# TEST REPORT

| | | |
|---|---|---|
| **Reference No.** | : | WTH24D05101864W002 |
| **FCC ID** | : | OKUKP2951B |
| **Applicant** | : | Shenzhen Junlan Electronic Ltd |
| **Address** | : | No. 277, Pingkui Road, Shijing Community, Pingshan Office, Pingshan New District, Shenzhen, China |
| **Manufacturer** | : | Shenzhen Junlan Electronic Ltd |
| **Address** | : | No. 277, Pingkui Road, Shijing Community, Pingshan Office, Pingshan New District, Shenzhen, China |
| **Product** | : | Portable Bluetooth party speaker |
| **Model(s)** | : | MX-BTS300, KP-2951B, MEMBTSPKR100, KP-2951A, MX-BTS3XX, KP-295XX, KP-2951XX(XX means unit color, it can be A to Z or N/A) |
| **Standards** | : | FCC 47CFR Part 15.247 |
| **Date of Receipt sample** | : | 2024-05-07 |
| **Date of Test** | : | 2024-05-08 to 2024-06-05 |
| **Date of Issue** | : | 2024-06-14 |
| **Test Result** | : | **Pass** |

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.


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# 2 Contents

Page

1 COVER PAGE ..... 1
2 CONTENTS ..... 2
3 REVISION HISTORY ..... 4
4 GENERAL INFORMATION ..... 5
4.1 GENERAL DESCRIPTION OF E.U.T. ..... 5
4.2 DETAILS OF E.U.T. ..... 5
4.3 CHANNEL LIST ..... 6
4.4 TEST MODE ..... 6
4.5 TEST FACILITY ..... 7
5 TEST SUMMARY ..... 8
6 EQUIPMENT USED DURING TEST ..... 9
6.1 EQUIPMENTS LIST ..... 9
6.2 MEASUREMENT UNCERTAINTY ..... 10
7 CONDUCTED EMISSION ..... 11
7.1 E.U.T. OPERATION ..... 11
7.2 EUT SETUP ..... 11
7.3 MEASUREMENT DESCRIPTION ..... 11
7.4 CONDUCTED EMISSION TEST RESULT ..... 12
8 RADIATED SPURIOUS EMISSIONS ..... 14
8.1 EUT OPERATION ..... 14
8.2 TEST SETUP ..... 15
8.3 SPECTRUM ANALYZER SETUP ..... 16
8.4 TEST PROCEDURE ..... 17
8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION ..... 17
8.6 SUMMARY OF TEST RESULTS ..... 18
9 CONDUCTED SPURIOUS EMISSIONS ..... 21
9.1 TEST PROCEDURE ..... 21
9.2 TEST RESULT ..... 22
10 BAND EDGE MEASUREMENT ..... 37
10.1 TEST PROCEDURE ..... 37
10.2 TEST RESULT ..... 38
11 20 DB BANDWIDTH AND 99% BANDWIDTH MEASUREMENT ..... 44
11.1 TEST PROCEDURE ..... 44
11.2 TEST RESULT ..... 44
12 MAXIMUM PEAK OUTPUT POWER ..... 55
12.1 TEST PROCEDURE ..... 55
12.2 TEST RESULT ..... 56
13 HOPPING CHANNEL SEPARATION ..... 62
13.1 TEST PROCEDURE ..... 62
13.2 TEST RESULT ..... 63
14 NUMBER OF HOPPING FREQUENCY ..... 69

14.1 TEST PROCEDURE .....69
14.2 TEST RESULT .....70
**15 DWELL TIME .....72**
15.1 TEST PROCEDURE .....72
15.2 TEST RESULT .....72
**16 ANTENNA REQUIREMENT .....78**
**17 RF EXPOSURE .....78**
**18 PHOTOGRAPHS OF TEST SETUP AND EUT. .....78**

# 3 Revision History

| Test Report No. | Date of Receipt sample | Date of Test | Date of Issue | Purpose | Comment | Approved |
|---|---|---|---|---|---|---|
| WTH24D05101864W002 | 2024-05-07 | 2024-05-08 to 2024-06-05 | 2024-06-14 | Original | - | Valid |

# 4 General Information

## 4.1 General Description of E.U.T.

| | |
|---|---|
| Product: | Portable Bluetooth party speaker |
| Model(s): | MX-BTS300, KP-2951B, MEMBTSPKR100, KP-2951A, MX-BTS3XX, KP-295XX, KP-2951XX(XX means unit color, it can be A to Z or N/A) |
| Model Description: | Only the model names and unit colors are different.<br>The test sample model was KP-2951B. |
| Test Sample No.: | 1-1/1 |
| Bluetooth Version: | 5.0 |
| Hardware Version: | V2.0 |
| Software Version: | V1.2 |

## 4.2 Details of E.U.T.

| | |
|---|---|
| Operation Frequency: | 2402~2480MHz |
| Max. RF output power: | 3.27dBm |
| Type of Modulation: | GFSK, π/4DQPSK, 8DPSK |
| Antenna installation: | PCB printed antenna |
| Antenna Gain: | 3.38dBi |

Note:
#: The antenna gain is provided by the applicant, and the applicant should be responsible for its authenticity, WALTEK lab has not verified the authenticity of its information.

| | |
|---|---|
| Ratings: | Input: 16.0V⎓ 1500mA from adapter |
| Adapter: | Input: 100-240V~, 50/60Hz, 0.8A MAX<br>Output: 16.0V⎓ 1500mA<br>Model: GKYZD0150160US<br>Manufacturer: SHENZHEN SHI GUANGKAIYUAN TECHNOLOGY LTD. |

## 4.3 Channel List

Normal

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 0 | 2402 | 1 | 2403 | 2 | 2404 | 3 | 2405 |
| 4 | 2406 | 5 | 2407 | 6 | 2408 | 7 | 2409 |
| 8 | 2410 | 9 | 2411 | 10 | 2412 | 11 | 2413 |
| 12 | 2414 | 13 | 2415 | 14 | 2416 | 15 | 2417 |
| 16 | 2418 | 17 | 2419 | 18 | 2420 | 19 | 2421 |
| 20 | 2422 | 21 | 2423 | 22 | 2424 | 23 | 2425 |
| 24 | 2426 | 25 | 2427 | 26 | 2428 | 27 | 2429 |
| 28 | 2430 | 29 | 2431 | 30 | 2432 | 31 | 2433 |
| 32 | 2434 | 33 | 2435 | 34 | 2436 | 35 | 2437 |
| 36 | 2438 | 37 | 2439 | 38 | 2440 | 39 | 2441 |
| 40 | 2442 | 41 | 2443 | 42 | 2444 | 43 | 2445 |
| 44 | 2446 | 45 | 2447 | 46 | 2448 | 47 | 2449 |
| 48 | 2450 | 49 | 2451 | 50 | 2452 | 51 | 2453 |
| 52 | 2454 | 53 | 2455 | 54 | 2456 | 55 | 2457 |
| 56 | 2458 | 57 | 2459 | 58 | 2460 | 59 | 2461 |
| 60 | 2462 | 61 | 2463 | 62 | 2464 | 63 | 2465 |
| 64 | 2466 | 65 | 2467 | 66 | 2468 | 67 | 2469 |
| 68 | 2470 | 69 | 2471 | 70 | 2472 | 71 | 2473 |
| 72 | 2474 | 73 | 2475 | 74 | 2476 | 75 | 2477 |
| 76 | 2478 | 77 | 2479 | 78 | 2480 | - | - |

## 4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests; the worst data were recorded and reported.

| Test mode | Low channel | Middle channel | High channel |
|---|---|---|---|
| Transmitting | 2402MHz | 2441MHz | 2480MHz |

## 4.5 Test Facility

The test facility has a test site registered with the following organizations:

**ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.**

Waltek Testing Group Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A, October 15, 2016.

**FCC Designation No.: CN1201. Test Firm Registration No.: 523476.**

Waltek Testing Group Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

# 5 Test Summary

| Test Items | Test Requirement | Result |
|---|---|---|
| Radiated Spurious Emissions | 15.205(a)<br>15.209<br>15.247(d) | PASS |
| Conducted Spurious emissions | 15.247(d) | PASS |
| Band edge | 15.247(d)<br>15.205(a) | PASS |
| Conducted Emission | 15.207 | PASS |
| 20 dB Bandwidth and 99% Bandwidth | 15.247(a)(1) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Frequency Separation | 15.247(a)(1) | PASS |
| Number of Hopping Frequency | 15.247(a)(1)(iii) | PASS |
| Dwell time | 15.247(a)(1)(iii) | PASS |
| Antenna Requirement | 15.203 | Complies |
| Maximum Permissible Exposure<br>(Exposure of Humans to RF Fields) | 1.1307(b)(1) | PASS |

# 6 Equipment Used during Test

## 6.1 Equipments List

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. Date | Calibration Due Date |
|---|---|---|---|---|---|---|
| **Conducted Emissions 1#** | | | | | | |
| 1 | EMI Test Receiver | R&S | ESCI | 100947 | 2023-07-27 | 2024-07-26 |
| 2 | LISN | R&S | ENV216 | 100115 | 2023-07-27 | 2024-07-26 |
| 3 | Cable | Top | TYPE16(3.5M) | - | 2023-07-27 | 2024-07-26 |
| **3m Semi-anechoic Chamber for Radiation Emissions 1#** | | | | | | |
| 1 | Spectrum Analyzer | R&S | FSP30 | 100091 | 2024-04-22 | 2025-04-21 |
| 2 | Amplifier | Agilent | 8447D | 2944A10178 | 2023-07-27 | 2024-07-26 |
| 3 | Tri-log Broadband Antenna | SCHWARZBECK | VULB9163 | 336 | 2023-08-07 | 2024-08-06 |
| 4 | Coaxial Cable | Top | TYPE16(13M) | - | 2024-04-22 | 2025-04-21 |
| 5 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9120D | 667 | 2024-01-23 | 2025-01-22 |
| 6 | Broad-band Horn Antenna | SCHWARZBECK | BBHA 9170 | 335 | 2023-07-27 | 2024-07-26 |
| 7 | Broadband Preamplifier | COMPLIANCE | PAP-1G18 | 2004 | 2023-08-08 | 2024-08-07 |
| 8 | Coaxial Cable | Top | ZT26-NJ-NJ-8M/FA | - | 2024-04-22 | 2025-04-21 |
| 9 | Microwave Amplifier | SCHWARZBECK | BBV 9721 | 100472 | 2023-07-27 | 2024-07-26 |
| 10 | Coaxial Cable | Top | ZT40-2.92J-2.92J-2.0M | 17100919 | 2024-04-22 | 2025-04-21 |
| **3m Semi-anechoic Chamber for Radiation Emissions 2#** | | | | | | |
| 1 | Test Receiver | R&S | ESCI | 101296 | 2024-04-22 | 2025-04-21 |
| 2 | Trilog Broadband Antenna | SCHWARZBECK | VULB9160 | 9160-3325 | 2023-11-04 | 2024-11-03 |
| 3 | Active Loop Antenna | Com-Power | AL-130R | 10160007 | 2024-04-27 | 2025-04-26 |
| 4 | Amplifier | ANRITSU | MH648A | M43381 | 2024-04-22 | 2025-04-21 |
| 5 | Cable | HUBER+SUHNER | CBL2 | 525178 | 2024-04-22 | 2025-04-21 |
| **RF Conducting** | | | | | | |
| 1 | Spectrum Analyzer | R&S | FSP40 | 100501 | 2023-07-27 | 2024-07-26 |
| 2 | Spectrum Analyzer | Agilent | N9020A | MY49100060 | 2023-07-27 | 2024-07-26 |

**Test Software:**

| Test Item | Software name | Software version |
|---|---|---|
| Conduction disturbance<br>Radiated Emission(3m) | EZ-EMC | EZ-EMC(RA-03A1-1) |

## 6.2 Measurement Uncertainty

| Parameter | Uncertainty |
|---|---|
| Conducted Emission | ± 3.64 dB(AC mains 150KHz~30MHz) |
| Radiated Spurious Emissions | ± 5.08 dB (Bilog antenna 30M~1000MHz) |
| | ± 4.99 dB (Horn antenna 1000M~25000MHz) |
| Radio Frequency | ± 1 x $10^{-7}$Hz |
| RF Power | ± 0.42 dB |
| Dwell time | 1.0% |
| Conducted Spurious Emissions | ± 2.76 dB (9kHz~26500MHz) |
| Confidence interval：95%. Confidence factor:k=2 | |

# 7 Conducted Emission

Test Requirement: FCC 47CFR Part 15 Section 15.207

Test Method: ANSI C63.10:2013

Test Result: PASS

Frequency Range: 150kHz to 30MHz

Limit:

| Frequency (MHz) | Limit (dBμV) | |
|---|---|---|
| | Quasi-pea | Average |
| 0.15 to 0.5 | 66 to 56* | 56 to 46 |
| 0.5 to 5 | 56 | 46 |
| 5to 30 | 60 | 50 |

## 7.1 E.U.T. Operation

Operating Environment:

Temperature: 25.6°C

Humidity: 52.6%RH

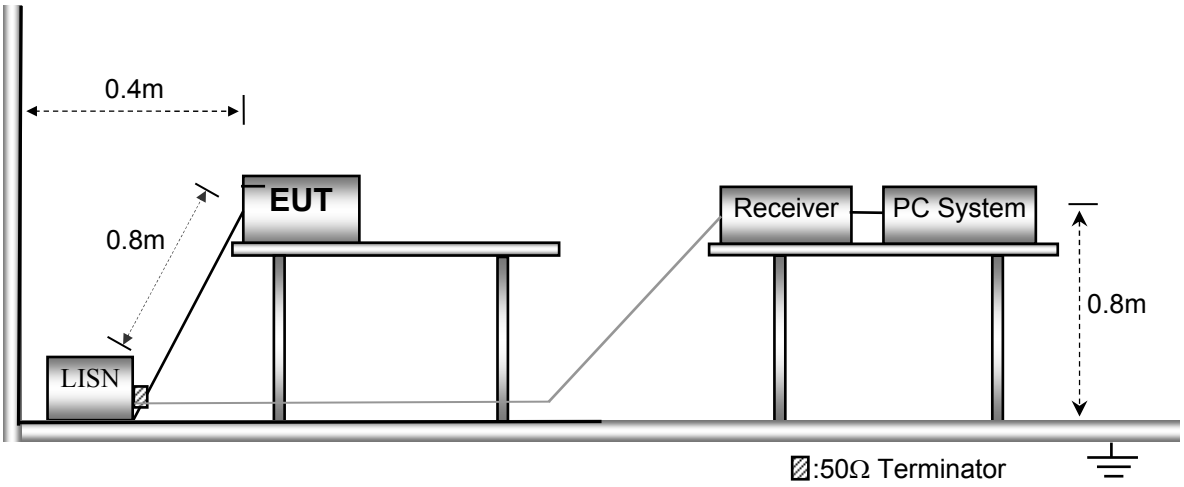
Atmospheric Pressure: 101.5kPa

EUT Operation:

The test was performed in Transmitting mode, the worst test data were shown in the report.

## 7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10: 2013.



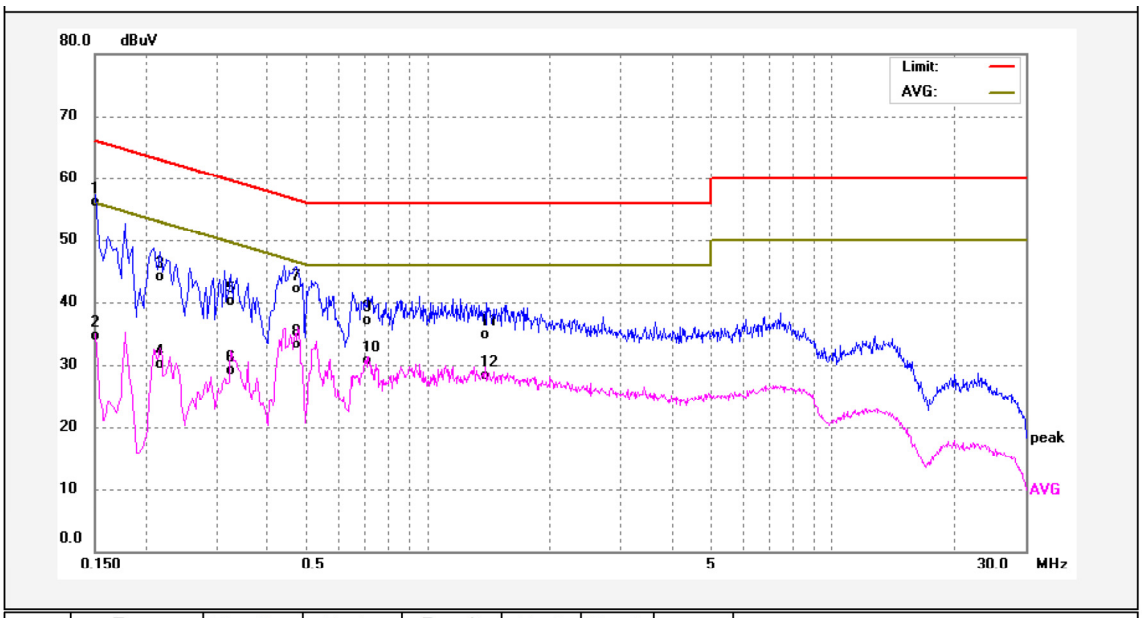

## 7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 7.4 Conducted Emission Test Result

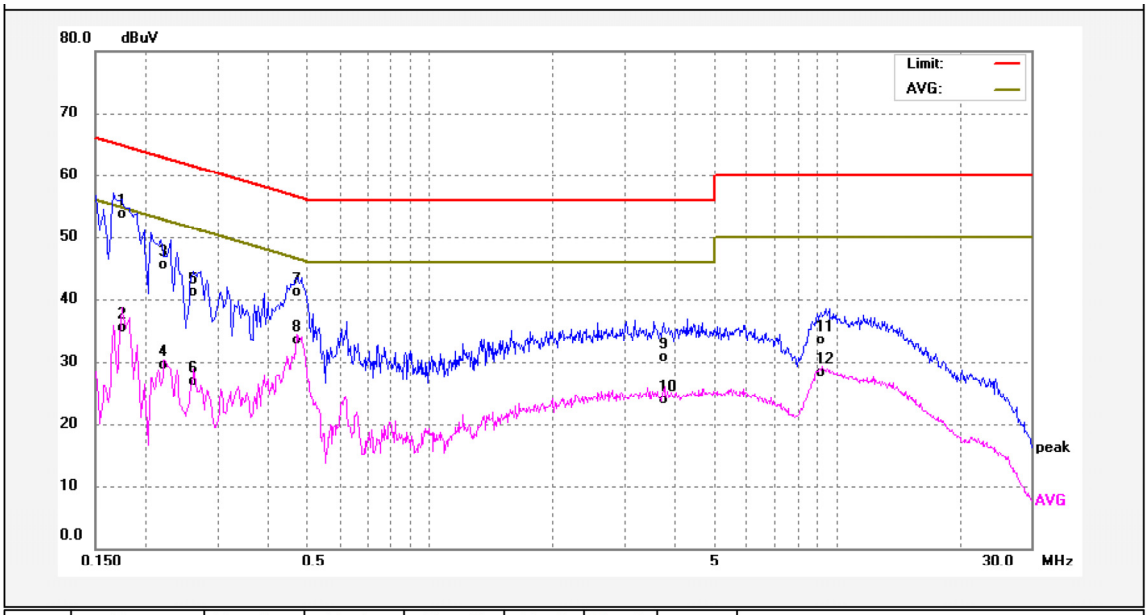
Remark: only the worst data (GFSK modulation Low channel mode) were reported

Live line:




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1500 | 45.17 | 10.92 | 56.09 | 65.99 | -9.90 | QP | |
| 2 | 0.1500 | 23.80 | 10.92 | 34.72 | 55.99 | -21.27 | AVG | |
| 3 | 0.2180 | 33.15 | 10.94 | 44.09 | 62.89 | -18.80 | QP | |
| 4 | 0.2180 | 19.07 | 10.94 | 30.01 | 52.89 | -22.88 | AVG | |
| 5 | 0.3260 | 29.10 | 10.97 | 40.07 | 59.55 | -19.48 | QP | |
| 6 | 0.3260 | 18.19 | 10.97 | 29.16 | 49.55 | -20.39 | AVG | |
| 7 | 0.4780 | 31.04 | 10.99 | 42.03 | 56.37 | -14.34 | QP | |
| 8 | 0.4780 | 22.30 | 10.99 | 33.29 | 46.37 | -13.08 | AVG | |
| 9 | 0.7140 | 26.10 | 11.01 | 37.11 | 56.00 | -18.89 | QP | |
| 10 | 0.7140 | 19.72 | 11.01 | 30.73 | 46.00 | -15.27 | AVG | |
| 11 | 1.3860 | 23.86 | 11.05 | 34.91 | 56.00 | -21.09 | QP | |
| 12 | 1.3860 | 17.19 | 11.05 | 28.24 | 46.00 | -17.76 | AVG | |

