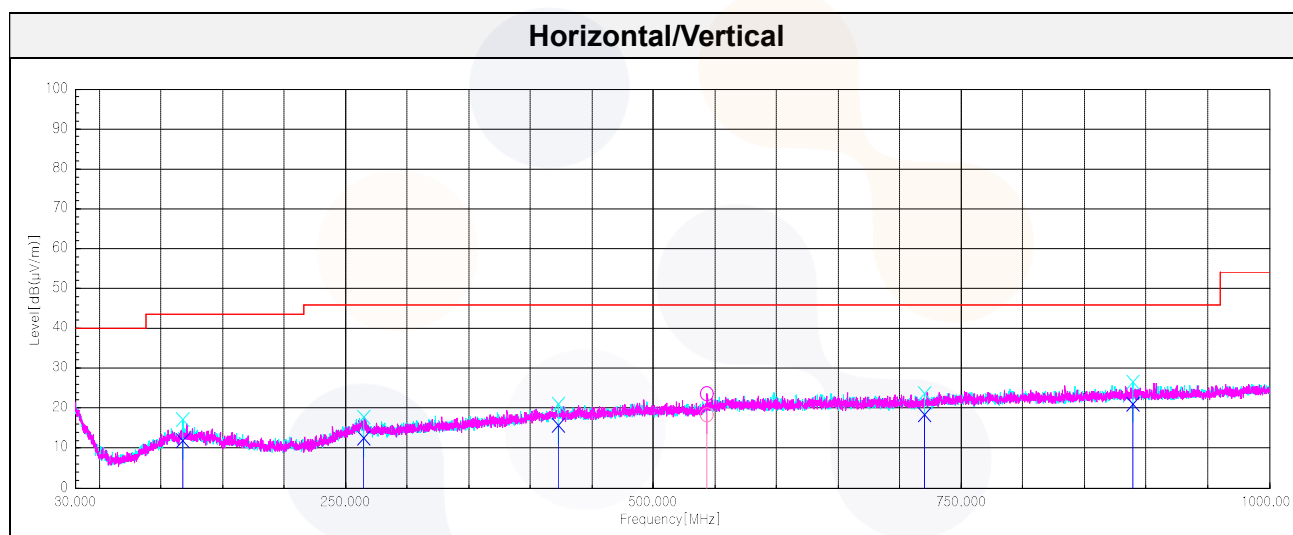


**Test results (Below 1 000 MHz) – Worst case: GFSK 2 480 MHz**

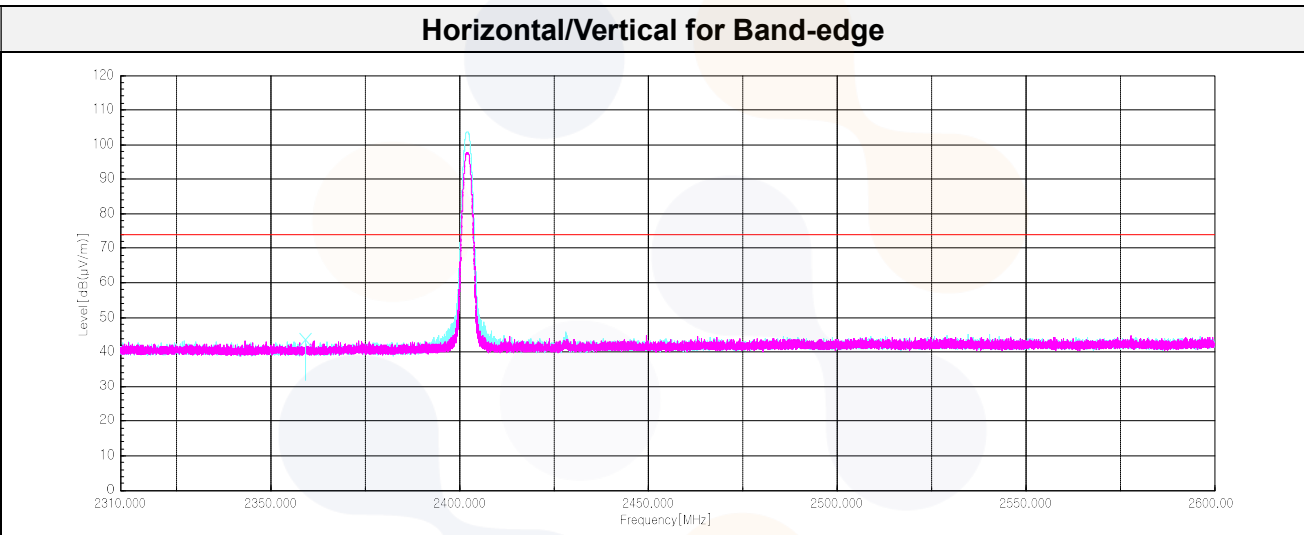
| Frequency              | Pol.  | Reading  | Ant. Factor | Amp. + Cable | DCCF | Result     | Limit      | Margin |
|------------------------|-------|----------|-------------|--------------|------|------------|------------|--------|
| (MHz)                  | (V/H) | (dB(μV)) | (dB)        | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Quasi peak data</b> |       |          |             |              |      |            |            |        |
| 117.91 <sup>1)</sup>   | V     | 25.50    | 17.80       | -31.51       | -    | 11.79      | 43.50      | 31.71  |
| 264.62 <sup>1)</sup>   | V     | 23.50    | 19.88       | -30.96       | -    | 12.42      | 46.00      | 33.58  |
| 422.73                 | V     | 23.80    | 22.50       | -30.70       | -    | 15.60      | 46.00      | 30.40  |
| 543.62                 | H     | 24.70    | 24.06       | -30.45       | -    | 18.31      | 46.00      | 27.69  |
| 720.16                 | V     | 23.20    | 25.00       | -30.00       | -    | 18.20      | 46.00      | 27.80  |
| 889.30                 | V     | 23.40    | 26.46       | -28.95       | -    | 20.91      | 46.00      | 25.09  |



