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FCC PART 90

TEST REPORT

APPLICANT	MIDLAND RADIO CORPORATION
	5900 PARRETTA DRIVE
	KANSAS CITY, MO 64116
FCC ID	MMA901050
MODEL NUMBER	STM1050B
PRODUCT DESCRIPTION	MOBILE TRANSCEIVER
DATE SAMPLE RECEIVED	11/1/2006
DATE TESTED	11/14/2006
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	M\MidlandRadio_MMA\3036AUT6\3036AUT6TestReport.doc
TOTAL PAGES	24
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
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: January 15, 2007

Tested by: Nam Nguyen

GENERAL INFORMATION

DUT Specification

The test results relate only to the items tested.	
DUT Description	MOBILE TRANSCEIVER
FCC ID	MMA901050
Model Number	STM1050B
Operating Frequency	136-174 MHz
No. of Channels Tested	3
Type of Emission	F3E, F2D, F1E, F1D
Modulation	FM
DUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Test Condition	The DUT was tested in the laboratory with normal temperature and humidity. The temperature was 26ºC with a relative humidity of 50%.
Modification to the DUT	None
Test Exercise	The DUT was placed in continuous transmit
Applicable Standards	TIA 603 FCC CFR 47 Part 90
Test Facility	Timco Engineering, Inc. at 849 NW State Road 45 Newberry, FL 32669 USA

TEST PROCEDURES

Power Line Conducted Interference: If required for DUT, 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/TIA 603-C:2004 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.

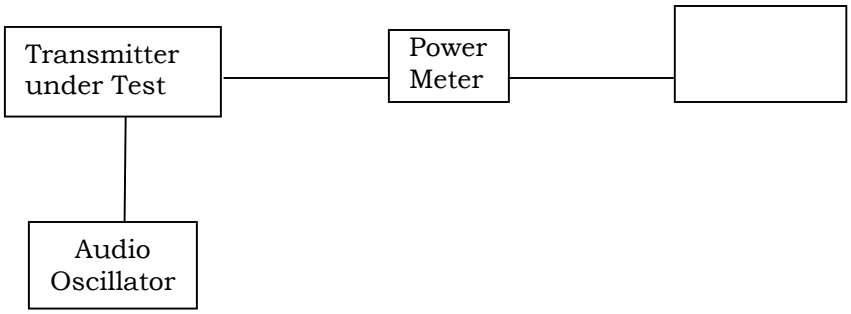
RF POWER OUTPUT

Rule Part No.: Part 2.1046(a),

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 – 50.00 Watts
MID - 32.00 Watts
LOW - 2.50 Watts

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

FOR LOW POWER SETTING INPUT POWER: (13.8V)(2.18A) = 30.08 Watts
FOR HIGH POWER SETTING INPUT POWER: (13.8V)(7.0A) = 96.60 Watts

MODULATION CHARACTERISTICS

Part 2.1033(c)
Part 2.1033(c) (4) Type of Emission: 11K2F2D, 11K2F1D
Part 90.209
Part 90.207 Bn = 2M + 2DK
M = B/2 = 9600/2= 4800
D = 800
K=1
Bn = 2(4800)+2(800) = 11.2k

Part 2.1033(c) (4) Type of Emission: 11K0F3E
Part 90.209
Part 90.207 Bn = 2M + 2DK
M = 3000
D = 2400
K=1
Bn = 2(3000)+2(2400) = 10.8k

Part 2.1033(c) (4) Type of Emission: 16K0F3E
Part 90.209
Part 90.207 Bn = 2M + 2DK
M = 3000
D = 4600
K=1
Bn = 2(3000)+2(4600) = 15.2k

