

TEST REPORT

KOSTEC Co., Ltd. 28(175-20, Annyeong-dong) 406-gil sejaro, Hwaseong-si, Gyeonggi-do, Korea Tel:031-222-4251, Fax:031-222-4252	Report No.: KST-FCR-170006	 KOSTEC Co., Ltd. http://www.kostec.org
1. Applicant • Name : Dogtra Co., Ltd. • Address : #715-2(146BL-3L) Gojan-dong, Namdong-gu, Incheon, Korea		
2. Test Item • Product Name: DOG TRAINING DEVICE • Model Name: HF10U • Brand: None • FCC ID: SWN-HF10U		
3. Manufacturer • Name : Dogtra Co., Ltd. • Address : #715-2(146BL-3L) Gojan-dong, Namdong-gu, Incheon, Korea		
4. Date of Test : 2017. 07. 07.		
5. Test Method Used : FCC CFR 47, Part 15. Subpart C-15.249		
6. Test Result : Compliance		
7. Note: None		
Supplementary Information The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in <u>ANSI C 63.10-2013</u>. We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.		
The results shown in this test report refer only to the sample(s) tested unless otherwise stated.		
Affirmation	Tested by Name : Jung, Ho-Cheol  (Signature)	Technical Manager Name : Park, Gyeong-Hyeon  (Signature)
2017. 07. 10.		
KOSTEC Co., Ltd.		

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1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd.

128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

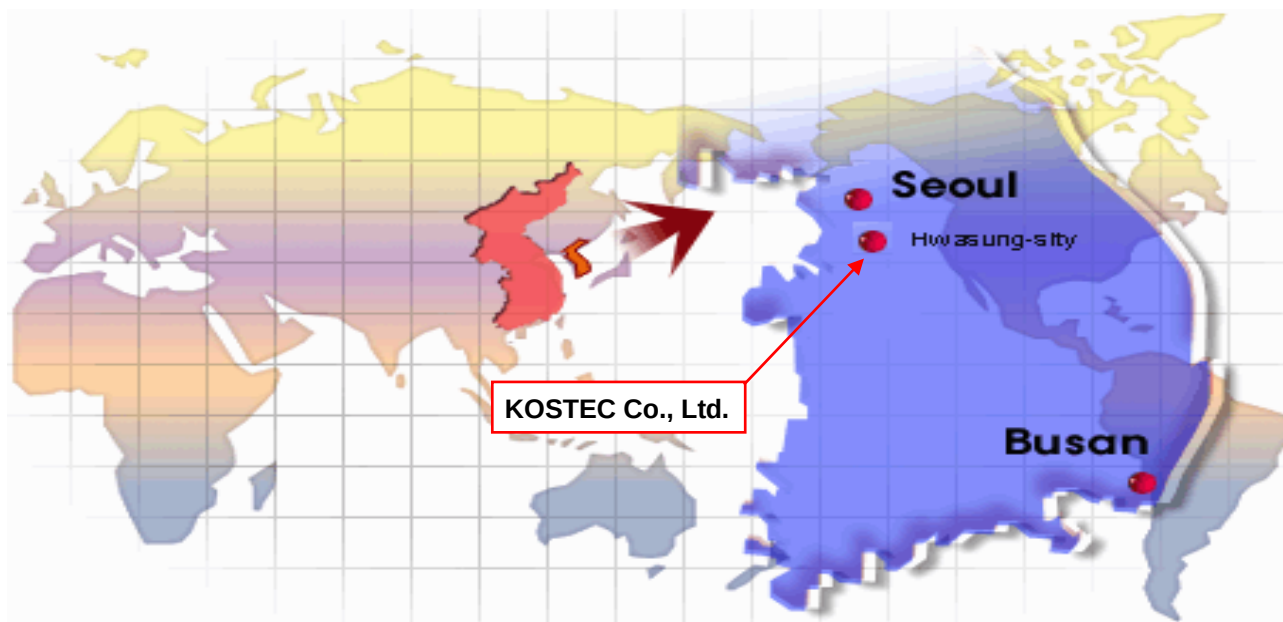
Registration information

KOLAS No. : 232

FCC Designation No. : KR0041

IC Registration Site No. : 8305A-1

1.2 Location



1.3 Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Gyeong Hyeon, Park	2017. 07. 10.

