

TEST REPORT

Reference No..... : WTX20X07047864W-1
FCC ID : 2ATDU-01455
Applicant : FERMAX ELECTRONICA, S.A.U.
Address : AV. TRES CRUCES, 133, VALENCIA, 46017, SPAIN
Product Name : MEET MARINE PANEL
Test Model. : 1455
Standards : FCC Part 15.225
Date of Receipt sample : Jul.21, 2020
Date of Test..... : Jul.21, 2020 to Aug.05, 2020, Oct.19, 2020
Date of Issue : Oct.19, 2020
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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Report version

Version No.	Date of issue	Description
Rev.00	Oct.19, 2020	Original
/	/	/

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: FERMAX ELECTRONICA, S.A.U.
Address of applicant: AV. TRES CRUCES, 133, VALENCIA, 46017, .SPAIN

Manufacturer: FERMAX ELECTRONICA, S.A.U.
Address of manufacturer: AV. TRES CRUCES, 133, VALENCIA, 46017, .SPAIN

General Description of EUT	
Product Name:	MEET MARINE PANEL
Trade Name:	FERMAX
Model No.:	1455
Adding Model(s):	1452
Rated Voltage:	DC 12V
Power Adapter Model:	/
Software Version	V02.10
Hardware Version	902D-A9-03
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model 1455, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Support Standards:	NFC
Frequency Range:	13.56MHz
Max. Field Strength:	56.88dBuV/m (at 3m)
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.225: Operation within the band 13.110-14.010 MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

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

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Test Facility

Address of the test laboratory

Laboratory: Waltek Testing Group (Shenzhen) Co., Ltd.

Address: 1/F., Room 101, Building 1, Hongwei Industrial Park, Liuxian 2nd Road, Block 70 Bao'an District, Shenzhen, Guangdong, China

FCC – Registration No.: 125990

Waltek Testing Group (Shenzhen) 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. The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Waltek Testing Group (Shenzhen) 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 Test Mode

The EUT was operated in the continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	13.56MHz

Test Conditions	
Temperature:	22~25 °C
Relative Humidity:	50~55 %.
ATM Pressure:	1019 mbar

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
AC Cable	1.2	Shielded	Without Ferrite
DC Cable	1.6	Shielded	Without Ferrite
POE AC Cable	0.8	Shielded	Without Ferrite
POE DC Cable	0.7	Shielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Bus Card	/	/	/
Adapter	/	XH1200-2000	/
POE Adapter	TP-LINK	T535113-2X1	/
Ethernet POE Switch	TP-LINK	TL-SF1005P	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Frequency Deviation	2.3%	± 5%
Conducted Emissions	Conducted	9-150kHz ± 3.74dB
		0.15-30MHz ± 3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ± 4.52dB
		0.2-1GHz ± 5.56dB
		1-6GHz ± 3.84dB
		6-18GHz ± 3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2020-04-28	2021-04-27
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2020-04-28	2021-04-27
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2020-04-28	2021-04-27
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2020-04-28	2021-04-27
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2019-05-05	2021-05-04
SEMT-1042	Horn Antenna	ETS	3117	00086197	2019-05-05	2021-05-04
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2019-05-05	2021-05-04
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2020-04-28	2021-04-27
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2020-04-28	2021-04-27
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2020-04-28	2021-04-27
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2020-04-28	2021-04-27
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2020-04-28	2021-04-27
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2020-03-17	2021-03-16
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2020-03-17	2021-03-16
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2020-03-17	2021-03-16
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2020-03-17	2021-03-16
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2020-03-17	2021-03-16
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2020-03-17	2021-03-16
SEMT-1087	Anechoic chamber	SAEMC	FSAC318	/	2020-04-28	2021-04-27

Software List			
Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)*	Farad	EZ-EMC	RA-03A1
EMI Test Software (Conducted Emission)*	Farad	EZ-EMC	RA-03A1

*Remark: indicates software version used in the compliance certification testing

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.209	Radiated Emission	Compliant
§15.225(a)	Field Strength	Compliant
§15.225(b)(c)	Out of Band Emission	Compliant
§15.225(e)	Frequency Stability	Compliant
§15.207(a)	Conducted Emission	Compliant
§15.215(c)	Emission Bandwidth	Compliant

N/A: not applicable

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 15.203, 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.

3.2 Test Result

This product has a PCB antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.225(a), the field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

According to §15.225(d), the field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

