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# TEST REPORT

**Eurofins KCTL Co.,Ltd.**
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Suwon-si, Gyeonggi-do, 16677, Korea
TEL: 82-70-5008-1021 FAX: 82-505-299-8311
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eurofins | KCTL

**1. Client**

- Name : CAMTIC
- Address : 67, Yusang-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, Republic of Korea
- Date of Receipt : 2023-07-18

**2. Use of Report** : Certification

**3. Name of Product / Model** : SKY KICK-CTR/ SKICK-C

**4. Manufacturer / Country of Origin** : CAMTIC / Korea

**5. FCC ID** : 2BB5P-SKYKICK-CTR

**6. Date of Test** : 2023-07-31 to 2023-08-11

**7. Location of Test** : ■ Permanent Testing Lab ☐ On Site Testing
(Address:65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)

**8. Test method used** : FCC Part 15 Subpart C, 15.249

**9. Test Result** : Refer to the test result in the test report

| | | |
|---|---|---|
| Affirmation | Tested by<br>Name : Hyesom Shin (Signature) | Technical Manager<br>Name : Harim Lee (Signature) |

2023-09-22

**Eurofins KCTL Co.,Ltd.**

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by Eurofins KCTL Co.,Ltd.

## REPORT REVISION HISTORY

| Date | Revision | Page No |
|---|---|---|
| 2023-09-22 | Originally issued | - |
| | | |
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| | | |

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## General remarks for test reports

**Statement concerning the uncertainty of the measurement systems used for the tests**

(may be required by the product standard or client)

☐ **Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:**

**Procedure number, issue date and title:**

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ **Statement not required by the standard or client used for type testing**

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# 1. General information

| | | |
|---|---|---|
| Client | : | CAMTIC |
| Address | : | 67, Yusang-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, Republic of Korea |
| Manufacturer | : | CAMTIC |
| Address | : | 67, Yusang-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, Republic of Korea |
| Laboratory | : | Eurofins KCTL Co.,Ltd. |
| Address | : | 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea |
| Accreditations | : | FCC Site Designation No: KR0040, FCC Site Registration No: 687132 |
| | | VCCI Registration No. : R-20080, G-20078, C-20059, T-20056 |
| | | CAB Identifier: KR0040 |
| | | ISED Number: 8035A |
| | | KOLAS No.: KT231 |

# 2. Device information

| | | |
|---|---|---|
| Equipment under test | : | SKY KICK-CTR |
| Model | : | SKICK-C |
| Modulation technique | : | GFSK |
| Number of channels | : | 78 ch |
| Power source | : | DC 3 V |
| Antenna specification | : | Wire Antenna |
| Antenna gain | : | -3.8 dBi |
| Frequency range | : | 2 403 ㎒ ~ 2 480 ㎒ |
| Software version | : | 23.6.1 |
| Hardware version | : | 23.6.1 |
| Test device serial No. | : | N/A |
| Operation temperature | : | -20 ℃ ~ 50 ℃ |

## 2.1. Frequency/channel operations

| Ch. | Frequency (㎒) |
|---|---|
| Low | 2 403 |
| Mid | 2 440 |
| High | 2 480 |

Table 2.1.1 GFSK

## 3. Antenna requirement

**Requirement of FCC part section 15.203:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

- The transmitter has permanently attached Wire Antenna on board.
- The E.U.T Complies with the requirement of §15.203, §15.249.

# 4. Summary of tests

| FCC Part Section(s) | Parameter | Test Condition | Test Results |
|---|---|---|---|
| 15.215(c) | 20 dB Bandwidth | Conducted | Pass |
| 15.249(a),(d),(e) | Field strength of fundamental & harmonic | Radiated | Pass |

**Notes:**

1. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
2. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation
3. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013

# 5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k$=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the $U_{CISPR}$ measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

| Parameter | Expanded uncertainty (±) | |
|---|---|---|
| Radiated spurious emissions | Below 30 ㎒ | 2.3 ㏈ |
| | 30 ㎒ to 1 000 ㎒ | 2.5 ㏈ |
| | 1 000 ㎒ to 18 000 ㎒ | 4.7 ㏈ |
| | Above 18 000 ㎒ | 4.8 ㏈ |

# 6. Test results

## 6.1. 20 dB Bandwidth

**Limit**

According to §15.215(c), For Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained.

**Test procedure**

ANSI C63.10 – Section 6.9.2, 6.9.3

**Occupied bandwidth (or 20 dB emission bandwidth)**

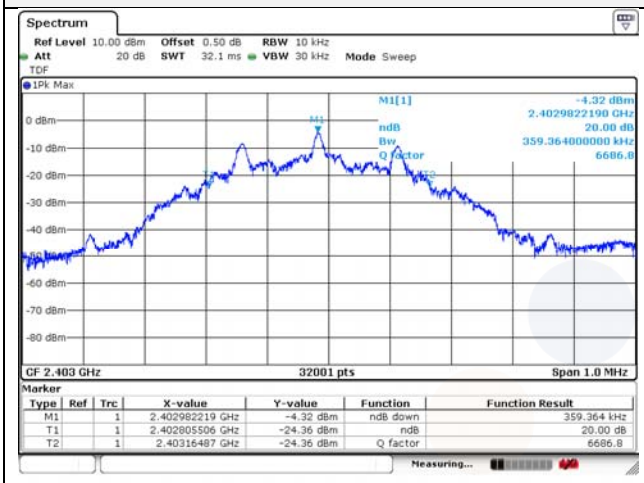
The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −26 dB, corresponding to 6 dB BW, 20 dB BW, and 26 dB BW, respectively. In this subclause, the ratio is designated by "−xx dB." The reference value is either the level of the unmodulated carrier or the highest level of the spectral envelope of the modulated signal, as stated by the applicable requirement. Some requirements might specify a specific maximum or minimum value for the "−xx dB" bandwidth; other requirements might specify that the "−xx dB" bandwidth be entirely contained within the authorized or designated frequency band

