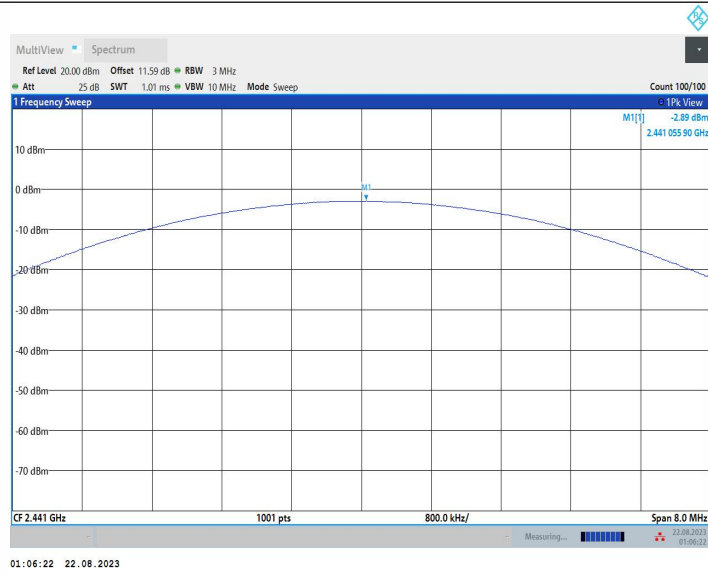
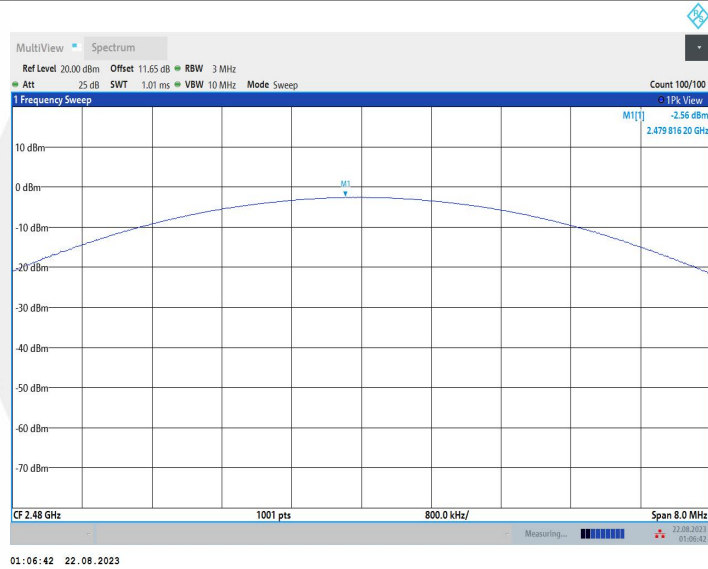




3DH5\_Ant1\_2480



## 9.6 CONDUCTED SUPRIIOUS EMISSION

### 9.6.1 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02

According to IC RSS-247.5.5

### 9.6.2 Conformance 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, based on either an RF conducted, provided the transmitter demonstrates compliance with the peak conducted power limits.

### 9.6.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

### 9.6.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

#### ■ Reference level measurement

Establish a reference level by using the following procedure:

Set instrument center frequency to DSS channel center frequency.

Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.

Set the RBW = 100 kHz. Set the VBW  $\geq 3 \times$  RBW.

Set Detector = peak. Set Sweep time = auto couple.

Set Trace mode = max hold. Allow trace to fully stabilize.

Use the peak marker function to determine the maximum Maximumconducetedlevel.

Note that the channel found to contain the maximum conduceted level can be used to establish the reference level.

#### ■ Band-edge measurement

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation

Set RBW  $\geq 1\%$  of the span=100kHzSet VBW  $\geq 3 \times$  RBW

Set Sweep = autoSet Detector function = peakSet Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

#### ■ Emission level measurement

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.(30MHz to 25GHz).Set RBW = 100 kHzSet VBW  $\geq$  RBW

Set Sweep = autoSet Detector function = peakSet Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.

### 9.6.5 Test Results

|                    |           |
|--------------------|-----------|
| Temperature:       | 25°C      |
| Relative Humidity: | 45%       |
| ATM Pressure:      | 1011 mbar |

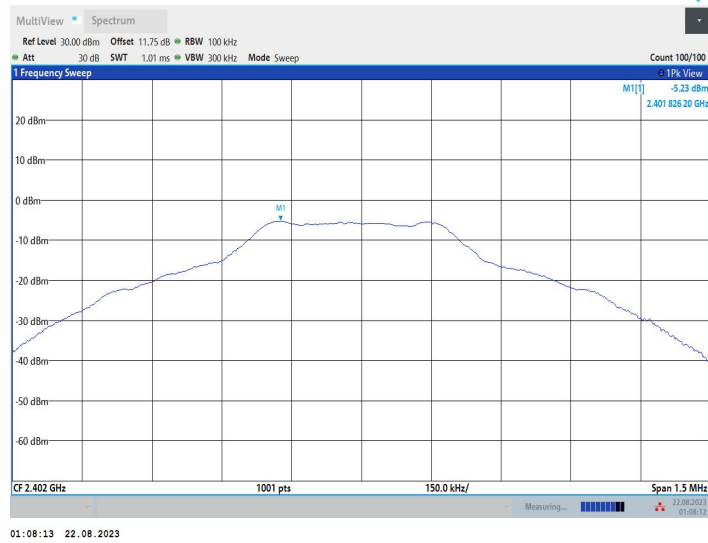
Note: N/A

All the antenna(Antenna 1) and modes(GFSK,  $\pi/4$ -DQPSK, 8DPSK, Hopping) mode have been tested, and the worst(Antenna 1,GFSK, Hopping) result recorded was report as below:

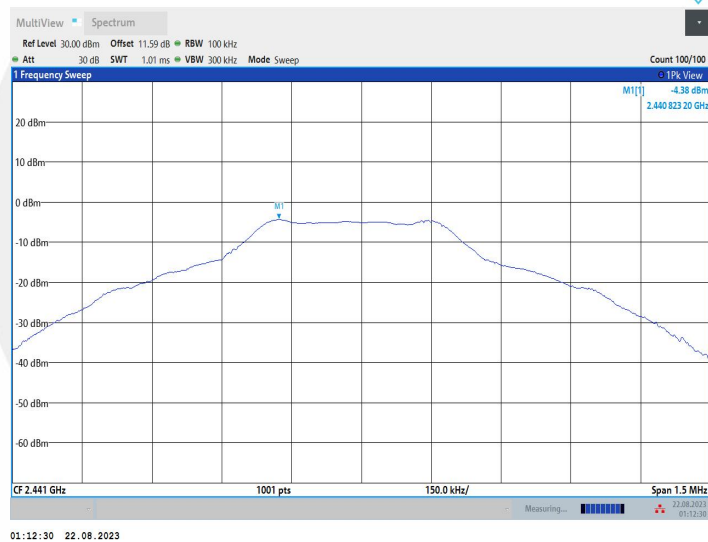
#### Reference level measurement

| TestMode | Antenna | Freq(MHz) | Max.Point[MHz] | Result[dBm] |
|----------|---------|-----------|----------------|-------------|
| DH5      | Ant1    | 2402      | 2401.83        | -5.23       |
|          |         | 2441      | 2440.82        | -4.38       |
|          |         | 2480      | 2479.82        | -3.93       |
| 2DH5     | Ant1    | 2402      | 2402.15        | -5.29       |
|          |         | 2441      | 2441.14        | -4.40       |
|          |         | 2480      | 2480.14        | -3.96       |
| 3DH5     | Ant1    | 2402      | 2401.82        | -5.29       |
|          |         | 2441      | 2440.82        | -4.40       |
|          |         | 2480      | 2479.82        | -3.92       |

