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FCC PART 90 TEST REPORT

APPLICANT	MIDLAND RADIO CORPORATION
	5900 PARRETTA DRIVE
	KANSAS CITY MO 64120 USA
FCC ID	MMASD225U2
MODEL NUMBER	SD225U2
PRODUCT DESCRIPTION	DATA MODULE
DATE SAMPLE RECEIVED	11/15/2006
DATE TESTED	12/4/2006
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	3151AUT6TestReport.doc
TOTAL PAGES	28
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.**



Certificate # 0955-01

STATEMENT OF COMPLIANCE

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. No modifications were made to the equipment during testing in order to demonstrate compliance with these standards.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.



Certificate #0955-01

Authorized by: Mario de Aranzeta

Signature: <Mario de Aranzeta>

Function: Engineer

Date: 1/4/2007

GENERAL INFORMATION

DUT Specification

The test results relate only to the items tested.	
DUT Description	DATA MODULE
FCC ID	MMASD225U2
Model Number	SD225U2
Serial Number	N/A
Operating Frequency	440 – 480 MHz
No. of Channels	16
Type of Emission	F3E, F2D
Modulation	FM
DUT Power Source	<input checked="" type="checkbox"/> 110–120Vac/50– 60Hz
	<input type="checkbox"/> DC Power
	<input 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 checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Antenna Connector	BNC
Test Condition	The temperature was 26°C with a relative humidity of 50%.
Modification to the DUT	None
Test Exercise	The DUT was placed in continuous transmit mode.
Applicable Standards	TIA 603-C:2004, FCC CFR 47 Part 90
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C:2004 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

Radiation Interference: The test procedure used was ANSI C63.4-2003 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

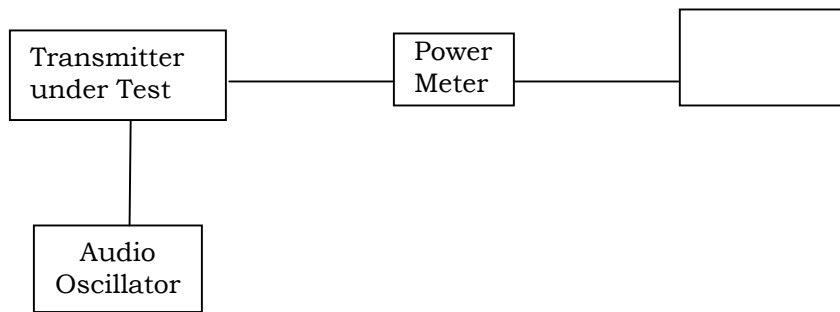
RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), Part 87.131

Test Requirements:

Method of Measurement: RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data:

OUTPUT POWER: HIGH – 5.00 Watts
 LOW - 1.00 Watts

Part 2.1033 (C)(8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER: $(12.0V)(0.54A) = 6.48$ Watts
 FOR HIGH POWER SETTING INPUT POWER: $(12.0V)(1.4A) = 16.80$ Watts

MODULATION CHARACTERISTICS

Part 2.1033(c)

Part 2.1033(c) (4) Type of Emission: 11K2F2D

Part 90.209

Part 90.207 $B_n = 2M + 2DK$

$$M = B/2 = 9600/2 = 4800$$

$$D = 800$$

$$K=1$$

$$B_n = 2(4800) + 2(800) = 11.2k$$

Part 2.1033(c) (4) Type of Emission: 10K8F3E

Part 90.209

Part 90.207 $B_n = 2M + 2DK$

$$M = 3000$$

$$D = 2400$$

$$K=1$$

$$B_n = 2(3000) + 2(2400) = 10.8k$$

Part 2.1033(c) (4) Type of Emission: 15K2F3E

Part 90.209

Part 90.207 $B_n = 2M + 2DK$

$$M = 3000$$

$$D = 4600$$

$$K=1$$

$$B_n = 2(3000) + 2(4600) = 15.2k$$

Part 2.1033(c) (4) Type of Emission: 20K0F2D

Part 90.209

Part 90.207 $B_n = 2M + 2DK$

$$M = 19200/2 = 9600$$

$$D = 400$$

$$K=1$$

$$B_n = 2(9600) + 2(400) = 20.0k$$

MODULATION CHARACTERISTICS

Rule Part No.: Part 2.1047(a)(b)

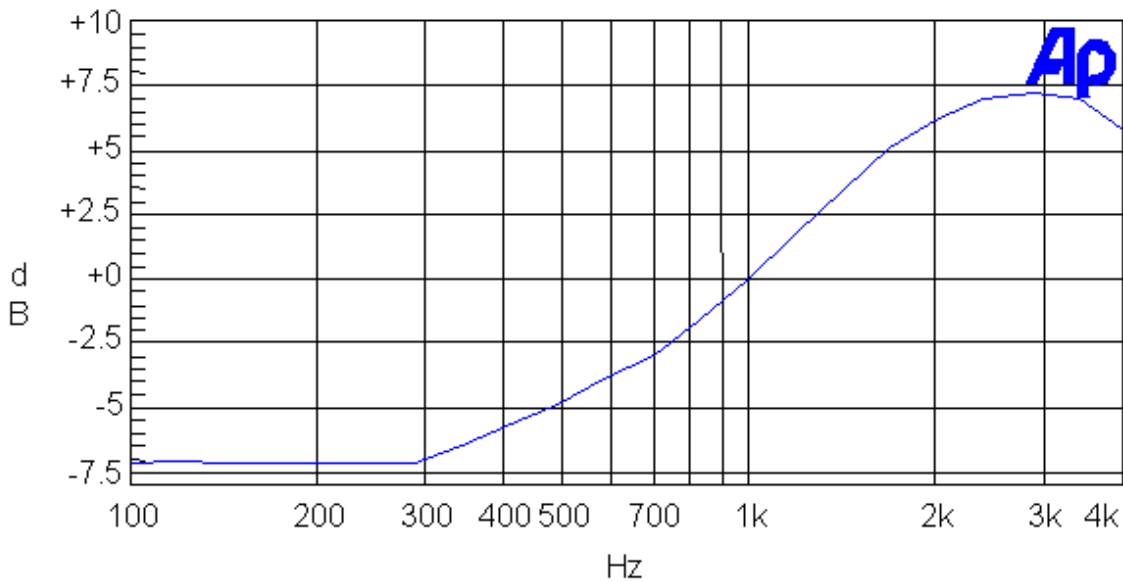
Test Requirements:

Method of Measurement:

Audio frequency response

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with no exception. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.

