

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-210023	 KOSTEC Co., Ltd. http://www.kostec.org
<p>1. Applicant</p> <ul style="list-style-type: none"> • Name : Gen2wave • Address : 7th fl., Point town B/D, Gumi-ro, Bundang-gu, Seongnam-si, South Korea <p>2. Test Item</p> <ul style="list-style-type: none"> • Product Name: BIO SLED • Model Name: A10 • Brand: - • FCC ID: 2AWCDA10 <p>3. Manufacturer</p> <ul style="list-style-type: none"> • Name : Gen2wave • Address : 7th fl., Point town B/D, Gumi-ro, Bundang-gu, Seongnam-si, South Korea <p>4. Date of Test : 2021. 09. 01. ~ 2021. 09. 02.</p> <p>5. Test Method Used : FCC CFR 47, Part 15.225</p> <p>6. Test Result : Compliance</p> <p>7. Note: None</p>		
<p>Supplementary Information</p> <p>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>.</p> <p>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.</p>		
<p>The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report is not related to KOLAS accreditation.</p>		
Affirmation	Tested by Name : Lee, Mi-Young  (Signature)	Technical Manager Name : Park, Gyeong-Hyeon  (Signature)
<p>2021. 09. 06.</p>		
<p>KOSTEC Co., Ltd.</p>		



Table of Contents

1. GENERAL INFORMATION	3
1.1 Test Facility	3
1.2 Location	3
1.3 Revision History of test report	4
2. EQUIPMENT DESCRIPTION	5
3. SYSTEM CONFIGURATION FOR TEST	6
3.1 Characteristics of equipment	6
3.2 Used peripherals list	6
3.3 Product Modification	6
3.4 Operating Mode	6
3.5 Test Setup of EUT	6
3.6 Used Test Equipment List	7
4. SUMMARY TEST RESULTS	9
5. MEASUREMENT RESULTS	10
5.1 Carrier Frequency tolerance	10
5.2 Field strength of radiated emissions	12
5.3 20 dB Bandwidth	20
5.4 Antenna requirement	23
5.5 AC Power Conducted emissions	24

1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd.

28(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Telephone Number: 82-31-222-4251

Facsimile Number: 82-31-222-4252

Registration information

KOLAS No.: KT232

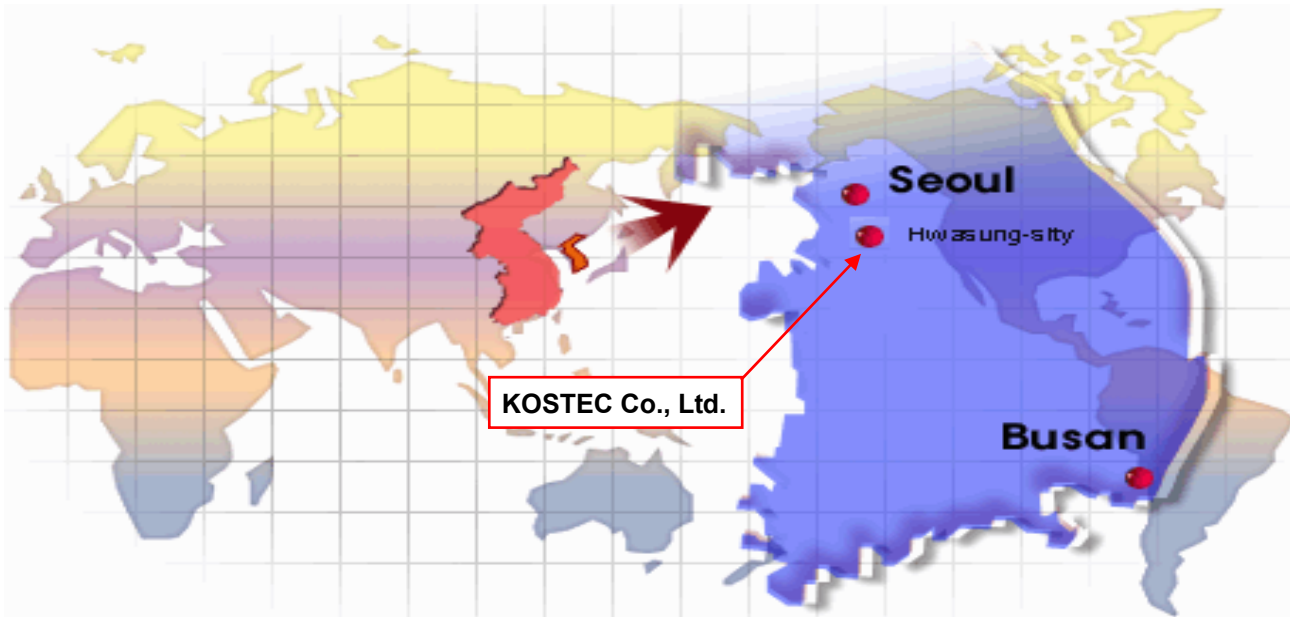
RRA (National Radio Research Agency): KR0041

FCC Designation No.: KR0041

IC Designation No.: KR0041

VCCI Membership No.: 2005

1.2 Location





1.3 Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Park, Gyeong-Hyeon	2021. 09. 06.

2. EQUIPMENT DESCRIPTION

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

Equipment Name	SLED
Model No	A10
Usage	Biometric & biographic data capture
Serial Number	Proto type
Modulation type	ASK
Emission Type	A1D
Maximum output power	RFID 1(ACM1281U) : 27.87 dB μ V/m @ 3 m RFID 2(HID_13.56 MHz) : 19.65 dB μ V/m @ 3 m RFID 2(HID_125 kHz) : 75.95 dB μ V/m @ 3 m
Operated Frequency	13.56 MHz, 125 kHz
Channel Number	3 ea (1 for each operating RFID module)
Operation temperature	-10 °C ~ 55 °C
Power Source	Li-ion battery / DC 3.7 V / 6700 mA
Antenna Description	Internal PCB antenna
Remark	<ol style="list-style-type: none"> 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 (Y) 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	2AWCDA10

3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

Biometric & biographic data capture device.

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
Smartphone	SM-G973N	0052257	SAMSUNG	

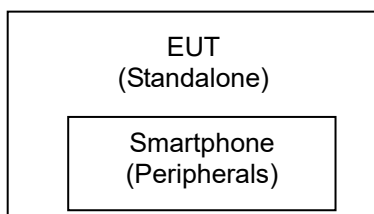
3.3 Product Modification

N/A

3.4 Operating Mode

Constantly transmitting with a modulated carrier at maximum power.

