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TEST REPORT

Eurofins KCTL Co.,Ltd.
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1. Client

- Name : CAMTIC
- Address : 67, Yusang-ro, Deokjin-gu, Jeonju-si, Jeollabuk-do, Republic of Korea
- Date of Receipt : 2023-07-11

2. Use of Report : Certification

3. Name of Product / Model : SKY KICK / SKICK

4. Manufacturer / Country of Origin : CAMTIC / Korea

5. FCC ID : 2BB5P-SKYKICK

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 Name : Hyesom Shin (Signature)	Technical Manager Name : Harim Lee (Signature)

2023-10-06

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	-
2023-10-06	Updated	5

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Note. The report No. KR23-SRF0208 is superseded by the report No. KR23-SRF0208-A.

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
Model	:	SKICK
Modulation technique	:	GFSK
Number of channels	:	78 ch
Power source	:	DC 7.6 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

2.2. Maximum Conducted output power

Frequency(㎒)	Measured Conducted Output Power		
	Reading	D.C.F.	Result
	(dBm)	(dB)	(dBm)
2 403	-20.29	14.69	-5.60
2 440	-20.07	14.69	-5.38
2 480	-19.98	14.69	-5.29

Note.
Measured output power(Average) = Reading value of average power + D.C.F.

2.3. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
Battery	CAMTIC	Lithium-ion Polymer battery	N/A	500mAh/2S/7.6V/40C

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		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 kHz to 30 MHz. 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 MHz	2.3 dB
	30 MHz to 1 000 MHz	2.5 dB
	1 000 MHz to 18 000 MHz	4.7 dB
	Above 18 000 MHz	4.8 dB

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)

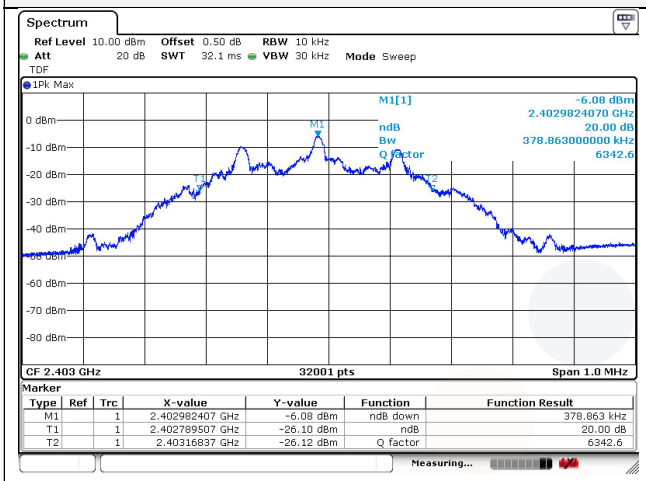
The occupied bandwidth is measured as the width of the spectral envelope of the modulated signal, at an amplitude level reduced from a reference value by a specified ratio (or in decibels, a specified number of dB down from the reference value). Typical ratios, expressed in dB, are −6 dB, −20 dB, and −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

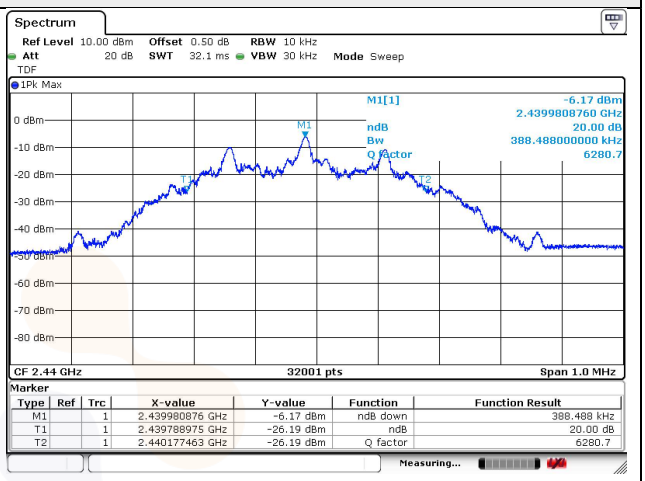
Test mode	Frequency(㎒)	20 ㏈ Bandwidth(㎐)
GFSK	2 403	0.379
	2 440	0.388
	2 480	0.393

