

## EMC TEST REPORT for Intentional Radiator (BT Function)

**No. 150300463SHA-001**

Applicant : Monitor Audio Ltd.  
Unit 2, 24 Brook Road, Rayleigh, Essex SS6 7XJ England

Manufacturer : Monitor Audio Ltd.  
Unit 2, 24 Brook Road, Rayleigh, Essex SS6 7XJ England

Equipment : Wireless Speaker

Type/Model : airstream s150

### SUMMARY

The equipment complies with the requirements according to the following standard(s):

**47CFR Part 15 (2014):** Radio Frequency Devices

**ANSI C63.4 (2009):** American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

**RSS-210 Issue 8 (December 2010):** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

**RSS-Gen Issue 4 (November 2014):** General Requirements and Information for the Certification of Radio communication Equipment

Date of issue: Apr 27, 2015

Prepared by:



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Reviewed by:



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**FCC ID: O7VMA191815**  
**IC: 5928A-MA191815**

## **Description of Test Facility**

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## **1. General Information**

### **1.1 Applicant Information**

Applicant: Monitor Audio Ltd.  
Unit 2, 24 Brook Road, Rayleigh, Essex SS6 7XJ  
England

Name of contact: Liam Halpin  
Tel: 44-1268-798565

Fax: 44-1268-740589

Manufacturer: Monitor Audio Ltd.  
Unit 2, 24 Brook Road, Rayleigh, Essex SS6 7XJ  
England

Sample received date : Mar 12, 2015  
Sample Identification No: \*0150312-30-001\*  
Date of test: Mar 13, 2015 ~ Mar 26, 2015

### **1.2 Identification of the EUT**

Equipment: Wireless Speaker  
Type/model: airstream s1500  
FCC ID: O7VMA191815  
IC: 5928A-MA191815

### 1.3 Technical specification

|                                            |                                                                                                                                                                                                                            |
|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Frequency Band:                  | 2402 - 2480 MHz                                                                                                                                                                                                            |
| Modulation:                                | GFSK, $\pi/4$ -DQPSK and 8DPSK                                                                                                                                                                                             |
| Gain of Antenna:                           | Internal PCB antenna, 1.0dBi max                                                                                                                                                                                           |
| Rating:                                    | 17V  , 2.3A                                                                                                                               |
| Description of EUT:<br>adapter<br><br>data | The EUT is a BT audio device. In this report, only bluetooth function was assessed. There are two<br><br>for EUT model AS600-170-AD230 and model<br>S048CM1700230 we tested them and list the worst<br><br>in this report. |
| Channel Description:                       | The channel spacing is 1MHz.                                                                                                                                                                                               |

### 1.4 Mode of operation during the test / Test peripherals used

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

The lowest, middle and highest channel were tested as representatives (2402MHz, 2441MHz and 2480MHz).

Test Peripherals:

PC: HP Compaq 6730b(used for configure engineering mode and not used for final test.)

SW:Bluetest3



## 2. Test Specification

### 2.1 Instrument list

| Equipment             | Type                              | Manu.             | Internal no.  | Cal. Date  | Due date   |
|-----------------------|-----------------------------------|-------------------|---------------|------------|------------|
| Semi-anechoic chamber | -                                 | Albatross project | EC 3048       | 2014-5-12  | 2015-5-11  |
| Test Receiver         | ESCS 30                           | R&S               | EC 2107       | 2014-10-21 | 2015-10-20 |
| A.M.N.                | ESH2-Z5                           | R&S               | EC 3119       | 2015-1-9   | 2016-1-8   |
| A.M.N.                | ENV4200                           | R&S               | EC3558        | 2014-8-11  | 2015-8-10  |
| High Pass Filter      | WHKX 1.0/15G-10SS                 | Wainwright        | EC4297-1      | 2015-1-9   | 2016-1-8   |
| High Pass Filter      | WHKX 2.8/18G-12SS                 | Wainwright        | EC4297-2      | 2015-1-9   | 2016-1-8   |
| High Pass Filter      | WHKX 7.0/1.8G-8SS                 | Wainwright        | EC4297-3      | 2015-1-9   | 2016-1-8   |
| Band Reject Filter    | WRCGV 2400/2483-2390/2493-35/10SS | Wainwright        | EC4297-4      | 2015-1-9   | 2016-1-8   |
| Test Receiver         | FSV40                             | R&S               | /             | 2014-10-21 | 2015-10-20 |
| Pre-amplifier         | Pre-amp 18                        | R&S               | EC 3222       | 2014-4-12  | 2015-4-11  |
| Pre-amplifier         | Tpa0118-40                        | R&S               | EC 4792-2     | 2014-4-12  | 2015-4-11  |
| Horn antenna          | HF 906                            | R&S               | EC 3049       | 2014-5-13  | 2016-5-12  |
| Horn antenna          | 3117                              | ETS               | EC 4792-1     | 2014-4-17  | 2016-4-16  |
| Horn antenna          | HAP18-26W                         |                   | EC 4792-3     | 2014-4-10  | 2016-4-9   |
| Bilog Antenna         | CBL 6112D                         | TESEQ             | EC 4206       | 2012-5-16  | 2014-5-15  |
| Test Receiver         | ESCS 30                           | R&S               | EC 2107       | 2014-10-21 | 2015-10-20 |
| Test Receiver         | ESIB 26                           | R&S               | EC 3045       | 2014-10-21 | 2015-10-20 |
| Test Receiver         | ESCI 7                            | R&S               | EC4501        | 2014-12-13 | 2014-12-12 |
| Loop antenna          | 9230-1/92291-1                    | Schwarzbeck       | 086814/084814 | 2014-12-16 | 2015-12-15 |

### 2.2 Test Standard

47CFR Part 15 (2014)  
ANSI C63.4: 2009  
RSS-210 Issue 8 (December 2010)  
RSS-Gen Issue 4 (November 2014)  
KDB 558074 DTS

## 2.3 Test Summary

**This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.**

| TEST ITEM                                | FCC REFERENCE     | IC REFERENCE               | RESULT |
|------------------------------------------|-------------------|----------------------------|--------|
| 20 dB Bandwidth                          | 15.247(a)(1)      | RSS-210 Issue 8 Annex 8    | Tested |
| Carrier Frequency Separation             | 15.247(a)(1)      | RSS-210 Issue 8 Annex 8    | Pass   |
| Output power                             | 15.247(b)(1)      | RSS-210 Issue 8 Annex 8    | Pass   |
| Radiated Spurious Emissions              | 15.205 & 15.209   | RSS-210 Issue 8 Clause 2   | Pass   |
| Conducted Spurious Emissions & Band Edge | 15.247(d)         | RSS-210 Issue 8 Annex 8    | Pass   |
| Power line conducted emission            | 15.207            | RSS-Gen Issue 4 Clause 8.8 | Pass   |
| Number of Hopping Frequencies            | 15.247(a)(1)(iii) | RSS-210 Issue 8 Annex 8    | Pass   |
| Dwell time                               | 15.247(a)(1)(iii) | RSS-210 Issue 8 Annex 8    | Pass   |
| Occupied bandwidth                       | -                 | RSS-Gen Issue 4 Clause 6.6 | Tested |
| Spurious emission for receiver           | 15B               | RSS-310 Issue 3 Clause 3.1 | NA     |

Note: "NA" means "not applied".



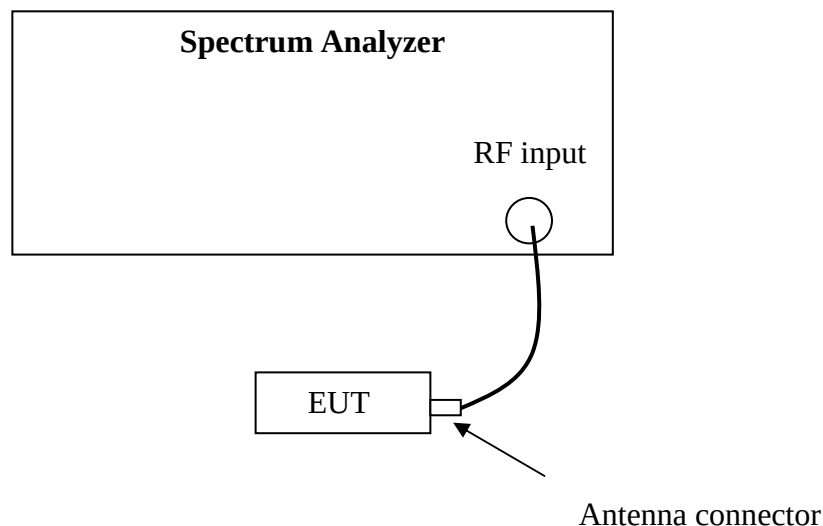
### 3. 20 dB Bandwidth

**Test result:** Tested

#### 3.1 Limit

- ☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
- ☒ 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 125mW.

#### 3.2 Test Configuration



#### 3.3 Test Procedure and test setup

The 20 bandwidth per FCC § 15.247(a)(1) is measured using the Spectrum Analyzer with Span = 2 to 3 times the 20 dB bandwidth,  $RBW \geq 1\%$  of the 20 dB bandwidth,  $VBW \geq RBW$ , Sweep = auto, Detector = peak, Trace = max hold.

The test was performed at 3 channels (lowest, middle and highest channel).

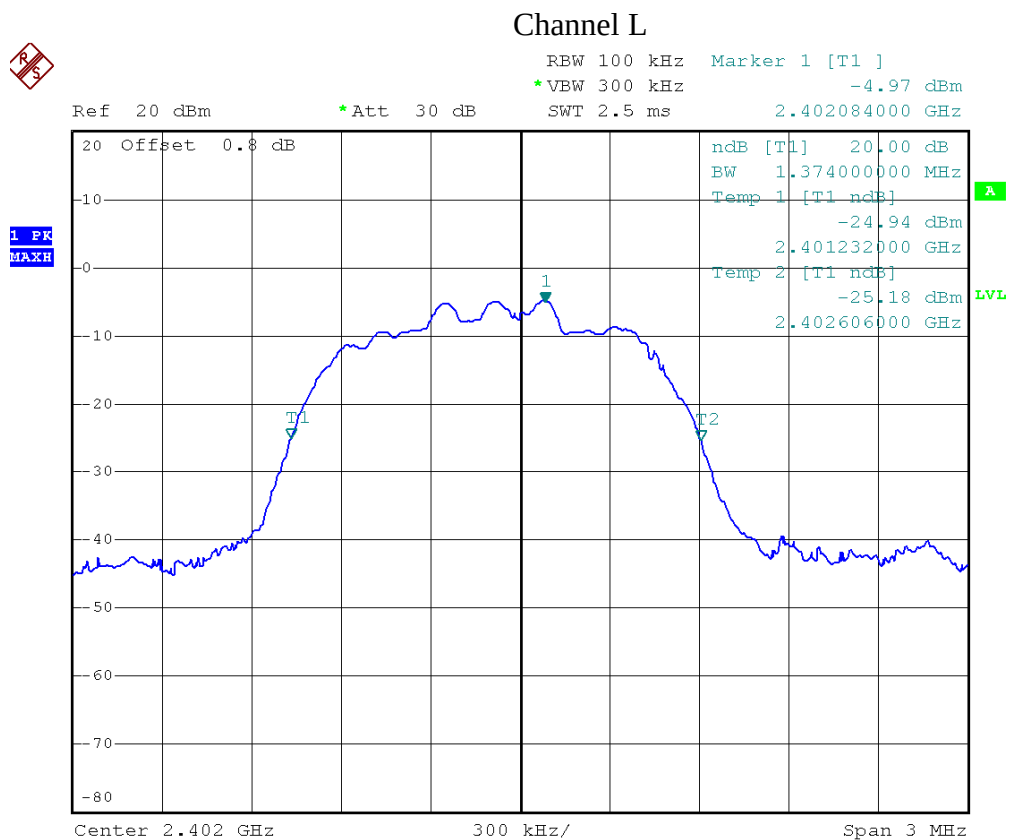
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

### 3.4 Test Protocol

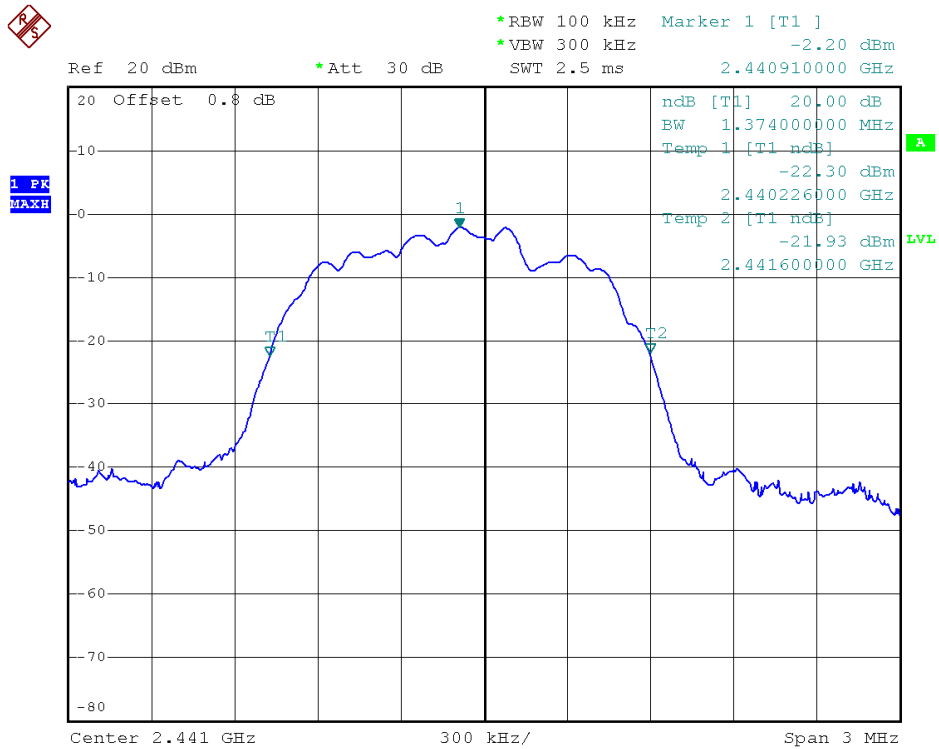
Temperature : 25°C  
Relative Humidity : 55 %

Maximum 20dB RF Bandwidth

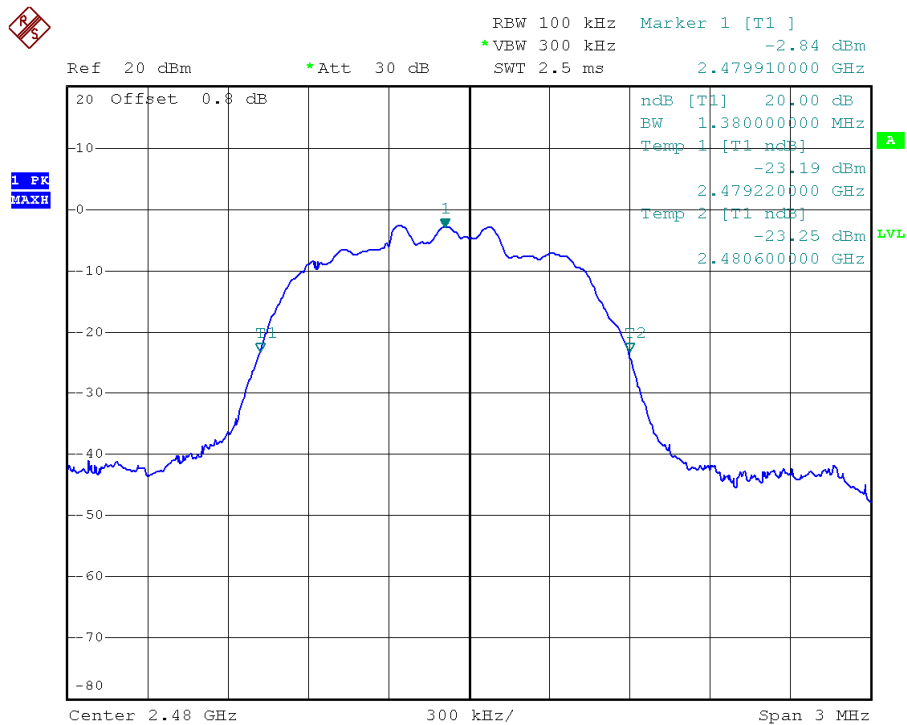
| Mode  | CH | 20dB Bandwidth (kHz) | Two-thirds of Bandwidth (kHz) |
|-------|----|----------------------|-------------------------------|
| 8DPSK | L  | 1374                 | 916                           |
|       | M  | 1374                 | 916                           |
|       | H  | 1380                 | 920                           |



### Channel M



### Channel H



## 4. Carrier Frequency Separation

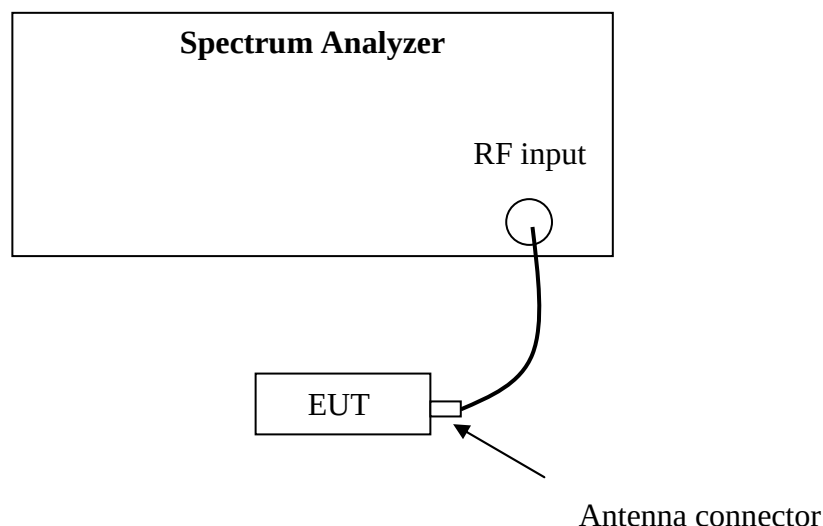
**Test result:** Pass

### 4.1 Limit

☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

☒ 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 125mW.

