

FCC Part 15B

Measurement and Test Report

For

NumWorks SAS

Romain Goyet 24 rue Godot de Moroy, 75009, Paris France

FCC ID: 2ALWP-N0110

FCC Rule(s):	<u>FCC Part 15 Subpart B</u>
Product Description:	<u>Numworks Graphing Calculator</u>
Tested Model:	<u>N0110</u>
Report No.:	<u>WTX19X05030862W</u>
Sample Receipt Date:	<u>2019-05-16</u>
Tested Date:	<u>2019-05-16 to 2019-06-25</u>
Issued Date:	<u>2019-06-25</u>
Tested By:	<u>Mike Shi / Engineer</u> <i>Mike Shi</i>
Reviewed By:	<u>Silin Chen / EMC Manager</u> <i>Silin Chen</i>
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM Test Technology Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: NumWorks SAS
Address of applicant: Romain Goyet 24 rue Godot de Moroy, 75009, Paris
France

Manufacturer: NumWorks SAS
Address of manufacturer: Romain Goyet 24 rue Godot de Moroy, 75009, Paris
France

General Description of EUT	
Product Name:	Numworks Graphing Calculator
Trade Name:	Numworks
Model No.:	N0110
Adding Model(s):	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Rated Voltage:	DC 5V; DC 3.7V by Battery
Rated Capacity:	1450mAh
Rated Power:	5.365Wh
Power Adapter Model:	/
Highest Internal Frequency:	192MHz
Classification of ITE:	Class B

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15 Subpart B:Unintentional Radiators.

ANSI C63.4-2014:American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Operation Mode

The equipment under test (EUT) was configured to measure its highest possible emission. The test modes were adapted according to the operation manual for use, more detailed description as follows:

Test Mode List:

Test Mode	Description	Remark	Power Supply Mode
TM1	Working and charging	Micro usb connect Adapter	DC 5V(Input with adapter AC 120V/60Hz)
TM2	Connect to PC update	Micro usb connect PC	/

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
Micro USB	1.2	Shielded	Without Core

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
Adapter	/	HJ-0501000	/

Special Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Conducted Emissions	Conducted	9-150kHz ± 3.74 dB
		0.15-30MHz ± 3.34 dB
Radiated Emissions	Radiated	30-200MHz ± 4.52 dB
		0.2-1GHz ± 5.56 dB
		1-6GHz ± 3.84 dB
		6-18GHz ± 3.92 dB

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
Spectrum Analyzer	Agilent	E4407B	MY41440400	2019-04-30	2020-04-29
Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2019-04-30	2020-04-29
EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2019-04-30	2020-04-29
Amplifier	Agilent	8447F	3113A06717	2019-04-30	2020-04-29
Amplifier	C&D	PAP-1G18	2002	2019-04-30	2020-04-29
Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2019-04-30	2020-04-29
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2019-04-30	2020-04-29
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2019-04-30	2020-04-29

2. SUMMARY OF TEST RESULTS

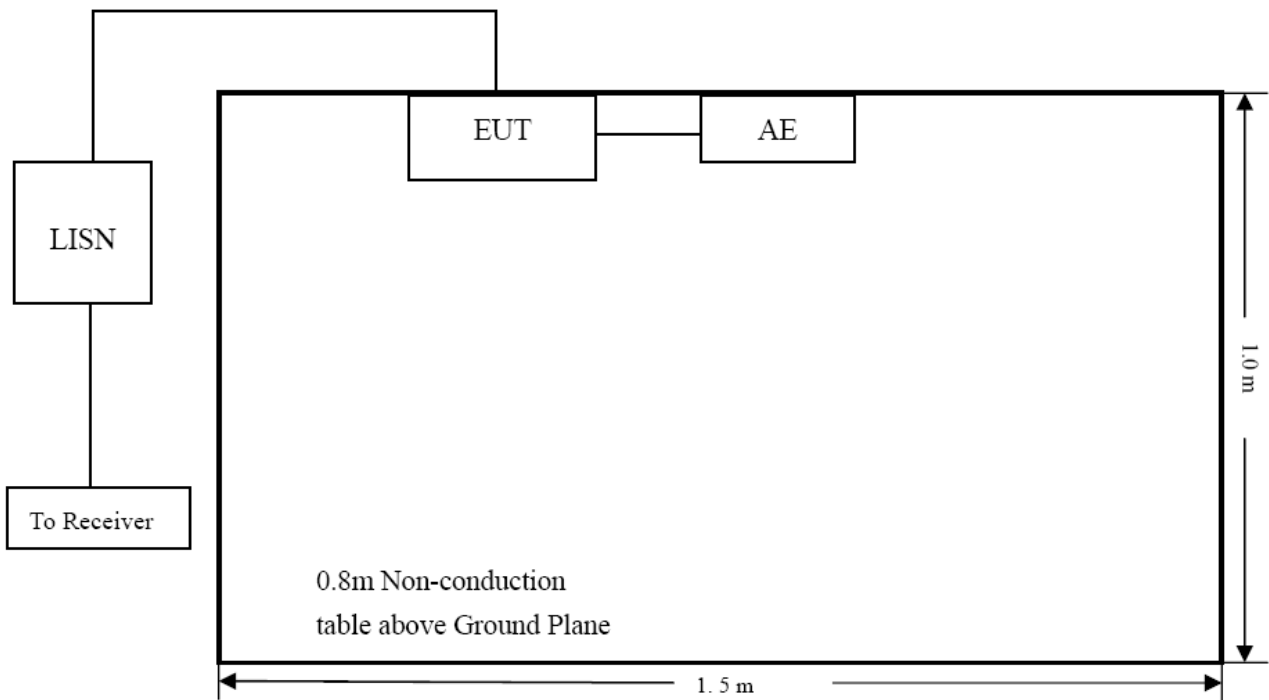
Description of Test	Result
§15.107(a) Conducted Emission	Compliant
§15.109(a) Radiated Emission	Compliant

3. Conducted Emissions

3.1 Test Procedure

Test is conducting under the description of ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