Note: Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

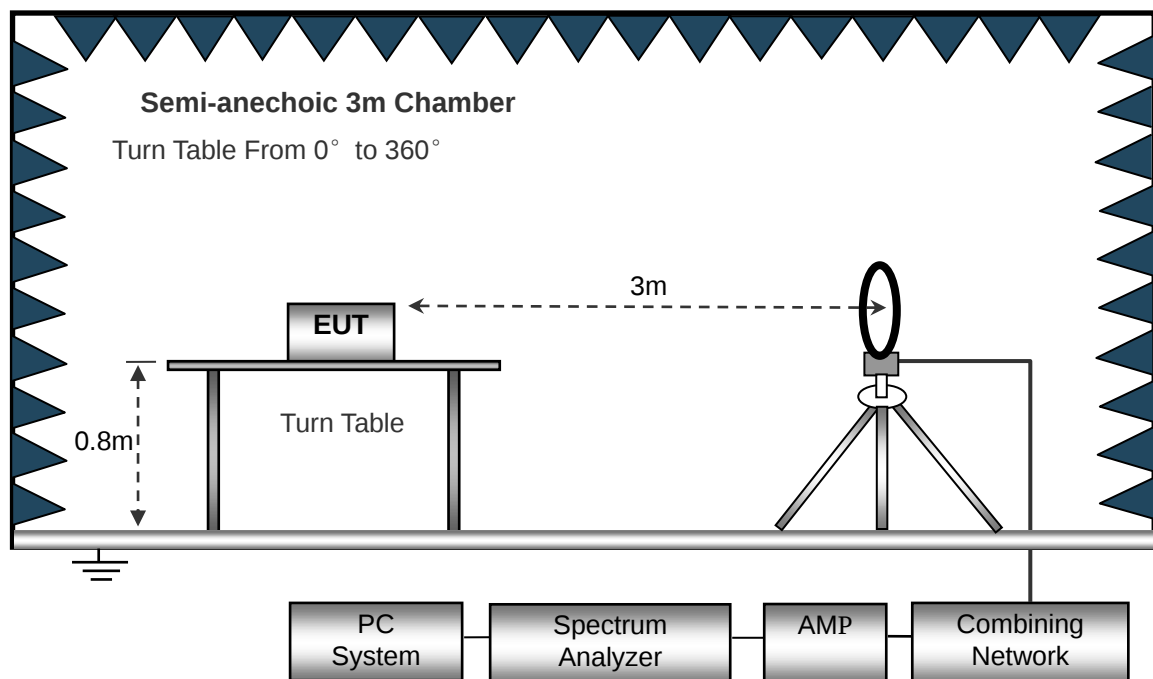
4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.225(d) and FCC Part 15.209 Limit.

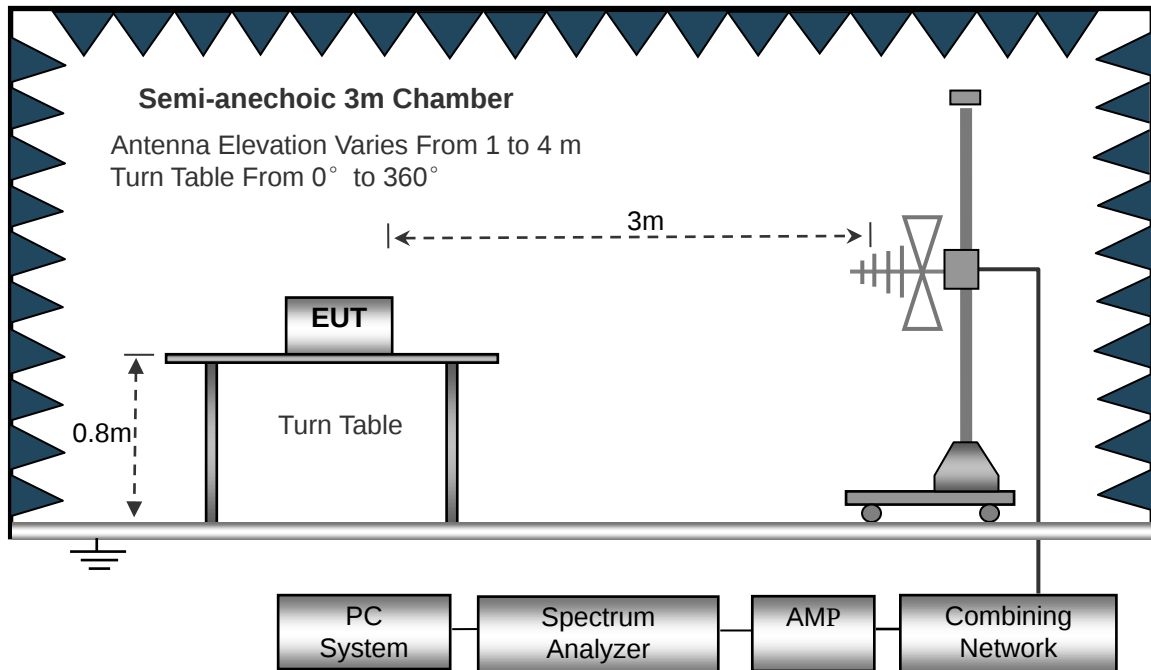
The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm

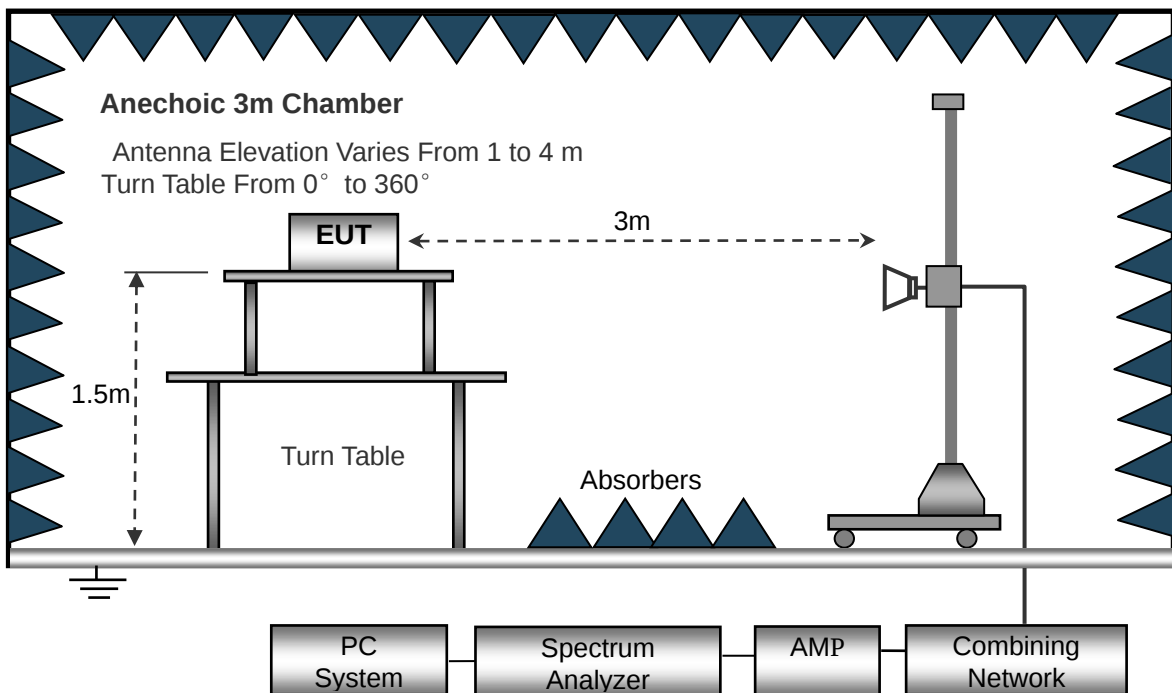
The test setup for emission measurement below 30MHz..



