

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

Test Report No. : OT-194-RWD-018
AGR No. : A192A-095R
Applicant : BLUECOM Co., Ltd.
Address : 116, Venture-ro, Yeonsu-gu, Incheon, 22013, South Korea
Manufacturer : BLUECOM Co., Ltd.
Address : 116, Venture-ro, Yeonsu-gu, Incheon, 22013, South Korea
Type of Equipment : Bluetooth Earbud
FCC ID. : U3WBCST90
Model Name : BCS-T90
Serial number : N/A
Total page of Report : 35 pages (including this page)
Date of Incoming : March 18, 2019
Date of issue : April 03, 2019


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: 
 Ki-Hong, Nam / Chief Engineer
 ONETECH Corp.

Approved by: 
 Keun-Young, Choi / Vice President
 ONETECH Corp.

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Revision History

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-194-RWD-018	April 03, 2019	Initial Release	All

1. VERIFICATION OF COMPLIANCE

Applicant : BLUECOM Co., Ltd.
Address : 116, Venture-ro, Yeonsu-gu, Incheon, 22013, South Korea
Contact Person : Ki-eok, Park / Principal Engineer
Telephone No. : +82-32-8100-582
FCC ID : U3WBCST90
Model Name : BCS-T90
Brand Name : -
Serial Number : N/A
Date : April 03, 2019

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Bluetooth Earbud
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
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.

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-1842

IC (Industry Canada) – Registration No. Site# 3736A-3

-. Site Accreditation:

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The BLUECOM Co., Ltd., Model BCS-T90 (referred to as the EUT in this report) is a Bluetooth Earbud. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Bluetooth Earbud		
Temperature Range	-10 °C ~ 50 °C		
OPERATING FREQUENCY	Bluetooth LE	2 402 MHz ~ 2 480 MHz	
	Bluetooth	2 402 MHz ~ 2 480 MHz	
MODULATION TYPE	Bluetooth LE	GFSK	
	Bluetooth	GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8-DPSK for 3Mbps	
RF OUTPUT POWER'	Bluetooth LE	9.80 dBm	
	Bluetooth	1 Mbps	9.36 dBm
		2 Mbps	9.20 dBm
		3 Mbps	9.55 dBm
ANTENNA TYPE	FPCB Antenna		
ANTENNA GAIN	3.00 dBi		
List of each Osc. or crystal Freq.(Freq. \geq 1 MHz)	32 MHz		
RATED SUPPLY VOLTAGE	DC 3.6 V		

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

-. None

4. EUT MODIFICATIONS

-. None

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	BLUECOM Co., Ltd.	BCS-T90G	N/A
Power Board	BLUECOM Co., Ltd.	N/A	N/A
Touch Board	BLUECOM Co., Ltd.	Stone_FPCB_Touch	N/A
Antenna Board	BLUECOM Co., Ltd.	BCS-T90 FPCB_ANT	N/A
Battery	N/A	GP1458-08N+PCM	N/A

5.2 Peripheral equipment

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

-. Charging mode

Model	Manufacturer	Description	Connected to
BCS-T90	BLUECOM Co., Ltd.	Bluetooth Earbud (EUT)	Cradle
BCS-T90C	BLUECOM Co., Ltd.	Cradle	EUT
SU10334-15004	LG Electronics	Adaptor	-

-. Transmitting Mode

Model	Manufacturer	Description	Connected to
BCS-T90	BLUECOM Co., Ltd.	Bluetooth Earbud (EUT)	Notebook PC
Pavilion	HP	Notebook PC	EUT

5.3 Mode of operation during the test

-. For Bluetooth function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel (2 402 MHz), Middle Channel (2 441 MHz), and High Channel (2 480 MHz) with each data transfer rate, 1 Mbps, 2 Mbps and 3 Mbps. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis, but the worst data was recorded in this test report.

-. EUT is PCB with the same structure by the left and right. So, We tested for Right Earset

5.4 Configuration of Test System

Line Conducted Test: The EUT was tested in a Charging mode. The EUT was connected to USB and the power of USB was connected to Adaptor. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

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 a 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)
Charging mode	X

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	X

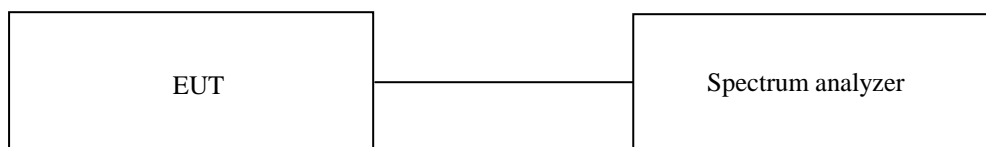
7. MINIMUM 6 dB BANDWIDTH

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	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data

