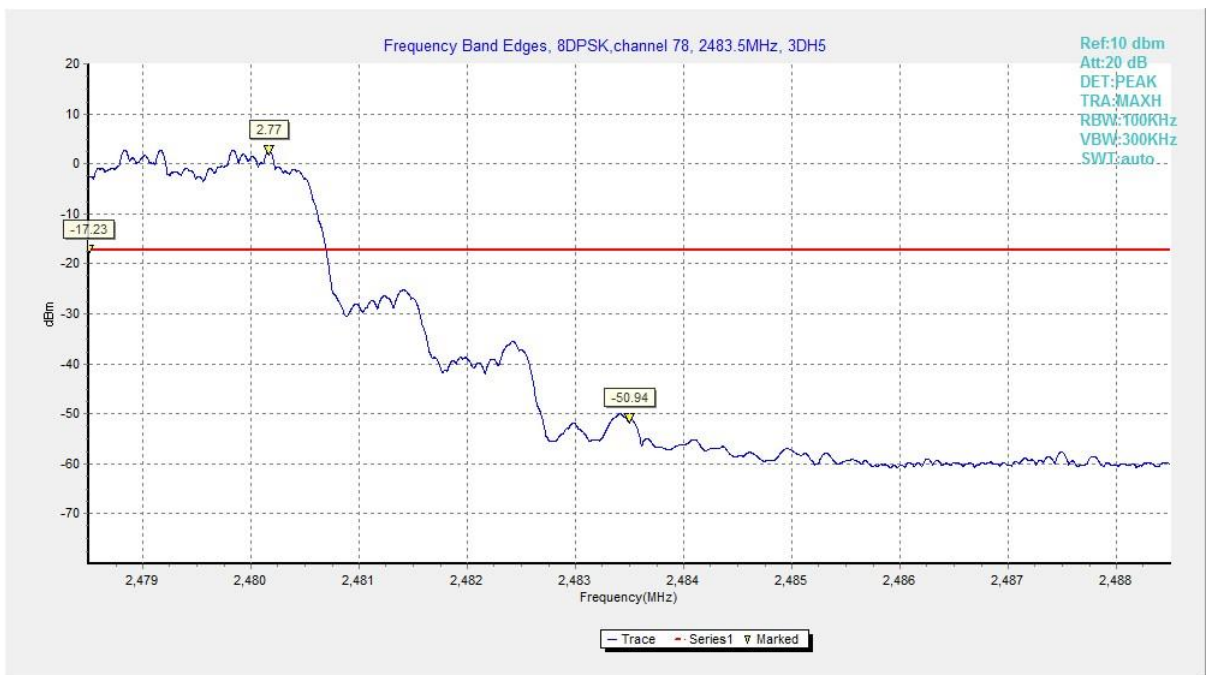


Fig. 6 Band Edges (8DPSK, Ch 78, Hopping ON)

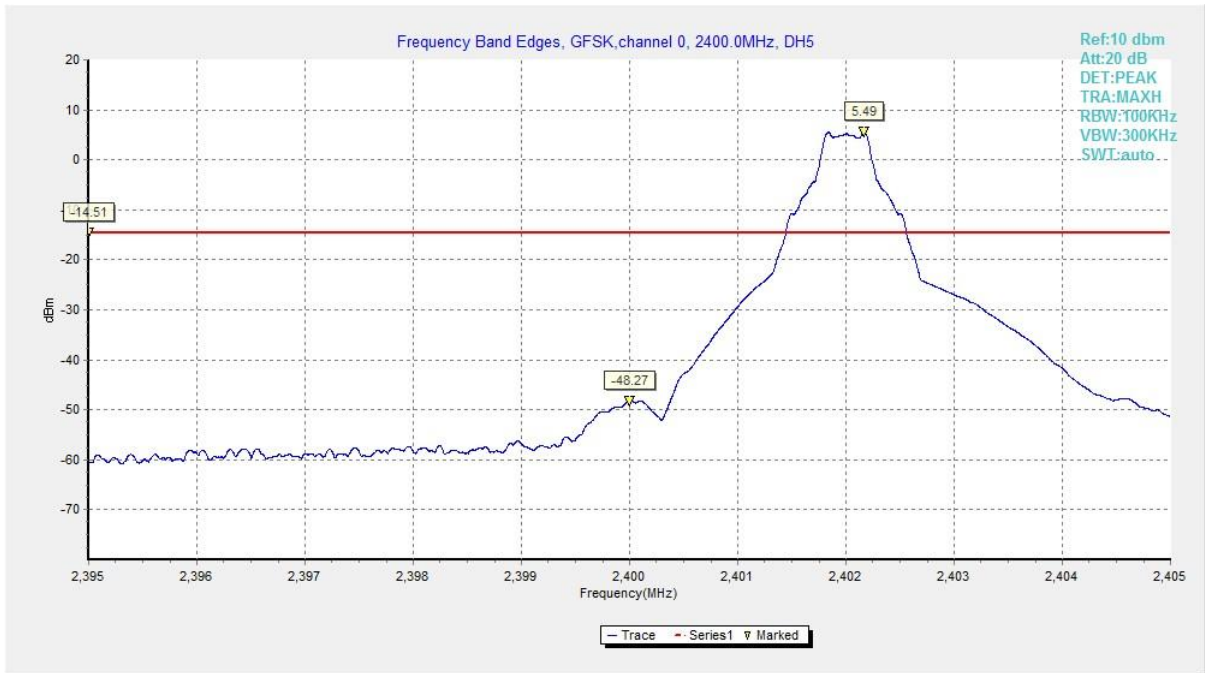


Fig. 7 Band Edges (GFSK, Ch 0, Hopping OFF)

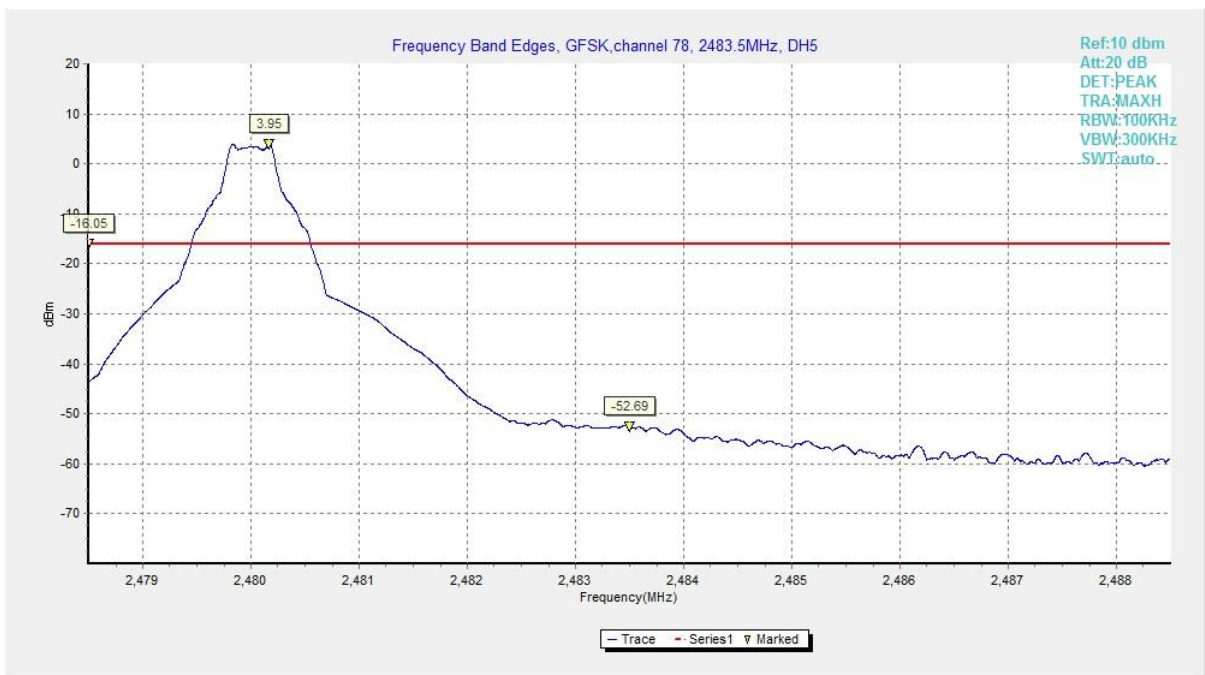


Fig. 8 Band Edges (GFSK, Ch 78, Hopping OFF)

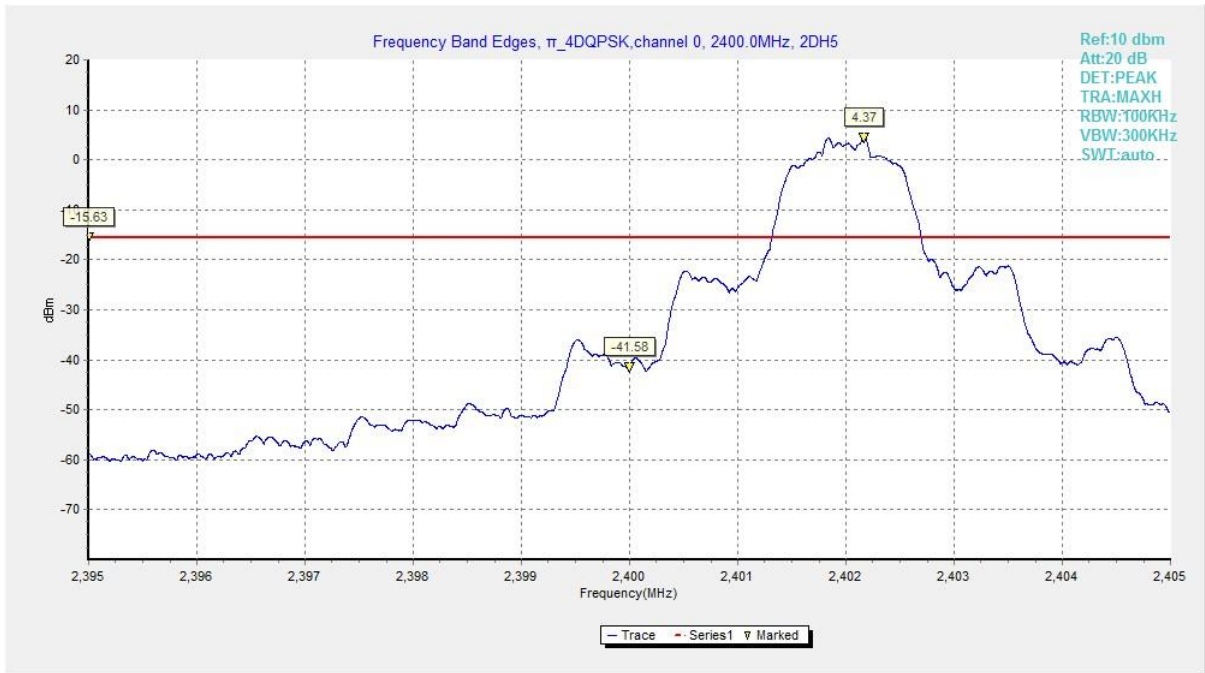


Fig. 9 Band Edges ($\pi/4$ DQPSK, Ch 0, Hopping OFF)

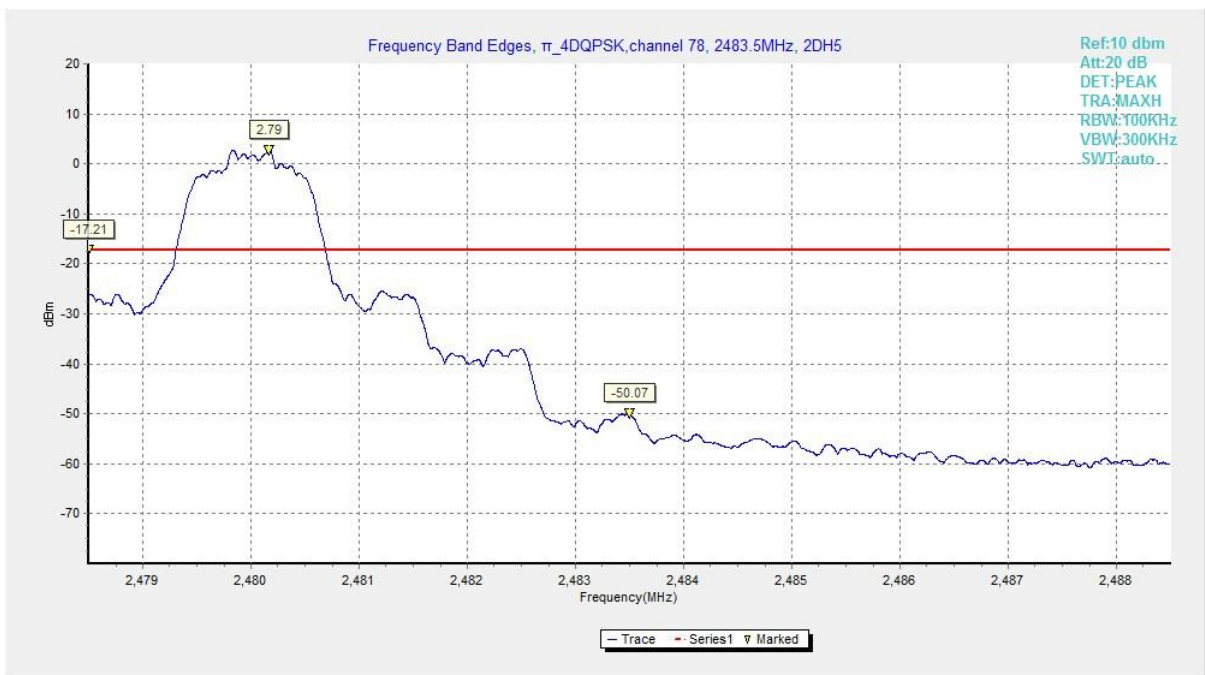


Fig. 10 Band Edges ($\pi/4$ DQPSK, Ch 78, Hopping OFF)

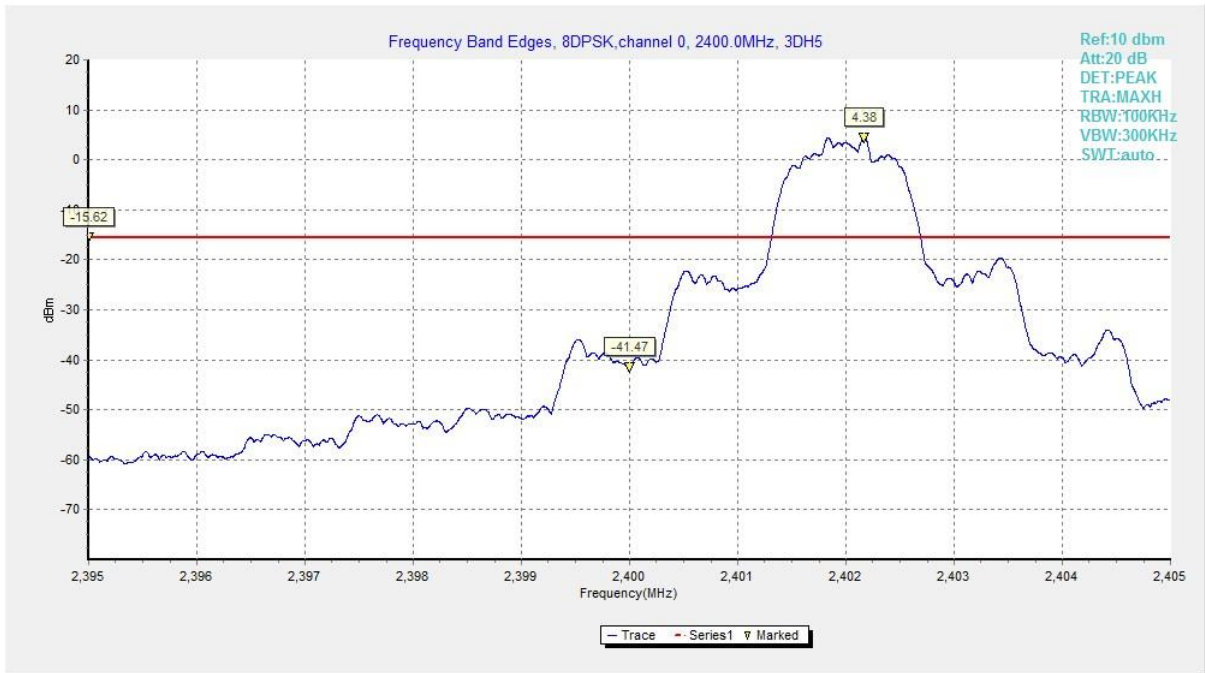


Fig. 11 Band Edges (8DPSK, Ch 0, Hopping OFF)

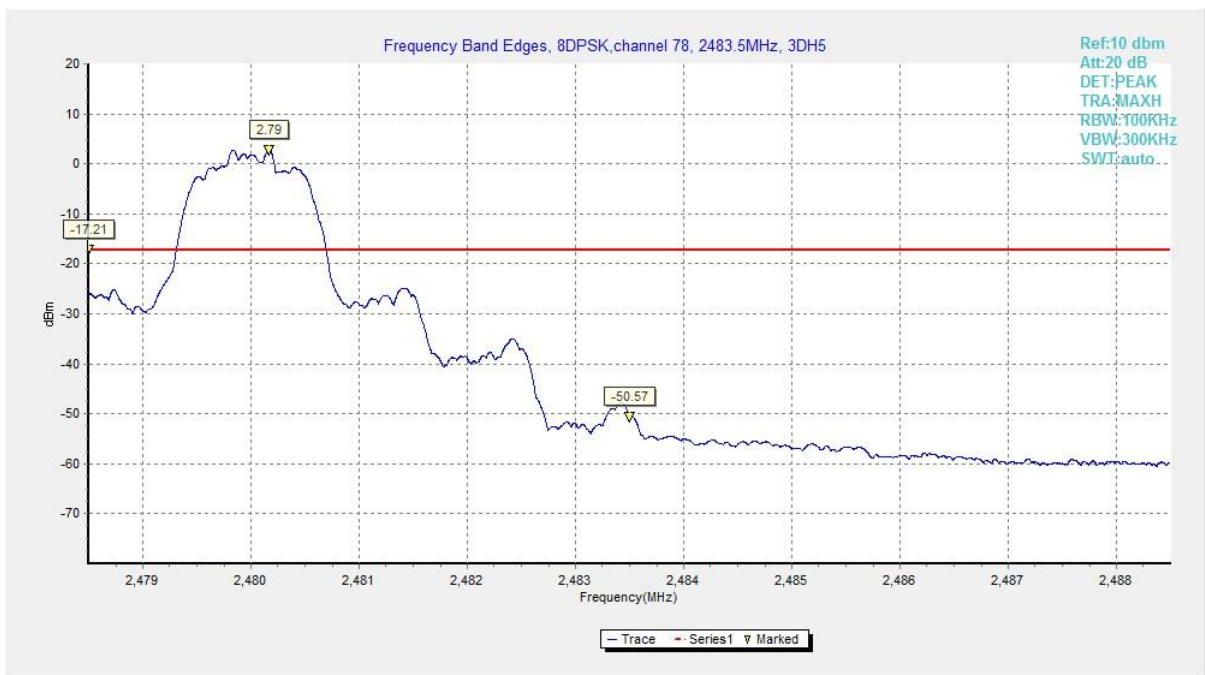


Fig. 12 Band Edges (8DPSK, Ch 78, Hopping OFF)

A.3 Conducted Emission

Measurement Limit:

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

Measurement Results:

| MODE | Channel | Frequency Range | Test Results | Conclusion |
|---------------|--------------|-----------------|--------------|------------|
| GFSK | 0 | 2.402 GHz | Fig.13 | P |
| | | 1GHz-3GHz | Fig.14 | P |
| | | 3GHz-10GHz | Fig.15 | P |
| | 39 | 2.441 GHz | Fig.16 | P |
| | | 1GHz-3GHz | Fig.17 | P |
| | | 3GHz-10GHz | Fig.18 | P |
| | 78 | 2.480 GHz | Fig.19 | P |
| | | 1GHz-3GHz | Fig.20 | P |
| | | 3GHz-10GHz | Fig.21 | P |
| $\pi/4$ DQPSK | 0 | 2.402 GHz | Fig.22 | P |
| | | 1GHz-3GHz | Fig.23 | P |
| | | 3GHz-10GHz | Fig.24 | P |
| | 39 | 2.441 GHz | Fig.25 | P |
| | | 1GHz-3GHz | Fig.26 | P |
| | | 3GHz-10GHz | Fig.27 | P |
| | 78 | 2.480 GHz | Fig.28 | P |
| | | 1GHz-3GHz | Fig.29 | P |
| | | 3GHz-10GHz | Fig.30 | P |
| 8DPSK | 0 | 2.402 GHz | Fig.31 | P |
| | | 1GHz-3GHz | Fig.32 | P |
| | | 3GHz-10GHz | Fig.33 | P |
| | 39 | 2.441 GHz | Fig.34 | P |
| | | 1GHz-3GHz | Fig.35 | P |
| | | 3GHz-10GHz | Fig.36 | P |
| | 78 | 2.480 GHz | Fig.37 | P |
| | | 1GHz-3GHz | Fig.38 | P |
| | | 3GHz-10GHz | Fig.39 | P |
| / | All channels | 30 MHz-1GHz | Fig.40 | P |
| | | 10GHz-26GHz | Fig.41 | P |

See below for test graphs.

