

## ***FCC EVALUATION REPORT FOR CERTIFICATION***

**Applicant: U-HAN PRESEN Co., Ltd.****#275 Taepyeong Jung-gu , Daegu,****South Korea.****Attn : Mr. Joong- Sik Shin / CEO****Date of Issue: Feb. 20, 2017****Order Number: GETEC-C1-17-067****Test Report Number: GETEC-E3-17-001****Test Site: GUMI UNIVERSITY EMC CENTER****FCC Registration Number: 269701****FCC ID. : 2AK24PMC2****Applicant : U-HAN PRESEN Co., Ltd.**

**Rule Part(s) : FCC Part 15 Subpart B**  
**Equipment Class : Class B computing device peripheral (JBP)**  
**EUT Type : Presenmarker**  
**Type of Authority : Certification**  
**Model Name : PMC2**  
**Trade Name : U-HAN PRESEN**

**This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4 (2014) / Canadian standard ICES-003**

**I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.**

**Tested by,**

**Hyun Kim, Senior Engineer**  
**GUMI UNIVERSITY EMC CENTER**

**Reviewed by,**

**Jae-Hoon Jeong, Technical Manager**  
**GUMI UNIVERSITY EMC CENTER**



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**Scope:** Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

## 1. General Information

**Applicant:** U-HAN PRESEN Co., Ltd.

**Applicant Address:** #275 Taepyeong Jung-gu , Daegu, South Korea

**Manufacturer:** U-HAN PRESEN Co., Ltd.

**Manufacturer Address:** #275 Taepyeong Jung-gu , Daegu, South Korea

**Contact Person:** Mr. Joong- Sik Shin / CEO

**Telephone Number:** +82-53-421-1900 **Fax Number:** +82-53-422-6166

● FCC ID	2AK24PMC2
● EUT Type	Presenmarker
● Equipment Class	Class B computing device peripheral (JBP)
● Model Name	PMC2
● Trade Name	U-HAN PRESEN
● Serial Number	Prototype
● Rule Part(s)	FCC Part 15 Subpart B
● Type of Authority	Certification
● Test Procedure(s)	ANSI C63.4 (2014)
● Dates of Test	Feb. 01, 2017
● Place of Test	<b>GUMI UNIVERSITY EMC CENTER</b> (FCC Test Firm Registration Number: 269701) 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea.
● Test Report Number	GETEC-E3-17-001
● Date of Issue	Feb. 20, 2017



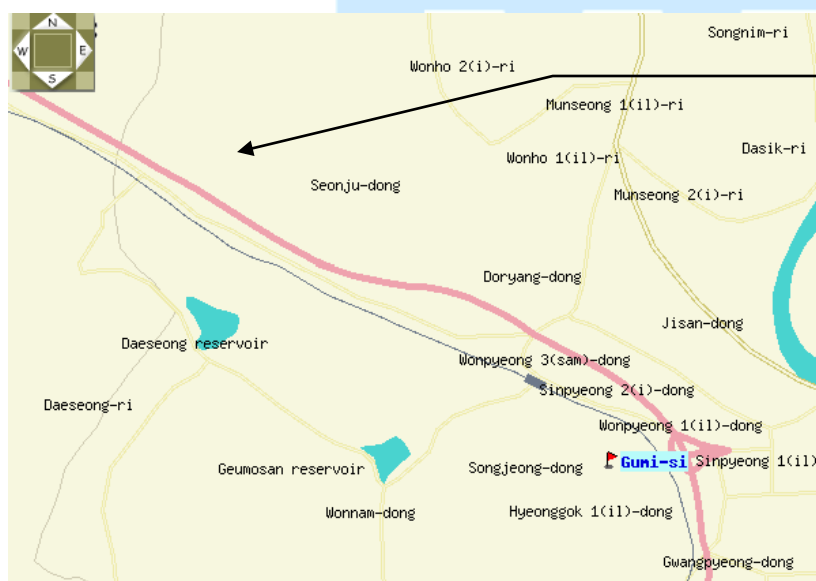
## 2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2014) was used in determining radiated and conducted emissions emanating from **U-HAN PRESEN CO., LTD. Presenmarker (Model Name: PMC2)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea.

