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## FCC PART 15.249 TEST REPORT

### UNLICENSED INTENTIONAL RADIATOR

<b>Applicant</b>	INVIVO CORPORATION	
<b>Address</b>	12151 RESEARCH PARKWAY SUITE 200	
	ORLANDO FL 32826	
<b>FCC ID</b>	S6W2GMODSB	
<b>Model Number</b>	989803183661	
<b>Product Description</b>	WIRELESS MODULE	
<b>Date Sample Received</b>	11/12/2013	
<b>Date Tested</b>	11/18/2013	
<b>Tested By</b>	JOE SCOGLIO	
<b>Approved By</b>	JOE SCOGLIO	
<b>Report Number</b>	1941AUT13TestReport.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



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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.



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:

Joe Scoglio  
Engineering Project Manager

**Date:** 11/18/2013

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## GENERAL INFORMATION

### DUT Specification

The test results relate only to the items tested.		
<b>Applicable Standard</b>	Part 15.249	
<b>DUT Description</b>	WIRELESS MODULE	
<b>FCC ID</b>	S6W2GMODSB	
<b>Model Number</b>	989803183661	
<b>Operating Frequency</b>	TX: 2402 MHz to 2482 MHz	RX: Same
<b>No. of Channels</b>	80	
<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
<b>Antenna Connector</b>	Permanently attached	
<b>Test Facility</b>	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.	
<b>Test Conditions</b>	Temperature: 26°C Relative humidity: 50%	
<b>Test Exercise</b>	The DUT was placed in continuous transmit mode of operation.	
<b>Modifications</b>	none	

### Test Supporting Equipment

Supporting Device	Manufacturer	Model / FCC ID	Serial Number
N/A			

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## EMC 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
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	06/14/12	06/14/14
Frequency Counter	HP	5385A	2730A03025	08/22/13	08/22/15
Frequency Counter	HP	5352B	2632A00165	06/26/13	06/26/15
Digital Multimeter	Fluke	77	43850817	02/22/12	02/22/14
Digital Multimeter	Fluke	FLUKE-77-3	79510405	06/20/13	06/20/15
Frequency Counter	HP	5385A	3242A07460	06/16/13	06/16/15
Antenna: Active Loop	ETS-Lindgren	6502	00062529	10/09/13	10/09/15
Antenna: Double-Ridged Horn	Electro-Metrics	RGA-180	2319	06/19/12	06/19/14
LISN	Electro-Metrics	EM-7820	2682	02/26/13	02/26/15
DC Power Supply	HP	6264B		05/06/13	05/06/15
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	06/13/12	06/13/14
Temperature Chamber	Thermotron Corp.	S1.2 Mini Max	25-1420-09	07/03/12	07/03/14
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Biconnical	Eaton	94455-1	1057	06/14/13	06/14/15

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## EMC EQUIPMENT LIST Cont

Antenna: Log- Periodic	Eaton	96005	1243	05/31/13	05/31/15
Analyzer Silver Tower Quasi- Peak Adapter	HP	85650A	2811A01175	06/05/13	06/05/15
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	06/05/13	06/05/15
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	06/05/13	06/05/15
Antenna: Standard Gain Horn 18.0-26.3 GHz	Systron Donner	DBE-520-20	Not Serialized		No Cal Req

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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 worse case emissions were reported. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

**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 dB $\mu$ V) 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:

$$\begin{array}{llll}
 \text{Freq (MHz)} & \text{Meter Reading} & + \text{ACF} & + \text{CL} = \text{FS} \\
 33 & 20 \text{ dB}\mu\text{V} & + 10.36 \text{ dB} & + 0.5 = 30.86 \text{ dB}\mu\text{V/m} @ 3\text{m}
 \end{array}$$

**Power Line Conducted Interference:** The procedure used was ANSI C63.4-2003 using a 50 $\mu$ H 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 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 (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.:** 15.249, 15.209

### Requirements:

Frequency	Limits
Part 15.209	
9 to 490 kHz	2400/F (kHz) $\mu$ V/m @ 300 meters
490 to 1705 kHz	24000/F (kHz) $\mu$ V/m @ 30 meters
1705 kHz to 30 MHz	29.54 dB $\mu$ V/m @ 30 meters
30 – 88	40.0 dB $\mu$ V/m @ 3 meters
80 – 216	43.5 dB $\mu$ V/m @ 3 meters
216 – 960	46.0 dB $\mu$ V/m @ 3 meters
Above 960	54.0 dB $\mu$ V/m @ 3 meters
Part 15.249	
Fundamental 902 – 928 MHz	94.0 dB $\mu$ V/m @ 3 meters
Fundamental 2.4 – 2.4835 MHz	94.0 dB $\mu$ V/m @ 3 meters
Harmonics	54.0 dB $\mu$ V/m @ 3 meters

**Test Data:** Radiated emissions were measured from the lowest frequency generated or 9 kHz to the 10<sup>th</sup> harmonic intentional emission. Measurements in the table are peak unless noted otherwise.

