

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

Test Report No. : W17NR-D082
AGR No. : A17OA-122
Applicant : Remote Solution Co., Ltd.
Address : 92, Chogokri, Nammyun, Kimchon City, Kyungbuk, 740-871, South Korea
Manufacturer : Remote Solution Co., Ltd.
Address : 326-14, Apo-daero, Nam-myeon, Gimcheon-si, Gyeongsangbuk-do, Republic of Korea
Type of Equipment : Zigbee Module
FCC ID. : TX4MC85A00
Model Name : MC85A00
Serial number : N/A
Total page of Report : 36 pages (including this page)
Date of Incoming : November 20, 2017
Date of issue : November 30, 2017

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 / Asst, Chief Engineer
ONETECH Corp.

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

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W17NR-D082	November 30, 2017	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : Remote Solution Co., Ltd.
 Address : 92, Chogokri, Nammyun, Kimchon City, Kyungbuk, 740-871, South Korea
 Contact Person : Shin Sang Hyun / Researcher
 Telephone No. : +82-54-420-4517
 FCC ID : TX4MC85A00
 Model Name : MC85A00
 Brand Name : -
 Serial Number : N/A
 Date : November 30, 2017

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Zigbee Module
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 Remote Solution Co., Ltd., Model MC85A00 (referred to as the EUT in this report) is a Zigbee Module. The product specification described herein was obtained from product data sheet or user’s manual.

Device Type	Zigbee Module
Temperature Range	-40 °C ~ 80 °C
Operating Frequency	2 405 MHz ~ 2 480 MHz
RF Output Power	-0.24 dBm
Number of Channel	16 Channel
Modulation Type	O-QPSK (Zigbee)
Antenna Type	PCB Pattern Antenna
Antenna Gain	2.55 dBi
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	32.768 kHz, 24 MHz

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	Remote Solution Co., Ltd.	1BL-3079A	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
MC85A00	Remote Solution Co., Ltd.	Zigbee Module (EUT)	-
Probook	H.P	Notebook PC	-
SmartRF06 Evaluation Board	Texas Instruments Incorporated	Jig board	EUT

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 2 405 MHz, 2 440 MHz, and 2 480 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.

5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to Jig Board and the power of USB was connected to Notebook PC. 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 PCB pattern 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 Tests, the following operating mode was investigated

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

6.2 General Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

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

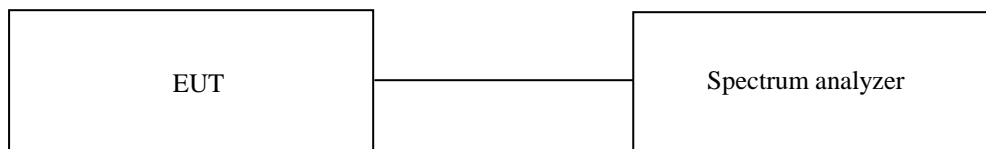
7. MINIMUM 6 dB BANDWIDTH

7.1 Operating environment

Temperature : 24.3 °C
 Relative humidity : 43.9 % 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	Apr. 05, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data

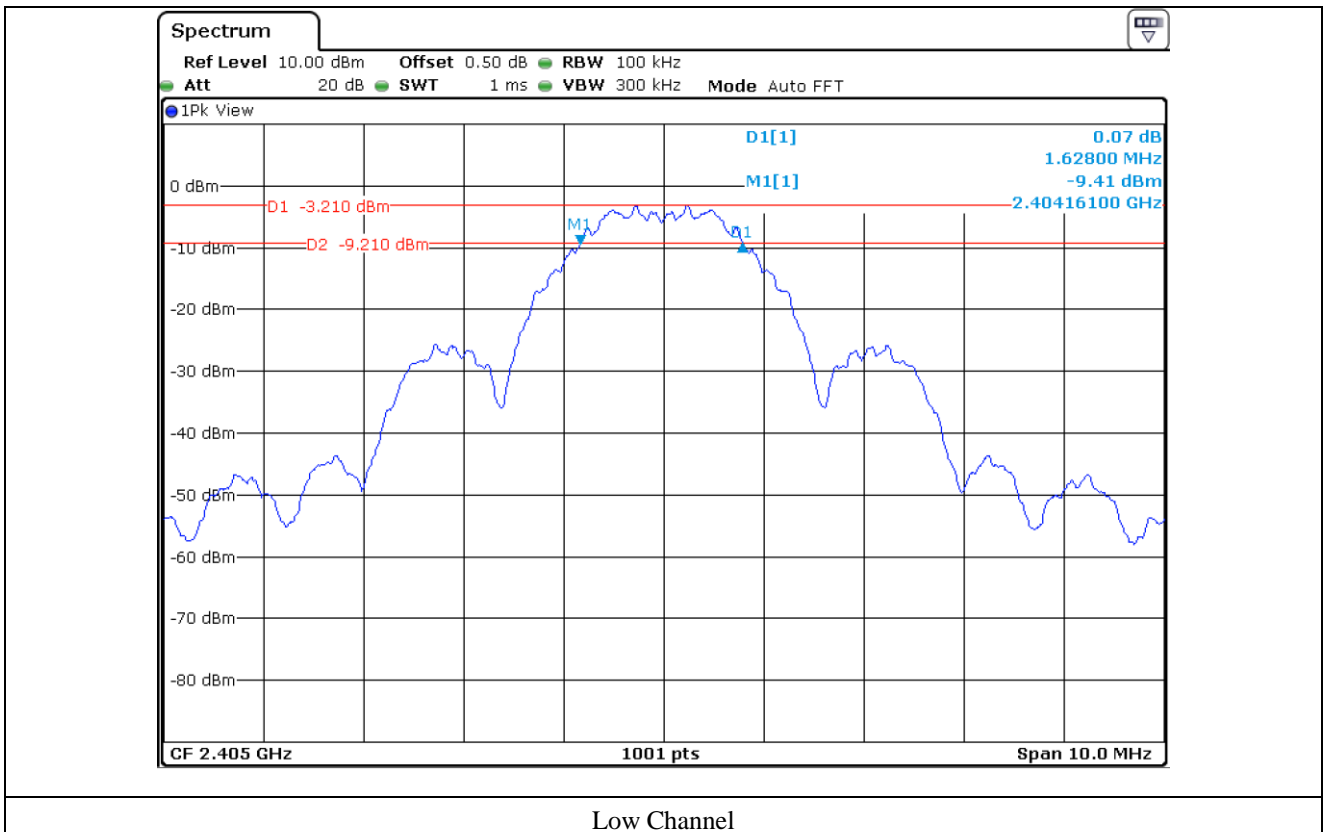
- Test Date : November 22, 2017 ~ November 24, 2017
- Test Result : Pass

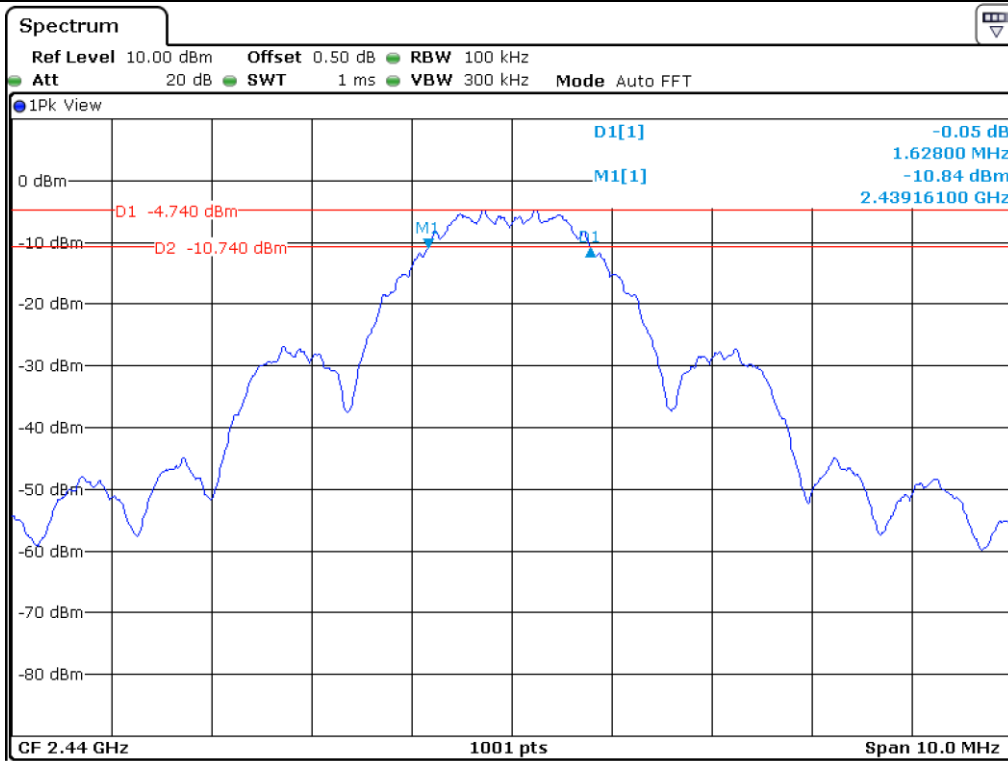
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT (MHz)	MARGIN (MHz)
Low	2 405.00	1.63	0.50	1.13
Middle	2 440.00	1.63	0.50	1.13
High	2 480.00	1.62	0.50	1.12