This test site is one of the highest point of Gumi UNIVERSITY at about 200 km away from Seoul city and 40 km away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 (2014)



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Fig 1. The map above shows the Gumi UNIVERSITY in vicinity area.



### 3. Product Information

#### 3.1 Description of EUT

The Equipment under Test (EUT) is the **U-HAN PRESEN Co., Ltd.**  
**Presenmarker (Model Name: PMC2) FCC ID.: 2AK24PMC2**

<b>Model</b>	U-Han presen : Presenmarker
<b>Image Sensor</b>	1/3 inch Wide-VGA CMOS Sensor
<b>Sensor Name</b>	On Semiconductor – MT9V034
<b>IR Filter</b>	IRCF 16*16 0.55T T50% = 650+/- 10nm
<b>Resolution</b>	Wide-VGA (752(H) x 480(V))
<b>Pixel Size</b>	6.0 x 6.0 um
<b>Frame Rate</b>	Max. 60fps@VGA
<b>Digital Interface</b>	USB 2.0
<b>Shutter Type</b>	Global Shutter
<b>Lens Mount</b>	Board mount Lens
<b>Operating Temp.</b>	-5°C ~ 40°C
<b>Storage Temp.</b>	-30°C ~ 70°C
<b>Supply Voltage</b>	USB 5V
<b>Dimension</b>	82(w) X 34(h) X 32(d) mm



### 3.2 Support Equipment / Cables used

#### 3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Laptop	LG Electronics inc	LGS53	S/N: 202QCQX560812 FCC ID.: Verification

See “Appendix D – Test Setup Photographs” for actual system test set-up

#### 3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
-	-	-	-

#### 3.2.3 Used Cable(s)

Cable Name	Condition	Description
USB cable	Connected to the EUT and Laptop	1.35 m shielded with a ferrite core

### 3.3 Modification Item(s)

- None



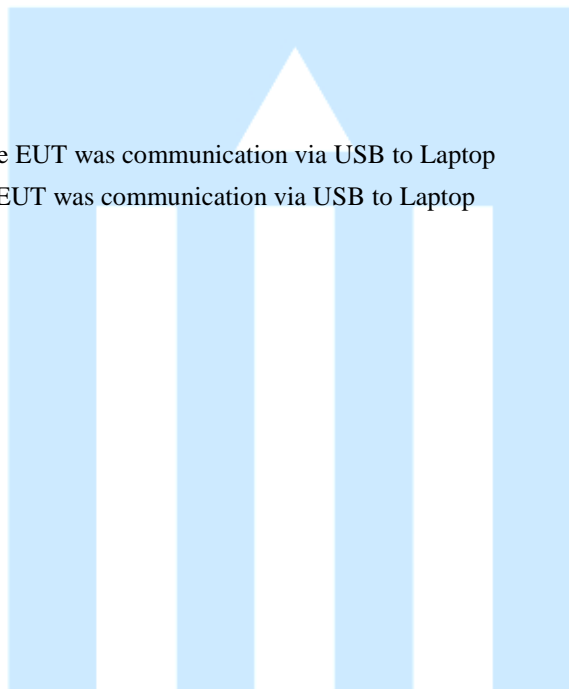
## 4. Description of tests

### 4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The test conditions of the noted test mode(s) in this test report are;

- Test Voltage / Frequency : AC 120 V / 60 Hz
- Test Mode(s)
  - . USB communication
- Operating test pattern
  - . Conducted Emission: The EUT was communication via USB to Laptop
  - . Radiated Emission: The EUT was communication via USB to Laptop







## 4.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure.  
(FCC Test Film Registration No.: 269701)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.4 m in height and 0.8 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCI).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