### 4.2 Test Configuration



### 4.3 Test Procedure and test setup

The Carrier Frequency Separation per FCC § 15.247(a)(1) is measured using the Spectrum Analyzer with Span can capture two adjacent channels,  $RBW \geq 1\%$  of the span,  $VBW \geq RBW$ , Sweep = auto, Detector = peak, Trace = max hold. The test was performed at 3 channels (lowest, middle and highest channel). The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

#### 4.4 Test Protocol

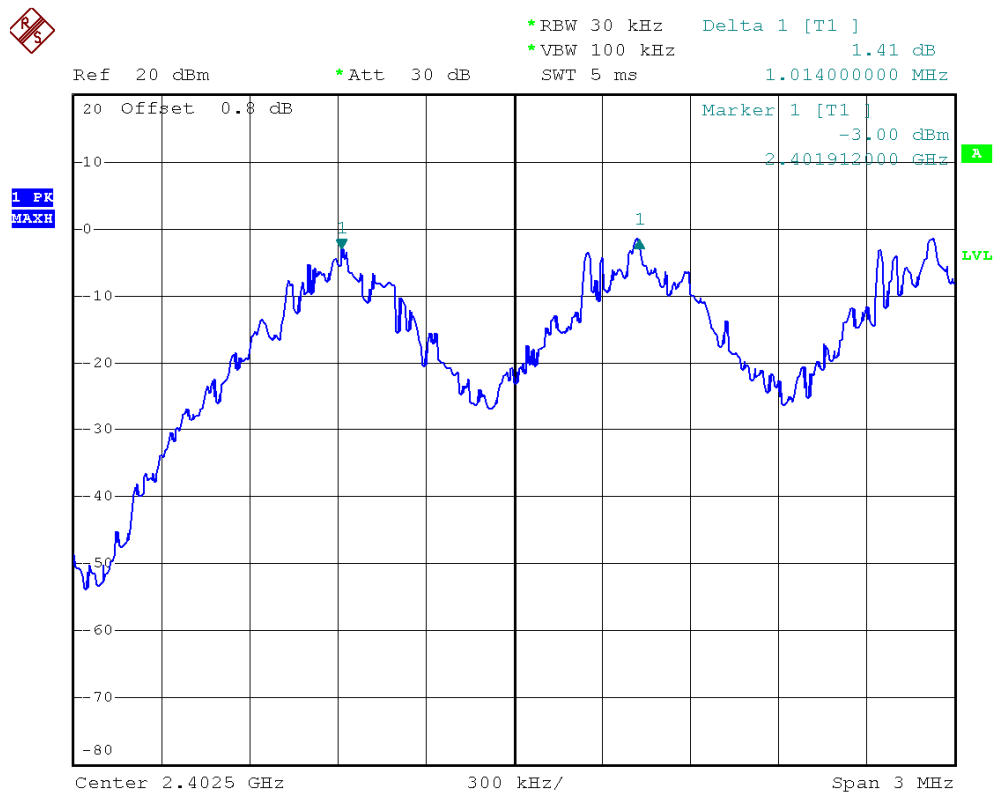
Temperature : 22°C

Relative Humidity : 55 %

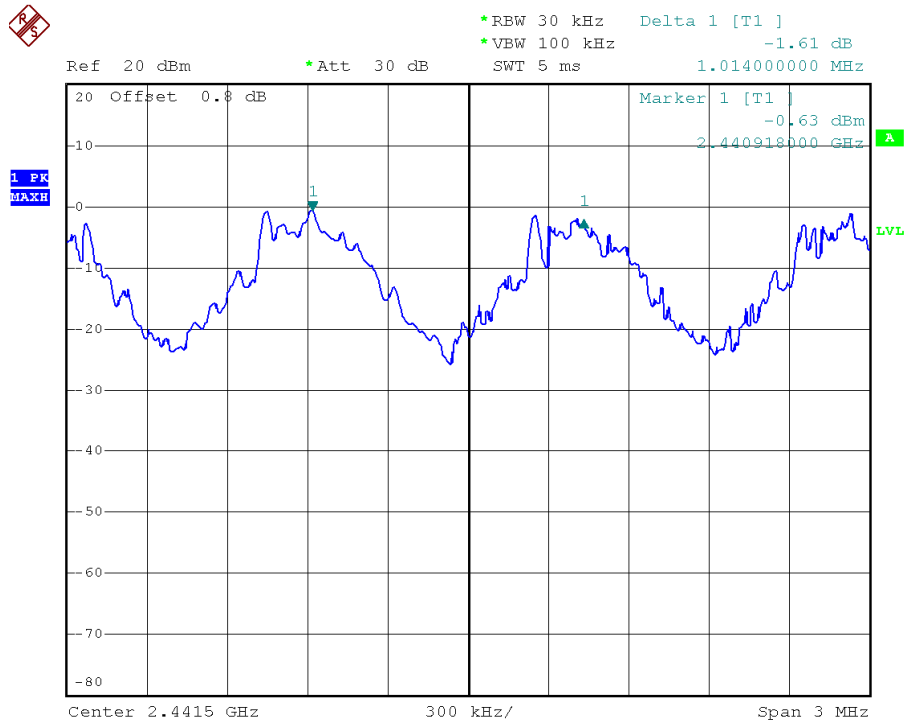
Minimum Hopping Channel Carrier Frequency Separation

| Mode | CH | Frequency Separation (kHz) | Limit (kHz) |
|------|----|----------------------------|-------------|
| GFSK | L  | 1014                       | ≥916        |
|      | M  | 1014                       | ≥916        |
|      | H  | 1008                       | ≥920        |

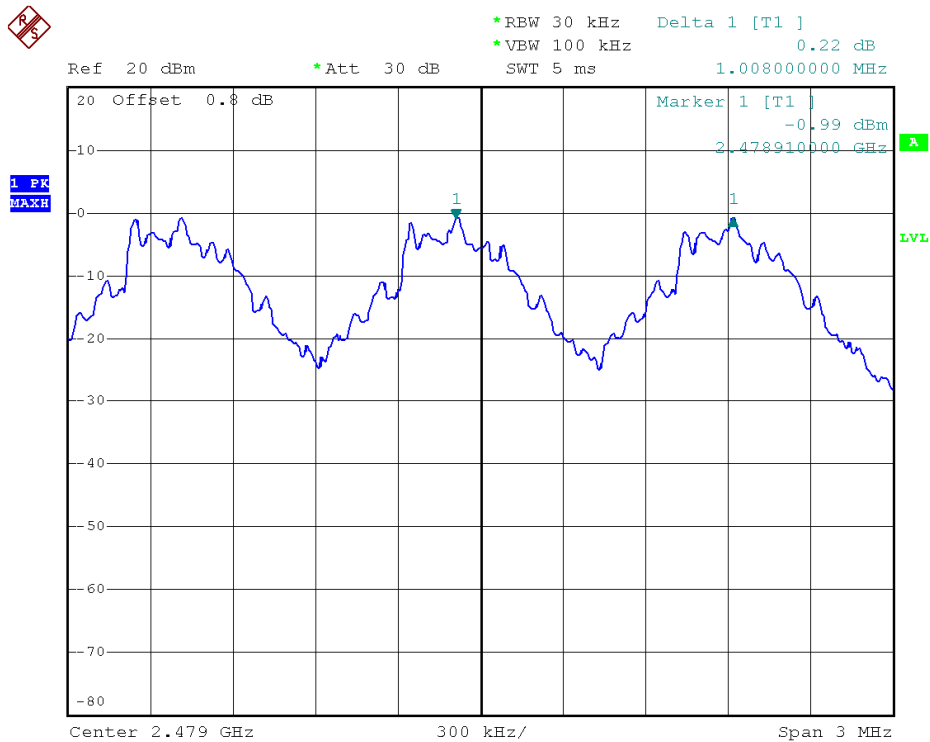
#### Channel L



### Channel M



### Channel H



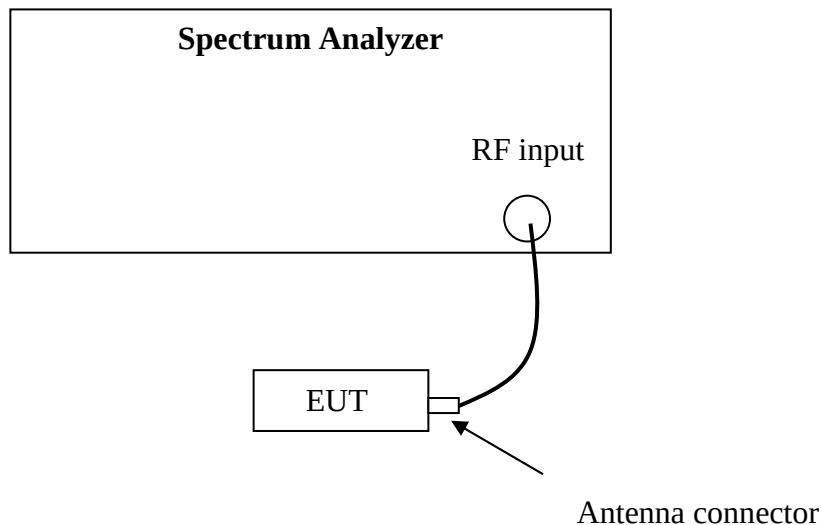
## 5. Maximum peak output power

Test result: Pass

### 5.1 Test limit

- ☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
- ☒ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts  
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
- ☐ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

### 5.2 Test Configuration



### 5.3 Test procedure and test setup

The power output per FCC § 15.247(b) is measured using the Spectrum Analyzer with Span = 5 times the 20 dB bandwidth, RBW ≥ the 20 dB bandwidth, VBW ≥ RBW, Sweep = auto, Detector = peak, Trace = max hold.  
The test was performed at 3 channels (lowest, middle and highest channel).  
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

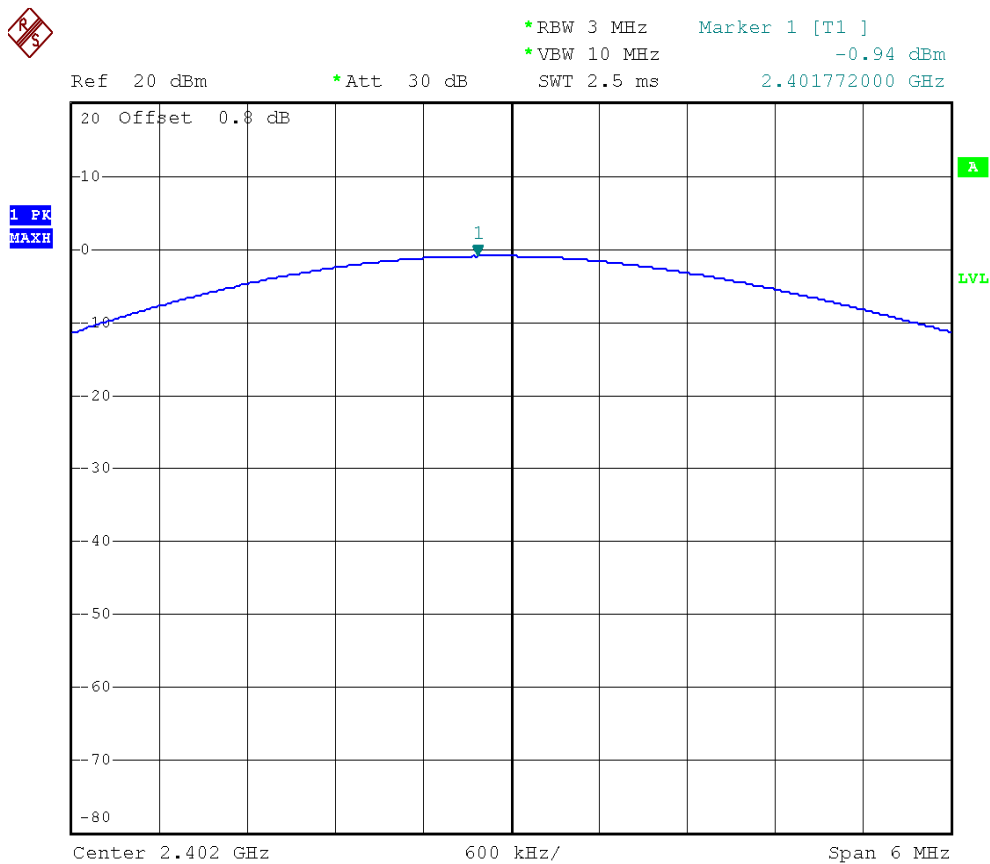
#### 5.4 Test protocol

Temperature : 25 °C  
Relative Humidity : 55 %

| Mode | CH | Cable loss (dB) | Corrected reading (dBm) | Limit (dBm) |
|------|----|-----------------|-------------------------|-------------|
| GFSK | L  | 0.8             | -0.94                   | ≤21.00      |
|      | M  | 0.8             | 1.20                    |             |
|      | H  | 0.8             | 1.02                    |             |

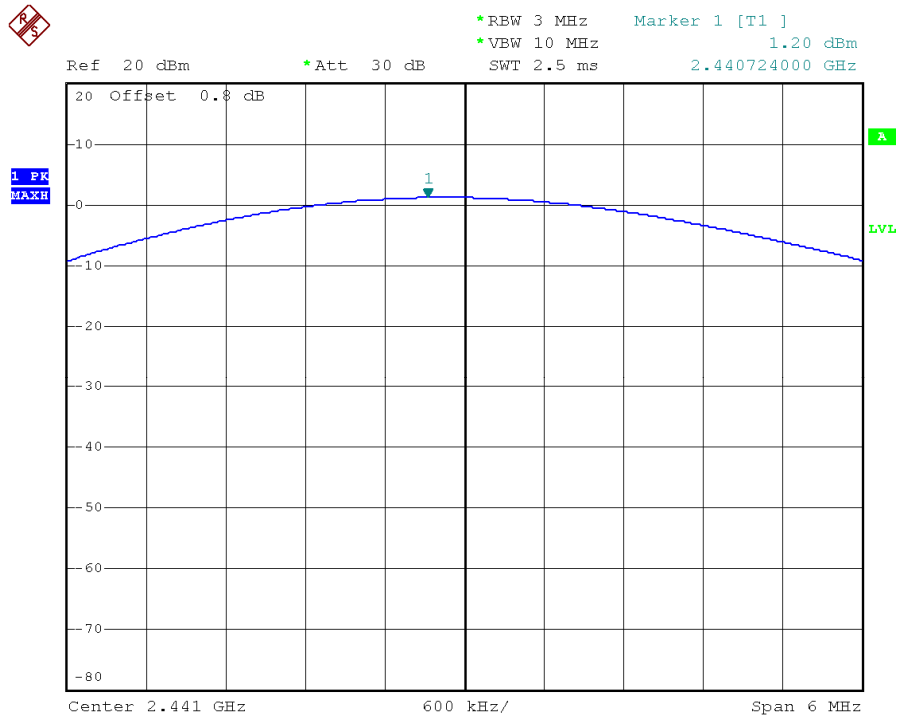
*The maximum EIRP of the EUT = 1.20dBm + 1.00dBi = 2.20dBm = 0.0016W which is lower than the EIRP limit of RSS-210.*

