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FCC PART 90

TEST REPORT

APPLICANT	MIDLAND RADIO CORPORATION
	1120 CLAY ST.
	NORTH KANSAS CITY MO 64116 USA
FCC ID	MMA911060B
MODEL NUMBER	91-1060B
PRODUCT DESCRIPTION	60 WATT VHF BASE STATION
DATE SAMPLE RECEIVED	11/1/2006
DATE TESTED	11/13/2006
TESTED BY	RICHARD BLOCK
APPROVED BY	MARIO DE ARANZETA
TIMCO REPORT NO.	3033AUT6TestReport.doc
TOTAL PAGES	28
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

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

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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. 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: 11/30/06

GENERAL INFORMATION

DUT Specification

The test results relate only to the items tested.	
DUT Description	60 WATT VHF BASE STATION
FCC ID	MMA911060B
Model Number	91-1060B
Serial Number	N/A
Operating Frequency	150-174 MHz
Type of Emission	11K0F3E, 11K0F2D, 11K0F1D, 11K0F1E, 16K0F3E
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
Antenna	N/A
Antenna Connector	N

Test Facility: The test sites used by Timco Engineering Inc. for collecting radiated and conducted emission data are located at 849 NW State Road 45 Newberry, FL 32669 USA.

Test Condition: The DUT was tested in the laboratory in an environment with normal temperature and humidity. The ambient temperature of the DUT was 76°F with a relative humidity of 55%.

Modification to the DUT: No modification was made to the DUT during testing.

Test Exercise (e.g software description, test signal, etc.): The DUT was placed in continuous transmit mode of operation.

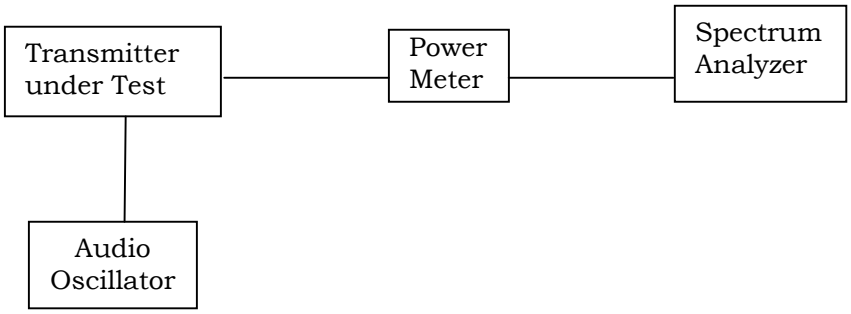
RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), 90.205

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: 60 Watts

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

DC Voltage: 12 Vdc DC Current: 9 A
DC Power: 108 Watts

MODULATION CHARACTERISTICS

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

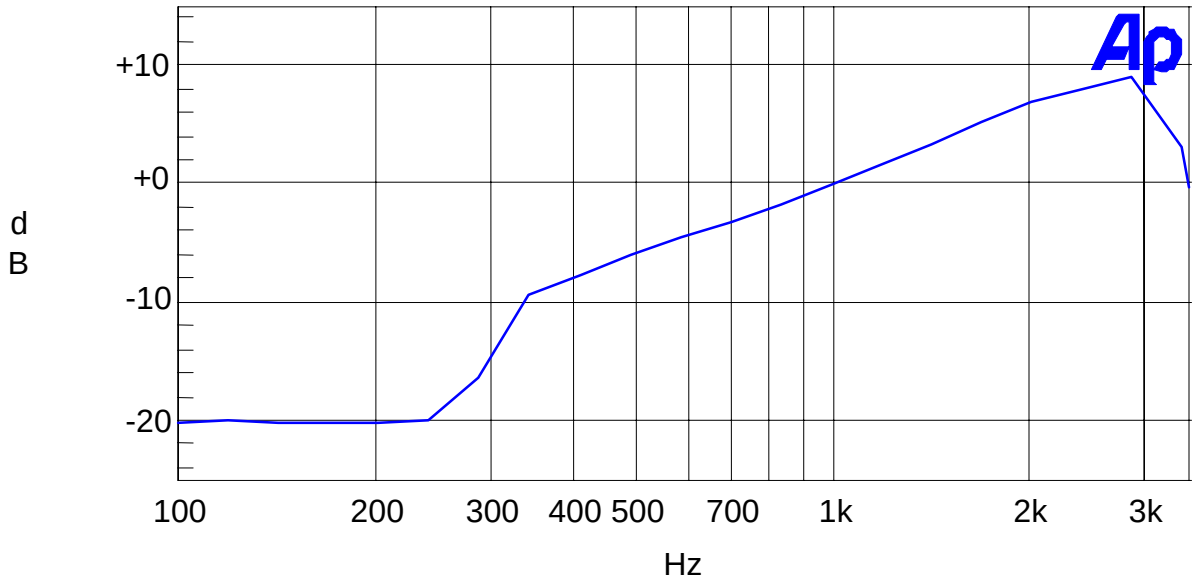
Test Requirements:

Method of Measurement:

Audio frequency response

The audio frequency response was measured in accordance with TIA/EIA 603. 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