The test setup for emission measurement from 30 MHz to 1 GHz..



The test setup for emission measurement above 1 GHz..



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 -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

4.4 Summary of Test Results/Plots

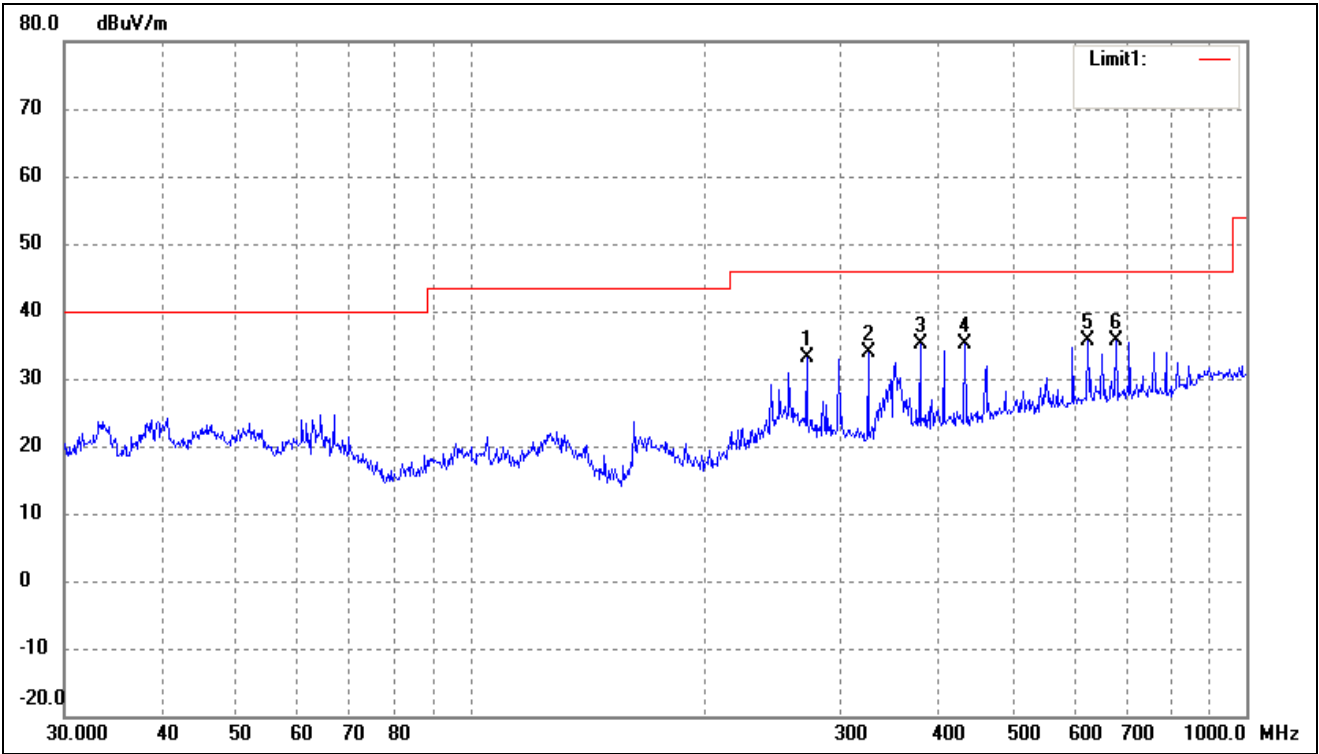
Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

➤ Below 30MHz

Frequency	Reading	Correction Factor	Result	Limit	Margin	Polar	Detector
MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	X/Y/Z	
13.56	51.81	-4.45	47.36	124	-76.64	X	Peak
27.12	50.41	-2.27	48.14	69.5	-21.36	X	Peak
13.56	66.01	-9.13	56.88	124	-67.12	Y	Peak
27.12	43.75	-2.27	41.48	69.5	-28.02	Y	Peak
13.56	63.76	-9.13	54.63	124	-69.37	Z	Peak
27.12	45.05	-2.27	42.78	69.5	-26.72	Z	Peak