3.2 Basic Test Setup Block Diagram



3.3 Environmental Conditions

Temperature:	26 °C
Relative Humidity:	60%
ATM Pressure:	1011 mbar

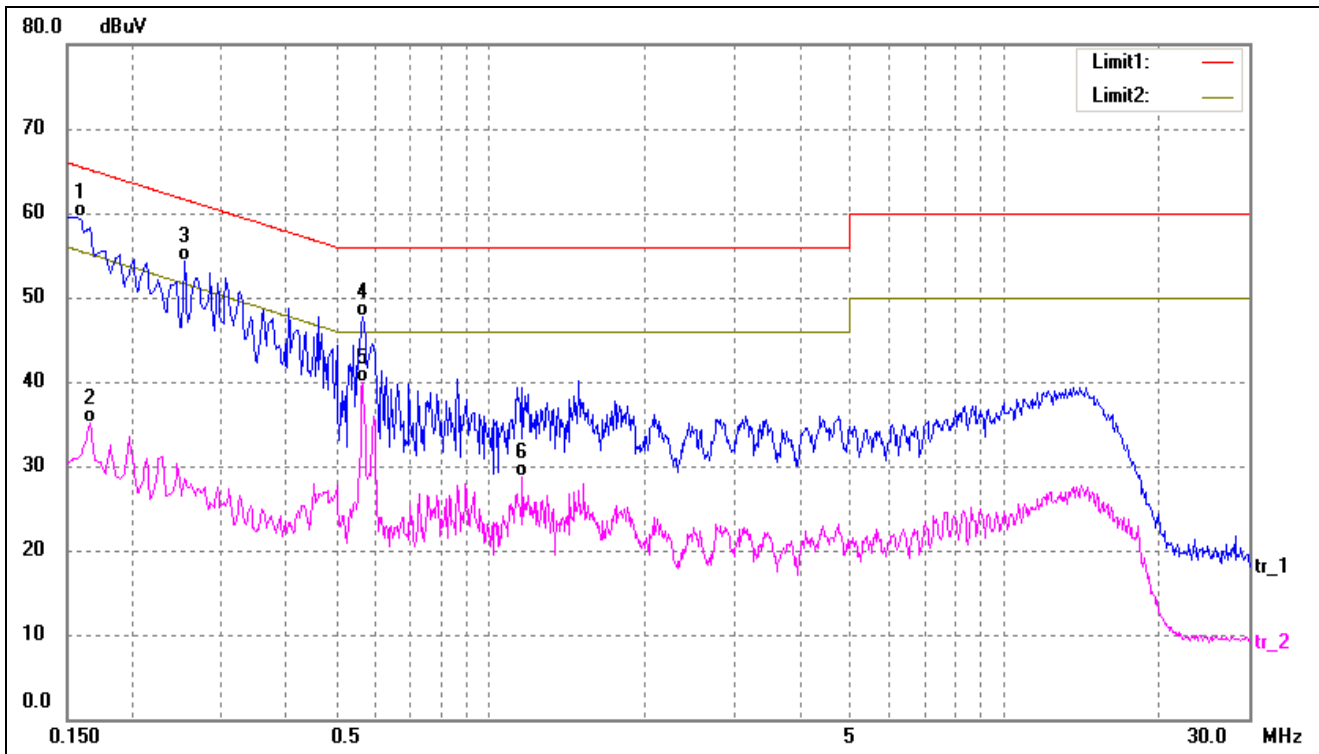
3.4 Summary of Test Results/Plots

According to the data in section 3.5, the EUT complied with the FCC Part 15.107(a) conducted margin for a Class B device, with the *worst* margin reading of:

-6.04 dB at 0.1580 MHz in the Line, QP detector, 0.15-30 MHz

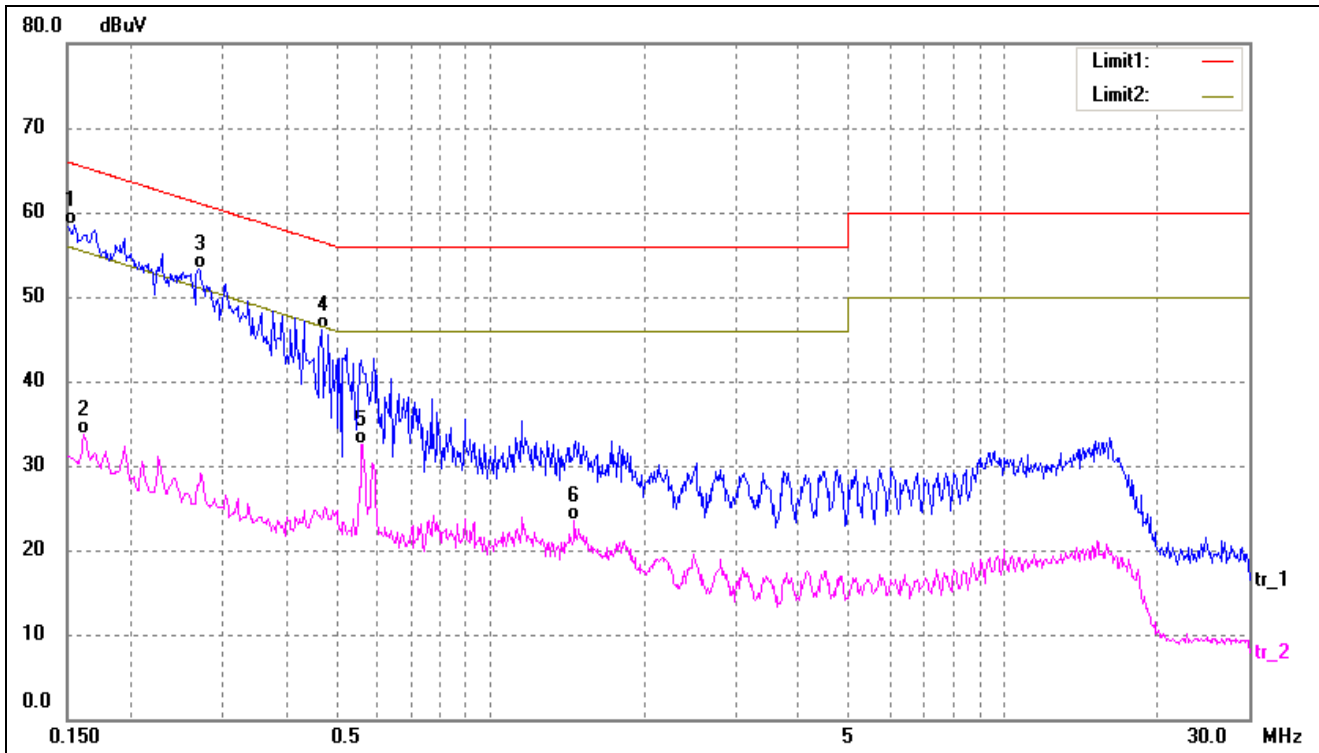
3.5 Conducted Emissions Test Data

Test mode:	TM1	Polarity:	Line
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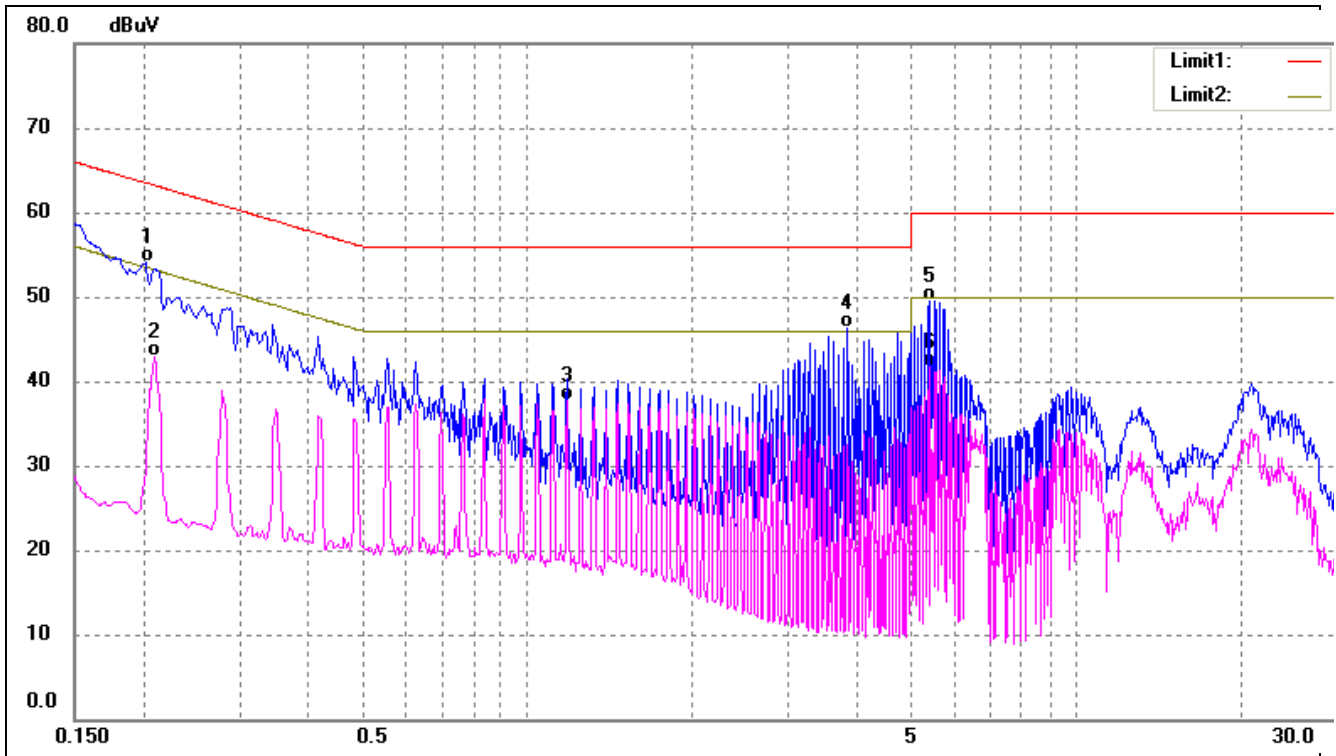
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1580	49.43	10.10	59.53	65.57	-6.04	QP
2	0.1660	25.01	10.11	35.12	55.16	-20.04	AVG
3	0.2540	44.24	10.16	54.40	61.63	-7.23	QP
4	0.5660	37.47	10.32	47.79	56.00	-8.21	QP
5	0.5660	29.51	10.32	39.83	46.00	-6.17	AVG
6	1.1580	18.11	10.52	28.63	46.00	-17.37	AVG

Test mode:	TM1	Polarity:	Neutral
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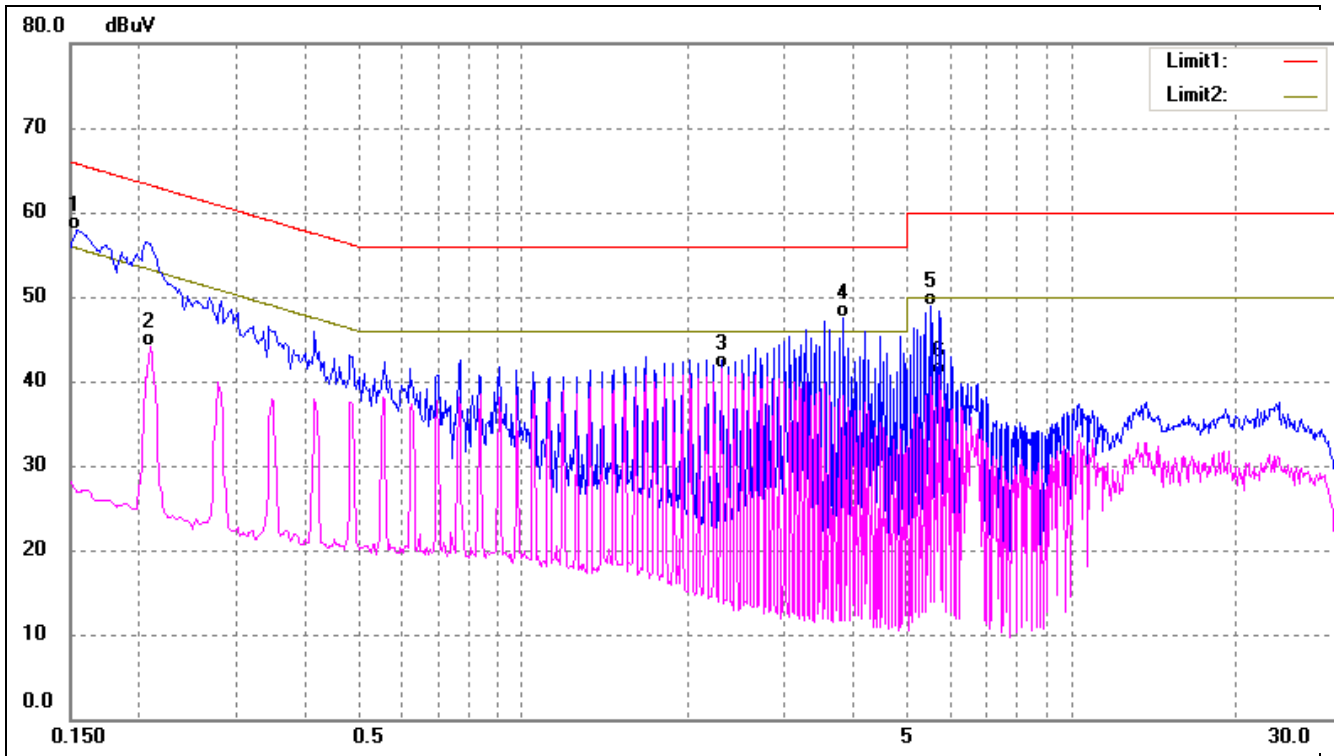
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1548	48.40	10.10	58.50	65.74	-7.24	QP
2	0.1620	23.54	10.10	33.64	55.36	-21.72	AVG
3	0.2701	43.18	10.17	53.35	61.11	-7.76	QP
4	0.4700	35.76	10.28	46.04	56.51	-10.47	QP
5	0.5620	22.25	10.32	32.57	46.00	-13.43	AVG
6	1.4580	13.00	10.55	23.55	46.00	-22.45	AVG

Test mode:	TM2	Polarity:	Line
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.2020	44.03	10.12	54.15	63.53	-9.38	QP
2	0.2100	32.72	10.13	42.85	53.21	-10.36	AVG
3*	1.1860	27.16	10.52	37.68	46.00	-8.32	AVG
4	3.8340	35.50	10.71	46.21	56.00	-9.79	QP
5	5.4420	38.73	10.78	49.51	60.00	-10.49	QP
6	5.4420	30.87	10.78	41.65	50.00	-8.35	AVG

Test mode:	TM2	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1540	47.88	10.10	57.98	65.78	-7.80	QP
2	0.2100	34.03	10.13	44.16	53.21	-9.05	AVG
3*	2.3020	30.89	10.63	41.52	46.00	-4.48	AVG
4	3.8340	36.70	10.71	47.41	56.00	-8.59	QP
5	5.5100	38.12	10.78	48.90	60.00	-11.10	QP
6	5.7180	29.90	10.79	40.69	50.00	-9.31	AVG