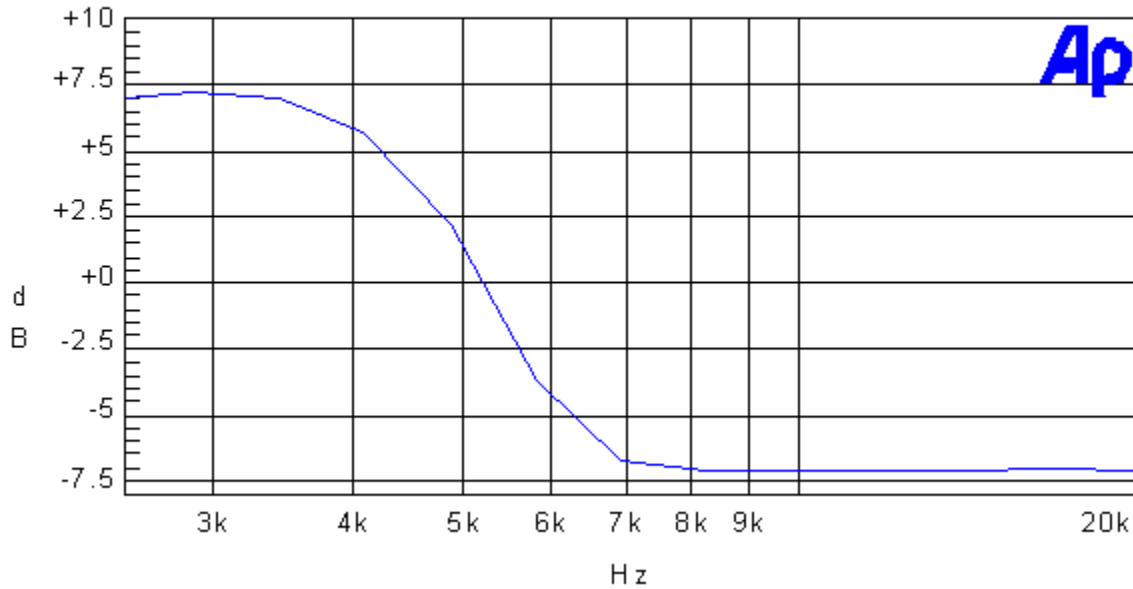
Audio Frequency Response Plot



VOICE MODULATED COMMUNICATION EQUIPMENT

Part 2.1047(a) Voice modulated communication equipment: For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Audio Low Pass Filter



AUDIO INPUT VERSUS MODULATION

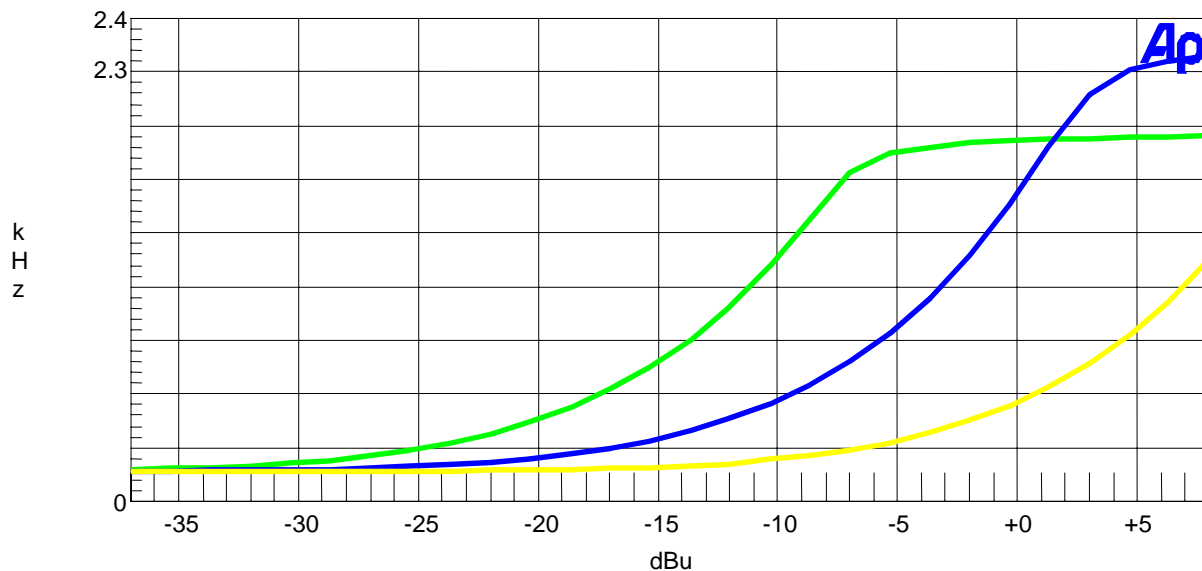
Rule Part No.: Part 2.1047(b) & 90

Test Requirements:

Method of Measurement: **Modulation cannot exceed 100%**, The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C:2004. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz.