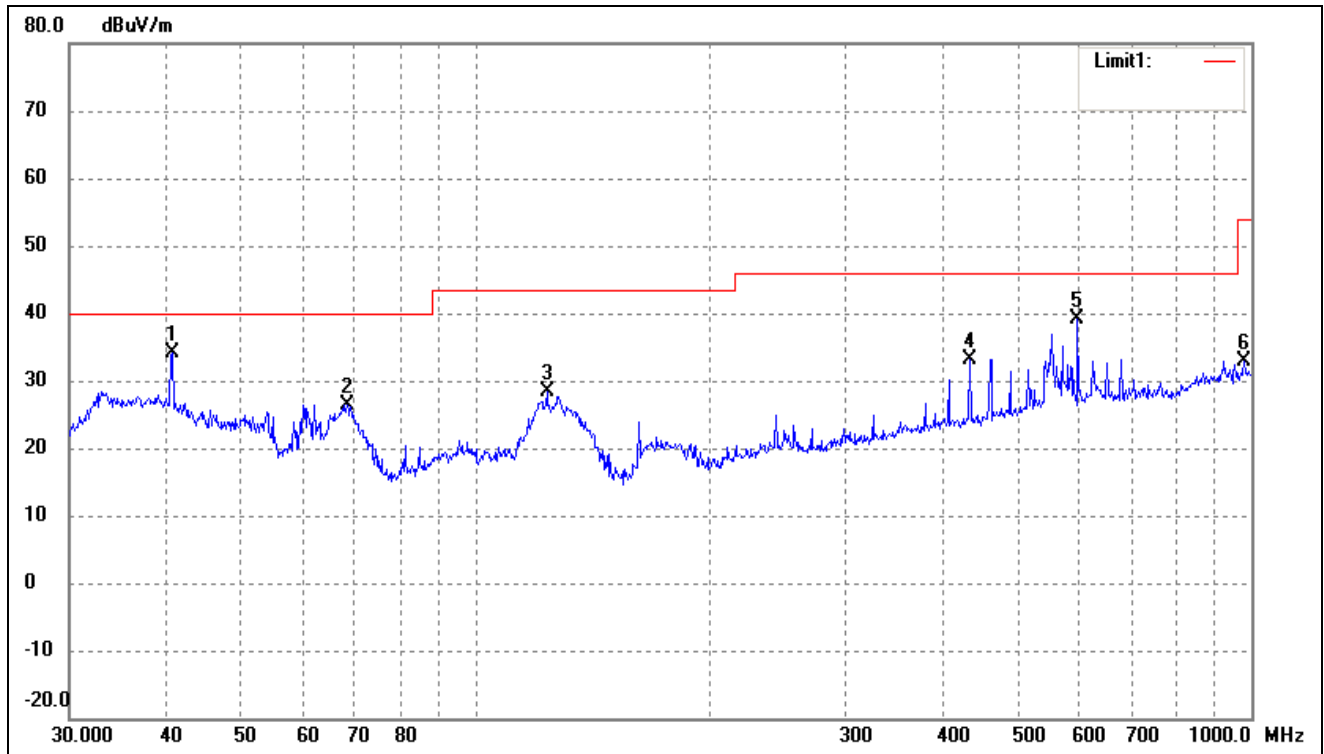
➤ Above 30MHz

Test Mode	TM1	Polarity:	Horizontal
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No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	()	(cm)	
1	271.3246	43.84	-10.79	33.05	46.00	-12.95	-	-	peak
2	325.5958	42.72	-8.93	33.79	46.00	-12.21	-	-	peak
3	379.9141	42.07	-7.04	35.03	46.00	-10.97	-	-	peak
4	434.0651	41.02	-5.78	35.24	46.00	-10.76	-	-	peak
5	625.0780	37.70	-2.15	35.55	46.00	-10.45	-	-	peak
6	679.9600	37.48	-1.87	35.61	46.00	-10.39	-	-	peak

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	40.7016	46.07	-11.96	34.11	40.00	-5.89	-	-	peak
2	68.3908	40.77	-14.41	26.36	40.00	-13.64	-	-	peak
3	123.6985	43.66	-15.30	28.36	43.50	-15.14	-	-	peak
4	434.0651	38.84	-5.78	33.06	46.00	-12.94	-	-	peak
5	597.2234	41.23	-2.01	39.22	46.00	-6.78	-	-	peak
6	979.1804	31.41	1.55	32.96	54.00	-21.04	-	-	peak

Remark: '-' Means the test Degree and Height are not recorded by the test software and only show the worst case in the test report.

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics.

5. OUT OF BAND EMISSIONS

5.1 Standard Applicable

According to FCC 15.225 (b), within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