MODULATION CHARACTERISTICS

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

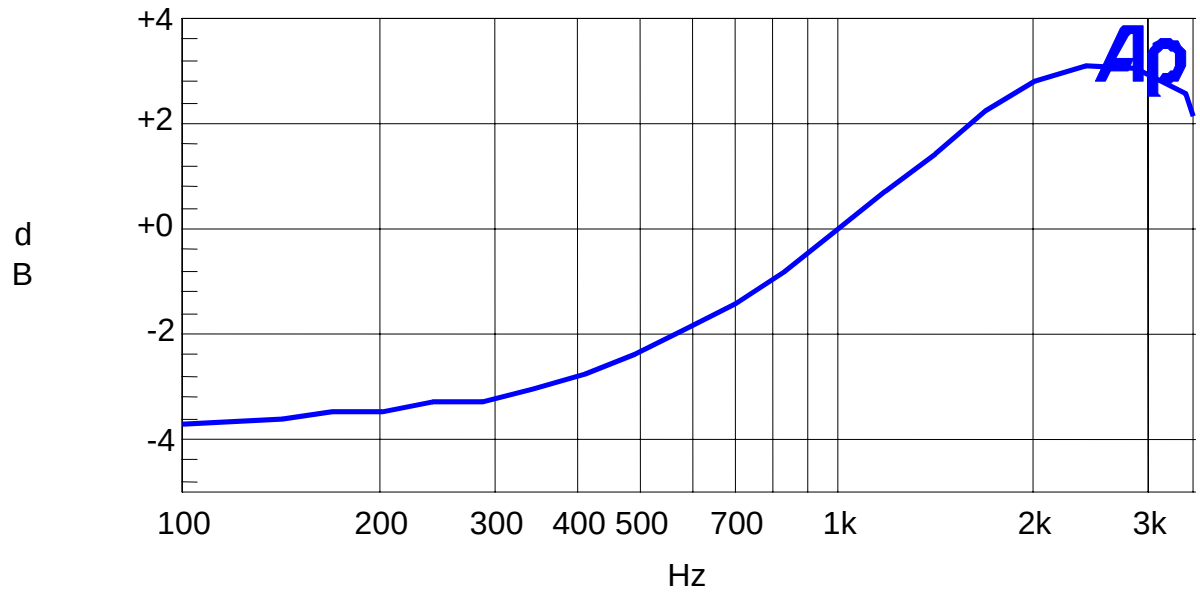
Test Requirements:

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

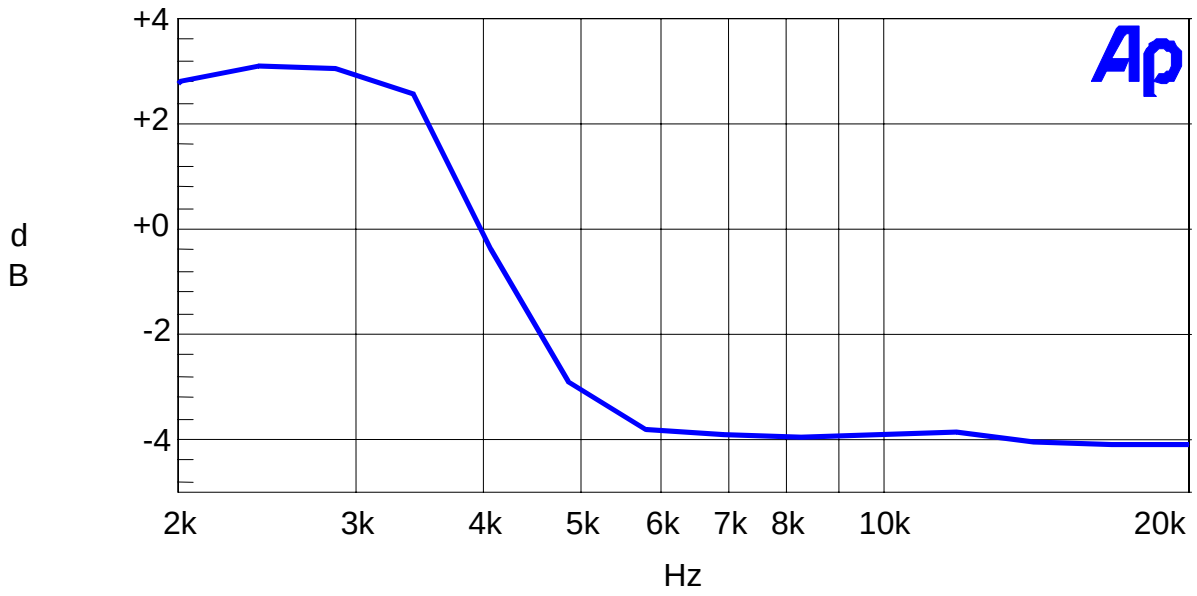


Color	Line Style	Thick	Data	Axis
Blue	Solid	2	Anlr.Level A!Normalize	Left

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 Plot



Color	Line Style	Thick	Data	Axis
Blue	Solid	2	Anlr.Level A!Normalize	Left

AUDIO INPUT VERSUS MODULATION

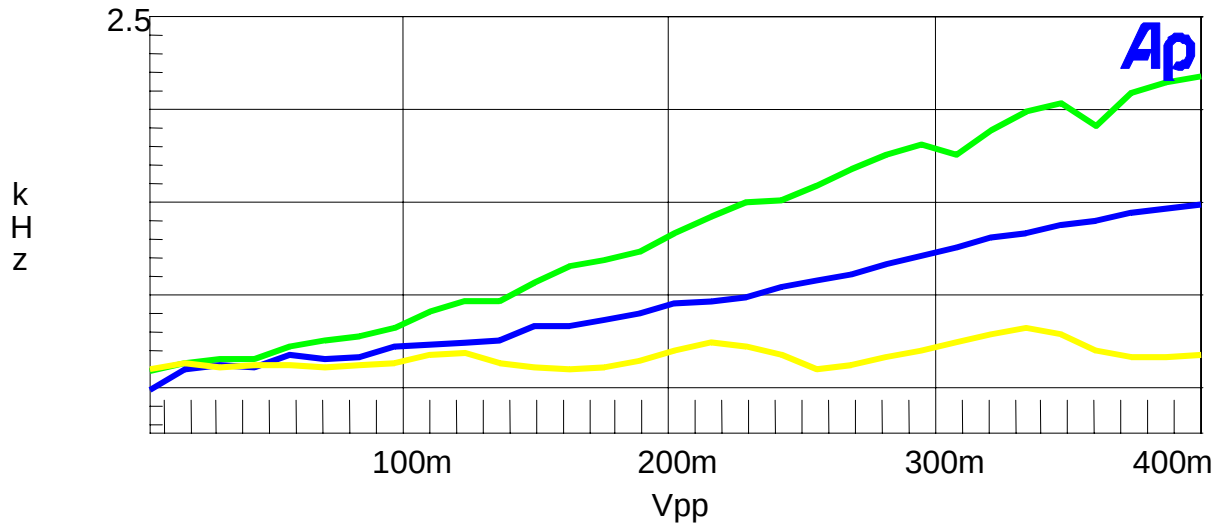
Rule Part No.: Part 2.1047(b) & 90

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 TIA/EIA Specification 603. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz.

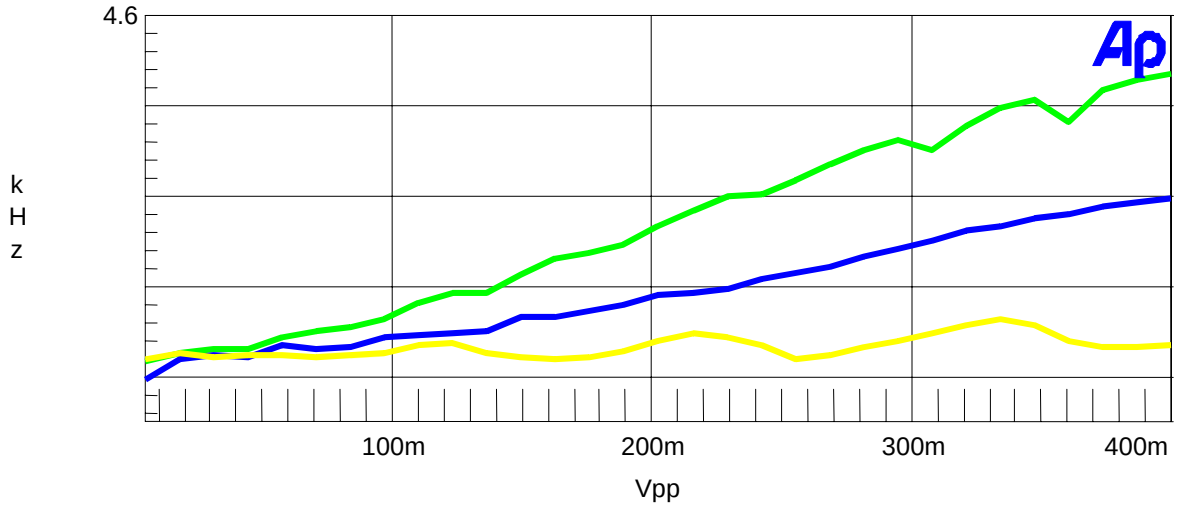
Test data:

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 Plots:
2.5 KHz (Green), 1.0 KHz (Blue), and 300 Hz



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 2.1049(c) EMISSION 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 + 10log(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 (fd in kHz) of more than 5 kHz but not more than10 kHz: At least 83 log (fd/5) dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least 29 log(fd2/11)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(Po)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 f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 (fd - 2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10log(P) dB or 70 dB, whichever is the lesser attenuation.

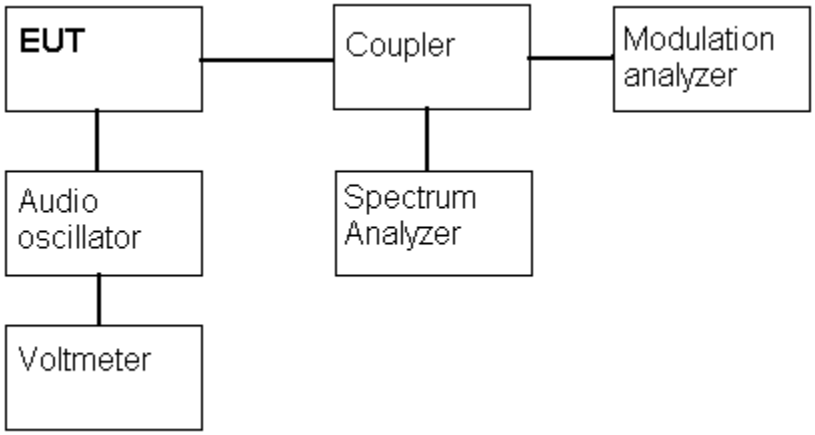
Part 90.210(e) Emission Mask E – 6.25 kHz channel BW equipment.
For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.
(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd – 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 + 10log(P) dB or 65 dB, whichever is the lesser attenuation.