Remark. Margin = Measured Value - Limit

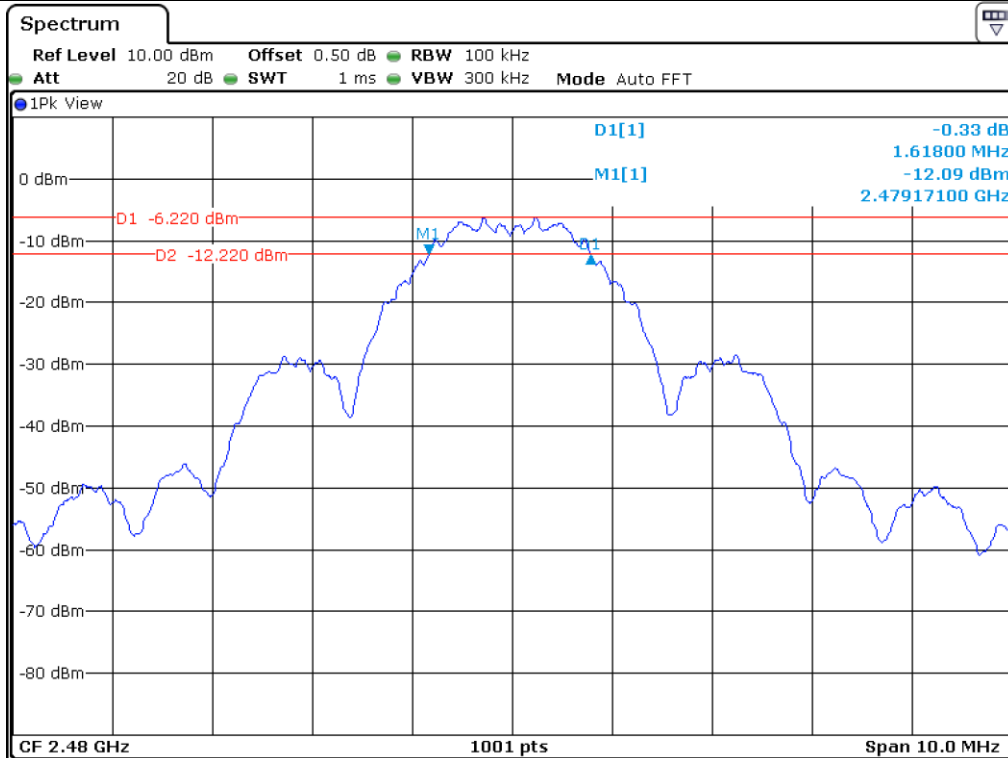


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

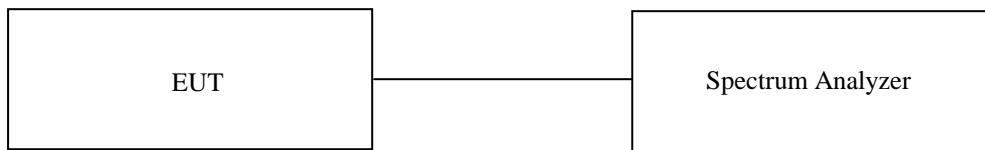
8.1 Operating environment

Temperature : 24.3 °C
 Relative humidity : 43.9 % 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	Apr. 05, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

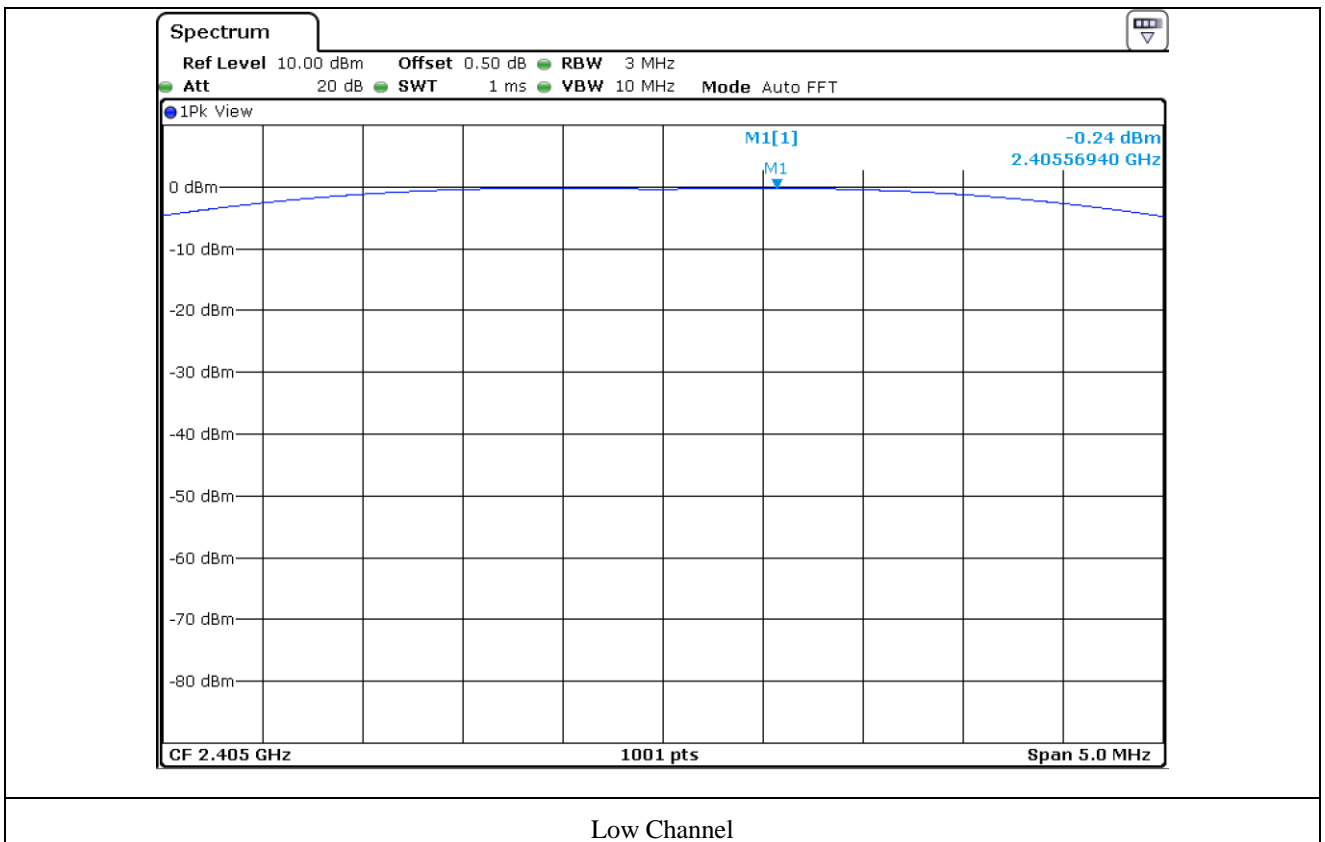
8.4 Test data

- Test Date : November 22, 2017 ~ November 24, 2017
- Test Result : Pass

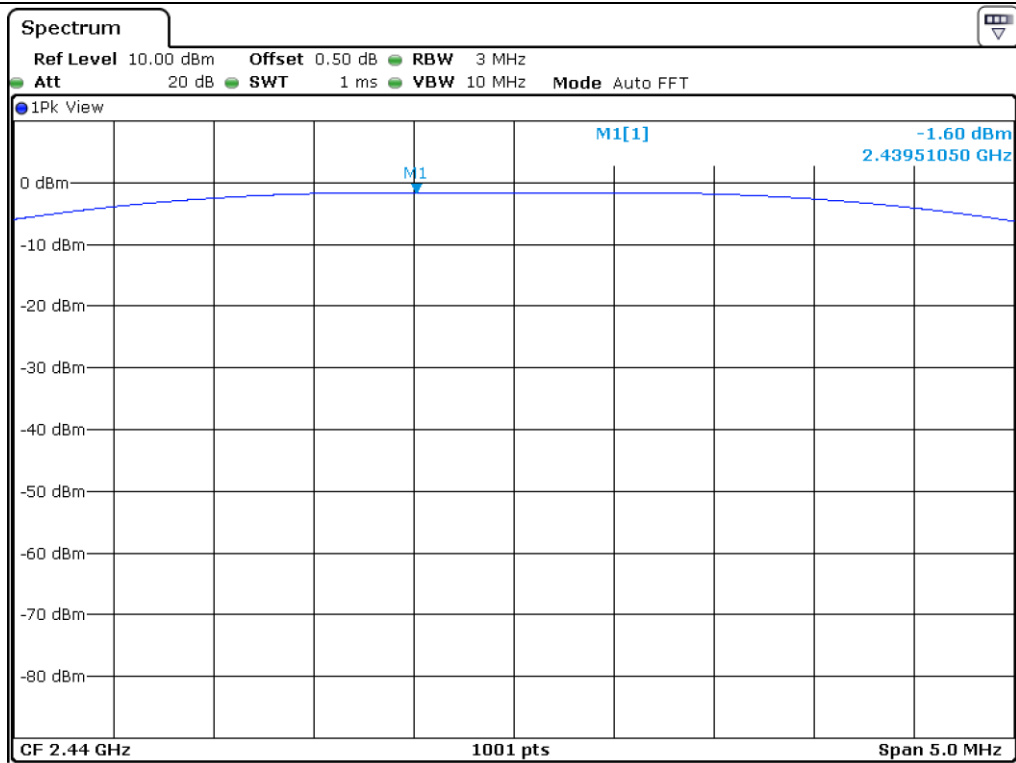
CHANNEL	FREQUENCY (MHz)	DTS (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 405.00	1.63	-0.24	30.00	30.24
MIDDLE	2 440.00	1.63	-1.60	30.00	31.60
HIGH	2 480.00	1.62	-2.91	30.00	32.91

