

TABLE OF CONTENTS LIST

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

TEST REPORT:

PAGE	1.....COVER SHEET - GENERAL INFORMATION & TECHNICAL DESCR.
PAGE	2.....RF POWER OUTPUT
PAGE	3.....MODULATION CHARACTERISTICS & AUDIO FREQUENCY RESPONSE PLOT
PAGE	4.....MODULATION LIMITING PLOT - 300 Hz
PAGE	5.....MODULATION LIMITING PLOT - 1000 Hz
PAGE	6.....MODULATION LIMITING PLOT - 2500 Hz
PAGE	7.....POST LIMITER PLOT
PAGE	8.....OCCUPIED BANDWIDTH
PAGE	9.....OCCUPIED BANDWIDTH PLOT
PAGE	10.....SPURIOUS EMISSIONS AT ANTENNA TERMINALS
PAGE	11.....METHOD OF MEASURING SPURIOUS EMISSIONS AT ANTENNA TERM.
PAGE	12.....FIELD STRENGTH OF SPURIOUS EMISSIONS
PAGE	13.....METHOD OF MEASURING RADIATED SPURIOUS EMISSIONS
PAGE	14.....FREQUENCY STABILITY
PAGE	15.....MPE RF SAFETY CALCULATION
PAGE	16-18..LIST OF TEST EQUIPMENT

EXHIBITS CONTAINING:

EXHIBIT	1.....FCC ID LABEL SAMPLE
EXHIBIT	2.....SKETCH OF LOCATION
EXHIBIT	3.....BLOCK DIAGRAM
EXHIBIT	4.....SCHEMATICS
EXHIBIT	5.....USER'S MANUAL
EXHIBIT	6.....EXTERNAL PHOTOS
EXHIBIT	7.....INTERNAL PHOTOS
EXHIBIT	8.....PARTS LIST
EXHIBIT	8.....TUNING PROCEDURE
EXHIBIT	9.....CIRCUIT DESCRIPTION
EXHIBIT	10.....TEST SETUP PHOTOGRAPHS

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

TABLE OF CONTENTS LIST

GENERAL INFORMATION REQUIRED  
FOR TYPE ACCEPTANCE

2.1033(c)(1)(2) MIDLAND RADIO CORPORATION will manufacture the  
FCCID: MMA700671A VHF TRANSCEIVER in quantity, for use  
under FCC RULES PART 90.

MIDLAND RADIO CORPORATION  
1120 CLAY STREET  
NORTH KANSAS CITY, MO. 64116

2.1033 (c) TECHNICAL DESCRIPTION

2.1033(c)(3) Instruction book. A draft copy of the instruction  
manual is included as EXHIBIT 5.

2.1033(c) (4) Type of Emission: 15K0F3E  
90.207

Bn = 2M + 2DK  
M = 3000  
D = 4500  
Bn = 2(3000)+2(4500) = 15.0k

90.209(5) Authorized Bandwidth 20 kHz

2.1033(c)(5) Frequency Range: 30-36 MHz  
90.205(b)

2.1033(c)(6)(7) Power Output shall not exceed 300 Watts into a 50 ohm  
90.205(b) resistive load. There are no user power controls.

2.1033(c)(8) DC Voltages and Current into Final Amplifier:

INPUT POWER: (13.5V)(17.3A) = 233.55 Watts

2.1033(c)(9) Tune-up procedure. The tune-up procedure is included in  
Exhibit 8.

2.1033(c)(10) Complete Circuit Diagrams: The circuit diagram is  
included as EXHIBIT 4. The block diagram is included  
as EXHIBIT 3.

2.1033(c)(11) A photograph or a drawing of the equipment identifica  
tion label is included as Exhibit #1.

2.1033(c)(12) Photographs(8"X10") of the equipment of sufficient  
clarity to reveal equipment construction and layout,  
including meters, labels for controls, including any  
view under shields - See EXHIBIT 6-7.

2.1033(c)(13) Digital modulation is not allowed.

