

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

Test Report No. : OT-183-RWD-041

AGR No. : A17NA-430

Applicant : omnic&s.Inc.

Address : #314, 288 Digital-ro, Guro-gu, Daerung Post Tower 1cha, Seoul, 08390, South Korea

Manufacturer : omnic&s.Inc.

Address : #314, 288 Digital-ro, Guro-gu, Daerung Post Tower 1cha, Seoul, 08390, South Korea

Type of Equipment : EEG measurement & brain training wireless headset

FCC ID. : 2APFA-OCW-H20

Model Name : OCW-H20

Multiple Model Name : N/A

Serial number : N/A

Total page of Report : 34 pages (including this page)

Date of Incoming : March 01, 2018

Date of issue : March 30, 2018

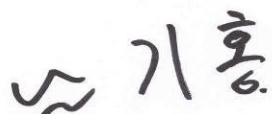
SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C Section 15.247*


This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by:


Ki-Hong, Nam / Chief Engineer
ONETECH Corp.

Approved by:


Keun-Young, Choi / Vice President
ONETECH Corp.

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Revision History

| Rev. No. | Issue Report No. | Issued Date | Revisions | Section Affected |
|----------|------------------|-------------|-----------------|------------------|
| 0 | OT-183-RWD-041 | 2018.03.30 | Initial Release | All |
| | | | | |
| | | | | |

1. VERIFICATION OF COMPLIANCE

Applicant : omnic&s.Inc.
 Address : #314, 288 Digital-ro, Guro-gu, Daerung Post Tower 1cha, Seoul, 08390, South Korea
 Contact Person : Hyungmin, Kim / Dept. manager
 Telephone No. : +82-2-70-7605-6127
 FCC ID : 2APFA-OCW-H20
 Model Name : OCW-H20
 Brand Name : -
 Serial Number : N/A
 Date : March 30, 2018

| | |
|--|---|
| EQUIPMENT CLASS | DTS – DIGITAL TRNSMISSION SYSTEM |
| E.U.T. DESCRIPTION | EEG measurement & brain training wireless headset |
| 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 |

* Please contact us [(TEL : +82-31-799-9500 (Ext.0)] for verification of this test report.

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 omnic&s.Inc., Model OCW-H20 (referred to as the EUT in this report) is a EEG measurement & brain training wireless headset. The product specification described herein was obtained from product data sheet or user’s manual.

| | | | |
|--|---|---|----------|
| Device Type | EEG measurement & brain training wireless headset | | |
| Temperature Range | 5 °C ~ + 40 °C | | |
| Operating Frequency | Bluetooth LE | 2 402 MHz ~ 2 480 MHz | |
| | Bluetooth | 2 402 MHz ~ 2 480 MHz | |
| RF Output Power | Bluetooth LE | -2.83 dBm | |
| | Bluetooth | 1 Mbps | 8.77 dBm |
| | | 2 Mbps | 7.84 dBm |
| | | 3 Mbps | 8.01 dBm |
| Modulation Type | Bluetooth LE | DSSS Modulation(GFSK) | |
| | Bluetooth | 1 Mbps: GFSK 2 Mbps: $\pi/4$ -QPSK 3 Mbps: 8-DPSK | |
| Antenna Type | Bluetooth LE : Ceramic Chip Antenna Bluetooth : Chip Antenna | | |
| Antenna Gain | Bluetooth LE : 1.10 dBi Bluetooth : 2.30 dBi | | |
| SW version | EA1.0.0 | | |
| HW version | HS ver1.0.1 | | |
| Electrical Rating | DC 3.70 V | | |
| List of each Osc. or crystal Freq.(Freq. >= 1 MHz) | Bluetooth LE | 26 MHz | |
| | Bluetooth | 32.768 kHz, 38.4 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 | OMNIC&S Inc. | N/A | N/A |
| Sub Board | OMNIC&S Inc. | 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 |
|---------|--------------|---|--------------|
| OCW-H20 | OMNIC&S Inc. | EEG measurement & brain training wireless headset (EUT) | - |
| JIG | N/A | TEST JIG | EUT |
| Probook | HP | Notebook PC | - |
| Adaptor | Apple Inc | DC Adaptor | - |

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 adapter. 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 (Bluetooth) and Ceramic Chip Antenna (Bluetooth LE) 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 |

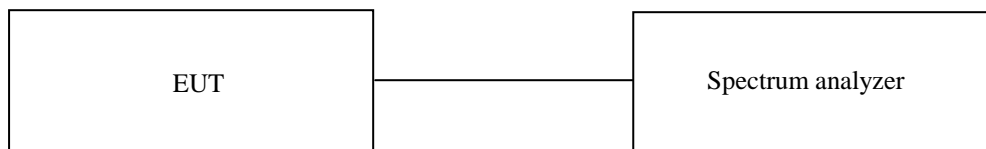
7. MINIMUM 6 dB BANDWIDTH

7.1 Operating environment

Temperature : 23 °C
 Relative humidity : 45 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



7.3 Test equipment used

| Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - FSV40 | Rohde & Schwarz | Signal Analyzer | 101009 | Apr. 05, 2017 (1Y) |


All test equipment used is calibrated on a regular basis.

7.4 Test data

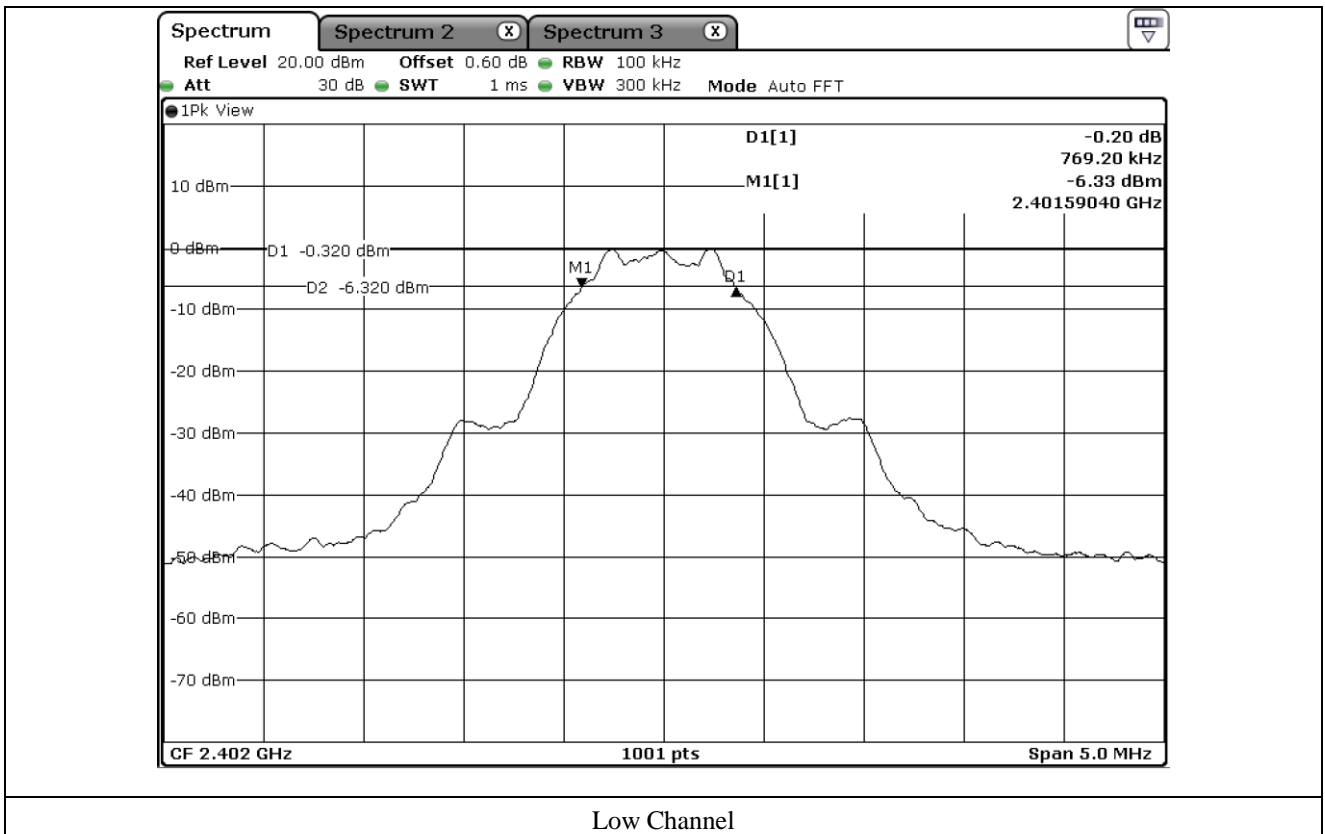
- Test Date : March 01, 2018 ~ March 12, 2018
- Test Result : Pass

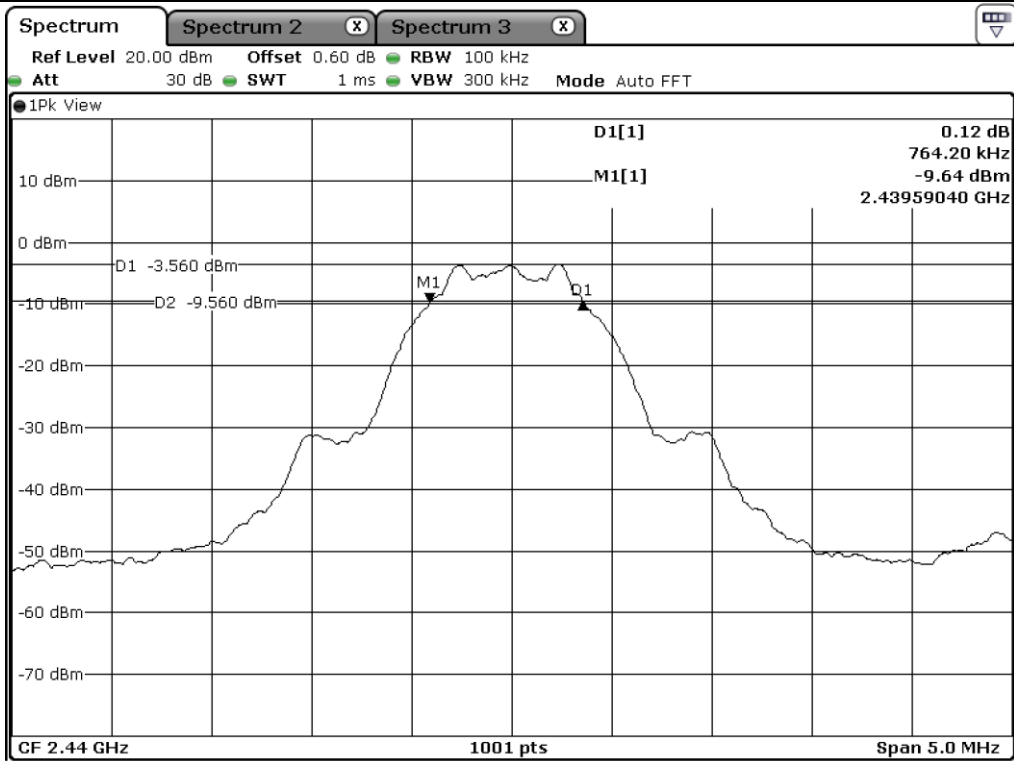
| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (kHz) | LIMIT (kHz) | MARGIN (kHz) |
|---------|----------------|----------------------|-------------|--------------|
| Low | 2 402.00 | 769.20 | 500.00 | 269.20 |
| Middle | 2 440.00 | 764.20 | 500.00 | 264.20 |
| High | 2 480.00 | 759.20 | 500.00 | 259.20 |

