



FCC LISTED, REGISTRATION  
NUMBER: 720267

Informe de ensayo n°:  
Test report No:

**NIE: 52739RRF.001**

## Test report

### USA FCC Part 15.247, 15.209

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

|                                                                                                 |                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Identificación del objeto ensayado.....:</b><br>Identification of item tested                | Multimedia System                                                                                                                                                                                                                                                                                      |
| <b>Marca .....</b><br>Trademark                                                                 | Continental                                                                                                                                                                                                                                                                                            |
| <b>Modelo y/o referencia tipo .....</b><br>Model and /or type reference                         | AIO NAC                                                                                                                                                                                                                                                                                                |
| <b>Other identification of the product .....</b>                                                | FCC ID: ZFW-AIO                                                                                                                                                                                                                                                                                        |
| <b>Final HW version .....</b>                                                                   | 01.02                                                                                                                                                                                                                                                                                                  |
| <b>Final SW version .....</b>                                                                   | 65.03.63.52                                                                                                                                                                                                                                                                                            |
| <b>Características .....</b><br>Features                                                        | Radio (FM, AM), Navigation (GPS + GLONASS), BT 3.0 EDR, WiFi b,g,n 2.4GHz, Internal touchscreen colour display, CAN interface to car, Internal Audio Amplifier, USB plug.                                                                                                                              |
| <b>Solicitante .....</b><br>Applicant                                                           | Continental Automotive Rambouillet France SAS<br>1, rue de Clairefontaine - 78120 Rambouillet France                                                                                                                                                                                                   |
| <b>Método de ensayo solicitado, norma.....:</b><br>Test method requested, standard              | USA FCC Part 15.247 10-1-15 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.<br>USA FCC Part 15.209 10-1-15 Edition: Radiated emission limits; general requirements.<br>ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices. |
| <b>Resultado .....</b><br>Summary                                                               | IN COMPLIANCE                                                                                                                                                                                                                                                                                          |
| <b>Aprobado por (nombre / cargo y firma) .....</b><br>Approved by (name / position & signature) | A. Llamas<br>RF Lab. Manager<br><b>ALEJANDRO LLAMAS RODRIGUEZ</b><br>Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ                                                                                                                                                                               |
| <b>Fecha de realización .....</b><br>Date of issue                                              | 2017-06-20<br>Fecha: 2017.06.20 10:13:16 +02'00'                                                                                                                                                                                                                                                       |
| <b>Formato de informe No. ....</b><br>Report template No                                        | FDT08_19                                                                                                                                                                                                                                                                                               |

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## Competences and guarantees

DEKRA Testing and Certification is a testing laboratory accredited by the National Accreditation Body (ENAC - Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification 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 conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification has a calibration and maintenance program for its measurement equipment.

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 DEKRA Testing and Certification at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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## General conditions

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4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification and the Accreditation Bodies.

## Uncertainty

Uncertainty (factor  $k=2$ ) was calculated according to the DEKRA Testing and Certification internal document PODT000.

## Usage of samples

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

Sample S/01 is composed of the following elements:

| Control N° | Description           | Model   | Serial N°       | Date of reception |
|------------|-----------------------|---------|-----------------|-------------------|
| 52739B/001 | Multimedia System     | AIO NAC | QN0017110000004 | 2017-05-10        |
| 49652/063  | DAB antenna           | HAMA    | ---             | 2016-10-19        |
| 49652/114  | GPS antenna           | ---     | ---             | 2016-11-15        |
| 49652/294  | Power supply cable    | ---     | ---             | 2016-12-19        |
| 49652/185  | CAN-Traffic Simulator | ---     | ---             | 2016-11-17        |

1. Sample S/01 has undergone following test(s).  
All radiated tests indicated in appendixes A and B.

Sample S/02 is composed of the following elements:

| Control N° | Description           | Model   | Serial N°       | Date of reception |
|------------|-----------------------|---------|-----------------|-------------------|
| 52739B/002 | Multimedia System     | AIO NAC | QN0017110000003 | 2017-05-10        |
| 49652/294  | Power supply cable    | ---     | ---             | 2016-12-19        |
| 49652/185  | CAN-Traffic Simulator | ---     | ---             | 2016-11-17        |

1. Sample S/02 has undergone following test(s).  
All conducted tests indicated in appendixes A and B.

## Test sample description

The test sample (AIO) consists of a Multimedia System. AIO is an OEM product for PSA. The AIO is connected to the BSI (Boitier de Servitude Intelligent) via a CAN Low Speed BUS.

## Identification of the client

Continental Automotive Rambouillet France SAS  
1, rue de Clairefontaine - 78120 Rambouillet France.

## Testing period

The performed test started on 2017-05-13 and finished on 2017-05-23.  
The tests have been performed at DEKRA Testing and Certification.

## Environmental conditions

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

|                                      |                              |
|--------------------------------------|------------------------------|
| <b>Temperature</b>                   | Min. = 15 °C<br>Max. = 35 °C |
| <b>Relative humidity</b>             | Min. = 20 %<br>Max. = 75 %   |
| <b>Shielding effectiveness</b>       | > 100 dB                     |
| <b>Electric insulation</b>           | > 10 k $\Omega$              |
| <b>Reference resistance to earth</b> | < 1 $\Omega$                 |

In the semianechoic chamber, the following limits were not exceeded during the test.

|                                      |                                                                                                  |
|--------------------------------------|--------------------------------------------------------------------------------------------------|
| <b>Temperature</b>                   | Min. = 15 °C<br>Max. = 35 °C                                                                     |
| <b>Relative humidity</b>             | Min. = 20 %<br>Max. = 75 %                                                                       |
| <b>Air pressure</b>                  | Min. = 860 mbar<br>Max. = 1060 mbar                                                              |
| <b>Shielding effectiveness</b>       | > 100 dB                                                                                         |
| <b>Electric insulation</b>           | > 10 k $\Omega$                                                                                  |
| <b>Reference resistance to earth</b> | < 1 $\Omega$                                                                                     |
| <b>Normal site attenuation (NSA)</b> | < $\pm 4$ dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz) |
| <b>Field homogeneity</b>             | 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:

|                                      |                                     |
|--------------------------------------|-------------------------------------|
| <b>Temperature</b>                   | Min. = 15 °C<br>Max. = 35 °C        |
| <b>Relative humidity</b>             | Min. = 20 %<br>Max. = 75 %          |
| <b>Air pressure</b>                  | Min. = 860 mbar<br>Max. = 1060 mbar |
| <b>Shielding effectiveness</b>       | > 100 dB                            |
| <b>Electric insulation</b>           | > 10 k $\Omega$                     |
| <b>Reference resistance to earth</b> | < 1 $\Omega$                        |

## Remarks and comments

1; The tests have been performed by the technical personnel: Pedro Parada, Carlos Alberto Contreras, Carolina Postigo and José Carlos Luque.

2: Used instrumentation:

### Conducted Measurements

|    |                                       | Last Cal. date | Cal. due date |
|----|---------------------------------------|----------------|---------------|
| 1. | Spectrum analyser Agilent E4440A      | 2015/10        | 2017/10       |
| 2. | DC power supply R&S NGPE 40/40        | 2014/11        | 2017/11       |
| 3. | RF Bluetooth Test Set Anritsu MT8852B | N.A.           | N.A.          |

### Radiated Measurements

|     |                                                                  | Last Cal. date | Cal. due date |
|-----|------------------------------------------------------------------|----------------|---------------|
| 1.  | Semianechoic Absorber Lined Chamber ETS FACT3 200STP             | N.A.           | N.A.          |
| 2.  | BiconicalLog antenna ETS LINDGREN 3142E                          | 2017/07        | 2020/04       |
| 3.  | Multi Device Controller EMCO 2090                                | N.A.           | N.A.          |
| 4.  | Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D | 2016/11        | 2019/11       |
| 5.  | Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170           | 2017/03        | 2020/03       |
| 6.  | EMI Test Receiver R&S ESU 40                                     | 2016/03        | 2018/03       |
| 7.  | Spectrum analyser Rohde & Schwarz FSW50                          | 2015/12        | 2017/12       |
| 8.  | RF pre-amplifier 20 MHz-7 GHz PAM-0207                           | 2016/09        | 2017/09       |
| 9.  | RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M           | 2016/02        | 2018/02       |
| 10. | RF pre-amplifier 18-40 GHz BONN ELEKTRONIK BLMA 1840-1M          | 2015/12        | 2017/12       |
| 11. | RF Bluetooth Test Set Anritsu MT8852B                            | N.A.           | N.A.          |

## Testing verdicts

|                      |     |
|----------------------|-----|
| Not applicable ..... | N/A |
| Pass .....           | P   |
| Fail .....           | F   |
| Not measured .....   | N/M |

### 1. - BT EDR

| FCC PART 15 PARAGRAPH            |                                                           | VERDICT |   |   |    |
|----------------------------------|-----------------------------------------------------------|---------|---|---|----|
|                                  |                                                           | NA      | P | F | NM |
| FCC 15.247 Subclause (a) (1)     | 20 dB Bandwidth and Carrier frequency separation          |         | P |   |    |
| FCC 15.247 Subclause (a)(1)(iii) | Number of hopping channels                                |         | P |   |    |
| FCC 15.247 Subclause (a)(1)(iii) | Time of occupancy (Dwell Time)                            |         | P |   |    |
| FCC 15.247 Subclause (b)         | Maximum peak output power and antenna gain                |         | P |   |    |
| FCC 15.247 Subclause (d)         | Band-edge compliance of conducted emissions (Transmitter) |         | P |   |    |
| FCC 15.247 Subclause (d)         | Emission limitations conducted (Transmitter)              |         | P |   |    |
| FCC 15.247 Subclause (d)         | Emission limitations radiated (Transmitter)               |         | P |   |    |

### 2. WiFi 2.4 GHz (802.11b/g/n20/n40).

| FCC PART 15 PARAGRAPH            |                                              | VERDICT |   |   |    |
|----------------------------------|----------------------------------------------|---------|---|---|----|
|                                  |                                              | NA      | P | F | NM |
| Section 15.247 Subclause (a) (2) | 6 dB Bandwidth                               |         | P |   |    |
| Section 15.247 Subclause (b)     | Maximum output power and antenna gain        |         | P |   |    |
| Section 15.247 Subclause (d)     | Emission limitations conducted (Transmitter) |         | P |   |    |
| Section 15.247 Subclause (d)     | Band-edge emissions compliance (Transmitter) |         | P |   |    |
| Section 15.247 Subclause (e)     | Power spectral density                       |         | P |   |    |
| Section 15.247 Subclause (d)     | Emission limitations radiated (Transmitter)  |         | P |   |    |

## Appendix A – Test result (Bluetooth EDR)

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## TEST CONDITIONS

Power supply (V):

$V_{\text{nominal}} = 12 \text{ Vdc}$

Type of power supply = External power supply (Battery).

Type of antenna: Integral antenna

Declared Gain for antenna (maximum) = -1.85 dBi

TEST FREQUENCIES:

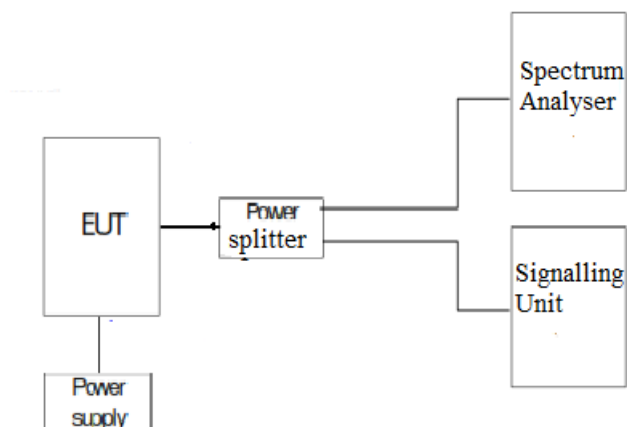
Lowest channel: 2402 MHz

Middle channel: 2441 MHz

Highest channel: 2480 MHz

## CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to a Bluetooth signalling unit (Bluetooth test set) and to the spectrum analyzer using a 6 dB power splitter. The reading in the spectrum analyzer is corrected taking into account the power splitter loss.



The DC supply voltage is applied using an external calibrated power supply.

## 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.

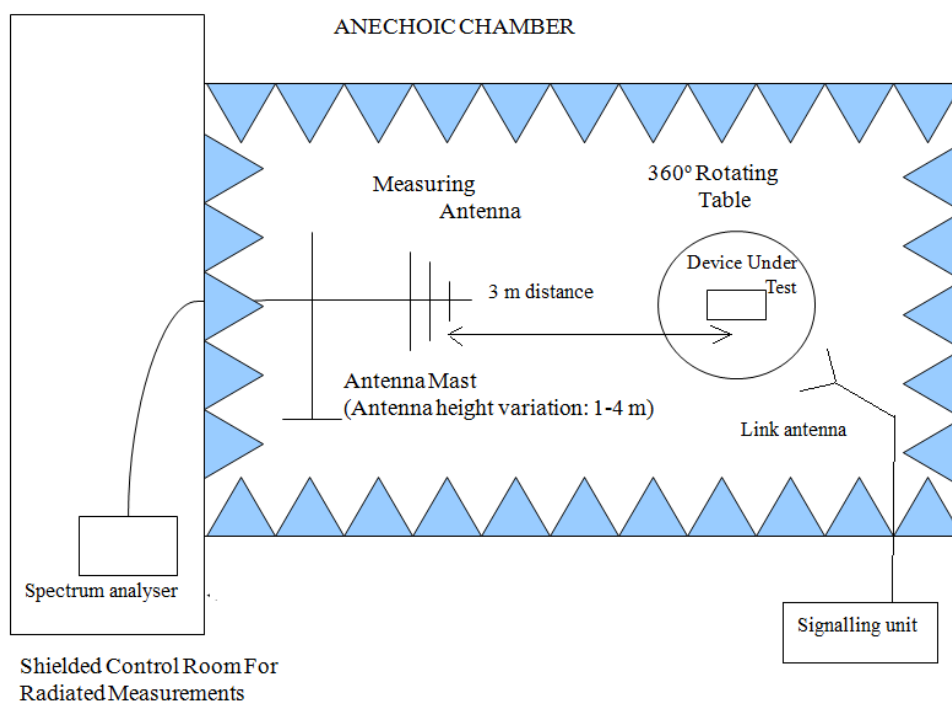
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission.

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

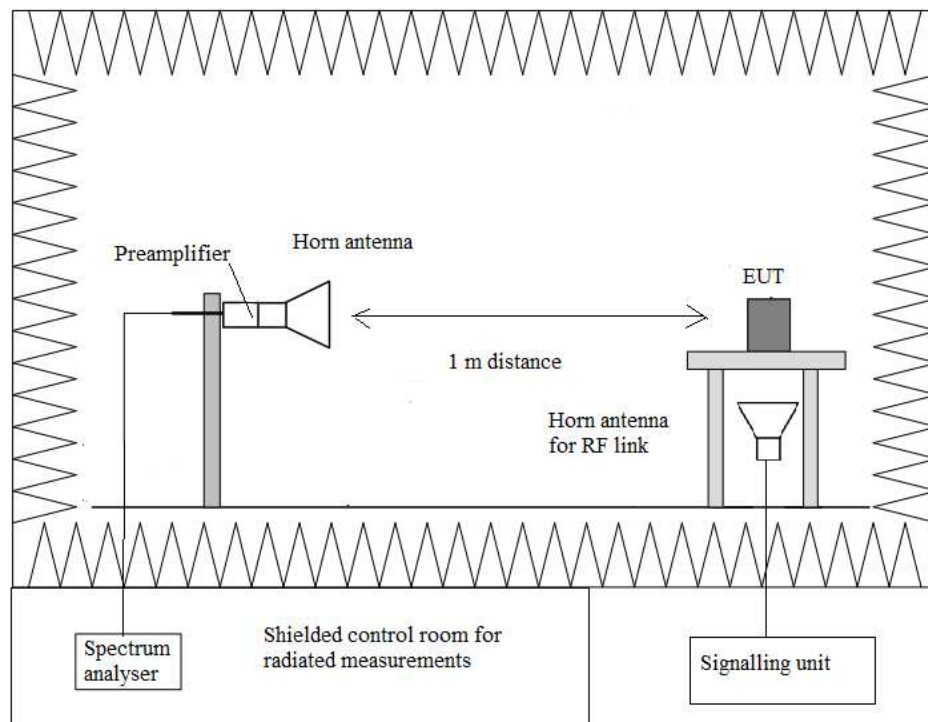
Measurements were made in both horizontal and vertical planes of polarization.

An additional horn antenna is used to control the equipment under test with the Bluetooth signalling unit (Bluetooth test set).

Radiated measurements setup  $f < 1$  GHz



## Radiated measurements setup $f > 1$ GHz



## FCC Section 15.247 Subclause (a) (1). 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<br>2402 MHz | Middle frequency<br>2441 MHz | Highest frequency<br>2480 MHz |
|--------------------------------|------------------------------|------------------------------|-------------------------------|
| 20 dB Spectrum bandwidth (kHz) | 944.488                      | 949.509                      | 945.520                       |
| Measurement uncertainty (kHz)  | <±5.00                       |                              |                               |

Modulation: Π/4-DQPSK (2Mbps)

|                                | Lowest frequency<br>2402 MHz | Middle frequency<br>2441 MHz | Highest frequency<br>2480 MHz |
|--------------------------------|------------------------------|------------------------------|-------------------------------|
| 20 dB Spectrum bandwidth (kHz) | 1316                         | 1316                         | 1316                          |
| Measurement uncertainty (kHz)  | <±5.00                       |                              |                               |

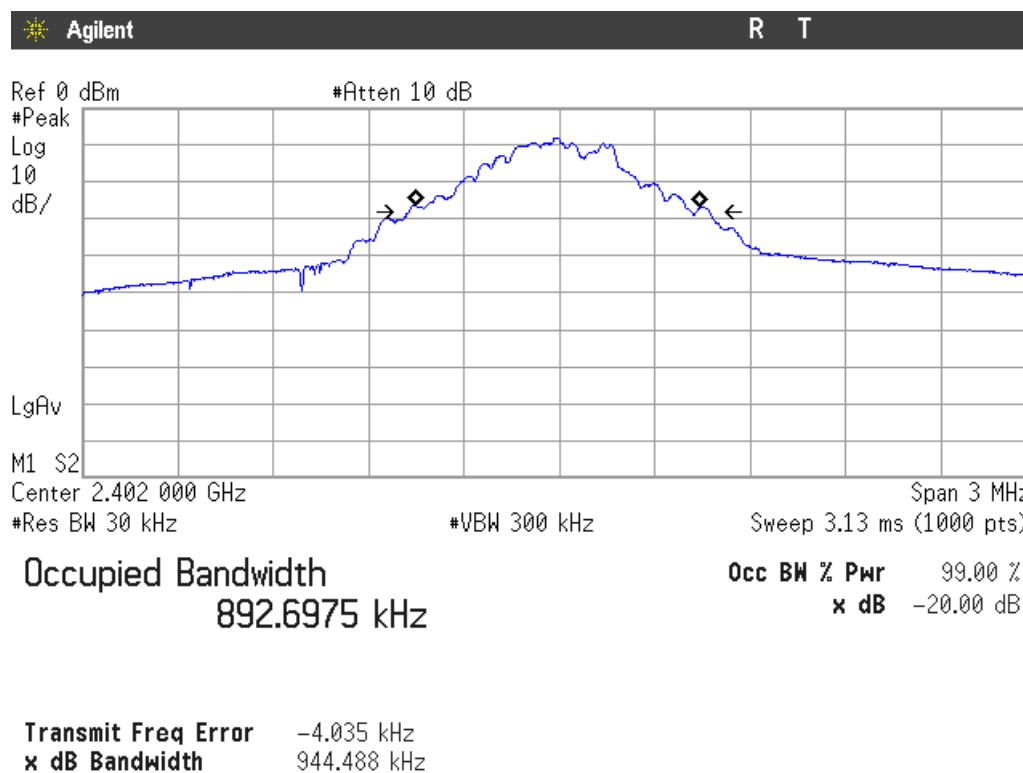
Modulation: 8-DPSK (3Mbps)

|                                | Lowest frequency<br>2402 MHz | Middle frequency<br>2441 MHz | Highest frequency<br>2480 MHz |
|--------------------------------|------------------------------|------------------------------|-------------------------------|
| 20 dB Spectrum bandwidth (kHz) | 1301                         | 1317                         | 1305                          |
| Measurement uncertainty (kHz)  | <±5.00                       |                              |                               |

## Modulation: GFSK

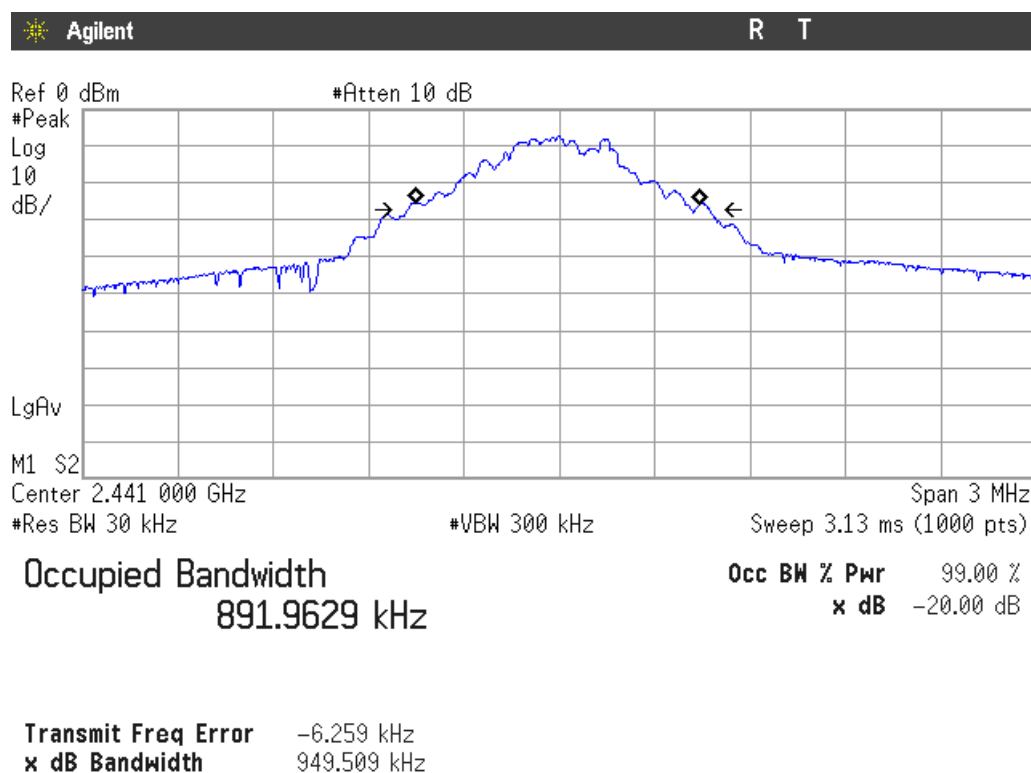
20 dB BANDWIDTH.

Lowest Channel: 2402 MHz.



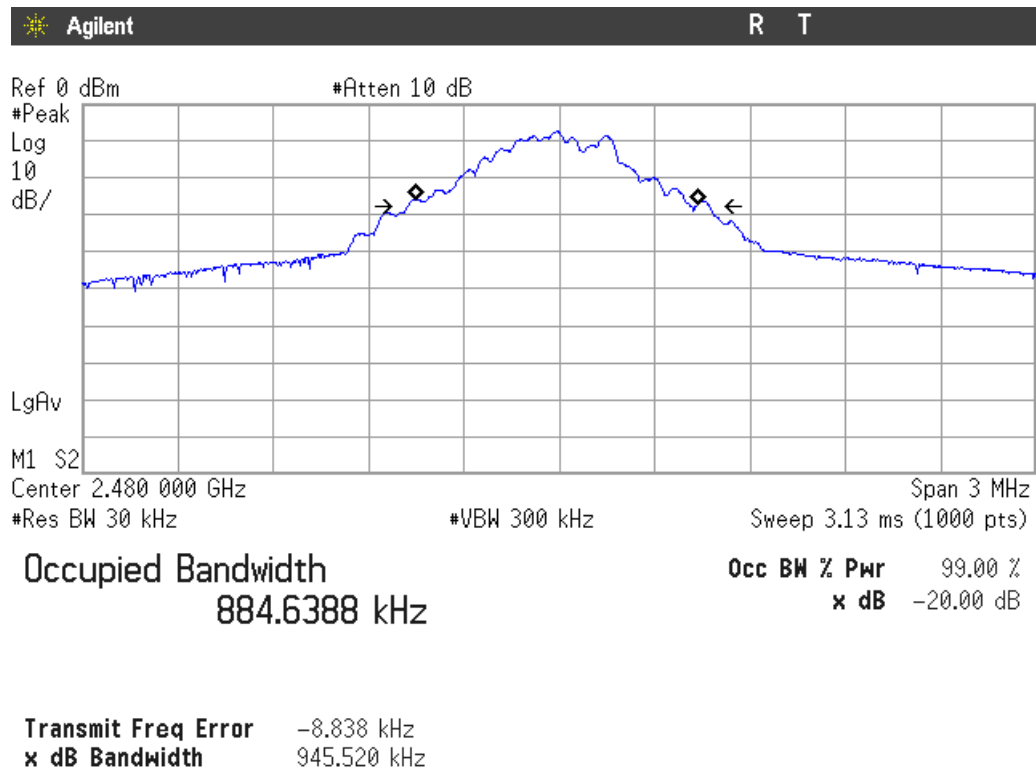
20 dB BANDWIDTH

Middle Channel: 2441 MHz.

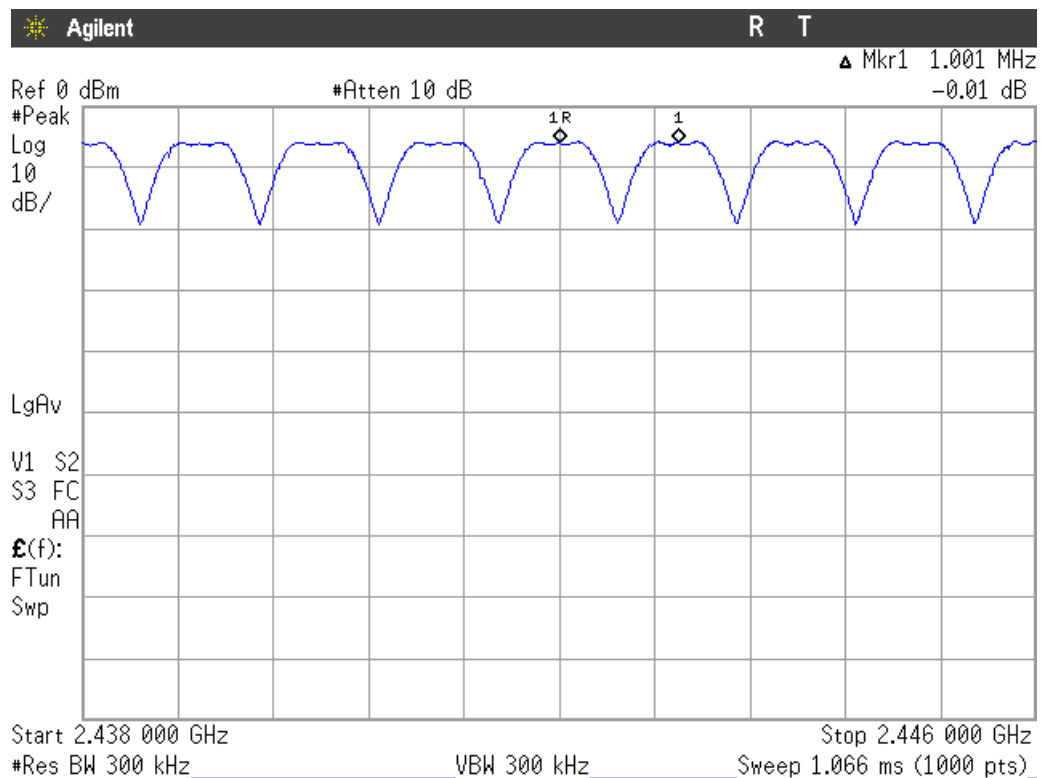


20 dB BANDWIDTH

Highest Channel: 2480 MHz.



Carrier frequency separation



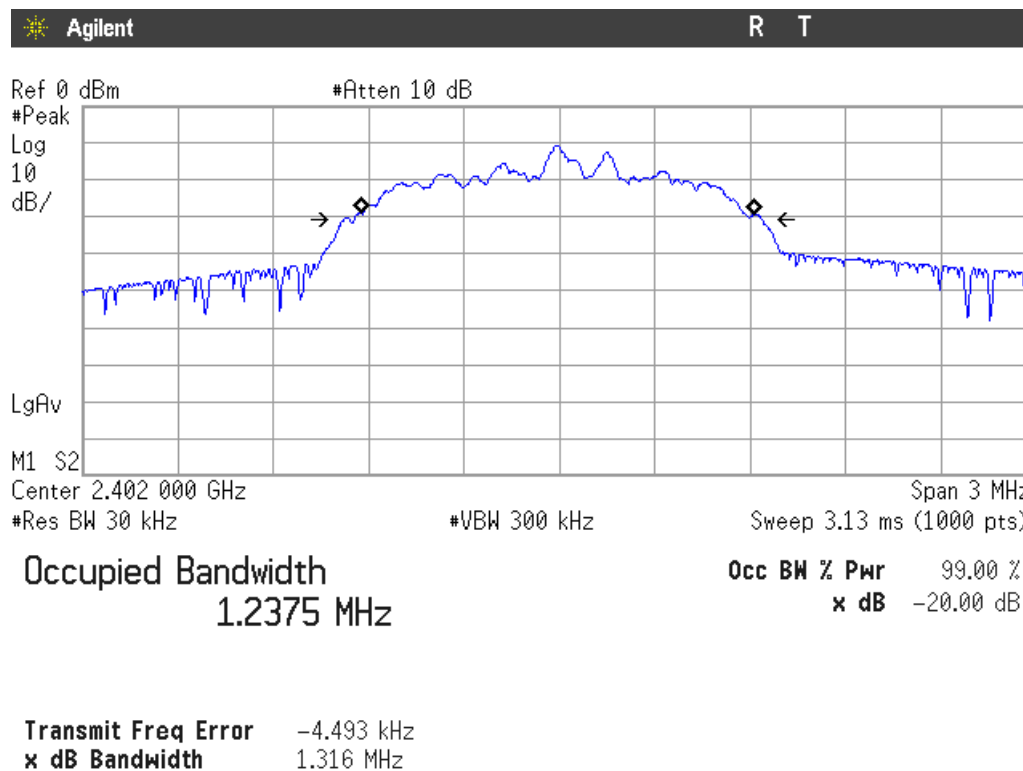
The hopping channel carrier frequencies are separated by a minimum of the two-thirds of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

## Modulation: $\Pi/4$ -DQPSK

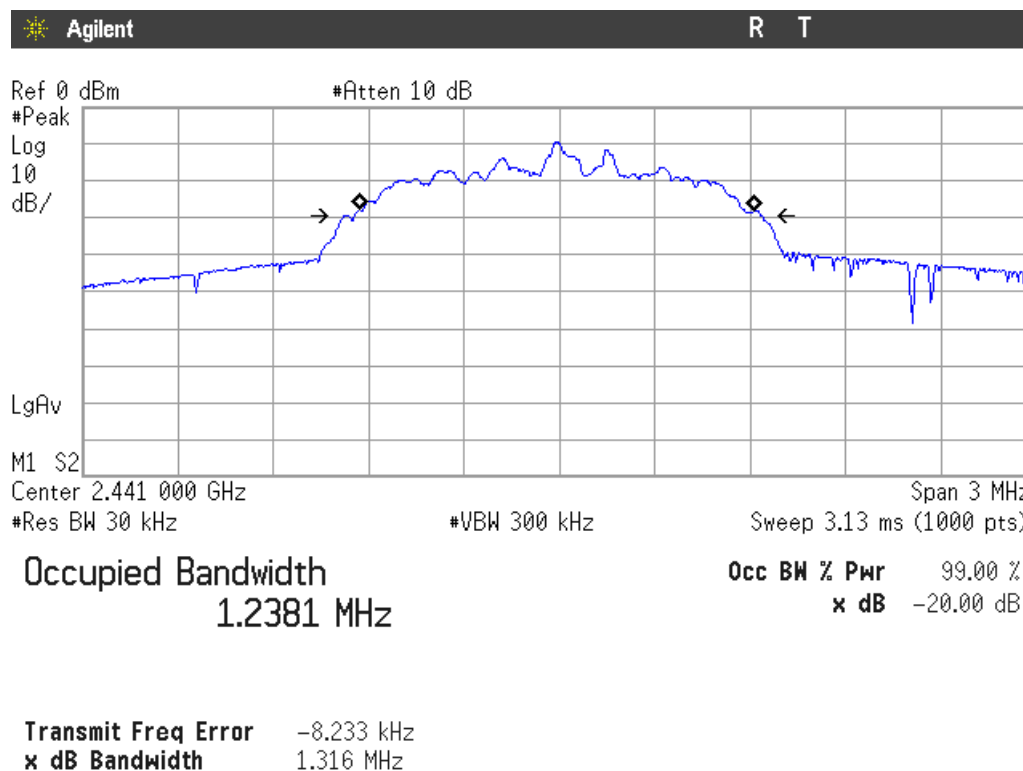
20 dB BANDWIDTH.

Lowest Channel: 2402 MHz.



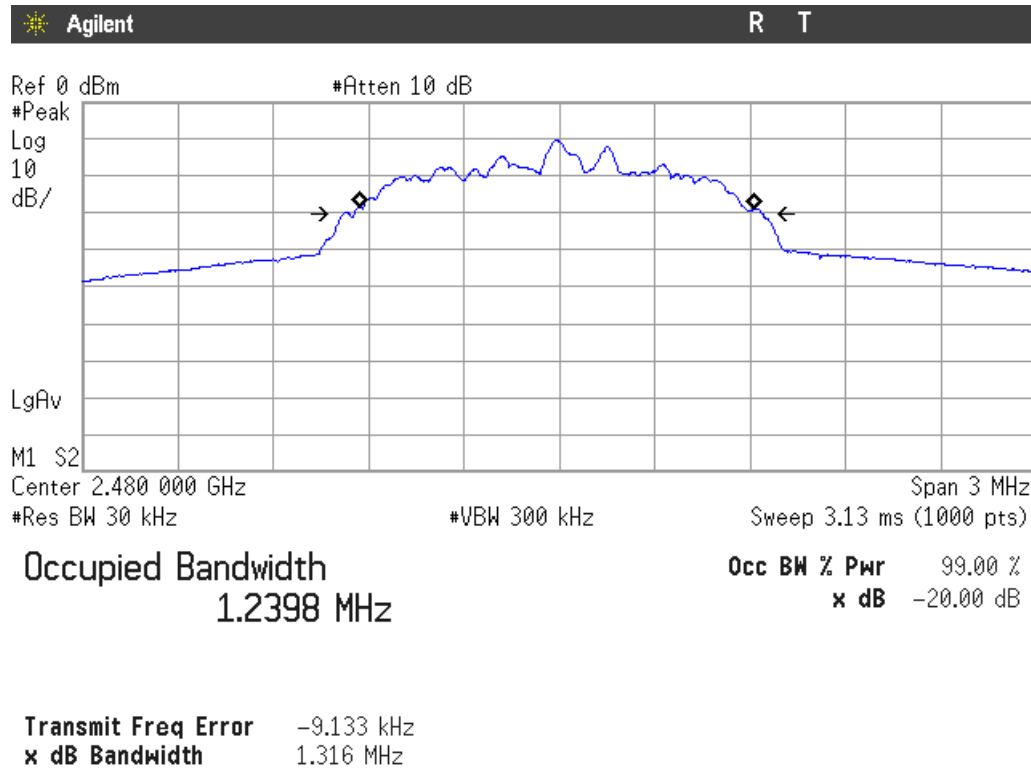
20 dB BANDWIDTH

Middle Channel: 2441 MHz.

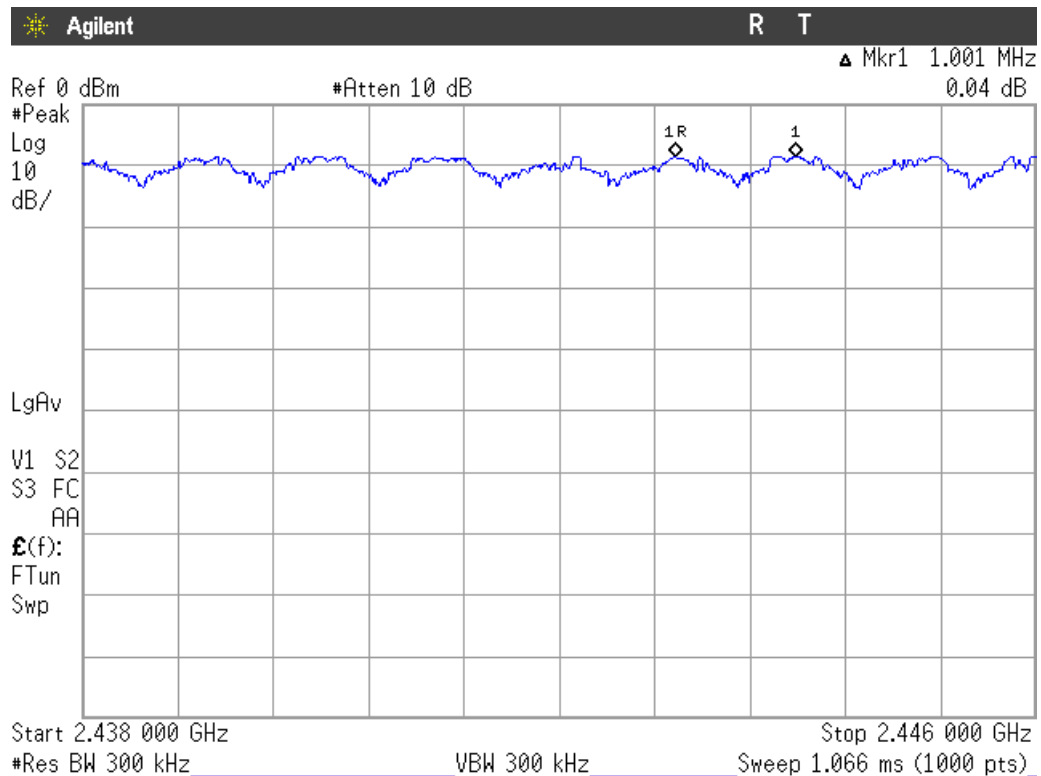


20 dB BANDWIDTH

Highest Channel: 2480 MHz.



Carrier frequency separation



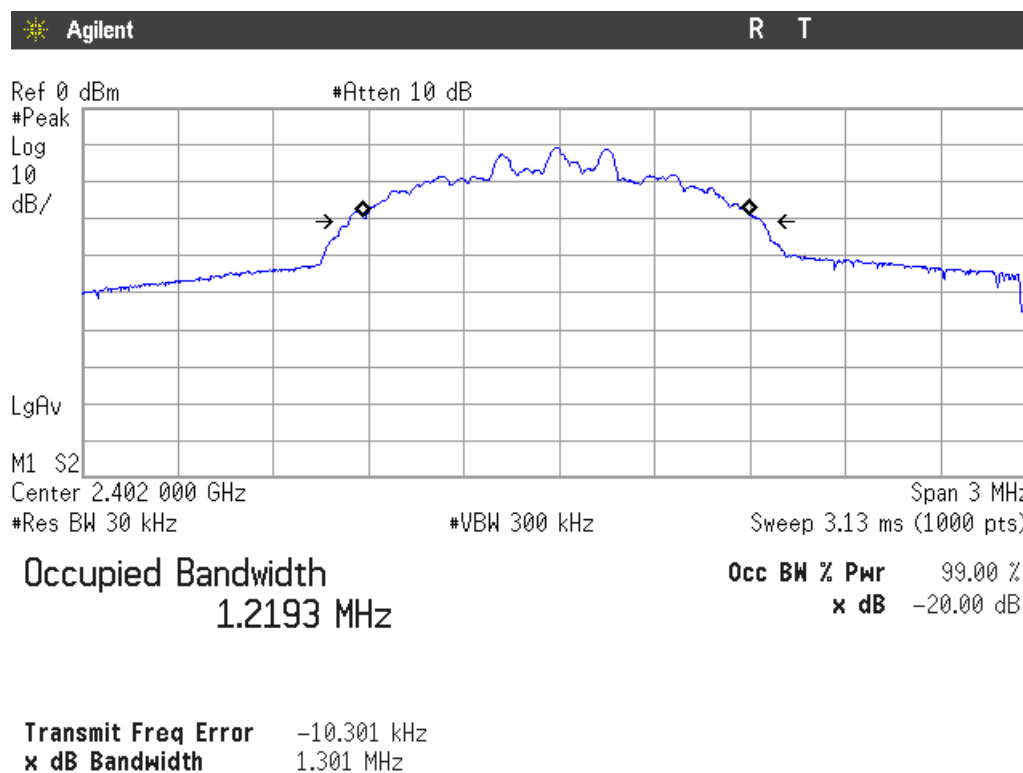
The hopping channel carrier frequencies are separated by a minimum of the two-thirds of the 20 dB bandwidth of the hopping channel

Verdict: PASS

## Modulation: 8-DPSK

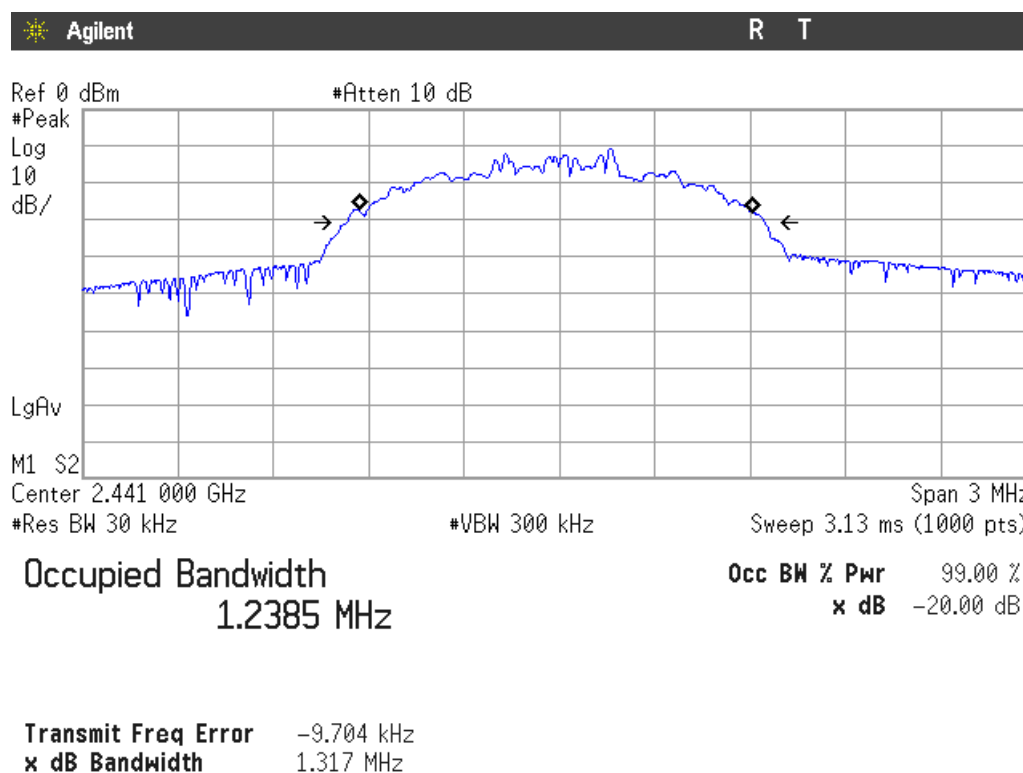
20 dB BANDWIDTH

Lowest Channel: 2402 MHz.



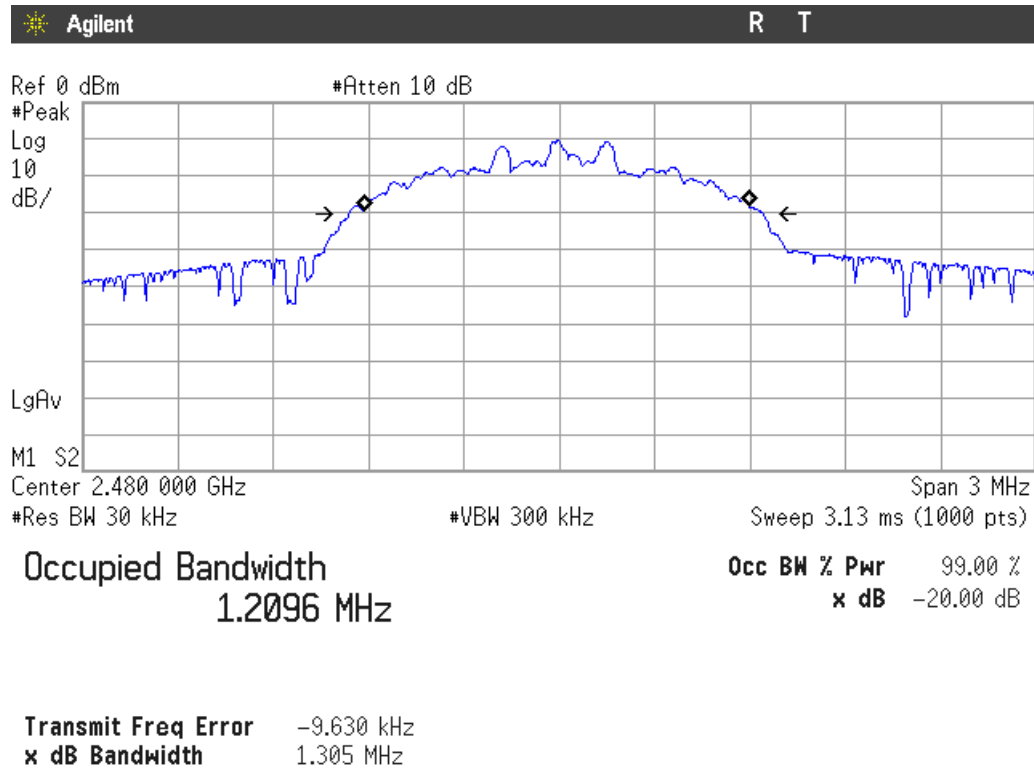
20 dB BANDWIDTH

Middle Channel: 2441 MHz.

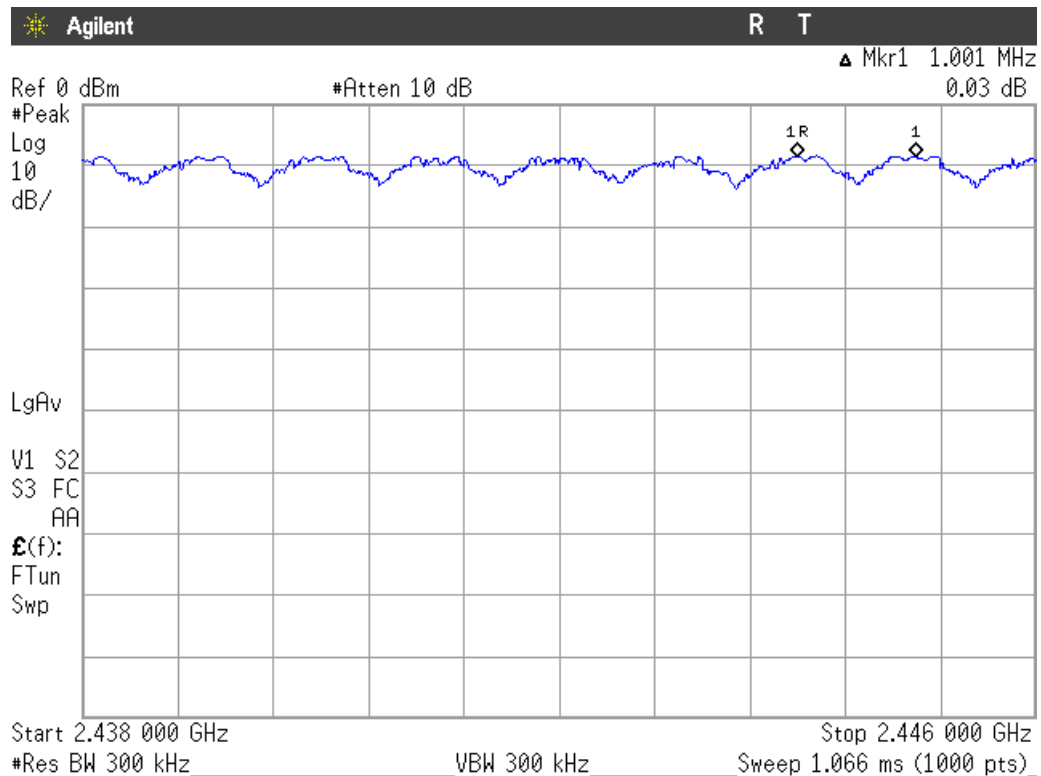


20 dB BANDWIDTH

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). Number of hopping channels**

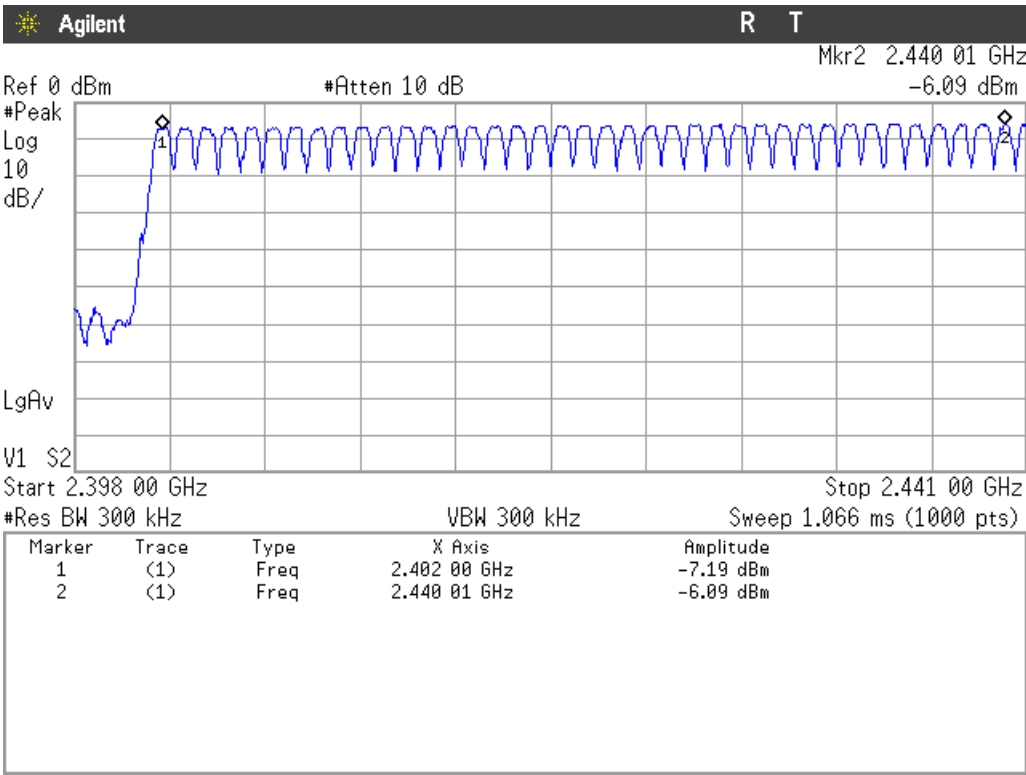
**SPECIFICATION**

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

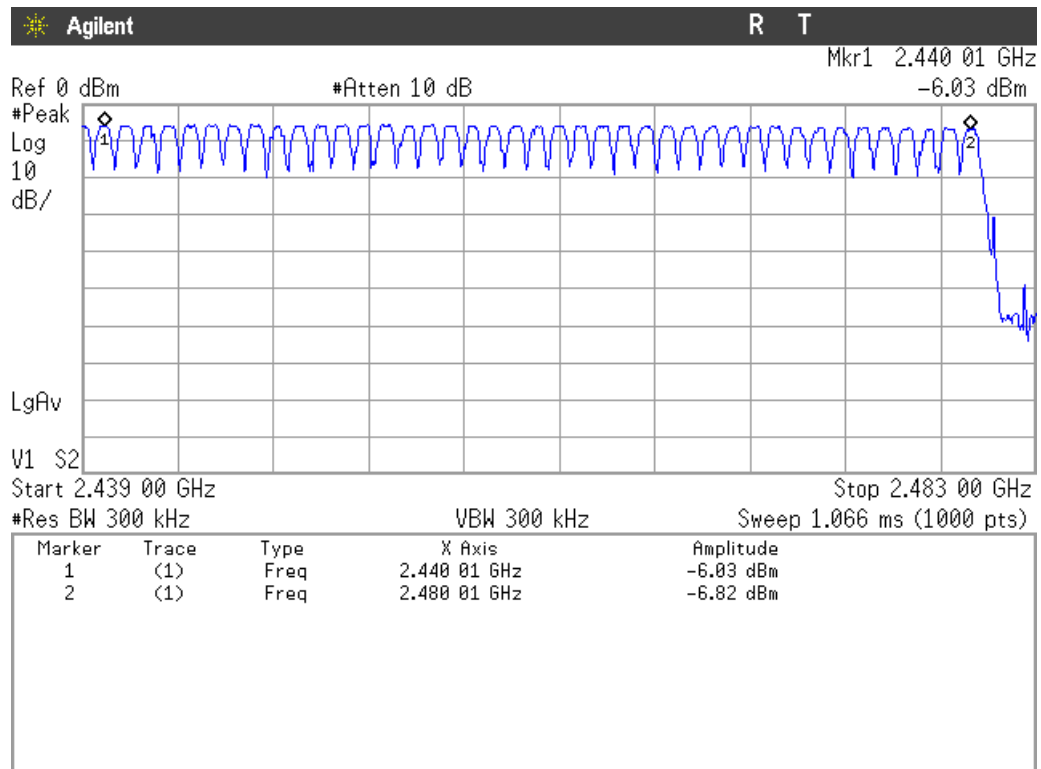
**RESULTS**

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

**Modulation: GFSK**



Number of hopping frequencies: 39

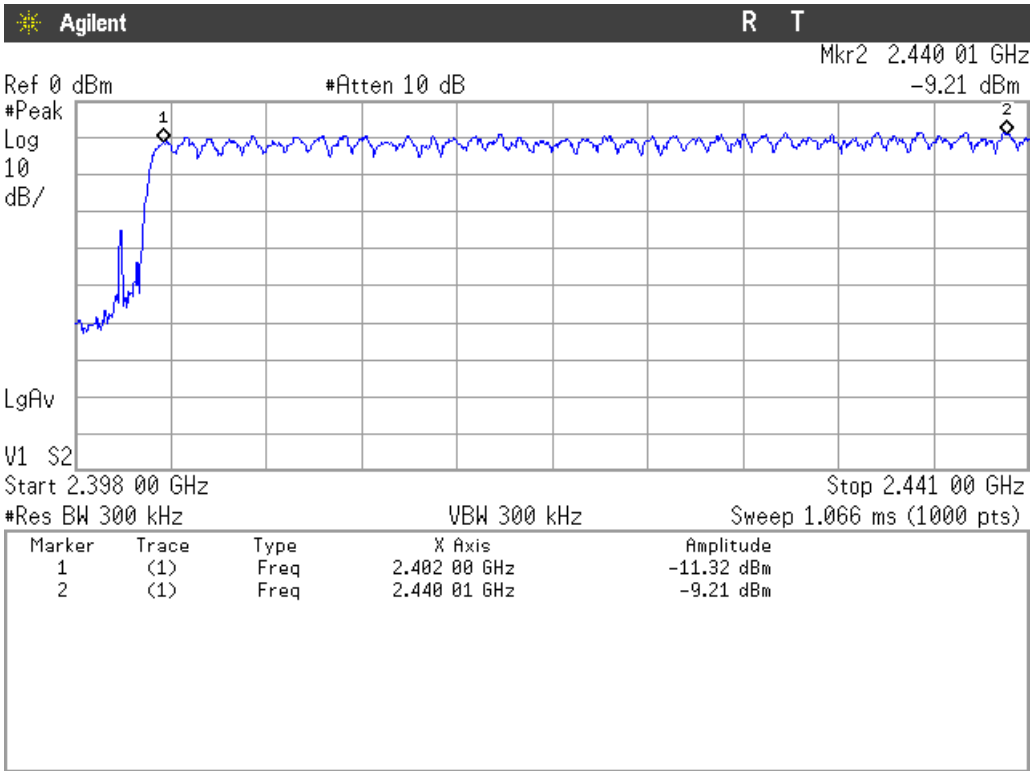


Number of hopping frequencies: 40

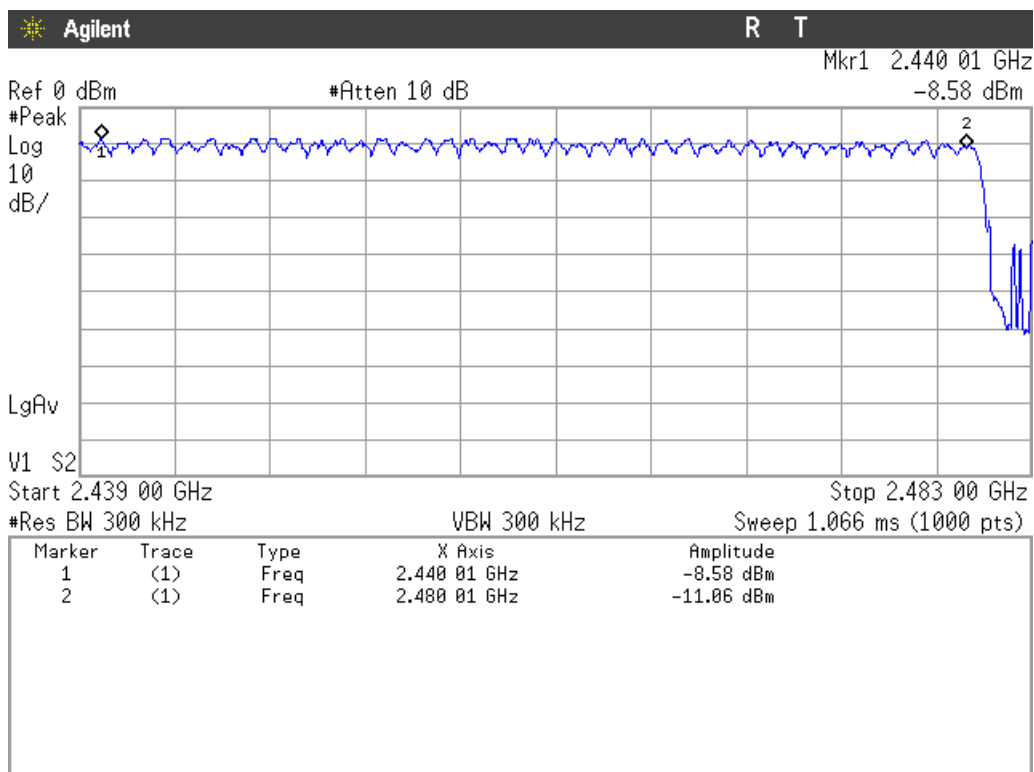
Total number of hopping frequencies: 79

Verdict: PASS

**Modulation:  $\Pi/4$ -DQPSK**



Number of hopping frequencies: 39

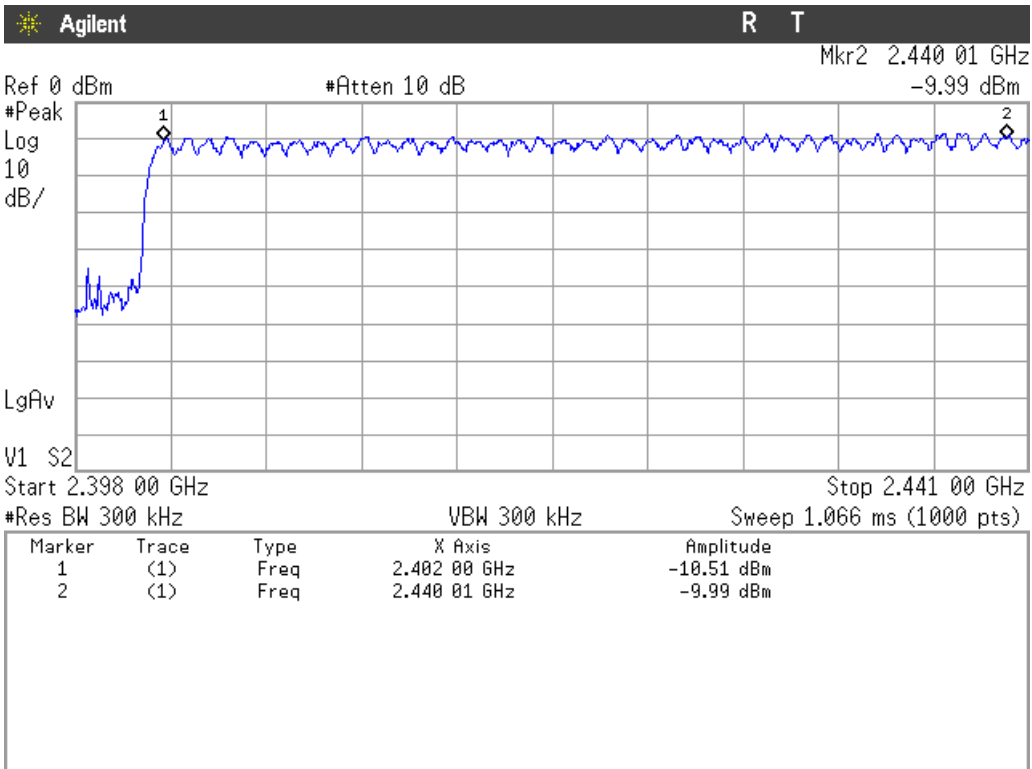


Number of hopping frequencies: 40

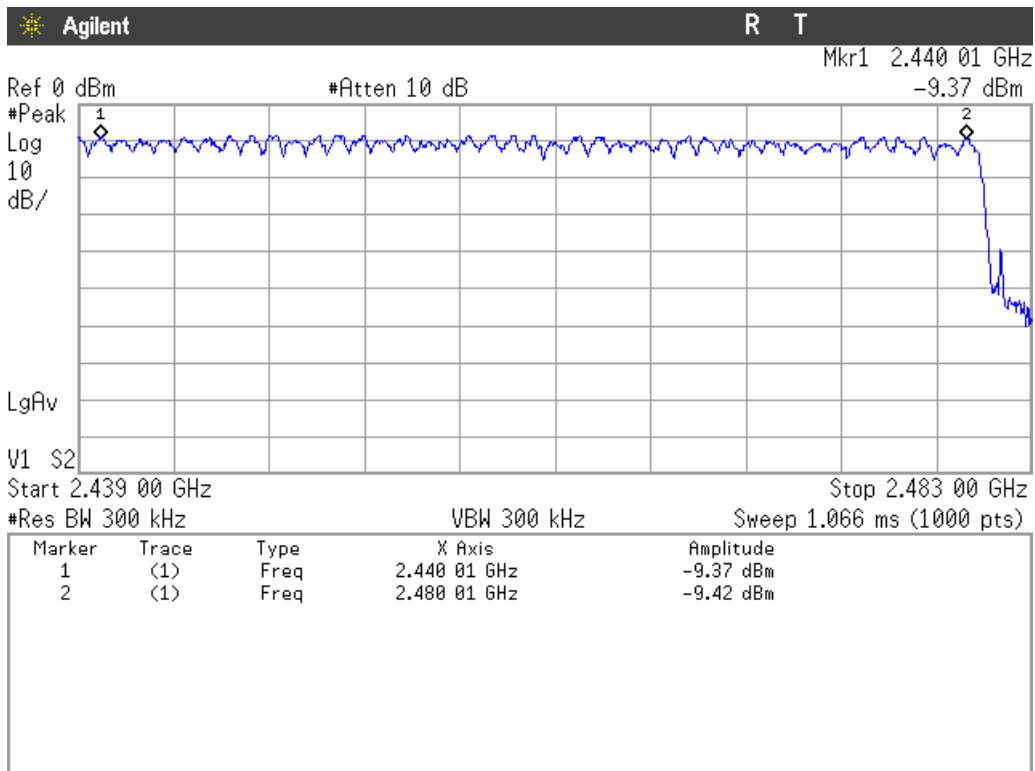
Total number of hopping frequencies: 79

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). Time of occupancy (Dwell Time)

### SPECIFICATION

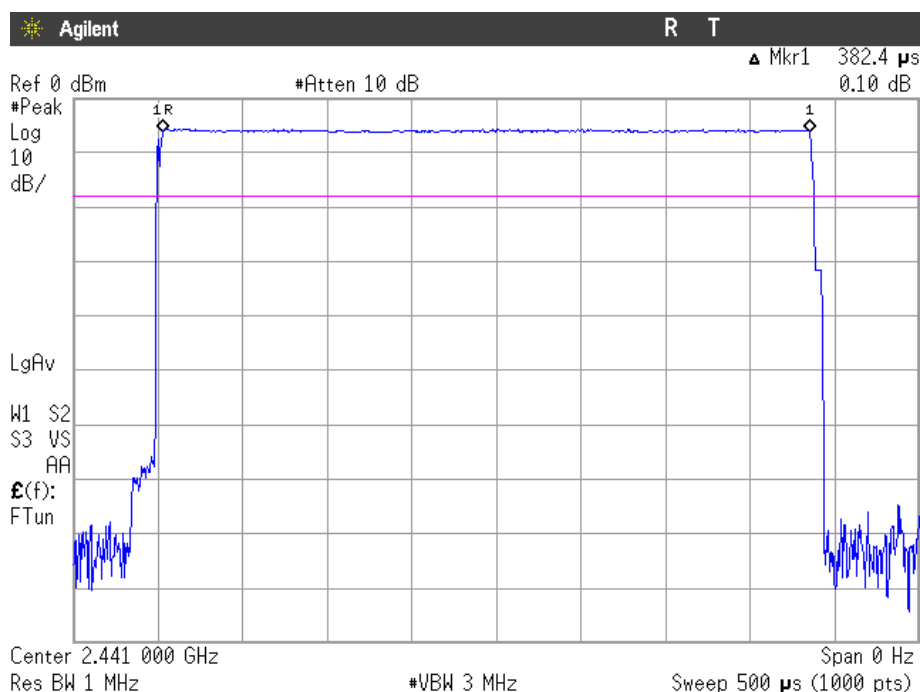
The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed =  $0.4 \times 79 = 31.6$  seconds.

