

FCC Part 15B
Measurement and Test Report
For
NumWorks
24 Rue Godot de Mauroy, 75009, Paris France

FCC ID: 2ALWP-N0100

FCC Rule(s): FCC Part 15 Subpart B

Product Description: Numworks Graphing Calculator

Tested Model: N0100

Report No.: STR17048266I

Tested Date: 2017-04-26 to 2017-04-28

Issued Date: 2017-04-28

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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
Address of applicant: 24 Rue Godot de Mauroy, 75009, Paris France

Manufacturer: NumWorks
Address of manufacturer: 24 Rue Godot de Mauroy, 75009, Paris France

General Description of EUT	
Product Name:	Numworks Graphing Calculator
Trade Name:	Numworks
Model No.:	N0100
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 3.8V
Rated Current:	0.15A
Rated Power:	/
Power Adapter Model:	/
Lowest Internal Frequency:	25MHz
Highest Internal Frequency:	25MHz
Classification of ITE:	Class B

1.2 Test Standards

The following report is prepared on behalf of the NumWorks in accordance with Part 2, Subpart J, and Part 15, Subparts A and B of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart B, and section 15.205, 15.107, and 15.109 rules.

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

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

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.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.5 EUT Setup and Operation Mode

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

Test Mode List:

Test Mode	Description	Remark
TM1	Charging & Working	Connect to Adapter
TM2	Downloading	Upgraded software via “DfuSe_Demo_V3.0.5_Setup.exe” which provided from manufacturer
TM3	/	/

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
USB Cable	0.95M	Unshielded	Without Core

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
Adapter	TX	TX-140711	/
Notebook	Lenovo	T410	/

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	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2016-06-04	2017-06-03
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
SEMT-1042	Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03

2. SUMMARY OF TEST RESULTS

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

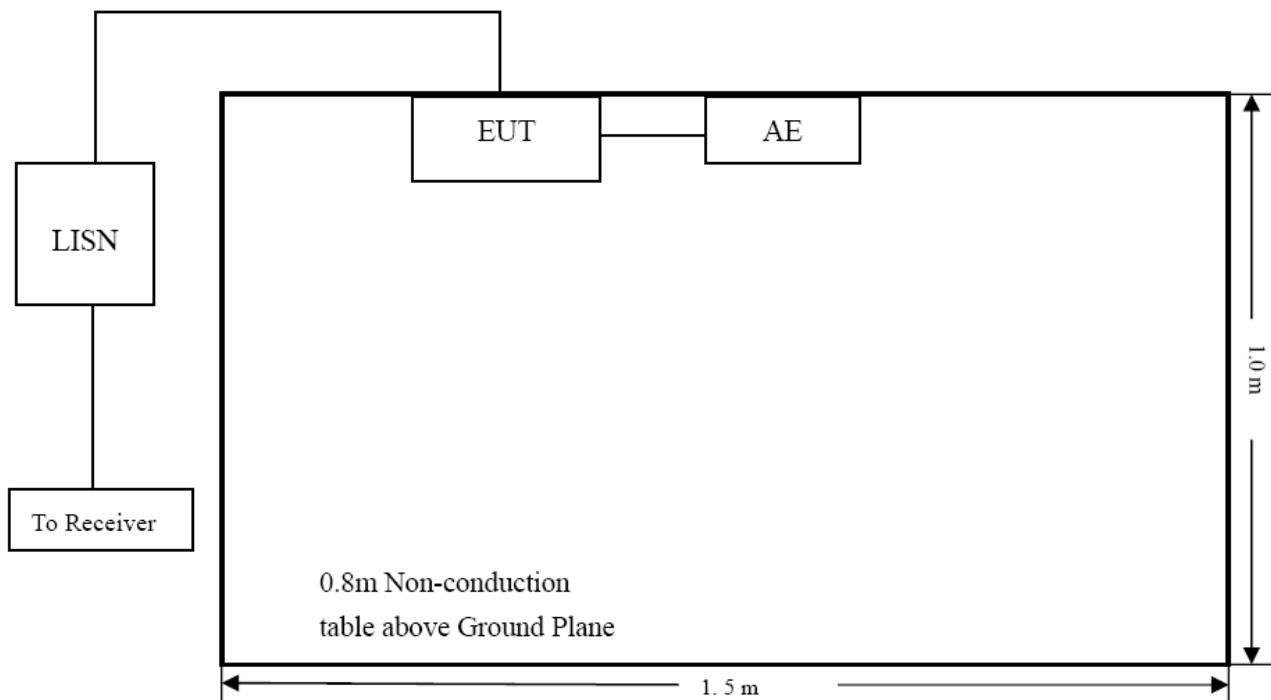
N/A: not applicable

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:	23 °C
Relative Humidity:	52%
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:

-7.25 dB at 0.1540 MHz in the **Line, QP** detector at TM2, 0.15-30MHz

3.5 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

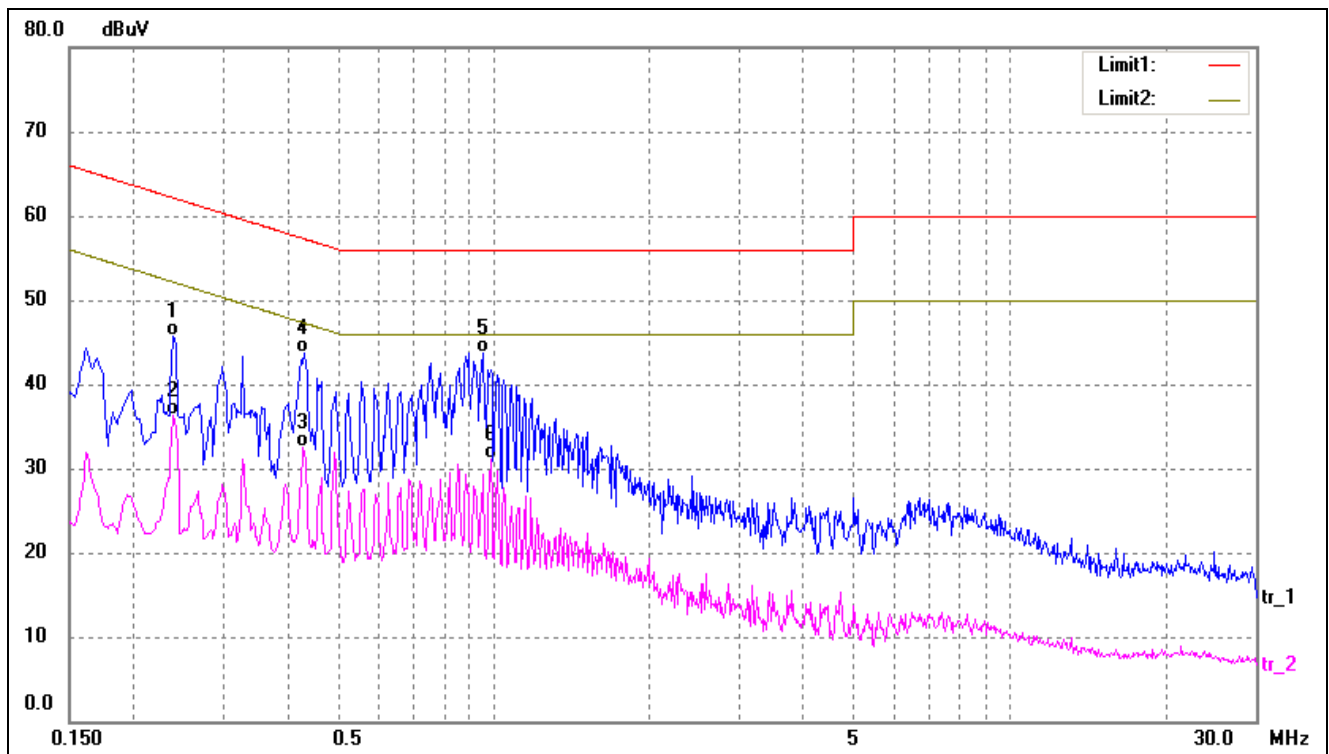
EUT: Numworks Graphing Calculator

Tested Model: N0100

Operating Condition: TM1

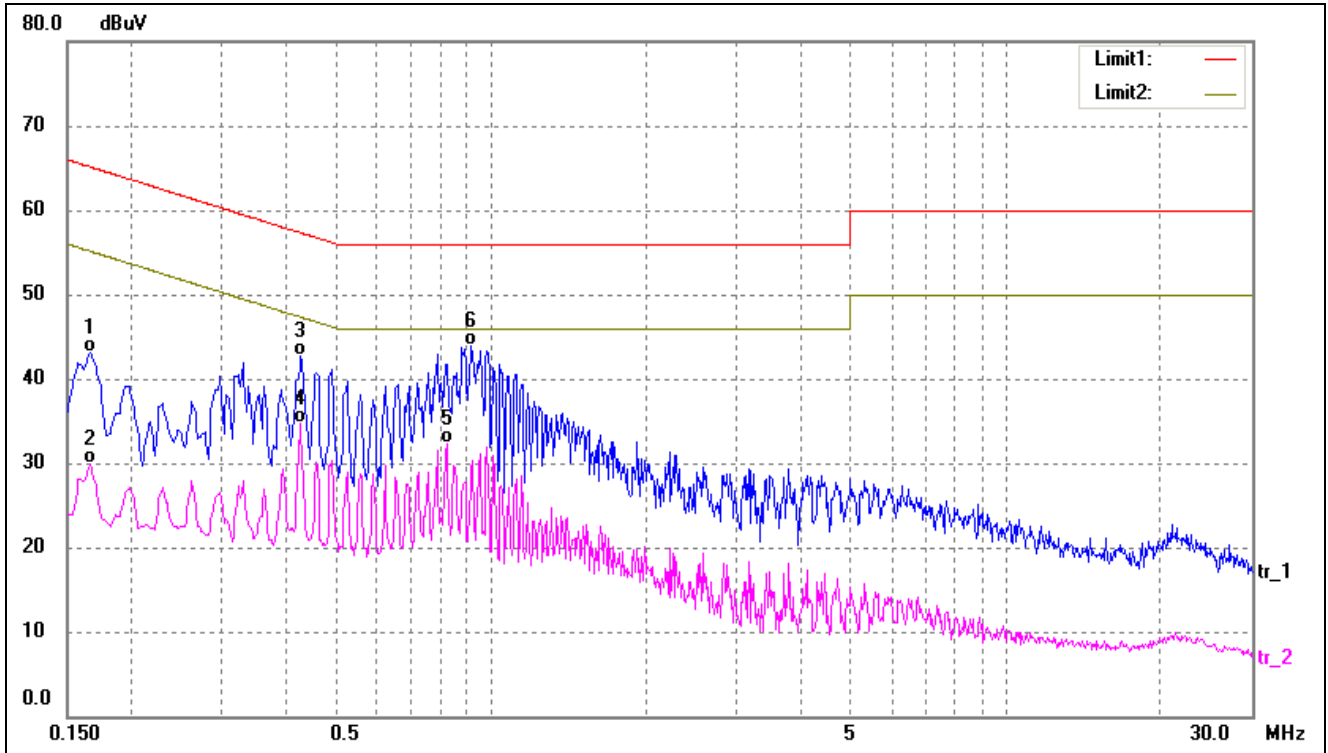
Comment: AC 120V/60Hz, Adapter DC 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.2380	35.97	9.80	45.77	62.17	-16.40	QP
2	0.2380	26.43	9.80	36.23	52.17	-15.94	AVG
3	0.4260	22.77	9.80	32.57	47.33	-14.76	AVG
4	0.4300	33.87	9.80	43.67	57.25	-13.58	QP
5*	0.9540	34.01	9.76	43.77	56.00	-12.23	QP
6	0.9860	21.42	9.76	31.18	46.00	-14.82	AVG