20 ㏈ bandwidth

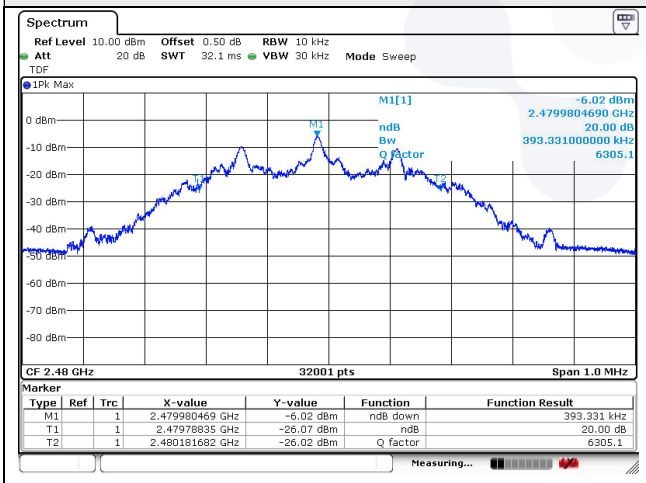
2 403 ㎒



2 440 ㎒



2 480 ㎒



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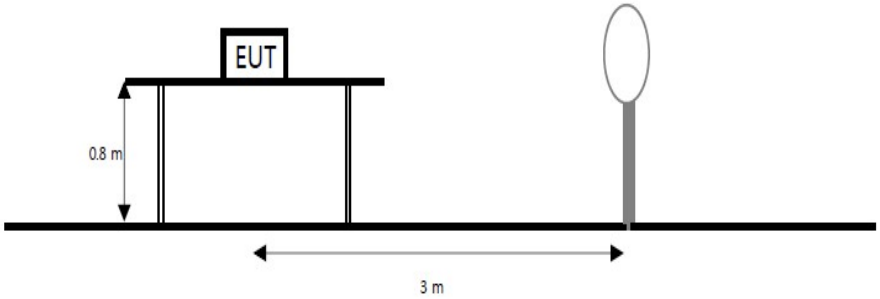
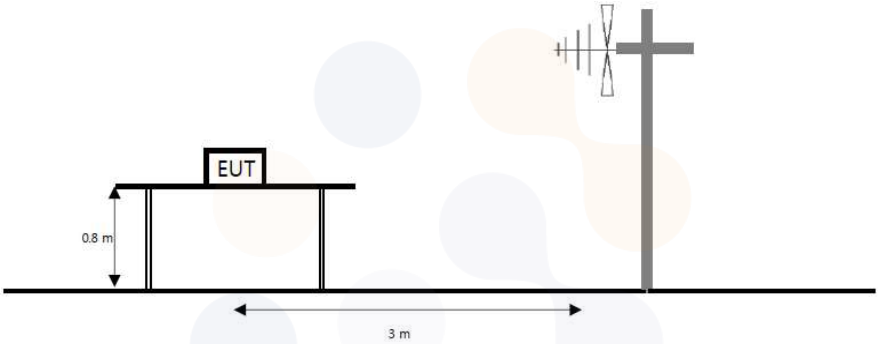
6.2. Field strength of fundamental & harmonic

Test setup

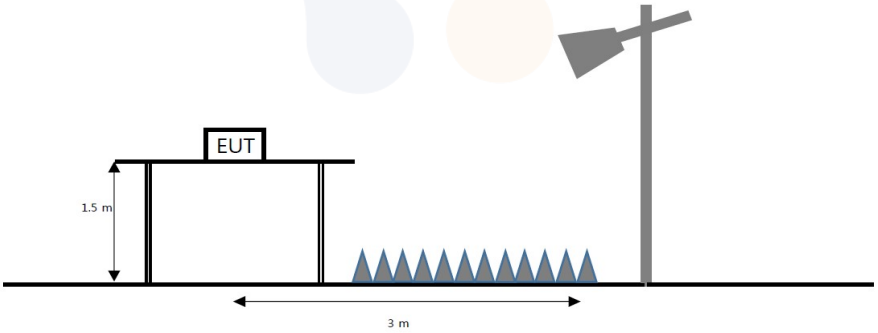
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ emissions.



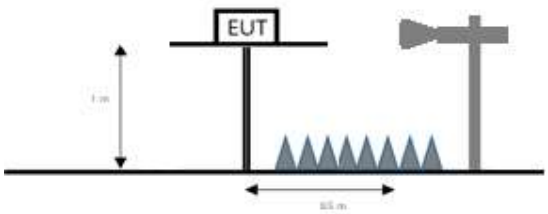
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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 (㎛V/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 (㎟V/m)	Field strength of harmonics (㎛V/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.

