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Report No.: 2102TW0202-U1
Report Version: 0.0
Issue Date: 2021-06-25

MEASUREMENT REPORT
FCC Part 15B

Applicant:	Acnodes
Address:	14628 Central Ave., Chino, CA 91710
Application Type:	Supplier's Declaration of Conformity
Product:	PCH8XXX Stainless Steel Full IP67/69K Panel PC
Brand Name:	N/A
Model Number:	PCH8 series stainless steel Full IP67/IP69K Panel PC
FCC Rule Part(s):	FCC Part 15 Subpart B: 2021 (Class B)
Test Procedure(s):	ANSI C63.4-2014; ANSI C63.4a-2017
Received Date:	February 3, 2021
Test Date:	June 23~24, 2021

Tested By : Fran Chen
(Fran Chen)

Reviewed By : Paddy Chen
(Paddy Chen)

Approved By : Chenz Ker
(Chenz Ker)

The test results only relate to the tested sample.
This equipment has been shown to be capable of 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. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
2102TW0202-U1	0.0	Draft Report	2021-06-25	

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Description Page

§2.1033 General Information

Applicant	Acnodes
Applicant Address	14628 Central Ave., Chino, CA 91710
Manufacturer	Acnodes
Manufacturer Address	14628 Central Ave., Chino, CA 91710
Test Site	MRT Technology (Taiwan) Co., Ltd
Test Site Address	No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C)
MRT FCC Registration No.	153292
Test Device Serial No.	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Fuxing Rd., Taoyuan, Taiwan (R.O.C)

- **MRT facility is a FCC registered (Reg. No. 153292) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.**
- **MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.**
- **MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Taiwan, EU and TELEC Rules.**

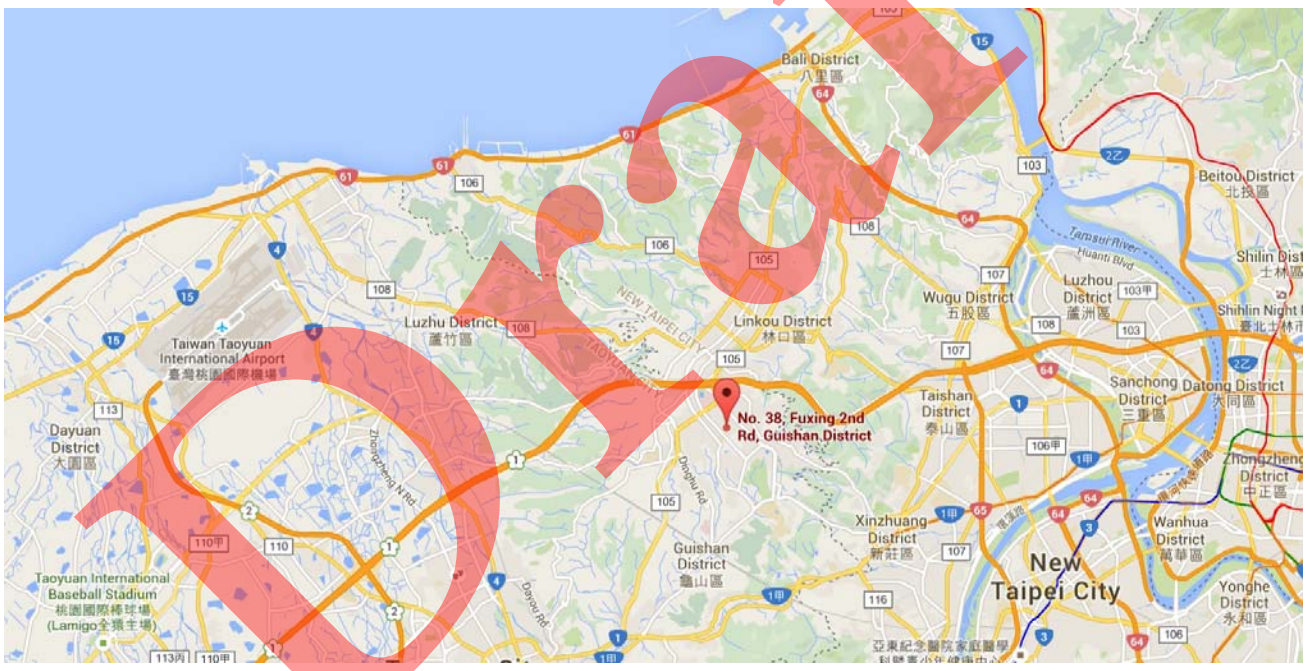
1. INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2 MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



2. PRODUCT INFORMATION

2.1 Equipment Description

Product Name	PCH8XXX Stainless Steel Full IP67/69K Panel PC
Brand Name	N/A
Model Number	PCH8 series stainless steel Full IP67/IP69K Panel PC
Highest Operating Frequency	1.86GHz
Test Voltage	DC 12V

