



RADIO PERFORMANCE TEST REPORT

Test Report No.	: OT-204-RWD-076
AGR No.	: A201A-394
Applicant	: PS TEC Co., Ltd.
Address	: 80, HWANGGEUM 3-RO 7BEON-GIL, YANGCHON-EUP, GIMPO-SI, GYEONGGI-DO, KOREA
Manufacturer	: PS TEC Co., Ltd.
Address	: 80, HWANGGEUM 3-RO 7BEON-GIL, YANGCHON-EUP, GIMPO-SI, GYEONGGI-DO, KOREA
Type of Equipment	: Autonomous Counter
FCC ID.	: 2AVSN-PSM-NGC-NP01
Model Name	: PSM-NGC-NP01
Multiple Model Name	: N/A
Serial number	: N/A
Total page of Report	: 30 pages (including this page)
Date of Incoming	: February 05, 2020
Date of issue	: April 24, 2020

# 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.

Nh

Reviewed by:

Ha-Ram Lee / Manager ONETECH Corp.

reharie Approved by:

Jae-Ho Lee / General Manager ONETECH Corp.

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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)



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# **Revision History**

Rev. No.	Issue Report No.	Issued Date	Revisions	Section Affected
0	OT-204-RWD-076	April 24, 2020	Initial Issue	All



## **1. VERIFICATION OF COMPLIANCE**

Applicant : PS TEC Co., Ltd.

Address : 80, HWANGGEUM 3-RO 7BEON-GIL, YANGCHON-EUP, GIMPO-SI, GYEONGGI-DO, KOREA

Contact Person : Bo Young Hwang/General Manager

Telephone No. : +82-2-3408-1750

FCC ID : 2AVSN-PSM-NGC-NP01

Model Name : PSM-NGC-NP01

- Brand Name : N/A
- Serial Number : N/A
- Date : April 24, 2020

EQUIPMENT CLASS	DTS – DIGITAL TRNSMISSION SYSTEM
KIND OF EQUIPMENT	Autonomous Counter
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT	Cartification
AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED	FCC PART 15 SUBPART C Section 15.247
UNDER FCC RULES PART(S)	FCC PART IS SUBPART C Section 15.247
Modifications on the Equipment to Achieve	None
Compliance	ivone
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	N/A (See Note)
15.203	Antenna Requirement	Met requirement / PASS

Note. : As This product uses DC battery, This test has not been performed.

#### 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

-. Lab Accreditation:

ISED (Innovation, Science and Economic Development Canada) - Registration No. Site# 3736A-3

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)



## **3. GENERAL INFORMATION**

#### **3.1 Product Description**

The PS TEC Co., Ltd., Model PSM-NGC-NP01 (referred to as the EUT in this report) is an Autonomous Counter. The product specification described herein was obtained from product data sheet or user's manual.

DEVICE TYPE	Autonomous Counter
OPERATING FREQUENCY	2 402 MHz ~ 2 480 MHz
RF OUTPUT POWER	-1.94 dBm
NUMBER OF CHANNEL	40 Channels
MODULATION TYPE	GFSK(Bluetooth LE)
ANTENNA TYPE	Chip Antenna
ANTENNA GAIN	2.31 dBi
LIST OF EACH OSC. OR CRYSTAL.	
FREQ.(FREQ.>=1 MHz)	32 MHz
Hardware / Software version	1.0 / 1.0

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	N/A	-
Sub Board	N/A	N/A	-
Battery	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
80QQ	Lenovo	Notebook PC	EUT

#### 5.3 Mode of operation during the test

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

For final testing, the EUT was set at 2 402 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 "XY" axis, but the worst data was recorded in this report.



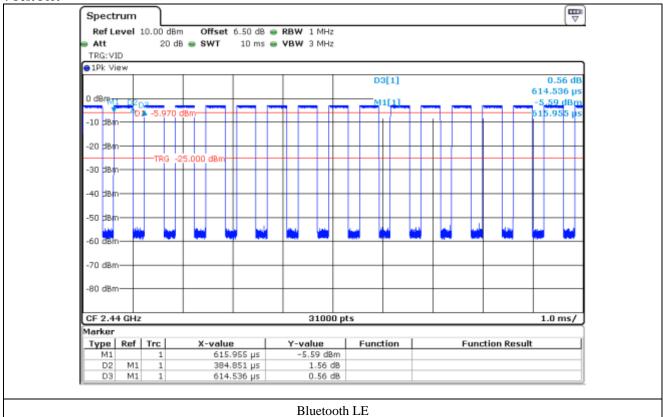
-. Duty Cycle

Mode	Tx On Time	Tx Off Time	Duty Cycle	Correction Factor
Wide	[ ms ]	[ ms ]	[%]	[ dB ]
Bluetooth LE	0.385	0.615	38.50	4.15

