FCC Part 15C
Measurement and Test Report

For

Zhejiang Libiao Robotics Co., Ltd.

Building 22 Project Y Xixi art collection Village Fangxi Road Hangzhou City, Zhejiang

FCC ID: 2AQQMJTROBOTII

FCC Rule(s):	FCC Part 15.249
Product Description:	JTRobotII Sorting Robots
Tested Model:	JTRobotII
Report No.:	STR18108076I-1
Sample Receipt Date:	2018-10-15
Tested Date:	2018-10-16 to 2018-11-14
Issued Date:	2018-11-14
Tested By:	Mike Shi / Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

Shenzhen SEM Test Technology Co., Ltd.
1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C.（518101）
Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Zhejiang Libiao Robotics Co., Ltd.
Address of applicant:	Building 22 Project Y Xixi art collection Village Fangxi Road Hangzhou City, Zhejiang
Manufacturer:	Zhejiang Libiao Robotics Co., Ltd.
Address of manufacturer:	Building 22 Project Y Xixi art collection Village Fangxi Road Hangzhou City, Zhejiang

General Description of EUT	
Product Name:	JTRobotII Sorting Robots
Brand Name:	/
Model No.:	JTRobotII
Adding Model:	/
Rated Voltage:	Battery:DC2.4*2
Battery capacity:	20Ah
Power Adaptor:	/
Software Version:	V 1.13
Hardware Version:	V 0.2
Note: The test data is gathered from a production sample provided by the manufacturer.	

Technical Characteristics of EUT	
Frequency Range:	904.2MHz-926.2MHz
Max. Field Strength:	93.62dBuV/m
Modulation:	GFSK;
Antenna Type:	Integral Antenna
Antenna Gain:	-5.45dBi
Lowest Internal Frequency of EUT:	8MHz

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	904.2 MHz
TM2	Middle Channel	915.2 MHz
TM3	High Channel	926.2 MHz

Test Conditions	
Temperature:	22~25 °C
Relative humidity	50~56 %.
ATM Pressure:	1019 mbar

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

Accessories Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
AC Cable	1.8	Unshielded	With Core
DC Cable	1.0	Unshielded	With Core

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Adapter	Xinsu Global	XSG0505000MM	/

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 an integral 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:

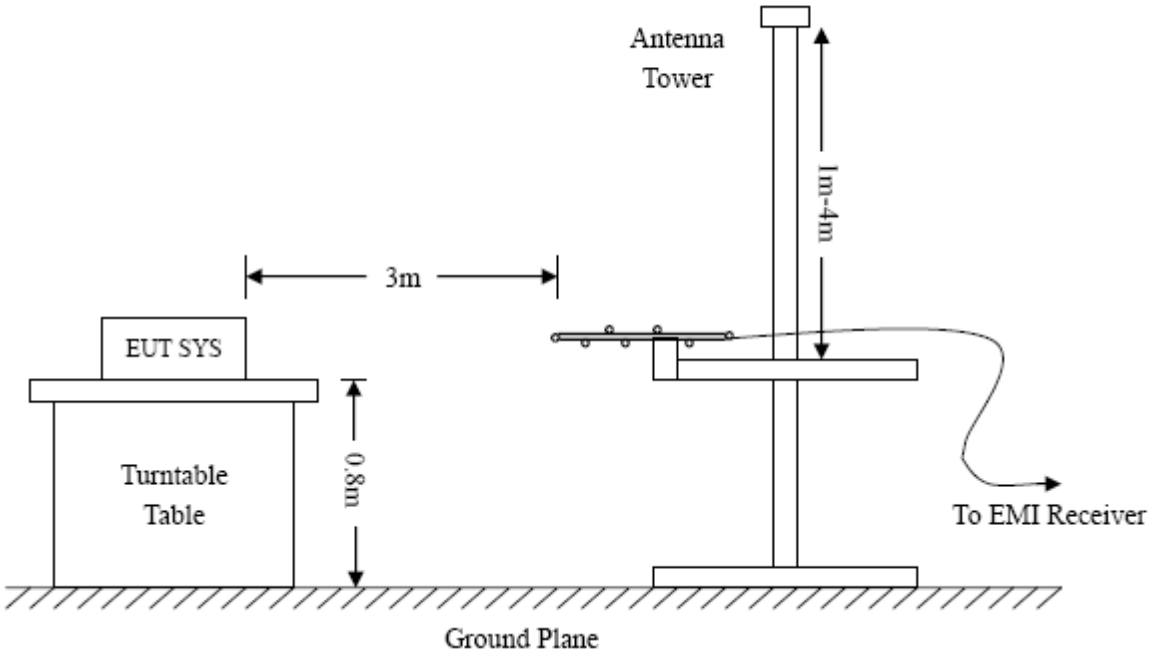
Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

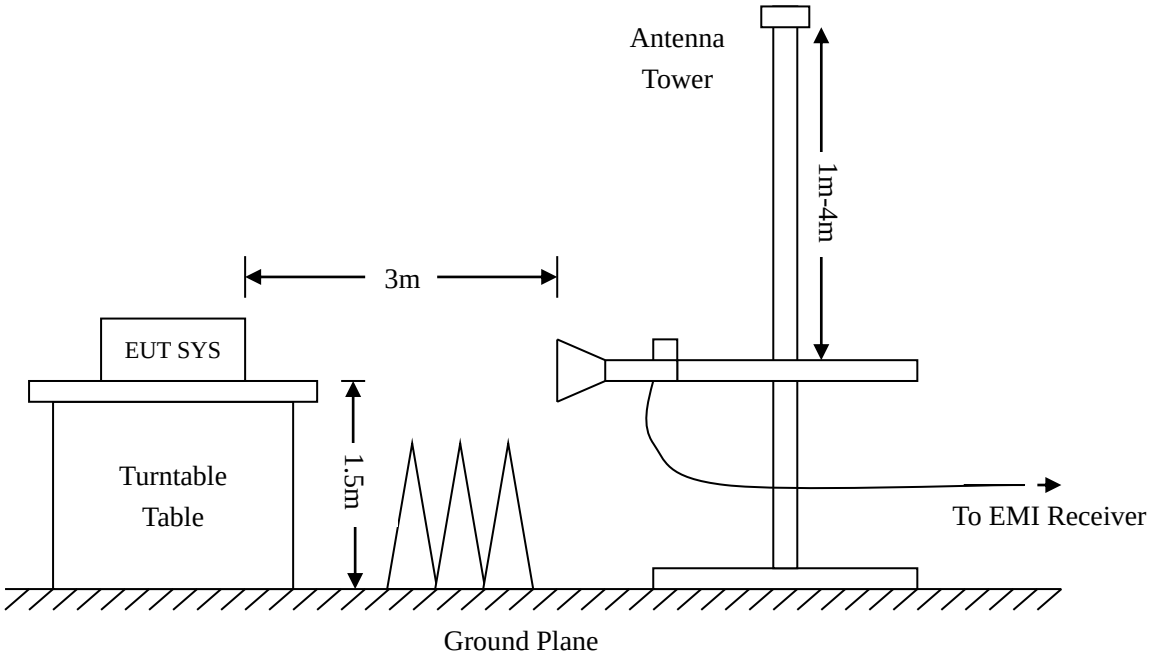
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

