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TEST REPORT

Report Number	200500063SEL-EMC1
Applicant Name/Address	Sungshin Hasco, Ltd 65, Gongdan 7-ro, Jillyang-eup, Gyeongsan-si, Gyeongbuk-do, South Korea, 38465
Test Sample Description	
- Product .....:	Digital Manifold Gauge
- Model and/or Brand name .....:	MDM008A
- Variant model name.....:	-
- Manufacturer Name / Address ..:	Sungshin Hasco, Ltd 65, Gongdan 7-ro, Jillyang-eup, Gyeongsan-si, Gyeongbuk-do, South Korea, 38465
- Rating(s) .....:	DC 6 V
Receipt of sample(s)	12 May 2020
Date of Test	29 Jun. 2020
Test Method(s)	FCC Part 15 Subpart B(Class B)
Test Results & Uncertainty	See EMC Results Conclusion
Issue date	07 Jul. 2020

Note 1. The results shown in this test report refer only to the sample(s) tested.

Note 2: This report shall not be reproduced except in full, without the written approval of Intertek.

Note 3: This laboratory is not accredited for the test results marked as *.

Tested by;

Name: Harry Jeon
EMC Engineer

Approved by;

Name: Rina Bae
EMC Technical Manager

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SECTION 2 EMC RESULTS CONCLUSION (WITH JUSTIFICATION)

We tested the Digital Manifold Gauge, Model: MDM008A, to determine if it was in compliance with the relevant US standard as marked on the test report.
We found that the unit met the requirement of FCC Part 15 Subpart B, ICES-003 Issue 6 standards when tested as received.

Test Items	Applied Standards	Results			
		Comply	Not Comply	N/A	See Note
Disturbance Voltage	FCC Part 15 Subpart B	☐	☐	☒	☐
Radiated disturbance (Below 1 GHz)	FCC Part 15 Subpart B	☒	☐	☐	☒
Radiated disturbance (Above 1 GHz)	FCC Part 15 Subpart B	☒	☐	☐	☒
Note 1) When determining the test conclusion, the Measurement Uncertainty of test has been considered.					

Measurement Uncertainty

Conducted Emission	150 kHz – 30 MHz	U = 3.3 [dB]
	(Confidence level approximately 95 %, k = 2)	
Radiated Emissions	9 kHz – 30 MHz	U = 4.5 [dB]
	30 MHz – 1 000 MHz	Horizontal: U = 4.3 [dB] Vertical: U = 4.5 [dB]
	1 GHz – 6 GHz	Horizontal: U = 5.6 [dB] Vertical: U = 5.4 [dB]
	6 GHz – 18 GHz	Horizontal: U = 5.8 [dB] Vertical: U = 5.8 [dB]
	(Confidence level approximately 95 %, k = 2)	

SECTION 3 TEST ENVIRONMENT AND CONDITIONS

Test Environment

Test Item	Test Site	Test date (MM-DD)	Temp (℃)	Humidity (% R.H.)	Pressure (kPa)
Disturbance Voltage	Shielded Room #2	-	-	-	-
Radiated disturbance (Below 1 GHz)	10 m chamber	06-29	23.2 ± 0.5	38.7 ± 0.5	
Radiated disturbance (Above 1 GHz)	10 m chamber	06-29	23.3 ± 0.5	38.8 ± 0.5	

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SECTION 4 EUT INFORMATION

Equipment Under Test (EUT):	Digital Manifold Gauge
Model:	MDM008A
Variant Model:	-
Serial No.:	-
Rated Voltage:	DC 6 V
Tested Voltage:	DC 6 V
Maximum clock frequency:	2 480 MHz
Variant model information:	-

SECTION 5 TEST CONFIGURATION, OPERATION MODE AND SET-UP

Test Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer	ETC.
Digital Manifold Gauge	MDM008A	-	Sungshin Hasco, Ltd	EUT
Temperature Sensor Clamp X 2	-	-	Sungshin Hasco, Ltd	EUT
Smart Phone	SM-G981N	R3CN5066PCV	Samsung Electronics Co., Ltd.	-