Note - Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) \* 100

Correction Factor : 10 \* Log(1 / (Duty Cycle / 100))







#### **5.4** Configuration of Test System

Line Conducted Test:As the EUT is operated by DC battery, this test item is not requirement to be performed.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<br/>conducted at 3 meter open area test site.<br/>The turntable was rotated through 360 degrees and the EUT was tested by positioned

three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

#### **5.5 Antenna Requirement**

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

#### Antenna Construction:

The antenna of the EUT is a Chip Antenna on the main board in the EUT, so no consideration of replacement by the user.

#### 6. PRELIMINARY TEST

#### 6.1 AC Power line Conducted Emissions Tests

As the EUT is operated by DC battery, this test item is not requirement to be performed.

#### **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	Х



# 7. MIMIMUM 6 dB BANDWIDTH

#### 7.1 Operating environment

Temperature	:	25 °C
Relative humidity	:	49 % 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.
-	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



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#### 7.4 Test data

-. Test Date : February 13, 2020 ~ February 28, 2020

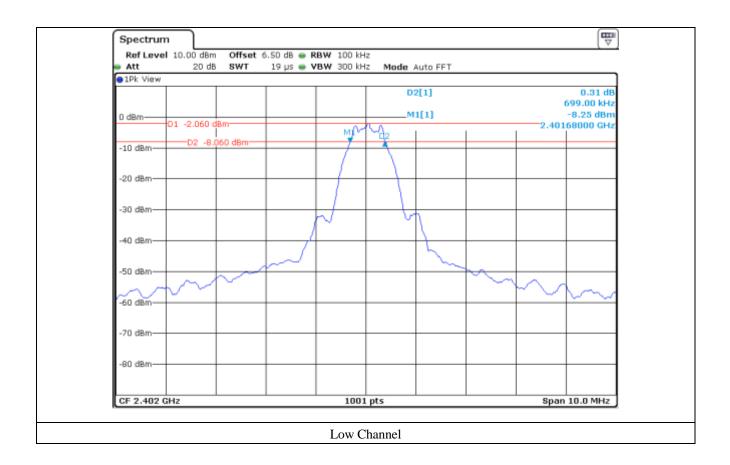
: Pass

-. Test Result

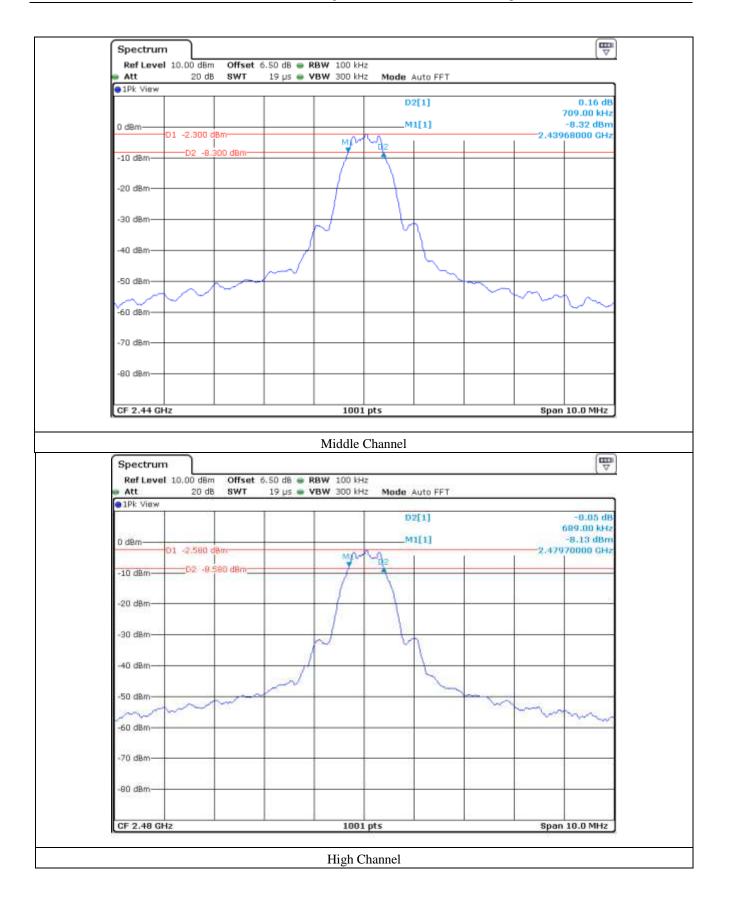
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (kHz)	LIMIT (kHz)	MARGIN (kHz)
Low	2 402.00	699.00	500	199.00
Middle	2 440.00	709.00	500	209.00
High	2 480.00	689.00	500	189.00