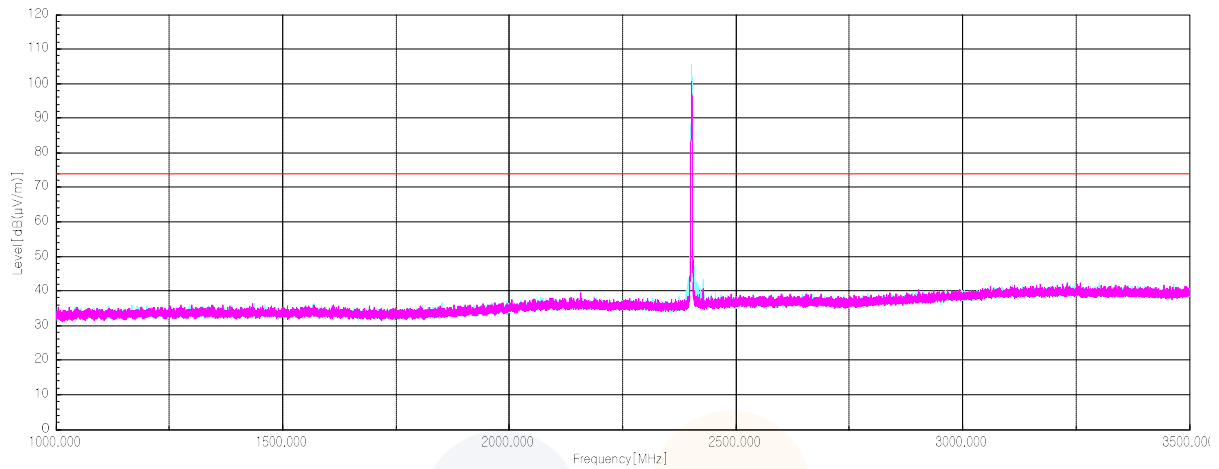
**Test results (Above 1 000 MHz)**

**GFSK Low Channel**

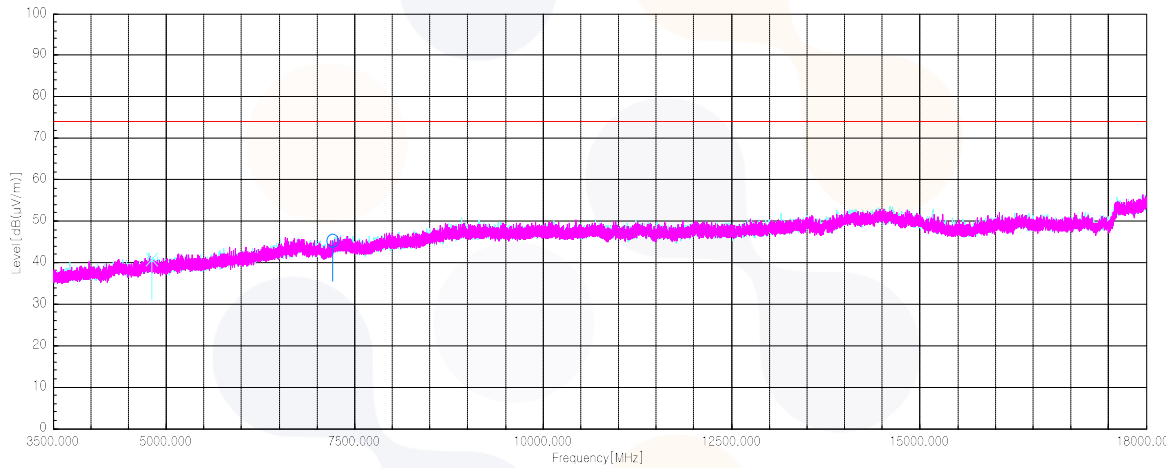
| Frequency                                                      | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | Result           | Limit            | Margin |
|----------------------------------------------------------------|-------|----------------|-------------|--------------|------|------------------|------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu$ V)) | (dB)        | (dB)         | (dB) | (dB( $\mu$ V/m)) | (dB( $\mu$ V/m)) | (dB)   |
| <b>Peak data</b>                                               |       |                |             |              |      |                  |                  |        |
| 2 359.20 <sup>1)</sup>                                         | V     | 46.90          | 26.90       | -30.44       | -    | 43.36            | 74.00            | 30.64  |
| 4 808.38 <sup>1)</sup>                                         | V     | 54.70          | 32.35       | -46.11       | -    | 40.94            | 74.00            | 33.06  |
| 7 209.10                                                       | H     | 52.30          | 37.12       | -44.32       | -    | 45.10            | 74.00            | 28.90  |
| <b>Average Data</b>                                            |       |                |             |              |      |                  |                  |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                |             |              |      |                  |                  |        |



**Horizontal/Vertical for 1 GHz ~ 3.5 GHz**



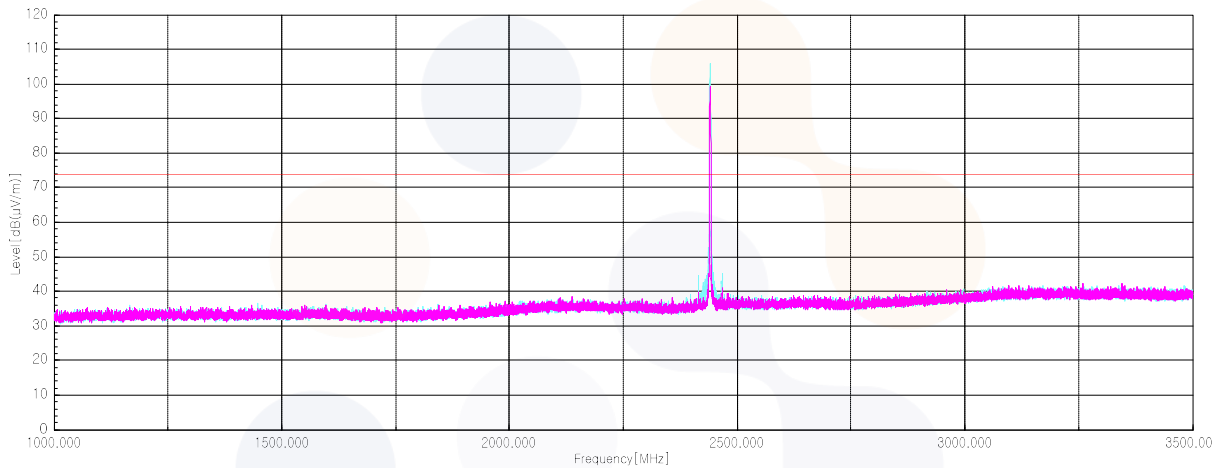
**Horizontal/Vertical for 3.5 GHz ~ 18 GHz**



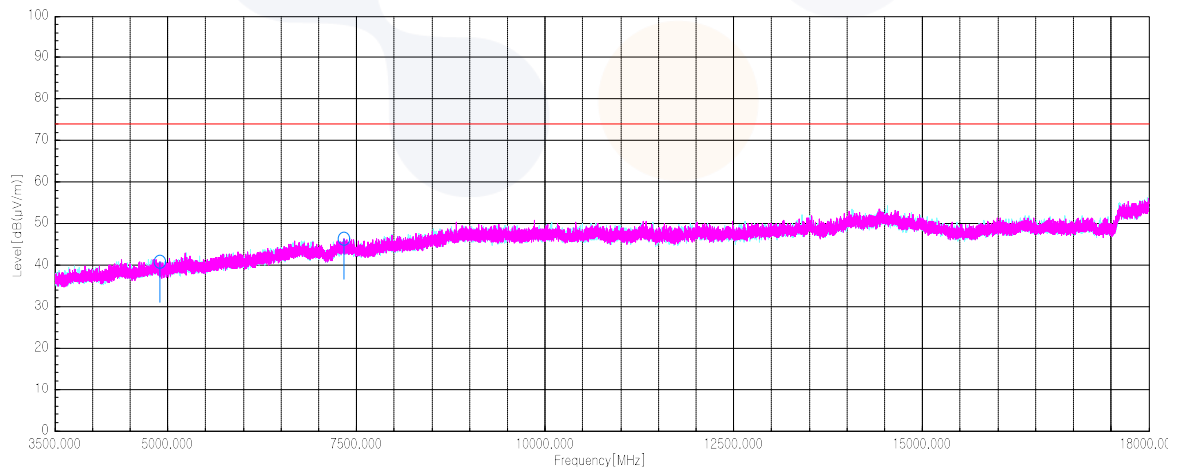
### GFSK\_Mid Channel

| Frequency                                                      | Pol.  | Reading  | Ant. Factor | Amp. + Cable | DCCF | Result     | Limit      | Margin |
|----------------------------------------------------------------|-------|----------|-------------|--------------|------|------------|------------|--------|
| (MHz)                                                          | (V/H) | (dB(μV)) | (dB)        | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>                                               |       |          |             |              |      |            |            |        |
| 4 892.00 <sup>1)</sup>                                         | H     | 53.70    | 32.85       | -45.73       | -    | 40.82      | 74.00      | 33.18  |
| 7 326.55 <sup>1)</sup>                                         | H     | 53.50    | 36.99       | -44.29       | -    | 46.20      | 74.00      | 27.80  |
| <b>Average Data</b>                                            |       |          |             |              |      |            |            |        |
| No spurious emissions were detected within 20 dB of the limit. |       |          |             |              |      |            |            |        |