3.5 Test Setup of EUT



3.6 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Next Cal Date	Cal interval	used
1	T & H Chamber	PL-3J	15003623	ESPEC CORP	2021.11.04	1 year	<input type="checkbox"/>
2	T & H Chamber	SH-662	93000067	ESPEC CORP	2022.08.27	1 year	<input checked="" type="checkbox"/>
3	T & H Chamber	SH-641	92006831	ESPEC CORP	2022.03.29	1 year	<input type="checkbox"/>
4	Spectrum Analyzer	8563EC	3046A00527	Agilent Technology	2022.01.19	1 year	<input type="checkbox"/>
5	Spectrum Analyzer	FSV30	104029	Rohde & Schwarz	2022.08.30	1 year	<input type="checkbox"/>
6	Spectrum Analyzer	FSV30	20-353063	Rohde & Schwarz	2022.01.19	1 year	<input type="checkbox"/>
7	Spectrum Analyzer	FSV40	101727	Rohde & Schwarz	2022.07.19	1 year	<input type="checkbox"/>
8	Signal Analyzer	FSW43	101294	Rohde & Schwarz	2022.02.18	1 year	<input checked="" type="checkbox"/>
9	Signal Analyzer	FSW85	101602	Rohde & Schwarz	2022.06.30	1 year	<input type="checkbox"/>
10	EMI Test Receiver	ESCI7	100823	Rohde & Schwarz	2022.01.20	1 year	<input type="checkbox"/>
11	EMI Test Receiver	ESI	837514/004	Rohde & Schwarz	2022.08.30	1 year	<input checked="" type="checkbox"/>
12	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2022.01.20	1 year	<input type="checkbox"/>
13	Network Analyzer	8753ES	US39172348	AGILENT	2022.08.31	1 year	<input type="checkbox"/>
14	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2022.01.19	1 year	<input type="checkbox"/>
15	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2022.01.19	1 year	<input type="checkbox"/>
16	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2022.01.19	1 year	<input type="checkbox"/>
17	Audio Analyzer	8903B	3514A16919	Agilent Technology	2022.01.19	1 year	<input type="checkbox"/>
18	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2022.01.18	1 year	<input type="checkbox"/>
19	Modulation Analyzer	8901A	3041A05716	H.P	2022.01.18	1 year	<input type="checkbox"/>
20	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2022.08.30	1 year	<input type="checkbox"/>
21	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2022.01.18	1 year	<input type="checkbox"/>
22	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2022.01.18	1 year	<input type="checkbox"/>
23	GNSS Signal Generator	TC-2800A	2800A000494	TESCOM CO., LTD.	2022.01.19	1 year	<input type="checkbox"/>
24	Signal Generator	SMB100A	179628	Rohde & Schwarz	2022.05.04	1 year	<input type="checkbox"/>
25	Signal Generator	N5173B	MY57280148	KEYSIGHT	2022.06.11	1 year	<input type="checkbox"/>
26	SLIDAC	None	0207-4	Myoung sung Ele.	2022.01.20	1 year	<input type="checkbox"/>
27	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2022.01.20	1 year	<input type="checkbox"/>
28	DC Power supply	E3610A	KR24104505	Agilent Technology	2022.01.19	1 year	<input type="checkbox"/>
29	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2022.01.20	1 year	<input type="checkbox"/>
30	DC Power Supply	SM 3004-D	114701000117	DELTAELEKTRONIKA	2022.01.19	1 year	<input type="checkbox"/>
31	DC Power supply	6632B	MY43004005	Agilent Technology	2022.01.20	1 year	<input checked="" type="checkbox"/>
32	DC Power Supply	6632B	MY43004137	Agilent Technology	2022.01.20	1 year	<input type="checkbox"/>
33	Termination	1433-3	LM718	WEINSCHEL	2022.07.16	1 year	<input type="checkbox"/>
34	Termination	1432-3	QR946	AEROFLEX/WEINSCHEL	2022.07.16	1 year	<input type="checkbox"/>
35	Attenuator	24-30-34	BX5630	Aeroflex / Weinschel	2021.12.04	1 year	<input type="checkbox"/>
36	Attenuator	8498A	3318A09485	HP	2022.01.19	1 year	<input type="checkbox"/>
37	Step Attenuator	8494B	3308A32809	HP	2022.01.19	1 year	<input type="checkbox"/>
38	RF Step Attenuator	RSP	100091	Rohde & Schwarz	2022.01.19	1 year	<input type="checkbox"/>
39	Attenuator	18B50W-20F	64671	INMET	2022.01.19	1 year	<input type="checkbox"/>
40	Attenuator	10 dB	1	Rohde & Schwarz	2022.05.04	1 year	<input type="checkbox"/>
41	Attenuator	54A-10	74564	WEINSCHEL	2022.08.31	1 year	<input type="checkbox"/>
42	Attenuator	56-10	66920	WEINSCHEL	2022.05.04	1 year	<input type="checkbox"/>
43	Attenuator	48-30-33-LIM	BL5350	Weinschel Corp.	2022.07.16	1 year	<input type="checkbox"/>
44	Power divider	11636B	51212	HP	2022.01.21	1 year	<input type="checkbox"/>
45	3Way Power divider	KPDSU3W	00070365	KMW	2022.08.30	1 year	<input type="checkbox"/>
46	4Way Power divider	70052651	173834	KRYTAR	2022.01.19	1 year	<input type="checkbox"/>
47	3Way Power divider	1580	SQ361	WEINSCHEL	2022.05.04	1 year	<input type="checkbox"/>
48	OSP	OSP120	101577	Rohde & Schwarz	2022.06.14	1 year	<input type="checkbox"/>
49	White noise audio filter	ST31EQ	101902	SoundTech	2022.08.31	1 year	<input type="checkbox"/>
50	Dual directional coupler	778D	17693	HEWLETT PACKARD	2022.01.19	1 year	<input type="checkbox"/>
51	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2022.01.19	1 year	<input type="checkbox"/>

