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## FCC PART 15.231 AND IC RSS-210 (i8) TEST REPORT LOW POWER UNLICENSED TRANSMITTER

<b>Applicant</b>	ENTERPRISE ELECTRONICS, L.L.C.
<b>Address</b>	1577 STAR-BATT DRIVE ROCHESTER HILLS MI 48309 USA
<b>FCC ID</b>	QV4-LRL053
<b>IC</b>	4545A-LRL053
<b>Product Description</b>	RF KEYPAD
<b>Date Sample Received</b>	7/9/2013
<b>Date Tested</b>	7/11/2013
<b>Tested By</b>	NAM NGUYEN
<b>Approved By</b>	NAM NGUYEN
<b>Timco Report No.</b>	1193AUT13TestReport.docx
<b>Test Results</b>	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Testing Certificate # 0955-01

## TABLE OF CONTENTS

GENERAL REMARKS .....	3
REPORT SUMMARY .....	4
TEST ENVIRONMENT .....	4
TEST SETUP .....	4
DUT SPECIFICATION .....	5
MANUFACTURE DECLARATION OF COMPLIANCE WITH PART 15.231(A) .....	6
TEST EQUIPMENT LIST .....	7
TEST PROCEDURES .....	8
RADIATION INTERFERENCE .....	9
CALCULATION OF DUTY CYCLE .....	11
OCCUPIED BANDWIDTH .....	15
POWER LINE CONDUCTED INTERFERENCE .....	17

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
FCC ID: QV4-LRL053  
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REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**GENERAL REMARKS**

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**Summary**

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

**Attestations**

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.



Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.  
849 NW State Road 45  
Newberry, Fl 32669



**Authorized Signatory Name:**

Nam Nguyen  
Project Manager/Testing Technician

**Date: July 12, 2013**

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
FCC ID: QV4-LRL053  
IC: 4545A-LRL053  
REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**REPORT SUMMARY**

Disclaimer	The test results only relate to the item tested.
Applicable Rule(s)	FCC Pt 15.231, Pt 15.209, Pt 15.207, ANSI C63.4: 2003

**TEST ENVIRONMENT**

Test Facility	The test sites are located at 849 NW State Road 45 Newberry, FL 32669 USA.
Test Condition:	Temperature: 26°C Relative humidity: 50%

**TEST SETUP**

Test Exercise (e.g software description, test signal, etc.):	The DUT was placed in continuous transmit mode of operation.
Deviation from the standard(s)	No deviation from the standard(s)
Modification to the DUT:	No modification was made to the DUT.
Supporting Peripheral Equipment	Not applicable. The device is a stand-alone remote control radio.

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**DUT SPECIFICATION**

<b>Applicant</b>	ENTERPRISE ELECTRONICS LLC		
<b>Description</b>	RF KEYPAD		
<b>FCC ID</b>	QV4-LRL053		
<b>IC</b>	4545A-LRL053		
<b>Model Number</b>	LRL053		
<b>Frequency Range</b>	314.95 MHz (EARWIG) 315.00 MHz (SHARK)		
<b>DUT Power Source</b>	<input type="checkbox"/> 110-120Vac/50- 60Hz		
	<input type="checkbox"/> DC Power		
	<input checked="" type="checkbox"/> Battery Operated Exclusively		
<b>Test Item</b>	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Production
<b>Type of Equipment</b>	<input type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input checked="" type="checkbox"/> Portable

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**MANUFACTURE DECLARATION OF COMPLIANCE WITH PART 15.231(A)**

Item	Description	Yes	No
1	Does this device transmit a signal that is only used to control another device?	Yes	
2	Does this device send data with this control signal?		No
3	Does this device send data? Data is, things like: temperature, wind direction, fluid amount, rate of flow, etc.		No
4	Does this device transmit continuously or automatically?		No
5	If manually operated does this device stop transmitting within 5 seconds of releasing the button?	Yes	
6	If automatically operated does it deactivate 5 seconds after activation?	NA	
7	Does it transmit at regular predetermined intervals?		No
8	Does it poll or send supervisory information?		No
	If yes does it do a system integrity check? How often?		
9	Is this a fire, security or safety of life device?		No
	If YES does the device stop transmitting after the alarm condition is satisfied?		
10	Duty cycle: Maximum on-time?		50%
	If YES, on-time in 100 ms? If Other, please specify here		250µs
	On time in		500µs
11	Modulation technique: Please specify the modulation of the test sample, FM, or AFSK, or FSK, or on-off keying, or others?	On-off keying	