2.1033(c)(14) The data required by 2.1046 through 2.1057 is  
submitted below.

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

2.1046(a)      RF power output.

90.205(b)      RF power is measured by connecting a 50 ohm,  
Resistive wattmeter to the RF output connector.  
With a nominal battery voltage of 13.6 VDC, and the  
Transmitter properly adjusted, the RF output measures:

OUTPUT POWER: HIGH:    130 Watts

METHOD OF MEASURING RF POWER OUTPUT

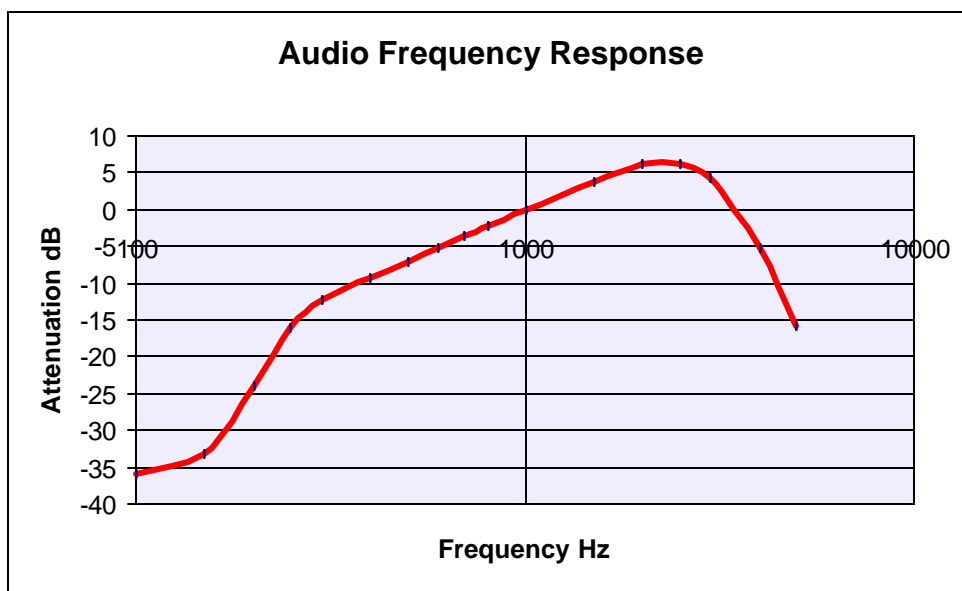


2.1047(a)(b)      Modulation characteristics:

AUDIO FREQUENCY RESPONSE

The audio frequency response was measured in accordance with TIA/EIA Specification 603. The audio frequency response curve is shown below.

The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured.



APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

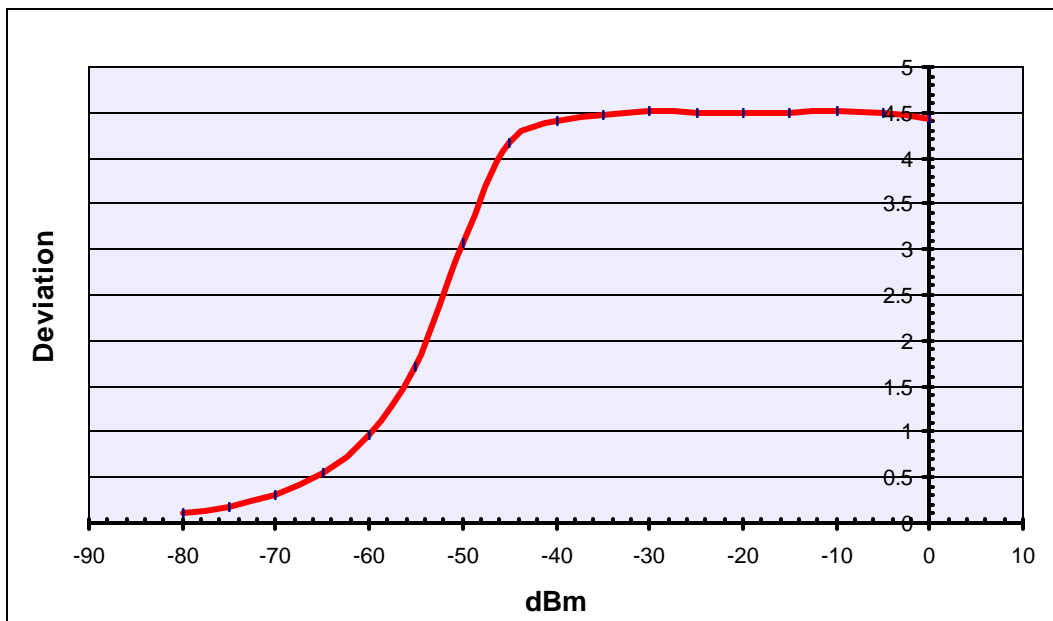
REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