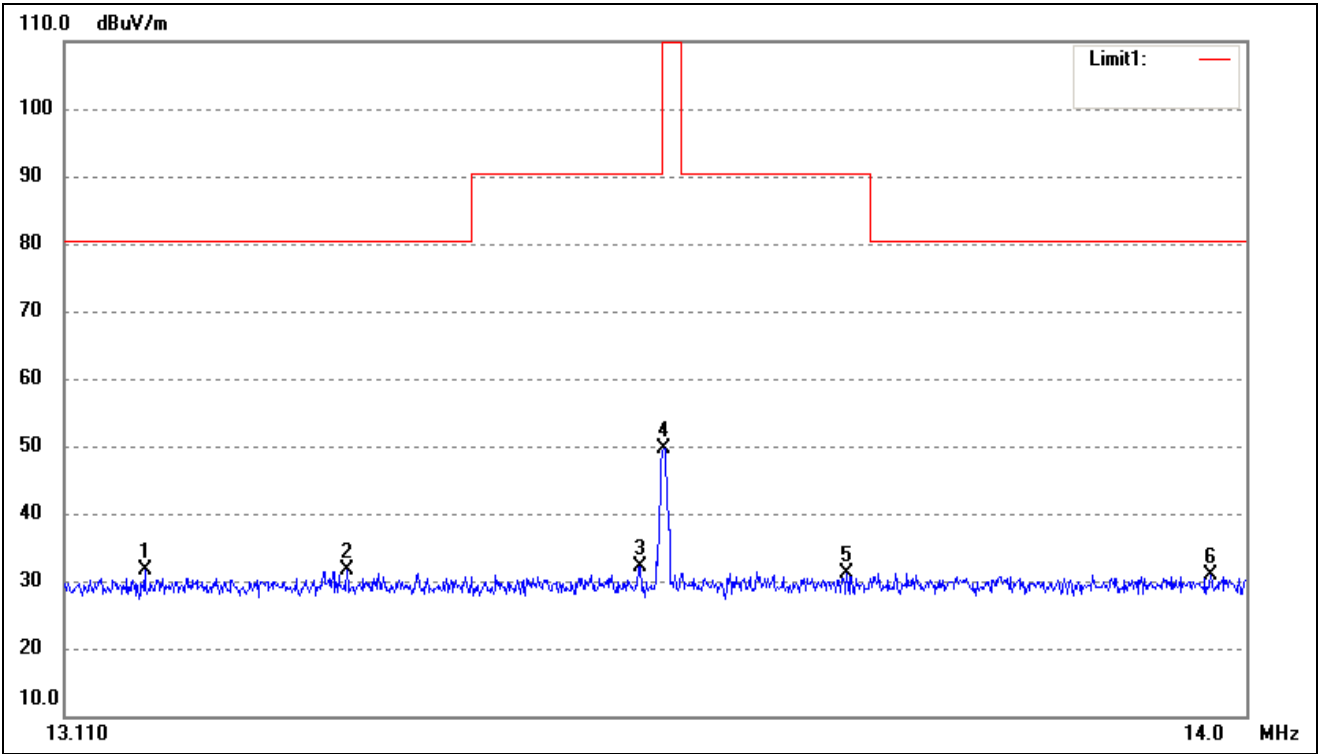
5.2 Test Procedure

As the radiation test, set the RBW=10kHz VBW=30kHz, observed the outside band of 13.11MHz to 14.01MHz, than mark the higher-level emission for comparing with the FCC rules.

5.3 Summary of Test Results/Plots

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Test Mode	TM1	Polarity:	/
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No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	()	(cm)	
1	13.1687	33.74	-2.10	31.64	80.50	-48.86	-	-	peak
2	13.3174	33.80	-2.10	31.70	80.50	-48.80	-	-	peak
3	13.5361	34.33	-2.08	32.25	90.50	-58.25	-	-	peak
4	13.5539	51.81	-2.08	49.73	124.00	-74.27	-	-	peak
5	13.6926	33.31	-2.08	31.23	90.50	-59.27	-	-	peak
6	13.9724	32.87	-2.06	30.81	80.50	-49.69	-	-	peak

Remark: ‘-’Means’ the test Degree and Height are not recorded by the test software and only show the worst case in the test report.

6. Frequency Stability

6.1 Standard Applicable

According to 15.225(e), the frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure.

6.3 Summary of Test Results/Plots

Reference Frequency: 13.56MHz, Limit: 100ppm				
Voltage(%)	Power(VDC)	TEMP(°C)	Freq.Dev(Hz)	Deviation(ppm)
100%	12	-30	439	32
100%		-20	448	33
100%		-10	444	33
100%		0	435	32
100%		+10	444	33
100%		+20	444	33
100%		+30	444	33
100%		+40	443	33
100%		+50	445	33
Low	10.2	+20	441	33
High	13.8	+20	442	33

7. EMISSION BANDWIDTH

7.1 Applicable Standard

According to 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

7.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Set span = 20kHz, centered on a transmitting channel

RBW = 1% ~5% 20dB Bandwidth, VBW=3* RBW

Sweep = auto

Detector function = peak

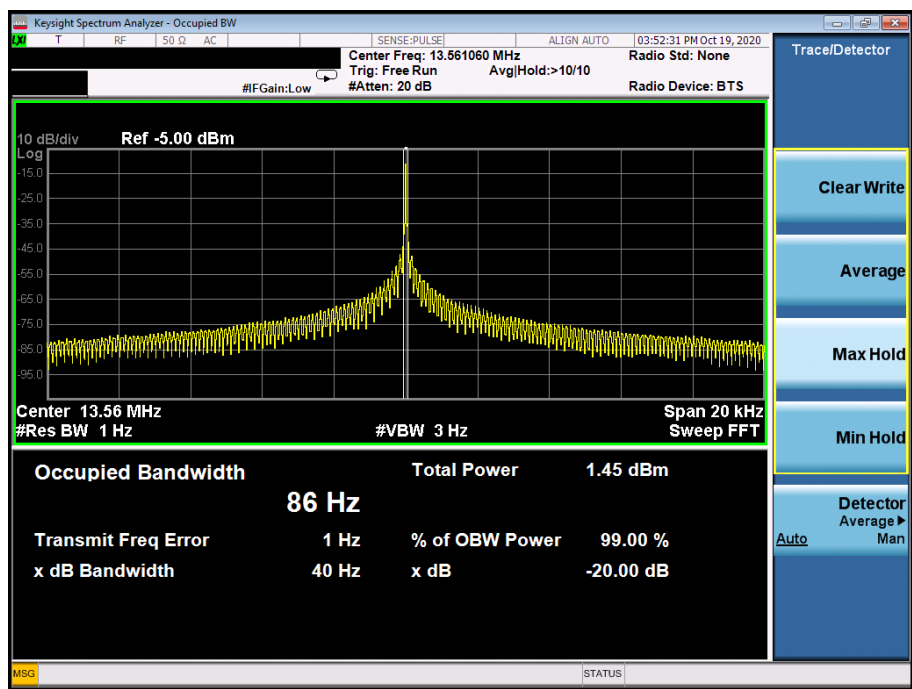
Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down of the emission.

