RF Test Report

Applicant	:	OpenPath Security, Inc.
Product Type	:	Smart Reader v2
Trade Name	:	openpath
Model Number	:	OP-R2-STND, OP-R2-MULL
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Received Date	:	Jan. 28, 2021
Test Period	:	Feb. 24, 2021 ~ Mar. 16, 2021
Issued Date	:	Mar. 24, 2021

Issued by

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade District,
Taoyuan City 33465, Taiwan (R.O.C.)
Tel：+886-3-2710188 / Fax：+886-3-2710190

Taiwan Accreditation Foundation accreditation number: 1330
Frequency Range : 9 kHz to 40 GHz
Test Firm MRA designation number: TW0010

Note:

1.The test results are valid only for samples provided by customers and under the test conditions described in this report.
2.This report shall not be reproduced except in full, without the written approval of A Test Lab Technology Corporation.
3.The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Revision History

Rev.	Issued Date	Revisions	Revised By
00	Mar. 24, 2021	Initial Issue	Yu Chiang

Verification of Compliance

Applicant	:	OpenPath Security, Inc.
Product Type	:	Smart Reader v2
Trade Name	:	openpath
Model Number	:	OP-R2-STND, OP-R2-MULL
FCC ID	:	2APJVOPR2LHF
EUT Rated Voltage	:	DC 12 / 24 V, 0.25 / 0.12 A
Test Voltage	:	120 Vac / 60 Hz
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade District, Taoyuan City 33465, Taiwan (R.O.C.) Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330 http://www.atl-lab.com.tw/e-index.htm

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By : Fly Lu

(Manager) (Fly Lu)

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1 General Information

1.1. Summary of Test Result

Standard	Item	Results	Remark
15.203	Antenna Requirement	Meet Require	---
15.207(a)	Conducted Emissions Voltage	PASS	---
15.205 (a) 15.209 (a)	Radiated Emission Limits	PASS	---

Standard	Description
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Decision Rule

■ Uncertainty is not included.

□ Uncertainty is included.

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Conducted Emission	150 kHz ~ 30 MHz	2.7 dB
Radiated Emission	9 kHz ~ 30 MHz	2.2 dB
	30 MHz ~ 1000 MHz	5.1 dB
	1000 MHz ~ 18000 MHz	5.1 dB
	18000 MHz ~ 26500 MHz	4.4 dB
	26500 MHz ~ 40000 MHz	4.6 dB

2 EUT Description

Applicant	OpenPath Security, Inc. 13428 Maxella Ave, #866, Marina Del Rey, CA 90292
Manufacturer	OpenPath Security, Inc. 13428 Maxella Ave, #866, Marina Del Rey, CA 90292
Product	Smart Reader v2
Trade Name	openpath
Model Number	OP-R2-STND, OP-R2-MULL
Models different description	The difference is only the appearance size of the product.
FCC ID	2APJVOPR2LHF
Frequency Range	125 KHz
Modulation Type	ASK
Number of Channels	1 Channel
Antenna Type	Loop Antenna
Operate Temp. Range	-30 ~ 60 ℃

3 Test Methodology

3.1. Mode of Operation

In the test report use EUT model: OP-R2-STND to operate testing.
The following test mode(s) were scanned during the preliminary test：

Test Mode
Mode 1: Transmit Mode
Mode 2: Continuous TX Mode
Mode 3: Receiver Mode

After verification, all tests were carried out with the worst case test modes.

ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation.

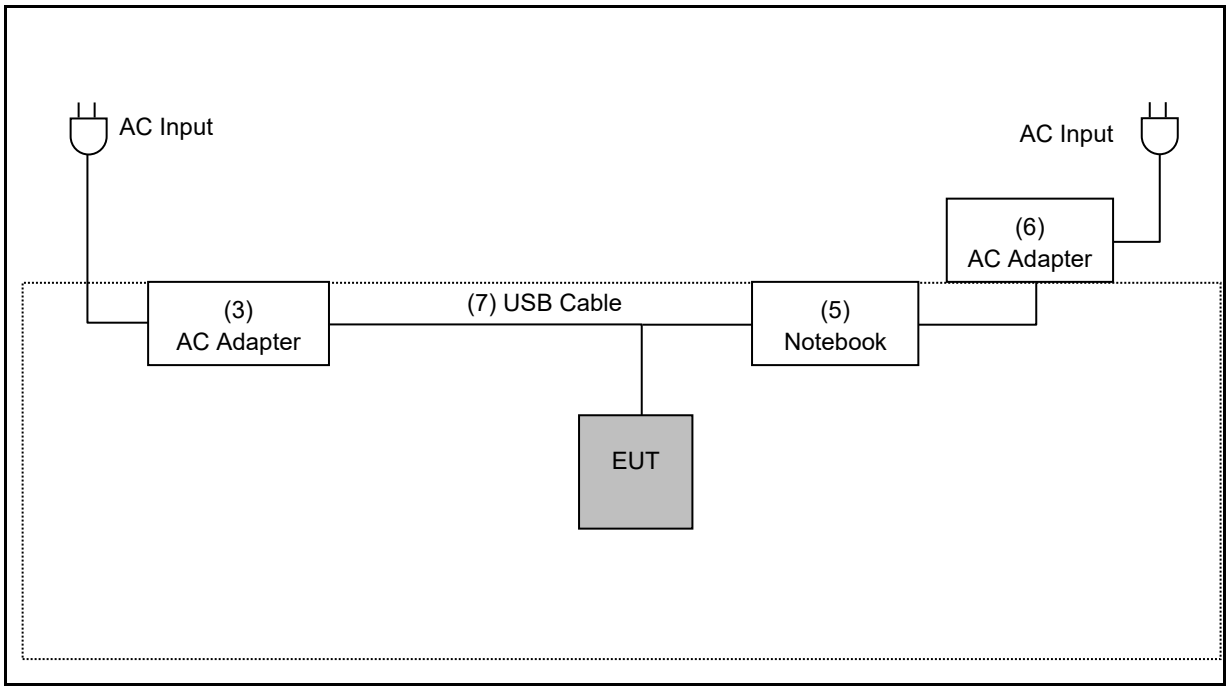
3.2. EUT Test Step

1.	Setup the EUT shown on “Configuration of Test System Details.”
2.	Turn on the power of all equipment.
3.	The EUT will start to operate function.