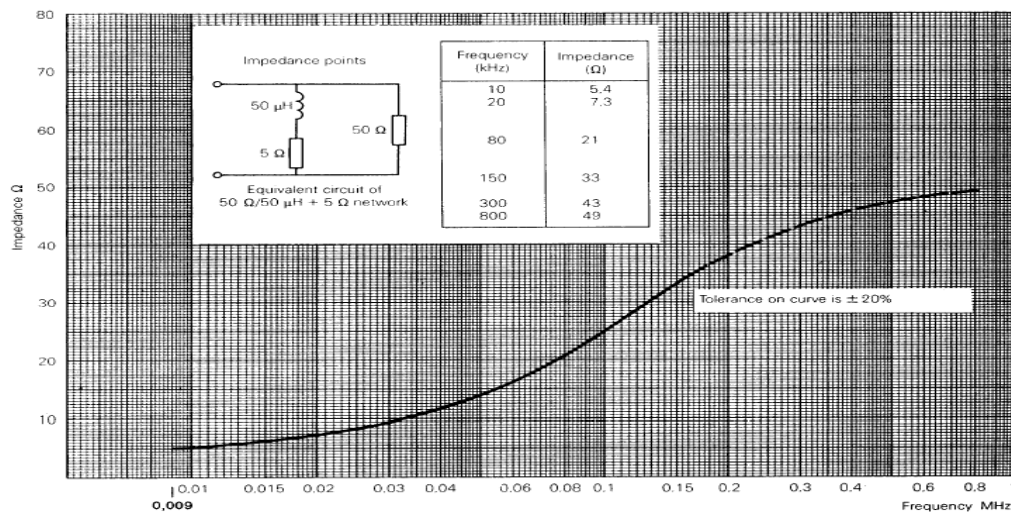


Fig 2. Impedance of LISN



### 4.3 Radiated Emission

Exploratory Radiated measurements were conducted at the 3 m or 10 m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1 GHz were made at 3 m or 10 m Chamber (FCC Test Firm Registration No.: 269701) or Open area test site (FCC Test Firm Registration No.: 269701) that complies with CISPR 16/ANSI C63.4.

Above 1 GHz final measurements were conducted at the 3m Chamber (FCC Test Firm Registration No.: 269701) only.

For measurements above 1GHz, the bottom side of 3 m chamber was installed with absorbers in order to meet SVSWR Limit.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1 GHz) and Peak & Average mode (Above 1 GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

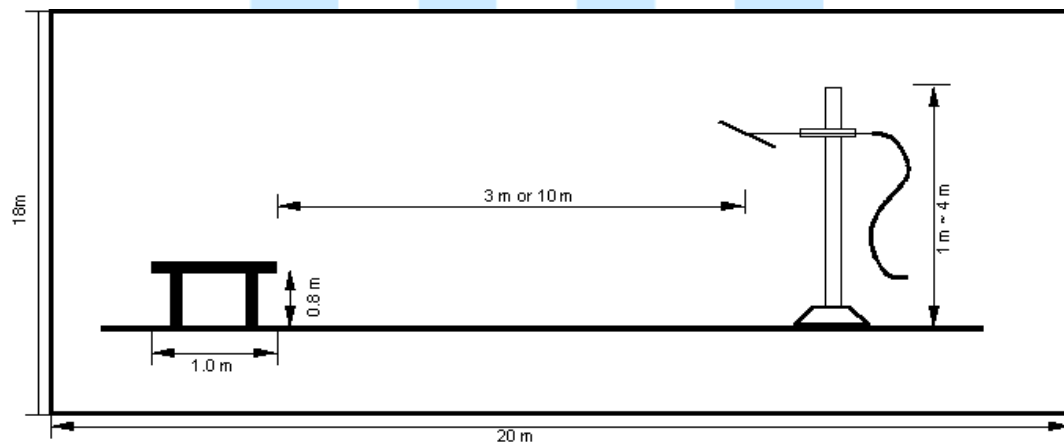


Fig 3. Dimensions of test site (Below 1 GHz)