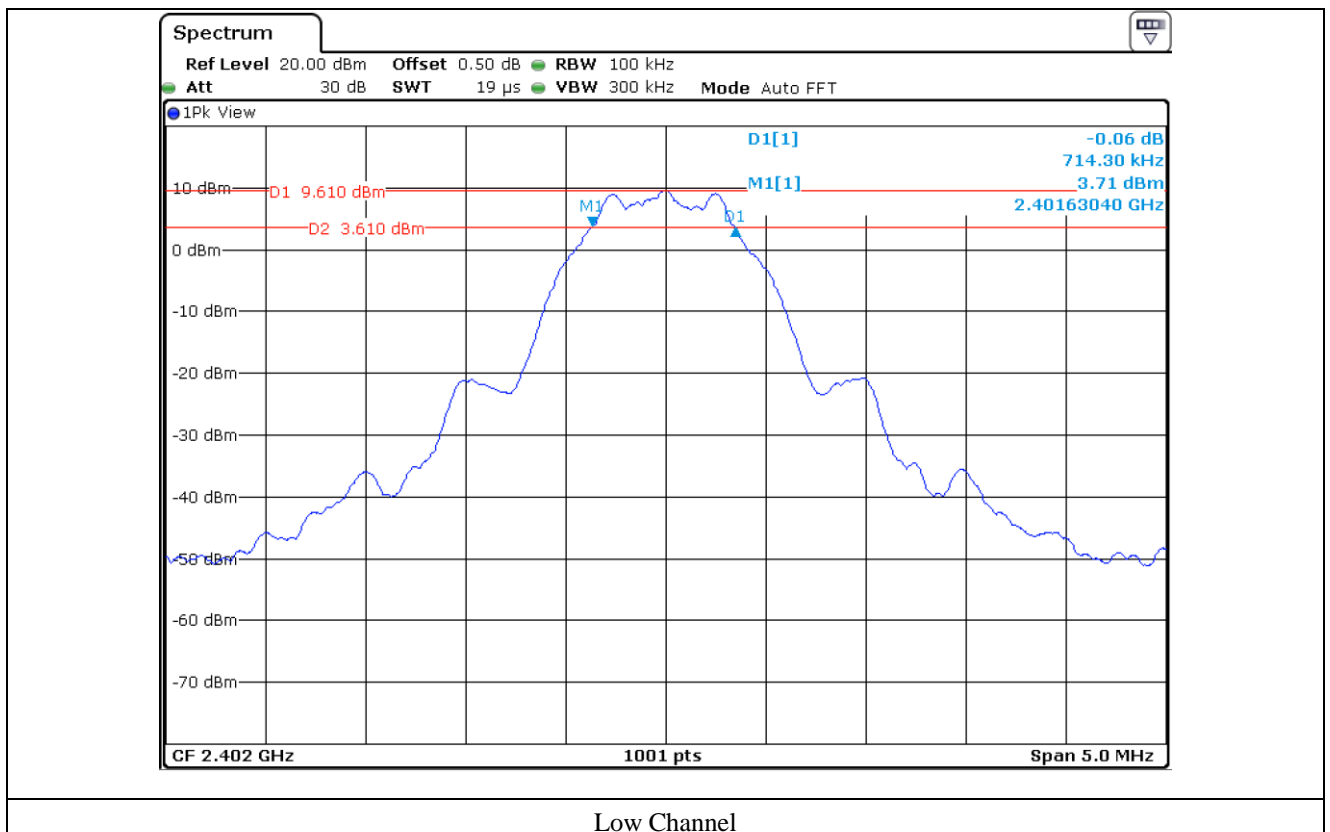
-. Test Date : March 18, 2019

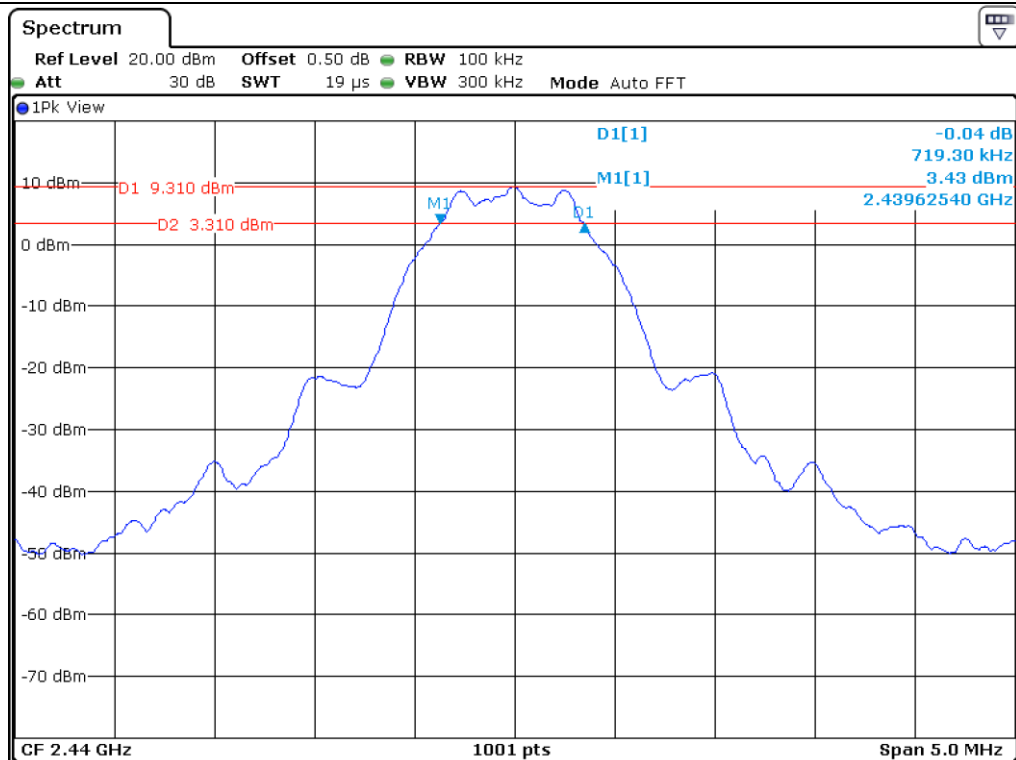
-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	714.30	500.00	214.30
Middle	2 440.00	719.30	500.00	219.30
High	2 480.00	719.30	500.00	219.30

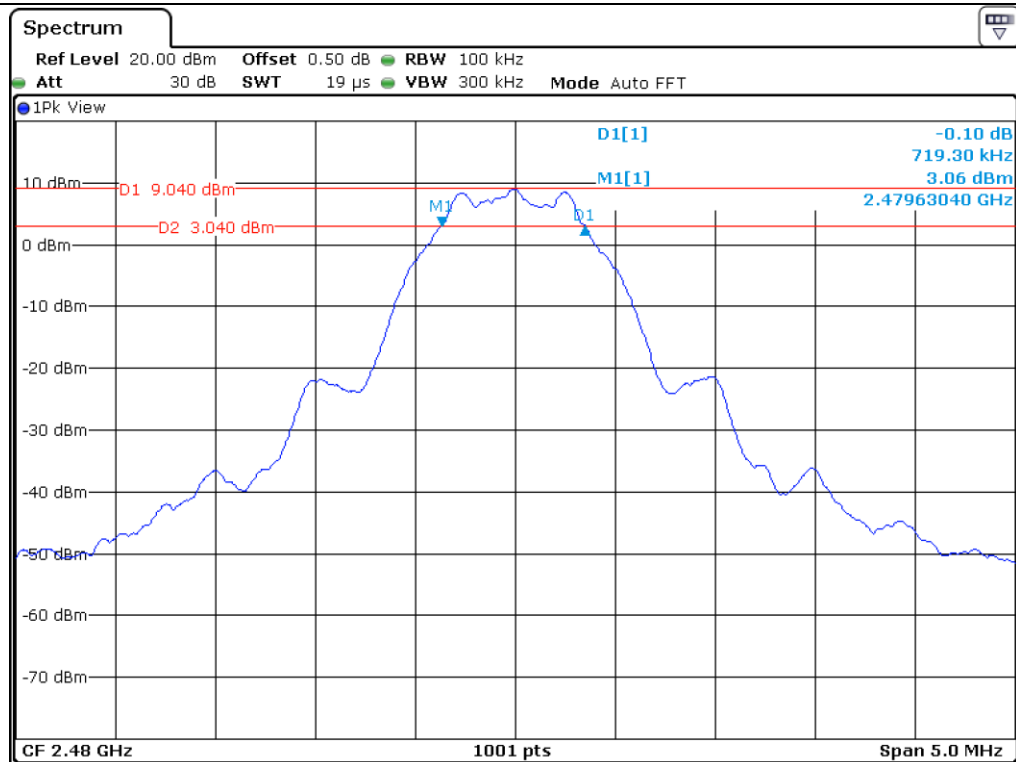
Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

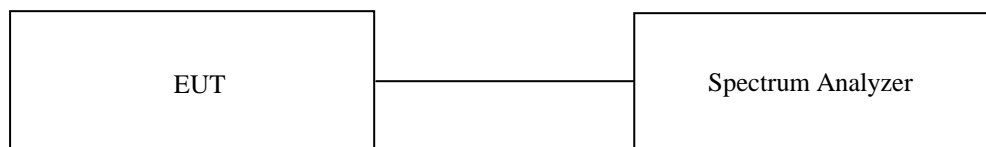
8.1 Operating environment

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 \geq 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	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data