Neutral line:




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.1740 | 42.77 | 10.95 | 53.72 | 64.76 | -11.04 | QP | |
| 2 | 0.1740 | 24.62 | 10.95 | 35.57 | 54.76 | -19.19 | AVG | |
| 3 | 0.2220 | 34.58 | 10.97 | 45.55 | 62.74 | -17.19 | QP | |
| 4 | 0.2220 | 18.46 | 10.97 | 29.43 | 52.74 | -23.31 | AVG | |
| 5 | 0.2620 | 30.14 | 11.00 | 41.14 | 61.36 | -20.22 | QP | |
| 6 | 0.2620 | 15.85 | 11.00 | 26.85 | 51.36 | -24.51 | AVG | |
| 7 | 0.4700 | 30.01 | 11.07 | 41.08 | 56.51 | -15.43 | QP | |
| 8 | 0.4700 | 22.36 | 11.07 | 33.43 | 46.51 | -13.08 | AVG | |
| 9 | 3.7620 | 19.39 | 11.34 | 30.73 | 56.00 | -25.27 | QP | |
| 10 | 3.7620 | 12.66 | 11.34 | 24.00 | 46.00 | -22.00 | AVG | |
| 11 | 9.1820 | 22.08 | 11.46 | 33.54 | 60.00 | -26.46 | QP | |
| 12 | 9.1820 | 16.89 | 11.46 | 28.35 | 50.00 | -21.65 | AVG | |

# 8 Radiated Spurious Emissions

Test Requirement: FCC 47CFR Part 15 Section 15.205 &15.209 & 15.247

Test Method: ANSI C63.10: 2013

Test Result: PASS

Measurement Distance: 3m

Limit:

| Frequency (MHz) | Field Strength | | Field Strength Limit at 3m Measurement Dist | |
|---|---|---|---|---|
| | uV/m | Distance (m) | uV/m | dBuV/m |
| 0.009 ~ 0.490 | 2400/F(kHz) | 300 | 10000 * 2400/F(kHz) | $20\log^{(2400/F(kHz))} + 80$ |
| 0.490 ~ 1.705 | 24000/F(kHz) | 30 | 100 * 24000/F(kHz) | $20\log^{(24000/F(kHz))} + 40$ |
| 1.705 ~ 30 | 30 | 30 | 100 * 30 | $20\log^{(30)} + 40$ |
| 30 ~ 88 | 100 | 3 | 100 | $20\log^{(100)}$ |
| 88 ~ 216 | 150 | 3 | 150 | $20\log^{(150)}$ |
| 216 ~ 960 | 200 | 3 | 200 | $20\log^{(200)}$ |
| Above 960 | 500 | 3 | 500 | $20\log^{(500)}$ |

## 8.1 EUT Operation

Operating Environment **:**

Temperature: 25.1°C

Humidity: 55.9%RH

Atmospheric Pressure: 101.3kPa

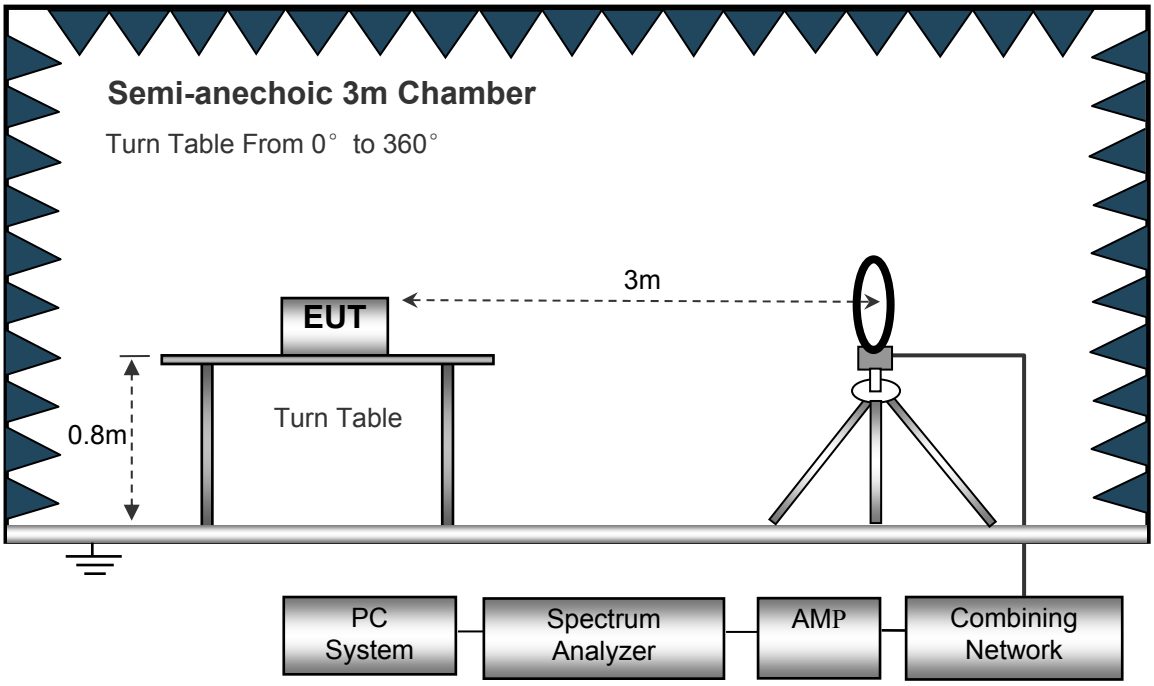
EUT Operation :

The test was performed in Transmitting mode, the worst test data were shown in the report.

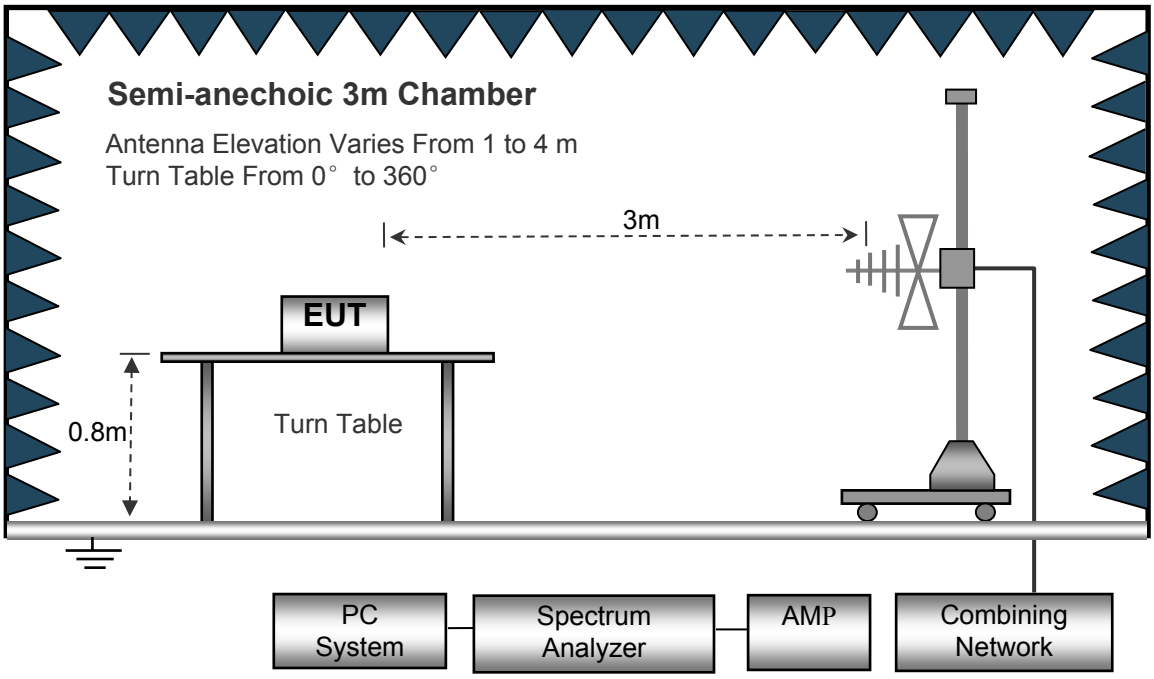
## 8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

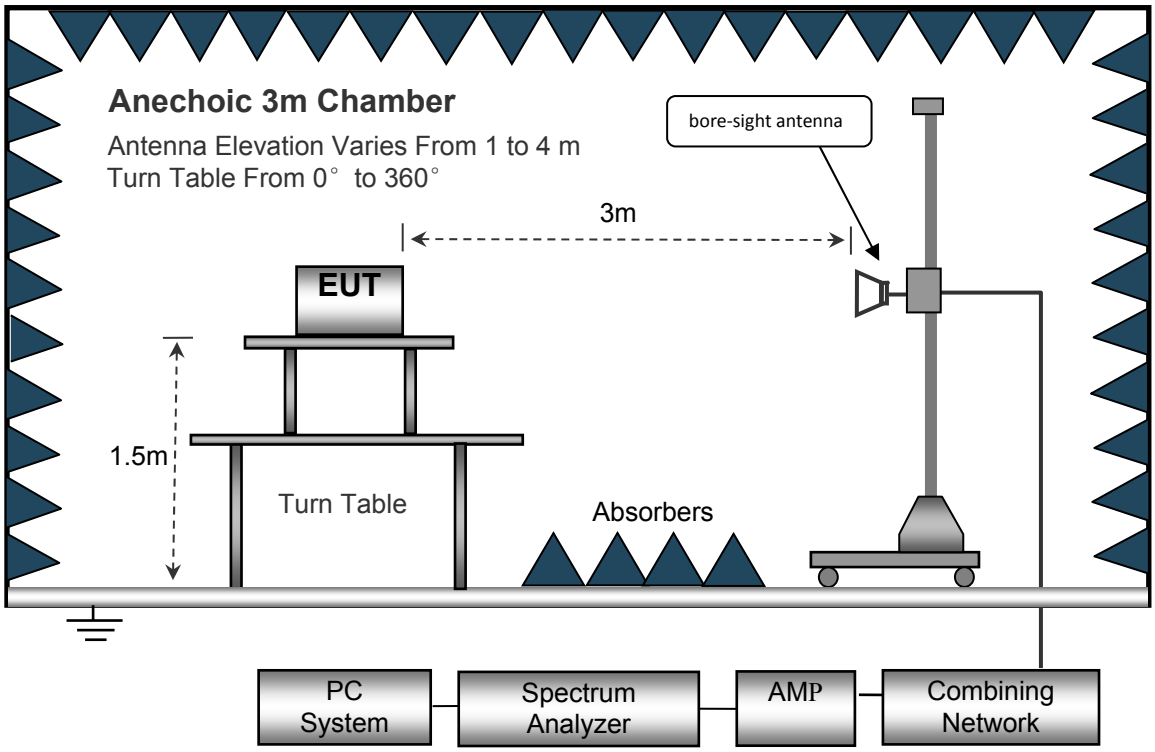
The test setup for emission measurement below 30MHz.




The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.




## 8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz

Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz
Detector ..... Ave.
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 10Hz

## 8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the Z position. So the data shown was the Z position only.

## 8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Limit

## 8.6 Summary of Test Results

**Test Frequency: 9kHz~30MHz**

The measurements were more than 20 dB below the limit and not reported.

**Test Frequency: 30MHz ~ 8GHz**

Remark: only the worst data (8DPSK modulation mode) were reported.

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Height | Polar | | | | |
| (MHz) | (dBμV) | (PK/QP/Ave) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 8DPSK Low Channel | | | | | | | | | |
| 207.85 | 45.82 | QP | 320 | 1.2 | H | -13.22 | 32.60 | 43.50 | -10.90 |
| 207.85 | 49.78 | QP | 34 | 1.4 | V | -13.22 | 36.56 | 43.50 | -6.94 |
| 4804.00 | 55.61 | PK | 44 | 1.9 | V | -1.06 | 54.55 | 74.00 | -19.45 |
| 4804.00 | 40.95 | Ave | 44 | 1.9 | V | -1.06 | 39.89 | 54.00 | -14.11 |
| 7206.00 | 52.44 | PK | 35 | 1.4 | H | 1.32 | 53.76 | 74.00 | -20.24 |
| 7206.00 | 40.75 | Ave | 35 | 1.4 | H | 1.32 | 42.07 | 54.00 | -11.93 |
| 2346.22 | 45.85 | PK | 308 | 1.7 | V | -13.26 | 32.59 | 74.00 | -41.41 |
| 2346.22 | 37.70 | Ave | 308 | 1.7 | V | -13.26 | 24.44 | 54.00 | -29.56 |
| 2350.68 | 43.73 | PK | 337 | 1.4 | H | -13.02 | 30.71 | 74.00 | -43.29 |
| 2350.68 | 37.49 | Ave | 337 | 1.4 | H | -13.02 | 24.47 | 54.00 | -29.53 |
| 2489.41 | 42.85 | PK | 177 | 1.2 | V | -13.20 | 29.65 | 74.00 | -44.35 |
| 2489.41 | 37.51 | Ave | 177 | 1.2 | V | -13.20 | 24.31 | 54.00 | -29.69 |

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Height | Polar | | | | |
| (MHz) | (dBμV) | (PK/QP/Ave) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 8DPSK Middle Channel | | | | | | | | | |
| 207.85 | 45.21 | QP | 76 | 1.2 | H | -13.22 | 31.99 | 43.50 | -11.51 |
| 207.85 | 48.54 | QP | 31 | 1.5 | V | -13.22 | 35.32 | 43.50 | -8.18 |
| 4882.00 | 54.14 | PK | 12 | 1.2 | V | -0.62 | 53.52 | 74.00 | -20.48 |
| 4882.00 | 40.17 | Ave | 12 | 1.2 | V | -0.62 | 39.55 | 54.00 | -14.45 |
| 7323.00 | 52.37 | PK | 296 | 2.0 | H | 2.21 | 54.58 | 74.00 | -19.42 |
| 7323.00 | 40.60 | Ave | 296 | 2.0 | H | 2.21 | 42.81 | 54.00 | -11.19 |
| 2338.13 | 44.44 | PK | 6 | 1.4 | V | -13.19 | 31.25 | 74.00 | -42.75 |
| 2338.13 | 37.58 | Ave | 6 | 1.4 | V | -13.19 | 24.39 | 54.00 | -29.61 |
| 2379.68 | 43.03 | PK | 341 | 1.7 | H | -13.14 | 29.89 | 74.00 | -44.11 |
| 2379.68 | 36.83 | Ave | 341 | 1.7 | H | -13.14 | 23.69 | 54.00 | -30.31 |
| 2491.67 | 42.61 | PK | 88 | 1.3 | V | -13.08 | 29.53 | 74.00 | -44.47 |
| 2491.67 | 36.93 | Ave | 88 | 1.3 | V | -13.08 | 23.85 | 54.00 | -30.15 |

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna | | Corrected Factor | Corrected Amplitude | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Height | Polar | | | | |
| (MHz) | (dBμV) | (PK/QP/Ave) | Degree | (m) | (H/V) | (dB) | (dBμV/m) | (dBμV/m) | (dB) |
| 8DPSK High Channel | | | | | | | | | |
| 207.85 | 43.92 | QP | 59 | 1.7 | H | -13.22 | 30.70 | 43.50 | -12.80 |
| 207.85 | 47.90 | QP | 331 | 1.9 | V | -13.22 | 34.68 | 43.50 | -8.82 |
| 4960.00 | 55.60 | PK | 76 | 1.5 | V | -0.24 | 55.36 | 74.00 | -18.64 |
| 4960.00 | 38.85 | Ave | 76 | 1.5 | V | -0.24 | 38.61 | 54.00 | -15.39 |
| 7440.00 | 50.53 | PK | 190 | 1.4 | H | 2.84 | 53.37 | 74.00 | -20.63 |
| 7440.00 | 39.52 | Ave | 190 | 1.4 | H | 2.84 | 42.36 | 54.00 | -11.64 |
| 2315.24 | 44.61 | PK | 269 | 1.9 | V | -13.19 | 31.42 | 74.00 | -42.58 |
| 2315.24 | 36.75 | Ave | 269 | 1.9 | V | -13.19 | 23.56 | 54.00 | -30.44 |
| 2355.06 | 41.16 | PK | 179 | 1.5 | H | -13.14 | 28.02 | 74.00 | -45.98 |
| 2355.06 | 36.67 | Ave | 179 | 1.5 | H | -13.14 | 23.53 | 54.00 | -30.47 |
| 2489.95 | 41.11 | PK | 171 | 1.8 | V | -13.08 | 28.03 | 74.00 | -45.97 |
| 2489.95 | 35.41 | Ave | 171 | 1.8 | V | -13.08 | 22.33 | 54.00 | -31.67 |

**Test Frequency: 8GHz~25GHz**

The measurements were more than 20 dB below the limit and not recorded

# 9 Conducted Spurious Emissions

Test Requirement: FCC 47CFR Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

Test Result: PASS

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

## 9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:

Blow 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

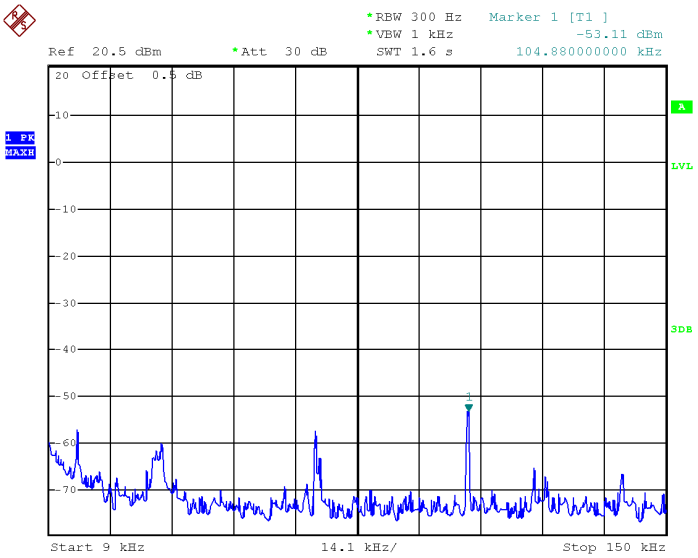
Detector function = peak, Trace = max hold

