

FCC Part 15C Measurement and Test Report

For

Swidget Corp

6-677 Innovation Drive, Kingston, Ontario K7K7E6, Canada

FCC ID: 2AR26-SWIDGETZW004

FCC Rule(s): FCC Part 15.249

Product Description: Z-Wave Control + Power Out Light

Tested Model: ZW003RWA

Report No.: WTX19X02007751W

Sample Receipt Date: 2019-02-18

Tested Date: 2019-02-18 to 2019-02-25

Issued Date: 2019-02-25

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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.

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	3
1.2 TEST STANDARDS.....	4
1.3 TEST METHODOLOGY.....	4
1.4 TEST FACILITY.....	4
1.5 EUT SETUP AND TEST MODE.....	5
1.6 MEASUREMENT UNCERTAINTY.....	5
1.7 TEST EQUIPMENT LIST AND DETAILS.....	6
2. SUMMARY OF TEST RESULTS.....	7
3. ANTENNA REQUIREMENTS.....	8
3.1 STANDARD APPLICABLE.....	8
3.2 TEST RESULT.....	8
4. RADIATED EMISSIONS.....	9
4.1 STANDARD APPLICABLE.....	9
4.2 TEST PROCEDURE.....	9
4.3 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	11
4.4 SUMMARY OF TEST RESULTS/PLOTS.....	11
5. OUT OF BAND EMISSIONS.....	17
5.1 STANDARD APPLICABLE.....	17
5.2 TEST PROCEDURE.....	17
5.3 SUMMARY OF TEST RESULTS/PLOTS.....	17
6. EMISSION BANDWIDTH.....	20
6.1 STANDARD APPLICABLE.....	20
6.2 TEST PROCEDURE.....	20
6.3 SUMMARY OF TEST RESULTS/PLOTS.....	20
7. CONDUCTED EMISSIONS.....	22
7.1 TEST PROCEDURE.....	22
7.2 BASIC TEST SETUP BLOCK DIAGRAM.....	22
7.3 TEST RECEIVER SETUP.....	22
7.4 SUMMARY OF TEST RESULTS/PLOTS.....	22

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Swidget Corp
Address of applicant: 6-677 Innovation Drive, Kingston, Ontario K7K7E6, Canada

Manufacturer: Swidget Corp
Address of manufacturer: 6-677 Innovation Drive, Kingston, Ontario K7K7E6, Canada

General Description of EUT	
Product Name:	Z-Wave Control + Power Out Light
Brand Name:	Swidget
Model No.:	ZW003RWA
Adding Model:	/
Rated Voltage:	DC5V
Power Adaptor:	/
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	908MHz-916MHz
Max. Field Strength:	86.18dBuV/m
Modulation:	FSK
Antenna Type:	Chip
Antenna Gain:	0dBi
Lowest Internal Frequency of EUT:	32MHz

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.249: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz.

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 results 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 C63.10-2013, 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

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 Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency 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	Low Channel	908MHz
TM2	High Channel	916MHz

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

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	± 1.5%
Conducted Spurious Emission	Conducted	±2.17dB
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	2018-05-22	2019-05-21
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2018-05-22	2019-05-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2018-05-22	2019-05-21
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2018-05-22	2019-05-21
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2018-05-22	2019-05-21
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2020-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2018-05-22	2019-05-21
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2018-05-22	2019-05-21
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2018-05-22	2019-05-21
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2018-05-22	2019-05-21
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2018-05-22	2019-05-21
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2018-05-22	2019-05-21
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2018-05-22	2019-05-21
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2018-05-22	2019-05-21
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2018-05-22	2019-05-21
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2018-03-19	2019-03-18
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2018-03-19	2019-03-18
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2018-03-19	2019-03-18
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2018-03-19	2019-03-18
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18



2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.209(a)(f)	Radiated Spurious Emissions	Compliant
§15.249(a)	Field Strength of Emissions	Compliant
§15.249(d)	Out of Band Emission	Compliant
§15.215 (c)	Emission Bandwidth	Compliant

N/A: not applicable

3. Antenna Requirements

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 chip antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

