**FCC LISTED, REGISTRATION NUMBER: 905266**

**IC LISTED REGISTRATION NUMBER**
**IC 4621A-1**

**AT4 wireless, S.A.**
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Libro 82, Folio 133, Hoja MA3729

# TEST REPORT

## REFERENCE STANDARD:
## USA FCC Part 15.247 and 15.207
## CANADA RSS-210, RSS-Gen

**Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.**
**Licence-Exempt Radio Apparatus (All Frequency Bands): Category I Equipment.**
**General Requirements and Information for the Certification of Radio Apparatus.**

| | |
|---|---|
| **NIE** ..... : | 39342RRF.002 |
| Approved by (name / position & signature) ..... : | A. Llamas / RF Lab. Manager |
| Elaboration date ..... : | 2013-08-09 |

Alejandro Llamas Rodríguez
Firmado digitalmente por Alejandro Llamas Rodríguez
Fecha: 2013.08.09 15:24:42 +02'00'
.....

| | |
|---|---|
| **Identification of item tested** ..... : | FITNESS MONITOR |
| Trademark ..... : | ADIDAS |
| Model and/or type reference ..... : | G76792 |
| Serial number ..... : | D10813060000099, D10813060000106 |
| Other identification of the product ..... : | Commercial name: MICOACH SMART RUN<br>Hw version: 7.0.0<br>Sw version: 1.6.2<br>FCC ID: ZLGSMARTRUN<br>IC ID: 9722B-SMARTRUN |
| Features ..... : | Bluetooth 4.0+EDR, Wlan b/g/n20 1x1, GPS receiver, battery charger |
| Description ..... : | FITNESS MONITOR |

| | |
|---|---|
| **Applicant** ..... : | ADIDAS AG |
| Address ..... : | WORLD OF SPORTS, ADI-DASSLER-STRABE 1, D-91074 HERZOGENAURACH, GERMANY |
| CIF/NIF/Passport ..... : | DE132490588 |
| Contact person: | Simon Drabble |
| Telephone / Fax ..... : | +49 160 8 84 2687 / +49 9132 84 5773 |
| e-mail: ..... : | simon.drabble@adidas.com |

| | |
|---|---|
| **Test samples supplier** ..... : | ELEKTROBIT |
| Address ..... : | Tutkijantie 8, Oulu FINLAND |
| CIF/NIF/Passport ..... : | 1737565-0 |
| Contact person: ..... : | Pertti Harmaala |
| Telephone / Fax ..... : | +358 403445781 |
| e-mail: ..... : | Pertti.harmaala@elektrobit.com |

| | |
|---|---|
| **Manufacturer** ..... : | Same as applicant |

| | |
|---|---|
| **Test method requested** .....: | See Standard |
| Standard .....: | USA FCC Part 15.247 10-01-11 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.<br><br>USA FCC Part 15.209 10-01-11 Edition: Radiated emission limits; general requirements.<br><br>USA FCC Part 15.207 10–01–11 Edition: Conducted limits<br><br>CANADA RSS-210 Issue 8 (December 2010).<br><br>CANADA RSS-Gen Issue 3 (December 2010).<br><br>FCC part 15.247 and Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum System DA 00-705 Released March 30, 2000.<br><br>ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices. |
| Test procedure .....: | PERF010 |
| Non-standardized test method .....: | N/A |
| Used instrumentation .....: | |

Conducted Measurements

| | | Last Cal. date | Cal. due date |
|---|---|---|---|
| 1. | Spectrum analyser Agilent PSA E4440A | 2012/02 | 2014/02 |
| 2. | EMI Test Receiver R&S ESU40 | 2012/03 | 2014/03 |
| 3. | Transient limiter. HP 11947A | 2012/09 | 2014/09 |
| 4. | Line Impedance Stabilization Network (L.I.S.N.) R&S. ESH2-Z5 | 2013/01 | 2015/01 |
| 5. | DC power supply R&S NGPE 40/40 | 2011/11 | 2014/11 |
| 6. | Universal Power Meter R&S NRP-Z11 | 2012/12 | 2014/12 |

Radiated Measurements

| | | Last Cal. date | Cal. due date |
|---|---|---|---|
| 1. | Semianechoic Absorber Lined Chamber IR 11. BS | N.A. | N.A. |
| 2. | Control Chamber IR 12.BC | N.A. | N.A. |
| 3. | Hybrid Bilog antenna Sunol Sciences Corporation JB6 | 2011/05 | 2014/05 |
| 4. | Antenna mast EM 1072 NMT | N.A. | N.A. |
| 5. | Rotating table EM 1084-4. ON | N.A. | N.A. |
| 6. | Double-ridge Guide Horn antenna 1-18 GHz HP 11966E | 2011/05 | 2014/05 |
| 7. | Double-ridge Guide Horn antenna 18-40 GHz Agilent 119665J | 2011/09 | 2014/09 |
| 8. | EMI Test Receiver R&S ESIB26 | 2011/11 | 2013/11 |
| 9. | RF pre-amplifier Miteq JS4-12002600-30-5A. | 2012/07 | 2014/07 |
| 10. | Multi Device Controller EMCO 2090 | N.A. | N.A. |
| 11. | Spectrum Analyzer Agilent E4440A | 2012/02 | 2014/02 |
| 12. | RF pre-amplifier Miteq AFS5-04001300-15-10P-6. | 2012/07 | 2014/07 |
| 13. | RF pre-amplifier Schaffner CPA 9231A. | 2013/06 | 2015/06 |

**Report template No**. .....: FDT08_14

## INDEX

## Competences and guarantees

AT4 wireless is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjuction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 905266.

AT4 wireless is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621A-1.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance programme for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

## General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

## Uncertainty

Uncertainty (factor k=2) was calculated according to the AT4 wireless internal document:

PODT000: Procedimiento para el cálculo de incertidumbres de medida.

## Usage of samples

Samples undergoing test have been selected by: **the client**.

Sample M/01 is composed of the following elements:

| Control Nº | Description | Model | Serial Nº | Date of reception |
|---|---|---|---|---|
| 39342C/08 | Fitness monitor with integral antenna | G76792 | D10813060000106 | 02/07/2013 |

Sample M/02 is composed of the following elements:

| Control Nº | Description | Model | Serial Nº | Date of reception |
|---|---|---|---|---|
| 39342C/07 | Fitness monitor with antenna connector | G76792 | D10813060000099 | 02/07/2013 |

Sample S/01 is composed of the following elements:

| Control Nº | Description | Model | Serial Nº | Date of reception |
|---|---|---|---|---|
| 39342C/01 | MICOACH SMART RUN. Fitness Monitor | G76792 | 010813060000087 | 02/07/2013 |

Auxiliary element used with the sample S/01:

| Control Nº | Description | Model | Serial Nº | Date of reception |
|---|---|---|---|---|
| 39342/02 | Charger base | --- | B01-0008 | 02/07/2013 |

1. Sample M/01 has undergone following test(s).
   All radiated tests indicated in annex A.

2. Sample M/02 has undergone following test(s).
   All conducted tests indicated in annex A.

3. SampleS/01 has undergone the next test(s):
   Continuous conducted emission, power leads, in appendix B.

## Testing period

The performed test started on 2013-07-02 and finished on 2013-07-12.

The tests have been performed at AT4 wireless.

## Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

| | |
|---|---|
| Temperature | Min. = 21.4 ºC<br>Max. = 22.4 ºC |
| Relative humidity | Min. = 48.9 %<br>Max. = 52.9 % |
| Shielding effectiveness | > 100 dB |
| Electric insulation | > 10 kΩ |
| Reference resistance to earth | < 0,5 Ω |

In the semianechoic chamber (21 meters x 11 meters x 8 meters), the following limits were not exceeded during the test.

| | |
|---|---|
| Temperature | Min. = 20.8 ºC<br>Max. = 21.6 ºC |
| Relative humidity | Min. = 54 %<br>Max. = 58 % |
| Air pressure | Min. = 1020 mbar<br>Max. = 1020 mbar |
| Shielding effectiveness | > 100 dB |
| Electric insulation | > 10 kΩ |
| Reference resistance to earth | < 0,5 Ω |
| Normal site attenuation (NSA) | < ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz) |
| Field homogeneity | More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz). |

In the chamber for conducted measurements the following limits were not exceeded during the test:

| | |
|---|---|
| Temperature | Min. = 24.2 ºC<br>Max. = 25.7 ºC |
| Relative humidity | Min. = 42.1 %<br>Max. = 46.2 % |
| Air pressure | Min. = 1020 mbar<br>Max. = 1020 mbar |
| Shielding effectiveness | > 100 dB |
| Electric insulation | > 10 kΩ |
| Reference resistance to earth | < 0,5 Ω |

## Summary

Considering the results of the performed test according to standard USA FCC Parts 15.247 and 15.207 / Canada RSS-210, the item under test is **IN COMPLIANCE** with the requested specifications specified in the standard.

NOTE: The results presented in this Test Report apply only to the particular item under test established in page 1 of this document, as presented for test on the date(s) shown in section, "USAGE OF SAMPLES, TESTING PERIOD AND ENVIRONMENTAL CONDITIONS".

## Remarks and comments

1.- No comments.

## Testing verdicts

Not applicable .....: NA

Pass.....: P

Fail .....: F

Not measured.....: NM

| FCC PART 15 / RSS-210 PARAGRAPH | VERDICT | | | |
|---|---|---|---|---|
| | NA | P | F | NM |
| FCC 15.247 Subclause (a) (1). 20 dB Bandwidth and Carrier frequency separation / RSS-210 Clause A8.1 (b) | | P | | |
| FCC 15.247 Subclause (a) (1) (iii). Number of hopping channels / RSS-210 Clause A8.1 (d) | | P | | |
| FCC 15.247 Subclause (a) (1) (iii). Time of occupancy (Dwell Time) / RSS-210 Clause A8.1 (d) | | P | | |
| FCC 15.247 Subclause (b). Maximum peak output power (radiated) and antenna gain / RSS-210, Clause A8.4 (2) | | P | | |
| FCC 15.247 Subclause (c). Band-edge of radiated emissions (Transmitter) / RSS-210 Clauses 2.2 & A8.5 | | P | | |
| FCC 15.247 Subclause (c). Emission limitations conducted (Transmitter) / RSS-210 Clauses 2.2 & A8.5 | | P | | |
| FCC 15.247 Subclause (c). Emission limitations radiated (Transmitter) / RSS-210 Clauses 2.2 & A8.5 | | P | | |
| FCC 15.207. Conducted limits | | P | | |

# APPENDIX A: Test results

**INDEX**

## TEST CONDITIONS

Power supply (V):

$V_n$ = 3.7 Vdc

$V_{min}$ = N/A

$V_{max}$ = N/A

Type of power supply: Rechargeable battery.

Declared Gain for antenna = -1.0 dBi

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2441 MHz

Highest channel: 2480 MHz

The test channels and modulation modes are selected using the test mode supplied with the Equipment Under Test (E.U.T.).

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

**FCC Section 15.247 Subclause (a) (1) / RSS-210 Clause A8.1 (b). 20 dB Bandwidth and Carrier frequency separation**

SPECIFICATION

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 an output power no greater than 125 mW.

RESULTS

(See next plots)

Modulation: GFSK

| | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| 20 dB Spectrum bandwidth (kHz) | 954.283 | 952.981 | 949.162 |
| Measurement uncertainty (kHz) | ±11 | | |

Modulation: Π/4-DQPSK (2Mbps)

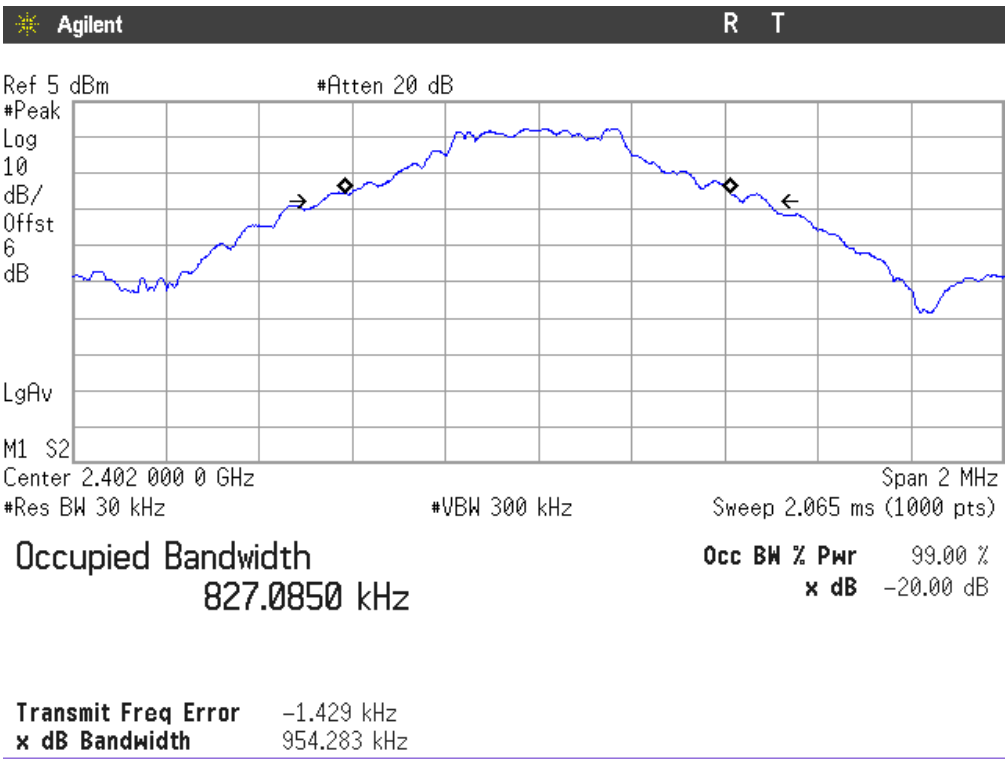
| | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| 20 dB Spectrum bandwidth (kHz) | 1345 | 1346 | 1347 |
| Measurement uncertainty (kHz) | ±11 | | |

Modulation: 8-DPSK (3Mbps)

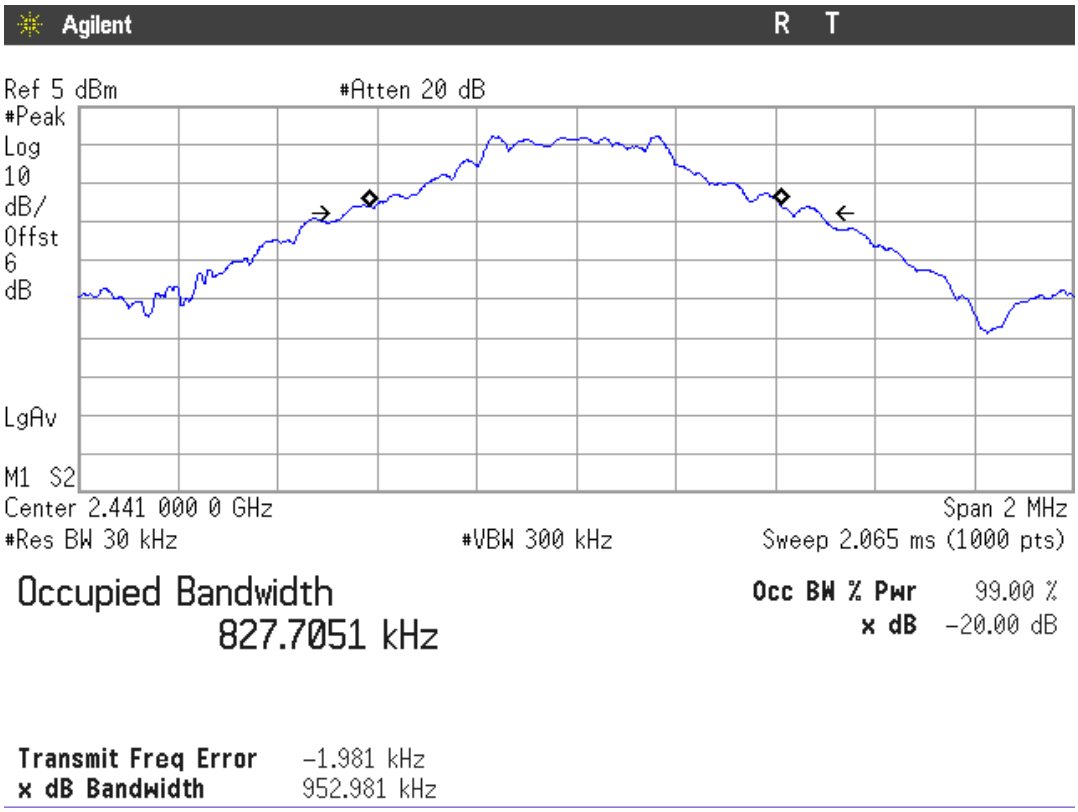
| | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| 20 dB Spectrum bandwidth (kHz) | 1320 | 1321 | 1320 |
| Measurement uncertainty (kHz) | ±11 | | |

**Modulation: GFSK**

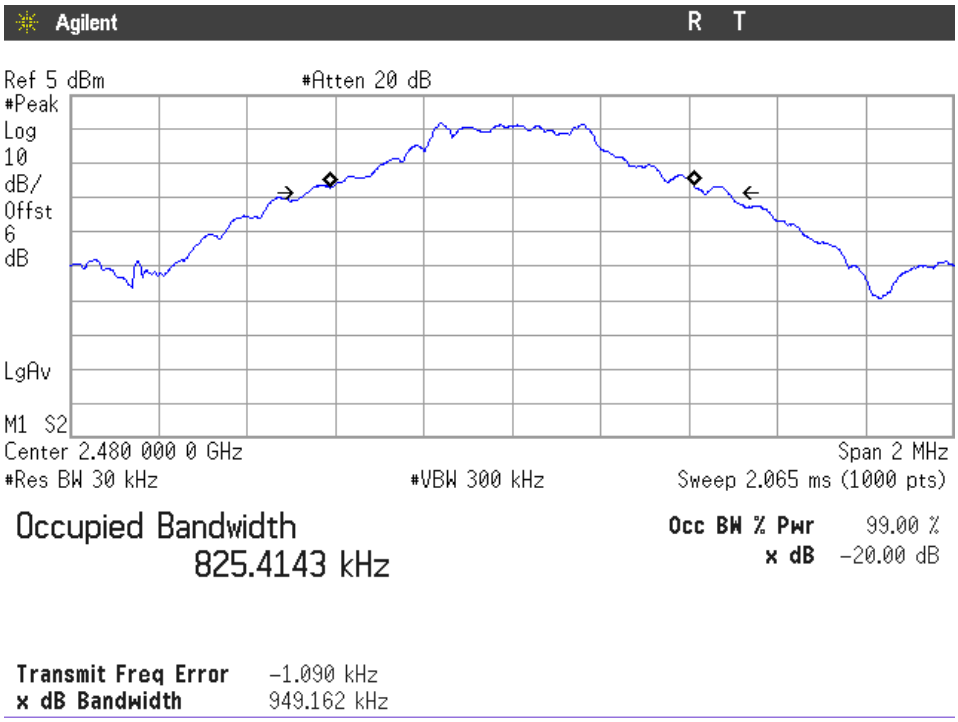
20 dB BANDWIDTH. Lowest Channel: 2402 MHz.



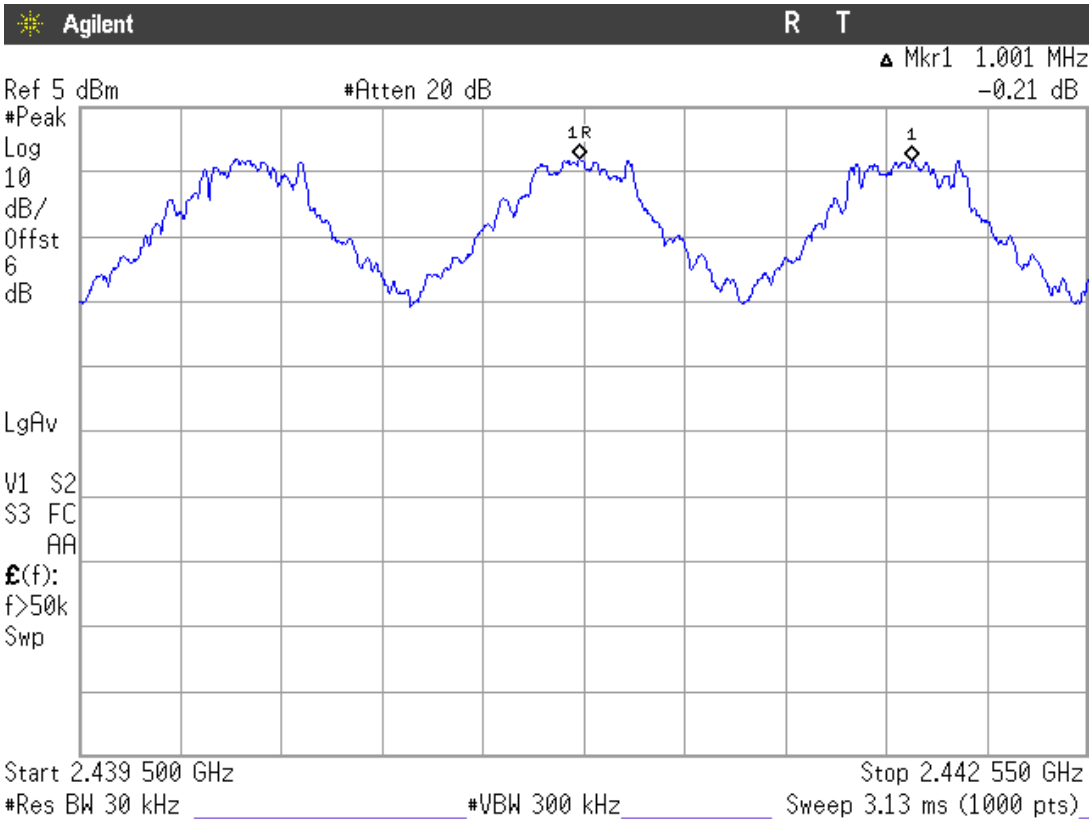

20 dB BANDWIDTH Middle Channel: 2441 MHz.



20 dB BANDWIDTH Highest Channel: 2480 MHz.




Carrier frequency separation

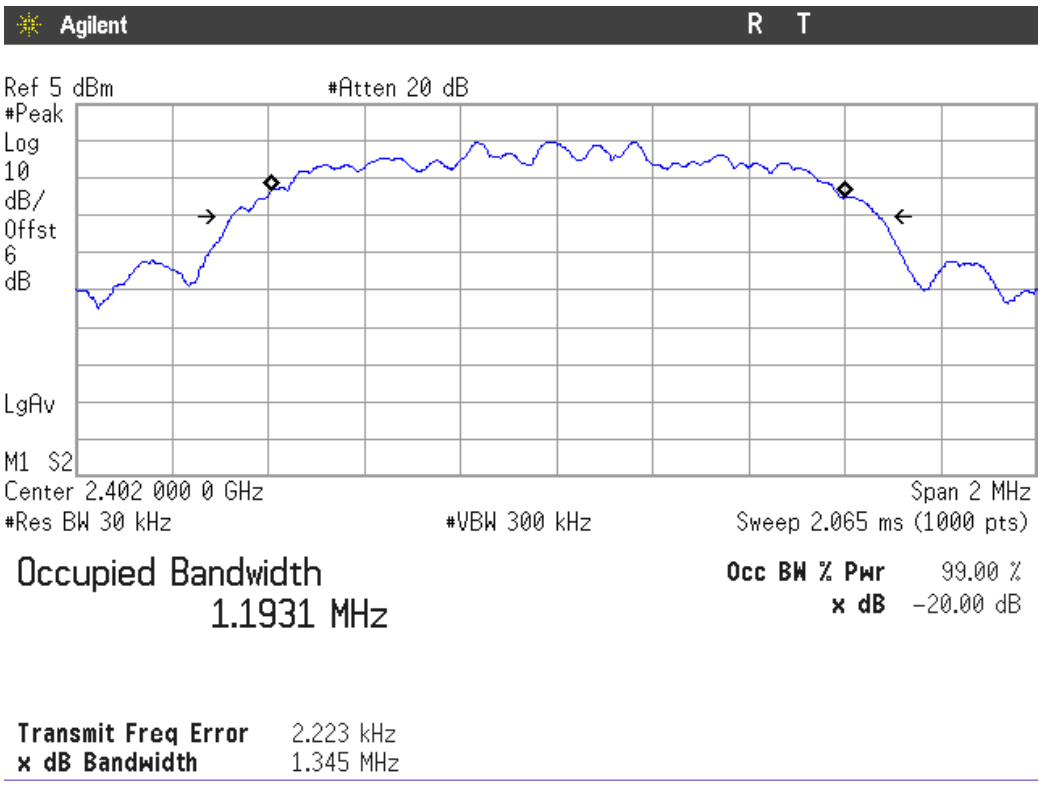



The hopping channel carrier frequencies are separated by a minimum of the 20 dB bandwidth of the hopping channel.

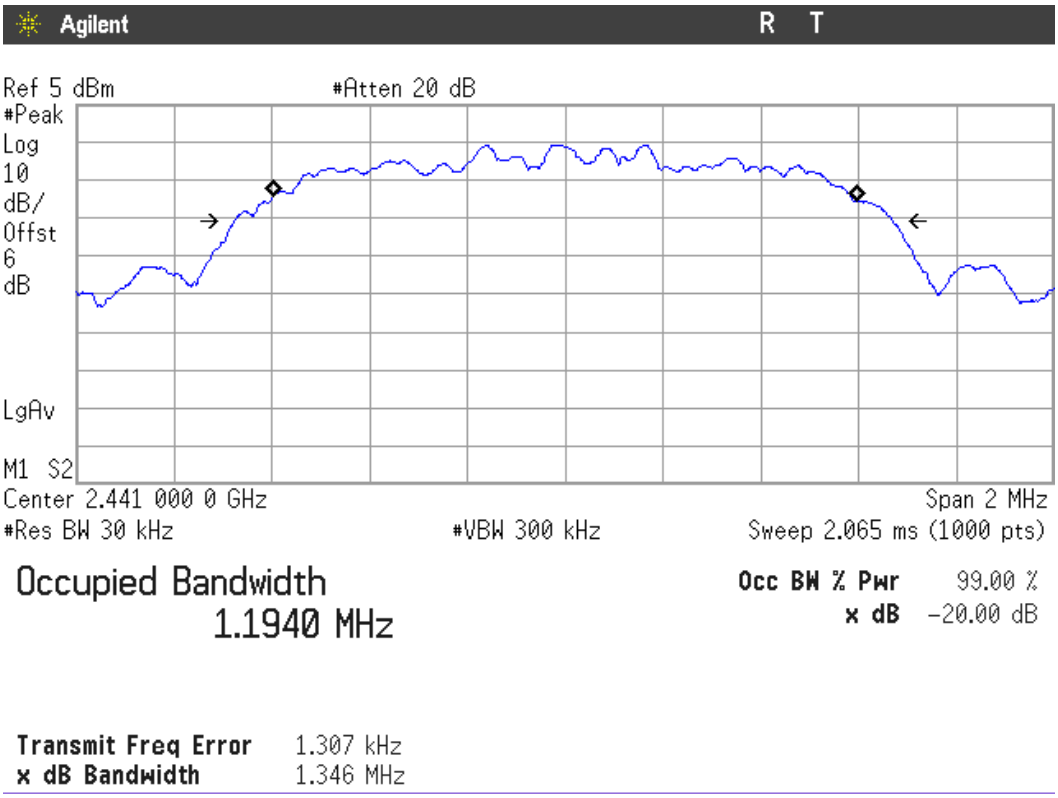
Verdict: PASS

**Modulation: II/4-DQPSK**

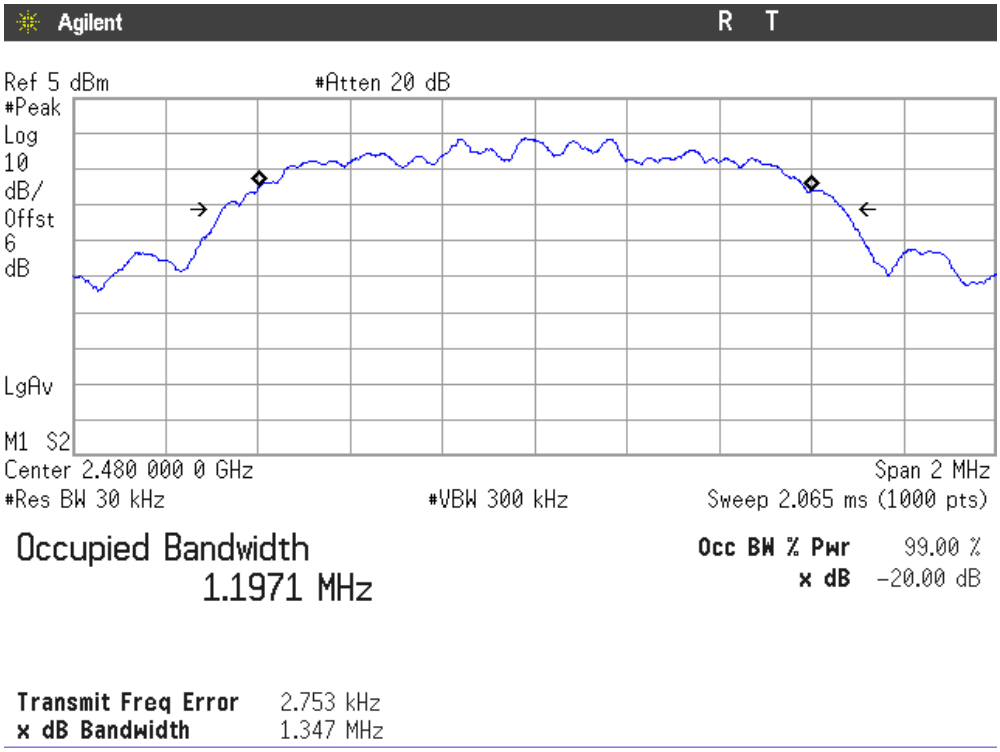
20 dB BANDWIDTH. Lowest Channel: 2402 MHz.



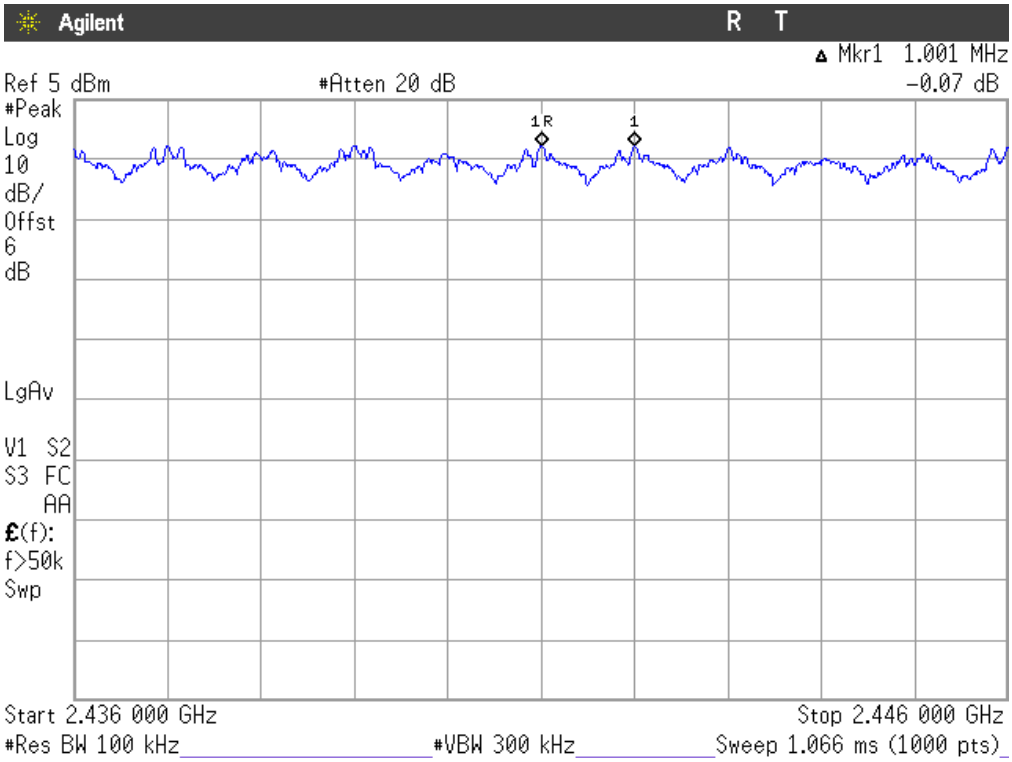

20 dB BANDWIDTH Middle Channel: 2441 MHz.



20 dB BANDWIDTH Highest Channel: 2480 MHz.