Remark. Margin = Measured Value - Limit

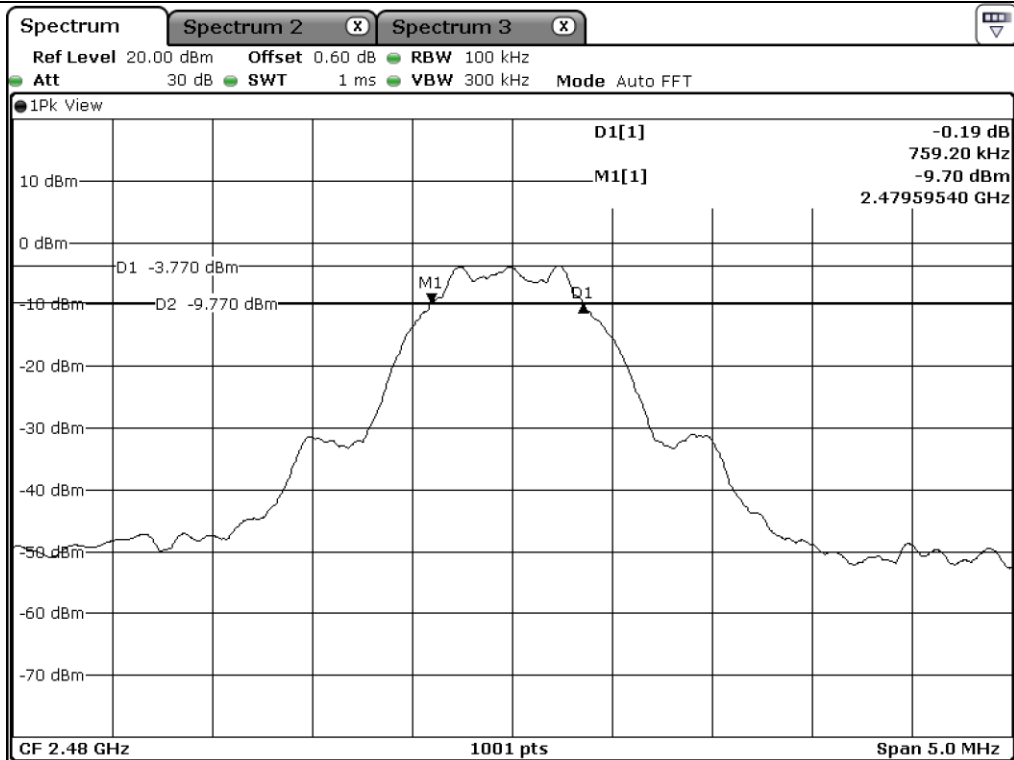


Tested by: Yu-Seog, Sim / Assistant Manager





Middle Channel



High Channel

8. MAXIMUM PEAK OUTPUT POWER

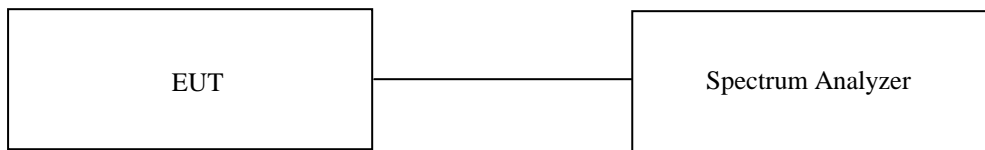
8.1 Operating environment

Temperature : 23 °C
 Relative humidity : 45 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to \geq DTS Bandwidth, the video bandwidth is set to 3 times the resolution bandwidth.



8.3 Test equipment used

| Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - FSV40 | Rohde & Schwarz | Signal Analyzer | 101009 | Apr. 05, 2017 (1Y) |


All test equipment used is calibrated on a regular basis.

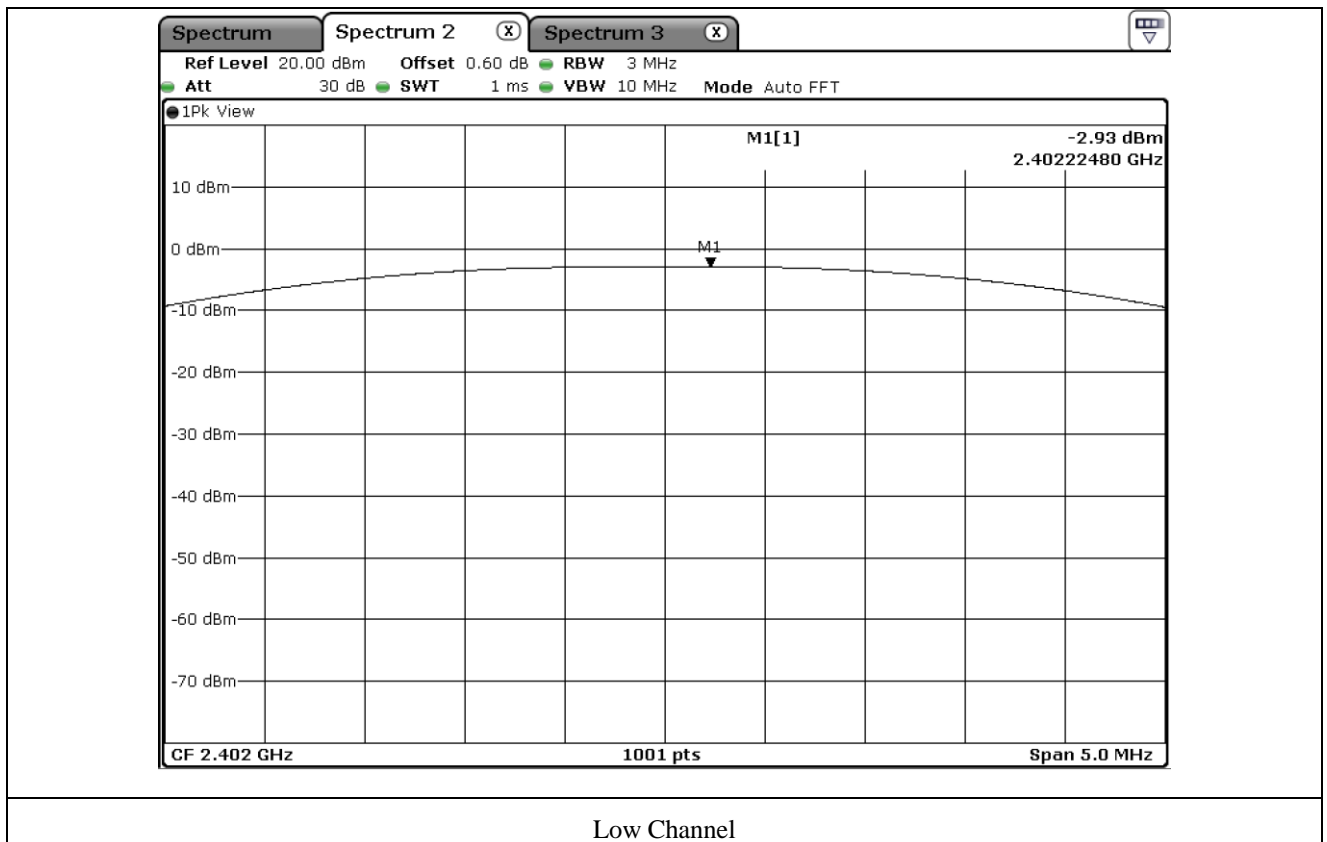
8.4 Test data

- Test Date : March 01, 2018 ~ March 12, 2018
- Test Result : Pass

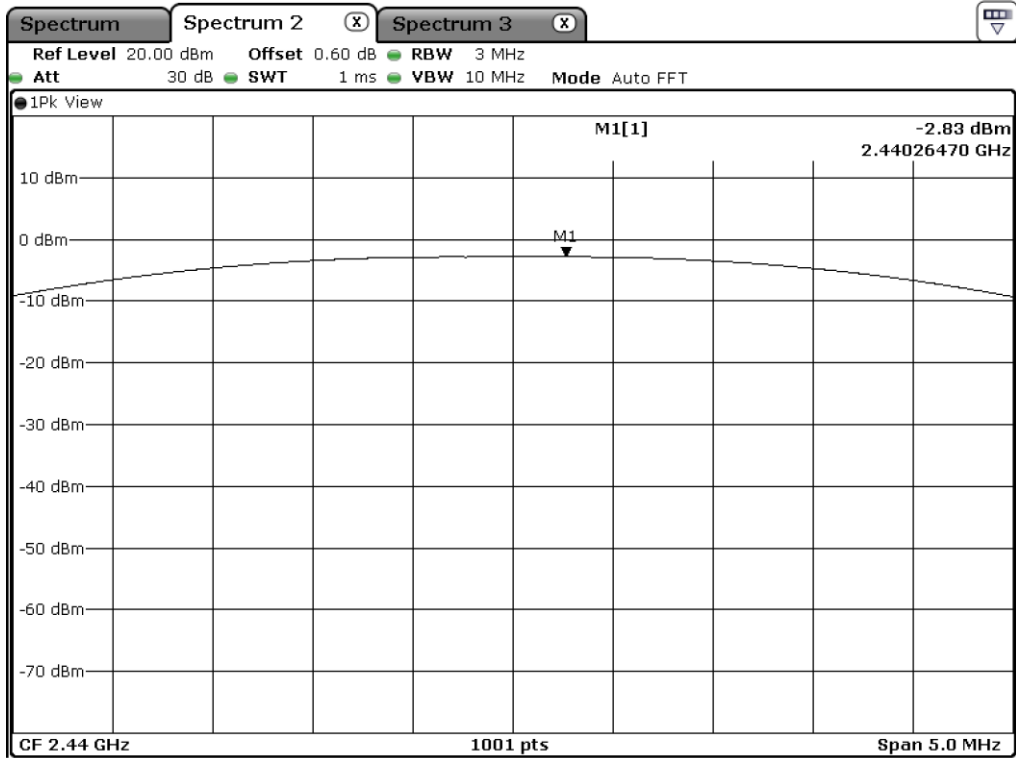
| CHANNEL | FREQUENCY (MHz) | MEASURED VALUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|-----------------|----------------------|-------------|-------------|
| LOW | 2 402.00 | -2.93 | 30.00 | 32.93 |
| MIDDLE | 2 440.00 | -2.83 | 30.00 | 32.83 |
| HIGH | 2 480.00 | -3.05 | 30.00 | 33.05 |