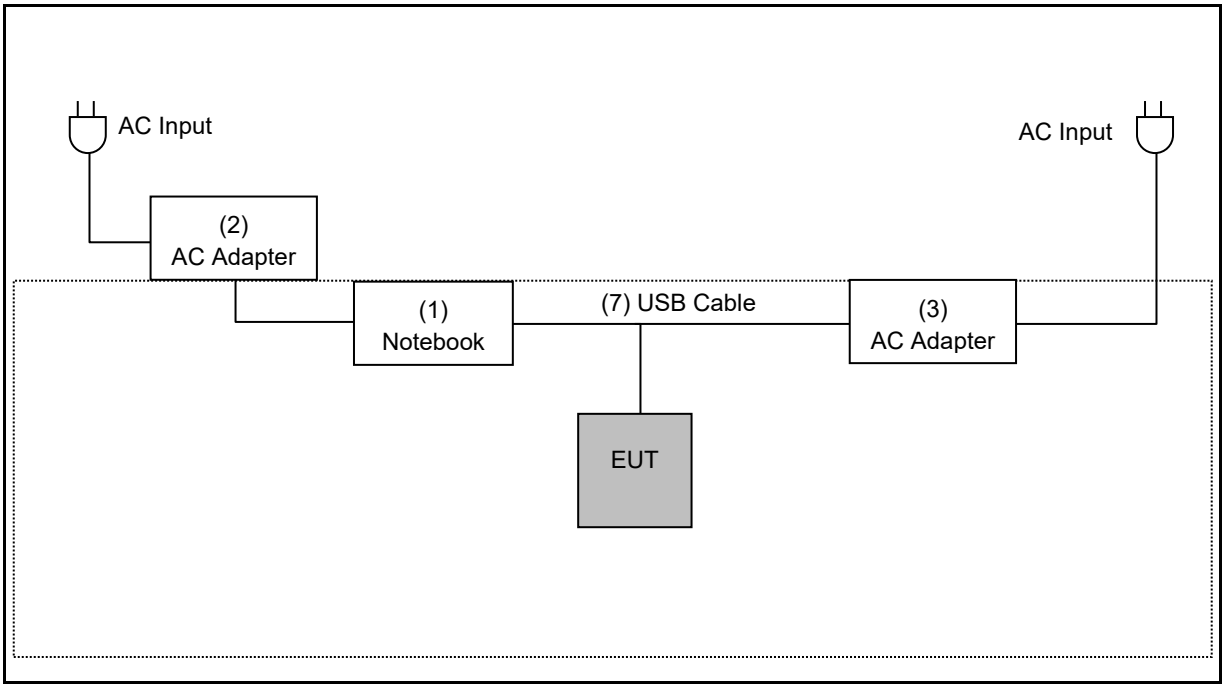
Measurement Software			
No.	Description	Software	Version
1	Conducted Emission	EZ EMC	1.1.4.3
2	Radiated Emission	EZ EMC	1.1.4.4

3.3. Configuration of Test System Details

Conducted Emission



Radiated Emission



Devices Description					
Product		Manufacturer	Model Number	Serial Number	Power Cord
(1)	Notebook	ASUS	P2430U	GANXCV04H86940A	---
(2)	AC Adapter	ASUS	ADP-65GD D	---	Non-shielded, 0.8 m
(3)	AC Adapter	Powertron Elcttronics Corp	PA1015-3HU	---	---
(4)	AC Adapter	Powertron Elcttronics Corp	PA1024-120HUB200	---	---
(5)	Notebook	ASUS	BU400A	D1NXAS148534020	---
(6)	AC Adapter	ASUS	EXA1203YH	---	Non-shielded, 0.8 m
(7)	USB Cable	openpath	A	---	---

3.4. Test Instruments

Conducted Emission

Test Period: Mar. 09 ~ Mar. 16, 2021

Testing Engineer: Andy Lu, JS. Liao

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Test Receiver	R&S	ESCI	100367	05/25/2020	1 year
RF Cable	Woken	00100D1380194M	TE-02-03	05/25/2020	1 year
LISN	R&S	ENV216	101040	03/23/2020	1 year
LISN	R&S	ENV216	101041	04/06/2020	1 year

Radiated Emissions

Test Period: Feb. 24 ~ Mar. 15, 2021

Testing Engineer: Ricky Liu, Hung Chou, Brian Lin

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Keysight	N9030B	MY57143537	04/14/2020	1 year
Amplifier	Agilent	8447D	2944A11119	01/15/2021	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	03/27/2020	1 year
Broadband Antenna	Schwarzbeck	VULB9168	01146	07/03/2020	1 year
Coaxial Cable	Titan	T0710AT327A10A900	J11004	08/13/2020	1 year

Note: N.C.R. = No Calibration Request.

