TIMCO ENGINEERING, Inc.

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FCC PART 90
TEST REPORT

APPLICANT	KOOS TECHNICAL SERVICES
	1025 GREENWOOD BLVD SUITE 391 LAKE MARY FLORIDA 32746
FCC ID	ZBGATRUHF-1
MODEL NUMBER	ATRUHF-1
PRODUCT DESCRIPTION	UHF AGILITY TELEMETRY RADIO
DATE SAMPLE RECEIVED	5/3/2012
DATE TESTED	6/12/2012
TESTED BY	JOE SCOGLIO
APPROVED BY	MARIO R. DE ARANZETA
TIMCO REPORT NO.	1133AUT12TestReport.doc
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

TABLE OF CONTENTS

GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:
☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

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: 2005 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: June 13, 2012

GENERAL INFORMATION
DUT Specification

DUT Description	UHF AGILITY TELEMETRY RADIO
FCC ID	ZBGATRUHF-1
Model Number	ATRUHF-1
Serial Number	N/A
Operating Frequency	450-470 MHz
Test Frequencies	451.0 MHz, 460.0 MHz, 469.0 MHz
DUT Power Source	☐ 110–120Vac/50– 60Hz
	☐ DC Power 12V
	☒ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☒ Fixed
	☐ Mobile
	☐ Portable
Test Conditions	The temperature was 26°C 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, IC RSS-119, RSS-GEN
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

TEST PROCEDURES

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 micro volt at the output of the antenna.

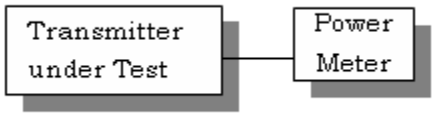
RF POWER OUTPUT

Rule Part No.: FCC Part 2.1046(a), IC RSS-119 4.1 and 5.4, RSS-GEN 4.8

Test Requirements:

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

Test Setup Diagram:



Test Data:

OUTPUT POWER: HIGH – 3.3 Watts Conducted
LOW - 0.009 Watts Conducted

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: FCC Part 2.1051(a), RSS-GEN 7.1.4

Requirements: 12.5 kHz CH spacing– 50+10log(3.3) = 55
6.25 kHz CH spacing - 55+10log(3.3) = 60

Method of Measurement: The carrier was modulated 100%. 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.

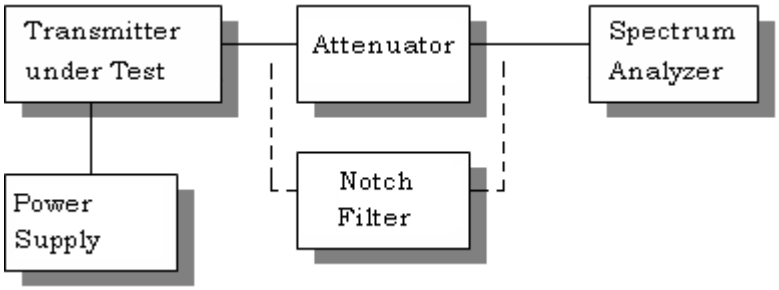
Test Data:

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
451.0	451	0		451	451	0
	902	76.1			902	75.6
	1353	74.8			1353	96
	1804	90			1804	94
	2255	76.7			2255	104.9
	2706	93.7			2706	92.7
	3157	97.5			3157	106.7
	3608	105.7			3608	104.3
	4059	97.7			4059	103.7
	4510	106.8			4510	103.5

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
460.0	460	0		460.0	460	0
	920	74.2			920	75.9
	1380	76.8			1380	94.9
	1840	89.4			1840	95
	2300	74.6			2300	106.2
	2760	97.9			2760	94.7
	3220	102.3			3220	108.8
	3680	106			3680	103.3
	4140	99.2			4140	108.4
	4600	113.5			4600	101.9

TF HIGH POWER	EF	dB below carrier		TF LOW POWER	EF	dB below carrier
469.0	469	0		469.0	469	0
	938	73.8			938	74.9
	1407	75.4			1407	94.8
	1876	86.2			1876	93.6
	2345	77.2			2345	104.2
	2814	95.1			2814	97.2
	3283	103.1			3283	108.5
	3752	103.9			3752	102.5
	4221	109.9			4221	108.6
	4690	111.2			4690	102.7

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.