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	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:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

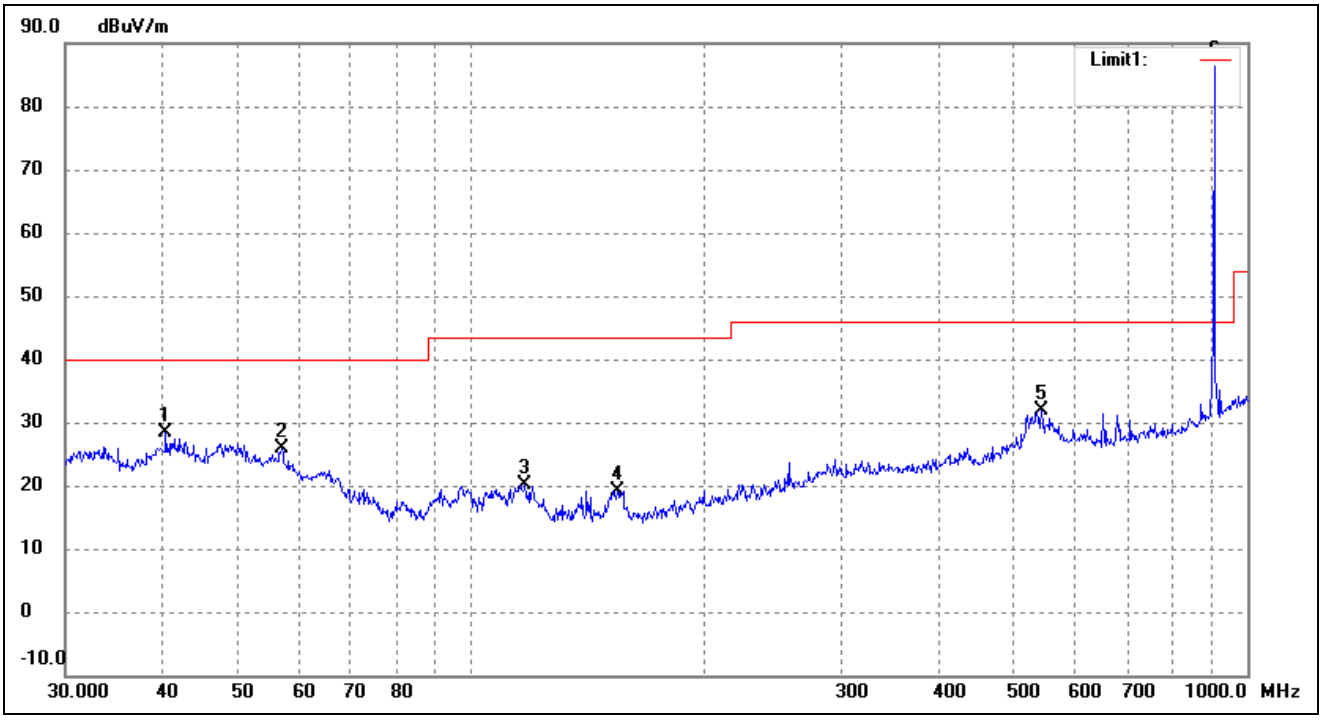
Margin = Corr. Ampl. – FCC Part 15C Limit

