

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

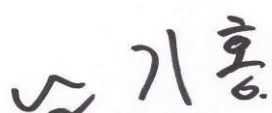
Test Report No. : W17OR-D015
AGR No. : A179A-389
Applicant : Samsung Electronics Co Ltd
Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States
Manufacturer : Samsung Electronics Co Ltd
Address : Maetan dong 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do 16677, Korea
Type of Equipment : DIAL CONTROLLER
FCC ID. : A3LTM1710A
Model Name : TM1710A
Serial number : N/A
Total page of Report : 51 pages (including this page)
Date of Incoming : October 10, 2017
Date of issue : October 19, 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
W17OR-D015	October 19, 2017	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : Samsung Electronics Co Ltd

Address : 19 Chapin Rd., Building D, Pine Brook, New Jersey, 07058, United States

Contact Person : minhyung, cho / Senior Engineer

Telephone No. : +82-31-277-2688

FCC ID : A3LTM1710A

Model Name : TM1710A

Brand Name : 

Serial Number : N/A

Date : October 19, 2017

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	DIAL CONTROLLER
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 Samsung Electronics Co Ltd, Model TM1710A (referred to as the EUT in this report) is a DIAL CONTROLLER. The product specification described herein was obtained from product data sheet or user's manual.

Device Type	DIAL CONTROLLER
Temperature Range	-10 °C ~ 40 °C
Operating Frequency	2 402 MHz ~ 2 480 MHz
RF Output Power	4.61 dBm
Number of Channel	40 Channel
Modulation Type	GFSK (Bluetooth LE)
Antenna Type	Chip Antenna
Antenna Gain	1.99 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	Samsung Electronics Co Ltd	TM1710	N/A
Battery	N/A	YU10453-16003	N/A

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested: None

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 2 402 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 LISN. 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 Chip 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

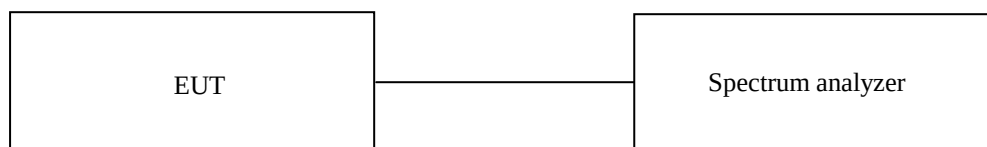
7. MINIMUM 6 dB BANDWIDTH

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

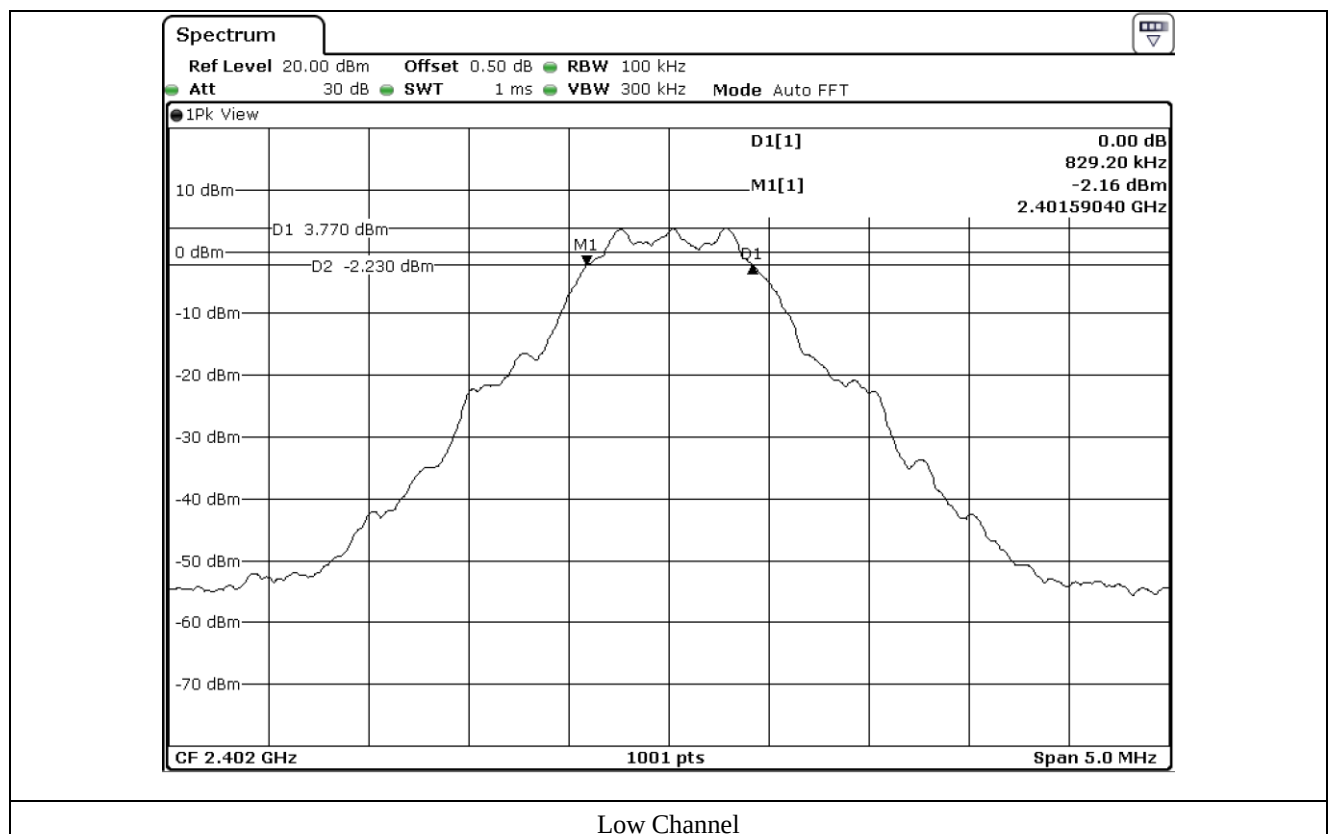
-. Test Date : October 17, 2017 ~ October 19, 2017

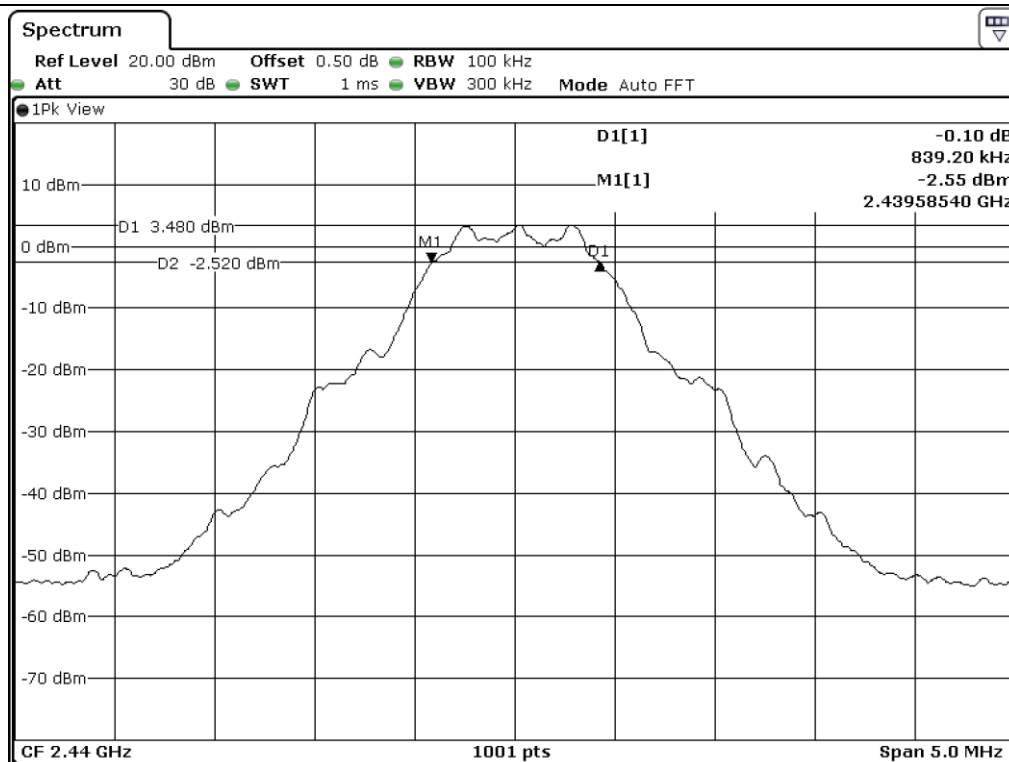
-. Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	829.20	500.00	329.20
Middle	2 440.00	839.20	500.00	339.20
High	2 480.00	834.20	500.00	334.20

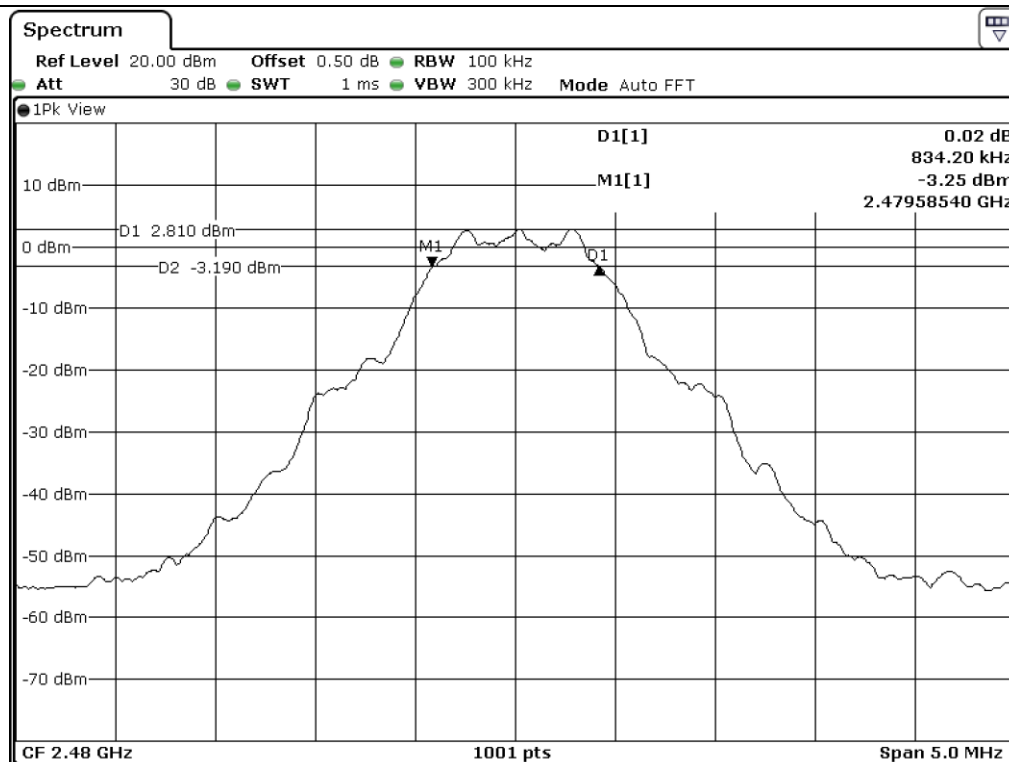
Remark. Margin = Measured Value - Limit

Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

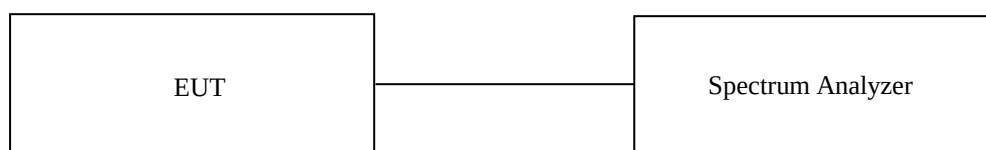
8.1 Operating environment

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 : October 17, 2017 ~ October 19, 2017

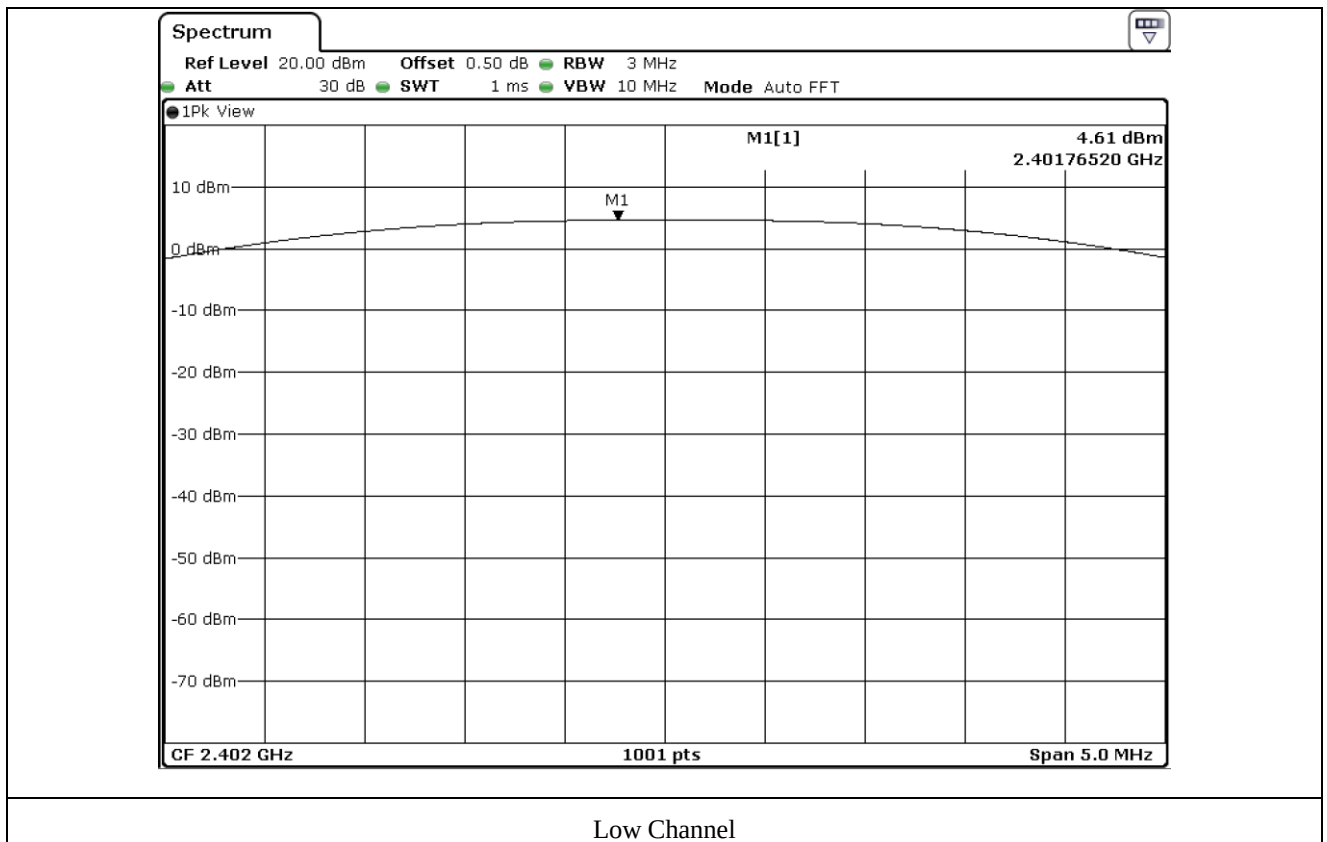
-. Test Result : Pass

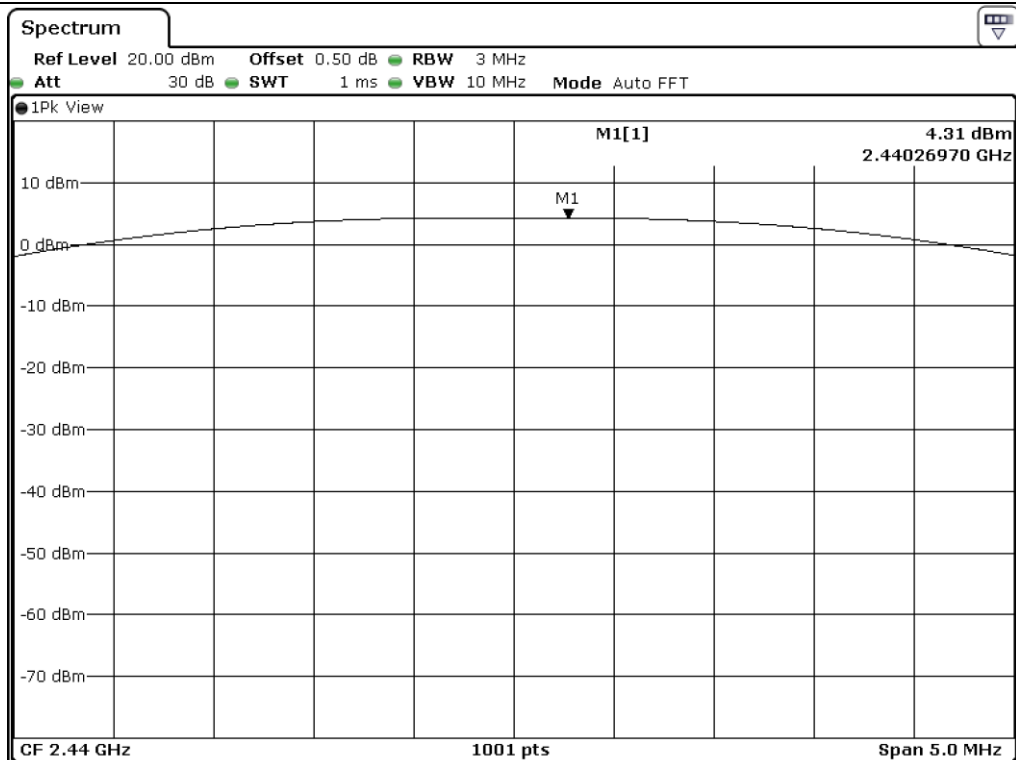
CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	4.61	30.00	25.39
MIDDLE	2 440.00	4.31	30.00	25.69
HIGH	2 480.00	3.61	30.00	26.39

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

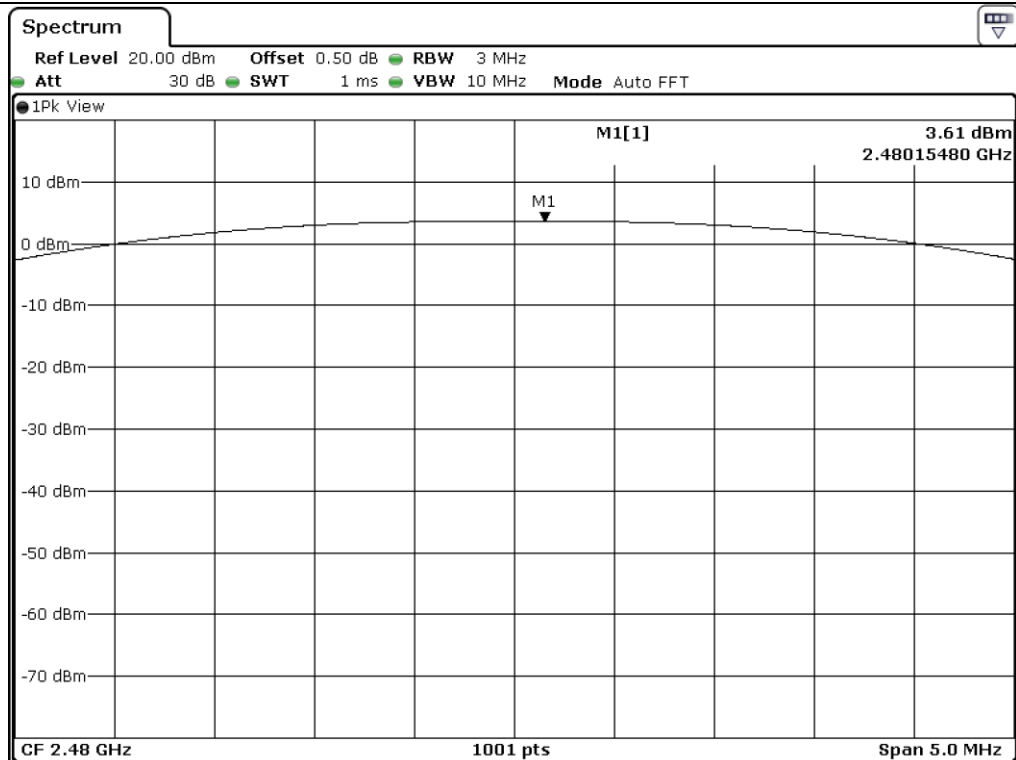


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 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.