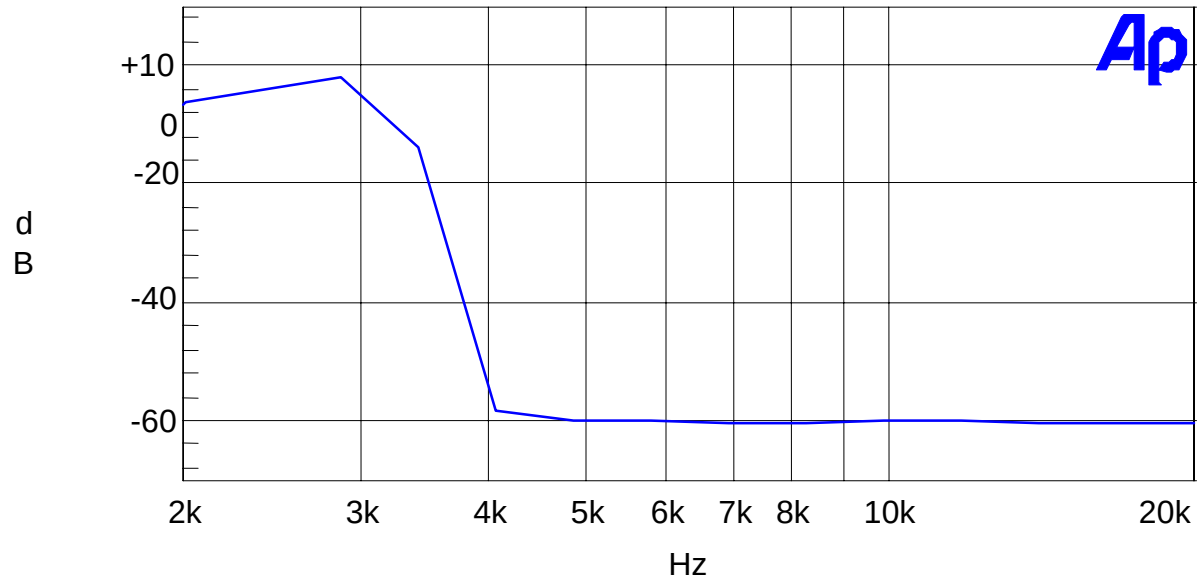
Rule Part No.: Part 2.1047(a)

Test Requirements:

Method of Measurement:

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	1	Anlr.Level A!Normalize	Left

MaxFreq.at1

AUDIO INPUT VERSUS MODULATION

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

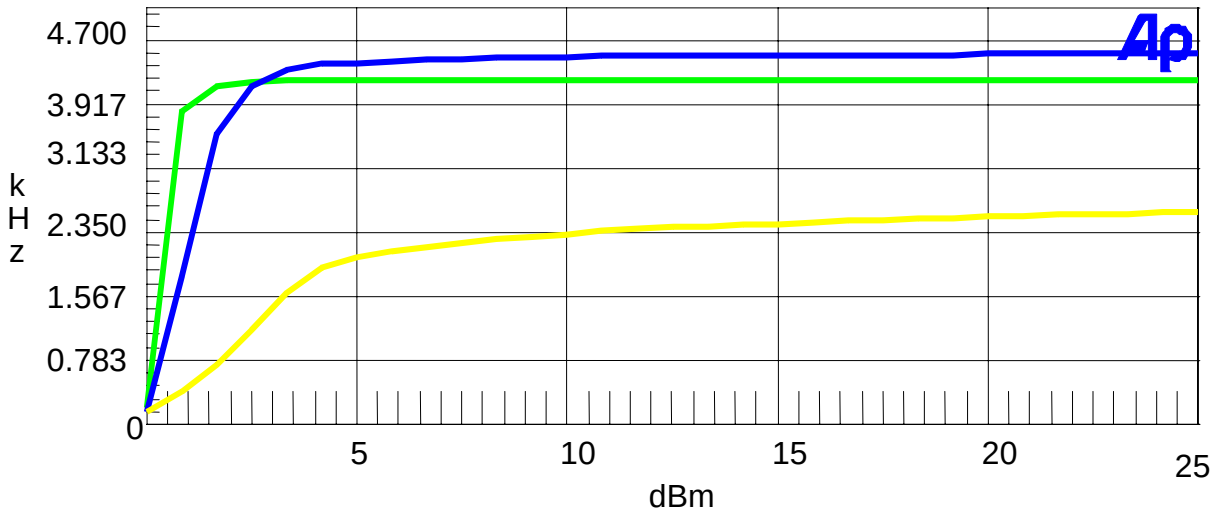
Test Requirements:

Method of Measurement: Modulation should not exceed 100%, The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA 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 Plot 25kHz