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

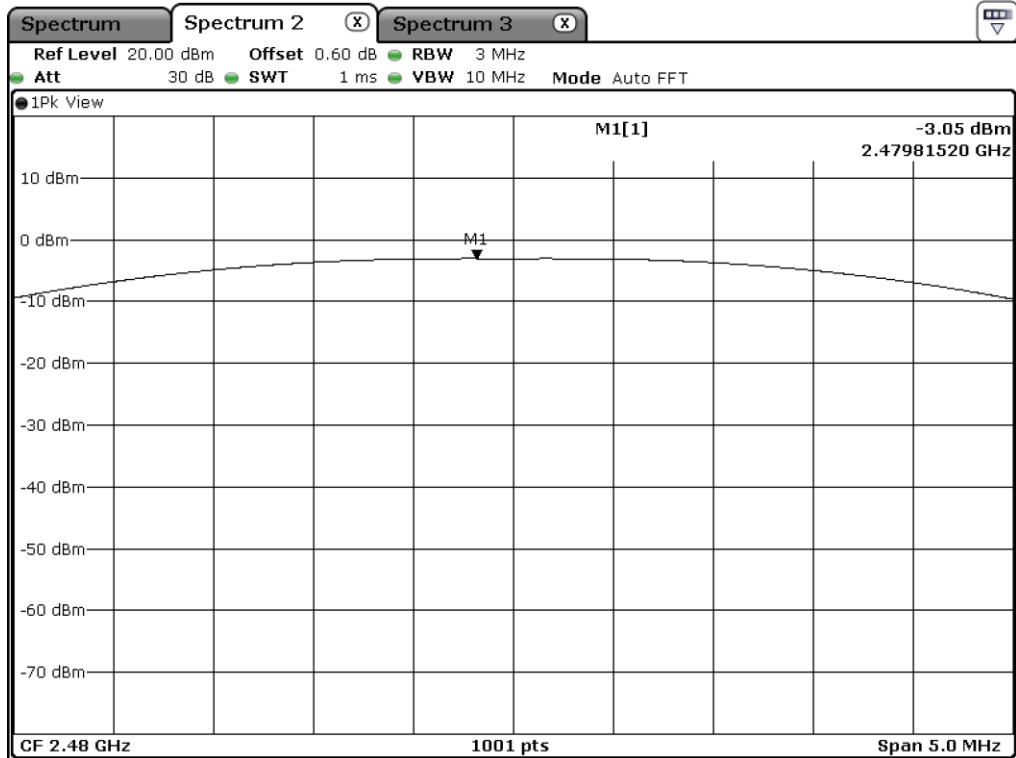

Tested by: Yu-Seog, Sim / Assistant Manager



Low Channel



Middle Channel



High Channel

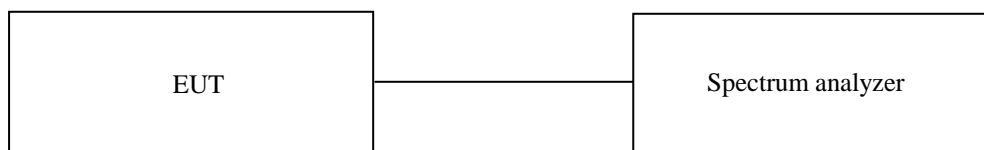
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 23 °C
 Relative humidity : 45 % R.H.

9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, the video bandwidth is set to 3 times the resolution bandwidth and peak detection was used.



9.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

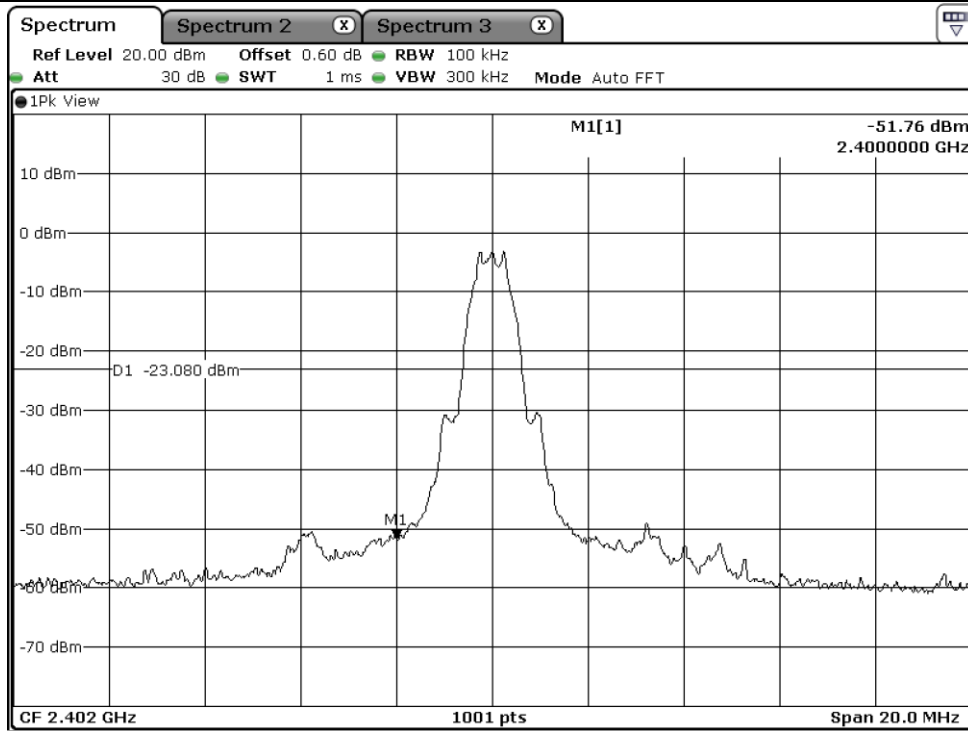
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal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

9.4 Test equipment used

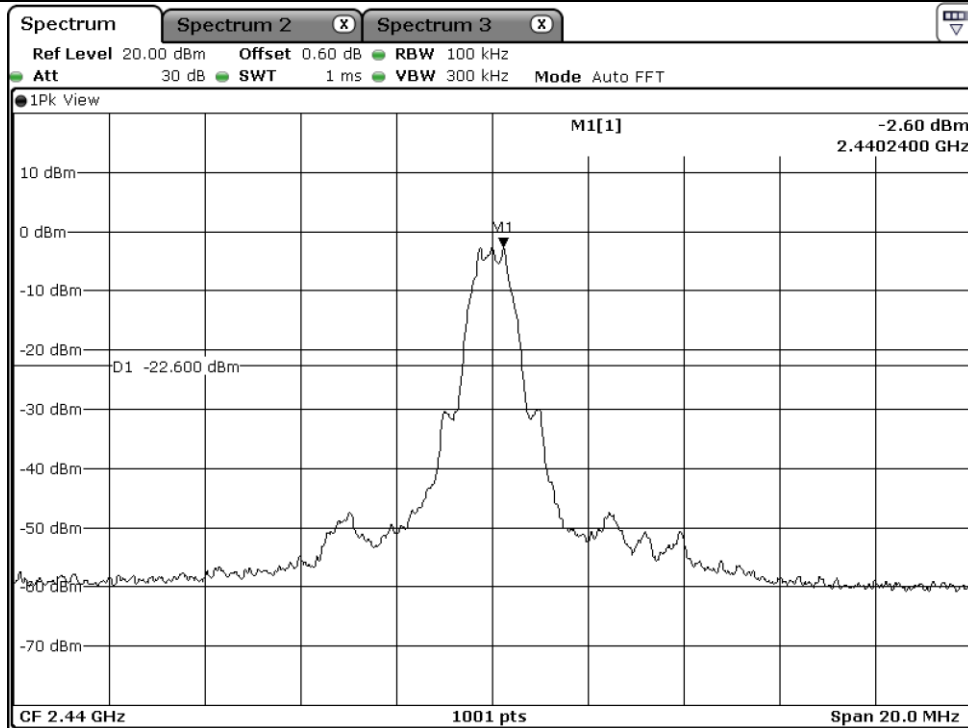
| Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|-----------------|-------------------|--------------------------|---------------|--------------------|
| ■ - FSV40 | Rohde & Schwarz | Signal Analyzer | 101009 | Apr. 05, 2017 (1Y) |
| ■ - ESU | Rohde & Schwarz | EMI Test Receiver | 100261 | Apr. 06, 2017 (1Y) |
| ■ - 310N | Sonoma Instrument | Pre-Amplifier | 312544 | Apr. 05, 2017 (1Y) |
| ■ - BBV9718 | Schwarzbeck | Amplifier | 310 | Sep. 01, 2017 (1Y) |
| ■ - SCU40A | Rohde & Schwarz | Signal Conditioning unit | 100436 | Apr. 04, 2017 (1Y) |
| ■ - DT3000-3t | Innco System | Turn Table | DT3000/093 | N/A |
| ■ - MA-4000XPET | Innco System | Antenna Master | MA4000/509 | N/A |
| ■ - VULB9163 | Schwarzbeck | TRILOG Broadband Antenna | 9163-421 | Apr. 15, 2016 (2Y) |
| ■ - BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D295 | May 26, 2017 (2Y) |
| ■ - BBHA9170 | Schwarzbeck | Horn Antenna | BBHA9170179 | Jul. 28, 2017 (2Y) |

All test equipment used is calibrated on a regular basis.

