



Nemko Test Report: 10248775_TRF_FCC90-RSS119_Rev1

Applicant: Long Range Systems
4550 Excel Pkwy. Suite 200
Addison, Texas 75001
USA

**Equipment Under Test:
(E.U.T.)** TX-9560EZ and TX-9560MT

FCC Identifier: M74TX9560

Industry Canada Identifier: 5501A-T9560

In Accordance With: **FCC Part 90, Subpart I and
Industry Canada, RSS-119, Issue 11**
Private Land Mobile Transmitter

TESTED BY:

A handwritten signature in black ink, appearing to read 'David Light'.

David Light, Wireless Engineer

DATE: 06 September 2013

APPROVED BY:

A handwritten signature in black ink, appearing to read 'Tom Tidwell'.

Tom Tidwell, Reviewer

DATE: 1 November 2013

Total Number of Pages: 29

Table of Contents

SECTION 1.	SUMMARY OF TEST RESULTS	3
SECTION 2.	GENERAL EQUIPMENT SPECIFICATION	5
SECTION 3.	RF POWER OUTPUT	6
SECTION 4.	OCCUPIED BANDWIDTH	7
SECTION 5.	SPURIOUS EMISSIONS AT ANTENNA TERMINALS	9
SECTION 6.	FIELD STRENGTH OF SPURIOUS EMISSIONS	11
SECTION 7.	FREQUENCY STABILITY	13
SECTION 8.	TRANSIENT FREQUENCY BEHAVIOR	15
SECTION 9.	TEST EQUIPMENT LIST	18
ANNEX A - TEST METHODOLOGIES		19
ANNEX B - TEST DIAGRAMS		25

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Section 1. Summary of Test Results

Manufacturer: Long Range Systems

Model Number: TX-9560EZ, TX-9560MT

Serial No.: Nemko Sample # 00000506

***Note - Model variants include TX-9560MT, TX-9560EZ. These transmitters are identical except for the user interface keyboard.**General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Subpart I and Industry Canada RSS-119, Issue 11. EIA/TIA 603 was used as a test method for these measurements.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE
TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".



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EQUIPMENT: TX-9560**PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	90.205 / 5.4.1	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	NA *
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	NA *
Modulation Limiting	TIA EIA-603.3.2.6	NA *
Occupied Bandwidth	90.210 / 5.10	Complies
Spurious Emissions at Antenna Terminals	90.210 / 5.5.8 Table 3	Complies
Field Strength of Spurious Emissions	90.210 / 5.5.8 Table 3	Complies
Frequency Stability	90.213 / 5.3	Complies
Transient Frequency Behavior	90.214 / 5.9	Complies

Footnotes:

The transmitter has no audio components.

.

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input: 4.8 Vdc NiHM battery

Frequency Range: 467.75 MHz

Tunable Bands: 1

Type(s) of Modulation:	F3E (Voice)	F1D (FSK)	F1E	D7W (QAM)	Other
	☐	☒	☐	☐	☐

Emission Designator: 8K92F1D

Output Impedance: 50 ohms

RF Power Output: 5 mW

Channel Spacing(s): N/A

Operator Selection of
Operating Frequency: Single Channel. Not selectable by user

System Description

Hand held 467.75 MHz paging transmitter for use with LRS receiver products. Uses FSK modulation at 1200 Baud data rate. Up to 64 character message data length.

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 20 August 2013

Measurement Results: Complies.**Measurement Data:**

Frequency (MHz)	Modulation	Peak Output Power (dBm)	Peak Output Power (mW)
467.75	FSK	7.3	5.4

Spectrum Analyzer Setting: RBW/VBW = 1 MHz
Peak Detector**Equipment Used:** 1036-1082-1472**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 20 °C**Relative Humidity:** 45 %