Carrier frequency separation

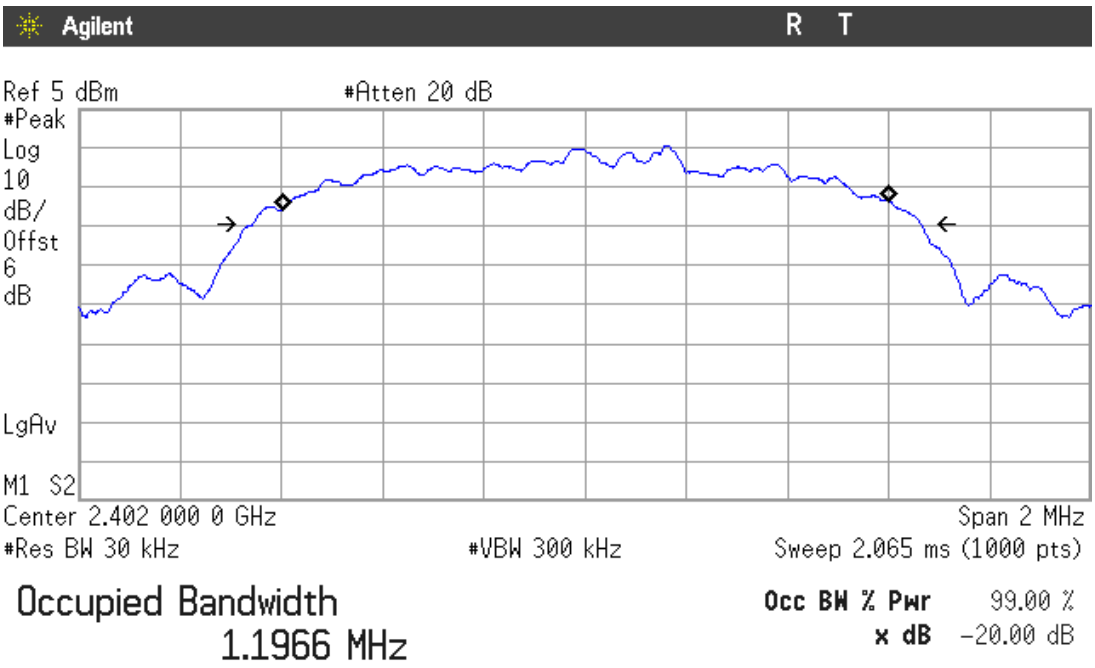



The hopping channel carrier frequencies are separated by a minimum of the two-thirds of the 20 dB bandwidth of the hopping channel

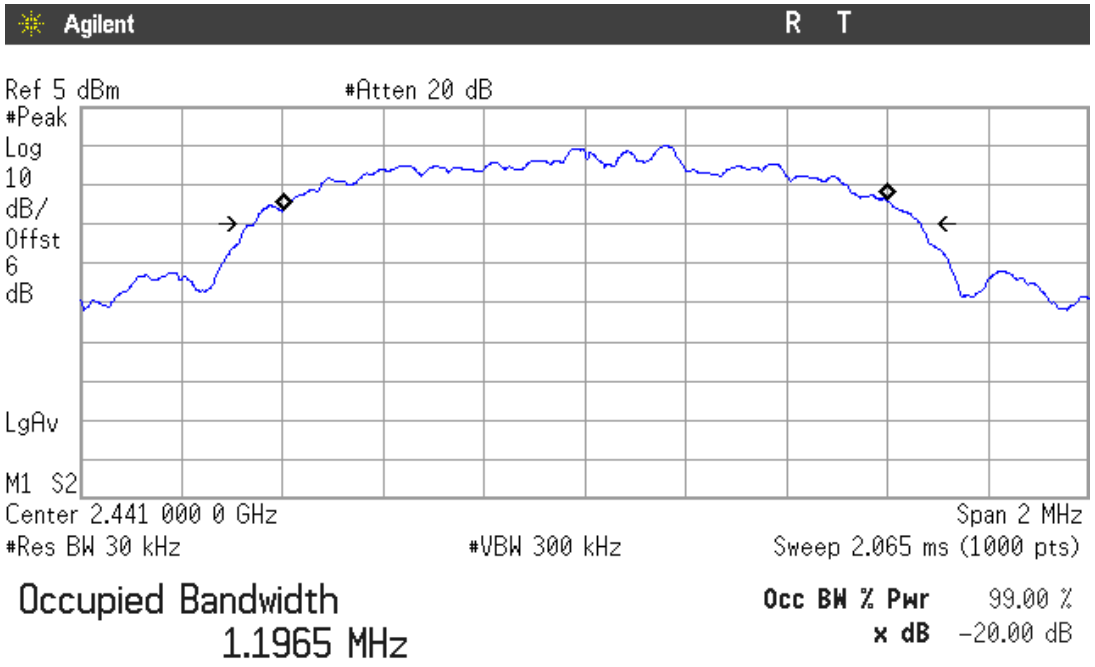
Verdict: PASS

**Modulation: 8-DPSK**

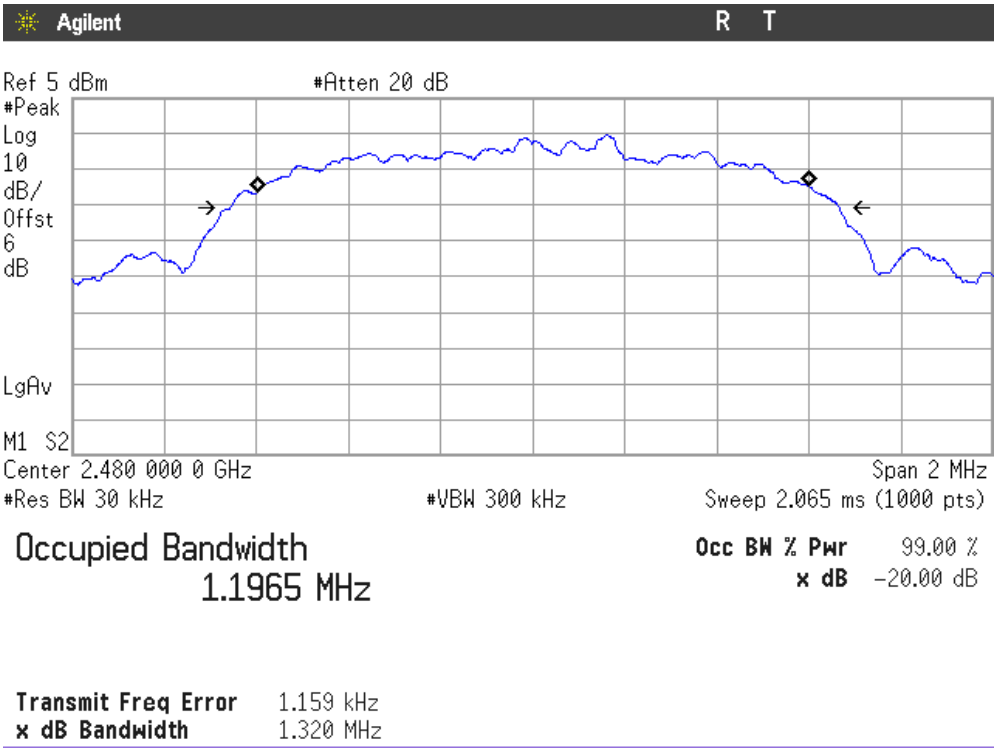
20 dB BANDWIDTH Lowest Channel: 2402 MHz.



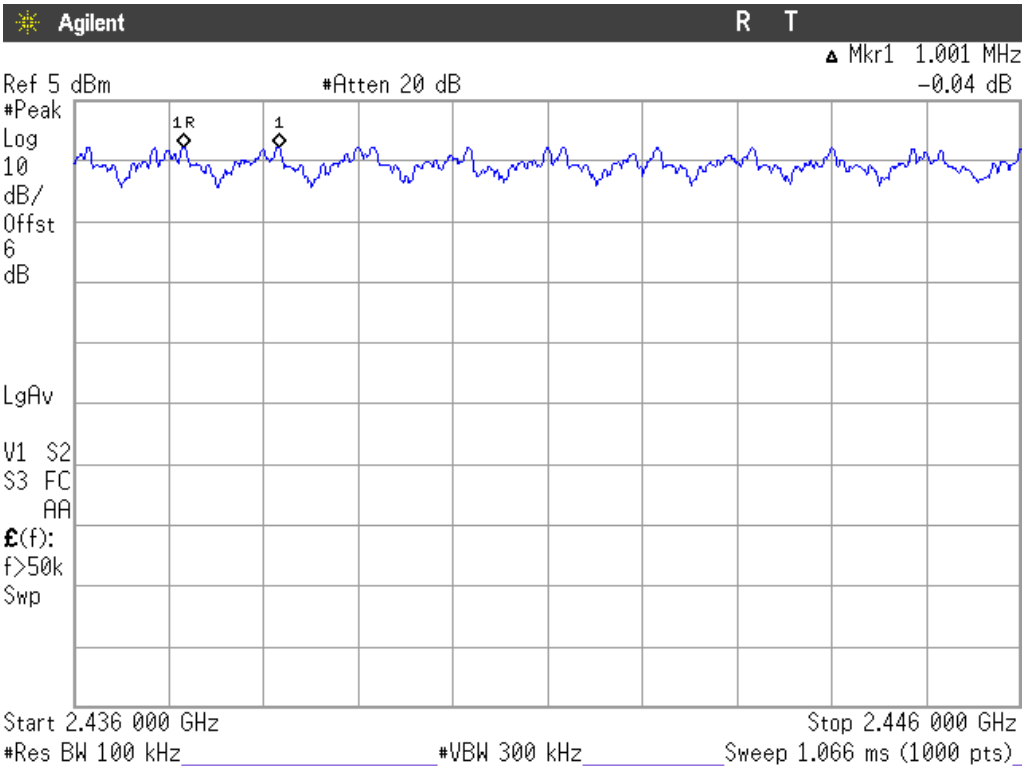

20 dB BANDWIDTH Middle Channel: 2441 MHz.



20 dB BANDWIDTH Highest Channel: 2480 MHz.




Carrier frequency separation




The hopping channel carrier frequencies are separated by a minimum of the two-thirds of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

## FCC Section 15.247 Subclause (a) (1) (iii) / RSS-210 Clause A8.1 (d). Number of hopping channels

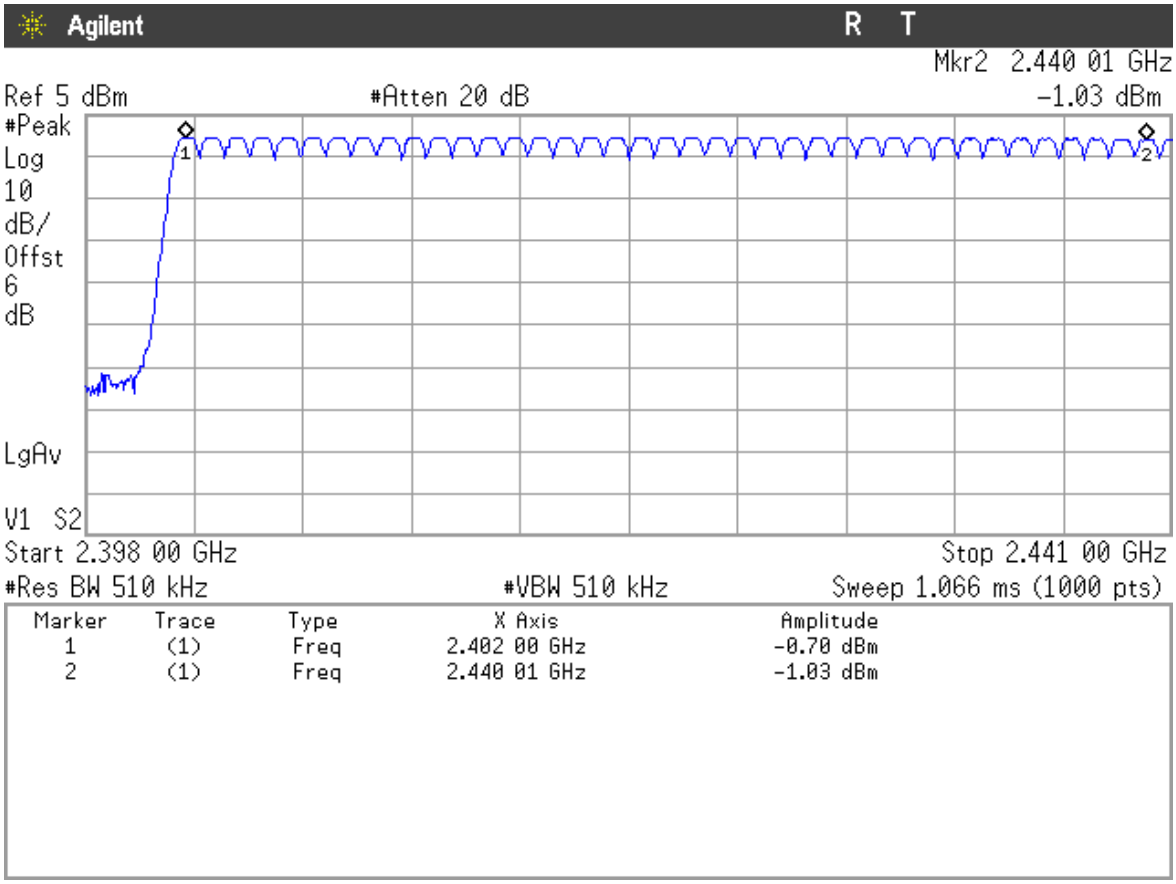
SPECIFICATION

Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 channels.

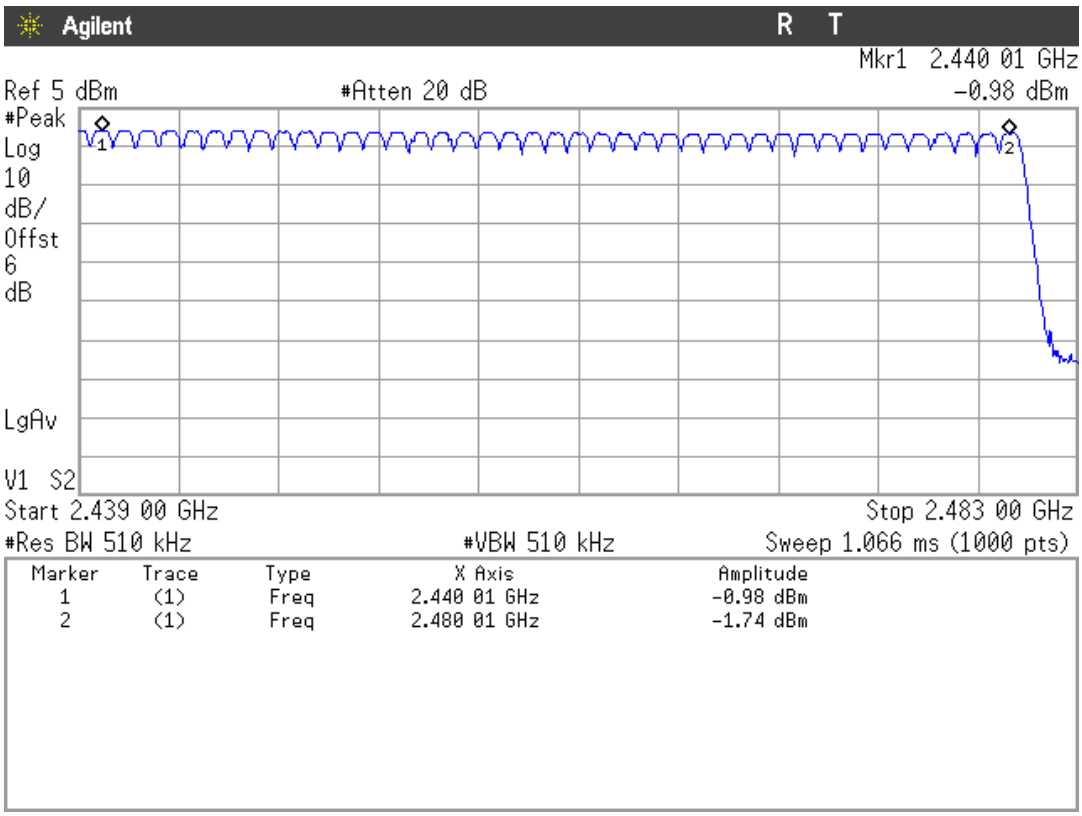
RESULTS

The number of hopping channels is 79 for all three modes (see next plots).

**Modulation: GFSK**




Number of hopping frequencies: 39

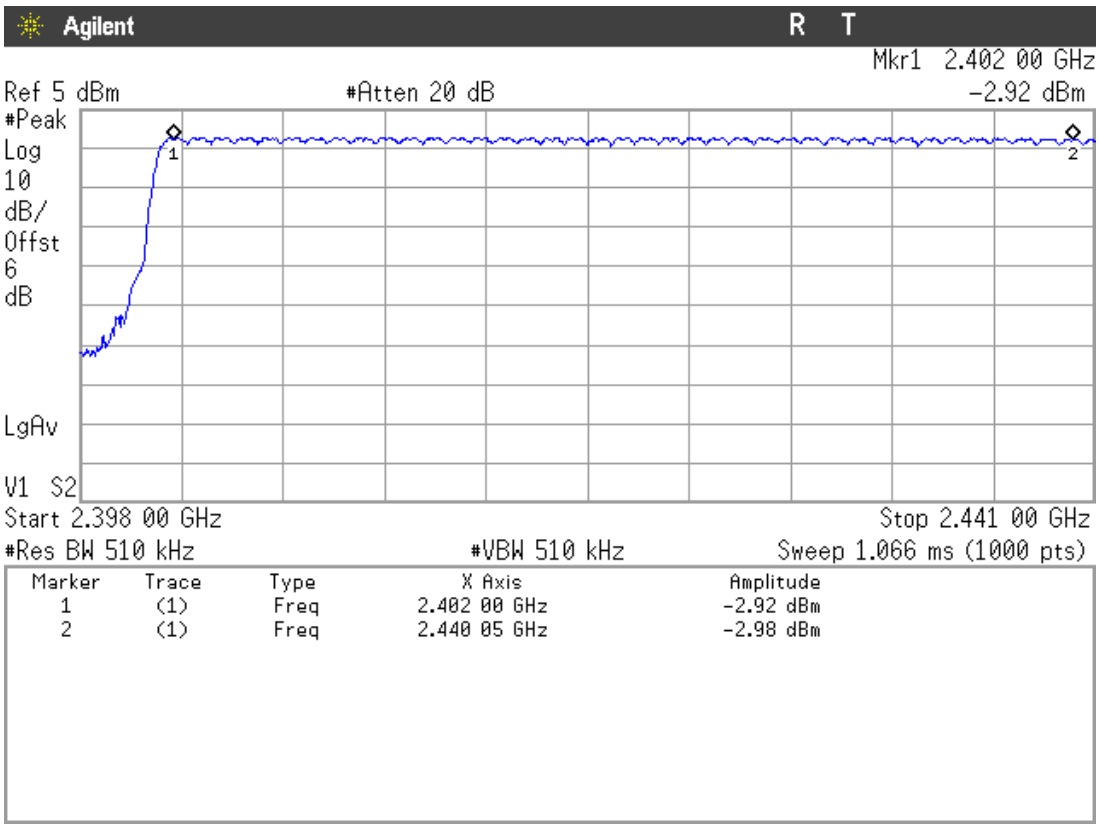



Number of hopping frequencies: 40

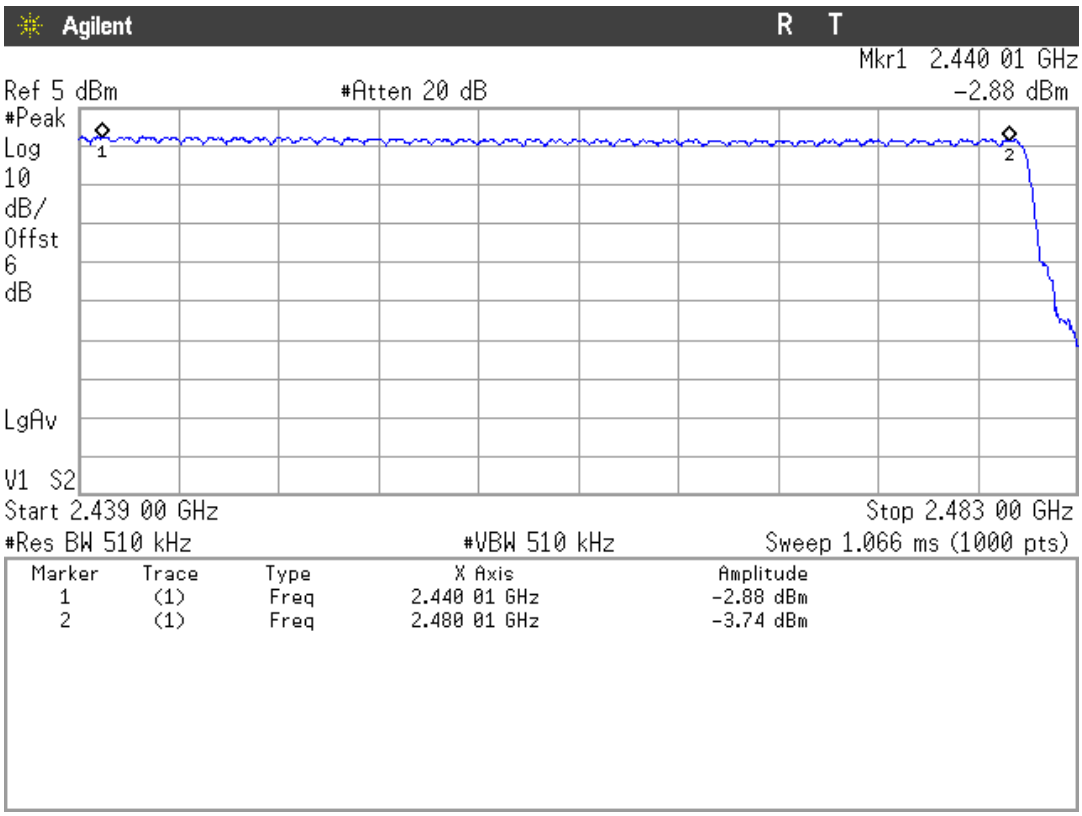
Total number of hopping frequencies: 79

Verdict: PASS

**Modulation: II/4-DQPSK**




Number of hopping frequencies: 39

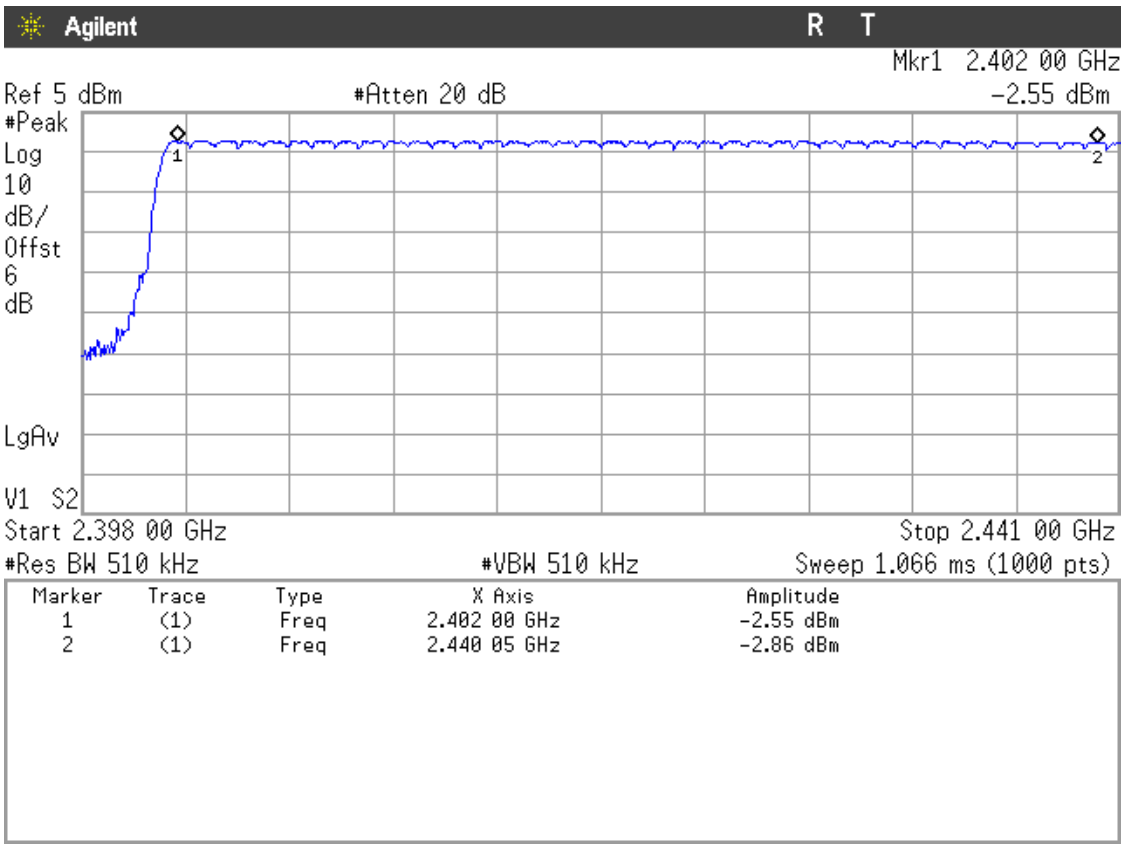



Number of hopping frequencies: 40

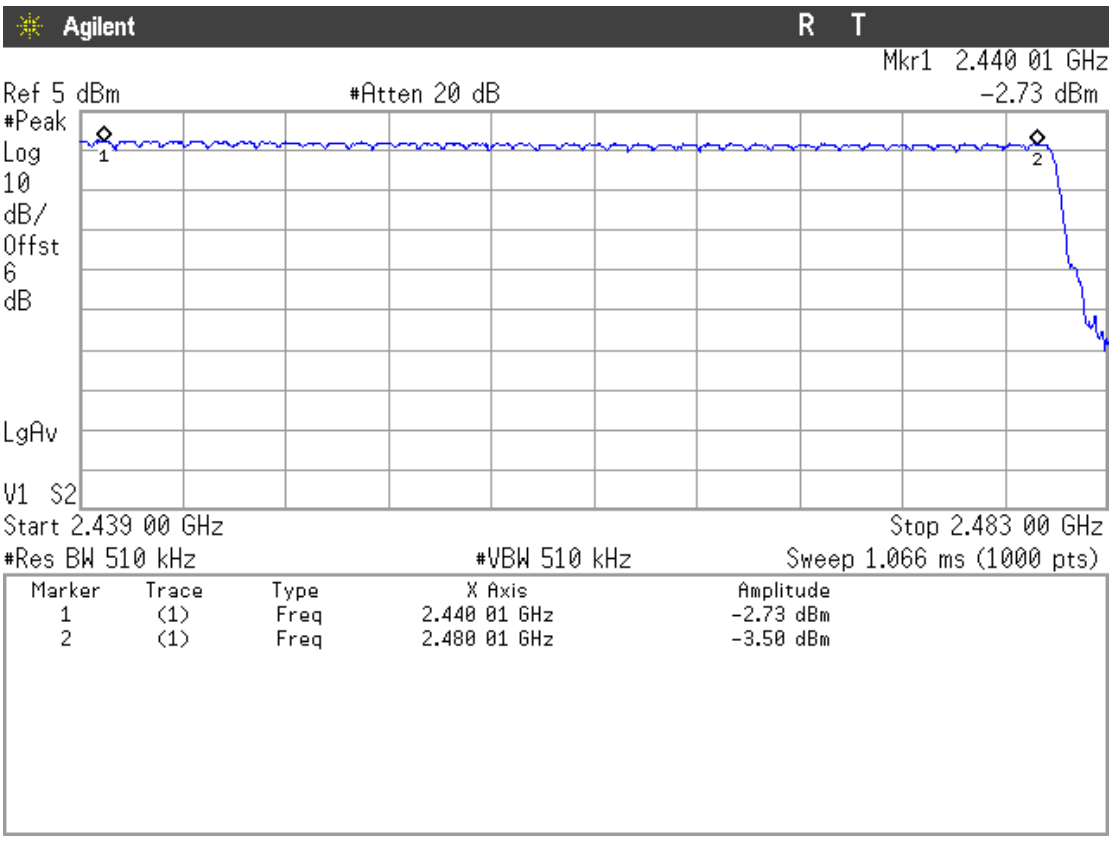
Total number of hopping frequencies: 79

Verdict: PASS

**Modulation: 8-DPSK**




Number of hopping frequencies: 39




Number of hopping frequencies: 40

Total number of hopping frequencies: 79

Verdict: PASS

**FCC Section 15.247 Subclause (a) (1) (iii) / RSS-210 Clause A8.1 (d). Time of occupancy (Dwell Time)**

SPECIFICATION

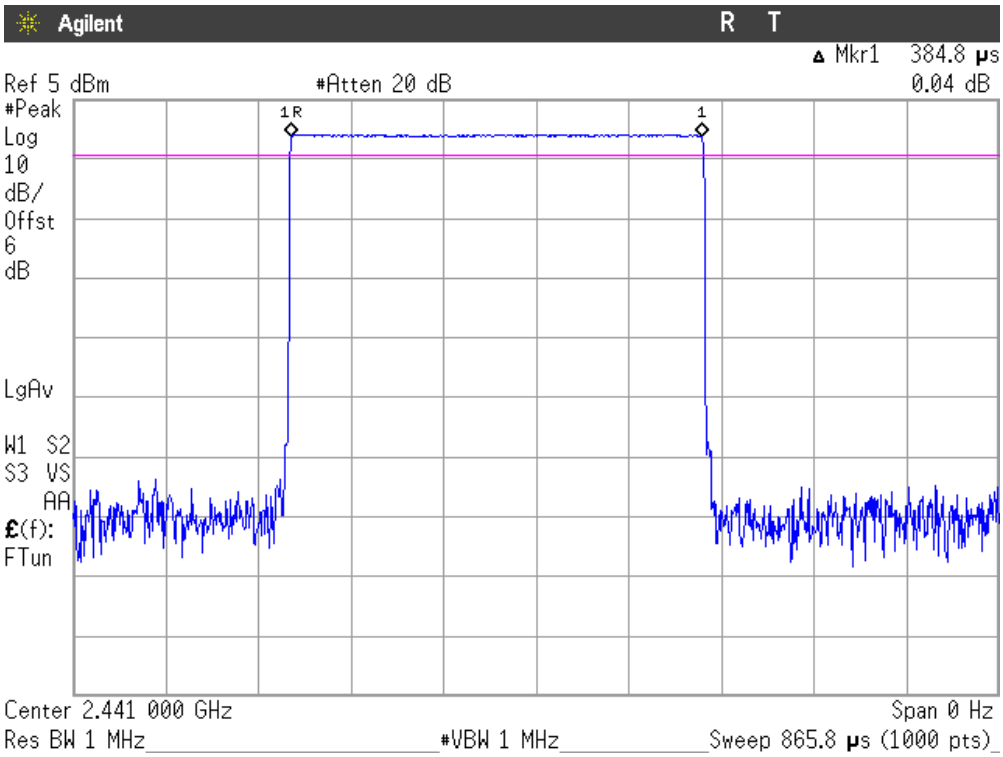
The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = 0.4 x 79= 31.6 seconds.

RESULTS

**Modulation: GFSK**

1. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH1.

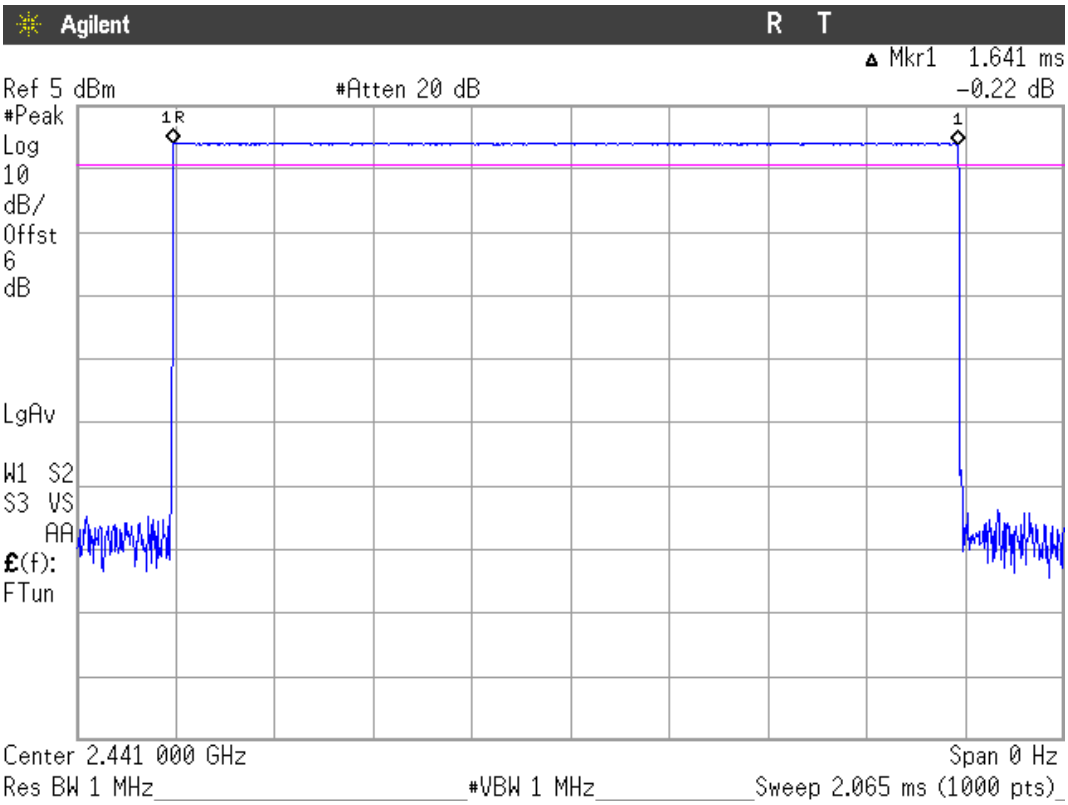
The system makes worst case 1600 hops per second or 1 time slot has a length of 625µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearance.
Each Tx-time per appearance is 384.8 µs (see next plot).
So we have 320.11 x 384.8 µs = 123.18 ms per 31.6 seconds.




Verdict: PASS

2. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH3.