Remark. Margin = Measured Value - Limit

Tested by: Youngyong Kim/ Assistant Manager









# 8. MAXIMUM PEAK OUTPUT POWER

#### 8.1 Operating environment

Temperature	:	25 °C
Relative humidity	:	49 % 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.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



## 8.4 Test data

-. Test Date : February 13, 2020 ~ February 28, 2020

: Pass

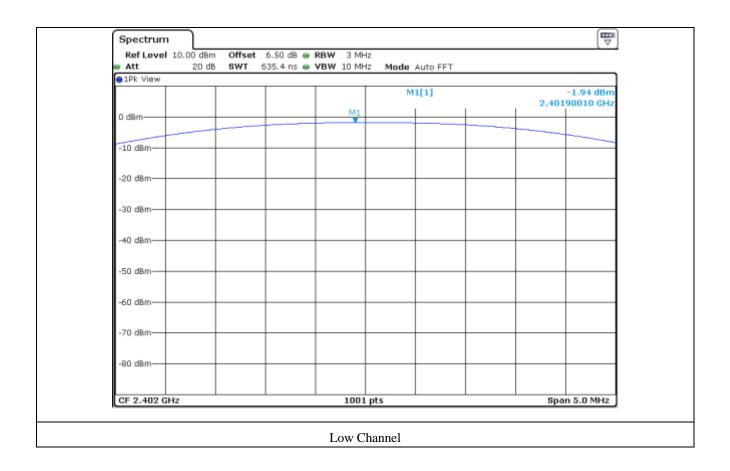
-. Test Result

CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 402.00	-1.94	30.00	31.94
MIDDLE	2 440.00	-2.19	30.00	32.19
HIGH	2 480.00	-2.46	30.00	32.46

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



#### Tested by: Youngyong Kim/ Assistant Manager





Spectrum Ref Level 10	0.00 dBm	Offset	6.50 dB	RBW 3 M	-IZ				
Att	20 dB			<b>VBW</b> 10 MH		Auto FFT			
1Pk View									
					M	1[1]			-2.19 dBn
						I	1	2.43	77520 GH
0 dBm				M1					
									-
-10 dBm									
0.0.10									
-20 dBm									
-30 dBm									
-40 dBm									
-vo abiii									
-50 dBm									
-60 dBm									
70 40									
-70 dBm									
-80 dBm									
CF 2.44 GHz				1001	l pts			Spa	an 5.0 MHz
					Channel				(œ
Spectrum Ref Level 1	).00 dBm 20 dB			RBW 3 Mi	Hz	Auto FFT			(III V
Ref Level 1					Hz	Auto FFT			
Ref Level 1 Att				RBW 3 Mi	Hz Hz <b>Mode</b>				-2.46 dBn
Ref Level 1 Att				RBW 3 Mi	Hz Hz <b>Mode</b>	Auto FFT		2.480	
Ref Level 1 Att				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1 Att 1Pk View				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1 Att 1Pk View 0 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1 Att 1Pk View				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 10 Att 1Pk View 0 dBm -10 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1 Att 1Pk View 0 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 10 Att 1Pk View 0 dBm -10 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm       -60 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm       -60 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm       -60 dBm       -70 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.48	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm       -60 dBm				RBW 3 Mi	Hz Hz <b>Mode</b>			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm       -60 dBm       -70 dBm				RBW 3 MH VBW 10 MH	Hz Mode			2.480	-2.46 dBn
Ref Level 1/       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm       -60 dBm       -70 dBm				RBW 3 Mi	Hz Mode				-2.46 dBn



## 9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

#### 9.1 Operating environment

Temperature	:	25 °C
Relative humidity	:	49 % R.H.

