TEST REPORT

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KCTL

1. Client

- Name : MAT Co., Ltd.
- Address : 1F, 16, Beolmal-ro 118beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
- Date of Receipt : 2019-03-19

2. Use of Report : -

3. Name of Product and Model : Wireless Remote Lighting Controller / CL400

4. Manufacturer and Country of Origin : MAT Co., Ltd. / Korea

5. FCC ID : 2ASUN-CL400

6. Date of Test : 2019-04-25 to 2019-05-10

2019-05-17

7. Test Standards : FCC Part 15 Subpart C, 15.247

8. Test Results : Refer to the test result in the test report

Affirmation	Tested by Name : Kwonse Kim (Signature)	Technical Manager Name : Jaehyong Lee (Signature)

2019-05-17

KCTL Inc.

Report revision history

Date	Revision	Page No
2019-05-16	Initial report	-
2019-05-17	Updated	5, 10, 16, 20, 27
2019-05-17	Updated	1, 33

CONTENTS

1. General information

Client : MAT Co., Ltd.
Address : 1F, 16, Beolmal-ro 118beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Manufacturer : MAT Co., Ltd.
Address : 1F, 16, Beolmal-ro 118beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Laboratory : KCTL Inc.
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-3327, G-198, C-3706, T-1849
Industry Canada Registration No. : 8035A
KOLAS No.: KT231

2. Device information

Equipment under test : Wireless Remote Lighting Controller
Model : CL400
Frequency range : 2 402 ㎒ ~ 2 480 ㎒
Modulation technique : GFSK
Number of channels : 40 ch
Power source : AC 120 V
Antenna specification : Internal Antenna
Antenna gain : 2.714 dBi
Software version : CL400_BASE_V1.1
CL400_UP_V1.2
EFR32_MODULE_V1.2
Hardware version : V1.0
Test device serial No. : N/A
Operation temperature : -40 ℃ ~ 70 ℃

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

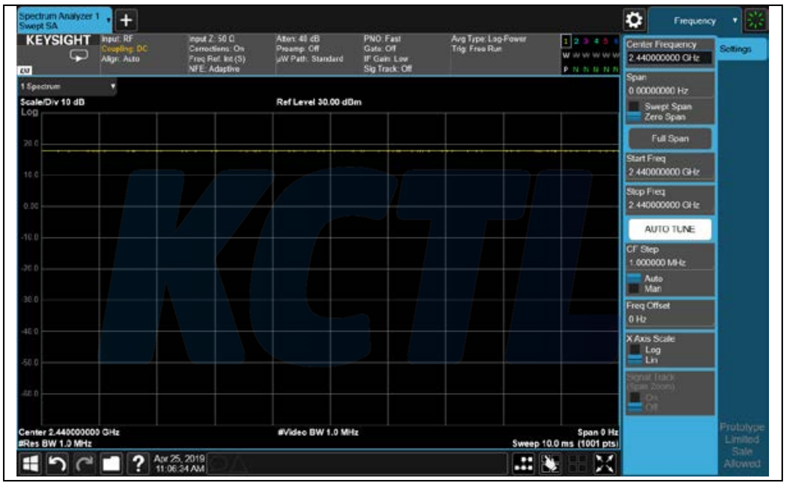
2.2. Frequency/channel operations

This device contains the following capabilities:
GFSK

Ch.	Frequency (㎒)
00	2 402
. .	. .
19	2 440
. .	. .
39	2 480

Table 2.2.1. GFSK

2.3. Duty Cycle Correction Factor



Note1) : period : 0 ㎳, On time : 0 ㎳
Note2) : GFSK is a continuous transmission (duty cycle >= 98 %)

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 Internal Antenna on board.

4. Summary of tests

FCC Part section(s)	Parameter	Test results
15.247(b)(3)	Maximum peak output power	Pass
15.247(e)	Peak power spectral density	Pass
15.247(a)(2)	6 dB channel bandwidth	Pass
15.247(d), 15.205(a), 15.209(a)	Spurious emission	Pass
	Band-edge, restricted band	Pass
15.207(a)	Conducted emissions	Pass

Notes:

1. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2. 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.
3. 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
4. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
   - KDB 558074 D01 v05r02

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	
Conducted RF power	1.76 ㏈	
Conducted spurious emissions	4.03 ㏈	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒	2.28 ㏈
	30 ㎒ ~ 300 ㎒	4.98 ㏈
	300 ㎒ ~ 1 000 ㎒	5.14 ㏈
	1 ㎓ ~ 6 ㎓	6.70 ㏈
	Above 6 ㎓	6.60 ㏈
Conducted emissions	9 ㎑ ~ 150 ㎑	3.66 ㏈
	150 ㎑ ~ 30 ㎒	3.26 ㏈

6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.
With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Frequency (㎒)	Factor(㏈)	Frequency (㎒)	Factor(㏈)
30	10.28	17 000	13.00
100	10.34	18 000	13.06
200	10.36	19 000	13.32
300	10.46	20 000	13.20
400	10.54	21 000	13.40
500	10.58	22 000	13.48
600	10.55	23 000	13.95
700	10.62	24 000	14.13
800	10.68	25 000	14.19
900	10.88	26 000	14.24
1 000	10.77	26 500	14.67
2 000	11.04	27 000	14.78
3 000	11.37	28 000	14.91
4 000	11.42	29 000	14.67
5 000	11.81	30 000	14.73
6 000	11.71	31 000	14.43
7 000	12.02	32 000	14.16
8 000	12.43	33 000	14.41
9 000	12.16	34 000	14.60
10 000	12.39	35 000	14.59
11 000	12.52	36 000	14.41
12 000	12.68	37 000	14.20
13 000	13.22	38 000	14.43
14 000	13.72	39 000	14.51
15 000	13.02	40 000	14.39
16 000	12.81	-	-

Note.
Offset(㏈) = RF cable loss(㏈) + Attenuator(㏈) + Offset (㏈)

7. Test results

7.1. Maximum peak output power

Test setup

EUT — Attenuator — Power sensor

Limit

According to §15.247(b)(3), For systems using digital modulation in the 902-928 ㎒, 2 400-2 483.5 ㎒, and 5 725-5 850 ㎒ bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test procedure

558074 D01 DTS Meas Guidance - Section 8.3 , ANSI C63.10 - Section 11.9

Test settings

General

Section 15.247 permits the maximum conducted (average) output power to be measured as an alternative to the maximum peak conducted output power for demonstrating compliance to the limit. When this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth (see ANSI C63.10 for measurement guidance).

When using a spectrum analyzer or EMI receiver to perform these measurements, it shall be capable of utilizing a number of measurement points in each sweep that is greater than or equal to twice the span/RBW to set a bin-to-bin spacing of ≤ RBW/2 so that narrowband signals are not lost between frequency bins.

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level. The intent is to test at 100 % duty cycle; however a small reduction in duty cycle (to no lower than 98 %) is permitted, if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

If continuous transmission (or at least 98 % duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level, with the transmit duration as long as possible, and the duty cycle as high as possible during which sweep triggering/signal gating techniques may be used to perform the measurement over the transmission duration.

Maximum peak conducted output power

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

PKPM1 Peak power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

Measurement using a power meter (PM)

Method AVGPM is a measurement using an RF average power meter, as follows:

a) As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied:
   1) The EUT is configured to transmit continuously, or to transmit with a constant duty cycle.
   2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.
   3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
b) If the transmitter does not transmit continuously, measure the duty cycle, D, of the transmitter

output signal as described in 11.6.

c) Measure the average power of the transmitter. This measurement is an average over both the ON and OFF periods of the transmitter.

d) Adjust the measurement in ㏈m by adding [10 log(1/D)], where D is the duty cycle.

Notes:

A peak responding power sensor is used, where the power sensor system video bandwidth is greater than the occupied bandwidth of the EUT.

