



849 NW State Road 45
Newberry, FL 32669 USA
Ph: 888.472.2424 or 352.472.5500
Fax: 352.472.2030
Email: info@timcoengr.com
Website: www.timcoengr.com

**FCC PART 15.249 AND
IC RSS-210, ISSUE 8
TEST REPORT
UNLICENSED INTENTIONAL RADIATOR**

Applicant	MIDLAND RADIO CORPORATION
Address	5900 PARRETTA DRIVE
	KANSAS CITY MISSOURI 64120 USA
FCC ID	MMABTX1
IC	3690A-BTX1
Model Number	BTX1
Product Description	BLUETOOTH TRANSMITTER
Date Sample Received	2/1/2013
Date Tested	3/22/2013
Tested By	Joe Scoglio
Approved By	Joe Scoglio
Report Number	209AUT13TestReport.doc
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.**



Testing Certificate #0955-01

TABLE OF CONTENT

GENERAL REMARKS	3
GENERAL INFORMATION	4
EMC EQUIPMENT LIST.....	5
TEST PROCEDURES.....	6
RADIATION INTERFERENCE	7
OCCUPIED BANDWIDTH	8
BAND EDGE COMPLIANCE	9
DUTY CYCLE.....	15
POWER LINE CONDUCTED INTERFERENCE	17

APPLICANT: MIDLAND RADIO CORPORATION
FCC ID: MMABTX1
IC: 3690A-BTX1
REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

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 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
Project Manager

Date: 3/22/2013

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

GENERAL INFORMATION

DUT Specification

The test results relate only to the items tested.			
Applicable Standard	Part 15.249, RSS-210, ISSUE 8		
DUT Description	BLUETOOTH TRANSMITTER		
FCC ID	MMABTX1		
IC	3690A-BTX1		
Model Number	BTX1		
Operating Frequency	TX: 2402 to 2480 MHz	RX: Same	
No. of Channels	78		
Modulations	GFSK		
DUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz		
	<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.		
Test Facility	Timco Engineering Inc. located at 849 NW State Road 45 Newberry, FL 32669 USA.		
Test Conditions	Temperature: 26°C Relative humidity: 50%		
Test Exercise	The DUT was placed in continuous transmit mode of operation.		
Modifications	none		

Test Supporting Equipment

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

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/ Char Date	Due Date
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	06/14/12	06/14/14
Frequency Counter	HP	5352B	2632A00165	06/22/11	06/22/13
Digital Multimeter	Fluke	77	43850817	02/22/12	02/22/13
Digital Multimeter	Fluke	FLUKE-77-3	79510405	06/13/11	06/13/13
Frequency Counter	HP	5385A	3242A07460	06/22/11	06/22/13
Antenna: Active Loop	ETS-Lindgren	6502	00062529	09/23/10	09/23/13
Antenna: Double-Ridged Horn	Electro-Metrics	RGA-180	2319	06/19/12	06/19/14
LISN	Electro-Metrics	ANS-25/2	2604	10/28/11	10/28/13
DC Power Supply	HP	6264B		03/21/11	03/21/13
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	06/13/12	06/13/14
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/04/11	05/04/13
Digital Multimeter	Fluke	77	35053830	09/09/11	09/09/13
Antenna: Biconnical	Eaton	94455-1	1096	05/04/11	05/04/13
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

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

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 dBμV) 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 dBμV	+ 10.36 dB	+ 0.5 = 30.86 dBμV/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 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.

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

RADIATION INTERFERENCE

Rules Part No.: 15.249, 15.209, RSS-GEN 7.2.5 (Table 5)

Requirements:

Frequency	Limits
Part 15.209, RSS-GEN 7.2.5 (Table 5)	
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	
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: Emissions were measured from the lowest frequency generated or 9 kHz to the tenth harmonic. Measurements are peak unless stated otherwise.

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB μ V	Ant. Pol	Coax Loss dB	Correction Factor dB/m	Correction Factor dB	Field Strength dB μ V/m	Margin dB
2,402.0	2,402.00	67.7	H	3.18	32.40	-10.2	93.08	0.92
2,402.0	2,402.00	67.9	V	3.18	32.40	-10.2	93.28	0.72
2,402.0	4,804.00	10.6	V	4.90	34.38	-10.2	39.68	14.32
2,402.0	4,804.00	11.2	H	4.90	34.38	-10.2	40.28	13.72
2,441.0	2,441.00	66.7	H	3.21	32.48	-10.2	92.19	1.81
2,441.0	2,441.00	68.0	V	3.21	32.48	-10.2	93.49	0.51
2,441.0	4,882.00	12.3	V	4.94	34.43	-10.2	41.47	12.53
2,441.0	4,882.00	13.0	H	4.94	34.43	-10.2	42.17	11.83
2,480.0	2,480.00	66.0	H	3.24	32.56	-10.2	91.6	2.4
2,480.0	2,480.00	67.3	V	3.24	32.56	-10.2	92.9	1.1
2,480.0	4,960.00	10.9	V	4.98	34.48	-10.2	40.16	13.84
2,480.0	4,960.00	11.4	H	4.98	34.48	-10.2	40.66	13.34