### Horizontal/Vertical for 1 GHz ~ 3.5 GHz

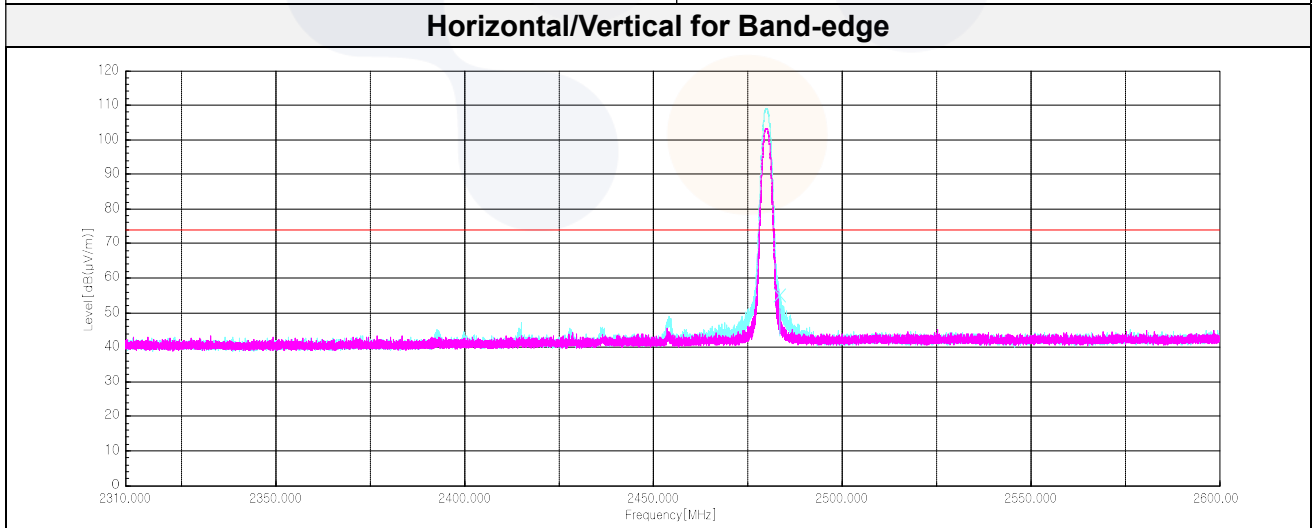
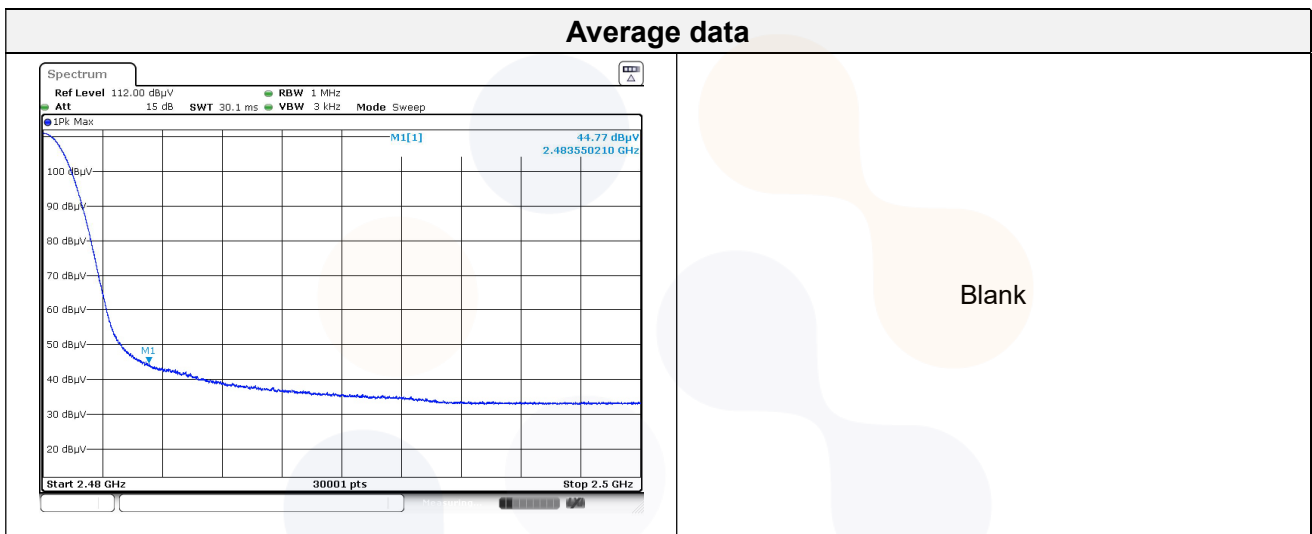


### Horizontal/Vertical for 3.5 GHz ~ 18 GHz

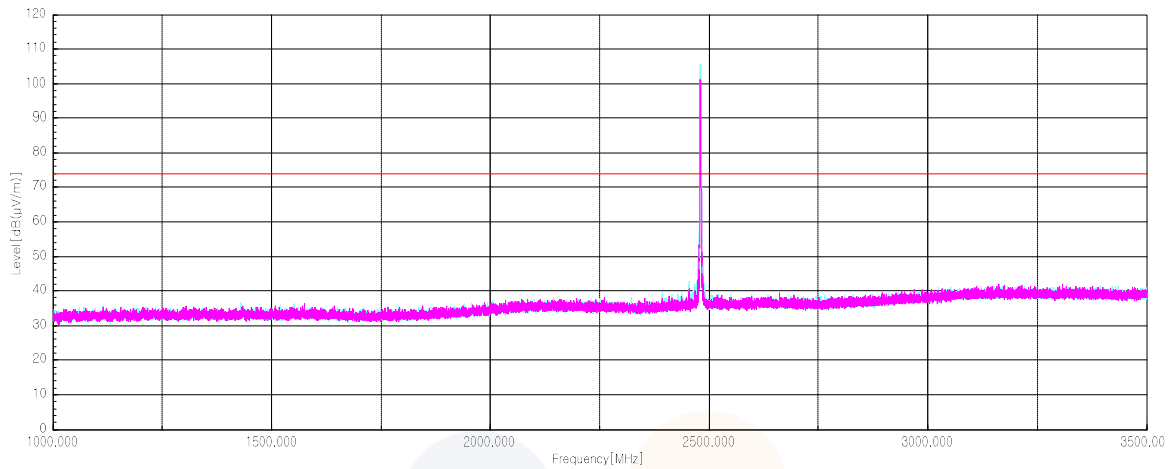


### GFSK\_High Channel

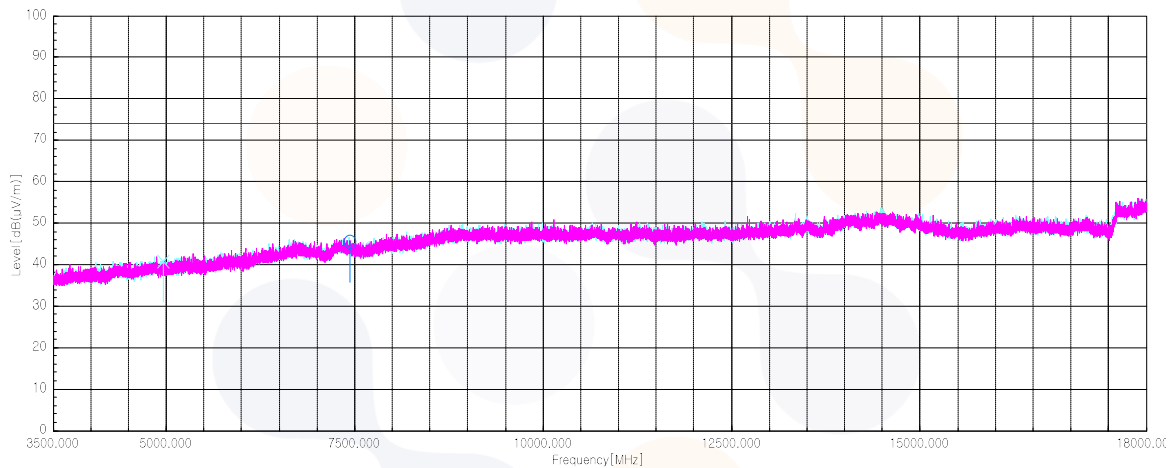
| Frequency              | Pol.  | Reading  | Ant. Factor | Amp. + Cable | DCCF | Result     | Limit      | Margin |
|------------------------|-------|----------|-------------|--------------|------|------------|------------|--------|
| (MHz)                  | (V/H) | (dB(μV)) | (dB)        | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>       |       |          |             |              |      |            |            |        |
| 2 483.55 <sup>1)</sup> | V     | 57.50    | 27.70       | -30.24       | -    | 54.96      | 74.00      | 19.04  |
| 4 961.12 <sup>1)</sup> | V     | 53.50    | 32.82       | -45.42       | -    | 40.90      | 74.00      | 33.10  |
| 7 440.62 <sup>1)</sup> | H     | 53.00    | 36.82       | -44.09       | -    | 45.73      | 74.00      | 28.27  |
| <b>Average Data</b>    |       |          |             |              |      |            |            |        |
| 2 483.55 <sup>1)</sup> | V     | 44.77    | 27.70       | -30.24       | -    | 42.23      | 54.00      | 11.77  |