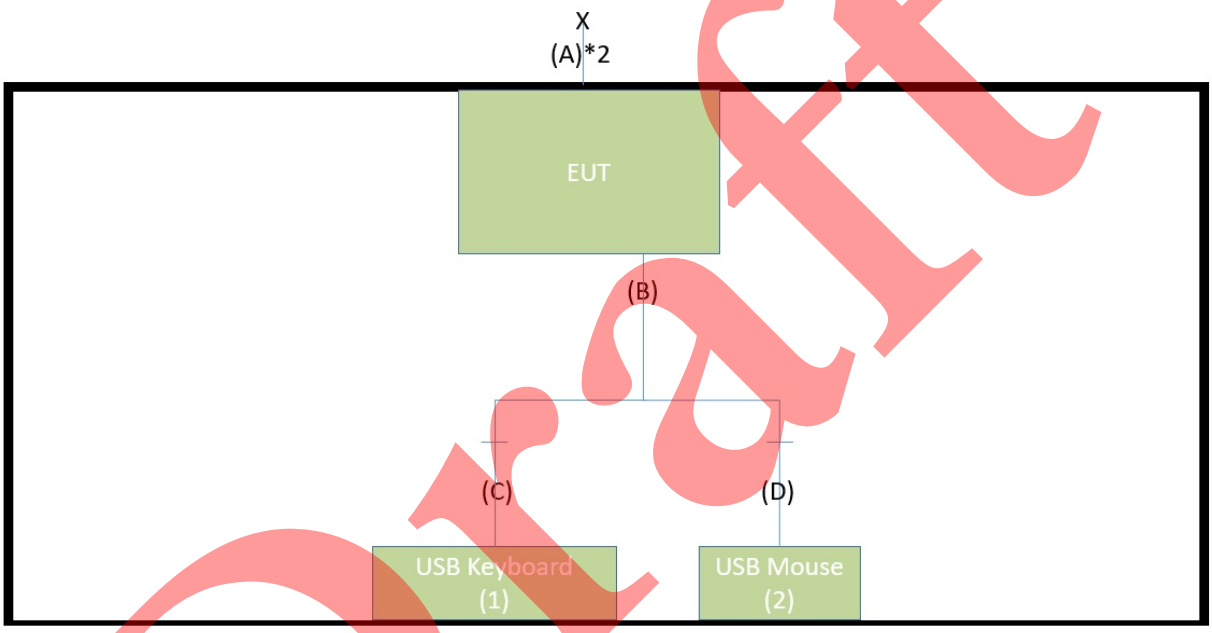
2.2 Test Mode

Pre-Test Mode	
EMI Mode	Mode1: Normal Operation with DC 12V Input
Final Test Mode	
EMI Mode	Mode1: Normal Operation with DC 12V Input

2.3 Test Configuration

The **PCH8XXX Stainless Steel Full IP67/69K Panel PC** was tested per the guidance FCC Part 15 Subpart B: 2021 and ANSI C63.4-2014 / ANSI C63.4a-2017 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

Connection Diagram (Mode1)



	Signal Cable Type	Signal Cable Description
A	M12 to RS-232 Cable	Shielded, 1.8m
B	M12 to USB Cable	Shielded, 1.8m
C	Keyboard-USB Cable	Shielded, 1.5m
D	Mouse-USB Cable	Shielded, 1.6m

2.4 Test System Details

The types for all equipment, and descriptions of all cables used in the tested system (including inserted cards) are:

Mode1:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	USB Keyboard	Lenovo	SK-8825	06151749	N/A
2	USB Mouse	Lenovo	M-U0025-O	HS427HA10SR	N/A

2.5 Test Software

1.	Setup the EUT and simulators as shown on 2.3.
2.	Turn on the power of all equipment.
3.	Turn on the test software, make the EUT with full load.
4.	Start test.

2.6 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

3. DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical Equipment in the Range of 9kHz to 18GHz (ANSI C63.4-2014 & ANSI C63.4a-2017) was used in the measurement of the device.

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside an 9'x4'x3' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the 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 receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150 kHz to 30 MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site.

Line conducted emissions test results are shown in Section 6.2.

3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30 MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30 MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the boresight antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB beam-width of horn antenna, the horn antenna should be always directed to the EUT when rising height.
Radiated emissions test results are shown in Section 6.3.

4. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2022/3/24
Two-Line V-Network	R&S	ENV216	MRTTWA00019	1 year	2022/3/23
Two-Line V-Network	R&S	ENV216	MRTTWA00020	1 year	2022/4/28

Radiated Emissions – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTTWA00009	1 year	2022/3/24
Signal Analyzer	R&S	FSV40	MRTTWA00007	1 year	2022/3/23
Broadband Preamplifier	Schwarzbeck	BBV 9718	MRTTWA00005	1 year	2022/4/21
Broadband TRILOG Antenna	Schwarzbeck	VULB 9162	MRTTWA00001	1 year	2021/10/5
Broadband Horn antenna	Schwarzbeck	BBHA 9120D	MRTTWA00003	1 year	2022/4/21
Bore-Sight Antenna Tower	Max-Full	MF-7802	1308210	N/A	N/A

Test Software

Software	Version	Function
e3	9.160520a	EMI Test Software
EMI	V3	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement – SR2
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.15MHz~30MHz: ± 2.53dB
Radiated disturbance Measurement – AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~30MHz: ± 3.92dB 30MHz~1GHz: ± 4.25dB 1GHz~18GHz: ± 4.40dB 18GHz~40GHz: ± 4.45dB

6. TEST RESULT

6.1 Summary

Product Name: **PCH8XXX Stainless Steel Full IP67/69K Panel PC**

Applicant: **Acnodes**

Test Mode: **Mode 1**

FCC Part Section(s)	Test Description	Test Result
15.107	Conducted Emissions	N/A
15.109	Radiated Emissions	Pass

Note1: Determining compliance is based on the test results met the regulation limits or requirements declared by clients, and the test results don't take into account the value of measurement uncertainty.

