Head office & Test Lab: 28(175-20,Annyeong-dong)
406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea
Tel: +82-31-222-4251 / Fax: +82-31-222-4252

TEST REPORT

Report No: KST-FCR-160001(1)

Applicant	Name	SAM JIN CO.,LTD
	Address	81,Anyangcheonseo-ro, Manan-gu, Anyang-si, Gyeonggi-do, 430-817, South Korea
Manufacturer	Name	SAM JIN CO.,LTD
	Address	81,Anyangcheonseo-ro, Manan-gu, Anyang-si, Gyeonggi-do, 430-817, South Korea
Equipment	Name	Motion Sensor
	Model No	STS-IRM-250
	Brand	None
	FCC ID	2AF4S-STS-IRM-250
	IC ID	20753-STSIRM250
Test Standard	FCC CFR 47, Part 15. Subpart C-15.247 558074 D01 DTS Meas. Guidance v03r03 RSS-GEN Issue 4 RSS-247 Issue 1	
Test Date(s)	2016. 03. 02 - 2016. 03. 03	
Issue Date	2016. 03. 07	
Test Result	Compliance	
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 ANSI C 63.10-2013.

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.

Tested by	Mi Young, Lee	Approved by	Gyeong Hyeon, Park
Signature		Signature	

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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
FCC Registration No. : 525762
IC Registration Site No. : 8305A

1.2 Location

Head office & Test Lab: 28(175-20,Annyeong-dong)
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Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Gyeong Hyeon, Park	2016.03.07
1	add a space between SAM and JIN	1	Gyeong Hyeon, Park	2016.03.10

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2. EQUIPMENT DESCRIPTION

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

Equipment Name	Motion Sensor
Model No	STS-IRM-250
Usage	Motion Sensor
Serial Number	Proto type
Modulation type	O-QPSK
Emission Type	G1D
Maximum output power	7.09 dBm
Operated Frequency	2 405 ㎒ - 2 470 ㎒
Channel Number	14
Operation temperature	0 ℃ - 40 ℃
Power Source	DC 3.0 V
Antenna Description	Internal chip Antenna, Max gain: 1.05 dBi
Remark	1. The data rates used when evaluating the EUT were the lowest data rates. The device was operating at its maximum output power at the lowest data rate for all measurements. 2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test. 3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (X) is shown in the report. 4. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.
FCC ID	2AF4S-STS-IRM-250
IC ID	20753-STSIRM250

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3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

The equipment under test was motion sensor with the functions of zigbee operating in the 2.4 ㎓ bands.

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
Notebook	BCM-1063	2Z7S1Z1	Dell Inc	
Adapter	DA65NM111-00	None	Dell Inc	For notebook

3.3 Product Modification

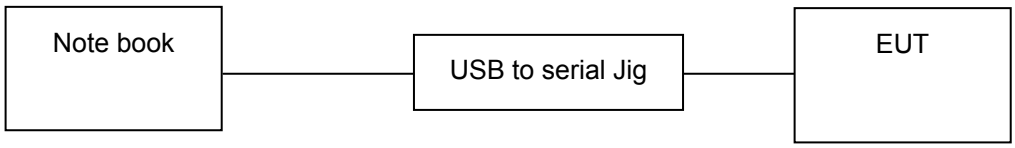
N/A

3.4 Operating Mode

* Constantly transmitting with a modulated carrier at maximum power on the bottom, middle and top channels.

3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode using the test mode which controlled by Tera Term. After command sent to EUT, notebook and USB to serial Jig were removed. The test command and the test Jig and cables were provided by the applicant.



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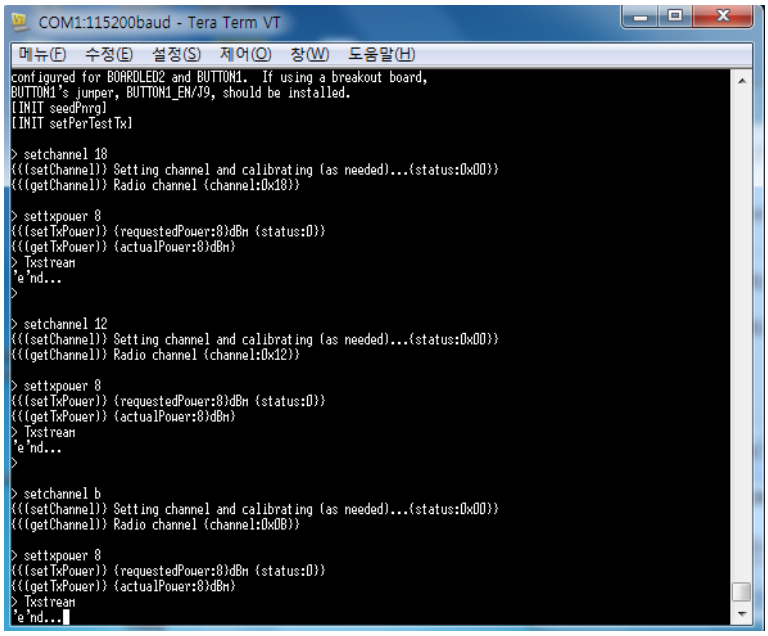
3.6 Parameters of Test Software Setting

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

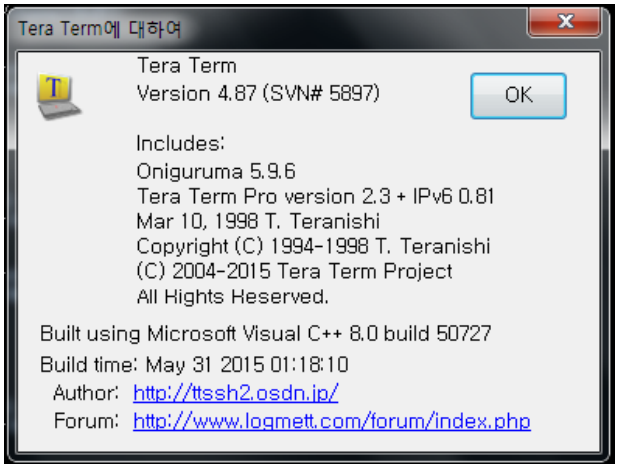
▣ TX Power setting value during test

Band	Rate	TX Power setting value		
		Low CH	Middle CH	High CH
2.4 GHz band	250 kbps	8	8	8

▣ Test Program



▣ Test Program Version



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3.7 Table for Carrier Frequencies

Frequency Band	Channel No	Frequency (㎒)	Channel No.	Frequency (㎒)
2.4 ㎓ band	**11**	**2 405**	19	2 445
	12	2 410	20	2 450
	13	2 415	21	2 455
	14	2 420	22	2 460
	15	2 425	23	2 465
	16	2 430	**24**	**2 470**
	17	2 435		
	18	**2 440**		

