ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : **OT-206-RWD-084**

AGR No. : **A205A-265**

Applicant : **ZTACOM Co.,Ltd**

Address : **103-510, KT Daeduk 2 Research Center, 70, Yuseong-daero-1689beon-gil, Yuseong-gu, Daejeon, 34047, South Korea**

Manufacturer : **ZTACOM Co.,Ltd**

Address : **103-510, KT Daeduk 2 Research Center, 70, Yuseong-daero-1689beon-gil, Yuseong-gu, Daejeon, 34047, South Korea**

Type of Equipment : **GPS Tracker & Messenger**

FCC ID. : **2AUFQZLC-100U**

Model Name : **ZLC-100U**

Multiple Model Name : **N/A**

Serial number : **N/A**

Total page of Report : **34 pages (including this page)**

Date of Incoming : **June 17, 2020**

Date of issue : **June 30, 2020**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.247***

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: Tae-Ho, Kim / Senior Manager, ONETECH Corp.

Approved by: Ki-Hong, Nam / General Manager, ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-206-RWD-084	June 30, 2020	Initial Release	All

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1. VERIFICATION OF COMPLIANCE

Applicant : ZTACOM Co.,Ltd

Address : 103-510, KT Daeduk 2 Research Center, 70, Yuseong-daero-1689beon-gil, Yuseong-gu, Daejeon, 34047, South Korea

Contact Person : Byungmin Park / Director of Technology

Telephone No. : +82-10-3620-7652

FCC ID : 2AUFQZLC-100U

Model Name : ZLC-100U

Brand Name : -

Serial Number : N/A

Date : June 30, 2020

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	GPS Tracker & Messenger
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C Section 15.247 558074 D01 15.247 Meas Guidance v05r02
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.247 (a) (2)	Minimum 6 dB Bandwidth	Met the Limit / PASS
15.247 (b) (3)	Maximum Peak Conducted Output Power	Met the Limit / PASS
15.247 (d)	100 kHz Bandwidth Outside the Frequency Band	Met the Limit / PASS
15.247 (d)	Radiated Emission which fall in the Restricted Band	Met the Limit / PASS
15.247 (e)	Peak Power Spectral Density	Met the Limit / PASS
15.209	Radiated Emission Limits	Met the Limit / PASS
15.207	Conducted Limits	Met the Limit / PASS
15.203	Antenna Requirement	Met requirement / PASS

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART C Section 15.247.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666/ T-11842

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The ZTACOM Co.,Ltd, Model ZLC-100U (referred to as the EUT in this report) is an GPS Tracker & Messenger, Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	GPS Tracker & Messenger	
Temperature Range	-20 °C ~ +60 °C	
Rated Supply Voltage	DC 3.7 V	
OPERATING FREQUENCY	LoRa	903 MHz ~ 914.2 MHz
	Bluetooth LE	2 402 MHz ~ 2 480 MHz
MODULATION TYPE	LoRa	CSS
	Bluetooth LE	GFSK
RF OUTPUT POWER	LoRa	11.32 dBm
	Bluetooth LE	-2.47 dBm
NUMBER OF CHANNEL	LoRa	8 Channel
	Bluetooth LE	40 Channel
ANTENNA TYPE	LoRa : FPCB Antenna Bluetooth LE : PCB Antenna	
ANTENNA GAIN	LoRa : -2.0 dBi Bluetooth : 1.0 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	32 MHz	

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

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5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	ZTACOM Co.,Ltd	IM CARD REV1.3	N/A
DC Battery	N/A	N/A	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
ZLC-100U	ZTACOM Co.,Ltd	GPS Tracker & Messenger (EUT)	-
YP-05	N/A	Jig Board	EUT
Ideapad 330	LENOVO	Notebook PC	-
PA-1450-55LR	LITE-ON TECHNOLOGY (CHANGZHOU) Co., Ltd.	AC Adapter	

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at 903.0 MHz, 909.4 MHz, and 914.2 MHz to get a maximum emission levels from the EUT. The EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XZ” axis, but the worst data was recorded in this report.

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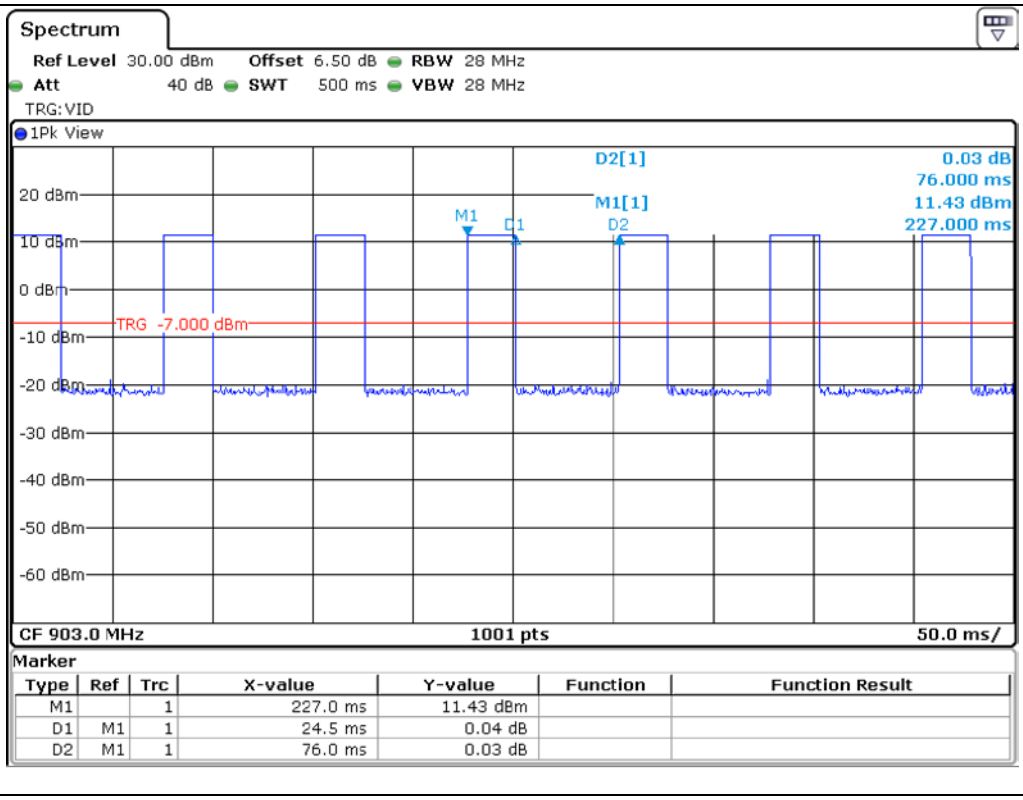
-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Correction Factor [dB]
LoRa	24.50	51.50	32.24	4.92

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Correction Factor : 10 * Log(1 / (Duty Cycle / 100))

-. Test Plot



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-. Channel List

LoRa		Bluetooth LE			
Channel	**Frequency [MHz]**	**Channel**	**Frequency [MHz]**	**Channel**	**Frequency [MHz]**
64	903.00	0	2 402.00	21	2 444.00
65	904.60	1	2 404.00	22	2 446.00
66	906.20	2	2 406.00	23	2 448.00
67	907.80	3	2 408.00	24	2 450.00
68	909.40	4	2 410.00	25	2 452.00
69	911.00	5	2 412.00	26	2 454.00
70	912.60	6	2 414.00	27	2 456.00
71	914.20	7	2 416.00	28	2 458.00
		8	2 418.00	29	2 460.00
		9	2 420.00	30	2 462.00
		10	2 422.00	31	2 464.00
		11	2 424.00	32	2 466.00
		12	2 426.00	33	2 468.00
		13	2 428.00	34	2 470.00
		14	2 430.00	35	2 472.00
		15	2 432.00	36	2 474.00
		16	2 434.00	37	2 476.00
		17	2 436.00	38	2 478.00
		18	2 438.00	39	2 480.00
		19	2 440.00	-	-
		20	2 442.00	-	-

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5.4 Configuration of Test System

Line Conducted Test: It is not need to test this requirement, because the EUT shall be operated by DC battery.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter Semi Anechoic Chamber.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

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

Antenna Construction:

The antenna of the EUT is FPCB Antenna on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied by battery.	

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode & Charging Mode	X

7. MIMIMUM 6 dB BANDWIDTH

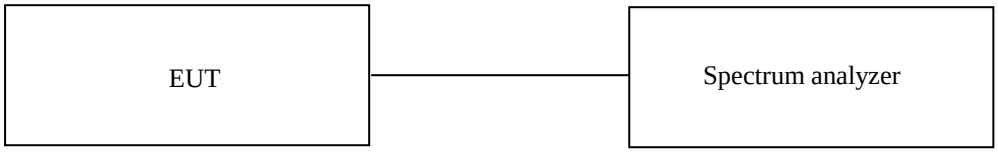
7.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Feb. 21, 2020 (1Y)

All test equipment used is calibrated on a regular basis.