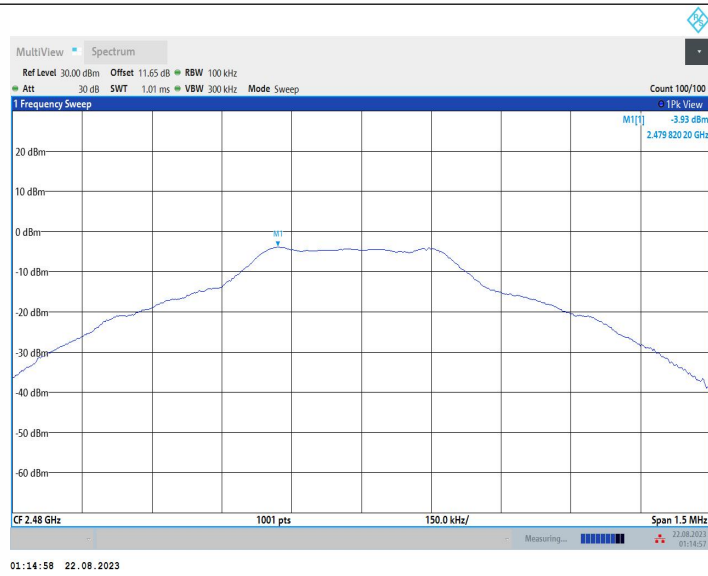
## DH5\_Ant1\_2402



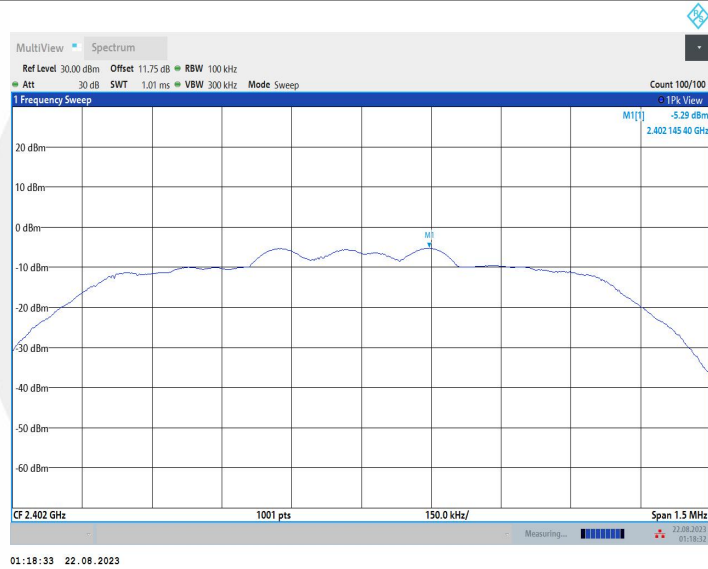
## DH5\_Ant1\_2441



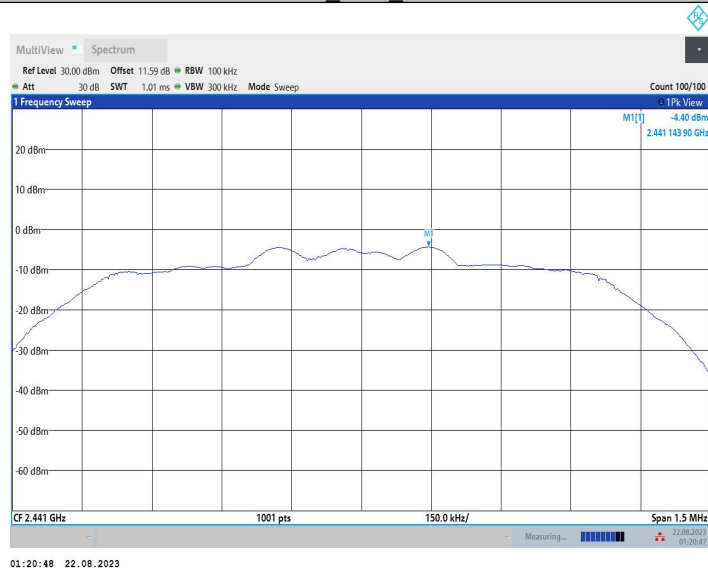
## DH5\_Ant1\_2480



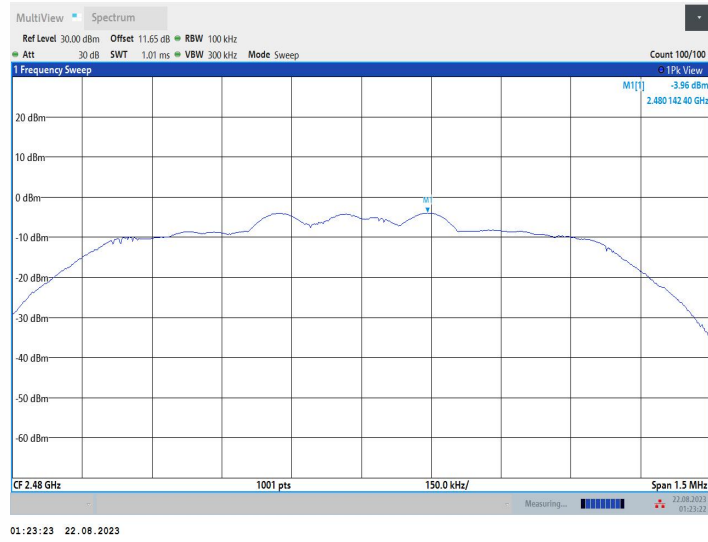
2DH5\_Ant1\_2402



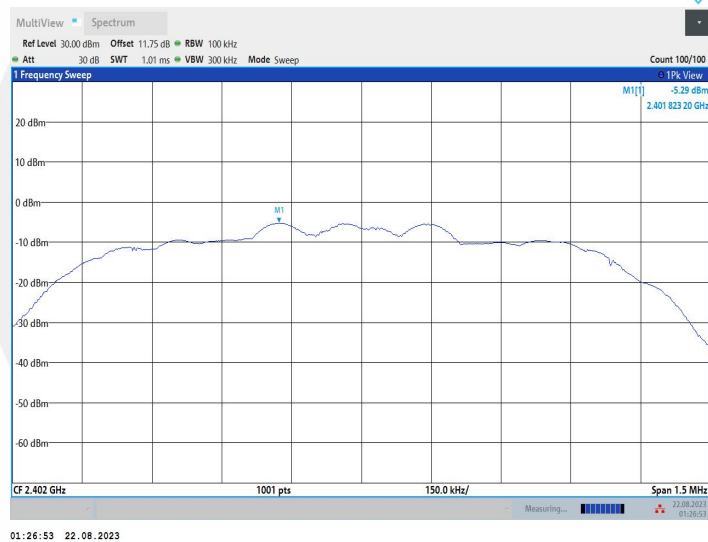
2DH5\_Ant1\_2441



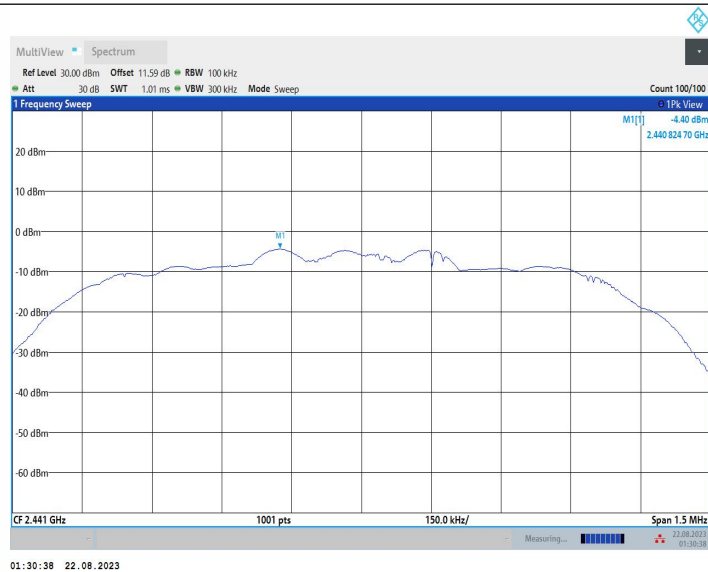
## 2DH5\_Ant1\_2480



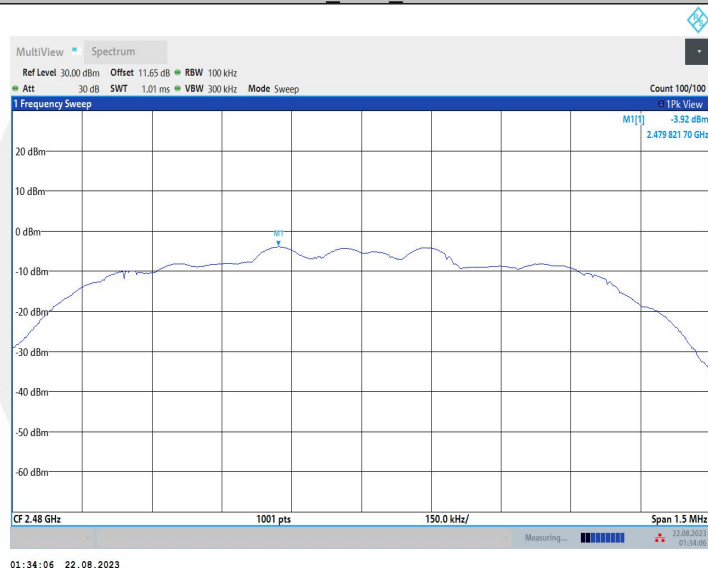
## 3DH5\_Ant1\_2402



## 3DH5\_Ant1\_2441



3DH5\_Ant1\_2480

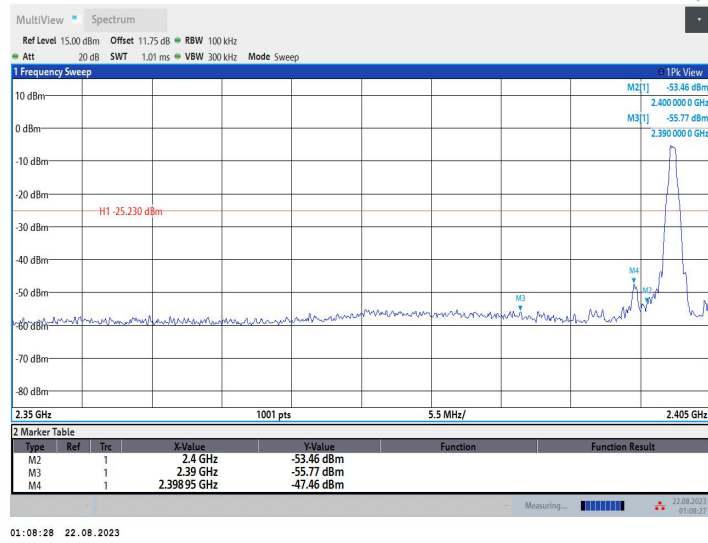


# Band edge measurements

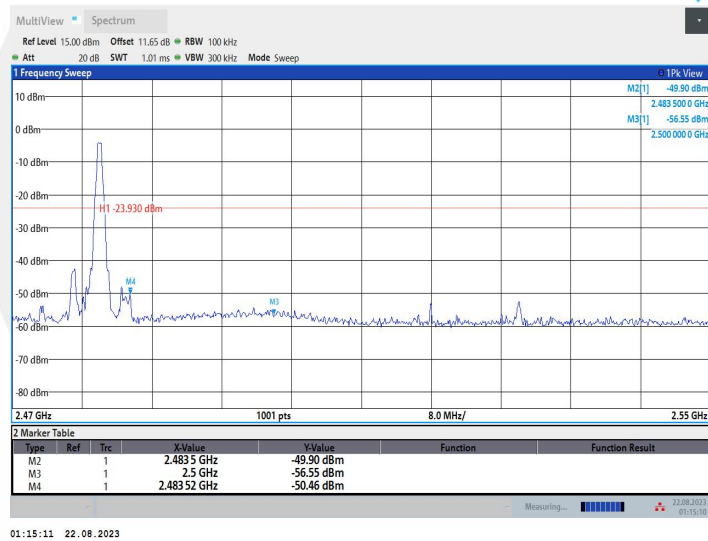
| TestMode | Antenna | ChName | Frequency[MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|----------|---------|--------|----------------|----------------|--------------|-------------|---------|
| DH5      | Ant1    | Low    | 2402           | -5.23          | -47.46       | ≤-25.23     | PASS    |
|          |         | High   | 2480           | -3.93          | -50.46       | ≤-23.93     | PASS    |
|          |         | Low    | Hop_2402       | -5.97          | -53.54       | ≤-25.97     | PASS    |
|          |         | High   | Hop_2480       | -4.06          | -51.82       | ≤-24.06     | PASS    |
| 2DH5     | Ant1    | Low    | 2402           | -5.29          | -48.75       | ≤-25.29     | PASS    |
|          |         | High   | 2480           | -3.96          | -49.94       | ≤-23.96     | PASS    |
|          |         | Low    | Hop_2402       | -5.64          | -53.92       | ≤-25.64     | PASS    |
|          |         | High   | Hop_2480       | -4.06          | -51.89       | ≤-24.06     | PASS    |
| 3DH5     | Ant1    | Low    | 2402           | -5.29          | -48.76       | ≤-25.29     | PASS    |
|          |         | High   | 2480           | -3.92          | -48.76       | ≤-23.92     | PASS    |
|          |         | Low    | Hop_2402       | -8.64          | -54.65       | ≤-28.64     | PASS    |
|          |         | High   | Hop_2480       | -5.36          | -51.59       | ≤-25.36     | PASS    |