## 9.2 Test Result

**9kHz – 150KHz**

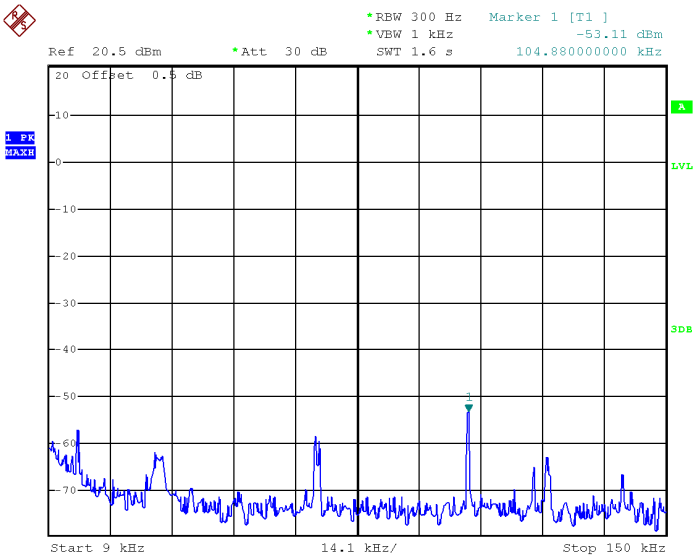
**GFSK**

Low Channel



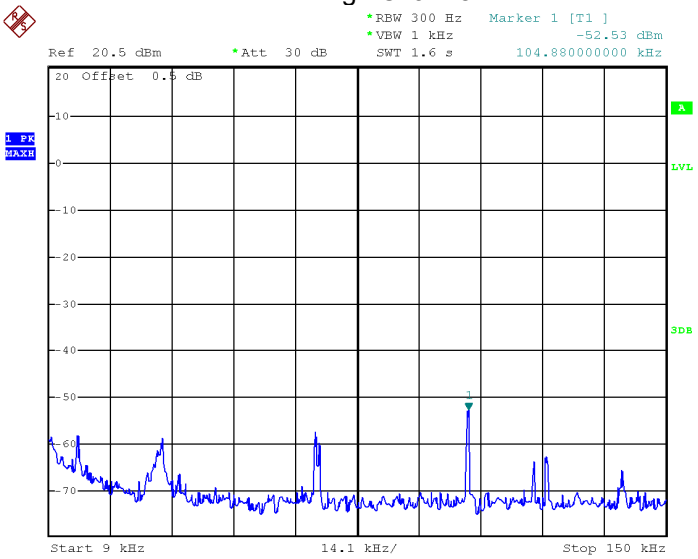

Date: 17.MAY.2024 10:51:28

Middle Channel




Date: 17.MAY.2024 10:51:46

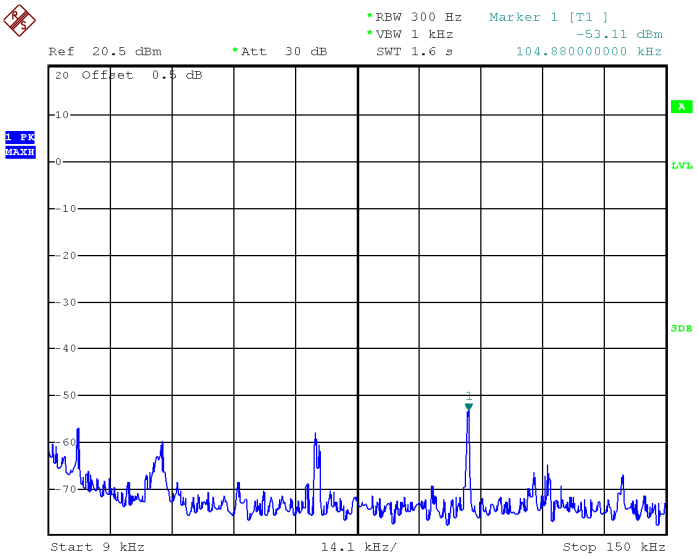
High Channel




Date: 17.MAY.2024 10:53:19

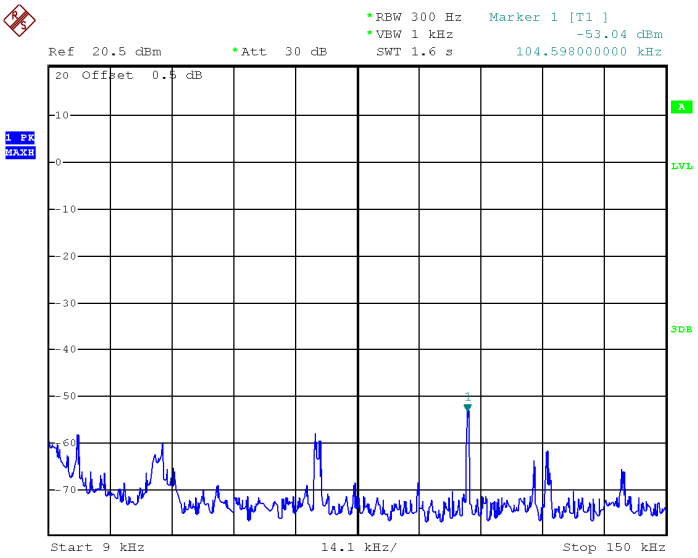
**π/4DQPSK**

Low Channel



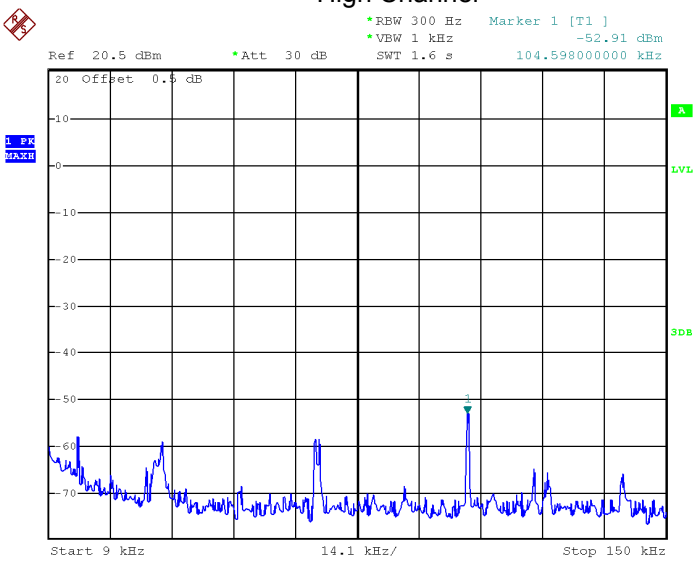

Date: 17.MAY.2024 10:50:59

Middle Channel




Date: 17.MAY.2024 10:50:34

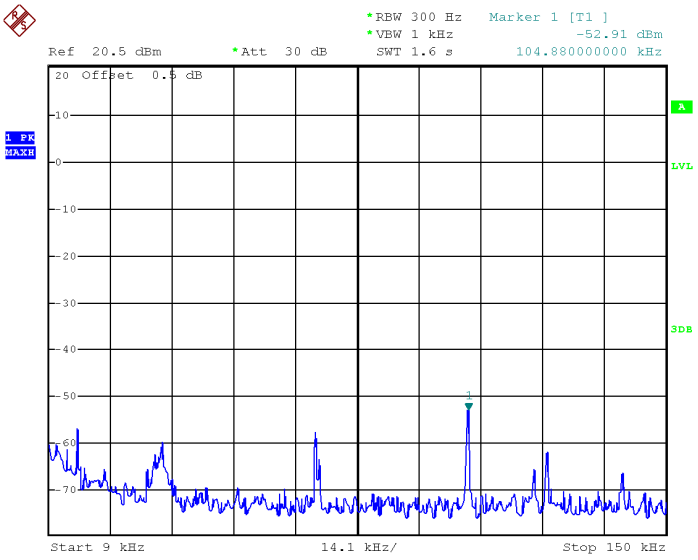
High Channel




Date: 17.MAY.2024 10:50:13

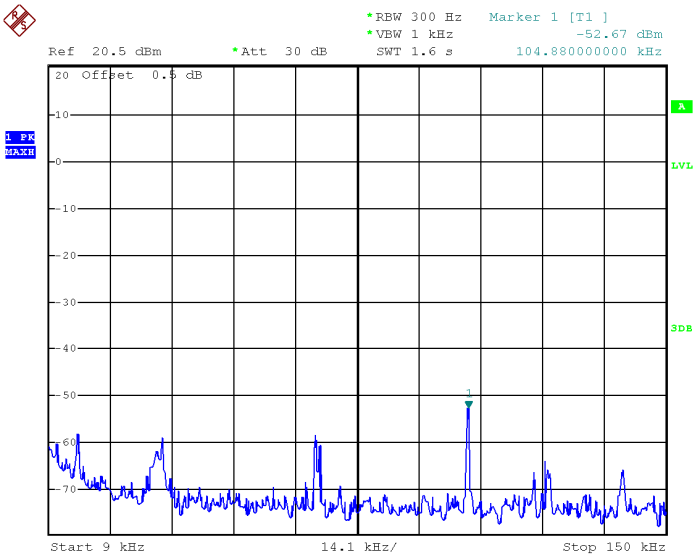
## 8DPSK

### Low Channel



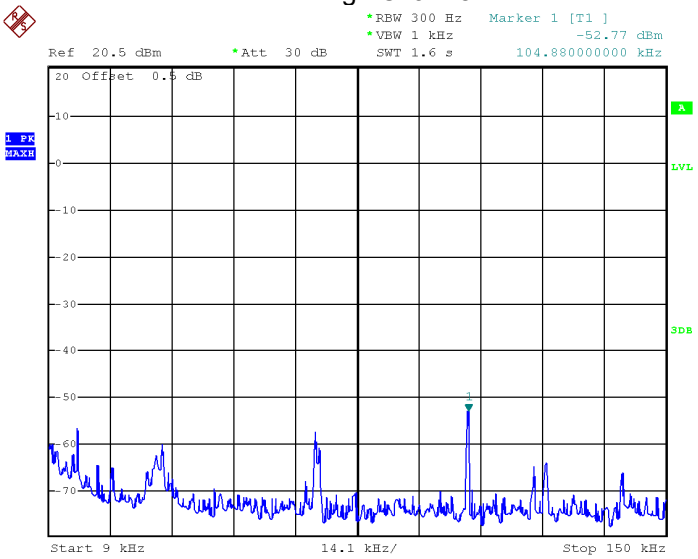

Date: 17.MAY.2024 10:54:41

### Middle Channel




Date: 17.MAY.2024 10:54:06

High Channel

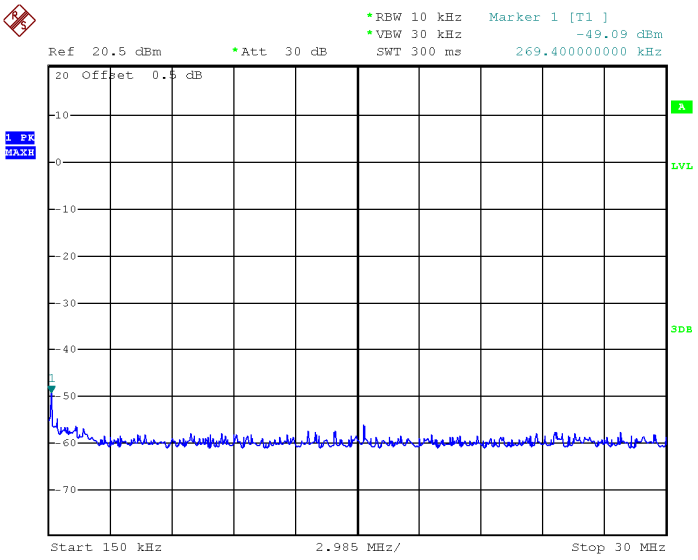



Date: 17.MAY.2024 10:53:42

**150kHz – 30MHz**

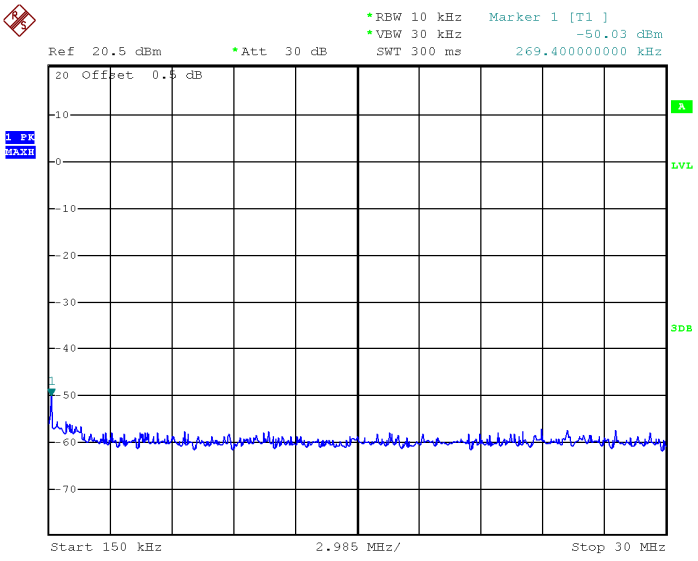
**GFSK**

Low Channel



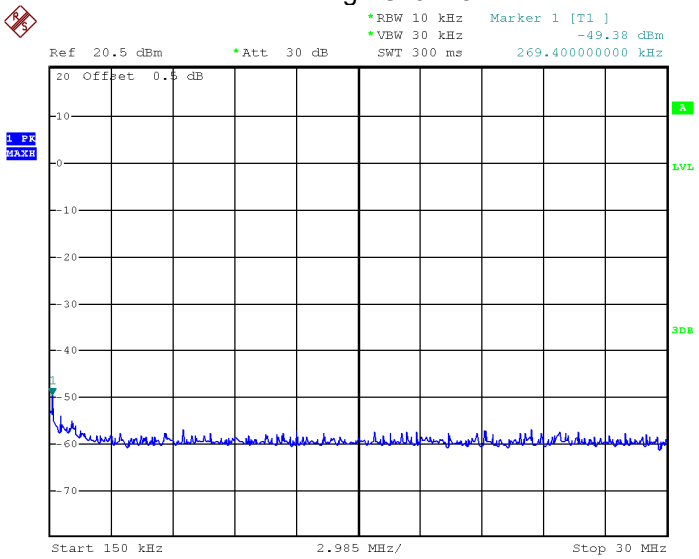

Date: 17.MAY.2024 10:46:32

Middle Channel




Date: 17.MAY.2024 10:47:31

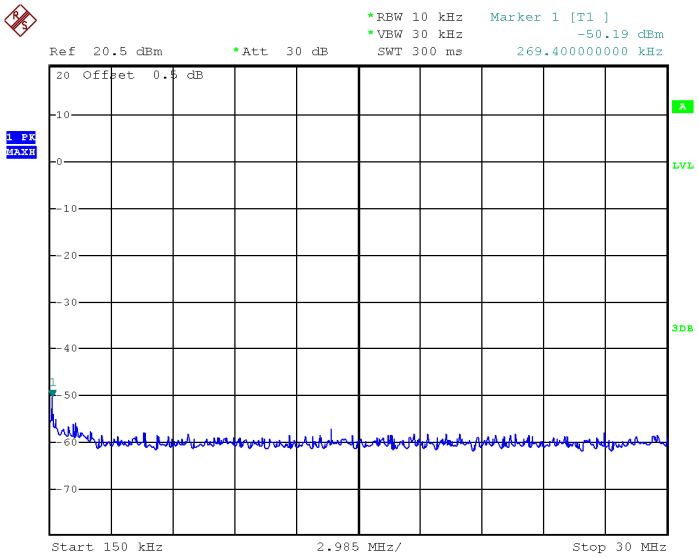
High Channel




Date: 17.MAY.2024 10:48:08

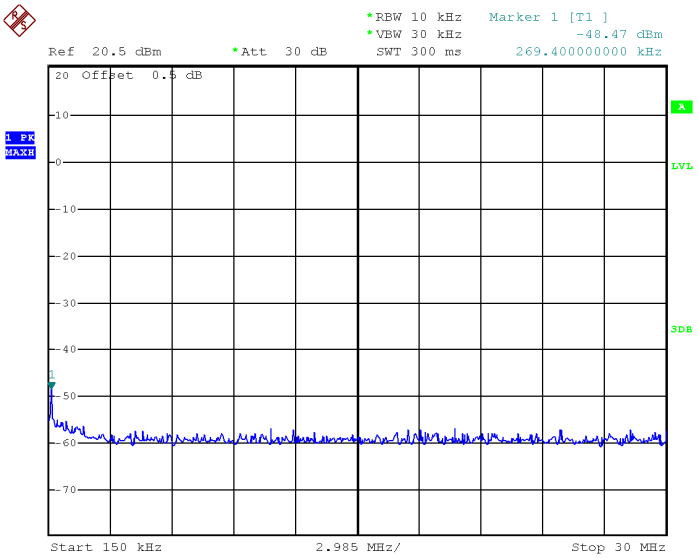
**π/4DQPSK**

Low Channel



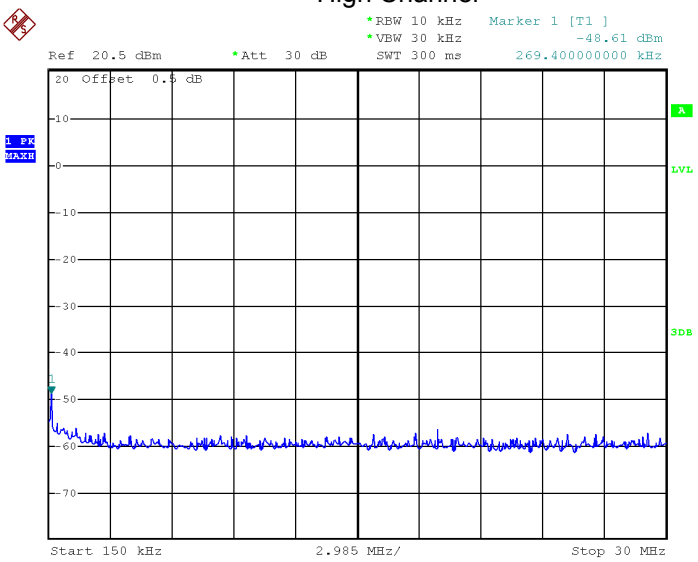

Date: 17.MAY.2024 10:46:09

Middle Channel




Date: 17.MAY.2024 10:48:56

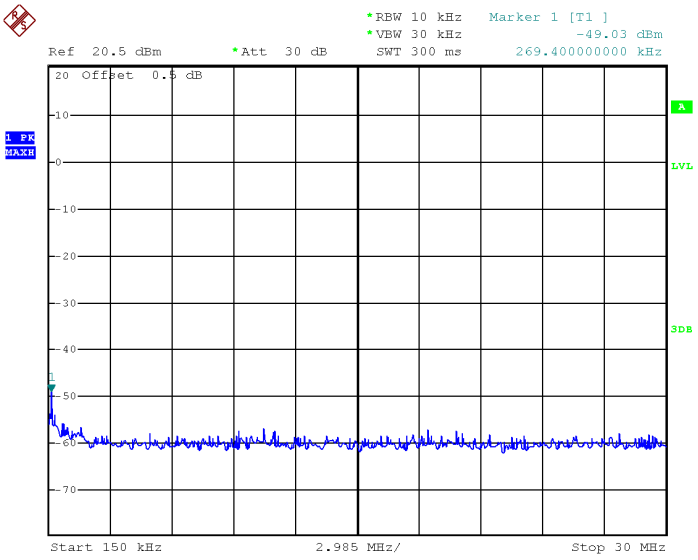
High Channel




Date: 17.MAY.2024 10:49:24

