



Test Report

Date : 2017-10-06

No. : HM170913

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Applicant: Gatekeeper System (HK) Ltd.
36/F, Tower 2, Times Square, 1 Matheson Street, Causeway Bay,
Hong Kong

Manufacturer: Gatekeeper System (HK) Ltd.
36/F, Tower 2, Times Square, 1 Matheson Street, Causeway Bay,
Hong Kong

Description of Sample(s): Product: Long Range Transmitter 2
Brand Name: Gatekeeper Systems
Model Number: D-9670A
FCC ID: W3Z-D9670A

Date Sample(s) Received: 2017-08-22

Date Tested: 2017-09-04 to 2017-09-06

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2016 and ANSI C63.10:2013 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): ---


CHEUNG Chi, Kenneth
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.



The Hong Kong Standards and Testing Centre Limited

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1.0 General Details

1.1 Equipment Under Test [EUT] Description of Sample(s)

Product: Long Range Transmitter 2
Manufacturer: Gatekeeper System (HK) Ltd.
36/F, Tower 2, Times Square, 1 Matheson Street, Causeway Bay, Hong Kong
Brand Name: Gatekeeper Systems
Model Number: D-9670A
Rating: 3.3Vd.c.
The AC Adaptor used for the tests was provided by the applicant with the following details: Model KTP505-03315U-V1 Input: 100-240Va.c. 50-60Hz. 0.19 MAX Output: 3.3Vd.c. 1.5A 4.95W MAX

1.2 Description of EUT Operation

The Equipment Under Test (EUT) is a Long Range Transmitter 2 of Gatekeeper System (HK) Ltd., which is 2.4GHz transceiver.
The D-9670A Operational mode transmissions are modulated at 500kbps MSK (Minimum Shift Keying), with a deviation of 19 kHz (Carson's rule bandwidth about 80 kHz). The EUT will transmit RF signal after receive a 20kbps FSK RF signal from companion devices.
The EUT was tested under test mode which was set in maximum output power (RF output Power 9 = 0 dBm) and transmit continuously.

1.3 Date of Order

2017-08-22

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2017-09-04 to 2017-09-06

1.6 Country of Origin

China

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2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2016 Regulations and ANSI C63.10:2013 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary					
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result	
				Pass	Fail
Field Strength of Fundamental & Harmonics Emissions	FCC 47CFR 15.249	ANSI C63.10:2013	N/A	☒	☐
AC power-line conducted emissions	FCC 47CFR 15.207	ANSI C63.10:2013	N/A	☒	☐
Radiated Emissions	FCC 47CFR 15.209	ANSI C63.10:2013	N/A	☒	☐

Note: N/A - Not Applicable

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3.0 Test Results

3.1 Emission

3.1.1 Field Strength of Fundamental & Harmonics Emissions

Test Requirement:	FCC 47CFR 15.249
Test Method:	ANSI C63.10:2013
Test Date:	2017-09-04
Mode of Operation:	On Mode

Test Method:

For emission measurements at or below 1 GHz, the sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. For emission measurements above 1 GHz, the sample was placed 1.5m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. In the frequency range of 9kHz to 30MHz, The center of the loop antenna shall be 1 meter above the ground and rotated loop axis for maximum reading. The emissions worst-case are shown in Test Results of the following pages.

Remark: 3 orthogonal axis apply to hand-held device only.

*: Semi-anechoic chamber located on the G/F of The Hong Kong Standards and Testing Centre Ltd. with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Designation Number: HK0001.

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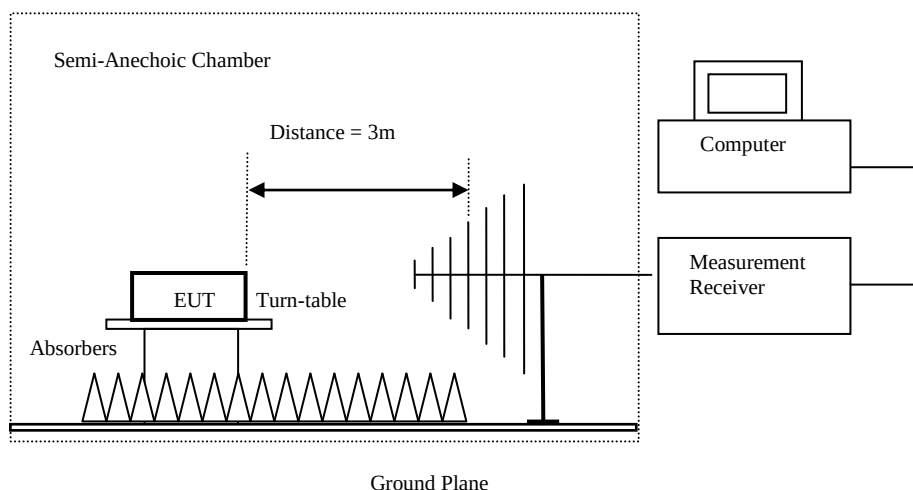
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Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)	RBW: 10kHz
	VBW: 30kHz
	Sweep: Auto
	Span: Fully capture the emissions being measured
	Trace: Max. hold
30MHz – 1GHz (QP)	RBW: 120kHz
	VBW: 120kHz
	Sweep: Auto
	Span: Fully capture the emissions being measured
	Trace: Max. hold
Above 1GHz (Pk & Av)	RBW: 3MHz
	VBW: 3MHz
	Sweep: Auto
	Span: Fully capture the emissions being measured
	Trace: Max. hold

