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TEST REPORT

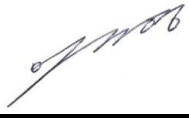
Report No: KST-FCR-090007

Applicant	Name	SEGI LIMITED.
	Address	ROOM 1808, 18/F, TOWER2, ADMIRALTY CENTER, 18 HARCOURT ROAD
Manufacturer	Name	SEGI LIMITED.
	Address	ROOM 1808, 18/F, TOWER2, ADMIRALTY CENTER, 18 HARCOURT ROAD
Equipment	Name	Two-Way FM Antenna
	Model No	ANT-SS-25
	Usage	Remote Controller for Car System
	FCC ID	VA5JA510WSS
	CANADA IC	7087A-R510WSS
Test Standard	FCC CFR 47, Part 15. Subpart C-15.247 : 2009. RSS-210 Issue 7 : 2007, RSS-Gen Issue 2 : 2007	
Test Date(s)	2009. 08. 29 ~ 2009. 09. 01	
Issue Date	2009. 10. 16	
Test Result	Compliance	

Supplementary Information

The device bearing the brand name and FCC ID, CANADA IC 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 63.4-2003.

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.

180-254, Annyeong-dong, Hwaseong-si, Gyeonggi-do, South Korea

The open area field test site and conducted measurement facility are used for these testing. This site at was fully described in a reports submitted to the Federal Communications Commission (FCC).

The details of these reports have been found to be in complies with the requirements of Section 2.948 of the FCC Rules on November 14, 2002. The facility also complies with the radiated and conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission (FCC) has the reports on file and KOSTEC Co., Ltd. is listed under FCC Registration No.525762. The test site has been approved by the FCC for public use and is List in the FCC Public Access Link CORES (Commission Registration System)

Registration information

KCC (Korea Communications Commission) Number : KR0041

KOLAS(Korea laboratory accreditation Scheme) Number : 232

FCC Registration Number(FRN) : 525762

IC Company Number(C,N) : 8305A

VCCI Registration Number : R-1657 / C –1763

1.2 Location

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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 Class	Category Ⅰ(according to RSS-Gen in CANADA Standard)
1) Equipment Name	Two-Way FM Antenna
2) Model No	ANT-SS-25
3) Usage	Remote Controller for Car System
4) Serial Number	None
5) Oscillation type	PLL (Phase Local Loop)
6) Data Sequence type	FHSS (Frequency Hopping Spread Spectrum)
7) ITU emission type	Not required (because it is unlicensed devices)
8) Modulation type	FSK
9) Operated Frequency	910.920 MHz ~ 919.080 MHz
10) Max. conducted power	81.85 mW (Max. peak conducted power)
11) Number of hopping channel	25 Ch
12) Communication type	Half duplex(Two-Way)
13) Microprocessor	Atmega88V
14) Weight / Dimension	135g / 65(L) mm x 37(W) mm x 15(D) mm
15) Operation temperature	- 40℃~ + 80℃
16) Power Source	5.0 Vdc (Supplied from main controller installed Car)
17) Antenna Description	Type: Wire, Connection: Fixed, Length: 17.5 cm, Gain: -0.675 dBi

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3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

This device is Two-way Car Main controller for Car's Engine start/stop and door open/close, it is named Two-Way FM Antenna, and also it is design to RF Part with control part, Rated power source was supplied 5 Vdc from Main controller installed Car

Operation description is response short message by user's push button remote controller

For more than describe is written the user manual

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
Power supply	E3610A	KR24104505	Agilent Technology	
Test Jig**	It is connected the EUT			

** it is used for only conducted test, ie: Occupied bandwidth and conducted power etc.

3.3 Product Modification

N/A

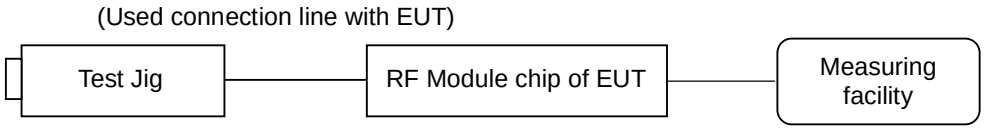
3.4 Operating Mode

All measurements were intended to emit maximum RF continuously signal from EUT

3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode using the Test Jig.

For controlling the EUT, the test Jig were provided by the applicant.



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3.6 Table for Test condition

Test Items	Channel No	Frequency (MHz)	Operated Condition
Carrier frequency separation	14	914.662	Hopping on and continuous modulation setting mode
	15	915.000	
	16	915.338	
Number of hopping frequencies	1 ~ 25	910.920 ~ 919.080	Hopping on mode
Time of occupancy (Dwell Time)	13	945.000	Hopping on mode
Conducted peak output power	1	910.920	Hopping off and continuous modulation setting mode
	15	915.000	
	25	919.080	
Band-edge Compliance	1	910.920	Hopping off/on and continuous modulation setting mode
	25	919.080	
Spurious RF conducted emissions	-	-	Frequency band setting by required standard (FCC and IC Rules)**
Spurious radiated emissions	-	-	

*Channel number is based on lowest, middle, highest channel setting and also hopping on/off mode operation

Please see plot shown in this chapter 5.6 and 5.7

3.7 Table for Parameters of Test Jig Setting

During testing, channel change & modulation and carrier controlling test Jig is provided by the applicant.

Output power expected by the customer and is going to be fixed on the firmware of the final end product.

▣ Table for Channel selecting with test Jig

Frequency (MHz)	910.920	915.000	919.080
Channel Number	Ch 1	Ch 15	Ch 25
	Lowest channel	Middle channel	Highest channel

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3.8 Used Test Equipment List

No.	Instrument	Model	Serial No.	Manufacturer	Due to Cal. Date	Used
1	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2010.05.20	☒
2	Test Receiver	ESCS30	100111	Rohde & Schwarz	2010.03.07	☒
3	Test Receiver	ESPI3	100109	Rohde & Schwarz	2010.03.03	☐
4	LISN	ESH2-Z5	100044	Rohde & Schwarz	2010.03.16	☐
5	LISN	ESH3-Z5	100147	Rohde & Schwarz	2010.06.25	☐
6	Ultra broadband Antenna	HL562	100075	Rohde & Schwarz	2010.03.20	☒
7	Ultra broadband Antenna	HL562	100076	Rohde & Schwarz	2010.04.14	☐
8	Dipole Antenna	HZ-12	100005	Rohde & Schwarz	2010.04.03	☐
9	Dipole Antenna	HZ-13	100007	Rohde & Schwarz	2010.04.03	☐
10	Horn Antenna	3115	2996	EMCO	2010.06.13	☒
11	Loop Antenna	6502	9203-0493	EMCO	2010.06.15	☐
12	Digital Signal Generator	E4436B	US39260458	HP	2010.05.20	☒
13	Tracking CW Signal Source	85645A	070521-A1	HP	2010.05.20	☒
14	RF Power Amplifier	8347A	3307A01571	HP	2010.05.20	☒
15	Microwave Amplifier	8349B	2627A01037	HP	2010.05.20	☒
16	Attenuator	8498A	3318A09485	HP	2010.05.20	☒
17	Temperature & Humidity Chamber	EY-101	90E14260	TABAI ESPEC	2010.03.16	☐
18	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2010.05.20	☐
19	RF Power Sensor	ECP-E18A	US37181768	Agilent Technology	2010.05.20	☐
20	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2010.05.20	☐
21	Band rejection filter	WTR-BRF2442-84NM	09020001	WAVE TECH Co.,Ltd.	2010.03.03	☒
22	SLIDAC	None	0207-4	Myoung-Sung Electronic Co., Ltd.	2010.05.20	☐
23	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2010.06.04	☐
24	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2010.05.20	☐
25	DC Power supply	E3610A	KR24104505	Agilent Technology	2010.05.20	☒
26	Antenna Master	-	-	Daeil EMC	-	☒
27	Turn Table	-	-	Daeil EMC	-	☒

4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Carrier frequency separation and 20 dB Bandwidth	15.247(a)(1)	Clause 5.1	☒	Compliance
Number of hopping channel	15.247(a)(1)(i)	Clause 5.2	☒	Compliance
Time of occupancy (Dwell Time)	15.247(a)(1)(i)	Clause 5.3	☒	Compliance
Max. Conducted peak output power	15.247(b)(2)	Clause 5.4	☒	Compliance
Band-edge compliance	15.247(d)	Clause 5.5	☒	Compliance
Spurious RF conducted emissions	15.247(d)	Clause 5.6	☒	Compliance
Spurious radiated emissions	15.247(d), 15.209	Clause 5.7	☒	Compliance
Antenna requirement	15.203, 15.247	Clause 5.8	☒	Compliance
Compliance : 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.				

