

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

Test Report No. : OT-182-RWD-003

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 : 70 pages (including this page)

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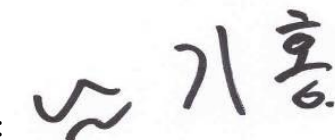
SUMMARY

The equipment complies with the regulation; **FCC PART 15 SUBPART E Section 15.407**

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-003	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. : +82-31-776-6400
FCC ID : A3LWISP50S
Model Name : WISP50S
Brand Name : SAMSUNG
Serial Number : N/A
Date : February 01, 2018

EQUIPMENT CLASS	Unlicensed National Information Infrastructure(UNII)
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 E Section 15.407 KDB 789033 D01 General UNII Test Procedures
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
15.407(a)	26 dB Bandwidth	PASS
	99 % Occupied Bandwidth	PASS
15.407(a)	Maximum Conducted Output Power	Met the Limit / PASS
15.407(a)	Peak Power Spectral Density	Met the Limit / PASS
15.407(a)	Peak Excursion	Met the Limit / PASS
15.407(g)	Frequency Stability	Met the Limit / PASS
15.407(b)	Undesirable Emissions	Met the Limit / PASS
15.205, 15.407(b)	General Field Strength Limits (Restricted Bandsand Radiated Emission Limits)	Met the Limit / PASS
15.207	AC Conducted Emissions 150 kHz-30 MHz	Met the Limit / 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 E Section 15.407

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

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EMC-003 (Rev.2)

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

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 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 open area test site.

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.

5.4 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 26 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 26 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 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

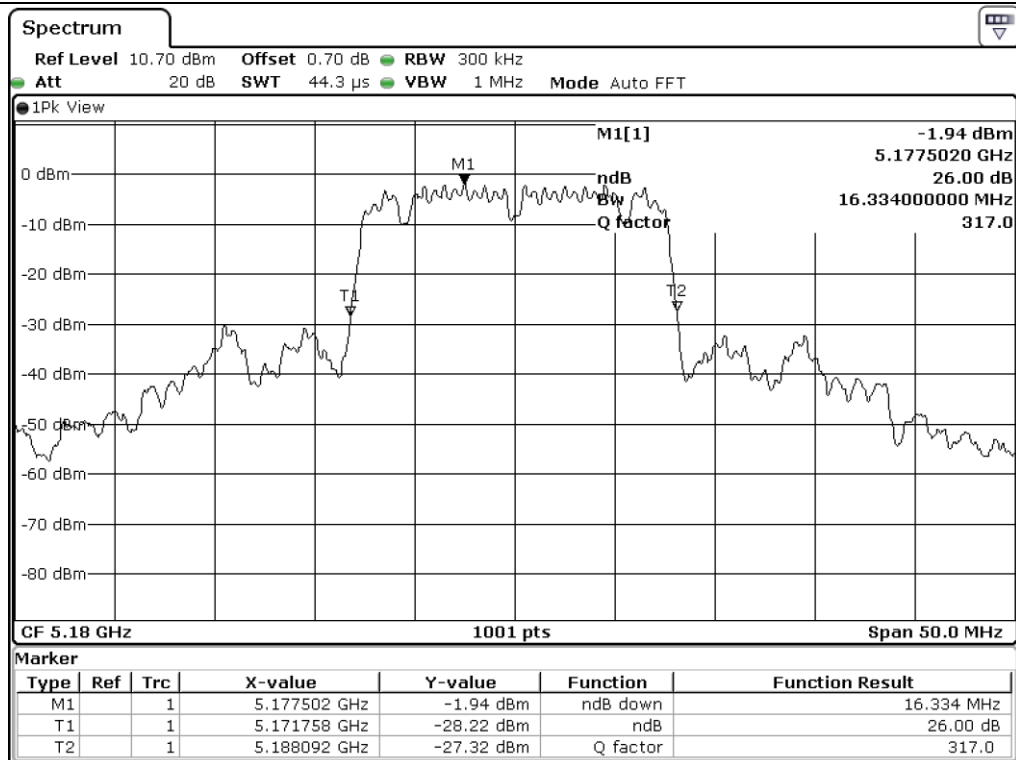
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180.00	16.33
	Middle	5 210.00	16.33
	High	5 240.00	16.33
5 725 ~ 5 850	Low	5 736.00	16.68
	Middle	5 762.00	16.68
	High	5 814.00	16.68

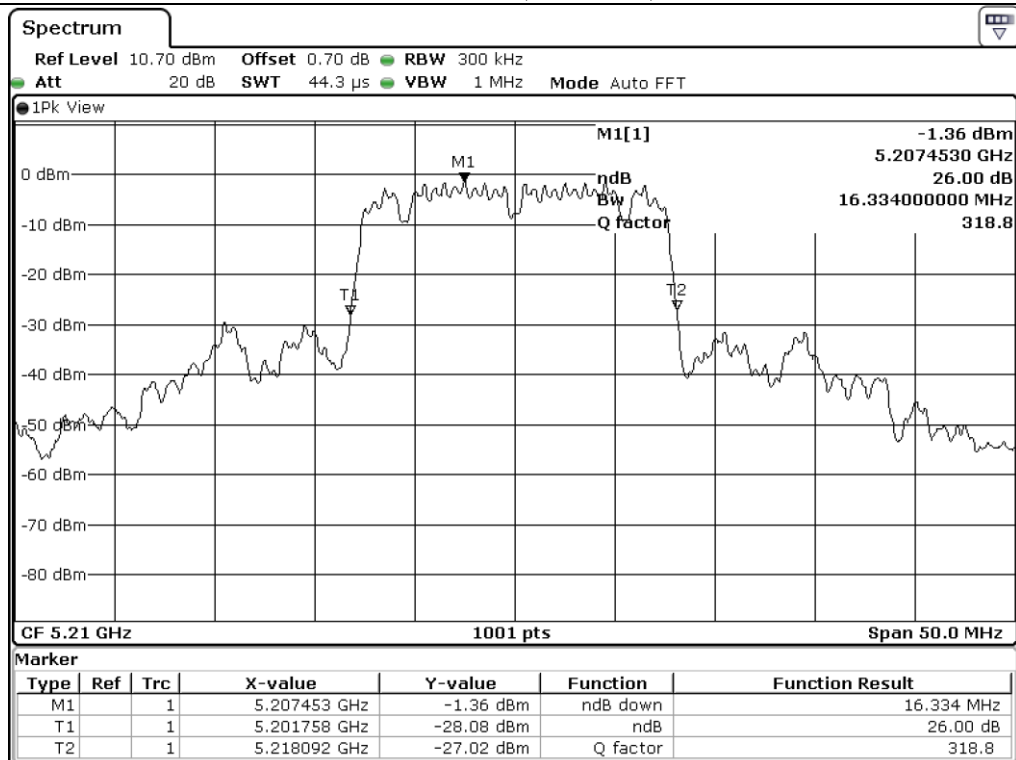
Remark: See next page for measurement data.



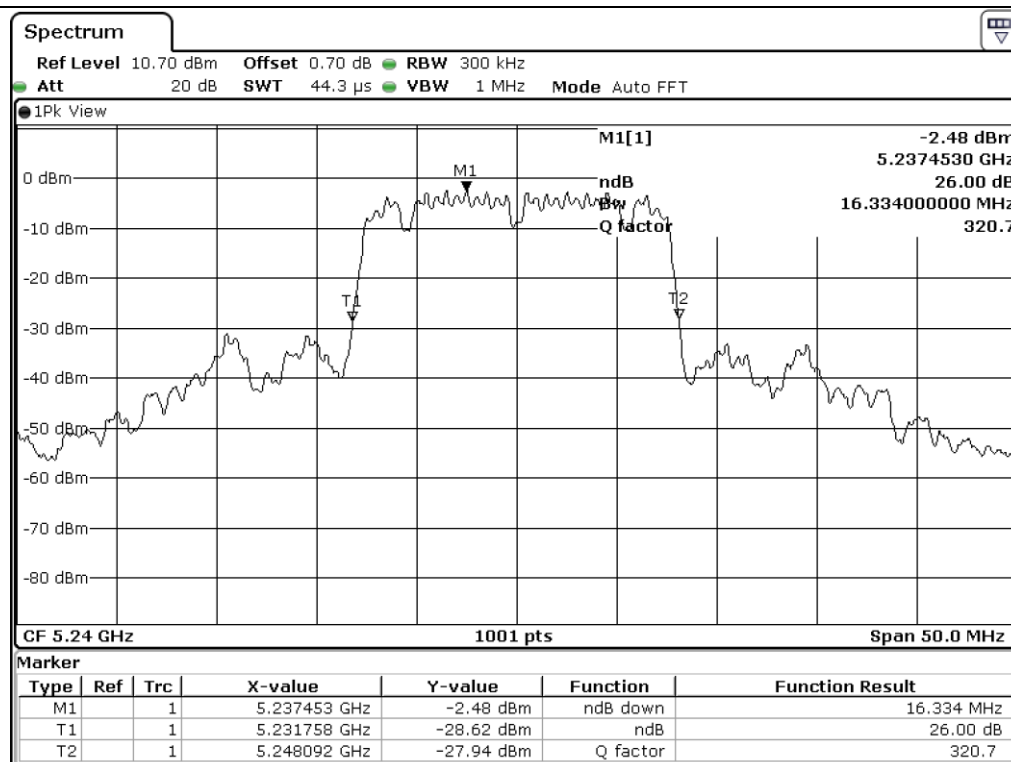
Tested by: Tae-Ho, Kim / Senior Manager



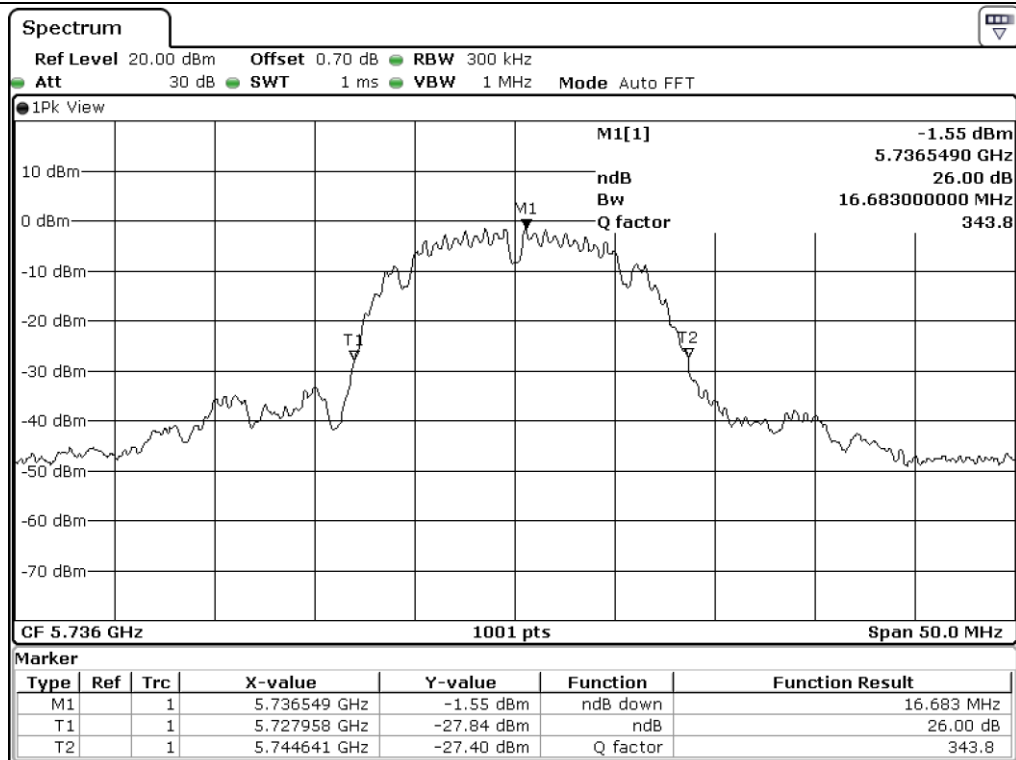
Low Channel (5 180 MHz)



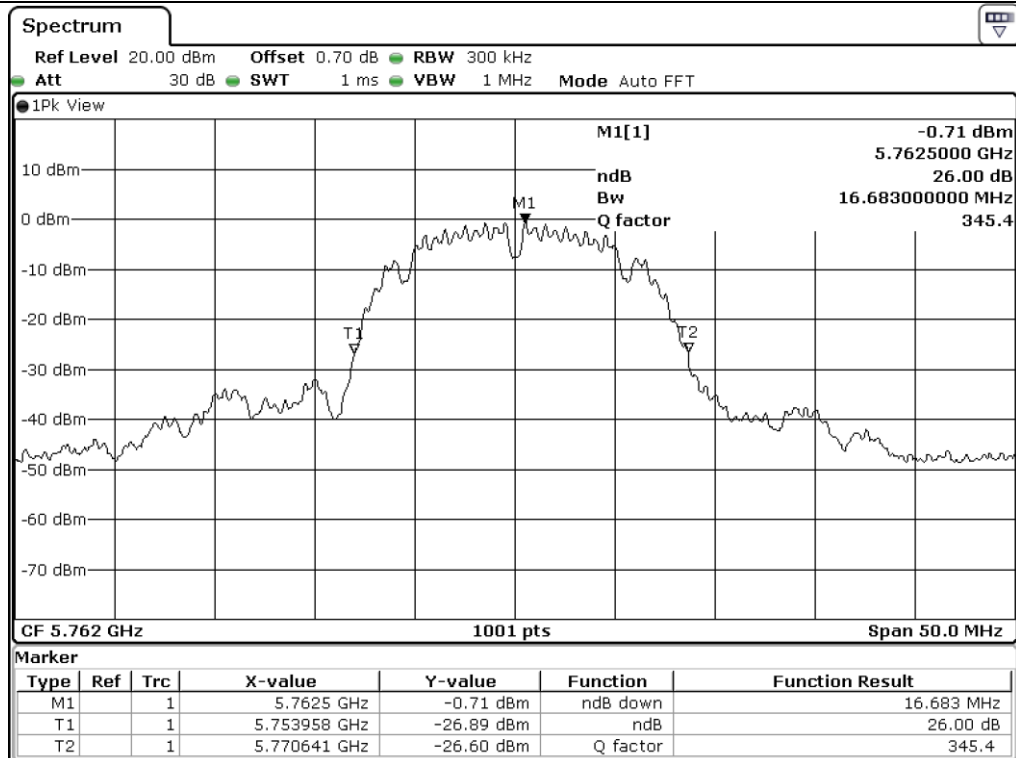
Middle Channel (5 210 MHz)



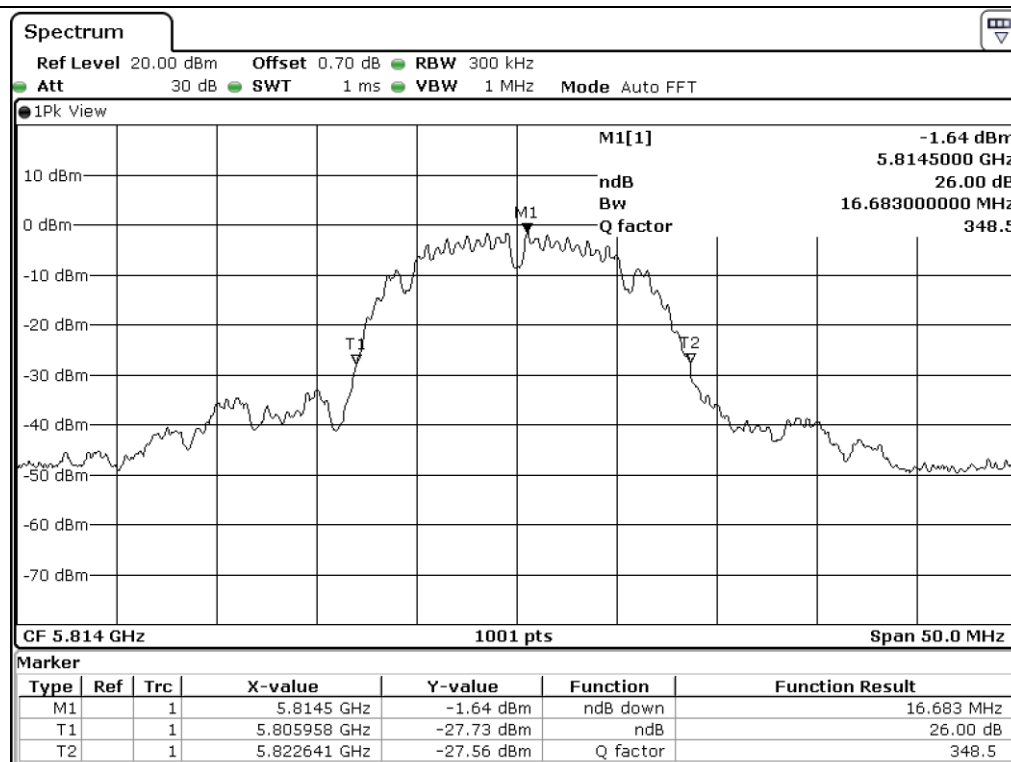
High Channel (5 240 MHz)



Low Channel (5 736 MHz)



Middle Channel (5 762 MHz)



High Channel (5 814 MHz)

7.5 Test data for Antenna 1

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

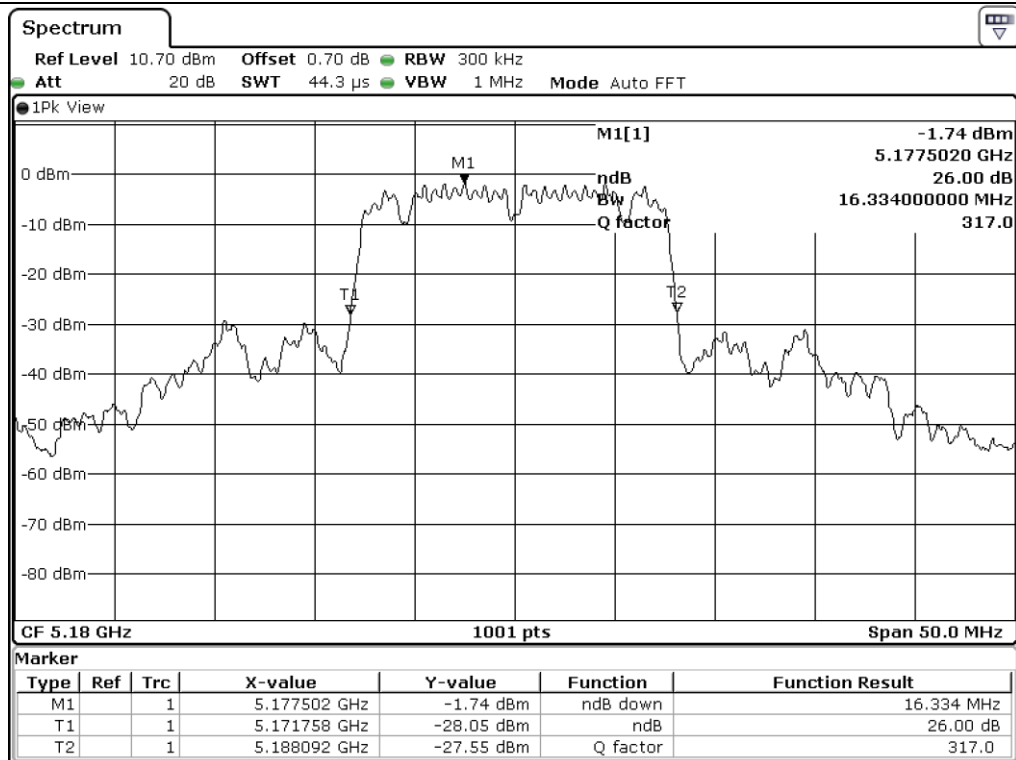
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 150 ~ 5 250	Low	5 180.00	16.33
	Middle	5 210.00	16.33
	High	5 240.00	16.33
5 725 ~ 5 850	Low	5 736.00	16.68
	Middle	5 762.00	16.68
	High	5 814.00	16.68

