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FCC PART 90

TEST REPORT

APPLICANT	Qual-Tron, Inc.
	9409 E. 55h PLACE SOUTH TULSA OK 74145 USA
FCC ID	FCC ID: OGE-QTIMIDSMCDT
MODEL NUMBER	MCDT
PRODUCT DESCRIPTION	138-153 MHZ Data Radio
DATE SAMPLE RECEIVED	2/2/2010
DATE TESTED	2/19/2010
TESTED BY	Joe Scoglio
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	3024ZUT9TestReport.PDF
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

TABLE OF CONTENTS

ATTESTATIONS

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

ACCREDITED

Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

Authorized Signatory Name:

Mario de Aranzeta C.E.T.
Compliance Engineer/ Lab. Supervisor

Date: March 9, 2010

DUT SPECIFICATION

DUT Description	DATA RADIO
FCC ID	FCC ID: OGE-QTIMIDSMCDT
Model Number	MCDT
Operating Frequency	138-153 MHz Data Radio
Type of Emission	16K0F1D/11K0F1D, 16K0F2D/11K0F2D
Modulation	FM
DUT Power Source	☐ 110–120Vac/50– 60Hz
	☒ DC Power 6V
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable

TEST ENVIRONMENT AND TEST SETUP

Test Conditions	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	ANSI/TIA 603-C:2004, FCC CFR 47 Part 90
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

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 1/11/09	1/10/12
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	Listed 5/11/07	5/11/10
AC Voltmeter	HP	400FL	2213A14499	CAL 12/29/08	12/29/10
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 11/30/09	11/30/11
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 11/30/09	11/30/11
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 11/30/09	11/30/11
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 11/30/09	11/30/11
Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 3/30/09	3/30/11
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/3/09	3/3/12
Antenna: Dipole Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 4/5/09	4/5/12
Frequency Counter	HP	5385A	2730A03025	CAL 7/6/09	7/6/11
Hygro-Thermometer	Extech	445703	0602	CAL 11/15/09	11/15/11
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	CAL 12/1/08	12/1/10
Measuring Tape-7.5M	Kraftixx	7.5M PROFI		CHAR 11/13/09	11/13/11
Modulation Analyzer	HP	8901A	3435A06868	CAL 5/9/09	5/9/11
Digital Multimeter	Fluke	FLUKE-77-3	79510405	CAL 5/14/09	5/14/11
System One	Audio Precision	System One	SYS1-45868	CHAR 2/27/08	2/27/10
Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 4/25/08	4/25/10

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 UUT 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 ANSI/TIA 603-C:2004, 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. The ambient temperature of the UUT was 76°F with a humidity of 55%.

RF POWER OUTPUT

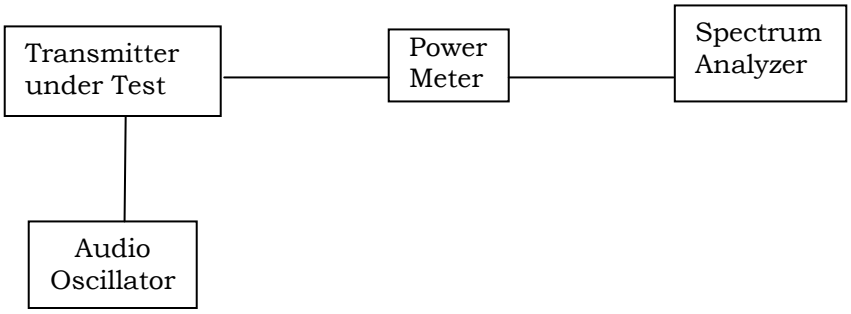
Rule Part No.: Part 2.1046(a), Part 90

Test Requirements:

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

For the device 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 – 2.9 Watts
LOW - 1.7 Watts

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

FOR LOW POWER SETTING INPUT POWER: (6.0V)(0.76A) = 4.56 Watts
FOR HIGH POWER SETTING INPUT POWER: (6.0V)(3.16A) = 18.96Watts

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. 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

N/A DATA RADIO ONLY

VOICE MODULATED COMMUNICATION EQUIPMENT

Part 2.1047(a): 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.