Test procedure: TIA/EIA-603 para 2.2.11.

Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT



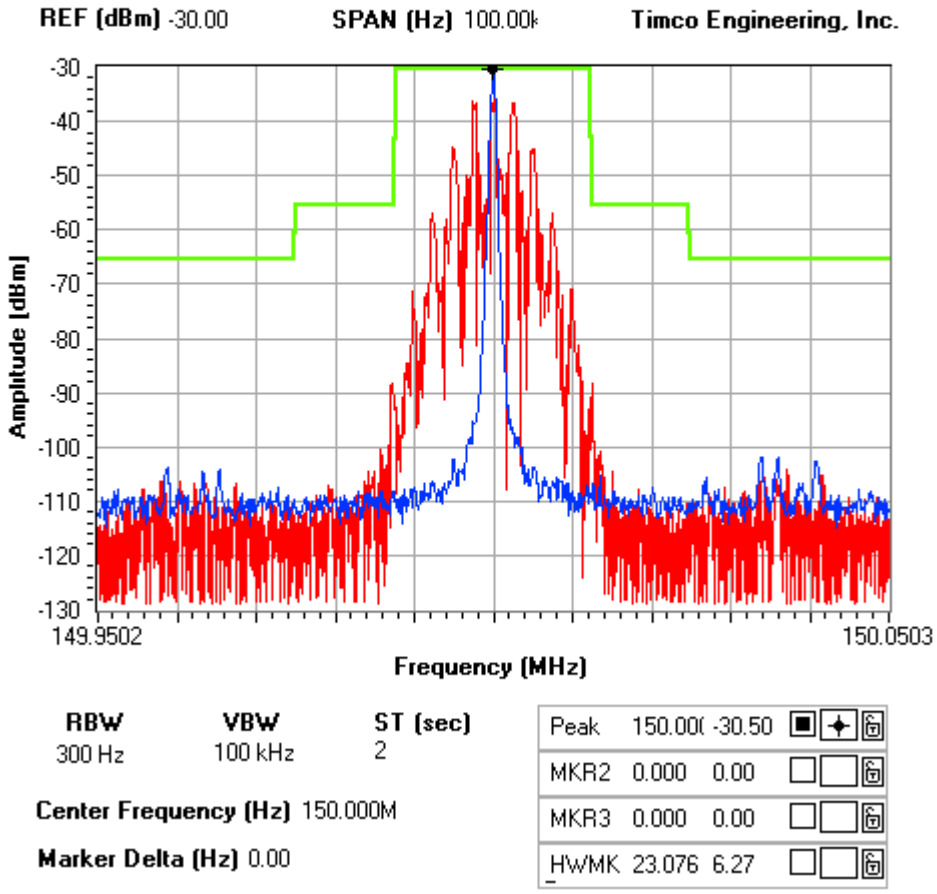
OCCUPIED BANDWIDTH PLOTS

Part 90.210(b) 25.0 kHz Channel Spacing

NOTES:

MIDLAND RADIO CORPORATION - FCC ID: MMA901050B
OCCUPIED BANDWIDTH PLOT - WIDE BAND

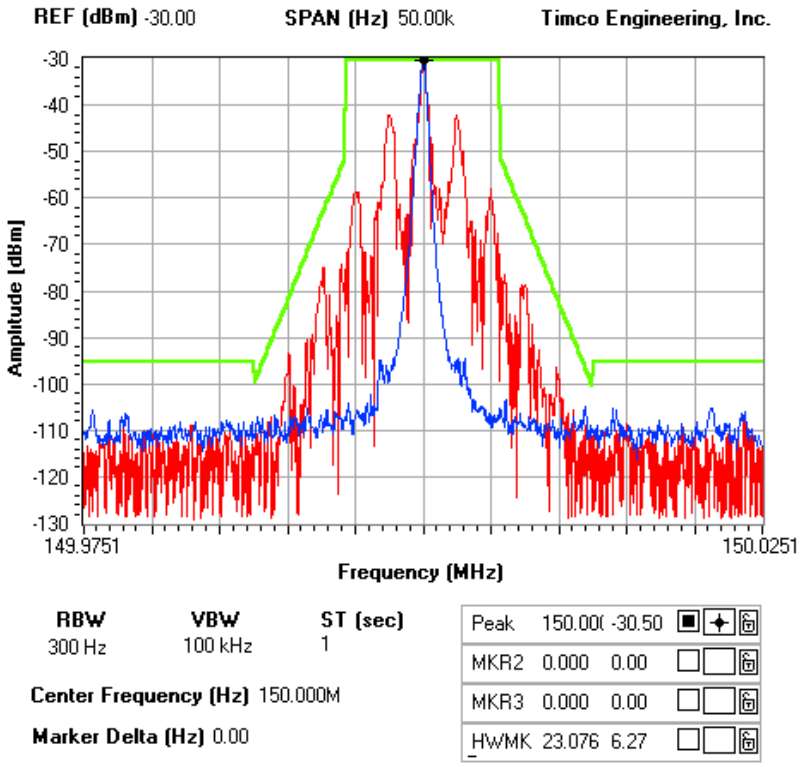
FCC 90.210 Mask (b)