Conclusion: Pass

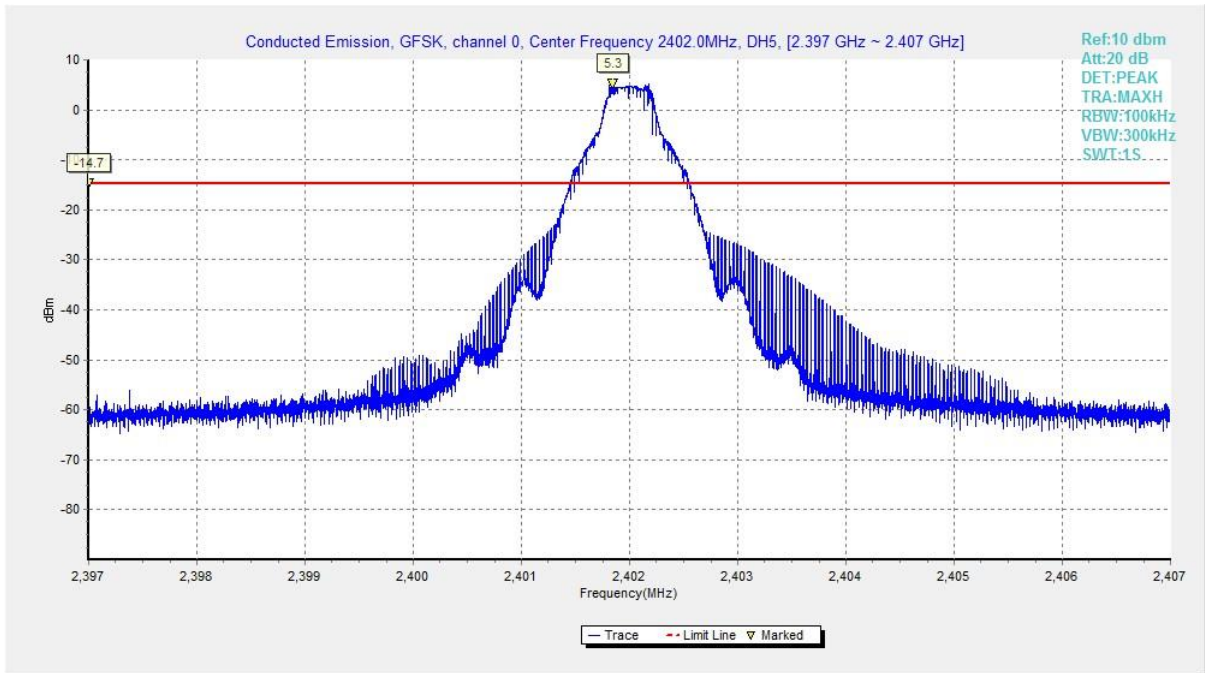


Fig. 13 Conducted Spurious Emission (GFSK, Ch0, 2.402GHz)

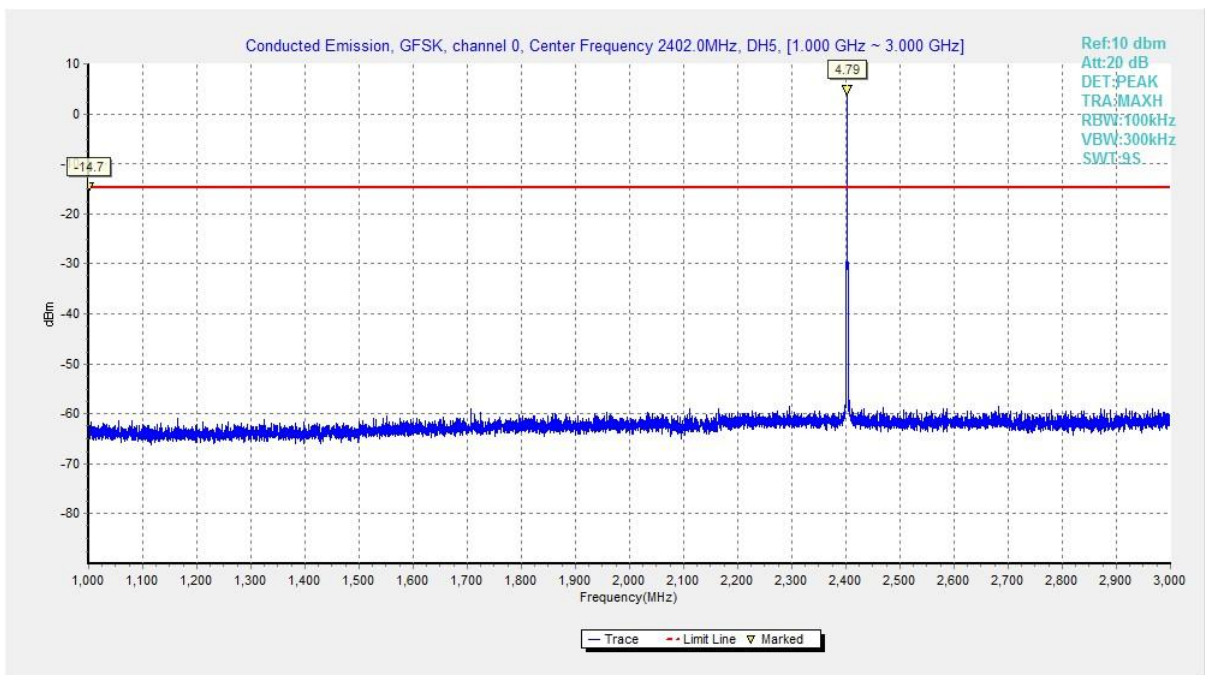


Fig. 14 Conducted Spurious Emission (GFSK, Ch0, 1 GHz-3 GHz)

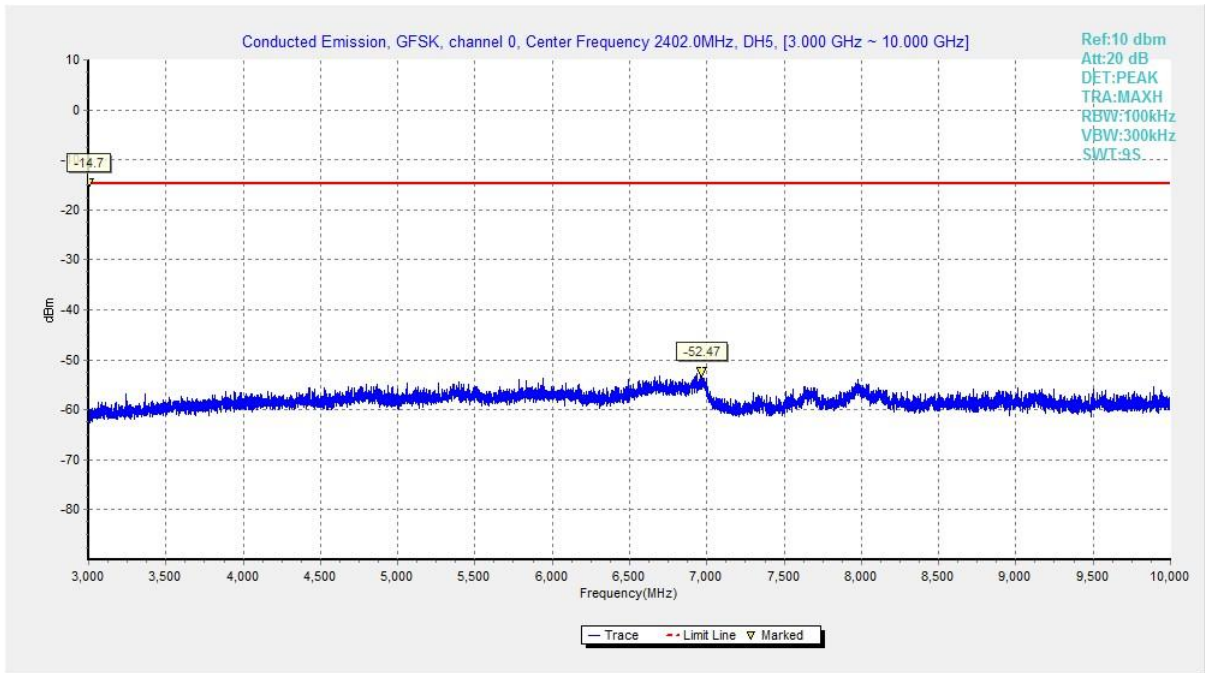


Fig. 15 Conducted Spurious Emission (GFSK, Ch0, 3GHz-10 GHz)

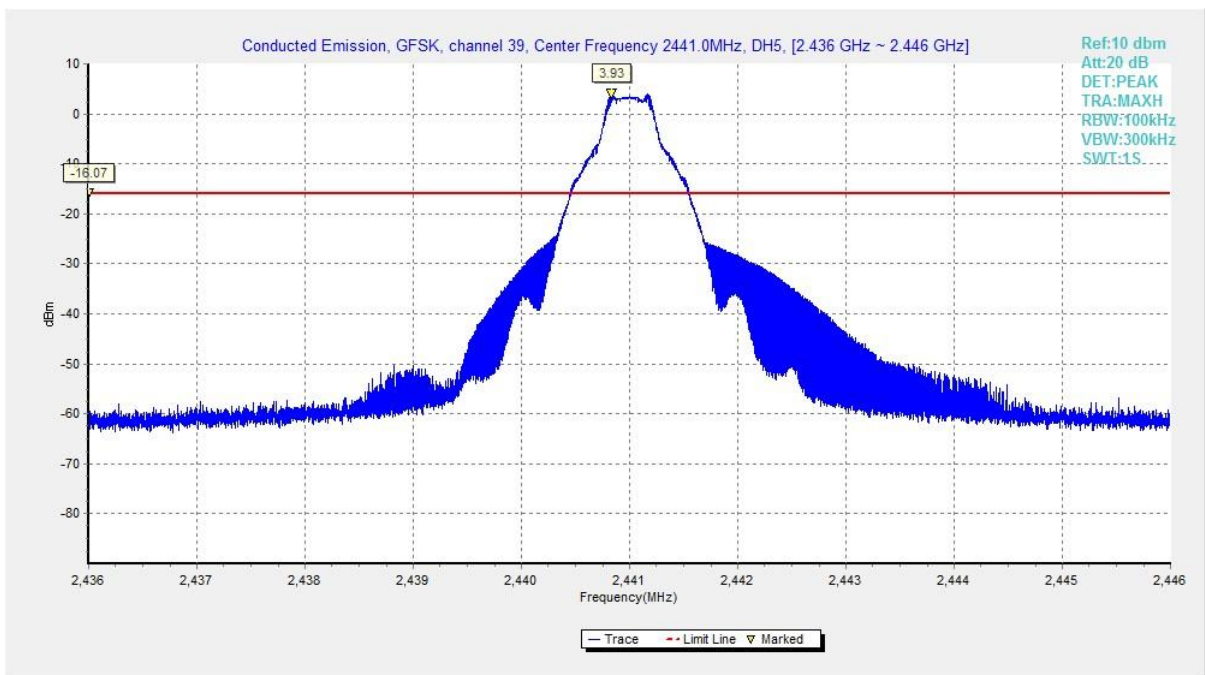


Fig. 16 Conducted Spurious Emission (GFSK, Ch39, 2.441GHz)

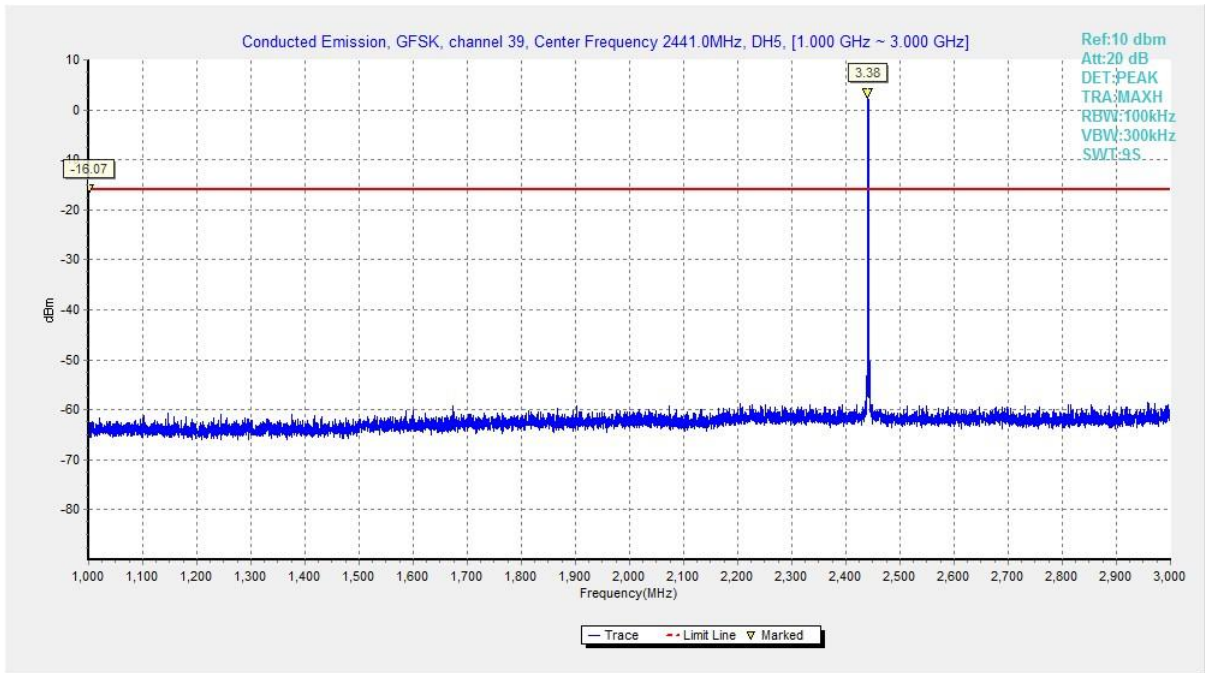


Fig. 17 Conducted Spurious Emission (GFSK, Ch39, 1GHz-3 GHz)

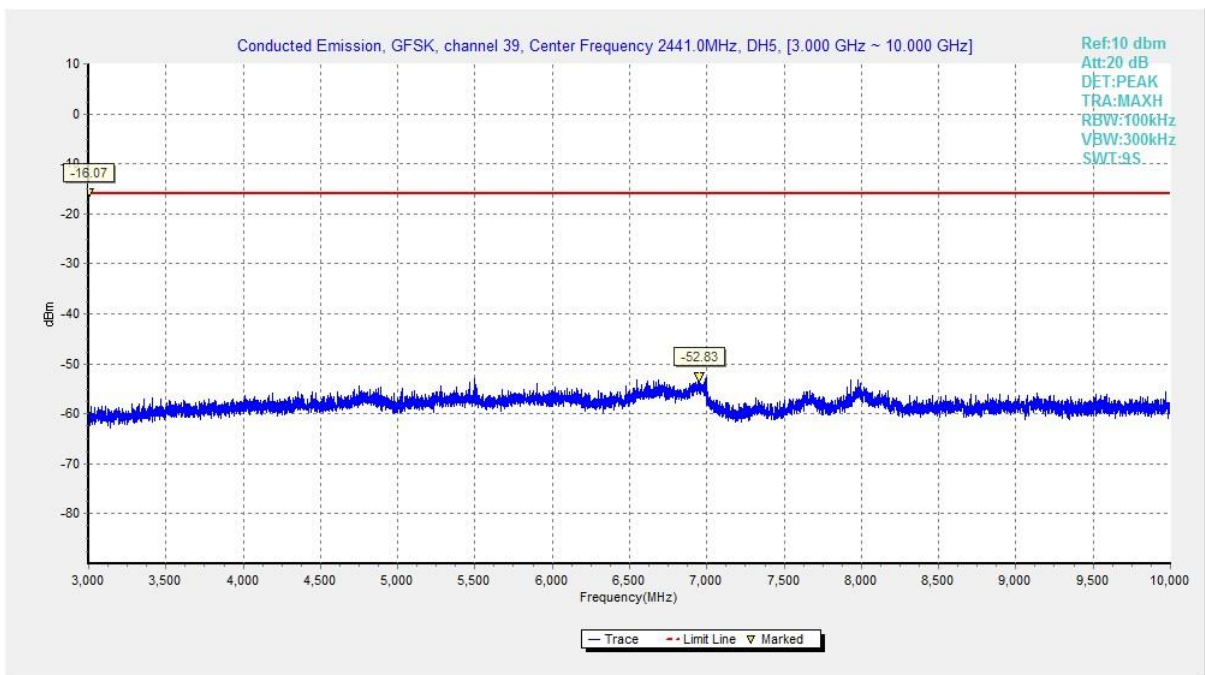


Fig. 18 Conducted Spurious Emission (GFSK, Ch39, 3GHz-10 GHz)

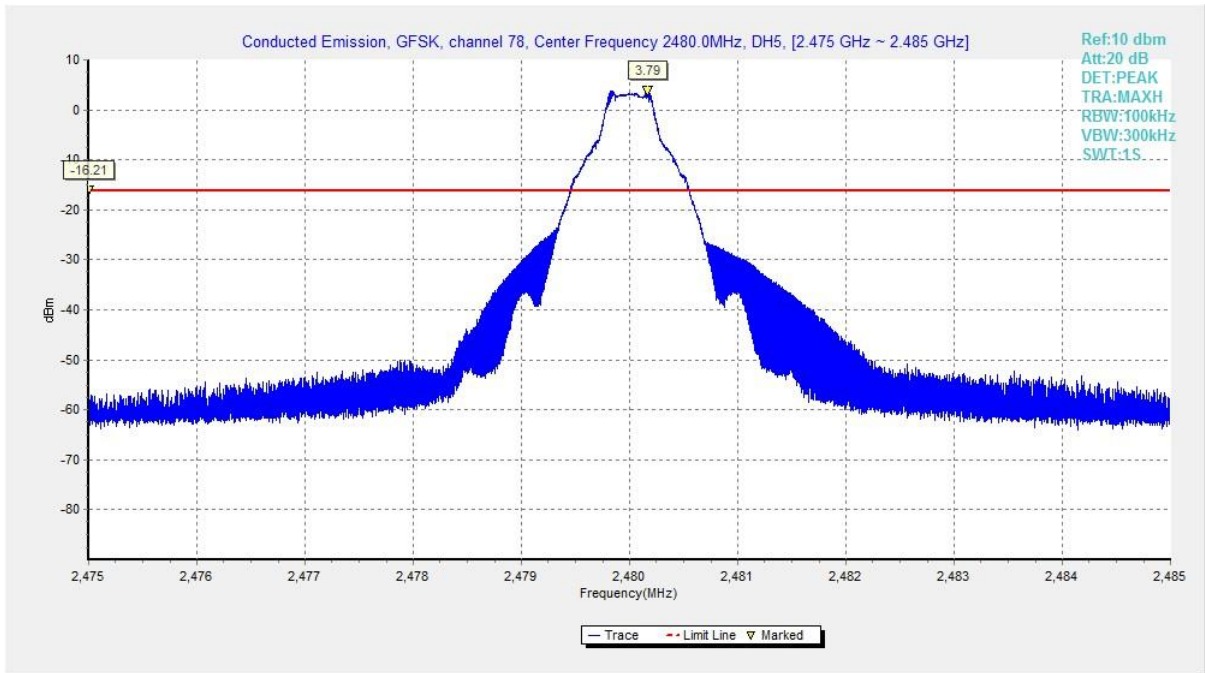


Fig. 19 Conducted Spurious Emission (GFSK, Ch78, 2.480GHz)

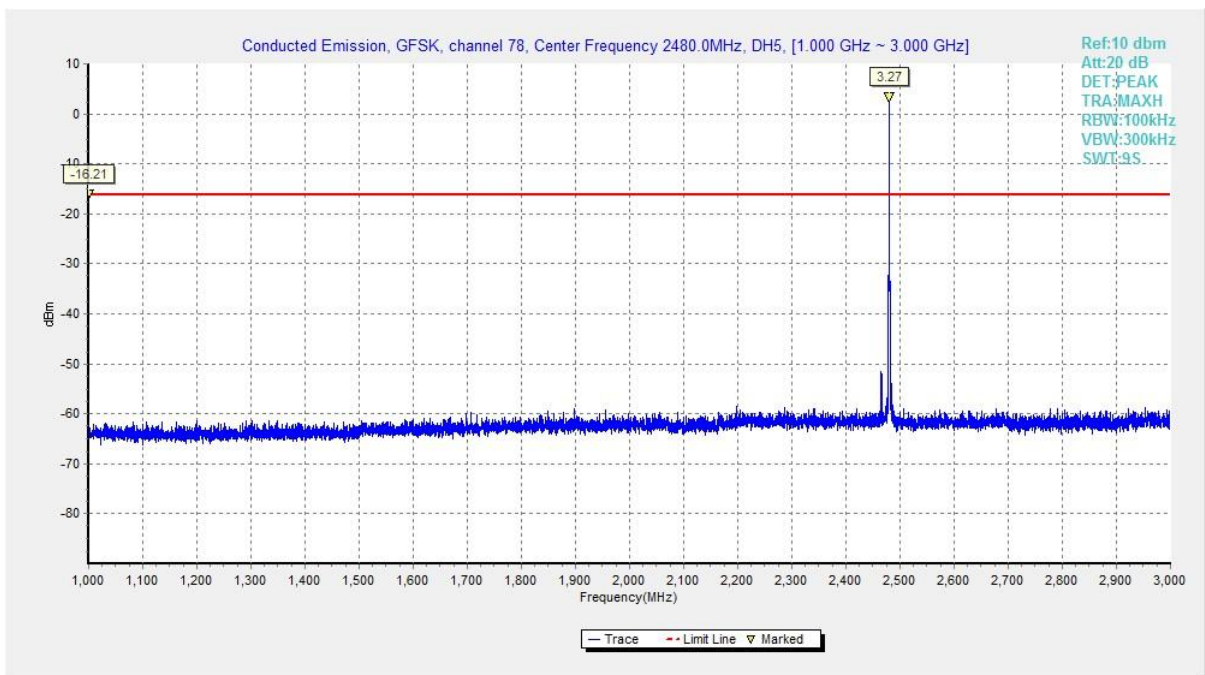


Fig. 20 Conducted Spurious Emission (GFSK, Ch78, 1GHz-3 GHz)

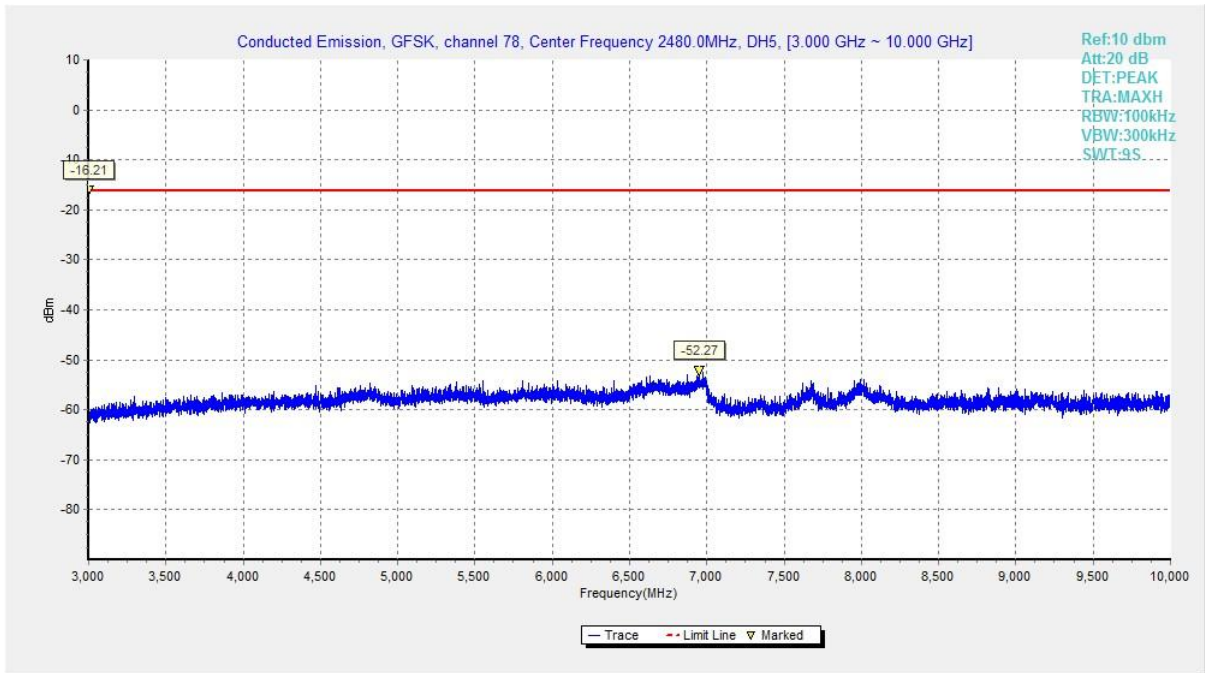


Fig. 21 Conducted Spurious Emission (GFSK, Ch78, 3GHz-10 GHz)

