EMC TEST REPORT

KOSTEC CO., Ltd. 28(175-20, Annyeong-dong) 406-gil sejaro, Hwaseong-si, Gyeonggi-do, Korea Tel:031-222-4251, Fax:031-222-4252	Report No. : KST-FCC-180028(1)	KOSTEC Co., Ltd. http://www.kostec.org

1. Applicant

   • Name : GCS Co., Ltd.

   • Address : 1008(#1003, #1009), 555, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea

2. Test Item

   • Product Name : Plamere

   • Model Name : GPM-1000

   • Multi List Model Name : None

3. Manufacturer

   • Name : GCS Co., Ltd.

   • Address : 1008(#1003, #1009), 555, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea

4. Date of Test : Jun. 13, 2018

5. Test Method Used :

   47 CFR Part 15 Subpart B Class B

6. Test Result : Pass

7. Note: -

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by Name : Seok-Jin, Jung (Signature)	Technical Manager Name : Chang-Ho, Lee (Signature)

2018 . 09 . 17 .

KOSTEC Co., Ltd.

Revision History of Test Report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Chang-Ho, Lee	Jun. 18, 2018
1	Describe clear of test standard	Page 1	Chang-Ho, Lee	Sep. 17, 2018

Contents

1. Product Information

1) Equipment :	Plamere
2) Model Name :	GPM-1000
3) Serial No.:	GPM-1-29187
4) Type of Sample Tested :	Pre-production
5) Supplied Power for Test :	AC 120 V, 60 Hz
6) Clock used :	820 kHz
7) High Frequency Used :	820 kHz
8) Port :	Micro USB
9) Manufacturer :	GCS Co., Ltd.
Address :	1008(#1003, #1009), 555, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea

2. Information of Testing Laboratory

"KOSTEC(Korea Standard Technology Co., Ltd.)" EMC laboratory was established to provide EMC testing service to manufacturer in September, 1999.
In December 2011, we, KOSTEC has additional installed Semi-anechoic chamber consisting an integral style of 3m and 10m sizes. And 10m Semi-anechoic chamber is 9.8 m (W) x 18.8 m (D) x 8.7 m (H) size made by SY-Corporation. KOSTEC has one open area test site and one 10m semi-anechoic chamber and three 3 m semi-anechoic chamber + absorber four shield room for power line conducted emission testing. The field test site and conducted measurement facility are used for these testing, where are located following address and drawing. This site was fully described in a report dated November 14, 2002, that was submitted to the FCC.
The test site shall comply with the requirements in CISPR 16-1-4 referenced in CAN/CSA-CISPR 22-10 or with ANSI C63.4 depending on which test method was followed.

KOSTEC CO., LTD.

Head office & Test Lab ;

: 28(175-20, Annyeong-dong) 406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Telephone Number: 82-31-222-4251
Facsimile Number: 82-31-222-4252

MSIP(Ministry of Science, ICT & Future Planning) Number: KR0041

FCC Designation Number: KR0041

IC Industry Canada: 8305A

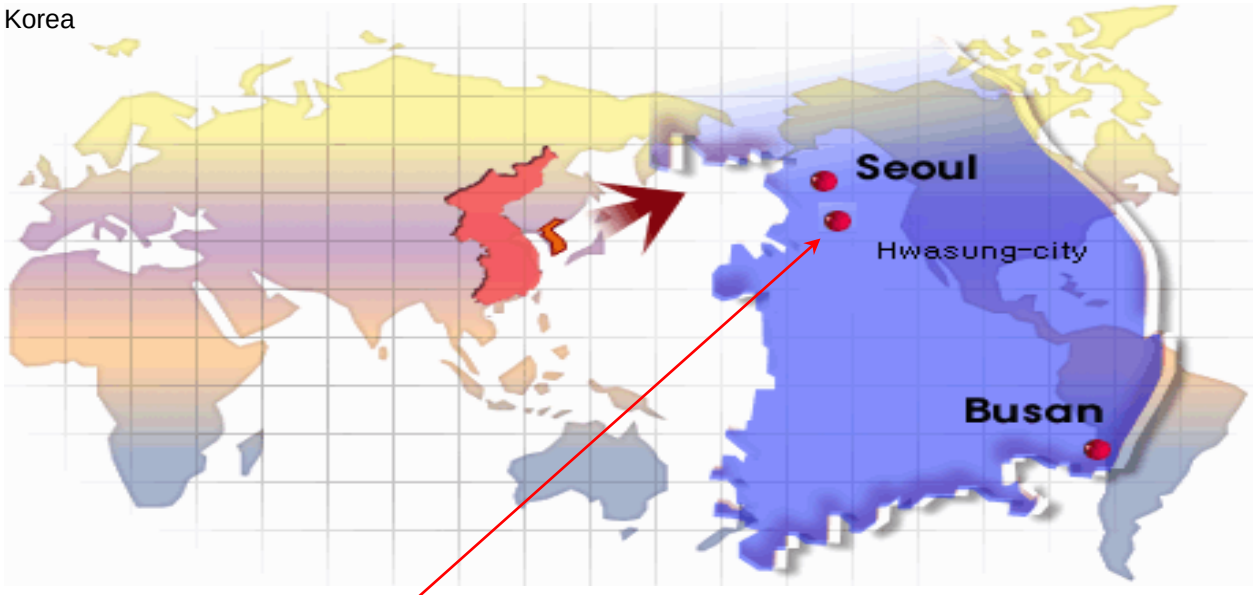
VCCI Membership Number of KOSTEC Co., Ltd.: 2005