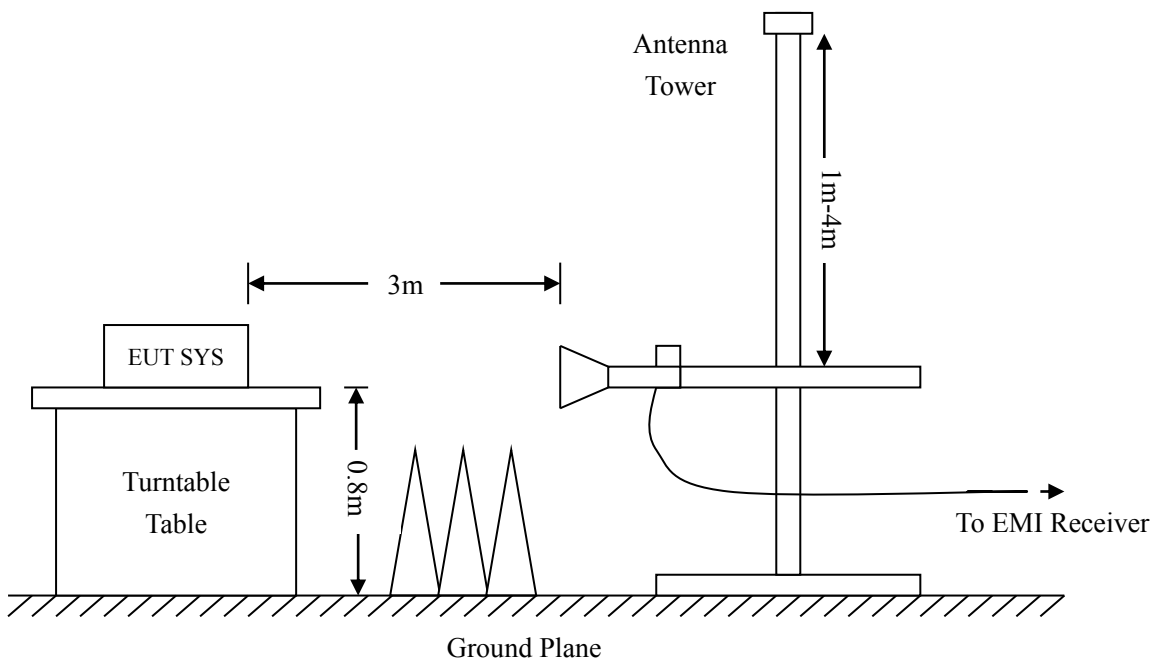
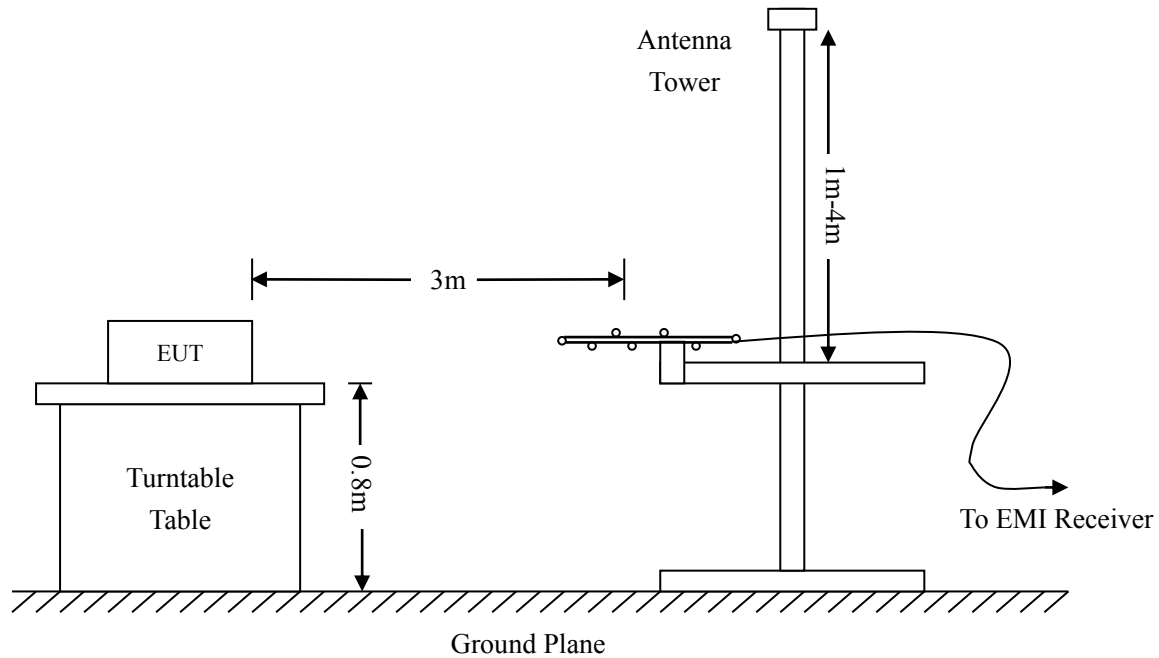
4. RADIATED EMISSION

4.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.109 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



4.2 Test Receiver Setup

Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} - \text{Corr. Factor}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit for a Class B device. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15.109(a) Limit}$$