-. Test Date : March 18, 2019

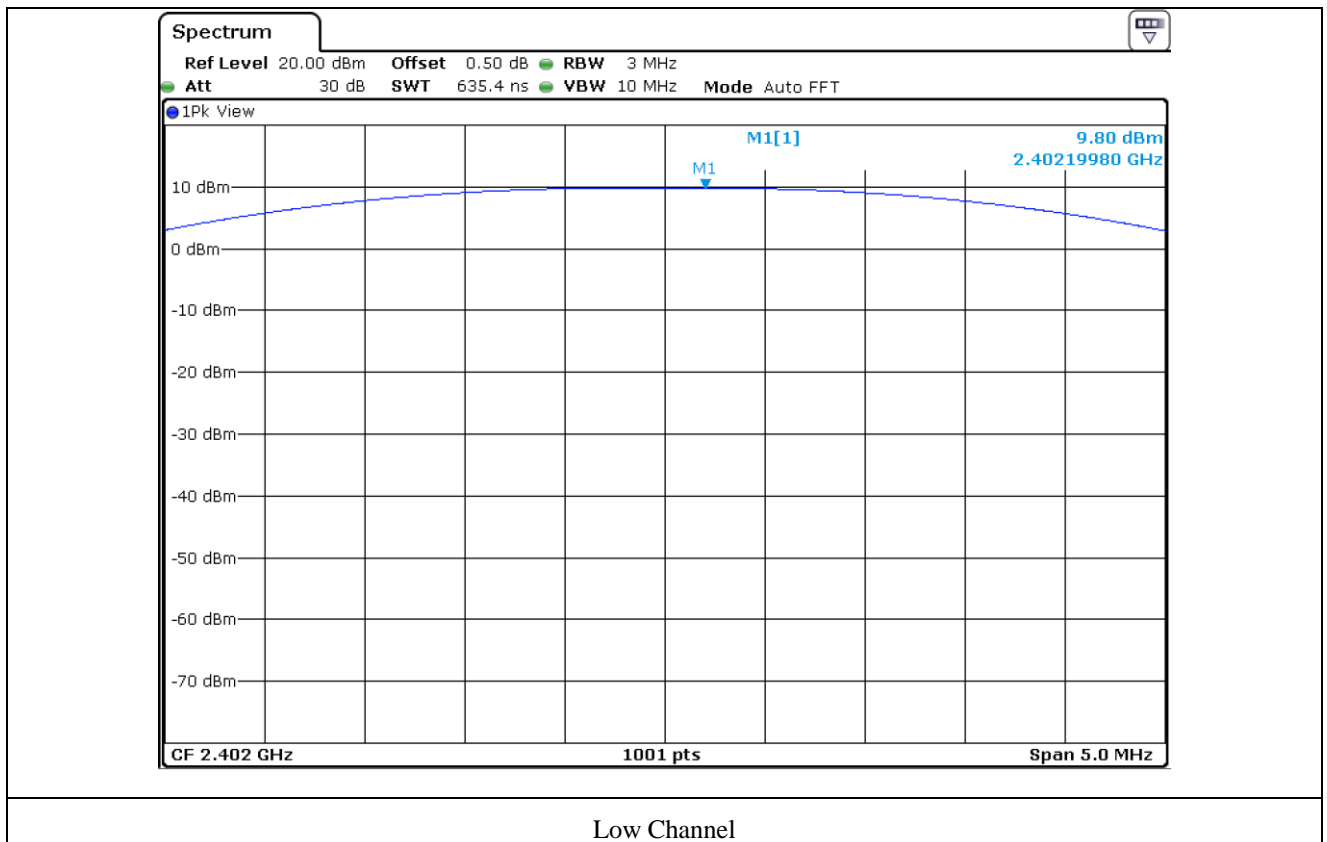
-. Test Result : Pass

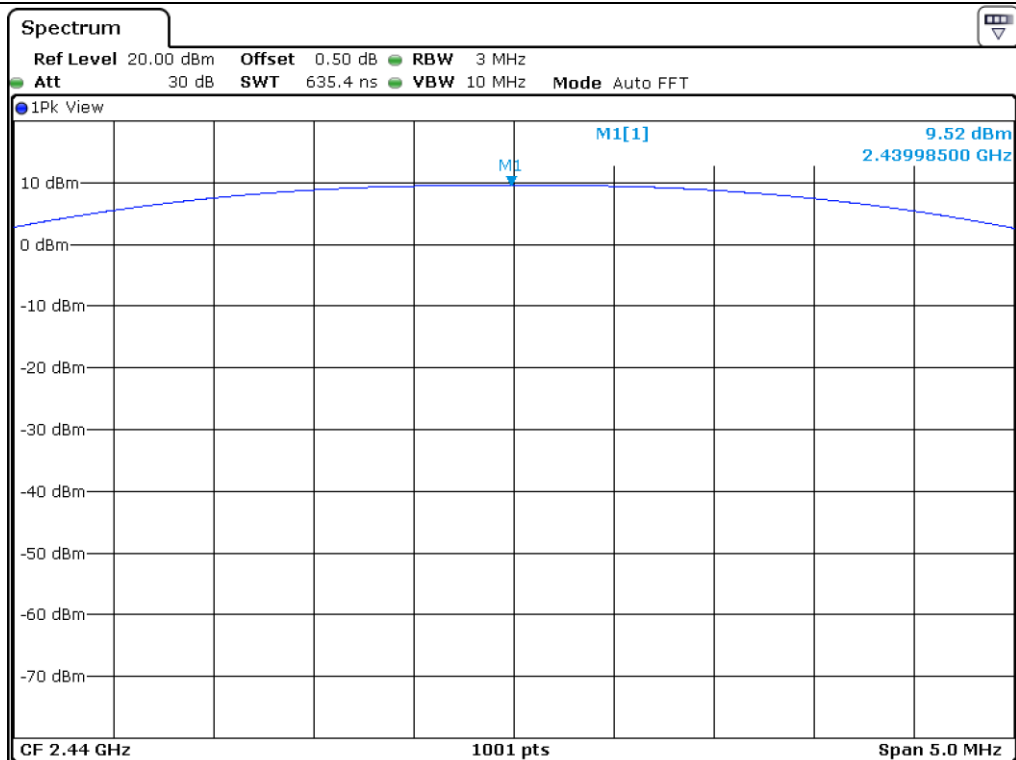
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	9.80	30.00	20.20
MIDDLE	2 440.00	9.52	30.00	20.48
HIGH	2 480.00	9.23	30.00	20.77

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

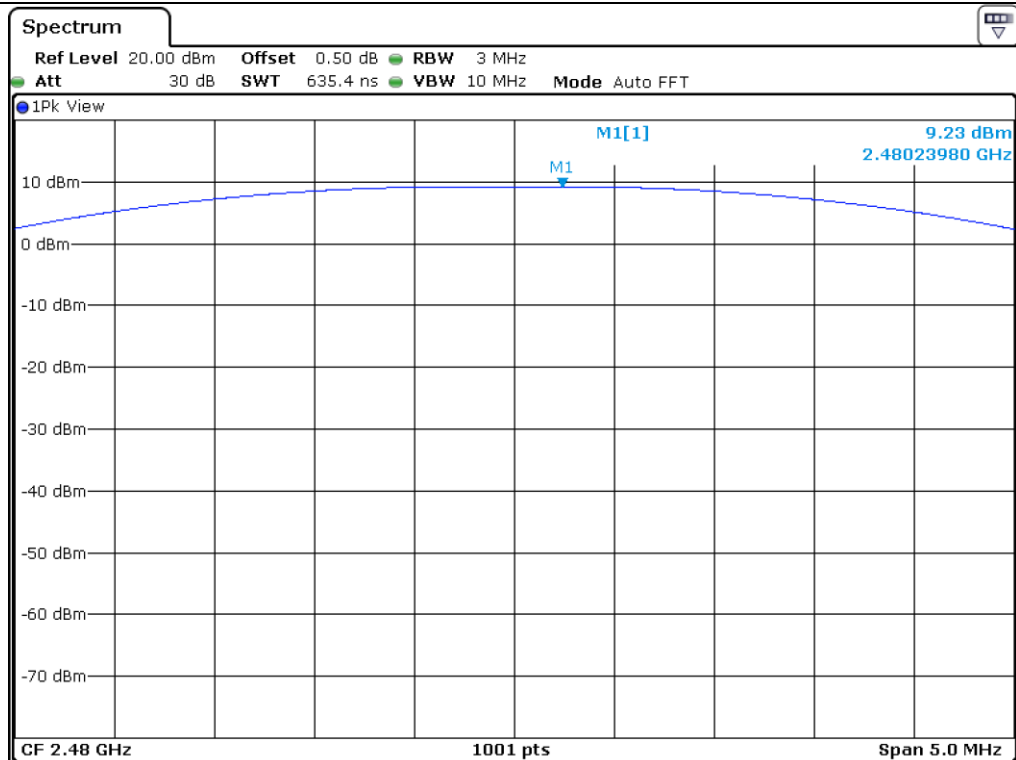


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

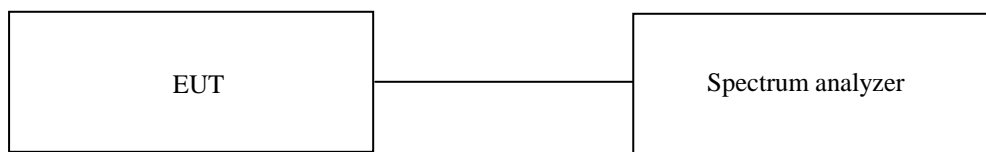
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

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

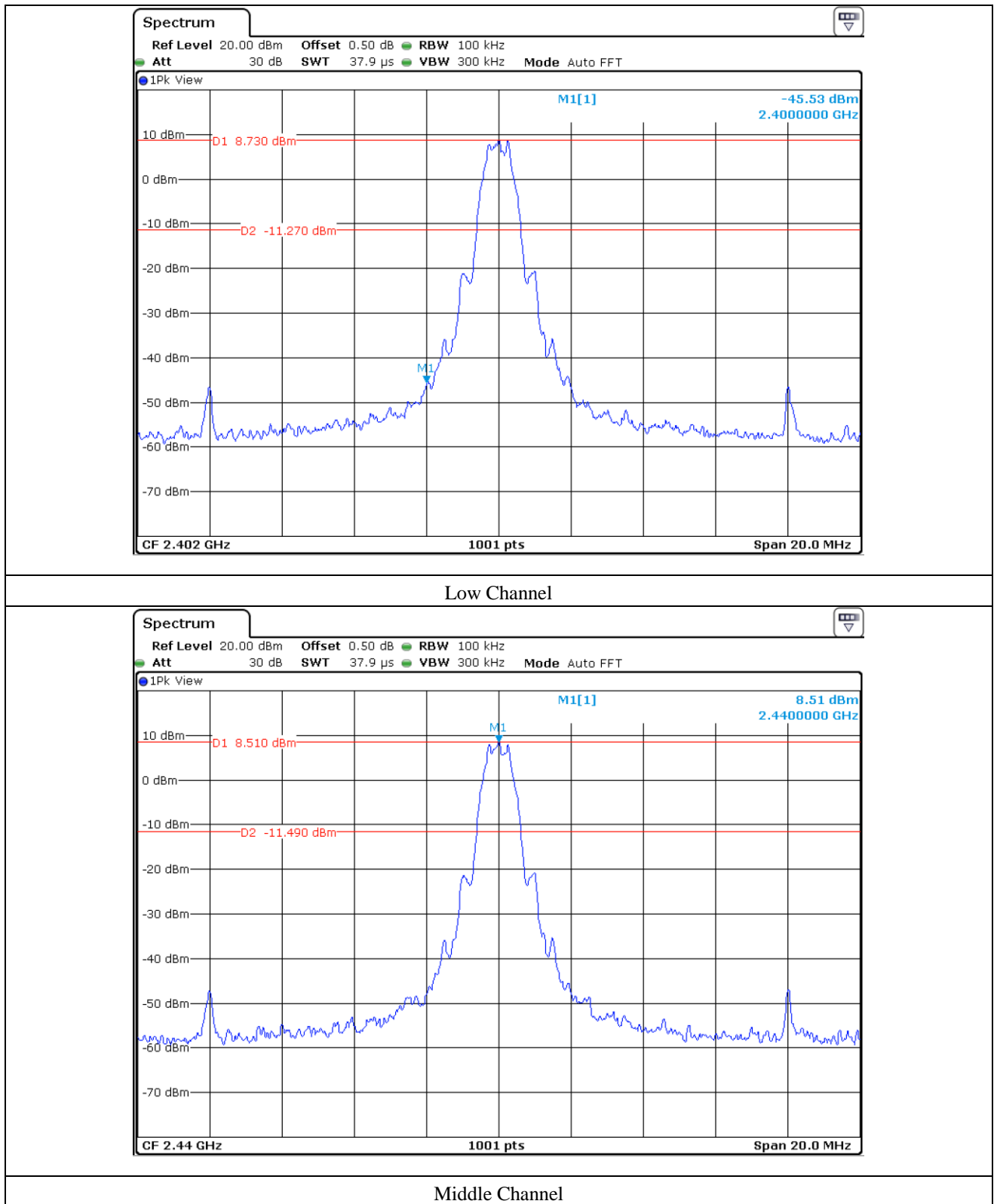
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