7.3 Summary of Test Results/Plots

Tx Frequency	20dB Emission bandwidth(Hz)
13.56MHz	86

Please refer to the test plots as below:



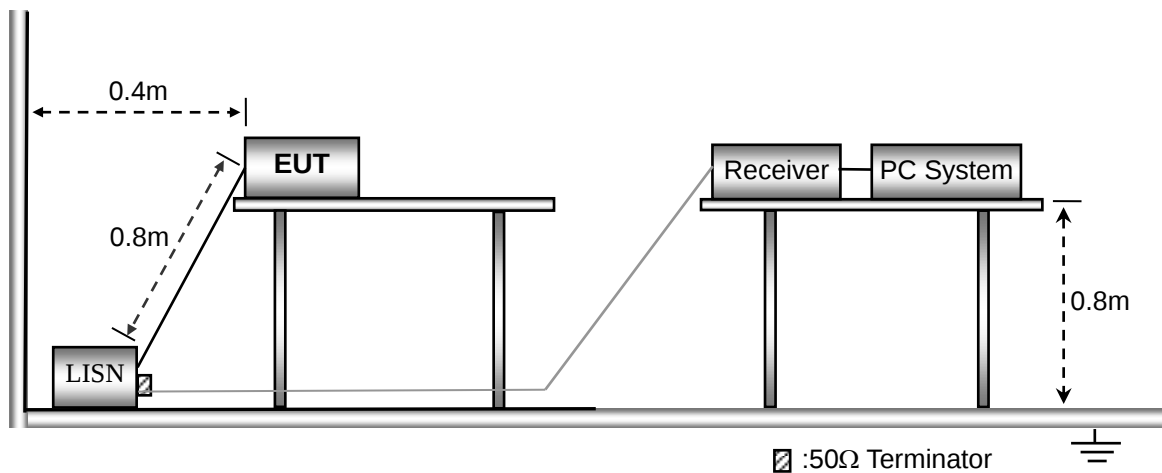
8. Conducted Emissions

8.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 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.

8.2 Basic Test Setup Block Diagram



8.3 Test Receiver Setup

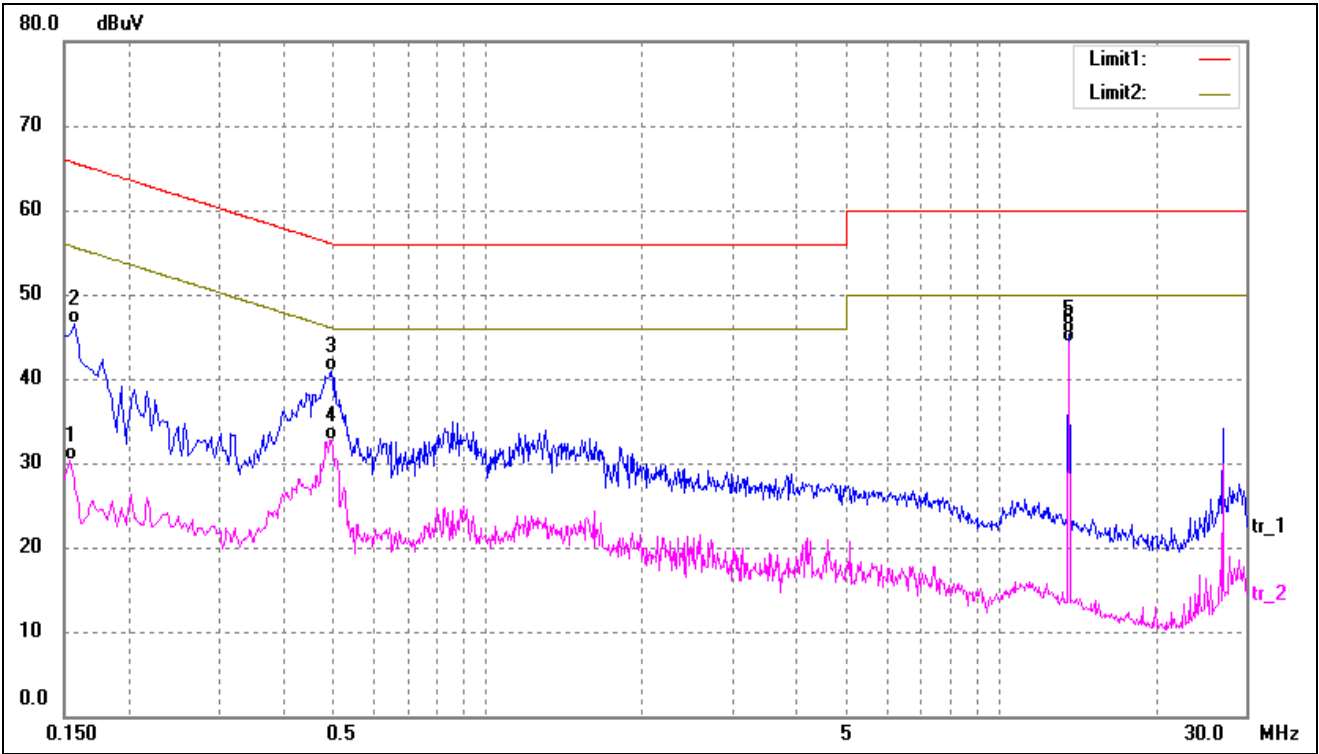
During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency	150 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