4.4 Environmental Conditions

Temperature:	22 °C
Relative Humidity:	54 %
ATM Pressure:	1011 mbar

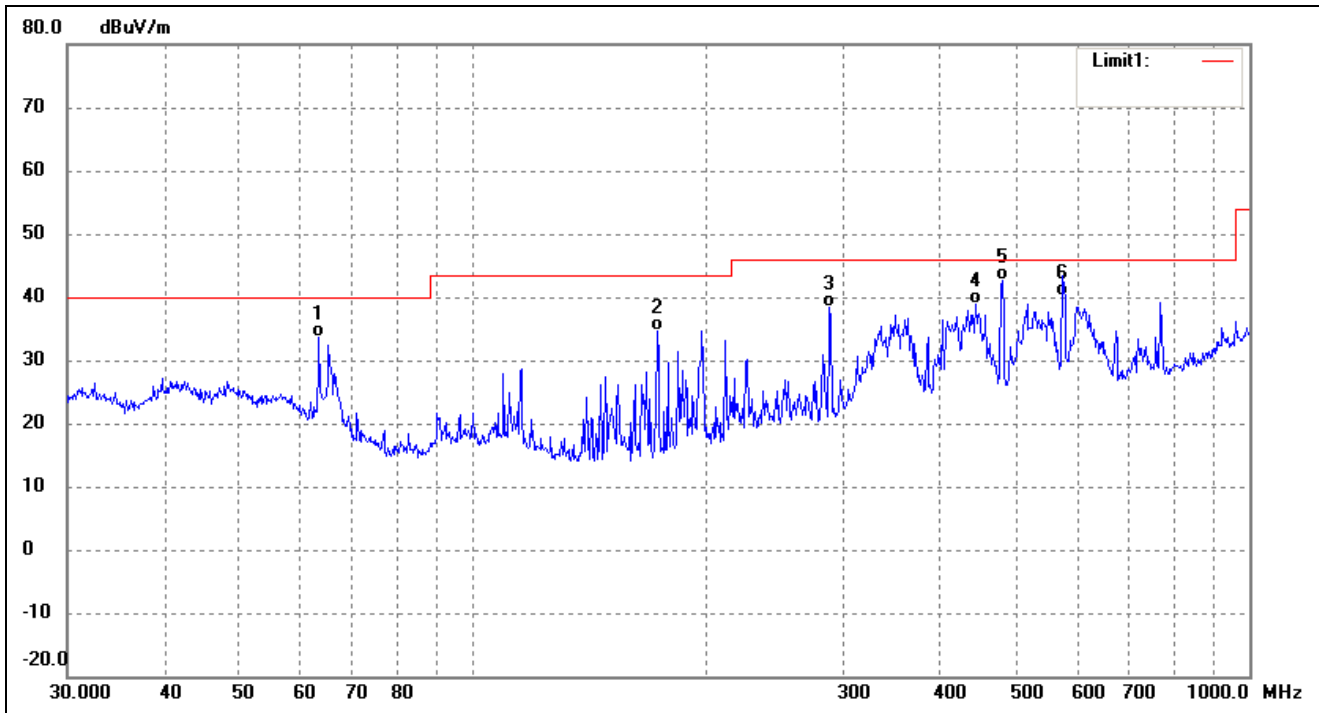
4.5 Summary of Test Results/Plots

According to the data, the EUT complied with the FCC Part 15.109(a) rule, and had the worst margin of:

-3.13 dB at 480.5276 MHz in the Vertical polarization, Below 1GHz, 30 MHz to 1 GHz, 3 Meters

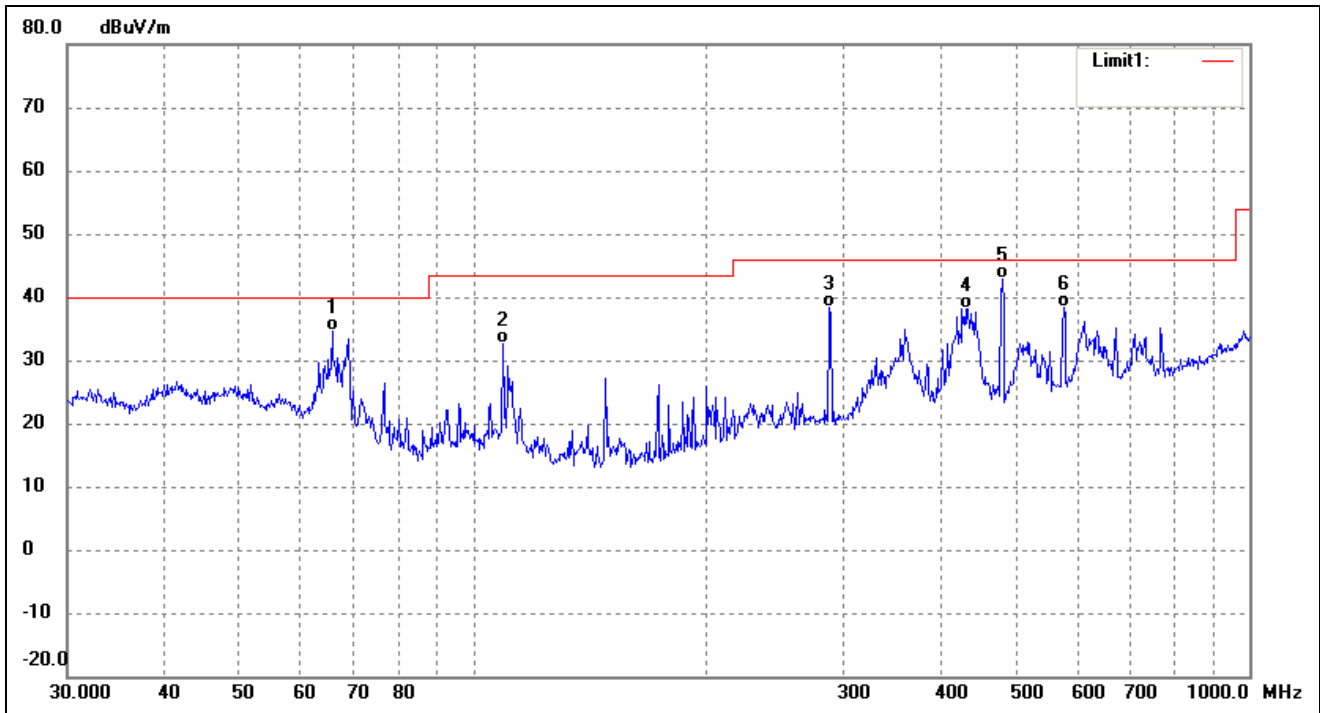
Below 1GHz

Test mode:	TM1	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	63.3132	45.38	-11.79	33.59	40.00	-6.41	205	100	QP
2	172.5988	50.54	-15.86	34.68	43.50	-8.82	95	100	QP
3	287.9904	48.29	-9.93	38.36	46.00	-7.64	80	100	QP
4	443.2943	45.95	-6.95	39.00	46.00	-7.00	264	100	QP
5	480.5276	48.92	-6.32	42.60	46.00	-3.40	336	100	QP
6	574.6258	44.80	-4.57	40.23	46.00	-5.77	213	100	QP

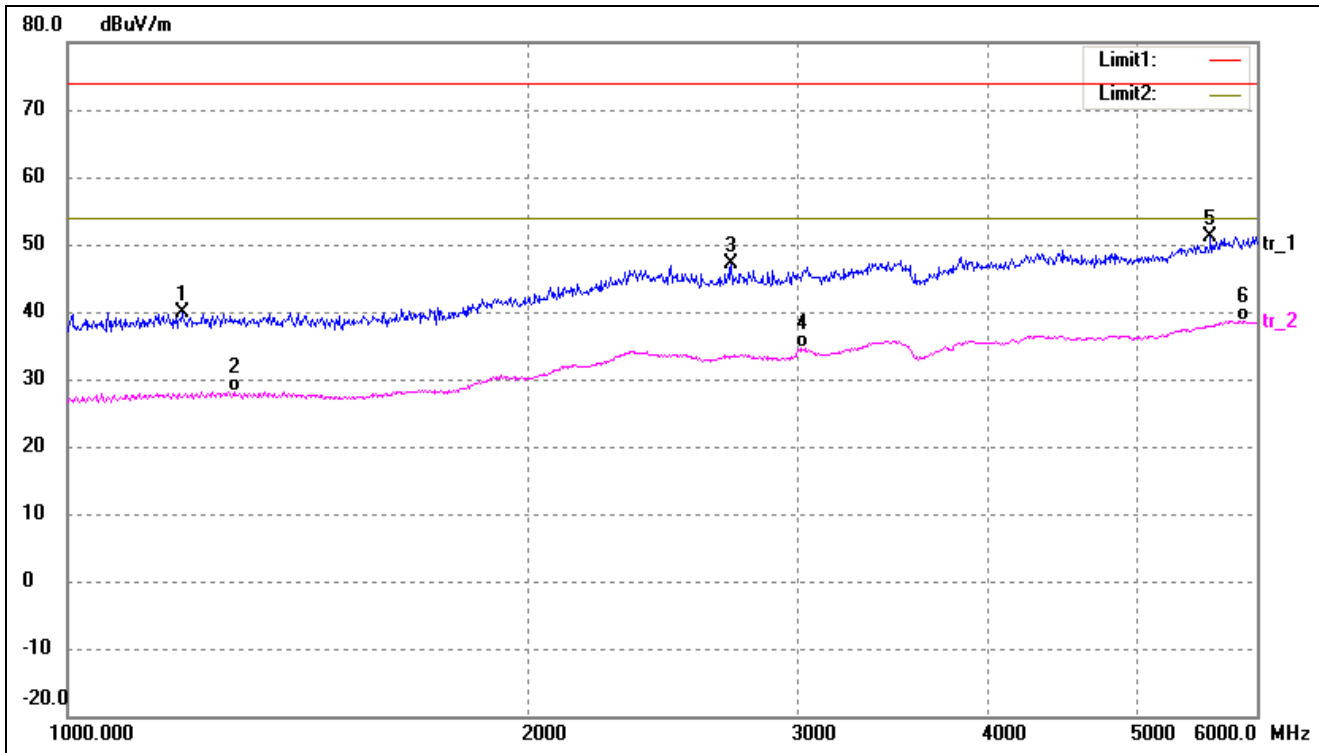
Test mode:	TM1	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	65.8031	47.08	-12.53	34.55	40.00	-5.45	72	100	QP
2	109.4116	47.02	-14.43	32.59	43.50	-10.91	112	100	QP
3	287.9904	48.37	-9.93	38.44	46.00	-7.56	97	100	QP
4	431.0316	45.08	-7.01	38.07	46.00	-7.93	95	100	QP
5	480.5276	49.19	-6.32	42.87	46.00	-3.13	359	100	QP
6	576.6443	42.78	-4.51	38.27	46.00	-7.73	307	100	QP