4.4 Summary of Test Results/Plots

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

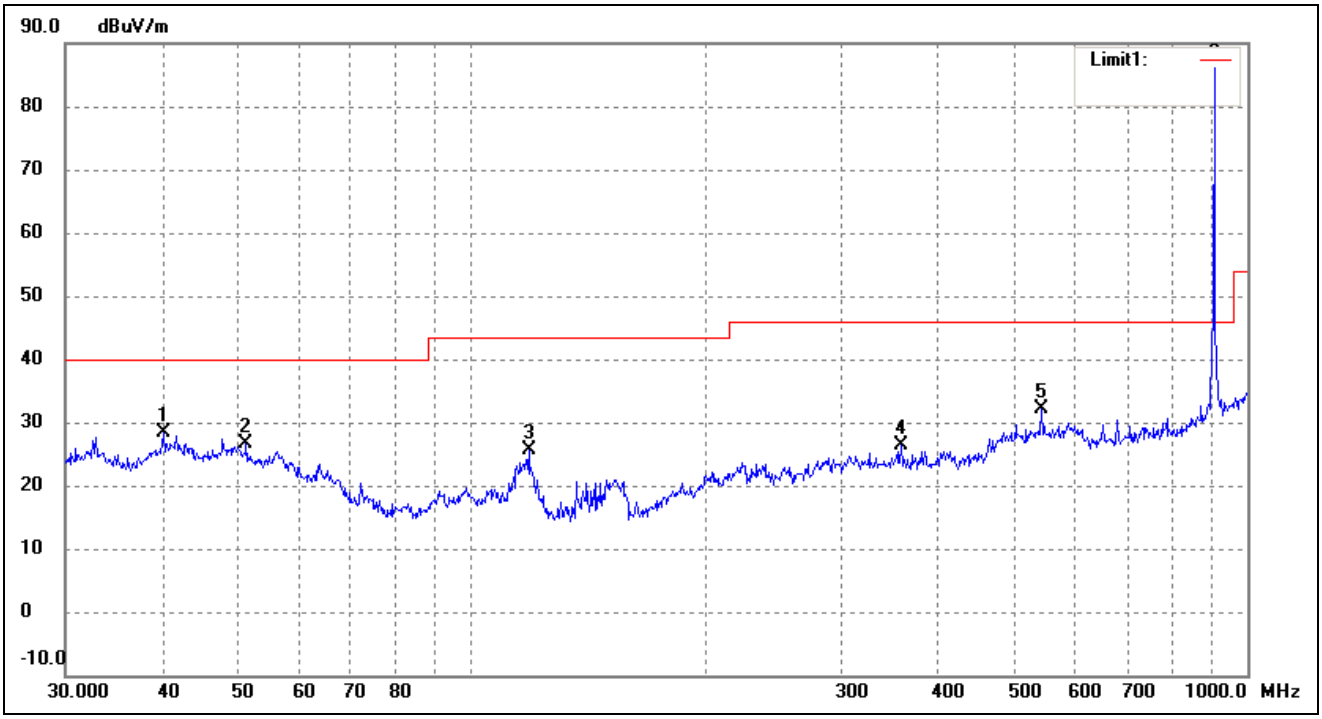
➢ Spurious Emissions Below 1GHz

Test Channel	Low	Polarity:	Horizontal



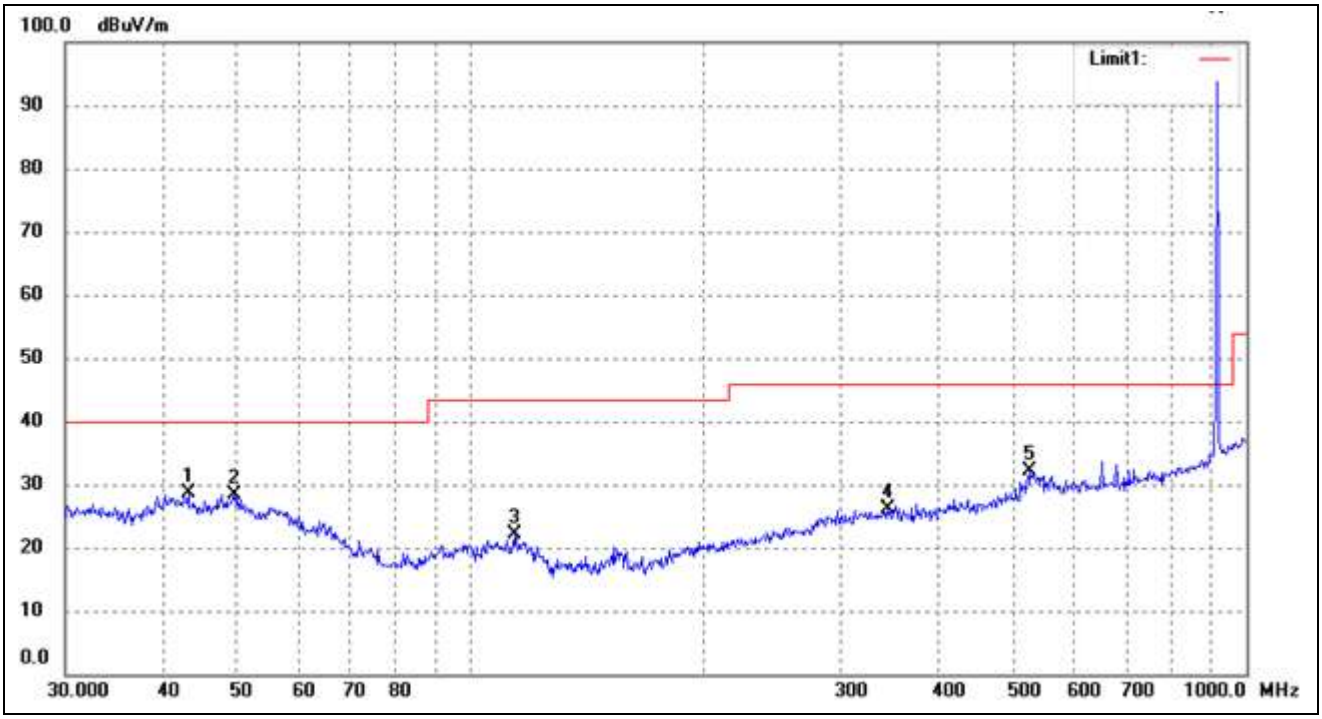
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	40.4172	36.73	-8.43	28.30	40.00	-11.70	207	100	peak
2	56.9912	35.88	-10.06	25.82	40.00	-14.18	90	100	peak
3	117.3603	35.86	-15.65	20.21	43.50	-23.29	92	100	peak
4	154.2786	36.43	-17.19	19.24	43.50	-24.26	121	100	peak
5	543.2742	37.21	-5.43	31.78	46.00	-14.22	95	100	peak
6	906.4824	84.28	1.55	85.83	94.00	-8.17	311	100	Fun. QP

Test Channel	Low	Polarity:	Vertical



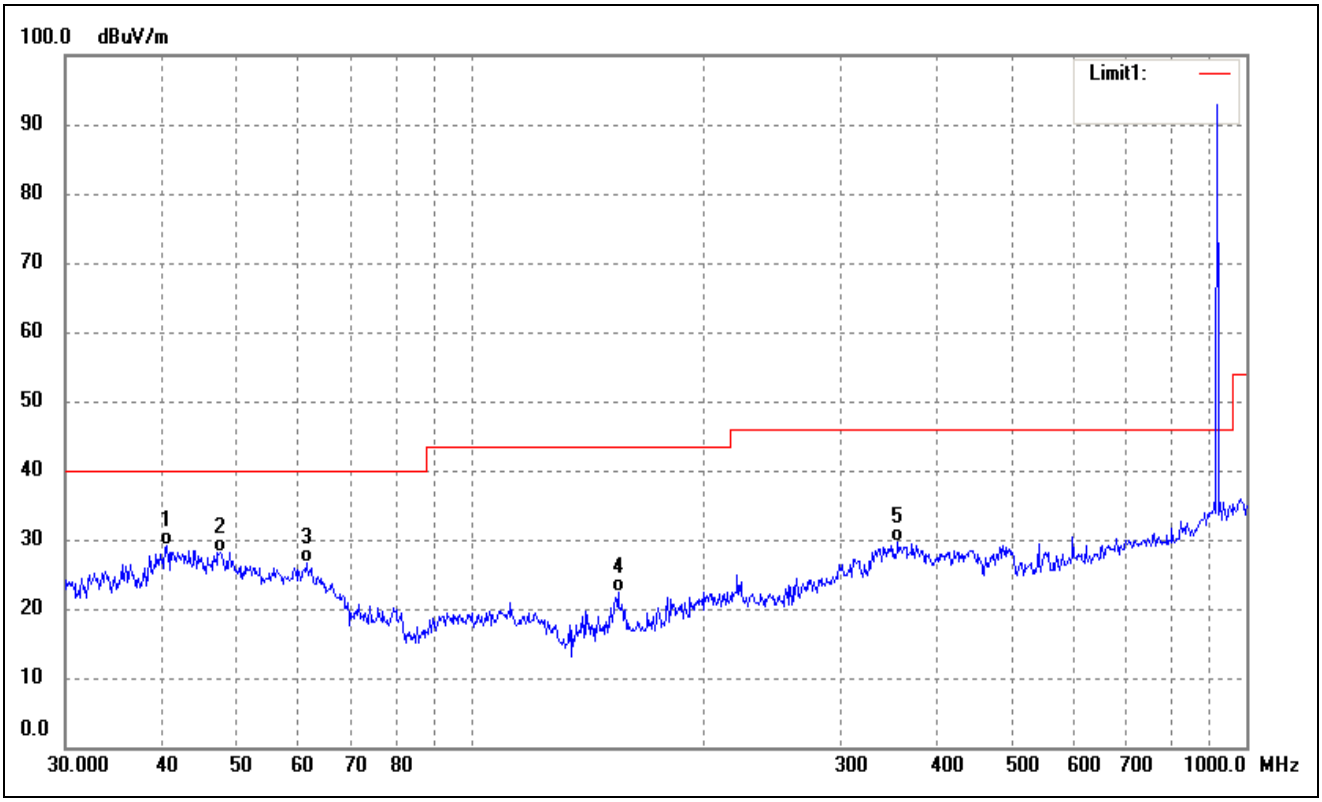
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	40.1347	36.77	-8.51	28.26	40.00	-11.74	338	100	peak
2	51.3005	35.14	-8.57	26.57	40.00	-13.43	92	100	peak
3	118.6014	41.46	-15.82	25.64	43.50	-17.86	64	100	peak
4	357.9287	34.42	-8.13	26.29	46.00	-19.71	103	100	peak
5	543.2742	37.45	-5.43	32.02	46.00	-13.98	112	100	peak
6	906.4824	84.12	1.55	85.67	94.00	-8.33	131	100	Fun. QP