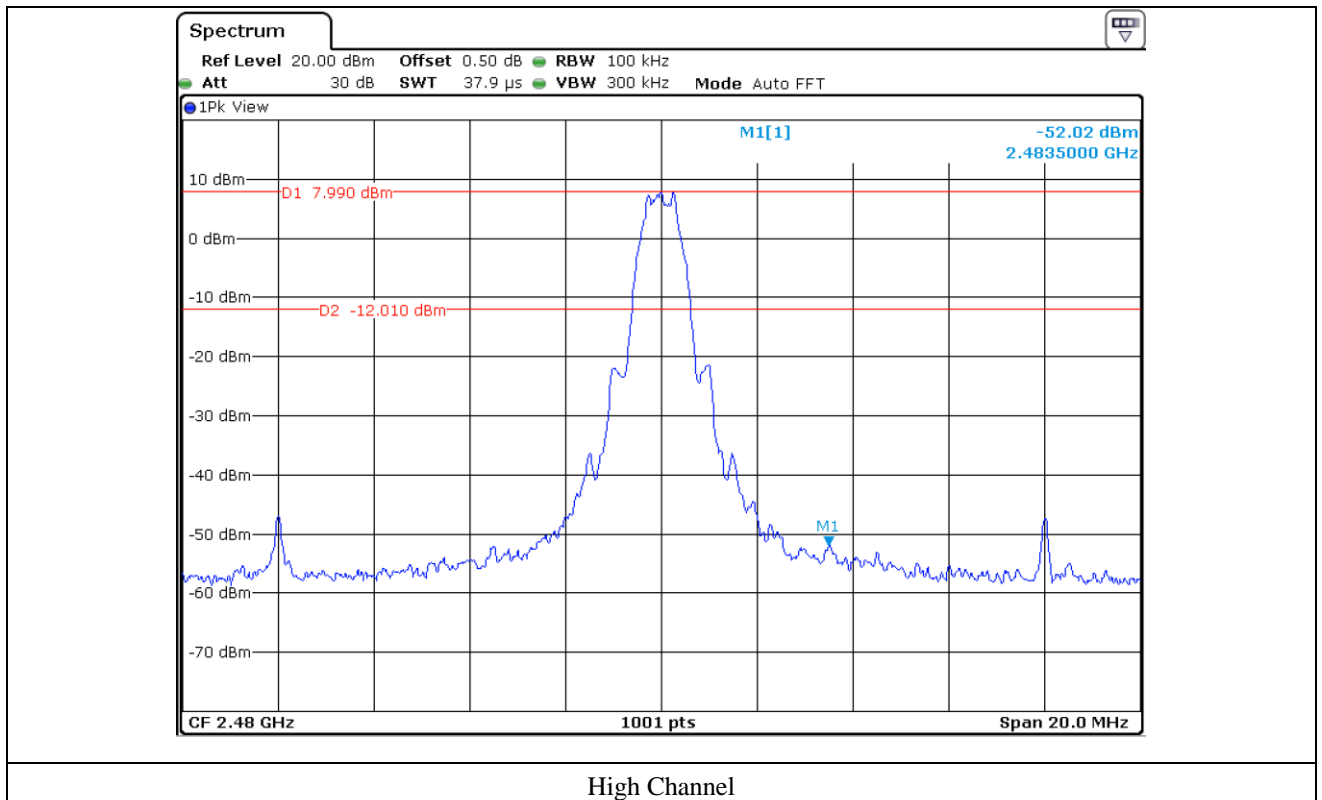
9.4 Test equipment used

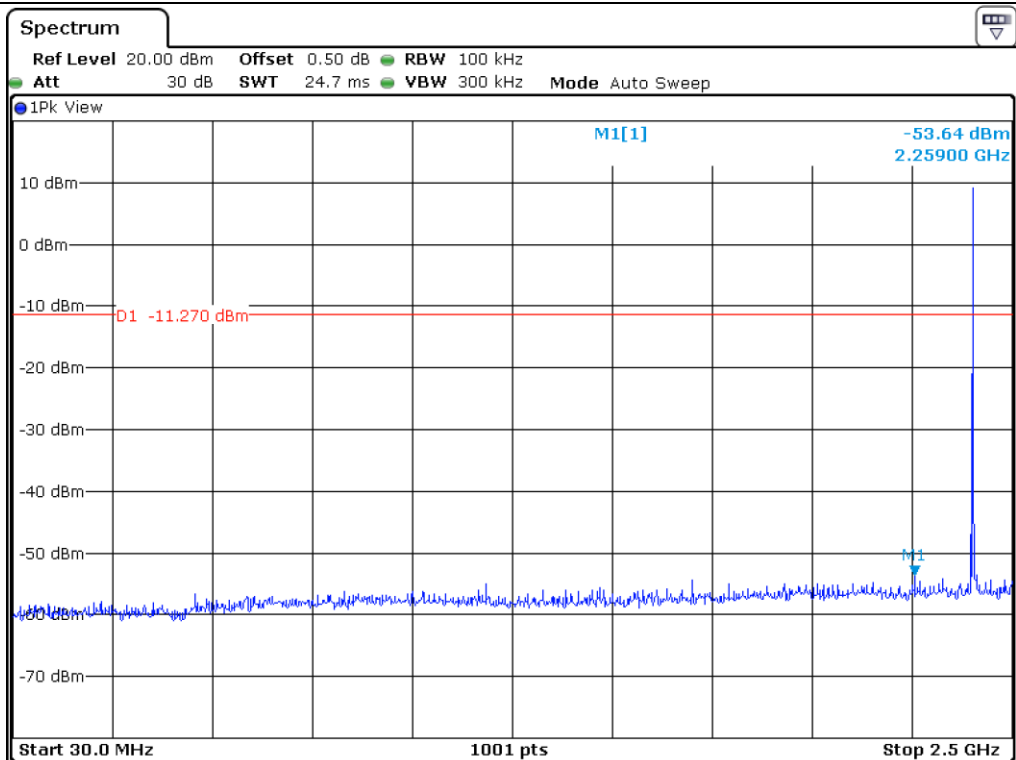
	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 05, 2018 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2018 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Amplifier	009	Mar. 20, 2018 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 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. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