3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	20-30
Humidity (%RH)	25-75	45-75

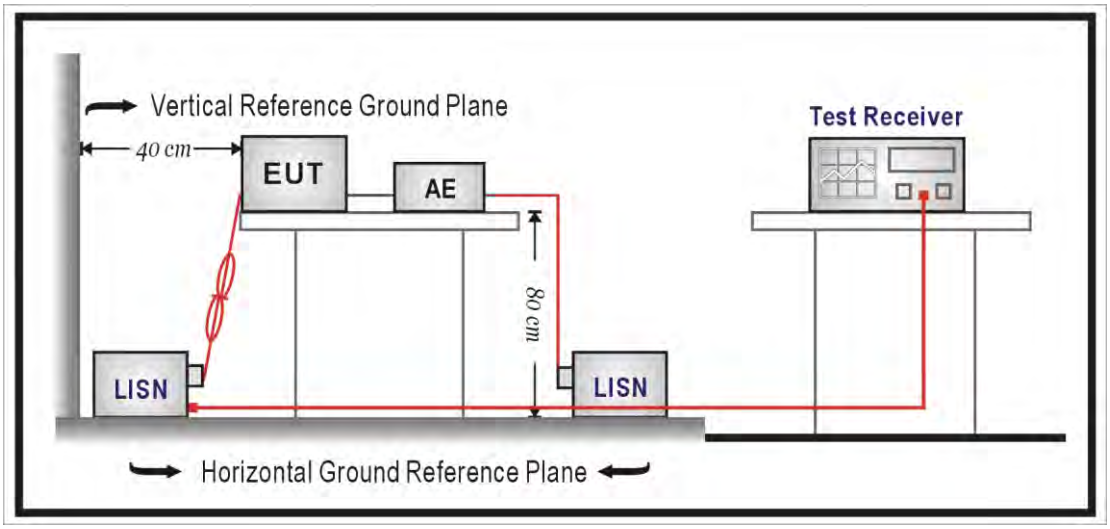
4 Measurement Procedure

4.1. AC Power Line Conducted Emission Measurement

■ **Limit**

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

■ **Test Setup**



■ **Test Procedure**

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 Ω// 50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 Ω// 50 uH coupling impedance with 50 ohm termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40 cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80 cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12 mm insulating material.

Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150 kHz to 30 MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8 m from the AMN. If the mains power cable is longer than 1 m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4 m. All of interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1 m. All 50 Ω ports of the LISN shall be resistively terminated into 50 Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

4.2. Radiated Emission Measurement

■ **Limit**

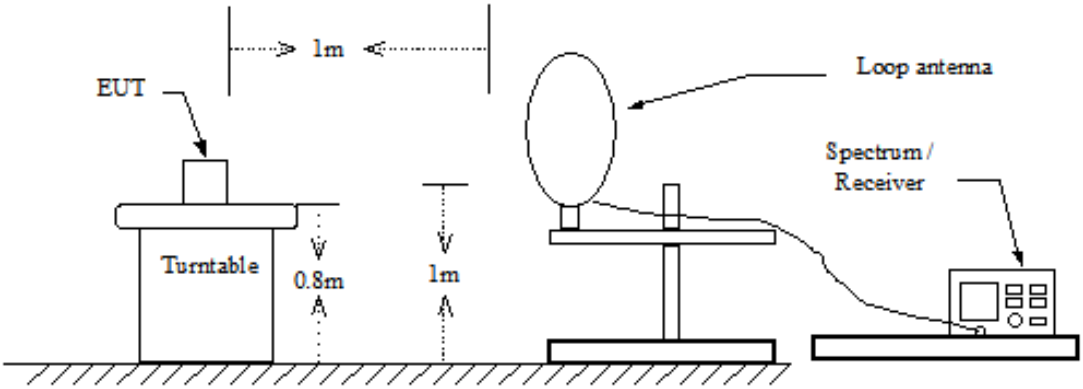
According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m at meter)	Measurement Distance (meter)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 - 88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

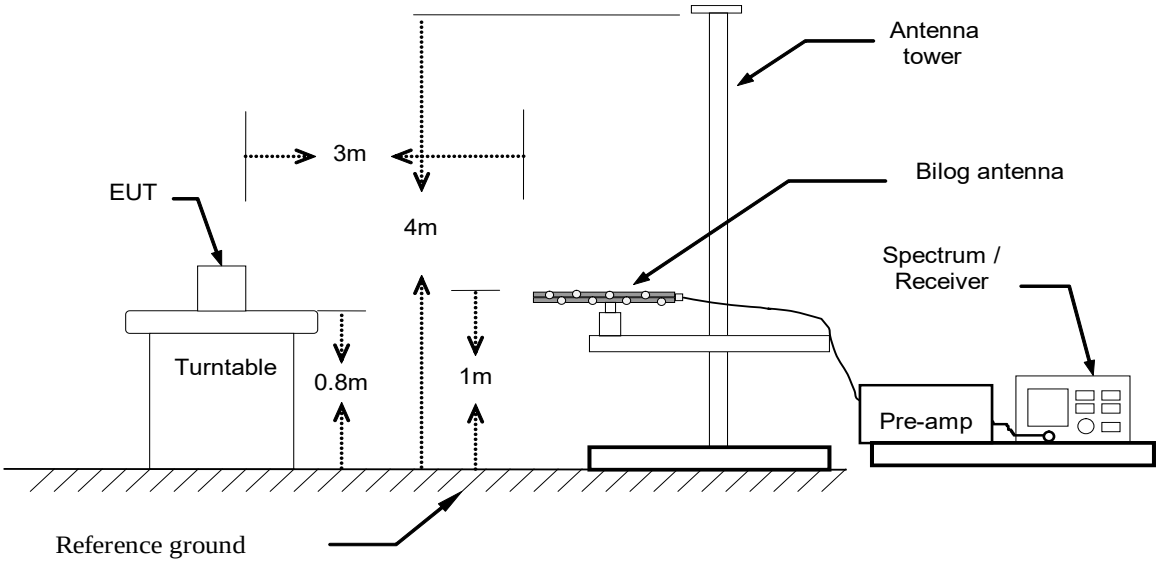
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

■ **Setup**

9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



■ **Test Procedure**

Final radiation measurements were made on a three-meter Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 3 Hz to 44 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

Broadband/Horn Antenna were used in frequency 30 MHz to 18 GHz at a distance of 3 meter. Loop/Horn Antenna was used in frequency 9 kHz to 30 MHz and 18 to 26.5 GHz at a distance of 1 meter. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer’s 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in microvolt pre-meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in microvolt per-meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

(1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)
FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.
P.S Amplitude is auto calculate in spectrum analyzer.