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 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

## TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	12/31/11	12/31/13
3-Meter OATS	TEI	N/A	N/A	12/31/11	12/31/13
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	10/28/11	10/28/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	10/28/11	10/28/13
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	10/28/11	10/28/13
EMI Receiver	Rohde & Schwarz	ESIB40	100274	3/16/12	3/16/14
Antenna: Biconnical	Eaton	94455-1	1057	06/14/13	06/14/15
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Antenna Loop	EMCO	6512	9706-1211	06/14/12	06/14/14

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 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**TEST PROCEDURES**

**Power line conducted Emissions:** The test procedure used was ANSI C63.4-2003.

**Spurious Emissions:** The test procedure used was ANSI C63.4-2003 using a spectrum analyzer with a preselector. The bandwidth of the spectrum analyzer was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz and the video bandwidth was always greater than the RBW.

**Occupied Bandwidth:** A small sample of the transmitter output was fed into the spectrum analyzer and a was generated. The vertical scale is set to 10 dB per division.

**Formula Of Conversion Factors:** The field strength at 3m was established by adding the meter reading of the spectrum analyzer to the antenna correction factor supplied by the antenna manufacturer plus the coax loss. The antenna correction factors are stated in terms of dB/m. The gain of the preselector was accounted for in the spectrum analyzer reading.

Example:

Freq MHz	Meter Reading dBuV	ACF dB/m	Cable Loss dB	Field Strength dBuV/m @ 3 m
33	20	+10.36	+1.2	= 31.56

**ANSI C63.4-2003 Measurement:** The DUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The DUT was placed in the center of the table. The table used for radiated measurements is capable of continuous rotation.

Peak readings were taken in three (3) orthogonal planes when necessary and the highest readings were converted to average readings based on the duty cycle.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx



**RADIATION INTERFERENCE**

**Rules Part No.:** 15.231

**Requirements:**

Fundamental Frequency (MHz)	Field Strength of Fundamental (dBµV/m)	Field Strength of Harmonics and Spurious Emissions (dBµV/m @ 3m)
40.66 to 40.70	67.04	47.04
70 to 130	61.94	41.94
130 to 174	61.94 to 71.48	41.94 to 51.48
174 to 260	71.48	51.48
260 to 470	71.48 to 81.94	51.48 to 61.94
470 and above	81.94	61.94

No fundamental frequency is allowed in the restricted bands.

Spurious emissions in the restricted bands must be less than 54 dBµV/m or to the limits of 15.209.

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

- 1) for the band 130-174 MHz, µV/m at 3 meters = 56.81818(F)-6136.3636;
- 2) for the band 260-470 MHz, µV/m at 3 meters = 41.6667(F)-7083.3333.

Sample calculation of limit @ 315 MHz:

$$41.6667 (315) - 7083.3333 = 6041.68 \mu\text{V/m}$$

$$20\log(6041.68) = 75.62\text{dB}\mu\text{V/m limit @ 315 MHz}$$

Sample calculation of limit @ 433.92 MHz:

$$41.6667 (433.9) - 7083.3333 = 10,995.85 \mu\text{V/m}$$

$$20\log(10,995.85) = 80.82 \text{ dB}\mu\text{V/m limit @ 433.9 MHz}$$

**FOR THIS DUT:**

The limit for average field strength in dBµV/m for the fundamental frequency is 75.62 dBµV/m.

The limit for average field strength in dBµV/m for the harmonics and other spurious frequencies is 55.62 dBµV/m unless it is in a restricted band.

The EUT was tested in the orthogonal planes for the fundamental emission. All other measurements are worst case.