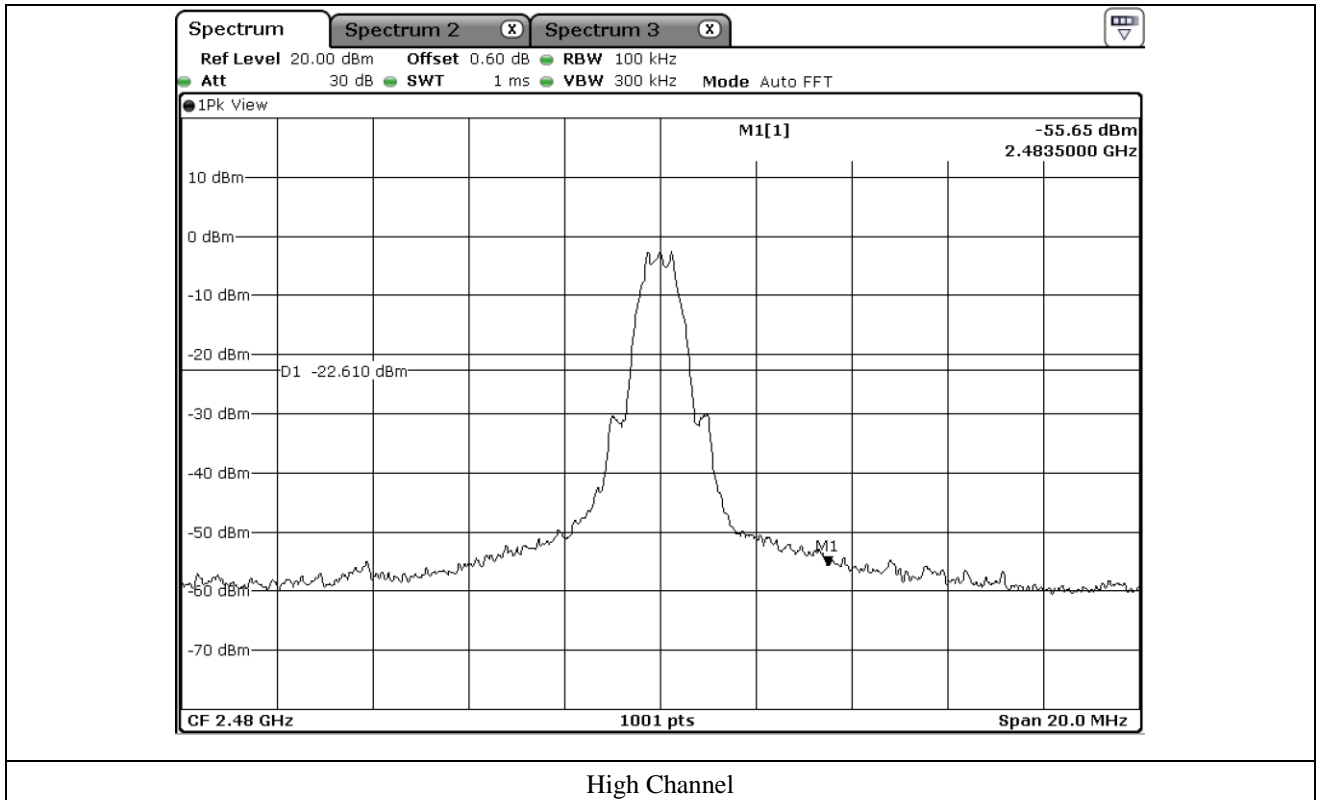
9.5 Test data for conducted emission

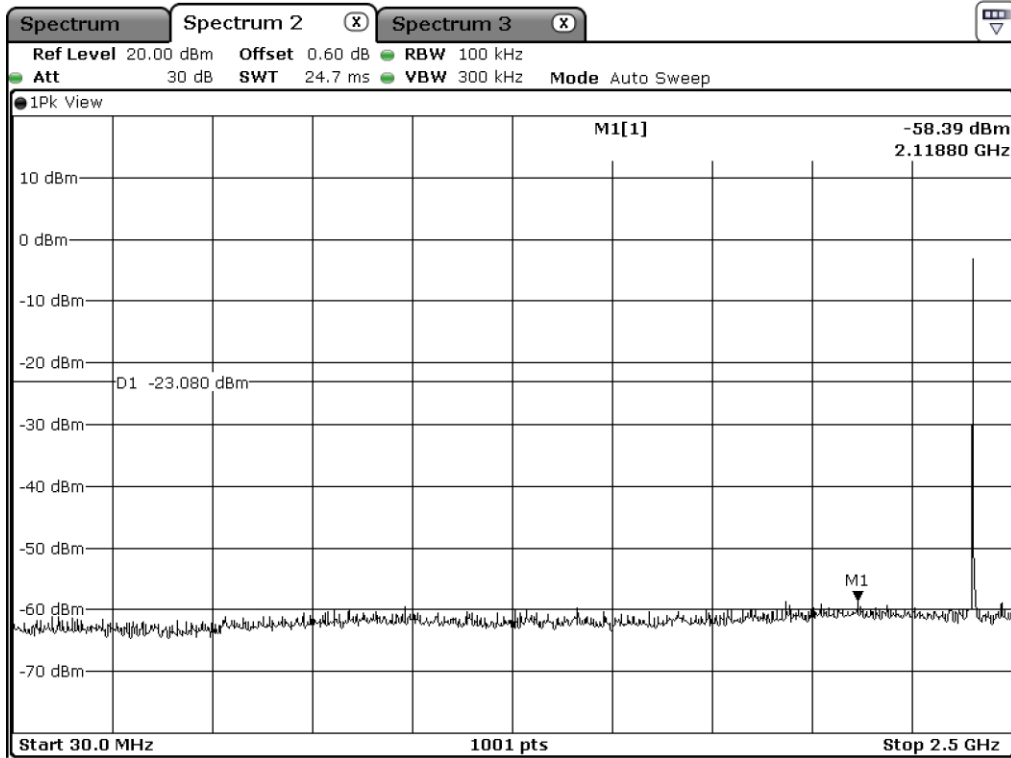


Low Channel

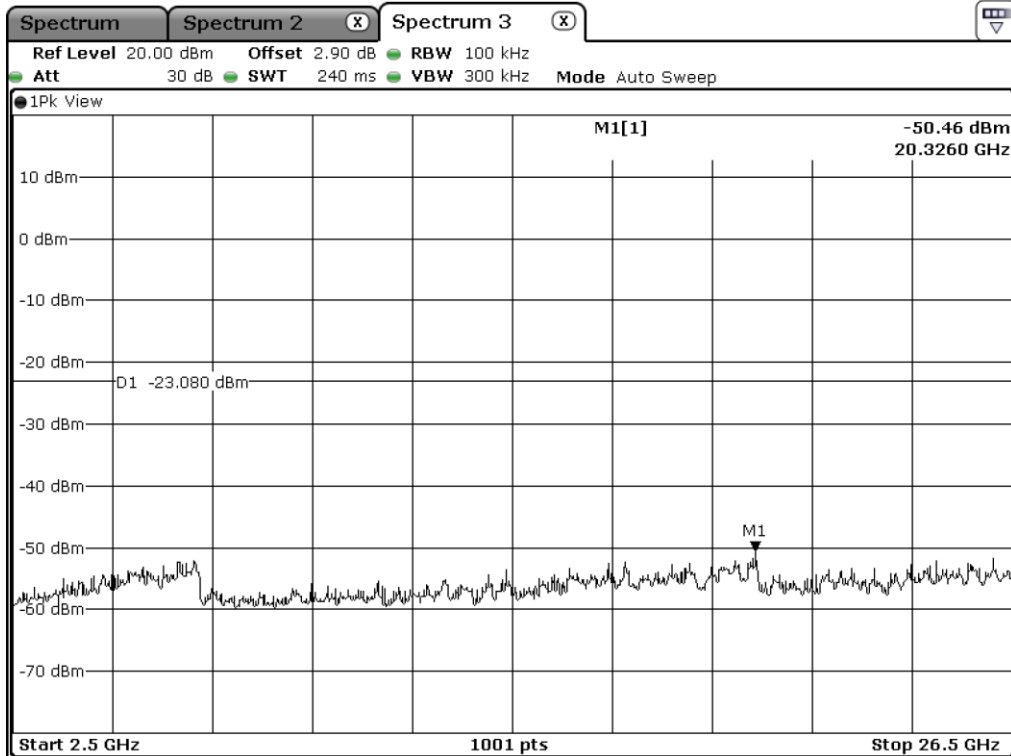


Middle Channel

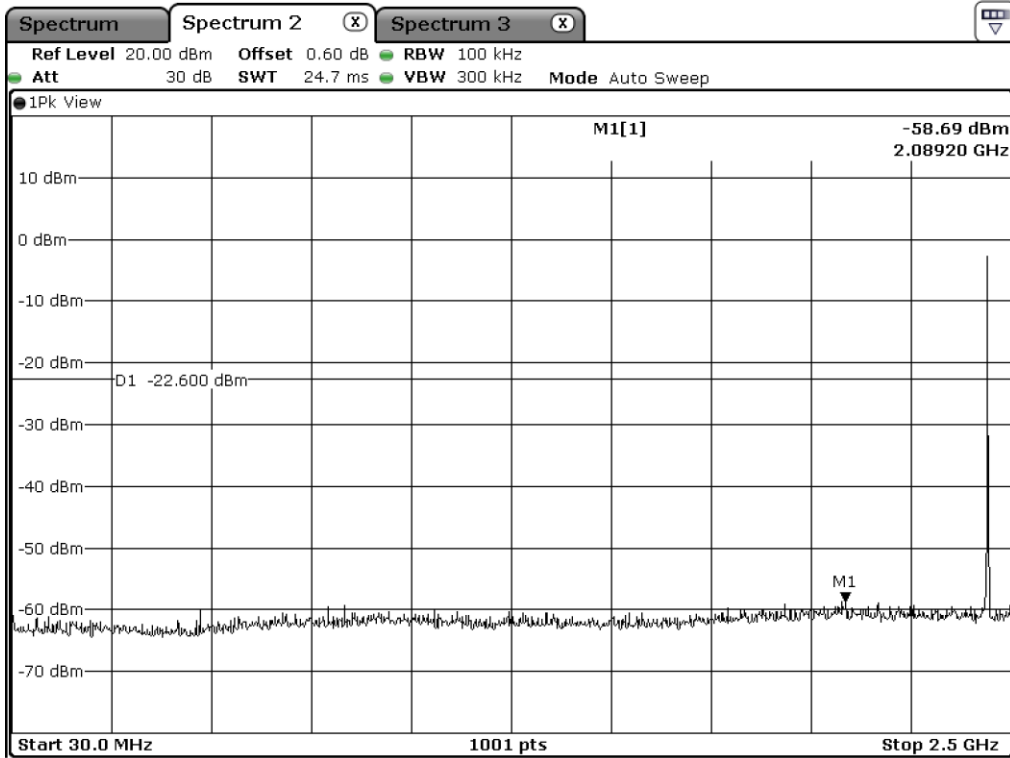




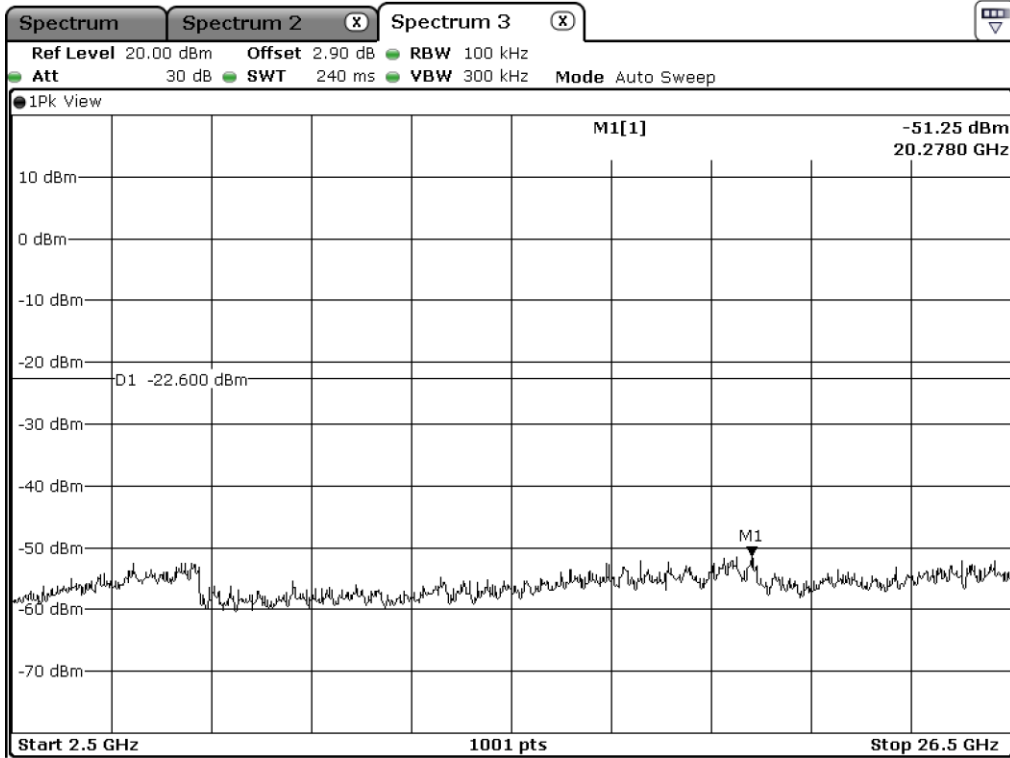
Low Channel



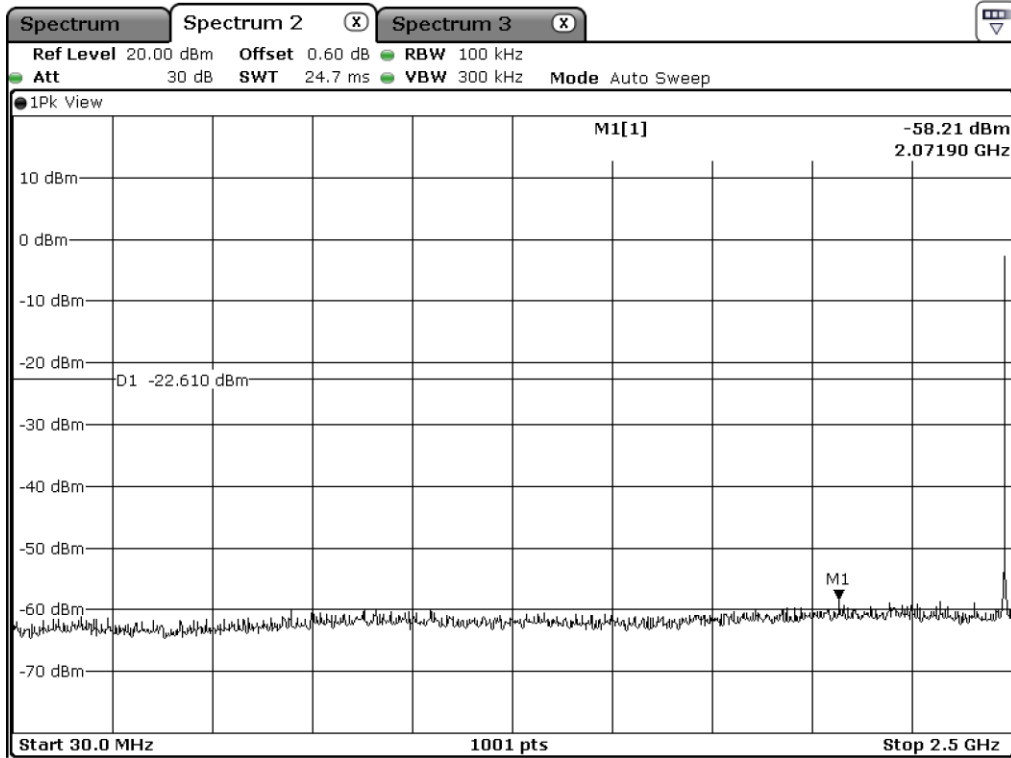
Low Channel



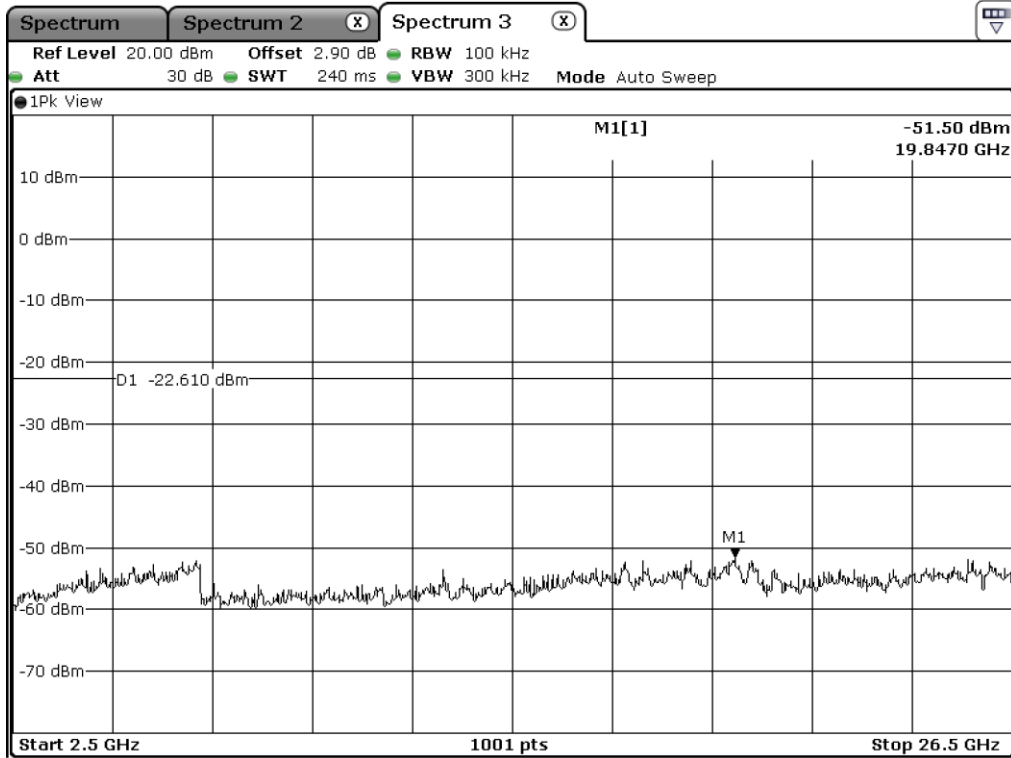
Middle Channel



Middle Channel



High Channel



High Channel

9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

- Test Date : March 01, 2018 ~ March 12, 2018
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for 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 | | | | | | | | | |
| 2 375.97 | 32.22 | Peak | H | 26.94 | 9.20 | 34.76 | 33.60 | 74.00 | 40.40 |
| 2 376.13 | 25.43 | Average | H | | | | 26.81 | 54.00 | 27.19 |
| 2 323.86 | 30.48 | Peak | V | | | | 31.86 | 74.00 | 42.14 |
| 2 362.14 | 23.99 | Average | V | | | | 25.37 | 54.00 | 28.63 |
| Test Data for High Channel | | | | | | | | | |
| 2 483.55 | 36.21 | Peak | H | 27.47 | 9.49 | 35.51 | 37.66 | 74.00 | 36.34 |
| 2 485.38 | 27.54 | Average | H | | | | 28.99 | 54.00 | 25.01 |
| 2 383.54 | 34.72 | Peak | V | | | | 36.17 | 74.00 | 37.83 |
| 2 483.50 | 26.35 | Average | V | | | | 27.80 | 54.00 | 26.20 |

Tabulated test data for Restricted Band

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

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

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



Tested by: Yu-Seog, Sim / Assistant Manager

9.6.2 Spurious & Harmonic Radiated Emission

- Test Date : March 01, 2018 ~ March 12, 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
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