Test data: 12.5kHz Channel Spacing:

Modulation Limiting Plot
2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz (Yellow)



Color	Line Style	Thick	Data	Axis
Green	Solid	3	Anlr.Level A	Left
Blue	Solid	3	Anlr.Level A	Left
Yellow	Solid	3	Anlr.Level A	Left

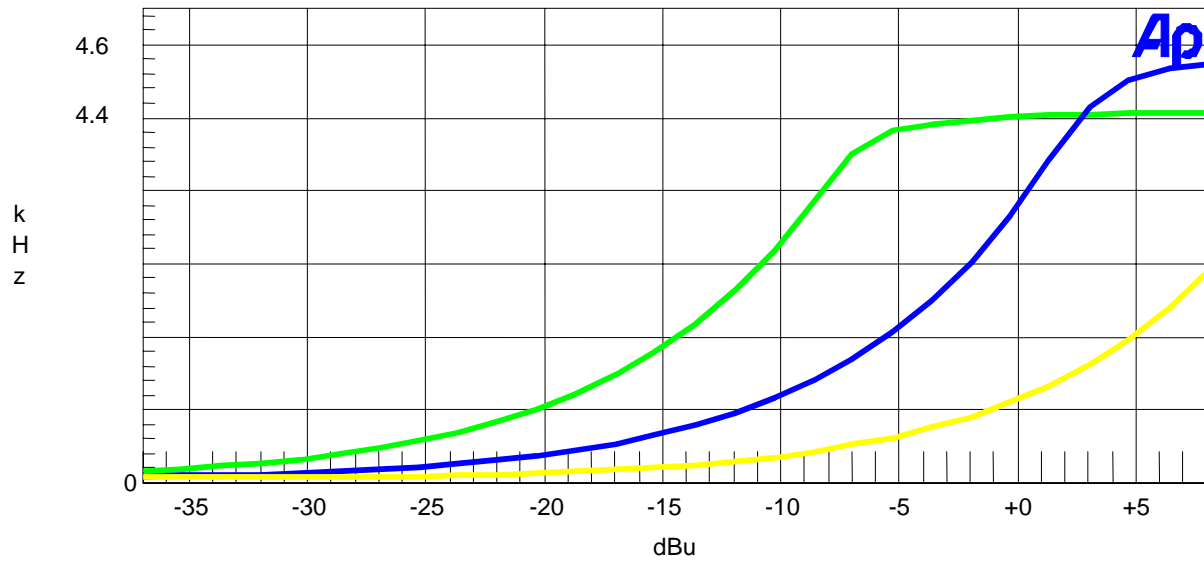
Applicant: MIDLAND RADIO CORPORATION

FCC ID: MMASD225U2

Report: M\MidlandRadio_MMA\3151AUT6\3151AUT6TestReport.doc

25kHz Channel Spacing:

**Modulation Limiting Plots:
2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz (Yellow)**



Color	Line Style	Thick	Data	Axis
Green	Solid	3	Anlr.Level A	Left
Blue	Solid	3	Anlr.Level A	Left
Yellow	Solid	3	Anlr.Level A	Left

Part 2.1049 Occupied bandwidth:

Part 90.210(b) 25kHz Channel Spacing

Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least $43 + 10\log(P)$ dB.

Part 90.210(c) 12.5kHz Channel Spacing Not Equipped with a Low Pass Filter

For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz but not more than 10 kHz: At least $83 \log(f_d/5)$ dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least $29 \log(f_d/11)$ dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least $43 + 10 \log(P_o)$ dB.

Part 90.210(d) Emission Mask D - 12.5 kHz channel BW equipment.

For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least $7.27(f_d - 2.88)$ kHz) dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10\log(P)$ dB or 70 dB, whichever is the lesser attenuation.

Part 90.210(e) Emission Mask E - 6.25 kHz channel BW equipment.

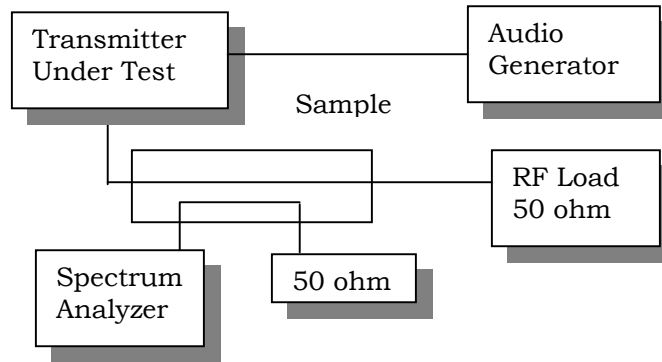
For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.
- (2) On any frequency from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3.0)$ kHz) or $55 + 10 \log(P)$ or 65, whichever us the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6kHz: At least $55 + 10\log(P)$ dB or 65 dB, whichever is the lesser attenuation.

OCCUPIED BANDWIDTH MEASUREMENT

Test procedure: ANSI/TIA-603-C:2004 para 2.2.11.

