

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

Test Report No. : OT-18O-RWD-027
AGR No : A189A-017
Applicant : YUWON ELECTRONICS CO., Ltd.
Address : Rm1303 (STX W-Tower)90, 53gil, Gyeongin-ro, Guro-gu, Seoul, 152-865, Korea
Manufacturer : YUWON ELECTRONICS CO., Ltd.
Address : Rm1303 (STX W-Tower)90, 53gil, Gyeongin-ro, Guro-gu, Seoul, 152-865, Korea
Type of Equipment : RF REMOTE CONTROL
FCC ID. : 2ARHXWR1843-RF
Model Name : WR1843-RF
Serial number : N/A
Total page of Report : 21 pages (including this page)
Date of Incoming : October 09, 2018
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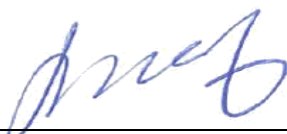
SUMMARY

The equipment complies with the regulation; **FCC Part 15 Subpart C Section 15.249.**

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: 
 Jae-Ho Lee / Chief Engineer
 ONETECH Corp.

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

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Revision History

Issue Report No.	Issued Date	Revisions	Effect Section
OT-18O-RWD-027	October 11, 2018	Initial Release	All

1. VERIFICATION OF COMPLIANCE

APPLICANT : YUWON ELECTRONICS CO., Ltd.
 ADDRESS : Rm1303 (STX W-Tower)90, 53gil, Gyeongin-ro, Guro-gu, Seoul, 152-865, Korea
 CONTACT PERSON : Hong Chae, Kim / General Manager
 TELEPHONE NO : +82-2-2068-7280
 FCC ID : 2ARHXWR1843-RF
 MODEL NAME : WR1843-RF
 BRAND NAME : N/A
 SERIAL NUMBER : N/A
 DATE : October 11, 2018

EQUIPMENT CLASS	DXC – Low Power Communications Transmitter
KIND OF EQUIPMENT	RF REMOTE CONTROL
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 15.249
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	No
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
15.249 (a)	Field Strength of Emission	Met the Limit / PASS
15.249 (c)	Measurement distance	Met the Requirement / PASS
15.249 (d)	Emissions Radiated Outside of the Specified Frequency Band	Met the Limit / PASS
15.249 (e)	Radiated Emissions above 1 000 MHz	Met the Limit / PASS
15.209	Radiated Emission Limits, General Requirement	Met the Limit / PASS
15.207	Conducted Limits	N/A (See Note)
15.203	Antenna Requirement	Met the Requirement / PASS

Note: This test is not performed because the EUT is operated by DC battery.

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 section 2.1.

2.5 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.10: 2013 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 YUWON ELECTRONICS CO., Ltd., Model: WR1843-RF (referred to as the EUT in this report) is an RF REMOTE CONTROL. Product specification information described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	RF REMOTE CONTROL
OPERATING FREQUENCY	2 405 MHz ~ 2 480 MHz
FIELD STRENGTH	92.80 dBμV/m
ANTENNA TYPE	Inserted into the main board (Pattern Antenna)
ANTENNA GAIN	1.83 dBi
MODULATION	O-QPSK
Tx DATA SPEED	250 kbps
USED RF CHIP	Maker: GreenPeak Technologies, Model Name:GP565
LIST OF EACH OSC. OR CRY. FREQ.(FREQ. >= 1 MHz)	32 MHz
RATED SUPPLY VOLTAGE	3.0 V Battery

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	N/A	YEPBAF073A REV 1.0	N/A

5.2 Peripheral equipment

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

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting is programmed.

For final testing, the EUT was set at Low Channel (2 405 MHz), Middle Channel (2 440 MHz), and High Channel (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 "XY" axis.

5.4 Configuration of Test System

Line Conducted Test It is not need to test this requirement, because the EUT shall be operated by DC battery.

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

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 pattern antenna on the main board in the EUT, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied by battery.	