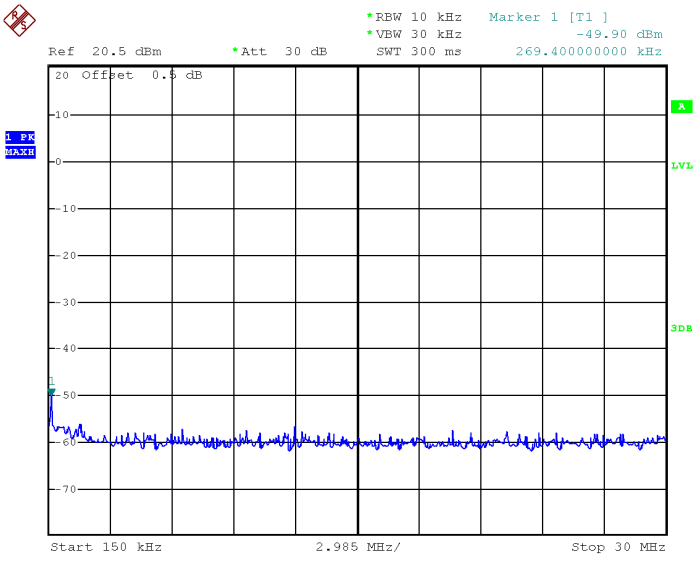
## 8DPSK

### Low Channel



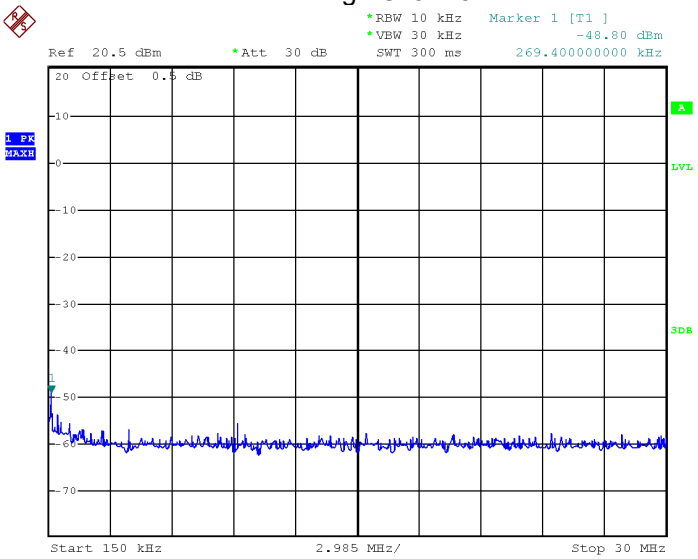

Date: 17.MAY.2024 10:45:53

### Middle Channel




Date: 17.MAY.2024 10:45:35

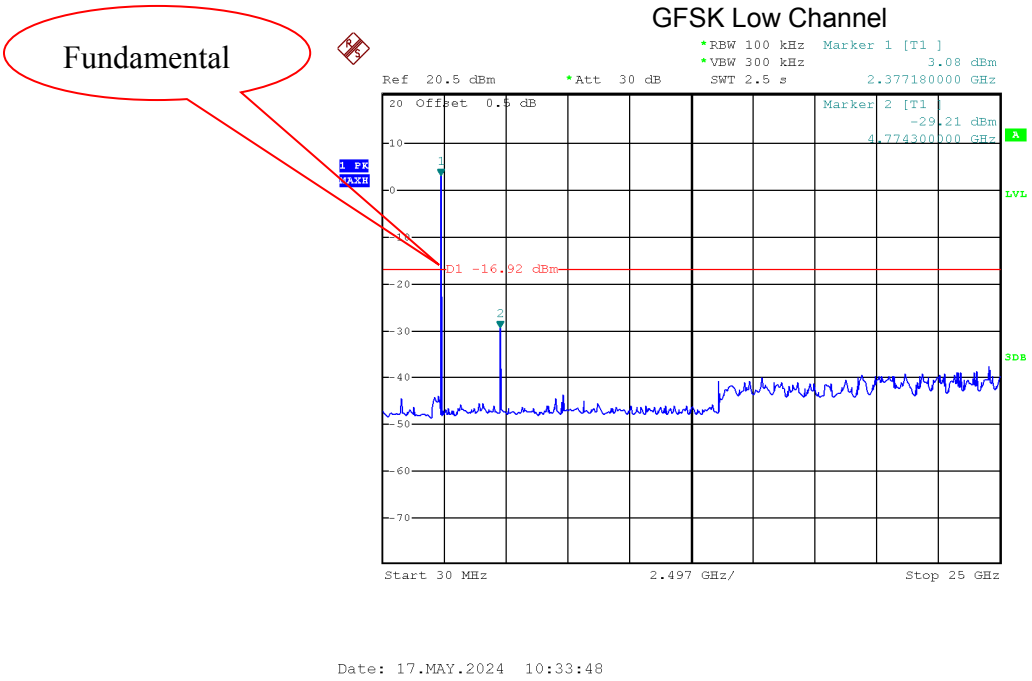
High Channel




Date: 17.MAY.2024 10:45:18

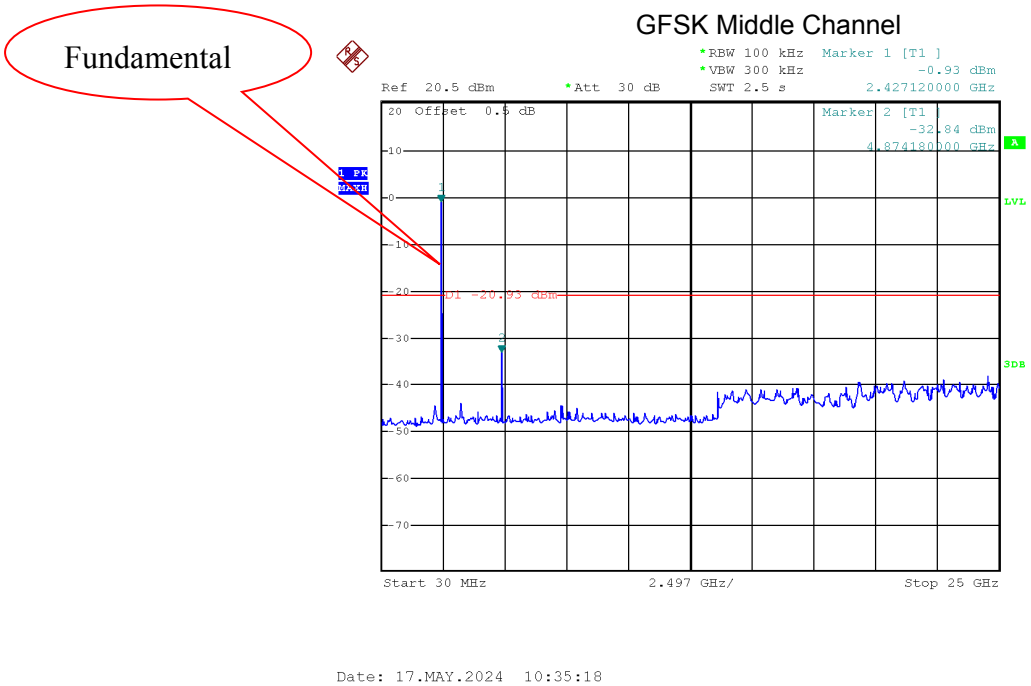
**30MHz – 25GHz**

GFSK Low Channel

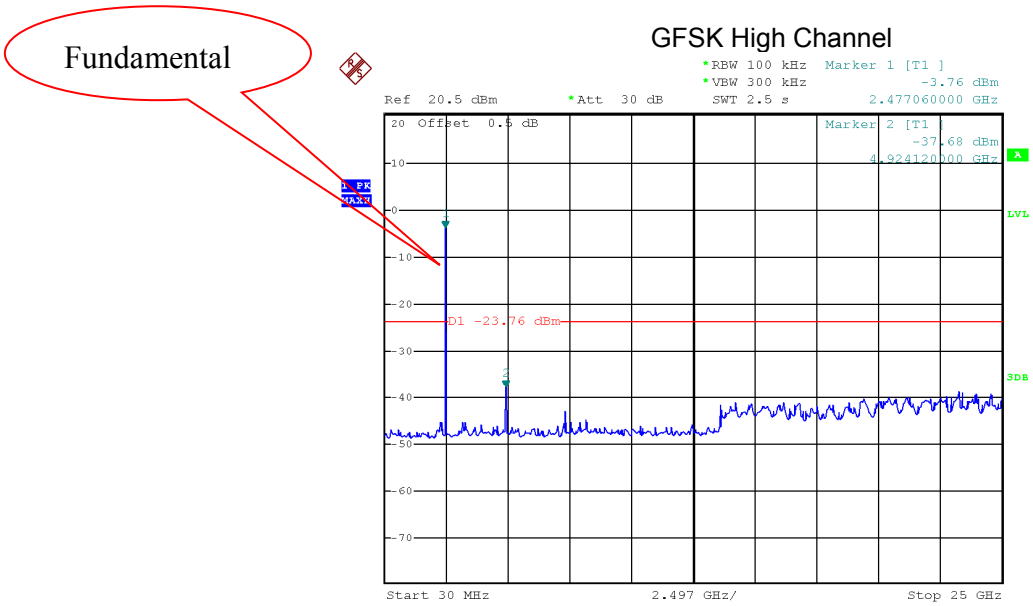



Date: 17.MAY.2024 10:33:48

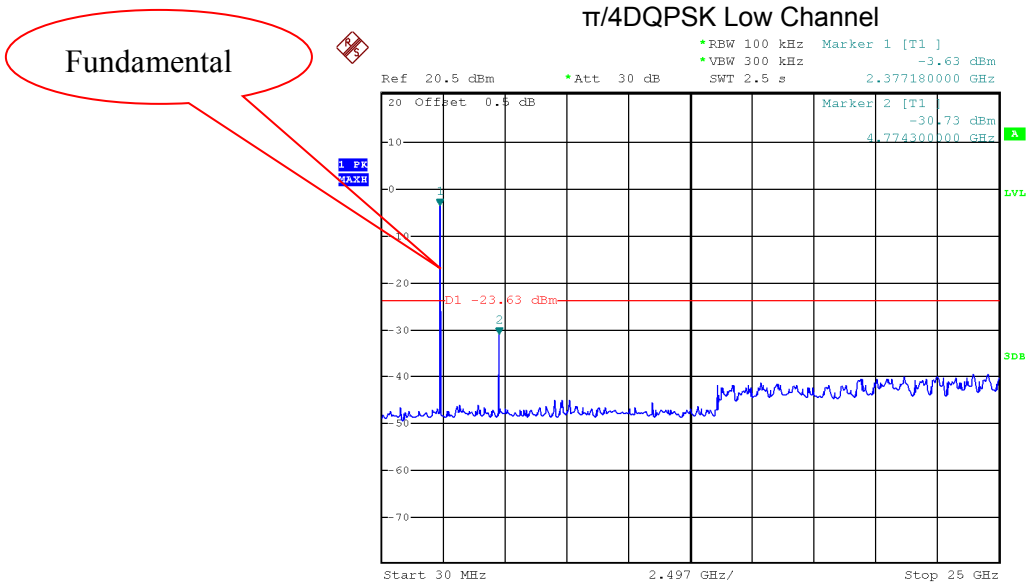
GFSK Middle Channel




Date: 17.MAY.2024 10:35:18

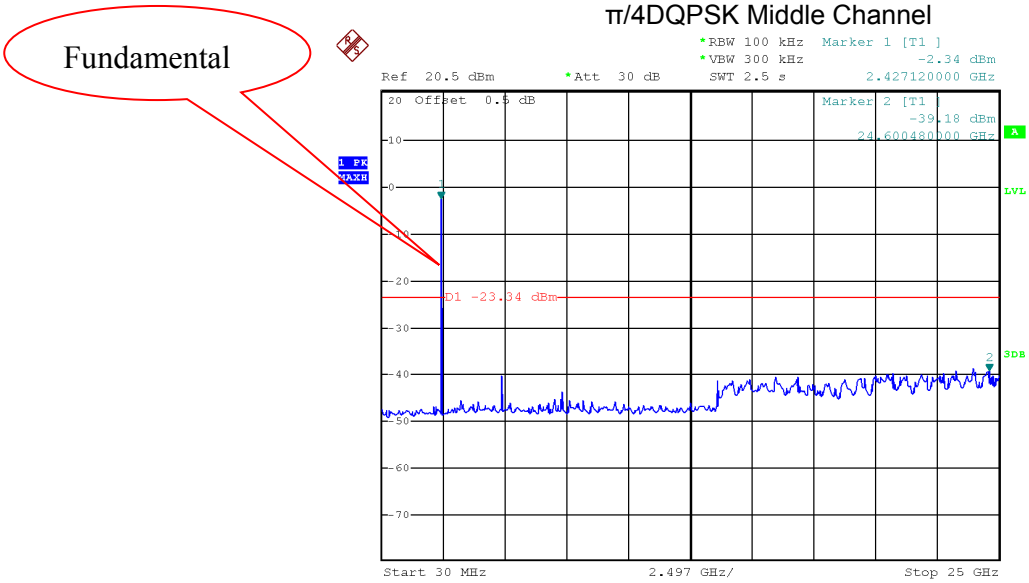



Date: 17.MAY.2024 11:24:56



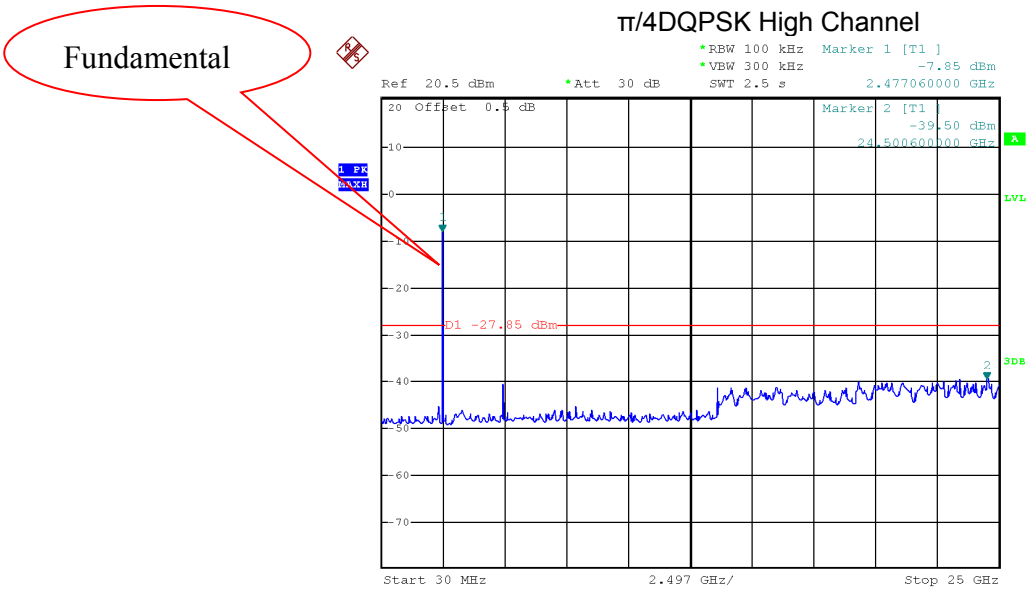

Date: 17.MAY.2024 10:40:19

π/4DQPSK Middle Channel



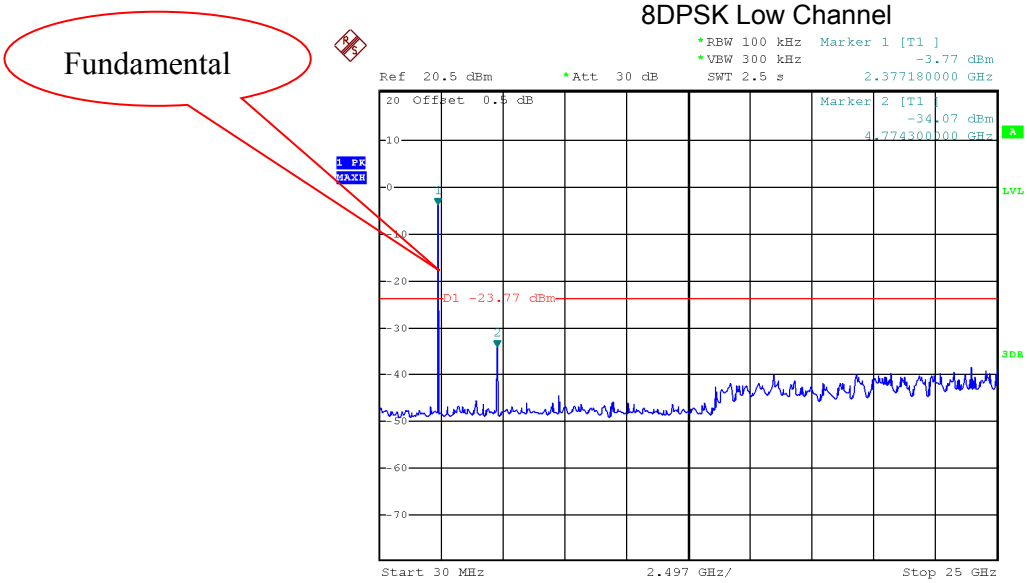

Date: 17.MAY.2024 10:38:59

π/4DQPSK High Channel



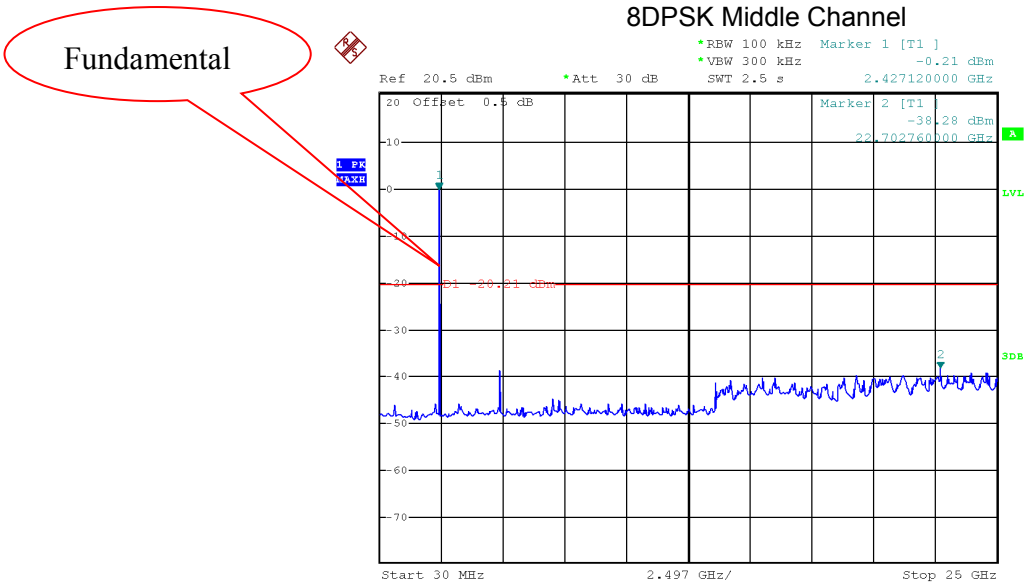

Date: 17.MAY.2024 10:37:22

8DPSK Low Channel



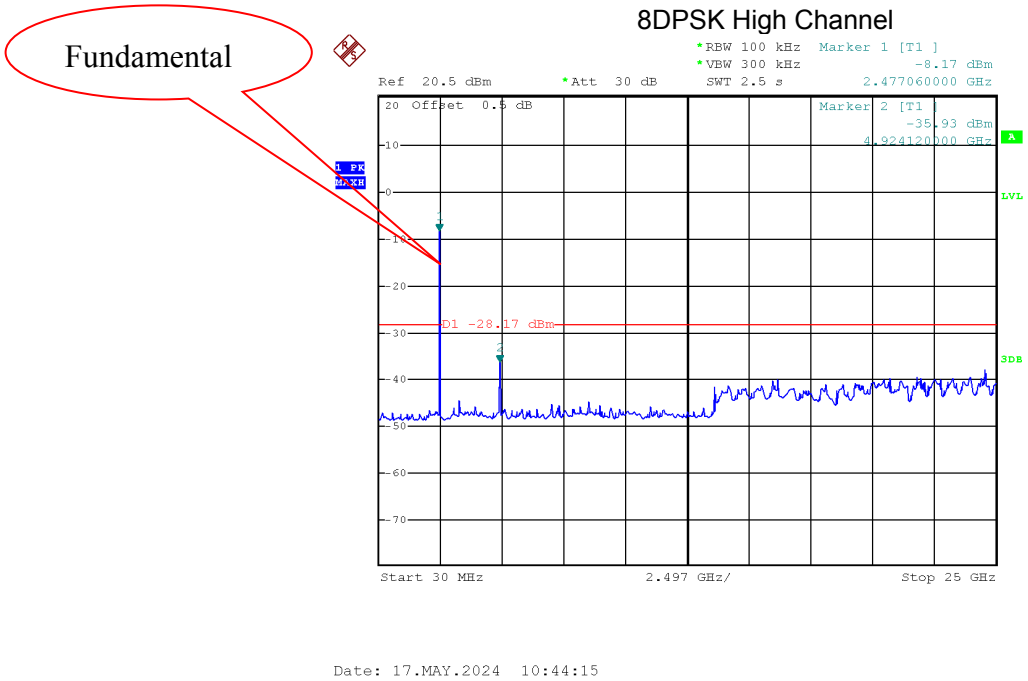

Date: 17.MAY.2024 10:41:40

8DPSK Middle Channel




Date: 17.MAY.2024 10:42:56

8DPSK High Channel




Date: 17.MAY.2024 10:44:15

# 10 Band Edge Measurement

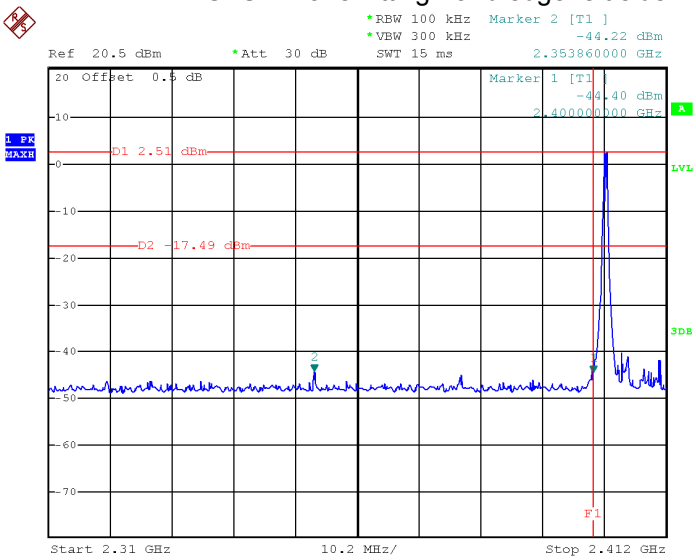
| | |
|---|---|
| Test Requirement: | Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)). |
| Test Method: | ANSI C63.10: 2013 |
| Test Limit: | Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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)). |
| Test Mode: | Transmitting |