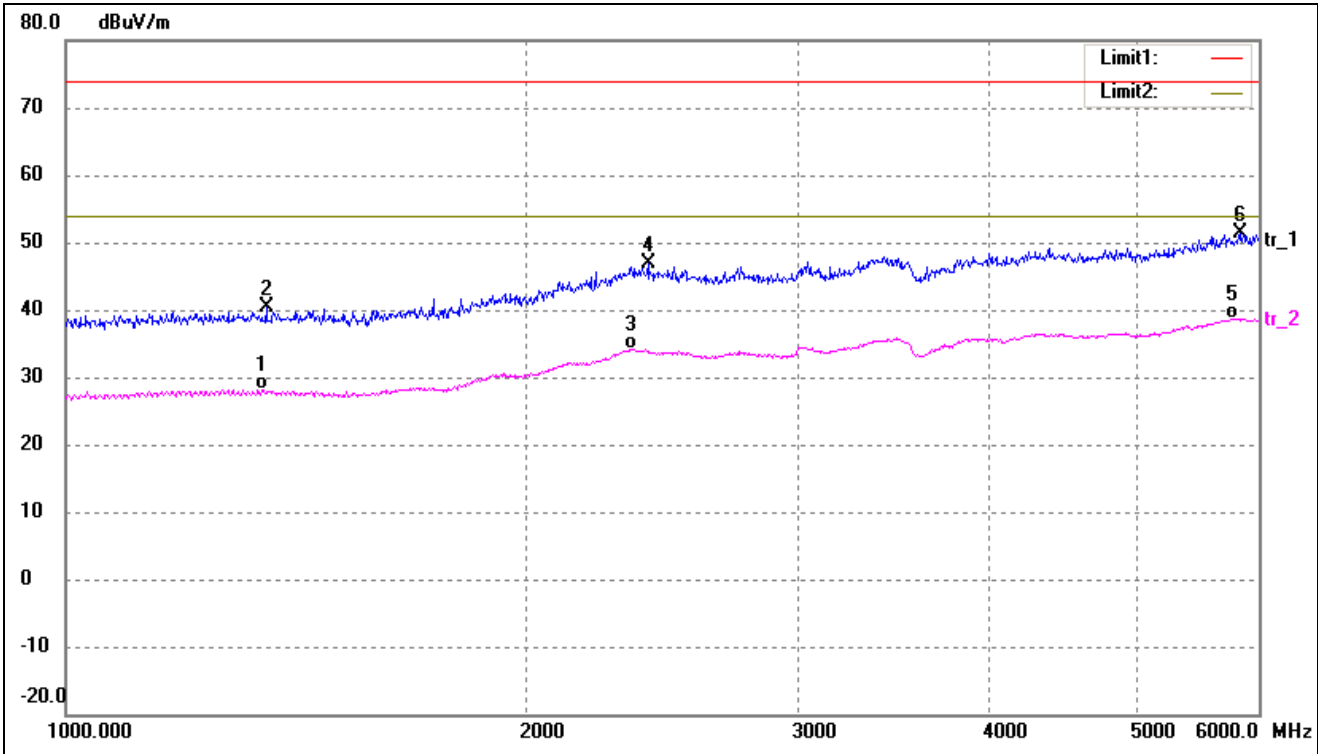
Above 1GHz

Test mode:	TM1	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	1187.688	53.93	-13.96	39.97	74.00	-34.03	127	100	peak
2	1285.113	41.81	-13.76	28.05	54.00	-25.95	95	100	AVG
3	2717.743	53.33	-6.31	47.02	74.00	-26.98	88	100	peak
4	3020.782	40.43	-5.86	34.57	54.00	-19.43	107	100	AVG
5	5595.042	53.09	-1.87	51.22	74.00	-22.78	360	100	peak
6	5872.370	39.84	-1.15	38.69	54.00	-15.31	343	100	AVG