Test results

Frequency(㎒)	Measured output power (㏈m)		Limit(㏈m)
	Peak	Average	
2 402	18.08	17.96	30
2 440	17.97	17.87	
2 480	17.77	17.66	

7.2. Peak Power Spectral Density

Test setup

EUT	Attenuator	Spectrum analyzer

Limit

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 ㏈m in any 3 ㎑ band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test procedure

558074 D01 DTS Meas Guidance - Section 8.4, ANSI C63.10 - Section 11.10

Test settings

Method PKPSD (peak PSD)

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

1) Set analyzer center frequency to DTS channel center frequency.
2) Set the span to 1.5 times the DTS bandwidth.
3) Set the RBW to: 3 ㎑ ≤ RBW ≤ 100 ㎑.
4) Set the VBW ≥ 3 x RBW.
5) Detector = peak.
6) Sweep time = auto couple.
7) Trace mode = max hold.
8) Allow trace to fully stabilize.
9) Use the peak marker function to determine the maximum amplitude level within the RBW.
10) If measured value exceeds limit, reduce RBW (no less than 3 ㎑) and repeat.

Test results

Frequency(㎒)	PSD(㏈ m/3 ㎑)	Limit(㏈ m/3 ㎑)
2 402	3.43	8
2 440	4.03	
2 480	3.68	

GFSK

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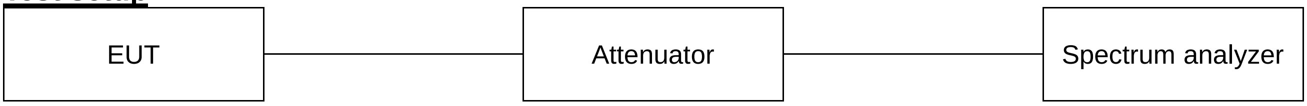
7.3. 6 dB Bandwidth(DTS Channel Bandwidth)

Test setup



Limit

According to §15.247(a)(2) Systems using digital modulation techniques may operate in the 902–928 ㎒, 2 400–2 483.5 ㎒, and 5 725–5 850 ㎒ bands. The minimum 6 ㏈ bandwidth shall be at least 500 ㎑.

Test procedure

558074 D01 DTS Meas Guidance - Section 8.2, ANSI C63.10 - Section 11.8

Test settings

DTS bandwidth

One of the following procedures may be used to determine the modulated DTS bandwidth.

Option 1

1) Set RBW = 100 ㎑.
2) Set the video bandwidth (VBW) ≥ 3 x RBW.
3) Detector = Peak.
4) Trace mode = max hold.
5) Sweep = auto couple.
6) Allow the trace to stabilize.
7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 ㏈ relative to the maximum level measured in the fundamental emission.

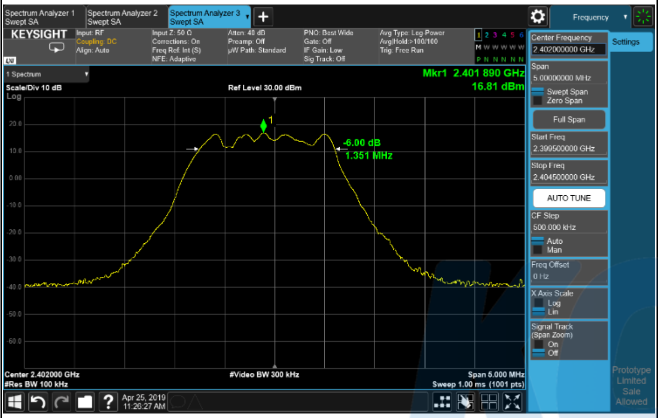
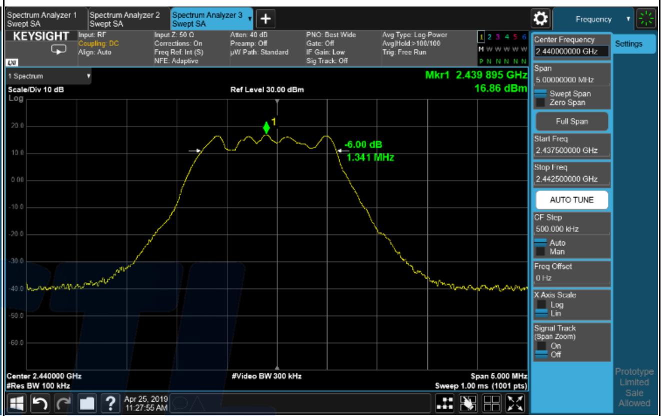
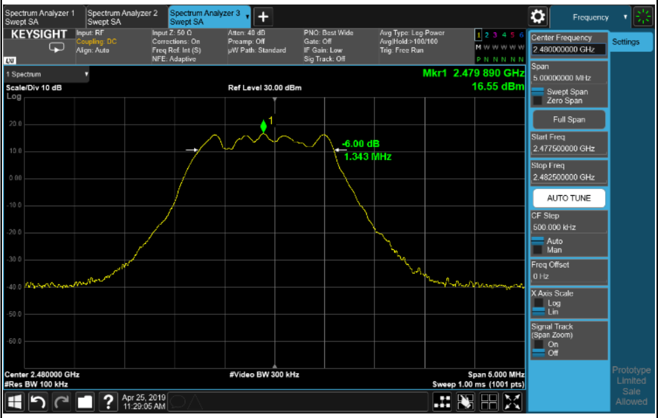
Option 2

The automatic bandwidth measurement capability of an instrument may be employed using the X ㏈ bandwidth mode with X set to 6 ㏈, if the functionality described in 11.8.1 (i.e., RBW = 100 ㎑, VBW ≥ 3 × RBW, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥6 ㏈.

Test results

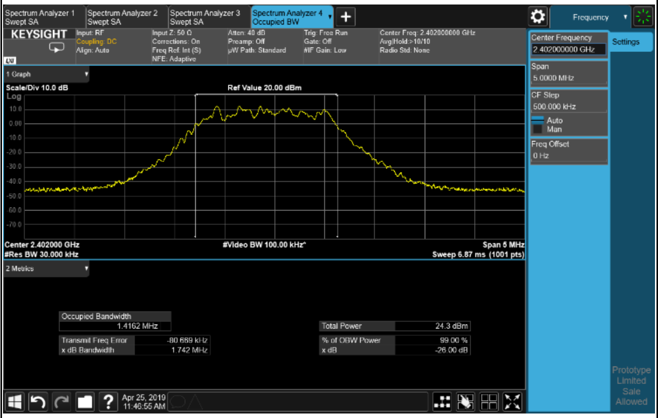
Frequency(㎒)	6 ㏈ bandwidth(㎒)	99 % Measured Bandwidth(㎒)
2 402	1.35	1.42
2 440	1.34	1.42
2 480	1.34	1.44

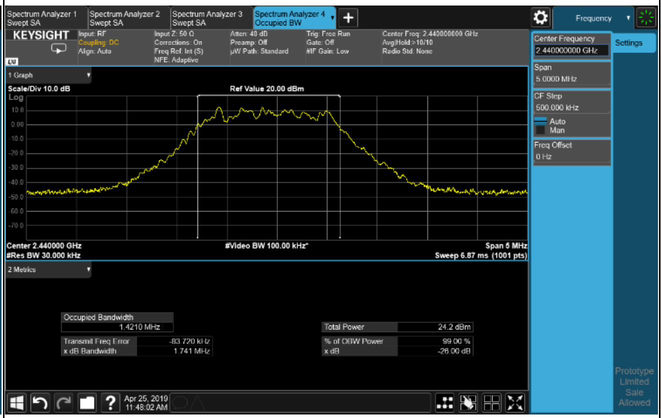
6 ㏈ bandwidth(㎒)

