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**FCC PART 15.249 & IC RSS-210 (i8) ANNEX A2.9
UNLICENSED INTENTIONAL RADIATOR
COMBINED TEST REPORT**

Applicant	GRAMOVOX LLC
Address	222 W. MERCHANDISE MART CHICAGO, IL 60654
FCC ID	2ACTGGRX1
IC Certification Number	12193A-GRX1
Model Number	GVX1801
Product Description	BT Transmitter
FCC Standard Applied	47 CFR §15.249
Industry Canada Standard Applied	RSS-210 Issue 8 Annex A2.9
Date Sample Received	7/16/2014
Date Tested	8/6/2014
Tested By	Cory Leverett
Approved By	Sid Sanders
Report Number	1235AUT14TestReport.docx
Test Results	<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.**

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

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: 2005 requirements.

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:

Cory Leverett

Project Manager

Date: 8/12/14



APPLICANT: GRAMOVOK LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

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GENERAL INFORMATION

EUT Specification

The test results relate only to the items tested.			
Applicable Standards	FCC Part 15.249 & IC RSS-210 (i8), RSS-GEN (i3)		
EUT Description	GRAMOVOX - TX		
FCC ID	2ACTGGRX1		
IC Certification Number	12193A-GRX1		
Model Number	GVX1801		
Operating Frequency	TX: 2402-2481 MHz	RX: Same	
No. of Channels	79	Modulations	GFSK & Pi/4 QPSK
EUT Power Source	<input checked="" type="checkbox"/> 110–120Vac/50– 60Hz when Charging		
	<input type="checkbox"/> DC Power		
	<input checked="" type="checkbox"/> Battery Operated Exclusively		
Test Item	<input type="checkbox"/> Prototype	<input checked="" type="checkbox"/> Pre-Production	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed	<input type="checkbox"/> Mobile	<input checked="" type="checkbox"/> Portable
Antenna Connector	FCC Rules require that the antenna connector be unique. There is no antenna connector, it has an integrated PCB antenna		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Conditions in the Test laboratory	Temperature: 26°C Relative humidity: 50%		
Test Exercise	The EUT was controlled by test software provided by the applicant.		
Revision History of EUT	None		

Test Supporting Equipment

Description	Type	Connector	Length
USB A/B 2.0 Cable	Hi-Speed USB Cable	USA Type A and Type B	1 meter
350MHZ Patch cord	Network cable	Ethernet connector	2 meter
Bluetooth Transceiver Test Software	CSR Blue Suite 2.5.0	Blue Test 3	N/A
AC Outlet USB Charging adapter	110v	USB	NA
USB to SPI Programmer	USB/Ethernet	USB 2.0, RJ-45, 8-PIN Molex	NA

APPLICANT: GRAMOVOX LLC

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TEST RESULTS SUMMARY

FCC Rules Part No.	Industry Canada Rules	RESULTS – Pass/Fail/NA
15.249 Fundamental Emission	RSS-210 (i8) ANNEX A2.9, RSS-GEN (i3)	Pass
15.249 & 15.209 Harmonics & Spurious	RSS-210 (i8) ANNEX A2.9, RSS-GEN (i3)	Pass
15.205 & 2.202 Occupied Bandwidth	RSS-GEN (i3), 4.6	Pass
15.249 & 15.205 Bandedge Compliance	RSS-GEN (i3), 4.6	Pass
15.207 Power Line Emissions	RSS-GEN (i3), 7.2.4	Pass

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3-Meter Semi- Anechoic Chamber	Panashield	N/A	N/A	12/31/13	12/31/15
Coaxial Cable - Chamber 3 cable set	SemiFlex	NA	Chamber 3PC Set	1/13/14	1/13/16
Antenna- Active Loop	ETS-Lindgren	6502	00062529	10/09/2013	10/09/2015
Antenna: Biconnical	Eaton	94455-1	1057	06/14/13	06/14/15
Antenna: Log-Periodic	Eaton	96005	1243	05/31/13	05/31/15
Antenna: Double- Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/05/2012	10/05/2014
EMI Test *Receiver*	Rhode & Schwarz	ESU 40	100320	03/21/15	03/21/17
Coaxial Cable #65	General Cable Co.	E9917 RG233/U	Timco #65	06/26/13	06/26/15
LISN	Electro-Metrics	FCC-25/2	2512	06/05/13	06/05/15
Software: Field Strength Program	Timco	Version 4.0	N/A	N/A	N/A

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TEST PROCEDURES

Radiation Interference: ANSI C63.4-2003 using a spectrum analyzer, a preselector, a quasi-peak adapter, and an appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100 kHz with an appropriate sweep speed and the video bandwidth was 300 kHz up to 1 GHz and 1 MHz with a video BW of 3 MHz above 1 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The antenna was placed in both the horizontal and vertical planes and the worst case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental. Emissions were scanned from 30MHz to the tenth harmonic of the fundamental frequency at three places in the band. All emissions greater than 20 dB from the limit are not reported.

Formula Of Conversion Factors: The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the preselector was accounted for in the spectrum analyzer meter reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+ CL	= FS
33	20 dBuV	+ 10.36 dB	+ 0.5	= 30.86 dBuV/m @ 3m

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30 MHz.