**Horizontal/Vertical for 1 GHz ~ 3.5 GHz**

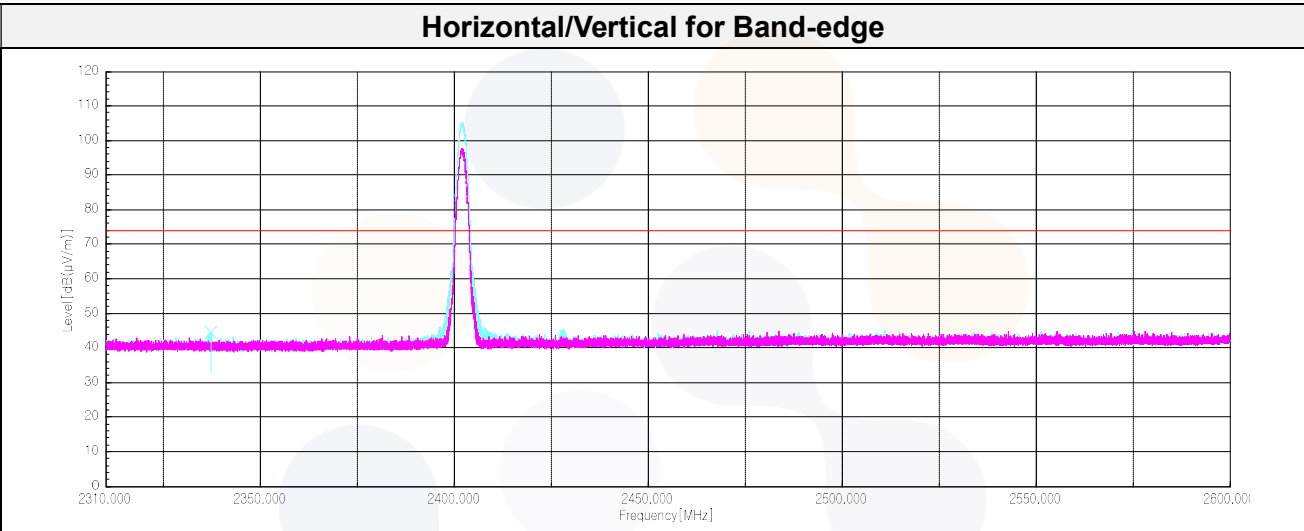


**Horizontal/Vertical for 3.5 GHz ~ 18 GHz**

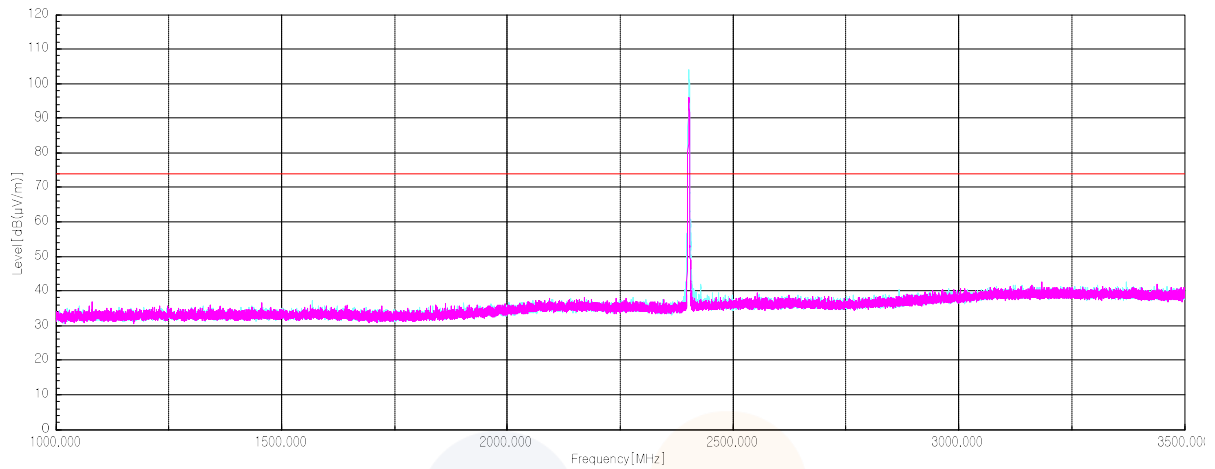


### 8DPSK Low Channel

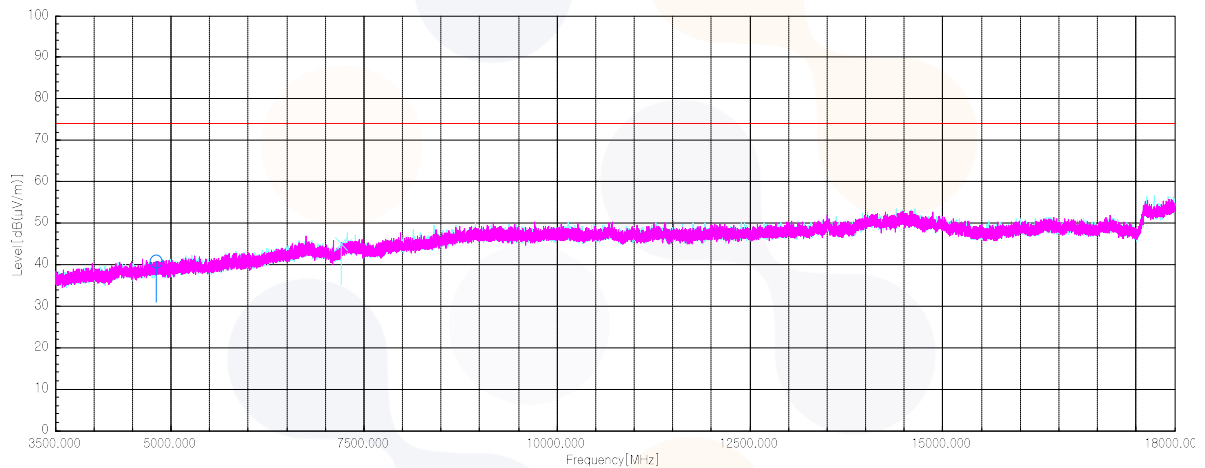
| Frequency                                                      | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | Result           | Limit            | Margin |
|----------------------------------------------------------------|-------|----------------|-------------|--------------|------|------------------|------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu$ V)) | (dB)        | (dB)         | (dB) | (dB( $\mu$ V/m)) | (dB( $\mu$ V/m)) | (dB)   |
| <b>Peak data</b>                                               |       |                |             |              |      |                  |                  |        |
| 2 337.07 <sup>1)</sup>                                         | V     | 48.10          | 27.00       | -30.47       | -    | 44.63            | 74.00            | 29.37  |
| 4 805.48 <sup>1)</sup>                                         | H     | 54.60          | 32.33       | -46.12       | -    | 40.81            | 74.00            | 33.19  |
| 7 202.33                                                       | V     | 52.30          | 37.10       | -44.30       | -    | 45.10            | 74.00            | 28.90  |
| <b>Average Data</b>                                            |       |                |             |              |      |                  |                  |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                |             |              |      |                  |                  |        |



**Horizontal/Vertical for 1 GHz ~ 3.5 GHz**



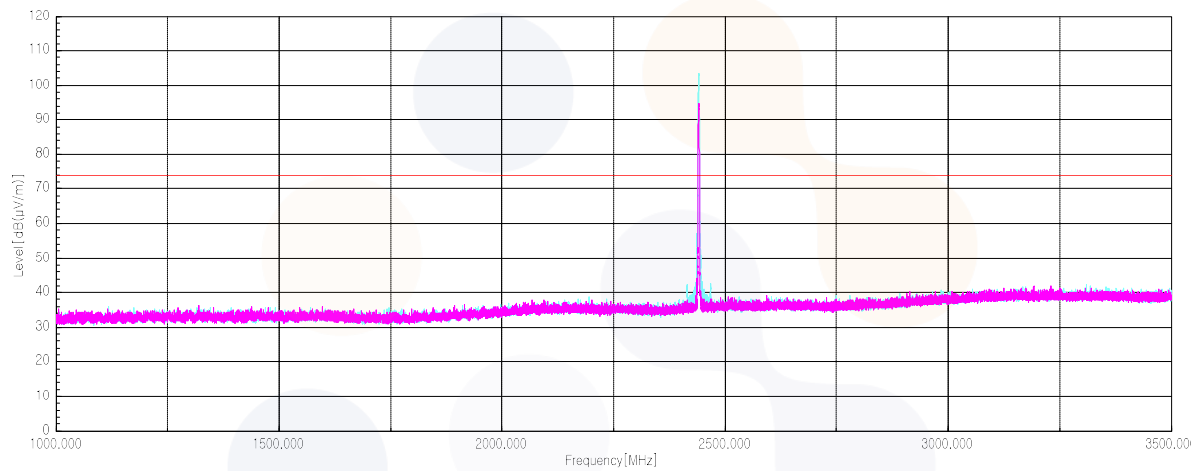
**Horizontal/Vertical for 3.5 GHz ~ 18 GHz**