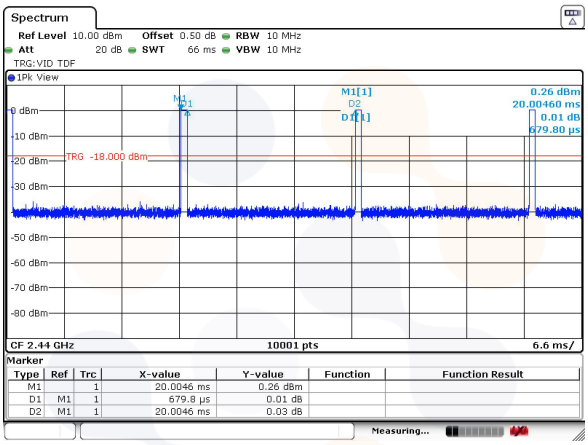
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

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	20.005	0.680	0.034 0	3.40	14.69

GFSK



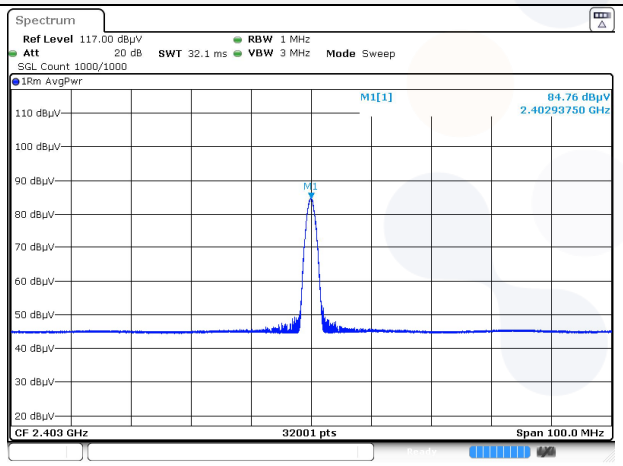
3. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) - or F_d(㏈)
4. [1)] means restricted band
5. Average test would be performed if the peak result were greater than the average limit.
6. Band edge Limit = The main wave limit is 50 ㎷/m at 3 m, attenuate 50 ㏈.
   This Average limit, 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								
2 402.94	H	100.49	27.43	-47.88	-	80.04	113.98	33.94
2 439.95	H	99.82	27.70	-48.01	-	79.51	113.98	34.47
2 479.86	H	98.76	27.90	-48.13	-	78.53	113.98	35.45
Average Data								
2 402.94	H	84.76	27.43	-47.88	14.69	79.00	93.98	14.98
2 439.95	H	83.43	27.60	-48.01	14.69	77.71	93.98	16.27
2 479.86	H	81.64	27.90	-48.13	14.69	76.10	93.98	17.88

Average Data



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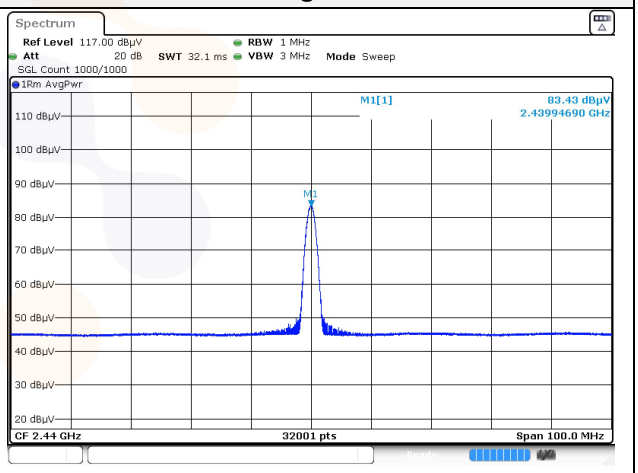

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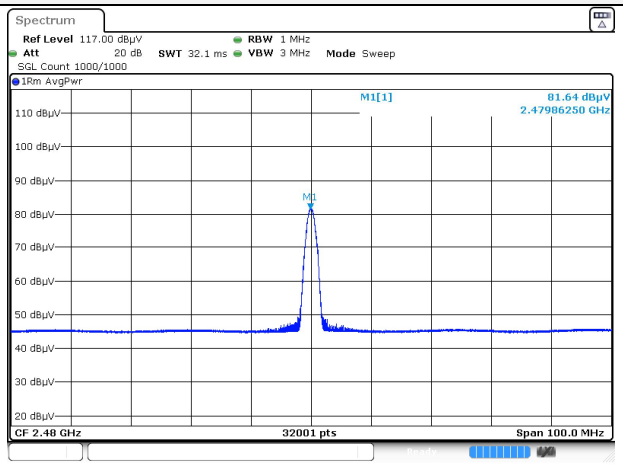