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3.8 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	2016.09.17	1 year	☐
2	T & H Chamber	SH-641	92006831	ESPEC CORP	2017.02.04	1 year	☐
3	Constant switch Tester	DS-COT	None	Dong sung Ele.	N/A	N/A	☐
4	Vibration Tester	70UA	L90016	IDEX Co.,Ltd	N/A	N/A	☐
5	Vibration Meter	VM-6360	N225098	LANDTEK	2016.04.07	1 year	☐
6	Falling Tester	SWD-8000	None	Sinwoo	N/A	N/A	☐
7	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2017.02.02	1 year	☐
8	Spectrum Analyzer	8593E	3710A02859	Agilent Technology	2017.02.02	1 year	☐
9	Spectrum Analyzer	FSV30	20-353063	Rohde& Schwarz	2017.02.02	1 year	☒
10	EMI Test Receiver	ESCI7	100823	Rohde& Schwarz	2017.02.02	1 year	☒
11	EMI Test Receiver	ESI	837514/004	Rohde& Schwarz	2016.10.08	1 year	☒
12	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2017.02.04	1 year	☐
13	Network Analyzer	8753ES	US39172348	AGILENT	2016.09.16	1 year	☐
14	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2017.02.03	1 year	☐
15	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2017.02.03	1 year	☐
16	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2017.02.01	1 year	☐
17	Modulation Analyzer	8901A	3538A07071	Agilent Technology	2017.02.03	1 year	☐
18	Audio Analyzer	8903B	3514A16919	Agilent Technology	2017.02.01	1 year	☐
19	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2017.02.04	1 year	☐
20	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2016.09.16	1 year	☐
21	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2017.02.03	1 year	☒
22	ESG Vector Signal Generator	E4438C	MY42083133	Agilent Technology	2016.09.16	1 year	☐
23	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2017.02.03	1 year	☐
24	Tracking Source	85645A	070521-A1	Agilent Technology	2017.02.02	1 year	☐
25	SLIDAC	None	0207-4	Myoung sung Ele.	2017.02.01	1 year	☐
26	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2017.02.01	1 year	☐
27	DC Power supply	6038A	3440A12674	Agilent Technology	2017.02.01	1 year	☐
28	DC Power supply	E3610A	KR24104505	Agilent Technology	2017.02.01	1 year	☐
29	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2017.02.01	1 year	☐
30	DC Power Supply	SM 3004-D	114701000117	DELTA ELEKTRONIKA	2017.02.01	1 year	☐
31	Dummy Load	8173	3780	Bird Electronic Co., Corp	2017.02.03	1 year	☐
32	Attenuator	50FH-030-500	140410 9433	JEW Idustries Inc.	2017.02.03	1 year	☐
33	Attenuator	765-20	9703	Narda	2016.09.16	1 year	☐
34	Attenuator	8498A	3318A09485	HP	2017.02.03	1 year	☐
35	Step Attenuator	8494B	3308A32809	HP	2017.02.03	1 year	☐
36	Step Attenuator	8495D	3308A01464	HP	2017.02.02	1 year	☒
37	Power divider	11636B	51212	HP	2017.02.02	1 year	☐
38	3Way Power divider	KPDSU3W	00070365	KMW	2016.09.16	1 year	☐
39	4Way Power divider	70052651	173834	KRYTAR	2017.02.02	1 year	☐
40	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2017.02.03	1 year	☒
41	White noise audio filter	ST31EQ	101902	SoundTech	2016.09.16	1 year	☐
42	Dual directional coupler	778D	17693	HEWLETT PACKARD	2017.02.03	1 year	☐
43	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2017.02.03	1 year	☐
44	Band rejection filter	3TNF-0006	26	DOVER Tech	2017.02.04	1 year	☐
45	Band rejection filter	3TNF-0008	317	DOVER Tech	2017.02.04	1 year	☐
46	Band rejection filter	3TNF-0007	311	DOVER Tech	2017.02.04	1 year	☐
47	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2017.02.03	1 year	☐
48	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2017.02.03	1 year	☐
49	Radio Communication Alalyzer	MT8815A	6200429622	ANRITSU	2017.02.04	1 year	☐
50	CDMA Mobile Station Test Set	E8285A	US40081298	AGILENT	2017.02.04	1 year	☐
51	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2017.02.04	1 year	☐
52	Radio Communication Tester	CMU 200	112026	Rohde & Schwarz	2017.02.03	1 year	☐

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No.	Instrument	Model	S/N	Manufacturer	Due to cal date	Cal interval	used
53	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2017.02.03	1 year	☐
54	RF Up/Down Converter	DCP-1780	980901003	CREDIX	2017.02.03	1 year	☐
55	DECT Test set	8923B	3829U00364	HP	2017.02.04	1 year	☐
56	DECT Test set	CMD60	840677/005	Rohde& Schwarz	2016.09.16	1 year	☐
57	Loop Antenna	6502	9203-0493	EMCO	2017.06.04	2 year	☒
58	Dipole Antenna	HZ-12	100005	Rohde & Schwarz	2016.07.01	2 year	☐
59	Dipole Antenna	HZ-13	100007	Rohde & Schwarz	2016.07.01	2 year	☐
60	BiconiLog Antenna	3142B	1745	EMCO	2016.06.16	2 year	☒
61	Horn Antenna	3115	9605-4834	EMCO	2016.06.16	2 year	☐
62	Horn Antenna	3115	2996	EMCO	2018.02.12	2 year	☒
63	Horn Antenna	BBHA9170	BBHA9170152	SCHWARZBECK	2017.04.30	2 year	☒
64	Antenna Mast(OSA)	AT14	None	Daeil EMC	N/A	N/A	☐
65	Turn table(OSA)	None	None	Daeil EMC	N/A	N/A	☐
66	RF Amplifier(OSA)	8447D	2944A07881	AGILENT	2017.02.01	1 year	☐
67	Antenna Master(3)	AT13	None	AUDIX	N/A	N/A	☒
68	Turn Table(3)	None	None	AUDIX	N/A	N/A	☒
69	PREAMPLIFIER(3)	8449B	3008A02577	Agilent	2016.02.05	1 year	☒
70	Antenna Master(10)	MA4000-EP	None	inno systems GmbH	N/A	N/A	☒
71	Turn Table(10)	None	None	inno systems GmbH	N/A	N/A	☒
72	AMPLIFIER(10)	TK-PA6S	120009	TESTEK	2017.02.02	1 year	☒
73	Vernier Calipers	None	8280373	Mitutoyo	2016.09.17	1 year	☐

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4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	IC Rule	Reference Clause	Used	Test Result
Max. Conducted output power	15.247(b)(3)	RSS-247, 5.4(4)	Clause 5.1	☒	Compliance
Power spectral density	15.247(e)	RSS-247, 5.2(2)	Clause 5.2	☒	Compliance
6 dB spectrum Bandwidth	15.247(a)(2)	RSS-247, 5.2(1)	Clause 5.3	☒	Compliance
Band edge of RF conducted emissions	15.247(d)	RSS-247, 5.5	Clause 5.4	☒	Compliance
Spurious RF radiated emissions	15.247(d), 15.209	RSS-GEN,8.9	Clause 5.5	☒	Compliance
Antenna requirement	15.203, 15.247	-	Clause 5.6	☒	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.					

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5. MEASUREMENT RESULTS

5.1 Max. Conducted output power

5.1.1 Standard Applicable [FCC §15.247(b)(3) and RSS-247 5.4 (4)]

FCC

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.

IC

For DTSs employing digital modulation techniques operating in the bands 902 – 928 ㎒ and 2400 – 2483.5 ㎒, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W. Fixed point-to-point systems in the bands 2400-2483.5 MHz and 5725-5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding an e.i.r.p. of 4 W.

5.1.2 Test Environment conditions

- Ambient temperature : (19 - 20) ℃
- Relative Humidity : (50 - 55) % R.H.

5.1.3 Measurement Procedure

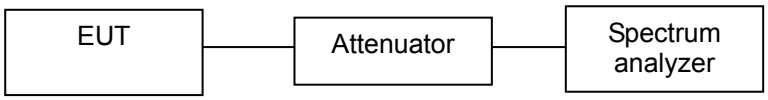
The transmitter output was connected to the spectrum analyzer with an attenuator. The maximum peak output power was measured and recorded with the spectrum analyzer. EUT was programmed to be in continuously transmitting mode.

All conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 v03r03 Section 9.1.1 Measurement Procedure RBW ≥ DTS bandwidth

The spectrum analyzer is set to the as follows :

- Set RBW≥DTS bandwidth
- Set the VBW ≥ 3 x RBW.
- Set the span 3 x RBW.
- Sweep time = auto couple.
- Detector = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

5.1.4 Test setup



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5.1.5 Measurement Result

Channel	Frequency [㎒]	Conducted Power		Limit [dBm]	Test Results
		[dBm]	[㎽]		
11	2 405	6.97	4.98	30	Compliance
18	2 440	7.09	5.12	30	Compliance
24	2 470	7.01	5.02	30	Compliance

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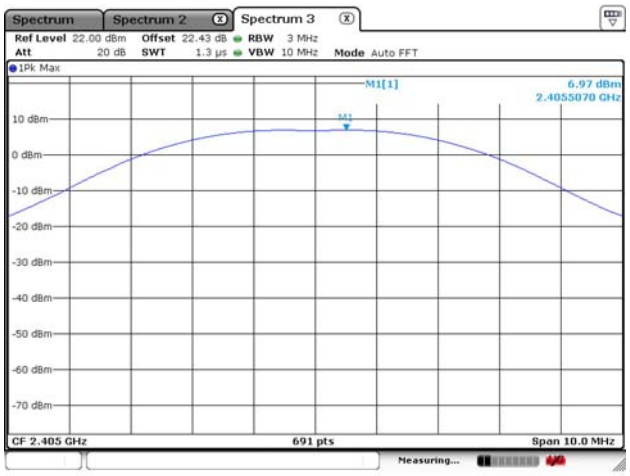
5.1.6 Test Plot

CH Low



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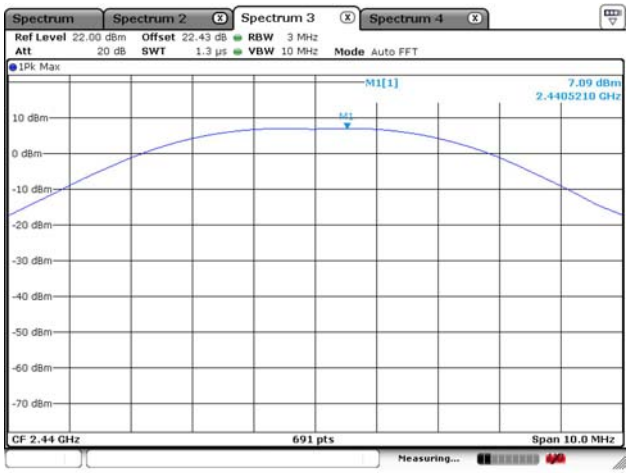
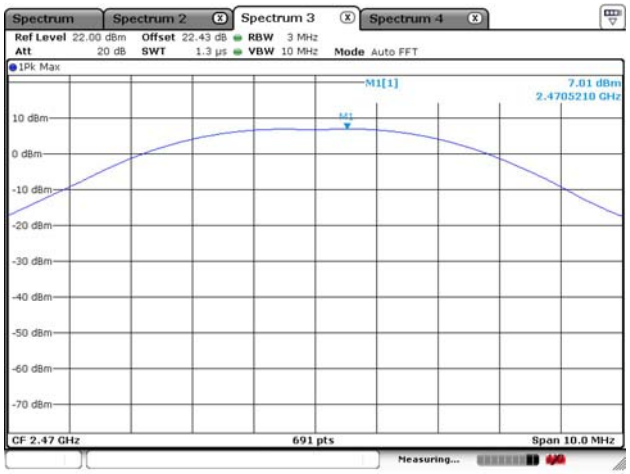


CH High



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5.2 Power spectral density

5.2.1 Standard Applicable [FCC §15.247(e) and RSS-247 5.2(2)]

FCC

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 transmit

IC

The transmitter power spectral density conducted from the transmitter 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 Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.2.2 Test Environment conditions

- Ambient temperature : (19 - 20) ℃
- Relative Humidity : (50 - 55) % R.H.

5.2.3 Measurement Procedure

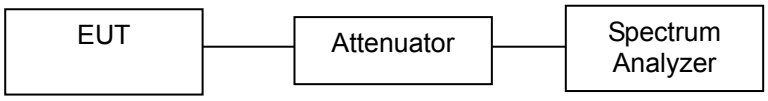
The power spectral density conducted from the intentional radiator was measured with a spectrum analyzer connected to the antenna terminal, while EUT had the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak power spectral density.

All conducted power tests were performed using a test receiver in accordance with FCC KDB 558074 v03r03 Section 10.1

The spectrum analyzer is set to the as follows :

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

5.2.4 Test setup



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5.2.5 Measurement Result

Channel	Frequency [㎒]	Result Value [㏈m]	Limit [㏈m]	Test Results
11	2 405	-7.42	8	Compliance
18	2 440	-7.28	8	Compliance
24	2 470	-7.19	8	Compliance

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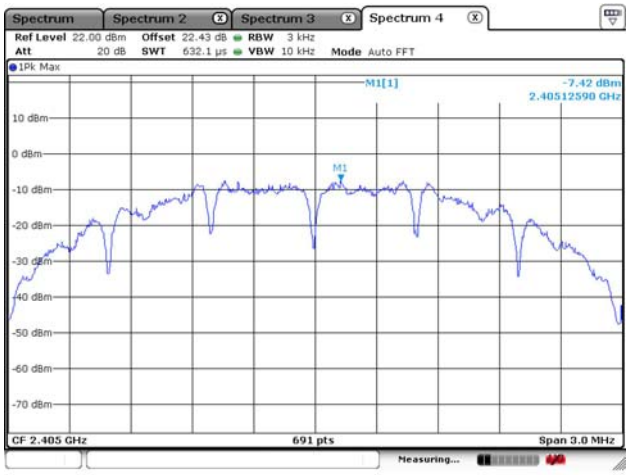
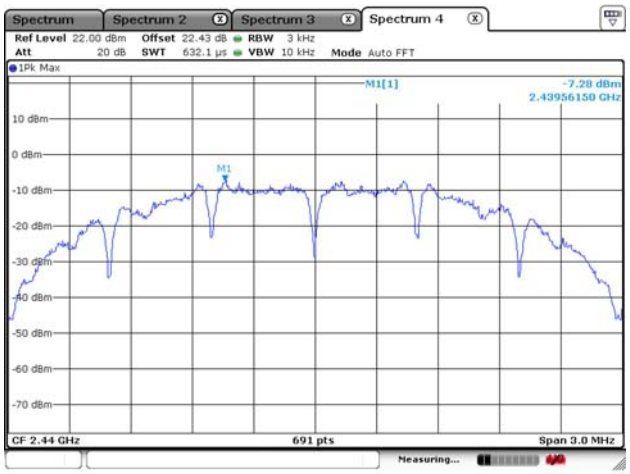
5.2.6 Test Plot

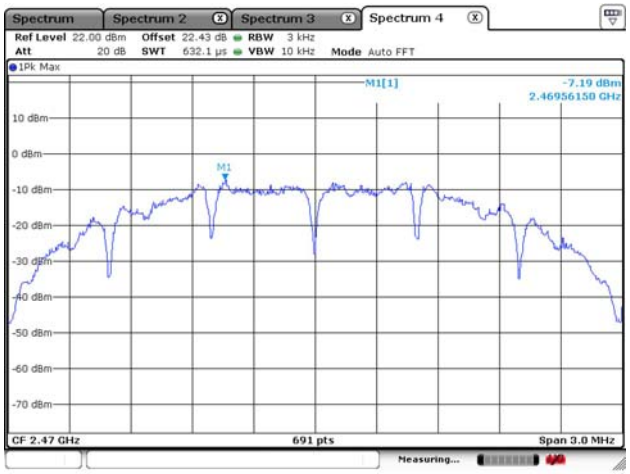
CH Low



CH Middle



CH High



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5.3 6 dB spectrum Bandwidth

5.3.1 Standard Applicable [FCC §15.247(a)(2) and RSS-247 5.2(1)]

FCC and IC

Systems using digital modulation techniques may operate in the 902–928 ㎒, 2400–2483.5 ㎒, and 5725–5850 ㎒ bands. The minimum 6 dB bandwidth shall be at least 500 ㎑.