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)
TX Mode	X

7. RADIATED EMISSION TEST

7.1 Operating environment

Temperature : 23.7°C
Relative humidity : 47.9 % R.H.

7.2 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 up to 25 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.

Test set-up photos are included in appendix I.

7.3 Measurement uncertainty

Radiated emission electric field intensity, 30 MHz ~ 1 000 MHz : ± 4.50 dB

Radiated emission electric field intensity, 1 000 MHz ~ 18 000 MHz: ± 5.52 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

7.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
□ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 27, 2017 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 27, 2017 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 28, 2018 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)
■ -	BBV9718B	Schwarzbeck	Broadband Preamplifier	009	Mar. 16, 2018 (1Y)
□ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	102346	Oct. 24, 2017 (1Y)
■ -	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
□ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
□ -	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Jun 05, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
□ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jul. 28, 2017 (2Y)
□ -	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Apr. 04, 2017 (1Y)

All test equipment used is calibrated on a regular basis.

7.5 Final Result of Measurement

7.5.1 Field Strength of the Fundamental Frequency

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Humidity Level : 47.9 % R.H.

Temperature: 23.7 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : RF REMOTE CONTROL

Date: October 10, 2018

Operating Condition : TX mode

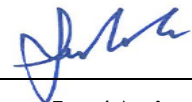
Distance : 3 m

Channel	Radiated Emissions			Ant	Correction Factors			Total	FCC Limit	
	Carrier Freq. (MHz)	Reading (dBμV)	Detector Mode	Pol.	Antenna (dB/m)	Cable (dB)	Pre-Amp (dB)	Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low	2 405.00	89.77	Peak	H	27.60	8.80	34.82	91.35	113.98	22.63
		87.64	Average	H				89.22	93.98	4.76
		76.35	Peak	V				77.93	113.98	36.05
		73.94	Average	V				75.52	93.98	18.46
Middle	2 440.00	90.46	Peak	H	27.80	8.90	34.36	92.80	113.98	21.18
		88.59	Average	H				90.93	93.98	3.05
		74.48	Peak	V				76.82	113.98	37.16
		72.16	Average	V				74.50	93.98	19.48
High	2 480.00	90.13	Peak	H	27.70	9.00	34.46	92.37	113.98	21.61
		87.94	Average	H				90.18	93.98	3.80
		74.34	Peak	V				76.58	113.98	37.40
		71.48	Average	V				73.72	93.98	20.26

*Remark: To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes, but the worst plane data were recorded in the report.

Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

Total = Reading + Antenna Factor + Cable Loss – Pre-amplifier gain.



Tested by: Ha-Ram, Lee / Assistant Manager

7.5.2 Emissions Radiated Outside of the Specified Frequency Bands

7.5.2.1 Test Data for Harmonic

Humidity Level : 47.9 % R.H.

Temperature: 23.7 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249(a)

Result : PASSED

EUT : RF REMOTE CONTROL

Date: October 10, 2018

Operating Condition : TX mode

Distance : 3 m

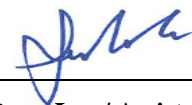
Channel	Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Pre-Amp (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low	4 810.00*	42.72	Peak	H	31.30	13.40	35.23	52.19	73.98	21.79
		30.50	Average	H				39.97	53.98	14.01
		41.75	Peak	V				51.22	73.98	22.76
		29.03	Average	V				38.50	53.98	15.48
	Other frequencies were not found up to 26.5 GHz.									
Middle	4 880.00*	42.31	Peak	H	31.10	13.60	35.26	51.75	73.98	22.23
		30.27	Average	H				39.71	53.98	14.27
		40.46	Peak	V				49.90	73.98	24.08
		28.61	Average	V				38.05	53.98	15.93
	Other frequencies were not found up to 26.5 GHz.									
High	4 960.00*	43.00	Peak	H	31.10	13.70	35.29	52.51	73.98	21.47
		29.99	Average	H				39.50	53.98	14.48
		41.05	Peak	V				50.56	73.98	23.42
		28.53	Average	V				38.04	53.98	15.94
	Other frequencies were not found up to 26.5 GHz.									