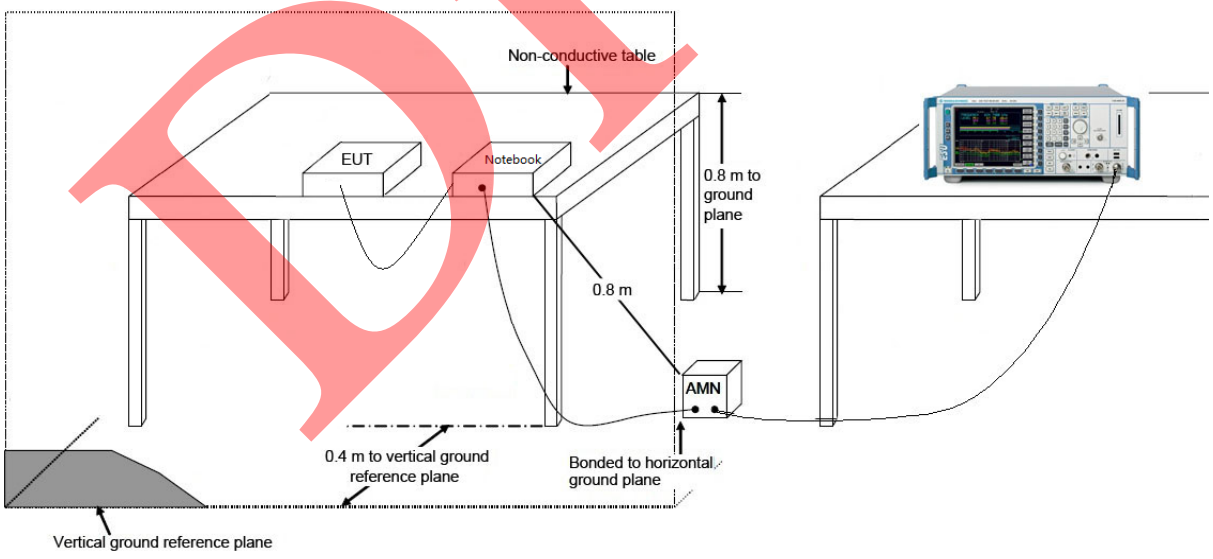
Note2: The EUT Power Input DC 12V, so do not need to test Conducted Emissions.

6.2 Conducted Emission Measurement

6.2.1 Test Limit

FCC Part 15.107 Limits				
Frequency (MHz)	Class A (dBμV)		Class B (dBμV)	
	QP	AV	QP	AV
0.15 - 0.50	79	66	66 - 56	56 – 46
0.50 ~ 5.0	73	60	56	46
5.0 - 30	73	60	60	50
Note 1: The lower limit shall apply at the transition frequencies. Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.				

6.2.2 Test Setup



6.2.3 Test Result

Note: The EUT Power Input DC 12V, so do not need to test Conducted Emissions.

6.3 Radiated Emission Measurement

6.3.1 Test Limit

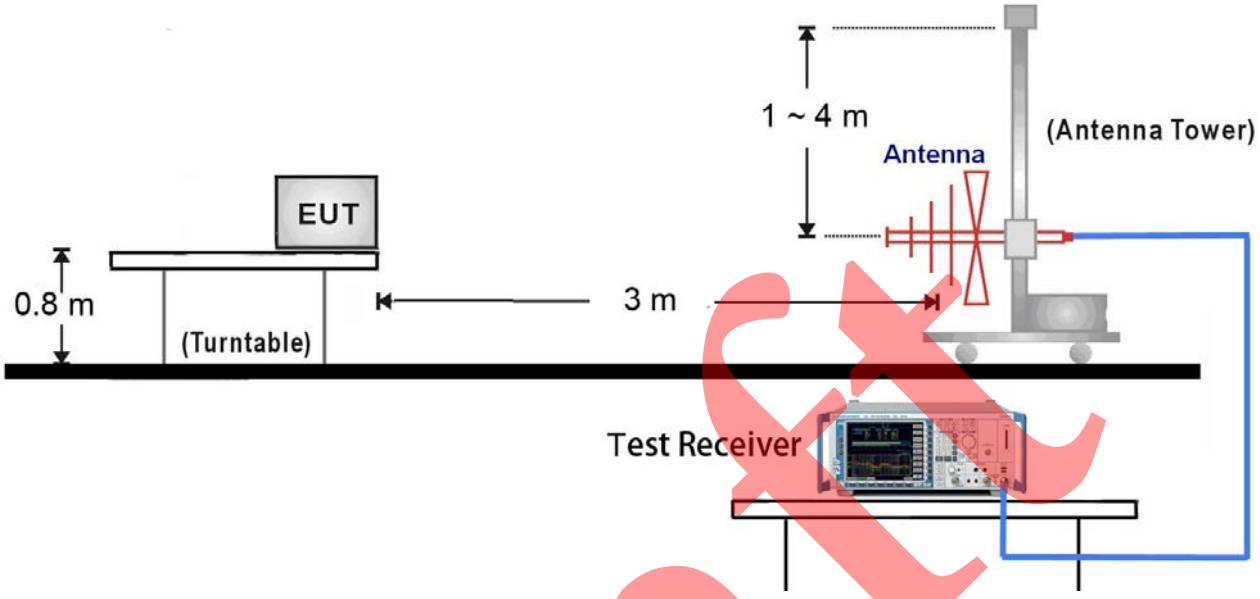
FCC Part 15.109 Limits			
Frequency (MHz)	Distance (m)	Class A Level (dBμV/m)	Class B Level (dBμV/m)
30 - 88	3	49.5	40
88 - 216	3	54	43.5
216 - 960	3	56.9	46
Above 960	3	60	54
Note 1: The lower limit shall apply at the transition frequency. Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system. Note 3: E field strength (dBμV/m) = 20 log E field strength (uV/m)			