Average Data

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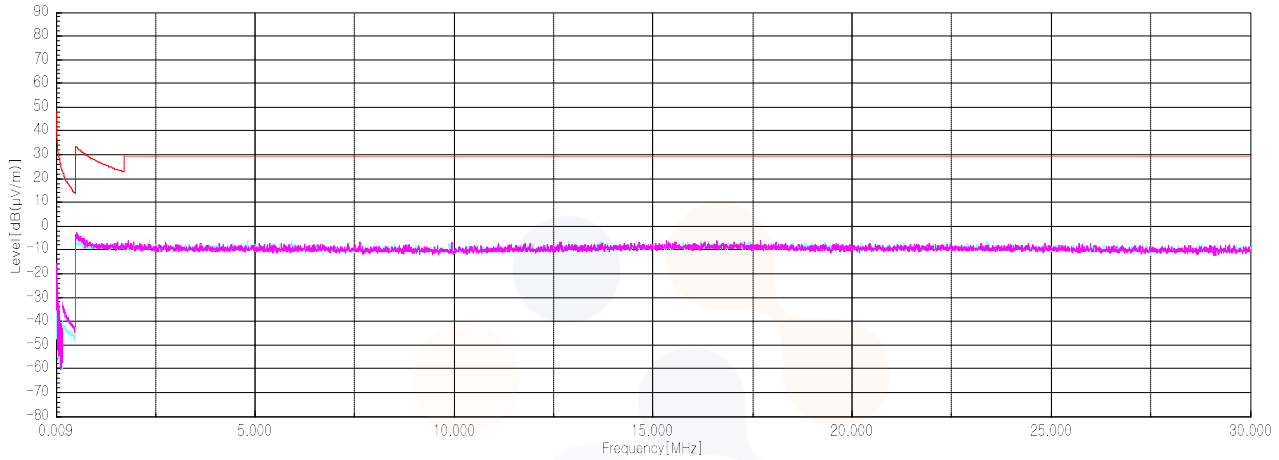
Field strength of harmonics

[Below 30 ㎒]

Worst case: GFSK_2 403 ㎒

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

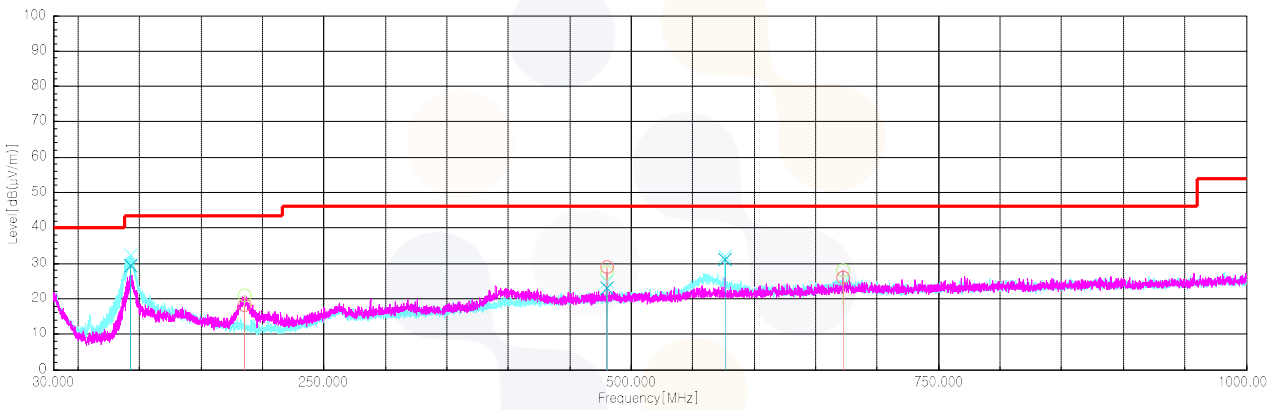


[Below 1 000 ㎒]

Worst case: GFSK_2 403 ㎒

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								
92.93	V	45.60	15.20	-31.61	-	29.19	43.50	14.31
185.69	H	34.90	14.80	-31.44	-	18.26	43.50	25.24
479.96	H	36.70	23.00	-30.68	-	29.02	46.00	16.98
480.08	V	30.80	23.00	-30.68	-	23.12	46.00	22.88
575.99	V	37.00	24.60	-30.58	-	31.02	46.00	14.98
672.14	H	31.50	24.90	-30.44	-	25.96	46.00	20.04