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity	Coax Loss dB	Correction Factor dB/m	Duty Cycle CF	Field Strength dB $\mu$ V/m	Margin dB
2,402.0	2,402.00	59.5	V	3.18	32.40	13	82.08	11.92
2,402.0	2,402.00	61.8	H	3.18	32.40	13	84.38	9.62
2,402.0	4,804.00	6.4	V	4.90	34.38	13	32.68	21.32
2,402.0	4,804.00	6.9	H	4.90	34.38	13	33.18	20.82
2,441.0	2,441.00	57.6	V	3.21	32.48	13	80.29	13.71
2,441.0	2,441.00	60.7	H	3.21	32.48	13	83.39	10.61
2,441.0	4,882.00	6.6	V	4.94	34.43	13	32.97	21.03
2,441.0	4,882.00	6.8	H	4.94	34.43	13	33.17	20.83
2,480.0	2,480.00	52.5	V	3.24	32.56	13	75.3	18.7
2,480.0	2,480.00	56.8	H	3.24	32.56	13	79.6	14.4
2,480.0	4,960.00	4.4	H	4.98	34.48	13	30.86	23.14
2,480.0	4,960.00	4.6	V	4.98	34.48	13	31.06	22.94

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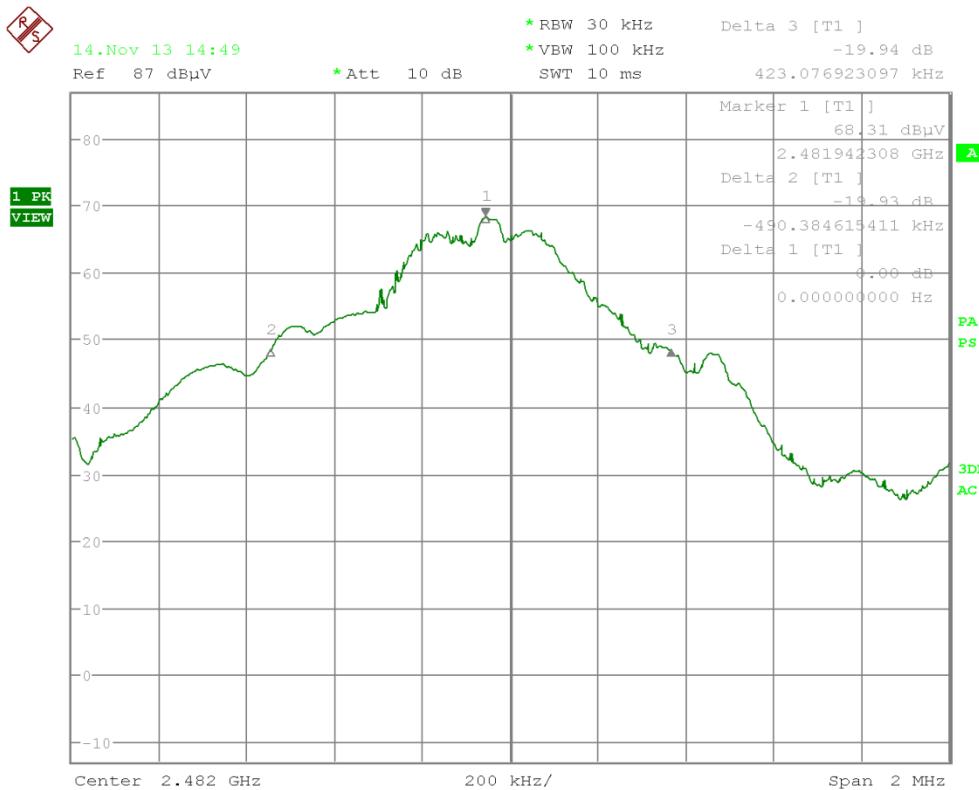
REPORT #: I\INVIVO\1941AUT13\1941AUT13TestReport.docx

## OCCUPIED BANDWIDTH

**Rules Part No.:** 15.249 (d)

**Requirements:** The field strength of any emissions appearing outside the specified frequency bands, except harmonics shall be attenuated at least 50 dB below the level of the carrier or to the general limits of 15.209 whichever is the lesser.