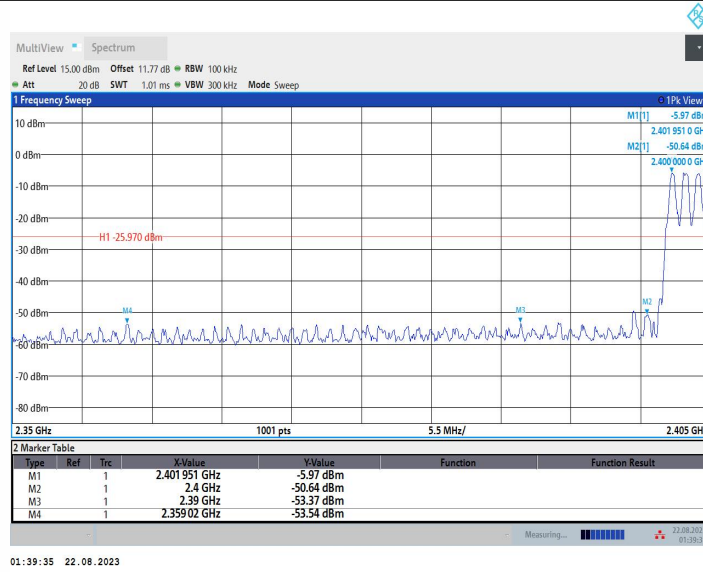
### DH5\_Ant1\_Low\_2402



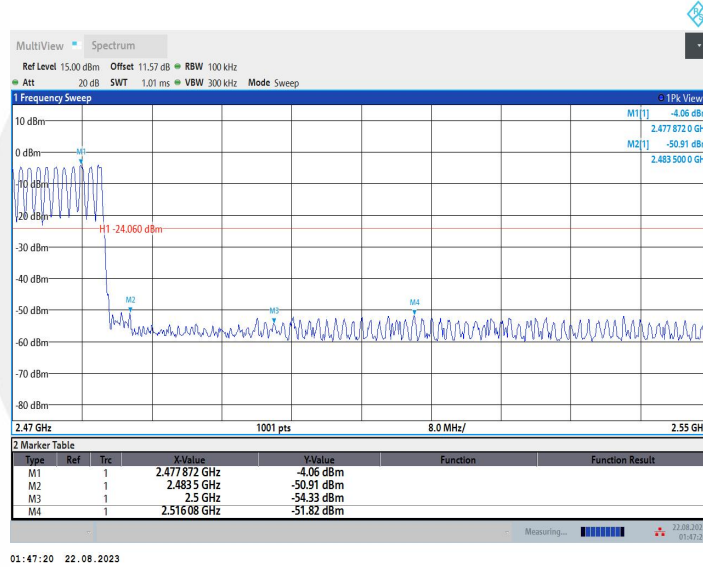
### DH5\_Ant1\_High\_2480



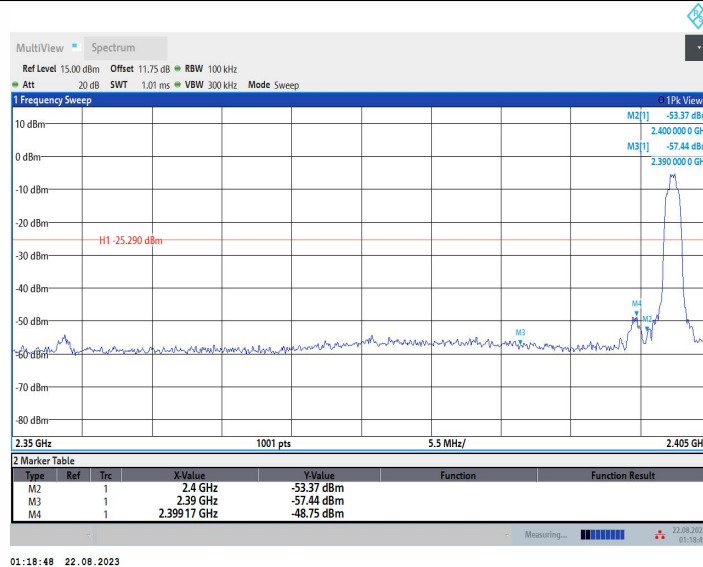
### DH5\_Ant1\_Low\_Hop\_2402



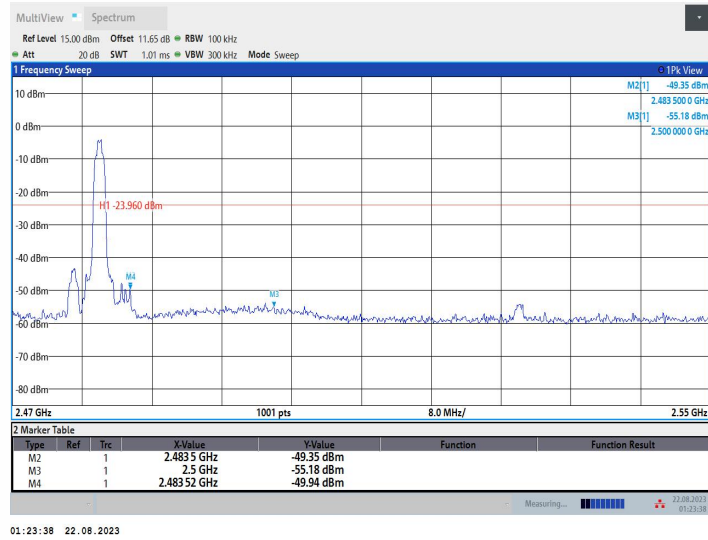
DH5\_Ant1\_High\_Hop\_2480



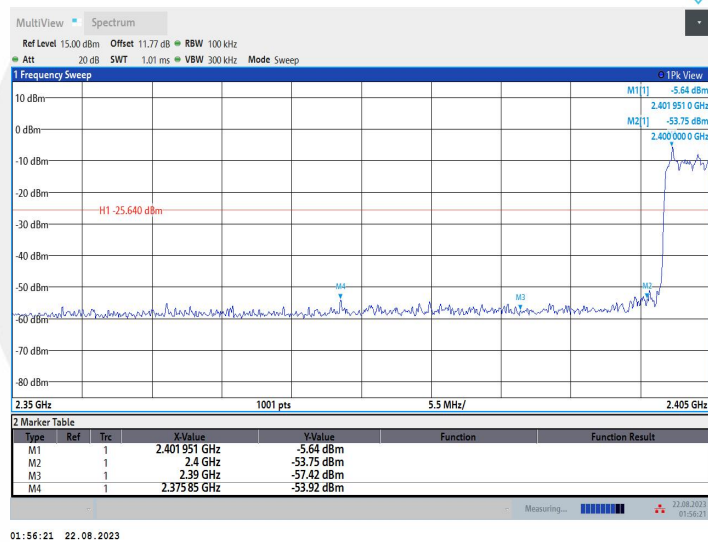
2DH5\_Ant1\_Low\_2402



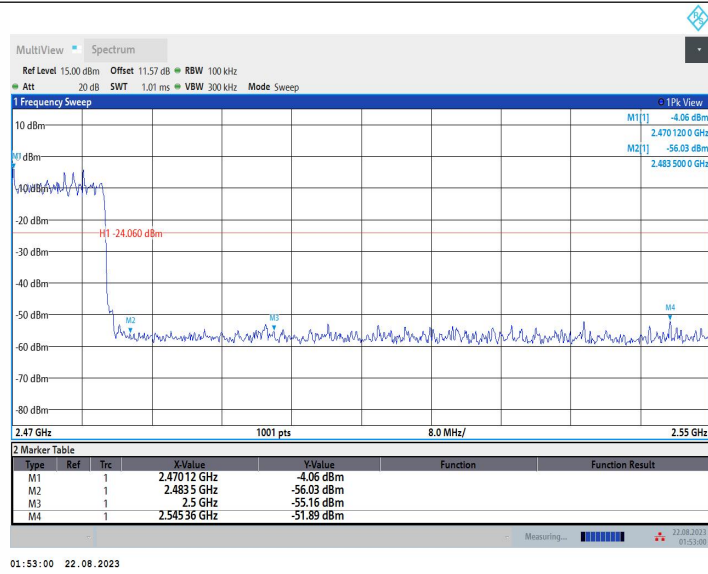
## 2DH5\_Ant1\_High\_2480



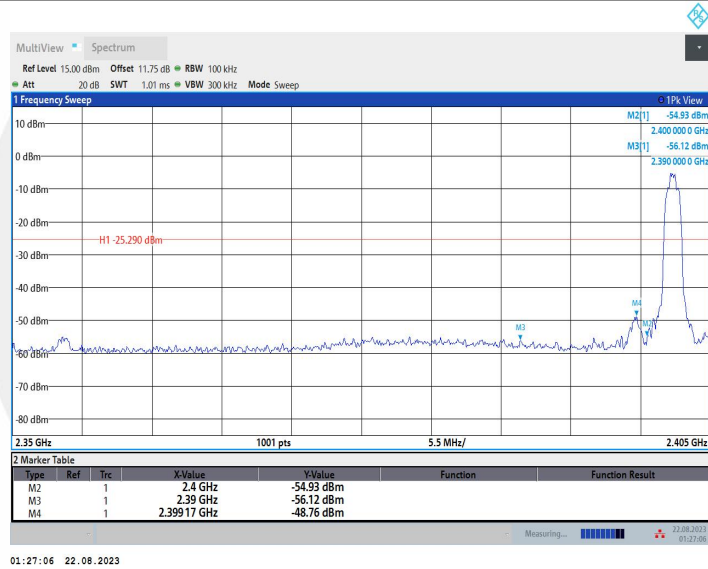
## 2DH5\_Ant1\_Low\_Hop\_2402



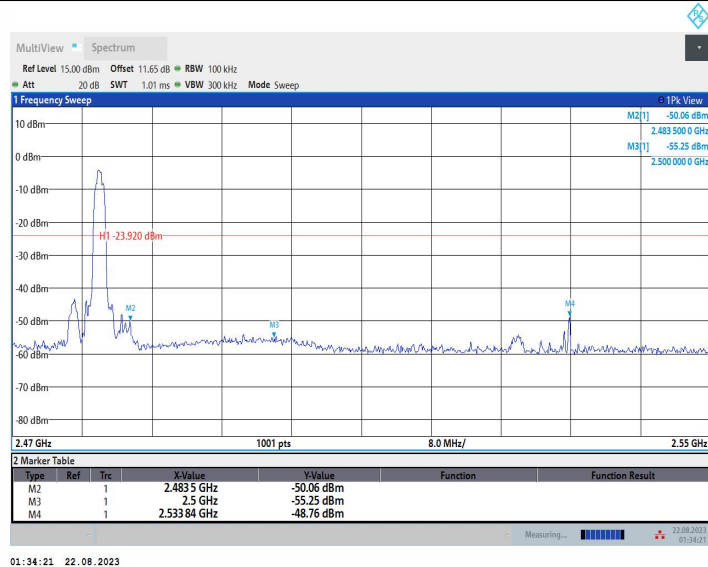
## 2DH5\_Ant1\_High\_Hop\_2480



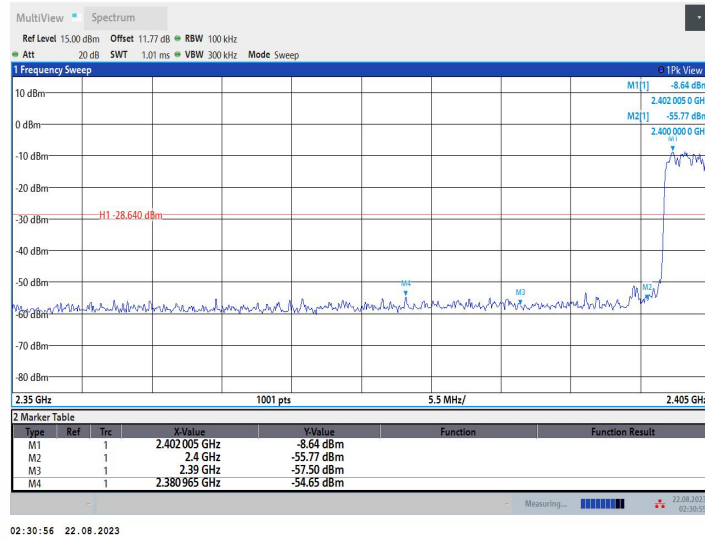
## 3DH5\_Ant1\_Low\_2402



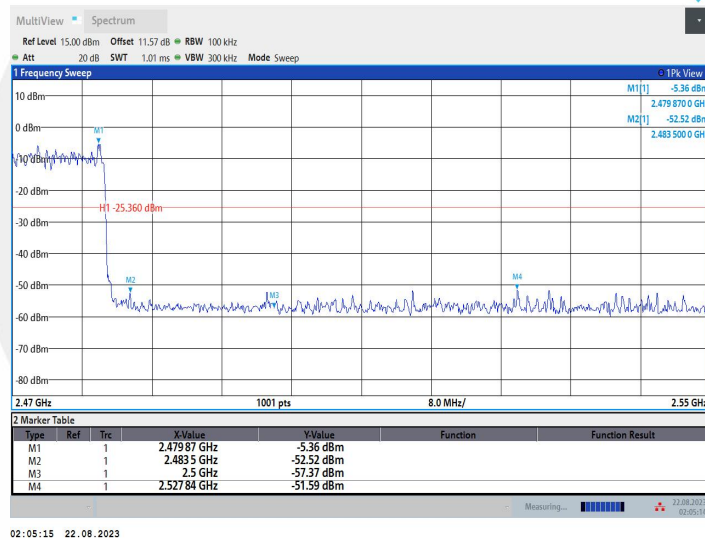
## 3DH5\_Ant1\_High\_2480



## 3DH5\_Ant1\_Low\_Hop\_2402



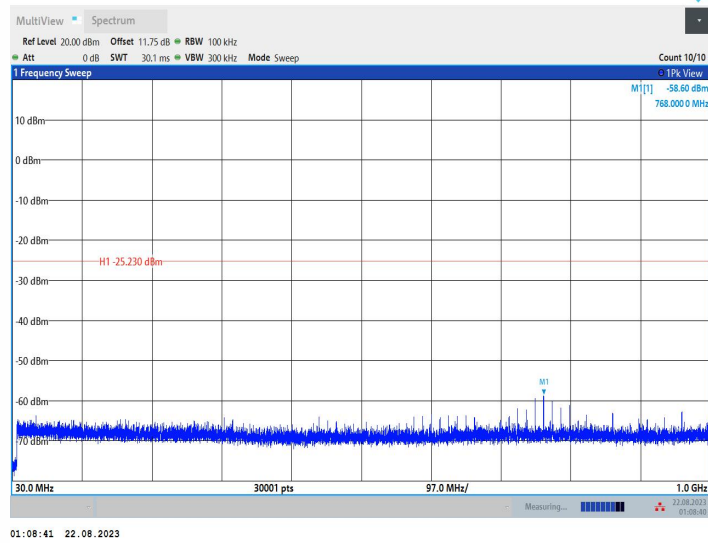
## 3DH5\_Ant1\_High\_Hop\_2480



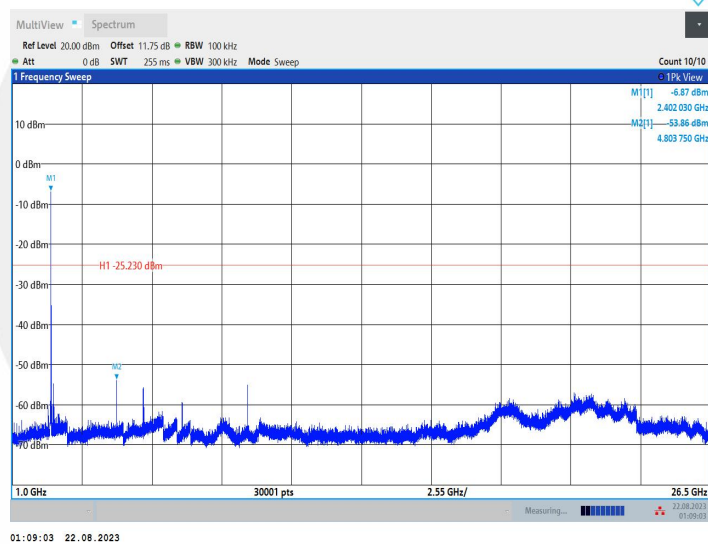
# Conducted Spurious Emission

| TestMode | Antenna | Frequency[MHz] | FreqRange [MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|----------|---------|----------------|-----------------|----------------|--------------|-------------|---------|
| DH5      | Ant1    | 2402           | 30~1000         | -5.23          | -58.6        | ≤-25.23     | PASS    |
|          |         |                | 1000~26500      | -5.23          | -53.86       | ≤-25.23     | PASS    |
|          |         | 2441           | 30~1000         | -4.38          | -58.49       | ≤-24.38     | PASS    |
|          |         |                | 1000~26500      | -4.38          | -51.21       | ≤-24.38     | PASS    |