| Frequency (GHz) | Reading (dBμV) | Detector Mode | Ant. Pol. (H/V) | Ant. Factor | Cable Loss | Amp Gain | Total (dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|-------------------------------------|----------------|---------------|-----------------|-------------|------------|----------|----------------|-----------------|-------------|
| Test Data for Low Channel | | | | | | | | | |
| 4 804.00 | 36.51 | Peak | H | 30.84 | 12.31 | 35.74 | 43.92 | 74.00 | 30.08 |
| | 32.14 | Average | H | | | | 39.55 | 54.00 | 14.45 |
| | 36.85 | Peak | V | | | | 44.26 | 74.00 | 29.74 |
| | 33.24 | Average | V | | | | 40.65 | 54.00 | 13.35 |
| Test Data for Middle Channel | | | | | | | | | |
| 4 880.00 | 36.48 | Peak | H | 30.01 | 12.43 | 35.80 | 43.12 | 74.00 | 30.88 |
| | 32.96 | Average | H | | | | 39.60 | 54.00 | 14.40 |
| | 36.95 | Peak | V | | | | 43.59 | 74.00 | 30.41 |
| | 33.27 | Average | V | | | | 39.91 | 54.00 | 14.09 |
| Test Data for High Channel | | | | | | | | | |
| 4 960.00 | 36.97 | Peak | H | 31.15 | 12.81 | 35.96 | 44.97 | 74.00 | 29.03 |
| | 32.68 | Average | H | | | | 40.68 | 54.00 | 13.32 |
| | 37.24 | Peak | V | | | | 45.24 | 74.00 | 28.76 |
| | 33.55 | Average | V | | | | 41.55 | 54.00 | 12.45 |

Tabulated test data for Restricted Band

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

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

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



Tested by: Yu-Seog, Sim / Assistant Manager

10. PEAK POWER SPECTRAL DENSITY

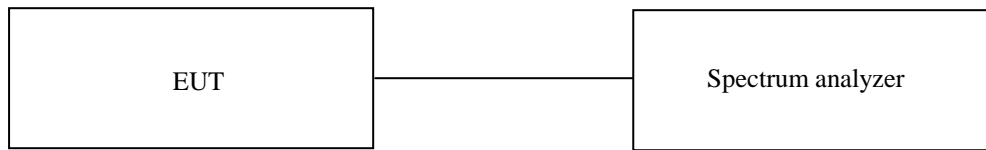
10.1 Operating environment

Temperature : 23 °C
 Relative humidity : 45 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$, the video bandwidth is set to 3 times the resolution bandwidth.



10.3 Test equipment used

| Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|--------------|-----------------|-----------------|---------------|--------------------|
| ■ - FSV40 | Rohde & Schwarz | Signal Analyzer | 101009 | Apr. 05, 2017 (1Y) |

All test equipment used is calibrated on a regular basis.