### RESULTS

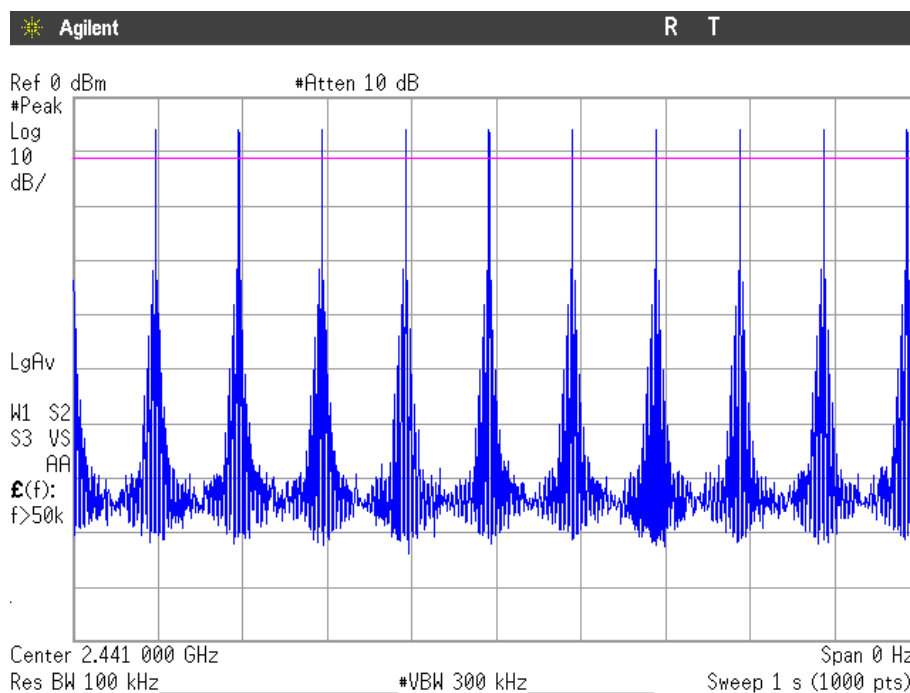
#### **Modulation: GFSK**

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

- Tx- time per hop = 382.4  $\mu$ s (see next plot).



- Number of hops over a period of 1 seconds = 10 (see next plot).



Number of hops in the period specified in the requirements = (10 hops) x (31.6 s / 1 s) = 316 hops.

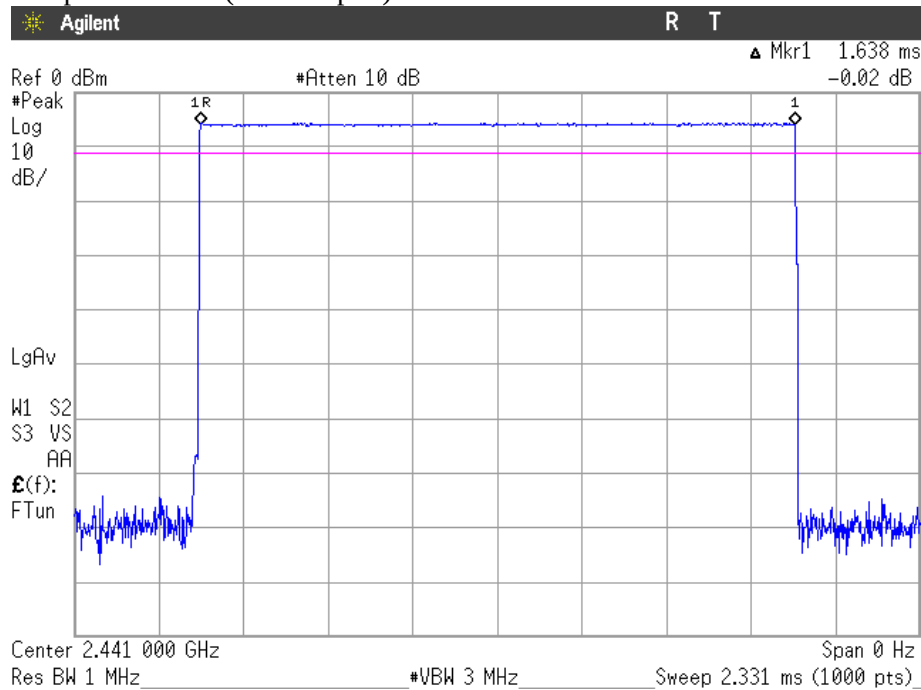
Averaging time of occupancy = 382.4  $\mu$ s x 316 hops = 120.83 ms per 31.6 seconds.

|                             |              |
|-----------------------------|--------------|
| Measurement uncertainty (%) | < $\pm$ 0.01 |
|-----------------------------|--------------|

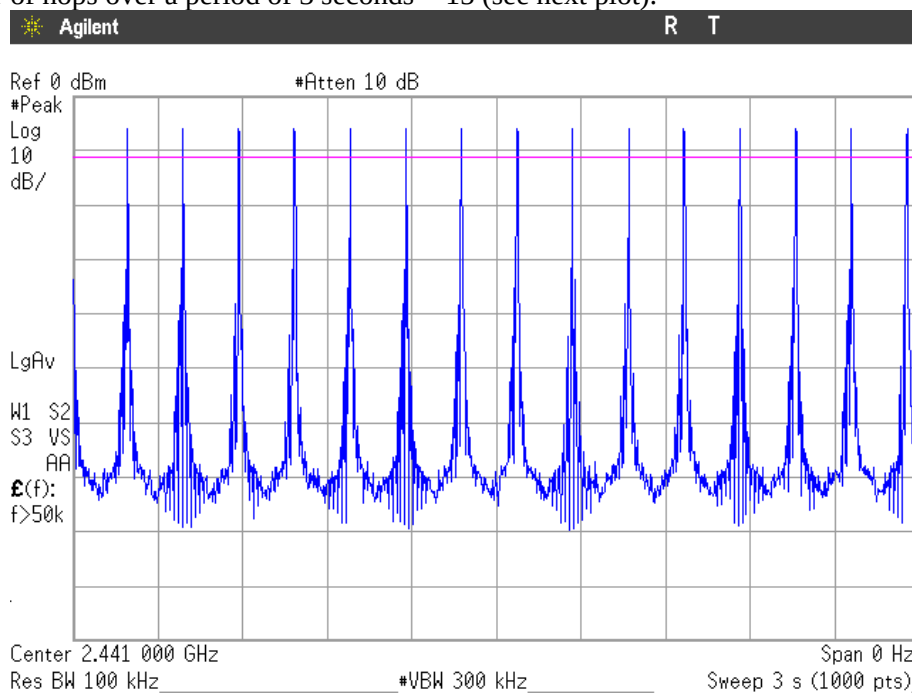
Verdict: PASS

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

- Tx- time per hop = 1.638 ms (see next plot).



- Number of hops over a period of 3 seconds = 15 (see next plot).



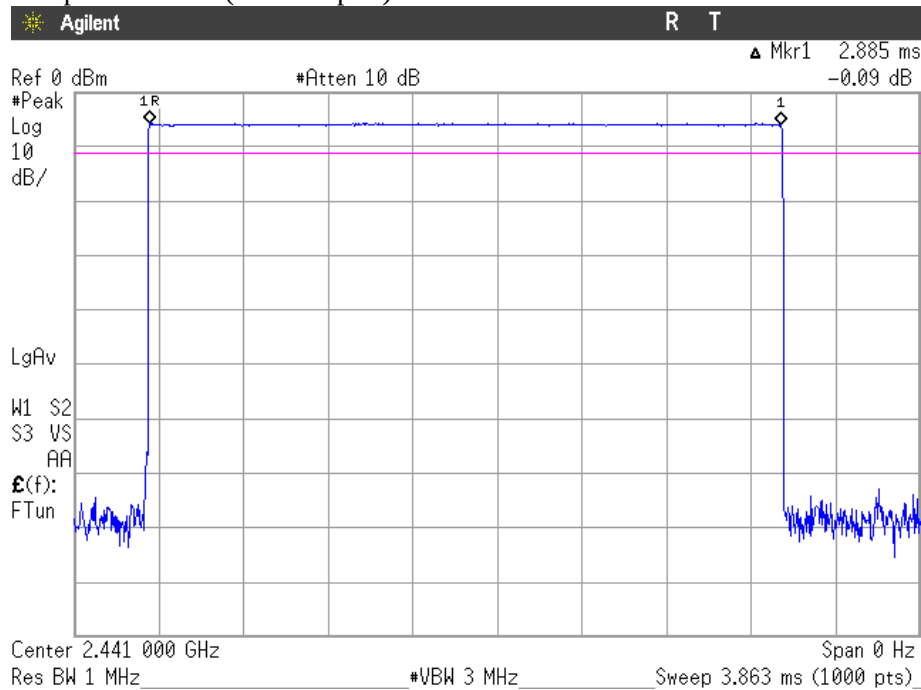
Number of hops in the period specified in the requirements = (15 hops) x (31.6 s / 3 s) = 158 hops.  
Averaging time of occupancy = 1.638 ms x 158 hops = 258.80 ms per 31.6 seconds.

|                             |        |
|-----------------------------|--------|
| Measurement uncertainty (%) | <±0.01 |
|-----------------------------|--------|

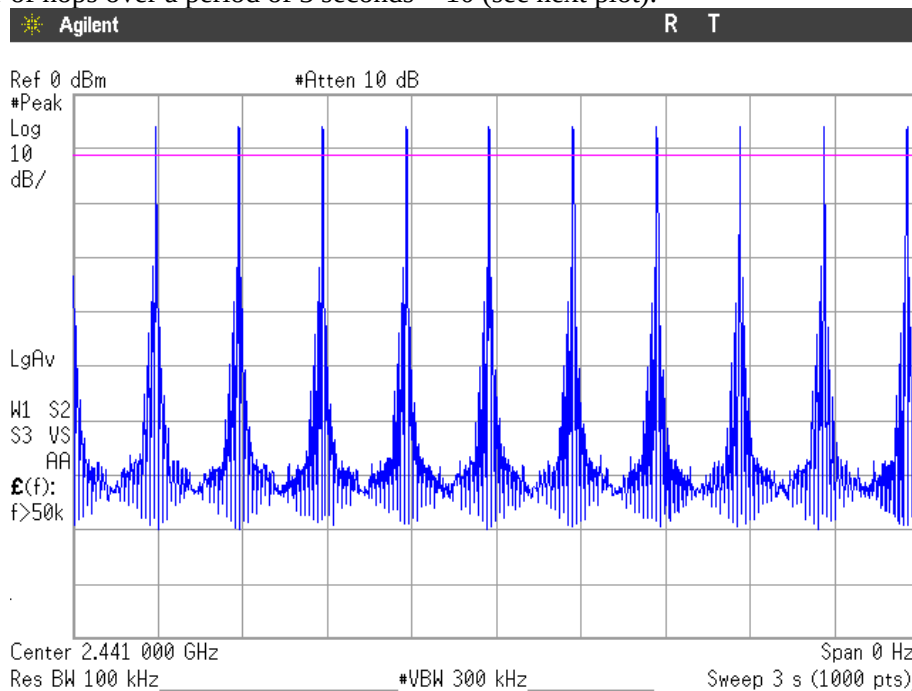
Verdict: PASS

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

- Tx- time per hop = 2.885 ms (see next plot).



- Number of hops over a period of 3 seconds = 10 (see next plot).



Number of hops in the period specified in the requirements = (10 hops) x (31.6 s / 3 s) = 105.33 hops.  
Averaging time of occupancy = 2.885 ms x 105.33 hops = 303.88 ms per 31.6 seconds.

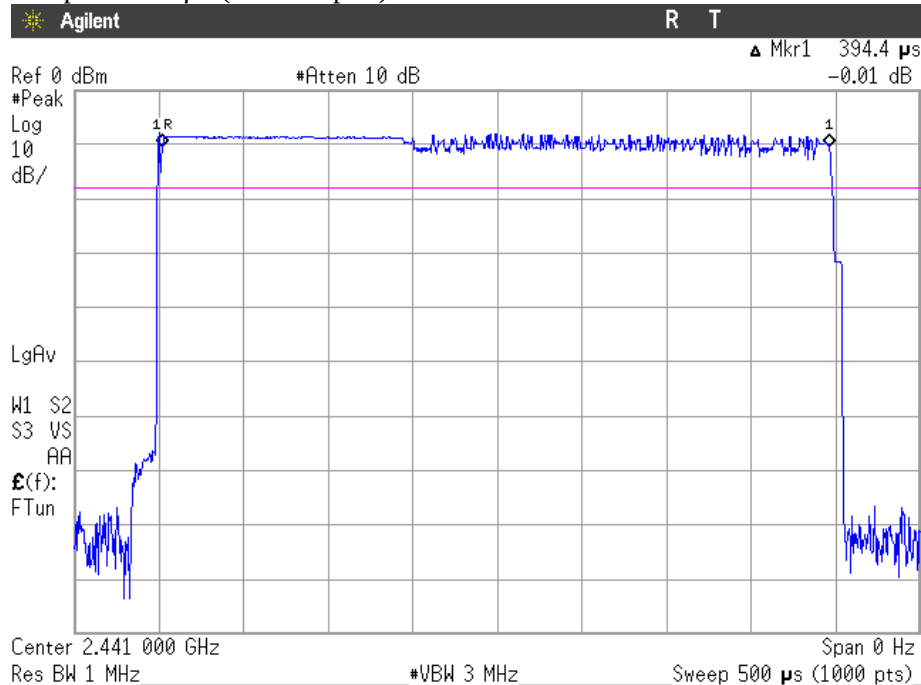
|                             |        |
|-----------------------------|--------|
| Measurement uncertainty (%) | <±0.01 |
|-----------------------------|--------|

Verdict: PASS

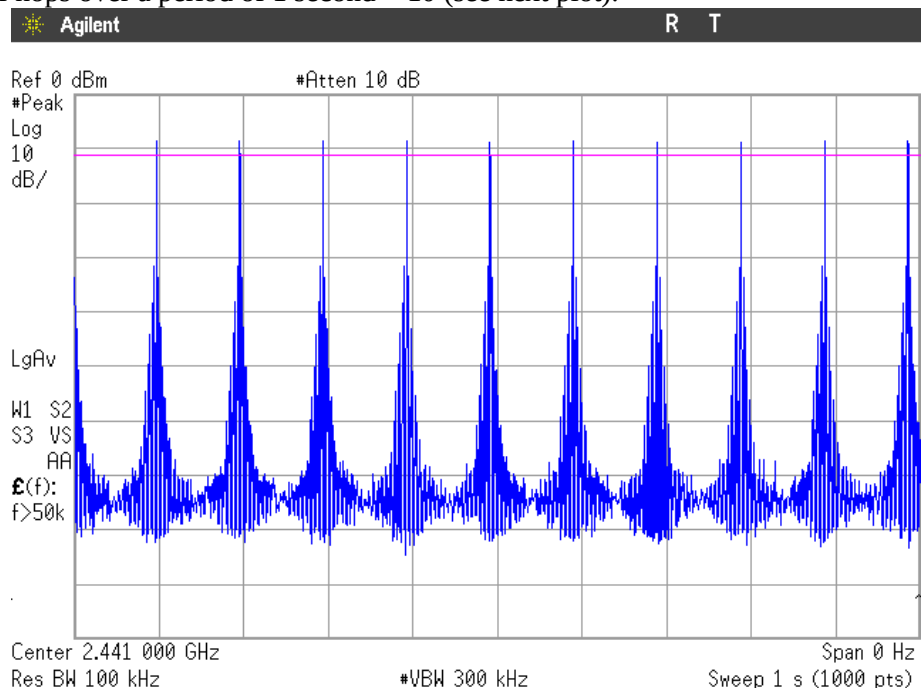
## Modulation: $\Pi/4$ -DQPSK

### 1. TIME OF OCCUPANCY (DWEELL TIME) FOR PACKET TYPE DH1.

- Tx- time per hop = 394.4  $\mu$ s (see next plot).



- Number of hops over a period of 1 second = 10 (see next plot).



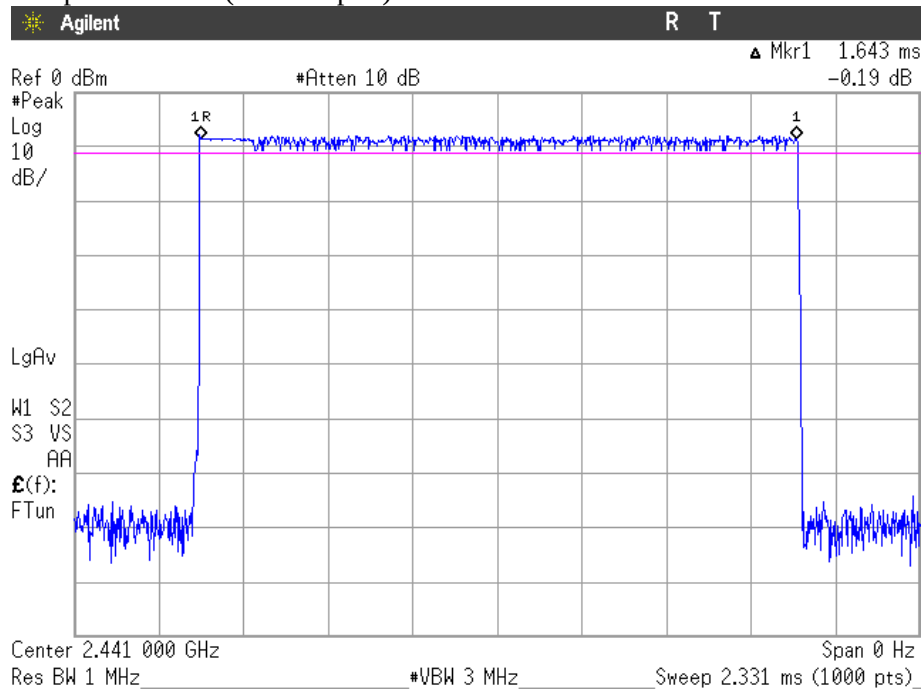
Number of hops in the period specified in the requirements = (10 hops) x (31.6 s / 1 s) = 316 hops.  
Averaging time of occupancy = 394.4  $\mu$ s x 316 hops = 124.63 ms per 31.6 seconds.

|                             |              |
|-----------------------------|--------------|
| Measurement uncertainty (%) | < $\pm$ 0.01 |
|-----------------------------|--------------|

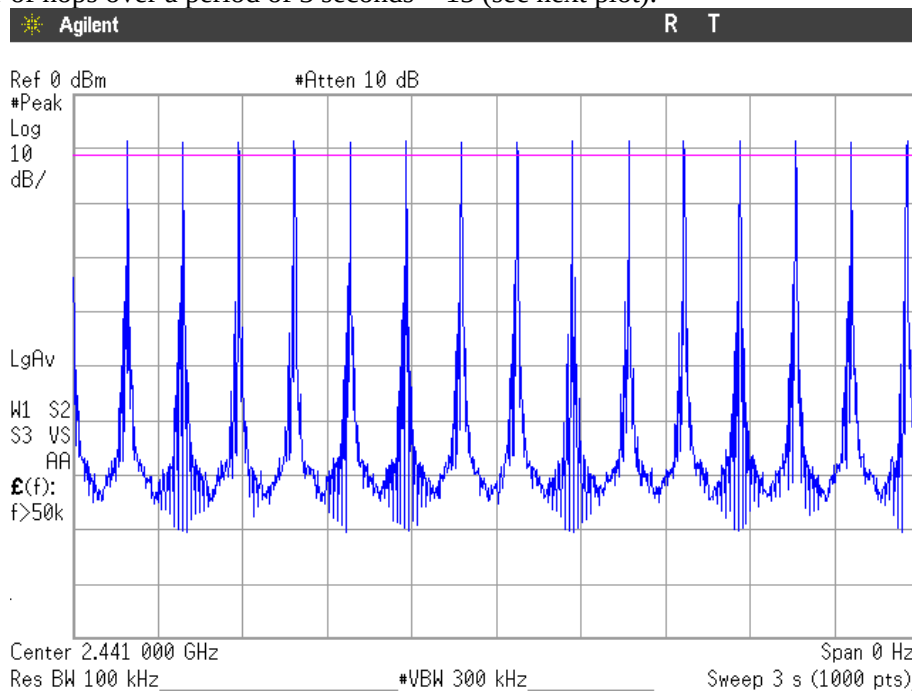
Verdict: PASS

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

- Tx- time per hop = 1.643 ms (see next plot).



- Number of hops over a period of 3 seconds = 15 (see next plot).



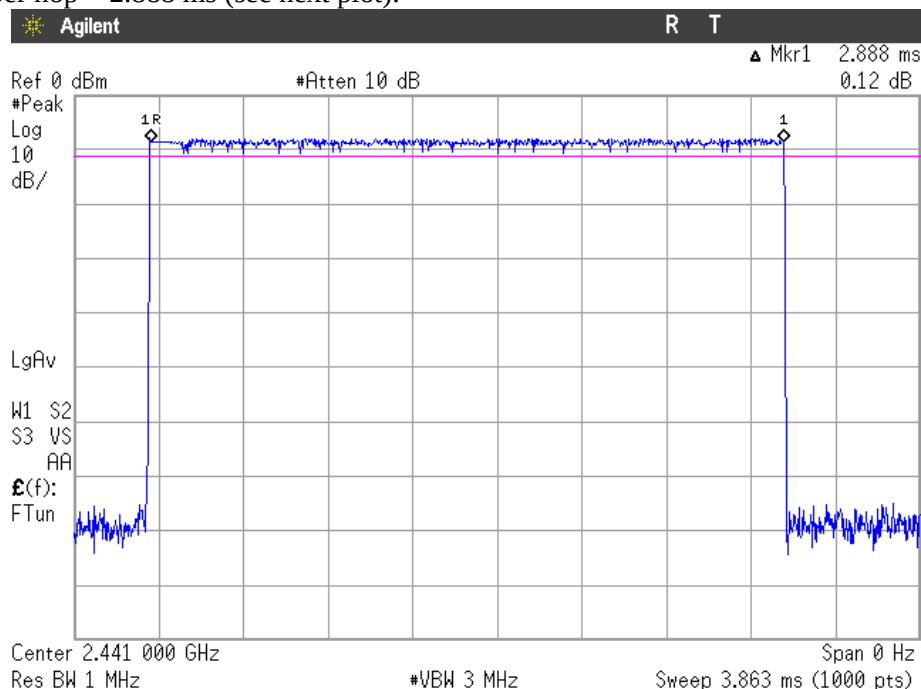
Number of hops in the period specified in the requirements = (15 hops) x (31.6 s / 3 s) = 158 hops.  
Averaging time of occupancy = 1.643 ms x 158 hops = 259.59 ms per 31.6 seconds.

|                             |        |
|-----------------------------|--------|
| Measurement uncertainty (%) | <±0.01 |
|-----------------------------|--------|

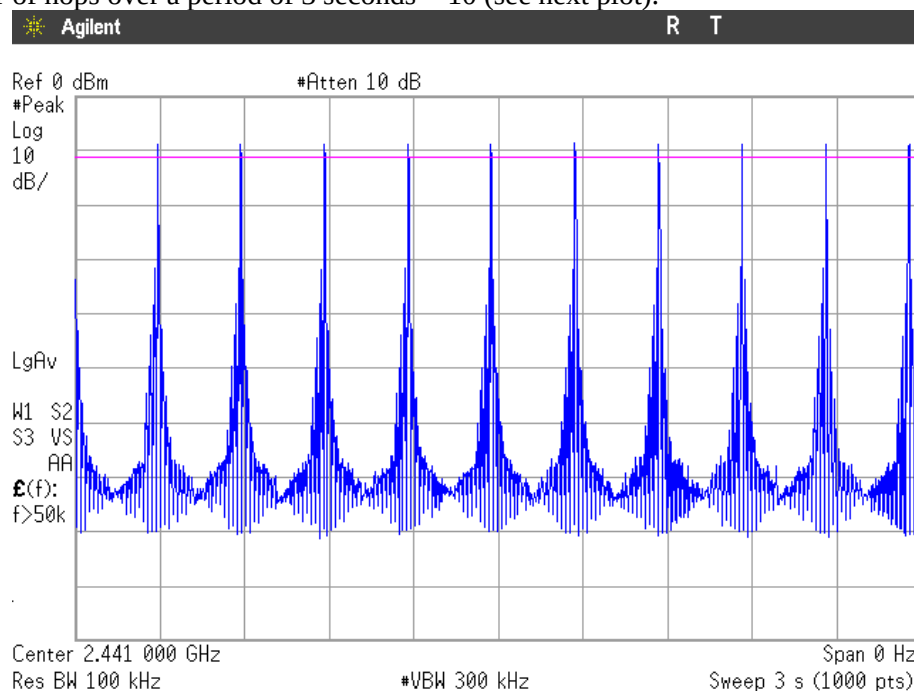
Verdict: PASS

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

- Tx- time per hop = 2.888 ms (see next plot).



- Number of hops over a period of 3 seconds = 10 (see next plot).



Number of hops in the period specified in the requirements = (10 hops) x (31.6 s / 3 s) = 105.33 hops.

Averaging time of occupancy = 2.888 ms x 105.33 hops = 304.19 ms per 31.6 seconds.

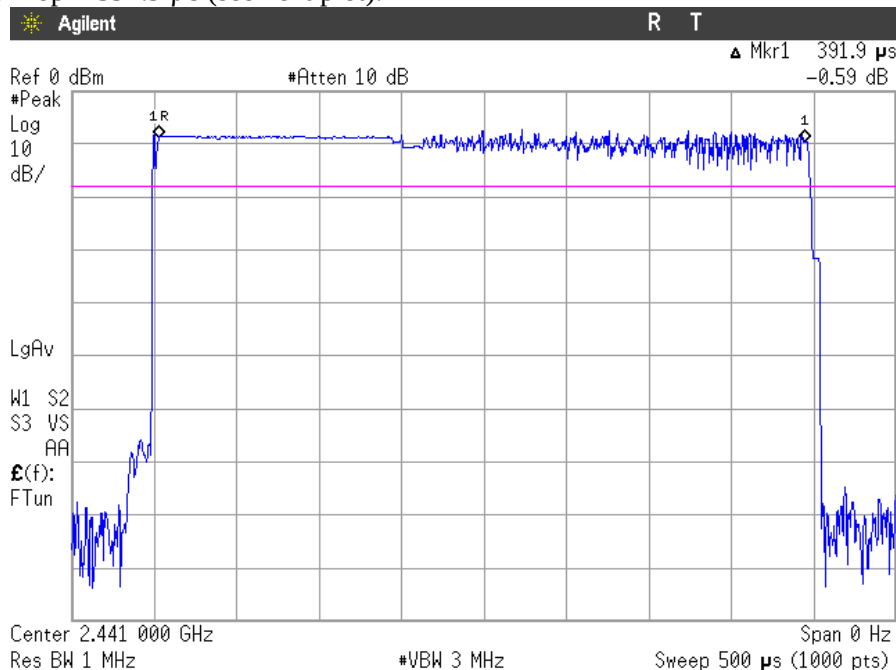
|                             |        |
|-----------------------------|--------|
| Measurement uncertainty (%) | <±0.01 |
|-----------------------------|--------|

Verdict: PASS

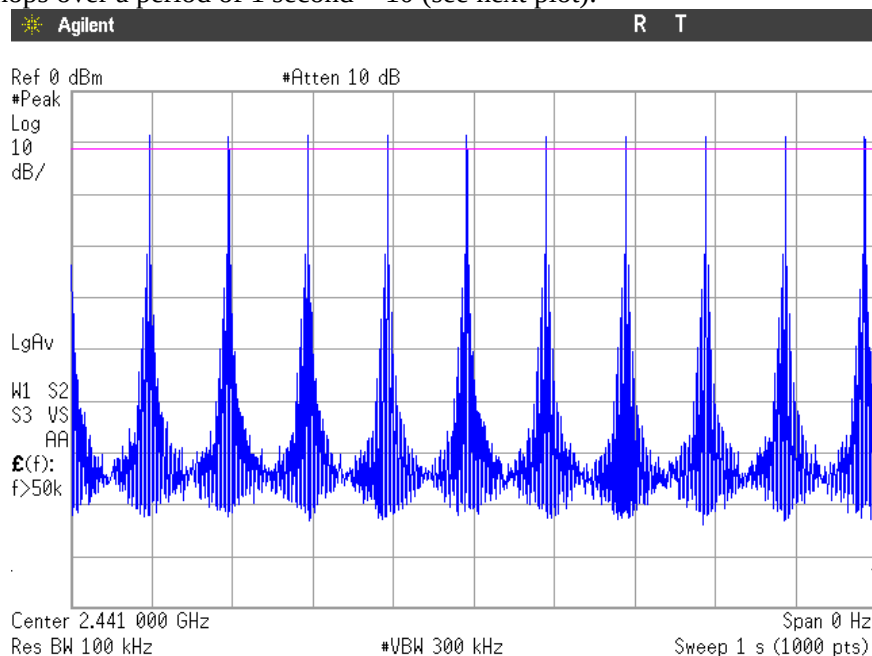
## Modulation: 8-DPSK

### 1. TIME OF OCCUPANCY (DWEELL TIME) FOR PACKET TYPE DH1.

- Tx- time per hop = 391.9  $\mu$ s (see next plot).



- Number of hops over a period of 1 second = 10 (see next plot).



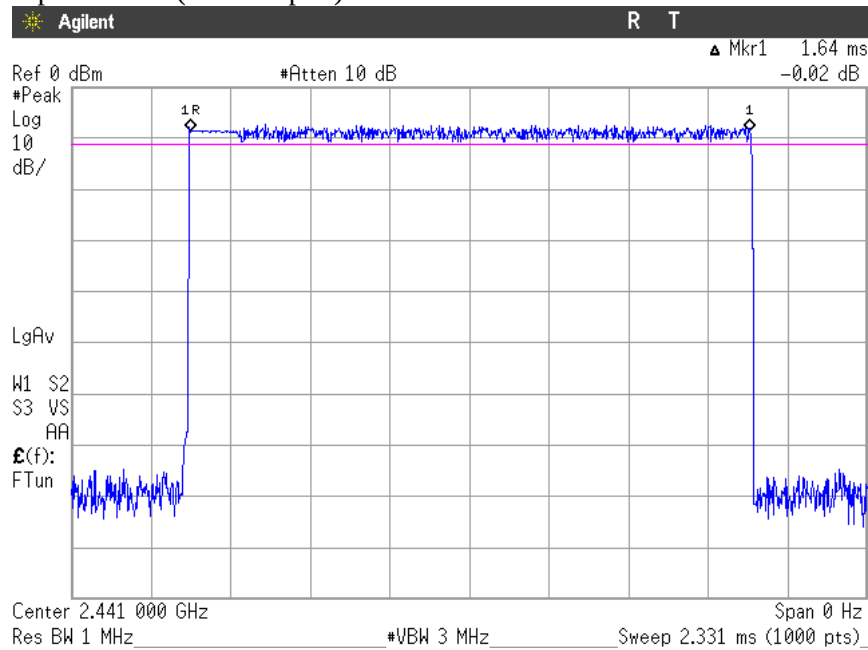
Number of hops in the period specified in the requirements = (10 hops) x (31.6 s / 1 s) = 316 hops.  
Averaging time of occupancy = 391.9  $\mu$ s x 316 hops = 123.84 ms per 31.6 seconds.

|                             |              |
|-----------------------------|--------------|
| Measurement uncertainty (%) | < $\pm$ 0.01 |
|-----------------------------|--------------|

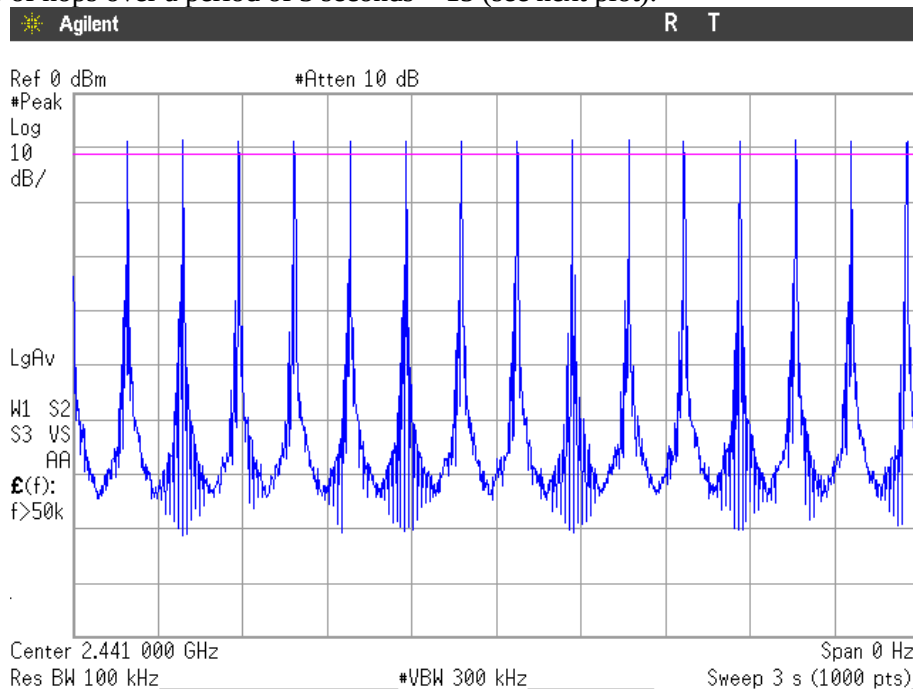
Verdict: PASS

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

- Tx- time per hop = 1.64 ms (see next plot).



- Number of hops over a period of 3 seconds = 15 (see next plot).



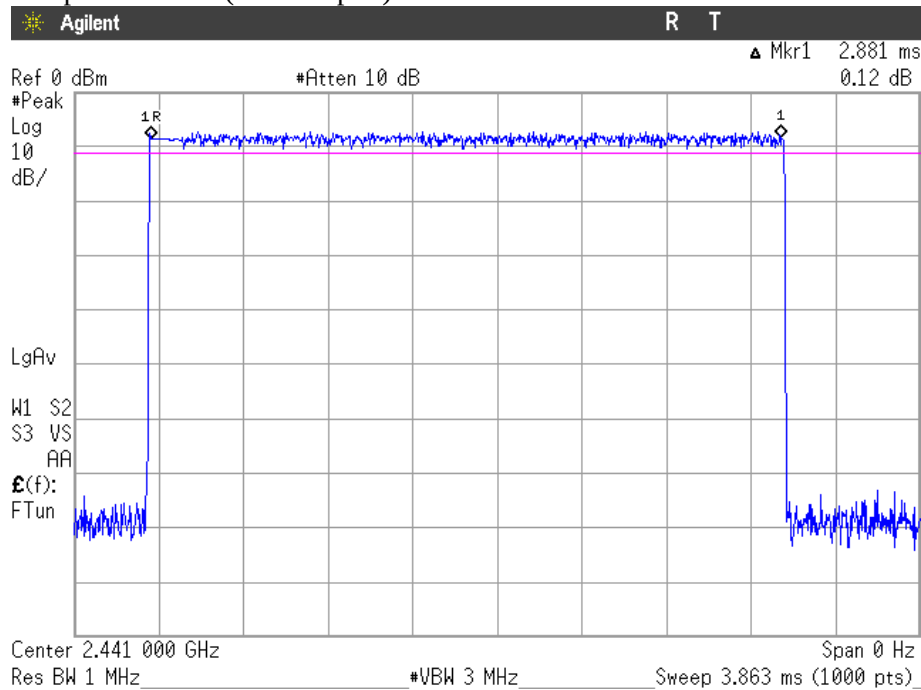
Number of hops in the period specified in the requirements = (15 hops) x (31.6 s / 3 s) = 158 hops.  
Averaging time of occupancy = 1.64 ms x 158 hops = 259.12 ms per 31.6 seconds.

|                             |        |
|-----------------------------|--------|
| Measurement uncertainty (%) | <±0.01 |
|-----------------------------|--------|

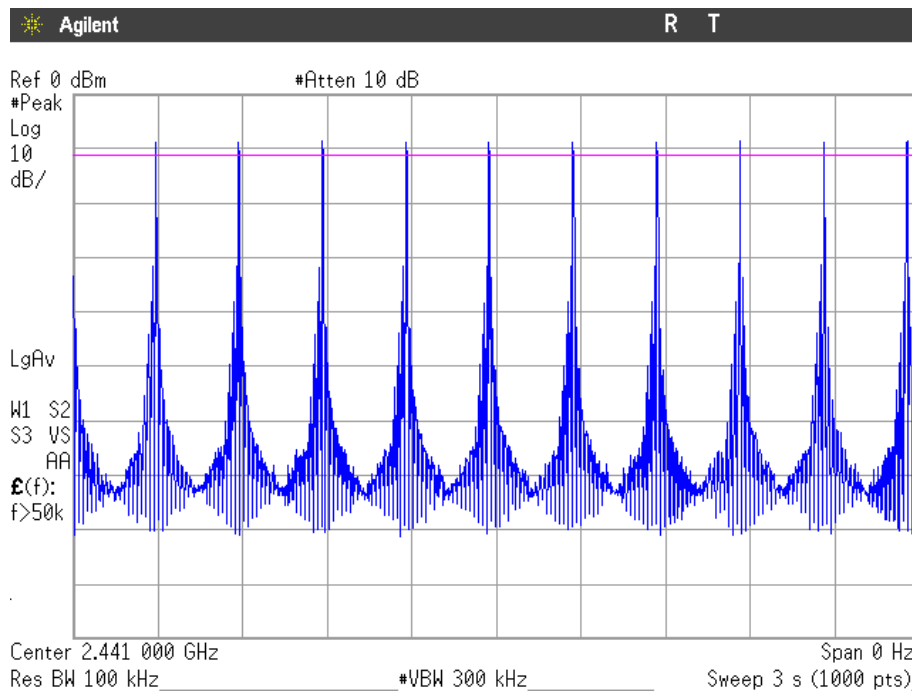
Verdict: PASS

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

- Tx- time per hop = 2.881 ms (see next plot).



- Number of hops over a period of 3 seconds = 10 (see next plot).



Number of hops in the period specified in the requirements = (10 hops) x ( 31.6 s / 3 s ) = 105.33 hops.  
Averaging time of occupancy = 2.881 ms x 105.33 hops = 303.46 ms per 31.6 seconds.

|                             |        |
|-----------------------------|--------|
| Measurement uncertainty (%) | <±0.01 |
|-----------------------------|--------|

Verdict: PASS

## FCC Section 15.247 Subclause (b). 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).

MAXIMUM OUTPUT POWER. See next plots.

Declared maximum antenna gain: -1.85 dBi.

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

Modulation: GFSK

|                              | Lowest frequency<br>2402 MHz | Middle frequency<br>2441 MHz | Highest frequency<br>2480 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum peak power (dBm)     | -5.05                        | -4.29                        | -4.77                         |
| Maximum EIRP power (dBm)     | -6.90                        | -6.14                        | -6.62                         |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

Modulation: Π/4-DQPSK (2Mbps)

|                              | Lowest frequency<br>2402 MHz | Middle frequency<br>2441 MHz | Highest frequency<br>2480 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum peak power (dBm)     | -5.10                        | -4.34                        | -4.80                         |
| Maximum EIRP power (dBm)     | -6.95                        | -6.19                        | -6.65                         |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

Modulation: 8-DPSK (3Mbps)

|                              | Lowest frequency<br>2402 MHz | Middle frequency<br>2441 MHz | Highest frequency<br>2480 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum peak power (dBm)     | -5.14                        | -4.34                        | -4.83                         |
| Maximum EIRP power (dBm)     | -6.99                        | -6.19                        | -6.68                         |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

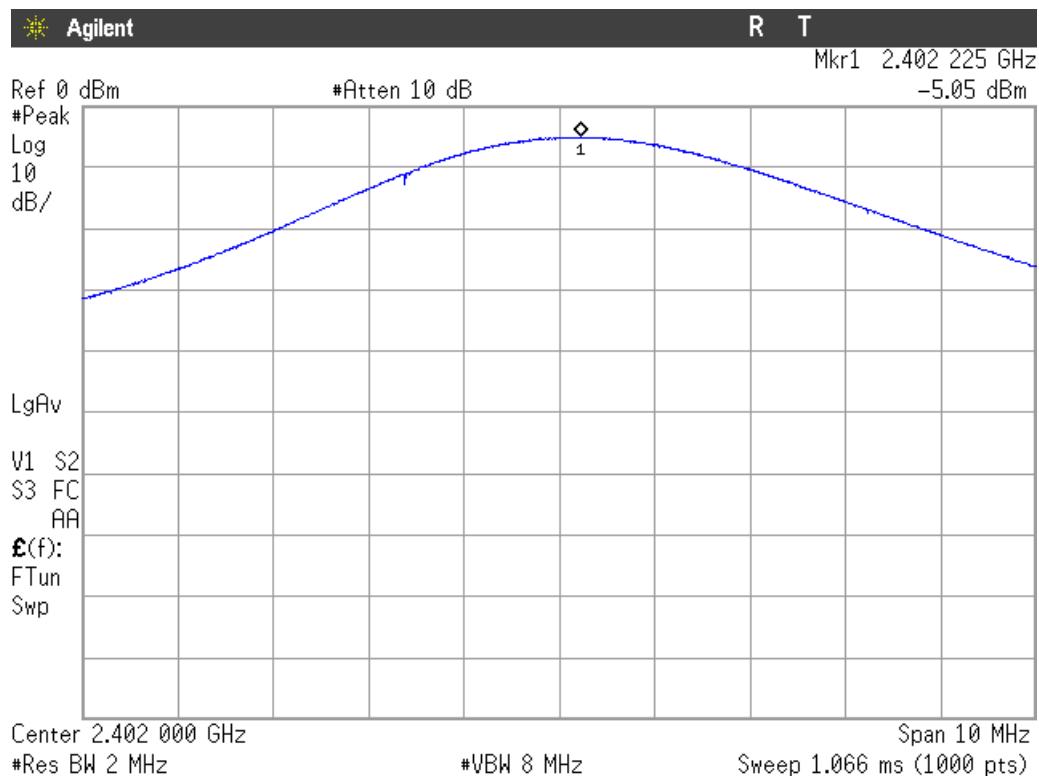
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

## PEAK OUTPUT POWER (CONDUCTED).

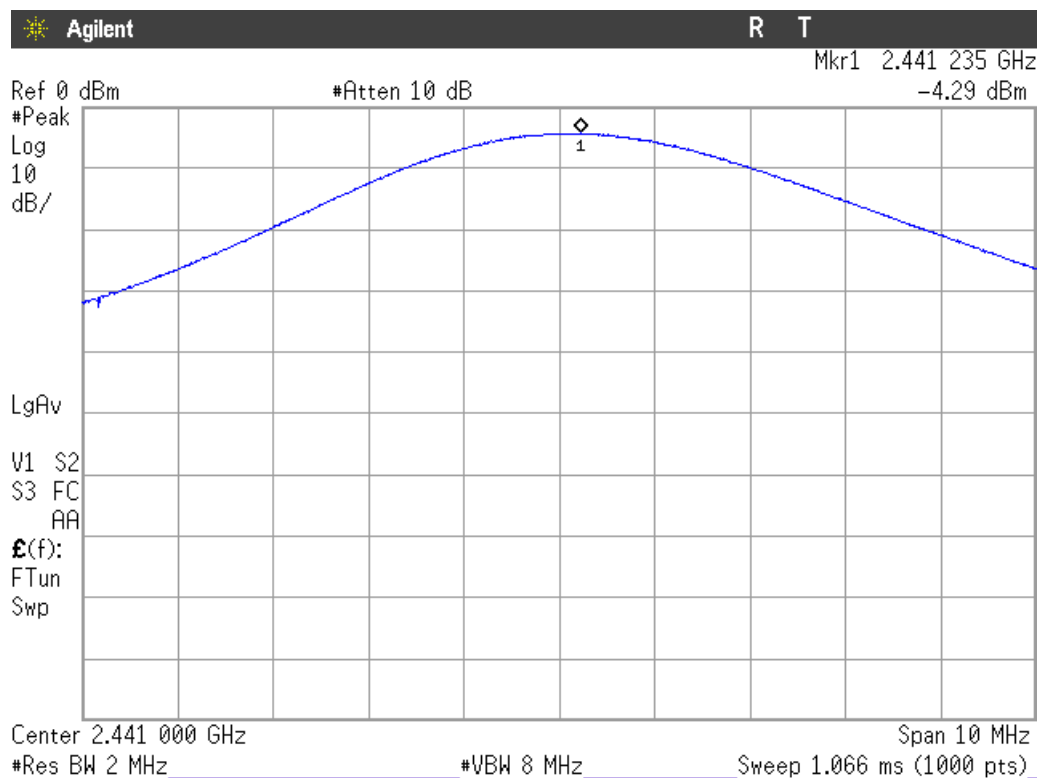
Modulation: GFSK

Lowest Channel: 2402 MHz.



Modulation: GFSK

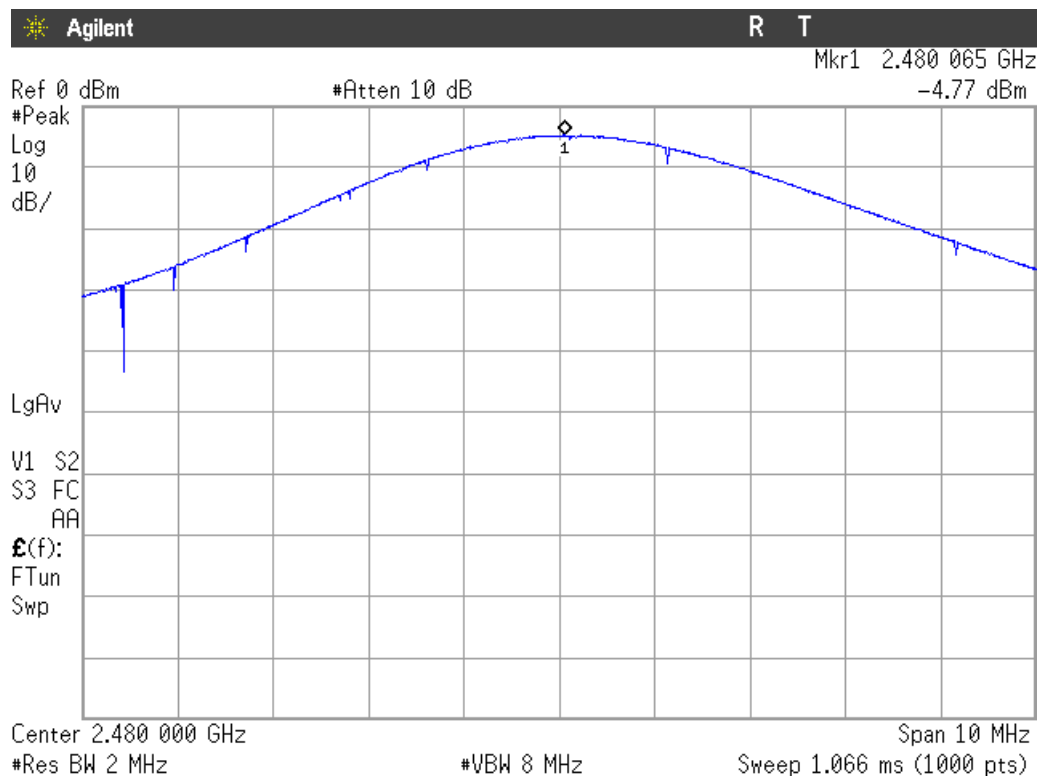
Middle Channel: 2441 MHz.



## PEAK OUTPUT POWER (CONDUCTED).

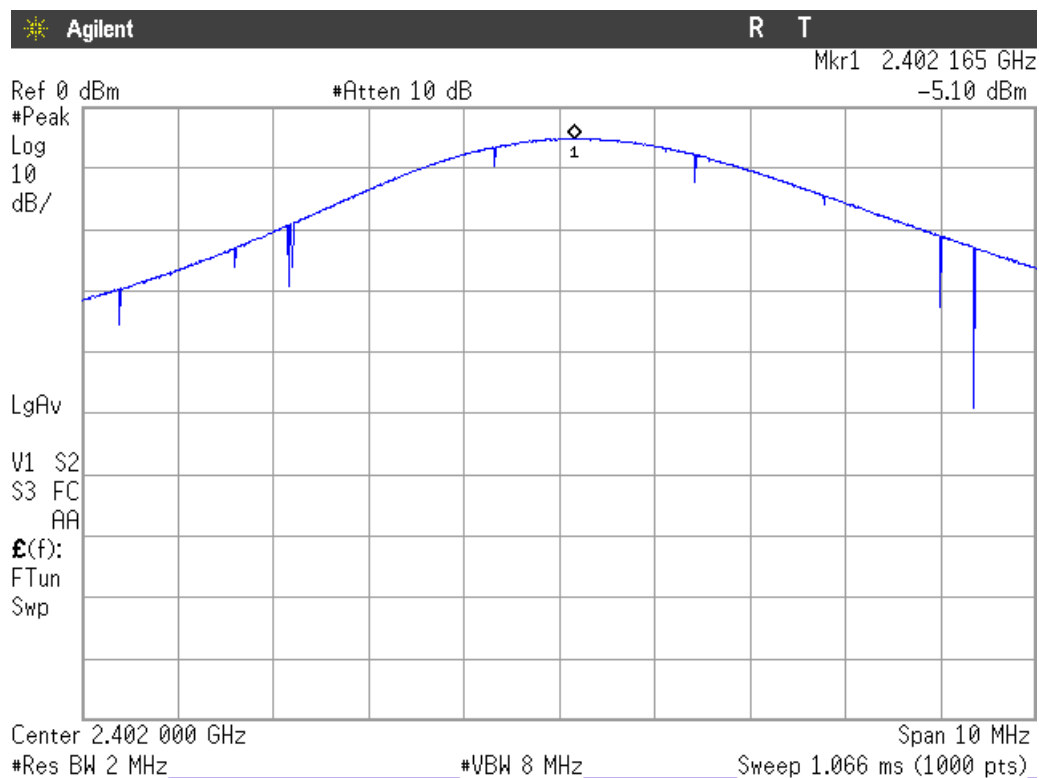
Modulation: GFSK

Highest Channel: 2480 MHz.



Modulation:  $\Pi/4$ -DQPSK

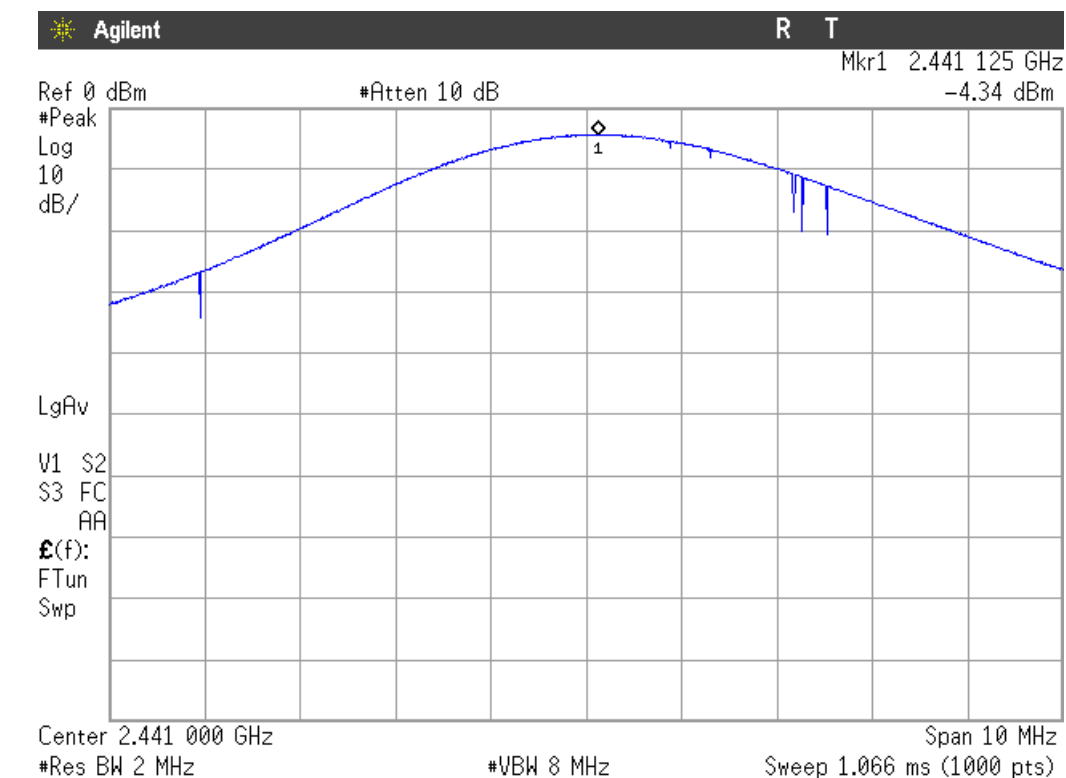
Lowest Channel: 2402 MHz



## PEAK OUTPUT POWER (CONDUCTED)

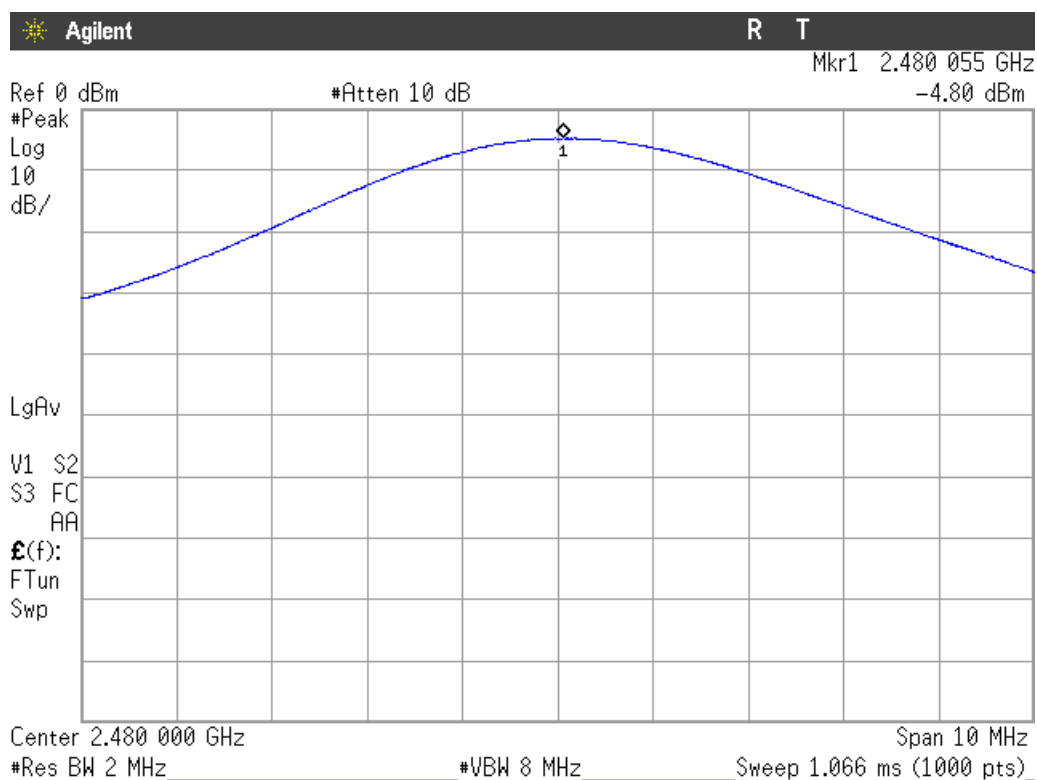
Modulation:  $\Pi/4$ -DQPSK

Middle Channel: 2441 MHz.



Modulation:  $\Pi/4$ -DQPSK

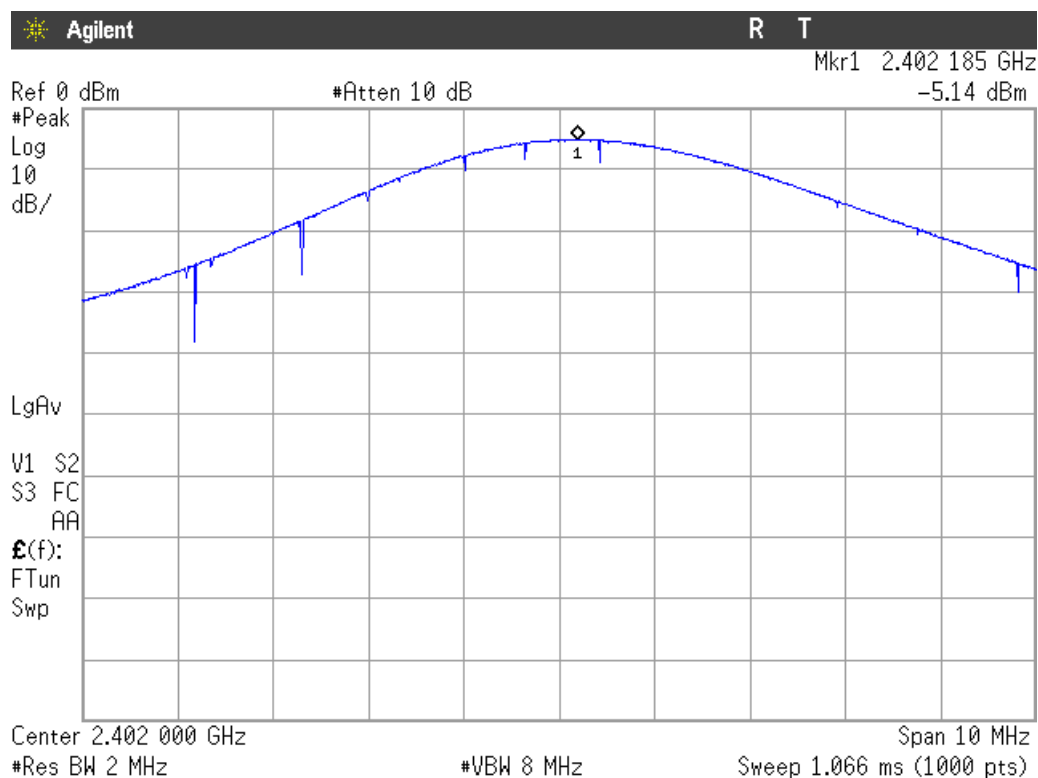
Highest Channel: 2480 MHz.



## PEAK OUTPUT POWER (CONDUCTED).

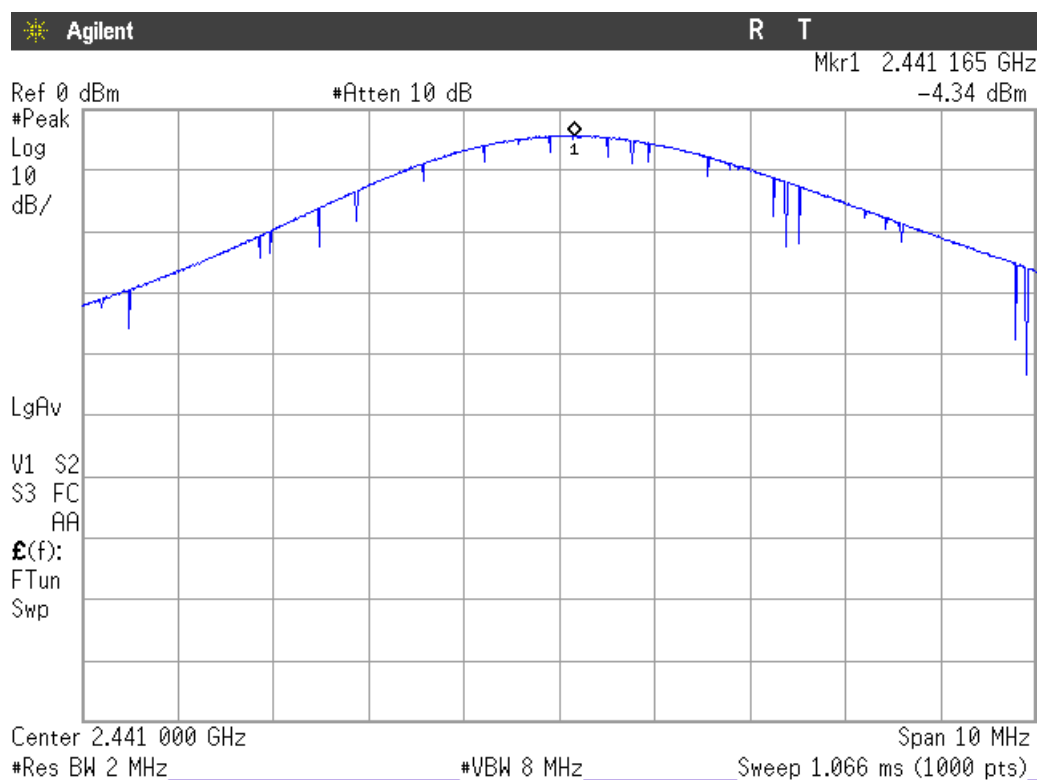
Modulation: 8-DPSK

Lowest Channel: 2402 MHz



Modulation: 8-DPSK

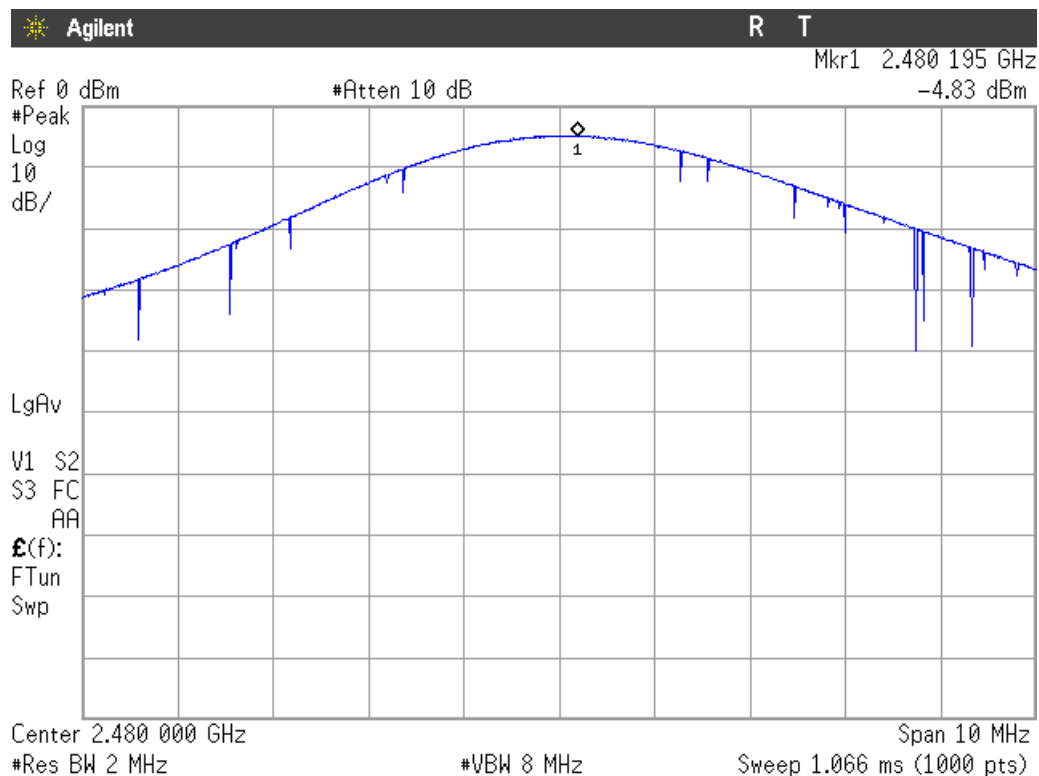
Middle Channel: 2441 MHz.



## PEAK OUTPUT POWER (CONDUCTED).

Modulation: 8-DPSK

Highest Channel: 2480 MHz.