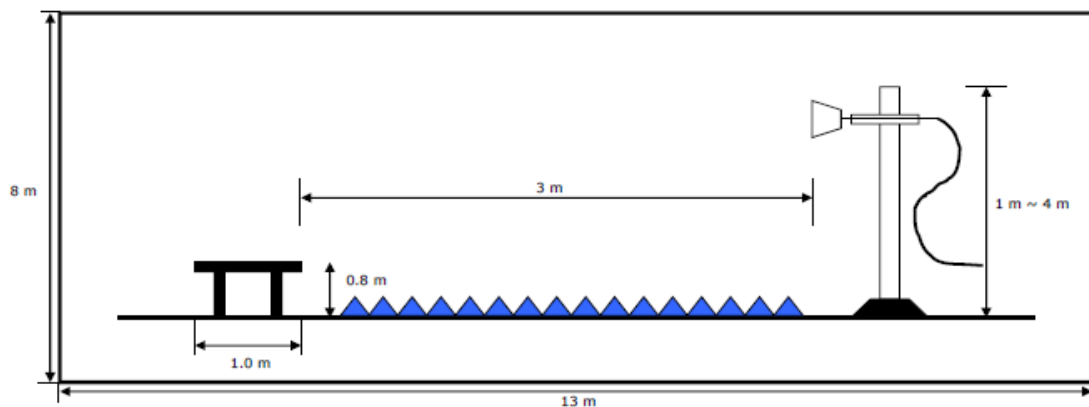


Fig 4. Dimensions of test site (Above 1 GHz)



## 5. Conducted Emission

### 5.1 Operating Environment

Temperature : 20.9 °C  
Relative Humidity : 38.6 % R.H.

### 5.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.4 m heights above the floor, 0.8 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

### 5.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement."

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	3.85 dB	Confidence level of approximately 95 % ( $k = 2$ )
Conducted emission (150 kHz ~ 30 MHz)	3.32 dB	Confidence level of approximately 95 % ( $k = 2$ )

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



#### 5.4 Limit

RFI Conducted	FCC Limit(dBμV) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

#### 5.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCI	Rohde & Schwarz	EMI Test Receiver	100237	Apr. 18, 2017
■ - ENV216	Rohde & Schwarz	LISN	100172	Apr. 19, 2017
□ - ENV216	Rohde & Schwarz	LISN	100173	Apr. 19, 2017
□ - ISN T8	TESEQ.GmbH	ISN	24568	Apr. 22, 2017
□ - ST 08	TESEQ.GmbH	ISN	42870	Jun. 09, 2017
■ - EMC 32	Rohde & Schwarz	Software	Ver 8.53	N/A

#### 5.6 Test data for Conducted Emission

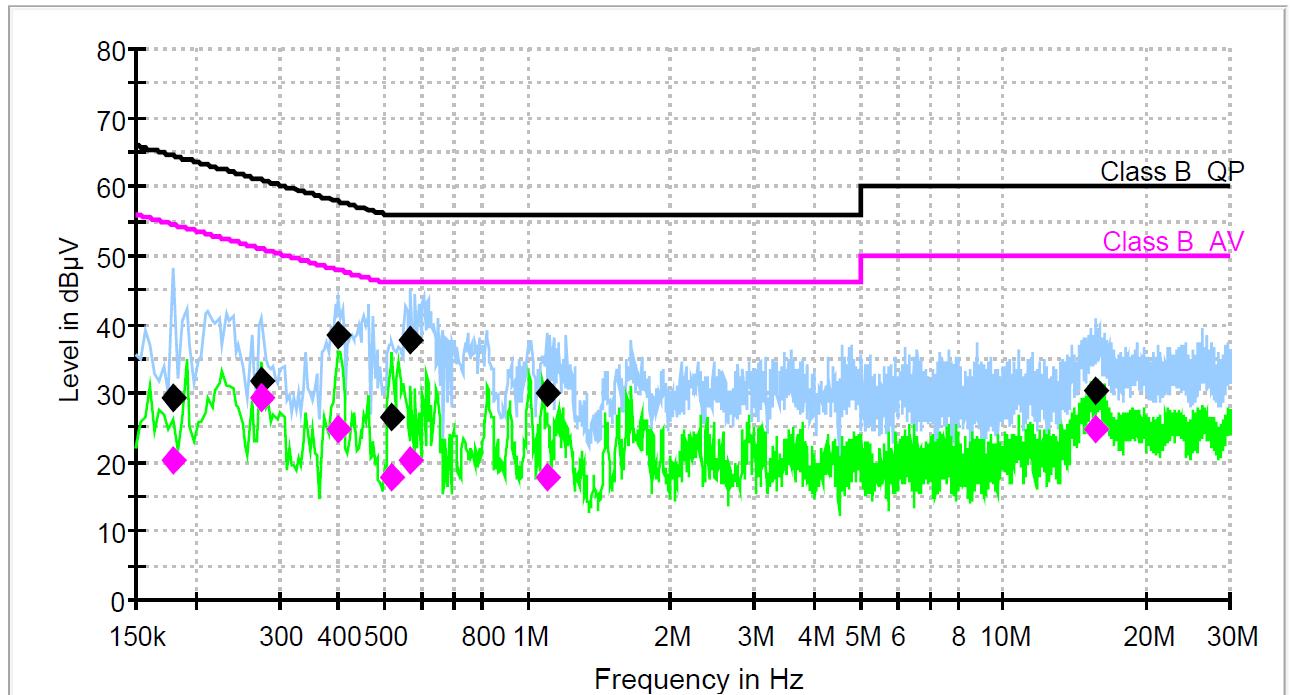
- Test Date : Feb. 01, 2017  
- Resolution Bandwidth : 9 kHz  
- Frequency Range : 0.15 MHz ~ 30 MHz  
- Line : L1: Live, N: Neutral