## 10.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
   Detector function = peak, Trace = max hold

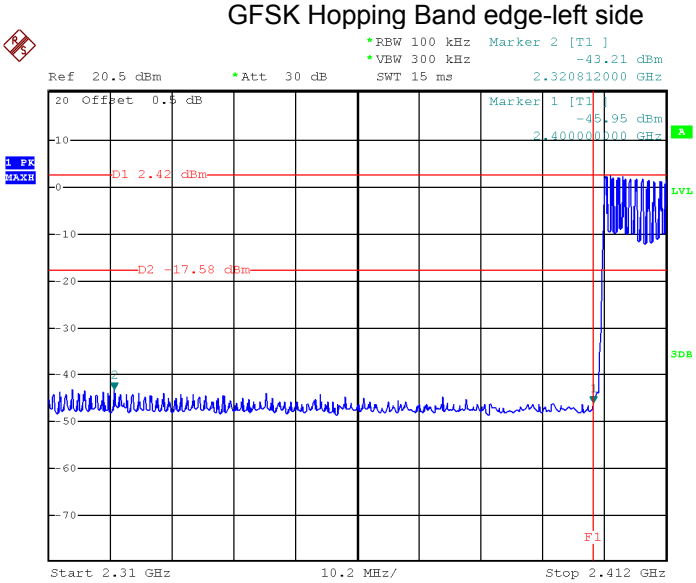
## 10.2 Test Result

GFSK Transmitting Band edge-left side



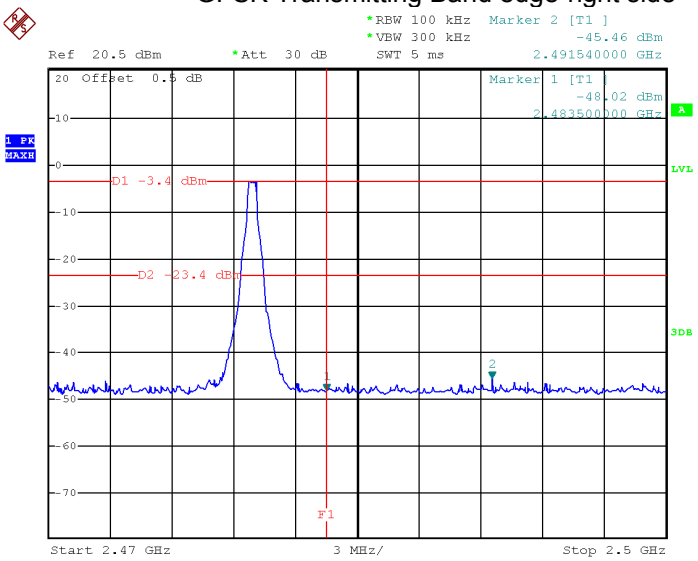

Date: 16.MAY.2024 18:01:33

GFSK Hopping Band edge-left side



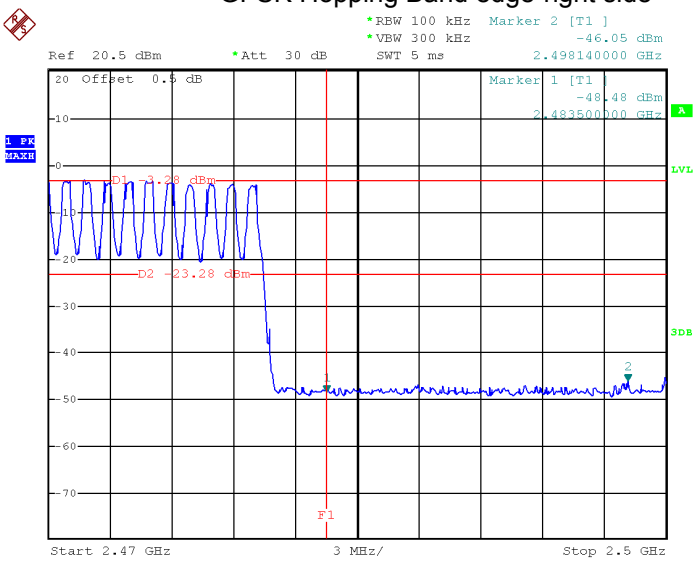

Date: 16.MAY.2024 19:06:15

GFSK Transmitting Band edge-right side



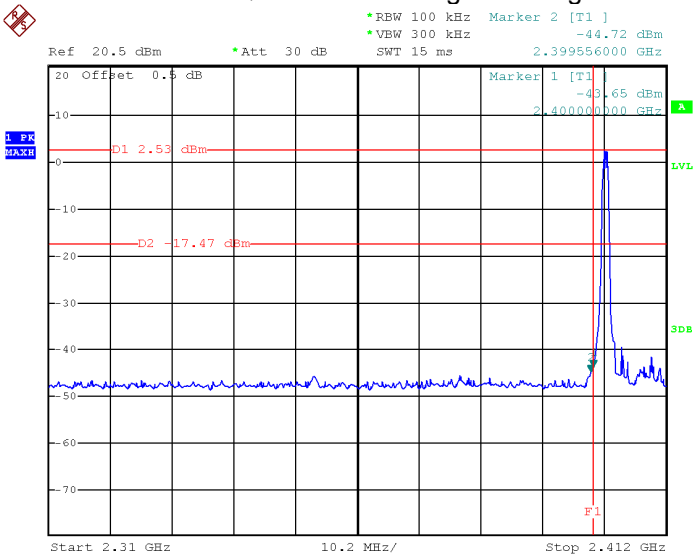

Date: 16.MAY.2024 17:34:33

GFSK Hopping Band edge-right side



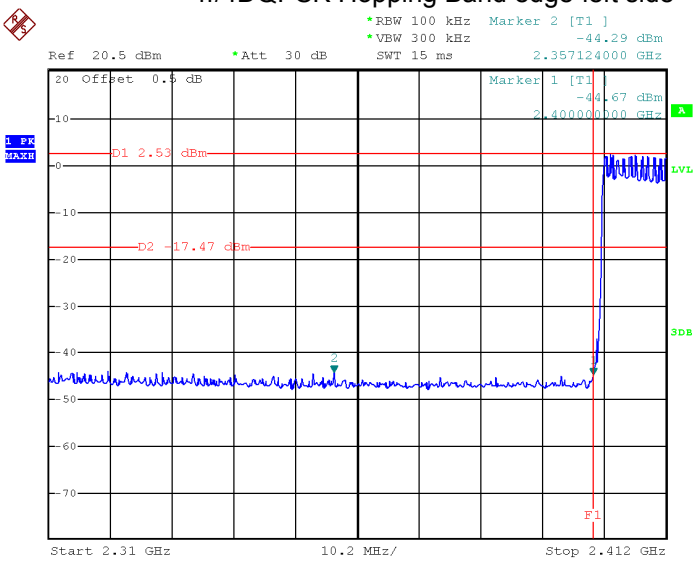

Date: 16.MAY.2024 17:58:14

π/4DQPSK Transmitting Band edge-left side



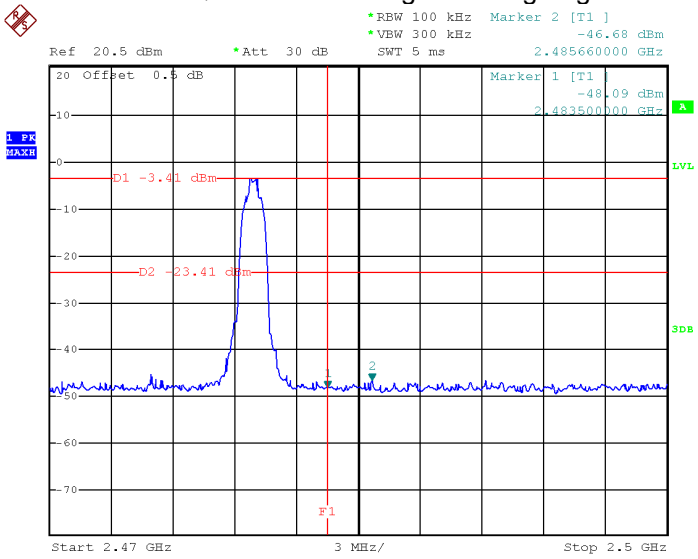

Date: 16.MAY.2024 18:07:20

π/4DQPSK Hopping Band edge-left side



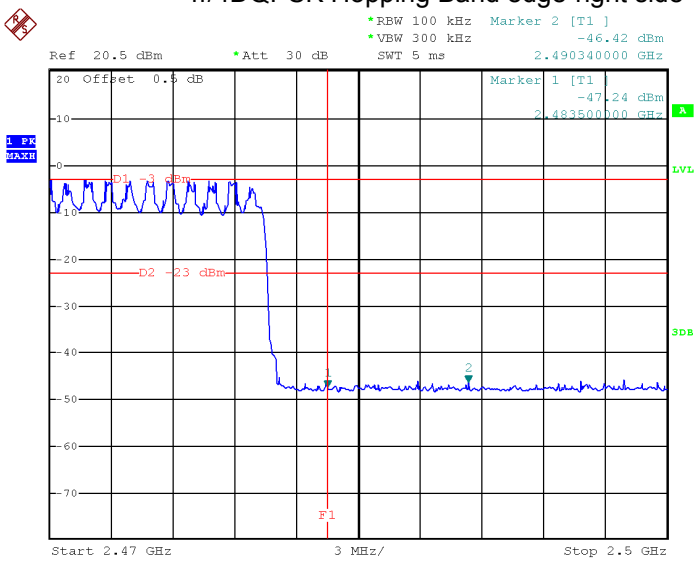

Date: 16.MAY.2024 18:58:41

π/4DQPSK Transmitting Band edge-right side



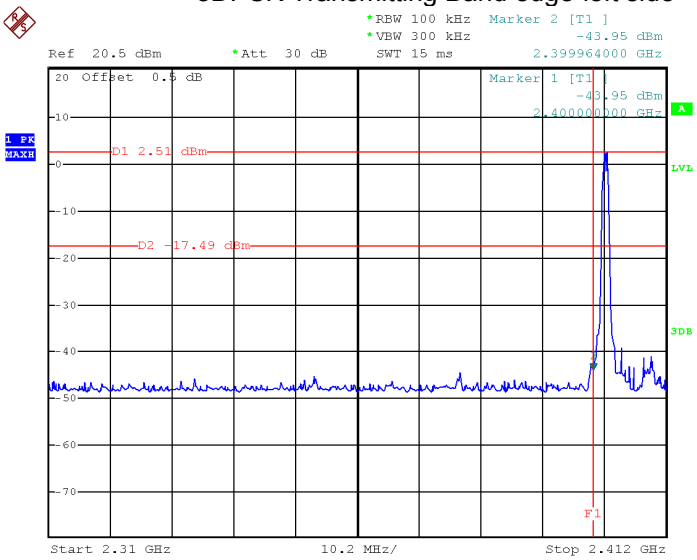

Date: 16.MAY.2024 17:37:00

π/4DQPSK Hopping Band edge-right side



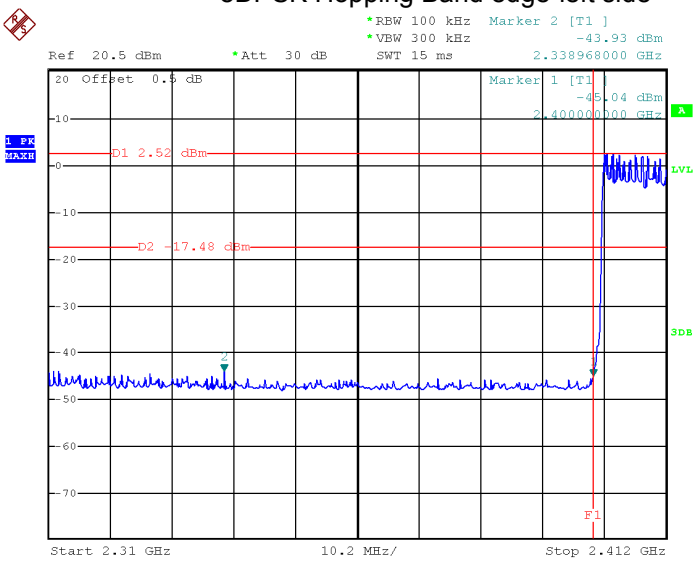

Date: 16.MAY.2024 17:55:53

8DPSK Transmitting Band edge-left side



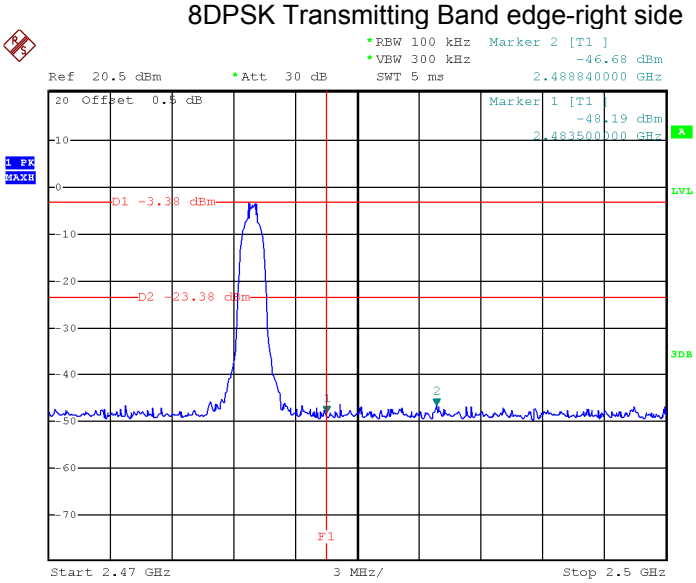

Date: 16.MAY.2024 18:10:18

8DPSK Hopping Band edge-left side



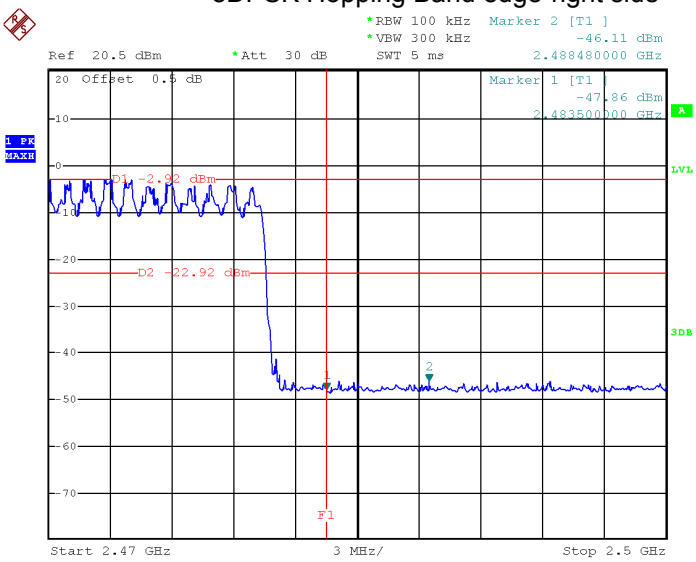

Date: 16.MAY.2024 18:19:02

8DPSK Transmitting Band edge-right side




Date: 16.MAY.2024 17:38:40

8DPSK Hopping Band edge-right side




Date: 16.MAY.2024 17:46:38

# 11 20 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: FCC 47CFR Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

Test Mode: Test in fixing operating frequency at low, Middle, high channel.

## 11.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 30kHz, VBW = 100kHz

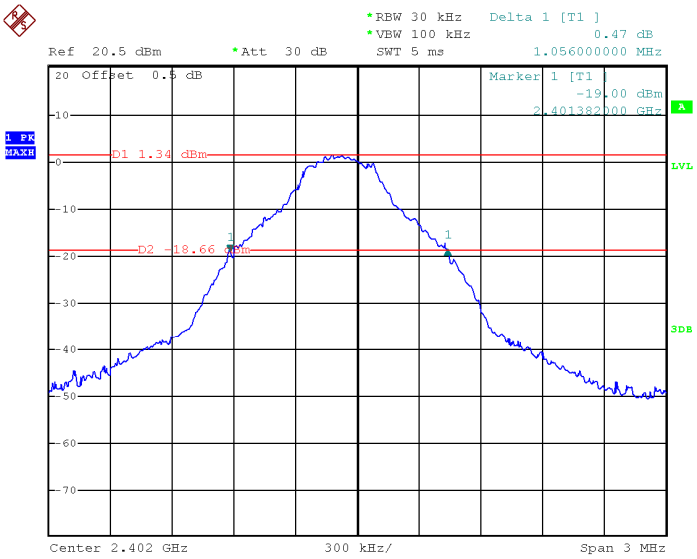
## 11.2 Test Result

| Modulation | Test Channel | 20 dB Bandwidth MHz | 99% Bandwidth MHz |
|---|---|---|---|
| GFSK | Low | 1.056 | 0.894 |
| GFSK | Middle | 0.996 | 0.894 |
| GFSK | High | 1.020 | 0.888 |
| π/4DQPSK | Low | 1.326 | 1.188 |
| π/4DQPSK | Middle | 1.350 | 1.194 |
| π/4DQPSK | High | 1.320 | 1.200 |
| 8DPSK | Low | 1.326 | 1.200 |
| 8DPSK | Middle | 1.320 | 1.206 |
| 8DPSK | High | 1.332 | 1.200 |