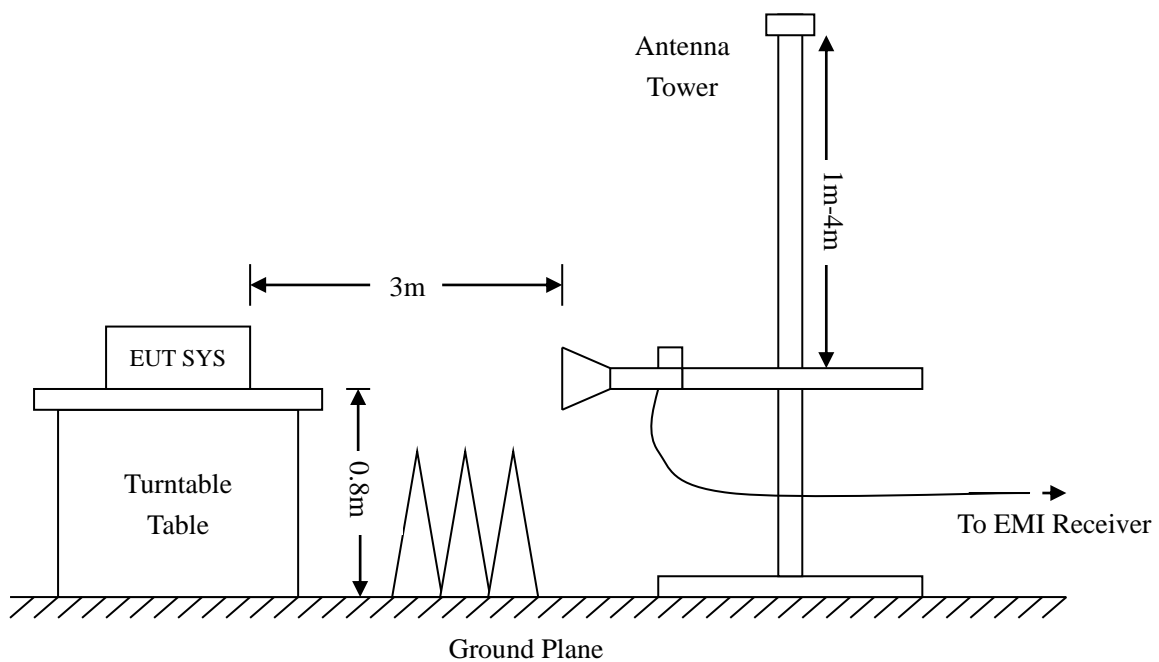
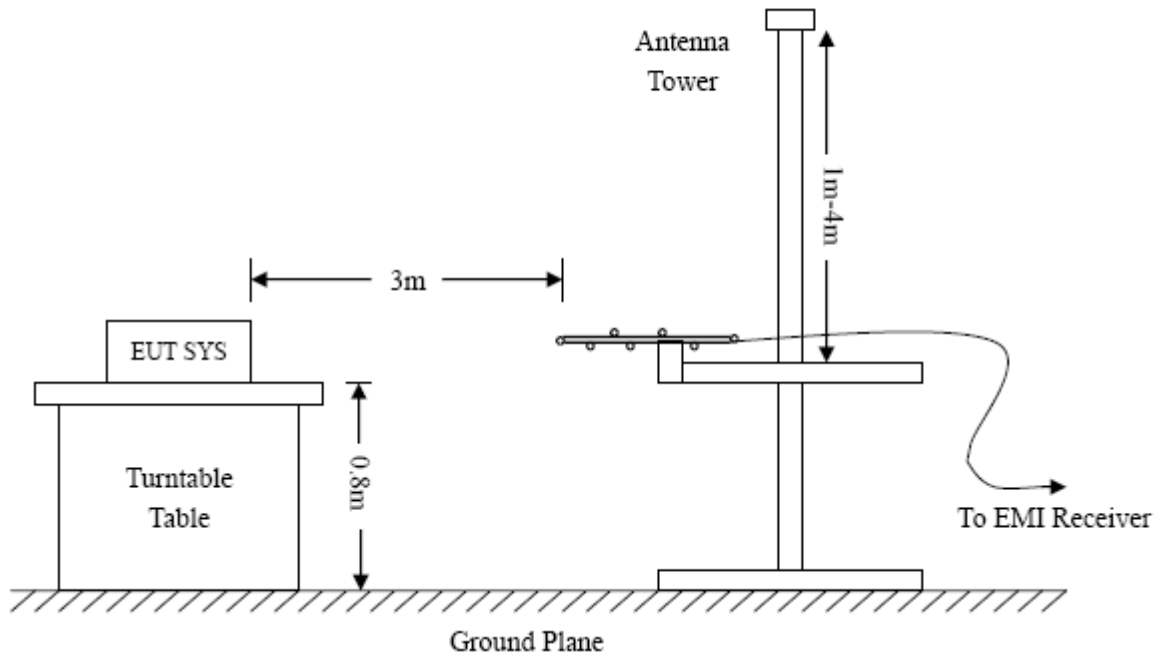
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. 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 15.249(a) 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.



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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of $-6\text{dB}\mu\text{V}$ means the emission is $6\text{dB}\mu\text{V}$ below the maximum limit. The equation for margin calculation is as follows:

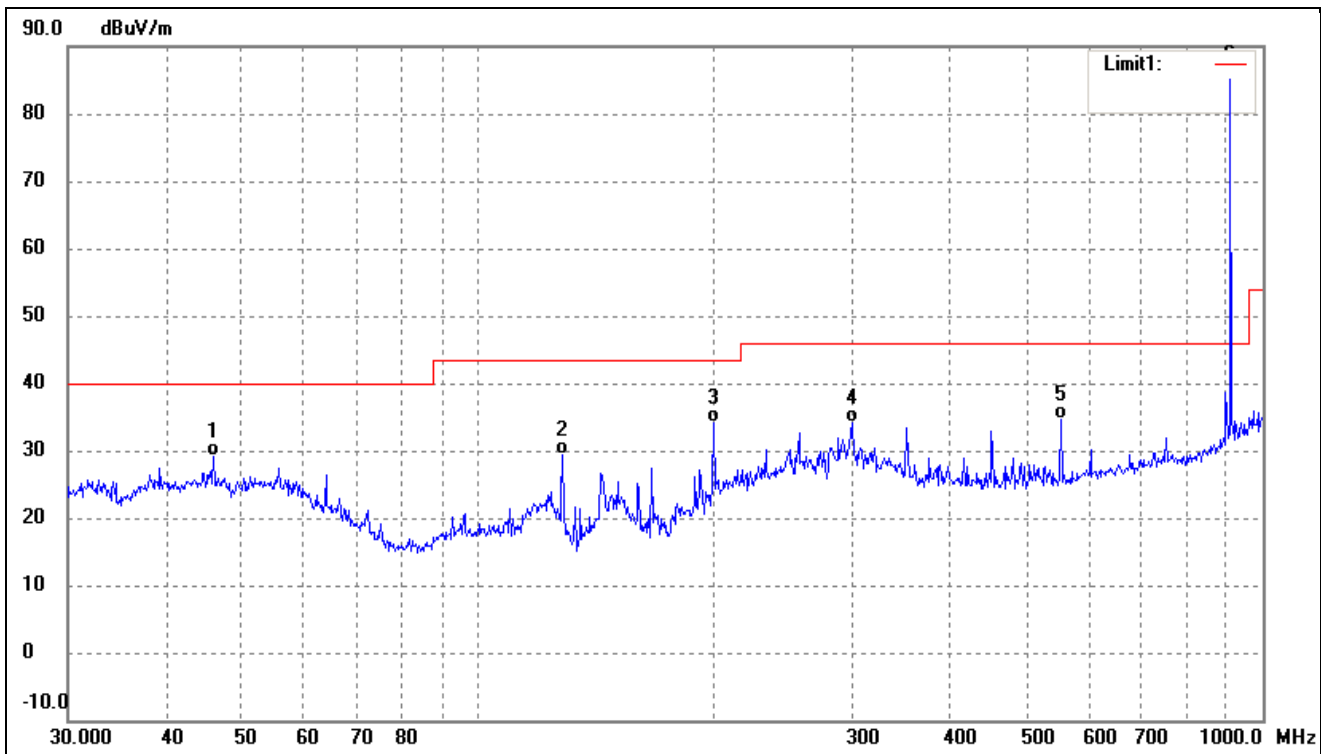
$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