▪ Operating condition: USB communication

Black(◆) marker: Final result Quasi Peak; Pink(◆) marker: Final result CISPR Average

Blue line: Peak value ; Green line: Average value



#### Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.179850	29.3	200.0	9.000	Off	L1	9.6	35.2	64.5	
0.276863	31.9	200.0	9.000	Off	L1	9.6	29.0	60.9	
0.399994	38.4	200.0	9.000	Off	L1	9.6	19.5	57.9	
0.519394	26.7	200.0	9.000	Off	L1	9.6	29.3	56.0	
0.567900	37.8	200.0	9.000	Off	L1	9.7	18.2	56.0	
1.094006	30.1	200.0	9.000	Off	L1	9.7	25.9	56.0	
15.556331	30.5	200.0	9.000	Off	L1	9.9	29.5	60.0	

#### Final Result 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.179850	20.3	200.0	9.000	Off	L1	9.6	34.2	54.5	
0.276863	29.5	200.0	9.000	Off	L1	9.6	21.4	50.9	
0.399994	24.8	200.0	9.000	Off	L1	9.6	23.0	47.9	
0.519394	17.8	200.0	9.000	Off	L1	9.6	28.2	46.0	
0.567900	20.3	200.0	9.000	Off	L1	9.7	25.7	46.0	
1.094006	17.8	200.0	9.000	Off	L1	9.7	28.2	46.0	
15.556331	24.8	200.0	9.000	Off	L1	9.9	25.2	50.0	

< Fig 5. Graph of continuous disturbance >



## 6. Radiated Emission

### 6.1 Operating Environment

Temperature : 19.3 °C  
Relative Humidity : 51.3 % R.H.

### 6.2 Test Set-up

A preliminary and final measurement was at 3 m & 10 m anechoic chamber.

The EUT was placed on a non-conductive turntable approximately 1.0 m above the ground plane.

The turntable with EUT 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.

### 6.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

Test Items(3 m Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	4.78 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	4.77 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	5.06 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.03 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m)	5.42 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (1 000 MHz ~ 18 000 MHz, 3 m)	5.64 dB	Confidence level of approximately 95 % ( $k = 2$ )
Test Items(10 m Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	4.36 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	4.37 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	4.49 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	4.47 dB	Confidence level of approximately 95 % ( $k = 2$ )
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m)	5.27 dB	Confidence level of approximately 95 % ( $k = 2$ )

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



#### 6.4 Limit

Frequency (MHz)	FCC Limit @ 3 m. dB $\mu$ V/m	CISPR Limit @ 10 m. dB $\mu$ V/m
30 ~ 88	40.0	30.0
88 ~ 216	43.5	30.0
216 ~ 230	46.0	30.0
230 ~ 960	46.0	37.0
960 ~ 1 000	54.0	37.0

Frequency (MHz)	FCC Class B Peak Limit @ 3 m dB $\mu$ V/m	FCC Class B Average Limit@ 3 m dB $\mu$ V/m
> 1 000	74.0	54.0

Frequency (MHz)	CISPR Class B Peak Limit @ 3 m dB $\mu$ V/m	CISPR Class B Average Limit@ 3 m dB $\mu$ V/m
> 1 000	70.0	50.0