## Test results

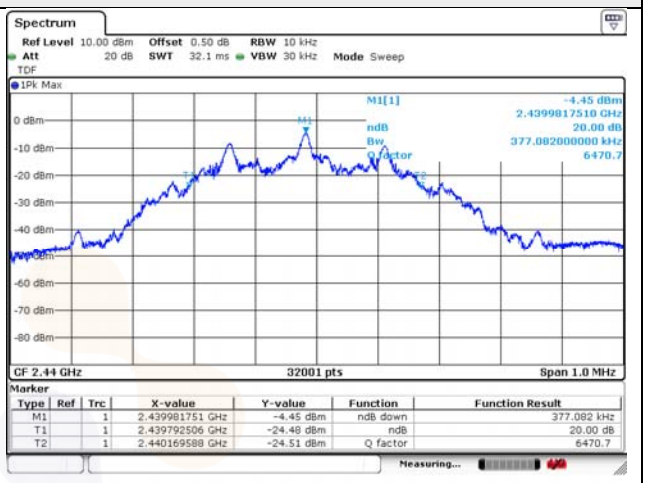
| Test mode | Frequency(㎒) | 20 ㏈ Bandwidth(㎐) |
|---|---|---|
| GFSK | 2 403 | 0.359 |
| | 2 440 | 0.377 |
| | 2 480 | 0.362 |

**20 ㏈ bandwidth**

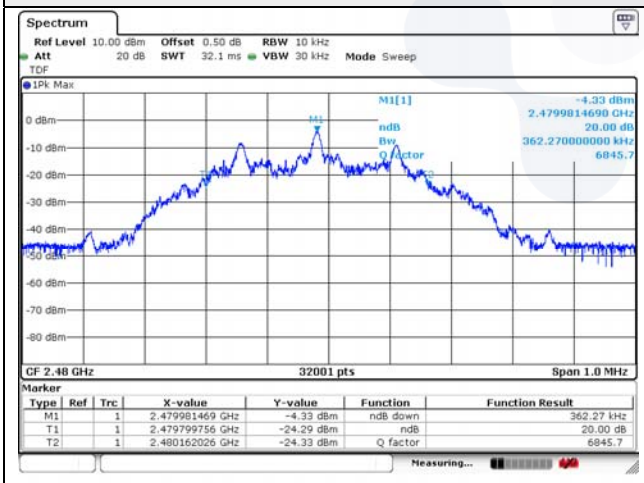
**2 403 ㎒**




**2 440 ㎒**




**2 480 ㎒**

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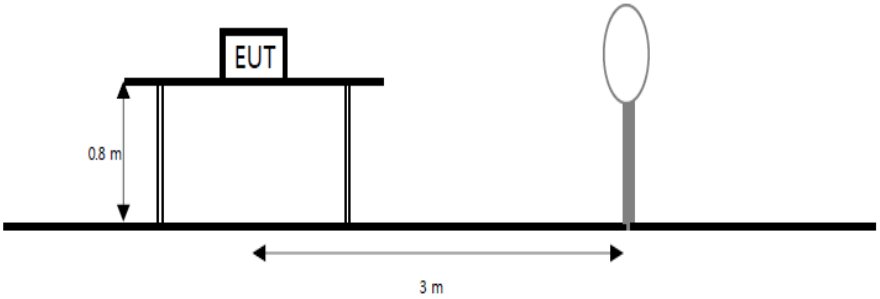
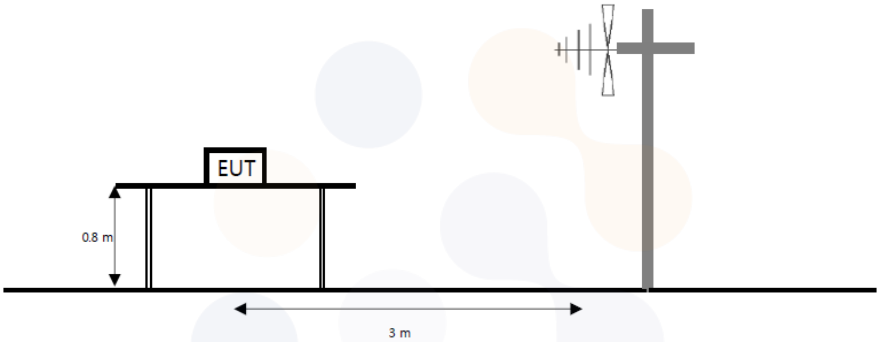
## 6.2. Field strength of fundamental & harmonic

**Test setup**

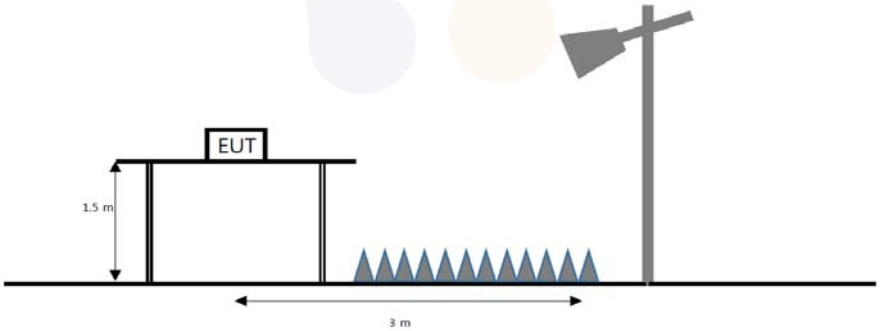
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ emissions.



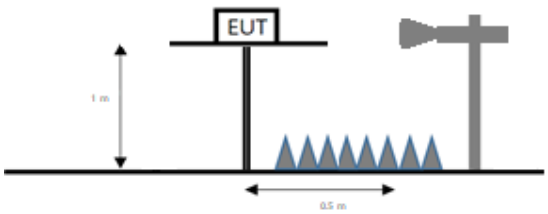

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 40 ㎓ emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from Above 40 ㎓ emissions.