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7.4 Test Data

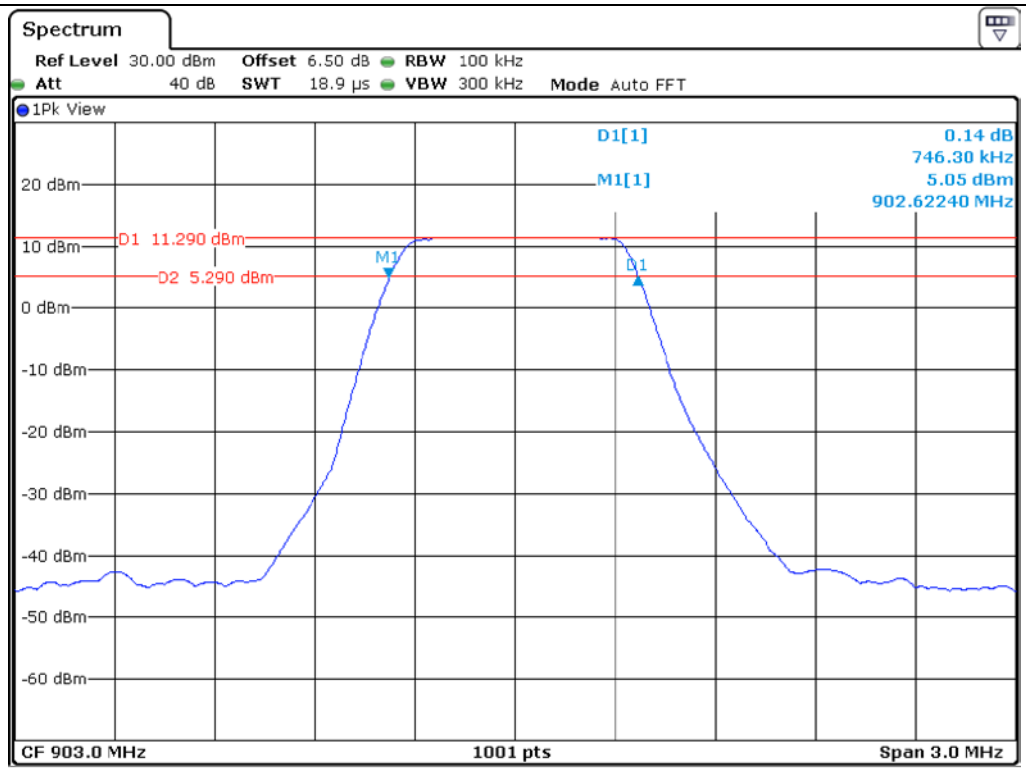
-. Test Date : June 17, 2020 ~ June 22, 2020

-. Test Result : Pass

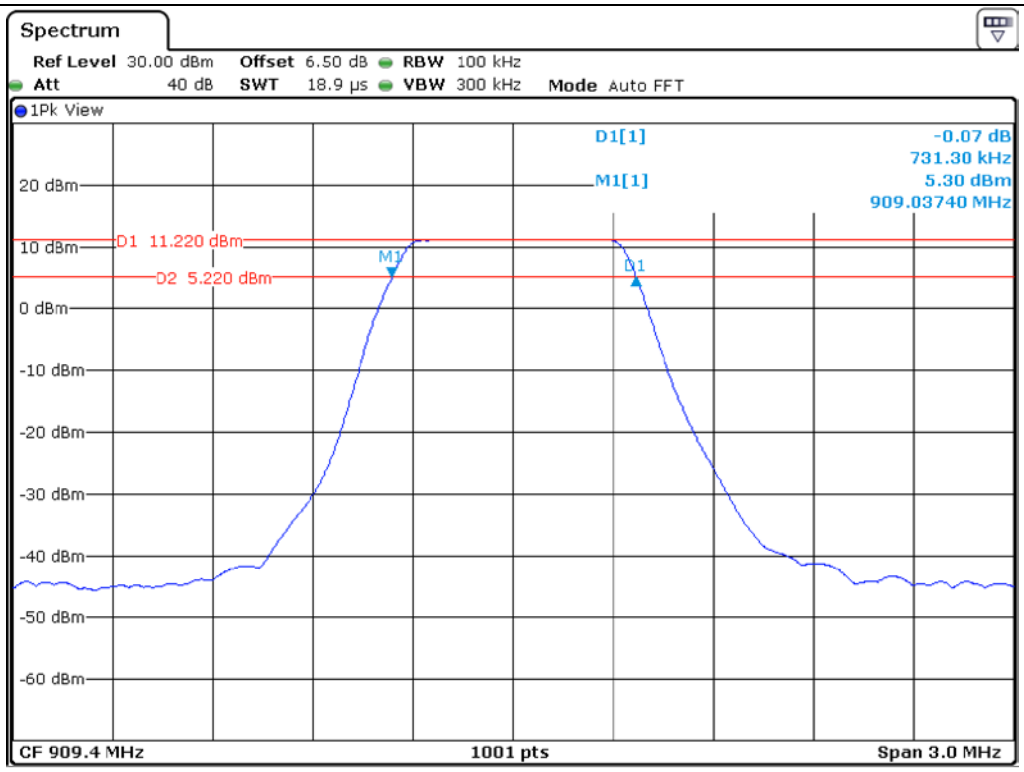
CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (kHz)	LIMIT (kHz)	Margin (kHz)
Low	903.00	746.30	500.00	246.30
Middle	909.40	731.30	500.00	231.30
High	914.20	725.30	500.00	225.30

Remark. Margin = Measured Value - Limit

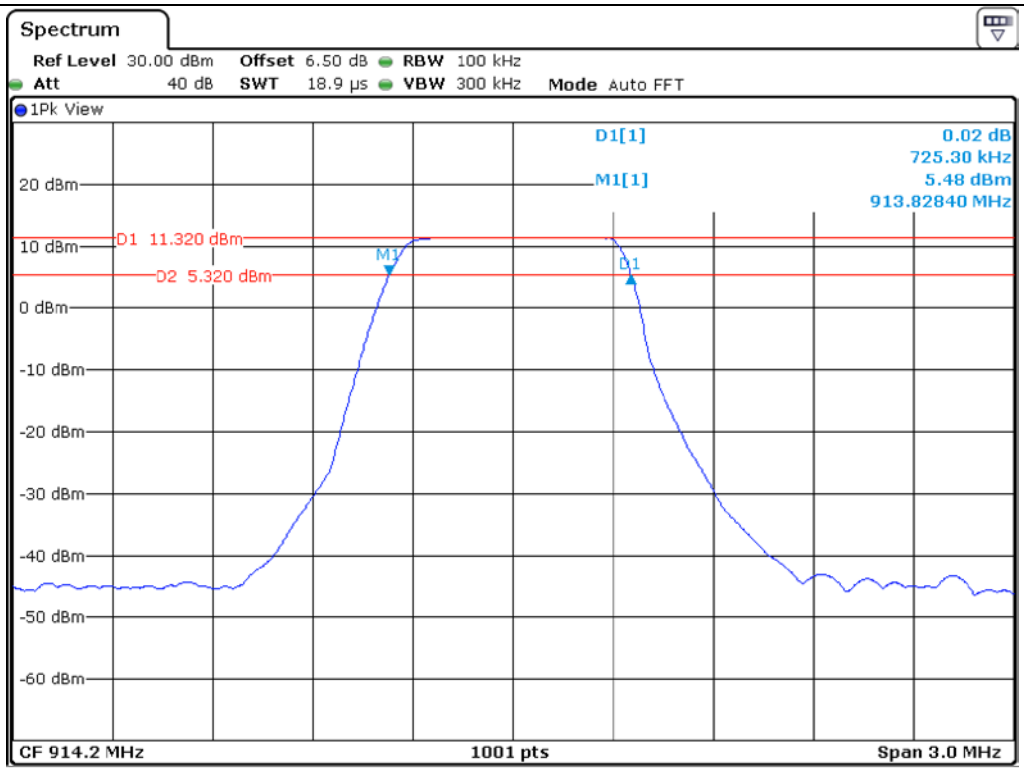
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

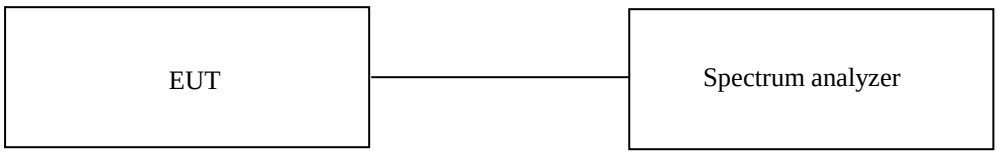
Temperature : 23 °C

Relative humidity : 45 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to ≥ DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Feb. 21, 2020 (1Y)

All test equipment used is calibrated on a regular basis.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

8.4 Test Data

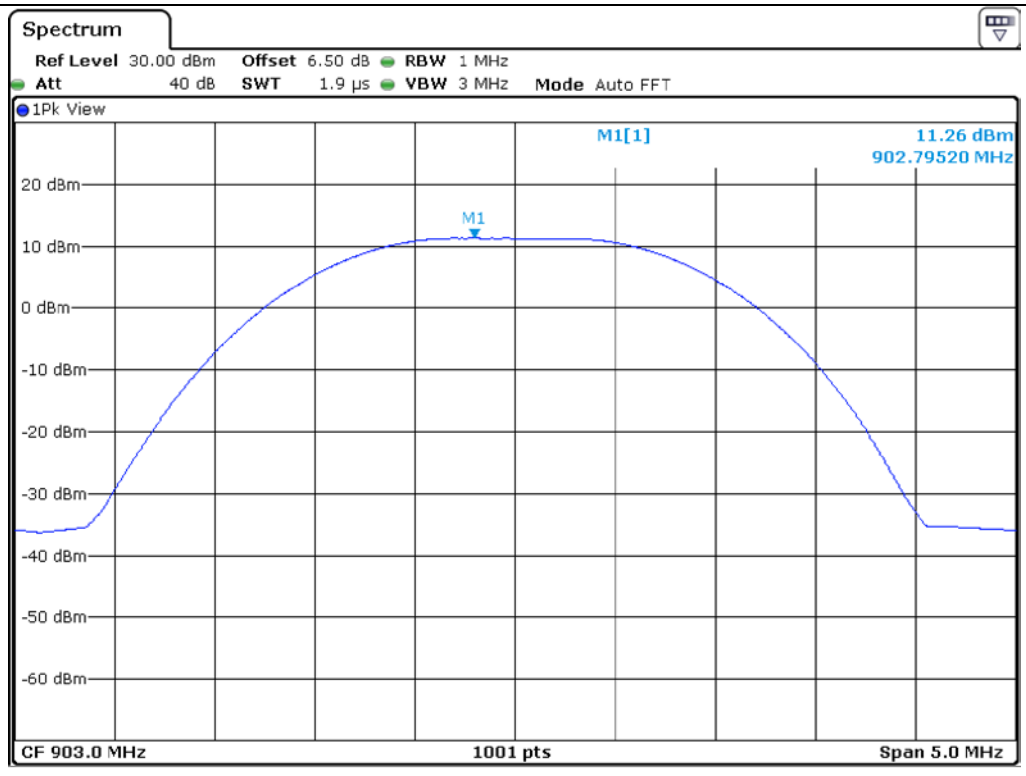
-. Test Date : June 17, 2020 ~ June 22, 2020