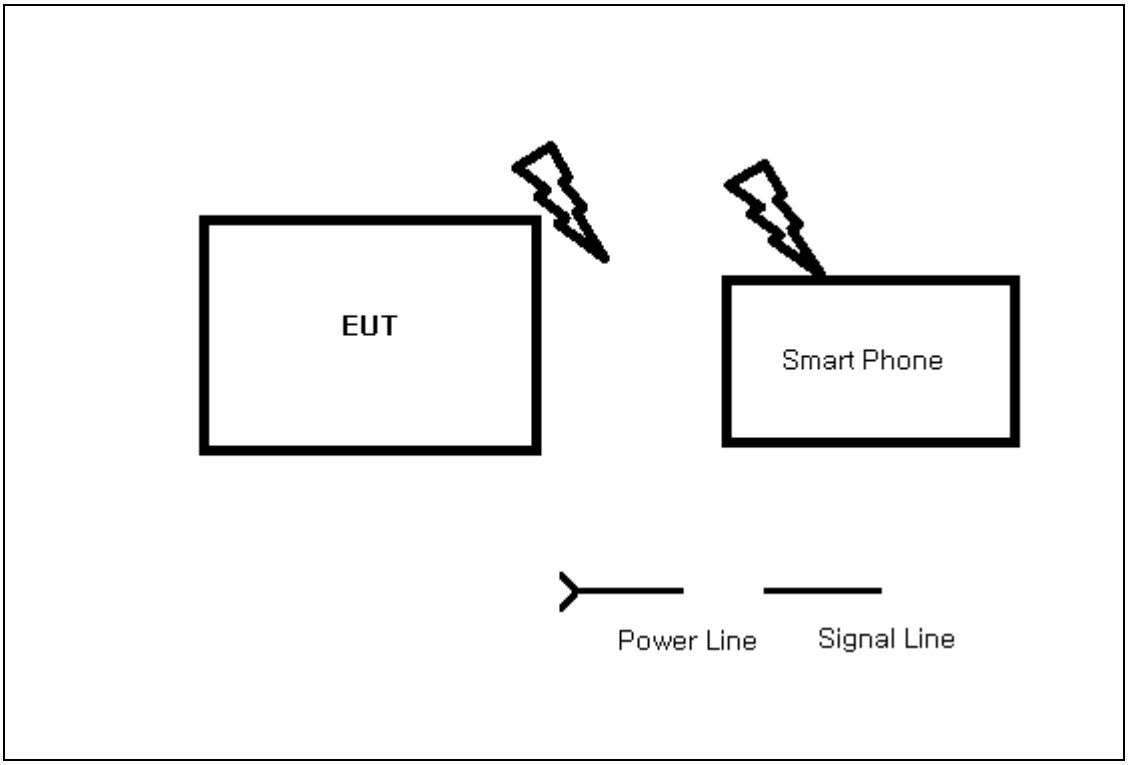
Used cable description

Start		END		CABLE		
Name	I/O Port	Name	I/O Port	Length (m)	Shield	With Ferrite
Digital Manifold Gauge (EUT)	K-TYPE X 2	Temperature Sensor Clamp X 2 (EUT)	K-TYPE	1.2	Unshielded	No
	-	Smart Phone	-	-	-	-

Test Operation Mode

- Operating Mode: A states that connect the smartphone and Bluetooth to run the “Microdam” app to check operation.

Test Setup



SECTION 6 EMISSION

Radiated disturbance test

Test Method and Summary

Test standard: FCC Part 15 Subpart B

Used Test Equipment

Control No.	Equipment	Manufacturer	Model No.	Serial No.	Next Cal.	Cal Int.
EMC002	EMI Test Receiver	R & S	ESU26	100590	2021.01.02	1Y
EMC025	Biconilog (Type7)	ETS-Lindgren	3142E	00203547	2021.02.25	2Y
EMC074	AMP	R & S	SCU-01D	1904843	2021.06.22	1Y

Operating Environment

Test Voltage: DC 6 V

Test Setup and Procedure

The EUT along with its peripherals were placed on a non-conducted table with a height of 0.8 m in height table above the reference ground plane.
Rotate the EUT from 0° to 360° and position the receiving antenna at heights from 1 m to 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 measurements above 1 GHz, place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal.
The final measurement antenna elevation shall be that which maximizes the emissions.