#### 9.2 Test set-up for conducted measurement

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

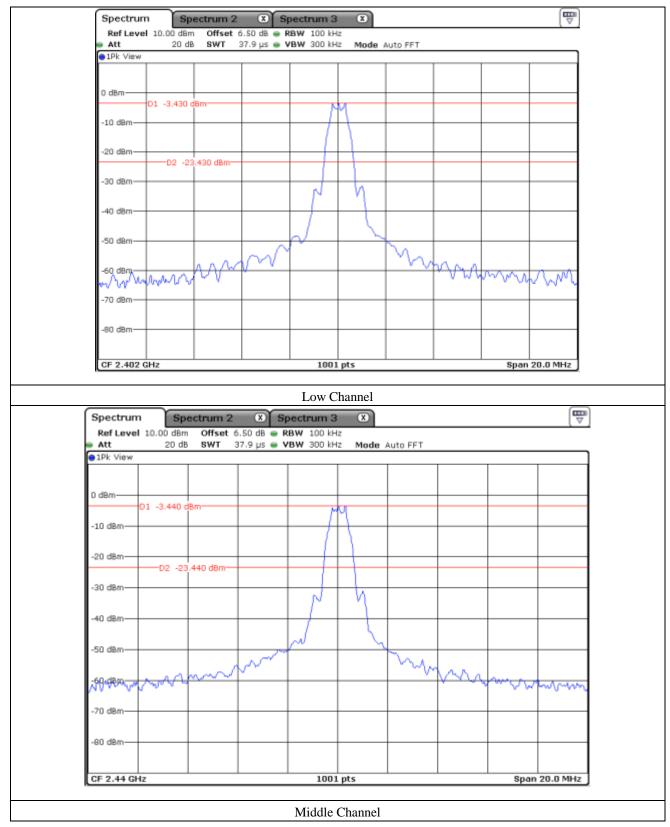
#### 9.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
- 1	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)
■ -	SCU18	Rohde & Schwarz	Pre-Amplifier	102266	Jul. 24, 2019 (1Y)
■ -	MA240	HD GmbH	Antenna Master	N/A	N/A
■ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DS420S	HD GmbH	Turn Table	N/A	N/A
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1349	Nov. 25, 2019 (2Y)

All test equipment used is calibrated on a regular basis.



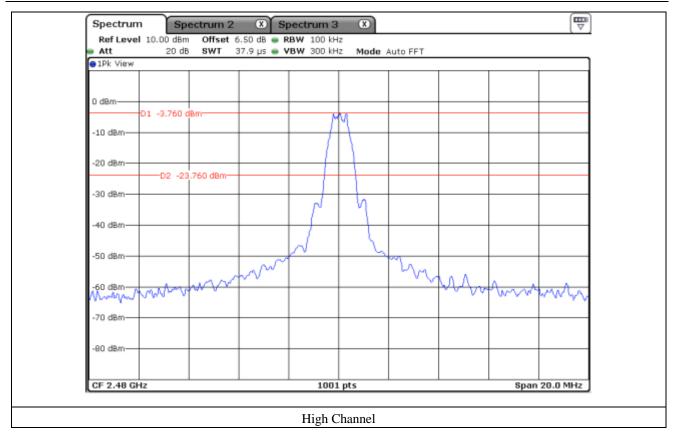
#### 9.5 Test data for conducted emission





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		ectrum 2		pectrum 3					
Att	10.00 dBm 20 dB			RBW 100 kH VBW 300 kH		Auto Sweep			
1Pk View	20 00	0	E 111 112 -	1011 00010	- House	nato Sweep			
					M	1[1]			61.62 dBm
					. I.		1	1	.73630 GHz
0 dBm									
-10 dBm—									
-20 dBm									
	-D1 -23.430	dBm-							
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm						M			
-ou usm-	and a second	المراجعة المتحد المساحد	adare the Alerton	manhanalanda	والمدر الموالة المعادية	and a market and	مهمدتهمامهم		and sid them
-70 dBm-									
-70 aBm-									
00 10									
-80 dBm									
Start 30.0	MHz			1001	pts			Sto	p 2.5 GHz
Spectrur		ectrum 2	1000	Low C	×				▼
Ref Leve Att	n Sp el 10.00 dBm 20 dE	Offset	8.S0 dB 🕳		×	auto Sweep			( <b>m</b> ⊽
Ref Leve	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				
Ref Leve Att	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A	Auto Sweep			53.47 dBm
Ref Leve Att	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				
Ref Leve Att 1Pk View	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A		ř		53.47 dBm
Ref Leve Att 1Pk View	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve Att 1Pk View	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve Att 1Pk View	l 10.00 dBm	Offset	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve Att 1Pk View 0 dBm	l 10.00 dBm	Offset SWT	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve Att 1Pk View 0 dBm	1 10.00 dBm 20 dB	Offset 5	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm	1 10.00 dBm 20 dB	Offset 5	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm	1 10.00 dBm 20 dB	Offset 5	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm	1 10.00 dBm 20 dB	Offset 5	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm	1 10.00 dBm 20 dB	Offset 5	8.S0 dB 🕳	pectrum 3 RBW 100 kH	X Z Z Mode A				53.47 dBm
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]		. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]	WMurrey		53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH	Z Mode A	1[1]	WINLow	. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]	WINLow	. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]	WINLow	. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm       -50 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]	WW	. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -40 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]	WW	. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm       -50 dBm       -50 dBm	01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	Z Mode A	1[1]	WINLSow	. 2	53.47 dBm 5.1690 GHz
Ref Leve       Att       1Pk View       0 dBm       -10 dBm       -20 dBm       -30 dBm       -30 dBm       -50 dBm       -50 dBm       -50 dBm	-01 -23,430	dBm	8.50 dB • 240 ms •	pectrum 3 RBW 100 kH VBW 300 kH	R ANDRE A	1[1]	William	2 Nexteriors/Y	53.47 dBm 5.1690 GHz