Test Setup:



Absorbers placed on top of the ground plane are for measurements above 1000MHz only.

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Limits for Field Strength of Fundamental & Harmonics Emissions [FCC 47CFR 15.249]:

Fundamental frequency [MHz]	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

Result of TX mode (Lowest Channel), (Above 1GHz): Pass

Field Strength of Fundamental and Harmonics Emissions Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2403.2	55.7	27.9	83.6	15,135.6	500,000	Vertical
* 4806.4	16.3	32.1	48.4	263.0	5,000	Vertical
7209.5	3.1	38.6	41.7	121.6	5,000	Vertical
9612.8	Emissions detected are more than 20 dB below the FCC Limits				5,000	Vertical
* 12016.0					5,000	Vertical
14419.2					5,000	Vertical
16822.4					5,000	Vertical
* 19225.6					5,000	Vertical
21628.8					5,000	Vertical
24032.0					5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2403.2	36.5	27.9	64.4	1,659.6	50,000	Vertical
* 4806.4	2.1	32.1	34.2	51.3	500	Vertical
7209.5	-1.0	38.6	37.6	75.9	500	Vertical
9612.8	Emissions detected are more than 20 dB below the FCC Limits				500	Vertical
* 12016.0					500	Vertical
14419.2					500	Vertical
16822.4					500	Vertical
* 19225.6					500	Vertical
21628.8					500	Vertical
24032.0					500	Vertical

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Result of TX mode (Middle Channel), (Above 1GHz): Pass

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2441.2	55.8	27.9	83.7	15,310.9	500,000	Vertical
* 4882.3	16.3	32.1	48.4	263.0	5,000	Vertical
* 7323.5	3.1	38.6	41.7	121.6	5,000	Vertical
9764.8	Emissions detected are more than 20 dB below the FCC Limits				5,000	Vertical
* 12206.0					5,000	Vertical
14647.2					5,000	Vertical
17088.4					5,000	Vertical
* 19529.6					5,000	Vertical
21970.8					5,000	Vertical
24412.0					5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2441.2	46.3	27.9	74.2	5,128.6	50,000	Vertical
* 4882.3	1.8	32.1	33.9	49.5	500	Vertical
* 7323.5	-0.5	38.6	38.1	80.4	500	Vertical
9764.8	Emissions detected are more than 20 dB below the FCC Limits				500	Vertical
* 12206.0					500	Vertical
14647.2					500	Vertical
17088.4					500	Vertical
* 19529.6					500	Vertical
21970.8					500	Vertical
24412.0					500	Vertical

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Result of TX mode (Highest Channel), (Above 1GHz): Pass

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2476.1	56.7	27.9	84.6	16,982.4	500,000	Vertical
* 4952.1	17.1	32.1	49.2	288.4	5,000	Vertical
* 7428.1	3.3	38.6	41.9	124.5	5,000	Vertical
9904.4	Emissions detected are more than 20 dB below the FCC Limits				5,000	Vertical
* 12380.5					5,000	Vertical
14856.6					5,000	Vertical
17332.7					5,000	Vertical
* 19808.8					5,000	Vertical
22284.9					5,000	Vertical
24761.0					5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2476.1	36.1	27.9	64.0	1,584.9	50,000	Vertical
* 4952.1	0.2	32.1	32.3	41.2	500	Vertical
* 7428.1	-0.7	38.6	37.9	78.5	500	Vertical
9904.4	Emissions detected are more than 20 dB below the FCC Limits				500	Vertical
* 12380.5					500	Vertical
14856.6					500	Vertical
17332.7					500	Vertical
* 19808.8					500	Vertical
22284.9					500	Vertical
24761.0					500	Vertical

Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz

*: Denotes restricted band of operation.