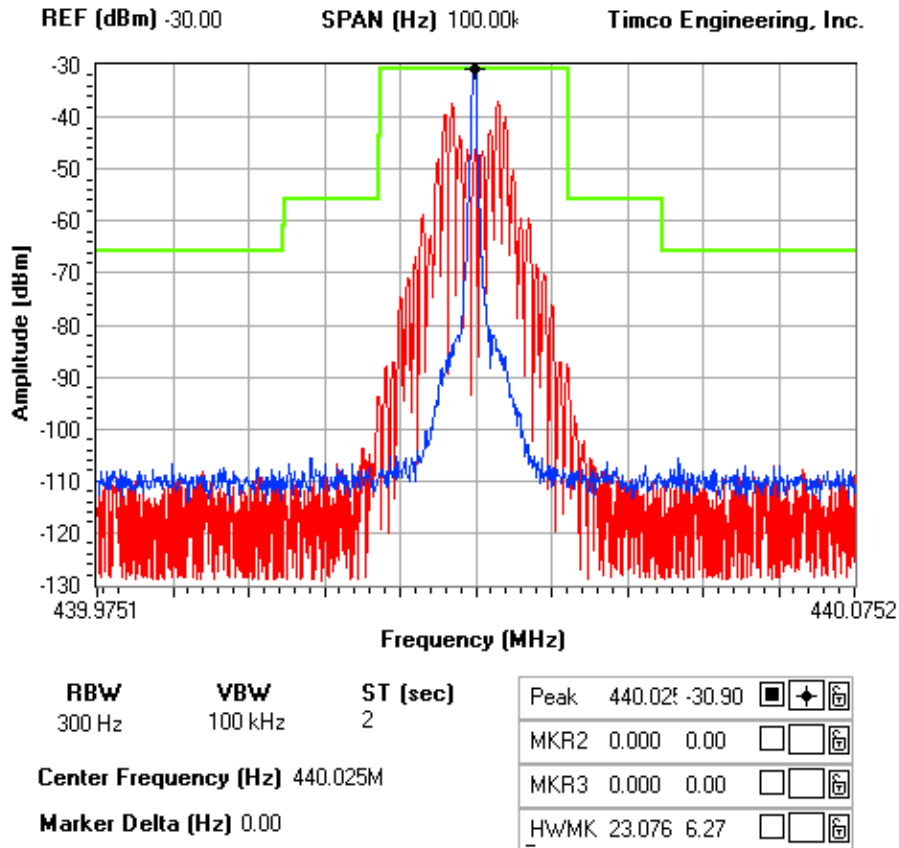
Test Setup Diagram:



OCCUPIED BANDWIDTH
Part 90.210(b) 25 kHz Channel Spacing

NOTES:

MIDLAND RADIO CORPORATION - FCC ID: MMASD225U2
 OCCUPIED BANDWIDTH PLOT - WIDE BAND



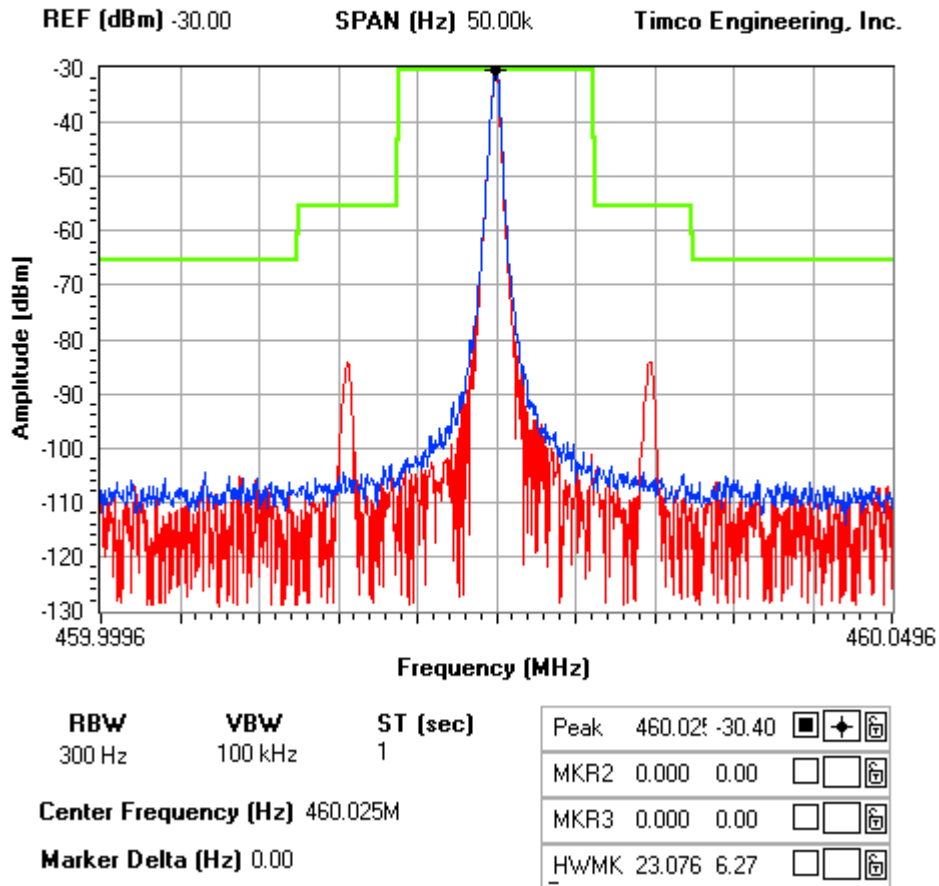
Applicant: MIDLAND RADIO CORPORATION

FCC ID: MMASD225U2

Report: M\MidlandRadio_MMA\3151AUT6\3151AUT6TestReport.doc

NOTES:

MIDLAND RADIO CORPORATION - FCC ID: MMASD225U2
 OCCUPIED BANDWIDTH PLOT - DATA INPUT



Applicant: MIDLAND RADIO CORPORATION

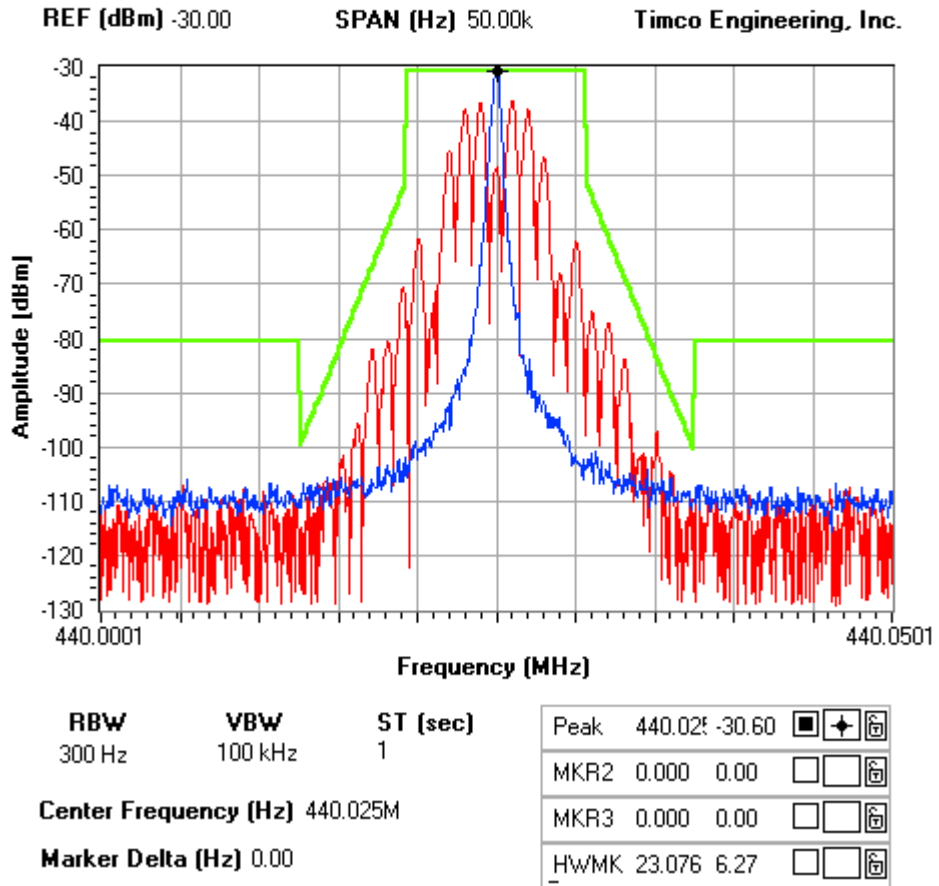
FCC ID: MMASD225U2

Report: M\MidlandRadio_MMA\3151AUT6\3151AUT6TestReport.doc

Part 90.210(d) Emission Mask D - 12.5 kHz channel

NOTES:

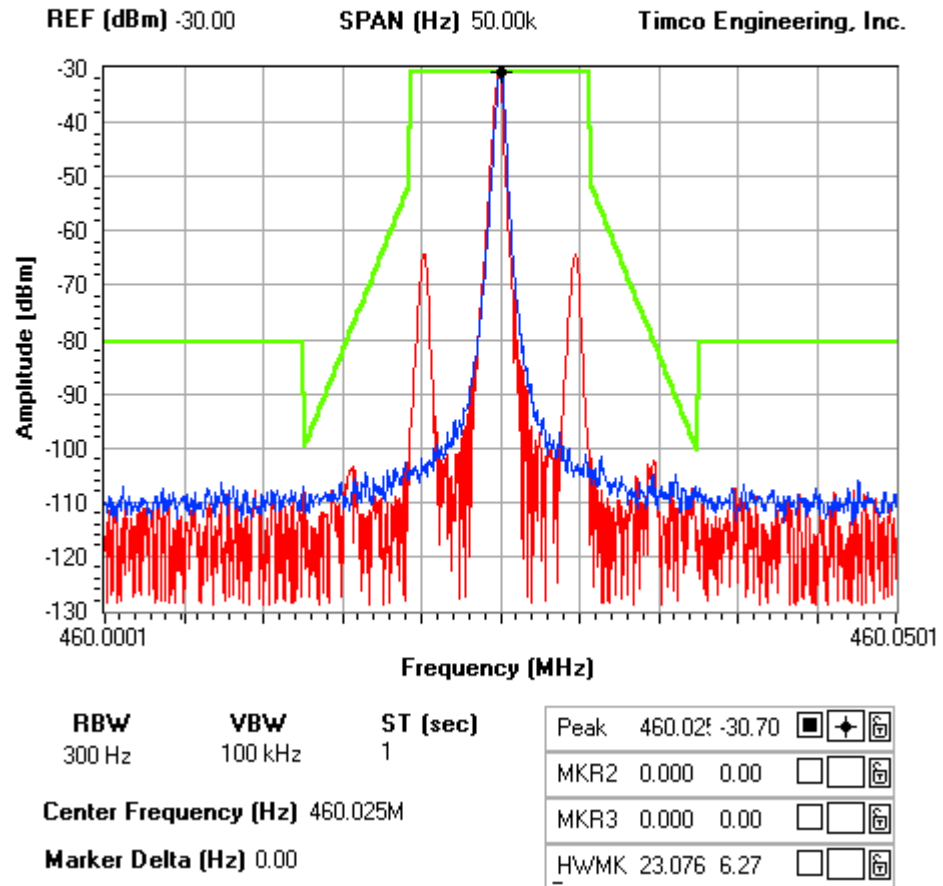
MIDLAND RADIO CORPORATION - FCC ID: MMASD225U2
 OCCUPIED BANDWIDTH PLOT - NARROW BAND



NOTES:

MIDLAND RADIO CORPORATION - FCC ID: MMASD225U2
 OCCUPIED BANDWIDTH PLOT - DATA INPUT

FCC 90.210 Mask D



Applicant: MIDLAND RADIO CORPORATION

FCC ID: MMASD225U2

Report: M\MidlandRadio_MMA\3151AUT6\3151AUT6TestReport.doc

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

Requirements: 25kHz Channel Spacing HIGH POWER: $43+10\log(5) = 50$ dBc
 LOW POWER: $43+10\log(1) = 43$ dBc
 12.5kHz Channel Spacing HIGH POWER: $50+10\log(5) = 57$ dBc
 LOW POWER: $50+10\log(1) = 50$ dBc

Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA-603-C:2004.