**Limit**

According to section 15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (㎒) | Field strength (㎛/m) | Measurement distance (m) |
|---|---|---|
| 0.009 - 0.490 | 2 400/F(㎑) | 300 |
| 0.490 - 1.705 | 24 000/F(㎑) | 30 |
| 1.705 - 30 | 30 | 30 |
| 30 - 88 | 100** | 3 |
| 88 - 216 | 150** | 3 |
| 216 - 960 | 200** | 3 |
| Above 960 | 500 | 3 |

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 ㎒, 76–88 ㎒, 174–216 ㎒ or 470–806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section15.231 and 15.241.

According to section 15.249(a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Frequency (㎒) | Field strength of fundamental (㎷/m) | Field strength of harmonics (㎛/m) |
|---|---|---|
| 902 – 928 | 50 | 500 |
| 2 400 – 2 483.5 | 50 | 500 |
| 5 725 – 5 875 | 50 | 500 |
| 24 000 – 24 250 | 250 | 2 500 |

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 ㎓ band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2 500 millivolts/meter.
(2) The frequency tolerance of the carrier signal shall be maintained within ±0.001% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.
(3) Antenna gain must be at least 33 ㏈i. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 ㏈i or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2 500 millivolts/meter.

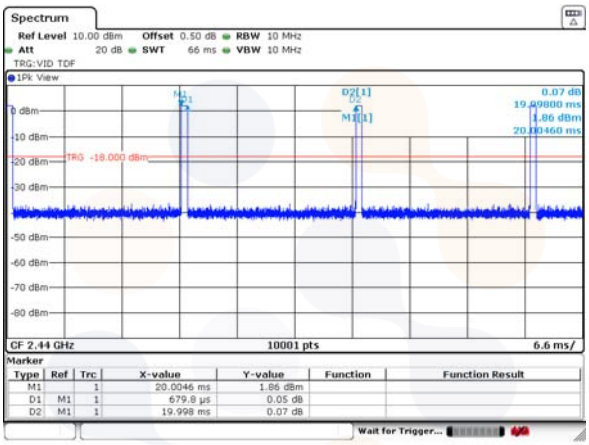
(c) Field strength limits are specified at a distance of 3 meters.
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

**Notes:**

1. $f$ <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/D_s)$
   $f$ ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/D_s)$
   Where:
   $F_d$= Distance factor in ㏈
   $D_m$= Measurement distance in meters
   $D_s$= Specification distance in meters
2. Duty Cycle Factor

| Test mode | Period (㎳) | On time (㎳) | Duty cycle | | Duty Cycle Factor (㏈) |
|---|---|---|---|---|---|
| | | | (Linear) | (%) | |
| GFSK | 19.998 0 | 0.679 8 | 0.034 0 | 3.40 | 14.68 |

**GFSK**



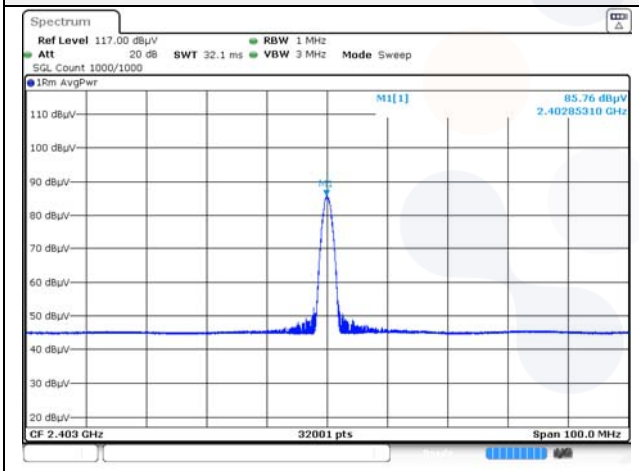

3. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) - or $F_d$(㏈)
4. [1)] means restricted band
5. Average test would be performed if the peak result were greater than the average limit.
6. Band edge Limit = The main wave limit is 50 �V/m at 3 m, attenuate 50 ㏈.
   This Average limit, so:
   93.98 ㏈㎶ - 50 ㏈ = 43.98 ㏈㎶
   General 15.209 limit = 54.00 ㏈㎶
   43.98 ㏈㎶ or 54.00 ㏈㎶ whichever is the lesser attenuation.
   This results Band edge limit 54.00 ㏈㎶

## Test results

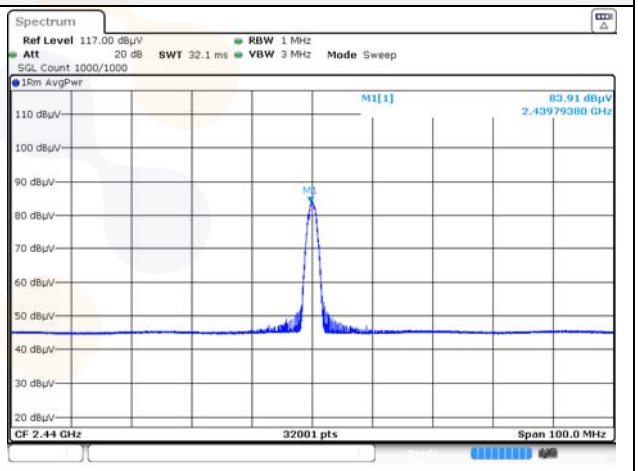
### Field strength of fundamental

| Frequency | Pol. | Reading | Antenna Factor | Amp. + Cable | DCF | Result | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| [MHz] | [V/H] | [dB(μV)] | [dB] | [dB] | [dB] | [dB(μV/m)] | [dB(μV/m)] | [dB] |
| **Peak data** | | | | | | | | |
| 2 402.85 | H | 103.81 | 27.43 | -47.88 | - | 83.36 | 113.98 | 30.62 |
| 2 439.79 | H | 104.43 | 27.60 | -48.01 | - | 84.02 | 113.98 | 29.96 |
| 2 479.99 | H | 105.37 | 27.80 | -48.13 | - | 85.04 | 113.98 | 28.94 |
| **Average Data** | | | | | | | | |
| 2 402.85 | H | 85.76 | 27.43 | -47.88 | 14.68 | 79.99 | 93.98 | 13.99 |
| 2 439.79 | H | 83.91 | 27.60 | -48.01 | 14.68 | 78.18 | 93.98 | 15.80 |
| 2 479.99 | H | 87.41 | 27.90 | -48.13 | 14.68 | 81.86 | 93.98 | 12.12 |

