

FCC PART 15B

TEST REPORT

For

Guangzhou Robustel LTD

ROOM F315, NO.95 DAGUAN MIDDLE ROAD, TIANHE DISTRICT, GUANGZHOU,
China

FCC ID: 2AAJGR1520

Report Type: Original Report	Product Type: Industrial Dual SIM Cellular VPN Router
Report Number:	RDG200804005-00A
Report Date:	2020-10-11
Reviewed By:	Ivan Cao Assistant Manager 
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Type:		Industrial Dual SIM Cellular VPN Router
Test Model:		R1520-4L Global
Multiple Model:		R1520-4L, R1520-4L (V)
Model Difference:		Refer to the DOS letter
Highest Operation Frequency:		2690 MHz
Rated Input Voltage:		DC 9-36V; Typical: DC 12V from adapter; DC 48V from PoE;
Adapter Information	Model:	GQ24-120150-AX
	Input:	AC 100~240V 50/60Hz 1A
	Output:	DC 12V 1.5A 18W
Serial Number:		RDG200804005-RF -S1
EUT Received Date:		2020.08.22

Objective

This report is prepared on behalf of **Guangzhou Robustel LTD** in accordance with Part 2, Part J, and Part 15, Subpart A and B of the Federal Communications Commission's rules..

The objective is to determine the compliance of EUT with: FCC Part 15B.

Related Submittal(s)/Grant(s)

FCC Part 15C DTS submissions with FCC ID: 2AAJGR1520

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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Unwanted Emissions, radiated	30M~200MHz: 4.55 dB, 200M~1GHz: 5.92 dB, 1G~6GHz: 4.98 dB, 6G~18GHz: 5.89 dB, 18G~26.5G: 5.47 dB, 26.5G~40G: 5.63 dB
Temperature	±1 °C
Humidity	±5%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier : CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “△”. Customer model name, addresses, names, trademarks etc. are not considered data.

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

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This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk “★”.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in typical fashion (as normally used by a typical user)

Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

Software 'Lan Test.exe' was used in test, which was provided by manufacturer.

Local Support Equipment List and Details

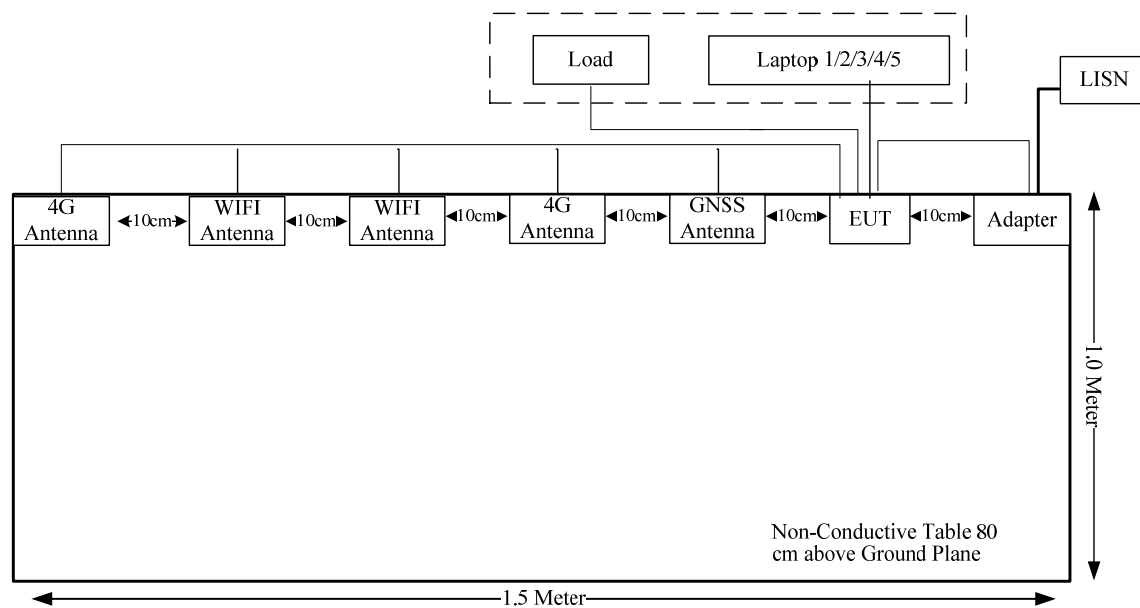
Manufacturer	Description	Model	Serial Number
DELL	Laptop	E6410	00426-OEM-8992662-00497
DELL	Laptop	E6410	00426-OEM-8992662-05476
DELL	Laptop	E6410	00426-OEM-8992662-12747
DELL	Laptop	E6410	00426-OEM-8992662-00568
DELL	Laptop	E6410	00426-OEM-8992662-00783
R&S	Universal Radio Communication Tester	CMU200	106 891
/	Load	/	/
ALFA	POE	APOE48V-1	/

Support Cable List and Details

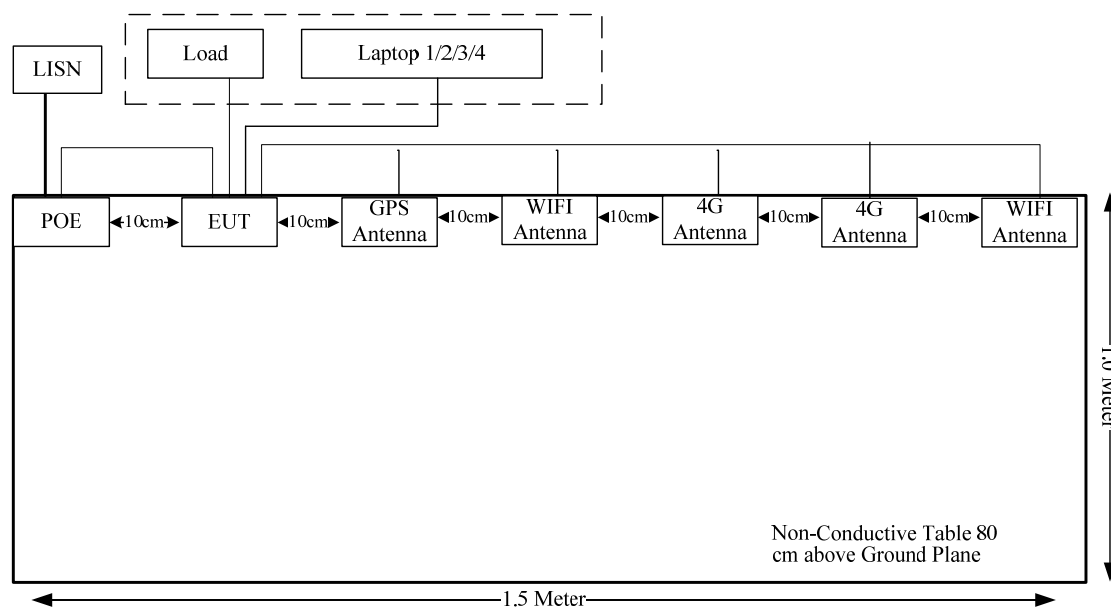
Cable Description	Shielding Type	Ferrite Core	Length(m)	From Port	To
RJ45 Cable*5	No	No	10	EUT	Laptop
RJ45 Cable	No	No	1	POE	EUT
Load cable	No	No	3	EUT	Load
Power cable	No	No	1.5	Adapter	EUT

