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FCC PART 90 VHF TEST REPORT

APPLICANT	KP ELECTRONIC SYSTEMS LTD.
	P.O. BOX 42 TEFEN INDUSTRIAL PARK 24959 ISRAEL
FCC ID	H78KPMT2PIT
MODEL NUMBER	MT2PIT
PRODUCT DESCRIPTION	VHF AUTOMATIC METER READING TRANSCIVER W/ 2.4 GHz MODULE
DATE SAMPLE RECEIVED	1/4/2016
DATE TESTED	1/22/2016
TESTED BY	Tim Royer
APPROVED BY	Cory Leverett
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

Report Number	Version Number	Description	Issue Date
12AUT16TestReport_	Rev1	Initial Issue	1/25/2016

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

Table of Contents

GENERAL REMARKS.....	3
GENERAL INFORMATION	4
TEST RESULTS SUMMARY	5
RF POWER OUTPUT	6
Test Data: Conducted Output Power Table	6
MODULATION CHARACTERISTICS	7
Test Data: 99% Emission Bandwidth Plot.....	7
OCCUPIED BANDWIDTH.....	8
TEST DATA: Emission Mask E Plot.....	9
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)	10
Test Data: Antenna Conducted Emissions Table.....	10
FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS.....	11
Test Data: Field Strength of Spurious Emission Table	11
FREQUENCY STABILITY.....	12
Test Data: Frequency Stability Table	12
TRANSIENT FREQUENCY RESPONSE	13
Test Data: Turn On Reponse Plot	15
Test Data: Turn Off Response Plot	16
EQUIPMENT LIST	17

GENERAL REMARKS

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

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 requirements.

I attest that the necessary measurements were made at:

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

Authorized Signatory Name:



Authorized Signatory Name: _____

Tim Royer
Project Manager/Testing Technician

Date: 1/25/2016

GENERAL INFORMATION

EUT Specification

EUT Description	VHF AUTOMATIC METER READING TRANSCIVER W/ 2.4 GHz MODULE
FCC ID	H78KPMT2PIT
Model Number	MT2PIT
Operating Frequency	172.5 – 173.5 MHz
Test Frequencies	173.2MHz
Type of Emission	2K55F1D
Modulation	FM
EUT Power Source	<input type="checkbox"/> 110–120Vac/50– 60Hz
	<input checked="" type="checkbox"/> DC Power 12V
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input checked="" type="checkbox"/> Pre-Production
	<input type="checkbox"/> Production
Type of Equipment	<input type="checkbox"/> Fixed
	<input checked="" type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Test Conditions	Temperature: 24-26°C Relative Humidity: 50 - 65%.
Modification to the EUT	None
Test Exercise	The EUT was operated in a normal mode.
Regulatory Standard	FCC CFR 47 Part 90, 90R, 90S
Measurement Standard	ANSI/TIA 603-D:2010 ANSI C63.4 – 2014
Test Facility	Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA.

TEST RESULTS SUMMARY

Test Description	FCC RULE PART NO.	RESULT
Modulation Characteristics	2.1047(a)(b)	Pass
RF Power Output	2.1046(a), 90.205(d)	Pass
Occupied Bandwidth	2.1049(c)(h), 90.210(e)	Pass
Spurious Emissions at Antenna Terminal	2.1051(a), 90.210(e)	Pass
Field Strength of Spurious Radiation	2.1053, 90.210(e)	Pass
Frequency Stability	2.1055, 90.213	Pass
Transient Frequency Response	90.214	Pass

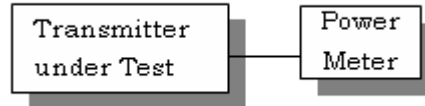
RF POWER OUTPUT

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

Requirements: 150 – 174 MHz Geographical dependent limit, reporting only.