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**Test Data:**

Tuned Frequency MHz	Emission Frequency MHz	*	Meter Reading dBμV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle Factor dB	Field Strength dBμV/m	Margin dB
314.9	314.94		34.1	V	1.11	13.9	7.03	42.08	33.54
314.9	314.94		51	H	1.11	13.9	7.03	56.71	18.91
314.9	314.94		44.4	H	1.11	13.9	7.03	50.11	25.51
314.9	314.94		47.9	V	1.11	13.9	7.03	53.61	22.01
314.9	314.94		42.4	H	1.11	13.9	7.03	48.11	27.51
314.9	314.94		48.1	V	1.11	13.9	7.03	53.81	21.81
314.9	629.9		5.6	V	1.63	18.9	7.03	16.83	38.79
314.9	629.9		9.2	H	1.63	18.9	7.03	20.43	35.19
314.9	944.85		6.4	V	2.02	23.89	7.03	23.01	32.61
314.9	944.85		11.6	H	2.02	23.89	7.03	28.21	27.41
314.9	1,259.80		10.6	V	2.31	28.08	7.03	31.69	23.93
314.9	1,259.80		11.7	H	2.31	28.08	7.03	32.79	22.83
314.9	1,574.75	**	10.1	H	2.56	29.13	7.03	32.49	21.51
314.9	1,574.75	**	10.1	V	2.56	29.13	7.03	32.49	21.51
314.9	1,889.70		10.6	V	2.81	30.96	7.03	35.07	20.55
314.9	1,889.70		10.8	H	2.81	30.96	7.03	35.27	20.35
314.9	2,204.65	**	9.3	V	3.04	32.01	7.03	35.05	18.95
314.9	2,204.65	**	10.1	H	3.04	32.01	7.03	35.85	18.15
314.9	2,519.60		9.6	H	3.26	32.62	7.03	36.18	19.44
314.9	2,519.60		10	V	3.26	32.62	7.03	36.58	19.04
314.9	2,834.55	**	10.2	V	3.48	32.87	7.03	37.25	16.75
314.9	2,834.55	**	10.9	H	3.48	32.87	7.03	37.95	16.05
314.9	3,149.50		9.4	H	3.73	33.03	7.03	36.86	18.76
314.9	3,149.50		9.6	V	3.73	33.03	7.03	37.06	18.56

\*\* -Denotes restricted bands

Note: Emissions that are 20 dB below the limit are not required to be reported.

Emissions were tested from the lowest frequency generated or 9 kHz to the 10<sup>th</sup> harmonic.

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E:\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

**CALCULATION OF DUTY CYCLE**

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the DUT is on within 100 ms.

Long Pulse	0.641*11=7.05ms
Short Pulse	0.36*20=7.20ms
On Time	14.25/20ms
Length of Pulse Train	62.5ms
Total	44.5/100ms


$$dB = 20 \cdot \log(\text{ON TIME}) / \text{PERIOD}$$

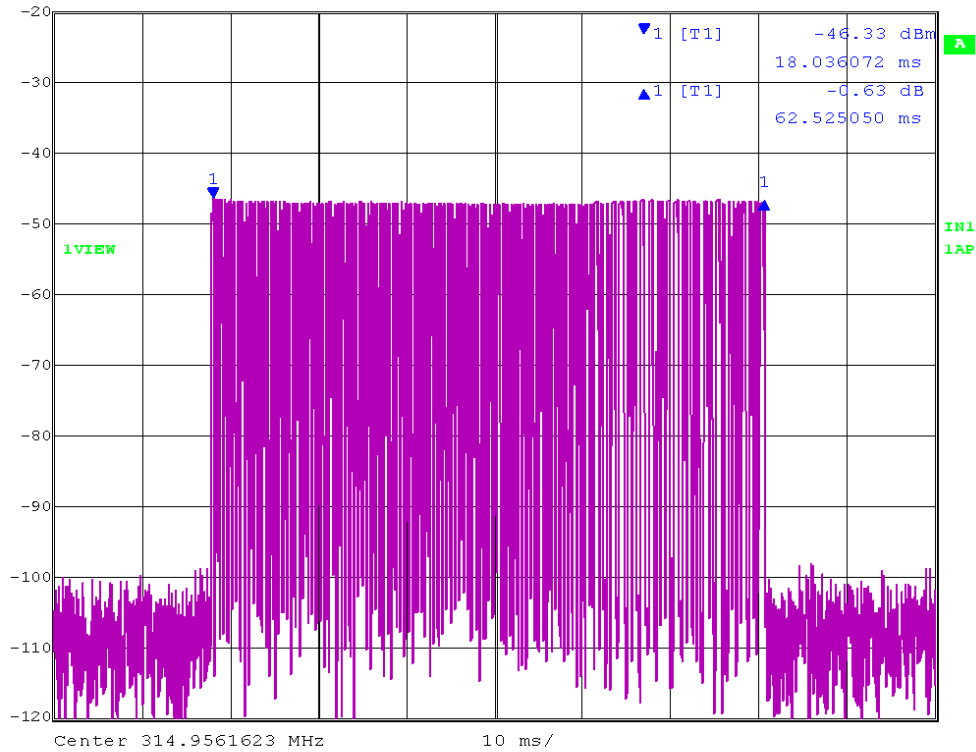
$$dB = 20 \cdot \log(44.5 / 100)$$

$$dB = 20 \cdot \log(0.445)$$

$$dB = -7.03$$

See the following plots.

