

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

Test Report No. : OT-182-RWD-001

AGR No. : A181A-263

Applicant : Samsung Electronics Co Ltd

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

Manufacturer : Samsung Electronics Co., Ltd.

Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 443-742, Korea

Type of Equipment : Audio transceiver module

FCC ID. : A3LWISP50S

Model Name : WISP50S

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 45 pages (including this page)

Date of Incoming : January 08, 2018

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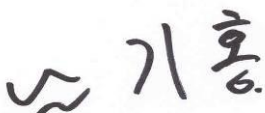
SUMMARY

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
OT-182-RWD-001	February 01, 2018	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 : Jaywoo. Lee

Telephone No. : -

FCC ID : A3LWISP50S

Model Name : WISP50S

Brand Name : SAMSUNG

Serial Number : N/A

Date : February 01, 2018

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
E.U.T. DESCRIPTION	Audio transceiver 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 KDB 558074 D01 DTS Meas Guidance
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 WISP50S (referred to as the EUT in this report) is a Audio transceiver module. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Audio transceiver module				
FREQUENCY RANGE	2.4 GHz Band	2 412 MHz ~ 2 464 MHz			
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band		5 180 MHz ~ 5 240 MHz	
		5 725 MHz ~ 5 850 MHz Band		5 736 MHz ~ 5 814 MHz	
MAX. RF OUTPUT POWER	2.4 GHz Band	Antenna 0		13.10 dBm	
		Antenna 1		12.80 dBm	
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band		Antenna 0	9.80 dBm
				Antenna 1	9.50 dBm
		5 725 MHz ~ 5 850 MHz Band	Antenna 0	8.10 dBm	
			Antenna 1	8.00 dBm	
MODULATION TYPE	QPSK				
ANTENNA TYPE	2.4 GHz Band	Antenna 0		0.9 dBi	
		Antenna 1		0.8 dBi	
	5 GHz Band	5 150 MHz ~ 5 250 MHz Band		Antenna 0	1.5 dBi
				Antenna 1	2.8 dBi
		5 725 MHz ~ 5 850 MHz Band	Antenna 0	3.6 dBi	
			Antenna 1	6.0 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)		44 MHz			
POWER RE QUIREMENT		DC 5.0 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	Samsung Electronics Co., Ltd.	N/A	N/A

5.2 Peripheral equipment

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

Model	Manufacturer	Description	Connected to
WISP50S	Samsung Electronics Co., Ltd.	Audio transceiver module (EUT)	-
Pavilion dv3	HP	Notebook PC	-
Series PPP0009L-E	LITE-ON TECHNOLOGY CORPORATION	AC/DC ADAPTER	-
JIG	N/A	TEST JIG	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 2 412 MHz, 2 438 MHz, and 2 464 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 m 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 transmitter antenna of the EUT is PCB Pattern Antenna, 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)
Transmitting 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 : 21 °C
Relative humidity : 41 % 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 for Antenna 0

-. Test Date : January 16, 2018 ~ January 26, 2018

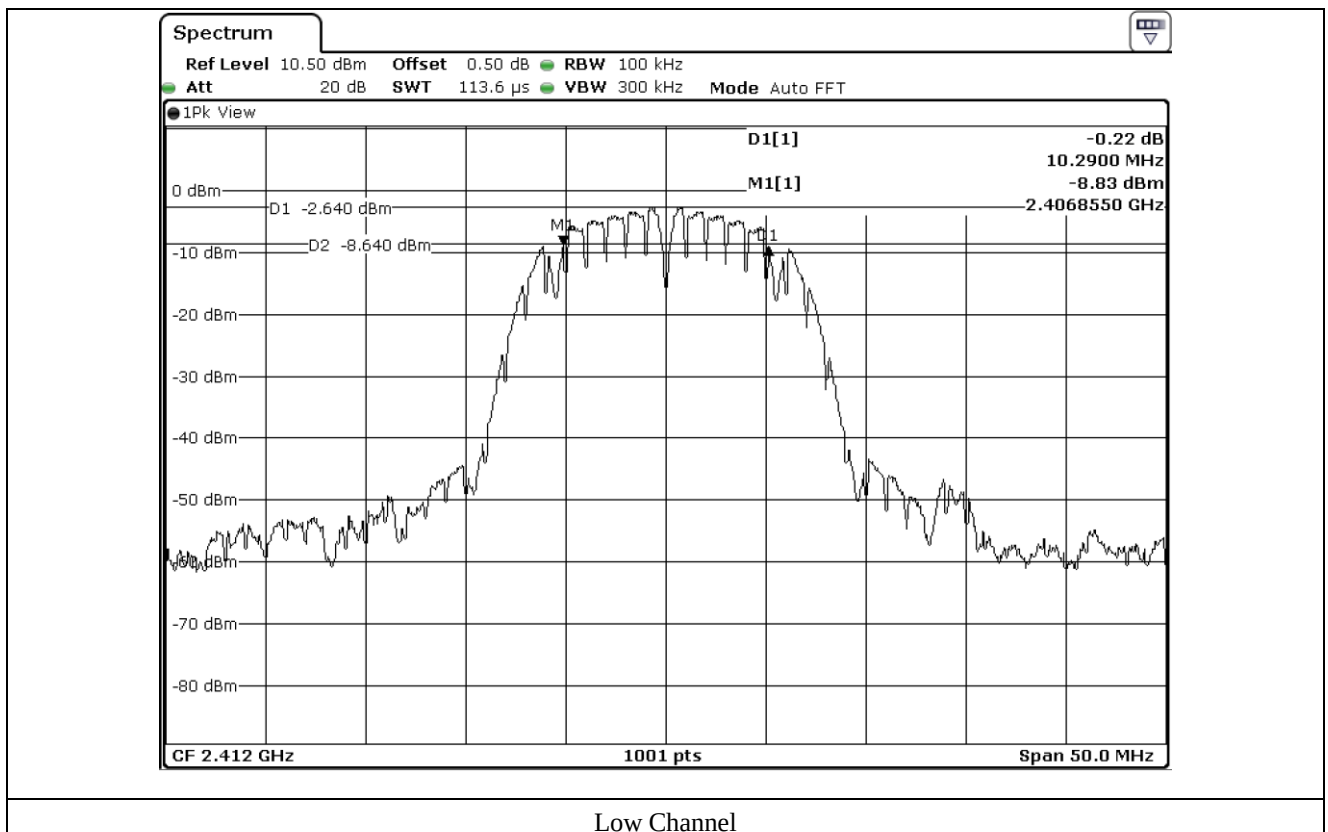
-. Test Result : Pass

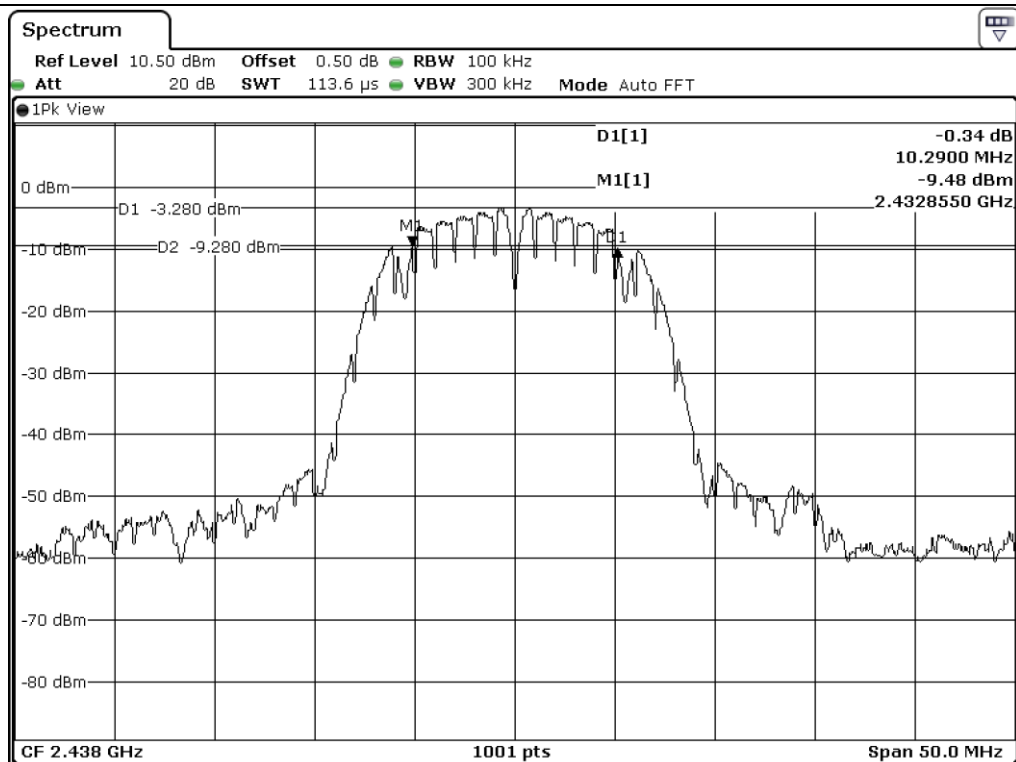
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT (MHz)	MARGIN (MHz)
Low	2 412.00	10.29	0.50	9.79
Middle	2 438.00	10.29	0.50	9.79
High	2 464.00	10.29	0.50	9.79