## FCC Section 15.247 Subclause (d). Band-edge compliance of conducted emissions (Transmitter)

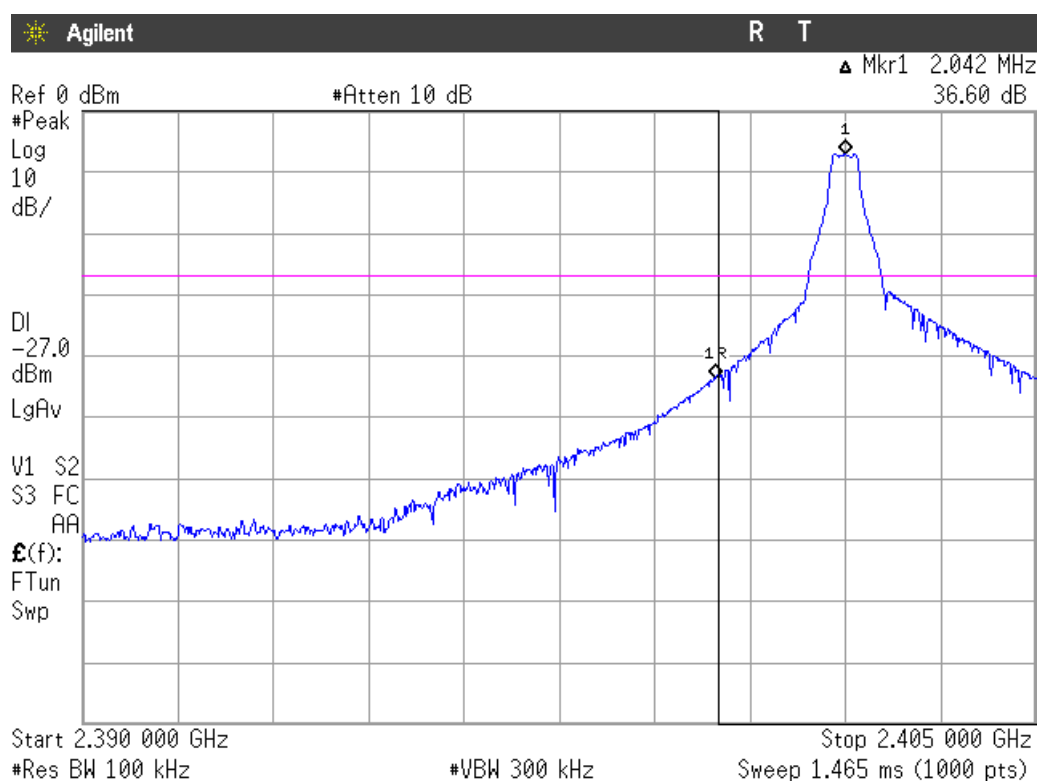
### SPECIFICATION

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

### RESULTS:

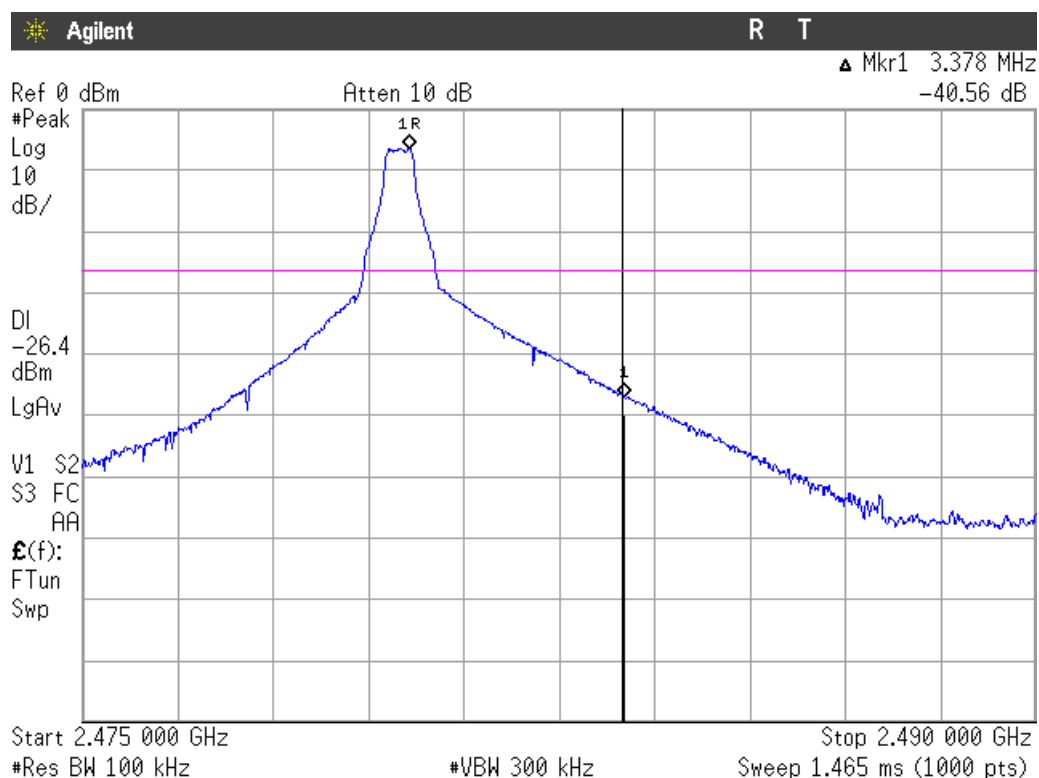
**Modulation: GFSK**

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



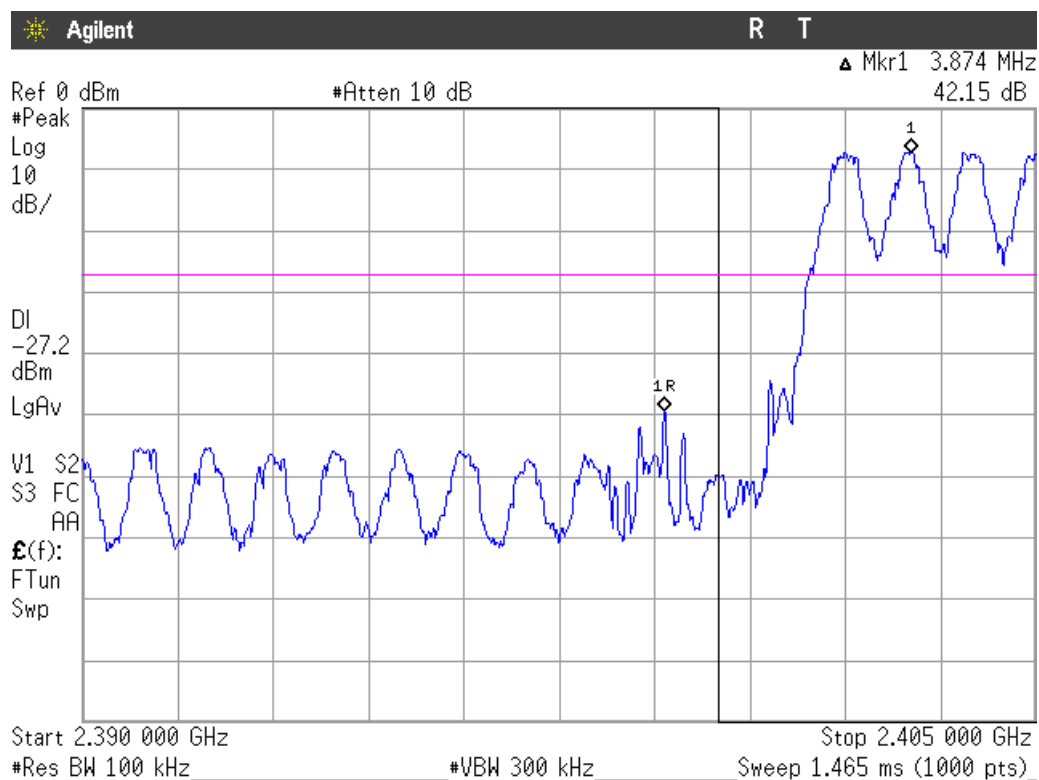
Verdict: PASS

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



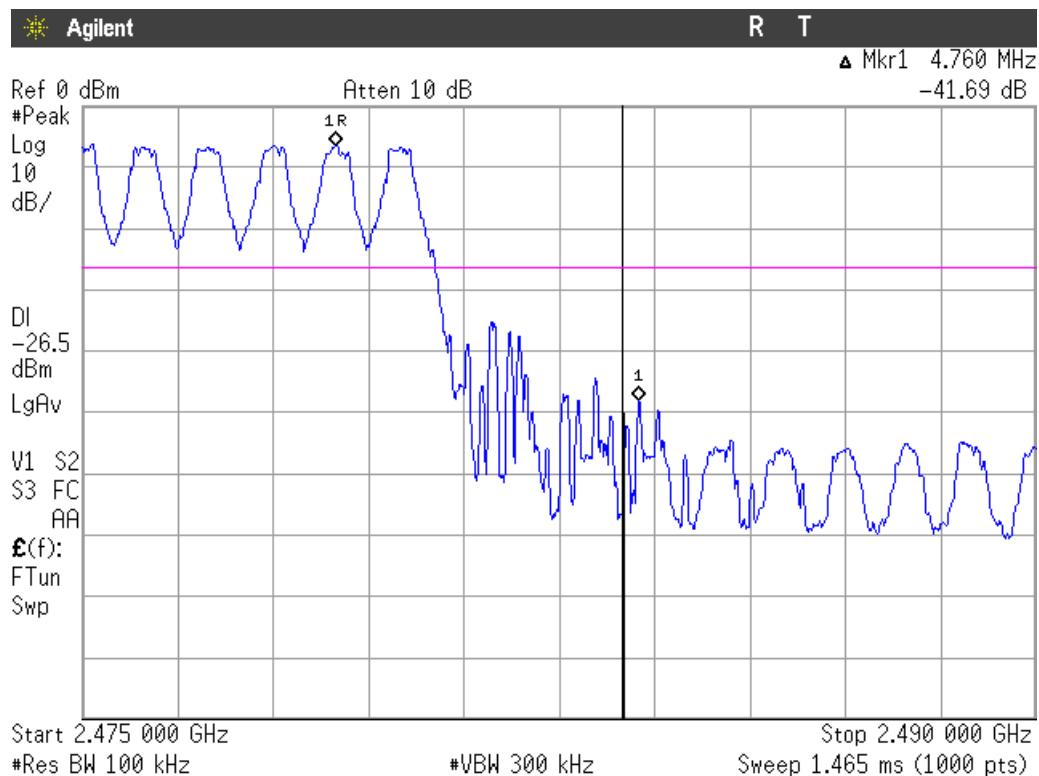
Verdict: PASS

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



Verdict: PASS

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

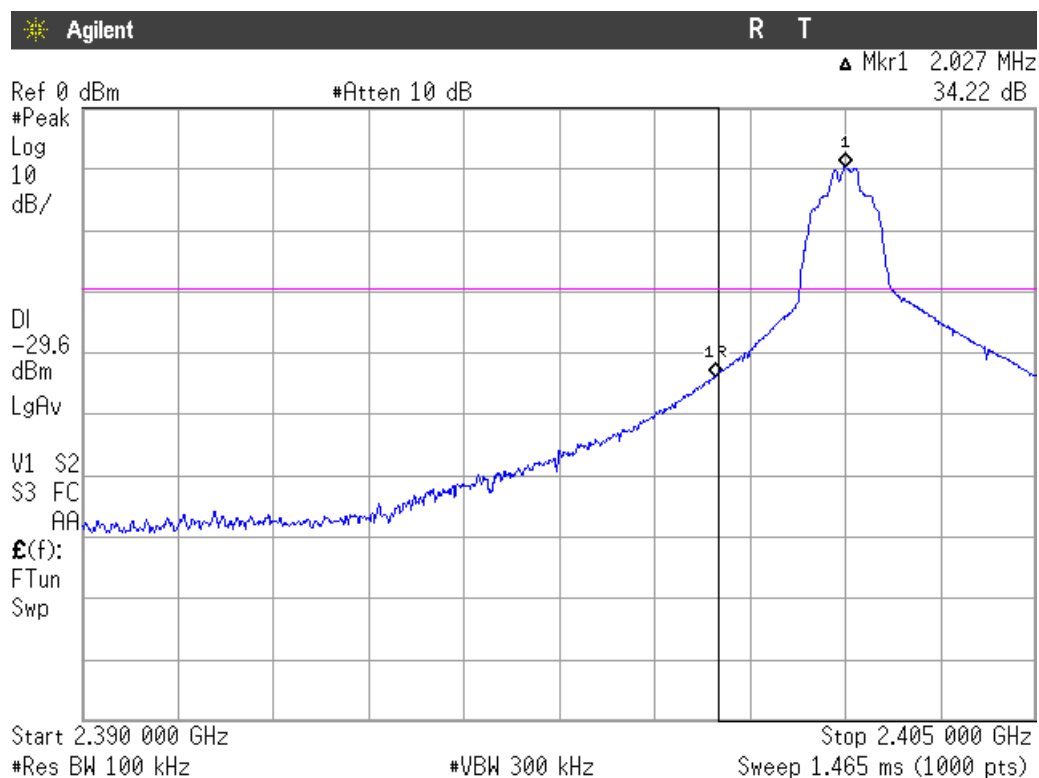


Verdict: PASS

|                              |        |
|------------------------------|--------|
| Measurement uncertainty (dB) | <±2.03 |
|------------------------------|--------|

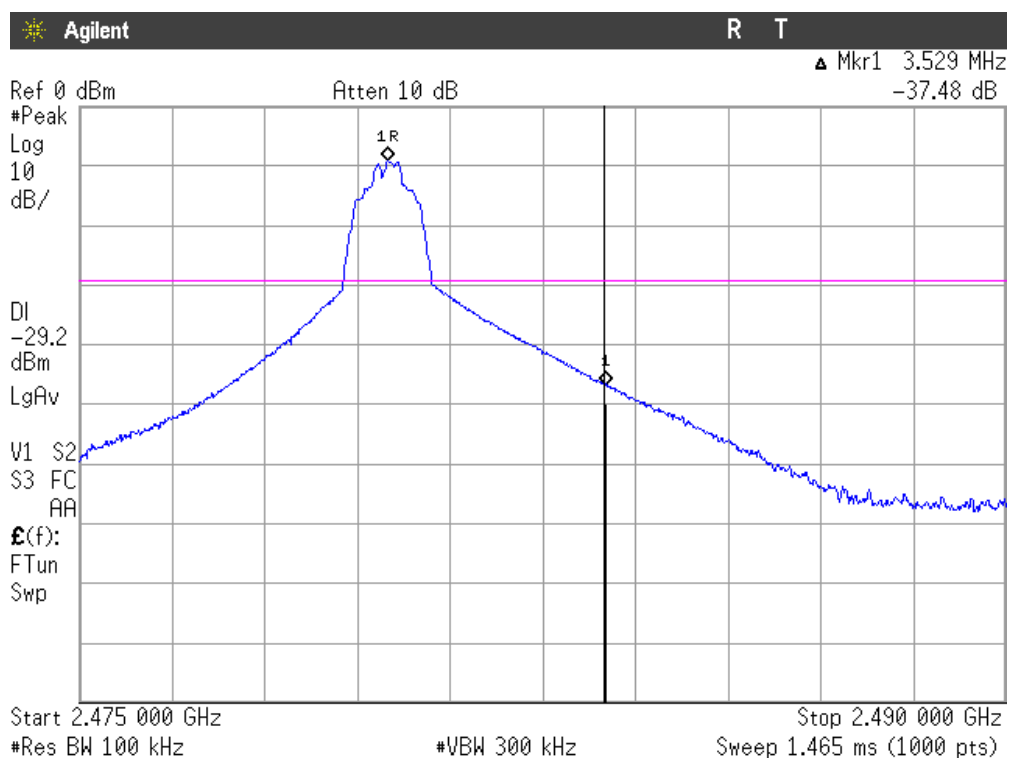
## Modulation: $\Pi/4$ -DQPSK

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



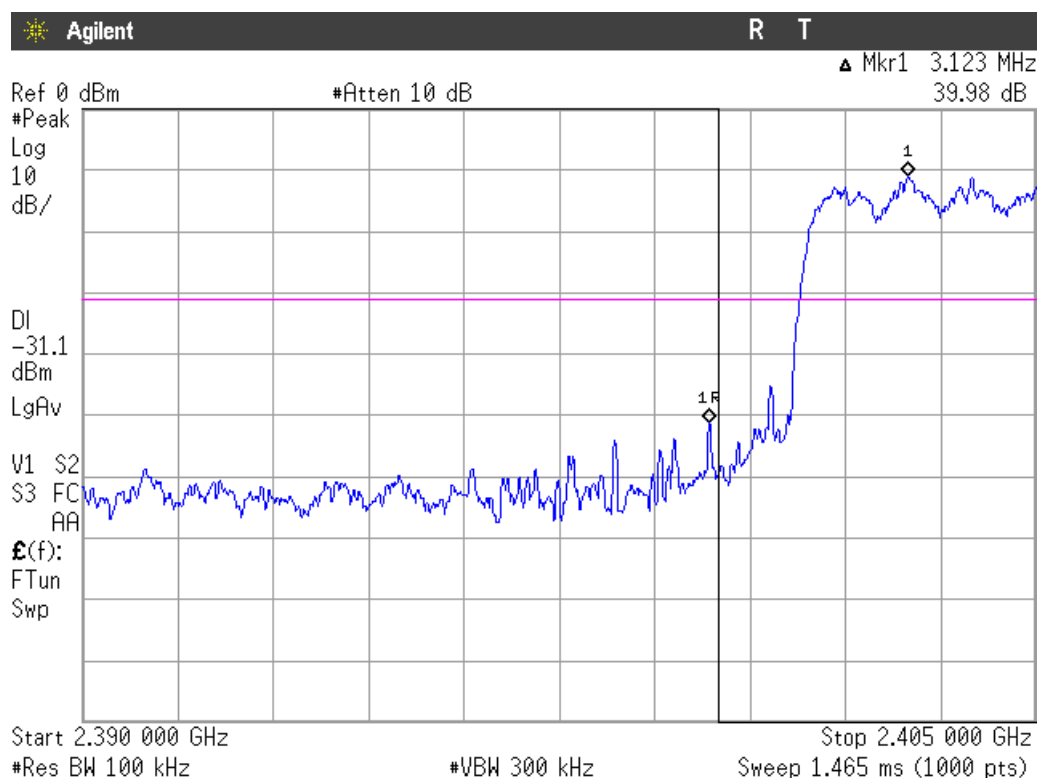
Verdict: PASS

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



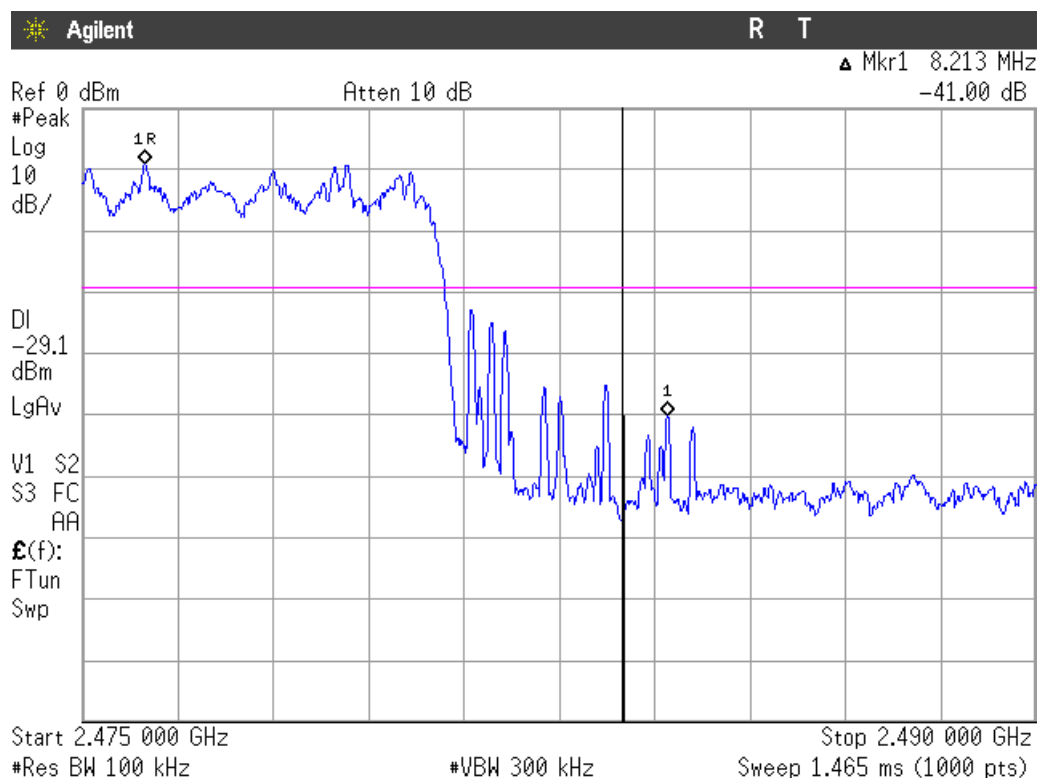
Verdict: PASS

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



Verdict: PASS

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

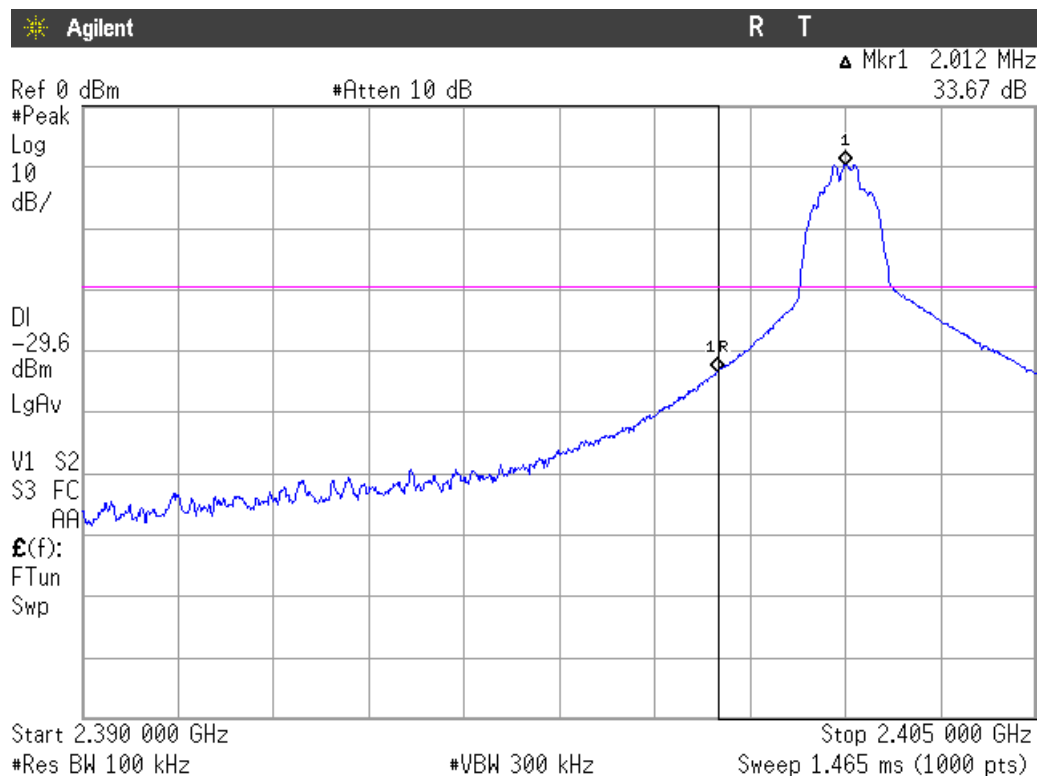


Verdict: PASS

|                              |        |
|------------------------------|--------|
| Measurement uncertainty (dB) | <±2.03 |
|------------------------------|--------|

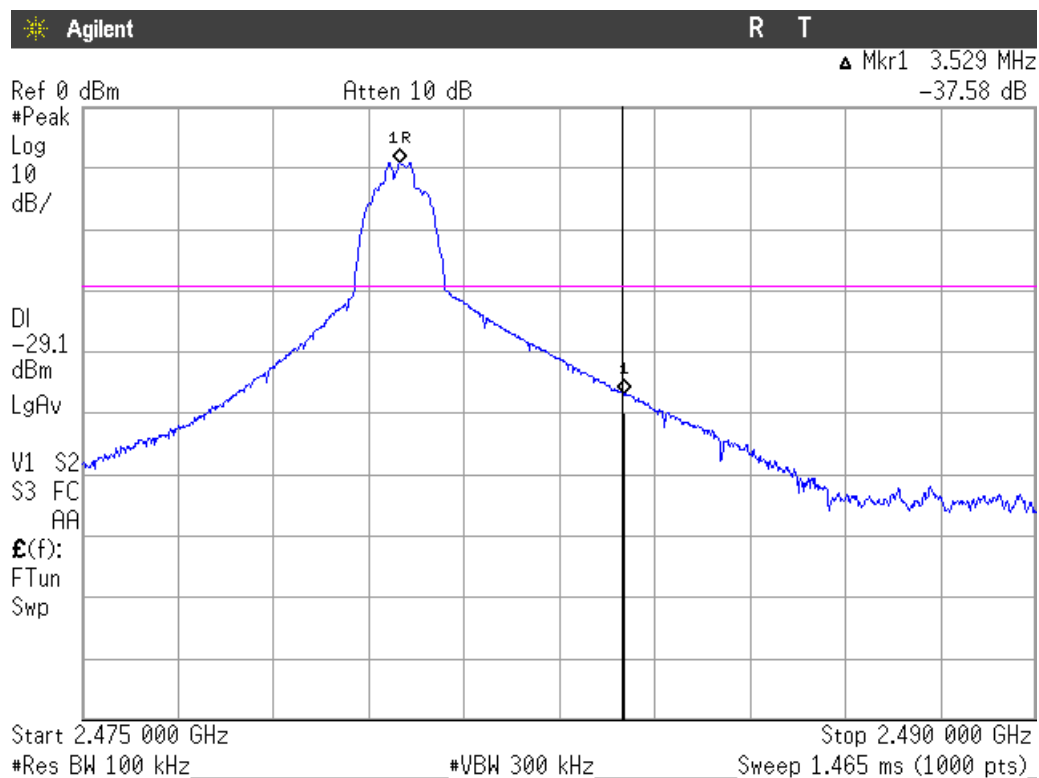
## Modulation: 8-DPSK

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



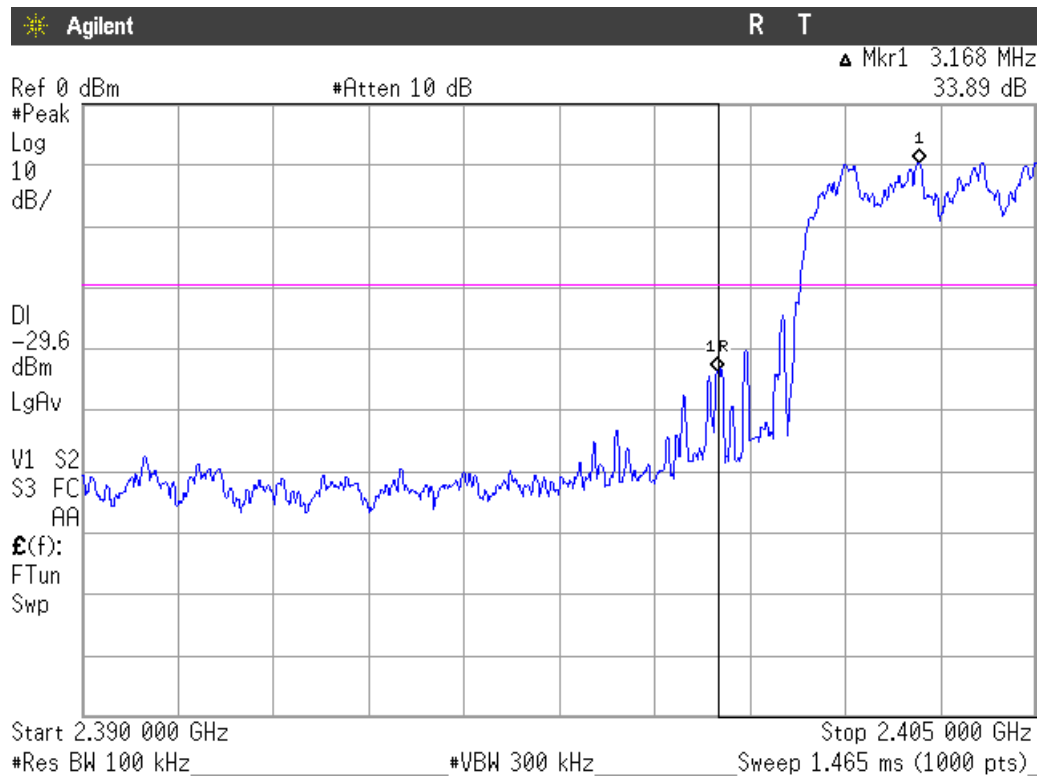
Verdict: PASS

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



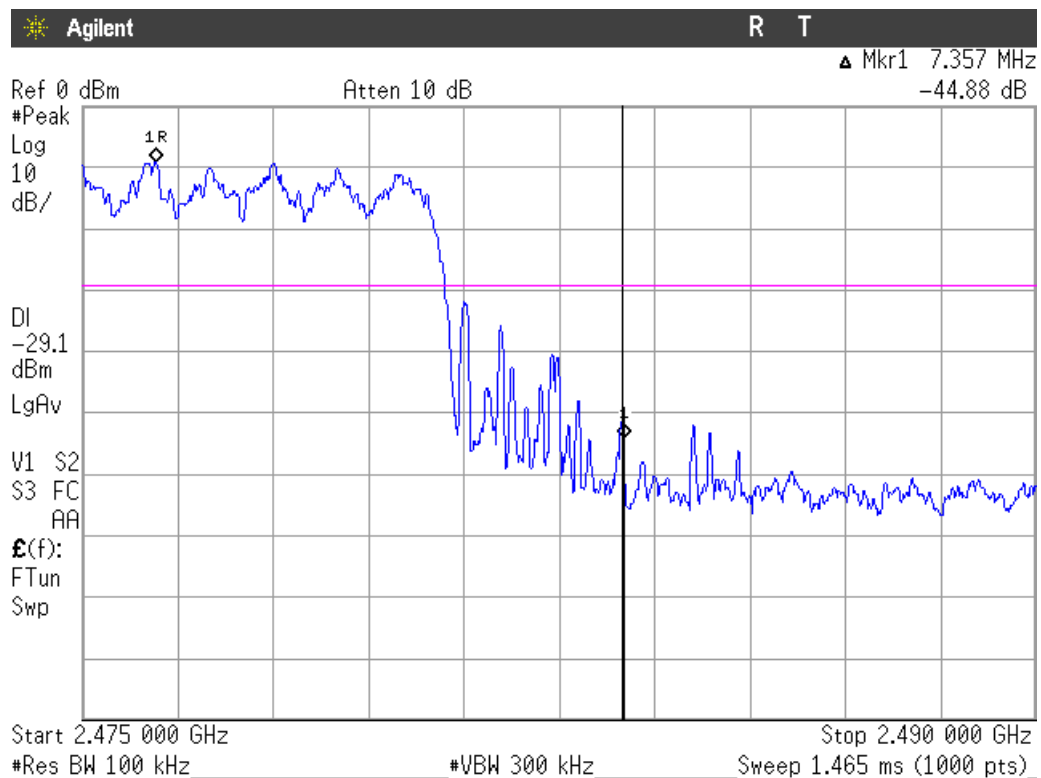
Verdict: PASS

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



Verdict: PASS

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



Verdict: PASS

|                              |        |
|------------------------------|--------|
| Measurement uncertainty (dB) | <±2.03 |
|------------------------------|--------|

## FCC Section 15.247 Subclause (d). 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:

#### **Modulation: GFSK**

1. LOW CHANNEL (2402 MHz).  
All peaks are more than 20 dB below the limit.
2. MIDDLE CHANNEL (2441 MHz)  
All peaks are more than 20 dB below the limit.
3. HIGH CHANNEL (2480 MHz)  
All peaks are more than 20 dB below the limit.

#### **Modulation: $\Pi/4$ -DQPSK**

1. LOW CHANNEL (2402 MHz).  
All peaks are more than 20 dB below the limit.
2. MIDDLE CHANNEL (2441 MHz)  
All peaks are more than 20 dB below the limit.
3. HIGH CHANNEL (2480 MHz)  
All peaks are more than 20 dB below the limit.

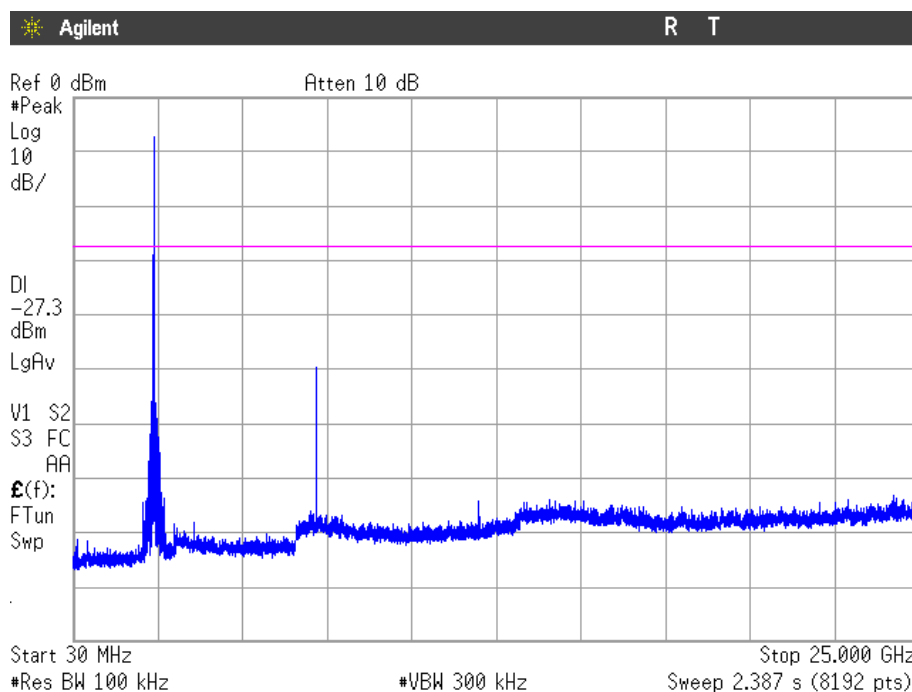
#### **Modulation: 8-DPSK**

1. LOW CHANNEL (2402 MHz).  
All peaks are more than 20 dB below the limit.
2. MIDDLE CHANNEL (2441 MHz)  
All peaks are more than 20 dB below the limit.
3. HIGH CHANNEL (2480 MHz)  
All peaks are more than 20 dB below the limit.

Verdict: PASS

## Modulation: GFSK

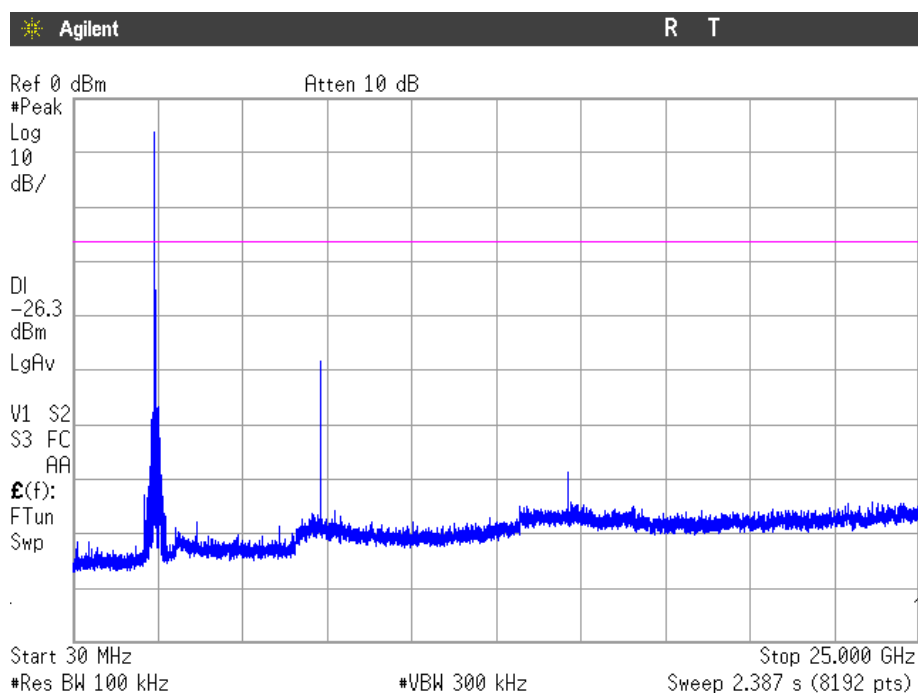
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).



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

Verdict: PASS

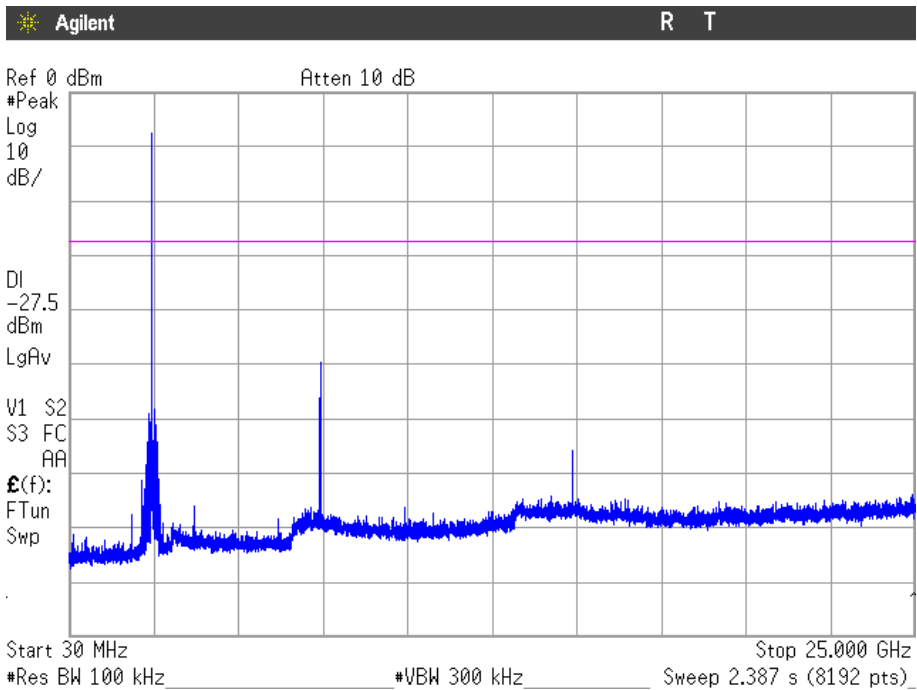
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).



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

Verdict: PASS

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



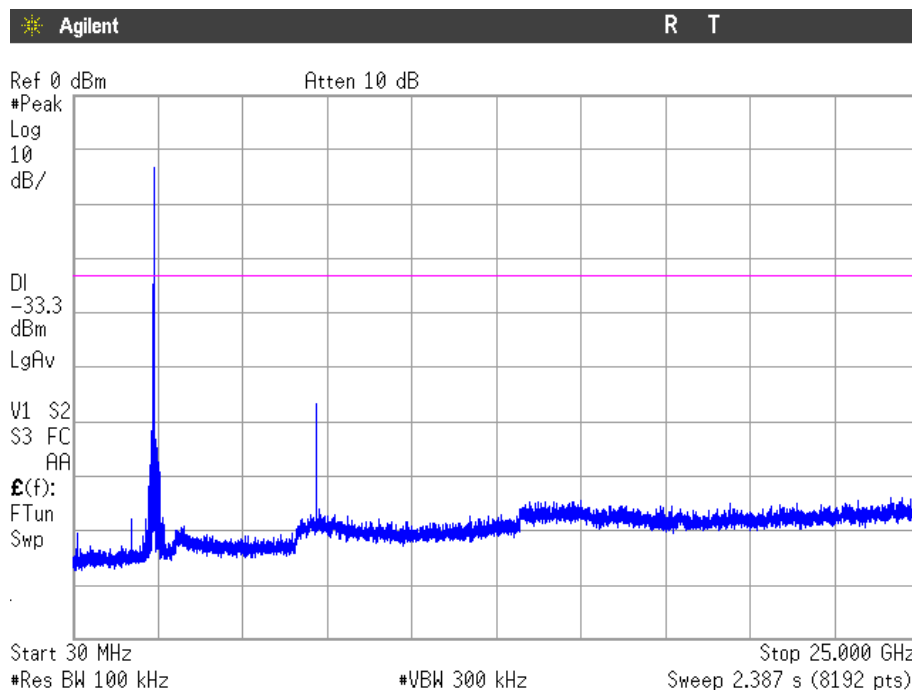
Note: The peak above the limits is the carrier frequency.

Verdict: PASS

|                              |        |
|------------------------------|--------|
| Measurement uncertainty (dB) | <±2.03 |
|------------------------------|--------|

## Modulation: $\Pi/4$ -DQPSK

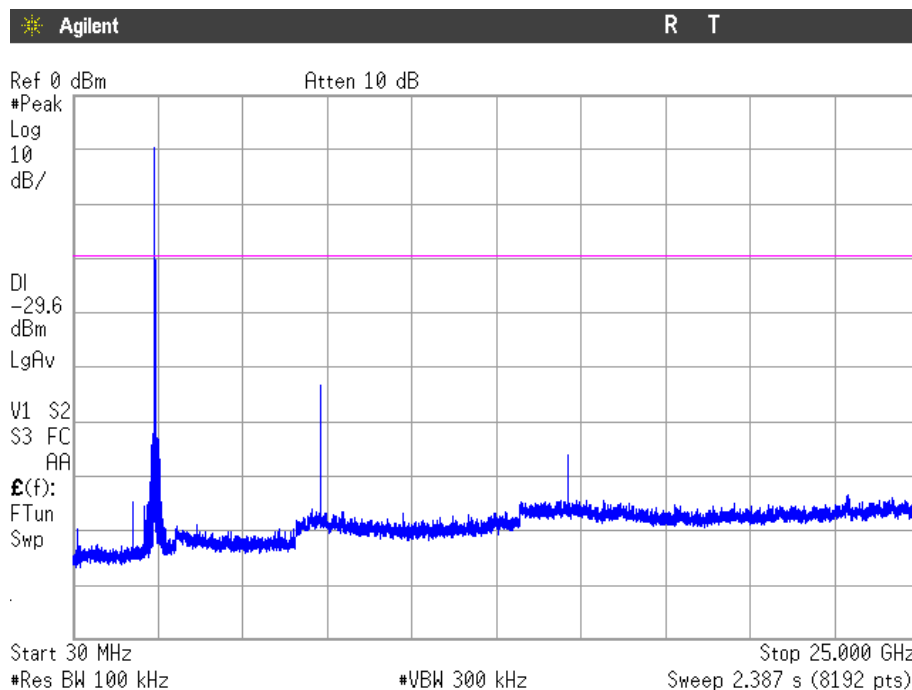
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).



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

Verdict: PASS

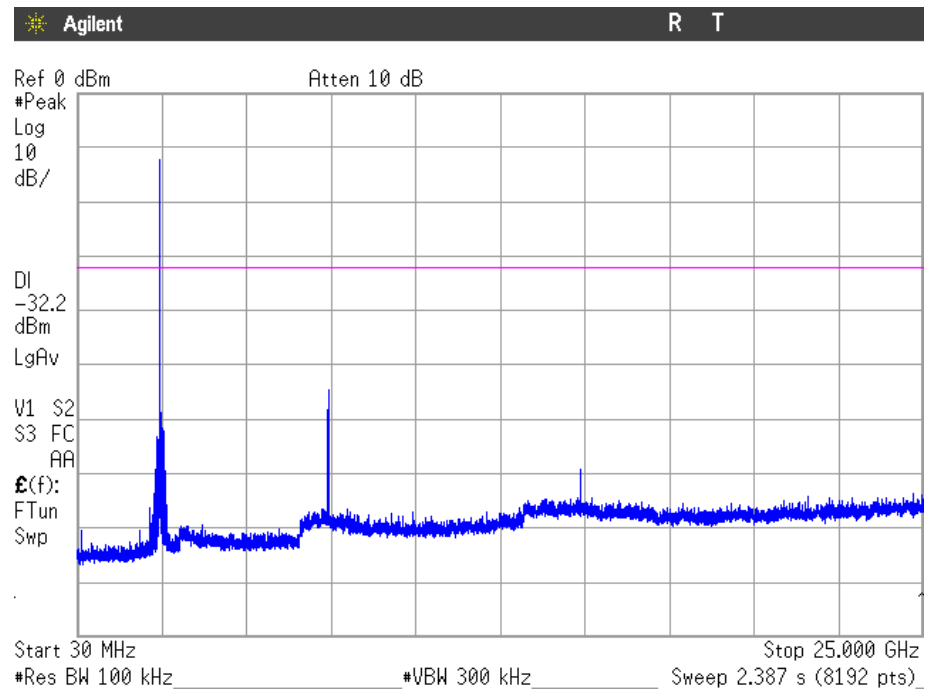
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).



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

Verdict: PASS

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



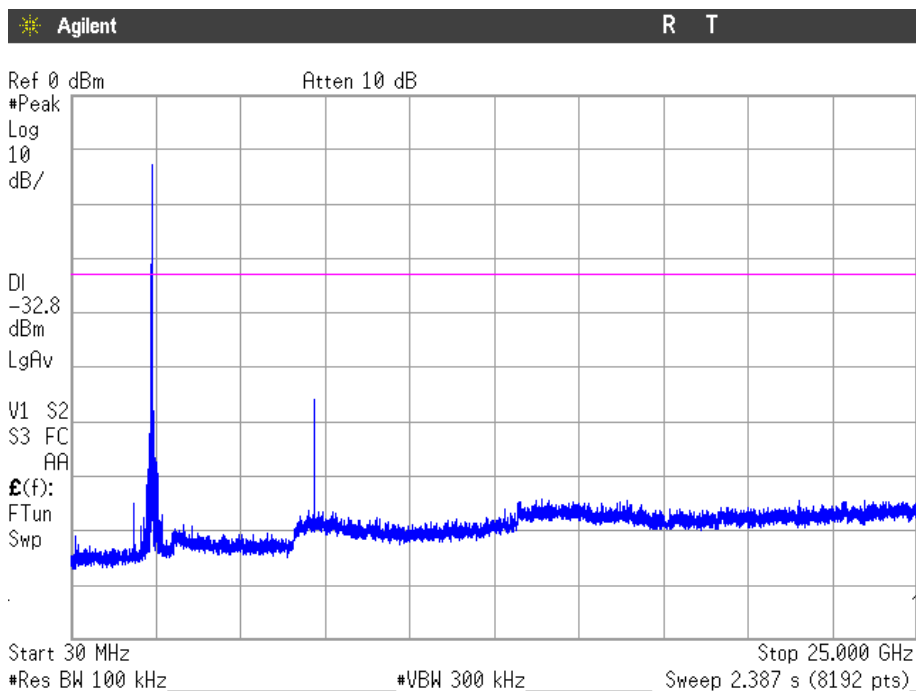
Note: The peak above the limit is the carrier frequency.

Verdict: PASS

|                              |        |
|------------------------------|--------|
| Measurement uncertainty (dB) | <±2.03 |
|------------------------------|--------|

## Modulation: 8-DPSK

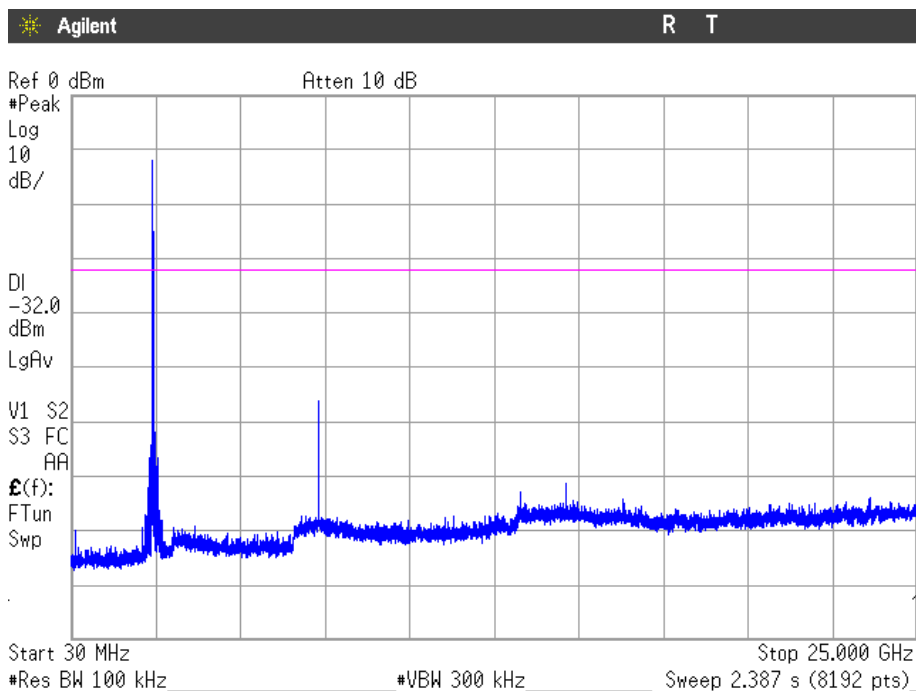
1. LOWEST CHANNEL (2402 MHz): 30 MHz-25 GHz (see next plot).



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

Verdict: PASS

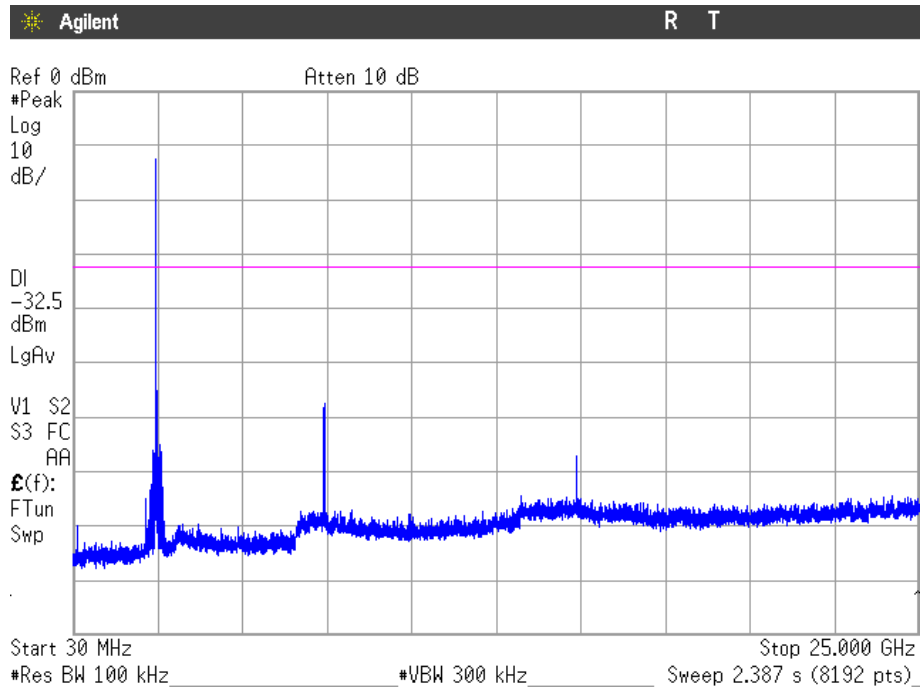
2. MIDDLE CHANNEL (2441 MHz): 30 MHz-25 GHz (see next plot).



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

|                              |        |
|------------------------------|--------|
| Measurement uncertainty (dB) | <±2.03 |
|------------------------------|--------|

## FCC Section 15.247 Subclause (d).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 ( $\mu\text{V/m}$ ) | Field strength ( $\text{dB}\mu\text{V/m}$ ) | Measurement distance (m) |
|-----------------------|------------------------------------|---------------------------------------------|--------------------------|
| 0.009-0.490           | 2400/F(kHz)                        | -                                           | 300                      |
| 0.490-1.705           | 24000/F(kHz)                       | -                                           | 30                       |
| 1.705 - 30.0          | 30                                 | -                                           | 30                       |
| 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 360° 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.

### 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.

Spurious levels operating (radiated) closest to limit.

| Spurious frequency (MHz) | Polarization | Detector   | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|------------|-------------------------------|------------------------------|
| 143.975                  | V            | Quasi-Peak | 30.23                         | $\pm 3.88$                   |
| 170.747                  | V            | Quasi-Peak | 30.93                         | $\pm 3.88$                   |
| 615.977                  | H            | Quasi-Peak | 34.67                         | $\pm 3.88$                   |
| 624.028                  | V            | Quasi-Peak | 30.23                         | $\pm 3.88$                   |
| 640.033                  | H            | Quasi-Peak | 33.90                         | $\pm 3.88$                   |
| 656.038                  | V            | Quasi-Peak | 30.53                         | $\pm 3.88$                   |
| 663.992                  | H            | Quasi-Peak | 35.65                         | $\pm 3.88$                   |
| 672.043                  | H            | Quasi-Peak | 36.73                         | $\pm 3.88$                   |
| 679.997                  | H            | Quasi-Peak | 37.01                         | $\pm 3.88$                   |
| 744.017                  | H            | Quasi-Peak | 33.99                         | $\pm 3.88$                   |
| 751.971                  | H            | Quasi-Peak | 34.35                         | $\pm 3.88$                   |

## Frequency range 1 GHz-25 GHz

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

Modulation: GFSK

### 1. CHANNEL: LOWEST (2402 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03217                  | V            | Peak     | 46.09                   | ± 4.87                       |
| 1.08010                  | V            | Peak     | 41.25                   | ± 4.87                       |
| 1.12810                  | H            | Peak     | 45.03                   | ± 4.87                       |
| 3.60275                  | V            | Peak     | 38.27                   | ± 4.87                       |
| 4.80375                  | V            | Peak     | 44.61                   | ± 4.87                       |
| 7.20525 (*)              | H            | Peak     | 60.84                   | ± 4.69                       |
|                          |              | Average  | 58.15                   | ± 4.69                       |
| 12.00975                 | V            | Peak     | 50.73                   | ± 4.87                       |

(\*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 84.45 dBμV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

### 2. CHANNEL: MIDDLE (2441 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03210                  | V            | Peak     | 46.50                   | ± 4.87                       |
| 1.08017                  | V            | Peak     | 44.06                   | ± 4.87                       |
| 1.12817                  | H            | Peak     | 44.35                   | ± 4.87                       |
| 1.17623                  | H            | Peak     | 44.28                   | ± 4.87                       |
| 3.66175                  | V            | Peak     | 39.32                   | ± 4.87                       |
| 4.88225                  | V            | Peak     | 47.94                   | ± 4.87                       |
| 7.32225                  | H            | Peak     | 57.40                   | ± 4.69                       |
|                          |              | Average  | 53.99                   | ± 4.69                       |
| 12.20525                 | V            | Peak     | 48.46                   | ± 4.87                       |

### 3. CHANNEL: HIGHEST (2480 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03197                  | V            | Peak     | 46.48                   | ± 4.87                       |
| 1.07990                  | H            | Peak     | 45.76                   | ± 4.87                       |
| 1.12817                  | H            | Peak     | 44.73                   | ± 4.87                       |
| 2.48357                  | V            | Peak     | 61.23                   | ± 4.87                       |
|                          |              | Average  | 38.32                   | ± 4.87                       |
| 3.17975                  | H            | Peak     | 40.67                   | ± 4.87                       |
| 4.95975                  | V            | Peak     | 48.75                   | ± 4.87                       |
| 7.44025                  | H            | Peak     | 54.17                   | ± 4.87                       |
|                          |              | Average  | 51.61                   | ± 4.87                       |

Verdict: PASS

Modulation: Π/4-DQPSK

### 1. CHANNEL: LOWEST (2402 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03210                  | V            | Peak     | 45.34                   | ± 4.87                       |
| 1.08003                  | H            | Peak     | 45.70                   | ± 4.87                       |
| 1.12803                  | H            | Peak     | 44.81                   | ± 4.87                       |
| 4.80425                  | V            | Peak     | 42.99                   | ± 4.87                       |
| 7.20625                  | H            | Peak     | 58.13                   | ± 4.87                       |
|                          |              | Average  | 53.92                   | ± 4.87                       |

## 2. CHANNEL: MIDDLE (2441 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03197                  | V            | Peak     | 46.05                         | $\pm 4.87$                   |
| 1.08010                  | V            | Peak     | 43.22                         | $\pm 4.87$                   |
| 1.12810                  | H            | Peak     | 44.82                         | $\pm 4.87$                   |
| 3.66125                  | V            | Peak     | 39.79                         | $\pm 4.87$                   |
| 4.88175                  | V            | Peak     | 46.03                         | $\pm 4.87$                   |
| 7.32325                  | V            | Peak     | 56.55                         | $\pm 4.87$                   |
|                          |              | Average  | 51.87                         | $\pm 4.87$                   |

## 3. CHANNEL: HIGHEST (2480 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03203                  | V            | Peak     | 45.60                         | $\pm 4.87$                   |
| 1.08023                  | H            | Peak     | 45.29                         | $\pm 4.87$                   |
| 1.17597                  | H            | Peak     | 44.55                         | $\pm 4.87$                   |
| 2.48354                  | V            | Peak     | 61.47                         | $\pm 4.87$                   |
|                          |              | Average  | 37.91                         | $\pm 4.87$                   |
| 3.71975                  | V            | Peak     | 39.80                         | $\pm 4.87$                   |
| 4.96025                  | V            | Peak     | 48.24                         | $\pm 4.87$                   |
| 7.43975                  | H            | Peak     | 52.25                         | $\pm 4.87$                   |

Verdict: PASS

Modulation: 8-DPSK

1. CHANNEL: LOWEST (2402 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03203                  | V            | Peak     | 45.05                         | $\pm 4.87$                   |
| 1.08010                  | H            | Peak     | 44.14                         | $\pm 4.87$                   |
| 1.12810                  | H            | Peak     | 45.39                         | $\pm 4.87$                   |
| 4.80425                  | H            | Peak     | 39.34                         | $\pm 4.87$                   |
| 7.20625                  | H            | Peak     | 58.35                         | $\pm 4.87$                   |
|                          |              | Average  | 53.75                         | $\pm 4.87$                   |

2. CHANNEL: MIDDLE (2441 MHz).

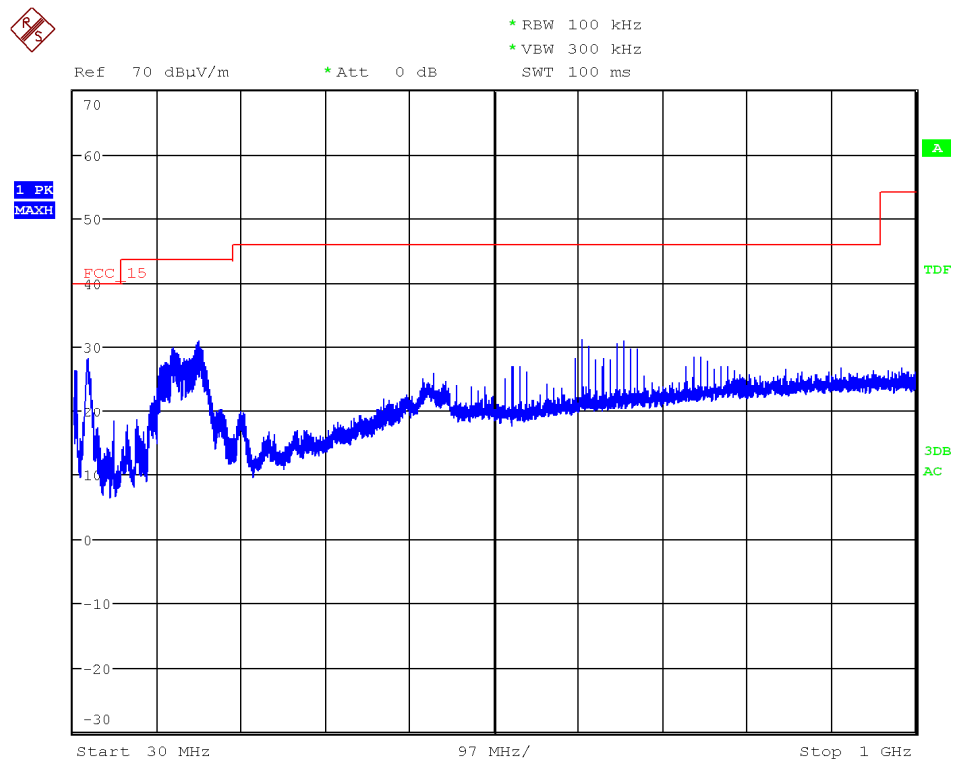
| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03210                  | V            | Peak     | 46.04                         | $\pm 4.87$                   |
| 1.08010                  | H            | Peak     | 44.89                         | $\pm 4.87$                   |
| 1.12823                  | H            | Peak     | 44.36                         | $\pm 4.87$                   |
| 3.66175                  | V            | Peak     | 39.65                         | $\pm 4.87$                   |
| 4.88225                  | V            | Peak     | 44.91                         | $\pm 4.87$                   |
| 7.32275                  | V            | Peak     | 55.44                         | $\pm 4.87$                   |
|                          |              | Average  | 50.97                         | $\pm 4.87$                   |

### 3. CHANNEL: HIGHEST (2480 MHz).

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03210                  | V            | Peak     | 45.80                   | ± 4.87                       |
| 1.08023                  | H            | Peak     | 44.54                   | ± 4.87                       |
| 1.12817                  | H            | Peak     | 44.17                   | ± 4.87                       |
| 2.48361                  | V            | Peak     | 59.62                   | ± 4.87                       |
|                          |              | Average  | 37.58                   | ± 4.87                       |
| 3.72075                  | H            | Peak     | 39.98                   | ± 4.87                       |
| 4.95975                  | V            | Peak     | 46.53                   | ± 4.87                       |
| 7.44075                  | H            | Peak     | 50.99                   | ± 4.87                       |

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

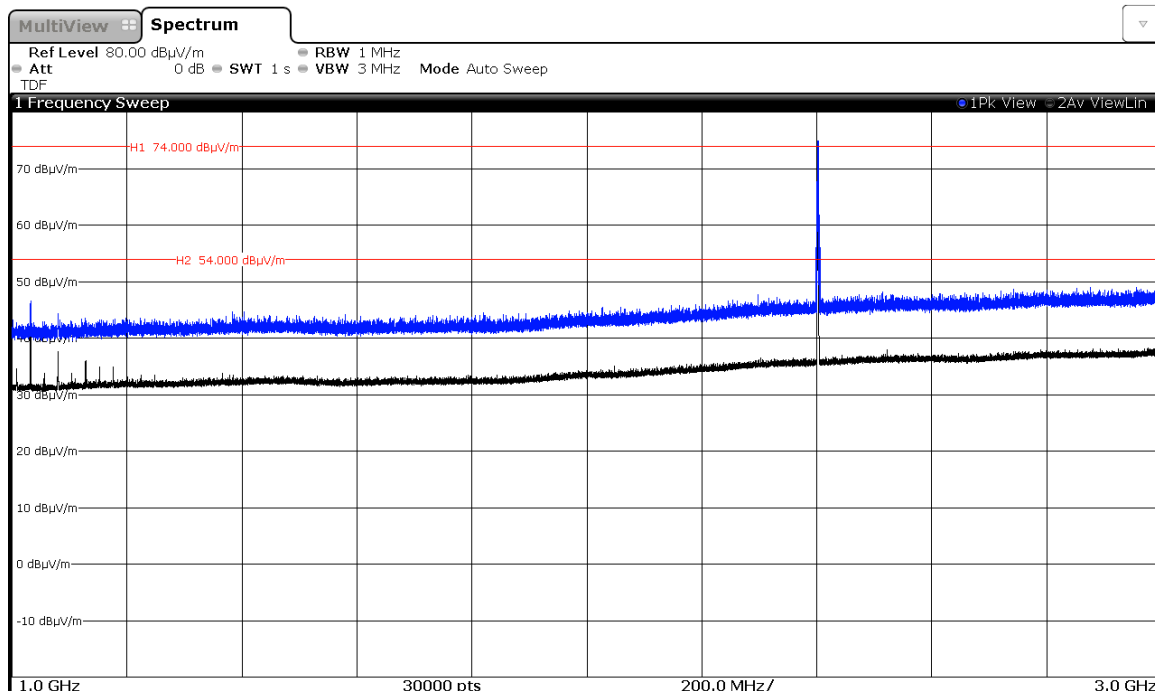


(This plot is valid for all three channels and all modulation modes).

## FREQUENCY RANGE 1 GHz to 3 GHz.

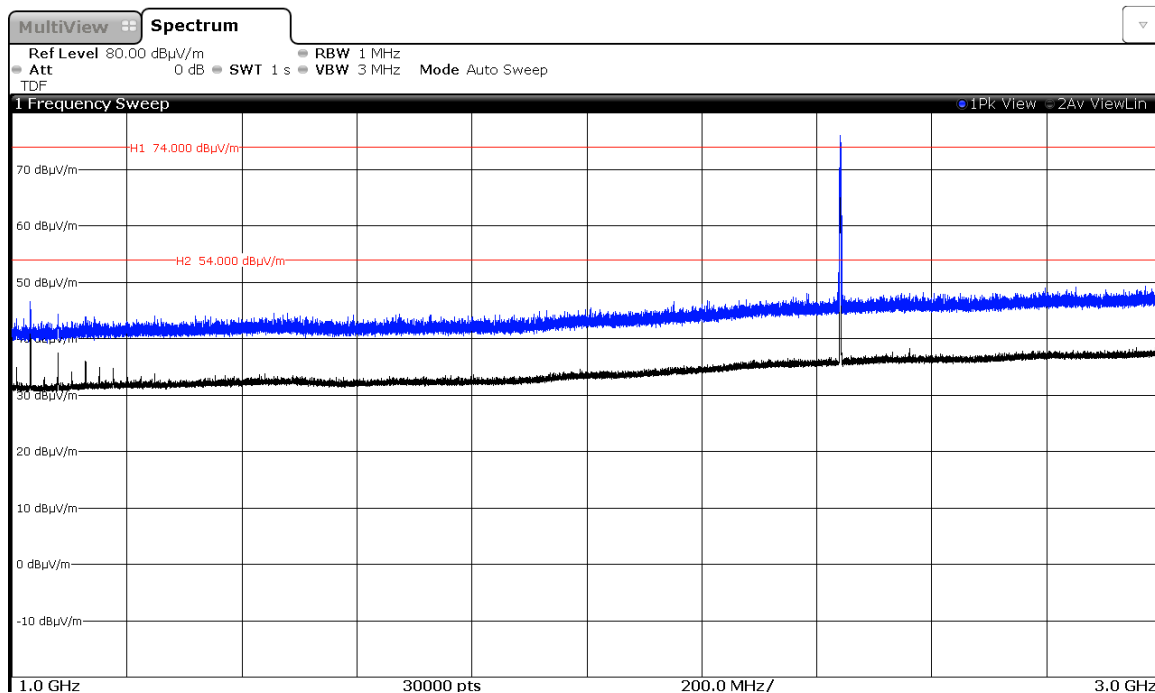
Modulation: GFSK

CHANNEL: Lowest (2402 MHz).



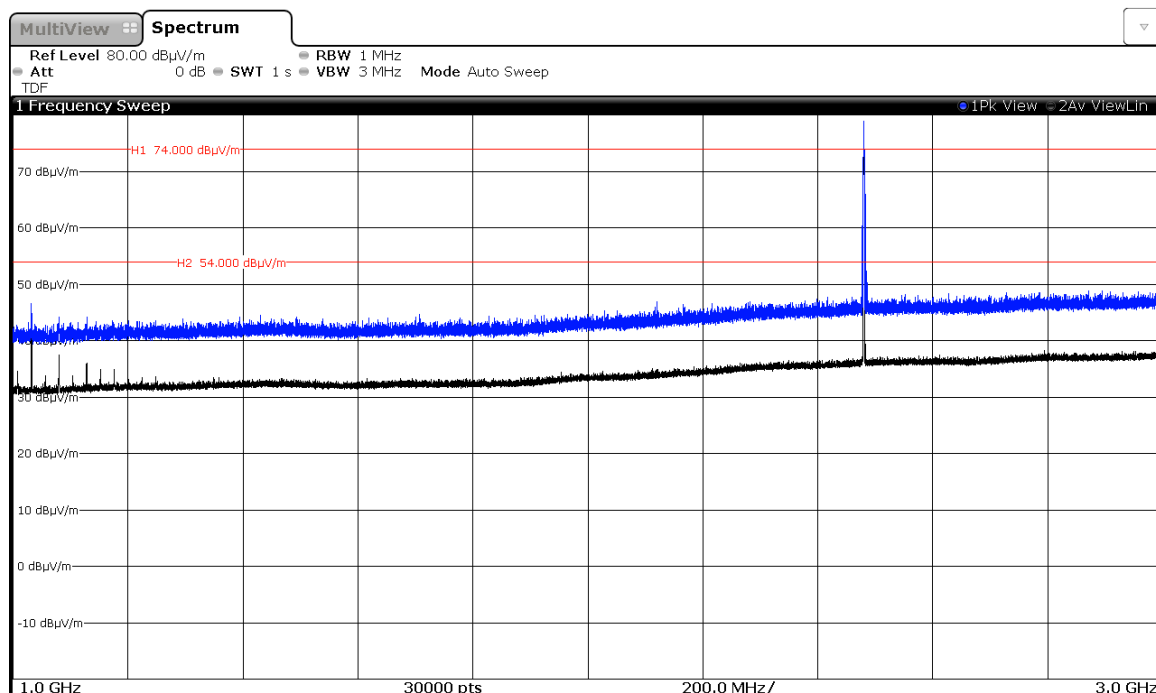
Note: The peak shown in the plot above the limits is the carrier frequency.

CHANNEL: Middle (2441 MHz).



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

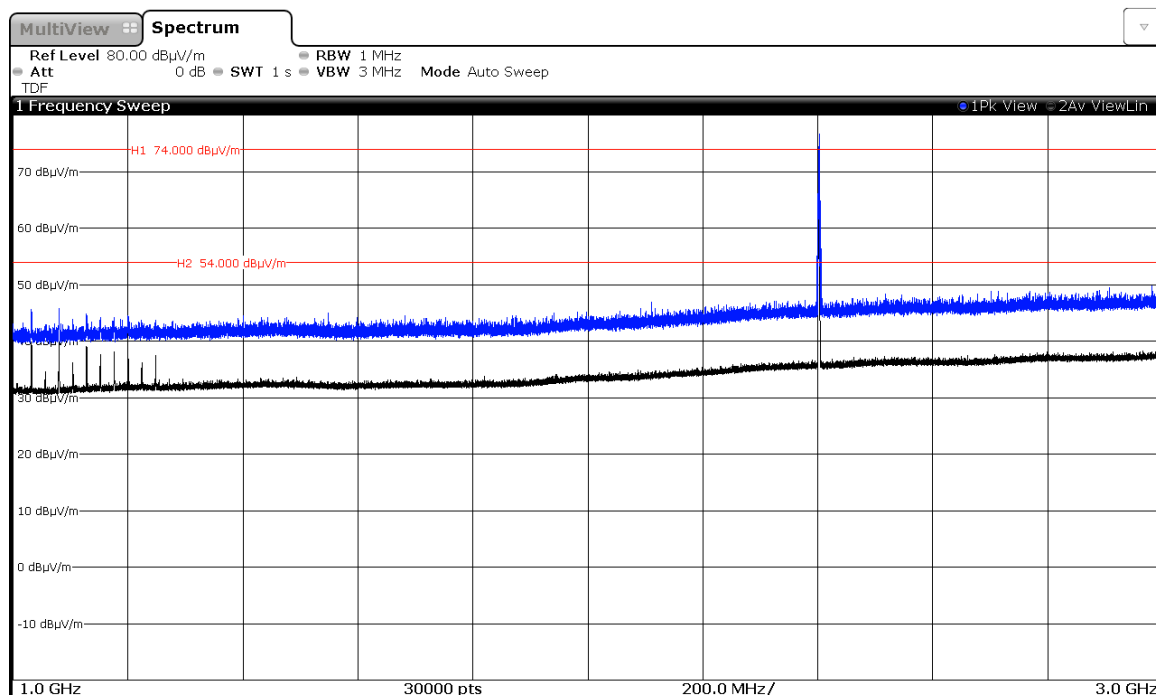
CHANNEL: Highest (2480 MHz).