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

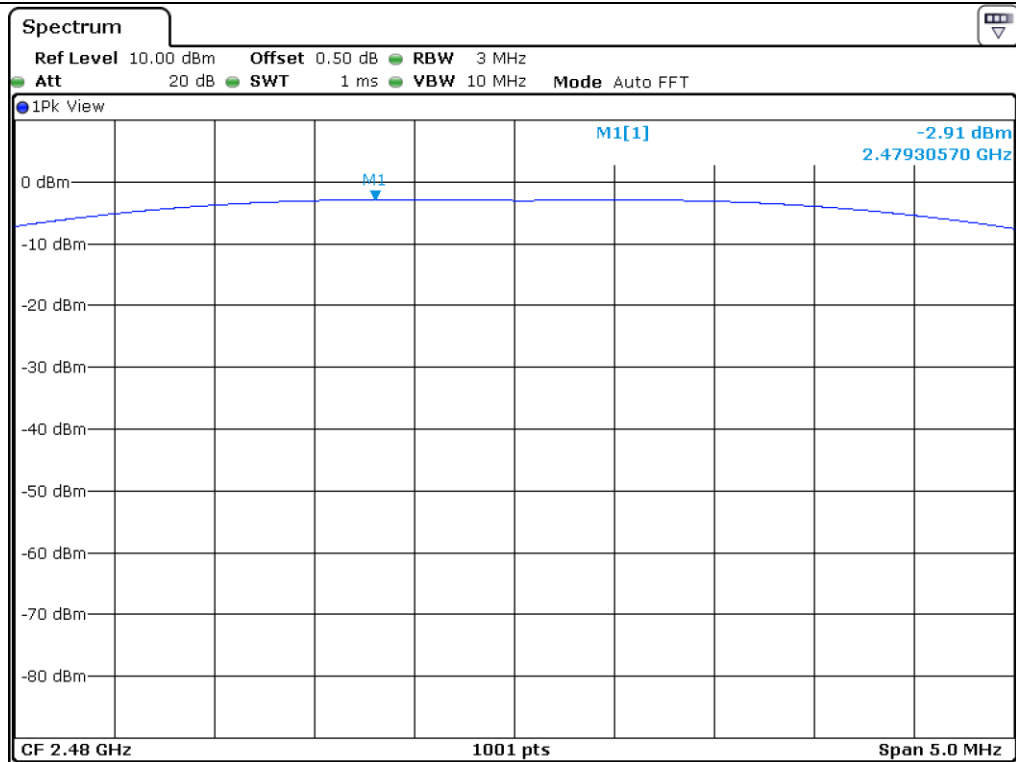
Tested by: Hyung-Kwon, Oh / Assistant Manager



Low Channel



Middle Channel



High Channel

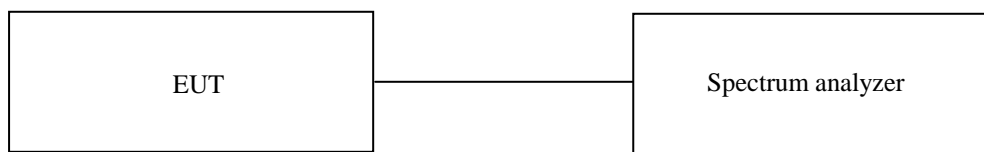
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 24.3 °C
 Relative humidity : 43.9 % 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.

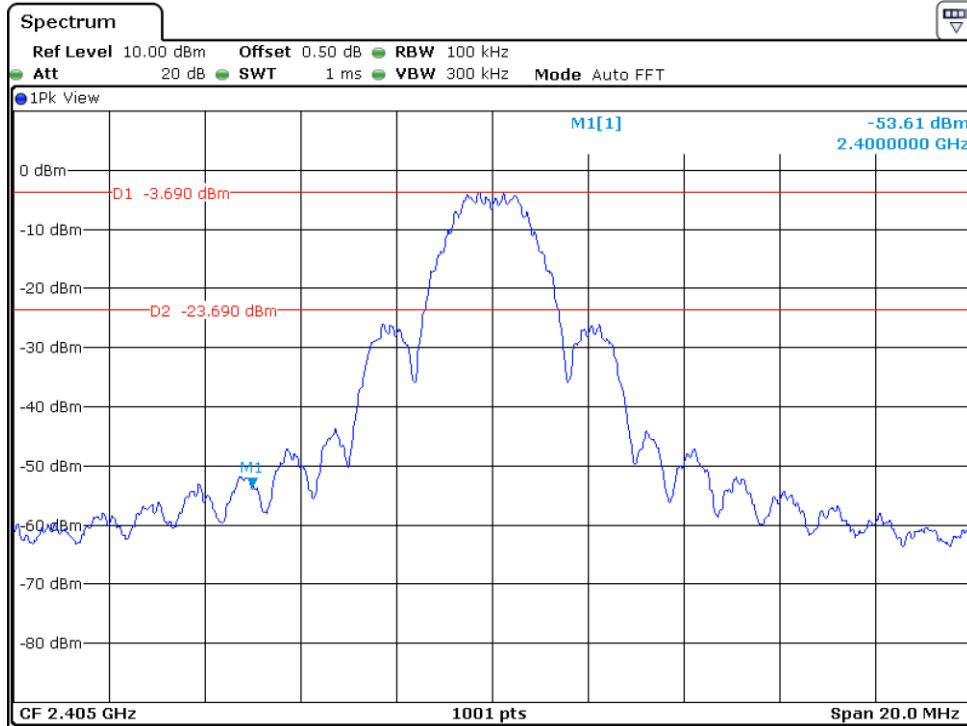
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal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

9.4 Test equipment used

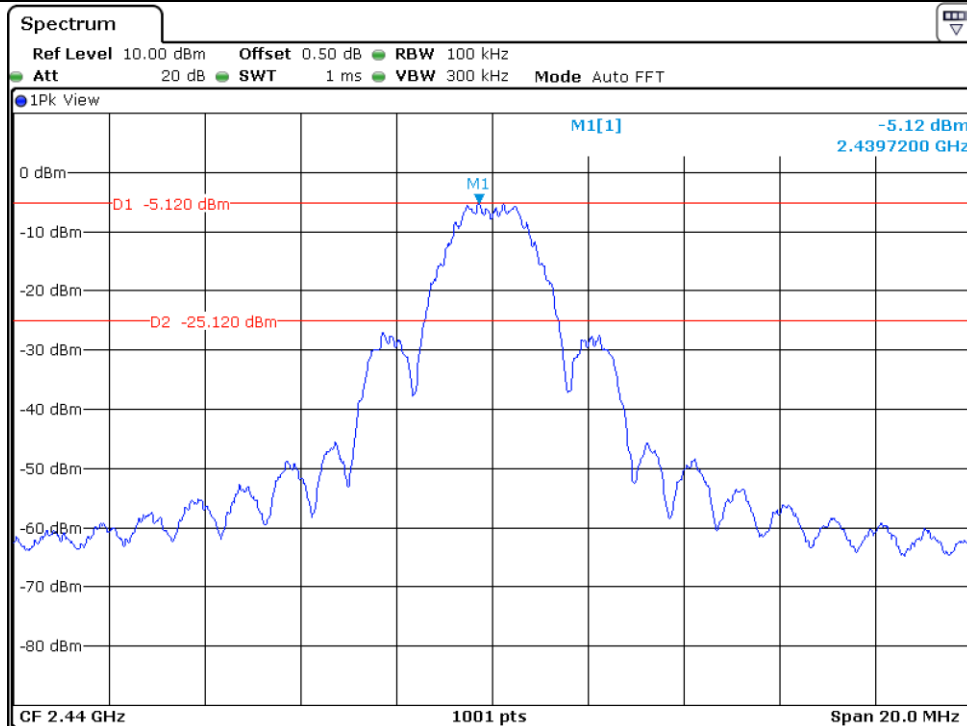
Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 06, 2017 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 05, 2017 (1Y)
■ - BBV9718	Schwarzbeck	Amplifier	310	Sep. 01, 2017 (1Y)
■ - SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Apr. 04, 2017 (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	9163-421	Apr. 15, 2016 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	May 26, 2017 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jul. 28, 2017 (2Y)

All test equipment used is calibrated on a regular basis.