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

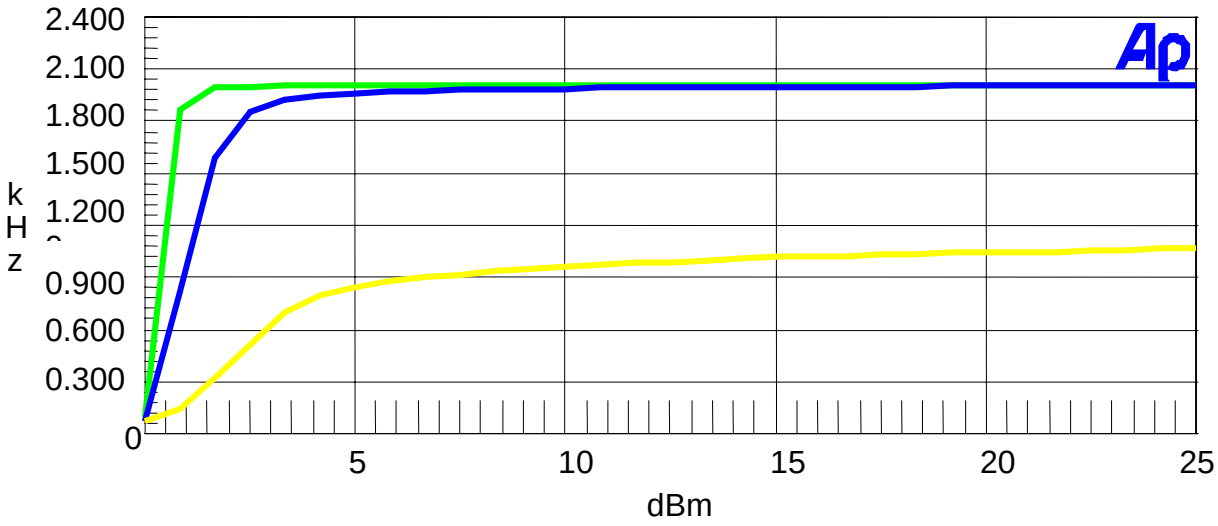


Color	Line Style	Thick	Data	Axis
Green	Solid	3	Anlr.Level A	Left
Blue	Solid	3	Anlr.Level A	Left
Yellow	Solid	3	Anlr.Level A	Left

modulation limiting.at2

Modulation Limiting Plot 12.5kHz

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.at2

OCCUPIED BANDWIDTH: Part 2.1049

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.

OTHER MODULATION CHARACTERISTICS

Part 2.1033(c)
Part 2.1033(c) (4) Type of Emission: 11K2F1D , 11K2F2D, and 11K2F1E
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: 11K2F3E
Part 90.209
Part 90.207 Bn = 2M + 2DK
M = 3000
D = 2100
K=1
Bn = 2(3000)+2(2100) = 10.2k

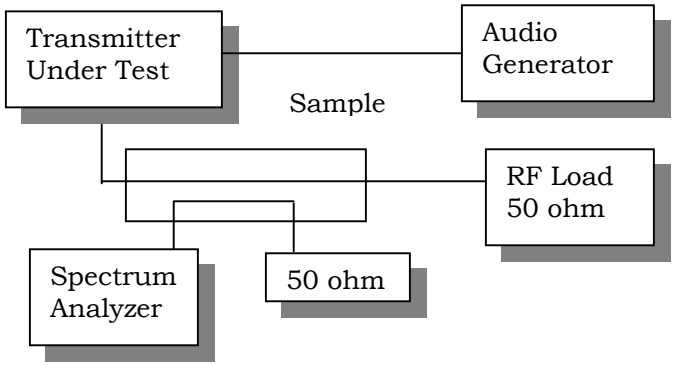
Part 2.1033(c) (4) Type of Emission: 16K0F3E
Part 90.209
Part 90.207 Bn = 2M + 2DK
M = 3000
D = 4700
K=1
Bn = 2(3000)+2(4700) = 15.4k

OCCUPIED BANDWIDTH

Test Requirements:

Method of Measurement: EIA/TIA 603 para 2.2.11

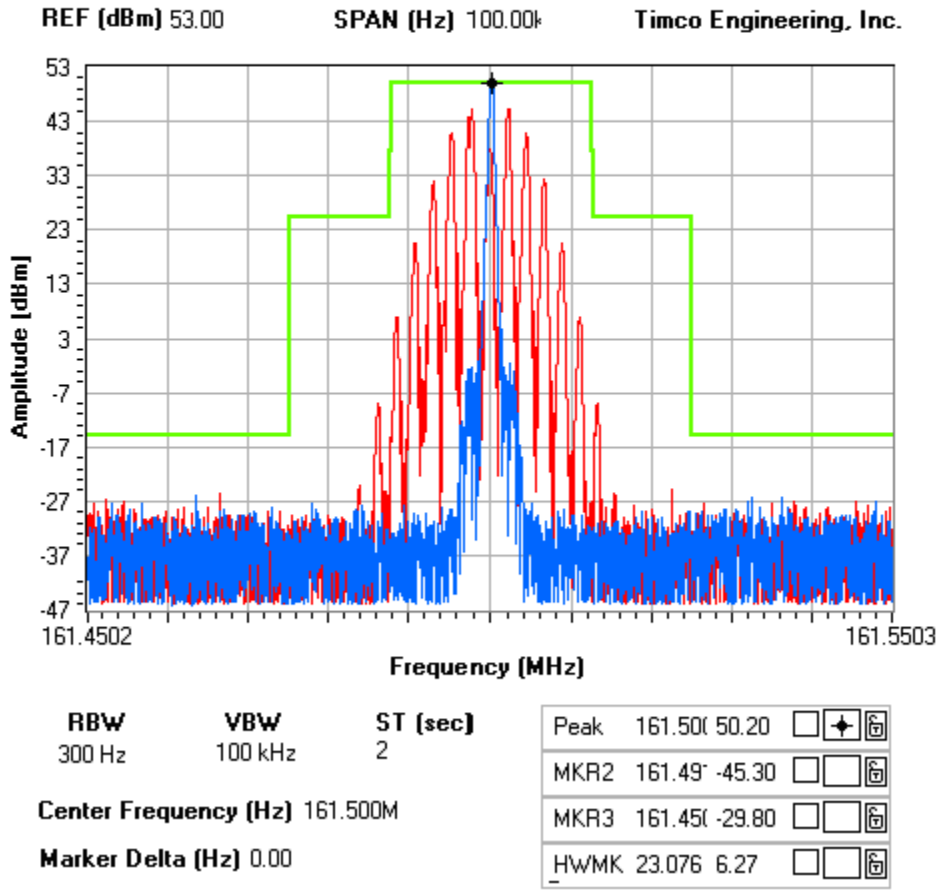
Test Setup Diagram:



Test Data: See the plots below

NOTES:
OCCUPIED BANDWIDTH -- 25kHz
MIDLAND RADIO CORPORATION -- FCC ID: MMA911110B

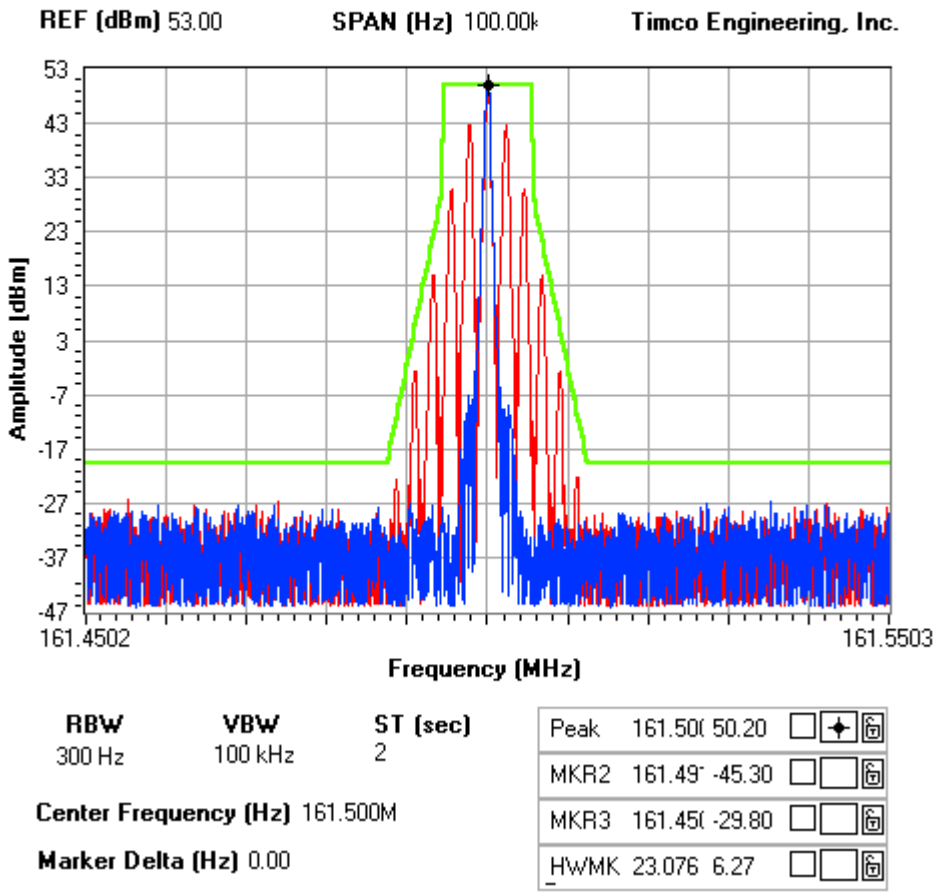
FCC 90.210 Mask B



NOTES:

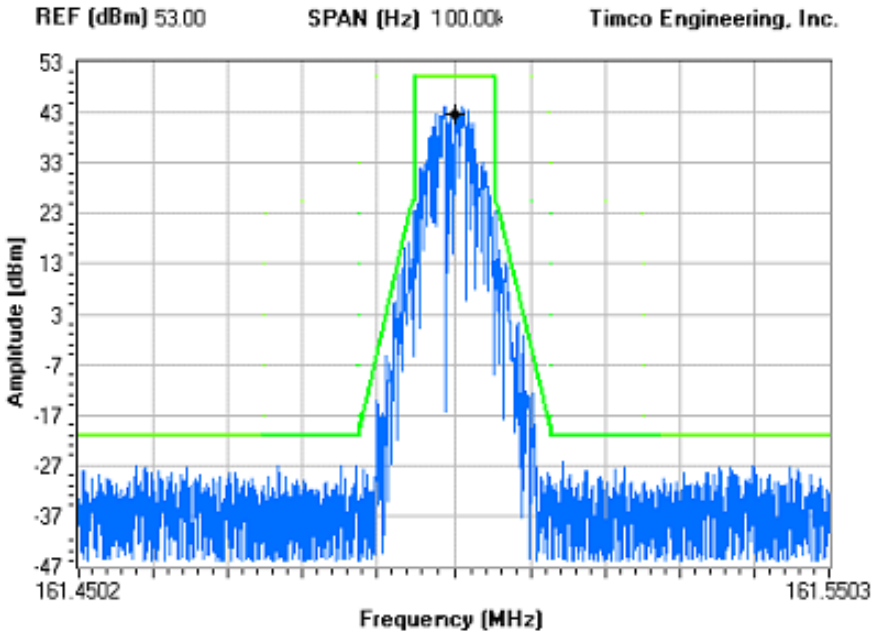
OCCUPIED BANDWIDTH -- 12.5kHz
MIDLAND RADIO CORPORATION -- FCC ID: MMA911110B

FCC 90.210 Mask D



NOTES:
OCCUPIED BANDWIDTH 12.5kHz -- DIGITAL
MIDLAND RADIO CORPORATION -- FCC ID: MMA9111108

FCC 90.210 Mask D



RBW	VBW	ST (sec)
300 Hz	100 kHz	2

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

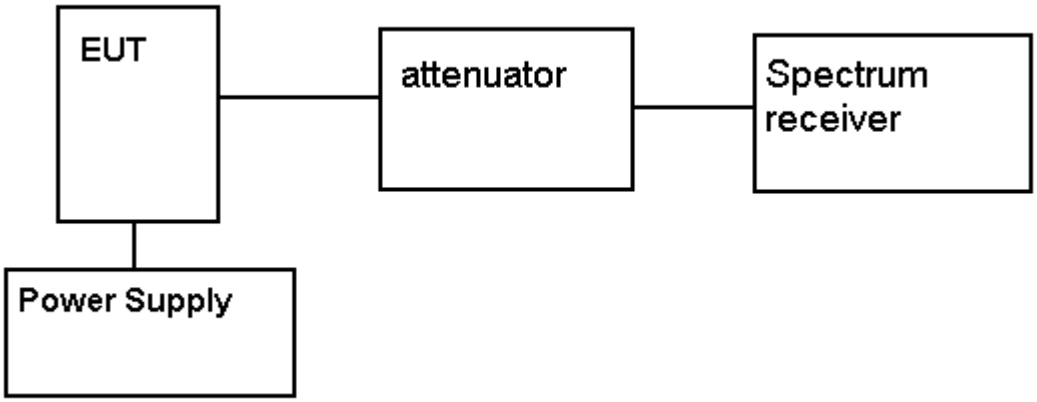
Requirements: 12.5 kHz Spacing = 50+10log(60) = 67.8 dB

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:

EF	dB below carrier		EF	dB below carrier		EF	dB below carrier
150.000	0.0		**161.500**	0.0		**173.975**	0.0
300.000	74.5		**323.000**	88.4		**347.950**	96.7
450.000	69.2		**484.500**	77.5		**521.925**	99.5
600.000	96.8		**646.000**	98.0		**695.900**	106.0
750.000	102.7		**807.500**	101.3		**869.875**	103.7
900.000	106.5		**969.000**	105.6		**1043.850**	96.3
1050.000	98.6		**1130.500**	97.1		**1217.825**	96.9
1200.000	97.7		**1292.000**	97.1		**1391.800**	95.4
1350.000	97.7		**1453.500**	97.0		**1565.775**	96.1
1500.000	96.8		**1615.000**	96.5		**1739.750**	96.1

METHOD OF MEASURING CONDUCTED SPURIOUS EMISSIONS



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

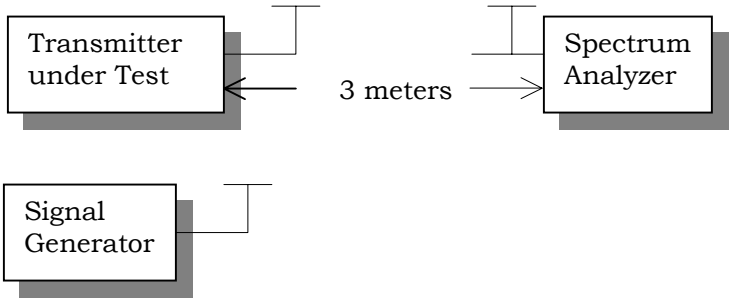
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

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

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:

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
150.00	0	0
300.00	H	123.97
450.00	H	120.35
600.00	H	109.15
750.00	H	97.93
900.00	V	105.24
1050.00	H	107.96
1200.00	V	96.61
1350.00	H	106.45
1500.00	H	98.1

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 emissions.

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
161.50	0	0
323.00	H	117.55
484.50	H	106.57
646.00	V	104.99
807.50	V	107.05
969.00	V	101.77
1130.50	V	100.89
1292.00	V	98.49
1453.50	H	93.48
1615.00	H	98.61

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
173.98	0	0
347.95	V	112.55
521.93	H	117.86
695.90	H	105.17
869.88	V	99.49
1043.85	V	101.28
1217.83	V	93.02
1391.80	V	106.56
1565.78	V	98.22
1739.75	H	98.56

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%
±1.5 PPM

Method of Measurements: TIA/EIA 603.

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		161.500076
Temperature (°C)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-30	161.500122	0.28
-20	161.500046	-0.19
-10	161.500031	-0.28
0	161.500031	-0.28
+10	161.500046	-0.19
+20	161.500076	0.00
+30	161.500046	-0.19
+40	161.500015	-0.38
+50	161.499985	-0.56

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery	**Frequency (MHz)**	**Frequency Stability (PPM)**
-15%	161.500076	0.00
0	161.500076	0.00
+15%	161.500076	0.00