5.3.2 Test Environment conditions

- Ambient temperature : (19 - 20) ℃
- Relative Humidity : (50 - 55) % R.H.

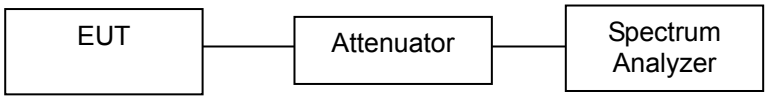
5.3.3 Measurement Procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 100 ㎑ and the video bandwidth of 100 ㎑ were used.
3. Measured the spectrum width with power higher than 6 dB below carrier.

The spectrum analyzer is set to the as follows :

- Set RBW = 100 ㎑.
- Set the video bandwidth (VBW) ≥ 3 x RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- 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 dB relative to the maximum level measured in the fundamental emission.

5.3.4 Test setup



5.3.5 Measurement Result

Channel	Frequency [㎒]	6 dB Bandwidth [㎒]	99% Bandwidth [㎒]	Limit [㎒]	Test Results
11	2 405	1.59	2.40	>0.5	Compliance
18	2 440	1.60	2.43	>0.5	Compliance
24	2 470	1.59	2.41	>0.5	Compliance

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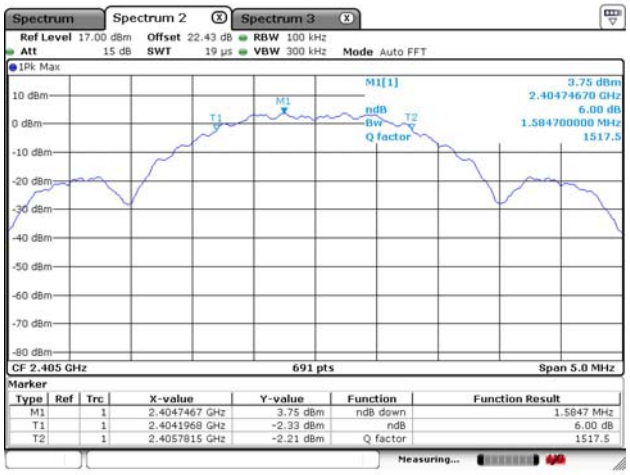
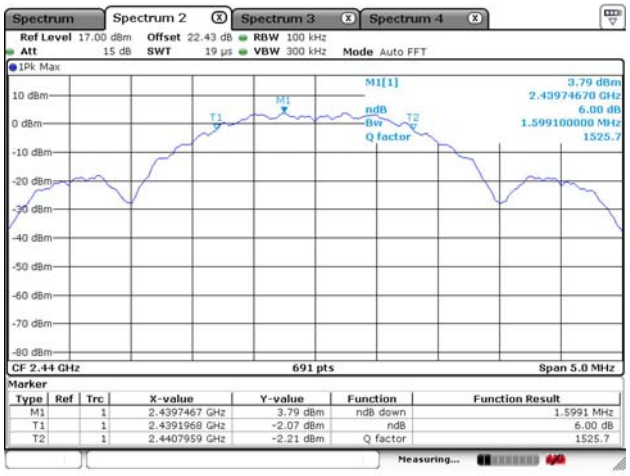
5.3.6 Test Plot (6 dB bandwidth)

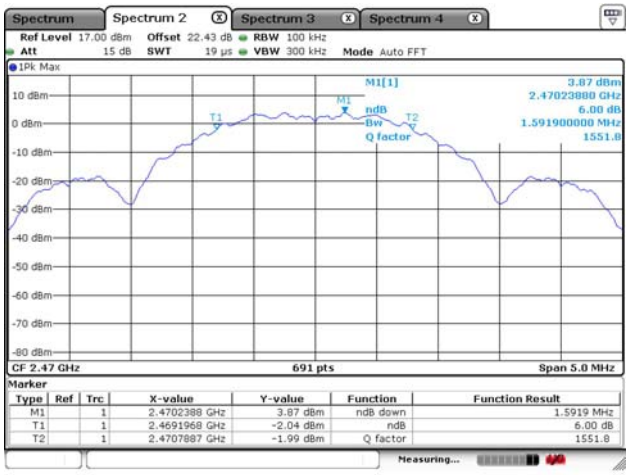
CH Low



CH Middle



CH High



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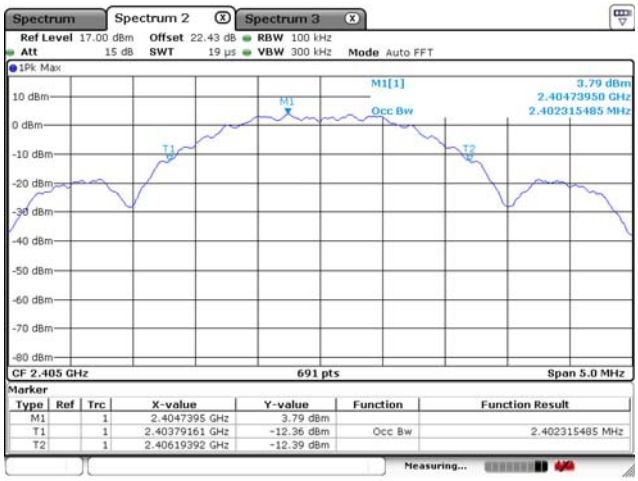
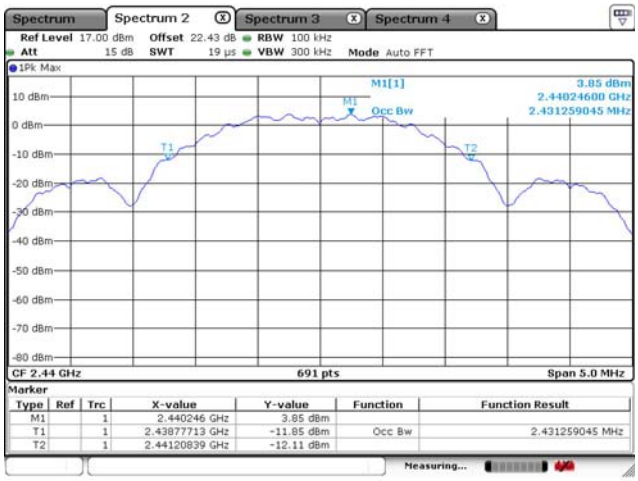
Test Plot (99 % band width)

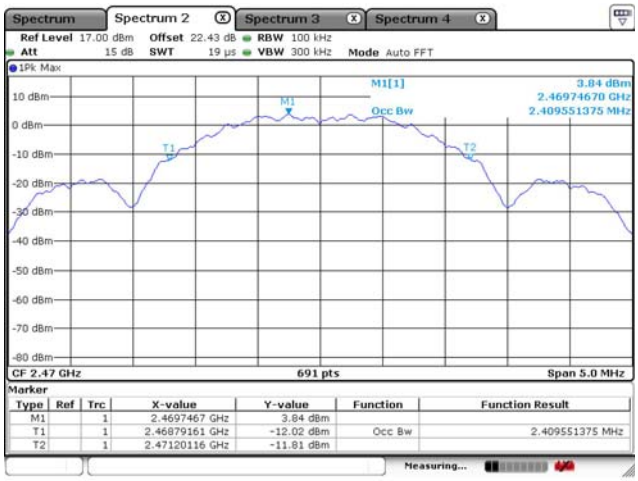
CH Low



CH Middle



CH High



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5.4 Band-edge Compliance of RF Conducted emissions

5.4.1 Standard Applicable [FCC §15.247(d) and RSS-247 5.5]

FCC and IC

In any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on RF conducted.