Block Diagram of Test Setup

Power by adapter:



Power by POE:



Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conducted emission					
R&S	LISN	ENV 216	101614	2019-09-12	2020-09-12
R&S	LISN	ENV 216	101614	2020-09-12	2021-09-12
R&S	EMI Test Receiver	ESCI	101121	2020-05-09	2021-05-09
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2020-09-05	2021-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
Radiated Emission					
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESR3	102453	2019-09-12	2020-09-12
R&S	EMI Test Receiver	ESR3	102453	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2020-05-06	2021-05-06
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
HP	Amplifier	8447D	2727A05902	2020-09-05	2021-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-05-09	2021-05-09
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2020-09-05	2021-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2020-09-05	2021-09-05
Sunol Sciences	Antenna	JB3	A060611-3	2020-07-21	2023-07-21
R&S	EMI Test Receiver	ESCI	100224	2019-09-12	2020-09-12
R&S	EMI Test Receiver	ESCI	100224	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-02	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-02	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-2200-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-2200-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-03	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-03	2020-09-05	2021-09-05
Sonoma	Amplifier	310N	185914	2019-10-13	2020-10-13
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
MICRO-COAX	Coaxial Cable	UFA147-1-2362-10 0100	64639 231029-001	2020-02-24	2021-02-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2019-09-05	2020-09-05
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2020-09-05	2021-09-05
R&S	Spectrum Analyzer	FSP 38	100478	2020-07-07	2021-07-07

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Environmental Conditions

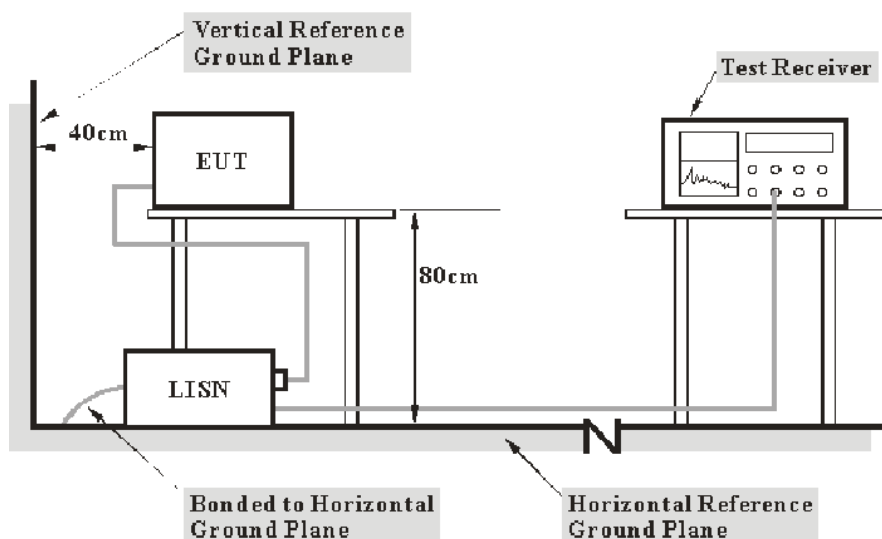
Test Item:	Conducted emissions	Radiated emissions Below 1GHz	Radiated emissions Above 1GHz
Test Date:	2020-08-07 & 2020-10-10	2020-08-13 & 2020-10-10	2020-09-28 & 2020-10-10
Tester:	Leo Long	Hanson Li	Joker Chen
Temperature:	24.9~27.1°C	26.1~26.4°C	27.1~29 °C
Relative Humidity:	52~71%	37~41%	35~45%
ATM Pressure:	100.2~100.9kPa	100.9~101.1kPa	100.5~100.9kPa

SUMMARY OF TEST RESULTS

SN	Rule and Clause	Description of Test	Test Result
1	FCC §15.107	Conducted emissions	Compliance
2	FCC §15.109	Radiated emissions	Compliance

CONDUCTED EMISSIONS

EUT Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15 B Class B limits.

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

The adapter was connected to the Main LISN with 120V/60Hz AC power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT, the report shall list the six emissions with the smallest margin relative to the limit, unless the margin is greater than 20 dB.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

V_C : corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

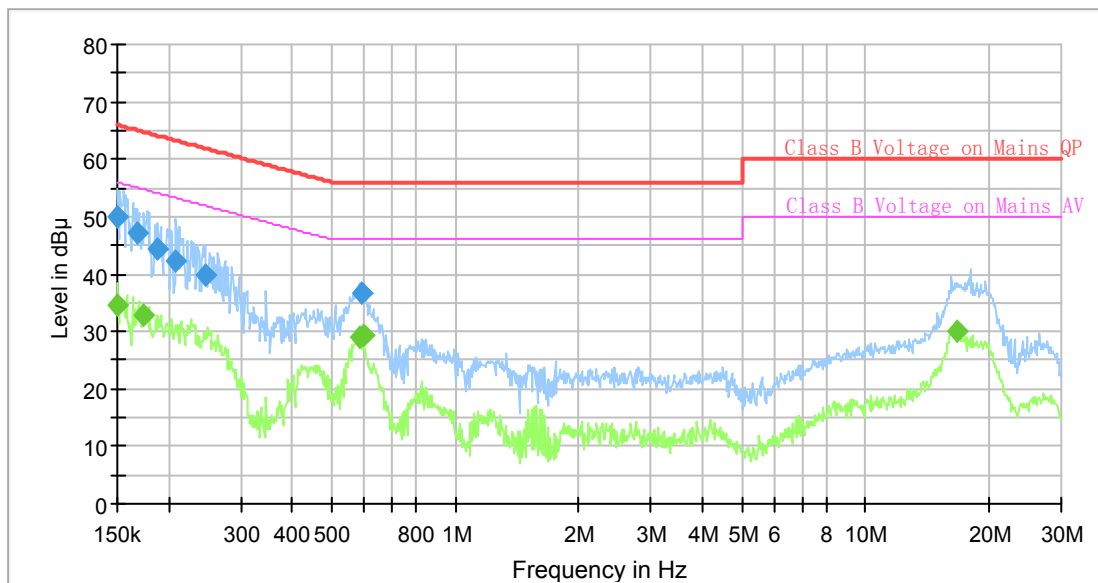
$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Data