Test Specification: Line

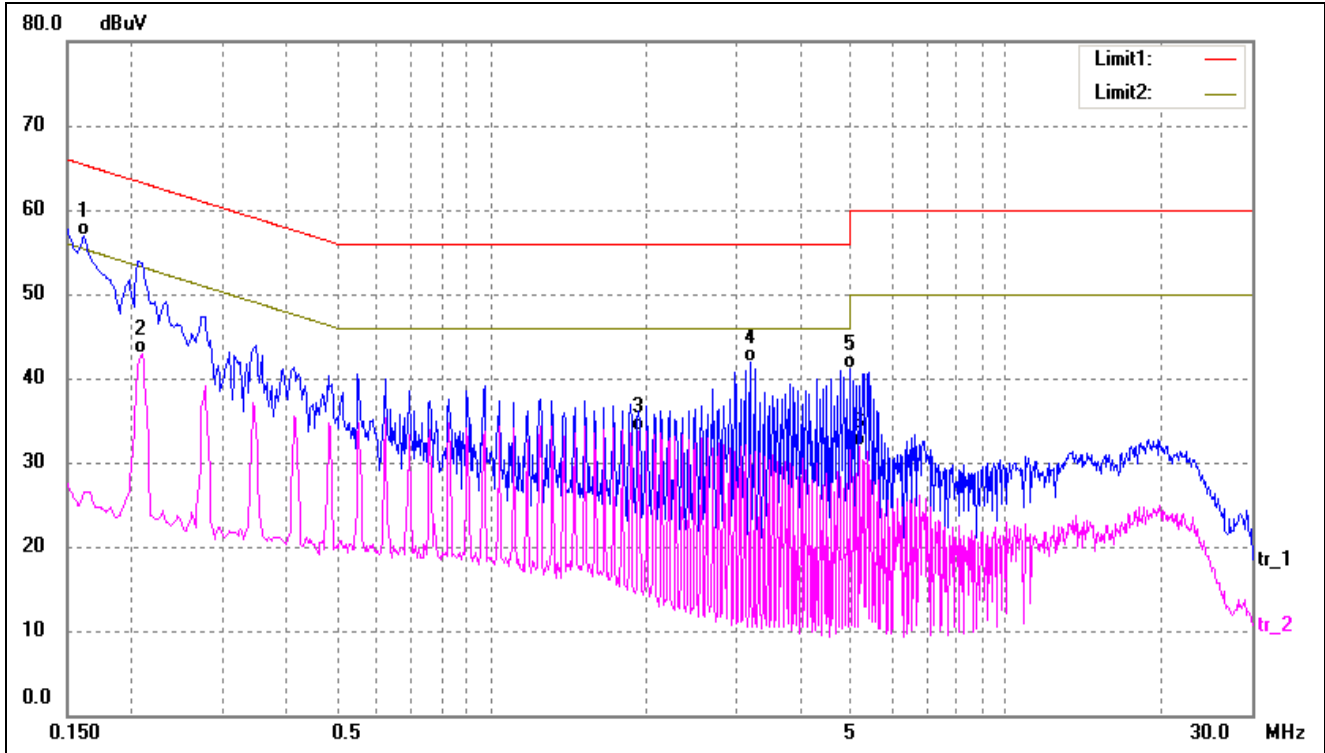


No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1660	33.37	9.83	43.20	65.16	-21.96	QP
2	0.1660	19.99	9.83	29.82	55.16	-25.34	AVG
3	0.4260	32.88	9.80	42.68	57.33	-14.65	QP
4	0.4260	24.84	9.80	34.64	47.33	-12.69	AVG
5	0.8180	22.48	9.77	32.25	46.00	-13.75	AVG
6*	0.9180	34.11	9.77	43.88	56.00	-12.12	QP

Plot of Conducted Emissions Test Data