2.1047(b)

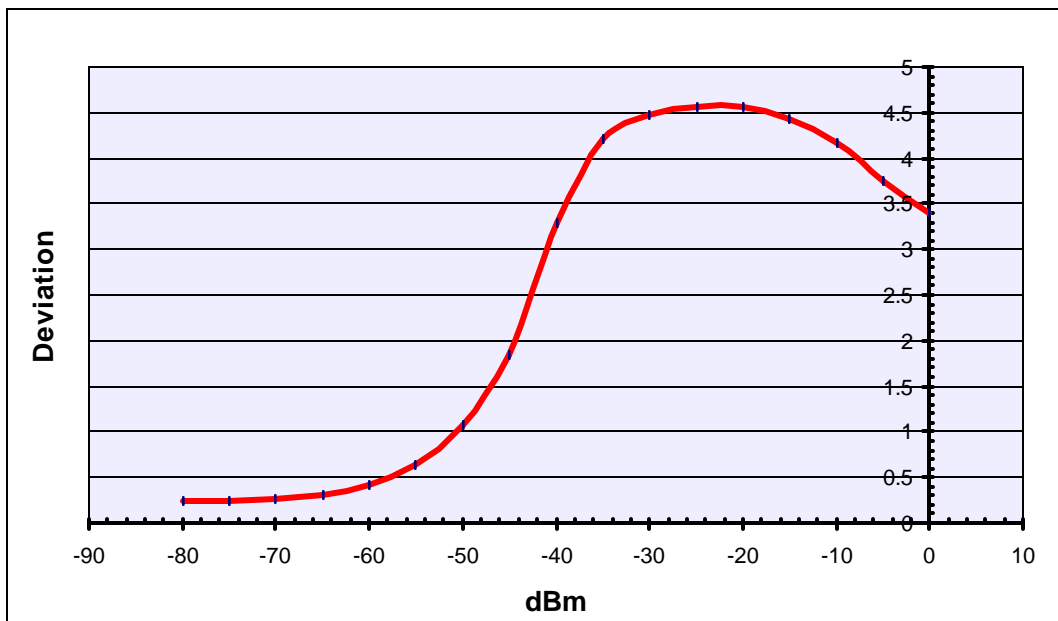
Audio input versus modulation

The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are shown below and on the next 2 pages. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz.