ICES-003 Issue 7 Limit			
Frequency (MHz)	Distance (m)	Class A Level (dBμV/m)	Class B Level (dBμV/m)
30 - 88	3	49.5	40
88 - 216	3	54	43.5
216 - 230	3	56	46
230 - 960	3	57	47
Above 960	3	60	54
Note 1: The more stringent limit applies at transition frequencies. Note 2: For the range of 230MHz to 960MHz, the limit of FCC Part 15.109 is more stringent than the limit of ICES-003 Issue 7, so only the limit of FCC Part 15.109 is shown in the test data.			

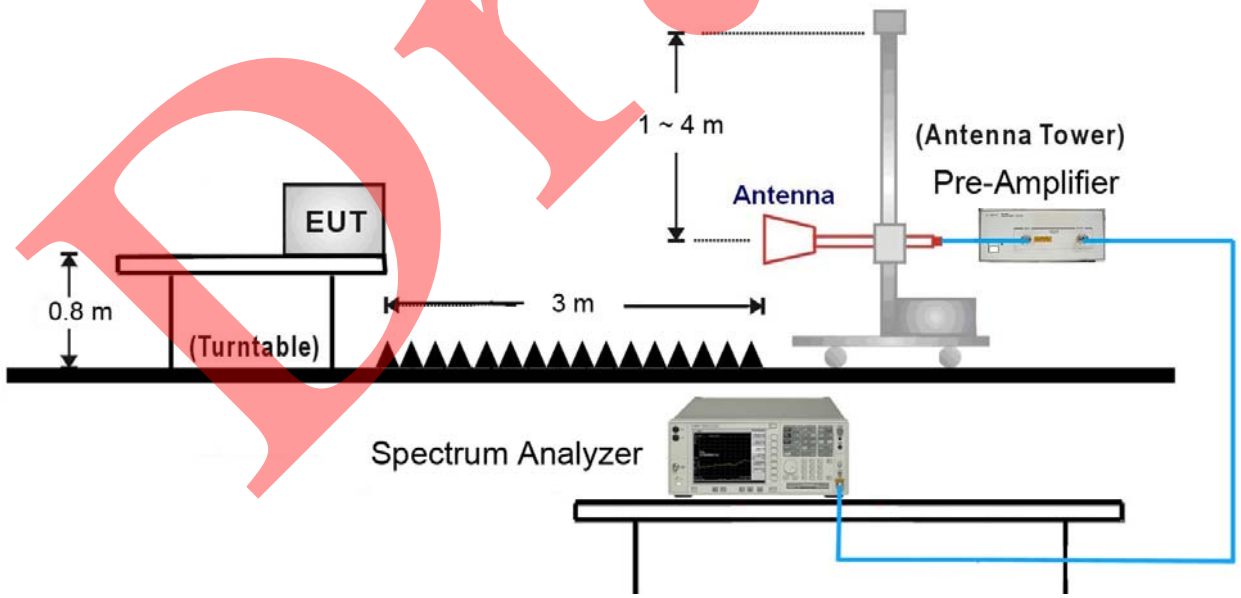
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30.
1.705-108	1000.
108-500	2000.
500-1000	5000.
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