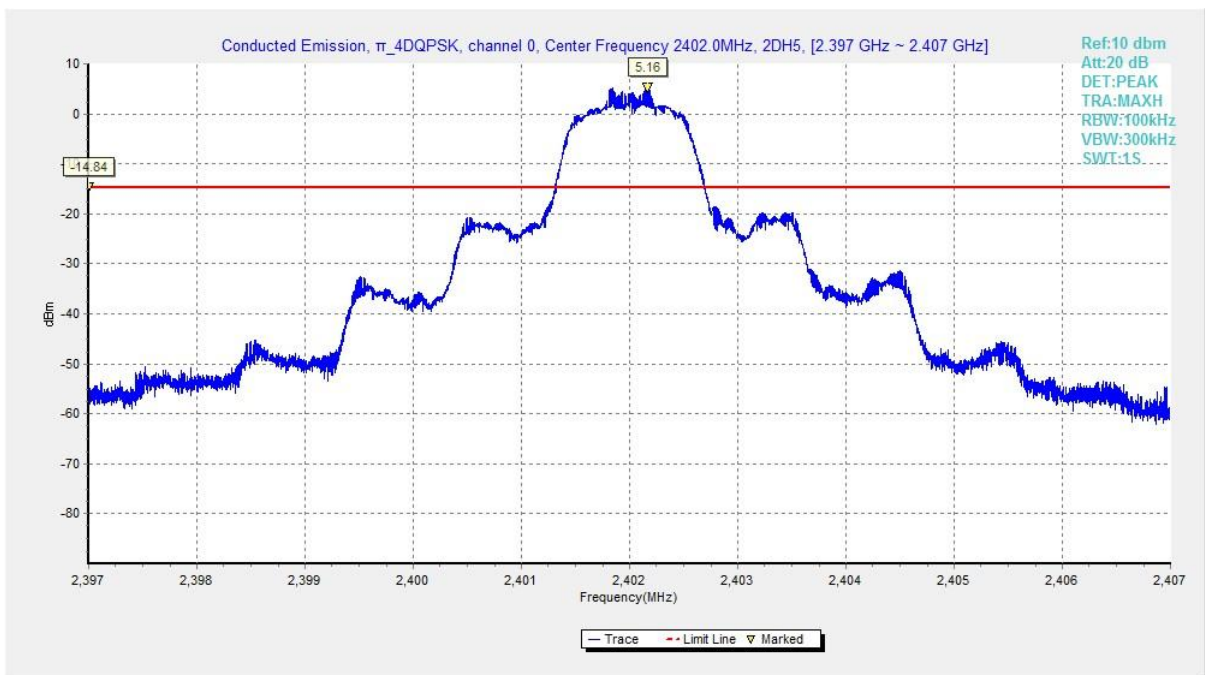


Fig. 22 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 2.402GHz)

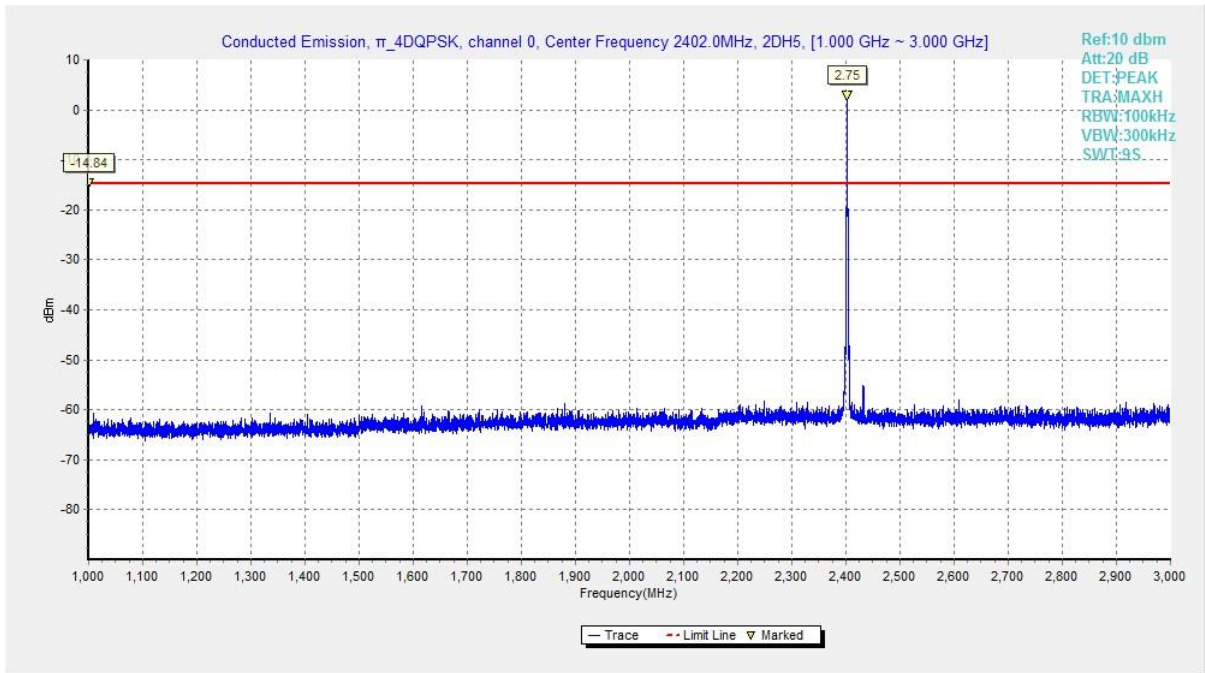


Fig. 23 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 1GHz-3 GHz)

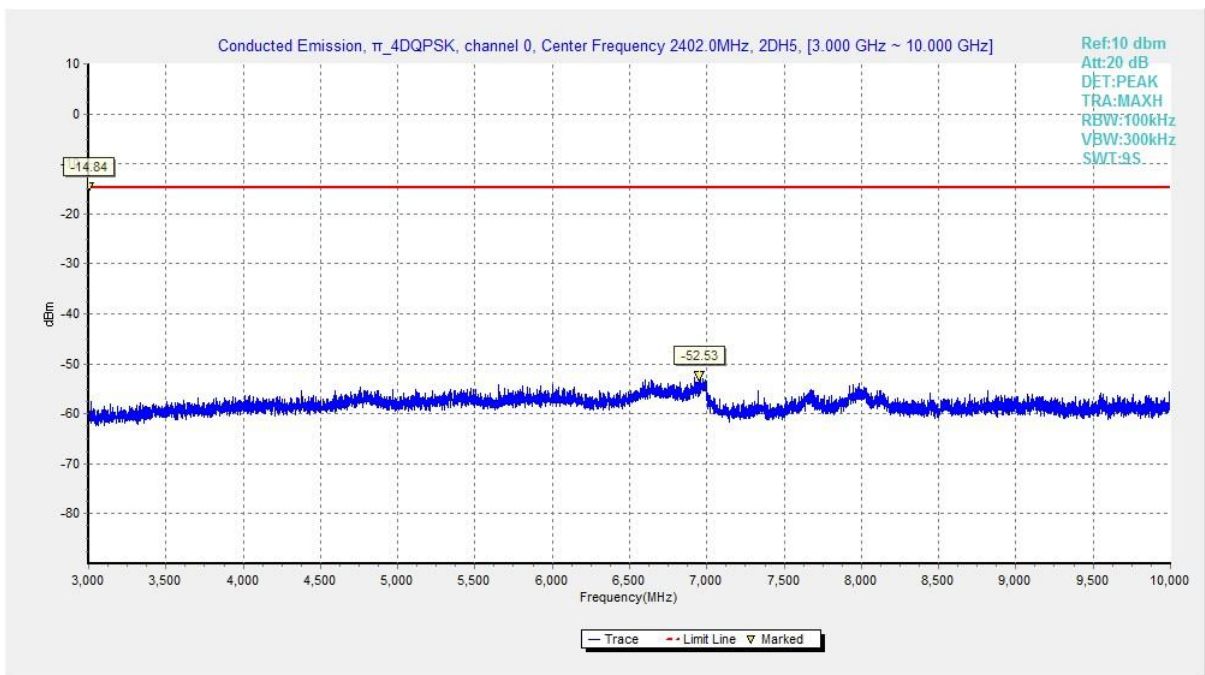


Fig. 24 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch0, 3GHz-10 GHz)

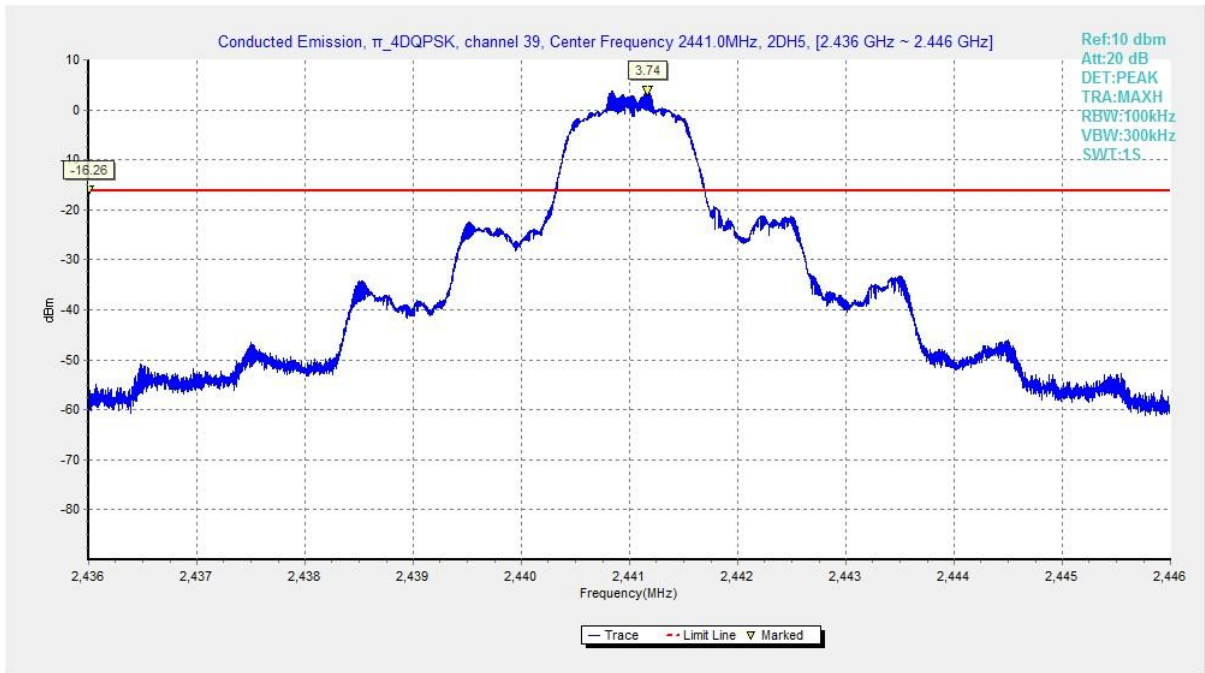


Fig. 25 Conducted Spurious Emission (π / 4 DQPSK, Ch39, 2.441GHz)

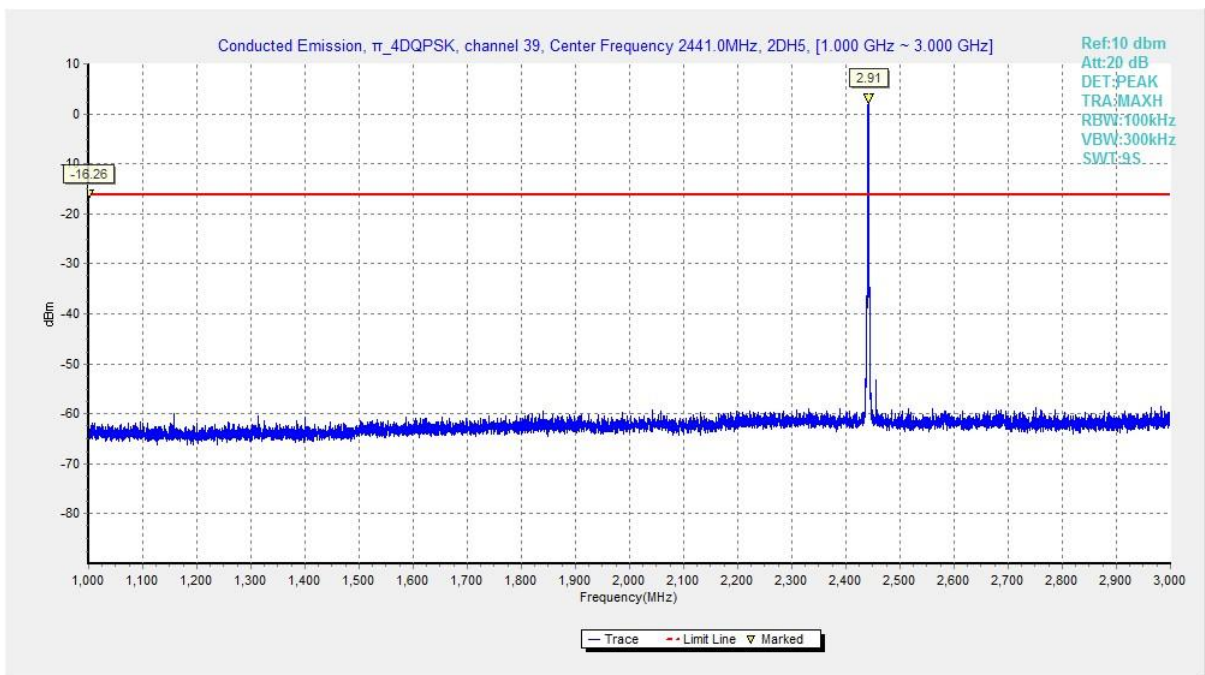


Fig. 26 Conducted Spurious Emission (π / 4 DQPSK, Ch39, 1GHz-3 GHz)

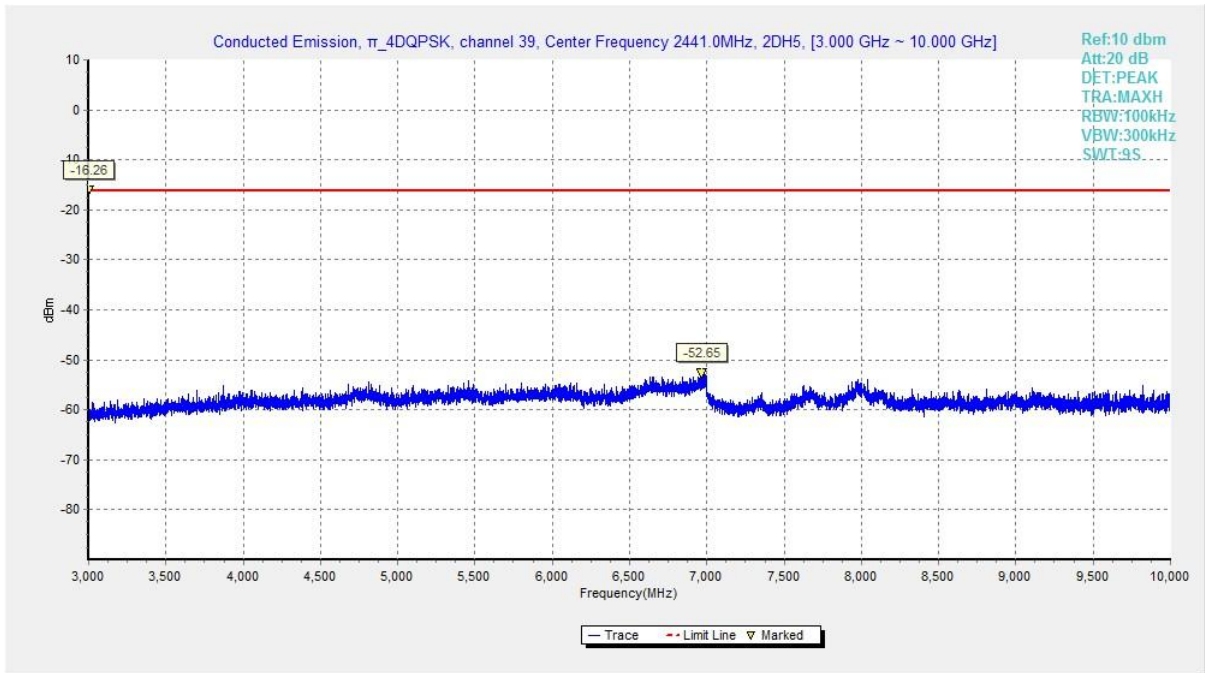


Fig. 27 Conducted Spurious Emission (π /4 DQPSK, Ch39, 3GHz-10 GHz)

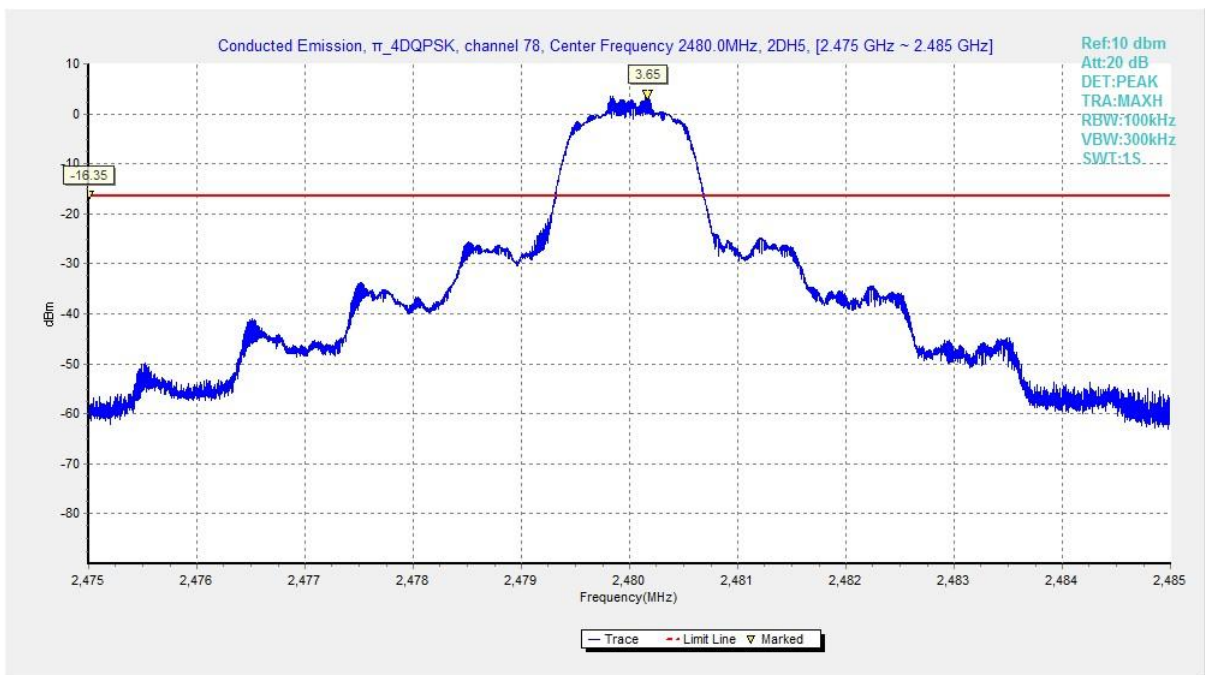


Fig. 28 Conducted Spurious Emission (π /4 DQPSK, Ch78, 2.480GHz)

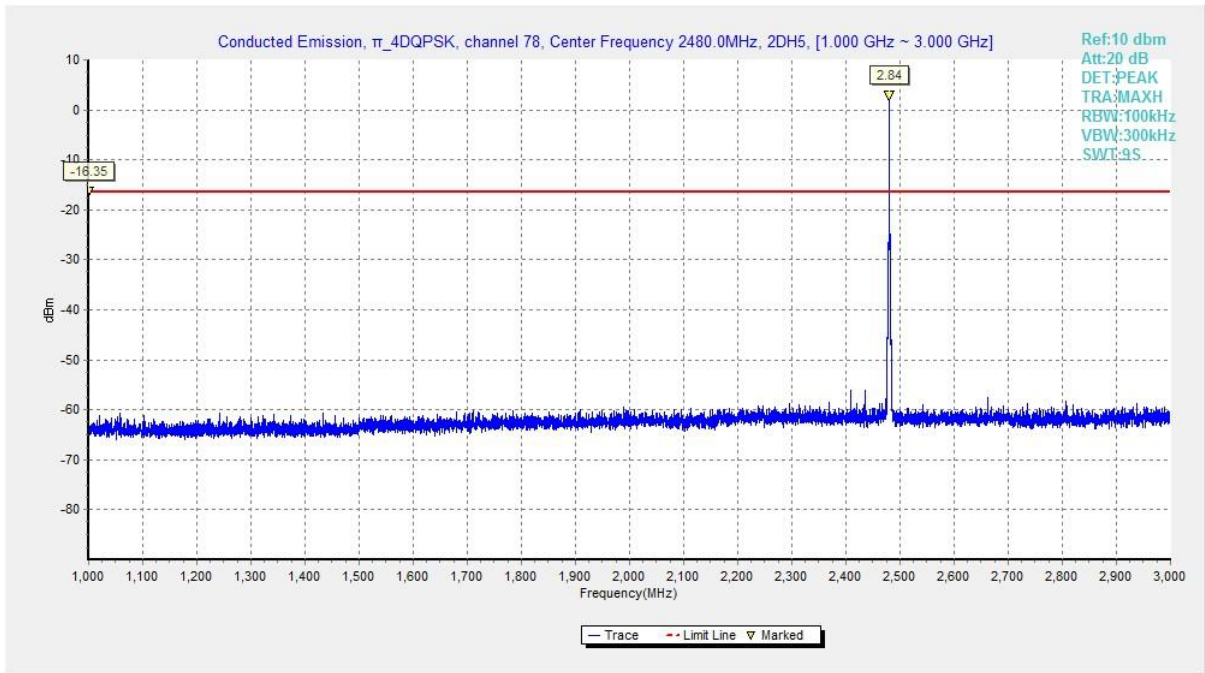


Fig. 29 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch78, 1GHz-3 GHz)

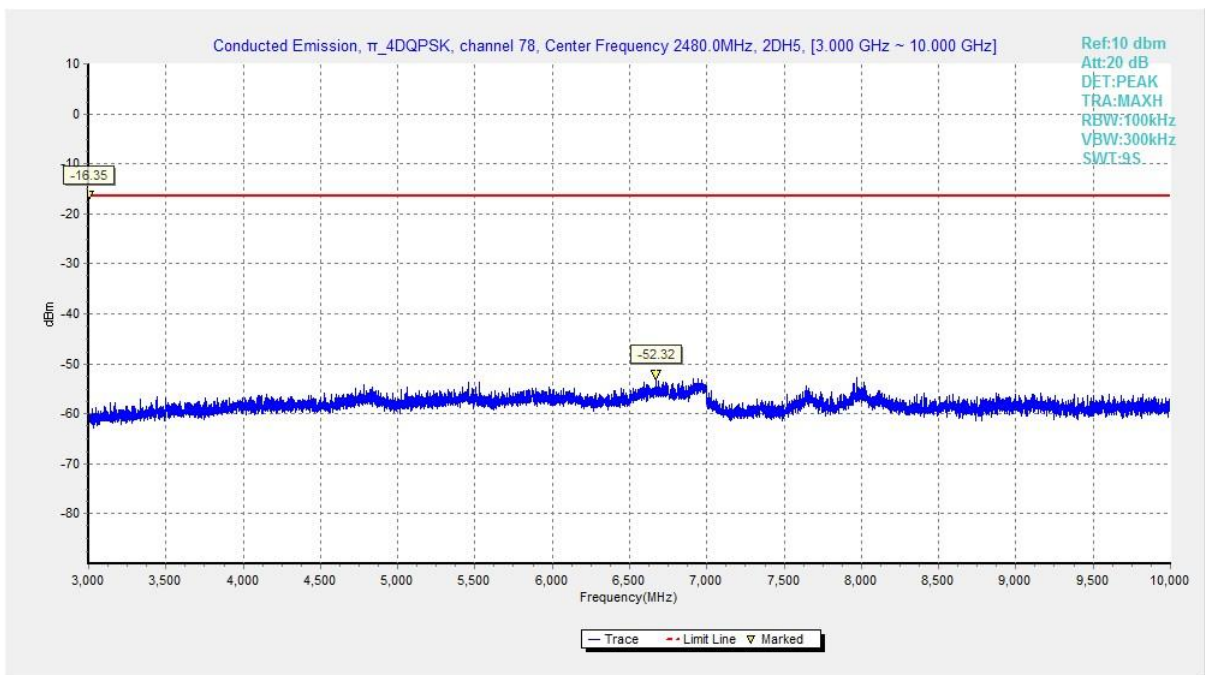


Fig. 30 Conducted Spurious Emission ($\pi/4$ DQPSK, Ch78, 3GHz-10 GHz)