Occupied Bandwidth: A small sample of the transmitter output was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to -10 dBm per division.

ANSI C63.4-2003 10.1 Measurement Procedures: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

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. Emissions attenuated more than 20 dB below the permissible value are not reported.



RADIATION INTERFERENCE

Rules Part No.: FCC 15.249, 15.209 & IC RSS-210 (i8) ANNEX A2.9, RSS-GEN (i3)

Requirements:

Frequency	Limits
Part 15.209 & RSS-GEN (i3)	
9 to 490 kHz	2400/F (kHz) μ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) μ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB μ V/m @ 30 meters
30 – 88	40.0 dB μ V/m @ 3 meters
80 – 216	43.5 dB μ V/m @ 3 meters
216 – 960	46.0 dB μ V/m @ 3 meters
Above 960	54.0 dB μ V/m @ 3 meters
Part 15.249 & RSS-210 (i8) ANNEX A.2.9	
Fundamental 902 – 928 MHz	94.0 dB μ V/m @ 3 meters
Fundamental 2.4 – 2.4835 GHz	94.0 dB μ V/m @ 3 meters
Harmonics	54.0 dB μ V/m @ 3 meters

Test Data: Peak Detector Used for all Measurement's.

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBuV	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle	Field Strength dBuV/m	Margin dB
2,402.00	2,402.00	57.7	V	3.18	32.48	8.31	85.05	8.95
2,402.00	2,402.00	63.7	H	3.18	32.48	8.31	91.05	2.95
2,402.00	4,804.00	14.3	H	4.9	34.1	8.31	44.99	9.01
2,402.00	4,804.00	16.6	V	4.9	34.1	8.31	47.29	6.71
2,402.00	4,882.00	15.2	H	4.94	34.1	8.31	45.93	8.07
2,402.00	7,206.00	13.6	H	5.72	35.82	8.31	46.83	7.17
2,402.00	7,206.00	14.1	V	5.72	35.82	8.31	47.33	6.67
2,441.00	2,441.00	65.1	V	3.21	32.57	8.31	92.57	1.43
2,441.00	2,441.00	66.2	V	3.21	32.57	8.31	93.67	0.33
2,441.00	4,882.00	14.6	V	4.94	34.1	8.31	45.33	8.67
2,441.00	7,323.00	13	V	5.79	35.77	8.31	46.25	7.75
2,441.00	7,323.00	13.1	H	5.79	35.77	8.31	46.35	7.65
2,481.00	2,481.00	62.3	V	3.24	32.66	8.31	89.89	4.11
2,481.00	2,481.00	65.9	H	3.24	32.66	8.31	93.49	0.51
2,481.00	4,962.00	13.1	H	4.98	34.1	8.31	43.87	10.13
2,481.00	4,962.00	13.6	V	4.98	34.1	8.31	44.37	9.63
2,481.00	7,443.00	14	V	5.87	35.72	8.31	47.28	6.72
2,481.00	7,443.00	14.9	H	5.87	35.72	8.31	48.18	5.82

APPLICANT: GRAMOVOK LLC

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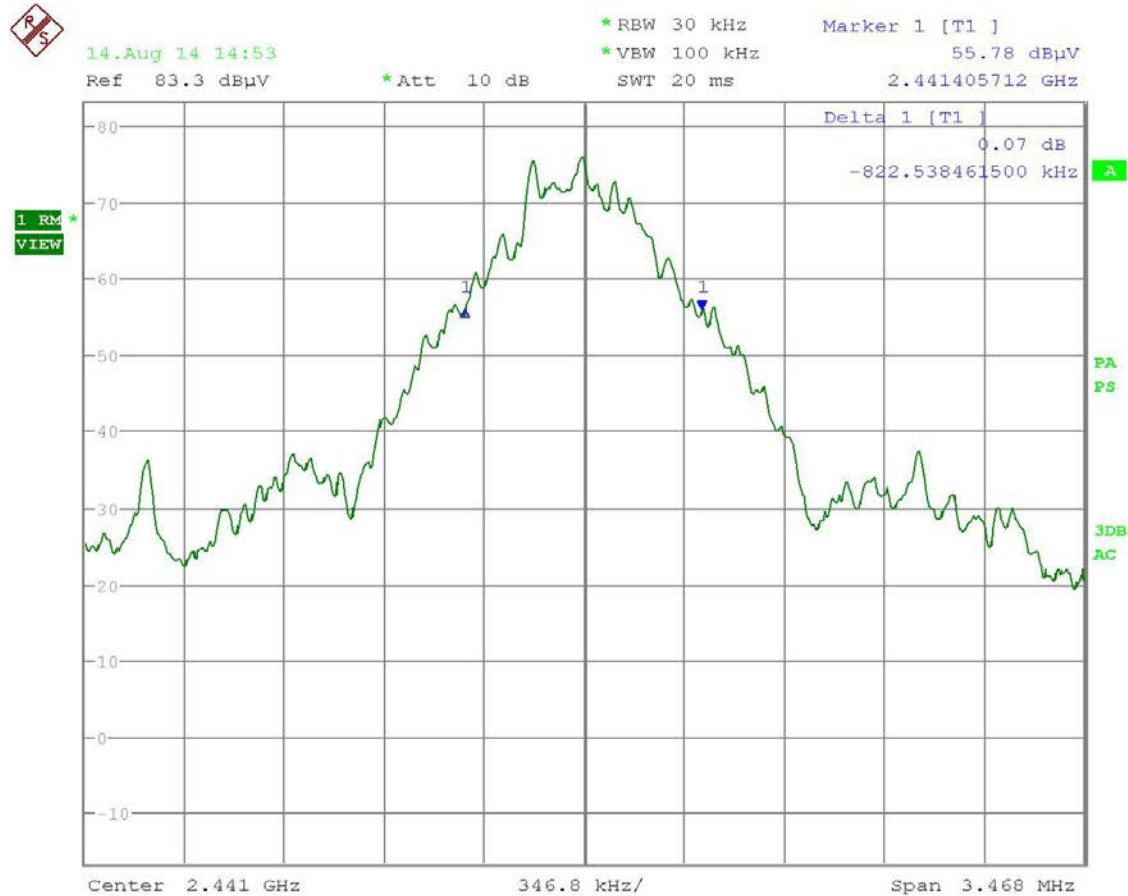
20 dB OCCUPIED BANDWIDTH