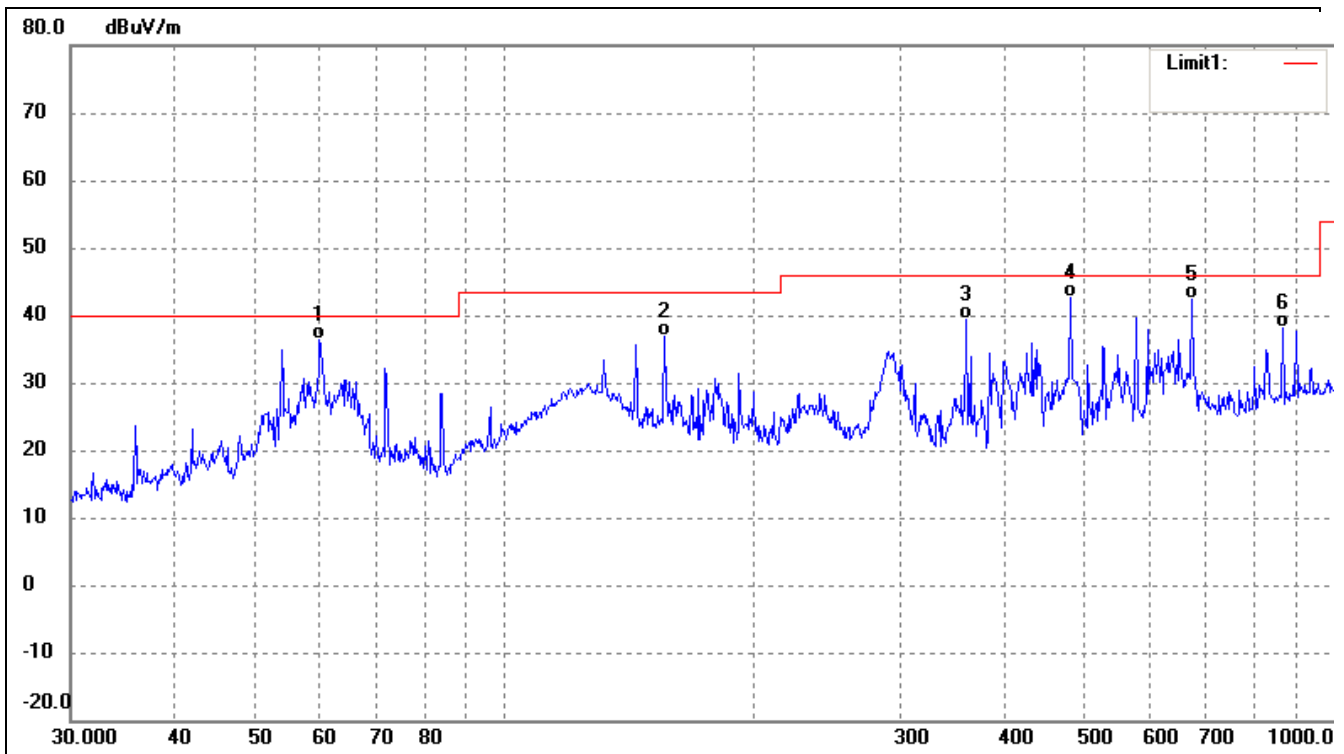
Test mode:	TM1	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	1343.987	41.80	-13.61	28.19	54.00	-25.81	96	100	AVG
2	1351.230	53.92	-13.59	40.33	74.00	-33.67	180	100	peak
3	2337.996	41.77	-7.62	34.15	54.00	-19.85	109	100	AVG
4	2397.385	54.10	-7.26	46.84	74.00	-27.16	116	100	peak
5	5768.089	40.14	-1.42	38.72	54.00	-15.28	207	100	AVG
6	5840.889	52.55	-1.23	51.32	74.00	-22.68	255	100	peak

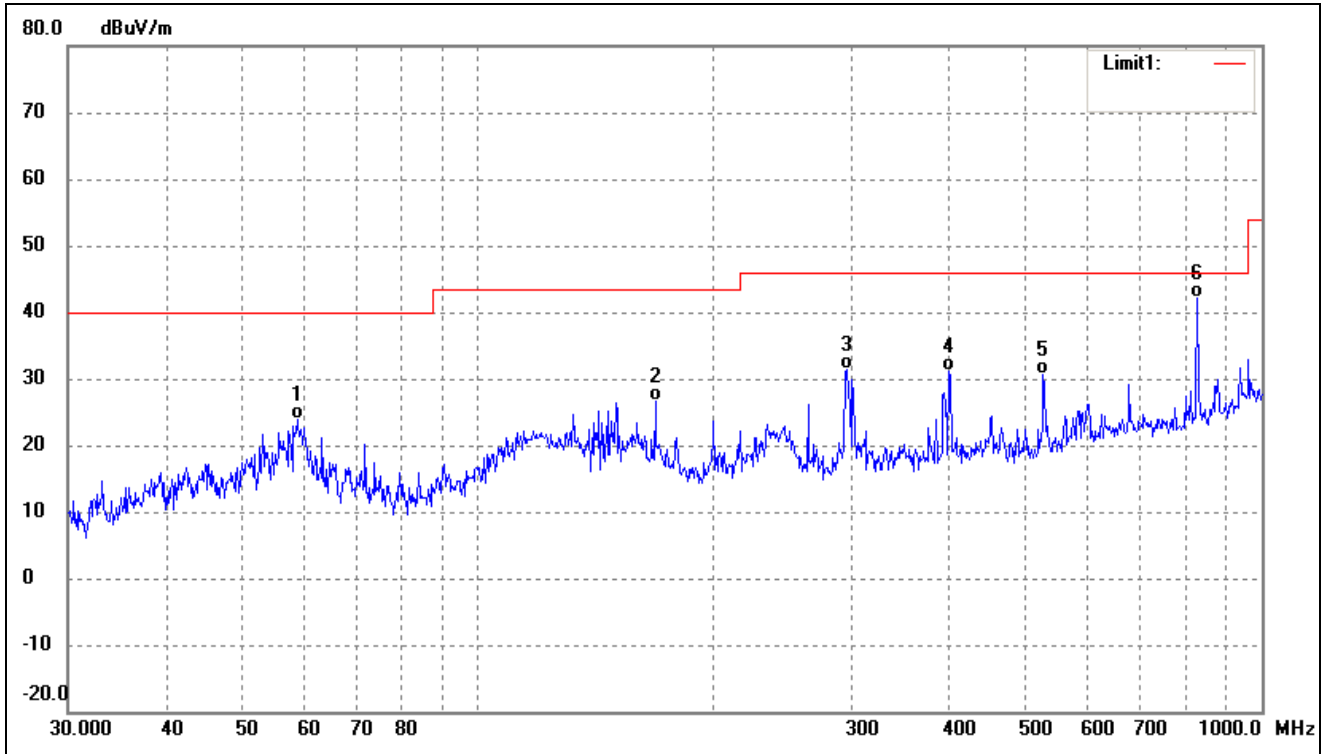
Below 1GHz

Test mode:	TM2	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	59.8588	49.73	-13.32	36.41	40.00	-3.59	145	100	QP
2	155.9100	53.63	-16.80	36.83	43.50	-6.67	226	100	QP
3	360.4476	46.61	-7.16	39.45	46.00	-6.55	136	100	QP
4	480.5276	48.41	-5.77	42.64	46.00	-3.36	178	100	QP
5	672.8445	44.75	-2.47	42.28	46.00	-3.72	360	100	QP
6	866.0878	37.80	0.28	38.08	46.00	-7.92	113	100	QP