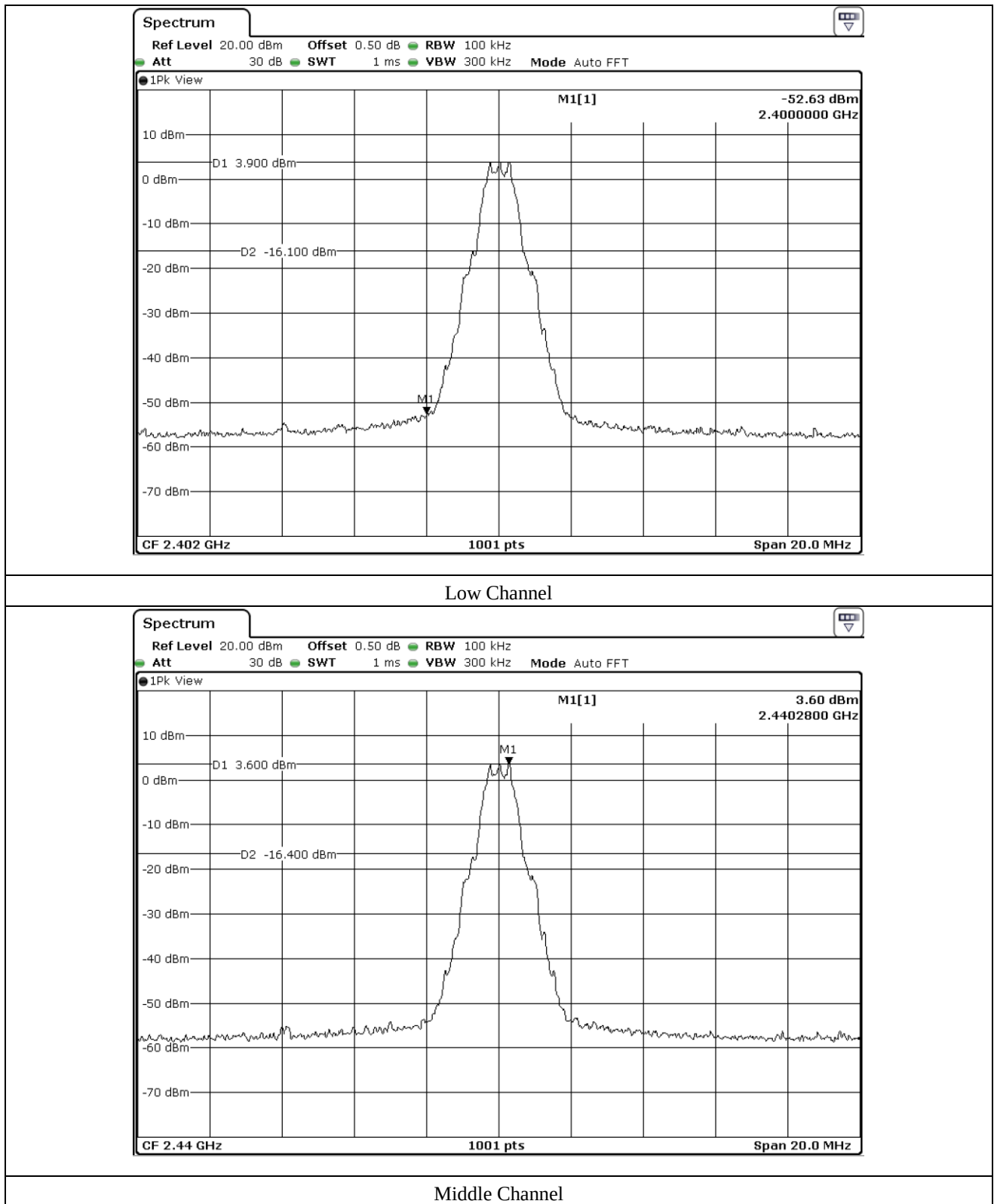
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal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

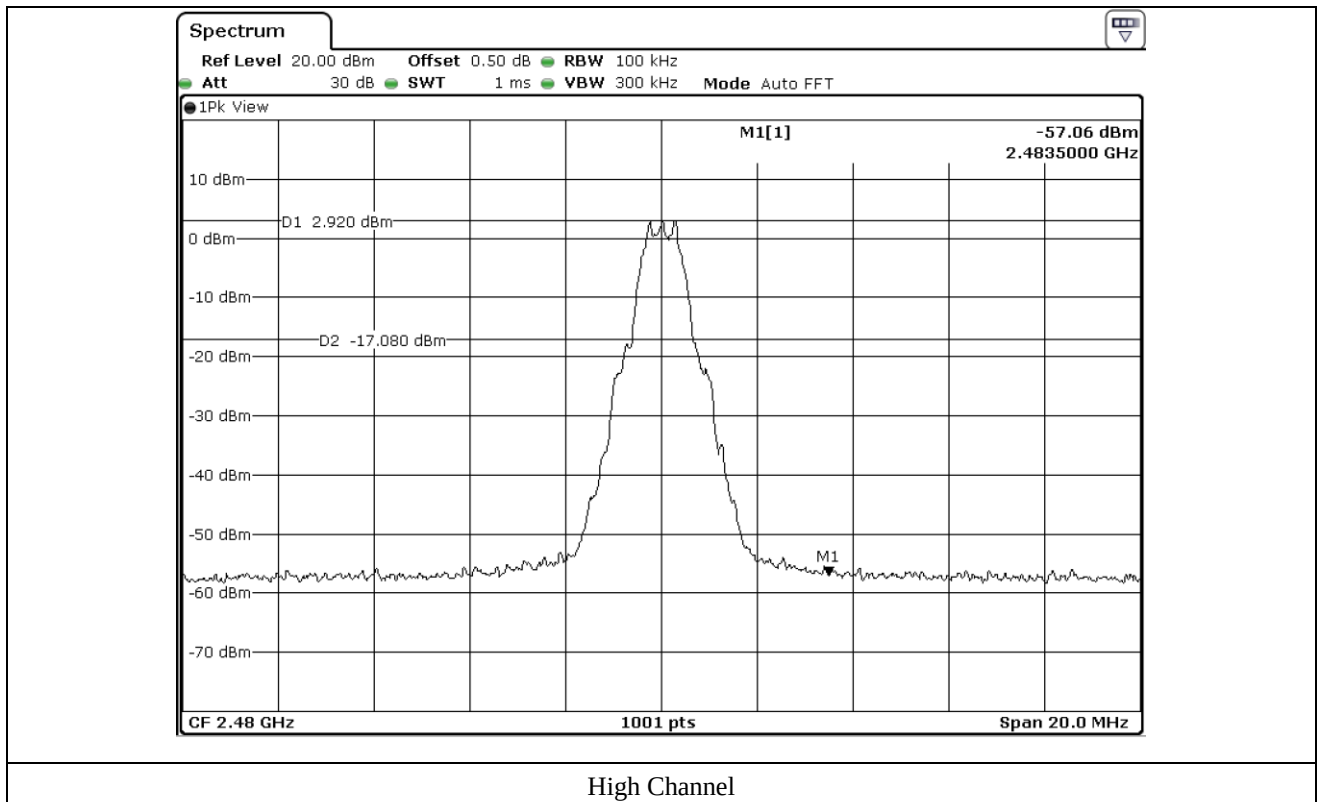
9.4 Test equipment used

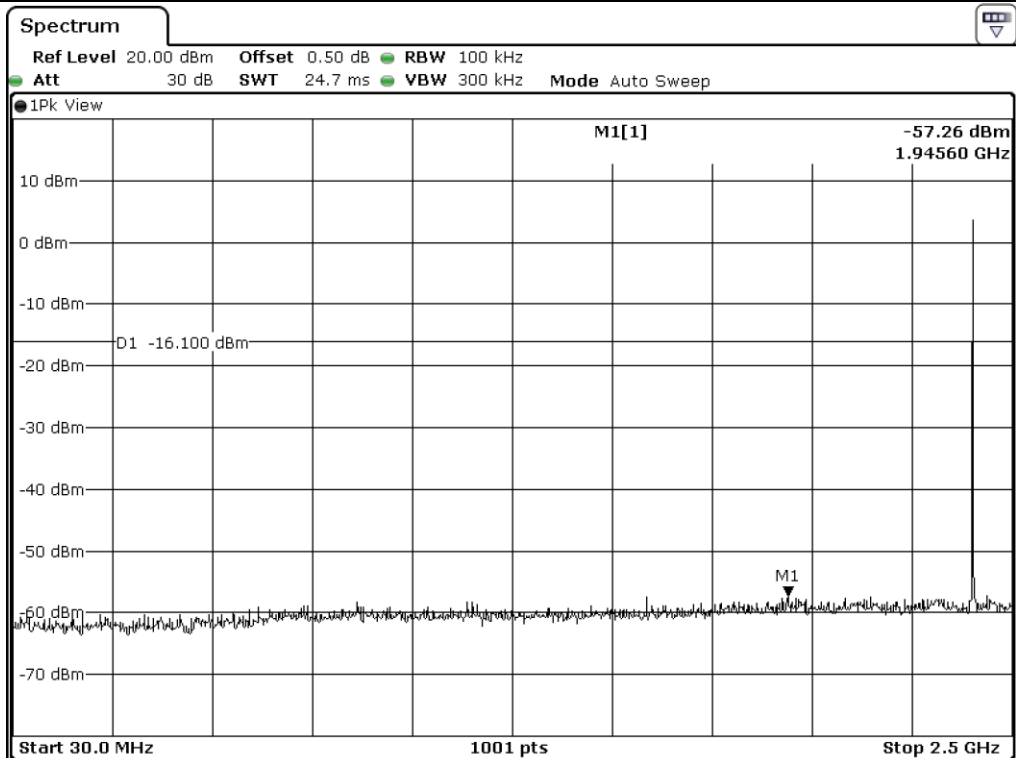
Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 06, 2017 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 05, 2017 (1Y)
■ - BBV9718	Schwarzbeck	Amplifier	310	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.

