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FCC PART 22

TEST REPORT

APPLICANT	HYTERA MOBILFUNK GMBH
ADDRESS	Fritz-Hahne-Str. 7
	Bad Muender D-31848 GERMANY
FCC ID	ZW4TIB500400
MODEL NUMBER	TIB500400
PRODUCT DESCRIPTION	TETRA INDOOR BASE TRANSCEIVER
DATE SAMPLE RECEIVED	9/4/2013
DATE TESTED	9/4/2013
TESTED BY	Nam Nguyen
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	1525UT13TestReport.docx
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.

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.

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
Engineering Project Manager

Date: September 4th, 2013

GENERAL INFORMATION

DUT Specification

DUT Description	TETRA INDOOR BASE TRANSCEIVER
FCC ID	ZW4TIB500400
Model Number	TIB500400
Operating Frequency	454 – 460 MHz
Type of Emission	20K0F3E
Modulation	FM
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 26ºC 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
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	10/28/11	10/28/13
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	10/28/11	10/28/13
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	06/05/13	06/05/15
EMI Receiver	Rohde & Schwarz	ESIB40	100274	3/16/12	3/16/14
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	12/07/11	12/07/13
Notch Filter	Microlab	HA-10N		5/17/13	5/17/15
Notch Filter	Microlab	HA-20N		5/17/13	5/17/15
Power Meter	Boonton Electronics	4531	11793	1/9/13	1/9/15
Sensor	Boonton	51072A	34647	01/19/13	01/19/15
Frequency Counter	HP	5385A	2730A03025	08/22/13	08/22/15
Signal Generator	HP	8640B	2308A21464	02/23/12	02/23/14
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	10/28/11	10/28/13
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	10/28/11	10/28/13
3-Meter Semi-Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13

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.

RF POWER OUTPUT

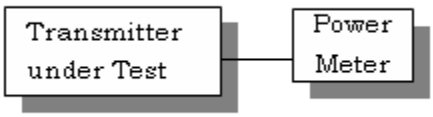
Rule Part No.: Part 2.1046(a), Part 90

Test Requirements:

Method of Measurement: RF power is measured by using a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage (if battery operated), or a properly adjusted power supply (if not battery operated), and the transmitter properly adjusted the RF output measures:

For the device with a fixed or integral antenna, the RF power is measured as ERP. The substitution method was used. The RF output measures:

Test Setup Diagram:



Test Data: RF power of the EUT can be set at 50W to 1W.

OUTPUT POWER:

Carrier A	RF POWER (W)	
Tuned Frequency (MHz)	HI	LOW
454.025	44.7	1
457.000	45.7	1
459.975	43.7	1

Carrier B	RF POWER (W)	
Tuned Frequency (MHz)	HI	LOW
454.025	47.9	1
457.000	46.8	1
459.975	47.9	1

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

Same as certified under part 90.

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 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

NA

0.20 modified TETRA modulation

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.

NA
Digital modulation 0.20 modified TETRA

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 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.

Modulation Limiting Plot

OTHER MODULATION CHARACTERISTICS

Part 2.1033(c)
Part 2.1033(c) (4) Type of Emission:
Part 90.209

Part 2.1033(c) (4) Type of Emission: 20K0D
Part 90.209
Part 90.207

Type of Emission: π/4DQPSK TETRA as defined in EN 300 392-2.
TETRA is a digital, trunked radio technology that operates with Time Division Multiple Access (TDMA) in four-slot channels within a twenty-five kilohertz bandwidth.

This unit has two distinct and different but similar modulation schemes. One being as defined above and the second mode which is similar and implemented through a software change only where:

Where the roll-off factor, which determines the width of the transmission band at a given symbol rate has been rolled off to 0.20. For normal TETRA the value is 0.35.

This spectrum of the normal 0.35 factor can't fulfill the requirement of the FCC. Therefore the shape of the output spectrum has been modified by changing from 0.35 to 0.20. This gives a narrowed spectrum that meets the FCC requirements for the 20 kHz bandwidth.