6.3.2 Test Setup

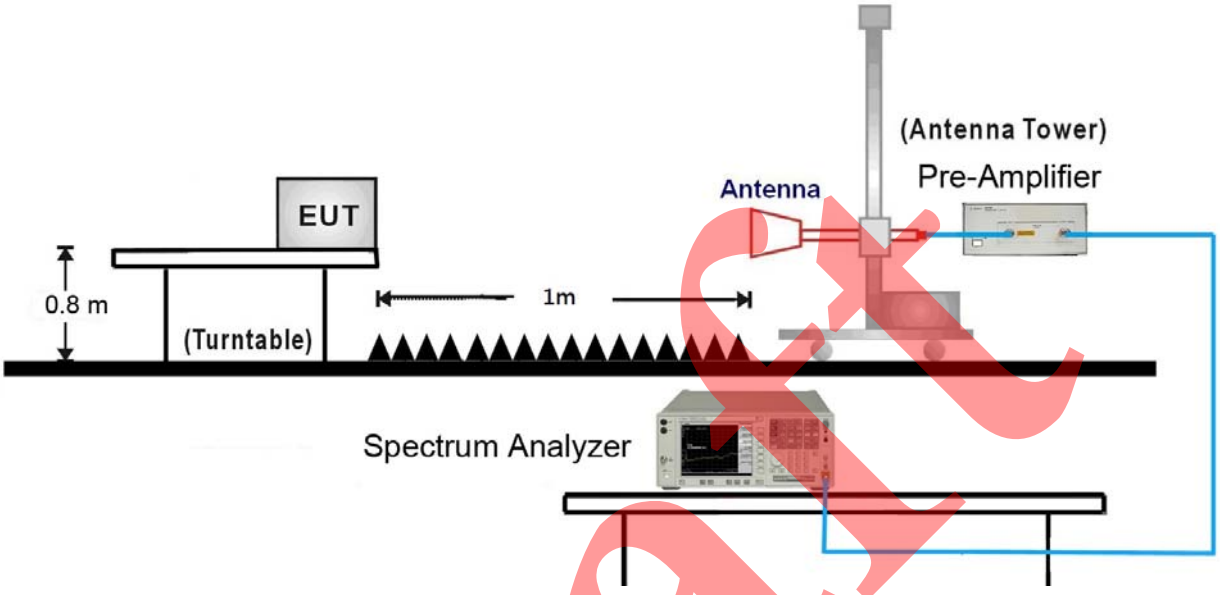
30MHz ~ 1GHz Test Setup:



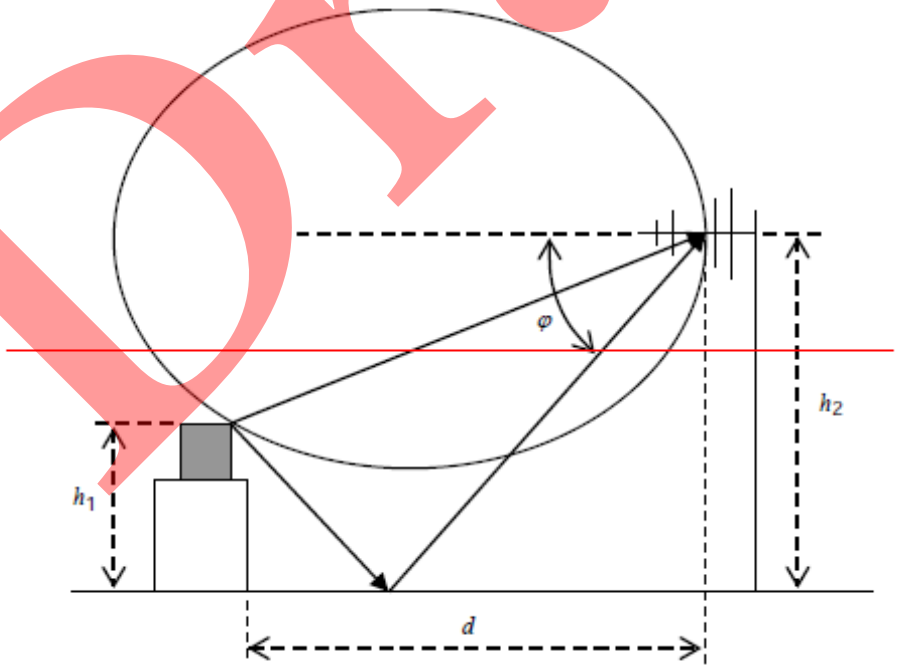
1GHz ~18GHz Test Setup:



18GHz ~40GHz Test Setup:

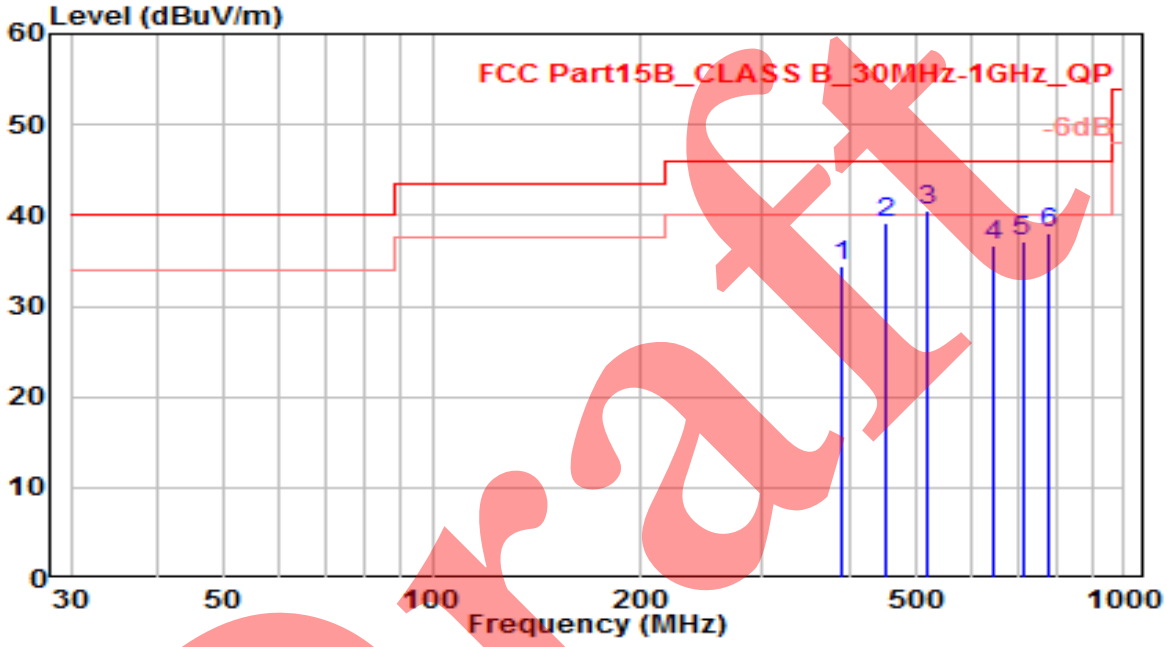


Boresight Test Setup:



6.3.3 Test Result

EUT	PCH8XXX Stainless Steel Full IP67/69K Panel PC	Date of Test	2021-06-23
Factor	VULB 9162	Temp. / Humidity	23°C /65%
Polarity	Horizontal	Site / Test Engineer	AC1 / Kaunaz
Test Mode	Mode1	Test Voltage	DC 12V

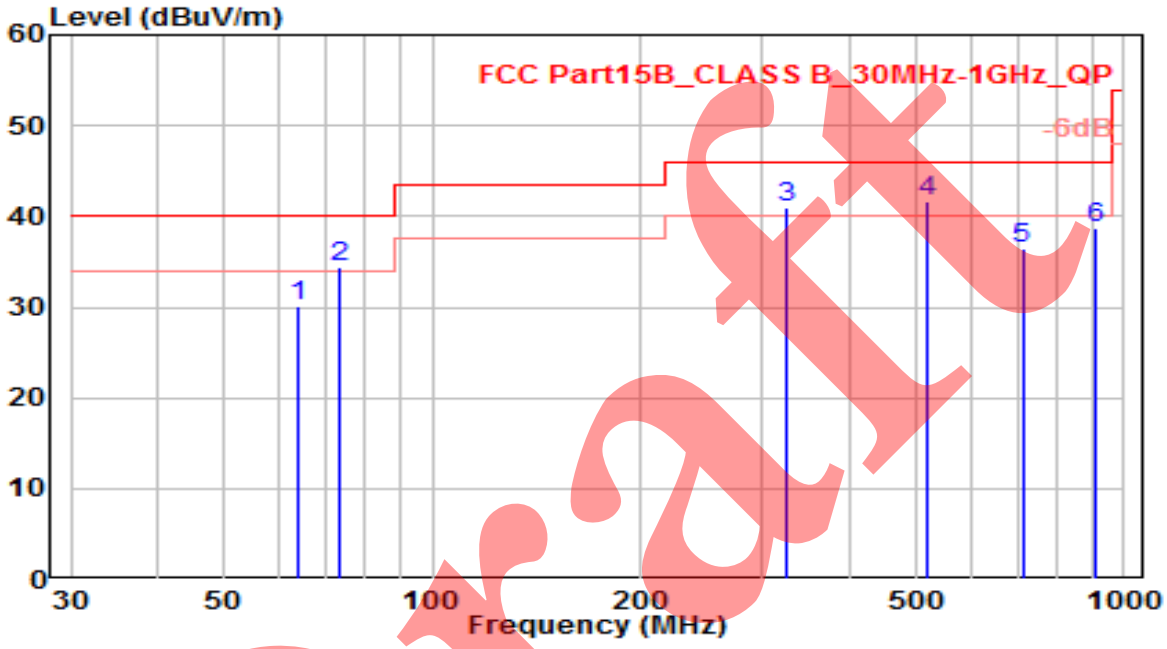


No		Frequency (MHz)	Reading (dBuV)	C.F (dB)	Measurement (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Height (cm)	Angle (deg)	Remark (QP/PK/AV)
1		388.900	10.49	23.88	34.36	-11.64	46.00	100	255	QP
2		453.890	14.25	24.99	39.25	-6.75	46.00	100	315	QP
3	*	517.910	14.10	26.43	40.53	-5.47	46.00	100	45	QP
4		647.890	8.10	28.58	36.68	-9.32	46.00	100	60	QP
5		712.880	7.70	29.52	37.22	-8.78	46.00	100	45	QP
6		777.870	7.62	30.33	37.95	-8.05	46.00	100	150	QP

Note:

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB).
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor).
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

EUT	PCH8XXX Stainless Steel Full IP67/69K Panel PC	Date of Test	2021-06-23
Factor	VULB 9162	Temp. / Humidity	23°C /65%
Polarity	Vertical	Site / Test Engineer	AC1 / Kaunaz
Test Mode	Mode1	Test Voltage	DC 12V