Description of Test	IC Rule	Reference Clause	Used	Test Result
Carrier frequency separation and 99% Occupied Bandwidth	RSS-210 (A 8.1) RSS-Gen 4.6.1	Clause 5.1	☒	Compliance
Number of hopping channel	RSS-210 (A 8.1)	Clause 5.2	☒	Compliance
Time of occupancy (Dwell Time)	RSS-210 (A 8.1)	Clause 5.3	☒	Compliance
Max. Conducted peak output power	RSS-210 (A 8.4)	Clause 5.4	☒	Compliance
Band-edge compliance	RSS-210 (A 8.5)	Clause 5.5	☒	Compliance
Spurious RF conducted emissions	RSS-210 (2.2).(A2.9)	Clause 5.6	☒	Compliance
Spurious radiated emissions	RSS-210 [2..2/A2.9 (a)]	Clause 5.7	☒	Compliance
Antenna requirement	RSS-Gen (7.1.5)	Clause 5.8	☒	Compliance
Compliance : 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 Carrier Frequency Separation and 20 dB, 99% Occupied Bandwidth

5.1.1 Standard Applicable [FCC §15.247(a),(1)] [RSS-210 A8.1(b)]

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB and 99% occupied bandwidth of the hopping channel, whichever is greater.

The maximum allowed 20 dB and 99% occupied bandwidth of the hopping channel is 500 KHz.

5.1.2 Measurement Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peak of the adjacent channels using the marker-Delta function was recorded as the measurement results.

The spectrum analyzer is set to the as follows :

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings ;

- Span : wide enough to capture the peak of two adjacent channels
- Resolution (or IF) Bandwidth(RBW) : ≥ 1% of the span
- Video (or Average) Bandwidth(VBW) : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.1.3 Measurement Result

- Environmental Conditions :

-. Temperature : 24 ℃, Relative Humidity : (54 ~ 56) % R.H.

Channel Number	Test Results			
	Measured frequency Separation [MHz]		Limit	Result
14, 15	0.338		≥ 25 kHz or 20dB bandwidth	Complies
15, 16	0.338			Complies
Channel Number	20 dB Occupied Bandwidth(KHz)	99% Occupied Bandwidth(KHz)	Limit	Result
1	285.3	275.7	≤ 500 KHz	Complies
15	285.7	274.0		Complies
25	286.9	270.8		Complies

* please see plot in this next page(5.1.4 ~ 5.1.6)

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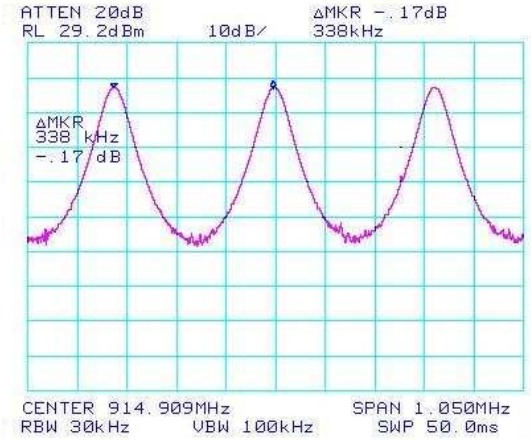
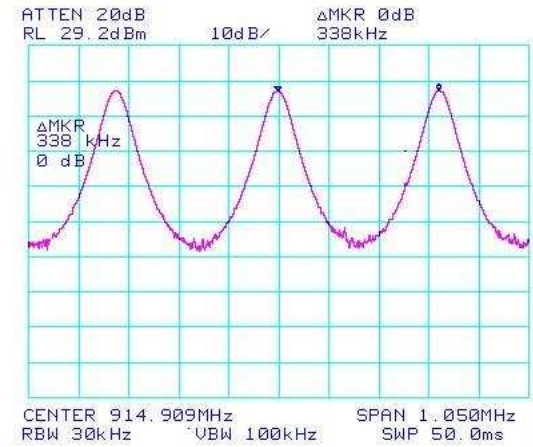
5.1.4 Test Plot (separation frequency)

⇒ Channel _14, 15 (914.662 MHz, 915.000 MHz)



⇒ Channel 15, 16 (915.000 MHz, 915.338 MHz)



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5.1.5 Test Plot (20 dB Occupied bandwidth)

⇒ Lowest Channel _ch 1 (910.920 MHz)

⇒ Middle Channel _ch 15 (915.000 MHz)

⇒ Highest Channel_ch 25 (919.080 MHz)

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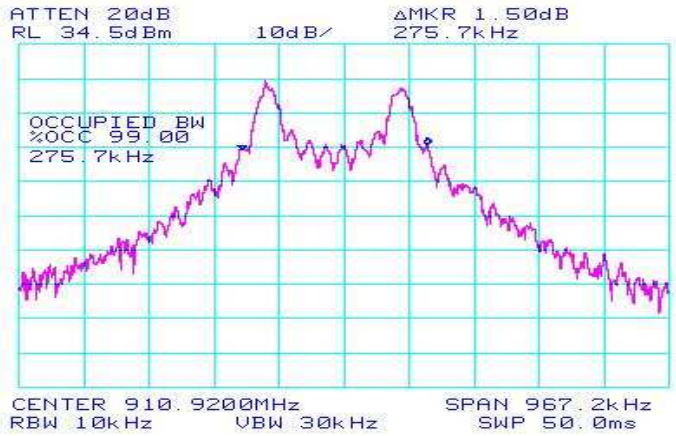
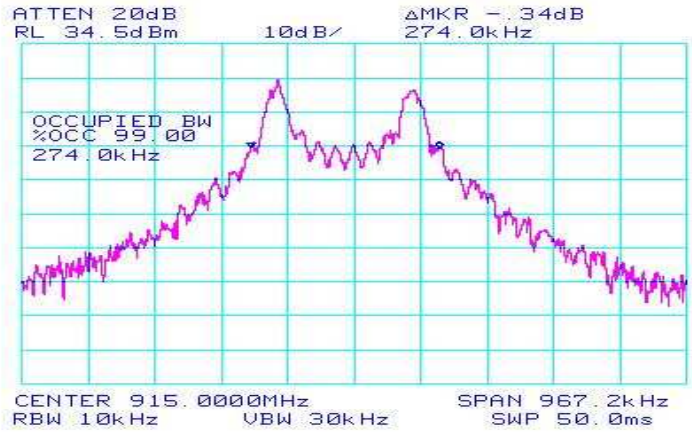
5.1.5 Test Plot (99% Occupied bandwidth)