4.4 Summary of Test Results/Plots

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

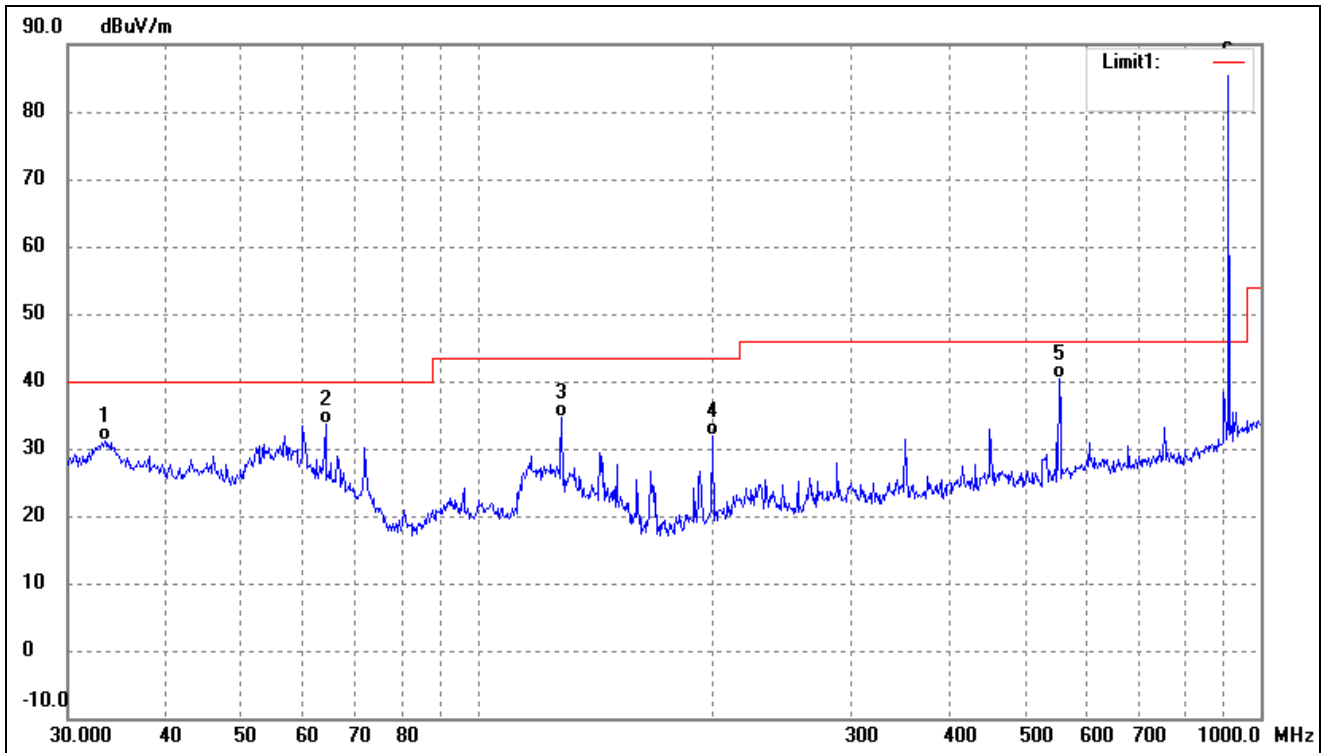
➤ Spurious Emissions Below 1GHz

Test Channel	908MHz	Polarity:	Horizontal
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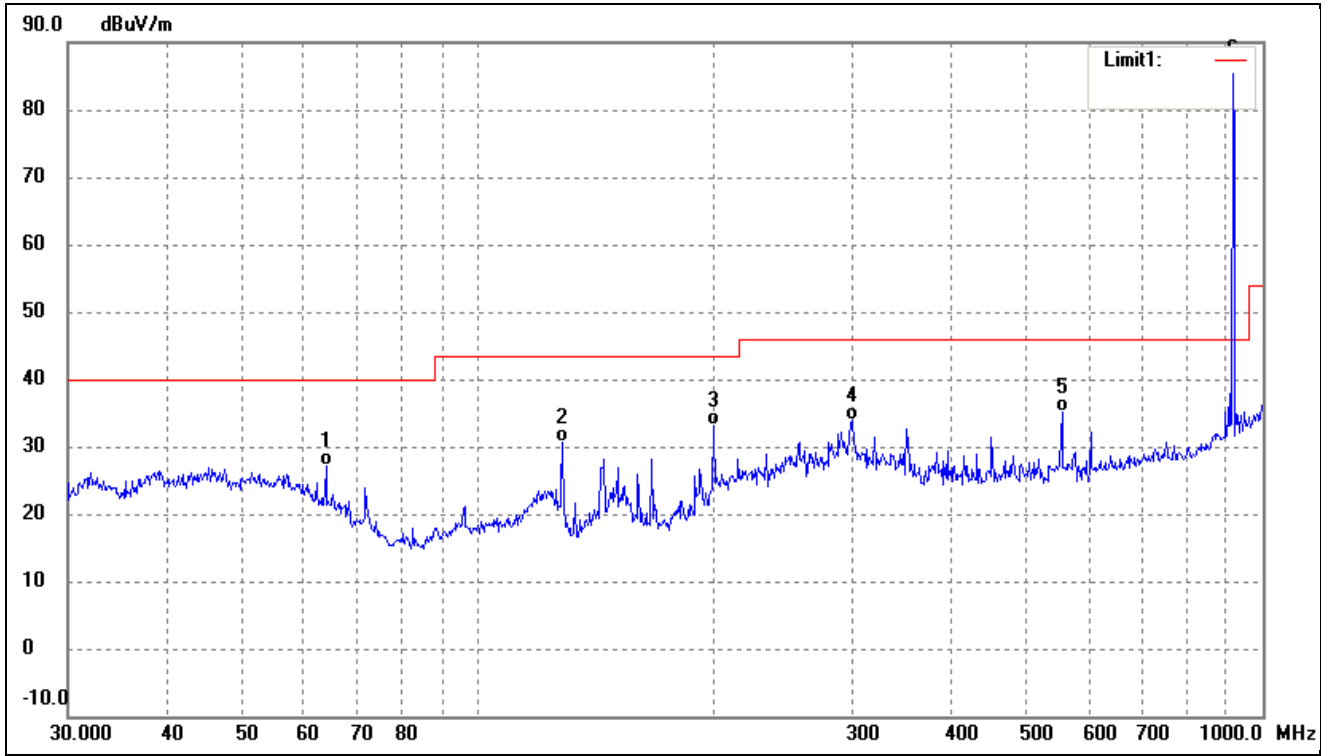
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	46.0164	37.10	-8.09	29.01	40.00	-10.99	284	100	QP
2	128.1130	46.75	-17.36	29.39	43.50	-14.11	98	100	QP
3	199.2855	47.20	-13.12	34.08	43.50	-9.42	298	100	QP
4	299.3158	43.56	-9.42	34.14	46.00	-11.86	118	100	QP