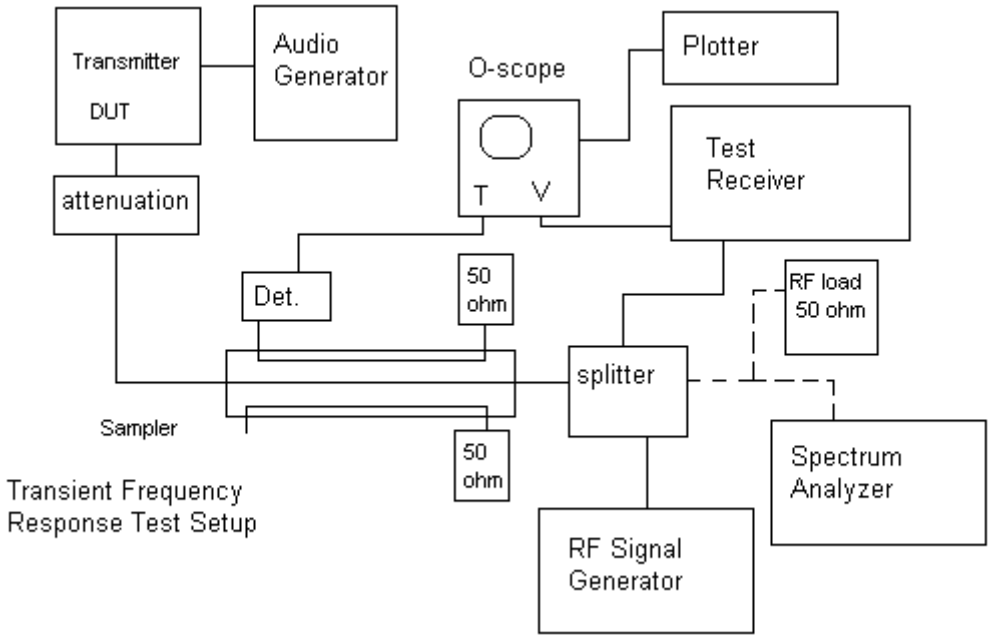
FREQUENCY STABILITY (contd)
Part 90.214 Transient Frequency Behavior

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:

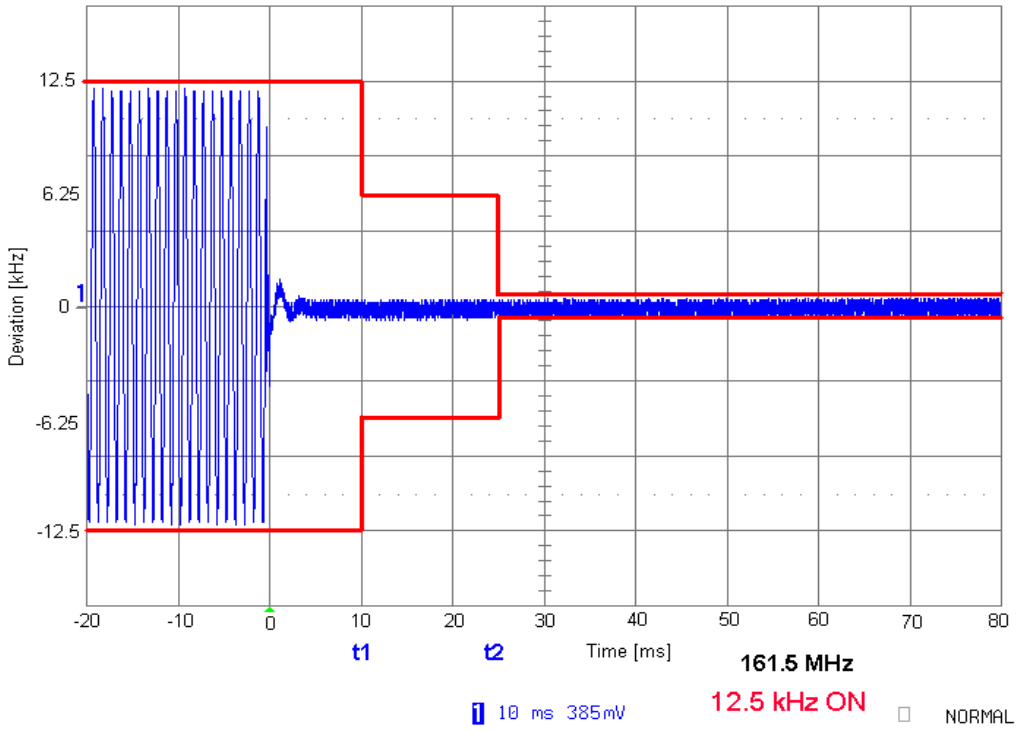
Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment 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