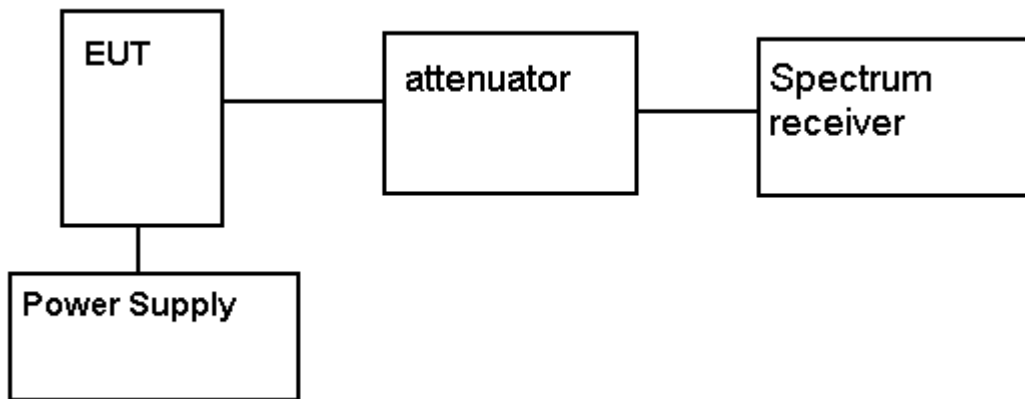
Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
440.04	880.08	76.3		440.04	880.08	69.1
	1320.12	65.6			1320.12	68.6
	1760.16	90.9			1760.16	88.3
	2200.20	88.4			2200.20	90.3
	2640.24	89.9			2640.24	90.9
	3080.28	83.4			3080.28	82.7
	3520.32	101.2			3520.32	87.6
	3960.36	87.7			3960.36	88.3
	4400.40	99			4400.40	92.4

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
460.00	920.00	75.8		460.00	920.00	80.4
	1380.00	70.5			1380.00	70.6
	1840.00	85			1840.00	90.3
	2300.00	82.6			2300.00	84.9
	2760.00	90.5			2760.00	90
	3220.00	79.5			3220.00	83.5
	3680.00	91.3			3680.00	80.5
	4140.00	95.5			4140.00	92.9
	4600.00	97.5			4600.00	92.4

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
479.95	959.90	77.6		479.95	959.90	81.3
	1439.85	69.9			1439.85	68.8
	1919.80	90.1			1919.80	85.4
	2399.75	92.3			2399.75	86.2
	2879.70	95.6			2879.70	86.4
	3359.65	92.5			3359.65	90.5
	3839.60	96.7			3839.60	90.1
	4319.55	99.9			4319.55	92.6
	4799.50	99.4			4799.50	93.6

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA 603-C:2004. The measurements were made at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

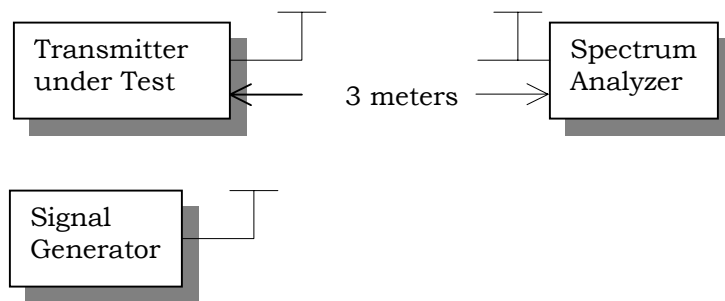
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Requirements: The FCC limits for radiated emissions are the same as previously stated for the conducted emission

METHOD OF MEASUREMENT: 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 ANSI/TIA 603-C:2004 using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

Test Setup Diagram:



Test Data:

High power:

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
440.04	0	0
880.08	V	65.4
1320.12	V	65.6784
1760.16	H	88.7245
2200.20	V	90.1467
2640.24	V	88.3689
3080.28	V	80.0911
3520.32	H	80.6253
3960.36	H	85.8115
4400.40	V	83.6976

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
460.00	0	0
920.00	V	66.88
1380.00	H	66.85
1840.00	V	77.58
2300.00	H	84.88
2760.00	V	83.29
3220.00	H	86.80
3680.00	V	86.22
4140.00	V	87.76
4600.00	V	87.13

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
479.95	0	0
959.90	V	63.96
1439.85	V	67.82
1919.80	H	80.12
2399.75	V	86.42
2879.70	V	73.72
3359.65	V	87.41
3839.60	V	82.11
4319.55	H	85.28
4799.50	V	87.31

Low power:

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
440.04	0	0
880.08	V	66.71
1320.12	V	63.5884
1760.16	V	74.0345
2200.20	V	86.0567
2640.24	H	86.4789
3080.28	V	78.4011
3520.32	H	75.9353
3960.36	H	84.9215
4400.40	H	80.5076

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
460.00	0	0
920.00	V	61.79
1380.00	V	61.36
1840.00	H	86.89
2300.00	H	82.69
2760.00	H	82.20
3220.00	V	83.71
3680.00	H	77.33
4140.00	V	84.47
4600.00	V	83.54

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
479.95	0	0
959.90	V	62.77
1439.85	H	72.43
1919.80	V	74.53
2399.75	V	77.73
2879.70	V	72.73
3359.65	V	81.32
3839.60	V	77.32
4319.55	H	80.89
4799.50	V	81.22

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%

Method of Measurements: ANSI/TIA 603-C:2004

Test Data:

Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	460.024492	-1.18
-20	460.026010	2.12
-10	460.026163	2.45
0	460.025873	1.82
+10	460.025575	1.17
+20	460.025315	0.60
+30	460.025073	0.08
+40	460.024811	-0.49
+50	460.024497	-1.17

Battery %	Frequency (MHz)	Frequency Stability (PPM)
-15%	460.025305	0.58
0	460.025037	0.00
+15%	460.025328	0.63



Part 2.1055(a)(1)