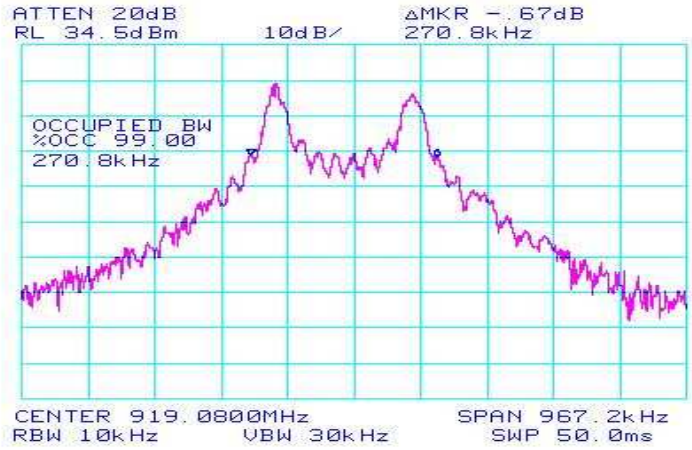
⇒ Lowest Channel _ch 1 (910.920 MHz)



⇒ Middle Channel _ch 15 (915.000 MHz)



⇒ Highest Channel_ch 25 (919.080 MHz)



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* Note : above the 20 dB Bandwidth measurement method is described FCC Public Notice(DA 00-705), (IC RSS-Gen 4.) and setting method on spectrum analyzer is as follows ;

- Span : approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- Resolution (or IF) Bandwidth(RBW) : ≥ 1% of the 20 dB bandwidth
- Video (or Average) Bandwidth(VBW) : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

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5.2 Number of hopping Channel

5.2.1 Standard Applicable [FCC §15.247(a),(1)(i)] [RSS-210 A8.1(d)]

For frequency hopping systems operating in the 902 MHz ~ 928 MHz band :

If the 20 dB bandwidth of the hopping channel is less than 250 KHz, the system shall use at least 50 hopping frequencies and if the 20 dB bandwidth of the hopping channel is 250 KHz or greater, the system shall use at least 25 hopping frequencies

5.2.2 Measurement Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna Terminal to get higher resolution, two frequency ranges within the 902 MHz ~ 928 MHz frequency band Hopping band were examined. The EUT must have its hoping function enabled.

After the trace being stable, it may prove necessary to break the span up to sections, in order to clearly show All of the hopping frequencies. The limit is specified in this paragraph 5.2.3

The spectrum analyzer is set to the as follows :

- Span : the frequency band of operation
- Resolution (or IF) Bandwidth(RBW) : ≥ 1% of the span
- Video (or Average) Bandwidth(VBW) : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.2.3 Measurement Result

- Environmental Conditions:

  -. Temperature : 24 ℃, Relative Humidity : (54 ~ 56) % R.H.

Channel Number	Hopping frequency band (MHz)	Test Results		
		Measured total number of Hopping Channels	Limit	Result
1 ~ 25	910.920 MHz ~ 919.080 MHz	25	≥ 25	Complies

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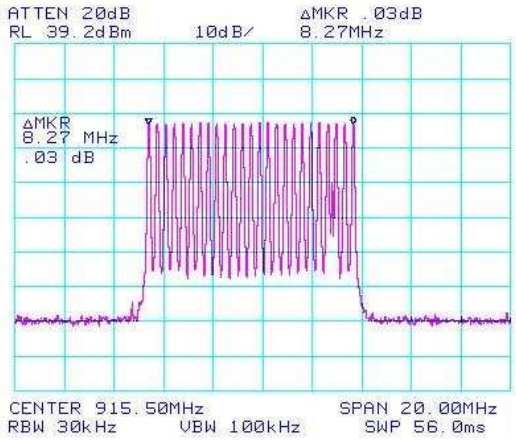
5.2.4 Test Plot

Hopping channel number / ch1 ~ ch25



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5.3 Time of occupancy (Dwell Time)

5.3.1 Standard Applicable [FCC §15.247(a),(1)(i)] [RSS-210 A8.1(d)]

For frequency hopping systems operating in the 902 MHz ~ 928 MHz band :

If the 20 dB bandwidth of the hopping channel is less than 250 KHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 second within 20 second period ; if the 20 dB bandwidth of the hopping channel is 250 KHz or greater, the system use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within 10 second period.

5.3.2 Measurement Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled. after used the marker-delta function to determine the dwell time.

The spectrum analyzer is set to the as follows :

- Span : Zero , Centered on a hopping channel
- Resolution (or IF) Bandwidth(RBW) : 1 MHz
- Video (or Average) Bandwidth(VBW) : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.3.3 Measurement Result

- Environmental Conditions :

-. Temperature : 24 ℃, Relative Humidity : (54 ~ 56) % R.H.

Slot length per channel (ms)	Test Results		
	Measured dwell time (ms)	Limit	Result
366.83	366.83	≤ 0.4 Sec	Complies

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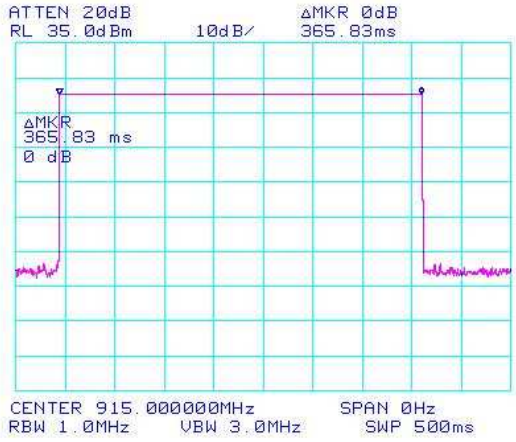
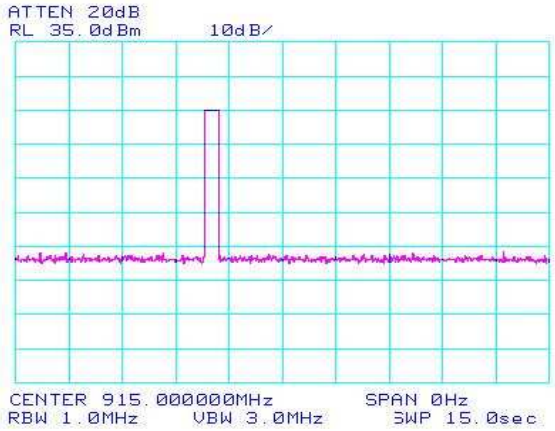
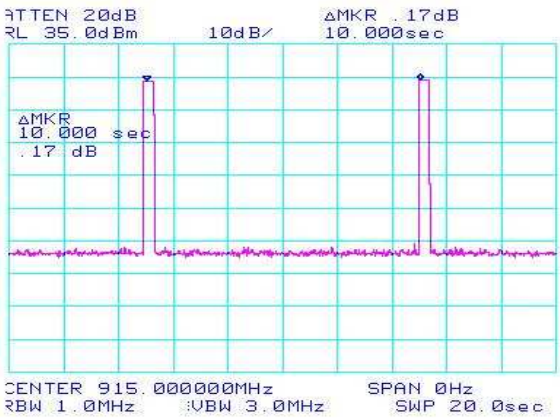
5.3.4 Test Plot

1. Burst width in one hop (ms)



2. Number of hop channel within 10 sec period





* This device send message to remote in case of trigger operation by the automotive sensing.

This system is use 25 hopping frequencies per every operation transmission time. The transmission time means Tx on time by one trigger operation.. The above plot show the burst width for any one hopping channel and number of hopping on any frequency within 10 sec.

The dwell time is calculated by burst width(time slot) x number of hopping channels in 10 s.

Dwell time = 365.83 ms x 1 = 365.83 ms

As a result, the average time of occupancy on any frequency is 365.83 ms within 10 sec.