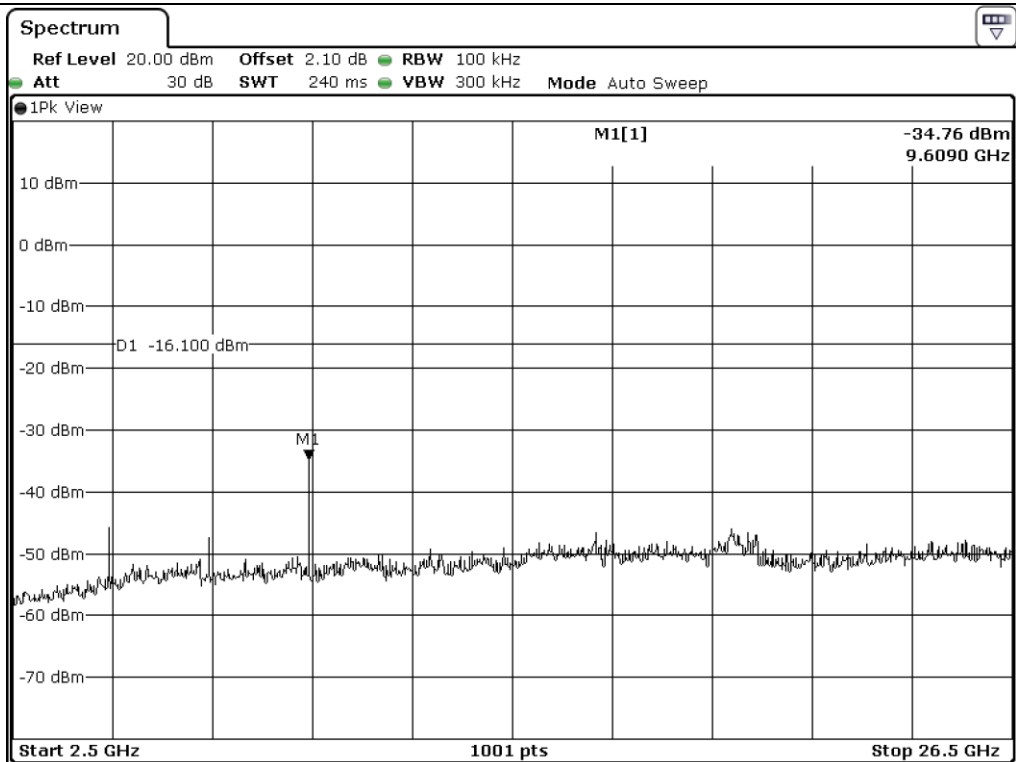
9.5 Test data for conducted emission



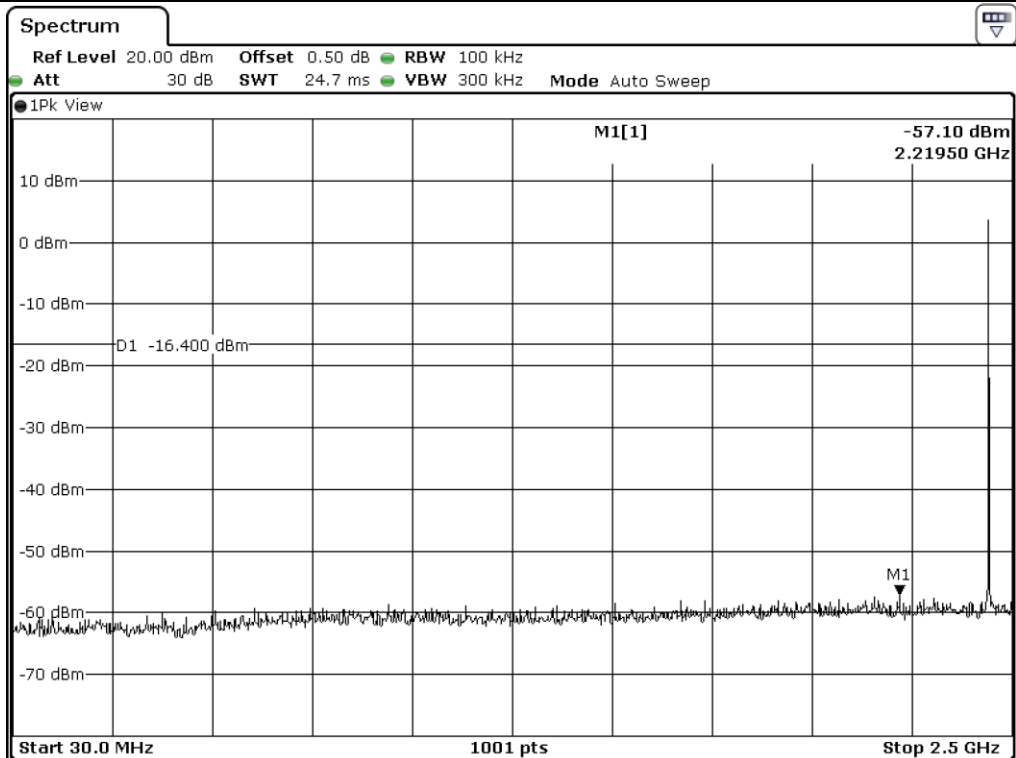




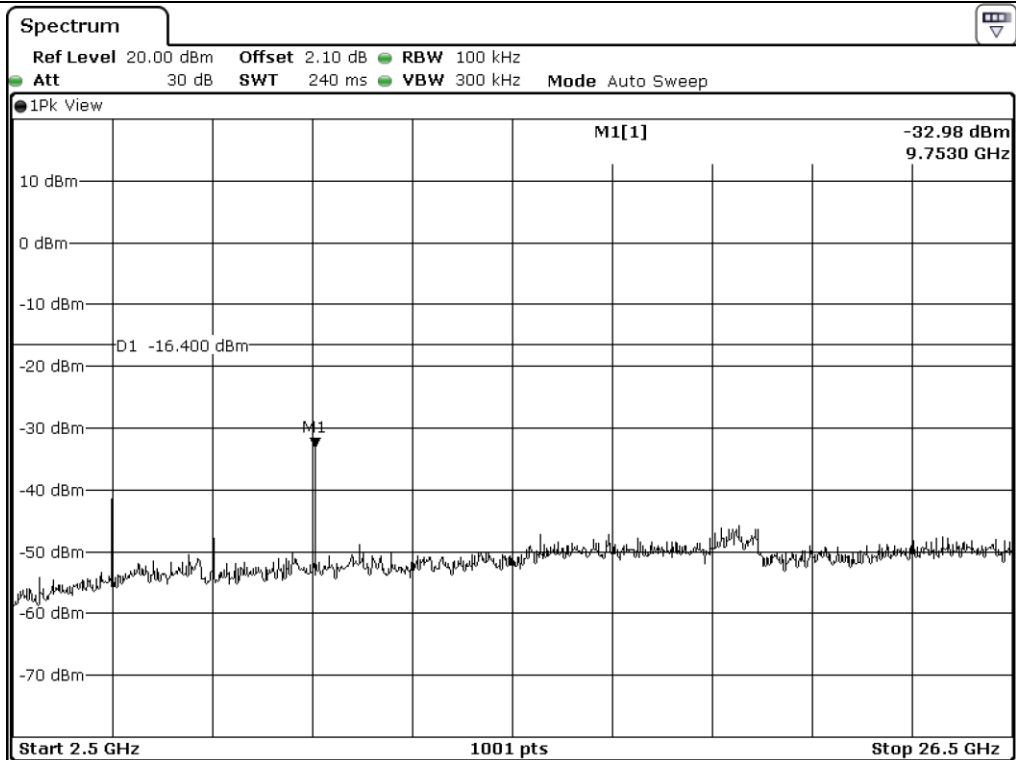
Low Channel



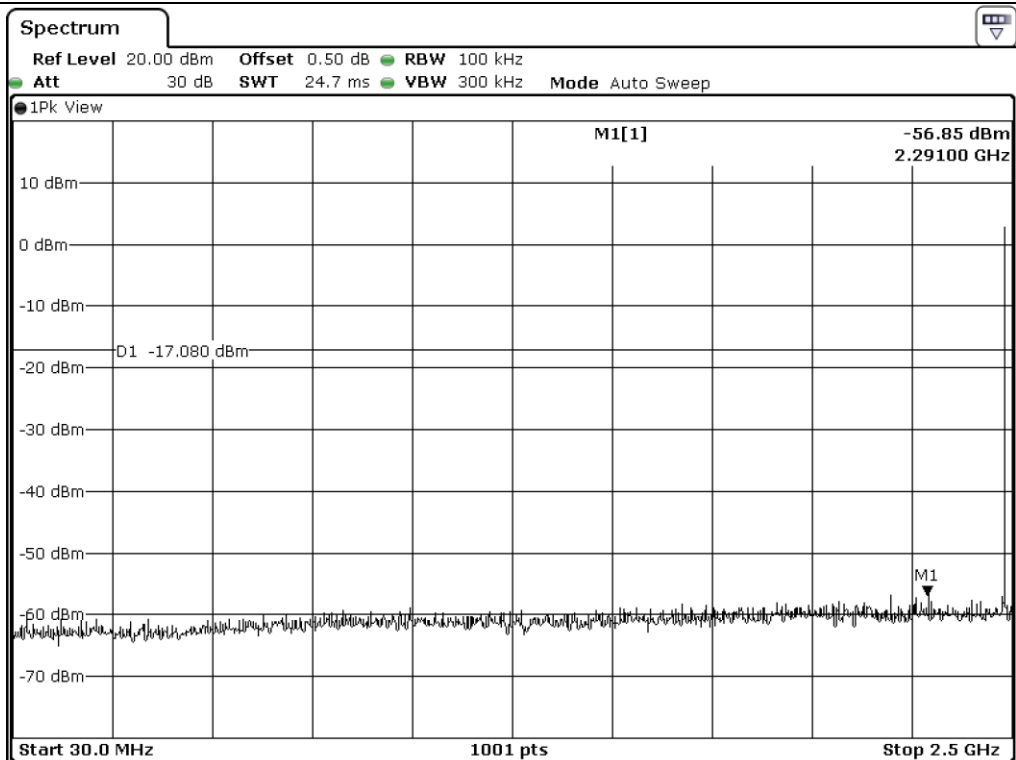
Low Channel



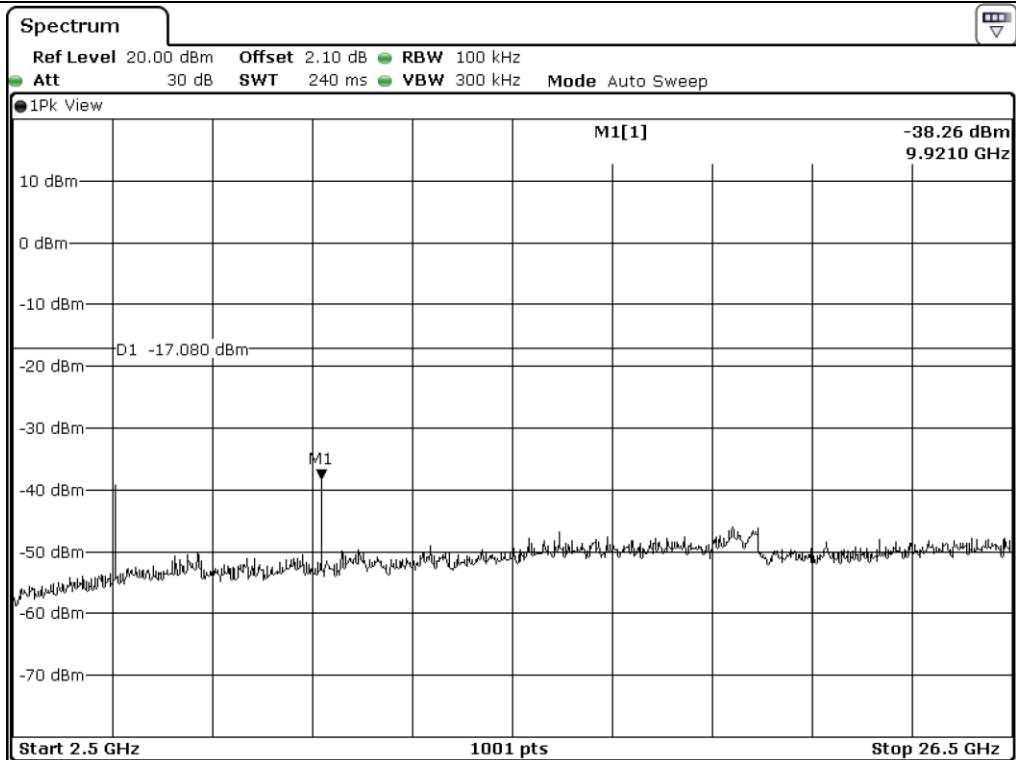
Middle Channel



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 : October 17, 2017 ~ October 19, 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 (MHz)	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									
2 372.875	39.08	Peak	H	26.65	11.36	42.75	34.34	74.00	39.66
2 338.139	27.95	Average	H	26.64	11.36	42.75	23.20	54.00	30.80
2 313.844	42.44	Peak	V	26.63	11.36	42.75	37.68	74.00	36.32
2 325.042	29.27	Average	V	26.64	11.36	42.75	24.52	54.00	29.48
Test Data for High Channel									
2 484.180	47.36	Peak	H	27.10	11.39	42.92	42.93	74.00	31.07
2 484.272	31.24	Average	H	27.10	11.39	42.92	26.81	54.00	27.19
2 484.203	41.25	Peak	V	27.10	11.39	42.92	36.82	74.00	37.18
2 484.387	27.55	Average	V	27.10	11.39	42.92	23.12	54.00	30.88

Tabulated test data for Restricted Band

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

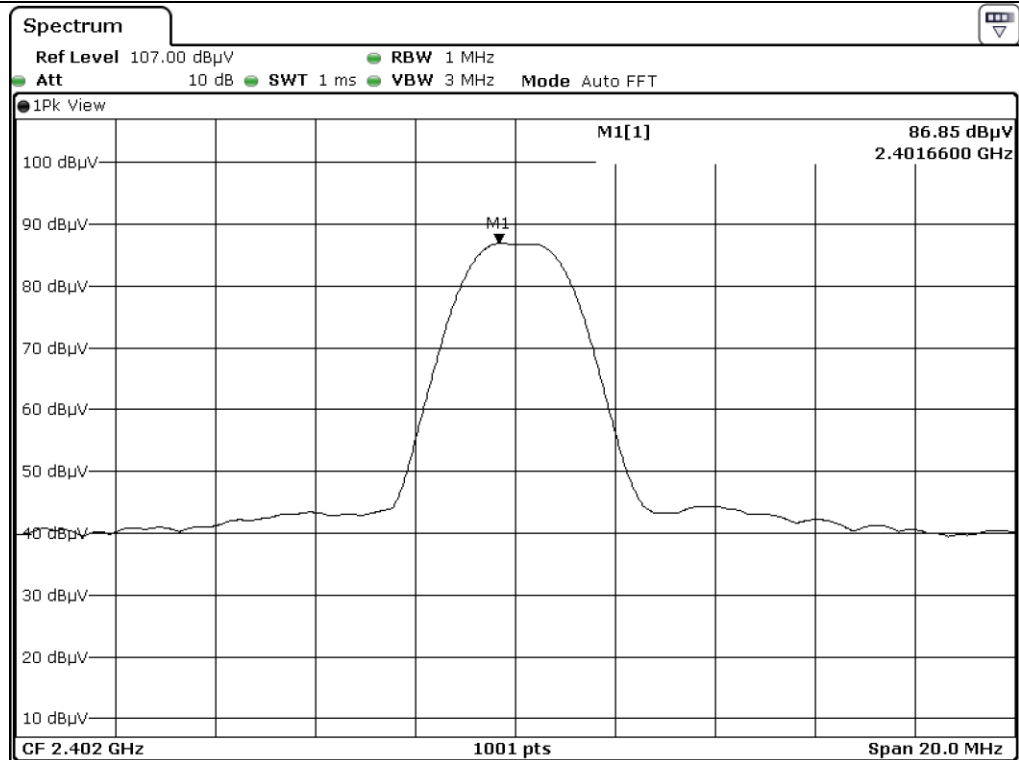
Margin (dB) = Limits (dBμV/m) - Total Level (dBμV/m)