## 6.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
□ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	Apr. 18, 2017
□ - ESU40	Rohde & Schwarz	EMI Test Receiver	100266	Jul. 20, 2017
■ - ESR7	Rohde & Schwarz	EMI Test Receiver	101382	Apr. 18, 2017
■ - VULB9160	Schwarzbeck	Broad Band Test Antenna	3193	Mar. 28, 2018
□ - BBHA9120D	Schwarzbeck	Horn ANT	207	Oct. 13, 2017
□ - MCU066	matur GmbH	Position Controller	1390306	N/A
□ - TT2.5SI	matur GmbH	Turntable	1390307	N/A
□ - AM 4.0	matur GmbH	Antenna Mast	1390308	N/A
□ - BBHA9120D	Schwarzbeck	Horn ANT	597	May. 13, 2017
■ - CO3000	Innco system GmbH	Position Controller	1390306	N/A
■ - DT3000	Innco system GmbH	Turntable	1390307	N/A
■ - MA4000-EP	Innco system GmbH	Antenna Mast	1390308	N/A
■ - MA4640-XP-ET	Innco system GmbH	Antenna Mast	MA4640/558	N/A
■ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258942	Dec. 06, 2017
■ - 87405A	Agilent	Preamplifier	MY39500777	Dec. 06, 2017
■ - EMC 32	Rohde & Schwarz	Software	Ver.9.26.01	N/A

## 6.6 Test data for Radiated Emission

- Test Date : Feb. 01 ,2017  
 - Measurement Distance : 3 m, 10 m  
 - Note : The EUT was tested made up 6 GHz, because, it was required from the client.  
 - Measurement

Frequency range	30 MHz ~ 1 GHz	Above 1 GHz
Detector mode	Quasi peak	Peak / Average
Resolution bandwidth	120 kHz	1 MHz