|          |         | 2480           | 30~1000         | -3.93          | -58.57       | ≤-23.93     | PASS    |
|          |         |                | 1000~26500      | -3.93          | -51.6        | ≤-23.93     | PASS    |
| 2DH5     | Ant1    | 2402           | 30~1000         | -5.29          | -58.28       | ≤-25.29     | PASS    |
|          |         |                | 1000~26500      | -5.29          | -52.8        | ≤-25.29     | PASS    |
|          |         | 2441           | 30~1000         | -4.40          | -57.83       | ≤-24.4      | PASS    |
|          |         |                | 1000~26500      | -4.40          | -51.54       | ≤-24.4      | PASS    |
|          |         | 2480           | 30~1000         | -3.96          | -58.39       | ≤-23.96     | PASS    |
|          |         |                | 1000~26500      | -3.96          | -54.6        | ≤-23.96     | PASS    |
| 3DH5     | Ant1    | 2402           | 30~1000         | -5.29          | -58.12       | ≤-25.29     | PASS    |
|          |         |                | 1000~26500      | -5.29          | -54.6        | ≤-25.29     | PASS    |
|          |         | 2441           | 30~1000         | -4.40          | -58.55       | ≤-24.4      | PASS    |
|          |         |                | 1000~26500      | -4.40          | -55.08       | ≤-24.4      | PASS    |
|          |         | 2480           | 30~1000         | -3.92          | -57.84       | ≤-23.92     | PASS    |
|          |         |                | 1000~26500      | -3.92          | -52.41       | ≤-23.92     | PASS    |