10.4 Test data

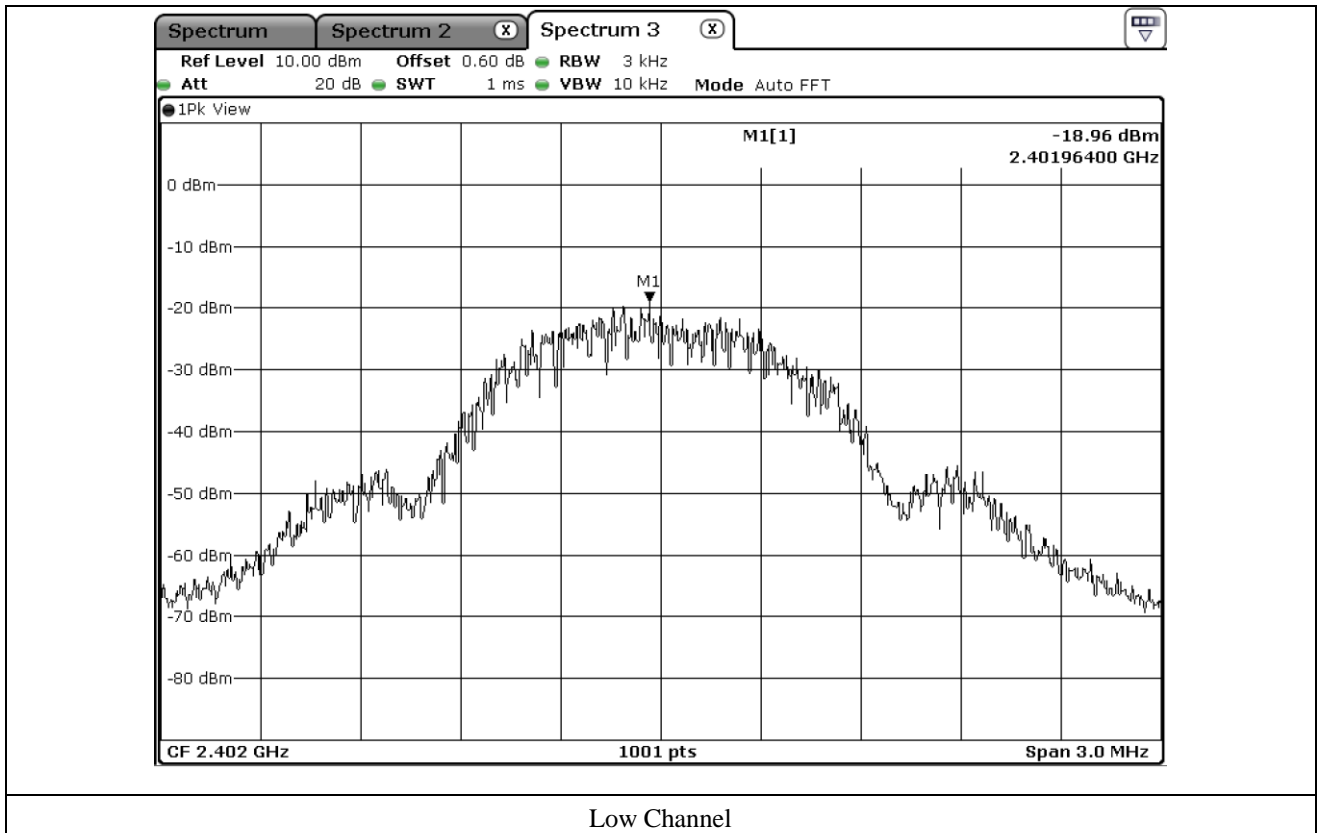
- Test Date : March 01, 2018 ~ March 12, 2018
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

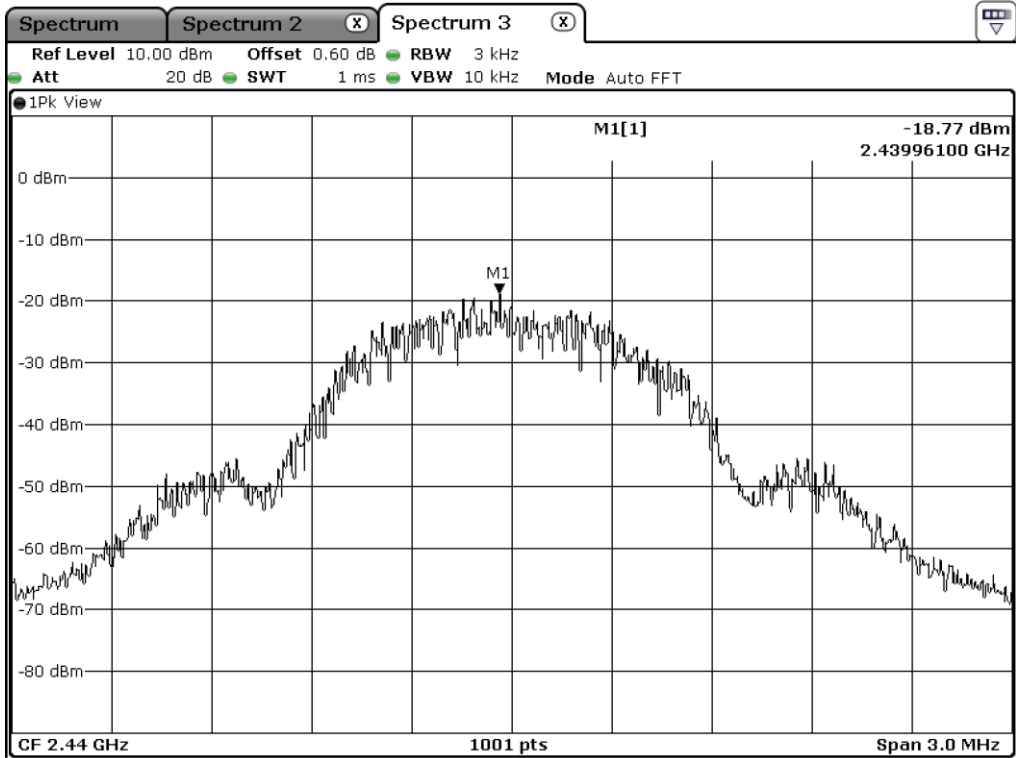
| CHANNEL | FREQUENCY(MHz) | MEASURED VALUE (dBm) | LIMIT (dBm) | MARGIN (dB) |
|---------|----------------|----------------------|-------------|-------------|
| Low | 2 402.00 | -18.96 | 8.00 | 26.96 |
| Middle | 2 440.00 | -18.77 | 8.00 | 26.77 |
| High | 2 480.00 | -18.93 | 8.00 | 26.93 |

Remark. Margin = Limit – Measured value

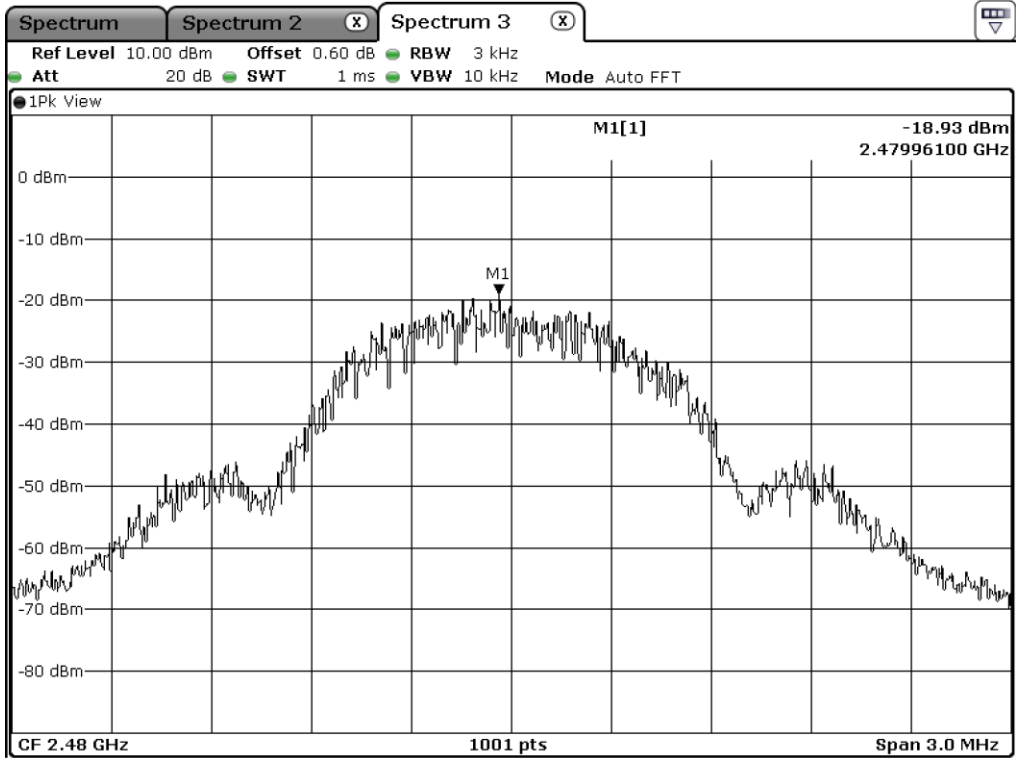


Tested by: Yu-Seog, Sim / Assistant Manager





Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 23 °C
 Relative humidity : 45 % R.H.

11.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

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

11.3 Test equipment used

| Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|-----------------|-------------------|--------------------------|---------------|--------------------|
| ■ - FSV40 | Rohde & Schwarz | Signal Analyzer | 101009 | Apr. 05, 2017 (1Y) |
| ■ - ESU | Rohde & Schwarz | EMI Test Receiver | 100261 | Apr. 06, 2017 (1Y) |
| ■ - 310N | Sonoma Instrument | Pre-Amplifier | 312544 | Apr. 05, 2017 (1Y) |
| ■ - BBV9718 | Schwarzbeck | Amplifier | 310 | Sep. 01, 2017 (1Y) |
| ■ - SCU40A | Rohde & Schwarz | Signal Conditioning unit | 100436 | Apr. 04, 2017 (1Y) |
| ■ - DT3000-3t | Innco System | Turn Table | DT3000/093 | N/A |
| ■ - MA-4000XPET | Innco System | Antenna Master | MA4000/509 | N/A |
| ■ - VULB9163 | Schwarzbeck | TRILOG Broadband Antenna | 9163-421 | Apr. 15, 2016 (2Y) |
| ■ - BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D295 | May 26, 2017 (2Y) |
| ■ - BBHA9170 | Schwarzbeck | Horn Antenna | BBHA9170179 | Jul. 28, 2017 (2Y) |