**MODULATION LIMITING PLOT - 300 Hz**



MODULATION LIMITING PLOT - 1000 Hz



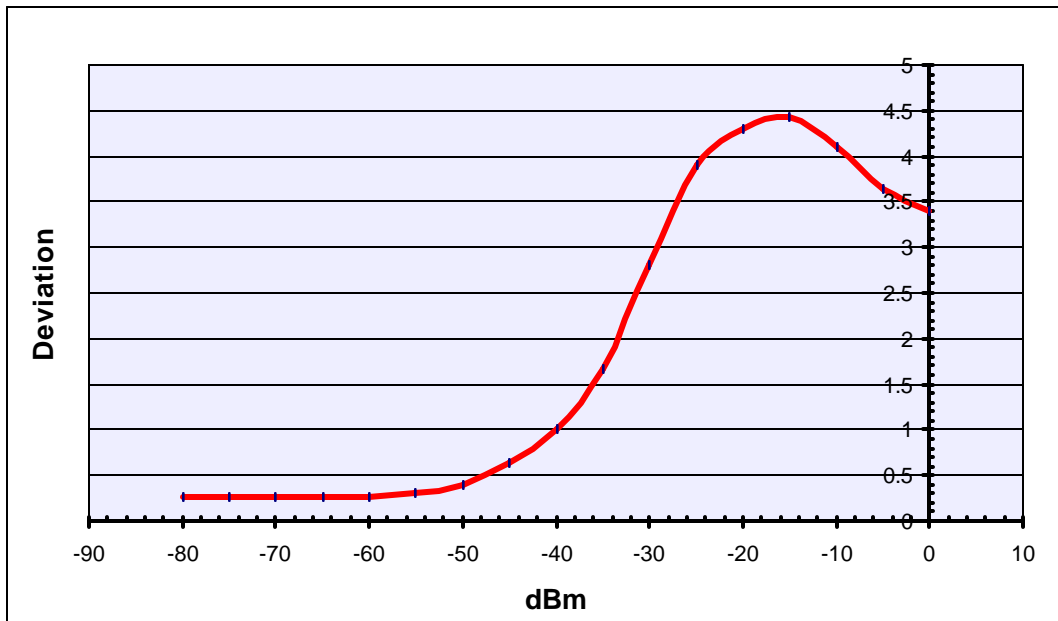
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

Page 5 of 18

MODULATION LIMITING PLOT - 2500 Hz



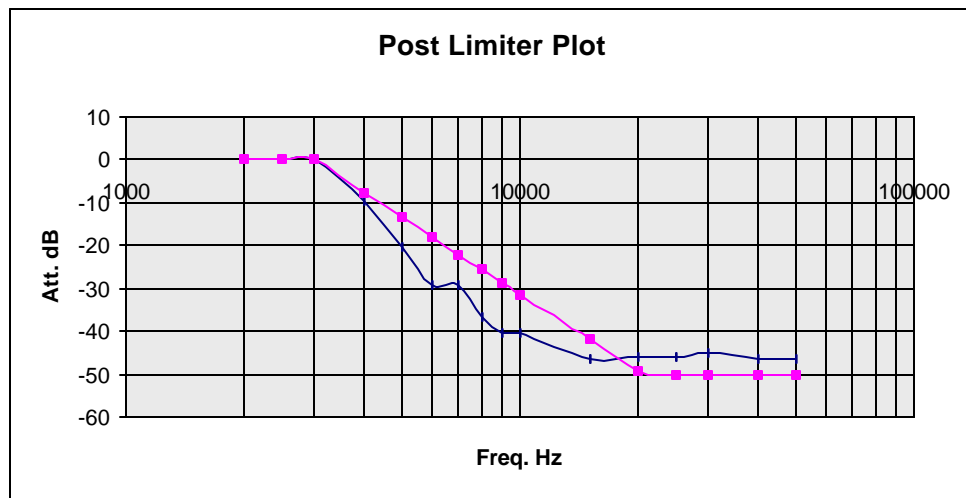
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

Page 6 of 18

Post Limiter Filter The filter must be between the modulation limiter and the modulated stage. There are no specifications for the Post Limiter Filter but a plot must be included in the FCC Application. See the plot below.