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

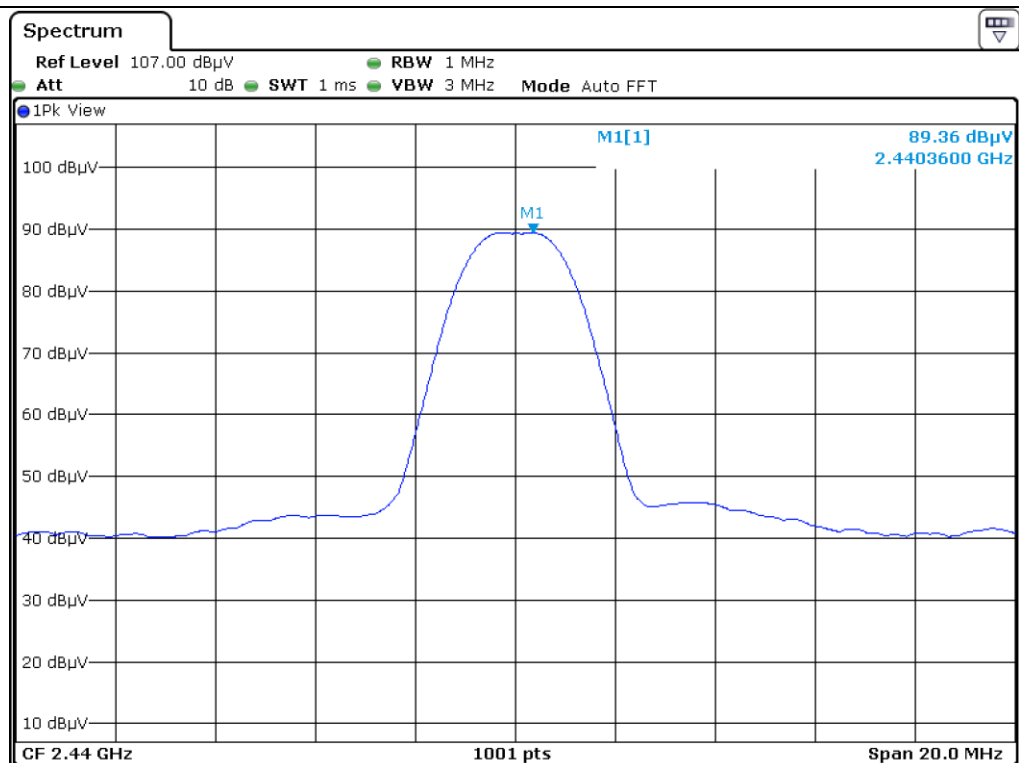


Tested by: Hyung-Kwon, Oh / Assistant Manager

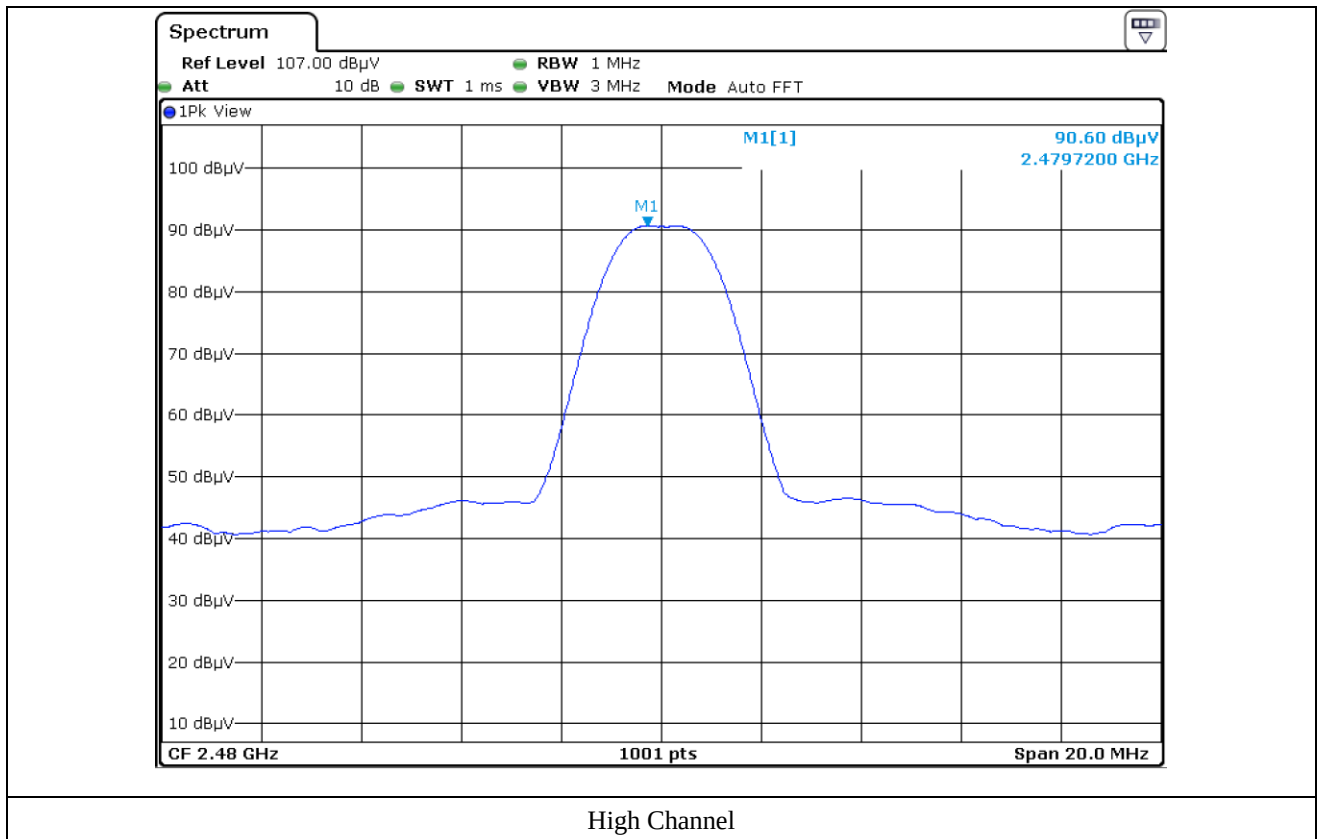
Fundamental of the signal

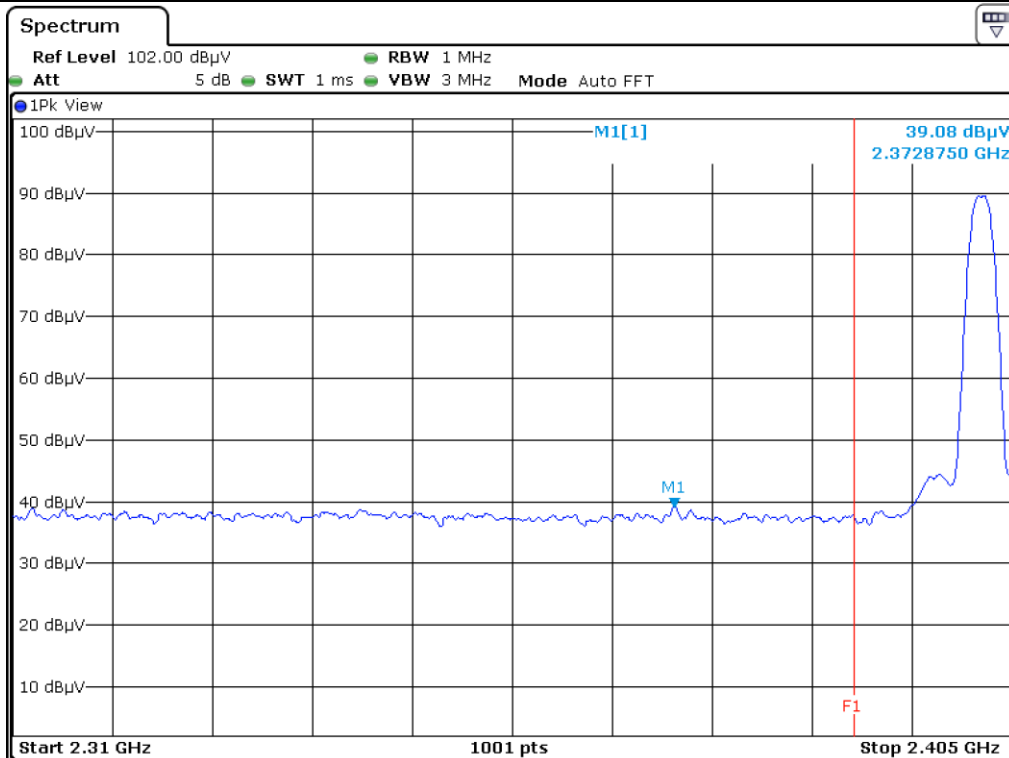


Low Channel

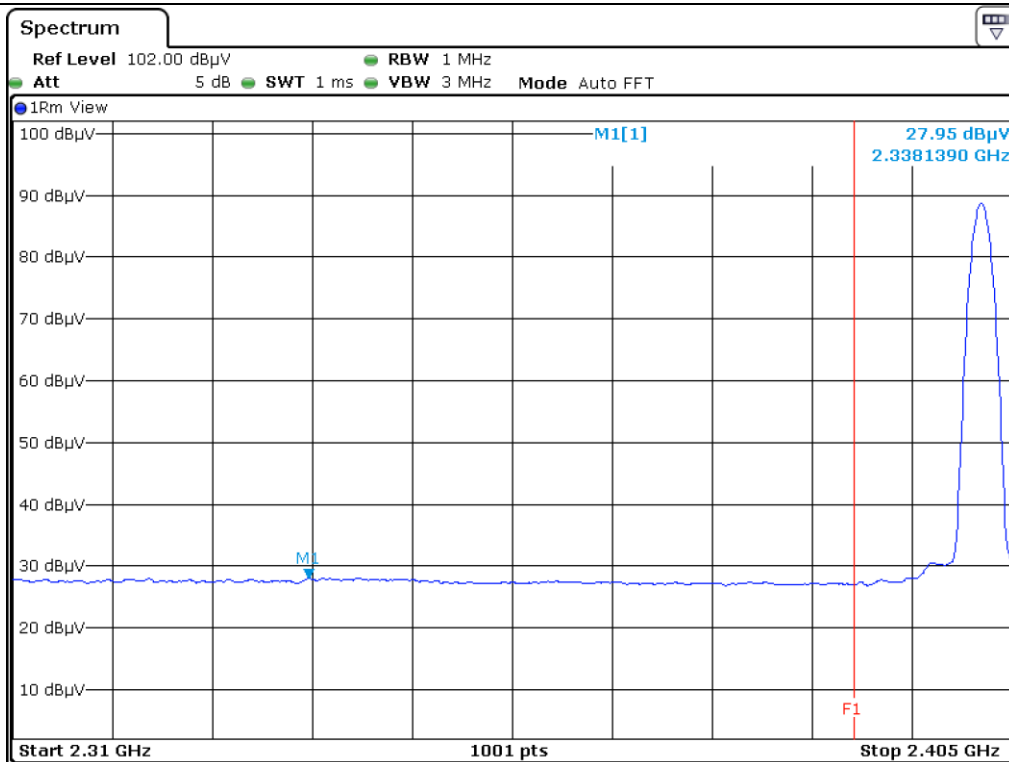


Middle Channel

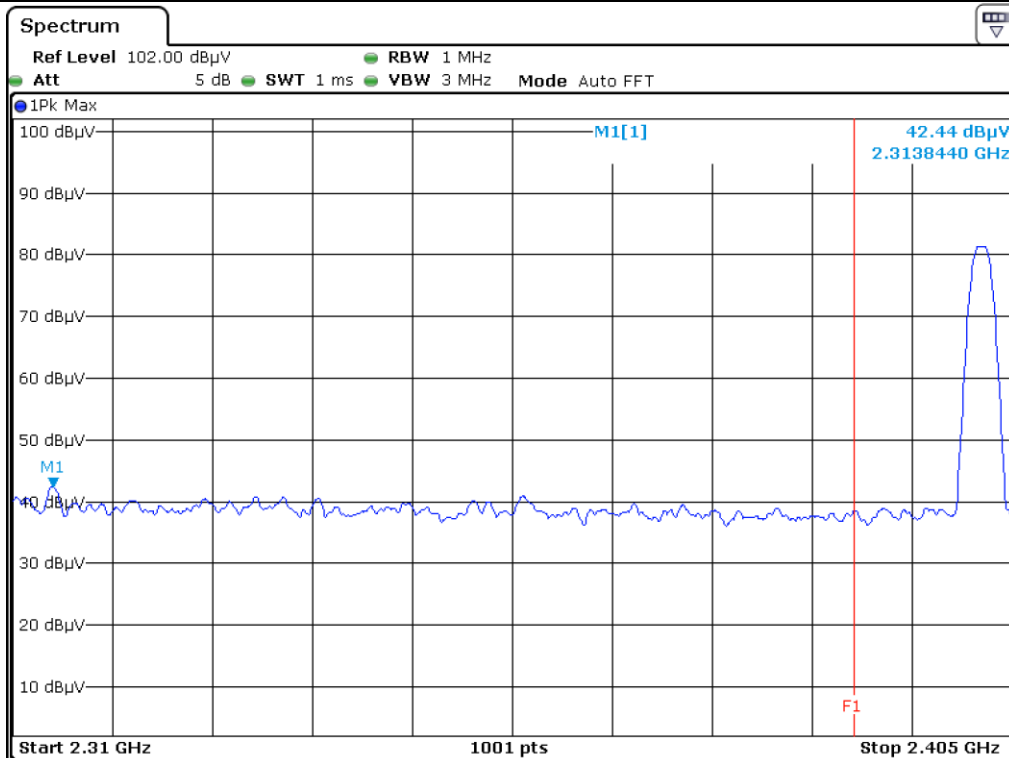




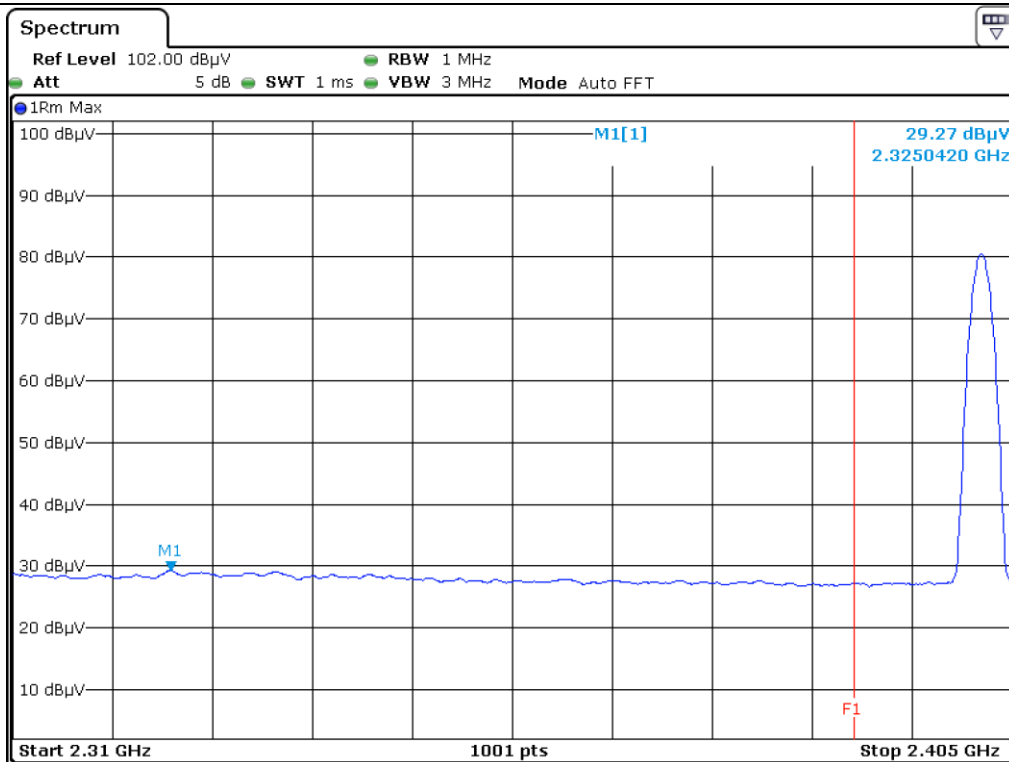
Low Channel _ Peak _ H



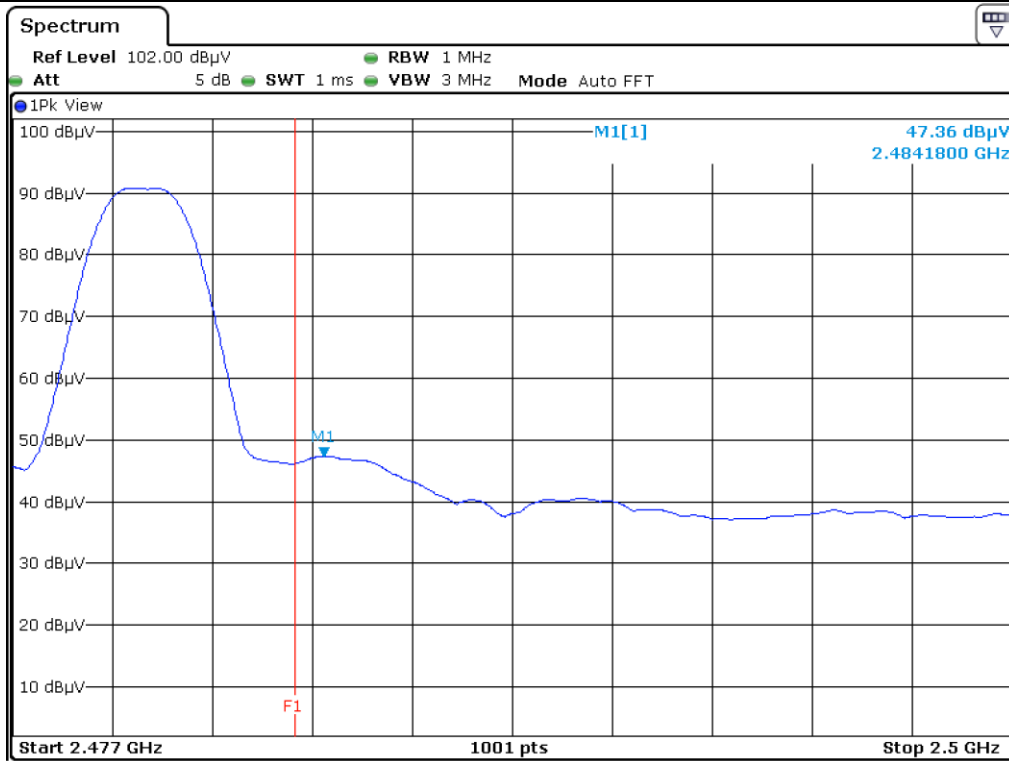
Low Channel _ Average _ H



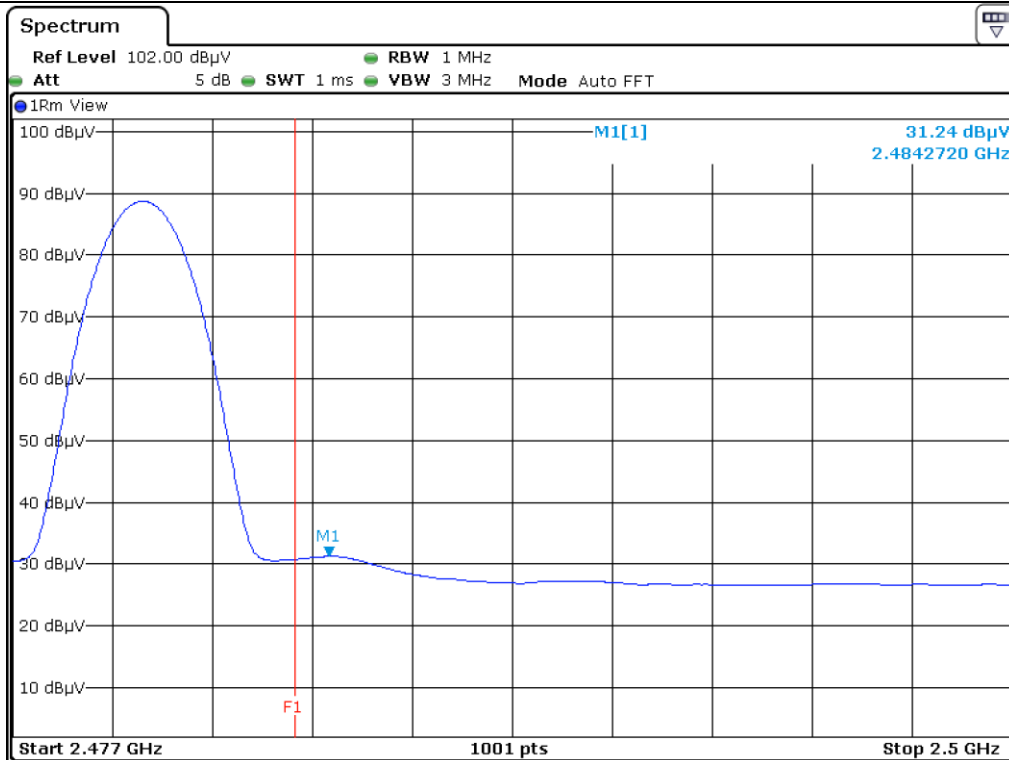
Low Channel _ Peak _ V



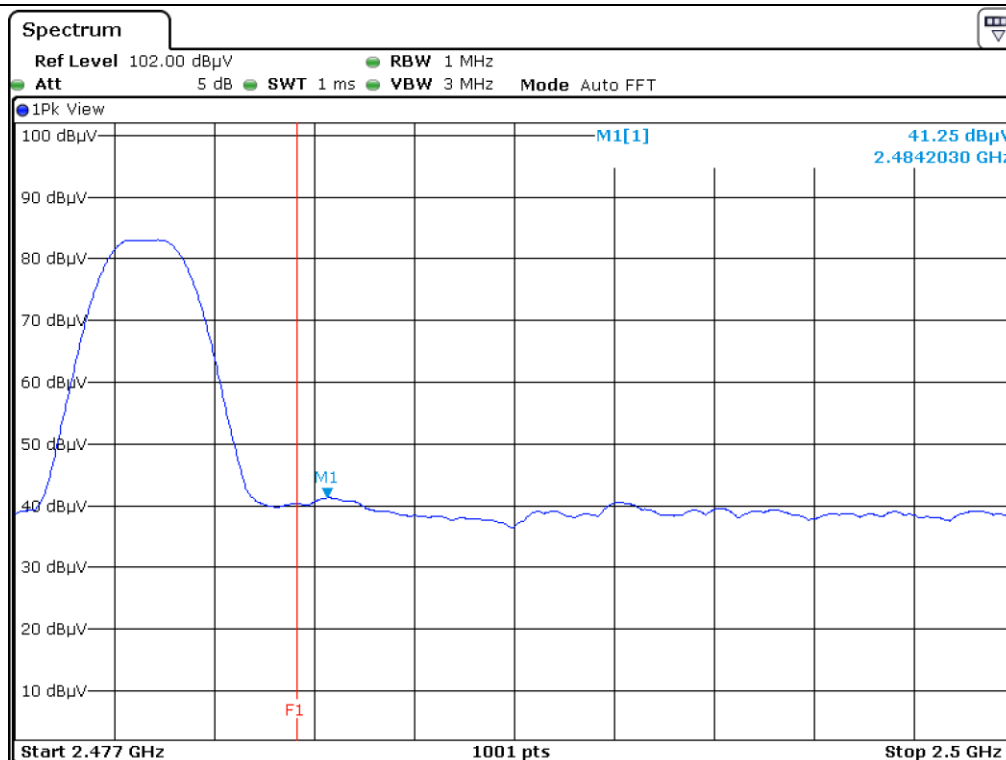
Low Channel _ Average _ V



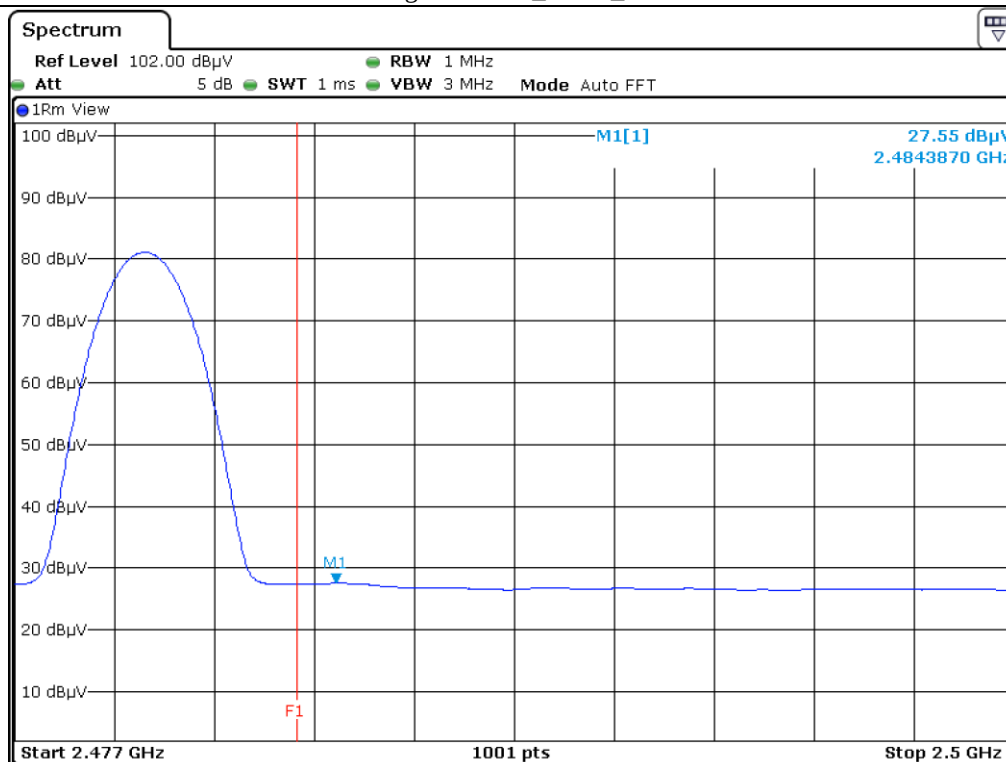
High Channel _ Peak _ H



High Channel _ Average _ H



High Channel _ Peak _ V



High Channel _ Average _ V

9.6.2 Spurious & Harmonic Radiated Emission

- Test Date : October 17, 2017 ~ October 19, 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 (MHz)	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	52.02	Peak	H	31.32	16.10	43.83	55.61	74.00	18.39
	42.73	Average	H				46.32	54.00	7.68
	42.08	Peak	V				45.67	74.00	28.33
	33.91	Average	V				37.50	54.00	16.50
Test Data for Middle Channel									
4 880.000	51.95	Peak	H	31.82	16.30	43.86	56.21	74.00	17.79
	42.14	Average	H				46.40	54.00	7.60
	42.69	Peak	V				46.95	74.00	27.05
	35.38	Average	V				39.64	54.00	14.36
Test Data for High Channel									
4 960.000	52.08	Peak	H	32.32	16.50	43.92	56.98	74.00	17.02
	43.62	Average	H				48.52	54.00	5.48
	42.93	Peak	V				47.83	74.00	26.17
	35.04	Average	V				39.94	54.00	14.06