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical, "*" Frequency fall in restricted band

Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

Total = Reading + Antenna Factor + Cable Loss – Pre-amplifier gain.



Tested by: Ha-Ram, Lee / Assistant Manager

7.5.2.2 Test Data for Frequency range: 30 MHz ~ 1 000 MHz

Humidity Level : 47.9 % R.H.

Temperature: 23.7 °C

Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)

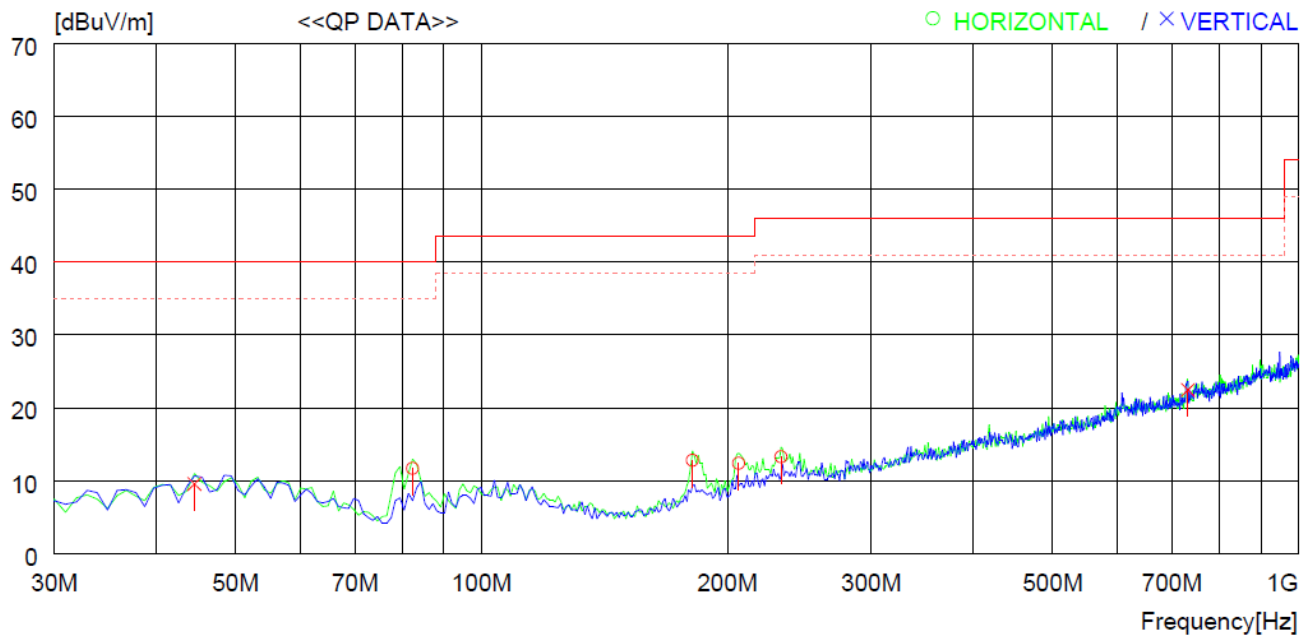
Result : PASSED

EUT : RF REMOTE CONTROL

Date: October 10, 2018

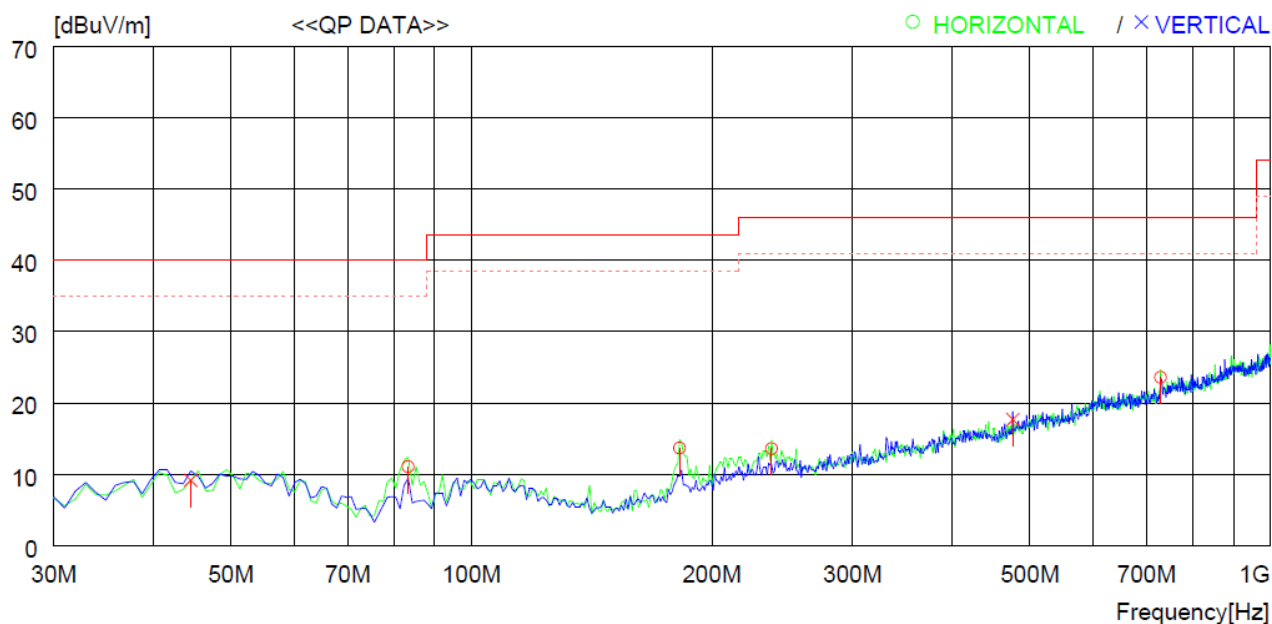
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Operating condition : Low Channel