OCCUPIED BANDWIDTH

Part 2.1049(c) EMISSION BANDWIDTH:
Part 90.210(b) 25kHz Channel Spacing

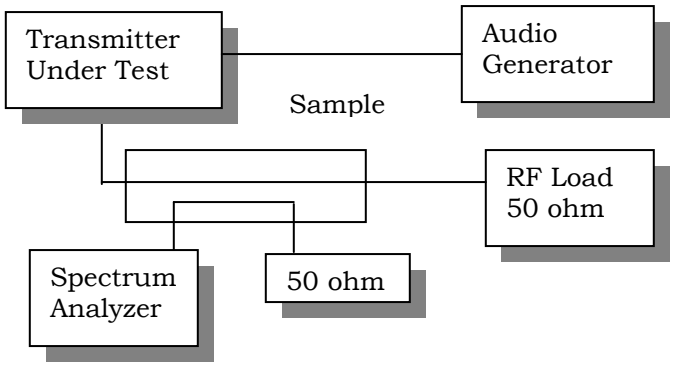
Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least 43 + 10log(P)dB.

Part 90.210(c) 25kHz 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.

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

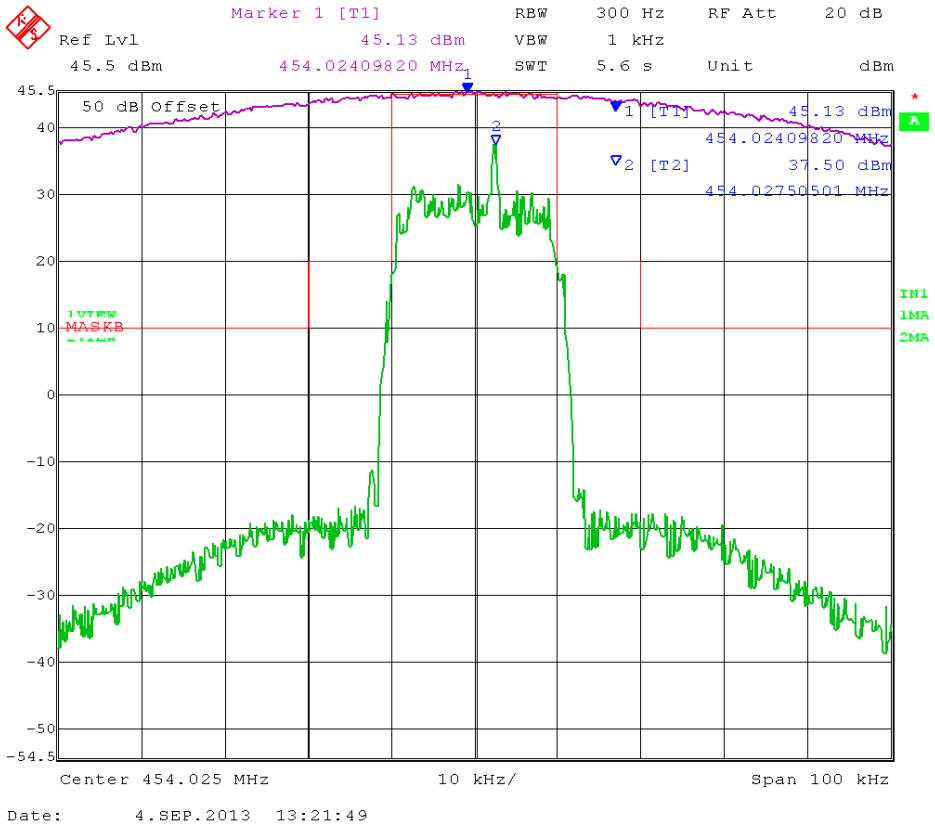
Test Setup Diagram:

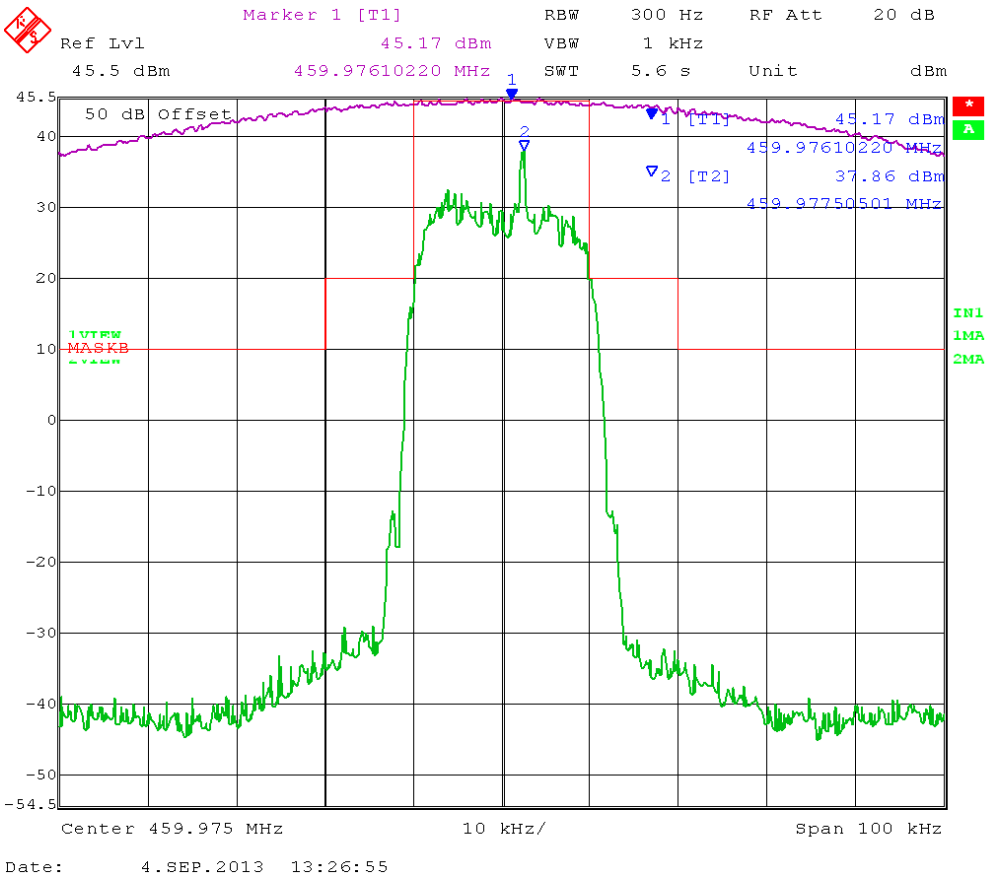


Test Data: See the plots below

OCCUPIED BANDWIDTH PLOTS

Part 90.210(b) 25 kHz Channel Spacing




Marker 1 [T1]
RBW 300 Hz
RF Att 20 dB
Ref Lvl
45.17 dBm
VBW 1 kHz
45.5 dBm
459.97610220 MHz
SWT 5.6 s
Unit dBm
50 dB Offset
1 [T1] 45.17 dBm
459.97610220 MHz
2 [T2] 37.86 dBm
459.97750501 MHz
MASKB
IN1
1MA
2MA
45.5
40
30
20
10
0
-10
-20
-30
-40
-50
-54.5
Center 459.975 MHz
10 kHz/
Span 100 kHz
Date: 4.SEP.2013 13:26:55

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

Requirements:

25kHz Channel Spacing = 43+10log(50) = 60.0 dBc
25kHz Channel Spacing = 43+10log(1) = 43.0 dBc

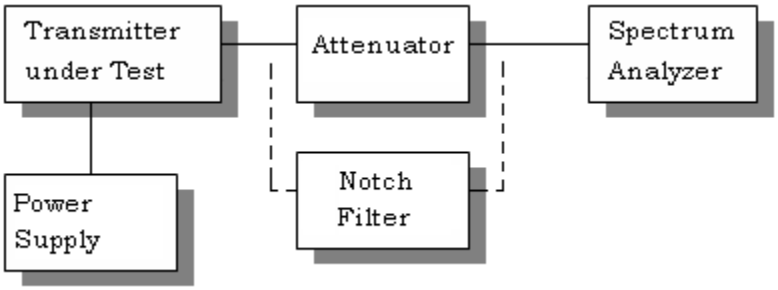
Method of Measurement: The carrier was modulated 100% using a 2500 Hz tone. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004.

Test Data:

HIGH POWER TF	EF	dB below carrier		LOW POWER TF	EF	dB below carrier
454.03	908.05	90.0		454.03	908.05	70.6
	1362.08	80.2			1362.08	60.8
	1816.10	88.4			1816.10	69
	2270.13	89.2			2270.13	69.8
	2724.15	92.7			2724.15	73.3
	3178.18	98.2			3178.18	78.8
	3632.20	104.8			3632.20	85.4
	4086.23	102.3			4086.23	82.9
	4540.25	103.5			4540.25	84.1

HIGH POWER TF	EF	dB below carrier		LOW POWER TF	EF	dB below carrier
459.98	919.95	89.0		459.98	919.95	69.8
	1379.93	78.0			1379.93	58.8
	1839.90	89.0			1839.90	69.8
	2299.88	89.9			2299.88	70.7
	2759.85	92.9			2759.85	73.7
	3219.83	95.3			3219.83	76.1
	3679.80	103.8			3679.80	84.6
	4139.78	104.5			4139.78	85.3
	4599.75	103.5			4599.75	84.3