2.1049(c)  
90.210(b)

EMISSION BANDWIDTH:

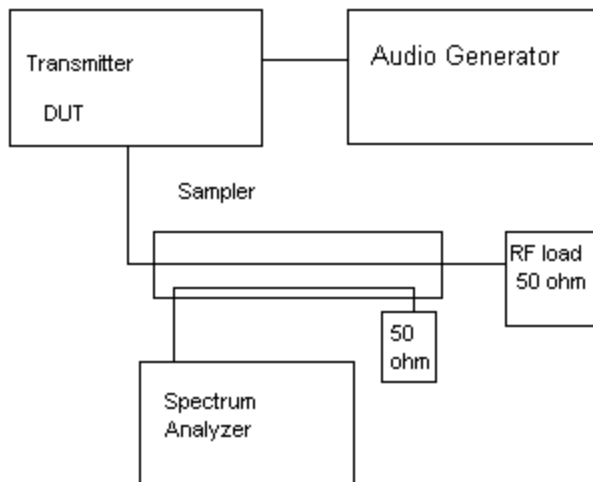
Data in the plots shows that the sidebands from greater than 50% to 100% of the authorized bandwidth must be attenuated by at least 25 dB and from 100 to 250% the sidebands must be attenuated by at least 35 dB. Beyond 250% the sidebands must be attenuated by at least  $43 + \log_{10}(TP)$ . The transmitter was modulated with 2500 Hz, adjusted for 50% modulation plus 16 dB. The spectrum analyzer was set with the unmodulated carrier at the top of the screen. The test procedure diagram follows. See the occupied bandwidth plot on the next page.

Radiotelephone transmitter with modulation limiter.

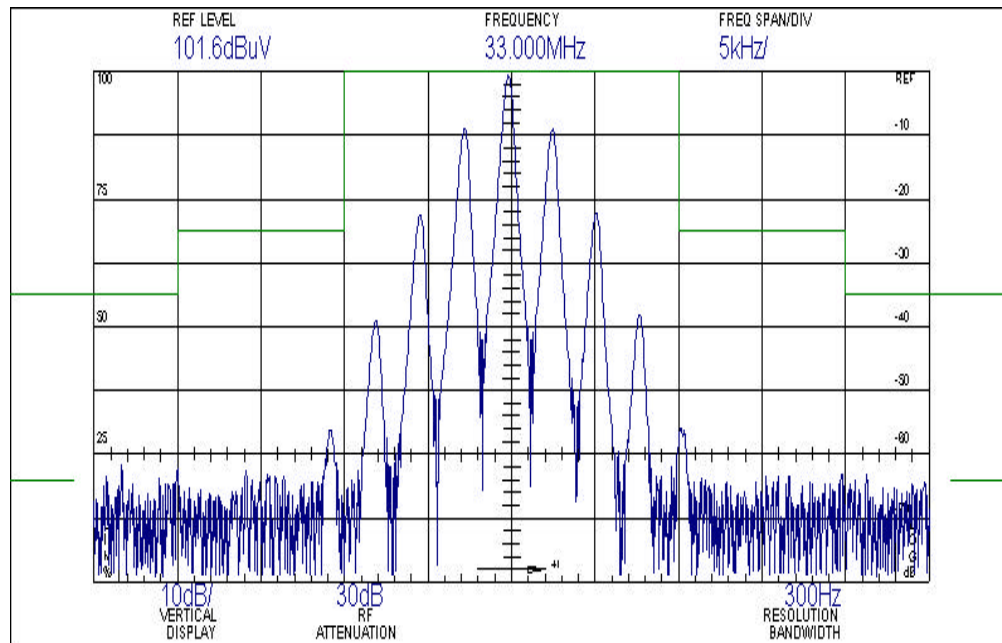
Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

Occupied BW Test Equipment Setup



# OCCUPIED BANDWIDTH PLOT



APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

2.1051 Spurious emissions at antenna terminals(conducted): Data on the following page shows the level of conducted spurious responses. The carrier was modulated 100% using a 2500Hz tone. The Spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with the standard TIA/EIA-603.