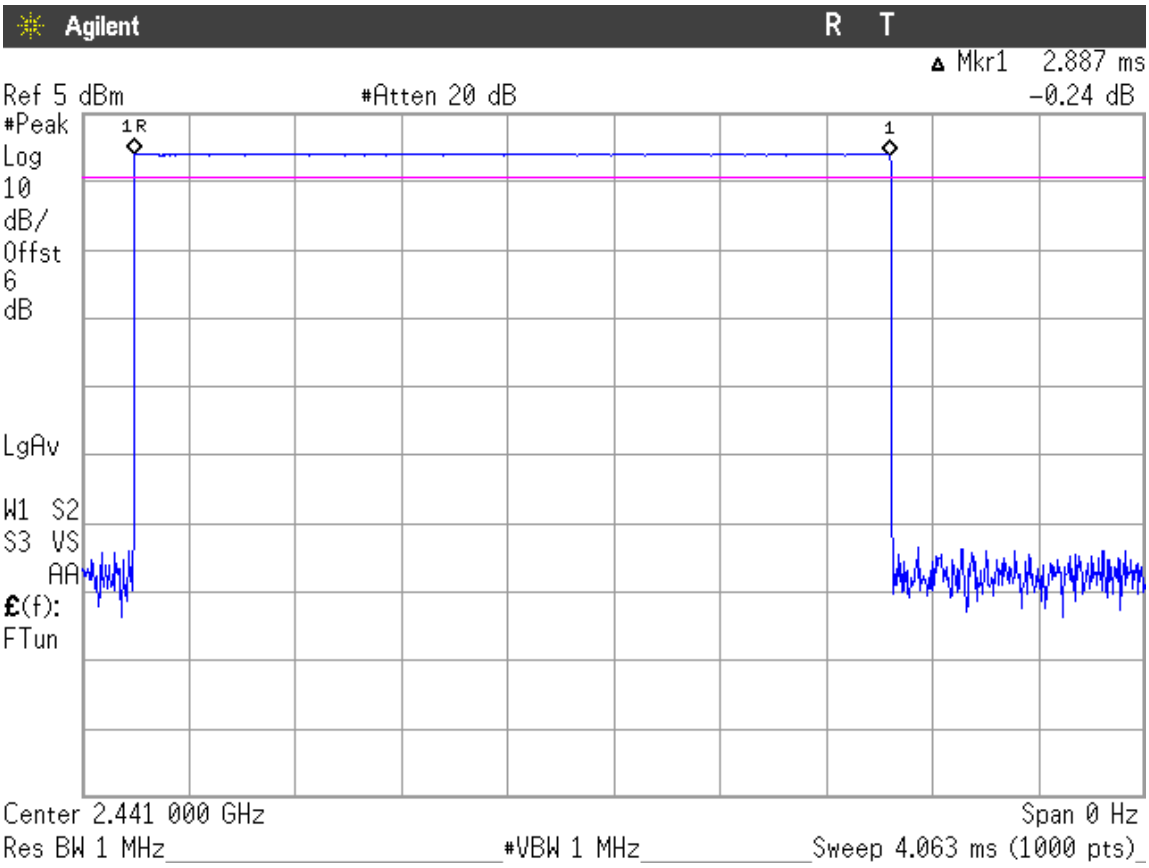
A DH3 Packet needs 3 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/4 = 400 hops per second with 79 channels. So you have each channel 400/79 = 5.1 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 5.1 x 31.6 = 161.16 times of appearance.
Each Tx-time per appearance is 1.641 ms (see next plot).
So we have 161.16 x 1.641 ms = 264.46 ms per 31.6 seconds.




Verdict: PASS

3. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH5.

A DH5 Packet needs 5 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/6 = 266.67 hops per second with 79 channels. So you have each channel 266.67/79 = 3.37 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 3.37 x 31.6 = 106.49 times of appearance.
Each Tx-time per appearance is 2.887 ms (see next plot).
So we have 106.49 x 2.887 ms = 307.44 ms per 31.6 seconds.

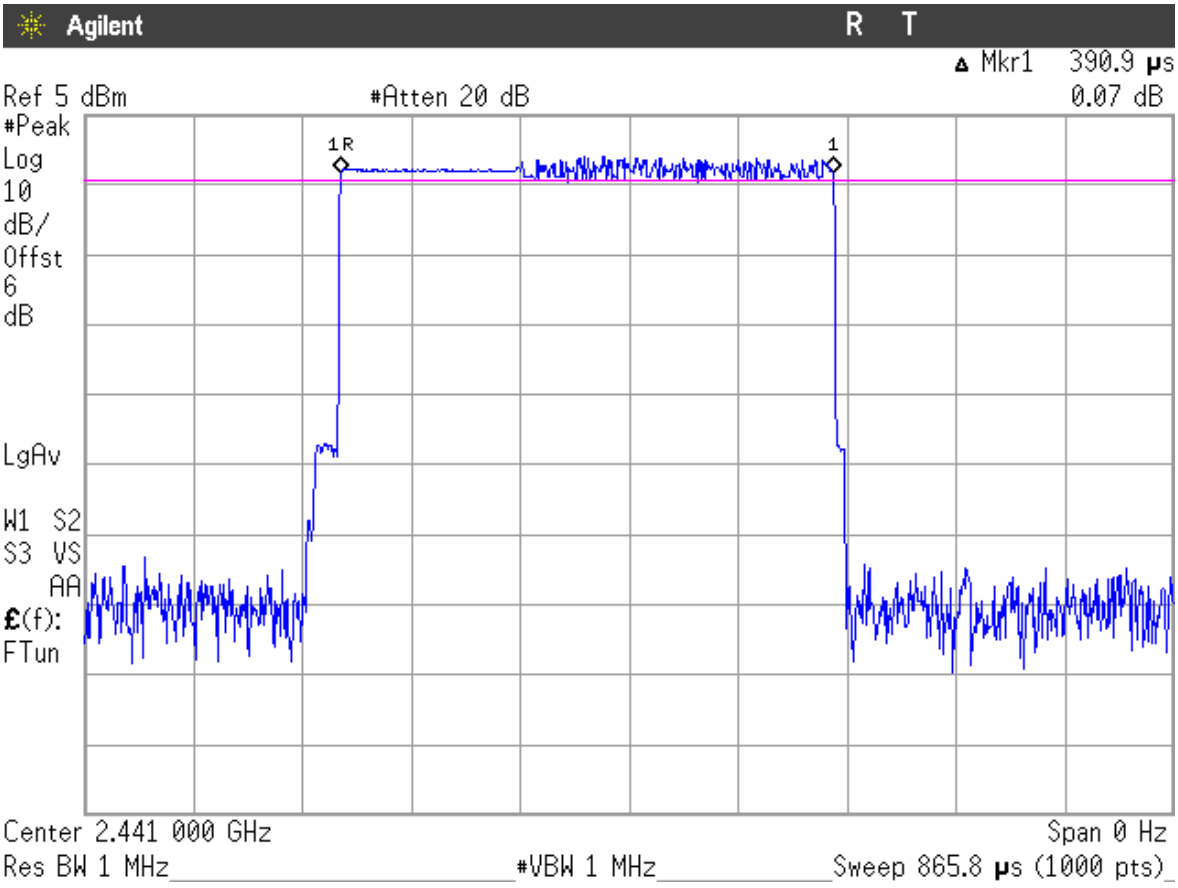



Verdict: PASS

**Modulation: Π/4-DQPSK**

1. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH1.

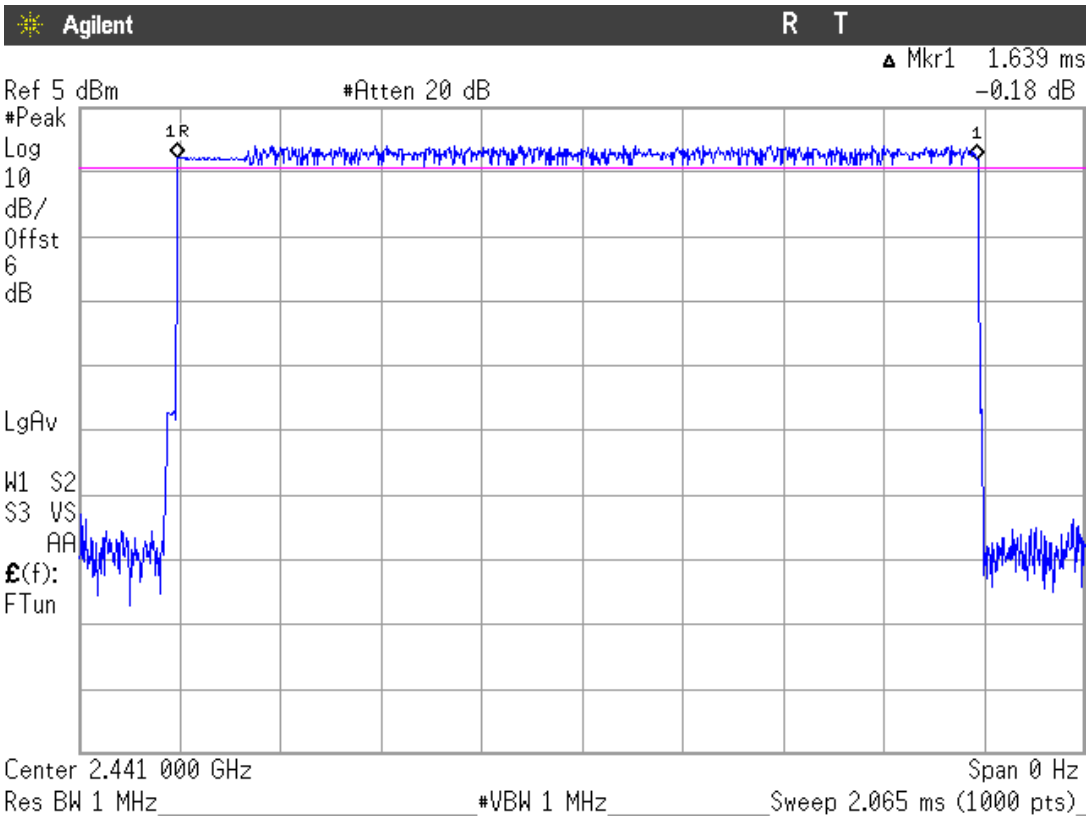
The system makes worst case 1600 hops per second or 1 time slot has a length of 625µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearance.
Each Tx-time per appearance is 390.9 µs (see next plot).
So we have 320.11 x 390.9 µs =125.13 ms per 31.6 seconds.




Verdict: PASS

2. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH3.

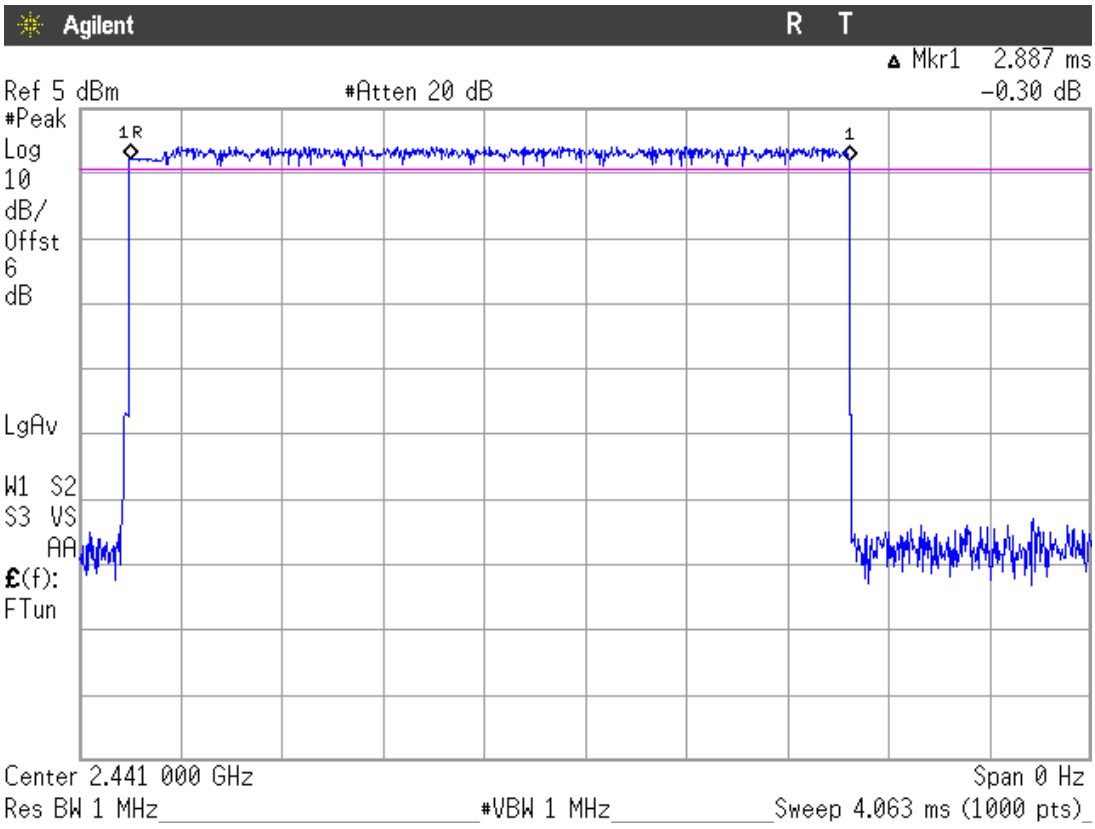
A DH3 Packet needs 3 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/4 = 400 hops per second with 79 channels. So you have each channel 400/79 = 5.1 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 5.1 x 31.6 = 161.16 times of appearance.
Each Tx-time per appearance is 1.639 ms (see next plot).
So we have 161.16 x 1.639 ms = 264.14 ms per 31.6 seconds.




Verdict: PASS

3. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH5.

A DH5 Packet needs 5 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/6 = 266.67 hops per second with 79 channels. So you have each channel 266.67/79 = 3.37 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 3.37 x 31.6 = 106.49 times of appearance.
Each Tx-time per appearance is 2.887 ms (see next plot).
So we have 106.49 x 2.887 ms = 307.44 ms per 31.6 seconds.

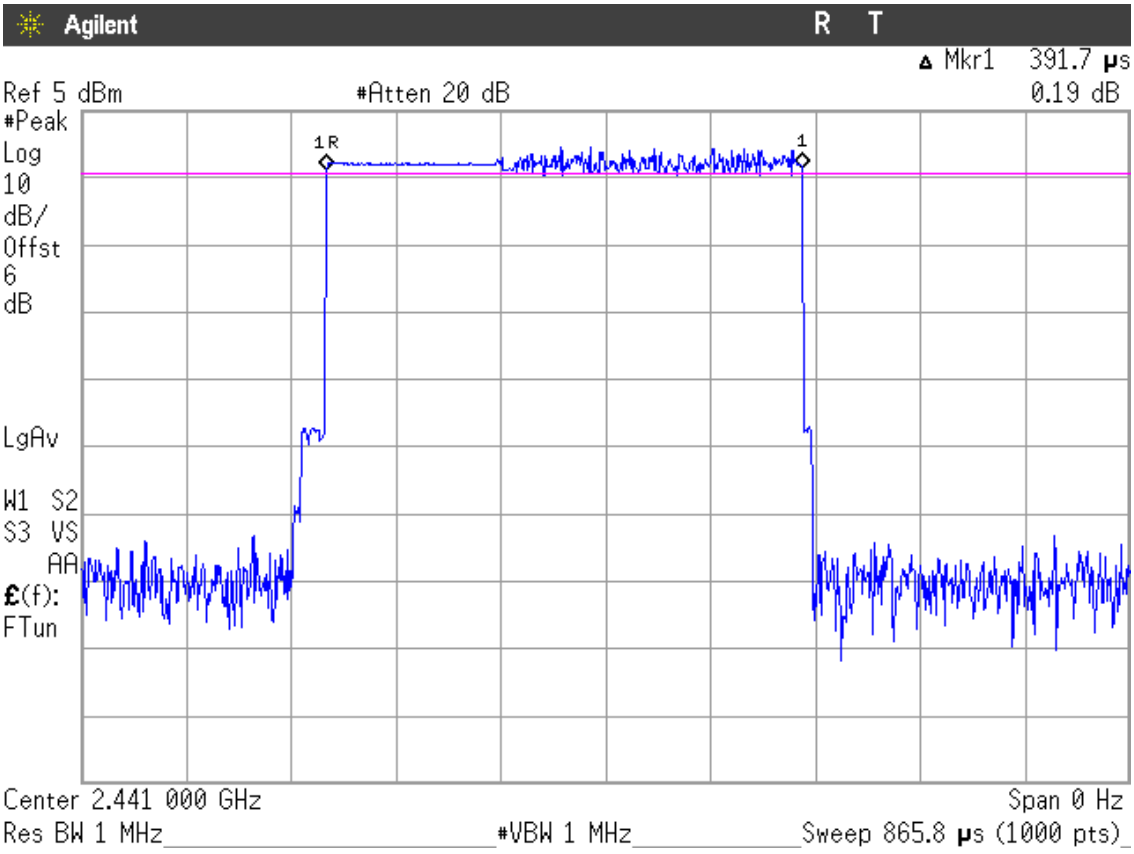



Verdict: PASS

**Modulation: 8-DPSK**

1. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH1.

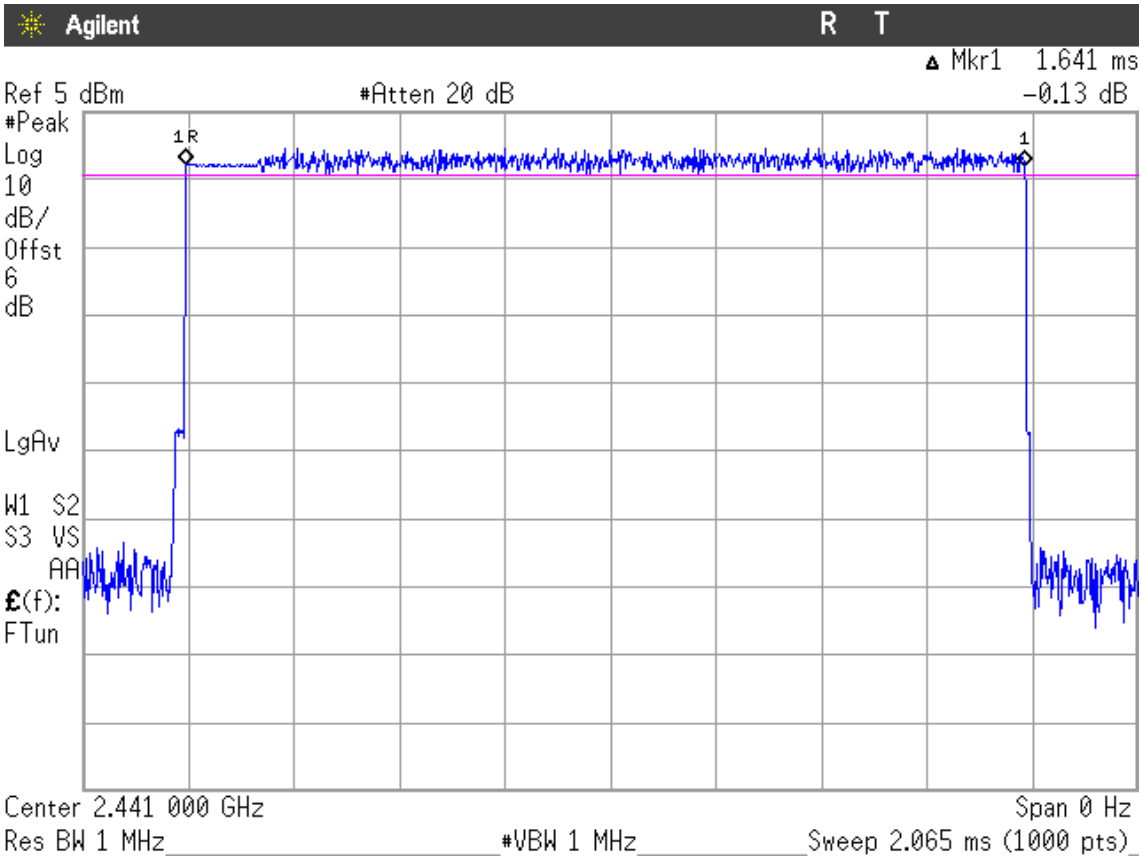
The system makes worst case 1600 hops per second or 1 time slot has a length of 625µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearance.
Each Tx-time per appearance is 391.7 µs (see next plot).
So we have 320.11 x 391.7 µs =125.39 ms per 31.6 seconds.




Verdict: PASS

2. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH3.

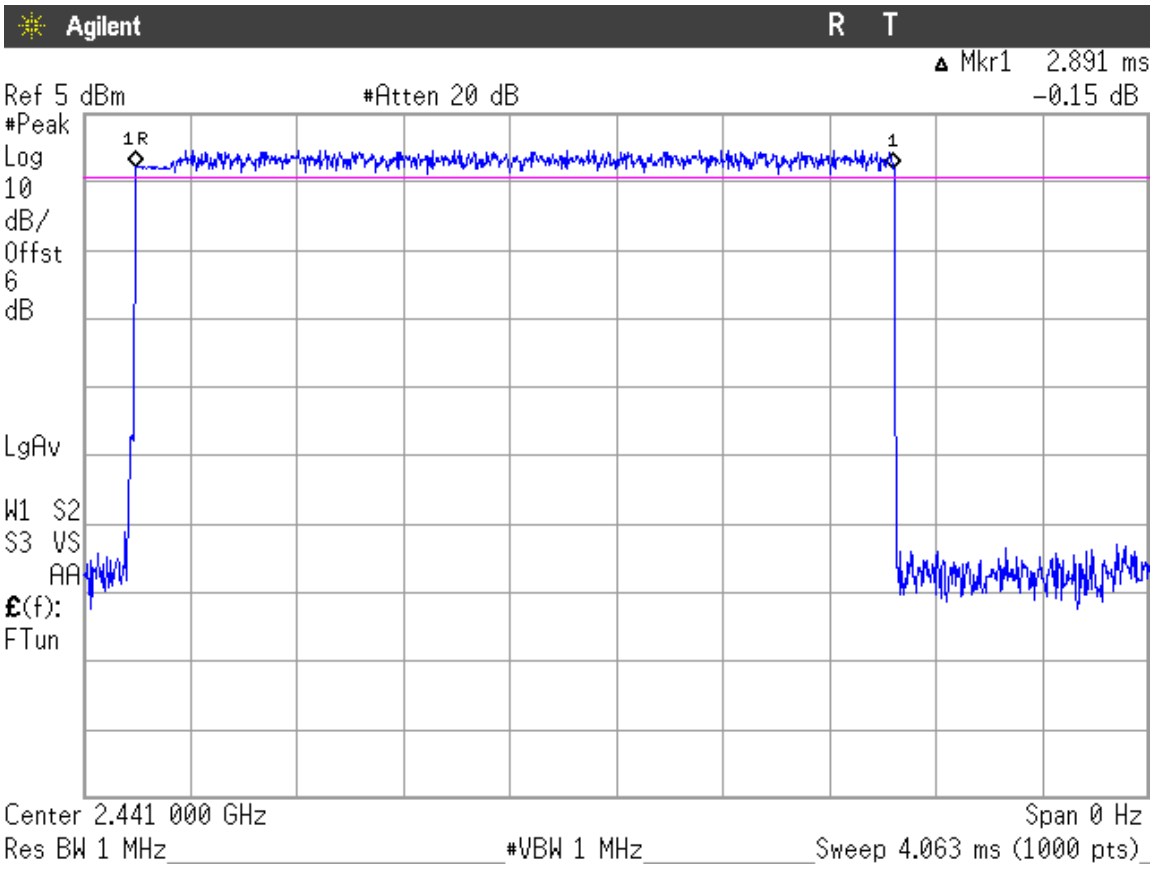
A DH3 Packet needs 3 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/4 = 400 hops per second with 79 channels. So you have each channel 400/79 = 5.1 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 5.1 x 31.6 = 161.16 times of appearance.
Each Tx-time per appearance is 1.641 ms (see next plot).
So we have 161.16 x 1.641 ms = 264.46 ms per 31.6 seconds.




Verdict: PASS

3. TIME OF OCCUPANCY (DWELL TIME) FOR PACKET TYPE DH5.

A DH5 Packet needs 5 time slots for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/6 = 266.67 hops per second with 79 channels. So you have each channel 266.67/79 = 3.37 times per second and so for a period of 0.4 x 79 = 31.6 seconds you have 3.37 x 31.6 = 106.49 times of appearance.
Each Tx-time per appearance is 2.891 ms (see next plot).
So we have 106.49 x 2.891 ms = 307.86 ms per 31.6 seconds.




Verdict: PASS

**FCC Section 15.247 Subclause (b) / RSS-210 Clause A8.4 (2). Maximum peak output power and antenna gain**

SPECIFICATION

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm).

RESULTS

MAXIMUM OUTPUT POWER. See next plots.

Declared maximum antenna gain: -1.0 dBi.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Modulation: GFSK

| | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| Maximum peak power (dBm) | -0.57 | -0.90 | -1.60 |
| Maximum EIRP power (dBm) | -1.57 | -1.90 | -2.60 |
| Measurement uncertainty (dB) | ±1.5 | | |

| **Average conducted power for SAR calculations** | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| Average conducted power (dBm) | -2.01 | -2.51 | -3.12 |
| Measurement uncertainty (dB) | ±1.5 | | |

Modulation: Π/4-DQPSK (2Mbps)

| | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| Maximum peak power (dBm) | -0.05 | -0.26 | -0.94 |
| Maximum EIRP power (dBm) | -1.05 | -1.26 | -1.94 |
| Measurement uncertainty (dB) | ±1.5 | | |

| **Average conducted power for SAR calculations** | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| Average conducted power (dBm) | -3.99 | -4.51 | -5.15 |
| Measurement uncertainty (dB) | ±1.5 | | |

Modulation: 8-DPSK (3Mbps)

| | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| Maximum peak power (dBm) | 0.64 | 0.55 | -0.13 |
| Maximum EIRP power (dBm) | -0.36 | -0.45 | -1.13 |
| Measurement uncertainty (dB) | ±1.5 | | |

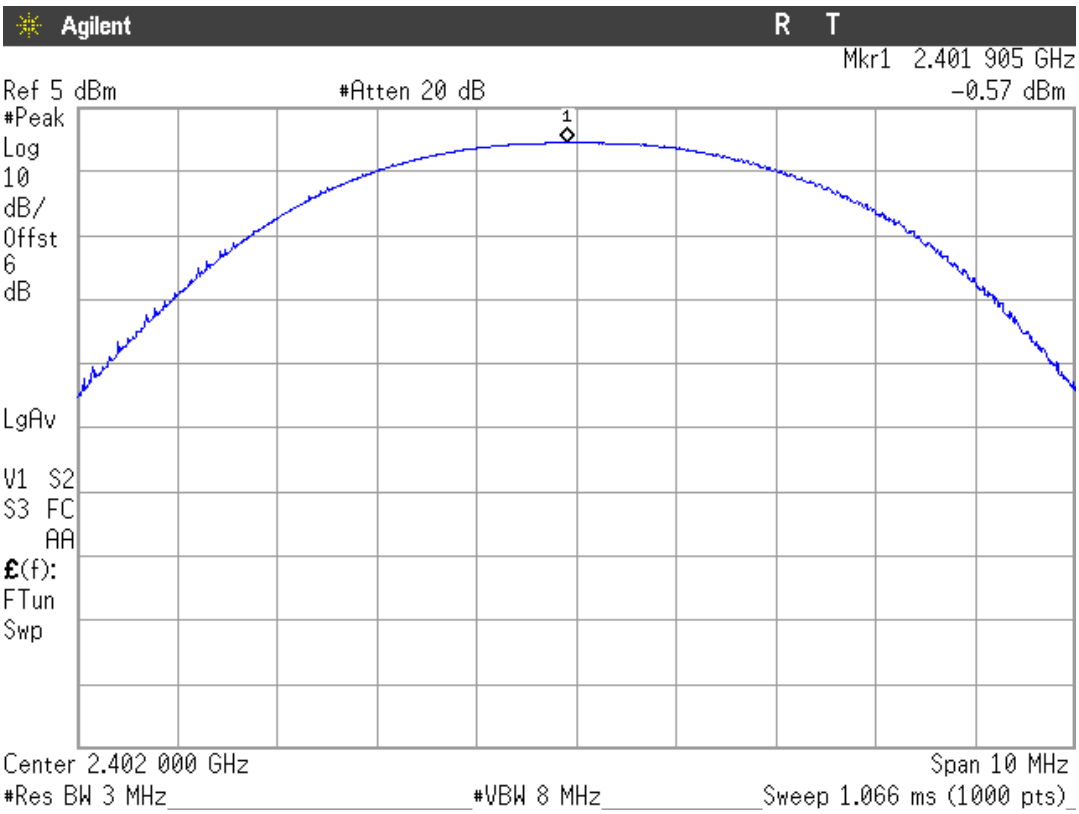
| **Average conducted power for SAR calculations** | Lowest frequency 2402 MHz | Middle frequency 2441 MHz | Highest frequency 2480 MHz |
|---|---|---|---|
| Average conducted power (dBm) | -4.00 | -4.50 | -5.13 |
| Measurement uncertainty (dB) | ±1.5 | | |

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

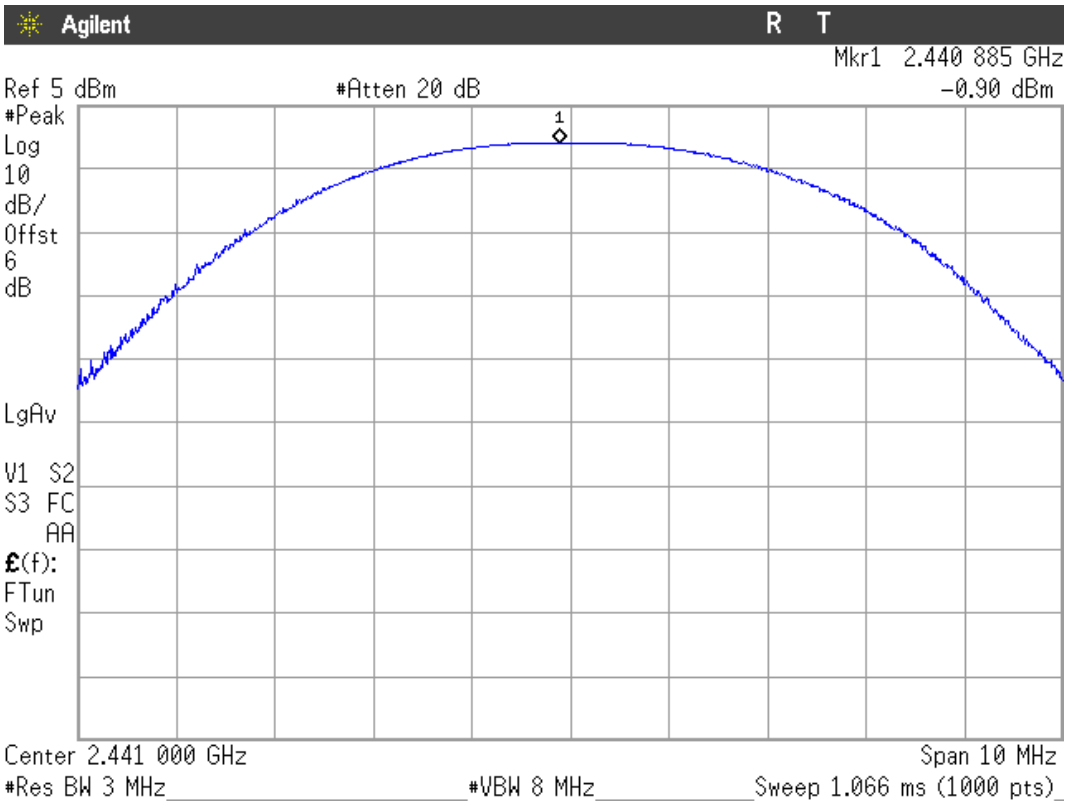
Verdict: PASS

PEAK OUTPUT POWER (CONDUCTED).

Modulation: GFSK Lowest Channel: 2402 MHz.

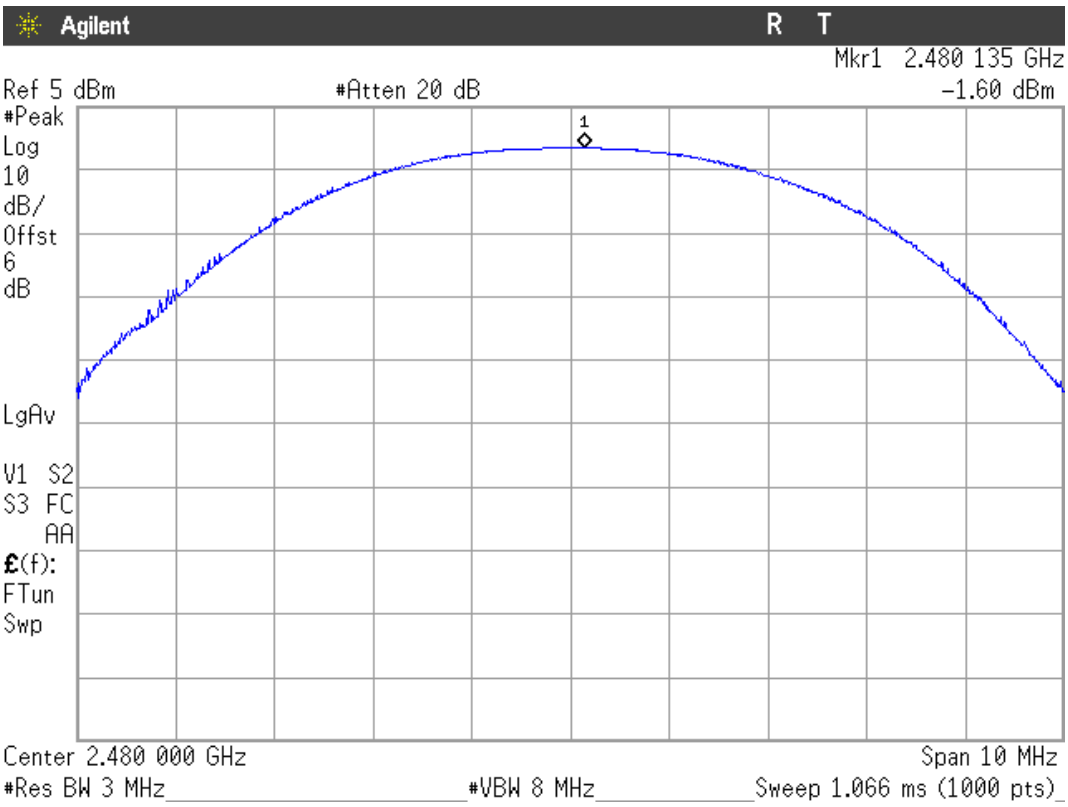



Modulation: GFSK Middle Channel: 2441 MHz.