### Test Data:



Date: 14.NOV.2013 14:49:36

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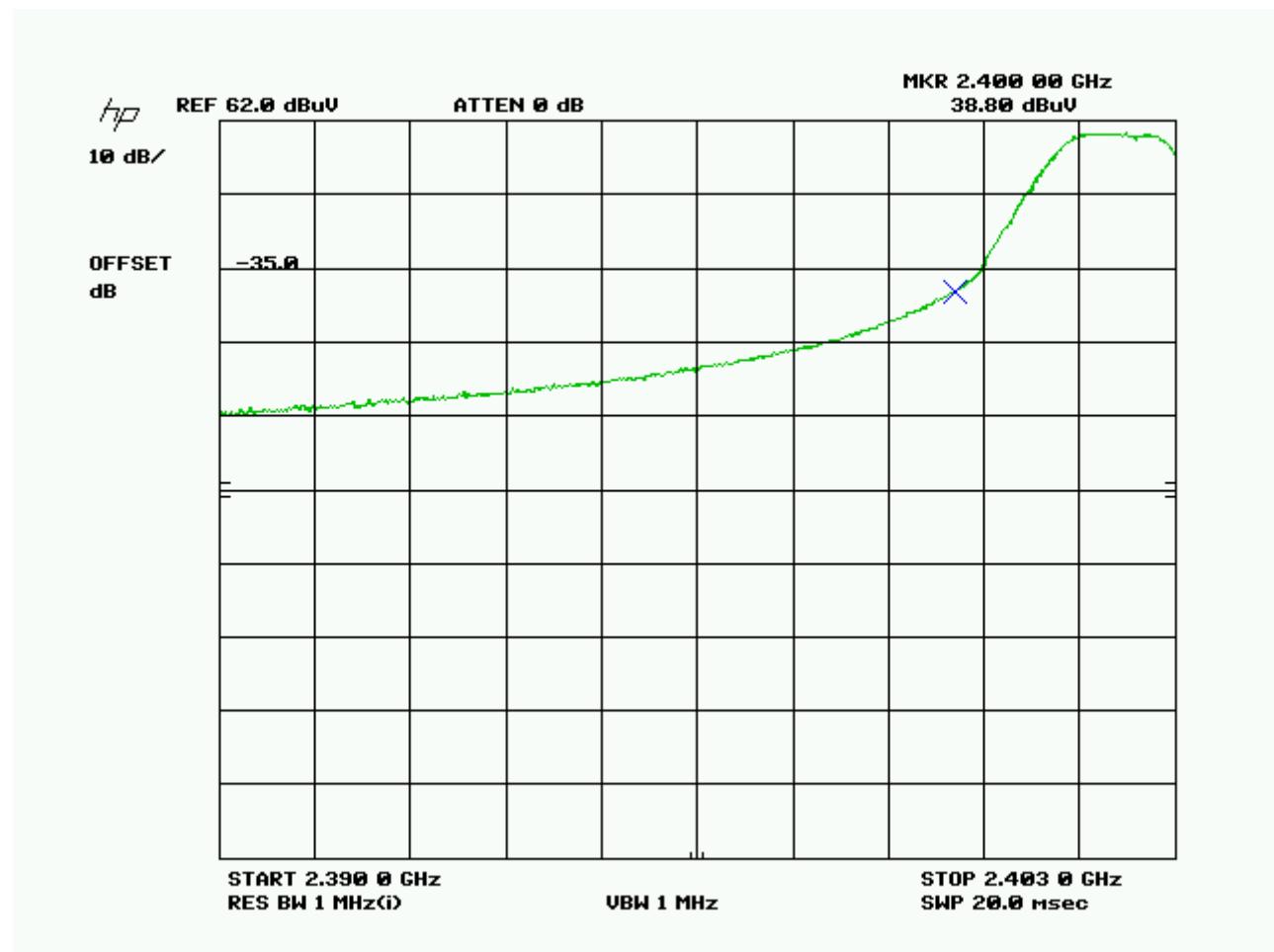
## BAND EDGE COMPLIANCE