-. Test Result : Pass

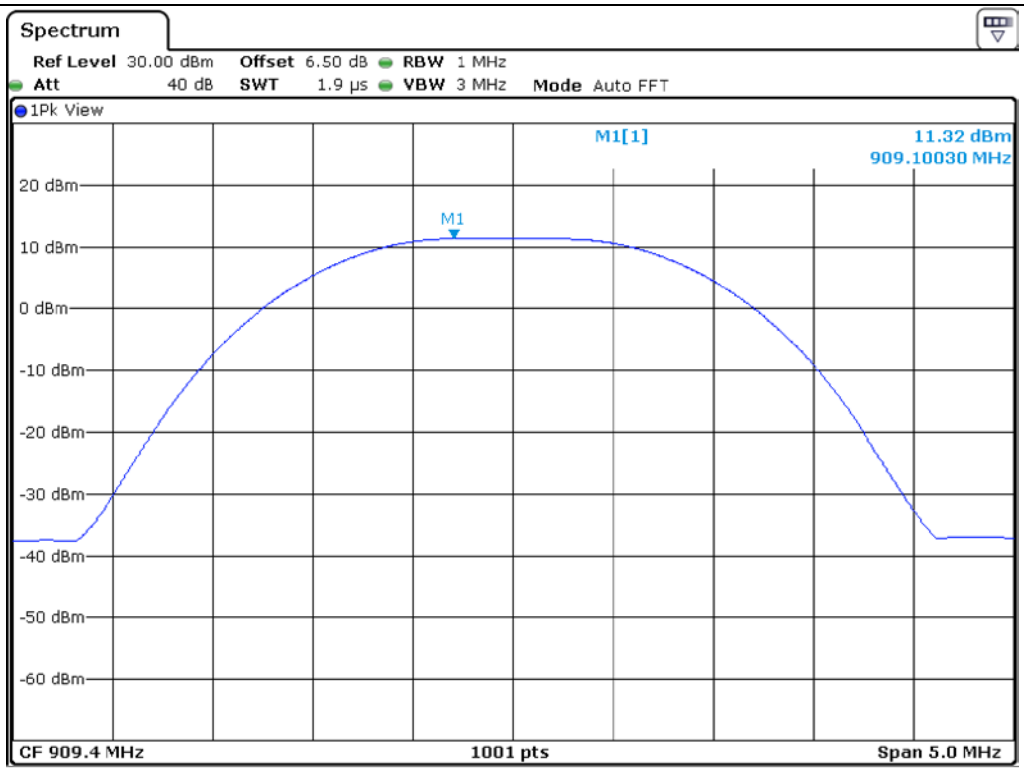
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	903.00	11.26	30.00	18.74
Middle	909.40	11.32	30.00	18.68
High	914.20	11.29	30.00	18.71

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

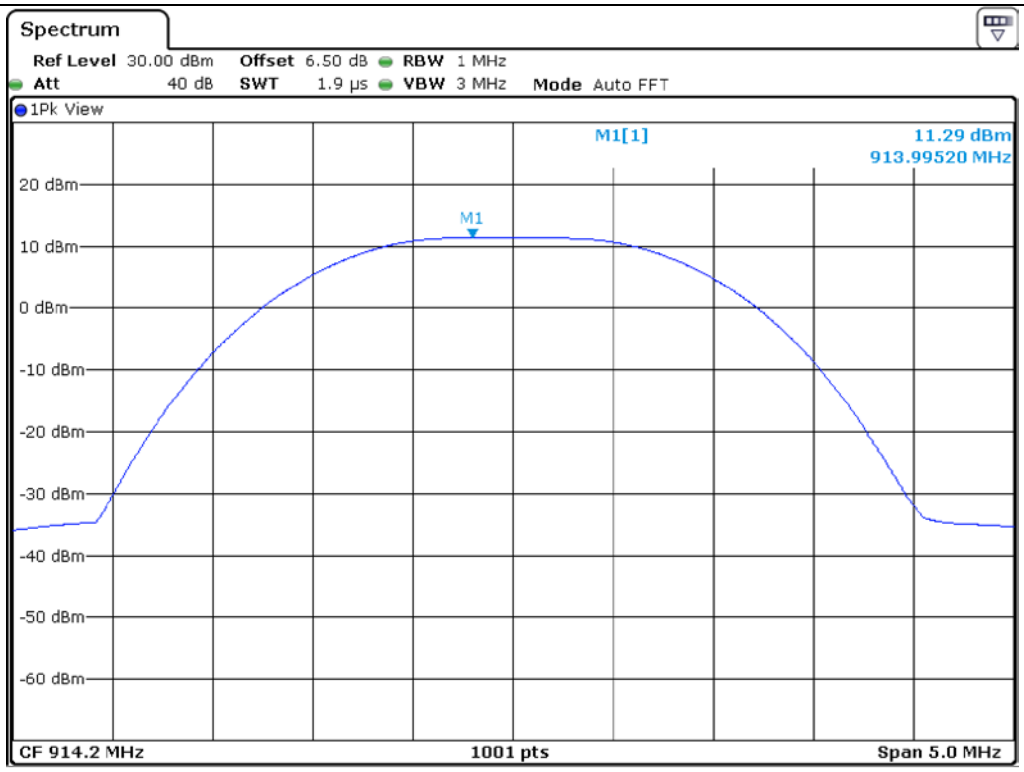
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



High Channel

9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

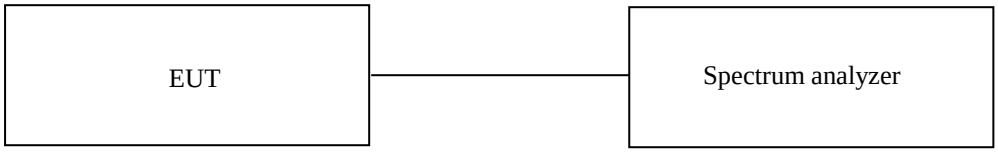
9.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



9.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from up to 10 GHz was scanned and emission levels maximized at each frequency recorded.

The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

9.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Feb. 21, 2020 (1Y)
■ -	ESW	Rohde & Schwarz	EMI Test Receiver	101851	Aug. 07, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 16, 2020 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Broadband Preamplifier	00009	Mar. 16, 2020 (1Y)
■ -	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Feb. 20, 2020 (1Y)
■ -	SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 24, 2019(1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 08, 2020 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2020(1Y)

All test equipment used is calibrated on a regular basis.

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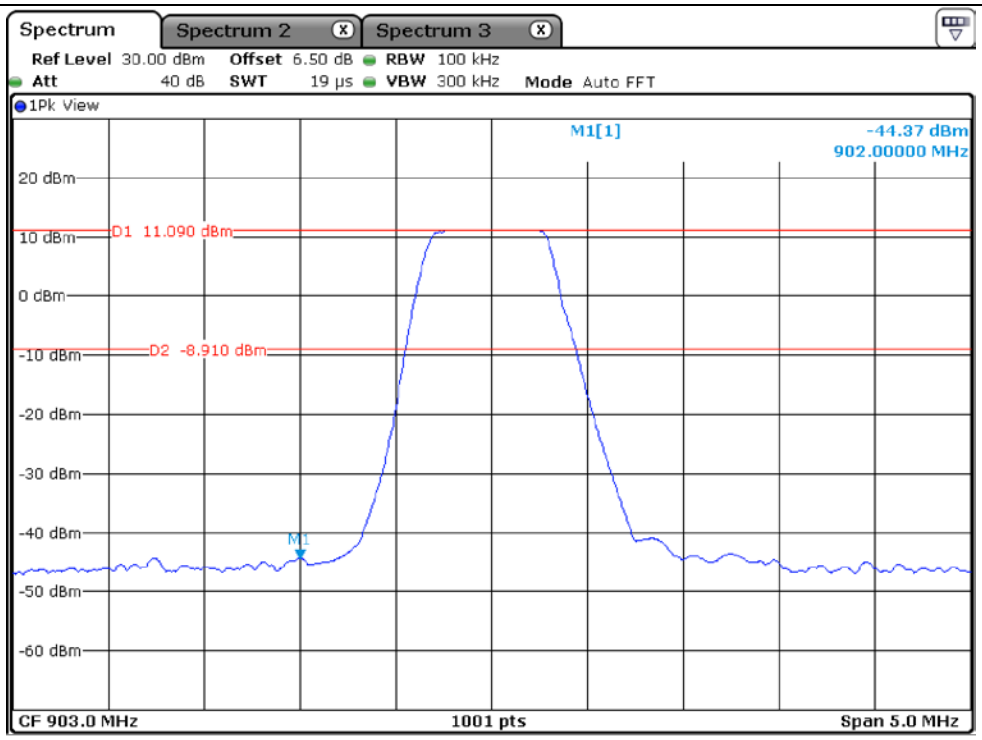
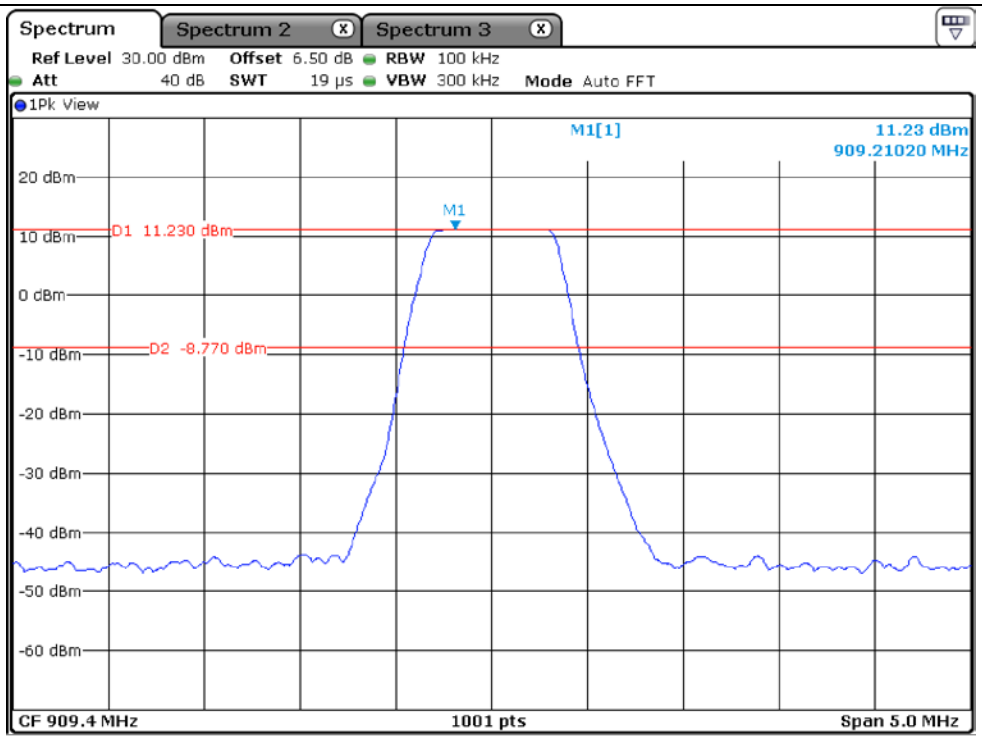
9.5 Test Data for conducted emission