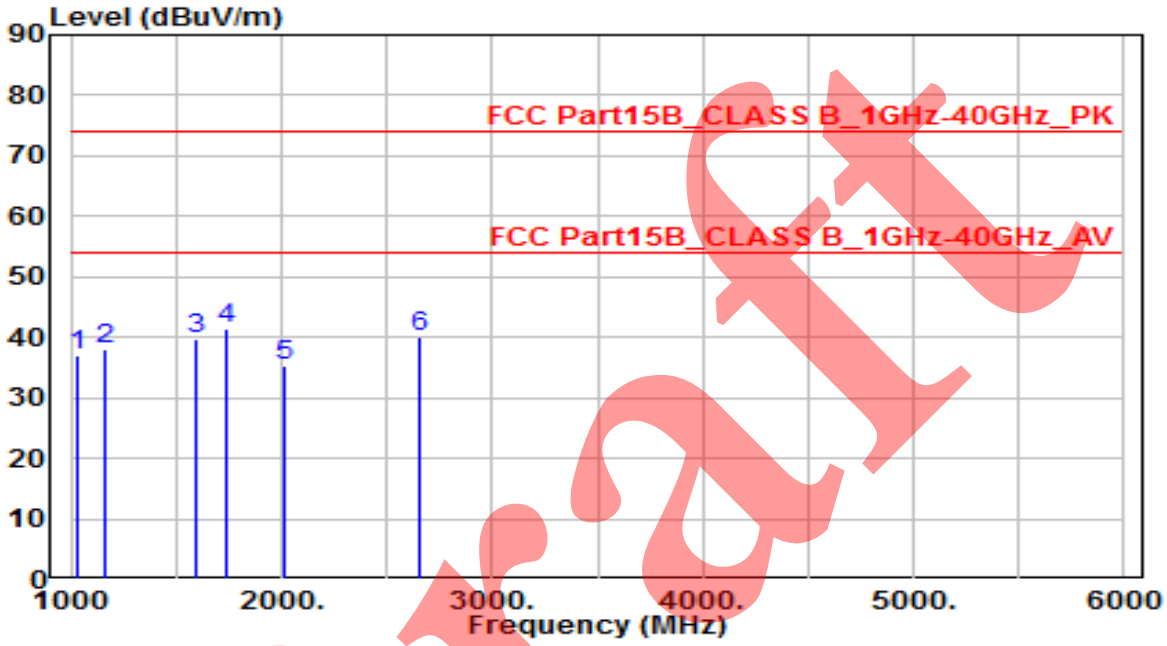


No		Frequency (MHz)	Reading (dBuV)	C.F (dB)	Measurement (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Height (cm)	Angle (deg)	Remark (QP/PK/AV)
1		63.950	11.10	18.93	30.03	-9.97	40.00	100	90	QP
2		73.650	18.50	16.01	34.51	-5.49	40.00	100	90	QP
3		323.910	18.64	22.33	40.97	-5.03	46.00	100	340	QP
4	*	517.910	15.30	26.43	41.73	-4.27	46.00	100	360	QP
5		712.880	6.90	29.52	36.42	-9.58	46.00	100	360	QP
6		907.850	6.92	31.83	38.75	-7.25	46.00	100	145	QP

Note:

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB).
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor).
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

EUT	PCH8XXX Stainless Steel Full IP67/69K Panel PC	Date of Test	2021-06-24
Factor	BBHA 9120D	Temp. / Humidity	23°C /65%
Polarity	Horizontal	Site / Test Engineer	AC1 / Kaunaz
Test Mode	Mode1	Test Voltage	DC 12V