#### Channel L

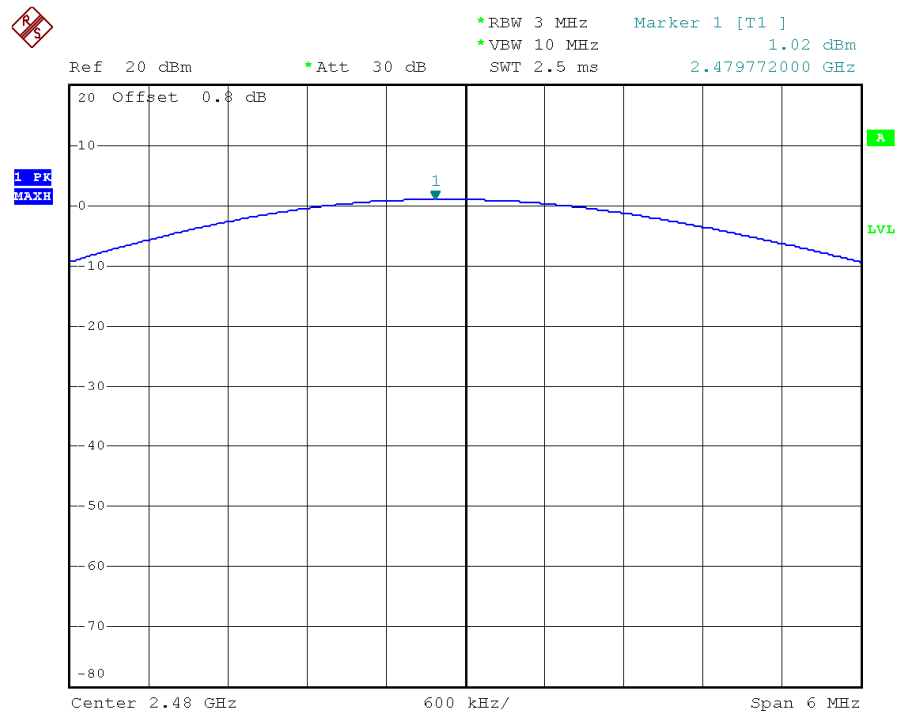




### Channel M



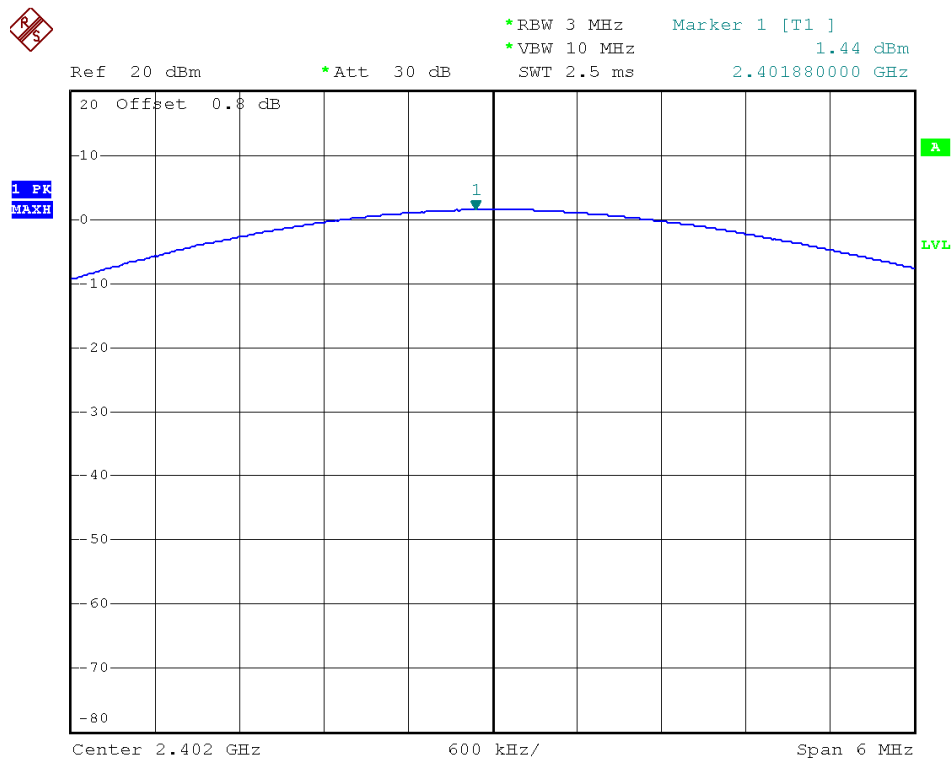
### Channel H



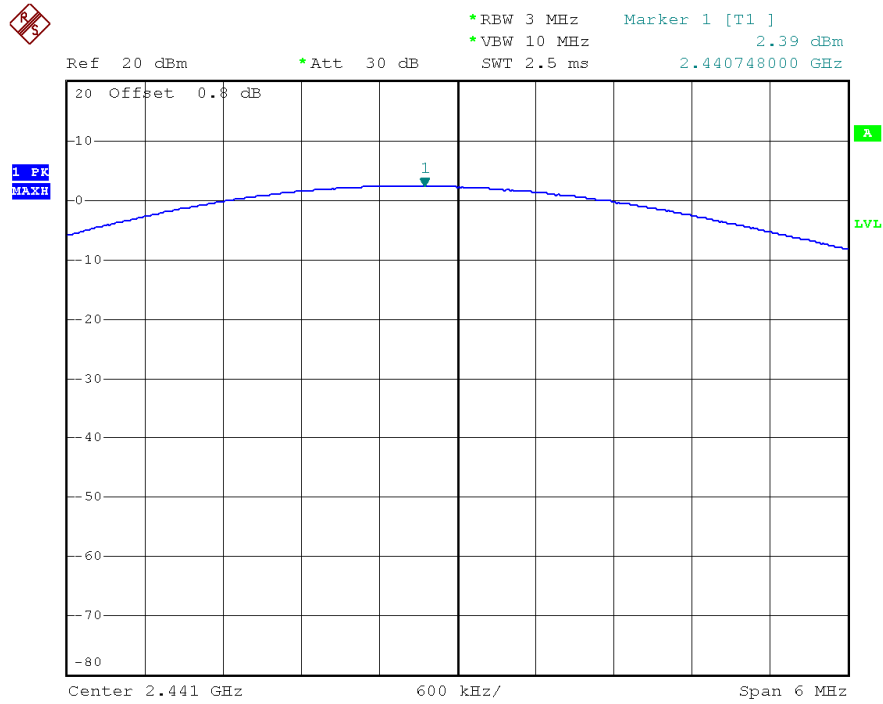
| Mode  | CH | Cable loss (dB) | Corrected reading (dBm) | Limit (dBm) |
|-------|----|-----------------|-------------------------|-------------|
| 8DPSK | L  | 0.80            | 1.44                    | ≤21.00      |
|       | M  | 0.80            | 2.39                    |             |
|       | H  | 0.80            | 1.81                    |             |

**The maximum EIRP of the EUT = 2.39dBm + 1.00dBi = 3.39dBm = 0.0021W which is lower than the EIRP limit of RSS-210.**

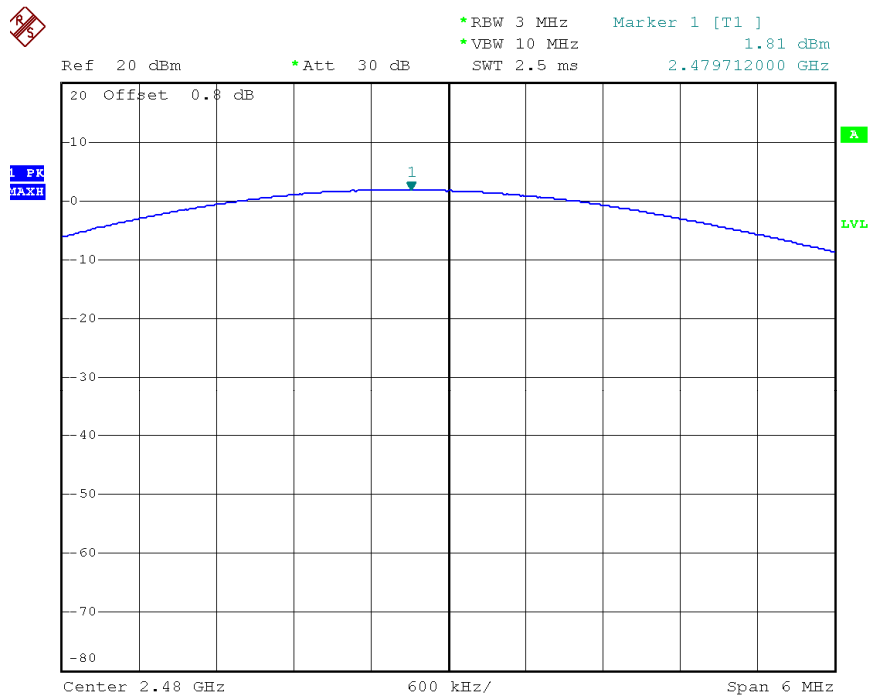
### Channel L



### Channel M



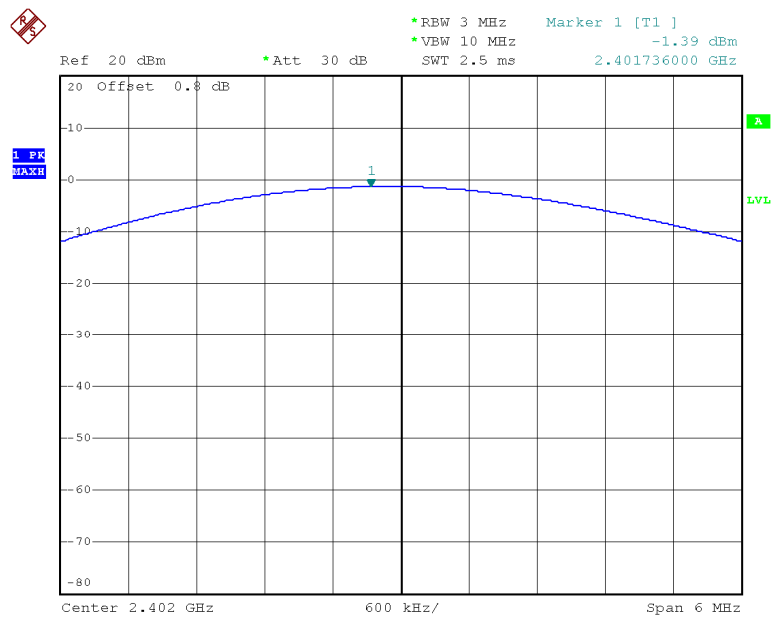
### Channel H



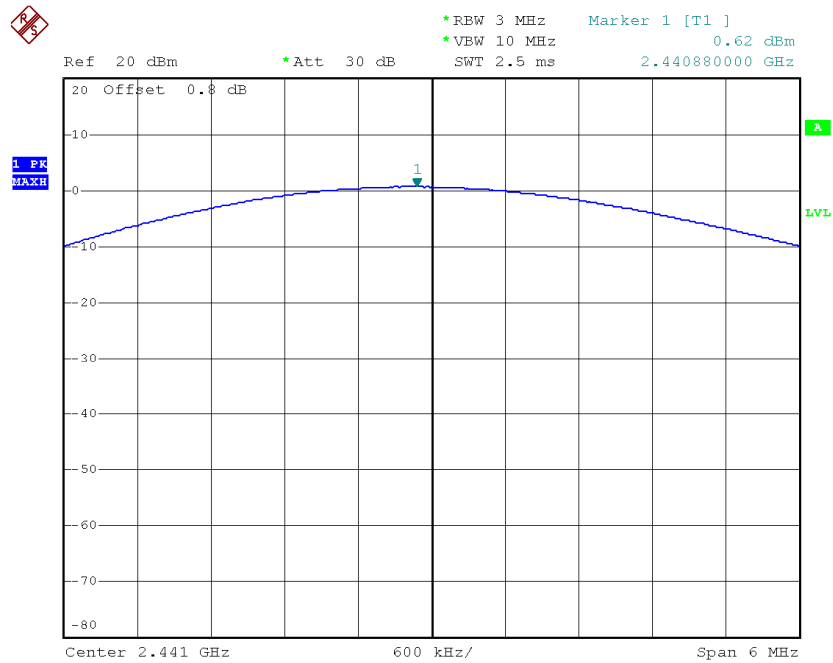
| Mode           | CH | Cable loss (dB) | Corrected reading (dBm) | Limit (dBm)  |
|----------------|----|-----------------|-------------------------|--------------|
| $\pi/4$ -DQPSK | L  | 0.80            | -1.39                   | $\leq 21.00$ |
|                | M  | 0.80            | 0.62                    |              |
|                | H  | 0.80            | 0.53                    |              |

*The maximum EIRP of the EUT = 0.62dBm + 1.00dBi = 1.62dBm = 0.0015W which is lower than the EIRP limit of RSS-210.*

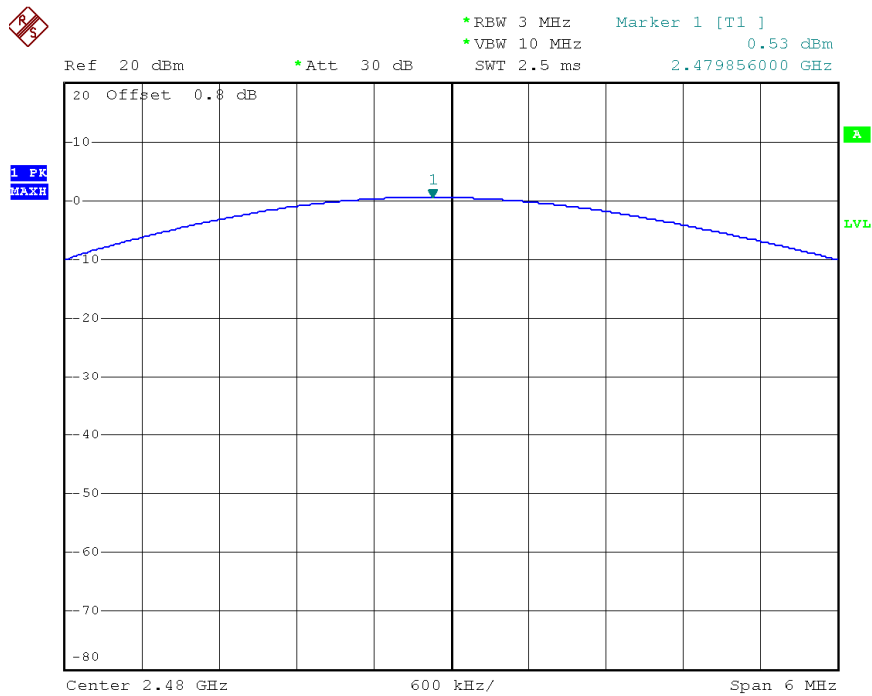
#### Channel L



### Channel M



### Channel H



## 6.0 Radiated Spurious Emissions

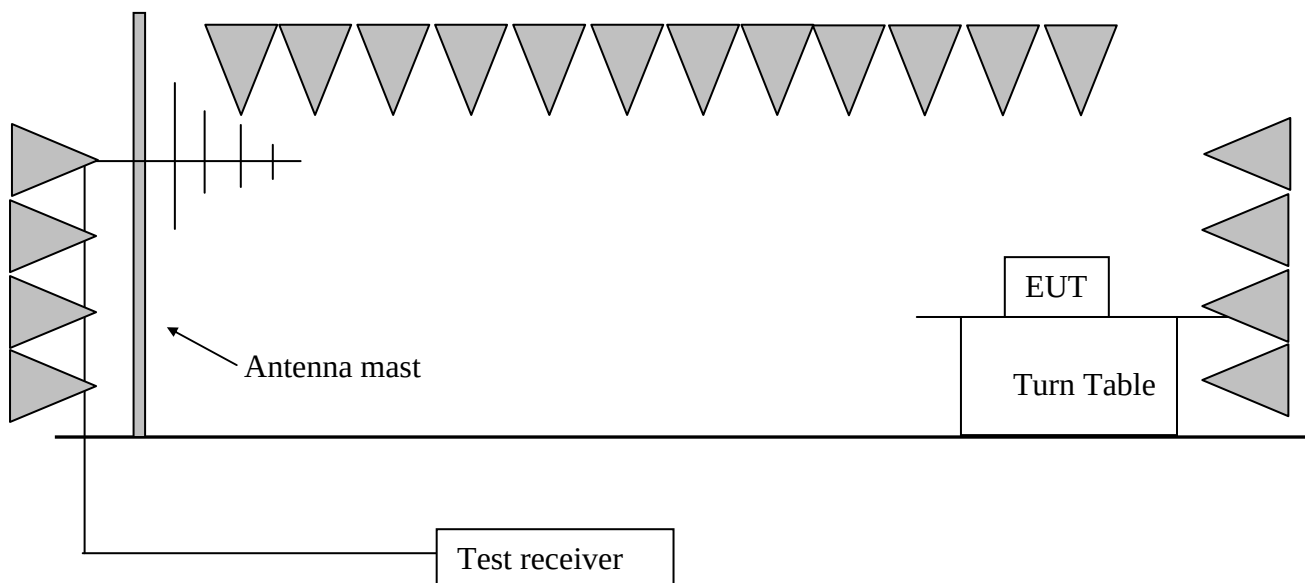
**Test result:** PASS

### 6.1 Test limit

The 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) showed as below:

| Frequency<br>(MHz) | Field Strength<br>(dBuV/m) | Measurement Distance<br>(m) |
|--------------------|----------------------------|-----------------------------|
| 30 - 88            | 40.0                       | 3                           |
| 88 - 216           | 43.5                       | 3                           |
| 216 - 960          | 46.0                       | 3                           |
| Above 960          | 54.0                       | 3                           |

### 6.2 Test Configuration



### **6.3 Test procedure and test setup**

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)

RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

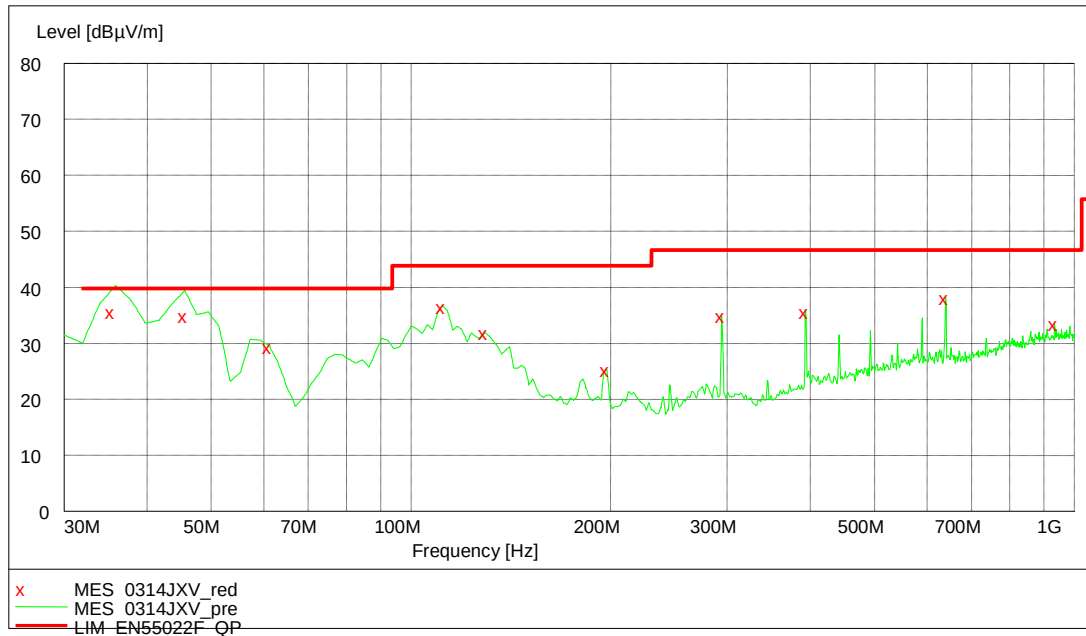
RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”.