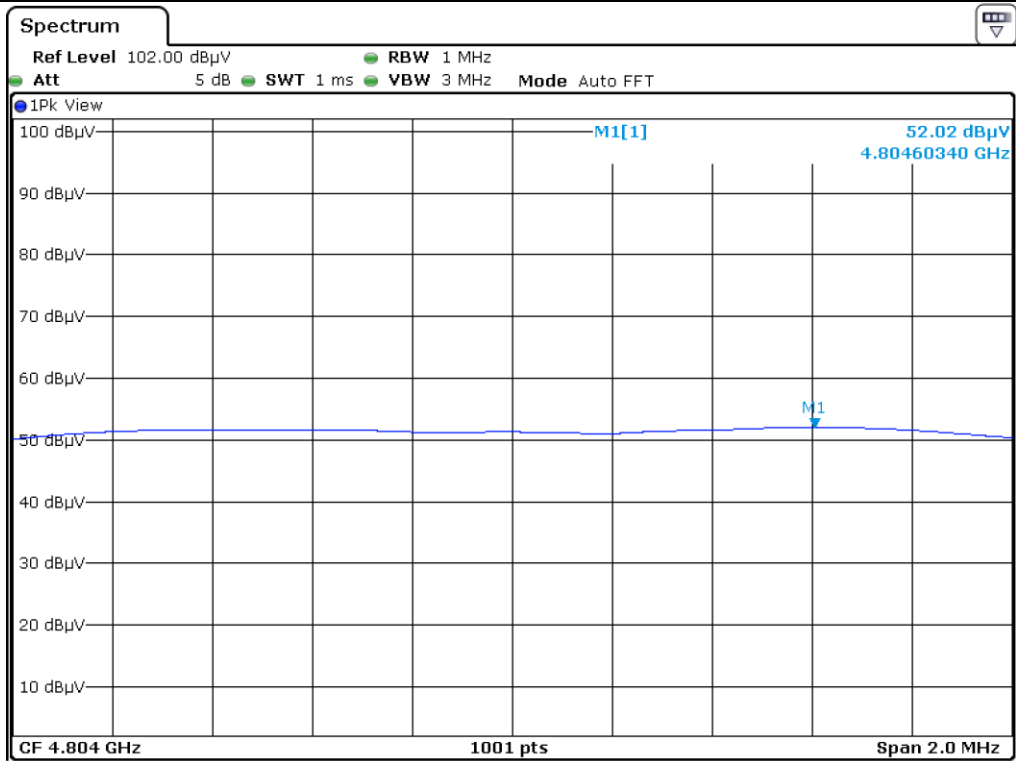
Tabulated test data for Restricted Band

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

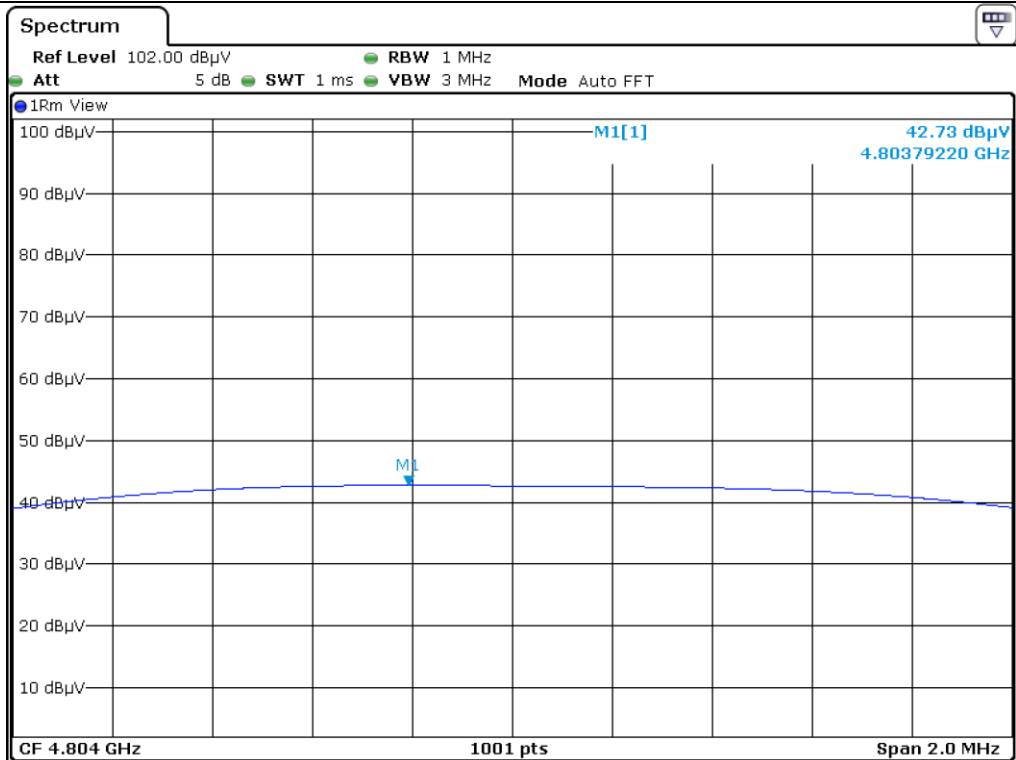
$$\text{Margin (dB)} = \text{Limits (dBμV/m)} - \text{Total Level (dBμV/m)}$$

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

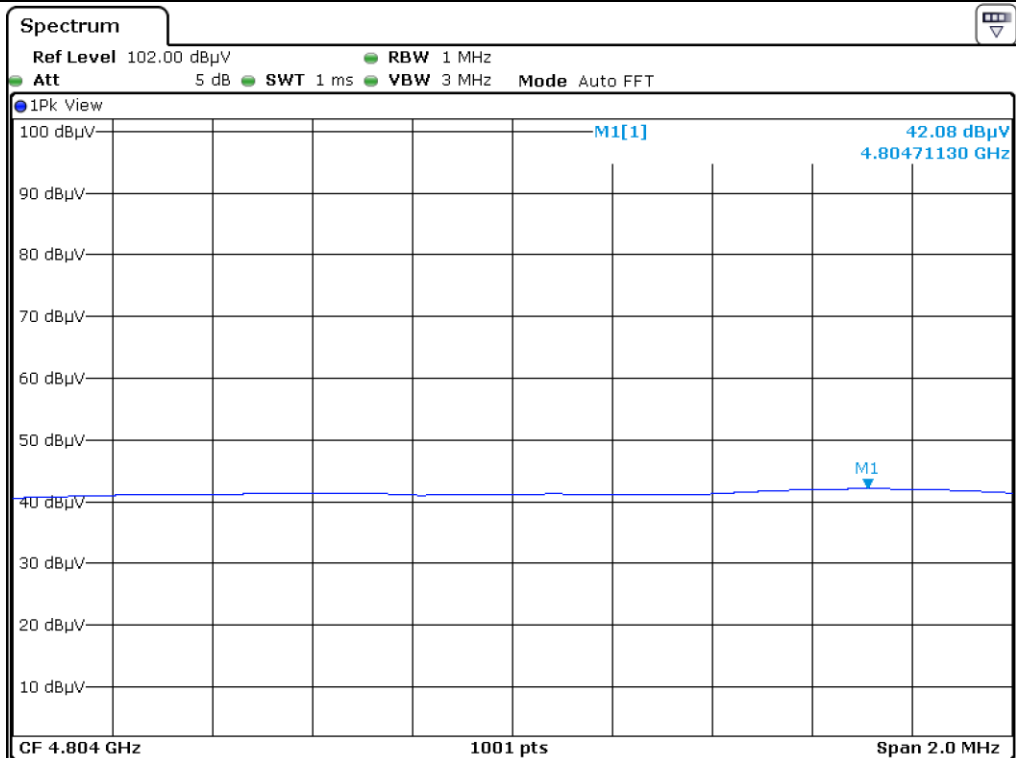
Tested by: Hyung-Kwon, Oh / Assistant Manager