No.	Instrument	Model	S/N	Manufacturer	Next Cal Date	Cal interval	used
52	Band rejection filter	3TNF-0006	26	DOVER Tech	2022.01.19	1 year	<input type="checkbox"/>
53	Band rejection filter	3TNF-0007	311	DOVER Tech	2022.01.19	1 year	<input type="checkbox"/>
54	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2022.01.19	1 year	<input type="checkbox"/>
55	Band rejection filter	WRCJV12-5695-5725-5825-5855-50SS	1	Wainwright Instruments GmbH	2022.05.04	1 year	<input type="checkbox"/>
56	Band rejection filter	WRCJV12-5120-5150-5350-5380-40SS	4	Wainwright Instruments GmbH	2022.05.04	1 year	<input type="checkbox"/>
57	Band rejection filter	WRCGV10-2360-2400-2500-2540-50SS	2	Wainwright Instruments GmbH	2022.05.04	1 year	<input type="checkbox"/>
58	Band rejection filter	CTF-155M-S1	001	RF One Electronics	2022.08.30	1 year	<input type="checkbox"/>
59	Band rejection filter	CTF-435M-S1	001	RF One Electronics	2022.08.30	1 year	<input type="checkbox"/>
60	Band rejection filter	CTF-5890M-70MS1	1	RF One Electronics	2022.01.19	1 year	<input type="checkbox"/>
61	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2022.01.19	1 year	<input type="checkbox"/>
62	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2022.01.19	1 year	<input type="checkbox"/>
63	Highpass Filter	WHNX6-5530-7000-26500-40CC	2	Wainwright Instruments GmbH	2022.05.04	1 year	<input type="checkbox"/>
64	Highpass Filter	WHNX6-2370-3000-26500-40CC	4	Wainwright Instruments GmbH	2022.05.04	1 year	<input type="checkbox"/>
65	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2022.01.19	1 year	<input type="checkbox"/>
66	WideBand Radio Communication Tester	CMW500	117235	Rohde & Schwarz	2022.01.19	1 year	<input type="checkbox"/>
67	WideBand Radio Communication Tester(with CMX500)	CMW500	167157	Rohde & Schwarz	2022.04.09	1 year	<input type="checkbox"/>
68	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2022.01.18	1 year	<input type="checkbox"/>
69	Loop Antenna	6502	9203-0493	EMCO	2023.05.31	2 year	<input type="checkbox"/>
70	Loop Antenna	FMZB1513	#374	Schwarzbeck	2023.02.26	2 year	<input checked="" type="checkbox"/>
71	BiconiLog Antenna	3142B	1745	EMCO	2022.04.24	2 year	<input type="checkbox"/>
72	Trilog-Broadband Antenna _(R)	VULB 9168	9168-606	SCHWARZBECK	2022.09.21	2 year	<input checked="" type="checkbox"/>
73	Biconical Antenna _(T)	VUBA9117	9117-342	Schwarz beck	2022.03.24	2 year	<input type="checkbox"/>
74	Horn Antenna	3115	9605-4834	EMCO	2022.03.06	2 year	<input type="checkbox"/>
75	Horn Antenna	QMS-00208	21909	STEATITE ANTENNA	2022.12.04	2 year	<input type="checkbox"/>
76	Horn Antenna _(R)	3117	00135191	ETS-LINDGREN	2022.04.29	2 year	<input type="checkbox"/>
77	Horn Antenna _(T)	3115	2996	EMCO	2022.02.14	2 year	<input type="checkbox"/>
78	Horn Antenna _(R)	BBHA 9170	9170-722	SCHWARZBECK	2022.05.12	2 year	<input type="checkbox"/>
79	Horn Antenna _(T)	BBHA 9170	743	SCHWARZBECK	2023.01.21	2 year	<input type="checkbox"/>
80	AMPLIFIER(A_10)	TK-PA6S	120009	TESTEK	2022.01.19	1 year	<input type="checkbox"/>
81	AMPLIFIER(C_3)	TK-PA01S	200141-L	TESTEK	2022.08.31	1 year	<input checked="" type="checkbox"/>
82	PREAMPLIFIER(C_3)	8449B	3008A02577	Agilent	2022.01.19	1 year	<input type="checkbox"/>
83	RF PRE AMPLIFIER	SCU08F2	100762	Rohde & Schwarz	2021.12.04	1 year	<input type="checkbox"/>
84	AMPLIFIER	TK-PA18	150003	TESTEK	2022.01.21	1 year	<input type="checkbox"/>
85	AMPLIFIER	TK-PA1840H	160010-L	TESTEK	2022.01.21	1 year	<input type="checkbox"/>
86	Horn Antenna	M19RH	T01	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
87	Horn Antenna	M19RH	R01	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
88	Horn Antenna	M12RH	T02	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
89	Horn Antenna	M12RH	R02	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
90	Horn Antenna	M08RH	T03	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
91	Horn Antenna	M08RH	R03	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
92	Horn Antenna	M05RH	T04	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
93	Horn Antenna	M05RH	R04	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
94	Horn Antenna	M03RH	T05	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
95	Horn Antenna	M03RH	R05	OML, Inc.	2022.05.29	2 year	<input type="checkbox"/>
96	Harmonic Mixer	M12HWD	200529-1	OML, Inc.	2022.07.12	1 year	<input type="checkbox"/>
97	Harmonic Mixer	M08HWD	200529-1	OML, Inc.	2022.07.12	1 year	<input type="checkbox"/>
98	Harmonic Mixer	M05HWD	200529-1	OML, Inc.	2022.07.12	1 year	<input type="checkbox"/>
99	Harmonic Mixer	M03HWD	200529-1	OML, Inc.	2022.07.12	1 year	<input type="checkbox"/>
100	Source Module	S19MS-A	200529-1	OML, Inc.	2022.07.02	1 year	<input type="checkbox"/>
101	Source Module	S12MS-A	200529-1	OML, Inc.	2022.07.02	1 year	<input type="checkbox"/>
102	Source Module	S08MS-A	200529-1	OML, Inc.	2022.07.02	1 year	<input type="checkbox"/>
103	Source Module	S05MS-A	200529-1	OML, Inc.	2022.07.02	1 year	<input type="checkbox"/>
104	Source Module	S03MS-A	200529-1	OML, Inc.	2022.07.02	1 year	<input type="checkbox"/>

4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Carrier frequency tolerance	15.225(e)	Clause 5.1	<input checked="" type="checkbox"/>	Compliance
Field strength of radiated emission	15.225(a) ~ (d)	Clause 5.2	<input checked="" type="checkbox"/>	Compliance
20 dB Bandwidth (Occupied bandwidth)	15.215(c), 2.1049	Clause 5.3	<input checked="" type="checkbox"/>	Compliance
Antenna requirement	15.203	Clause 5.4	<input checked="" type="checkbox"/>	Compliance
AC Conducted emission	15.207	Clause 5.5	<input checked="" type="checkbox"/>	Compliance
<p>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.</p>				

Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.225 & 15.207 & 15.209

ANSI C63.10-2013

ANSI C63.4-2014

5. MEASUREMENT RESULTS

5.1 Carrier Frequency tolerance

5.1.1 Standard Applicable [FCC Part 15.225(e)]

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency Over a temperature variation of -20 degrees C to +50 degrees C at normal supply voltage, and for a variation in the primary supply 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.

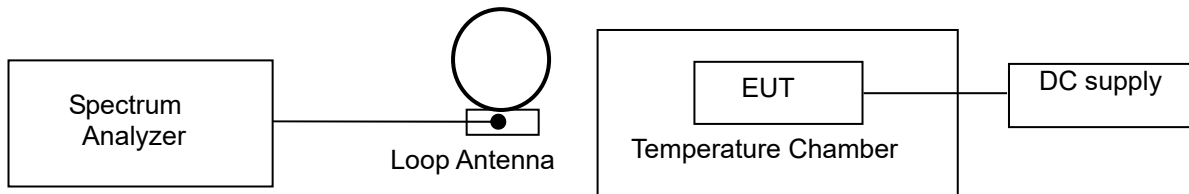
5.1.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C • Relative Humidity : (49 ~ 51) % R.H.

5.1.3 Measurement Procedure

Before measurements are made the equipment shall have reached thermal balance in the Test chamber period. and then it is normal operating for about 15 minutes after thermal balance has been reached. For tests at the extreme temperature, the equipment shall be left in the test chamber until thermal balance is attained, then the standby or receive condition for a period of a few minute after which the equipment shall meet the specified requirements. The test data sheet recorded measured value by frequency counter.

5.1.4 Test setup



5.1.5 Measurement Result

- RFID1 (ACM1281U)

Temp(°C)	Power Supply	Measured Freq(Hz)	Freq Drift	
			Hz	%
50	DC 5.0 (Vnom)*	13,560,337	337	0.002 5
40	DC 5.0 (Vnom)	13,560,333	333	0.002 5
30	DC 5.0 (Vnom)	13,560,297	297	0.002 2
20	DC 5.0 (Vnom)	13,560,263	263	0.001 9
10	DC 5.0 (Vnom)	13,560,255	255	0.001 9
0	DC 5.0 (Vnom)	13,560,174	174	0.001 3
-10	DC 5.0 (Vnom)	13,559,833	-167	-0.001 2
-20	DC 5.0 (Vnom)	13,559,641	-359	-0.002 6
Nom Temperature	DC 4.25 (Vmin)	13,560,267	267	0.002 0
Nom Temperature	DC 5.75 (Vmax)	13,560,262	262	0.001 9
Limit		Within in ±0.01 % or ±1 356 Hz		
Test Results		Compliance		

*based on the adapter power input.