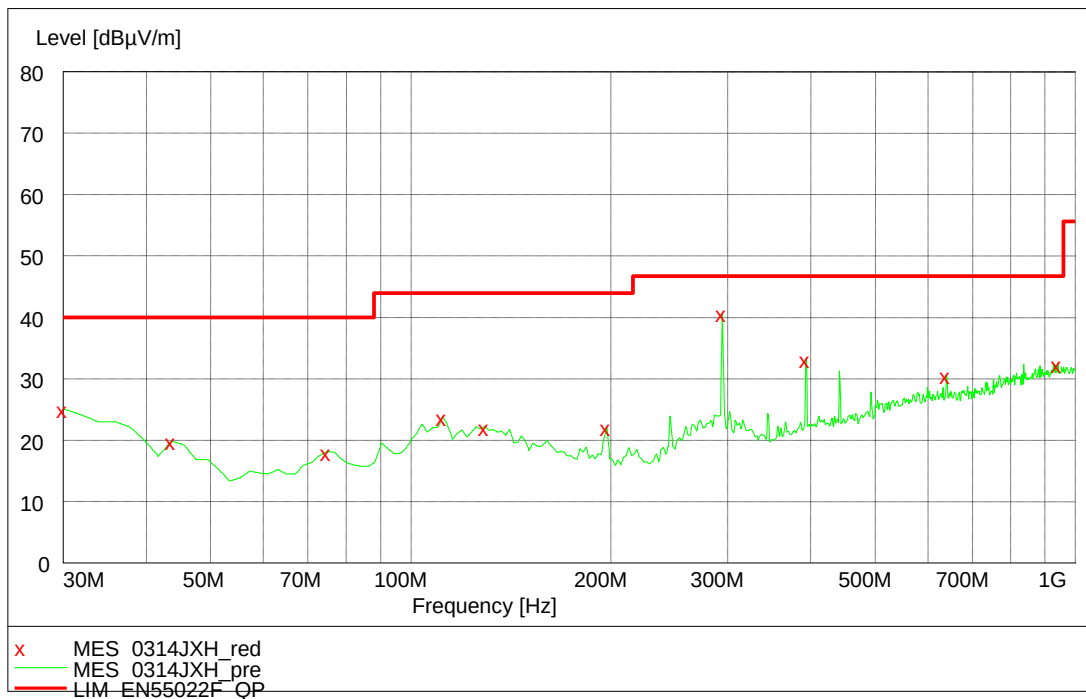
Temperature: 23 °C  
Relative humidity: 54%

Polarization: Vertical  
Adapter: AS600-170-AD230

Test Curve:



Polarization: Horizontal  
Adapter: AS600-170-AD230





#### 6.4 Test protocol

| CH | Antenna | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|-----------------------|----------------------------|----------------|-------------|----------|
| L  | V       | 2401.79         | -11.50                | 61.10                      | Fundamental    | /           | PK       |
|    | V       | 35.83           | 15.10                 | 36.21                      | 40.00          | 3.79        | QP       |
|    | V       | 45.55           | 19.70                 | 35.98                      | 40.00          | 4.02        | QP       |
|    | V       | 4781.56         | -3.60                 | 56.30                      | 74.00          | 17.70       | PK       |
|    | V       | 4781.56         | -3.60                 | 34.70                      | 54.00          | 19.30       | AV       |
|    | H       | 2401.79         | -11.50                | 61.23                      | Fundamental    | /           | PK       |
|    | H       | 294.34          | 13.44                 | 40.70                      | 46.00          | 5.30        | QP       |
|    | H       | 399.92          | 19.70                 | 32.20                      | 46.00          | 13.80       | PK       |
|    | H       | 2389.83         | -10.89                | 43.20                      | 54.00          | 10.80       | PK       |
|    | H       | 4781.56         | -3.60                 | 57.60                      | 74.00          | 16.40       | PK       |
| M  | H       | 4781.56         | -3.60                 | 35.40                      | 54.00          | 18.60       | AV       |
|    | V       | 2440.86         | -11.6                 | 61.20                      | Fundamental    | /           | PK       |
|    | V       | 35.83           | 15.10                 | 36.21                      | 40.00          | 3.79        | QP       |
|    | V       | 45.55           | 19.70                 | 35.98                      | 40.00          | 4.02        | QP       |
|    | V       | 4883.76         | -3.4                  | 62.80                      | 74.00          | 11.20       | PK       |
|    | V       | 4883.76         | -3.4                  | 39.20                      | 54.00          | 14.80       | AV       |
|    | V       | 7302.60         | 2.4                   | 54.40                      | 74.00          | 19.60       | PK       |
|    | V       | 7302.60         | 2.4                   | 34.30                      | 54.00          | 19.70       | AV       |
|    | H       | 2440.86         | -11.6                 | 61.20                      | Fundamental    | /           | PK       |
|    | H       | 294.34          | 13.44                 | 40.70                      | 46.00          | 5.30        | QP       |
|    | H       | 399.92          | 19.70                 | 32.20                      | 46.00          | 13.80       | PK       |
|    | H       | 4883.76         | -3.4                  | 61.30                      | 74.00          | 12.70       | PK       |
|    | H       | 4883.76         | -3.4                  | 37.90                      | 54.00          | 16.10       | AV       |
|    | H       | 7302.60         | 2.4                   | 55.60                      | 74.00          | 18.40       | PK       |
|    | H       | 7302.60         | 2.4                   | 34.20                      | 54.00          | 19.80       | AV       |
| H  | V       | 2480.92         | -11.50                | 61.30                      | Fundamental    | /           | PK       |
|    | V       | 35.83           | 15.10                 | 36.21                      | 40.00          | 3.79        | QP       |
|    | V       | 45.55           | 19.70                 | 35.98                      | 40.00          | 4.02        | QP       |
|    | V       | 4951.90         | -3.30                 | 59.90                      | 74.00          | 14.10       | PK       |
|    | V       | 4951.90         | -3.30                 | 34.70                      | 54.00          | 19.30       | AV       |
|    | V       | 7438.87         | 2.80                  | 51.90                      | 54.00          | 2.10        | PK       |
|    | H       | 2480.92         | -11.50                | 61.30                      | Fundamental    | /           | PK       |
|    | H       | 294.34          | 13.44                 | 40.70                      | 46.00          | 5.30        | QP       |
|    | H       | 399.92          | 19.70                 | 32.20                      | 46.00          | 13.80       | PK       |
|    | H       | 2483.68         | -10.94                | 42.30                      | 54.00          | 11.70       | PK       |
|    | H       | 4951.90         | -3.30                 | 61.80                      | 74.00          | 12.20       | PK       |
|    | H       | 4951.90         | -3.30                 | 38.40                      | 54.00          | 15.60       | AV       |
|    | H       | 7438.87         | 2.80                  | 55.70                      | 74.00          | 18.30       | PK       |
|    | H       | 7438.87         | 2.80                  | 36.20                      | 54.00          | 17.80       | AV       |

- Remark: 1. For fundamental emission, no amplifier is employed.  
2. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)  
3. Corrected Reading = Original Receiver Reading + Correct Factor  
4. Margin = limit – Corrected Reading  
5. If the PK reading is lower than AV limit, the AV test can be elided.  
6. The emission was conducted from 30MHz to 25GHz.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,  
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.  
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading =  
10dBuV + 0.20dB/m = 10.20dBuV/m  
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m, then Margin  
= 54 -10.20 = 43.80dBuV/m

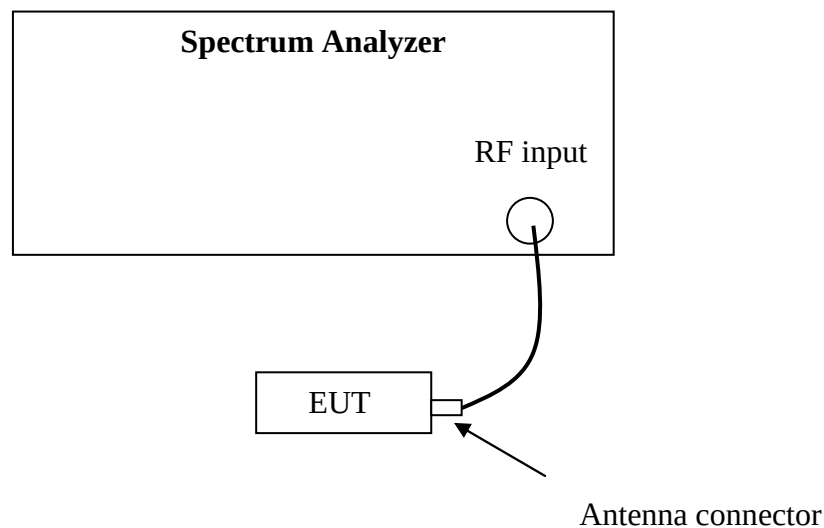
## 7. Conducted Spurious Emissions & Band Edge

Test result: **PASS**

### 7.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

### 7.2 Test Configuration



### 7.3 Test procedure and test setup

The Conducted Spurious Emissions per FCC § 15.247(d) is measured using the Spectrum Analyzer with Span wide enough capturing all spurious from the lowest emission frequency of the EUT up to 10th harmonics, RBW = 100kHz, VBW  $\geq$  RBW, Sweep = auto, Detector = peak, Trace = max hold.

The test was performed at 3 channels (lowest, middle and highest channel).

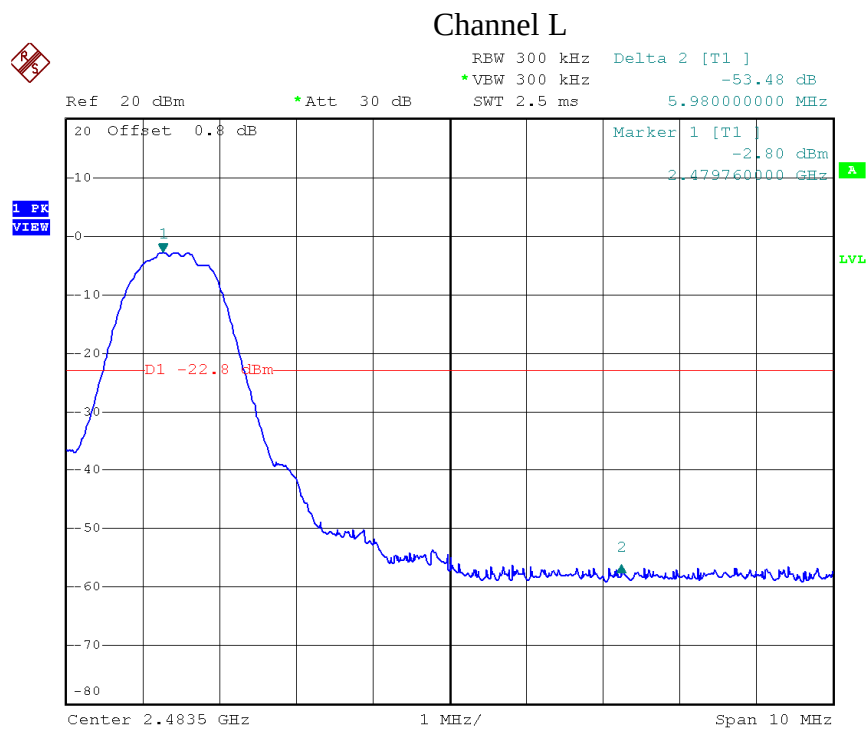
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

## 7.4 Test protocol

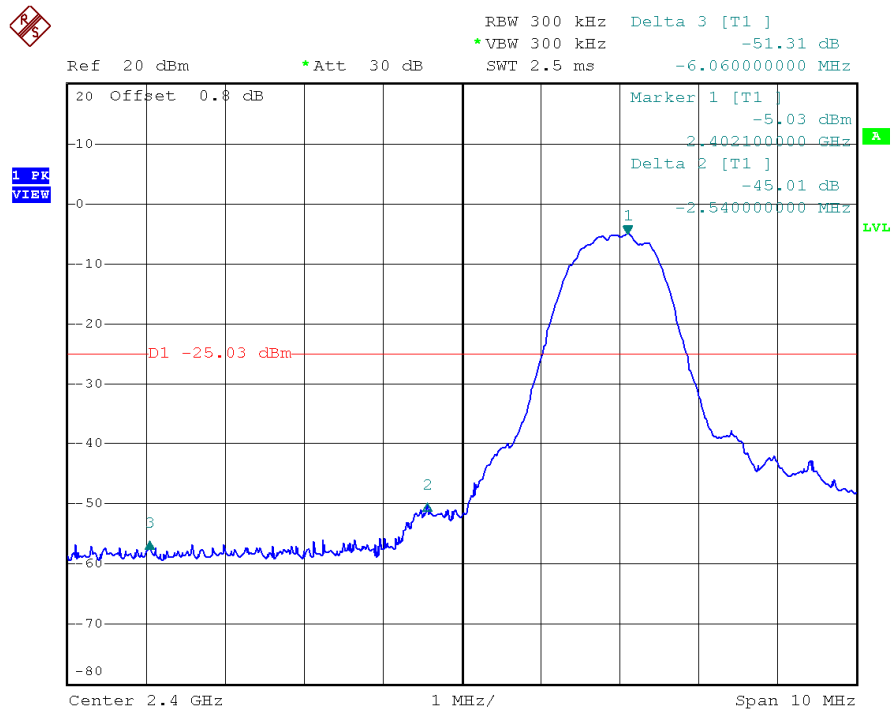
| Model | CH | Max reading among band (dBm) | The most restrict Attenuation outside band (dB) | Limit (dB) |
|-------|----|------------------------------|-------------------------------------------------|------------|
| GFSK  | L  | -8.53                        | 34.25                                           | ≥20        |
|       | M  | -8.20                        | 33.52                                           |            |
|       | H  | -8.98                        | 34.37                                           |            |

Note: The test was performed from 9kHz to 26GHz and the worst data is listed here.

## Band Edge:

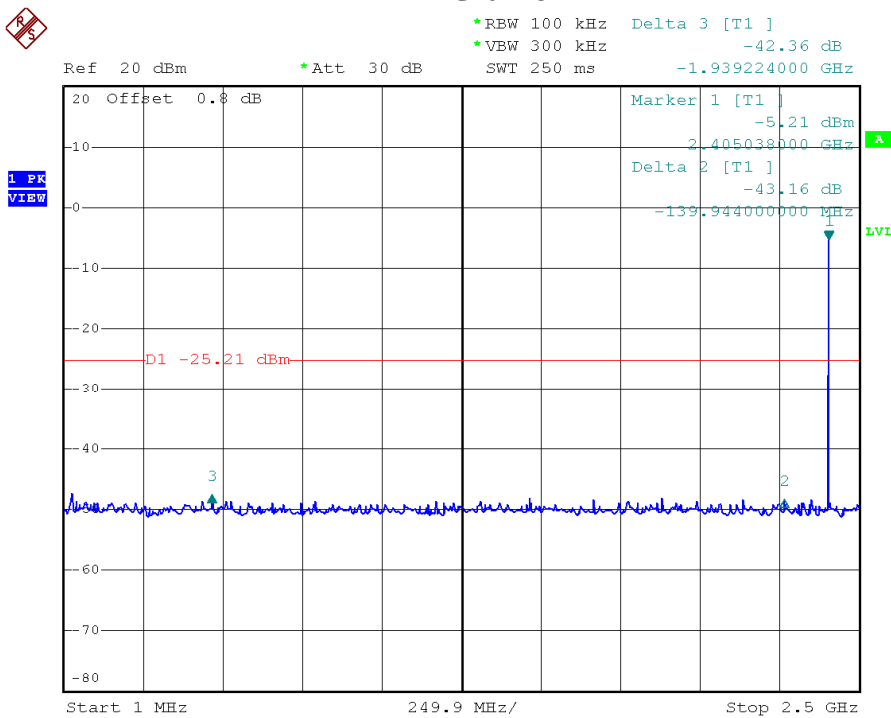


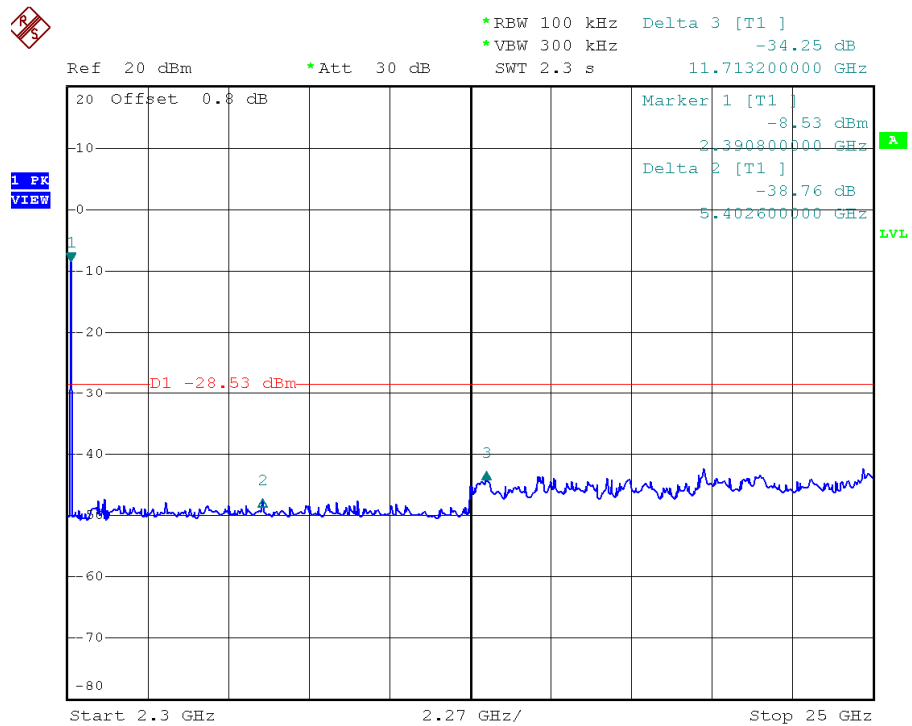
Channel H



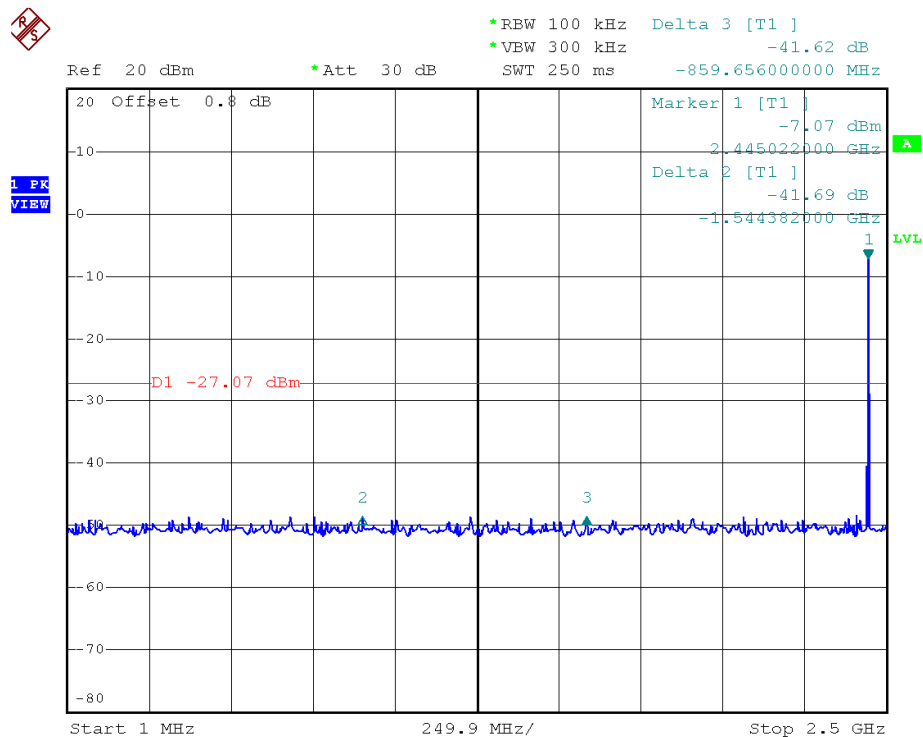
### Conducted Spurious Emissions:

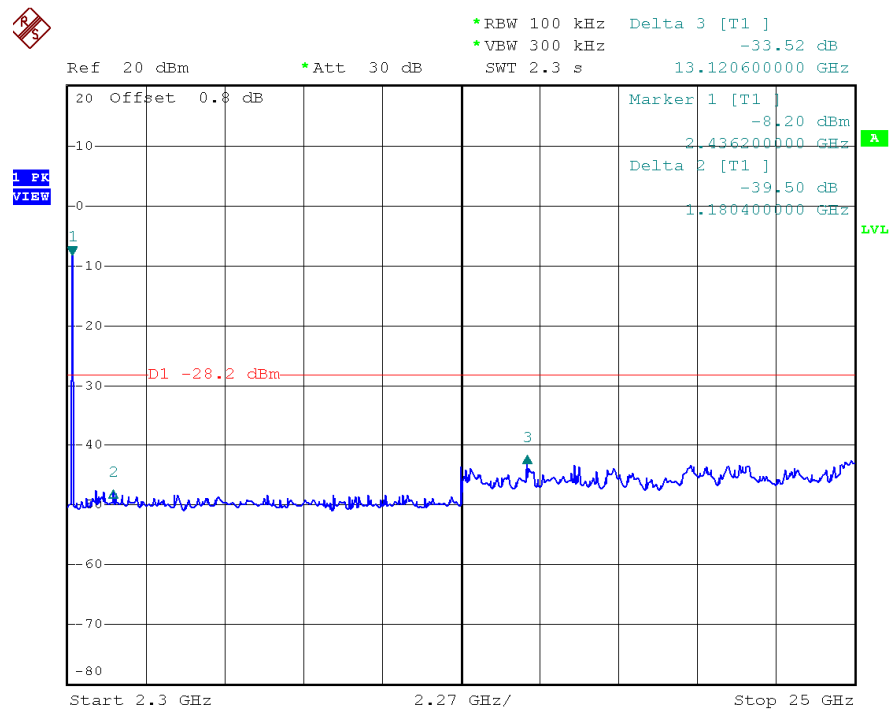
#### Channel L



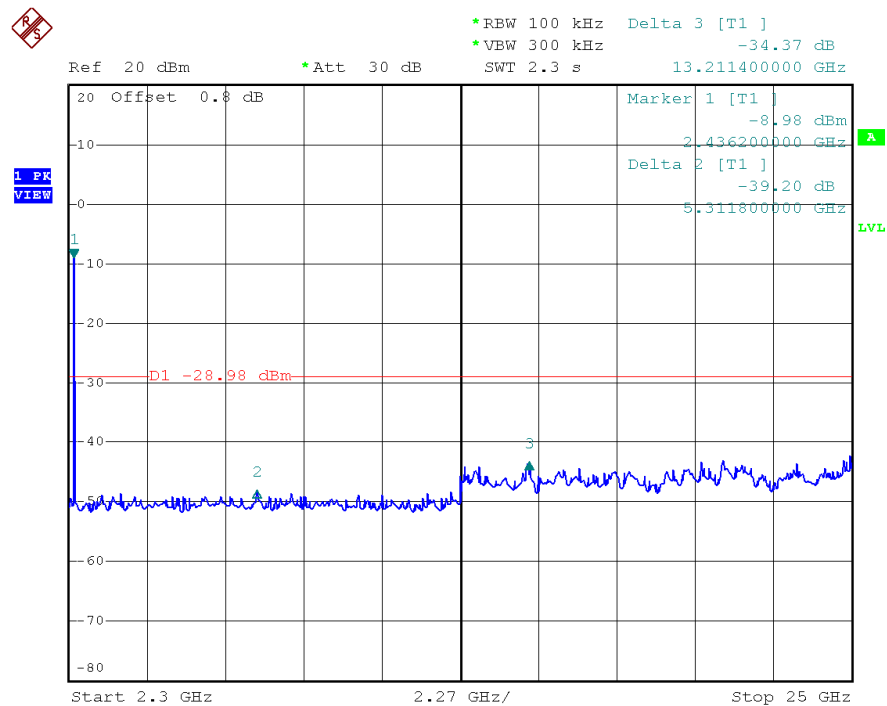


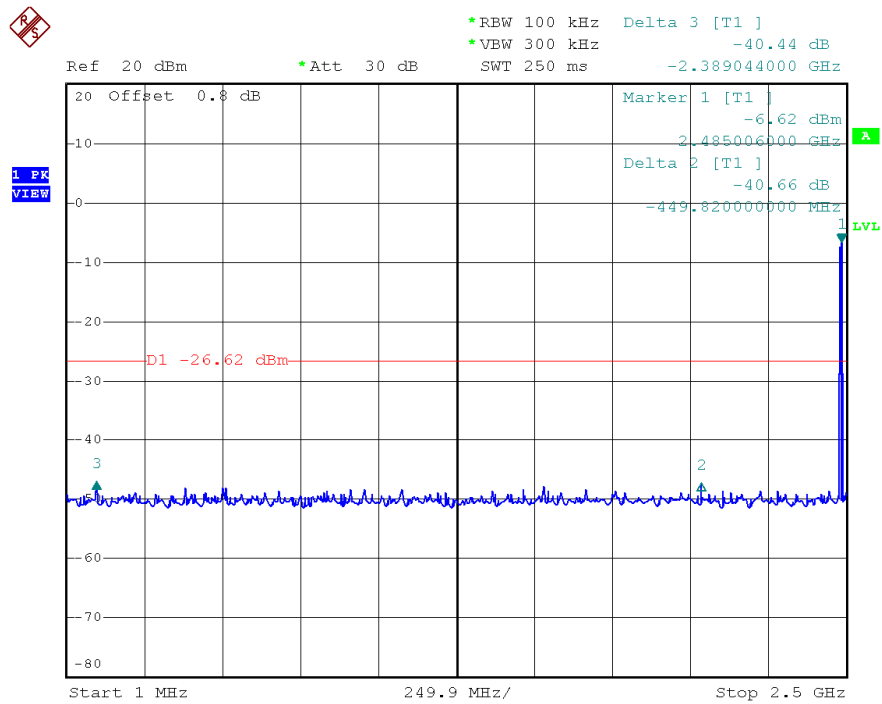
### Channel M





## Channel H







## 8. Power line conducted emission

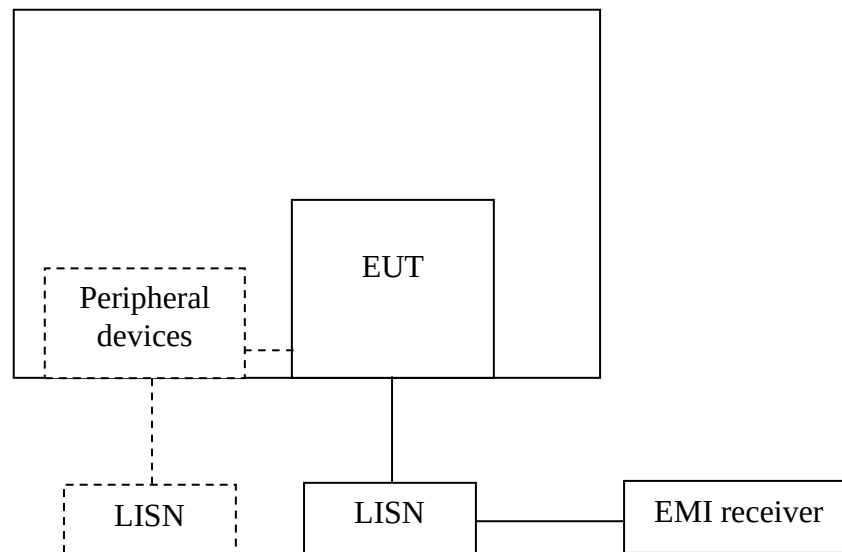
Test result: Pass

### 8.1 Limit

| Frequency of Emission (MHz) | Conducted Limit (dBuV) |            |
|-----------------------------|------------------------|------------|
|                             | QP                     | AV         |
| 0.15-0.5                    | 66 to 56*              | 56 to 46 * |
| 0.5-5                       | 56                     | 46         |
| 5-30                        | 60                     | 50         |

\* Decreases with the logarithm of the frequency.

### 8.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

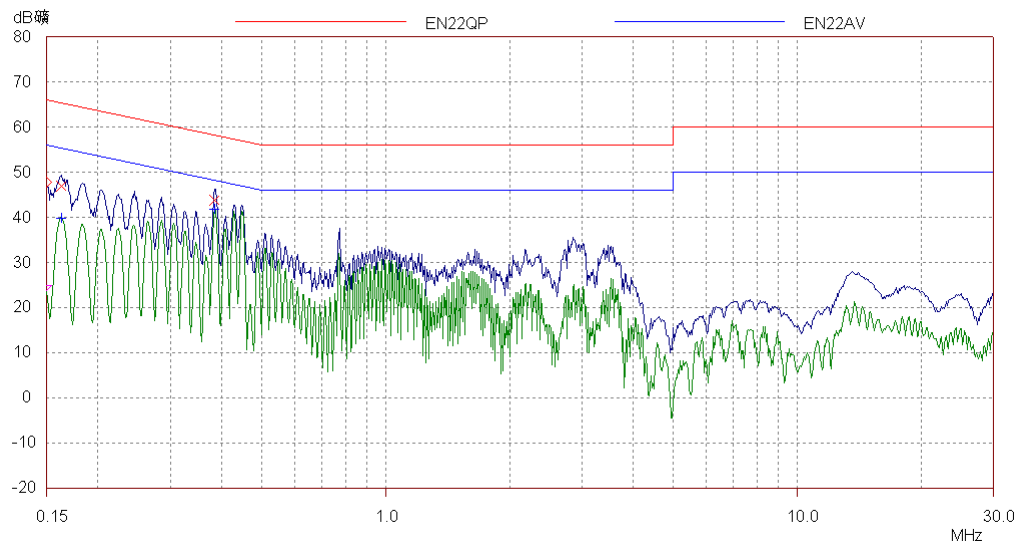
### **8.3 Test procedure and test set up**

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a  $50\Omega/50\mu\text{H}$  coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a  $50\Omega/50\mu\text{H}$  coupling impedance with  $50\Omega$  termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

## 8.4 Test protocol

L line(Adapter:AS600-170-AD230)

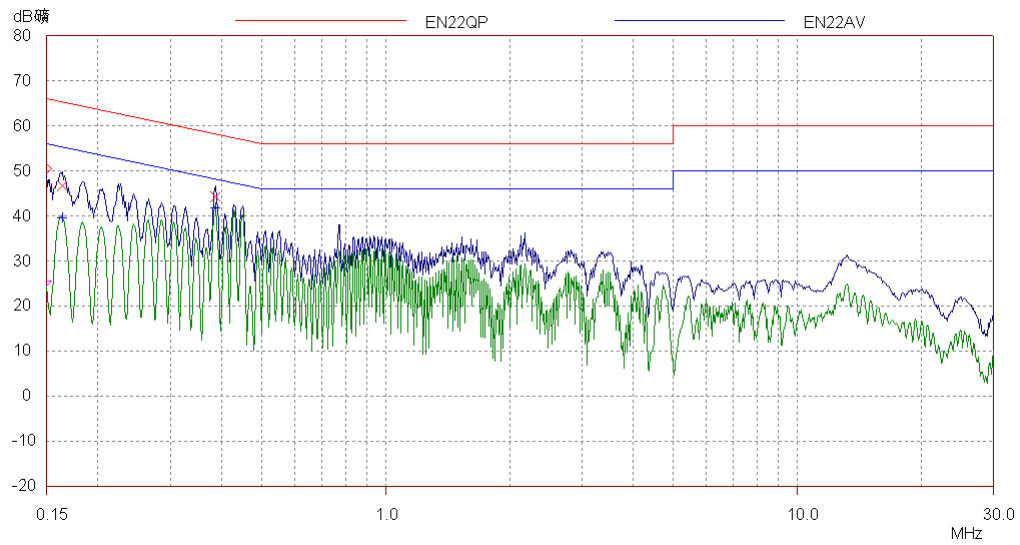


Test Data:

| Frequency (MHz) | Quasi-peak      |                 |                | Average         |                 |                |
|-----------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|                 | level<br>dB(μV) | Limit<br>dB(μV) | Margin<br>(dB) | level<br>dB(μV) | limit<br>dB(μV) | Margin<br>(dB) |
| 0.16            | 46.88           | 65.34           | 18.46          | 39.83           | 55.34           | 15.51          |
| 0.38            | 43.69           | 58.21           | 14.52          | 41.81           | 48.21           | 6.40           |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |

Note: \* means the emission level 20dB lower than the relevant limit.

N line(Adapter:AS600-170-AD230)

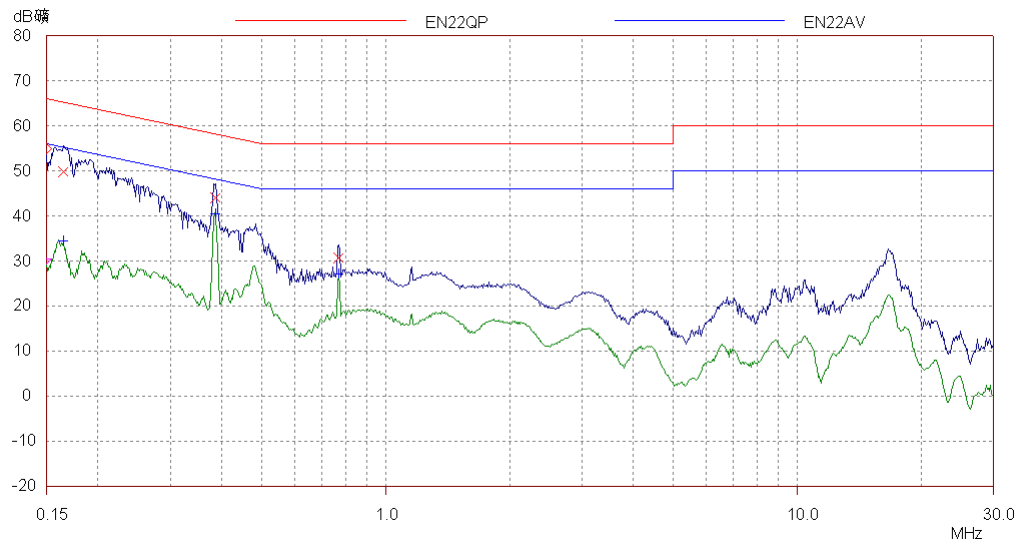


Test Data:

| Frequency (MHz) | Quasi-peak      |                 |                | Average         |                 |                |
|-----------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|                 | level<br>dB(μV) | Limit<br>dB(μV) | Margin<br>(dB) | level<br>dB(μV) | limit<br>dB(μV) | Margin<br>(dB) |
| 0.16            | 46.61           | 65.27           | 18.66          | 39.83           | 55.34           | 15.51          |
| 0.38            | 44.31           | 58.17           | 13.86          | 41.89           | 48.17           | 6.28           |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |

Note: \* means the emission level 20dB lower than the relevant limit.

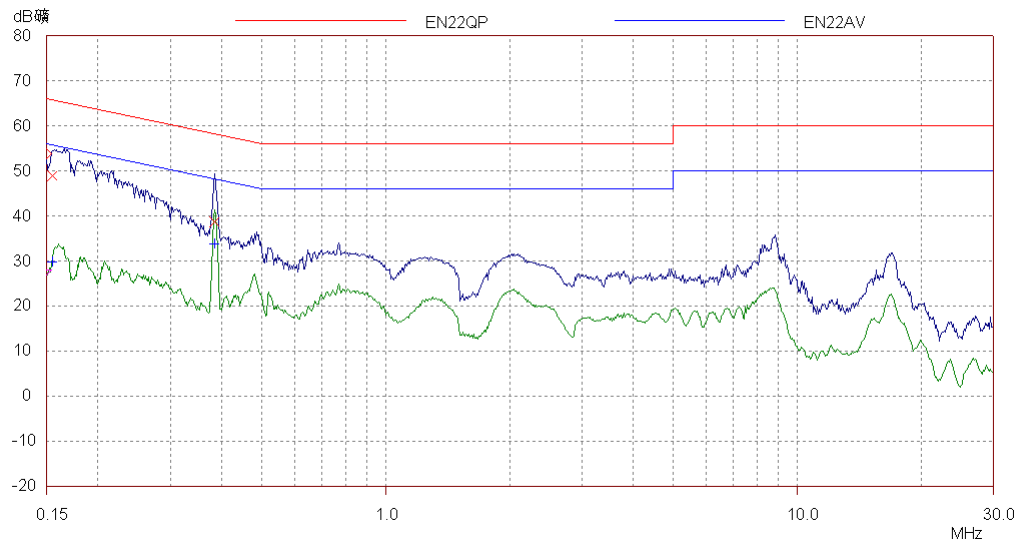
L line(Adapter:S048CM1700230)



Test Data:

| Frequency (MHz) | Quasi-peak      |                 |                | Average         |                 |                |
|-----------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|                 | level<br>dB(μV) | Limit<br>dB(μV) | Margin<br>(dB) | level<br>dB(μV) | limit<br>dB(μV) | Margin<br>(dB) |
| 0.16            | 49.87           | 65.24           | 15.37          | 34.36           | 55.24           | 20.88          |
| 0.38            | 44.11           | 58.17           | 14.06          | 40.48           | 48.17           | 7.69           |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |

N line(Adapter:S048CM1700230)



Test Data:

| Frequency (MHz) | Quasi-peak      |                 |                | Average         |                 |                |
|-----------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|                 | level<br>dB(μV) | Limit<br>dB(μV) | Margin<br>(dB) | level<br>dB(μV) | limit<br>dB(μV) | Margin<br>(dB) |
| 0.15            | 48.97           | 65.74           | 16.77          | 29.89           | 55.74           | 25.85          |
| 0.38            | 38.71           | 58.21           | 19.50          | 33.84           | 48.21           | 14.37          |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |
| *               | *               | *               | *              | *               | *               | *              |

Note: \* means the emission level 20dB lower than the relevant limit.