## Test plots

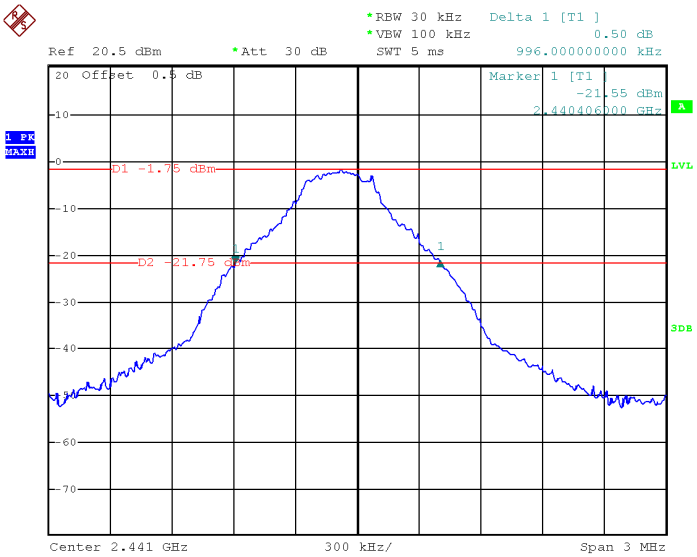
### 20 dB Bandwidth

GFSK Low Channel



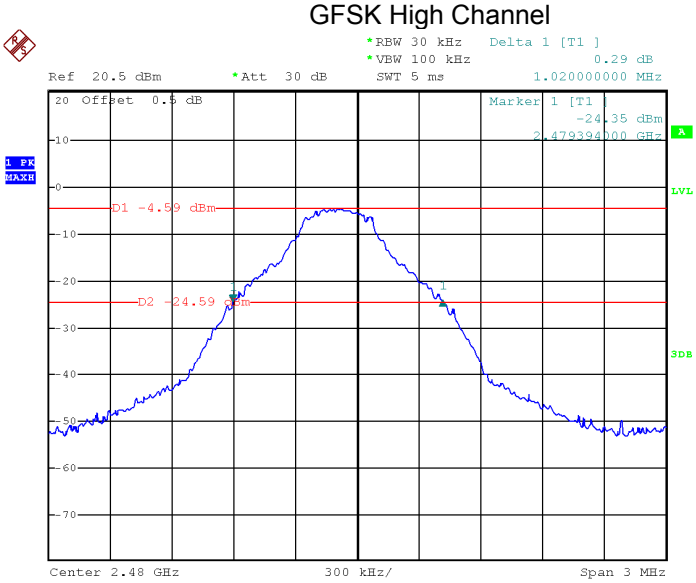

Date: 16.MAY.2024 17:25:40

GFSK Middle Channel



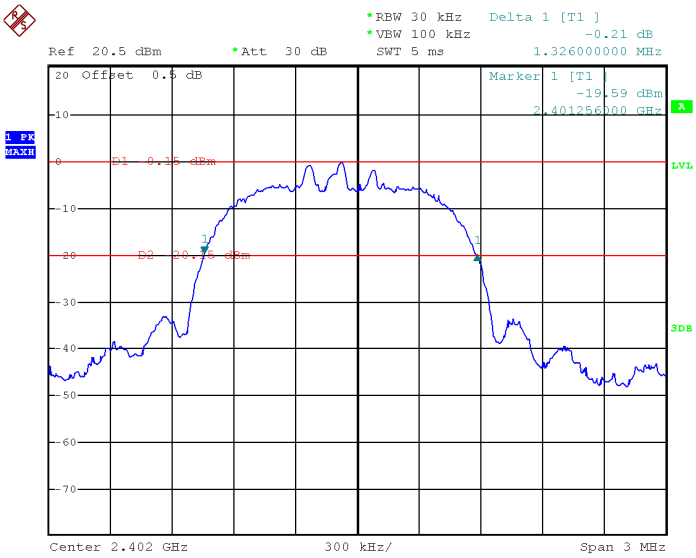

Date: 16.MAY.2024 17:28:07

GFSK High Channel



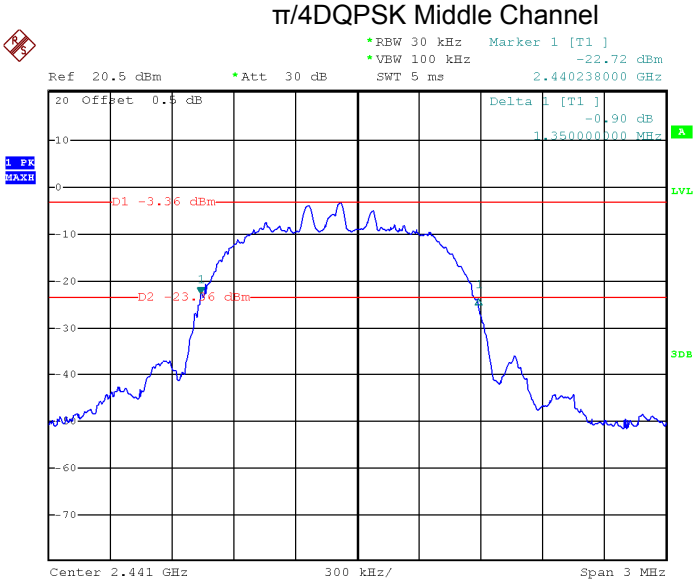

Date: 16.MAY.2024 17:30:42

π/4DQPSK Low Channel



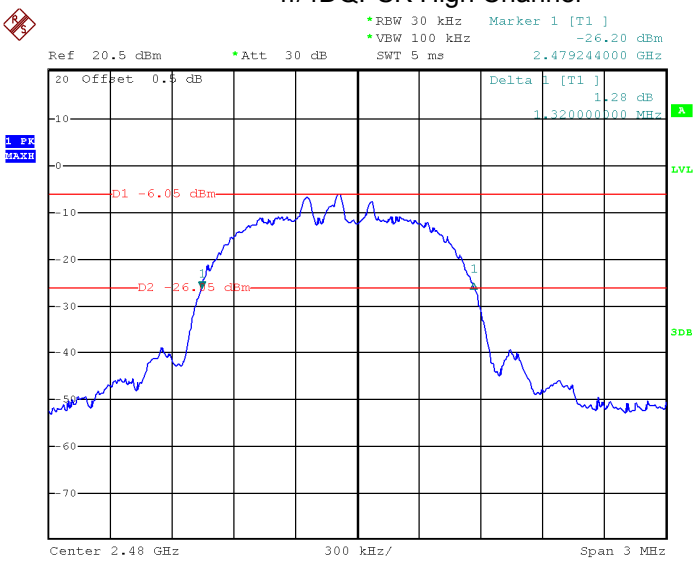

Date: 16.MAY.2024 17:12:02

π/4DQPSK Middle Channel



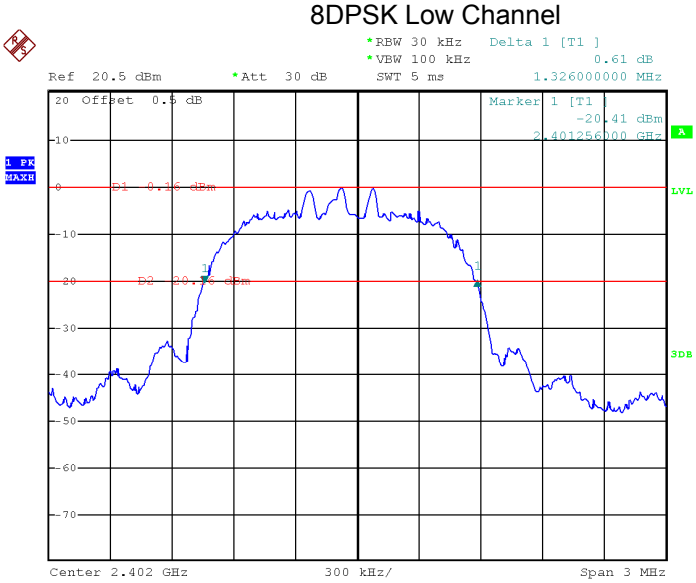

Date: 16.MAY.2024 17:14:26

π/4DQPSK High Channel



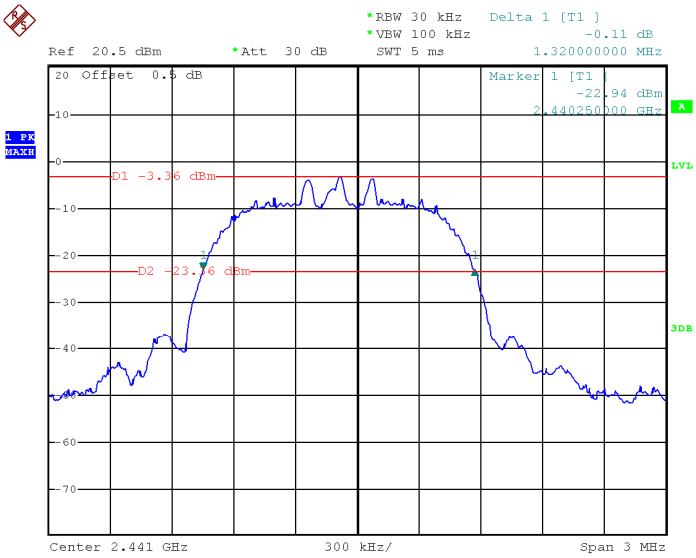

Date: 16.MAY.2024 17:16:32

8DPSK Low Channel



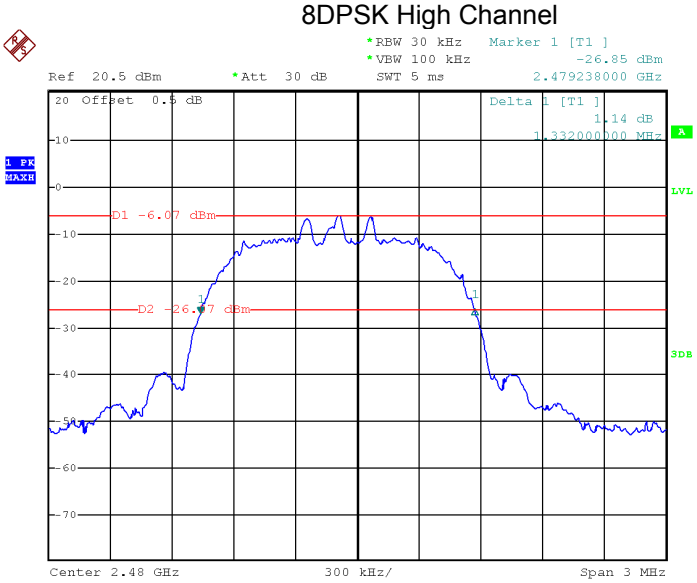

Date: 16.MAY.2024 17:22:58

8DPSK Middle Channel




Date: 16.MAY.2024 17:21:03

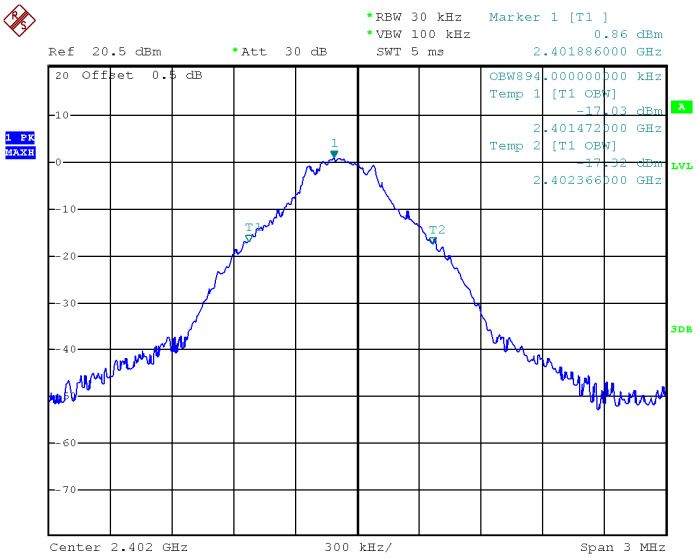
8DPSK High Channel




Date: 16.MAY.2024 17:19:11

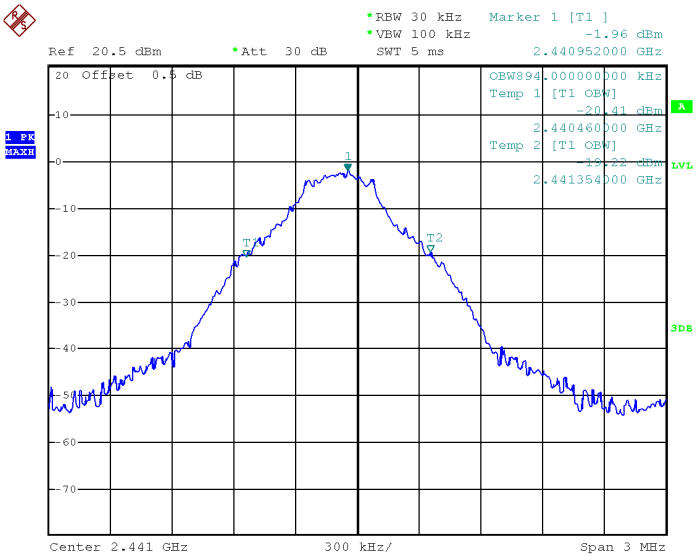
## 99% Bandwidth

GFSK Low Channel



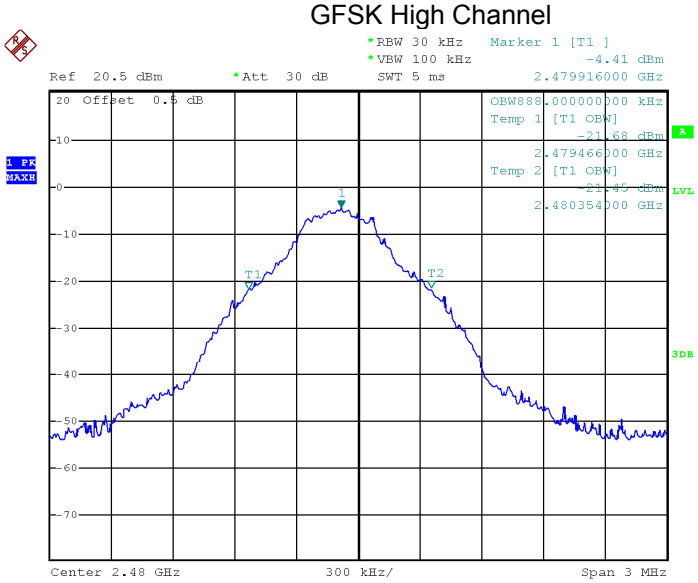

Date: 16.MAY.2024 16:31:03

GFSK Middle Channel



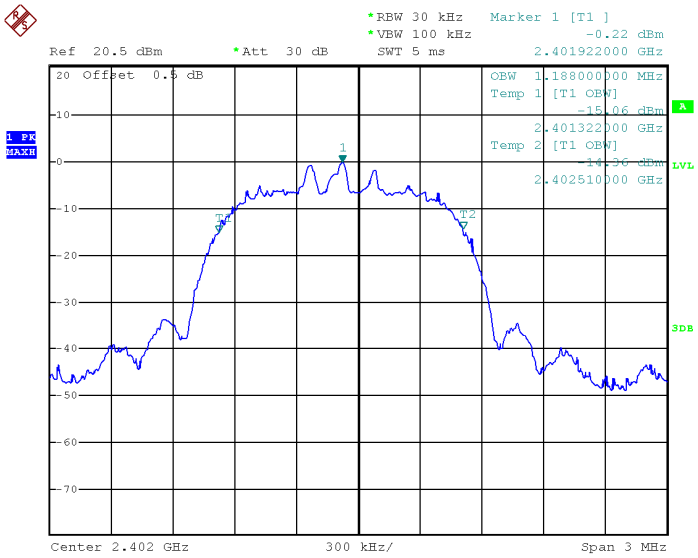

Date: 16.MAY.2024 16:28:48

GFSK High Channel



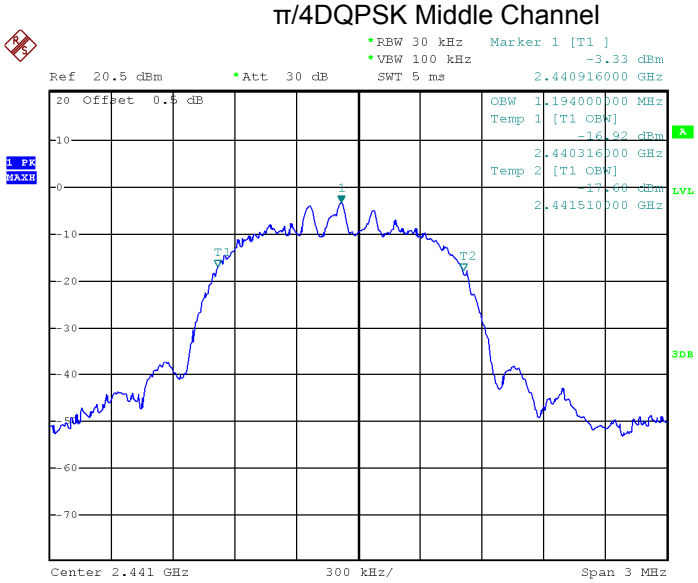

Date: 16.MAY.2024 16:29:52

π/4DQPSK Low Channel



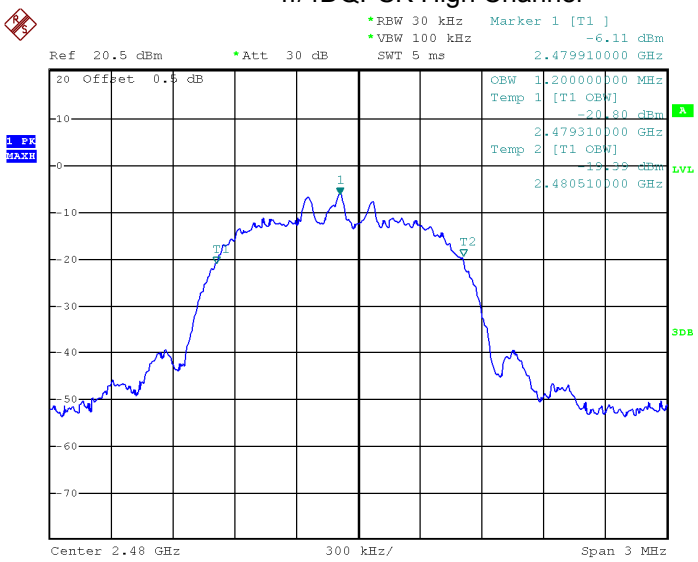

Date: 16.MAY.2024 16:32:56

π/4DQPSK Middle Channel



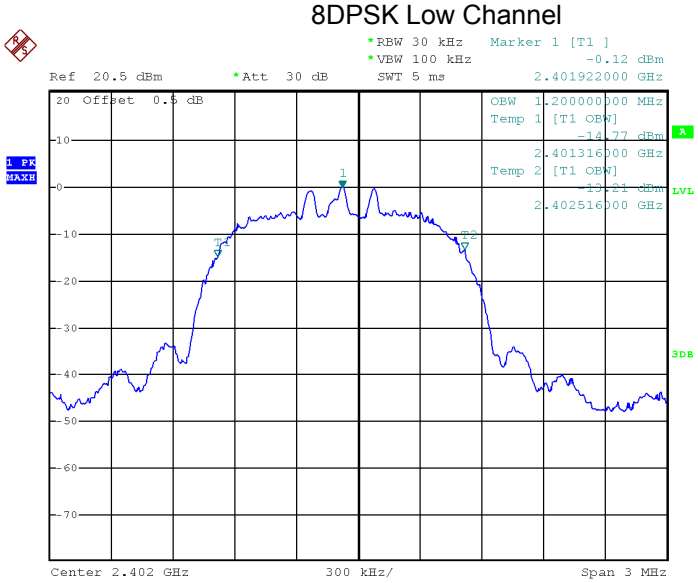

Date: 16.MAY.2024 16:33:44

π/4DQPSK High Channel



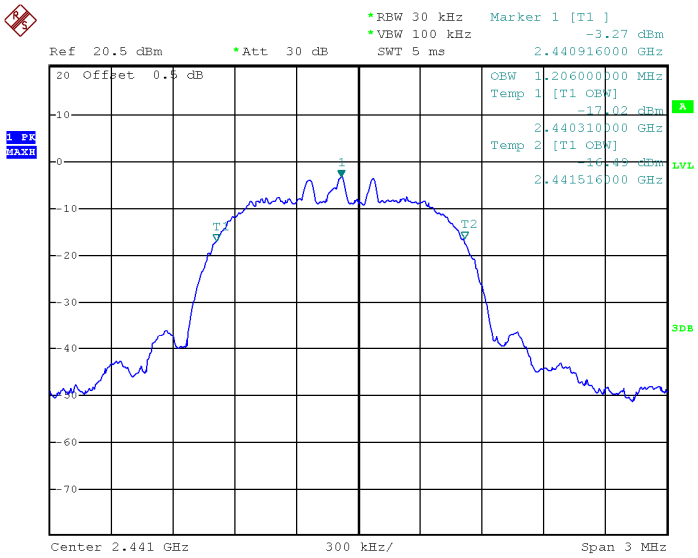

Date: 16.MAY.2024 16:34:37

8DPSK Low Channel



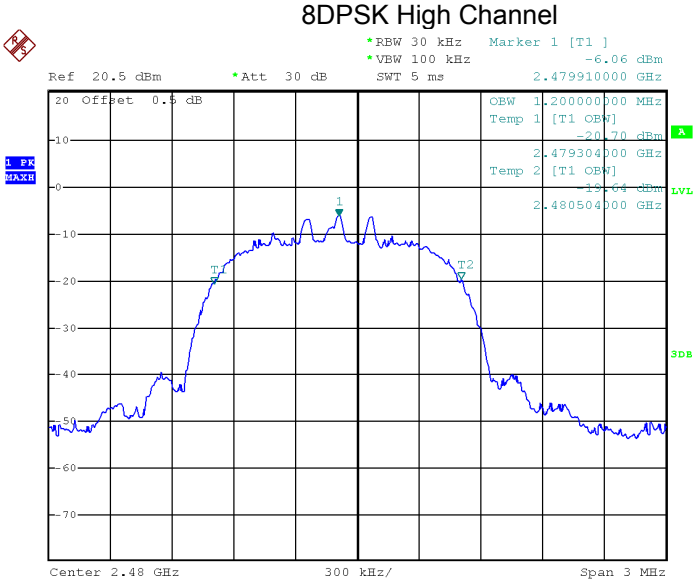

Date: 16.MAY.2024 16:46:03

8DPSK Middle Channel




Date: 16.MAY.2024 16:43:52

8DPSK High Channel




Date: 16.MAY.2024 16:35:44

# 12 Maximum Peak Output Power

Test Requirement: FCC 47CFR Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

Test Limit: Regulation 15.247 (a)(1), For frequency hopping systems operating in the 2400 2483.5 MHz band by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater 0.125 watts..

Test mode: Test in fixing frequency transmitting mode.