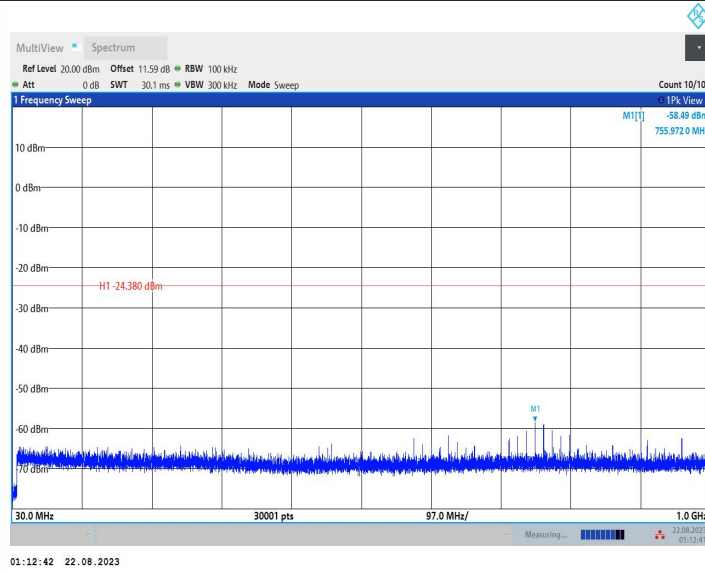
## DH5\_Ant1\_2402\_30~1000



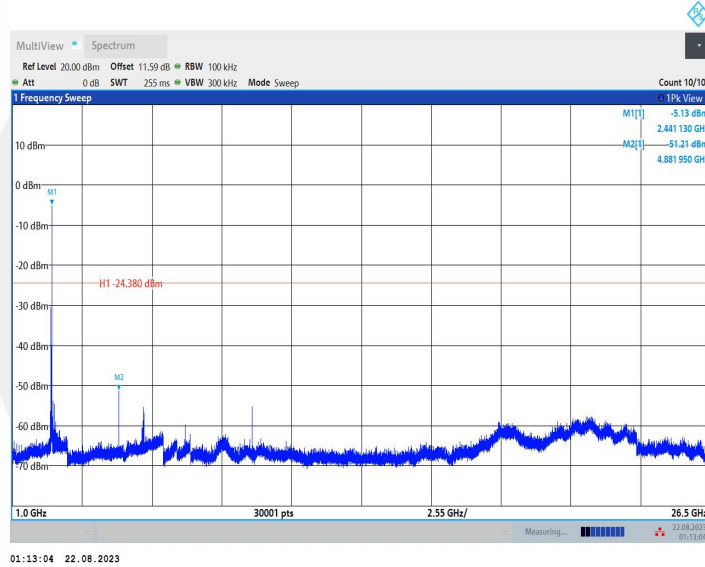
## DH5\_Ant1\_2402\_1000~26500



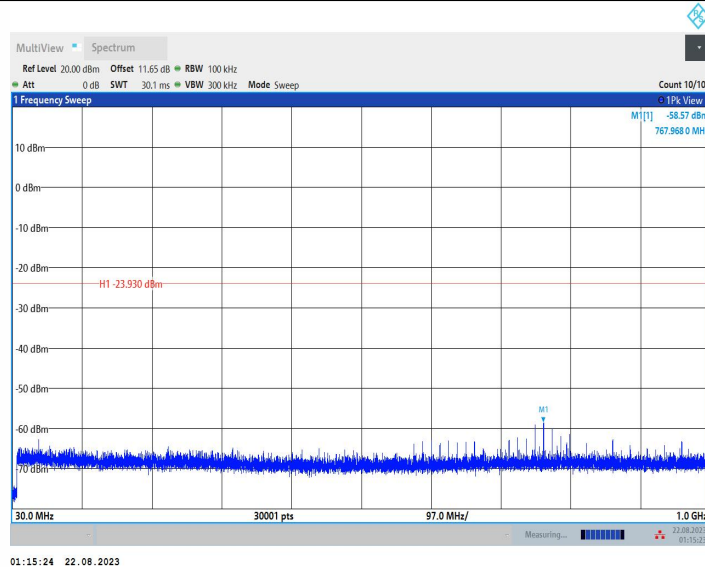
## DH5\_Ant1\_2441\_30~1000



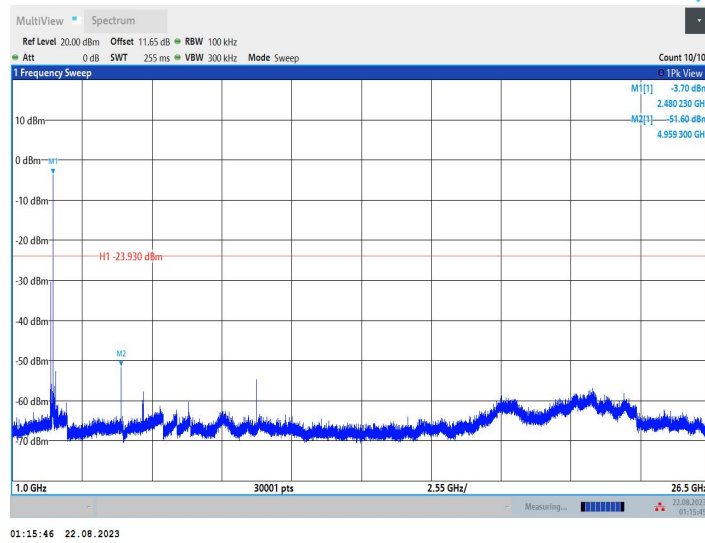
DH5\_Ant1\_2441\_1000~26500



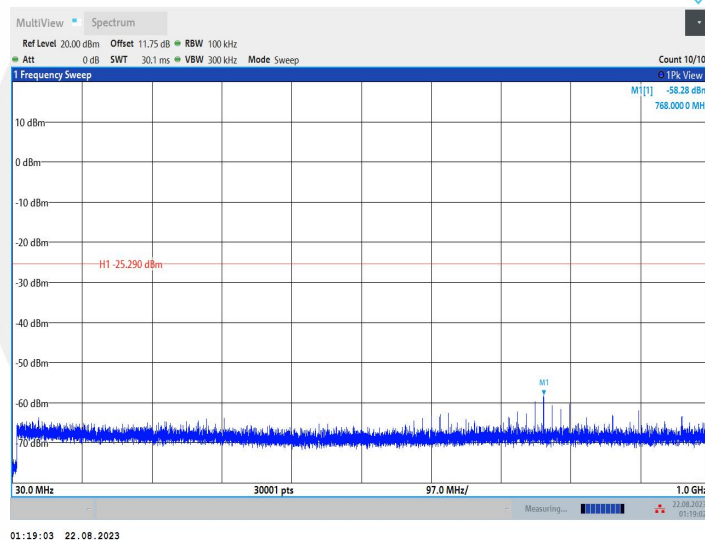
DH5\_Ant1\_2480\_30~1000



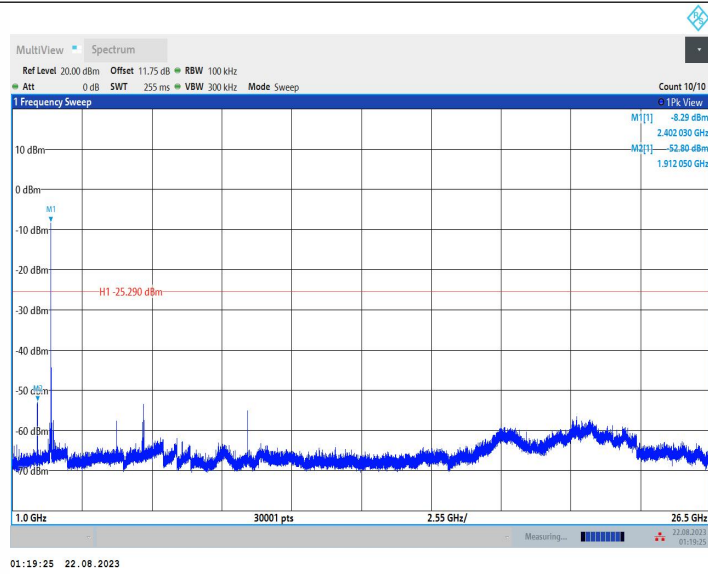
## DH5\_Ant1\_2480\_1000~26500



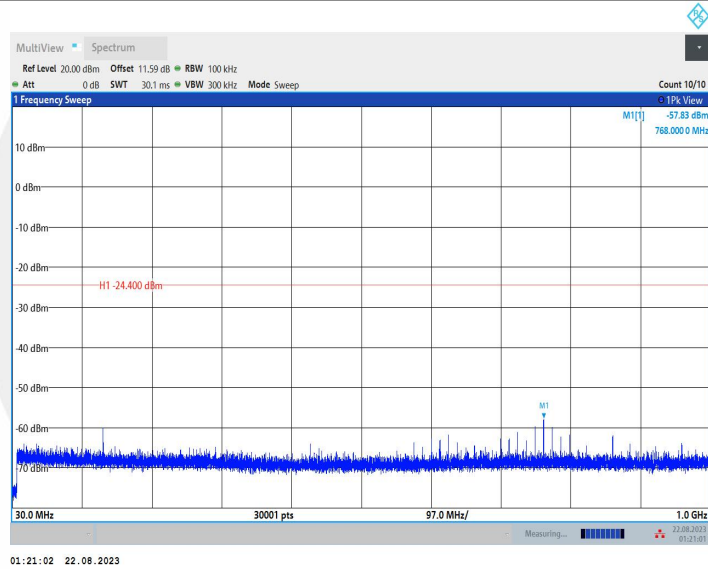
## 2DH5\_Ant1\_2402\_30~1000



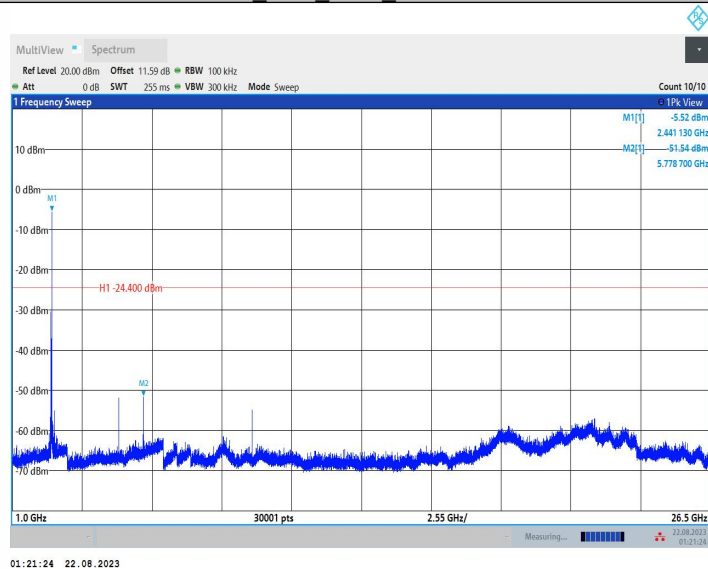