5.4.2 Test Environment conditions

- Ambient temperature : (19 - 20) ℃
- Relative Humidity : (50 - 55) % R.H.

5.4.3 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from signal generator.
② Reference frequency generated from the signal generator is supply to spectrum analyzer input port via RF cable and attenuator, and then, it's apply to offset value on spectrum analyzer.
③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.
④ Place the EUT on the table and set on the emission at the band-edge,
⑤ After the trace being stable, Use the marker-to-peak function to move the marker to the peak of the in-band emission.
⑥ The marker-delta value now displayed must comply with the limit specified in above standard.
⑦ please refer to the detailed procedure method KDB 558074 v03r03.

The spectrum analyzer is set to the as follows :

- Span : Wide enough to capture the peak level of the emission operating on the channel closet to the Band-edge, as well as any modulation products which fall outside of the authorized band of operation
- RBW : 100 ㎑ (≥ 1 % of the span)
- VBW : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : Max hold

5.4.4 Test setup

Please refer 5.3.4

5.4.5 Measurement Result

Setting Channel		Test Results		
		Measured value [㏈]	Limit [㏈]	Result
CH 11	~ 2 400 ㎒	-41.73	≤ 20 than PSD level	Compliance
CH 24	2 483.5 ㎒ ~	-52.52		Compliance

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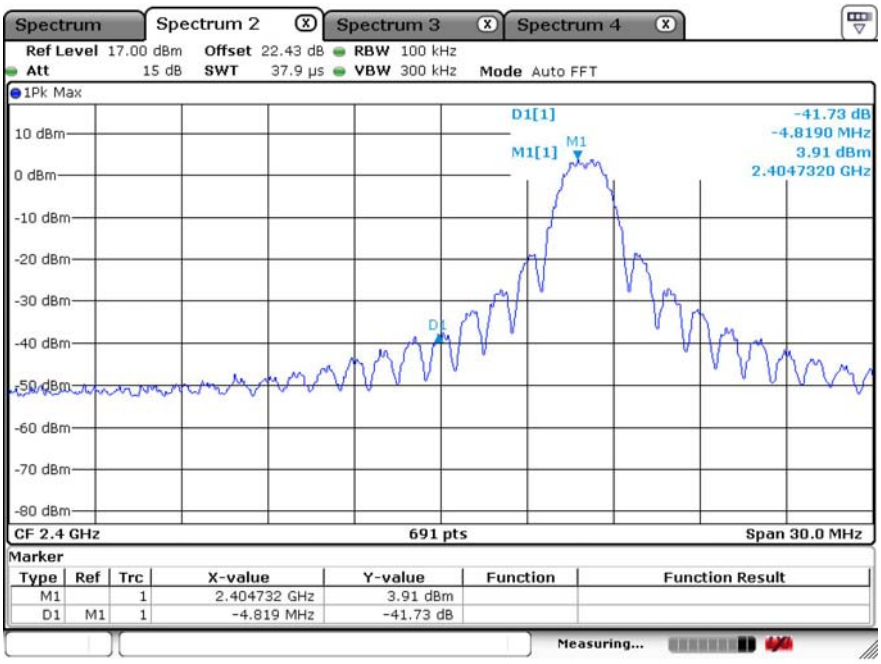
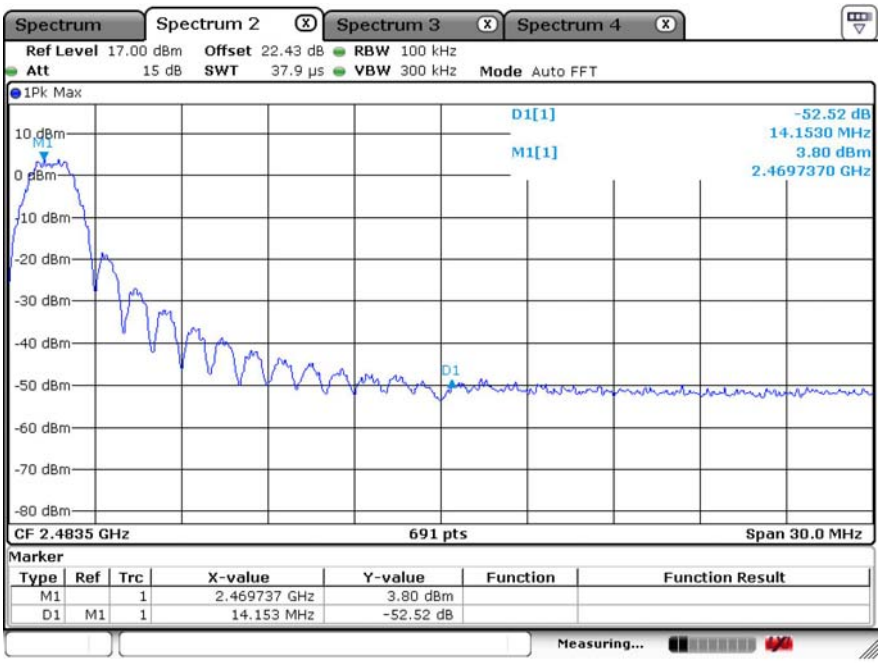
5.4.6 Test Plot (Band-edge)





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5.5 Spurious RF Radiated emissions

5.5.1 Standard Applicable [FCC §15.247(d) and RSS-247 5.5]

FCC

All other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10 ㎓, the frequency Range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40 ㎓, Whichever is lower. In addition, radiated emissions which fall in the restricted bands, as defined in Sec.15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a)

IC

In any 100 ㎑ bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 ㏈ below that in the 100 ㎑ bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 ㏈ instead of 20 ㏈. Attenuation below the general field strength limits specified in RSS-Gen is not required.