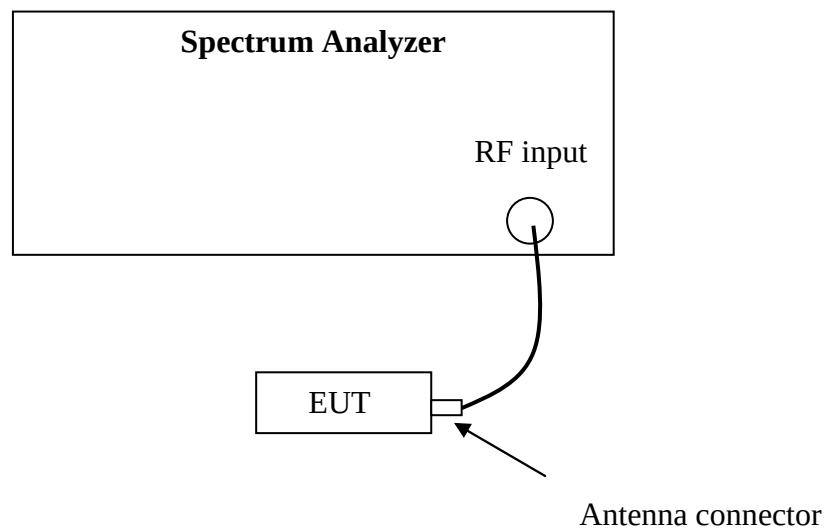
## 9. Number of Hopping Frequencies

Test result: Pass

### 9.1 Limit

Number of Hopping Frequencies in the 2400-2483.5 MHz band shall use at least 15 channels.

### 9.2 Test Configuration



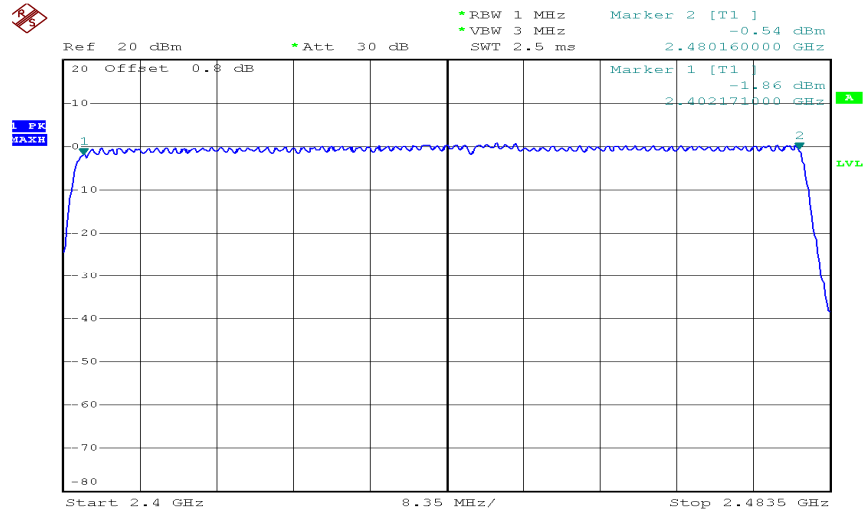
### 9.3 Test procedure and test setup

The channel number per FCC §15.247(a)(1)(iii) is measured using the Spectrum Analyzer with RBW=100kHz, VBW $\geq$ RBW, Sweep = auto, Detector = peak, Trace = max hold. The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

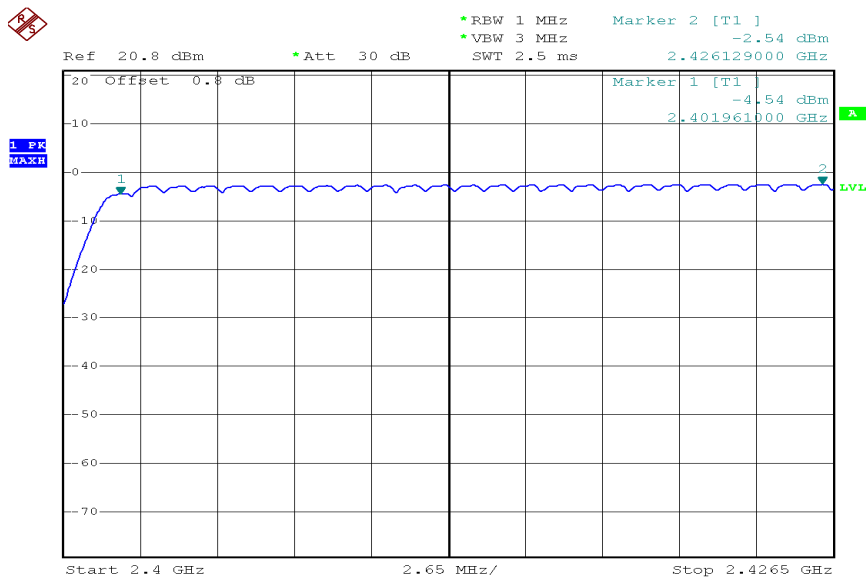
## 9.4 Test protocol

| Channel Number | Limit     |
|----------------|-----------|
| 79             | $\geq 15$ |

### CH00-CH78

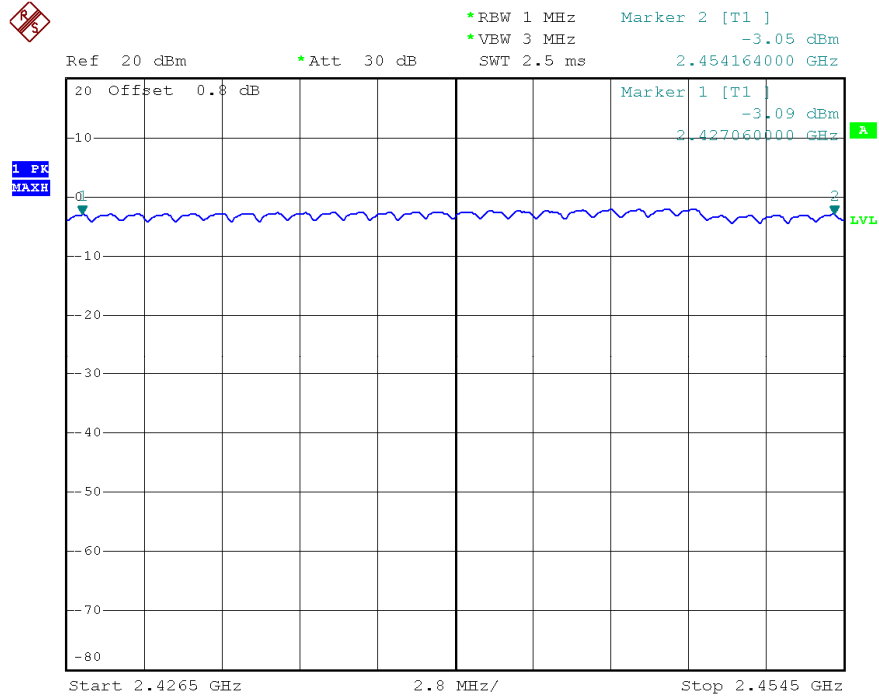


### CH00-CH24

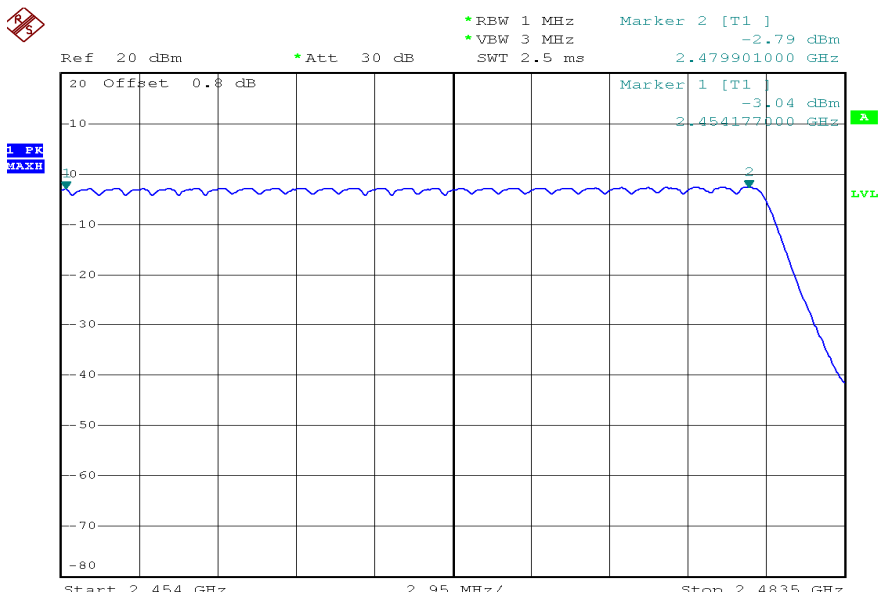




## CH25-CH52



## CH53-CH78



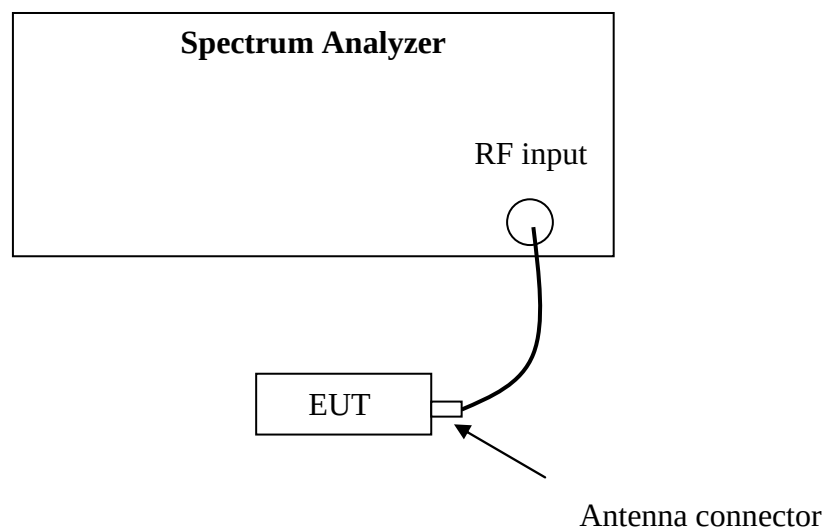
## 10.Dwell Time

**Test result:** Pass

### 10.1 Limit

The dwell time on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### 10.2 Test Configuration



### 10.3 Test procedure and test setup

Dwell time per FCC § 15.247(a)(1)(iii) is measured using the Spectrum Analyzer with Span = 0, RBW=1MHz, VBW $\geq$ RBW, Sweep can capture the entire dwell time, Detector = peak, Trace = max hold.

The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

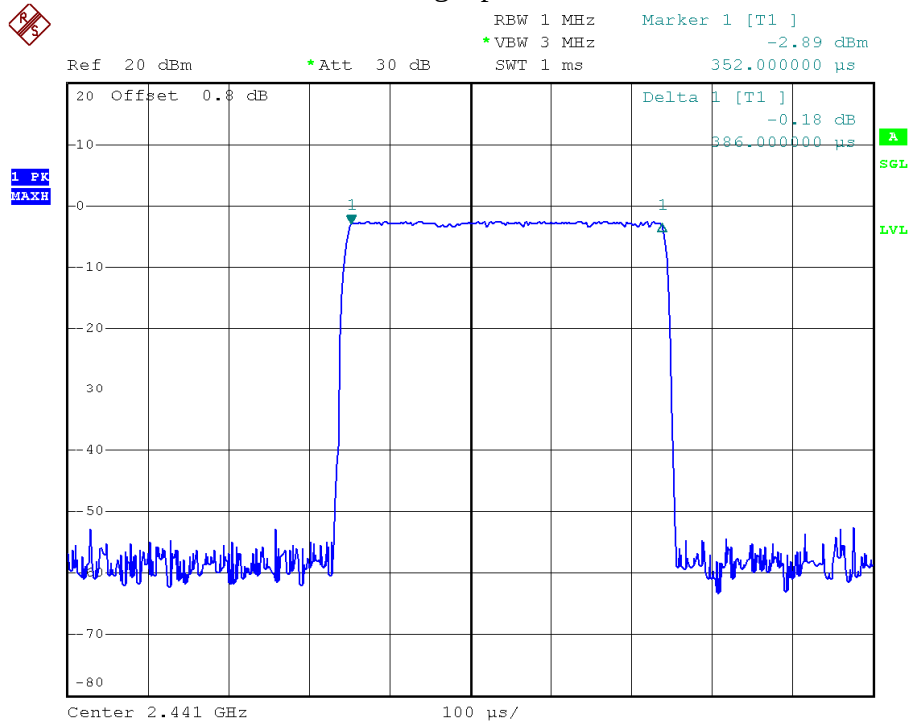
#### 10.4 Test protocol

| Packet | Occupancy time<br>for single hop<br>(ms)<br><b>O</b> | CH | Real observed<br>period<br>(s)<br><b>P</b> | Hops among<br>Observed<br>period<br><b>I</b> | Dwell time<br>(s)<br><b>T</b> | Limit<br>(s) |
|--------|------------------------------------------------------|----|--------------------------------------------|----------------------------------------------|-------------------------------|--------------|
| DH1    | 0.35                                                 | L  | 3.16                                       | 32                                           | 0.11                          | ≤0.4         |
|        |                                                      | M  | 3.16                                       | 32                                           | 0.11                          |              |
|        |                                                      | H  | 3.16                                       | 32                                           | 0.11                          |              |
| DH3    | 1.63                                                 | L  | 3.16                                       | 16                                           | 0.26                          |              |
|        |                                                      | M  | 3.16                                       | 16                                           | 0.26                          |              |
|        |                                                      | H  | 3.16                                       | 16                                           | 0.26                          |              |
| DH5    | 2.88                                                 | L  | 3.16                                       | 11                                           | 0.32                          |              |
|        |                                                      | M  | 3.16                                       | 11                                           | 0.32                          |              |
|        |                                                      | H  | 3.16                                       | 11                                           | 0.32                          |              |

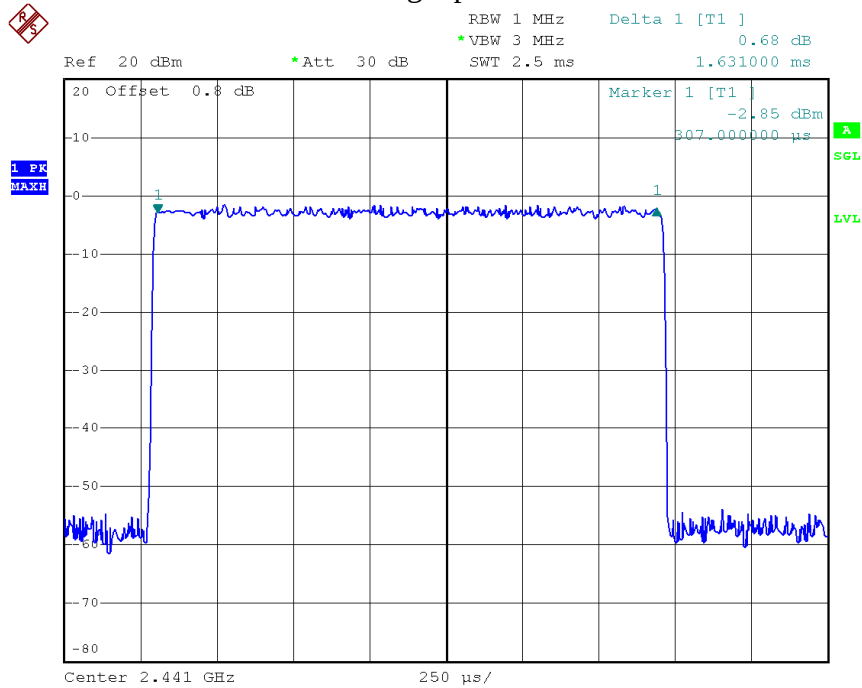
Remark: 1. There are 79 channels in all. So the complete observed period  $P = 0.4 * 79 = 31.6$  s.