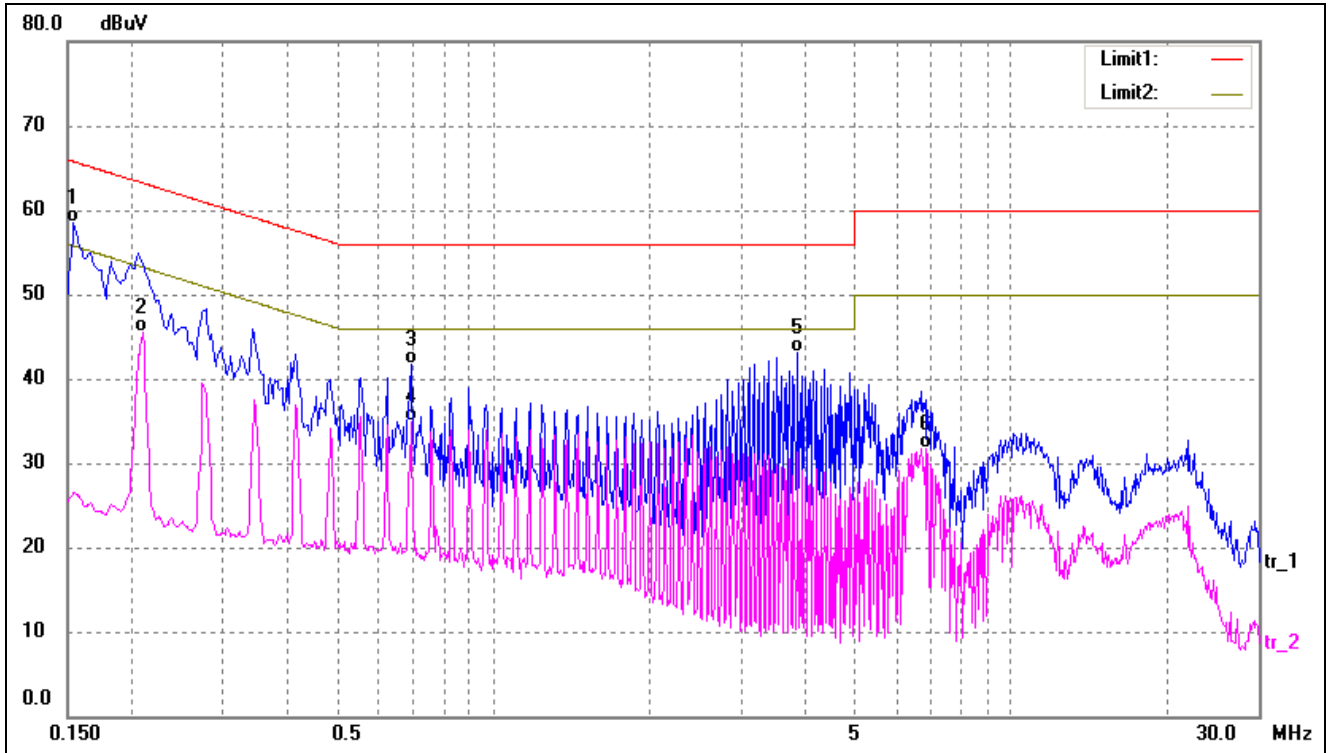
EUT: Numworks Graphing Calculator
 Tested Model: N0100
 Operating Condition: TM2
 Comment: AC 120V/60Hz, USB 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1620	47.00	9.84	56.84	65.36	-8.52	QP
2	0.2100	33.15	9.80	42.95	53.21	-10.26	AVG
3	1.9340	23.95	9.74	33.69	46.00	-12.31	AVG
4	3.1820	32.17	9.71	41.88	56.00	-14.12	QP
5	4.9780	31.54	9.66	41.20	56.00	-14.80	QP
6	5.1860	22.29	9.65	31.94	50.00	-18.06	AVG