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

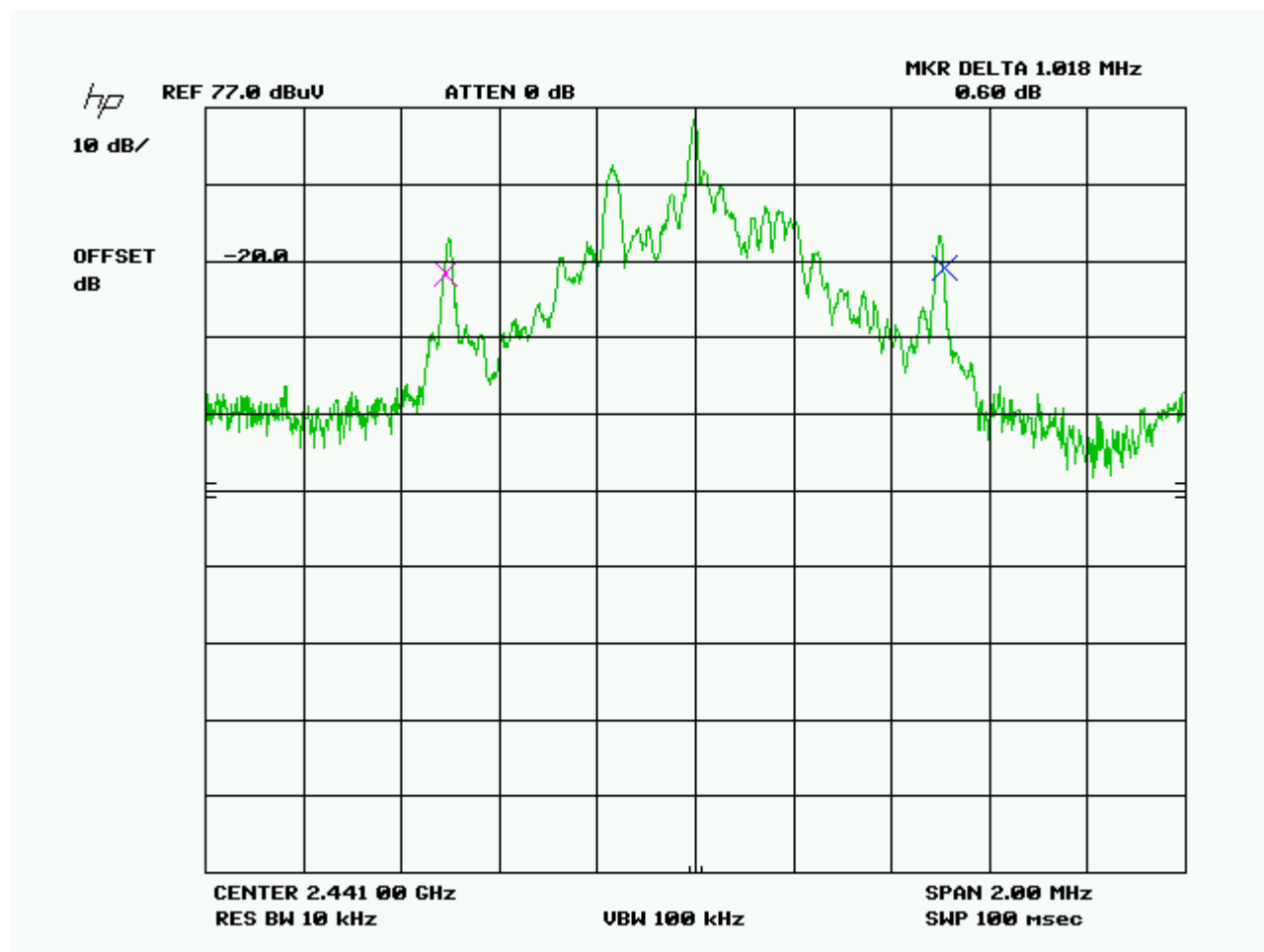
REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

OCCUPIED BANDWIDTH

Rules Part No.: 15.249 (d), RSS-210, RSS-GEN

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:



APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

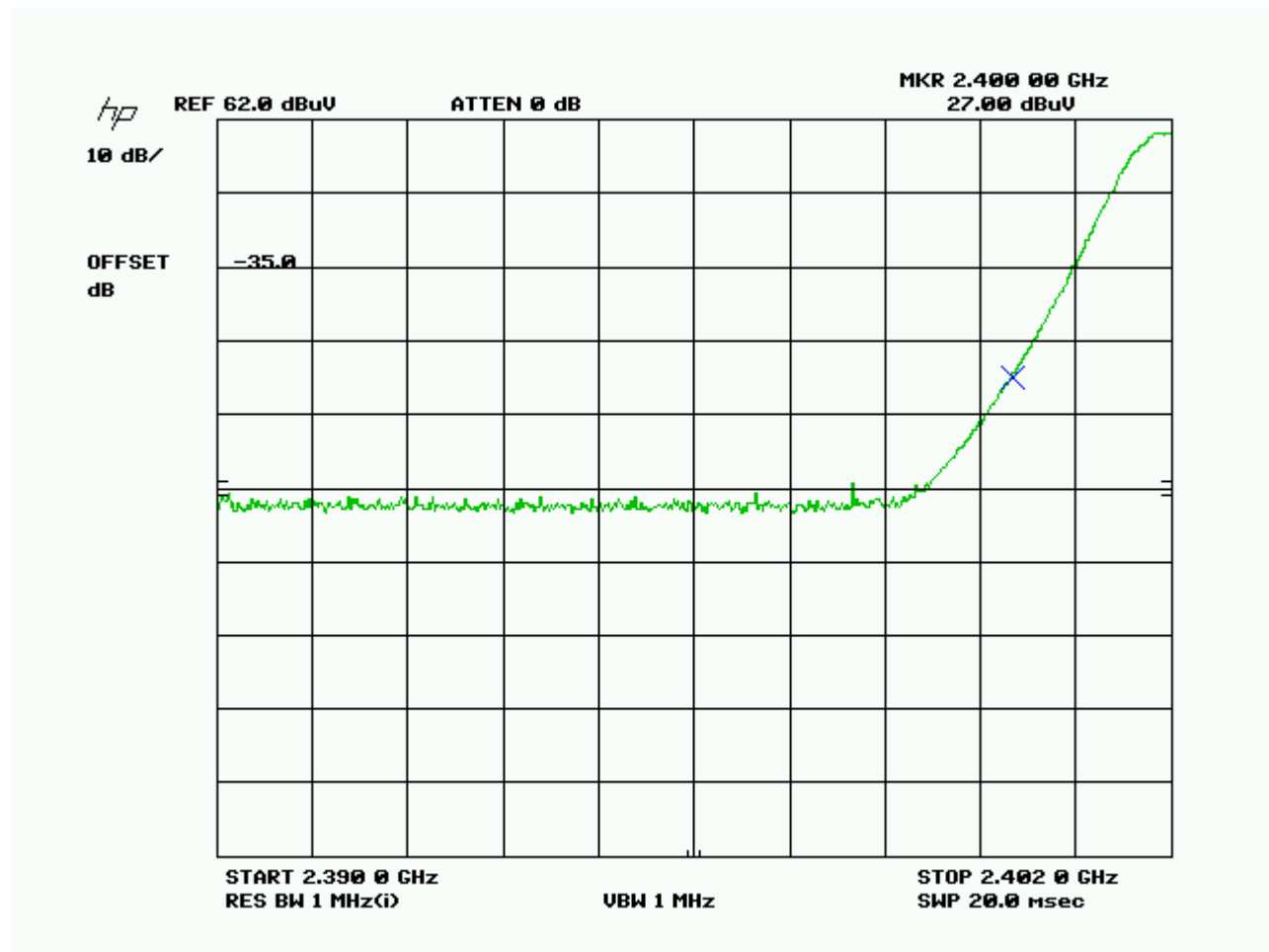
BAND EDGE COMPLIANCE

Rules Part No.: 15.249 (d), RSS-210, RSS-GEN

Requirements: 40 dBc or in the case of restricted bands 54 dB μ V/m.

Test Data:

Lower bandedge Peak Plot



Peak Plot

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dB μ V	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dB μ V/m	Margin dB
2,402.0	2,400.00	27.0	V	3.18	32.40	62.58	11.42