▪ RFID 2 (HID)

Temp(℃)	Power Supply	Measured Freq(Hz)	Freq Drift	
			Hz	%
50	DC 5.0 (Vnom)*	13,560,141	141	0.001 0
40	DC 5.0 (Vnom)	13,560,133	133	0.001 0
30	DC 5.0 (Vnom)	13,559,987	-13	-0.000 1
20	DC 5.0 (Vnom)	13,559,846	-154	-0.001 1
10	DC 5.0 (Vnom)	13,559,811	-189	-0.001 4
0	DC 5.0 (Vnom)	13,559,712	-288	-0.002 1
-10	DC 5.0 (Vnom)	13,559,611	-389	-0.002 9
-20	DC 5.0 (Vnom)	13,559,583	-417	-0.003 1
Nom Temperature	DC 4.25 (Vmin)	13,559,833	-167	-0.001 2
Nom Temperature	DC 5.75 (Vmax)	13,559,846	-154	-0.001 1
Limit		Within in ± 0.01 % or ± 1 356 Hz		
Test Results		Compliance		

*based on the adapter power input.

5.2 Field strength of radiated emissions

5.2.1 Standard Applicable [FCC Part 15.225(a) ~ (d)]

- (a) The Field strength of any emissions within the band 13.553 - 13.567 MHz shall not exceed 15,848 $\mu\text{V}/\text{m}$ at 30 meter
 (b) Within the bands 13.410 - 13.553 MHz and 13.567 - 13.710 MHz, the field strength of any emissions shall not exceed 334 micro volts/meter at 30 meter
 (c) Within the bands 13.110 - 13.410 MHz and 13.710 - 14.010 MHz, the field strength of any emissions shall not exceed 106 micro volts/meter at 30 meter
 (d) The Field strength of any emissions appearing outside of the 13.110 - 14.010 MHz band shall not exceed The general radiated emission limits in §15.209
 Above required standard (a ~ c) and (d) is brief describe table as follows

§ 15.225 [(a) ~(c)] : Limit for in-band field strength

Frequency Band (MHz)	Limit		Measurement distance (meter)
	($\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)	
13.553 - 13.567	15,848	84.00 (124.0 @ 3 m)	30
13.410 - 13.553 13.567 - 13.710	334	50.47 (90.5 @ 3 m)	30
13.110 - 13.410 13.710 - 14.010	106	40.50 (80.5 @ 3 m)	30

§15.209. limits for radiated emissions measurements

Frequency Band	Limit [$\mu\text{V}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	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

§15.205. Restrict Band of Operation

Only spurious emissions are permitted in any of the frequency bands listed below ;

[MHz]	[MHz]	[MHz]	[GHz]
0.090 - 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.
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 - 8.38 6 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			

** Until February 1, 1999, this restricted band shall be 0.490-0.510

5.2.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C • Relative Humidity : (49 ~ 51) % R.H.

5.2.3 Measurement Procedure

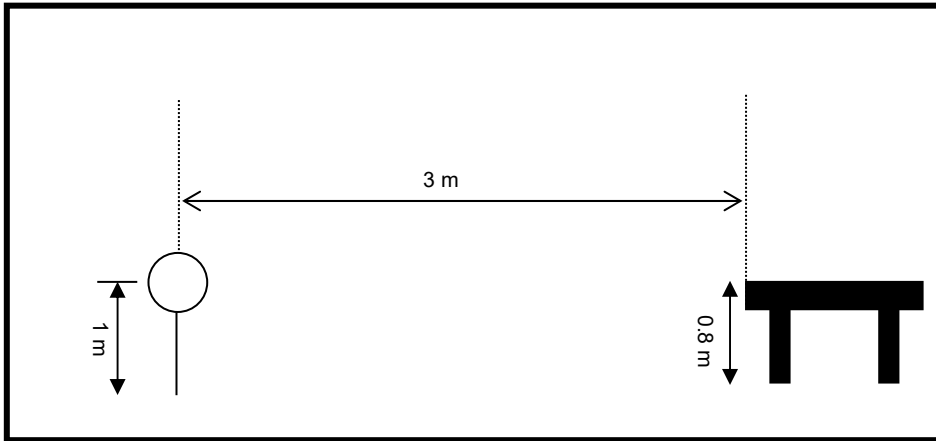
The measurements procedure of the Spurious RF Radiated emissions is as following describe method.

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:
Result(dBμV/m) = Reading(dBμV) + Antenna factor(dB/m)+ CL(dB) + 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/duty cycle)).
 - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
 - According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

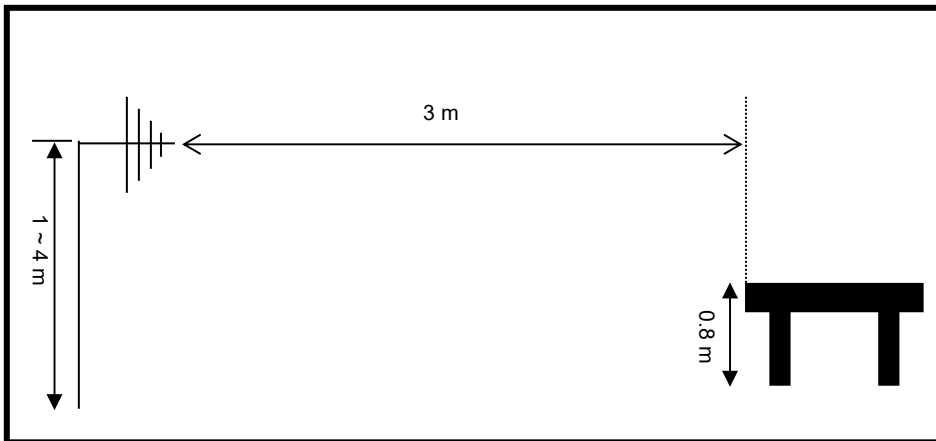
Above test was performed in accordance with ANSI C63.10-2013 Section 6.10.5 & 6.4, 6.5, 6.6

5.2.4 Test setup

Radiated emission setup, below 30 MHz



Radiated emission setup, below 1 000 MHz



5.2.5 Measurement Result

▣ IN-BAND

▪ RFID 1(ACM1281U)

Freq. (MHz)	Reading (dBμV/m)	Table (Deg)	Pstn (axis)	Antenna			CL (dB)	Distn factor (dB)	Meas Result (dBμV/m)	Limit (dBμV/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
13.560*	47.15	180	Y	1	-	20.11	0.61	-40	27.87	84.0	56.13	Compliance
13.384	28.12	180	Y	1	-	20.10	0.61	-40	12.97	40.5	27.53	Compliance
13.472	32.25	170	Y	1	-	20.11	0.61	-40	8.83	50.5	41.67	Compliance
13.650	32.32	170	Y	1	-	20.12	0.61	-40	13.05	50.5	37.45	Compliance
13.738	28.40	180	Y	1	-	20.12	0.61	-40	9.13	40.5	31.37	Compliance

▪ RFID 2(HID)