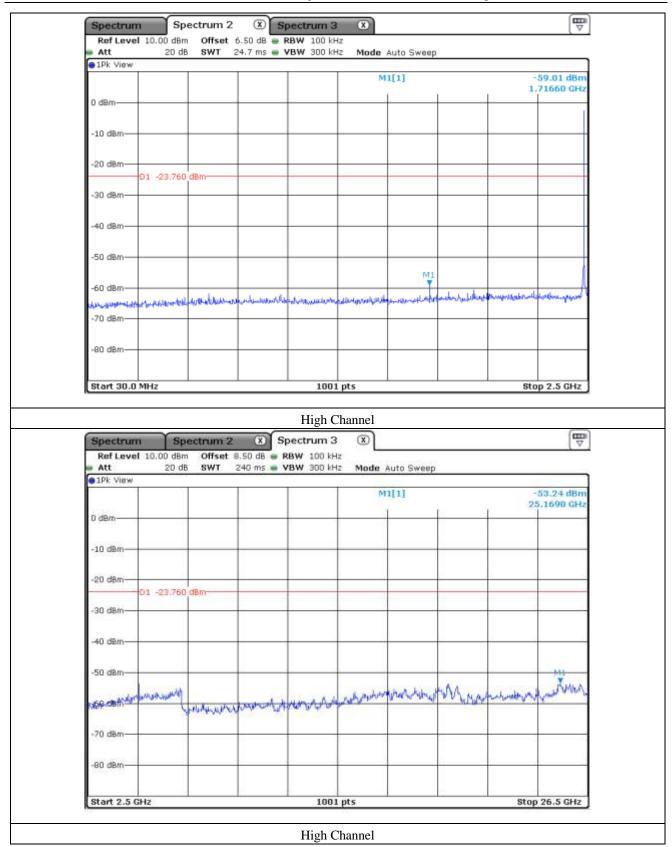


Define	n Sp I 10.00 dBm	ectrum 2		pectrum 3 RBW 100 kH					
Att	1 10.00 abr 20 dB			VBW 300 kH		Auto Sweep			
●1Pk View									
					M	1[1]			60.89 dBm
0.40							1	1.	.89670 GHz
0 d8m									1
-10 dBm									
-20 dBm-	01 -23.440	dam							
	01 -23,440	ubin							
-30 dBm-									
-40 dBm-									
-50 dBm									
-60 dBm							M1	A. J 1	
Languarman	فللإيطابعهم	-Monthe-mailton	nehrwipiham	hermolethenewilk	and a stranger	vous village and	employad	Malautapoleulus	فراسموه والمعارك
-70 dBm-									
-80 dBm									
Start 30.0	MHz			1001	l pts			Sto	p 2.5 GHz
Spectrum		ectrum 2		pectrum 3					
Spectrum	n Sp I 10.00 dBm 20 dB	Offset	8.50 dB 😑 1		(X)	Auto Sweep			▼
Spectrum Ref Leve	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				
Spectrur Ref Leve	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A	Auto Sweep			53.30 dBm
Spectrun Ref Leve Att Pk View	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				
Spectrur Ref Leve	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrun Ref Leve Att IPk View	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrun Ref Leve Att Pk View	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrum Ref Leve Att IPk View	10.00 dBm	Offset	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrun Ref Leve Att IPk View	10.00 dBm	Offset SWT	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrum Ref Leve Att 1Pk View 0 dBm- -10 dBm- -20 dBm-	I 10.00 dBm 20 dB	Offset SWT	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrum Ref Leve Att IPk View	I 10.00 dBm 20 dB	Offset SWT	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrum Ref Leve Att 1Pk View 0 dBm- -10 dBm- -20 dBm-	I 10.00 dBm 20 dB	Offset SWT	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrum Ref Leve Att 1Pk View 0 dBm- -10 dBm- -20 dBm-	I 10.00 dBm 20 dB	Offset SWT	8.50 dB 😑 1	pectrum 3 RBW 100 kH	Iz Mode A				53.30 dBm
Spectrum Ref Leve Att 1Pk View 0 dBm	I 10.00 dBm 20 dB	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm	I 10.00 dBm 20 dB	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]	WALKAR	2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm -30 dBm -50 dBm -50 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	Iz Mode A	1[1]	WAyaw	2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm -30 dBm -30 dBm -50 dBm -70 dBm -70 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm -30 dBm -50 dBm -50 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm -30 dBm -30 dBm -50 dBm -70 dBm -70 dBm	01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2	53.30 dBm 5.2410 GHz
Spectrum Ref Leve Att 1Pk View 0 dBm -10 dBm -20 dBm -30 dBm -30 dBm -50 dBm -70 dBm -70 dBm	-01 -23,440	dBm	8.50 dB • 1	pectrum 3 RBW 100 kH VBW 300 kH	IZ Mode A	1[1]		2) Marianta	53.30 dBm 5.2410 GHz