Remark. Margin = Measured Value - Limit

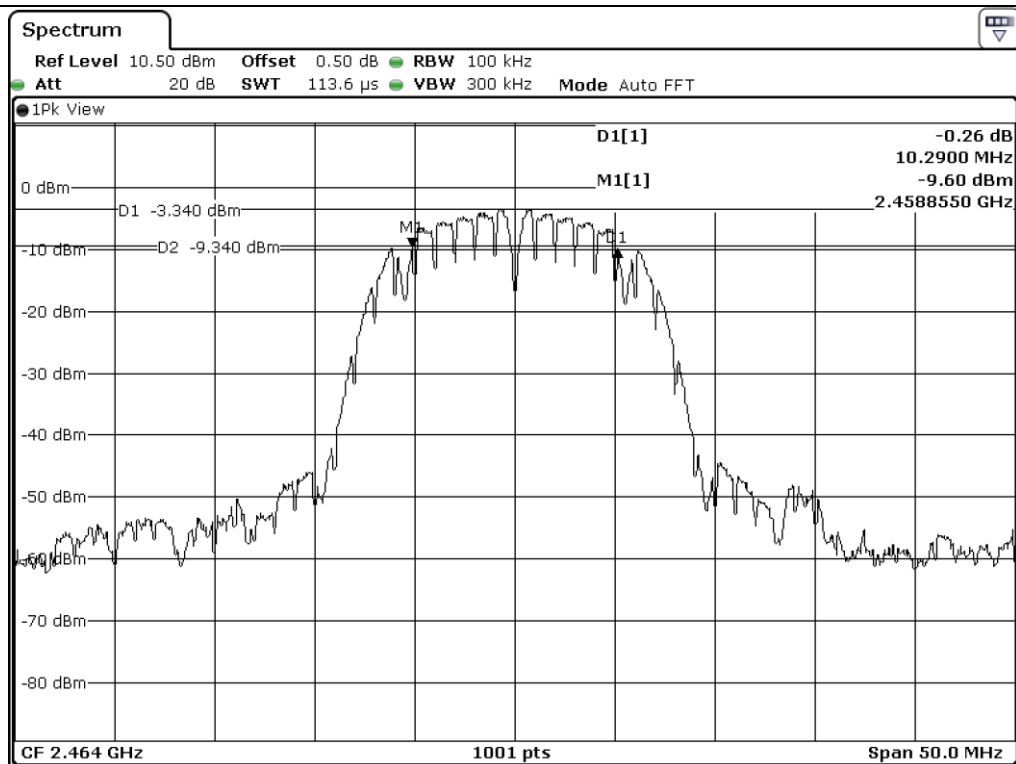


Tested by: Tae-Ho, Kim / Senior Manager





Middle Channel



High Channel

7.5 Test data for Antenna 1

-. Test Date : January 16, 2018 ~ January 26, 2018

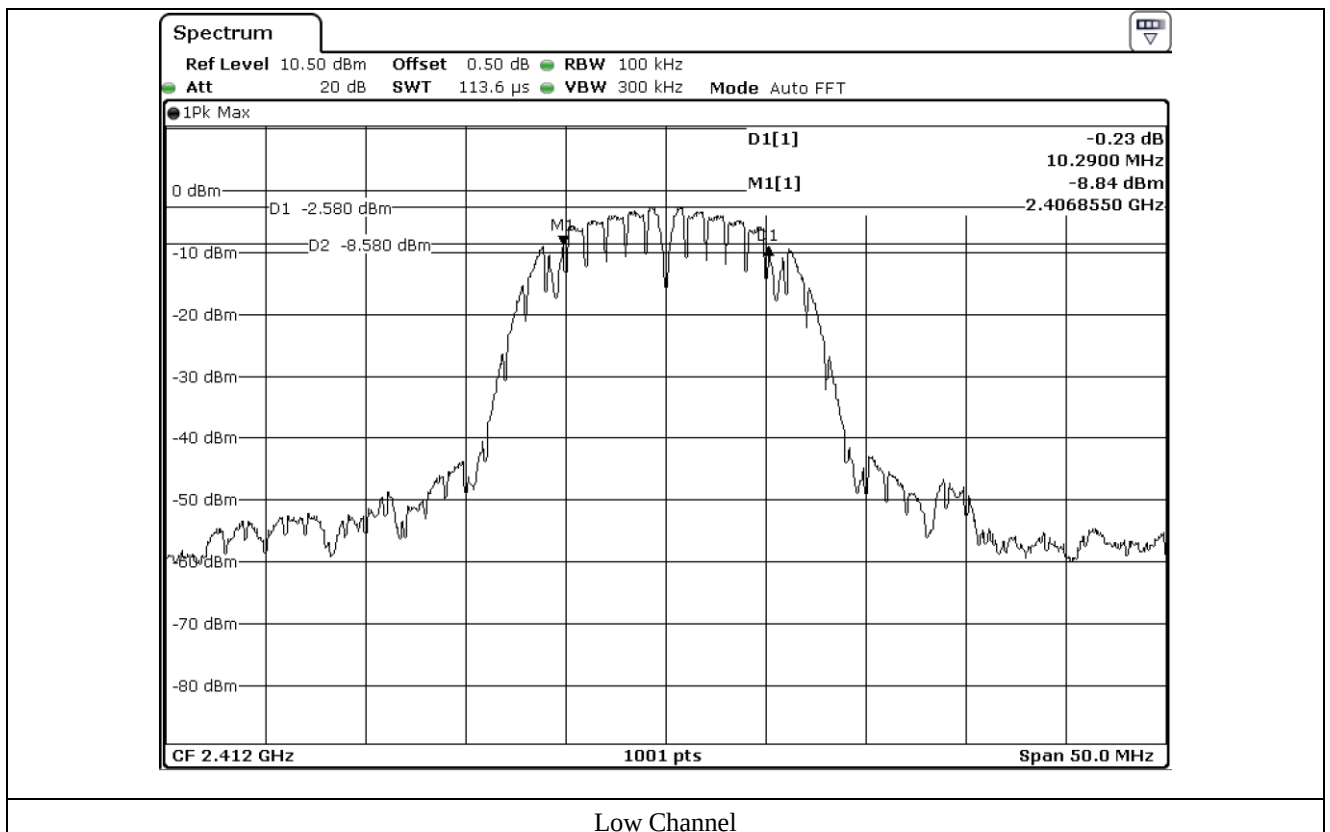
-. Test Result : Pass

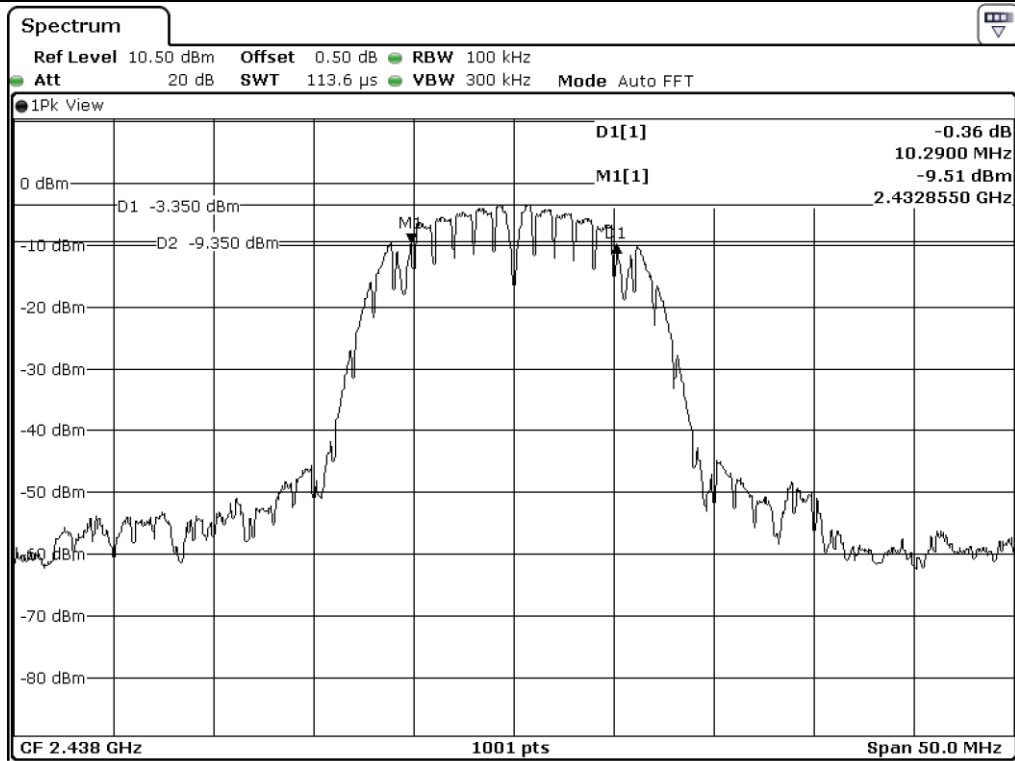
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT (MHz)	MARGIN (MHz)
Low	2 412.00	10.29	0.50	9.79
Middle	2 438.00	10.29	0.50	9.79
High	2 464.00	10.29	0.50	9.79

Remark. Margin = Measured Value - Limit

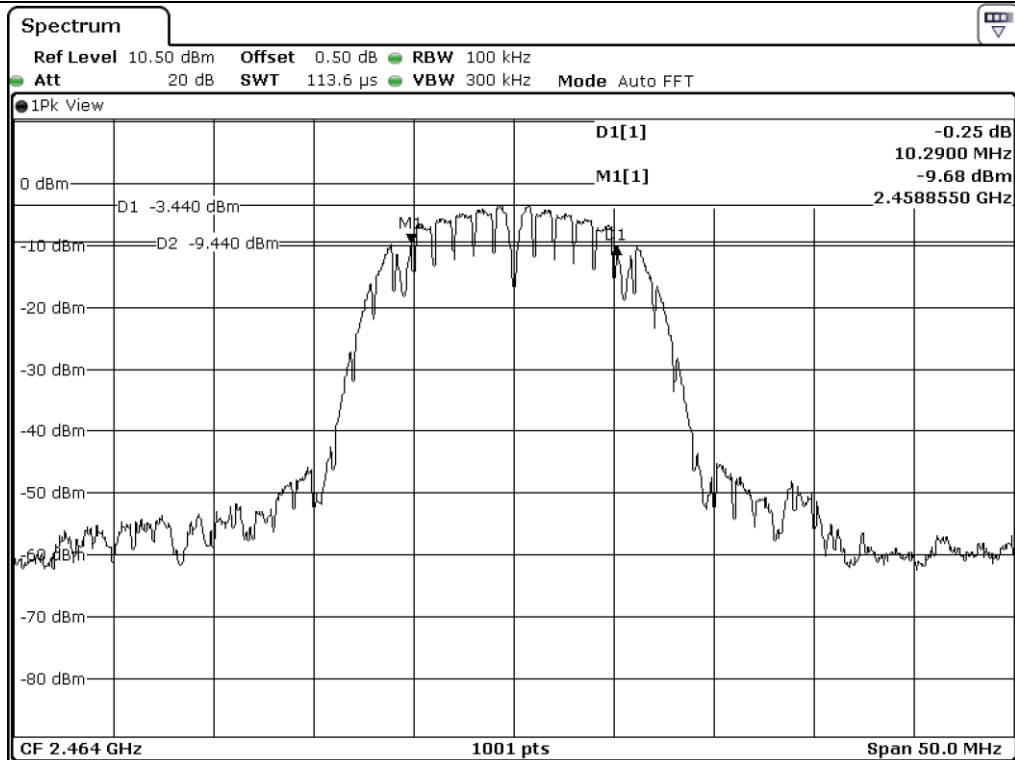


Tested by: Tae-Ho, Kim / Senior Manager





Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

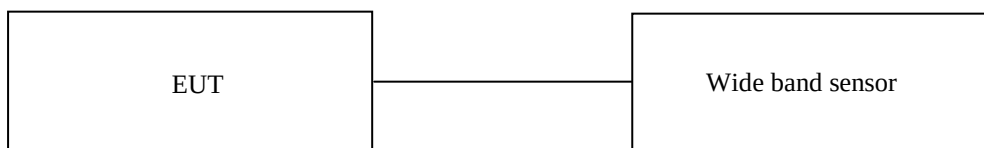
8.1 Operating environment

Temperature : 21 °C
Relative humidity : 41 % 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.
■ -	NRP-Z81	Rohde & Schwarz	Wide band Sensor	101975	Apr. 04, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data for Antenna 0

-. Test Date : January 16, 2018 ~ January 26, 2018

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	13.10	30.00	16.90
MIDDLE	2 438.00	12.40	30.00	17.60
HIGH	2 464.00	11.90	30.00	18.10

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

8.5 Test data for Antenna 1

-. Test Date : January 16, 2018 ~ January 26, 2018

-. Test Result : Pass

CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 412.00	12.80	30.00	17.20
MIDDLE	2 438.00	12.20	30.00	17.80
HIGH	2 464.00	11.60	30.00	18.40

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


 Tested by: Tae-Ho, Kim / Senior Manager

9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 21 °C
Relative humidity : 41 % 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.