## 2DH5\_Ant1\_2402\_1000~26500



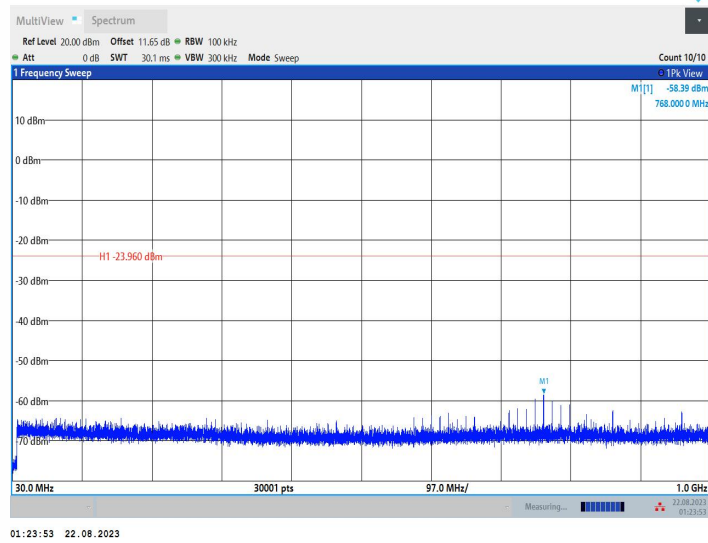
2DH5\_Ant1\_2441\_30~1000



2DH5\_Ant1\_2441\_1000~26500

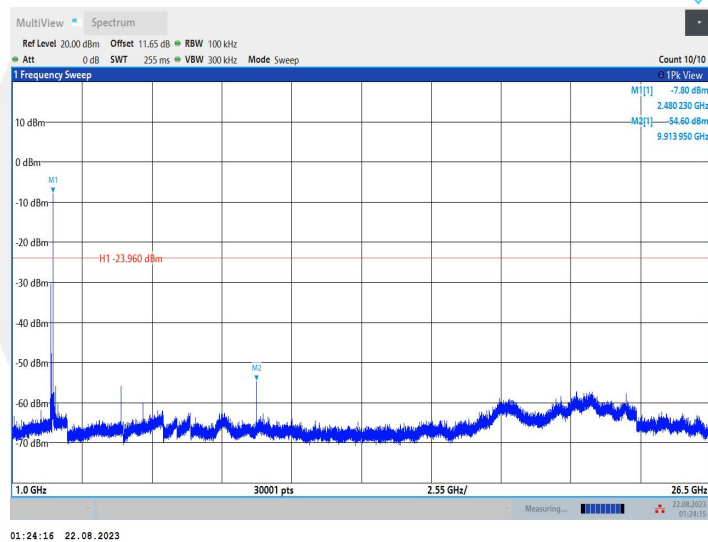


## 2DH5\_Ant1\_2480\_30~1000



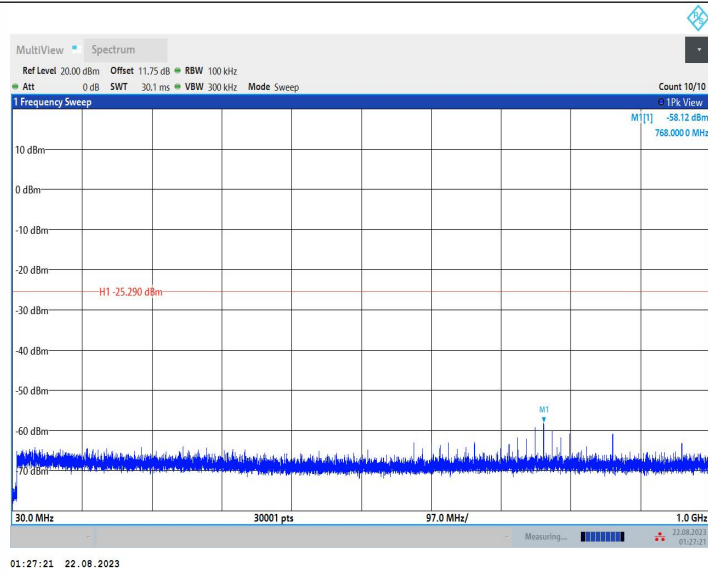
01:23:53 22.08.2023

## 2DH5\_Ant1\_2480\_1000~26500

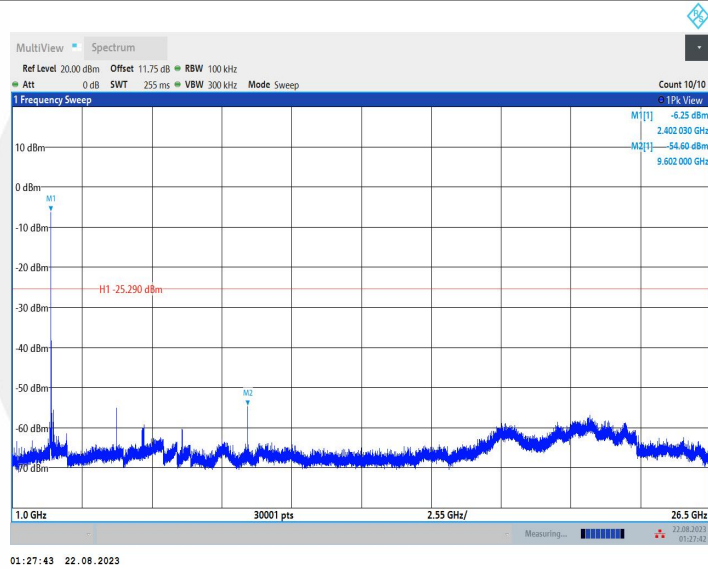


01:24:16 22.08.2023

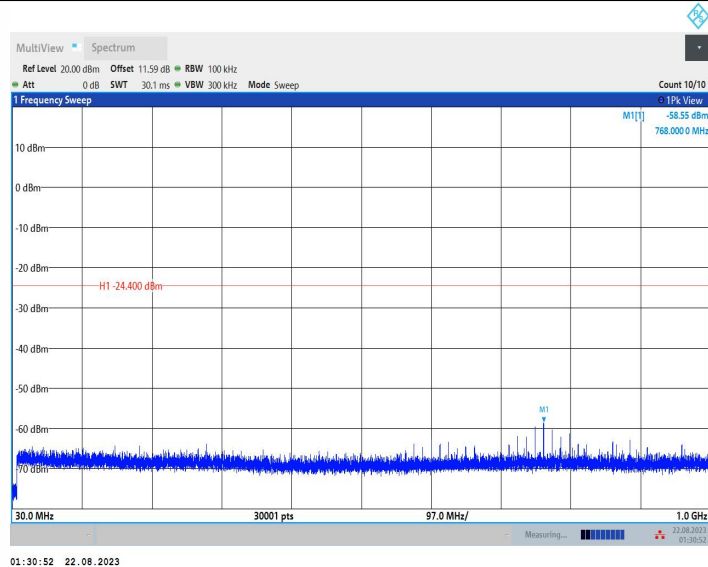
## 3DH5\_Ant1\_2402\_30~1000



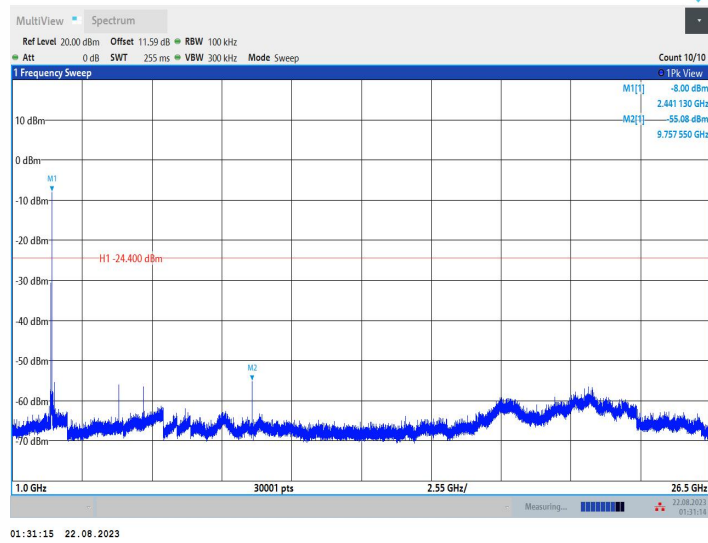
3DH5\_Ant1\_2402\_1000~26500