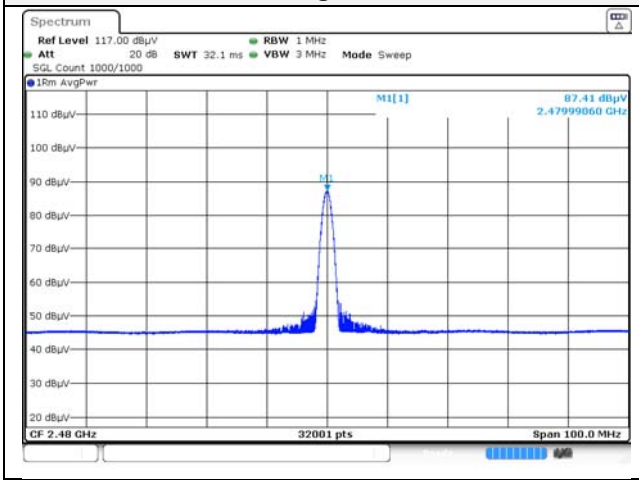
**Average Data**




**Average Data**




**Average Data**




**Average Data**

Blank

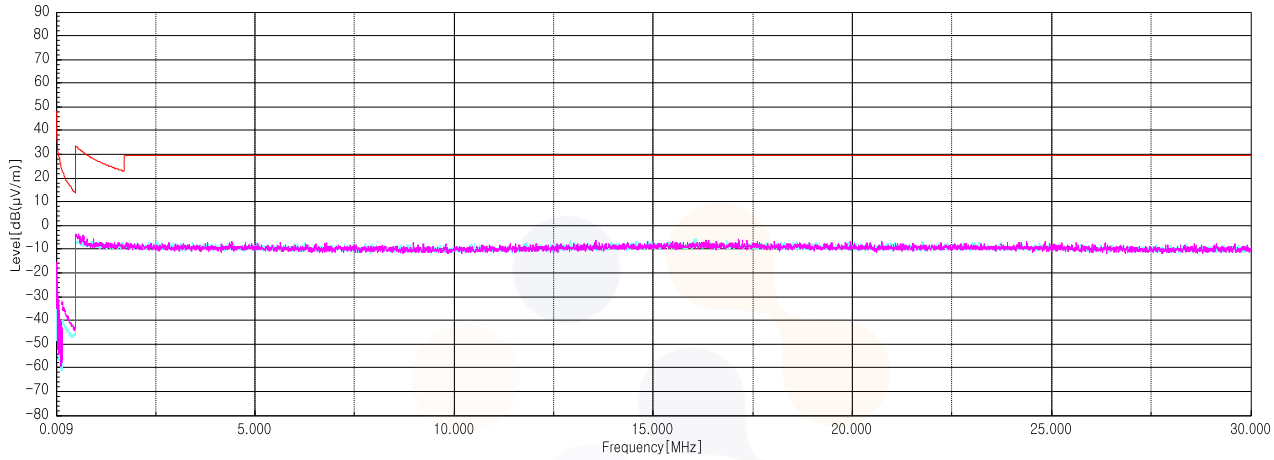
## Field strength of harmonics

**[Below 30 ㎒]**

**Worst case: GFSK_2 480 ㎒**

| Frequency | Pol. | Reading | Cable Loss | Amp Gain | Antenna Factor | DCCF | Result | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| [㎒] | [V/H] | [dB(μV)] | [dB] | [dB] | [dB] | [dB] | [dB(μV/m)] | [dB(μV/m)] | [dB] |
| No spurious emissions were detected within 20 ㏈ of the limit. | | | | | | | | | |