REQUIREMENTS: Emissions must be  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

$$\text{HIGH POWER} - 43 + 10\log(130) = 64.13 \text{ dB}$$

TF	EF	dB below carrier
30	30	0
	60	73.6
	90	71.6
	120	77.6
	150	78.1
	180	78.5
	210	78.0
	240	79.0
	270	>79.0
	300	>79.0

TF	EF	dB below carrier
33	33	0
	66	77.9
	99	70.1
	132	74.8
	165	77.1
	198	77.8
	231	78.1
	264	>79.0
	297	>79.0
	330	71.7

TF	EF	dB below carrier
36	36	0
	72	77.2
	108	66.2
	144	77.4
	179	78.4
	216	77.8
	252	78.9
	288	78.6
	324	79.0
	360	79.0

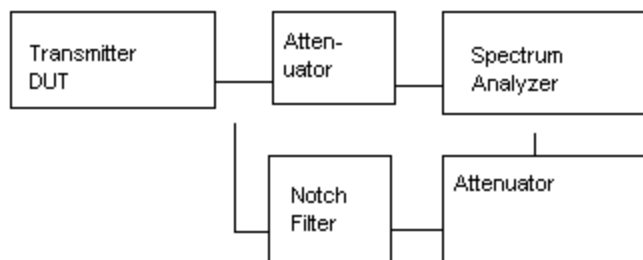
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

## Method of Measuring Conducted Spurious Emissions

Spurious Emissions at  
Antenna Terminals



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. An audio generator was connected to the UUT through a dummy microphone circuit and the output of the transmitter connected to a standard load and from the standard load through a preselector filter of the spectrum analyzer. The spectrum was scanned from 400 kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

2.1053 Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

HIGH POWER -  $43 + 10\log(130) = 64.13$  dB

TEST DATA:

Carrier Frequency is MHz	Attenuation in dBc
30.0(Carrier)	0.0
60.0	65.3
90.0	68.2
120.0	72.1
150.0	77.4
180.0	76.5
210.0	77.2
240.0	75.3
270.0	79.0
300.0	79.0
33.0(Carrier)	0.0
66.0	65.2
99.0	70.0
132.0	73.2
165.0	74.6
198.0	76.8
231.0	77.1
264.0	78.3
299.0	77.9
330.0	79.1
36.0(Carrier)	0.0
72.0	66.2
108.0	71.3
144.0	73.2
180.0	74.2
216.0	74.7
252.0	75.4
288.0	76.9
324.0	77.7
360.0	76.8

METHOD OF MEASUREMENTS: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

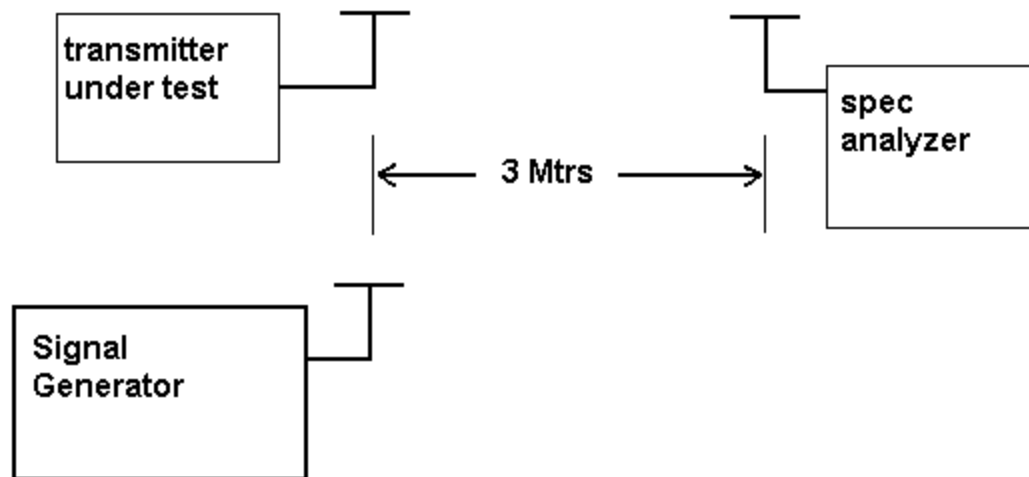
APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M\MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

Page 12 of 18

Method of Measuring Radiated Spurious Emissions



APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

Page 13 of 18

2.1055  
90.213(a)(1)

Frequency stability:

Temperature and voltage tests were performed to verify that the frequency remains within the .0020%, 20-ppm specification limit. The EUT was placed in the temperature chamber at 25 degrees C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15-second intervals. The worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30 degrees C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute, and again frequency readings were noted at 15-second intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10 degree increments up to + 50 degrees C.