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Report No. : OT-204-RWD-076





#### 9.6 Test data for radiated emission

#### 9.6.1 Radiated Emission which fall in the Restricted Band

- -. Test Date : February 13, 2020 ~ February 28, 2020
- -. Resolution bandwidth : 1 MHz for Peak and Average Mode
- -. Video bandwidth : 3 MHz for Peak and Average Mode
- -. Detector : Peak Mode(Peak), Average Mode(RMS)
- -. Measurement distance : 3 m
- -. Result : <u>PASSED</u>

Frequency	Reading	Detector	Ant. Pol.	Ant.	Cable	Amp	C.F	Total	Limits	Margin																											
(MHz)	(dBµV)	Mode	( <b>H</b> / <b>V</b> )	Factor	Loss	Gain	(dB)	(dBµV/m)	$(dB\mu V/m)$	( <b>dB</b> )																											
	Test Data for Low Channel																																				
2 347.20	20.68	Peak	Н				-	51.19	74.00	22.81																											
2 373.34	13.43	Average	Н	27.60			4.15	48.09	54.00	5.91																											
2 336.33	21.35	Peak	V	27.60	27.60	27.60	27.60	27.60	27.60	27.60	27.60	27.60	27.00	27.00	27.00	27.00	27.00	27.60	27.60	27.60	27.00	27.00	27.00	27.00	27.00	27.00	27.00	2.91	2.91	2.91	2.91	2.91	-	-	51.86	74.00	22.14
2 350.00	13.30	Average	V									4.15	47.96	54.00	6.04																						
			r	Test Data	for High	Channel																															
2 496.56	20.31	Peak	Н				-	50.83	74.00	23.17																											
2 488.93	13.39	Average	Н	27.50	2.02	2.00	7.50 3.02		4.15	48.06	54.00	5.94																									
2 492.54	20.65	Peak	V	27.50	27.50	27.50		5.02	5.02	-	-	51.17	74.00	22.83																							
2 492.16	13.29	Average	V				4.15	47.96	54.00	6.04																											

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Correction Factor

Tested by: Youngyong Kim/ Assistant Manager



## 9.6.2 Spurious & Harmonic Radiated Emission

Test Date	: February 13, 2020 ~ February 28, 2020
Resolution bandwidth	: 1 MHz for Peak and Average Mode

- -. Video bandwidth : 3 MHz for Peak and Average Mode
- -. Detector : Peak Mode(Peak), Average Mode(RMS)
- -. Frequency range : 1 GHz ~ 26.5 GHz
- -. Measurement distance : 3 m
- -. Result : PASSED