**Rules Part No.:** 15.249 (d)

**Requirements:** 40 dBc or in the case of restricted bands 54 dB $\mu$ V/m.

**Test Data:**

Lower bandedge



Peak Plot

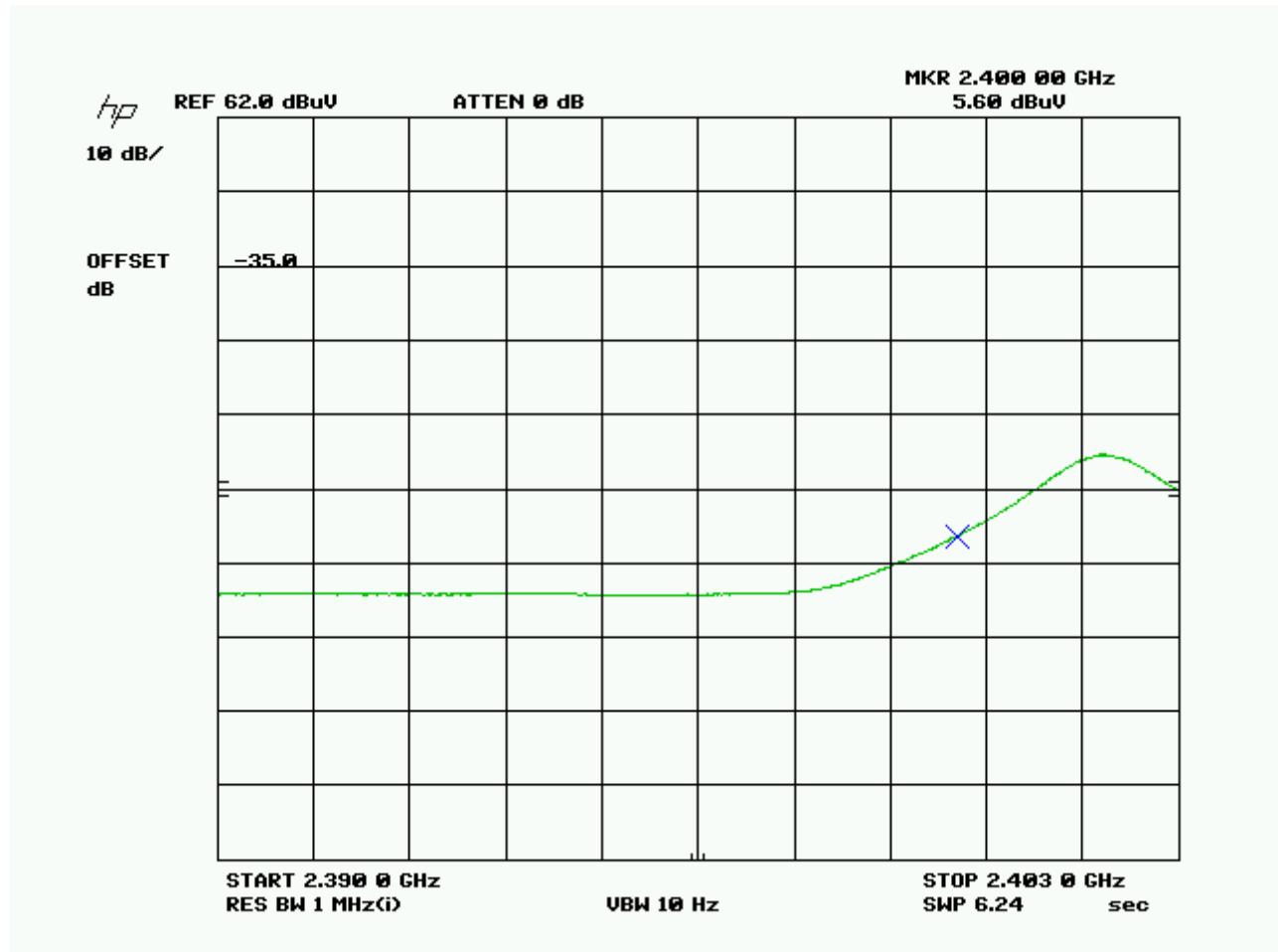
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty cycle dB	Field Strength dB $\mu$ V/m	Margin dB
2,402.0	2,400.00	38.8	H	3.18	32.40	13	61.38	12.62