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

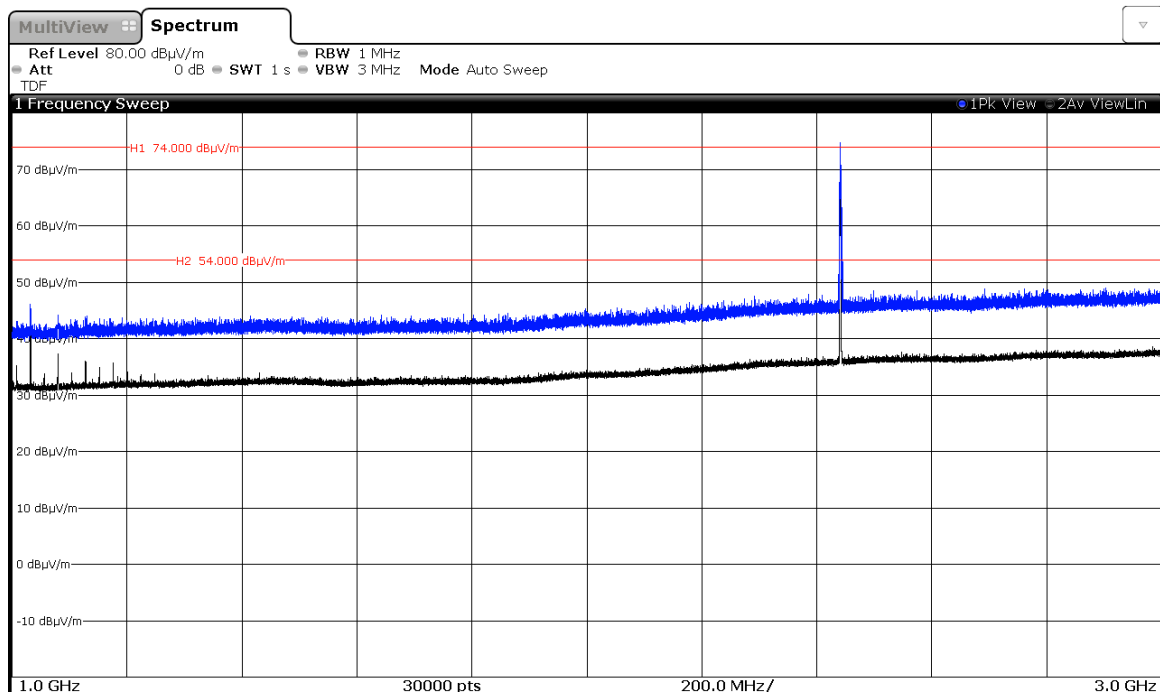
Modulation:  $\Pi/4$ -DQPSK

CHANNEL: Lowest (2402 MHz).



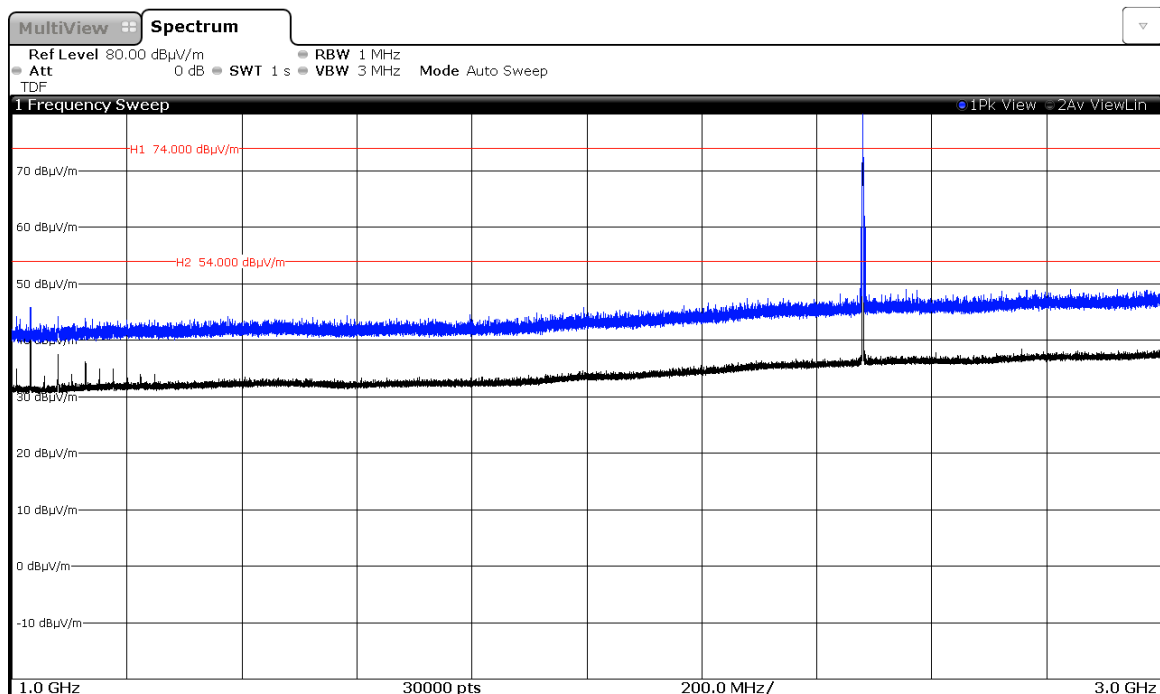
Note: The peak shown in the plot above the limits is the carrier frequency.

CHANNEL: Middle (2441 MHz).



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

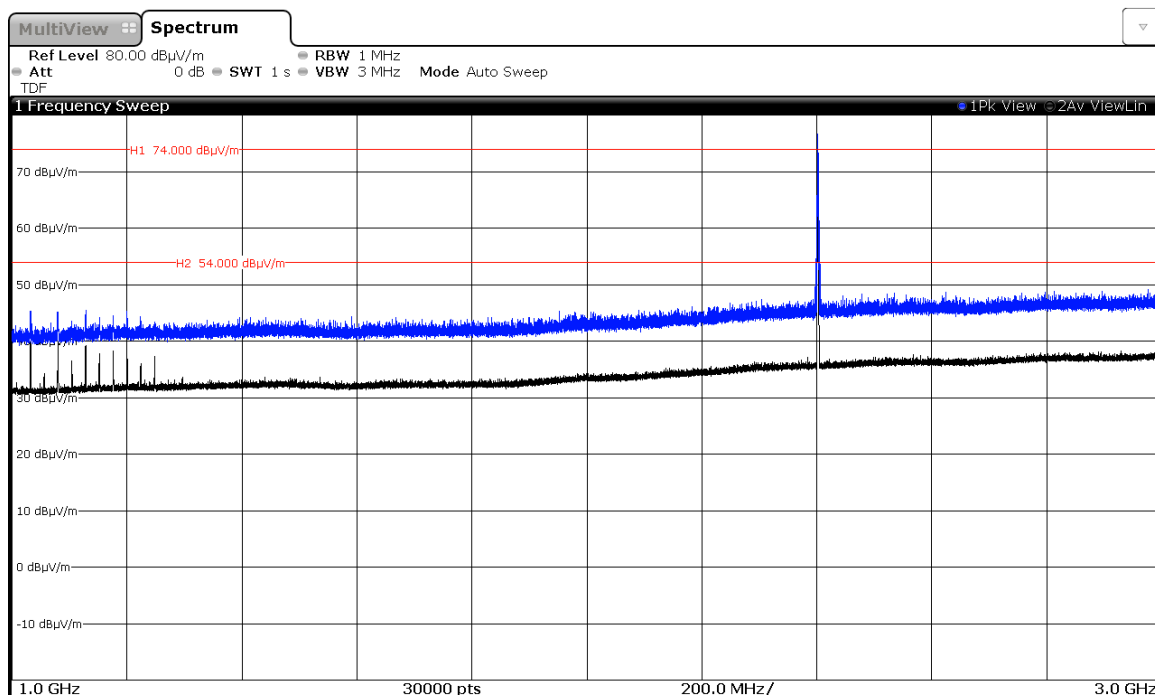
CHANNEL: Highest (2480 MHz).



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

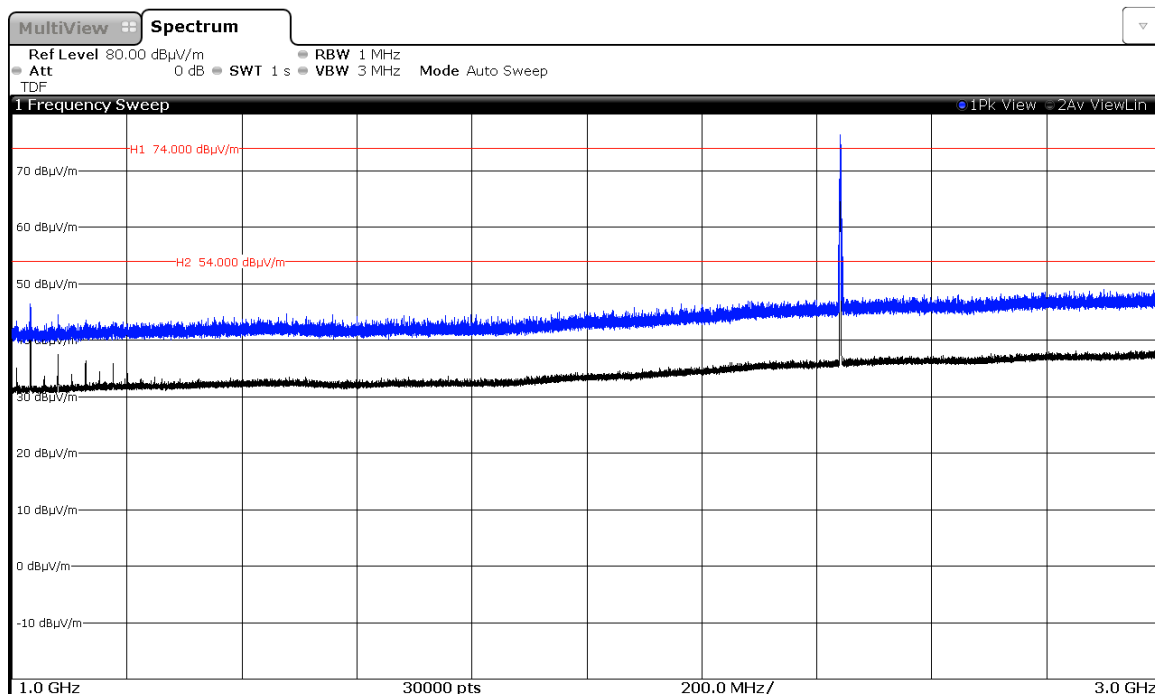
Modulation: 8-DPSK

CHANNEL: Lowest (2402 MHz).



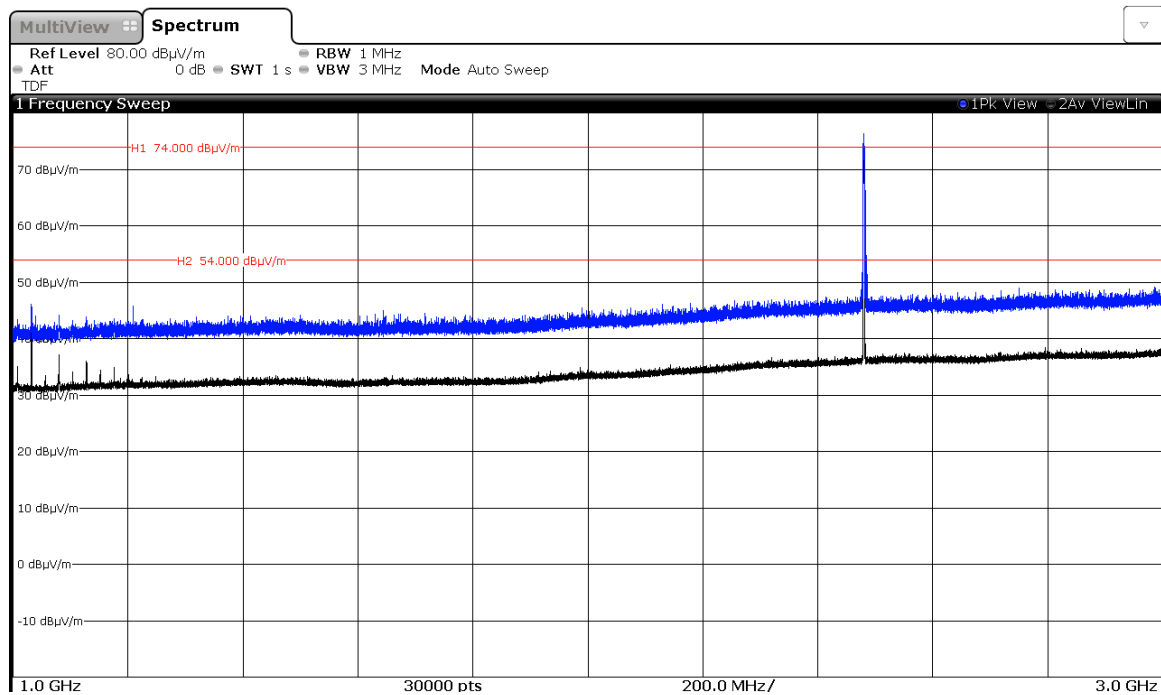
Note: The peak shown in the plot above the limits is the carrier frequency.

CHANNEL: Middle (2441 MHz).



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

CHANNEL: Highest (2480 MHz).

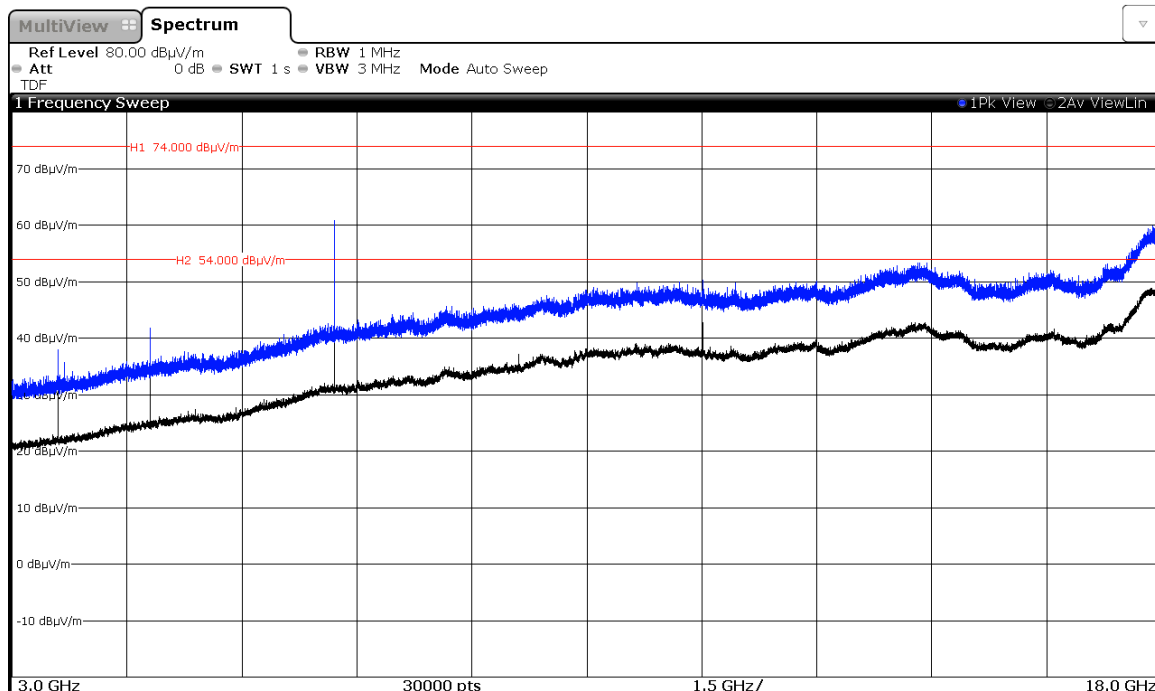


Note: The peak shown in the plot above the limits is the carrier frequency.

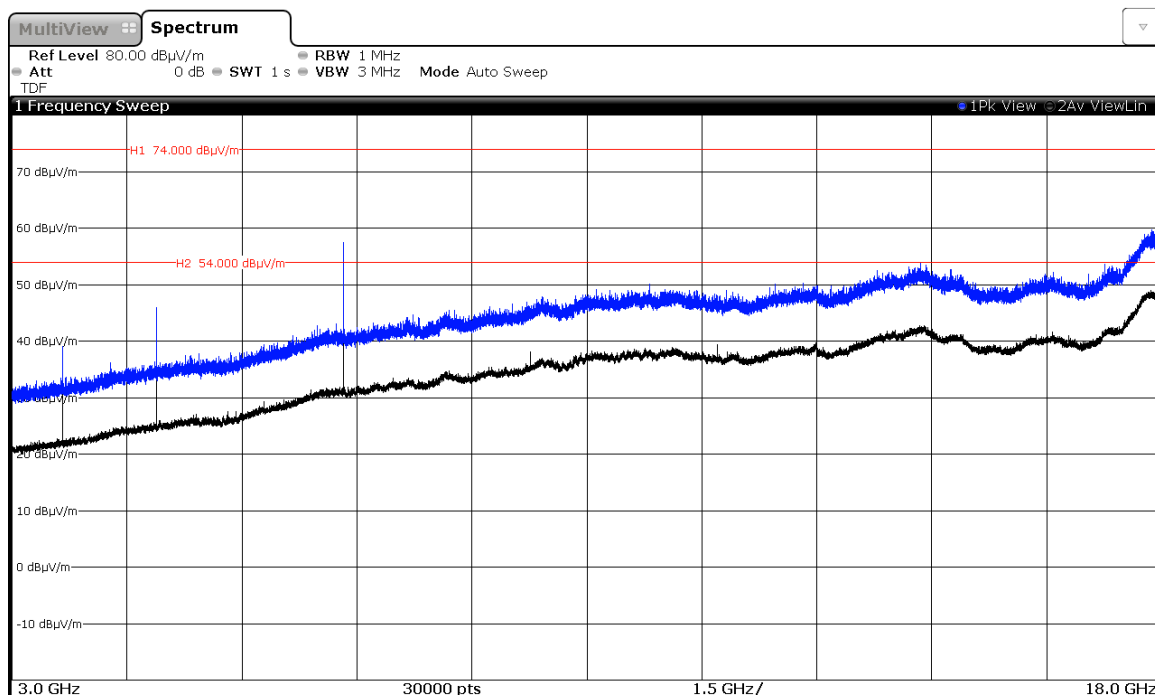
## FREQUENCY RANGE 3 GHz to 18 GHz.

Modulation: GFSK

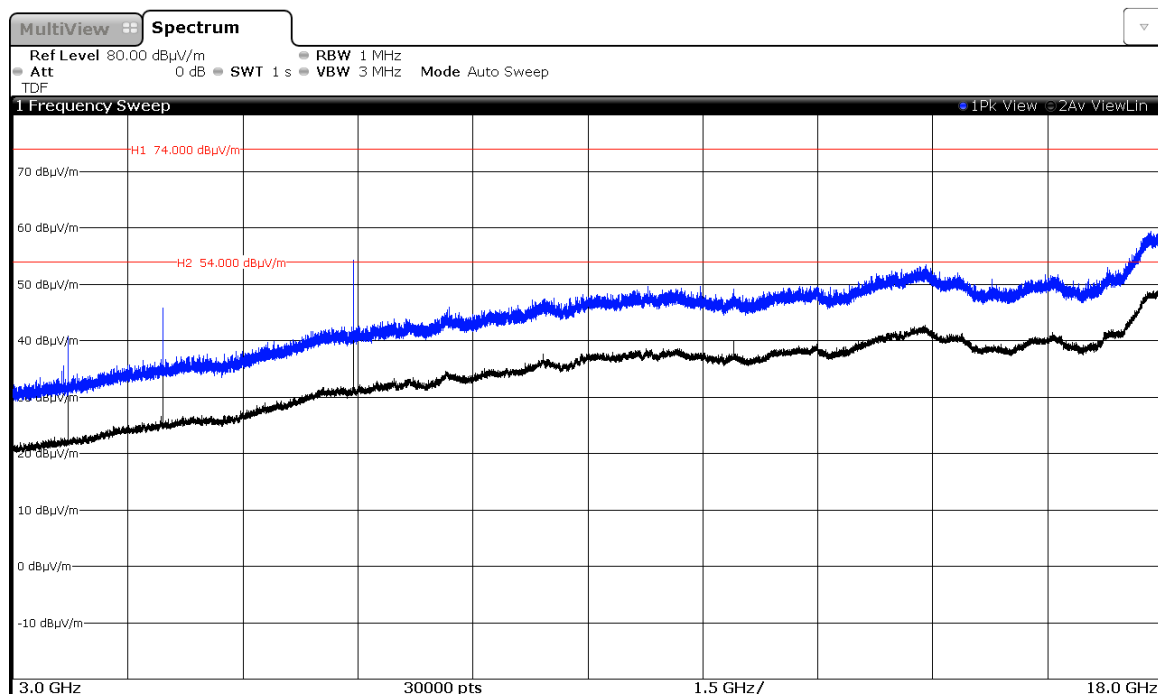
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2441 MHz).

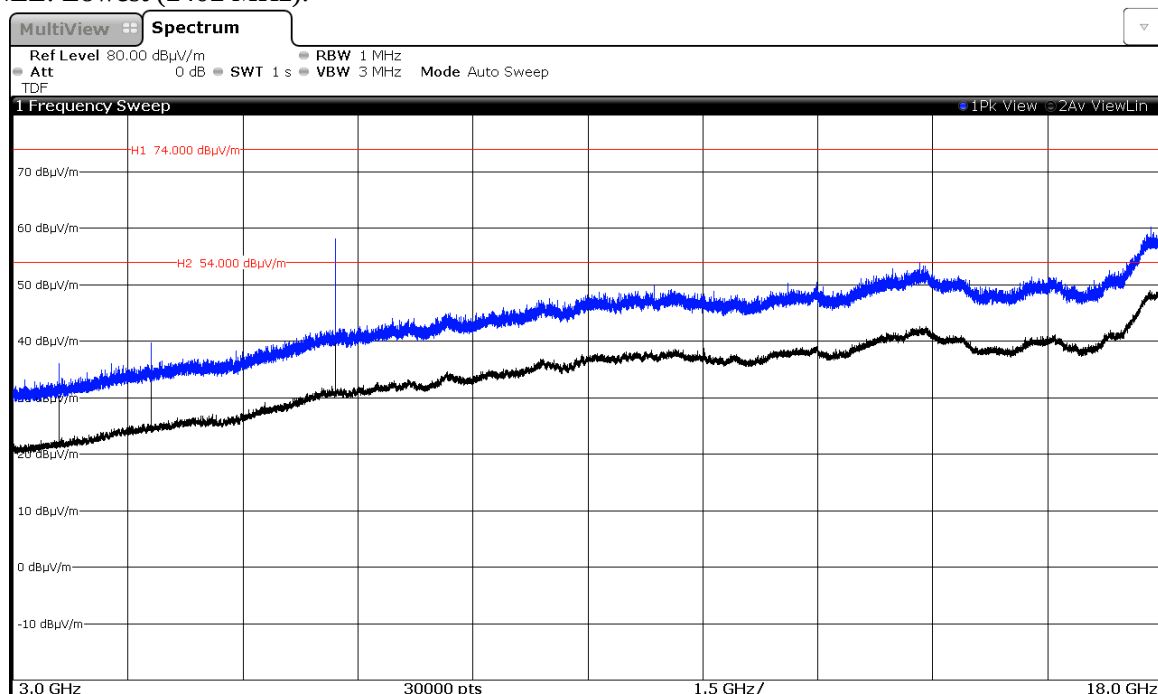


CHANNEL: Highest (2480 MHz).

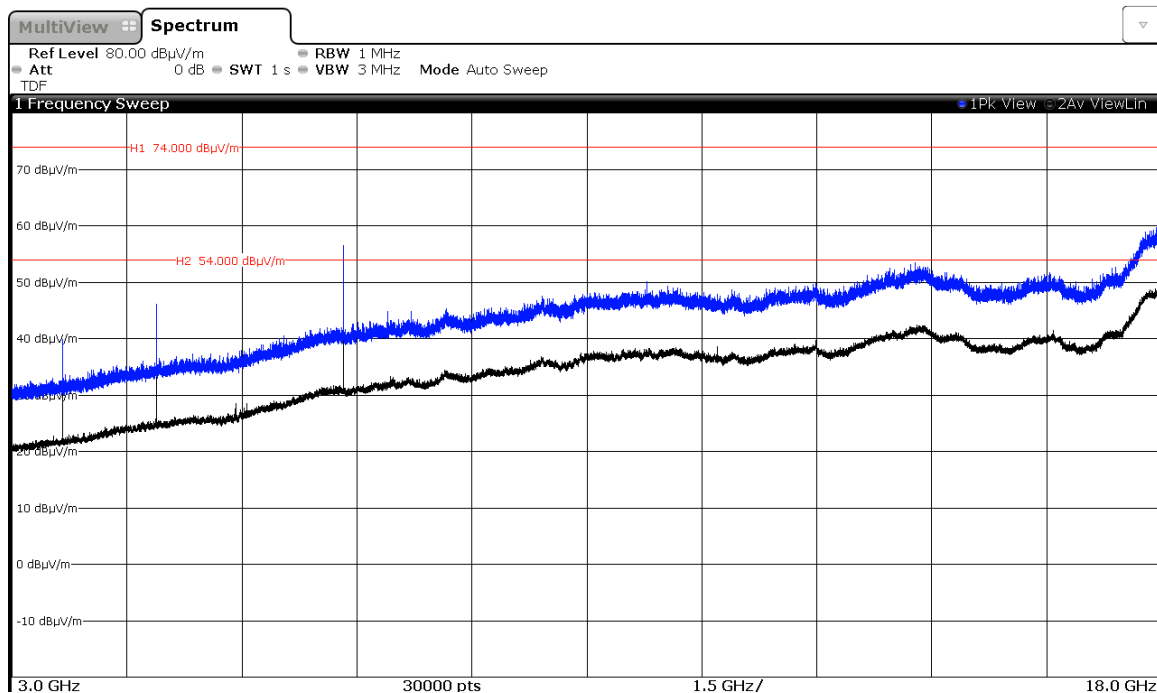


Modulation: Π/4-DQPSK

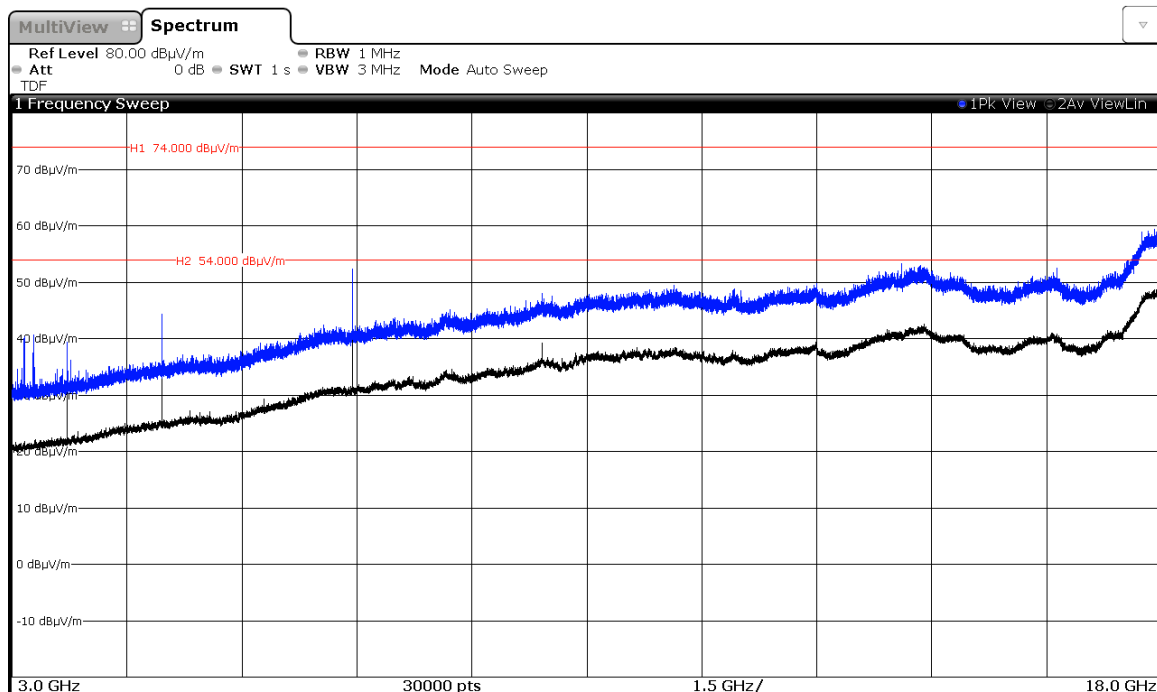
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2441 MHz).

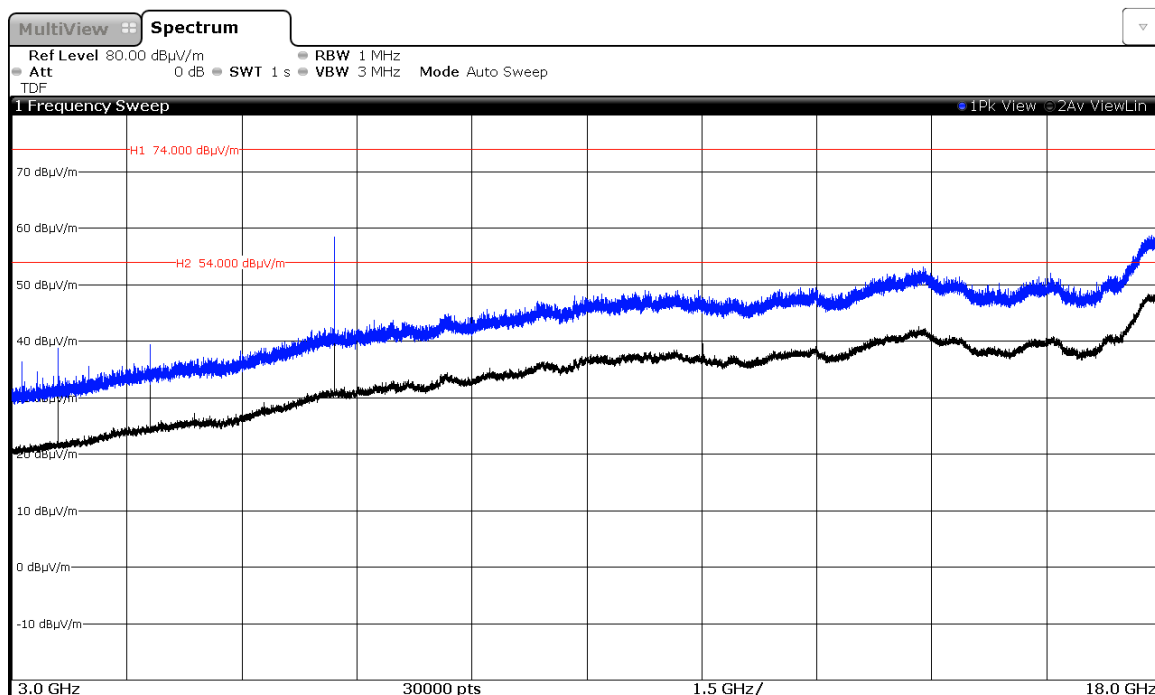


CHANNEL: Highest (2480 MHz).

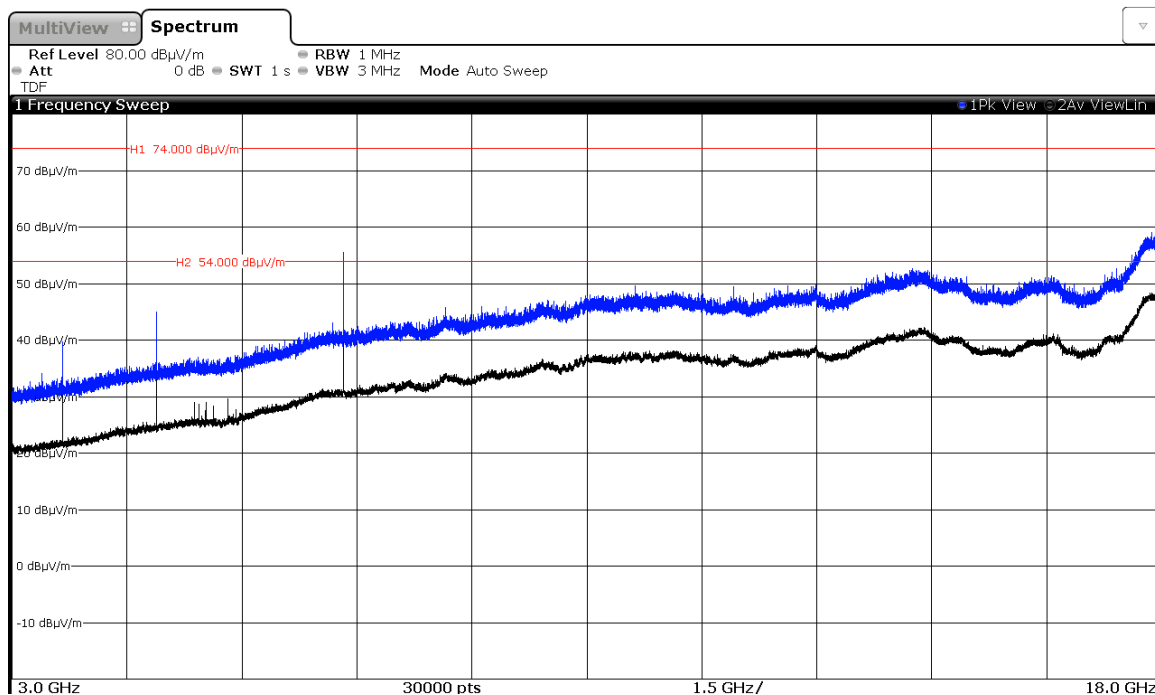


Modulation: 8-DPSK

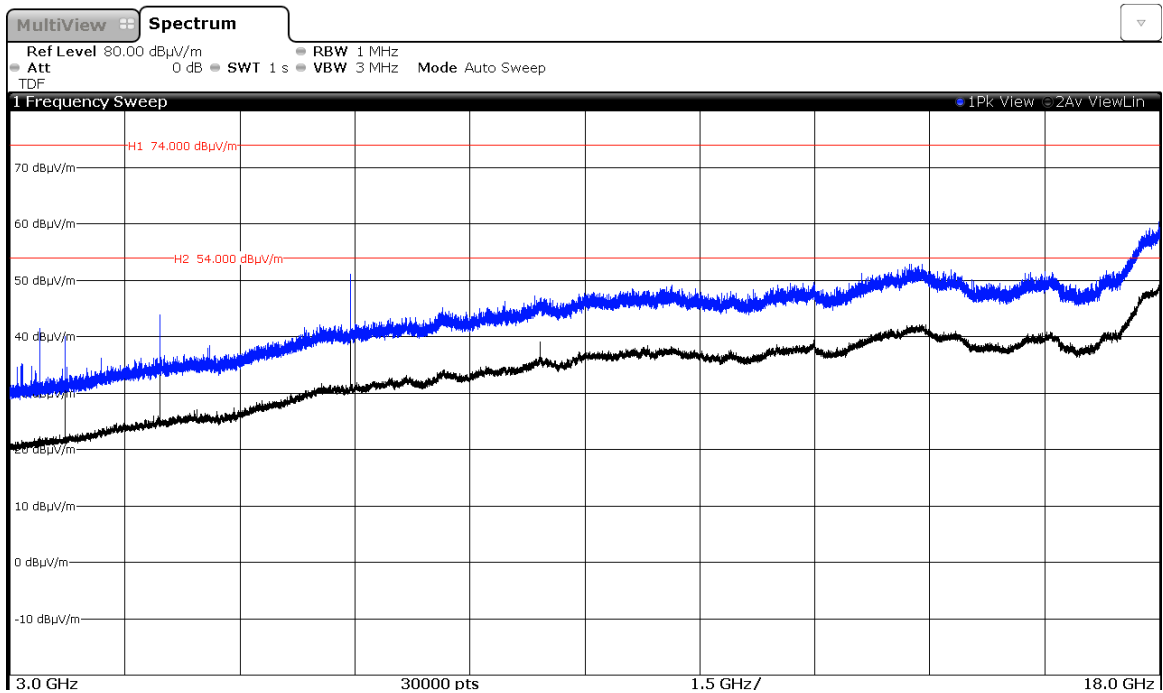
CHANNEL: Lowest (2402 MHz).



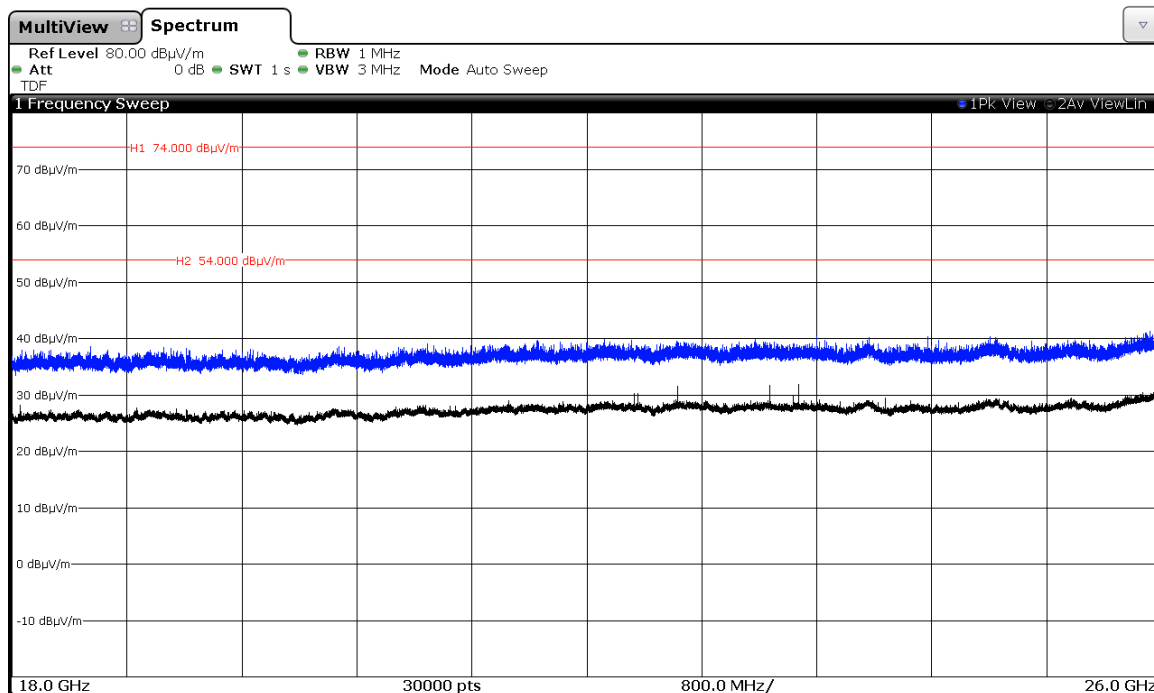
CHANNEL: Middle (2441 MHz).



CHANNEL: Highest (2480 MHz).



## FREQUENCY RANGE 18 GHz to 26 GHz.

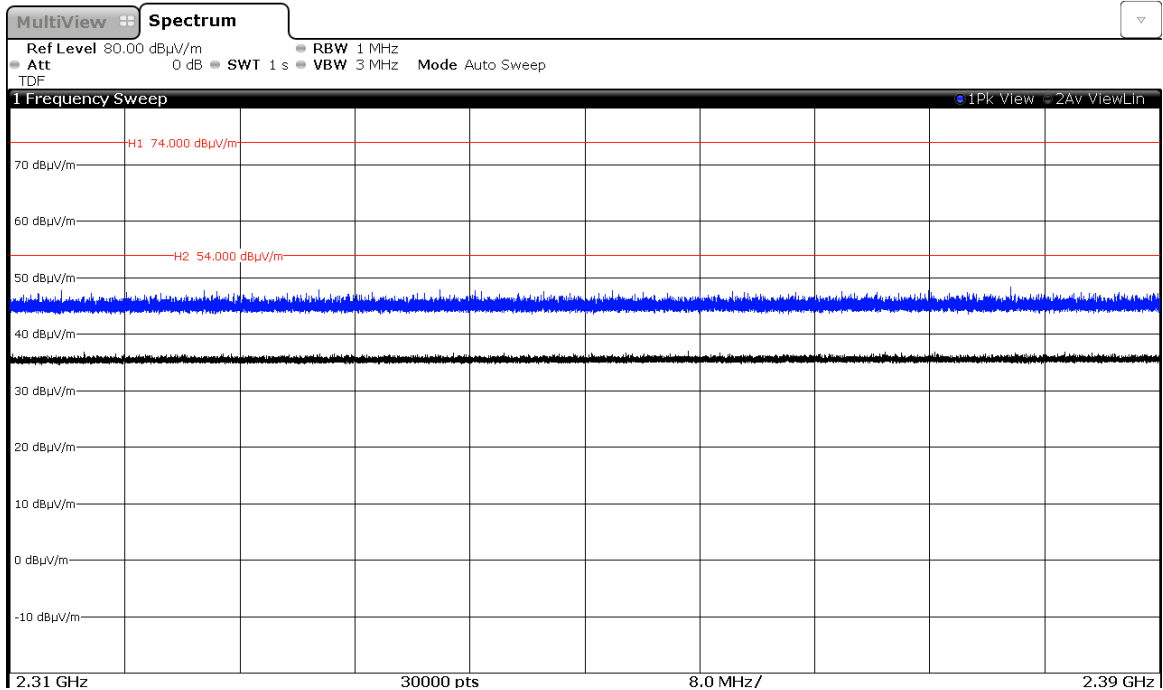


(This plot is valid for all three channels and all modulation modes).

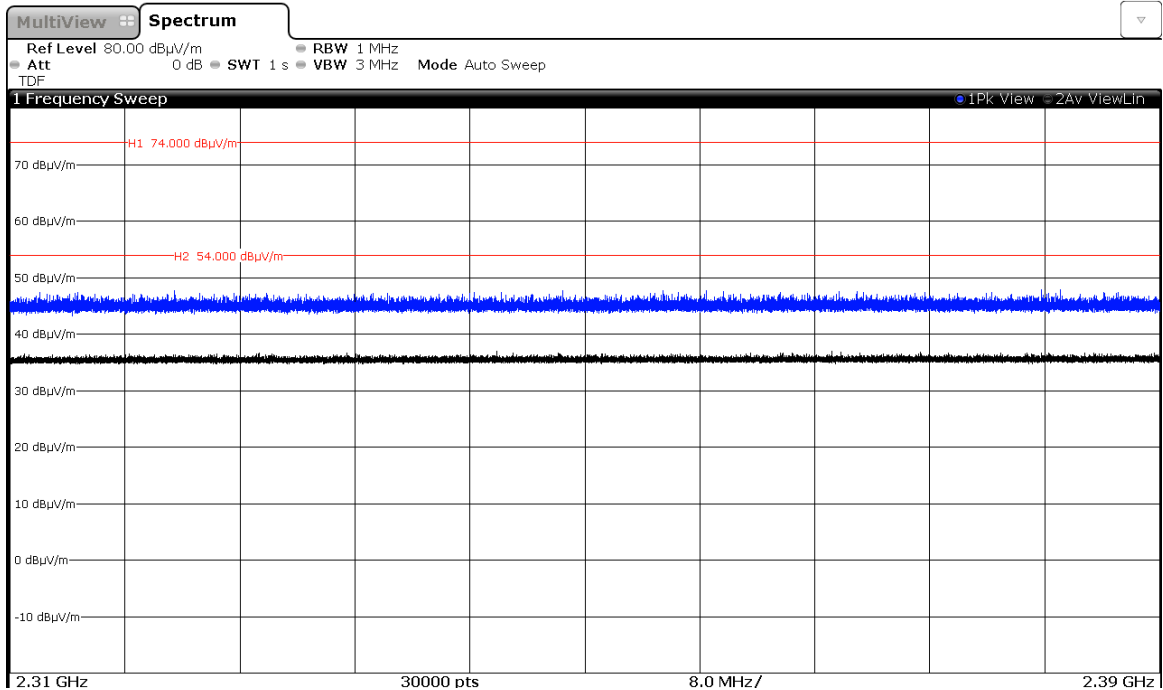
**FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)**

CHANNEL: Lowest

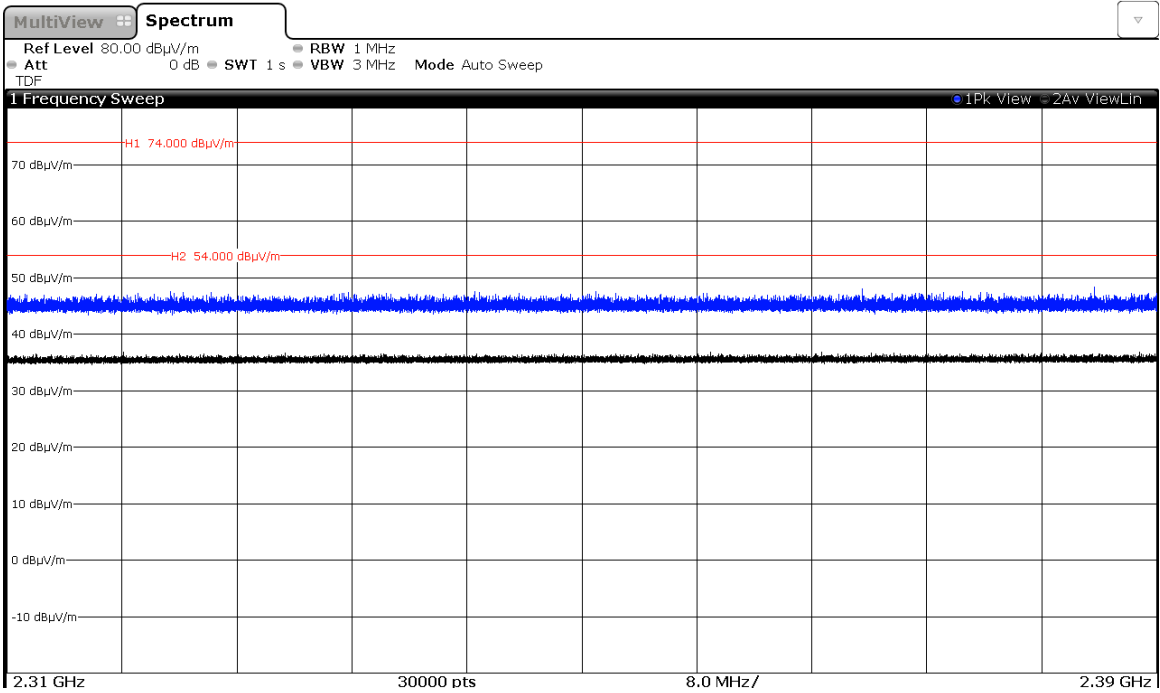
Modulation: GFSK



Modulation: Π/4-DQPSK

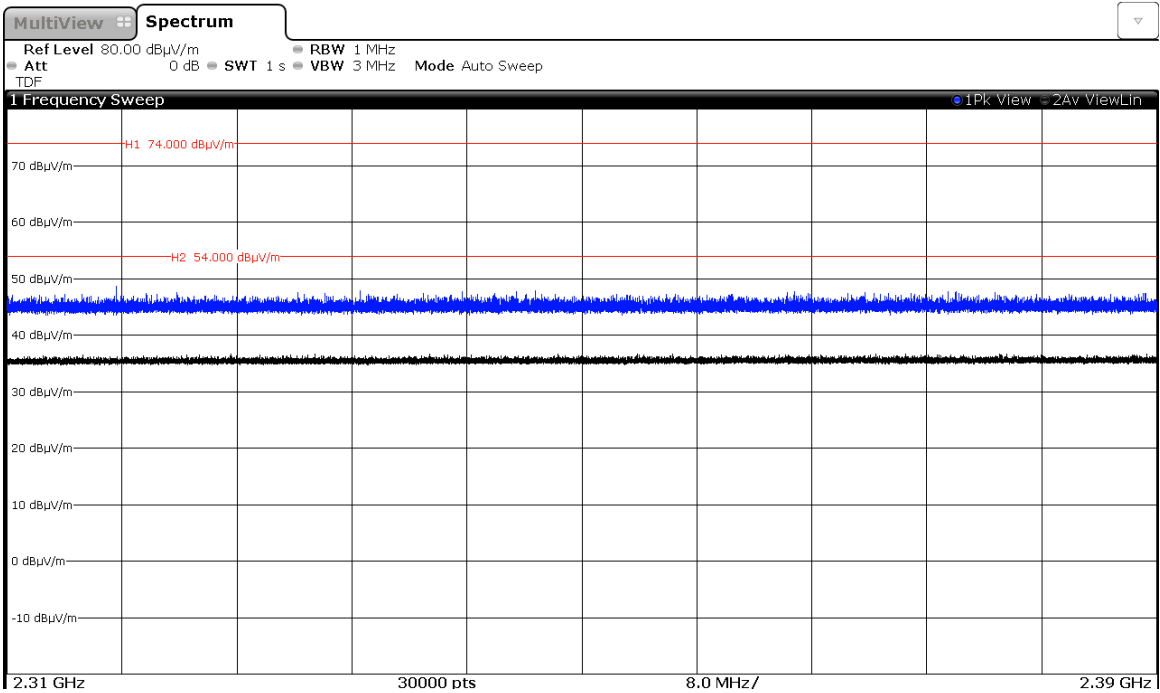


Modulation: 8-DPSK

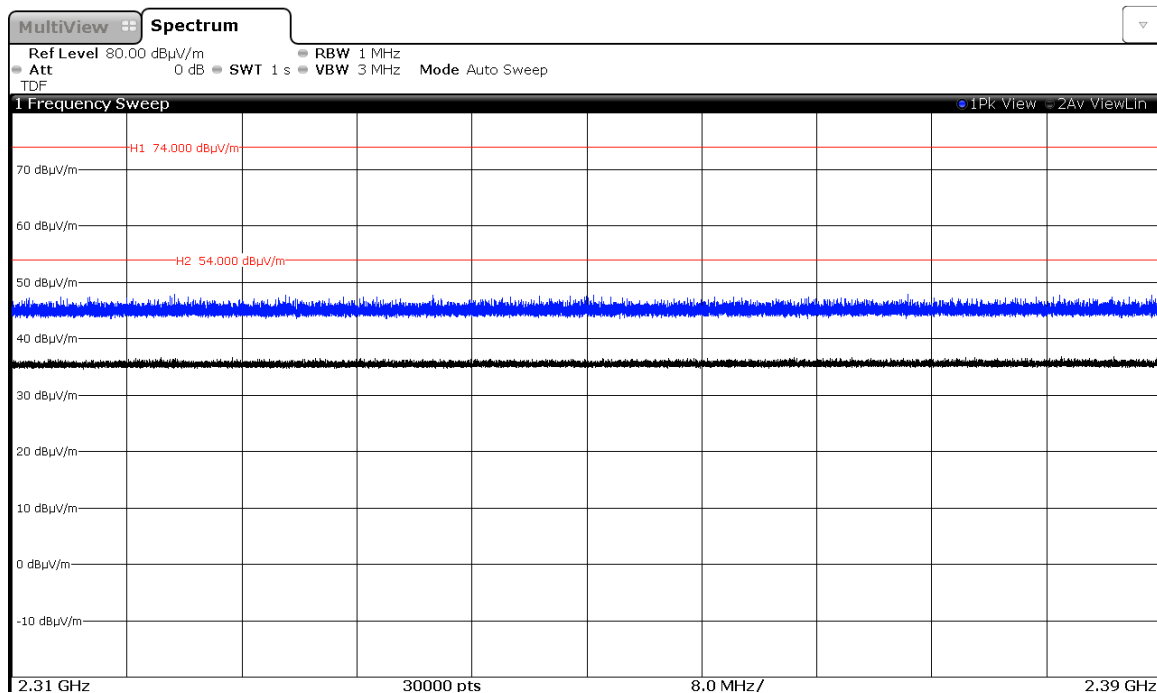


CHANNEL: Middle

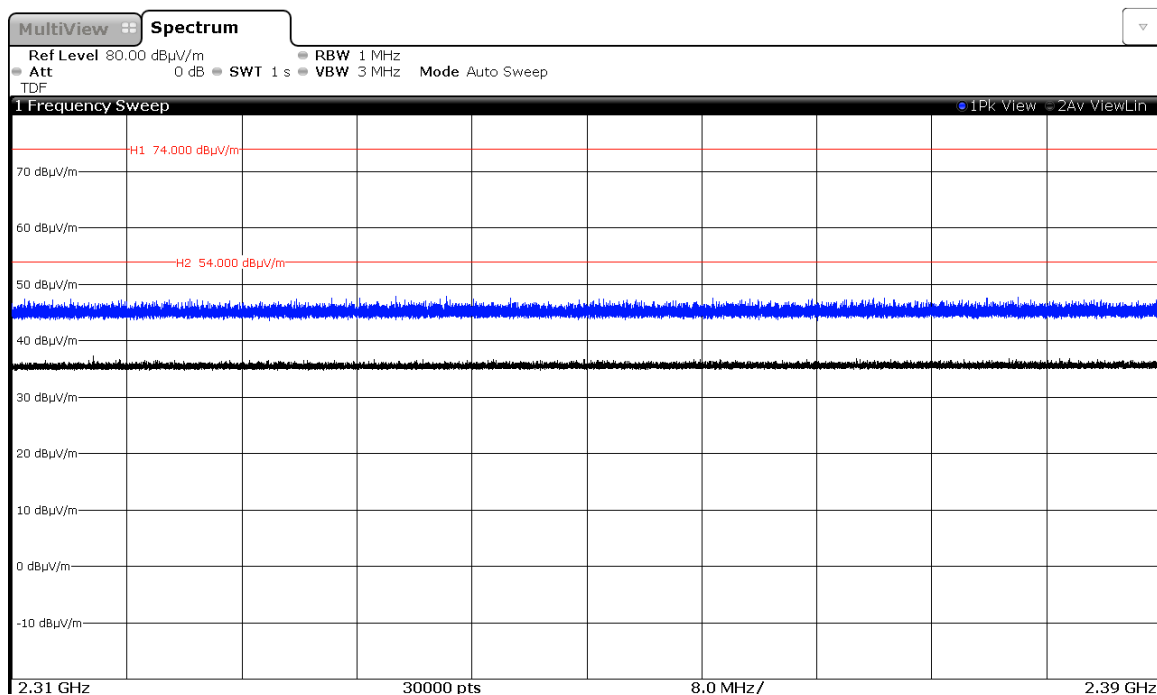
Modulation: GFSK



## Modulation: $\Pi/4$ -DQPSK

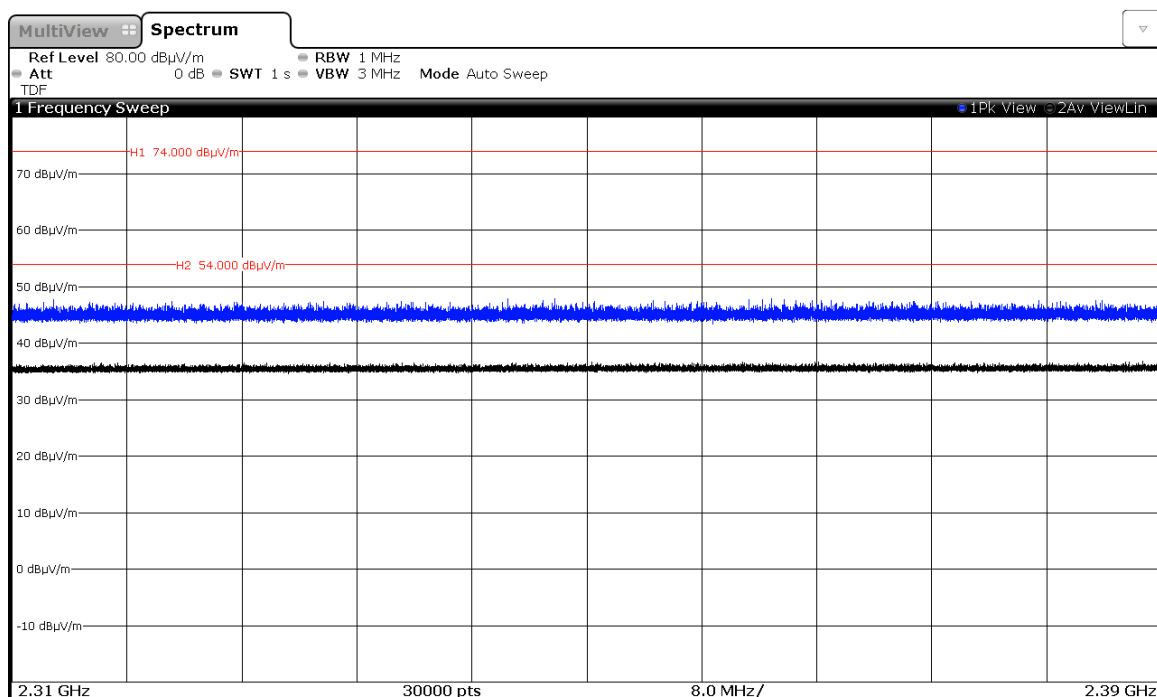


## Modulation: 8-DPSK

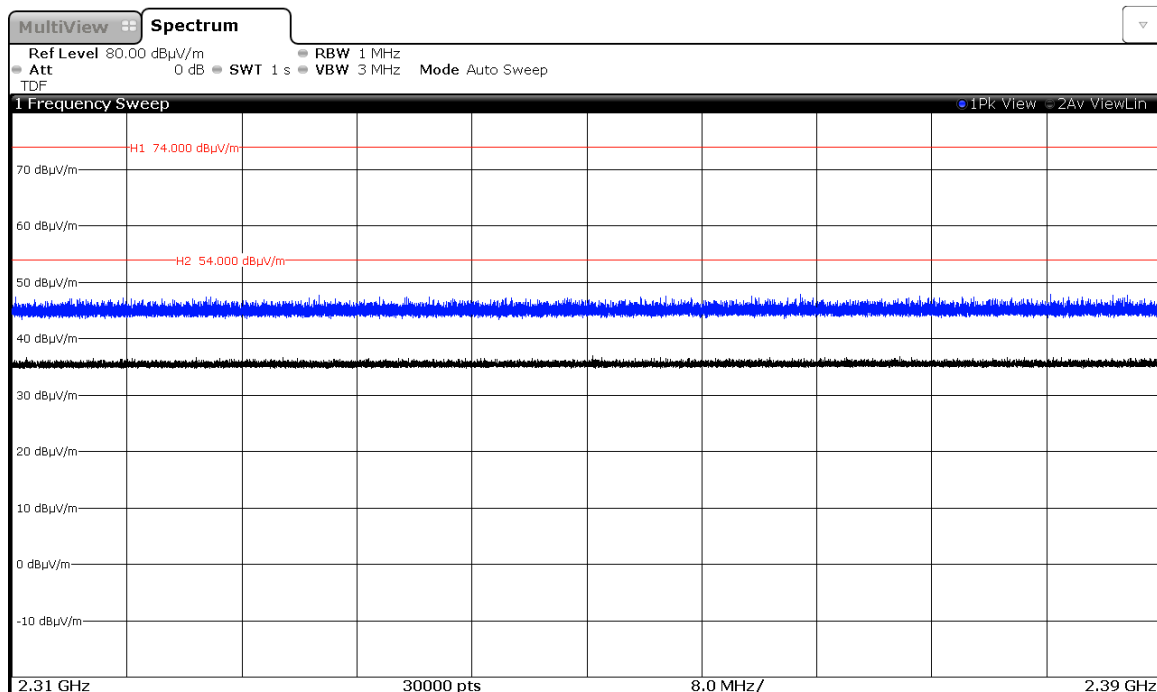


CHANNEL: Highest

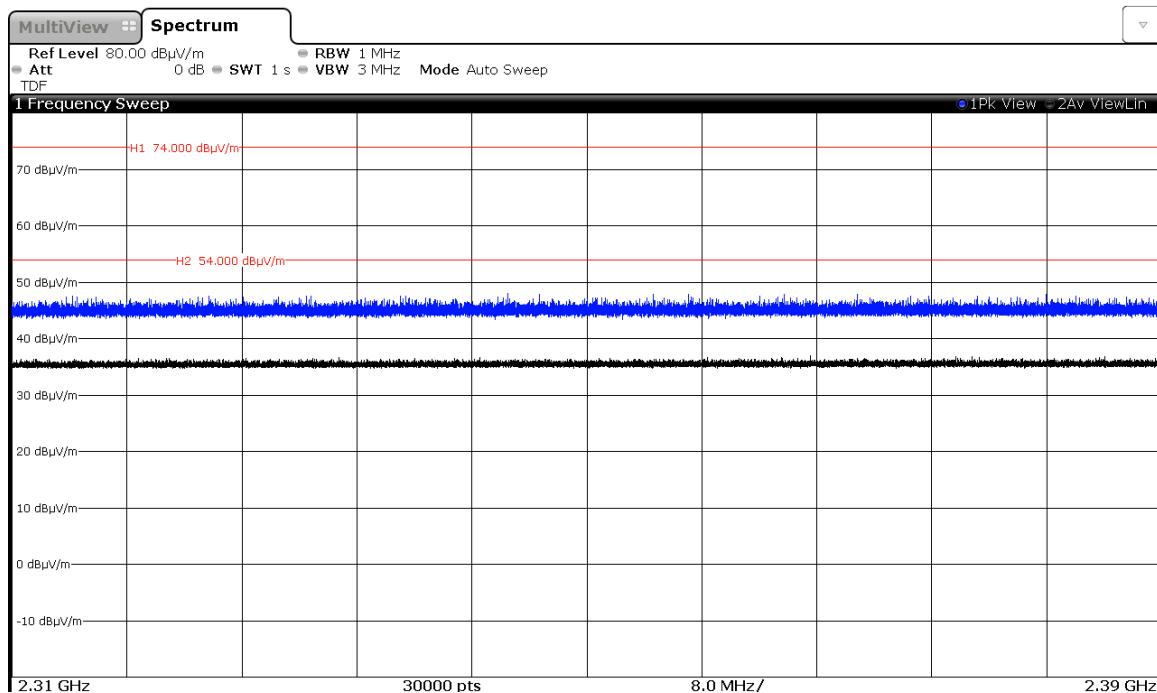
Modulation: GFSK



Modulation: Π/4-DQPSK



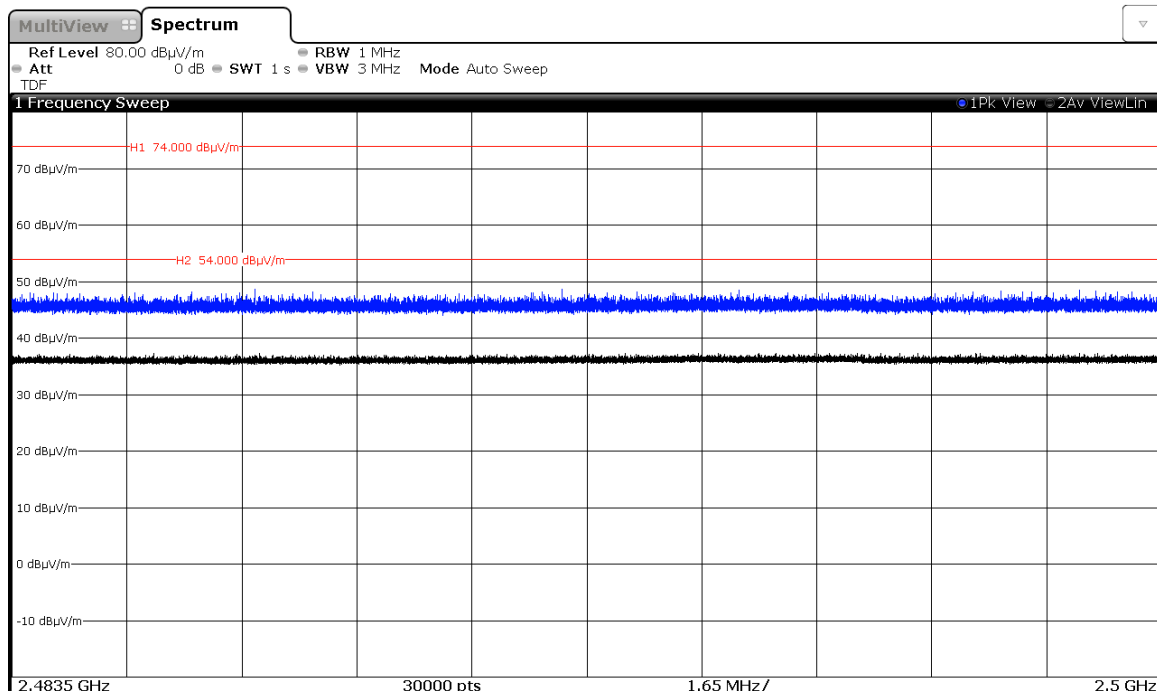
## Modulation: 8-DPSK



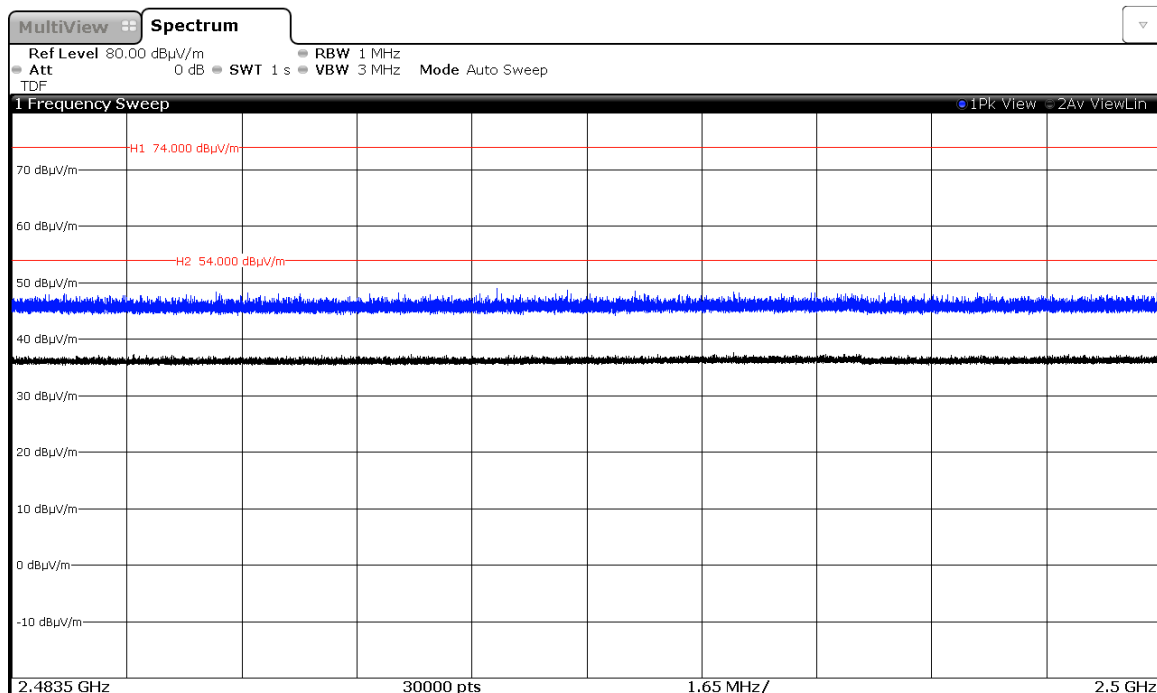
## FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