Freq. (MHz)	Reading (dBμV/m)	Table (Deg)	Pstn (axis)	Antenna			CL (dB)	Distn factor (dB)	Meas Result (dBμV/m)	Limit (dBμV/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
0.125*	55.49	170	Y	1	-	19.99	0.17	-	75.95	105.62	29.67	Compliance
13.560*	38.93	160	Y	1	-	20.11	0.61	-40	19.65	84.0	64.35	Compliance
13.422	19.31	170	Y	1	-	20.11	0.61	-40	0.03	50.5	50.47	Compliance
13.472	22.60	170	Y	1	-	20.11	0.61	-40	3.32	50.5	47.18	Compliance
13.569	23.99	180	Y	1	-	20.11	0.61	-40	4.71	50.5	45.79	Compliance
13.619	23.10	180	Y	1	-	20.12	0.61	-40	3.83	50.5	46.67	Compliance

*It is fundamental frequency

Note1. above measured frequency have been done at 3 m distance and corrected according to required FCC 15.209. e)

∴ Extrapolation distance factor : $40\log(3/30) = -40$ dB

If Measurement distance is 3 m and Mandatory requirement distance is 30 m at 30 MHz or less, extrapolation distance factor(dB) is $40 / \text{decade} = 40 \log_{10}(\text{MRD}/\text{MD})$

MRD is Mandatory requirement distance and MD is Measured distance

Note2. above measured frequencies is apply required standard FCC Part 15.225

Note3. All measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.

Note4. All measurements were recorded using a quasi-peak detector.

Freq.(MHz) : Measurement frequency

Reading(dBμV/m) : Indicated value for test receiver

Table (Deg) : Directional degree of Turn table

Pstn(axis) : Location axis of EUT

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor

Cbl(dB) : Cable loss,

Distn factor(dB) : distance correction factor [40 dB /decade as per § 15.31f(2)]

Meas Result (dBμV/m) : Reading(dBμV/m)+ Antenna factor.(dB/m)+ CL(dB) + Distn factor(dB)

Limit(dBμV/m): Limit value specified with FCC Rule

Mgn(dB) : FCC Limit (dBμV/m) – Meas Result(dBμV/m)

▣ OUT-BAND

▪ RFID 1(ACM1281U)

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Pstn (axis)	Antenna			CL (dB)	Pre AMP (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
122.32	55.83	180	Y	1.5	V	17.34	1.41	46.45	28.13	43.5	15.37	Compliance
190.44	52.76	180	Y	1.5	V	16.65	1.74	46.41	24.74	43.5	18.76	Compliance
217.64	48.20	170	Y	1.5	H	16.46	1.88	46.37	20.17	46.0	25.83	Compliance
272.52	44.56	170	Y	1.5	H	18.50	2.15	46.32	18.89	46.0	27.11	Compliance
458.40	51.55	180	Y	1.5	V	23.22	2.81	46.12	31.47	46.0	14.53	Compliance
505.79	51.77	190	Y	1.5	V	23.88	2.99	45.99	32.65	46.0	13.35	Compliance

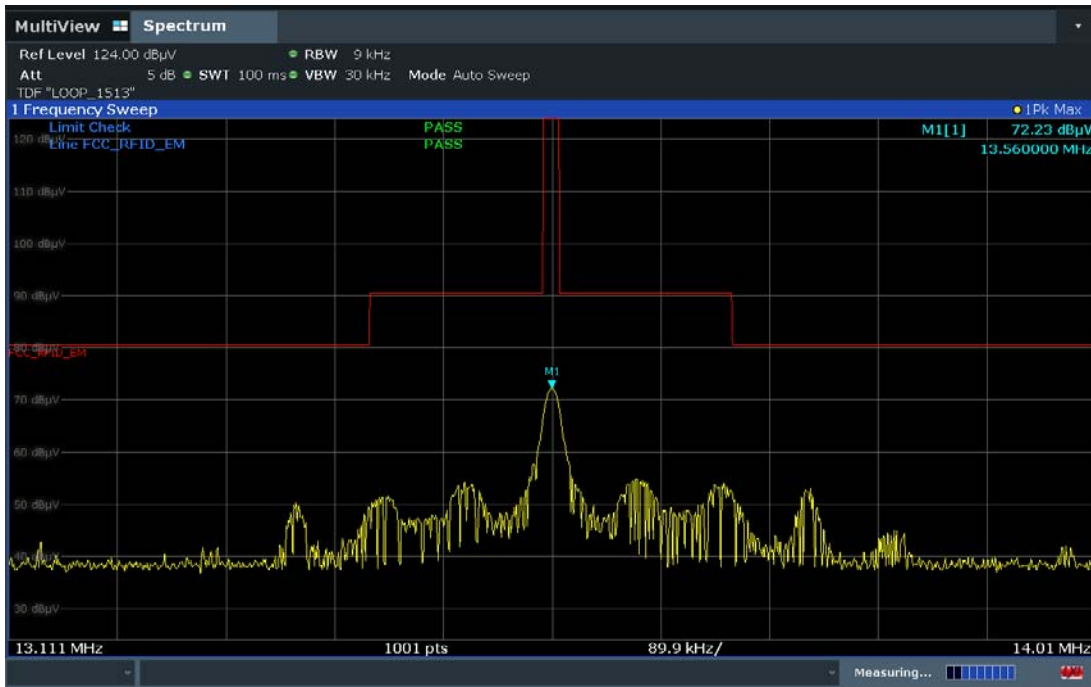
▪ RFID 2(HID)

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Pstn (axis)	Antenna			CL (dB)	Pre AMP (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
92.99	45.68	180	Y	1.5	H	14.07	1.18	46.46	14.47	43.5	29.03	Compliance
245.26	43.44	180	Y	1.5	H	17.53	2.04	46.33	16.68	46.0	29.32	Compliance
311.45	45.12	170	Y	1.5	H	19.64	2.28	46.30	20.74	46.0	25.26	Compliance
448.84	52.17	170	Y	1.5	V	23.07	2.78	46.14	31.87	46.0	14.13	Compliance
474.79	54.45	180	Y	1.5	V	23.46	2.87	46.07	34.71	46.0	11.29	Compliance
502.25	52.76	180	Y	1.5	V	23.83	2.97	46.00	33.57	46.0	12.43	Compliance
558.08	47.39	180	Y	1.5	V	24.73	3.17	45.93	29.37	46.0	16.63	Compliance