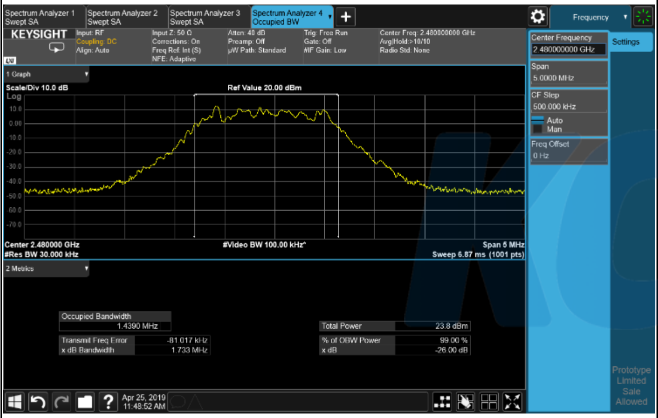
GFSK	
	
	Blank

99 % bandwidth(㎒)

GFSK







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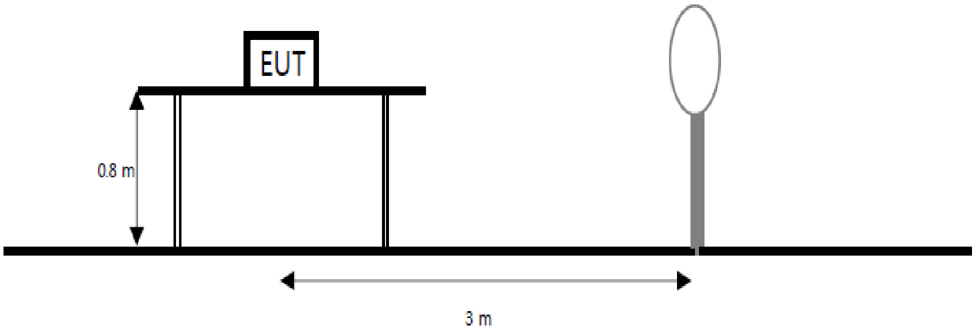
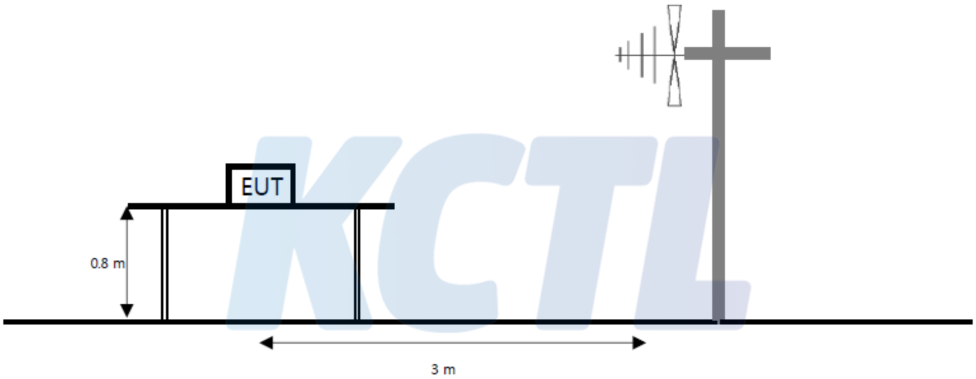
7.4. Spurious Emission, Band Edge and Restricted bands

Test setup

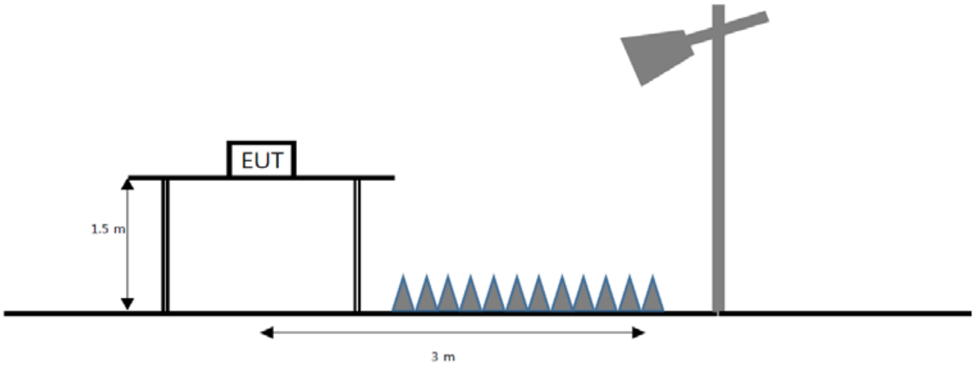
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions



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 the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



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 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

㎒	㎒	㎒	㎓
0.009 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.694 75 - 16.695 25	608 - 614	5.35 - 5.46
2.173 5 - 2.190 5	16.804 25 - 16.804 75	960 – 1 240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1 300 – 1 427	8.025 - 8.5
4.177 25 - 4.177 75	37.5 - 38.25	1 435 – 1 626.5	9.0 - 9.2
4.207 25 - 4.207 75	73 - 74.6	1 645.5 – 1 646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1 660 – 1 710	10.6 - 12.7
6.267 75 - 6.268 25	108 - 121.94	1 718.8 – 1 722.2	13.25 - 13.4
6.311 75 - 6.312 25	123 - 138	2 200 – 2 300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2 310 – 2 390	15.35 - 16.2
8.362 - 8.366	156.524 75 - 156.525 25	2 483.5 – 2 500	17.7 - 21.4
8.376 25 - 8.386 75	156.7 - 156.9	2 690 – 2 900	22.01 - 23.12
8.414 25 - 8.414 75	162.012 5 - 167.17	3 260 – 3 267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3 332 – 3 339	31.2 - 31.8
12.519 75 - 12.520 25	240 - 285	3 345.8 – 3 358	36.43 - 36.5
12.576 75 - 12.577 25	322 - 335.4	3 600 – 4 400	Above 38.6
13.36 - 13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 ㎒, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 ㎒, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

Test procedure

ANSI C63.10-2013

Test settings

Peak field strength measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW ≥ (3×RBW)
4. Detector = peak
5. Sweep time = auto
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

Table. RBW as a function of frequency

Frequency	RBW
9 ㎑ to 150 ㎑	200 ㎐ to 300 ㎐
0.15 ㎒ to 30 ㎒	9 ㎑ to 10 ㎑
30 ㎒ to 1 000 ㎒	100 ㎑ to 120 ㎑
> 1 000 ㎒	1 ㎒

Average field strength measurements

Trace averaging with continuous EUT transmission at full power

If the EUT can be configured or modified to transmit continuously (D ≥ 98%), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1. RBW = 1 ㎒ (unless otherwise specified).
2. VBW ≥ (3×RBW).
3. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
4. Averaging type = power (i.e., rms):
   1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
   2) Some instruments require linear display mode to use linear voltage averaging. Log or ㏈ averaging shall not be used.
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.

Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (D ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%), then the following procedure shall be used:

1. The EUT shall be configured to operate at the maximum achievable duty cycle.
2. Measure the duty cycle D of the transmitter output signal as described in 11.6.
3. RBW = 1 ㎒ (unless otherwise specified).
4. VBW ≥ [3 × RBW].
5. Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ (RBW / 2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

6. Averaging type = power (i.e., rms):
   1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
   2) Some instruments require linear display mode to use linear voltage averaging. Log or ㏈ averaging shall not be used.
7. Sweep time = auto.
8. Perform a trace average of at least 100 traces.
9. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
   1) If power averaging (rms) mode was used in step f), then the applicable correction factor is [10 log (1 / D)], where D is the duty cycle.
   2) If linear voltage averaging mode was used in step f), then the applicable correction factor is [20 log (1 / D)], where D is the duty cycle.
   3) If a specific emission is demonstrated to be continuous (D ≥ 98%) rather than turning ON and OFF with with the transmit cycle, then no duty cycle correction is required for that emission.