CHANNEL: Lowest

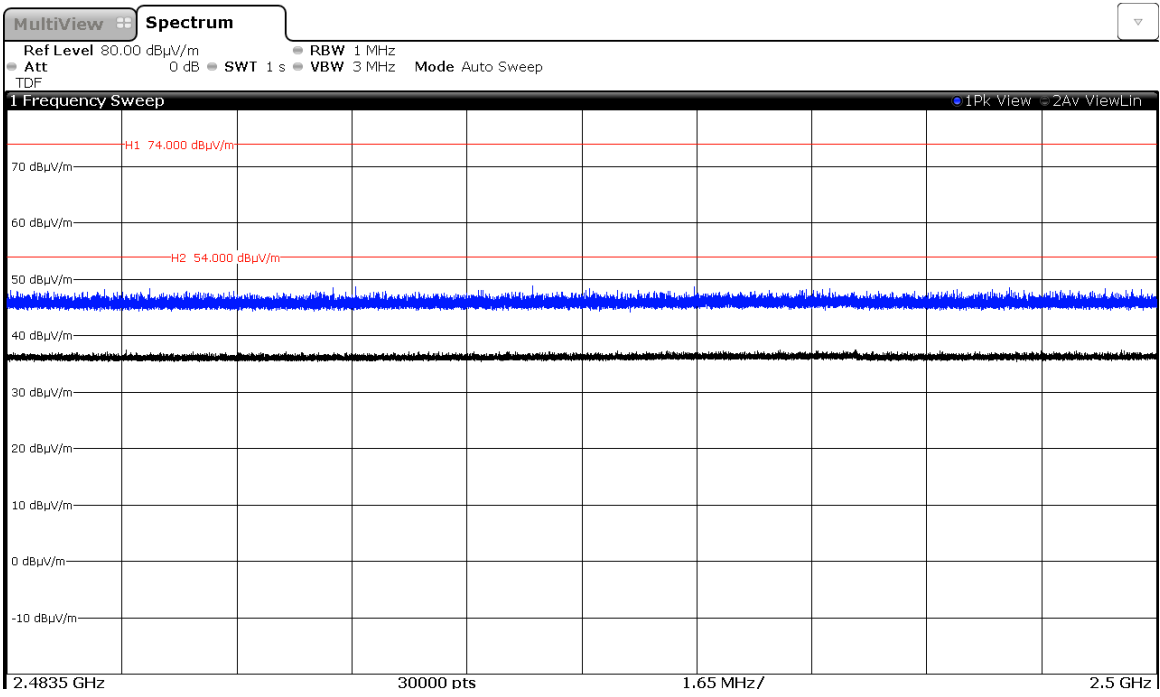
Modulation: GFSK



Modulation: Π/4-DQPSK

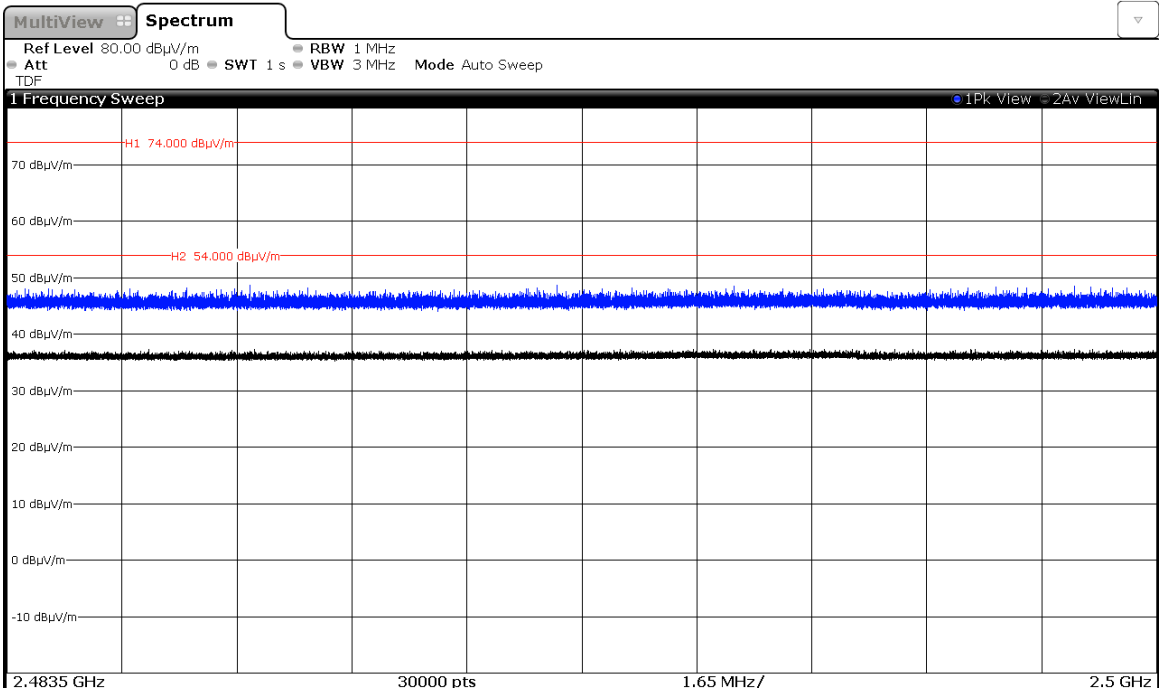


Modulation: 8-DPSK

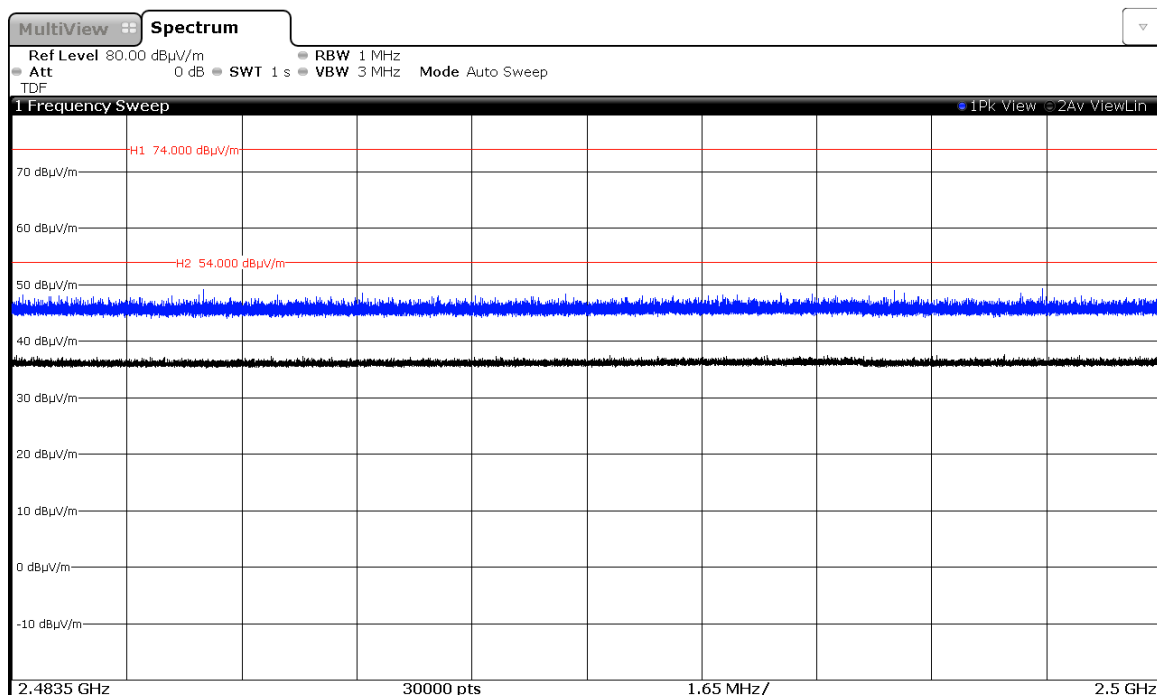


CHANNEL: Middle

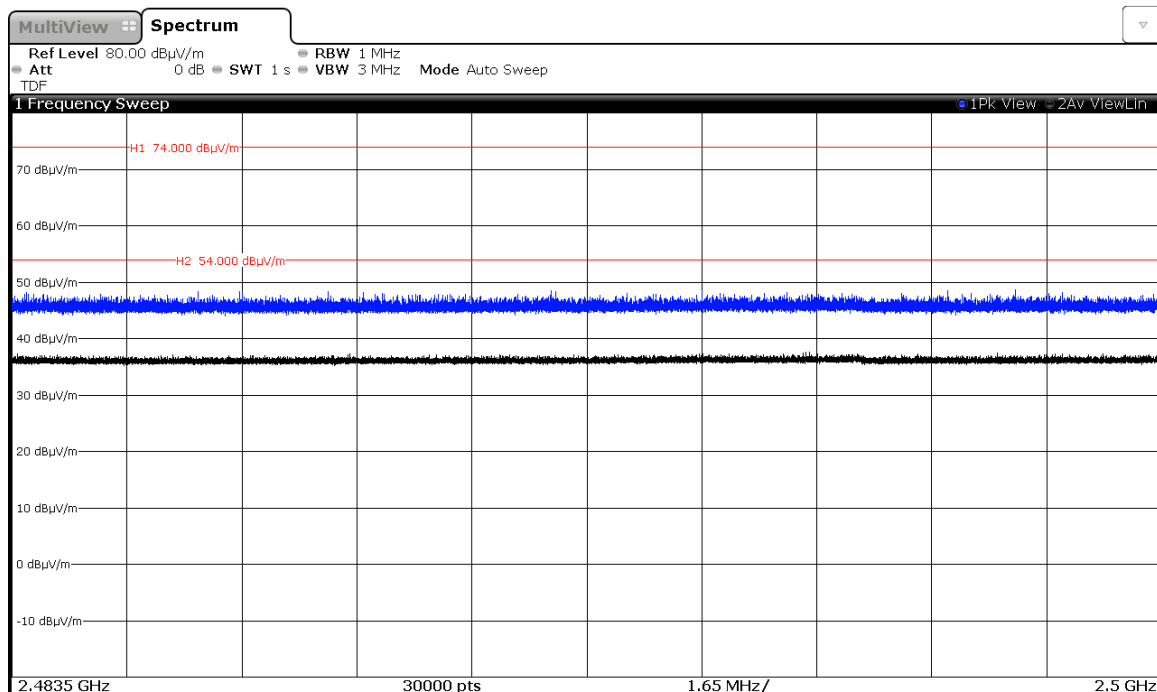
Modulation: GFSK



## Modulation: $\Pi/4$ -DQPSK

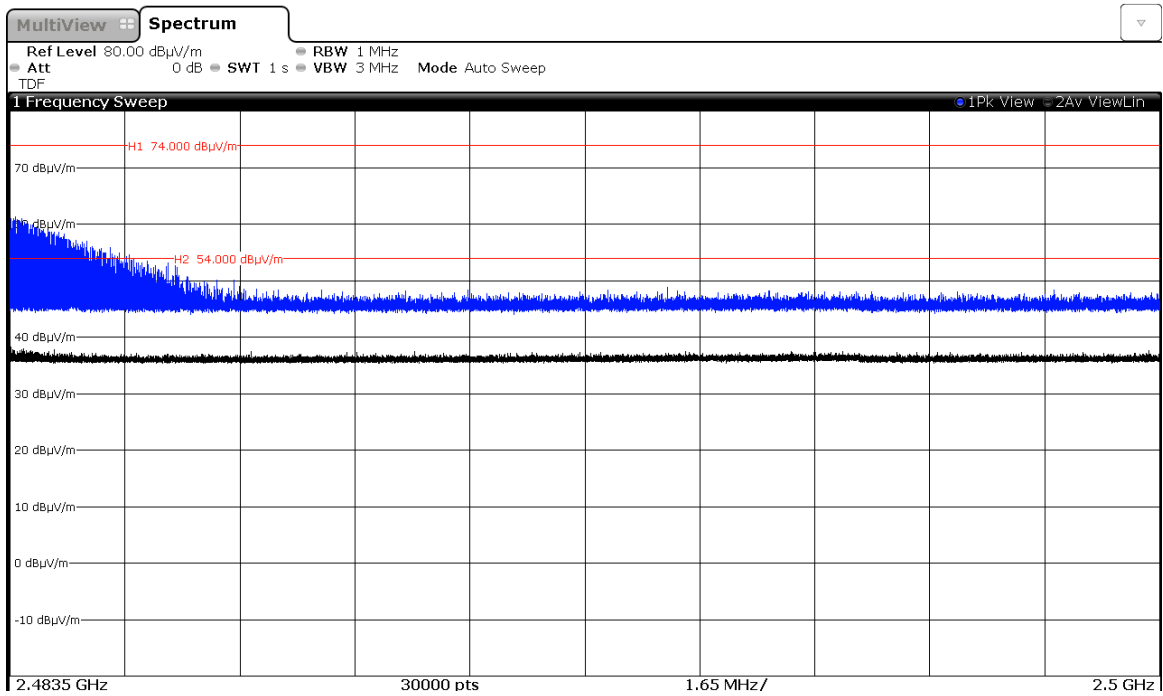


## Modulation: 8-DPSK

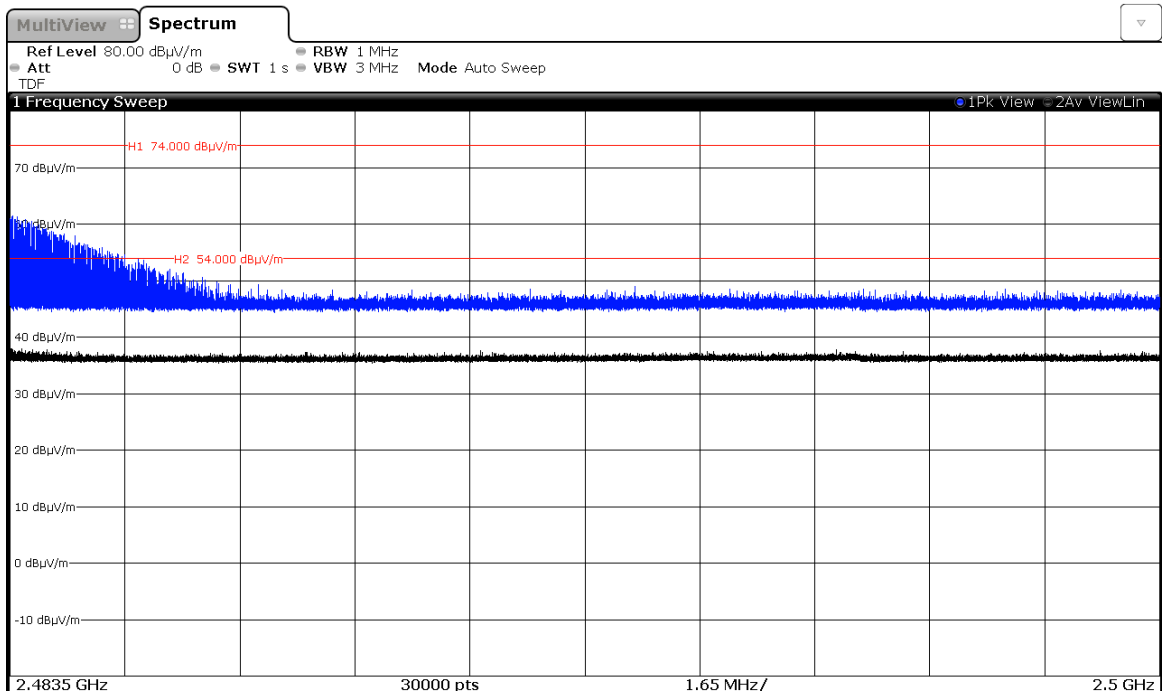


CHANNEL: Highest

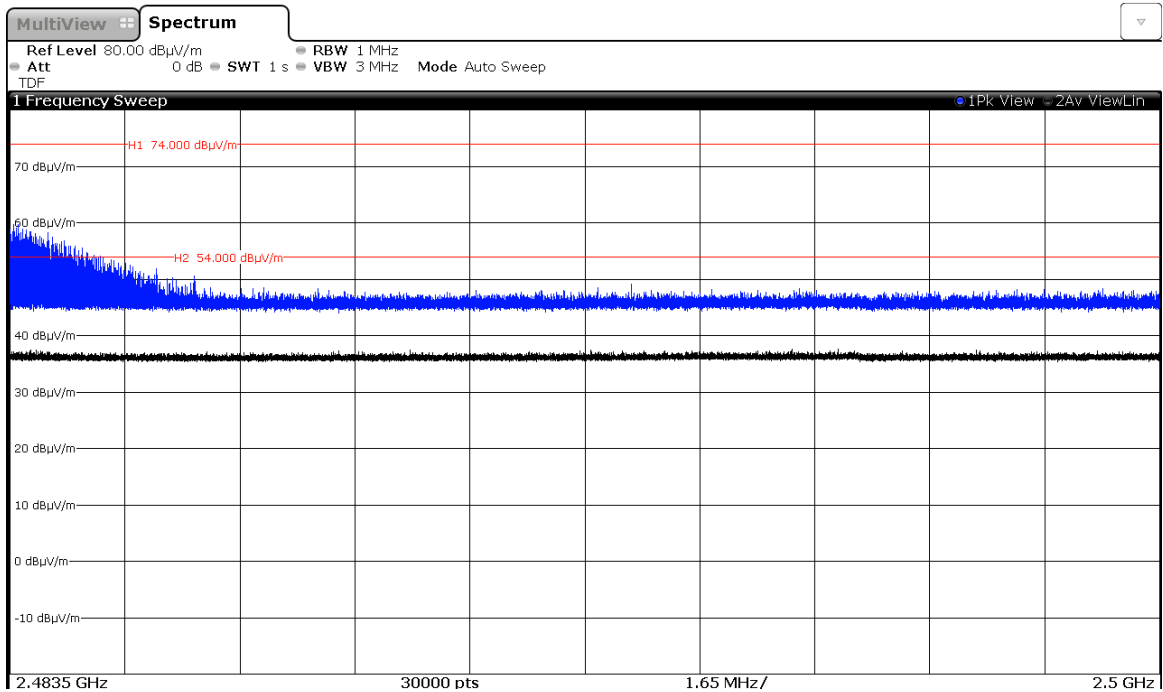
Modulation: GFSK



Modulation: Π/4-DQPSK



Modulation: 8-DPSK



## Appendix B – Test result “WiFi 2.4 GHz (802.11b/g/n20/n40)”

## INDEX

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## TEST CONDITIONS

Power supply (V):

$$V_{\text{nom}} = 12 \text{ Vdc}$$

Type of power supply = External power supply (Battery).

Type of antenna: Integral antenna

Declared Gain for antenna (maximum) = -1.85 dBi

### TEST FREQUENCIES:

For WiFi 802.11b/g/n20:

Lowest channel (1): 2412 MHz

Middle channel (6): 2437 MHz

Highest channel (11): 2462 MHz

For WiFi 802.11n40:

Lowest channel (3): 2422 MHz

Middle channel (6): 2437 MHz

Highest channel (9): 2452 MHz

The test set-up was made in accordance to the general provisions of FCC DTS Measurement 558074 D01 DTS Meas Guidance v04 dated 04/05/2017.

The sample was used to configure the EUT to continuously transmit at a specified output power in all channels with different modes and modulation schemes.

It was necessary to load the following file on the UNITEST software  
“unittest\_profile\_CSRC9xxx\_NAC\_EUR\_single\_antenna.txt”.

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

The data rates of 1Mb/s for 802.11b, 6.5Mb/s for 802.11g, MSC0 for 802.11n20, MSC0 for 802.11n40 were selected based on preliminary testing that identified those rates corresponding to the worst cases for output power and band edge levels at restricted bands.

### 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).

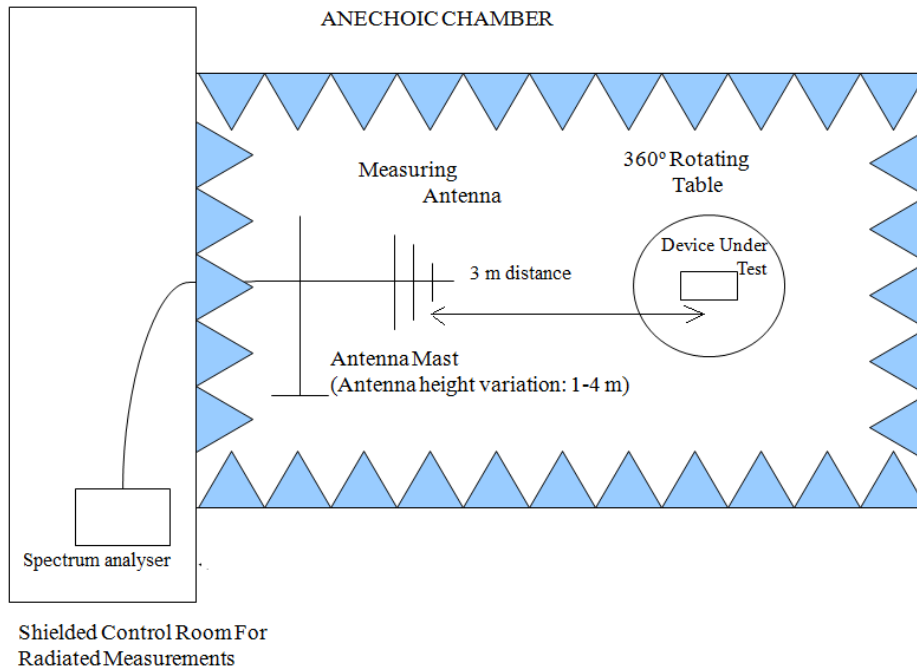
For radiated emissions in the range 1 GHz-25 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission.

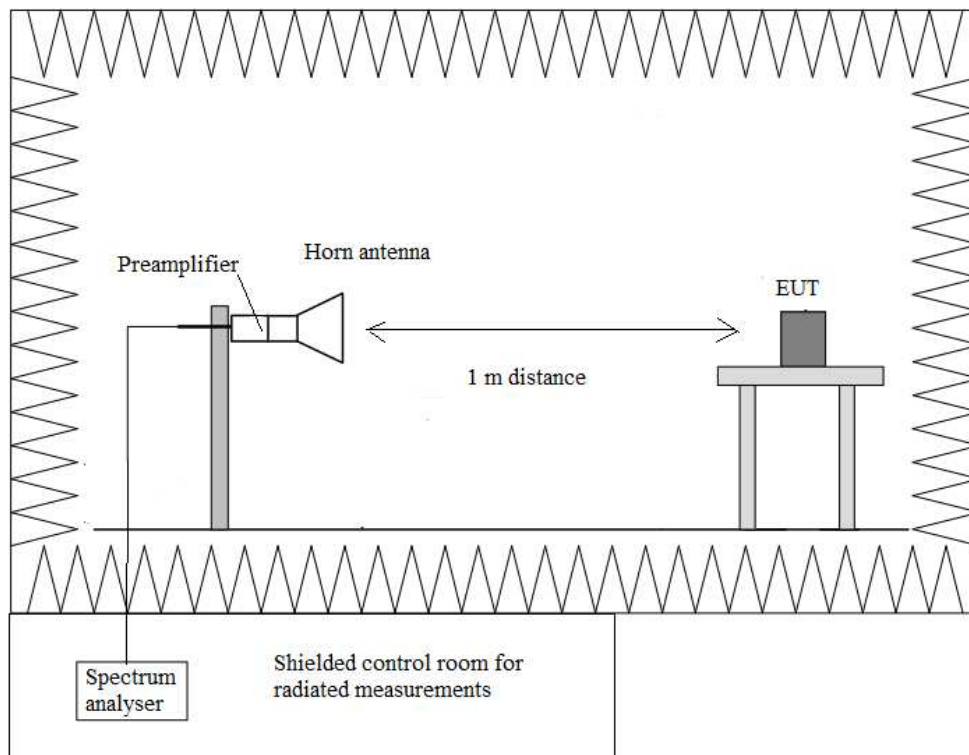
It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

## Radiated measurements setup $f < 1$ GHz



## Radiated measurements setup $f > 1$ GHz



## Occupied Bandwidth

### RESULTS

(see next plots)

#### Mode B

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 99% bandwidth (MHz)           | 13.223                       | 13.209                       | 13.294                        |
| -26 dBc bandwidth (MHz)       | 17.178                       | 17.180                       | 17.210                        |
| Measurement uncertainty (kHz) | <±50                         |                              |                               |

#### Mode G

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 99% bandwidth (MHz)           | 18.359                       | 18.446                       | 18.419                        |
| -26 dBc bandwidth (MHz)       | 23.193                       | 22.874                       | 23.059                        |
| Measurement uncertainty (kHz) | <±50                         |                              |                               |

#### Mode N20

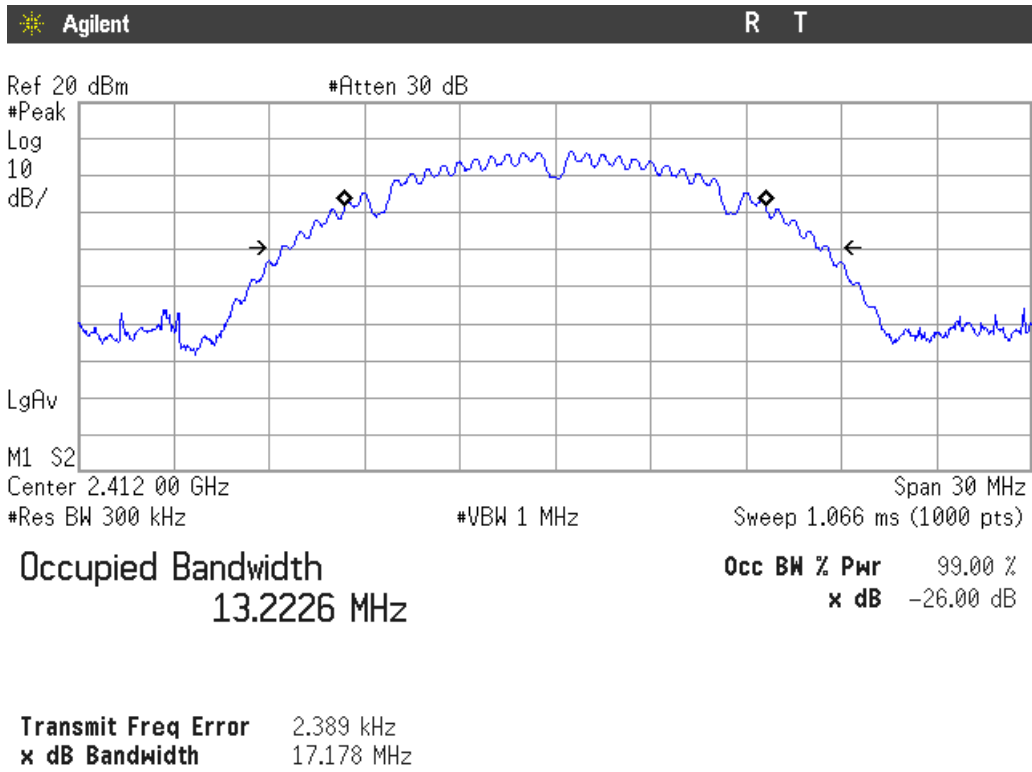
|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 99% bandwidth (MHz)           | 18.724                       | 18.744                       | 18.637                        |
| -26 dBc bandwidth (MHz)       | 22.232                       | 22.727                       | 22.645                        |
| Measurement uncertainty (kHz) | <±50                         |                              |                               |

#### Mode N40

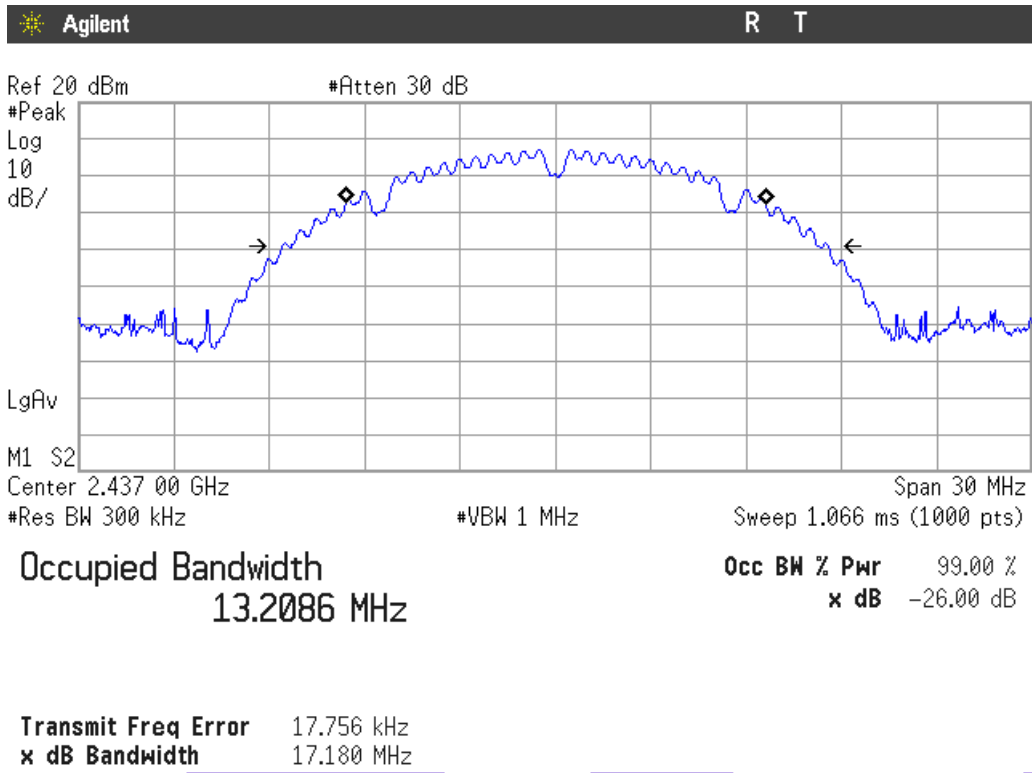
|                               | Lowest frequency<br>2422 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2452 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 99% bandwidth (MHz)           | 38.493                       | 38.428                       | 38.590                        |
| -26 dBc bandwidth (MHz)       | 45.063                       | 45.503                       | 45.573                        |
| Measurement uncertainty (kHz) | <±100                        |                              |                               |

Mode B

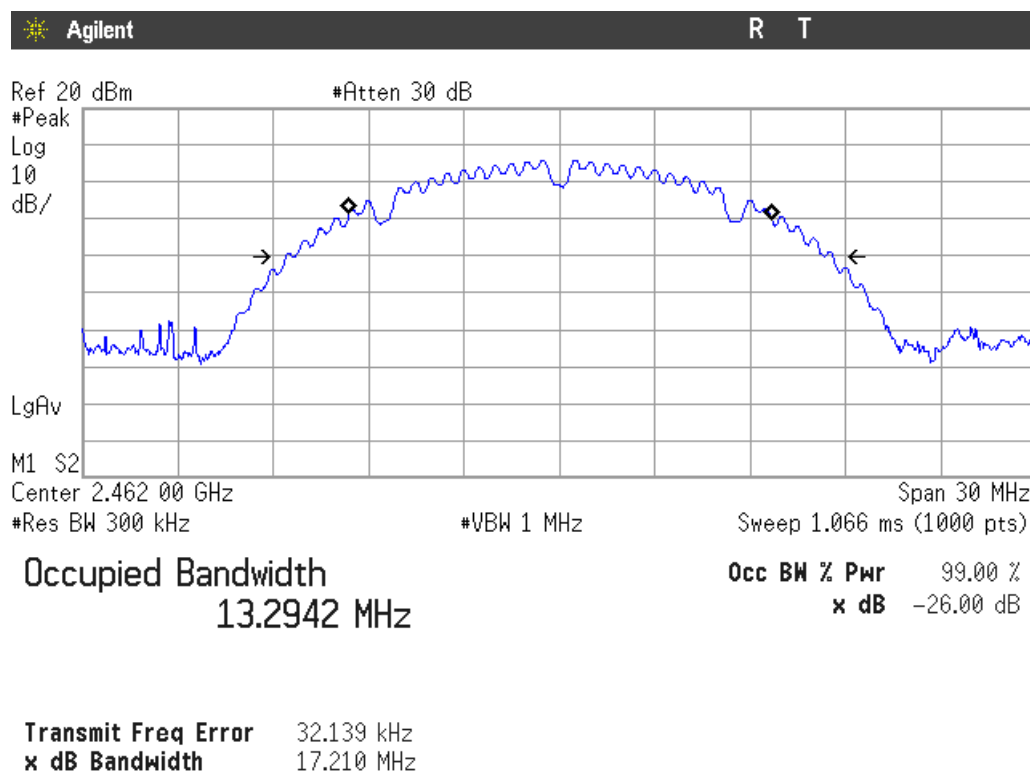
Lowest Channel



Middle Channel

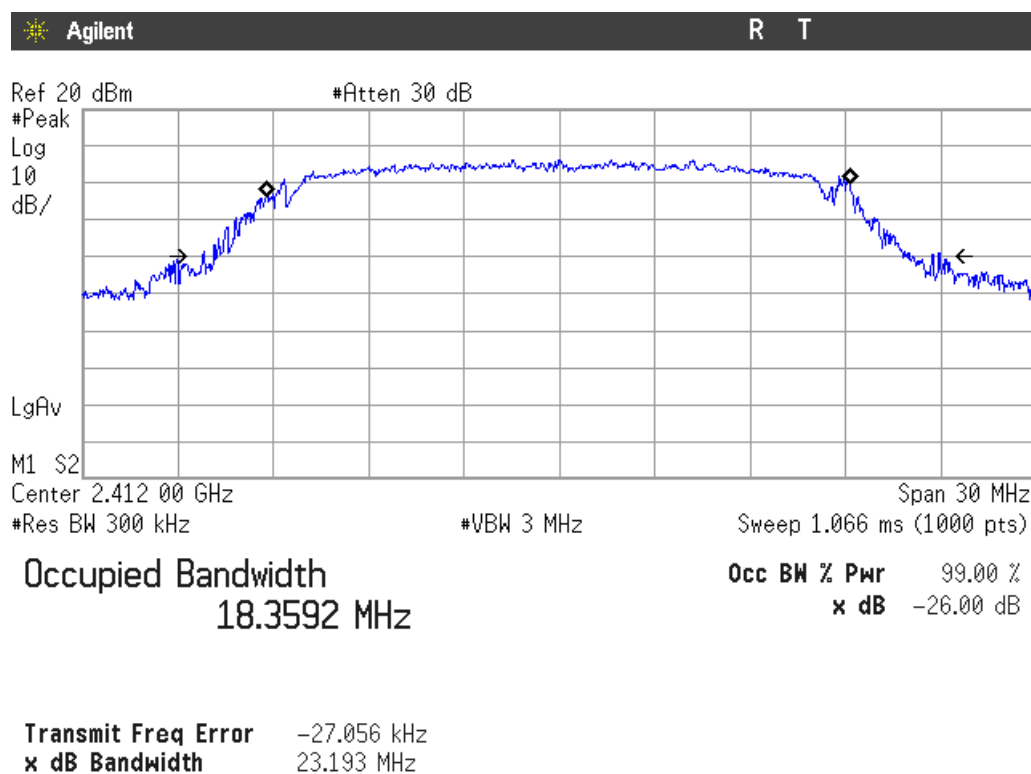


## Highest channel

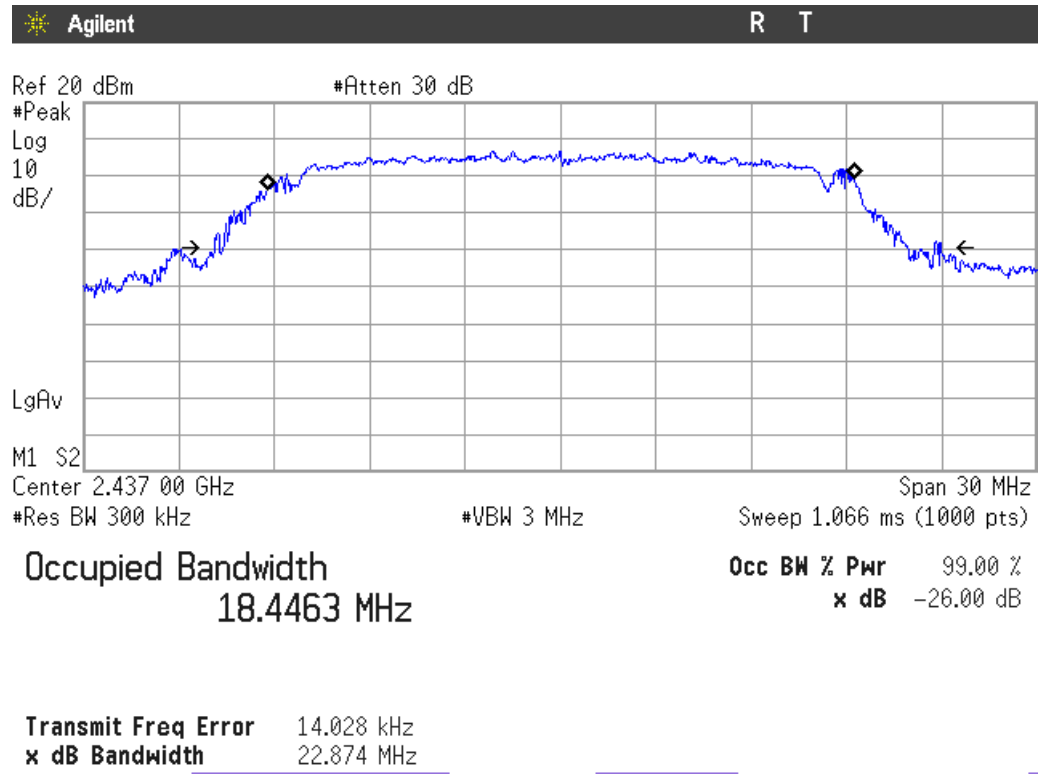


## Mode G

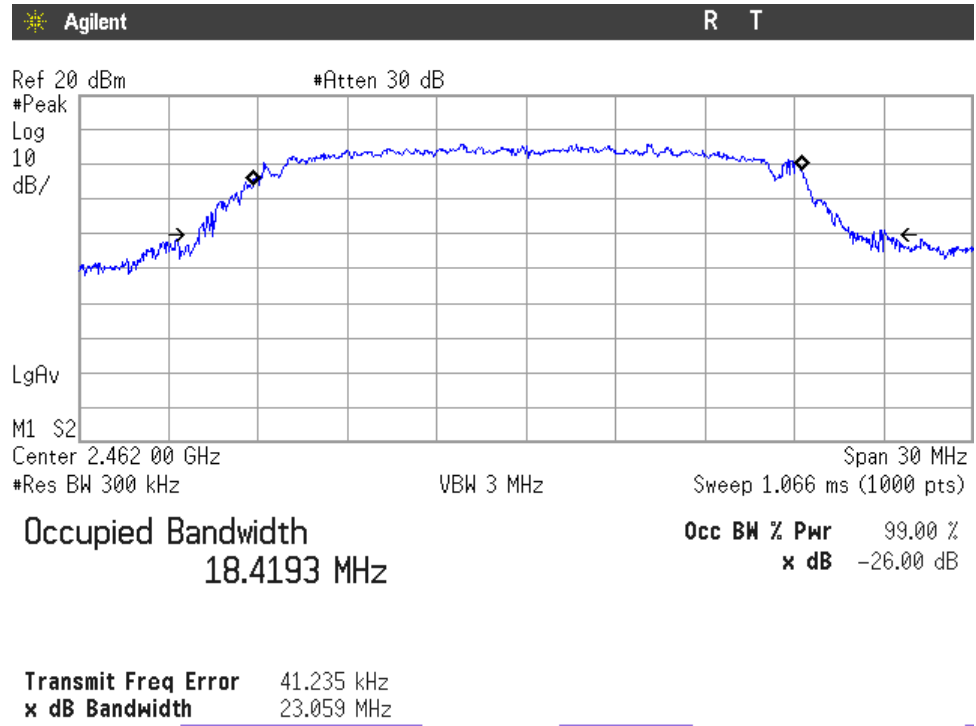
### Lowest Channel



Middle Channel

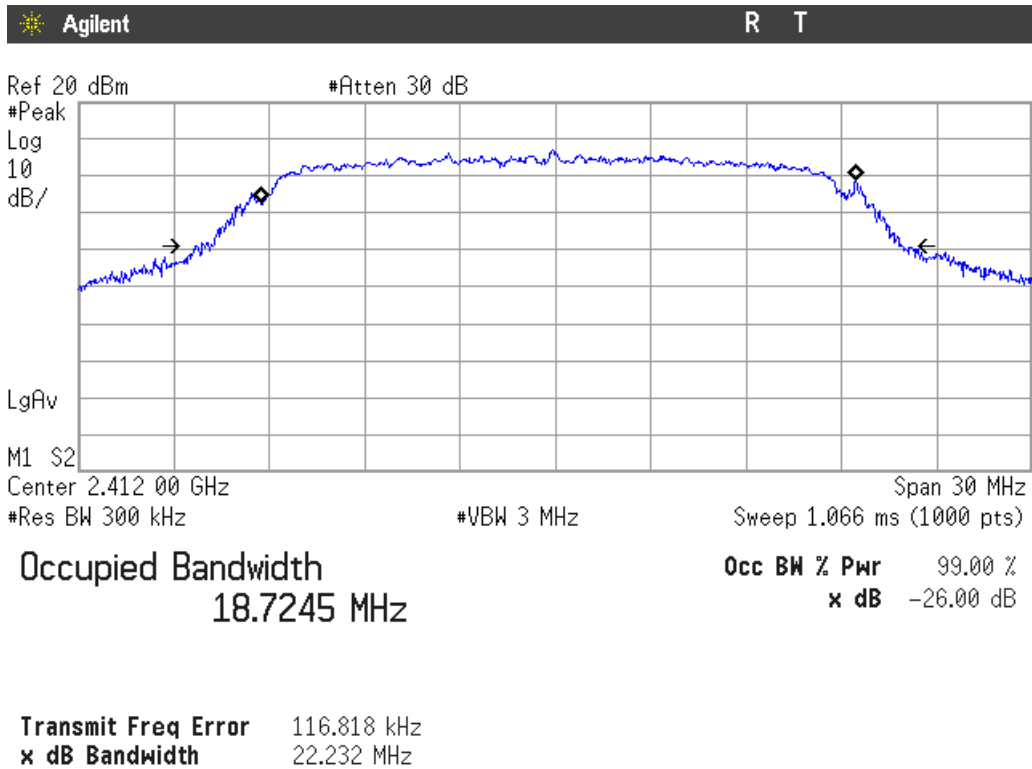


Highest channel

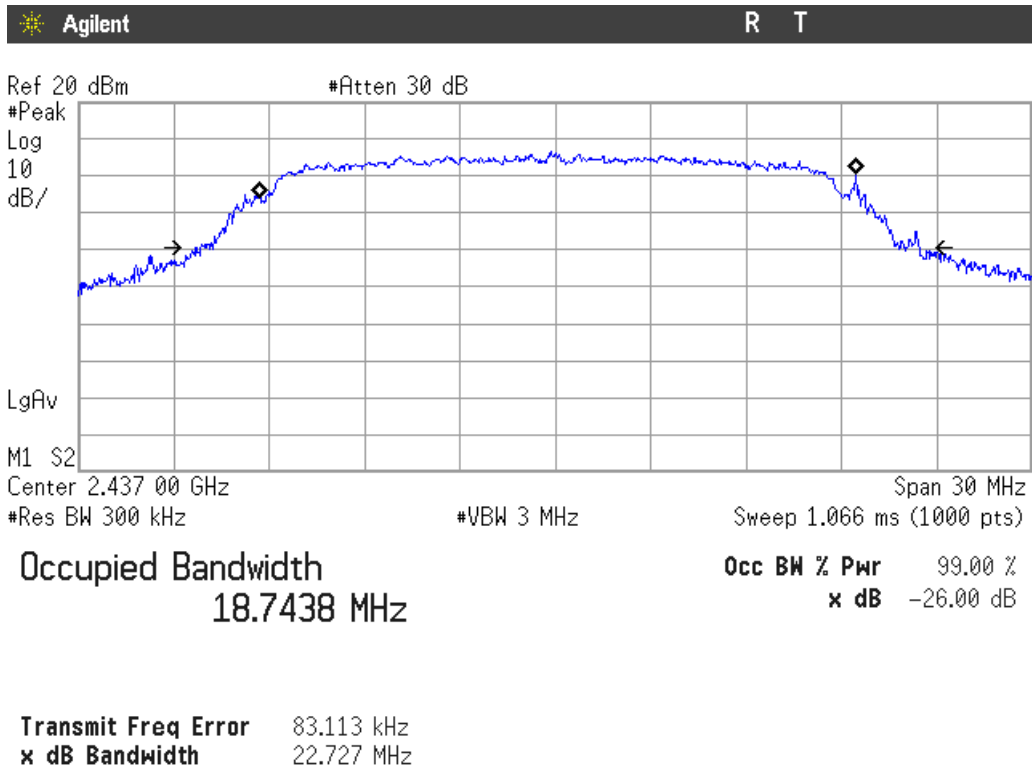


Mode N20

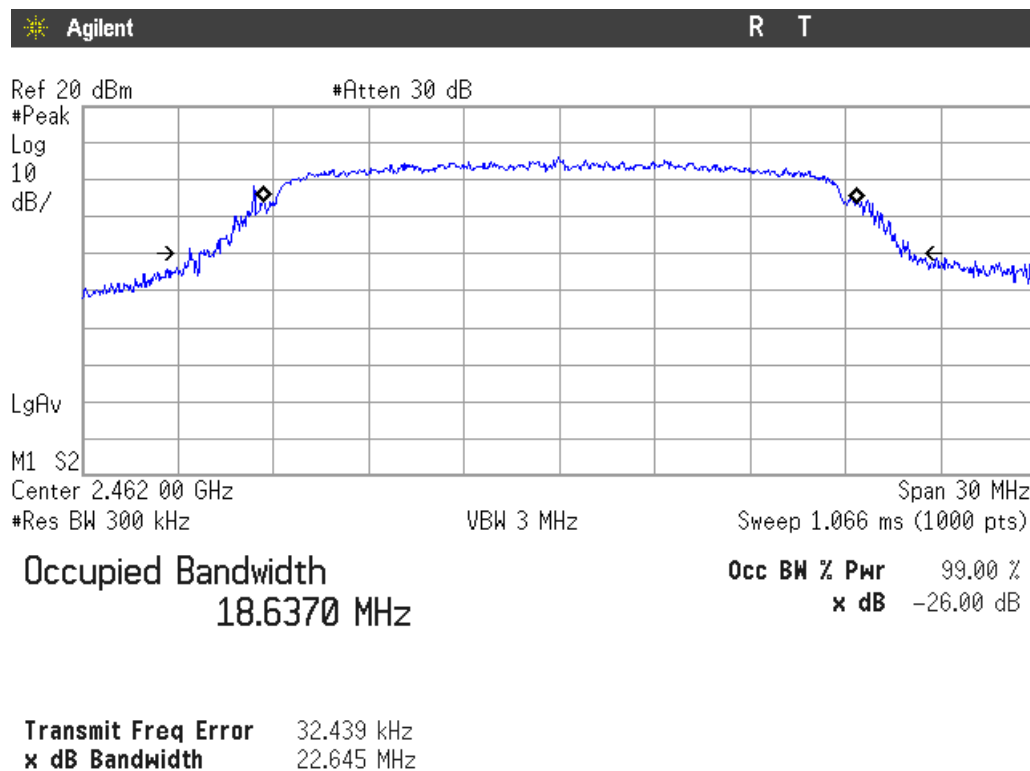
Lowest Channel



Middle Channel

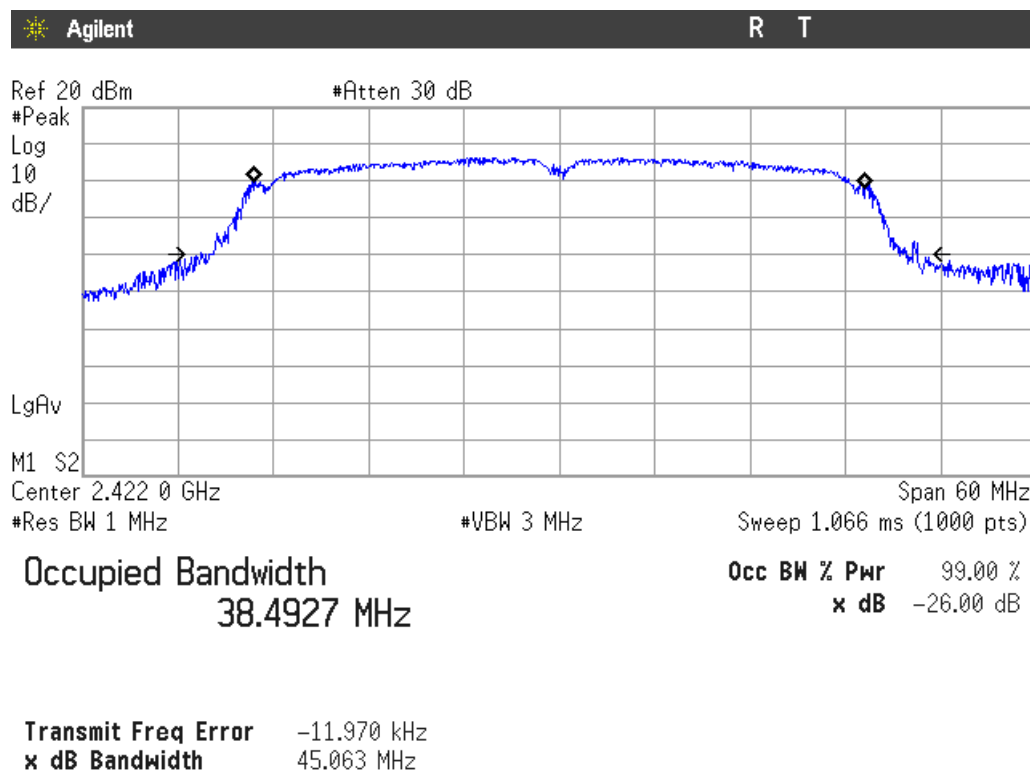


## Highest channel

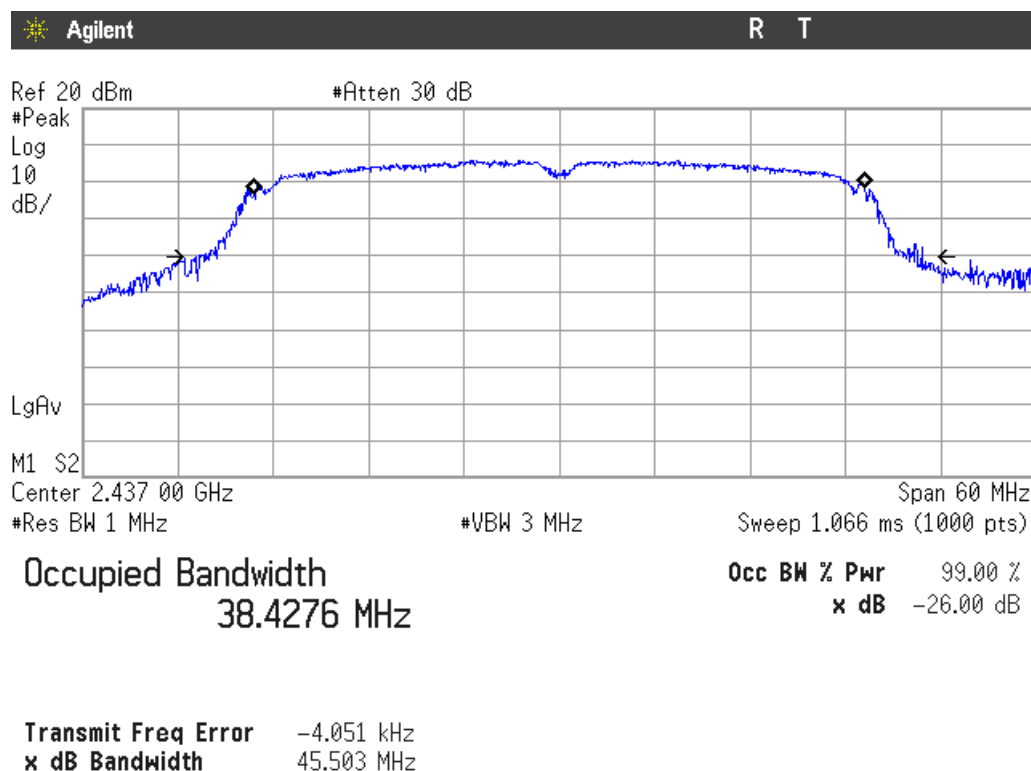


## Mode N40

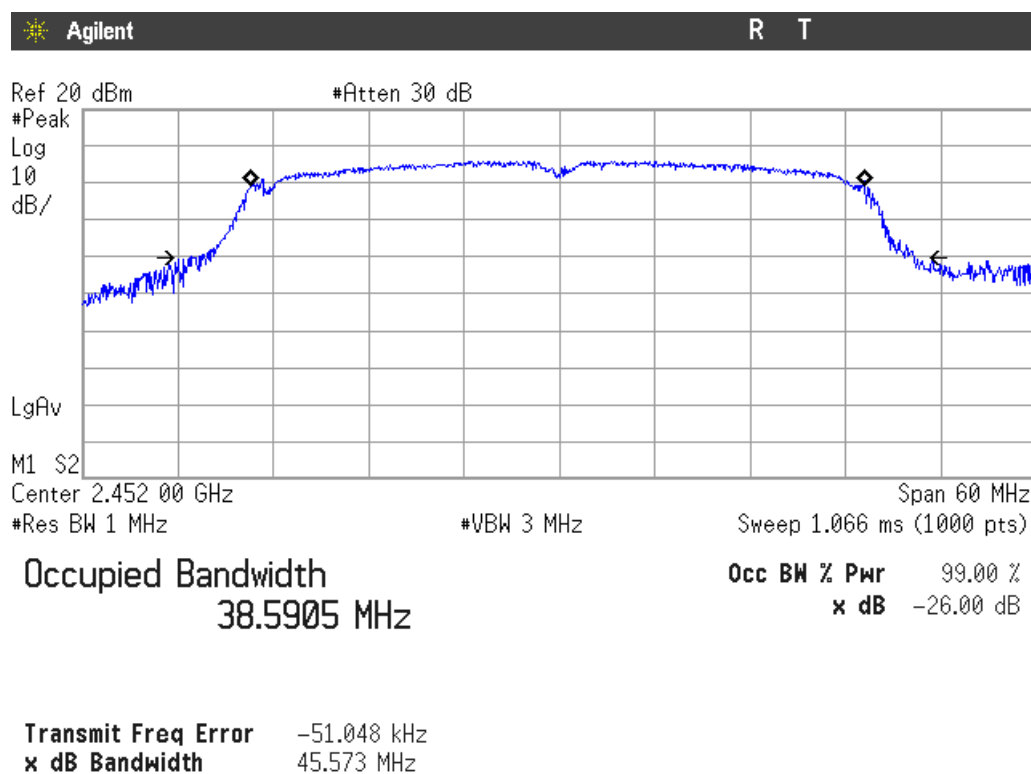
### Lowest Channel



## Middle Channel



## Highest channel



## Section 15.247 Subclause (a) (2). 6 dB Bandwidth

### SPECIFICATION

The minimum 6 dB bandwidth shall be at least 500 kHz.

### RESULTS

6 dB Bandwidth (see next plots).

#### Mode B

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 6 dB Spectrum bandwidth (MHz) | 8.108                        | 8.549                        | 8.108                         |
| Measurement uncertainty (kHz) | <±65.0                       |                              |                               |

#### Mode G

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 6 dB Spectrum bandwidth (MHz) | 15.175                       | 15.155                       | 15.335                        |
| Measurement uncertainty (kHz) | <±65.0                       |                              |                               |

#### Mode N20

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 6 dB Spectrum bandwidth (MHz) | 15.315                       | 15.455                       | 15.455                        |
| Measurement uncertainty (kHz) | <±65.0                       |                              |                               |

#### Mode N40

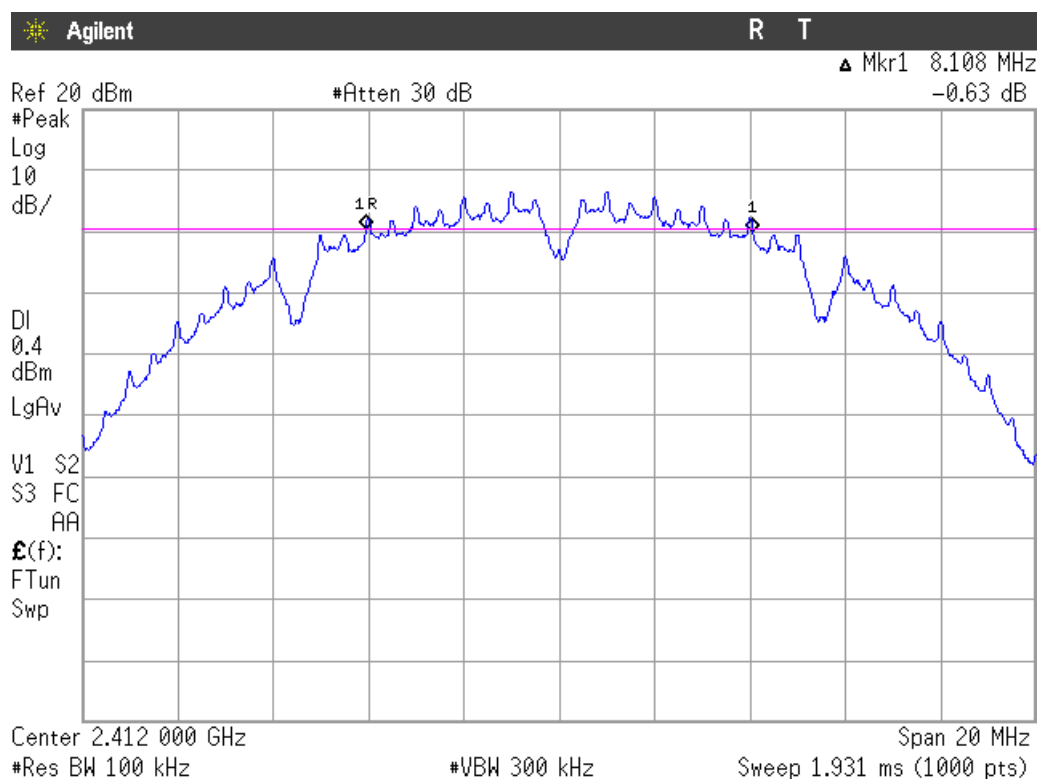
|                               | Lowest frequency<br>2422 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2452 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| 6 dB Spectrum bandwidth (MHz) | 35.19                        | 35.19                        | 35.09                         |
| Measurement uncertainty (kHz) | <±155.0                      |                              |                               |

Verdict: PASS

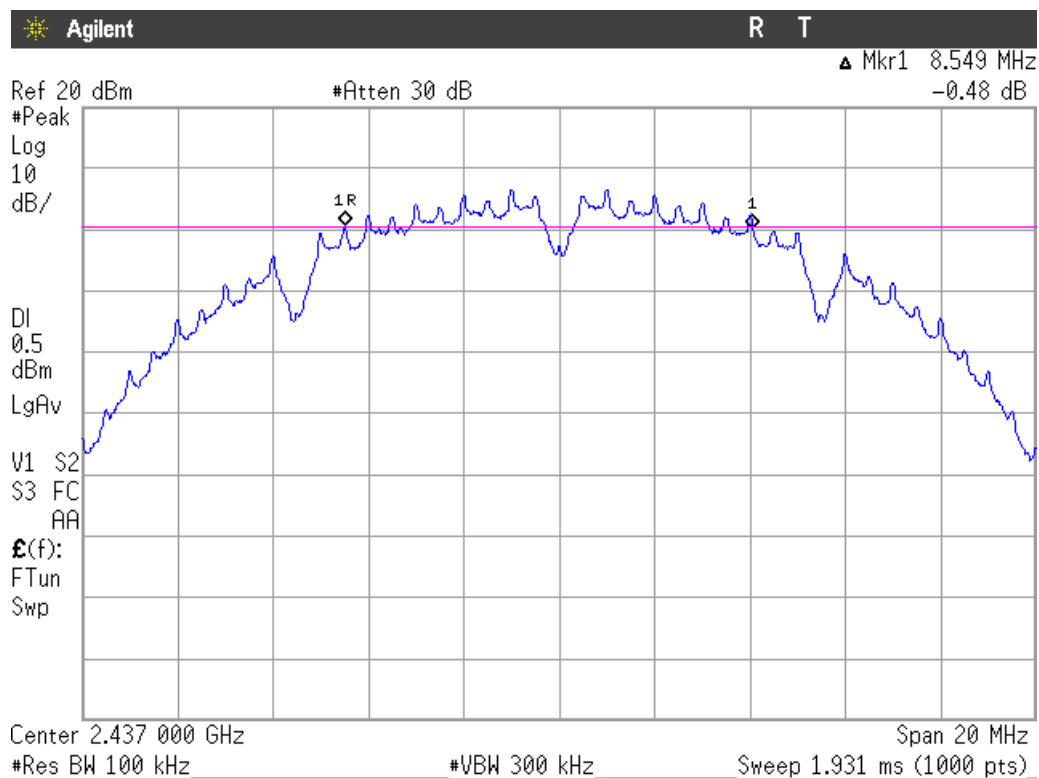
6 dB BANDWIDTH.