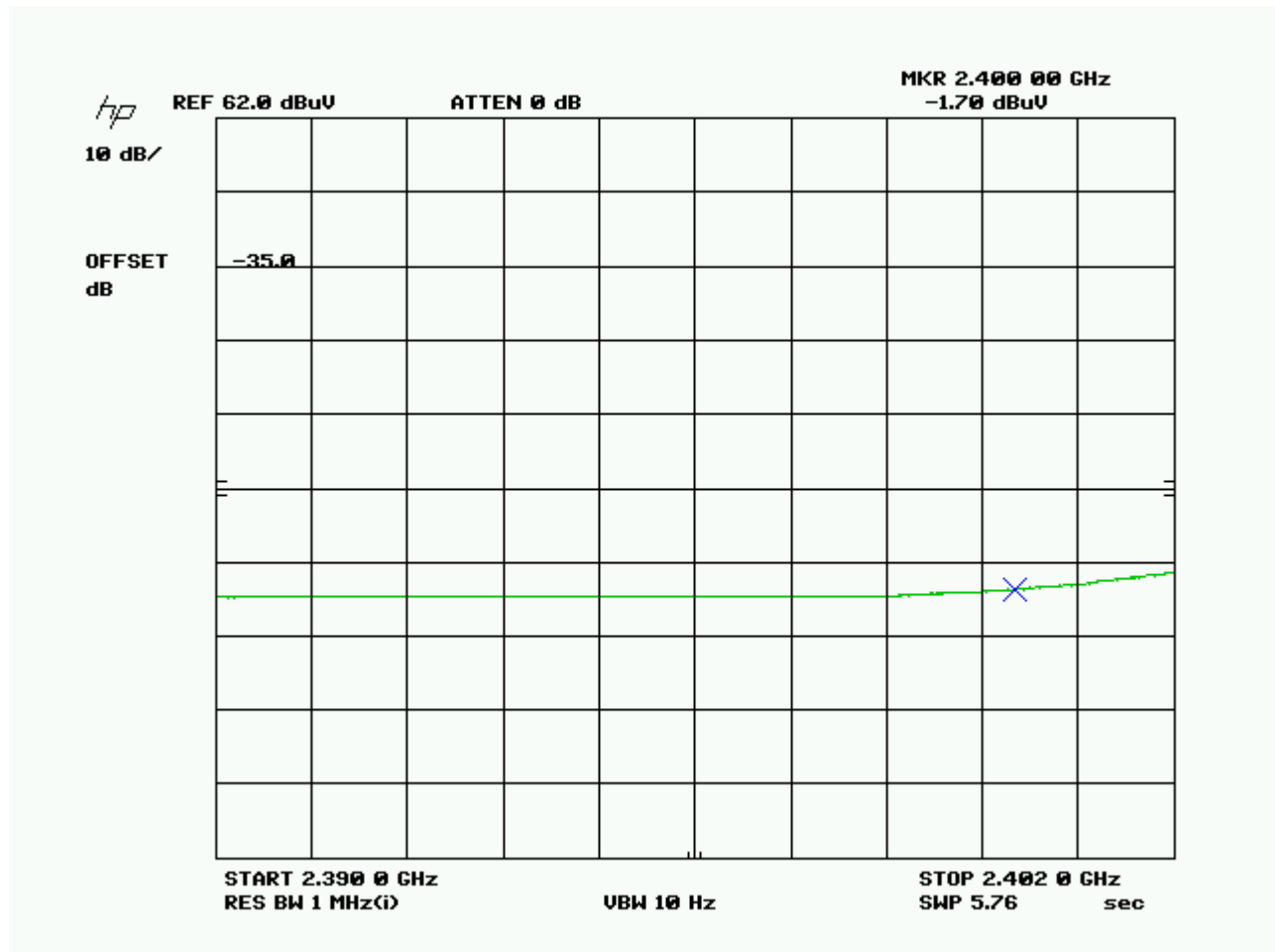
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

Lower bandedge Average Plot



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m	Margin dB
2,402.0	2,400.00	-1.7	V	3.18	32.40	33.88	20.12

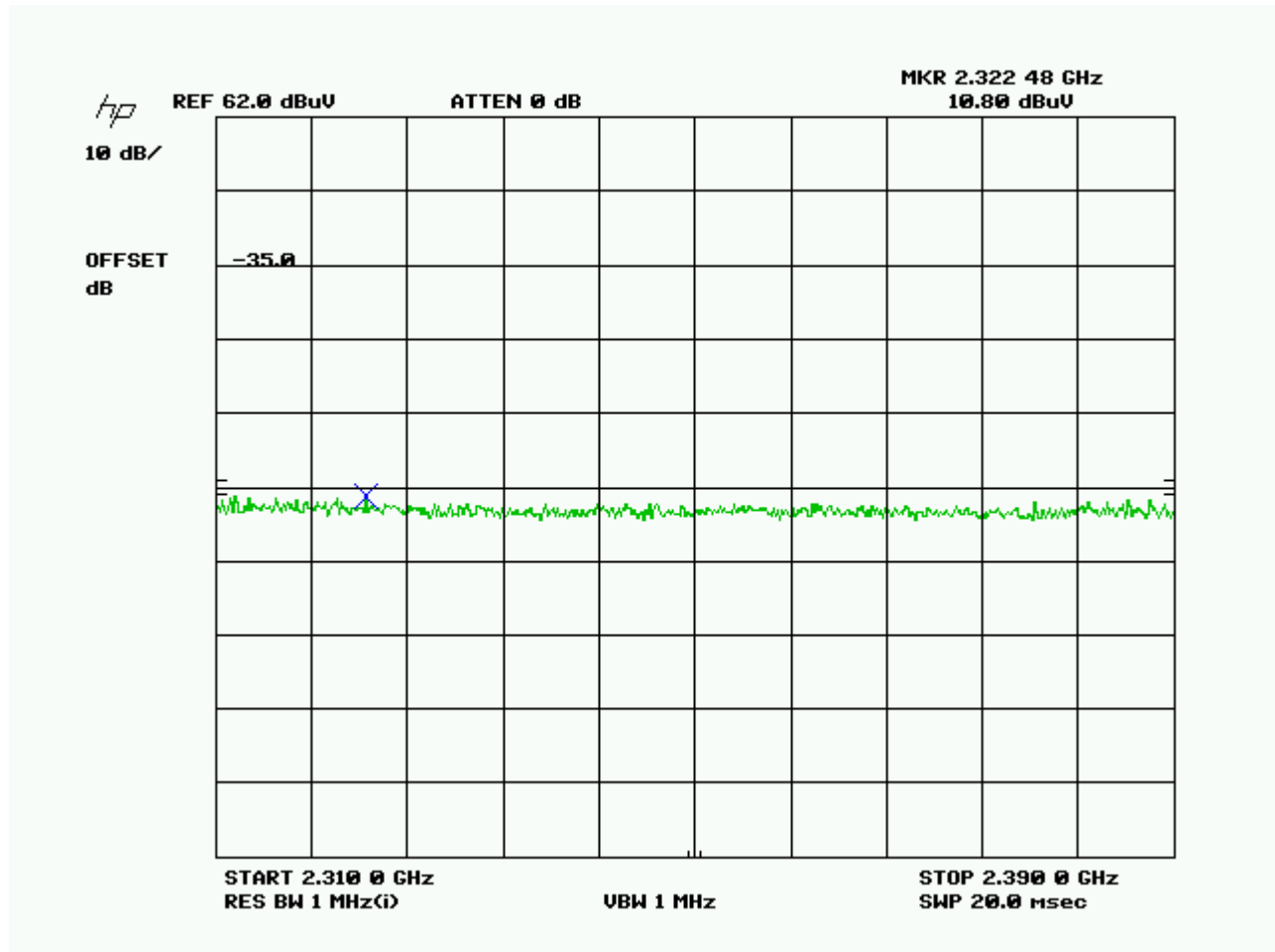
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