**Horizontal/Vertical**

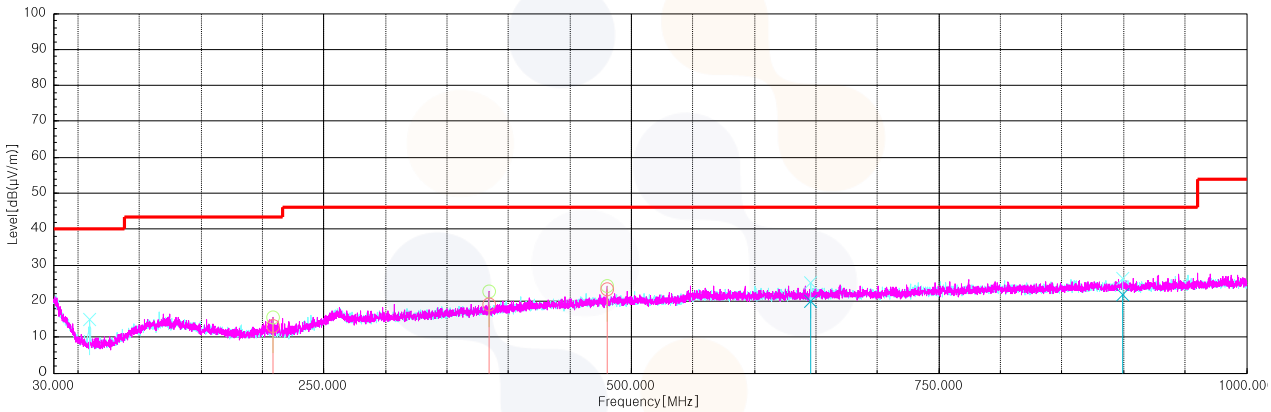


**[Below 1 000 ㎒]**

**Worst case: GFSK_2 480 ㎒**

| Frequency | Pol. | Reading | Antenna Factor | Amp. + Cable | DCF | Result | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| (㎒) | (V/H) | (dB(㎶)) | (dB) | (dB) | (dB) | (dB(㎶/m)) | (dB(㎶/m)) | (dB) |
| **Quasi peak data** | | | | | | | | |
| 59.46 | V | 32.10 | 12.20 | -31.72 | - | 12.58 | 40.00 | 27.42 |
| 208.36 | H | 28.90 | 15.48 | -31.40 | - | 12.98 | 43.50 | 30.52 |
| 384.05 | H | 29.30 | 20.90 | -31.09 | - | 19.11 | 46.00 | 26.89 |
| 480.08 | H | 30.90 | 23.00 | -30.68 | - | 23.22 | 46.00 | 22.78 |
| 645.95 | V | 25.60 | 24.80 | -30.49 | - | 19.91 | 46.00 | 26.09 |
| 899.36 | V | 24.50 | 26.50 | -29.30 | - | 21.70 | 46.00 | 24.30 |

**Horizontal/Vertical**

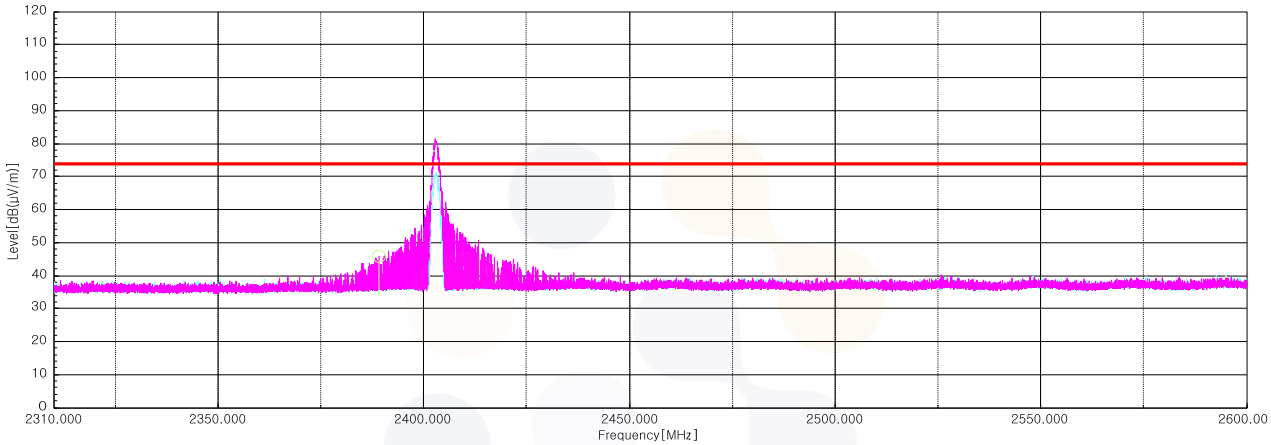


**[Above 1 000 ㎒]**

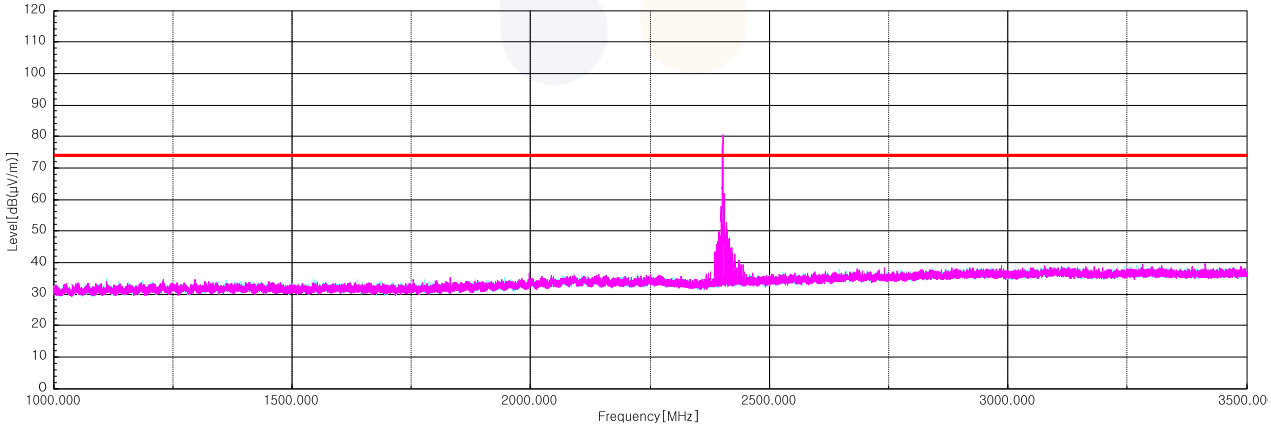
**GFSK_2 403 ㎒**

| Frequency | Pol. | Reading | Antenna Factor | Amp. + Cable | DCF | Result | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| [㎒] | [V/H] | [dB(μV)] | [dB] | [dB] | [dB] | [dB(μV/m)] | [dB(μV/m)] | [dB] |
| **Peak data** | | | | | | | | |
| 2 389.16[1)] | H | 50.40 | 27.29 | -31.90 | - | 45.79 | 74.00 | 28.21 |
| 4 805.48[1)] | H | 62.10 | 32.31 | -48.07 | - | 46.34 | 74.00 | 27.66 |
| 7 211.03 | V | 54.30 | 36.94 | -46.30 | - | 44.94 | 74.00 | 29.06 |