Measurements were made using a peak detector. Any emission less than 1000 MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Calculated measurement uncertainty : 9kHz to 30MHz 2.4dB
30MHz to 18GHz 5.0dB

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3.1.2 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement: FCC 47CFR 15.207

Test Method: ANSI C63.10:2013

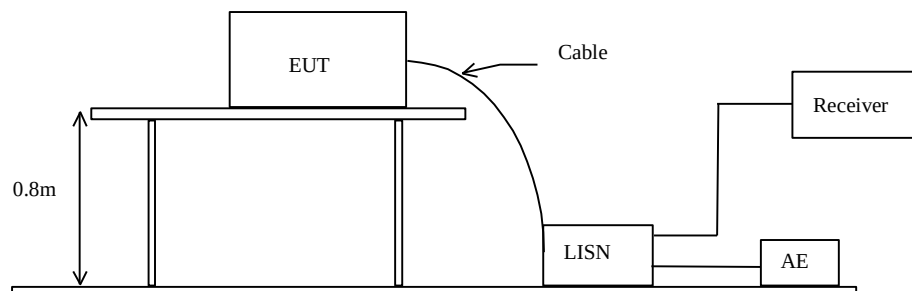
Test Date: 2017-09-04

Mode of Operation: Tx mode

Test Method:

The test was performed in accordance with ANSI C63.10:2013, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



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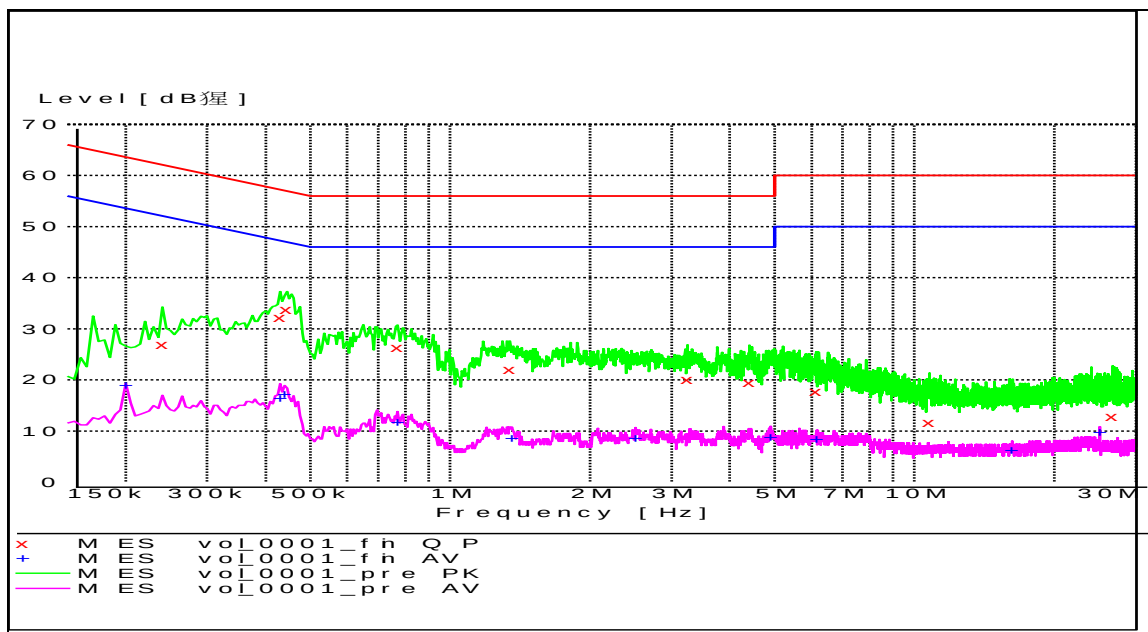
Limit for Conducted Emissions (FCC 47CFR 15.207):

Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of Tx mode – Live and Neutral: PASS



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MEASUREMENT RESULT: "vol_0001_fin QP"

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.240000	26.90	9.9	62	35.2	N	GND
0.430000	32.30	10.0	57	24.9	N	GND
0.445000	33.80	10.0	57	23.2	N	GND
0.770000	26.40	9.9	56	29.6	N	GND
1.345000	22.00	9.9	56	34.0	N	GND
3.245000	20.10	10.4	56	35.9	N	GND
4.420000	19.40	10.5	56	36.6	N	GND
6.145000	17.70	10.6	60	42.3	N	GND
10.770000	11.70	10.4	60	48.3	N	GND
26.680000	12.80	10.7	60	47.2	N	GND

MEASUREMENT RESULT: "vol_0001_fin AV"

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.200000	18.90	9.9	54	34.7	N	GND
0.430000	16.40	10.0	47	30.8	N	GND
0.440000	17.20	10.0	47	29.9	N	GND
0.770000	11.70	9.9	46	34.3	N	GND
1.360000	8.50	9.9	46	37.5	N	GND
2.505000	8.60	10.3	46	37.4	N	GND
4.910000	8.80	10.5	46	37.2	N	GND
6.160000	8.30	10.6	50	41.7	N	GND
16.230000	6.20	10.7	50	43.8	N	GND
25.060000	9.70	10.8	50	40.3	N	GND