5	552.8833	39.80	-5.22	34.58	46.00	-11.42	272	100	QP
6	909.6667	83.48	1.64	85.12	94.00	-8.88	297	100	QP

Test Channel	908MHz	Polarity:	Vertical
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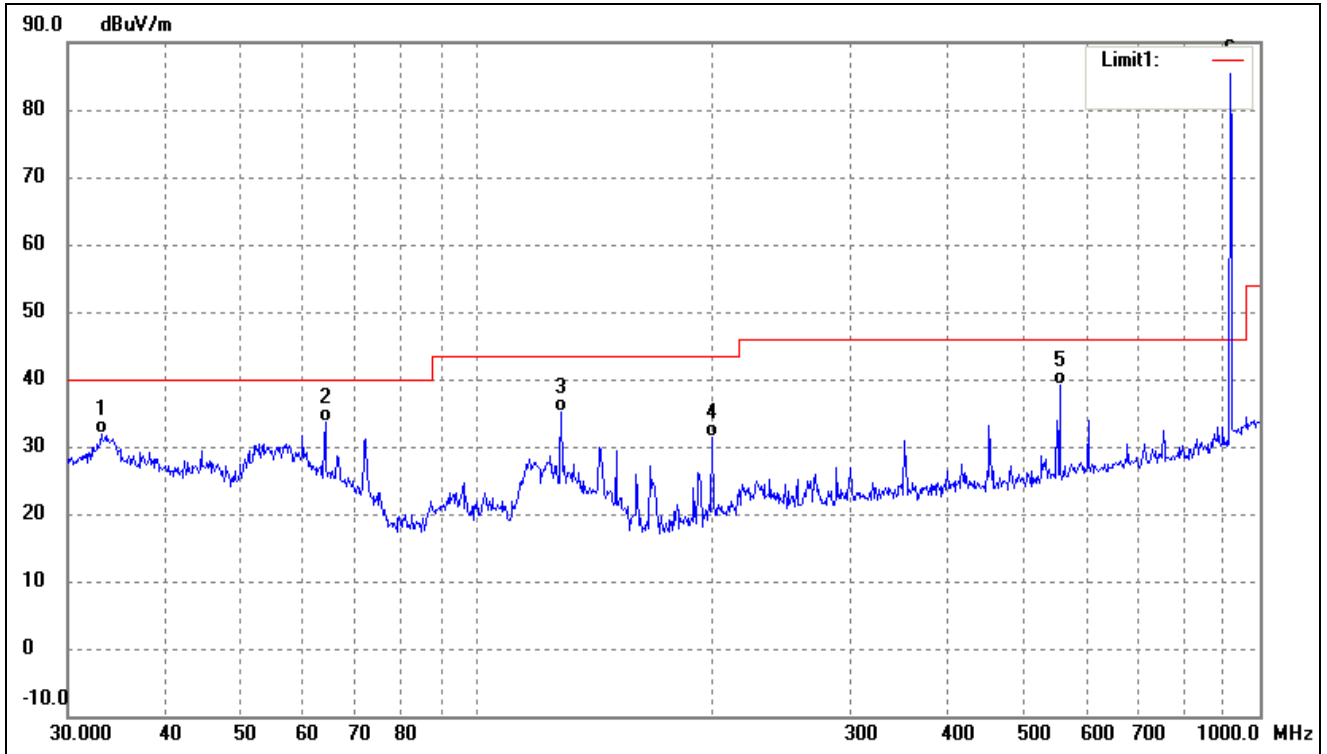
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	33.4449	40.83	-9.79	31.04	40.00	-8.96	299	100	QP
2	63.9828	45.60	-11.94	33.66	40.00	-6.34	99	100	QP
3	128.1130	52.04	-17.36	34.68	43.50	-8.82	214	100	QP
4	199.2855	44.99	-13.12	31.87	43.50	-11.63	97	100	QP
5	552.8833	45.52	-5.22	40.30	46.00	-5.70	333	100	QP
6	909.6667	83.77	1.64	85.41	94.00	-8.59	199	100	QP