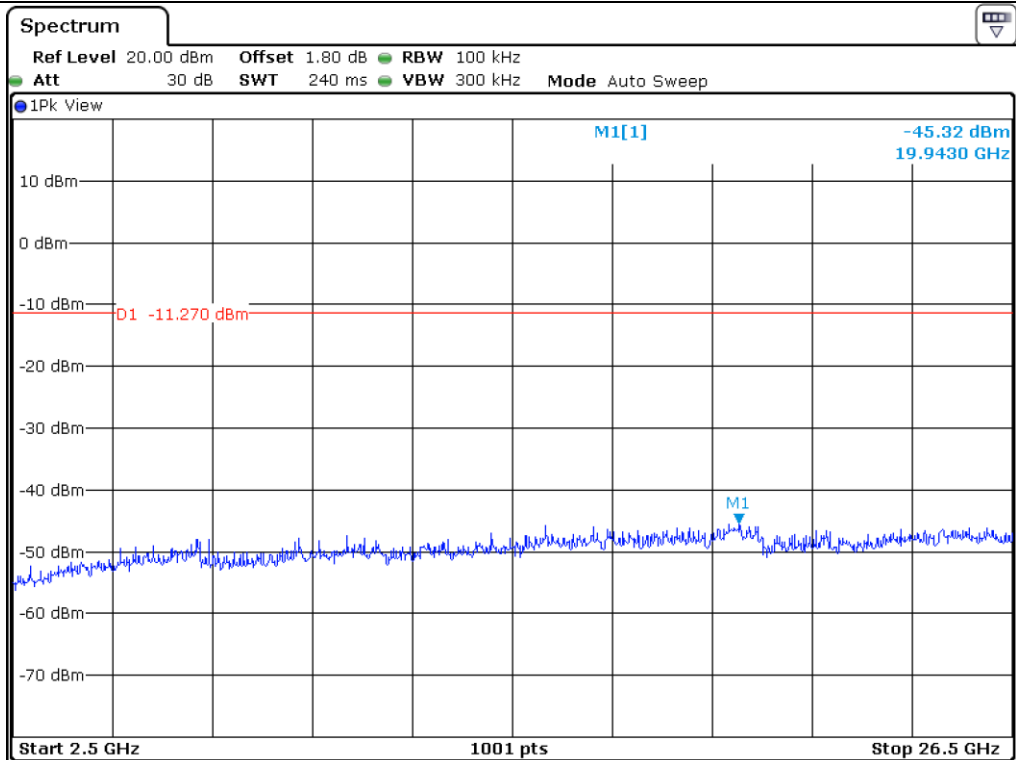
9.5 Test data for conducted emission



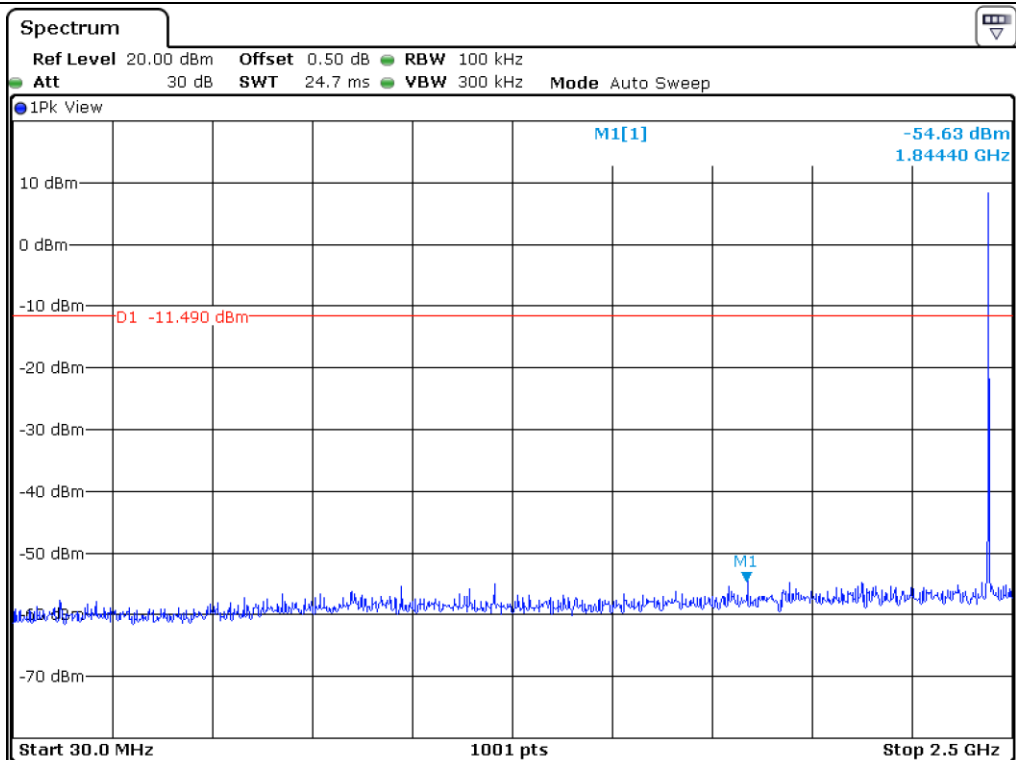




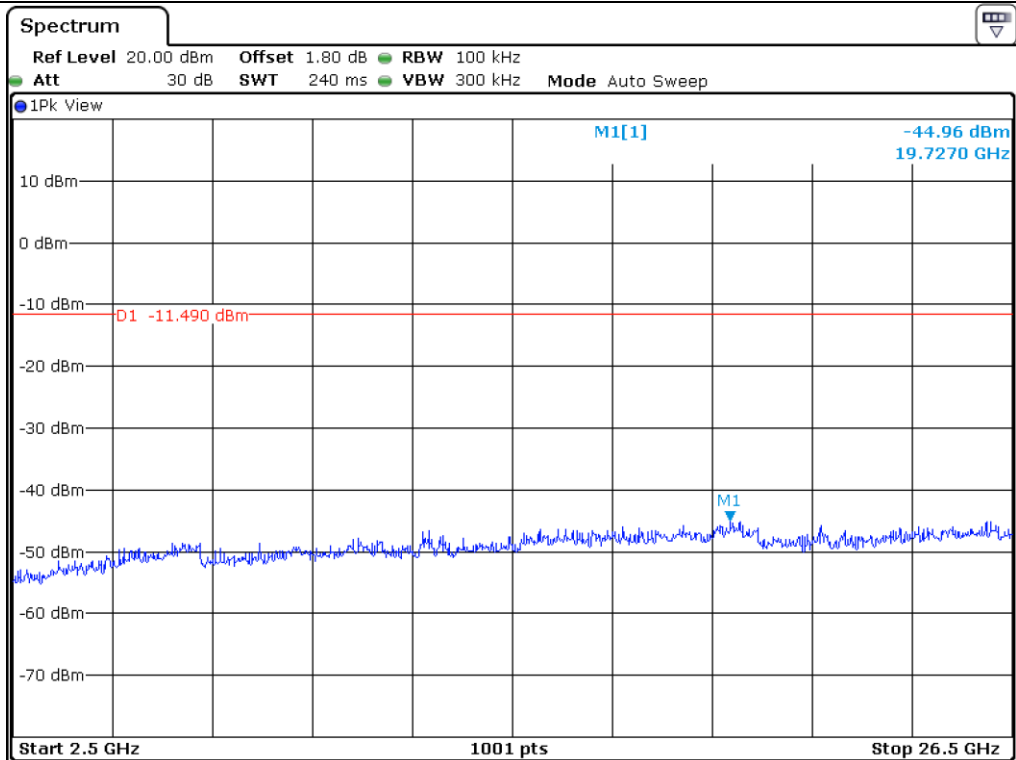
Low Channel



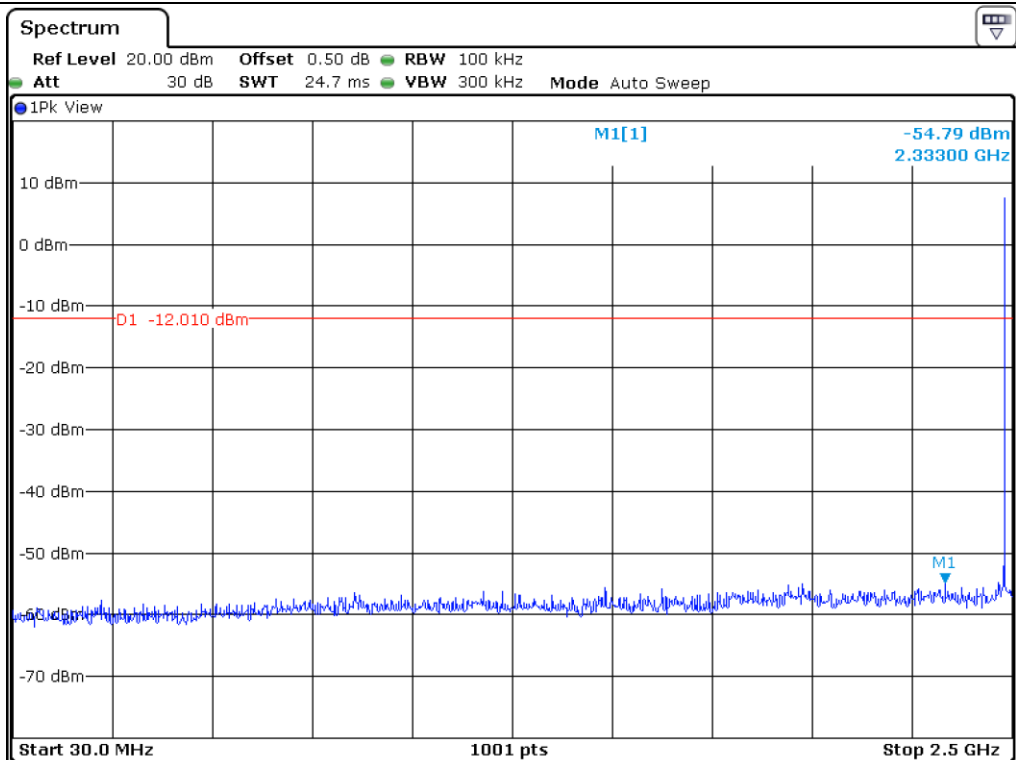
Low Channel



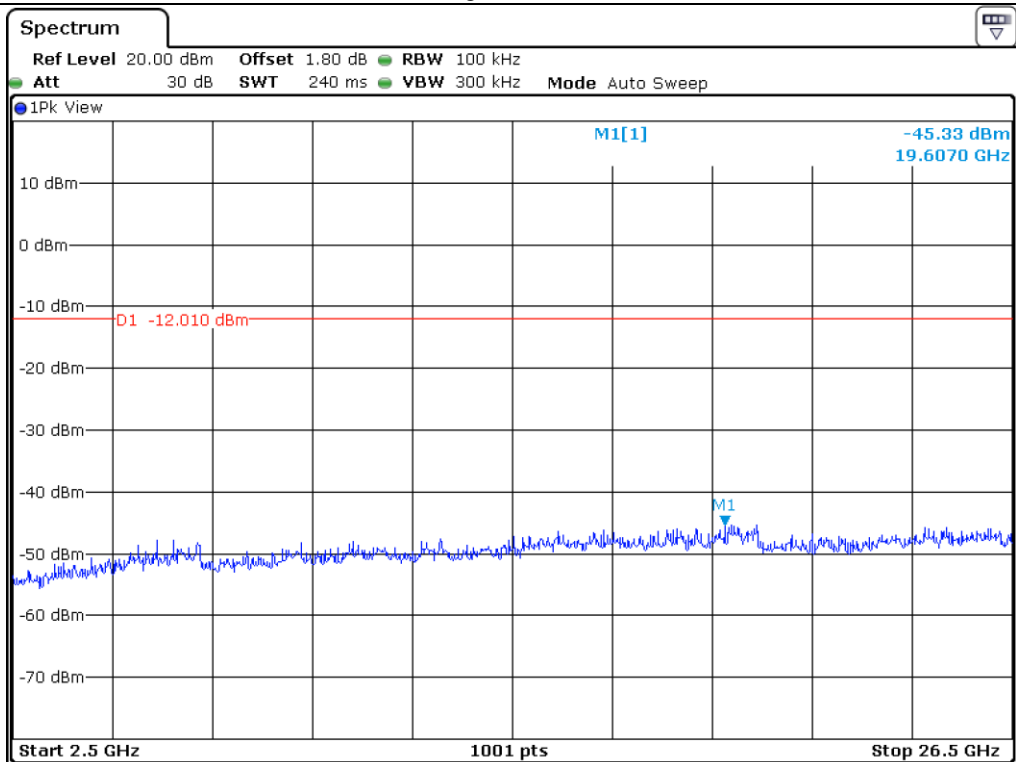
Middle Channel



Middle Channel



High Channel



High Channel

9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

- . Test Date : March 18, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 317.233	44.18	Peak	H	26.91	9.17	34.76	45.50	74.00	28.50
2 346.324	33.27	Average	H	26.91	9.17	34.72	34.63	54.00	19.37
2 342.328	44.07	Peak	V	26.91	9.17	34.72	45.43	74.00	28.57
2 386.843	33.47	Average	V	26.91	9.17	34.72	34.83	54.00	19.17
Test Data for High Channel									
2 491.420	44.26	Peak	H	27.47	9.49	35.51	45.71	74.00	28.29
2 483.508	33.46	Average	H	27.47	9.49	35.51	34.91	54.00	19.09
2 499.234	44.73	Peak	V	27.47	9.49	35.52	46.17	74.00	27.83
2 483.508	33.31	Average	V	27.47	9.49	35.51	34.76	54.00	19.24