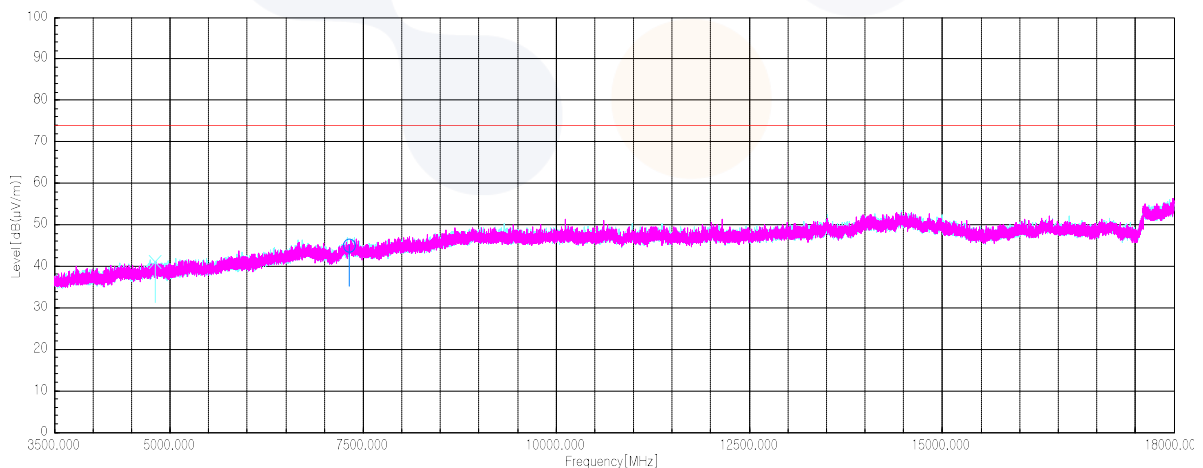
### 8DPSK\_Mid Channel

| Frequency                                                      | Pol.  | Reading  | Ant. Factor | Amp. + Cable | DCCF | Result     | Limit      | Margin |
|----------------------------------------------------------------|-------|----------|-------------|--------------|------|------------|------------|--------|
| (MHz)                                                          | (V/H) | (dB(μV)) | (dB)        | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>                                               |       |          |             |              |      |            |            |        |
| 4 810.80 <sup>1)</sup>                                         | V     | 54.60    | 32.36       | -46.10       | -    | 40.86      | 74.00      | 33.14  |
| 7 321.23 <sup>1)</sup>                                         | H     | 52.10    | 37.02       | -44.30       | -    | 44.82      | 74.00      | 29.18  |
| <b>Average Data</b>                                            |       |          |             |              |      |            |            |        |
| No spurious emissions were detected within 20 dB of the limit. |       |          |             |              |      |            |            |        |

### Horizontal/Vertical for 1 GHz ~ 3.5 GHz

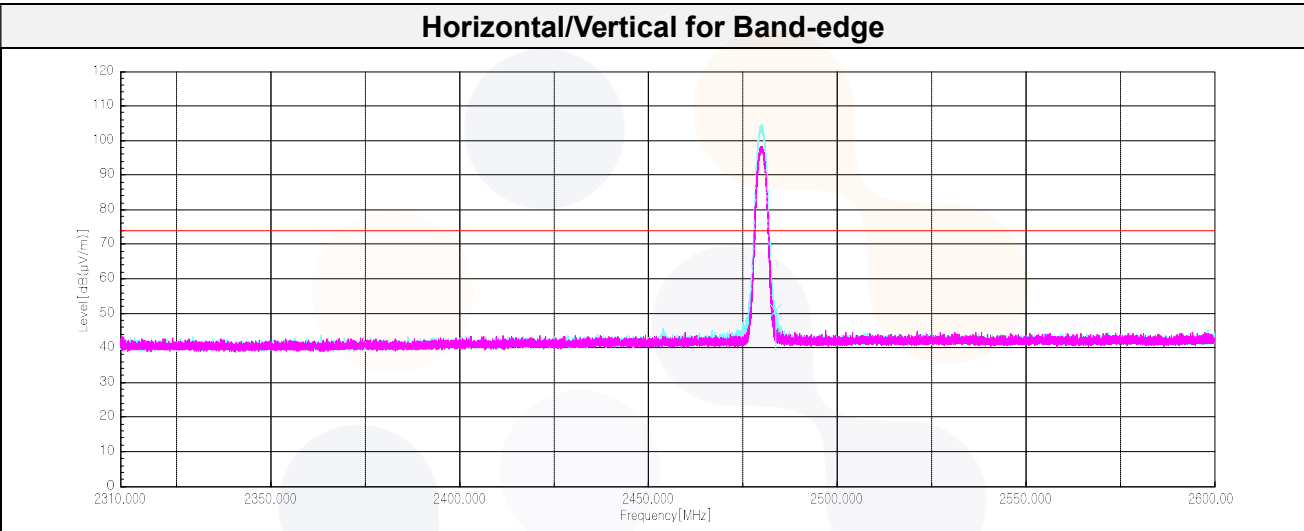


### Horizontal/Vertical for 3.5 GHz ~ 18 GHz

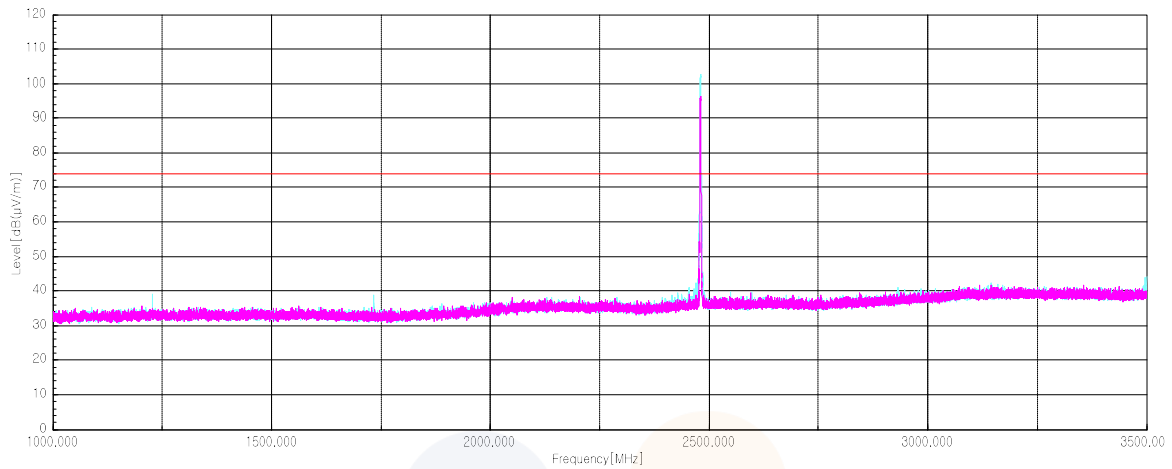


### 8DPSK\_High Channel

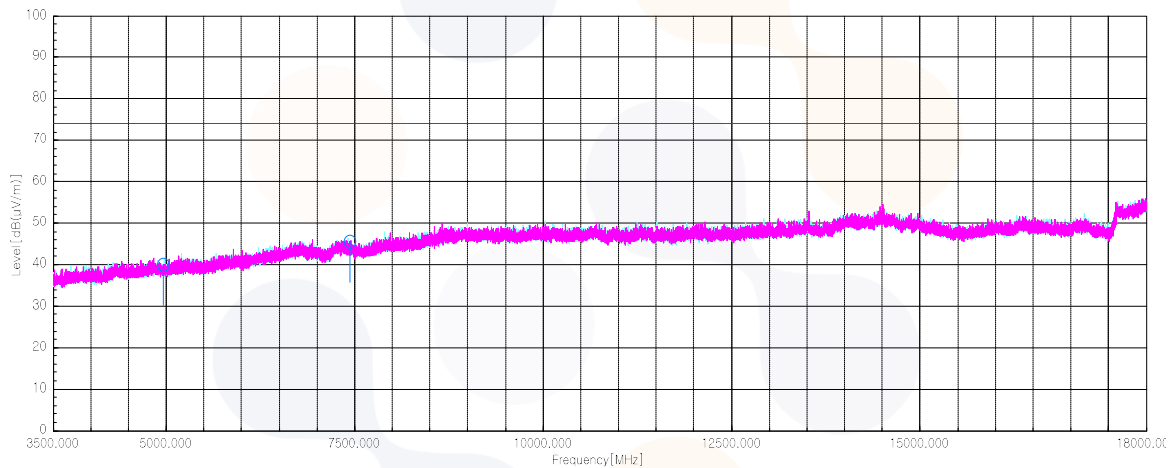
| Frequency                                                      | Pol.  | Reading         | Ant. Factor | Amp. + Cable | DCCF | Result            | Limit             | Margin |
|----------------------------------------------------------------|-------|-----------------|-------------|--------------|------|-------------------|-------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu V$ )) | (dB)        | (dB)         | (dB) | (dB( $\mu V/m$ )) | (dB( $\mu V/m$ )) | (dB)   |
| <b>Peak data</b>                                               |       |                 |             |              |      |                   |                   |        |
| 2 483.63 <sup>1)</sup>                                         | V     | 53.30           | 27.70       | -30.24       | -    | 50.76             | 74.00             | 23.24  |
| 4 957.25 <sup>1)</sup>                                         | H     | 52.50           | 32.81       | -45.44       | -    | 39.87             | 74.00             | 34.13  |
| 7 439.65 <sup>1)</sup>                                         | H     | 52.90           | 36.82       | -44.09       | -    | 45.63             | 74.00             | 28.37  |
| <b>Average Data</b>                                            |       |                 |             |              |      |                   |                   |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                 |             |              |      |                   |                   |        |