Test Channel	916MHz	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	63.9828	38.99	-11.94	27.05	40.00	-12.95	205	100	QP
2	128.1130	48.05	-17.36	30.69	43.50	-12.81	325	100	QP
3	199.2855	46.14	-13.12	33.02	43.50	-10.48	71	100	QP
4	299.3158	43.34	-9.42	33.92	46.00	-12.08	244	100	QP
5	554.8254	40.17	-5.15	35.02	46.00	-10.98	215	100	QP
6	916.0687	83.68	1.80	85.48	94.00	-8.52	203	100	QP

Test Channel	916MHz	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	33.0950	41.60	-9.77	31.83	40.00	-8.17	301	100	QP
2	63.9828	45.50	-11.94	33.56	40.00	-6.44	317	100	QP
3	128.1130	52.61	-17.36	35.25	43.50	-8.25	89	100	QP
4	199.2855	44.54	-13.12	31.42	43.50	-12.08	288	100	QP
5	554.8254	44.18	-5.15	39.03	46.00	-6.97	119	100	QP
6	916.0687	83.52	1.80	85.32	94.00	-8.68	160	100	QP

➤ Spurious Emissions Above 1GHz

Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar H/V	Detector
Low Channel-908MHz							
1816.00	67.76	-11.49	56.27	74	-17.73	H	PK
1816.00	50.24	-11.49	38.75	54	-15.25	H	AV
2724.00	64.54	-6.32	58.22	74	-15.78	V	PK
2724.00	47.45	-6.32	41.13	54	-12.87	V	AV
High Channel-916MHz							
1832.00	68.37	-11.33	57.04	74	-16.96	H	PK
1832.00	50.32	-11.33	38.99	54	-15.01	H	AV
2748.00	62.64	-6.26	56.38	74	-17.62	V	PK
2748.00	47.37	-6.26	41.11	54	-12.89	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 3th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured. The measurements greater than 20dB below the limit from 9kHz to 30MHz.

5. Out of Band Emissions

5.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 902MHz to 928MHz, than mark the higher-level emission for comparing with the FCC rules.

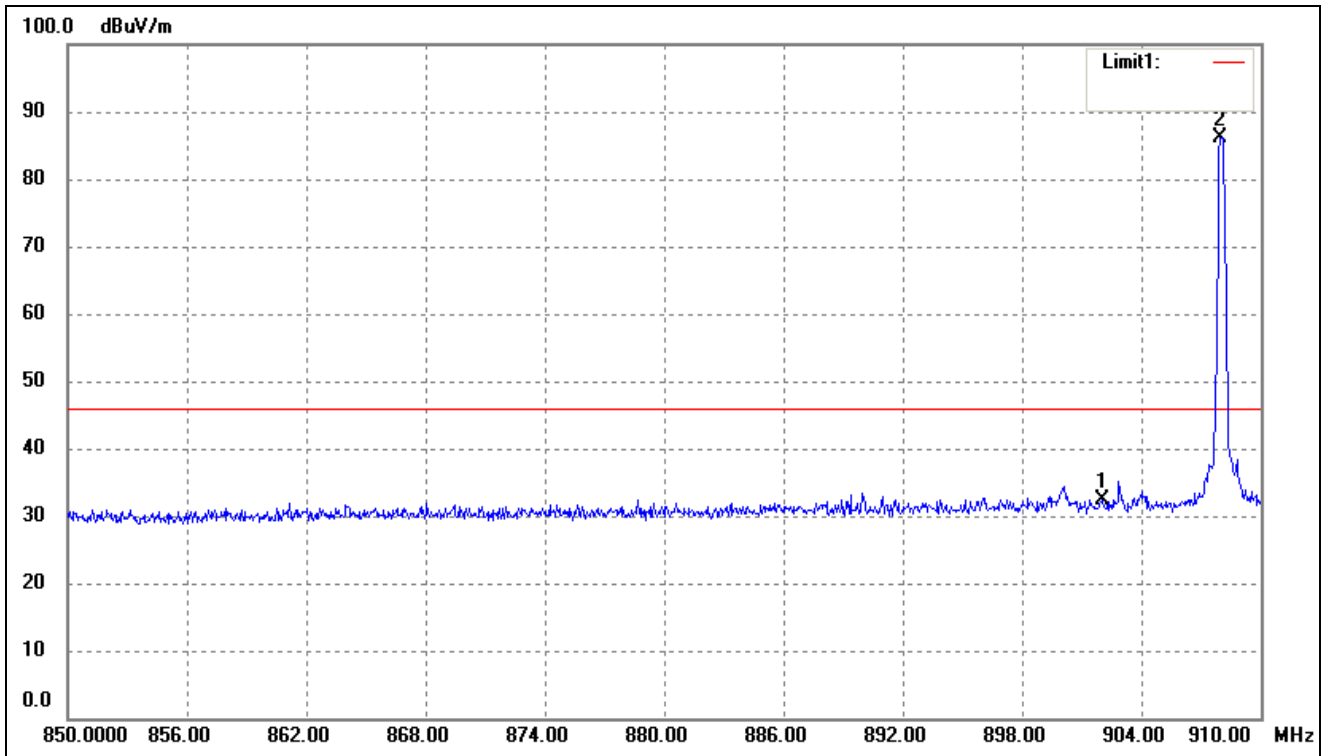
5.3 Summary of Test Results/Plots

Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	902.00	<46 dBuV	Pass
Highest	928.00	<46 dBuV	Pass