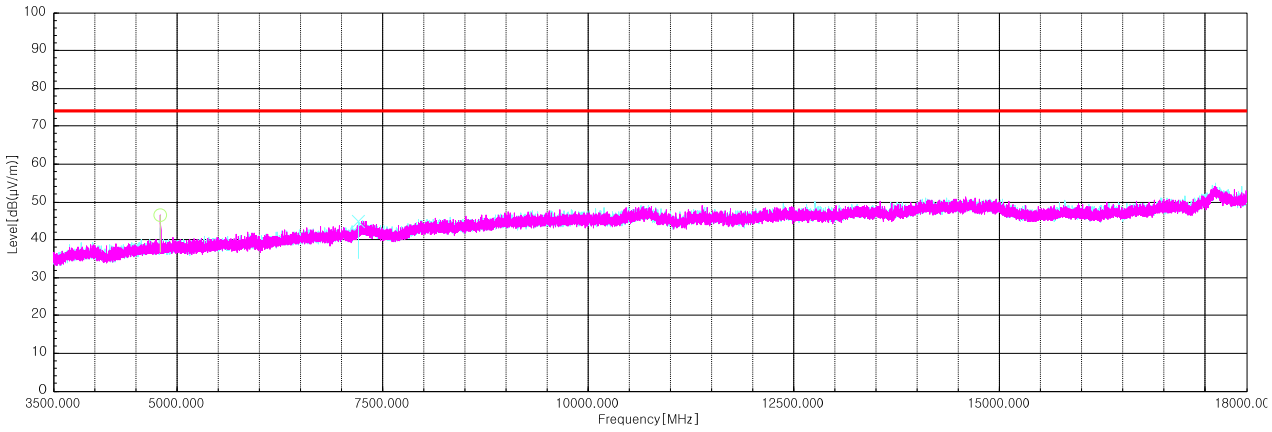
**Horizontal/Vertical for Band-edge**




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



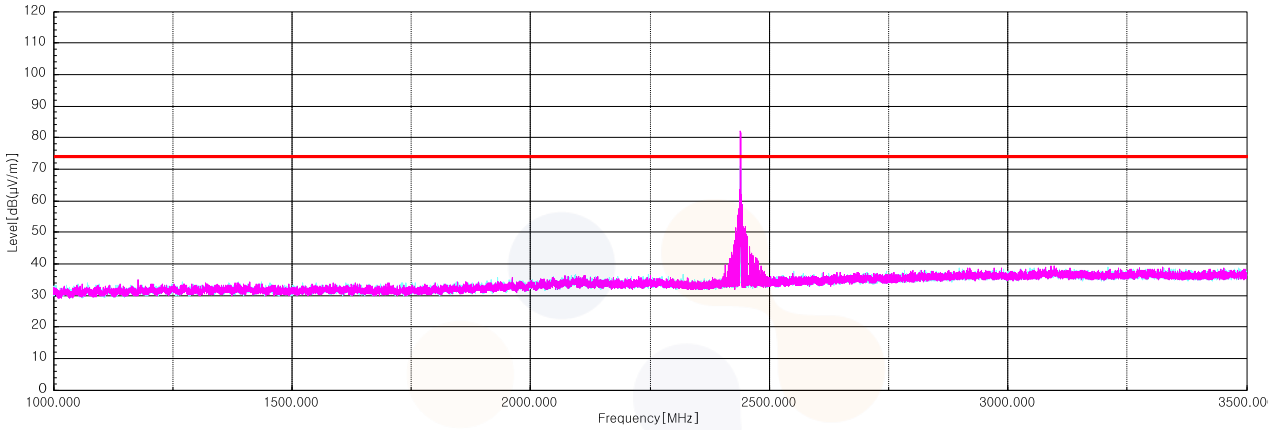
**Horizontal/Vertical for 3.5 GHz ~ 18 GHz**



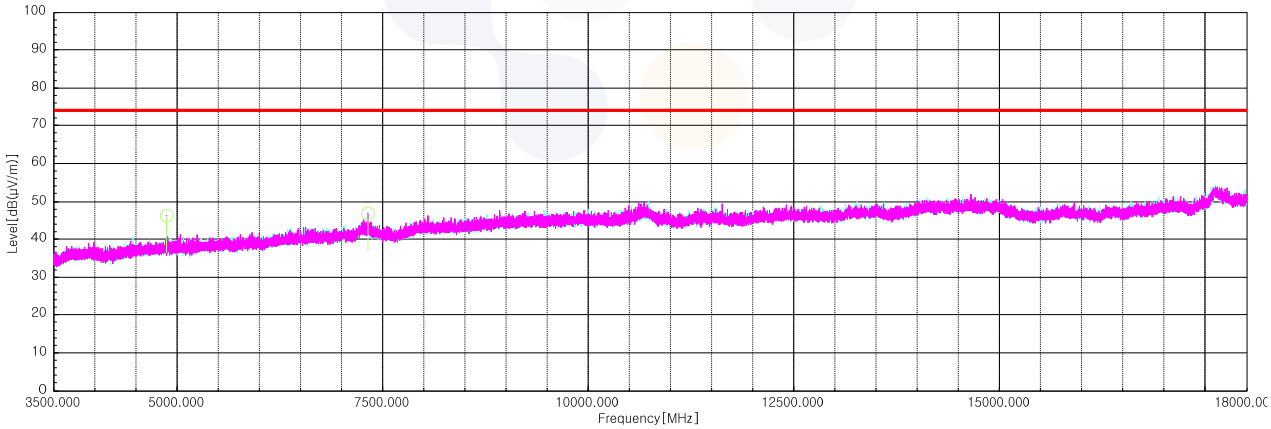
## GFSK_2 440 MHz

| Frequency | Pol. | Reading | Antenna Factor | Amp. + Cable | DCF | Result | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| [MHz] | [V/H] | [dB(μV)] | [dB] | [dB] | [dB] | [dB(μV/m)] | [dB(μV/m)] | [dB] |
| **Peak data** | | | | | | | | |
| 4 879.92[1)] | H | 61.20 | 32.62 | -47.67 | - | 46.15 | 74.00 | 27.85 |
| 7 319.78[1)] | H | 56.40 | 36.86 | -46.45 | - | 46.81 | 74.00 | 27.19 |