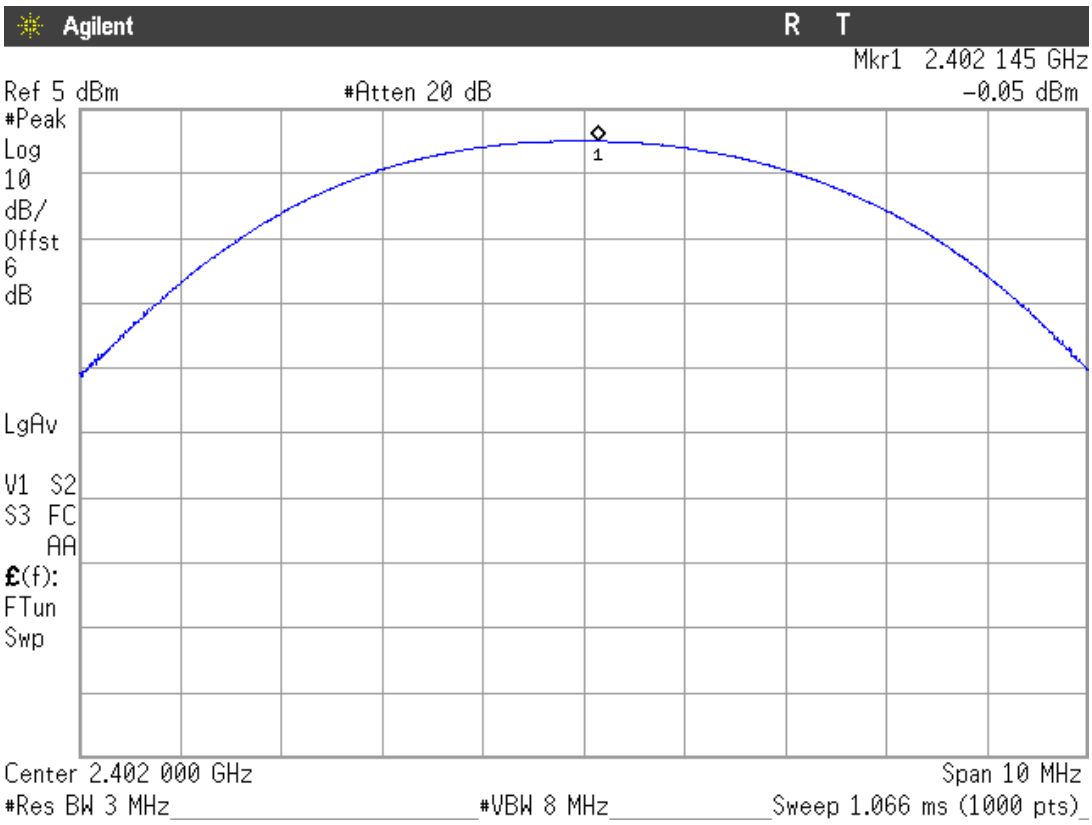


PEAK OUTPUT POWER (CONDUCTED).

Modulation: GFSK Highest Channel: 2480 MHz.

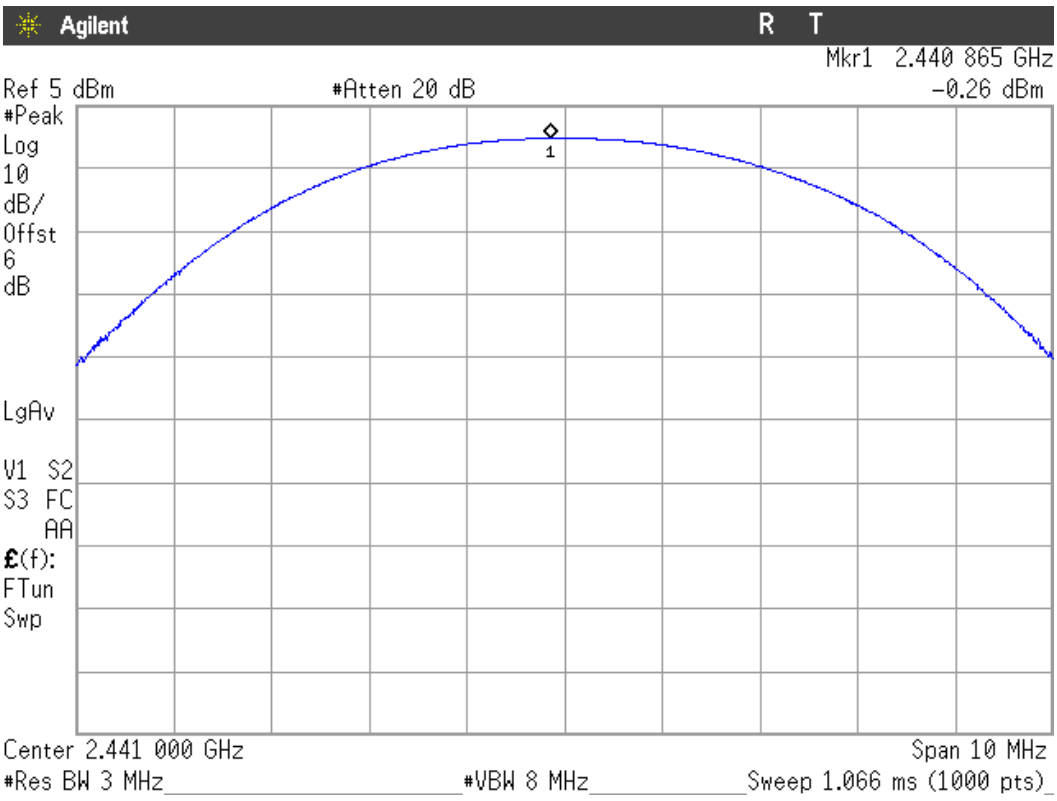



Modulation: Π/4-DQPSK Lowest Channel: 2402 MHz

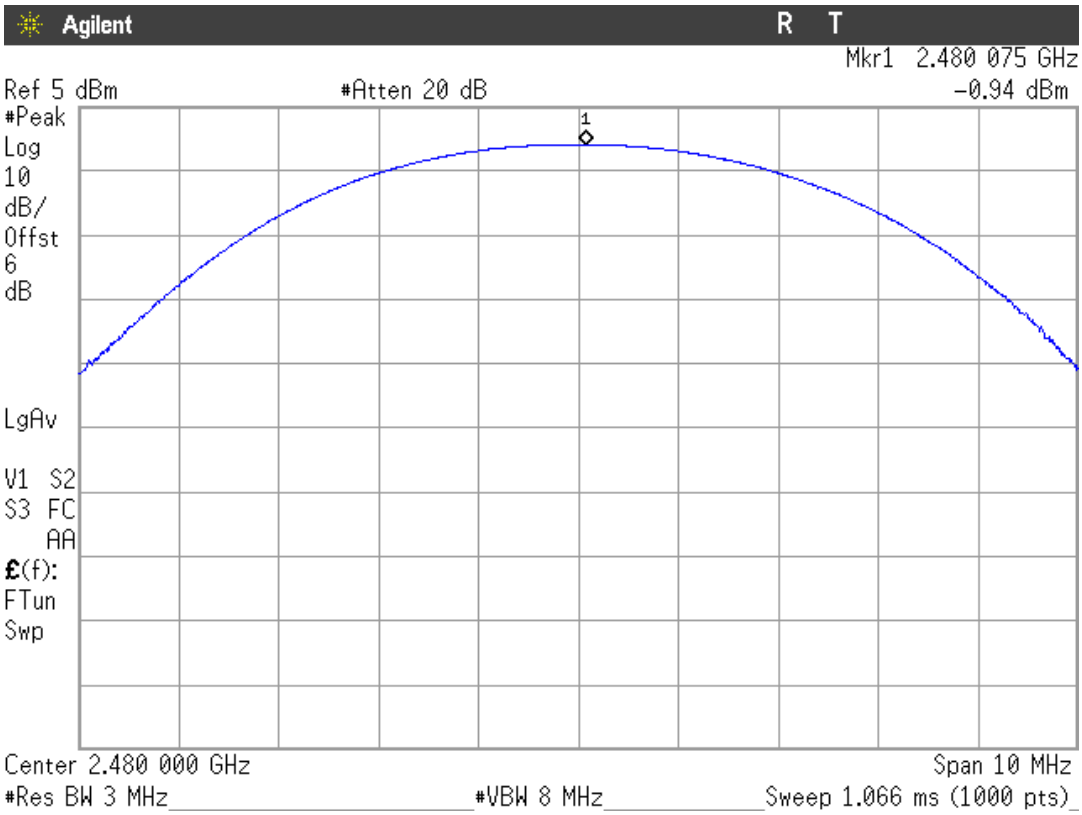


PEAK OUTPUT POWER (CONDUCTED)

Modulation: Π/4-DQPSK Middle Channel: 2441 MHz.

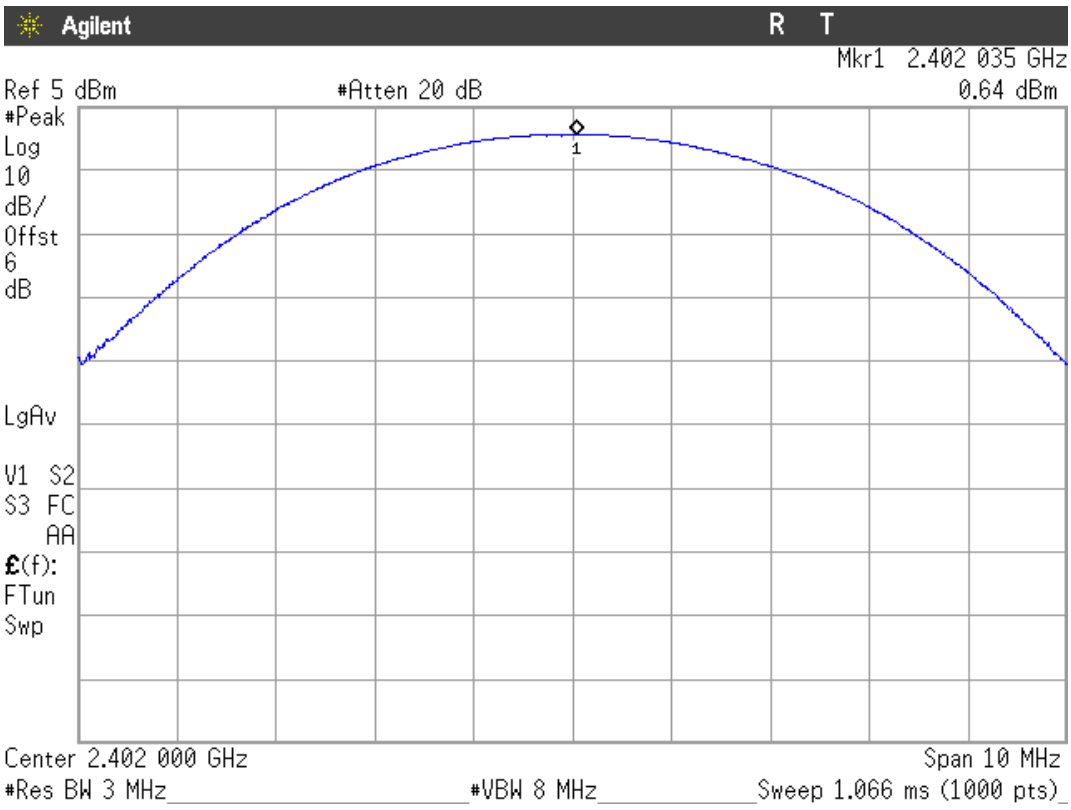



Modulation: Π/4-DQPSK Highest Channel: 2480 MHz.

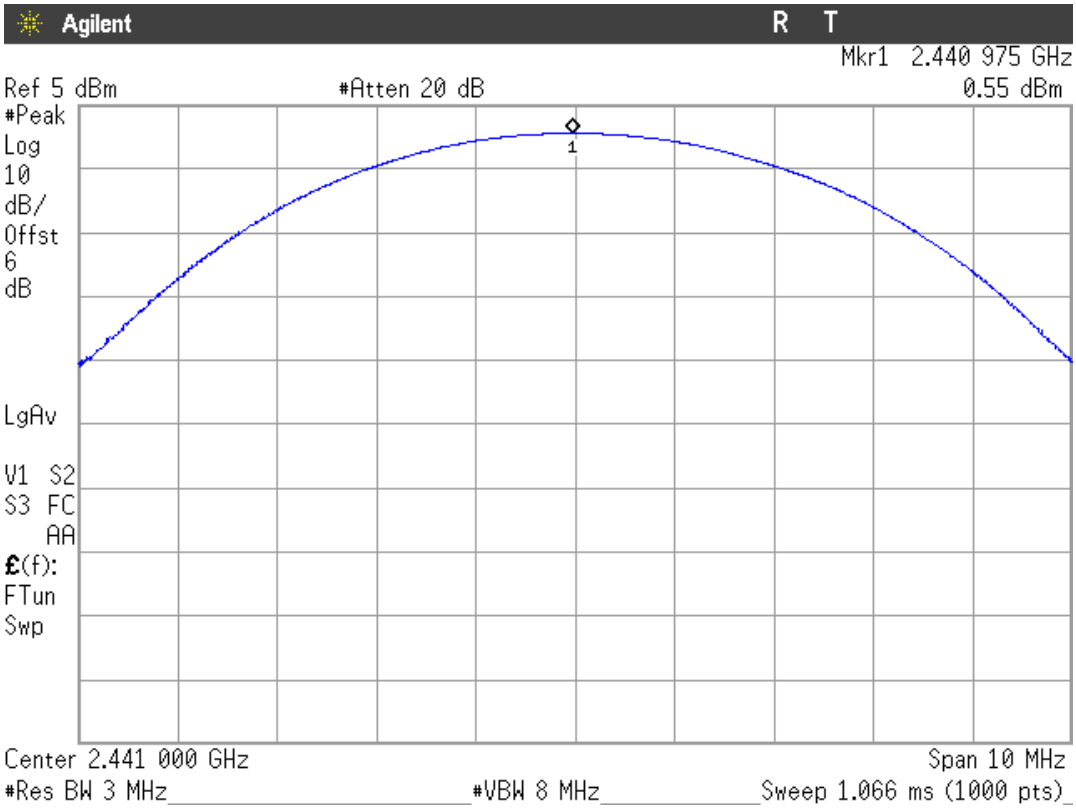


PEAK OUTPUT POWER (CONDUCTED).

Modulation: 8-DPSK Lowest Channel: 2402 MHz

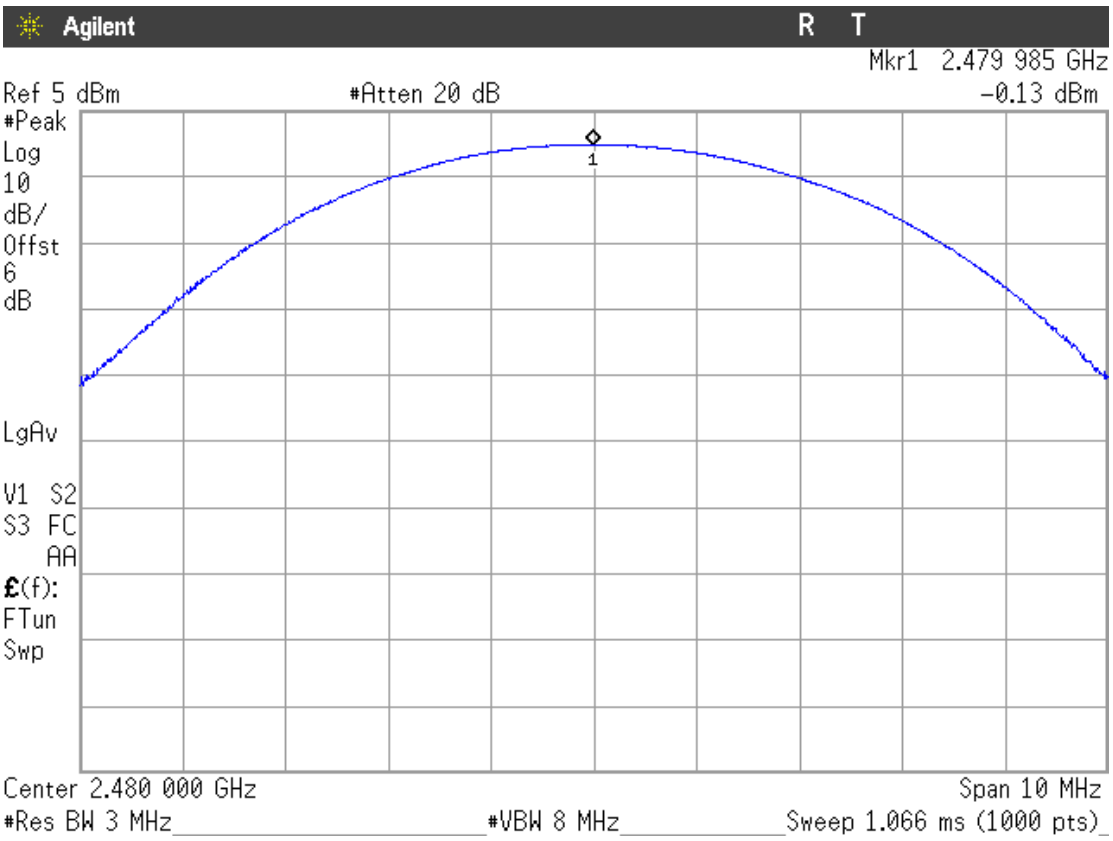



Modulation: 8-DPSK Middle Channel: 2441 MHz.



PEAK OUTPUT POWER (CONDUCTED).

Modulation: 8-DPSK  Highest Channel: 2480 MHz.



**FCC Section 15.247 Subclause (d) / RSS-210 Clauses 2.2 & A8.5. Band-edge compliance of conducted emissions (Transmitter)**

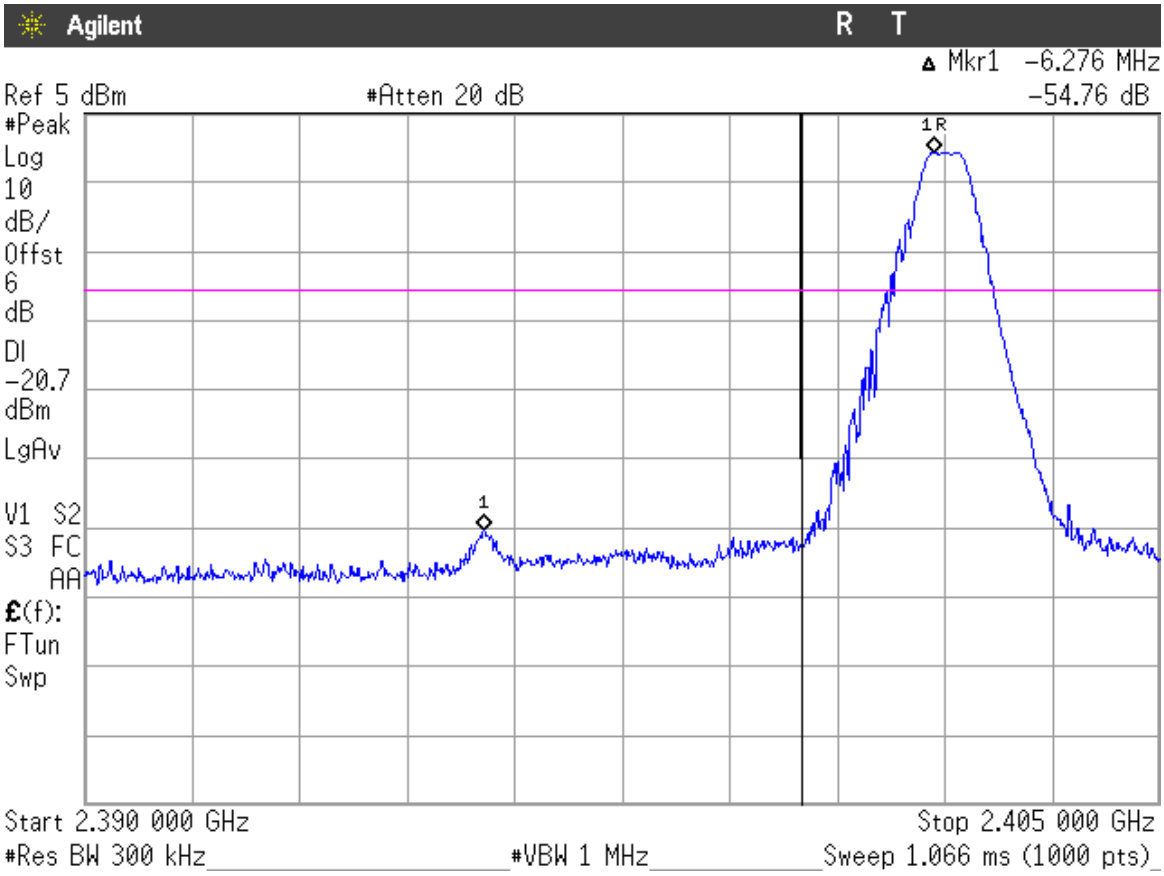
SPECIFICATION

Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20 dB below the highest level of the desired power.

RESULTS:

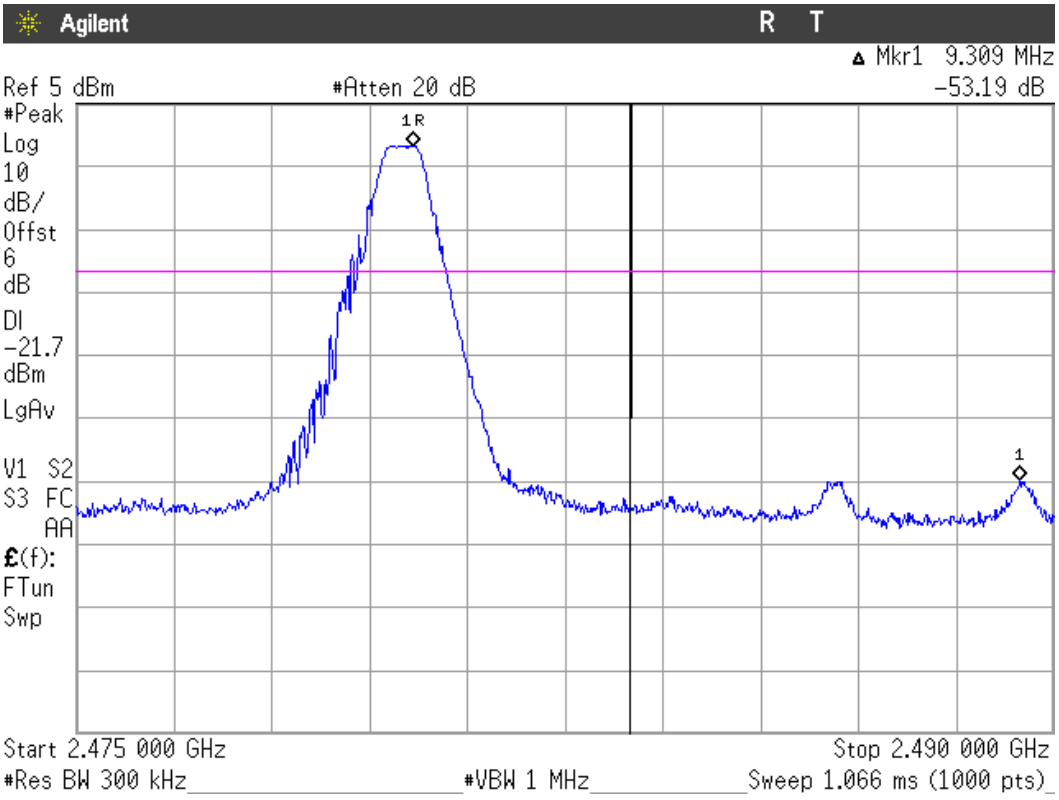
**Modulation: GFSK**

1. LOW FREQUENCY SECTION 2402 MHz (HOPPING OFF). See next plot.



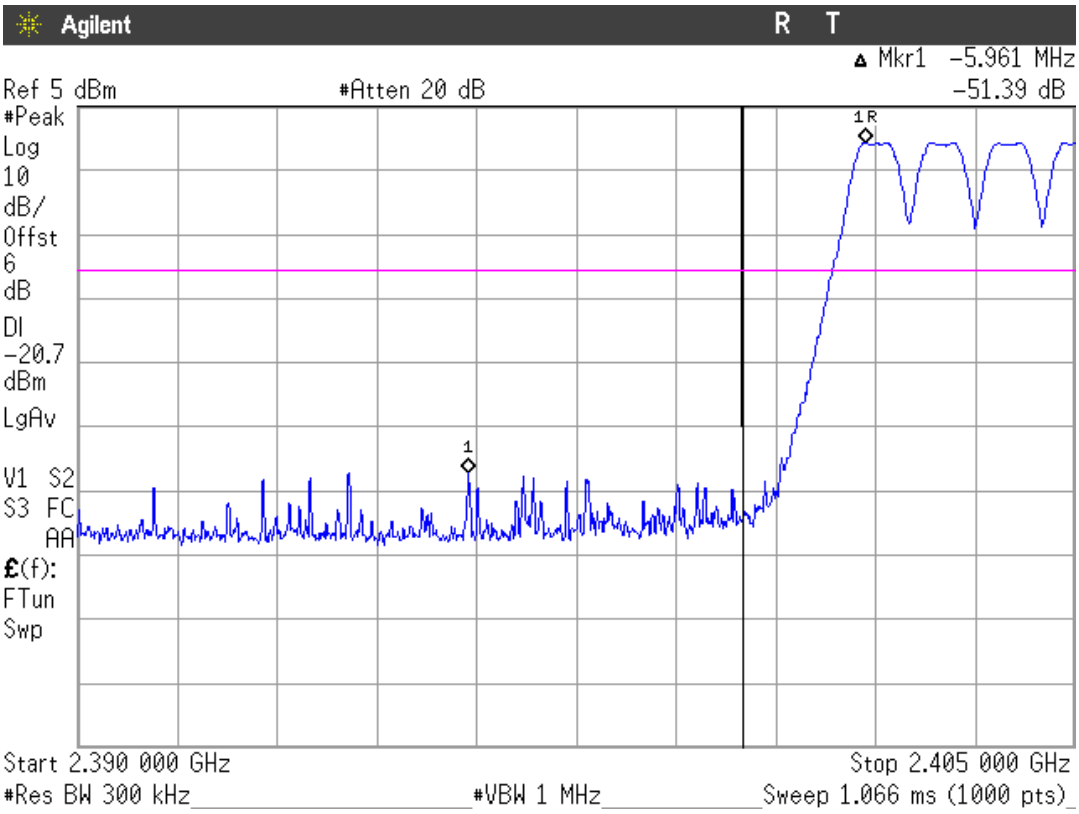

Verdict: PASS

2. HIGH FREQUENCY SECTION 2480 MHz (HOPPING OFF). See next plot.



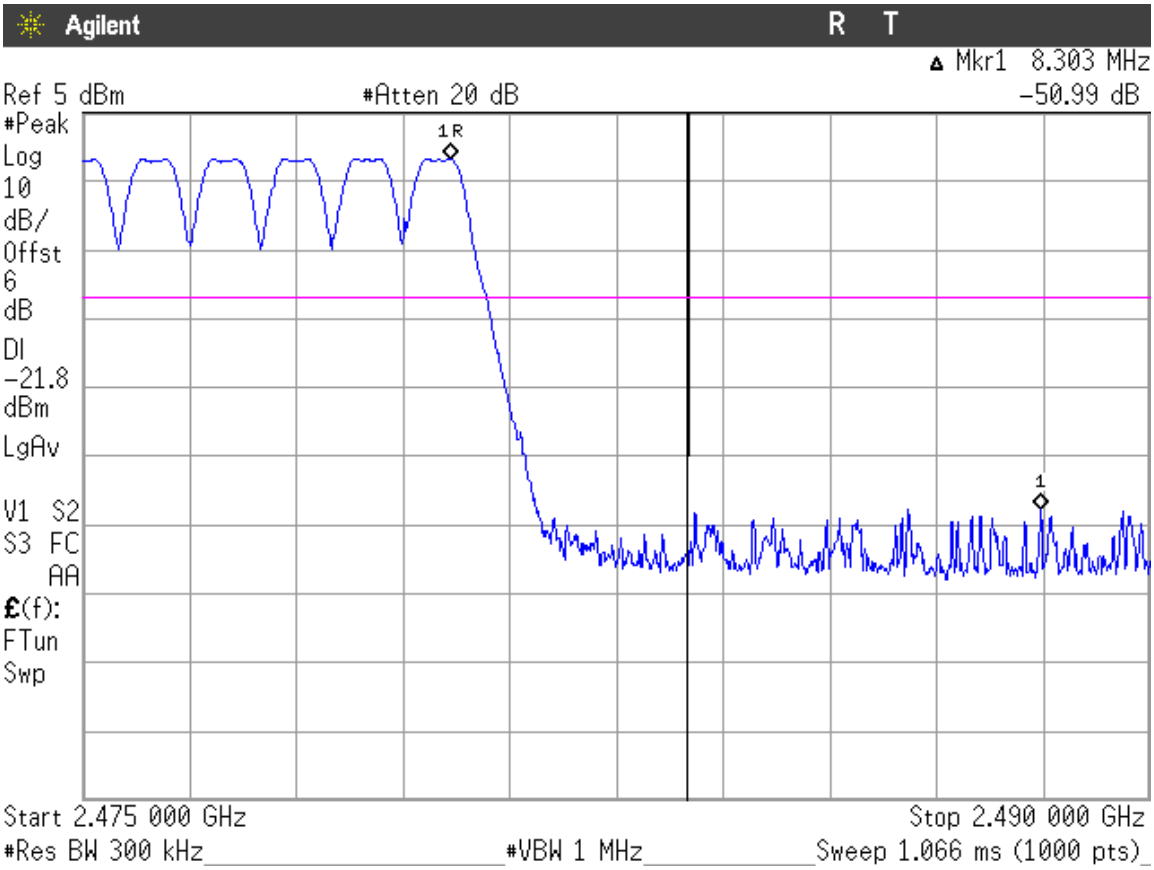

Verdict: PASS

3. LOW FREQUENCY SECTION (HOPPING ON). See next plot.




Verdict: PASS

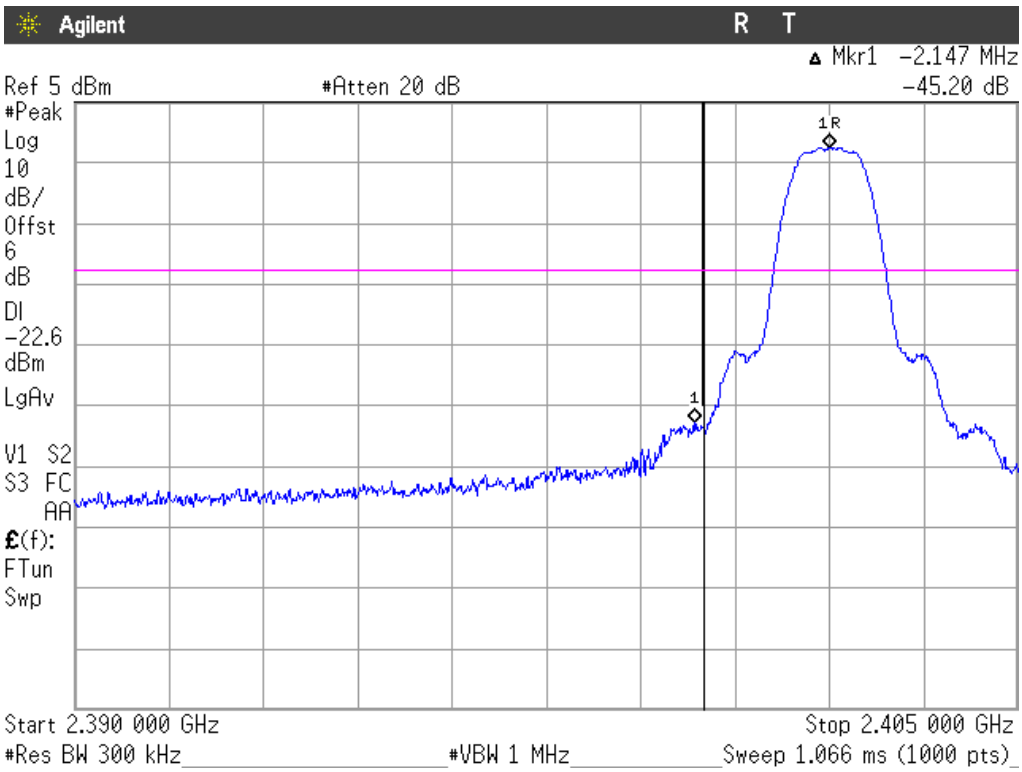
4. HIGH FREQUENCY SECTION (HOPPING ON). See next plot.