The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

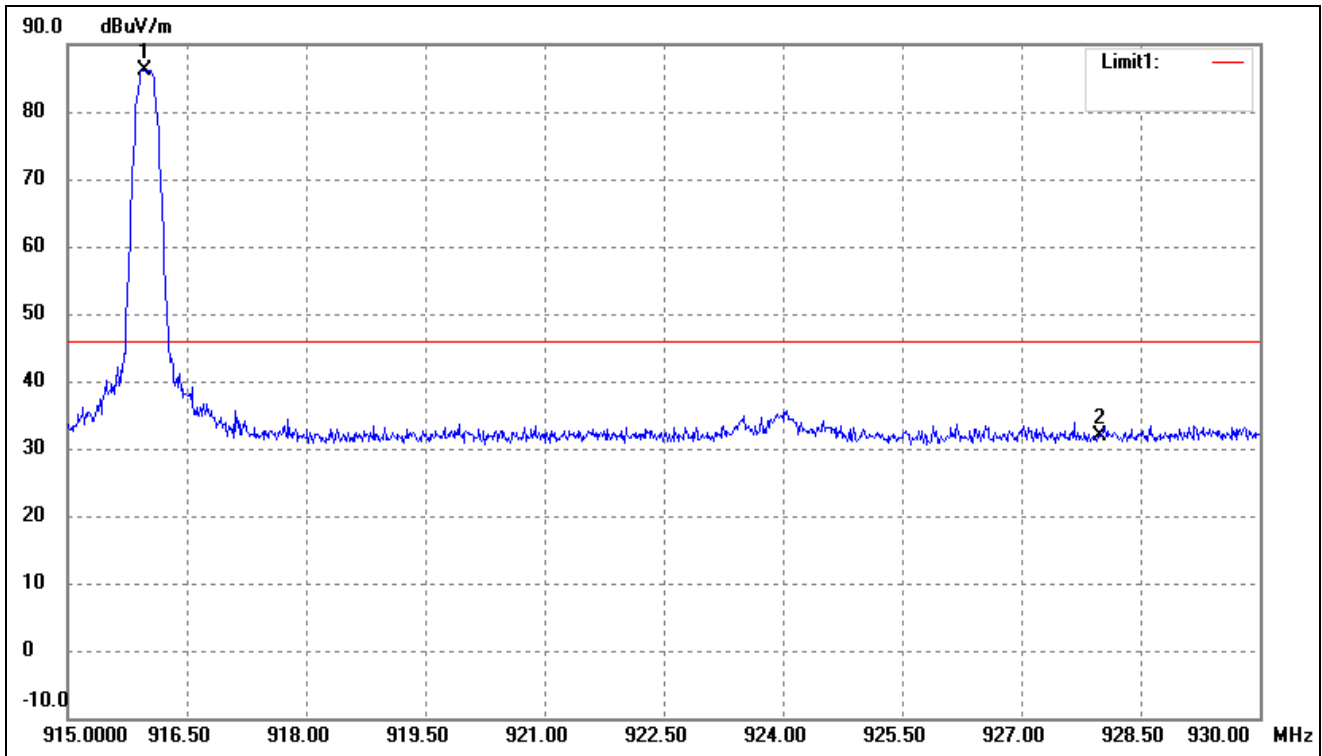
Please refer to the test plots as below.

Test Channel	908MHz	Polarity:	Horizontal(worst case)
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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	902.0000	30.94	1.44	32.38	46.00	-13.62	90	100	peak
2	907.9600	84.59	1.59	86.18	94.00	-7.82	60	100	peak

Test Channel	916MHz	Polarity:	Horizontal(worst case)
--------------	--------	-----------	------------------------



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	915.9600	84.32	1.80	86.12	94.00	-7.88	78	100	peak
2	928.0000	29.81	2.01	31.82	46.00	-14.18	245	100	peak

6. Emission Bandwidth

6.1 Standard Applicable

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.

6.2 Test Procedure

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

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 1MHz, centered on a transmitting channel

RBW \geq 1% 20dB Bandwidth, VBW \geq 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 and 99% bandwidth of the emission.

6.3 Summary of Test Results/Plots

Channel	Frequency MHz	20dB Bandwidth kHz
Low Channel	908	223.968
High Channel	916	225.845