Lower non-adjacent restricted band Peak Plot



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m	Margin dB
2,402.0	2,322.40	10.8	V	3.13	32.24	46.17	7.83

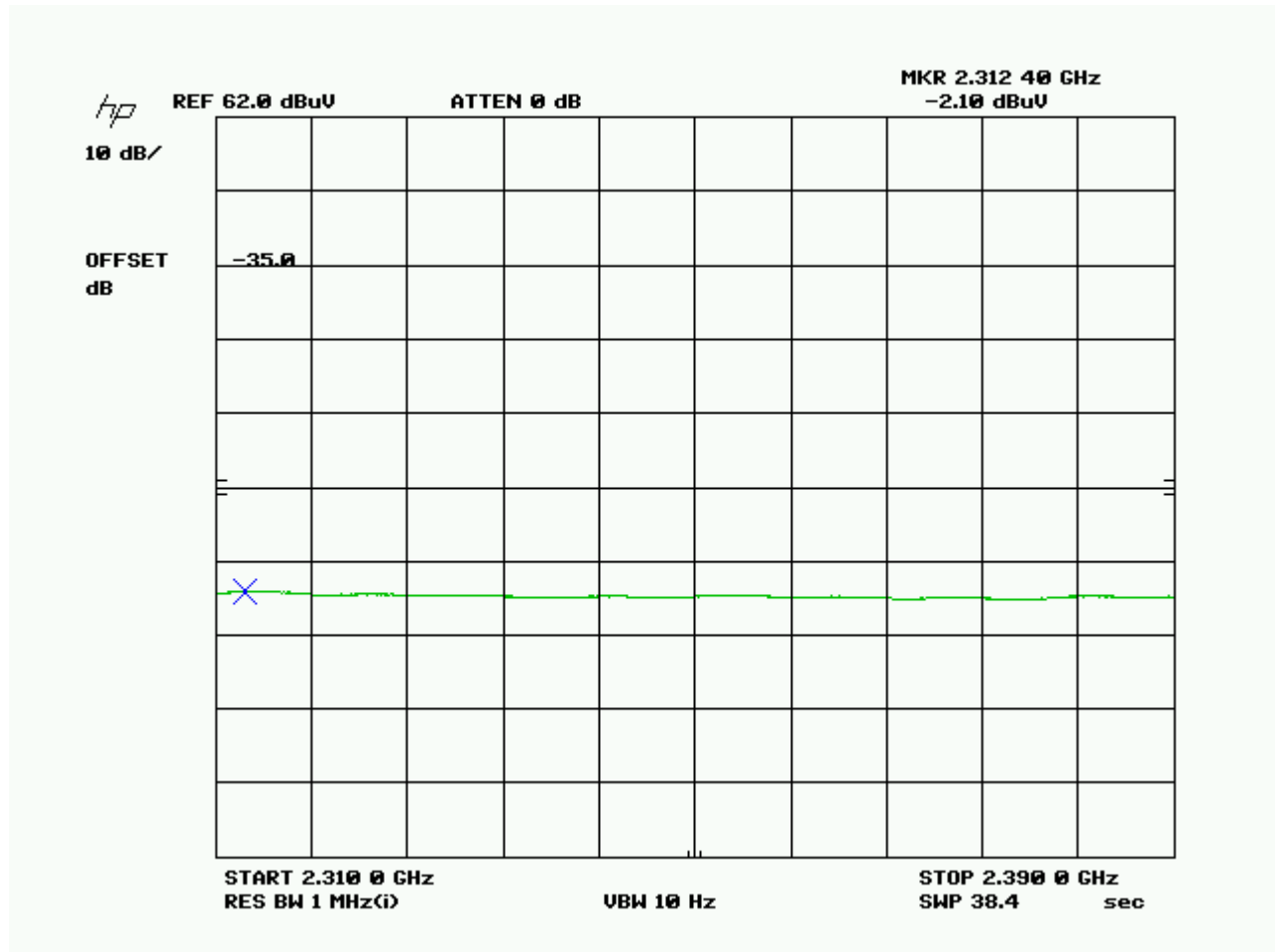
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

