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## FCC PART 90 TEST REPORT

APPLICANT	MIDLAND RADIO CORPORATION
	5900 PARRETTA DRIVE
	KANSAS CITY, MO 64120 USA
FCC ID	MMA700671C
MODEL NUMBER	70-0671C/70-0674C
PRODUCT DESCRIPTION	NON-BROADCAST TRANSMITTER
DATE SAMPLE RECEIVED	9/17/07
DATE TESTED	9/26/07
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	3092ZUT7TestReport.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.**



Certificate # 0955-01



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Applicant: MIDLAND RADIO CORPORATION

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## 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.

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.

**Authorized by:** Mario de Aranzeta

**Signature:** *Mario de Aranzeta*

**Function:** Engineer

**Date:** 11/6/07

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**GENERAL INFORMATION**

**DUT Specification**

The test results relate only to the items tested.	
<b>DUT Description</b>	NON-BROADCAST TRANSMITTER
<b>FCC ID</b>	MMA700671C
<b>Model Numbers</b>	70-0671C, 70-0674C
<b>Serial Number</b>	N/A
<b>Operating Frequency</b>	42-50 MHz
<b>Modulation</b>	FM
<b>DUT Power Source</b>	<input type="checkbox"/> 110-120Vac/50- 60Hz
	<input checked="" type="checkbox"/> DC Power
	<input 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 checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
<b>Test Facility</b>	Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669
<b>Test Condition</b>	The temperature was 26°C with a relative humidity of 50%.
<b>Modification to the DUT</b>	None
<b>Test Exercise (e.g software description, test signal, etc.</b>	The DUT was placed in continuous transmit mode of operation.
<b>Applicable Standards</b>	ANSI/TIA 603-C ,FCC CFR 47 Part 90

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**EQUIPMENT LIST**

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/20/07	3/19/10
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/11/07	5/10/10
Biconnical Antenna	Eaton	94455-1	1057	CAL 12/12/05	12/12/07
Biconnical Antenna	Eaton	94455-1	1096	CAL 8/17/06	8/17/08
Tan Tower Quasi-Peak Adapter	HP	85650A	3303AO1690	CAL 12/8/05	12/8/07
Tan Tower RF Preselector	HP	85685A	32211A01400	CAL 12/7/05	12/7/07
Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 12/7/05	12/7/07
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/06	8/27/08
Log-Periodic Antenna	Eaton	96005	1243	CAL 12/14/05	12/14/07

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## TEST PROCEDURES

**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 10<sup>th</sup> 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/TIA 603-C:2004 using an Agilent spectrum receiver with preselector. 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.

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## RF POWER OUTPUT

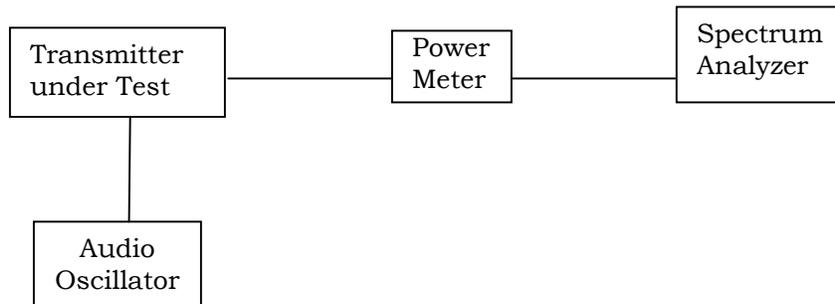
**Rule Part No.:** Part 2.1046(a), Part 90

### Test Requirements:

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

For a device that has a fixed antenna, RF power is measured as ERP as the antenna is permanently attached. The substitution method was used. With a nominal battery voltage, and the transmitter properly adjusted the RF output measures:

### Test Setup Diagram:



### Test Data:

OUTPUT POWER: HIGH – 110 Watts

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

INPUT POWER:  $(13.6V)(17.9A) = 243$  Watts

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**MODULATION CHARACTERISTICS**