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Limits

- 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 (MHz)	Upper frequency of measurement range (MHz)
Below 108	1 000
108 – 500	2 000
500 – 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

(1) Limit for Radiated Emission below 1 000 MHz

Frequency range (MHz)	Class A Equipment (10 m distance) Quasi-peak (dBµV/m)	Class B Equipment (3 m distance) Quasi-peak (dBµV/m)
30 to 88	39.0	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.
Note 4) Result (dBµV/m) = Reading (dBµV) + Corr. (Ant. Factor (dB/m) + Cable Loss (dB) – Amp. Gain (dB))
Result: QuasiPeak, Reading: Receiver reading value, Corr.: Correction Factor
Margin = Limit – Result

Frequency range (MHz)	Class A Equipment (10 m distance) Quasi-peak (dBµV/m)	Class B Equipment (10 m distance) Quasi-peak (dBµV/m)
30 to 230	40	30
230 to 1 000	47	37

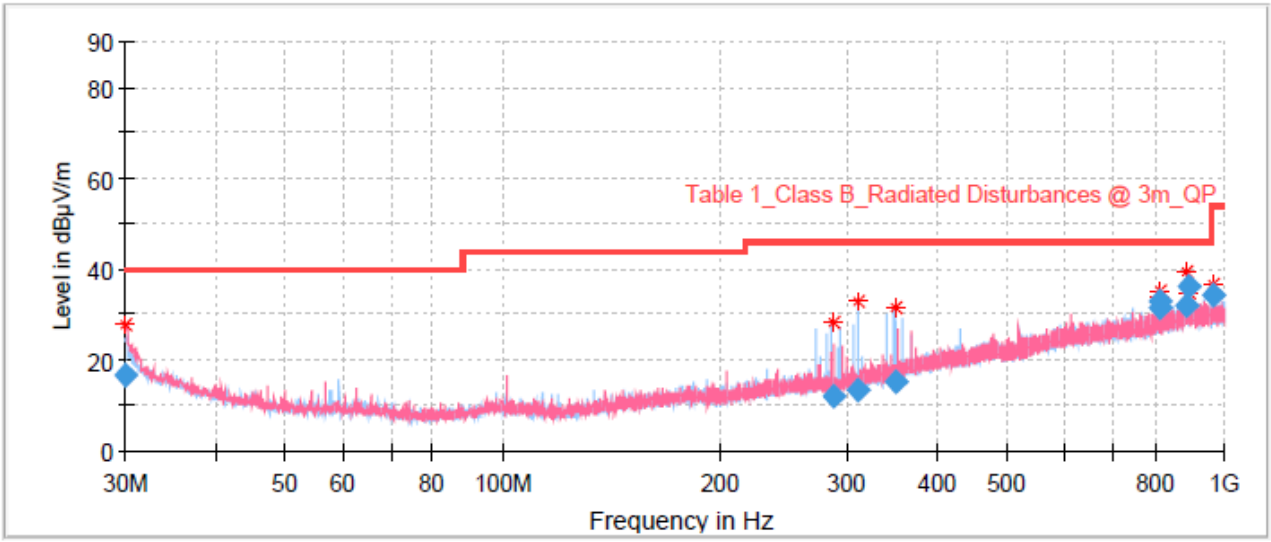
(2) Limits for Radiated Emission above 1 000 MHz at a measuring distance of 3 m

Frequency (GHz)	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) Result (dBµV/m) = Reading (dBµV) + Corr. (Ant. Factor (dB/m) + Cable Loss (dB) – Amp. Gain (dB))
Result: Final value, Reading: Receiver reading value, Corr.: Correction Factor
Margin = Limit – Result
Note 2) If measured at a distance other than 3 m, apply the following formula to compensate the measured value.
Em = Edm + 20*log(d/3) (d: Measured distance)
Em: Result of measured distance correction, Edm: Measured value

Test Data

[1 GHz Below]



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.03	16.50	40.00	23.50	105.0	V	164.00	-5.82
286.43	12.19	46.00	33.81	300.0	H	228.00	-8.01
310.74	13.40	46.00	32.60	100.0	H	29.00	-7.15
349.58	15.32	46.00	30.68	100.0	H	68.00	-5.27
811.88	32.79	46.00	13.21	290.0	H	3.00	4.74
813.32	31.70	46.00	14.30	105.0	V	0.00	4.79
888.44	32.21	46.00	13.79	194.0	H	145.00	6.34
892.52	36.30	46.00	9.70	400.0	H	0.00	6.40
964.26	34.14	54.00	19.86	390.0	H	149.00	6.65