Please refer to the following test plots

<p>908MHz</p>	<p>Agilent R T</p> <p>Ch Freq 908 MHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 908.000000 MHz</p> <p>Ref 6 dBm #Atten 15 dB</p> <p>#Peak</p> <p>Log 10 dB/Offset 1 dB</p> <p>Center 908 MHz Span 1 MHz</p> <p>#Res BW 3 kHz #VBW 10 kHz Sweep 114.4 ms (1001 pts)</p> <p>Occupied Bandwidth Occ BW % Pwr 99.00 %</p> <p>205.8868 kHz x dB -20.00 dB</p> <p>Transmit Freq Error -3.621 kHz</p> <p>x dB Bandwidth 223.968 kHz</p> <p>Freq/Channel</p> <p>Center Freq 908.000000 MHz</p> <p>Start Freq 907.500000 MHz</p> <p>Stop Freq 908.500000 MHz</p> <p>CF Step 100.000000 kHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
<p>916MHz</p>	<p>Agilent R T</p> <p>Ch Freq 916 MHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 916.000000 MHz</p> <p>Ref 6 dBm #Atten 15 dB</p> <p>#Peak</p> <p>Log 10 dB/Offset 1 dB</p> <p>Center 916 MHz Span 1 MHz</p> <p>#Res BW 3 kHz #VBW 10 kHz Sweep 114.4 ms (1001 pts)</p> <p>Occupied Bandwidth Occ BW % Pwr 99.00 %</p> <p>207.8793 kHz x dB -20.00 dB</p> <p>Transmit Freq Error -4.208 kHz</p> <p>x dB Bandwidth 225.845 kHz</p> <p>Freq/Channel</p> <p>Center Freq 916.000000 MHz</p> <p>Start Freq 915.500000 MHz</p> <p>Stop Freq 916.500000 MHz</p> <p>CF Step 100.000000 kHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>

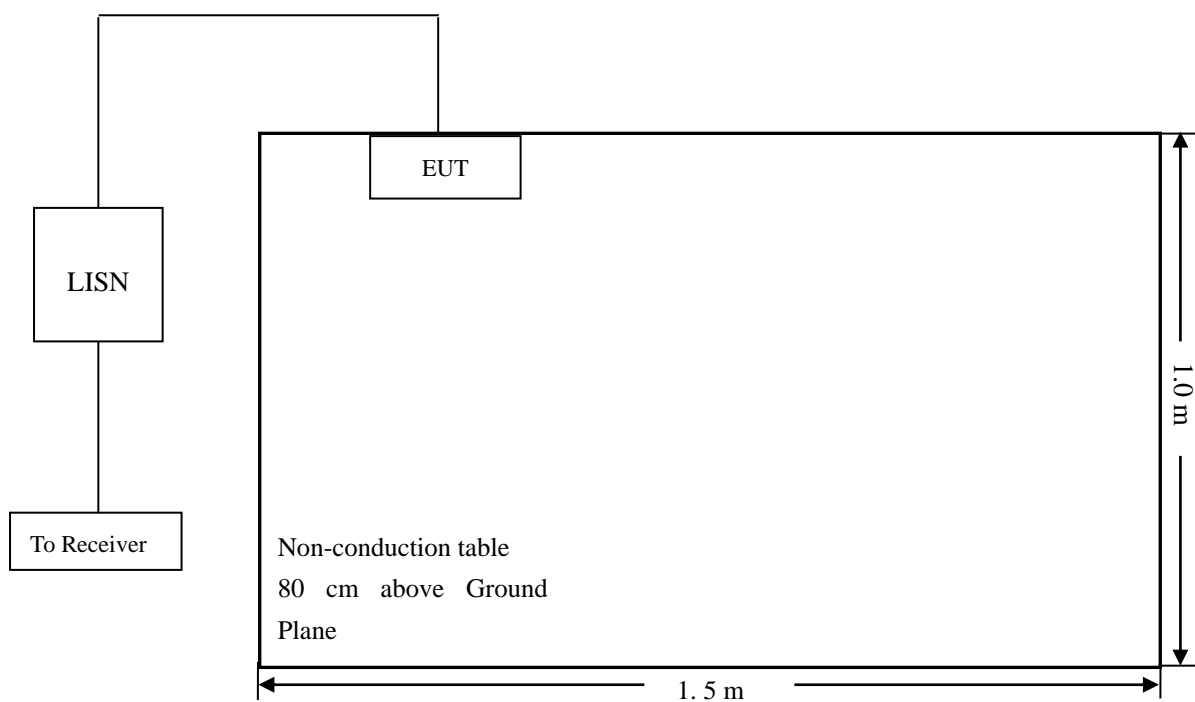
7. Conducted Emissions

7.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 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.