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

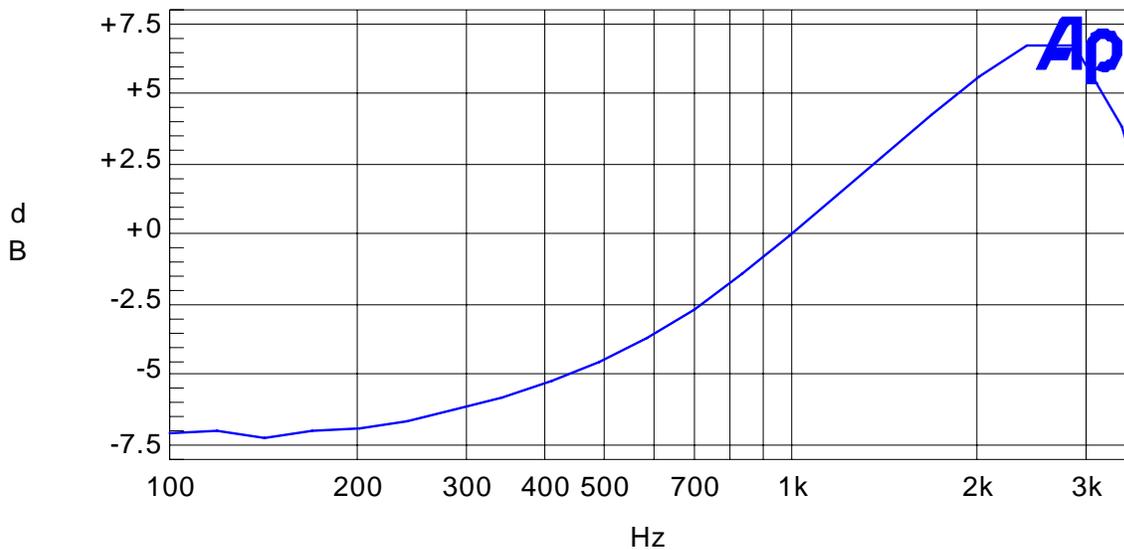
**Test Requirements:**

**Method of Measurement:**

*Audio frequency response*

The audio frequency response was measured in accordance with ANSI/TIA 603-C:2004 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**



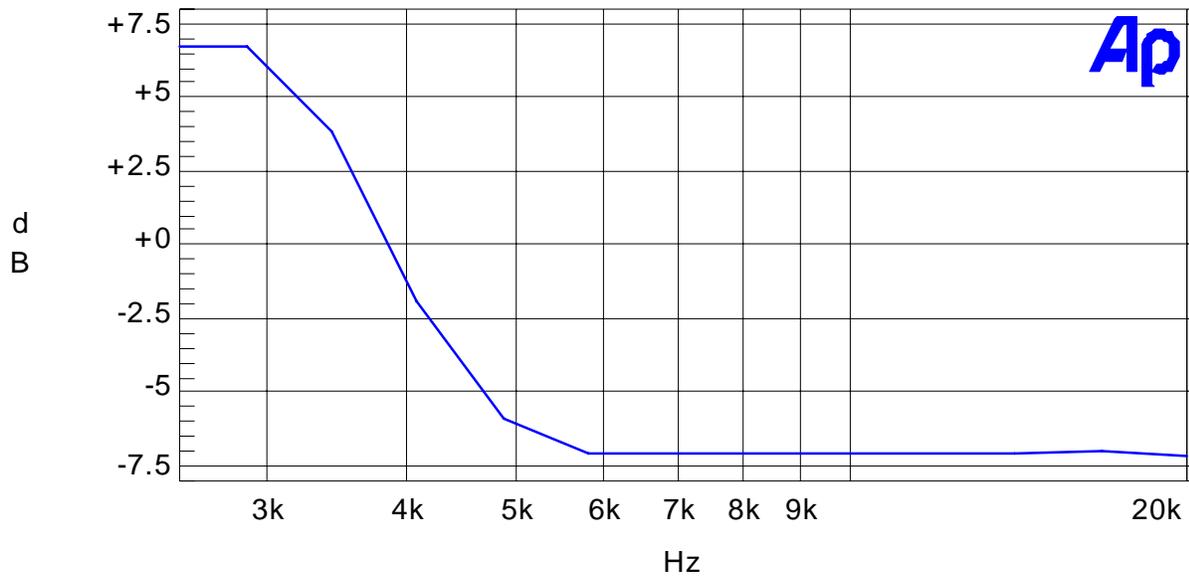
Color	Line Style	Thick	Data	Axis
Blue	Solid	1	Anlr.Level A!Normalize	Left