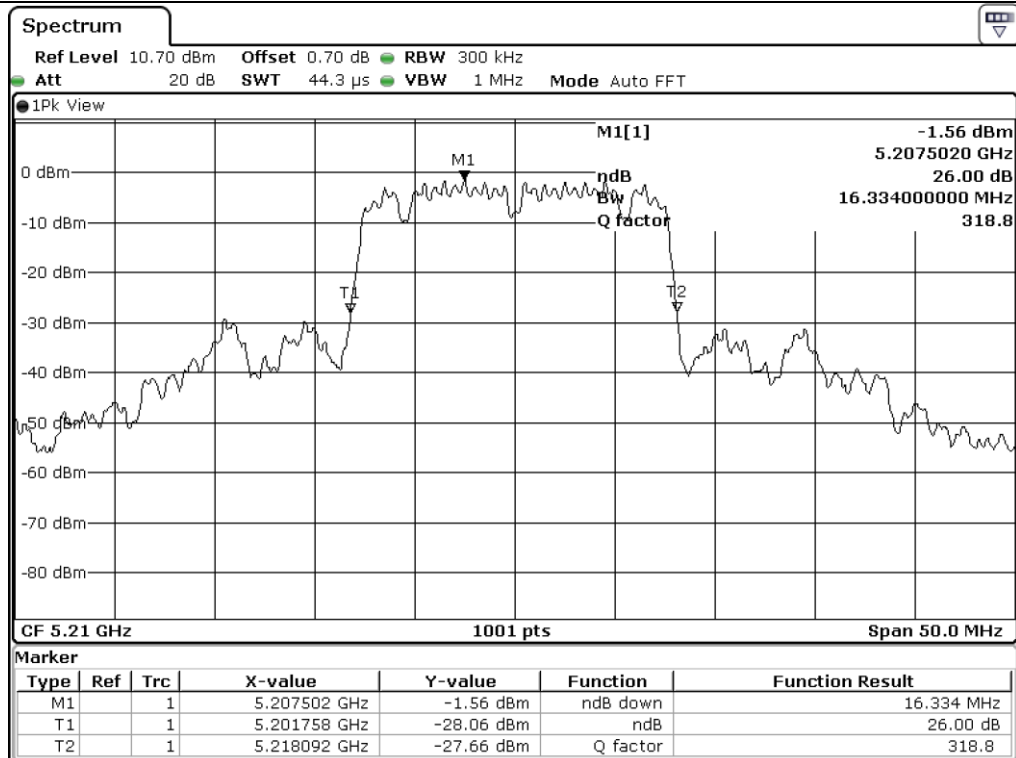
Remark: See next page for measurement data.



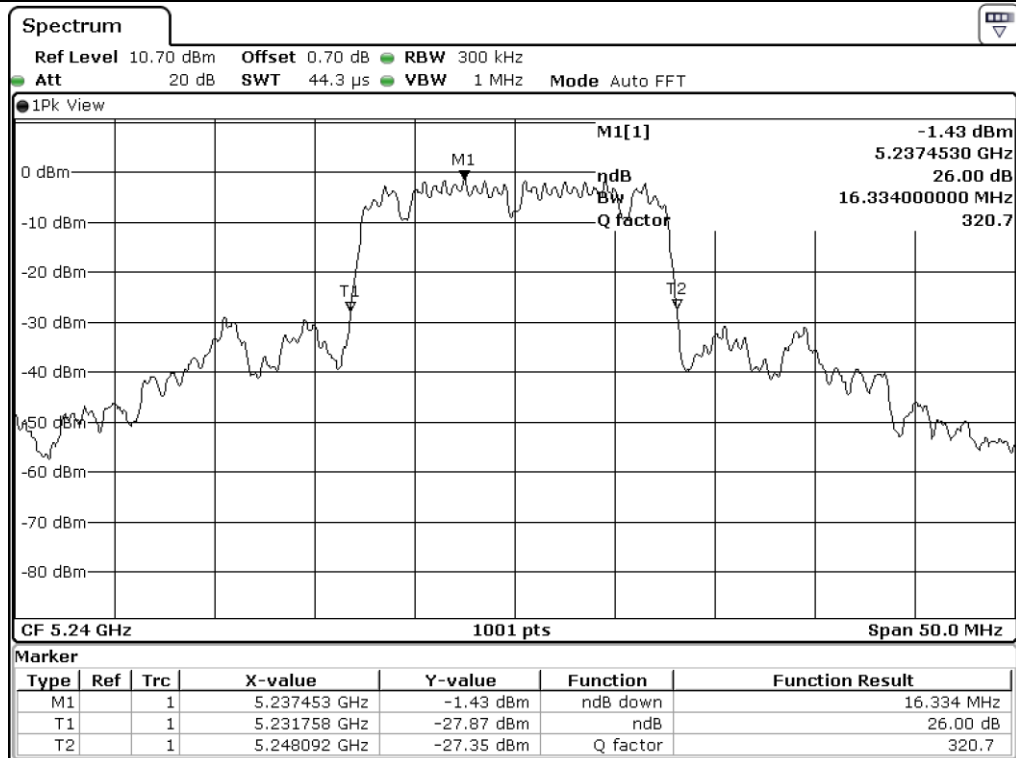
Tested by: Tae-Ho, Kim / Senior Manager



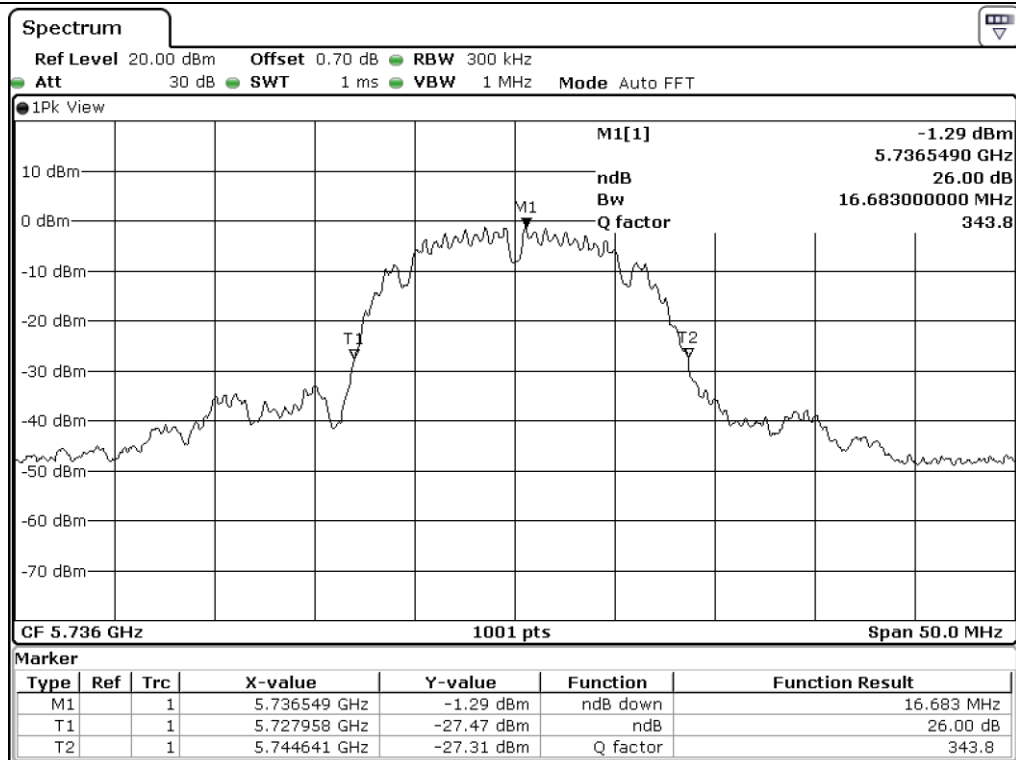
Low Channel (5 180 MHz)



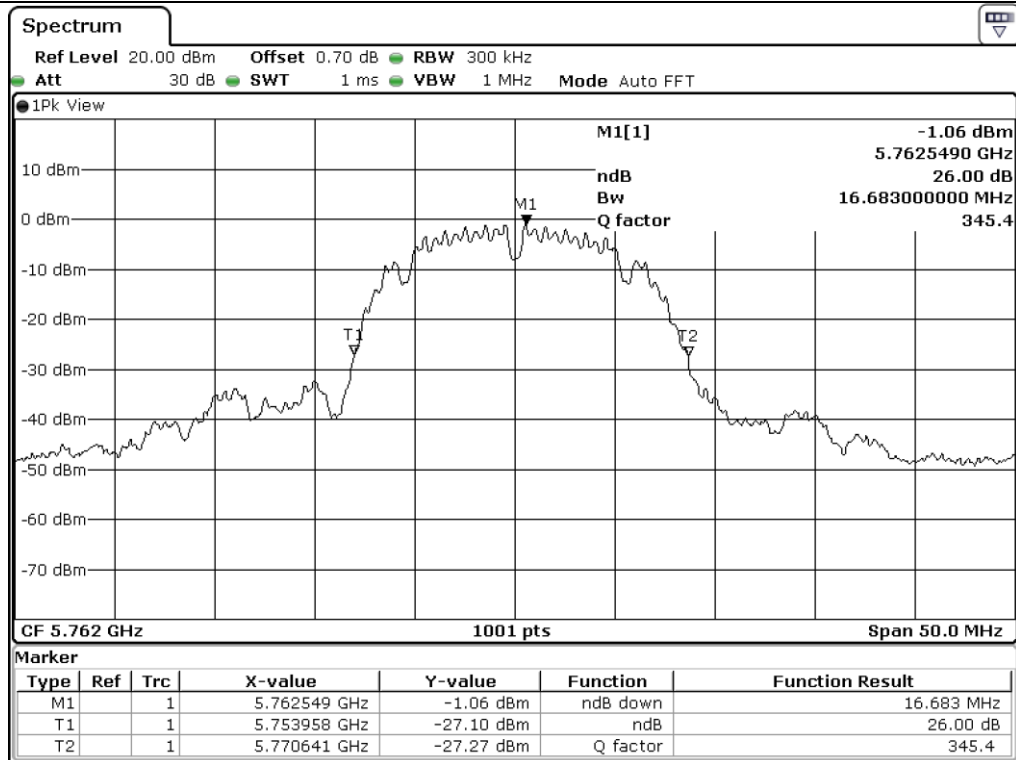
Middle Channel (5 210 MHz)



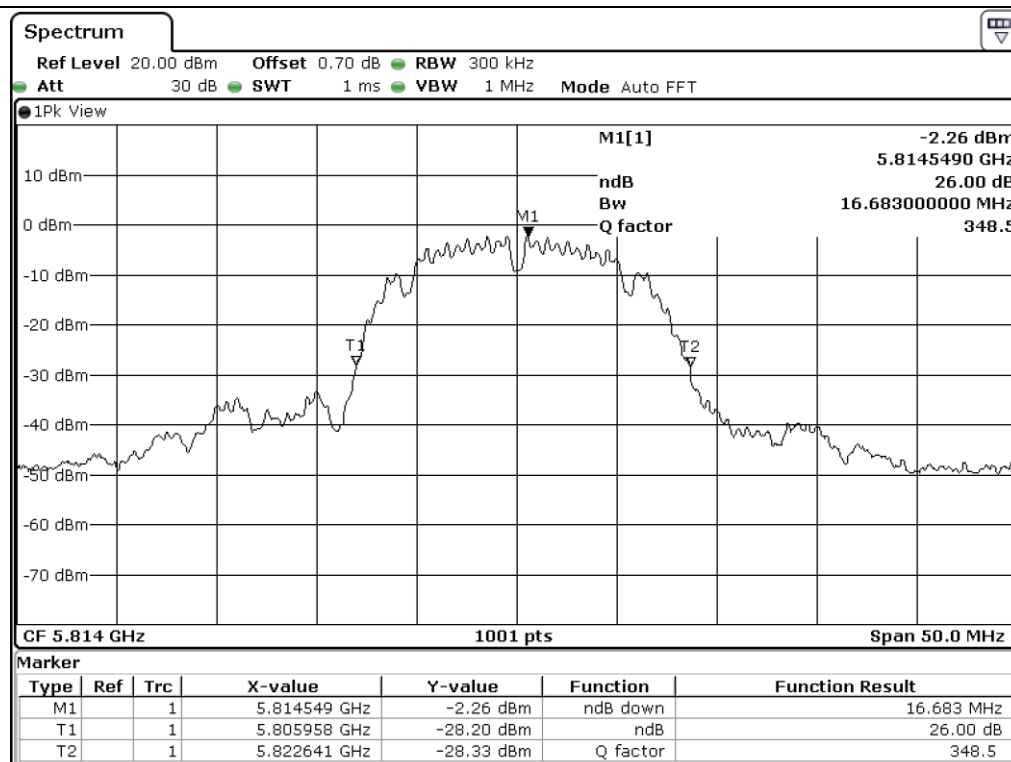
High Channel (5 240 MHz)



Low Channel (5 736 MHz)



Middle Channel (5 762 MHz)



High Channel (5 814 MHz)

8. 6 dB BANDWIDTH

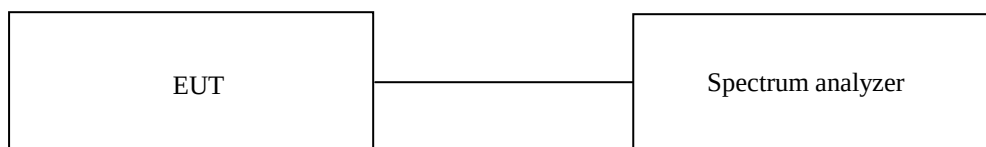
8.1 Operating environment

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 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.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Apr. 05, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data for Antenna 0

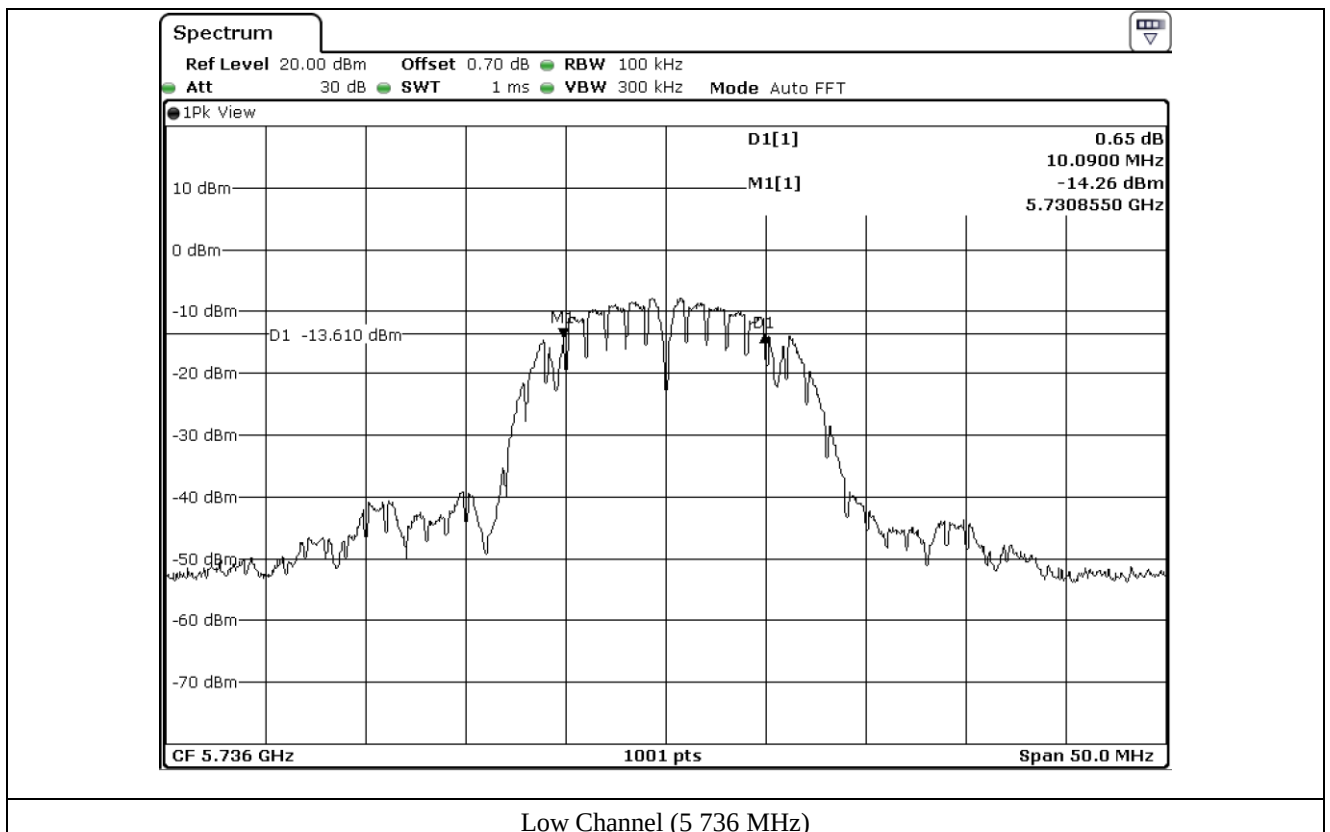
-. Test Date : January 16, 2018 ~ January 26, 2018

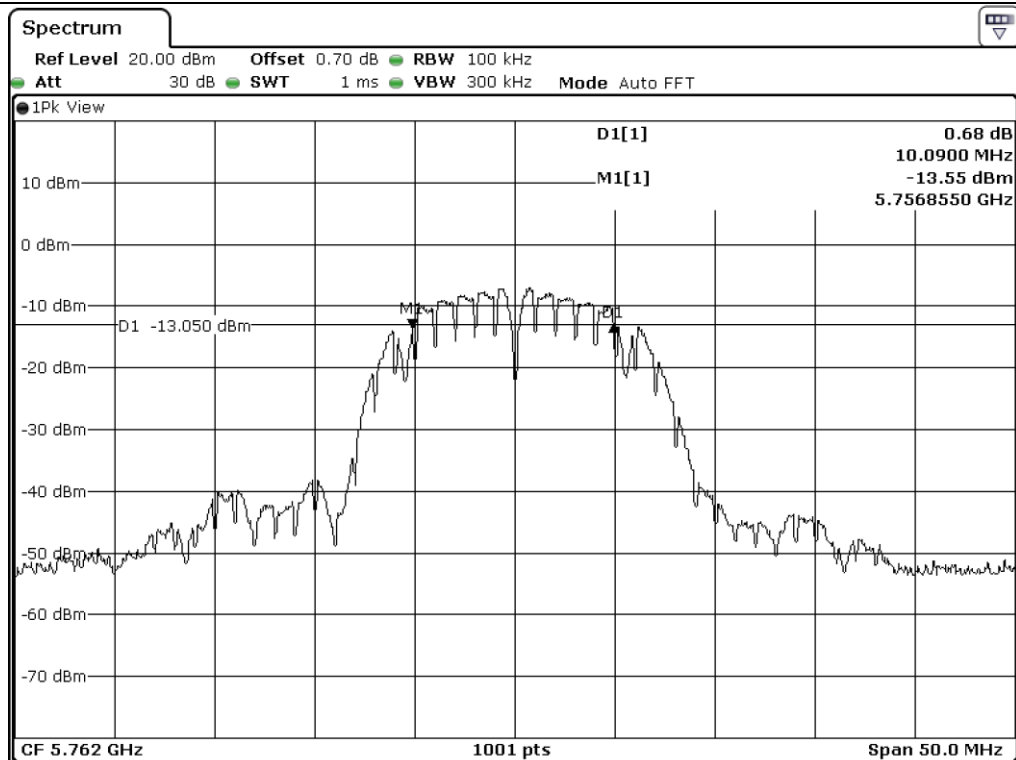
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 736.00	10.09
	Middle	5 762.00	10.09
	High	5 814.00	10.09