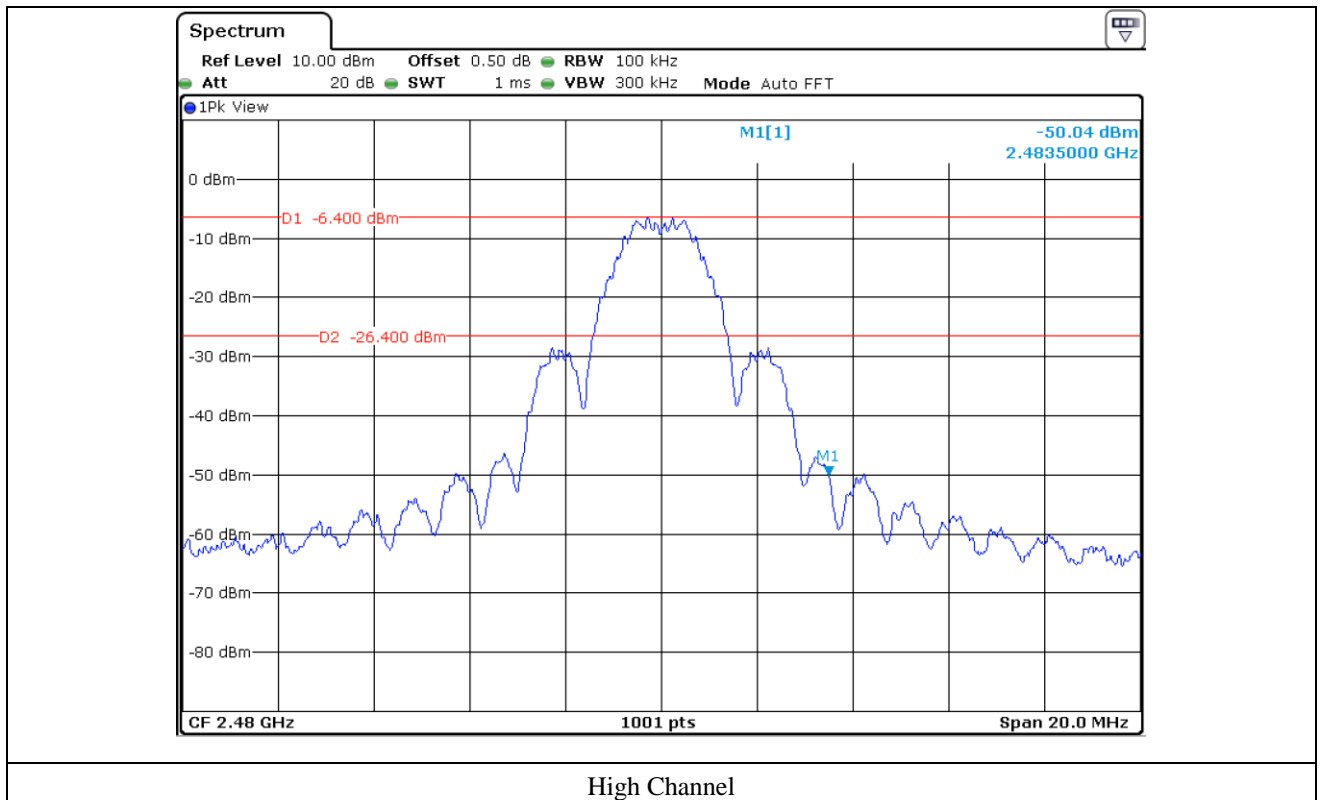
9.5 Test data for conducted emission

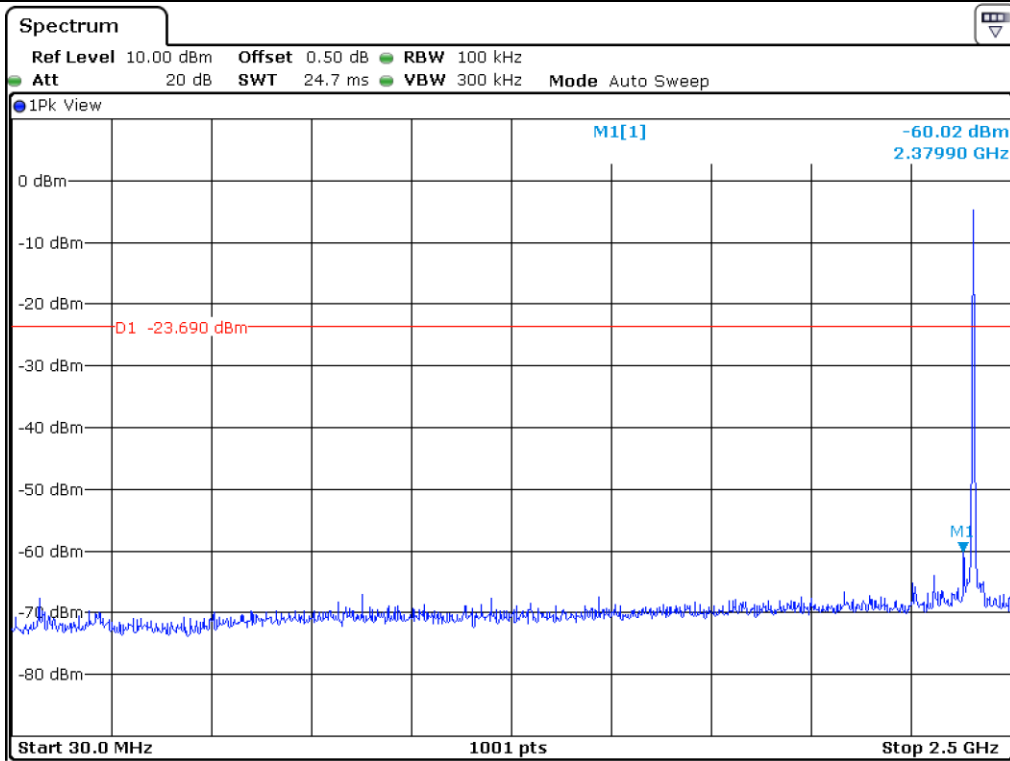


Low Channel

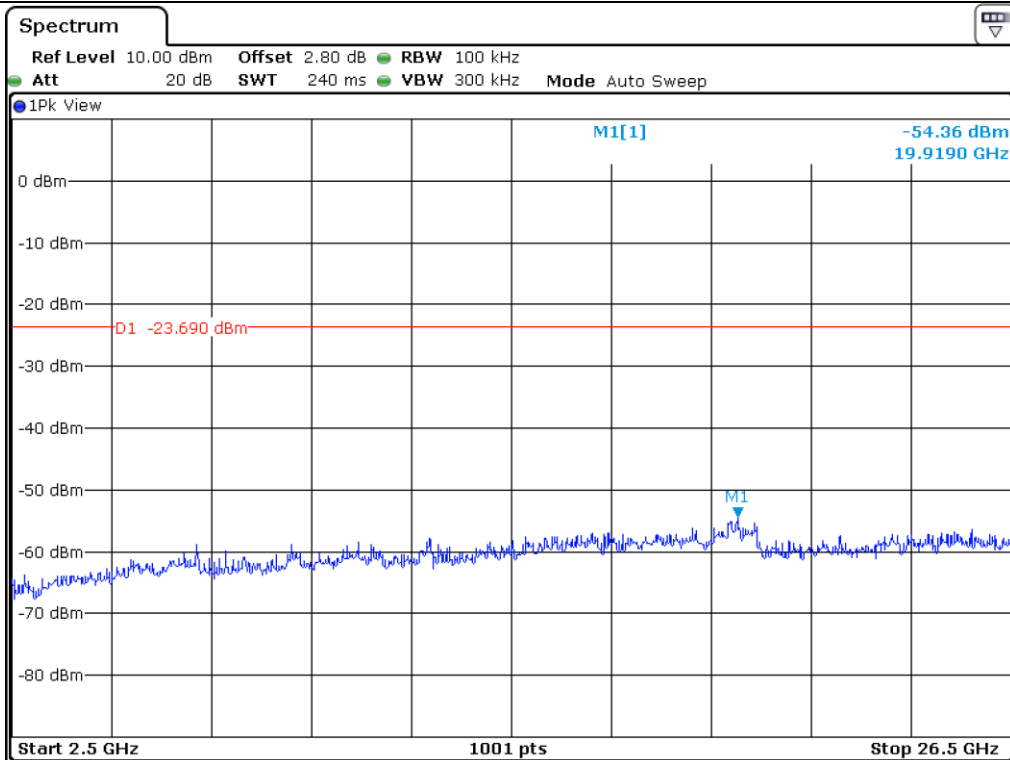


Middle Channel

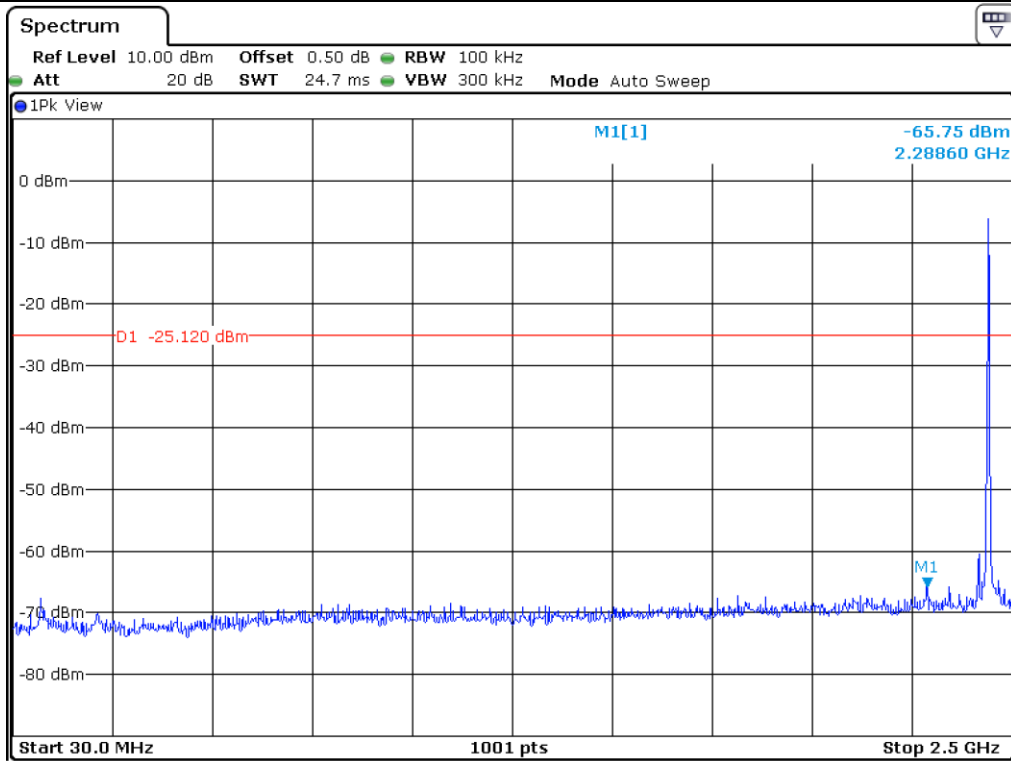




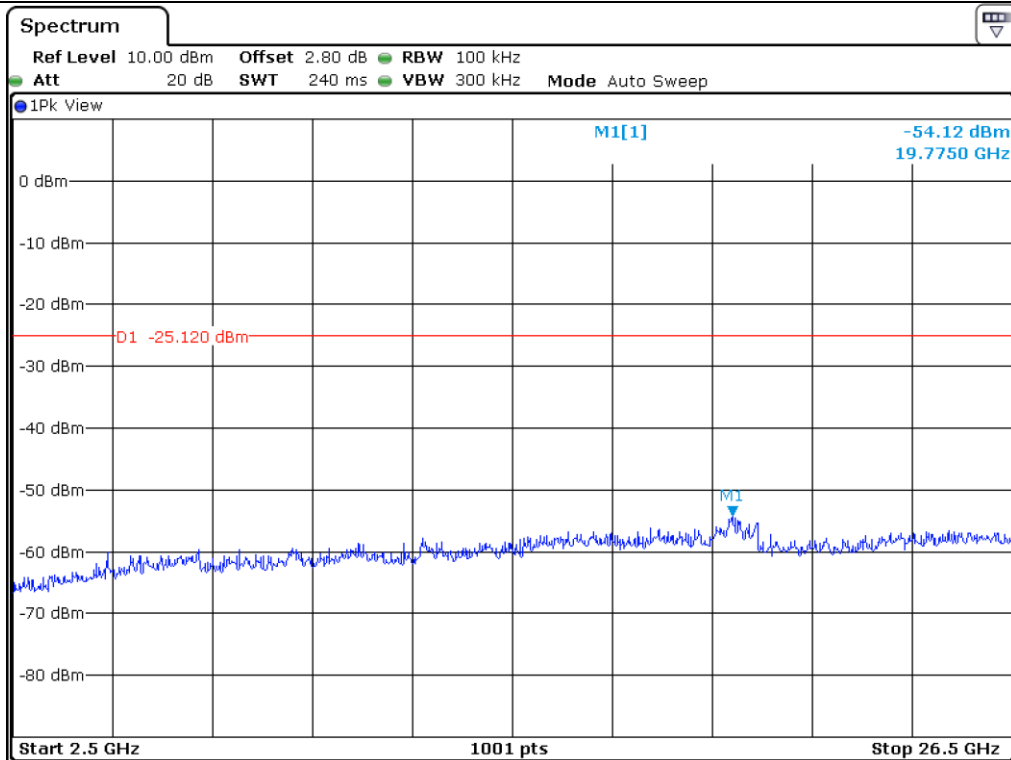
Low Channel



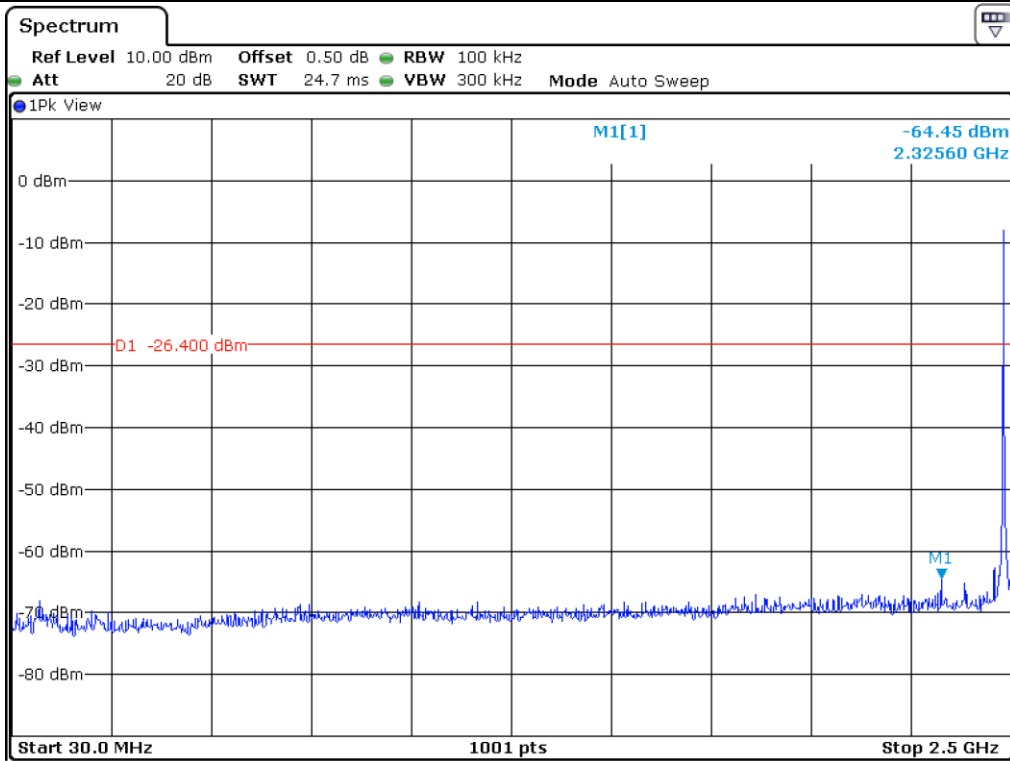
Low Channel



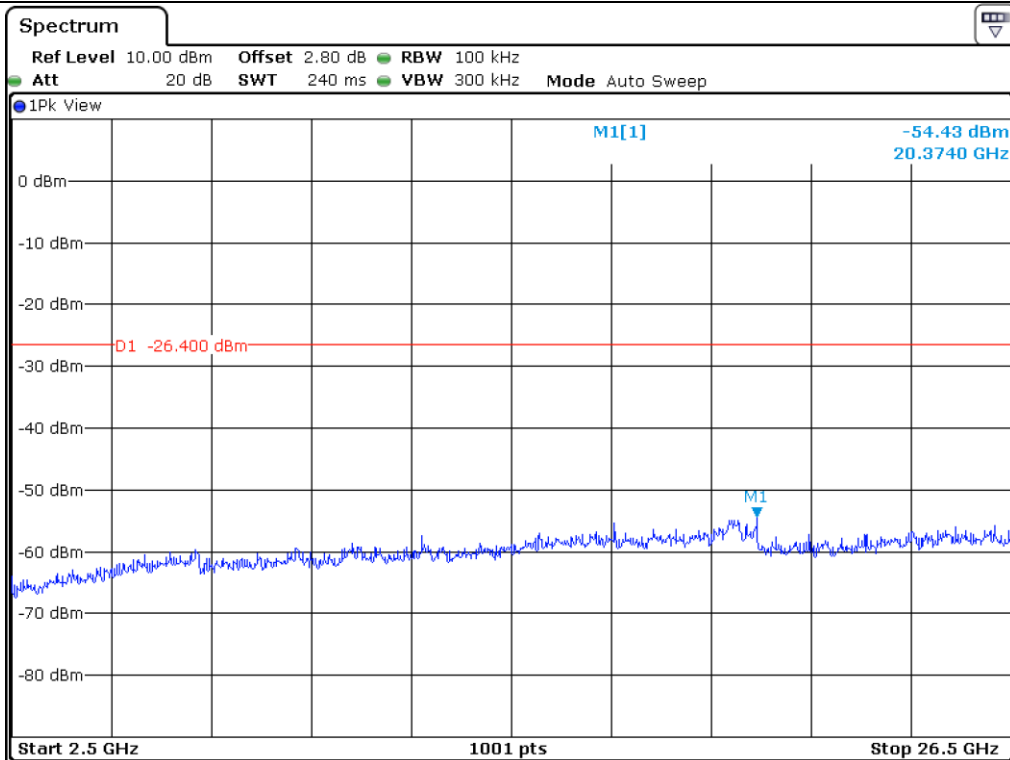
Middle Channel



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 : November 22, 2017 ~ November 24, 2017
- 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
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- 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									
2.382 318	41.34	Peak	H	26.94	9.20	34.76	42.72	74.00	31.28
2.380 769	30.69	Average	H				32.07	54.00	21.93
2.380 450	44.13	Peak	V				45.51	74.00	28.49
2.381 089	36.56	Average	V				37.94	54.00	16.06
Test Data for High Channel									
2.483 513	48.38	Peak	H	27.47	9.49	35.51	49.83	74.00	24.17
2.483 508	41.43	Average	H				42.88	54.00	11.12
2.483 515	55.80	Peak	V				57.25	74.00	16.75
2.483 504	49.20	Average	V				50.65	54.00	3.35

Tabulated test data for Restricted Band

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

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

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



Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.2 Spurious & Harmonic Radiated Emission

- Test Date : November 22, 2017 ~ November 24, 2017
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz 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
- Duty Cycle : > 98 %
- 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									