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1540	48.68	9.85	58.53	65.78	-7.25	QP
2	0.2100	35.79	9.80	45.59	53.21	-7.62	AVG
3	0.6900	31.95	9.78	41.73	56.00	-14.27	QP
4	0.6900	25.17	9.78	34.95	46.00	-11.05	AVG
5	3.8660	33.40	9.69	43.09	56.00	-12.91	QP
6	6.8340	22.10	9.61	31.71	50.00	-18.29	AVG

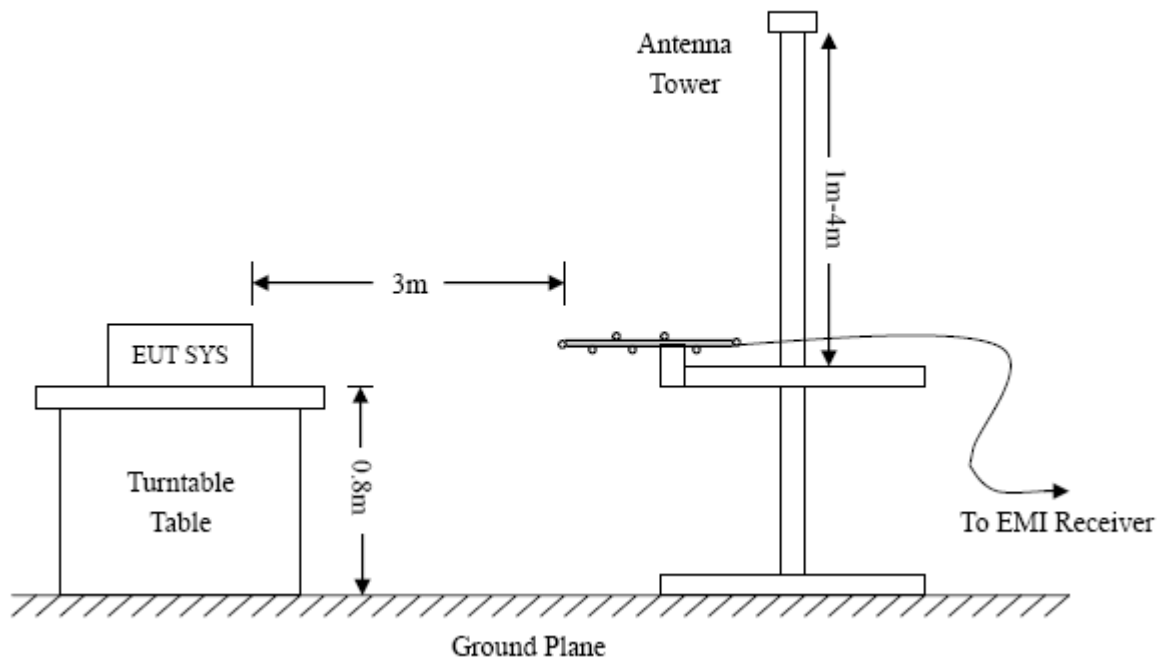
4. RADIATED EMISSION

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

RBW=10KHz,

VBW =30KHz

Sweep time= Auto

Trace = max hold

Detector function = peak

Frequency :30MHz-1GHz

RBW=120KHz,

VBW=300KHz

Sweep time= Auto

Trace = max hold

Detector function = peak, QP

Frequency :Above 1GHz

RBW=1MHz,

VBW=3MHz(Peak), 10Hz(AV)

Sweep time= Auto

Trace = max hold

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 -6dB μ V means the emission is 6dB μ V 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:	23 °C
Relative Humidity:	55 %
ATM Pressure:	1011 mbar