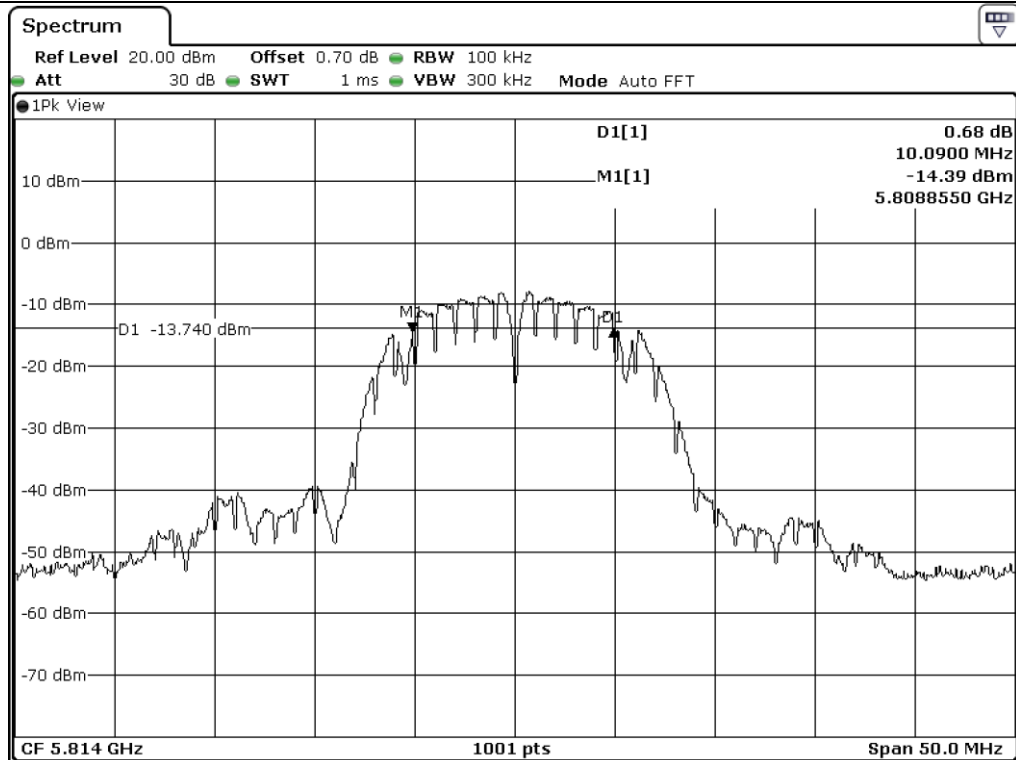


Tested by: Tae-Ho, Kim / Senior Manager





Middle Channel (5.762 MHz)



High Channel (5.814 MHz)

8.5 Test data for Antenna 1

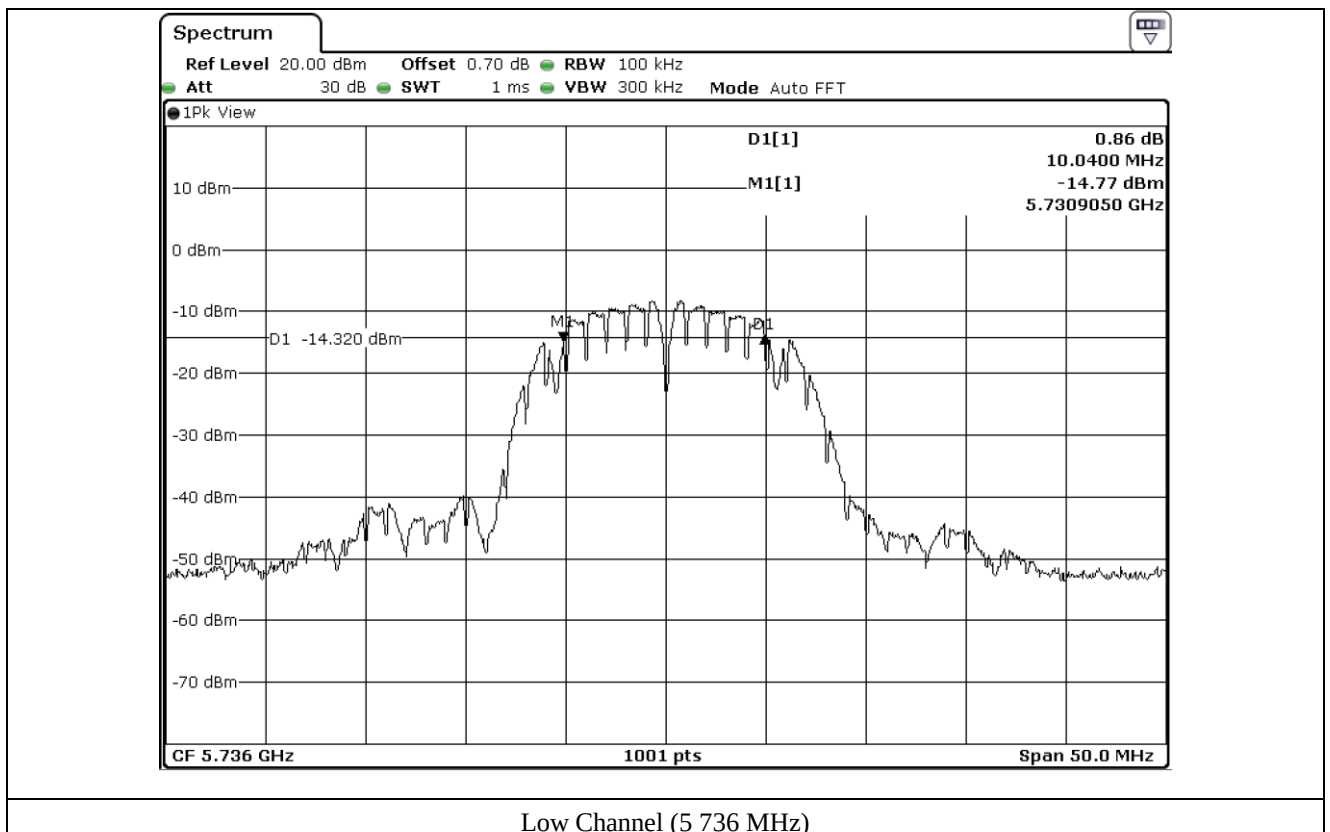
-. Test Date : January 16, 2018 ~ January 26, 2018

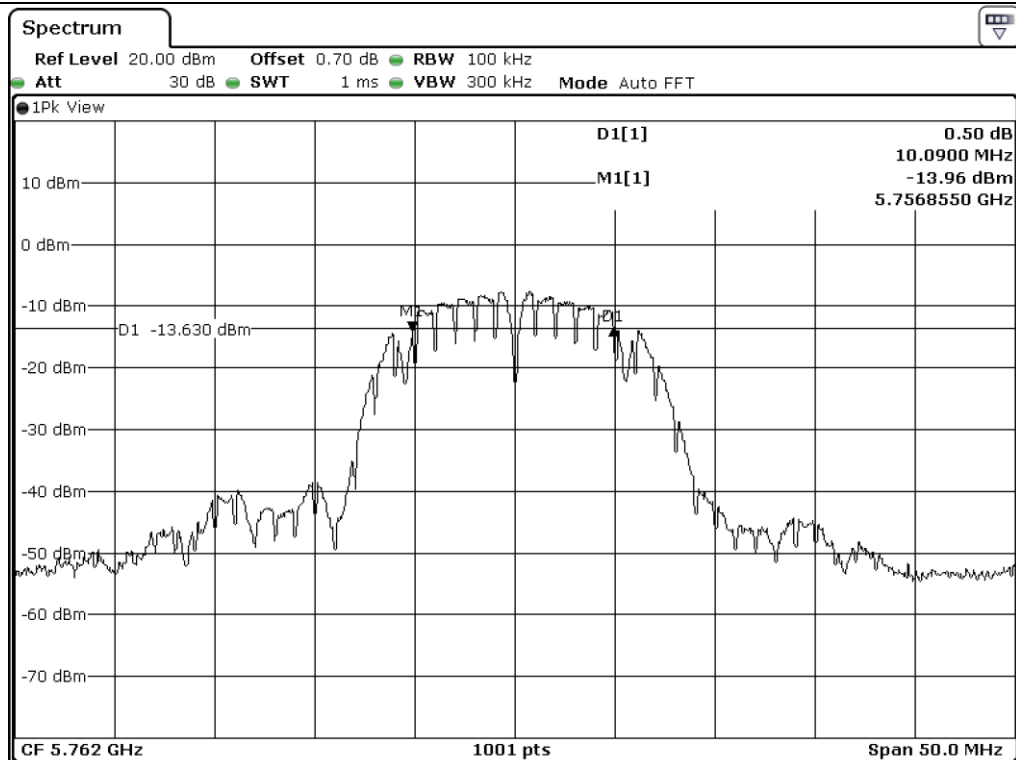
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745.00	16.33
	Middle	5 785.00	16.28
	High	5 825.00	16.28

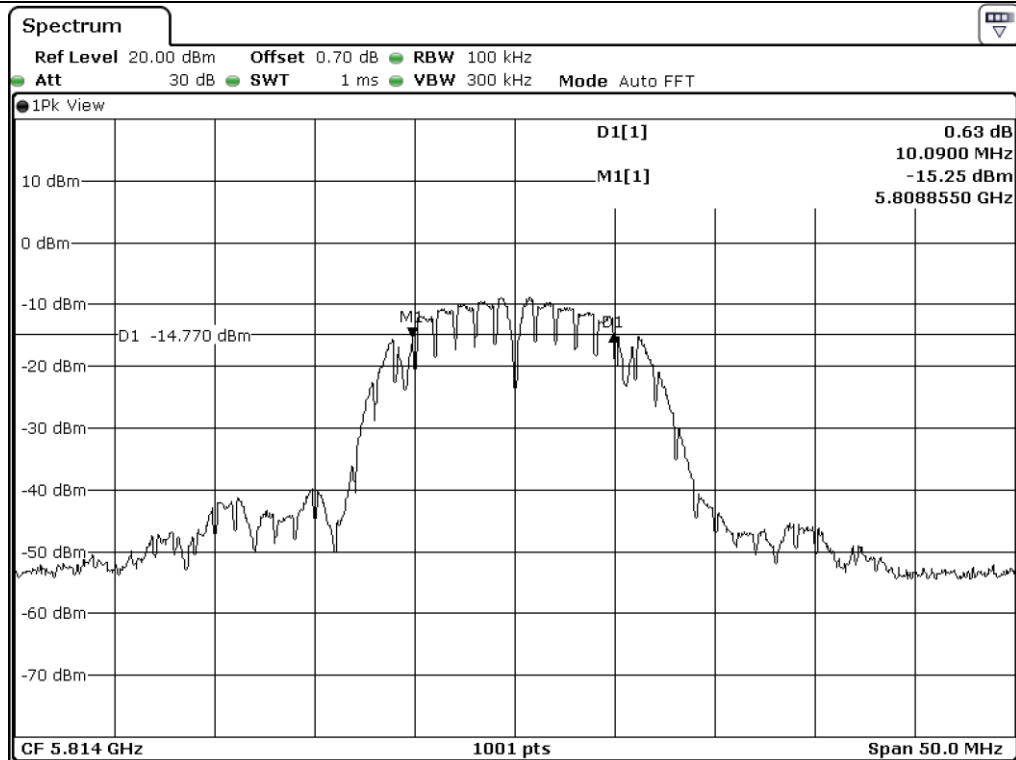


Tested by: Tae-Ho, Kim / Senior Manager





Middle Channel (5.762 MHz)



High Channel (5.814 MHz)

9 MAXIMUM PEAK OUTPUT POWER

9.1 Operating environment

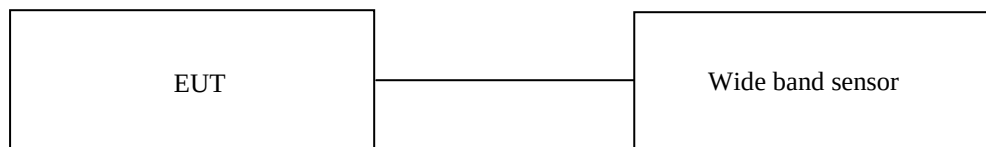
Temperature : 21 °C

Relative humidity : 41 % R.H.

9.2 Test set-up

The maximum peak output power was measured with the wide band sensor connected to the antenna output of the EUT. The Wide Band Sensor is measured when the EUT is transmitting at the appropriate center frequency its maximum power control level as described in Section E. 3.(KDB 789033 D02 General UNII Test Procedures New Rules v01r04).

Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.



9.3 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.

9.4 Test data for Antenna 0

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

-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 150 ~ 5 250	Low	5 180.00	9.50	30.00	20.50
	Middle	5 210.00	9.60	30.00	20.40
	High	5 240.00	9.80	30.00	20.20
5 725 ~ 5 850	Low	5 736.00	7.60	30.00	22.40
	Middle	5 762.00	7.90	30.00	22.10
	High	5 814.00	8.10	30.00	21.90

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

9.5 Test data for Antenna 1

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

-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 150 ~ 5 250	Low	5 180.00	9.40	30.00	20.60
	Middle	5 210.00	9.10	30.00	20.90
	High	5 240.00	9.50	30.00	20.50
5 725 ~ 5 850	Low	5 736.00	7.50	30.00	22.50
	Middle	5 762.00	7.80	30.00	22.20
	High	5 814.00	8.00	30.00	22.00

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


 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 1 MHz, the video bandwidth is set to 3 times the resolution bandwidth. The maximum level form the EUT in 1 MHz bandwidth was measured with above condition.



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

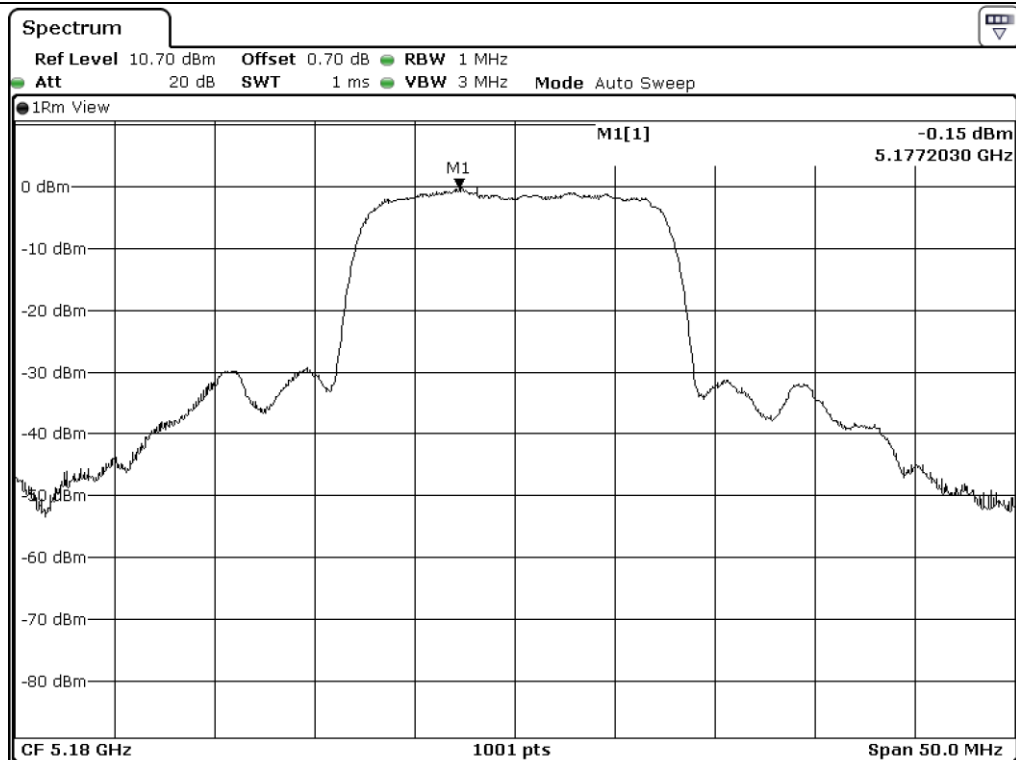
- . Test Date : January 16, 2018 ~ January 26, 2018
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 150 ~ 5 250	Low	5 180.00	-0.15	17.00	17.15
	Middle	5 210.00	-0.25	17.00	17.25
	High	5 240.00	0.04	17.00	16.96

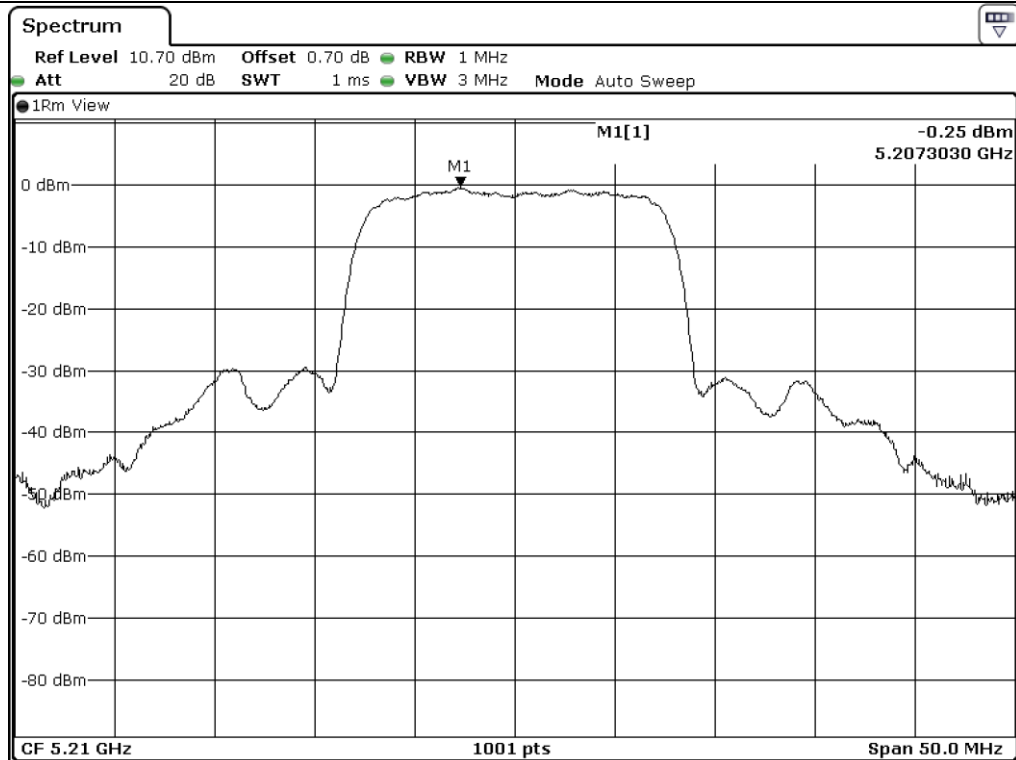
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm/500kHz)	MARGIN (dB)
5 725 ~ 5 850	Low	5 736.00	1.60	30.00	28.40
	Middle	5 762.00	1.25	30.00	28.75
	High	5 814.00	1.24	30.00	28.76

Remark: See next page for measurement data.