2. Average time of occupancy  $T = O * I * 31.6 / P$

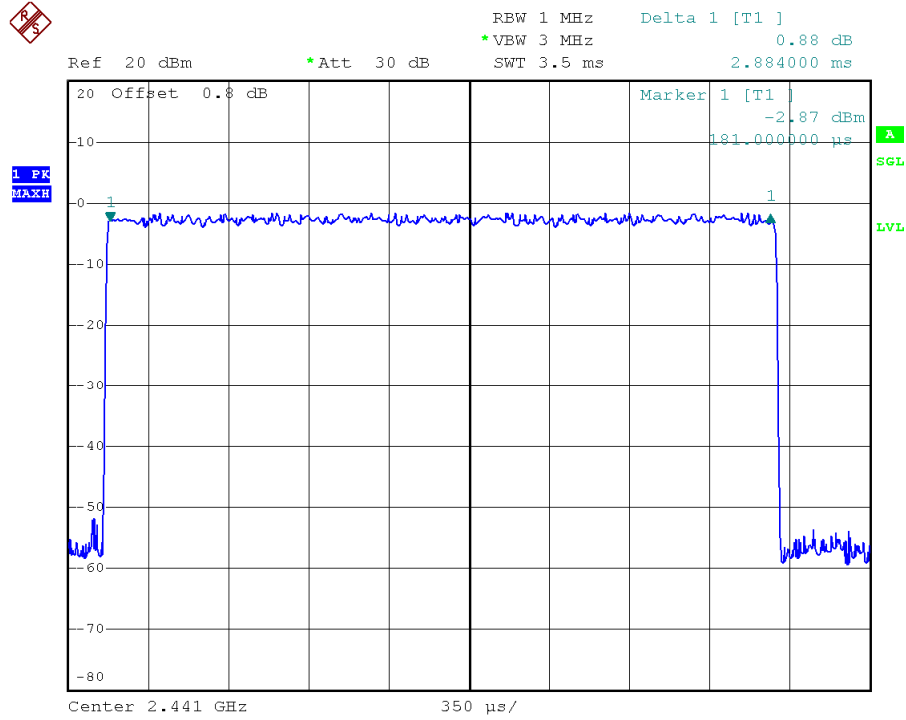
### Single pulse of DH1



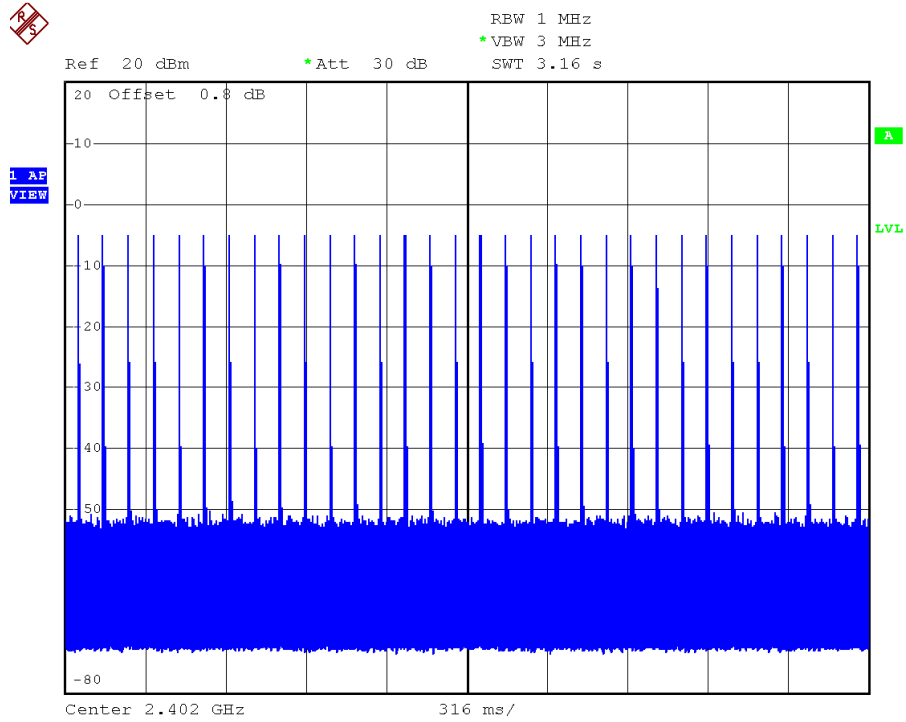
### Single pulse of DH3



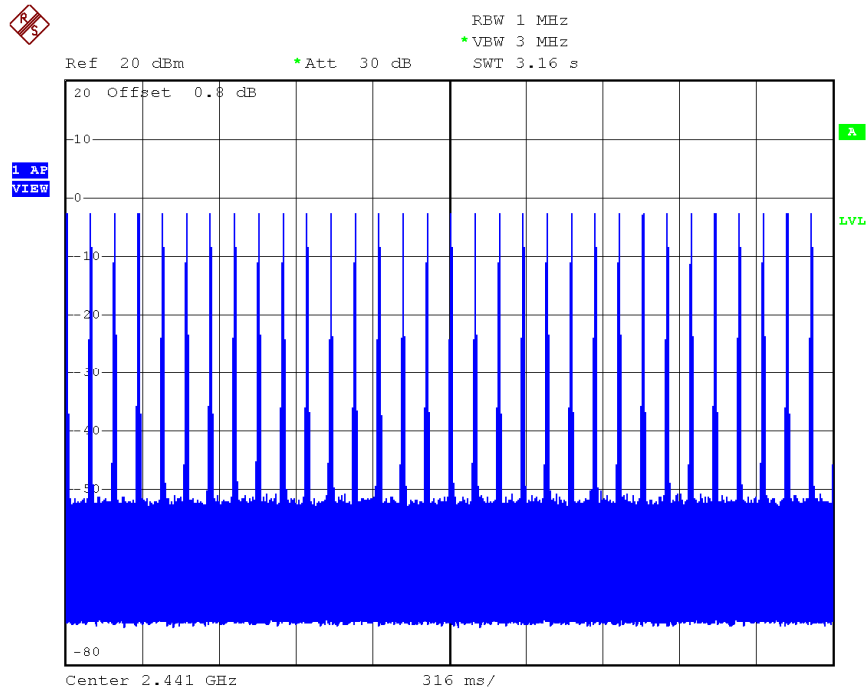
### Single pulse of DH5



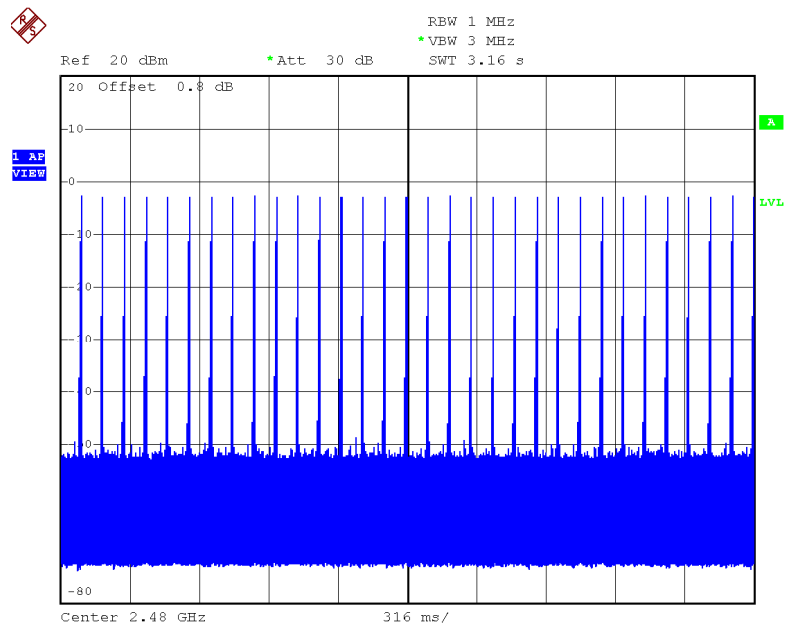
### Channel L of DH1



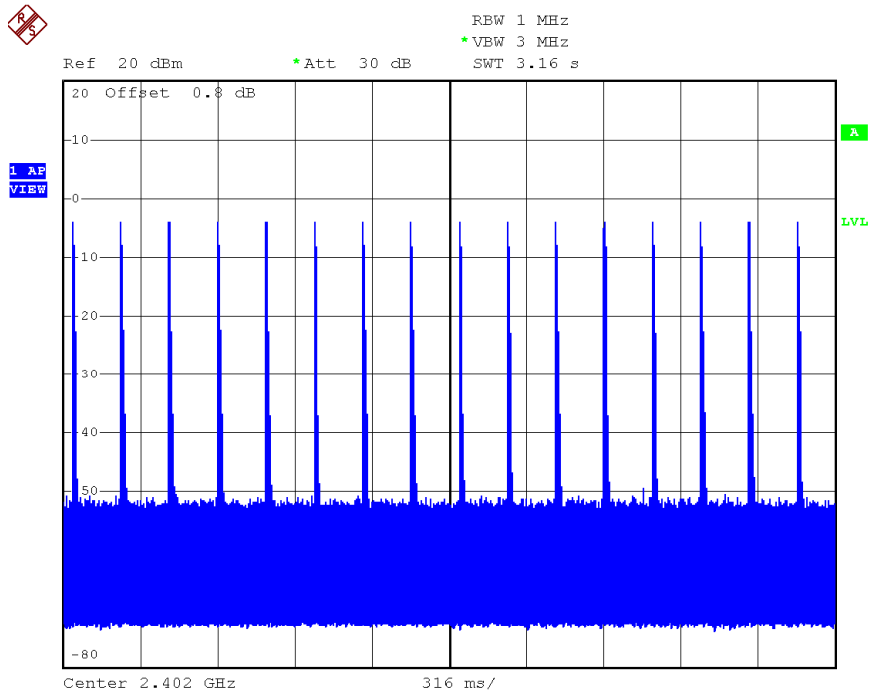
Channel M of DH1



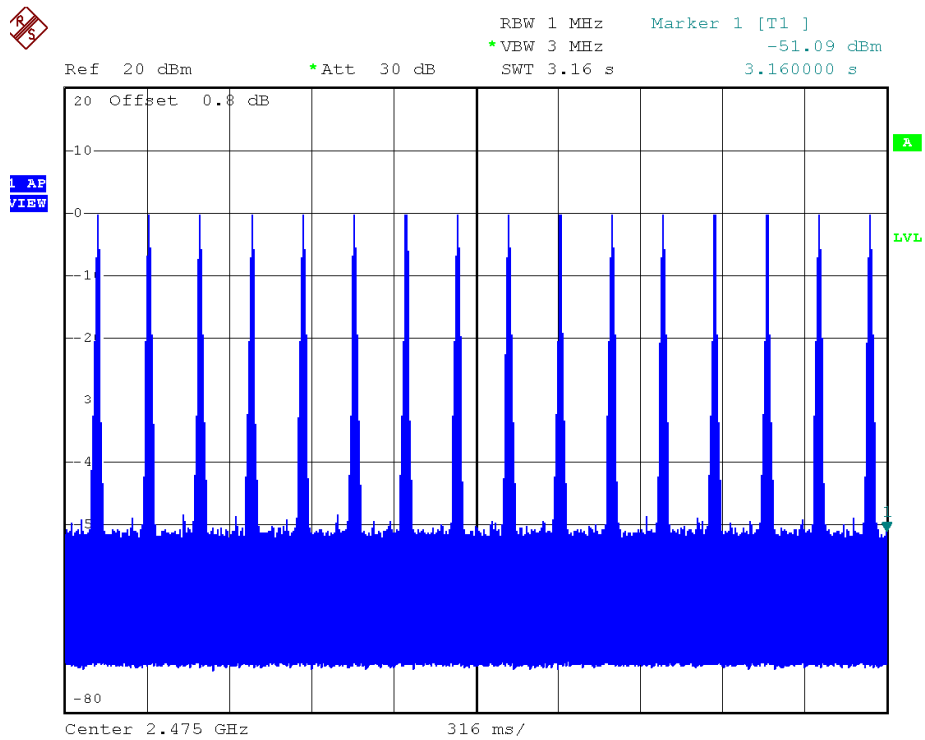
Channel H of DH1



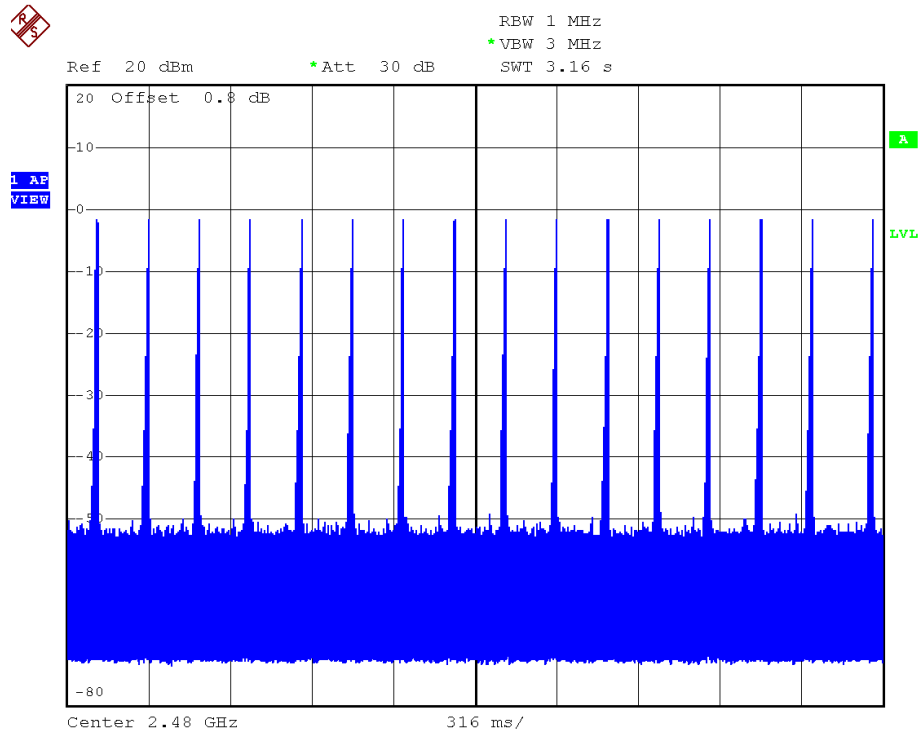
Channel L of DH3



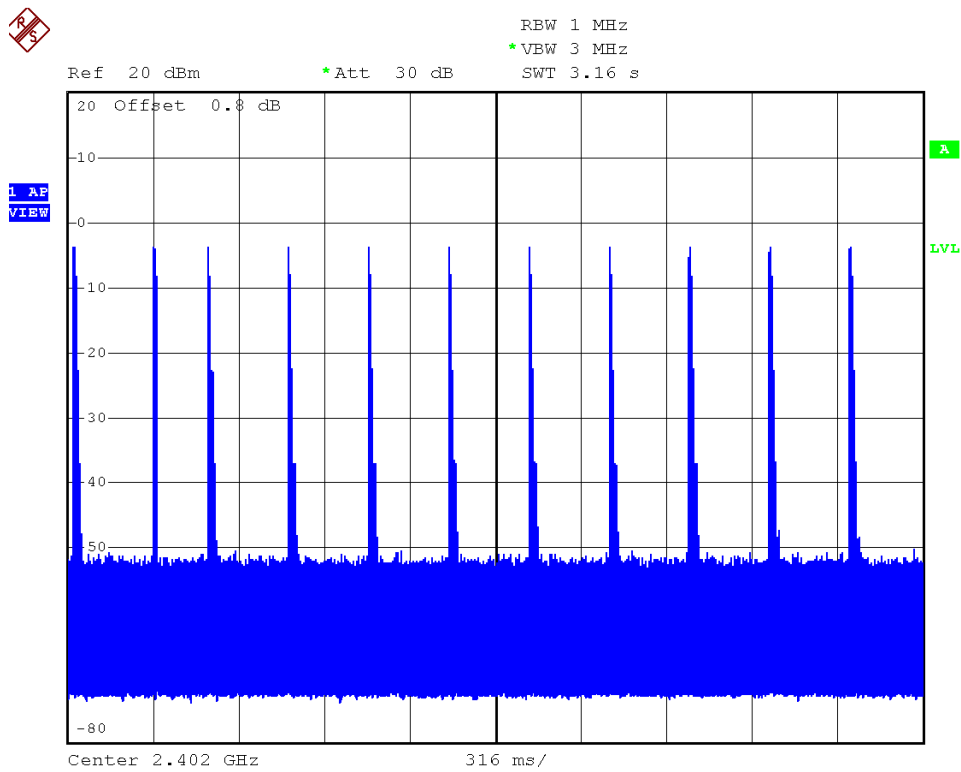
Channel M of DH3



### Channel H of DH3

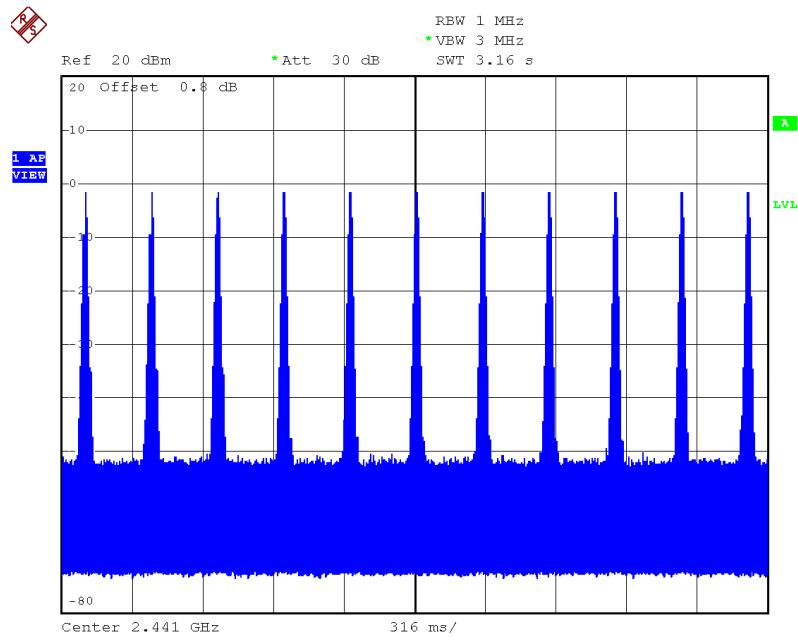


### Channel L of DH5

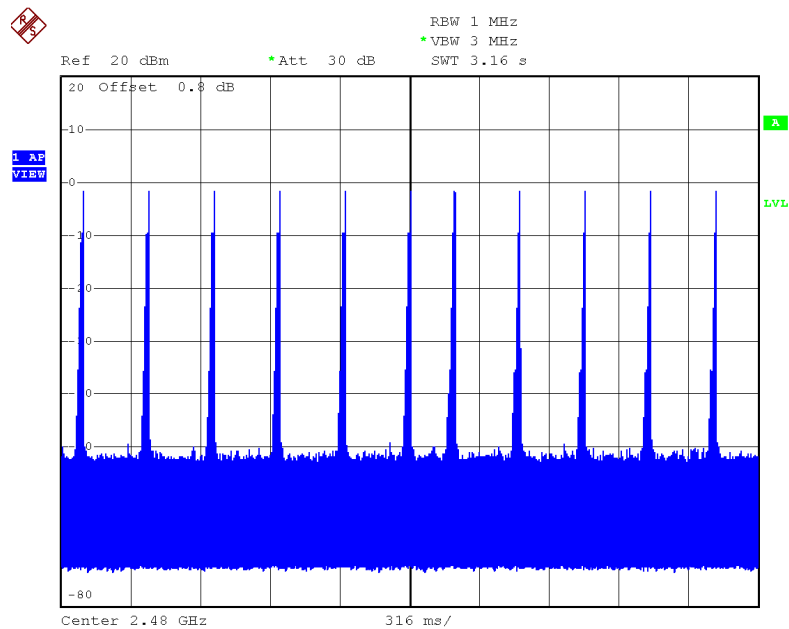




### Channel M of DH5



### Channel H of DH5



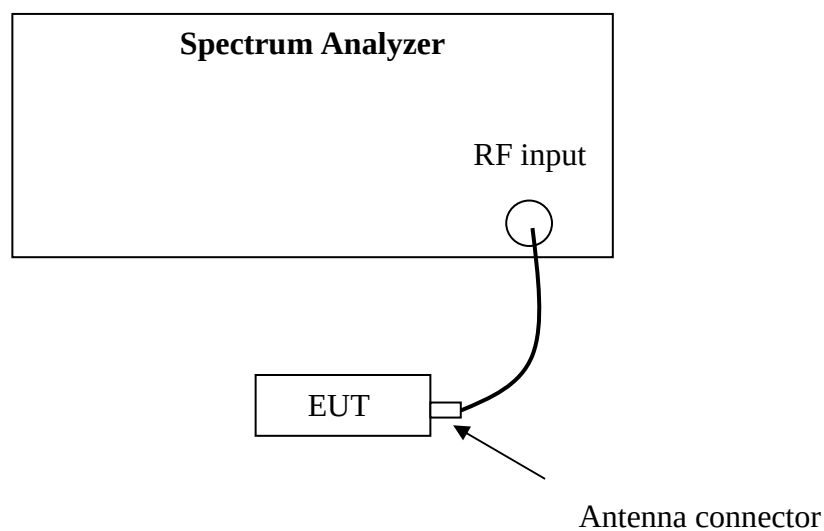
## 11.Occupied Bandwidth

Test Status: Tested

### 11.1 Test limit

None

### 11.2 Test Configuration



### 11.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 3 Clause 4.6.1 was measured using the Spectrum Analyzer with the RBW close to 1% of the selected span, VBW = 3 \* RBW Detector = Sample, Sweep = Auto.

## 11.4 Test protocol

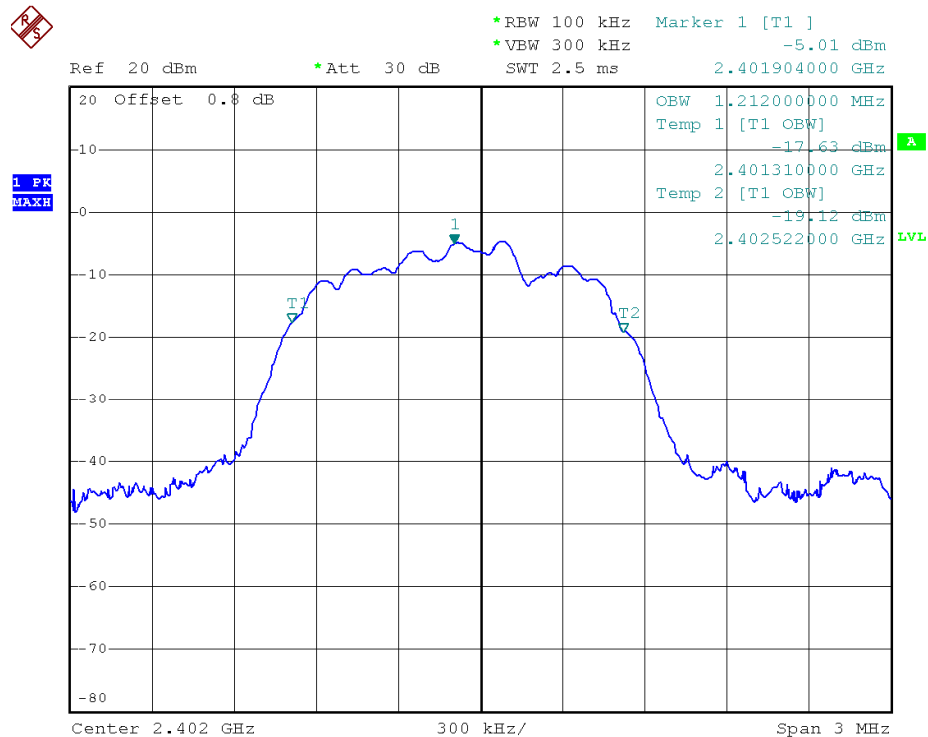
Temperature : 25°C  
Relative Humidity : 55 %

### Maximum Occupied Bandwidth

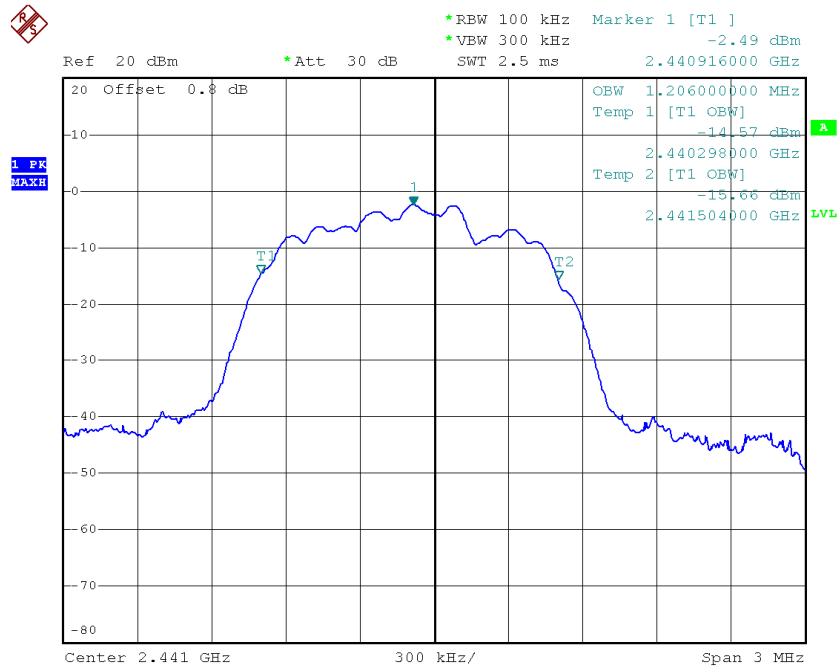
| Model | Channel | Occupied Bandwidth (kHz) |
|-------|---------|--------------------------|
| 8DPSK | L       | 1212                     |
|       | M       | 1206                     |
|       | H       | 1206                     |

**Note: Compared the EDR mode The 8DPSK Bandwidth is worse than  $\pi/4$ -DQPSK**

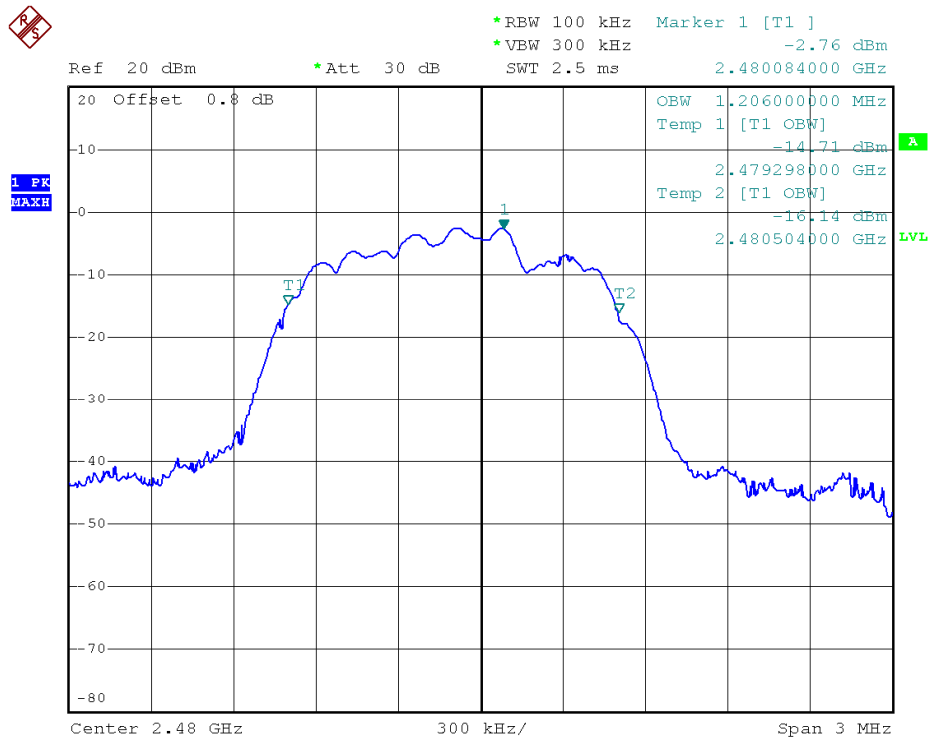
### Channel L



### Channel M

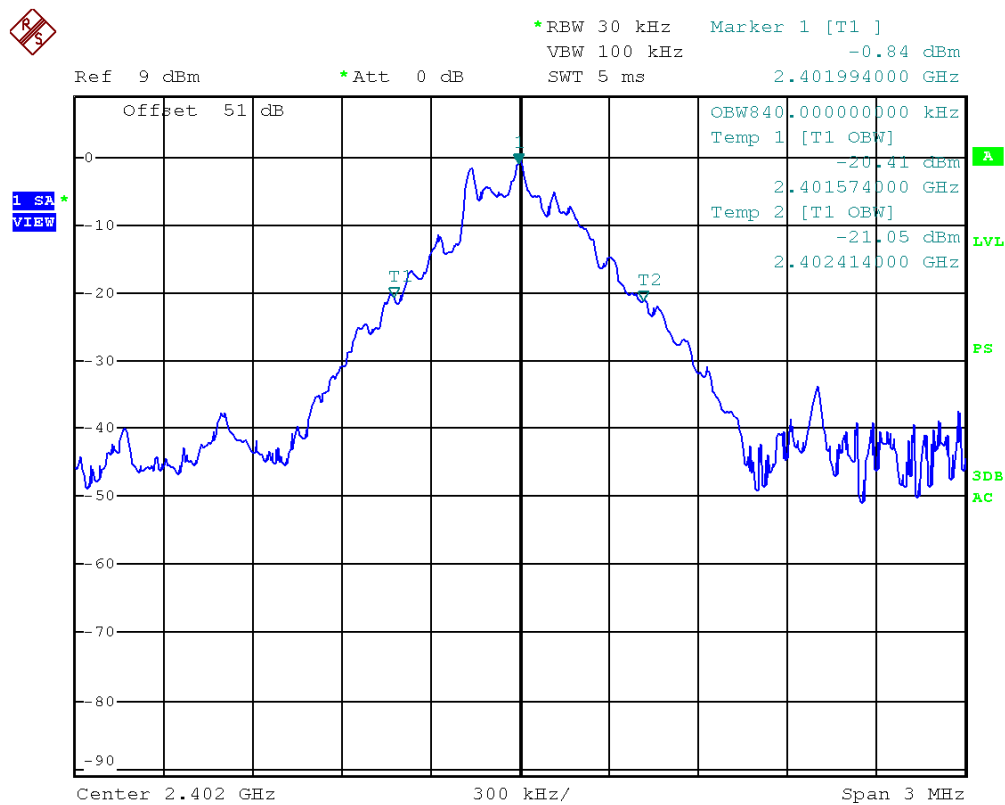


### Channel H

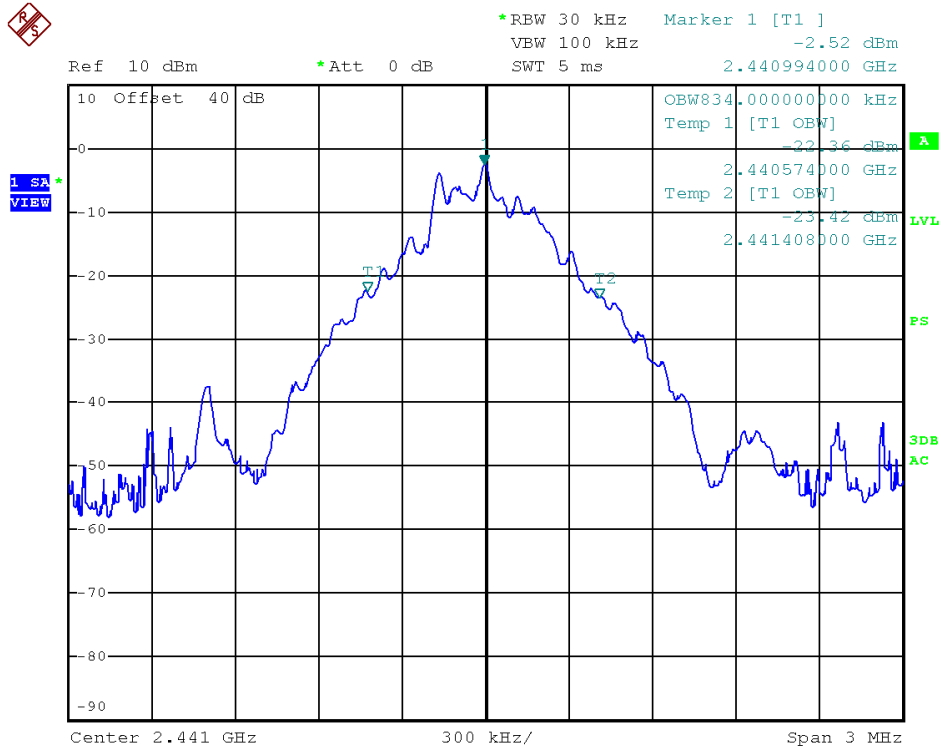


| Model | Channel | Occupied Bandwidth (kHz) |
|-------|---------|--------------------------|
| GFSK  | L       | 840.00                   |