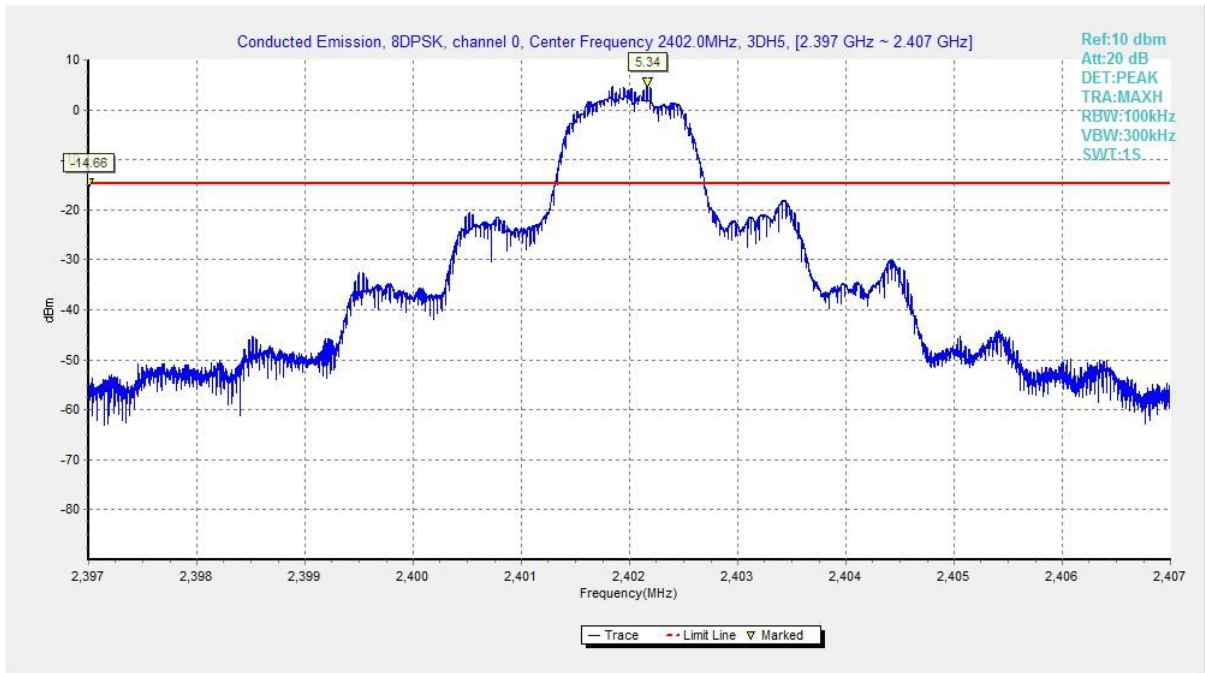


Fig. 31 Conducted Spurious Emission (8DPSK, Ch0, 2.402GHz)

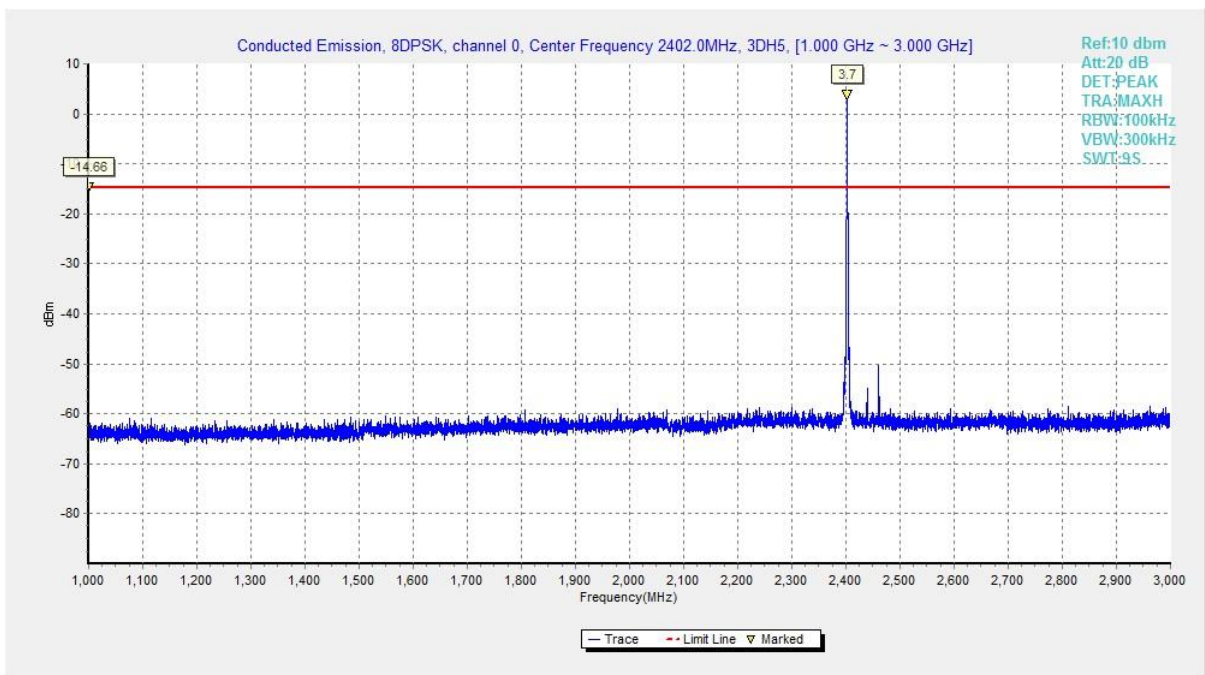


Fig. 32 Conducted Spurious Emission (8DPSK, Ch0, 1GHz-3 GHz)

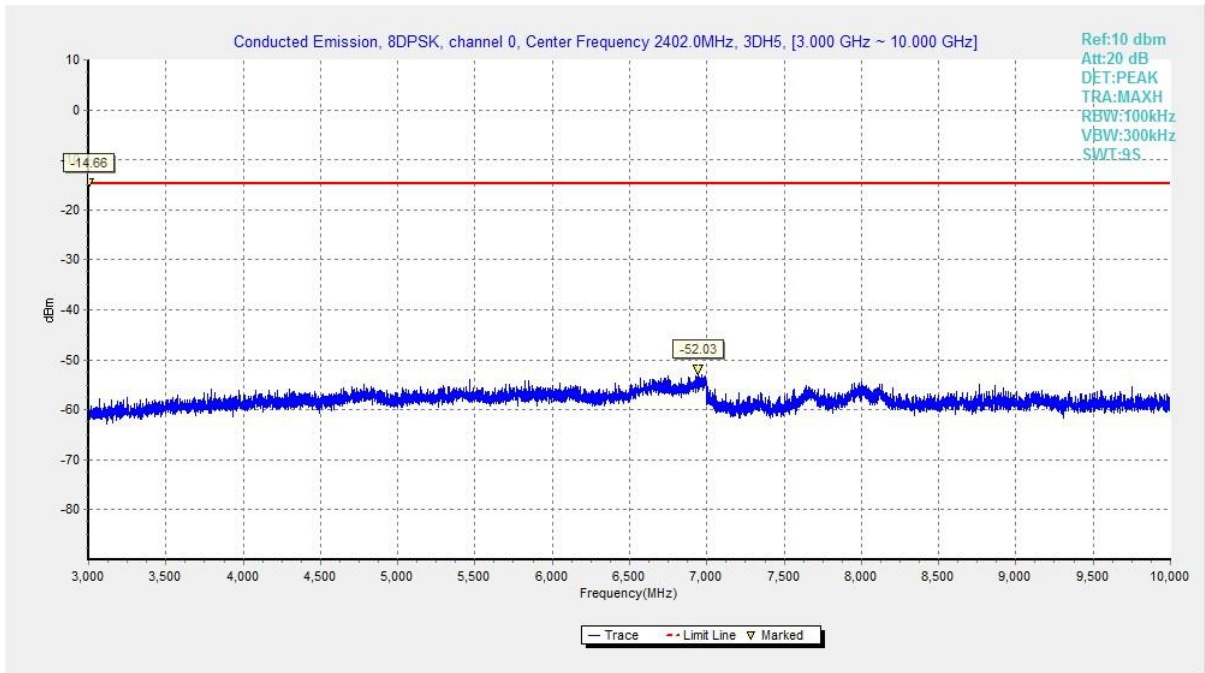


Fig. 33 Conducted Spurious Emission (8DPSK, Ch0, 3GHz-10 GHz)

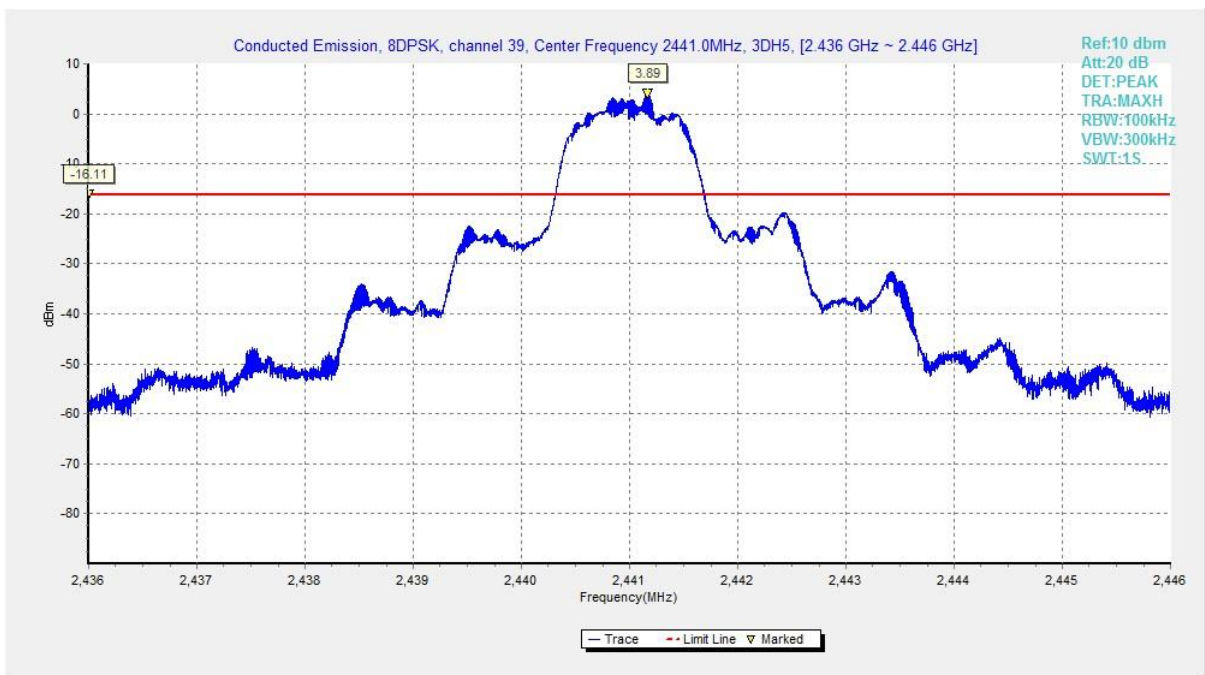


Fig. 34 Conducted Spurious Emission (8DPSK, Ch39, 2.441GHz)

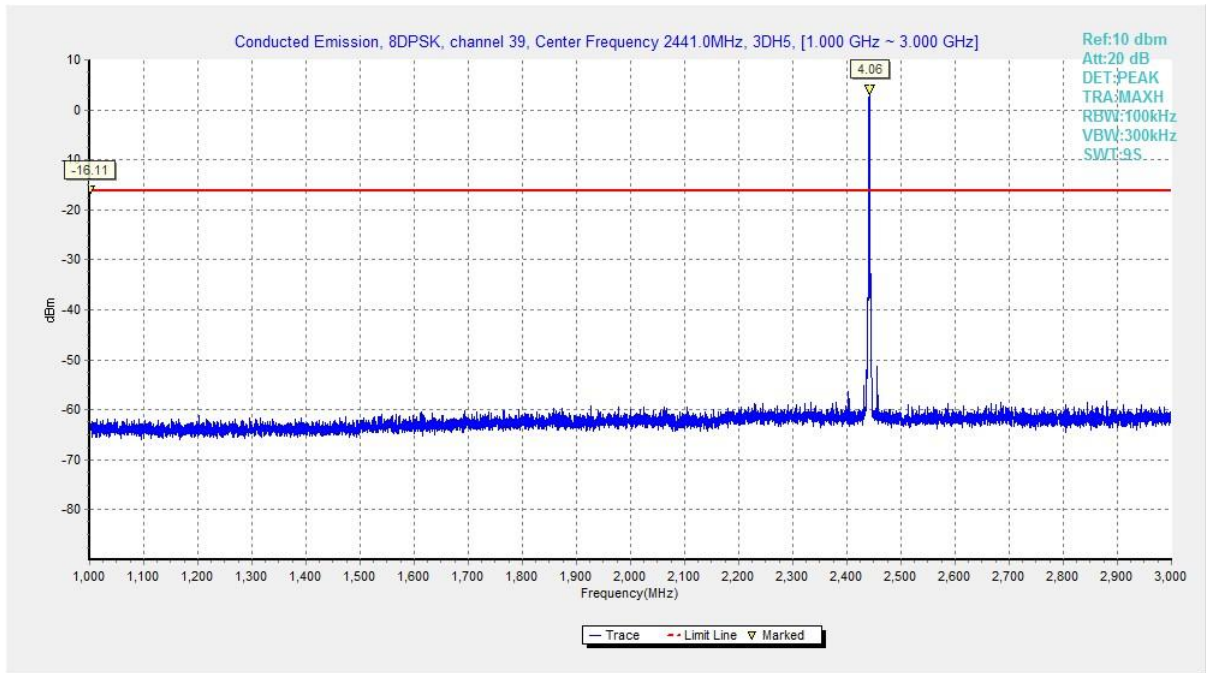


Fig. 35 Conducted Spurious Emission (8DPSK, Ch39, 1GHz-3 GHz)

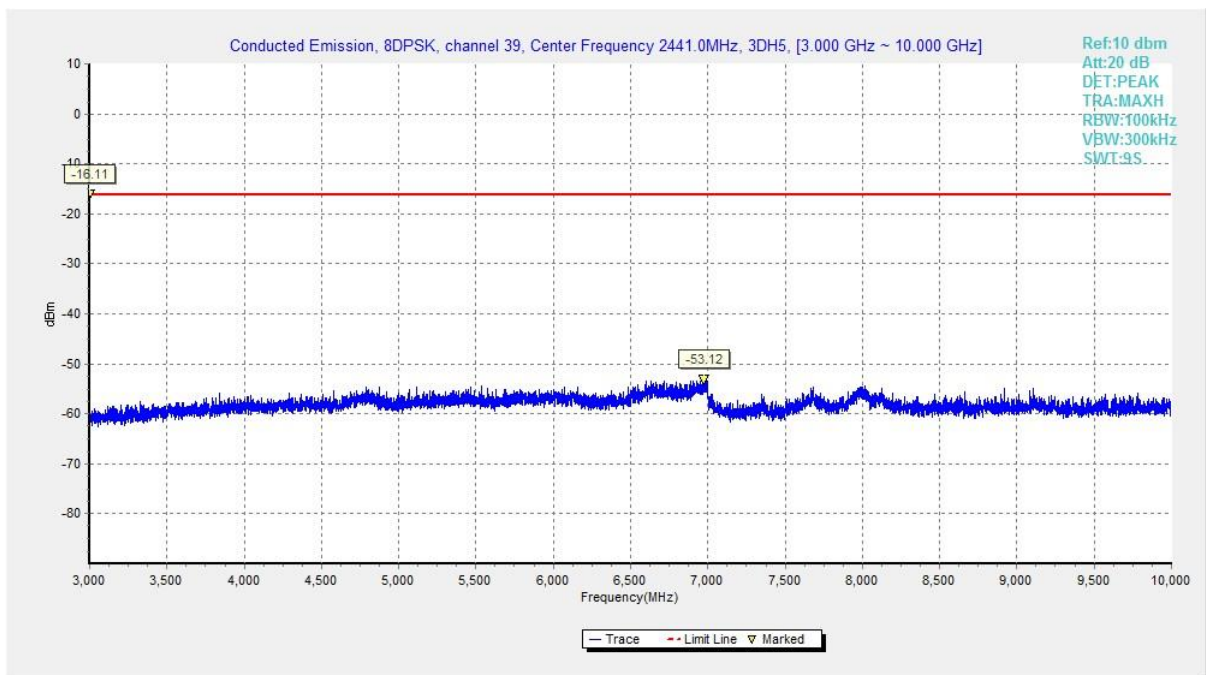


Fig. 36 Conducted Spurious Emission (8DPSK, Ch39, 3GHz-10 GHz)

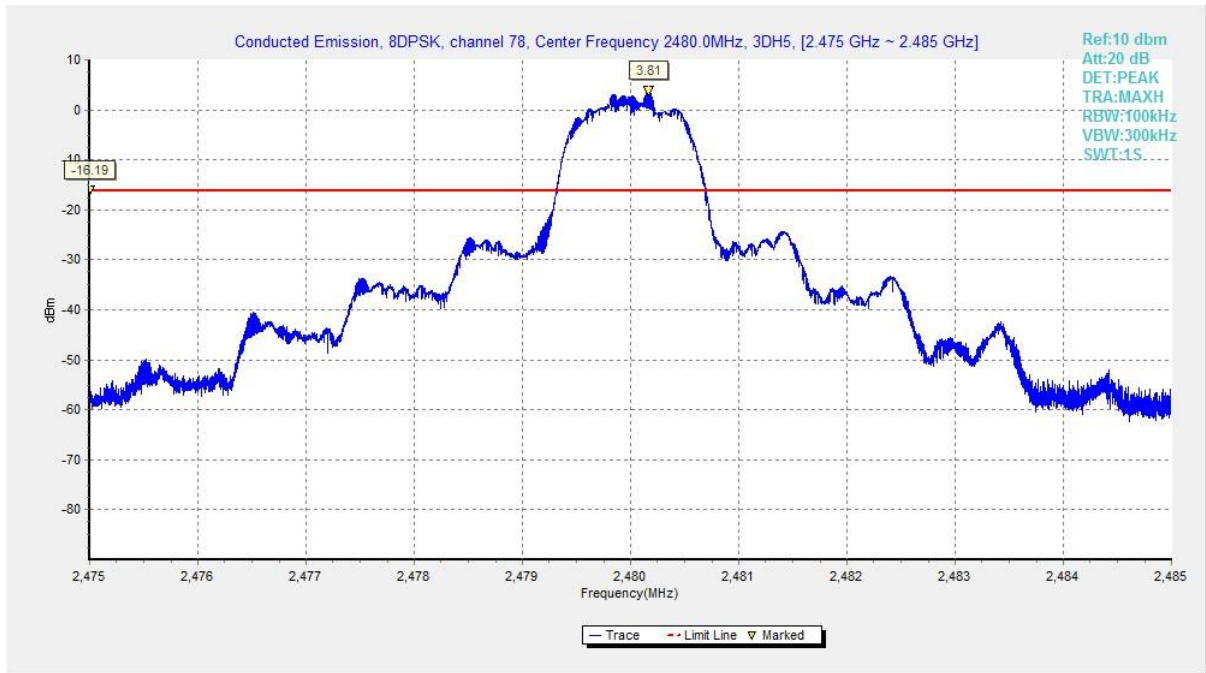


Fig. 37 Conducted Spurious Emission (8DPSK, Ch78, 2.480GHz)

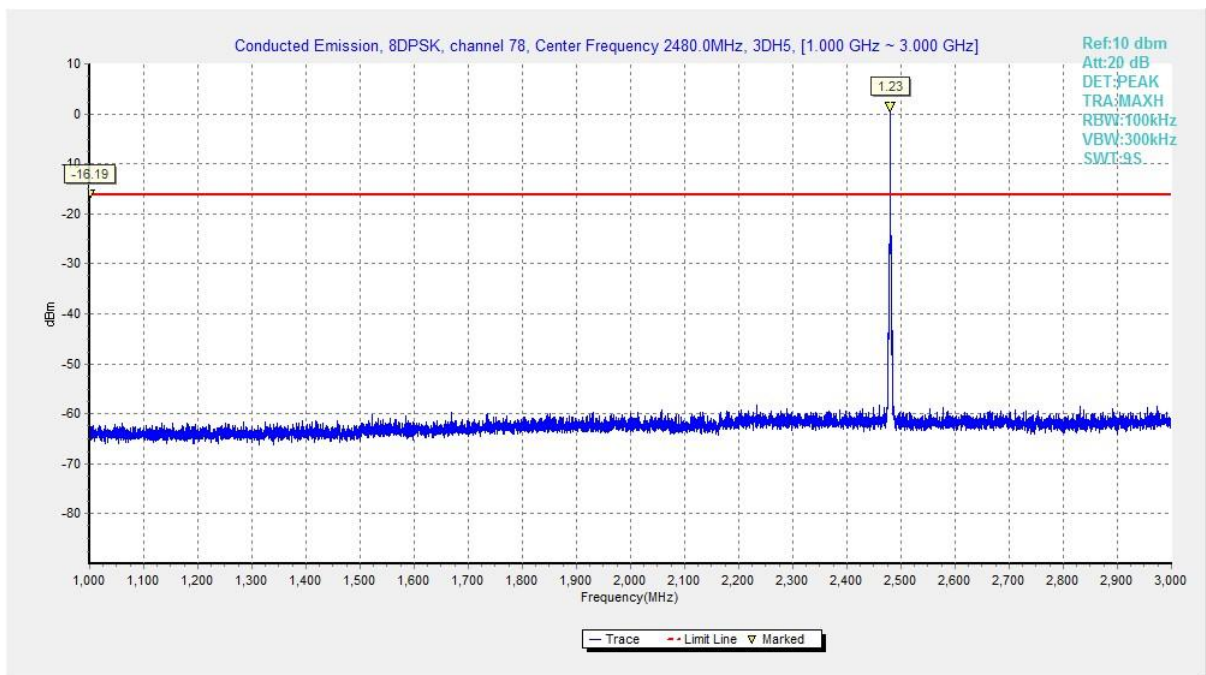


Fig. 38 Conducted Spurious Emission (8DPSK, Ch78, 1GHz-3 GHz)