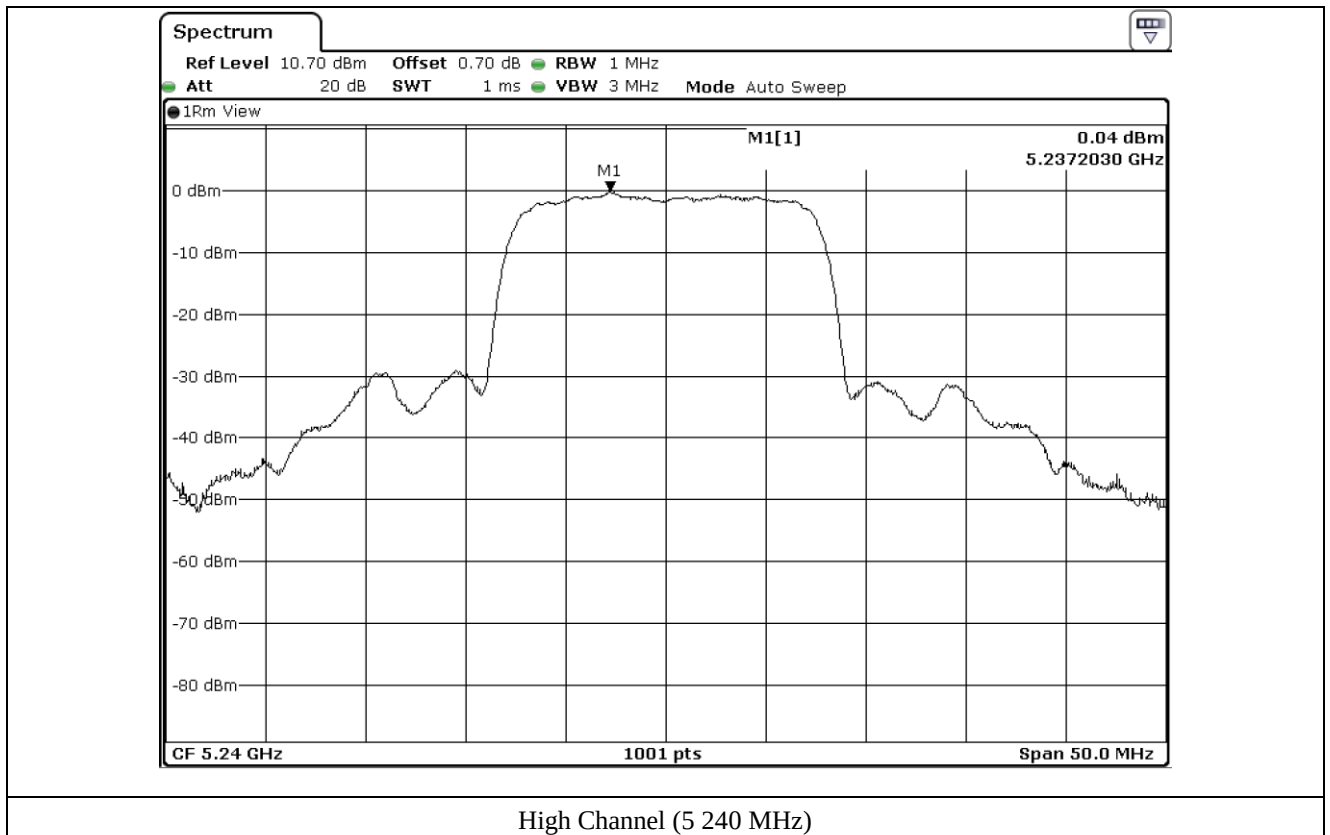

 Tested by: Tae-Ho, Kim / Senior Manager

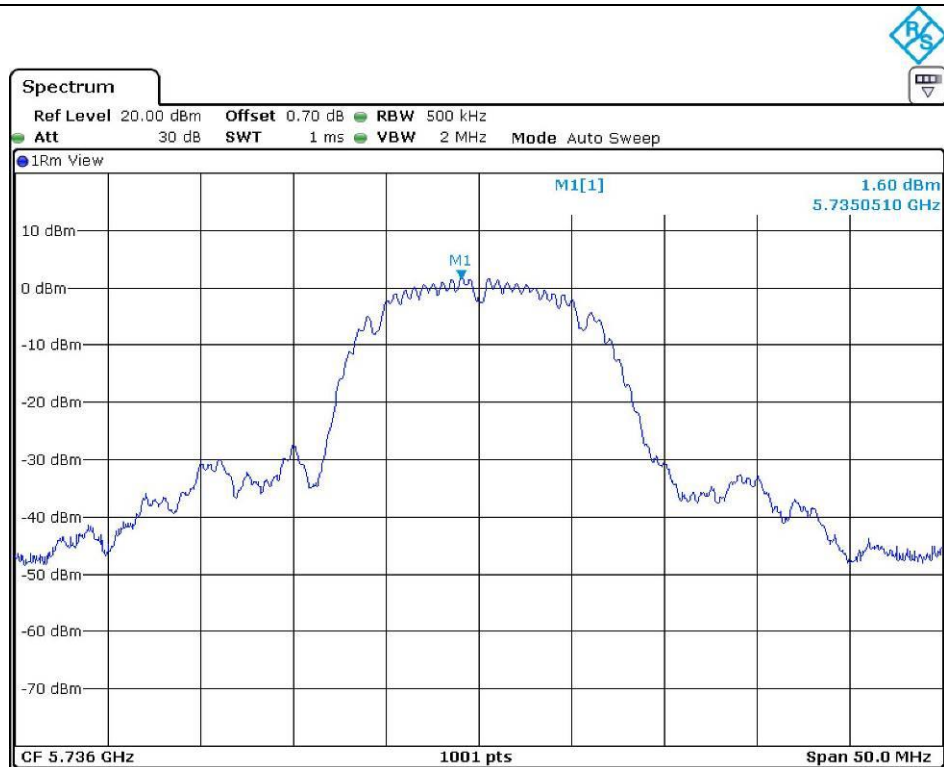


Low Channel (5 180 MHz)

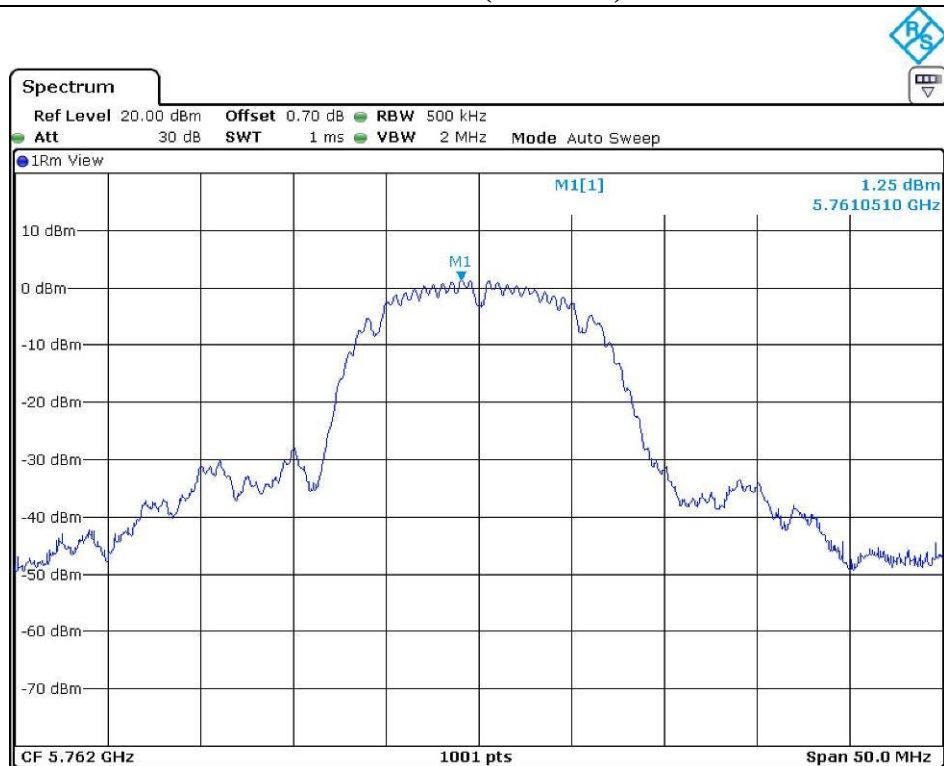


Middle Channel (5 210 MHz)

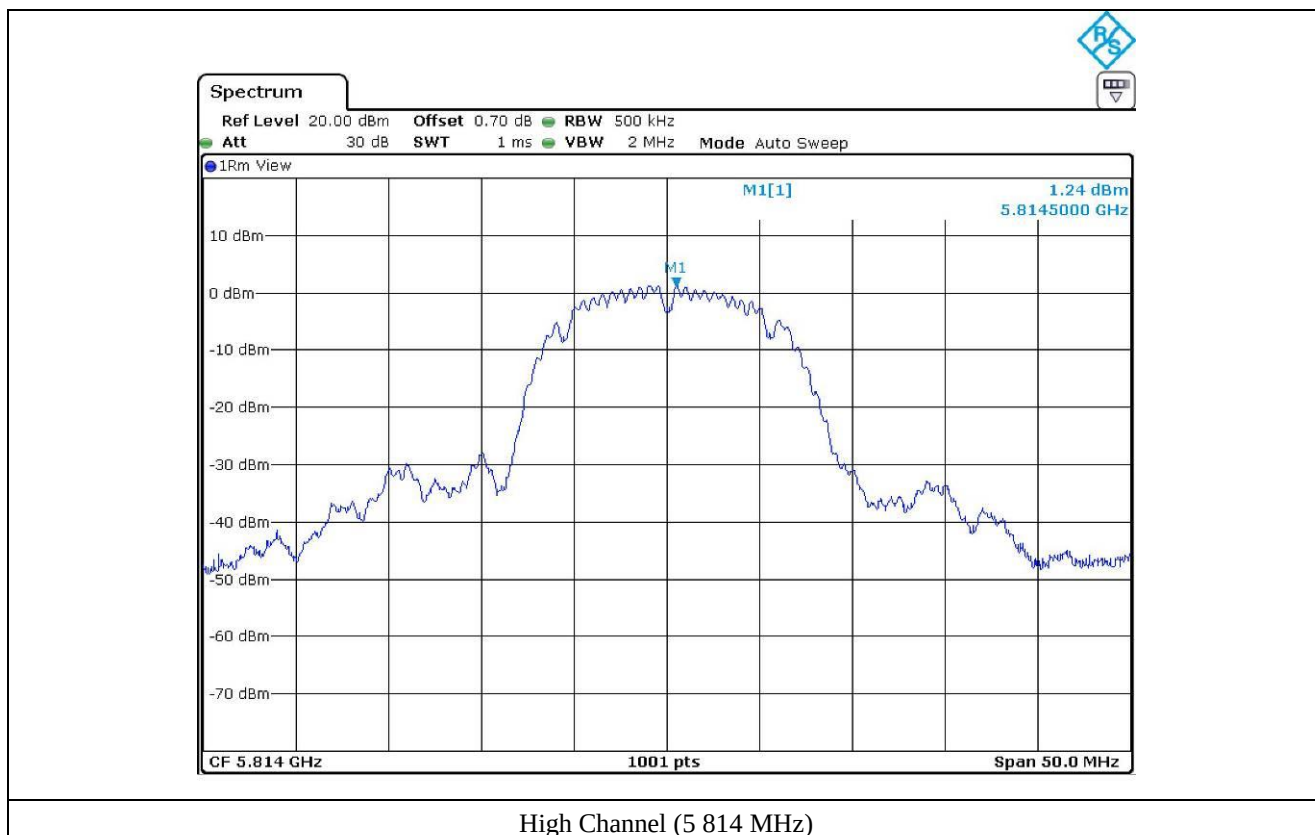




Low Channel (5 736 MHz)



Middle Channel (5 762 MHz)



10.5 Test data for Antenna 1

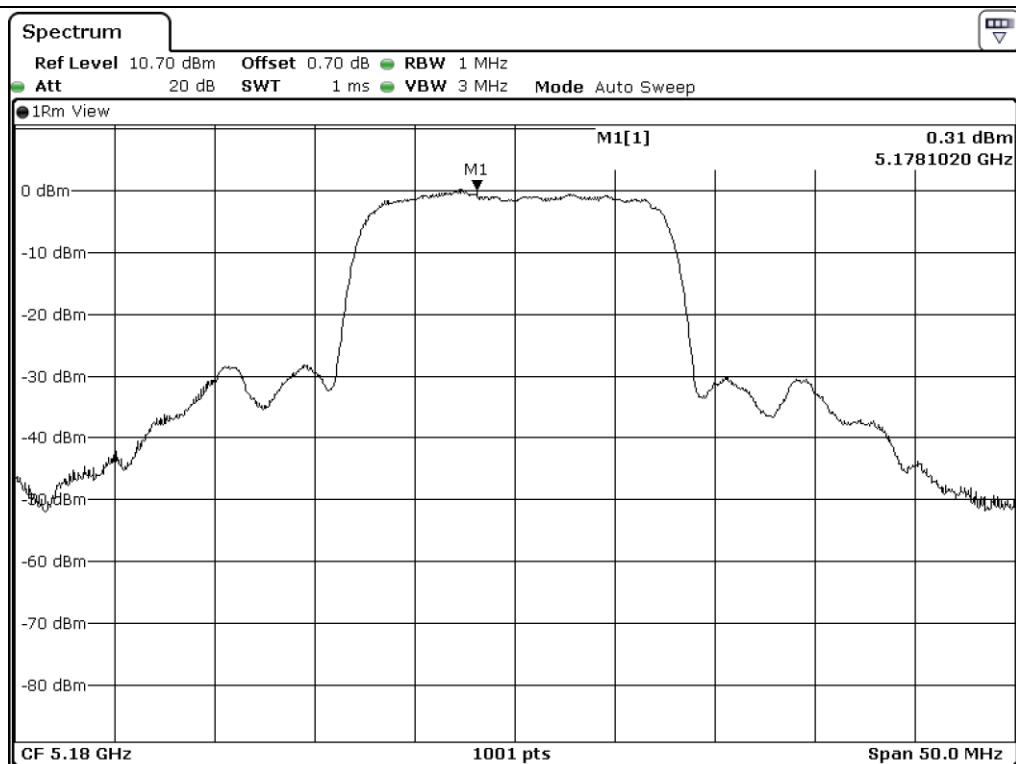
- . Test Date : January 16, 2018 ~ January 26, 2018
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 150 ~ 5 250	Low	5 180.00	0.31	17.00	16.69
	Middle	5 210.00	0.30	17.00	16.70
	High	5 240.00	0.64	17.00	16.36

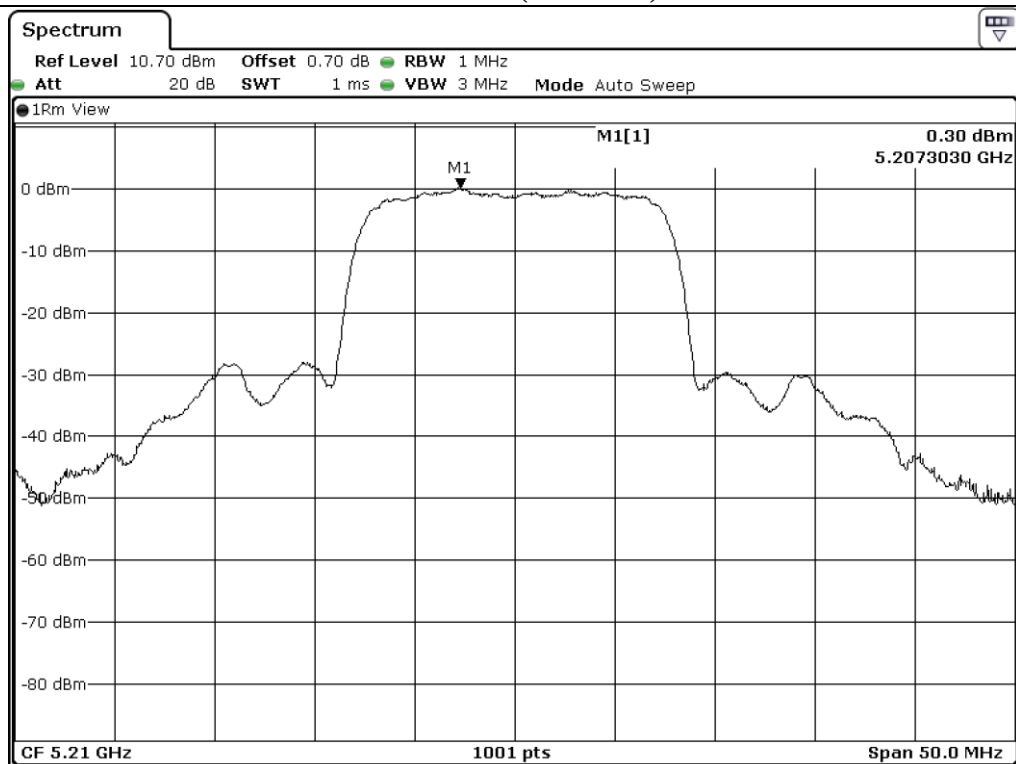
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm/500kHz)	MARGIN (dB)
5 725 ~ 5 850	Low	5 736.00	2.08	30.00	27.92
	Middle	5 762.00	1.44	30.00	28.56
	High	5 814.00	0.59	30.00	29.41

Remark: See next page for measurement data.