4 810.00	42.71	Peak	H	30.84	12.31	35.74	50.12	73.98	23.86
	31.76	Average	H				39.17	53.98	14.81
	45.51	Peak	V				52.92	73.98	21.06
	38.09	Average	V				45.50	53.98	8.48
Test Data for Middle Channel									
4 880.00	42.38	Peak	H	30.01	12.43	35.80	49.02	73.98	24.96
	31.60	Average	H				38.24	53.98	15.74
	45.34	Peak	V				51.98	73.98	22.00
	38.11	Average	V				44.75	53.98	9.23
Test Data for High Channel									
4 960.00	41.93	Peak	H	31.15	12.81	35.96	49.93	73.98	24.05
	31.31	Average	H				39.31	53.98	14.67
	45.21	Peak	V				53.21	73.98	20.77
	38.13	Average	V				46.13	53.98	7.85

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

9.6.3 Radiated Emission which fall in the Band Edge

- . Test Date : November 22, 2017 ~ November 24, 2017
- . Resolution bandwidth : 100 kHz and Peak Detector for Peak Mode
100 kHz and RMS Detector for Average Mode
- . Video bandwidth : 300 kHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . 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									
2.400 000	36.88	Peak	H	27.20	9.35	34.81	38.62	74.00	35.38
	29.22	Average	H				30.96	54.00	23.04
	46.49	Peak	V				48.23	74.00	25.77
	38.87	Average	V				40.61	54.00	13.39

Tabulated test data for Restricted Band

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

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

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



Tested by: Hyung-Kwon, Oh / Assistant Manager

10. PEAK POWER SPECTRAL DENSITY

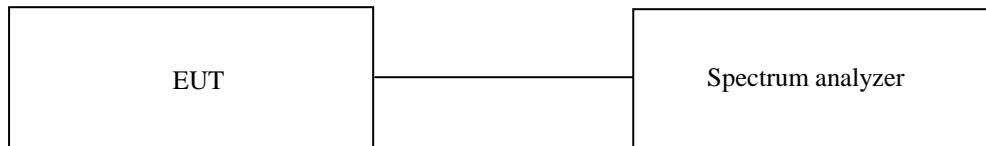
10.1 Operating environment

Temperature : 24.3 °C
 Relative humidity : 43.9 % 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	Apr. 05, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