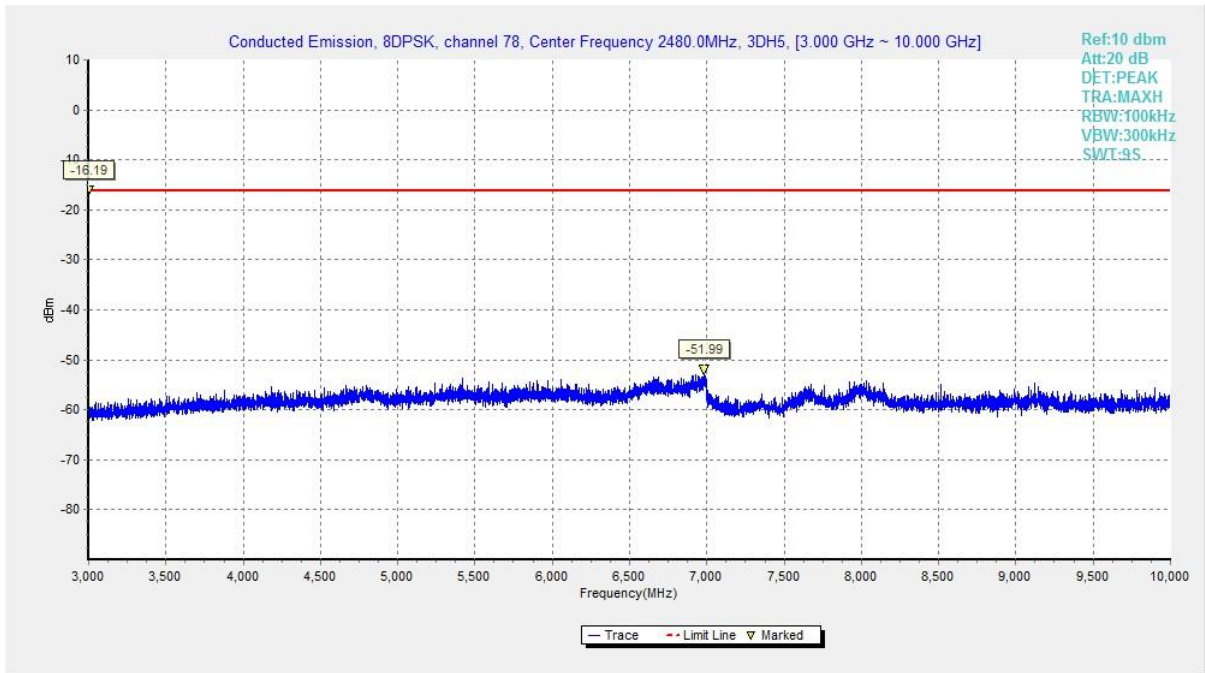


Fig. 39 Conducted Spurious Emission (8DPSK, Ch78, 3GHz-10 GHz)

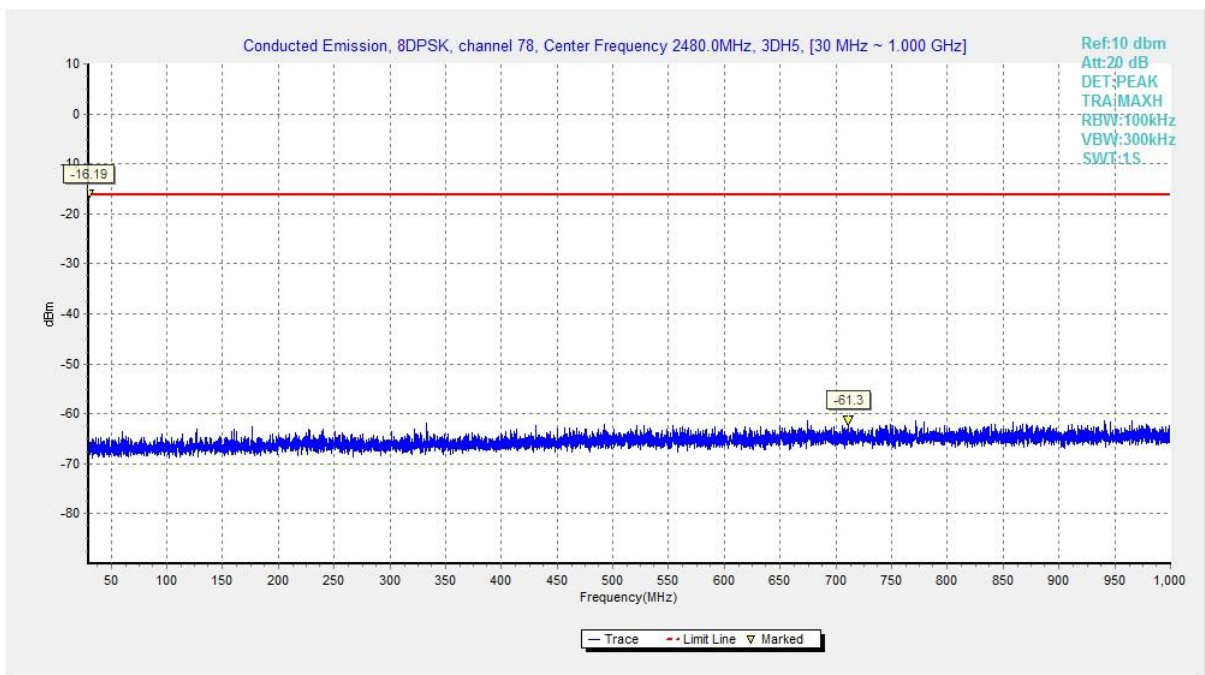


Fig. 40 Conducted Spurious Emission (All channel, 30 MHz-1 GHz)

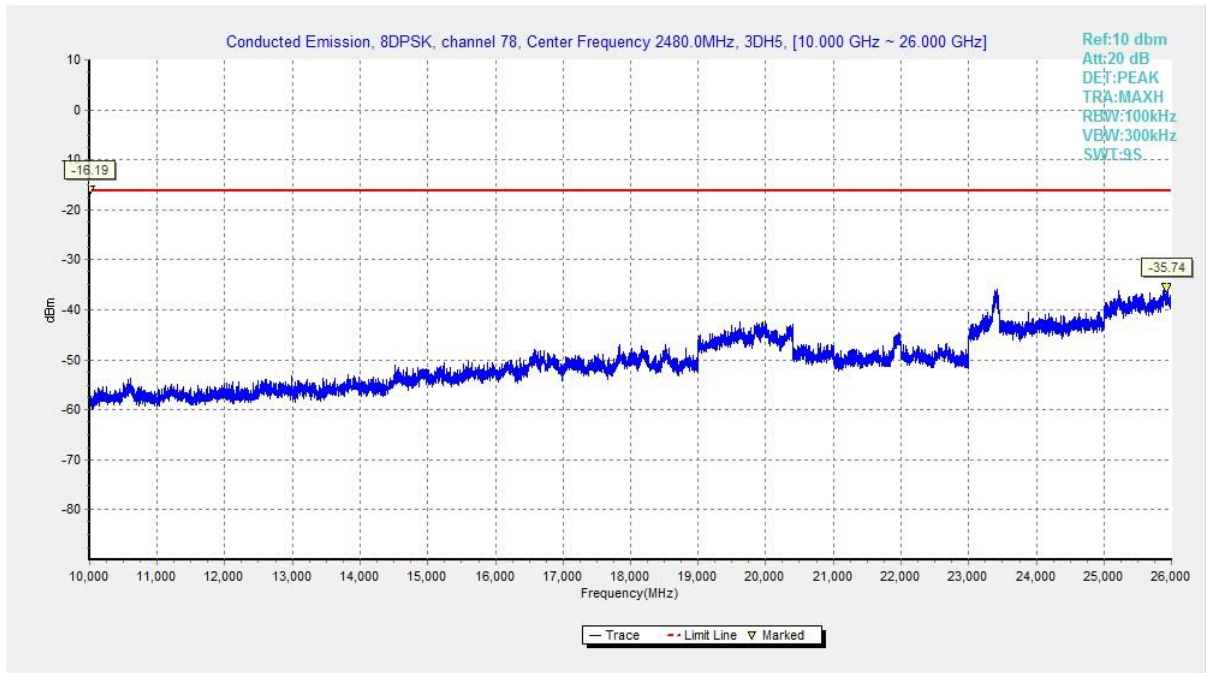


Fig. 41 Conducted Spurious Emission All channel, 10GHz-26 GHz)

A.4 Radiated Emission

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)).

Limit in restricted band:

| Frequency of emission (MHz) | Field strength ($\mu\text{V}/\text{m}$) | Measurement distance (meters) |
|-----------------------------|---|-------------------------------|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

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 | 120kHz/300kHz | 5 |
| 1000-4000 | 1MHz/3MHz | 15 |
| 4000-18000 | 1MHz/3MHz | 40 |
| 18000-26500 | 1MHz/3MHz | 20 |

Note: According to the performance evaluation, the radiated emission margin of EUT is over 20dB in the band from 9kHz to 30MHz. Therefore, the measurement starts from 30MHz to tenth harmonic.

The measurement results include the horizontal polarization and vertical polarization measurements.

Measurement Results:

| Mode | Channel | Frequency Range | Test Results | Conclusion |
|------------------|------------------------|---------------------|--------------|------------|
| GFSK | 0 | 1 GHz ~ 3 GHz | Fig.42 | P |
| | 0 | 3 GHz ~ 18 GHz | Fig.43 | P |
| | 39 | 1 GHz ~ 3 GHz | Fig.44 | P |
| | 39 | 3 GHz ~ 18 GHz | Fig.45 | P |
| | 78 | 1 GHz ~ 3 GHz | Fig.46 | P |
| | 78 | 3 GHz ~ 18 GHz | Fig.47 | P |
| | Restricted Band(CH0) | 2.38 GHz ~ 2.45 GHz | Fig.48 | P |
| | Restricted Band (CH78) | 2.45 GHz ~ 2.5 GHz | Fig.49 | P |
| $\pi/4$ DQPSK | 0 | 1 GHz ~ 3 GHz | Fig.50 | P |
| | 0 | 3 GHz ~ 18 GHz | Fig.51 | P |
| | 39 | 1 GHz ~ 3 GHz | Fig.52 | P |
| | 39 | 3 GHz ~ 18 GHz | Fig.53 | P |
| | 78 | 1 GHz ~ 3 GHz | Fig.54 | P |
| | 78 | 3 GHz ~ 18 GHz | Fig.55 | P |
| | Restricted Band (CH0) | 2.38 GHz ~ 2.45 GHz | Fig.56 | P |
| | Restricted Band (CH78) | 2.45 GHz ~ 2.5 GHz | Fig.57 | P |
| 8DPSK | 0 | 1 GHz ~ 3 GHz | Fig.58 | P |
| | 0 | 3 GHz ~ 18 GHz | Fig.59 | P |
| | 39 | 1 GHz ~ 3 GHz | Fig.60 | P |
| | 39 | 3 GHz ~ 18 GHz | Fig.61 | P |
| | 78 | 1 GHz ~ 3 GHz | Fig.62 | P |
| | 78 | 3 GHz ~ 18 GHz | Fig.63 | P |
| | Restricted Band (CH0) | 2.38 GHz ~ 2.45 GHz | Fig.64 | P |
| | Restricted Band (CH78) | 2.45 GHz ~ 2.5 GHz | Fig.65 | P |
| / | All channels | 9 kHz ~ 30 MHz | Fig.66 | P |
| | | 30 MHz ~ 1 GHz | Fig.67 | P |
| | | 18 GHz ~ 26.5 GHz | Fig.68 | P |

Worst Case Result
GFSK CH0 (3-18GHz)

| Frequency (MHz) | MaxPeak (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 10617.50 | 48.78 | 74.00 | 25.22 | H | 4.9 |
| 11706.00 | 49.99 | 74.00 | 24.01 | H | 6.9 |
| 13250.50 | 51.26 | 74.00 | 22.74 | V | 8.7 |
| 14812.50 | 51.93 | 74.00 | 22.07 | H | 10.7 |
| 16119.00 | 53.34 | 74.00 | 20.66 | H | 14.1 |
| 17244.50 | 54.05 | 74.00 | 19.95 | H | 14.8 |

| Frequency (MHz) | Average (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 10700.00 | 36.03 | 54.00 | 17.97 | H | 4.9 |
| 11616.50 | 37.73 | 54.00 | 16.27 | V | 6.8 |
| 13458.00 | 38.25 | 54.00 | 15.75 | H | 8.5 |
| 14869.00 | 39.86 | 54.00 | 14.14 | V | 10.9 |
| 16272.50 | 41.28 | 54.00 | 12.72 | H | 14.3 |
| 17338.00 | 42.36 | 54.00 | 11.64 | H | 14.8 |

 $\pi/4$ DQPSK CH0 (3-18GHz)

| Frequency (MHz) | MaxPeak (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 12171.00 | 49.16 | 74.00 | 24.84 | V | 7.2 |
| 13071.50 | 50.22 | 74.00 | 23.78 | V | 8.4 |
| 13936.00 | 50.01 | 74.00 | 23.99 | V | 9.5 |
| 15324.00 | 50.93 | 74.00 | 23.07 | V | 11.4 |
| 16480.50 | 54.27 | 74.00 | 19.73 | V | 14.6 |
| 17511.00 | 54.08 | 74.00 | 19.92 | V | 14.9 |

| Frequency (MHz) | Average (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 12307.50 | 37.47 | 54.00 | 16.53 | V | 7.1 |
| 13172.50 | 38.49 | 54.00 | 15.51 | V | 8.5 |
| 14070.50 | 37.94 | 54.00 | 16.06 | V | 9.9 |
| 15329.50 | 39.51 | 54.00 | 14.49 | V | 11.5 |
| 16521.00 | 42.19 | 54.00 | 11.81 | V | 14.8 |
| 17574.50 | 42.54 | 54.00 | 11.46 | V | 15.5 |

8DPSK CH0 (3-18GHz)

| Frequency (MHz) | MaxPeak (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 12629.00 | 49.78 | 74.00 | 24.22 | V | 7.7 |
| 13554.50 | 51.27 | 74.00 | 22.73 | V | 8.6 |
| 14491.00 | 52.00 | 74.00 | 22.00 | V | 11.4 |
| 15948.00 | 53.24 | 74.00 | 20.76 | V | 13.3 |
| 16899.00 | 53.54 | 74.00 | 20.46 | V | 15.1 |
| 17652.00 | 53.47 | 74.00 | 20.53 | V | 15.5 |

| Frequency (MHz) | Average (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Pol | Corr. (dB) |
|-----------------|------------------|----------------|-------------|-----|------------|
| 12779.00 | 37.32 | 54.00 | 16.68 | V | 7.8 |
| 13517.00 | 38.57 | 54.00 | 15.43 | V | 8.8 |
| 14583.50 | 39.74 | 54.00 | 14.26 | V | 11.3 |
| 15942.00 | 40.99 | 54.00 | 13.01 | V | 13.3 |
| 16747.00 | 42.57 | 54.00 | 11.43 | V | 14.9 |
| 17758.50 | 42.43 | 54.00 | 11.57 | V | 16.2 |

Note:

A "reference path loss" is established and the A_{Rpl} is the attenuation of "reference path loss", and Antenna Factor, the gain of the preamplifier, the cable loss. 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 - Gain of the preamplifier

See below for test graphs.

Conclusion: Pass

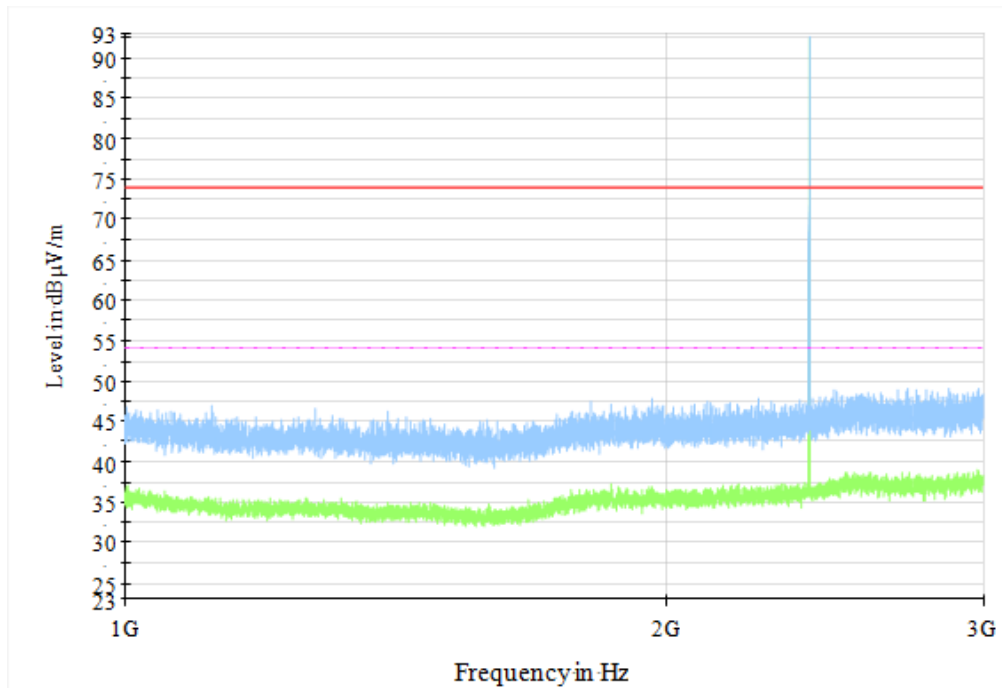


Fig. 42 Radiated Spurious Emission (GFSK, Ch0, 1GHz ~ 3GHz)

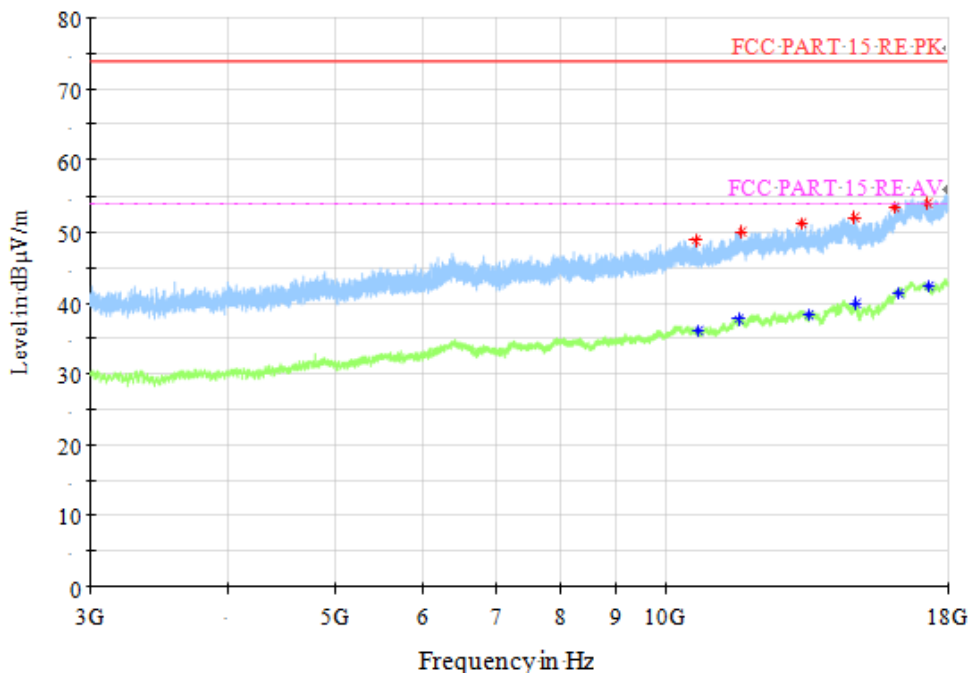


Fig. 43 Radiated Spurious Emission (GFSK, Ch0, 3GHz ~ 18GHz)

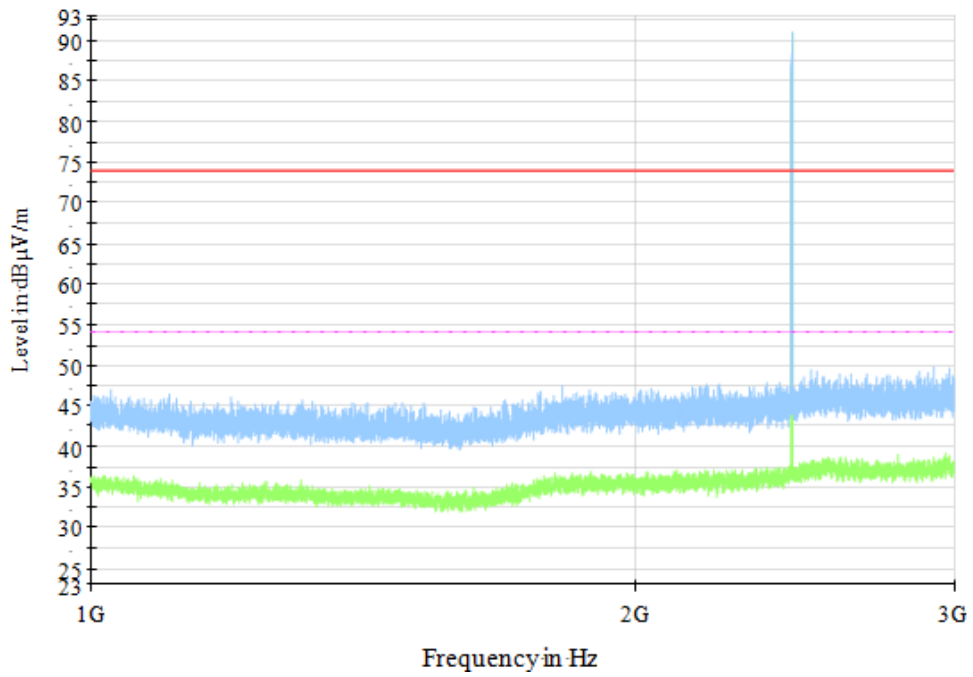


Fig. 44 Radiated Spurious Emission (GFSK, Ch39, 1GHz ~ 3GHz)

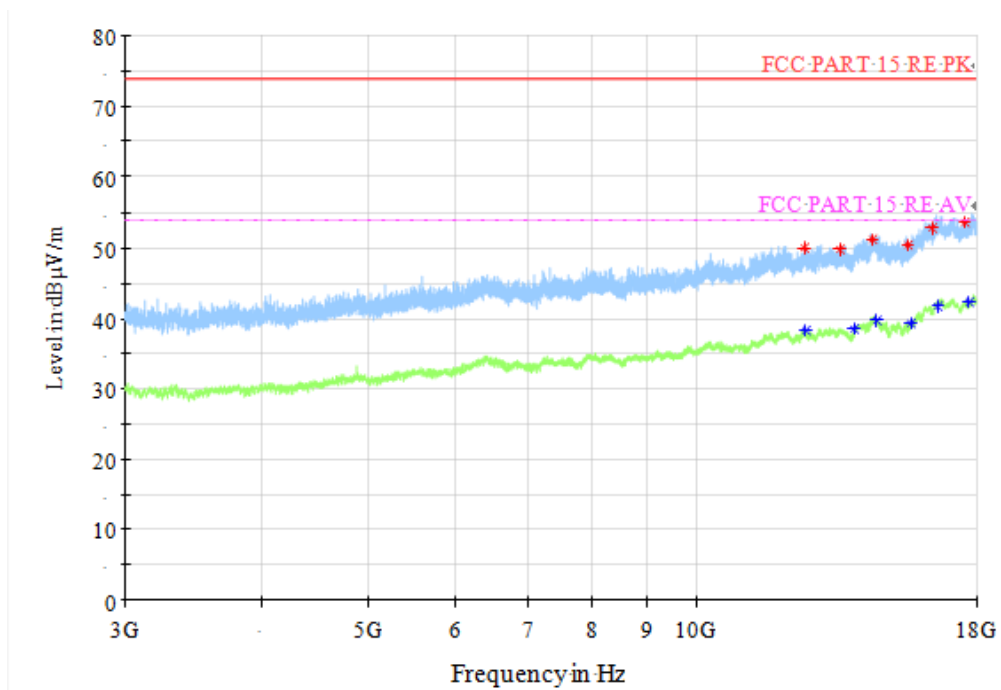


Fig. 45 Radiated Spurious Emission (GFSK, Ch39, 3GHz ~ 18GHz)