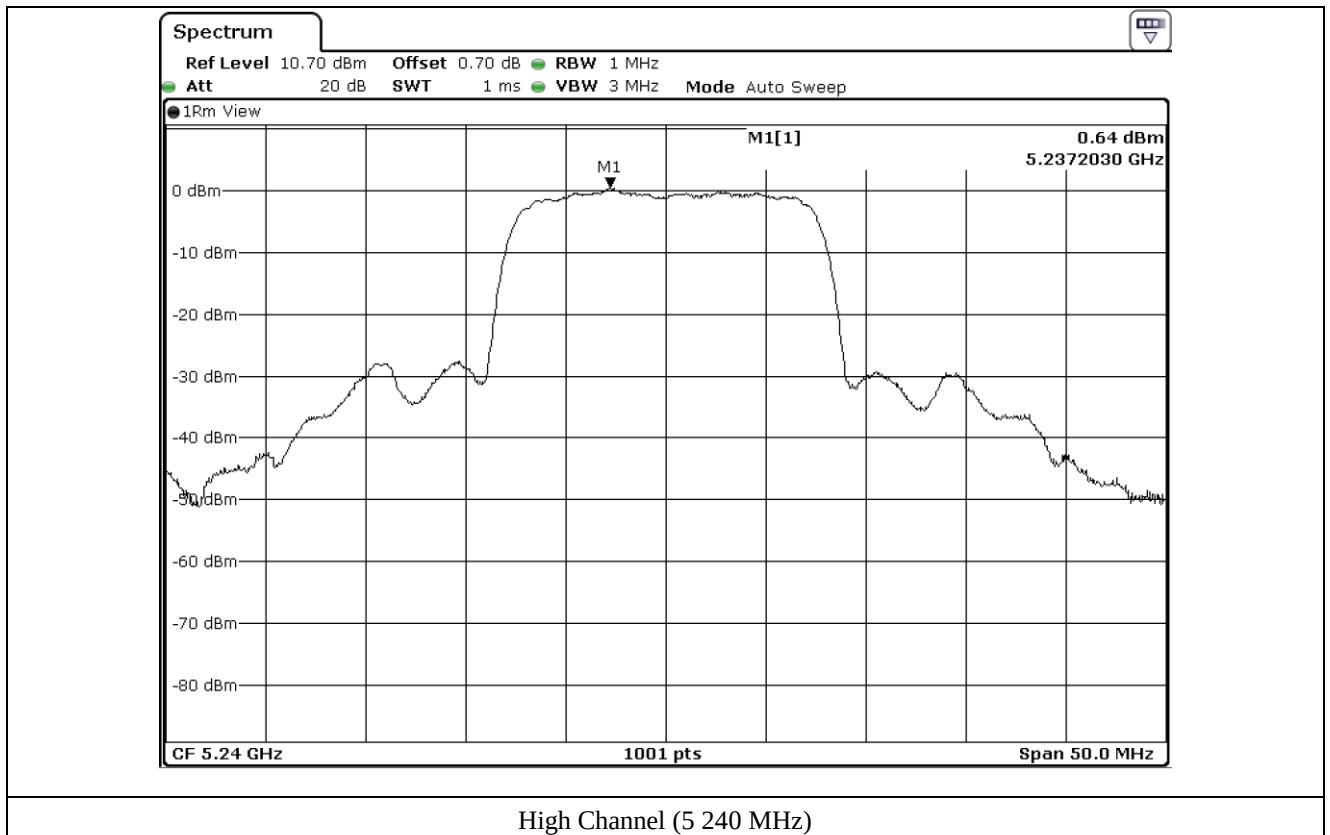

 Tested by: Tae-Ho, Kim / Senior Manager

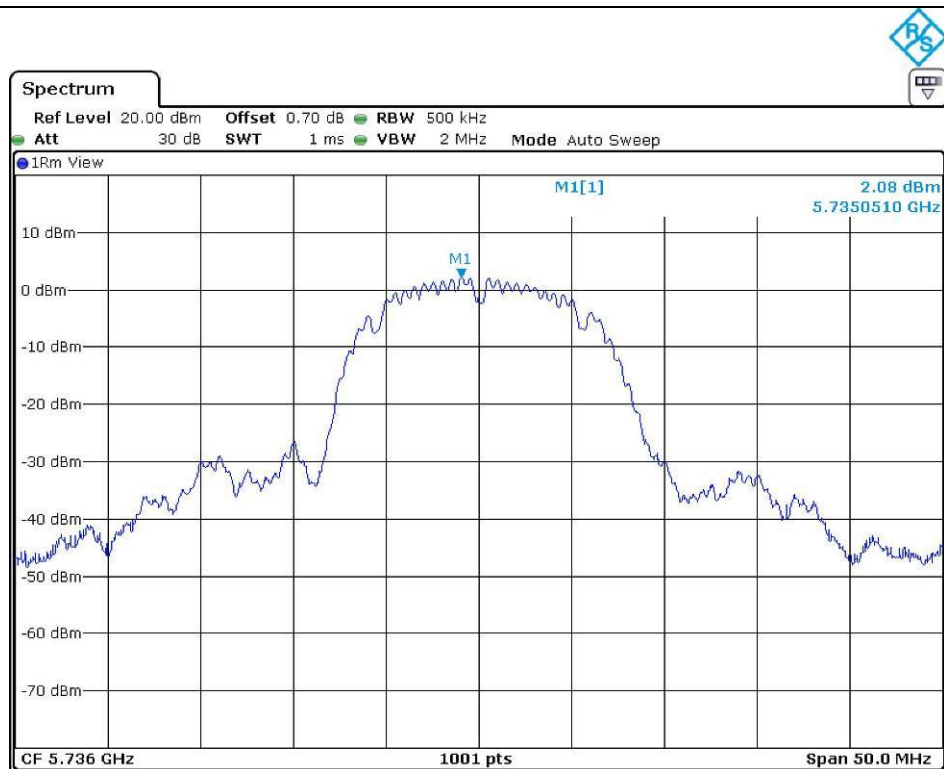


Low Channel (5 180 MHz)

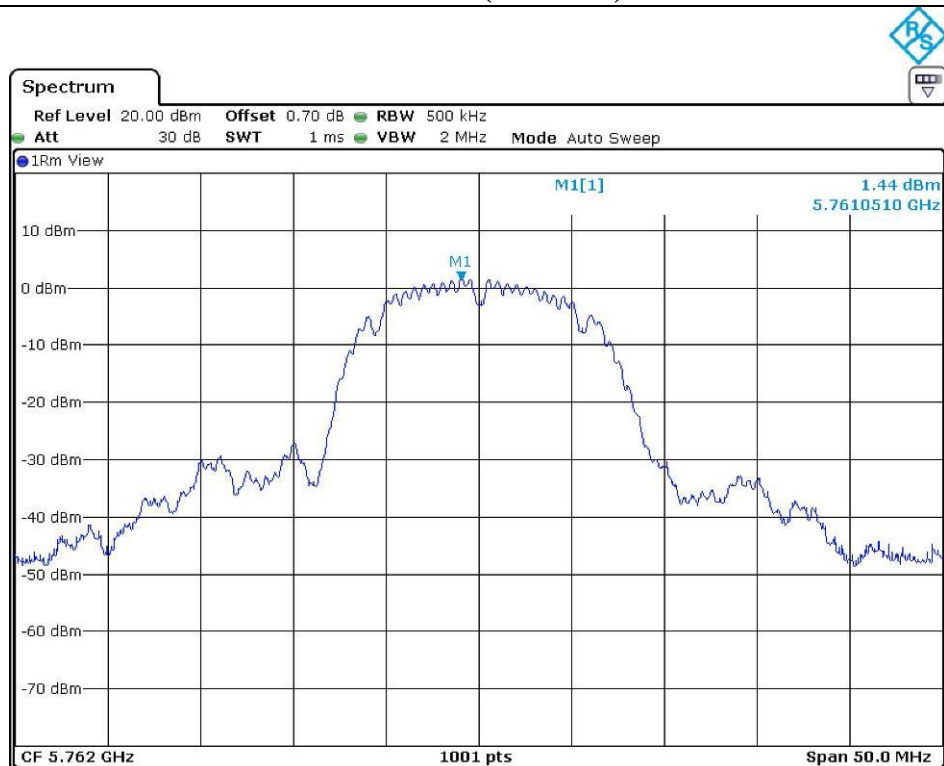


Middle Channel (5 210 MHz)

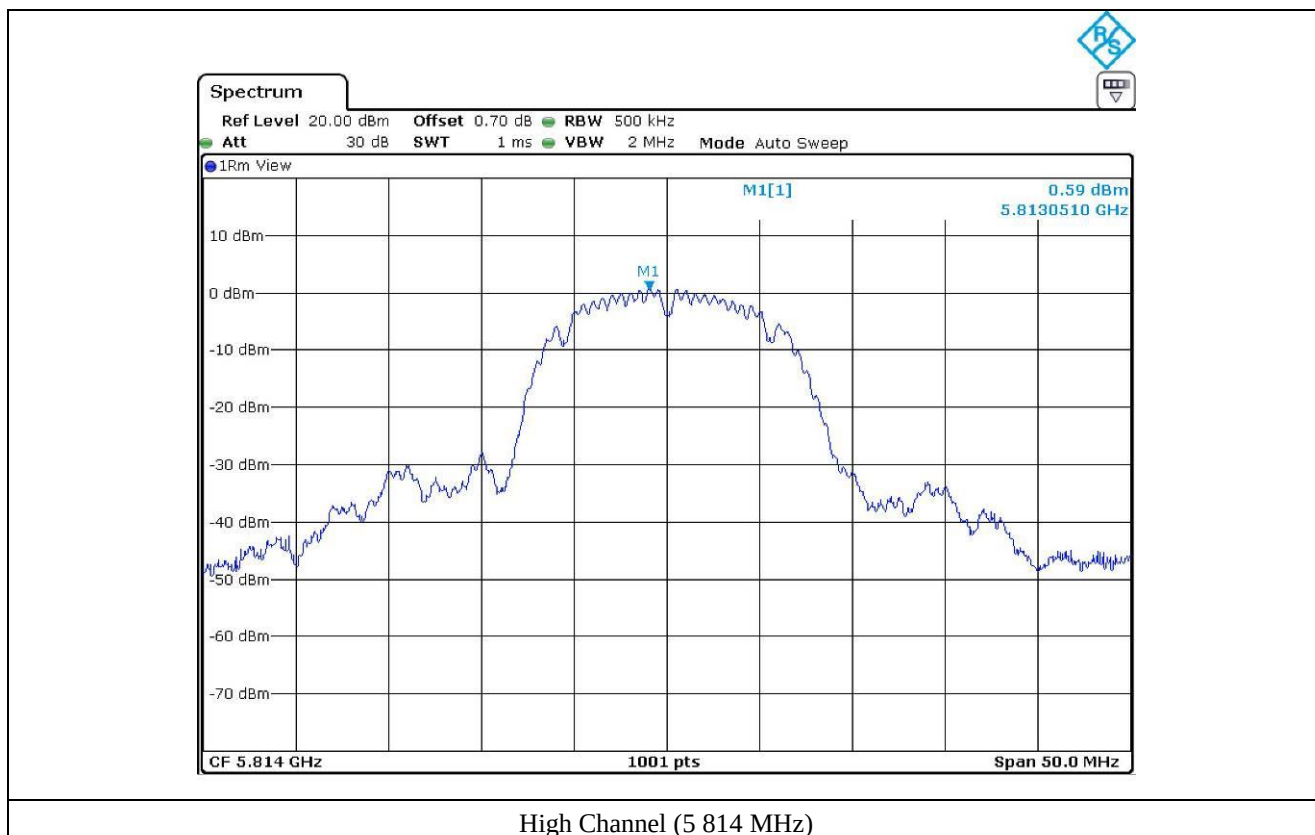




Low Channel (5 736 MHz)



Middle Channel (5 762 MHz)



11. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

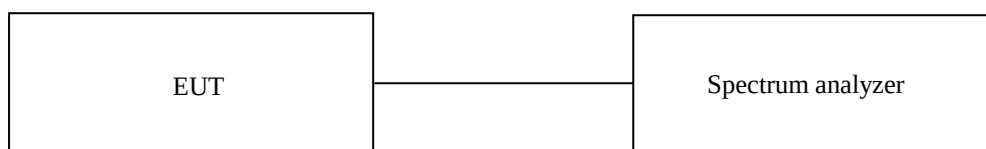
11.1 Operating environment

Temperature : 21 °C

Relative humidity : 41 % R.H.

11.2 Test set-up

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -20 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.



11.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ - SSE-43CI-A	Samkun Tech	Humidity Chamber	60712	Apr. 06, 2017 (1Y)
■ - DRP-305DN	DIGITAL Elec.	DC Power supply	4030195	Sep. 01, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test Data for U-NII-1

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

-. Result : Pass

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
-20	5 180 000 000	5 179 979 260	-20.740
-10		5 179 978 699	-21.301
0		5 179 978 160	-21.840
10		5 179 977 610	-22.390
20		5 179 977 104	-22.896
30		5 179 976 597	-23.403
40		5 179 976 022	-23.978
50		5 179 979 260	-20.740
-20	5 210 000 000	5 209 978 717	-21.283
-10		5 209 978 702	-21.298
0		5 209 978 131	-21.869
10		5 209 977 554	-22.446
20		5 209 977 047	-22.953
30		5 209 976 531	-23.469
40		5 209 976 021	-23.979
50		5 209 979 260	-20.740
-20	5 240 000 000	5 239 978 683	-21.317
-10		5 239 978 685	-21.315
0		5 239 978 106	-21.894
10		5 239 977 552	-22.448
20		5 239 976 955	-23.045
30		5 239 976 436	-23.564
40		5 239 975 869	-24.131
50		5 239 978 685	-21.315

Note : While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.
Four measurements in total are made.(ANSI C63.10-2013)


Tested by: Tae-Ho, Kim / Senior Manager

11.5 Test Data for U-NII-3

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

-. Result : Pass

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
-20	5 736 000 000	5 735 981 875	-18.125
-10		5 735 981 318	-18.682
0		5 735 980 727	-19.273
10		5 735 980 221	-19.779
20		5 735 979 691	-20.309
30		5 735 979 145	-20.855
40		5 735 978 595	-21.405
50		5 735 981 875	-18.125
-20	5 762 000 000	5 761 981 795	-18.205
-10		5 761 981 212	-18.788
0		5 761 980 620	-19.380
10		5 761 980 053	-19.947
20		5 761 979 525	-20.475
30		5 761 978 946	-21.054
40		5 761 978 379	-21.621
50		5 761 981 795	-18.205
-20	5 814 000 000	5 813 981 965	-18.035
-10		5 813 981 394	-18.606
0		5 813 980 890	-19.110
10		5 813 980 368	-19.632
20		5 813 979 786	-20.214
30		5 813 979 257	-20.743
40		5 813 978 731	-21.269
50		5 813 981 965	-18.035

Note : While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.

Four measurements in total are made.(ANSI C63.10-2013)


Tested by: Tae-Ho, Kim / Senior Manager

12. FREQUENCY STABILITY WITH VOLTAGE VARIATION

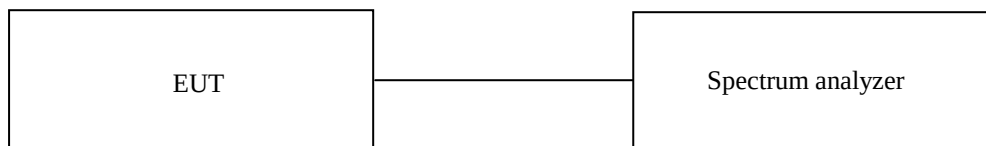
12.1 Operating environment

Temperature : 21 °C

Relative humidity : 41 % R.H.

12.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ -	DRP-305DN	DIGITAL Elec.	DC Power supply	4030195	Sep. 01, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

12.4 Test Data for U-NII-1

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

-. Result : Pass

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
5.5	5 180 000 000	5 179 976 886	-23.114
5.0		5 179 976 430	-23.570
4.5		5 179 975 923	-24.077
5.5	5 210 000 000	5 209 976 916	-23.084
5.0		5 209 976 438	-23.562
4.5		5 209 975 934	-24.066
5.5	5 240 000 000	5 239 976 649	-23.351
5.0		5 239 976 151	-23.849
4.5		5 239 975 647	-24.353

12.5 Test Data for U-NII-3

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

-. Result : Pass

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
5.5	5 736 000 000	5 735 981 438	-18.562
5.0		5 735 980 985	-19.015
4.5		5 735 980 476	-19.524
5.5	5 762 000 000	5 761 981 341	-18.659
5.0		5 761 980 906	-19.094
4.5		5 761 980 404	-19.596
5.5	5 814 000 000	5 813 981 225	-18.775
5.0		5 813 980 730	-19.270
4.5		5 813 980 229	-19.771


 Tested by: Tae-Ho, Kim / Senior Manager

13. RADIATED SPURIOUS EMISSIONS

13.1 Operating environment

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

13.2 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.

13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 27, 2017 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 05, 2017 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Oct. 25, 2017 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	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)
■ -	HFH2-Z2	Rohde & Schwarz	Loop Antenna	879285/26	Dec. 09, 2016 (2Y)
■ -	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Apr 04, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

13.5 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.									



Tested by: Tae-Ho, Kim / Senior Manager

13.6 Test data for 30 MHz ~ 1 GHz

13.6.1 Test data for Frequency U-NII-1

Humidity Level : 41 % R.H.

Temperature: 21 °C

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

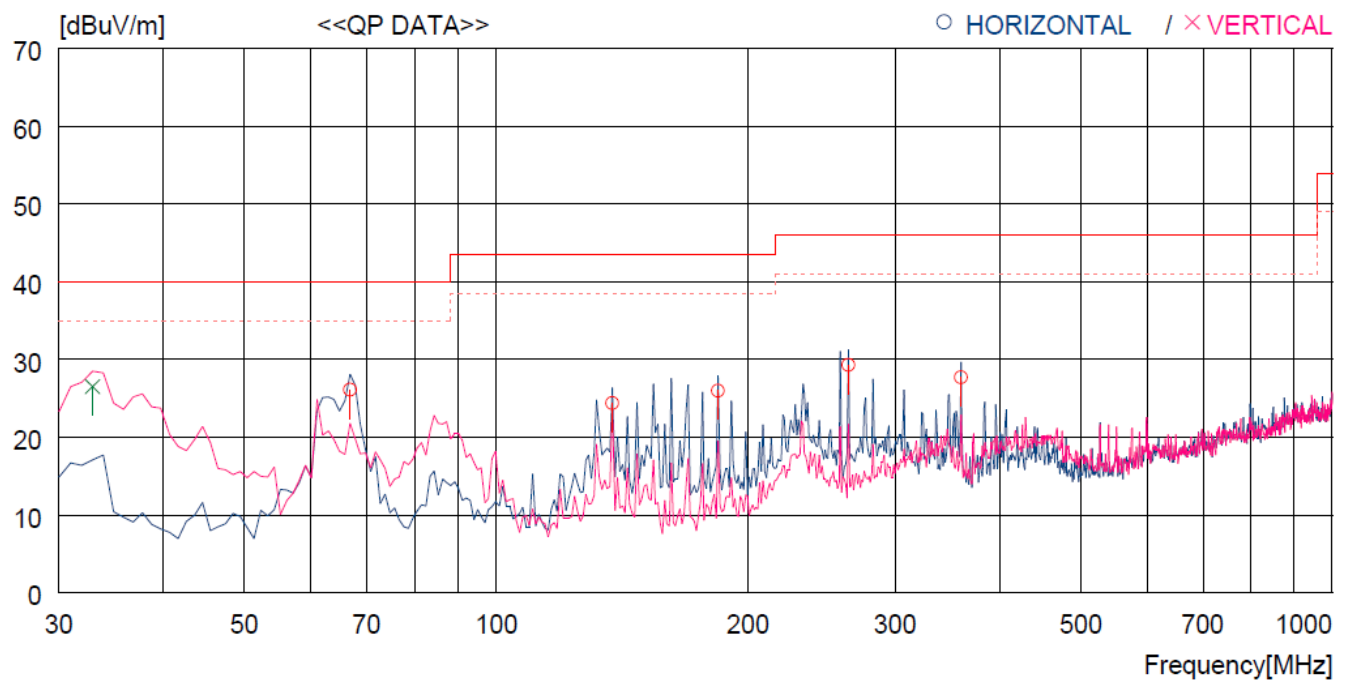
Result : PASSED

EUT : Audio transceiver module

Date: January 16, 2018 ~ January 26, 2018

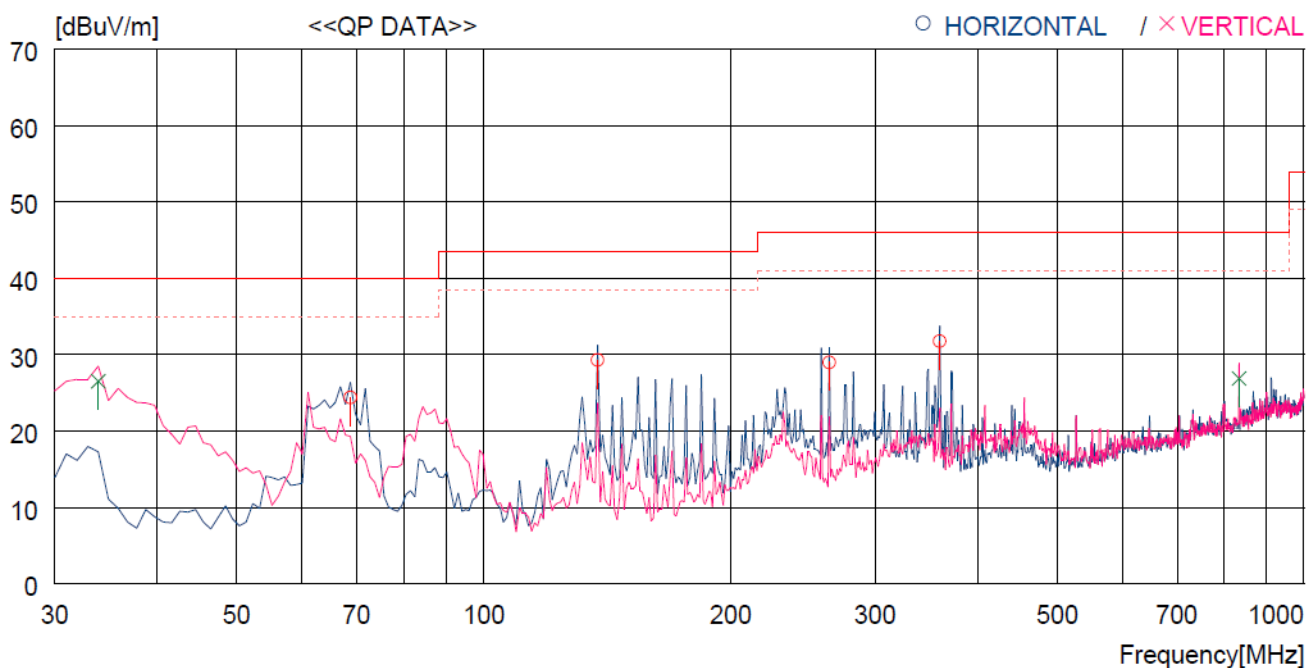
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