Rules Part No.: 15.249 (d)

Requirements: The field strength of any emissions appearing outside the bandedges and up to 10 kHz above and below the band edges shall be attenuated at least 50 dB below the level of the carrier or to the general limits of 15.249.

Test Data:

20 dB OCC BW Mod 1 = 822.53 KHz



Date: 14.AUG.2014 14:53:12

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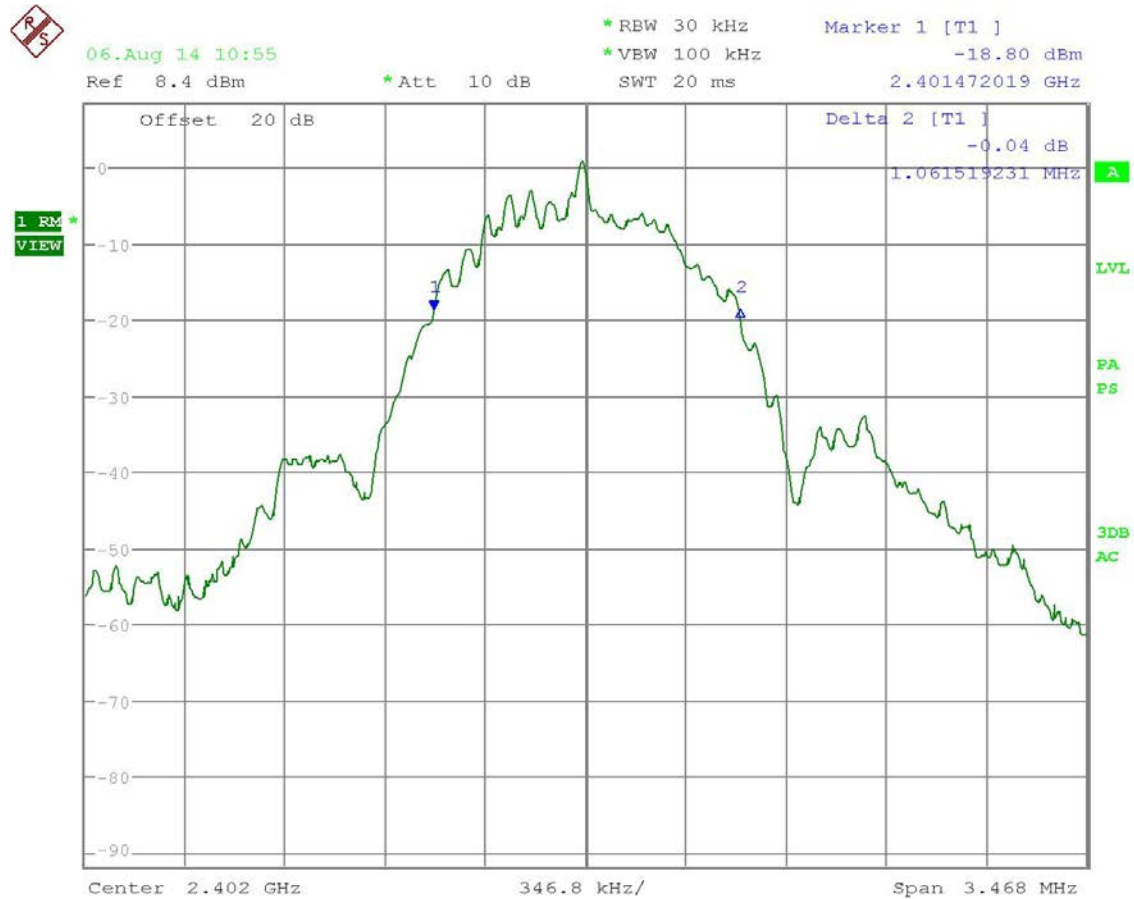
APPLICANT: GRAMOVAX LLC

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20 dB OCC BW Mod 2 = 1.06 MHz