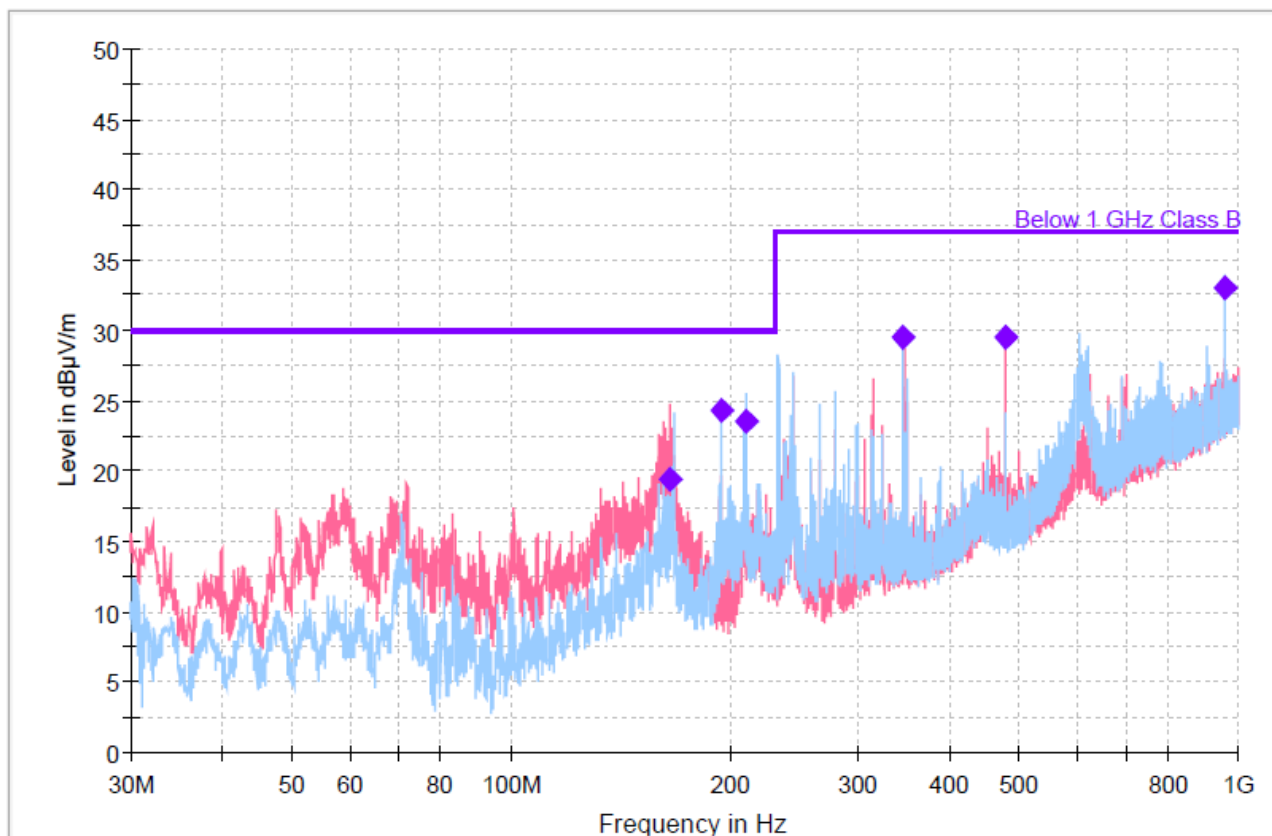


-, 30 MHz ~ 1 GHz

▪ Operating condition: USB communication

Purple(◆) marker: Final result Quasi Peak;

Pink line: Peak value of vertical polarization ; Blue line: Peak value of Horizontal polarization



## Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
32.015	13.56	30.00	16.44	10000.0	120.000	105.4	V	332.0	-13.1
37.593	17.08	30.00	12.92	10000.0	120.000	104.6	V	340.0	-12.5
43.765	20.97	30.00	9.03	10000.0	120.000	109.4	V	315.0	-11.7
47.745	15.96	30.00	14.04	10000.0	120.000	109.6	V	334.0	-11.5
50.483	19.11	30.00	10.89	10000.0	120.000	104.5	V	343.0	-11.4
65.743	16.46	30.00	13.54	10000.0	120.000	99.9	V	315.0	-12.3
150.007	18.61	30.00	11.39	10000.0	120.000	189.8	V	127.0	-9.8
199.998	19.57	30.00	10.43	10000.0	120.000	214.9	V	79.0	-12.4