MaxFreq.at1

**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**



Color	Line Style	Thick	Data	Axis
Blue	Solid	1	Anlr.Level A!Normalize	Left

MaxFreq.at1



## AUDIO INPUT VERSUS MODULATION

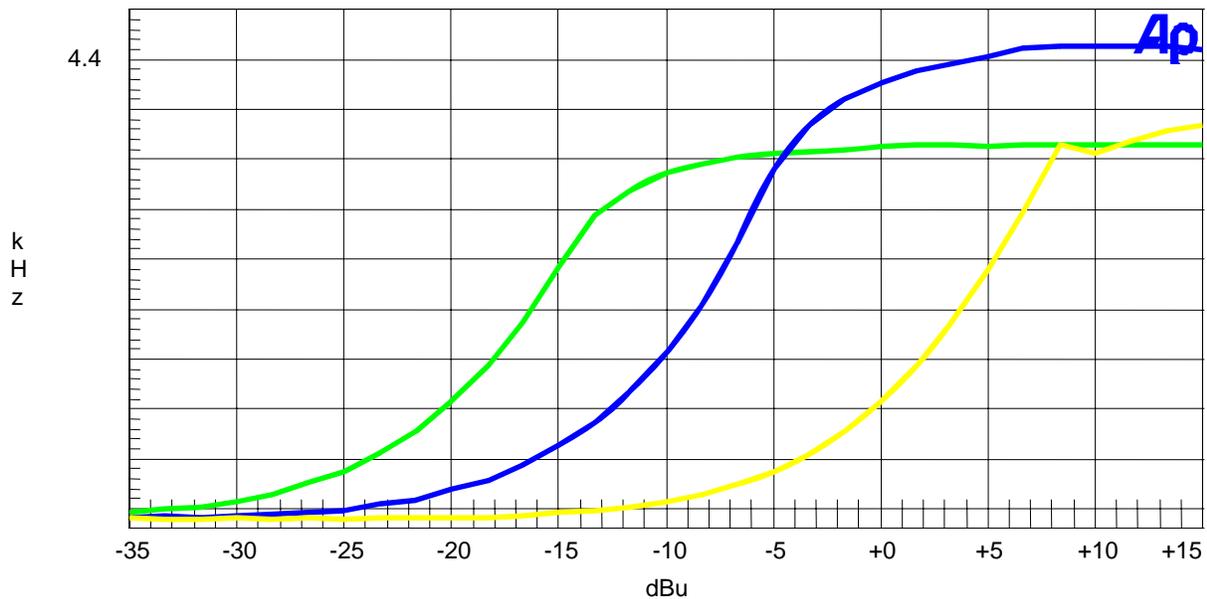
**Rule Part No.:** Part 2.1047(b) & 90

### Test Requirements:

**Method of Measurement:** Modulation shall not 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 3000 Hz.

### Test data:

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

modulation limiting.at1

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## **OTHER MODULATION CHARACTERISTICS**

**Part 2.1033(c) (4)** Type of Emission: 16K0F3E

**Part 90.209**

**Part 90.207**  $B_n = 2M + 2DK$

$M = 3000$

$D = 4700$

$K=1$

$B_n = 2(3000)+2(4700) = 15.4k$

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**OCCUPIED BANDWIDTH**

**Part 2.1049(c)**  
**Part 90.210(b) 25 kHz 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.

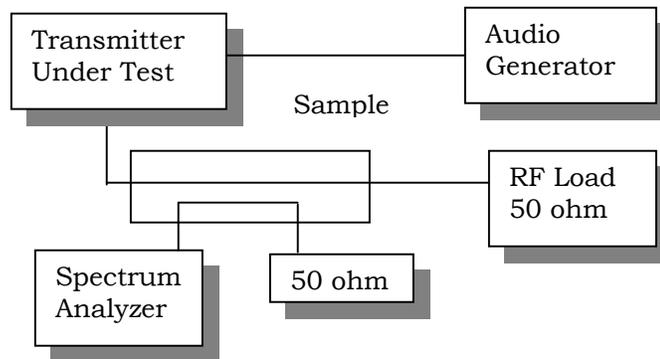
**Part 90.210(d) Emission Mask D - 12.5 kHz channel BW equipment.**

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  $7.27 (f_d - 2.88 \text{ kHz})$  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.