PROCEDURE: ANSI/TIA-603 § 2.2.1 Conducted Carrier Output Power

Test Setup Diagram:



Test Data: Conducted Output Power Table

Tuned Frequency (MHz)	RF POWER	
	dBm	Watts
173.00	31.93	1.56

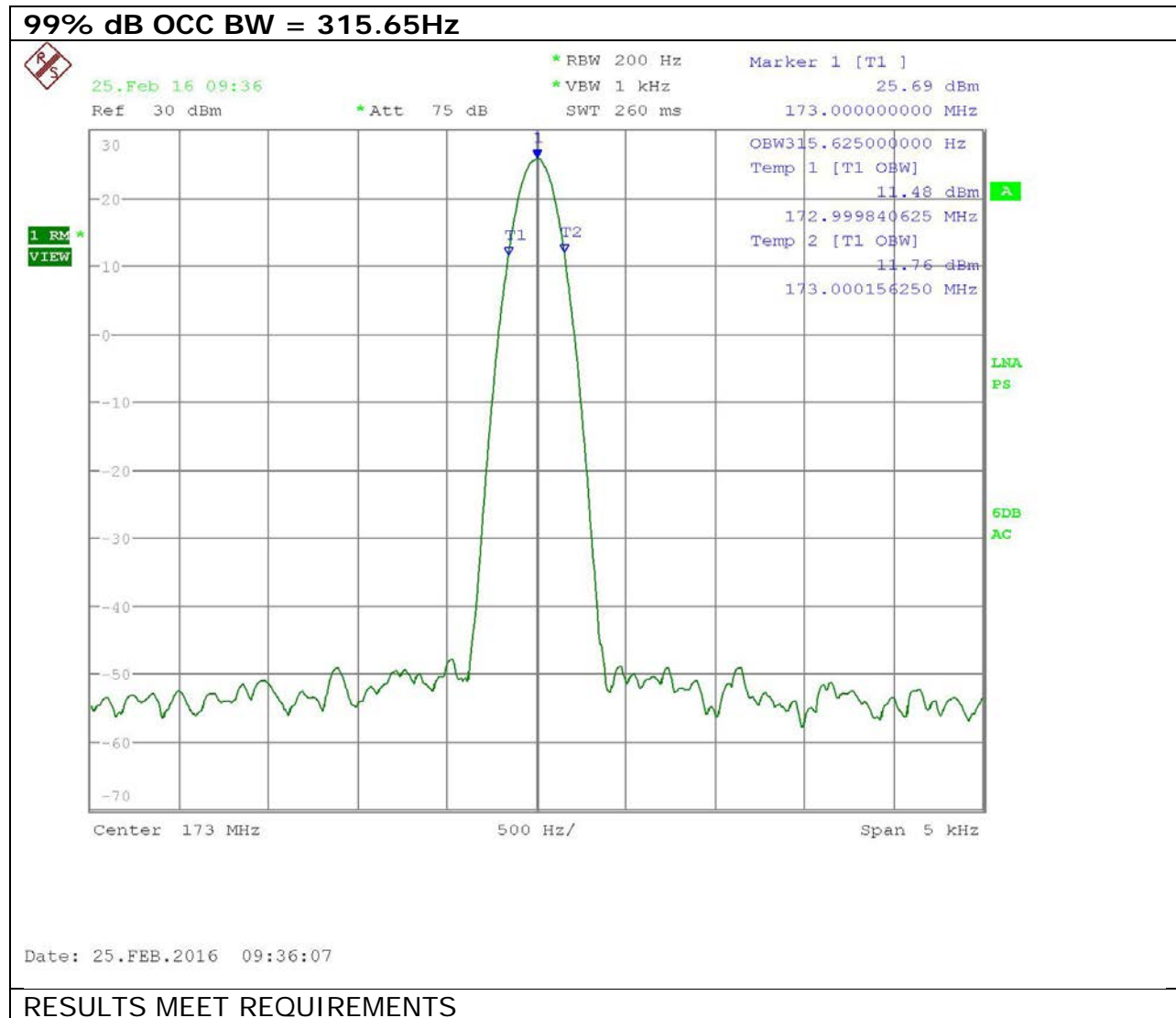
Part 2.1033 (C) (8) DC Input into the final amplifier

FOR LOW POWER SETTING INPUT POWER: $(5.54V) (0.83A) = 4.5982Watts$

MODULATION CHARACTERISTICS

Requirements: Part 2.1033(c), 2.1033(c) (4), 2.1047(a)(b), 90.209, 90.207

Test Data: 99% Emission Bandwidth Plot



OCCUPIED BANDWIDTH

RULE PART NO.: 2.1049(c) & 90.210

REQUIREMENTS: Applicable Emission Masks

Frequency band (MHz)	Mask for equipment with audio low pass filter	Mask for equipment without audio low pass filter
150-174 ²	B, D, or E	C, D, or E

²Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask.