N/A DATA RADIO ONLY

AUDIO INPUT VERSUS MODULATION

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

Test Requirements: Part 2.1047(b) & 90

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 3000 Hz.

Test data:

N/A DATA RADIO ONLY

Modulation Limiting Plot

OTHER MODULATION CHARACTERISTICS

Rule Part No.: Part 2.1033(c), Pt 90.209, Pt 90.207

Requirements: Part 2.1033(c) (4), Pt 90.209, Pt 90.207

Type of Emission: 11K2F1D , 11K2F2D,

Bn = 2M + 2DK
M = B/2 = 9600/2= 4800
D = 800
K=1
Bn = 2(4800)+2(800) = 11.2k

Type of Emission: 16K0F2D

Bn = 2M + 2DK
M = 3000
D = 4700
K=1
Bn = 2(3000)+2(4700) = 15.4k

OCCUPIED BANDWIDTH

Rule Part No.: Pt 2.1049

Requirements: Pt 2.1049

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:

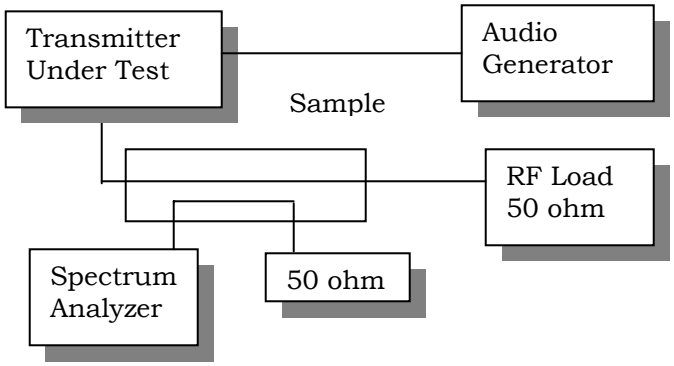
(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 (fd - 2.88 kHz) dB.
(3) On 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.

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

Test Setup Diagram:

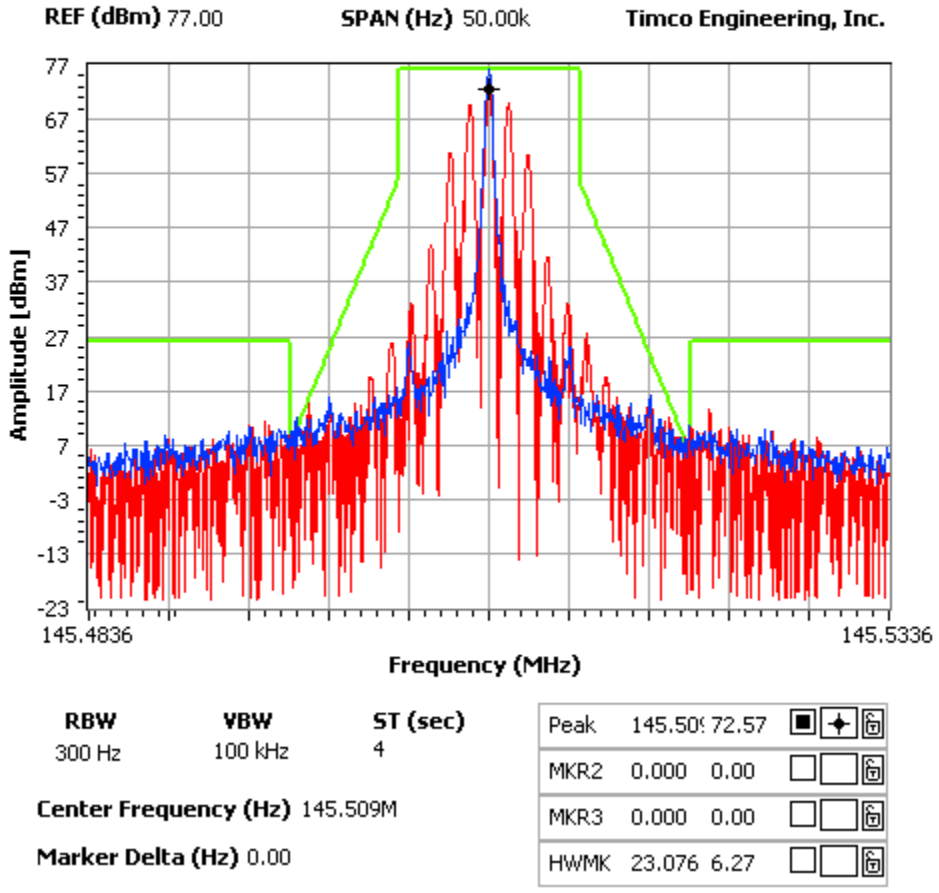


Test Data: See the plots below

OCCUPIED BANDWIDTH PLOTS

NOTES:
Occupied Bandwidth

FCC 90.210 Mask D



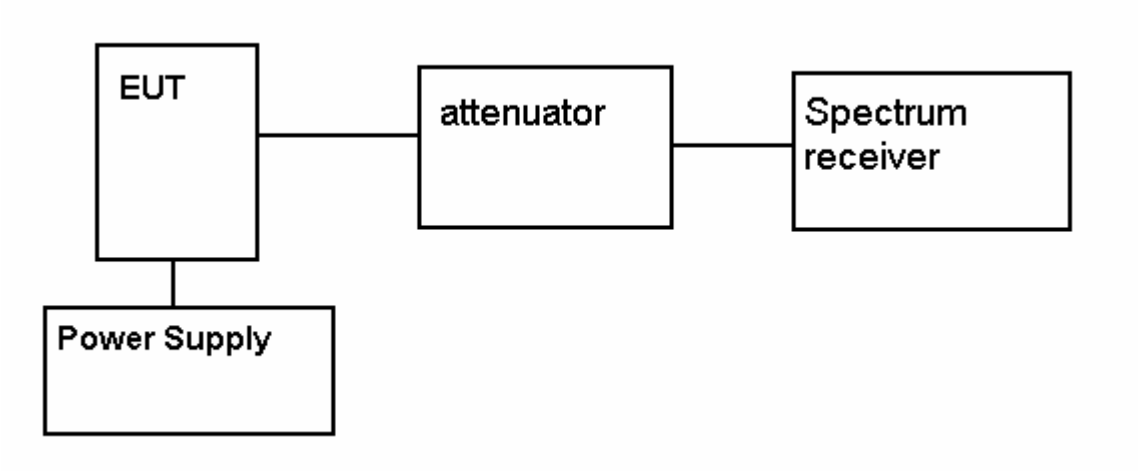
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

Requirements: 25kHz Channel Spacing = 43+10log(OP) = dBc
12.5kHz Channel Spacing = 50+10log(2.9) = 54 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.

Method of Measuring Conducted Spurious Emissions



Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
138	138	0		138	138	0
	276	54.7			276	56.2
	414	57.1			414	55.1
	552	62.1			552	68.4
	690	69.9			690	71.9
	828	60.5			828	70.6
	966	54.6			966	71.3
	1104	55.6			1104	57.6
	1242	64.8			1242	66.5
	1380	74			1380	78.1

[Continued]

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
145.5	145.5	0		145.5	145.5	0
	291	61.2			291	60.1
	436.5	60.4			436.5	60.5
	582	75.7			582	84.1
	727.5	65.9			727.5	64.3
	873	61.1			873	64.5
	1018.5	66.4			1018.5	64
	1164	77.1			1164	74.3
	1309.5	84.4			1309.5	79.4
	1455	85.6			1455	82.7

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
153	153	0		153	153	0
	306	57.6			306	56.8
	459	64.6			459	62.6
	612	69.9			612	78.2
	765	69.1			765	63.2
	918	73.7			918	62.9
	1071	66.1			1071	64.6
	1224	86.2			1224	81.6
	1377	86.6			1377	89.5
	1530	83.2			1530	82.8

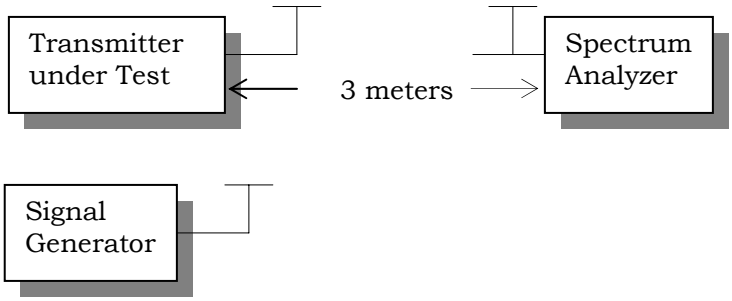
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: Part 2.1053

Requirements: 25kHz Channel Spacing = 43+10log(OP) = dBc
12.5kHz Channel Spacing = 50+10log(2.9) = 54 dBc

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.