VCCI Registration Number of EMI site: R-14202 / C-4685 / G-10834 / T-2225

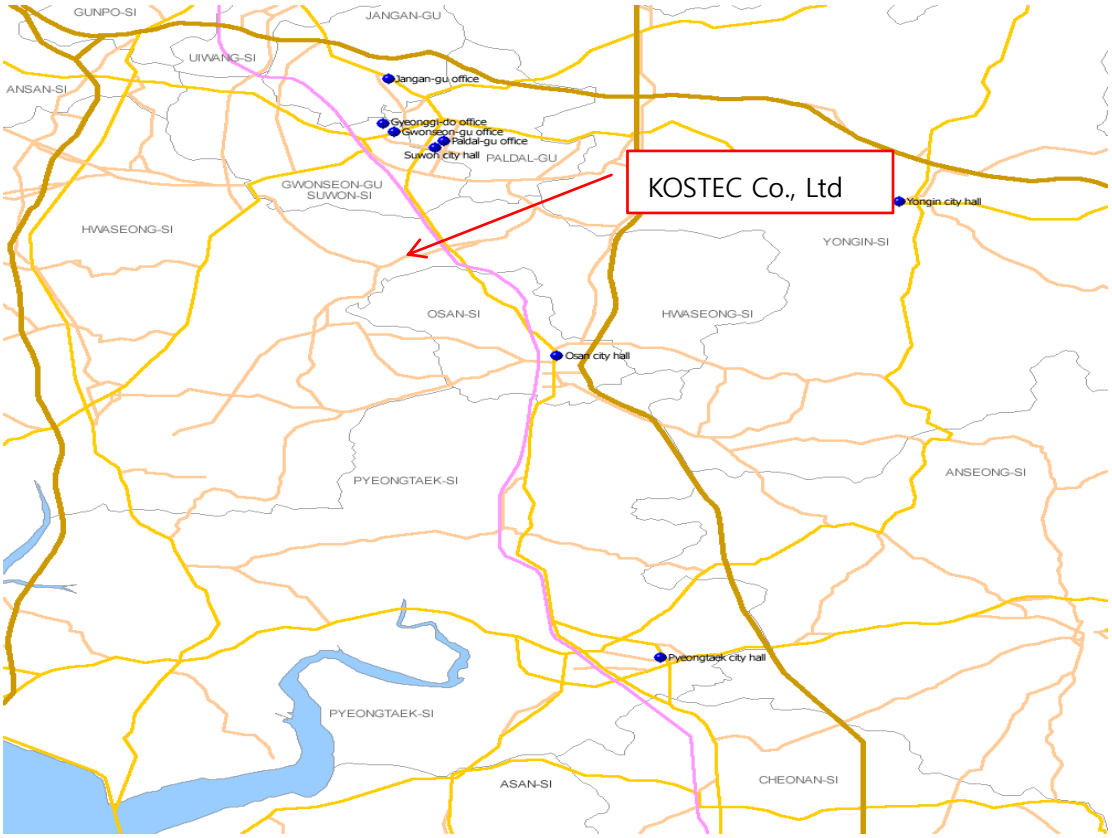
KOLAS Number: 232

Route Map of Measurement Facility

Korea



Hwaseong-si (Test site)



3. Summary of Test Results

3.1 Modification to the EUT

-

3.2 Summary of Test Results

The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 15 Subpart B Class B				
Clause	Test Requirement	Compliant	Not Compliant	Remark
15.107	Conducted Emissions on AC Power Ports	Pass	-	-
15.109	Radiated Emission	Pass	-	-

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

4. Test System Configuration

4.1 Operation Environment

Test Items	Test date	Temp (℃)	Humidity (%R.H.)	Pressure (kPa)
Conducted Emission Measurement	Jun. 13	20	46	-
Radiated Emission Measurement (Below 1 ㎓)	Jun. 13	20	49	
Radiated Emission Measurement (Above 1 ㎓)	-	-	-	

4.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC.
The factors contributing to uncertainties are test receiver, Cable loss, antenna factor calibration, Antenna directivity, antenna factor variation with height, antenna phase center variation, antenna Frequency interpolation, measurement distance variation, ite imperfection, mismatch, and system Repeatability.
Based on CISPR 16-4-2, The measurement uncertainty level with a 95 % confidence level were applied.

4.3 Sample calculation

Conducted Emission

The field strength is calculated by adding the LISN factor, cable loss from the measured reading.
The sample calculation is as follows:

FS = MR + Factor
MR = Meter Reading
Factor = Ant Factor, Cable Loss, etc

If MR is 30 ㏈, LISN Factor 1 ㏈, CL 1 ㏈
The result (FS) is
30 + 1 + 1 = 32 ㏈㎶

5. Condition and Procedure for Test activities

5.1 Configuration of EUT

Description	Manufacturer	Model/Part #	Serial Number
Plamere	**GCS Co., Ltd.**	**GPM-1000**	**GPM-1-29187**

5.2 Used cables

Cable Type	Shield	Length (m)	Ferrite	Connector	Connection Point 1	Connection Point 2
Micro USB	No	1.0	No	USB	EUT	Adaptor