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

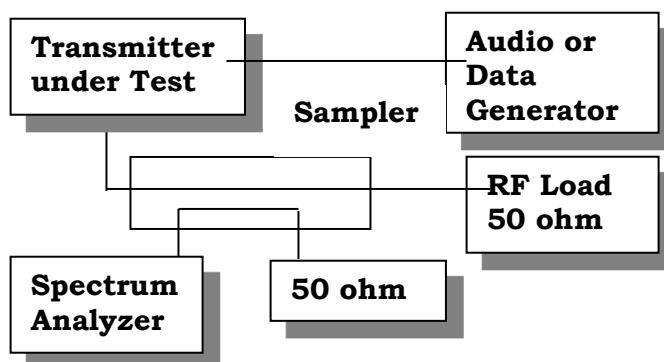
(1) On any frequency from the center of the authorized bandwidth f_0 to 3.0 kHz removed from f_0 : Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least $30 + 16.67(f_d - 3 \text{ kHz})$ or $55 + 10 \log(P)$ or 65 dB, whichever is the lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \log(P)$ or 65 dB, whichever is the lesser attenuation.

PROCEDURE:: ANSI/TIA-603 § 2.2.11 Sideband Spectrum

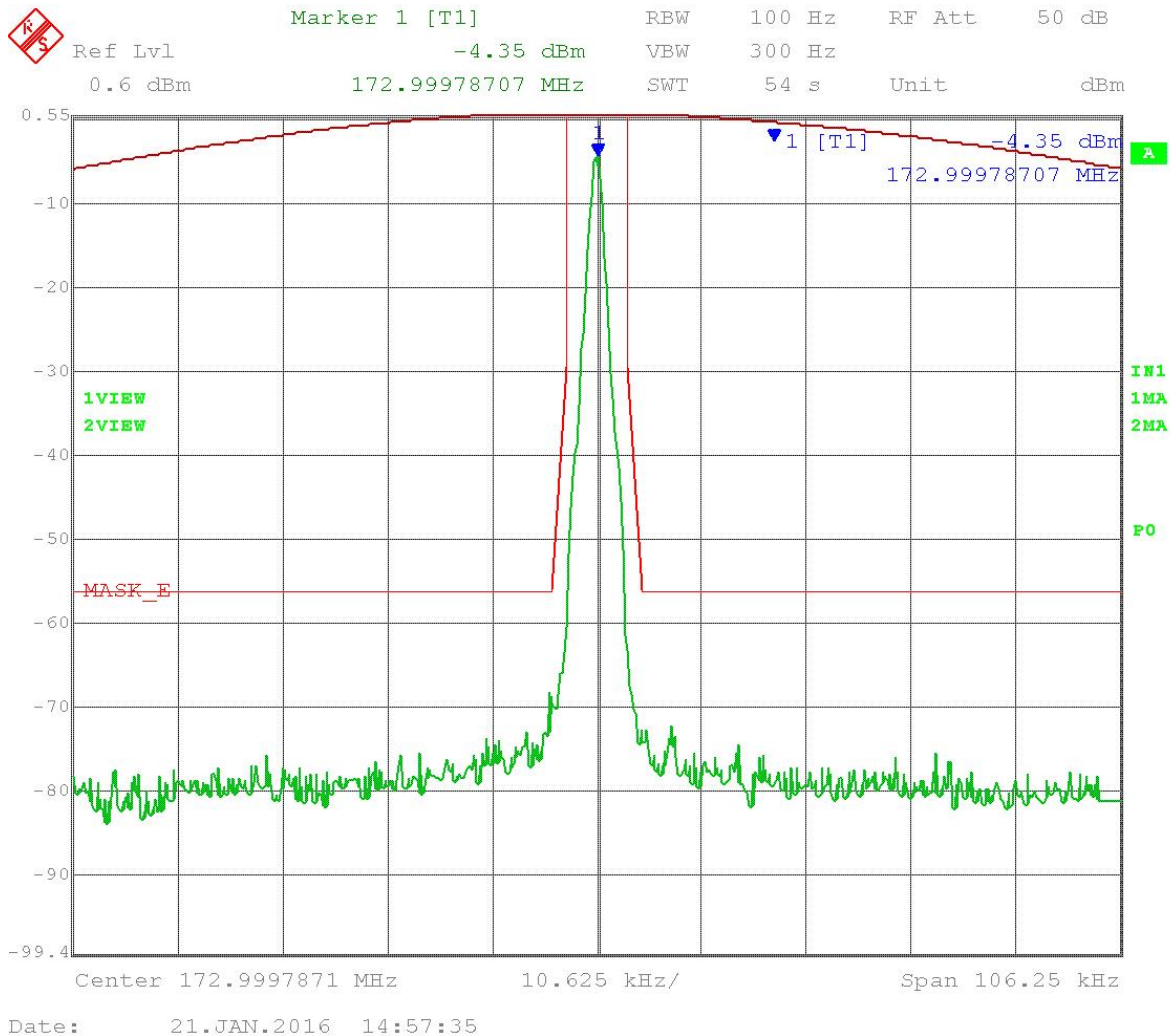
SETUP:



OCCUPIED BANDWIDTH

TEST DATA: Emission Mask E Plot

Part 90.210(b) Emission Mask e – Equipment with or without audio Low pass filter



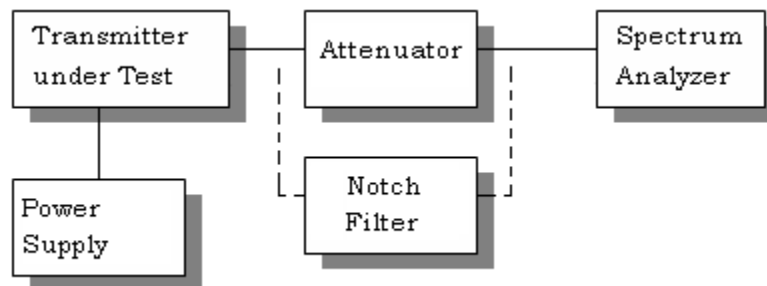
SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a), 90.210

Requirements:

6.25 kHz Channel Spacing = $55 + 10 \log(1.56) = 56.9$ dBc

PROCEDURE: ANSI/TIA-603 § 2.2.13 Unwanted Emissions: Conducted Spurious



Test Data: Antenna Conducted Emissions Table

The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental

	dBm	dBm	Watts
Power Output	31.93	31.93	1.56
Frequency	dBm	dBc	
173	31.93	0	
346	-40.4	72.33	
519	-50.4	82.33	
692	-72	103.93	
865	-83.5	115.43	
1038	-49.2	81.13	
1211	-76.8	108.73	
1384	-62.4	94.33	
1557	-76.4	108.33	
1730	-79.4	111.33	

Results meet requirement

FIELD STRENGTH OF SPURIOUS RADIATION EMISSIONS

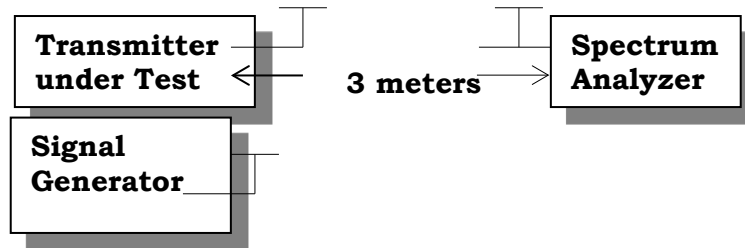
RULE PARTS. NO.: Part 2.1053, 90.210

Requirements:

6.25 kHz Channel Spacing = $55 + 10 \log (1.56) = 56.9 \text{ dBc}$

PROCEDURE: ANSI/TIA-603 § 2.2.12 Unwanted Emissions: Radiated Spurious

SETUP:



Test Data: Field Strength of Spurious Emission Table

The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental

Emission Frequency (MHz)	Power Mode	ERP Power Output (dBm)	ERP Power Output (Watts)	FCC Requirement dB	Bandwidth - BW - kHz
173	Hi	31.93	1.56	31.93	6.25
Emission Frequency (MHz)	Ant. Polarity	Below Carrier (dBc)		Margin	
346	H	119.16		87.23	
346	V	120.82		88.89	
519	H	115.89		83.96	
519	V	111.05		79.12	
692	H	112.21		80.28	
692	V	109.24		77.31	
865	H	109.74		77.81	
865	V	105.65		73.72	
1038	H	94.60		62.67	
1038	V	92.40		60.47	
1211	H	92.35		60.42	
1211	V	93.03		61.1	
1384	H	92.20		60.27	
1384	V	91.69		59.76	
1557	H	92.65		60.72	
1557	V	92.26		60.33	
1730	H	87.87		55.94	
1730	V	90.63		58.7	