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

NOTES:
MIDLAND RADIO CORPORATION - FCC ID: MMA901050B
OCCUPIED BANDWIDTH PLOT - NARROW BAND

FCC 90.210 Mask D



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

Requirements: 25kHz Channel Spacing = HIGH POWER: 43+10log(50) = 60 dB
LOW POWER: 43+10log(2.5) = 47 dB
12.5kHz Channel Spacing = HIGH POWER: 50+10log(50) = 67 dB
LOW POWER: 50+10log(2.5) = 54 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 TIA/EIA-603.

Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
136. 0	**272.00**	87.15		136.0	**272.00**	85.1
	408.00	71.91			**408.00**	103
	544.00	96.65			**544.00**	104.2
	680.00	89.02			**680.00**	86.3
	816.00	94.21			**816.00**	105.9
	952.00	NE			**952.00**	107.5
	1088.00	NE			**1088.00**	96.8
	1224.00	NE			**1224.00**	96.5
	1360.00	NE			**1360.00**	97

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
150. 0	**300.00**	90.54		150.0	**300.00**	94.6
	450.00	70.33			**450.00**	99.6
	600.00	97.08			**600.00**	103.9
	750.00	91.19			**750.00**	102.2
	900.00	94.7			**900.00**	106.8
	1050.00	NE			**1050.00**	96.8
	1200.00	NE			**1200.00**	97.5
	1350.00	NE			**1350.00**	97
	1500.00	NE			**1500.00**	96.5

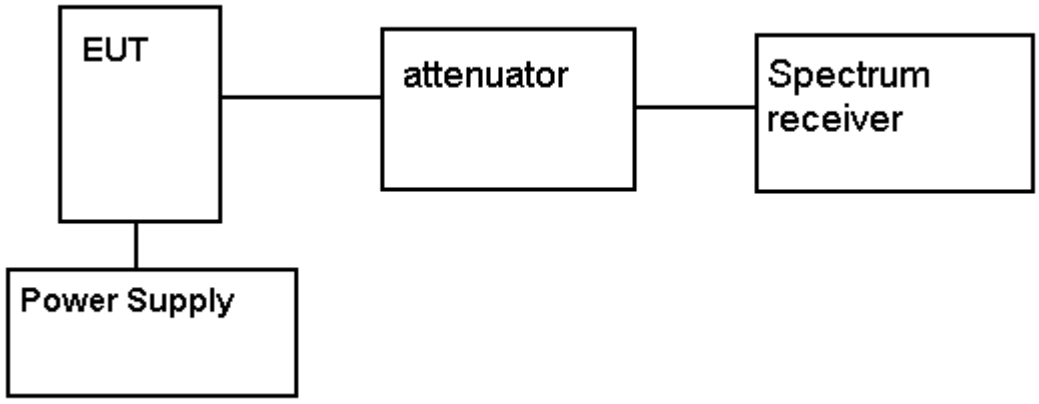
Rule Part No.: Part 2.1051(a)

Requirements: 25kHz Channel Spacing = HIGH POWER: 43+10log(50) = 60 dB
LOW POWER: 43+10log(2.5) = 47 dB
12.5kHz Channel Spacing = HIGH POWER: 50+10log(50) = 67 dB
LOW POWER: 50+10log(2.5) = 54 dB

TEST DATA CONTD.

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
174. 0	**348.00**	91.2		174.0	**348.00**	88.9
	522.00	73.55			**522.00**	99.2
	696.00	93.28			**696.00**	92.7
	870.00	91.37			**870.00**	102.9
	1044.00	86.71			**1044.00**	99.1
	1218.00	NE			**1218.00**	96.8
	1392.00	NE			**1392.00**	105.3
	1566.00	NE			**1566.00**	100.7
	1740.00	NE			**1740.00**	107.8

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. The measurements were made at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