Lower non-adjacent restricted band Average Plot



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m	Margin dB
2,402.0	2,312.40	-2.1	V	3.12	32.22	33.24	20.76

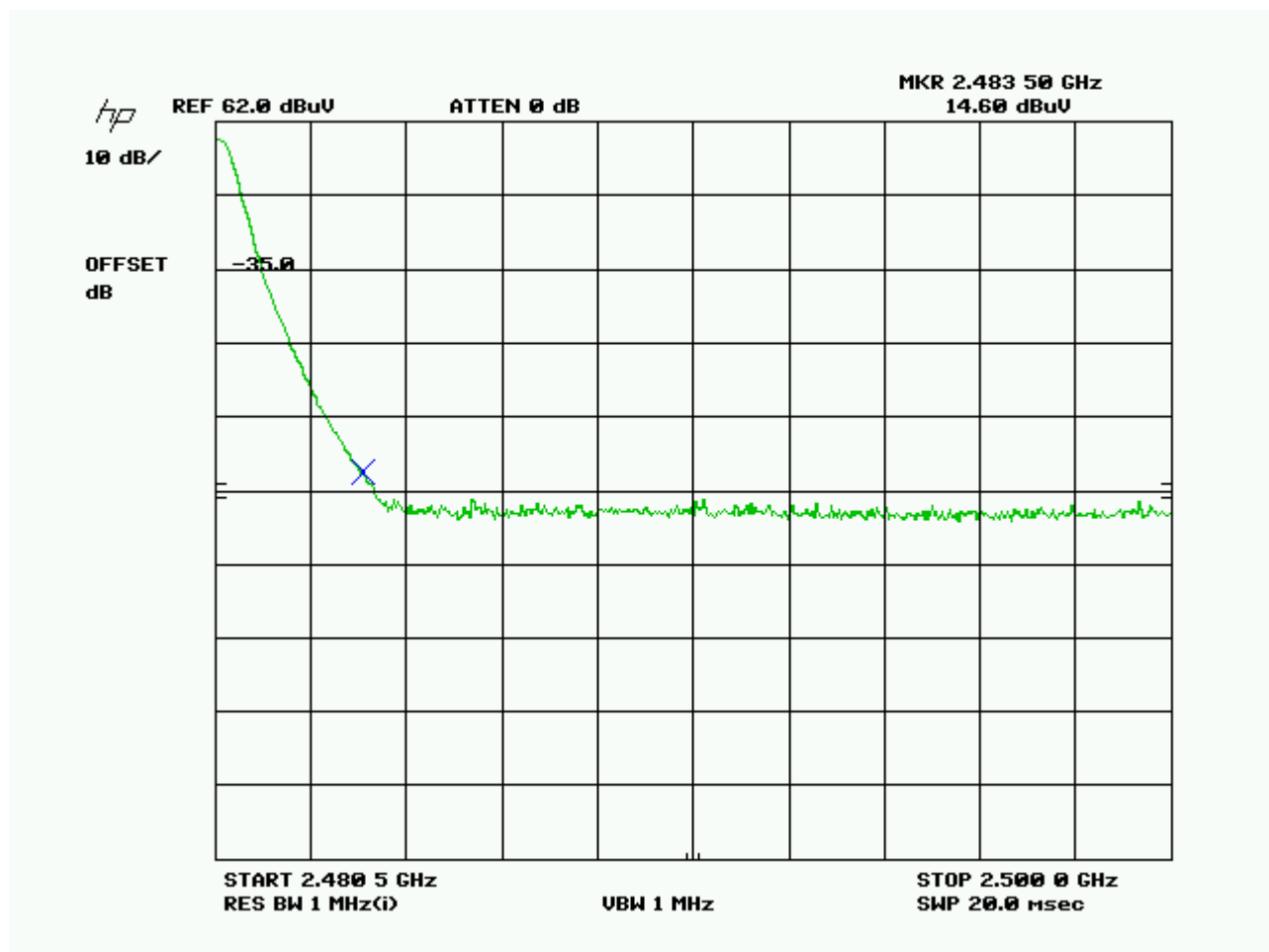
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

Upper bandedge Peak Plot



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m	Margin dB
2,480.0	2,483.50	14.6	V	3.24	32.57	50.41	3.59