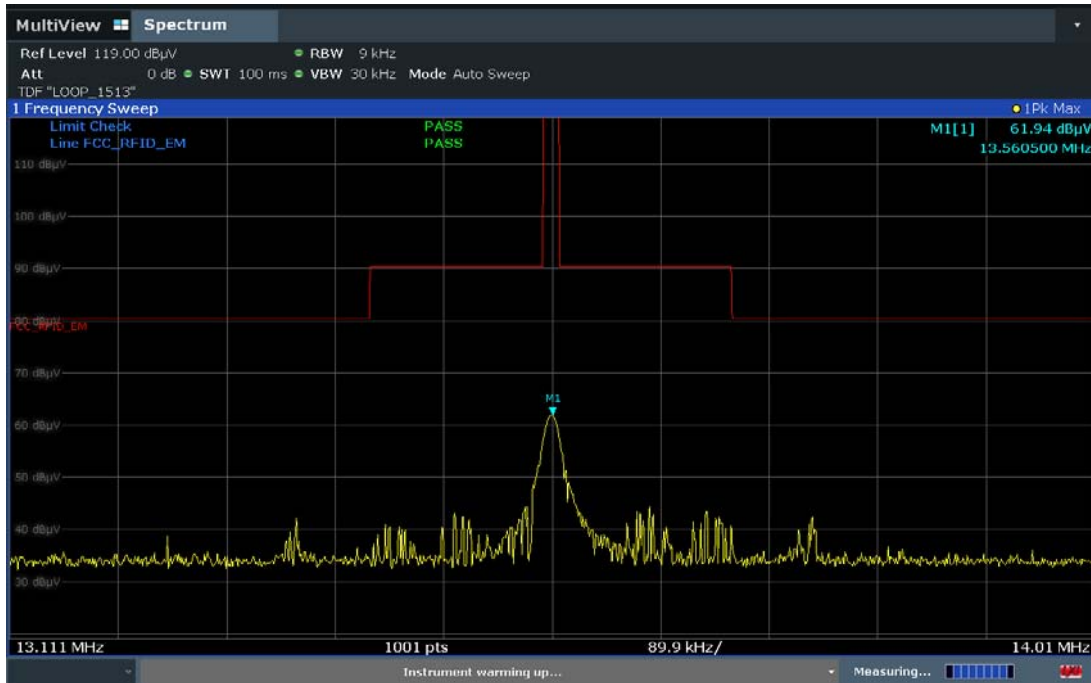
- It is not recorded on the report that the reading of emissions are attenuated more than 30 dB below the permissible limits or the field strength is too small to measured.
- The transmitter radiated spectrum was investigated from 9 kHz to 1 GHz.

5.2.6 Plots

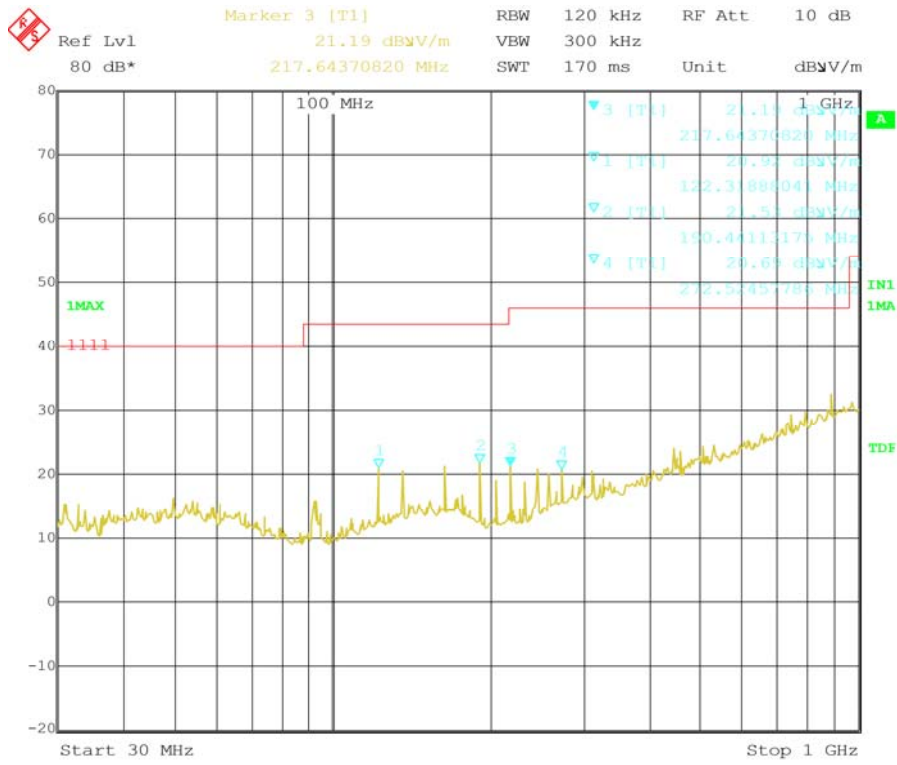
RFID 1(ACM1281U) – In band



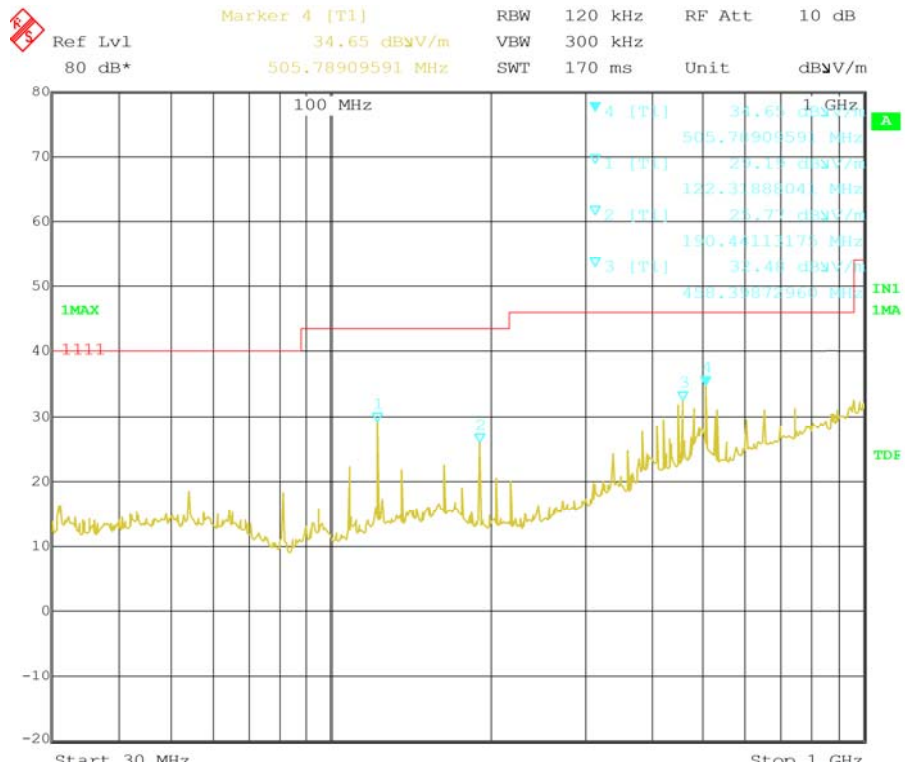
RFID 2(HID) – In band



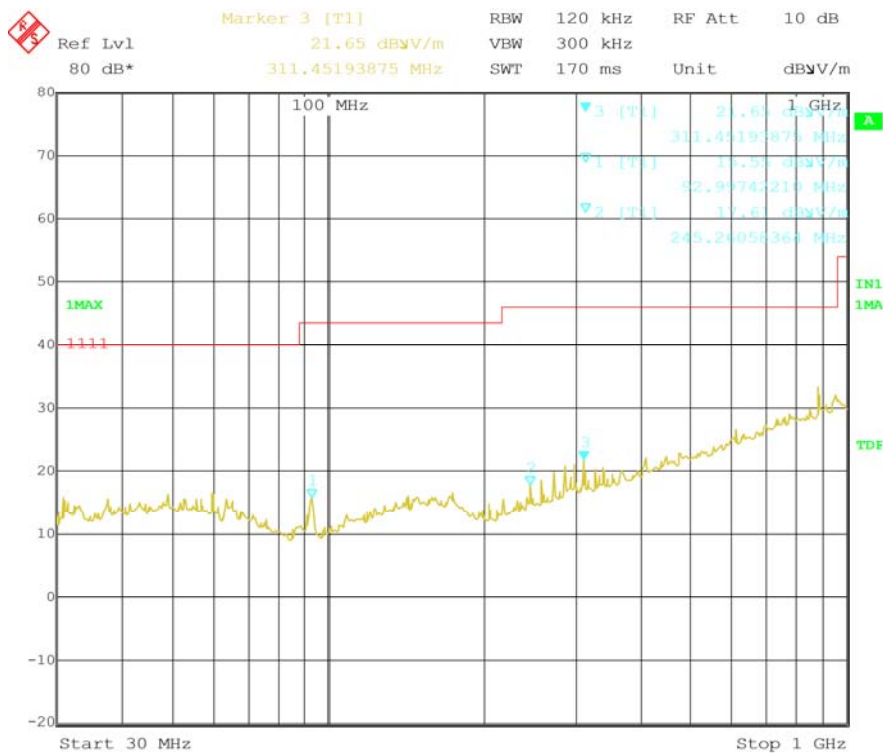
RFID 1(ACM1281U) – Out band (H)