Readings were also taken at minus 15% of the battery voltage of 13.6VDC, which we estimate to be the battery endpoint.

MEASUREMENT DATA:

Temperature C	Frequenc y Mhz	PPM
-29.50	32.999994	2.52
-19.70	33.000000	2.70
-9.80	32.999989	2.36
0.00	32.999910	-0.03
10.10	32.999936	0.76
20.00	32.999911	0.00
29.90	32.999989	2.36
40.40	33.000075	4.97
50.30	33.000085	5.27

Suply voltage %	suply voltage	PPM
1.15	15.64	1.67
1.10	14.96	0.42
1.05	14.28	0.15
0	0	0.00
0.95	13.60	0.30
0.90	12.92	0.27
0.85	12.24	0.21
0.80	10.88	0.06

Results: EUT meets the requirements.

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

The following table shows the calculation for meeting the Maximum Permissible Exposure limit. This radio must meet the General Population Exposure limit.

## MPE RF Safety Calculation

### Calculation Results

<b>Average Power at the Antenna</b>	65 watts (50% duty cycle)
<b>Antenna Gain in dBi</b>	2.20 dBi
<b>Distance to the Area of Interest</b>	7.00 feet
<b>Frequency of Operation</b>	33.000 MHz
<b>Are Ground Reflections Calculated?</b>	No
<b>Estimated RF Power Density</b>	0.1941mw/cm <sup>2</sup>

	<b>Controlled Environment</b>	<b>Uncontrolled Environment</b>
<b>Maximum Permissible Exposure (MPE)</b>	1.00 mw/cm <sup>2</sup>	0.21 mw/cm <sup>2</sup>
<b>Distance to Compliance From Center of Antenna</b>	3.09 feet	6.85 feet
<b>Does the Area of Interest Appear to be in Compliance?</b>	yes	yes

An RF exposure label “warning statement” will be affixed in a conspicuous location on the radio. A label sample is included with this submittal.



## EMC Equipment List

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
X	3-Meter OATS	TEI	N/A	N/A	Listed 12/22/99	12/22/02
	3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
	Receiver, Beige Tower Spectrum Analyzer (Tan)	HP	8566B Opt 462	3138A07786 3144A20661	CAL 8/31/01	8/31/03
	RF Preselector (Tan)	HP	85685A	3221A01400	CAL 8/31/01	8/31/03
	Quasi-Peak Adapter (Tan)	HP	85650A	3303A01690	CAL 8/31/01	8/31/03
X	Receiver, Blue Tower Spectrum Analyzer (Blue)	HP	8568B	2928A04729 2848A18049	CHAR 10/22/01	10/22/03
X	RF Preselector (Blue)	HP	85685A	2926A00983	CHAR 10/22/01	10/22/03
X	Quasi-Peak Adapter (Blue)	HP	85650A	2811A01279	CHAR 10/22/01	10/22/03
X	Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
	Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
	Biconnical Antenna	Eaton	94455-1	1057	CHAR 3/15/00	3/15/02
	BiconiLog Antenna	EMCO	3143	9409-1043		
X	Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 10/2/01	10/2/03
	Log-Periodic Antenna	Electro-Metrics	EM-6950	632	CHAR 10/15/01	10/15/03
	Log-Periodic Antenna	Electro-Metrics	LPA-30	409	CHAR 10/16/01	10/16/03
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/21/01	3/21/04
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 11/24/00	11/24/03
	Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 12/19/01	12/19/03
	Horn Antenna	Electro-Metrics	EM-6961	6246	CAL 3/21/01	3/21/03
	Horn Antenna	ATM	19-443-6R	None	No Cal Required	

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M/MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