8.4 Summary of Test Results/Plots

Power adapter

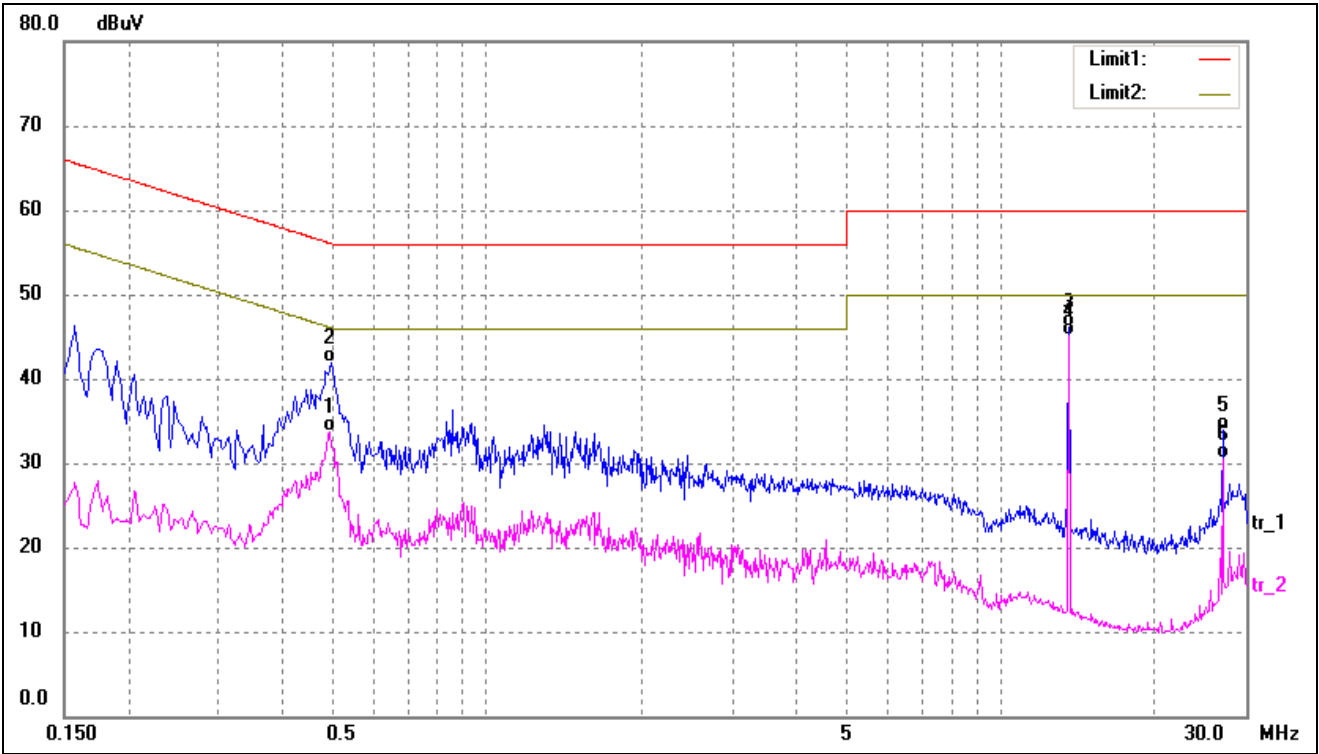
Test Mode	TM1(AC120V 60Hz)	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1539	20.14	10.25	30.39	55.78	-25.39	AVG
2	0.1580	36.27	10.25	46.52	65.56	-19.04	QP
3	0.4980	30.70	10.22	40.92	56.03	-15.11	QP
4	0.4980	22.50	10.22	32.72	46.03	-13.31	AVG
5	13.5620	34.77	10.50	45.27	60.00	-14.73	QP
6*	13.5620	33.73	10.50	44.23	50.00	-5.77	AVG