4.5 Summary of Test Results/Plots

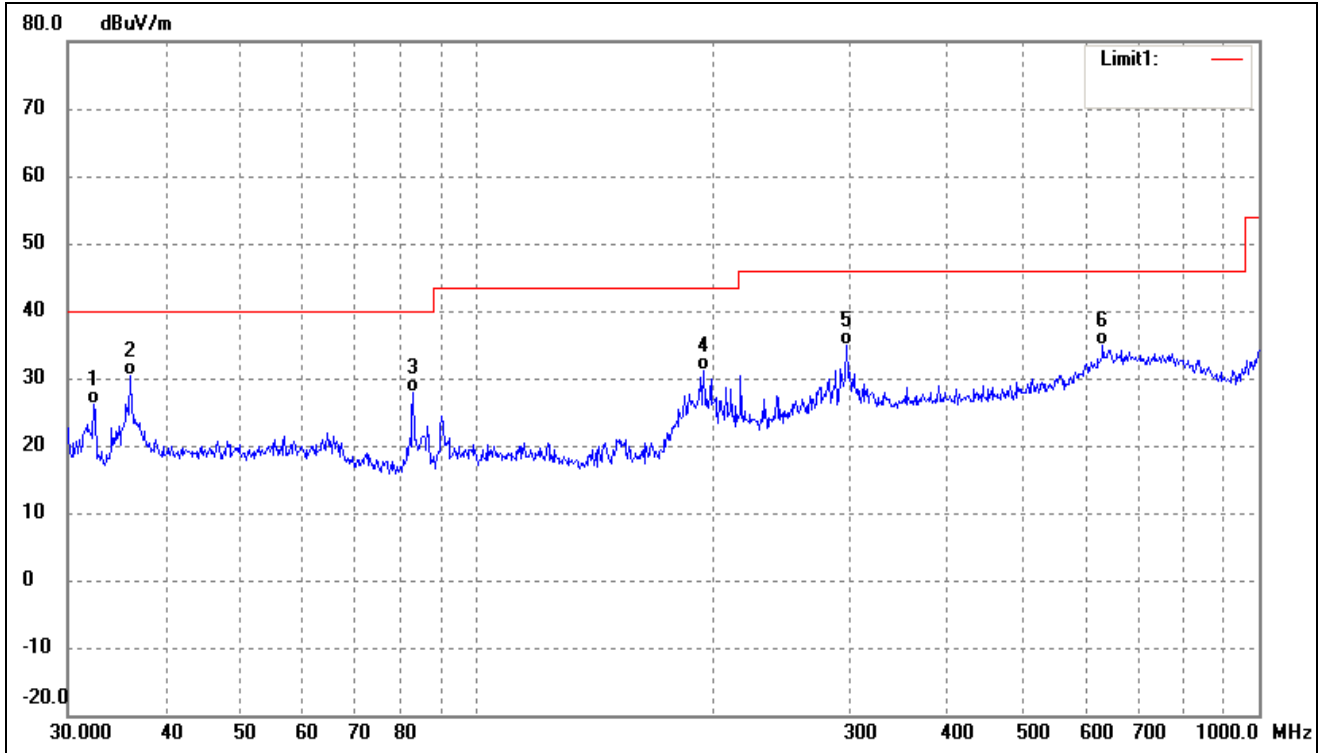
According to the data, the EUT complied with the FCC Part 15.109(a) rule, and had the worst margin of:

-7.01 dB at 526.3967 MHz in the Vertical polarization at TM2, 30 MHz to 1 GHz, 3Meters

Plot of Radiated Emissions Test Data

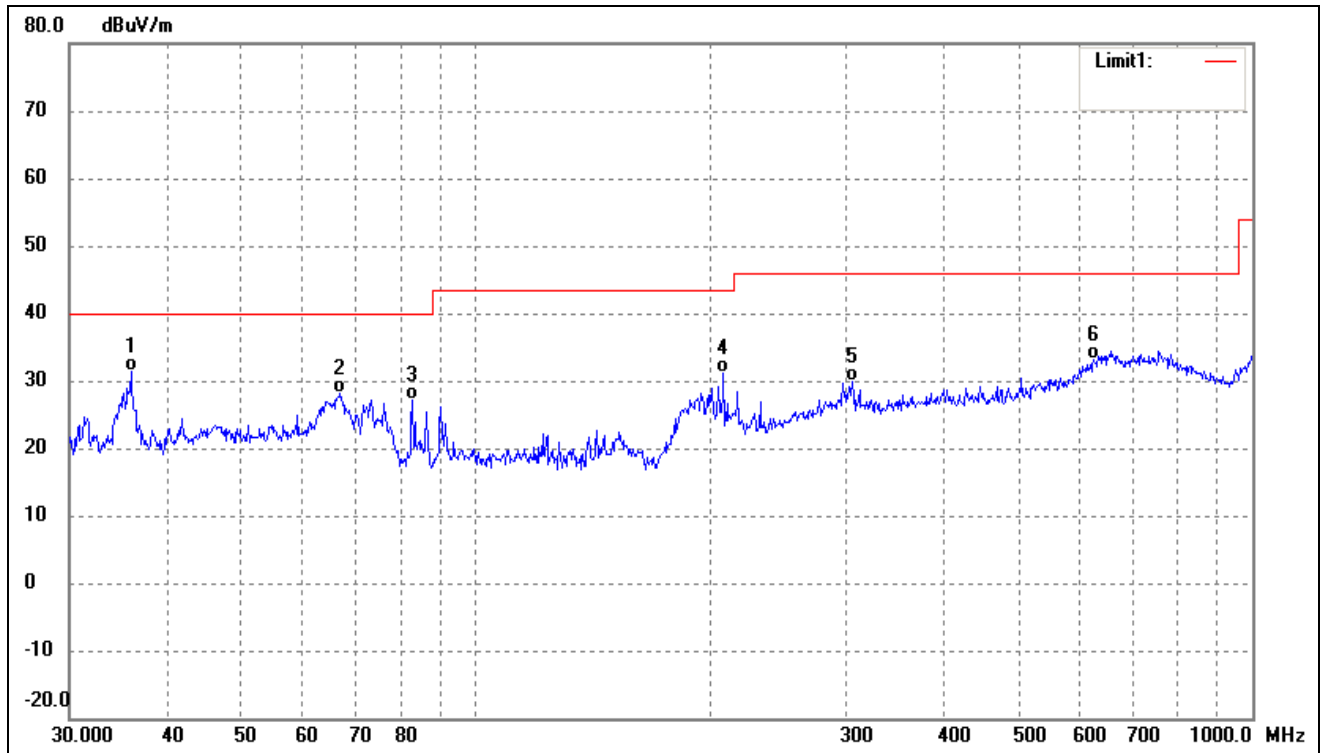
EUT: *Numworks Graphing Calculator*
 Tested Model: *N0100*
 Operating Condition: *TM1*
 Comment: *AC 120V/60Hz, Adapter DC 5V*