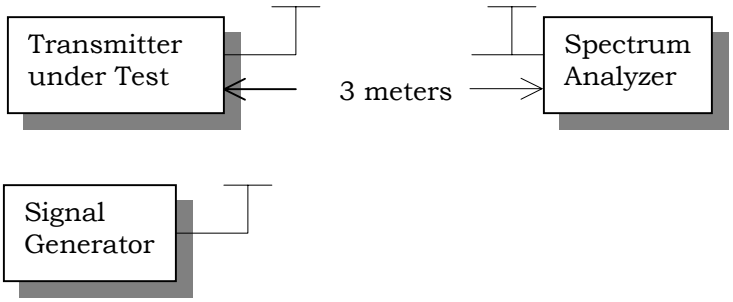
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Requirements: 25kHz Channel Spacing = HIGH POWER: 43+10log(50) = 60 dB
LOW POWER: 43+10log(2.5) = 47 dB
12.5kHz Channel Spacing = HIGH POWER: 50+10log(50) = 67 dB
LOW POWER: 50+10log(2.5) = 54 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 TIA/EIA STANDARD 603 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:

136.0 MHz 150.0 MHz 174.0 MHz

High power:

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
136	0	0
272	H	95.25
408	H	103.88
544	H	107.35
680	V	104.63
816	H	107.02
952	H	96.37
1088	H	91.52
1224	H/V	ne
1360	H/V	ne

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
150	0	0
300	H	93.17
450	H	107.55
600	H	98.35
750	V	105.73
900	H	96.74
1050	H	100.46
1200	H	101.71
1350	H/V	ne
1500	H/V	ne

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
174	0	0
348	H	98.45
522	H	101.76
696	V	104.37
870	V	90.29
1044	H	98.58
1218	H	98.82
1392	H	100.36
1566	H/V	ne
1740	H/V	ne

Rule Parts. No.: Part 2.1053

Requirements: 25kHz Channel Spacing = HIGH POWER: 43+10log(50) = 60 dB
LOW POWER: 43+10log(2.5) = 47 dB
12.5kHz Channel Spacing = HIGH POWER: 50+10log(50) = 67 dB
LOW POWER: 50+10log(2.5) = 54 dB

Low power:

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
136	0	0
272	H	75.75
408	H	94.08
544	H	102.05
680	V	87.13
816	H	96.92
952	V	82.67
1088	V	90.62
1224	H/V	ne
1360	H/V	ne

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
150	0	0
300	H	80.87
450	H	87.85
600	H	97.75
750	V	96.33
900	H	92.14
1050	V	90.76
1200	H/V	ne
1350	H/V	ne
1500	H/V	ne

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
174	0	0
348	H	95.45
522	H	102.96
696	V	90.47
870	H	88.69
1044	V	90.78
1218	V	92.22
1392	H/V	ne
1566	H/V	ne
1740	H/V	ne

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%
±2.5 PPM

Method of Measurements: TIA/EIA 603.

Test Data:

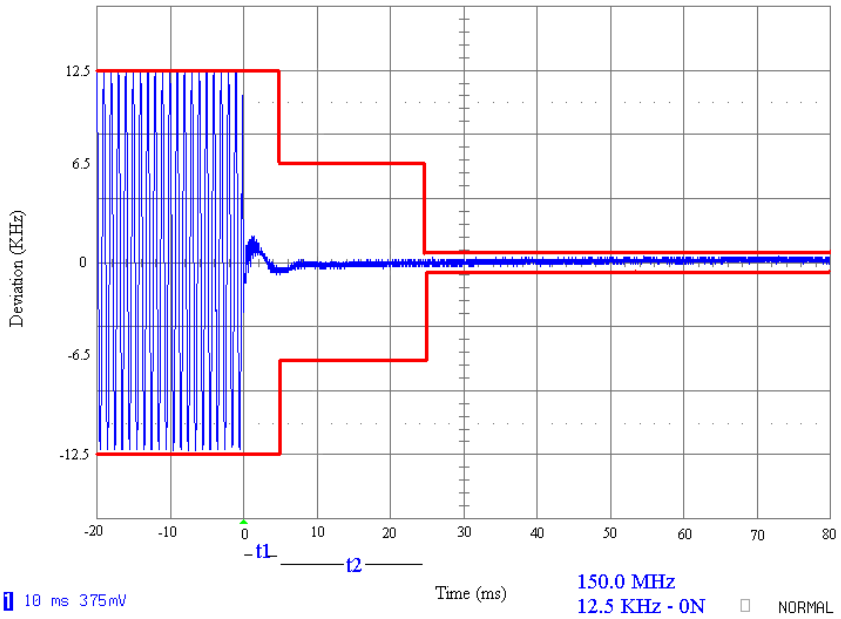
Temperature (ºC)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-30	150.000115	0.47
-20	150.000137	0.61
-10	150.000133	0.59
0	150.000123	0.52
+10	150.000110	0.43
+20	150.000108	0.42
+30	150.000069	0.16
+40	150.000024	-0.14
+50	149.999995	-0.33