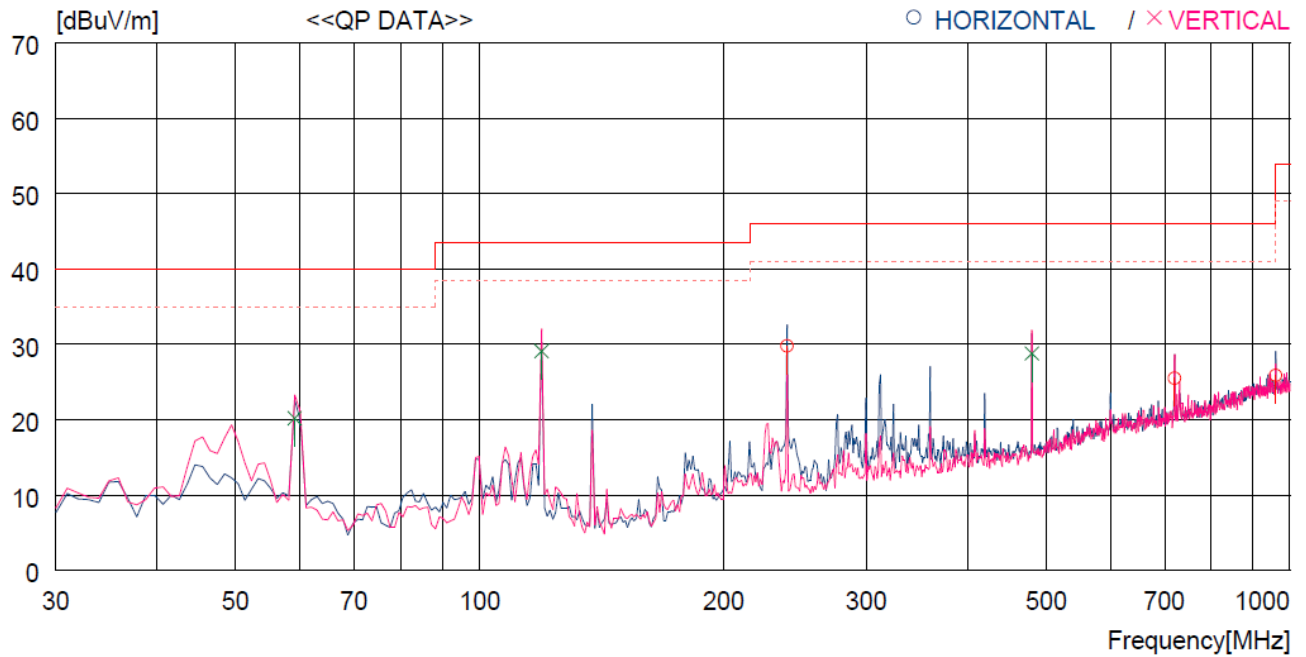
All test equipment used is calibrated on a regular basis.

11.4 Test data for 30 MHz ~ 1 GHz

Humidity Level : 45 % R.H. Temperature: 23°C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

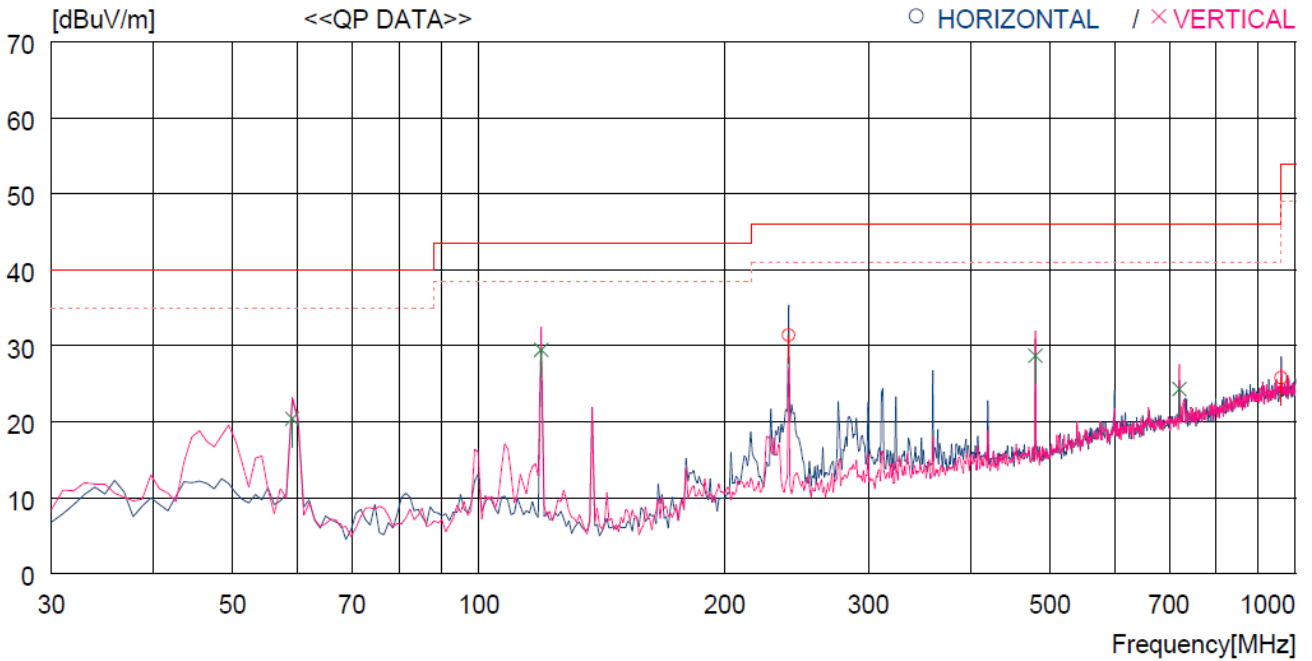
EUT : EEG measurement & brain training wireless headset Date: March 09, 2018
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



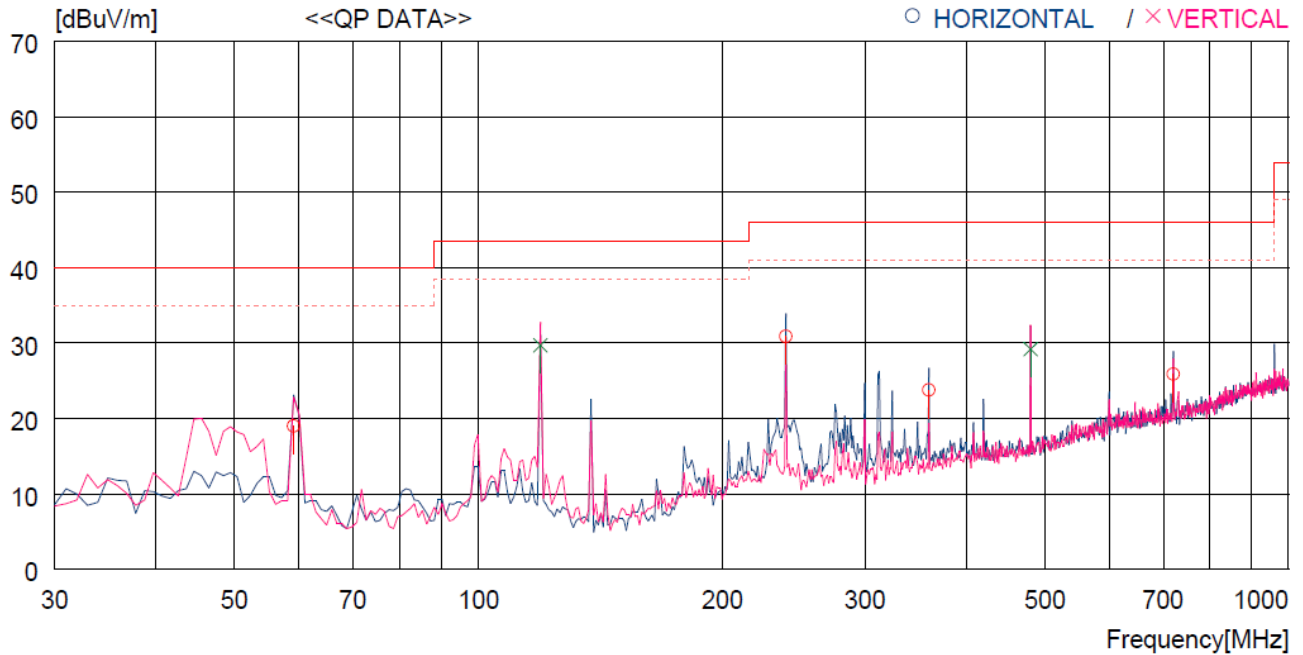
| No. | FREQ [MHz] | READING QP [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|------------------------|---------------|-------------------------|-----------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- | | | | | | | | | | |
| 1 | 239.525 | 47.3 | 12.0 | 3.6 | 33.1 | 29.8 | 46.0 | 16.2 | 400 | 190 |
| 2 | 720.630 | 33.3 | 19.5 | 6.2 | 33.5 | 25.5 | 46.0 | 20.5 | 400 | 359 |
| 3 | 960.210 | 28.7 | 22.0 | 7.2 | 32.0 | 25.9 | 54.0 | 28.1 | 400 | 359 |
| ----- Vertical ----- | | | | | | | | | | |
| 4 | 59.100 | 38.0 | 13.4 | 1.9 | 33.1 | 20.2 | 40.0 | 19.8 | 400 | 63 |
| 5 | 119.250 | 49.3 | 10.2 | 2.6 | 33.0 | 29.1 | 43.5 | 14.4 | 400 | 4 |
| 6 | 480.090 | 40.2 | 16.8 | 5.1 | 33.3 | 28.8 | 46.0 | 17.2 | 400 | 243 |

Operating condition : Middle Channel



| No. | FREQ [MHz] | READING QP [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|------------------------|---------------|-------------------------|-----------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- | | | | | | | | | | |
| 1 | 239.520 | 48.9 | 12.0 | 3.6 | 33.1 | 31.4 | 46.0 | 14.6 | 400 | 173 |
| 2 | 960.220 | 28.6 | 22.0 | 7.2 | 32.0 | 25.8 | 54.0 | 28.2 | 400 | 86 |
| ----- Vertical ----- | | | | | | | | | | |
| 3 | 59.100 | 38.2 | 13.4 | 1.9 | 33.1 | 20.4 | 40.0 | 19.6 | 400 | 249 |
| 4 | 119.240 | 49.7 | 10.2 | 2.6 | 33.0 | 29.5 | 43.5 | 14.0 | 400 | 249 |
| 5 | 480.085 | 40.1 | 16.8 | 5.1 | 33.3 | 28.7 | 46.0 | 17.3 | 400 | 249 |
| 6 | 720.635 | 32.1 | 19.5 | 6.2 | 33.5 | 24.3 | 46.0 | 21.7 | 400 | 156 |

Operating condition : High Channel



| No. | FREQ [MHz] | READING QP [dBuV] | ANT FACTOR [dB] | LOSS [dB] | GAIN [dB] | RESULT [dBuV/m] | LIMIT [dBuV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|------------------------|---------------|-------------------------|-----------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| ----- Horizontal ----- | | | | | | | | | | |
| 1 | 59.100 | 36.8 | 13.4 | 1.9 | 33.1 | 19.0 | 40.0 | 21.0 | 400 | 214 |
| 2 | 239.530 | 48.4 | 12.0 | 3.6 | 33.1 | 30.9 | 46.0 | 15.1 | 400 | 198 |
| 3 | 359.800 | 38.1 | 14.4 | 4.4 | 33.1 | 23.8 | 46.0 | 22.2 | 400 | 0 |
| 4 | 720.634 | 33.7 | 19.5 | 6.2 | 33.5 | 25.9 | 46.0 | 20.1 | 400 | 85 |
| ----- Vertical ----- | | | | | | | | | | |
| 5 | 119.260 | 49.9 | 10.2 | 2.6 | 33.0 | 29.7 | 43.5 | 13.8 | 400 | 106 |
| 6 | 480.080 | 40.6 | 16.8 | 5.1 | 33.3 | 29.2 | 46.0 | 16.8 | 400 | 285 |

Tested by: Yu-Seog, Sim / Assistant Manager

11.5 Test data for Below 30 MHz

- . Test Date : March 09, 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 (dB μ V) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dB μ V/m) | Limits (dB μ V/m) | Margin (dB) |
|---|----------------------|-----------------|-----------------|-----------|--------------------|------------|------------------------------|-----------------------|-------------|
| It was not observed any emissions from the EUT. | | | | | | | | | |

11.6 Test data for above 1 GHz

- . Test Date : March 09, 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 (dB μ V) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dB μ V/m) | Limits (dB μ V/m) | Margin (dB) |
|---|----------------------|-----------------|-----------------|-----------|--------------------|------------|------------------------------|-----------------------|-------------|
| It was not observed any emissions from the EUT. | | | | | | | | | |



Tested by: Yu-Seog, Sim / Assistant Manager

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 23 °C
 Relative humidity : 45 % R.H.