Frequency	Reading	Detector	Ant. Pol.	Ant.	Cable	Amp	C.F	Total	Limits	Margin													
(GHz)	(dBµV)	Mode	(H/V)	Factor	Loss	Gain	( <b>dB</b> )	$(dB\mu V/m)$	$(dB\mu V/m)$	(dB)													
Test Data for Low Channel																							
	20.10	Peak	Н				-	55.95	74.00	18.05													
	10.94	Average	Н	31.20	1 65		4.15	50.94	54.00	3.06													
4 804.00	21.04	Peak	V		31.20 4.65	31.20 4.0	31.20	31.20 4.65	4.65 -	-	-	56.89	74.00	17.11									
	10.14	Average	V					4.15	50.14	54.00	3.86												
				Test Data	n for Mid	dle Channe	ł																
	21.25	Peak	Н				-	57.37	74.00	16.63													
	10.67	Average	Н	31.40 4.72	31.40 4.72	31.40	31.40	31.40 4.72	31.40	31.40 4.72	31.40 4.72	21.40	21.40 4.72	4.72	4.72	4.72	31.40 4.72	) 4.72		4.15	50.94	54.00	3.06
4 880.00	20.54	Peak	V									4.72	4.72						31.40 4.72	31.40 4.72	51.40 4.72	4.72	4.72
	10.85	Average	V					4.15	51.12	54.00	2.88												
				Test Dat	ta for Hig	gh Channel																	
	20.43	Peak	Н				-	56.99	74.00	17.01													
	10.31	Average	Н	31.70	31.70	1.96		4.15	51.02	54.00	2.98												
4 960.00	20.18	Peak	V			31.70	31.70	31.70	31.70	31.70	31.70	31.70	31.70 4.86	31.70 4.86	31.70 4.86	91.70 4.86	31.70 4.86	4.86	4.86	-	-	56.74	74.00
	10.15	Average	V				4.15	50.86	54.00	3.14													

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

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

Total Level = Reading + Antenna Factor + Cable Loss - Amp Gain + Correction Factor

Tested by: Youngyong Kim/ Assistant Manager



## **10. PEAK POWER SPECTRAL DENSITY**

#### **10.1 Operating environment**

Temperature	:	25 °C
Relative humidity	:	49 % 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 kHz  $\leq$  RBW  $\leq$  100 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.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.



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## 10.4 Test data

-. Test Date : February 13, 2020 ~ February 28, 2020

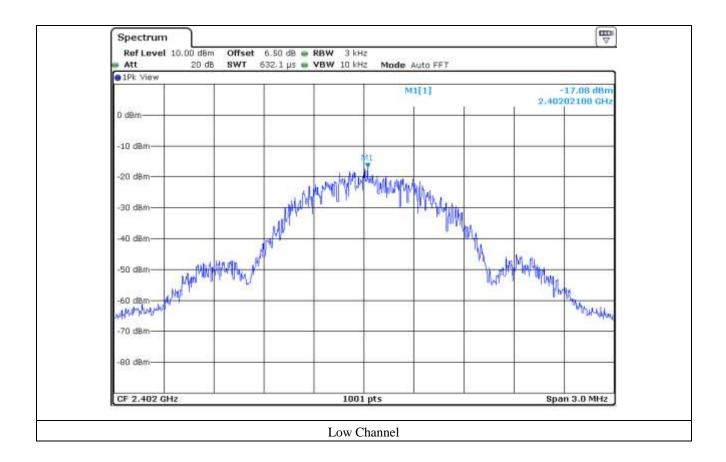
-. Test Result

: Pass -. Operating Condition : Continuous transmitting mode

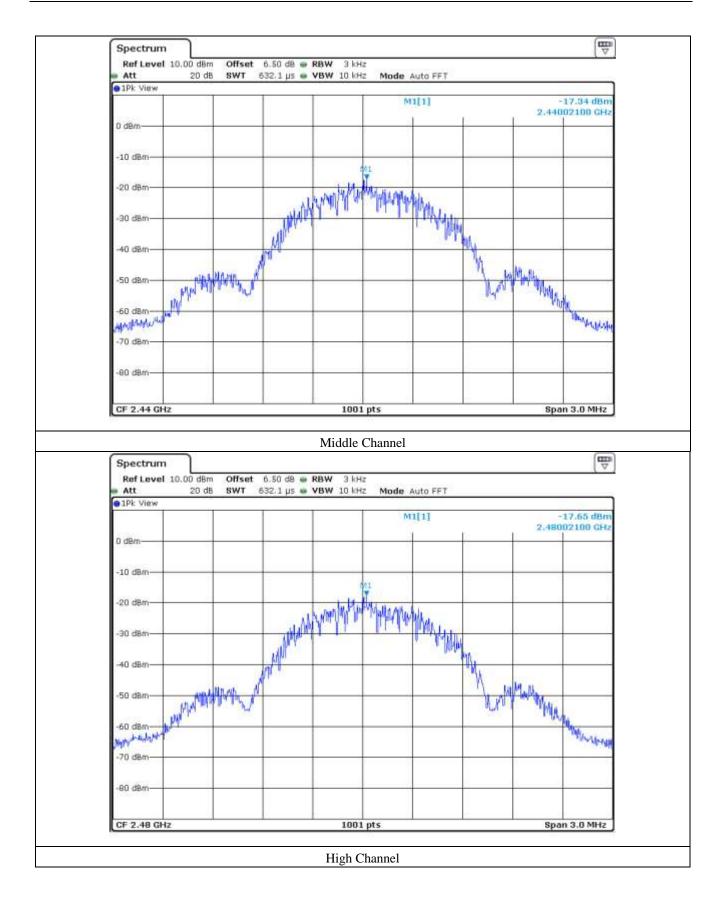
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-17.08	8.00	25.08
Middle	2 440.00	-17.34	8.00	25.34
High	2 480.00	-17.65	8.00	25.65