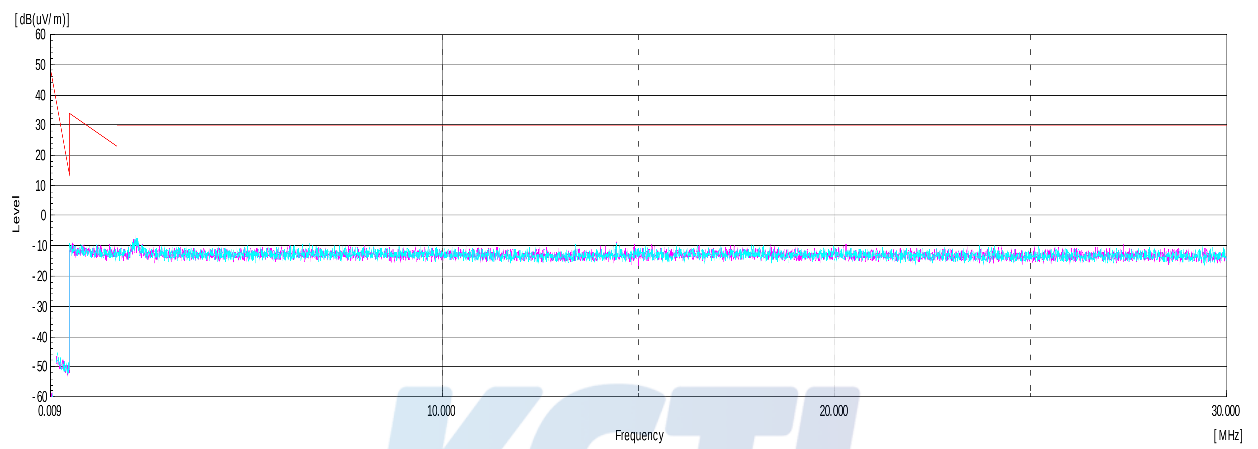
Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓. The resolution bandwidth of test receiver/spectrum analyzer is 1 ㎒ and the video bandwidth is 1 ㎑(≥1/T) for Average detection (AV) at frequency above 1 ㎓. (where T = pulse width)
2. f <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/Ds)$
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/Ds)$
   Where:
   F_d= Distance factor in ㏈
   D_m= Measurement distance in meters
   D_s= Specification distance in meters
3. Factors(㏈) = Antenna factor(㏈/m) + Cable loss(㏈) + or Amp. gain(㏈) + or F_d(㏈)
4. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of respective limits were not reported.
5. Average test would be performed if the peak result were greater than the average limit.
6. 1) means restricted band.
7. According to part 15.31(f)(2), an extrapolation factor of 40 dB/decade is applied because measured distance of radiated emission is 3 m.

Test results (Below 30 ㎒) –Worst case: GFSK Low frequency

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.									

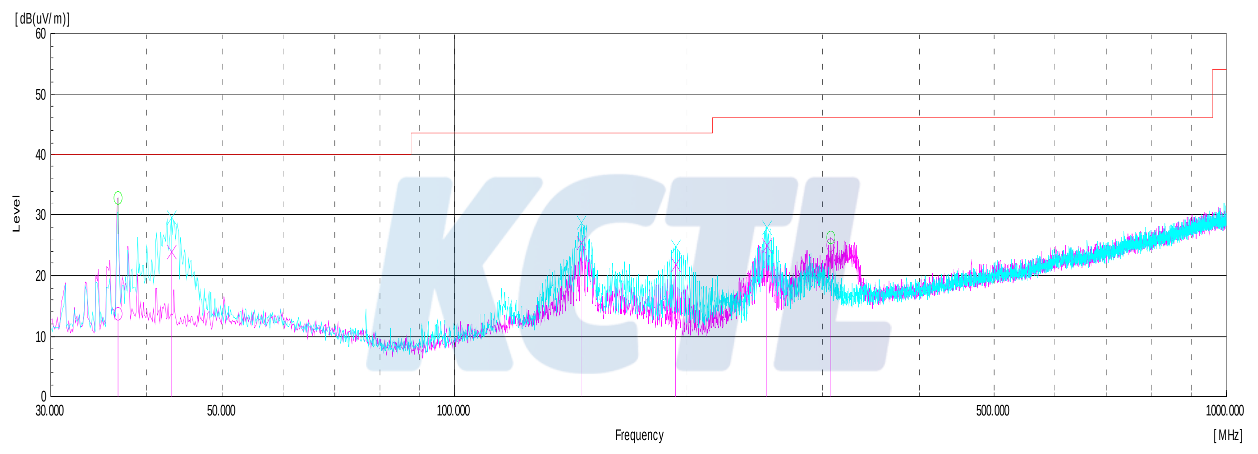
Horizontal/Vertical



Test results (Below 1 000 ㎒) –Worst case: GFSK Low frequency

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(㎶)]	[dB]	[dB]	[dB]	[dB]	[dB(㎶/m)]	[dB(㎶/m)]	[dB]
Quasi peak data									
36.67	H	26.80	1.21	-27.08	12.67	-	13.60	40.00	26.40
42.97	V	36.50	1.33	-26.97	13.24	-	24.10	40.00	15.90
146.04	V	35.70	2.63	-25.78	12.85	-	25.40	43.50	18.10
193.32	V	35.10	3.06	-26.73	10.47	-	21.90	43.50	21.60
254.07	V	35.90	3.54	-26.28	11.94	-	25.10	46.00	20.90
307.42	H	33.70	3.93	-26.19	13.66	-	25.10	46.00	20.90

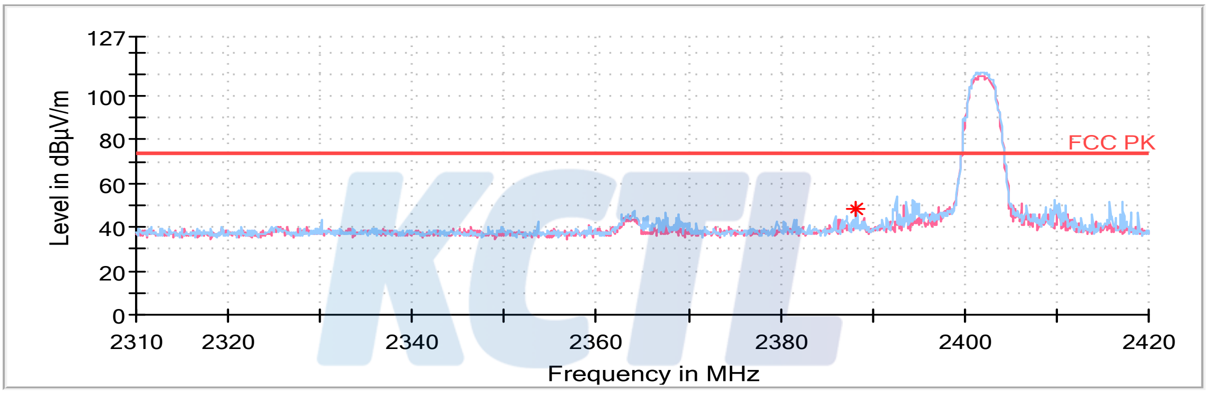
Horizontal/Vertical



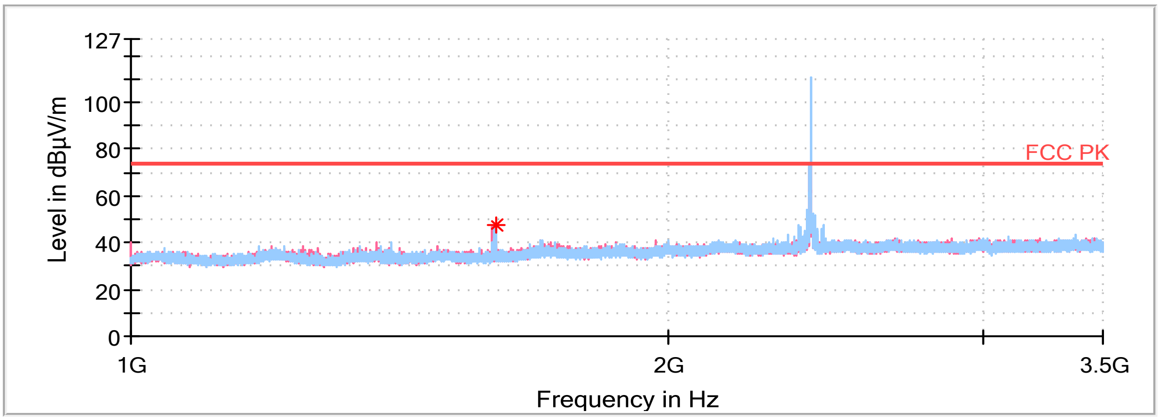
Test results (Above 1 000 ㎒)
Low Channel

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
[㎒]	[V/H]	[dB(㎶)]	[dB]	[dB]	[dB]	[dB]	[dB(㎶/m)]	[dB(㎶/m)]	[dB]
Peak data									
1 600.23[1)]	H	55.71	3.04	-37.41	26.20	-	47.54	74.00	26.46
2 388.28[1)]	H	52.41	3.70	-36.23	28.54	-	48.42	74.00	25.58
4 803.19[1)]	V	69.74	5.34	-60.83	32.80	-	47.05	74.00	26.95
Average Data									
No spurious emissions were detected within 20 ㏈ of the limit.									