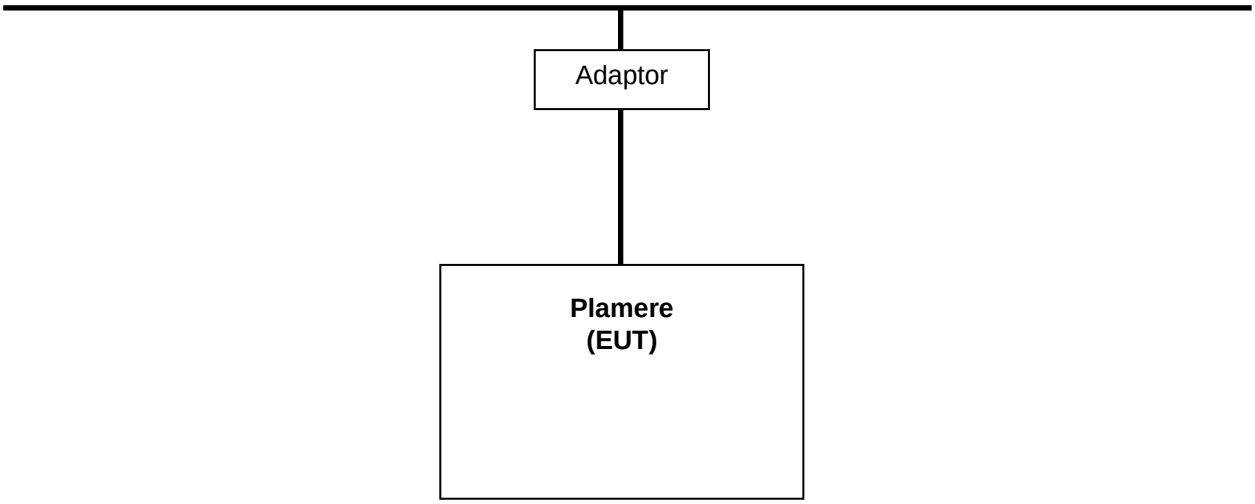
5.3 Operating conditions

After setting, Micro USB of the EUT was connected Adaptor.
And Then EUT was tested in a state of continuously operating and charging.

5.4 Used Peripherals

Description	Manufacturer	Model/Part #	Serial Number
Adaptor	HUIZHOU DONGYANG E&P ELECTRONICS CO., LTD.	EP-TA20KWK	R37H4DB6W93DK3

5.5 EUT Test Configuration



6. Summary of test results

Test Items		Class				Results			
Conducted Emission	☒	A	☐	B	☒	☒	Complied	☐	N/A
Radiated Emission	☒	A	☐	B	☒	☒	Complied	☐	N/A

7. Test Results

7.1 Conducted Emission Measurement

7.1.1 Measurement procedure

In the range of 0.15 ㎒ to 30 ㎒, the conducted disturbance was measured and set-up was made accordance with ANSI C63.4.
If the EUT is table top equipment, it was placed on a wooden table with a height of 0.8 m above the reference ground plane and 0.4 m from the conducting wall of the shielded room.
Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height up to 0.15 m above the reference ground plane.
Connect the EUT's power source lines to the appropriate power mains / peripherals through the LISN. All the other peripherals are connected to the 2nd LISN, if any.
Unused measuring port of the LISN was resistively terminated by 50 ohm terminator.
The measuring port of the LISN for EUT was connected to spectrum analyzer.
Using conducted emission test software, the emissions were scanned with peak detector mode.
After scanning over the frequency range, suspected emissions were selected to perform final measurement. When performing final measurement, the receiver was used which has Quasi-Peak detector and Average detector.
By varying the configuration of the test sample and the cable routing it was attempted to maximize the emission.
For further description of the configuration refer to the picture of the test set-up.

7.1.2 Limit for Conducted Disturbance

(1) Conducted disturbance at mains ports.

<table>
<tr><th rowspan="3">Frequency range
(㎒)</th><th colspan="4">Limits dB(μV)</th></tr>
<tr><th colspan="2">Quasi-peak</th><th colspan="2">Average</th></tr>
<tr><th>Class A</th><th>Class B</th><th>Class A</th><th>Class B</th></tr>
<tr><td>0.15 to 0.50</td><td>79</td><td>66 to 56</td><td>66</td><td>56 to 46</td></tr>
<tr><td>0.50 to 5</td><td rowspan="2">73</td><td>56</td><td rowspan="2">60</td><td>46</td></tr>
<tr><td>5 to 30</td><td>60</td><td>50</td></tr>
<tr><td colspan="5">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 0.15 MHz to 0.5 MHz.</td></tr>
</table>

Note) 1. Emission Level = Reading Value + Correction Factor.
2. Correction Factor = Cable Loss + Insertion Loss of LISN

7.1.3 Used equipment

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test receiver	ESCS30	100111	Rohde & Schwarz	2019. 01 .29	●
	ESPI3	100109	Rohde & Schwarz	2019. 01 .29	-
Pulse Limiter	ESH3-Z2	100097	Rohde & Schwarz	2019. 01 .29	●
Pulse Limiter	ESH3-Z2	100022	Rohde & Schwarz	2019. 01 .29	-
LISN	ESH3-Z5	100147	Rohde & Schwarz	2019. 01 .29	●
	ESH2-Z5	100044	Rohde & Schwarz	2019. 01 .29	-
	ESH2-Z5	100060	Rohde & Schwarz	2019. 01. 30	-
	3825/2	9402-2163	EMCO	2019. 01. 30	-
	ENV4200	830326/012	Rohde & Schwarz	2019. 01. 30	-
Test Program	EMC32 V8.52.0	-	Rohde & Schwarz	-	-
Test Program	ESxS-K1 Ver2.2	-	Rohde & Schwarz	-	●

Measurement uncertainty

Conducted Emission measurement: 3.36 dB (CL: Approx 95%, *k=2*)