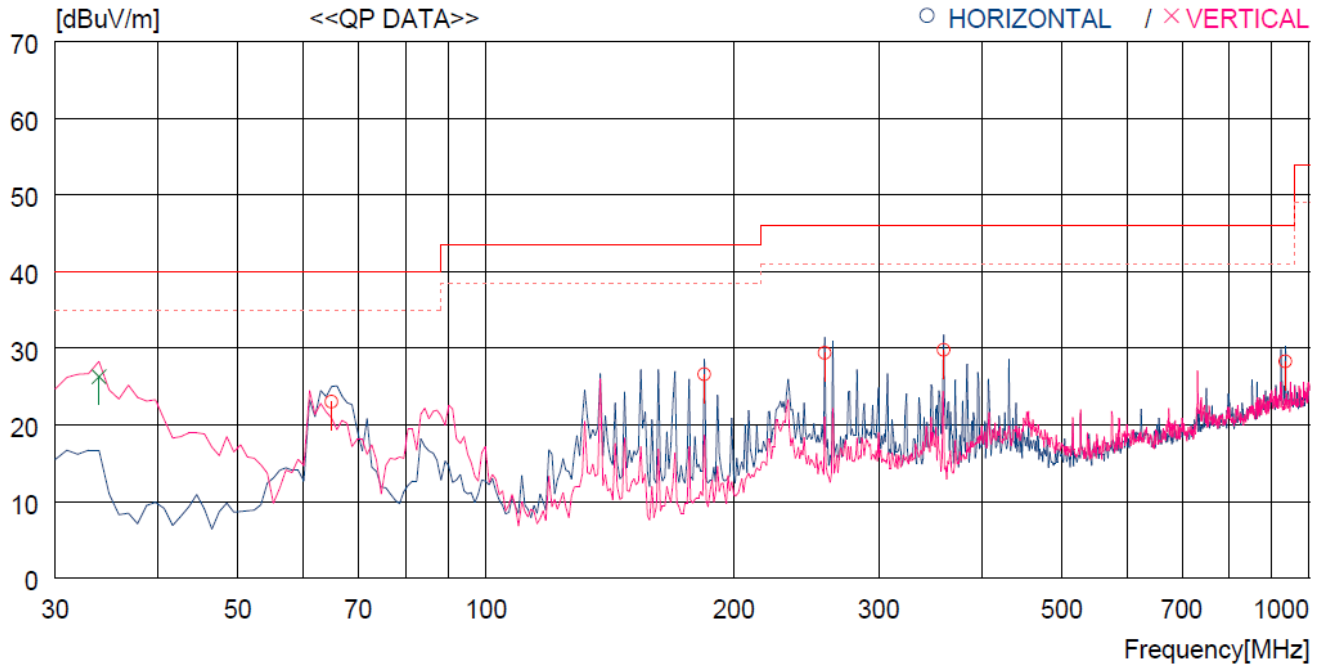
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	66.860	46.4	10.9	1.9	33.1	26.1	40.0	13.9	100	358
2	137.670	46.3	8.2	2.8	32.9	24.4	43.5	19.1	100	162
3	184.230	46.0	9.9	3.2	33.1	26.0	43.5	17.5	100	178
4	263.770	46.4	12.3	3.7	33.1	29.3	46.0	16.7	100	281
5	359.800	42.0	14.4	4.4	33.1	27.7	46.0	18.3	100	358
----- Vertical -----										
6	32.910	46.3	11.9	1.4	33.1	26.5	40.0	13.5	100	140

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	68.800	45.3	10.2	2.0	33.1	24.4	40.0	15.6	100	158
2	137.670	51.2	8.2	2.8	32.9	29.3	43.5	14.2	100	11
3	263.770	46.1	12.3	3.7	33.1	29.0	46.0	17.0	100	11
4	359.800	46.1	14.4	4.4	33.1	31.8	46.0	14.2	100	66
----- Vertical -----										
5	33.880	46.1	12.1	1.4	33.1	26.5	40.0	13.5	100	333
6	833.151	32.4	20.9	6.7	33.1	26.9	46.0	19.1	100	333

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	64.920	42.7	11.5	1.9	33.1	23.0	40.0	17.0	100	195
2	184.230	46.6	9.9	3.2	33.1	26.6	43.5	16.9	100	195
3	257.950	46.5	12.3	3.7	33.1	29.4	46.0	16.6	100	195
4	359.800	44.1	14.4	4.4	33.1	29.8	46.0	16.2	100	48
5	934.998	31.5	22.0	7.1	32.3	28.3	46.0	17.7	100	306
----- Vertical -----										
6	33.880	45.9	12.1	1.4	33.1	26.3	40.0	13.7	100	73


 Tested by: Tae-Ho, Kim / Senior Manager

13.6.2 Test data for Frequency U-NII-3

Humidity Level : 41 % R.H.

Temperature: 21 °C

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

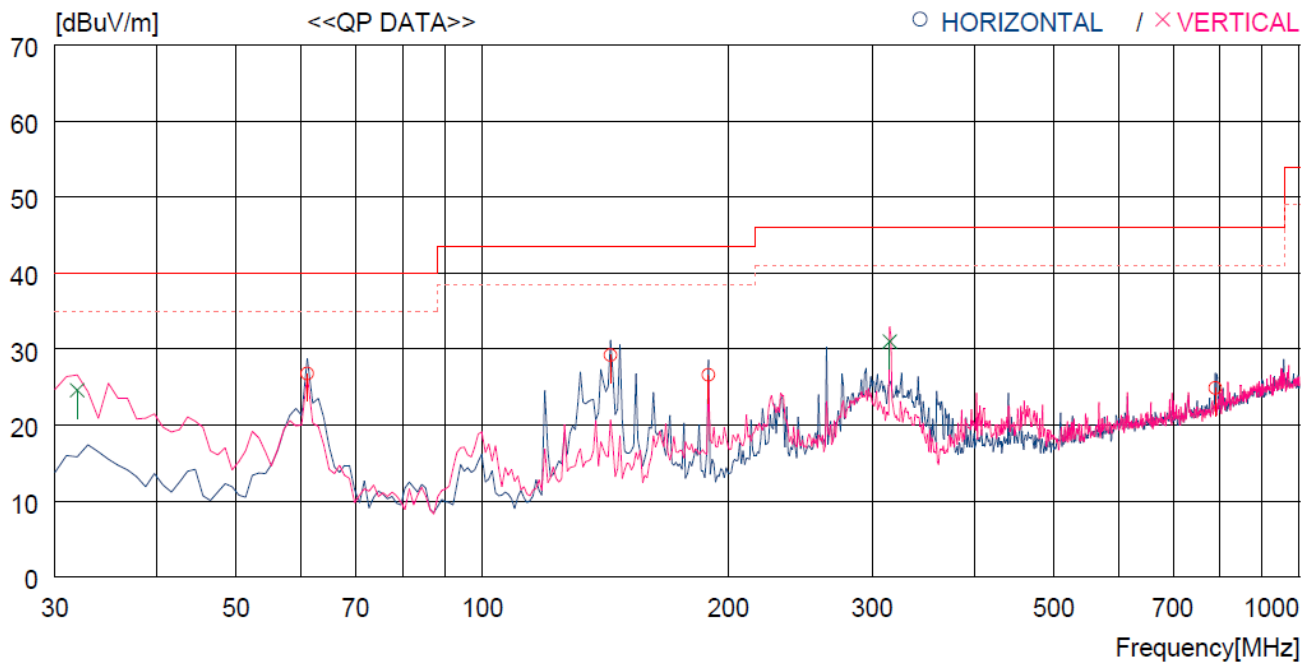
Result : PASSED

EUT : Audio transceiver module

Date: January 16, 2018 ~ January 26, 2018

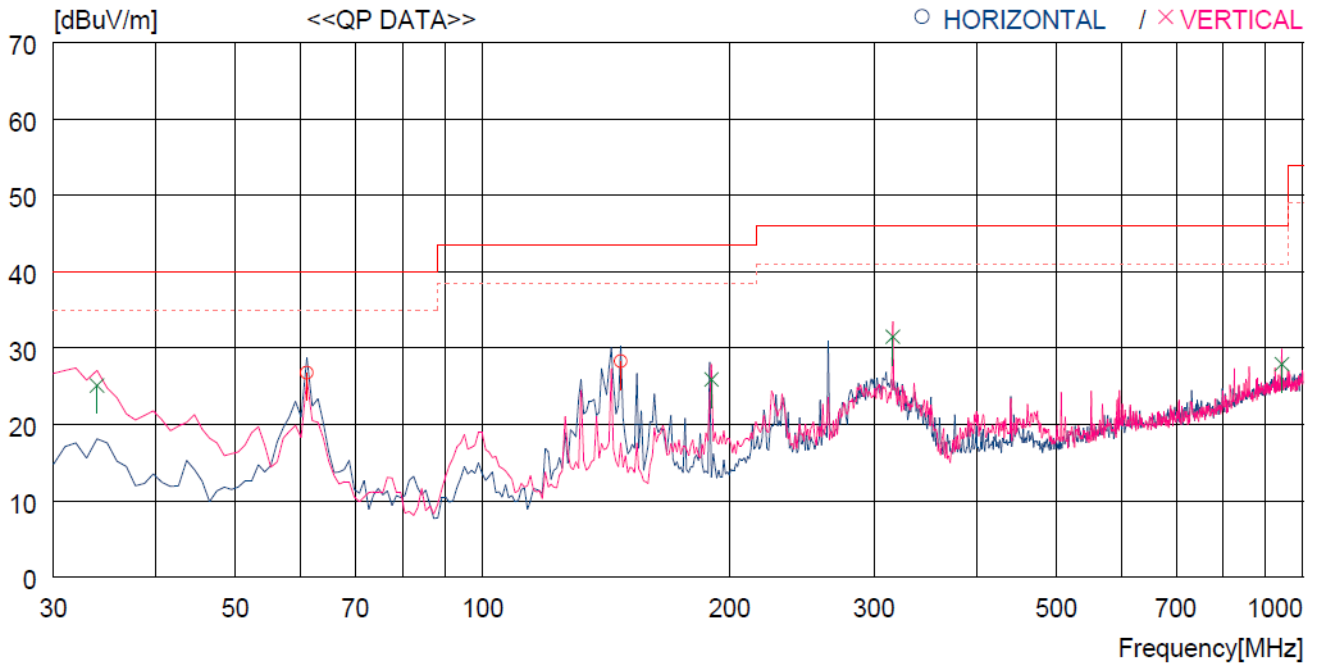
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



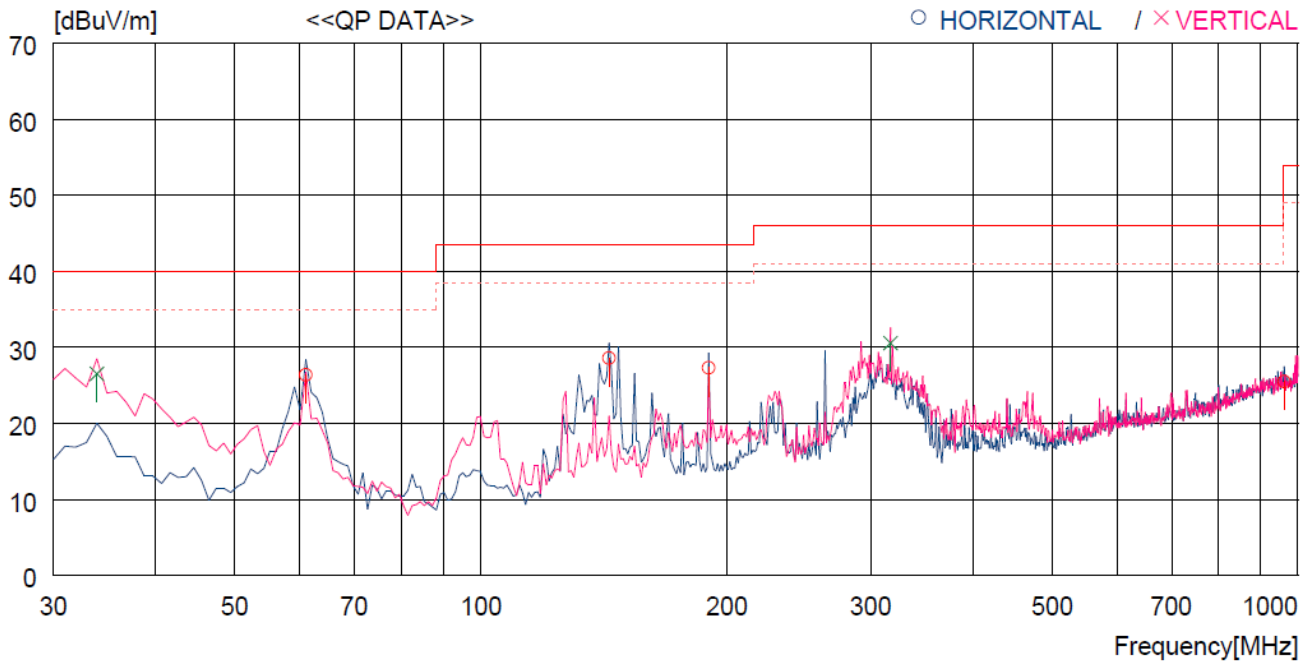
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
		[dBuV]	[dB]							
----- Horizontal -----										
1	61.040	45.2	12.8	1.9	33.1	26.8	40.0	13.2	400	359
2	143.490	50.8	8.5	2.8	32.9	29.2	43.5	14.3	200	359
3	189.080	45.5	10.9	3.3	33.1	26.6	43.5	16.9	300	98
4	788.532	31.1	20.6	6.5	33.3	24.9	46.0	21.1	100	0
----- Vertical -----										
5	31.940	43.6	12.7	1.4	33.1	24.6	40.0	15.4	100	359
6	315.180	46.1	13.8	4.1	33.0	31.0	46.0	15.0	100	359

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	61.040	45.1	12.9	1.9	33.1	26.8	40.0	13.2	300	33
2	147.370	50.5	7.8	2.9	32.9	28.3	43.5	15.2	200	346
----- Vertical -----										
3	33.880	44.7	12.1	1.4	33.1	25.1	40.0	14.9	100	0
4	190.050	45.1	10.6	3.3	33.1	25.9	43.5	17.6	100	191
5	316.150	46.9	13.5	4.1	33.0	31.5	46.0	14.5	100	191
6	941.788	31.1	21.9	7.1	32.2	27.9	46.0	18.1	100	88

Operating condition : High 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	61.040	44.7	12.9	1.9	33.1	26.4	40.0	13.6	400	0
2	143.490	50.8	7.9	2.8	32.9	28.6	43.5	14.9	200	0
3	190.050	46.5	10.6	3.3	33.1	27.3	43.5	16.2	300	359
4	962.157	28.3	22.0	7.2	32.0	25.5	54.0	28.5	200	119
----- Vertical -----										
5	33.880	46.1	12.1	1.4	33.1	26.5	40.0	13.5	100	124
6	317.120	46.0	13.5	4.1	33.0	30.6	46.0	15.4	200	359


 Tested by: Tae-Ho, Kim / Senior Manager

13.7 Test data for Frequency U-NII-1

13.7.1 Test data for Antenna 0

- . 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 ~ 40 GHz
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10 360.00	22.38	Peak	H	39.66	26.38	34.74	53.68	68.20	14.52
	22.06	Peak	V				53.36	68.20	14.84
Middle Channel									
10 440.00	21.98	Peak	H	39.84	26.74	34.76	53.80	68.20	14.40
	22.06	Peak	V				53.88	68.20	14.32
High Channel									
10 480.00	22.42	Peak	H	40.02	27.09	34.77	54.76	68.20	13.44
	22.18	Peak	V				54.52	68.20	13.68

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

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



Tested by: Tae-Ho, Kim / Senior Manager

13.7.2 Test data for Antenna 1

- 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 ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10 360.00	22.18	Peak	H	39.66	26.38	34.74	53.48	68.20	14.72
	21.78	Peak	V				53.08	68.20	15.12
Middle Channel									
10 440.00	22.51	Peak	H	39.84	26.74	34.76	54.33	68.20	13.87
	22.33	Peak	V				54.15	68.20	14.05
High Channel									
10 480.00	22.15	Peak	H	40.02	27.09	34.77	54.49	68.20	13.71
	22.40	Peak	V				54.74	68.20	13.46

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

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


 Tested by: Tae-Ho, Kim / Senior Manager

13.8 Test data for Frequency U-NII-3

13.8.1 Test data for Antenna 0

- 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 ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	22.68	Peak	H	40.07	28.32	33.75	57.32	73.98	16.66
	13.05	Average	H				47.69	53.98	6.29
	22.41	Peak	V				57.05	73.98	16.93
	12.84	Average	V				47.48	53.98	6.50
Middle Channel									
11 570.00	22.38	Peak	H	39.78	28.94	33.64	57.46	73.98	16.52
	12.64	Average	H				47.72	53.98	6.26
	22.15	Peak	V				57.23	73.98	16.75
	12.55	Average	V				47.63	53.98	6.35
High Channel									
11 650.00	22.74	Peak	H	39.49	29.56	33.61	58.18	73.98	15.80
	13.02	Average	H				48.46	53.98	5.52
	22.69	Peak	V				58.13	73.98	15.85
	13.12	Average	V				48.56	53.98	5.42

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

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


Tested by: Tae-Ho, Kim / Senior Manager

13.8.2 Test data for Antenna 1

- 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 ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : > 98 %
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11 490.00	22.15	Peak	H	40.07	28.32	33.75	56.79	73.98	17.19
	12.56	Average	H				47.20	53.98	6.78
	22.34	Peak	V				56.98	73.98	17.00
	12.60	Average	V				47.24	53.98	6.74
Middle Channel									
11 570.00	23.02	Peak	H	39.78	28.94	33.64	58.10	73.98	15.88
	12.84	Average	H				47.92	53.98	6.06
	22.71	Peak	V				57.79	73.98	16.19
	12.42	Average	V				47.50	53.98	6.48
High Channel									
11 650.00	23.44	Peak	H	39.49	29.56	33.61	58.88	73.98	15.10
	13.84	Average	H				49.28	53.98	4.70
	23.10	Peak	V				58.54	73.98	15.44
	13.51	Average	V				48.95	53.98	5.03

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

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


 Tested by: Tae-Ho, Kim / Senior Manager

14. RADIATED RESTRICTED BAND EDGE MEASUREMENTS

14.1 Operating environment

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

14.2 Test set-up

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.