## 12.1 Test Procedure

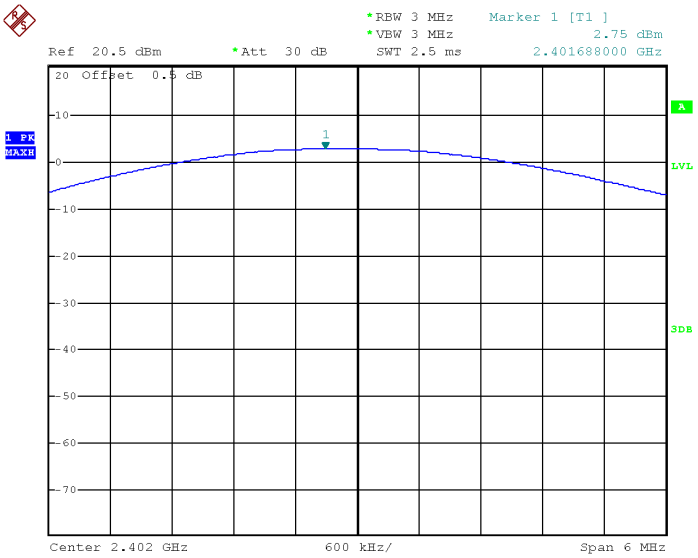
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer:
   a) Use the following spectrum analyzer settings:
      1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
      2) RBW ≥20 dB bandwidth of the emission being measured.
      3) VBW ≥ RBW.
      4) Sweep: Auto.
      5) Detector function: Peak.
      6) 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, after any corrections for external attenuators and cables.
   e) A plot of the test results and setup description shall be included in the test report.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

## 12.2 Test Result

| Modulation | Test Channel | Output Power (dBm) | Limit (dBm) |
|---|---|---|---|
| GFSK | Low | 2.75 | 30 |
| GFSK | Middle | -0.36 | 30 |
| GFSK | High | -3.13 | 30 |
| π/4DQPSK | Low | 2.76 | 21 |
| π/4DQPSK | Middle | -0.45 | 21 |
| π/4DQPSK | High | -3.17 | 21 |
| 8DPSK | Low | **3.27** | 21 |
| 8DPSK | Middle | 0.00 | 21 |
| 8DPSK | High | -2.68 | 21 |

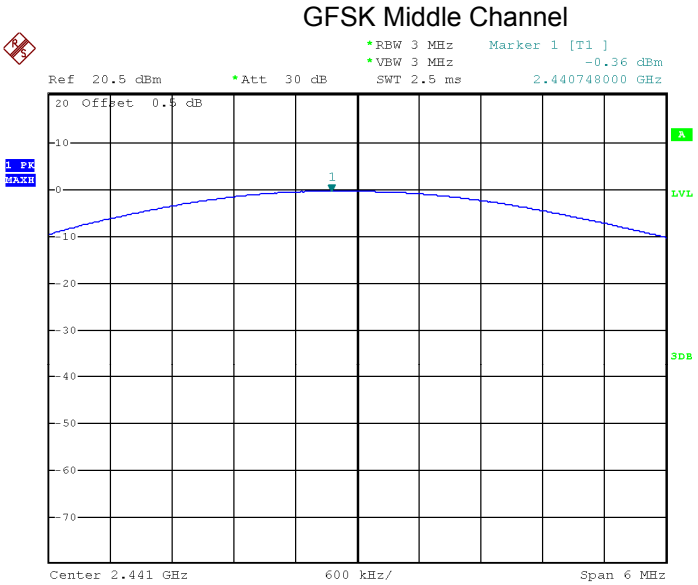
## Test plots

GFSK Low Channel



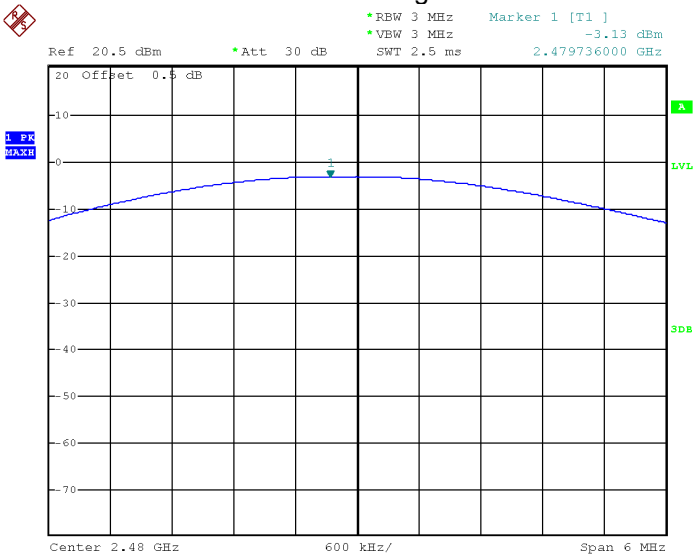

Date: 16.MAY.2024 16:31:43

GFSK Middle Channel



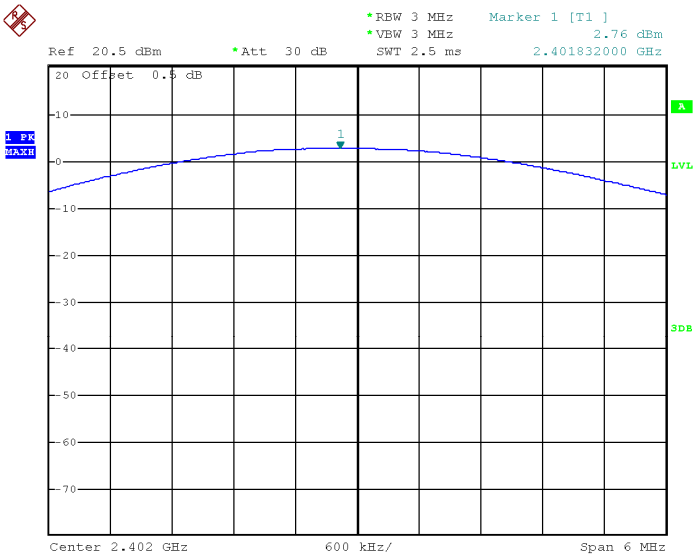

Date: 16.MAY.2024 16:59:03

GFSK High Channel



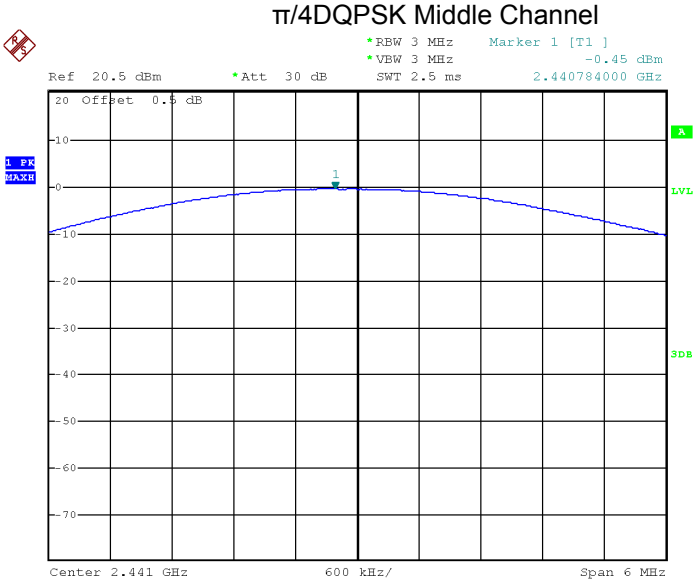

Date: 16.MAY.2024 16:58:10

π/4DQPSK Low Channel



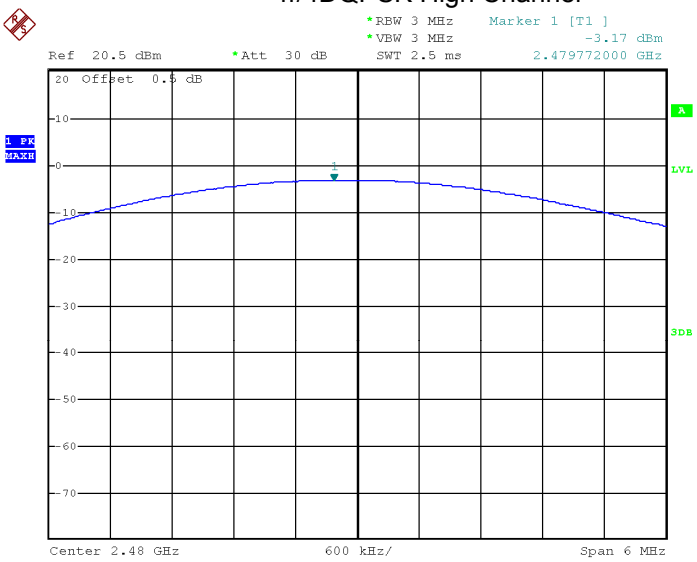

Date: 16.MAY.2024 16:59:55

π/4DQPSK Middle Channel



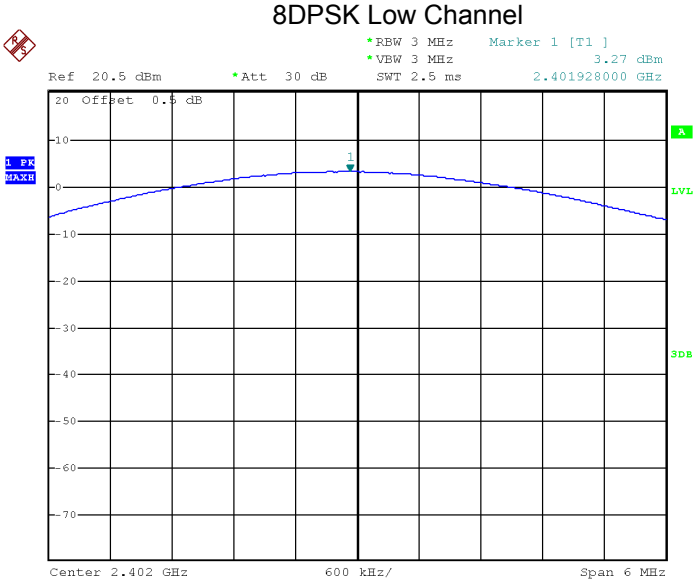

Date: 16.MAY.2024 17:00:27

π/4DQPSK High Channel



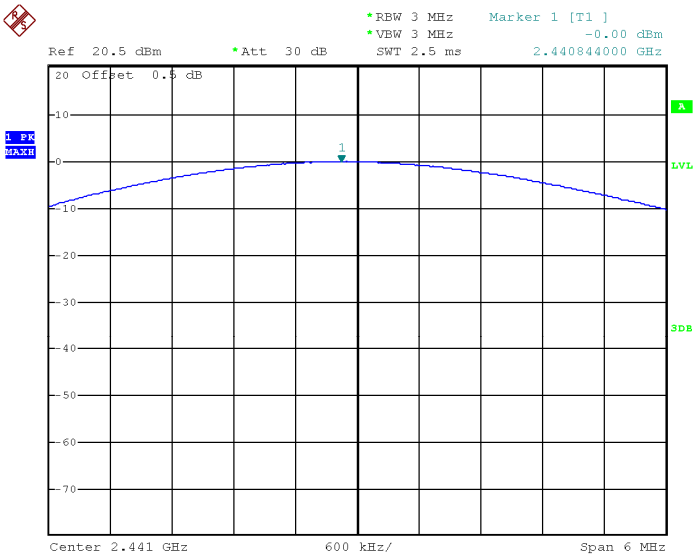

Date: 16.MAY.2024 17:00:56

8DPSK Low Channel



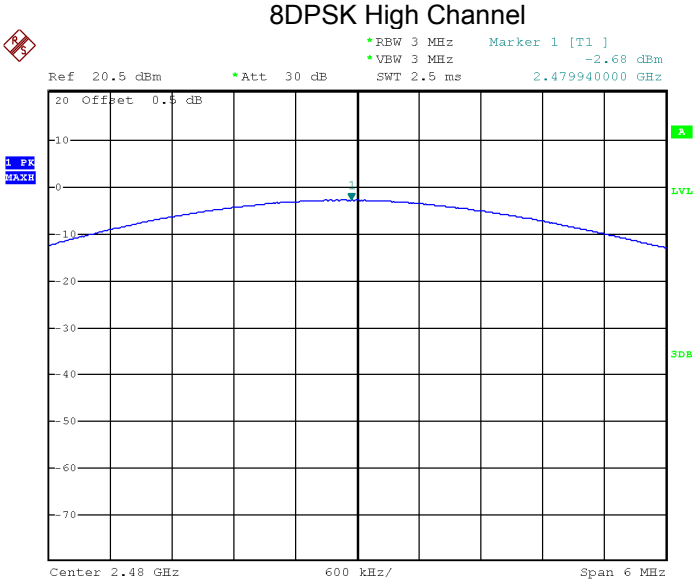

Date: 16.MAY.2024 16:48:39

8DPSK Middle Channel




Date: 16.MAY.2024 16:50:26

8DPSK High Channel




Date: 16.MAY.2024 16:51:27

# 13 Hopping Channel Separation

Test Requirement: FCC 47CFR Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

Test Limit: Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with power no greater than 0.125W.

Test Mode: Test in hopping transmitting operating mode.

## 13.1 Test Procedure

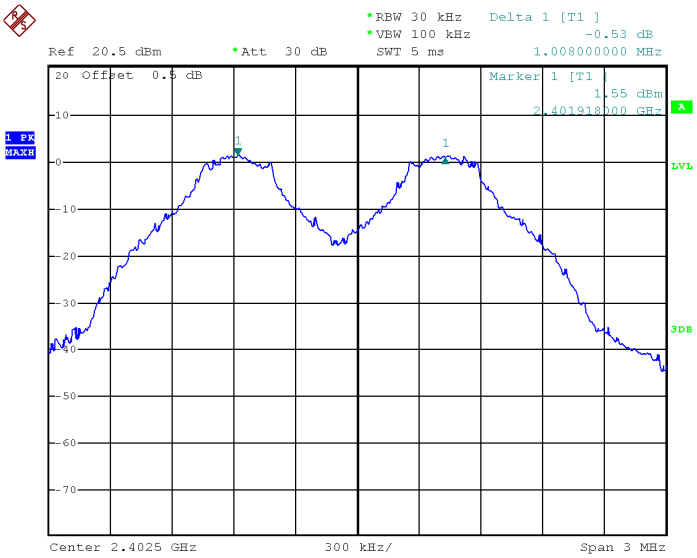
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer:
   a) Span: Wide enough to capture the peaks of two adjacent channels.
   b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
   c) Video (or average) bandwidth (VBW) ≥ RBW.
   d) Sweep: Auto.
   e) Detector function: Peak.
   f) Trace: Max hold.
   g) Allow the trace to stabilize.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

## 13.2 Test Result

| Modulation | Test Channel | Separation (MHz) | Limit(MHz) | Result |
|---|---|---|---|---|
| GFSK | Low | 1.008 | 0.704 | PASS |
| GFSK | Middle | 1.008 | 0.664 | PASS |
| GFSK | High | 1.008 | 0.680 | PASS |
| π/4DQPSK | Low | 1.008 | 0.884 | PASS |
| π/4DQPSK | Middle | 1.008 | 0.900 | PASS |
| π/4DQPSK | High | 1.002 | 0.880 | PASS |
| 8DPSK | Low | 1.008 | 0.884 | PASS |
| 8DPSK | Middle | 1.008 | 0.880 | PASS |
| 8DPSK | High | 1.008 | 0.888 | PASS |

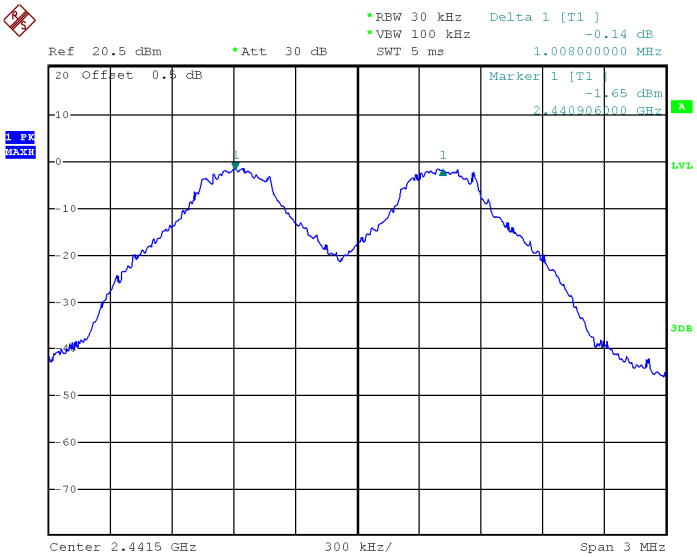
## Test plots

### GFSK Low Channel



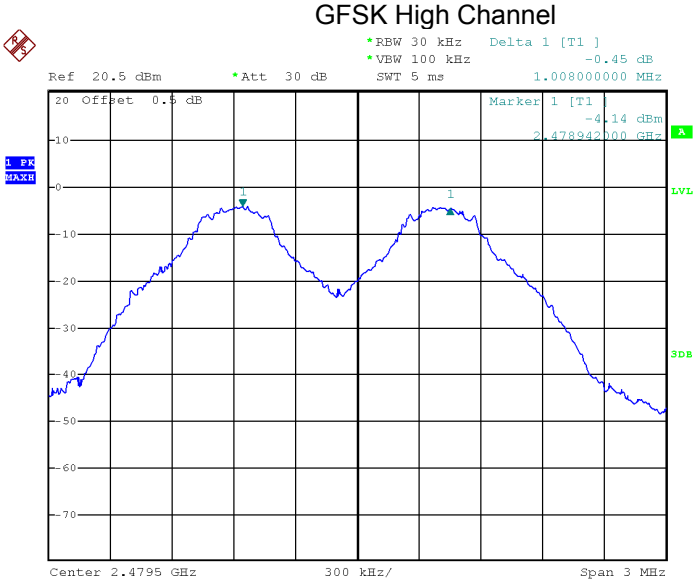

Date: 17.MAY.2024 10:29:44

### GFSK Middle Channel



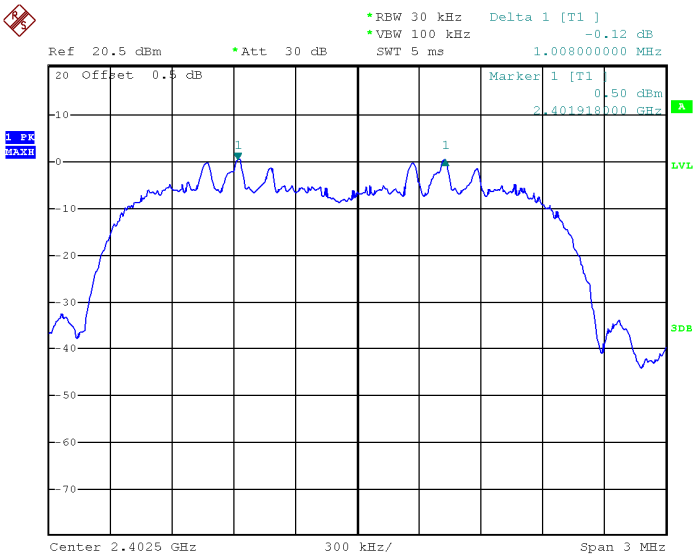

Date: 17.MAY.2024 10:24:51

GFSK High Channel



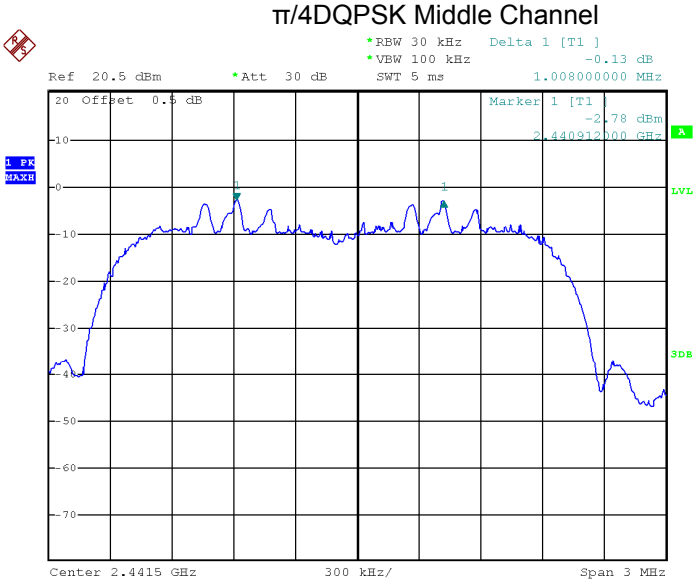

Date: 17.MAY.2024 10:22:38

π/4DQPSK Low Channel



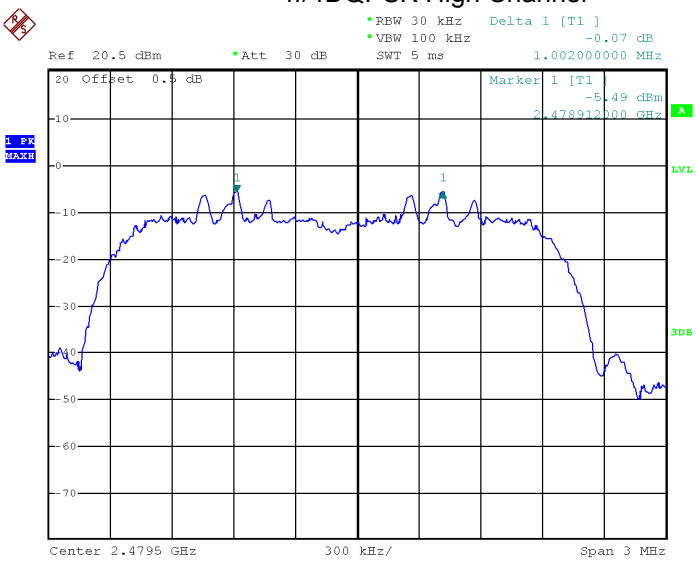

Date: 17.MAY.2024 10:27:53

π/4DQPSK Middle Channel



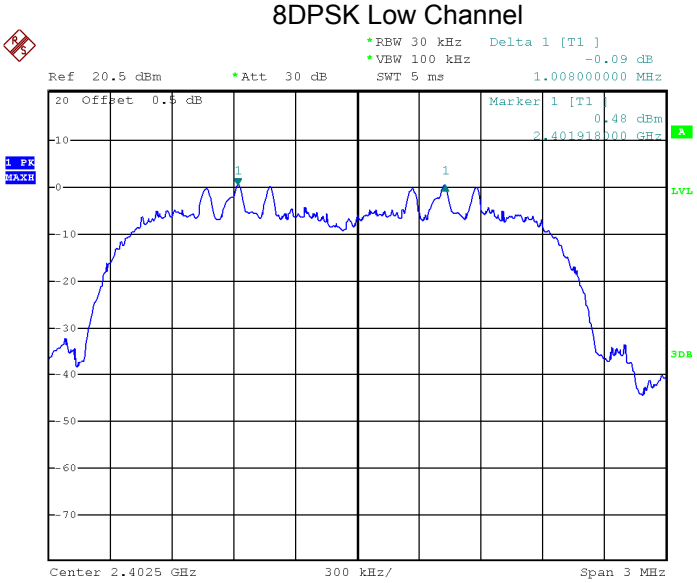

Date: 17.MAY.2024 10:26:14

π/4DQPSK High Channel



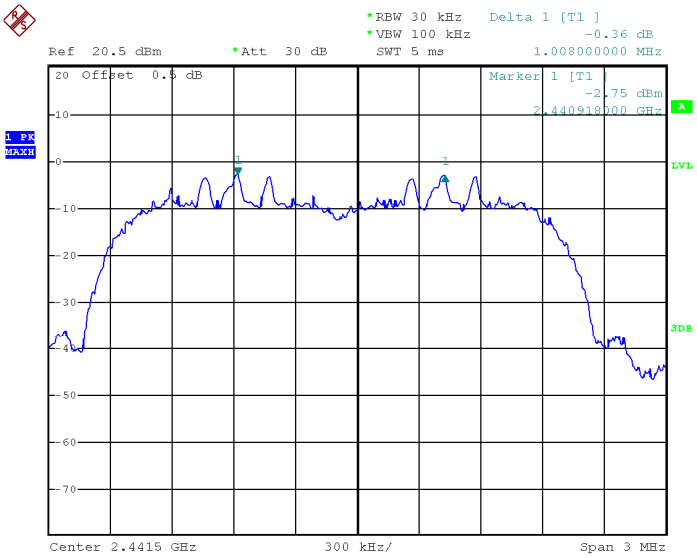

Date: 17.MAY.2024 10:19:13

8DPSK Low Channel



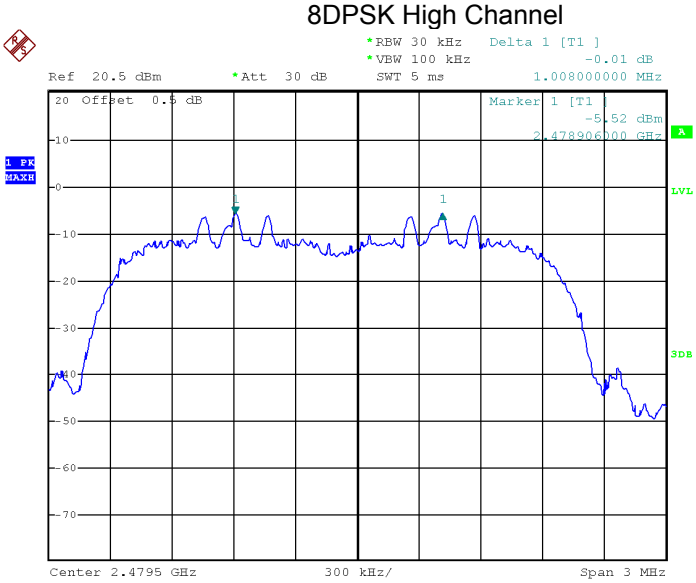

Date: 17.MAY.2024 10:14:22

8DPSK Middle Channel




Date: 17.MAY.2024 10:16:38

8DPSK High Channel




Date: 17.MAY.2024 10:17:40

# 14 Number of Hopping Frequency

Test Requirement: FCC 47CFR Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

Test Limit: Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Mode: Test in hopping transmitting operating mode.