Result meets requirement

FREQUENCY STABILITY

RULE PARTS. NO.: Part 2.1055, Part 90.213, 90.539(c)

Requirements: ± 1 ppm
Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%

PROCEDURE: ANSI/TIA-603 § 2.2.2 Carrier Frequency Stability

Test Data: Frequency Stability Table

Temperature	Frequency MHz	Cycles	PPM
25°C (reference)	172.99985		
-30°C	172.99991	60	0.347
-20°C	172.99993	80	0.462
-10°C	172.99994	90	0.520
0°C	172.99995	100	0.578
10°C	172.99991	60	0.347
20°C	172.99989	40	0.231
30°C	172.99988	30	0.173
40°C	172.99987	20	0.116
50°C	172.99989	40	0.231

Battery Voltage	Frequency	Cycles	PPM
-15%	172.999830	-20	-0.116
15%	172.999840	-10	-0.058

Result meets requirement

TRANSIENT FREQUENCY RESPONSE

RULE PARTS. NO.: 90.214

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 ^{1 2}	Maximum frequency difference ³	All equipment	
		150 to 174 MHz	421 to 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

¹ t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

t_1 is the time period immediately following t_{on} .

t_2 is the time period immediately following t_1 .

t_3 is the time period from the instant when the transmitter is turned off until t_{off} .

t_{off} is the instant when the 1 kHz test signal starts to rise.

² During the time from the end of t_2 to the beginning of t_3 , the frequency difference must not exceed the limits specified in §90.213.

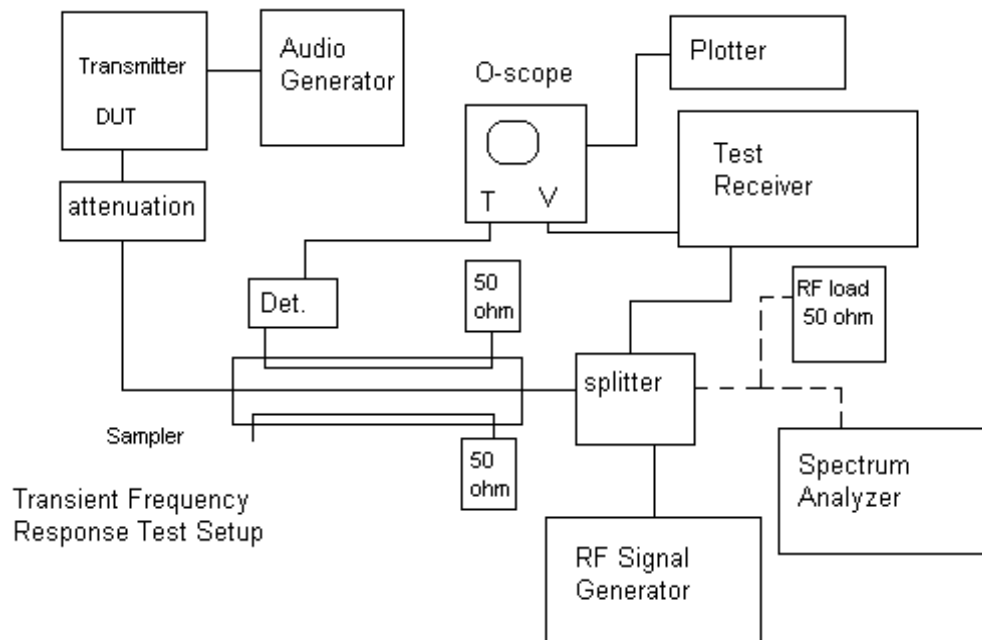
³ Difference between the actual transmitter frequency and the assigned transmitter frequency.