Verdict: PASS

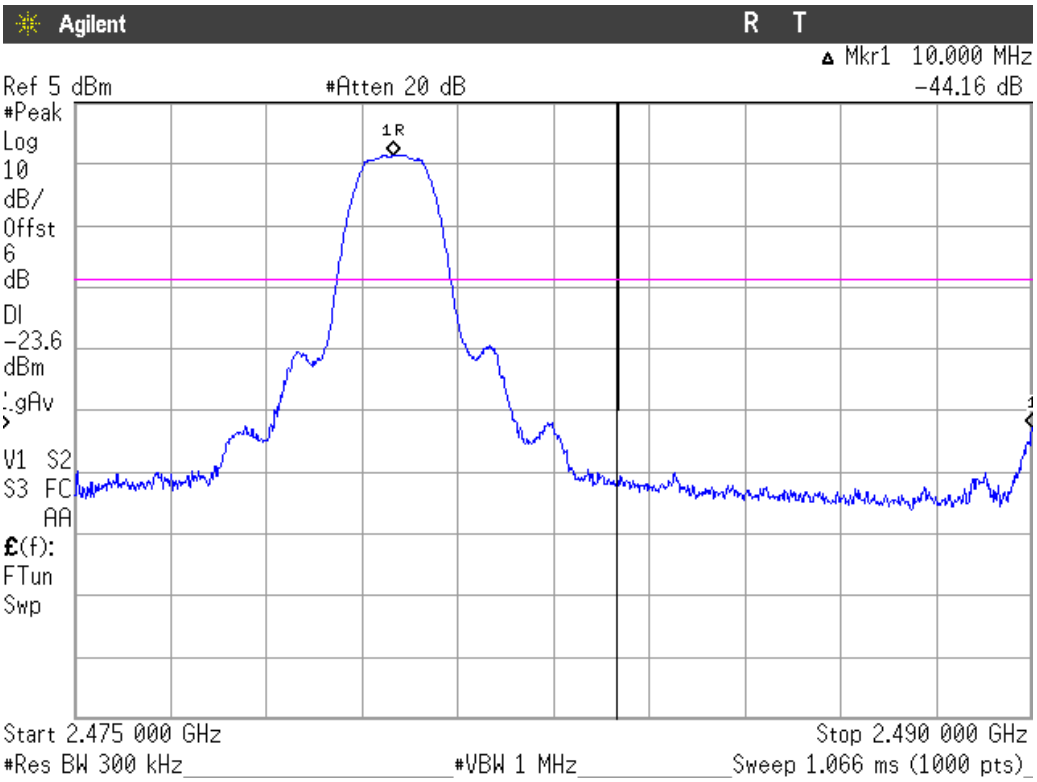
**Modulation: II/4-DQPSK**

1. LOW FREQUENCY SECTION 2402 MHz (HOPPING OFF). See next plot.



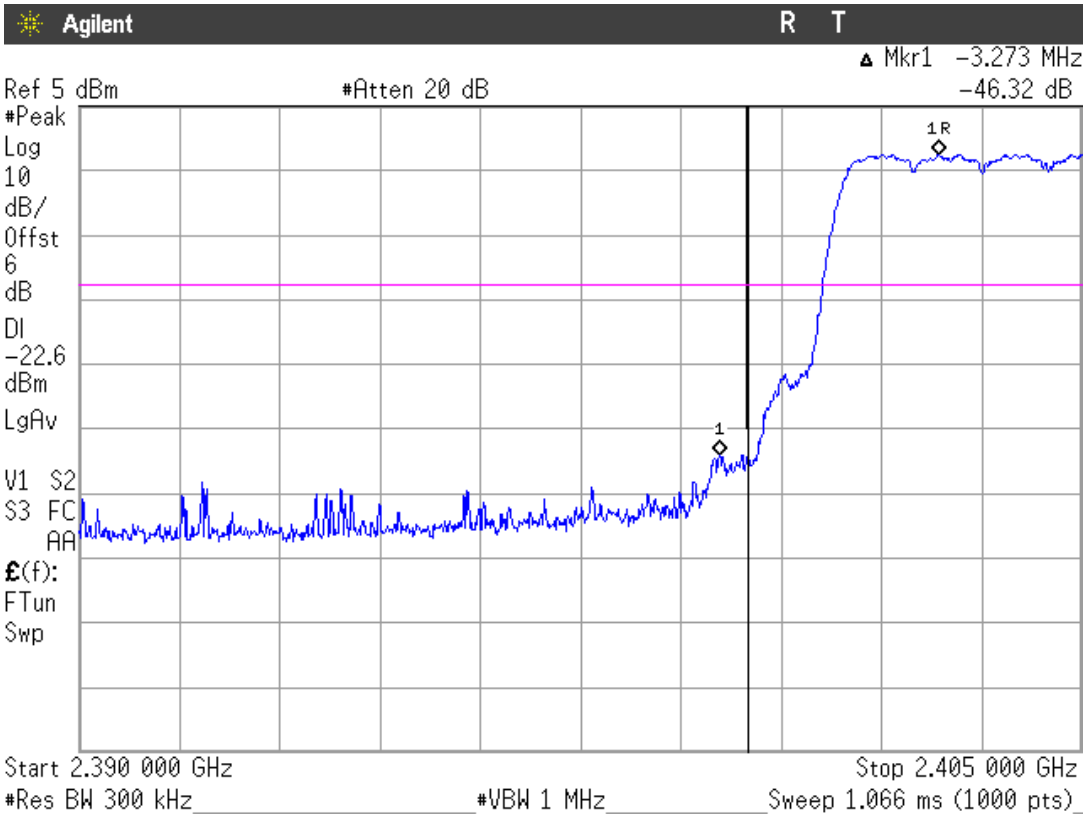

Verdict: PASS

2. HIGH FREQUENCY SECTION 2480 MHz (HOPPING OFF). See next plot.



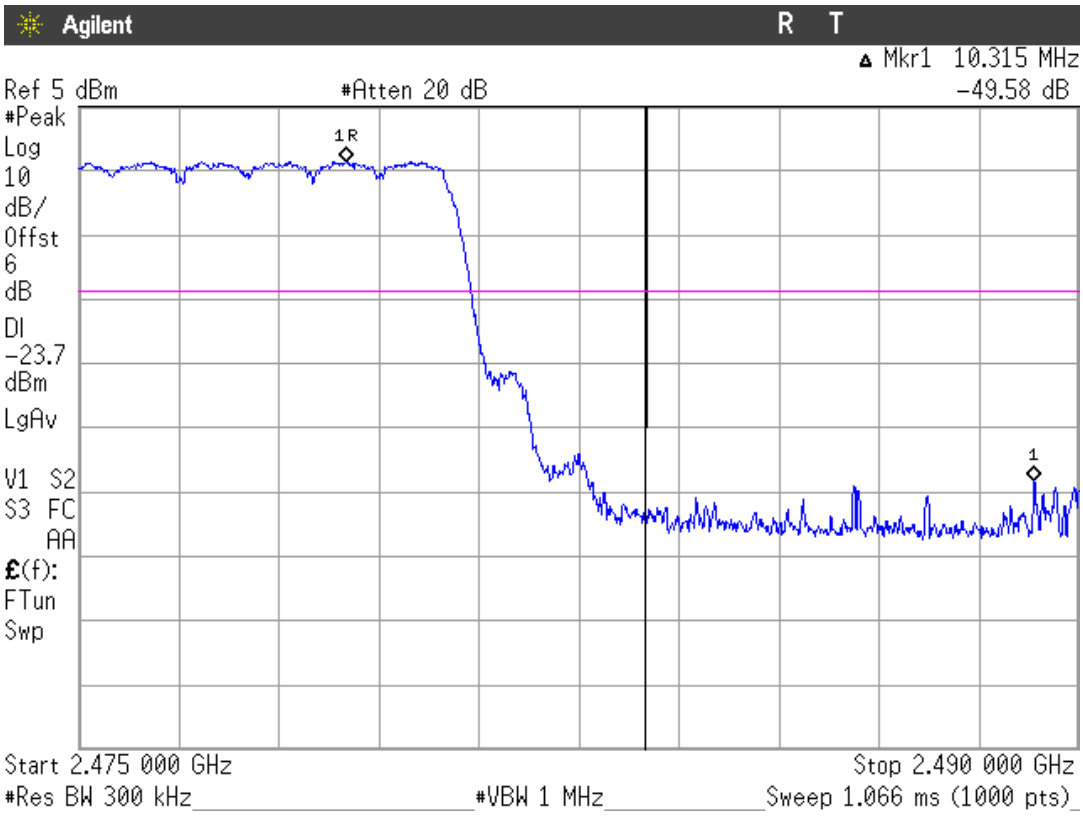

Verdict: PASS

3. LOW FREQUENCY SECTION (HOPPING ON). See next plot.




Verdict: PASS

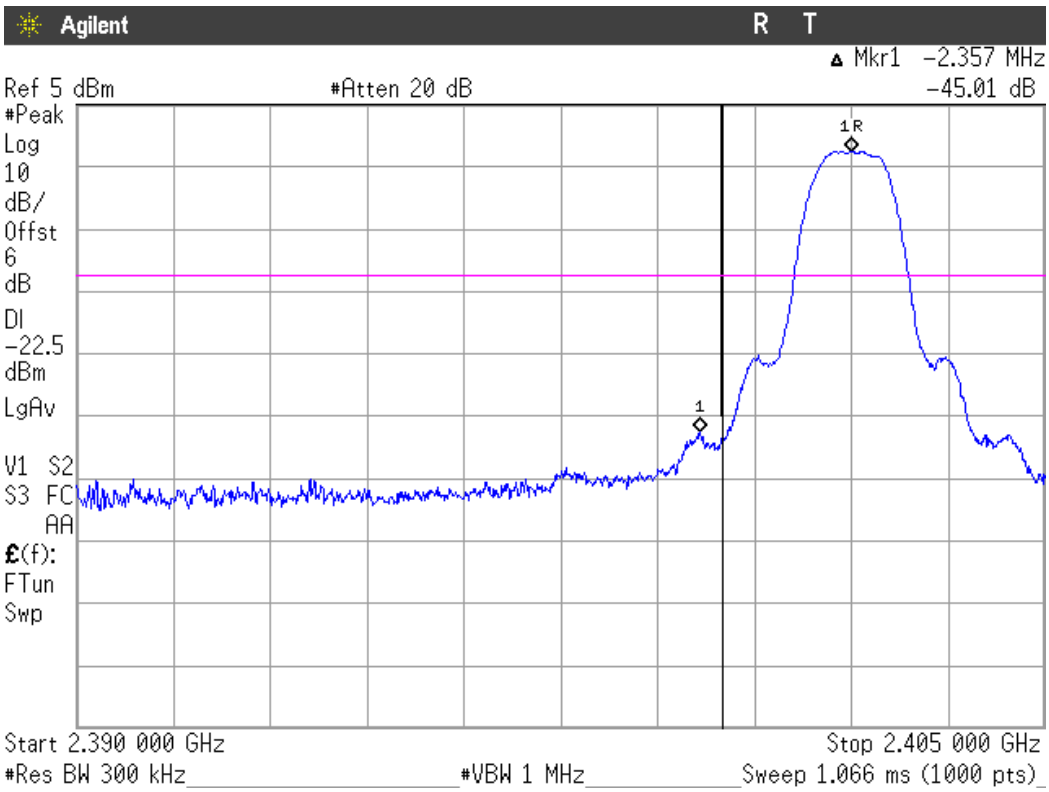
4. HIGH FREQUENCY SECTION (HOPPING ON). See next plot.




Verdict: PASS

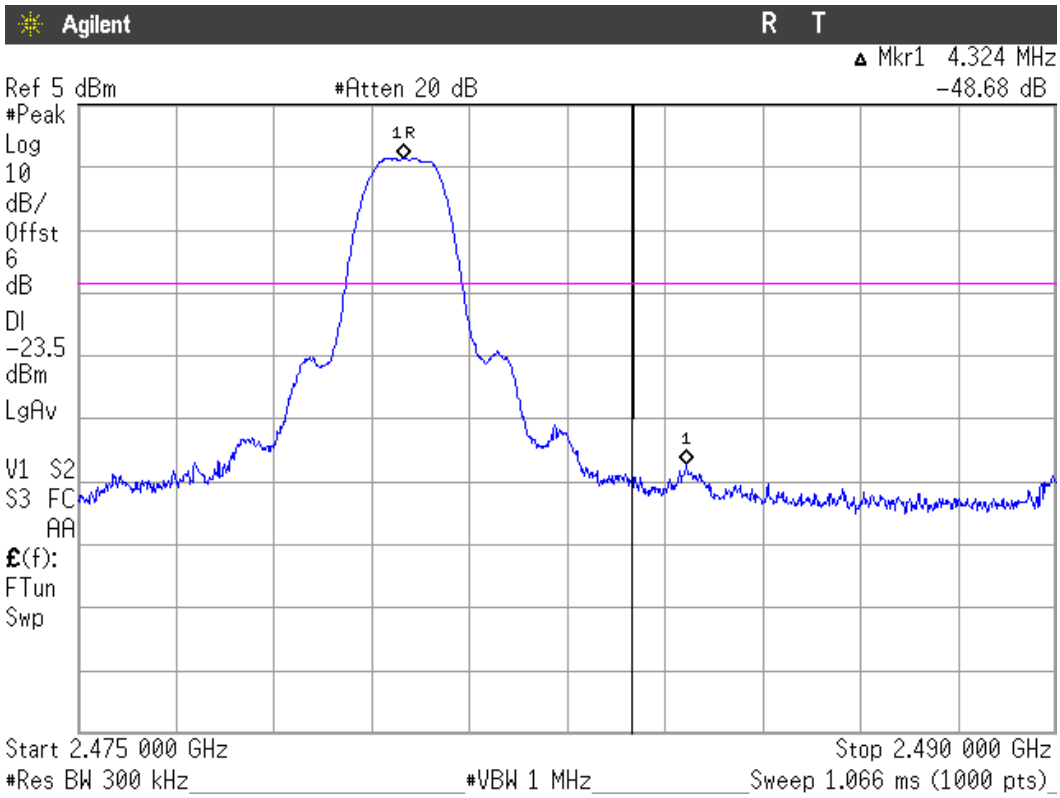
**Modulation: 8-DPSK**

1. LOW FREQUENCY SECTION 2402 MHz (HOPPING OFF). See next plot.



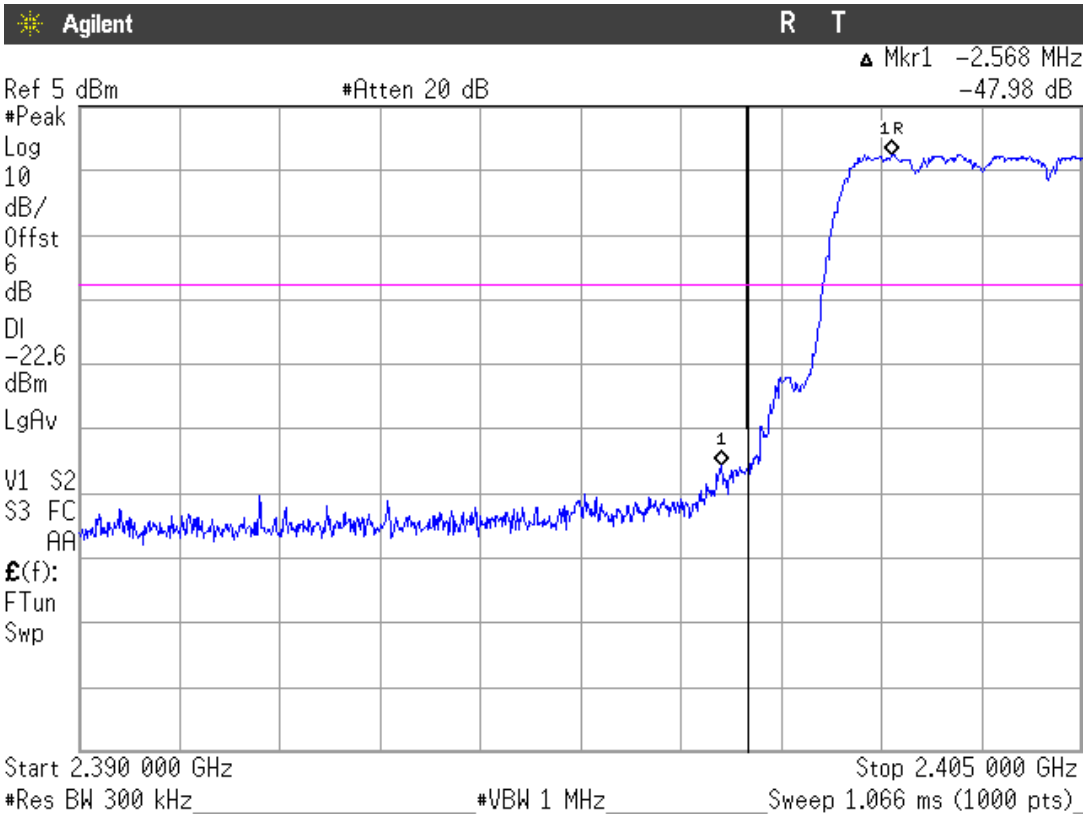

Verdict: PASS

2. HIGH FREQUENCY SECTION 2480 MHz (HOPPING OFF). See next plot.



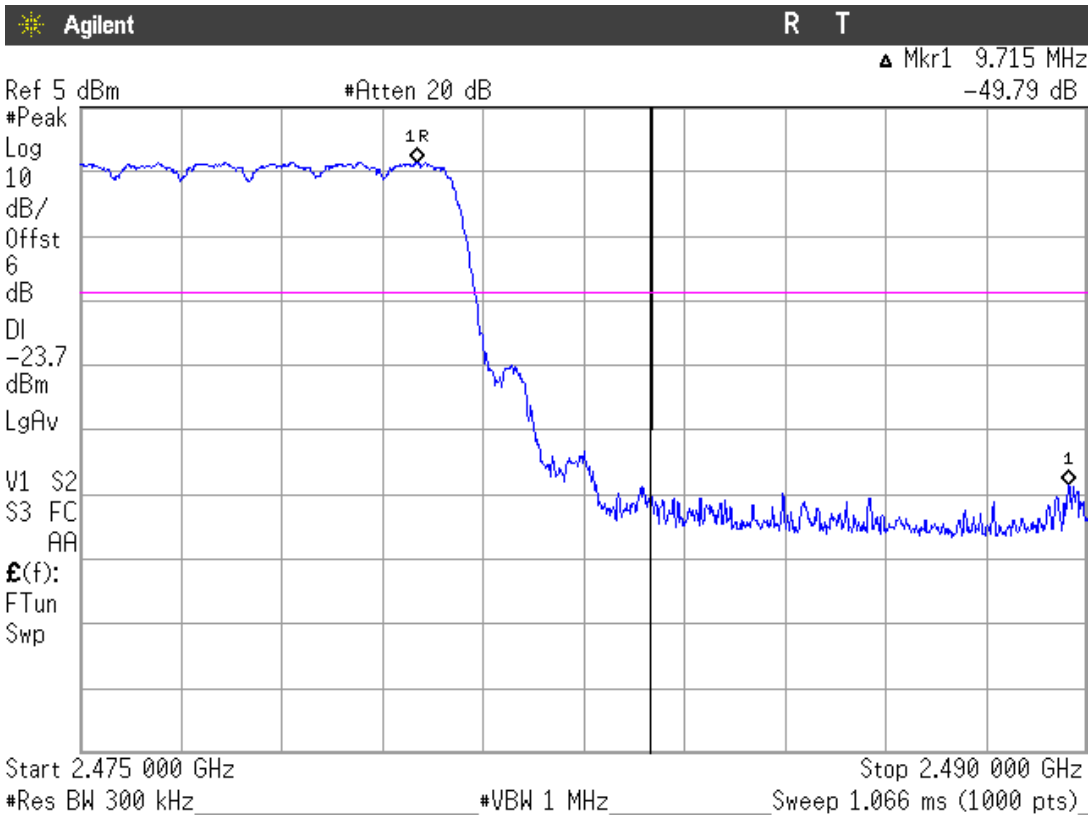

Verdict: PASS

3. LOW FREQUENCY SECTION (HOPPING ON). See next plot.




Verdict: PASS

4. HIGH FREQUENCY SECTION (HOPPING ON). See next plot.




Verdict: PASS

**FCC Section 15.247 Subclause (d) / RSS-210 Clause A8.5. Emission limitations conducted (Transmitter)**

SPECIFICATION

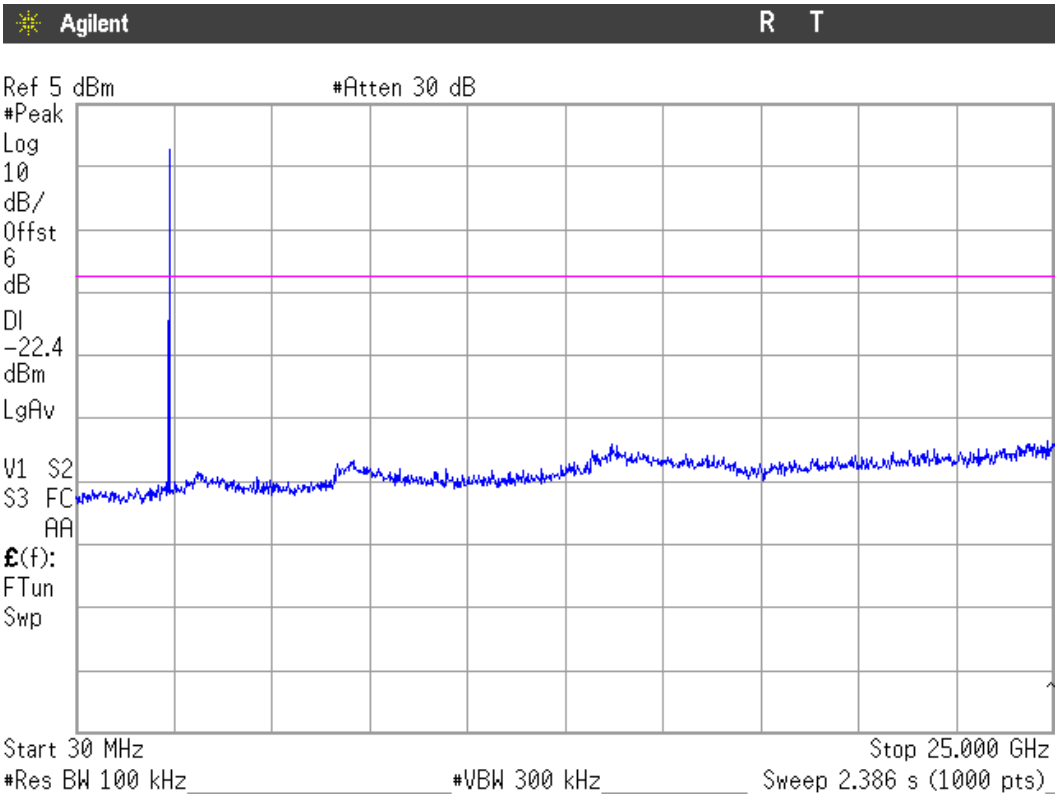
In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

RESULTS:

All peaks are more than 20 dB below the limit.

**Modulation: GFSK**

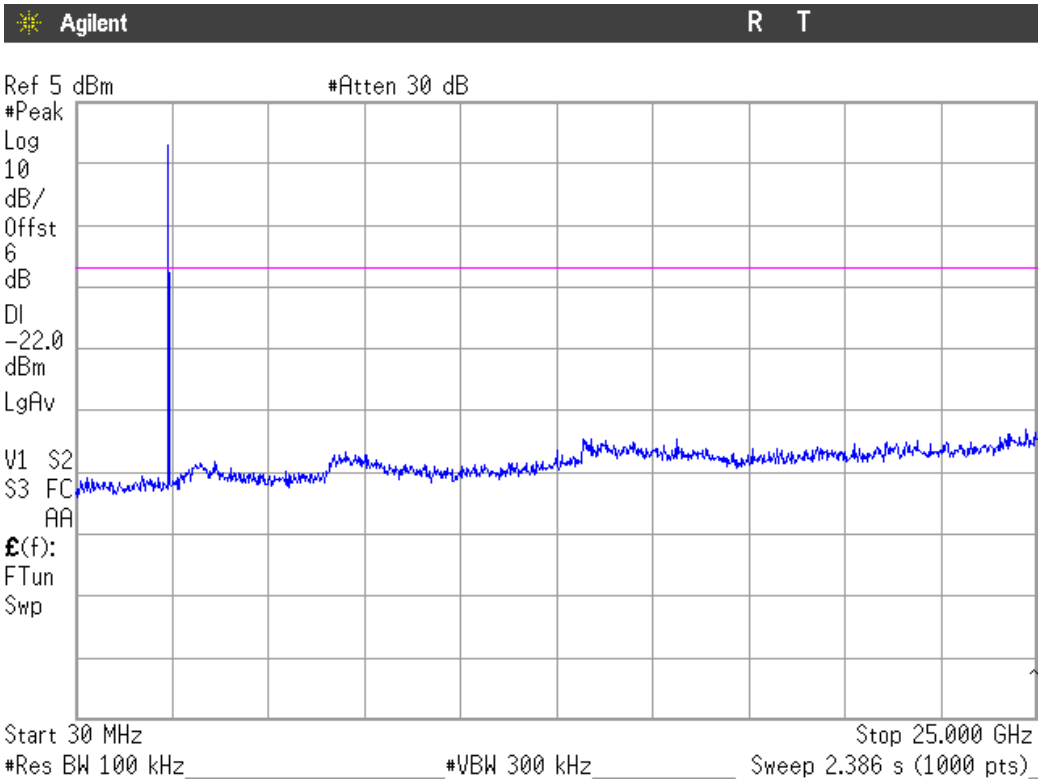
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).




Note: The peak above the limit is the carrier frequency.

Verdict: PASS

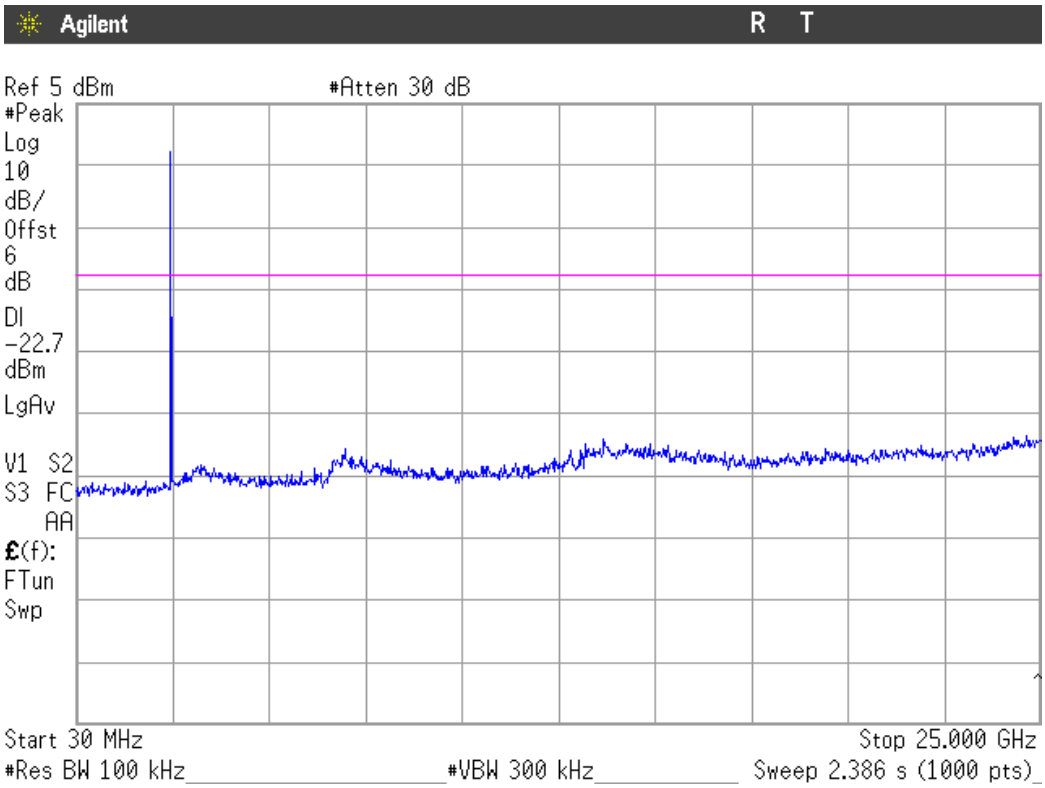
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).




Note: The peak above the limit is the carrier frequency.

Verdict: PASS

3. HIGH CHANNEL (2480 MHz): 30 MHz-25 GHz (see next plot).

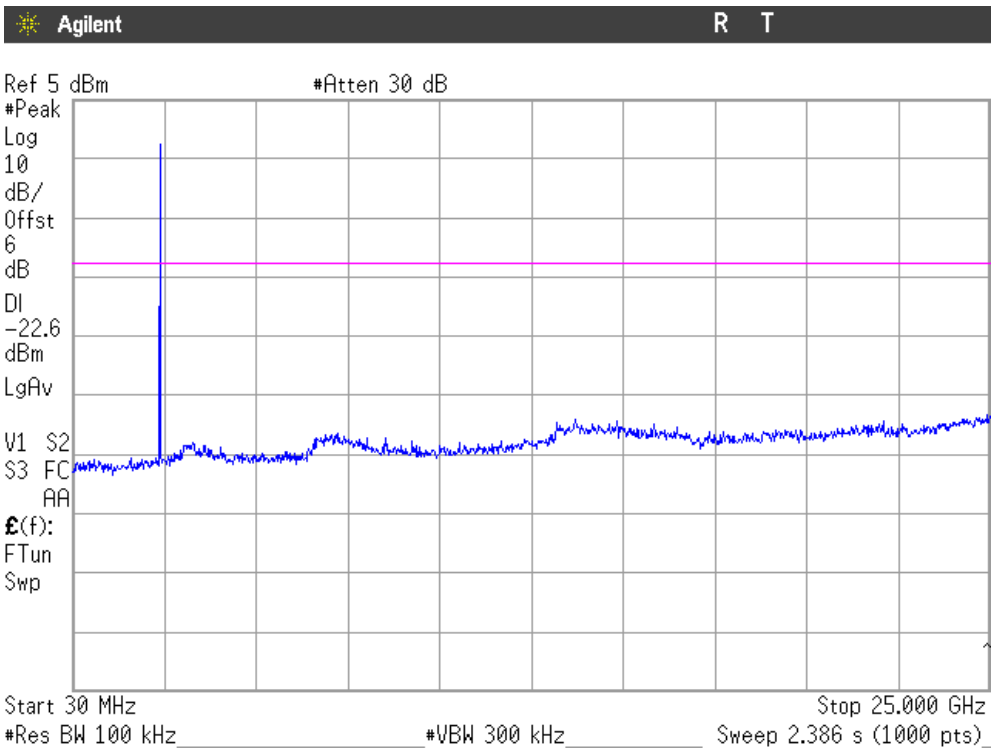



Note: The peak above the limit is the carrier frequency.

Verdict: PASS

**Modulation: II/4-DQPSK**

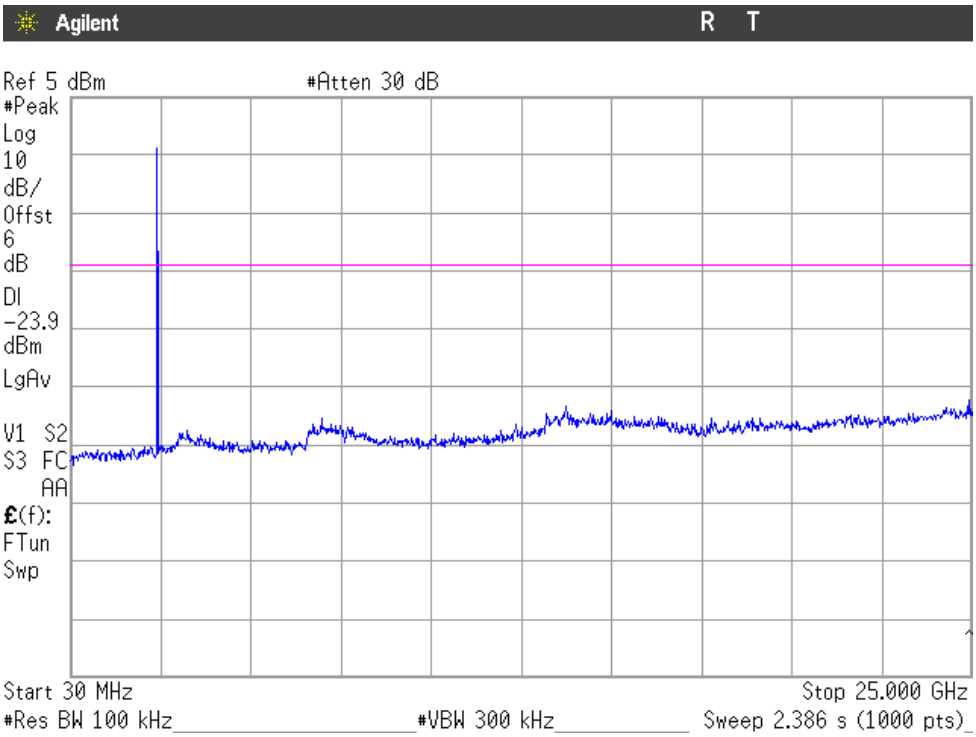
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).




Note: The peak above the limits is the carrier frequency.

Verdict: PASS

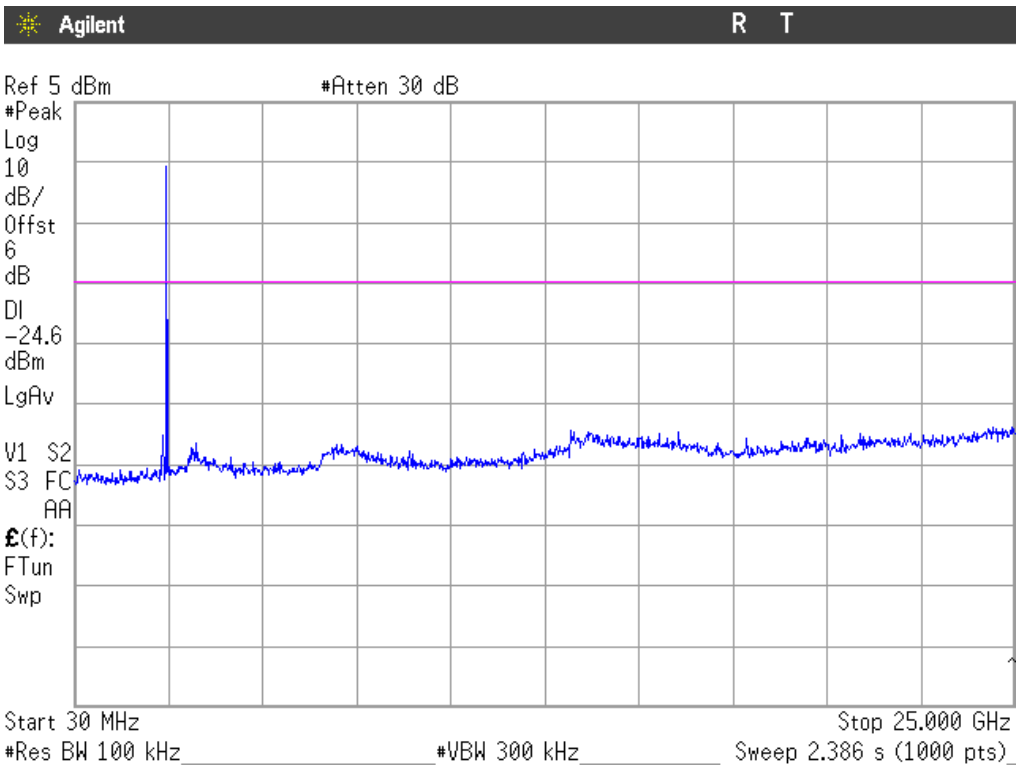
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).




Note: The peaks above the limits are the carrier frequencies.