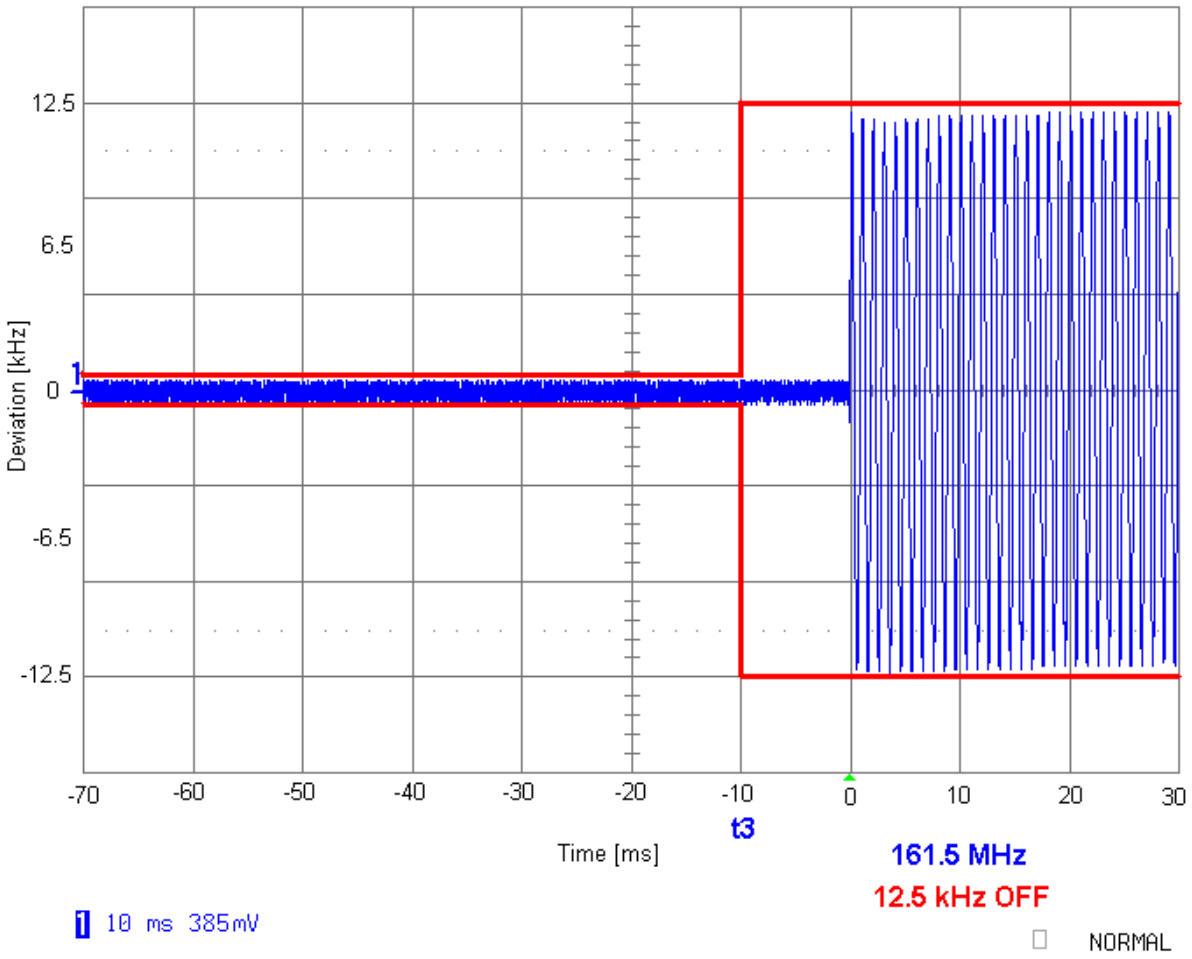
TEST PROCEEDURE: TIA/EIA TS603 PARA 2.2.19, the levels were set as follows:

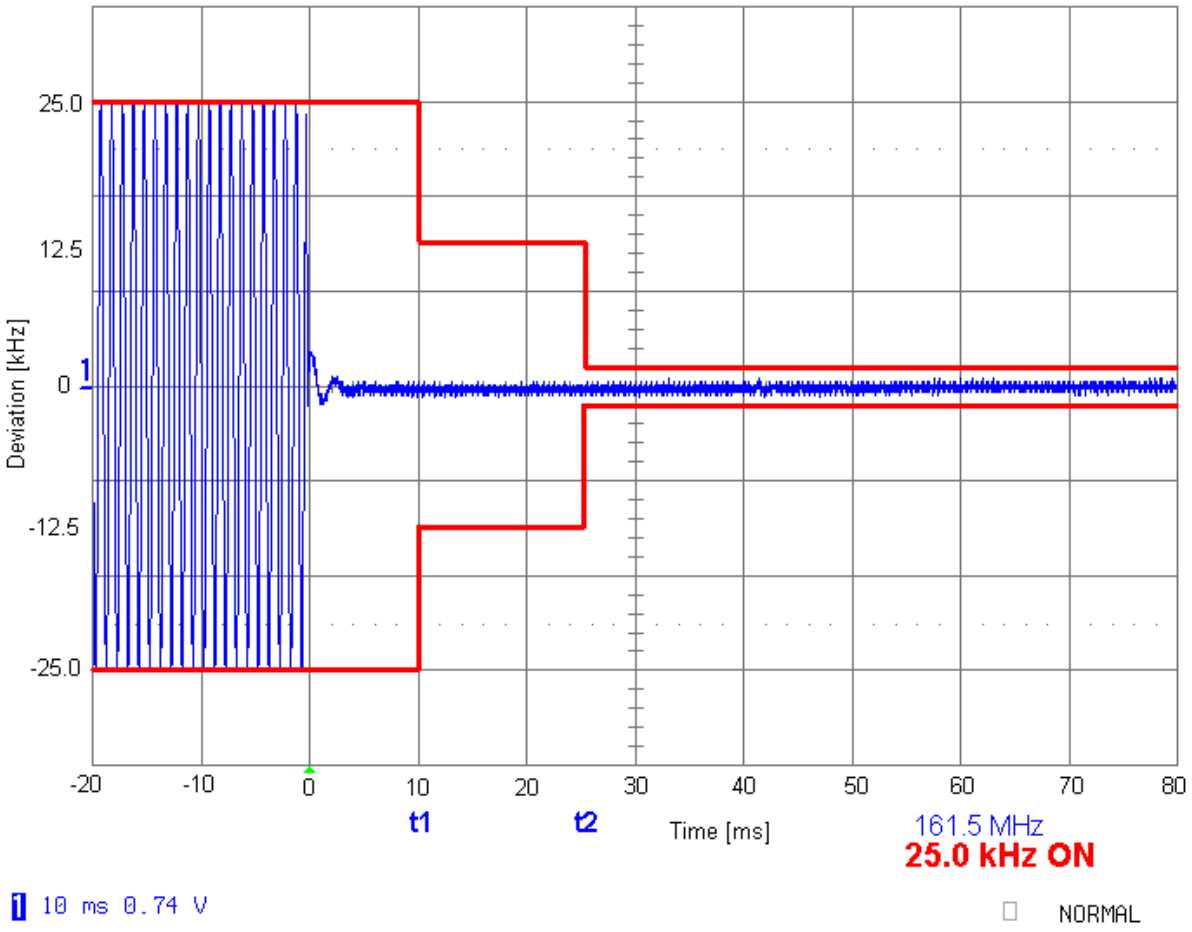
1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained 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.