Mode B

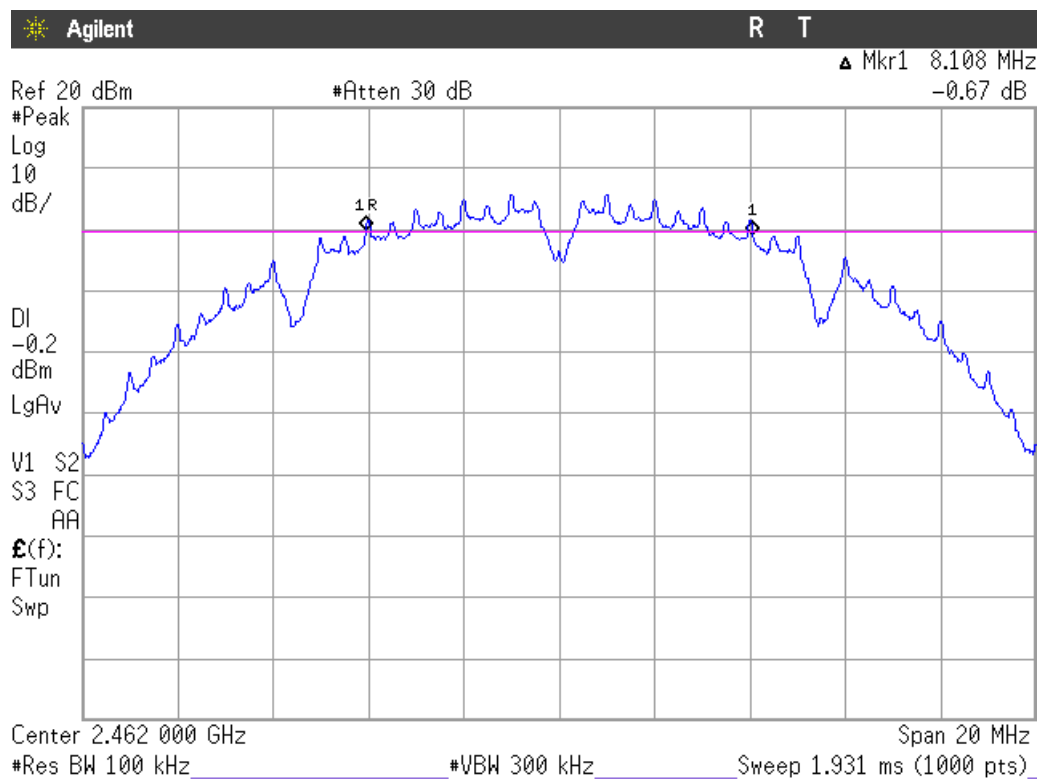
Lowest Channel



Middle Channel

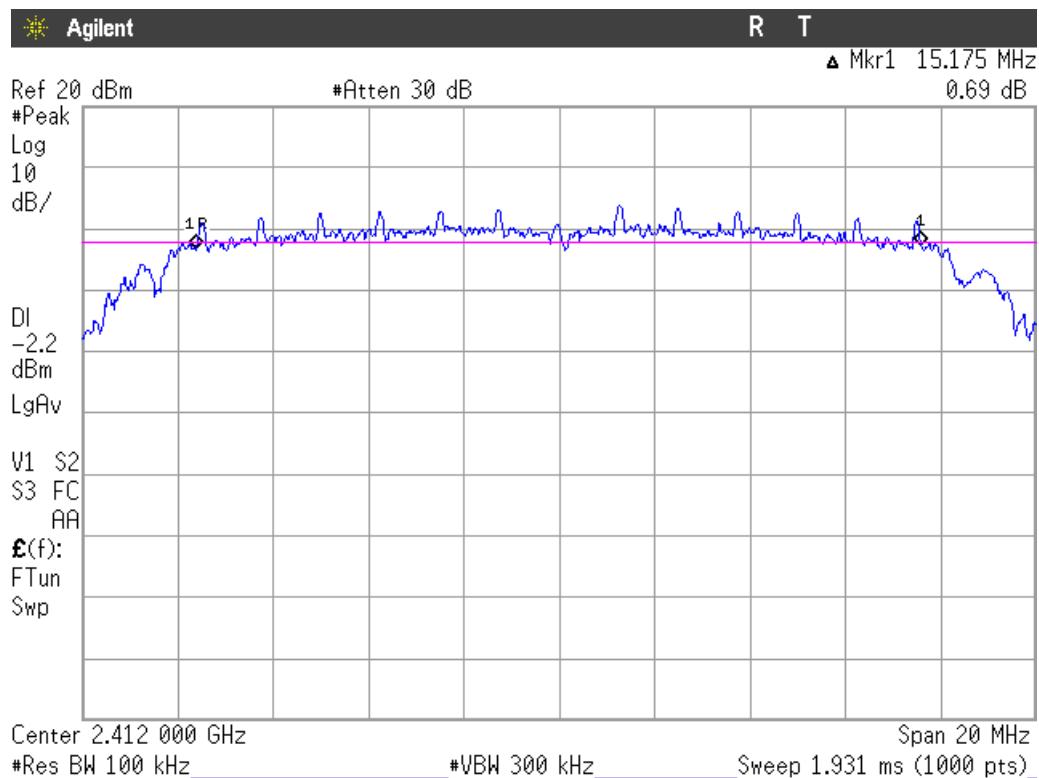


## Highest channel

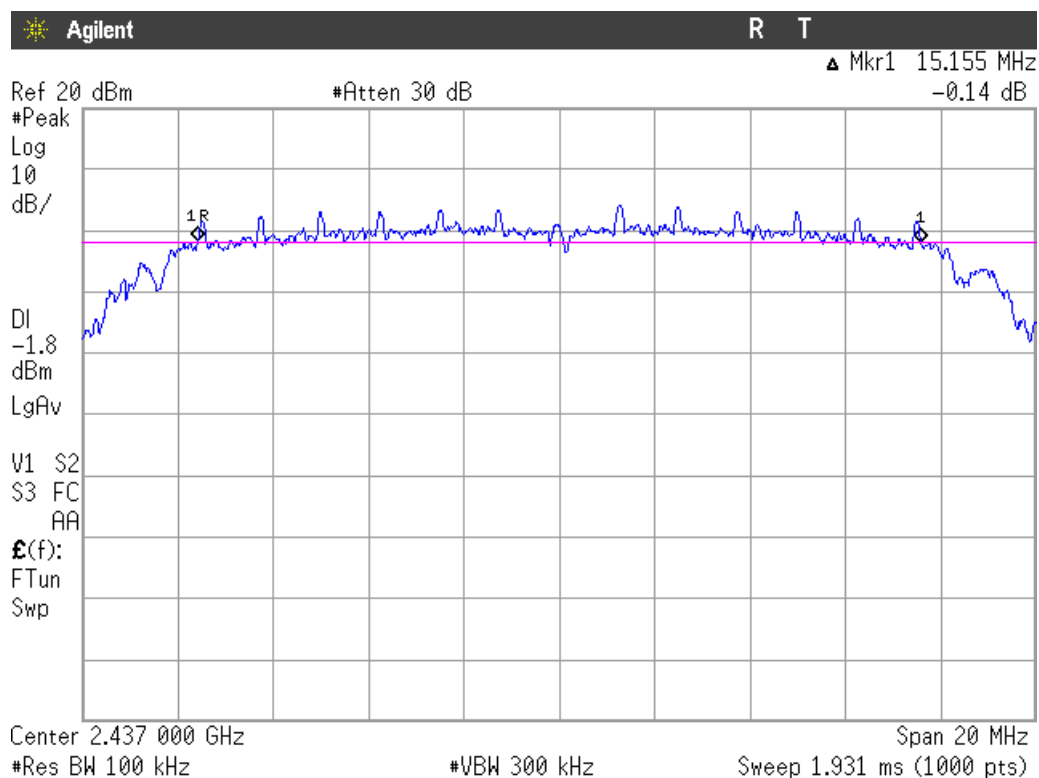


## Mode G

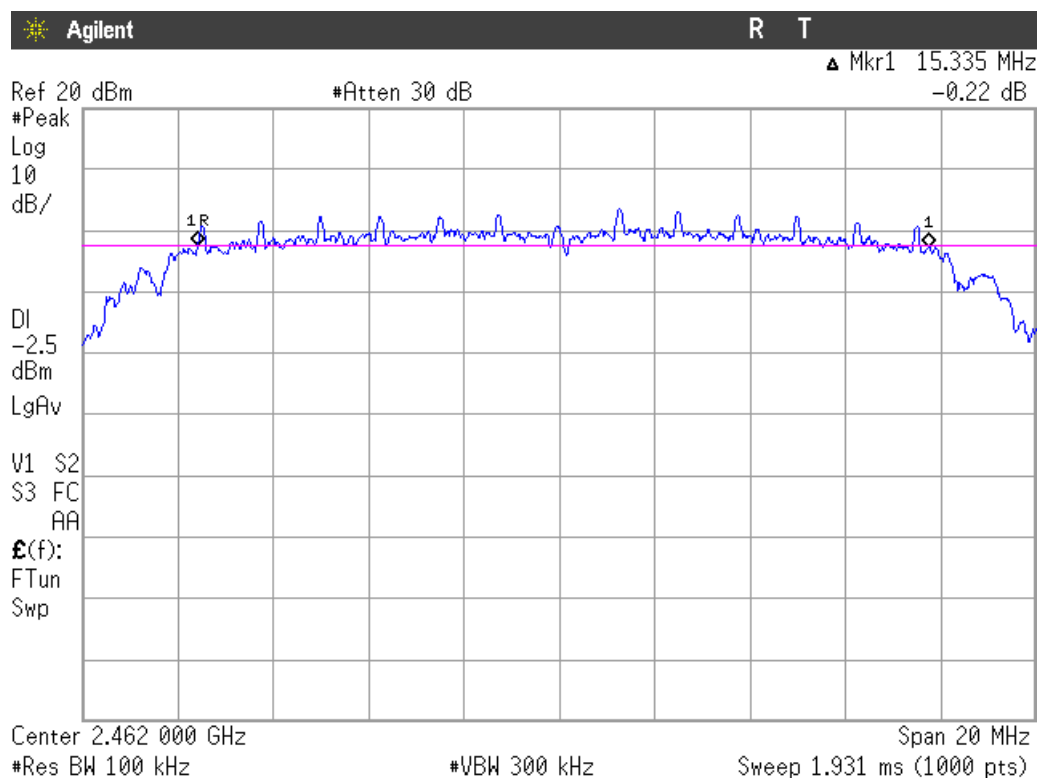
### Lowest Channel



## Middle Channel

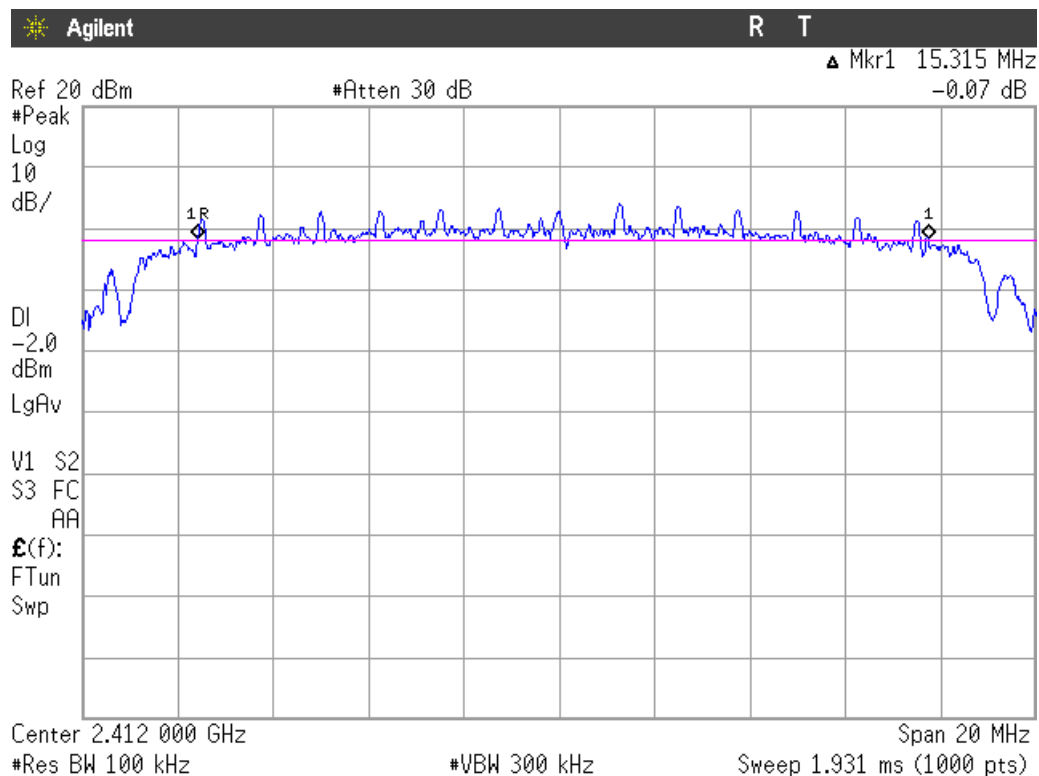


## Highest channel

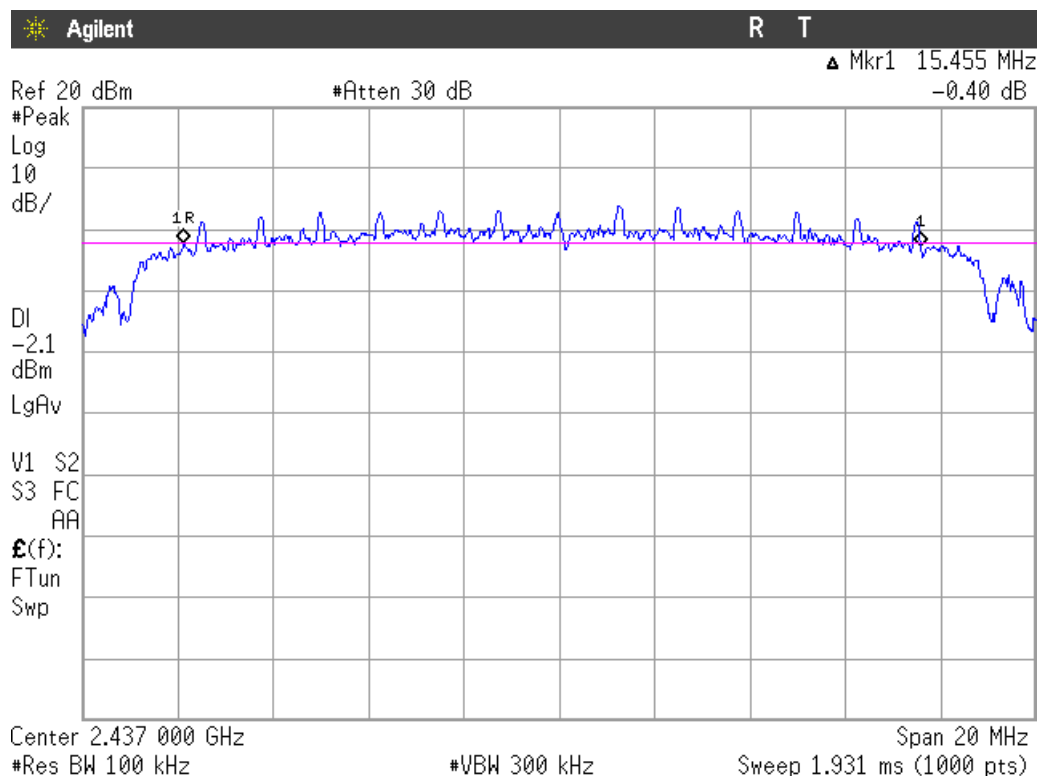


## Mode N20

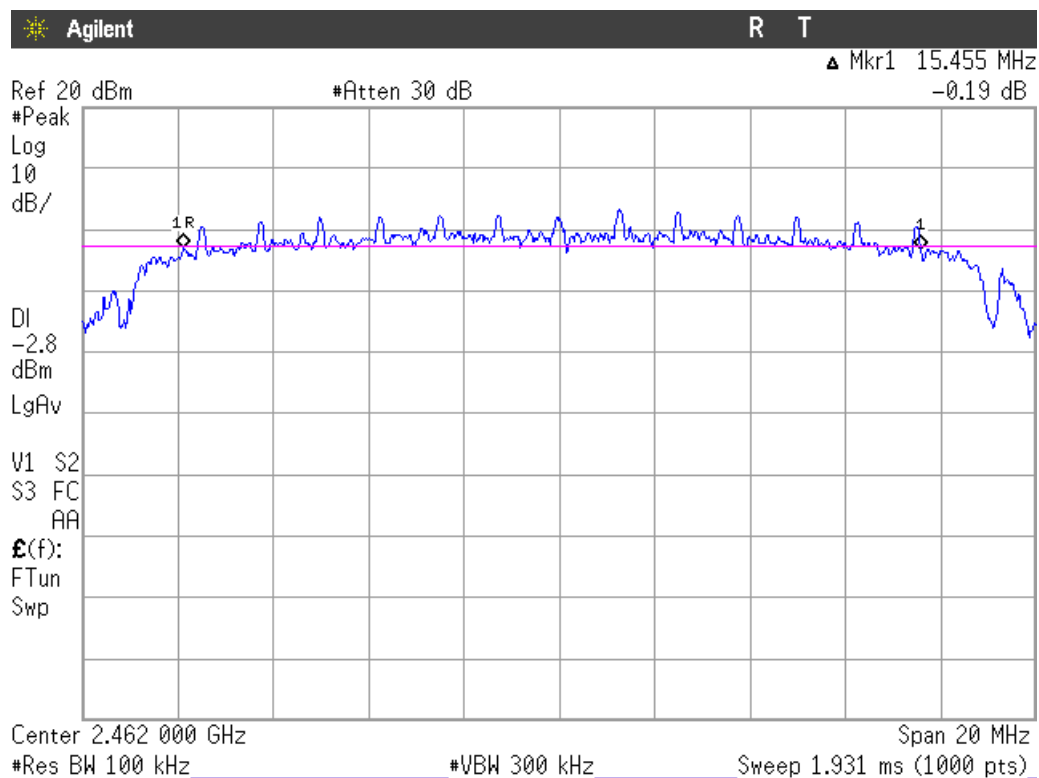
### Lowest Channel



### Middle Channel

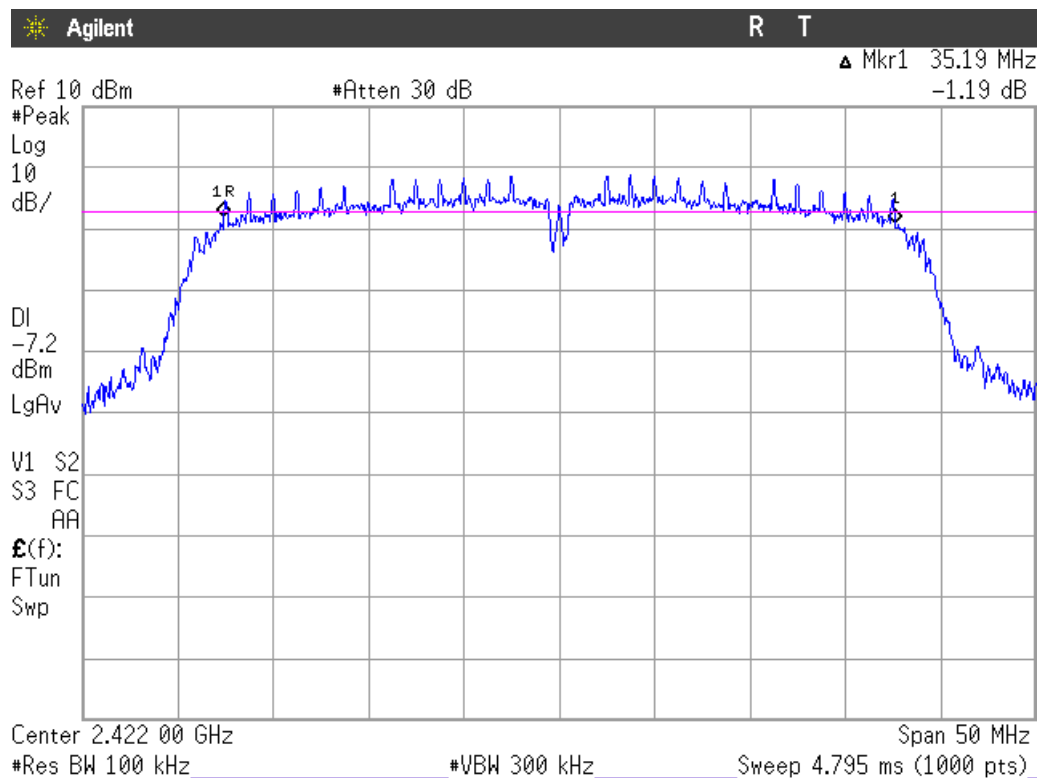


## Highest channel

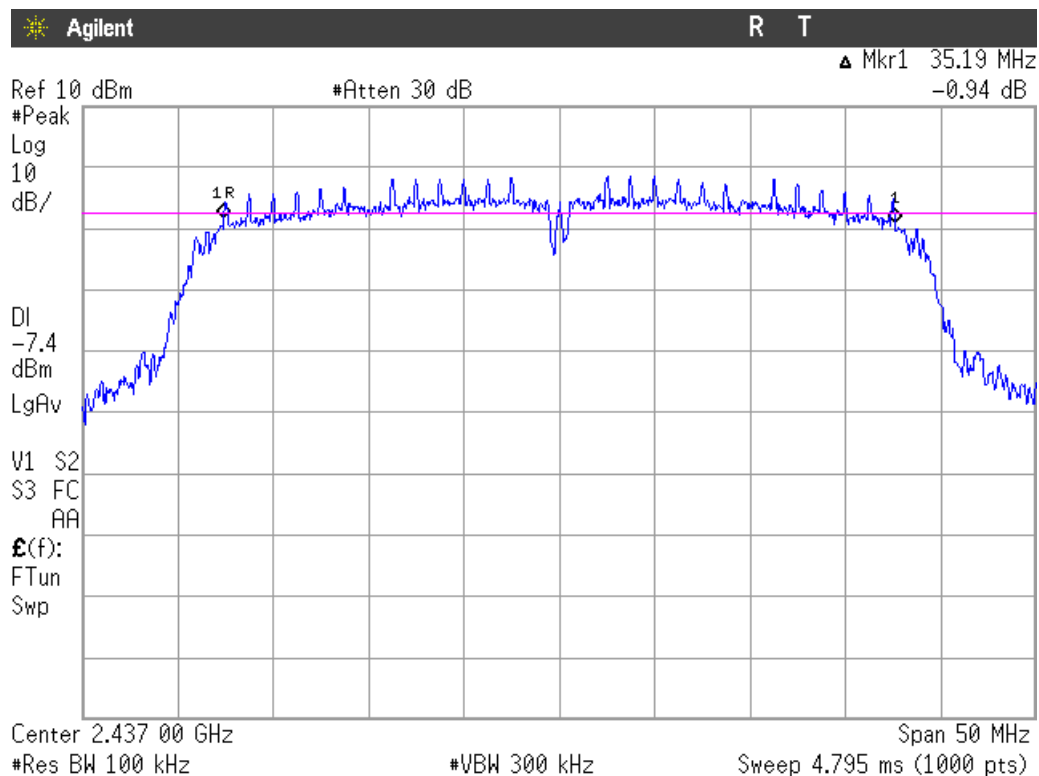


## Mode N40

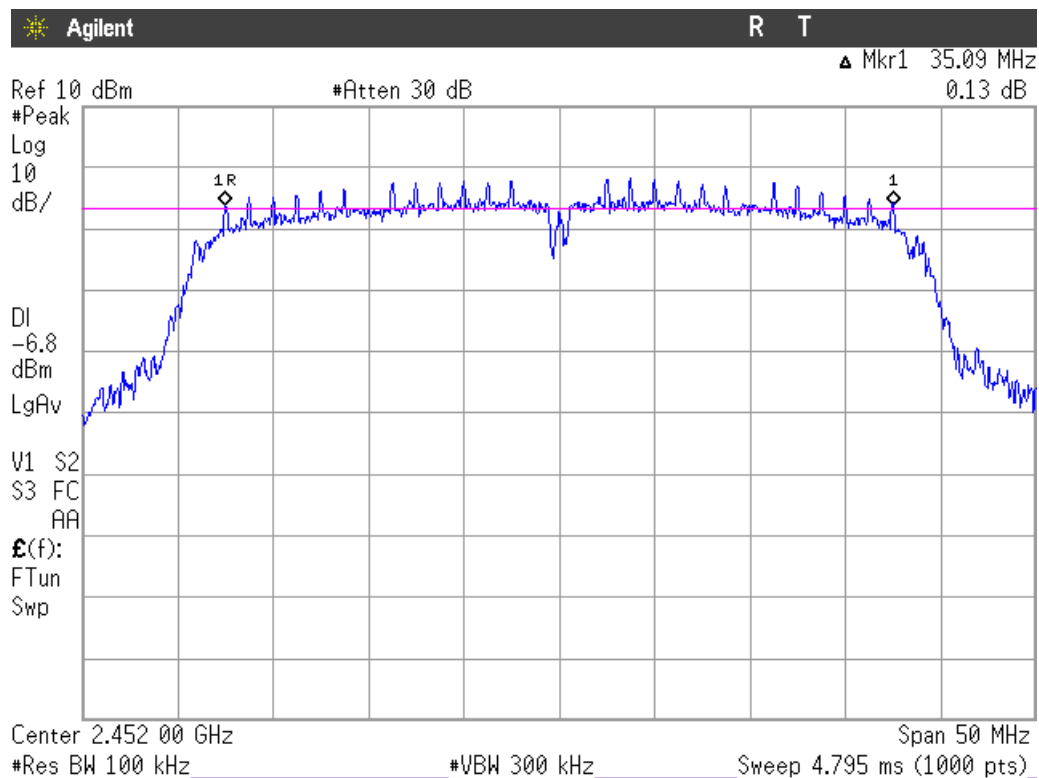
### Lowest Channel



## Middle Channel



## Highest channel



## Section 15.247 Subclause (b). Maximum output power and antenna gain

### SPECIFICATION

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

### RESULTS

For all modes, the maximum conducted (average) output power was measured using the method according to point 9.2.2.2 of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247 558074 D01 DTS Meas Guidance v04 dated 05/04/2017.

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

MAXIMUM OUTPUT POWER. See next plots.

Maximum declared antenna gain: -1.85 dBi.

Mode B: Average Conducted Output Power:

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum conducted power (dBm) | 14.21                        | 14.31                        | 14.07                         |
| Maximum EIRP power (dBm)      | 12.36                        | 12.46                        | 12.22                         |
| Measurement uncertainty (dB)  | <±0.79                       |                              |                               |

Mode G: Average Conducted Output Power:

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum conducted power (dBm) | 14.11                        | 13.59                        | 13.40                         |
| Maximum EIRP power (dBm)      | 12.26                        | 11.74                        | 11.55                         |
| Measurement uncertainty (dB)  | <±0.79                       |                              |                               |

Mode N20: Average Conducted Output Power:

|                               | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum conducted power (dBm) | 13.87                        | 13.41                        | 13.32                         |
| Maximum EIRP power (dBm)      | 12.02                        | 11.56                        | 11.47                         |
| Measurement uncertainty (dB)  | <±0.79                       |                              |                               |

Mode N40: Average Conducted Output Power:

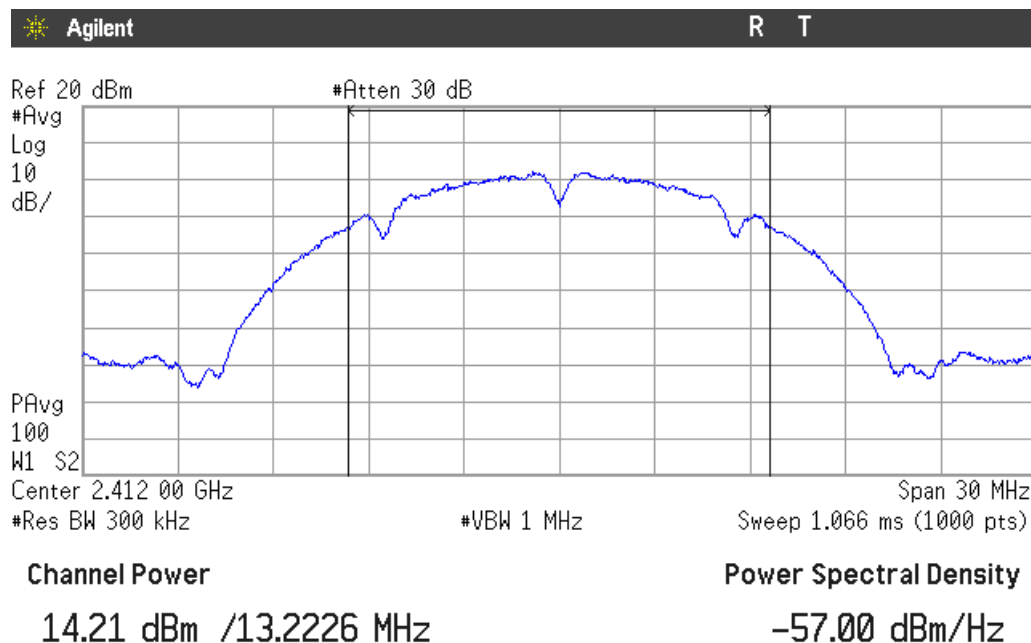
|                               | Lowest frequency<br>2422 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2452 MHz |
|-------------------------------|------------------------------|------------------------------|-------------------------------|
| Maximum conducted power (dBm) | 11.99                        | 11.37                        | 11.08                         |
| Maximum EIRP power (dBm)      | 10.14                        | 9.52                         | 9.23                          |
| Measurement uncertainty (dB)  | <±0.79                       |                              |                               |

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.

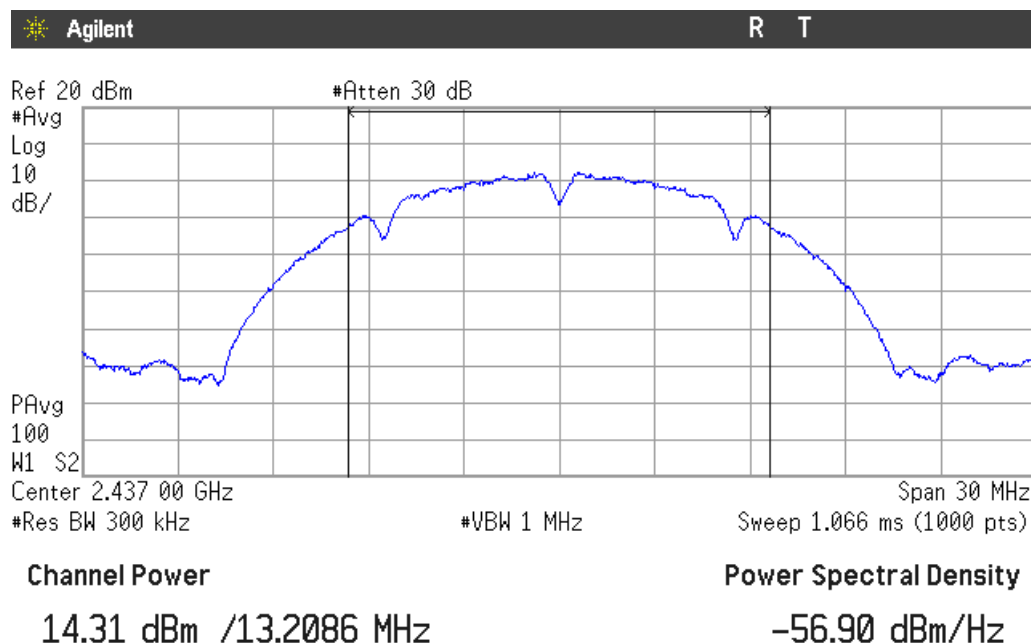
Verdict: PASS

## Mode B

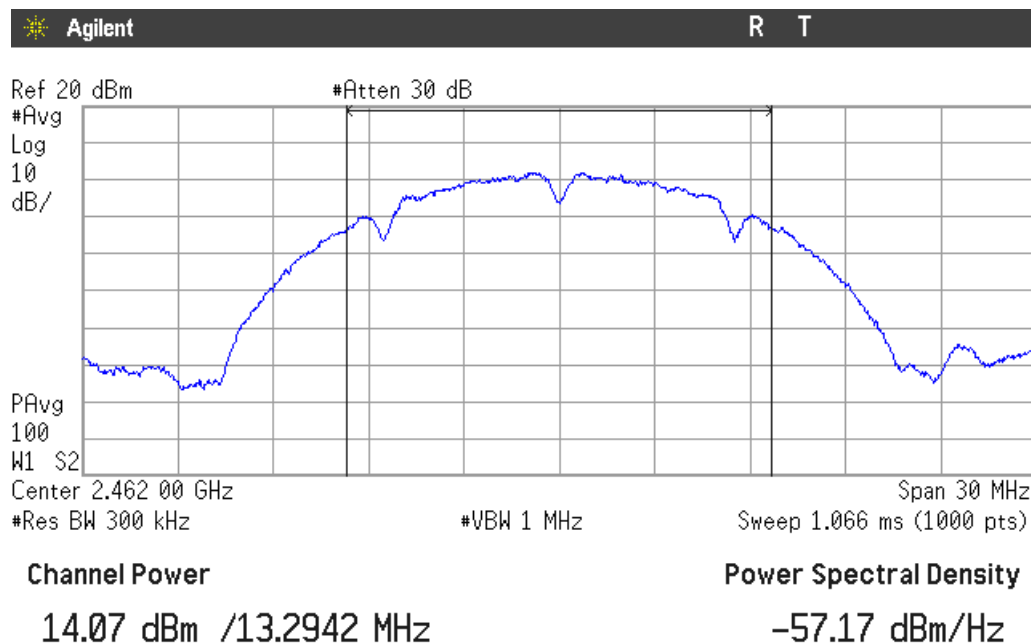
### Lowest Channel



### Middle Channel

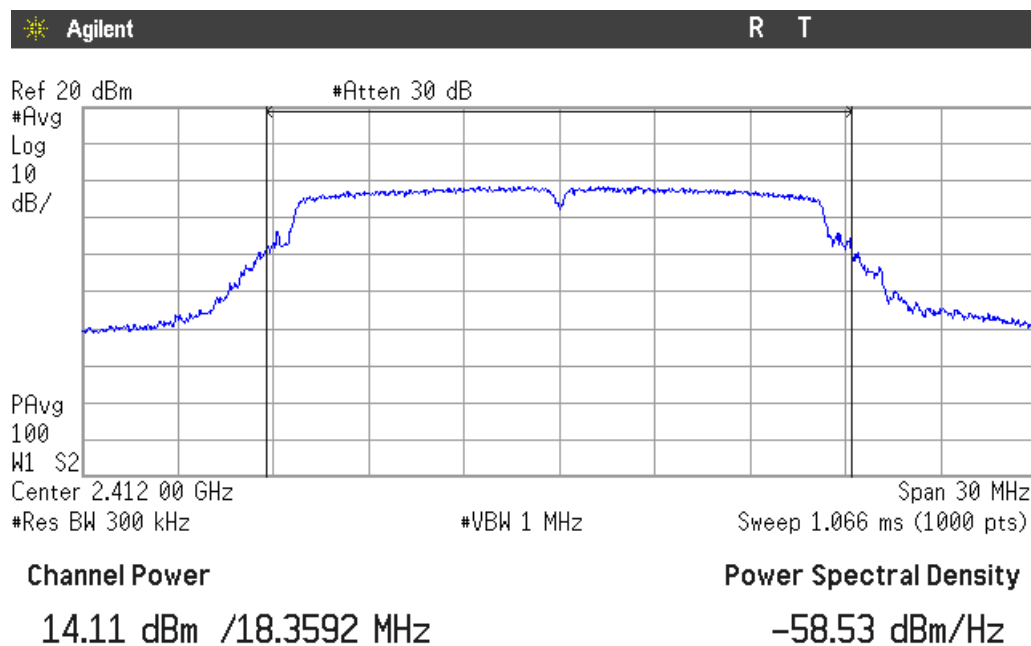


## Highest Channel

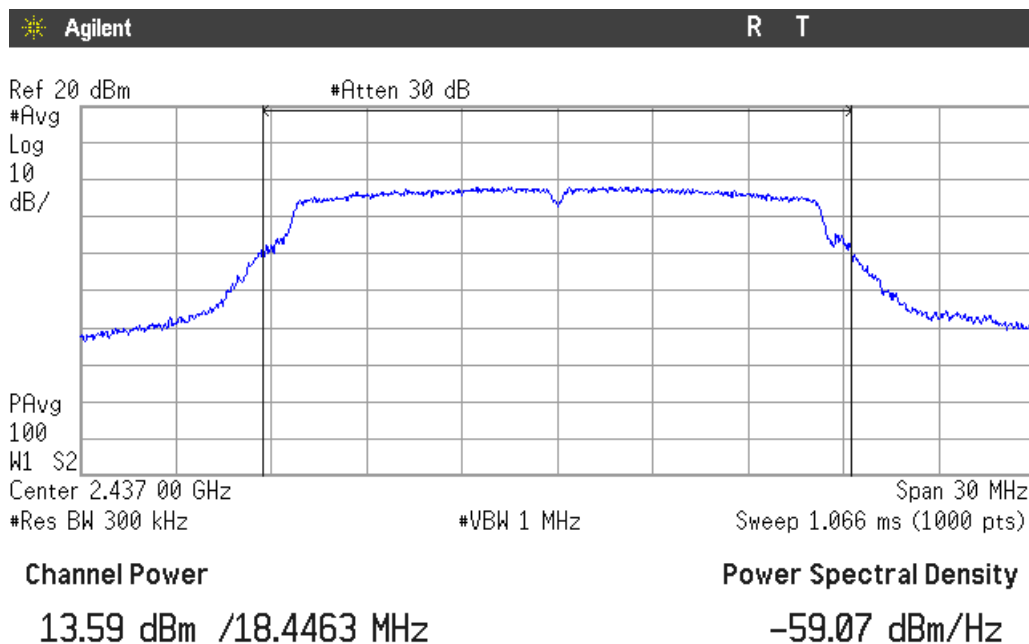


## Mode G

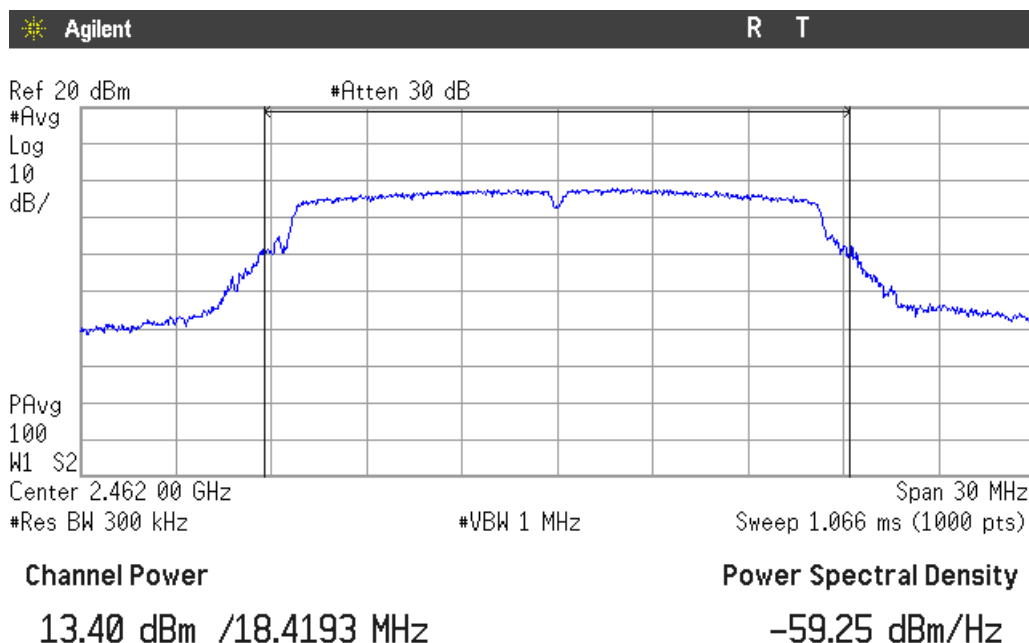
### Lowest Channel



## Middle Channel

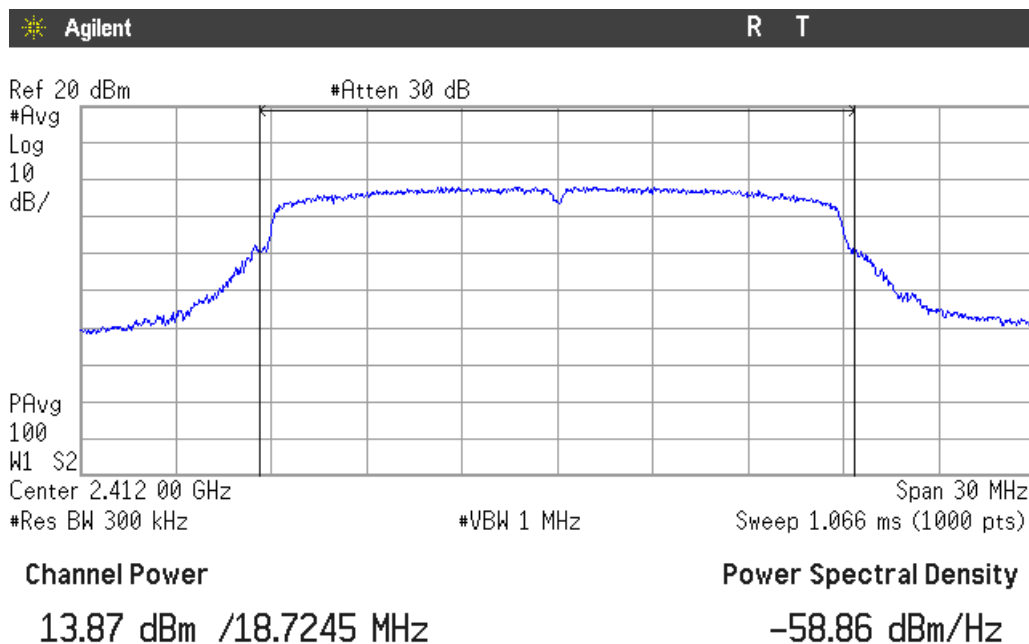


## Highest Channel

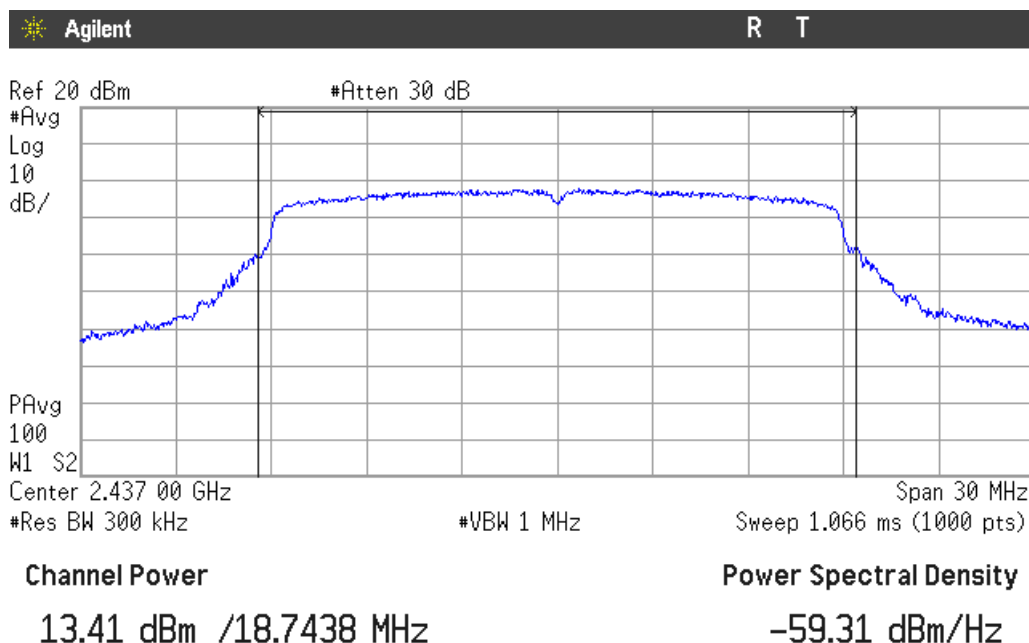


## Mode N20

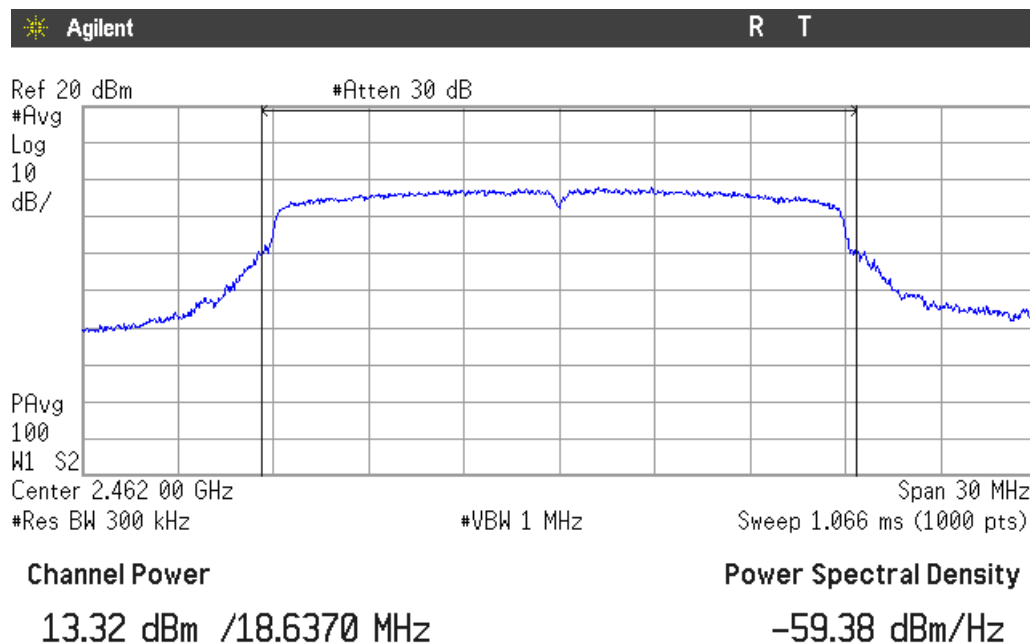
### Lowest Channel



### Middle Channel

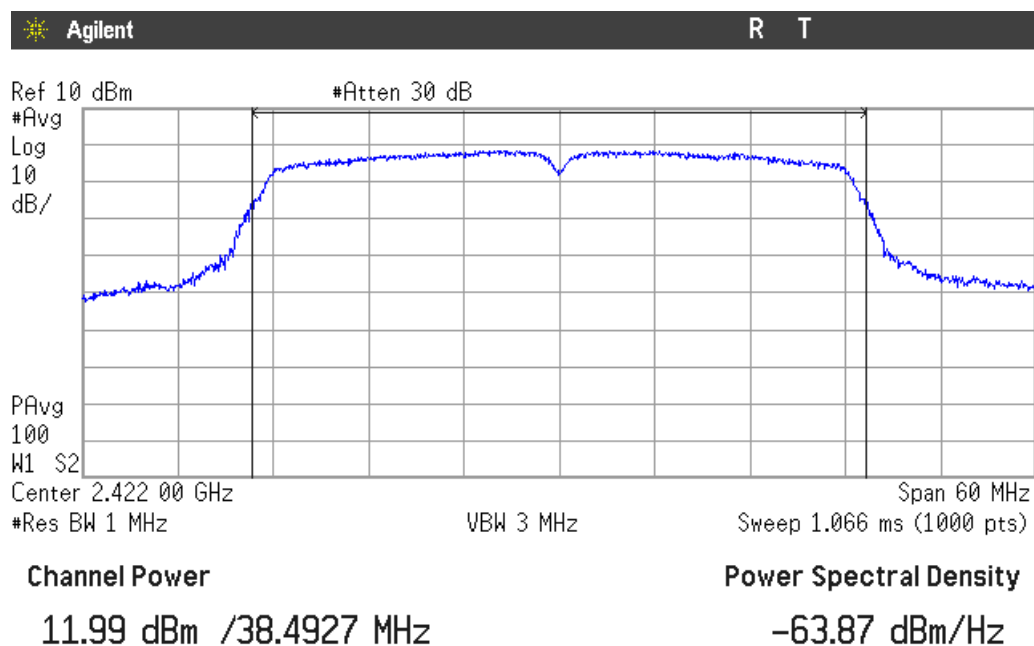


## Highest Channel

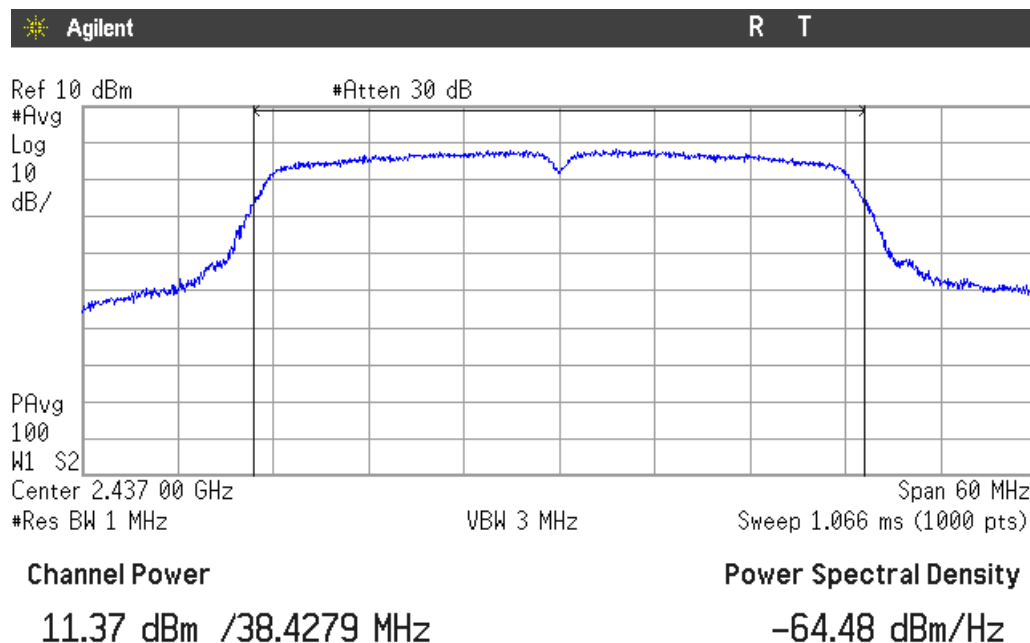


## Mode N40

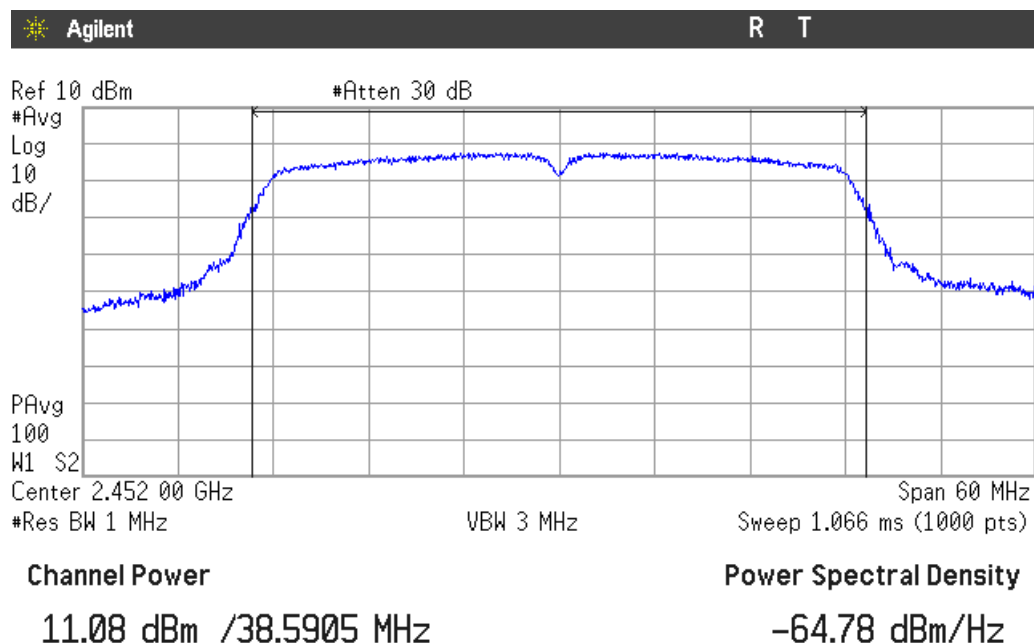
### Lowest Channel



## Middle Channel



## Highest Channel



## Section 15.247 Subclause (d). Emission limitations conducted (Transmitter)

### SPECIFICATION

In any 100 kHz bandwidth outside the frequency band in which the 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

### RESULTS:

#### Reference Level Measurement

##### Mode B

|                                      | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|--------------------------------------|------------------------------|------------------------------|-------------------------------|
| Reference Level Measurement<br>(dBm) | 6.45                         | 6.00                         | 5.72                          |
| Measurement uncertainty (dB)         | <±0.78                       |                              |                               |

##### Mode G

|                                      | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|--------------------------------------|------------------------------|------------------------------|-------------------------------|
| Reference Level Measurement<br>(dBm) | 3.36                         | 3.40                         | 3.41                          |
| Measurement uncertainty (dB)         | <±0.78                       |                              |                               |

##### Mode N20

|                                      | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|--------------------------------------|------------------------------|------------------------------|-------------------------------|
| Reference Level Measurement<br>(dBm) | 3.75                         | 3.27                         | 3.23                          |
| Measurement uncertainty (dB)         | <±0.78                       |                              |                               |

##### Mode N40

|                                      | Lowest frequency<br>2422 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2452 MHz |
|--------------------------------------|------------------------------|------------------------------|-------------------------------|
| Reference Level Measurement<br>(dBm) | -1.28                        | -1.62                        | -1.90                         |
| Measurement uncertainty (dB)         | <±0.78                       |                              |                               |

## Mode B

Lowest frequency 2412 MHz

| Lowest frequency 2412 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -23.55      |

| Middle frequency 2437 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -24.00      |

| Highest frequency 2462 MHz                     | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -24.28      |

## Mode G

| Lowest frequency 2412 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -26.64      |

| Middle frequency 2437 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -26.60      |

| Highest frequency 2462 MHz                     | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -26.59      |

## Mode N20

| Lowest frequency 2412 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -26.25      |

| Middle frequency 2437 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -26.73      |

| Highest frequency 2462 MHz                     | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -26.77      |

#### Mode N40

| Lowest frequency 2422 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -31.28      |

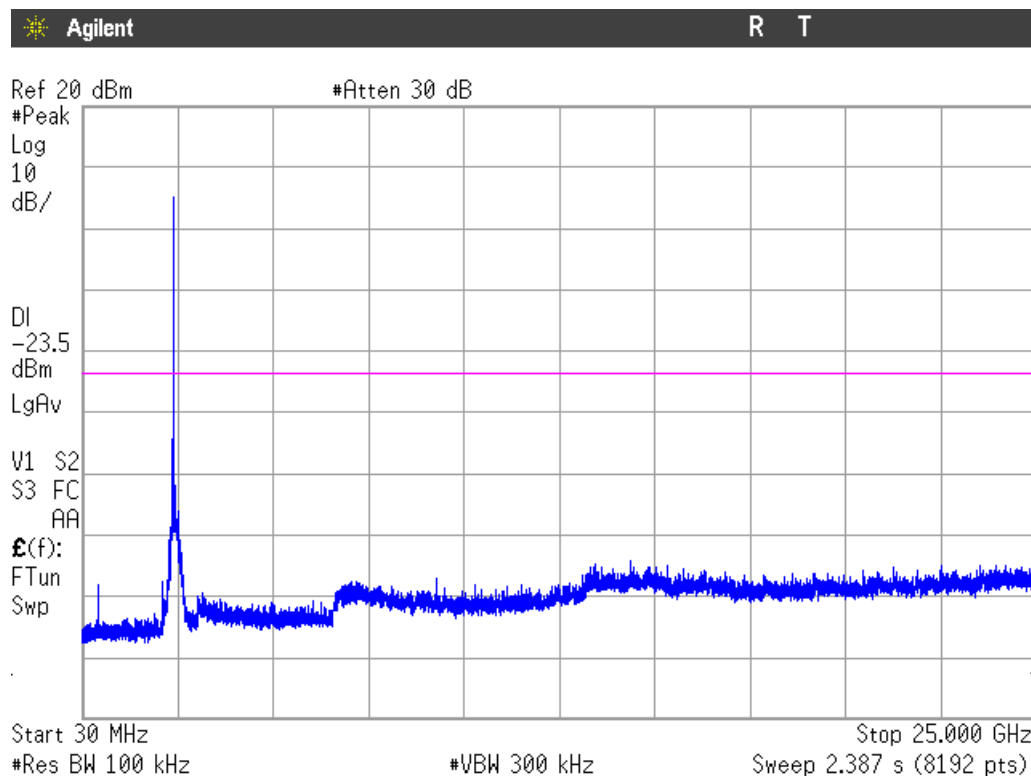
| Middle frequency 2437 MHz                      | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -31.62      |

| Highest frequency 2452 MHz                     | Limit (dBm) |
|------------------------------------------------|-------------|
| All peaks are more than 20 dB below the limit. | -31.90      |

Verdict: PASS

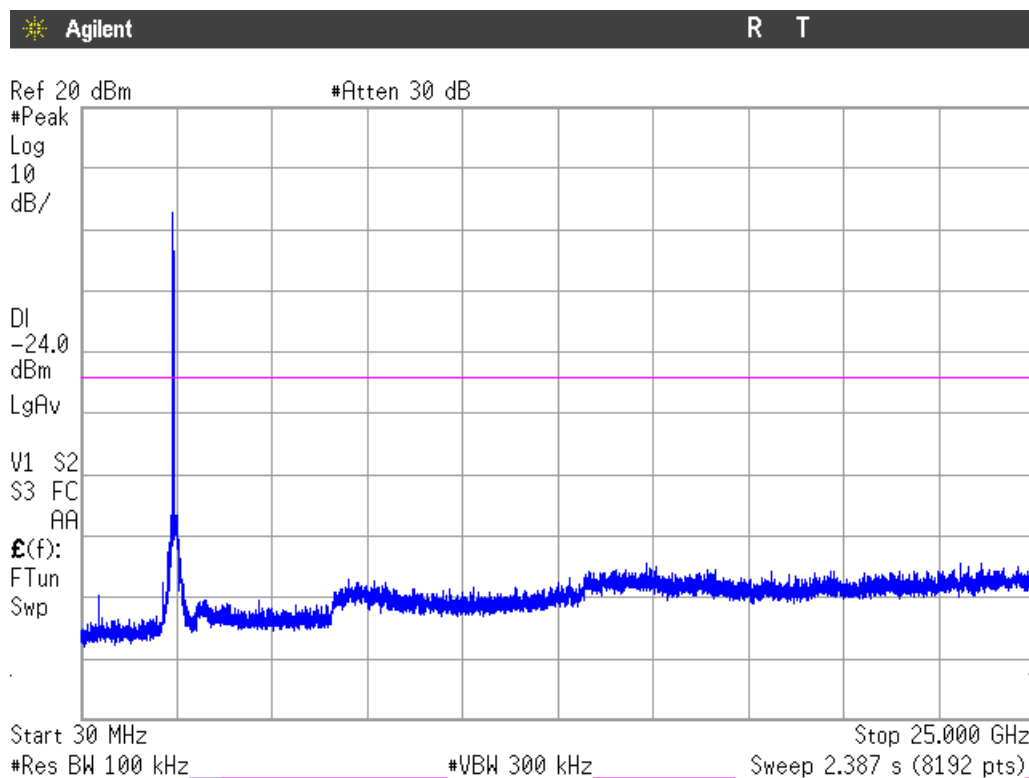
## Mode B

### Lowest Channel



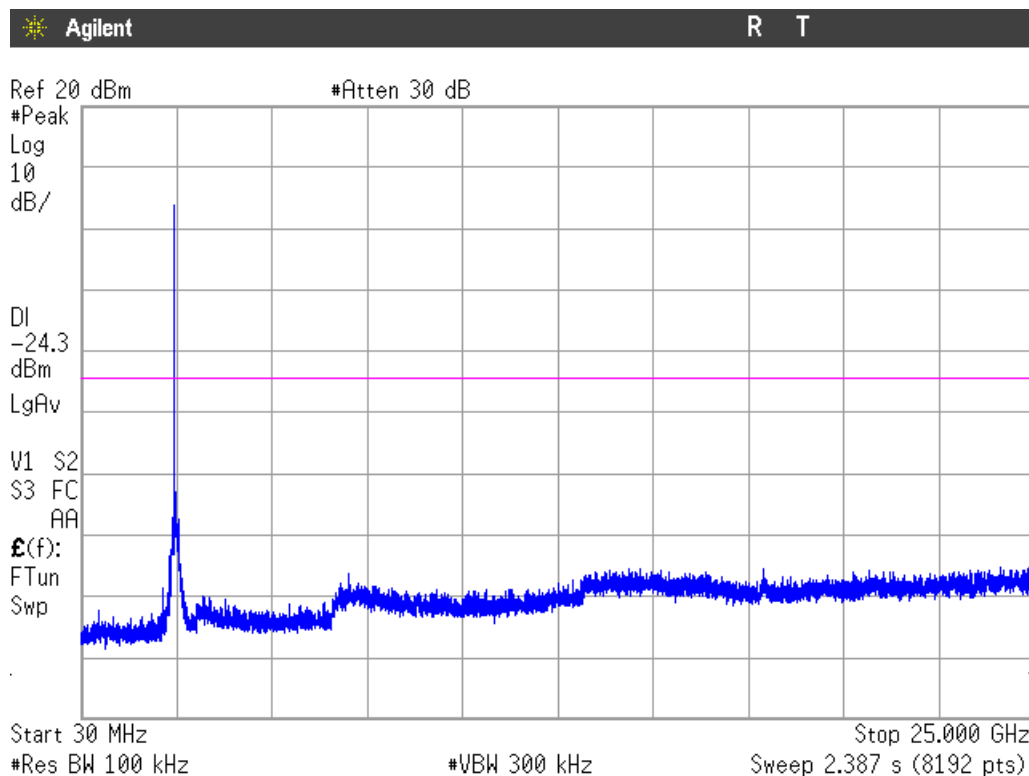
Note: The peak shown in the plot above the limit is the carrier frequency.

### Middle Channel



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

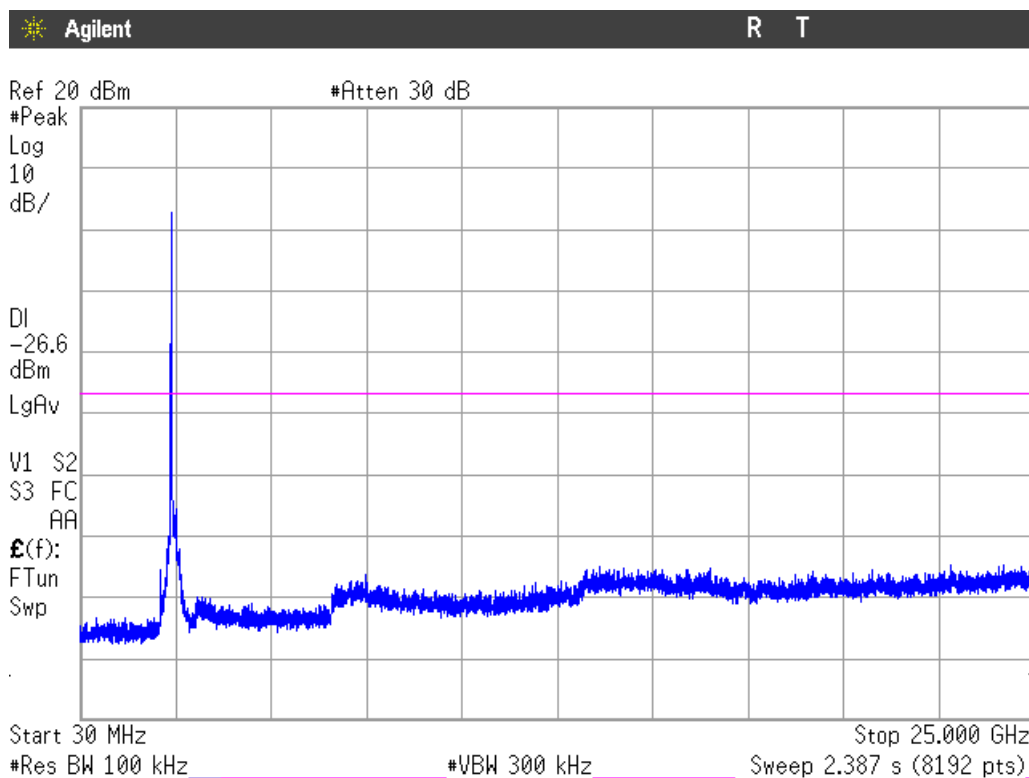
## Highest channel



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

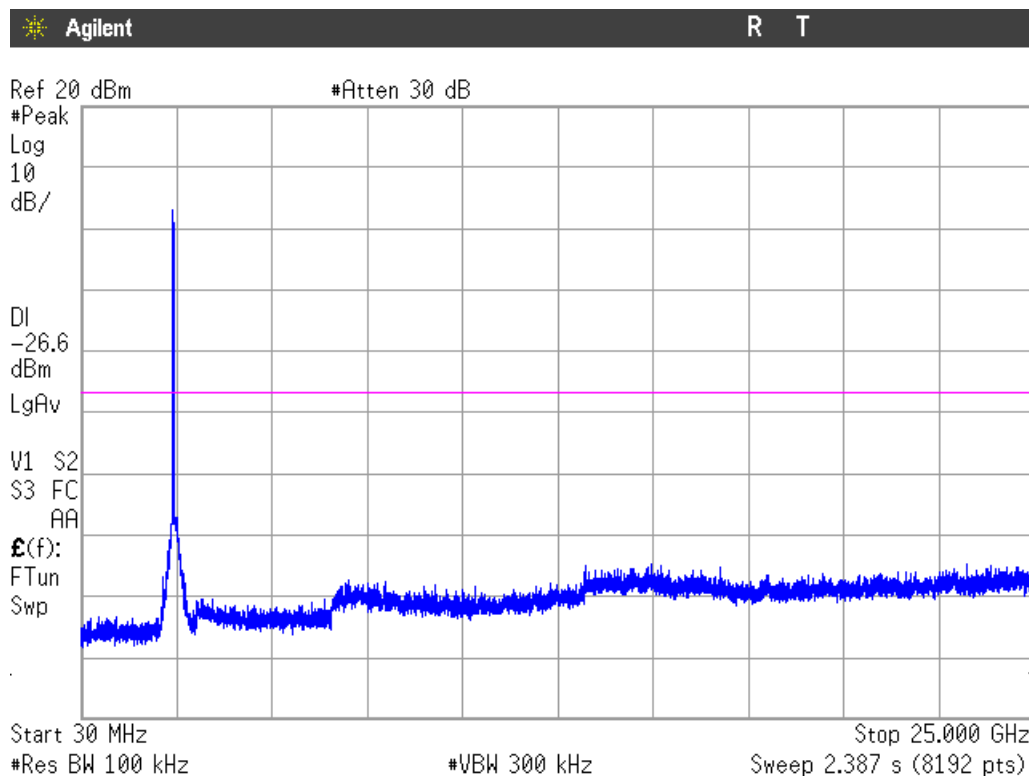
## Mode G

### Lowest Channel



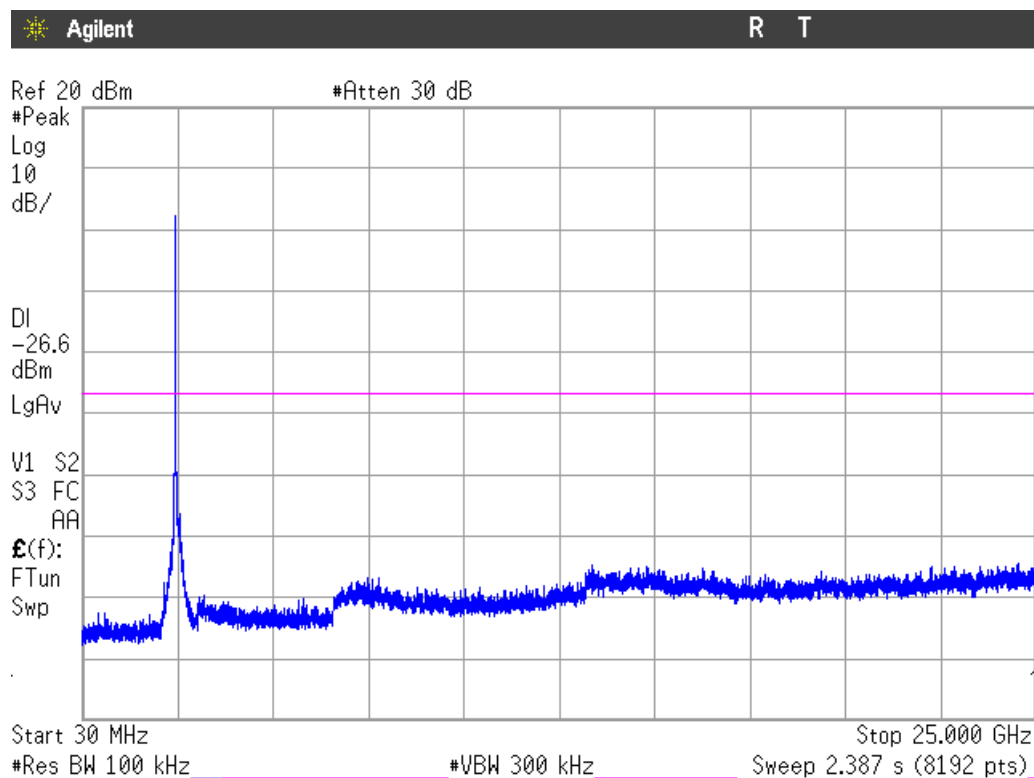
Note: The peak shown in the plot above the limit is the carrier frequency.