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

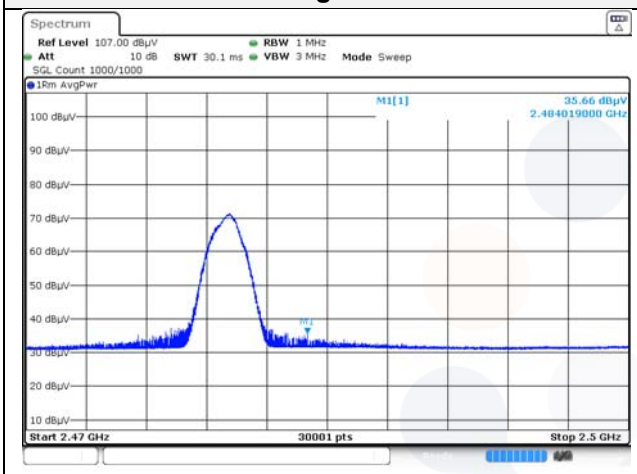



**Horizontal/Vertical for 3.5 GHz ~ 18 GHz**

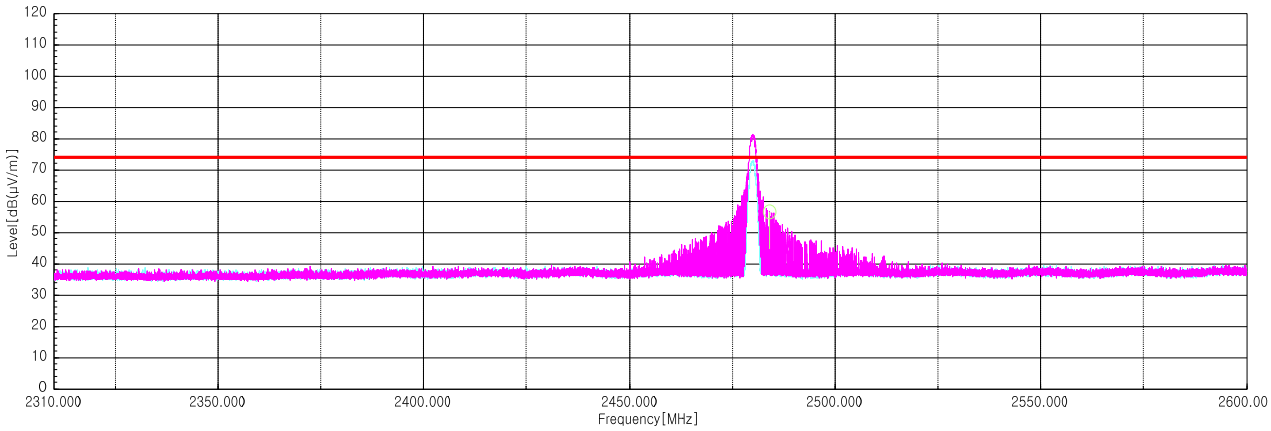


**GFSK_2 480 ㎒**

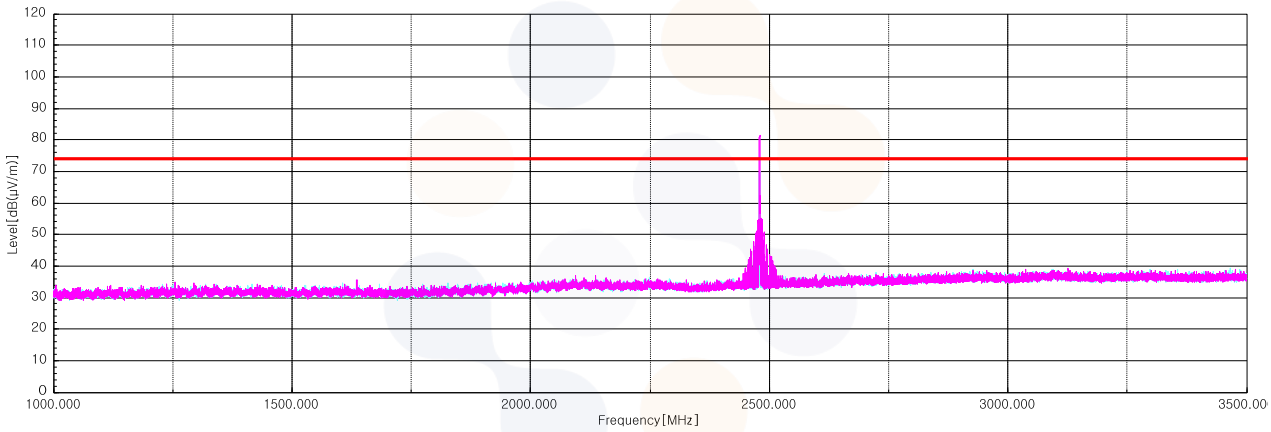
| Frequency | Pol. | Reading | Antenna Factor | Amp. + Cable | DCF | Result | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| [㎒] | [V/H] | [dB(μV)] | [dB] | [dB] | [dB] | [dB(μV/m)] | [dB(μV/m)] | [dB] |
| **Peak data** | | | | | | | | |
| 2 484.02[1)] | H | 61.20 | 27.80 | -32.27 | - | 56.73 | 74.00 | 17.27 |
| 4 959.67[1)] | H | 63.10 | 33.06 | -47.50 | - | 48.66 | 74.00 | 25.34 |
| 7 098.42 | V | 54.90 | 36.39 | -46.15 | - | 45.14 | 74.00 | 28.86 |
| **Average Data** | | | | | | | | |
| 2 484.02[1)] | H | 35.66 | 27.80 | -32.27 | 14.68 | 45.87 | 54.00 | 8.13 |