Date: 6.AUG.2014 10:55:40

APPLICANT: GRAMOVAX LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

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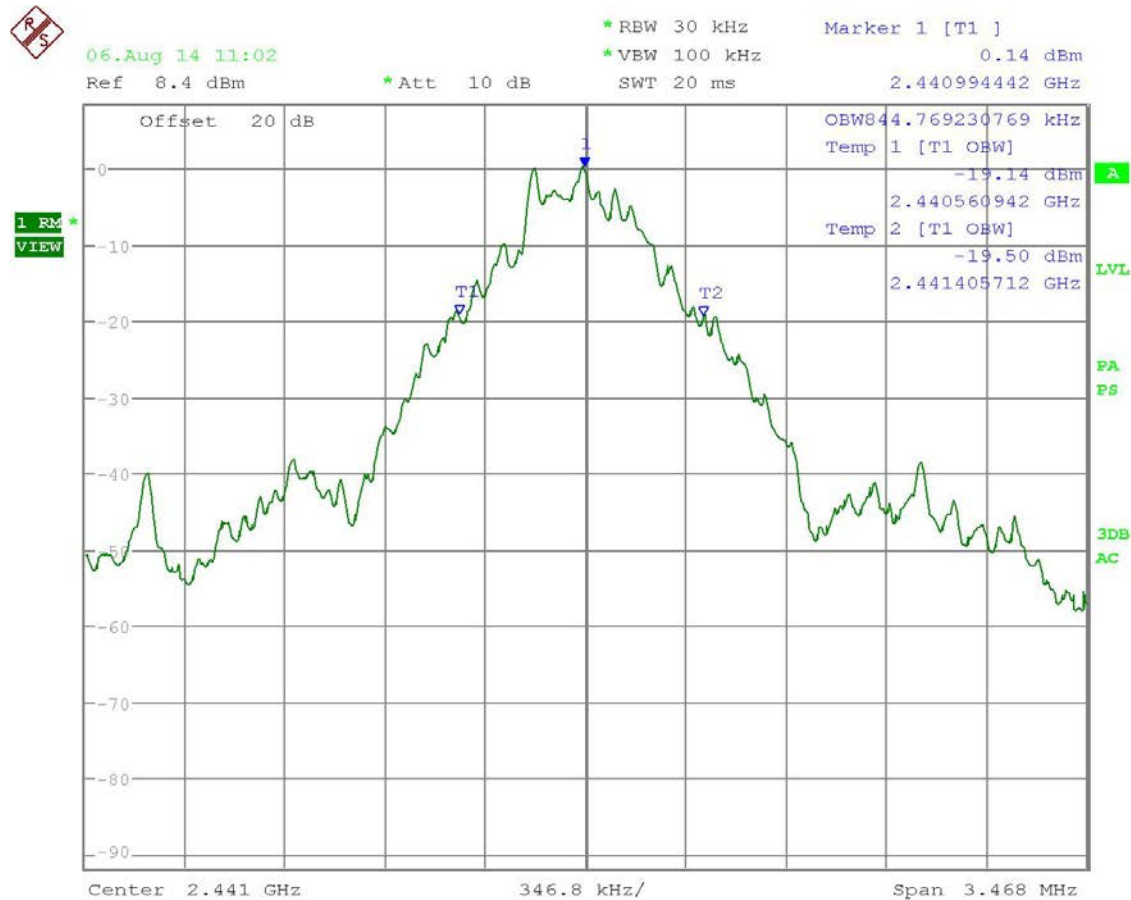
99% POWER OCCUPIED BANDWIDTH

Rules Part No.: RSS-GEN (i3), 4.6

Requirements: . Emissions radiated outside of the specified frequency bands, except for the harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the highest general field strength limits listed in RSS-GEN, whichever is less stringent.

Test Data:

99% OCC BW Mod 1 = 844.76 KHz



Date: 6.AUG.2014 11:02:11

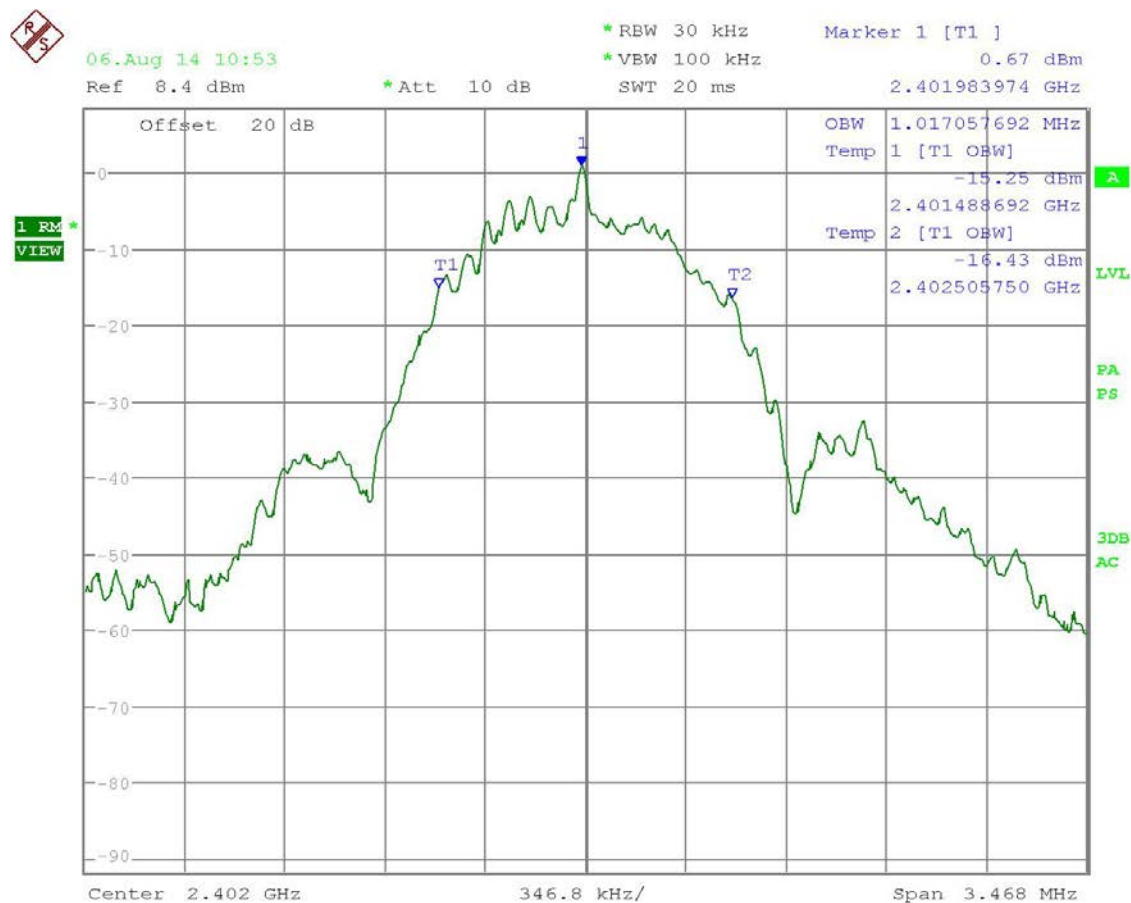
APPLICANT: GRAMOVAX LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

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99% OCC BW Mod 2 = 1.01 MHz



Date: 6.AUG.2014 10:53:35

APPLICANT: GRAMOVAX LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

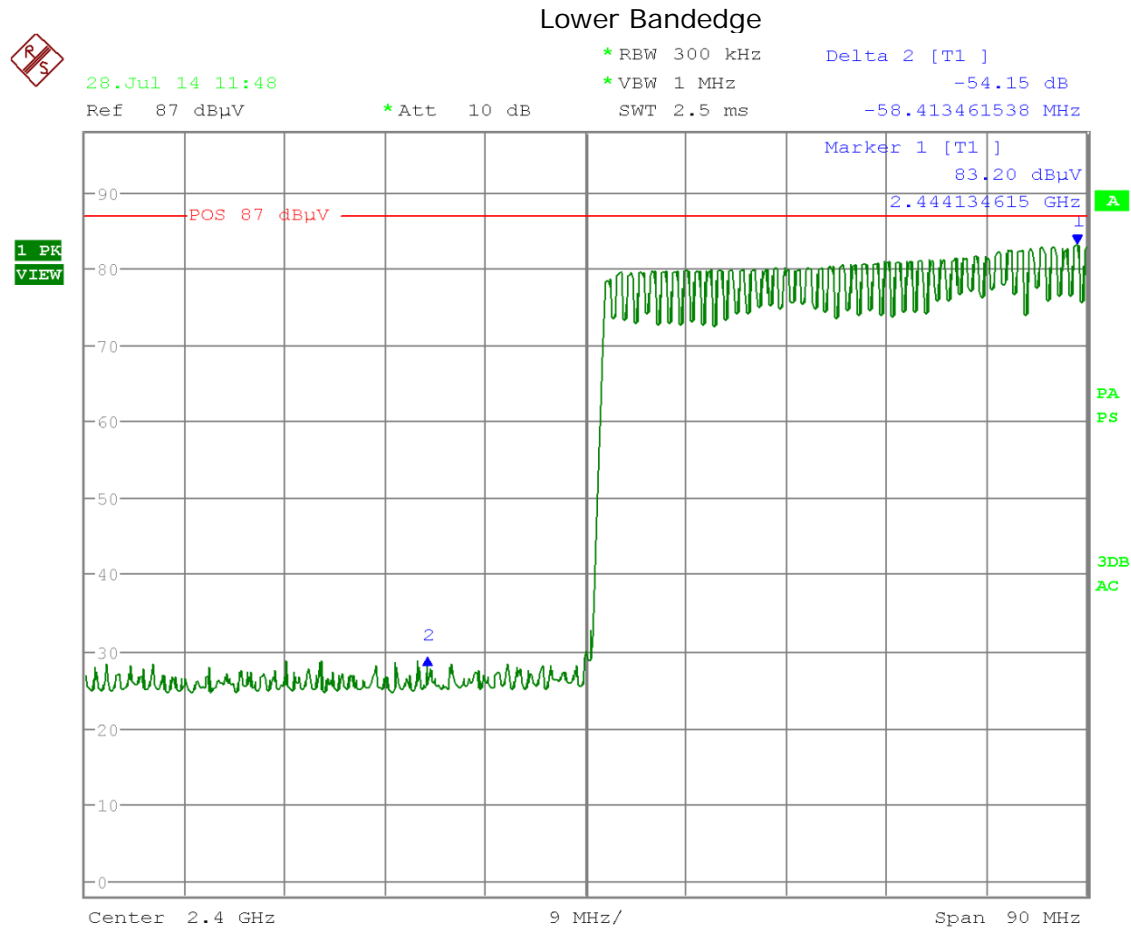
REPORT: V:\G\GRAMOVAX\1235AUT14\1235AUT14TESTREPORTREV1.DOCX Page 11 of 17