Test Channel	Middle	Polarity:	Horizontal



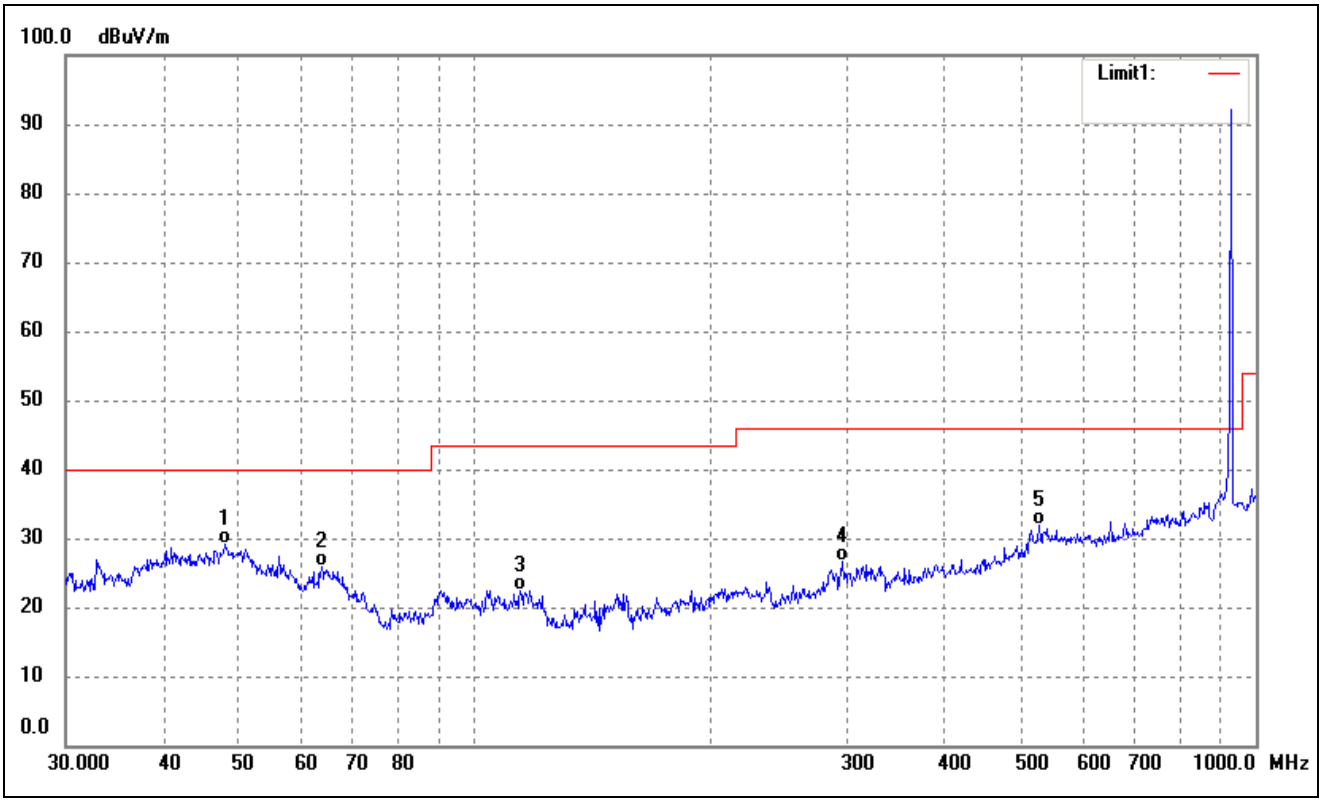
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	43.2017	36.60	-8.02	28.58	40.00	-11.42	94	100	peak
2	49.5328	36.78	-8.45	28.33	40.00	-11.67	191	100	peak
3	114.1138	37.22	-15.15	22.07	43.50	-21.43	80	100	peak
4	344.3855	34.21	-8.03	26.18	46.00	-19.82	136	100	peak
5	526.3967	37.74	-5.62	32.12	46.00	-13.88	156	100	peak
	916.0687	91.82	1.80	93.62	94.00	-0.38	214	100	Fun. QP