Please refer to following table and plots:

Power by adapter:

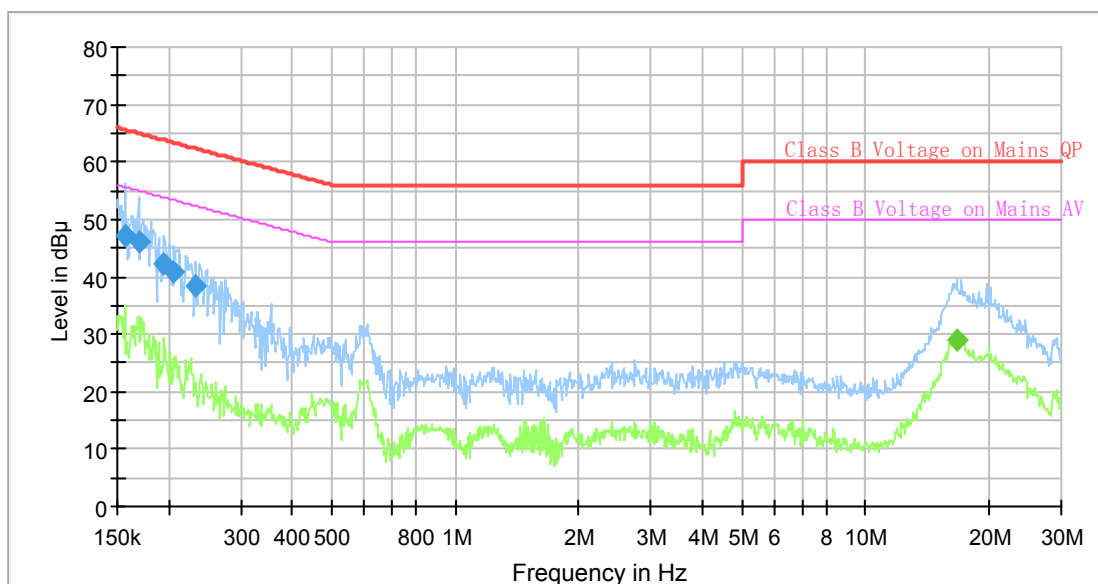
Port: L
Test Mode: Operating



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.150000	---	34.63	56.00	21.37	9.000	L1	9.6
0.150000	50.04	---	66.00	15.96	9.000	L1	9.6
0.167396	47.30	---	65.09	17.79	9.000	L1	9.6
0.174210	---	32.95	54.76	21.81	9.000	L1	9.6
0.188682	44.28	---	64.09	19.81	9.000	L1	9.6
0.208474	42.17	---	63.27	21.10	9.000	L1	9.6
0.245771	39.73	---	61.90	22.17	9.000	L1	9.6
0.582452	---	28.98	46.00	17.02	9.000	L1	9.6
0.591232	36.80	---	56.00	19.20	9.000	L1	9.6
0.600145	---	29.33	46.00	16.67	9.000	L1	9.6
16.711661	---	30.10	50.00	19.90	9.000	L1	10.1

Port: N
Test Mode: Operating



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.156887	47.28	---	65.63	18.35	9.000	N	9.6
0.169074	46.13	---	65.01	18.88	9.000	N	9.6
0.195386	42.35	---	63.80	21.45	9.000	N	9.6
0.206405	40.74	---	63.35	22.61	9.000	N	9.6
0.233814	38.27	---	62.31	24.04	9.000	N	9.6
16.711661	---	28.95	50.00	21.05	9.000	N	9.9

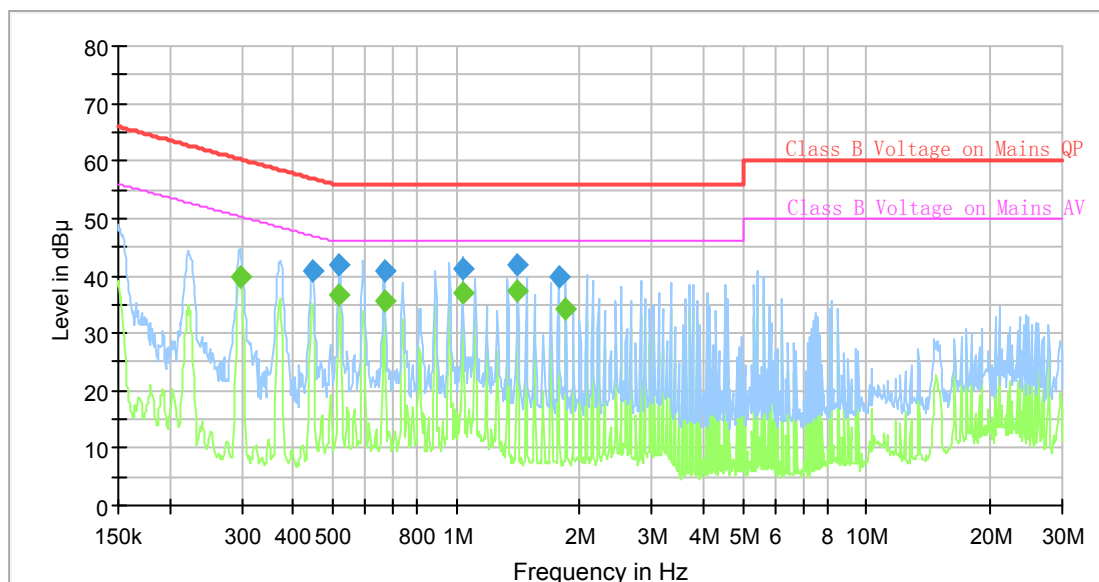
Power by POE:

Port:

L

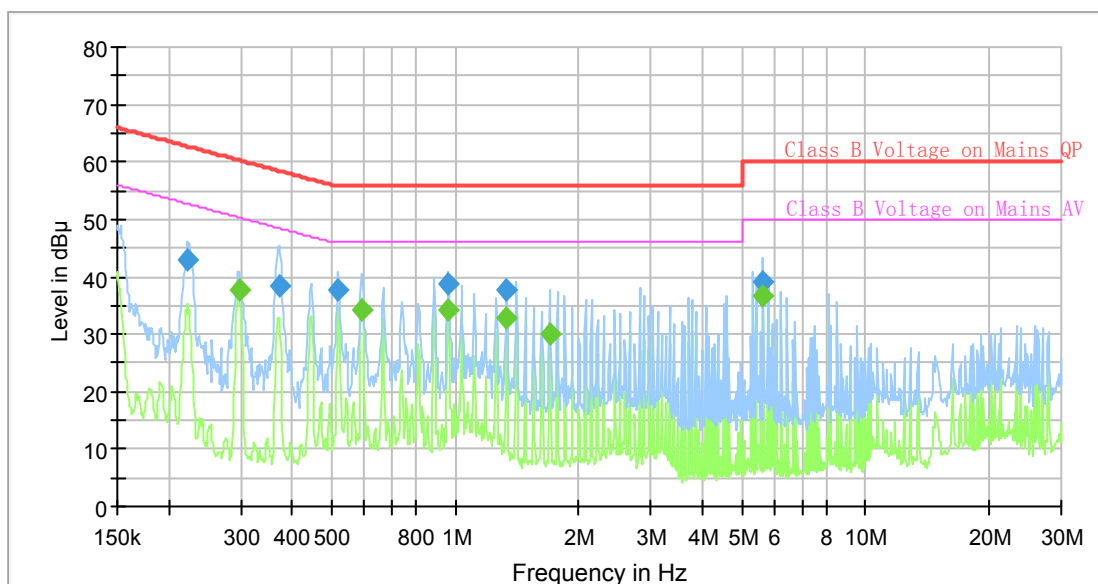
Test Mode:

Operating

**Final Result**

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.297058	---	39.97	50.32	10.35	9.000	L1	9.6
0.444931	40.73	---	56.97	16.24	9.000	L1	9.6
0.519327	---	36.57	46.00	9.43	9.000	L1	9.6
0.519327	42.01	---	56.00	13.99	9.000	L1	9.6
0.666413	---	35.52	46.00	10.48	9.000	L1	9.6
0.666413	40.72	---	56.00	15.28	9.000	L1	9.6
1.038779	41.38	---	56.00	14.62	9.000	L1	9.7
1.038779	---	36.87	46.00	9.13	9.000	L1	9.7
1.408163	41.82	---	56.00	14.18	9.000	L1	9.7
1.408163	---	37.38	46.00	8.62	9.000	L1	9.7
1.780155	39.88	---	56.00	16.12	9.000	L1	9.7
1.852620	---	34.36	46.00	11.64	9.000	L1	9.7

Port: N
Test Mode: Operating

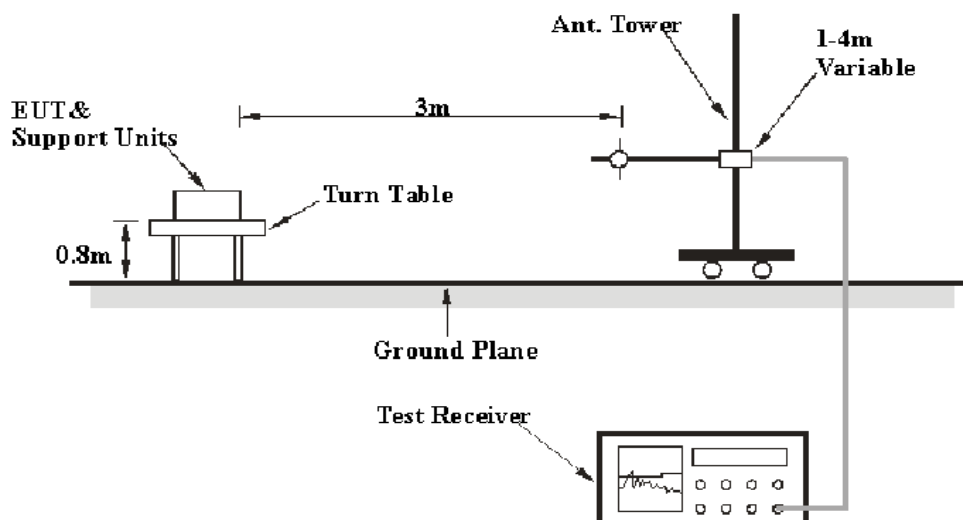


Final Result

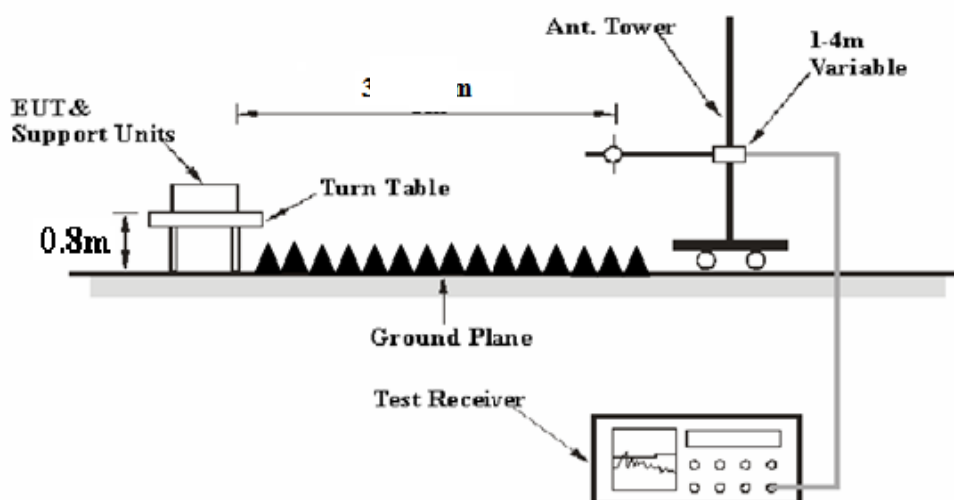
Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.222439	42.98	---	62.73	19.75	9.000	N	9.6
0.297058	---	37.90	50.32	12.42	9.000	N	9.6
0.371804	38.36	---	58.46	20.10	9.000	N	9.6
0.519327	37.90	---	56.00	18.10	9.000	N	9.6
0.591232	---	34.29	46.00	11.71	9.000	N	9.6
0.963901	---	34.29	46.00	11.71	9.000	N	9.6
0.963901	38.75	---	56.00	17.25	9.000	N	9.6
1.332988	---	33.00	46.00	13.00	9.000	N	9.6
1.332988	37.65	---	56.00	18.35	9.000	N	9.6
1.702015	---	30.08	46.00	15.92	9.000	N	9.6
5.634017	---	36.51	50.00	13.49	9.000	N	9.6
5.634017	39.20	---	60.00	20.80	9.000	N	9.6

RADIATED EMISSIONS

EUT Setup Below 1GHz:



Above 1GHz:



The radiated emission below 1GHz tests were performed in the 3 meters chamber test site A, above 1GHz tests were performed in the 3 meters chamber test site B, using the setup accordance with the ANSI C63.4-2014. The specification used was with the FCC Part 15 B Class B limits.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 13.5 GHz.