Verdict: PASS

3. HIGH CHANNEL (2480 MHz): 30 MHz-25 GHz (see next plot).

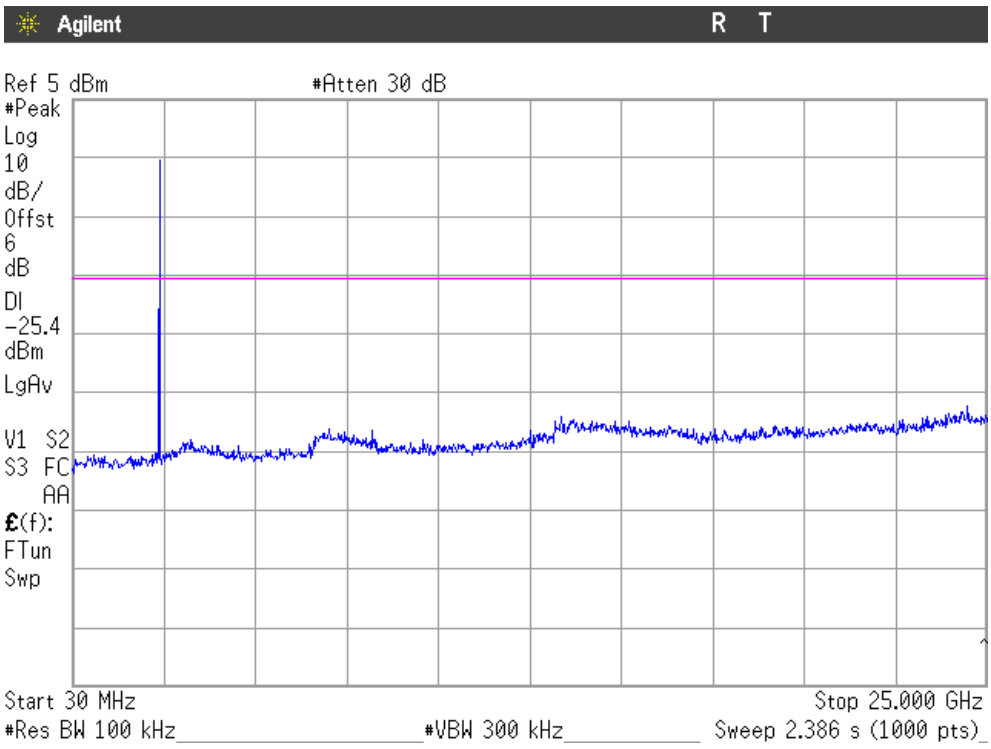



Note: The peak above the limit is the carrier frequency.

Verdict: PASS

**Modulation: 8-DPSK**

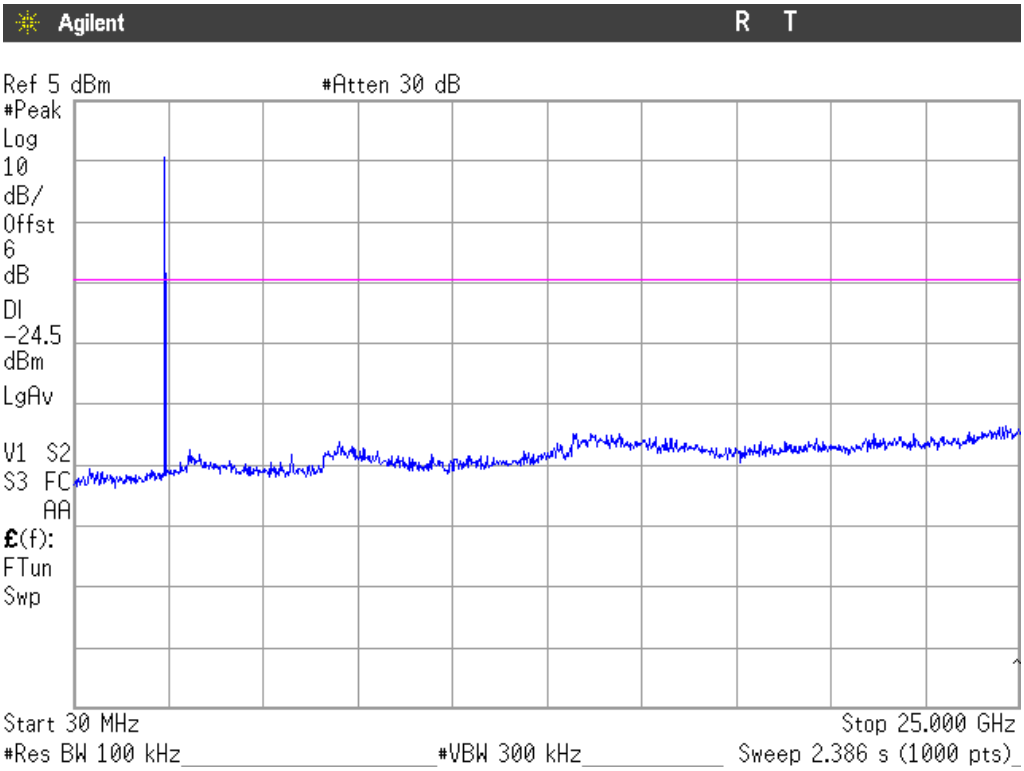
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).




Note: The peak above the limits is the carrier frequency.

Verdict: PASS

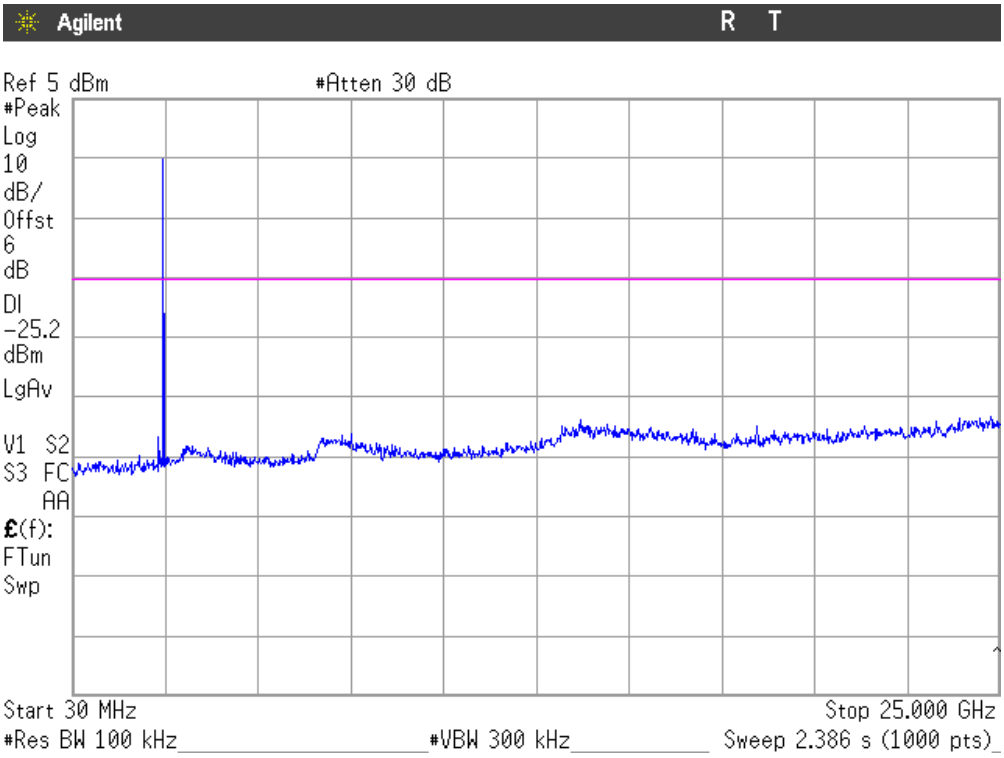
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).




Note: The peaks above the limit are the carrier frequencies.

Verdict: PASS

3. HIGH CHANNEL (2480 MHz): 30 MHz-25 GHz (see next plot).




Note: The peak above the limit is the carrier frequency.

Verdict: PASS

**FCC Section 15.247 Subclause (d) / RSS-210 Clauses 2.2. & A8.5. Emission limitations radiated (Transmitter)**

SPECIFICATION

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)):

| Frequency Range (MHz) | Field strength (µV/m) | Field strength (dBµV/m) | Measurement distance (m) |
|---|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | - | 300 |
| 0.490-1.705 | 24000/F(kHz) | - | 300 |
| 1.705 - 30.0 | 30 | - | 30 |
| 30 - 88 | 100 | 40 | 3 |
| 88 - 216 | 150 | 43.5 | 3 |
| 216 - 960 | 200 | 46 | 3 |
| 960 - 25000 | 500 | 54 | 3 |

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The equipment transmits continuously in the selected channel so it is not necessary a duty cycle correction factor.

**Frequency range 30 MHz-1000 MHz**.

Note: The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No spurious signals were found at less than 20 dB below the limit.

**Frequency range 1 GHz-25 GHz**

Modulation: GFSK

1. CHANNEL: LOWEST (2402 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.37736 | V | Peak | 48.42 | ± 4.0 |
| | V | Average | 33.92 | ± 4.0 |

2. CHANNEL: MIDDLE (2441 MHz).

No peaks were found.

3. CHANNEL: HIGHEST (2480 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.4835825 | V | Peak | 47.35 | ± 4.0 |
| | V | Average | 43.13 | ± 4.0 |

Verdict: PASS

Modulation: Π/4-DQPSK

1. CHANNEL: LOWEST (2402 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.36592 | V | Peak | 53.18 | ± 4.0 |
| | V | Average | 33.62 | ± 4.0 |
| 2.38400 | V | Peak | 53.88 | ± 4.0 |
| | V | Average | 33.94 | ± 4.0 |

2. CHANNEL: MIDDLE (2441 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.36632 | V | Peak | 53.31 | ± 4.0 |
| | V | Average | 33.77 | ± 4.0 |
| 2.38456 | V | Peak | 53.58 | ± 4.0 |
| | V | Average | 34.11 | ± 4.0 |

3. CHANNEL: HIGHEST (2480 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.36819 | V | Peak | 49.17 | ± 4.0 |
| | V | Average | 33.70 | ± 4.0 |
| 2.38640 | V | Peak | 50.06 | ± 4.0 |
| | V | Average | 33.94 | ± 4.0 |
| 2.48350 | V | Peak | 48.12 | ± 4.0 |
| | V | Average | 41.74 | ± 4.0 |
| 2.48378 | V | Peak | 50.13 | ± 4.0 |
| | V | Average | 39.09 | ± 4.0 |

Verdict: PASS

Modulation: 8-DPSK

1. CHANNEL: LOWEST (2402 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.3652 | V | Peak | 52.80 | ± 4.0 |
| | V | Average | 33.77 | ± 4.0 |
| 2.38336 | V | Peak | 53.30 | ± 4.0 |
| | V | Average | 31.21 | ± 4.0 |

2. CHANNEL: MIDDLE (2441 MHz).

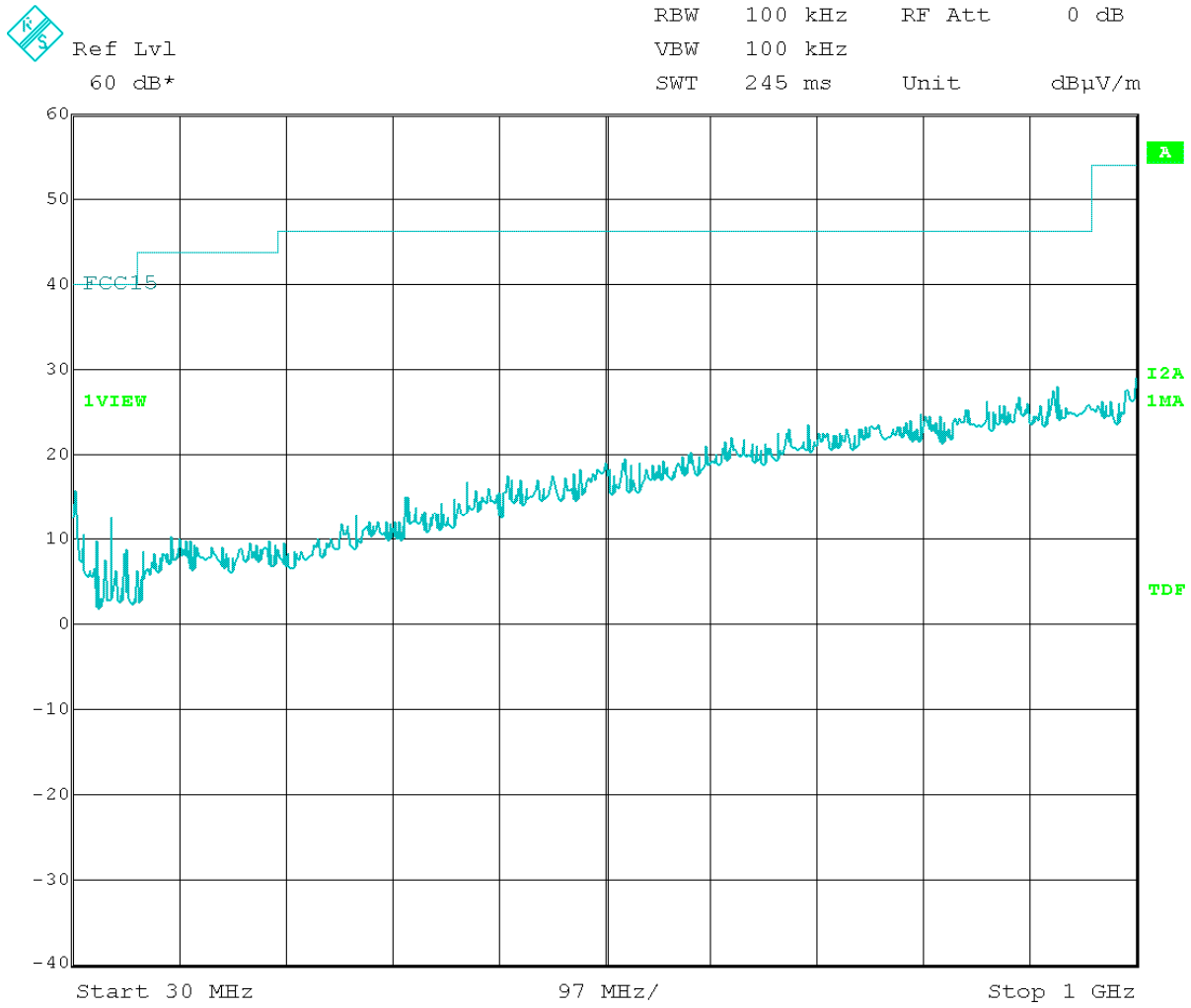
| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.36480 | V | Peak | 52.78 | ± 4.0 |
| | V | Average | 33.82 | ± 4.0 |
| 2.38288 | V | Peak | 53.09 | ± 4.0 |
| | V | Average | 34.15 | ± 4.0 |

3. CHANNEL: HIGHEST (2480 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBµV/m) | Measurement Uncertainty (dB) |
|---|---|---|---|---|
| 2.36456 | V | Peak | 52.89 | ± 4.0 |
| | V | Average | 33.77 | ± 4.0 |
| 2.38264 | V | Peak | 53.44 | ± 4.0 |
| | V | Average | 34.07 | ± 4.0 |
| 2.48350 | V | Peak | 48.52 | ± 4.0 |
| | V | Average | 39.61 | ± 4.0 |

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

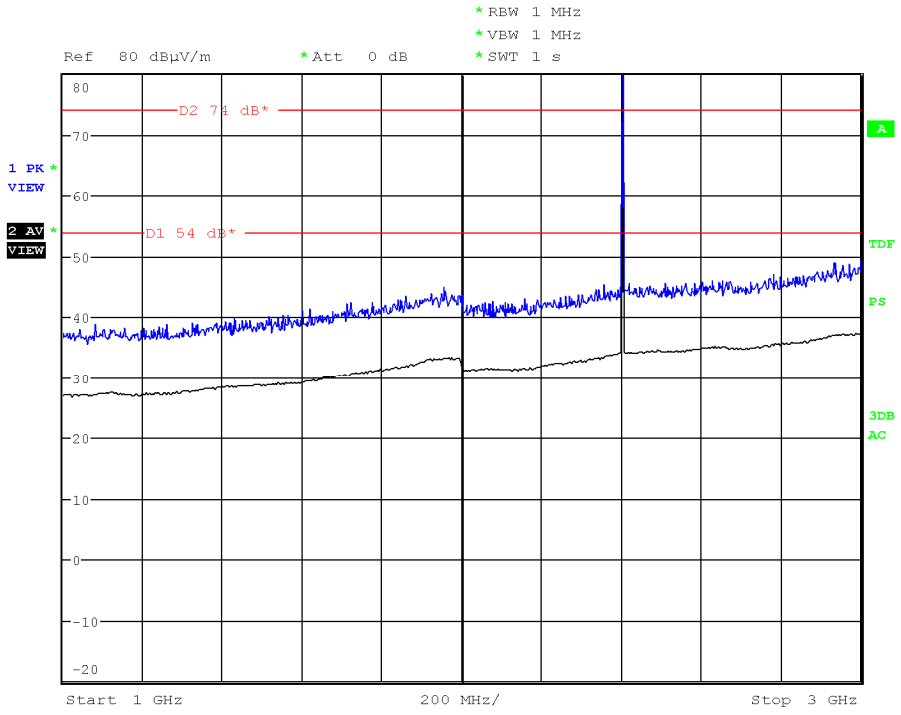



(This plot is valid for all three channels and all modulation modes).

FREQUENCY RANGE 1 GHz to 3 GHz.

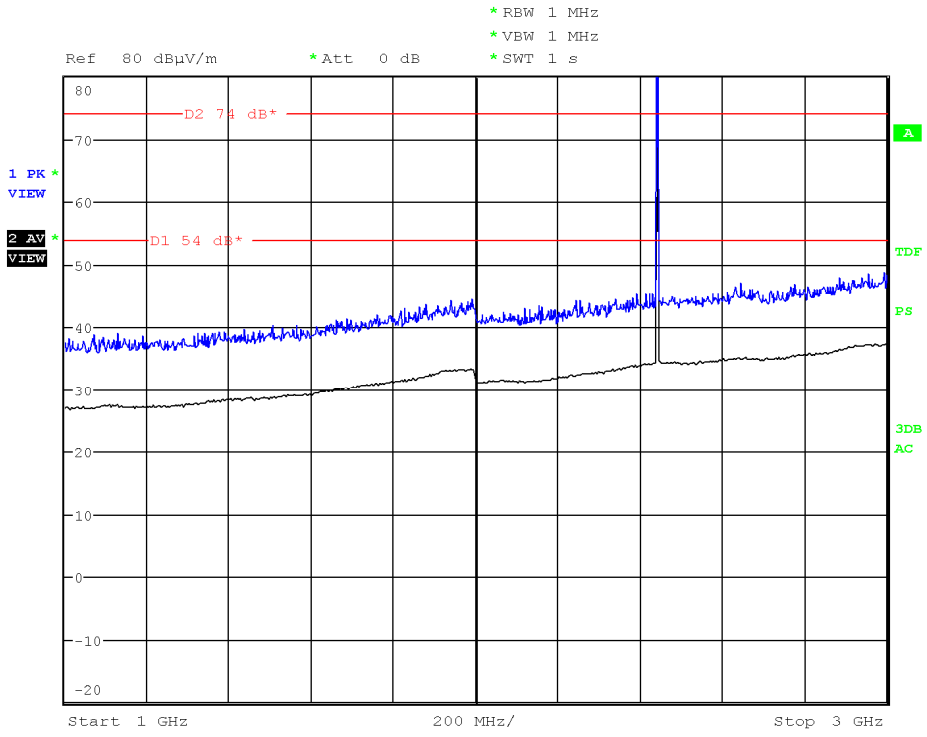
**Modulation: GFSK**

**CHANNEL: Lowest (2402 MHz).**



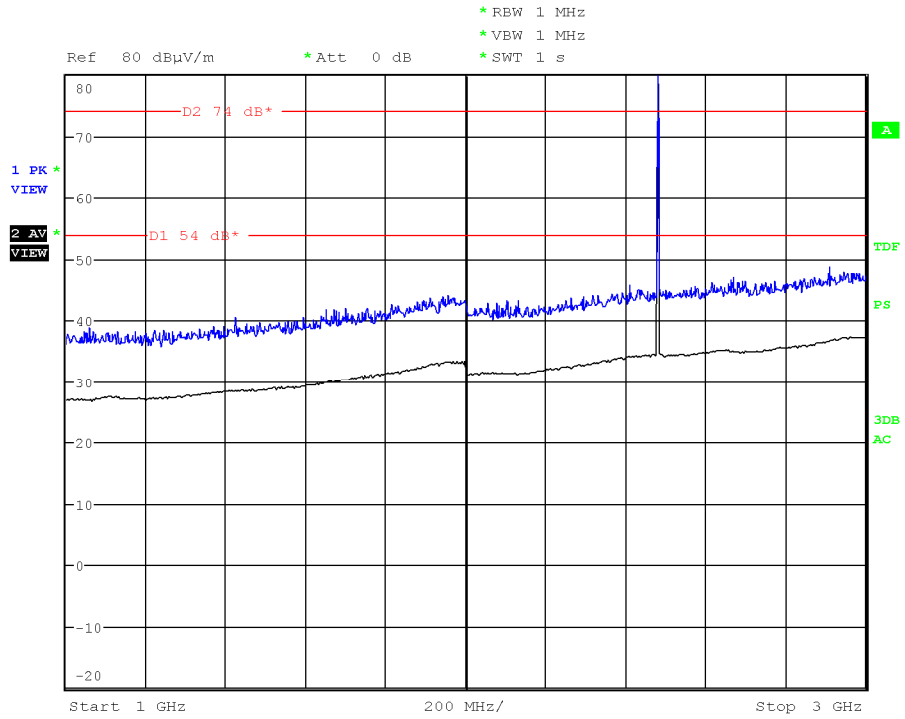

Note: The peak shown in the plot is the carrier frequency.

**CHANNEL: Middle (2441 MHz).**




Note: The peak shown in the plot is the carrier frequency.

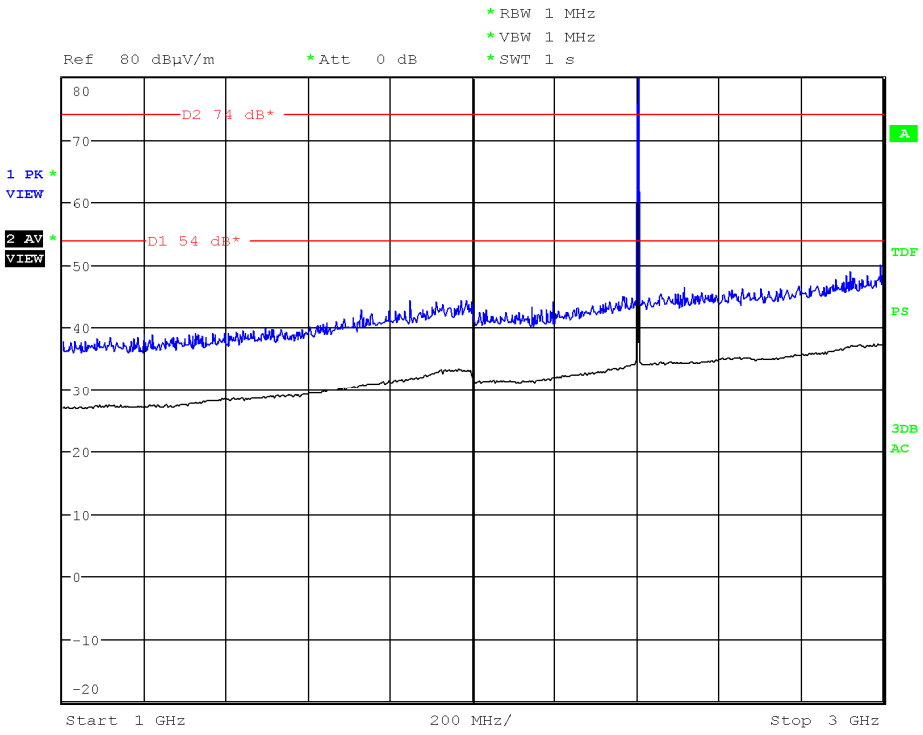
**CHANNEL: Highest (2480 MHz).**




Note: The peak shown in the plot is the carrier frequency.

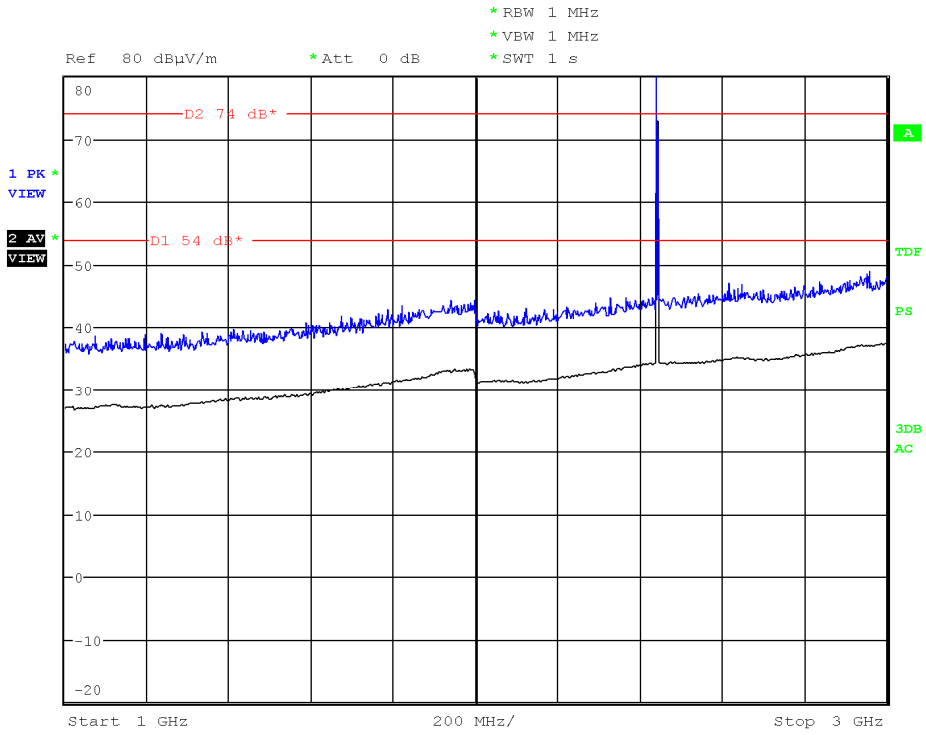
**Modulation: Π/4-DQPSK**

**CHANNEL: Lowest (2402 MHz).**



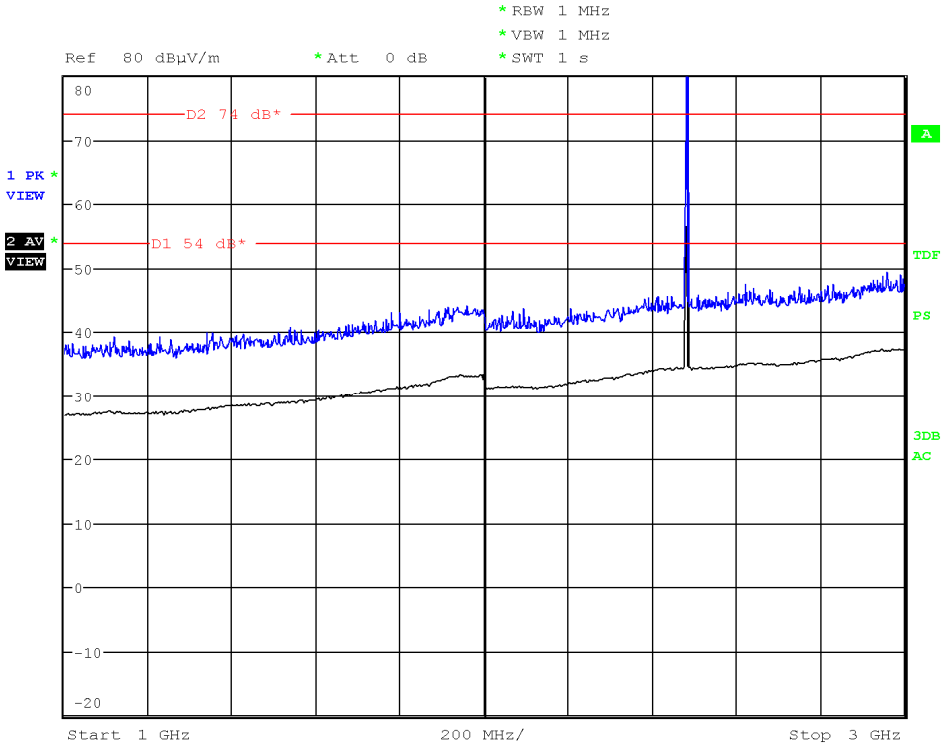

Note: The peak shown in the plot is the carrier frequency.

**CHANNEL: Middle (2441 MHz).**




Note: The peak shown in the plot is the carrier frequency.

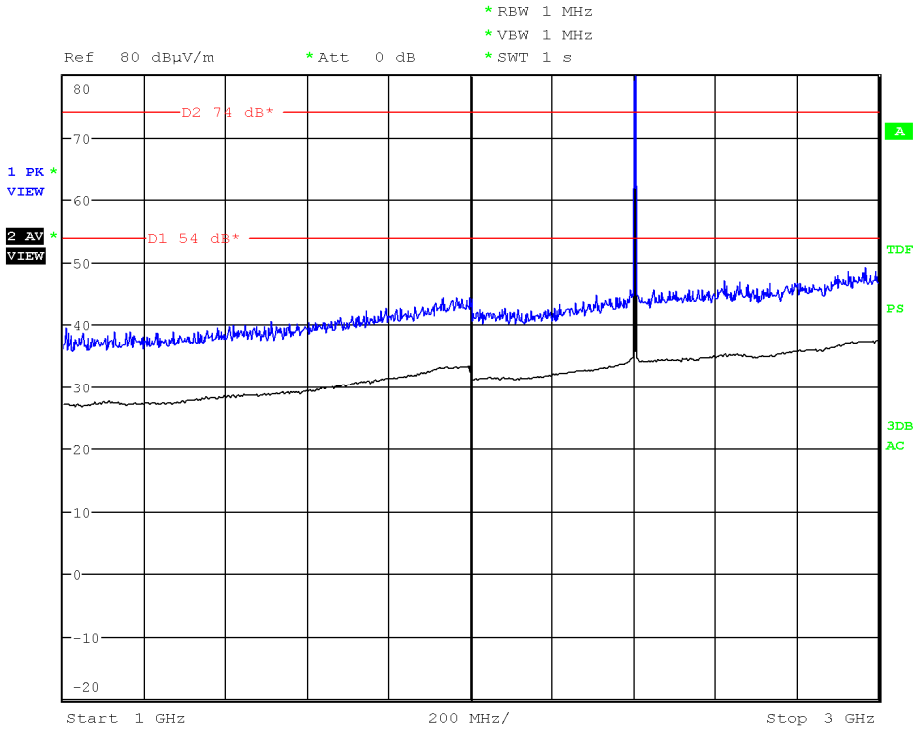
**CHANNEL: Highest (2480 MHz).**




Note: The peak shown in the plot is the carrier frequency.

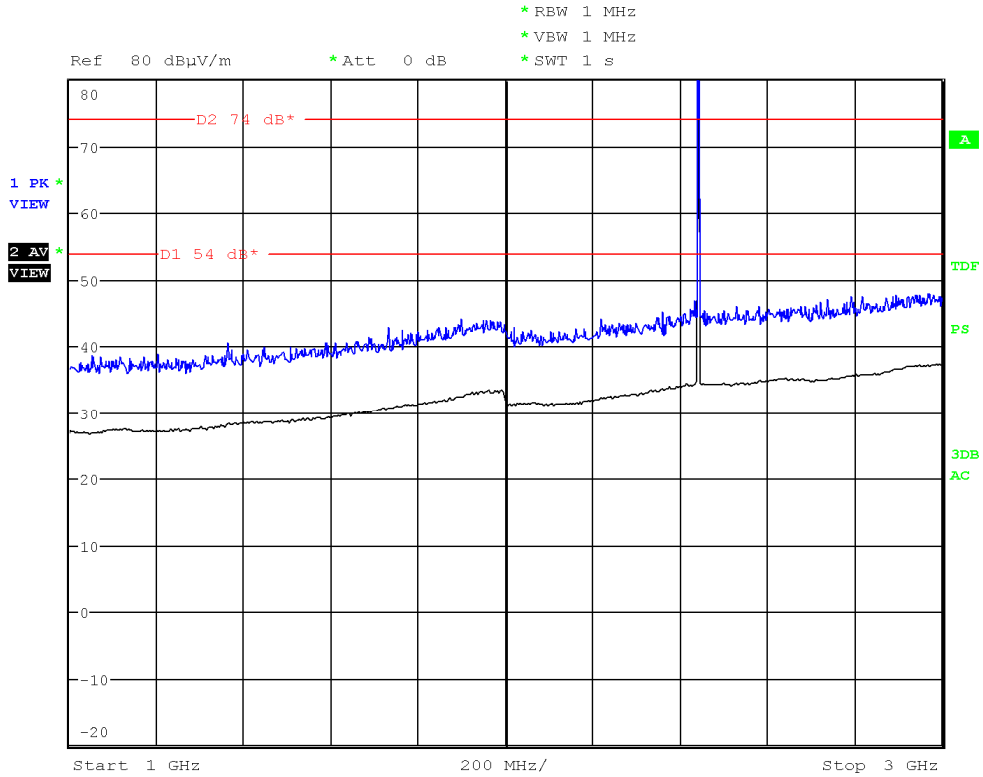
**Modulation: 8-DPSK**

**CHANNEL: Lowest (2402 MHz).**



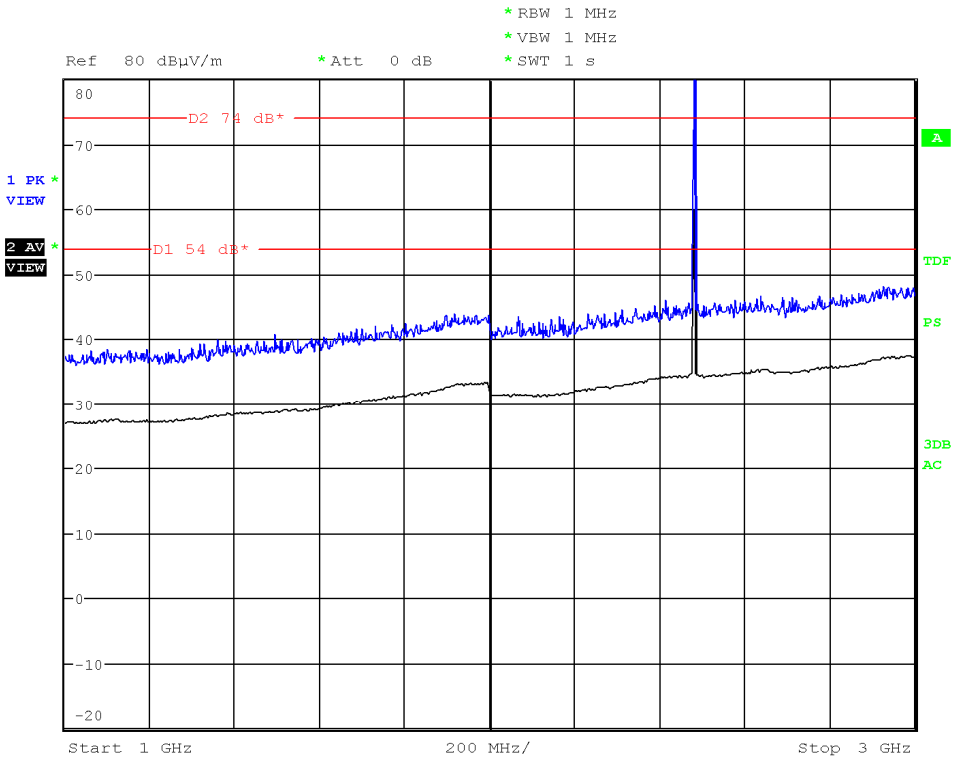

Note: The peak shown in the plot is the carrier frequency.