(2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)
The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:
(a) For fundamental frequency : Transmitter Output < +30 dBm
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

4.3. Antenna Requirement

■ **Require**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

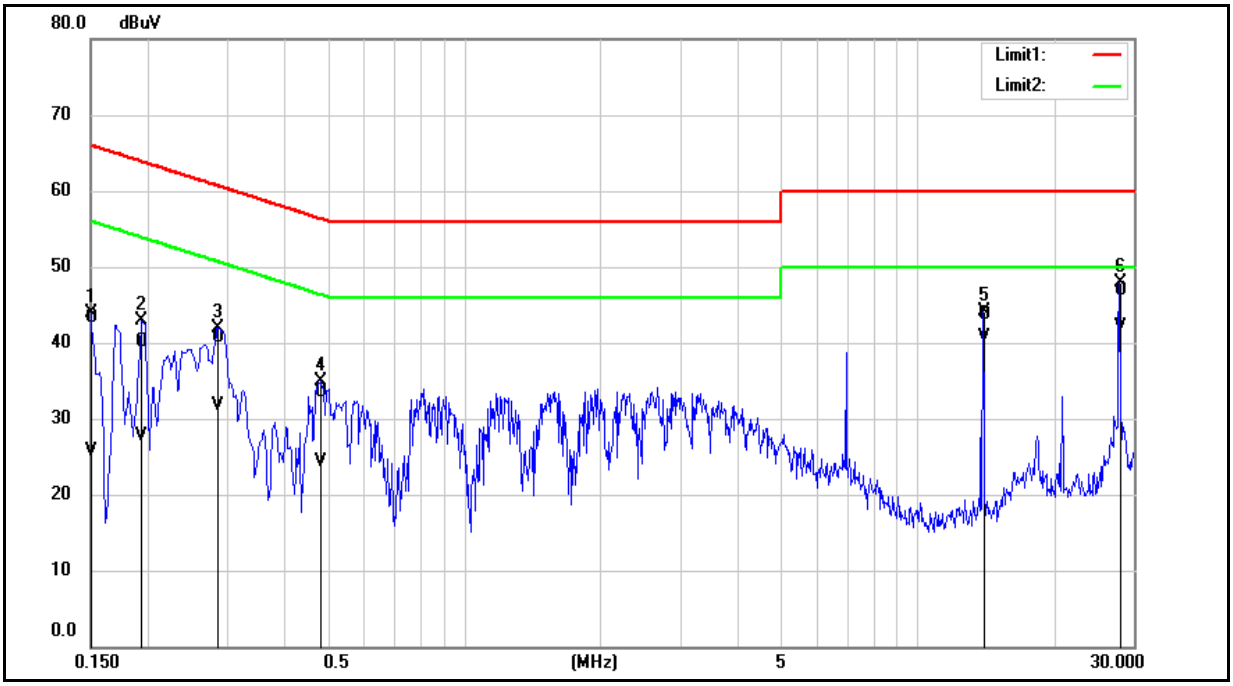
■ **Antenna Connector Construction**

The antenna connector used in this product is internal antenna, cannot be replaced by the end-user. See section 2 – antenna information.

5 Test Results

Annex A. Conducted Emission

Standard:	FCC Part 15C	Line:	L1
Test item:	Conducted Emission	Power:	AC 120 V/60 Hz
Mode:	Mode 1		
Description:			