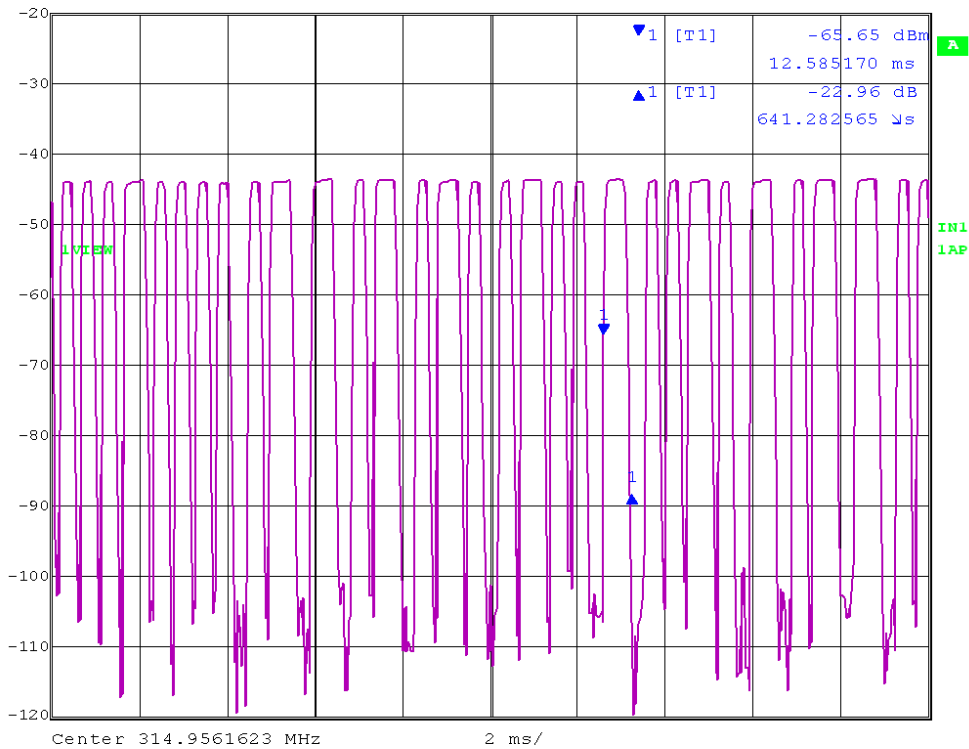

Delta 1 [T1]
RBW 10 kHz RF Att 10 dB  
Ref Lvl -20 dB -0.63 dB
VBW 10 kHz  
62.525050 ms
SWT 100 ms Unit dBm