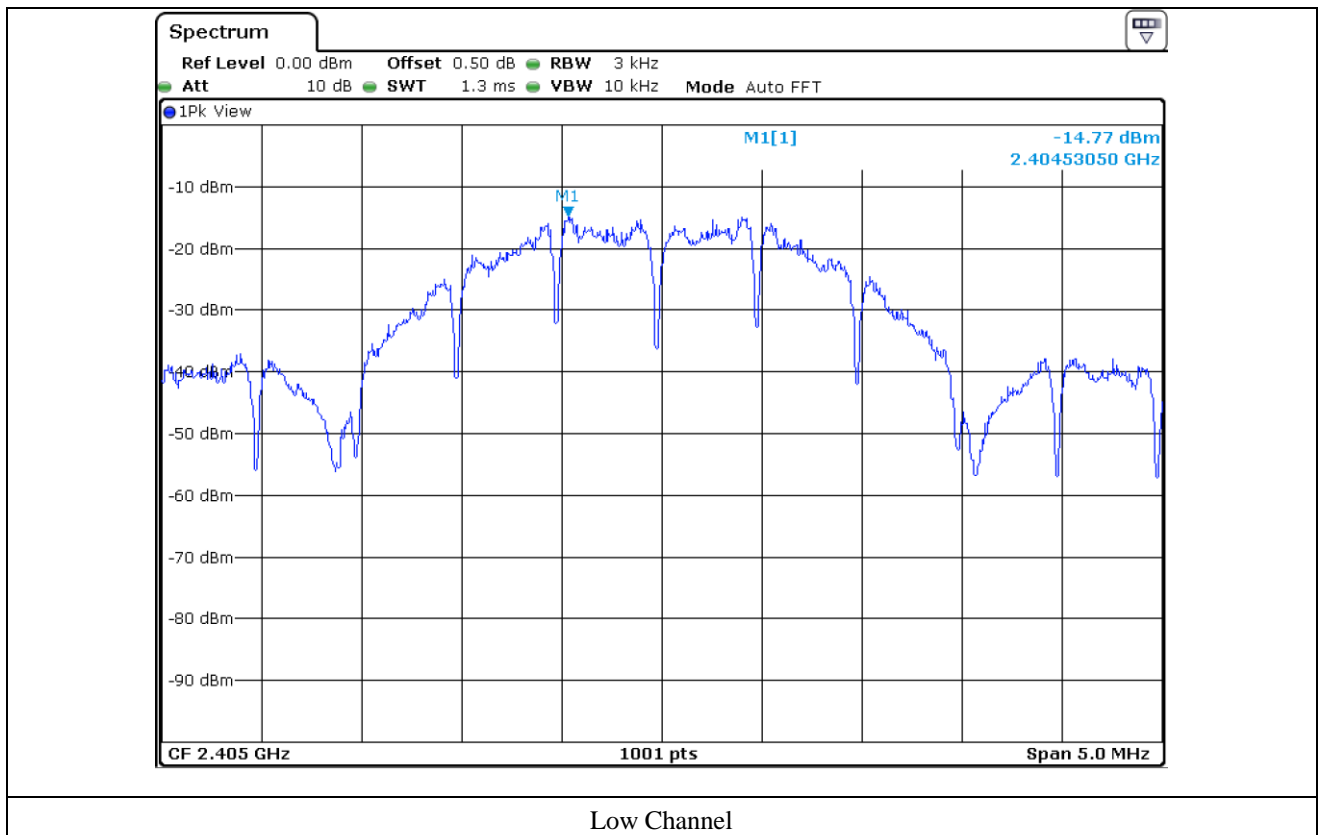
10.4 Test data

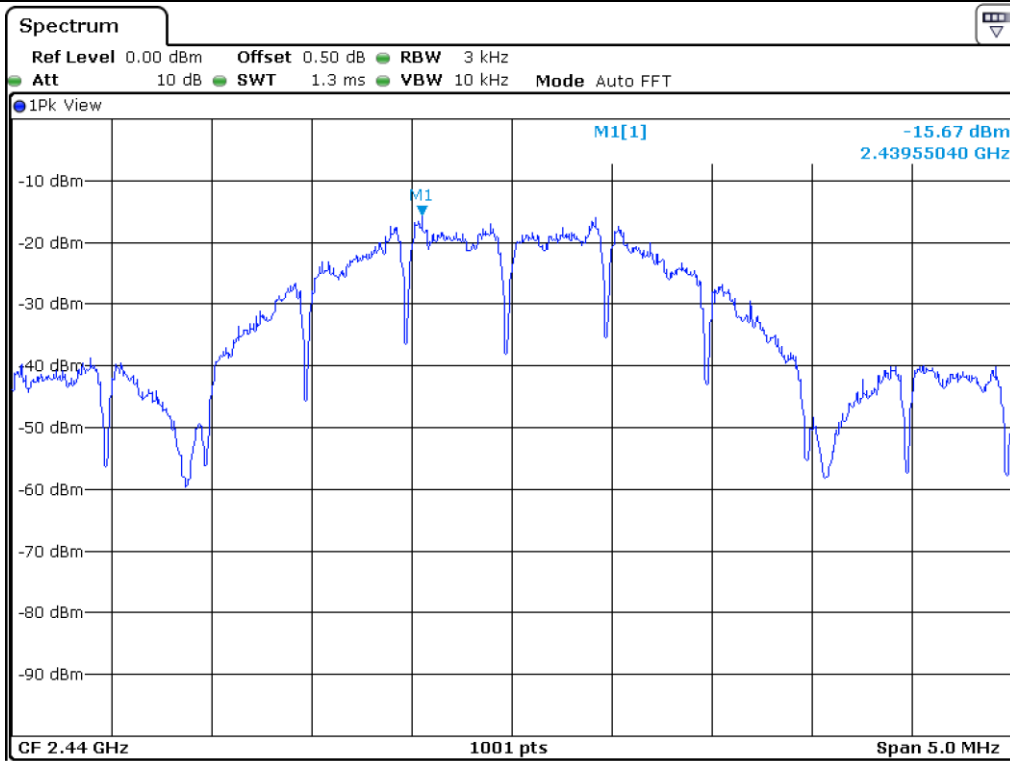
- Test Date : November 22, 2017 ~ November 24, 2017
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 405.00	-14.77	8.00	22.77
Middle	2 440.00	-15.67	8.00	23.67
High	2 480.00	-16.47	8.00	24.47

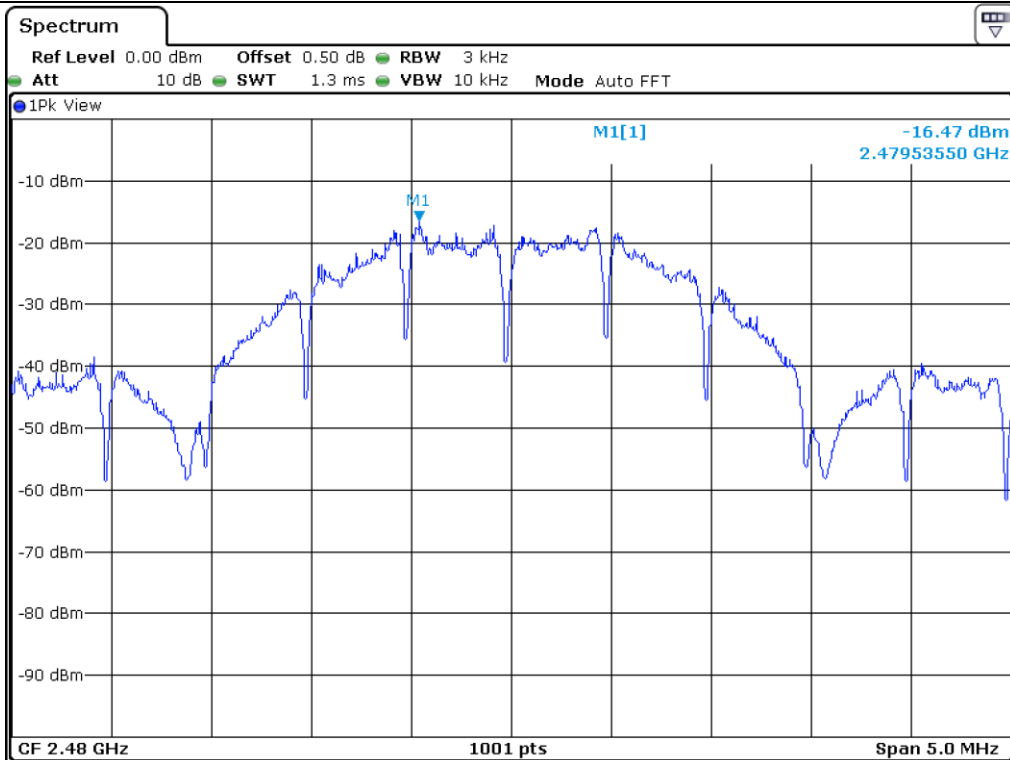
Remark. Margin = Limit – Measured value

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 24 °C
 Relative humidity : 44 % 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