**Method of Measurement: ANSI/TIA 603-C:2004**

**Test Setup Diagram:**



See the following plots



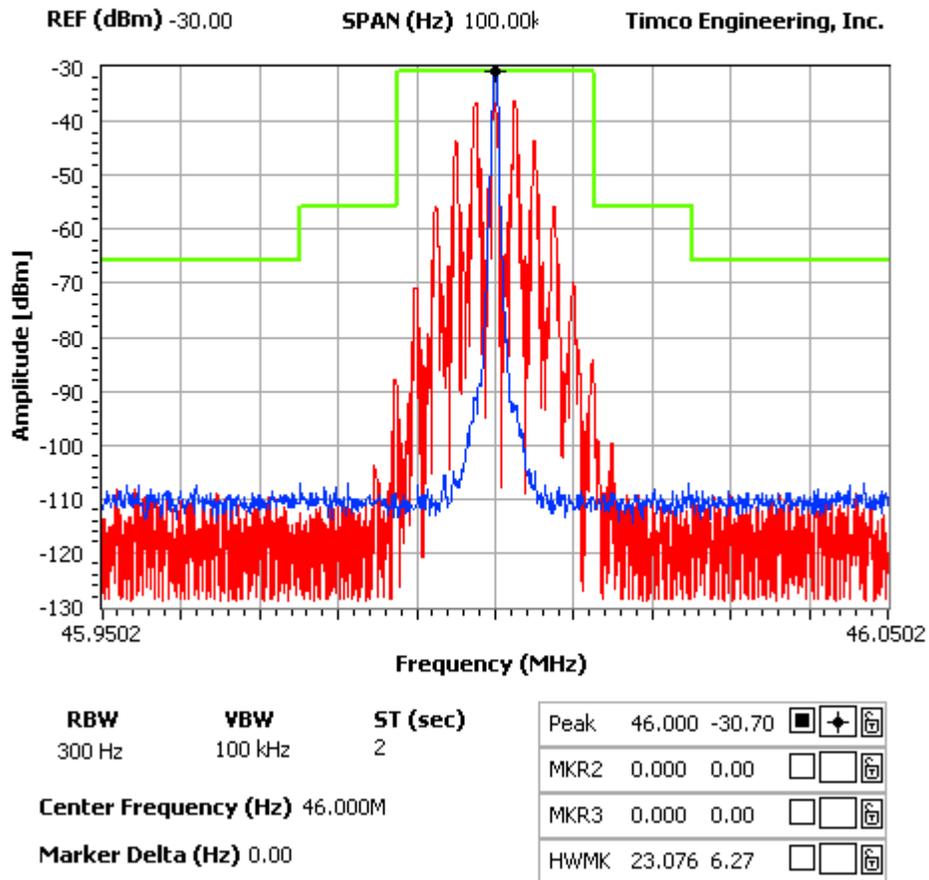
**OCCUPIED BANDWIDTH PLOTS**

**Part 90.210(d) Emission Mask D - 25 kHz channel**

**NOTES:**

MIDLAND RADIO CORPORATION\_NCP - FCC ID: NCP700671C  
 OCCUPIED BANDWIDTH PLOT

**FCC 90.210 Mask B**



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**SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)**