Low Channel



Middle Channel

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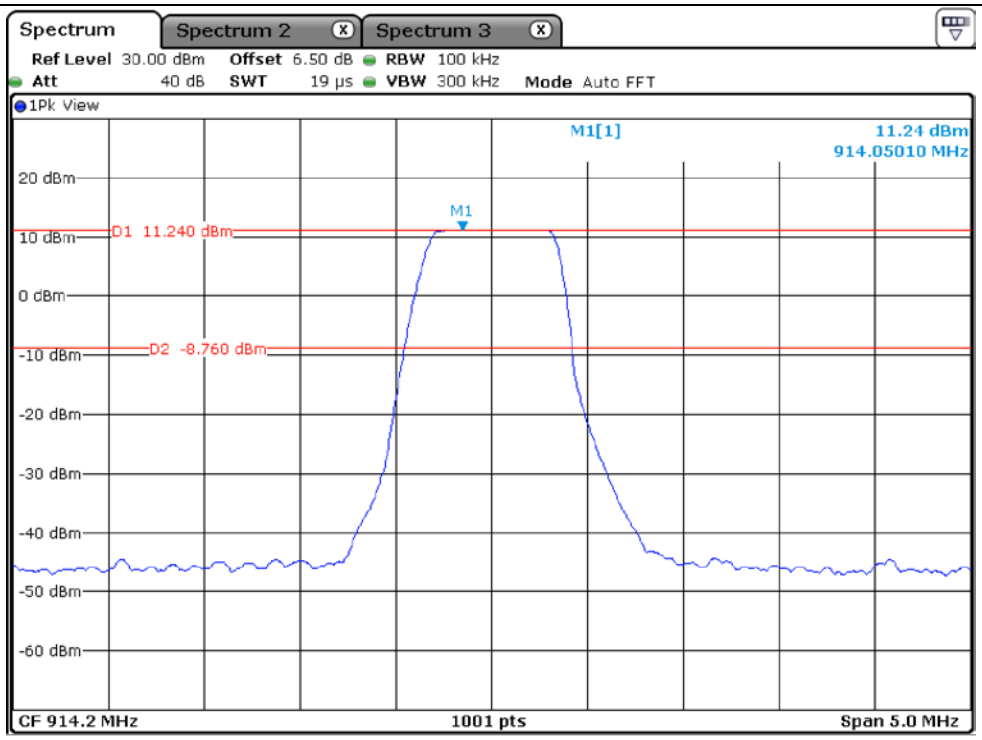
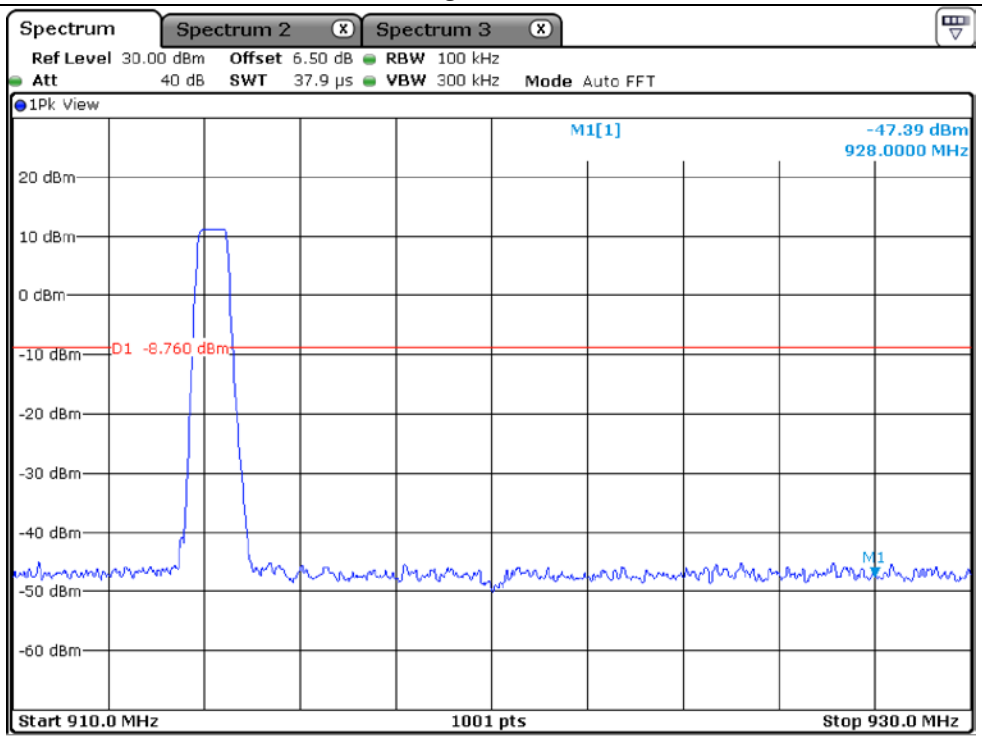
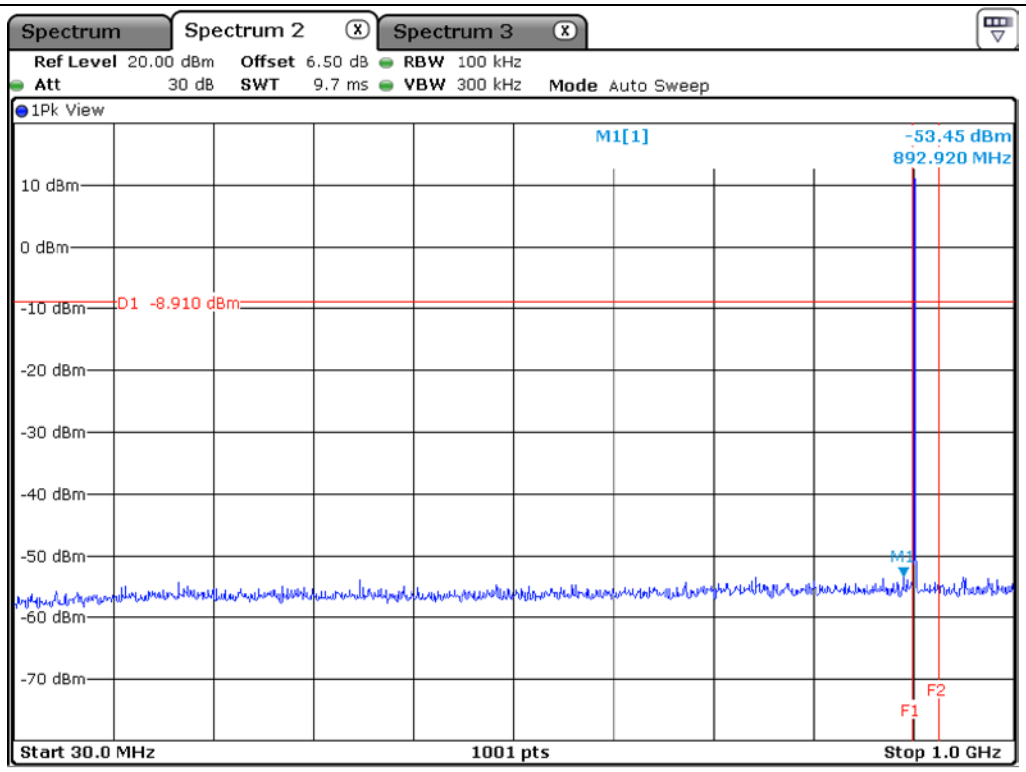