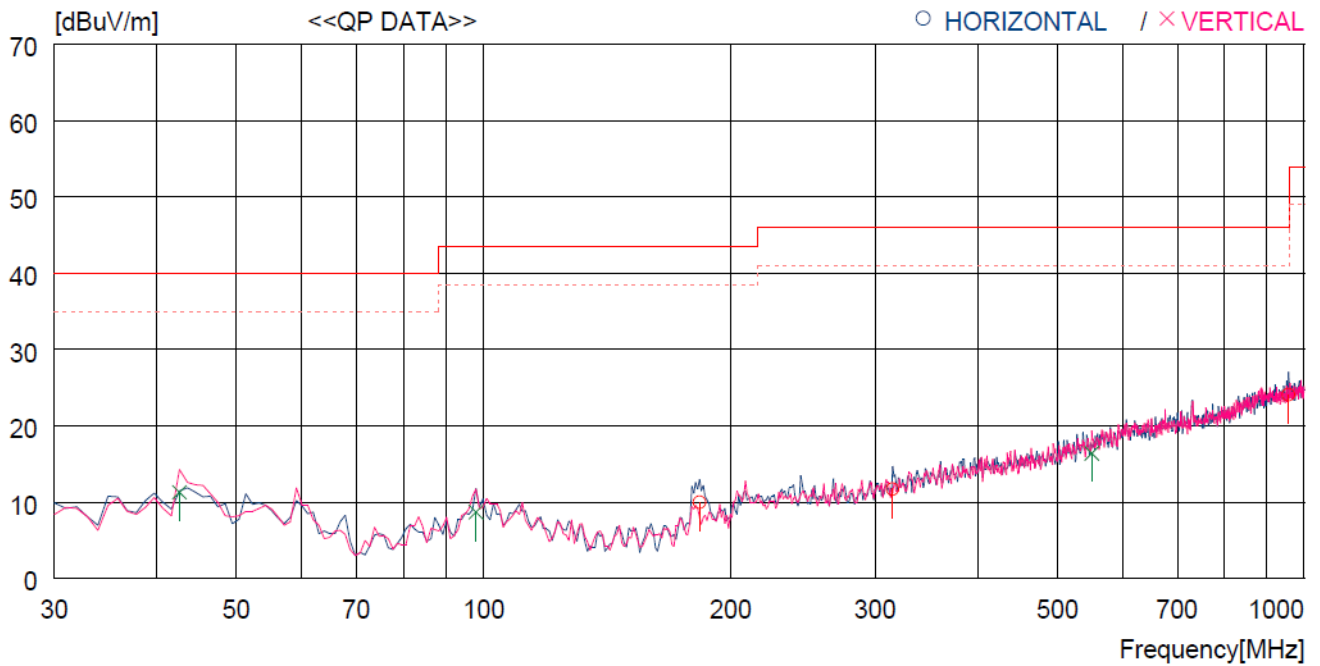
Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 06, 2017 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 05, 2017 (1Y)
■ - BBV9718	Schwarzbeck	Amplifier	310	Sep. 01, 2017 (1Y)
■ - SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Apr. 04, 2017 (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	9163-421	Apr. 15, 2016 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	May 26, 2017 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jul. 28, 2017 (2Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data for 30 MHz ~ 1 GHz

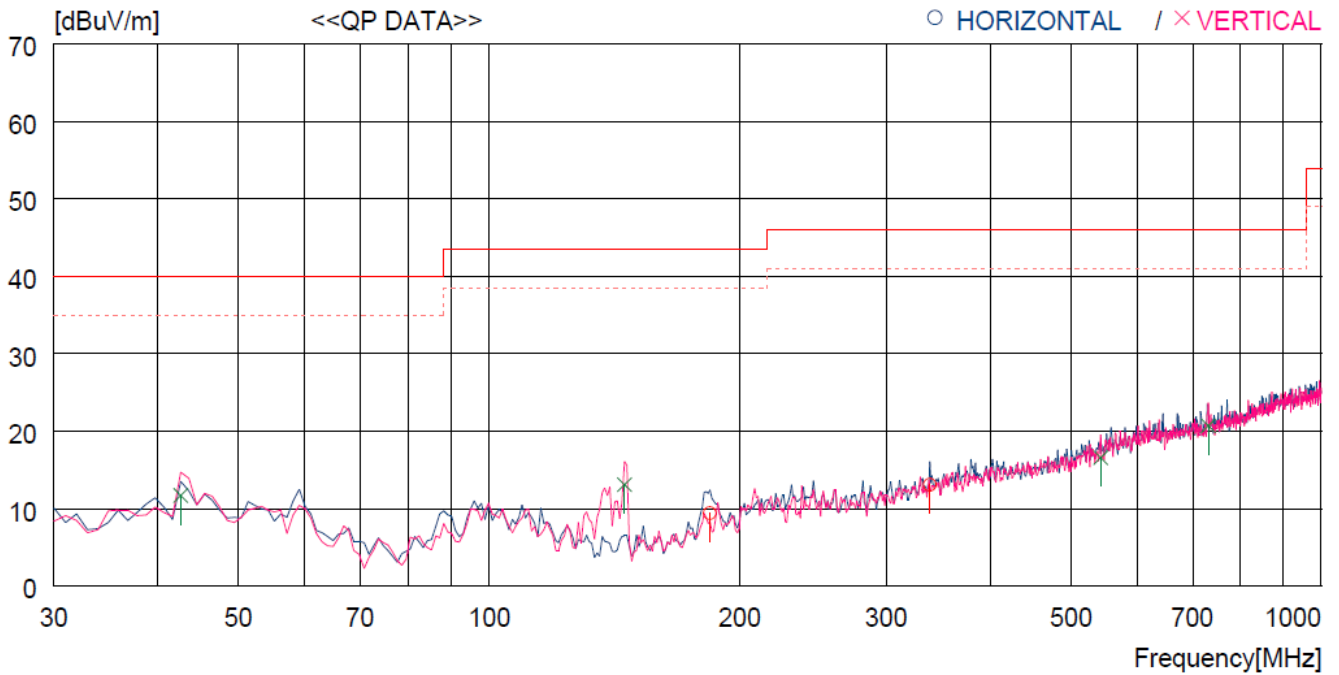
Humidity Level : 44 % R.H. Temperature: 24°C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Zigbee Module Date: November 23, 2017
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)
 Operating condition : Low Channel



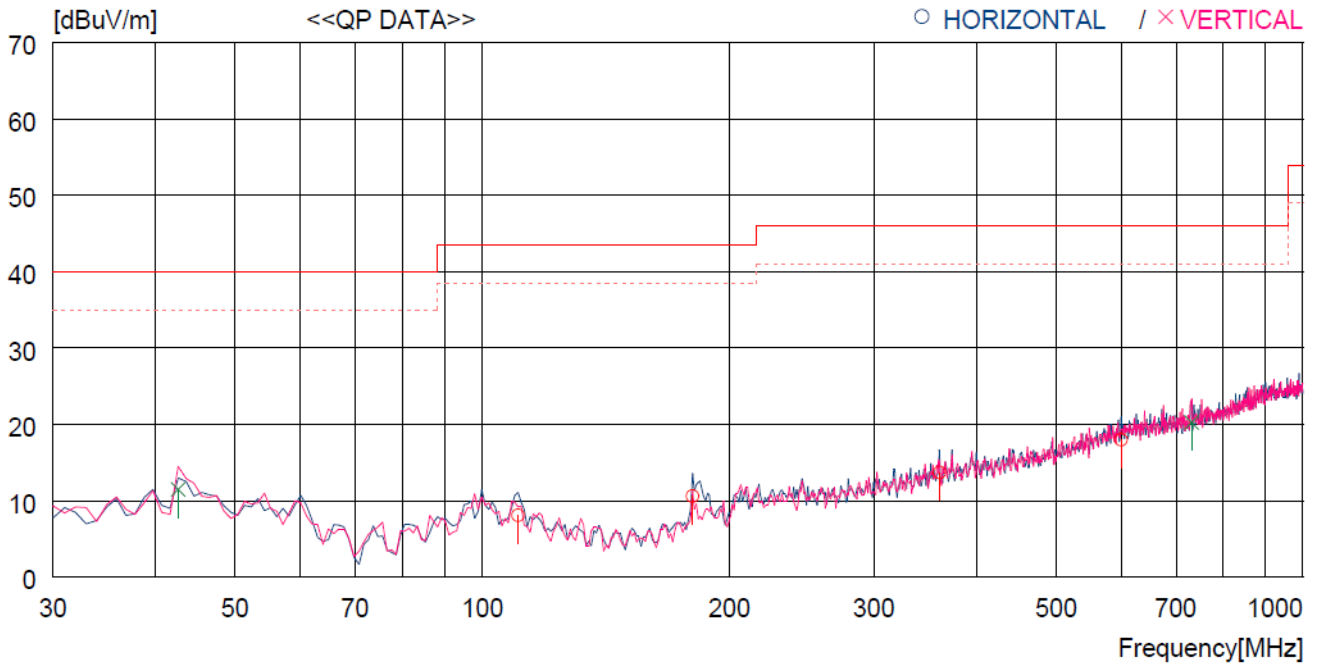
No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	183.260	30.1	9.8	3.2	33.1	10.0	43.5	33.5	400	359
2	315.180	27.1	13.5	4.1	33.0	11.7	46.0	34.3	400	356
3	956.337	27.0	22.0	7.2	32.1	24.1	46.0	21.9	400	81
----- Vertical -----										
4	42.610	29.0	13.7	1.7	33.1	11.3	40.0	28.7	400	0
5	97.900	27.8	11.5	2.4	33.0	8.7	43.5	34.8	400	0
6	550.889	26.8	17.5	5.4	33.3	16.4	46.0	29.6	400	0

Operating condition : Middle Channel



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	184.230	29.4	9.9	3.2	33.1	9.4	43.5	34.1	300	359
2	338.460	27.3	14.6	4.3	33.1	13.1	46.0	32.9	400	131
----- Vertical -----										
3	42.610	29.4	13.7	1.7	33.1	11.7	40.0	28.3	400	204
4	145.430	35.3	7.8	2.9	32.9	13.1	43.5	30.4	400	307
5	543.130	27.1	17.5	5.3	33.3	16.6	46.0	29.4	400	0
6	731.304	27.9	20.0	6.2	33.4	20.7	46.0	25.3	400	4

Operating condition : High Channel



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	110.510	27.1	11.5	2.5	33.0	8.1	43.5	35.4	400	235
2	180.350	31.1	9.4	3.2	33.1	10.6	43.5	32.9	400	0
3	360.770	28.0	14.4	4.4	33.1	13.7	46.0	32.3	400	294
4	600.358	26.4	19.3	5.6	33.3	18.0	46.0	28.0	400	354
----- Vertical -----										
5	42.610	29.2	13.7	1.7	33.1	11.5	40.0	28.5	400	359
6	731.304	27.5	20.0	6.2	33.4	20.3	46.0	25.7	400	359

Tested by: Hyung-Kwon, Oh / Assistant Manager

11.5 Test data for Below 30 MHz

- . Test Date : November 23, 2017
- . 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 (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									

11.6 Test data for above 1 GHz

- . Test Date : November 23, 2017
- . 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 (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/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 : 24 °C
 Relative humidity : 44 % 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 μH + 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.