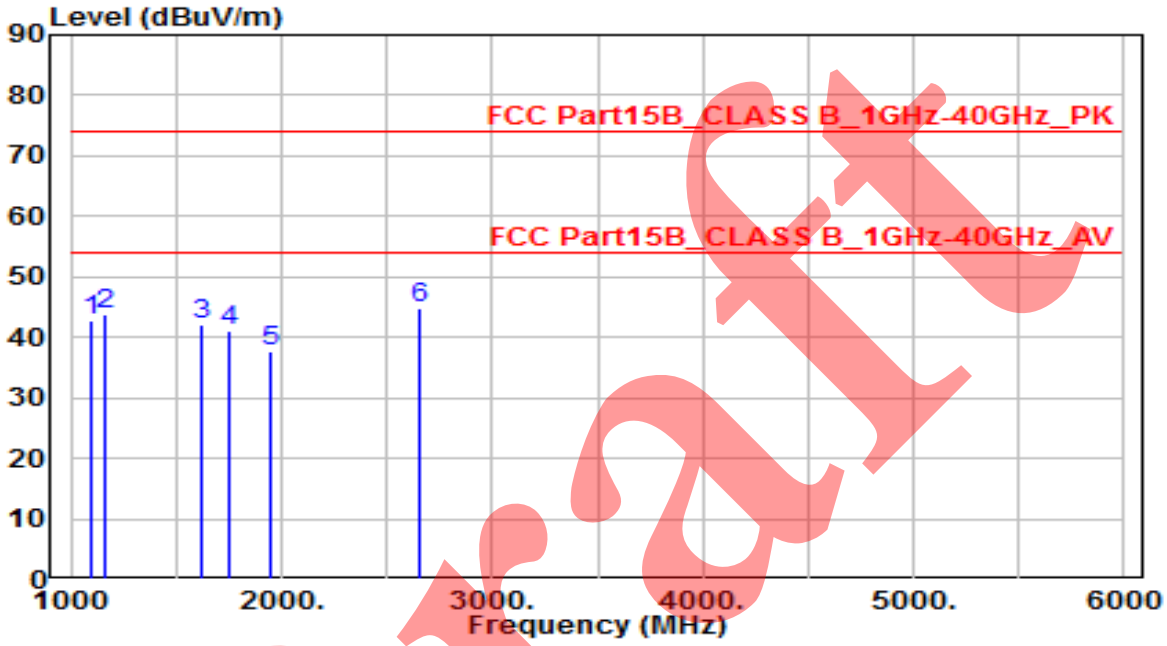


No		Frequency (MHz)	Reading (dBuV)	C.F (dB)	Measurement (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Height (cm)	Angle (deg)	Remark (QP/PK/AV)
1		1031.147	44.77	-7.81	36.96	-37.04	74.00	150	0	Peak
2		1166.283	45.15	-7.21	37.94	-36.06	74.00	150	0	Peak
3		1598.422	45.31	-5.47	39.84	-34.16	74.00	150	0	Peak
4	*	1735.527	46.44	-5.11	41.33	-32.67	74.00	150	0	Peak
5		2007.638	39.54	-4.39	35.16	-38.84	74.00	150	0	Peak
6		2656.106	42.55	-2.32	40.23	-33.77	74.00	150	0	Peak

Note:

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB) – Preamplifier(dB).
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor).
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

EUT	PCH8XXX Stainless Steel Full IP67/69K Panel PC	Date of Test	2021-06-24
Factor	BBHA 9120D	Temp. / Humidity	23°C /65%
Polarity	Vertical	Site / Test Engineer	AC1 / Kaunaz
Test Mode	Mode1	Test Voltage	DC 12V



No		Frequency (MHz)	Reading (dBuV)	C.F (dB)	Measurement (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Height (cm)	Angle (deg)	Remark (QP/PK/AV)
1		1100.124	50.15	-7.51	42.65	-31.35	74.00	150	0	Peak
2		1166.563	51.04	-7.21	43.83	-30.17	74.00	150	0	Peak
3		1619.198	47.69	-5.42	42.28	-31.72	74.00	150	0	Peak
4		1749.332	46.31	-5.08	41.23	-32.77	74.00	150	0	Peak
5		1943.748	42.31	-4.57	37.74	-36.26	74.00	150	0	Peak
6	*	2656.502	47.22	-2.32	44.91	-29.09	74.00	150	0	Peak

Note:

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB) – Preamplifier(dB).
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor).
4. The emission levels of other frequencies are very lower than the limit and not show in test report.

7 CONCLUSION

The data collected relate only the item(s) tested and show that the **PCH8XXX Stainless Steel Full IP67/69K Panel PC, Model No: PCH8 series stainless steel Full IP67/IP69K Panel PC** has been tested to comply with the requirements specified in §15.107 and §15.109 of the FCC Rules.

Appendix A - Test Photograph

Test Mode: Mode1

Description: Radiated Emission Test Setup for 30MHz ~ 1GHz

Test Mode: Mode1

Description: Radiated Emission Test Setup for 1GHz ~ 18GHz

Appendix B - EUT Photograph

(1) EUT Photo

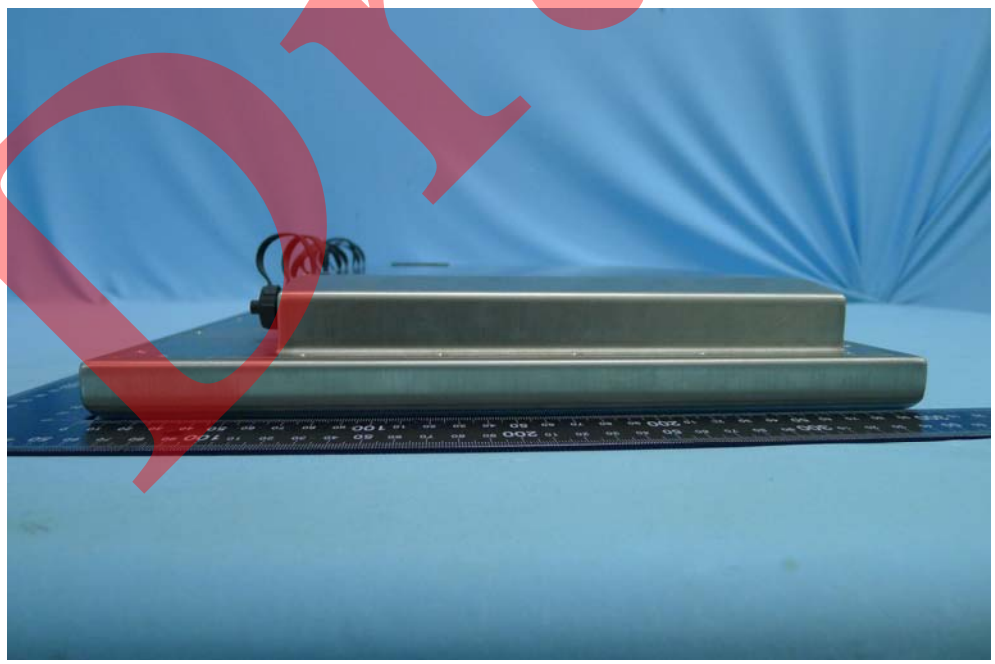
(2) EUT Photo

(3) EUT Photo

(4) EUT Photo

(5) EUT Photo

(6) EUT Photo



The End