7.1.4 Test Data

< Class B >

Freq.	Factor [dB]		POL	QP			CISPR AV		
				Limit	Reading	Result	Limit	Reading	Result
[㎒]	LISN	CABLE +P/L		[dBμV]	[dBμV]	[dBμV]	[dBμV]	[dBμV]	[dBμV]
0.162	0.12	9.96	L	65.38	39.43	39.55	55.38	24.20	24.32
0.189	0.12	9.97	L	64.08	40.82	40.94	54.08	27.40	27.52
0.287	0.12	9.98	N	60.62	43.44	43.56	50.62	33.20	33.32
0.349	0.12	9.98	N	58.98	45.98	46.10	48.98	35.80	35.92
0.408	0.12	9.98	N	57.69	50.91	51.03	47.69	40.70	40.82
0.466	0.13	9.99	N	56.58	46.12	46.25	46.58	38.10	38.23
0.693	0.14	10.00	N	56.00	40.49	40.63	46.00	27.00	27.14
0.744	0.14	10.01	N	56.00	40.81	40.95	46.00	26.90	27.04

* LISN: LISN insertion Loss, Cable: Cable Loss, P/L:Pulse Limiter Factor
* L: Line. Live, N: Line. Neutral
* Reading: test Receiver Reading Value (with Cable Loss & Pulse Limiter Factor)
* Result = LISN + Reading

7.1.5 Conducted Emission test graph

Line. Live

Kostec Co.,Ltd 13 Jun 2018 14:55

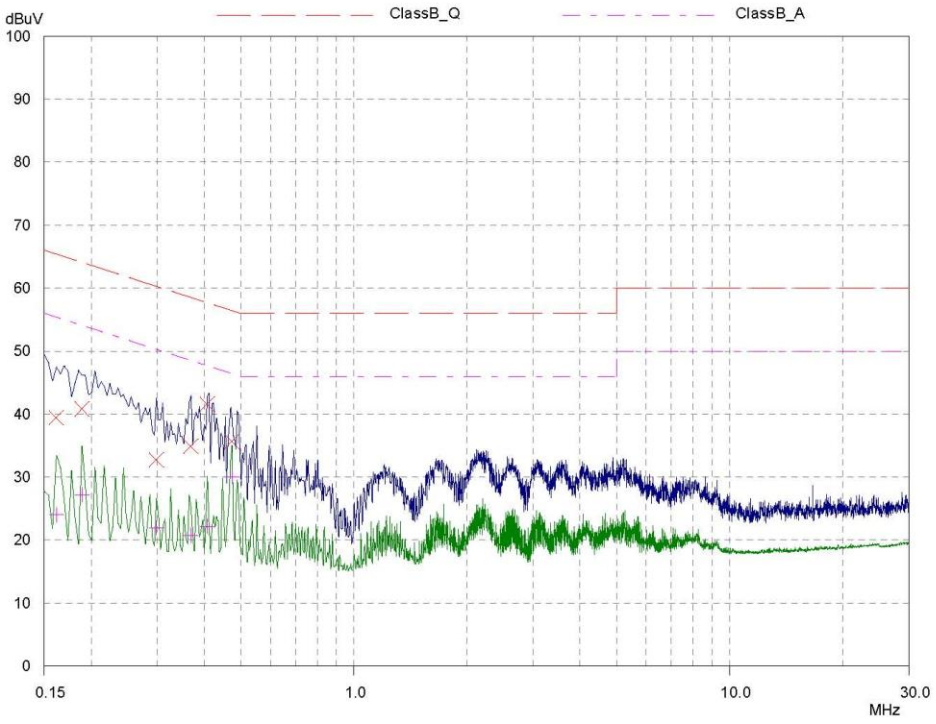
Conducted Emission

EUT:	KST-PO-18-0097
Manuf:	
Op Cond:	AC 120V, 60Hz
Operator:	I.S.PARK
Test Spec:	FCC
Comment:	LIVE
Result File:	0097_L.dat : New Measurement
Scan Settings	(1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	11	9kHz	30MHz	MAIN

Final Measurement:		
	Detectors:	X QP / + AV
	Meas Time:	1sec
	Peaks:	25
	Acc Margin:	50 dB



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Line. Neutral

Kostec Co.,Ltd 13 Jun 2018 15:10

Conducted Emission

EUT: KST-PO-18-0097
Manuf:
Op Cond: AC 120V, 60Hz
Operator: I.S.PARK
Test Spec: FCC
Comment: NEUTRAL

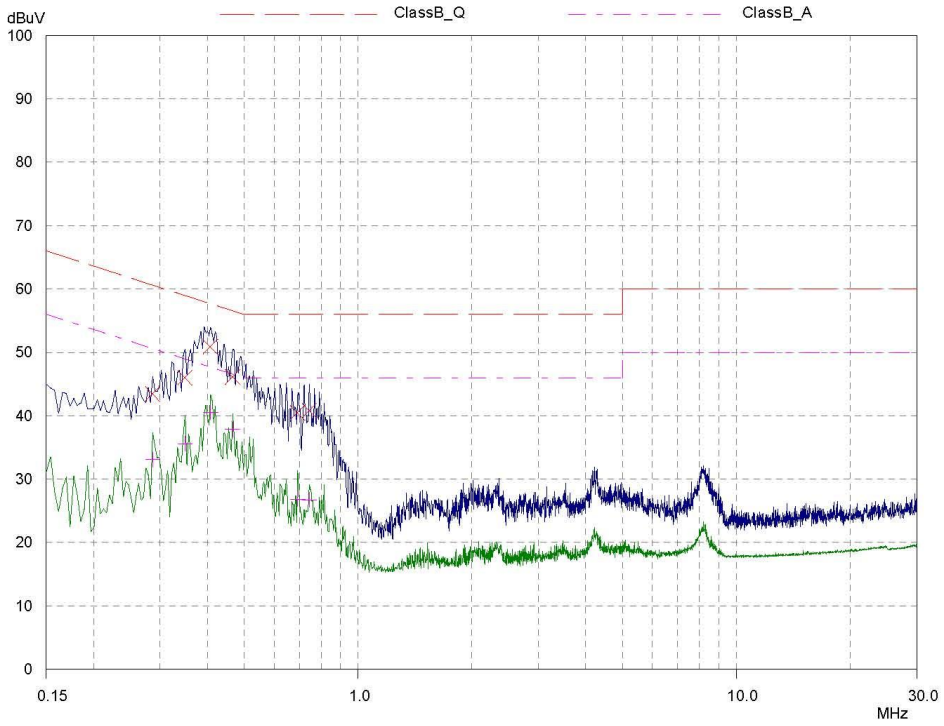
Result File: 0097_N.dat : New Measurement