Method of Measuring Conducted Spurious Emissions



FIELD STRENGTH OF SPURIOUS EMISSIONS

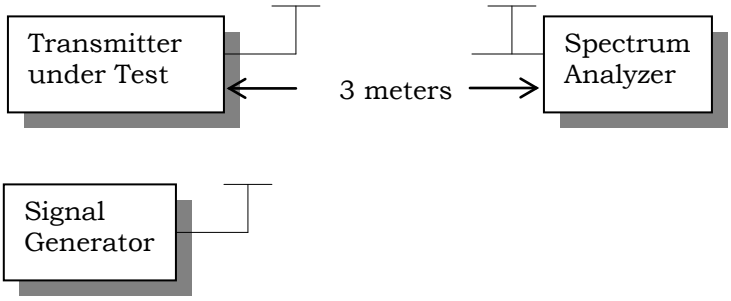
Rule Parts. No.: Part 2.1053

Requirements:

25 kHz Channel Spacing = 43+10log(50.0) = 60.0 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. 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:

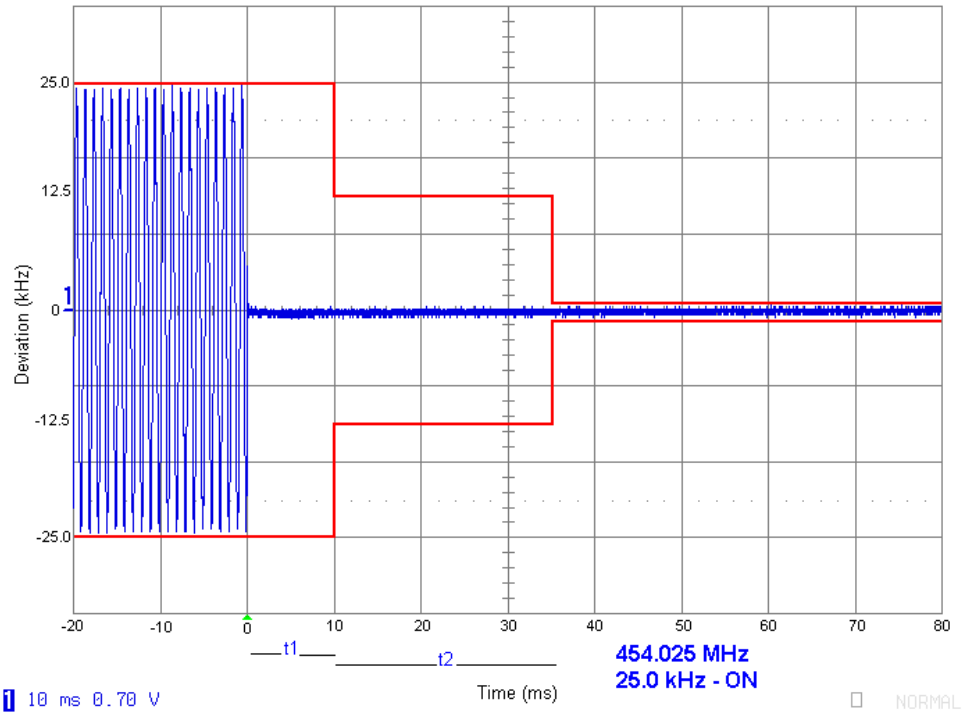
Tuned Frequency MHz	Emission Frequency MHz	Ant. Polarity	dB below carrier
454.03	63	V	100.6
454.03	70.1	H	117.6
454.03	72.8	V	111
454.03	73.2	H	116.5
454.03	78.3	H	116.2
454.03	92.6	H	116.5
454.03	117.7	H	116.5
454.03	121.5	V	110.3
454.03	248.8	H	114.4
454.03	261.6	V	115.5
454.03	313.6	V	112.9
454.03	350.4	H	110.8
454.03	400	V	114.5
454.03	1,356.08	V	116.6
454.03	1,808.10	V	96
454.03	2,712.15	V	108.8
459.98	1,379.93	V	115.8
459.98	1,839.90	V	97.2
459.98	2,759.85	V	107.6

