

FCC PART 15.231

TEST REPORT

For

Serene Innovations Inc.

14731 Carmenita Road Norwalk, CA 90650 USA

FCC ID: Z33-RCX

Report Type: Original Report	Product Type: RCx-Remote Transmitter
Test Engineer: William Li	<i>William Li</i>
Report Number: RSZ150303001-00	
Report Date: 2015-03-16	
Reviewed By: Jimmy Xiao RF Engineer	<i>Jimmy Xiao</i>
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

TABLE OF CONTENTS

GENERAL INFORMATION.....	3
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
OBJECTIVE	3
RELATED SUBMITTAL(S)/GRANT(S).....	3
TEST METHODOLOGY	3
TEST FACILITY	4
SYSTEM TEST CONFIGURATION.....	5
JUSTIFICATION	5
SPECIAL ACCESSORIES.....	5
EQUIPMENT MODIFICATIONS	5
EXTERNAL I/O CABLE.....	5
BLOCK DIAGRAM OF TEST SETUP	5
SUMMARY OF TEST RESULTS	6
FCC §15.203 - ANTENNA REQUIREMENT.....	7
APPLICABLE STANDARD	7
ANTENNA CONNECTOR CONSTRUCTION	7
FCC §15.207 (A) – AC LINE CONDUCTED EMISSIONS	8
APPLICABLE STANDARD	8
MEASUREMENT UNCERTAINTY	8
EUT SETUP	8
EMI TEST RECEIVER SETUP.....	9
TEST PROCEDURE	9
TEST EQUIPMENT LIST AND DETAILS.....	9
CORRECTED FACTOR & MARGIN CALCULATION	9
TEST RESULTS SUMMARY	10
TEST DATA	10
FCC §15.205, §15.209, §15.231 (B) - RADIATED EMISSIONS	13
APPLICABLE STANDARD	13
MEASUREMENT UNCERTAINTY	13
EUT SETUP	14
EMI TEST RECEIVER SETUP.....	14
TEST PROCEDURE	15
TEST EQUIPMENT LIST AND DETAILS.....	15
CORRECTED AMPLITUDE & MARGIN CALCULATION	15
TEST RESULTS SUMMARY	15
TEST DATA	16
FCC §15.231(C) – 20 DB EMISSION BANDWIDTH.....	19
APPLICABLE STANDARD	19
TEST PROCEDURE	19
TEST EQUIPMENT LIST AND DETAILS.....	19
TEST DATA	19
FCC §15.231(A)(2) - DEACTIVATION TESTING.....	21
APPLICABLE STANDARD	21
TEST PROCEDURE	21
TEST EQUIPMENT LIST AND DETAILS.....	21
TEST DATA	21

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Serene Innovations Inc.*'s product, model number: *RCx-Txm (FCC ID: Z33-RCX)* (or the "EUT") in this report was a *RCx-Remote Transmitter*, which was measured approximately: 8.7 cm (L) x 5.0 cm (W) x 2.2 cm (H), rated input voltage: DC 12V from battery or DC 12.0V from adapter.

Adapter Information:

Model: HNBB120050WU

Input: AC 100-240V, 50/60 Hz, 0.2 A

Output: 12.0V, 0.5A

**All measurement and test data in this report was gathered from production sample serial number: 1503008 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2015-03-03.*

Objective

This test report is prepared on behalf of *Serene Innovations Inc.* All the test measurements were performed according to the measurement procedure described in ANSI C63.4-2009.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.209, 15.35(c) and 15.231 rules.

Related Submittal(s)/Grant(s)

No related submittal(s)

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 - 2009, 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. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2010. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