Date: 11.JUL.2013 15:36:50

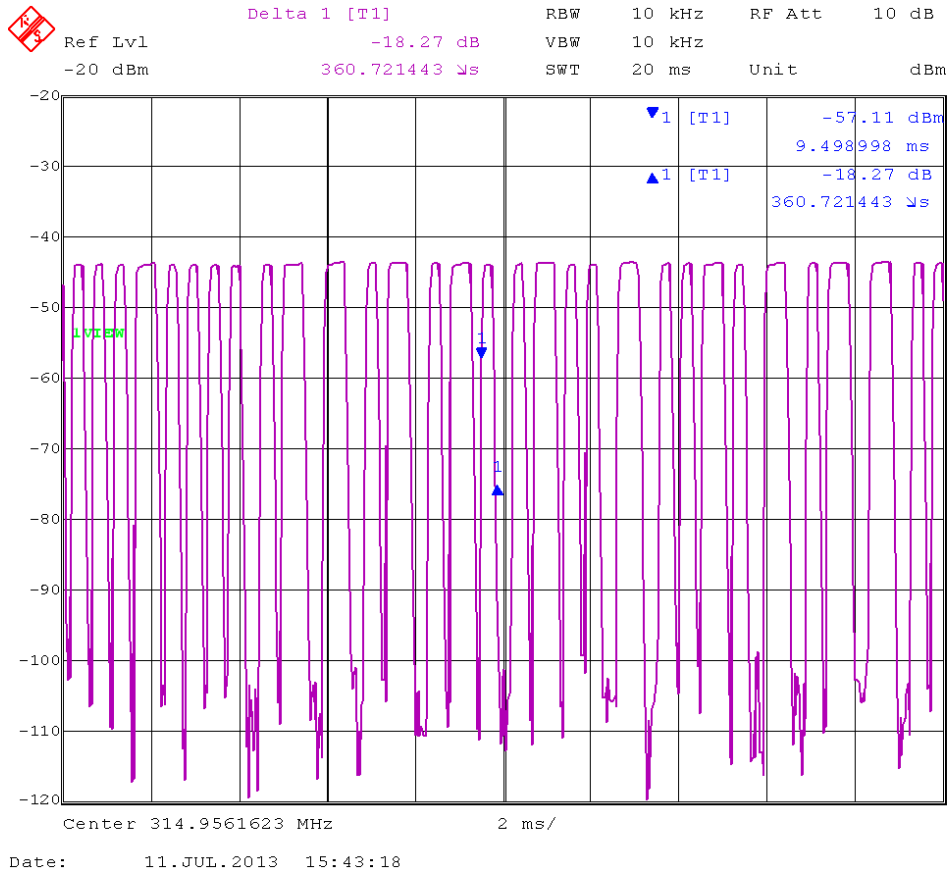
APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E:\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

⚠ Delta 1 [T1] RBW 10 kHz RF Att 10 dB  
 Ref Lvl -22.96 dB VBW 10 kHz  
 -20 dBm 641.282565  $\mu$ s SWT 20 ms Unit dBm



Date: 11.JUL.2013 15:41:20

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E:\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx



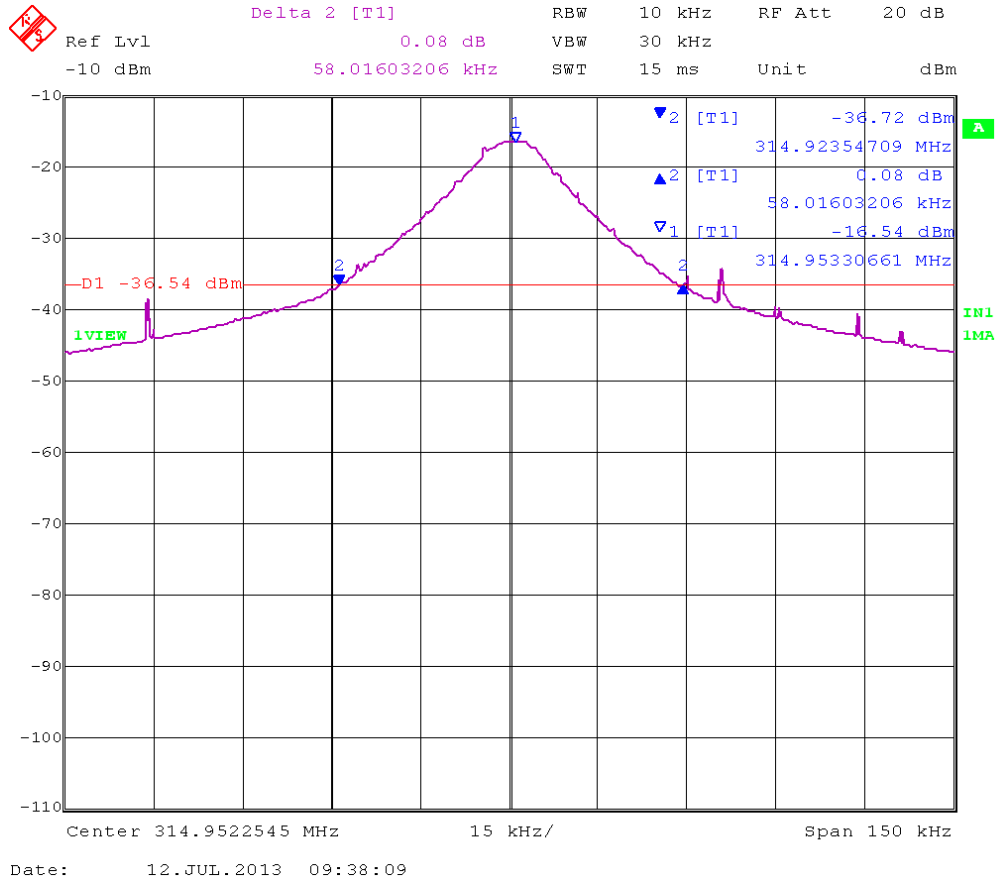
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 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx