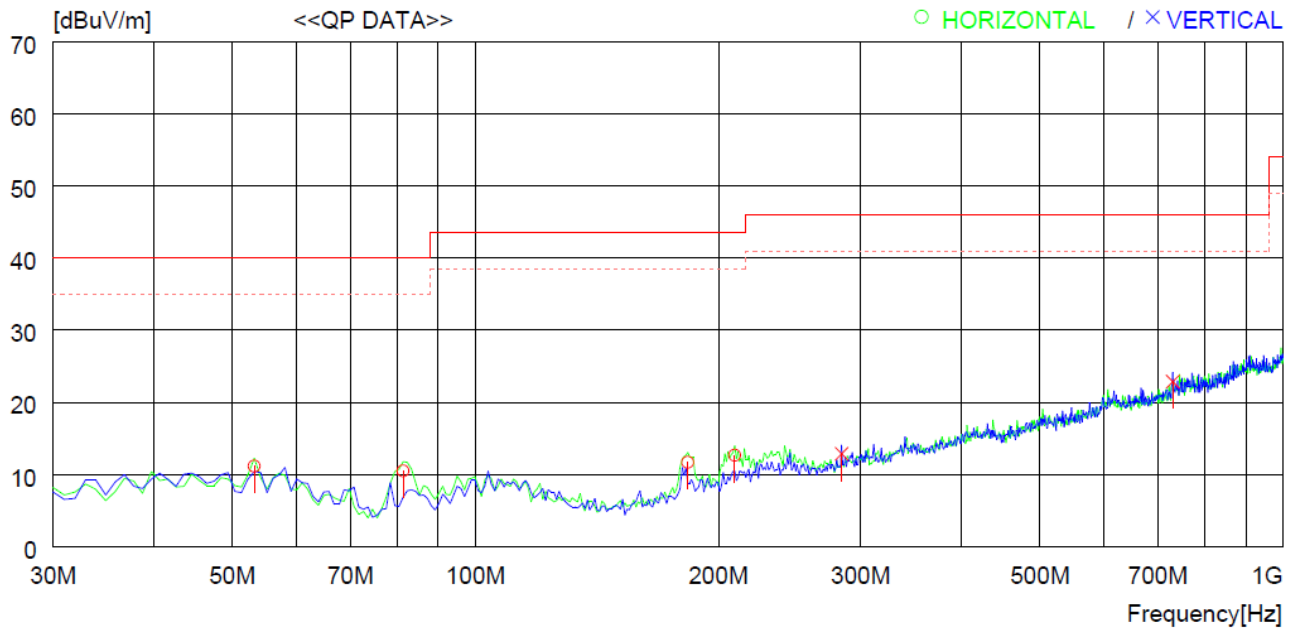
No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	82.380	34.5	8.2	2.0	33.0	11.7	40.0	28.3	300	36
2	181.320	33.1	9.6	3.1	33.0	12.8	43.5	30.7	400	325
3	206.540	31.4	10.7	3.3	33.0	12.4	43.5	31.1	200	307
4	232.730	30.7	12.0	3.5	32.9	13.3	46.0	32.7	100	0
----- Vertical -----										
5	44.550	27.1	14.1	1.5	33.1	9.6	40.0	30.4	200	0
6	732.274	29.1	20.3	6.3	33.2	22.5	46.0	23.5	300	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	83.350	33.5	8.5	2.1	33.0	11.1	40.0	28.9	300	356
2	182.290	33.8	9.8	3.1	33.0	13.7	43.5	29.8	300	0
3	237.580	30.7	12.2	3.6	32.9	13.6	46.0	32.4	200	359
4	729.364	30.4	20.2	6.2	33.2	23.6	46.0	22.4	400	218
----- Vertical -----										
5	44.550	26.7	14.1	1.5	33.1	9.2	40.0	30.8	100	359
6	476.201	29.0	16.8	5.1	33.2	17.7	46.0	28.3	200	118

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	53.280	28.6	13.9	1.8	33.1	11.2	40.0	28.8	200	359
2	81.410	33.5	8.0	2.0	33.0	10.5	40.0	29.5	300	0
3	183.260	31.7	9.9	3.1	33.0	11.7	43.5	31.8	300	0
4	209.450	31.6	10.8	3.3	33.0	12.7	43.5	30.8	200	359
----- Vertical -----										
5	284.140	28.8	13.2	3.9	33.0	12.9	46.0	33.1	400	0
6	730.334	29.6	20.2	6.3	33.2	22.9	46.0	23.1	200	328

Tested by: Ha-Ram, Lee / Assistant Manager

7.5.2.3 Test Data for Below 30 MHz

- . Test Date : October 10, 2018
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Detector : CISPR Quasi-Peak (Resolution Bandwidth: 9 kHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)
- . Result : PASSED

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.									

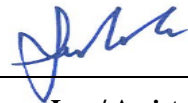


Tested by: Ha-Ram, Lee / Assistant Manager

7.5.2.4 Test Data above 1 GHz except for harmonic

- . Test Date : October 10, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (a)
- . Result : PASSED

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: Ha-Ram, Lee / Assistant Manager