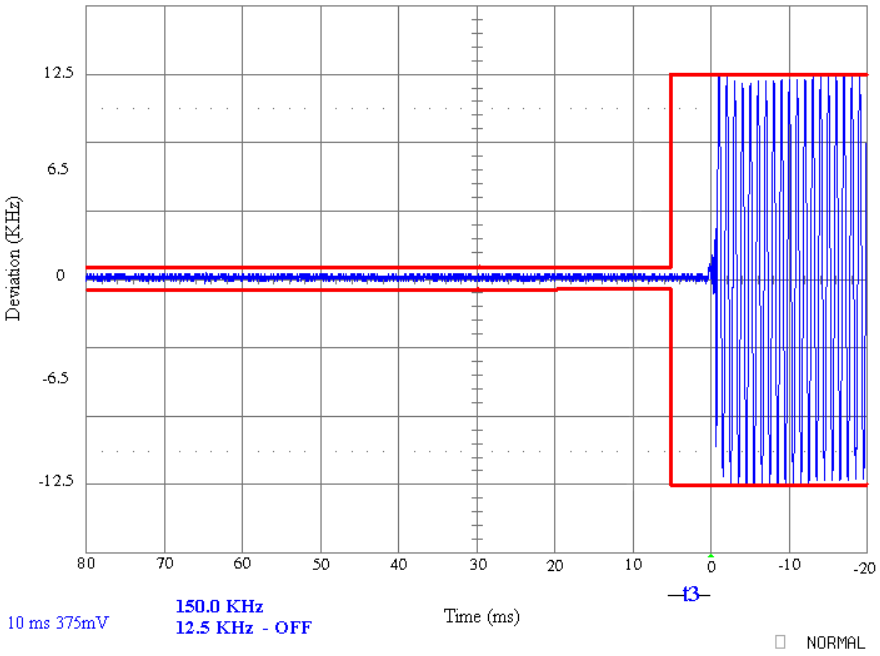
% Battery	**Frequency (MHz)**	**Frequency Stability (PPM)**
-15%	150.000108	0.42
13.8 V	150.000045	0
+15%	150.000109	0.43

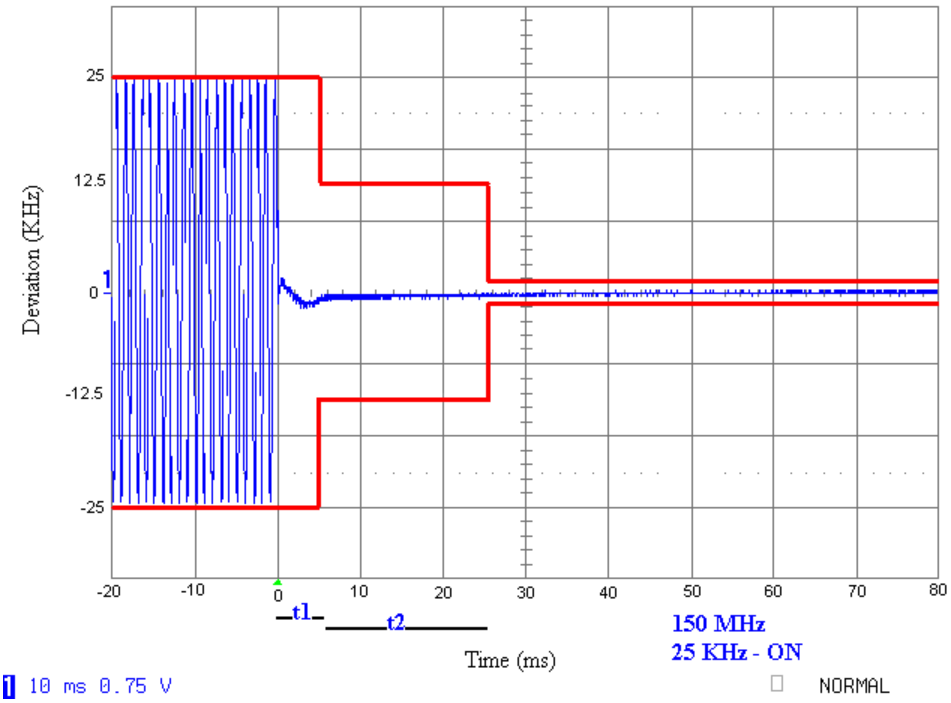
Part 90.214 **TRANSIENT FREQUENCY BEHAVIOUR**