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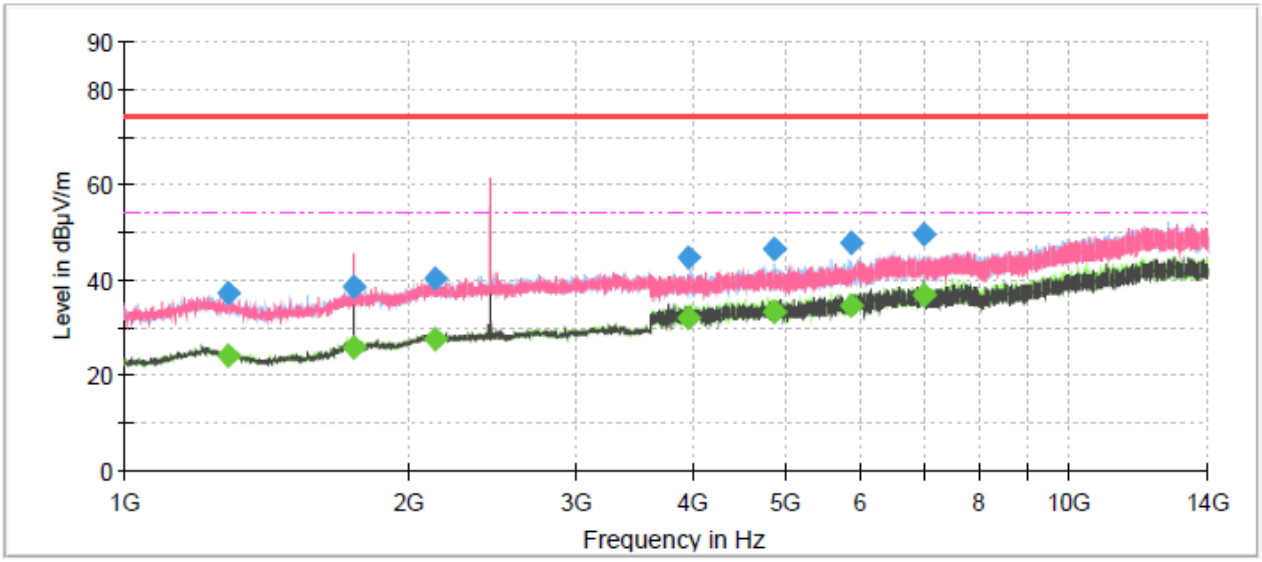
[1 GHz Above]

Result of measured distance correction 3.6 m



Frequency [MHz]	MaxPeak [dB(uV)/m]	CAverage [dB(uV)/m]	Limit [dB(uV/m)]	Margin [dB]	Height [cm]	Pol.	Azimuth [deg]	Corr. [dB]
1289.48	38.99		74.00	35.01	100.0	H	160.0	-2.6
1289.48		25.69	54.00	28.31	100.0	H	160.0	-2.6
1747.78	40.34		74.00	33.66	225.0	V	333.0	-1.6
1747.78		27.45	54.00	26.55	225.0	V	333.0	-1.6
2125.57	41.78		74.00	32.22	110.0	H	146.0	0.8
2125.57		29.11	54.00	24.89	110.0	H	146.0	0.8
3953.87		33.73	54.00	20.27	111.0	V	188.0	3.8
3953.87	46.47		74.00	27.53	111.0	V	188.0	3.8
4865.38	47.92		74.00	26.08	111.0	H	83.0	4.9
4865.38		34.95	54.00	19.05	111.0	H	83.0	4.9
5872.58		36.39	54.00	17.61	225.0	H	26.0	6.7
5872.58	49.25		74.00	24.75	225.0	H	26.0	6.7
7010.25		38.41	54.00	15.59	111.0	V	238.0	9.1
7010.25	51.24		74.00	22.76	111.0	V	238.0	9.1

* The 2.4 GHz band is the EUT's radio operating frequency.