2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

Equipment Name	DOG TRAINING DEVICE
Model No	HF10U
Usage	Remote controller using 2.45 GHz
Serial Number	Proto type
Modulation type	GFSK
Maximum Field strength of fundamental	80.36 dB μ V/m
Operated Frequency	2.45 GHz
Channel Number	1 ea
Operation temperature	-10 °C ~ 60 °C
Power Source	DC 3.0 V 220mAh CR2032 Battery
Antenna Description	Printed Antenna (Without any antenna connector)
Remark	1. The device was operating at its maximum output power for all measurements. 2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (X) is shown in the report. 3. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.
FCC ID	SWN-HF10U

3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

Remote controller using 2.45 GHz

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark

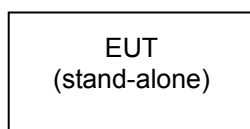
3.3 Product Modification

N/A

3.4 Operating Mode

Constantly transmitting with a carrier at maximum power.

3.5 Test Setup of EUT



3.6 Table for Carrier Frequencies

Freq Band	Low channel	Middle Channel	High Channel
2400 – 2483.5 MHz	-	2450 MHz	-

3.7 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
1	T & H Chamber	EY-101	90E14260	TABAI ESPEC	2017.09.07	1 year	☐
2	T & H Chamber	SH-641	92006831	ESPEC CORP	2018.05.31	1 year	☐
3	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2018.02.02	1 year	☐
4	Spectrum Analyzer	8593E	3710A02859	Agilent Technology	2018.02.02	1 year	☐
5	Spectrum Analyzer	FSV30	20-353063	Rohde & Schwarz	2018.02.01	1 year	☒
6	Signal Analyzer	N9010A	MY56070441	Agilent Technologies	2018.05.15	1 year	☐
7	EMI Test Receiver	ESCI7	100823	Rohde & Schwarz	2018.01.31	1 year	☒
8	EMI Test Receiver	ESI	837514/004	Rohde & Schwarz	2017.09.07	1 year	☒
9	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2018.02.03	1 year	☐
10	Network Analyzer	8753ES	US39172348	AGILENT	2017.09.06	1 year	☐
11	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2018.02.01	1 year	☐
12	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2018.02.01	1 year	☐
13	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2018.02.01	1 year	☐
14	Modulation Analyzer	8901A	3538A07071	Agilent Technology	2018.02.02	1 year	☐
15	Audio Analyzer	8903B	3514A16919	Agilent Technology	2018.01.31	1 year	☐
16	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2018.02.02	1 year	☐
17	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2017.09.06	1 year	☐
18	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2018.02.02	1 year	☐
19	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2018.02.02	1 year	☐
20	Signal Generator	SMB100A	179628	Rohde & Schwarz	2018.05.18	1 year	☐
21	Tracking Source	85645A	070521-A1	Agilent Technology	2018.02.03	1 year	☐
22	SLIDAC	None	0207-4	Myoung sung Ele.	2018.01.31	1 year	☐
23	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2018.02.01	1 year	☐
24	DC Power supply	6038A	3440A12674	Agilent Technology	2018.01.31	1 year	☐
25	DC Power supply	E3610A	KR24104505	Agilent Technology	2018.01.31	1 year	☐
26	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2018.01.31	1 year	☒
27	DC Power Supply	SM 3004-D	114701000117	DELTA ELEKTRONIKA	2018.01.31	1 year	☐
28	Dummy Load	8173	3780	Bird Electronic Co., Corp	2018.02.03	1 year	☐
29	Attenuator	50FH-030-500	140410 9433	JEW Industries Inc.	2018.02.02	1 year	☐
30	Attenuator	765-20	9703	Narda	2017.09.06	1 year	☐
31	Attenuator	24-30-34	BX5630	Aeroflex / Weinschel	2017.12.27	1 year	☐
32	Attenuator	8498A	3318A09485	HP	2018.02.01	1 year	☐
33	Step Attenuator	8494B	3308A32809	HP	2018.02.02	1 year	☐
34	Attenuator	18B50W-20F	64671	INMET	2018.02.02	1 year	☐
35	Attenuator	10 dB	1	Rohde & Schwarz	2018.05.18	1 year	☐
36	Attenuator	10 dB	2	Rohde & Schwarz	2018.05.18	1 year	☐
37	Attenuator	10 dB	3	Rohde & Schwarz	2018.05.18	1 year	☐
38	Attenuator	10 dB	4	Rohde & Schwarz	2018.05.18	1 year	☐
39	Attenuator	54A-10	74564	WEINSCHTEL	2018.05.18	1 year	☐
40	Attenuator	56-10	66920	WEINSCHTEL	2018.05.18	1 year	☐
41	Power divider	11636B	51212	HP	2018.02.01	1 year	☐
42	3Way Power divider	KPDSU3W	00070365	KMW	2017.09.06	1 year	☐
43	4Way Power divider	70052651	173834	KRYTAR	2018.02.01	1 year	☐
44	3Way Power divider	1580	SQ361	WEINSCHTEL	2018.05.18	1 year	☐
45	OSP	OSP120	101577	Rohde & Schwarz	2018.05.19	1 year	☐
46	White noise audio filter	ST31EQ	101902	SoundTech	2017.09.07	1 year	☐
47	Dual directional coupler	778D	17693	HEWLETT PACKARD	2018.02.02	1 year	☐
48	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2018.02.02	1 year	☐
49	Band rejection filter	3TNF-0006	26	DOVER Tech	2018.02.03	1 year	☐
50	Band rejection filter	3TNF-0008	317	DOVER Tech	2018.02.03	1 year	☐