§15.209 and RSS-Gen limits for radiated emissions measurements (distance at 3 m)

Frequency Band [㎒]	DISTANCE[Meters]	Limit [㎶/m]	Limit [㏈㎶/m]	Detector
0.009 ~ 0.490	300	2400/F(㎑)	67.6-20log(F)	Peak
0.490 ~ 1.705	30	24000/F(㎑)	87.6-20log(F)	Peak
1.705 ~ 30.0	30	30	29.54	Peak
30 - 88	3	100 **	40.00	Quasi peak
88 - 216	3	150 **	43.52	Quasi peak
216 - 960	3	200 **	46.02	Quasi peak
Above 960	3	500	54.00	Average
Above 1000	3	74.0㏈㎶/m (Peak), 54.0 ㏈㎶/m (Average)		

** fundamental emissions from intentional radiators operation 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 Section 15.231 and 15.241

§15.205. Restrict Band of Operation for FCC

[㎒]	[㎒]	[㎒]	[㎓]
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

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§15.205. Restrict Band of Operation for IC

[MHz]	[MHz]	[MHz]	[GHz]
0.090 - 0.110	12.519 75 - 12.520 25	399.9 - 410	5.35 - 5.46
2.173 5 - 2.190 5	12.576 75 - 12.577 25	608 - 614	7.25 - 7.75
3.020 - 3.026	13.36 - 13.41	960 - 1 427	8.025 - 8.
4.125 - 4.128	16.42 - 16.423	1 435 - 1 626.5	9.0 - 9.2
4.177 25 - 4.177 75	16.694 75 - 16.695 25	1 645.5 - 1 646.5	9.3 - 9.5
4.207 25 - 4.207 75	16.804 25 - 16.804 75	1 660 - 1 710	10.6 - 12.7
5.677 - 5.683	25.5 - 25.67	1 718.8 -1 722.2	13.25 - 13.4
6.215 - 6.218	37.5 -38.25	2 200 - 2 300	14.47 - 14.5
6.26775–6.26825	73 - 74.6	2 310 - 2 390	15.35 - 16.2
6.31175–6.31225	74.8 - 75.2	2 655 - 2 900	17.7 - 21.4
8.291 - 8.294	108 - 138	3 260 - 3 267	22.01 - 23.12
8.362 - 8.366	156.524 75 - 156.525 25	3 332 - 3 339	23.6 - 24.0
8.376 25 - 8.38 6 75	156.7 - 156.9	3 345.8 - 3 358	31.2 - 31.8
8.414 25 - 8.414 75	240 - 285	3 500 - 4 400	36.43 - 36.5
12.29 - 12.293	322 - 335.4	4 500 - 5 150	Above 38.6

5.5.2 Test Environment conditions

- Ambient temperature : (21 - 23) ℃
- Relative Humidity : (32 - 35) % R.H.

5.5.3 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)
- According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

5.5.4 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, The measurement uncertainty level with a 95 % confidence level were apply to Uncertainty of a radiation emissions measurement at Chamber of KOSTEC is ± 6.0 dB

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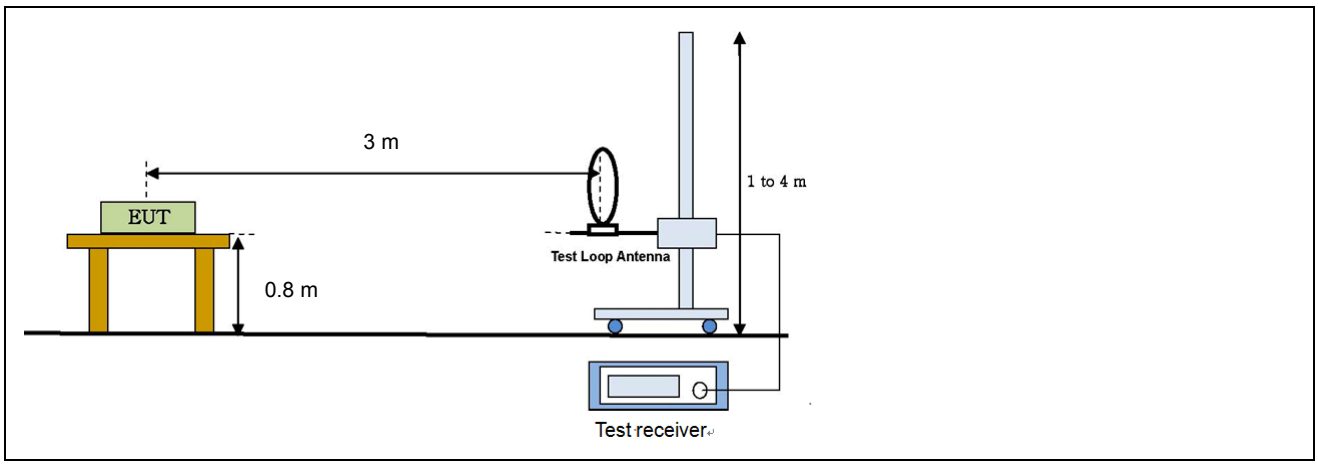
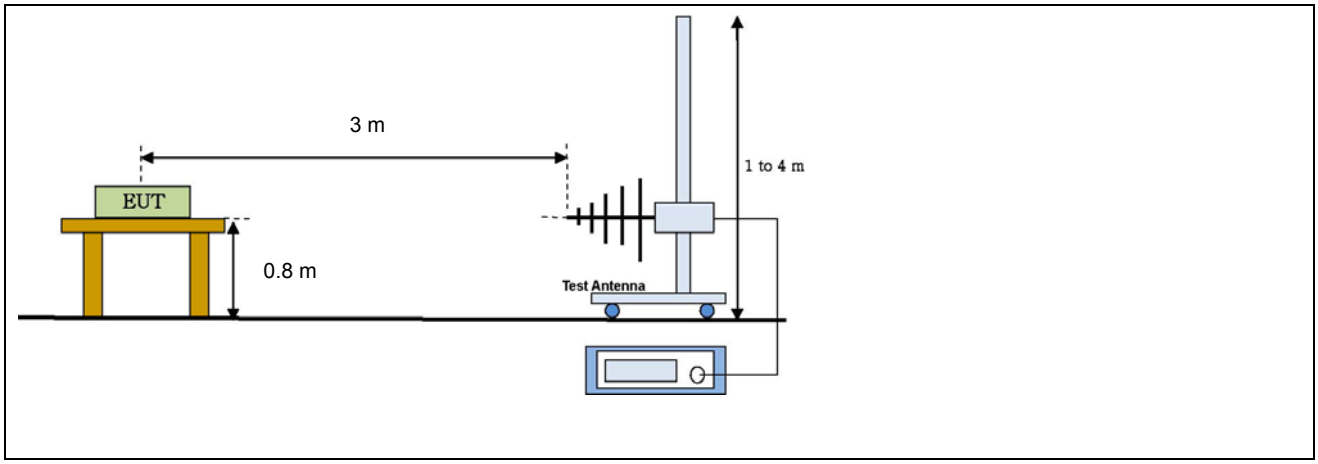
5.5.5 Test Configuration