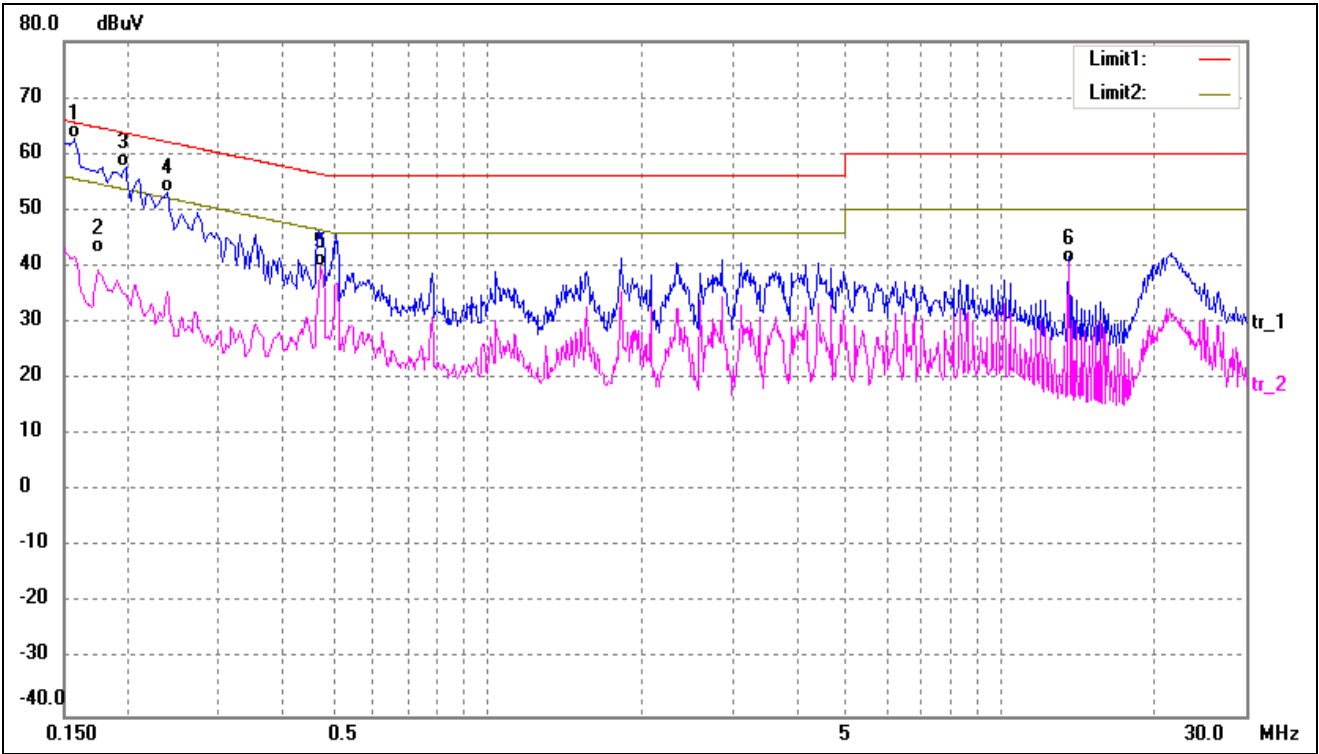
Power adapter

Test Mode	TM1(AC120V 60Hz)	Polarity:	Line
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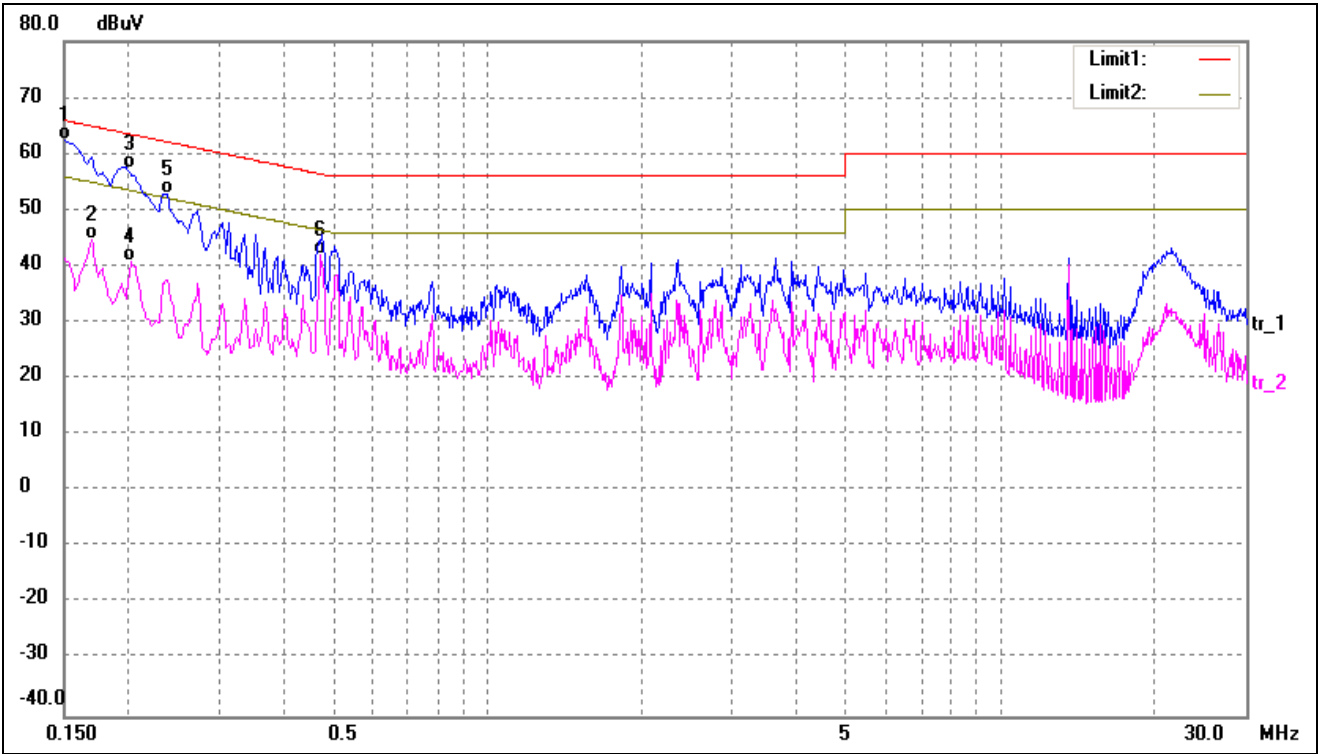
No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.4940	23.44	10.22	33.66	46.10	-12.44	AVG
2	0.4980	31.65	10.22	41.87	56.03	-14.16	QP
3	13.5620	35.61	10.50	46.11	60.00	-13.89	QP
4*	13.5620	34.51	10.50	45.01	50.00	-4.99	AVG
5	27.1220	23.32	10.65	33.97	60.00	-26.03	QP
6	27.1220	19.89	10.65	30.54	50.00	-19.46	AVG

Test Mode	POE Power Supply	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1580	52.36	10.25	62.61	65.56	-2.95	QP
2	0.1740	32.22	10.25	42.47	54.76	-12.29	AVG
3	0.1980	47.48	10.27	57.75	63.69	-5.94	QP
4	0.2380	42.84	10.26	53.10	62.16	-9.06	QP
5	0.4740	29.64	10.23	39.87	46.44	-6.57	AVG
6	13.5620	30.16	10.50	40.66	50.00	-9.34	AVG

Test Mode	POE Power Supply	Polarity:	Line
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1500	52.22	10.25	62.47	65.99	-3.52	QP
2	0.1700	34.38	10.25	44.63	54.96	-10.33	AVG
3	0.1986	47.09	10.27	57.36	63.66	-6.30	QP
4	0.2020	30.56	10.27	40.83	53.52	-12.69	AVG
5	0.2380	42.60	10.26	52.86	62.16	-9.30	QP
6	0.4740	31.68	10.23	41.91	46.44	-4.53	AVG

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