Page 16 of 18

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Passive Loop Antenna	EMC Test Systems	EMCO 6512	9706-1211	CHAR 7/10/01	7/10/03
	Line Impedance Stabilization . . .	Electro-Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03
	Line Impedance Stabilization . . .	Electro-Metrics	EM-7820	2682	CAL 3/16/01	3/16/03
	Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 5/25/99	5/25/01
	Termaline Wattmeter	Bird Electronic Corporation	6104	1926	CAL 12/12/01	12/12/03
	Oscilloscope	Tektronix	2230	300572	CHAR 2/1/01	2/1/03
X	Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
X	AC Voltmeter	HP	400FL	2213A14499	CAL 10/9/01	10/9/03
	AC Voltmeter	HP	400FL	2213A14261	CHAR 10/15/01	10/15/03
	AC Voltmeter	HP	400FL	2213A14728	CHAR 10/15/01	10/15/03
X	Digital Multimeter	Fluke	77	35053830	CHAR 1/8/02	1/8/04
	Digital Multimeter	Fluke	77	43850817	CHAR 1/8/02	1/8/04
	Digital Multimeter	HP	E2377A	2927J05849	CHAR 1/8/02	1/8/04
	Multimeter	Fluke	FLUKE-77-3	79510405	CAL 9/26/01	9/26/03
	Peak Power Meter	HP	8900C	2131A00545	CHAR 1/26/01	1/26/03
	Digital Thermometer	Fluke	2166A	42032	CAL 1/16/02	1/16/04
	Thermometer	Traulsen	SK-128		CHAR 1/22/02	1/22/04
X	Temp/Humidity gauge	EXTech	44577F	E000901	CHAR 1/22/02	1/22/04
	Frequency Counter	HP	5352B	2632A00165	CAL 11/28/01	11/28/03
	Power Sensor	Agilent Technologies	84811A	2551A02705	CAL 1/26/01	1/26/03
	Service Monitor	IFR	FM/AM 500A	5182	CAL 11/22/00	11/22/02
	Comm. Serv. Monitor	IFR	FM/AM 1200S	6593	CAL 5/12/02	5/12/04
	Signal Generator	HP	8640B	2308A21464	CAL 11/15/01	11/15/03
	Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M\MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Near Field Probe	HP	HP11940A	2650A02748	CHAR 2/1/01	2/1/03
	BandReject Filter	Lorch Microwave	5BR4-2400/ 60-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	6BR6-2442/ 300-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	5BR4-10525/ 900-S	Z1	CHAR 3/2/01	3/2/03
	High Pas Filter	Microlab	HA-10N		CHAR 10/4/01	10/4/03
	Audio Oscillator	HP	653A	832-00260	CHAR 3/1/01	3/1/03
	Frequency Counter	HP	5382A	1620A03535	CHAR 3/2/01	3/2/03
	Frequency Counter	HP	5385A	3242A07460	CHAR 12/11/01	12/11/03
	Preamplifier	HP	8449B-H02	3008A00372	CHAR 3/4/01	3/4/03
	Amplifier	HP	11975A	2738A01969	CHAR 3/1/01	3/1/03
	Egg Timer	Unk			CHAR 8/31/01	8/31/03
	Measuring Tape, 20M	Kraftixx	0631-20		CHAR 2/1/02	2/1/04
	Measuring Tape, 7.5M	Kraftixx	7.5M PROFI		2/1/02	2/1/04
	Coaxial Cable #51	Insulated Wire Inc.	NPS 2251-2880	Timco #51	CHAR 1/23/02	1/23/04
	Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 1/24/02	1/24/04
	Coaxial Cable #65	General Cable Co.	E9917 RG233/U	Timco #65	CHAR 1/23/02	1/23/04
	Coaxial Cable #106	Unknown	Unknown	Timco #106	CHAR 1/23/02	1/23/04

APPLICANT: MIDLAND RADIO CORPORATION

FCC ID: MMA700671A

REPORT #: M\MidlandRadio\_MMA\1157ZUT2\1157ZUT2TestReport.doc