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Lower bandedge



Average Plot

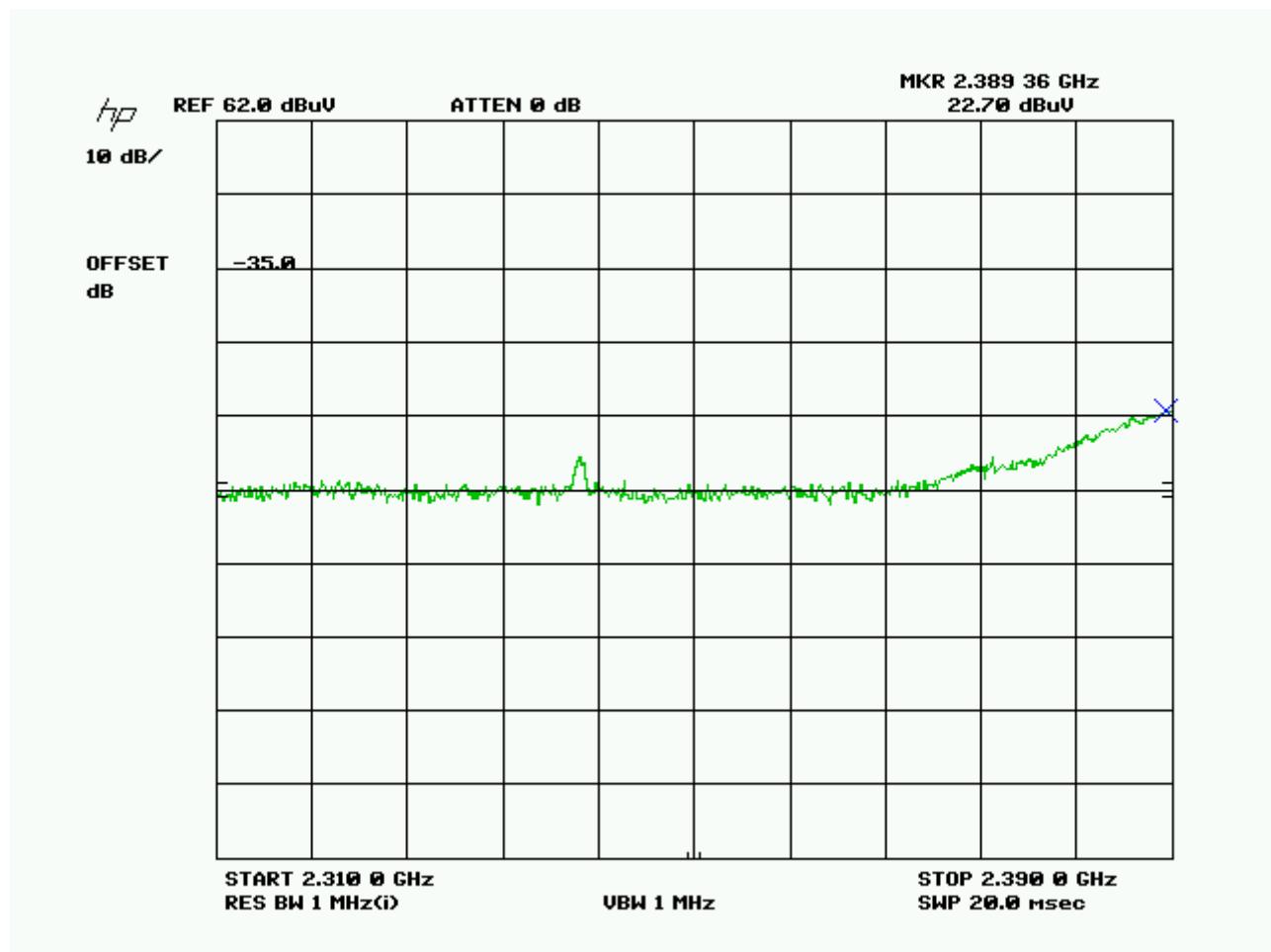
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty cycle dB	Field Strength dB $\mu$ V/m	Margin dB
2,402.0	2,400.00	5.6	H	3.18	32.40	13	28.18	25.82

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Lower non-adjacent restricted band