During the radiated emission test, the EMI test receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	Peak
	1 MHz	Reduced VBW	/	AVG

If the maximized peak measured value complies with under the limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

During the radiated emissions, the adapter was connected to the first AC floor outlet and the other support equipments were connected to the second AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The data was recorded in the Quasi-peak detection mode for below 1 GHz, peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Meter Reading+ Corrected

Note:

Corrected = Antenna Factor + Cable Loss - Amplifier Gain

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Result}$$

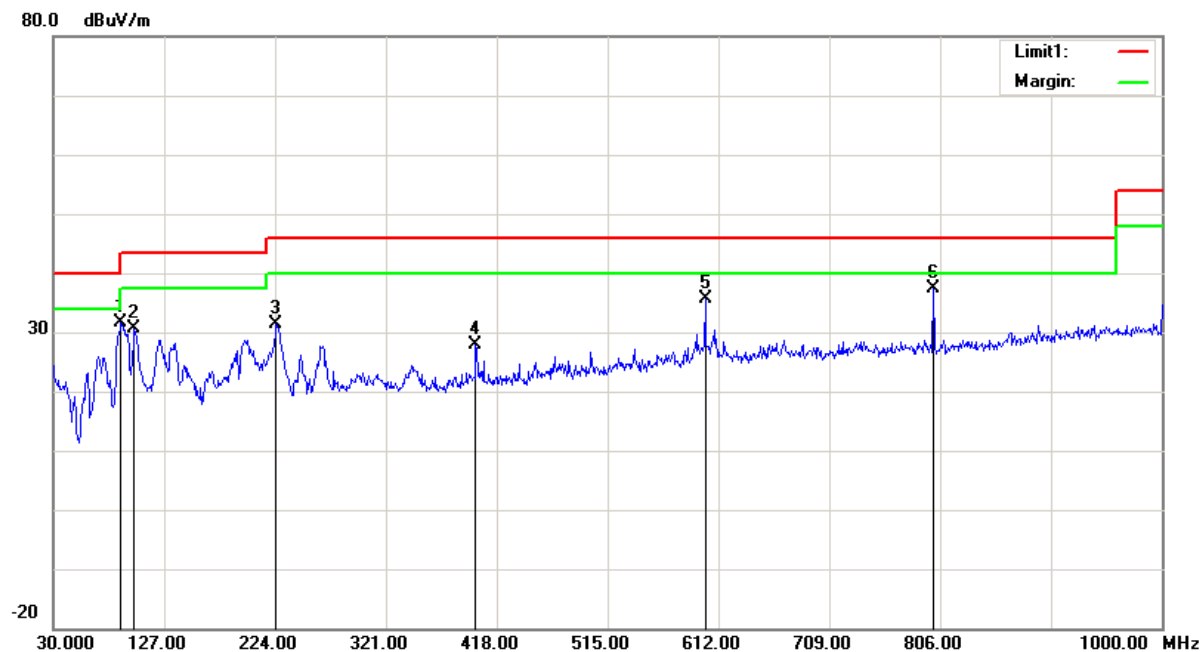
Test Data

Please refer to following table and plots:

Power by adapter:

Condition: FCC Part 15B Class B
Test Mode: Operating

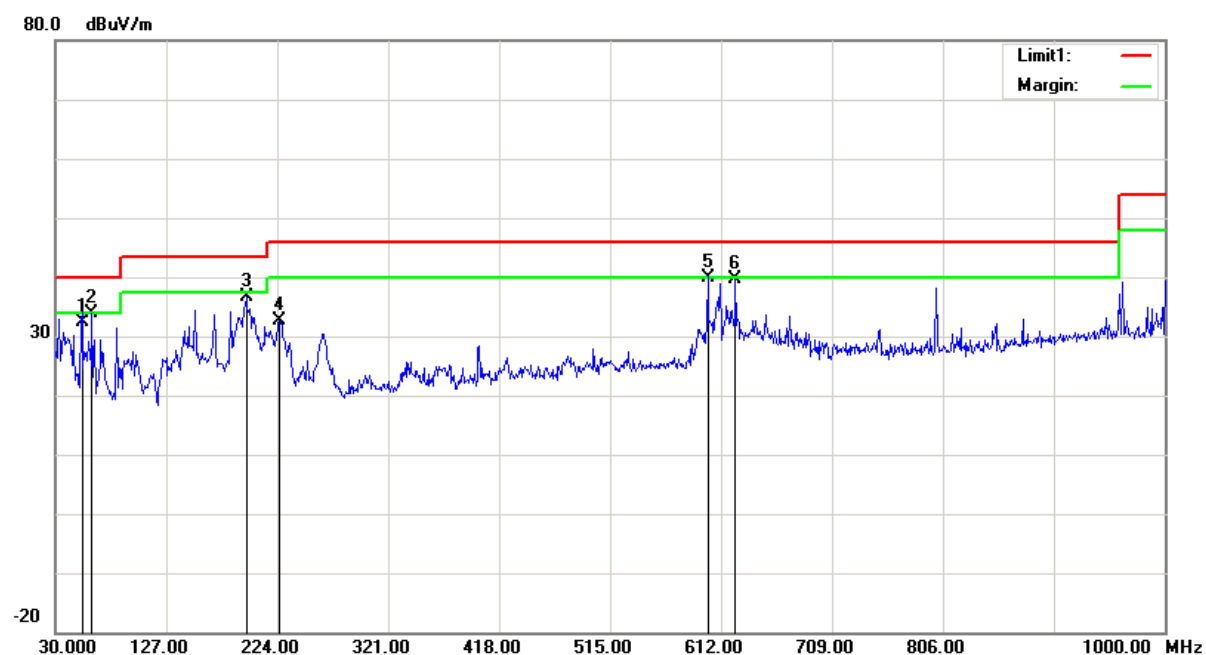
Polarization: Horizontal
Distance: 3m



Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
89.1700	46.77	peak	-15.24	31.53	43.50	11.97
100.8100	44.74	peak	-14.07	30.67	43.50	12.83
224.9700	42.23	peak	-10.88	31.35	46.00	14.65
399.5700	33.06	peak	-5.29	27.77	46.00	18.23
600.3600	36.86	peak	-1.35	35.51	46.00	10.49
800.1800	36.21	peak	1.09	37.30	46.00	8.70