SYSTEM TEST CONFIGURATION

Justification

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

Special Accessories

No special accessories was used

Equipment Modifications

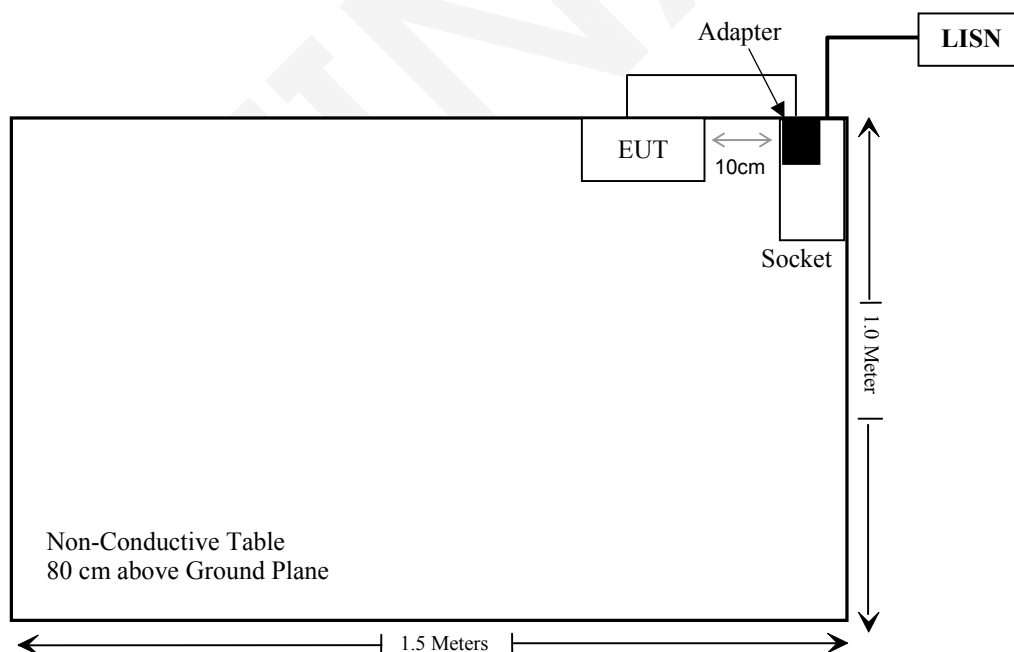
No modification was made to the EUT.

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Un-detachable DC Power Cable	1.8	EUT	Adapter

Block Diagram of Test Setup

For conducted emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.231 (b)	Radiated Emissions	Compliance
§15.231 (c)	20dB Bandwidth	Compliance
§15.231 (a)	Deactivation time	Compliance

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connector Construction

The EUT has a monopole antenna arrangement, which was permanently attached; fulfill the requirement of this section. Please refer to EUT photos.

Result: Compliant.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207

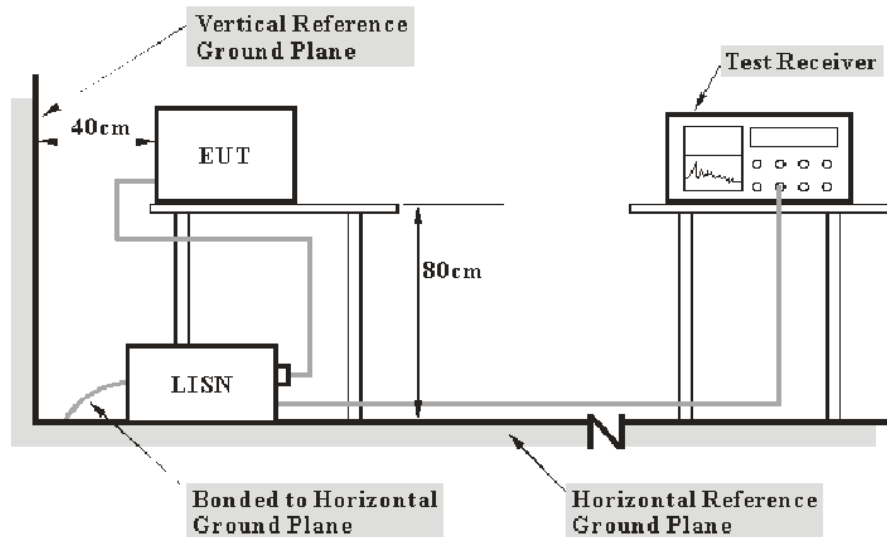
Measurement Uncertainty

Input quantities to be considered for conducted disturbance measurements may be receiver reading, attenuation of the connection between LISN and receiver, LISN voltage division factor, LISN VDF frequency interpolation and receiver related input quantities, etc.

Based on CISPR 16-4-2:2011, the expanded combined standard uncertainty of conducted disturbance test at Bay Area Compliance Laboratories Corp. (Shenzhen) is shown as below. And the uncertainty will not be taken into consideration for the test data recorded in the report.