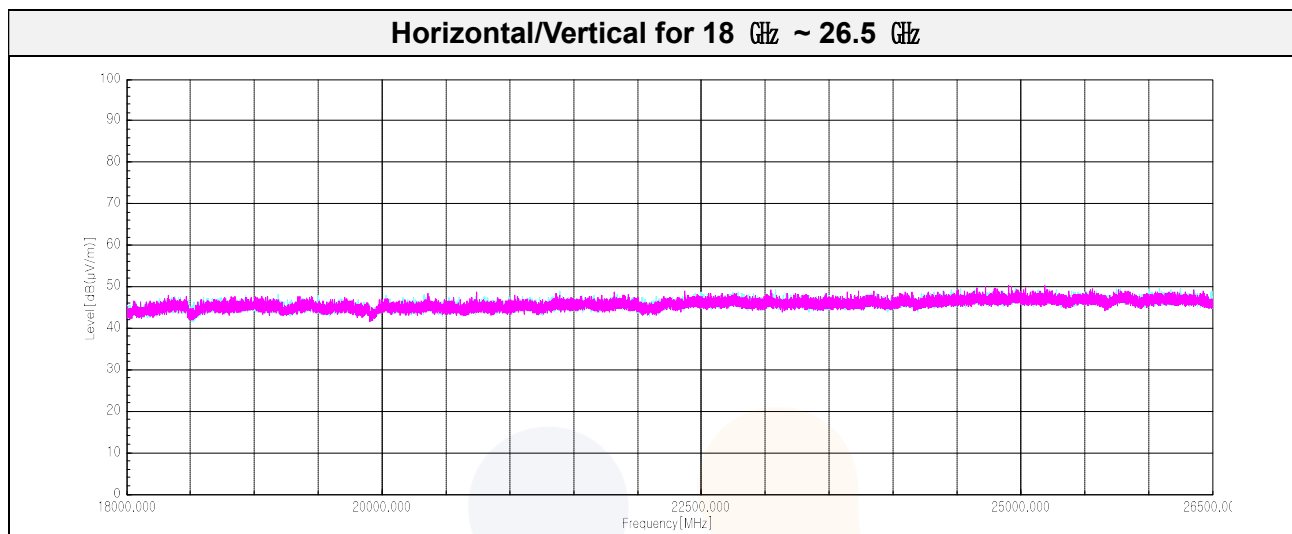
**Horizontal/Vertical for 1 GHz ~ 3.5 GHz**



**Horizontal/Vertical for 3.5 GHz ~ 18 GHz**



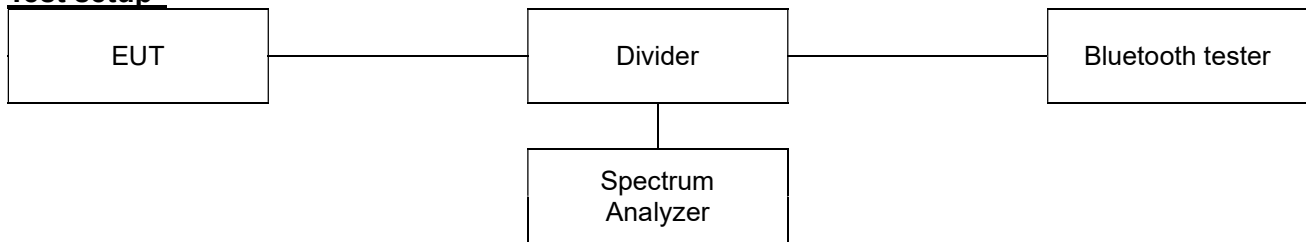
**Test results (Above 18 GHz) – Worst case: GFSK 2 480 MHz**



**Note:** The Worst case was based on the lowest margin condition considering Harmonic and Spurious Emission

## 7.7. Conducted Spurious Emission

### Test setup



### Limit

#### According to §15.247(d),

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operation, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation specified in §15.209(a) is not required. In addition, radiated emission limits specified in §15.209(a) (see §15.205(c)).

Limit : 20 dBc

### Test procedure

ANSI C63.10-2013 - Section 6.10.4, 7.8.8

### Test settings

#### ▪ Band-edge

- 1) 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
- 2) Reference level : As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log(\text{OBW}/\text{RBW})]$  below the reference level.
- 3) Attenuation: Auto (at least 10 dB preferred)
- 4) Sweep time = Coupled
- 5) RBW : 100 kHz
- 6) VBW : 300 kHz
- 7) Detector : Peak
- 8) Trace : Max hold

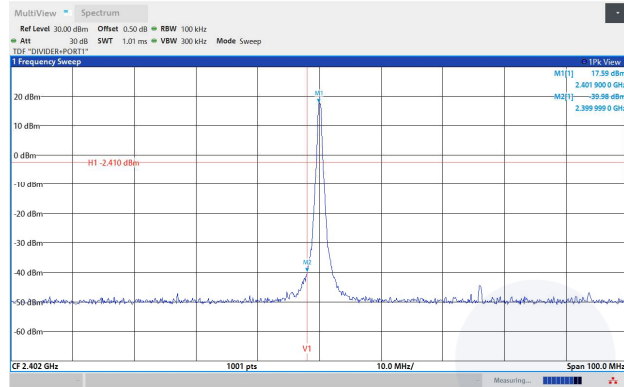
#### ▪ Spurious emissions

- 1) Span : 30 MHz to 10 times the operating frequency in GHz
- 2) RBW : 100 kHz
- 3) VBW : 300 kHz
- 4) Sweep time : Coupled
- 5) Detector : Peak

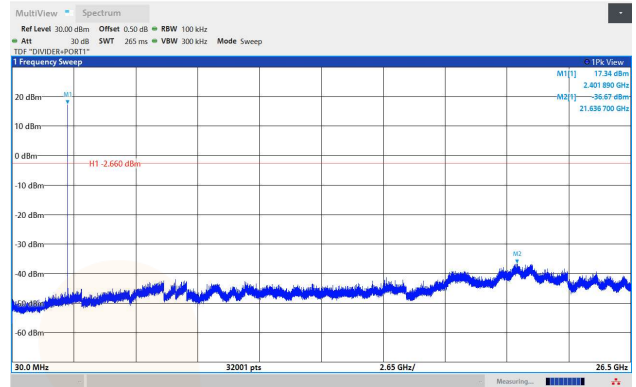
## Test results

### GFSK

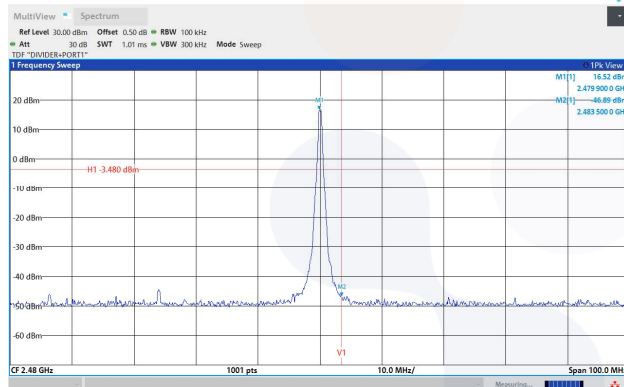
#### Conducted band-edge / Low ch.