7.5.2.5 Restricted Band & Band Edge

- . Test Date : October 10, 2018
- . Resolution bandwidth : 1 MHz for Peak and Average Mode / 100 kHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode / 300 kHz for Peak and Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Measurement distance : 3 m
- . Operating Condition : Low / High Channel
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Pre-Amp (dB)	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 341.21	46.60	Peak	H	27.60	8.80	34.32	48.68	74.00	25.32
2 341.21	39.86	Average	H				41.94	54.00	12.06
2 341.37	43.29	Peak	V				45.37	74.00	28.63
2 341.05	37.04	Average	V				39.12	54.00	14.88
Test Data for Low Channel									
2 400.00	43.83	Peak	H	27.60	8.80	34.32	45.91	74.00	28.09
2 400.00	34.69	Average	H				36.77	54.00	17.23
2 400.00	35.19	Peak	V				37.27	74.00	36.73
2 400.00	24.24	Average	V				26.32	54.00	27.68
Test Data for High Channel									
2 483.51	58.87	Peak	H	27.70	9.00	34.46	61.11	74.00	12.89
2 483.51	46.08	Average	H				48.32	54.00	5.68
2 483.51	44.69	Peak	V				46.93	74.00	27.07
2 483.51	33.65	Average	V				35.89	54.00	18.11

Remark. Margin (dB) = Limit (dBuV/m) – Total (dBuV/m)

Total = Reading + Antenna Factor + Cable Loss – Pre-amplifier gain.



Tested by: Ha-Ram, Lee / Assistant Manager

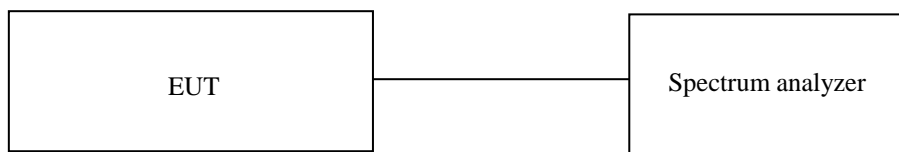
8. 20 dB BANDWIDTH

8.1 Operating environment

Temperature : 23.7 °C
Relative humidity : 47.9 % R.H.

8.2 Test set-up

The output signal of EUT was received by the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 20 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 20 dB.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Oct. 26, 2017 (1Y)

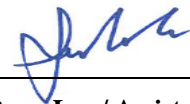
8.4 Test data for Bandwidth

-. Test Date : October 10, 2018
-. Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.215(c)

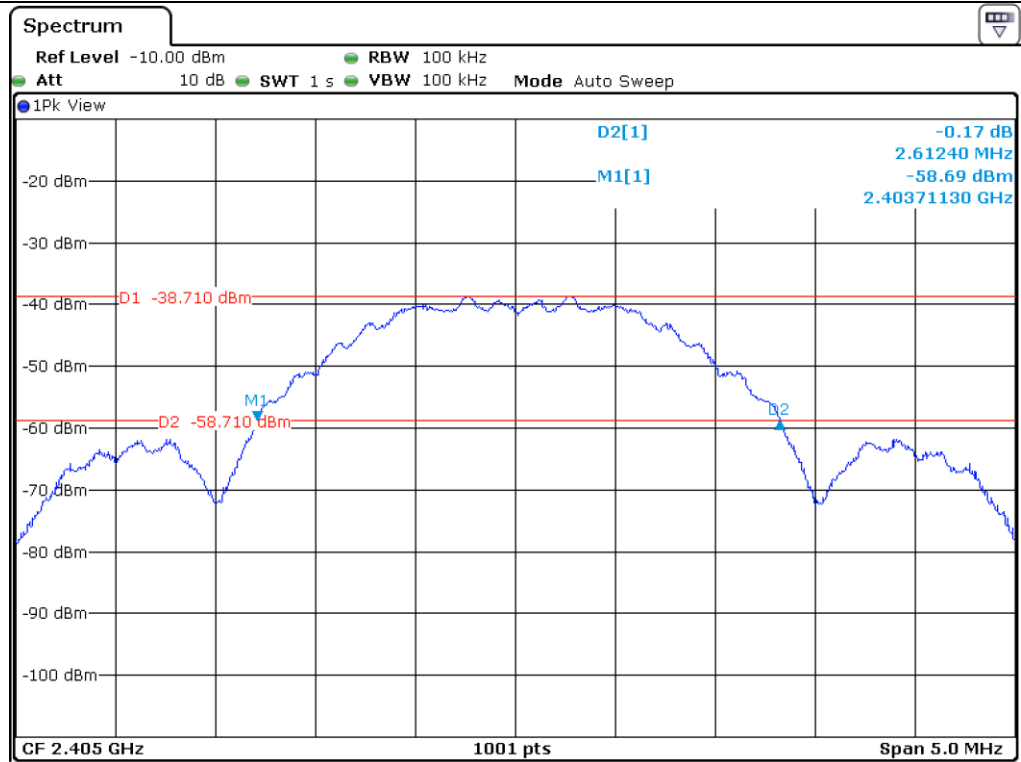
Channel	Operating Freq. (MHz)	20 dB Bandwidth (MHz)	Result
Low	2 405	2.612	Met the requirement / PASS
Middle	2 440	2.612	
High	2 480	2.602	