Test Channel	Middle	Polarity:	Vertical



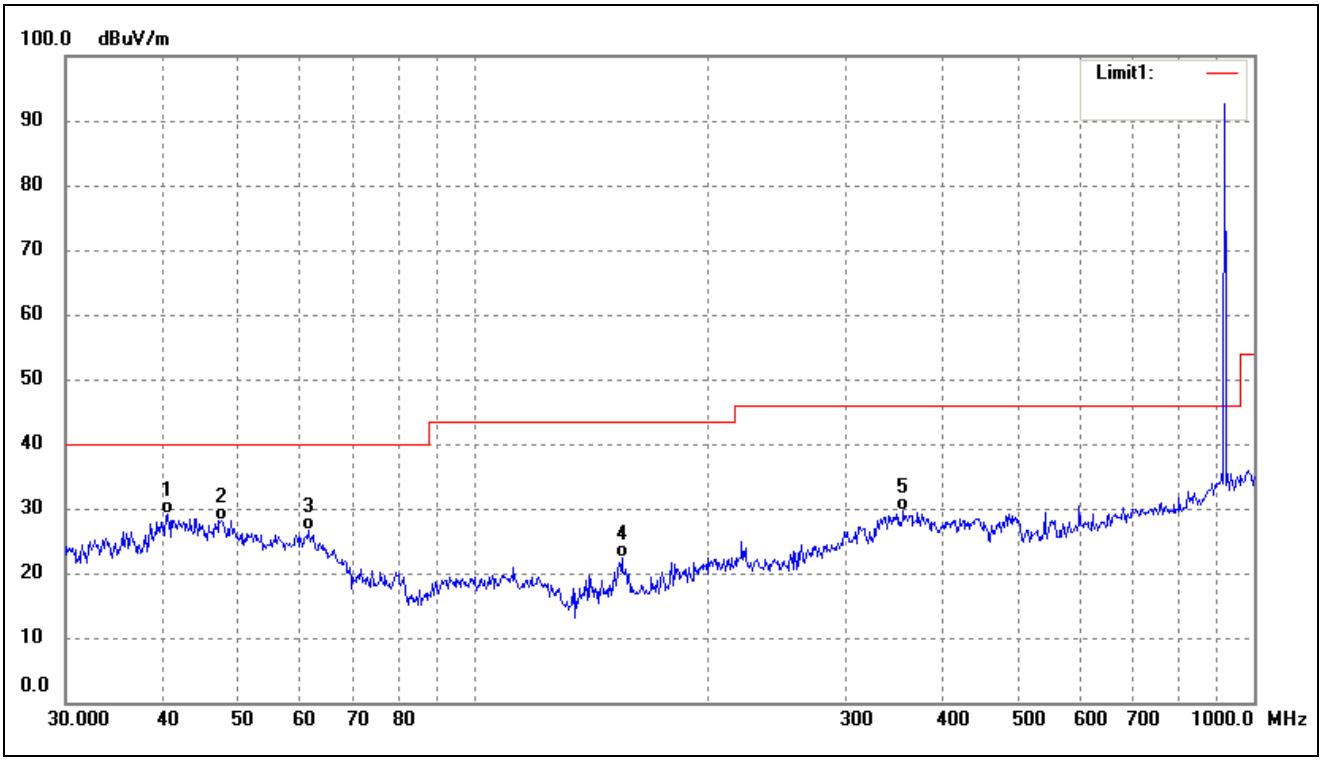
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	42.0066	36.31	-8.03	28.28	40.00	-11.72	351	100	peak
2	154.8205	39.55	-17.15	22.40	43.50	-21.10	175	100	peak
3	220.6171	38.37	-12.45	25.92	46.00	-20.08	58	100	peak
4	325.5958	34.80	-8.65	26.15	46.00	-19.85	249	100	peak
5	539.4775	36.37	-5.47	30.90	46.00	-15.10	345	100	peak
6	916.0687	91.38	1.80	93.18	94.00	-0.82	300	100	Fun. QP

Test Channel	High	Polarity:	Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	56.1974	37.01	-9.68	27.33	40.00	-12.67	242	100	peak
2	114.5146	36.55	-15.22	21.33	43.50	-22.17	90	100	peak
3	189.7385	34.65	-14.21	20.44	43.50	-23.06	156	100	peak
4	528.2458	37.94	-5.56	32.38	46.00	-13.62	97	100	peak
5	651.9417	36.26	-3.40	32.86	46.00	-13.14	251	100	peak
6	929.0082	90.45	2.03	92.48	94.00	-1.52	127	100	Fun. QP

Test Channel	High	Polarity:	Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	41.7130	36.79	-8.10	28.69	40.00	-11.31	351	100	peak
2	58.4074	36.71	-10.65	26.06	40.00	-13.94	175	100	peak
3	115.3205	39.13	-15.36	23.77	43.50	-19.73	58	100	peak
4	256.5211	36.75	-11.03	25.72	46.00	-20.28	249	100	peak
5	543.2742	37.36	-5.43	31.93	46.00	-14.07	345	100	peak
6	929.0082	91.02	2.03	93.05	94.00	-0.95	300	100	Fun. QP

➢ Spurious Emissions Above 1GHz

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-904.2MHz							
1808.40	46.05	10.23	56.28	74	-17.72	H	PK
1808.40	31.42	10.23	41.65	54	-12.35	H	AV
1808.40	45.28	10.23	55.51	74	-18.49	V	PK
1808.40	32.37	10.23	42.60	54	-11.40	V	AV
Middle Channel-915.2MHz							
1830.40	43.37	10.25	53.62	74	-20.38	H	PK
1830.40	33.07	10.25	43.32	54	-10.68	H	AV
1830.40	45.07	10.25	55.32	74	-18.68	V	PK
1830.40	32.79	10.25	43.04	54	-10.96	V	AV
High Channel-926.2MHz							
1852.40	45.02	10.29	55.31	74	-18.69	H	PK
1852.40	33.17	10.29	43.46	54	-10.54	H	AV
1852.40	47.49	10.29	57.78	74	-16.22	V	PK
1852.40	31.40	10.29	41.69	54	-12.31	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 2th 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.