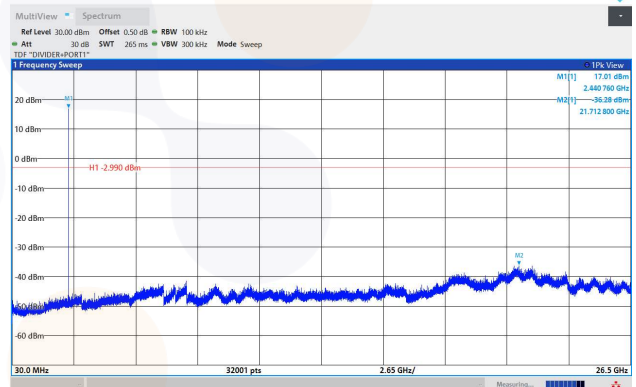
#### Conducted spurious / Low ch.



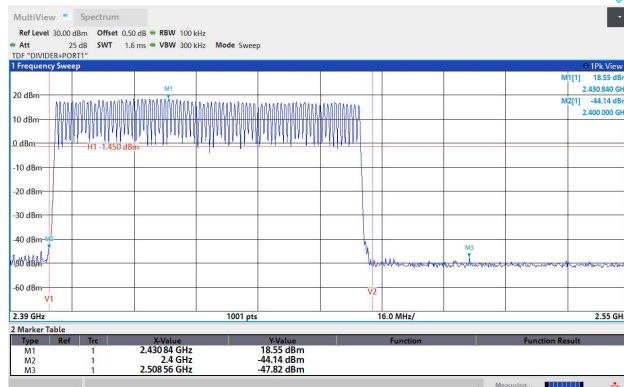
#### Conducted band-edge / High ch.



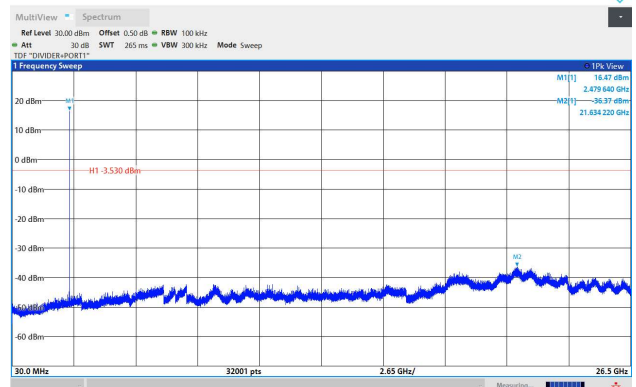
#### Conducted spurious / Mid ch.



#### Conducted band-edge / Hopping ch.

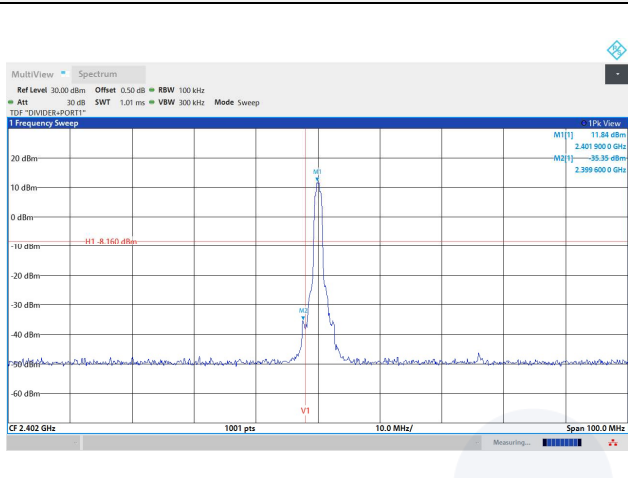


#### Conducted spurious / High ch.

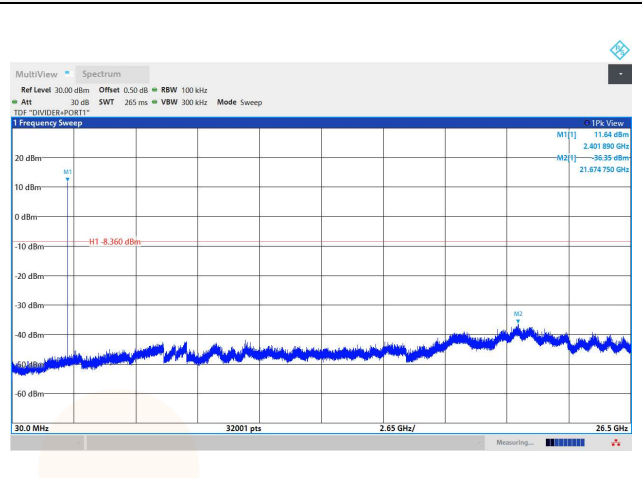


## 8DPSK

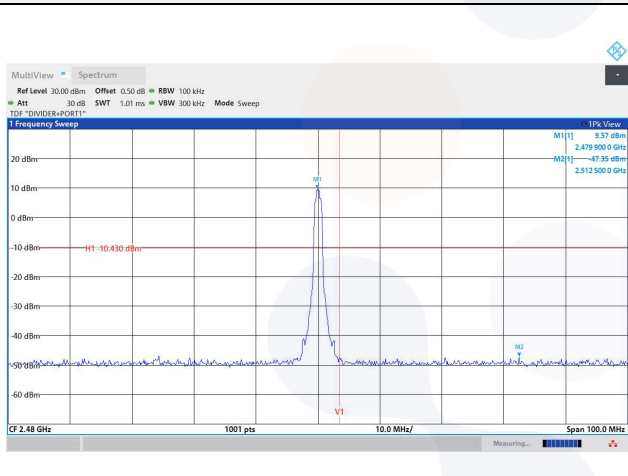
### Conducted band-edge / Low ch.



### Conducted spurious / Low ch.



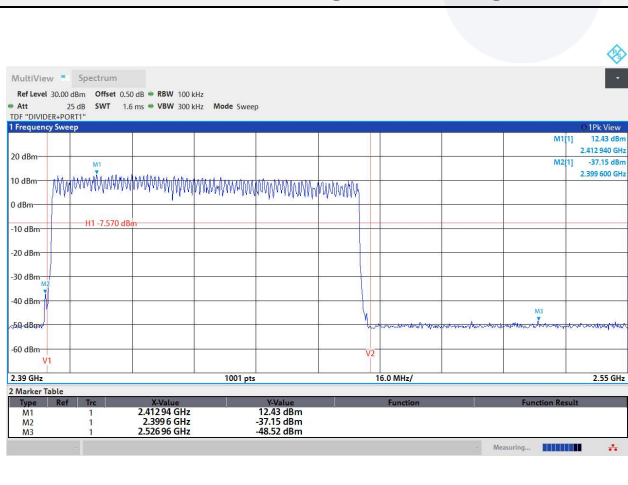
### Conducted band-edge / High ch.



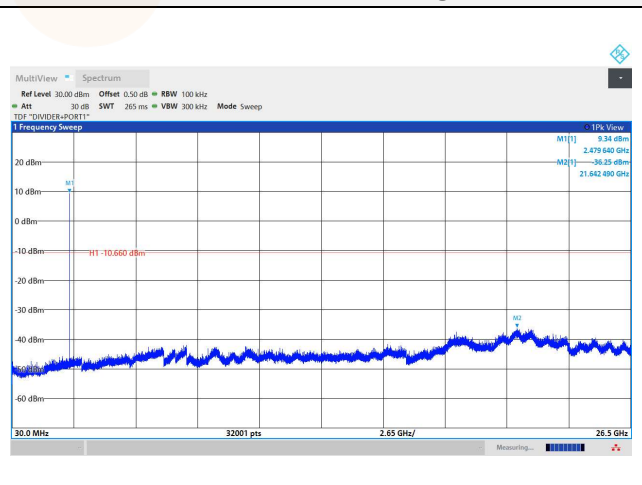
### Conducted spurious / Mid ch.