Port	Expanded Measurement uncertainty
AC Mains	3.26 dB (k=2, 95% level of confidence)
CAT 3	3.70 dB (k=2, 95% level of confidence)
CAT 5	3.86 dB (k=2, 95% level of confidence)
CAT 6	4.64 dB (k=2, 95% level of confidence)

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 C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The adapter was connected to a 120 VAC/60 Hz 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 LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2014-06-03	2015-06-03
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2014-06-09	2015-06-09
Rohde & Schwarz	LISN	ESH3-Z5	100113	NCR	NCR
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2014-10-15	2015-10-15
Rohde & Schwarz	CE Test software	EMC 32	V8.53	NCR	NCR

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

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

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:

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

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207, the worst margin reading as below:

20.5 dB at 0.396090 MHz in the **Line** conducted mode

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BACL, $U_{(L_m)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

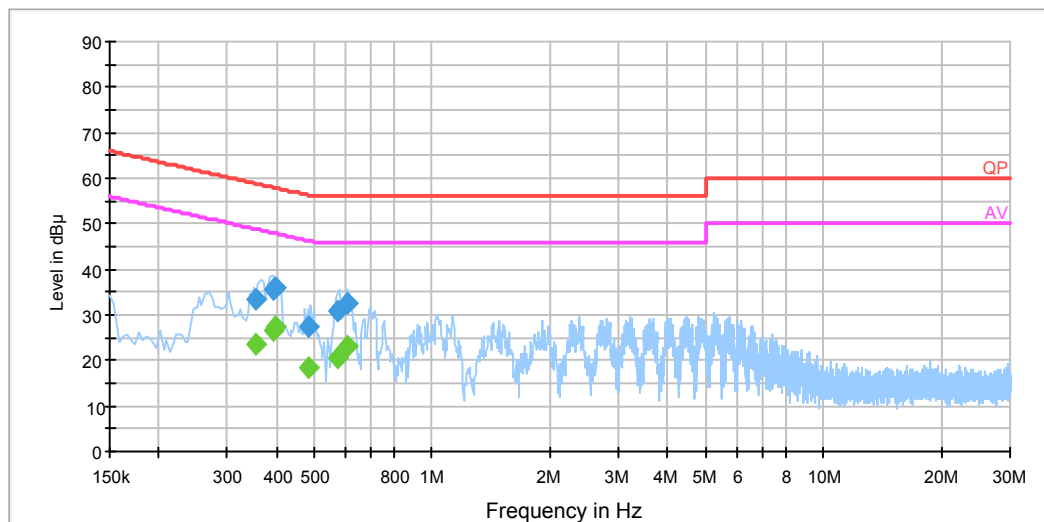
Test Data

Environmental Conditions

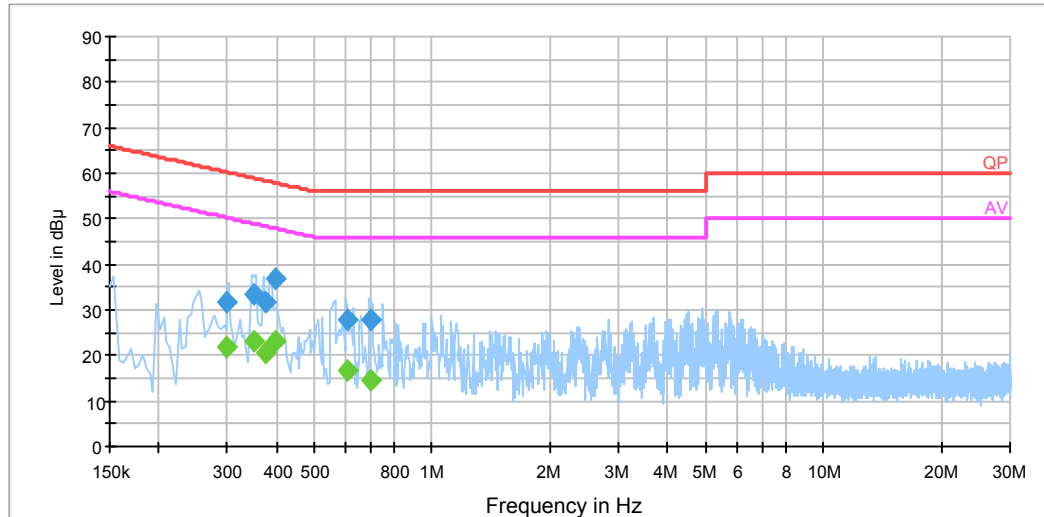
Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by William Li on 2015-03-13.