Test Setup Diagram:



Test Data:

HI POWER

Emission Frequency MHz	Ant. Polarity Y/N	EUT Signal Reading	Signal Generator Reading	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBm)	dB Below Carrier (dBc)
138.00	H	121.7	87.40	34.30	0	-0.61	33.69	0
276.00	H	30.7	88.10	-57.40	0	-0.61	-58.01	91.70
414.00	V	18.2	82.30	-64.10	0	-0.59	-64.69	98.38
552.00	H	24.5	79.10	-54.60	0	-0.65	-55.25	88.94
690.00	V	12.6	76.90	-64.30	0	-0.39	-64.69	98.38
828.00	V	9.9	72.90	-63.00	0	-1.13	-64.13	97.82
966.00	V	11.6	71.20	-59.60	0	-1.18	-60.78	94.47
1104.00	H	16	75.30	-59.30	1.28	3.37	-57.21	90.90
1242.00	V	13.6	73.60	-60.00	1.3	3.92	-57.38	91.07
1380.00	V	13.9	73.60	-59.70	1.32	4.47	-56.55	90.24

LOW POWER

Emission Frequency MHz	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBm)	dB Below Carrier (dBc)
138.00	H	120.3	87.40	32.90	0	-0.61	32.29	0
276.00	H	30.1	88.10	-58.00	0	-0.61	-58.61	90.90
414.00	H	16.4	84.40	-68.00	0	-0.59	-68.59	100.88
552.00	V	14	78.00	-64.00	0	-0.65	-64.65	96.94
690.00	V	11.7	76.90	-65.20	0	-0.39	-65.59	97.88
828.00	V	6.4	72.90	-66.50	0	-1.13	-67.63	99.92
966.00	H	7.7	72.70	-65.00	0	-1.18	-66.18	98.47

HI POWER

Emission Frequency MHz	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBm)	dB Below Carrier (dBc)
145.50	H	122.6	87.40	35.20	0	-0.61	34.59	0
291.00	H	29.8	83.60	-53.80	0	-0.69	-54.49	89.08
436.50	H	20	82.50	-62.50	0	-0.49	-62.99	97.58
582.00	H	14.5	79.70	-65.20	0	-0.71	-65.91	100.50
727.50	V	13.5	75.50	-62.00	0	-0.6	-62.60	97.19
873.00	V	7.7	71.20	-63.50	0	-0.71	-64.21	98.80
1018.50	H	15	72.70	-57.70	0.97	3.05	-55.62	90.21
1164.00	H	12	74.70	-62.70	1.29	3.56	-60.43	95.02
1309.50	H	15.5	74.70	-59.20	1.02	4.34	-55.88	90.47
1455.00	V	17	72.50	-55.50	1.04	4.71	-51.83	86.42

LOW POWER

Emission Frequency MHz	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBm)	dB Below Carrier (dBc)
145.50	H	119.7	87.40	32.30	0	-0.61	31.69	0
291.00	H	25.9	83.60	-57.70	0	-0.69	-58.39	90.08
436.50	H	14.3	82.50	-68.20	0	-0.49	-68.69	100.38
582.00	H	14	79.70	-65.70	0	-0.71	-66.41	98.10
727.50	V	12.4	75.50	-63.10	0	-0.6	-63.70	95.39
873.00	V	5.6	71.20	-65.60	0	-0.71	-66.31	98.00
1018.50	H	14.1	72.70	-58.60	0.97	3.05	-56.52	88.21
1164.00	H	12.1	74.70	-62.60	1.29	3.56	-60.33	92.02
1309.50	H	15.5	74.70	-59.20	1.02	4.34	-55.88	87.57
1455.00	V	16.1	72.50	-56.40	1.04	4.71	-52.73	84.42