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	3.9063kHz	9kHz	PK+AV	10msec	15 dB	OFF	60dB

Transducer	No.	Start	Stop	Name
	11	9kHz	30MHz	MAIN

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Peaks: 25
Acc Margin: 50 dB



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7.2 Radiated Emission Measurement

7.2.1 Measurement procedure

The radiated disturbance was measured and set-up was made accordance with ANSI C63.4.
If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 m above the reference ground plane and 3 m or 10 m away from the interference receiving antenna in the 10m semi-anechoic chamber.
Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height up to 0.15 m above the reference ground plane.
Rotate the EUT from (0 - 360)° and position the receiving antenna at heights from (1 - 4) m above the reference ground plane continuously to determine associated with higher emission levels and record them.
The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.
For below 1 ㎓ frequency range, Quasi-Peak detector with 120 ㎑ RBW was used.
Also Peak and Average detector with 1 ㎒ RBW were used for above 1 ㎓ frequency range.
For further description of the configuration refer to the picture of the test set-up.

7.2.2 Limit for Radiated Disturbance

- The test frequency range of Radiated Disturbance measurements are listed below.

Highest frequency generated or used in the device or on which the device operates or tunes (㎒)	Upper frequency of measurement range (㎒)
Below 108	1 000
108 – 500	2 000
500 – 1 000	5 000
Above 1 000	5^{th} harmonic of the highest frequency or 40 ㎓, whichever is lower

(1) Limit for Radiated Emission below 1 000MHz

Frequency range (㎒)	Class A Equipment (10 m distance)	Class B Equipment (3 m distance)
	Quasi-peak (dBμV/m)	Quasi-peak (dBμV/m)
30 to 88	39.1	40
88 to 216	43.5	43.5
216 to 960	46.4	46
960 to 1 000	49.5	54
Note 1 The lower limit shall apply at the transition frequency. Note 2 Additional provisions may be required for cases where interference occurs. Note 3 According to 15.109(g), as an alternative to the radiated emission limit shown above, digital devices may be shown to comply with the standards(CISPR), Pub. 22 shown as below.		
Frequency range (㎒)	**Class A Equipment (10 m distance)**	**Class B Equipment (10 m distance)**
	Quasi-peak (dBμV/m)	**Quasi-peak (dBμV/m)**
30 to 230	40	30
230 to 1 000	47	37

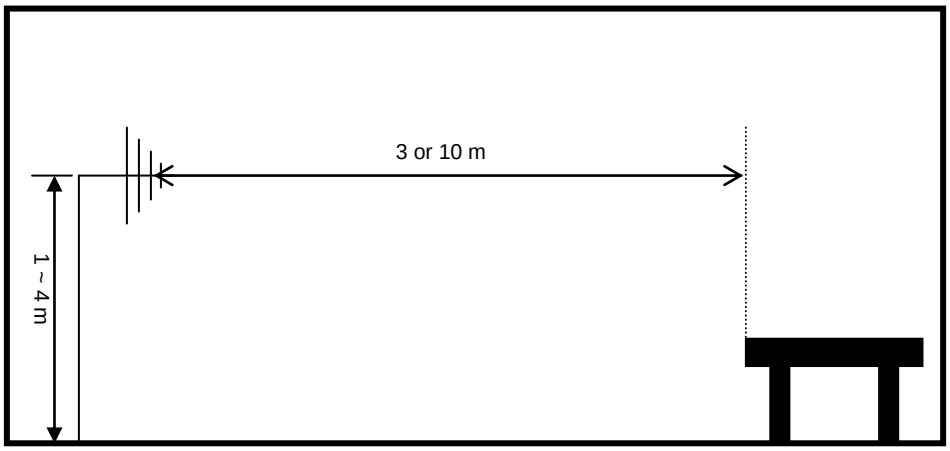
(2) Limits for Radiated Emission above 1 000 ㎒ at a measuring distance of 3 m

Frequency (㎓)	Class A Equipment		Class B Equipment	
	Peak (dBμV/m)	Average (dBμV/m)	Peak (dBμV/m)	Average (dBμV/m)
1 to 40	80	60	74	54

Note) 1. Emission Level = Reading Value + Correction Factor.
2. Correction Factor = Cable loss + Amp gain + Antenna Factor + Distance Compensation value