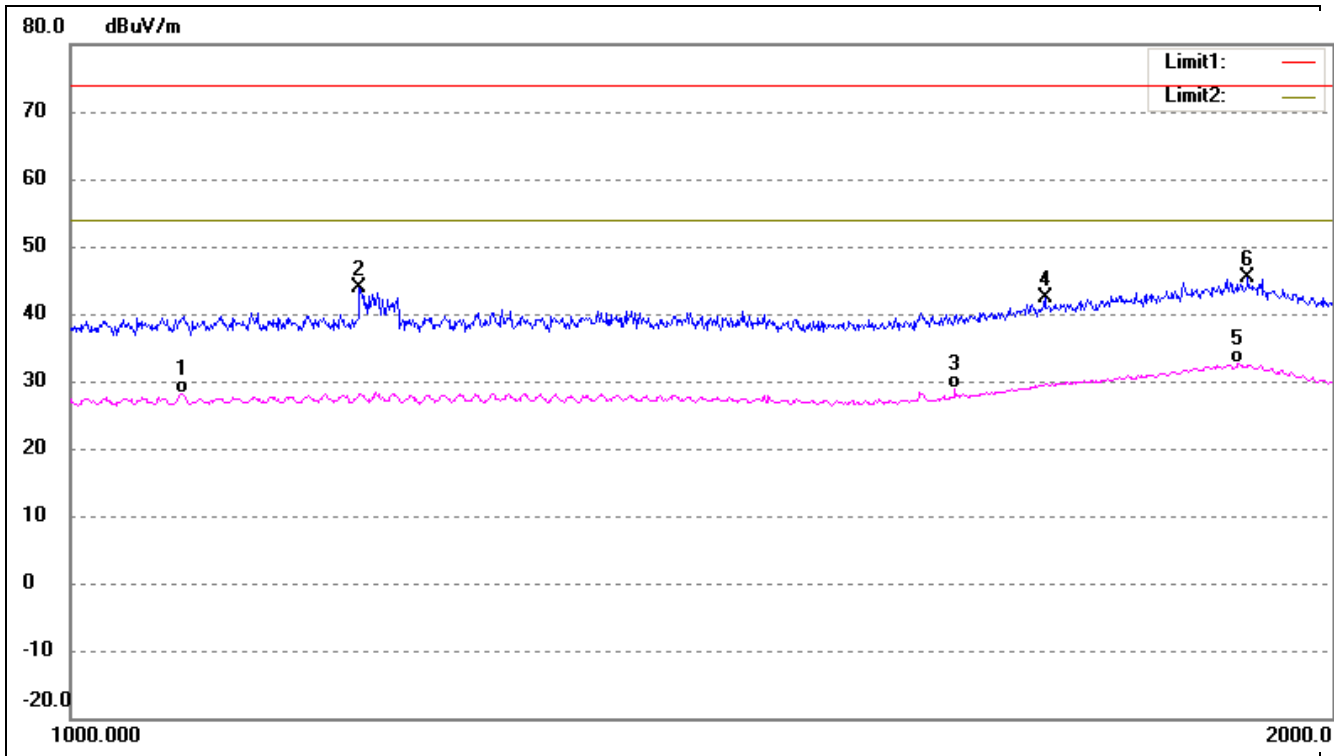
Test mode:	TM2	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	58.8185	37.01	-13.22	23.79	40.00	-16.21	180	100	QP
2	168.4138	42.76	-16.19	26.57	43.50	-16.93	176	100	QP
3	295.1469	39.62	-8.17	31.45	46.00	-14.55	335	100	QP
4	399.0302	37.81	-6.79	31.02	46.00	-14.98	260	100	QP
5	526.3967	35.76	-5.05	30.71	46.00	-15.29	180	100	QP
6	827.4934	42.45	-0.29	42.16	46.00	-3.84	25	100	QP

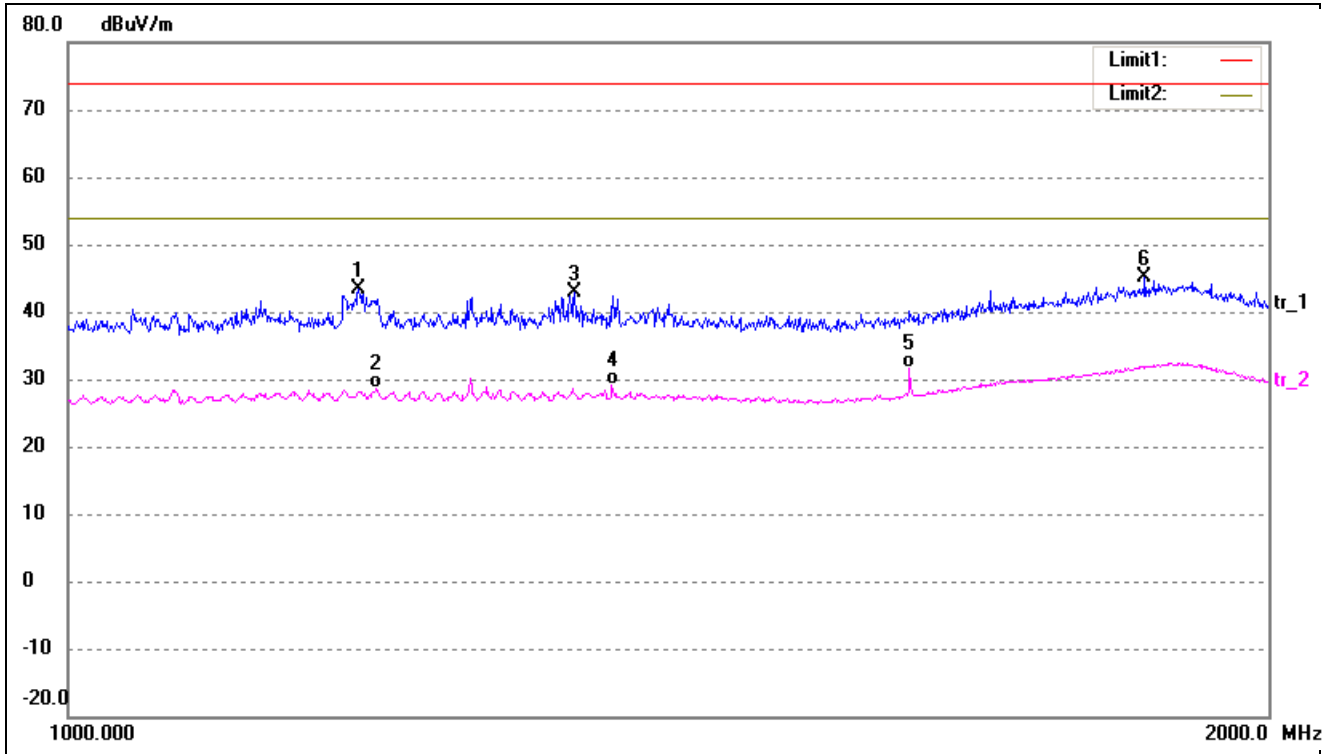
Above 1GHz

Test mode:	TM2	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	1062.896	42.24	-14.04	28.20	54.00	-25.80	134	100	AVG
2	1172.022	57.69	-13.92	43.77	74.00	-30.23	255	100	peak
3	1625.631	41.20	-12.36	28.84	54.00	-25.16	162	100	AVG
4	1707.635	53.55	-11.17	42.38	74.00	-31.62	33	100	peak
5	1898.684	40.79	-8.11	32.68	54.00	-21.32	256	100	AVG
6	1909.242	53.60	-8.27	45.33	74.00	-28.67	113	100	peak

Test mode:	TM2	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	1182.631	57.16	-13.90	43.26	74.00	-30.74	225	100	peak
2	1194.991	42.54	-13.89	28.65	54.00	-25.35	164	100	AVG
3	1339.784	56.46	-13.61	42.85	74.00	-31.15	331	100	peak
4	1368.884	42.81	-13.59	29.22	54.00	-24.78	152	100	AVG
5	1625.631	43.96	-12.36	31.60	54.00	-22.40	156	100	AVG
6	1862.190	53.48	-8.42	45.06	74.00	-28.94	246	100	peak

***** END OF REPORT *****