No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
51	Band rejection filter	3TNF-0007	311	DOVER Tech	2018.02.03	1 year	☐
52	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2018.02.02	1 year	☐
53	Band rejection filter	WRCJV12-5695-5725-5825-5855-50SS	1	Wainwright Instruments GmbH	2018.05.18	1 year	☐
54	Band rejection filter	WRCJV12-5120-5150-5350-5380-40SS	4	Wainwright Instruments GmbH	2018.05.18	1 year	☐
55	Band rejection filter	WRCGV10-2360-2400-2500-2540-50SS	2	Wainwright Instruments GmbH	2018.05.18	1 year	☐
56	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2018.02.02	1 year	☐
57	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2018.02.02	1 year	☐
58	Highpass Filter	WHNX6-5530-3000-26500-40CC	2	Wainwright Instruments GmbH	2018.05.19	1 year	☐
59	Highpass Filter	WHNX6-2370-7000-26500-40CC	4	Wainwright Instruments GmbH	2018.05.19	1 year	☐
60	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2018.02.03	1 year	☐
61	Radio Communication Tester	CMU 200	112026	Rohde & Schwarz	2018.02.03	1 year	☐
62	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2018.02.03	1 year	☐
63	RF Up/Down Converter	DCP-1780	980901003	CREDIX	2018.02.03	1 year	☐
64	DECT Test set	CMD60	840677/005	Rohde & Schwarz	2017.09.06	1 year	☐
65	Loop Antenna	6502	9203-0493	EMCO	2019.05.29	2 year	☒
66	BiconiLog Antenna	3142B	9910-1432	EMCO	2018.04.25	2 year	☒
67	Trilog-Broadband Antenna	VULB 9168	9168-606	SCHWARZBECK	2018.09.09	2 year	☐
68	Horn Antenna	3115	2996	EMCO	2018.02.11	2 year	☒
69	Horn Antenna	BBHA9170	BBHA9170152	SCHWARZBECK	2019.04.25	2 year	☐
70	Antenna Master(3)	AT13	None	AUDIX	N/A	N/A	☐
71	Turn Table(3)	None	None	AUDIX	N/A	N/A	☐
72	PREAMPLIFIER(3)	8449B	3008A02577	Agilent	2018.02.01	1 year	☐
73	Antenna Master(10)	MA4000-EP	None	inno systems GmbH	N/A	N/A	☒
74	Turn Table(10)	None	None	inno systems GmbH	N/A	N/A	☒
75	AMPLIFIER(10)	TK-PA6S	120009	TESTEK	2018.01.31	1 year	☒
76	Antenna Mast	MA2000-EP	None	inno systems GmbH	N/A	N/A	☐
77	Turn Device	DE3700-RH	None	inno systems GmbH	N/A	N/A	☐