Horizontal/Vertical

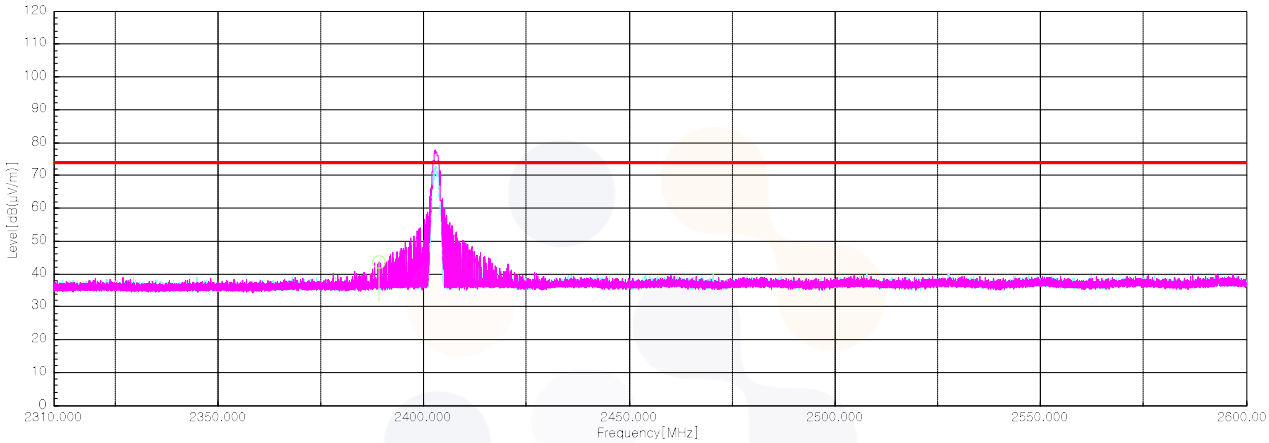


[Above 1 000 ㎒]

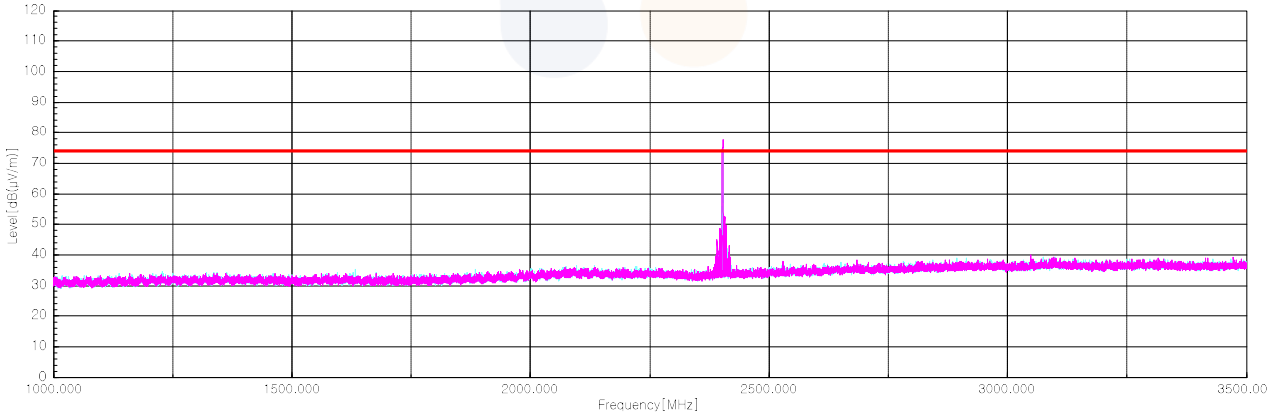
GFSK_2 403 ㎒

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								
2 389.07[1)]	H	48.30	27.29	-31.90	-	43.69	74.00	30.31
4 805.97[1)]	H	65.00	32.31	-48.07	-	49.24	74.00	24.76
7 230.85	H	53.90	37.02	-46.33	-	44.59	74.00	29.41

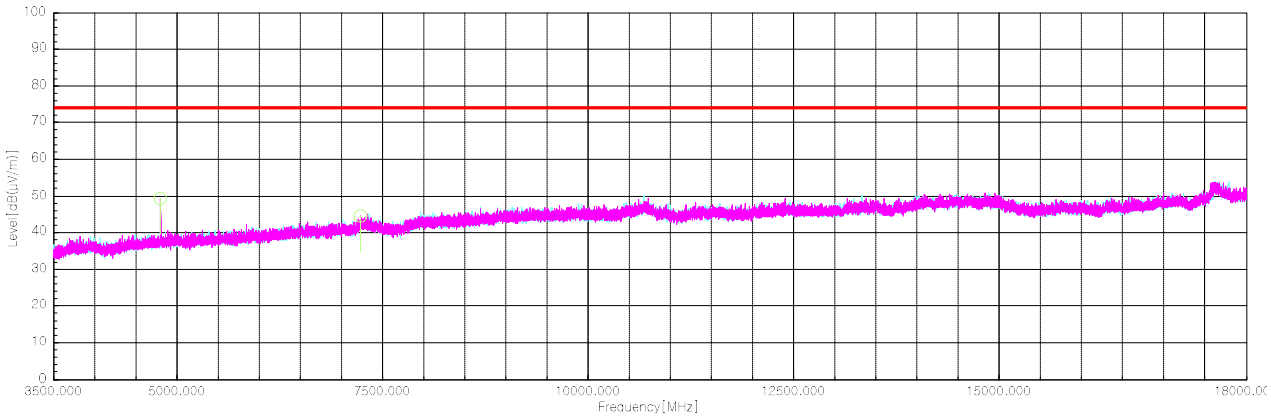
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