HI POWER

Emission Frequency MHz	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBm)	dB Below Carrier (dBc)
153.00	H	119.7	85.40	34.30	0	-0.03	34.27	0
306.00	H	30.3	83.40	-53.10	0	-0.95	-54.05	88.32
459.00	H	17.9	83.40	-65.50	0	-0.51	-66.01	100.28
612.00	V	18.9	78.40	-59.50	0	-0.67	-60.17	94.44
765.00	V	12.4	74.20	-61.80	0	-1.06	-62.86	97.13
918.00	H	9.6	72.50	-62.90	0	-0.82	-63.72	97.99
1071.00	V	15.6	74.40	-58.80	1.27	3.29	-56.78	91.05
1224.00	H	12.6	73.80	-61.20	1.3	3.91	-58.59	92.86
1377.00	V	15	73.30	-58.30	1.33	4.53	-55.10	89.37
1530.00	H	14.4	75.00	-60.60	1.35	4.99	-56.96	91.23

LOW POWER

Emission Frequency MHz	Ant. Polarity	EUT Signal Reading	Signal Generator Reading	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	ERP (dBm)	dB Below Carrier (dBc)
153.00	H	116.6	85.40	31.20	0	-0.03	31.17	0
306.00	H	22.7	83.40	-60.70	0	-0.95	-61.65	92.82
459.00	H	13	83.40	-70.40	0	-0.51	-70.91	102.08
612.00	V	20.8	78.40	-57.60	0	-0.67	-58.27	89.44
765.00	H	12.6	76.30	-63.70	0	-1.06	-64.76	95.93
918.00	H	8.5	72.50	-64.00	0	-0.82	-64.82	95.99
1071.00	H	12.5	74.00	-61.50	1.27	3.29	-59.48	90.65
1377.00	V	16	73.30	-57.30	1.33	4.53	-54.10	85.27
1530.00	V	16.1	74.80	-58.70	1.35	4.99	-55.06	86.23

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: ANSI/TIA 603-C: 2004.

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	145.499333	-4.74
-20	145.499750	-1.88
-10	145.499745	-1.91
0	145.499803	-1.51
+10	145.499943	-0.55
+20	145.500035	0.08
+30	145.499981	-0.29
+40	145.500047	0.16
+50	145.500216	1.33

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery	Frequency (MHz)	Frequency Stability (PPM)
-15%	145.499701	-2.21
0	145.500023	
+15%	145.500106	0.57

FREQUENCY STABILITY

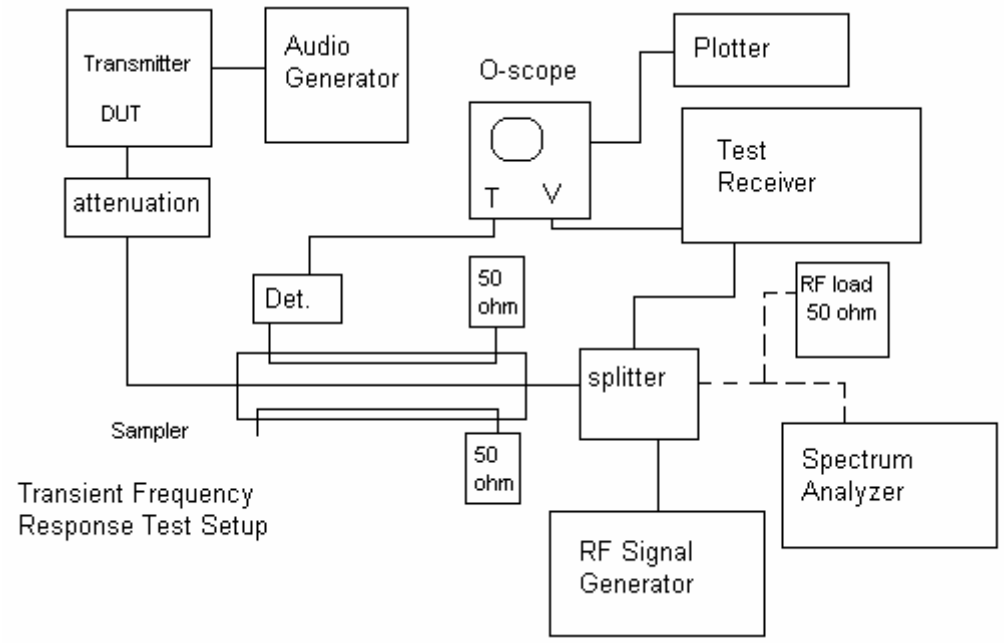
Part 90.214 Transient Frequency Behavior