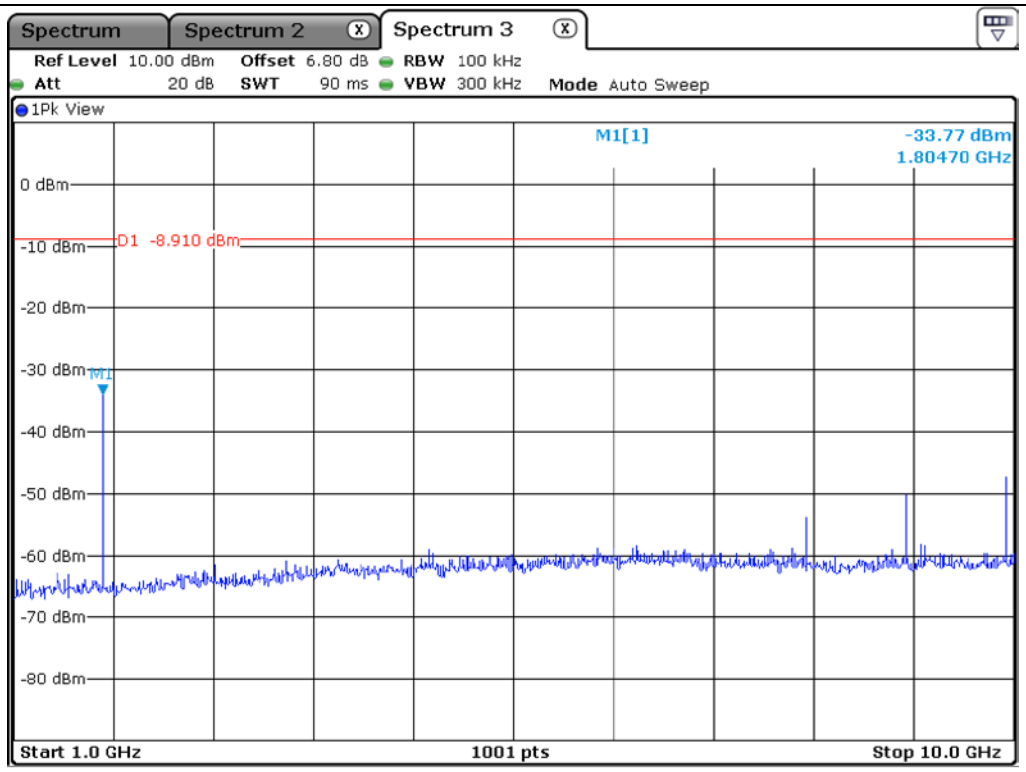
High Channel



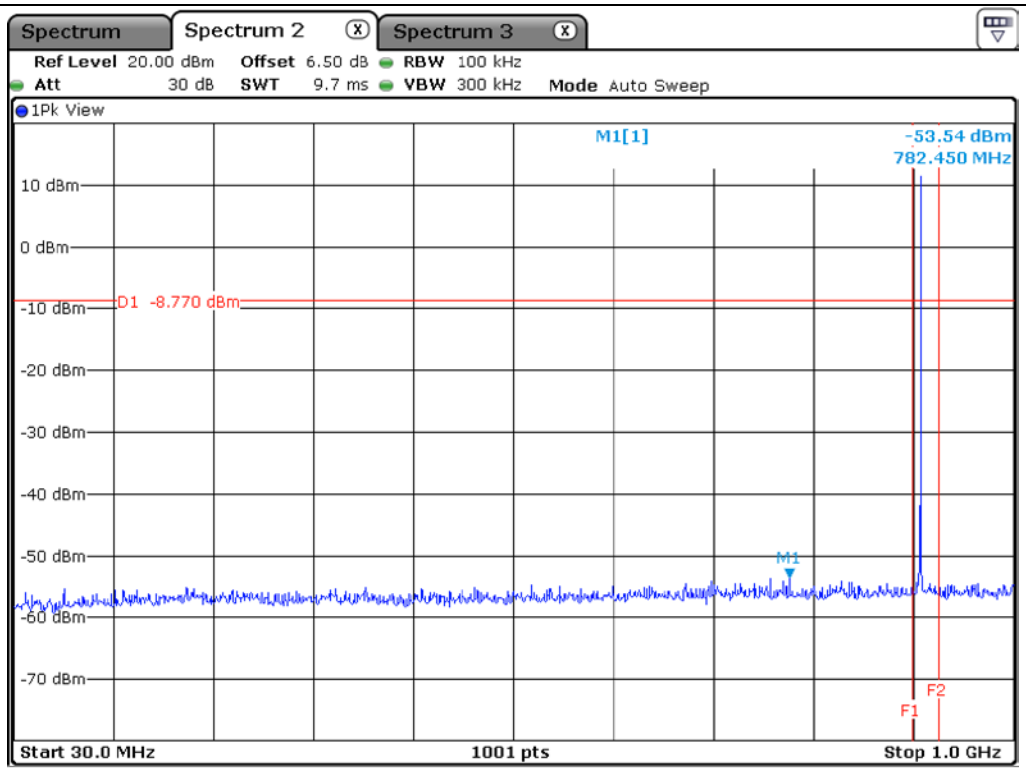
High Channel_1



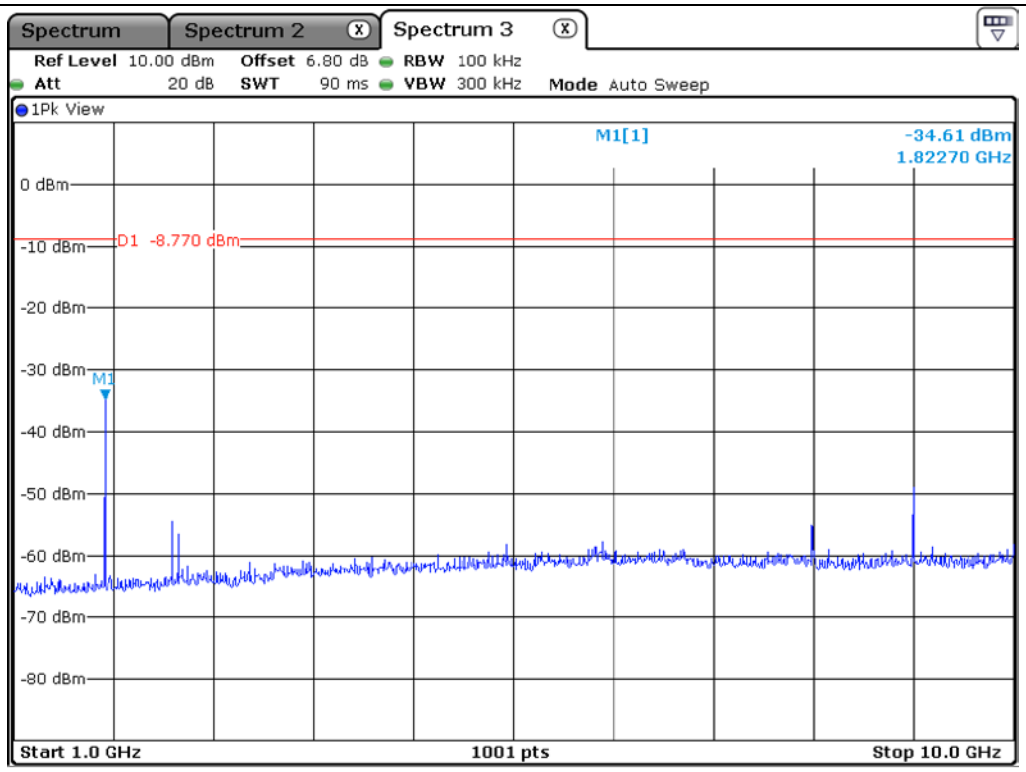
Low Channel



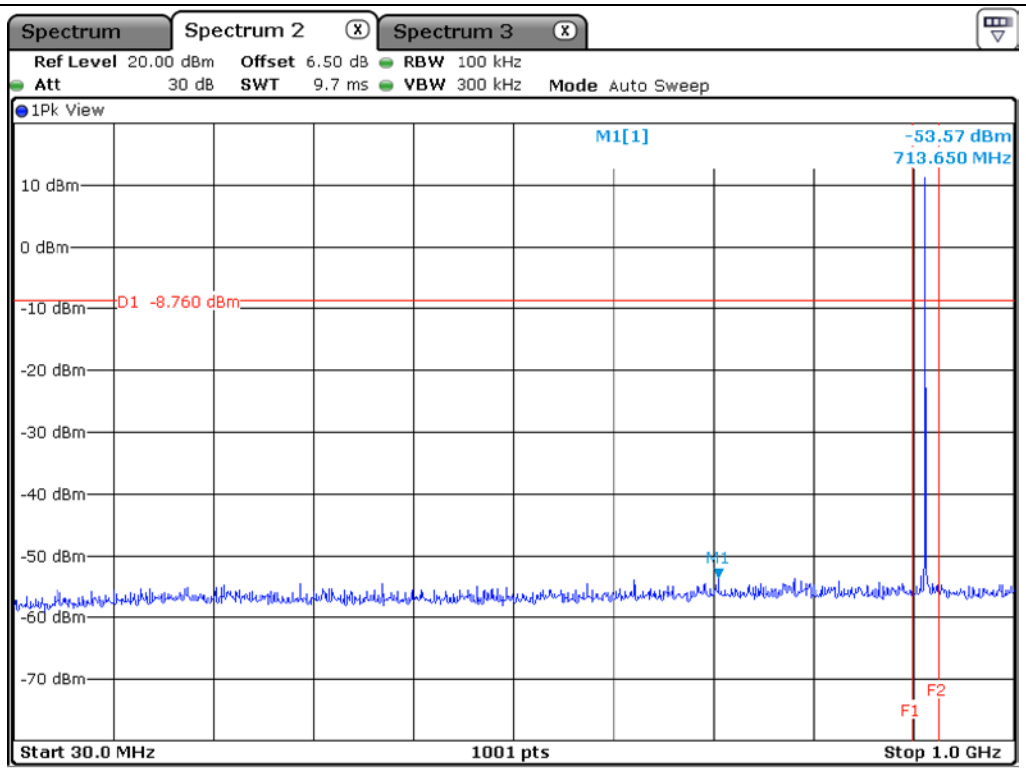
Low Channel



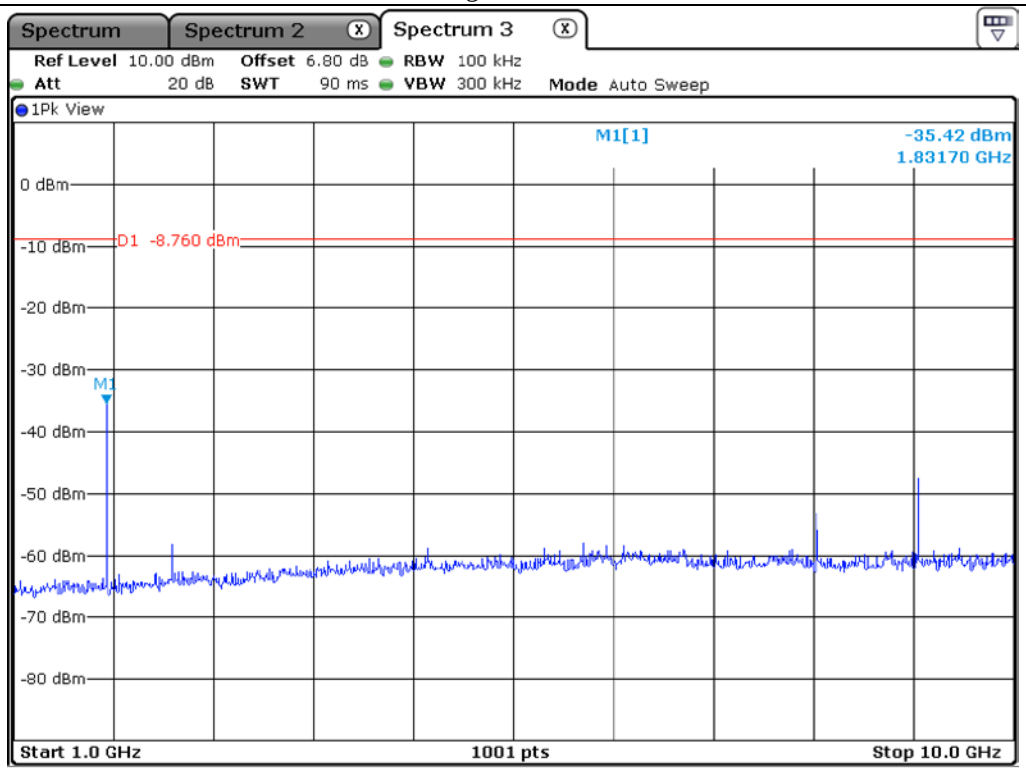
Middle Channel



Middle Channel



High Channel



High Channel

9.6 Test data for radiated emission

9.6.1 Spurious & Harmonic Radiated Emission

-. Test Date : June 17, 2020 ~ June 22, 2020

-. Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode

1 MHz and RMS Detector for Average Mode

-. Video bandwidth : 3 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 10.0 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 32.24 %

-. Result : PASSED

Channel	Frequency (MHz)	Reading (dBuV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	C.F (dB)	Total (dBμV/m)	Limits (dBuV/m)	Margin (dB)
Low	1 806.00	29.29	Peak	H	24.90	1.11	-	55.30	68.20	12.90
		22.97	Peak	V			-	48.98	68.20	19.22
	2 709.00	18.70	Peak	H	28.00	1.08	-	47.78	74.00	26.22
		6.54	Average	H			4.92	40.54	54.00	13.46
		18.14	Peak	V			-	47.22	74.00	26.78
		6.65	Average	V			4.92	40.65	54.00	13.35
Middle	1 818.80	29.24	Peak	H	24.90	1.11	-	55.25	68.20	12.95