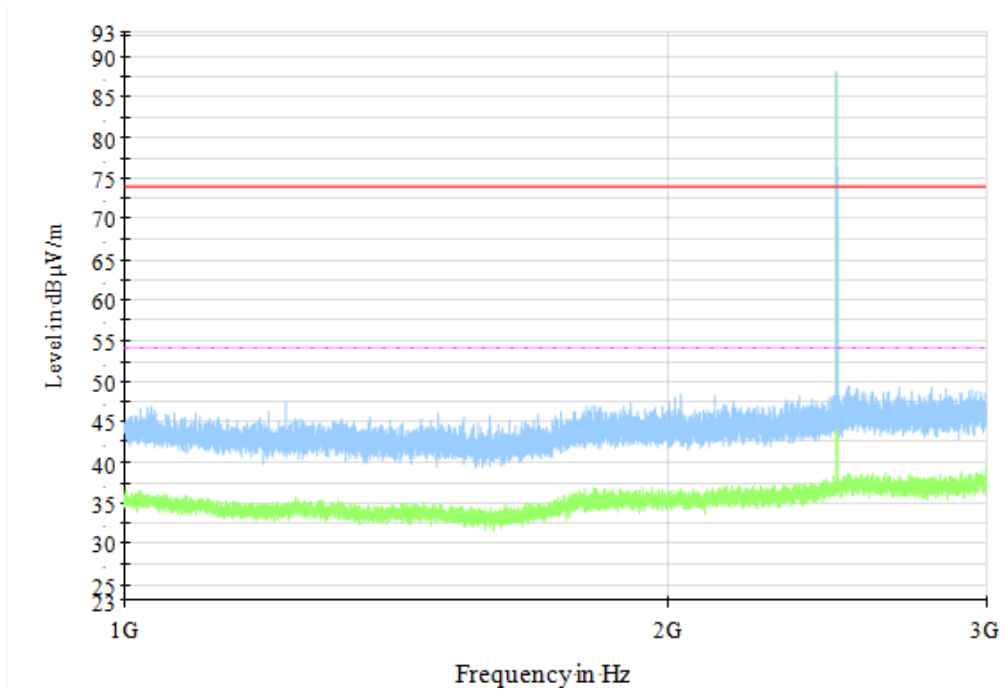


Fig. 46 Radiated Spurious Emission (GFSK, Ch78, 1GHz ~ 3GHz)

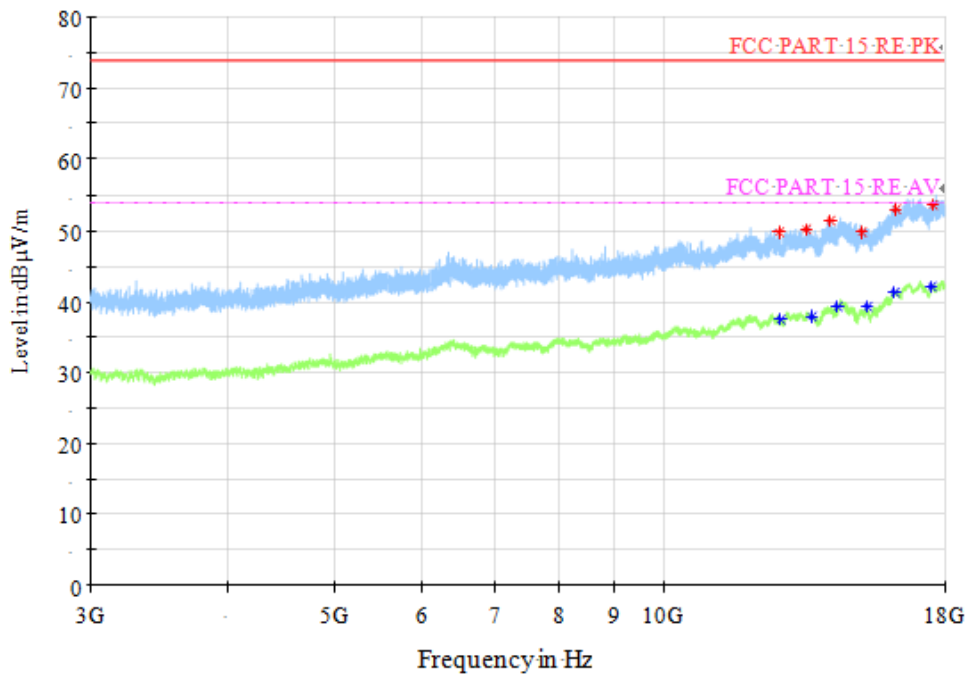


Fig. 47 Radiated Spurious Emission (GFSK, Ch78, 3GHz ~ 18GHz)

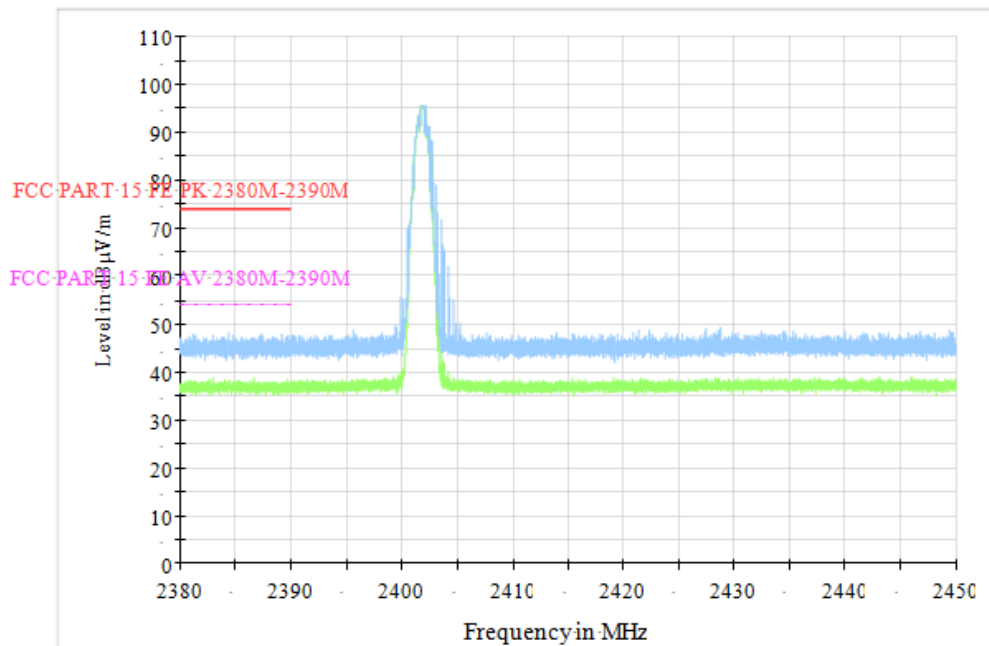


Fig. 48 Radiated Band Edges (GFSK, Ch0, 2380GHz ~ 2450GHz)

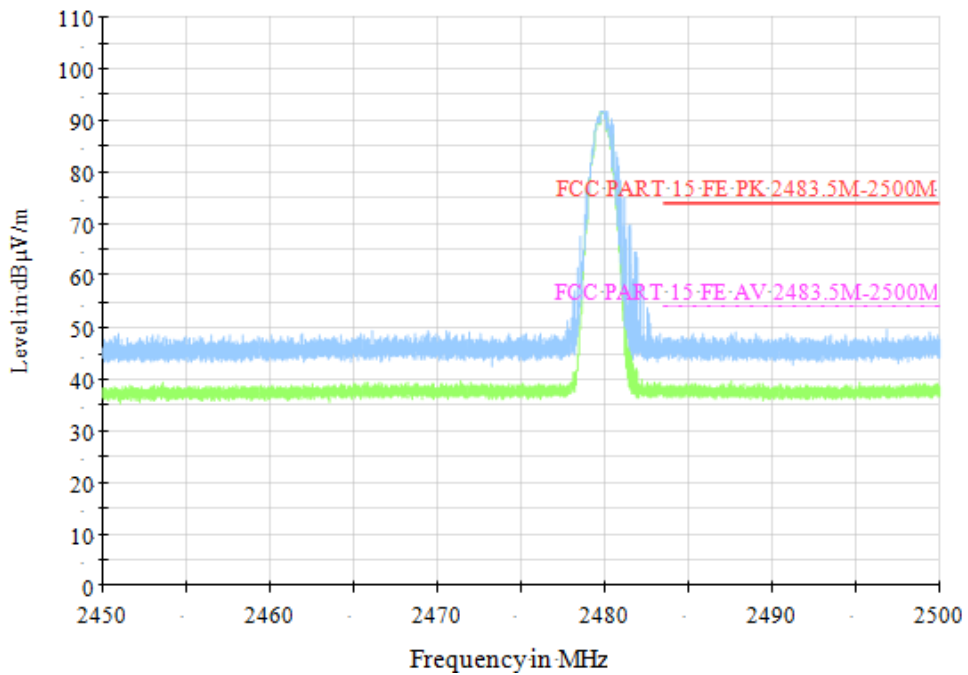


Fig. 49 Radiated Band Edges (GFSK, Ch78, 2450GHz ~ 2500GHz)

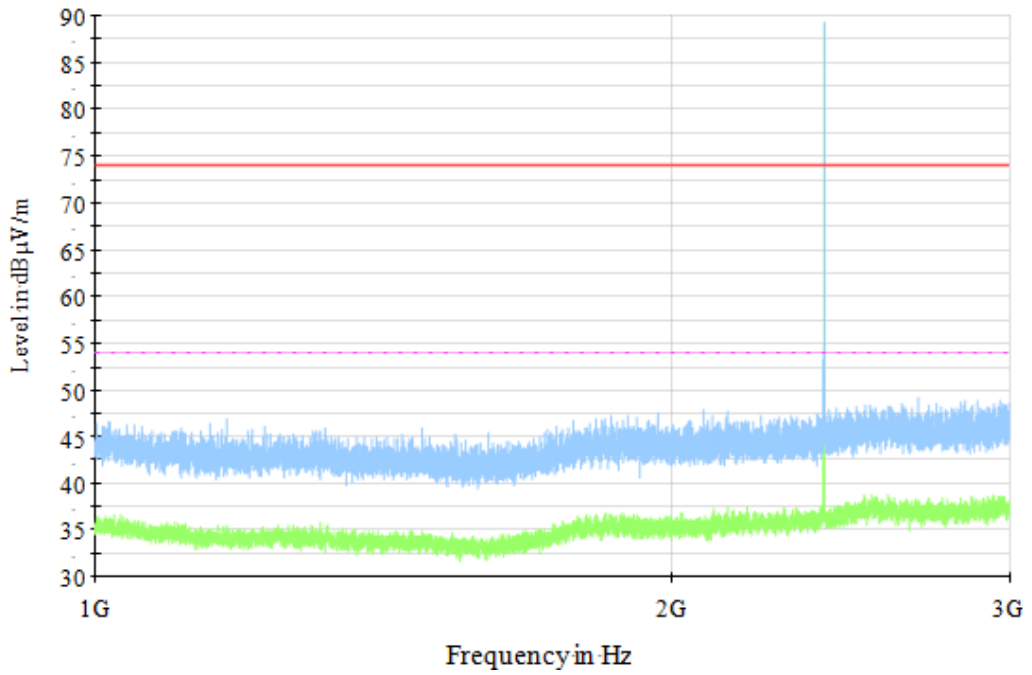


Fig. 50 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch0, 1GHz ~ 3GHz)

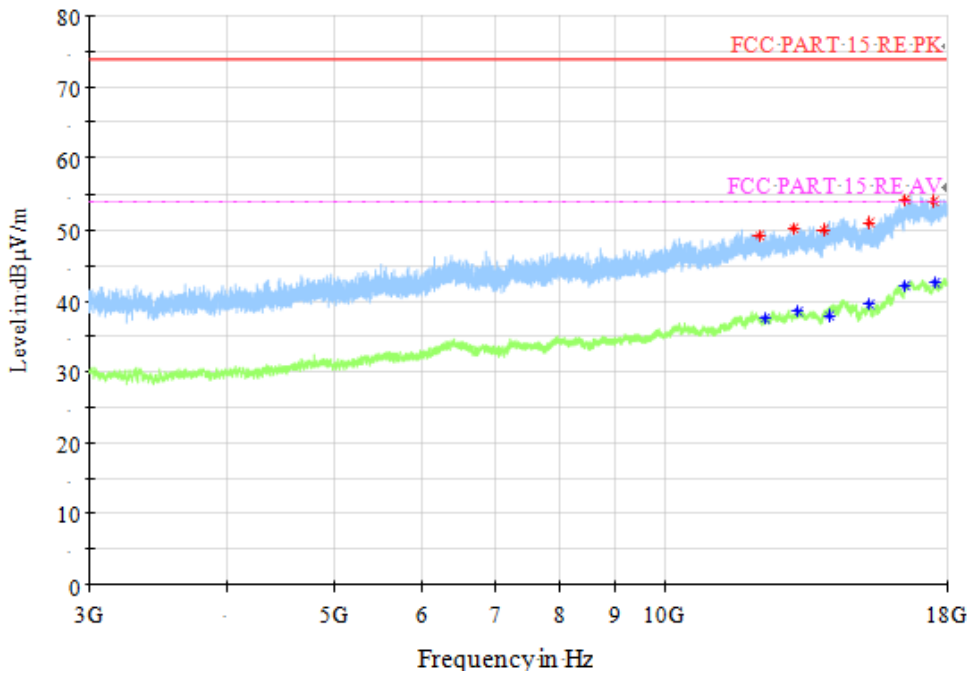


Fig. 51 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch0, 3GHz ~ 18GHz)

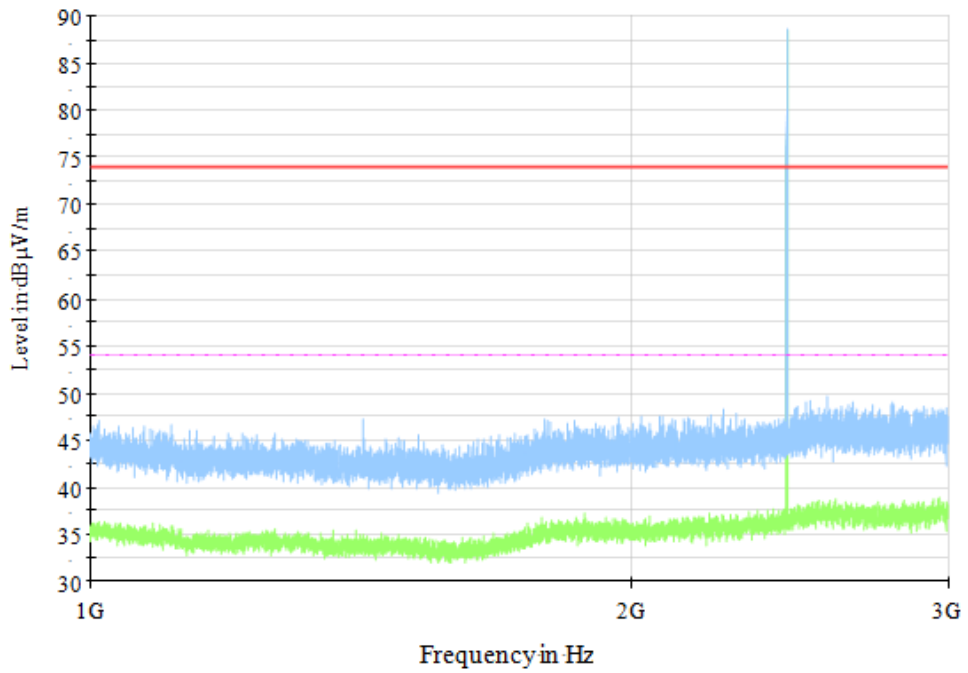


Fig. 52 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch39, 1GHz ~ 3GHz)

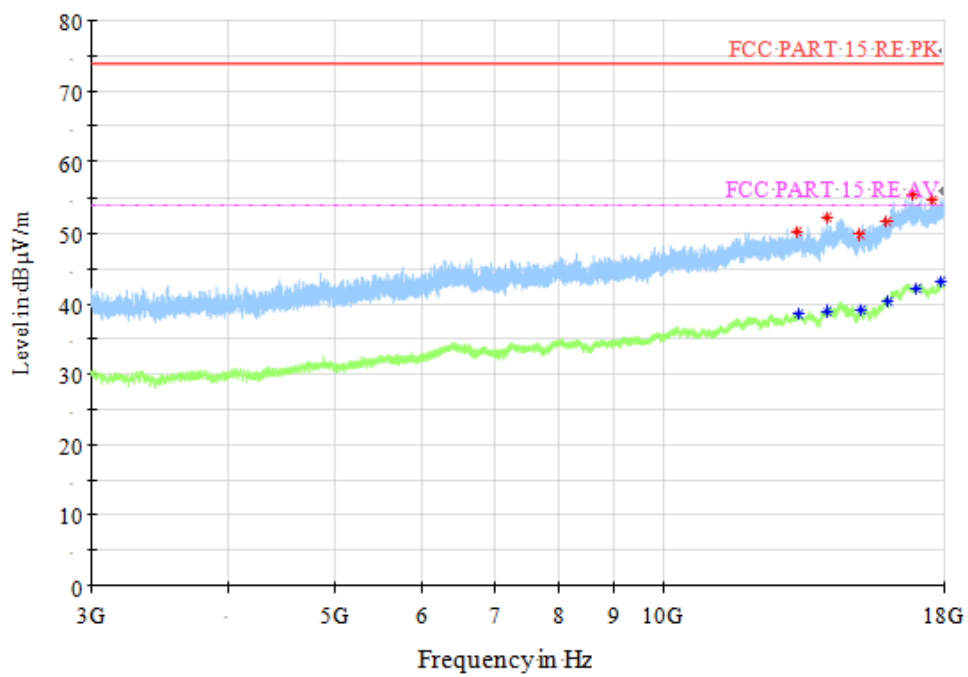


Fig. 53 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch39, 3GHz ~ 18GHz)

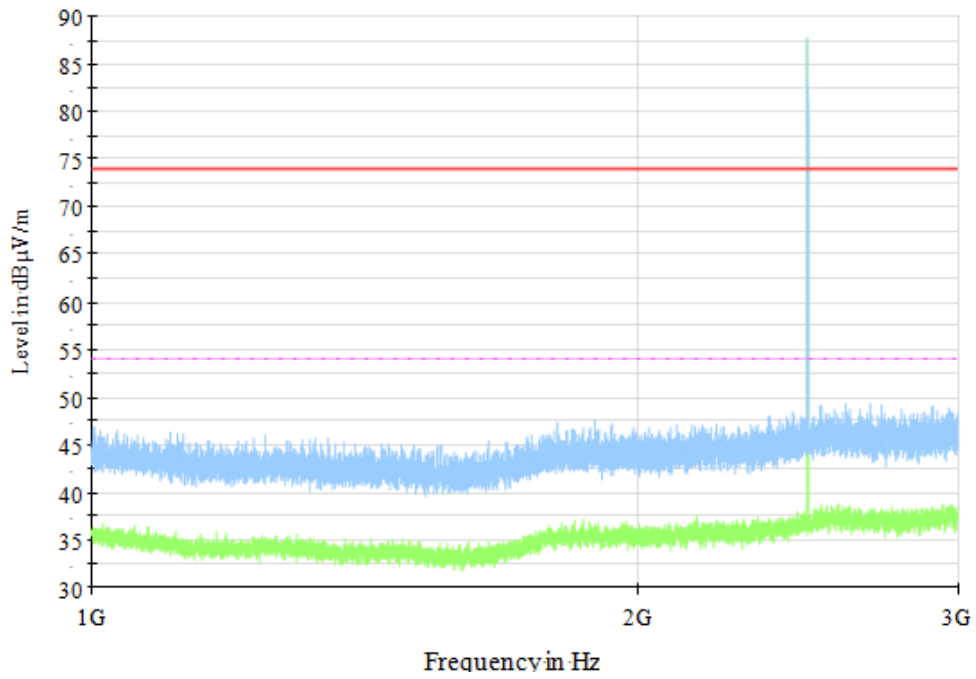


Fig. 54 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch78, 1GHz ~ 3GHz)

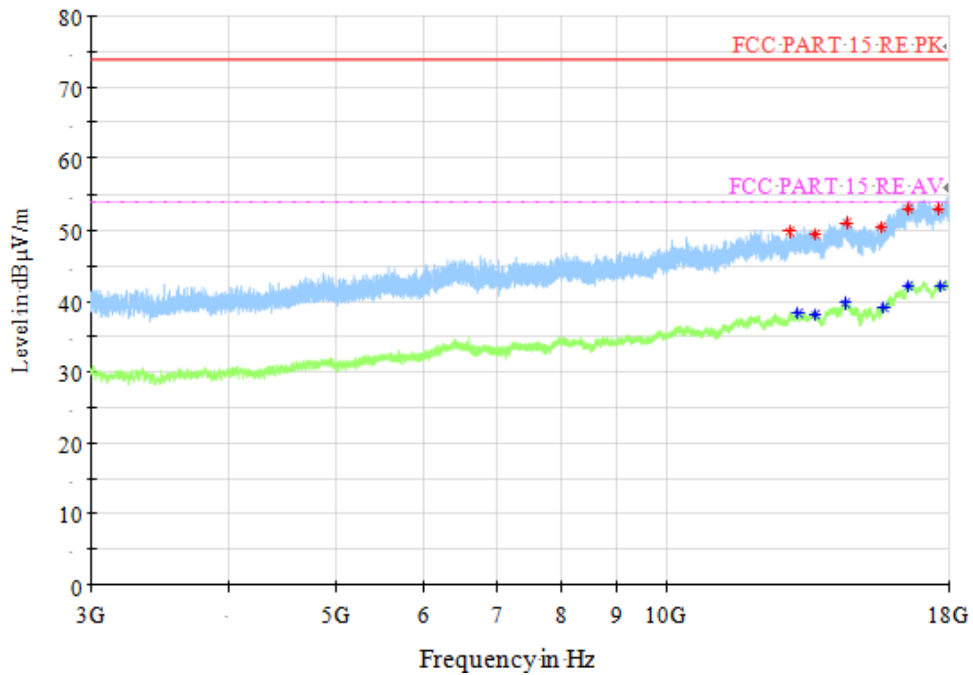


Fig. 55 Radiated Spurious Emission ($\pi/4$ DQPSK, Ch78, 3GHz ~ 18GHz)

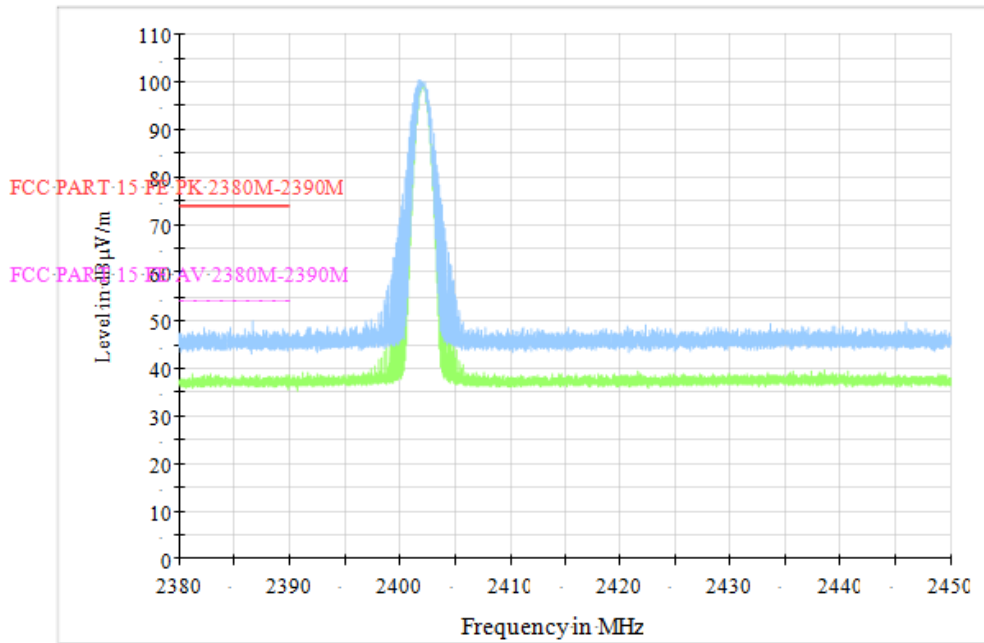


Fig. 56 Radiated Band Edges ($\pi/4$ DQPSK, Ch0, 2380GHz ~ 2450GHz)