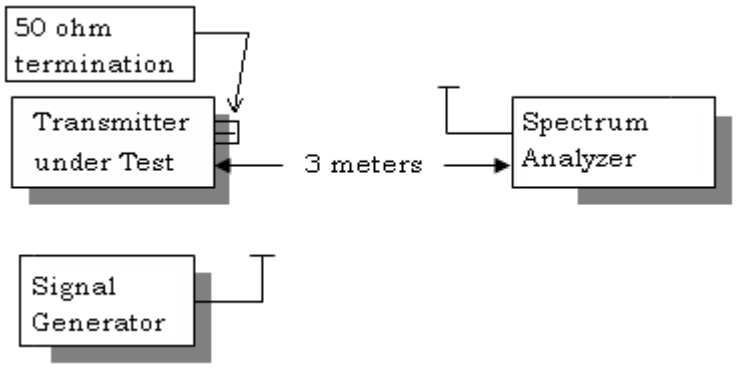
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053, RSS-GEN 4.9

Requirements:	12.5 kHz CH spacing–	50+10log(3.3) = 55
	6.25 kHz CH spacing -	55+10log(3.3) = 60
Low power		55+10log(0.1) = 45

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 **Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
451.00	V	0		451.00	V	0
902.00	V	72.8		902.00	V	48.8
1353.00	V	71.2		2706.00	V	54.1
1804.00	H	65.1		3608.00	H	63.3
2255.00	H	78.0		4510.00	V	59.7
2706.00	H	76.2				
3157.00	H	75.5				
3608.00	V	78.6				
4059.00	V	82.0				
4510.00	V	80.0				

High Power **Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
460.00	V	0		460.00	V	0
920.00	V	69.0		920.00	V	48.9
1380.00	H	76.4		2760.00	V	58.7
1840.00	V	70.2		3220.00	V	64.8
2300.00	V	78.4		3680.00	H	62.7
2760.00	V	79.7		4600.00	V	61.0
3220.00	V	78.3				
3680.00	H	77.7				
4140.00	V	82.2				
4600.00	V	84.8				

High Power **Low Power**

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)		Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
469.00	V	0		469.00	V	0
938.00	V	63.8		938.00	V	49.3
1407.00	H	72.4		2814.00	V	61.3
1876.00	H	72.9		3752.00	V	61.0
2345.00	V	75.5		4690.00	V	64.0
2814.00	H	81.4				
3283.00	V	80.9				
3752.00	H	79.8				
4221.00	V	86.4				
4690.00	V	87.5				

FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 90.213, RSS-119 5.3, RSS-GEN 7.2.4

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

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

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		451.000241
Temperature (ºC)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-30	451.000221	-0.04
-20	451.000244	0.01
-10	451.000242	0.00
0	451.000233	-0.02
+10	451.000232	-0.02
+20	451.000235	-0.01
+30	451.000215	-0.06
+40	451.000185	-0.12
+50	451.00017	-0.16

Assigned Frequency (Ref. Frequency) (MHz)		
% Battery (%)	**Frequency (MHz)**	**Frequency Stability (PPM)**
-15%	451.000241	0.00
+15%	451.000241	0.00