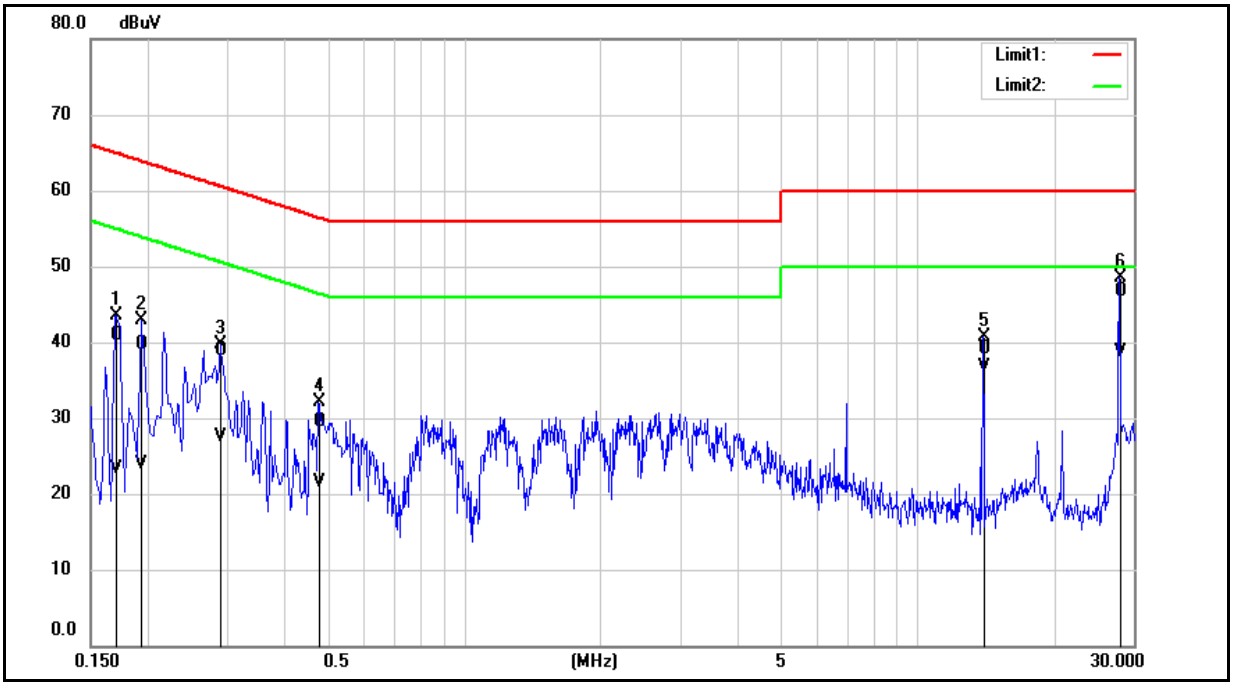


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1500	33.70	16.06	9.69	43.39	25.75	66.00	56.00	-22.61	-30.25	Pass
2	0.1940	30.32	17.96	9.69	40.01	27.65	63.86	53.86	-23.85	-26.21	Pass
3	0.2860	30.96	22.00	9.70	40.66	31.70	60.64	50.64	-19.98	-18.94	Pass
4	0.4820	23.78	14.53	9.70	33.48	24.23	56.30	46.30	-22.82	-22.07	Pass
5	13.9340	33.77	30.69	9.97	43.74	40.66	60.00	50.00	-16.26	-9.34	Pass
6	27.8660	36.77	31.90	10.19	46.96	42.09	60.00	50.00	-13.04	-7.91	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Standard:	FCC Part 15C	Line:	N
Test item:	Conducted Emission	Power:	AC 120 V/60 Hz
Mode:	Mode 1		
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1700	31.30	13.63	9.69	40.99	23.32	64.96	54.96	-23.97	-31.64	Pass
2	0.1940	30.01	14.20	9.69	39.70	23.89	63.86	53.86	-24.16	-29.97	Pass
3	0.2900	29.30	17.80	9.70	39.00	27.50	60.52	50.52	-21.52	-23.02	Pass
4	0.4780	19.90	11.76	9.70	29.60	21.46	56.37	46.37	-26.77	-24.91	Pass
5	13.9340	29.09	26.66	9.97	39.06	36.63	60.00	50.00	-20.94	-13.37	Pass
6	27.8660	36.51	28.46	10.19	46.70	38.65	60.00	50.00	-13.30	-11.35	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

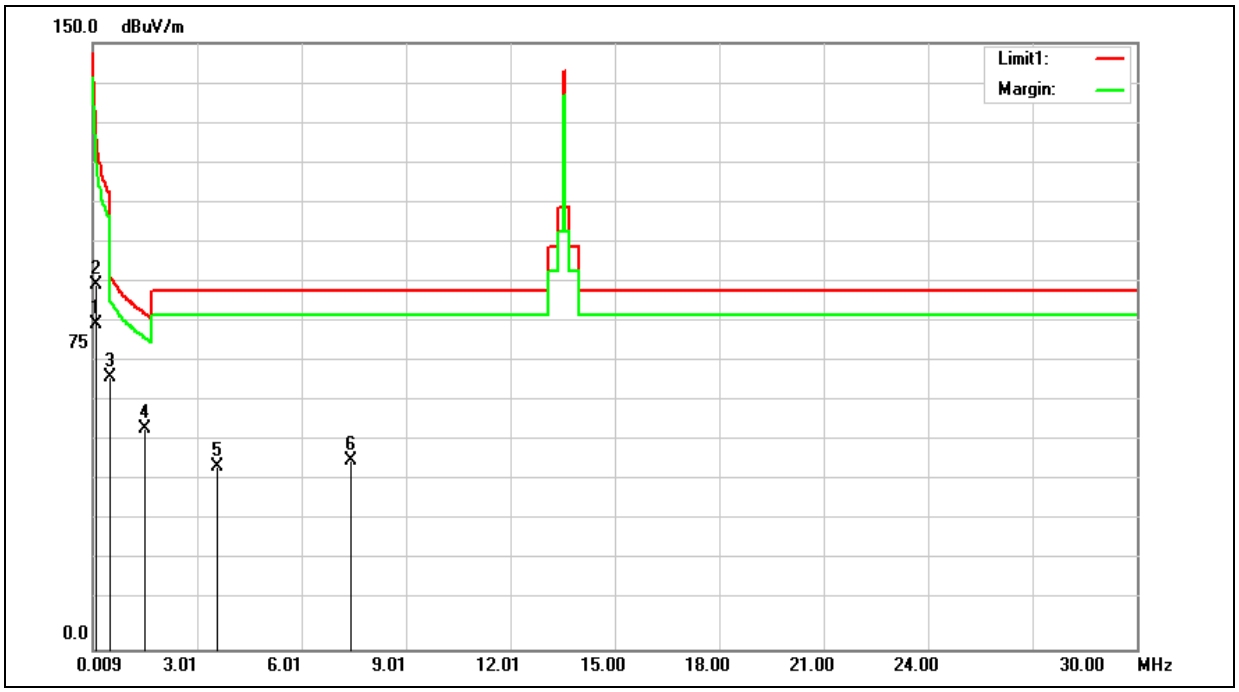
2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Annex B. Radiated Emission Measurement

Harmonic

9 kHz ~ 30 MHz:

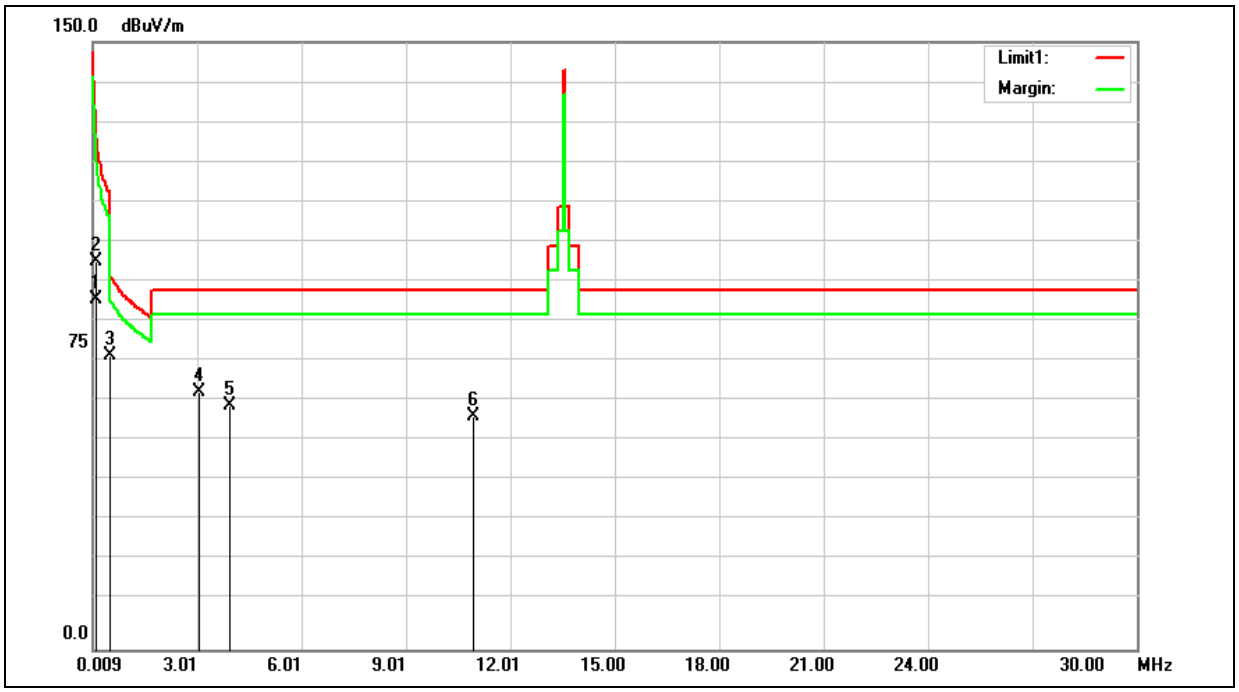
Standard:	FCC Part 15C	Test Distance:	300/30 m
Test item:	Harmonic		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV/m)	Derived Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.11	67.09	13.46	80.55	-21.74	26.78	-48.52	QP
2	0.125	76.71	13.52	90.23	-10.95	25.67	-36.62	QP
3	0.495	52.98	14.27	67.25	-1.98	33.71	-35.69	QP
4	1.5082	40.12	14.33	54.45	-5.10	24.04	-29.14	QP
5	3.578	30.38	14.64	45.02	-7.03	29.54	-36.57	QP
6	7.4168	31.34	15.52	46.86	1.14	29.54	-28.40	QP

Note: The level is measured at 1 meter and is converted into result at 300 or 30 meter.

Standard:	FCC Part 15C	Test Distance:	300/30 m
Test item:	Harmonic		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV/m)	Derived Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.11	72.80	13.46	86.26	-16.03	26.78	-42.81	QP
2	0.125	82.42	13.52	95.94	-5.24	25.67	-30.91	QP
3	0.495	58.27	14.27	72.54	3.31	33.71	-30.40	QP
4	3.068	48.96	14.45	63.41	10.03	29.54	-19.52	QP
5	3.9378	45.28	14.79	60.07	8.86	29.54	-20.68	QP
6	10.9257	41.69	15.95	57.64	15.29	29.54	-14.25	QP

Note: The level is measured at 1 meter and is converted into result at 300 or 30 meter.

Standard:	FCC Part 15C	Test Distance:	300/30 m
Test item:	Harmonic		
Mode:	Mode 3		
Ant.Polar.:	Horizontal		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV/m)	Derived Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.369	53.21	14.29	67.50	-24.28	16.26	-40.54	QP
2	0.6388	46.19	14.29	60.48	-6.53	31.50	-38.03	QP
3	0.8787	41.14	14.32	55.46	-8.78	28.73	-37.51	QP
4	1.2083	35.88	14.33	50.21	-11.27	25.96	-37.23	QP
5	1.8684	35.78	14.33	50.11	-7.58	29.54	-37.13	QP
6	2.7982	38.24	14.40	52.64	-1.54	29.54	-31.08	QP

Note: The level is measured at 1 meter and is converted into result at 300 or 30 meter.

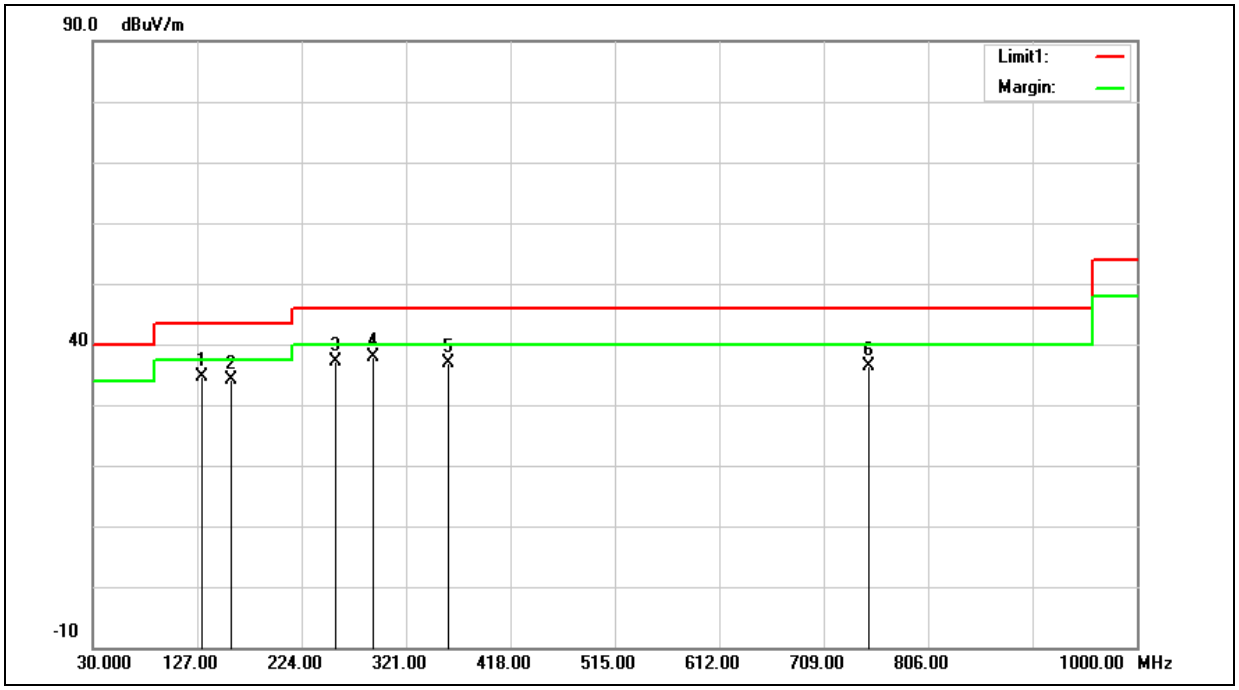
Standard:	FCC Part 15C	Test Distance:	300/30 m
Test item:	Harmonic		
Mode:	Mode 3		
Ant.Polar.:	Vertical		