Test Specification: *Horizontal*



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	32.4059	22.47	3.76	26.23	40.00	-13.77	34	100	QP
2	36.0007	26.00	4.33	30.33	40.00	-9.67	134	100	QP
3	82.9385	25.56	2.21	27.77	40.00	-12.23	57	100	QP
4	195.1365	28.08	3.13	31.21	43.50	-12.29	66	100	QP
5	297.2241	23.09	11.84	34.93	46.00	-11.07	134	100	QP
6	631.6884	17.03	17.78	34.81	46.00	-11.19	163	100	QP

Test Specification: Vertical

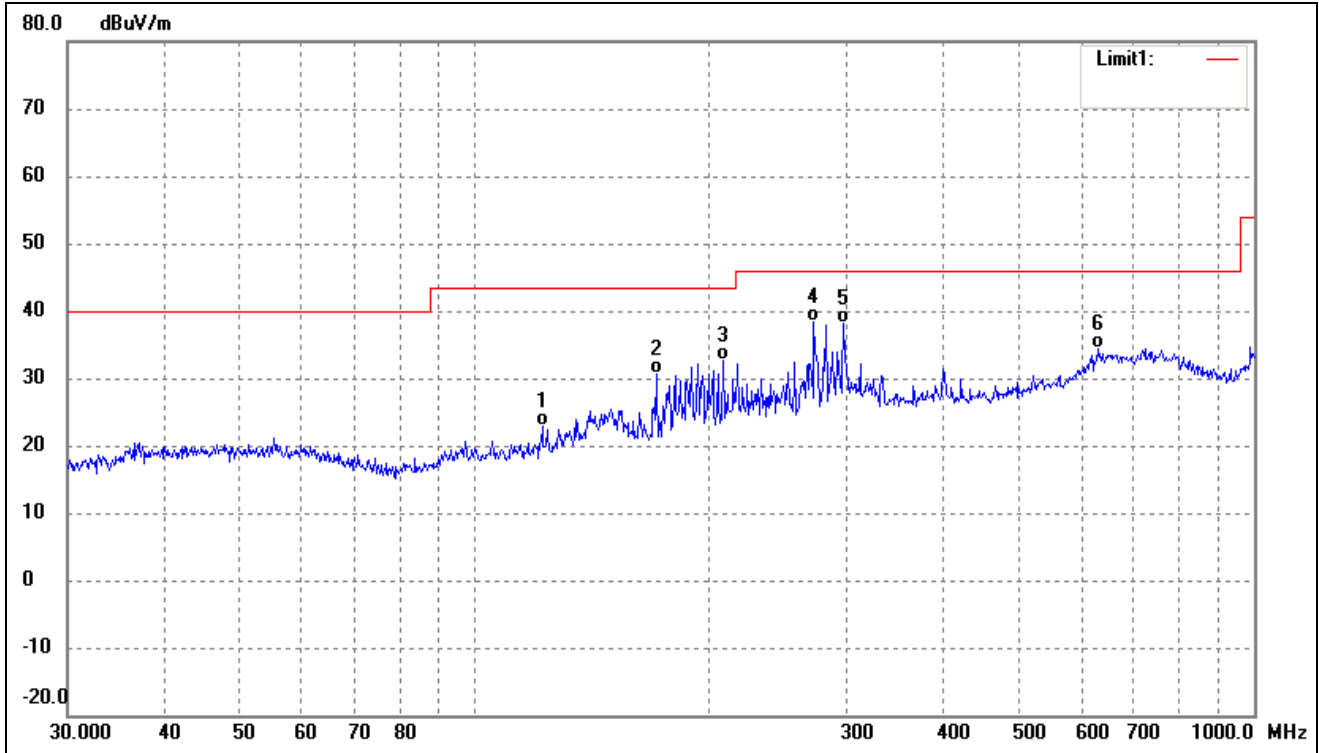


No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	36.0007	27.04	4.33	31.37	40.00	-8.63	23	100	QP
2	66.9669	24.57	3.56	28.13	40.00	-11.87	142	100	QP
3	82.9385	24.96	2.21	27.17	40.00	-12.83	331	100	QP
4	208.5803	26.00	5.22	31.22	43.50	-12.28	331	100	QP
5	305.6800	17.91	11.94	29.85	46.00	-16.15	33	100	QP
6	625.0780	15.62	17.55	33.17	46.00	-12.83	14	100	QP