TRANSIENT FREQUENCY BEHAVIOR

FCC Part 2.1055(a)(1)
FCC Part 90.214, IC RSS-119 5.8

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

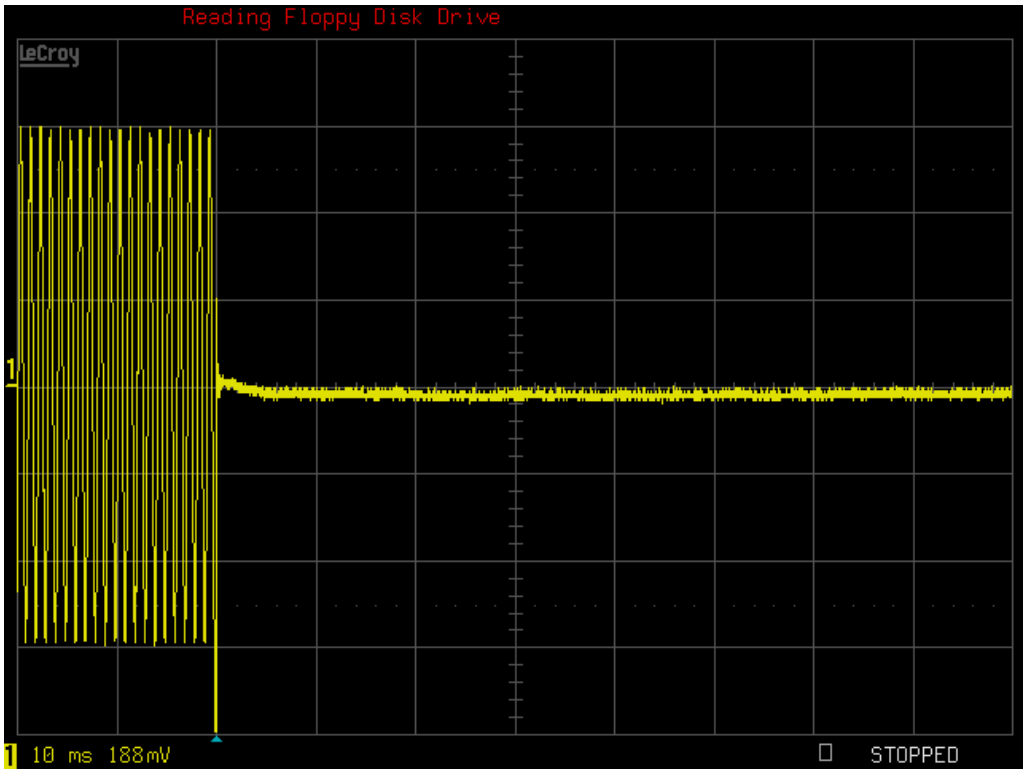
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

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

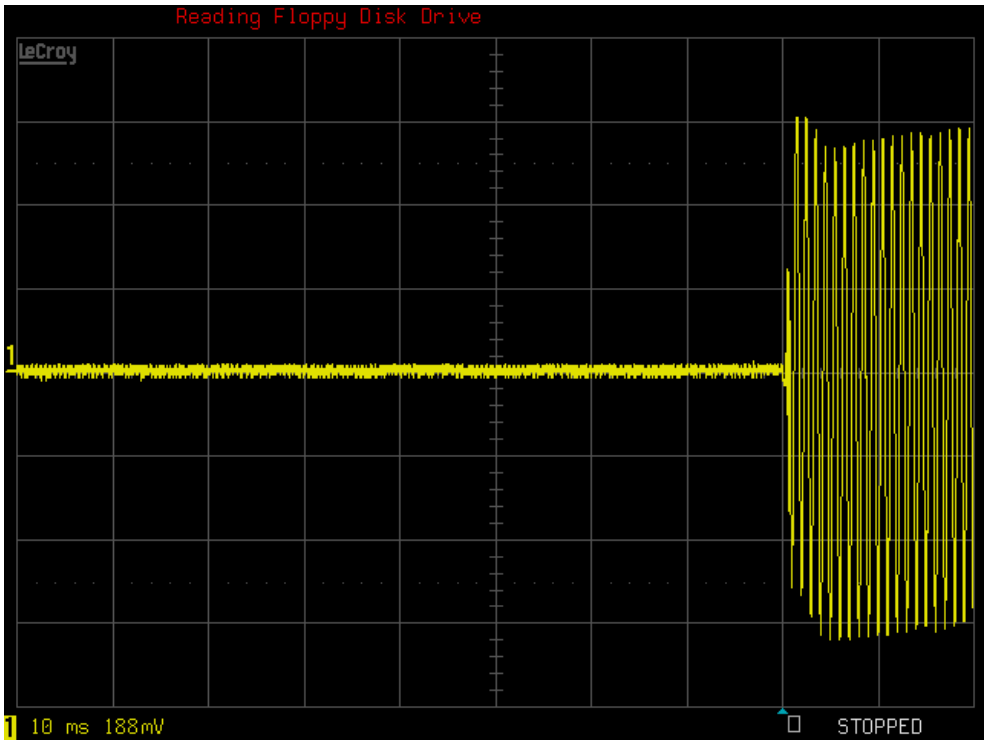
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