**CHANNEL: Middle (2441 MHz).**




Note: The peak shown in the plot is the carrier frequency.

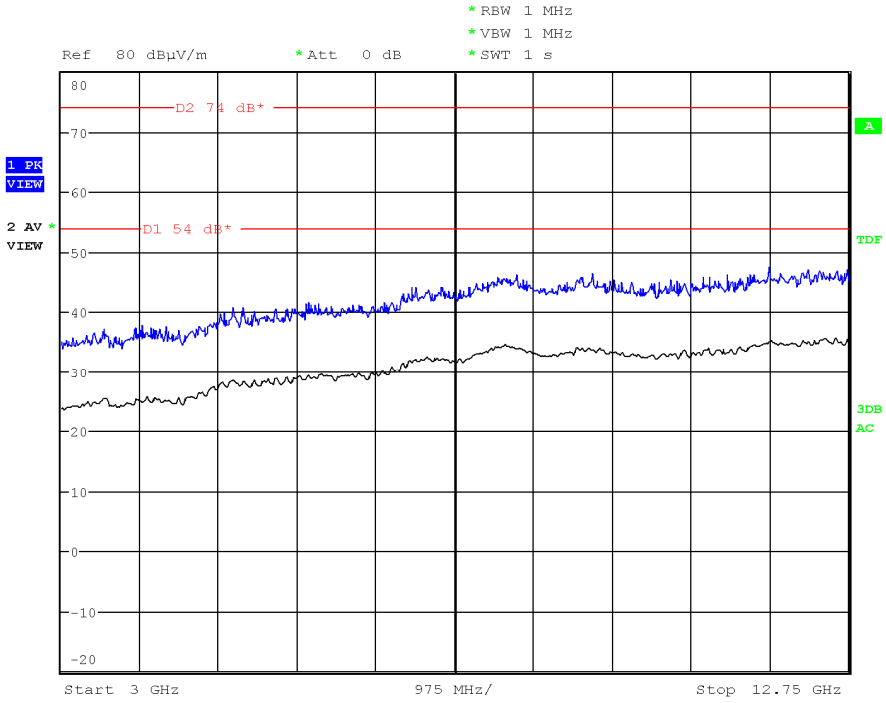
**CHANNEL: Highest (2480 MHz).**




Note: The peak shown in the plot is the carrier frequency.

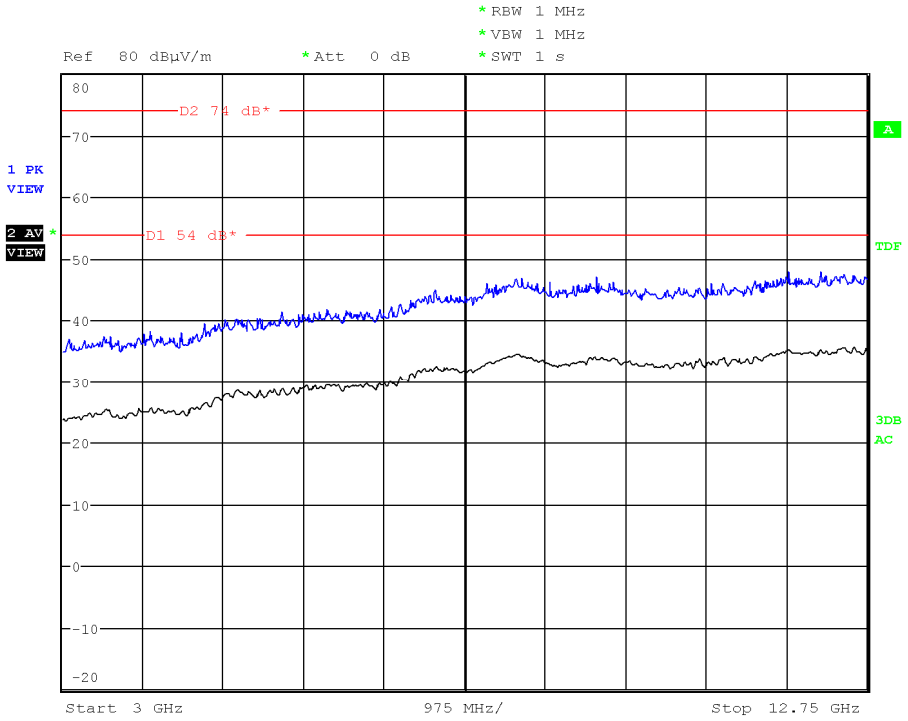
FREQUENCY RANGE 3 GHz to 12.75 GHz.

**Modulation: GFSK**



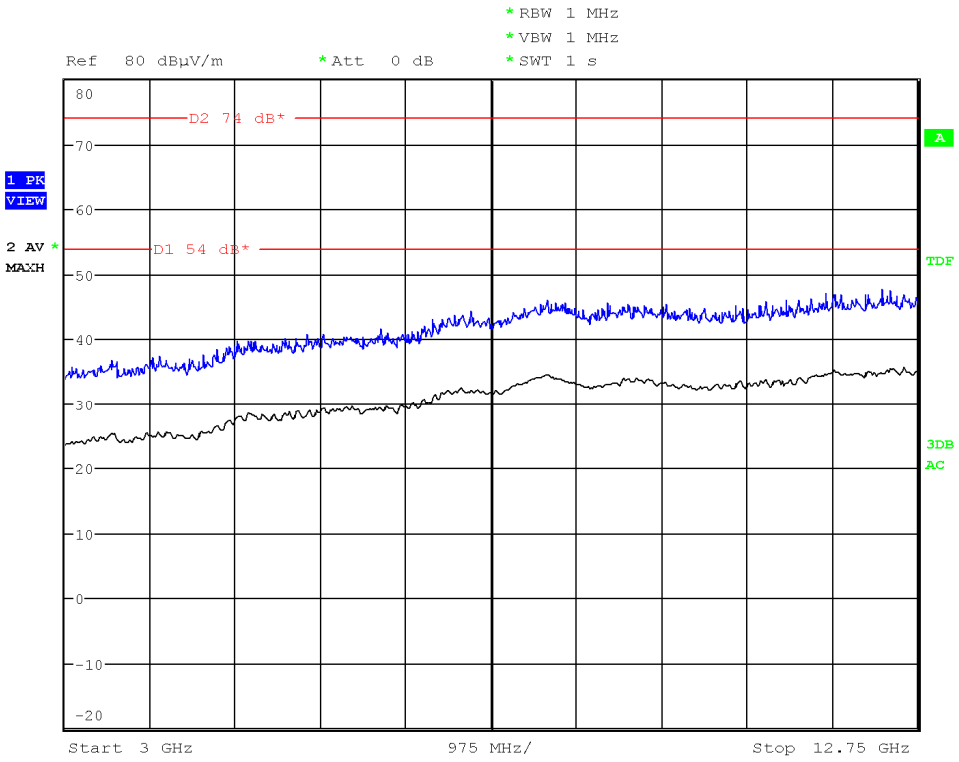

This plot is valid for all three channels.

**Modulation: Π/4-DQPSK**



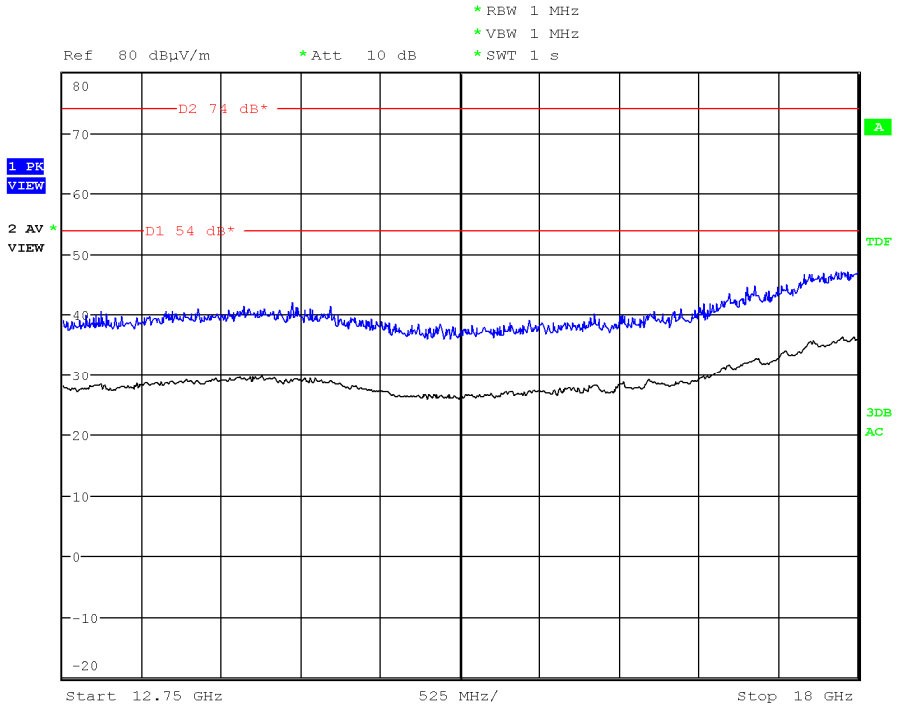

This plot is valid for all three channels.

**Modulation: 8-DPSK**



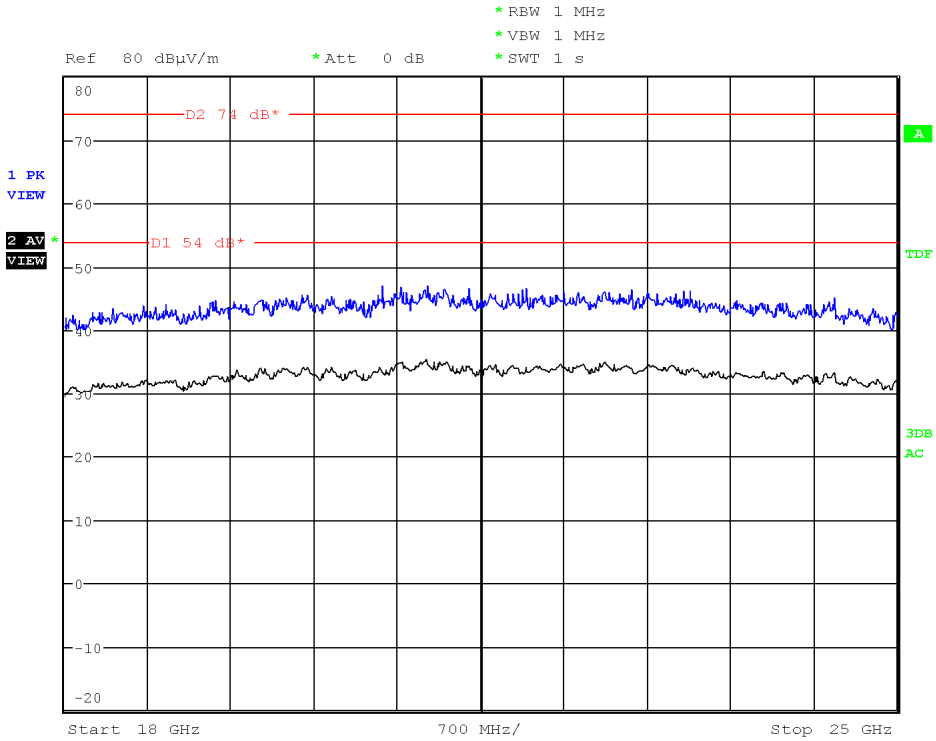

This plot is valid for all three channels.

FREQUENCY RANGE 12.75 GHz to 18 GHz.




(This plot is valid for all three channels and all modulation modes).

FREQUENCY RANGE 18 GHz to 25 GHz.

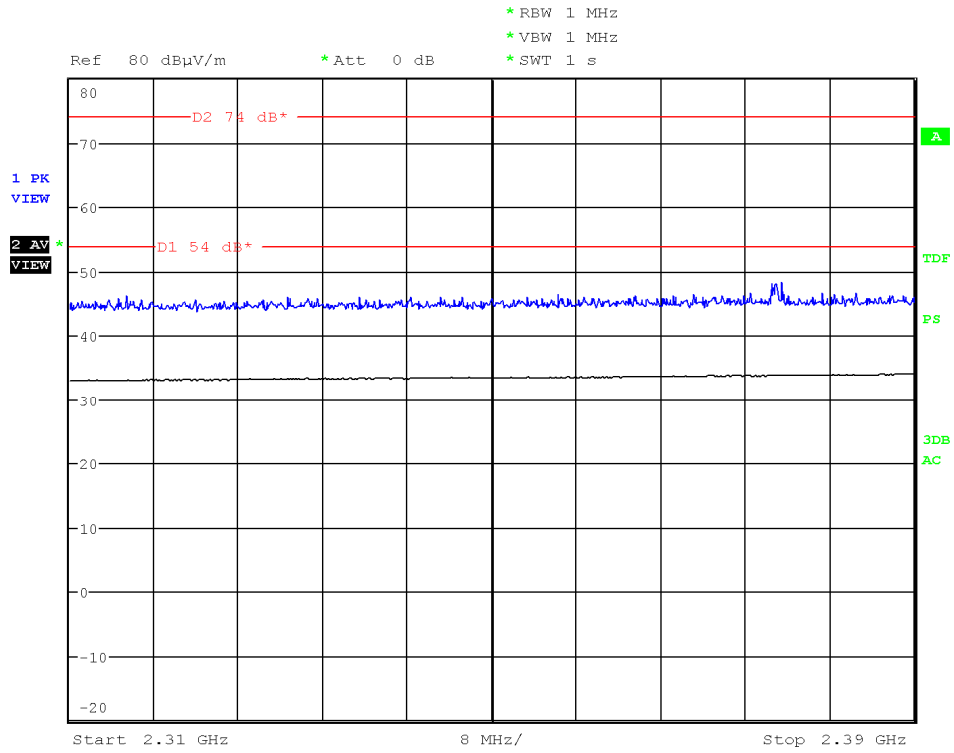



(This plot is valid for all three channels and all modulation modes).

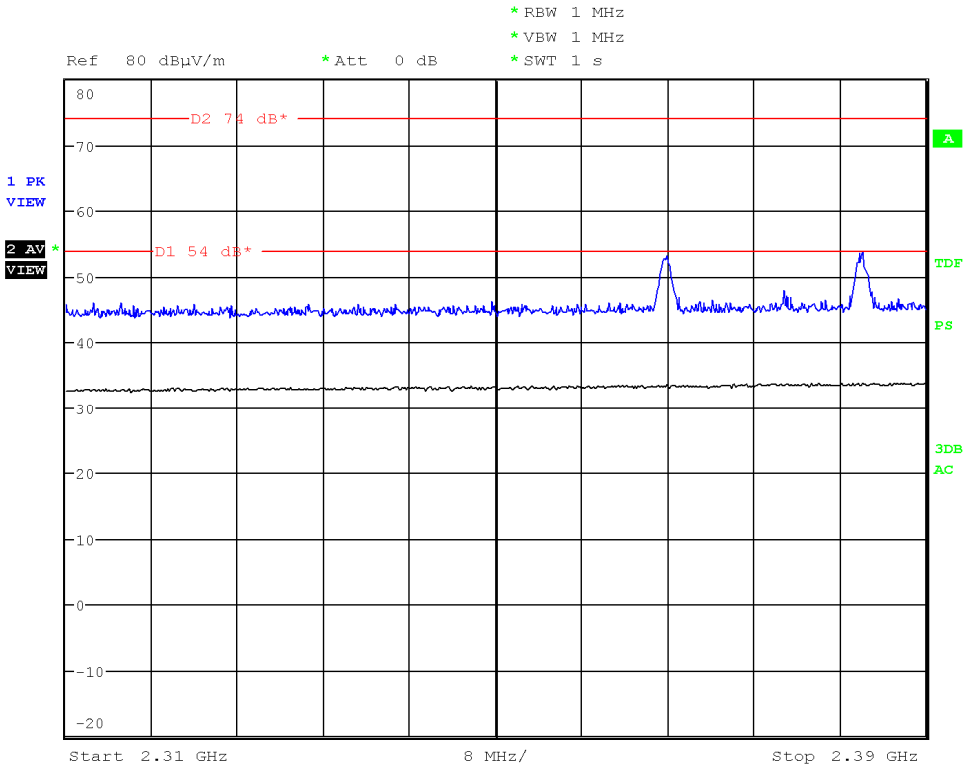
FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

**CHANNEL: Lowest**

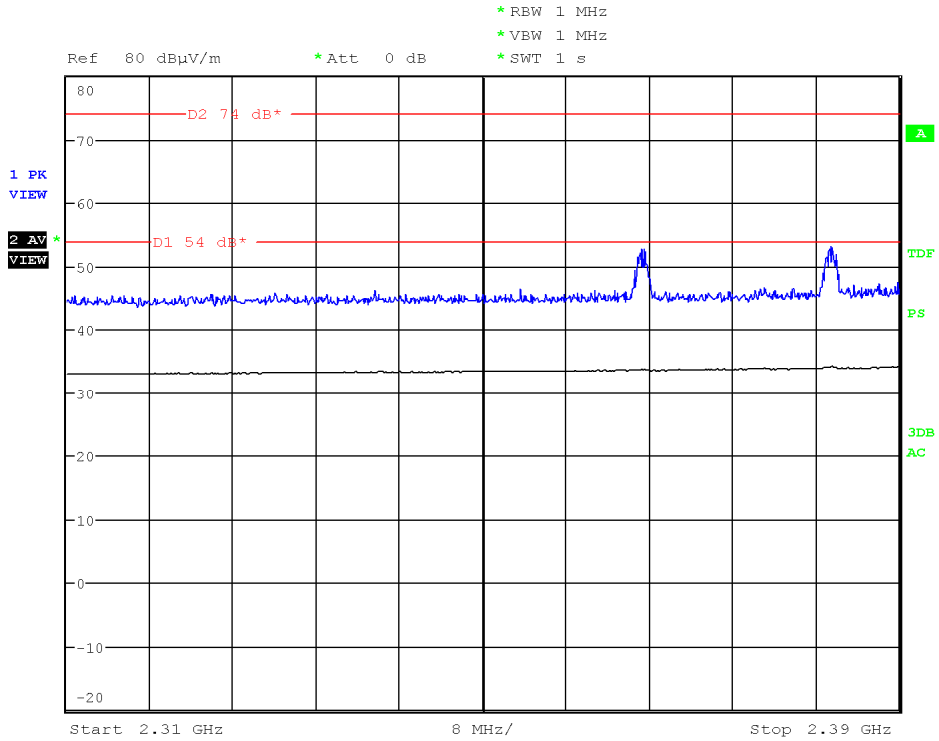
**Modulation: GFSK**




**Modulation: Π/4-DQPSK**

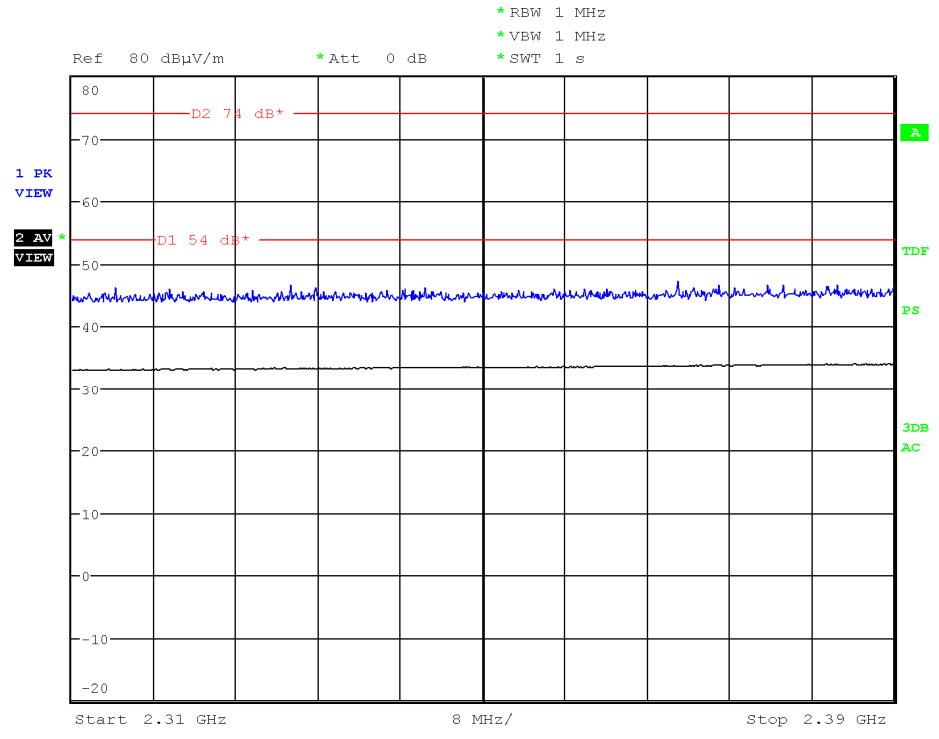


**Modulation: 8-DPSK**

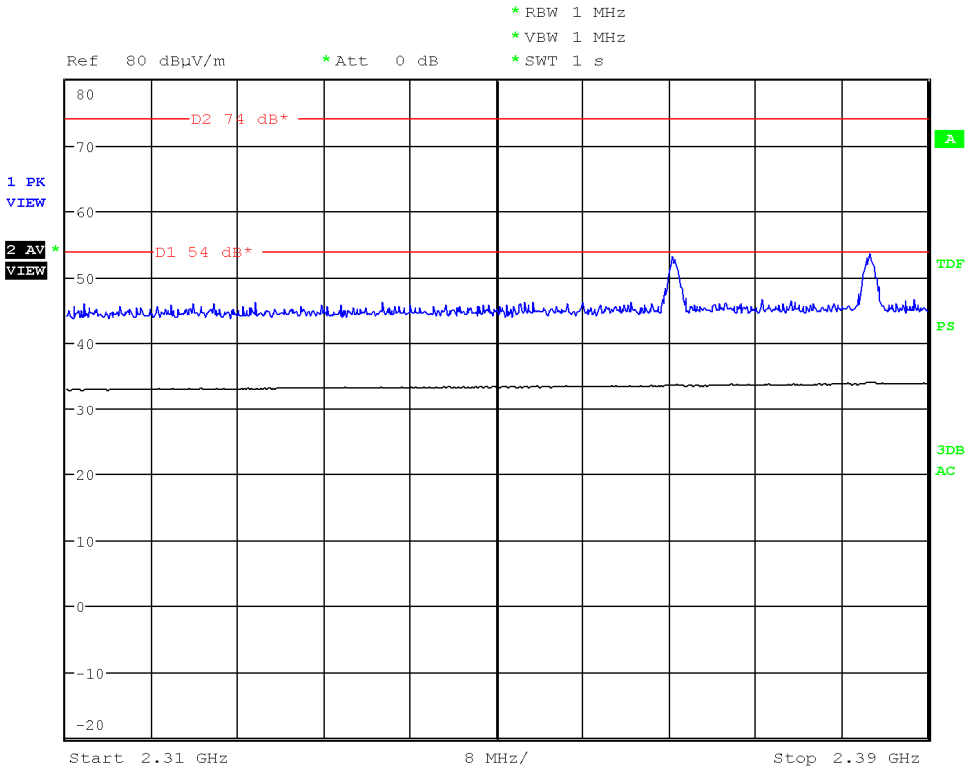



**CHANNEL: Middle**

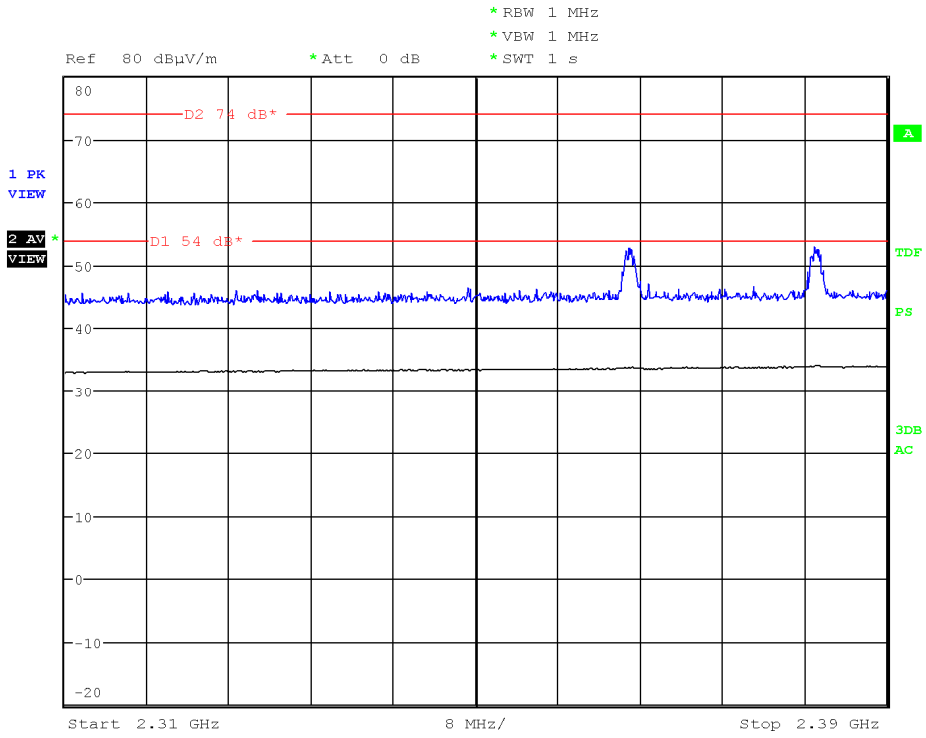
**Modulation: GFSK**



## Modulation: II/4-DQPSK

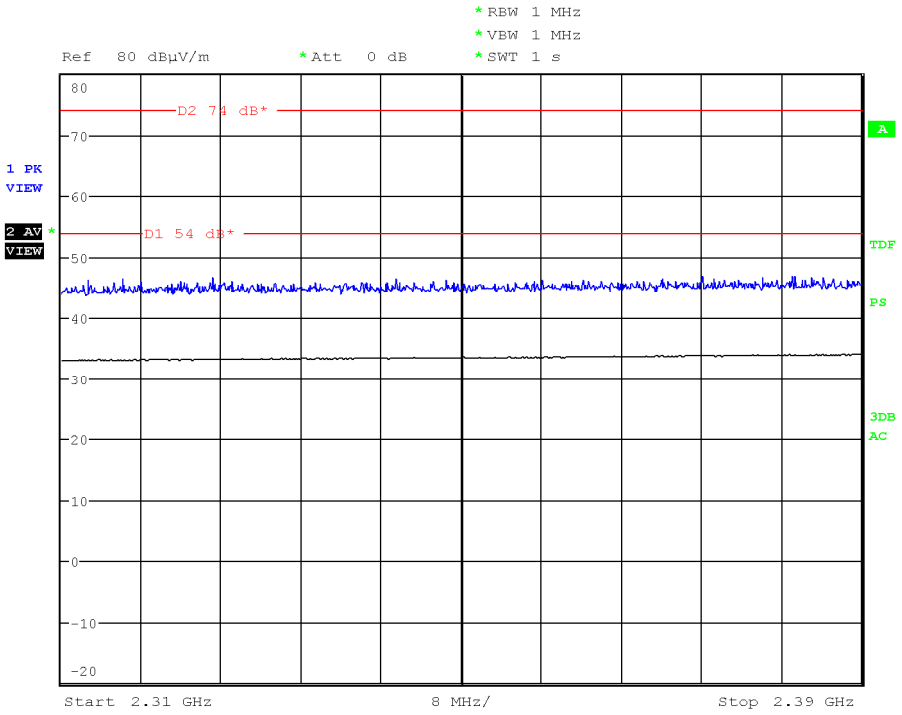



## Modulation: 8-DPSK

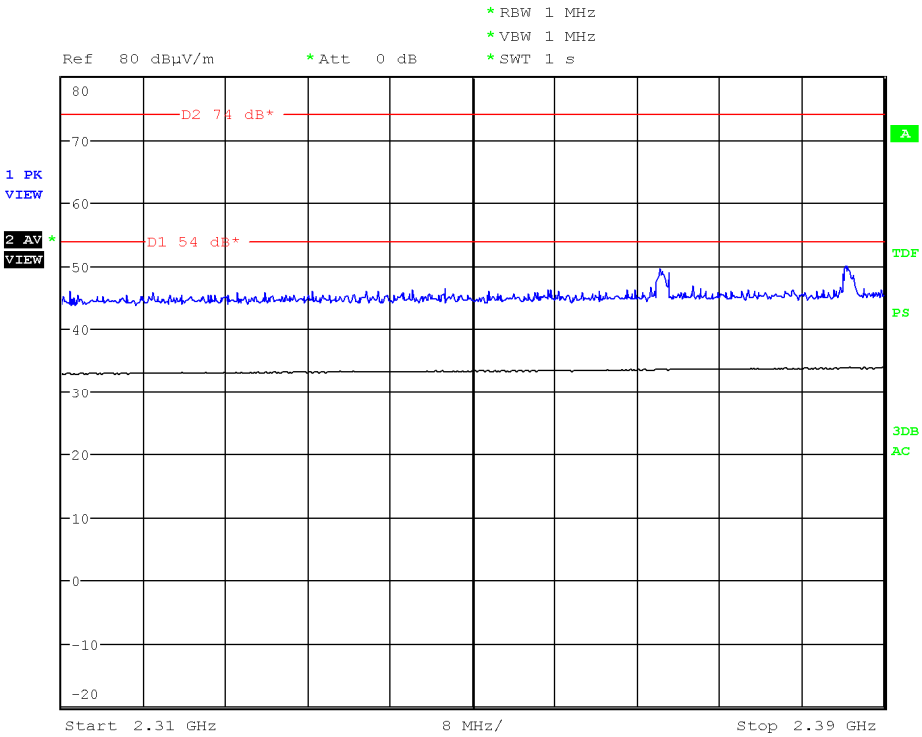


**CHANNEL: Highest**

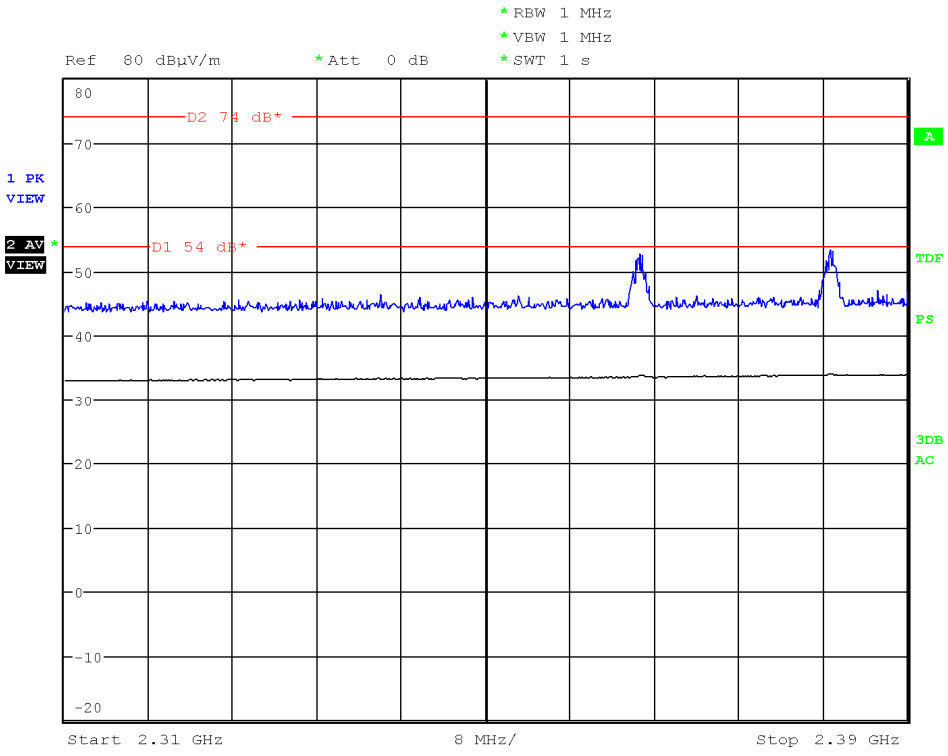
**Modulation: GFSK**




**Modulation: Π/4-DQPSK**



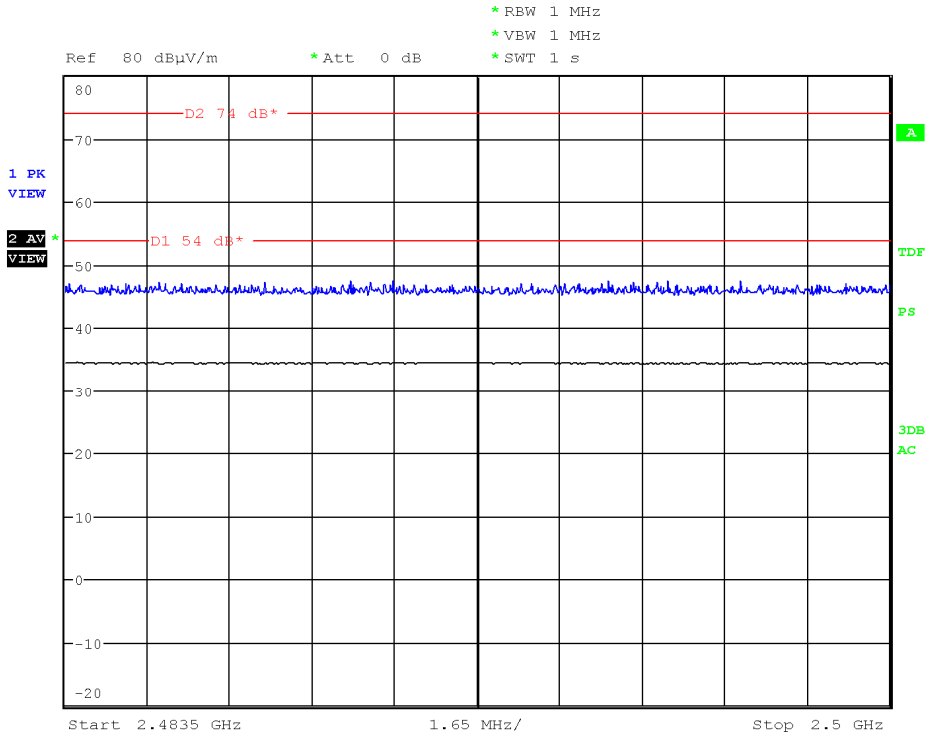
**Modulation: 8-DPSK**



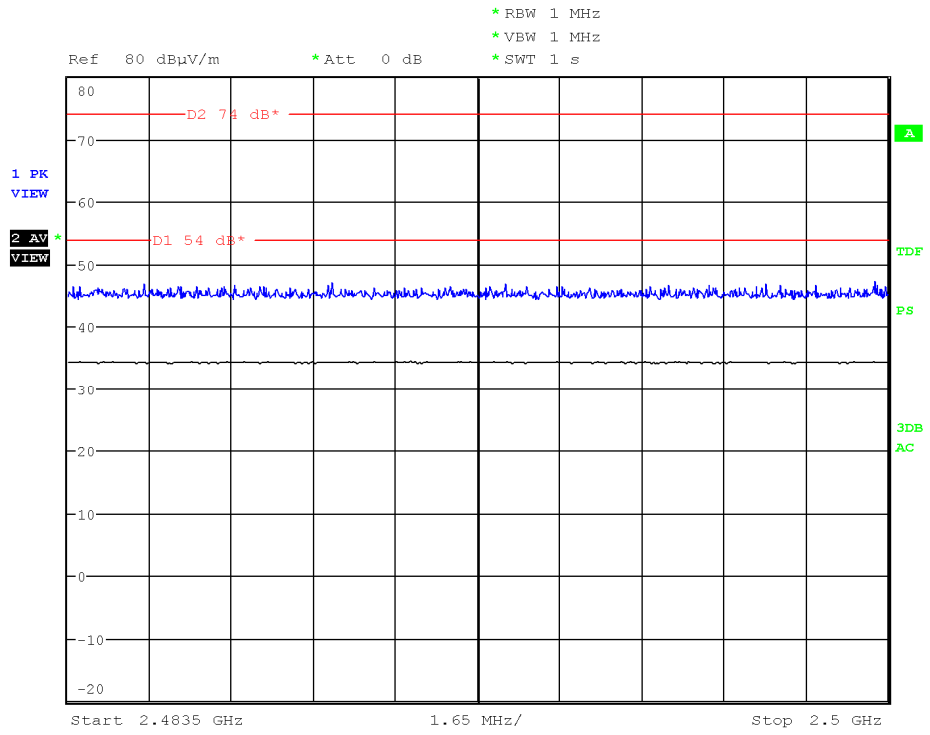
FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