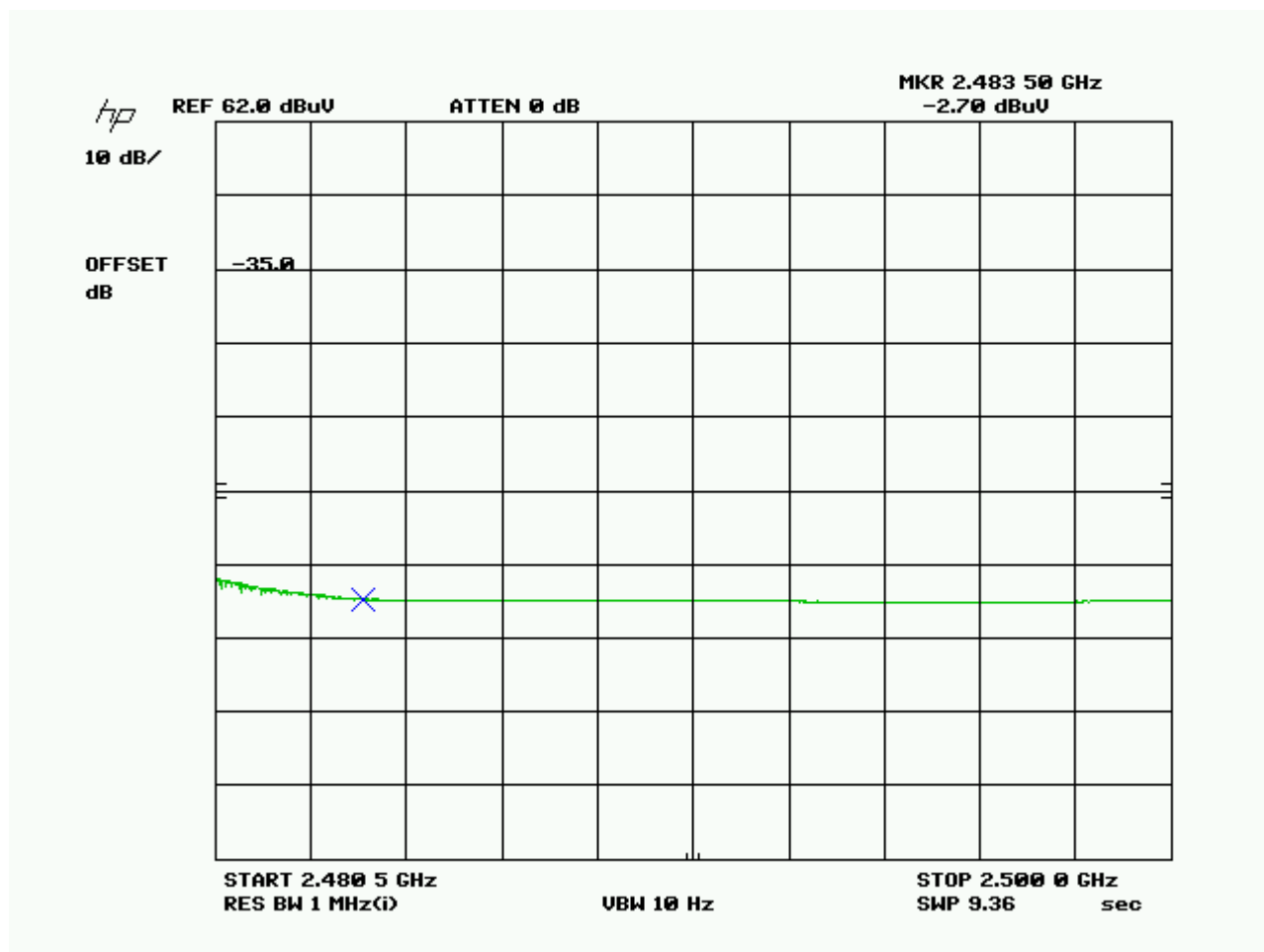
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

Upper bandedge Average Plot



Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBμV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBμV/m	Margin dB
2,480.0	2,483.50	-2.7	V	3.24	32.57	33.11	20.89

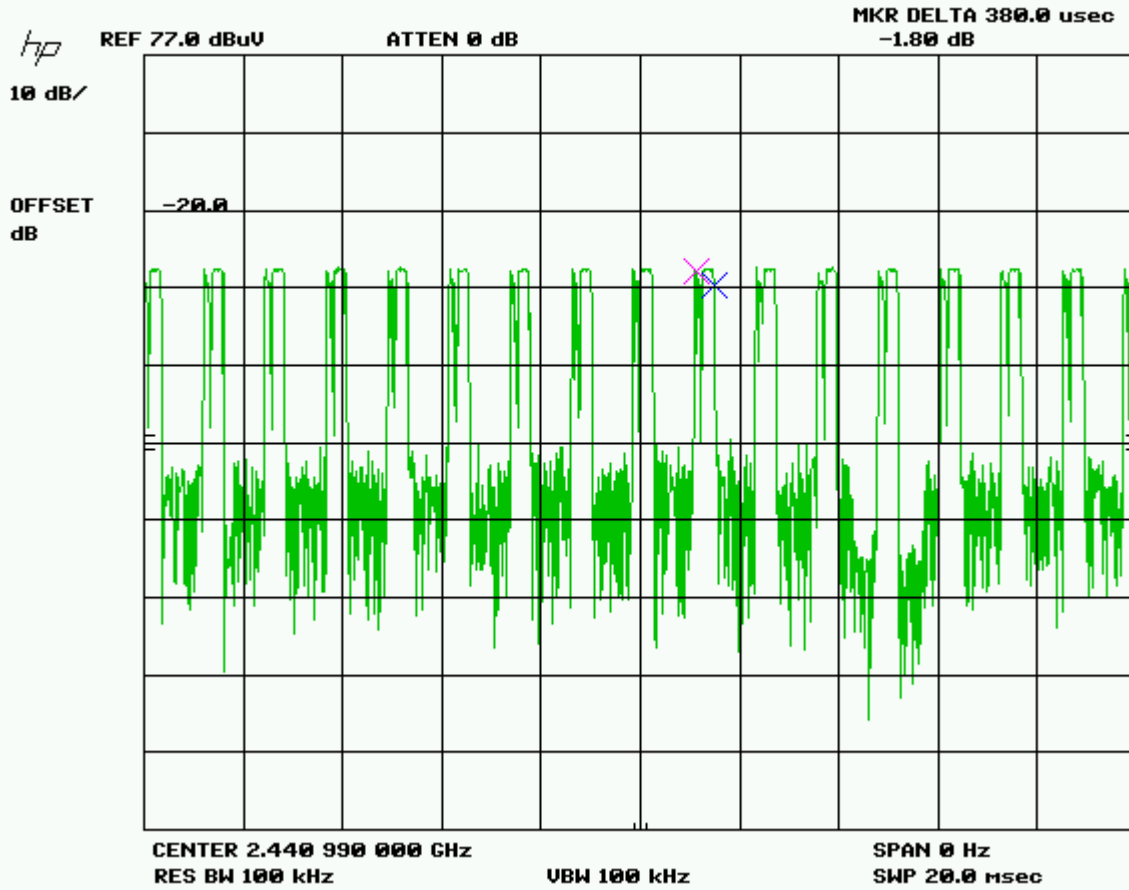
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