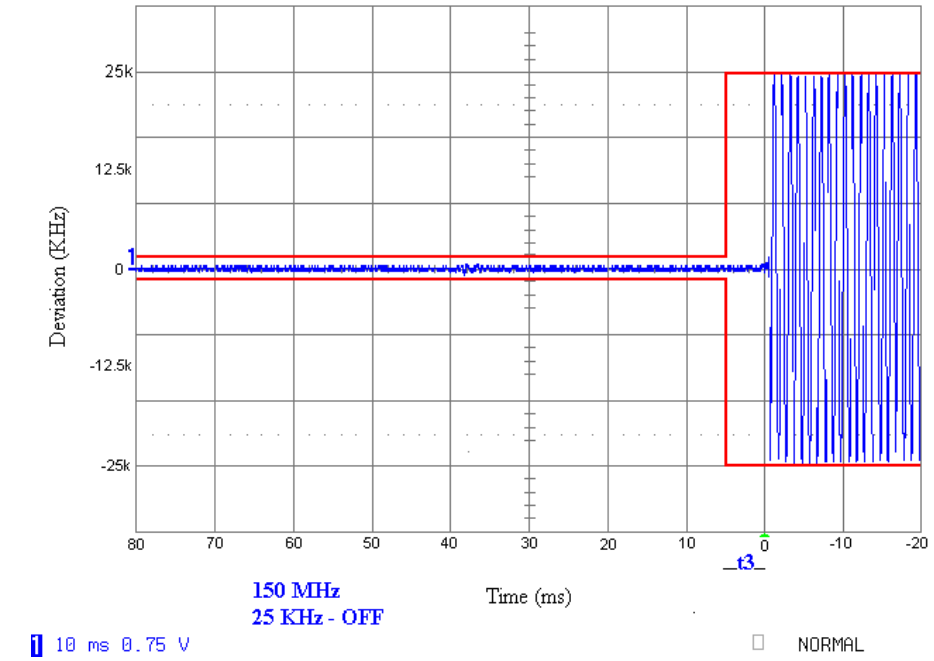
REQUIREMENTS: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies within the maximum frequency difference limits during the time intervals indicated:

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


12.5
6.5
0
-6.5
-12.5
Deviation (KHz)
-20
-10
0
10
20
30
40
50
60
70
80
t1
t2
Time (ms)
10 ms 375mV
150.0 MHz
12.5 KHz - 0N
NORMAL

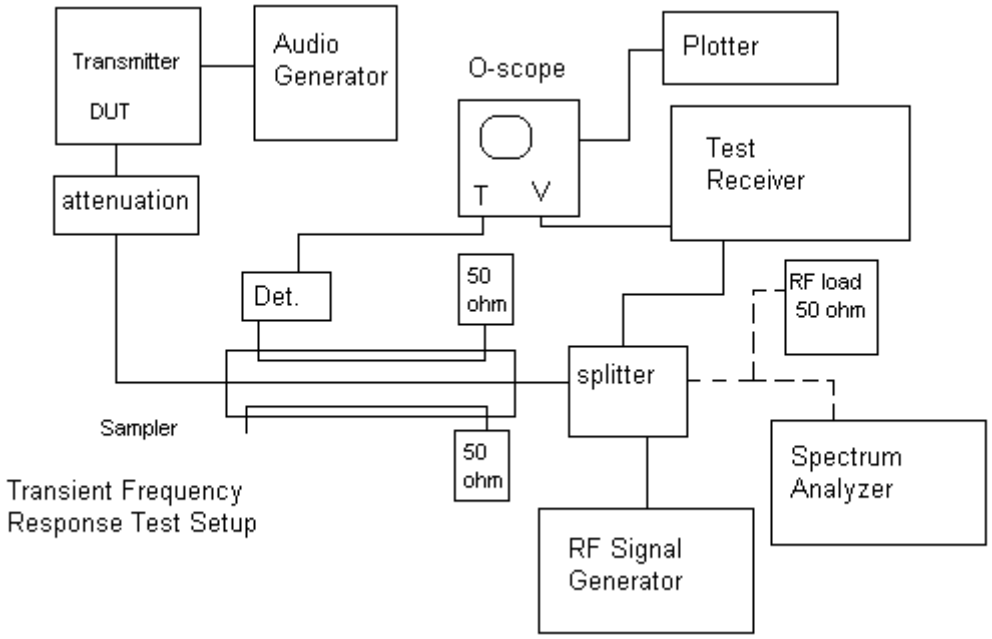

12.5
6.5
0
-6.5
-12.5
Deviation (KHz)
80
70
60
50
40
30
20
10
0
-10
-20
t3
Time (ms)
10 ms 375mV
150.0 KHz
12.5 KHz - OFF
NORMAL


25
12.5
0
-12.5
-25
Deviation (KHz)
1
-20
-10
0
10
20
30
40
50
60
70
80
t1
t2
Time (ms)
150 MHz
25 KHz - ON
10 ms 0.75 V
NORMAL


25k
12.5k
0
-12.5k
-25k
Deviation (KHz)
1
80
70
60
50
40
30
20
10
0
-10
-20
t3
150 MHz
25 KHz - OFF
Time (ms)
10 ms 0.75 V
NORMAL

TEST PROCEEDURE: ANSI/TIA 603-C:2004 PARA 2.2.19, the levels were set as follows;

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.



Transient Frequency Response Test Setup

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 12/1/06	12/1/08
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08