### Conducted band-edge / Hopping ch.

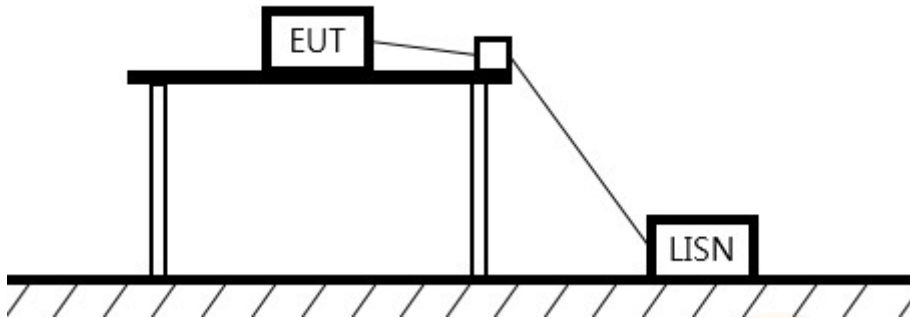


### Conducted spurious / High ch.



## 7.8. AC Conducted emission

### Test setup



### Limit

#### According to 15.207(a),

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

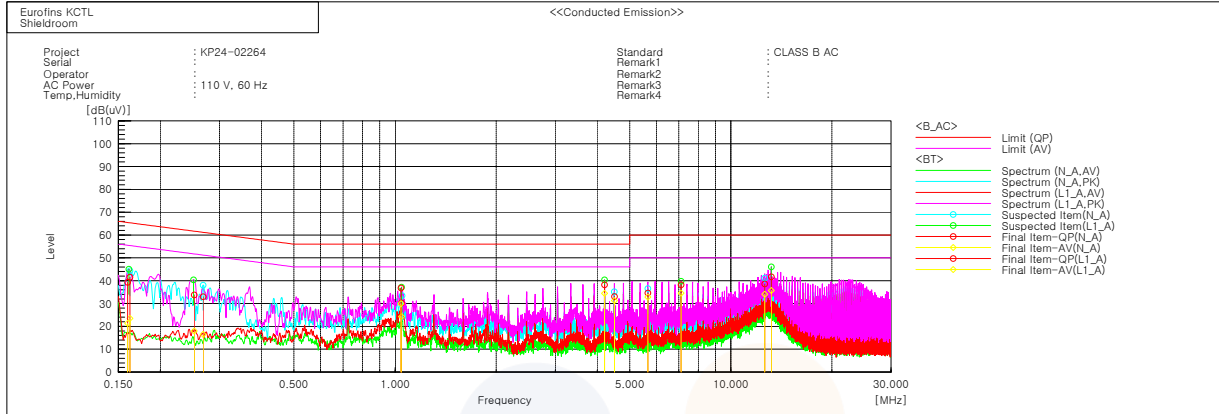
| Frequency of Emission (MHz) | Conducted limit (dBμV/m) |          |
|-----------------------------|--------------------------|----------|
|                             | Quasi-peak               | Average  |
| 0.15 – 0.50                 | 66 - 56*                 | 56 - 46* |
| 0.50 – 5.00                 | 56                       | 46       |
| 5.00 – 30.0                 | 60                       | 50       |

### Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

## Test results

### Worst case: GFSK 2 480 MHz



#### Final Result

##### --- N\_A Phase ---

| No. | Frequency [MHz] | Reading QP [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB] | Result QP [dB(uV)] | Result CAV [dB(uV)] | Limit QP [dB(uV)] | Limit AV [dB(uV)] | Margin QP [dB] | Margin CAV [dB] |
|-----|-----------------|---------------------|----------------------|----------|--------------------|---------------------|-------------------|-------------------|----------------|-----------------|
| 1   | 0.16234         | 31.3                | 13.2                 | 10.3     | 41.6               | 23.5                | 65.3              | 55.3              | 23.7           | 31.8            |
| 2   | 0.26811         | 23.0                | 6.5                  | 10.0     | 33.0               | 16.5                | 61.2              | 51.2              | 28.2           | 34.7            |
| 3   | 1.04561         | 20.2                | 14.3                 | 10.0     | 30.2               | 24.3                | 56.0              | 46.0              | 25.8           | 21.7            |
| 4   | 4.50037         | 23.0                | 21.3                 | 10.0     | 33.0               | 31.3                | 56.0              | 46.0              | 23.0           | 14.7            |
| 5   | 5.65999         | 24.5                | 22.8                 | 10.1     | 34.6               | 32.9                | 60.0              | 50.0              | 25.4           | 17.1            |
| 6   | 12.62475        | 27.8                | 23.3                 | 10.8     | 38.6               | 34.1                | 60.0              | 50.0              | 21.4           | 15.9            |

##### --- L1\_A Phase ---

| No. | Frequency [MHz] | Reading QP [dB(uV)] | Reading CAV [dB(uV)] | c.f [dB] | Result QP [dB(uV)] | Result CAV [dB(uV)] | Limit QP [dB(uV)] | Limit AV [dB(uV)] | Margin QP [dB] | Margin CAV [dB] |
|-----|-----------------|---------------------|----------------------|----------|--------------------|---------------------|-------------------|-------------------|----------------|-----------------|
| 1   | 0.15979         | 29.1                | 11.1                 | 10.2     | 39.3               | 21.3                | 65.5              | 55.5              | 26.2           | 34.2            |
| 2   | 0.25242         | 23.8                | 8.0                  | 10.0     | 33.8               | 18.0                | 61.7              | 51.7              | 27.9           | 33.7            |
| 3   | 1.04153         | 26.8                | 19.9                 | 10.0     | 36.8               | 29.9                | 56.0              | 46.0              | 19.2           | 16.1            |
| 4   | 4.20862         | 28.2                | 24.5                 | 10.0     | 38.2               | 34.5                | 56.0              | 46.0              | 17.8           | 11.5            |
| 5   | 7.11064         | 27.9                | 24.2                 | 10.3     | 38.2               | 34.5                | 60.0              | 50.0              | 21.8           | 15.5            |
| 6   | 13.2035         | 30.9                | 24.9                 | 10.8     | 41.7               | 35.7                | 60.0              | 50.0              | 18.3           | 14.3            |

## 8. Measurement equipment

| Equipment Name         | Manufacturer                | Model No.                   | Serial No.             | Next Cal. Date |
|------------------------|-----------------------------|-----------------------------|------------------------|----------------|
| Bluetooth Tester       | TESCOM                      | TC-3000B                    | 3000B640056            | 25.01.19       |
| Spectrum Analyzer      | R&S                         | FSV3040                     | 101427                 | 25.03.28       |
| Signal Generator       | R&S                         | SMB100A                     | 176206                 | 25.01.18       |
| DC Power Supply        | AGILENT                     | E3632A                      | MY40000265             | 24.04.27       |
| Power Divider          | Marki Microwave, Inc.       | PD-0040                     | D0002                  | 24.07.04       |
| Power Sensor           | R&S                         | NRP-Z81                     | 1137.9009.02-106224-tg | 24.09.12       |
| Spectrum Analyzer      | R&S                         | FSVA40                      | 101575                 | 24.06.19       |
| Spectrum Analyzer      | R&S                         | FSV40                       | 100988                 | 24.07.03       |
| PSA Spectrum Analyzer  | Agilent                     | E4440A                      | MY44303500             | 24.07.04       |
| EMI TEST RECEIVER      | R&S                         | ESC13                       | 101408                 | 24.08.18       |
| TWO-LINE V - NETWORK   | R&S                         | ENV216                      | 101358                 | 24.09.27       |
| Bluetooth Tester       | TESCOM                      | TC-3000C                    | 3000C000270            | 24.07.04       |
| Broadband PreAmplifier | SCHWARZBECK                 | BBV9718D                    | 57                     | 25.01.19       |
| Low Noise Amplifier    | TESTEK                      | TK-PA18H                    | 220124-L               | 24.10.12       |
| Low Noise Amplifier    | TESTEK                      | TK-PA1840H                  | 220133-L               | 24.10.17       |
| Amplifier              | SONOMA INSTRUMENT           | 310N                        | 421910                 | 24.10.12       |
| Bilog Antenna          | Teseq GmbH                  | CBL 6112D                   | 61521                  | 24.11.17       |
| Loop Antenna           | R&S                         | HFH2-Z2                     | 100355                 | 24.08.10       |
| Horn Antenna           | SCHWARZBECK                 | BBHA9120D                   | 2763                   | 24.10.18       |
| Horn Antenna           | SCHWARZBECK                 | BBHA9170                    | 1267                   | 24.10.16       |
| High Pass Filter       | Wainwright Instruments GmbH | WHKX12-2805-3000-18000-40SS | SN58                   | 24.10.16       |
| High Pass Filter       | QOTANA TECHNOLOGIES         | DBHF0508004000A             | 23041800061            | 24.07.10       |

**End of test report**