Plot of Radiated Emissions Test Data

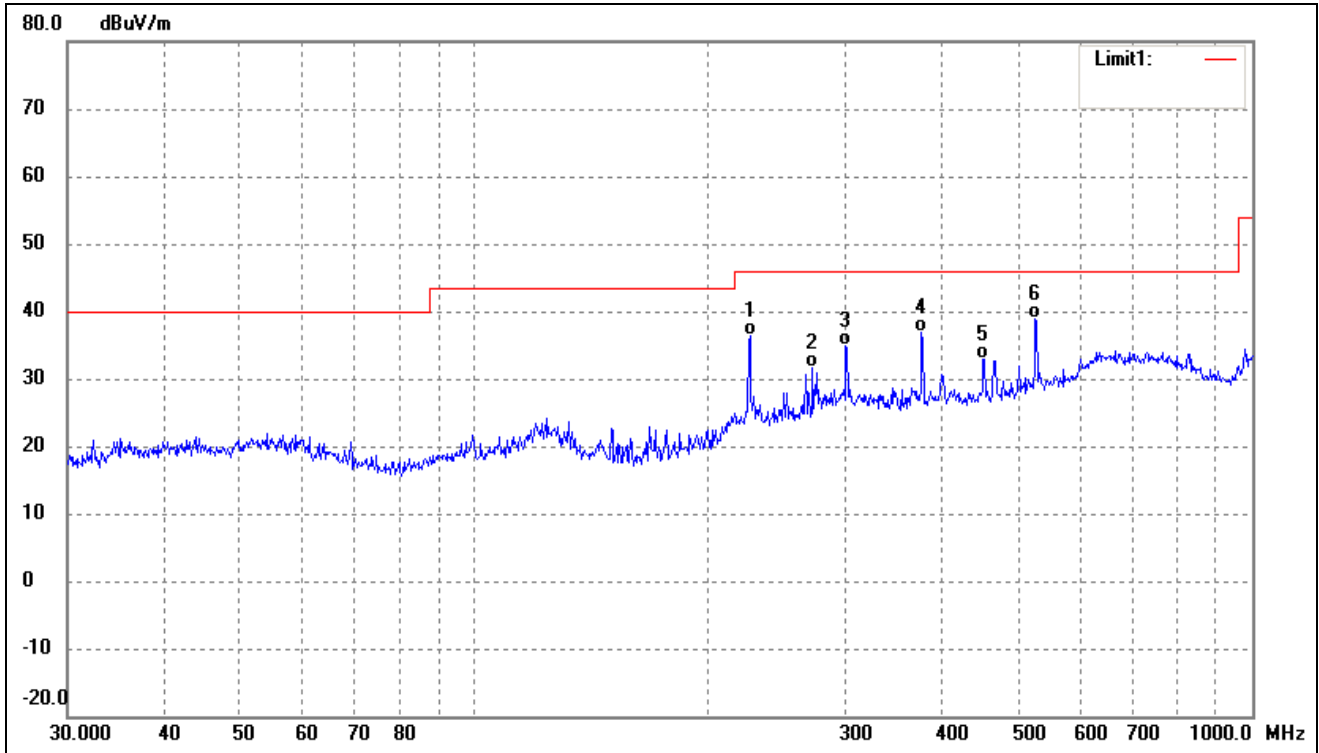
EUT: Numworks Graphing Calculator
 Tested Model: N0100
 Operating Condition: TM2
 Comment: AC 120V/60Hz, USB 5V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	121.9755	18.30	4.65	22.95	43.50	-20.55	65	100	QP
2	170.7926	28.25	2.46	30.71	43.50	-12.79	151	100	QP
3	208.5803	27.42	5.22	32.64	43.50	-10.86	55	100	QP
4	272.2776	27.91	10.58	38.49	46.00	-7.51	51	100	QP
5	297.2241	26.25	11.84	38.09	46.00	-7.91	11	100	QP
6	629.4772	16.77	17.70	34.47	46.00	-11.53	42	100	QP

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	226.0994	28.27	8.05	36.32	46.00	-9.68	41	100	QP
2	272.2776	20.95	10.58	31.53	46.00	-14.47	43	100	QP
3	300.3673	22.95	11.95	34.90	46.00	-11.10	133	100	QP
4	375.9385	25.19	11.81	37.00	46.00	-9.00	62	100	QP
5	451.1350	20.11	12.79	32.90	46.00	-13.10	141	100	QP
6	526.3967	25.12	13.87	38.99	46.00	-7.01	41	100	QP

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