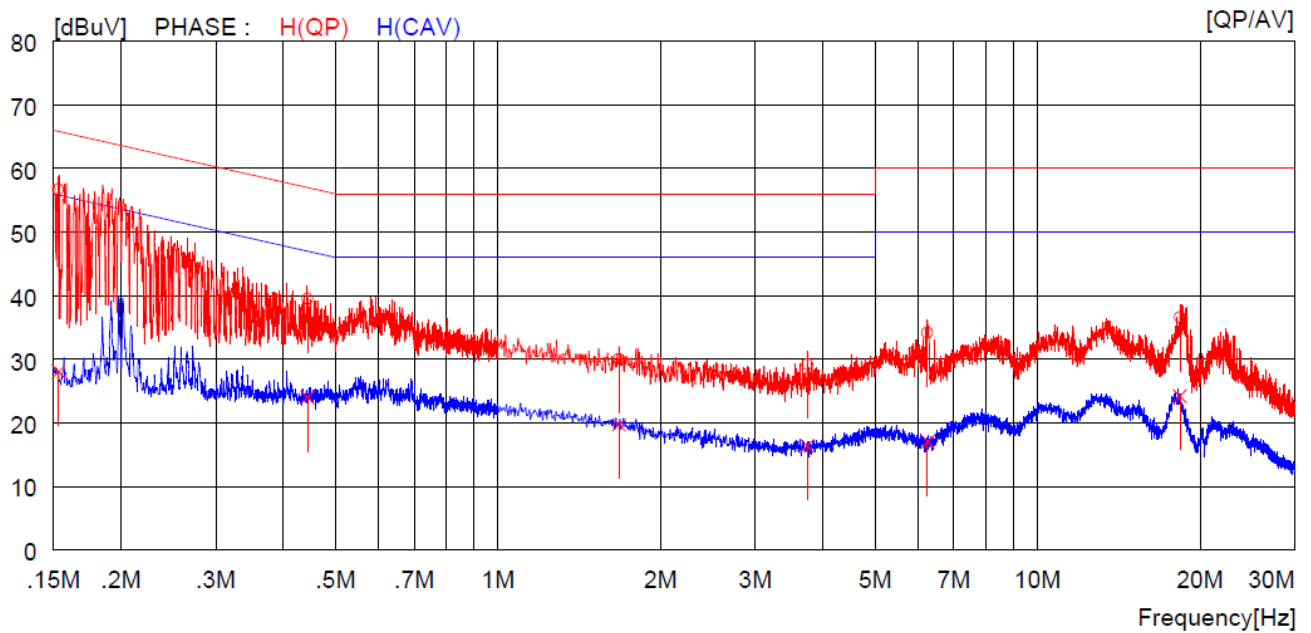
12.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ - ESPI	Rohde & Schwarz	Test Receiver	101012	Oct. 27, 2017 (1Y)
□ - ESHS10	Rohde & Schwarz	Test Receiver	834467/007	Apr. 03, 2017 (1Y)
□ - NSLK8128	Schwarzbeck	AMN	8128-216	Apr. 05, 2017 (1Y)
■ - NSLK8126	Schwarzbeck	AMN	8126-404	Apr. 03, 2017 (1Y)
□ - 3825/2	EMCO	AMN	9109-1869	Apr. 06, 2017 (1Y)
■ - 3825/2	EMCO	AMN	9109-1867	Apr. 07, 2017 (1Y)

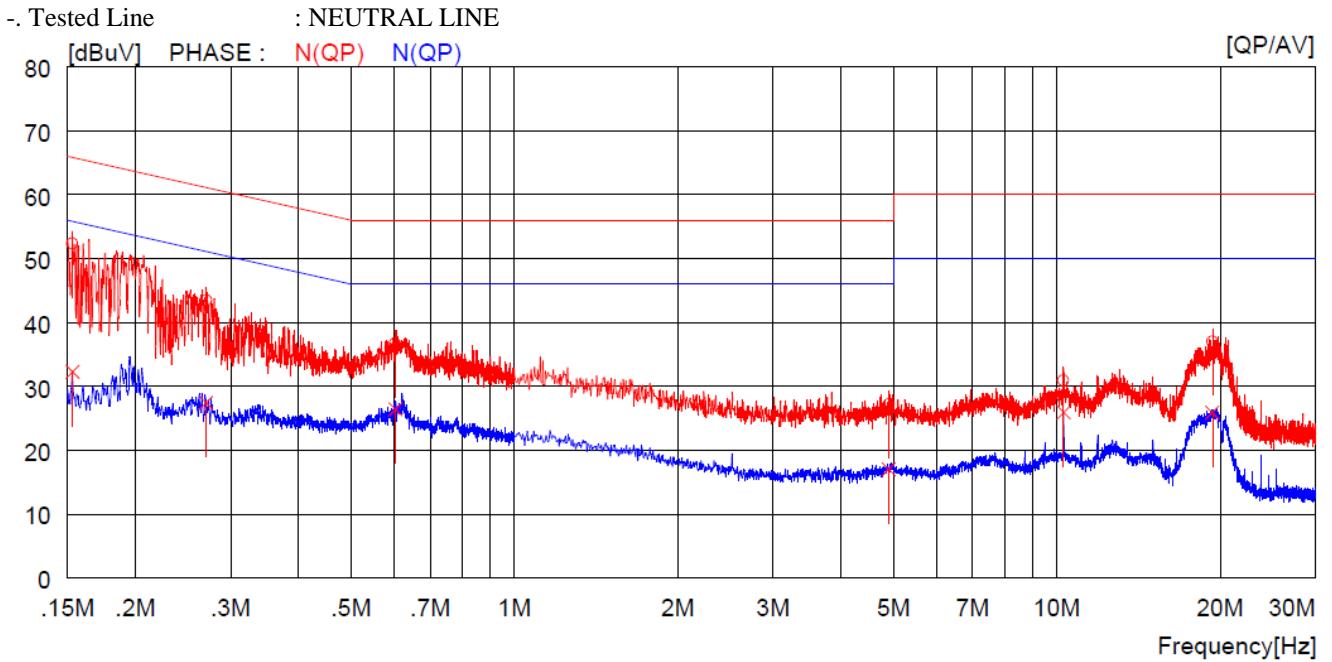
All test equipment used is calibrated on a regular basis.

12.4 Test data

- Test Date : November 23, 2017
- 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	0.15300	46.7	----	10.0	56.7	----	65.8	----	9.1	----	H(QP)
2	0.44300	29.5	----	10.0	39.5	----	57.0	----	17.5	----	H(QP)
3	1.67600	19.9	----	10.1	30.0	----	56.0	----	26.0	----	H(QP)
4	3.74000	19.0	----	10.2	29.2	----	56.0	----	26.8	----	H(QP)
5	6.25500	23.9	----	10.3	34.2	----	60.0	----	25.8	----	H(QP)
6	18.36000	25.9	----	10.7	36.6	----	60.0	----	23.4	----	H(QP)
7	0.15300	----	18.0	10.0	----	28.0	----	55.8	----	27.8	H(CAV)
8	0.44300	----	14.0	10.0	----	24.0	----	47.0	----	23.0	H(CAV)
9	1.67600	----	9.6	10.1	----	19.7	----	46.0	----	26.3	H(CAV)
10	3.74000	----	6.2	10.2	----	16.4	----	46.0	----	29.6	H(CAV)
11	6.25500	----	6.7	10.3	----	17.0	----	50.0	----	33.0	H(CAV)
12	18.36000	----	13.5	10.7	----	24.2	----	50.0	----	25.8	H(CAV)



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	0.15300	42.3	----	10.0	52.3	----	65.8	----	13.5	----	N (QP)
2	0.27000	33.5	----	10.0	43.5	----	61.1	----	17.6	----	N (QP)
3	0.60300	26.6	----	10.1	36.7	----	56.0	----	19.3	----	N (QP)
4	4.90000	17.0	----	10.2	27.2	----	56.0	----	28.8	----	N (QP)
5	10.29000	20.5	----	10.4	30.9	----	60.0	----	29.1	----	N (QP)
6	19.36000	26.3	----	10.7	37.0	----	60.0	----	23.0	----	N (QP)
7	0.15300	----	22.3	10.0	----	32.3	----	55.8	----	23.5	N (CAV)
8	0.27000	----	17.4	10.0	----	27.4	----	51.1	----	23.7	N (CAV)
9	0.60300	----	16.3	10.1	----	26.4	----	46.0	----	19.6	N (CAV)
10	4.90000	----	6.8	10.2	----	17.0	----	46.0	----	29.0	N (CAV)
11	10.29000	----	15.5	10.4	----	25.9	----	50.0	----	24.1	N (CAV)
12	19.36000	----	15.2	10.7	----	25.9	----	50.0	----	24.1	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