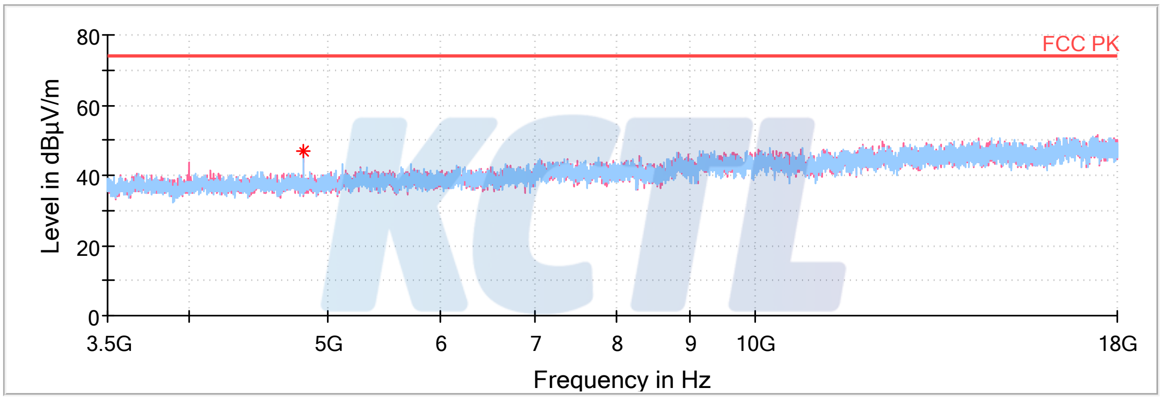
Horizontal/Vertical for Band-edge



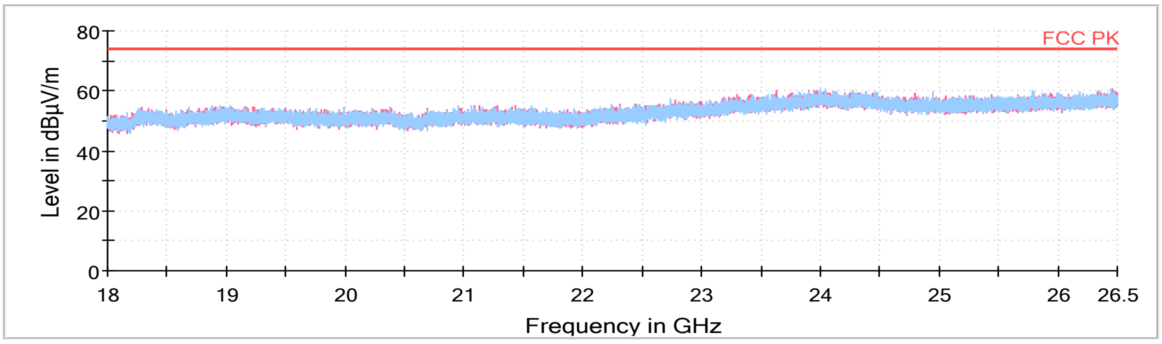
Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓



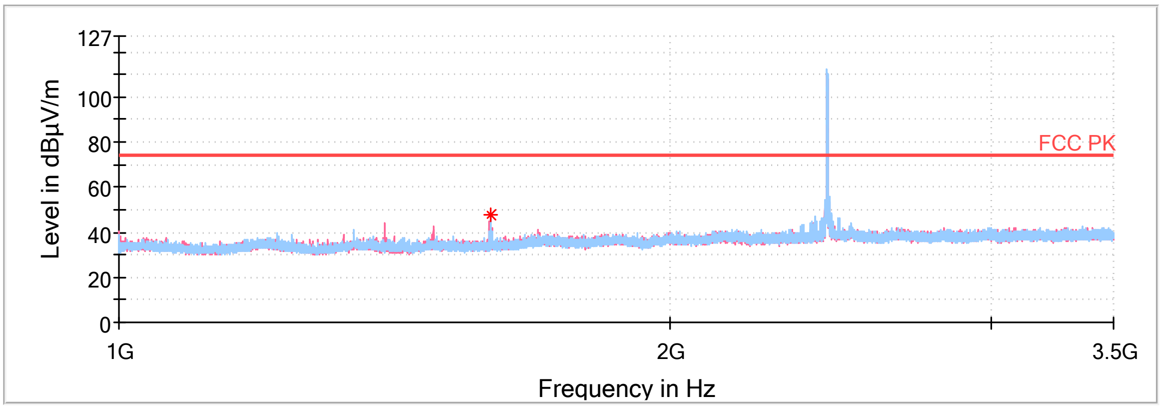
Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓



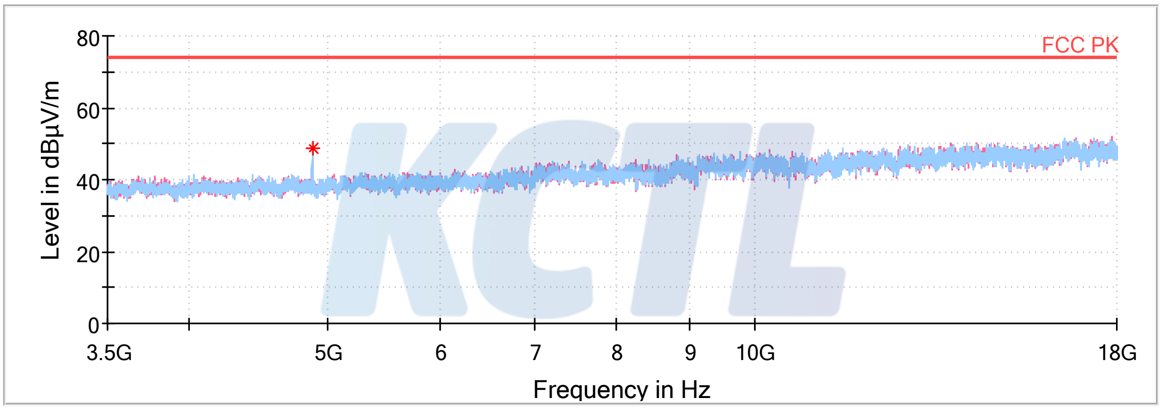
Middle Channel

Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
[MHz]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data									
1 598.67[1)]	H	55.99	3.04	-37.41	26.19	-	47.81	74.00	26.19
4 878.86[1)]	H	71.74	5.39	-61.06	32.84	-	48.91	74.00	25.09
Average Data									
No spurious emissions were detected within 20 dB of the limit.									