EQUIPMENT: TX-9560**PROJECT NO.:** 10248775_TRF_FCC90-RSS119_Rev1

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 2.989

TESTED BY: David Light

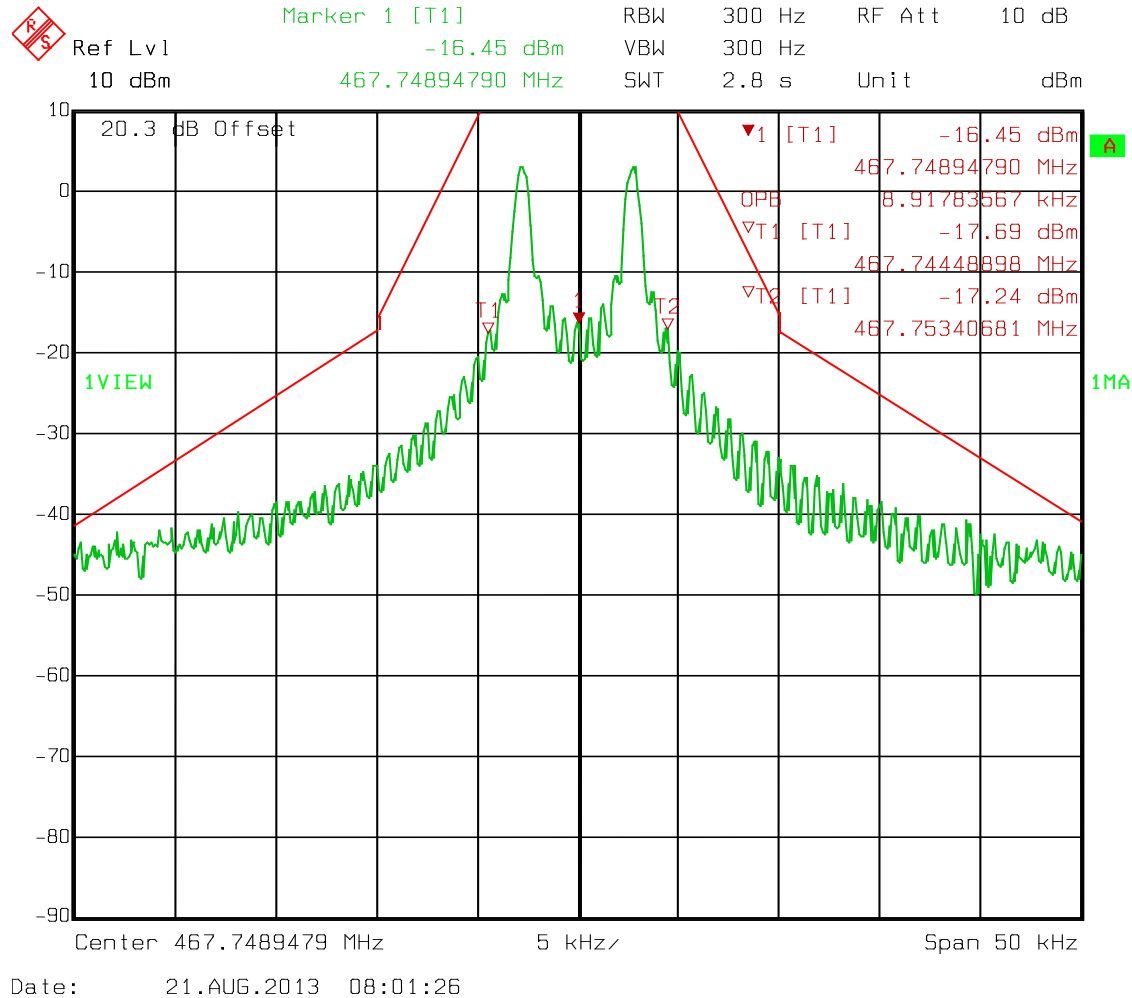
DATE: 20 August 2013

Measurement Results: Complies.**Equipment Used:** 1036-1082-1472**Measurement Uncertainty:** 1X10⁻⁷ ppm**Temperature:** 22 °C**Relative Humidity:** 45 %

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Occupied Bandwidth



EQUIPMENT: TX-9560**PROJECT NO.:** 10248775_TRF_FCC90-RSS119_Rev1

Section 5. Spurious Emissions at Antenna TerminalsNAME OF TEST: Spurious Emissions @ Antenna
Terminals