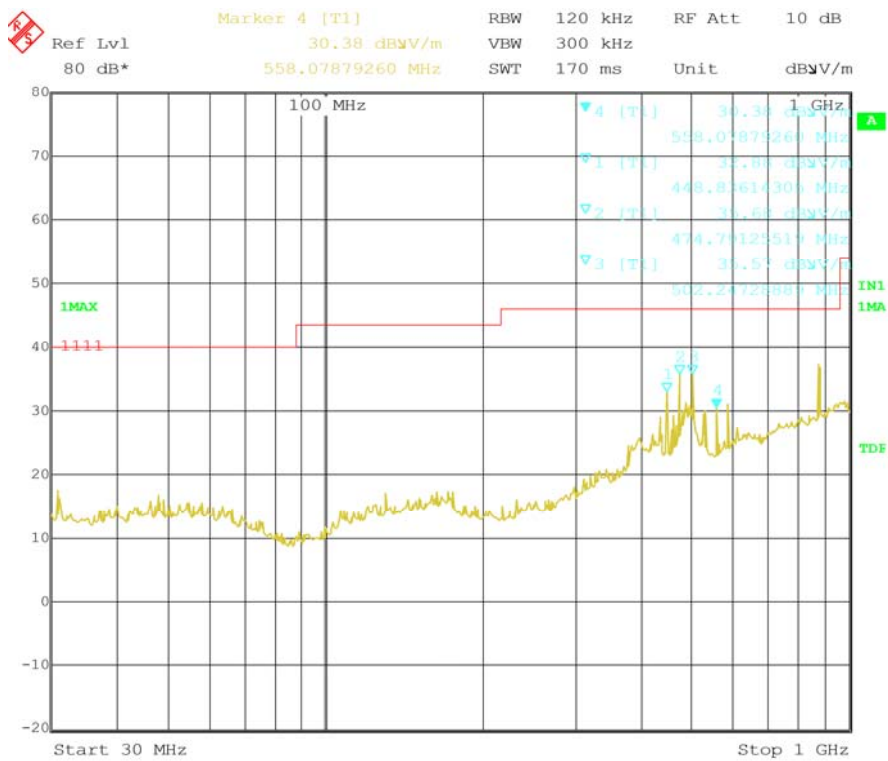
RFID 1(ACM1281U) – Out band (V)



RFID 2(HID) – Out band (H)



RFID 2(HID) – Out band (V)



5.3 20 dB Bandwidth (Occupied bandwidth)

5.3.1 Standard Applicable [FCC Part 15.215(c) & 2.1049]

The 20 dB & 99 % bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

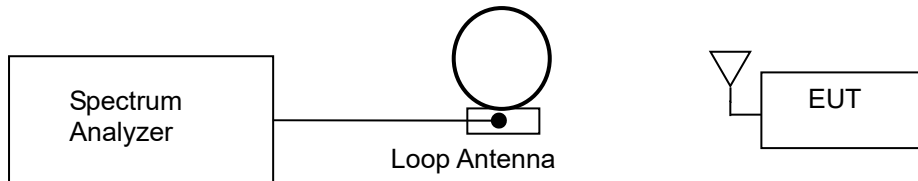
5.3.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C • Relative Humidity : (49 ~ 51) % R.H.

5.3.3 Measurement Procedure

Refer 5.3.1

5.3.4 Test setup



5.3.5 Measurement Result

Frequency [MHz]	20 dB Bandwidth [kHz]		Limit	Test Results
	RFID 1(ACM1281U)	RFID 2(HID)		
13.56	0.94	1.03	N/A – Information only	Compliance

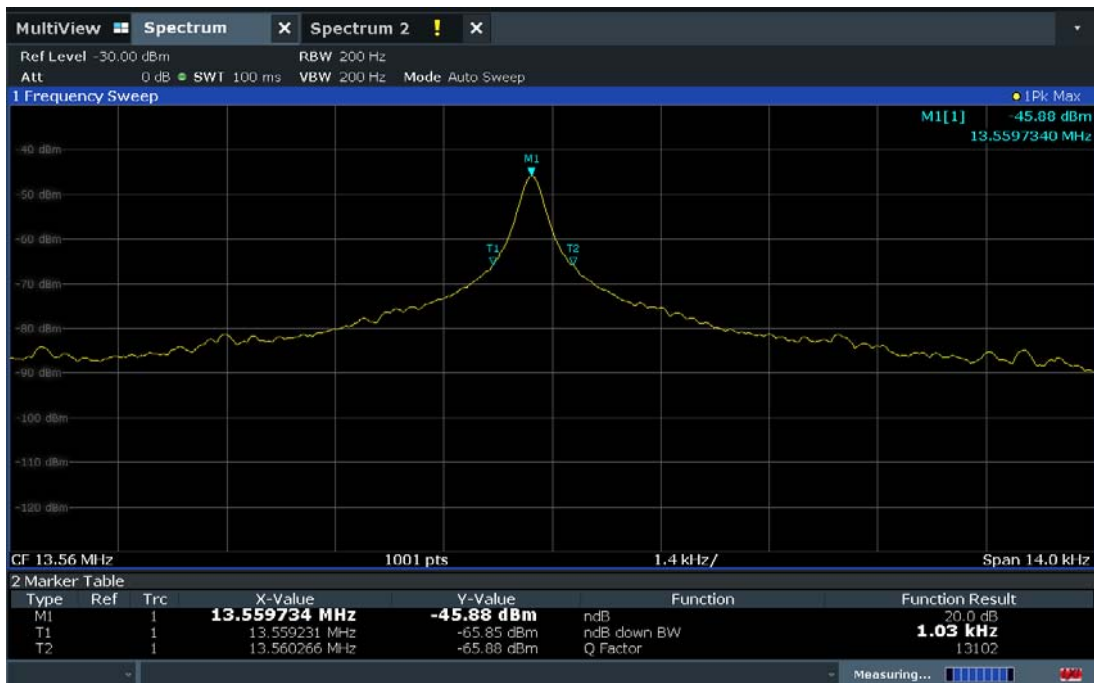
Frequency [MHz]	99% Bandwidth [kHz]	Limit	Test Results
	RFID 2(HID)		
0.125	1.67	N/A – Information only	Compliance