BAND EDGE COMPLIANCE

Rules Part No.: 15.249 (d), & RSS-GEN (i3), 4.6

Requirements: 50 dBc or in the case of restricted bands 54 dBuV/m.

Test Data:



Date: 28.JUL.2014 11:48:11

APPLICANT: GRAMOVAX LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

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Upper Bandedge

28.Jul 14 11:49

Ref 87 dBμV

*Att 10 dB

*RBW 300 kHz

*VBW 1 MHz

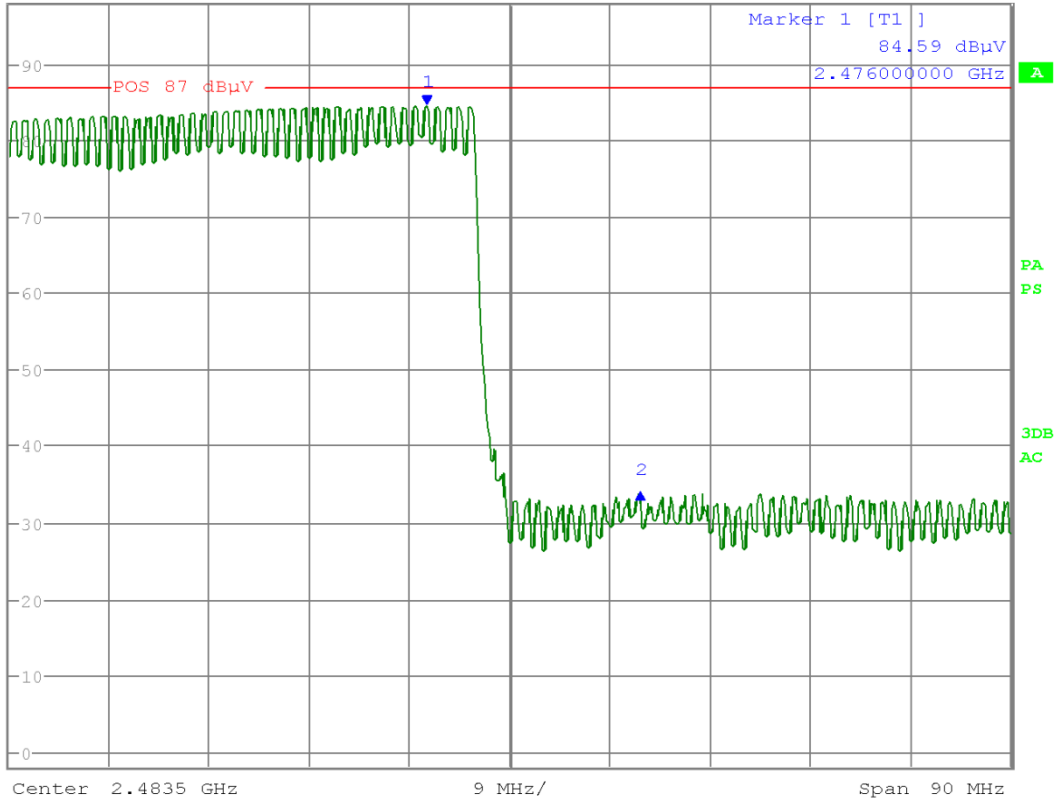
SWT 2.5 ms

Delta 2 [T1]