**CHANNEL: Lowest (2402 MHz).**

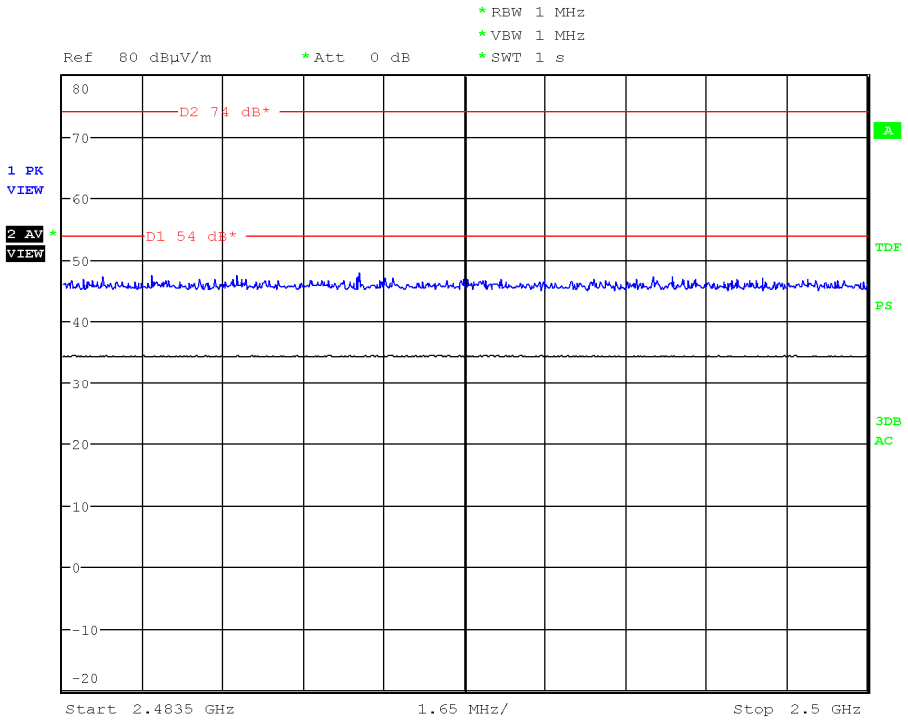
**Modulation: GFSK**




**Modulation: Π/4-DQPSK**

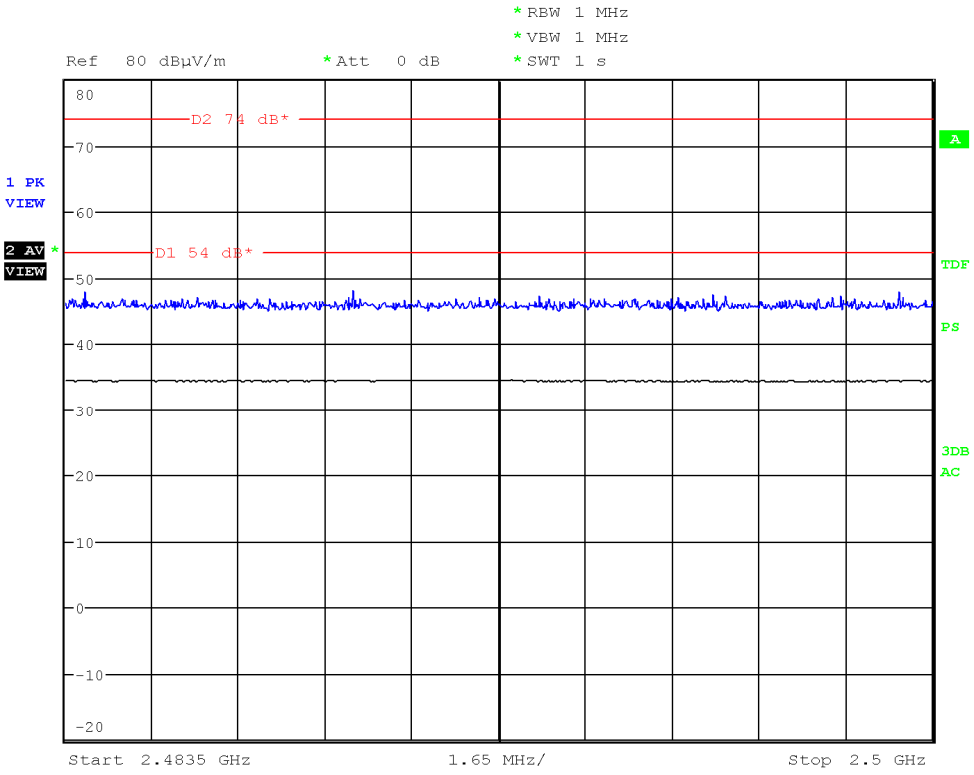


**Modulation: 8-DPSK**

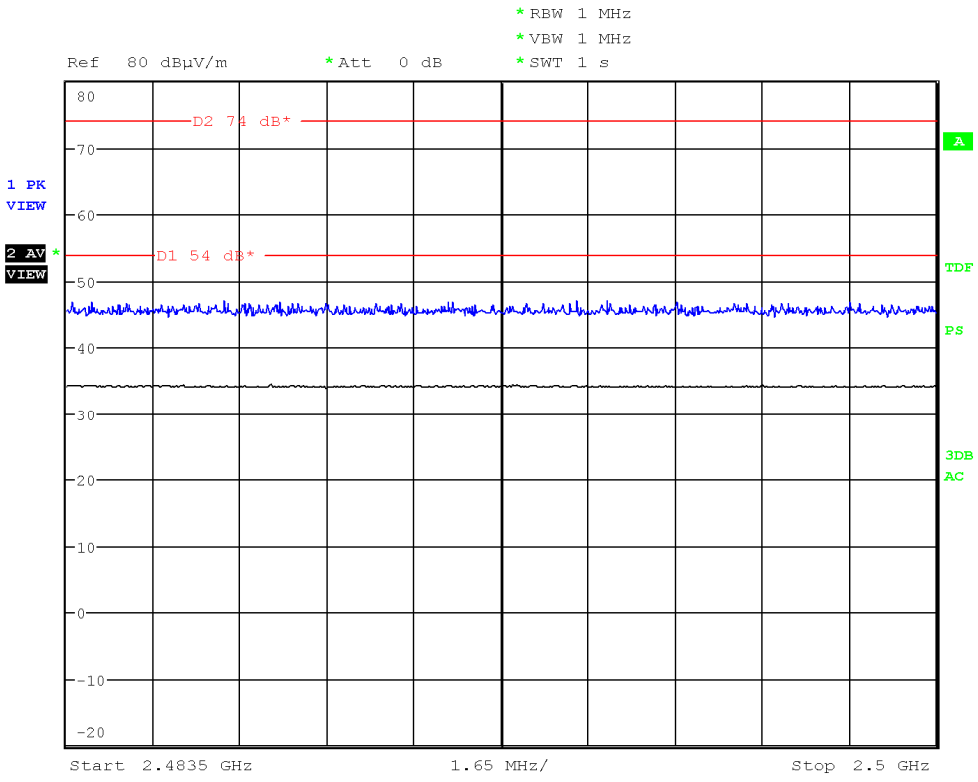



**CHANNEL: Middle**

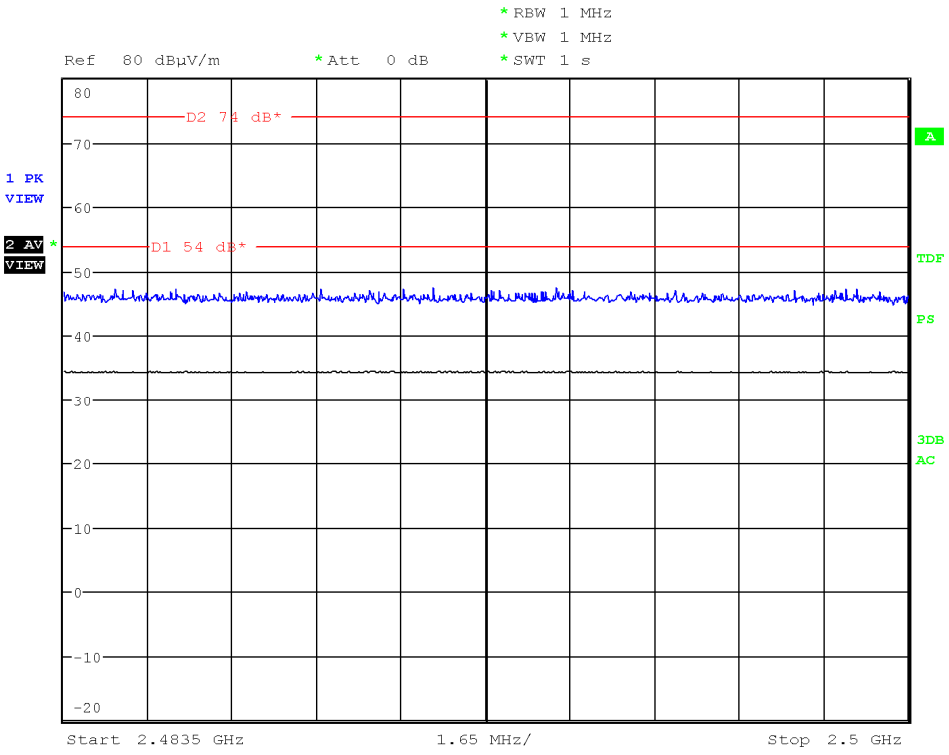
**Modulation: GFSK**



## Modulation: Π/4-DQPSK

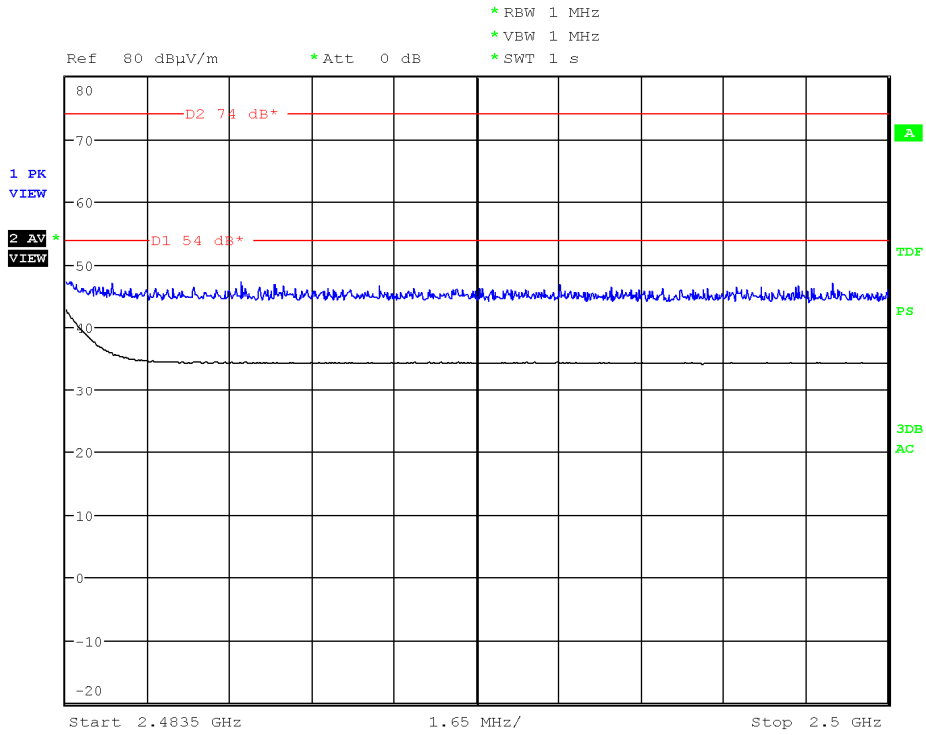



## Modulation: 8-DPSK

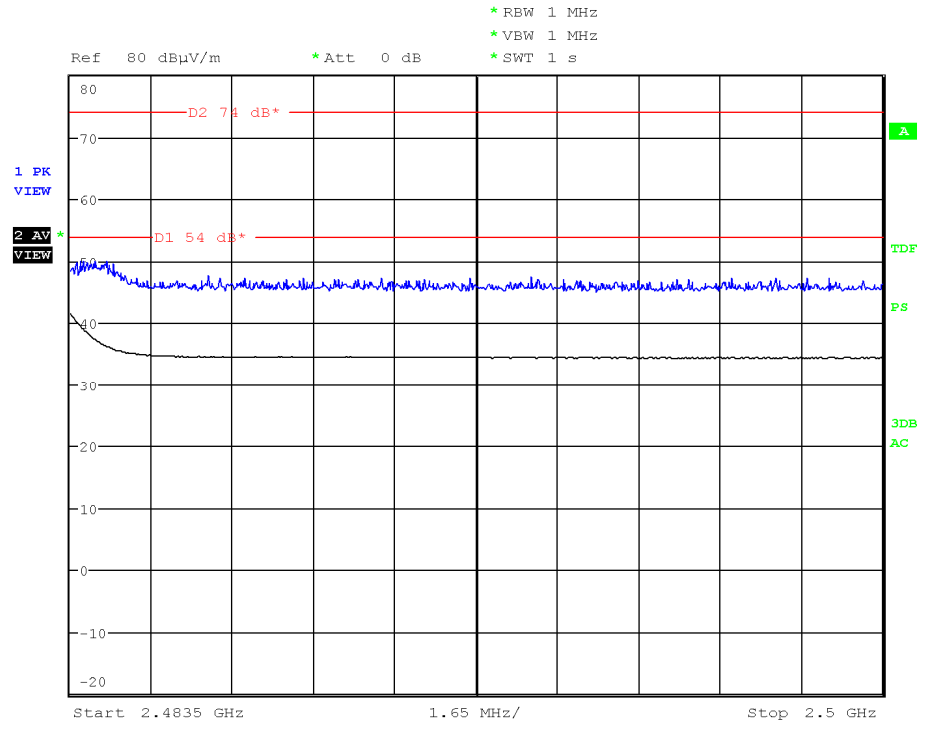


**CHANNEL: Highest (2480 MHz).**

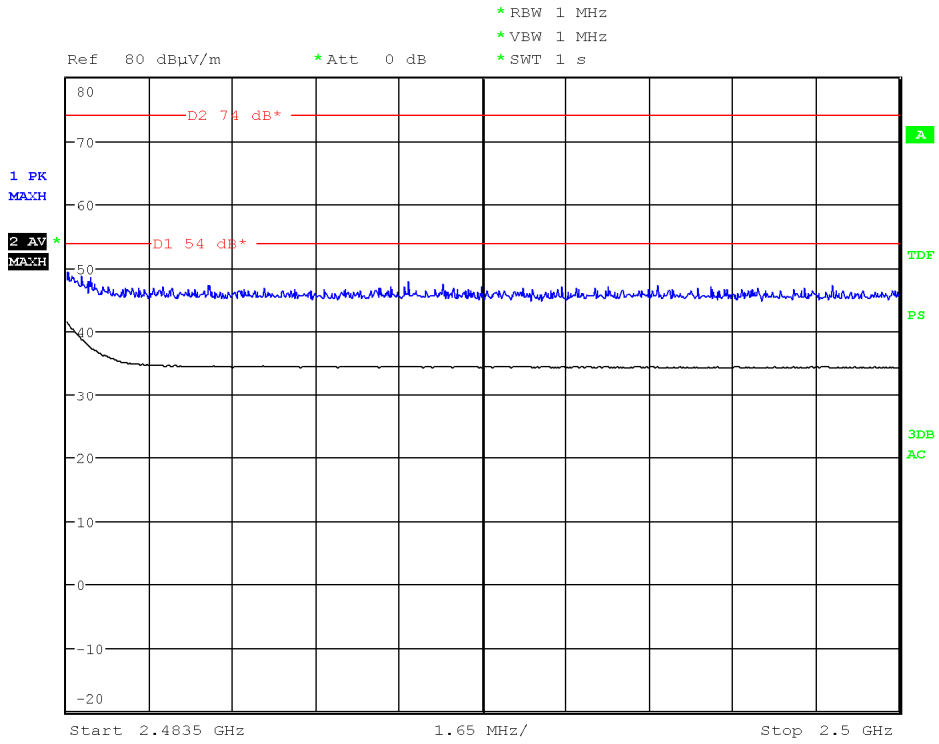
**Modulation: GFSK**




**Modulation: Π/4-DQPSK**



**Modulation: 8-DPSK**



# APPENDIX B: Measuring results for electromagnetic conducted emission

**CONTENT:**

## DESCRIPTION OF THE OPERATION MODES

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

In the following table appears the operation modes used by the samples tested to that it refers the present test report.

| OPERATION MODE | DESCRIPTION |
|---|---|
| OM#01 | EUT ON. Equipment charging battery by USB port. |
| OM#03 | EUT ON. Equipment charging battery by USB port. Bluetooth in communication mode. |

## CONTINUOUS CONDUCTED EMISSION ON POWER LEADS

| | | |
|---|---|---|
| **LIMITS:** | Product standard : | FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-12 ED) |
| | Test standard : | FCC RULES AND REGULATIONS 47 CFR PART 15, SUBPART B (10-01-12 ED) |

**CLASS B**

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B & IC RSS-Gen Issue 2, June 2007 in the frequency range 0,15 to 30 MHz, for Class B equipment was:

| **Frequency range (MHz)** | **Limit (dBµV)** | |
|---|---|---|
| | **Quasi-peak** | **Average** |
| 0,15 to 0,5 | 66-56 | 56-46 |
| 0,5 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

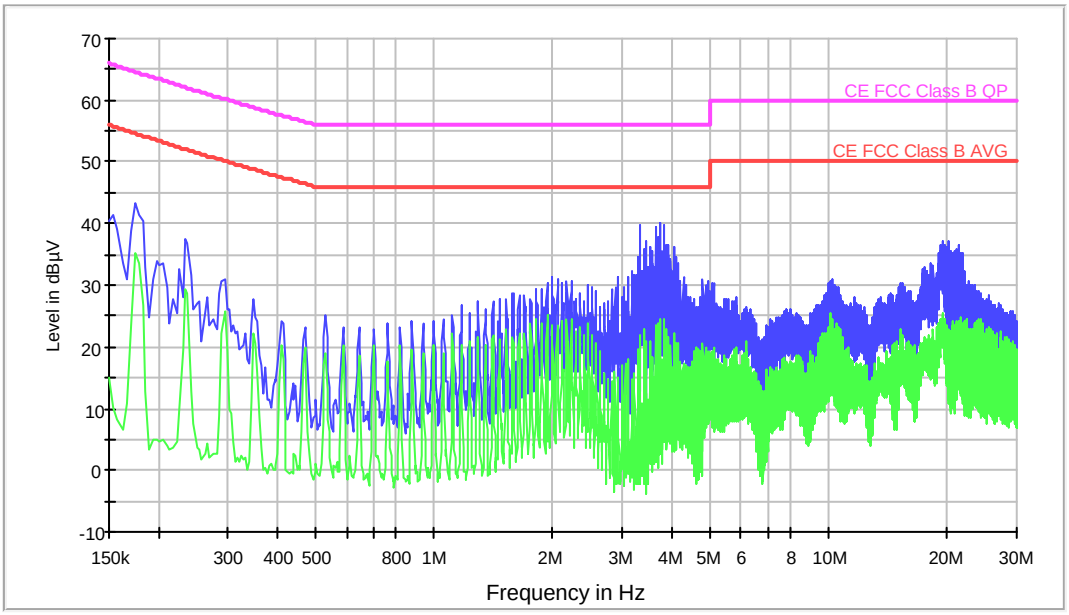
| | |
|---|---|
| **TESTED SAMPLES:** | S/01 |
| **TESTED OPERATION MODES:** | OM#01, 03 |
| **TEST RESULTS :** | CCmmnnhh: CC, Conducted Condition; mm: Sample number; nn: Operation mode; hh: wire |

| **CCmmnnhh** | **Description** | **Result** |
|---|---|---|
| CC01010N | Neutral wire noise | P |
| CC0101L1 | Phase wire noise | P |
| CC01030N | Neutral wire noise | P |
| CC0103L1 | Phase wire noise | P |

| Continuous Conducted emission : CC01010N | Detector : Peak / Average / Cuasi-peak |
|---|---|

Project: 39342REM.002
Company: ELEKTROBIT
Sample: S/01
Operation mode: OM#01
Description: EUT ON. Equipment charging battery by USB port. Neutral Noise

## EC FCC Class B ESPI CC



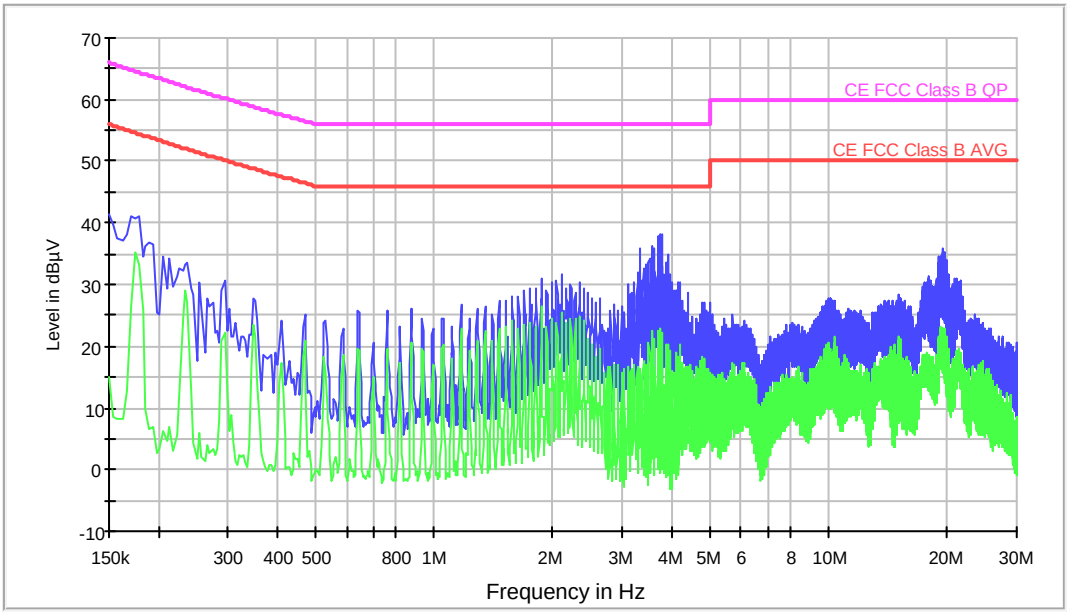

## Max Peak

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.174000 | 43.4 | 35.1 |
| 3.754000 | 40.1 | 24.3 |
| 6.158000 | 26.4 | 20.8 |
| 10.202000 | 30.9 | 24.3 |
| 14.302000 | 28.5 | 18.3 |
| 17.606000 | 32.9 | 18.8 |
| 19.430000 | 37.1 | 22.7 |
| 21.322000 | 36.5 | 21.4 |
| 24.058000 | 28.9 | 14.2 |
| 27.126000 | 27.0 | 19.6 |

| Continuous Conducted emission : CC0101L1 | Detector : Peak / Average / Cuasi-peak |
|---|---|

Project: 39342REM.002
Company: ELEKTROBIT
Sample: S/01
Operation mode: OM#01
Description: EUT ON. Equipment charging battery by USB port. Phase Noise

## EC FCC Class B ESPI CC



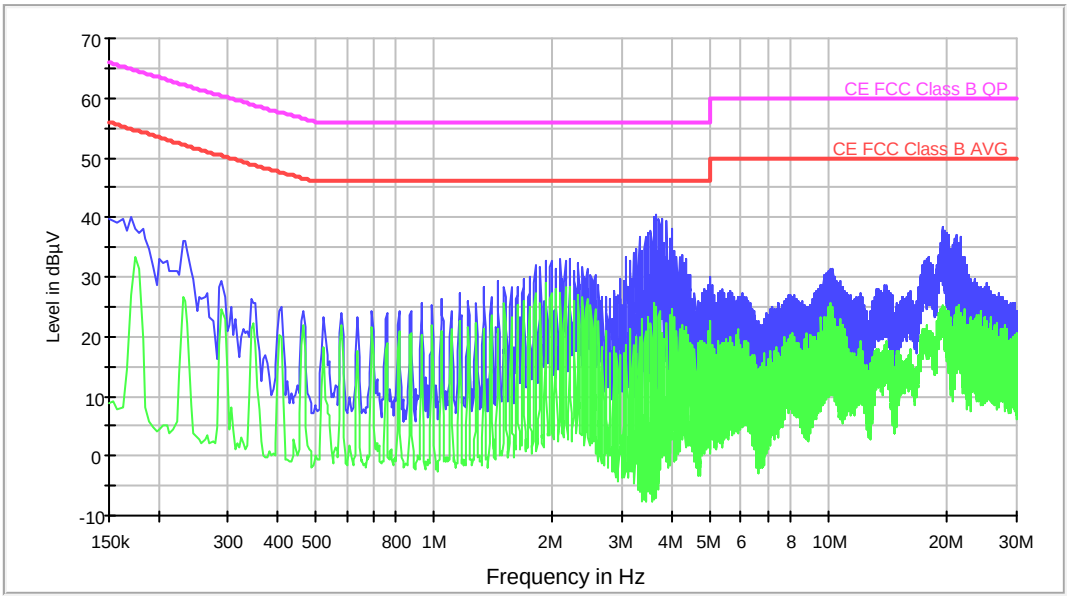

## Max Peak

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.150000 | 41.5 | 15.0 |
| 3.802000 | 38.0 | 22.3 |
| 8.066000 | 23.7 | 15.1 |
| 10.114000 | 27.8 | 18.0 |
| 13.794000 | 27.5 | 18.3 |
| 17.842000 | 31.3 | 18.7 |
| 19.398000 | 35.9 | 19.9 |
| 21.150000 | 31.0 | 18.2 |
| 24.586000 | 23.9 | 13.9 |
| 27.734000 | 21.7 | 7.2 |

| Continuous Conducted emission : CC01030N | Detector : Peak / Average / Cuasi-peak |
|---|---|

Project: 39342REM.002
Company: ELEKTROBIT
Sample: S/01
Operation mode: OM#03
Description: EUT ON. Equipment charging battery by USB port. Bluetooth in communication mode. Neutral Noise

## EC FCC Class B ESPI CC



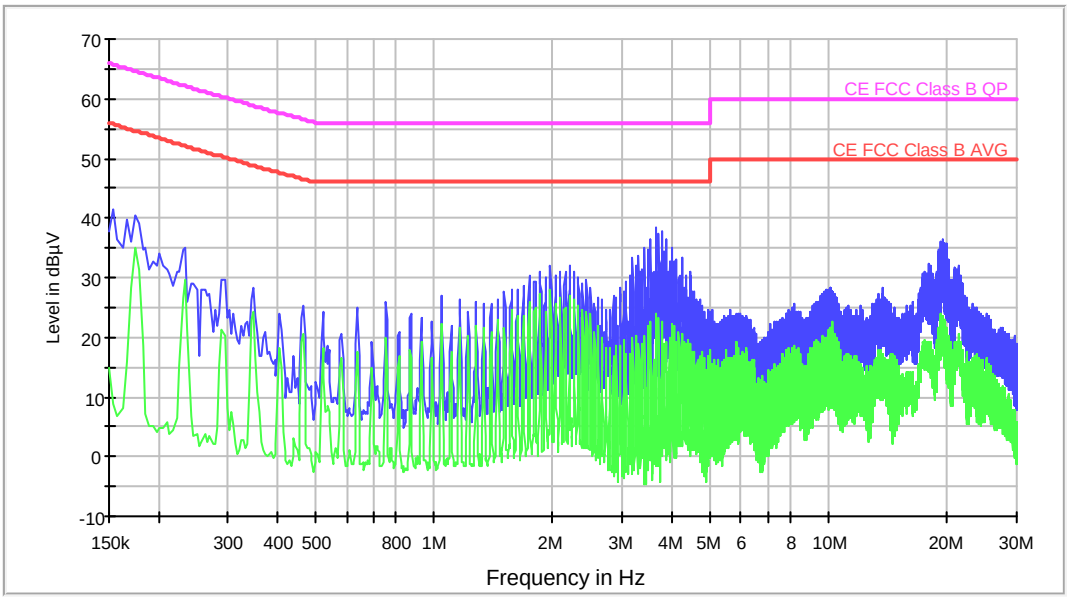

## Max Peak

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.170000 | 40.0 | 27.0 |
| 3.662000 | 40.5 | 25.1 |
| 7.962000 | 27.0 | 20.1 |
| 10.054000 | 31.4 | 25.0 |
| 13.890000 | 28.6 | 16.9 |
| 18.010000 | 33.3 | 20.2 |
| 19.398000 | 38.3 | 24.6 |
| 21.074000 | 36.9 | 23.2 |
| 25.210000 | 29.1 | 22.7 |
| 27.214000 | 26.7 | 13.4 |

| Continuous Conducted emission : CC0103L1 | Detector : Peak / Average / Cuasi-peak |
|---|---|

Project: 39342REM.002
Company: ELEKTROBIT
Sample: S/01
Operation mode: OM#03
Description: EUT ON. Equipment charging battery by USB port. Bluetooth in communication mode. Phase Noise

## EC FCC Class B ESPI CC




MaxPeak  Average  CE FCC Class B AVG  CE FCC Class B QP

## Max Peak

| Frequency (MHz) | MaxPeak-ClearWrite (dBµV) | Average-ClearWrite (dBµV) |
|---|---|---|
| 0.154000 | 41.4 | 8.8 |
| 3.658000 | 38.5 | 24.1 |
| 8.190000 | 25.5 | 18.1 |
| 10.162000 | 28.4 | 21.6 |
| 13.646000 | 28.4 | 15.2 |
| 17.878000 | 32.5 | 18.8 |
| 19.506000 | 36.3 | 23.5 |
| 21.254000 | 32.1 | 18.1 |
| 24.366000 | 24.1 | 9.9 |
| 27.662000 | 21.6 | 8.4 |