Remark. Margin = Limit – Measured value

#### Tested by: Youngyong Kim/ Assistant Manager









## **11. RADIATED EMISSION TEST**

#### **11.1 Operating environment**

Temperature	:	25 °C
Relative humidity	:	49 % 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.

110	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2019 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101199	Mar. 11, 2019 (1Y)
■ -	SCU18	Rohde & Schwarz	Pre-Amplifier	102266	Jul. 24, 2019 (1Y)
■ -	MA240	HD GmbH	Antenna Master	N/A	N/A
■ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DS420S	HD GmbH	Turn Table	N/A	N/A
- 1	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Jun. 05, 2018 (2Y)
- 1	BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1349	Nov. 25, 2019 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 07, 2020 (1Y)
-	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Mar. 11, 2019 (1Y)

# 11.3 Test equipment used

All test equipment used is calibrated on a regular basis.



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# 11.4 Test data for Transmitting Mode

## 11.4.1 Test data for 30 MHz ~ 1 GHz

Humidity Level	: <u>49 % R.H.</u> Temperature: <u>25 °C</u>								
Limits apply to	: FCC CFR 47, PART 15, SUBPART C, SECTION 15.247								
Result	: PASSED								
EUT	: Autonomous Counter	Date: February 13, 2020	~ February 28, 2020						
Detector	: CISPR Quasi-Peak (6 dB Ba	ndwidth: 120 kHz)							
60 [dBuV/m]	< <qp data="">&gt;</qp>	O HORIZONTAL /	× VERTICAL						
50									
40									
30		W b							
20			and the second						
10	Man Ampranum and	w when the weather we have the state of the							
0 30M 50	0M 70M 100M		/00M 1G requency[Hz]						
			requency[riz]						

No.	FREQ	READING QP F	ANT ACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
H(	orizontal -									
1 2 3 4 5	139.610 179.380 224.000 268.620 513.061	52.4 35.8	8.0 9.3 11.2 12.2 17.2	1.4 1.7 1.9 2.0 2.7	32.7 32.6 32.6 32.7 32.9	20.3 30.8 16.3 16.7 26.1	43.5 43.5 46.0 46.0 46.0	23.2 12.7 29.7 29.3 19.9	400 200 200 100 200	0 92 278 80 42
Ve	ertical									
6	687.655	36.6	19.2	3.4	32.9	26.3	46.0	19.7	200	359

4

Tested by: Youngyong Kim/ Assistant Manager



## 11.4.2 Test data for Below 30 MHz

- -. Test Date : February 13, 2020 ~ February 28, 2020
- -. 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	Reading	Ant. Pol.	Ant.	0	Ant. Factor	Cable	Emission	Limits	Margin
(MHz)	(dBµV)	(H/V)	Height (m)		(dB/m)	Loss	Level(dBµV/m)	(dBµV/m)	(dB)
			All emission	ns observe	ed were 20dB l	below the	limit.		

#### 11.4.3 Test data for above 1 GHz

- -. Test Date : February 13, 2020 ~ February 28, 2020
- -. Resolution bandwidth 21 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

Height (m)	(°)	( <b>dB/m</b> )	Loss	Level(dBµV/m)	$(dB\mu V/m)$	( <b>dB</b> )
All emission	ns observe	ad were 20dB 1	alow the	limit		
	All emission	All emissions observe	All emissions observed were 20dB l	All emissions observed were 20dB below the	All emissions observed were 20dB below the limit.	All emissions observed were 20dB below the limit.

la f

Tested by: Youngyong Kim/ Assistant Manager