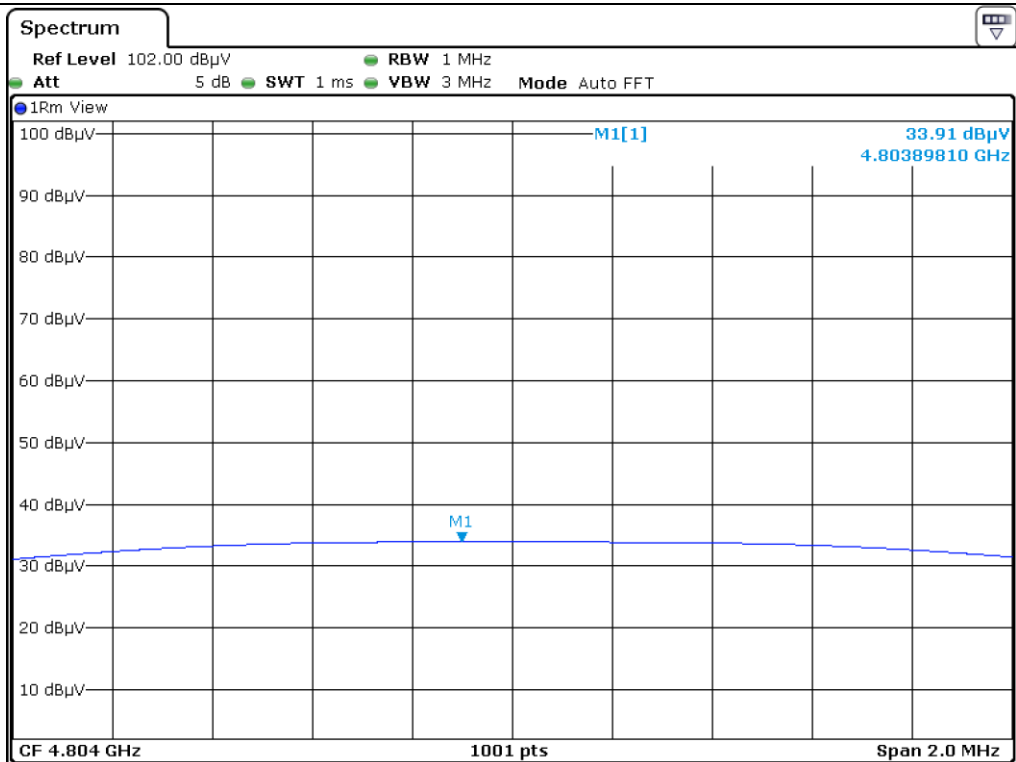
Low Channel _ Peak _ H



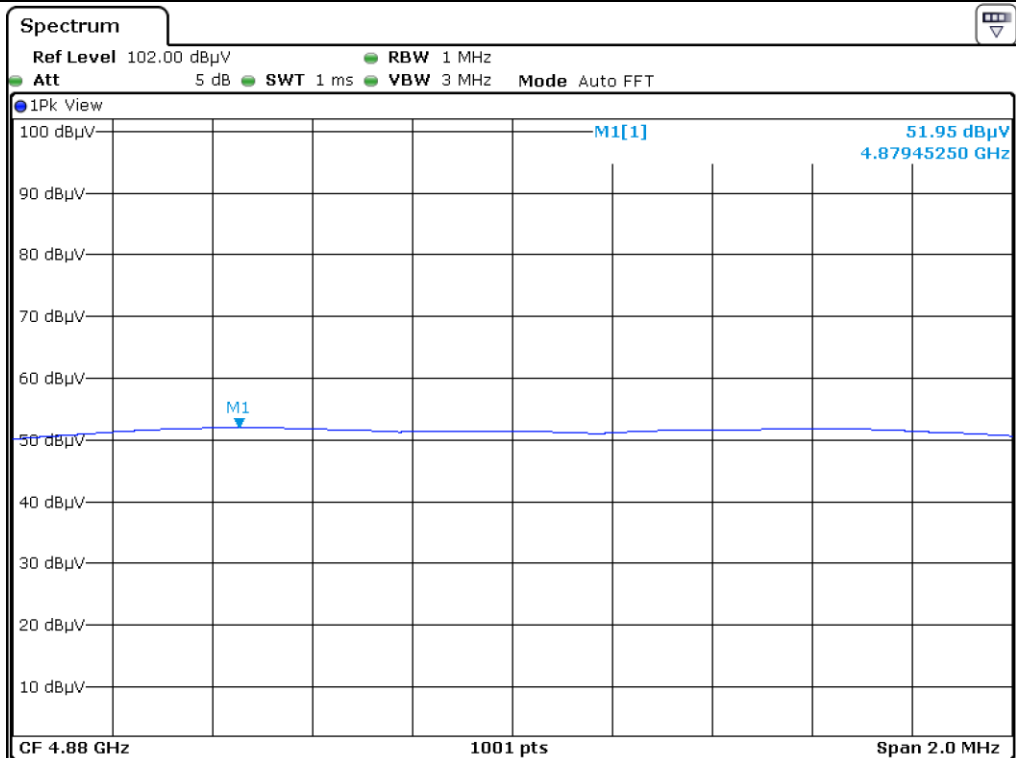
Low Channel _ Average _ H



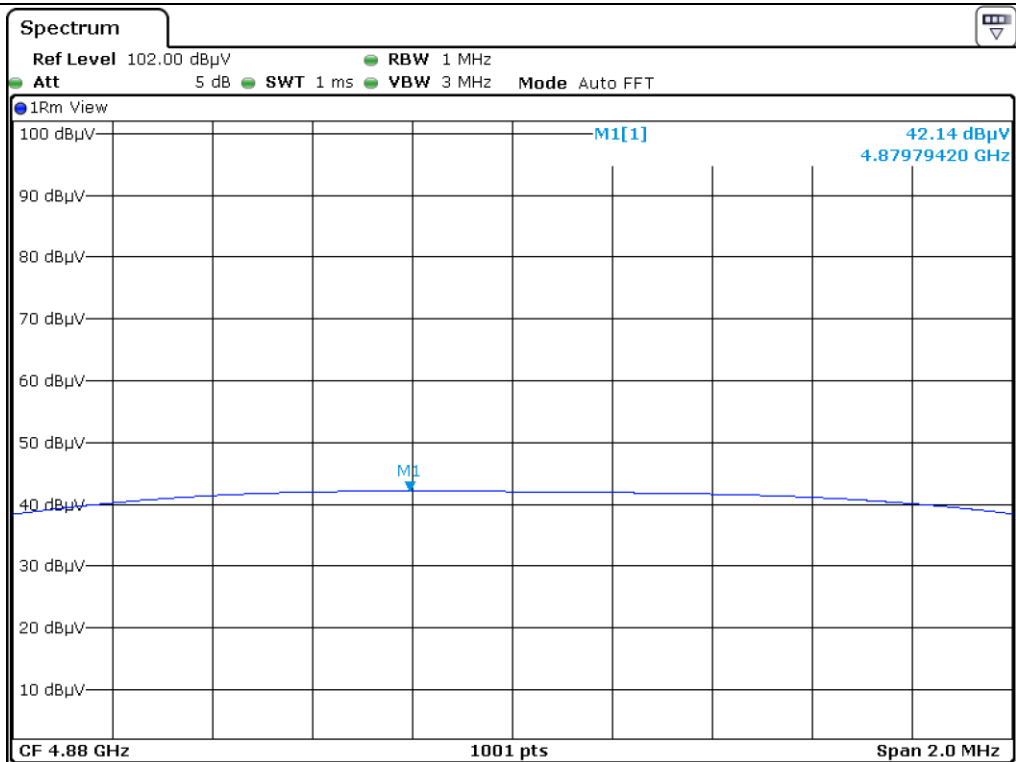
Low Channel _ Peak _ V



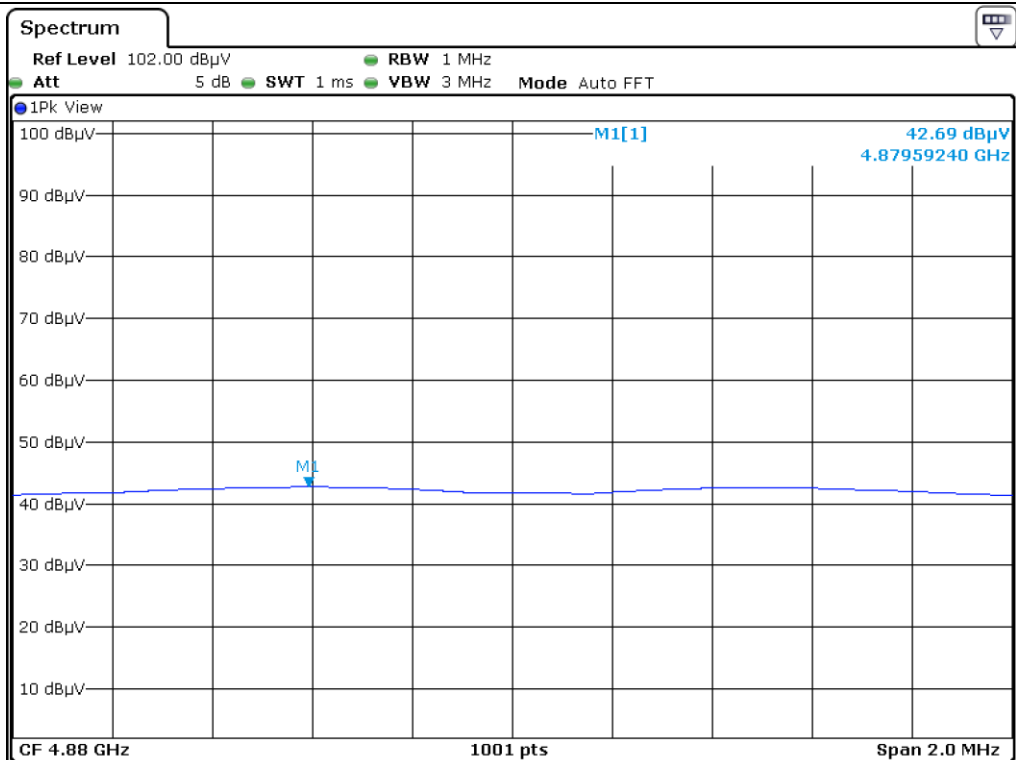
Low Channel _ Average _ V



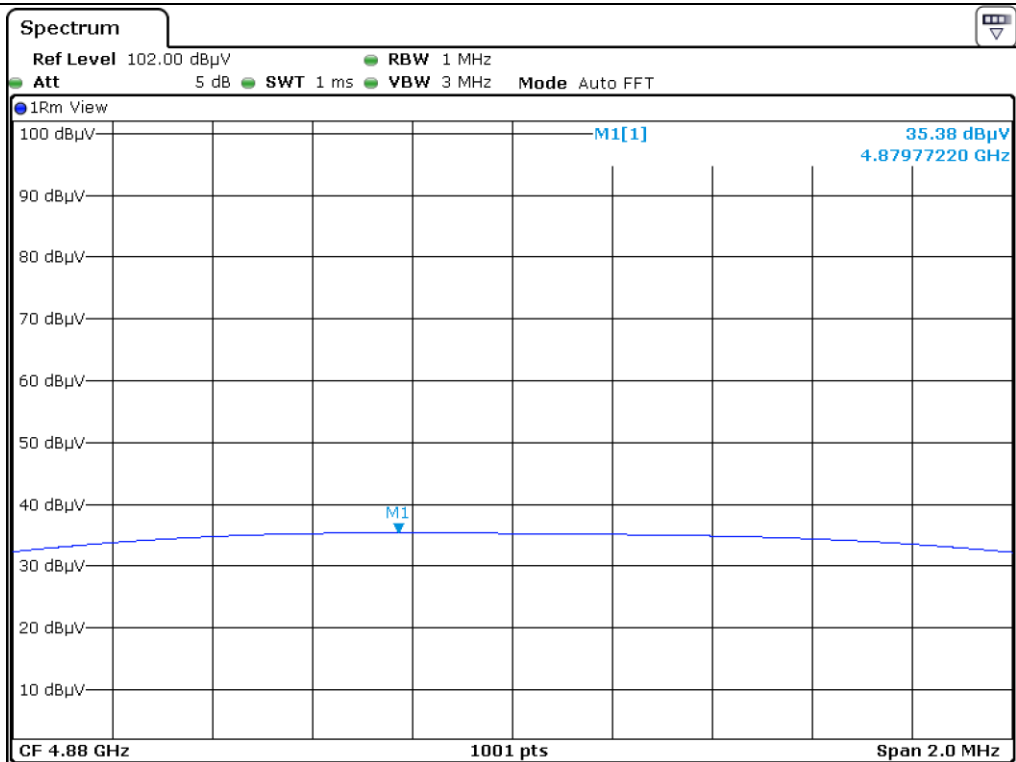
Middle Channel _ Peak _ H



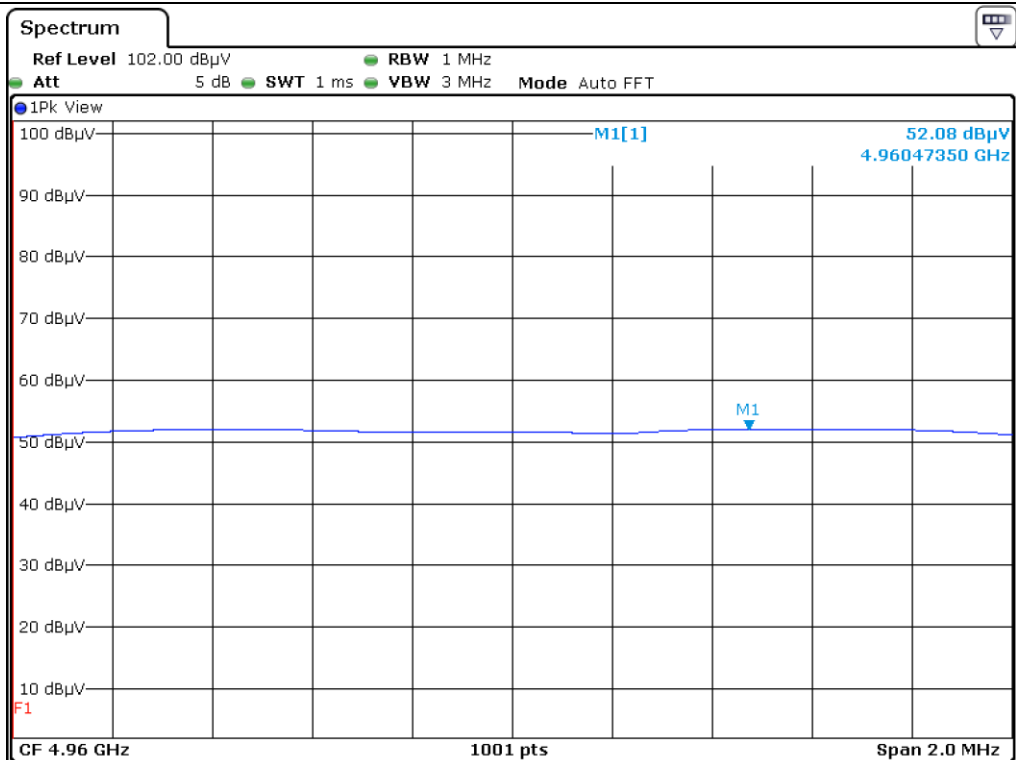
Middle Channel _ Average _ H



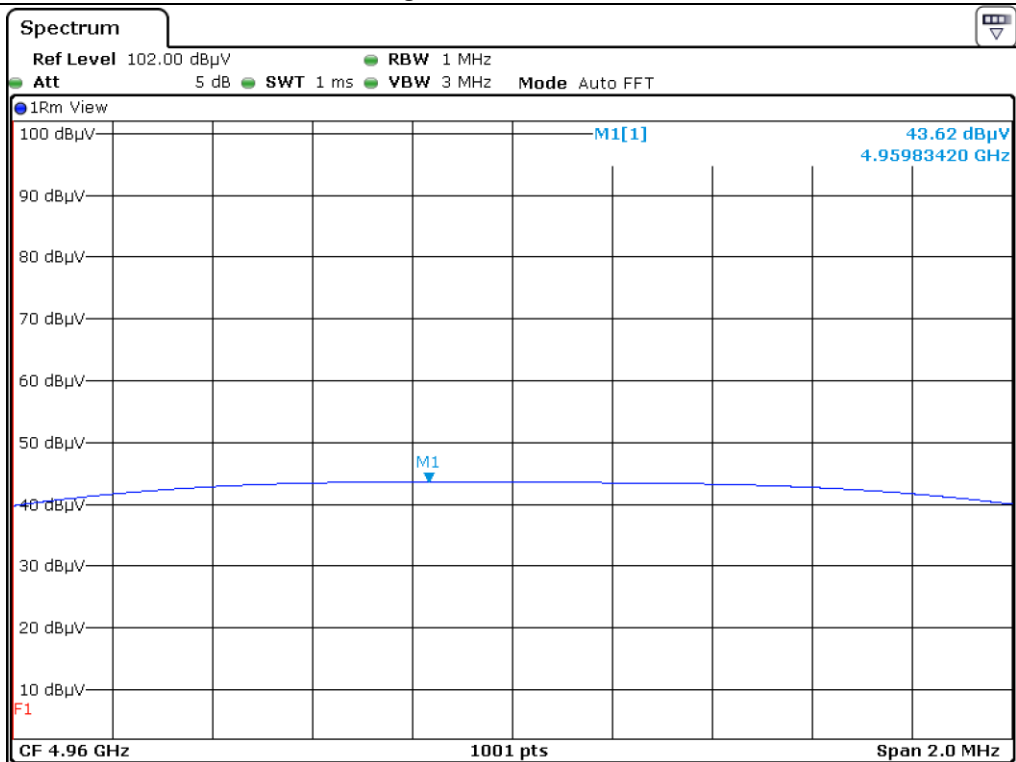
Middle Channel _ Peak _ V



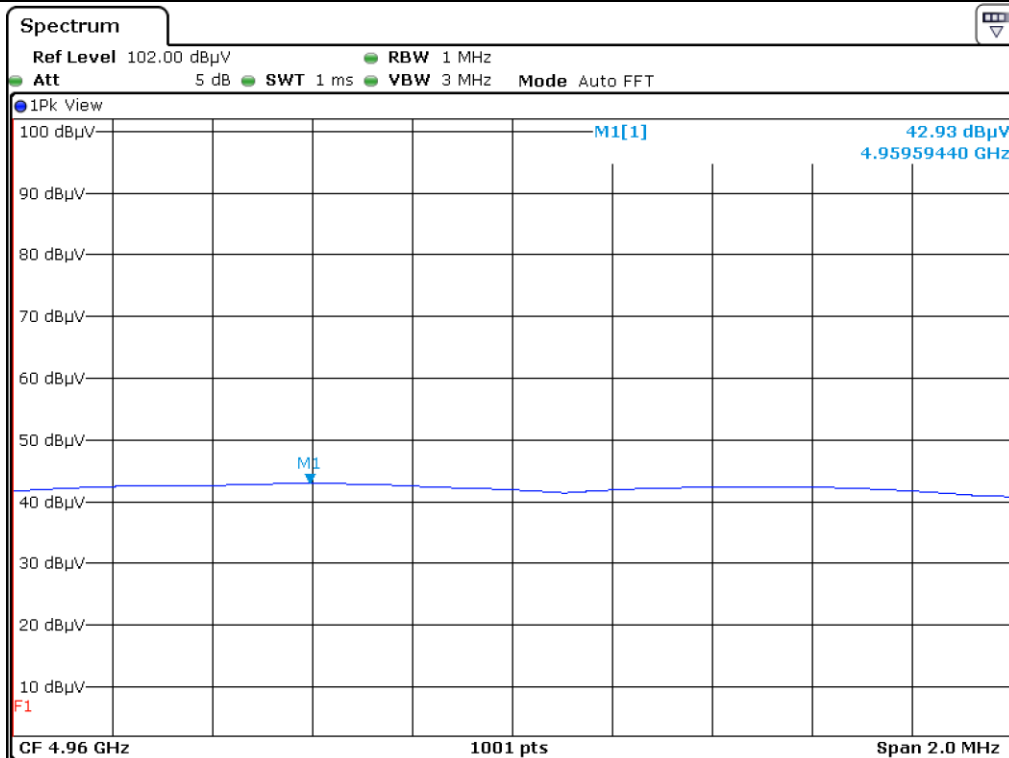
Middle Channel _ Average _ V



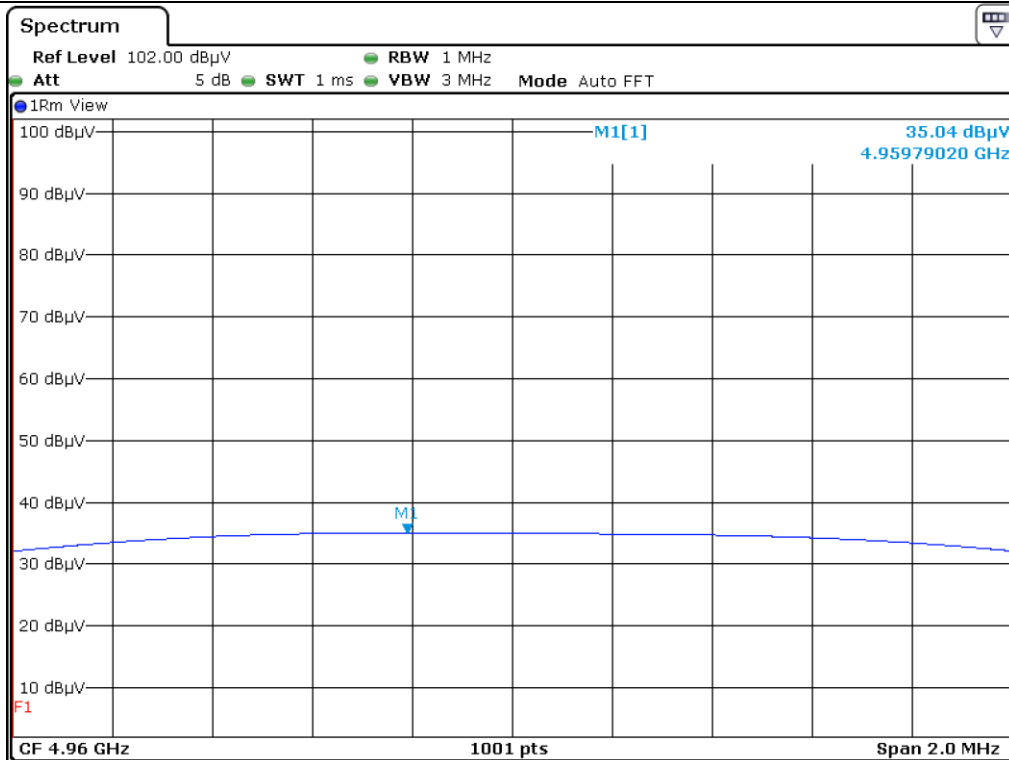
High Channel _ Peak _ H



High Channel _ Average _ H



High Channel _ Peak _ V



High Channel _ Average _ V

9.6.3 Radiated Emission which fall in the Band Edge

- . Test Date : October 17, 2017 ~ October 19, 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 (MHz)	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									
2 400.999	59.42	Peak	H	26.87	11.38	42.83	54.84	74.00	19.16
	50.93	Average	H				46.35	54.00	7.65
	51.31	Peak	V				46.73	74.00	27.27
	42.74	Average	V				38.16	54.00	15.84

Tabulated test data for Restricted Band

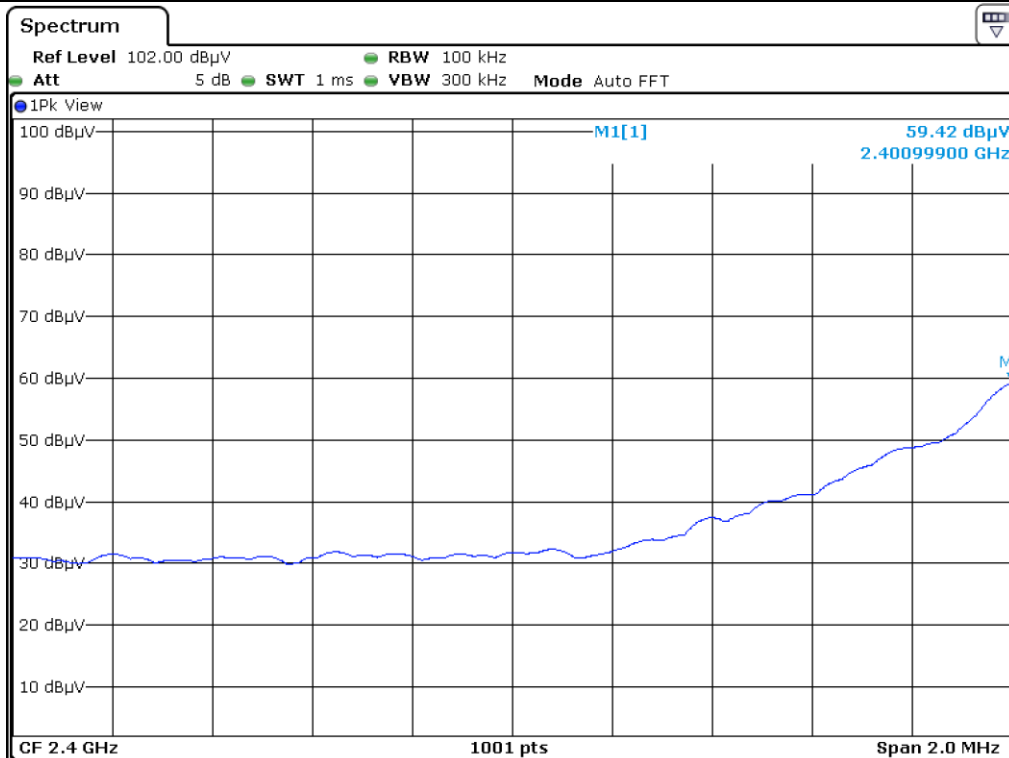
Remark: "H": Horizontal, "V": Vertical

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

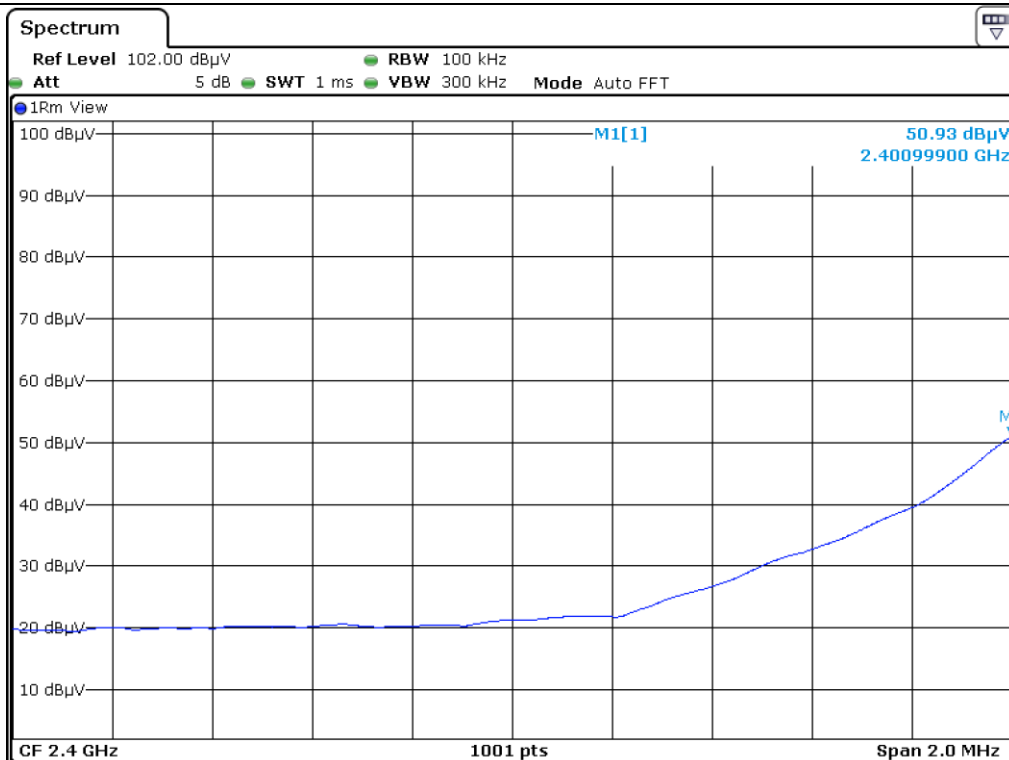
Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain



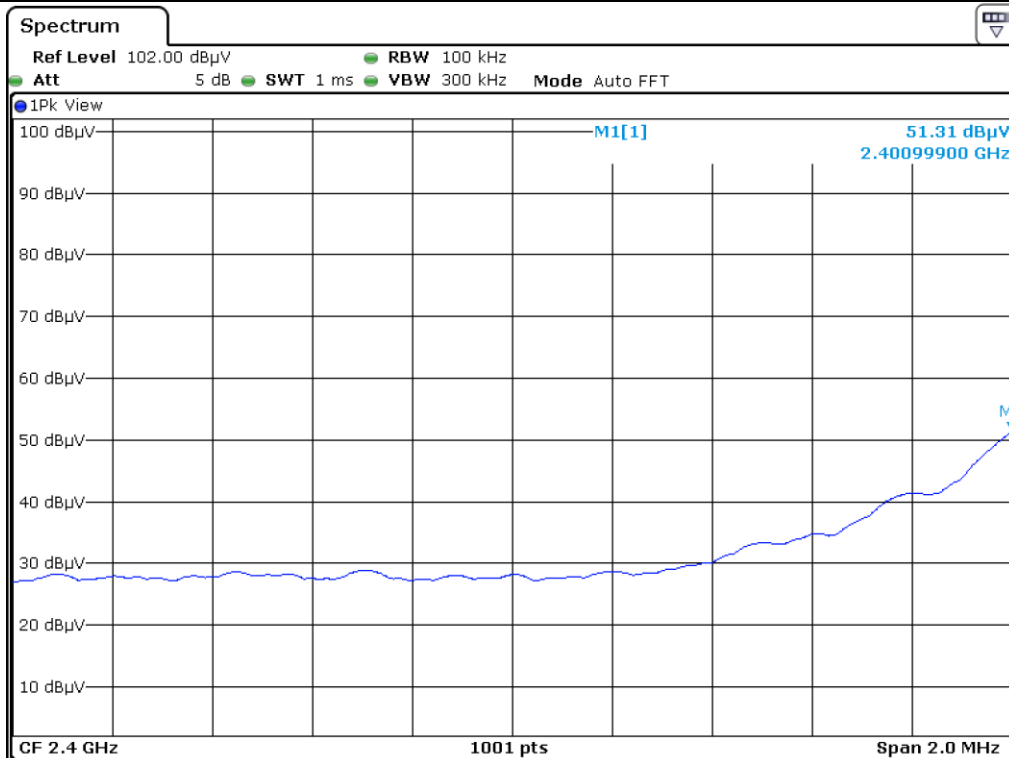
Tested by: Hyung-Kwon, Oh / Assistant Manager



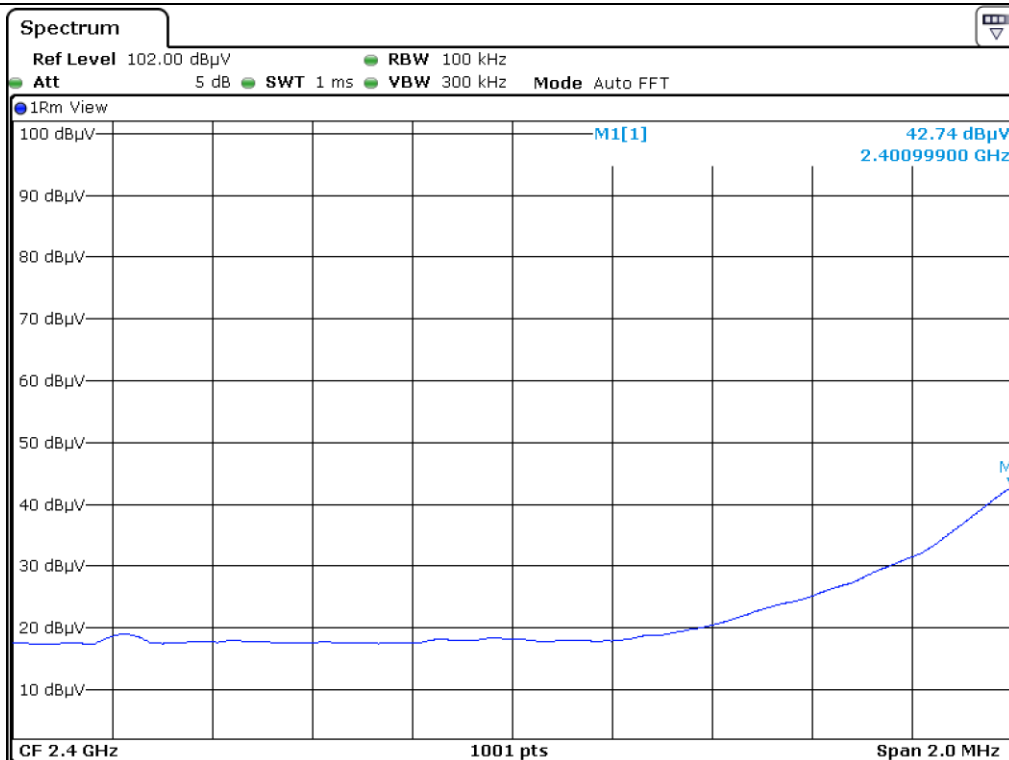
Low Channel _ Peak _ H



Low Channel _ Average _ H



Low Channel _ Peak _ V



Low Channel _ Average _ V

10. PEAK POWER SPECTRAL DENSITY

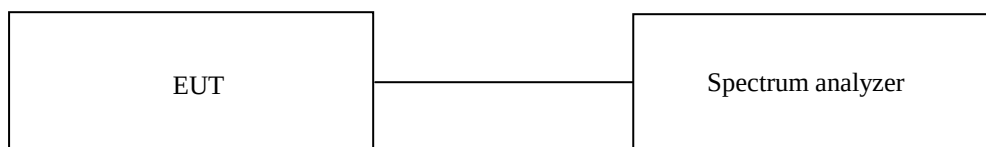
10.1 Operating environment

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 : October 17, 2017 ~ October 19, 2017

-. Test Result : Pass

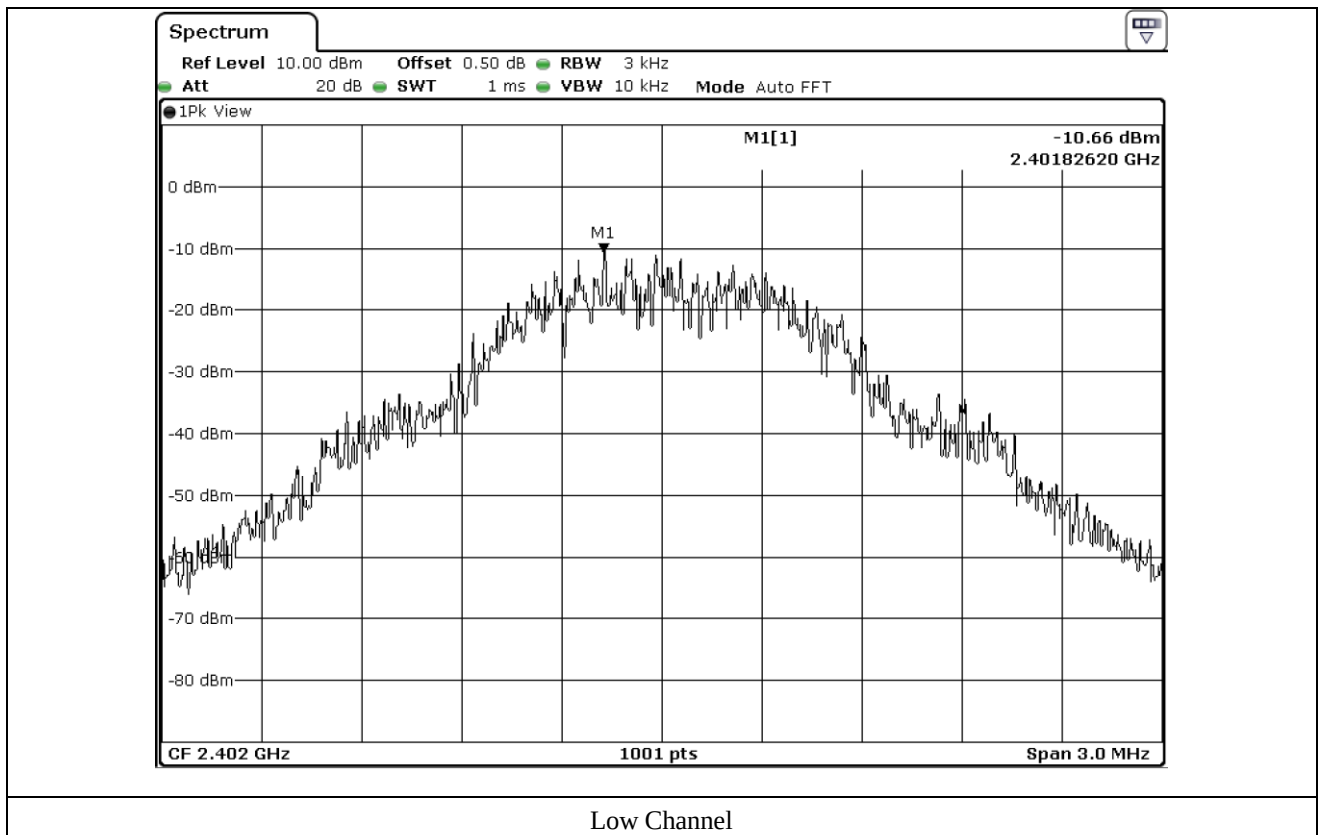
-. Operating Condition : Continuous transmitting mode

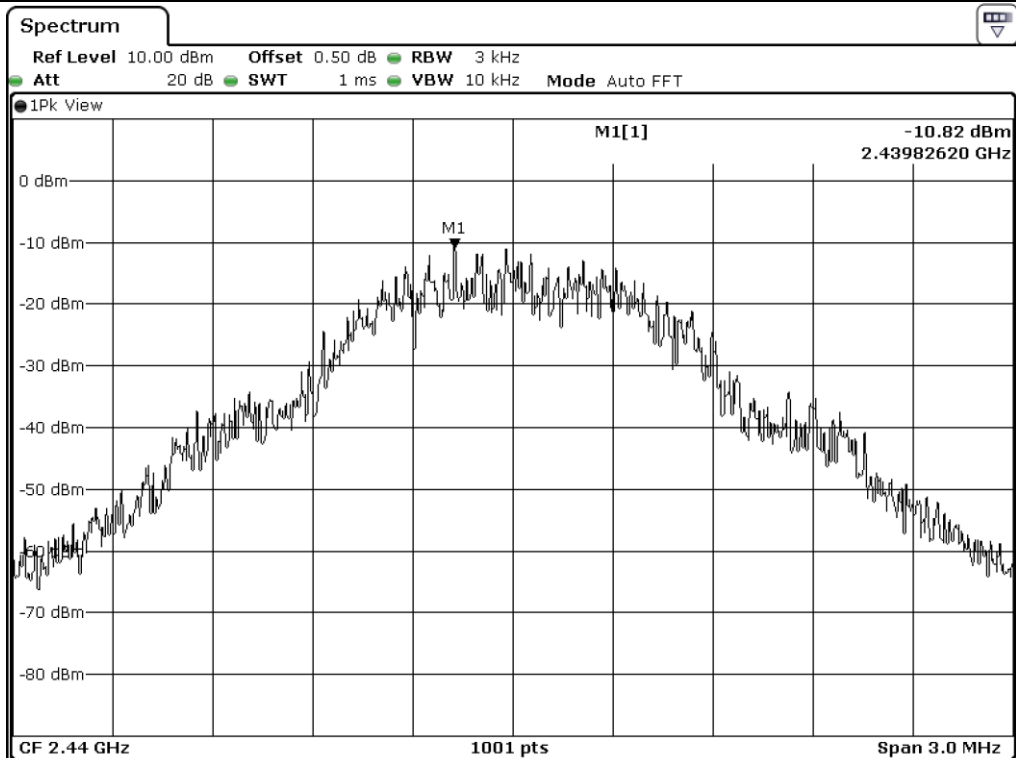
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-10.66	8.00	18.66
Middle	2 440.00	-10.82	8.00	18.82
High	2 480.00	-11.54	8.00	19.54

Remark. Margin = Limit – Measured value

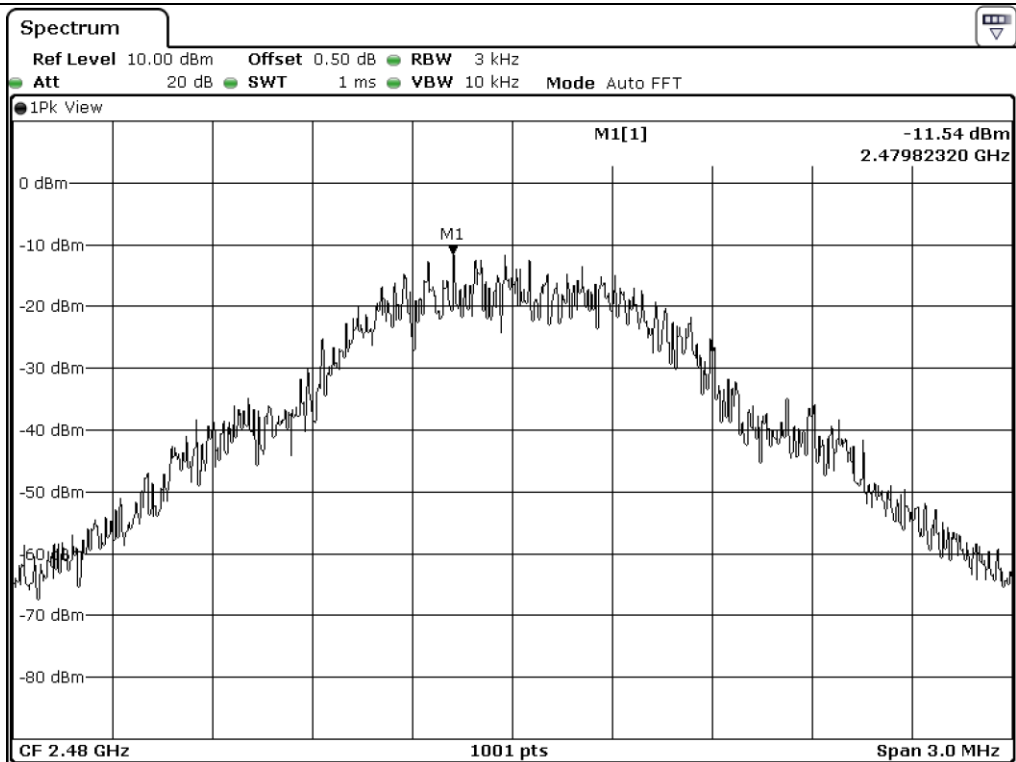


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

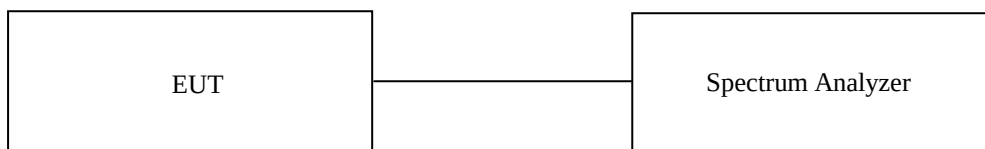
11. DUTY CYCLE

11.1 Operating environment

Temperature : 27 °C
Relative humidity : 45 % R.H.

11.2 Test set-up

The zero-span mode on a spectrum analyzer or EMI receiver, if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW \geq RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100 (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)



11.3 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.

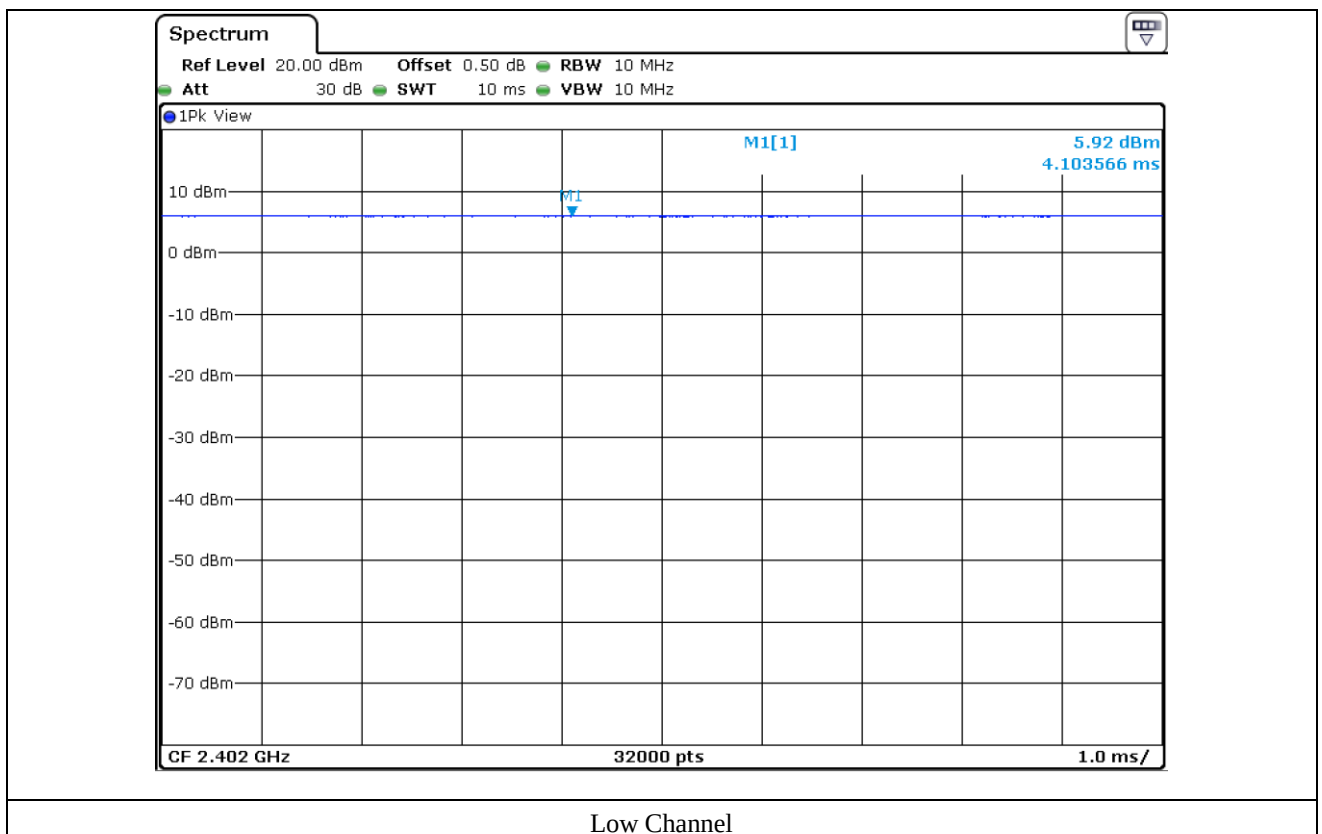
11.4 Test data for Worst case

-. Test Date : October 17, 2017 ~ October 19, 2017

-. Channel : Low

MODE	DUTY(%)
BLE	100.0

Remark: Duty Cycle = T_{ON}/T_{TOTAL} and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$



Tested by: Hyung-Kwon, Oh / Assistant Manager

12. RADIATED EMISSION TEST

12.1 Operating environment

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

12.2 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.

12.3 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)
■ - 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)
■ - BBHA 9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jul. 28, 2017 (2Y)

All test equipment used is calibrated on a regular basis.