Condition: FCC Part 15B Class B
Test Mode: Operating

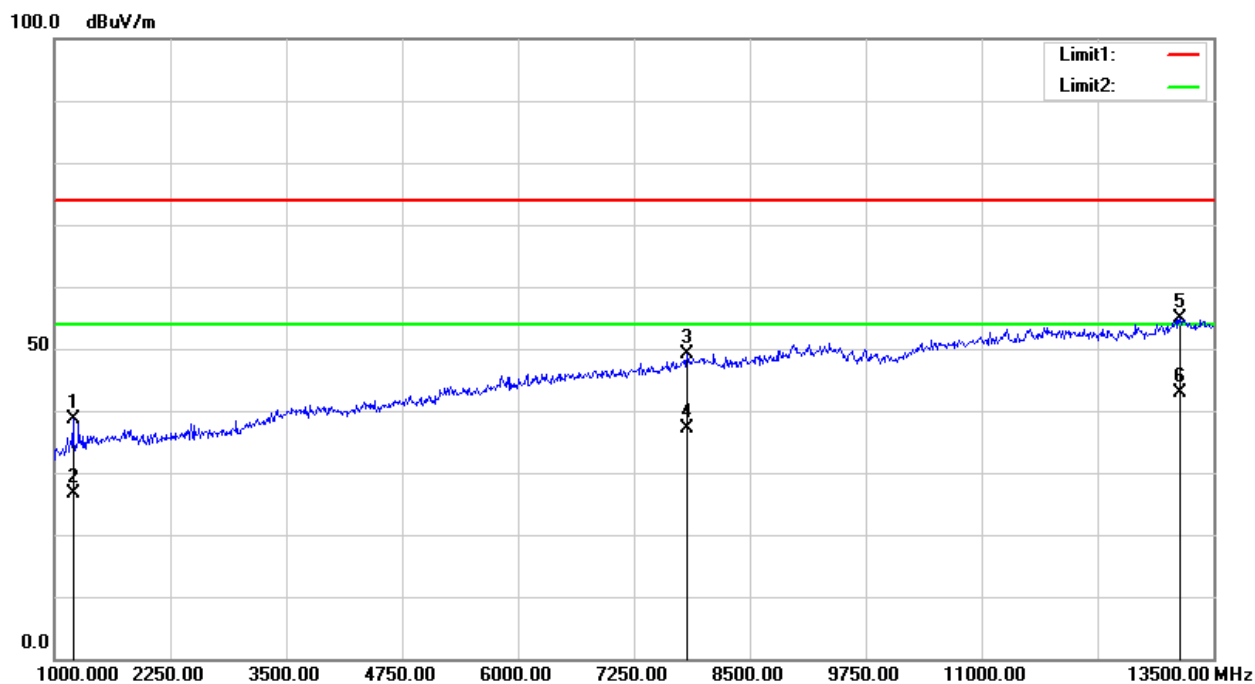
Polarization: Vertical
Distance: 3m



Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
53.2800	48.97	QP	-16.52	32.45	40.00	7.55
62.0100	50.57	peak	-16.59	33.98	40.00	6.02
196.8400	46.46	peak	-9.79	36.67	43.50	6.83
225.9400	43.46	peak	-10.80	32.66	46.00	13.34
600.3600	41.35	QP	-1.35	40.00	46.00	6.00
624.6100	40.47	peak	-0.76	39.71	46.00	6.29

Condition: FCC Part 15B Class B
Test Mode: Operating

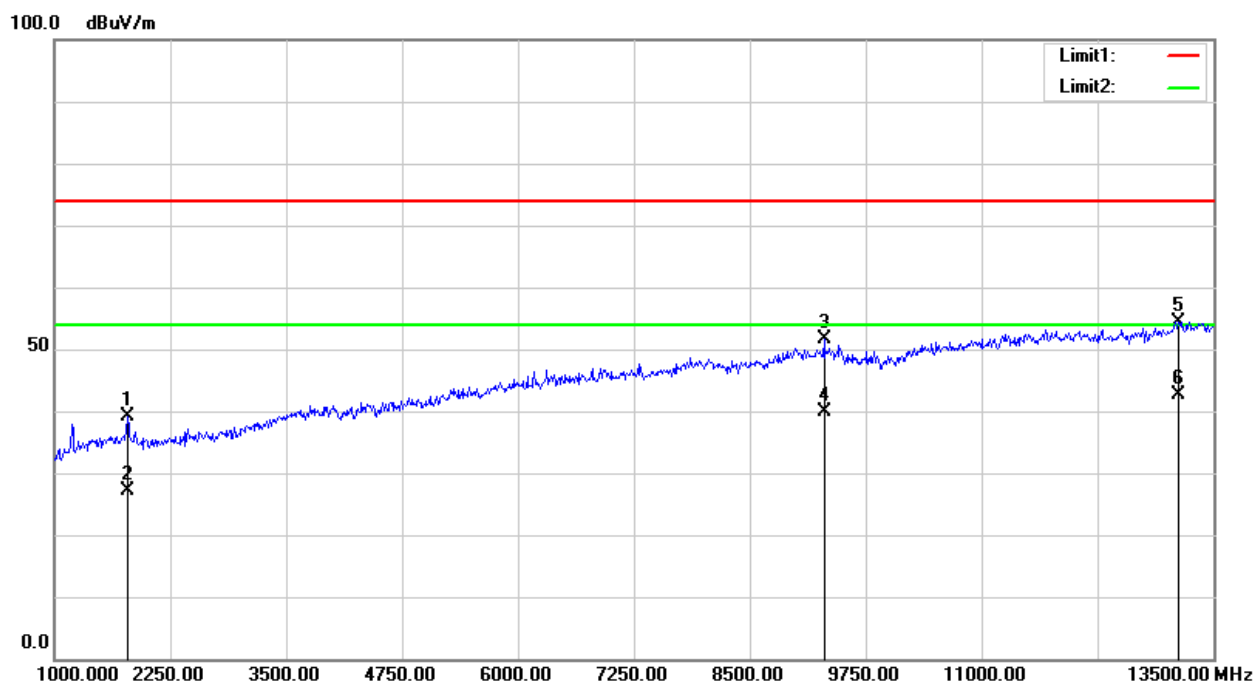
Polarization: Horizontal
Distance: 3m



Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1200.000	41.69	peak	-3.06	38.63	74.00	35.37
1200.000	29.71	AVG	-3.06	26.65	54.00	27.35
7825.000	36.55	peak	12.49	49.04	74.00	24.96
7825.000	24.60	AVG	12.49	37.09	54.00	16.91
13143.750	35.28	peak	19.65	54.93	74.00	19.07
13143.750	23.33	AVG	19.65	42.98	54.00	11.02