12.2 Test set-up

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

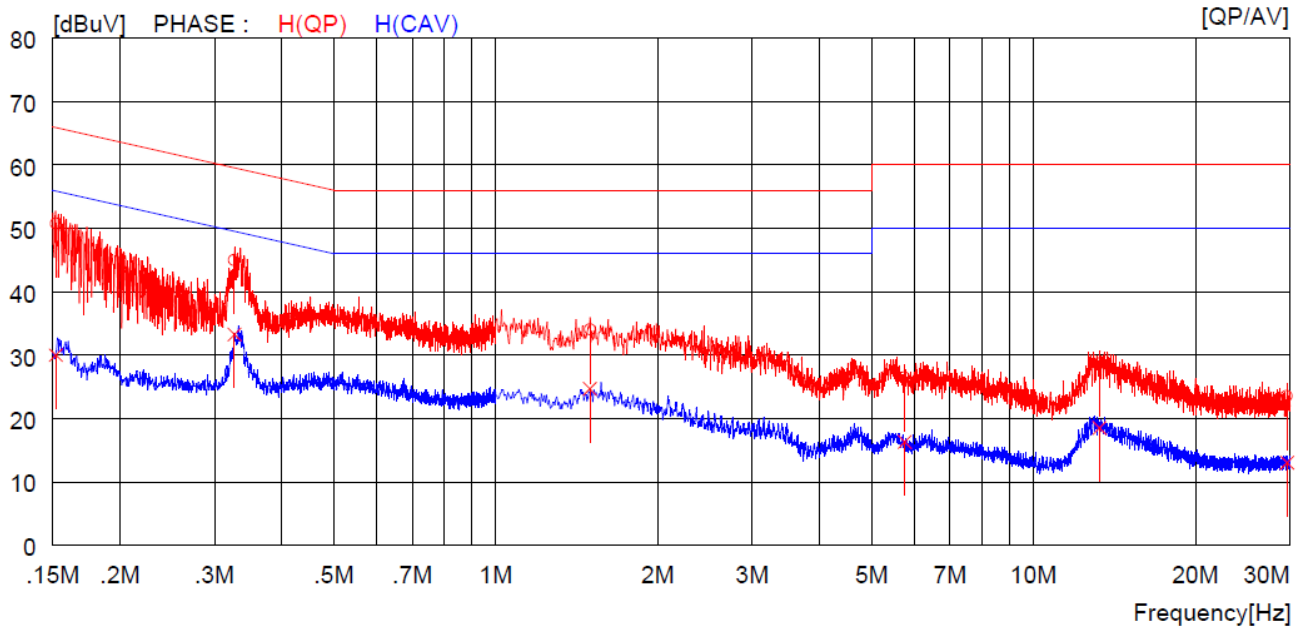
12.3 Test equipment used

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

All test equipment used is calibrated on a regular basis.

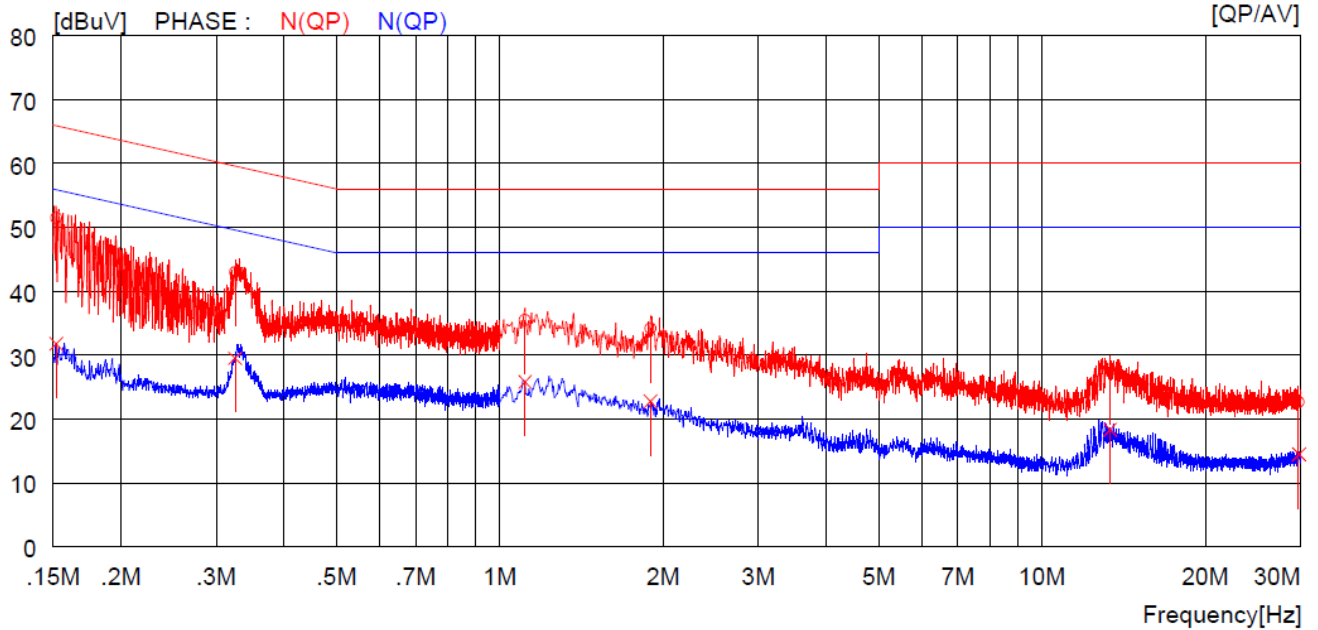
12.4 Test data

- Test Date : March 09, 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 | 0.15200 | 40.7 | ---- | 10.0 | 50.7 | ---- | 65.9 | ---- | 15.2 | ---- | H (QP) |
| 2 | 0.32600 | 35.0 | ---- | 10.0 | 45.0 | ---- | 59.6 | ---- | 14.6 | ---- | H (QP) |
| 3 | 1.49600 | 23.9 | ---- | 10.1 | 34.0 | ---- | 56.0 | ---- | 22.0 | ---- | H (QP) |
| 4 | 5.75500 | 16.3 | ---- | 10.2 | 26.5 | ---- | 60.0 | ---- | 33.5 | ---- | H (QP) |
| 5 | 13.27000 | 18.2 | ---- | 10.5 | 28.7 | ---- | 60.0 | ---- | 31.3 | ---- | H (QP) |
| 6 | 29.62000 | 12.7 | ---- | 10.8 | 23.5 | ---- | 60.0 | ---- | 36.5 | ---- | H (QP) |
| 7 | 0.15200 | ---- | 20.0 | 10.0 | ---- | 30.0 | ---- | 55.9 | ---- | 25.9 | H (CAV) |
| 8 | 0.32600 | ---- | 23.3 | 10.0 | ---- | 33.3 | ---- | 49.6 | ---- | 16.3 | H (CAV) |
| 9 | 1.49600 | ---- | 14.6 | 10.1 | ---- | 24.7 | ---- | 46.0 | ---- | 21.3 | H (CAV) |
| 10 | 5.75500 | ---- | 6.1 | 10.2 | ---- | 16.3 | ---- | 50.0 | ---- | 33.7 | H (CAV) |
| 11 | 13.27000 | ---- | 8.0 | 10.5 | ---- | 18.5 | ---- | 50.0 | ---- | 31.5 | H (CAV) |
| 12 | 29.62000 | ---- | 2.3 | 10.8 | ---- | 13.1 | ---- | 50.0 | ---- | 36.9 | 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 | 0.15200 | 41.4 | ---- | 10.0 | 51.4 | ---- | 65.9 | ---- | 14.5 | ---- | N (QP) |
| 2 | 0.32500 | 33.0 | ---- | 10.0 | 43.0 | ---- | 59.6 | ---- | 16.6 | ---- | N (QP) |
| 3 | 1.11200 | 25.4 | ---- | 10.1 | 35.5 | ---- | 56.0 | ---- | 20.5 | ---- | N (QP) |
| 4 | 1.89600 | 24.1 | ---- | 10.1 | 34.2 | ---- | 56.0 | ---- | 21.8 | ---- | N (QP) |
| 5 | 13.36000 | 17.1 | ---- | 10.6 | 27.7 | ---- | 60.0 | ---- | 32.3 | ---- | N (QP) |
| 6 | 29.77000 | 11.8 | ---- | 10.8 | 22.6 | ---- | 60.0 | ---- | 37.4 | ---- | N (QP) |
| 7 | 0.15200 | ---- | 21.8 | 10.0 | ---- | 31.8 | ---- | 55.9 | ---- | 24.1 | N (CAV) |
| 8 | 0.32500 | ---- | 19.5 | 10.0 | ---- | 29.5 | ---- | 49.6 | ---- | 20.1 | N (CAV) |
| 9 | 1.11200 | ---- | 15.7 | 10.1 | ---- | 25.8 | ---- | 46.0 | ---- | 20.2 | N (CAV) |
| 10 | 1.89600 | ---- | 12.7 | 10.1 | ---- | 22.8 | ---- | 46.0 | ---- | 23.2 | N (CAV) |
| 11 | 13.36000 | ---- | 7.7 | 10.6 | ---- | 18.3 | ---- | 50.0 | ---- | 31.7 | N (CAV) |
| 12 | 29.77000 | ---- | 3.7 | 10.8 | ---- | 14.5 | ---- | 50.0 | ---- | 35.5 | 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: Yu-Seog, Sim / Assistant Manager