## Middle Channel



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

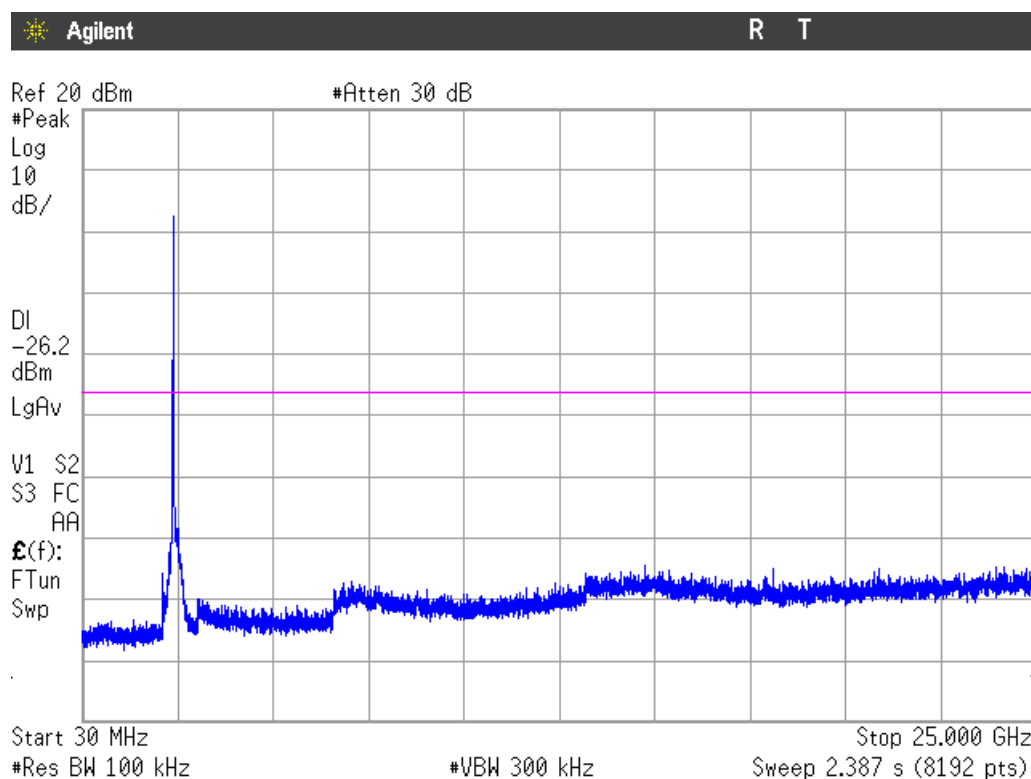
## Highest channel



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

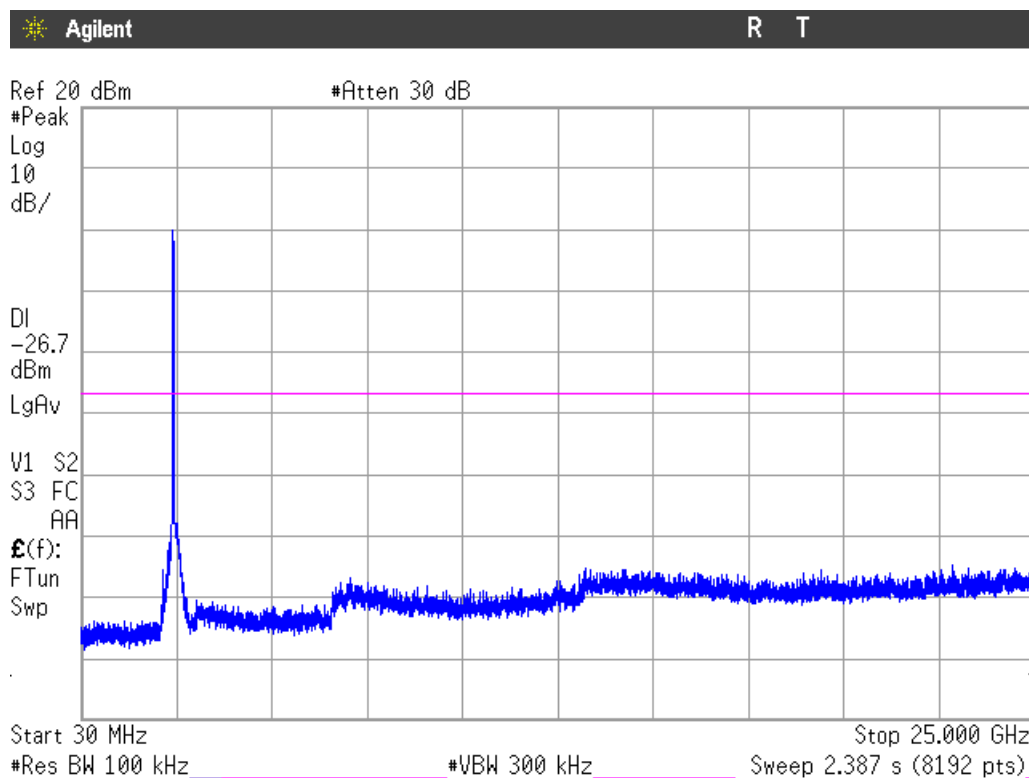
## Mode N20

### Lowest Channel



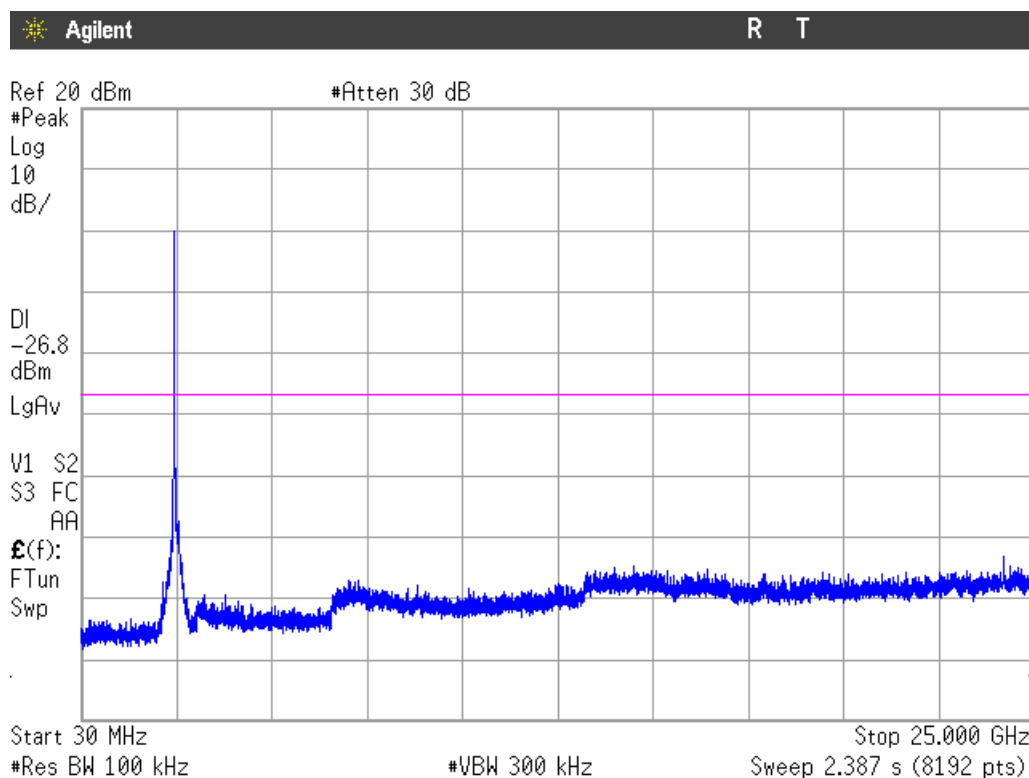
Note: The peak shown in the plot above the limit is the carrier frequency.

### Middle Channel



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

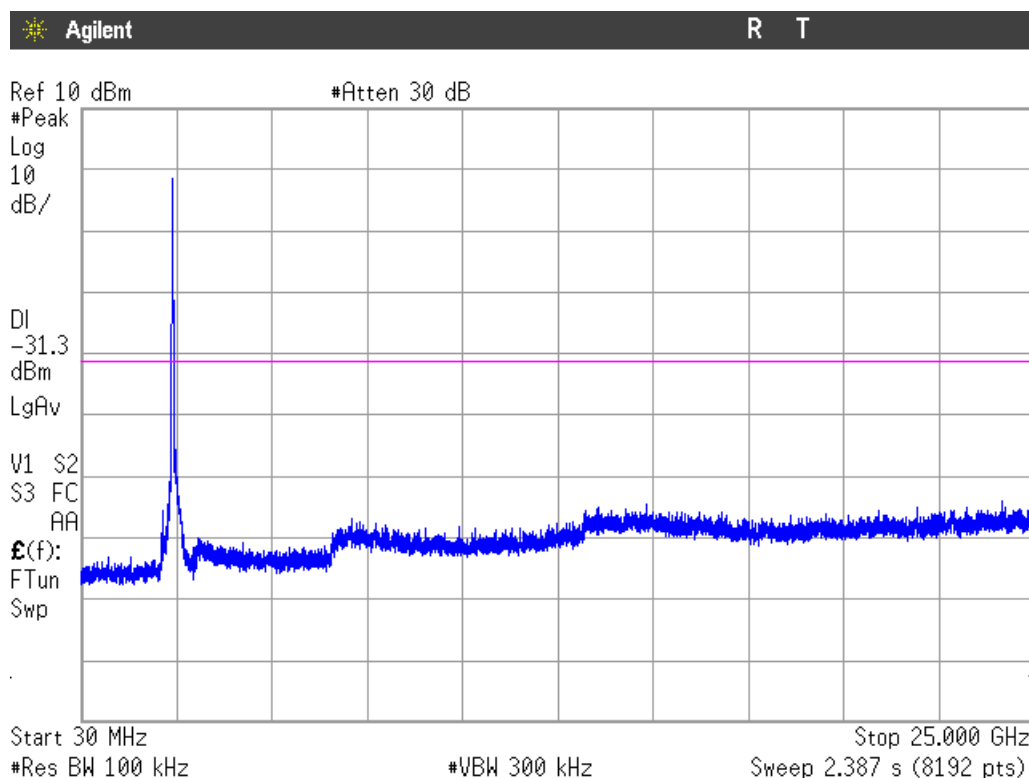
## Highest channel



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

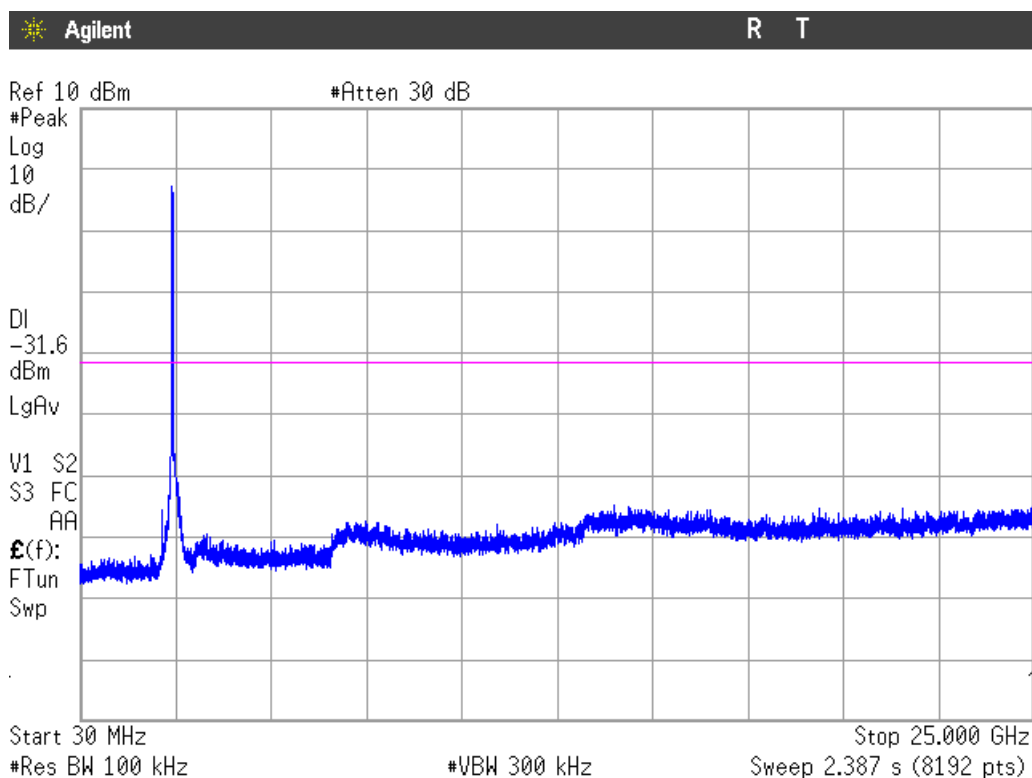
## Mode N40

### Lowest Channel



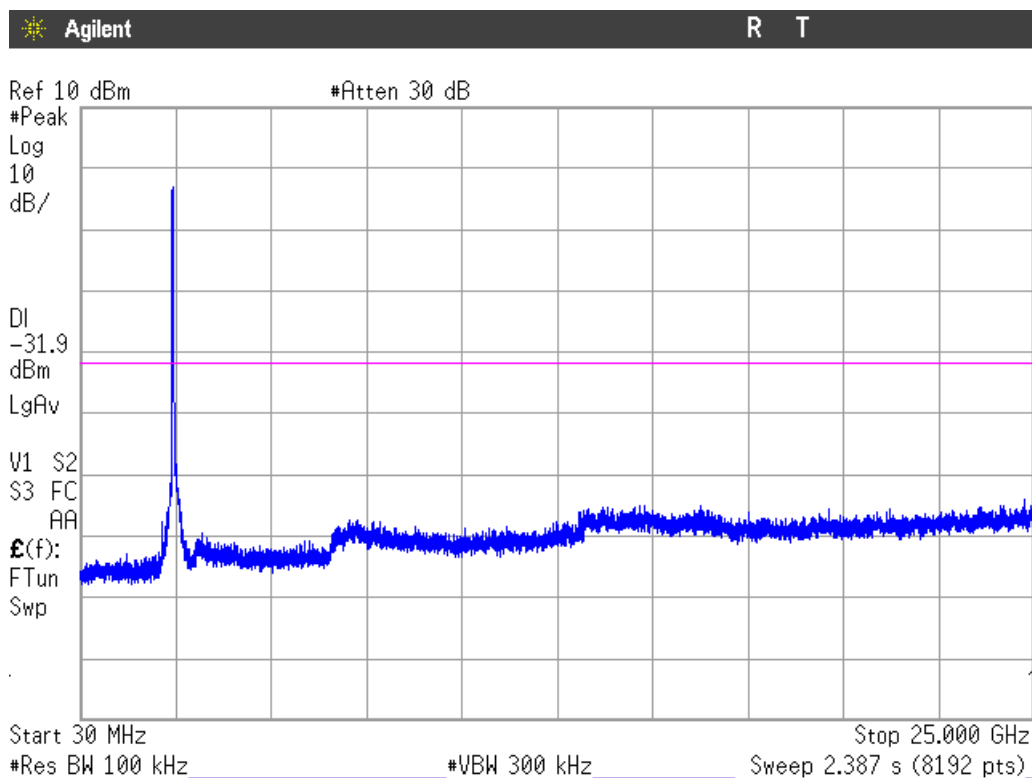
Note: The peak shown in the plot above the limit is the carrier frequency.

## Middle Channel



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

## Highest Channel



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

**Section 15.247 Subclause (d). Band-edge emissions compliance (Transmitter)**

**SPECIFICATION**

In any 100 kHz bandwidth outside the frequency band in which the 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

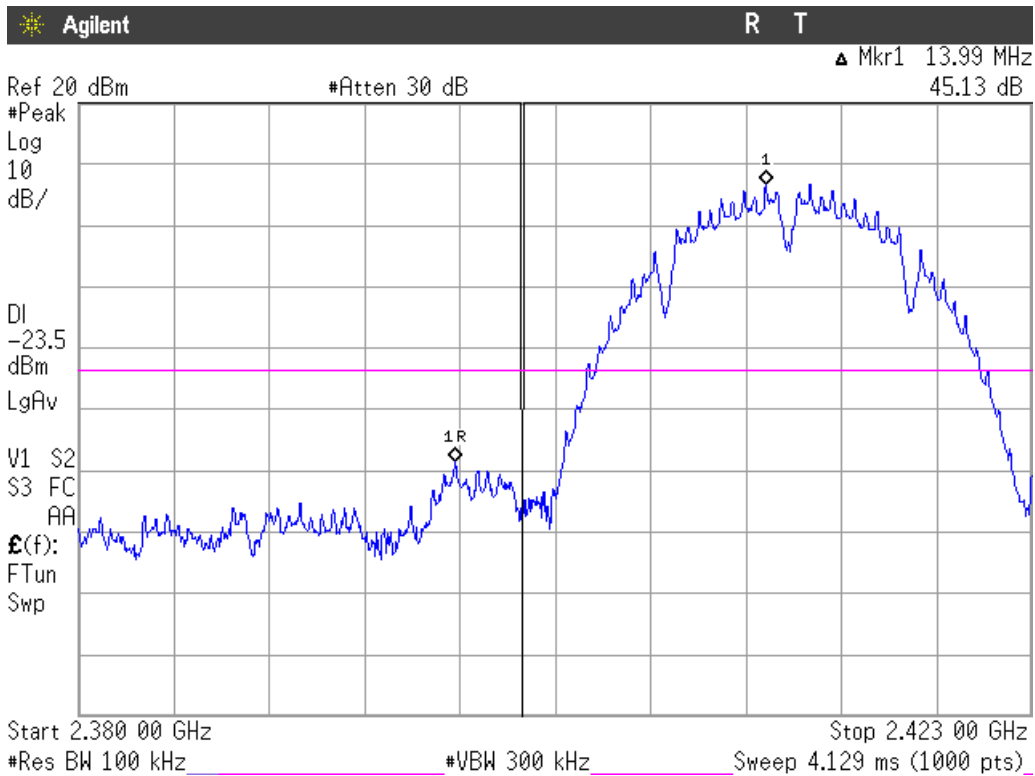
**RESULTS:**

Note: Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

LOW FREQUENCY SECTION 2412 MHz (b/g/n20) and LOW FREQUENCY SECTION 2422 MHz (n40) CONDUCTED.

**Mode B**

See next plot.

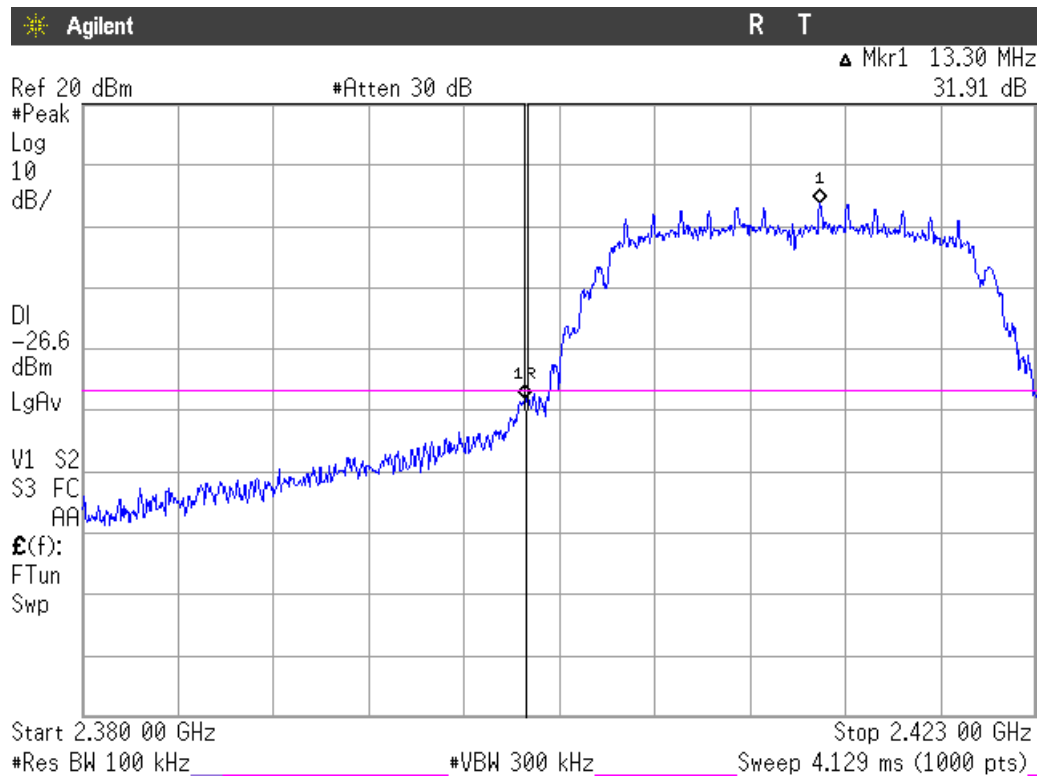


|                              |         |
|------------------------------|---------|
| Measurement uncertainty (dB) | < ±2.03 |
|------------------------------|---------|

Verdict: PASS

## Mode G

See next plot.



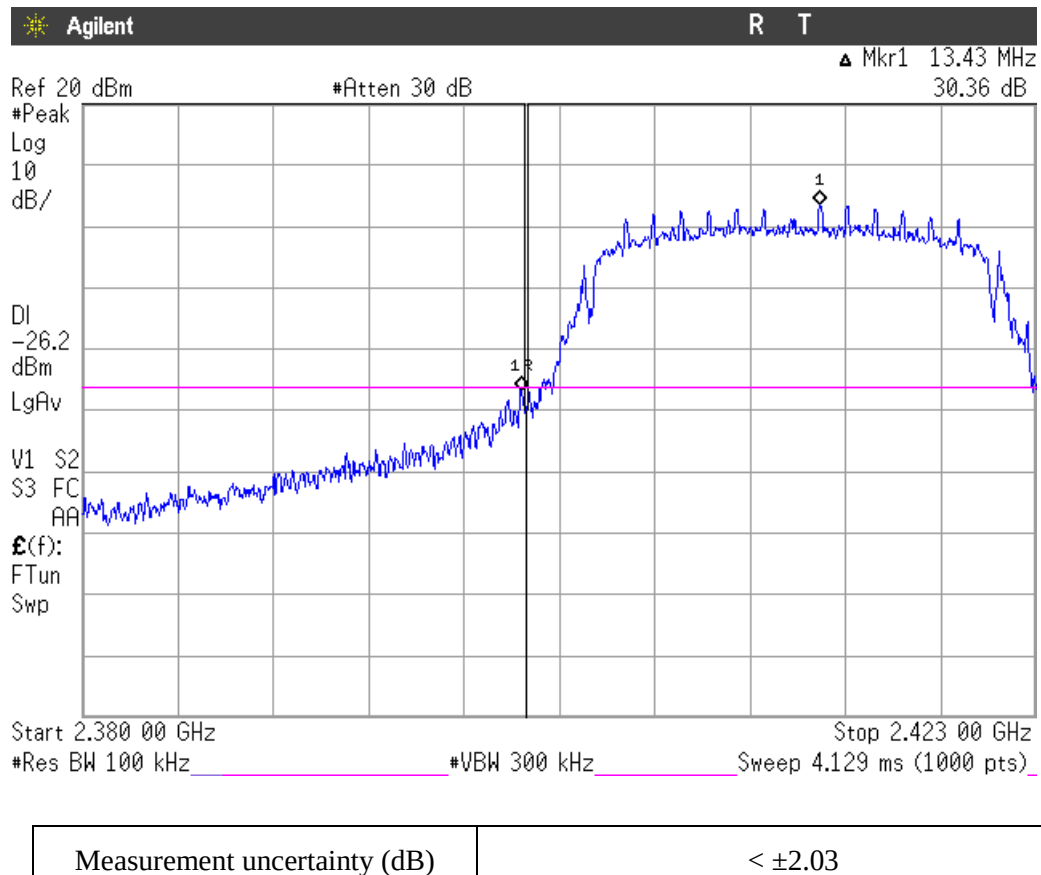
Measurement uncertainty (dB)

< ±2.03

Verdict: PASS

## Mode N20

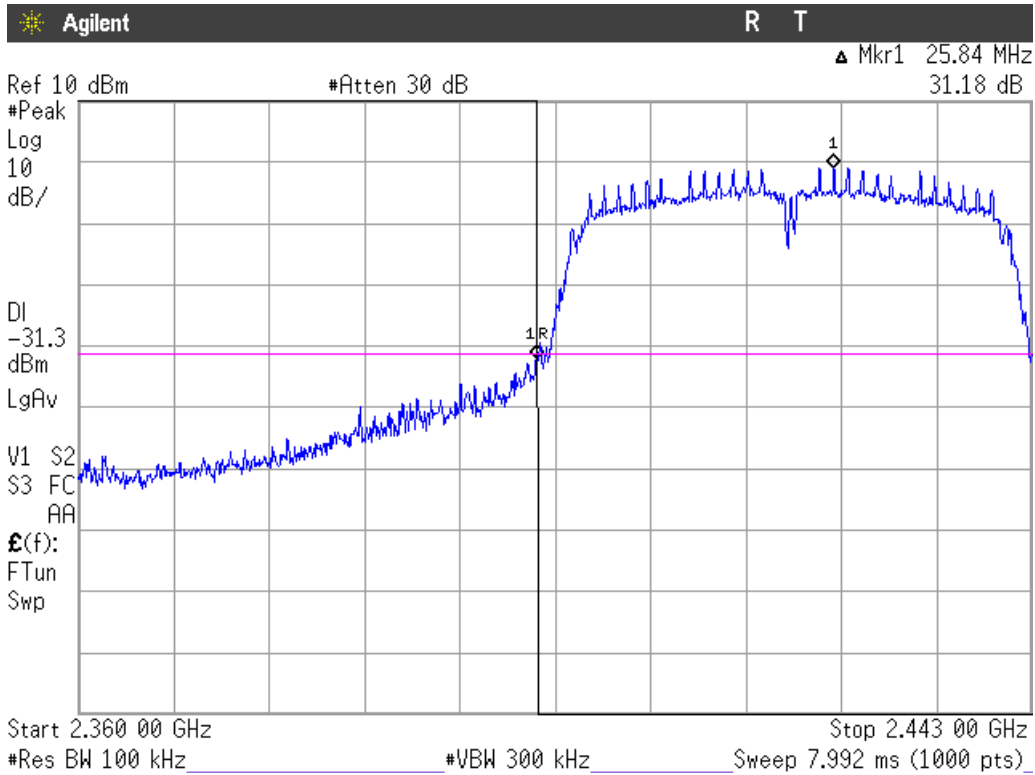
See next plot.



Verdict: PASS

Mode N40

See next plot.



|                              |         |
|------------------------------|---------|
| Measurement uncertainty (dB) | < ±2.03 |
|------------------------------|---------|

Verdict: PASS

## Section 15.247 Subclause (e). Power spectral density

### SPECIFICATION

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS

For all modes, the maximum power spectral density level in the fundamental emission was measured using the method AVGPS-1 according to point 10.3 of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247 558074 D01 DTS Meas Guidance v04 dated 05/04/2017.

Power spectral density (see next plots).

#### Mode B

|                              | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Power spectral density (dBm) | -2.49                        | -2.17                        | -2.30                         |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

#### Mode G

|                              | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Power spectral density (dBm) | -4.85                        | -6.23                        | -4.91                         |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

#### Mode N20

|                              | Lowest frequency<br>2412 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2462 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Power spectral density (dBm) | -5.52                        | -5.61                        | -5.31                         |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

#### Mode N40

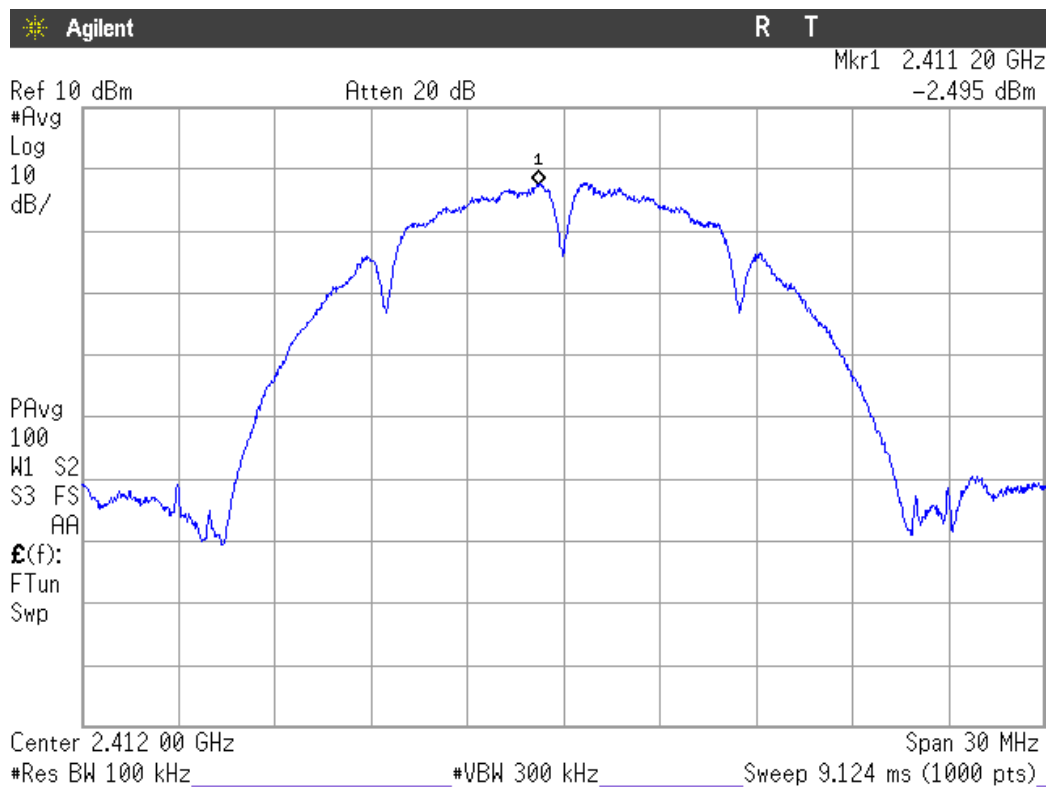
|                              | Lowest frequency<br>2422 MHz | Middle frequency<br>2437 MHz | Highest frequency<br>2452 MHz |
|------------------------------|------------------------------|------------------------------|-------------------------------|
| Power spectral density (dBm) | -10.53                       | -10.71                       | -10.54                        |
| Measurement uncertainty (dB) | <±0.78                       |                              |                               |

Verdict: PASS

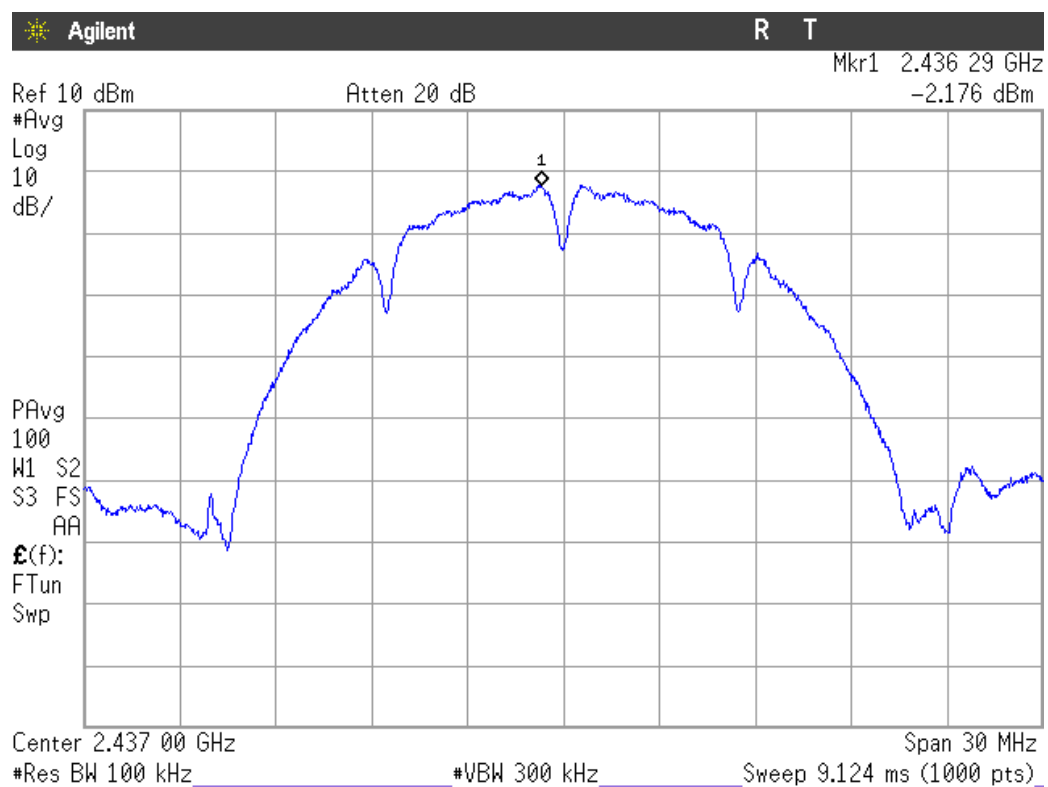
Power spectral density.

### Mode B

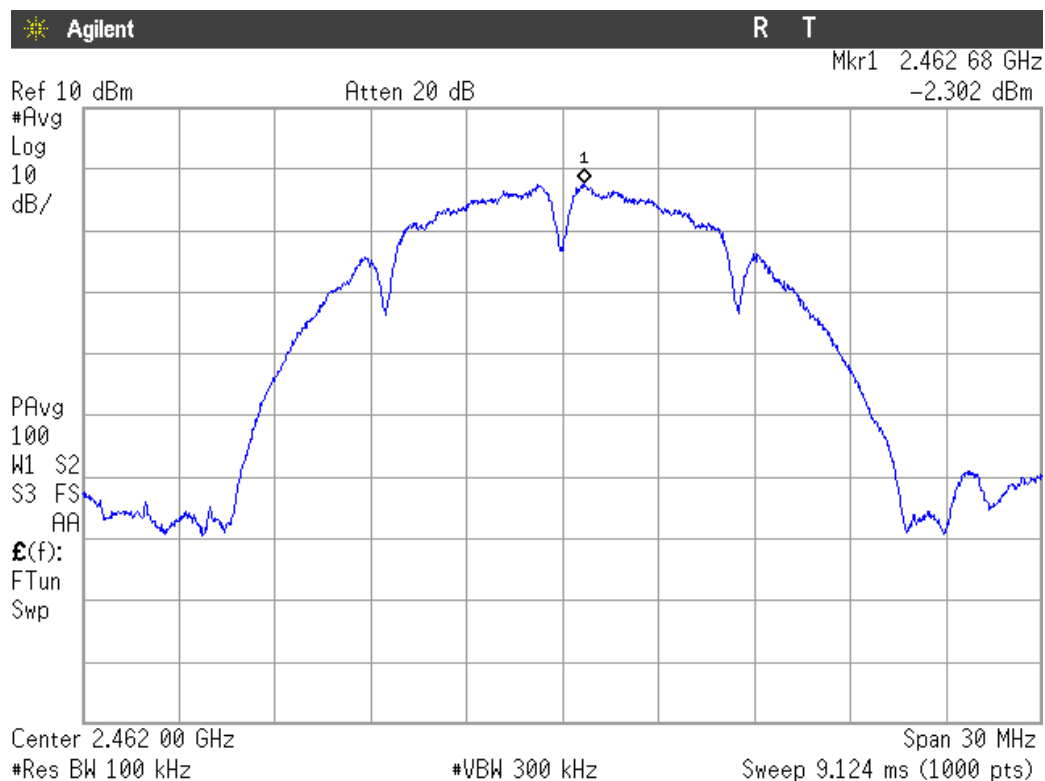
Lowest Channel



Middle Channel

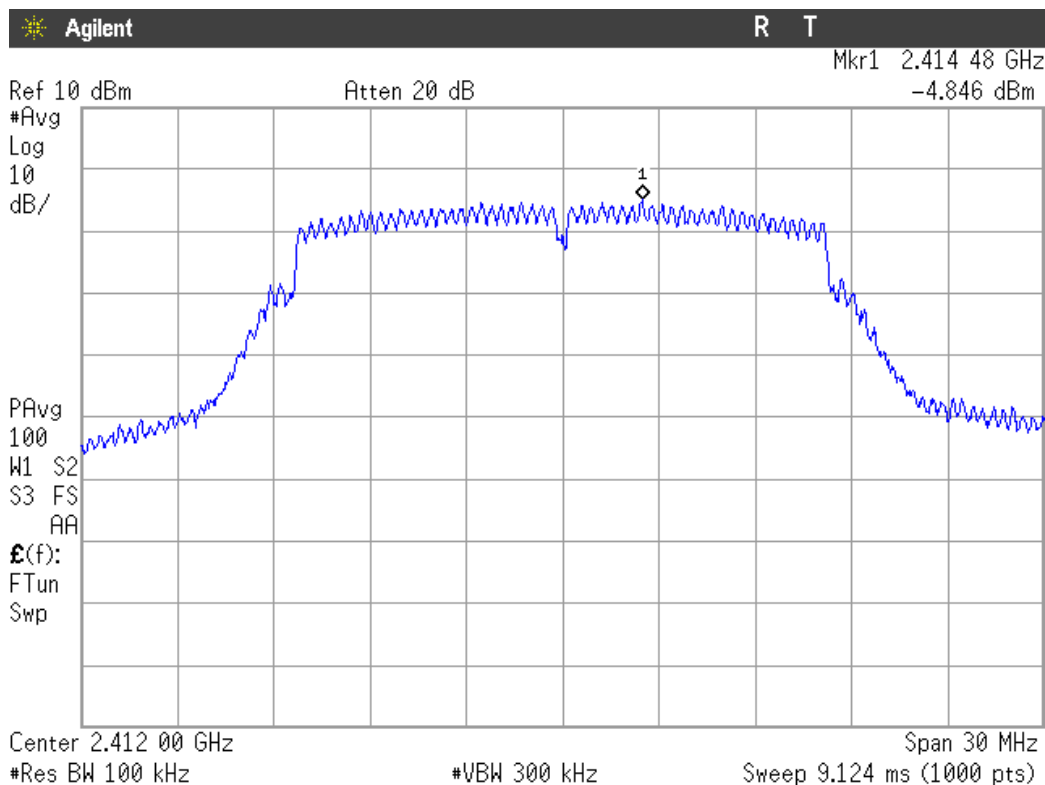


## Highest channel

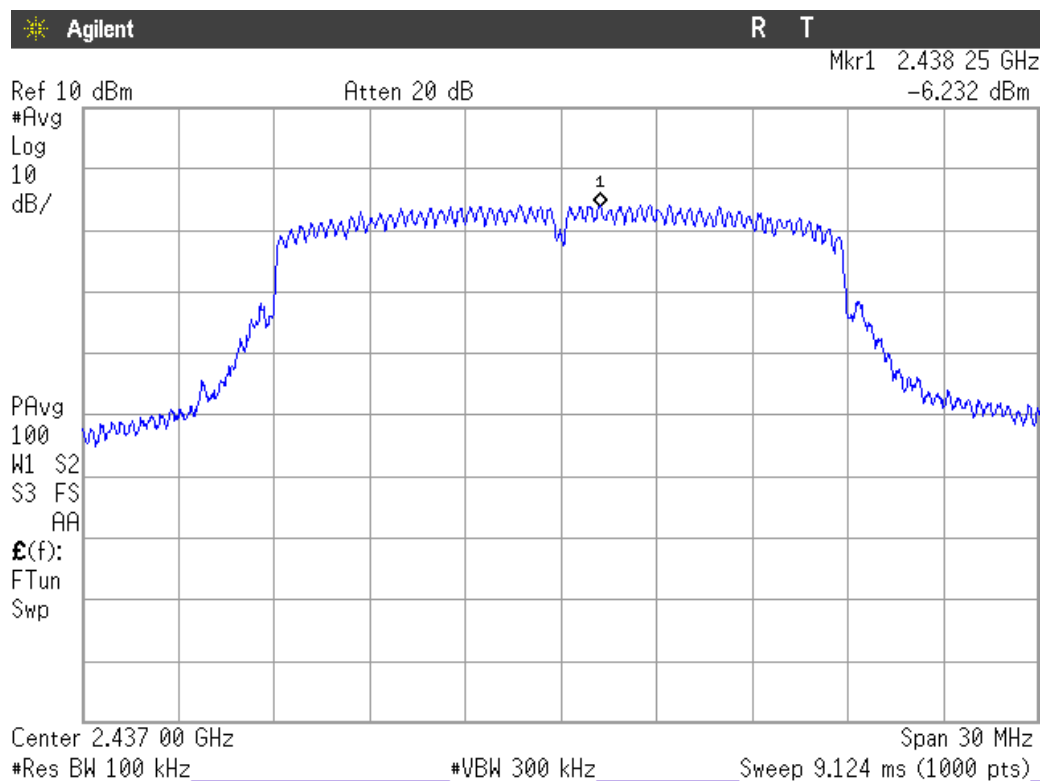


## Mode G

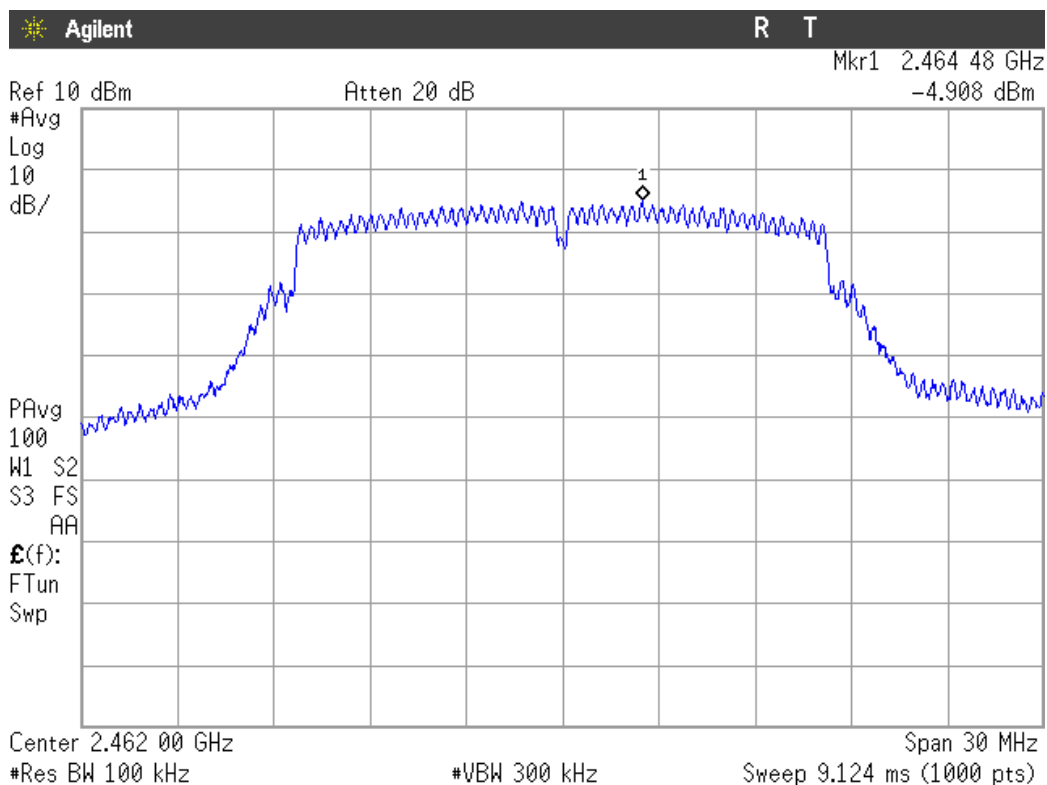
### Lowest Channel



## Middle Channel

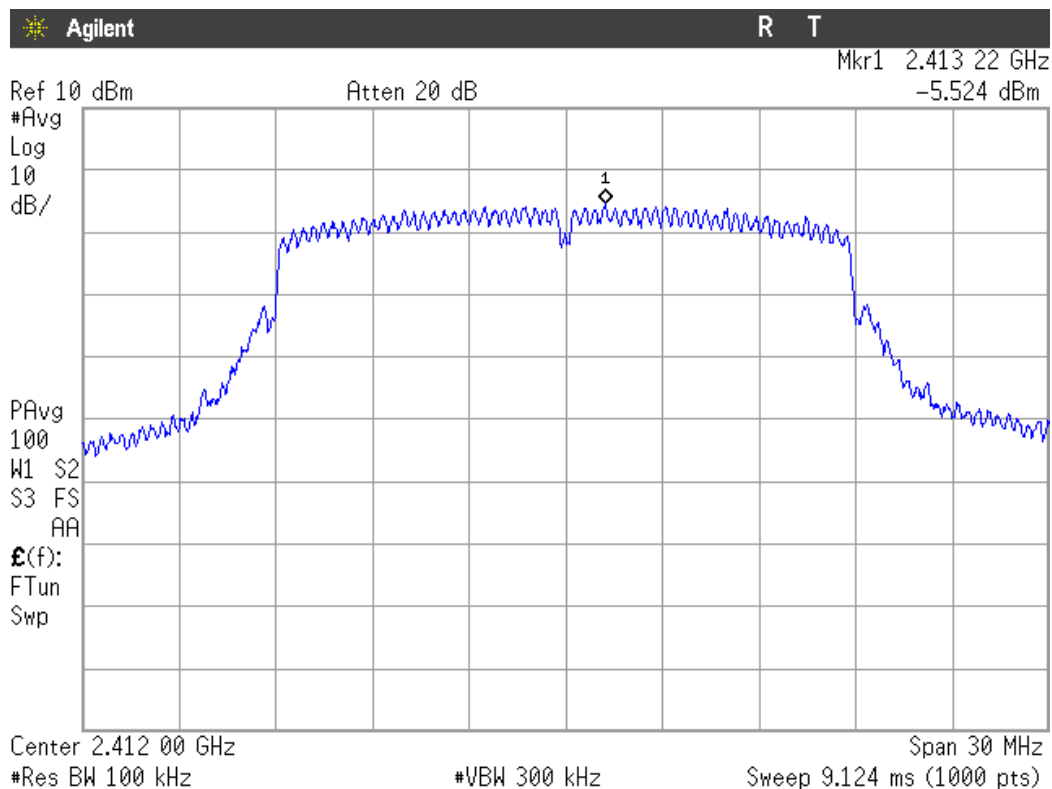


## Highest channel

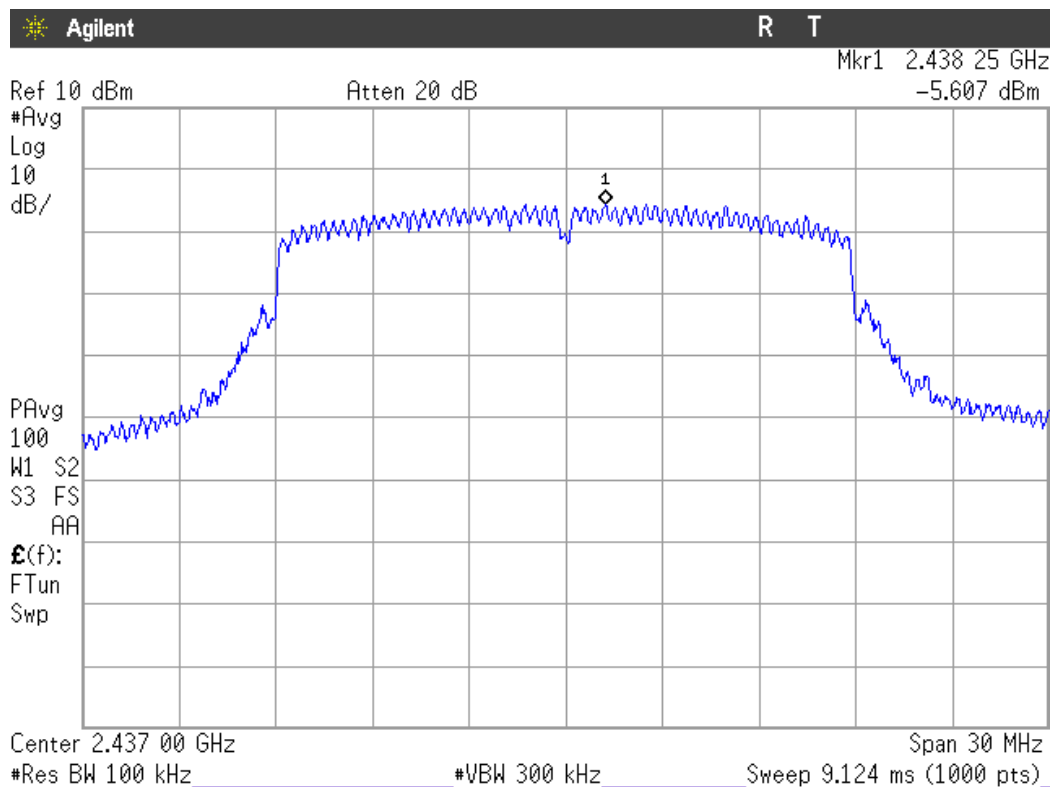


## Mode N20

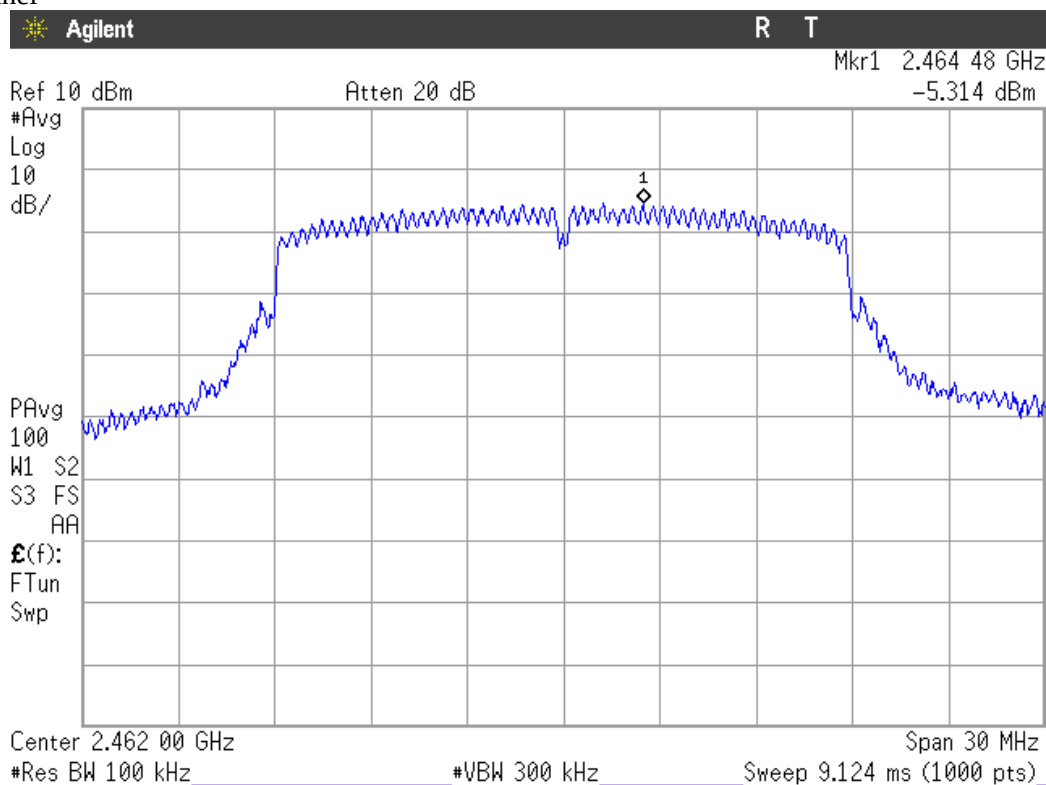
### Lowest Channel



### Middle Channel

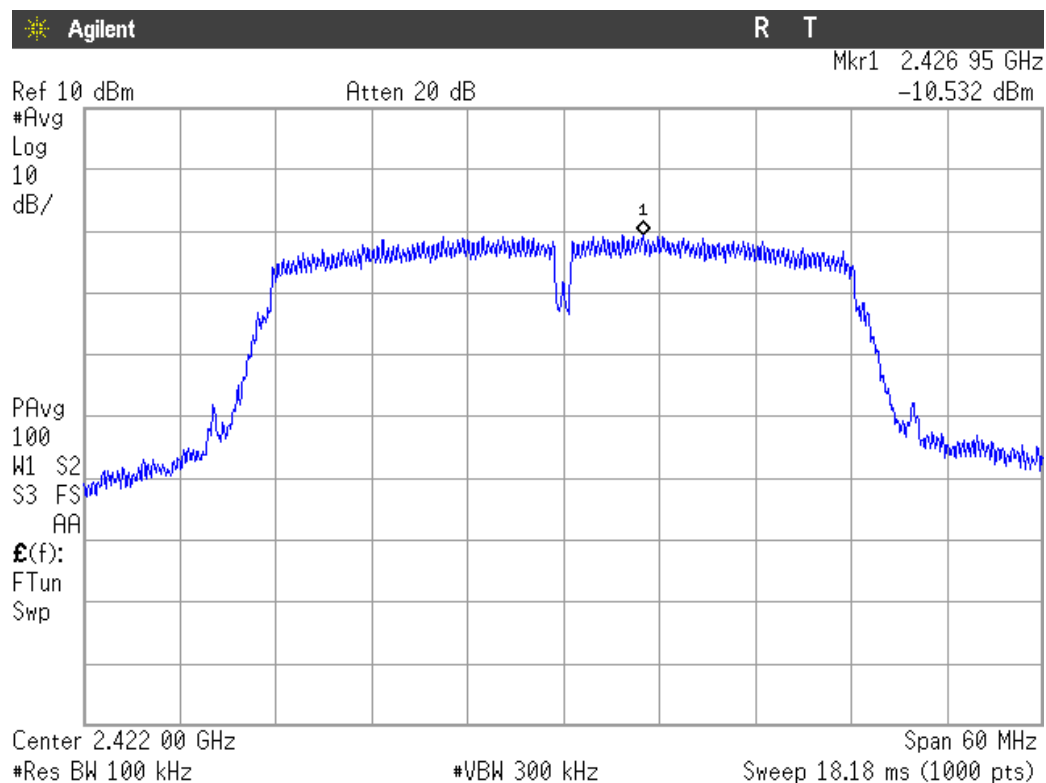


## Highest channel

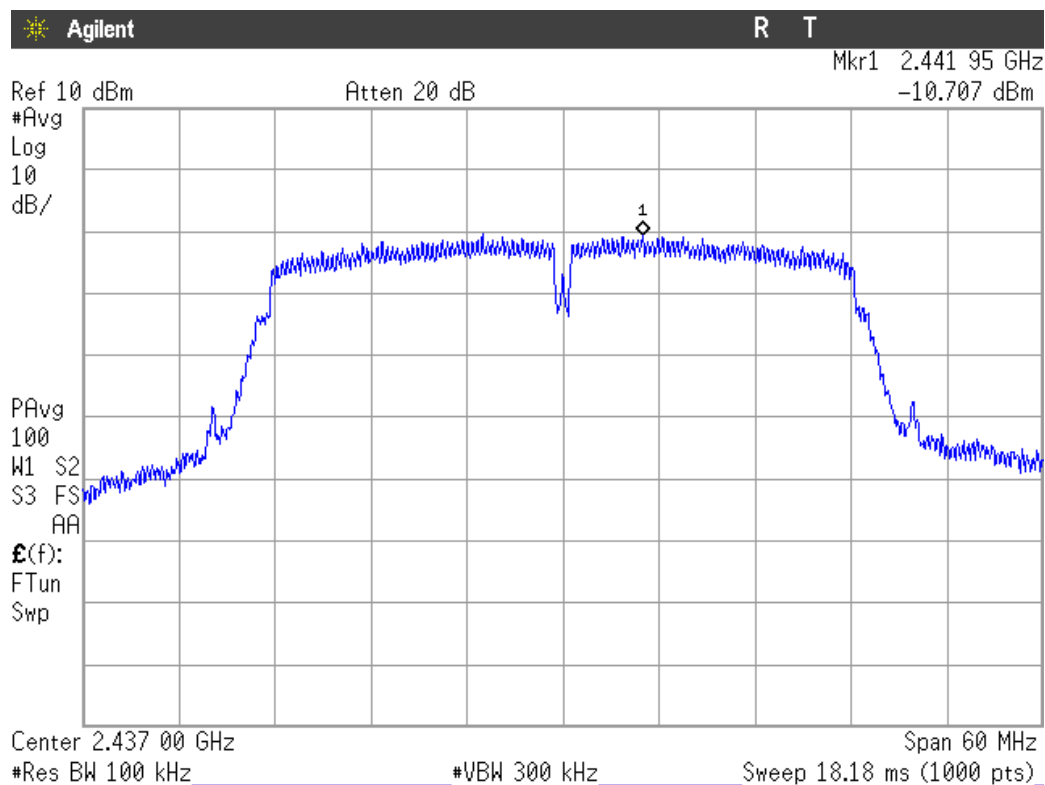


## Mode N40

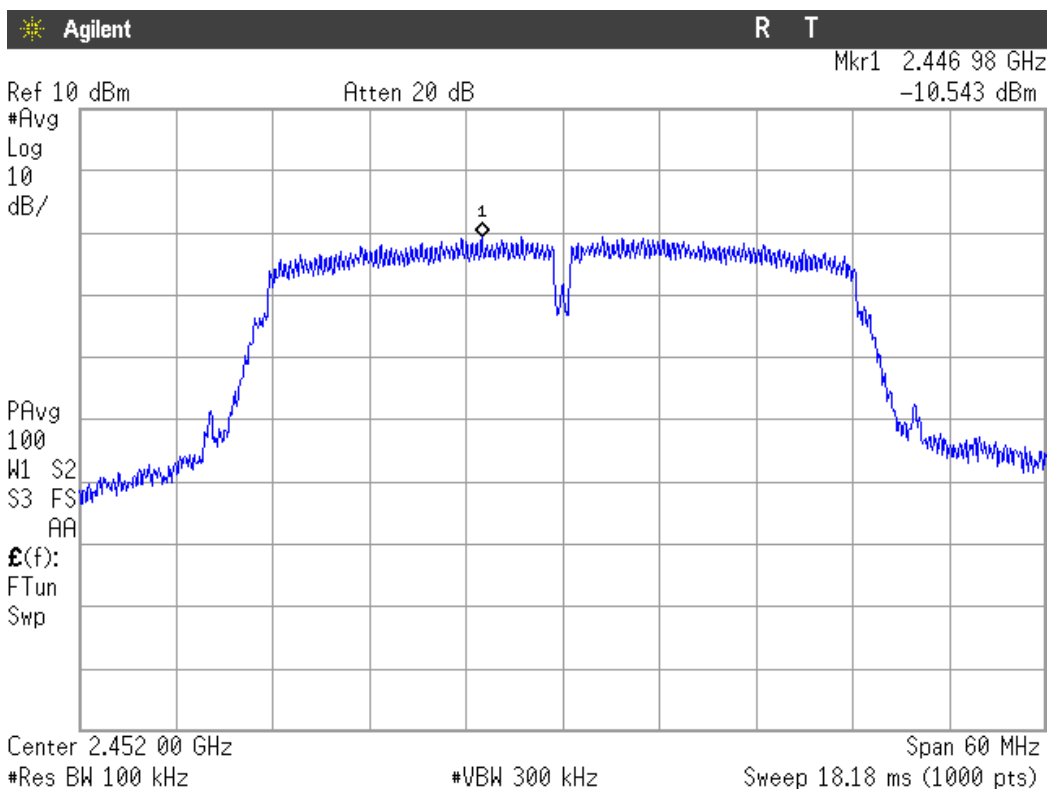
### Lowest Channel



## Middle Channel



## Highest channel



## Section 15.247 Subclause (d). 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 ( $\mu\text{V/m}$ ) | Field strength ( $\text{dB}\mu\text{V/m}$ ) | Measurement distance (m) |
|-----------------------|------------------------------------|---------------------------------------------|--------------------------|
| 0.009-0.490           | 2400/F(kHz)                        | -                                           | 300                      |
| 0.490-1.705           | 24000/F(kHz)                       | -                                           | 30                       |
| 1.705 - 30.0          | 30                                 | -                                           | 30                       |
| 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 360° 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.

### Frequency range 30 MHz-1000 MHz.

The spurious signals detected do not depend on either the operating channel or the modulation mode.

| Spurious frequency (GHz) | Polarization | Detector   | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|------------|-------------------------------|------------------------------|
| 52.213                   | PV           | Quasi-peak | 25.12                         | $\pm 3.88$                   |
| 62.204                   | PV           | Quasi-peak | 27.42                         | $\pm 3.88$                   |
| 71.710                   | PV           | Quasi-peak | 29.51                         | $\pm 3.88$                   |
| 96.154                   | PV           | Quasi-peak | 28.95                         | $\pm 3.88$                   |
| 124.963                  | PV           | Quasi-peak | 26.54                         | $\pm 3.88$                   |
| 185.394                  | PH           | Quasi-peak | 27.42                         | $\pm 3.88$                   |
| 663.992                  | PH           | Quasi-peak | 36.12                         | $\pm 3.88$                   |
| 672.043                  | PH           | Quasi-peak | 32.15                         | $\pm 3.88$                   |
| 679.997                  | PH           | Quasi-peak | 33.68                         | $\pm 3.88$                   |
| 688.048                  | PH           | Quasi-peak | 30.29                         | $\pm 3.88$                   |

### Frequency range 1 GHz-25 GHz.

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz (see next plots).

The field strength at the band edges was evaluated for each mode for the channel under test.

Spurious signals with peak levels above the average limit (54 dB $\mu$ V/m at 3 m) are measured with AVG detector for checking compliance with the average limit.

For spurious emissions (except field strength at the band edges that was performed for all modes) for OFDM modes 802.11g, 802.11n20 and 802.11n40 a preliminary scan was performed to determine the worst case. The next tables and plots show the results for the worst case (802.11g).

## 1. WiFi 2.4GHz 802.11 b mode.

1.1. CHANNEL 1: LOWEST (2412 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted band 2.31-2.39 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03210                  | PH           | Peak     | 45.46                   | ± 4.87                       |
| 1.07997                  | PV           | Peak     | 46.02                   | ± 4.87                       |
| 1.12810                  | PH           | Peak     | 44.71                   | ± 4.87                       |
| 2.29270                  | PV           | Peak     | 48.61                   | ± 4.87                       |
| 2.33060                  | PV           | Peak     | 50.33                   | ± 4.87                       |
| 2.53023                  | PV           | Peak     | 50.42                   | ± 4.87                       |
| 3.21575                  | PH           | Peak     | 42.84                   | ± 4.87                       |
| 4.82375                  | PV           | Peak     | 43.32                   | ± 4.87                       |
| 7.23225                  | PV           | Peak     | 46.26                   | ± 4.87                       |
| 9.64675                  | PV           | Peak     | 47.54                   | ± 4.87                       |
| 19.29587                 | PV           | Peak     | 43.81                   | ± 4.87                       |
| 23.98573                 | PV           | Peak     | 47.47                   | ± 4.87                       |

1.2. CHANNEL 6: MIDDLE (2437 MHz). Out-of-band spurious emissions in the 1-25 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03203                  | PV           | Peak     | 44.30                         | $\pm 4.87$                   |
| 1.08003                  | PV           | Peak     | 45.49                         | $\pm 4.87$                   |
| 1.12810                  | PV           | Peak     | 44.77                         | $\pm 4.87$                   |
| 2.50743                  | PV           | Peak     | 50.75                         | $\pm 4.87$                   |
| 2.55243                  | PV           | Peak     | 52.29                         | $\pm 4.87$                   |
| 3.24925                  | PH           | Peak     | 43.16                         | $\pm 4.87$                   |
| 4.87425                  | PH           | Peak     | 42.77                         | $\pm 4.87$                   |
| 9.74775                  | PH           | Peak     | 49.02                         | $\pm 4.87$                   |
| 19.49587                 | PV           | Peak     | 43.19                         | $\pm 4.87$                   |
| 23.27160                 | PH           | Peak     | 41.34                         | $\pm 4.87$                   |

1.3. CHANNEL 11: HIGHEST (2462 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted band 2.4835-2.5 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03200                  | PH           | Peak     | 44.65                         | $\pm 4.87$                   |
| 1.08010                  | PV           | Peak     | 45.03                         | $\pm 4.87$                   |
| 1.12803                  | PV           | Peak     | 44.22                         | $\pm 4.87$                   |
| 2.48350                  | PH           | Peak     | 52.62                         | $\pm 4.87$                   |
| 2.53770                  | PV           | Peak     | 49.89                         | $\pm 4.87$                   |
| 2.54616                  | PH           | Peak     | 52.42                         | $\pm 4.87$                   |
| 2.57963                  | PH           | Peak     | 52.69                         | $\pm 4.87$                   |
| 3.28275                  | PH           | Peak     | 42.94                         | $\pm 4.87$                   |
| 4.92425                  | PV           | Peak     | 44.48                         | $\pm 4.87$                   |
| 9.84775                  | PH           | Peak     | 48.22                         | $\pm 4.87$                   |
| 19.69587                 | PV           | Peak     | 43.23                         | $\pm 4.87$                   |
| 23.2716                  | PH           | Peak     | 39.38                         | $\pm 4.87$                   |

Verdict: PASS

## 2. WiFi 2.4GHz 802.11 g mode (worst case OFDM)

2.1. CHANNEL 1: LOWEST (2412 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted band 2.31-2.39 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 1.03190                  | PV           | Peak     | 45.31                   | ± 4.87                       |
| 1.08010                  | PV           | Peak     | 44.54                   | ± 4.87                       |
| 1.12803                  | PV           | Peak     | 44.30                   | ± 4.87                       |
| 2.29377                  | PH           | Peak     | 50.05                   | ± 4.87                       |
| 2.38563                  | PH           | Peak     | 60.16                   | ± 4.87                       |
|                          |              | Average  | 45.66                   | ± 4.87                       |
| 2.52903                  | PH           | Peak     | 53.58                   | ± 4.87                       |
| 3.21575                  | PH           | Peak     | 42.05                   | ± 4.87                       |
| 7.24275                  | PV           | Peak     | 47.64                   | ± 4.87                       |
| 9.64775                  | PH           | Peak     | 50.35                   | ± 4.87                       |
| 19.29587                 | PV           | Peak     | 43.49                   | ± 4.87                       |

## 2.2. CHANNEL 6: MIDDLE (2437 MHz). Out-of-band spurious emissions in the 1-25 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dB $\mu$ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------------|------------------------------|
| 1.03177                  | PV           | Peak     | 46.27                         | $\pm 4.87$                   |
| 1.08033                  | PV           | Peak     | 44.33                         | $\pm 4.87$                   |
| 1.12803                  | PV           | Peak     | 44.53                         | $\pm 4.87$                   |
| 2.52157                  | PH           | Peak     | 53.11                         | $\pm 4.87$                   |
| 2.55643                  | PH           | Peak     | 53.94                         | $\pm 4.87$                   |
| 3.24925                  | PH           | Peak     | 43.72                         | $\pm 4.87$                   |
| 9.74795                  | PH           | Peak     | 51.87                         | $\pm 4.87$                   |
| 19.49587                 | PV           | Peak     | 43.27                         | $\pm 4.87$                   |
| 23.96840                 | PV           | Peak     | 40.19                         | $\pm 4.87$                   |

2.3. CHANNEL 11: HIGHEST (2462 MHz). Out-of-band spurious emissions in the 1-25 GHz range and inside restricted band 2.4835-2.5 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|--------------------------|------------------------------|
| 1.03223                  | PV           | Peak     | 44.30                    | ± 4.87                       |
| 1.08000                  | PH           | Peak     | 44.66                    | ± 4.87                       |
| 1.12803                  | PV           | Peak     | 44.03                    | ± 4.87                       |
| 2.48402                  | PH           | Peak     | 69.27                    | ± 4.87                       |
|                          |              | Average  | 46.42                    | ± 4.87                       |
| 2.54730                  | PH           | Peak     | 53.08                    | ± 4.87                       |
| 2.58057                  | PH           | Peak     | 52.65                    | ± 4.87                       |
| 9.84775                  | PH           | Peak     | 50.29                    | ± 4.87                       |
| 19.69587                 | PV           | Peak     | 42.56                    | ± 4.87                       |
| 24.11747                 | PV           | Peak     | 40.62                    | ± 4.87                       |

Verdict: PASS

### 3. WiFi 2.4GHz 802.11 n20 mode

3.1. CHANNEL 1: LOWEST (2412 MHz). Spurious emissions in restricted band 2.31-2.39 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|--------------------------|------------------------------|
| 2.38950                  | PH           | Peak     | 58.53                    | ± 4.87                       |
|                          |              | Average  | 44.70                    | ± 4.87                       |

3.2. CHANNEL 11: HIGHEST (2462 MHz). Spurious emissions in restricted band 2.4835-2.5 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμ V/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|--------------------------|------------------------------|
| 2.48368                  | PH           | Peak     | 67.37                    | ± 4.87                       |
|                          |              | Average  | 47.27                    | ± 4.87                       |

Verdict: PASS

#### 4. WiFi 2.4GHz 802.11 n40 mode

##### 4.1. CHANNEL 1: LOWEST (2422 MHz). Spurious emissions in restricted band 2.31-2.39 GHz.

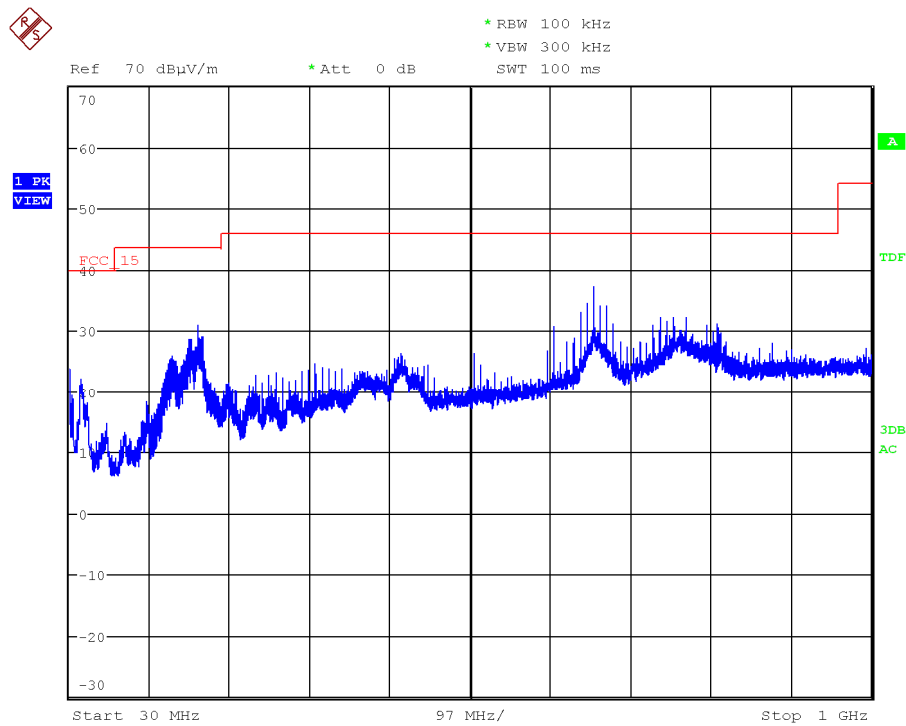
| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 2.38948                  | PH           | Peak     | 53.34                   | ± 4.87                       |

##### 4.2. CHANNEL 9: HIGHEST (2452 MHz). Spurious emissions in restricted band 2.31-2.39 GHz.

| Spurious frequency (GHz) | Polarization | Detector | Emission Level (dBμV/m) | Measurement Uncertainty (dB) |
|--------------------------|--------------|----------|-------------------------|------------------------------|
| 2.48354                  | PH           | Peak     | 62.93                   | ± 4.87                       |
|                          |              | Average  | 46.49                   | ± 4.87                       |

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

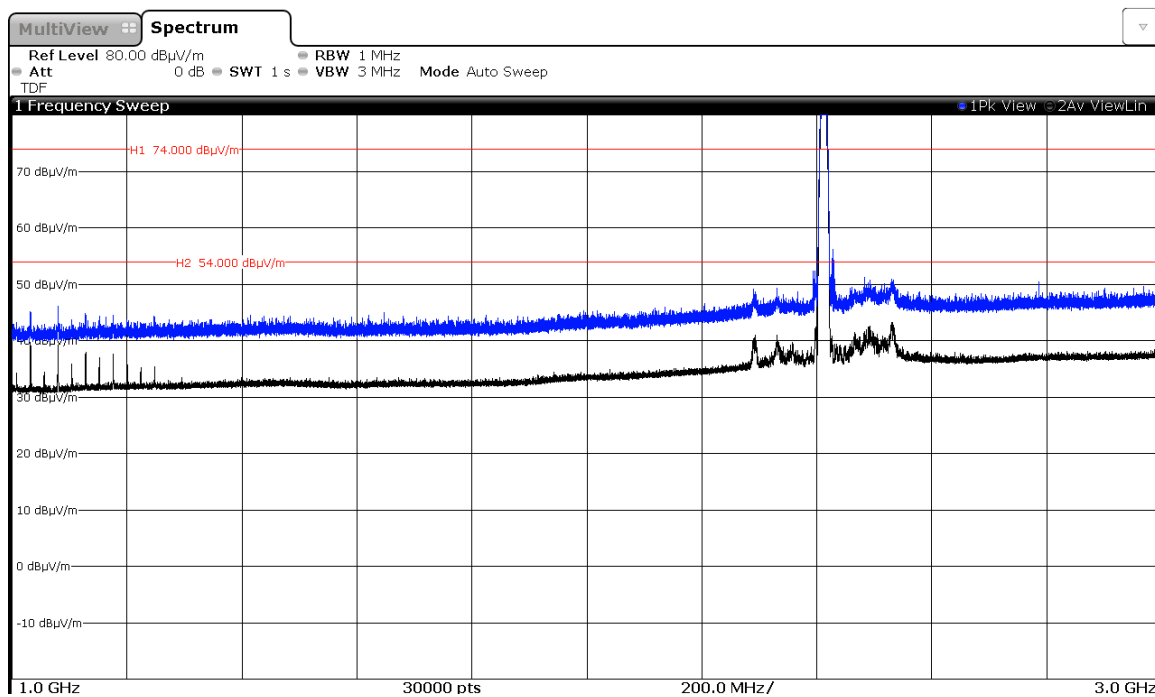


(This plot is valid for all three channels and modulation modes).