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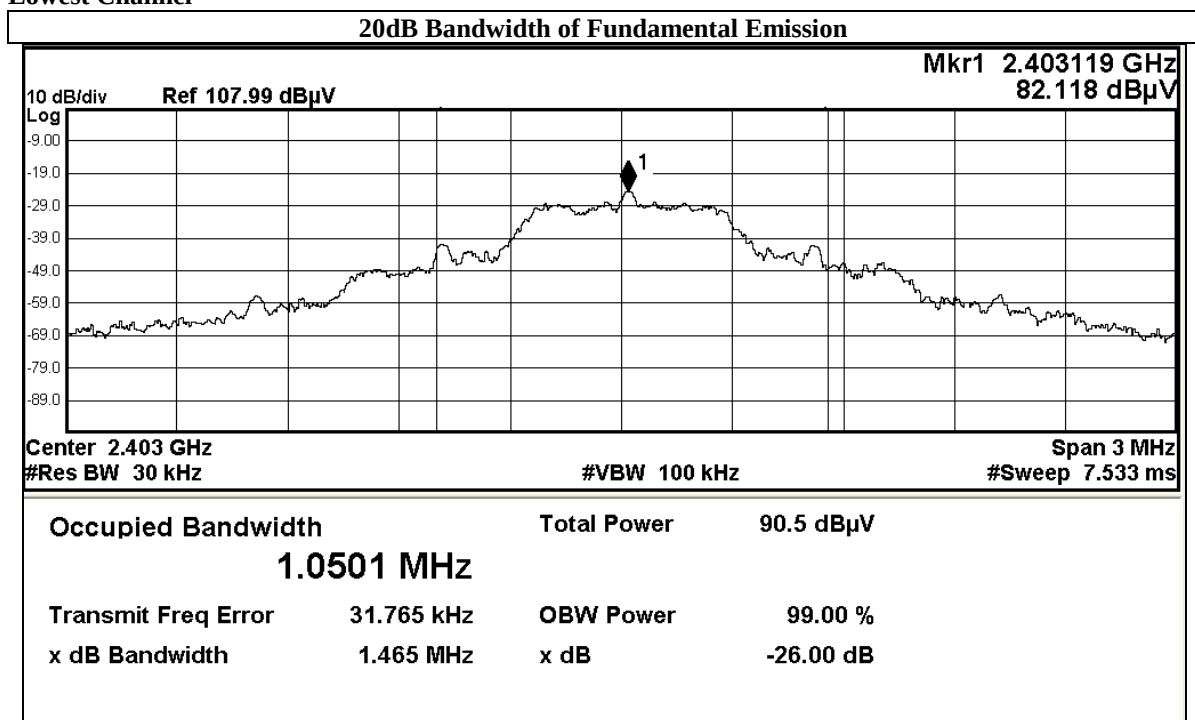
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Limits for 20dB Bandwidth of Fundamental Emission:

Frequency Range [MHz]	20dB Bandwidth [MHz]
2403.2	1.465

Lowest Channel



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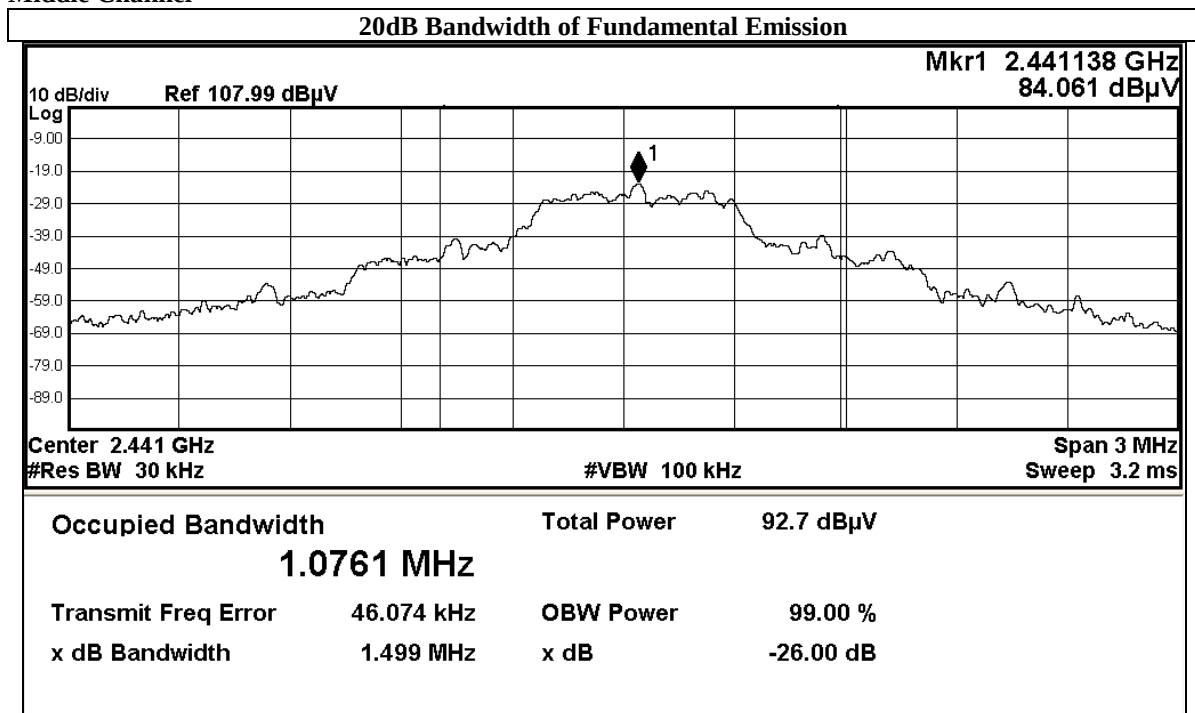
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Frequency Range [MHz]	20dB Bandwidth [MHz]
2441.2	1.499