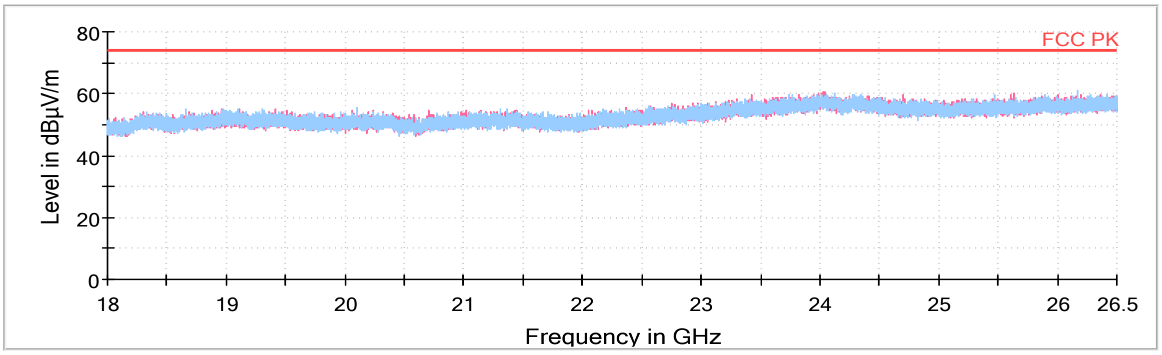
Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓

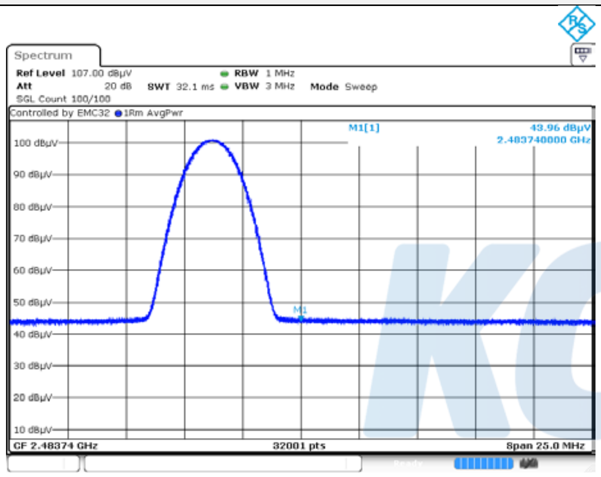


Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓

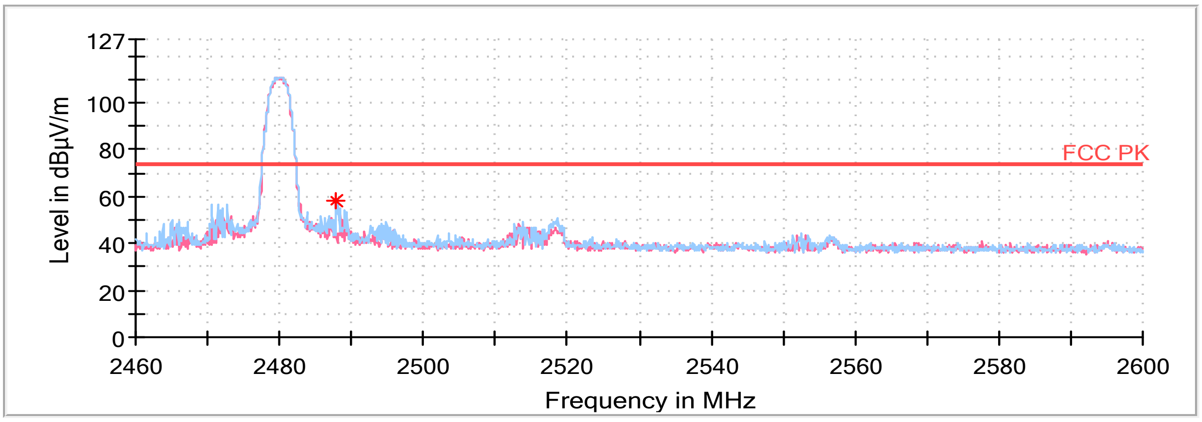


High Channel

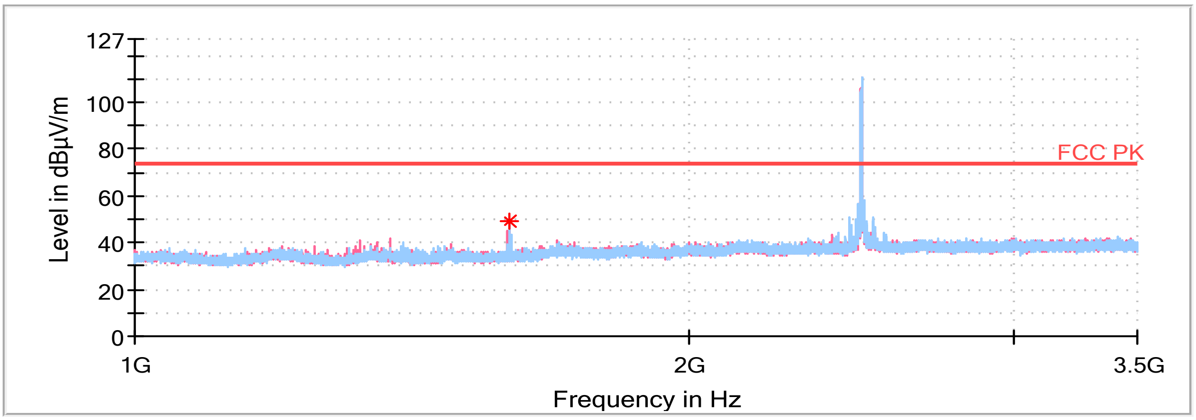
Frequency	Pol.	Reading	Cable Loss	Amp Gain	Antenna Factor	DCCF	Result	Limit	Margin
[MHz]	[V/H]	[dB(μV)]	[dB]	[dB]	[dB]	[dB]	[dB(μV/m)]	[dB(μV/m)]	[dB]
Peak data									
1 596.33 1)	H	57.02	3.04	-37.42	26.19	-	48.83	74.00	25.17
2 483.74 1)	H	61.71	3.77	-35.91	28.73	-	58.30	74.00	15.70
4 959.06 1)	V	68.68	5.44	-60.72	32.88	-	46.28	74.00	27.72
Average Data									
2 483.74 1)	H	46.96	3.77	-35.90	28.72	-	40.55	54.00	13.45