FREQUENCY RANGE 1 GHz to 3 GHz.

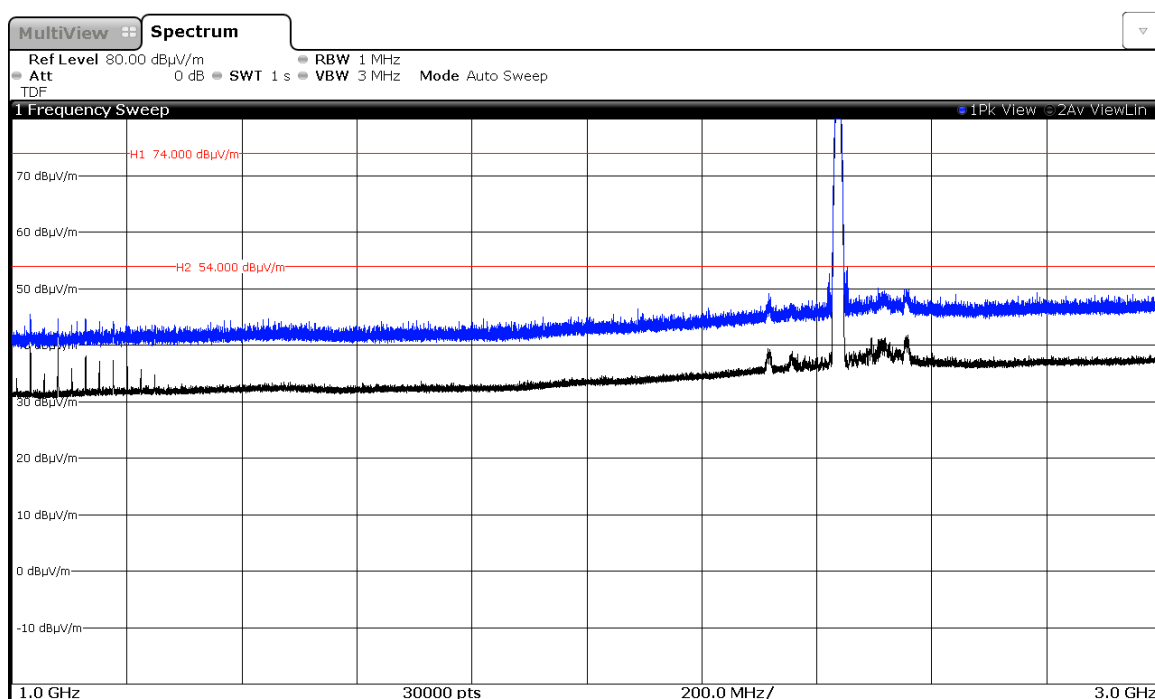
### 1. WiFi 2.4GHz 802.11 b mode

CHANNEL 1 (2412 MHz).



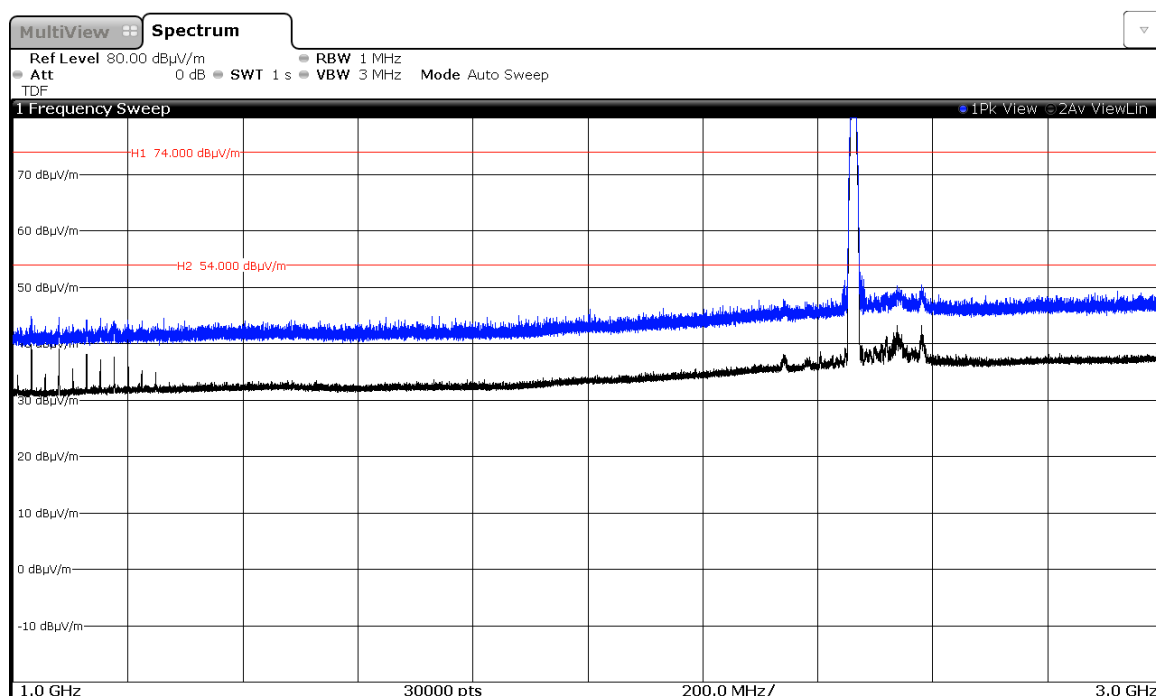
Note: The peak above the limit is the carrier frequency.

CHANNEL 6 (2437 MHz).



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

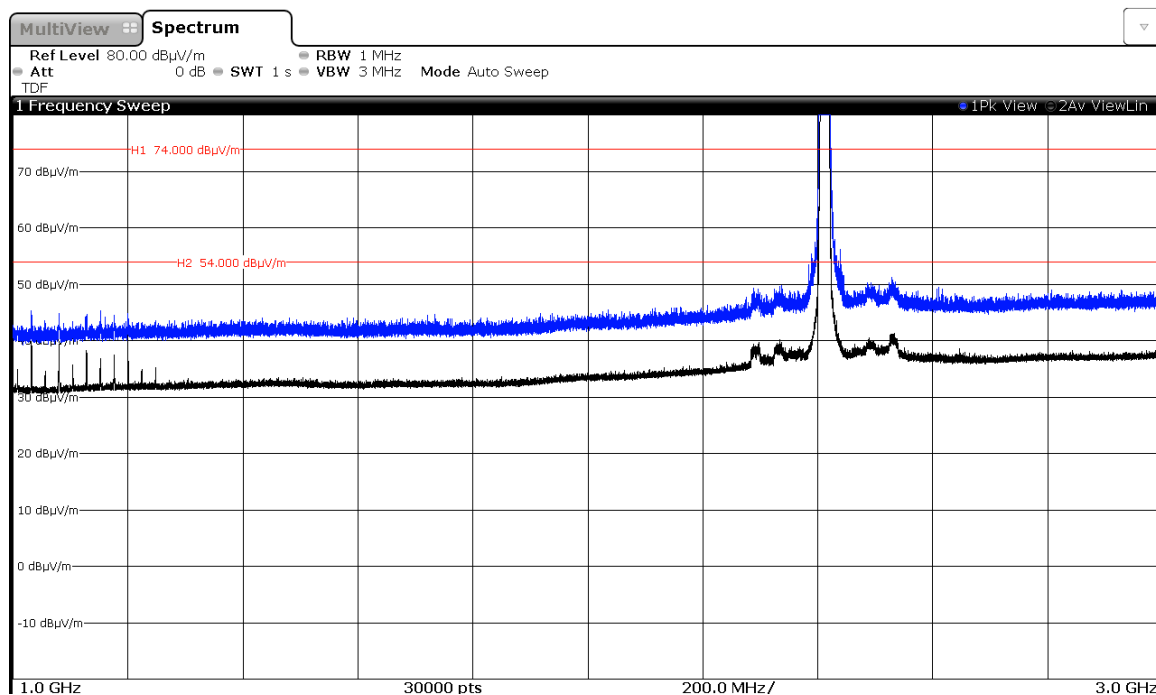
CHANNEL 11 (2462 MHz).



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

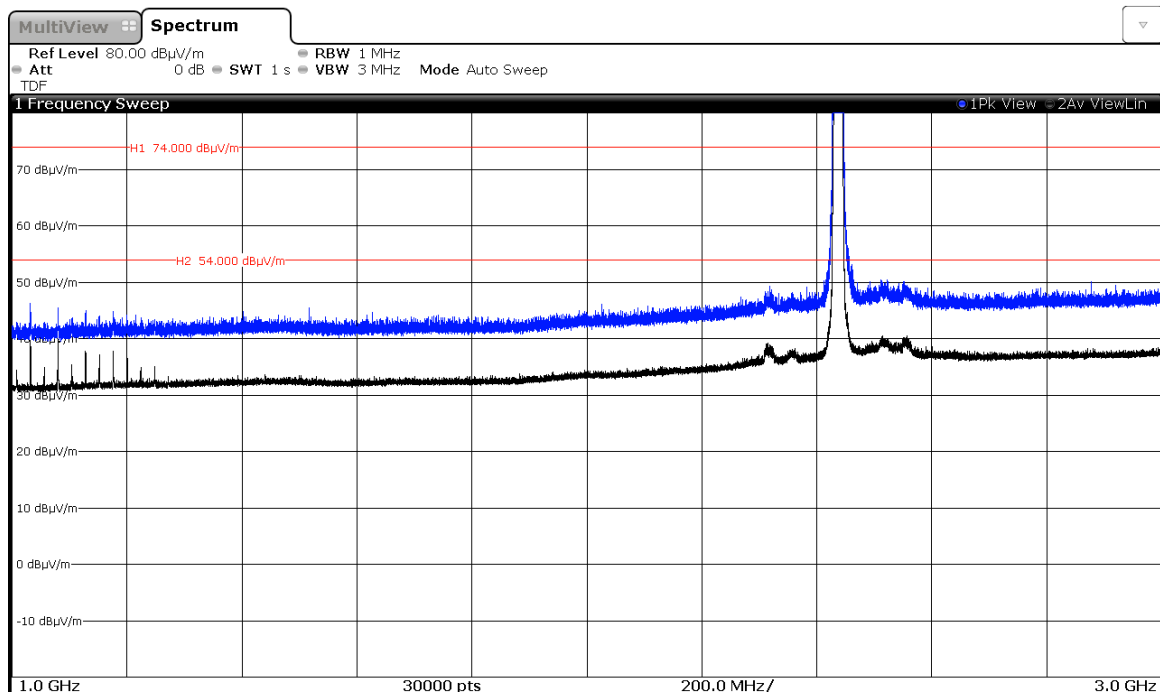
## 2. WiFi 2.4GHz 802.11 g mode (Worst case OFDM)

CHANNEL 1 (2412 MHz).



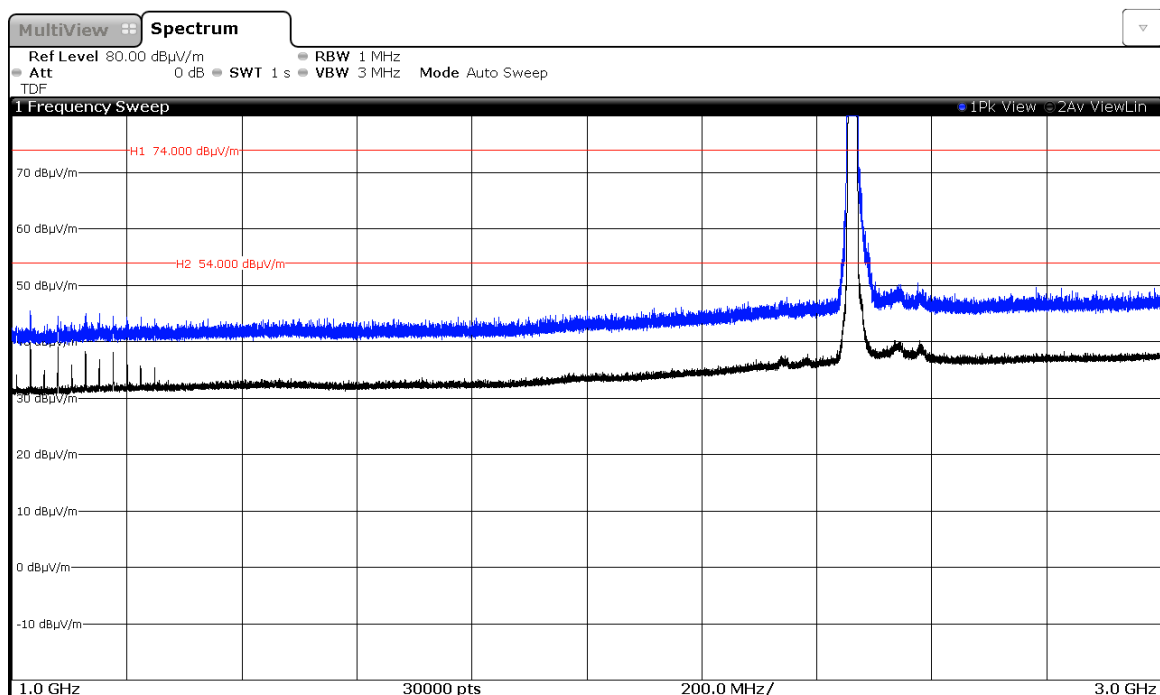
Note: The peak above the limit is the carrier frequency.

## CHANNEL 6 (2437 MHz).



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

## CHANNEL 11 (2462 MHz).

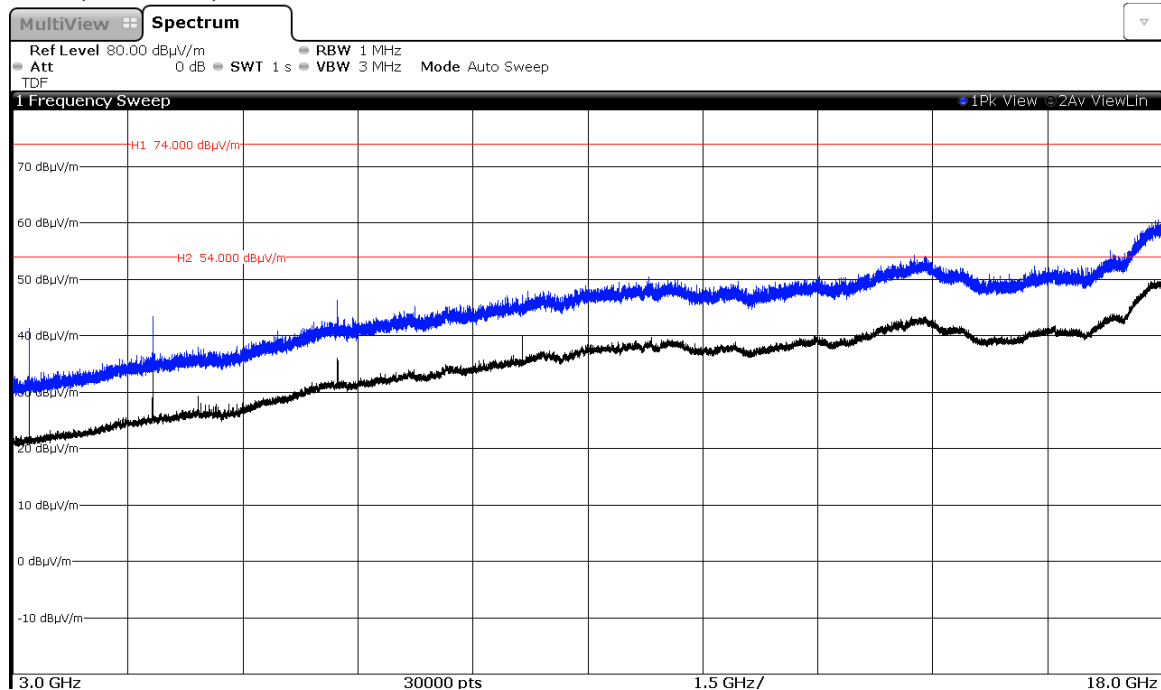


Note: The peak above the limit is the carrier frequency.

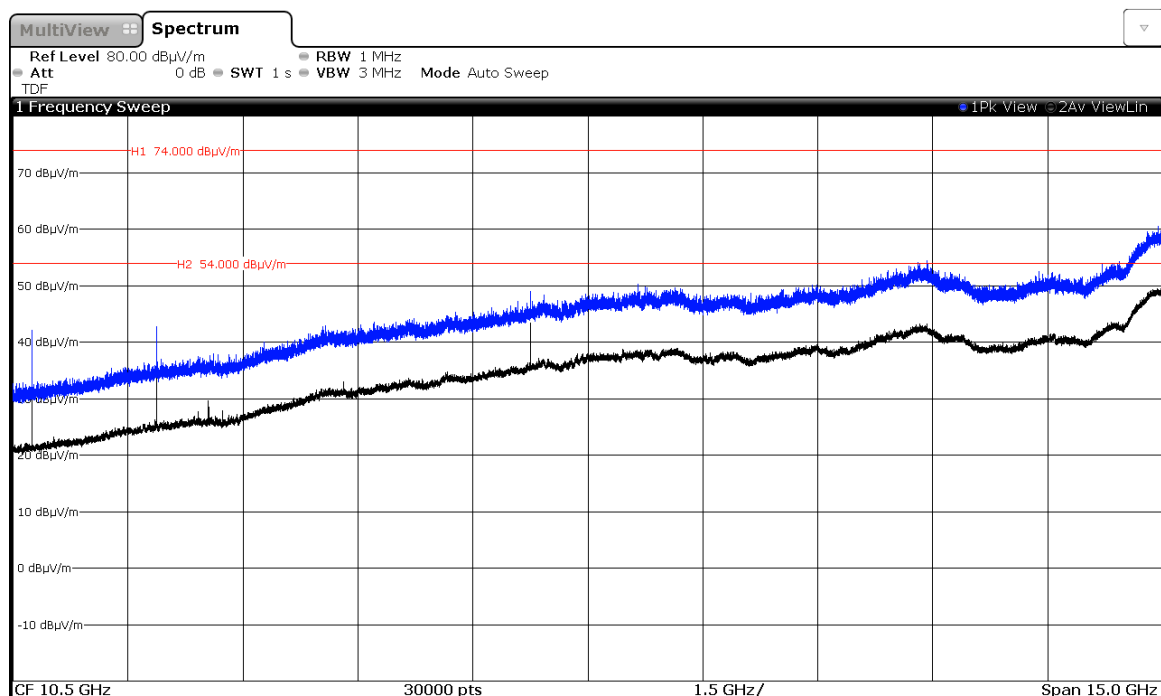
FREQUENCY RANGE 3 GHz to 18 GHz.

### 1. WiFi 2.4GHz 802.11 b mode

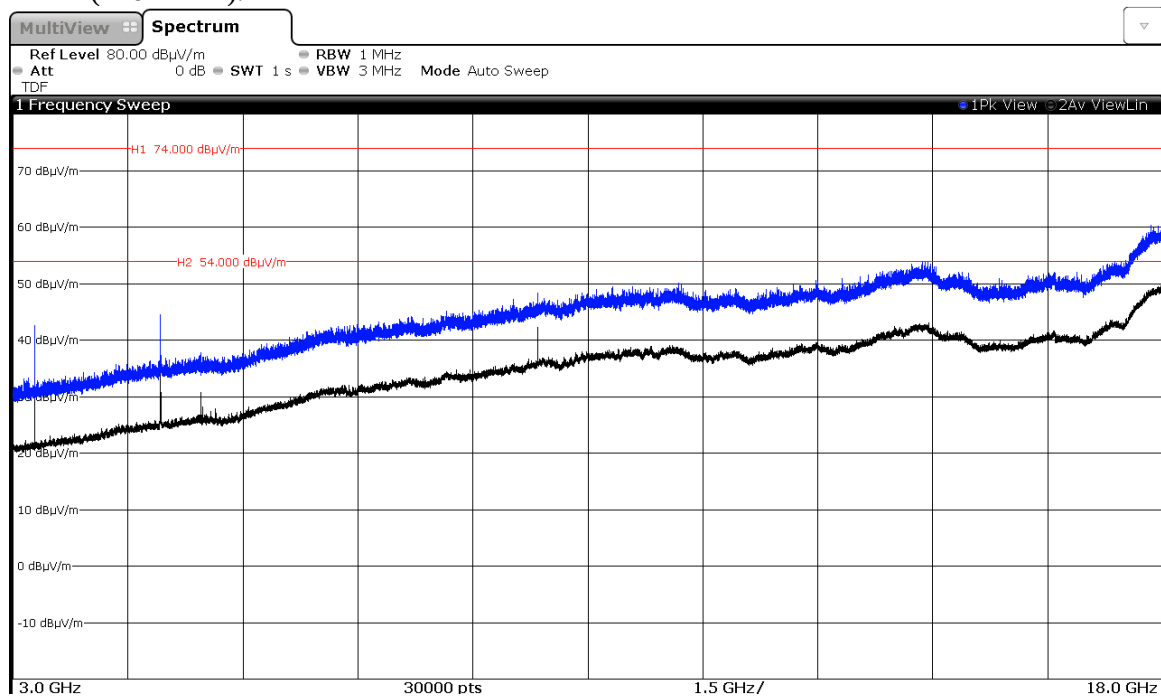
CHANNEL 1 (2412 MHz).



CHANNEL 6 (2437 MHz).

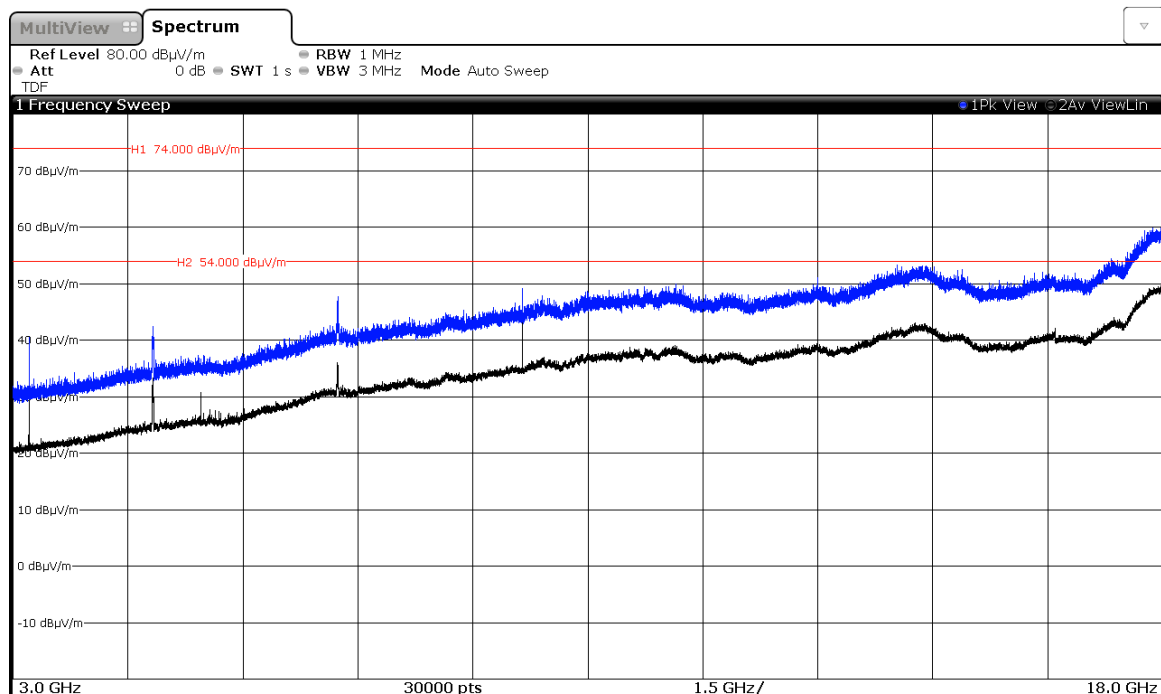


## CHANNEL 11 (2462 MHz).

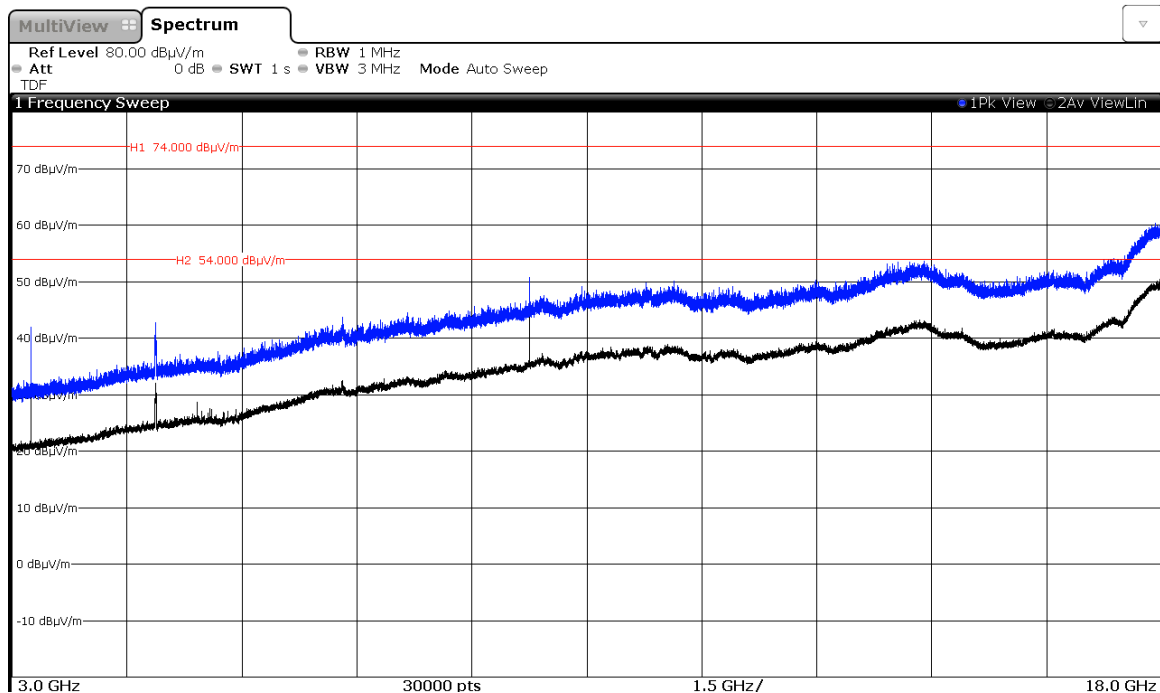


## 2. WiFi 2.4GHz 802.11 g mode (Worst case OFDM)

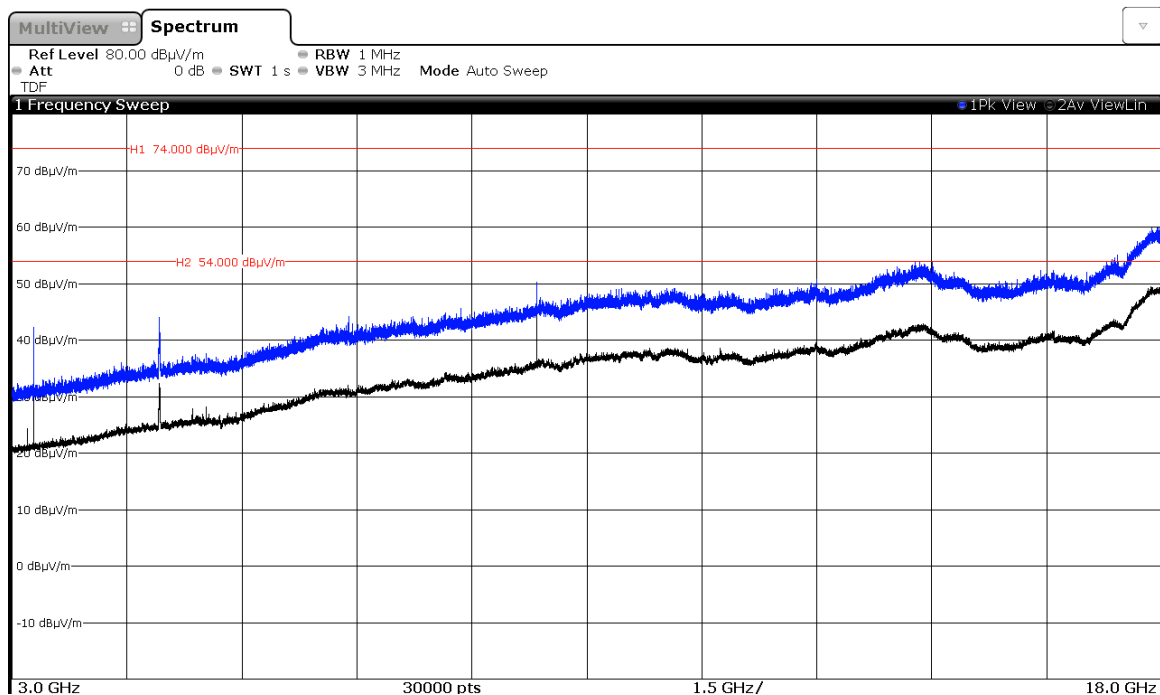
### CHANNEL 1 (2412 MHz).



CHANNEL 6 (2437 MHz).



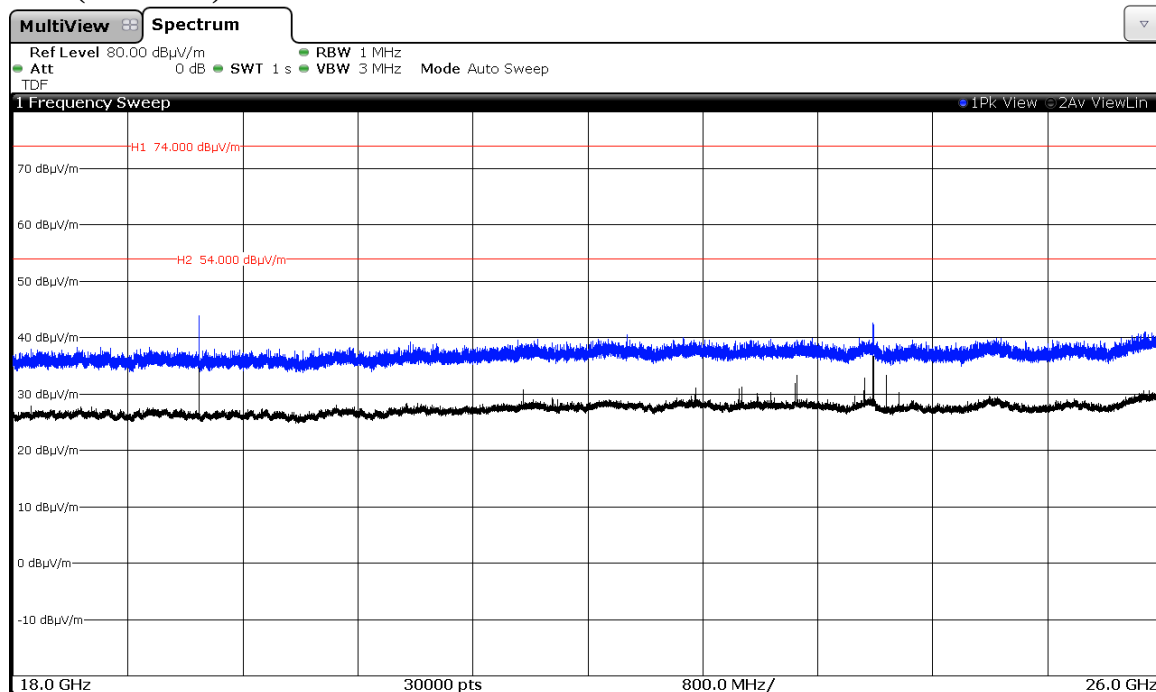
CHANNEL 11 (2462 MHz).



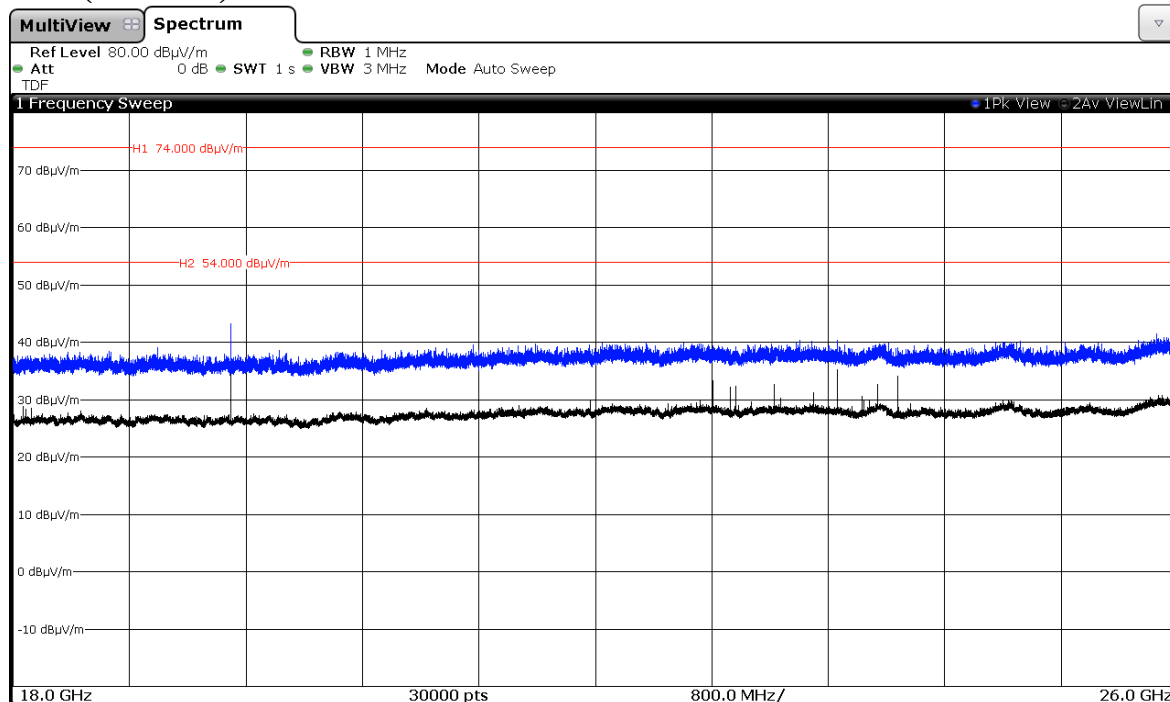
FREQUENCY RANGE 18 GHz to 26 GHz.

### 1. WiFi 2.4GHz 802.11 b mode

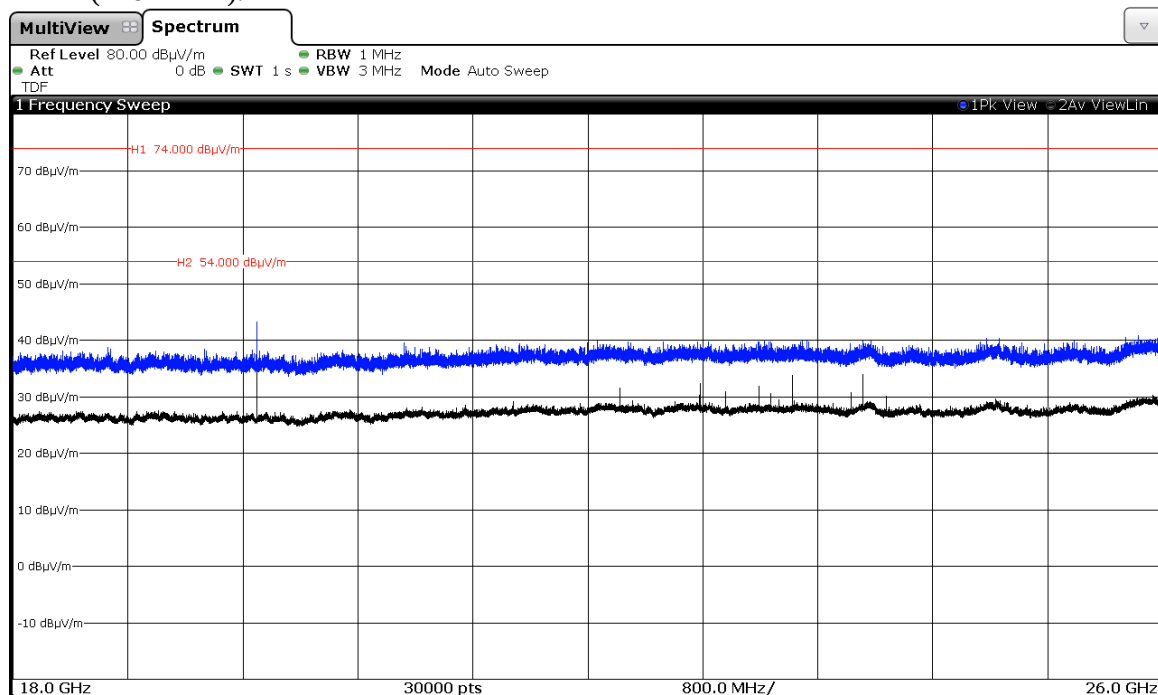
CHANNEL 1 (2412 MHz).



CHANNEL 6 (2437 MHz).

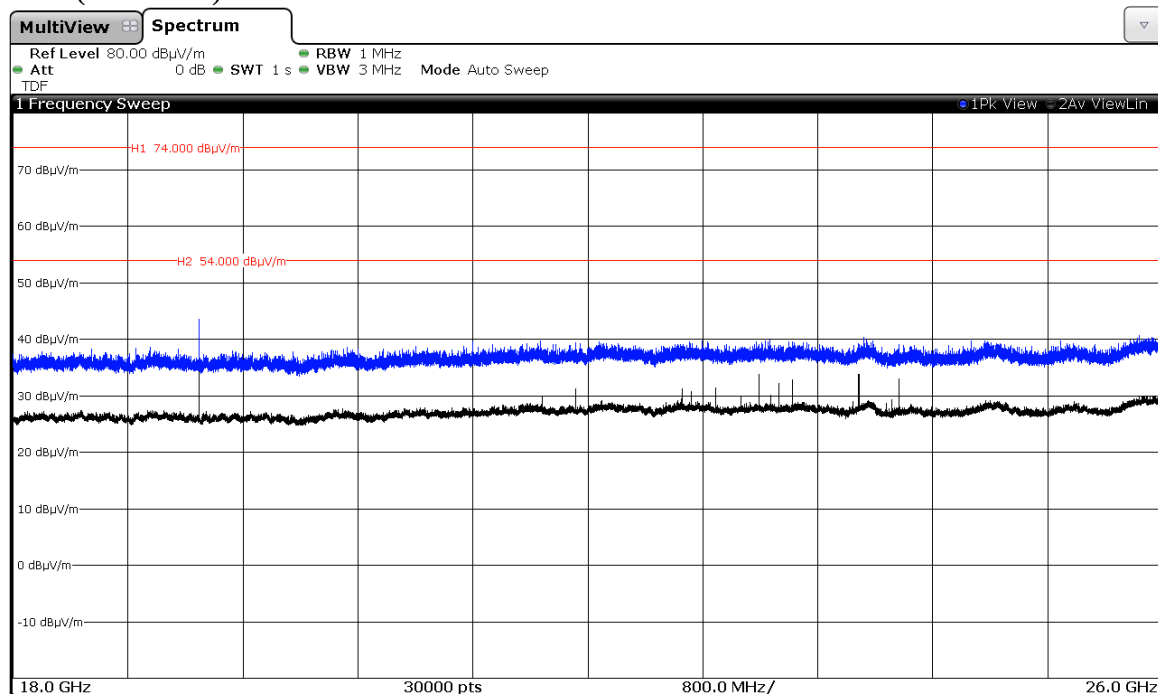


## CHANNEL 11 (2462 MHz).

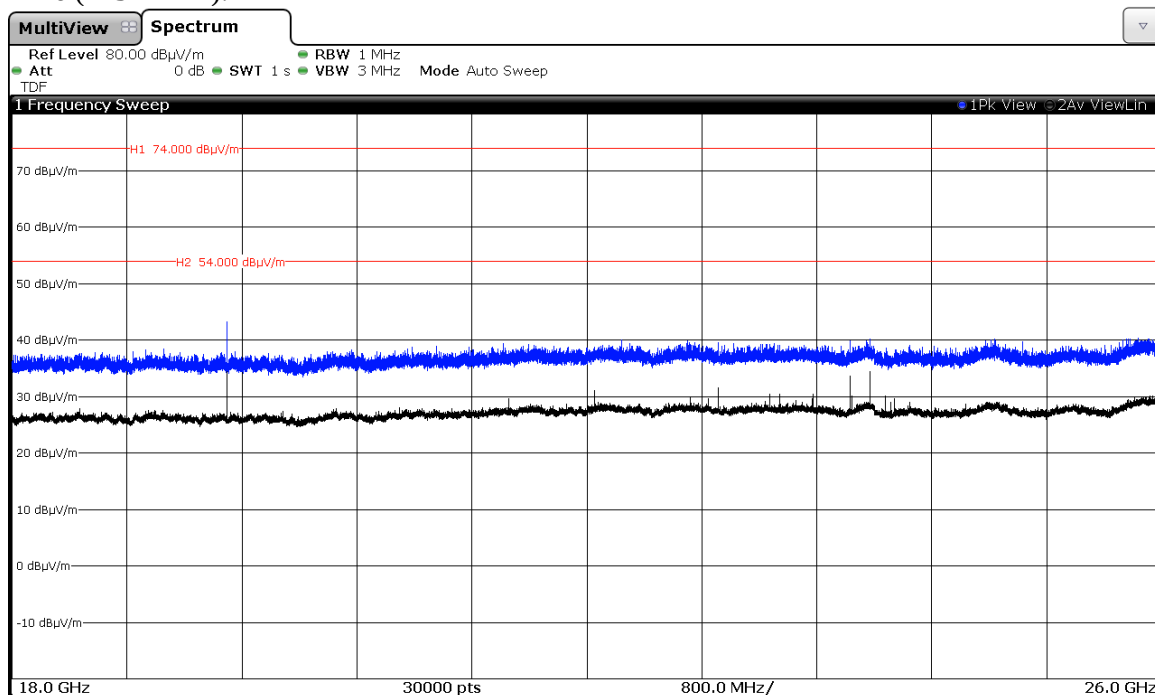


## 2. WiFi 2.4GHz 802.11 g mode (Worst case)

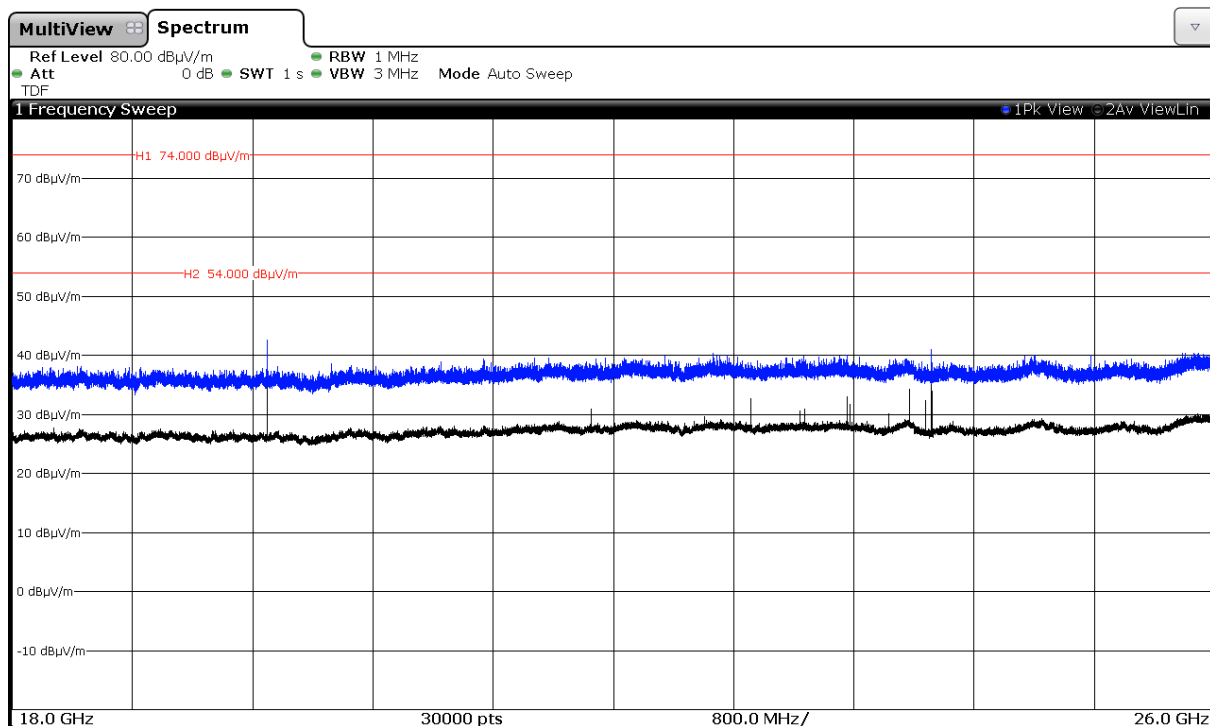
### CHANNEL 1 (2412 MHz).



## CHANNEL 6 (2437 MHz).



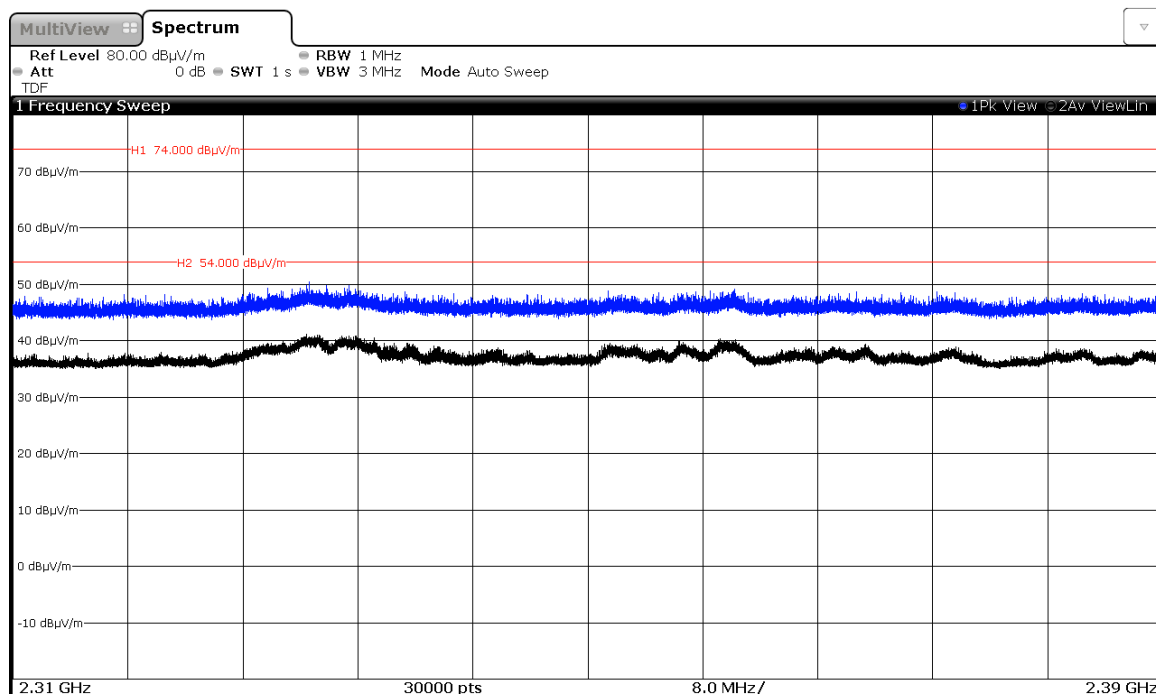
## CHANNEL 11 (2462 MHz).



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

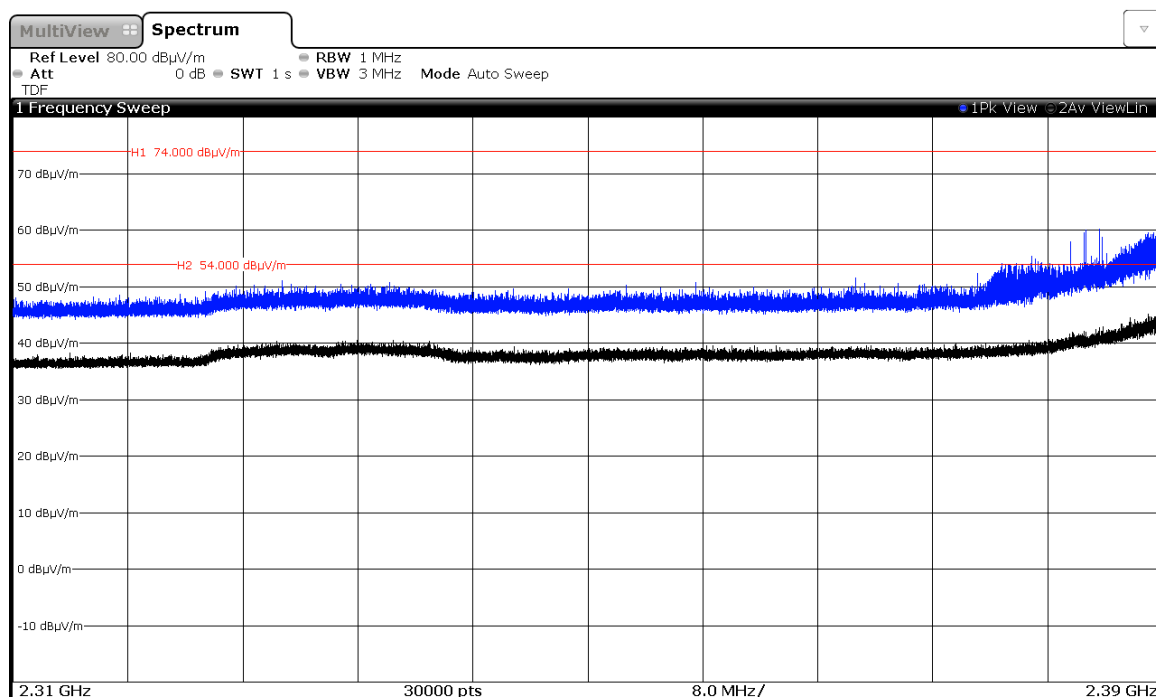
### 1. WiFi 2.4GHz 802.11 b mode

CHANNEL 1 (2412 MHz).



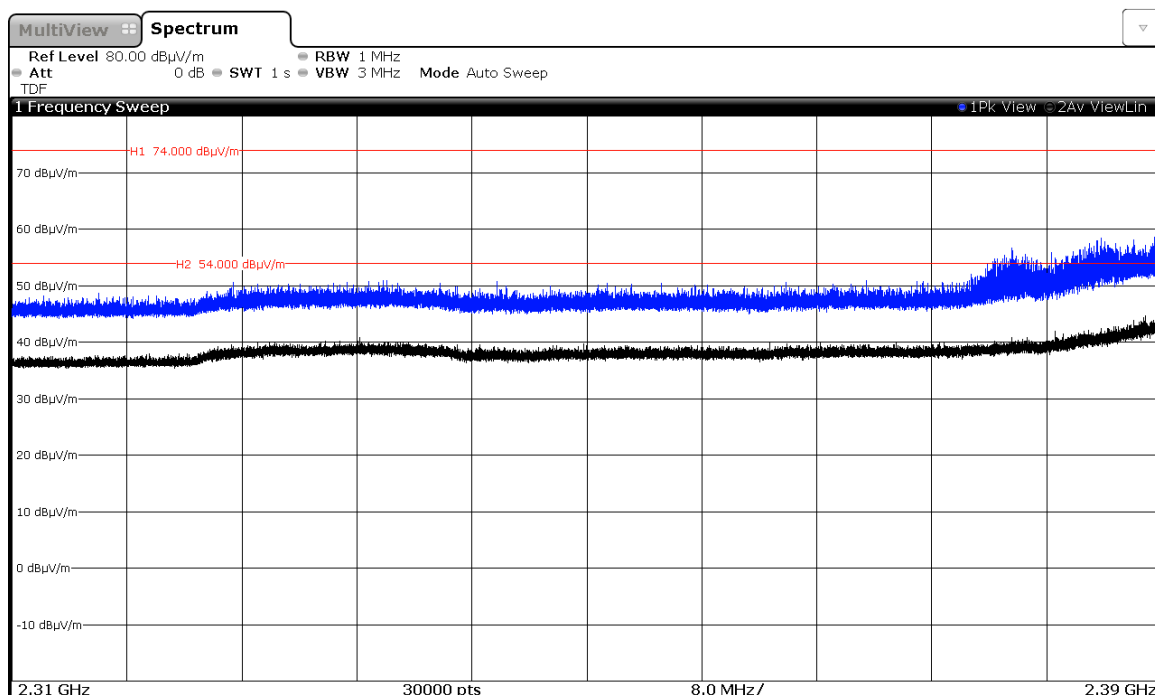
### 2. WiFi 2.4GHz 802.11 g mode

CHANNEL 1 (2412 MHz).



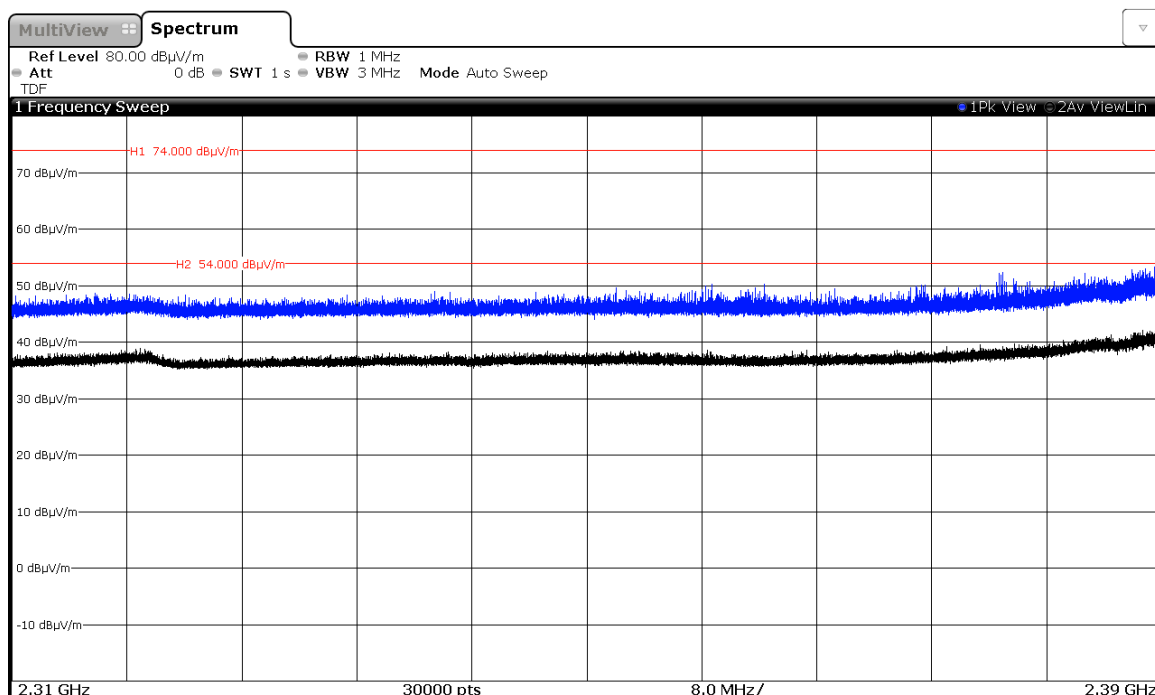
### 3. WiFi 2.4GHz 802.11 n20 mode

CHANNEL 1 (2412 MHz).



### 4. WiFi 2.4GHz 802.11 n40 mode

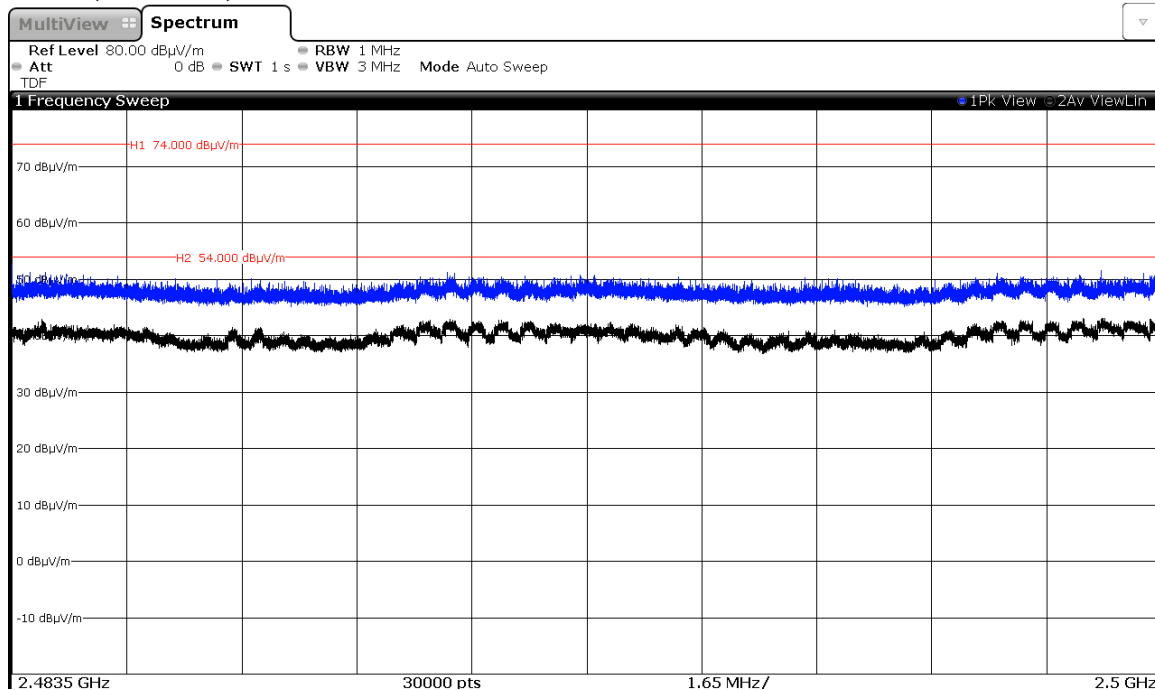
CHANNEL 3 (2422 MHz).



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

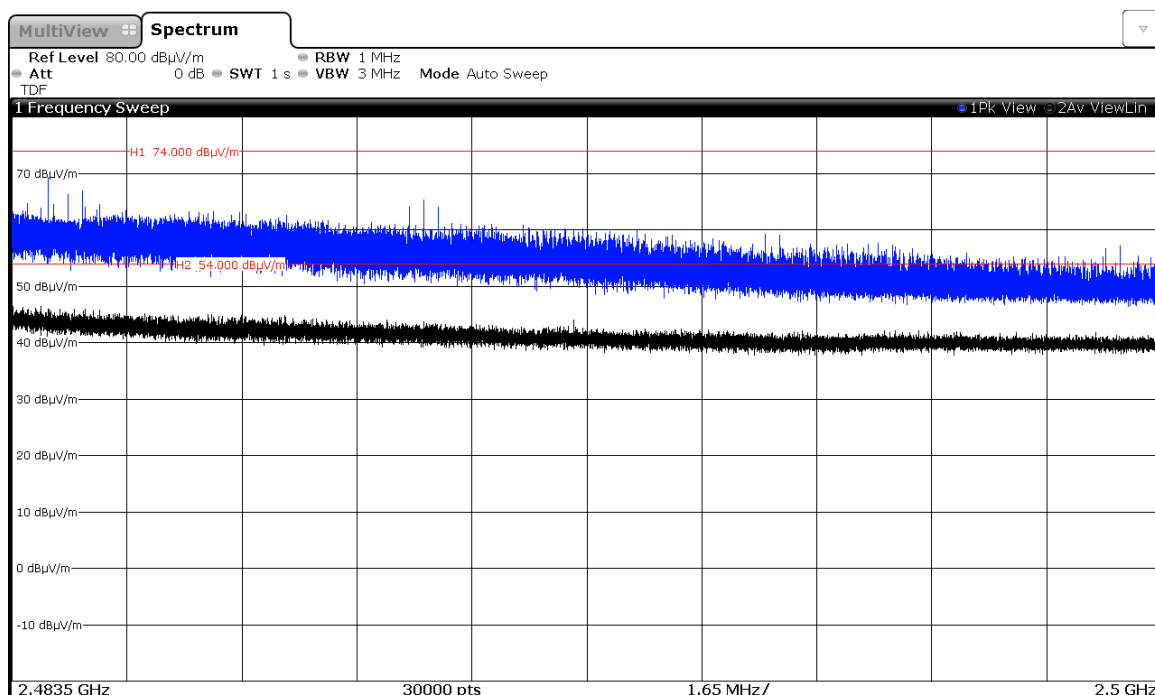
### 1. WiFi 2.4GHz 802.11 b mode

CHANNEL 11 (2462 MHz).



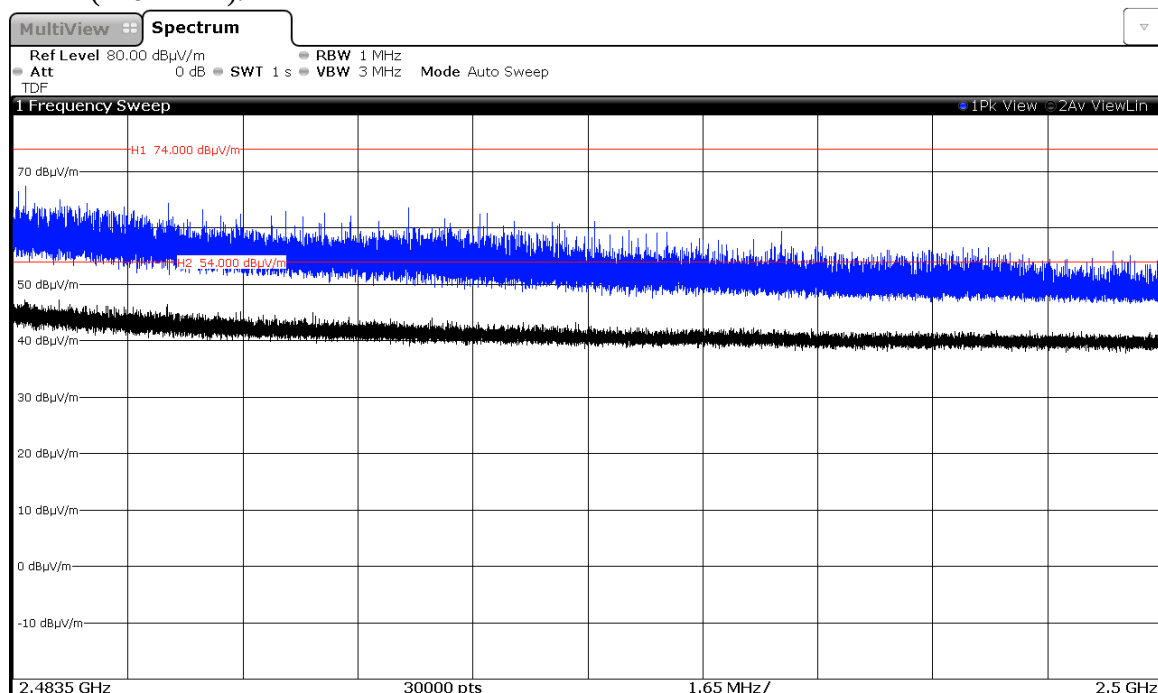
### 2. WiFi 2.4GHz 802.11 g mode

CHANNEL 11 (2462 MHz).



### 3. WiFi 2.4GHz 802.11 n20 mode

CHANNEL 11 (2462 MHz).



### 4. WiFi 2.4GHz 802.11 n40 mode

CHANNEL 9 (2452 MHz).