Disturbance Voltage test

Test Method and Summary

Test standard : FCC Part 15 Subpart B

Used Test Equipment

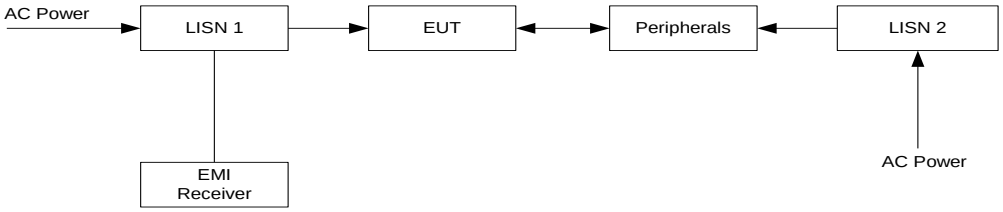
Control No.	Equipment	Manufacturer	Model No.	Serial No.	Next Cal.	Cal Int.
EMC004	EMI Test Receiver	R & S	ESR7	101560	2021.01.02	1Y
EMC007	Two-Line V-Network	R & S	ENV216	101982	2020.10.15	1Y

Operating Environment

Test Voltage: -

Test Setup and Procedure

Disturbance Voltage Test at Mains Terminal:



The EUT along with its peripherals were placed on a 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 m space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50 characteristic coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. The excess power cable between the EUT and the LISN was bundled.

Limits

Frequency range (MHz)	Limits dB(µV)			
	Quasi-peak		Average	
	Class A	Class B	Class A	Class B
0.15 to 0.50	79	66 to 56	66	56 to 46
0.50 to 5	73	56	60	46
5 to 30		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 (0.15 ~ 0.5) MHz.
Note 3) Result (dBµV) = Reading (dBµV) + Corr. (Insertion Loss (dB) + Cable Loss (dB))
Result: QuasiPeak/CAverage, Reading: Receiver reading value, Corr.: Correction Factor
Margin = Limit – Result