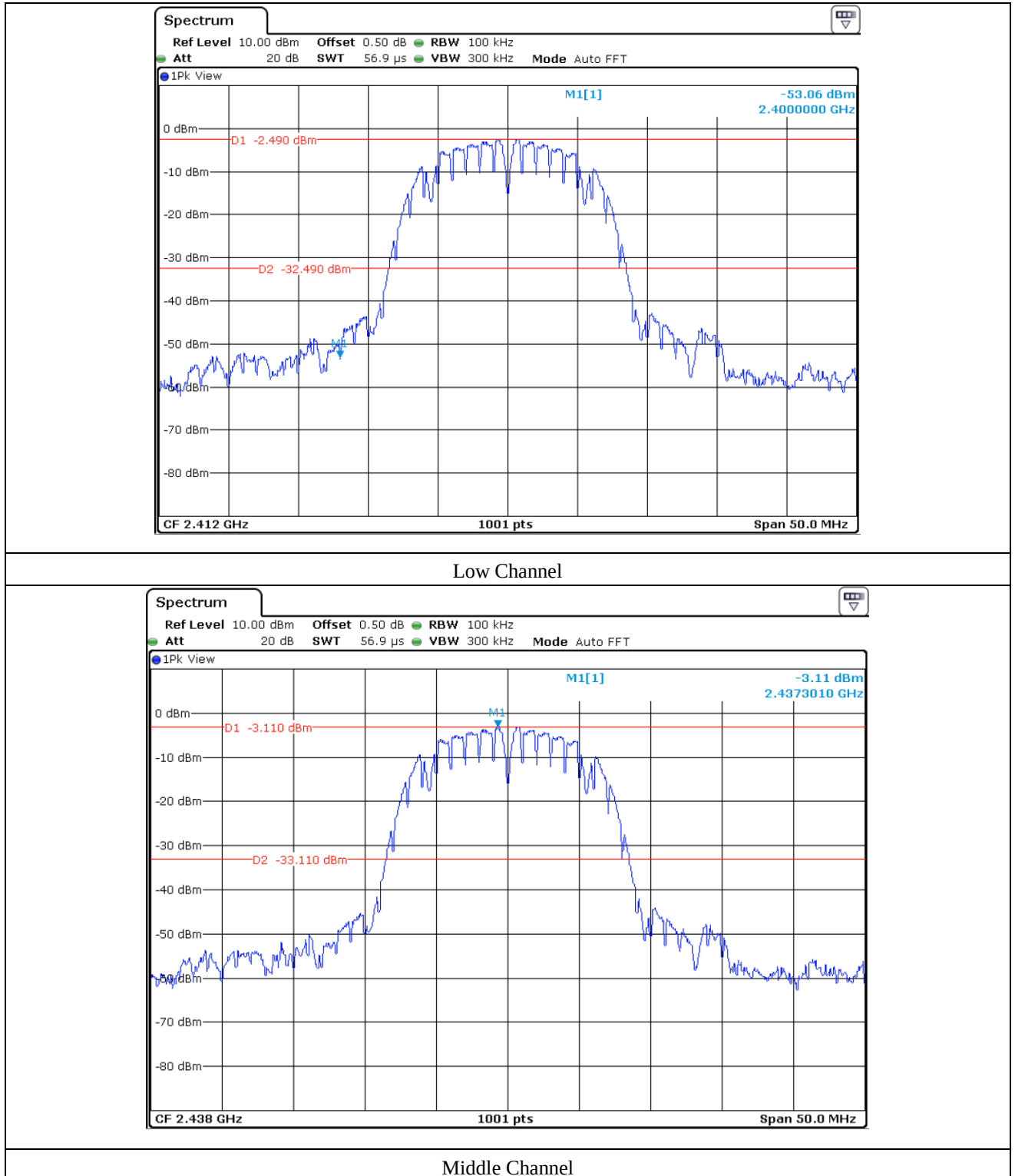
9.4 Test equipment used

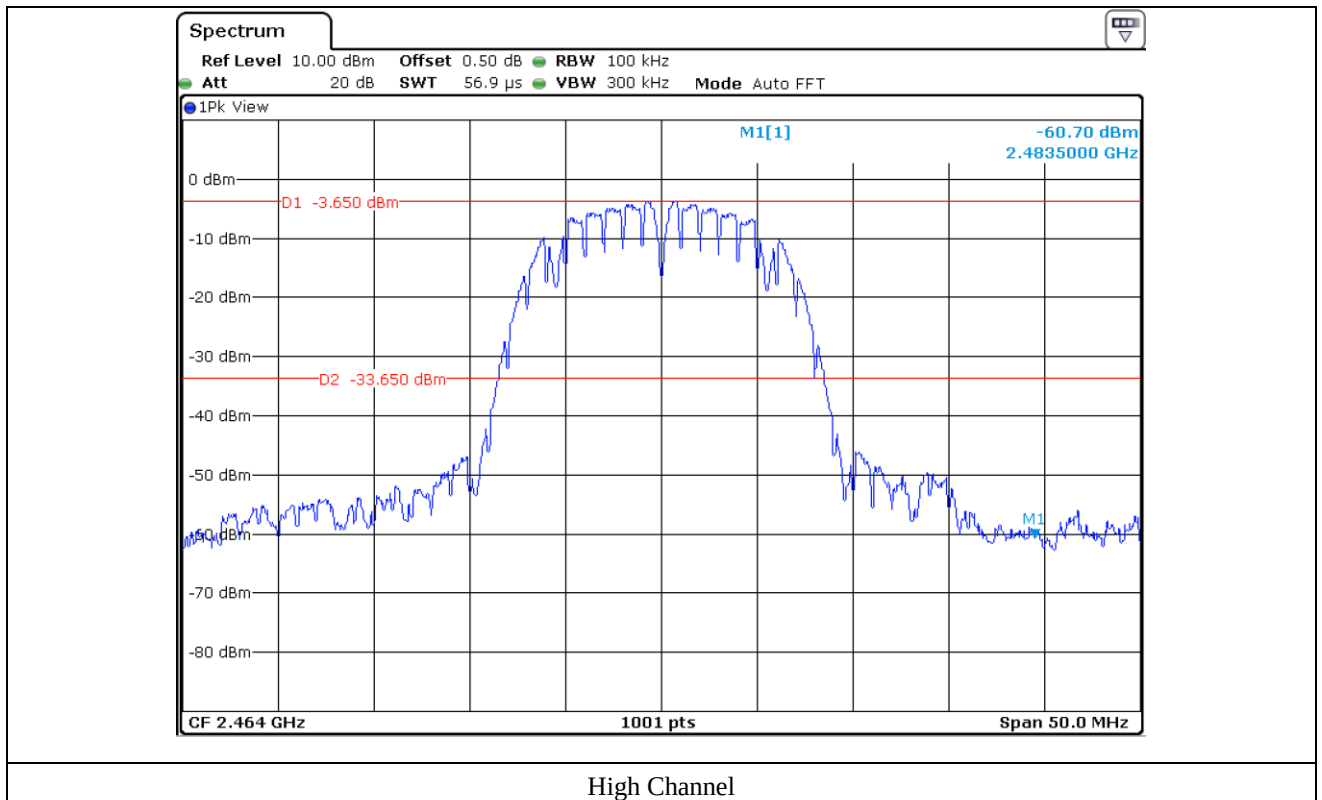
	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 06, 2017 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 05, 2017 (1Y)
■ -	BBV9718	Schwarzbeck	Amplifier	310	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)
■ -	BBHA 9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jul. 28, 2017 (2Y)

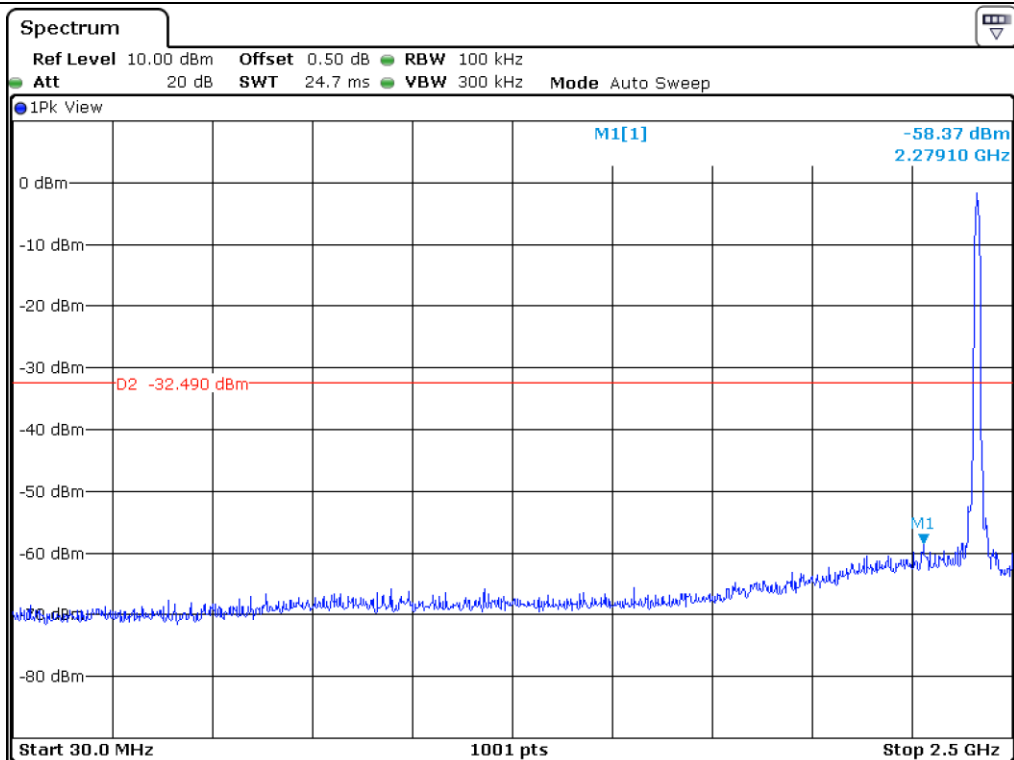
All test equipment used is calibrated on a regular basis.