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

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

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain



Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.2 Spurious & Harmonic Radiated Emission

- Test Date : March 18, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 804.000	43.99	Peak	H	30.84	12.31	35.74	51.40	74.00	22.60
	35.55	Average	H				42.96	54.00	11.04
	43.27	Peak	V				50.68	74.00	23.32
	34.29	Average	V				41.70	54.00	12.30
Test Data for Middle Channel									
4 880.000	46.14	Peak	H	30.01	12.43	35.80	52.78	74.00	21.22
	34.38	Average	H				41.02	54.00	12.98
	43.61	Peak	V				50.25	74.00	23.75
	33.44	Average	V				40.08	54.00	13.92
Test Data for High Channel									
4 960.000	43.99	Peak	H	31.15	12.81	35.96	51.99	74.00	22.01
	35.33	Average	H				43.33	54.00	10.67
	44.16	Peak	V				52.16	74.00	21.84
	33.70	Average	V				41.70	54.00	12.30

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

$$\text{Total Level} = \text{Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Pre-Amplifier Gain}$$



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10. PEAK POWER SPECTRAL DENSITY

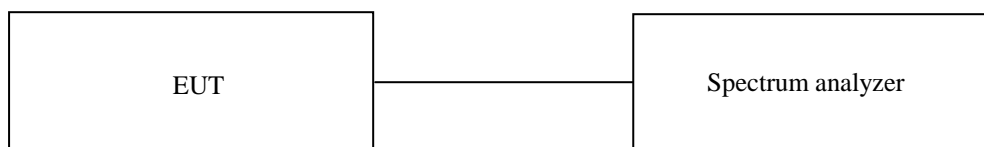
10.1 Operating environment

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 $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$, 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	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data

-. Test Date : March 18, 2019

-. Test Result : Pass

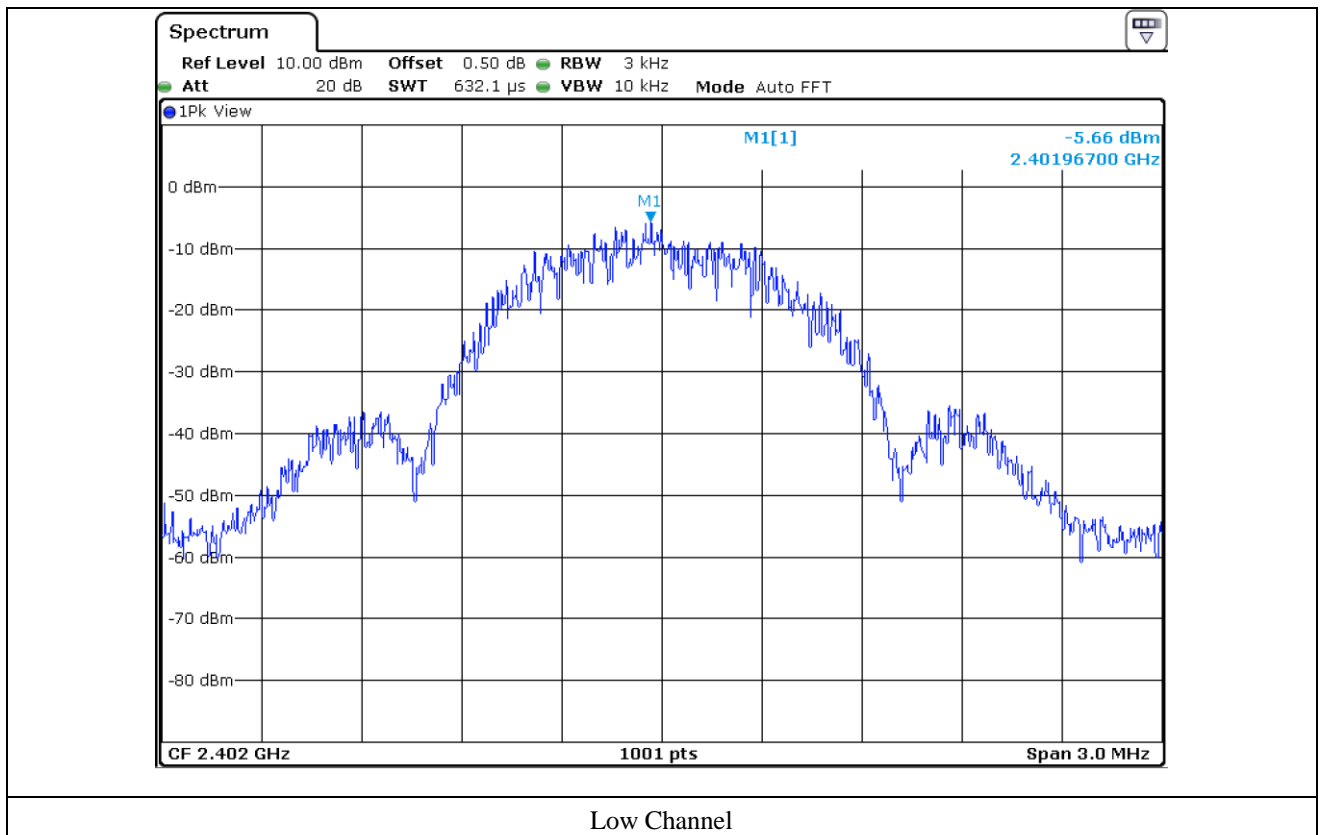
-. Operating Condition : Continuous transmitting mode

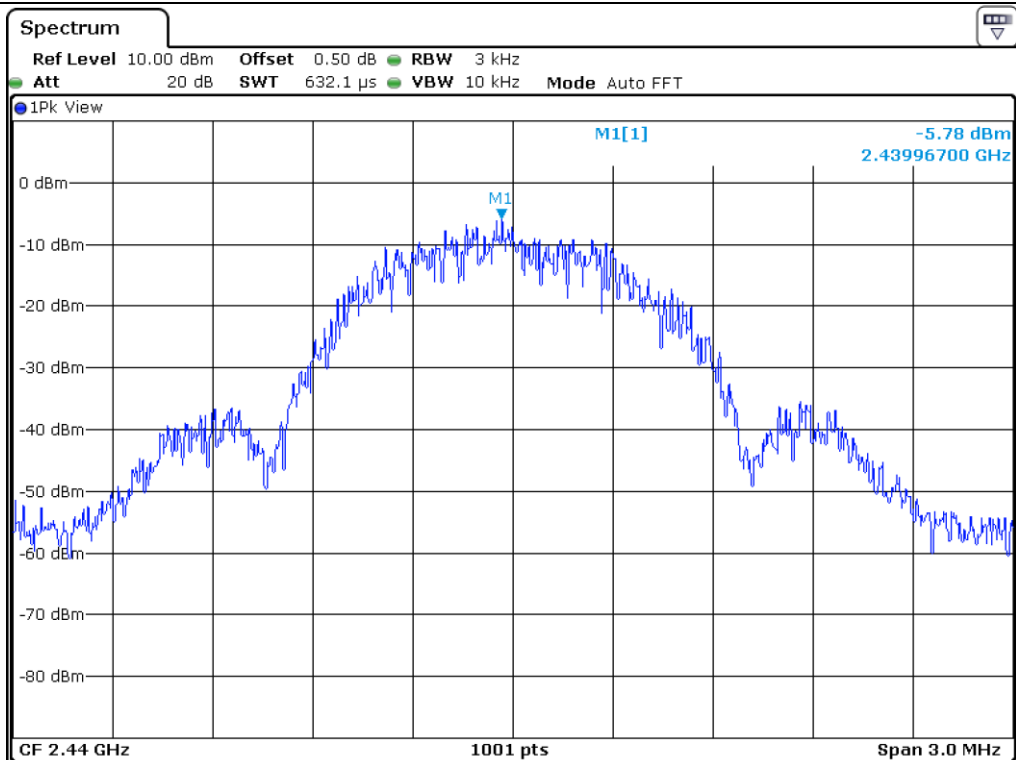
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-5.66	8.00	13.66
Middle	2 440.00	-5.78	8.00	13.78
High	2 480.00	-6.05	8.00	14.05