Average data	Average data
	Blank

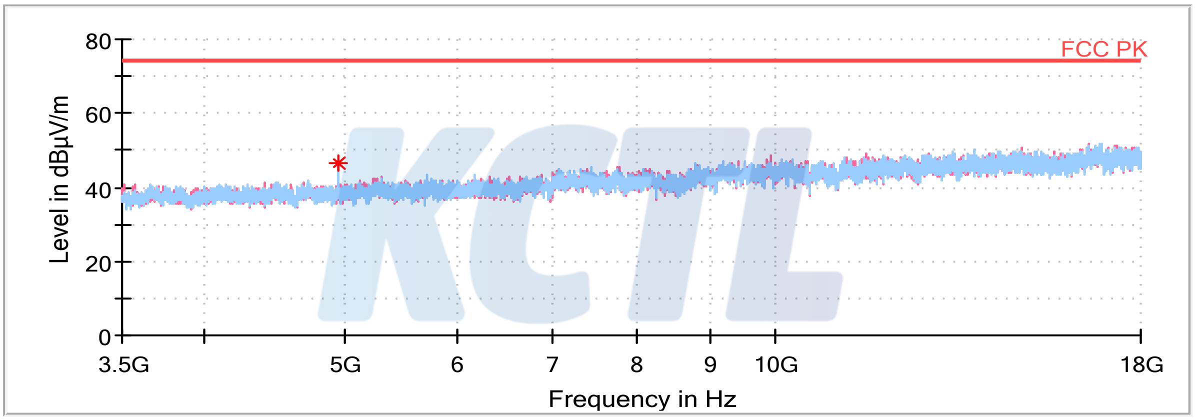
Horizontal/Vertical for Band-edge



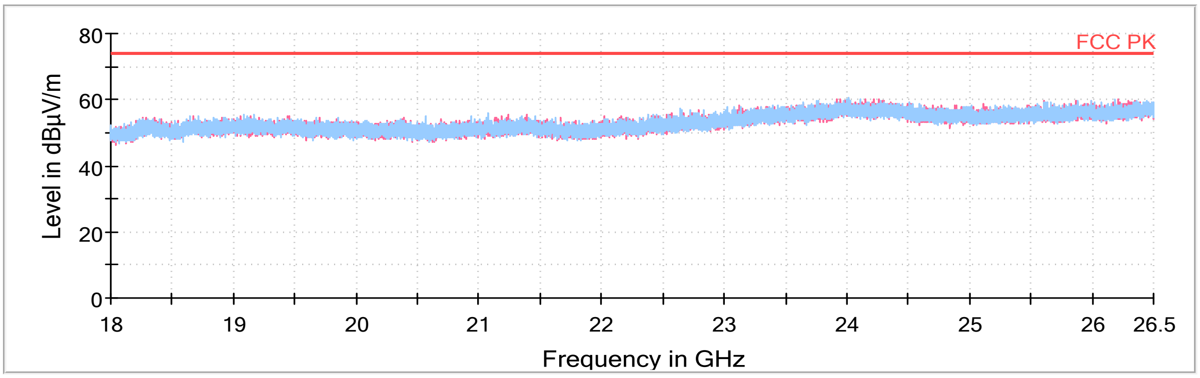
Horizontal/Vertical for 1 ㎓ ~ 3.5 ㎓



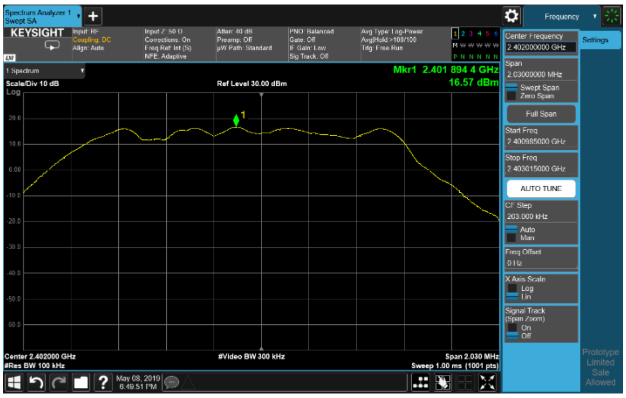
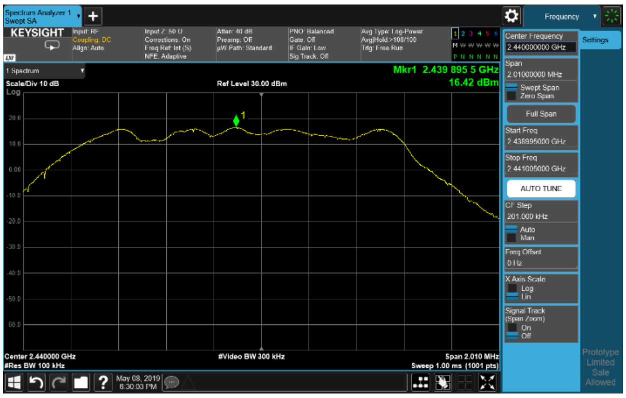
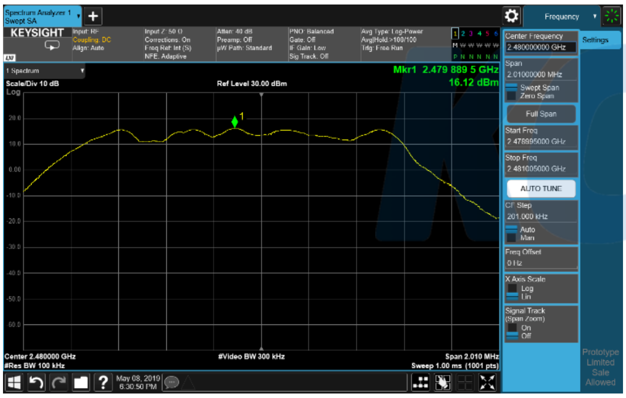
Horizontal/Vertical for 3.5 ㎓ ~ 18 ㎓

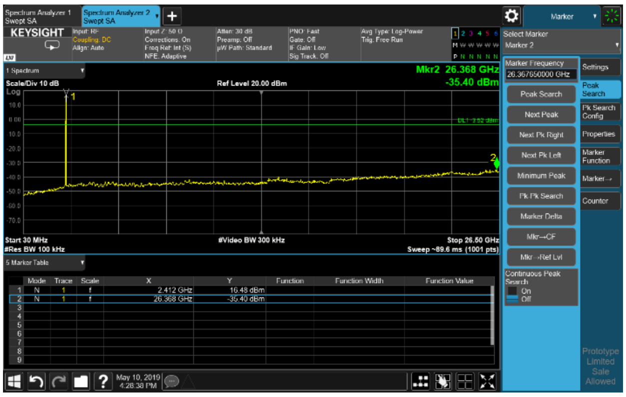
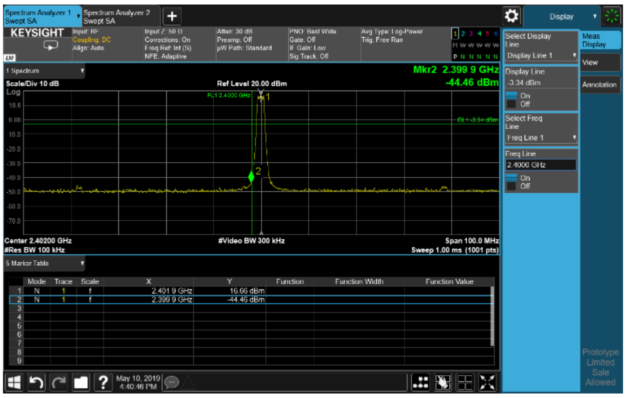
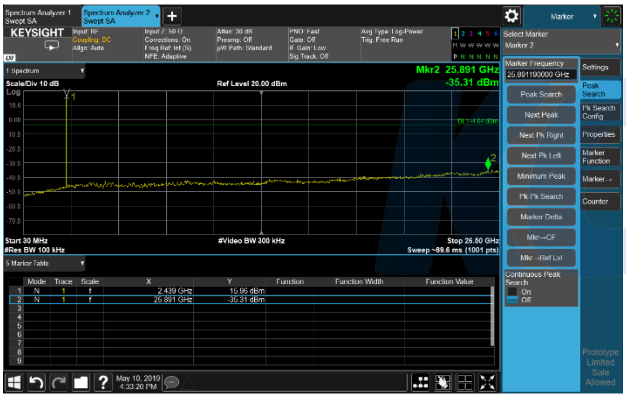
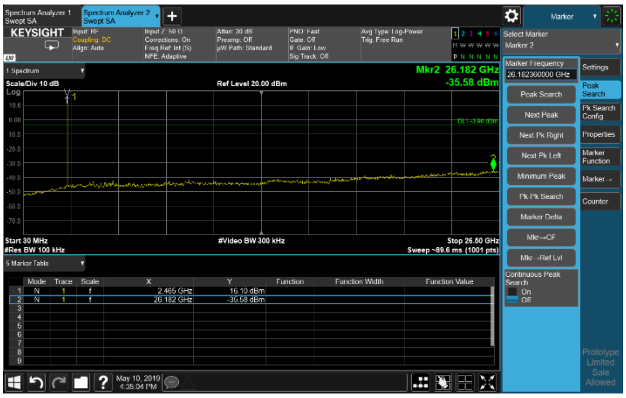
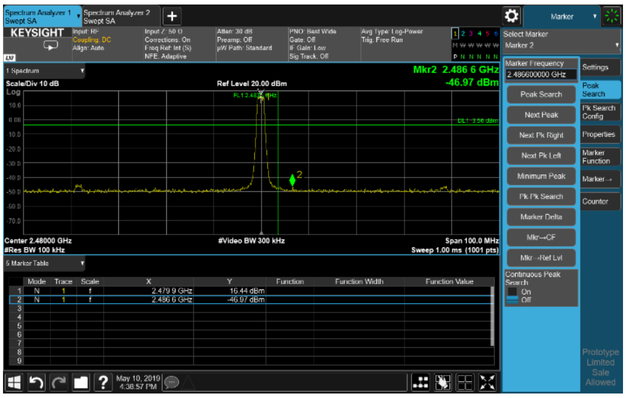