Middle Channel



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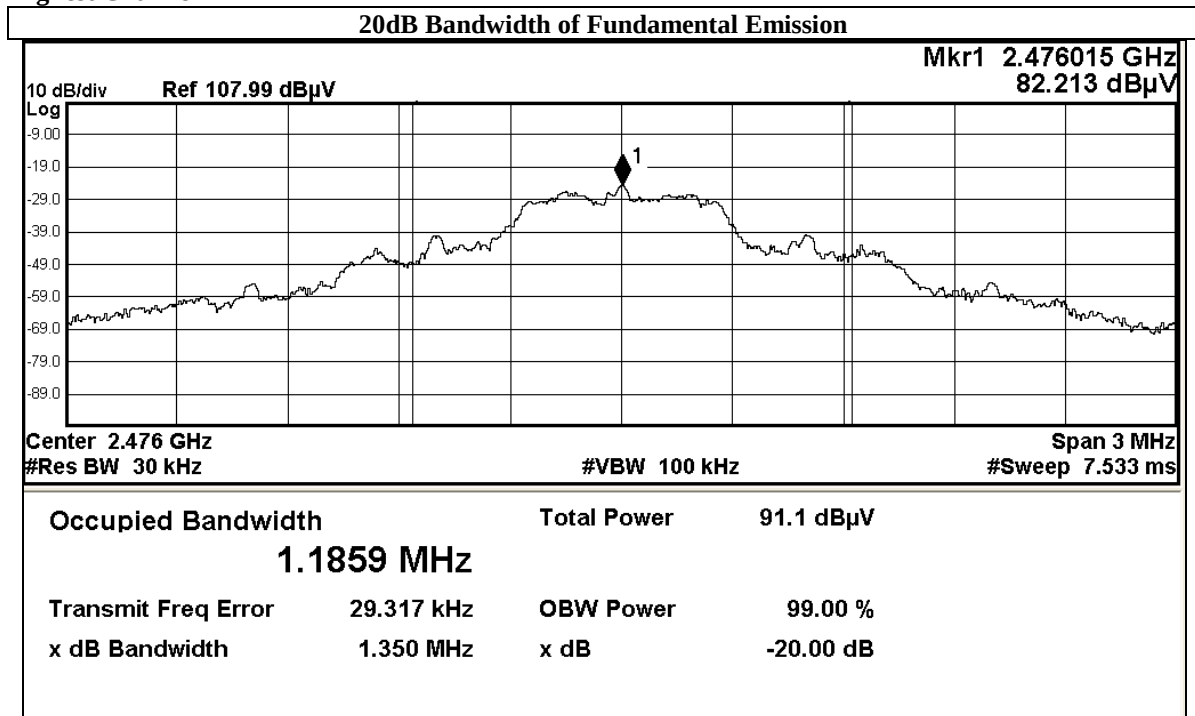
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Frequency Range [MHz]	20dB Bandwidth [MHz]
2476.0	1.350