-50.81 dB

19.182692308 MHz

1 PK
VIEW



Date: 28.JUL.2014 11:49:54

APPLICANT: GRAMOVox LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

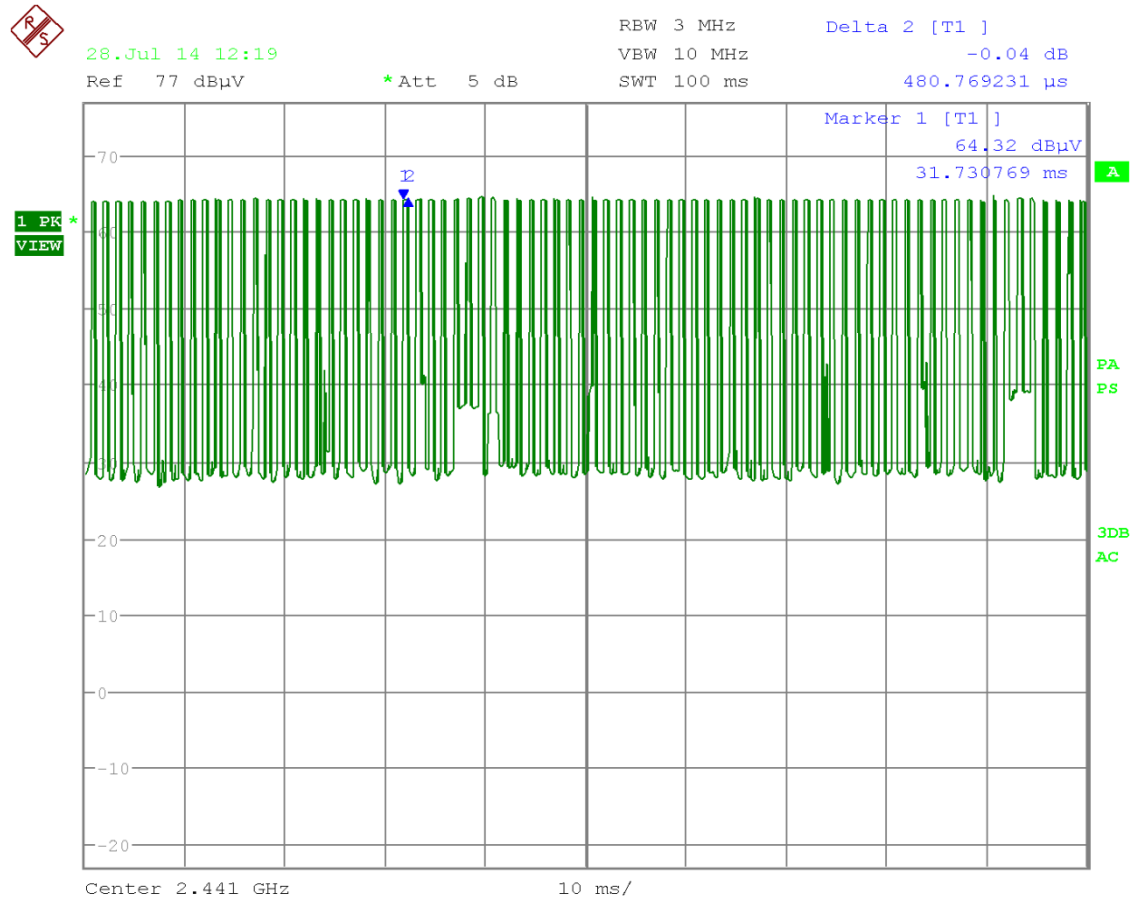
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DUTY CYCLE

Total # of pulses: 80 in 100 ms

Duration of pulse: .480 ms maximum duration of pulse according to manufacturer.

$20 \cdot \log ((.480 \cdot 80) / 100) = 20 \cdot \log (.384) = -8.31 \text{ dB}$



Date: 28.JUL.2014 12:19:37

APPLICANT: GRAMOVAX LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

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POWER LINE CONDUCTED INTERFERENCE

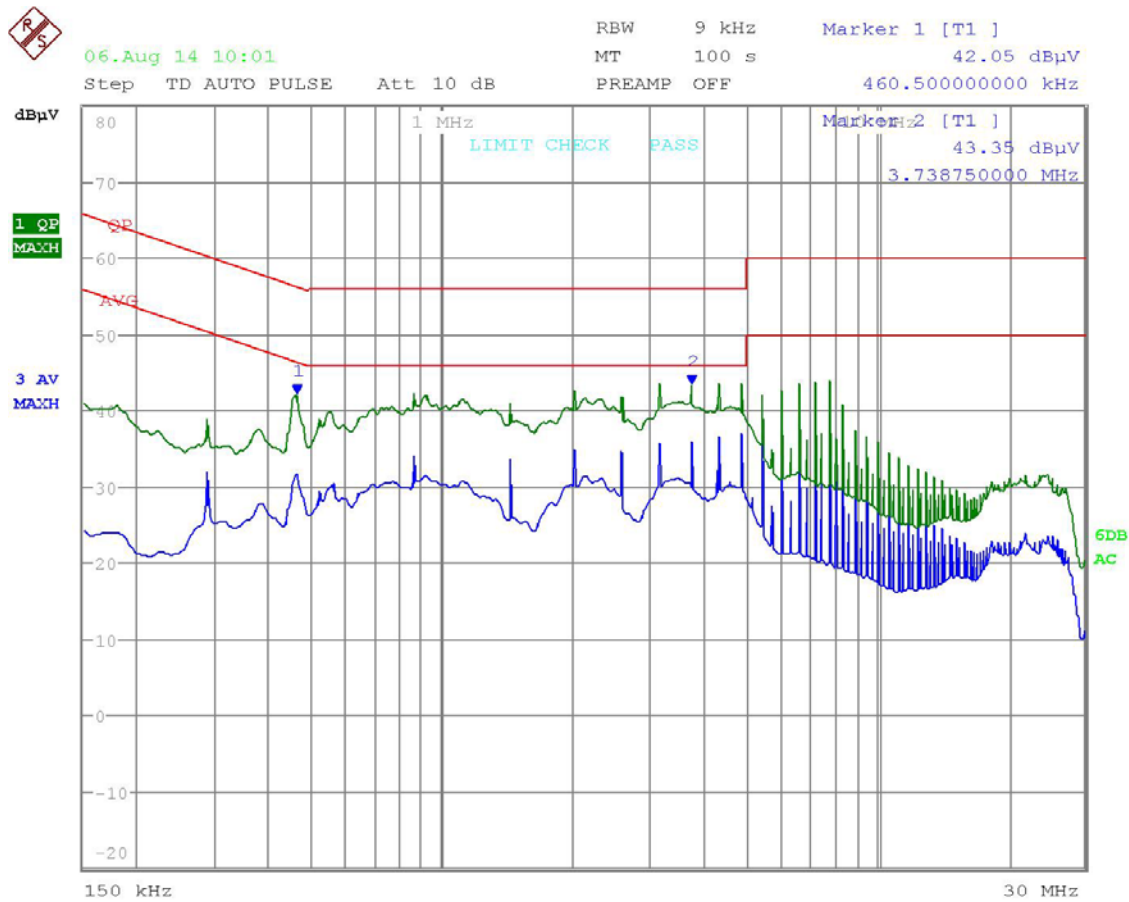
Rules Part No.: 15.207, & RSS-GEN (i3), 7.2.4