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5.4 Max. Conducted peak output power

5.4.1 Standard Applicable [FCC §15.247(b)(2)] [RSS-210 A8.4(2)]

For frequency hopping systems operating in the 902 MHz ~ 928 MHz band ;

1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channel

5.4.2 Test Conditions

• Attenuator : 30 dB • dc Block : 1.0 dB • Cable loss : 0.5 dB

• Environmental Conditions : Ambient temperature : 23 ℃, Relative Humidity : (53 ~ 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 CAL OUT(-10 dBm)

② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :

on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]

- dc Block(1.0 dB)+Cable loss(0.5 dB)+Attenuator (30 dB)

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 it hopping function disable at the highest, middle and the lowest available channels.

⑤ After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission

⑥ The indicated level is the peak output power.

⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705) and IC(RSS-Gen)

∗The spectrum analyzer is set to the as follows ;

- Span : approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- Resolution (or IF) Bandwidth(RBW) : > 20 dB bandwidth of the emission being measured
- Video (or Average) Bandwidth(VBW) : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

* above measurement frequency is selected to the lowest, Middle and Highest channel

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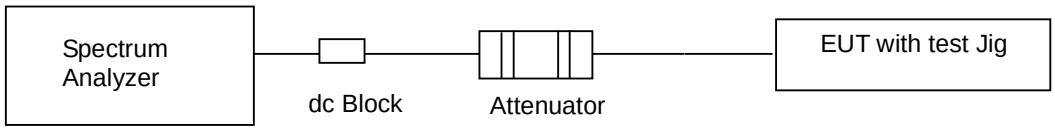
5.4.4 Test Setup Configuration



5.4.5 Measurement Result

Channel No.	Frequency [MHz]	Test Results		
		Measured power [mW]	Limit [mW]	Result
1	910.920	81.85**	≤ 250	Complies
15	915.000	81.82**		Complies
25	919.080	81.80**		Complies

** it is conducted power

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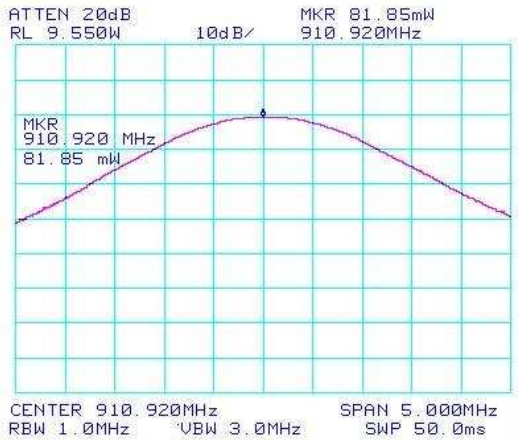
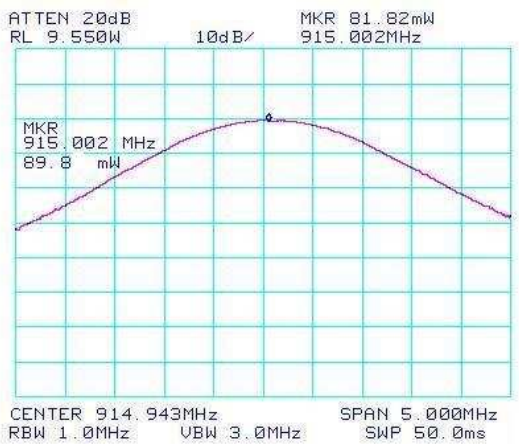
5.4.6 Test Plot

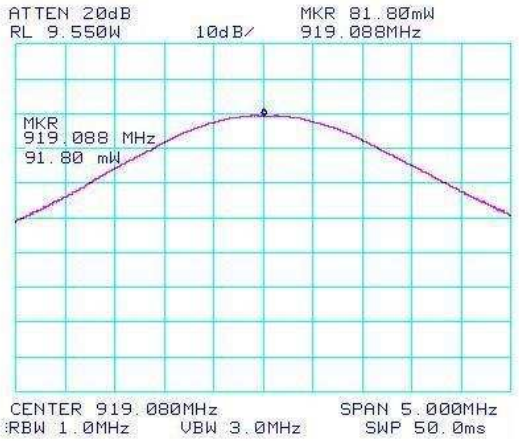
⇒ Lowest Channel _ch 1



⇒ Middle Channel _ch 15



⇒Highest Channel_ch 25



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5.5 Band-edge Compliance

5.5.1 Standard Applicable [FCC §15.247(d)] [RSS-210 A8.5]

In any 100 kHz 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 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

5.5.2 Test Conditions

• Attenuator : 30 dB • dc Block : 1.0 dB • Cable loss : 0.5 dB

• Environmental Conditions : Ambient temperature : 22 ℃, Relative Humidity : (53 ~ 54) % R.H.

5.7.2 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)

② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :

on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]

- dc Block(1.0 dB)+Cable loss(0.5 dB)+Attenuator (30 dB)

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 FCC Public Notice(DA 00-705) and IC(RSS-Gen 4.)

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

• Resolution (or IF) Bandwidth(RBW) : ≥ 1 % of the span

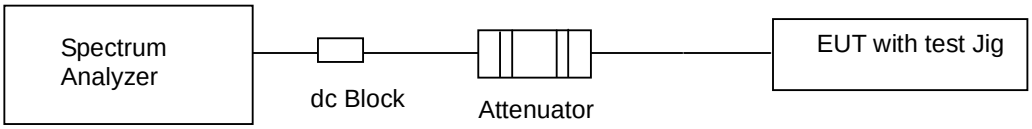
• Video (or Average) Bandwidth(VBW) : ≥ RBW

• Sweep : auto

• Detector function : peak

• Trace : Max hold

5.5.3 Test Setup Configuration



5.5.4 Measurement Result

Frequency Channel	Operating Frequency [MHz]		Test Results		
			Measured value [dBm]	Limit [dBc]	Result
Hopping off mode	Lowest channel	910.920	≤ - 50	≤ - 20	Compliance
	Highest channel	919.080			
Hopping on mode	Operating full band frequency	910.920 ~ 919.080	≤ - 50		Compliance

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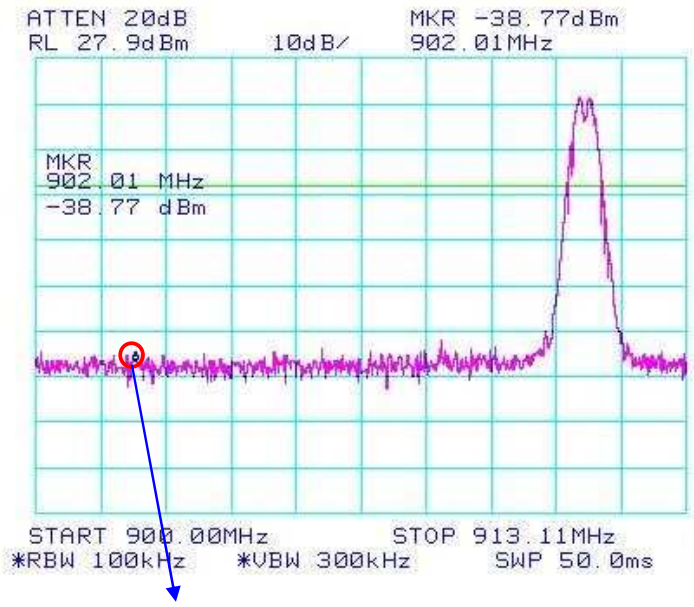
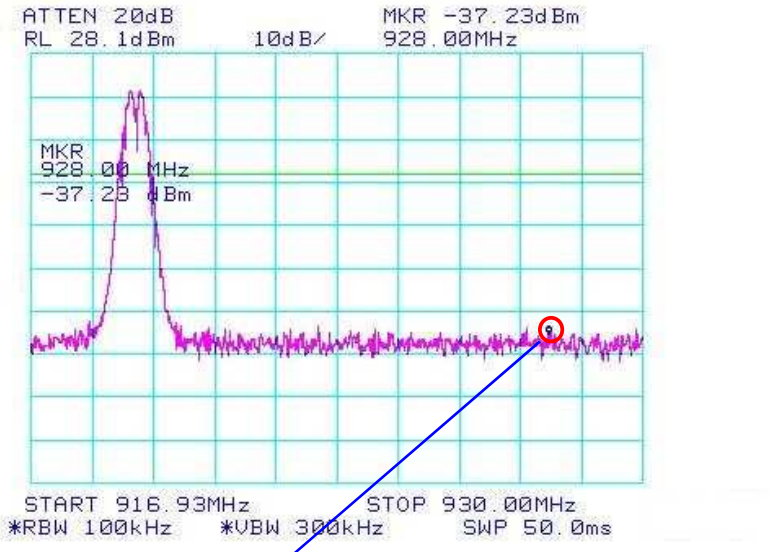
5.5.5 Test Plot (Hopping off_mode)