9.5 Test data for conducted emission

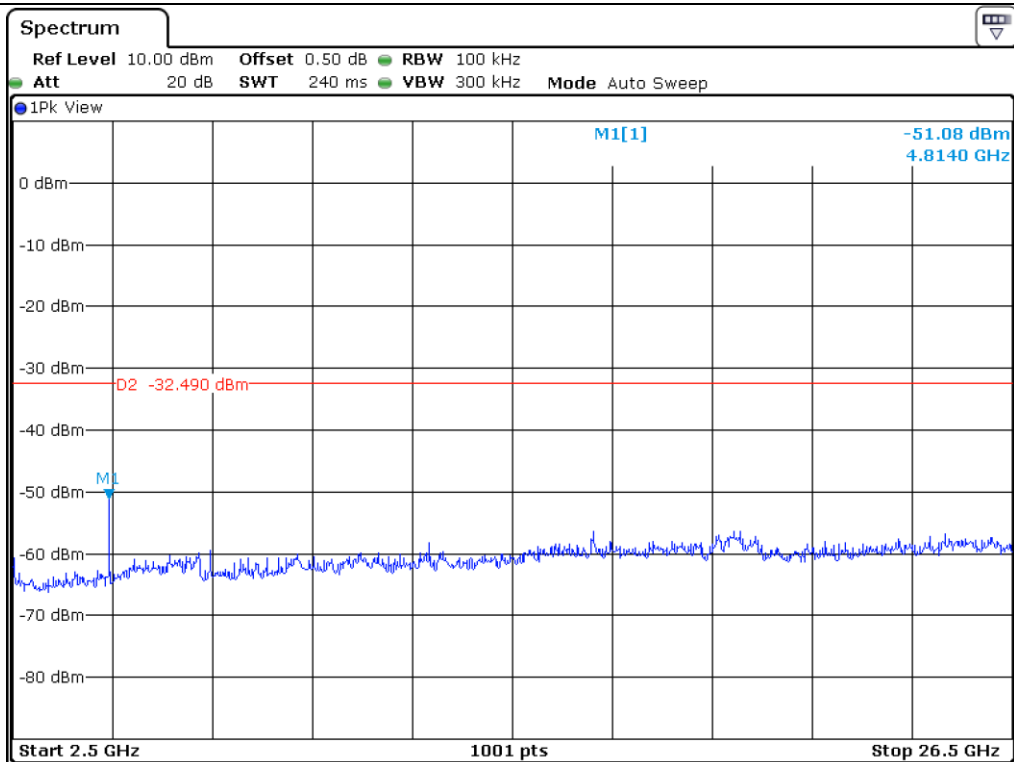
9.5.1 Test data for Antenna 0



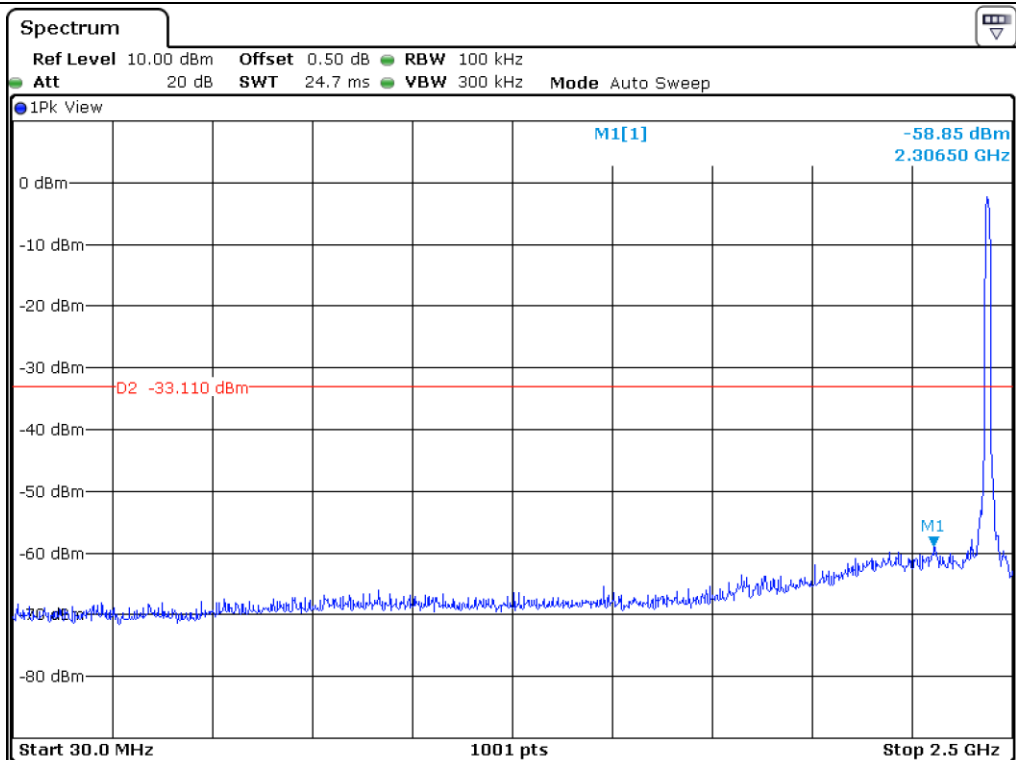




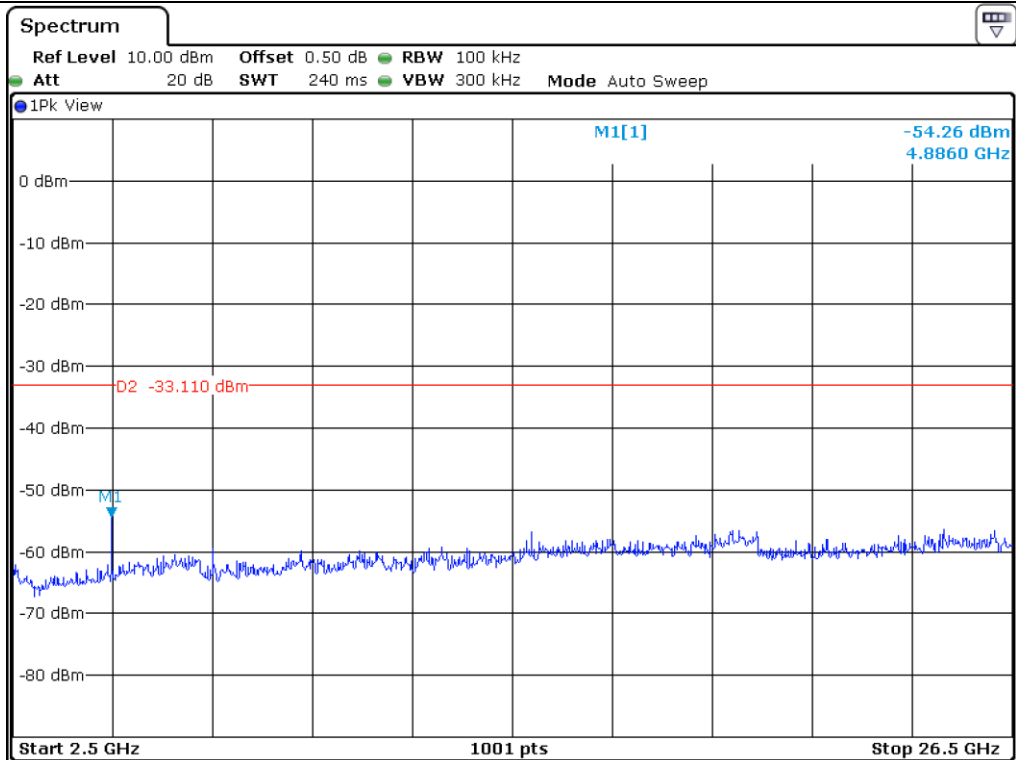
Low Channel



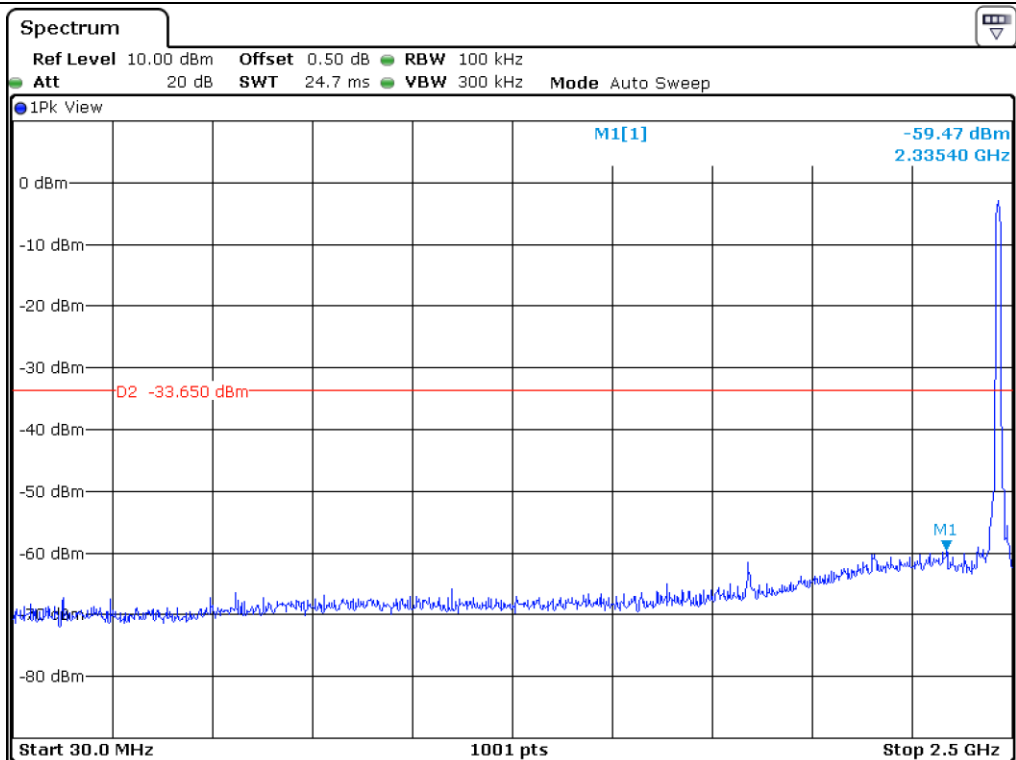
Low Channel



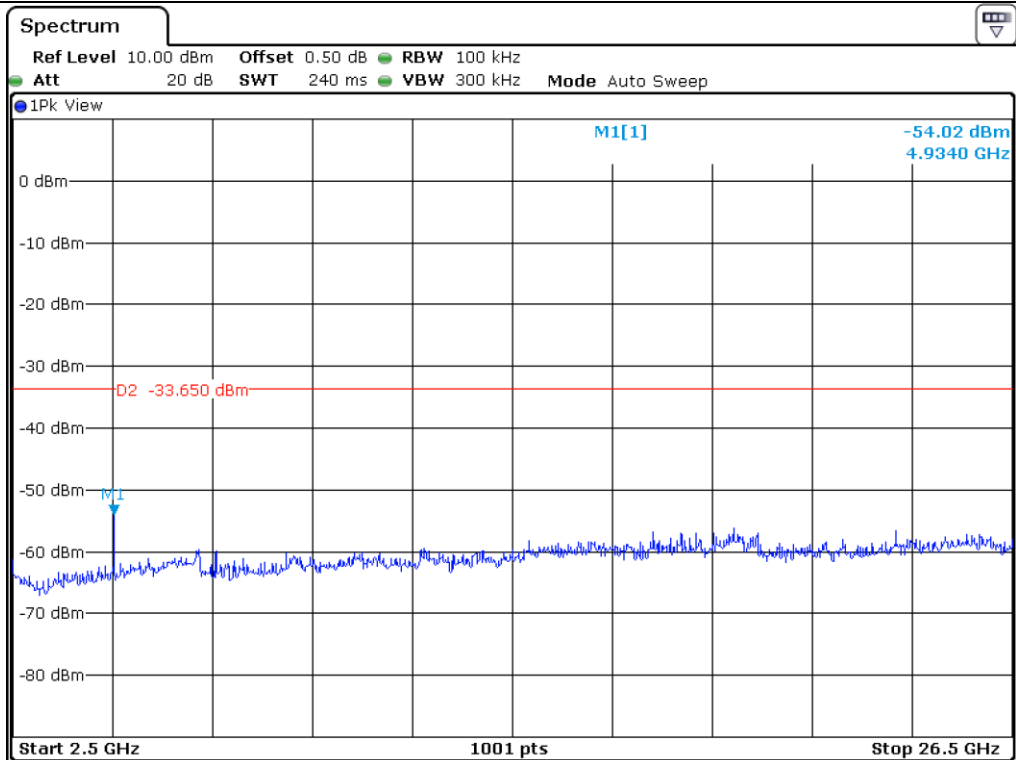
Middle Channel



Middle Channel

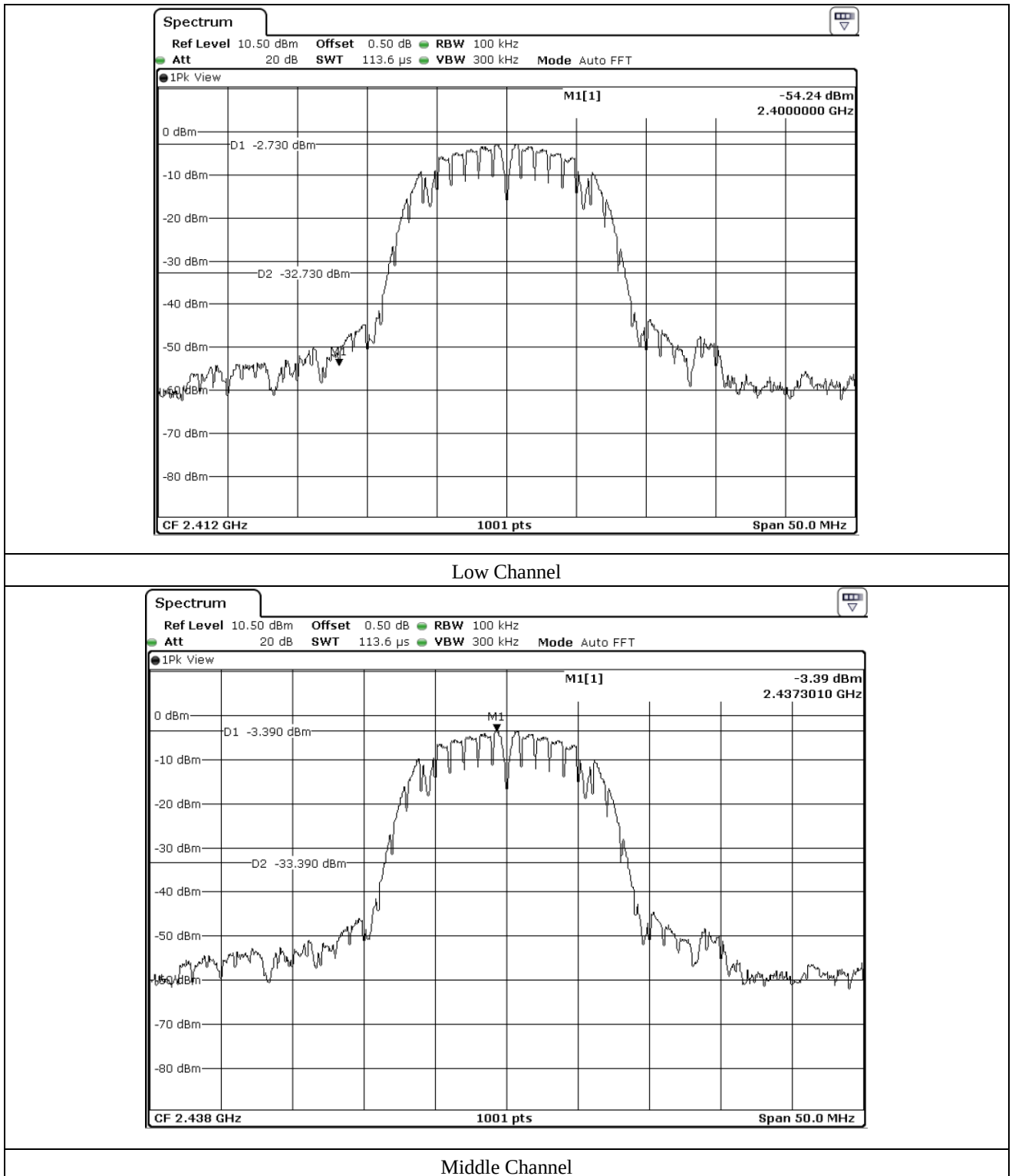


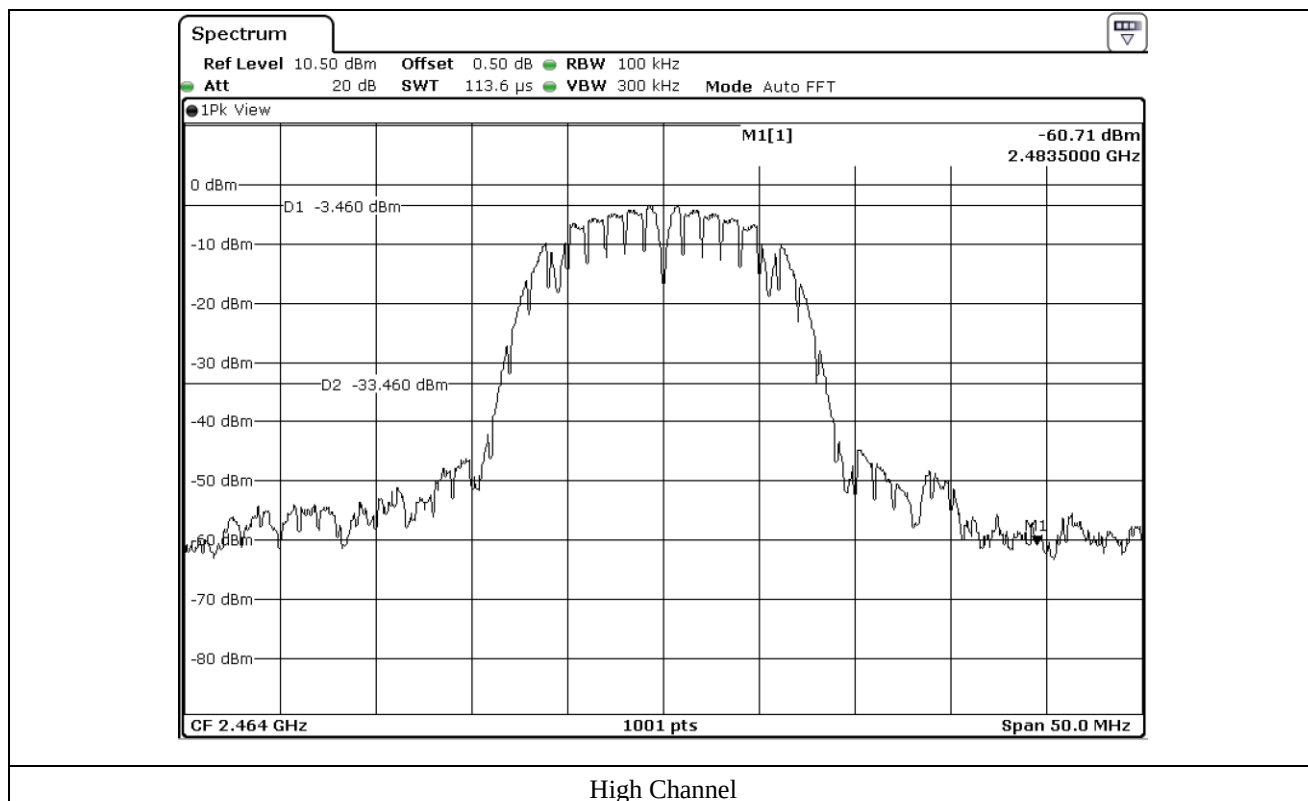
High Channel

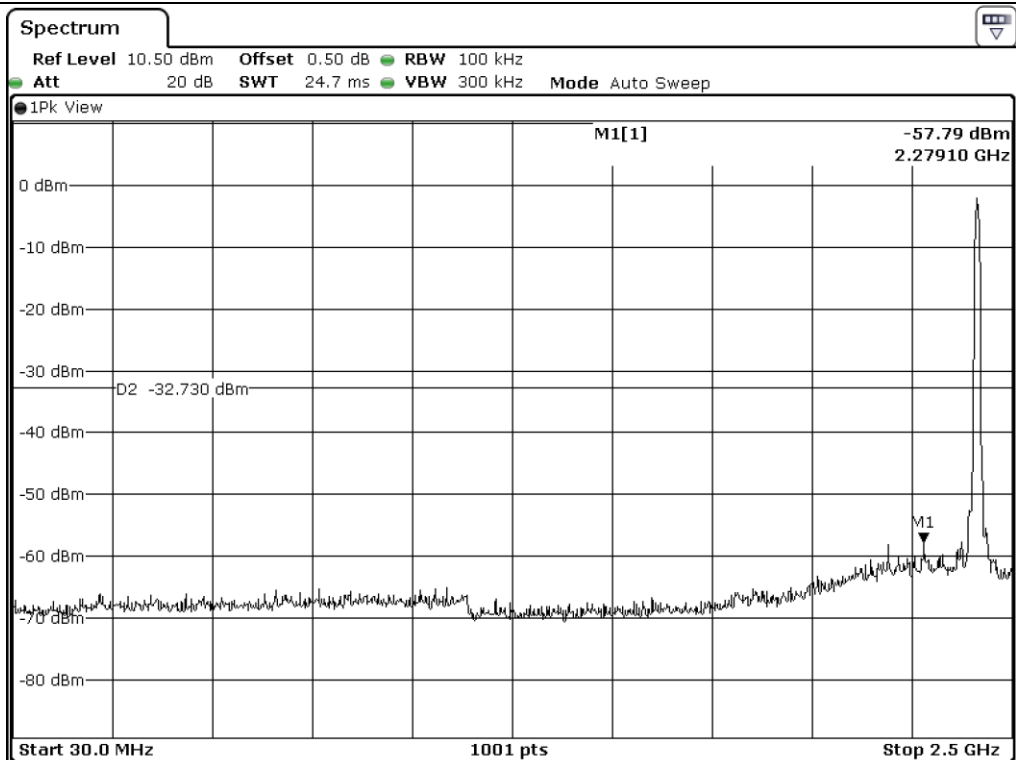


High Channel

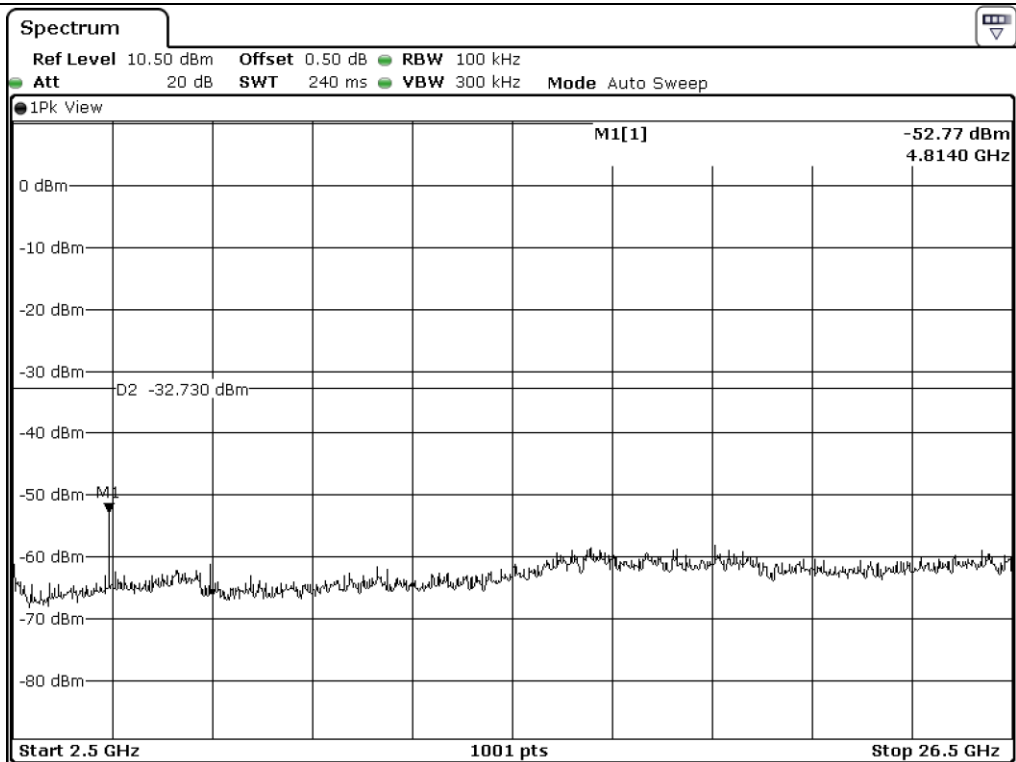
9.5.2 Test data for Antenna 1



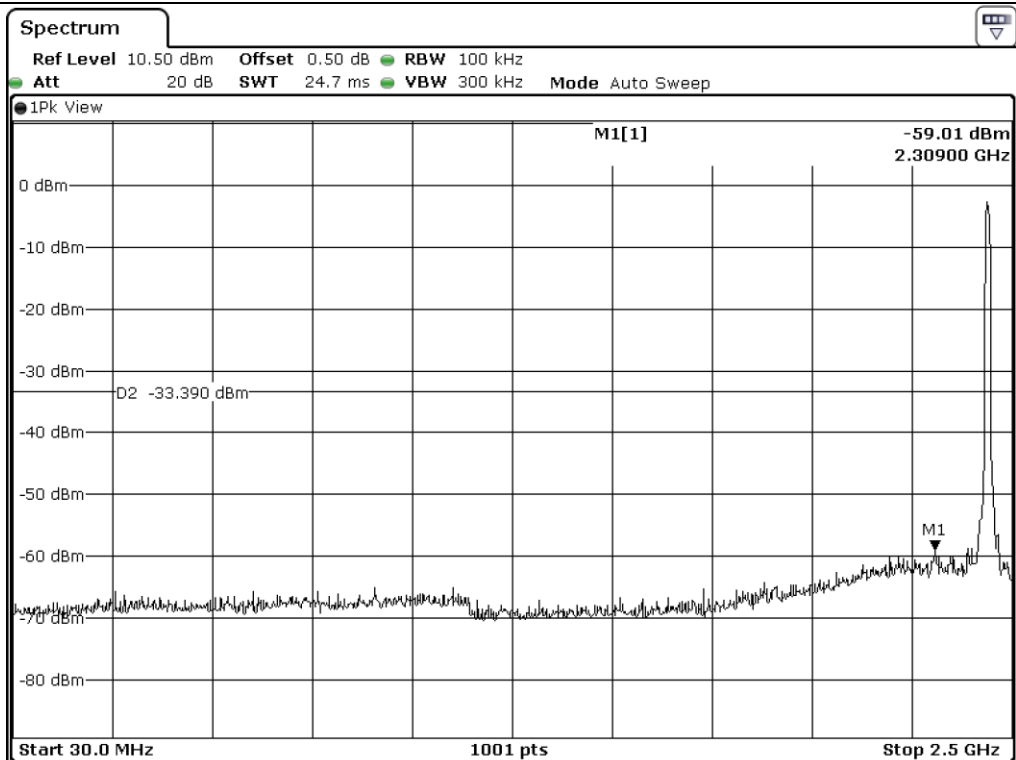




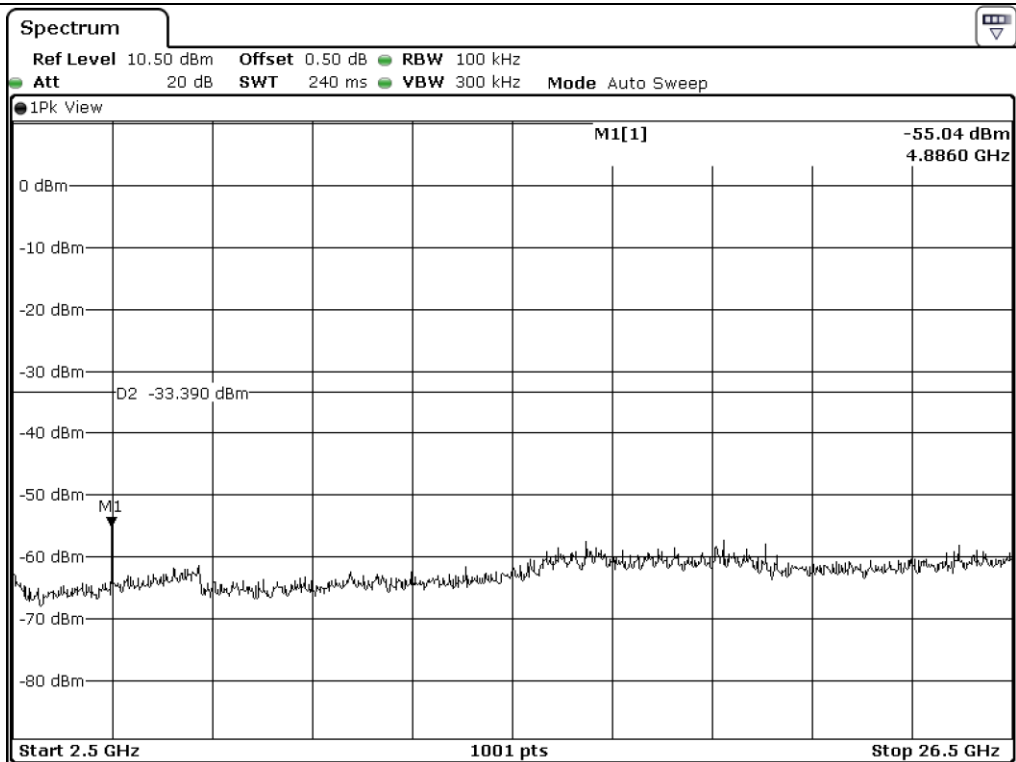
Low Channel



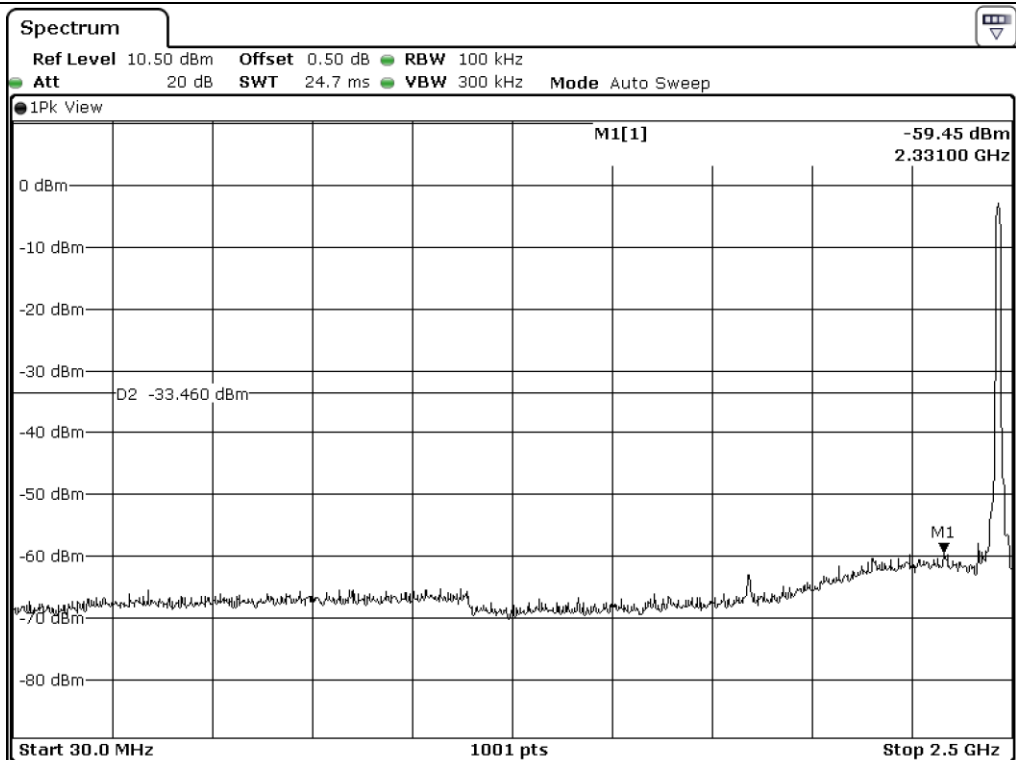
Low Channel