14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Apr. 05, 2017 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 27, 2017 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 05, 2017 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Oct. 25, 2017 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	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.

14.4 Test data for Frequency U-NII-1

14.4.1 Test data for Antenna 0

- . Test Date : January 16, 2018 ~ January 26, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
5 150.00	44.15	Peak	H	31.28	12.65	36.01	52.07	74.00	21.93
	35.48	Average	H				43.40	54.00	10.60
	38.15	Peak	V				46.07	74.00	27.93
	29.09	Average	V				37.01	54.00	16.99

Tabulated test data for Restricted Band

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

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



Tested by: Tae-Ho, Kim / Senior Manager

14.4.2 Test data for Antenna 1

- . Test Date : January 16, 2018 ~ January 26, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
5 150.00	43.06	Peak	H	31.28	12.65	36.01	50.98	74.00	23.02
	34.51	Average	H				42.43	54.00	11.57
	37.26	Peak	V				45.18	74.00	28.82
	28.09	Average	V				36.01	54.00	17.99

Tabulated test data for Restricted Band

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

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


 Tested by: Tae-Ho, Kim / Senior Manager

14.5 Test data for Frequency U-NII-3

14.5.1 Test data for Antenna 0

- . Test Date : January 16, 2018 ~ January 26, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . Result : Pass

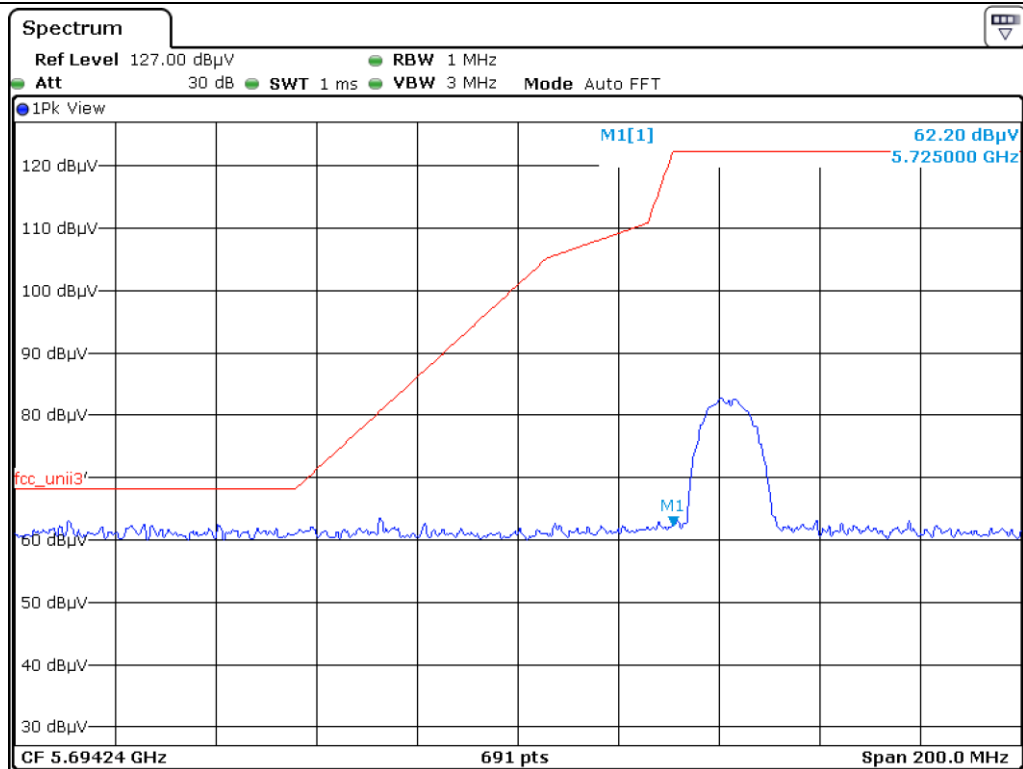
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	62.20	Peak	H	32.17	12.09	35.59	70.87	122.20	51.33
5 725.00	61.33	Peak	V	32.17	12.09	35.59	70.00	122.20	52.20
High Channel									
5 850.00	61.55	Peak	H	32.17	12.09	35.43	70.38	122.20	51.82
5 850.00	61.88	Peak	V	32.17	12.09	35.43	70.71	122.20	51.49

Tabulated test data for Restricted Band

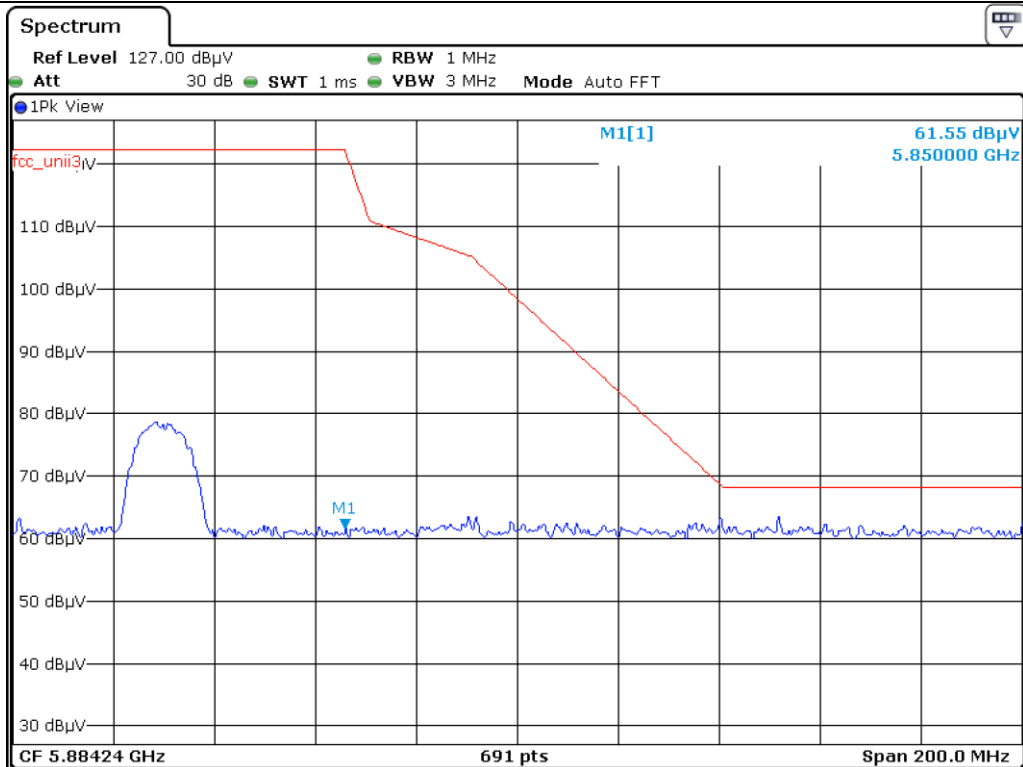
Remark - "H": Horizontal, "V": Vertical

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

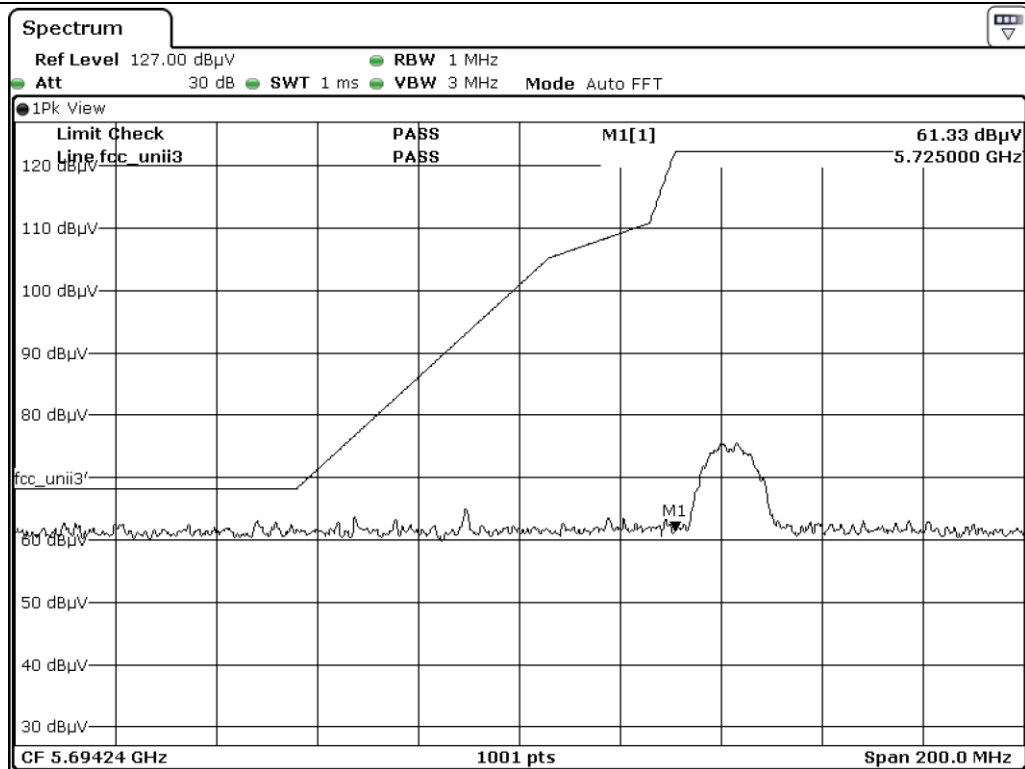

 Tested by: Tae-Ho, Kim / Senior Manager



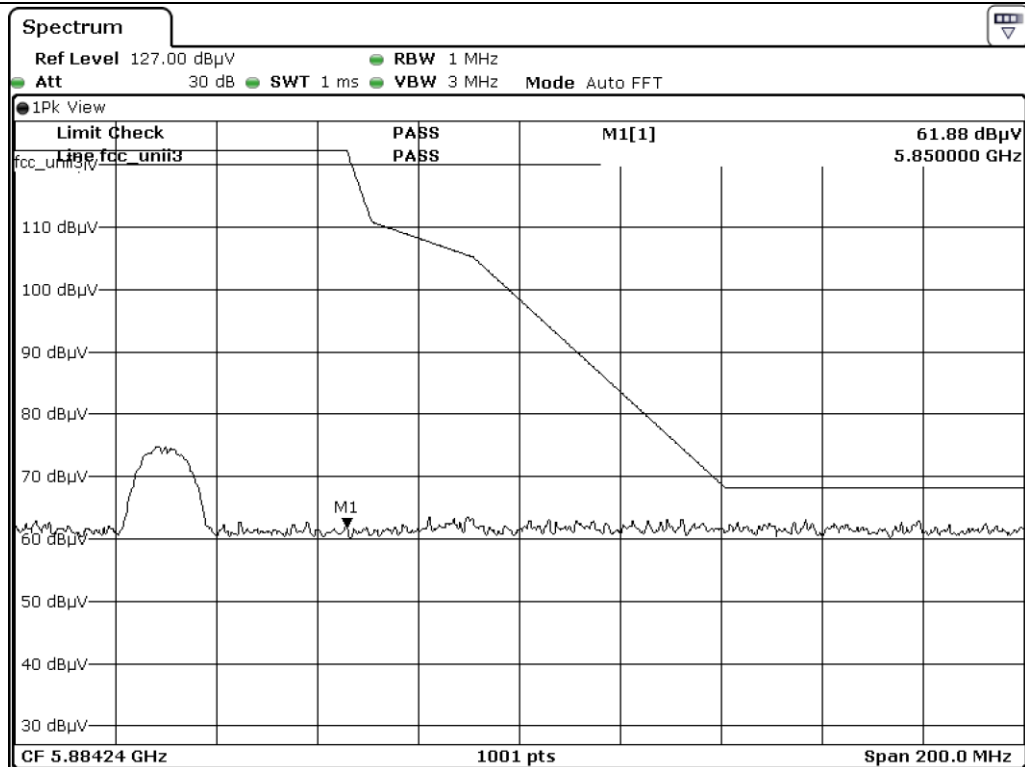
Low Channel (Horizontal)



High Channel (Horizontal)



Low Channel (Vertical)



High Channel (Vertical)

14.5.2 Test data for Antenna 1

- . Test Date : January 16, 2018 ~ January 26, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : > 98 %
- . Result : Pass

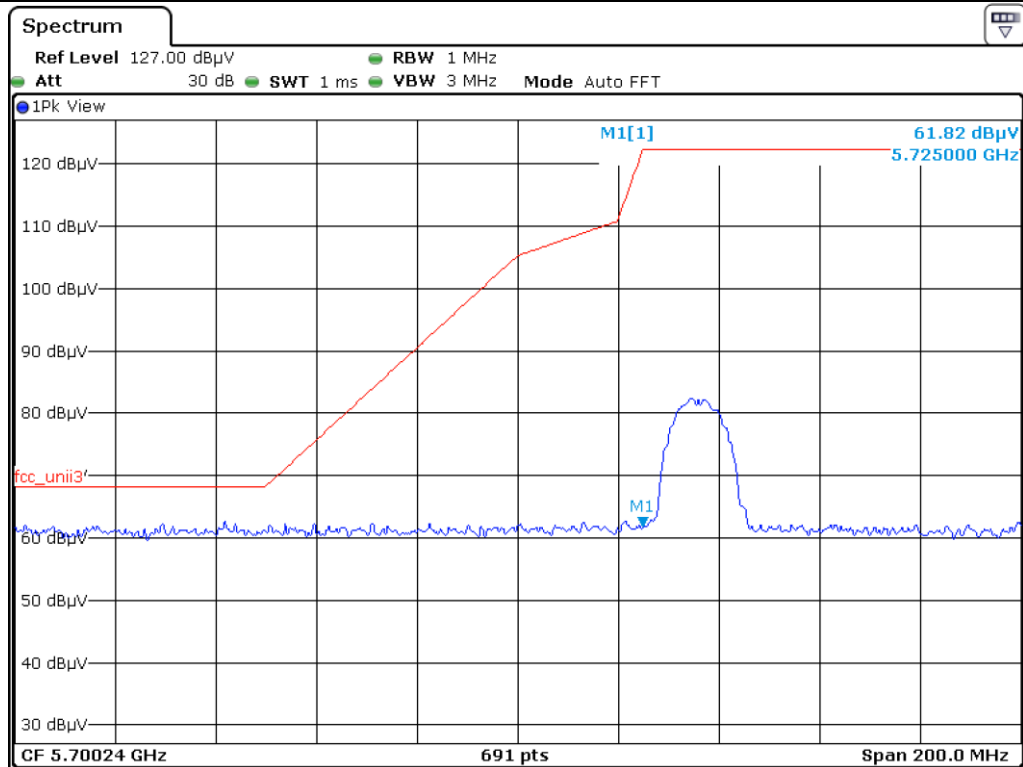
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	61.82	Peak	H	32.17	12.09	35.59	70.49	122.20	51.71
5 725.00	62.06	Peak	V	32.17	12.09	35.59	70.73	122.20	51.47
High Channel									
5 850.00	60.76	Peak	H	32.17	12.09	35.43	69.59	122.20	52.61
5 850.00	61.20	Peak	H	32.17	12.09	35.43	70.03	122.20	52.17