Peak Plot

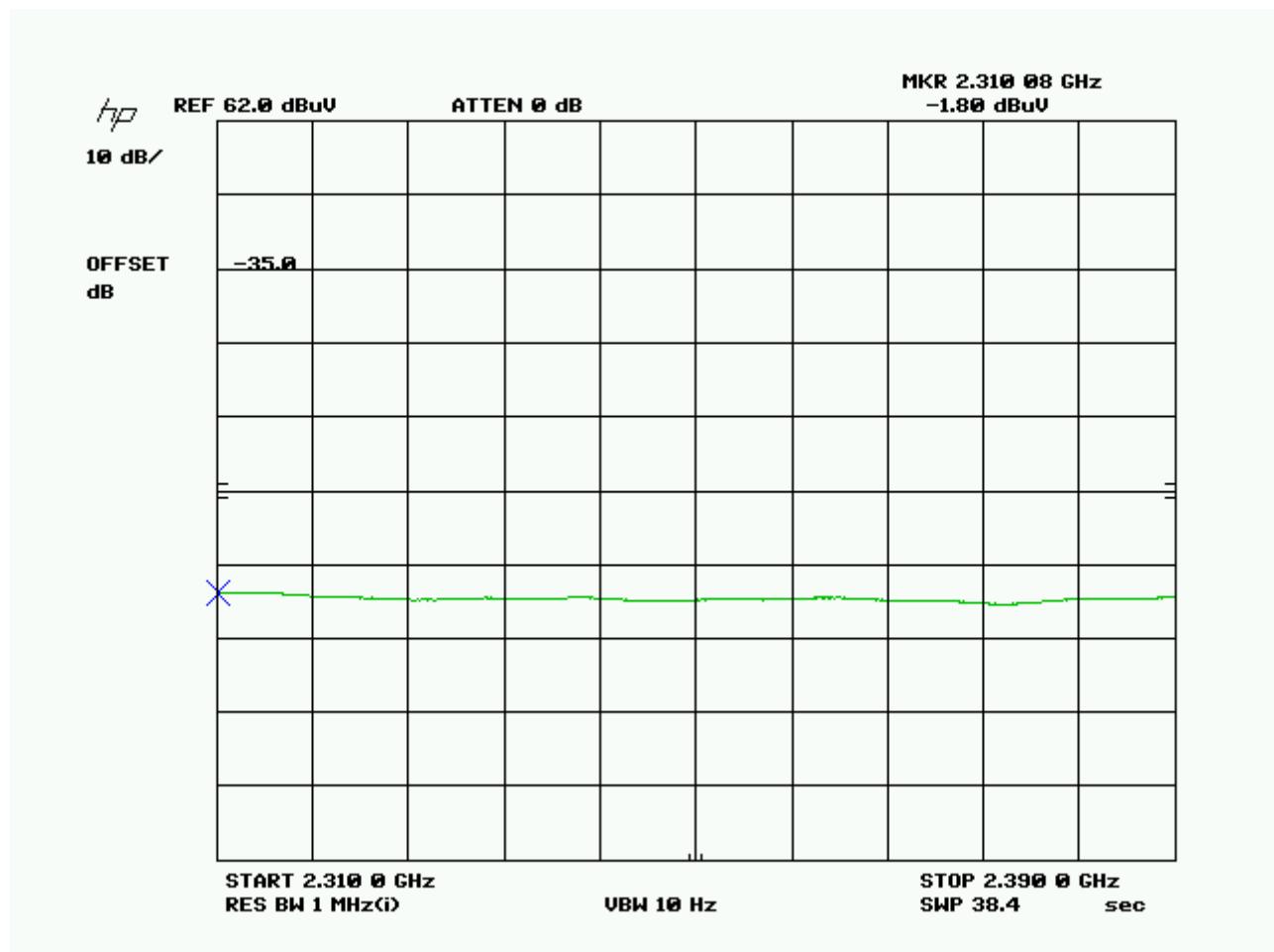
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty cycle CF dB	Field Strength dB $\mu$ V/m	Margin dB
2,402.0	2,389.30	22.7	H	3.17	32.38	13	45.25	28.75

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Lower non-adjacent restricted band