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: The attached graphs represent the emissions read for power line conducted for this device while charging the battery. Both lines were observed.

Line 1 Quasi Peak and Average



Date: 6.AUG.2014 10:01:00

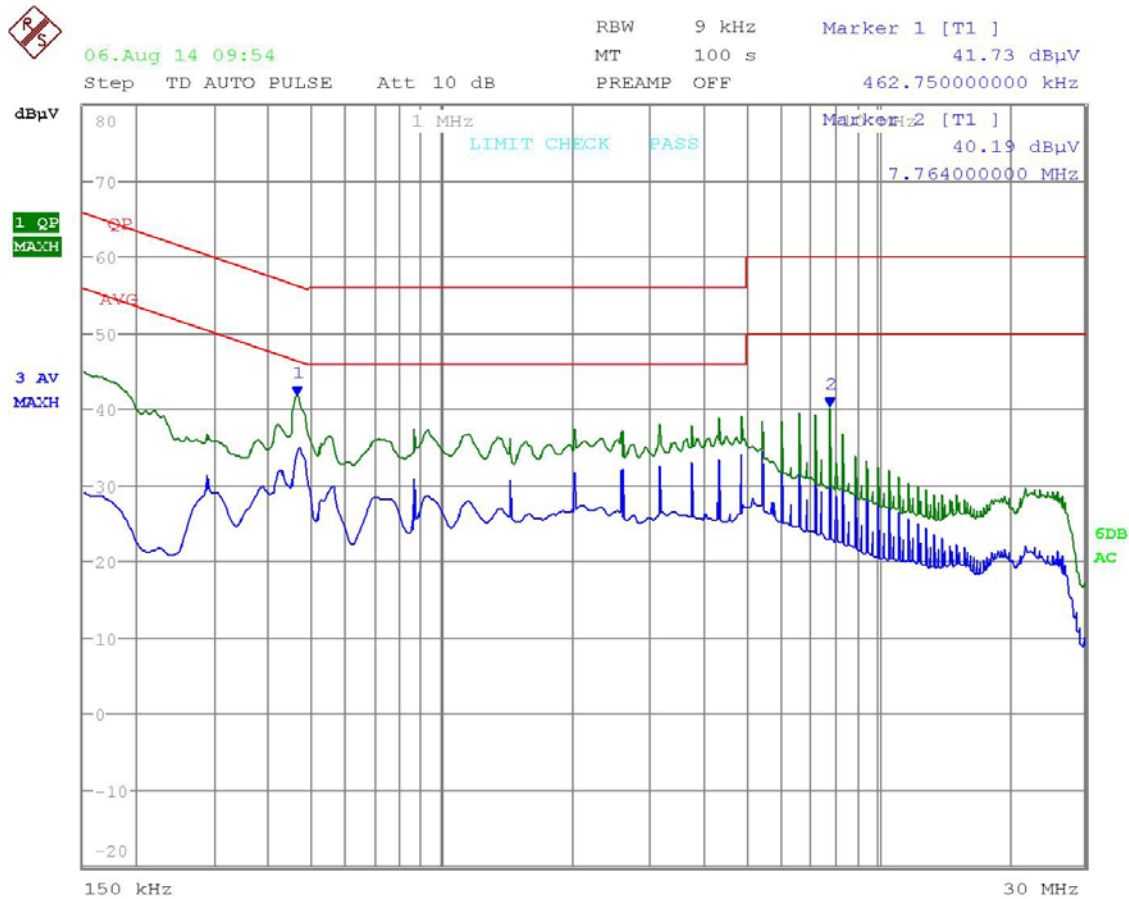
APPLICANT: GRAMOVAX LLC

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Line 2 Quasi Peak and Average



Date: 6.AUG.2014 09:54:39

APPLICANT: GRAMOVOK LLC

IC: 12193A-GRX1

FCC ID: 2ACTGGRX1

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