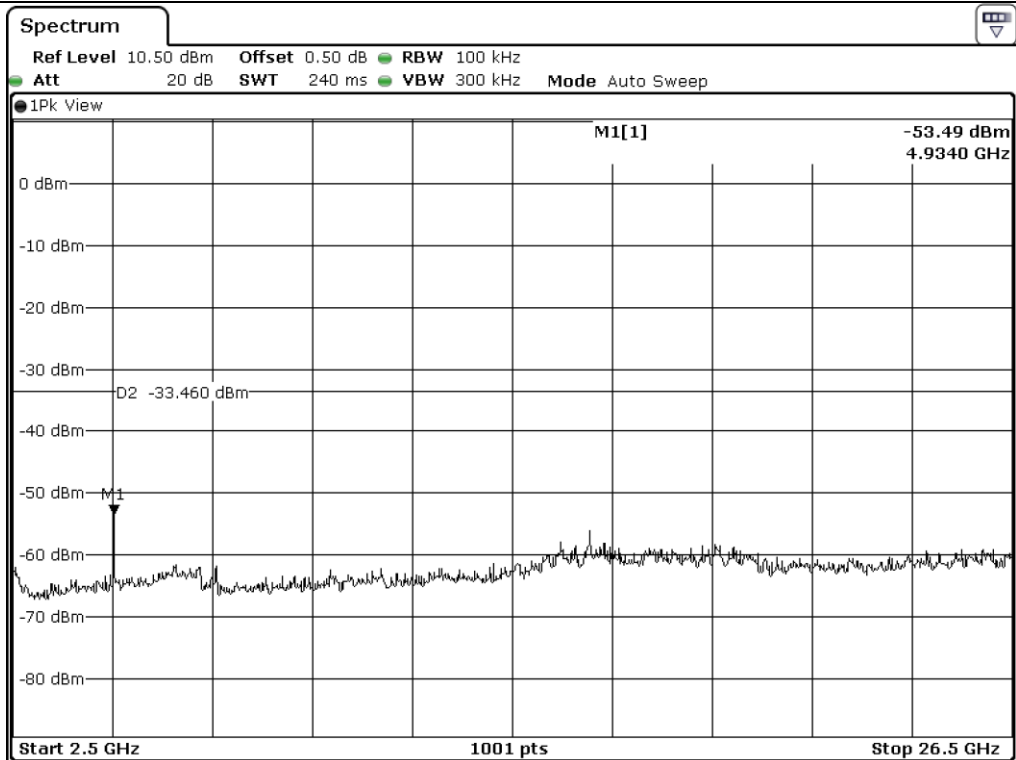
Middle Channel



Middle Channel



High Channel



High Channel

9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

9.6.1.1 Test data for Antenna 0

- . Test Date : January 16, 2018 ~ January 26, 2018
- . 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
- . 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									
2 390.00	40.51	Peak	H	26.94	9.20	34.76	41.89	74.00	32.11
	30.65	Average	H				32.03	54.00	21.97
	41.51	Peak	V				42.89	74.00	31.11
	31.55	Average	V				32.93	54.00	21.07
Test Data for High Channel									
2 483.50	39.65	Peak	H	27.47	9.49	35.51	41.10	74.00	32.90
	29.08	Average	H				30.53	54.00	23.47
	40.45	Peak	V				41.90	74.00	32.10
	30.05	Average	V				31.50	54.00	22.50