< Fig 6. Radiated emission result (30 MHz ~ 1 000 MHz) >



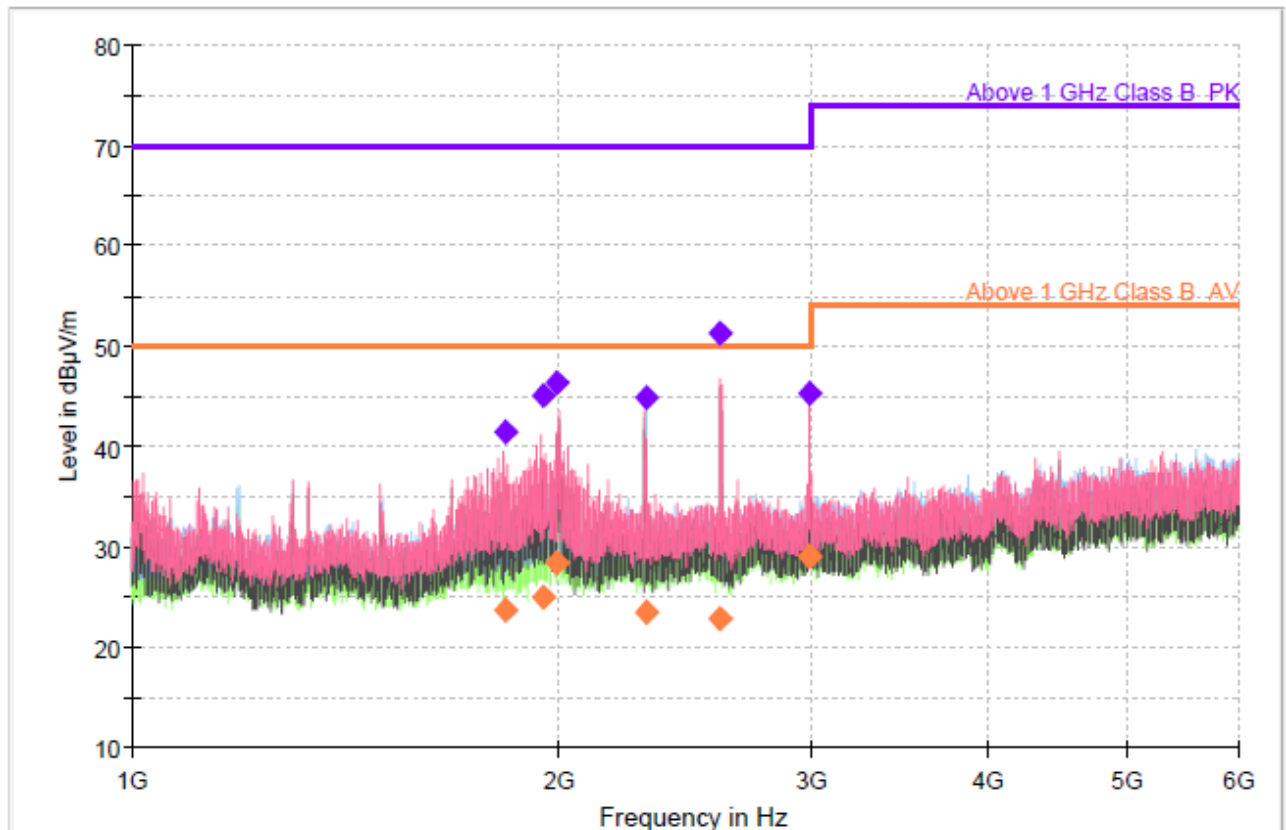
-. 1 GHz ~ 6 GHz

▪ Operating condition: USB communication

Orange(◆) marker: Final result CISPR Average, Purple (◆)marker: Final result Peak;

Pink line: Peak value of vertical polarization ; Blue line: Peak value of Horizontal polarization

Black line: Average value of vertical polarization ; Green line: Peak value of Horizontal polarization



## Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1828.000	41.51	---	70.00	28.49	1000.0	1000.000	195.5	V	12.0	-7.0
1828.000	---	23.60	50.00	26.40	1000.0	1000.000	195.5	V	12.0	-7.0
1944.533	---	25.08	50.00	24.92	1000.0	1000.000	125.2	V	-24.0	-6.3
1944.533	45.09	---	70.00	24.91	1000.0	1000.000	125.2	V	-24.0	-6.3
1991.400	---	28.31	50.00	21.69	1000.0	1000.000	104.4	V	8.0	-6.1
1991.400	46.49	---	70.00	23.51	1000.0	1000.000	104.4	V	8.0	-6.1
2297.700	---	23.50	50.00	26.50	1000.0	1000.000	125.3	H	194.0	-4.6
2297.700	44.91	---	70.00	25.09	1000.0	1000.000	125.3	H	194.0	-4.6
2594.467	---	22.74	50.00	27.26	1000.0	1000.000	104.7	V	2.0	-3.1
2594.467	51.36	---	70.00	18.64	1000.0	1000.000	104.7	V	2.0	-3.1
2991.400	45.35	---	70.00	24.65	1000.0	1000.000	103.7	V	98.0	-1.4
2991.400	---	28.95	50.00	21.05	1000.0	1000.000	103.7	V	98.0	-1.4

< Fig 77. Radiated emission result (1 000 MHz ~6 000 MHz) >



## 7. Sample Calculations

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

### 7.1 Example 1 :

#### ■ 20.3 MHz

Class B Limit	= 250 $\mu\text{V}$ = 48 dB $\mu\text{V}$
Reading	= 39.2 dB $\mu\text{V}$
$10^{(39.2\text{dB}\mu\text{V}/20)}$	= 91.2 $\mu\text{V}$
Margin	= 48 dB $\mu\text{V}$ - 39.2 dB $\mu\text{V}$ = 8.8 dB

### 7.2 Example 2 :

#### ■ 66.7 MHz

Class B Limit	= 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$
Reading	= 31.0 dB $\mu\text{V}$
Antenna Factor + Cable Loss	= 5.8 dB
Total	= 36.8 dB $\mu\text{V}/\text{m}$
Margin	= 40.0 dB $\mu\text{V}/\text{m}$ - 36.8 dB $\mu\text{V}/\text{m}$ = 3.2 dB



## 8. Recommendation & Conclusion

The data collected shows that the **U-HAN PRESEN Co., Ltd.**

**Presenmarker (Model Name: PMC2)** was complies with §15.107, 15.109 of the FCC Rules.

- The end -