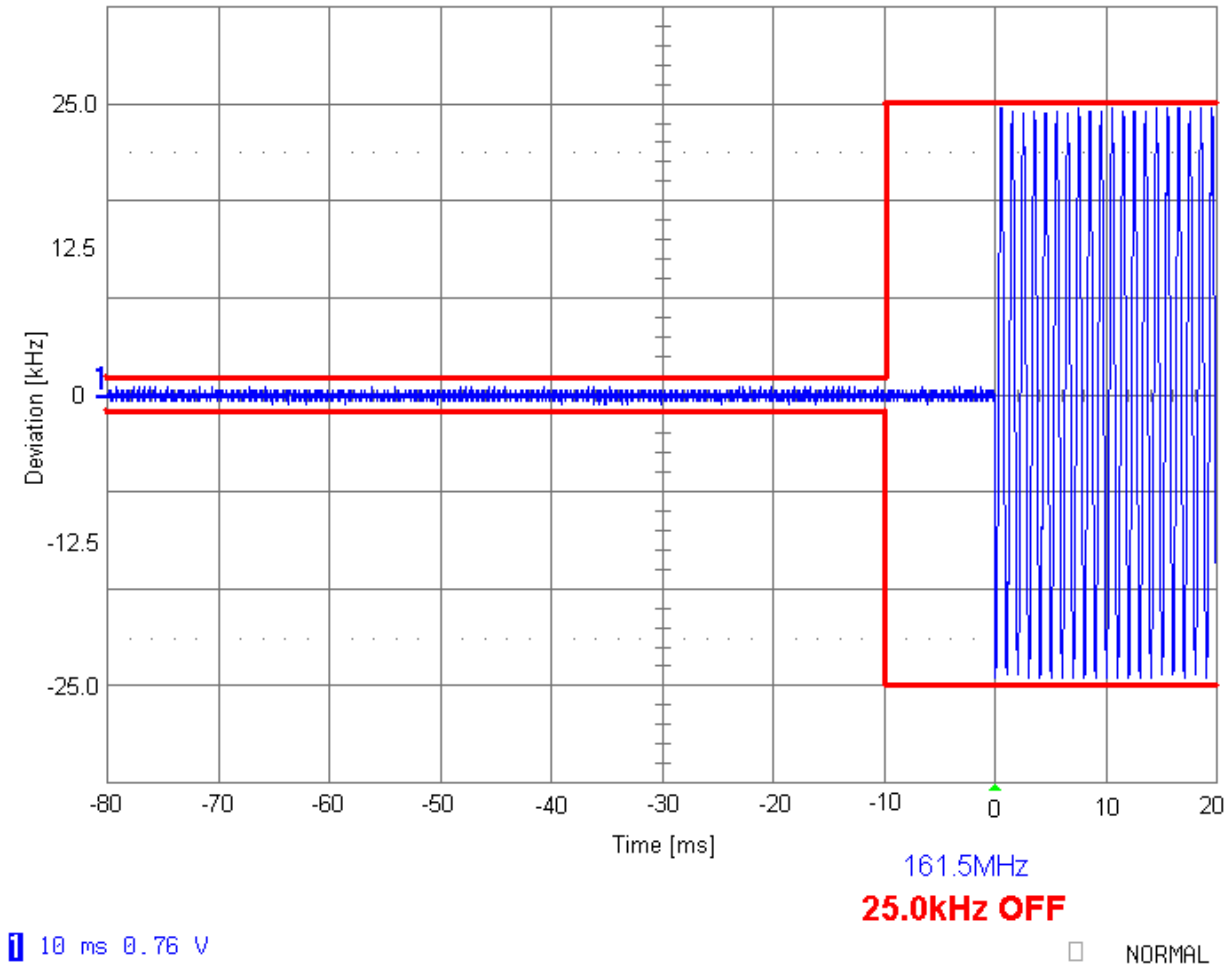


Transient Frequency Response Test Setup


12.5
6.25
0
-6.25
-12.5
Deviation [kHz]
-20
-10
0
10
20
30
40
50
60
70
80
t1
t2
Time [ms]
161.5 MHz
12.5 kHz ON
10 ms 385mV
NORMAL


12.5
6.5
0
-6.5
-12.5
Deviation [kHz]
1
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
t3
Time [ms]
161.5 MHz
12.5 kHz OFF
1 10 ms 385mV
NORMAL


25.0
12.5
0
-12.5
-25.0
Deviation [kHz]
-20
-10
0
10
20
30
40
50
60
70
80
t1
t2
Time [ms]
161.5 MHz
25.0 kHz ON
1 10 ms 0.74 V
NORMAL


25.0
12.5
0
-12.5
-25.0
Deviation [kHz]
1
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
Time [ms]
161.5MHz
25.0kHz OFF
1 10 ms 0.76 V
NORMAL

TEST SET UP PHOTO