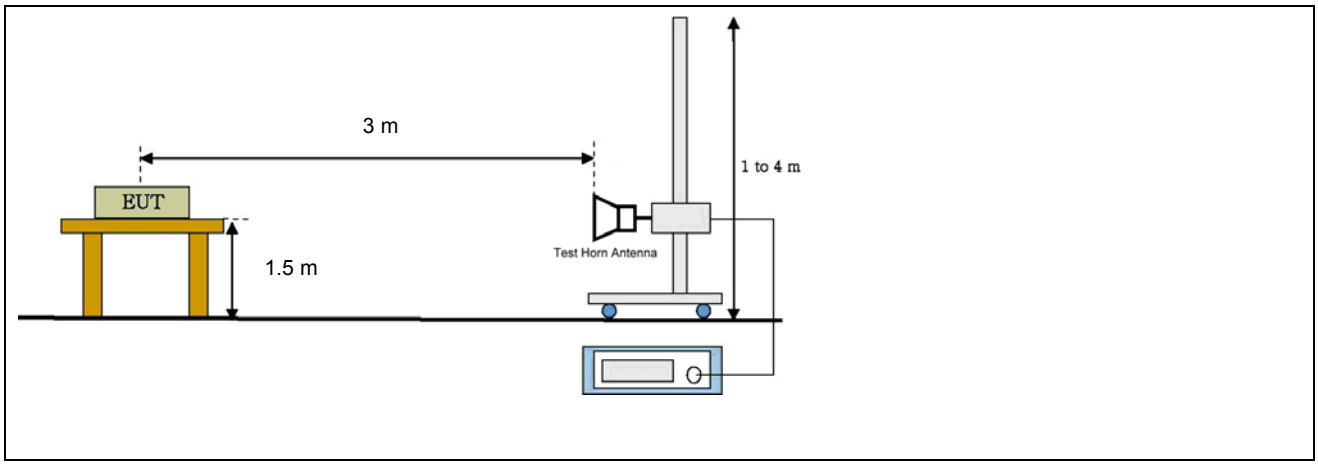
Radiated emission setup, Below 30 MHz



Radiated emission setup, Below 1 000 MHz



Radiated emission setup, Above 1 GHz



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5.5.6 Measurement Result

Above 1 ㎓

CH11 (2 405 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
2.388*	50.91	39.27	160	1.5	V	28.62	2.50	-34.35	47.68	36.04	74	54	26.32	17.96	Compliance
2.390*	52.75	41.51	150	1.5	H	28.62	2.50	-34.35	49.52	38.28	74	54	24.48	15.72	Compliance
4.811	57.04	49.50	160	1.5	V	33.14	3.67	-33.48	60.38	52.84	74	54	13.62	1.16	Compliance
4.811	57.54	50.24	150	1.5	H	33.14	3.67	-33.48	60.88	53.58	74	54	13.12	0.42	Compliance
7.220	56.17	45.23	160	1.5	V	36.11	4.19	-33.72	62.75	51.81	74	54	11.25	2.19	Compliance
7.220	53.20	43.08	160	1.5	H	36.11	4.19	-33.72	59.78	49.66	74	54	14.22	4.34	Compliance

* Restrict band emissions.

CH18 (2 440 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
4.879	52.13	44.55	160	1.5	H	33.29	3.68	-33.48	55.62	48.04	74	54	18.38	5.96	Compliance
4.879	52.29	44.61	160	1.5	V	33.29	3.68	-33.48	55.78	48.10	74	54	18.22	5.90	Compliance
7.318	50.38	41.62	160	1.5	H	36.24	4.16	-33.73	57.06	48.30	74	54	16.94	5.70	Compliance
7.318	54.12	46.39	150	1.5	V	36.24	4.16	-33.73	60.80	53.07	74	54	13.20	0.93	Compliance

CH24 (2 470 ㎒)

Freq. (㎓)	Reading (dB㎶/m)		Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB㎶/m)		Limit (dB㎶/m)		Mgn. (dB)		Result
	PK	AV		Height (m)	Pol. (H/V)	Fctr. (dB/m)			PK	AV	PK	AV	PK	AV	
2.484*	51.79	39.80	160	1.5	V	28.89	2.56	-34.32	48.91	36.92	74	54	25.09	17.08	Compliance
2.484*	52.36	39.81	160	1.5	H	28.89	2.56	-34.32	49.48	36.93	74	54	24.52	17.07	Compliance
4.941	50.55	42.28	160	1.5	V	33.43	3.65	-33.48	54.15	45.88	74	54	19.85	8.12	Compliance
4.941	47.92	37.29	150	1.5	H	33.43	3.65	-33.48	51.52	40.89	74	54	22.48	13.11	Compliance
7.412	48.73	33.82	160	1.5	V	36.36	4.13	-33.73	55.50	40.59	74	54	18.50	13.41	Compliance

* Restrict band emissions.

※Note

- Above 1 ㎓ is measured average and peak detector mode on Spectrum analyzer in accordance with FCC Rule15.35
- Limit: 54 dB㎶/m(Average), 74 dB㎶/m(Peak), Attenuated more than 20 dB below the permissible value.
- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- For the below 30 ㎒ and above 7.412 ㎓, measured any other signal is not detected on test receiver
- The transmitter radiated spectrum was investigated from 9 ㎑ to 26.5 ㎓.

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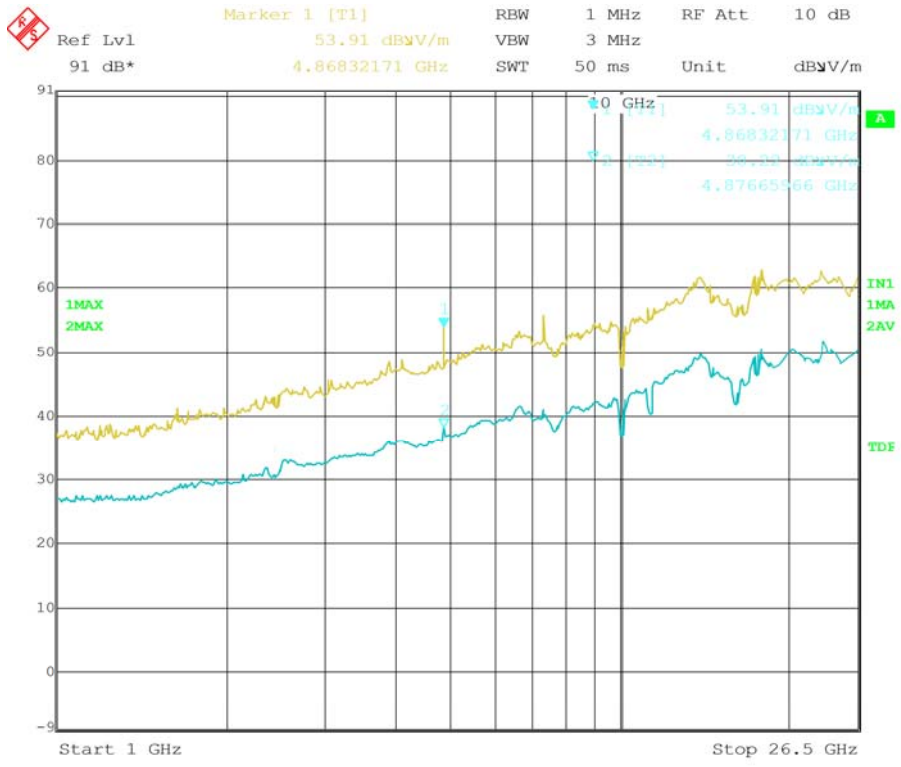
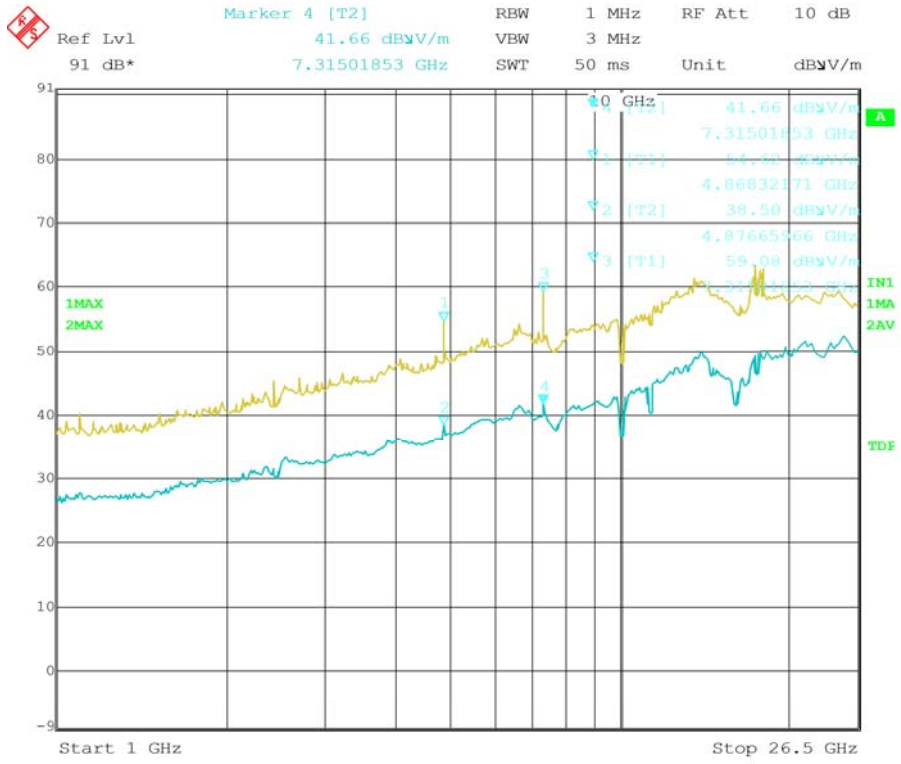
Test Plot

Horizontal



Vertical



* Worst case only.