⇒ Lowest Channel _ch 1



▶ Lowest band-edge point

⇒ Highest Channel _ch 25



▶ Highest band-edge point

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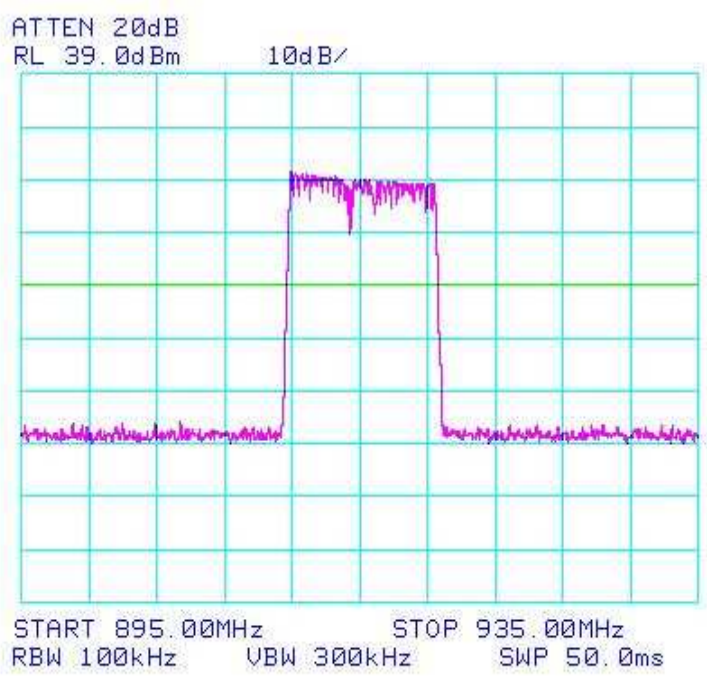
5.5.6 Test Plot (Hopping on_ mode)



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5.6 Spurious RF conducted emissions

5.6.1 Standard Applicable [FCC §15.247(d)] [RSS-210 A8.5]

In additional in this clause 5.5.1 In any 100 kHz 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 e at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

5.6.2 Test Conditions

• Attenuator : 30 dB • dc Block : 1.0 dB • Cable loss : 0.5 dB

• Environmental Conditions : Ambient temperature : 22 ℃, Relative Humidity : (53 ~ 54) % R.H.

5.6.3 Measurement Procedure

① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)

② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :

on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]

- dc Block(1.0 dB)+Cable loss(0.5 dB)+Attenuator (30 dB)

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 out band

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 spurious emission must comply with the limit specified in above standard.

⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

The spectrum analyzer is set to the as follows :

• Span : wide enough to capture the peak level of the in-band emission and all spurious emissions from the Lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

• Resolution (or IF) Bandwidth(RBW) : 100 kHz

• Video (or Average) Bandwidth(VBW) : ≥ RBW

• Sweep : Auto

• Detector function : Peak

• Trace : Max hold

∗ Test setup of configuration is same as in this clause 5.5.3

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5.6.4 Measurement Result

Hopping mode	Channel Range	Frequency band [MHz]	Test Results		
			Measured value [dBc]	Limit [dBc]	Result
Hopping off	Lowest channel (910.920 MHz)	30 MHz – 928 MHz	- 51.67	≤ - 20	Compliance
		700 MHz – 10 GHz	-51.00		Compliance
	Middle channel (915.000 MHz)	30 MHz – 928 MHz	-50.33		Compliance
		700 MHz – 10 GHz	-49.50		Compliance
	Highest channel (919.080 MHz)	30 MHz – 928 MHz	- 55.16		Compliance
		700 MHz – 10 GHz	-49.10		Compliance
Hopping on	Hopping ch (1~25)	30 MHz – 1 000 MHz	-49.66		Compliance
		700 MHz – 10 GHz	-45.00		Compliance

*Note: Spurious level at Hopping mode is 20dB below within the band that contains the highest level of the desired power. see to as below Test Plot of 5.6.5

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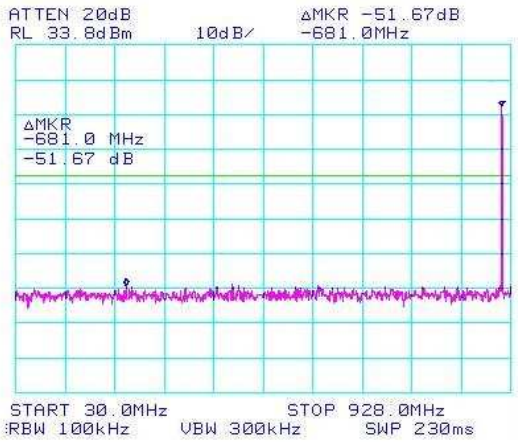
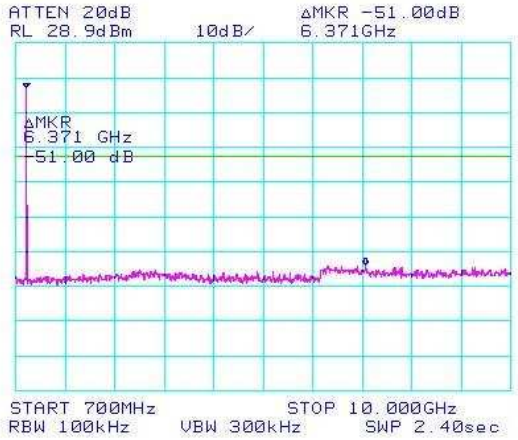
5.6.5 Test Plot (Hopping off)