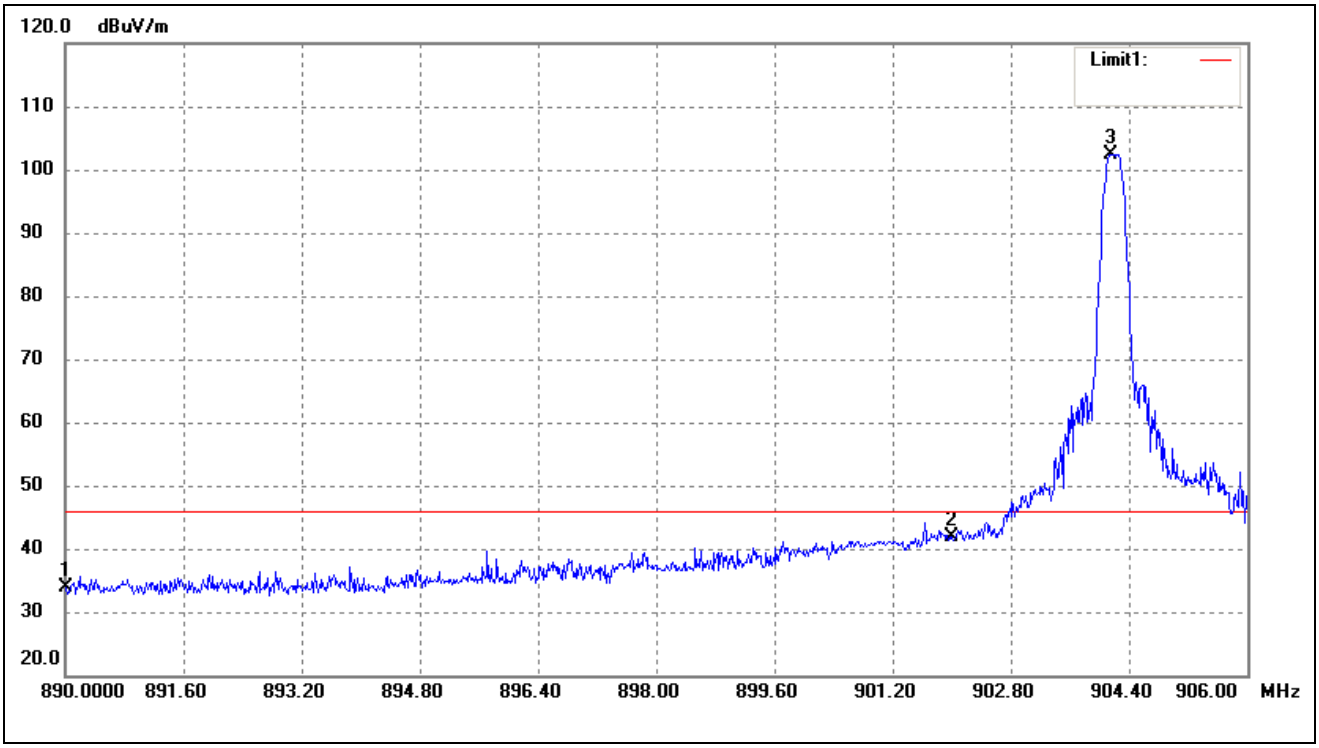
5.3 Summary of Test Results/Plots

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.

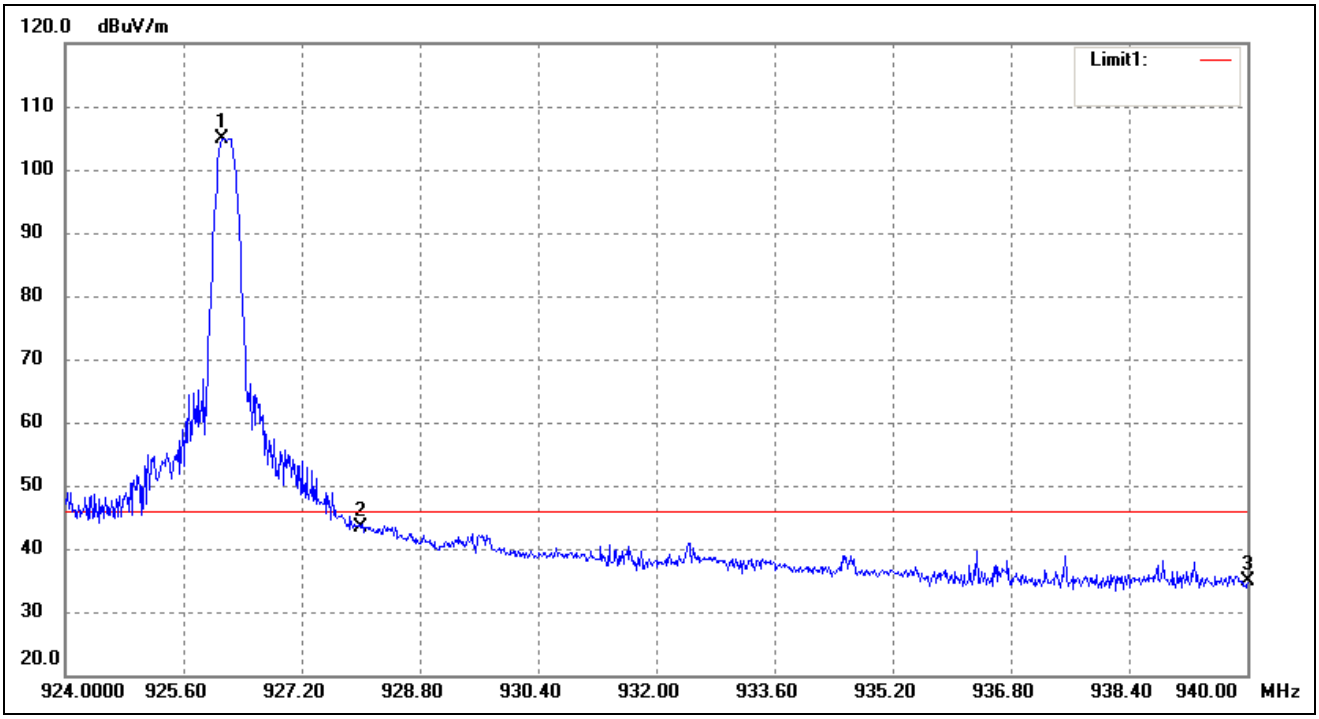
Please refer to the test plots as below.

Test Channel	Low	Polarity:	Vertical(worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	890.0000	32.98	0.98	33.96	46.00	-12.04	Peak Detector
2	902.0000	40.34	1.44	41.78	46.00	-4.22	Peak Detector

Test Channel	High	Polarity:	Vertical(worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	928.0000	41.31	2.01	43.32	46.00	-2.68	Peak Detector
2	940.0000	32.62	2.30	34.92	46.00	-11.08	Peak Detector