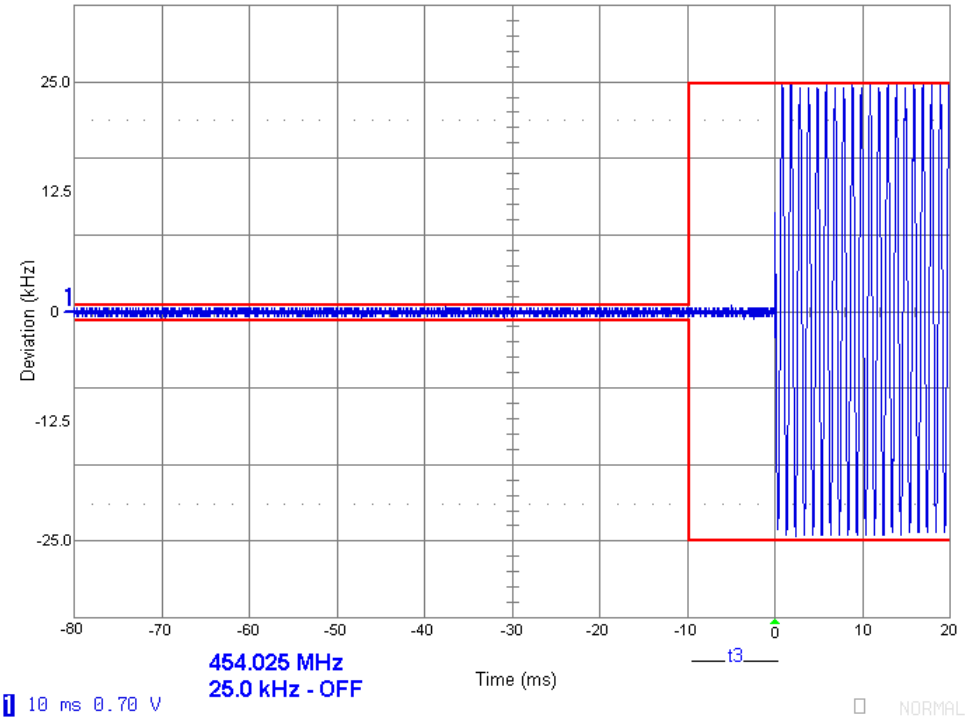
TRANSIENT FREQUENCY RESPONSE

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:

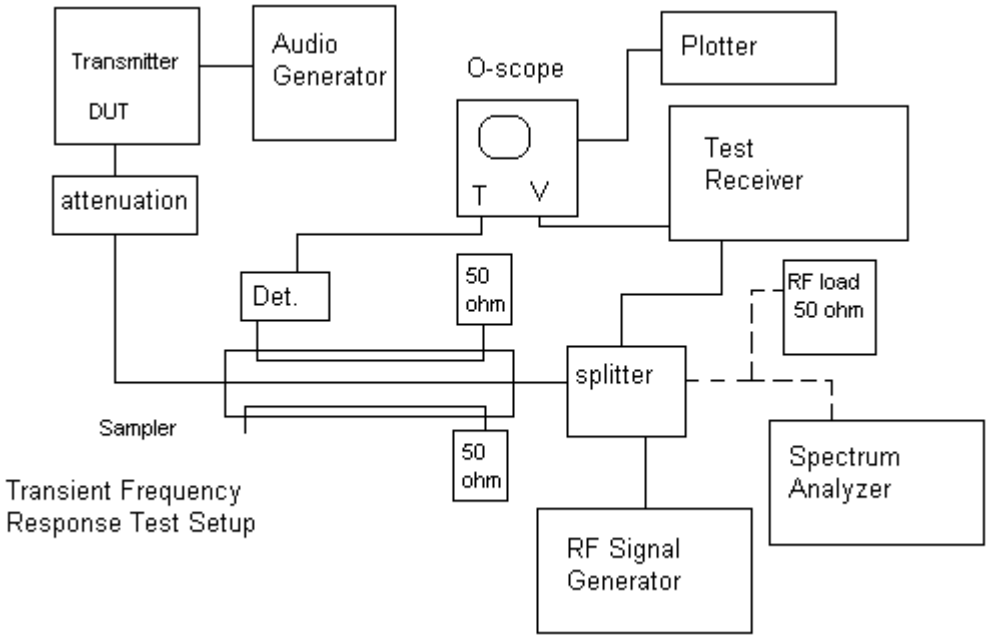
Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment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


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)
454.025 MHz
25.0 kHz - ON
10 ms 0.70 V
NORMAL


25.0
12.5
0
-12.5
-25.0
Deviation (kHz)
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
t3
Time (ms)
454.025 MHz
25.0 kHz - OFF
10 ms 0.70 V
NORMAL

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