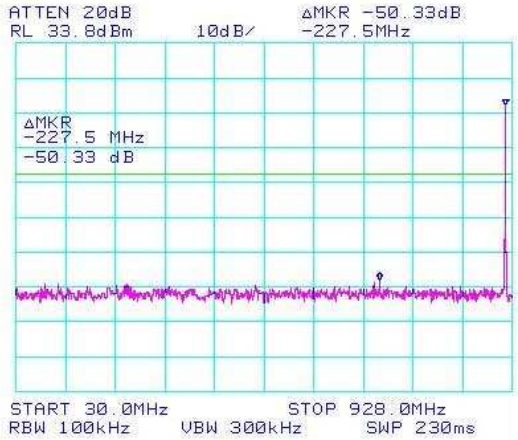
⇒Lowest Channel ……30 MHz ~ 928 MHz



⇒Lowest Channel ……700 MHz ~ 10 GHz



⇒Middle Channel ……30 MHz ~ 928 MHz



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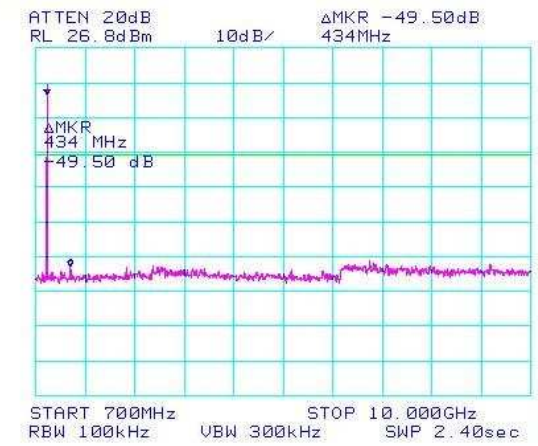
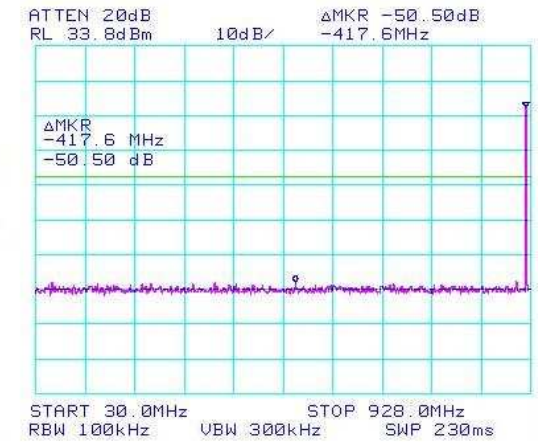
Continuous

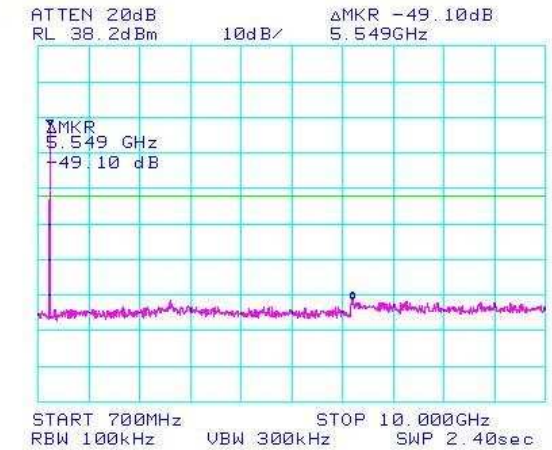
⇒Middle Channel ……700 MHz ~ 10 GHz



⇒Highest Channel ……30 MHz ~ 928 MHz



⇒Highest Channel …… 700 MHz ~ 10 GHz



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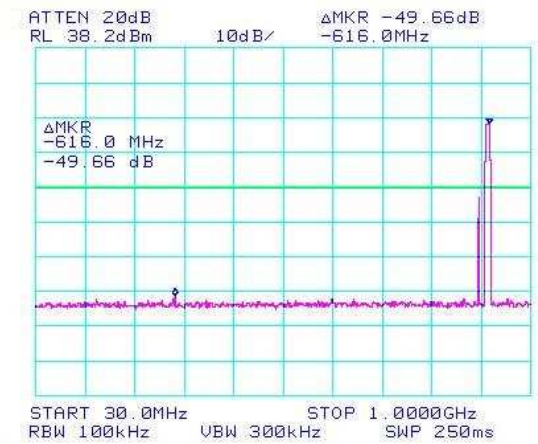
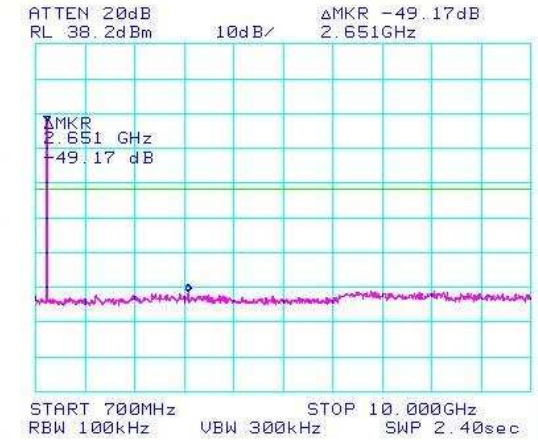
5.6.6 Test Plot (Hopping on)

⇒frequency band (30 MHz ~ 1.0 GHz)



⇒frequency band (700 MHz ~ 10 GHz)



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5.7 Spurious radiated emissions

5.7.1 Standard Applicable [FCC §15.247(d)] [RSS-210 2.2]

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 GHz, the frequency Range of measurements : to the tenth harmonic of the highest fundamental frequency, 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), there is corresponding the specified Average limit according to 15.35(b)

5.7.2 Measurement Procedure

① As below test setup figure, for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is test mode function. Also was placed on a non-metallic table height of 0.8 m above the reference ground plane. If EUT is connected to cables, that were fixed to cause maximum emission. antenna was used to Horn antenna for above 1 GHz and Broadband antenna below 1GHz. it made with the antenna positioned in both the horizontal and vertical planes of polarization.

② For emission frequencies measured each below and above 1 GHz, a pre-scan is performed in a Shield chamber to determine the accurate frequencies before final test, after maximum emissions level will be checked on a open test site and measuring distance is 3 meter from EUT to receiver antenna.

③ For emission frequencies measured below 1 GHz, set the Test Receiver on a 120KHz resolution bandwidth using measurement instrumentation employing a CISPR quasi-peak detector. and for above1 GHz, set the spectrum analyzer on a 1 MHz resolution bandwidth with average detector for each frequency measured in step② and then EUT is located Position X,Y,Z on turn table

④ The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0º to 360º with a speed as slow as possible, and keep the highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

⑤ Repeat step④ until all frequencies to be measured were complete.

⑥ Repeat step⑤ with search antenna in vertical polarized orientations.

⑦ Check the frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worst case and record the result.

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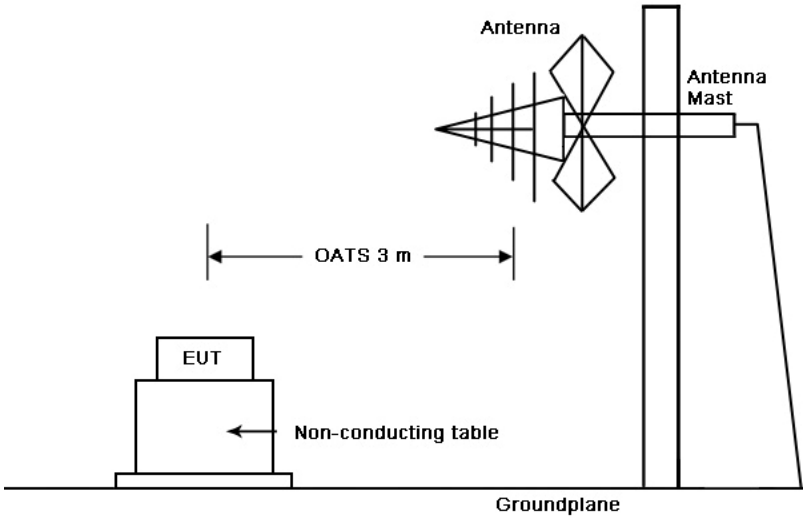
The measurement results are obtained as described below:

Result(dBμV/m) = Reading(dBμV/m) + Antenna factor(dB/m)+ CL(dB) + other application factor (dB)



5.7.3 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. 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 OATS(Open Area Test Site) of KOSTEC is ± 4.0 dB

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§15.209 and RSS-210(2.7 Table 2) : limits for radiated emissions measurements (distance at 3m)			
Frequency Band	Limit [μV/m]	Limit [dBμV/m]	Detector
30 - 88	100 (3 nW)	40.0	Quasi peak
88 - 216	150 (6.8 nW)	43.5	Quasi peak
216 - 960	200 (12 nW)	46.0	Quasi peak
Above 960	500 (75 nW)	54.0	Average