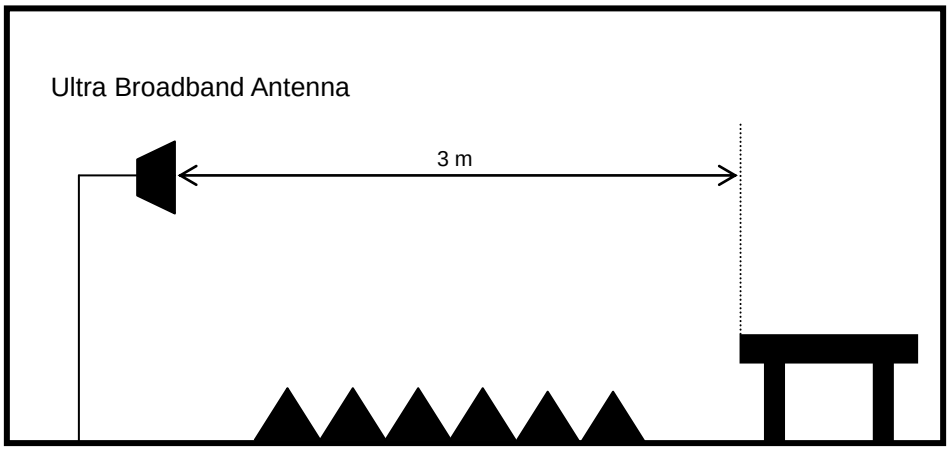
Fig.1 Dimensions of test site (Below 1 ㎓) : Class A (10 m), Class B (3 m)

Semi-Anechoic Chamber (9.8 m x 18.8 m x 8.7 m)



Dimensions of test site (Above 1 ㎓)

Semi-Anechoic Chamber + Absorber



7.2.3 Used equipment

10 m Semi-Anechoic chamber (Below 1 ㎓)

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESCI7	100823	R&S	2019.01.29	●
Biconilog Antenna	3142B	1745	EMCO	2020.05.10	●
AMPLIFIER	TK-PA6S	120009	TESTEK	2019.01.29	●
Antenna Master	MA4000-EP	-	Inno systems GmbH	-	●
Turn Table	-	-	Inno systems GmbH	-	●

10 m Semi-Anechoic chamber (Above 1 ㎓)

Equipment	Model No.	Serial No.	Manufacturer	Next cal date	Used
Test Receiver	ESI	837514/004	R&S	2018.09.05	-
Horn Antenna	3115	2996	EMCO	2020.02.14	-
Antenna Master	AT13	-	AUDIX	-	-
Turn Table	-	-	AUDIX	-	-
AMPLIFIER (1 ㎓ ~ 26.5 ㎓)	8449B	3008A00149	Agilent	2018.09.12	-

Measurement uncertainty

Radiated Emission measurement: Below 1 ㎓ : 3.66 ㏈ (CL: Approx 95 %, *k=2*)
Above 1 ㎓ : 4.04 ㏈ (CL: Approx 95 %, *k=2*)

7.2.4 Test Data

1) Below 1 ㎓

< Class B >

Freq.	Reading	POL	H [m]	Factor			Limit	Result
[㎒]	[dBμV]			ANT. [dB/m]	CABLE [dB]	AMP. [dB]	[dBμV/m]	[dBμV/m]
39.04	46.83	V	1.0	13.26	2.03	-41.56	40.00	20.56
44.31	54.38	V	1.0	10.63	2.05	-42.02	40.00	25.04
47.99	58.63	V	1.0	9.34	2.10	-42.31	40.00	27.77
58.33	54.32	V	1.0	7.53	2.24	-42.40	40.00	21.69
161.61	43.94	V	1.0	9.37	3.40	-41.71	43.50	15.00
182.39	46.31	V	1.0	9.89	3.64	-41.58	43.50	18.26

*Result = Reading + antenna factor + cable loss + AMP. *Reading: test receiver reading value
*POL = antenna Polarization / H = antenna Height *Receiving Antenna Mode : Horizontal, Vertical
*ANT. = antenna factor / CABLE = used cable loss/AMP.: Gain of the Amplifier
*Test site : 10 m Semi-Anechoic chamber

* Except for the above data, the emission levels were very low, so that the other data are not reported.
(See Radiated Emission Graph)

2) Above 1 ㎓

< Class B >

Freq. [GHz]	Reading		POL	H [m]	Factor				Peak		CISPR Average	
	Peak [dBμV]	CISPR Average [dBμV]			ANT. [dB/m]	CABLE [dB]	AMP. [dB]	Distance [dB]	Limit [dBμV/m]	Result [dBμV/m]	Limit [dBμV/m]	Result [dBμV/m]
-	-	-	-	-	-	-	-	-	-	-	-	-