7.2 Basic Test Setup Block Diagram



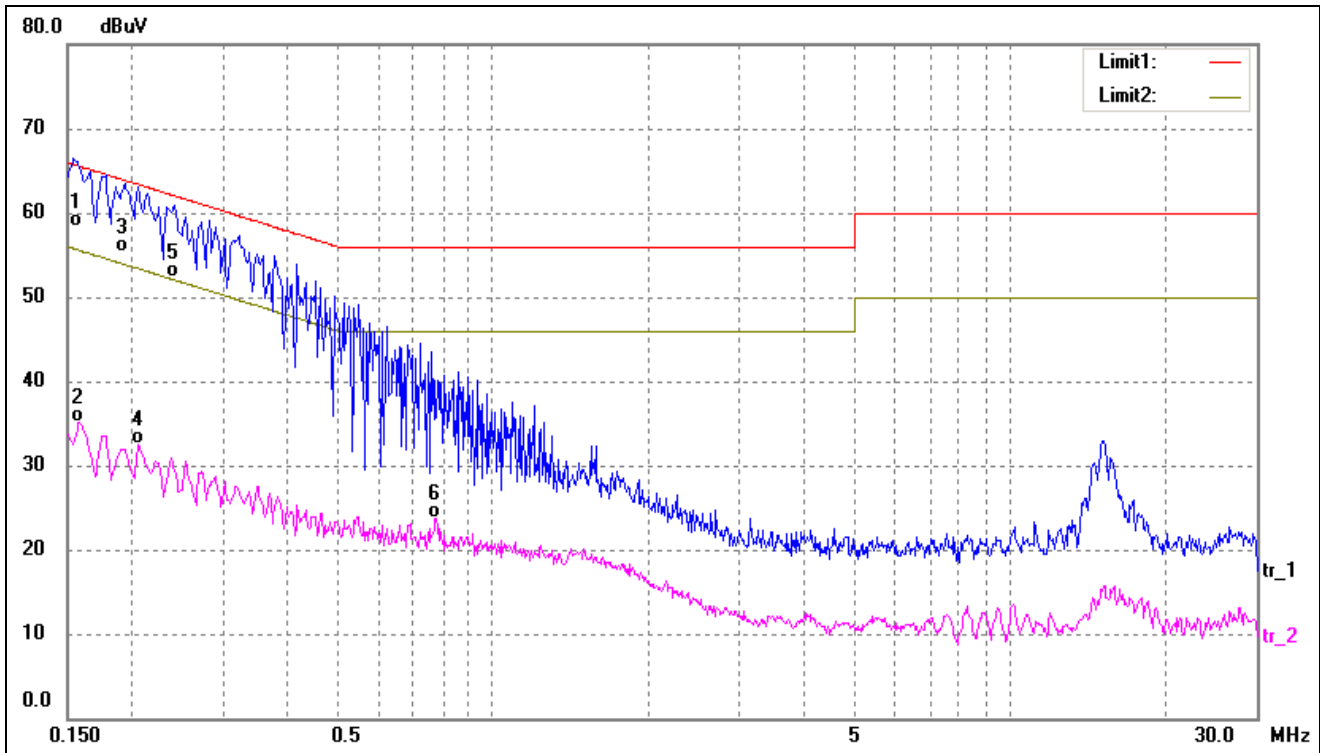
7.3 Test Receiver Setup

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

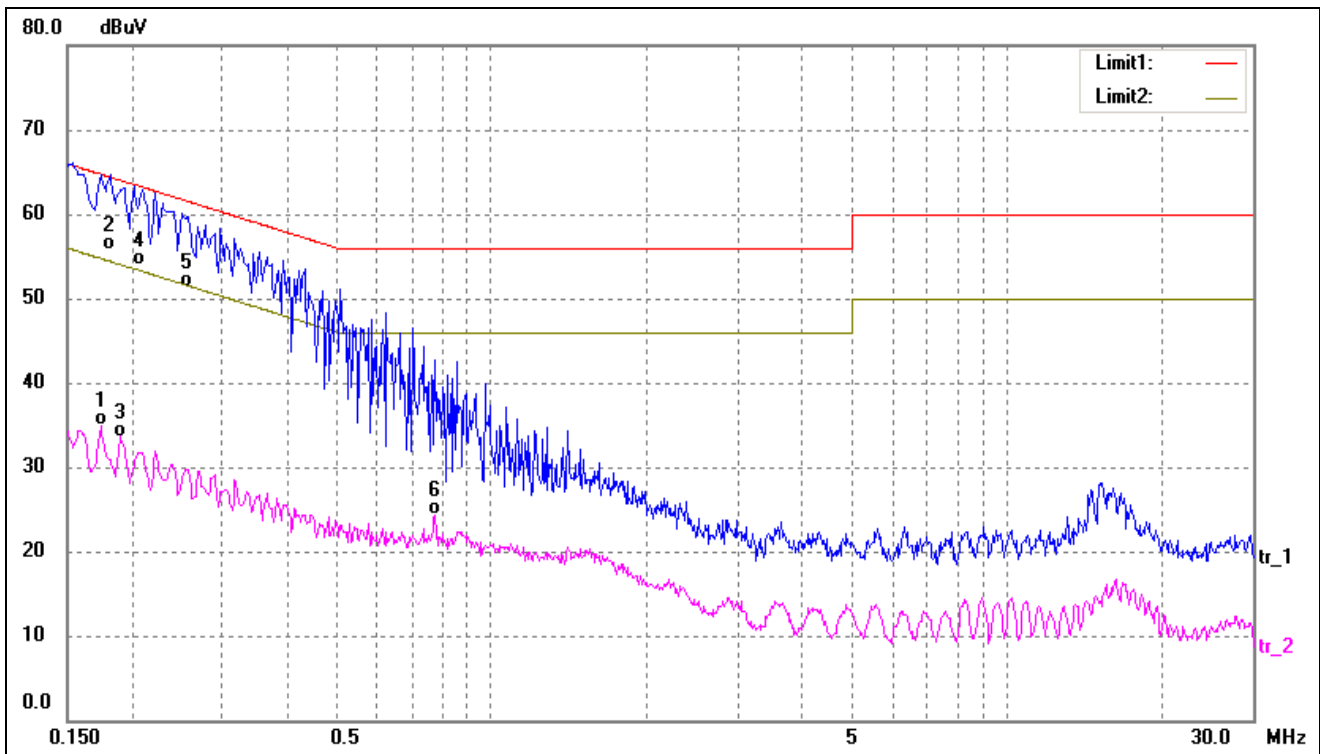
7.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1540	48.27	10.10	58.37	65.78	-7.41	QP
2	0.1580	25.09	10.10	35.19	55.57	-20.38	AVG
3	0.1940	45.11	10.12	55.23	63.86	-8.63	QP
4	0.2060	22.30	10.12	32.42	53.37	-20.95	AVG
5	0.2420	42.25	10.15	52.40	62.03	-9.63	QP
6	0.7740	13.39	10.41	23.80	46.00	-22.20	AVG

Test Mode	Communication	AC120V 60Hz	Polarity:	Line
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1740	24.86	10.11	34.97	54.77	-19.80	AVG
2*	0.1820	45.62	10.11	55.73	64.39	-8.66	QP
3	0.1900	23.48	10.12	33.60	54.04	-20.44	AVG
4	0.2100	43.84	10.13	53.97	63.21	-9.24	QP
5	0.2580	41.08	10.16	51.24	61.50	-10.26	QP
6	0.7780	13.88	10.42	24.30	46.00	-21.70	AVG

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