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: Tae-Ho, Kim / Senior Manager

9.6.1.2 Test data for Antenna 1

- Test Date : January 16, 2018 ~ January 26, 2018
- 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
- 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									
2 390.00	39.84	Peak	H	26.94	9.20	34.76	41.22	74.00	32.78
	30.24	Average	H				31.62	54.00	22.38
	41.22	Peak	V				42.60	74.00	31.40
	31.51	Average	V				32.89	54.00	21.11
Test Data for High Channel									
2 483.50	40.21	Peak	H	27.47	9.49	35.51	41.66	74.00	32.34
	29.61	Average	H				31.06	54.00	22.94
	39.51	Peak	V				40.96	74.00	33.04
	30.12	Average	V				31.57	54.00	22.43

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: Tae-Ho, Kim / Senior Manager

9.6.2 Spurious & Harmonic Radiated Emission

9.6.2.1 Test data for Antenna 0

- Test Date : January 16, 2018 ~ January 26, 2018
- 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
- 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									
4 824.00	41.42	Peak	H	30.84	12.31	35.74	48.83	74.00	25.17
	31.01	Average	H				38.42	54.00	15.58
	41.88	Peak	V				49.29	74.00	24.71
	31.12	Average	V				38.53	54.00	15.47
Test Data for Middle Channel									
4 876.00	41.21	Peak	H	30.01	12.43	35.80	47.85	74.00	26.15
	30.84	Average	H				37.48	54.00	16.52
	42.99	Peak	V				49.63	74.00	24.37
	31.25	Average	V				37.89	54.00	16.11
Test Data for High Channel									
4 928.00	41.41	Peak	H	31.15	12.81	35.96	49.41	74.00	24.59
	30.33	Average	H				38.33	54.00	15.67
	42.07	Peak	V				50.07	74.00	23.93
	30.68	Average	V				38.68	54.00	15.32

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: Tae-Ho, Kim / Senior Manager

9.6.2.2 Test data for Antenna 1

- Test Date : January 16, 2018 ~ January 26, 2018
- 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
- 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									
4 824.00	41.24	Peak	H	30.84	12.31	35.74	48.65	74.00	25.35
	30.48	Average	H				37.89	54.00	16.11
	42.06	Peak	V				49.47	74.00	24.53
	31.11	Average	V				38.52	54.00	15.48
Test Data for Middle Channel									
4 876.00	42.14	Peak	H	30.01	12.43	35.80	48.78	74.00	25.22
	32.84	Average	H				39.48	54.00	14.52
	41.75	Peak	V				48.39	74.00	25.61
	31.21	Average	V				37.85	54.00	16.15
Test Data for High Channel									
4 928.00	42.10	Peak	H	31.15	12.81	35.96	50.10	74.00	23.90
	31.89	Average	H				39.89	54.00	14.11
	41.51	Peak	V				49.51	74.00	24.49
	31.26	Average	V				39.26	54.00	14.74

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: Tae-Ho, Kim / Senior Manager

10. PEAK POWER SPECTRUL DENSITY

10.1 Operating environment

Temperature : 21 °C
Relative humidity : 41 % 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 for Antenna 0

-. Test Date : January 16, 2018 ~ January 26, 2018

-. Test Result : Pass

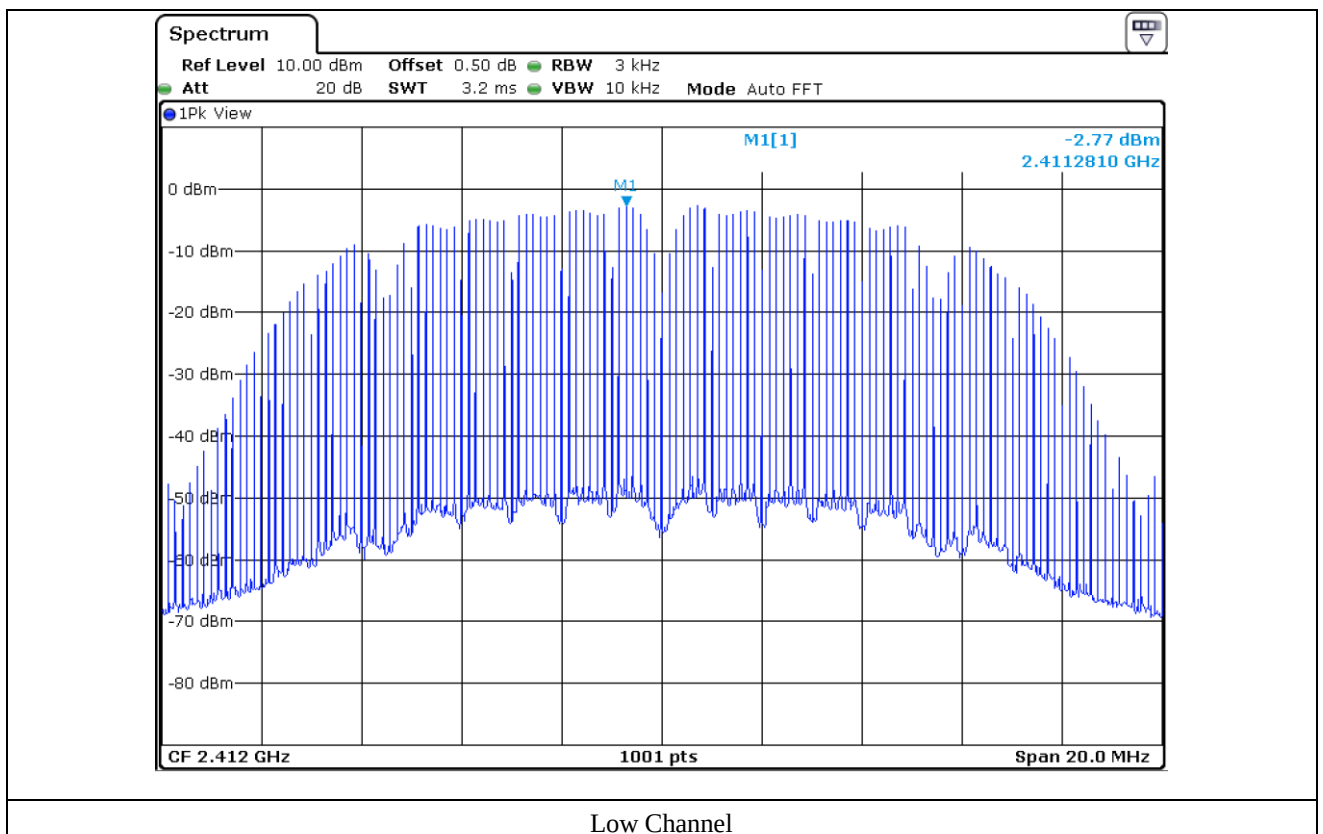
-. Operating Condition : Continuous transmitting mode

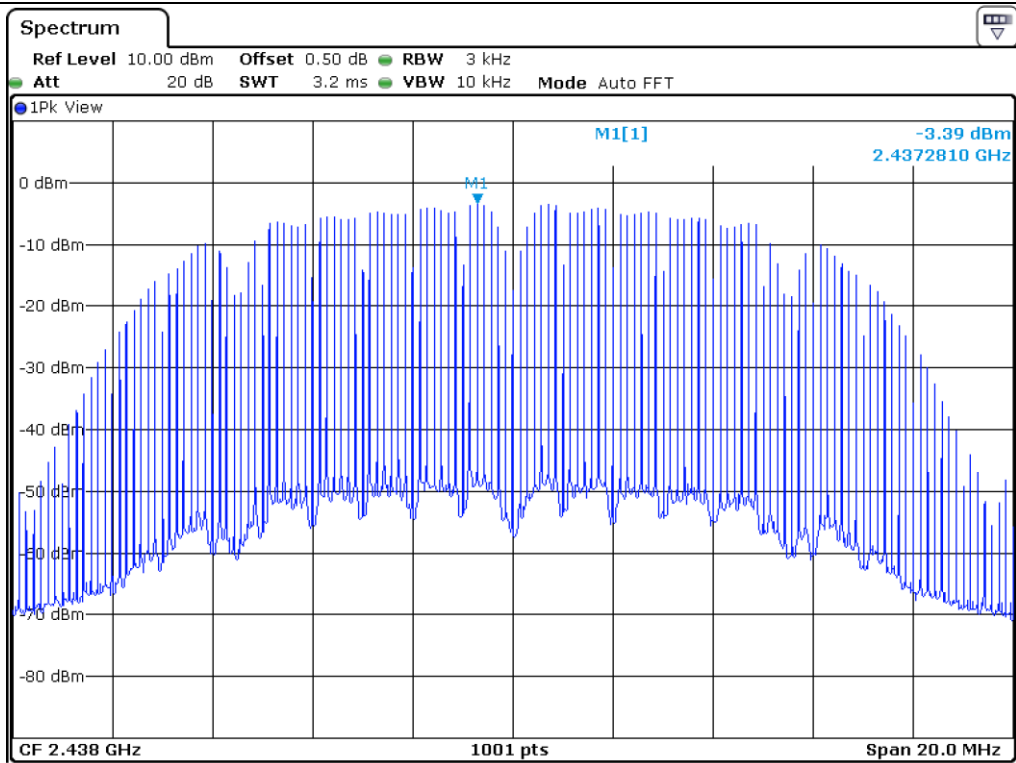
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-2.77	8.00	10.77
Middle	2 442.00	-3.39	8.00	11.39
High	2 462.00	-3.93	8.00	11.93