4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Field strength of radiated emission	15.249(a)	Clause 5.1	☒	Compliance
AC Conducted emission	15.207	Clause 5.2	☐	N/A
20 dB bandwidth measurement	15.215(c)	Clause 5.3	☒	Compliance
Antenna requirement	15.203	Clause 5.4	☒	Compliance
Compliance/pass : The EUT complies with the essential requirements in the standard. Not Compliance : The EUT does not comply with the essential requirements in the standard. N/A : The test was not applicable in the standard. - This test item is not applicable as the product solely employs battery power for operation.				

Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.249

ANSI C 63.10-2013

5. MEASUREMENT RESULTS

5.1 Field strength of radiated emission

5.1.1 Standard Applicable [FCC §15.249(a)]

(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:

Fundamental frequency (MHz)	Field strength of fundamental			Field strength of harmonics			Measurement distance (meter)
	(mV/m)	(dBμV/m)		(μV/m)	(dBμV/m)		
	AV	AV	PK	AV	AV	PK	
902-928 MHz	50	94	114	500	54	74	3
2400-2483.5 MHz	50	94	114	500	54	74	3
5725-5875 MHz	50	94	114	500	54	74	3
24.0-24.25 GHz	250	108	128	2500	68	88	3

Note :

- Field strength limits are specified at a distance of 3 meters.
- 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.
- The emission limits shown above are based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

§15.209. limits for radiated emissions measurements

Frequency Band	Limit (μV/m)	Limit (dBμV/m)	Measurement distance (meter)	Detector
0.009 – 0.490	2 400/F (kHz)	-	300	
0.490 – 1.705	2 4000/F (kHz)	-	30	
1.705 – 30.0	30	29.54	30	Quasi peak
30 - 88	100 **	40.0	3	Quasi peak
88 - 216	150 **	43.5	3	Quasi peak
216 - 960	200 **	46.0	3	Quasi peak
Above 960	500	54.0	3	Peak & Average

** fundamental emissions from intentional radiators operation under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, or 470-806 MHz. However, operation within these Frequency bands is permitted under other sections of this Part Section 15.231 and 15.241

5.1.2 Test Environment conditions

- Ambient temperature : (22 - 23) °C
- Relative Humidity : (56 - 58) % R.H.

5.1.3 Measurement Procedure

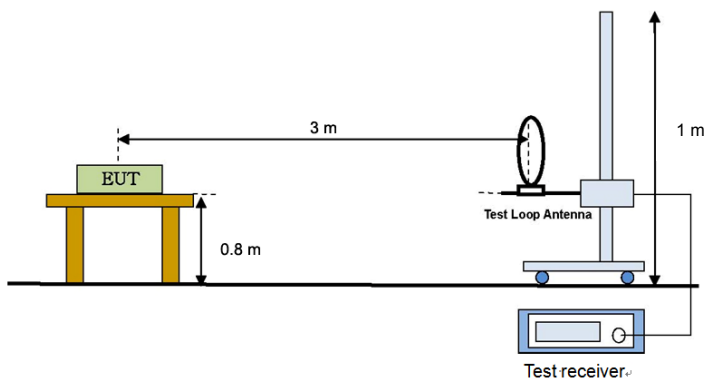
The measurements procedure of the Spurious RF Radiated emissions is as following describe method.