Highest Channel



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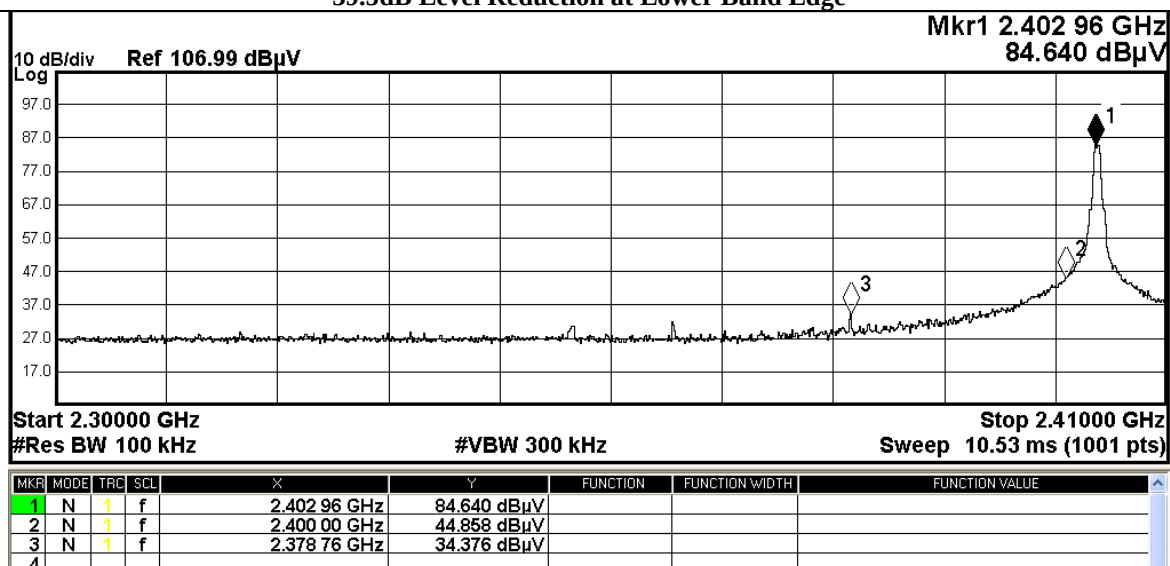
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Band Edge Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
TX mode – Lowest Fundamental	39.8

39.5dB Level Reduction at Lower Band Edge



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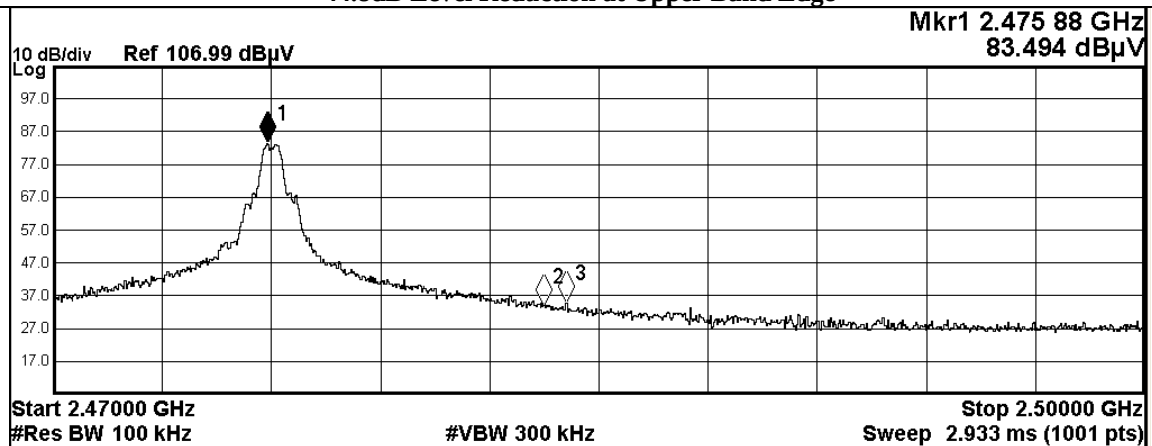
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Band Edge Measurement:

Frequency Range [MHz]	Radiated Emission Attenuated below the Fundamental [dB]
TX mode – Highest Fundamental	49.5

44.8dB Level Reduction at Upper Band Edge



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	f	f	2.475 88 GHz	83.494 dBμV			
2	N	f	f	2.483 50 GHz	33.989 dBμV			
3	N	f	f	2.484 10 GHz	34.814 dBμV			
4								

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Limits for Radiated Emissions [FCC 47 CFR 15.209]:

Frequency Range [MHz]	Quasi-Peak Limits [μV/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result of On mode, (9kHz – 30MHz): PASS

Emissions detected are more than 20 dB below the FCC Limits

Result of On mode, (30MHz – 1GHz): PASS

Field Strength of Fundamental and Harmonics Emissions Quasi-Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
90.3	0.4	9.2	9.6	3.0	100	Horizontal
110.3	0.3	10.3	10.6	3.4	150	Horizontal
223.4	0.5	14.0	14.5	5.3	150	Horizontal
261.3	1.1	15.7	16.8	6.9	200	Horizontal
340.8	1.5	18.6	20.1	10.1	200	Horizontal
423.5	1.5	21.1	22.6	13.5	200	Horizontal

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Result of On mode (TX mode, Band-edge measurement), (1GHz – 18GHz): PASS

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2399.1	20.7	27.9	48.6	269.2	5,000	Vertical
2484.6	18.3	28.0	46.3	206.5	5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2399.1	9.1	27.9	37.0	70.8	500	Vertical
2484.6	10.1	28.0	38.1	80.4	500	Vertical

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Result of Receiver mode, (9kHz – 30MHz): PASS

Emissions detected are more than 20 dB below the Limits

Result of Receiver mode, (30MHz – 1GHz): PASS

Emissions detected are more than 20 dB below the Limits

Result of Receiver mode, (1GHz – 18GHz): PASS

Field Strength of Fundamental and Harmonics Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2441.2	5.3	27.9	33.2	45.7	5,000	Vertical