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

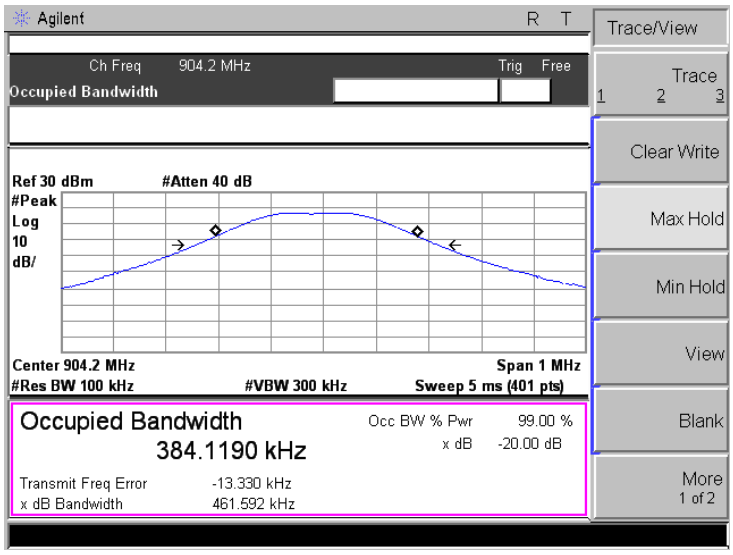
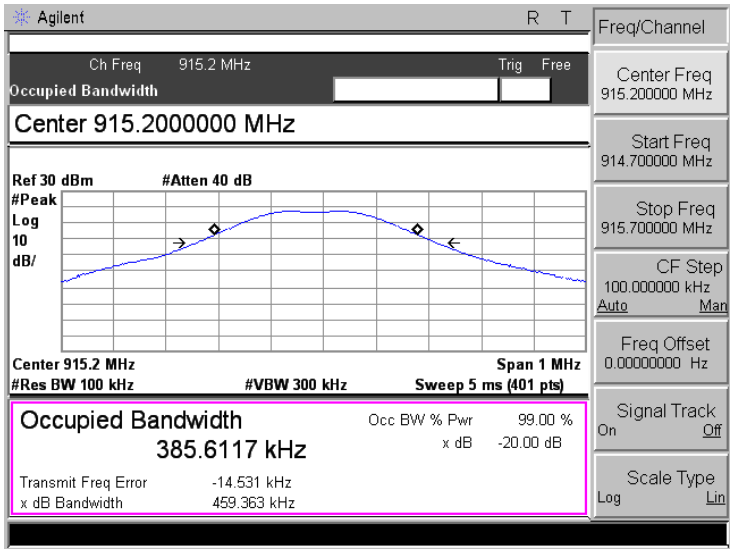
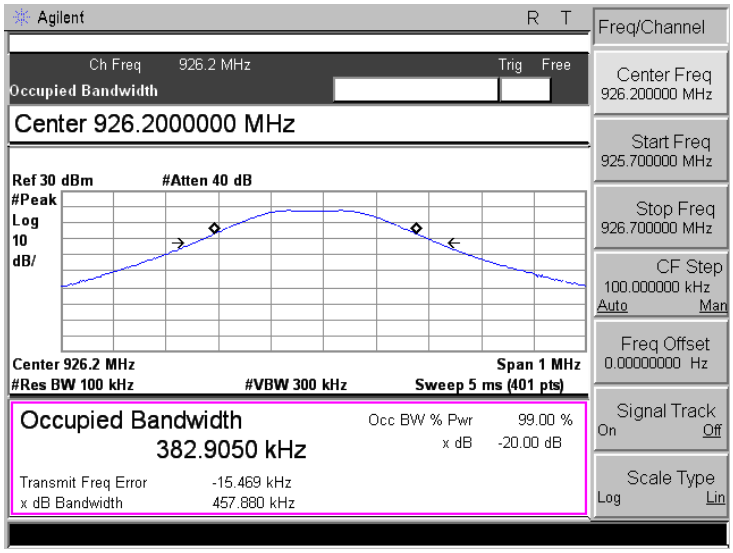
According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

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 ≥1% 20dB Bandwidth, VBW ≥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	904.2	461.592
Middle Channel	915.2	459.363
High Channel	926.2	457.880

Please refer to the following test plots

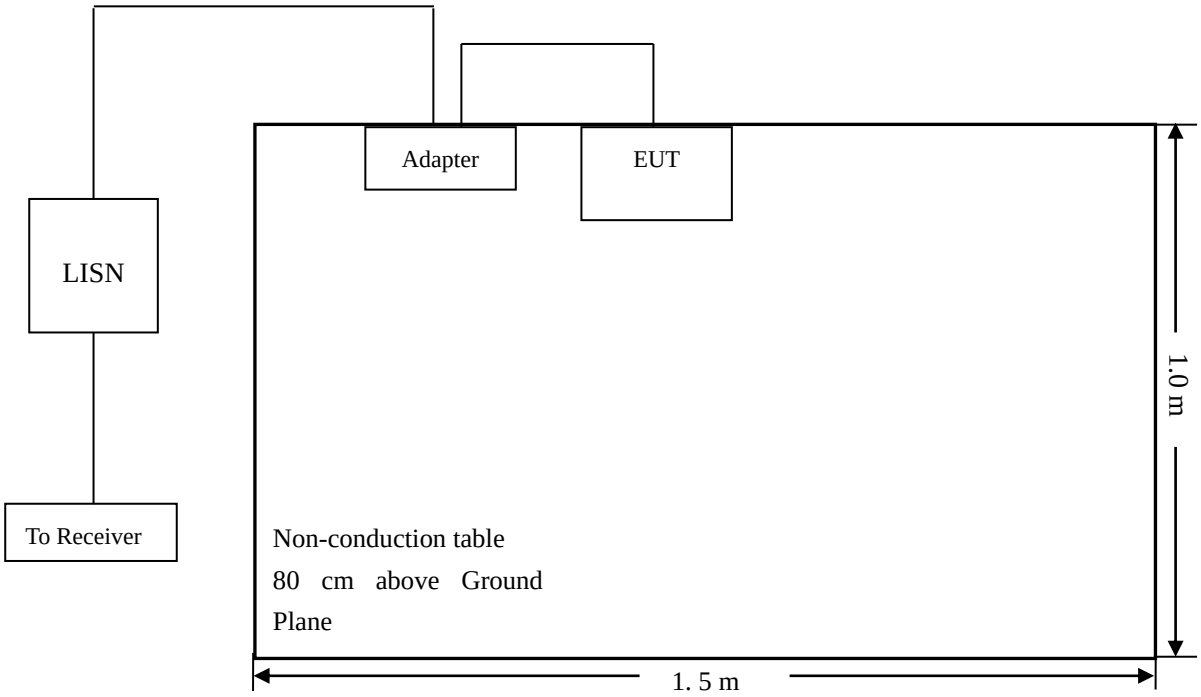
Low Channel	
Middle Channel	
High Channel	