DUTY CYCLE

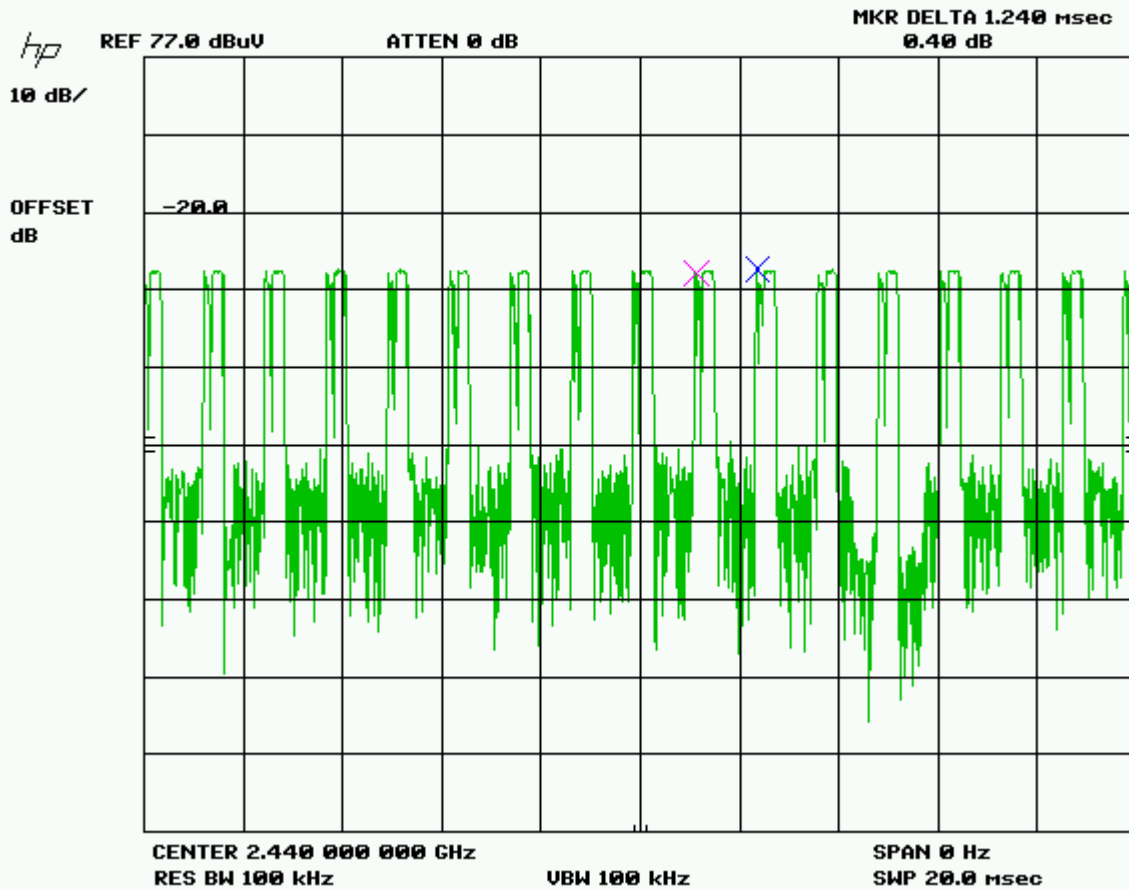


APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc



Total # of pulses: 81 in 100 ms

Duration of pulse: .380 ms

$20 \times \log \left(\frac{81 \times .380}{100} \right) = 20 \times \log (0.3078) = 10.2 \text{ dB}$

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMABTX1

IC: 3690A-BTX1

REPORT #: M\MidlandRadio MMA\209AUT13\209AUT13TestReport.doc

POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: 15.207, RSS-GEN

Requirements:

Frequency (MHz)	Quasi Peak Limits (dB μ V)	Average Limits (dB μ 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.