Part 90.214

Transient Frequency Behavior

REQUIREMENTS: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz

Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels

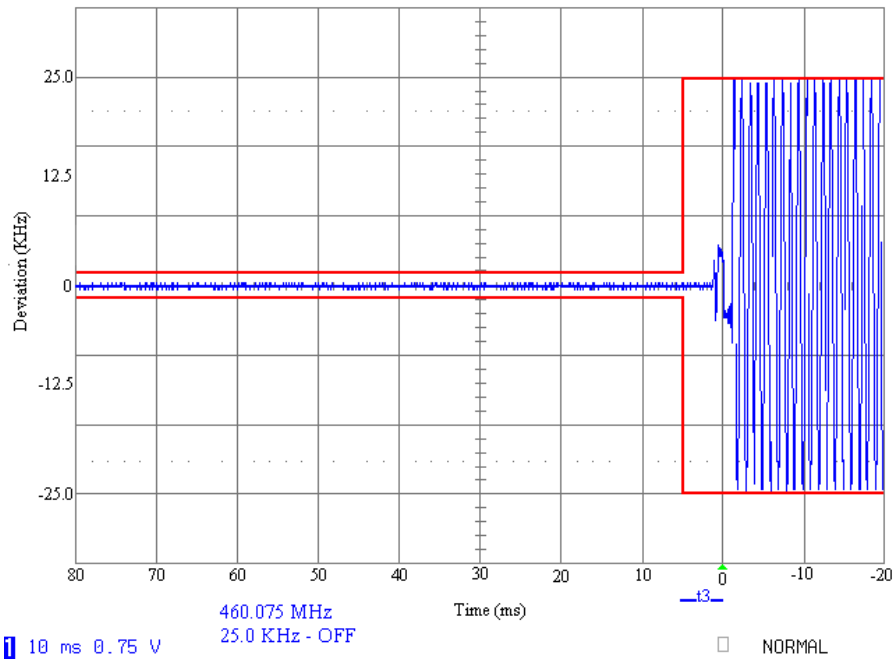
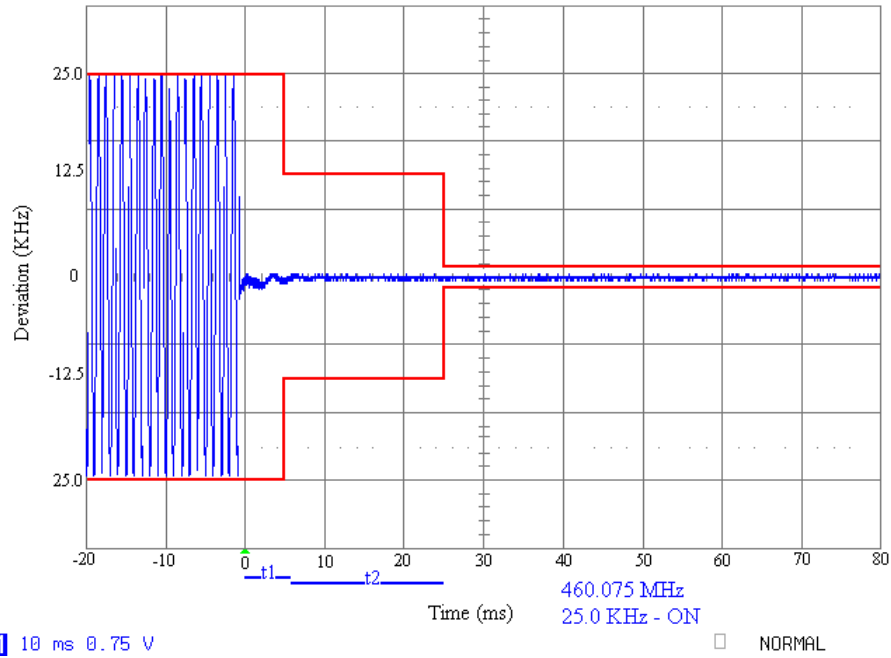
t_1^4	± 25.0 kHz	5.0 mS	10.0 mS
t_2	± 12.5 kHz	20.0 mS	25.0 mS
t_3^4	± 25.0 kHz	5.0 mS	10.0 mS