EUT operation mode: Transmitting

AC 120V/60 Hz, Line**EMI Auto Test L**

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.355250	33.6	19.2	58.8	25.2	QP
0.355250	23.4	19.2	48.8	25.4	Ave.
0.391790	35.5	19.2	58.0	22.5	QP
0.391790	26.5	19.2	48.0	21.5	Ave.
0.396090	35.9	19.2	57.9	22.0	QP
0.396090	27.4	19.2	47.9	20.5	Ave.
0.482650	27.3	19.3	56.3	29.0	QP
0.482650	18.4	19.3	46.3	27.9	Ave.
0.573330	30.9	19.3	56.0	25.1	QP
0.573330	20.6	19.3	46.0	25.4	Ave.
0.604910	32.7	19.3	56.0	23.3	QP
0.604910	23.1	19.3	46.0	22.9	Ave.

AC 120V/60 Hz, Neutral**EMI Auto Test N**

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.297470	31.8	19.2	60.3	28.5	QP
0.297470	22.0	19.2	50.3	28.3	Ave.
0.348810	33.5	19.2	59.0	25.5	QP
0.348810	23.0	19.2	49.0	26.0	Ave.
0.375550	31.9	19.2	58.4	26.5	QP
0.375550	20.5	19.2	48.4	27.9	Ave.
0.395850	37.0	19.2	57.9	20.9	QP
0.395850	23.0	19.2	47.9	24.9	Ave.
0.604970	27.8	19.3	56.0	28.2	QP
0.604970	16.9	19.3	46.0	29.1	Ave.
0.695650	28.0	19.3	56.0	28.0	QP
0.695650	14.4	19.3	46.0	31.6	Ave.

Note:

- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

FCC §15.205, §15.209, §15.231 (b) - RADIATED EMISSIONS**Applicable Standard**

FCC §15.205, §15.209, §15.231 (b)

According to FCC §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions ((Microvolts /meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

*Linear interpolations.

The above field strength limits are specified at a distance of 3-meters the tighter limits apply at the band edges.

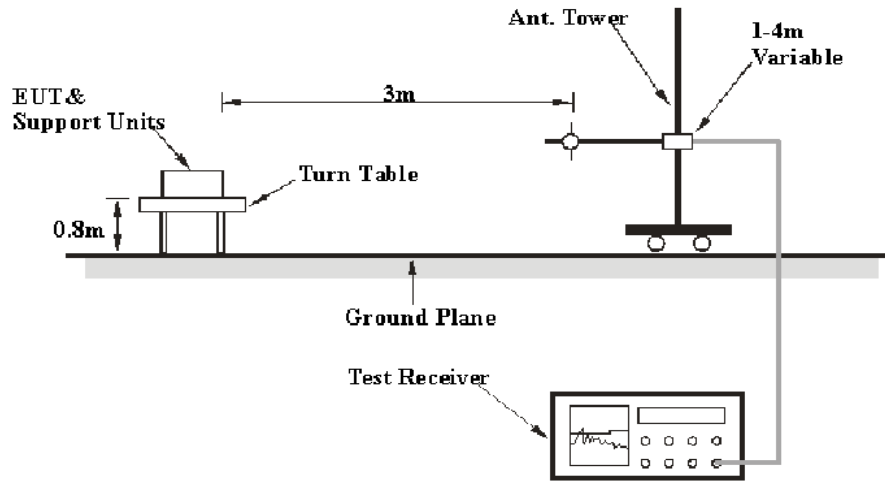
Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