§15.249 and RSS-210(A 2.9 (a) : The field strengths measured at 3 metres shall not exceed the following:		
Fundamental Frequencies (MHz)	Field Strength (milivolts/m)	
	Fundamental	Harmonics
902 ~ 928	50 (Note 1)	0.5
2 400 ~ 2 483.5	50 (Note 1)	0.5
5 725 ~ 5 875	50 (Note 1)	0.5

§15.205 and RSS-210(2.7 Table 1) : 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**	16.69475 - 16.69525	608 -614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 -1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.
4.17725 - 4.17775	37.5 -38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 -6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 -6.26825	108 - 121.94	1718.8 -1722.2	13.25 - 13.
6.31175 -6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.4142 5 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6

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

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5.7.4 Measurement Result (Transmitter mode)

• Environmental Conditions :

- Temperature : 24 ℃, Relative Humidity : (56 ~ 57) % R.H. Pressure : 100.2 kPa

▣ Lowest Channel_01 (910.920 MHz)

Below 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cbl (dB)	Pre amp	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						

* No emission in the restricted bands was detected.

Above 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cbl (dB)	Pre Amp (dB)	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
1.82197	43.17	85	Y	1.5	V	25.33	4.63	30	43.13	54.00	10.87	Pass
Above 1,82197	Nil emission											

※above listed emission is not falling in the restricted bands of 15.205

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

▣ Middle Channel_ 15 (915.000 MHz)

Below 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cbl (dB)	Pre amp	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						

* No emission in the restricted bands was detected.

Above 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cbl (dB)	Pre Amp (dB)	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
1,83017	42.67	122	X	1.7	V	25.33	4.63	30	42.63	54.00	11.37	Pass
Above 1,83017	Nil emission											

※above listed emission is not falling in the restricted bands of 15.205

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▣ Higest Channel_25 (919.080 MHz)

Below 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cbl (dB)	Pre amp	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						

* No emission in the restricted bands was detected.

Above 1 ㎓

Freq. (㎒)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cbl (dB)	Pre Amp (dB)	Meas Result (dB㎶/m)	Limit (dB㎶/m)	Mgn (dB)	Result
				Height (m)	Pol. (H/V)	Fctr. (dB/m)						
1.83820	42.83	90	Y	1.8	V	25.33	4.63	30	42.79	54.00	11.21	Pass
Above 1.83820	Nil emission											

※above listed emission is not falling in the restricted bands of 15.205

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

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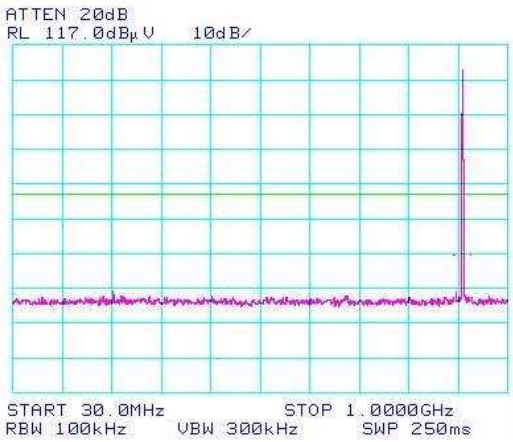
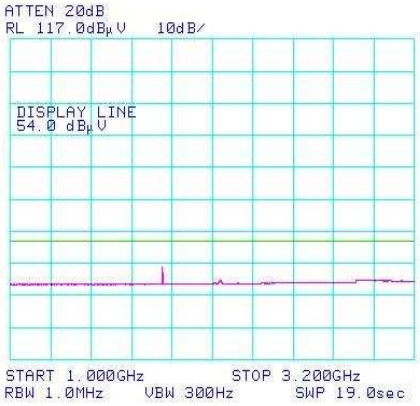
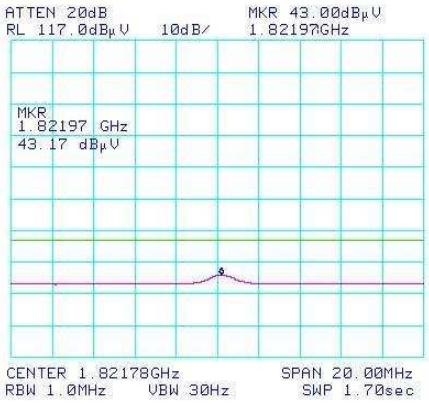
5.7.5 Test Plot (Hopping off)