Field Strength of Fundamental and Harmonics Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2441.2	2.3	27.9	30.2	32.4	500	Vertical

Remarks:

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz
Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty : 30MHz to 18GHz 5.0dB

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Appendix A

LIST OF MEASUREMENT EQUIPMENT

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM215	MULTIDevice CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURN TABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2017/04/24	2018/04/24
EM355	BICONILOG ANTENNA	ETS-LINDGREN	3143B	00094856	2016/03/03	2018/03/03
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2017/06/01	2018/06/01
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2016/04/27	2018/04/27
EM302	PRECISION OMNIDIRECTIONAL DIPOLE (1 – 6GHZ)	SEIBERSDORF LABORATORIES	POD 16	161806/L	2016/05/11	2018/05/11
EM303	PRECISION OMNIDIRECTIONAL DIPOLE (6 – 18GHZ)	SEIBERSDORF LABORATORIES	POD 618	6181908/L	2016/05/11	2018/05/11

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM232	LISN	SCHAFFNER	NNB41	04/100082	2017/03/03	2018/03/03
EM145	EMI TEST RECEIVER	R & S	ESCS 30	830245/021	2017/06/01	2018/06/01
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2017/01/11	2018/01/11
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057- 99A	2017/02/03	2022/02/03

Remarks:

CM Corrective Maintenance

N/A Not Applicable or Not Available

TBD To Be Determined

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Appendix B

Photographs of EUT

Front View of the product



Rear View of the product



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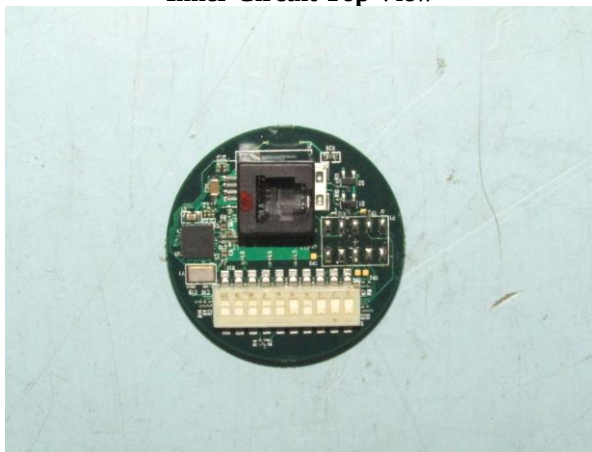
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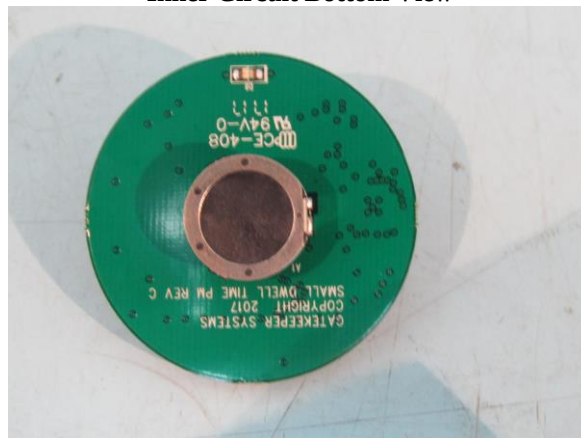
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Photographs of EUT