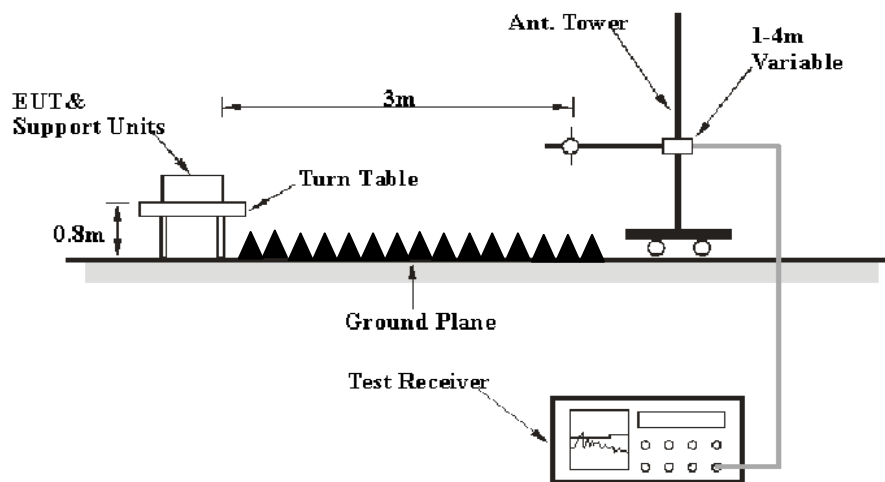
Based on CISPR 16-4-2:2011, the expended combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) is 5.91 dB for 30MHz-1GHz and 4.92 dB for above 1GHz, and it will not be taken into consideration for the test data recorded in the report.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4 - 2009. The specification used was the FCC 15 § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 5 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK

Test Procedure

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

All final data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak detection mode above 1 GHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Amplifier	8447E	1937A01046	2014-05-06	2015-05-06
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2014-11-03	2015-11-03
TDK	Chamber	Chamber A	2#	2012-10-15	2015-10-15
Sunol Sciences	Broadband Antenna	JB3	A111513	2014-06-18	2017-06-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2014-04-23	2015-04-23
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-01	2017-11-30
R&S	Auto test Software	EMC32	V9.10	NCR	NCR

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

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Loss and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Loss} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 5.8 dB means the emission is 5.8 dB below the limit. The equation for margin calculation is as follows:

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

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231, the worst margin reading as below:

5.40 dB at 433.92 MHz in the Horizontal polarization

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(L_m)}$ is less than $+U_{cispr}$, if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data**Environmental Conditions**

Temperature:	20~24 °C
Relative Humidity:	48~50 %
ATM Pressure:	101.0 kPa

The testing was performed by William Li on 2015-03-05 & 2015-03-11.

Test mode: Transmitting

30MHz-5GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.231/205/209		
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)	Comment
433.92	90.70	PK	68	1.2	H	-10	80.70	100.8	20.10	Fundamental
433.92	79.62	PK	95	1.4	V	-10	69.62	100.8	31.18	Fundamental
867.84	55.30	PK	100	1.5	H	-3.5	51.80	80.80	29.00	Harmonic
867.84	56.23	PK	39	1.6	V	-3.5	52.73	80.80	28.07	Harmonic
1301.76	51.46	PK	348	2.3	H	-0.78	50.68	74.00	23.32	Harmonic
1301.76	47.62	PK	348	2.3	V	-0.58	47.04	74.00	26.96	Harmonic

Field Strength of Average Emission							
Frequency (MHz)	Peak Measurement @3m (dBμV/m)	Polar (H/V)	Duty Cycle Correction Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.231/205/209		
					Limit (dBμV/m)	Margin (dB)	Comment
433.92	80.70	H	-5.30	75.40	80.80	5.40	Fundamental
433.92	69.62	V	-5.30	64.32	80.80	16.48	Fundamental
867.84	51.80	H	-5.30	46.50	60.79	14.29	Harmonic
867.84	52.73	V	-5.30	47.43	60.79	13.36	Harmonic
1301.76	50.68	H	-5.30	45.38	54.00	8.62	Harmonic
1301.76	47.04	V	-5.30	41.74	54.00	12.26	Harmonic

Note:

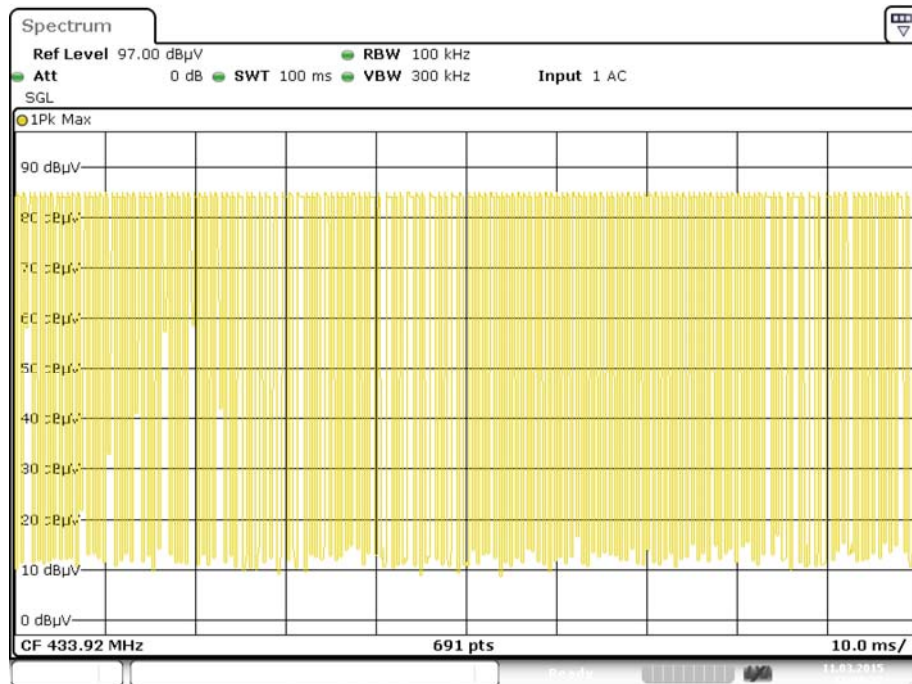
Calculate Average value based on Duty Cycle correction factor:

Duty Cycle = $(T_{on1} * 10 + T_{on2} * 132) / 100ms = (0.6522ms * 10 + 0.3623ms * 132) / 100ms = 54.35\%$