⇒Lowest Channel ……30 MHz ~ 1 000 MHz

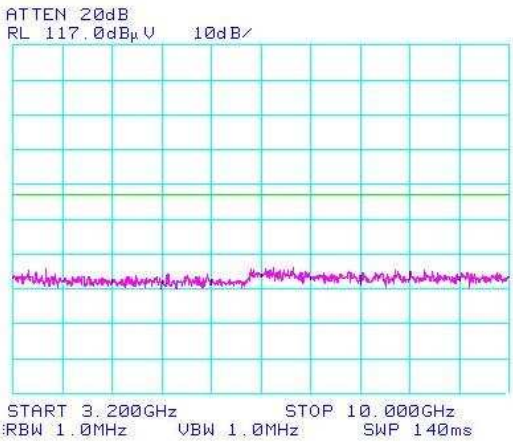


⇒Lowest Channel ……1.0 GHz ~ 3.2 GHz



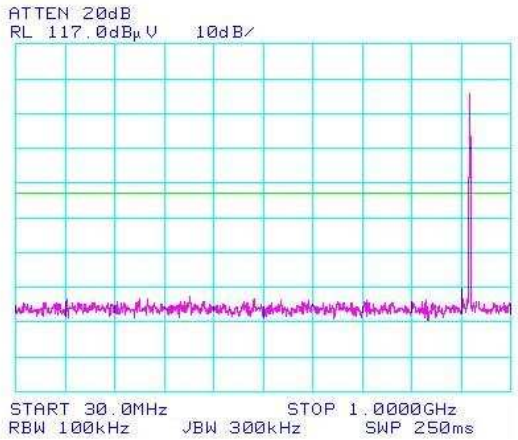


⇒ Lowest Channel ……3.2 GHz ~ 10 GHz

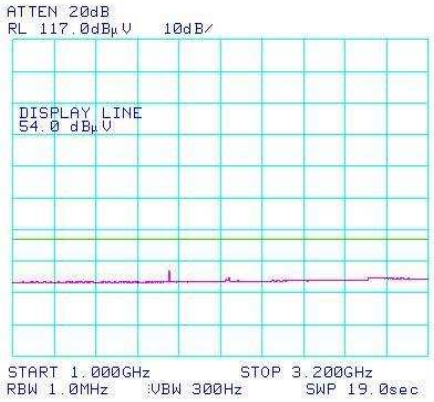


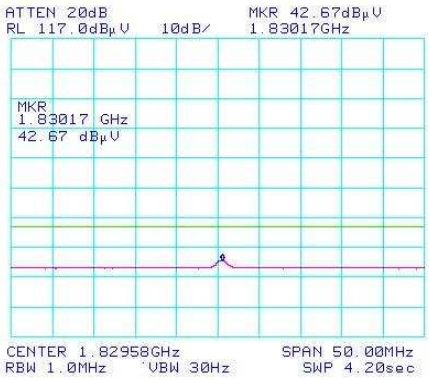
Continuous

⇒Middle Channel ……30 MHz ~ 1 000 MHz

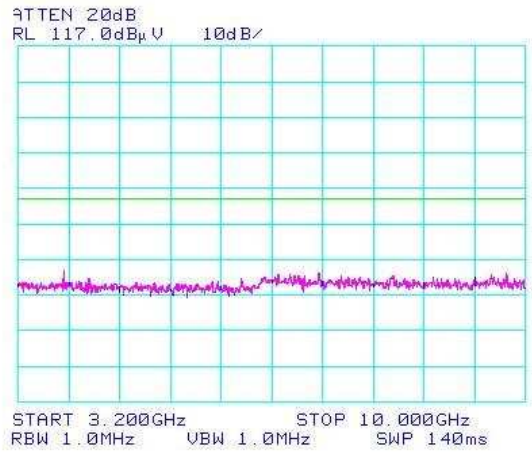


⇒ Middle Channel ……1.0 GHz ~ 3.2 GHz





⇒ Middle Channel ……3.2 GHz ~ 10 GHz



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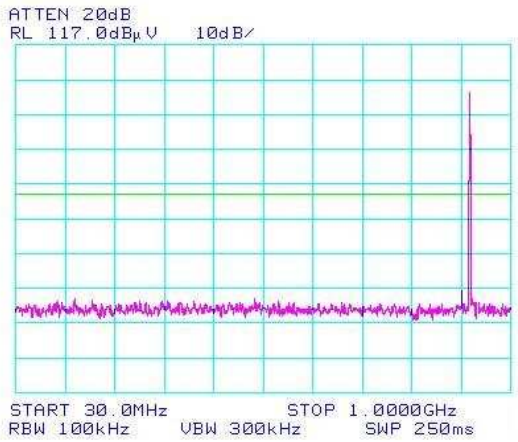
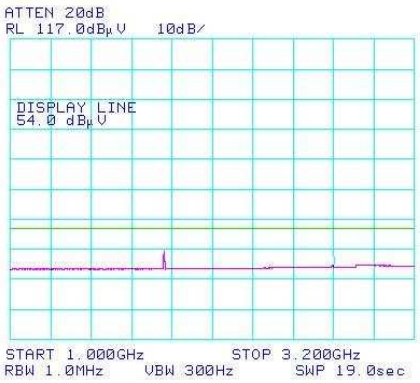
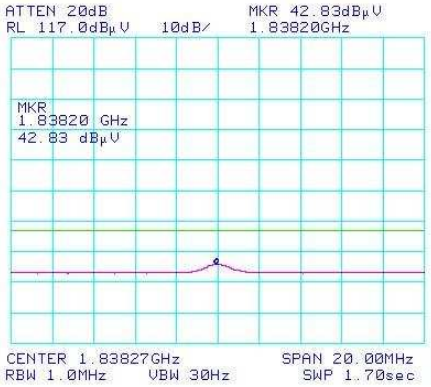
Continuous

⇒Highest Channel ……30 MHz ~ 1 000 MHz

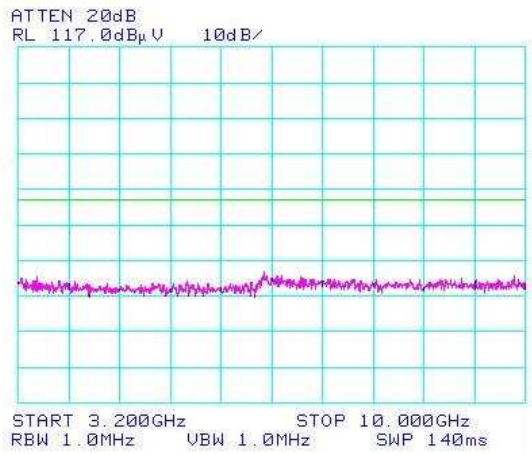


⇒ Highest Channel ……1.0 GHz ~ 3.2 GHz





⇒ Highest ……3.2 GHz ~ 10 GHz



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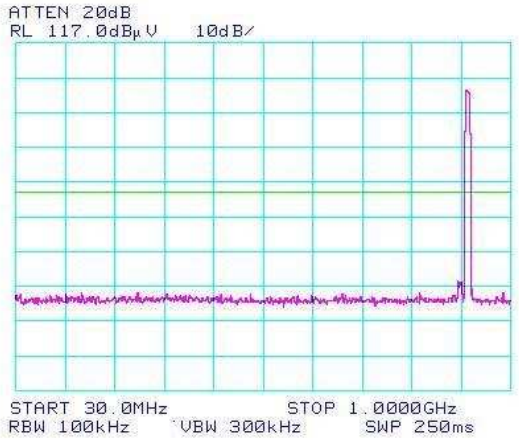
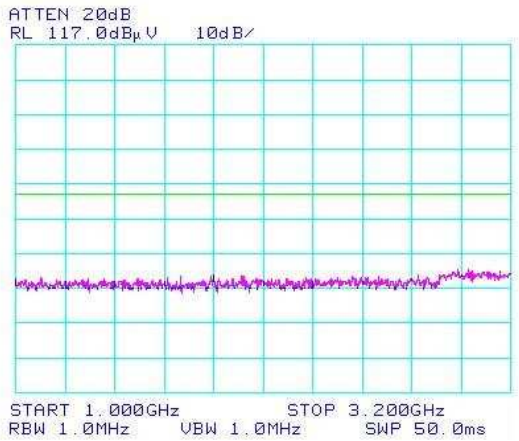
5.7.6 Test Plot (Hopping on)

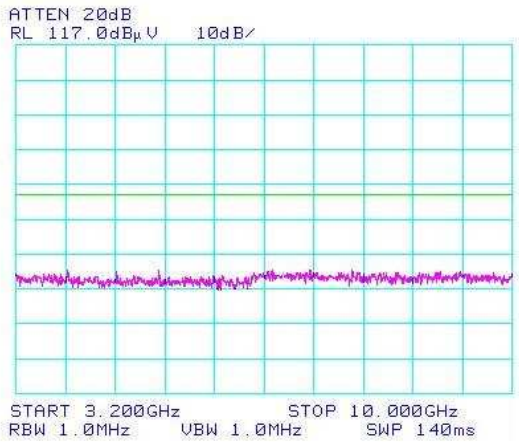
⇒Frequency range……30 MHz ~ 1 000 MHz



⇒ Frequency range ……1.0 GHz ~ 3.2 GHz



⇒ Frequency range ……3.2 GHz ~ 10 GHz



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5.7.7 Measurement Result (Receive mode)

• Environmental Conditions :

- Temperature : 23 ℃, Relative Humidity : (55 ~ 57) % R.H. Pressure : 100.5 kPa

▣ Below 1 ㎓

Freq. (MHz)	Reading (dB㎶/m)	Table (Deg)	Pstn (axis)	Antenna			Cable Loss(dB)	Result (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
				Height (m)	Pol. (H/V)	Fctr. (dB/m)				
Signal is not detected										

Above 1 ㎓

Freq. (MHz)	Reading (dBμV/m)	Table (Deg)	Pstn (axis)	Antenna			Cable Loss(dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
				Height (m)	Pol. (H/V)	Fctr. (dB/m)				
Signal is not detected										

Freq.(㎒) : Measurement frequency, Reading(dB㎶/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
Cable loss(dB) : Cable loss, Result(dB㎶/m) : Reading(dB㎶/m) + Antenna factor(dB/m)+ Cable loss(dB)
FCC Limit(dB㎶/m): Limit value specified with FCC Rule, FCC Margin(dB) : FCC Limit (dB㎶/m)- Result(dB㎶/m)

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5.8 General requirement

5.8.1 Antenna requirement [FCC §15.203, §15.247(4)(1)] [RSS-Gen 7.1.5]

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 6dBi.

According to above requirement standard's This product's antenna type is an wire type and it's gain is -0.675dBi, So radiated emission field strength from EUT is below requirement standard limit

5.8.2 User information [FCC §15.21 and IC Rule]

For intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

According to above requirement standards. this warning statement is described on user manual