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:

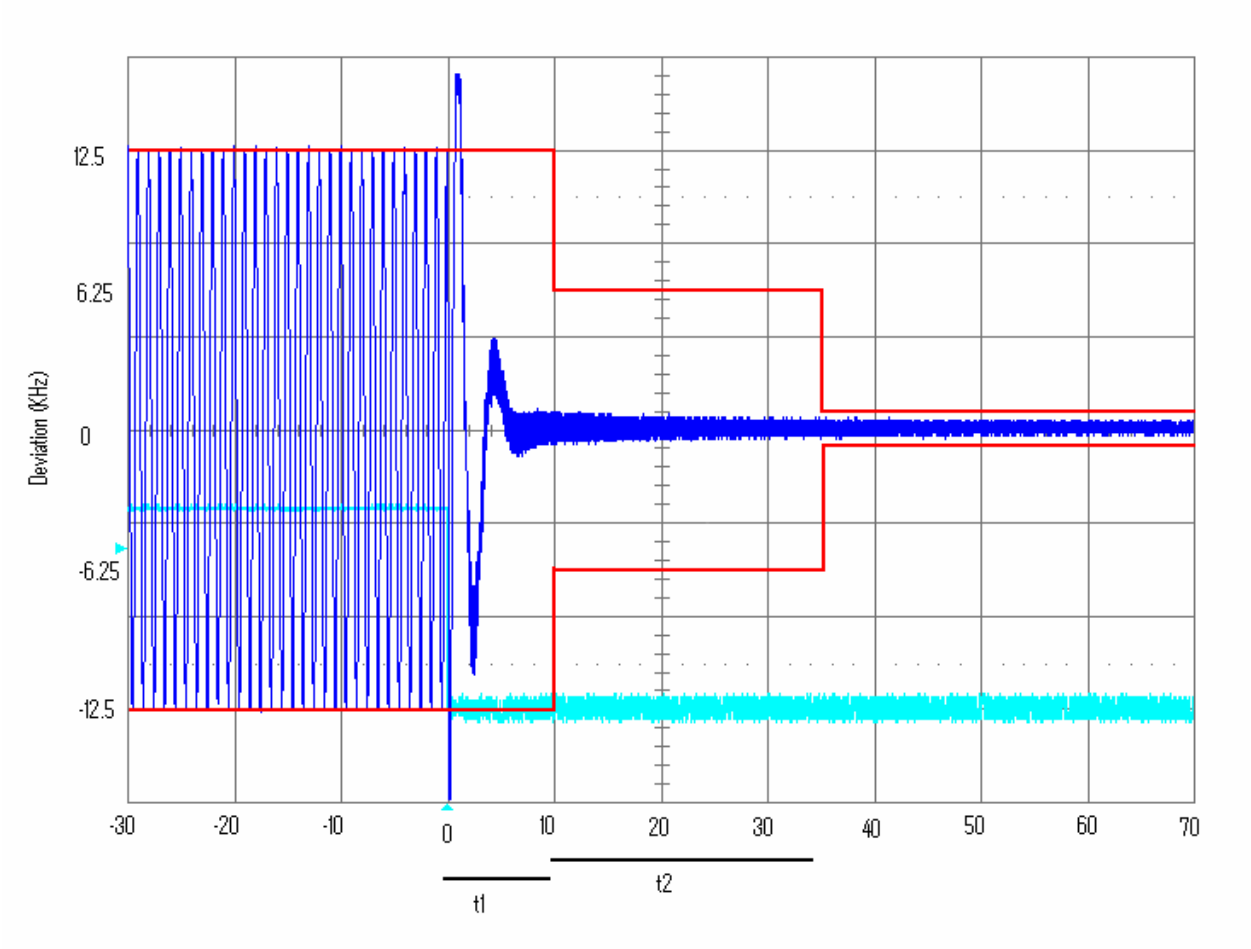
Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment 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: ANSI/TIA 603-C:2004, the levels were set as follows:

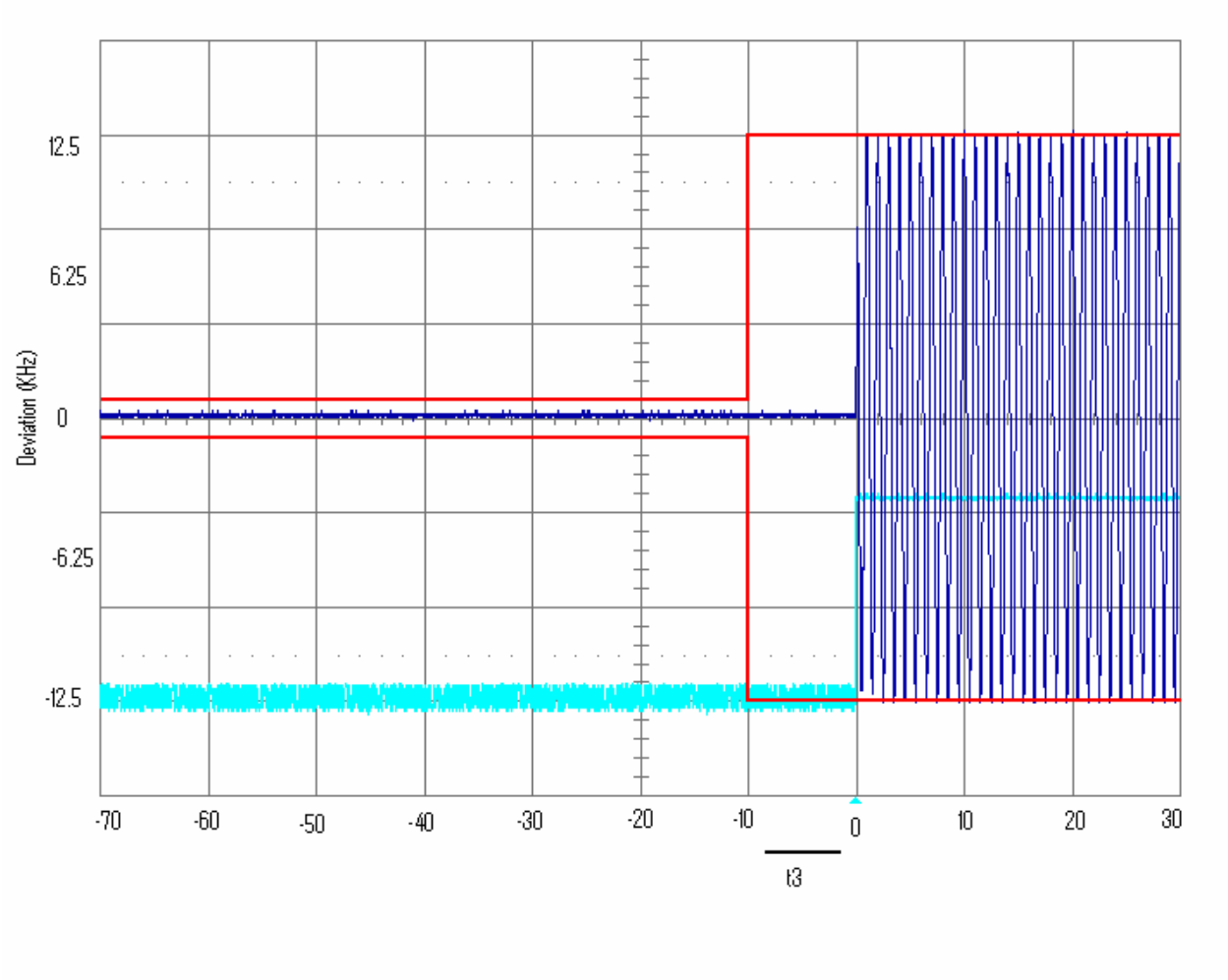
1. Using the variable attenuator the transmitter level was set to 40 dB below the test receivers maximum input level, then the transmitter was turned off.
2. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained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



Transient Frequency Response Test Setup



TRANSIENT FREQUENCY RESPONSE (ON)



TRANSIENT FREQUENCY RESPONSE (OFF)