Average Plot

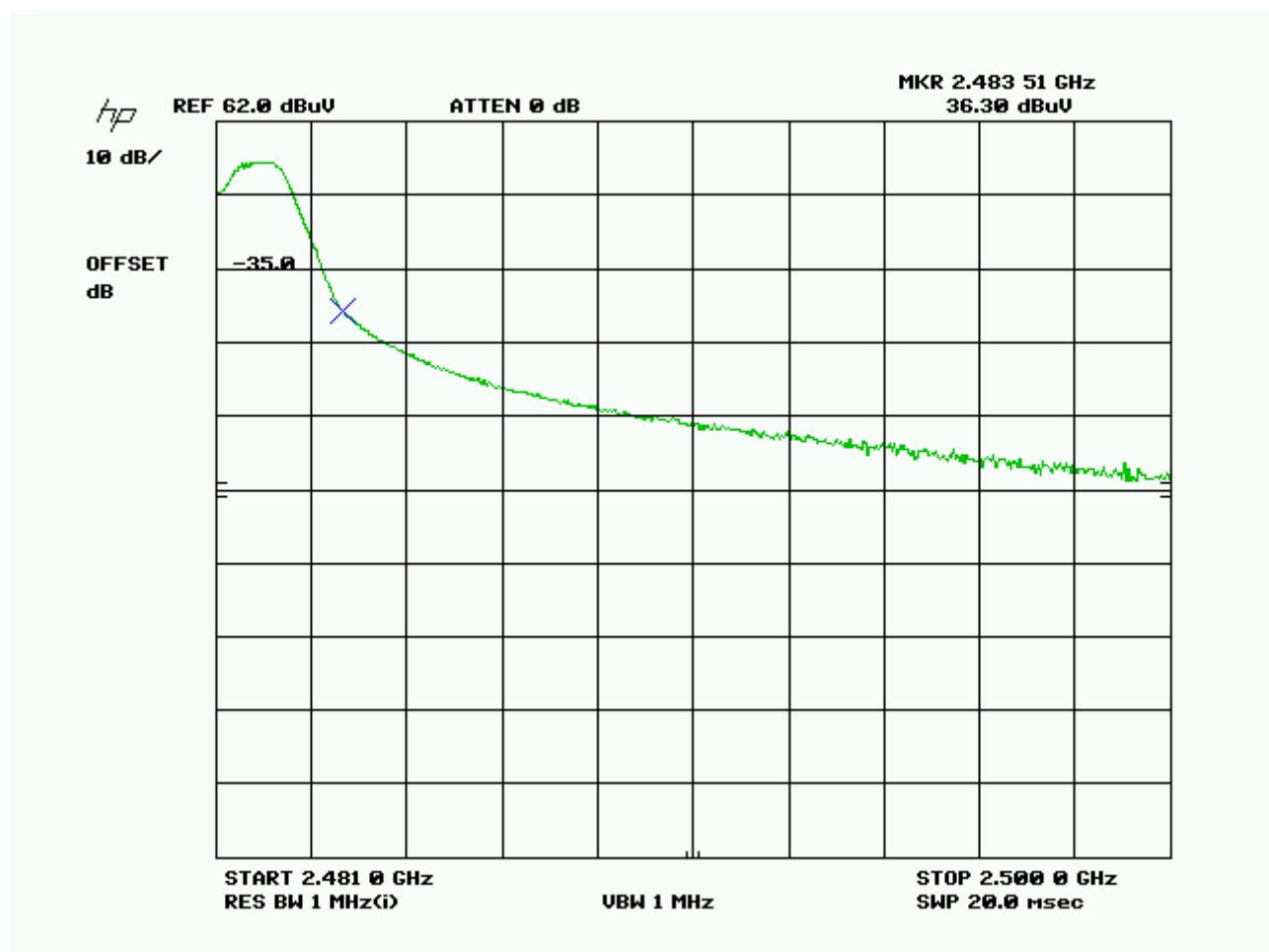
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty Cycle CF dB	Field Strength dB $\mu$ V/m	Margin dB
2,402.0	2,310.00	-1.8	H	3.12	32.22	13	20.54	33.46