Condition: FCC Part 15B Class B
Test Mode: Operating

Polarization: Vertical
Distance: 3m

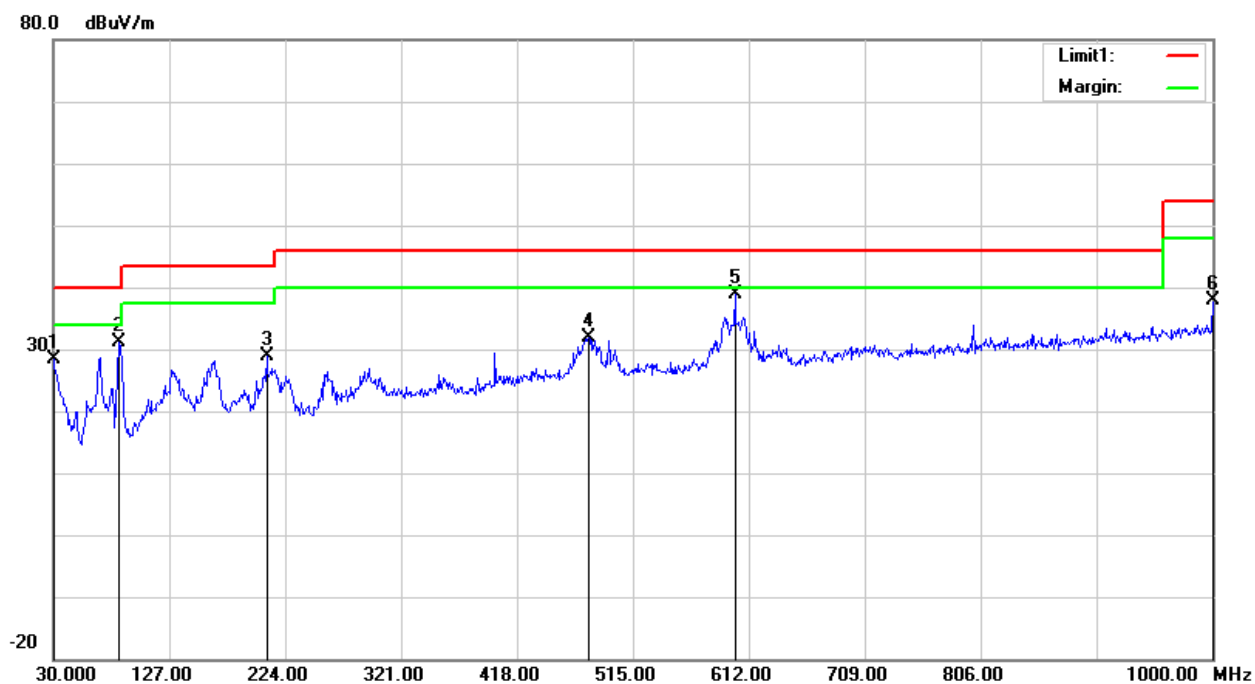


Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1793.750	39.99	peak	-0.80	39.19	74.00	34.81
1793.750	28.02	AVG	-0.80	27.22	54.00	26.78
9300.000	37.55	peak	14.18	51.73	74.00	22.27
9300.000	25.61	AVG	14.18	39.79	54.00	14.21
13131.250	34.74	peak	19.74	54.48	74.00	19.52
13131.250	22.81	AVG	19.74	42.55	54.00	11.45

Power by POE:

Condition: FCC Part 15B Class B
Test Mode: Operating

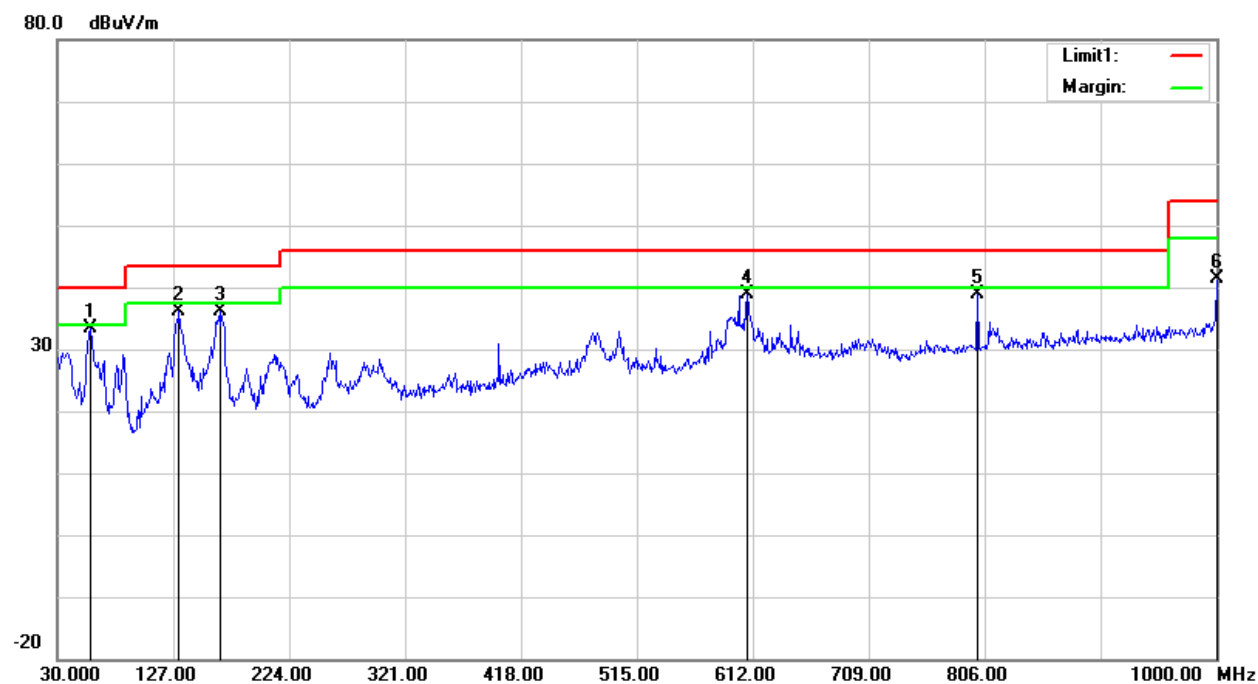
Polarization: Horizontal
Distance: 3m



Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
30.0000	26.93	peak	1.46	28.39	40.00	11.61
85.2900	42.72	peak	-11.60	31.12	40.00	8.88
208.4800	36.27	peak	-7.29	28.98	43.50	14.52
478.1400	32.32	peak	-0.40	31.92	46.00	14.08
600.3600	38.20	peak	0.76	38.96	46.00	7.04
1000.0000	37.02	peak	0.85	37.87	54.00	16.13