Duty Cycle factor = $20 * \log(\text{Duty Cycle}) = -5.30$

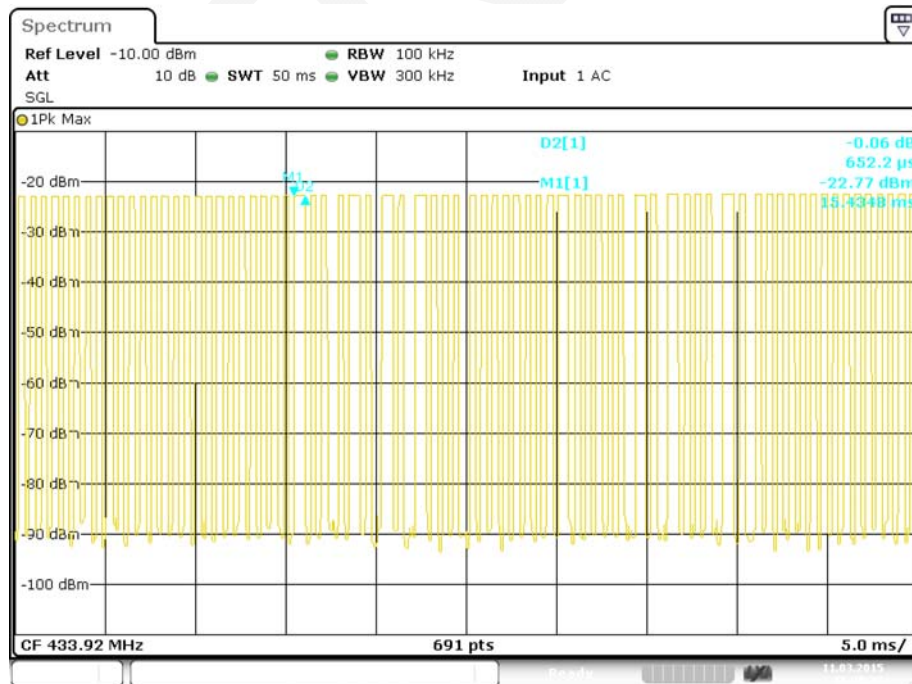
Average = Peak + Duty Cycle factor

T=100ms



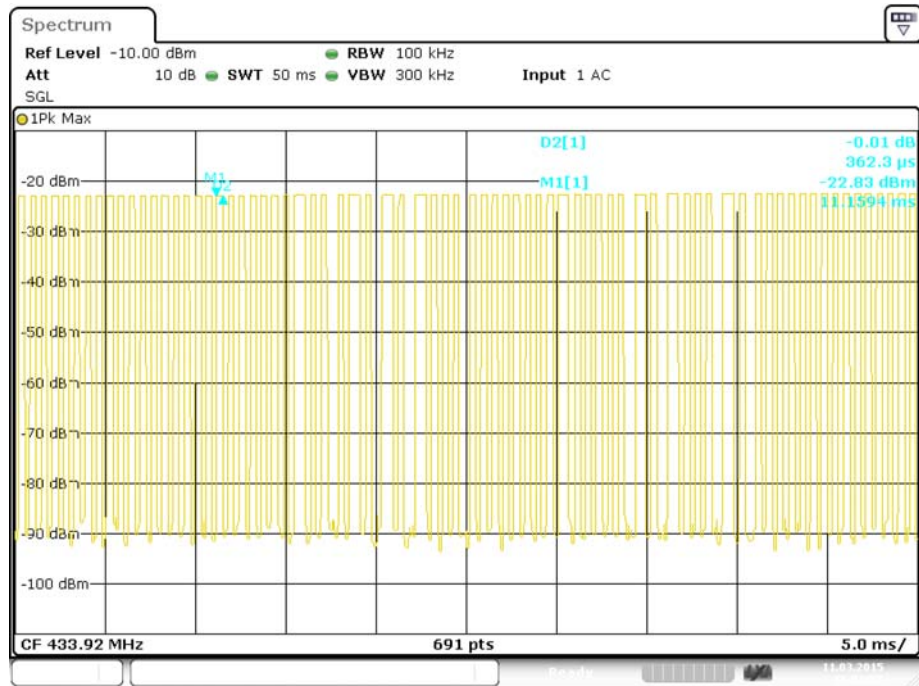
Date: 11.MAR.2015 11:00:23

T_{on1}



Date: 11.MAR.2015 16:48:39

T_{on2}



Date: 11.MAR.2015 16:51:55

FCC §15.231(c) – 20 dB EMISSION BANDWIDTH**Applicable Standard**

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22

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

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by William Li on 2015-03-05.

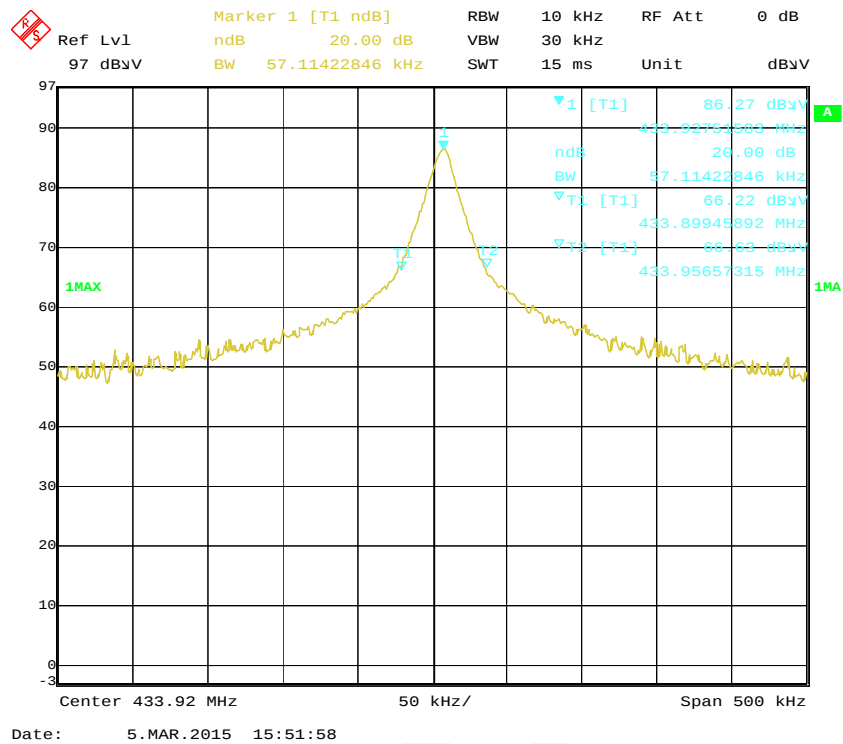
Test Mode: Transmitting

Please refer to following table and plot.

Channel Frequency (MHz)	20 dB Emission Bandwidth (kHz)	<Limit (kHz)	Result
433.92	57.1	1084.8	Pass

Note: Limit = 0.25% * center frequency = 0.25% * 433.92 MHz = 1084.8 kHz
20dB bandwidth = 57.1kHz < 1084.8 kHz

20 dB Emission Bandwidth



FCC §15.231(a)(2) - DEACTIVATION TESTING**Applicable Standard**

Per FCC §15.231(a) (2), a transmitter activated automatically shall cease transmission within 5 seconds after activation.