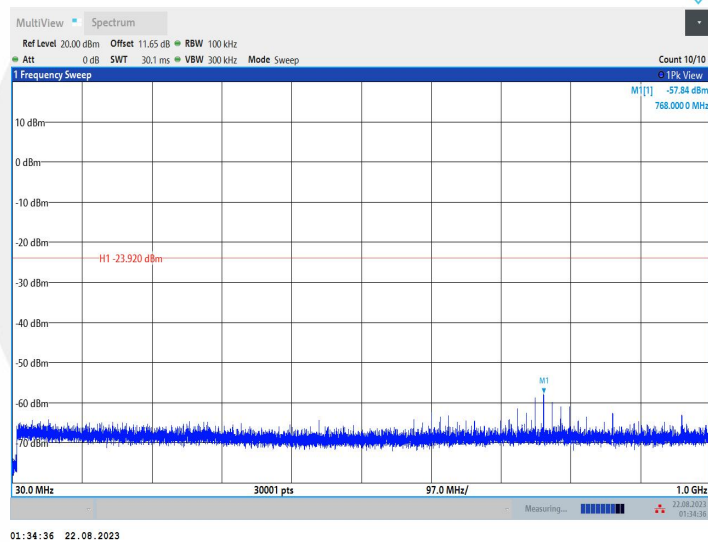
3DH5\_Ant1\_2441\_30~1000



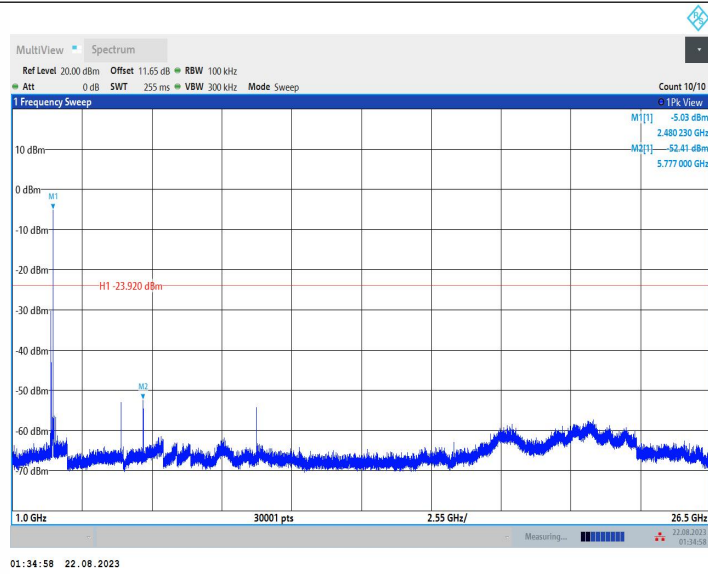
## 3DH5\_Ant1\_2441\_1000~26500



## 3DH5\_Ant1\_2480\_30~1000



## 3DH5\_Ant1\_2480\_1000~26500



## 9.7 RADIATED SPURIOUS EMISSION

### 9.7.1 Applicable Standard

According to FCC Part 15.247(d), 15.205, 15.209 and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02  
According to IC RSS-Gen and RSS-247

### 9.7.2 Conformance Limit

According to FCC Part 15.247(d): 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)).