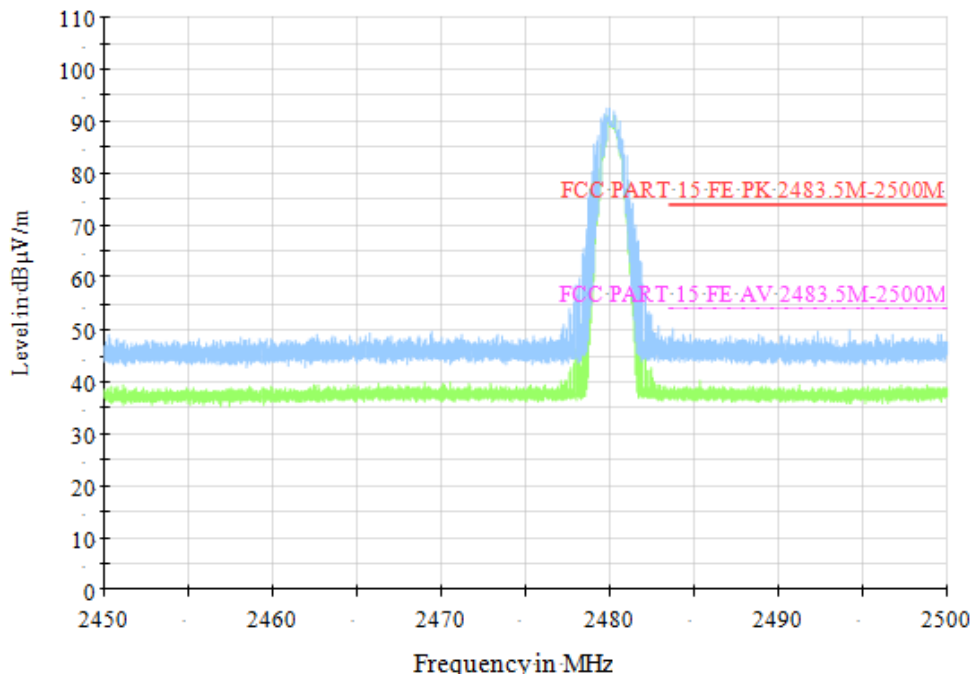


Fig. 57 Radiated Band Edges ($\pi/4$ DQPSK, Ch78, 2450GHz ~ 2500GHz)

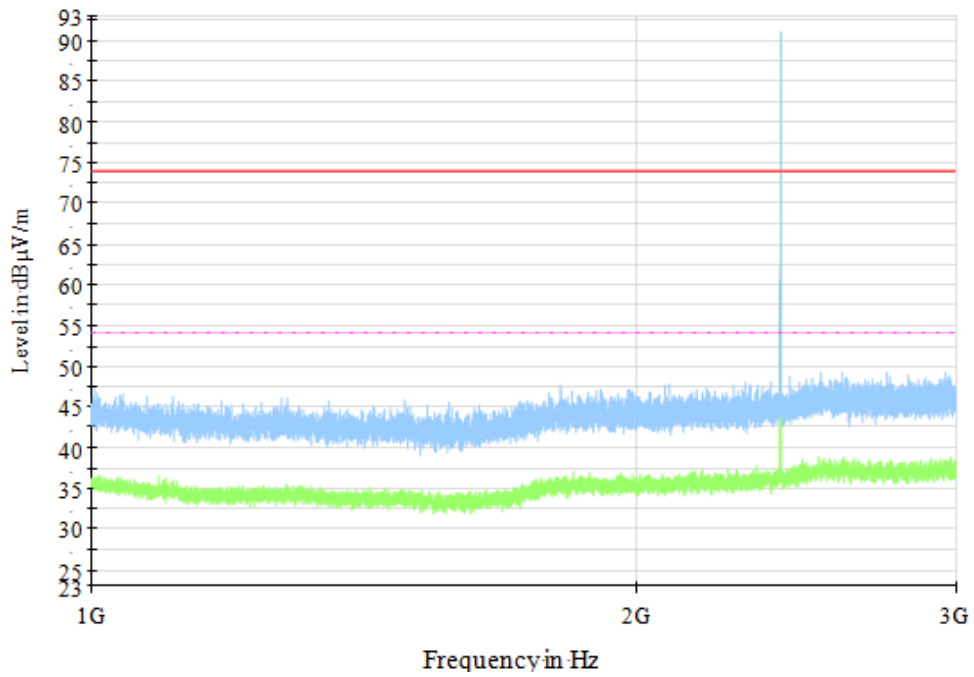


Fig. 58 Radiated Spurious Emission (8DPSK, Ch0, 1GHz ~ 3GHz)

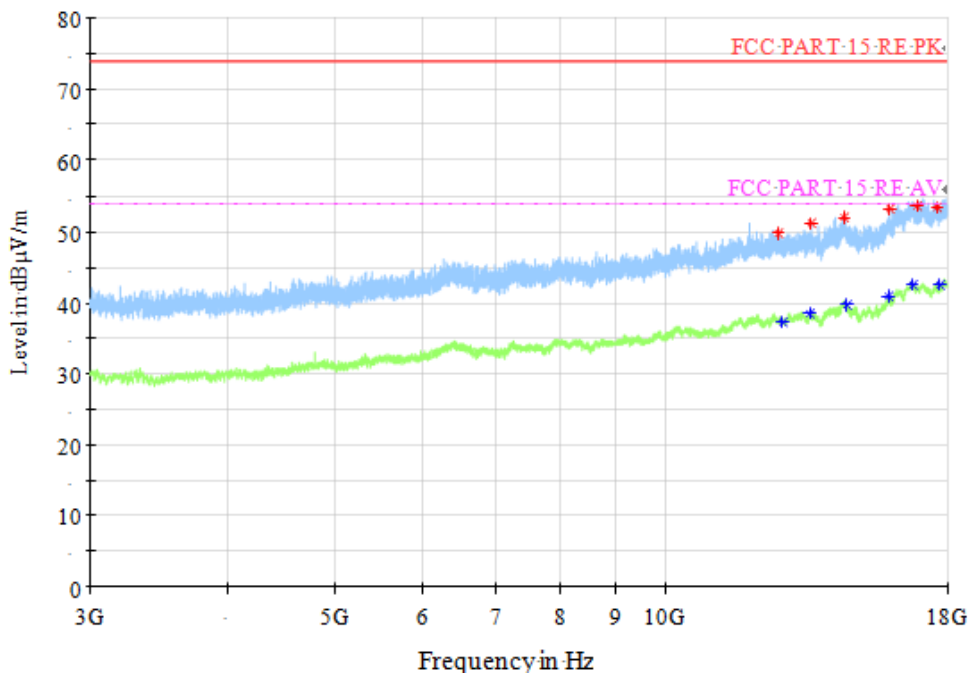


Fig. 59 Radiated Spurious Emission (8DPSK, Ch0, 3GHz ~ 18GHz)

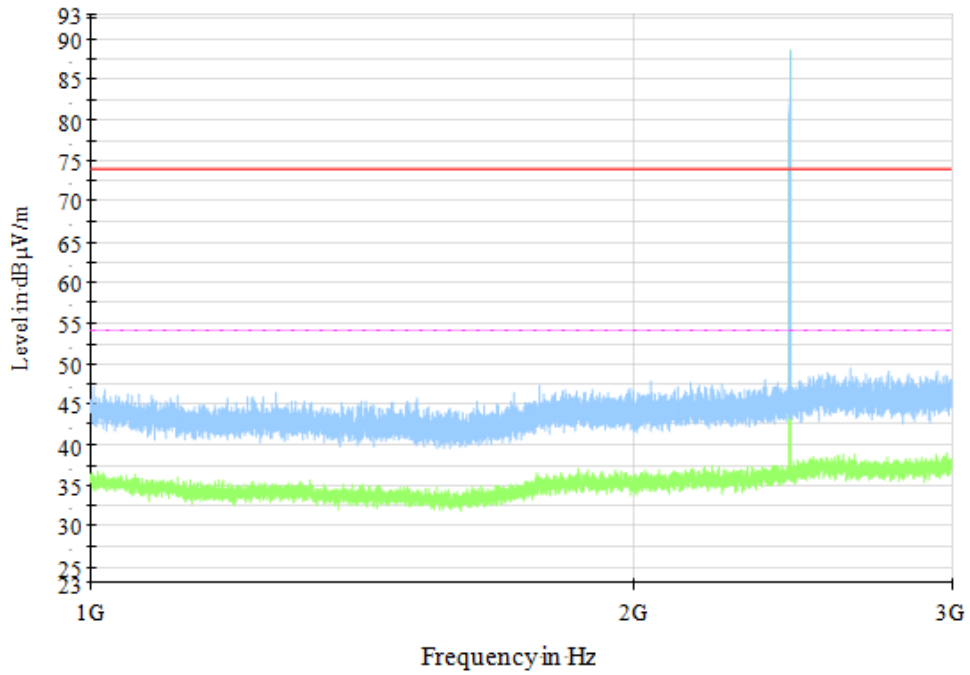


Fig. 60 Radiated Spurious Emission (8DPSK, Ch39, 1GHz ~ 3GHz)

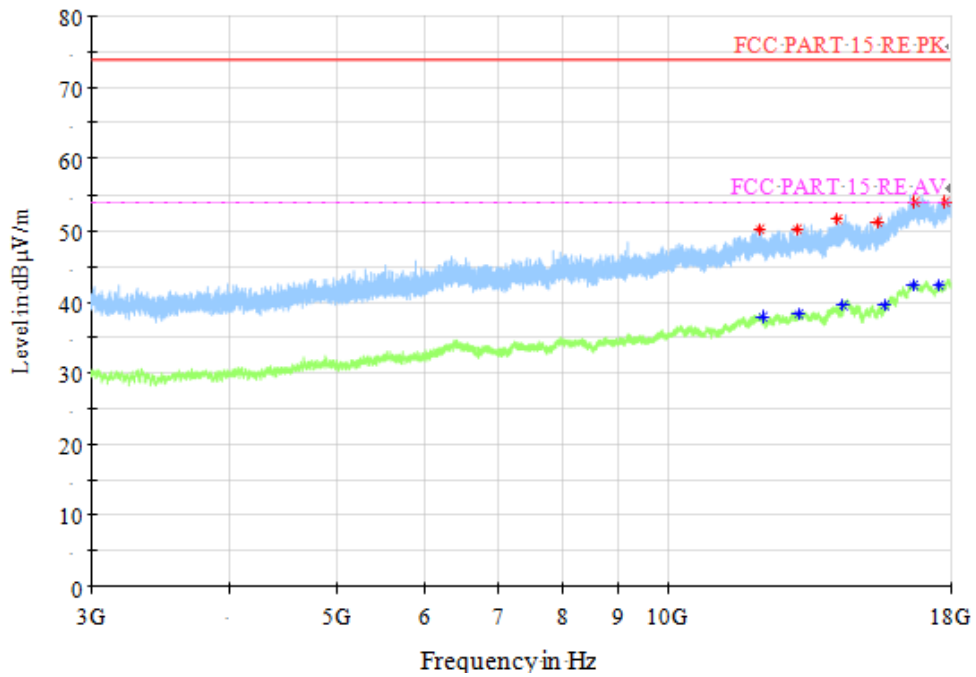


Fig. 61 Radiated Spurious Emission (8DPSK, Ch39, 3GHz ~ 18GHz)

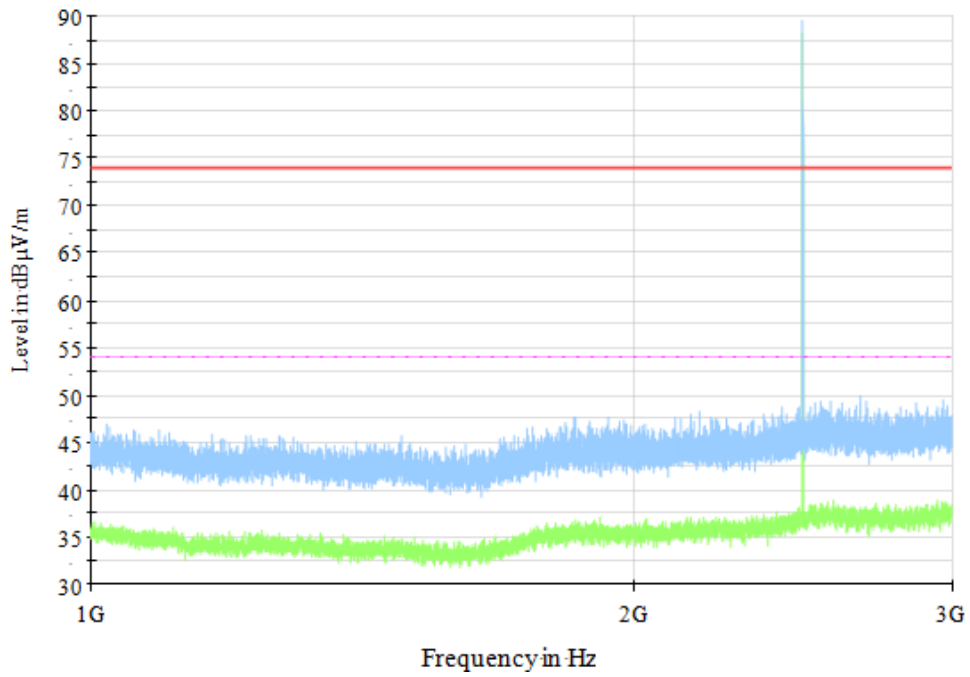


Fig. 62 Radiated Spurious Emission (8DPSK, Ch78, 1GHz ~ 3GHz)

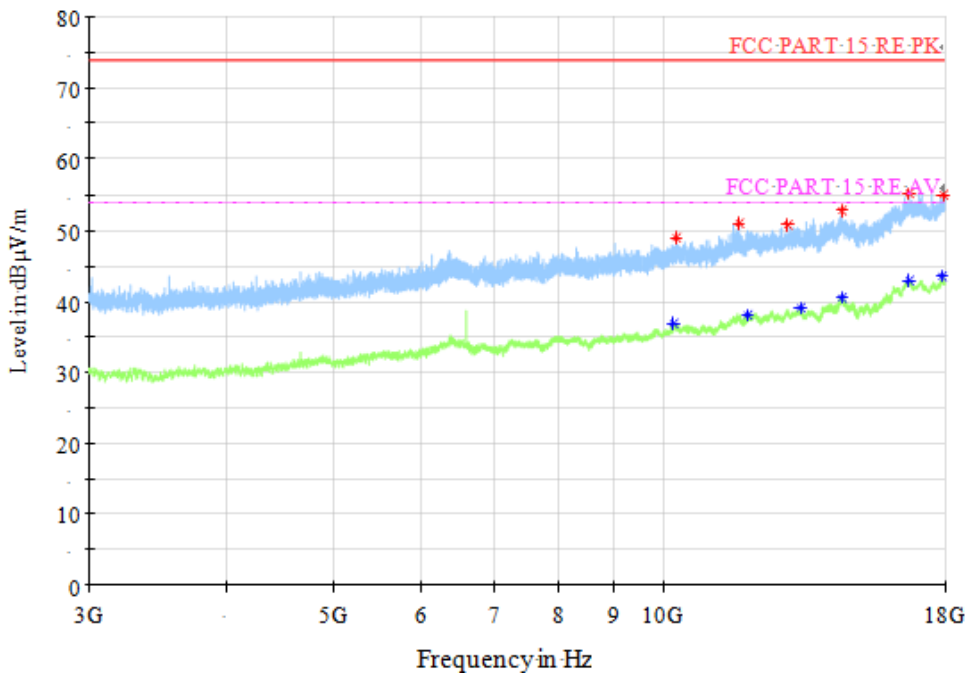


Fig. 63 Radiated Spurious Emission (8DPSK, Ch78, 3GHz ~ 18GHz)

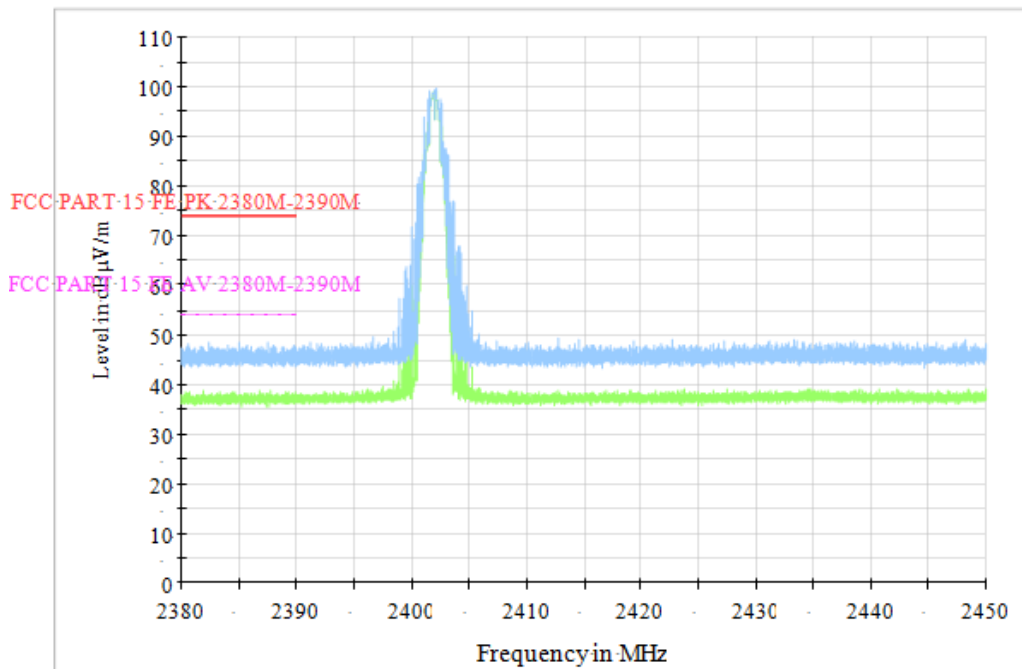


Fig. 64 Radiated Band Edges (8DPSK, Ch0, 2380GHz ~ 2450GHz)

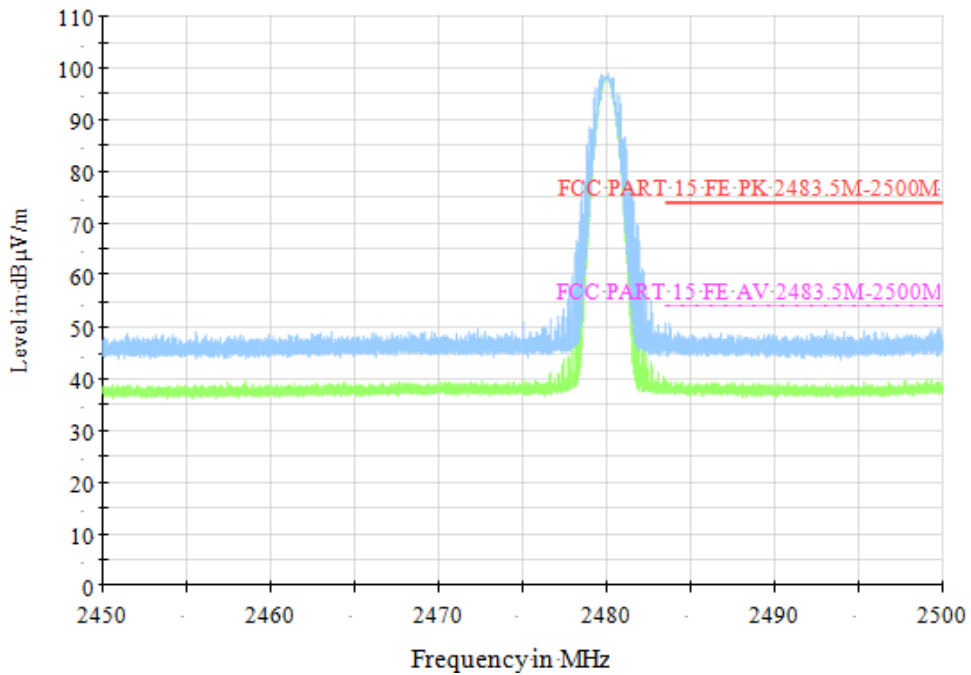


Fig. 65 Radiated Band Edges (8DPSK, Ch78, 2450GHz ~ 2500GHz)

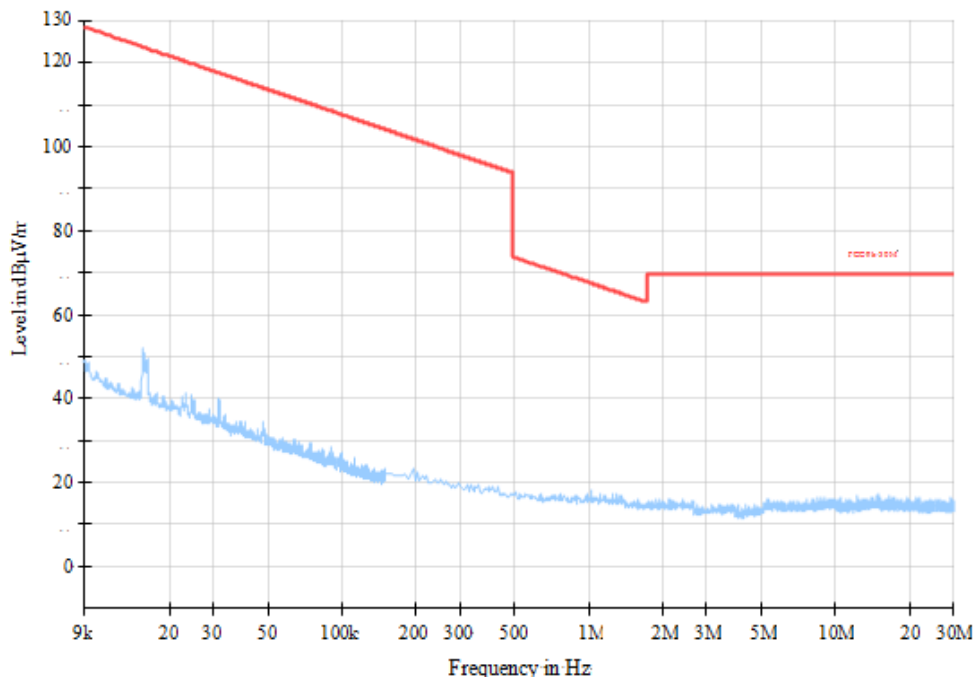


Fig. 66 Radiated Spurious Emission (All Channels, 9kHz ~ 30MHz)