PARA. NO.: 2.991

TESTED BY: David Light

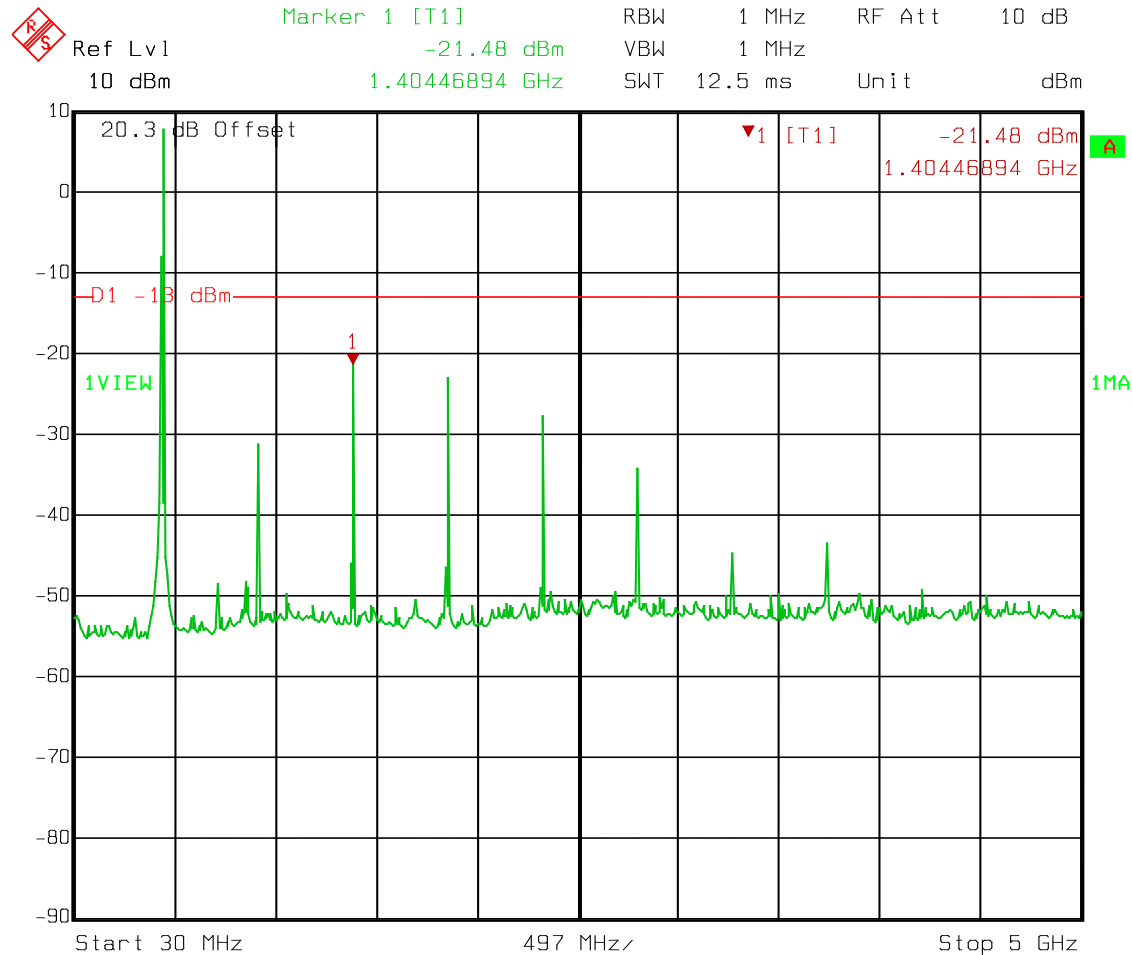
DATE: 20 August 2013

Measurement Results: Complies.**Test Data:** See attached plot(s).**Equipment Used:** 1036-1082-1472**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 45 %

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Spurious Emissions



Date: 21.AUG.2013 07:58:02

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Section 6. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions PARA. NO.: 2.993

TESTED BY: David Light

DATE: 20 August 2013

Measurement Results: Complies.**Measurement Data:** Refer to data below.**Analyzer Settings:** <1 MHz RBW/VBW = 100 kHz
>1 MHz RBW/VBW = 1 MHz
Peak detector

The spectrum was searched from 30 MHz to the tenth harmonic of the carrier.