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Upper bandedge



Peak Plot

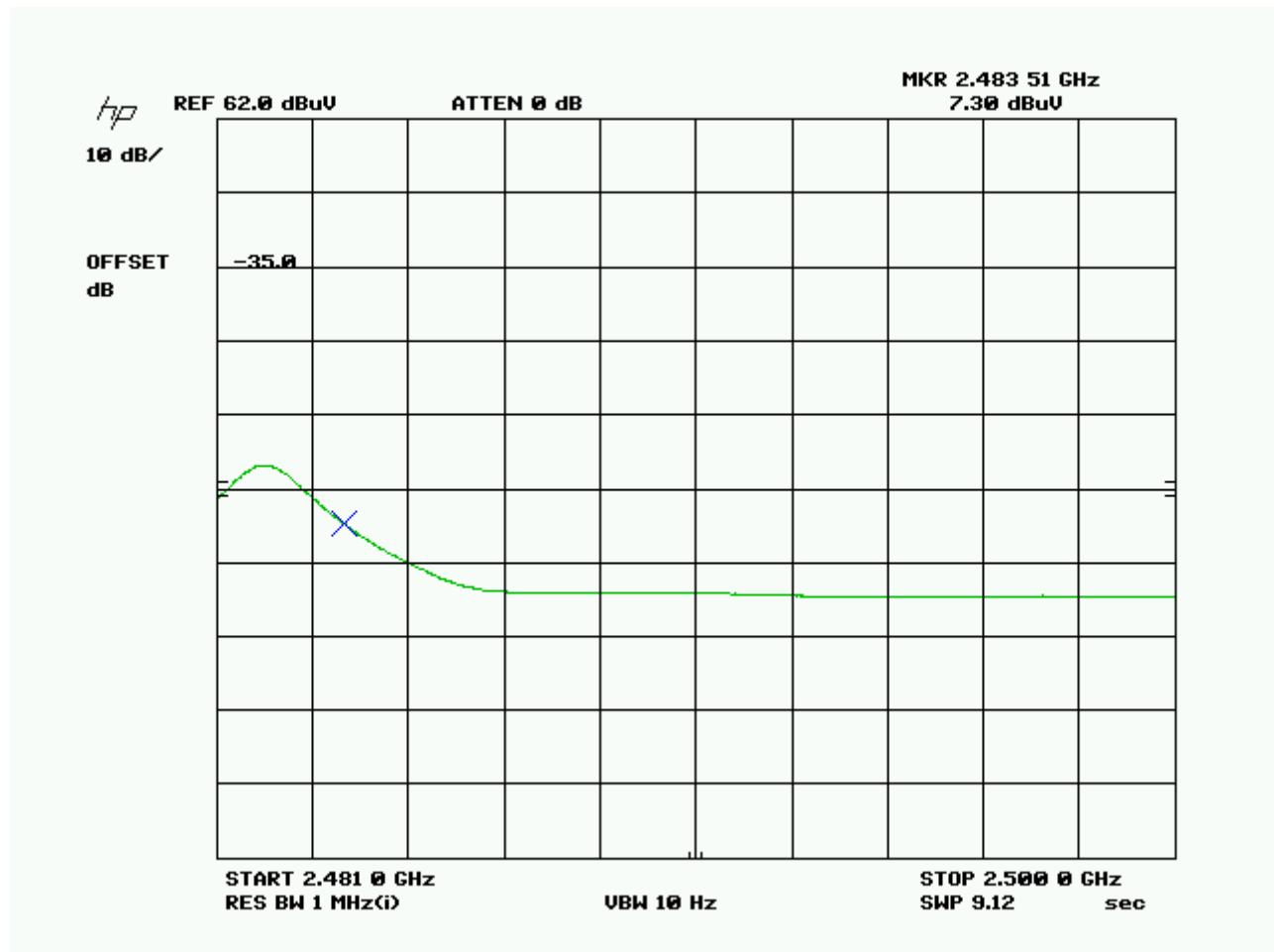
Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty Cycle CF dB	Field Strength dB $\mu$ V/m	Margin dB
2,482.0	2,483.50	36.3	H	3.24	32.57	13	59.11	14.89

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Upper bandedge



Average Plot

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB $\mu$ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty Cycle CF dB	Field Strength dB $\mu$ V/m	Margin dB
2,482.0	2,483.50	7.3	H	3.24	32.57	13	30.11	23.89

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## DUTY CYCLE

As per the manufacturer, the Duty Cycle is 22% or 13 dB

In any 1 second period of time the transmitter transmits a packet in 224 us at a rate of 992 Hz and a packet at 4 Hz in 128 us.

$(992 \text{ Hz} \times 224 \text{ us}) + (4 \text{ Hz} \times 128 \text{ us}) / 1 \text{ second} = 22.2 \% \text{ duty cycle.}$

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## POWER LINE CONDUCTED INTERFERENCE

**Rules Part No.:** 15.207

**Requirements:**

Frequency (MHz)	Quasi Peak Limits (dB $\mu$ V)	Average Limits (dB $\mu$ V)
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. Both lines were observed.

N/A  
Battery or vehicle powered DUT.

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