Remark. Margin = Limit – Measured value

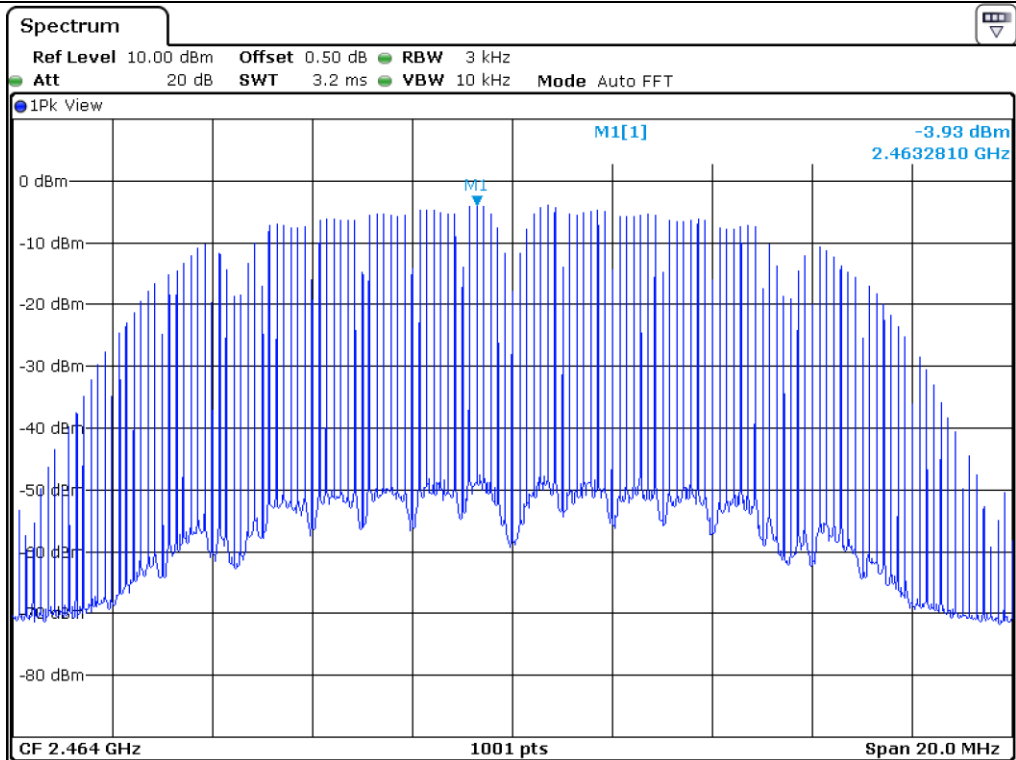


Tested by: Tae-Ho, Kim / Senior Manager





Middle Channel



High Channel

10.5 Test data for Antenna 1

-. Test Date : January 16, 2018 ~ January 26, 2018

-. Test Result : Pass

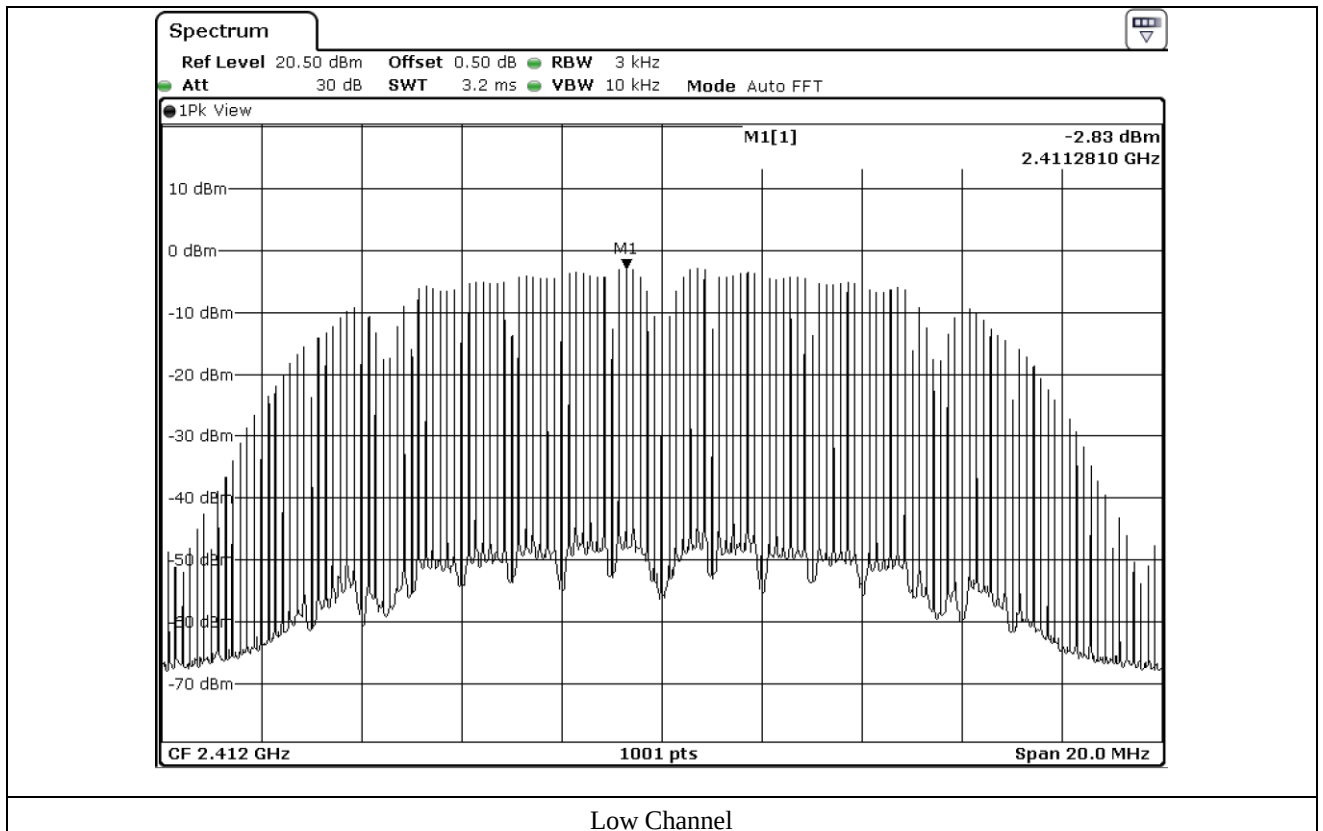
-. Operating Condition : Continuous transmitting mode

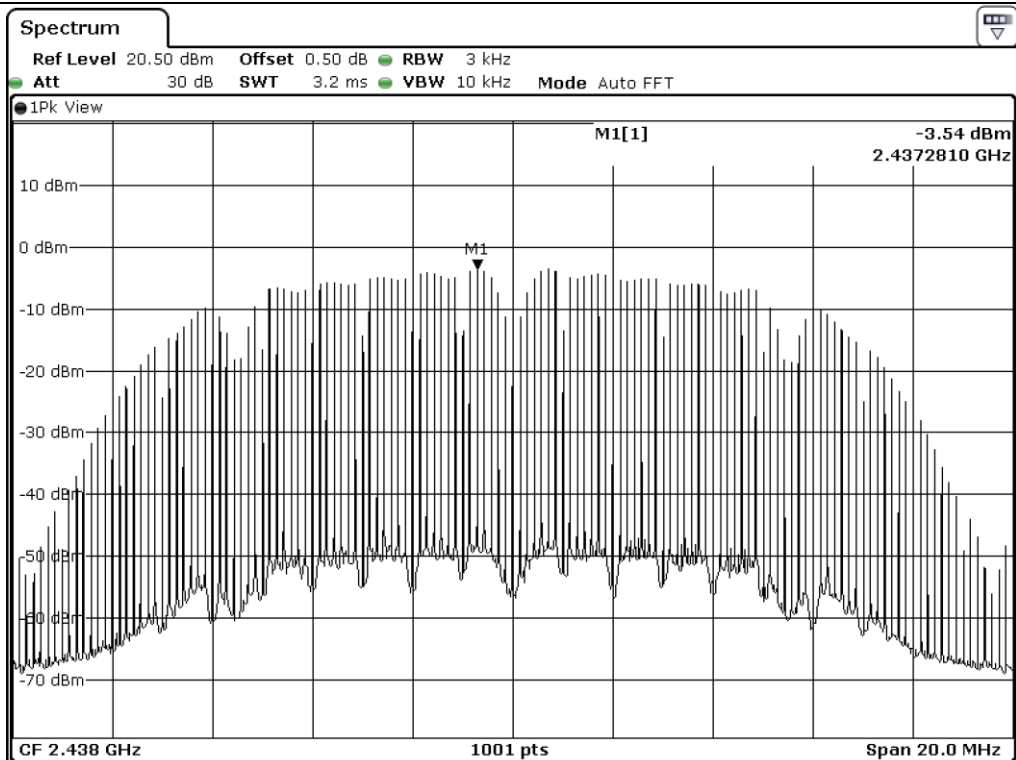
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412.00	-2.83	8.00	10.83
Middle	2 442.00	-3.54	8.00	11.54
High	2 462.00	-4.24	8.00	12.24

Remark. Margin = Limit – Measured value

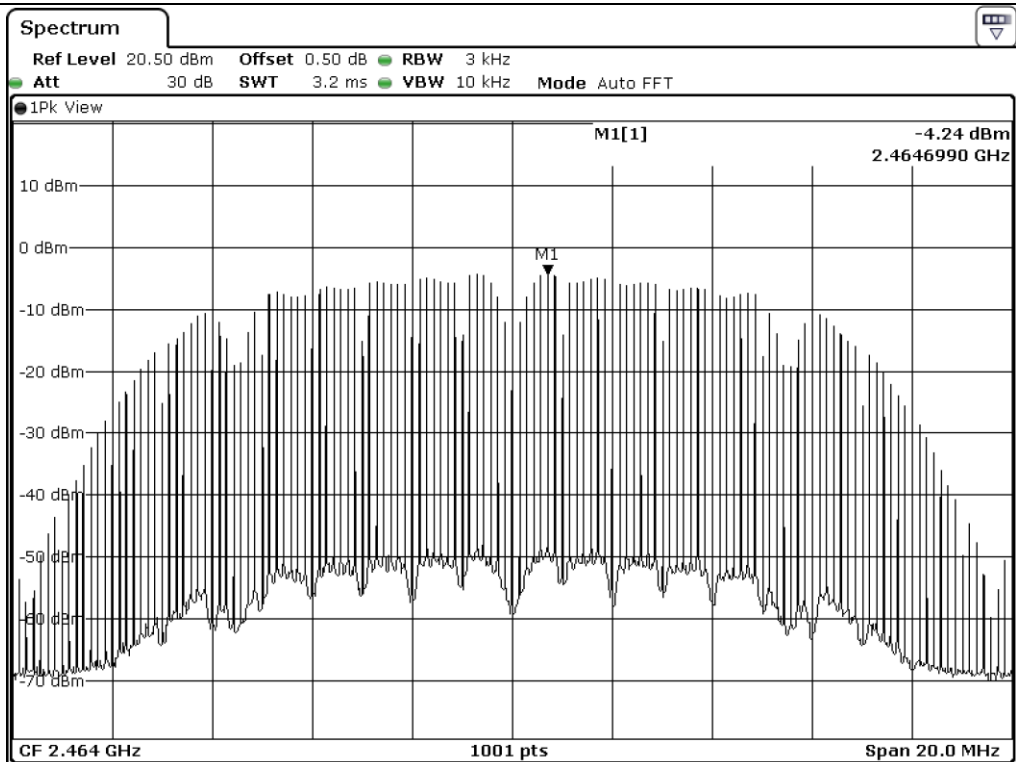


Tested by: Tae-Ho, Kim / Senior Manager





Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 21 °C
Relative humidity : 41 % R.H.

11.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. 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 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)
■ - 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.

11.4 Test data for 30 MHz ~ 1 GHz

Humidity Level : 41 % R.H.

Temperature: 21 °C

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

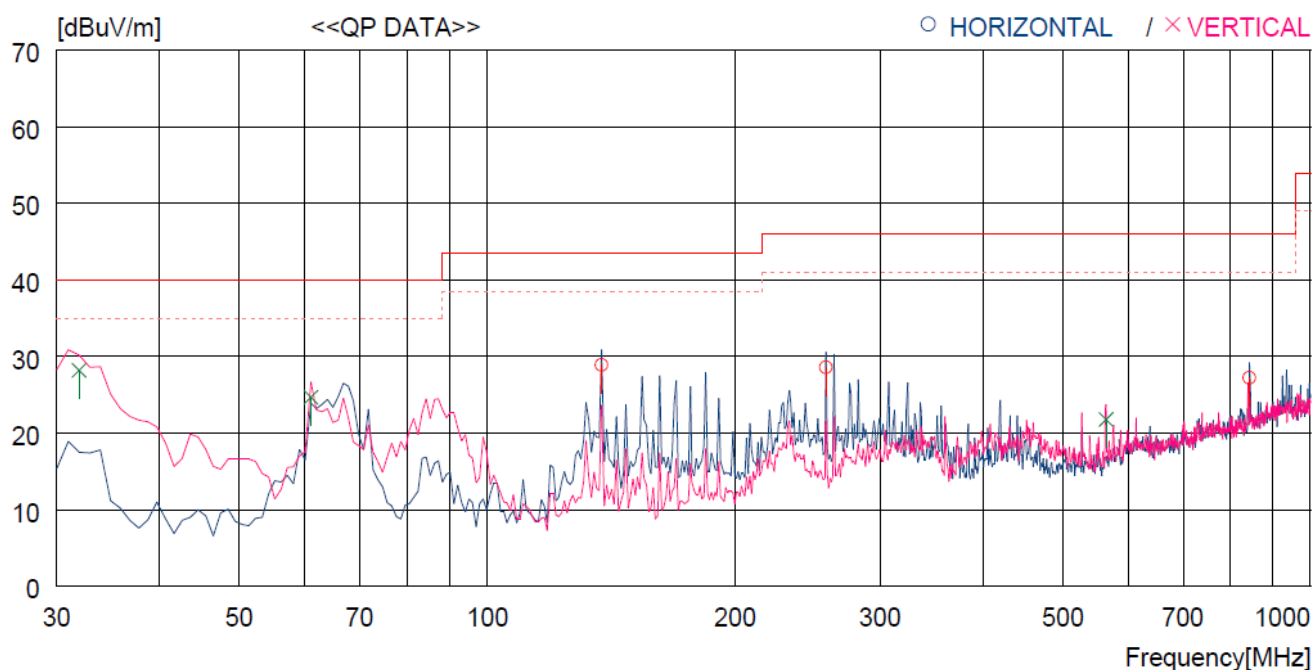
Result : PASSED

EUT : Audio transceiver module

Date: January 16, 2018 ~ January 26, 2018

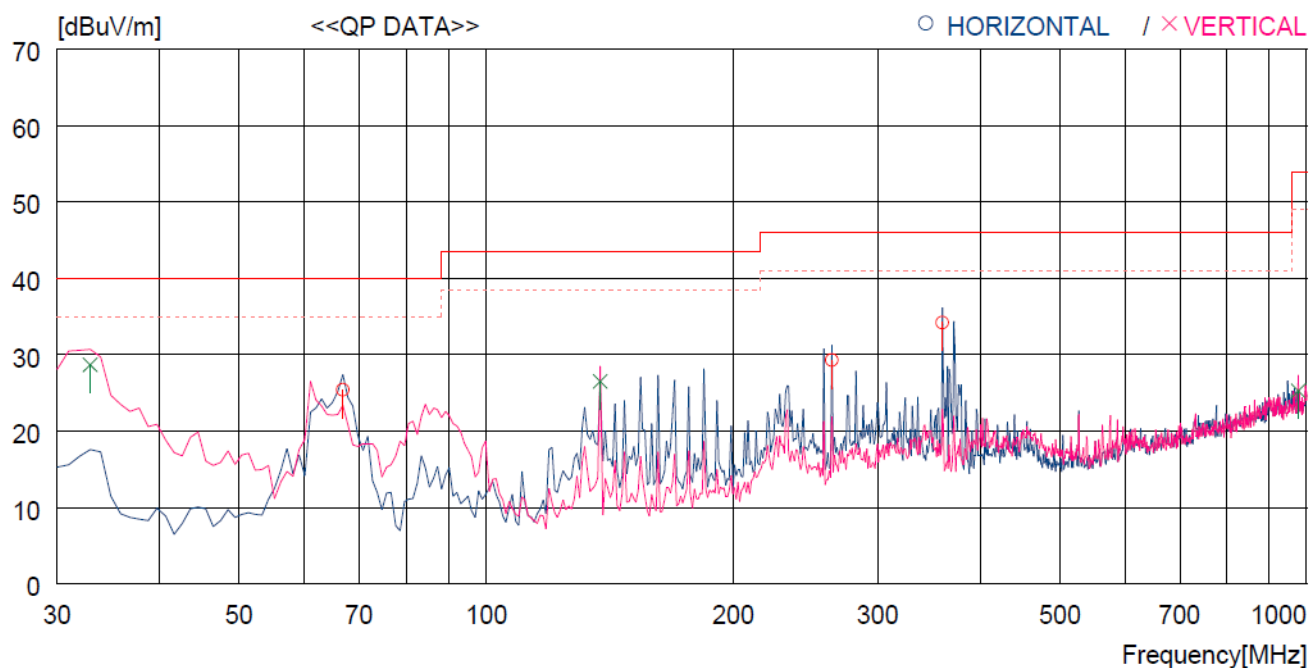
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