Test Data

N/A

SECTION 7 APPENDIX I

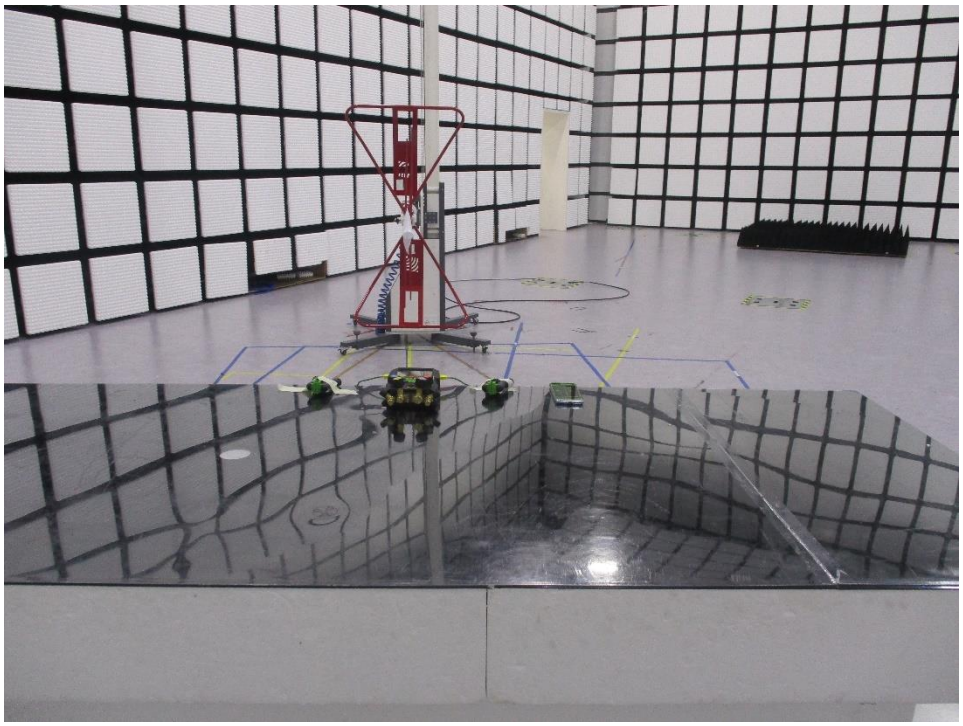
Photographs of Test Configurations

N/A

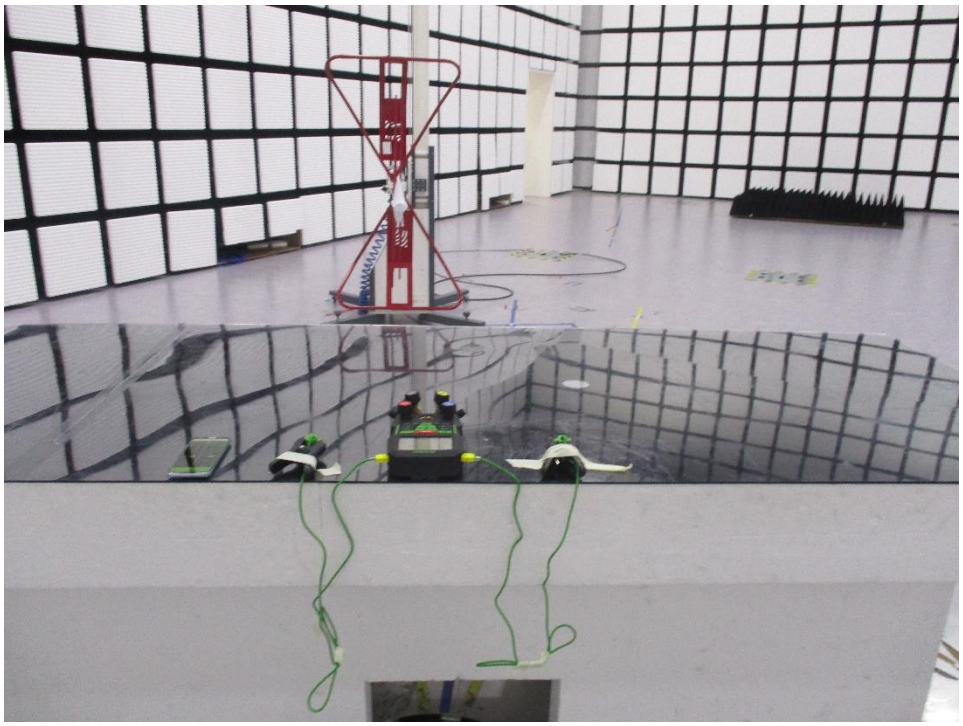
Disturbance Voltage Test

N/A

Disturbance Voltage Test

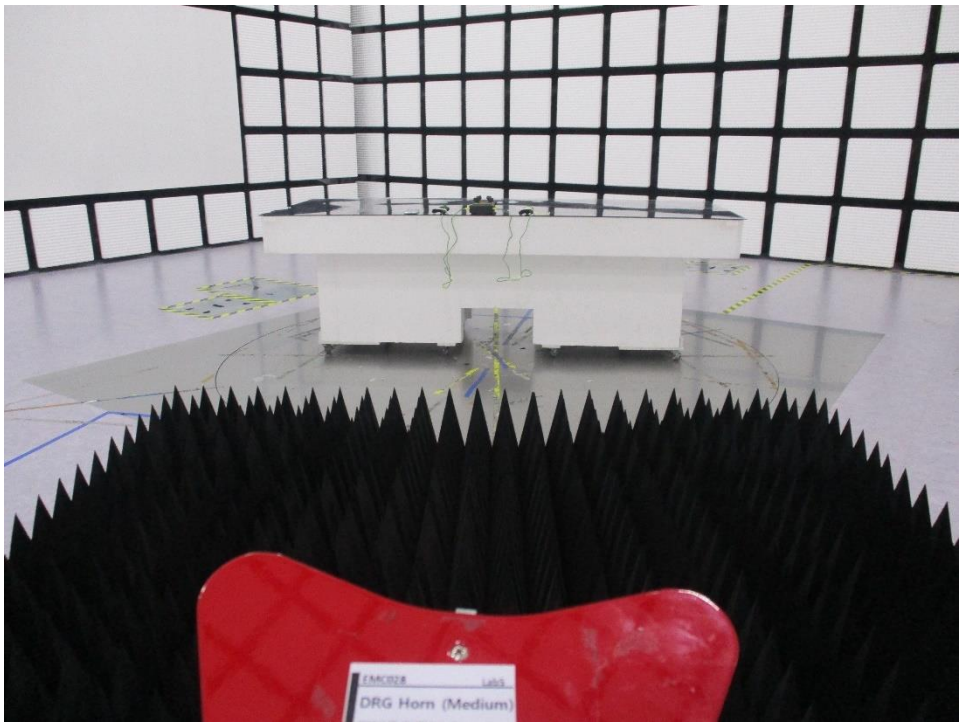


Radiated disturbance (30 MHz ~ 1 GHz)



Radiated disturbance (30 MHz ~ 1 GHz)

Radiated disturbance (Above 1 GHz)



Radiated disturbance (Above 1 GHz)

SECTION 8 APPENDIX II

Photographs of EUT

Front

Rear

Temperature Sensor Clamp

- E N D -