12.4 Test data for 30 MHz ~ 1 GHz

Humidity Level : 46 % R.H.

Temperature: 25 °C

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

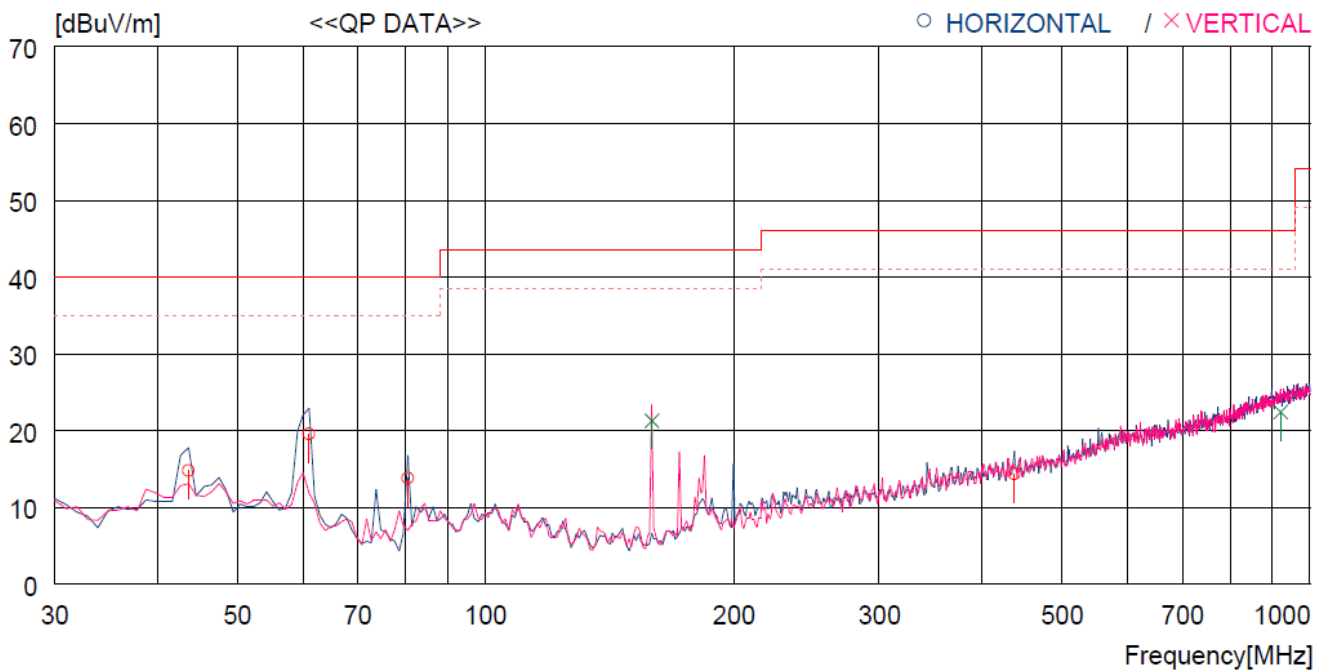
Result : PASSED

EUT : DIAL CONTROLLER

Date: October 17, 2017

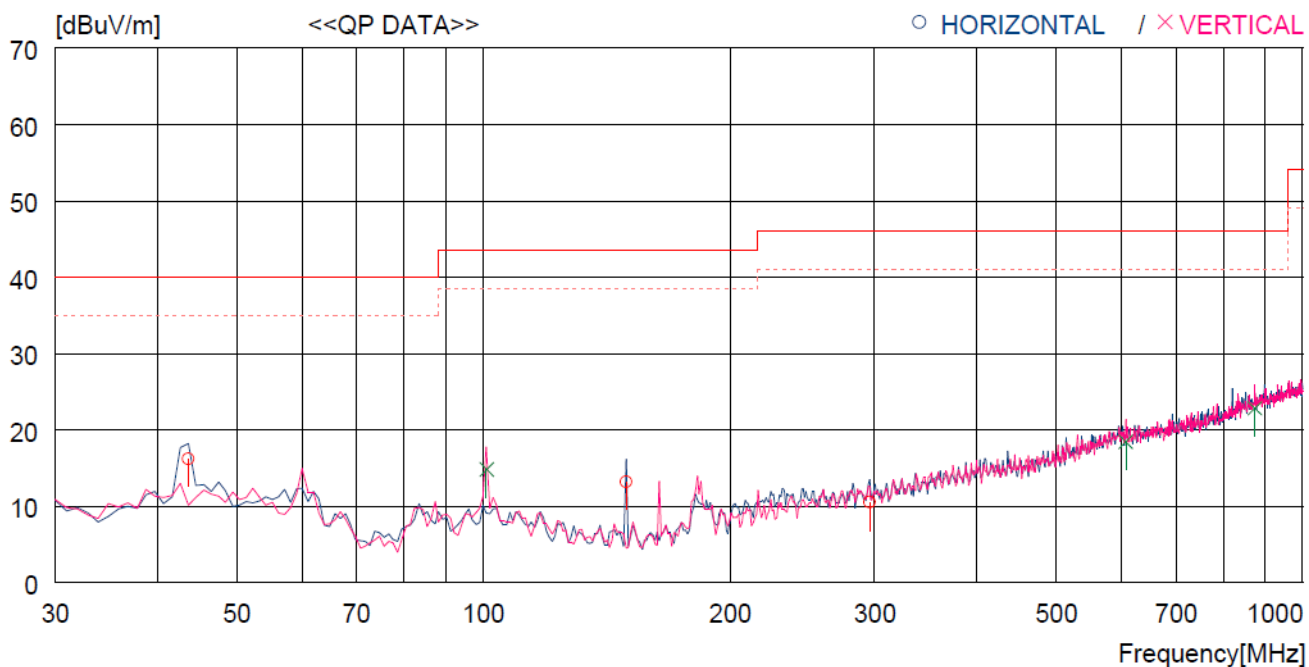
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
		[dBuV]	[dB]							
----- Horizontal -----										
1	43.580	32.4	13.8	1.7	33.1	14.8	40.0	25.2	400	359
2	61.040	37.8	12.9	1.9	33.1	19.5	40.0	20.5	300	0
3	80.440	37.0	7.6	2.2	33.0	13.8	40.0	26.2	200	230
4	437.401	26.0	16.7	4.8	33.2	14.3	46.0	31.7	300	358
----- Vertical -----										
5	159.010	43.0	8.3	3.0	33.0	21.3	43.5	22.2	400	0
6	920.448	25.6	22.1	7.1	32.4	22.4	46.0	23.6	300	151

Operating condition : Middle Channel



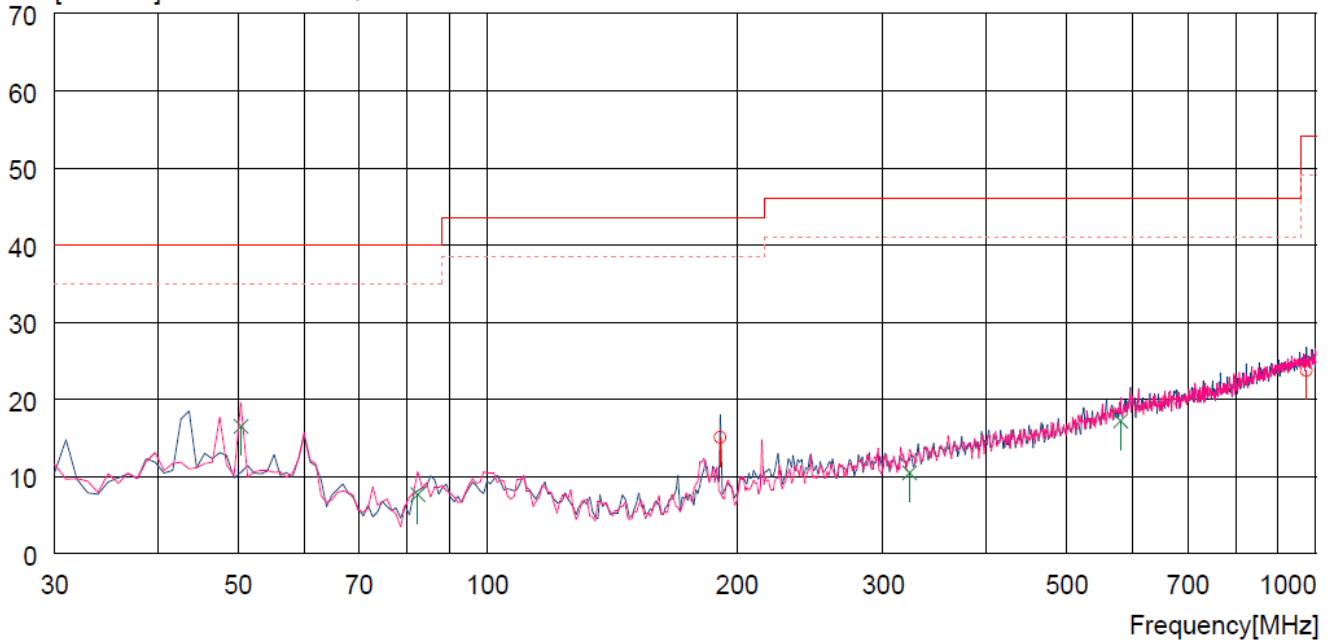
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	43.580	33.8	13.8	1.7	33.1	16.2	40.0	23.8	400	2
2	149.310	35.5	7.7	2.9	32.9	13.2	43.5	30.3	200	296
3	295.780	26.2	13.3	4.0	33.0	10.5	46.0	35.5	300	128
----- Vertical -----										
4	100.810	33.5	11.9	2.4	33.0	14.8	43.5	28.7	200	358
5	608.118	26.8	19.4	5.6	33.4	18.4	46.0	27.6	400	287
6	872.920	27.3	21.4	6.9	32.8	22.8	46.0	23.2	300	359

Operating condition : High Channel

[dBuV/m]

<<QP DATA>>

○ HORIZONTAL / × VERTICAL



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	191.020	34.2	10.6	3.3	33.1	15.0	43.5	28.5	300	0
2	974.767	26.3	22.1	7.2	31.9	23.7	54.0	30.3	400	186
----- Vertical -----										
3	50.370	34.2	13.7	1.7	33.1	16.5	40.0	23.5	200	349
4	82.380	30.3	8.1	2.2	33.0	7.6	40.0	32.4	400	265
5	322.940	25.8	13.7	4.1	33.1	10.5	46.0	35.5	400	248
6	580.959	26.6	18.4	5.5	33.3	17.2	46.0	28.8	400	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

12.5 Test data for Below 30 MHz

- . Test Date : October 17, 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 (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.									

12.6 Test data for above 1 GHz

- . Test Date : October 17, 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 (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

13. CONDUCTED EMISSION TEST

13.1 Operating environment

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

13.2 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.

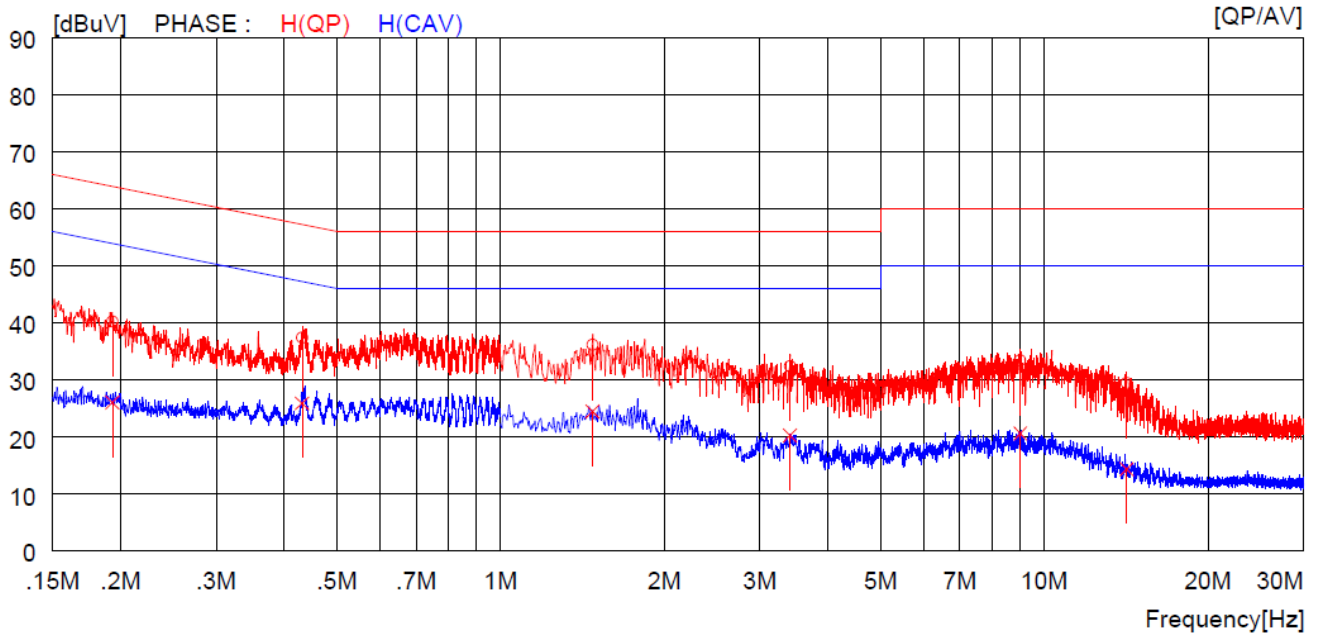
13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESPI	Rohde & Schwarz	Test Receiver	101012	Nov. 01, 2016 (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.

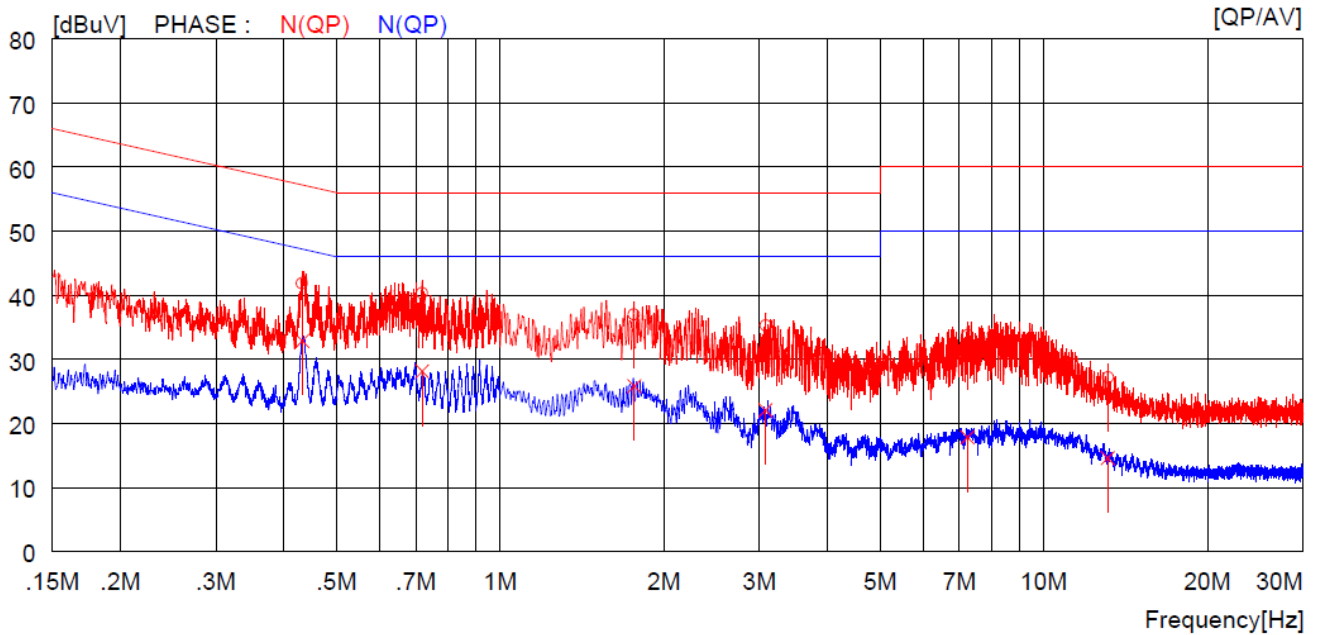
13.4 Test data

- Test Date : October 17, 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	0.19300	30.2	----	10.0	40.2	----	63.9	----	23.7	----	H (QP)
2	0.43100	27.4	----	10.0	37.4	----	57.2	----	19.8	----	H (QP)
3	1.47600	26.0	----	10.1	36.1	----	56.0	----	19.9	----	H (QP)
4	3.40800	22.2	----	10.2	32.4	----	56.0	----	23.6	----	H (QP)
5	9.03500	23.0	----	10.4	33.4	----	60.0	----	26.6	----	H (QP)
6	14.18000	18.8	----	10.6	29.4	----	60.0	----	30.6	----	H (QP)
7	0.19300	----	16.1	10.0	----	26.1	----	53.9	----	27.8	H (CAV)
8	0.43100	----	15.9	10.0	----	25.9	----	47.2	----	21.3	H (CAV)
9	1.47600	----	14.4	10.1	----	24.5	----	46.0	----	21.5	H (CAV)
10	3.40800	----	10.1	10.2	----	20.3	----	46.0	----	25.7	H (CAV)
11	9.03500	----	10.2	10.4	----	20.6	----	50.0	----	29.4	H (CAV)
12	14.18000	----	3.8	10.6	----	14.4	----	50.0	----	35.6	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	0.43200	31.8	----	10.0	41.8	----	57.2	----	15.4	----	N (QP)
2	0.71800	30.2	----	10.1	40.3	----	56.0	----	15.7	----	N (QP)
3	1.76400	26.9	----	10.1	37.0	----	56.0	----	19.0	----	N (QP)
4	3.07600	25.1	----	10.2	35.3	----	56.0	----	20.7	----	N (QP)
5	7.24500	23.4	----	10.3	33.7	----	60.0	----	26.3	----	N (QP)
6	13.13000	16.7	----	10.5	27.2	----	60.0	----	32.8	----	N (QP)
7	0.43200	----	22.9	10.0	----	32.9	----	47.2	----	14.3	N (CAV)
8	0.71800	----	18.0	10.1	----	28.1	----	46.0	----	17.9	N (CAV)
9	1.76400	----	15.7	10.1	----	25.8	----	46.0	----	20.2	N (CAV)
10	3.07600	----	11.9	10.2	----	22.1	----	46.0	----	23.9	N (CAV)
11	7.24500	----	7.5	10.3	----	17.8	----	50.0	----	32.2	N (CAV)
12	13.13000	----	4.1	10.5	----	14.6	----	50.0	----	35.4	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