		23.84	Peak	V			-	49.85	68.20	18.35
	2 728.20	18.81	Peak	H	28.00	1.08	-	47.89	74.00	26.11
		6.41	Average	H			4.92	40.41	54.00	13.59
		18.78	Peak	V			-	47.86	74.00	26.14
		6.60	Average	V			4.92	40.60	54.00	13.40
High	1 828.40	29.26	Peak	H	24.90	1.11	-	55.27	68.20	12.93
		23.97	Peak	V			-	49.98	68.20	18.22
	2 742.60	18.53	Peak	H	28.00	1.08	-	47.61	74.00	26.39
		6.36	Average	H			4.92	40.36	54.00	13.64
		18.84	Peak	V			-	47.92	74.00	26.08
		6.34	Average	V			4.92	40.34	54.00	13.66

Tabulated test data for Harmonic Radiated Emission

Remark: “H”: Horizontal, “V”: Vertical

Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor

Tested by: Hyung-Kwon, Oh / Assistant Manager

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10. PEAK POWER SPECTRUL DENSITY

10.1 Operating environment

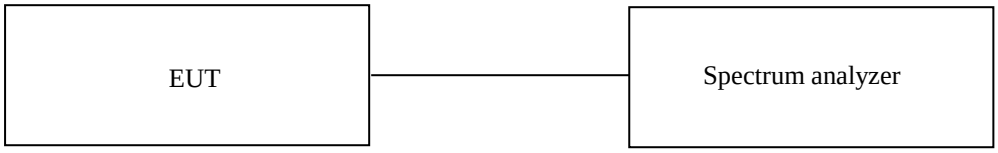
Temperature : 23 °C

Relative humidity : 45 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to 3 kHz ≤ RBW ≤100 kHz , the video bandwidth is set to 3 times the resolution bandwidth.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Feb. 21, 2020 (1Y)

All test equipment used is calibrated on a regular basis.