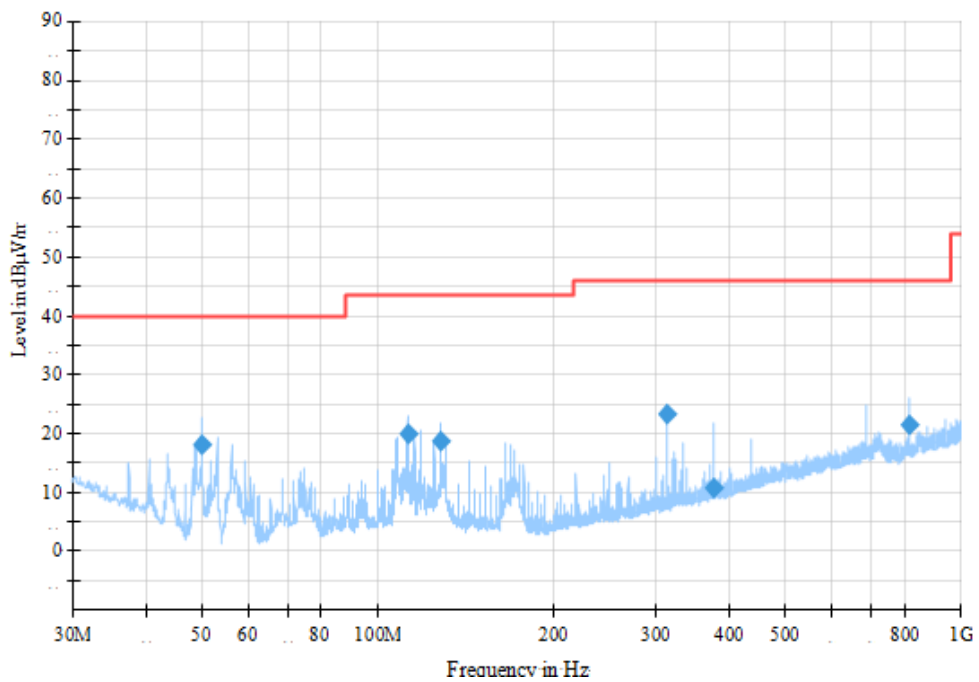


Fig. 67 Radiated Spurious Emission (All Channels, 30MHz ~ 1GHz)

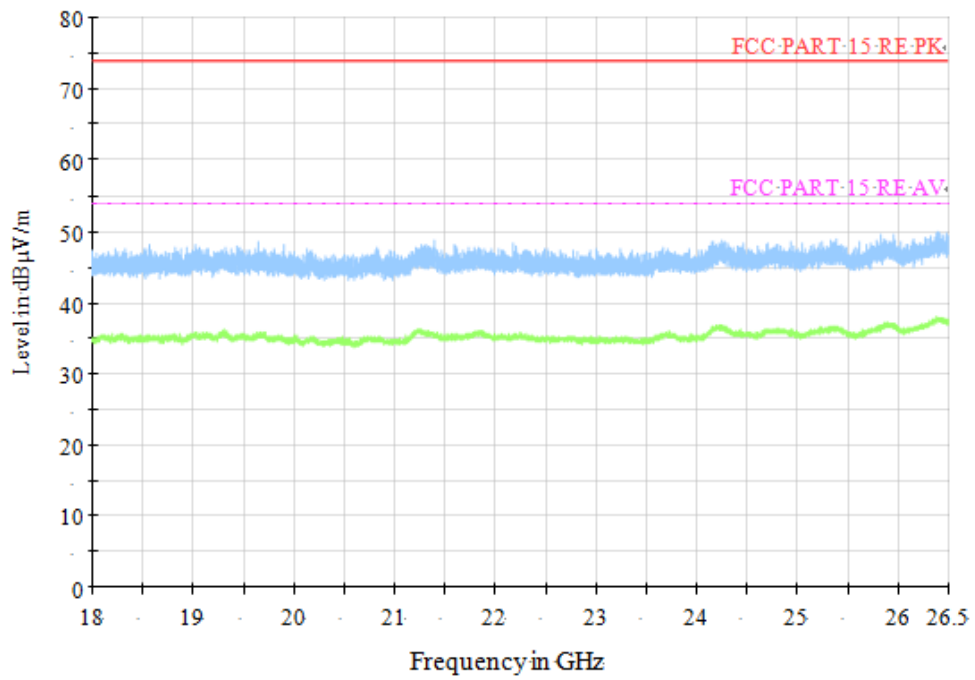


Fig. 68 Radiated Spurious Emission (All Channels, 18GHz ~ 26.5GHz)

A.5 20dB Bandwidth

Measurement Limit:

| Standard | Limit (kHz) |
|----------------------------|-------------|
| FCC 47 CFR Part 15.247 (a) | / |

Measurement Result:

| Mode | Channel | 20dB Bandwidth (kHz) | | conclusion |
|---------------|---------|----------------------|---------|------------|
| GFSK | 0 | Fig.69 | 936.00 | / |
| | 39 | Fig.70 | 936.75 | |
| | 78 | Fig.71 | 937.50 | |
| $\pi/4$ DQPSK | 0 | Fig.72 | 1284.75 | / |
| | 39 | Fig.73 | 1283.25 | |
| | 78 | Fig.74 | 1293.00 | |
| 8DPSK | 0 | Fig.75 | 1271.25 | / |
| | 39 | Fig.76 | 1281.75 | |
| | 78 | Fig.77 | 1279.50 | |

See below for test graphs.

Conclusion: PASS

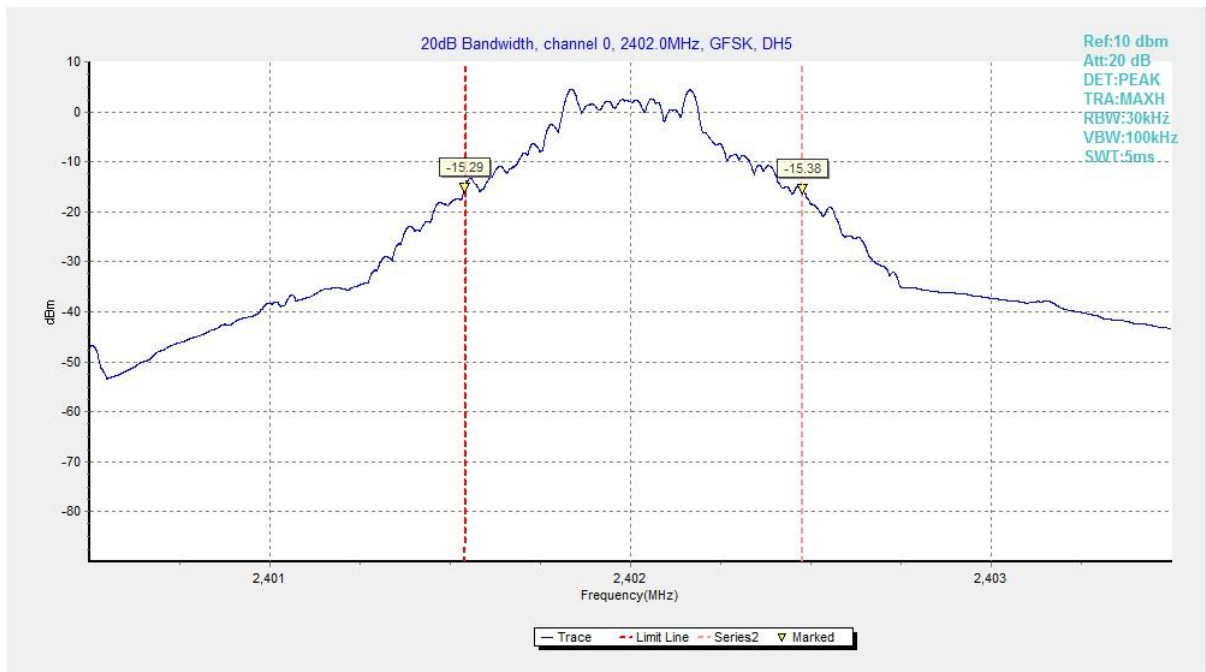


Fig. 69 20dB Bandwidth (GFSK, Ch 0)

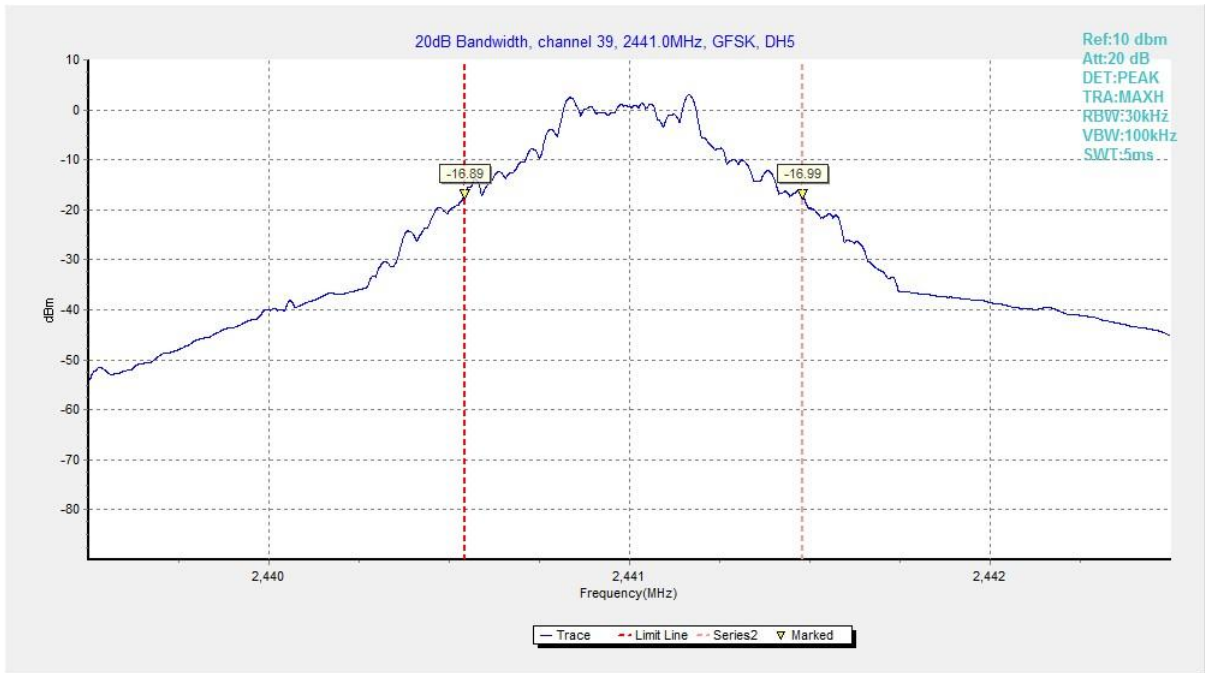


Fig. 70 20dB Bandwidth (GFSK, Ch 39)

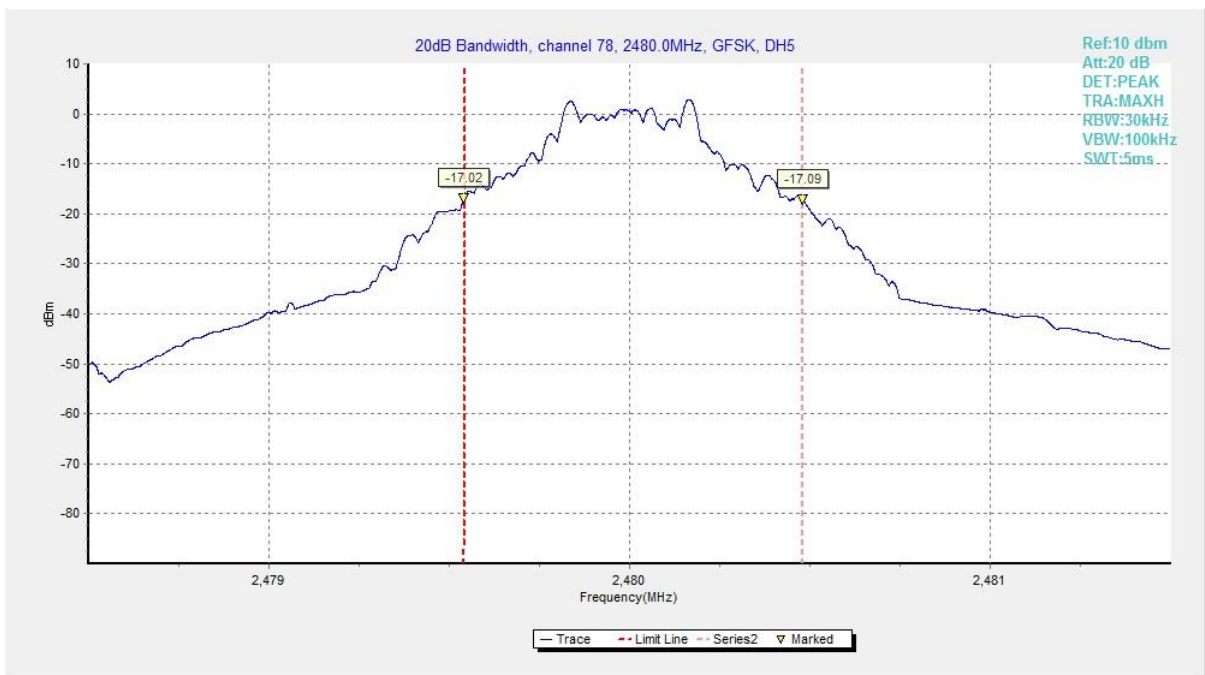


Fig. 71 20dB Bandwidth (GFSK, Ch 78)

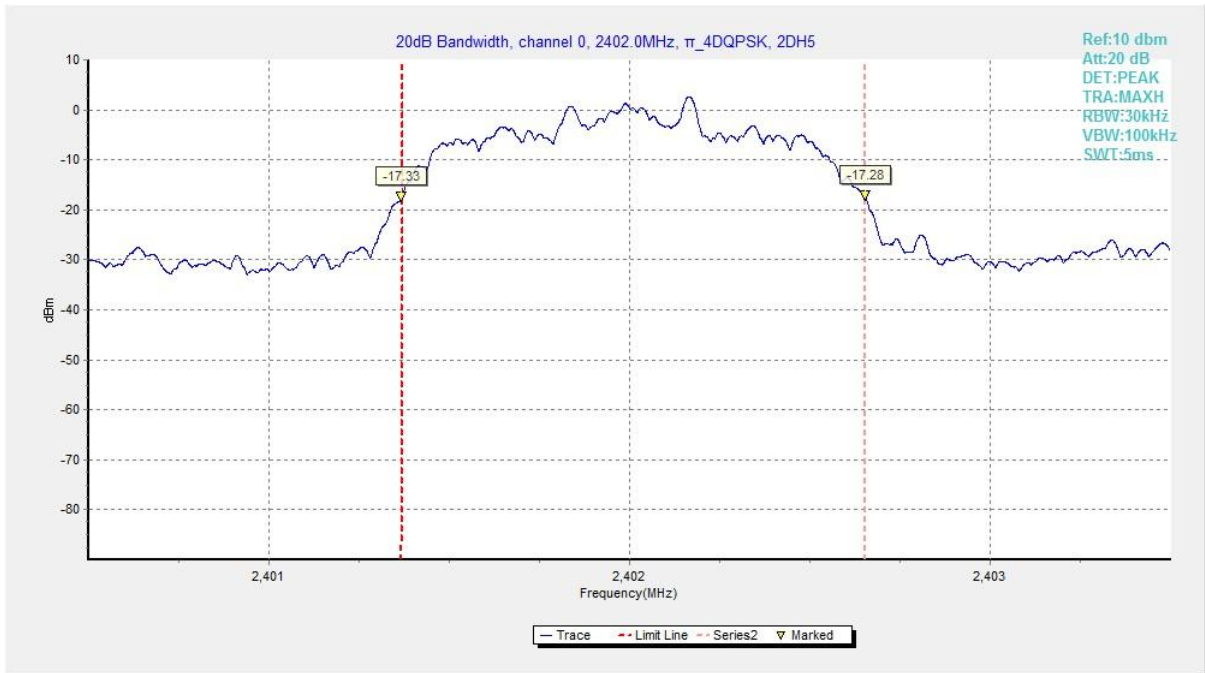


Fig. 72 20dB Bandwidth (π /4 DQPSK, Ch 0)

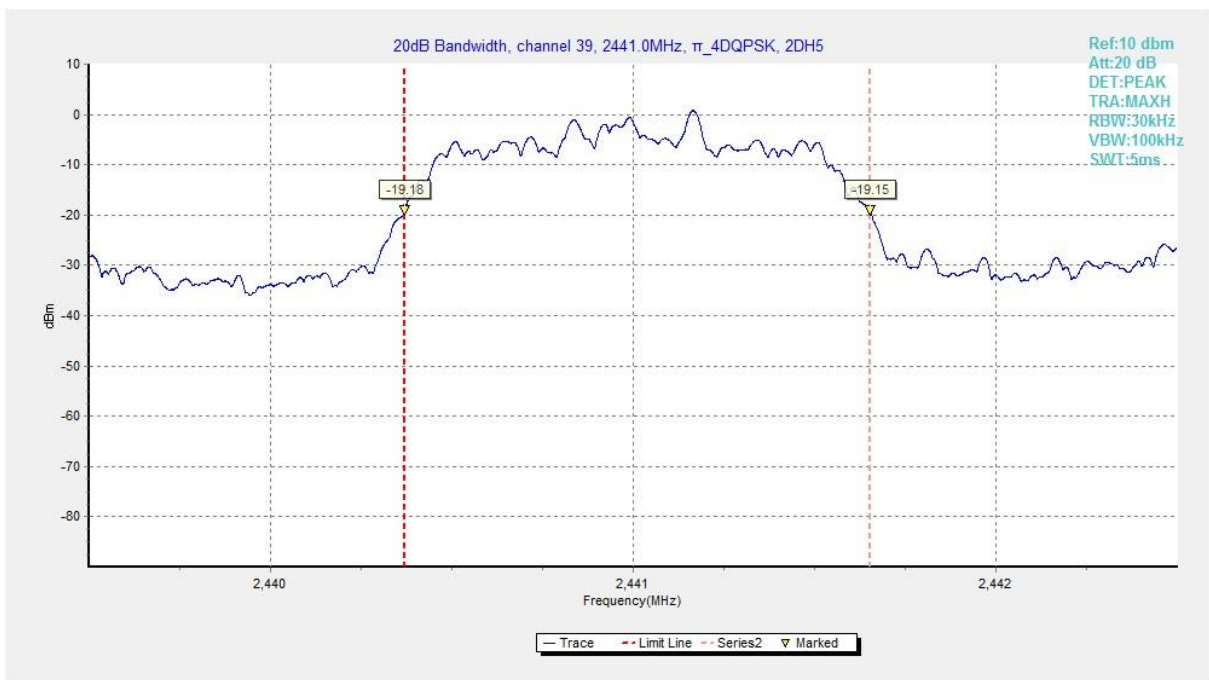


Fig. 73 20dB Bandwidth (π /4 DQPSK, Ch 39)

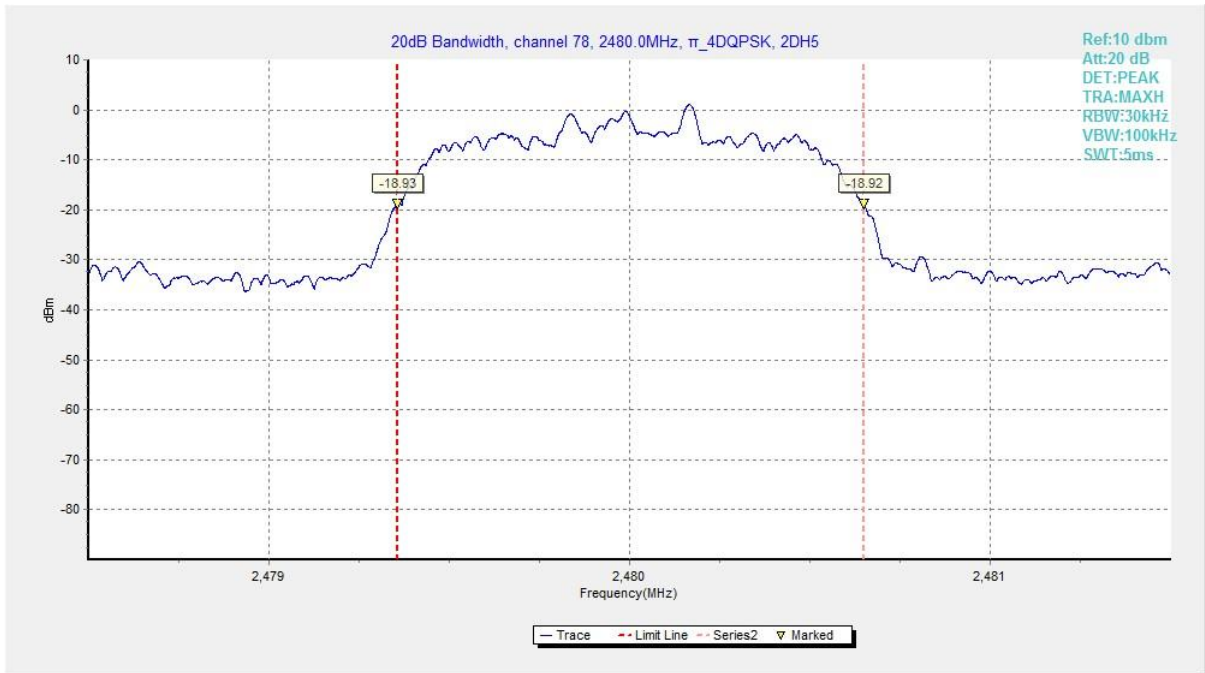


Fig. 74 20dB Bandwidth ($\pi/4$ DQPSK, Ch 78)

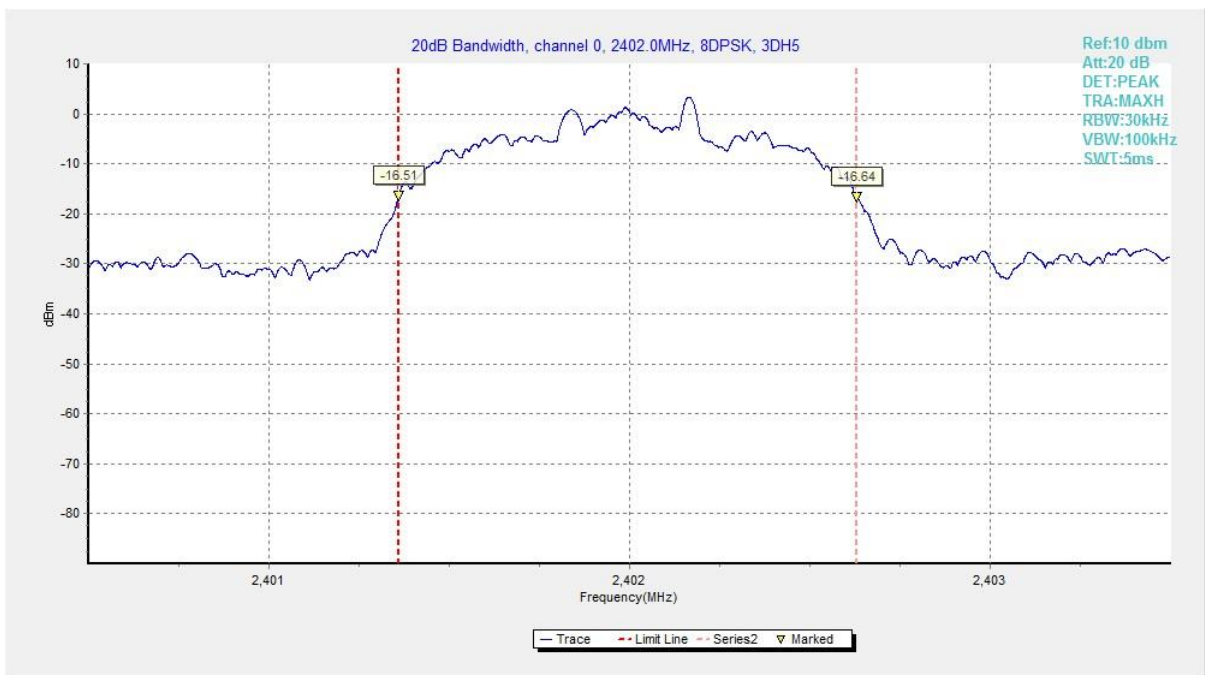


Fig. 75 20dB Bandwidth (8DPSK, Ch 0)