1. The EUT was placed on the top of a rotating table (0.8 meters for below 1 GHz and 1.5 meters for above 1 GHz) above the ground at a 3 meter camber. The table was rotated 360 degree to determine the position of the highest radiation.
 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna master.
 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both Horizontal and vertical polarizations of the antenna are set to make the measurement.
 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotating table was turned from 0 - 360 degrees to find the maximum reading.
 5. The measuring receiver was set to peak detector and specified bandwidth with max hold function.
 6. Low, Middle and high channels were measured, and radiation measurements are performed in X, Y, Z axis positioning. And found the worst axis position and only the test worst case mode is recorded in the report.
- The measurement results are obtained as described below:

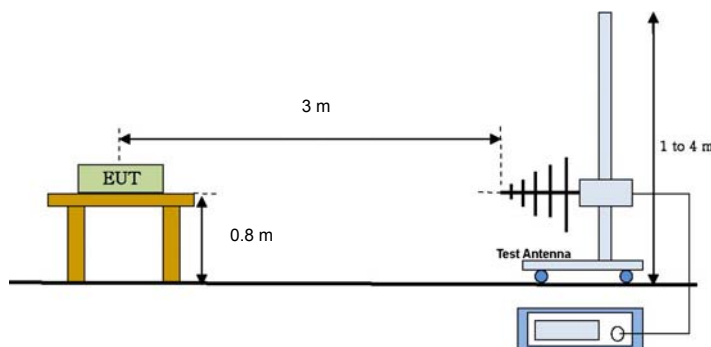
$$\text{Result(dB } \mu\text{V/m)} = \text{Reading(dB } \mu\text{V)} + \text{Antenna factor(dB/m)} + \text{CL(dB)} + \text{other applicable factor (dB)}$$
 - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for RMS Average (Duty cycle < 98 %) for Average detection (AV) at frequency above 1 GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
 - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle $\geq$ 98 %) for Average detection (AV) at frequency above 1 GHz.
 - According to §15.33 (a)(1), Frequency range of radiated measurement is performed the fifth harmonic.
 - If testing is performed with EUT is set at 1 meter away from the interference-receiving antenna, applied distance factor $20\log(3/1)$

5.1.4 Test setup

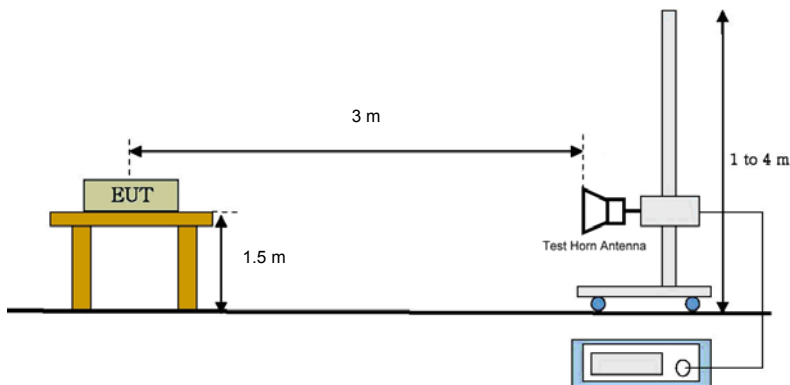
Radiated emission setup, Below 30 MHz



Radiated emission setup, Below 1 000 MHz



Radiated emission setup, Above 1 GHz



5.1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are test receiver, Cable loss, Antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, Antenna frequency interpolation, measurement distance variation, Site imperfection, mismatch, and system repeatability based on NIS 80,81.

Radiated Emission measurement: Below 1 GHz : 4.32 dB (CL: Approx 95 %, k=2)
Above 1 GHz : 4.14 dB (CL: Approx 95 %, k=2)

5.1.6 Measurement Result

Field strength of Fundamental

Freq. (MHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
2450	78.87	76.95	90	1.5	V	29.13	2.95	-30.59	80.36	78.44	114	94	33.64	15.56	Compliance

Field strength of harmonics and Band Edge

Freq. (MHz)	Reading (dB μ V/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)		Limit (dB μ V/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Compliance

* There is no harmonic & Band Edge emission.