**Rule Part No.:** Part 2.1051(a)

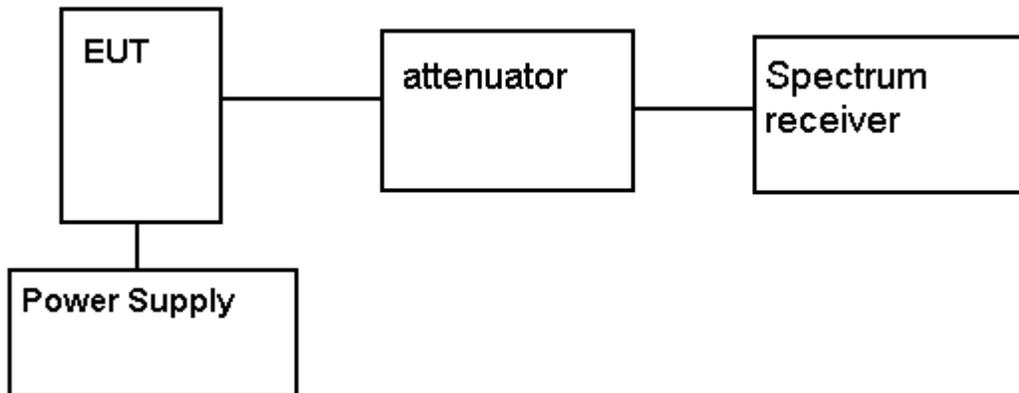
**Requirements:** For 25 kHz  $43 + 10\log(110) = 63.4$  dB

**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:**

EF	dB below carrier		EF	dB below carrier
46.00	0		50.00	0
92.00	81.1		100.00	81.4
138.00	81.1		150.00	88.7
184.00	94.5		200.00	92.6
230.00	91.0		250.00	92.1
276.00	98.4		300.00	87.2
322.00	97.4		350.00	94.5
368.00	102.3		400.00	95.0
414.00	101.3		450.00	96.4
460.00	95.1		500.00	101.2

**Method of Measuring Conducted Spurious Emissions**



**FIELD STRENGTH OF SPURIOUS EMISSIONS**

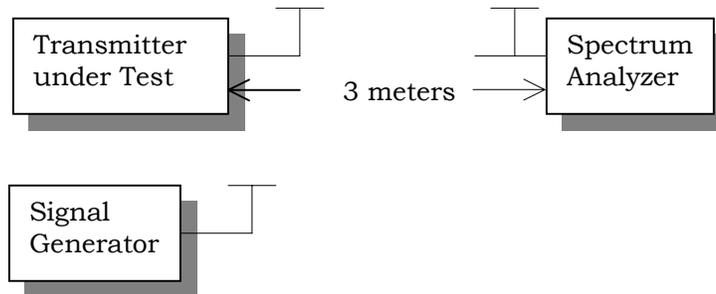
**Rule Parts. No.:** Part 2.1053

**Requirements:**

For 25 kHz  $43 + 10\log(110) = 63.4$  dB

**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:**

**SAMPLE #1**

TUNED FREQUENCY MHz	EMISSION FREQUENCY MHz	dBc	TUNED FREQUENCY MHz	EMISSION FREQUENCY MHz	dBc
46	46.00	0	50	50.00	0
	92.00	84.46		100.00	87.96
	138.00	73.86		150.00	70.36
	184.00	67.70		200.00	74.76
	230.00	66.26		250.00	74.16
	276.00	69.62		300.00	72.06
	322.00	74.56		350.00	67.16
	368.00	80.28		400.00	73.06
	414.00	78.90		450.00	72.46
	460.00	77.40		500.00	75.56



**FREQUENCY STABILITY**

**Rule Parts. No.:** Part 2.1055, Part 90.213

**Requirements:** Temperature range requirements: -30 to +50° C.  
Voltage Variation +, -15%  
±20 PPM

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

**Test Data:**

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		45.999981
<b>Temperature (°C)</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-30	45.999966	-0.33
-20	46.000002	0.46
-10	45.999957	-0.52
0	45.999934	-1.02
+10	45.999954	-0.59
+20	45.999974	-0.15
+30	45.999986	0.11
+40	45.999994	0.28
+50	45.999968	-0.28

<b>Assigned Frequency (Ref. Frequency) (MHz)</b>		
<b>% Battery</b>	<b>Frequency (MHz)</b>	<b>Frequency Stability (PPM)</b>
-15%	45.999975	-0.13
0		
+15%	45.999973	-0.17

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