Condition: FCC Part 15B Class B
Test Mode: Operating

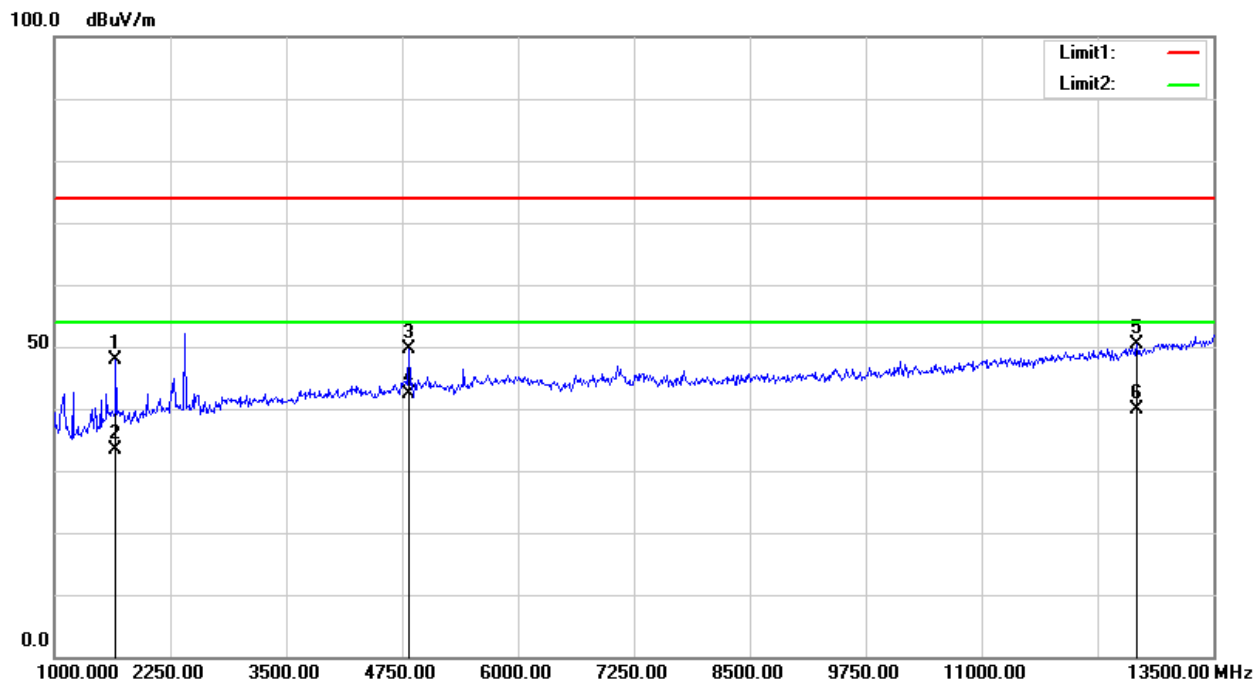
Polarization: Vertical
Distance: 3m



Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
57.1600	45.89	peak	-12.44	33.45	40.00	6.55
131.8500	41.24	peak	-5.07	36.17	43.50	7.33
166.7700	42.54	peak	-6.51	36.03	43.50	7.47
607.1500	38.04	peak	0.87	38.91	46.00	7.09
800.1800	35.28	peak	3.71	38.99	46.00	7.01
1000.0000	40.60	peak	0.85	41.45	54.00	12.55

Condition: FCC Part 15B Class B
Test Mode: Operating

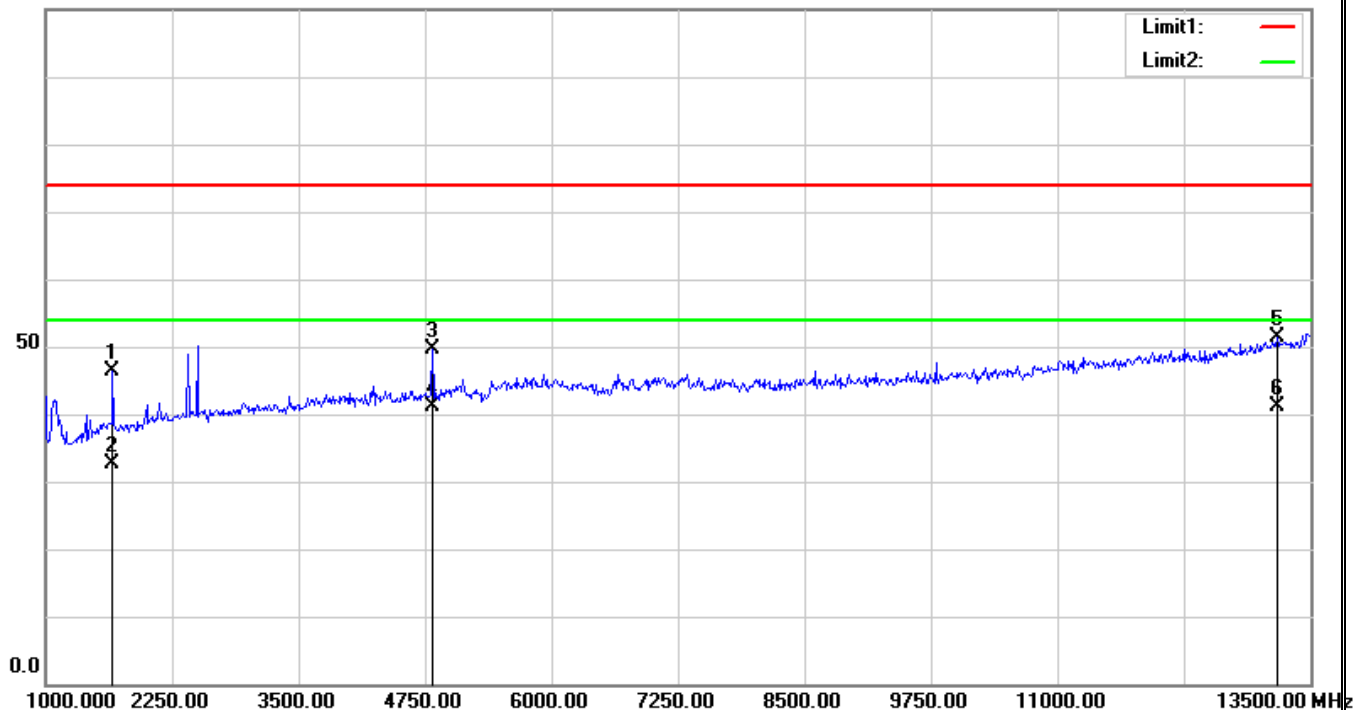
Polarization: Horizontal
Distance: 3m



Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1668.750	46.15	peak	1.72	47.87	74.00	26.13
1668.750	31.70	AVG	1.72	33.42	54.00	20.58
4825.000	39.22	peak	10.53	49.75	74.00	24.25
4825.000	31.87	AVG	10.53	42.40	54.00	11.60
12681.250	29.59	peak	20.89	50.48	74.00	23.52
12681.250	18.87	AVG	20.89	39.76	54.00	14.24

Condition: FCC Part 15B Class B
Test Mode: Operating

Polarization: Vertical
Distance: 3m

100.0 dB μ V/m

Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1668.750	44.73	peak	1.72	46.45	74.00	27.55
1668.750	30.87	AVG	1.72	32.59	54.00	21.41
4825.000	38.98	peak	10.53	49.51	74.00	24.49
4825.000	30.70	AVG	10.53	41.23	54.00	12.77
13175.000	29.32	peak	22.17	51.49	74.00	22.51
13175.000	18.87	AVG	22.17	41.04	54.00	12.96

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