Remark. Margin = Limit – Measured value

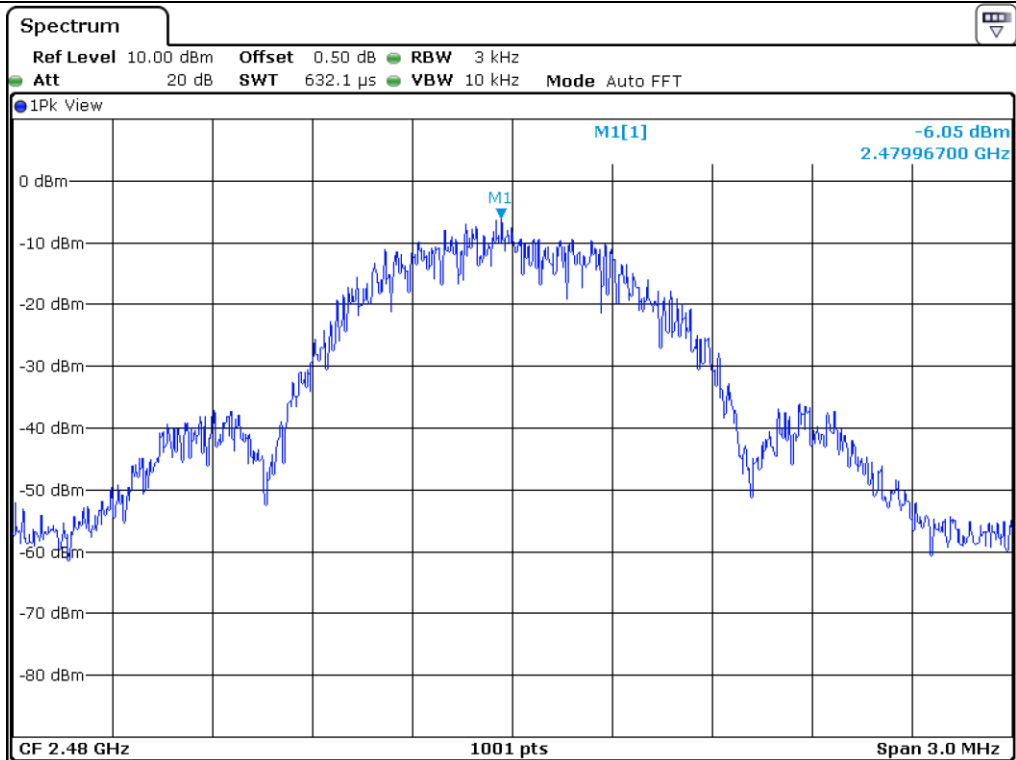


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 25 °C
Relative humidity : 46 % 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 a non-conductive 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 26.5 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.

11.3 Test equipment used

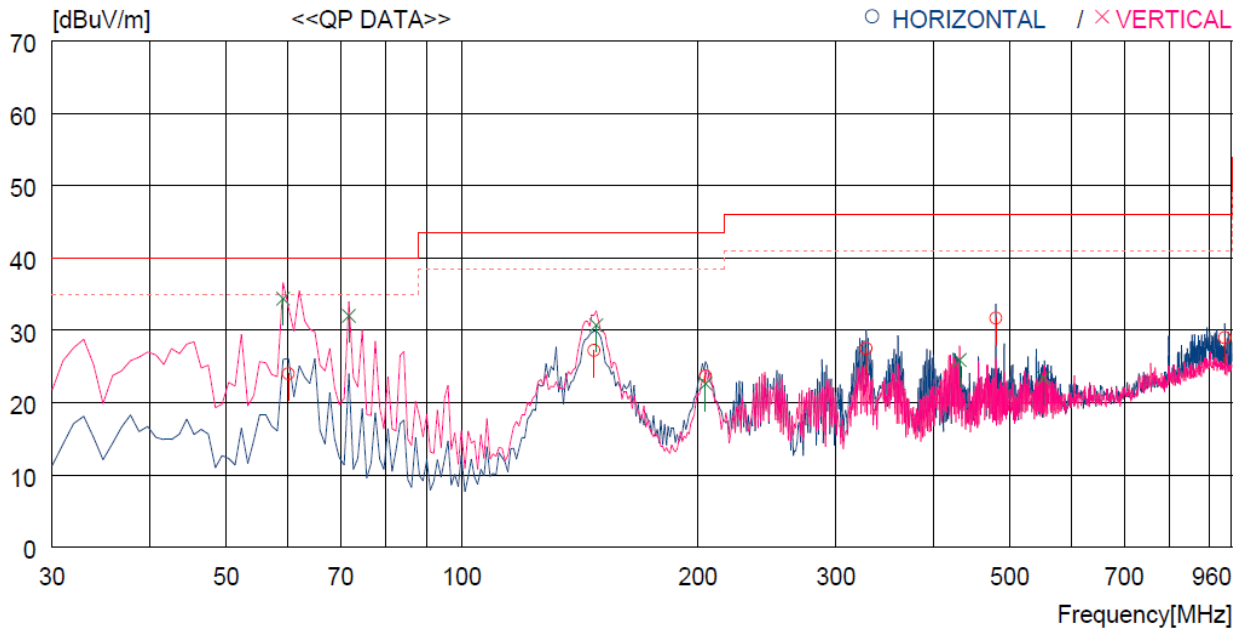
	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2018 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Amplifier	009	Mar. 20, 2018 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 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. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test Data for Transmitting mode

11.4.1 Test data for 30 MHz ~ 960 MHz

- Test Date : March 20, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 960 MHz
- Measurement distance : 3 m



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	60.070	42.1	13.2	1.8	33.1	24.0	40.0	16.0	400	0
2	147.370	49.2	8.2	2.8	33.0	27.2	43.5	16.3	400	359
3	204.600	42.8	10.6	3.3	33.0	23.7	43.5	19.8	300	359
4	327.790	42.1	14.2	4.2	33.0	27.5	46.0	18.5	300	359
5	480.081	42.9	16.9	5.1	33.2	31.7	46.0	14.3	100	359
6	940.818	31.6	22.2	7.2	32.0	29.0	46.0	17.0	100	359
----- Vertical -----										
7	59.100	52.4	13.3	1.8	33.1	34.4	40.0	5.6	100	249
8	71.710	54.1	9.0	2.0	33.1	32.0	40.0	8.0	200	104
9	148.340	52.7	8.1	2.9	33.0	30.7	43.5	12.8	100	0
10	204.600	41.7	10.6	3.3	33.0	22.6	43.5	20.9	100	258
11	431.581	37.8	16.4	4.8	33.1	25.9	46.0	20.1	100	84
12	551.859	33.4	17.9	5.4	33.3	23.4	46.0	22.6	100	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

11.4.2 Test data for Below 30 MHz

- . Test Date : March 20, 2019
- . 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)
It was not observed any emissions from the EUT.									

11.4.3 Test data for above 1 GHz

- . Test Date : March 20, 2019
- . 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

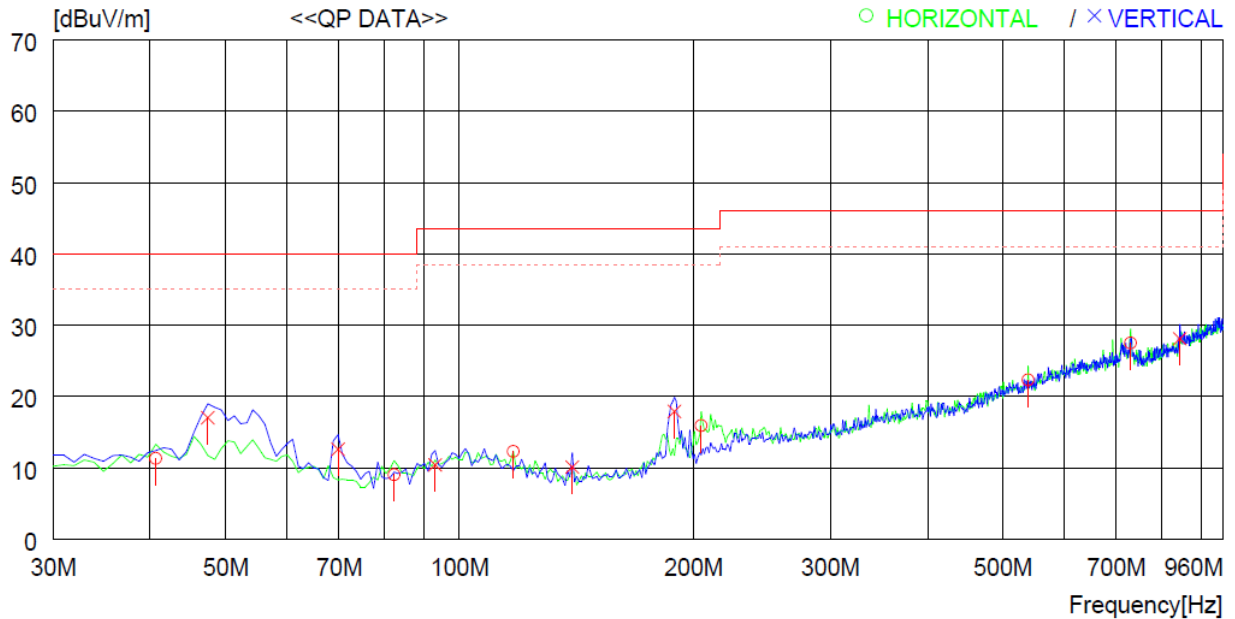
Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									


 Tested by: Hyung-Kwon, Oh / Assistant Manager

11.5 Test data for Charging mode

11.5.1 Test data for 30 MHz ~ 960 MHz

- Test Date : March 20, 2019
- Resolution bandwidth : 120 kHz
- Frequency range : 30 MHz ~ 960 MHz
- Measurement distance : 3 m



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	40.670	28.7	14.2	1.5	33.1	11.3	40.0	28.7	400	111
2	82.380	31.6	8.4	2.0	33.0	9.0	40.0	31.0	100	0
3	117.300	32.1	10.7	2.5	33.0	12.3	43.5	31.2	400	118
4	204.600	34.7	10.9	3.3	33.0	15.9	43.5	27.6	200	91
5	539.250	31.9	18.3	5.4	33.3	22.3	46.0	23.7	300	2
6	730.334	34.0	20.4	6.3	33.2	27.5	46.0	18.5	400	359
----- Vertical -----										
7	47.460	34.2	14.3	1.6	33.1	17.0	40.0	23.0	200	0
8	69.770	34.3	9.4	2.0	33.1	12.6	40.0	27.4	100	140
9	93.050	29.6	11.6	2.2	33.0	10.4	43.5	33.1	300	2
10	139.610	32.0	8.4	2.7	33.0	10.1	43.5	33.4	100	359
11	189.080	36.8	10.9	3.2	33.0	17.9	43.5	25.6	200	346
12	844.791	32.6	21.5	6.8	32.8	28.1	46.0	17.9	200	178

Tested by: Hyung-Kwon, Oh / Assistant Manager

11.5.2 Test data for Below 30 MHz

- . Test Date : March 20, 2019
- . 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

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								

11.5.3 Test data for above 1 GHz

- . Test Date : March 20, 2019
- . 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

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Factor (dB/m)	Cable Loss	Amp Gain	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.								