Tabulated test data for Restricted Band

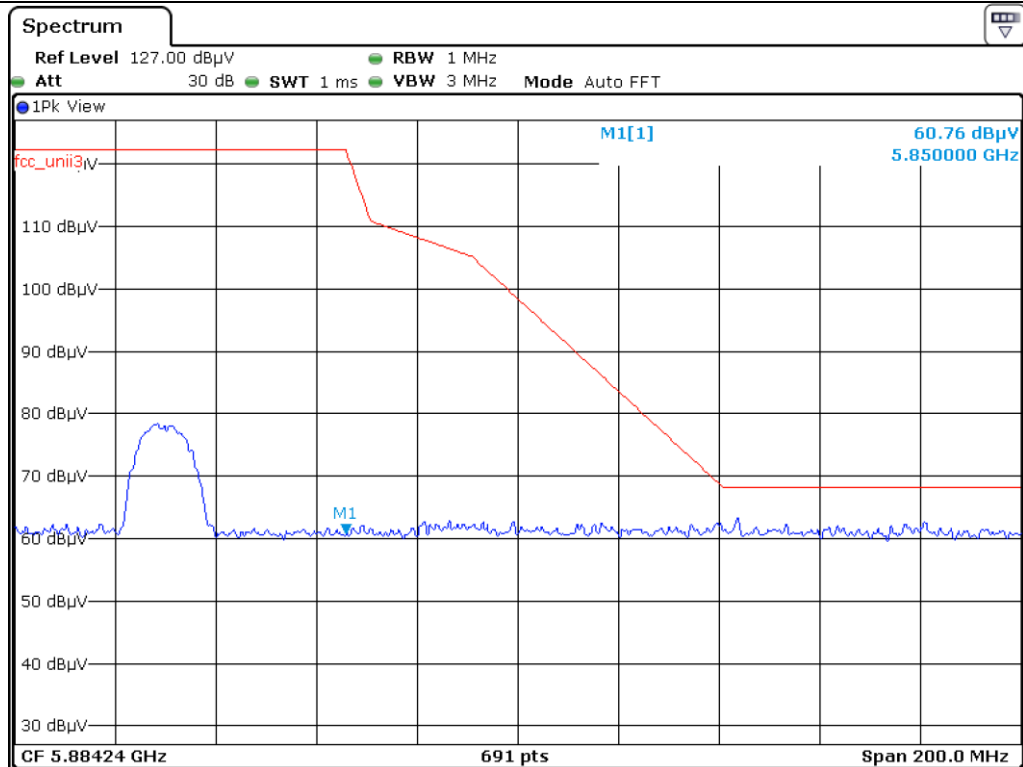
Remark - "H": Horizontal, "V": Vertical

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

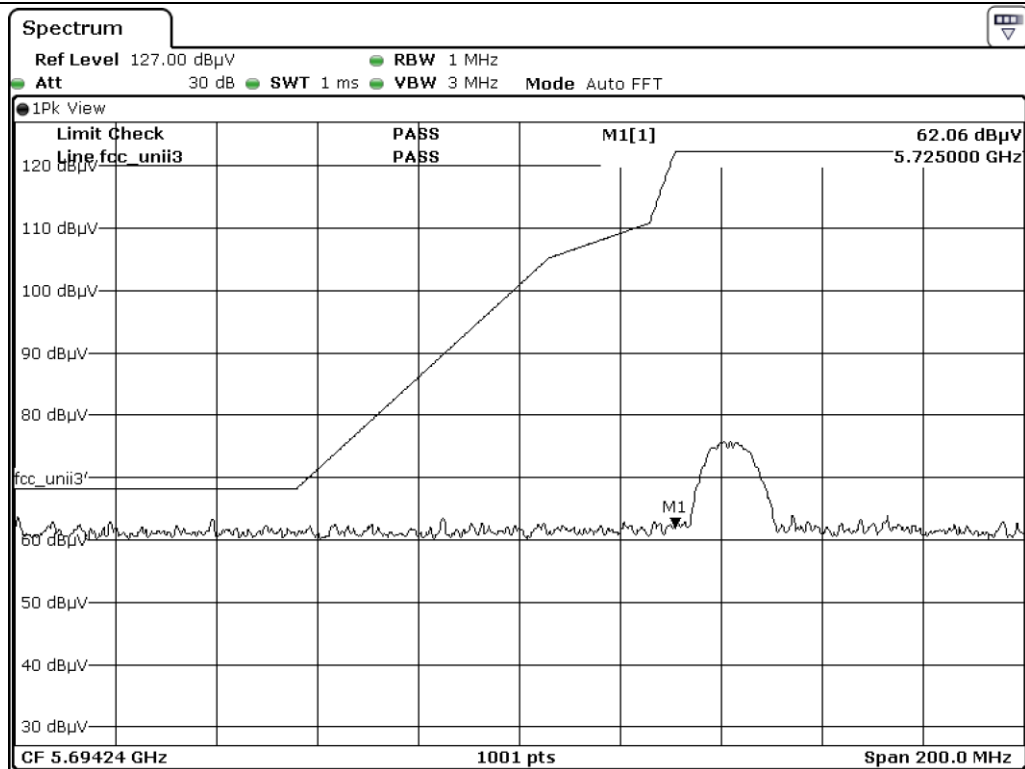

 Tested by: Tae-Ho, Kim / Senior Manager



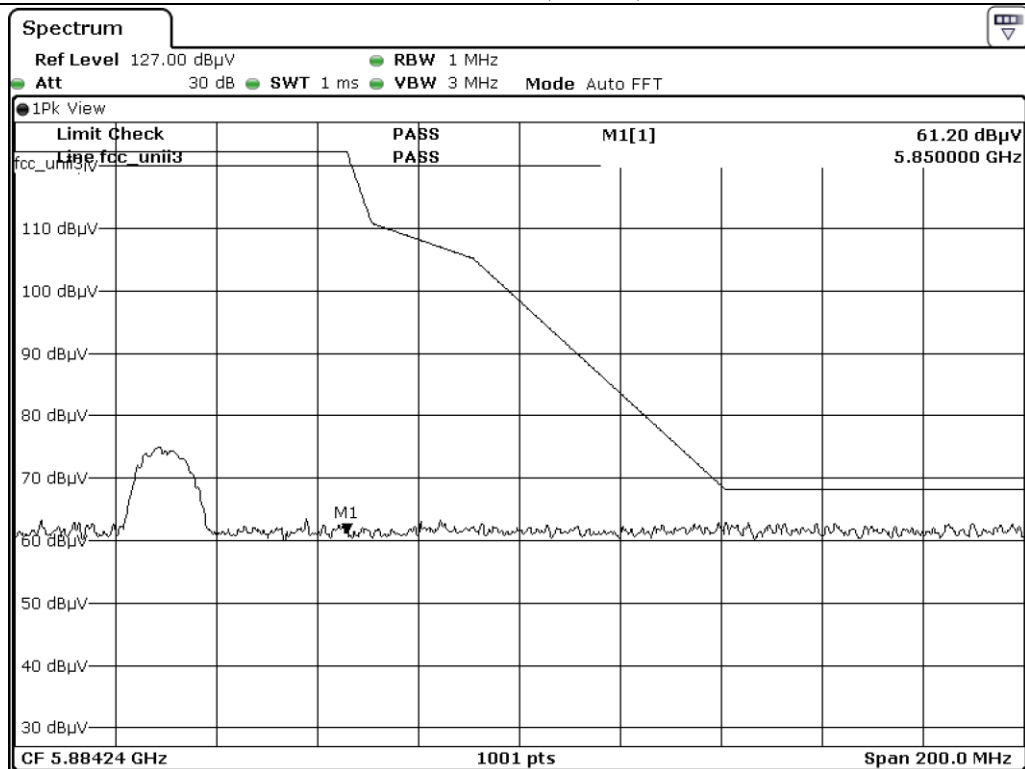
Low Channel (Horizontal)



High Channel (Horizontal)



Low Channel (Vertical)



High Channel (Vertical)

15. CONDUCTED EMISSION TEST

15.1 Operating environment

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

15.2 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.

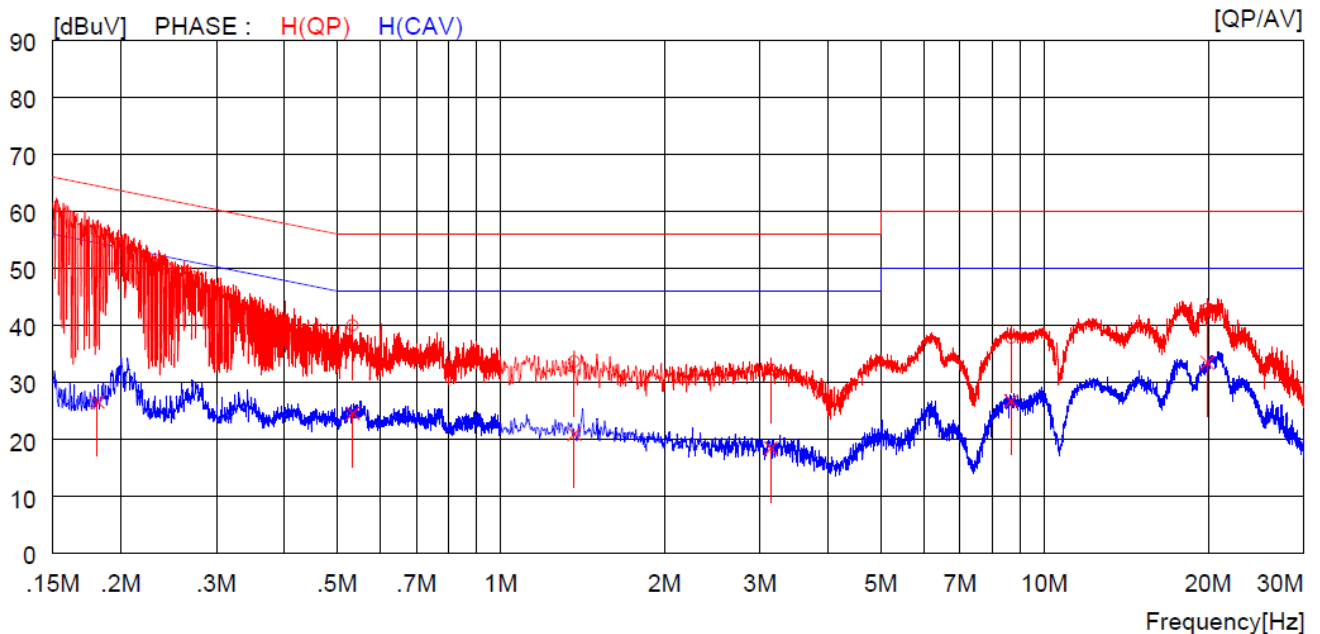
15.3 Test equipment used

	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.

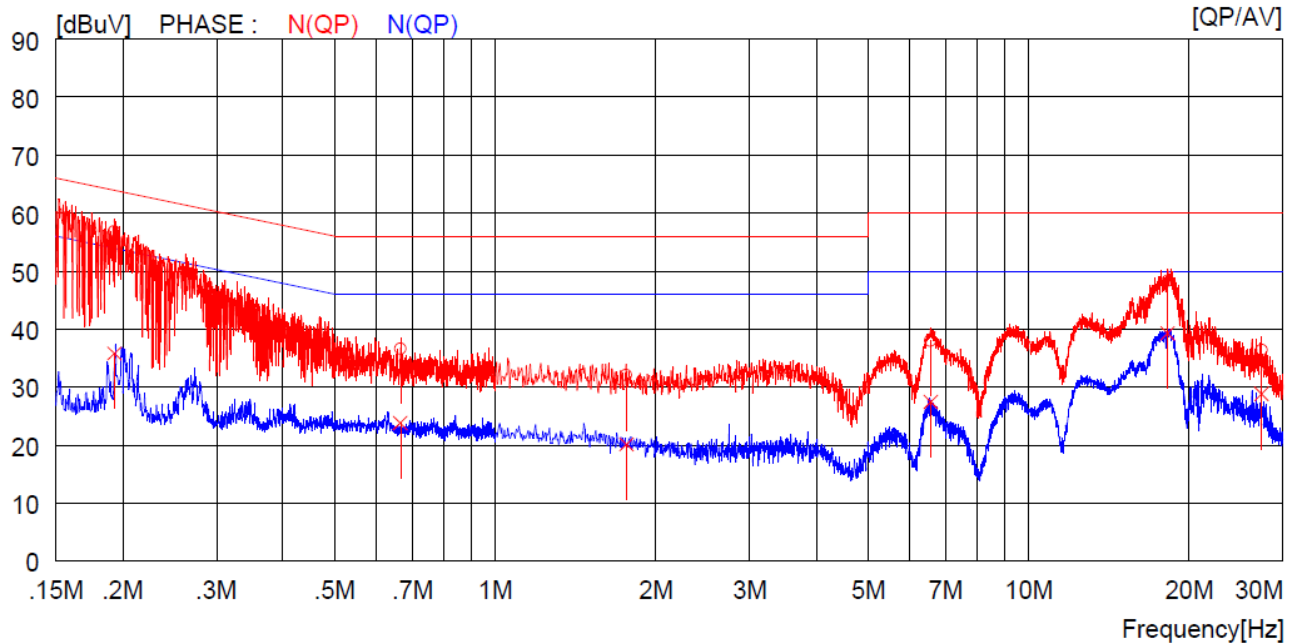
15.4 Test data for Frequency U-NII-1

- . 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	0.18100	46.5	----	10.0	56.5	----	64.4	----	7.9	----	H (QP)
2	0.53400	30.0	----	10.0	40.0	----	56.0	----	16.0	----	H (QP)
3	1.36400	23.5	----	10.1	33.6	----	56.0	----	22.4	----	H (QP)
4	3.14000	22.1	----	10.2	32.3	----	56.0	----	23.7	----	H (QP)
5	8.68500	27.4	----	10.4	37.8	----	60.0	----	22.2	----	H (QP)
6	19.92000	32.1	----	10.7	42.8	----	60.0	----	17.2	----	H (QP)
7	0.18100	----	16.6	10.0	----	26.6	----	54.4	----	27.8	H (CAV)
8	0.53400	----	14.6	10.0	----	24.6	----	46.0	----	21.4	H (CAV)
9	1.36400	----	10.9	10.1	----	21.0	----	46.0	----	25.0	H (CAV)
10	3.14000	----	8.3	10.2	----	18.5	----	46.0	----	27.5	H (CAV)
11	8.68500	----	16.4	10.4	----	26.8	----	50.0	----	23.2	H (CAV)
12	19.92000	----	22.8	10.7	----	33.5	----	50.0	----	16.5	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	0.19300	46.9	----	10.0	56.9	----	63.9	----	7.0	----	N (QP)
2	0.66400	26.5	----	10.1	36.6	----	56.0	----	19.4	----	N (QP)
3	1.76000	21.9	----	10.1	32.0	----	56.0	----	24.0	----	N (QP)
4	6.55000	27.7	----	10.3	38.0	----	60.0	----	22.0	----	N (QP)
5	18.24000	37.6	----	10.7	48.3	----	60.0	----	11.7	----	N (QP)
6	27.36000	25.7	----	10.7	36.4	----	60.0	----	23.6	----	N (QP)
7	0.19300	----	25.8	10.0	----	35.8	----	53.9	----	18.1	N (CAV)
8	0.66400	----	13.7	10.1	----	23.8	----	46.0	----	22.2	N (CAV)
9	1.76000	----	10.0	10.1	----	20.1	----	46.0	----	25.9	N (CAV)
10	6.55000	----	17.1	10.3	----	27.4	----	50.0	----	22.6	N (CAV)
11	18.24000	----	28.6	10.7	----	39.3	----	50.0	----	10.7	N (CAV)
12	27.36000	----	18.1	10.7	----	28.8	----	50.0	----	21.2	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

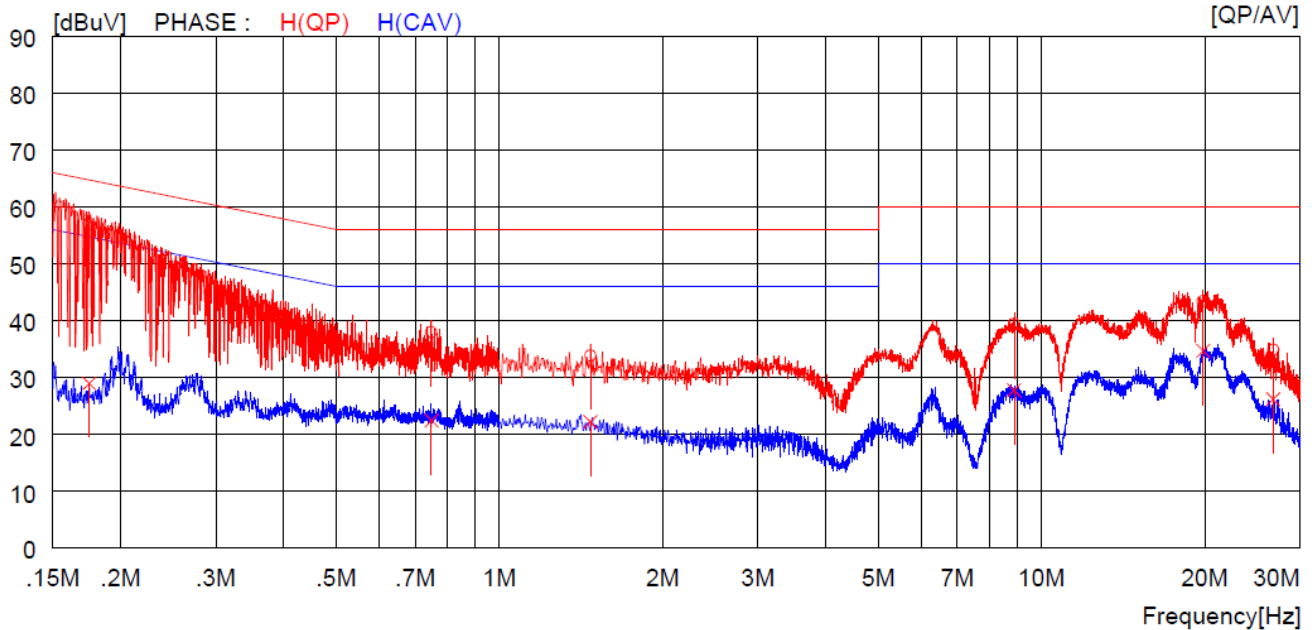
15.4 Test data for Frequency U-NII-3

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

-. Resolution bandwidth : 9 kHz

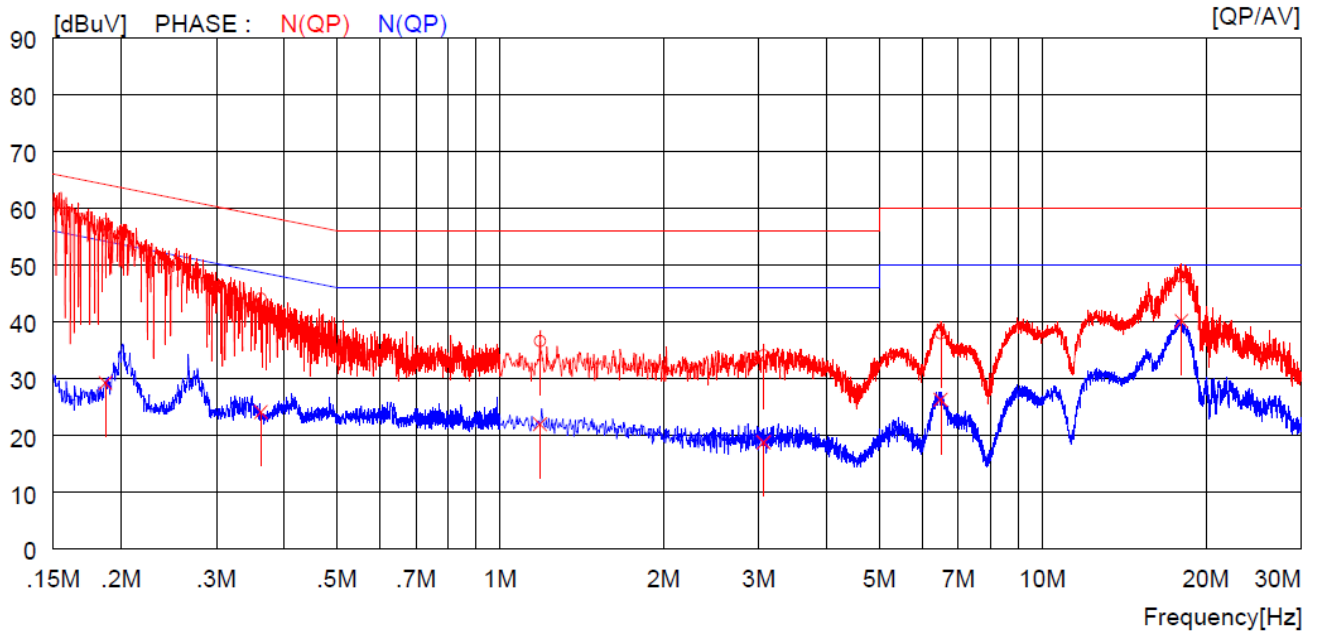
-. Frequency range : 0.15 MHz ~ 30 MHz

-. 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	0.17500	47.1	----	10.0	57.1	----	64.7	----	7.6	----	H (QP)
2	0.74900	27.9	----	10.1	38.0	----	56.0	----	18.0	----	H (QP)
3	1.47200	23.8	----	10.1	33.9	----	56.0	----	22.1	----	H (QP)
4	8.90500	29.0	----	10.4	39.4	----	60.0	----	20.6	----	H (QP)
5	19.86000	32.7	----	10.7	43.4	----	60.0	----	16.6	----	H (QP)
6	26.78000	24.2	----	10.7	34.9	----	60.0	----	25.1	----	H (QP)
7	0.17500	----	19.0	10.0	----	29.0	----	54.7	----	25.7	H (CAV)
8	0.74900	----	12.3	10.1	----	22.4	----	46.0	----	23.6	H (CAV)
9	1.47200	----	12.1	10.1	----	22.2	----	46.0	----	23.8	H (CAV)
10	8.90500	----	17.4	10.4	----	27.8	----	50.0	----	22.2	H (CAV)
11	19.86000	----	24.0	10.7	----	34.7	----	50.0	----	15.3	H (CAV)
12	26.78000	----	15.5	10.7	----	26.2	----	50.0	----	23.8	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	0.18700	47.2	----	10.0	57.2	----	64.2	----	7.0	----	N (QP)
2	0.36200	34.1	----	10.0	44.1	----	58.7	----	14.6	----	N (QP)
3	1.18400	26.5	----	10.1	36.6	----	56.0	----	19.4	----	N (QP)
4	3.06000	23.9	----	10.2	34.1	----	56.0	----	21.9	----	N (QP)
5	6.48500	27.7	----	10.3	38.0	----	60.0	----	22.0	----	N (QP)
6	18.03000	37.3	----	10.7	48.0	----	60.0	----	12.0	----	N (QP)
7	0.18700	----	19.3	10.0	----	29.3	----	54.2	----	24.9	N (CAV)
8	0.36200	----	14.1	10.0	----	24.1	----	48.7	----	24.6	N (CAV)
9	1.18400	----	11.9	10.1	----	22.0	----	46.0	----	24.0	N (CAV)
10	3.06000	----	8.6	10.2	----	18.8	----	46.0	----	27.2	N (CAV)
11	6.48500	----	16.0	10.3	----	26.3	----	50.0	----	23.7	N (CAV)
12	18.03000	----	29.5	10.7	----	40.2	----	50.0	----	9.8	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