| Average Data | Average Data |
|---|---|
|  | Blank |

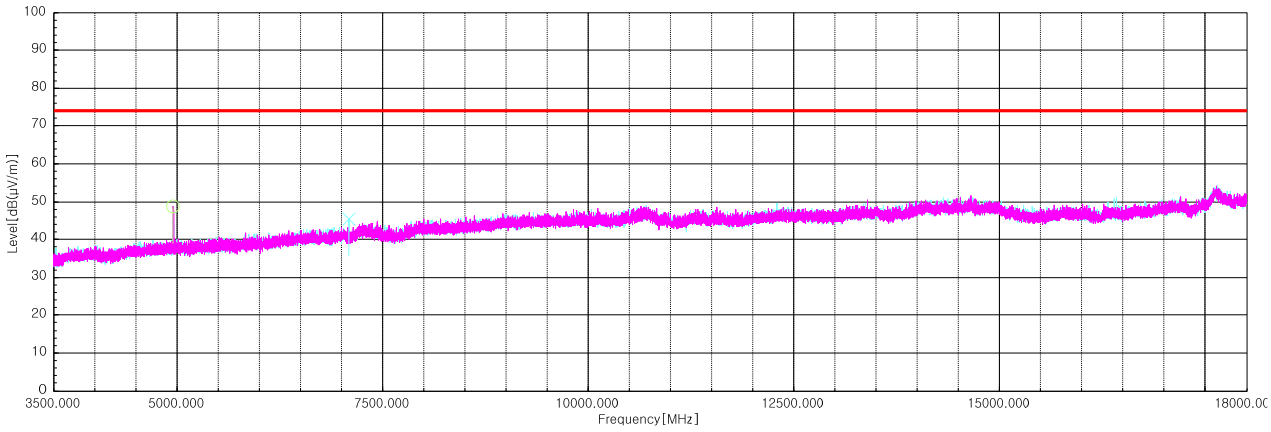
## Horizontal/Vertical for Band-edge




## Horizontal/Vertical for 1 GHz ~ 3.5 GHz



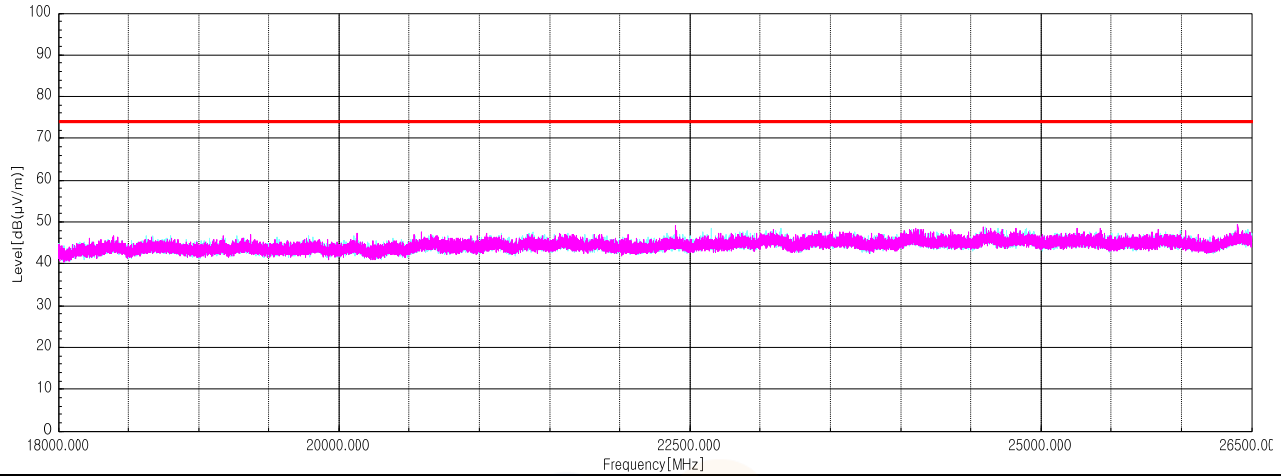

## Horizontal/Vertical for 3.5 GHz ~ 18 GHz



**[Above 18 ㎓]**

**Worst case: GFSK_2 480 ㎒**

**Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓**




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

## 7. Measurement equipment

| Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSV30 | 100810 | 24.07.03 |
| Attenuator | API Inmet | 40AH2W-10 | 11 | 24.05.03 |
| DC Power Supply | AGILENT | E3632A | MY40016393 | 24.07.03 |
| Controller | INNCO SYSTEMS | CO3000 | 1441/54370322/P | - |
| Antenna Mast | INNCO SYSTEMS | MA4640-XP-ET | - | - |
| Turn Device | INNCO SYSTEMS | DS1200-S-1t | - | - |
| Spectrum Analyzer | R&S | FSVA40 | 101575 | 24.06.19 |
| PSA Spectrum Analyzer | Agilent | E4440A | MY46186407 | 24.03.22 |
| Broadband PreAmplifier | SCHWARZBECK | BBV9718D | 57 | 24.03.17 |
| Low Noise Amplifier | TESTEK | TK-PA18H | 220124-L | 23.12.02 |
| Low Noise Amplifier | TESTEK | TK-PA1840H | 220133-L | 23.12.02 |
| Amplifier | SONOMA INSTRUMENT | 310N | 421821 | 23.12.14 |
| Horn Antenna | SCHWARZBECK | BBHA9120D | 2763 | 23.12.06 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | 1267 | 23.12.05 |
| Bilog Antenna | Teseq GmbH | CBL 6112D | 63756 | 24.11.17 |
| Loop Antenna | R&S | HFH2-Z2 | 100355 | 24.08.10 |
| High Pass Filter | Wainwright Instruments GmbH | WHKX12-2805-3000-18000-40SS | SN58 | 23.12.14 |
| Signal Generator | R&S | SMB100A | 176206 | 24.01.19 |

**End of test report**