According to FCC Part 15.205, Restricted bands

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110       | 16.42-16.423        | 399.9-410     | 4.5-5.15    |
| 10.495-0.505      | 16.69475-16.69525   | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.80425-16.80475   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | (2)         |
| 13.36-13.41       |                     |               |             |

According to FCC Part 15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

| Restricted Frequency(MHz) | Field Strength (μV/m) | Field Strength (dBμV/m) | Measurement Distance |
|---------------------------|-----------------------|-------------------------|----------------------|
| 0.009-0.490               | 2400/F(KHz)           | 20 log (uV/m)           | 300                  |
| 0.490-1.705               | 24000/F(KHz)          | 20 log (uV/m)           | 30                   |
| 1.705-30                  | 30                    | 29.5                    | 30                   |
| 30-88                     | 100                   | 40                      | 3                    |
| 88-216                    | 150                   | 43.5                    | 3                    |
| 216-960                   | 200                   | 46                      | 3                    |
| Above 960                 | 500                   | 54                      | 3                    |

### 9.7.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

### 9.7.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

For Above 1GHz:

The EUT was placed on a turn table which is 1.5m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 1GHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz for

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 30MHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 9kHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 150KHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 200Hz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. 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", derived from  $20\log(\text{dwell time}/100 \text{ ms})$ , in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

## 9.7.5 Test Results

### ■ Spurious Emission below 30MHz(9KHz to 30MHz)

|                    |           |
|--------------------|-----------|
| Temperature:       | 22° C     |
| Relative Humidity: | 45%       |
| ATM Pressure:      | 1011 mbar |

| Freq.<br>(MHz) | Ant.Pol.<br>H/V | Emission<br>Level(dBuV/m) |    | Limit 3m(dBuV/m) |    | Over(dB) |    |
|----------------|-----------------|---------------------------|----|------------------|----|----------|----|
|                |                 | PK                        | AV | PK               | AV | PK       | AV |
| --             | --              | --                        | -- | --               | -- | --       | -- |

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =  $40\log(\text{Specific distance}/\text{test distance})$  (dB);

Limit line = Specific limits(dBuV) + distance extrapolation factor

### ■ Spurious Emission Above 1GHz(1GHz to 25GHz)

All the antenna(Antenna 1) and modes(GFSK,  $\pi/4$ -DQPSK, 8DPSK) mode have been tested, and the worst(Antenna 1,GFSK) result recorded was report as below:

Test mode: GFSK Frequency: Channel 0: 2402MHz

| Freq.<br>(MHz) | Ant.Pol. | Emission Level(dBuV/m) |       | Limit 3m(dBuV/m) |       | Over(dB) |      |
|----------------|----------|------------------------|-------|------------------|-------|----------|------|
|                | H/V      | PK                     | AV    | PK               | AV    | PK       | AV   |
| 11495.62       | V        | 60.58                  | 47.83 | 74.00            | 54.00 | 13.42    | 6.17 |
| 14647.5        | V        | 64.09                  | 47.31 | 74.00            | 54.00 | 9.91     | 6.69 |
| 17593.12       | V        | 71.18                  | 50.37 | 74.00            | 54.00 | 2.82     | 3.63 |
| 11527.5        | H        | 60.04                  | 47.35 | 74.00            | 54.00 | 13.96    | 6.65 |
| 14746.87       | H        | 64.14                  | 45.91 | 74.00            | 54.00 | 9.86     | 8.09 |
| 17608.12       | H        | 70.92                  | 50.21 | 74.00            | 54.00 | 3.08     | 3.79 |

Test mode: GFSK Frequency: Channel 39: 2441MHz

| Freq.<br>(MHz) | Ant.Pol. | Emission Level(dBuV/m) |       | Limit 3m(dBuV/m) |       | Over(dB) |      |
|----------------|----------|------------------------|-------|------------------|-------|----------|------|
|                | H/V      | PK                     | AV    | PK               | AV    | PK       | AV   |
| 11495.62       | V        | 61.08                  | 48.13 | 74.00            | 54.00 | 13.42    | 5.87 |
| 14647.5        | V        | 64.59                  | 47.32 | 74.00            | 54.00 | 9.91     | 6.68 |
| 17593.12       | V        | 71.68                  | 50.04 | 74.00            | 54.00 | 2.82     | 3.96 |
| 11527.5        | H        | 60.54                  | 47.35 | 74.00            | 54.00 | 13.96    | 6.65 |
| 14746.87       | H        | 64.64                  | 45.98 | 74.00            | 54.00 | 9.86     | 8.02 |
| 17608.12       | H        | 71.42                  | 50.23 | 74.00            | 54.00 | 3.08     | 3.77 |

Test mode: GFSK Frequency: Channel 78: 2480MHz

| Freq.<br>(MHz) | Ant.Pol. | Emission Level(dBuV/m) |       | Limit 3m(dBuV/m) |       | Over(dB) |       |
|----------------|----------|------------------------|-------|------------------|-------|----------|-------|
|                | H/V      | PK                     | AV    | PK               | AV    | PK       | AV    |
| 11495.62       | V        | 60.08                  | 48.62 | 74.00            | 54.00 | 13.42    | 5.38  |
| 14647.5        | V        | 63.59                  | 47.43 | 74.00            | 54.00 | 9.91     | 6.57  |
| 17593.12       | V        | 70.68                  | 50.33 | 74.00            | 54.00 | 2.82     | 3.67  |
| 11527.5        | H        | 59.54                  | 39.12 | 74.00            | 54.00 | 13.96    | 14.88 |
| 14746.87       | H        | 63.64                  | 46.32 | 74.00            | 54.00 | 9.86     | 7.68  |
| 17608.12       | H        | 70.42                  | 50.04 | 74.00            | 54.00 | 3.08     | 3.96  |

- Note:**
- (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
  - (2) Emission Level= Reading Level+Correct Factor.
  - (3) Correct Factor= Ant\_F + Cab\_L - Preamp
  - (4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

# ■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

All the antenna(Antenna 1) and modes(GFSK,  $\pi/4$ -DQPSK, 8DPSK, Hopping) mode have been tested, and the worst(Antenna 1,GFSK, Hopping) result recorded was report as below:

Test mode: GFSK Frequency: Channel 0: 2402MHz

| Frequency (MHz) | Polarity H/V | PK(dBuV/m) (VBW=3MHz) | Limit 3m (dBuV/m) | AV(dBuV/m) (VBW=10Hz) | Limit 3m (dBuV/m) |
|-----------------|--------------|-----------------------|-------------------|-----------------------|-------------------|
| 2389.4          | H            | 52.85                 | 74.00             | 43.00                 | 54.00             |
| 2389.93         | V            | 50.01                 | 74.00             | 43.20                 | 54.00             |

Test mode: GFSK Frequency: Channel 78: 2480MHz

| Frequency (MHz) | Polarity H/V | PK(dBuV/m) (VBW=3MHz) | Limit 3m (dBuV/m) | AV(dBuV/m) (VBW=10Hz) | Limit 3m (dBuV/m) |
|-----------------|--------------|-----------------------|-------------------|-----------------------|-------------------|
| 2483.52         | H            | 48.75                 | 74.00             | 42.83                 | 54.00             |
| 2483.71         | V            | 47.79                 | 74.00             | 43.19                 | 54.00             |

Test mode: GFSK Frequency: Hopping

| Frequency (MHz) | Polarity H/V | PK(dBuV/m) (VBW=3MHz) | Limit 3m (dBuV/m) | AV(dBuV/m) (VBW=10Hz) | Limit 3m (dBuV/m) |
|-----------------|--------------|-----------------------|-------------------|-----------------------|-------------------|
| 2393.36         | H            | 55.92                 | 74.00             | 45.52                 | 54.00             |
| 2482.28         | H            | 48.57                 | 74.00             | 42.19                 | 54.00             |
| 2397.13         | V            | 54.74                 | 74.00             | 46.21                 | 54.00             |
| 2483.23         | V            | 45.76                 | 74.00             | 42.20                 | 54.00             |

- Note:**
- (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
  - (2) Emission Level= Reading Level+Correct Factor.
  - (3) Correct Factor= Ant\_F + Cab\_L - Preamp
  - (4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.