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10.4 Test Data

-. Test Date : June 17, 2020 ~ June 22, 2020

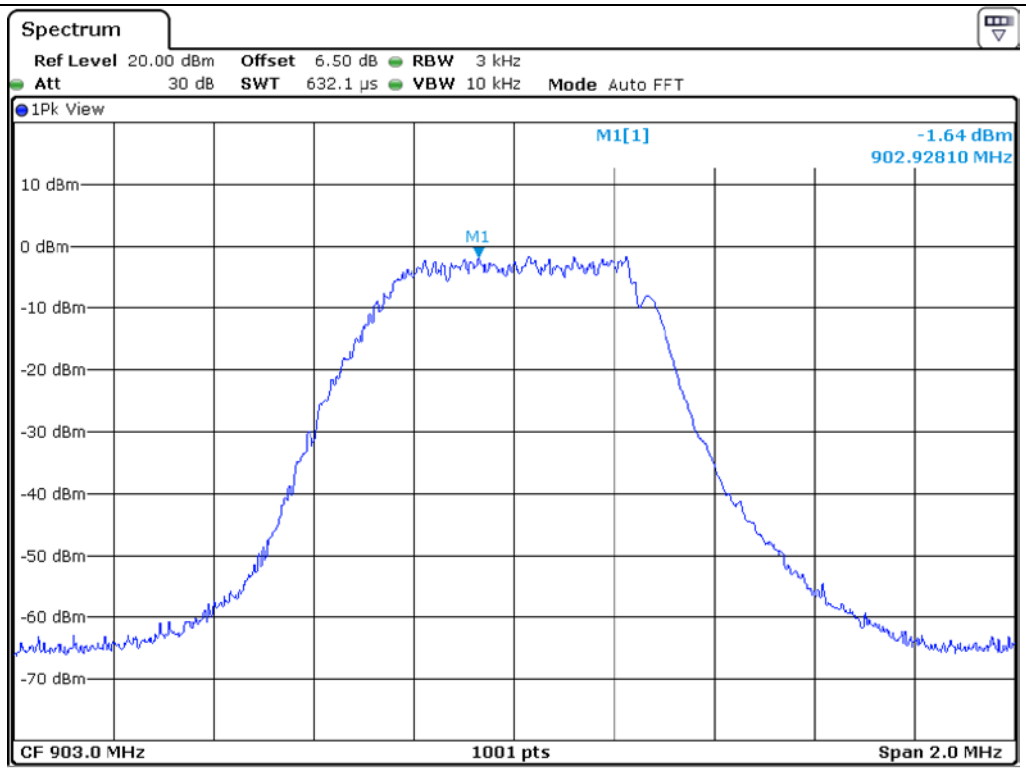
-. Test Result : Pass

-. Operating Condition : Continuous transmitting mode

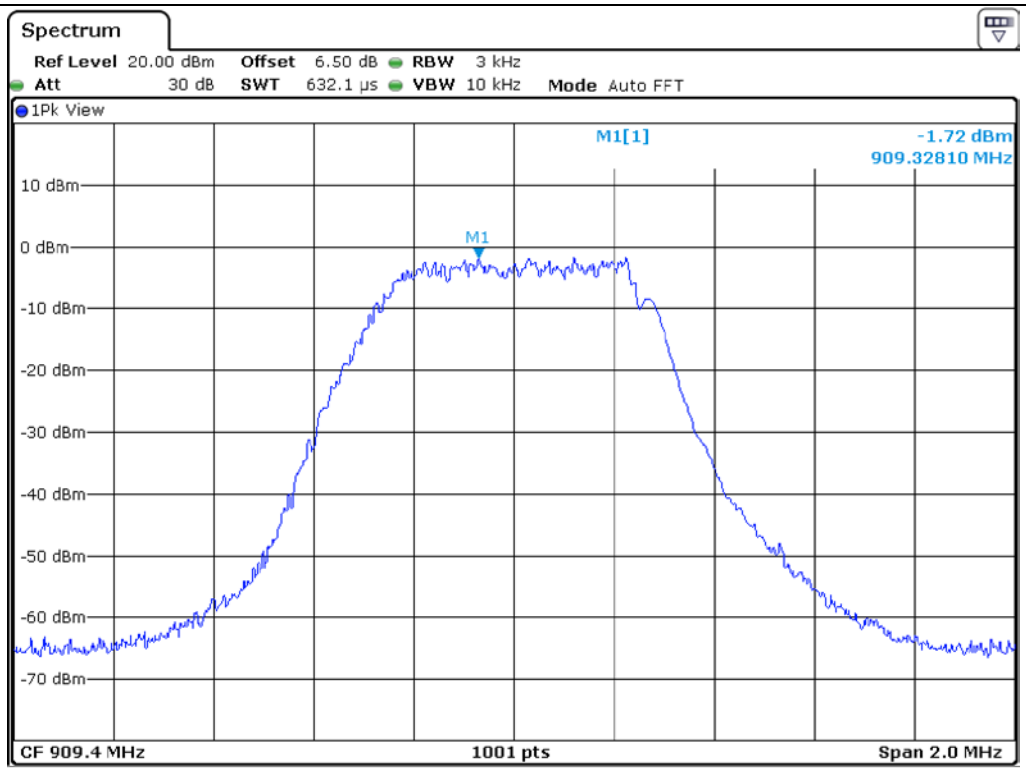
CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	903.00	-1.64	8.00	9.64
Middle	909.40	-1.72	8.00	9.72
High	914.20	-1.68	8.00	9.68

Remark. Margin = Limit – Measured value

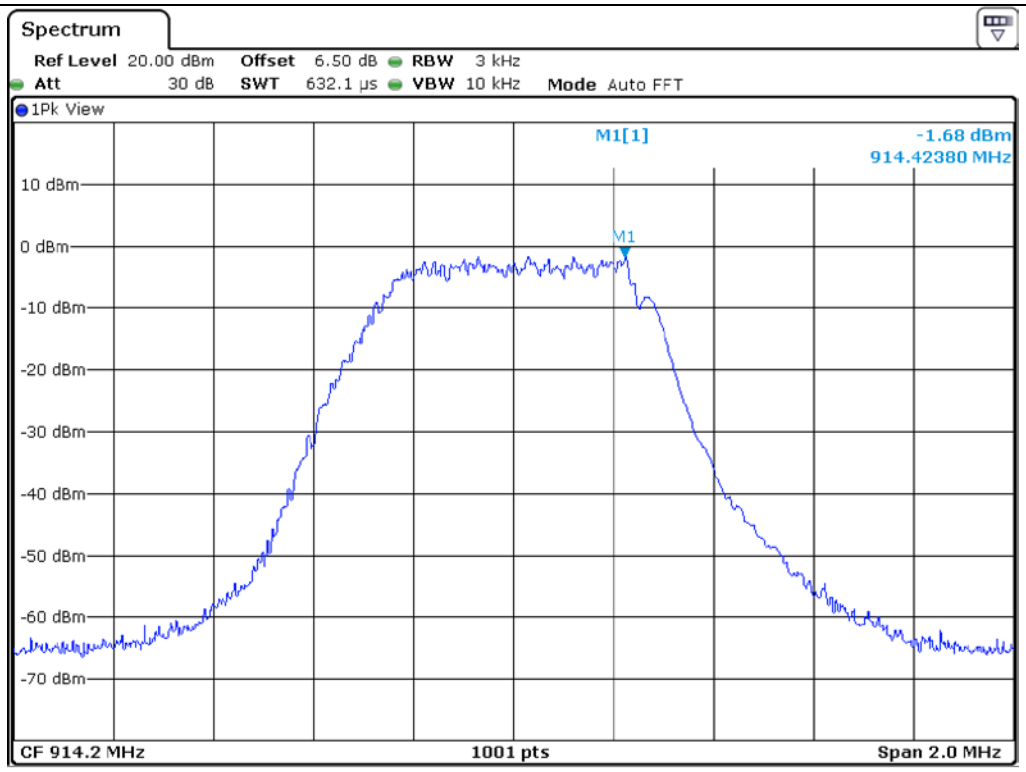
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 23 °C

Relative humidity : 45 % R.H.

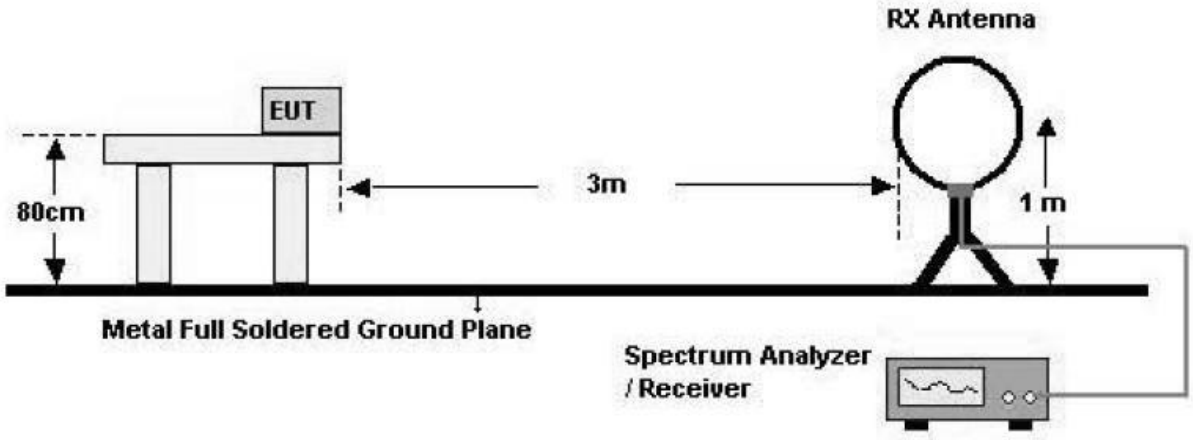
11.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

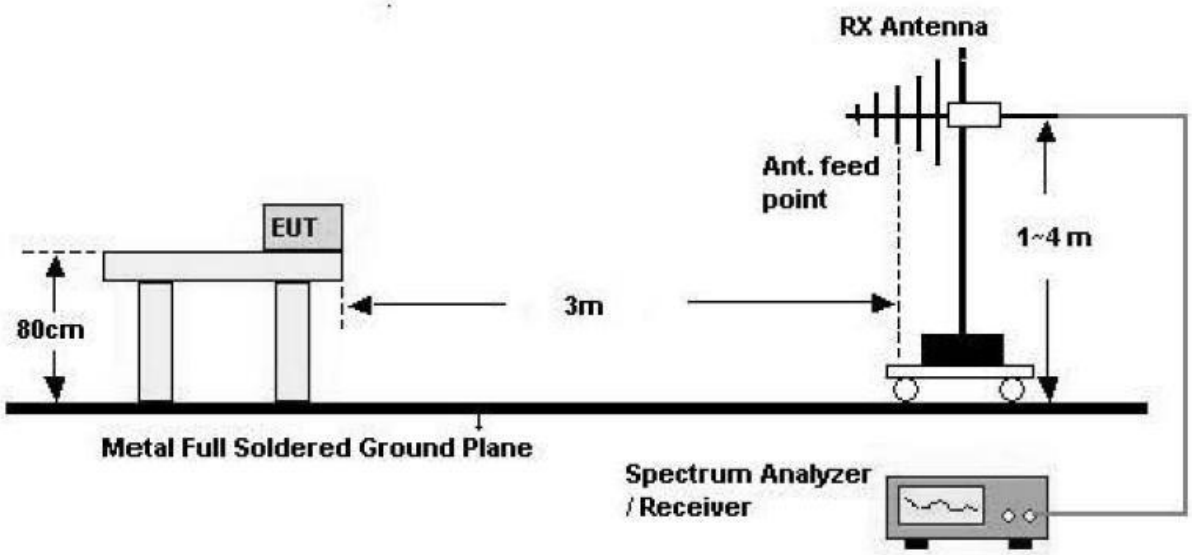
The frequency spectrum from 30 MHz to 10 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

- Test Configuration

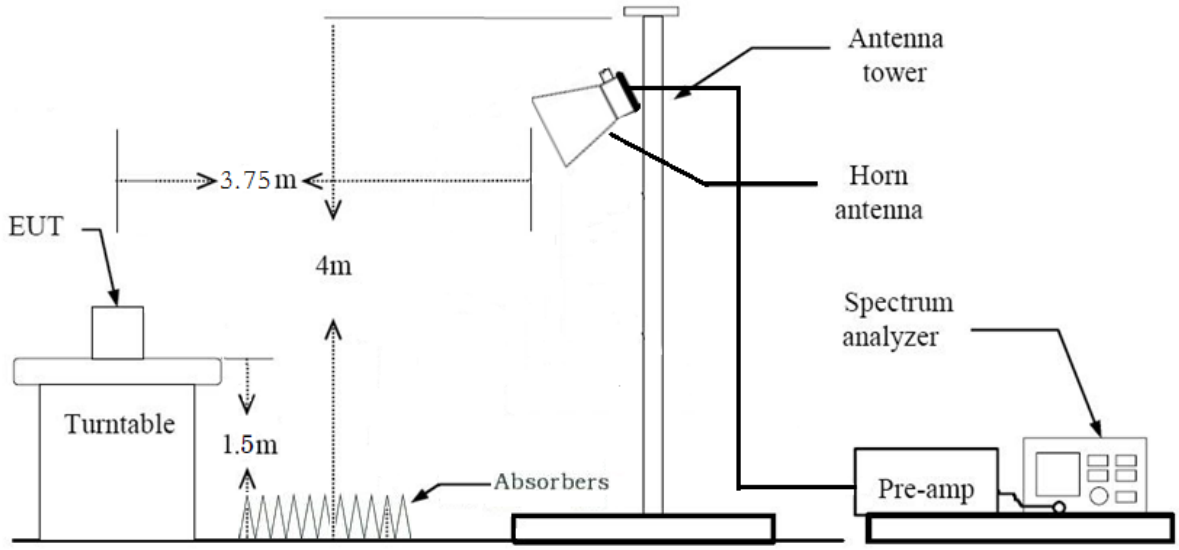
1. Below 30 MHz



2. 30 MHz - 1 GHz



3. Above 1 GHz



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Feb. 21, 2020 (1Y)
■ -	ESW	Rohde & Schwarz	EMI Test Receiver	101851	Aug. 07, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 16, 2020 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Broadband Preamplifier	00009	Mar. 16, 2020 (1Y)
■ -	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Feb. 20, 2020 (1Y)
■ -	SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jul. 24, 2019(1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 08, 2020 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jul. 16, 2019 (1Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2020(1Y)

All test equipment used is calibrated on a regular basis.