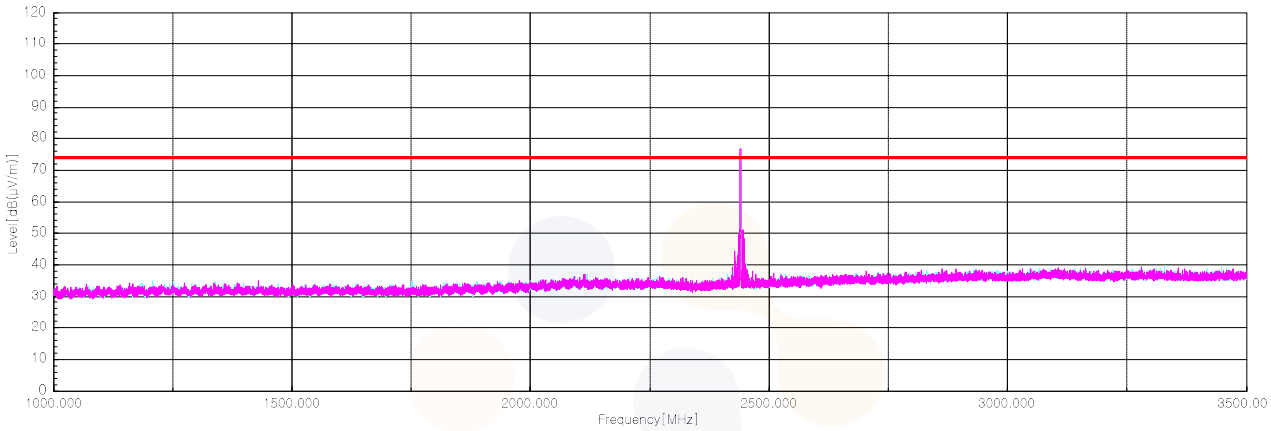
Horizontal/Vertical for 3.5 GHz ~ 18 GHz



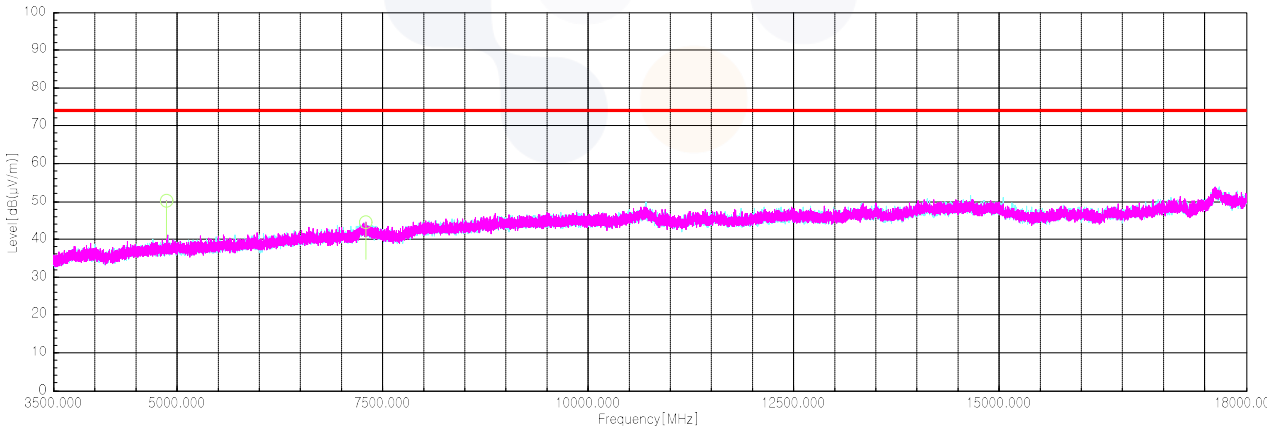
GFSK_2 440 MHz

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								
4 879.43[1)]	H	65.30	32.62	-47.67	-	50.25	74.00	23.75
7 303.83[1)]	H	54.00	36.89	-46.43	-	44.46	74.00	29.54