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Near-Field Result (dBuV/m)	Derived Value (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.5786	46.23	14.29	60.52	-7.35	32.36	-39.71	QP
2	0.7886	39.83	14.31	54.14	-11.04	29.67	-40.71	QP
3	1.4485	38.37	14.32	52.69	-7.21	24.39	-31.60	QP
4	2.3182	39.43	14.36	53.79	-2.03	29.54	-31.57	QP
5	3.0381	39.90	14.44	54.34	0.87	29.54	-28.67	QP
6	3.9378	34.67	14.79	49.46	-1.75	29.54	-31.29	QP

Note: The level is measured at 1 meter and is converted into result at 300 or 30 meter.

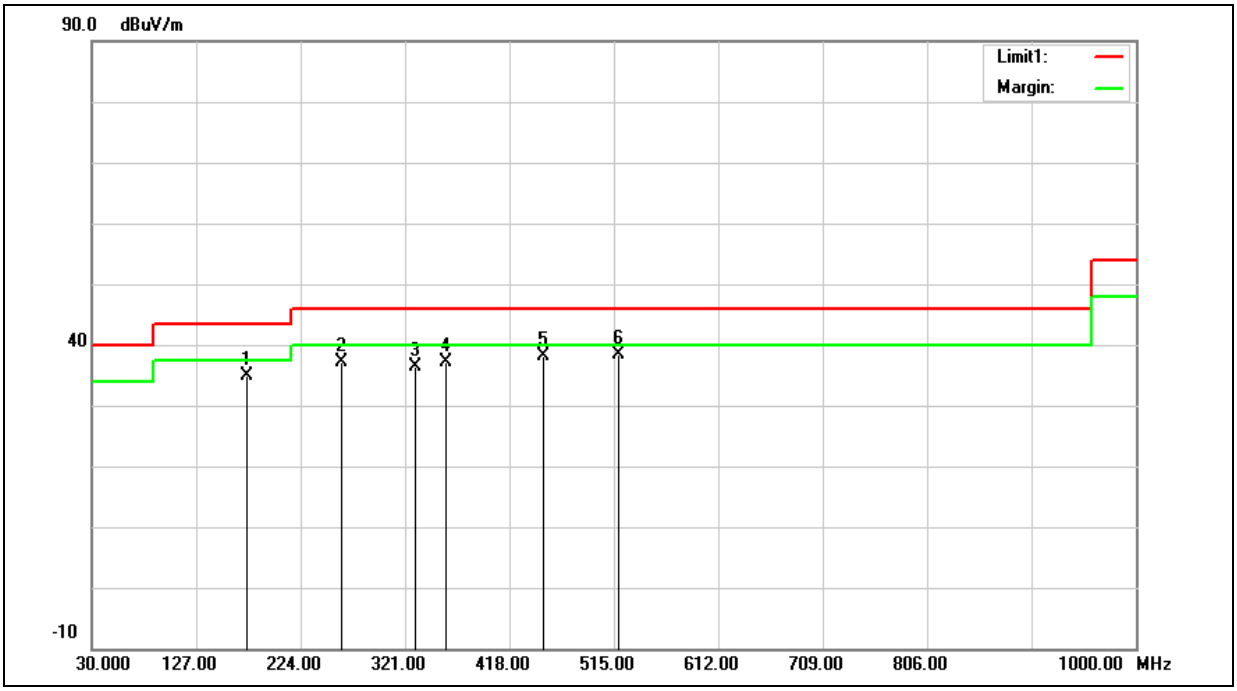
30 MHz ~ 1 GHz:

Standard:	FCC Part 15C	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Mode 2		
Ant.Polar.:	Horizontal		



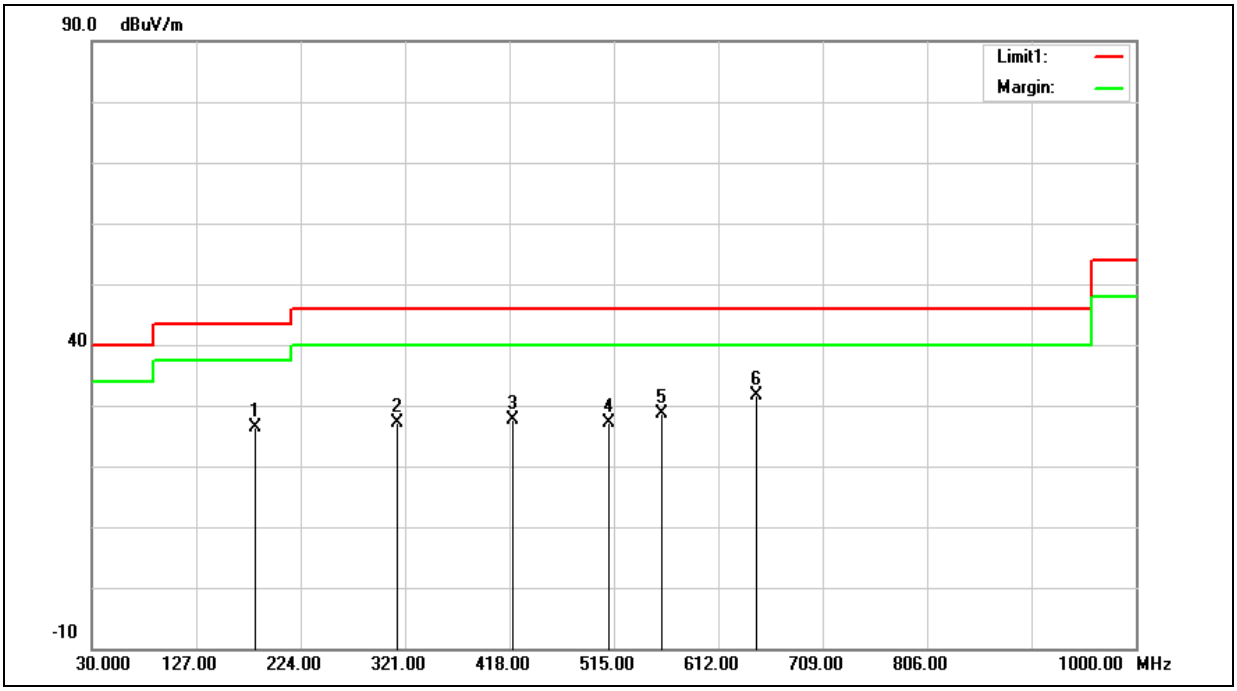
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	130.8800	43.25	-8.74	34.51	43.50	-8.99	QP
2	159.0100	41.70	-7.51	34.19	43.50	-9.31	QP
3	256.0100	45.19	-8.16	37.03	46.00	-8.97	QP
4	289.9600	44.71	-6.77	37.94	46.00	-8.06	QP
5	359.8000	42.41	-5.45	36.96	46.00	-9.04	QP
6	750.7100	35.57	0.85	36.42	46.00	-9.58	QP