Radiated emission Below 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)						
-	-	-	-	-	-	-	-	-	-	-	Compliance

* There is no spurious emission.

- Freq.(MHz) : Measurement frequency,
- Reading(dB μ V/m) : Indicated value for test receiver,
- Table (Deg) : Directional degree of Turn table
- Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor,
- Cbl(dB) : Cable loss, • Pre AMP(dB) : Preampifier gain(dB)
- Meas Result (dB μ V/m) : Reading(dB μ V/m)+ Antenna factor.(dB/m) + CL(dB) - Pre AMP(dB)
- Limit(dB μ V/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB μ V/m) – Meas Result(dB μ V/m)

5.2 AC Power Conducted emissions

5.2.1 Standard Applicable [FCC §15.207(a)]

For 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 frequencies hopping mode within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

Frequency of Emission(MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

5.2.2 Test Environment conditions

- Ambient temperature :
- Relative Humidity :

5.2.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.2.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2017. 02. 02	1 year	☐
LISN	ESH2-Z5	100044	R&S	2017. 02. 02	1 year	☐
	ESH3-Z5	100147	R&S	2017. 02. 02	1 year	☐

*Test Program: " ESXS-K1 V2.2"

Measurement uncertainty

Conducted Emission measurement: 3.5 dB (CL: Approx 95%, k=2)

5.2.5 Measurement Result

- N/A

5.3 20 dB bandwidth measurement

5.3.1 Standard applicable [FCC §15.215(c), § 2.1049]

According to 15.215(c), Ensure that the 20 dB occupied bandwidth shall be fall in the specified operating frequency range.

5.3.2 Test Environment conditions

- Ambient temperature : (22 - 23) °C • Relative Humidity : (56 - 58) % R.H.

5.3.3 Measurement Procedure

1. The 20 dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.
2. Measure the maximum width of the emission that is 20 dB down from the peak of the emission. The 99 % occupied bandwidth is the frequency bandwidth of the signal power at the 99 % channel power of occupied bandwidth.

The spectrum analyzer is set to the as follows :

- RBW : 100 kHz (1% to 5% of the occupied bandwidth)
- VBW : >3 x RBW
- Detector function : peak
- Trace : max hold

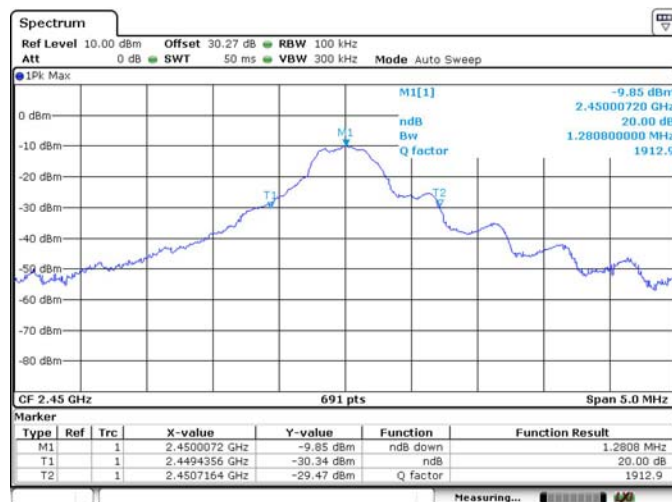
5.3.4 Test setup

Refer 5.1.4

5.3.5 Measurement Result

Frequency (MHz)	20 dB bandwidth (kHz)
2450	1281

5.3.6 Test plot



5.4 Antenna requirement

5.4.1 Standard applicable [FCC §15.203]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit So that broken antenna can be replaced by the user, but the Use of a standard antenna jack or electrical connector is prohibited.

The antenna is built-in PCB of EUT without any antenna connector. So this product is complies with the requirement of §15.203.