Horizontal/Vertical for 1 GHz ~ 3.5 GHz

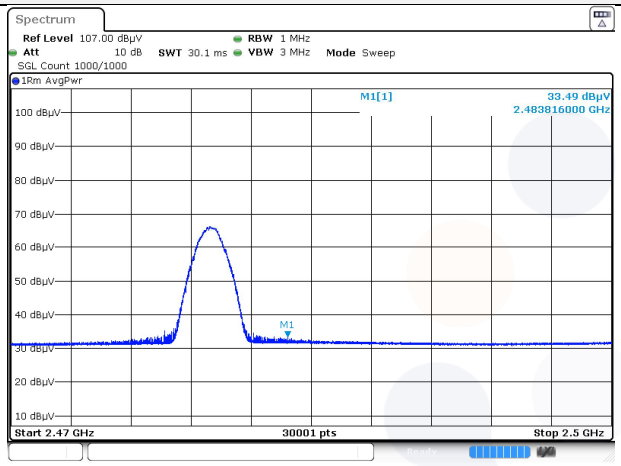


Horizontal/Vertical for 3.5 GHz ~ 18 GHz

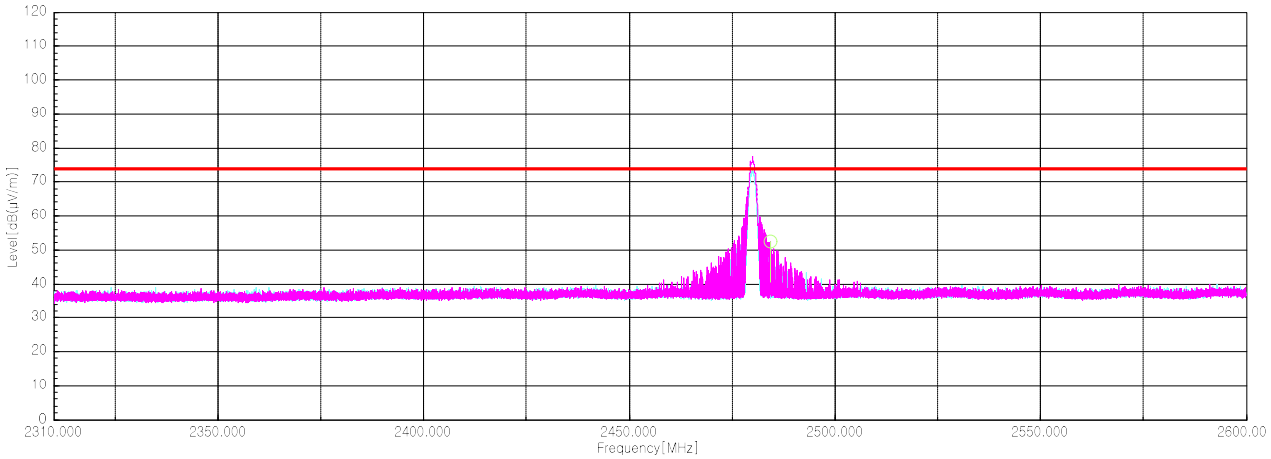


GFSK_2 480 ㎒

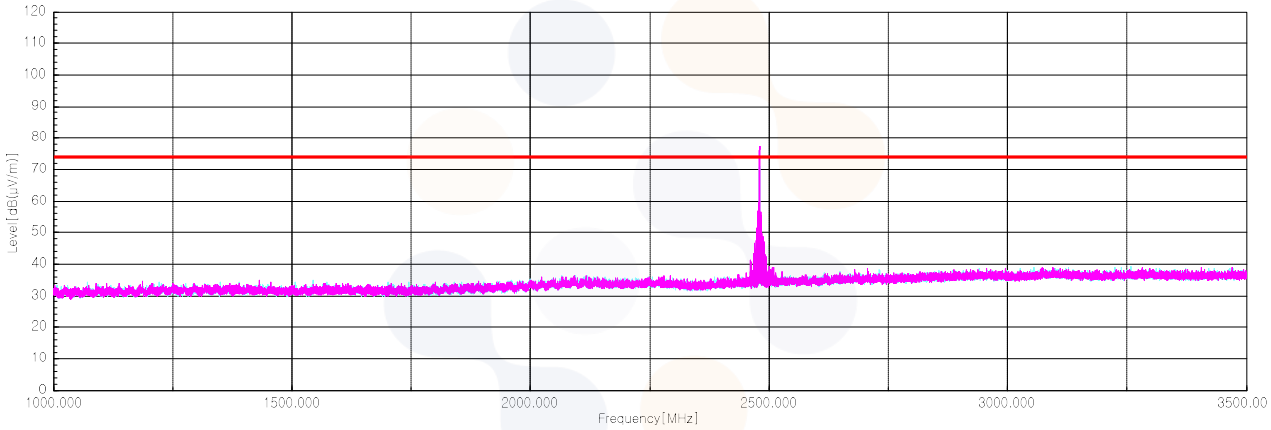
Frequency	Pol.	Reading	Antenna Factor	Amp. + Cable	DCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data								
2 483.82[1)]	H	57.00	27.80	-32.27	-	52.53	74.00	21.47
4 959.67[1)]	H	64.10	33.06	-47.50	-	49.66	74.00	24.34
7 352.17[1)]	H	53.90	36.80	-46.50	-	44.20	74.00	29.80
Average Data								
2 483.82[1)]	H	33.49	27.80	-32.27	14.69	43.71	54.00	10.29