Inner Circuit Top View



Inner Circuit Bottom View



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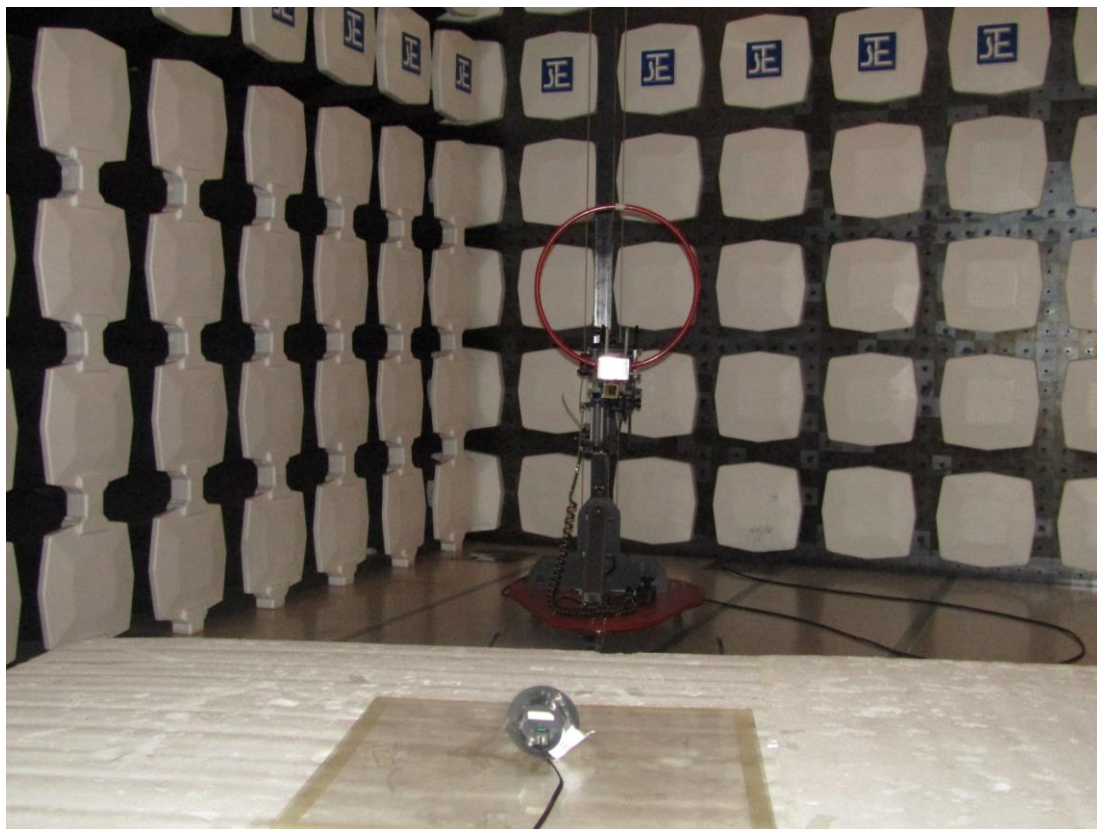
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Photographs of EUT

Measurement of Radiated Emission Test Set Up (9kHz to 30MHz)



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Photographs of EUT

Measurement of Radiated Emission Test Set Up (30MHz to 1000MHz)



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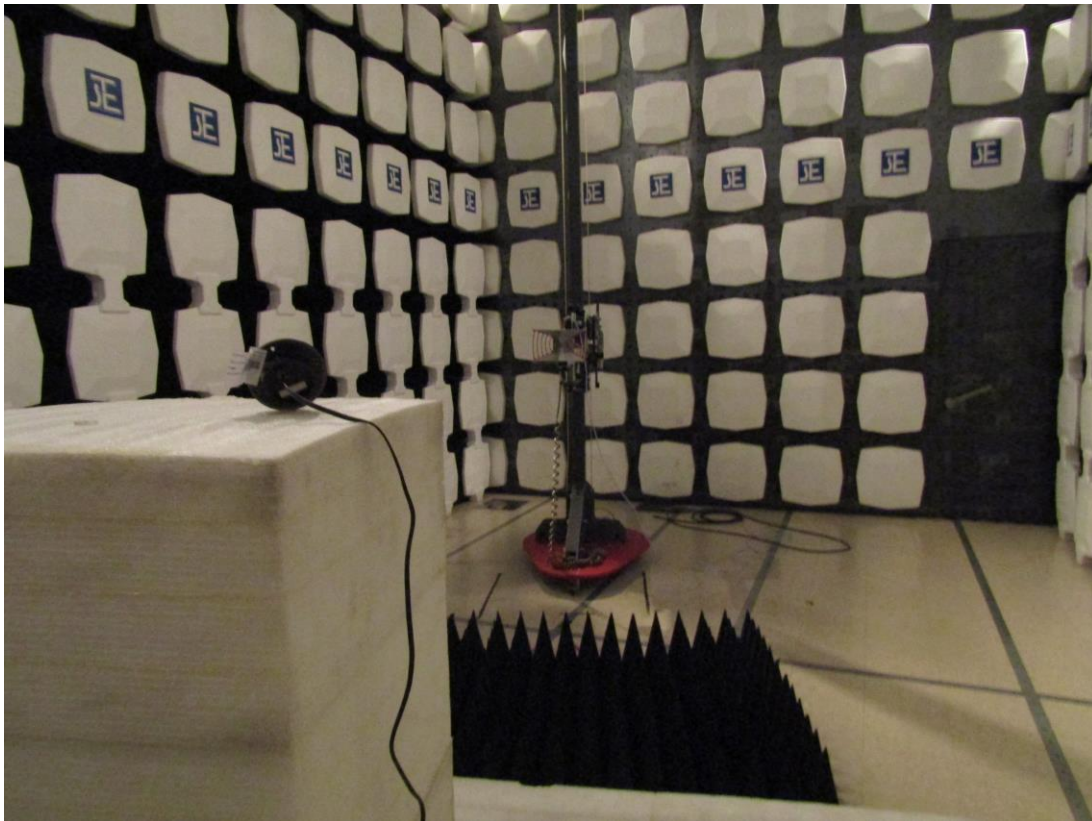
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Photographs of EUT

Measurement of Radiated Emission Test Set Up (Above 1000MHz)



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