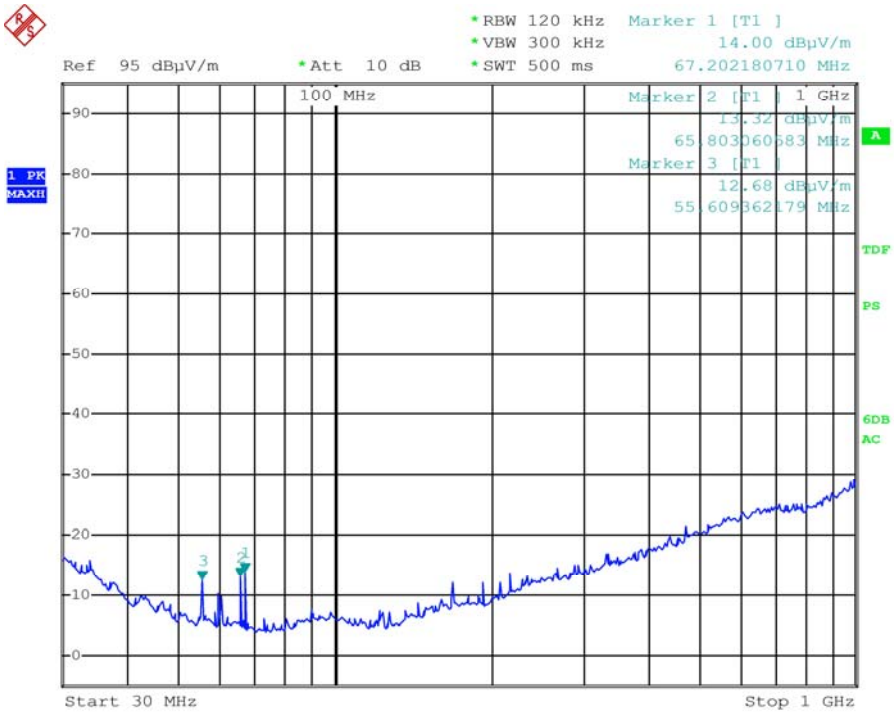
* Fundamental signal was rejected by band rejection filter.

Below 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Antenna			CL (dB)	AMP (dB)	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)						
55.61	-18.34	170	3.2	H	20.76	0.50	7.64	10.56	40.00	29.44	Compliance
65.80	-16.40	170	3.0	H	19.95	0.59	6.20	10.34	40.00	29.66	Compliance
67.20	-15.32	170	3.2	H	19.87	0.60	6.08	11.24	40.00	28.76	Compliance

Freq.(㎒) : Measurement frequency, Reading(dB㎶/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) : Preamplifier gain(dB)
Meas Result (dB㎶/m) :Reading(dB㎶/m)+ Antenna factor.(dB/m)+ CL(dB) - Pre AMP(dB)
Limit(dB㎶/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB㎶/m) – Meas Result(dB㎶/m)

Test Plot



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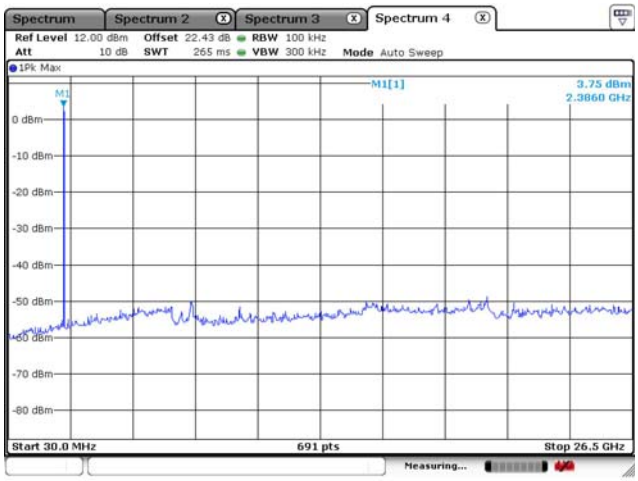
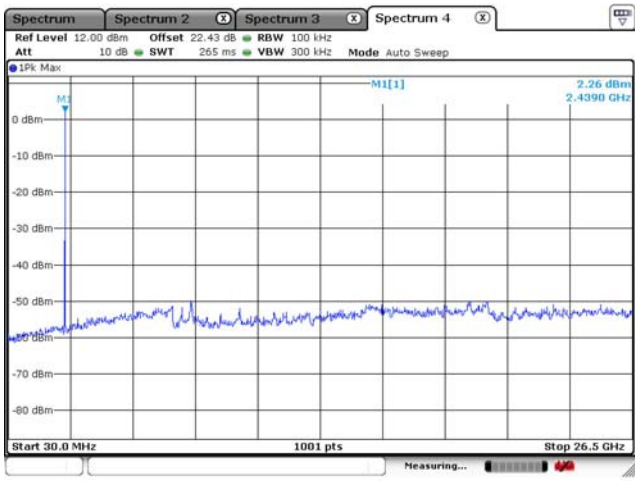
Test Plot (Conducted spurious emissions)

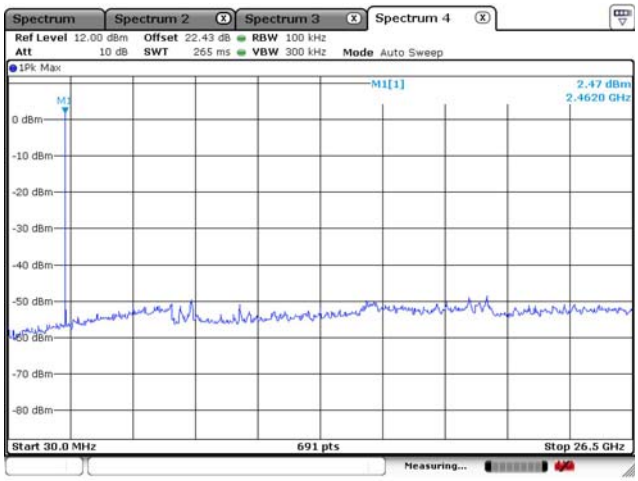
CH Low



CH Middle



CH High



Note: It is not recorded on the report that the reading of emissions are attenuated more than 20 ㏈ below the permissible limits

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5.6 Antenna requirement

5.6.1 Standard applicable [FCC §15.203, §15.247(4)(1)]

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.

And according to §15.247(4)(1), 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.

5.6.2 Antenna gain

Frequency Band	Antenna Type	Gain [dBi]	Limit [dBi]	Results
2.4 GHz	Chip Antenna (Permanently attached antenna)	1.05	≤ 6	Compliance