|       | M       | 834.00                   |
|       | H       | 828.00                   |

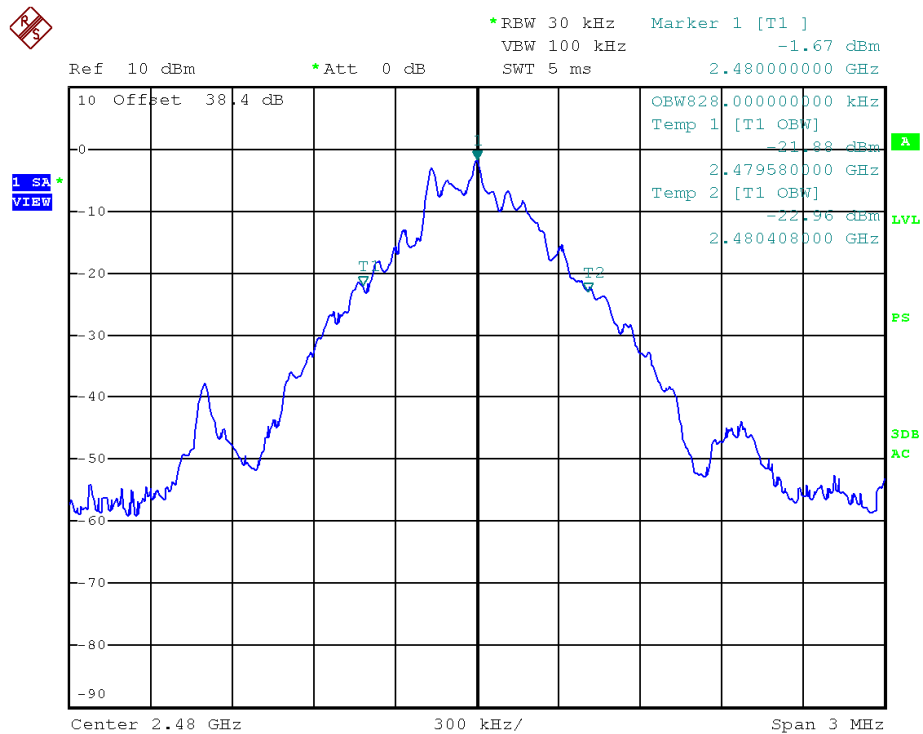
### Channel L



### Channel M



### Channel H



## 8. Spurious emission for receiver

**Test result:** NA

### 12.1 Test limit

The spurious emission shall test through 3 times tuneable or local oscillator frequency whichever is the higher, without exceeding 40 GHz.

☐ If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5nW above 1 GHz.

☐ If a radiated measurement is made, all spurious emissions shall comply with the limits of Table below:

| Frequency<br>(MHz) | Field Strength<br>(dBuV/m) | Measurement Distance<br>(m) |
|--------------------|----------------------------|-----------------------------|
| 30 - 88            | 40.0                       | 3                           |
| 88 - 216           | 43.5                       | 3                           |
| 216 - 960          | 46.0                       | 3                           |
| Above 960          | 54.0                       | 3                           |

### 12.2 Test Configuration

Please refer to clause 6.2

### 12.3 Test procedure and test setup

Please refer to clause 6.3.

## 12.4 Test protocol

| Polarization | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|--------------|-----------------|-----------------------|----------------------------|----------------|-------------|----------|
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |
| -            | -               | -                     | -                          | -              | -           | -        |

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = limit – Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,

Original Receiver Reading = 10dBuV.

Then Correct Factor = 30.20 + 2.00 = 32.20dB/m; Corrected Reading = 10dBuV + 32.20dB/m = 42.20dBuV/m

Assuming limit = 54dBuV/m, Corrected Reading = 42.20dBuV/m, then Margin = 54 - 42.20 = 11.80dBuV/m