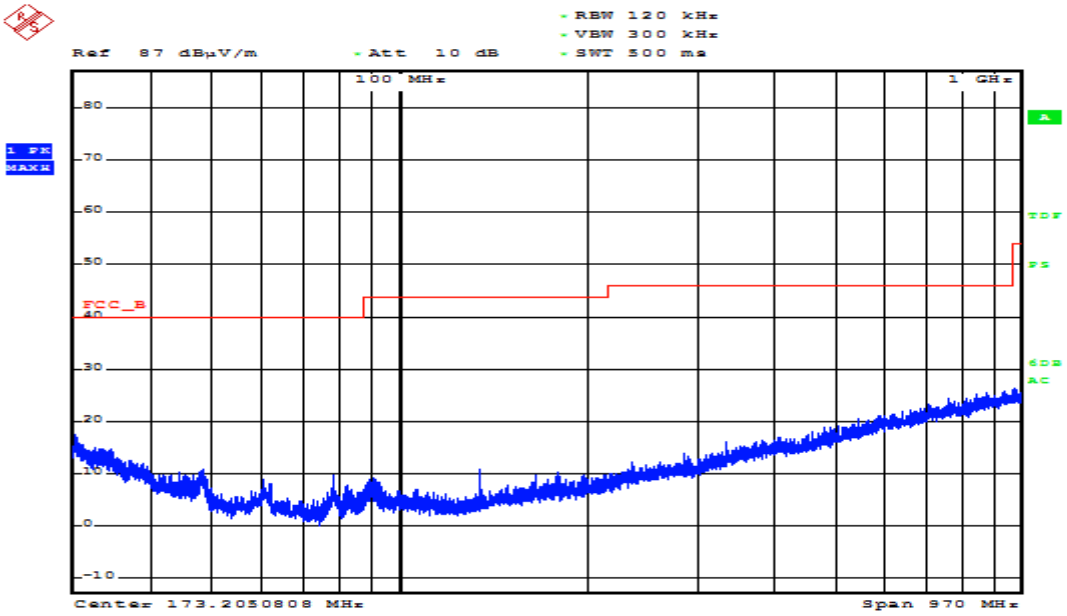
*Result = Reading + antenna factor + cable loss + AMP. + Distance compensation value
*Reading: test receiver reading value *POL = antenna Polarization / H = antenna Height
*ANT. = antenna factor / CABLE = used cable loss / AMP.: Gain of the Amplifier /
Distance : Distance compensation value
* Receiving Antenna Mode : Horizontal, Vertical * Test site : 10 m Semi-Anechoic chamber

*This test doesn't apply to EUT because EUT's maximum internal frequency is less than 108 ㎒.

7.2.5 Radiated Emission test graph

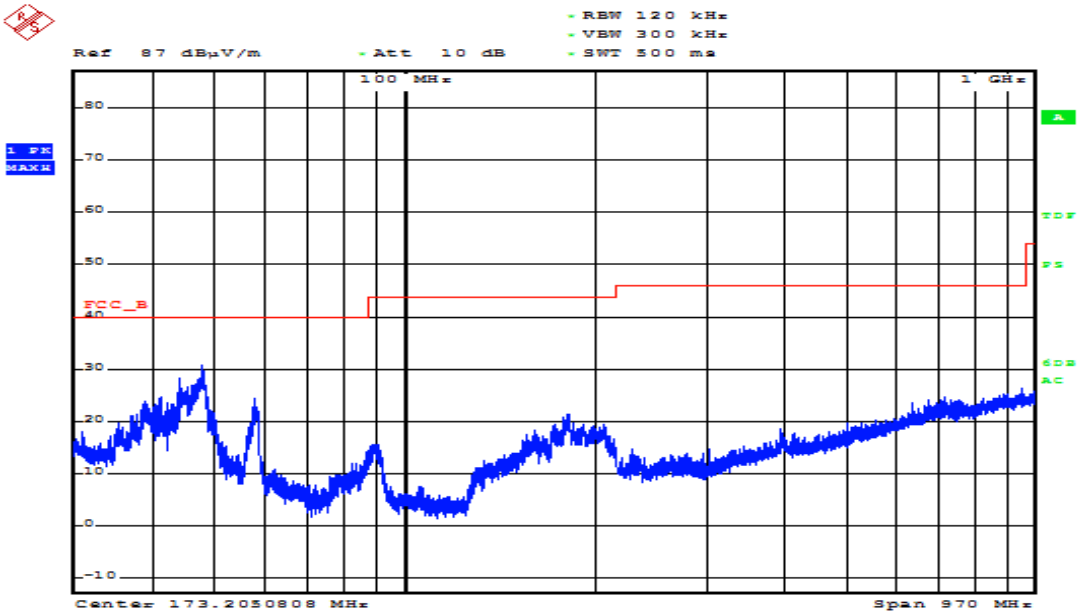
1) Below 1 ㎓

Horizontal



Date: 13.JUN.2018 16:40:40

Vertical



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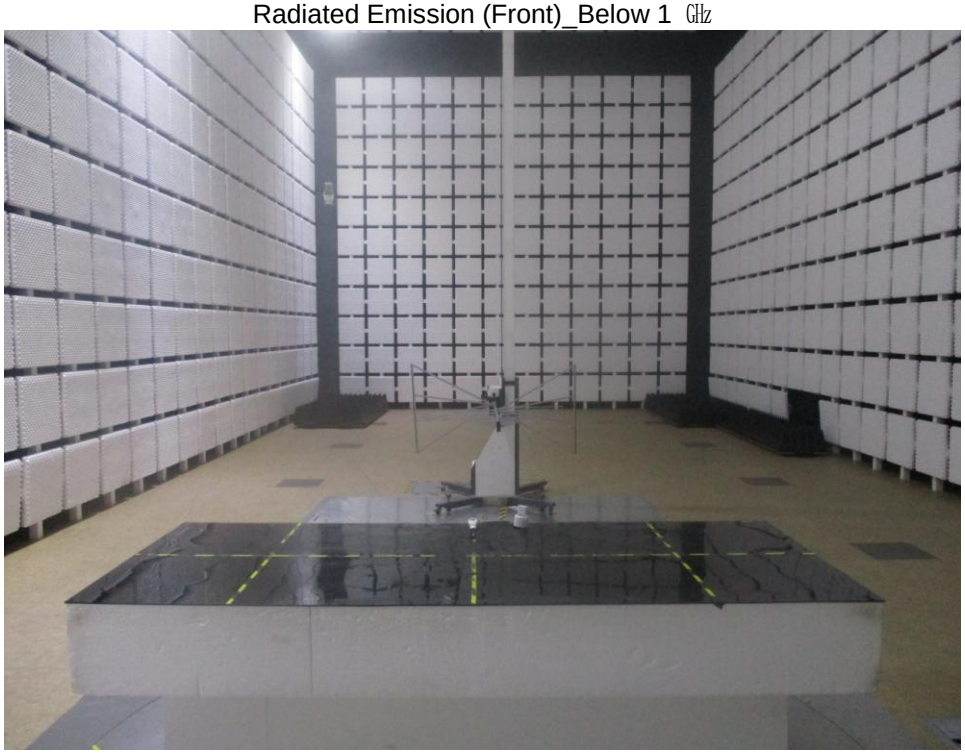
8. Test Setup and EUT Photographs