⁴ If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

TRANSIENT FREQUENCY RESPONSE

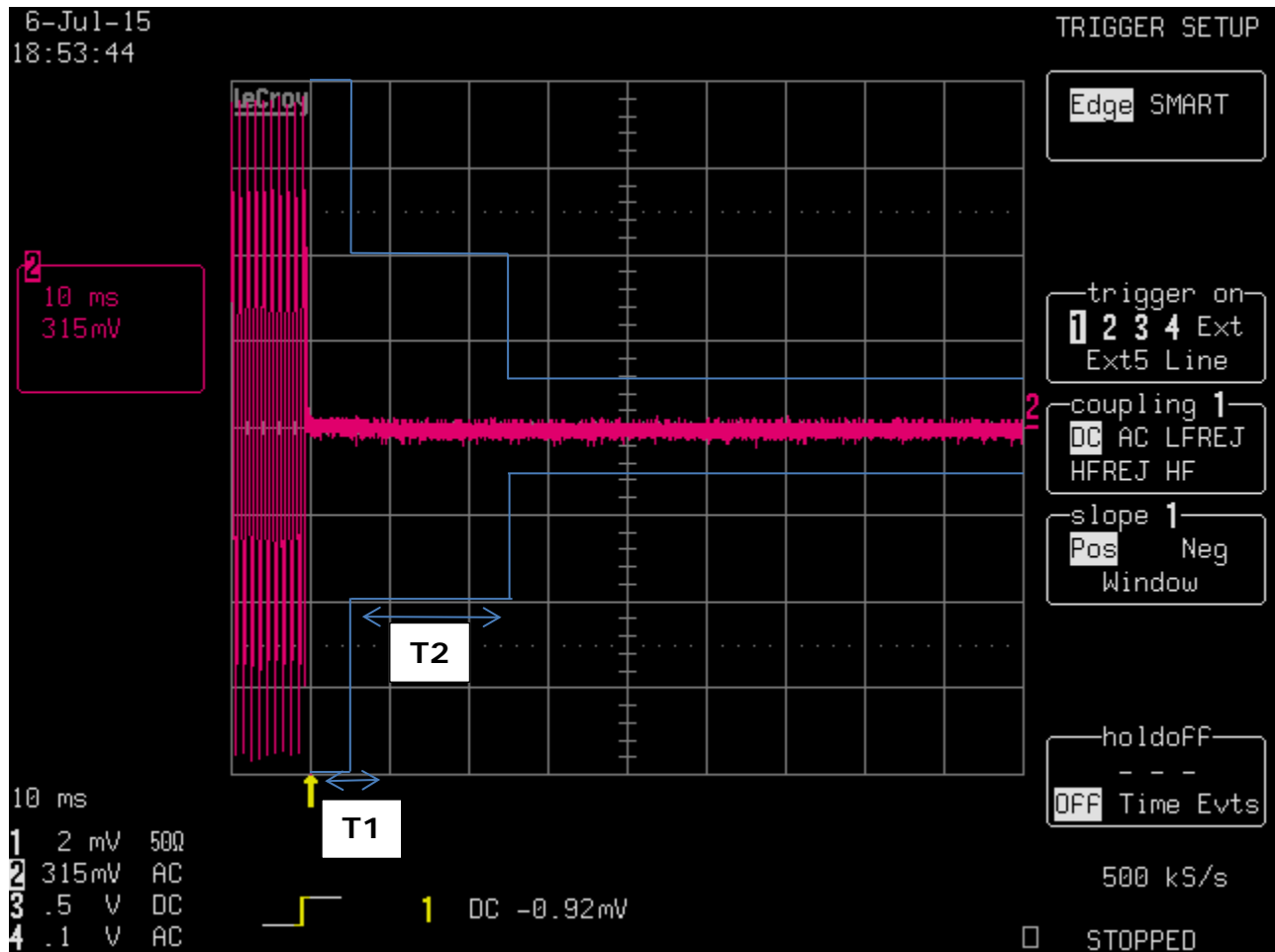
PROCEDURE: ANSI/TIA-603 § 2.2.19 Transient frequency behavior

TEST SETUP DIAGRAM:



TRANSIENT FREQUENCY RESPONSE

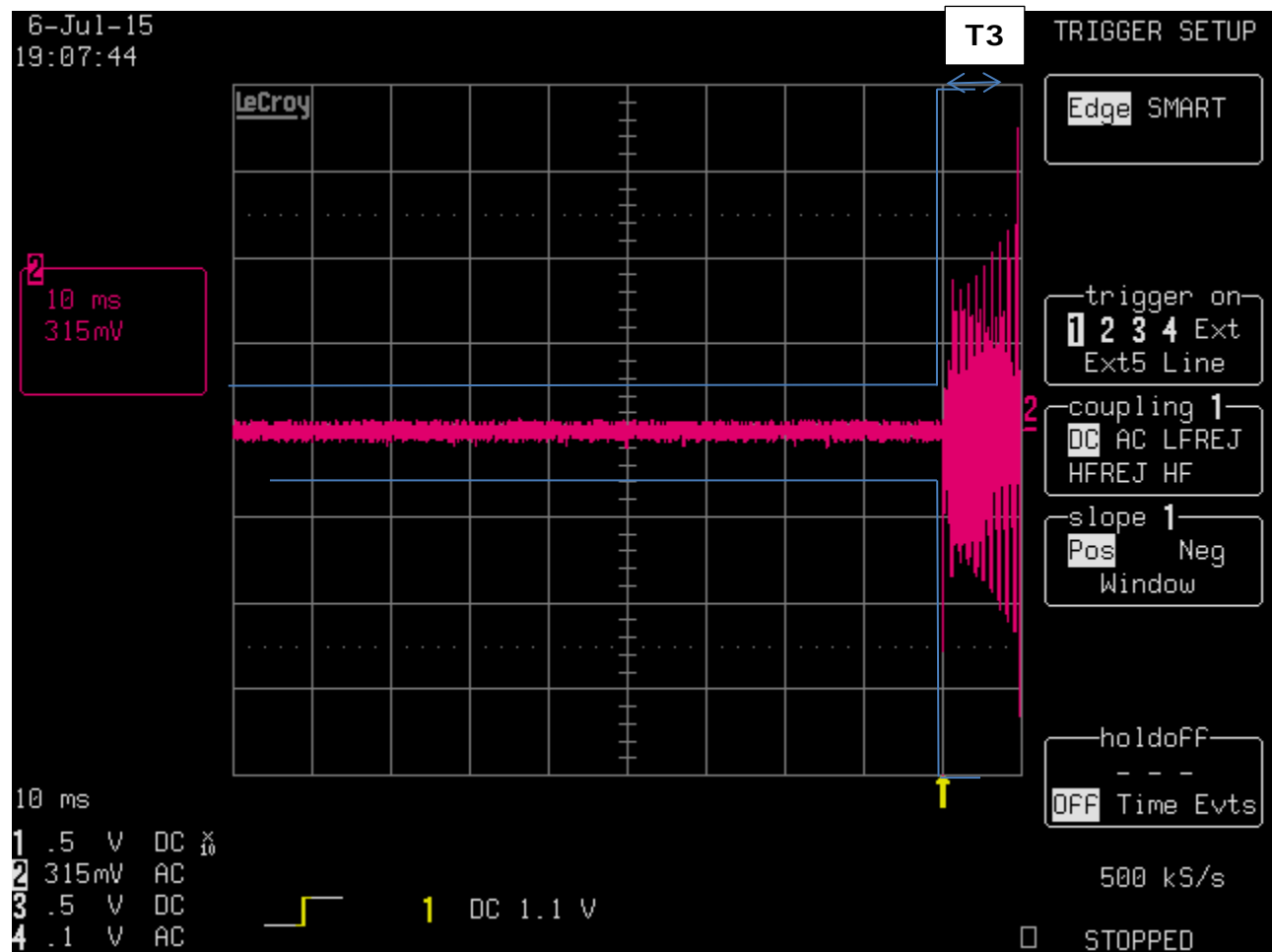
Test Data: Turn On Reponse Plot



Results meet requirements

TRANSIENT FREQUENCY RESPONSE

Test Data: Turn Off Response Plot



Results meet requirements

EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Antenna: Biconnical	Eaton	94455-1	1057	11/18/15	11/18/17
Antenna: Log-Periodic	Eaton	96005	1243	7/14/15	7/14/17
Temperature Chamber LARGE	Tenney Engineering	TTRC	11717-7	08/19/14	08/19/16
Frequency Counter Small Chamber	HP	5385A	3242A07460	07/01/15	07/01/17
CHAMBER	Panashield	N/A	N/A	01/05/16	03/01/16
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	06/13/14	06/13/16
Software: Field Strength Program	Timco	N/A	Version 4.0	N/A	N/A
Antenna: Active Loop	ETS-Lindgren	6502	00062529	11/18/15	11/18/17
Hygro-Thermometer	Extech	445703	0602	06/30/15	06/30/17
EMI Test Receiver R & S ESU 40 Chamber	Rohde & Schwarz	ESU 40	100320	03/11/14	03/11/16
Signal Generator HP 8648C	HP	8648C	3623A02898	08/29/13	02/29/16

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3