Average Data	Average Data
	Blank

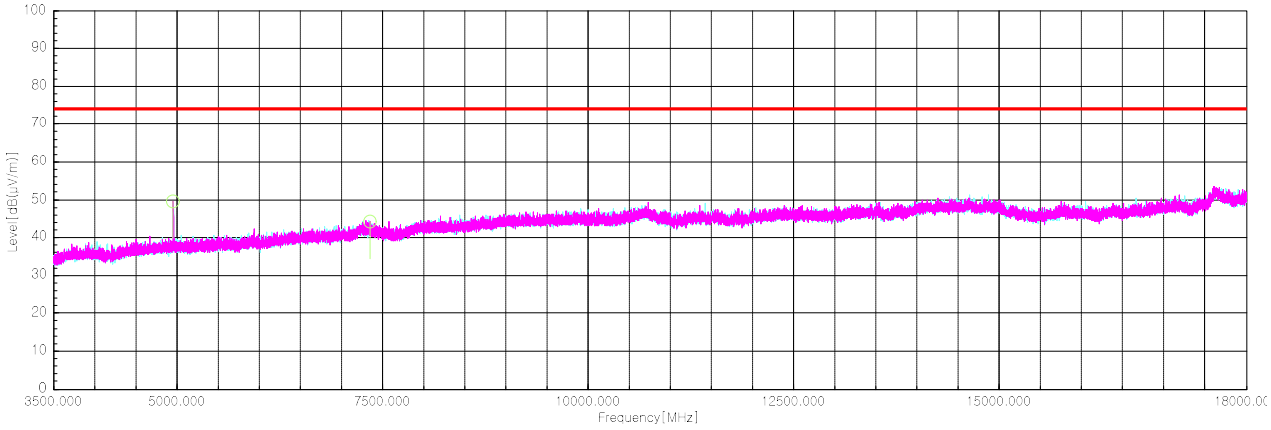
Horizontal/Vertical for Band-edge



Horizontal/Vertical for 1 GHz ~ 3.5 GHz



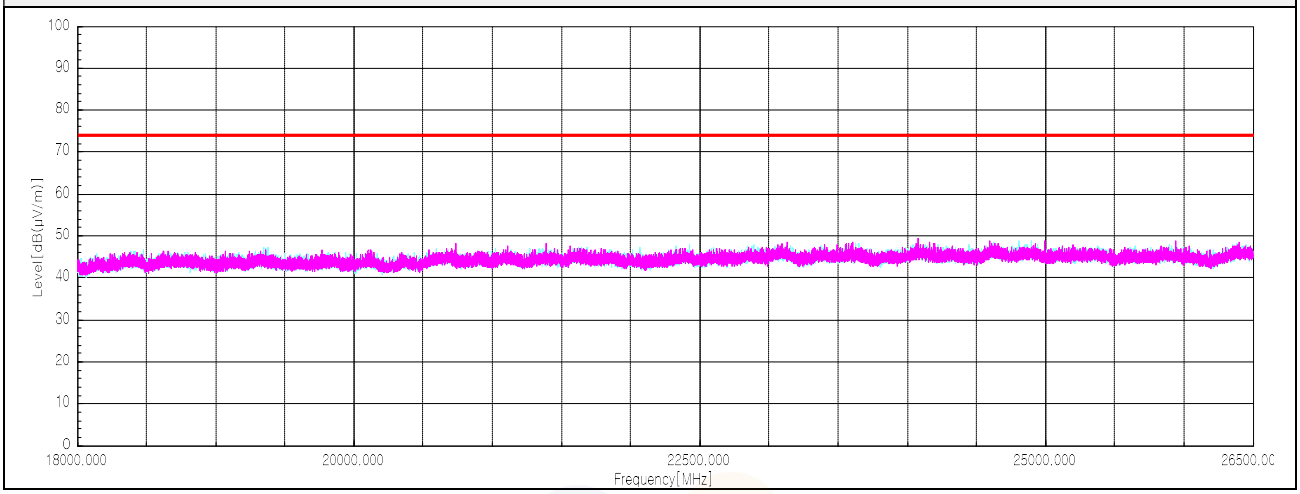
Horizontal/Vertical for 3.5 GHz ~ 18 GHz



[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