Test Procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=100kHz, VBW=100kHz, Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	837405/023	2014-08-22	2015-08-22

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

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by William Li on 2015-03-05.

Test Mode: Transmitting

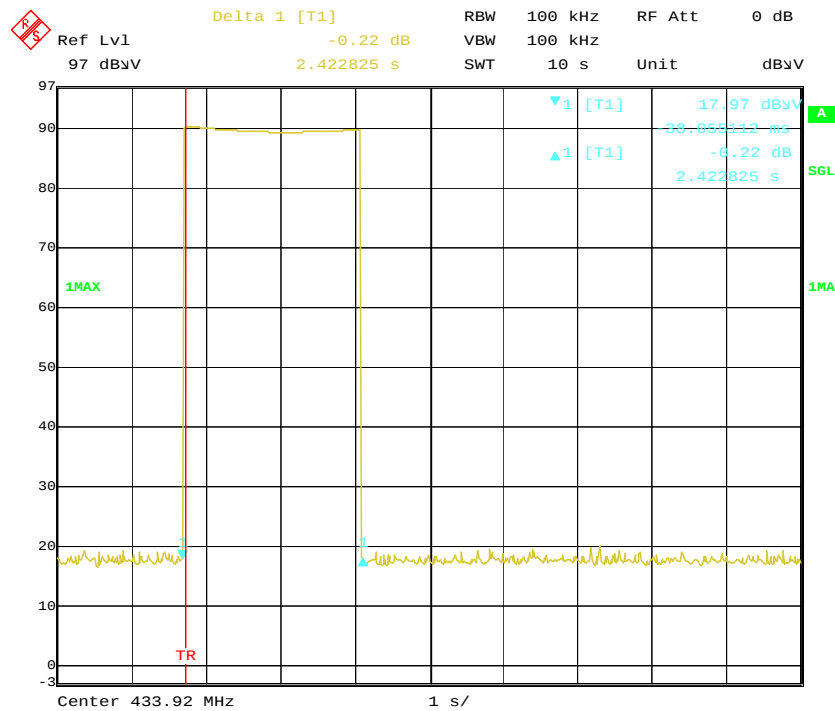
Test Result: Compliant, please refer to following plot

Transmission period	Limit	Result
2.4228 s	< 5 s	Pass

Note:

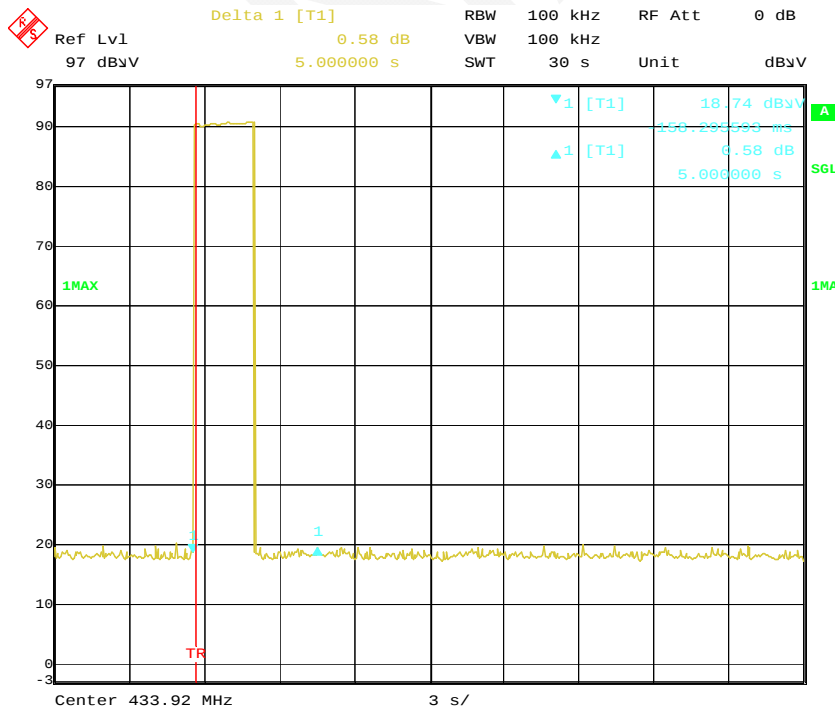
- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation

Transmission time



Date: 5.MAR.2015 17:03:33

5S



Date: 5.MAR.2015 17:06:32

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