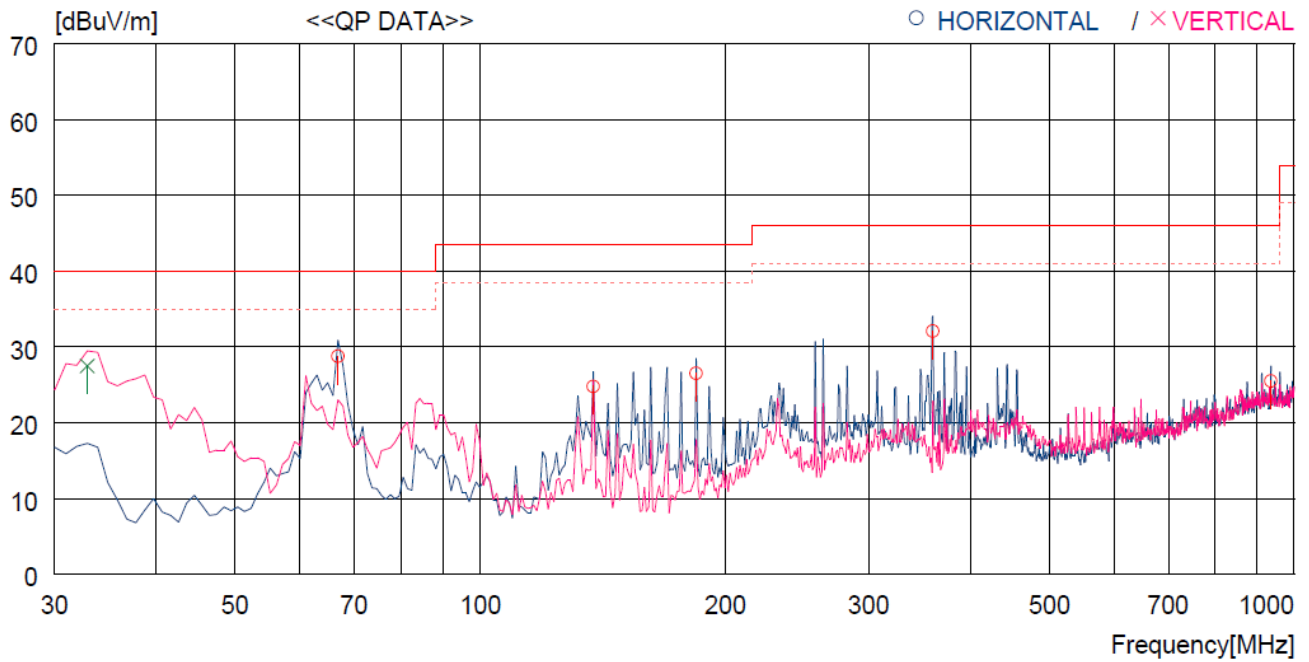
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
		[dBuV]	[dB]							
----- Horizontal -----										
1	137.670	50.8	8.2	2.8	32.9	28.9	43.5	14.6	133	0
2	257.950	45.7	12.3	3.7	33.1	28.6	46.0	17.4	133	0
3	842.851	32.5	21.0	6.7	33.0	27.2	46.0	18.8	133	0
----- Vertical -----										
4	31.940	48.2	11.7	1.4	33.1	28.2	40.0	11.8	100	54
5	61.040	43.0	12.9	1.9	33.1	24.7	40.0	15.3	100	261
6	564.469	32.0	17.7	5.4	33.3	21.8	46.0	24.2	100	103

Operating condition : Middle Channel



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	66.860	45.7	10.9	1.9	33.1	25.4	40.0	14.6	100	114
2	263.770	46.4	12.3	3.7	33.1	29.3	46.0	16.7	100	344
3	359.800	48.5	14.4	4.4	33.1	34.2	46.0	11.8	100	344
----- Vertical -----										
4	32.910	48.5	11.9	1.4	33.1	28.7	40.0	11.3	100	158
5	137.670	48.4	8.2	2.8	32.9	26.5	43.5	17.0	100	26
6	976.707	27.8	22.1	7.2	31.8	25.3	54.0	28.7	100	26

Operating condition : High Channel



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	66.860	49.1	10.9	1.9	33.1	28.8	40.0	11.2	100	160
2	137.670	46.7	8.2	2.8	32.9	24.8	43.5	18.7	100	52
3	184.230	46.5	9.9	3.2	33.1	26.5	43.5	17.0	100	176
4	359.800	46.4	14.4	4.4	33.1	32.1	46.0	13.9	100	100
5	935.968	28.8	21.9	7.1	32.3	25.5	46.0	20.5	100	232
----- Vertical -----										
6	32.910	47.3	11.9	1.4	33.1	27.5	40.0	12.5	100	233


 Tested by: Tae-Ho, Kim / Senior Manager

11.5 Test data for Below 30 MHz

- Test Date : January 16, 2018 ~ January 26, 2018
- 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.									

11.6 Test data for above 1 GHz

- Test Date : January 16, 2018 ~ January 26, 2018
- 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: Tae-Ho, Kim / Senior Manager

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 21 °C
Relative humidity : 41 % 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)
■ -	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.

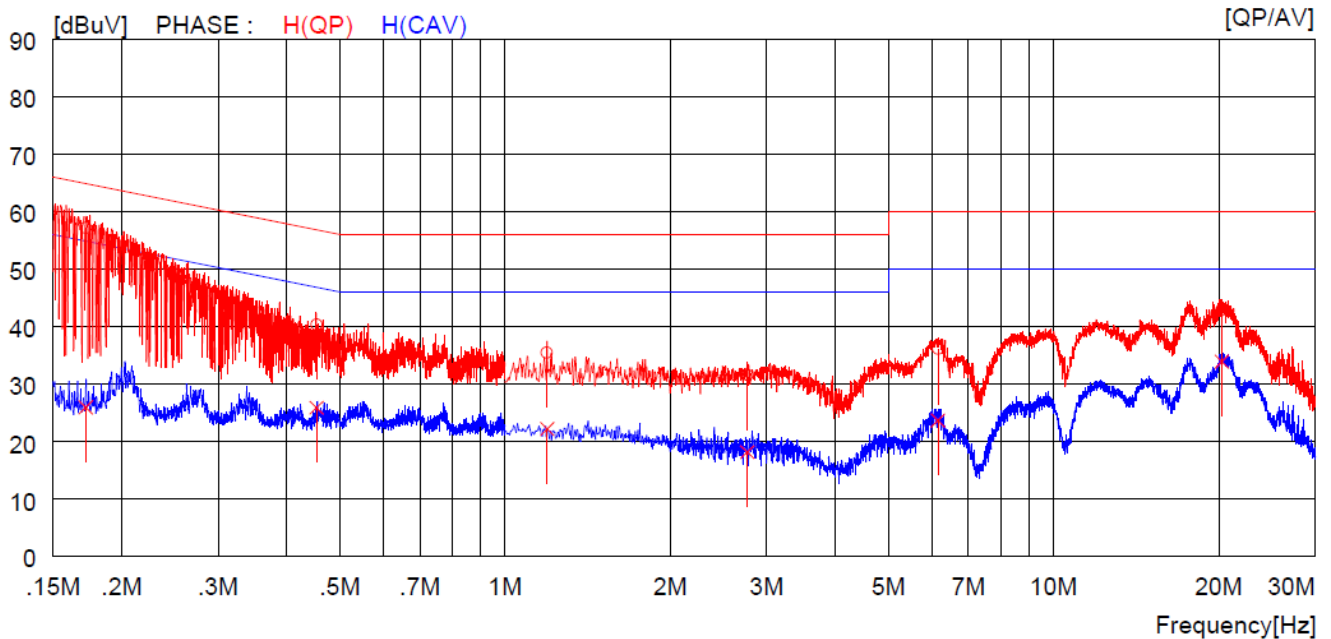
12.4 Test data

-. Test Date : January 16, 2018 ~ January 26, 2018

-. Resolution bandwidth : 9 kHz

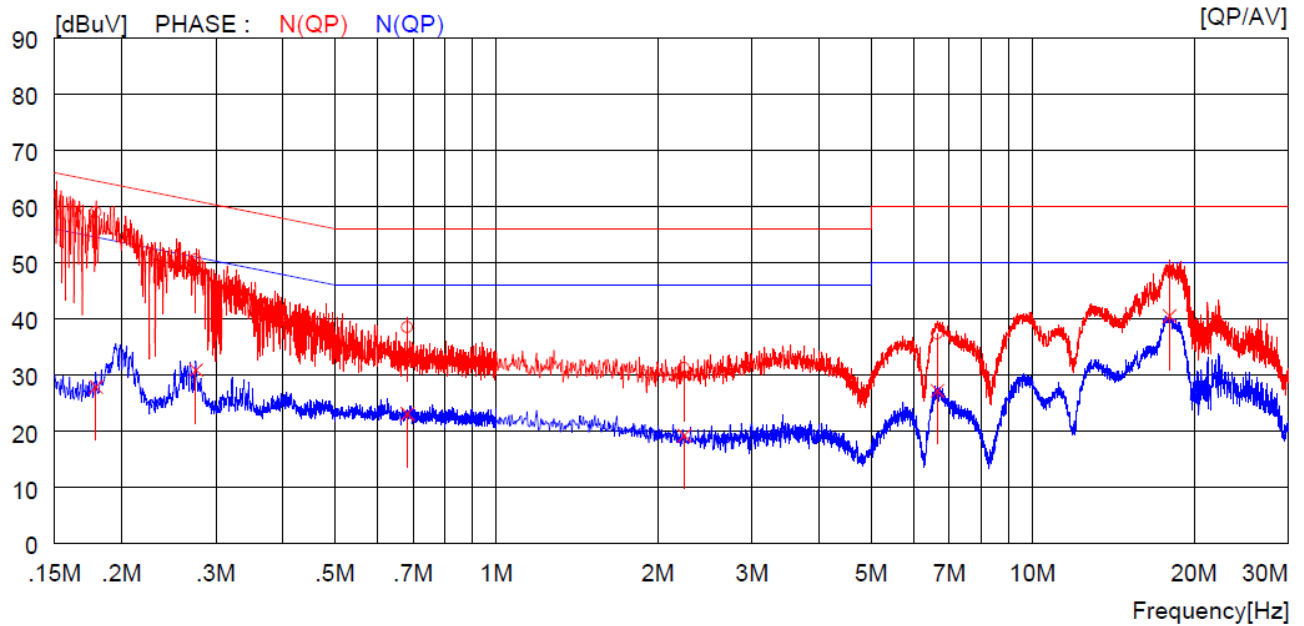
-. Frequency range : 0.15 MHz ~ 30 MHz

-. 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	0.17200	47.2	----	10.0	57.2	----	64.9	----	7.7	----	H (QP)
2	0.45300	30.4	----	10.0	40.4	----	56.8	----	16.4	----	H (QP)
3	1.19200	25.4	----	10.1	35.5	----	56.0	----	20.5	----	H (QP)
4	2.76400	21.4	----	10.2	31.6	----	56.0	----	24.4	----	H (QP)
5	6.16000	25.8	----	10.3	36.1	----	60.0	----	23.9	----	H (QP)
6	20.26000	32.0	----	10.8	42.8	----	60.0	----	17.2	----	H (QP)
7	0.17200	----	16.0	10.0	----	26.0	----	54.9	----	28.9	H (CAV)
8	0.45300	----	15.9	10.0	----	25.9	----	46.8	----	20.9	H (CAV)
9	1.19200	----	12.1	10.1	----	22.2	----	46.0	----	23.8	H (CAV)
10	2.76400	----	8.0	10.2	----	18.2	----	46.0	----	27.8	H (CAV)
11	6.16000	----	13.4	10.3	----	23.7	----	50.0	----	26.3	H (CAV)
12	20.26000	----	23.1	10.8	----	33.9	----	50.0	----	16.1	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	0.17900	49.0	----	10.0	59.0	----	64.5	----	5.5	----	N (QP)
2	0.27500	40.6	----	10.0	50.6	----	61.0	----	10.4	----	N (QP)
3	0.68200	28.4	----	10.1	38.5	----	56.0	----	17.5	----	N (QP)
4	2.24000	21.2	----	10.1	31.3	----	56.0	----	24.7	----	N (QP)
5	6.64500	27.1	----	10.3	37.4	----	60.0	----	22.6	----	N (QP)
6	18.01000	37.8	----	10.7	48.5	----	60.0	----	11.5	----	N (QP)
7	0.17900	----	17.9	10.0	----	27.9	----	54.5	----	26.6	N (CAV)
8	0.27500	----	20.9	10.0	----	30.9	----	51.0	----	20.1	N (CAV)
9	0.68200	----	13.0	10.1	----	23.1	----	46.0	----	22.9	N (CAV)
10	2.24000	----	9.2	10.1	----	19.3	----	46.0	----	26.7	N (CAV)
11	6.64500	----	16.9	10.3	----	27.2	----	50.0	----	22.8	N (CAV)
12	18.01000	----	29.8	10.7	----	40.5	----	50.0	----	9.5	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: Tae-Ho, Kim / Senior Manager