Remark: See next page for 20 dB Bandwidth test data.

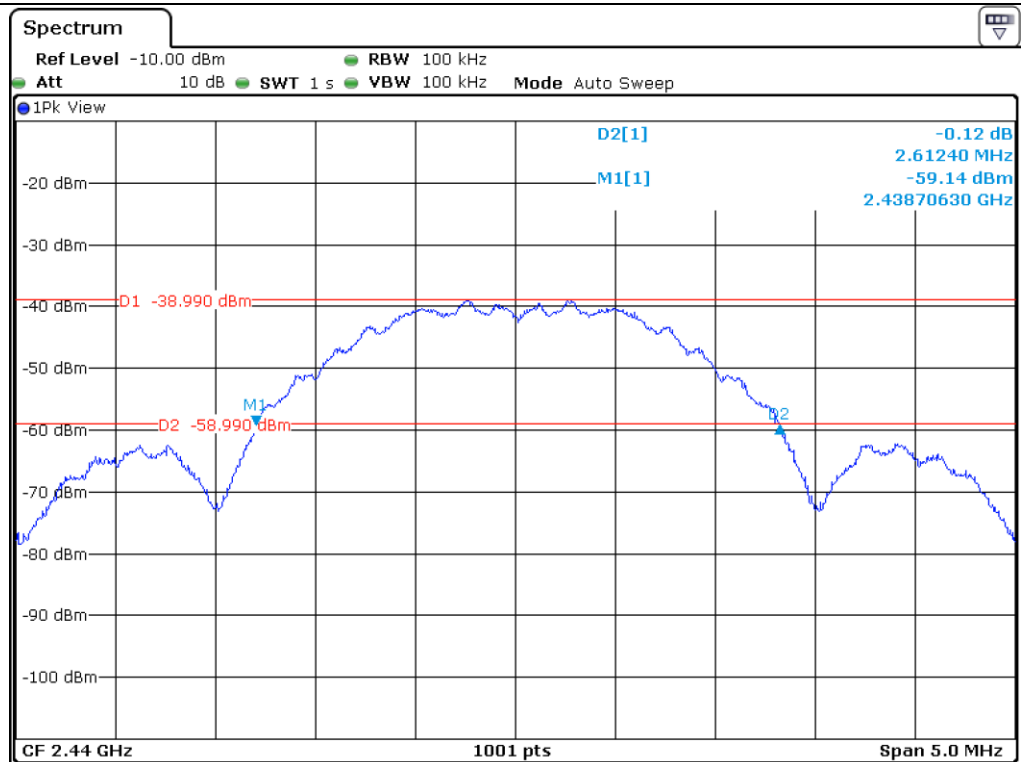
The 20 dB bandwidth is within the assigned frequency band from 2 400 MHz to 2 483.5 MHz.



Tested by: Ha-Ram, Lee / Assistant Manager



Low Channel



Middle Channel