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11.4 Test Data for LoRa

11.4.1 Test data for 30 MHz ~ 1 GHz

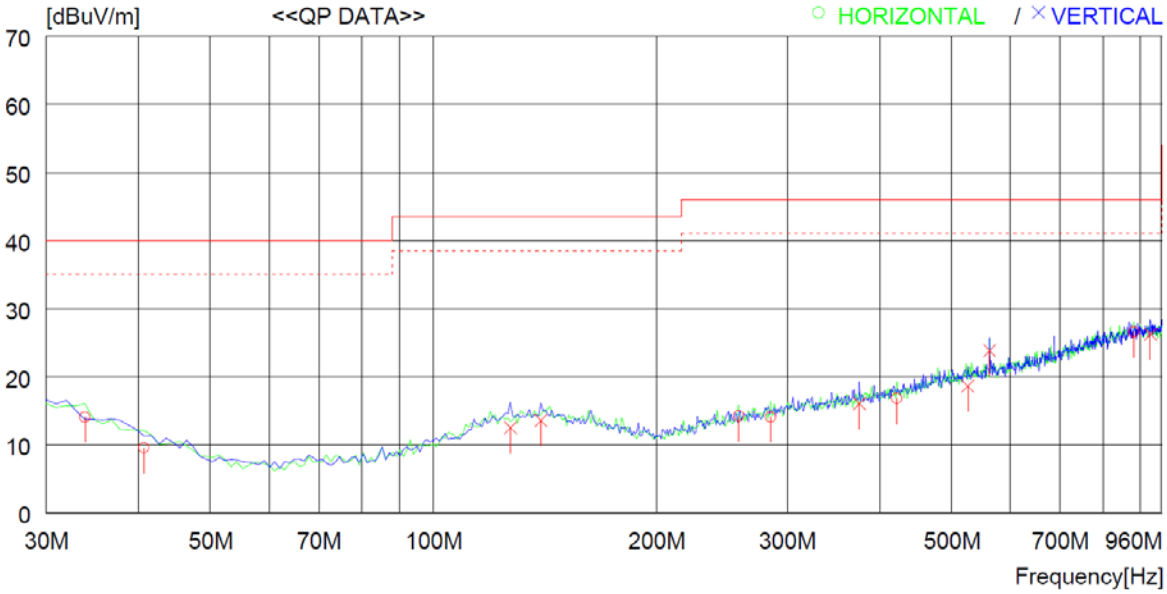
Humidity Level : 45 % R.H. Temperature: 23 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : GPS Tracker & Messenger Date: June 17, 2020 ~ June 22, 2020

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	33.880	35.2	11.0	0.5	32.6	14.1	40.0	25.9	200	359
2	40.670	31.1	10.6	0.5	32.7	9.5	40.0	30.5	100	90
3	257.950	34.8	10.6	1.5	32.7	14.2	46.0	31.8	200	119
4	285.110	32.7	12.5	1.6	32.7	14.1	46.0	31.9	200	289
5	421.881	30.8	16.7	2.0	32.7	16.8	46.0	29.2	100	0
6	880.679	32.9	23.0	2.7	32.1	26.5	46.0	19.5	100	274
----- Vertical ------										
7	127.000	33.3	10.8	1.1	32.7	12.5	43.5	31.0	200	359
8	139.610	34.4	10.8	1.1	32.7	13.6	43.5	29.9	100	359
9	375.320	31.1	15.7	1.9	32.7	16.0	46.0	30.0	200	243
10	525.670	31.0	18.3	2.2	32.9	18.6	46.0	27.4	100	359
11	562.529	35.4	19.1	2.3	33.0	23.8	46.0	22.2	200	0
12	927.238	31.8	23.4	2.9	31.9	26.2	46.0	19.8	100	346

Tested by: Hyung-Kwon, Oh / Assistant Manager

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11.4.2 Test Data for Below 30 MHz

-. Test Date : June 17, 2020 ~ June 22, 2020

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

11.4.3 Test Data for above 1 GHz

-. Test Date : June 17, 2020 ~ June 22, 2020

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 10.0 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

Tested by: Hyung-Kwon, Oh / Assistant Manager

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11.5 Test data for Intermodulation Mode(Bluetooth LE + LoRa)

11.5.1 Test data for 30 MHz ~ 1 GHz

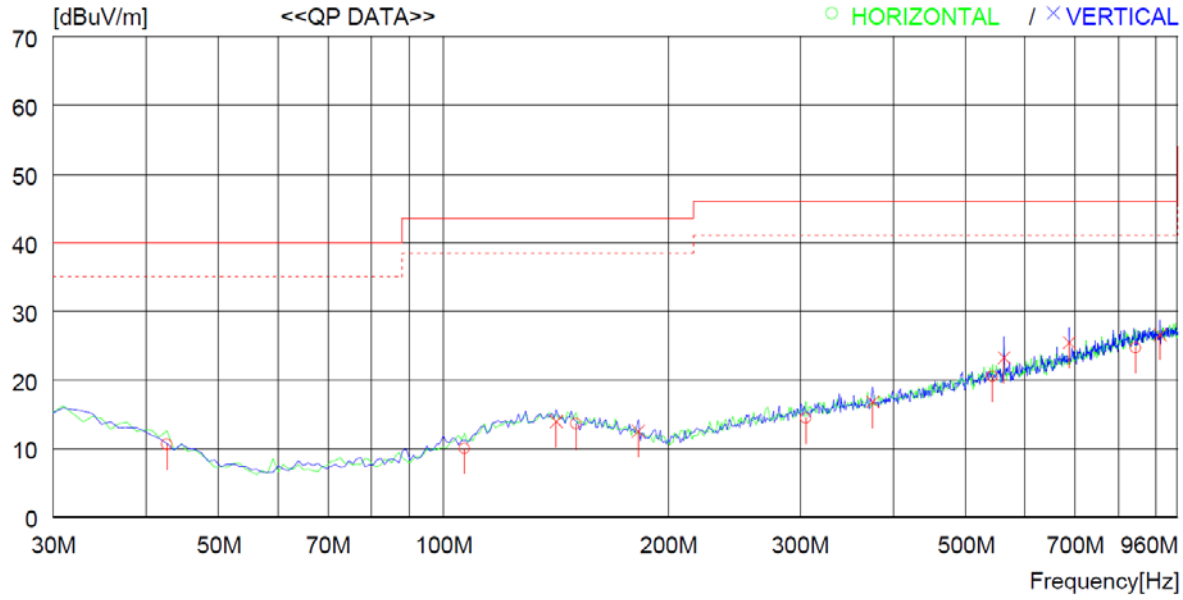
Humidity Level : 43 % R.H. Temperature: 24 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : GPS Tracker & Messenger Date: June 17, 2020 ~ June 22, 2020

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	42.610	32.1	10.6	0.6	32.7	10.6	40.0	29.4	200	349
2	106.630	31.8	9.9	1.0	32.7	10.0	43.5	33.5	200	2
3	150.280	33.3	11.7	1.2	32.6	13.6	43.5	29.9	200	359
4	305.480	31.7	13.7	1.7	32.7	14.4	46.0	31.6	200	305
5	543.130	32.4	18.7	2.3	32.9	20.5	46.0	25.5	100	0
6	843.821	32.1	22.5	2.4	32.3	24.7	46.0	21.3	200	264
----- Vertical ------										
7	141.550	34.6	10.9	1.1	32.7	13.9	43.5	29.6	200	0
8	182.290	30.8	13.0	1.3	32.6	12.5	43.5	31.0	100	2
9	375.320	31.9	15.7	1.9	32.7	16.8	46.0	29.2	200	0
10	562.529	34.8	19.1	2.3	33.0	23.2	46.0	22.8	200	199
11	687.655	35.0	20.8	2.5	32.9	25.4	46.0	20.6	200	156
12	909.779	32.4	23.3	2.9	32.0	26.6	46.0	19.4	200	34

Tested by: Hyung-Kwon, Oh / Assistant Manager

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11.5.2 Test data for Below 30 MHz

-. Test Date : June 17, 2020 ~ June 22, 2020

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

11.5.3 Test data for above 1 GHz

-. Test Date : June 17, 2020 ~ June 22, 2020

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
Emission from the EUT more than 20 dB below the limit in each frequency range.									

Tested by: Hyung-Kwon, Oh / Assistant Manager

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