## 14.1 Test Procedure

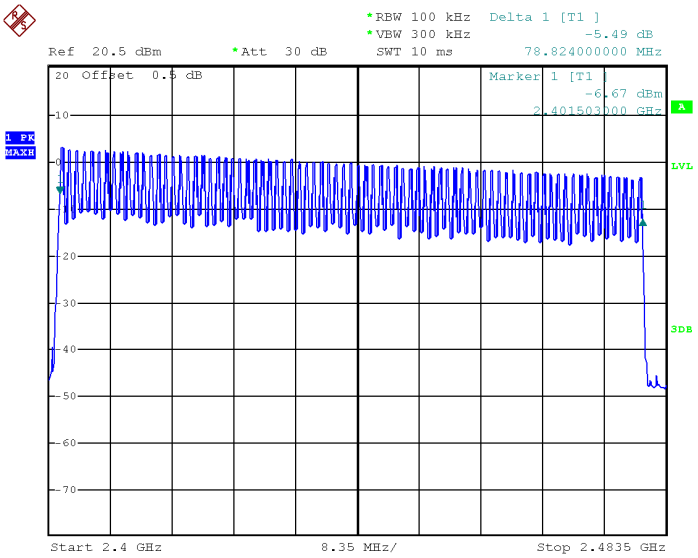
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer:
   a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
   b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
   c) VBW ≥ RBW.
   d) Sweep: Auto.
   e) Detector function: Peak.
   f) Trace: Max hold.
   g) Allow the trace to stabilize..
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

## 14.2 Test Result

**Test Plots:**

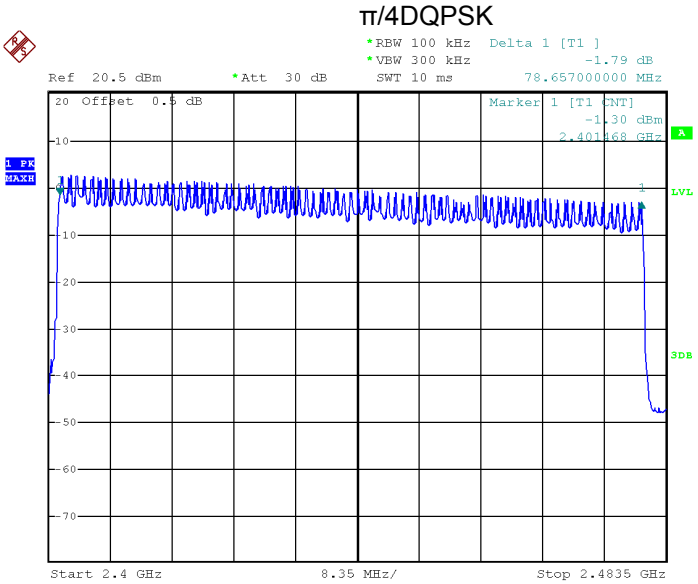
79 Channels in total

GFSK




Date: 17.MAY.2024 11:23:11

π/4DQPSK

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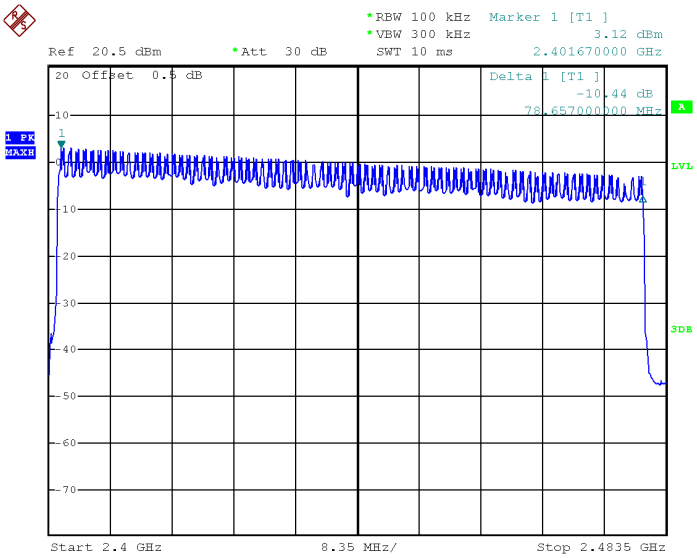
8DPSK

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# 15 Dwell Time

Test Requirement: FCC 47CFR Part 15 Section 15.247

Test Method: ANSI C63.10: 2013

Test Limit: Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Mode: Test in hopping transmitting operating mode.

## 15.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

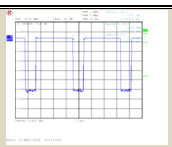
## 15.2 Test Result

DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

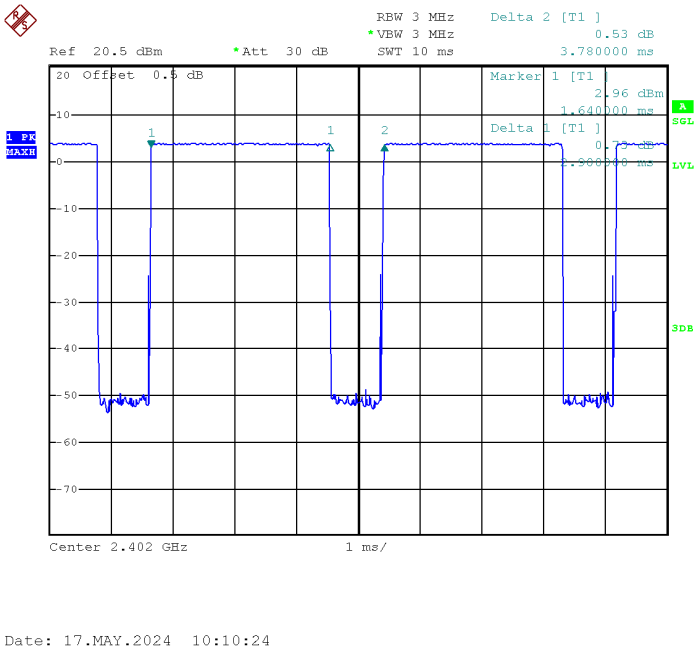
DH1 Packet permit maximum 1600 / 79 /2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

| Data Packet | Dwell Time(s) |
|---|---|
| DH5 | 1600/79/6*0.4*79*(MkrDelta)/1000 |
| DH3 | 1600/79/4*0.4*79*(MkrDelta)/1000 |
| DH1 | 1600/79/2*0.4*79*(MkrDelta)/1000 |
| Remark: Mkr Delta is once pulse time. | |

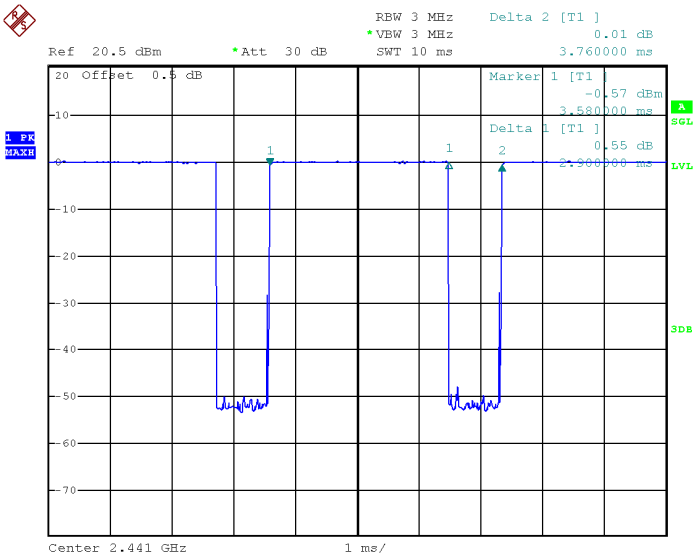
| Modulation | Data Packet |  Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|---|---|---|---|---|---|
| GFSK | DH5 | Low | 2.900 | 0.309 | 0.4 |
| | | middle | 2.900 | 0.309 | 0.4 |
| | | High | 2.900 | 0.309 | 0.4 |
| π/4DQPSK | 2DH5 | Low | 2.900 | 0.309 | 0.4 |
| | | middle | 2.900 | 0.309 | 0.4 |
| | | High | 2.900 | 0.309 | 0.4 |
| 8DPSK | 3DH5 | Low | 2.900 | 0.309 | 0.4 |
| | | middle | 2.900 | 0.309 | 0.4 |
| | | High | 2.900 | 0.309 | 0.4 |

Remark: Only the worst-case mode DH5, 2DH5 and 3DH5 were recorded.

Test Plots
GFSK DH5 Low Channel

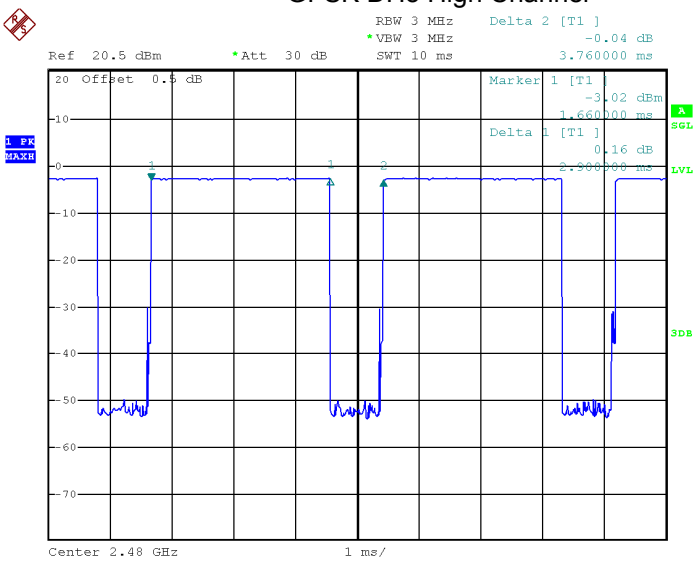


GFSK DH5 Middle Channel




Date: 17.MAY.2024 12:07:43

GFSK DH5 High Channel

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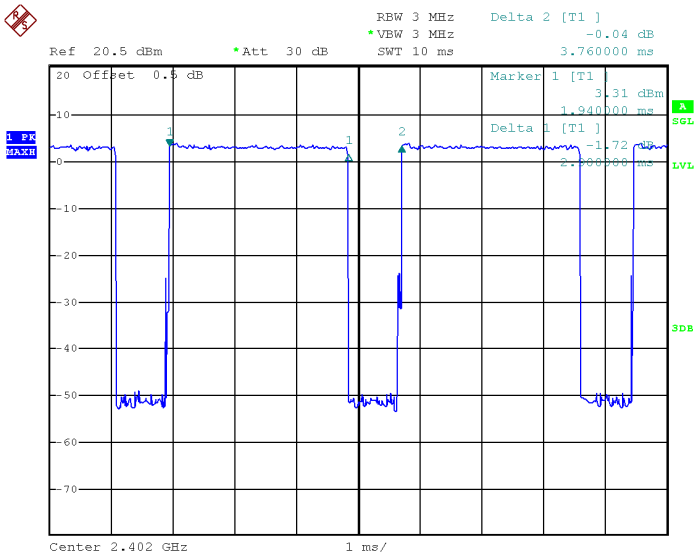
π/4DQPSK 2DH5 Low Channel

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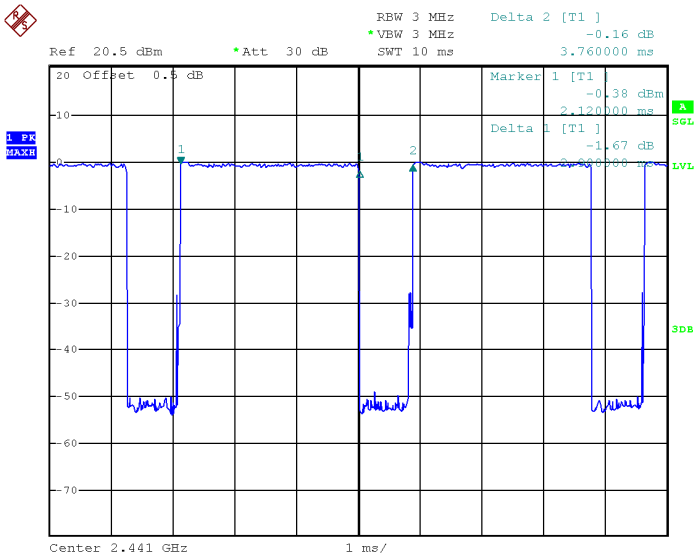
π/4DQPSK 2DH5 Middle Channel

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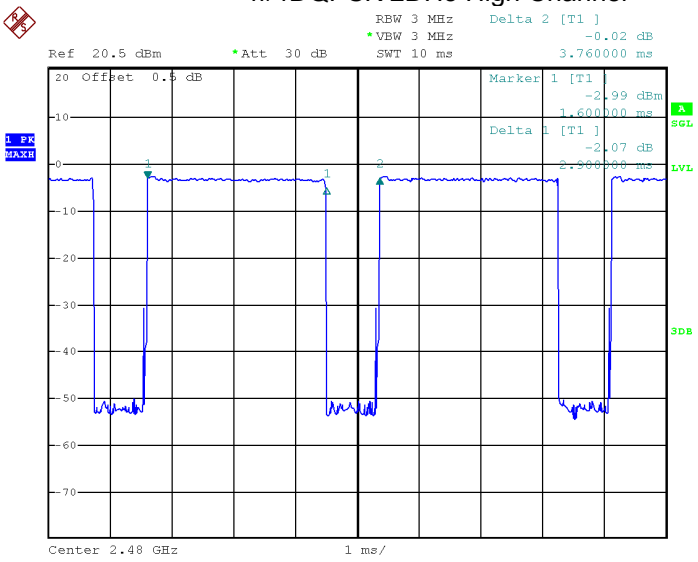
π/4DQPSK 2DH5 High Channel

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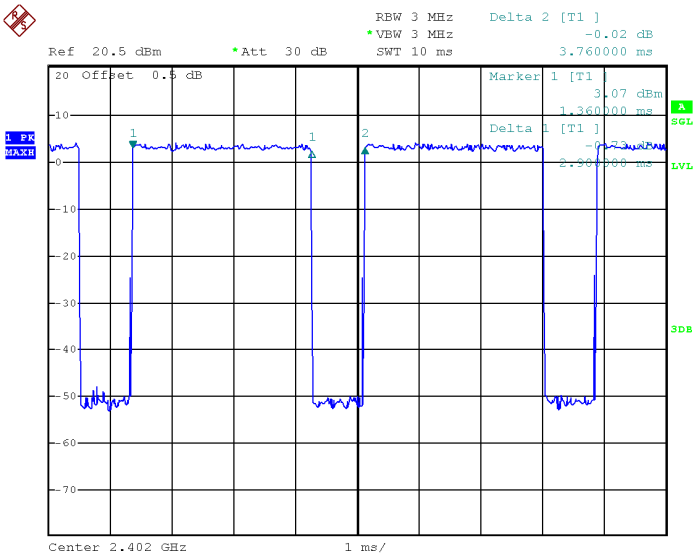
8DPSK 3DH5 Low Channel

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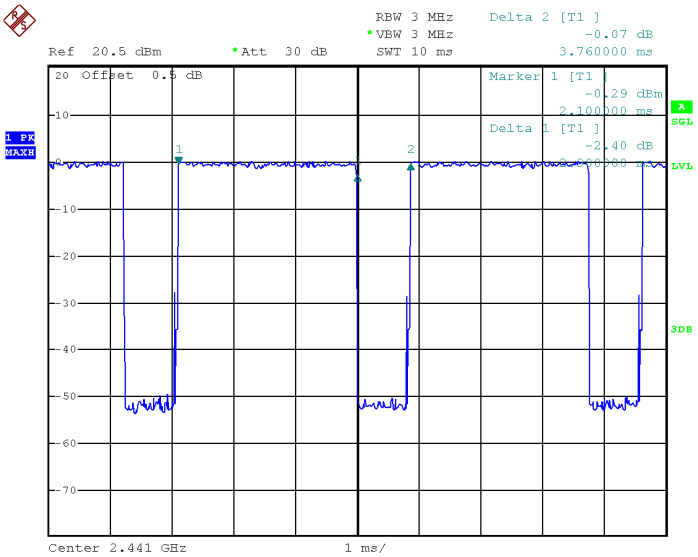
8DPSK 3DH5 Middle Channel

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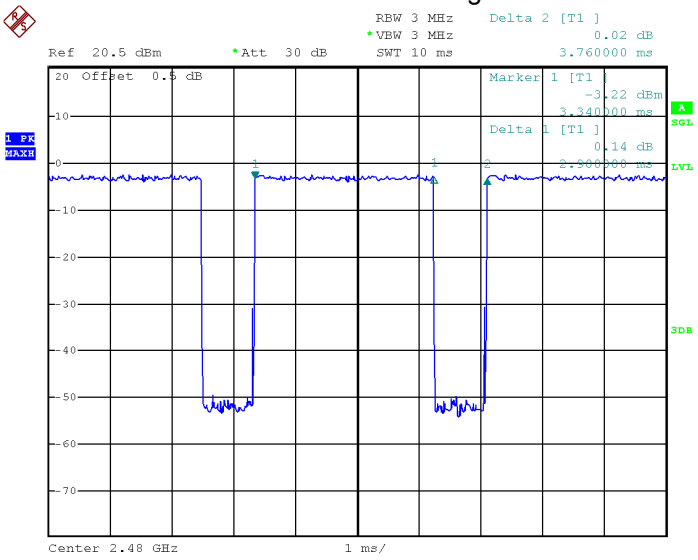
8DPSK 3DH5 High Channel

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# 16 Antenna Requirement

According to the FCC Part 15 Paragraph 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. This product has a PCB printed antenna, fulfil the requirement of this section.

Note: Please refer to EUT photos for more details.

# 17 RF Exposure

Remark: refer to MPE test report: WTH24D05101864W003.

# 18 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-KP-2951B-Photos

======End of Report======