5.3.6 Test Plot

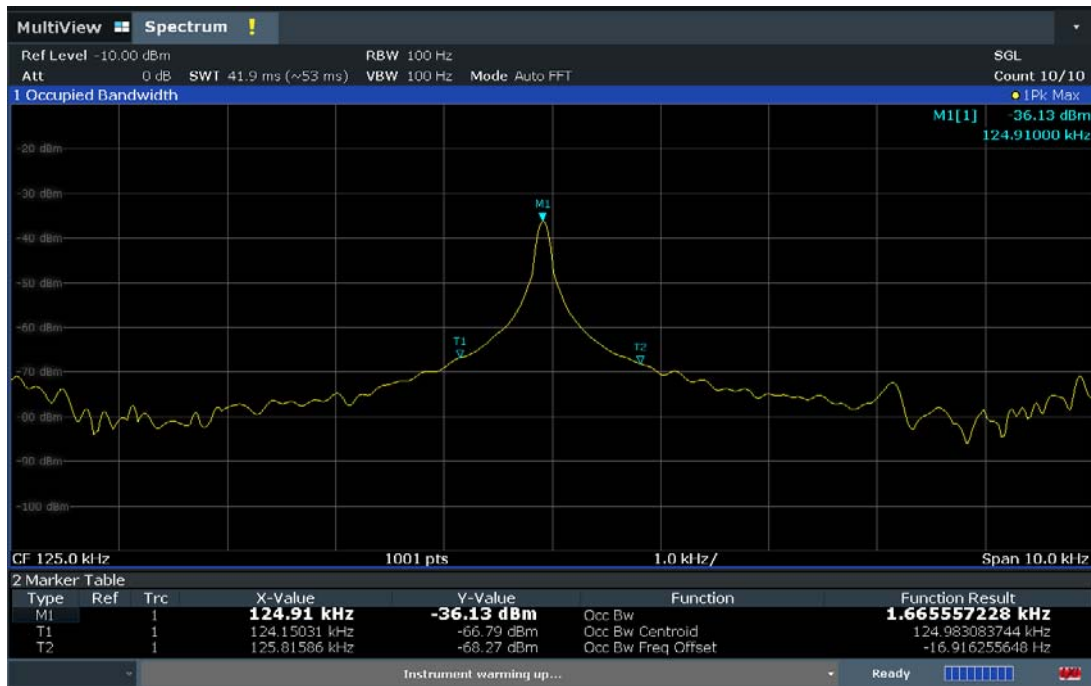
RFID 1(ACM1281U)



RFID 2(HID-13.56 MHz)



RFID 2(HID-125 kHz)



5.4 Antenna requirement

5.4.1 Standard applicable [FCC Part 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.

5.4.2 Antenna details

Frequency Band	Antenna Type	Gain [dBi]	Results
13.56 MHz	Internal PCB antenna	N/A	Compliance
125 kHz	Internal coil antenna	N/A	Compliance

5.5 AC Power Conducted emissions

5.5.1 Standard Applicable [FCC Part15.207(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

5.5.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) °C • Relative Humidity : (49 ~ 51) % R.H.

5.5.3 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.

5.5.4 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Cal interval	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2022. 01. 20	1 year	<input checked="" type="checkbox"/>
Pulse Limiter	ESH3-Z2	100097	Rohde & Schwarz	2022. 01. 20	1 year	<input checked="" type="checkbox"/>
LISN	ESH2-Z5	100044	R&S	2022. 01. 20	1 year	<input type="checkbox"/>
	ESH3-Z5	100147	R&S	2022. 01. 20	1 year	<input checked="" type="checkbox"/>

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

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 indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the UCISPR measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

0.009 ~ 0.15 MHz : 3.98 dB(CL: Approx 95 %, $k=2$)

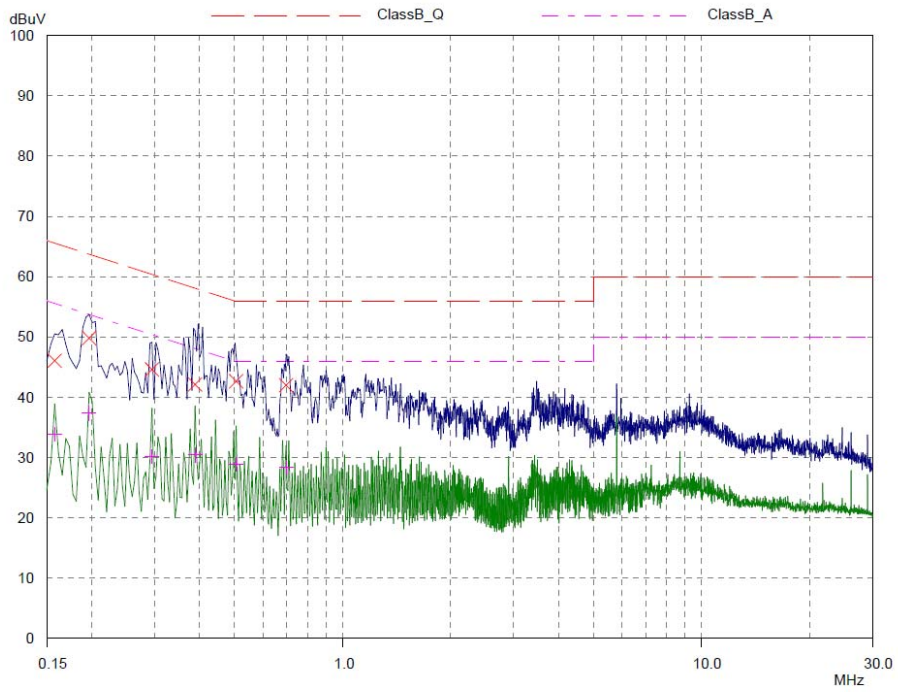
0.15 ~ 30 MHz : 3.48 dB(CL: Approx 95 %, $k=2$)

5.5.5 Measurement Result

Freq. [MHz]	Factor [dB]		POL	QP			CISPR AV		
	LISN	CABLE +P/L		Limit [dBμV]	Reading [dBμV]	Result [dBμV]	Limit [dBμV]	Reading [dBμV]	Result [dBμV]
0.158	0.13	10.02	L	65.58	46.07	46.20	55.58	32.92	33.05
0.197	0.12	9.87	L	63.74	49.82	49.94	53.74	36.39	36.51
0.295	0.12	9.86	L	60.40	44.62	44.74	50.40	29.83	29.95
0.388	0.12	9.86	L	58.10	42.12	42.24	48.10	29.22	29.34
0.505	0.12	9.86	L	56.00	42.65	42.77	46.00	28.60	28.72
0.697	0.13	10.00	L	56.00	42.01	42.14	46.00	28.13	28.26
0.162	0.11	10.01	N	65.38	47.79	47.90	55.38	35.86	35.97
0.201	0.11	9.86	N	63.58	50.43	50.54	53.58	37.95	38.06
0.298	0.11	9.86	N	60.29	46.30	46.41	50.29	38.00	38.11
0.357	0.11	9.86	N	58.80	52.55	52.66	48.80	41.74	41.85
0.396	0.11	9.86	N	57.93	54.75	54.86	47.93	44.52	44.63
0.470	0.11	9.86	N	56.51	48.11	48.22	46.51	39.00	39.11

- * LISN: LISN insertion Loss, Cable: Cable Loss, P/L:pulse limiter factor
- * L: Line. Live, N: Line. Neutral
- * Reading: test receiver reading value (with cable loss & pulse limiter factor)
- * Result = LISN + Reading

Line. Live



Line. Neutral