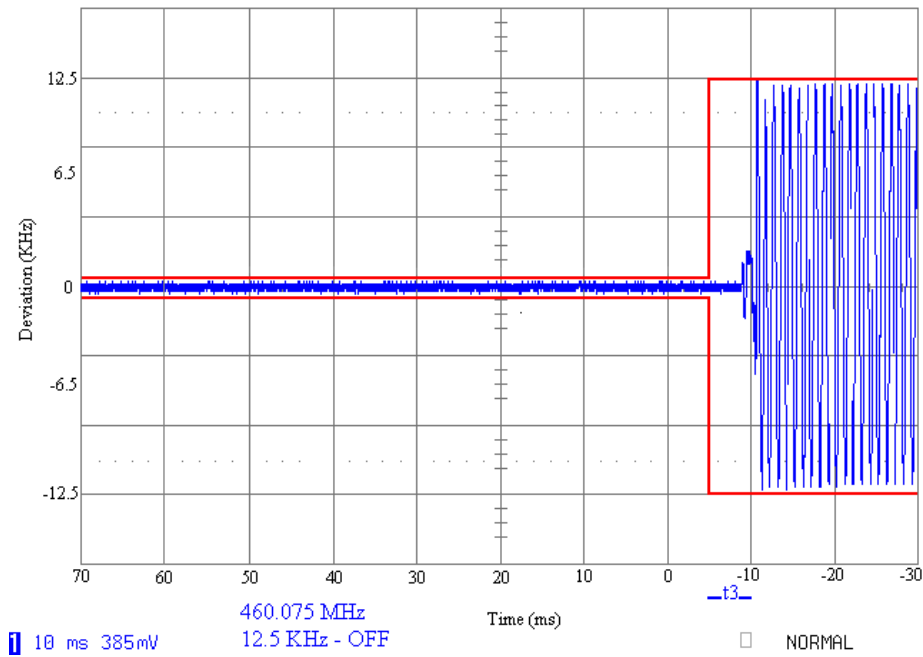
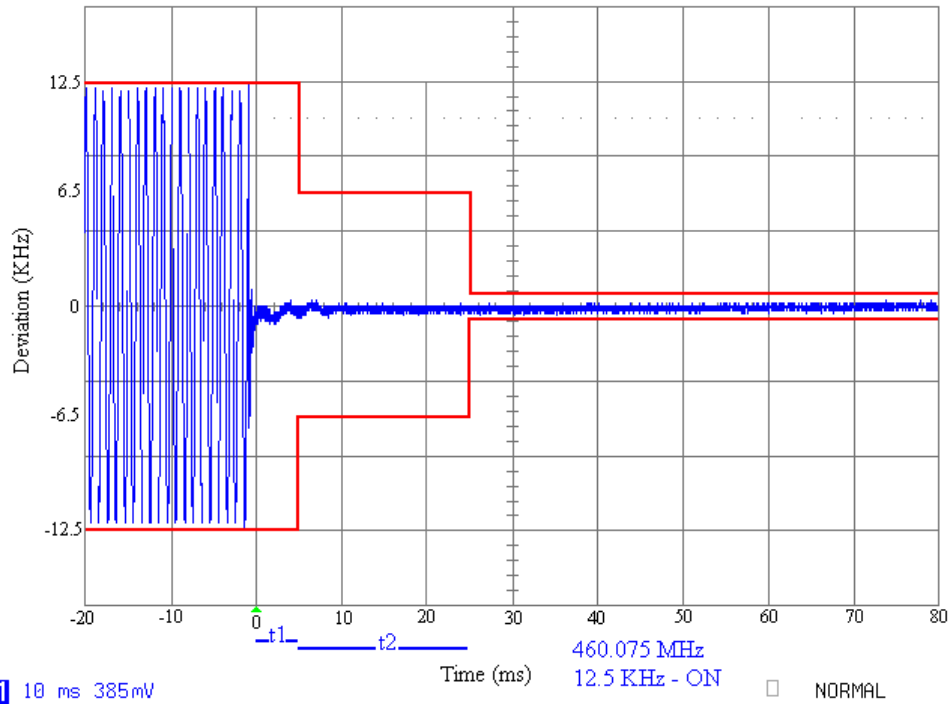
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

t_1^4	± 12.5 kHz	5.0 mS	10.0 mS
t_2	± 6.25 kHz	20.0 mS	25.0 mS
t_3^4	± 12.5 kHz	5.0 mS	10.0 mS

Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

t_1^4	± 6.25 kHz	5.0 mS	10.0 mS
t_2	± 3.125 kHz	20.0 mS	25.0 mS
t_3^4	± 6.25 kHz	5.0 mS	10.0 mS





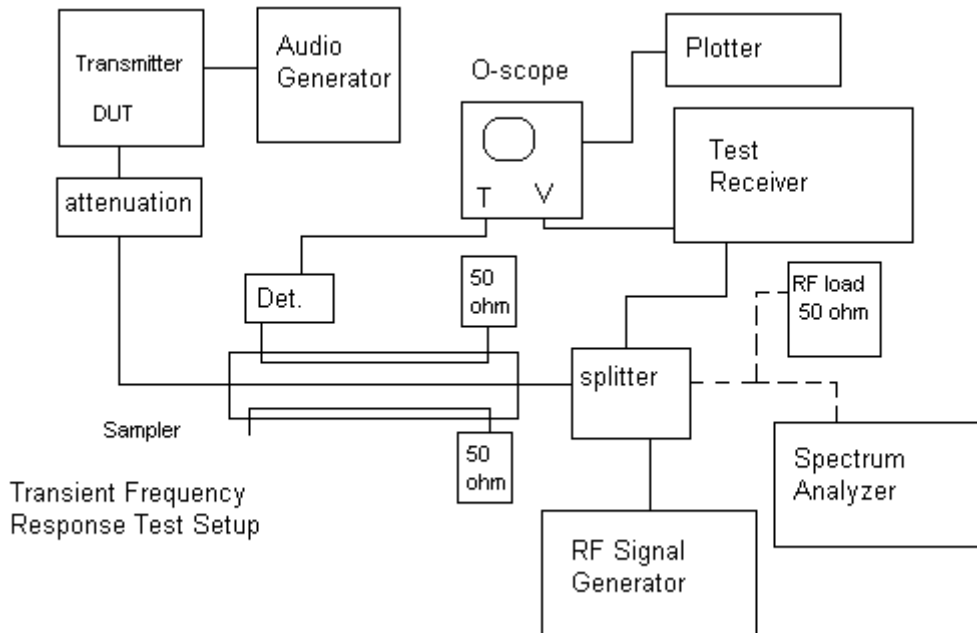
Applicant: MIDLAND RADIO CORPORATION

FCC ID: MMASD225U2

Report: M\MidlandRadio_MMA\3151AUT6\3151AUT6TestReport.doc

TEST PROCEEDURE: ANSI/TIA 603-C:2004 PARA 2.2.19

1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
3. Reduce the attenuation between the transmitter and the RF detector by 30 dB.
4. With the levels set as above the transient frequency behavior was observed & recorded.



EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 12/7/05	12/7/07
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 12/7/05	12/7/07
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 12/8/05	12/8/07
Analyzer Tan Tower Preamplifier	HP	8449B- H02	3008A00372	CAL 12/8/05	12/8/07
Antenna: Biconnical	Electro- Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Antenna: Log- Periodic	Electro- Metrics	LPA-25	1122	CAL 8/26/04	8/26/06
Antenna: Double- Ridged Horn	Electro- Metrics	RGA-180	2319	CAL 12/29/04	12/29/06
LISN	Electro- Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08
Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 7/16/04	7/16/06