Standard:	FCC Part 15C	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Mode 2		
Ant.Polar.:	Vertical		



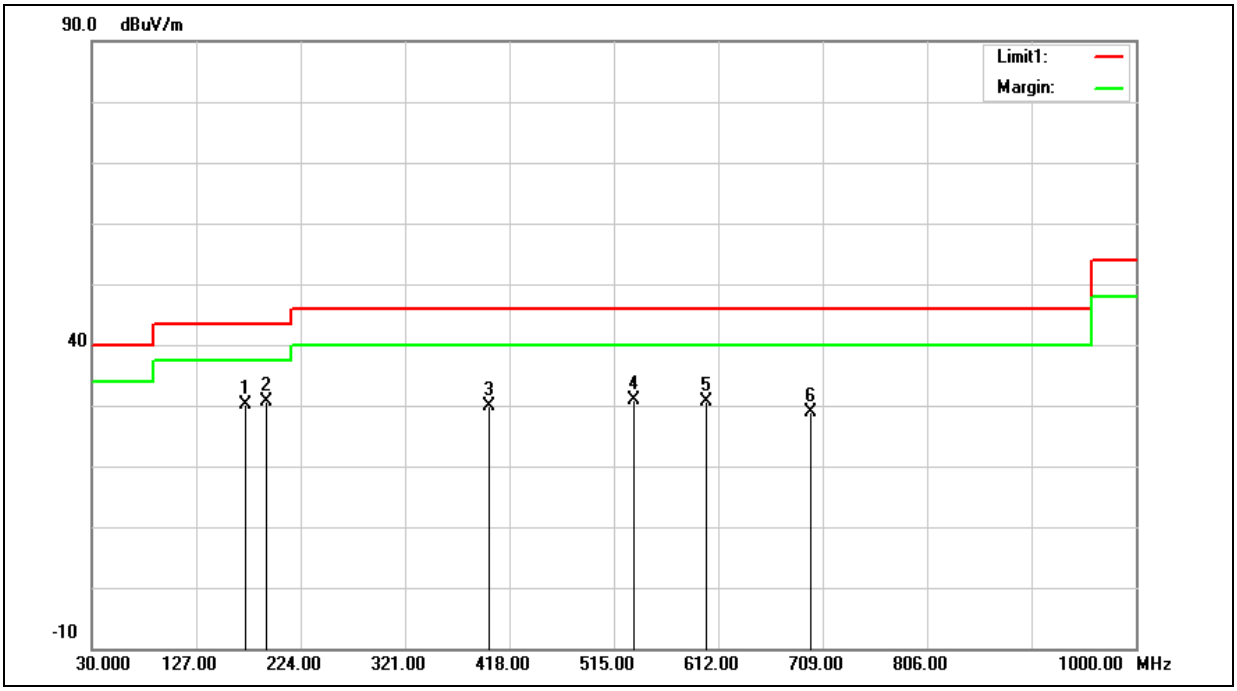
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	174.5300	43.17	-8.27	34.90	43.50	-8.60	QP
2	261.8300	45.12	-7.99	37.13	46.00	-8.87	QP
3	330.7000	42.40	-5.96	36.44	46.00	-9.56	QP
4	358.8300	42.65	-5.48	37.17	46.00	-8.83	QP
5	450.0100	42.15	-3.90	38.25	46.00	-7.75	QP
6	519.8500	41.55	-3.15	38.40	46.00	-7.60	QP

Standard:	FCC Part 15C	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Mode 3		
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	181.3200	35.49	-9.11	26.38	43.50	-17.12	QP
2	314.2100	33.33	-6.26	27.07	46.00	-18.93	QP
3	420.9100	31.99	-4.43	27.56	46.00	-18.44	QP
4	510.1500	30.51	-3.38	27.13	46.00	-18.87	QP
5	559.6200	30.87	-2.21	28.66	46.00	-17.34	QP
6	647.8900	32.37	-0.74	31.63	46.00	-14.37	QP

Standard:	FCC Part 15C	Test Distance:	3 m
Test item:	Harmonic		
Mode:	Mode 3		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	172.5900	38.17	-8.04	30.13	43.50	-13.37	QP
2	191.9900	40.48	-9.97	30.51	43.50	-12.99	QP
3	399.5700	34.66	-4.81	29.85	46.00	-16.15	QP
4	533.4300	33.79	-2.82	30.97	46.00	-15.03	QP
5	600.3600	31.81	-1.26	30.55	46.00	-15.45	QP
6	698.3300	28.99	-0.03	28.96	46.00	-17.04	QP

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