# OCCUPIED BANDWIDTH

**Rules Part No.:** 15.231(C)

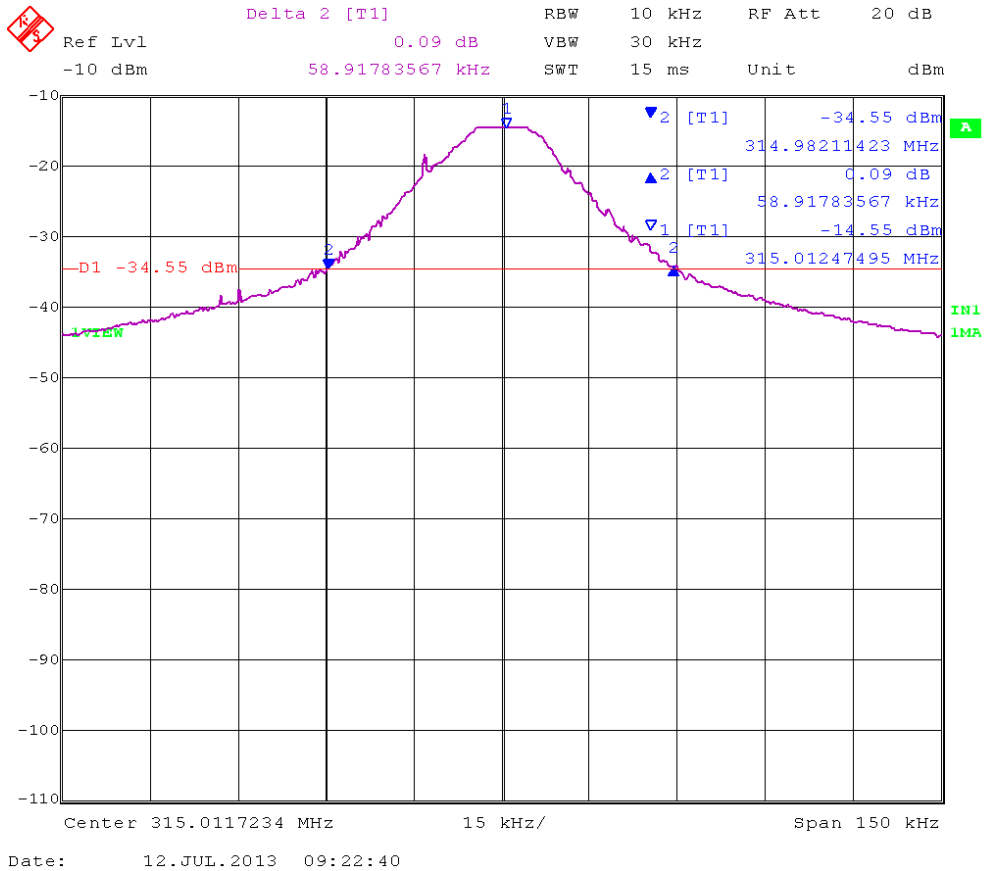
**Requirements:** The bandwidth of the emission shall be no wider than .25% of the center frequency for devices operating between 70 and 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

**Test Data:** Please refer to the following plots.



## EARWIG 314.95 MHz

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
 FCC ID: QV4-LRL053  
 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx



**SHARK 315.00 MHz**

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
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 IC: 4545A-LRL053  
 REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx



## POWER LINE CONDUCTED INTERFERENCE

**Rules Part No.:** Pt 15.207

**Requirements:**

Frequency (MHz)	Quasi Peak Limits (dBuV)	Average Limits (dBuV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

**Test Data:** Not applicable because the DUT is battery operated exclusively.

APPLICANT: ENTERPRISE ELECTRONICS, L.L.C.  
FCC ID: QV4-LRL053  
IC: 4545A-LRL053  
REPORT: E\ENTERPRISE\_QV4\1193AUT13\1193AUT13TestReport.docx