Tested by: Hyung-Kwon, Oh / Assistant Manager

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 25 °C
Relative humidity : 46 % R.H.

12.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μ H + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

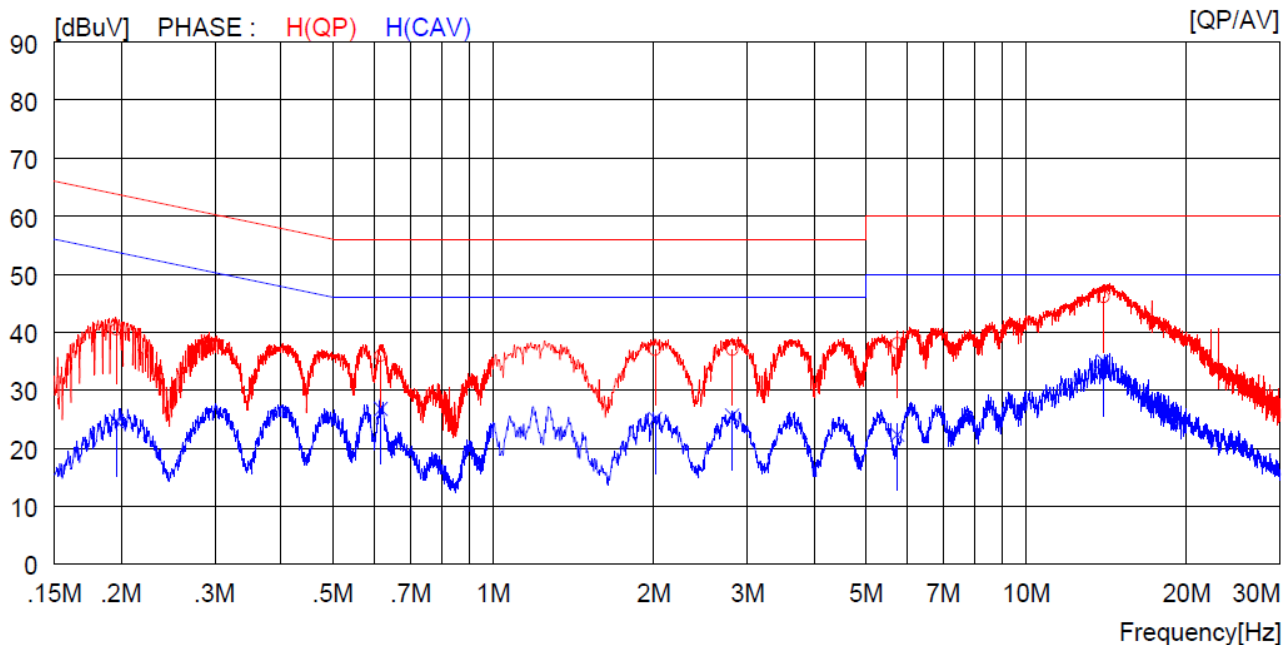
12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 22, 2018 (1Y)
■ -	NSLK8128	SCHWARZ BECK	LISN	8128-216	Mar. 20, 2018 (1Y)
□ -	NNLK8121	SCHWARZ BECK	LISN	804	Oct. 22, 2018 (1Y)
■ -	ESH3Z2	Rohde & Schwarz	Pulse Limiter	100655	Mar. 20, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

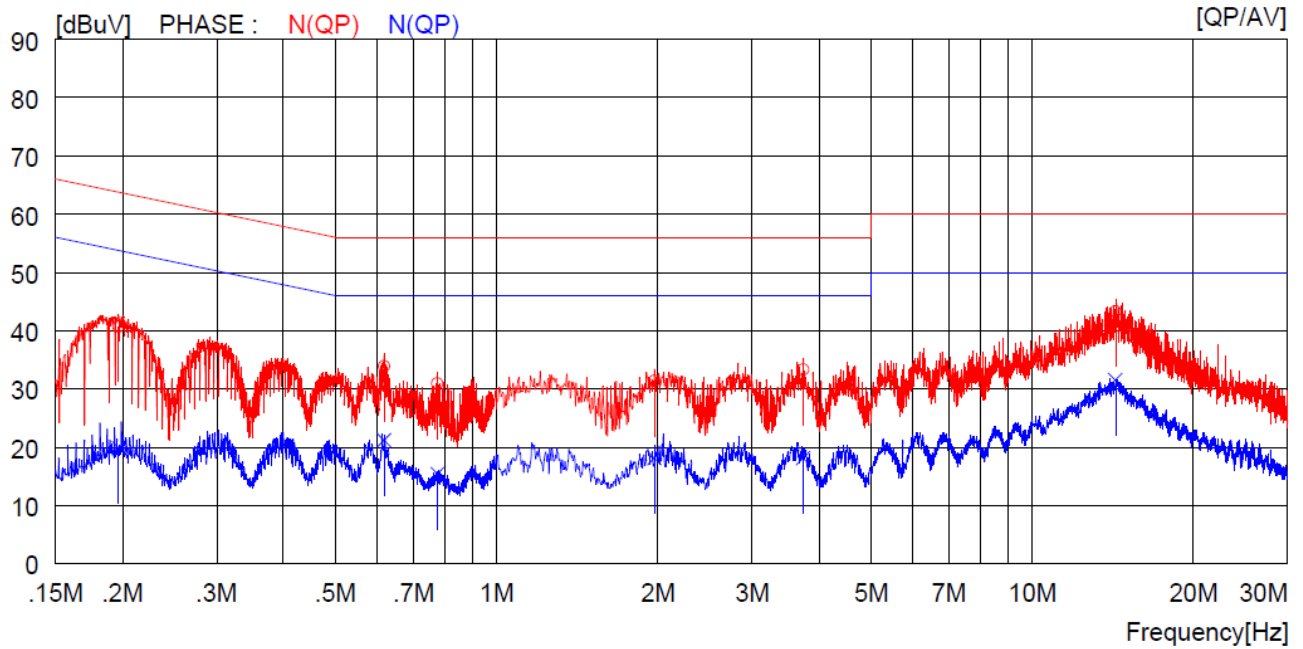
12.4 Test data for Charging Mode

- Test Date : March 20, 2019
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19600	30.6	----	9.9	40.5	----	63.8	----	23.3	----	H (QP)
2	0.61500	26.0	----	9.9	35.9	----	56.0	----	20.1	----	H (QP)
3	2.01200	26.9	----	10.0	36.9	----	56.0	----	19.1	----	H (QP)
4	2.80800	27.0	----	10.0	37.0	----	56.0	----	19.0	----	H (QP)
5	5.73500	28.0	----	10.1	38.1	----	60.0	----	21.9	----	H (QP)
6	13.98000	35.9	----	10.2	46.1	----	60.0	----	13.9	----	H (QP)
7	0.19600	----	14.8	9.9	----	24.7	----	53.8	----	29.1	H (CAV)
8	0.61500	----	16.9	9.9	----	26.8	----	46.0	----	19.2	H (CAV)
9	2.01200	----	15.1	10.0	----	25.1	----	46.0	----	20.9	H (CAV)
10	2.80800	----	15.6	10.0	----	25.6	----	46.0	----	20.4	H (CAV)
11	5.73500	----	12.2	10.1	----	22.3	----	50.0	----	27.7	H (CAV)
12	13.98000	----	24.8	10.2	----	35.0	----	50.0	----	15.0	H (CAV)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19700	30.8	----	9.9	40.7	----	63.7	----	23.0	----	N(QP)
2	0.61600	24.0	----	9.9	33.9	----	56.0	----	22.1	----	N(QP)
3	0.77500	21.0	----	9.9	30.9	----	56.0	----	25.1	----	N(QP)
4	1.97200	21.4	----	10.0	31.4	----	56.0	----	24.6	----	N(QP)
5	3.73600	23.2	----	10.1	33.3	----	56.0	----	22.7	----	N(QP)
6	14.31000	33.1	----	10.2	43.3	----	60.0	----	16.7	----	N(QP)
7	0.19700	----	9.9	9.9	----	19.8	----	53.7	----	33.9	N(CAV)
8	0.61600	----	11.3	9.9	----	21.2	----	46.0	----	24.8	N(CAV)
9	0.77500	----	5.5	9.9	----	15.4	----	46.0	----	30.6	N(CAV)
10	1.97200	----	8.1	10.0	----	18.1	----	46.0	----	27.9	N(CAV)
11	3.73600	----	8.0	10.1	----	18.1	----	46.0	----	27.9	N(CAV)
12	14.31000	----	21.3	10.2	----	31.5	----	50.0	----	18.5	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Hyung-Kwon, Oh / Assistant Manager