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



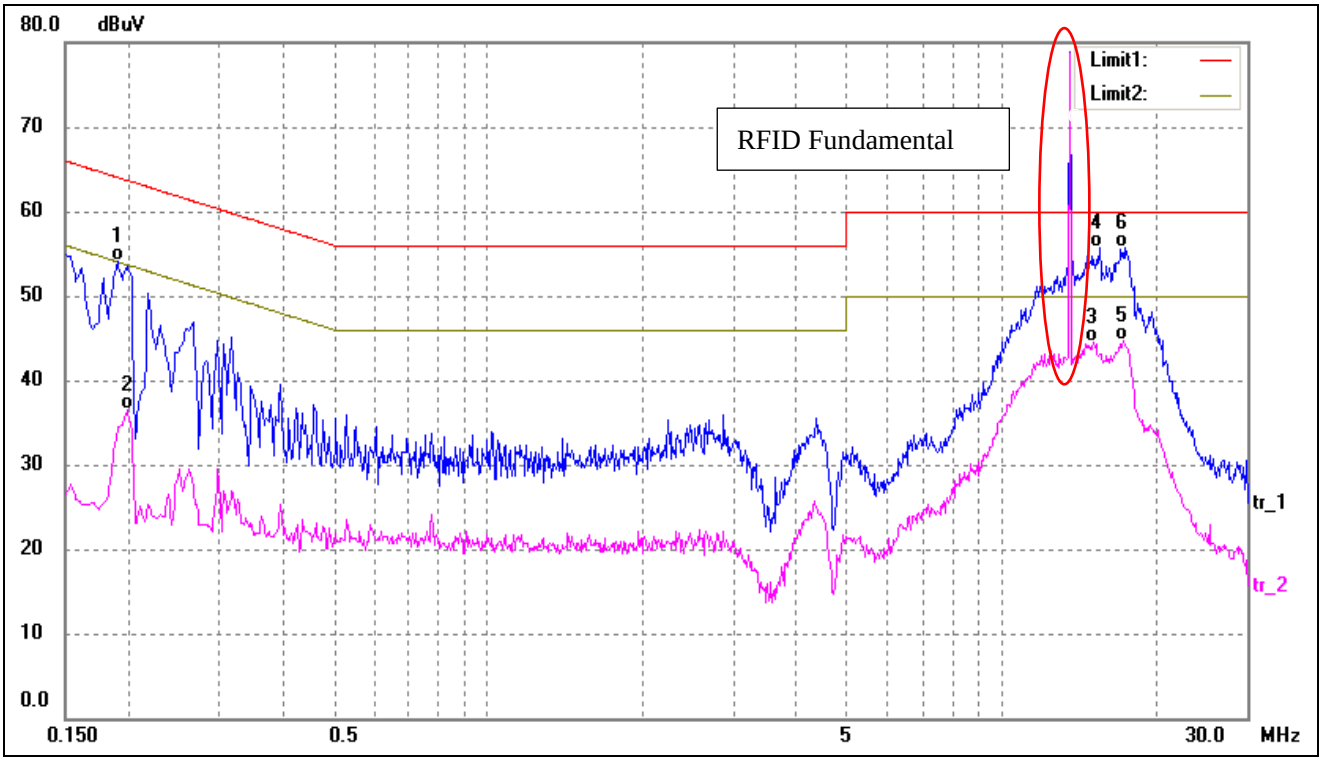
7.3 Test Receiver Setup

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

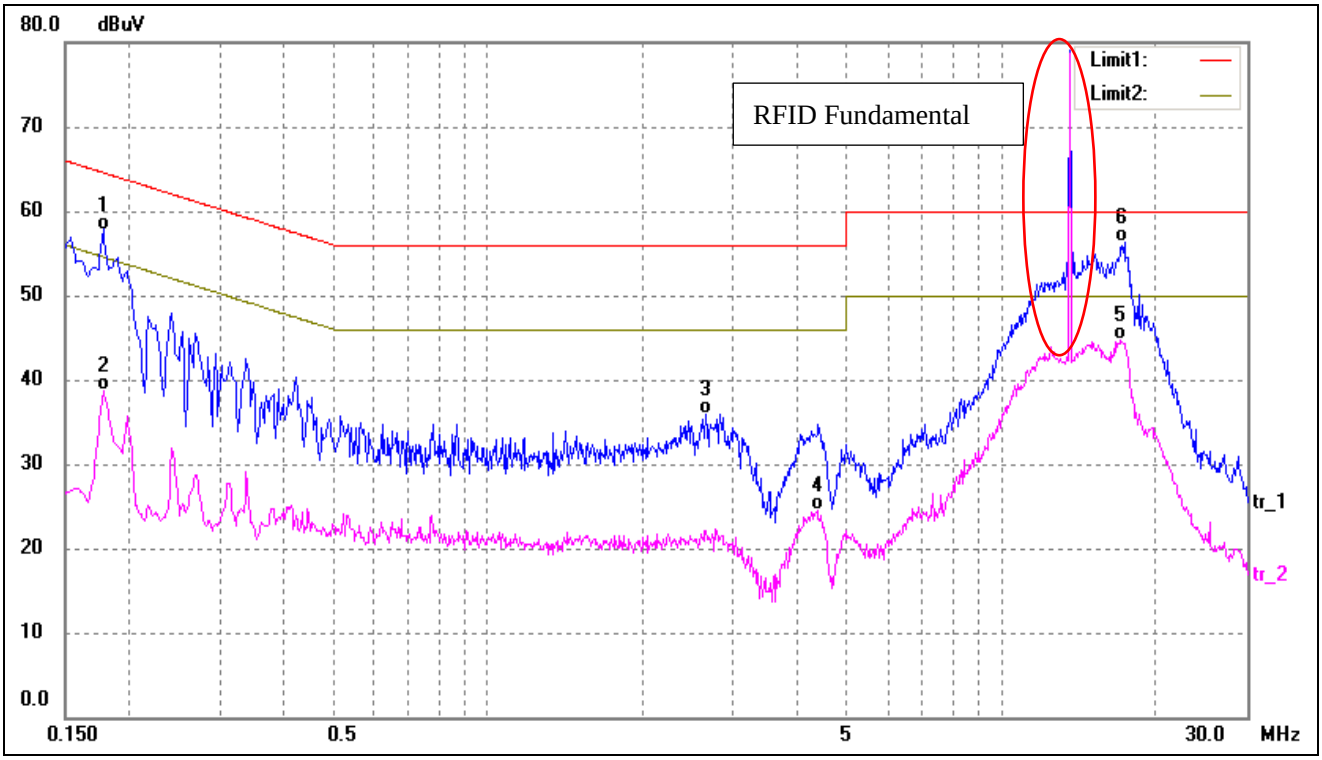
7.4 Summary of Test Results/Plots

Test Mode	Communication	AC120V 60Hz	Polarity:	Neutral



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1900	43.98	10.12	54.10	64.04	-9.94	QP
2	0.1980	26.39	10.12	36.51	53.69	-17.18	AVG
3	15.0820	33.53	11.03	44.56	50.00	-5.44	AVG
4	15.4860	44.62	11.04	55.66	60.00	-4.34	QP
5	17.2100	33.64	11.09	44.73	50.00	-5.27	AVG
6*	17.3700	44.66	11.10	55.76	60.00	-4.24	QP

Test Mode	Communication	AC120V 60Hz	Polarity:	Line



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1780	47.69	10.11	57.80	64.58	-6.78	QP
2	0.1780	28.69	10.11	38.80	54.58	-15.78	AVG
3	2.6500	25.31	10.65	35.96	56.00	-20.04	QP
4	4.3780	13.85	10.74	24.59	46.00	-21.41	AVG
5	17.0580	33.64	11.09	44.73	50.00	-5.27	AVG
6*	17.2940	45.15	11.10	56.25	60.00	-3.75	QP

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