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

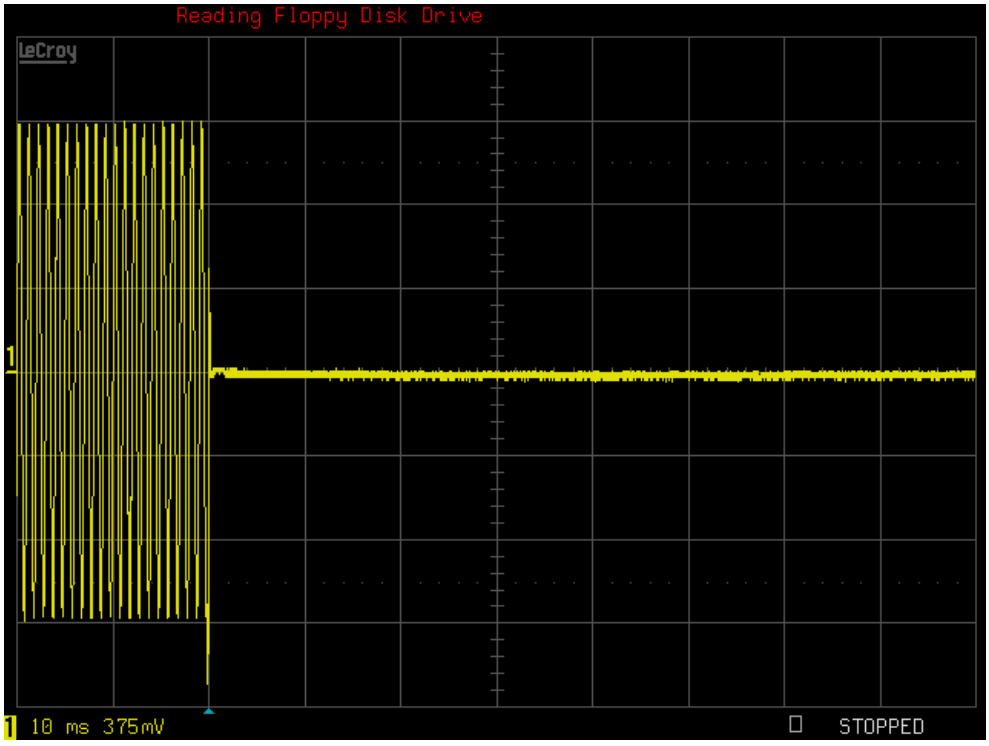
NARROW BAND – ON



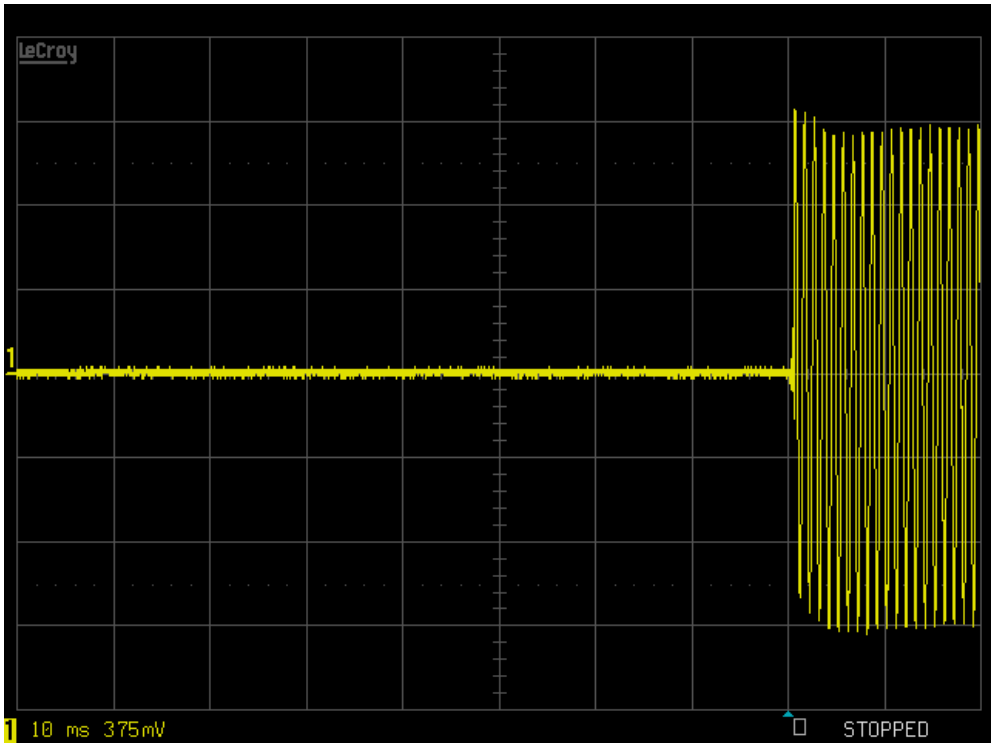
NARROW BAND – OFF



WIDE BAND - ON



WIDE BAND – OFF

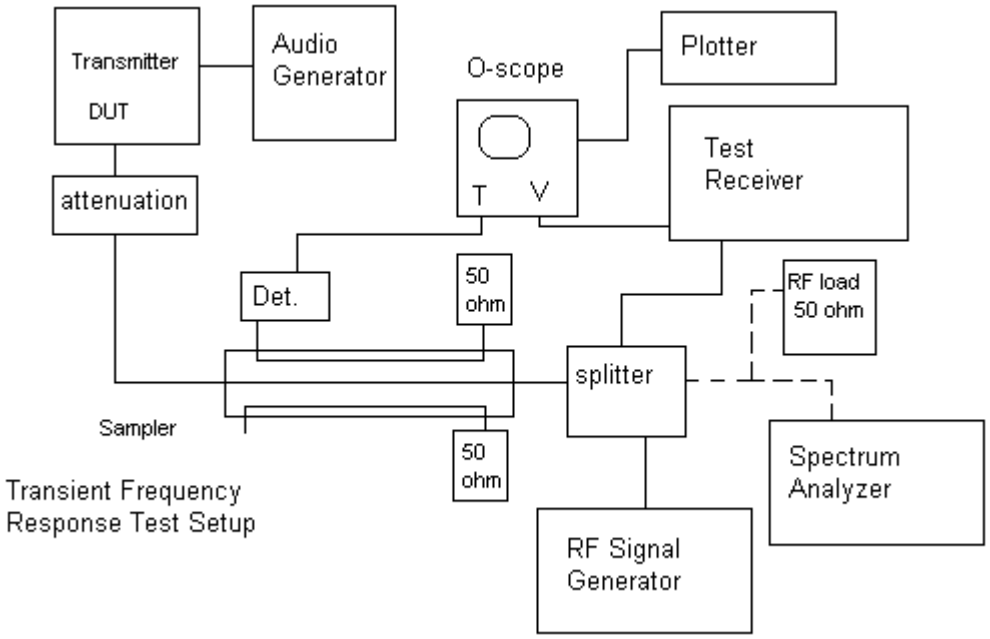


TEST PROCEDURE: ANSI/TIA 603-C: 2004 PARA 2.2.19

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. 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	11/24/09	10/28/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	11/21/09	10/28/13
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	11/10/10	11/10/12
Antenna: Biconnical	Eaton	94455-1	1096	05/04/11	05/04/13
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/04/11	05/04/13
Frequency Counter	HP	5352B	2632A00165	06/22/11	06/22/13
Frequency Counter	HP	5385A	2730A03025	08/17/11	08/17/13
Signal Generator	HP	8640B	2308A21464	02/23/12	02/23/14
Hygro-Thermometer	Extech	445703	0602	06/15/11	06/15/13
Digital Multimeter	Fluke	77	35053830	09/09/11	09/09/13
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	11/21/09	10/28/13
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	11/10/10	11/10/12
Modulation Analyzer	HP	8901A	3435A06868	07/18/11	07/18/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	11/22/09	10/28/13
Analyzer Silver Tower Quasi-Peak Adapter	HP	85650A	3303A01844	11/23/10	11/23/12
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13