Horizontal/Vertical for 18 ㎓ ~ 26.5 ㎓



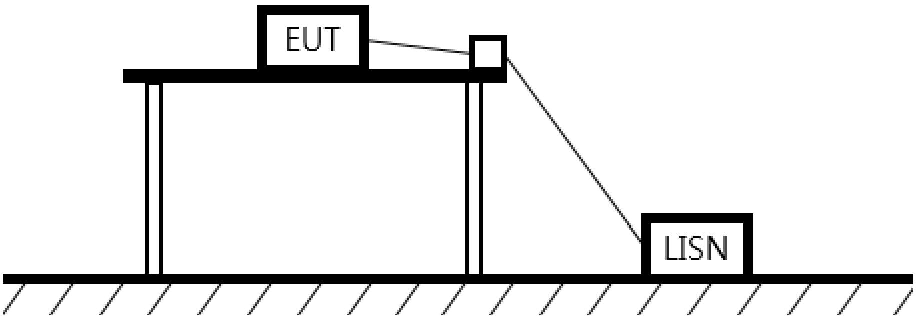
Test results

Reference	
	
2 402 ㎒	2 440 ㎒
	Blank
2 480 ㎒	

Conducted Emissions	Band edge
	
2 402 ㎒	2 402 ㎒
	Blank
2 440 ㎒	
	
2 480 ㎒	2 480 ㎒

7.5. AC Conducted emission

Test setup



Limit

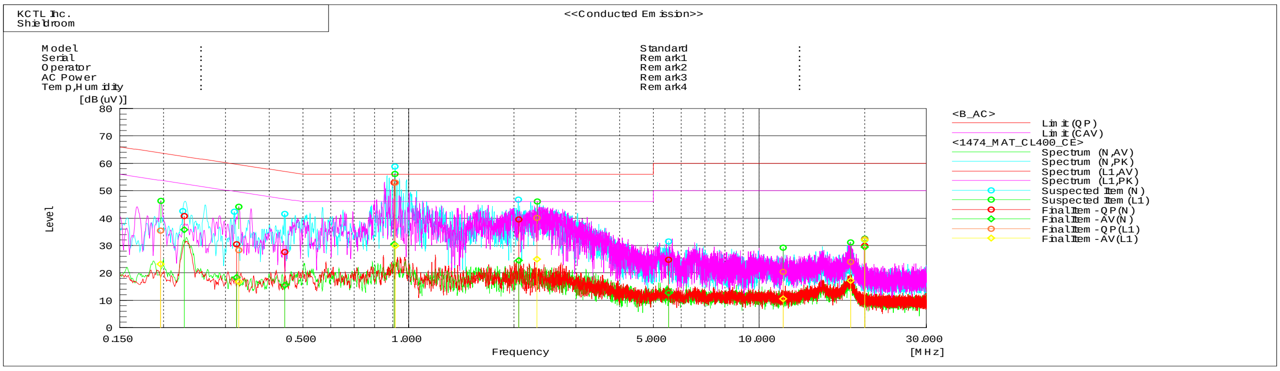
According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50uH/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 (㎒)	Conducted limit (dB㎶/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 ㎝ in which is located 40 ㎝ 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 ㎒ to 30 ㎒.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 ㎑ or to quasi-peak and average within a bandwidth of 9 ㎑. The EUT was in transmitting mode during the measurements.

Test results



Final Result

--- N 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	0.22927	31.0	26.1	9.7	40.7	35.8	62.5	52.5	21.8	16.7
2	0.32321	20.8	8.6	9.7	30.5	18.3	59.6	49.6	29.1	31.3
3	0.4433	17.8	5.6	9.8	27.6	15.4	57.0	47.0	29.4	31.6
4	0.91015	43.3	20.7	9.7	53.0	30.4	56.0	46.0	3.0	15.6
5	2.06142	29.8	14.9	9.7	39.5	24.6	56.0	46.0	16.5	21.4
6	5.52523	15.0	2.9	9.7	24.7	12.6	60.0	50.0	35.3	37.4
7	19.99925	19.9	19.5	10.0	29.9	29.5	60.0	50.0	30.1	20.5

--- L1 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	0.19597	25.4	13.2	10.0	35.4	23.2	63.8	53.8	28.4	30.6
2	0.3281	18.5	6.9	9.8	28.3	16.7	59.5	49.5	31.2	32.8
3	0.91743	43.1	20.1	9.8	52.9	29.9	56.0	46.0	3.1	16.1
4	2.32519	30.2	15.3	9.8	40.0	25.1	56.0	46.0	16.0	20.9
5	11.7167	10.3	0.5	10.0	20.3	10.5	60.0	50.0	39.7	39.5
6	18.23639	13.7	7.0	10.2	23.9	17.2	60.0	50.0	36.1	32.8
7	20.00115	22.0	21.8	10.2	32.2	32.0	60.0	50.0	27.8	18.0

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
PXA Signal Analyzer	KEYSIGHT	N9040B	US55230151	18.10.31	19.10.31
Spectrum Analyzer	R&S	FSV30	100807	18.08.01	19.08.01
Wideband Power Sensor	R & S	NRP-Z81	102398	19.01.25	20.01.25
ATTENUATOR	API Inmet	40AH2W-10	14	18.05.17	19.05.17
				19.05.17	20.05.17
Vector Signal Generator	R & S	SMBV100A	257566	19.01.04	20.01.04
Signal Generator	R & S	SMR40	100007	18.05.15	19.05.15
				19.05.13	20.05.13
EMI TEST RECEIVER	R & S	ESCI7	100732	18.08.23	19.08.23
Bi-Log Antenna	SCHWARZBECK	VULB 9168	583	18.05.04	20.05.04
Amplifier	SONOMA INSTRUMENT	310N	284608	18.08.23	19.08.23
COAXIAL FIXED ATTENUATOR	Agilent	8491B-003	2708A18758	19.05.04	20.05.04
Horn antenna	ETS.lindgren	3116	00086632	18.02.15	20.02.15
Horn antenna	ETS.lindgren	3117	161225	17.05.18	19.05.18
Broadband PreAmplifier	SCHWARZBECK	BBV9718	216	18.08.01	19.08.01
AMPLIFIER	L-3 Narda-MITEQ	AFS5-00101800-25-S-5	2054571	19.02.21	20.02.21
AMPLIFIER	L-3 Narda-MITEQ	AMF-7D-01001800 -22-10P	2031196	19.02.21	20.02.21
AMPLIFIER	L-3 Narda-MITEQ	JS44-18004000-33 -8P	2000997	18.08.02	19.08.02
LOOP Antenna	R & S	HFH2-Z2	100355	18.08.24	20.08.24
Antenna Mast	Innco Systems	MA4640-XP-ET	-	-	-
Turn Table	Innco Systems	DT2000	79	-	-
Antenna Mast	Innco Systems	MA4000-EP	303	-	-
Turn Table	Innco Systems	DT2000	79	-	-
Highpass Filter	WT	WT-A1698-HS	WT160411001	18.05.14	19.05.14
				19.05.14	20.05.14
TWO-LINE V - NETWORK	R&S	ENV216	101584	19.04.05	20.04.05
EMI TEST RECEIVER	R & S	ESCI3	100001	18.08.23	19.08.23
Cable Assembly	RadiAll	2301761768000PJ	1724.659		-
Cable Assembly	gigalane	RG-400	-		-
Cable Assembly	HUER+SUHNER	SUCOFLEX 104	MY4342/4		-

End of test report