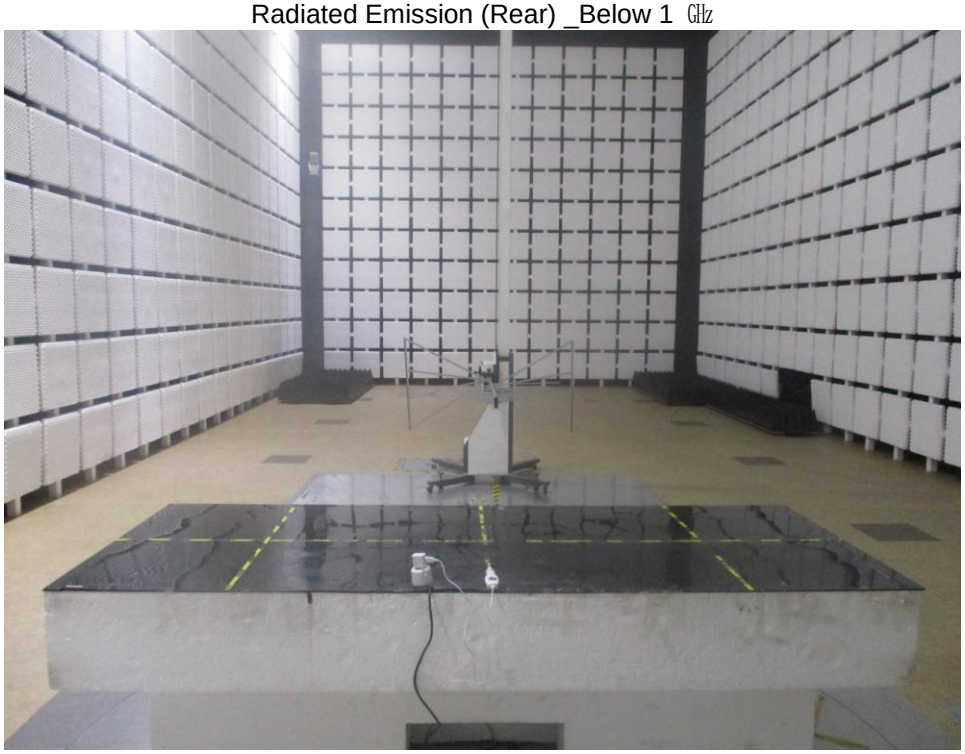
Conducted Emission (Front)

Conducted Emission (Rear)

Radiated Emission (Front)_Below 1 ㎓



Radiated Emission (Rear) _Below 1 ㎓



Radiated Emission (Front)_Above 1 ㎓

N/A

Radiated Emission (Rear)_Above 1 ㎓

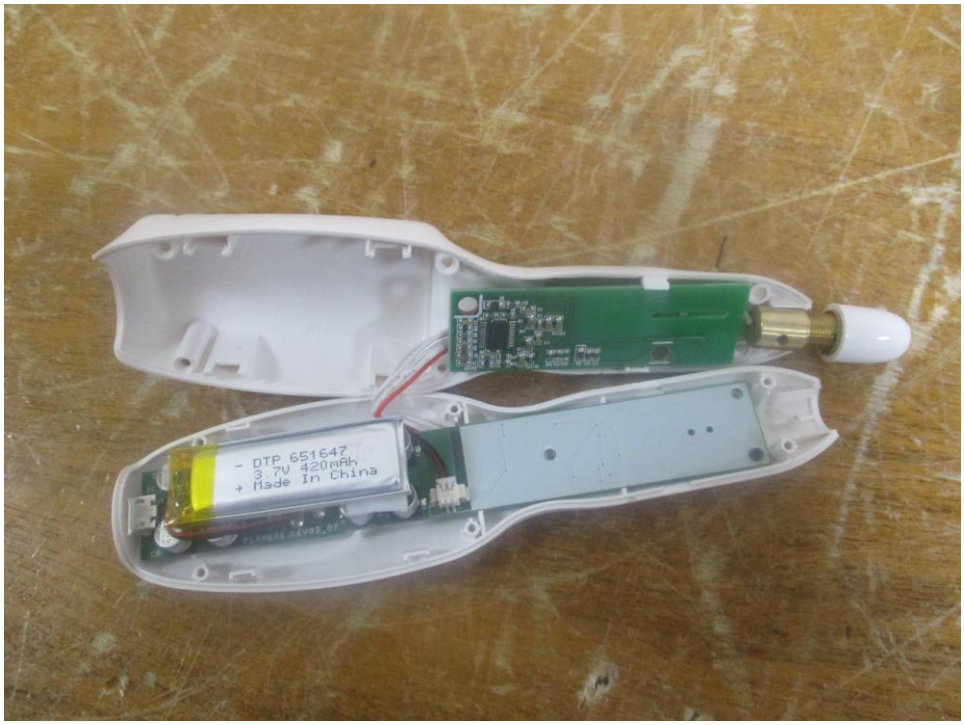
N/A

EUT

Front

Rear

Inside



Port