Equipment Used: 1783-1767-1763-993-1016-1025**Measurement Uncertainty:** +/-1.7 dB**Temperature:** 22 °C**Relative Humidity:** 54 %

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Test Data – Spurious Emissions

Frequency (MHz)	Meter Reading (dBm)	Substitution Level (dBm)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarity	Comments
935.5	-35.1	-29.2		24.6	3.6	-25.6	-13.0	-12.5700	V	
1403.25	-31.1	-30.5		31.2	3.7	-26.8	-13.0	-13.8400	V	
1871	-39.6	-40.0		31.5	6.2	-33.8	-13.0	-20.7700	V	
2338.75	-45.0	-41.9		31.8	5.6	-36.3	-13.0	-23.2600	V	
2806.5	-47.9	-41.8		30.8	7.1	-34.7	-13.0	-21.6600	V	
3274.25	-50.9	-42.6		31.3	7.4	-35.2	-13.0	-22.2300	V	
3742	-55.8	-45.0		31.7	8.0	-37.1	-13.0	-24.0500	V	
4209.75	-57.2	-42.9		31.5	7.9	-35.0	-13.0	-22.0200	V	
4677.5	-58.0	-47.3		30.7	9.1	-38.2	-13.0	-25.2400	V	
935.5	-41.3	-35.9		24.6	3.6	-32.3	-13.0	-19.2700	H	
1403.25	-33.0	-32.5		31.2	3.7	-28.8	-13.0	-15.8400	H	
1871	-41.8	-39.8		31.5	6.2	-33.6	-13.0	-20.5700	H	
2338.75	-44.1	-39.1		31.8	5.6	-33.5	-13.0	-20.4600	H	
2806.5	-50.2	-47.4		30.8	7.1	-40.3	-13.0	-27.2600	H	
3274.25	-47.6	-44.5		31.3	7.4	-37.1	-13.0	-24.1300	H	
3742	-56.6	-54.4		31.7	8.0	-46.5	-13.0	-33.4500	H	
4209.75	-56.3	-52.9		31.5	7.9	-45.0	-13.0	-32.0200	H	
4677.5	-53.3	-49.0		30.7	9.1	-39.9	-13.0	-26.9400	H	
Notes:										

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability

PARA. NO.: 2.995

TESTED BY: David Light

DATE: 21 August 2013

Measurement Results: Complies.**Measurement Data:** See attached data**Measurement Data:** See attached table.Standard Test Frequency: 467.750880 MHz
Standard Test Voltage: 4.8 Vdc**Equipment Used:** 1036-1082-1472**Measurement Uncertainty:** 1 x 10⁻⁷ ppm**Lab Temperature:** 22 °C**Relative Humidity:** 45 %

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**Test Data – Frequency Stability**

Temp (°C)	Measured Frequency (MHz)		Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment
20	467.750880		4.8	0	2338.8	0.0	
20	467.750880		3.5	0	2338.8	0.0	Battery cutoff
50	467.750120		4.8	-760	2338.8	-1.6	
40	467.750640		4.8	-240	2338.8	-0.5	
30	467.751040		4.8	160	2338.8	0.3	
10	467.750900		4.8	20	2338.8	0.0	
0	467.750600		4.8	-280	2338.8	-0.6	
-10	467.750600		4.8	-280	2338.8	-0.6	
-20	467.750280		4.8	-600	2338.8	-1.3	
-30	467.750800		4.8	-80	2338.8	-0.2	
Notes:							

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Section 8. Transient Frequency Behavior

NAME OF TEST: Transient Frequency Behavior	PARA. NO.: 90.214
TESTED BY: David Light	DATE: 06 September 2013

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 23 °C
Humidity: 48 %

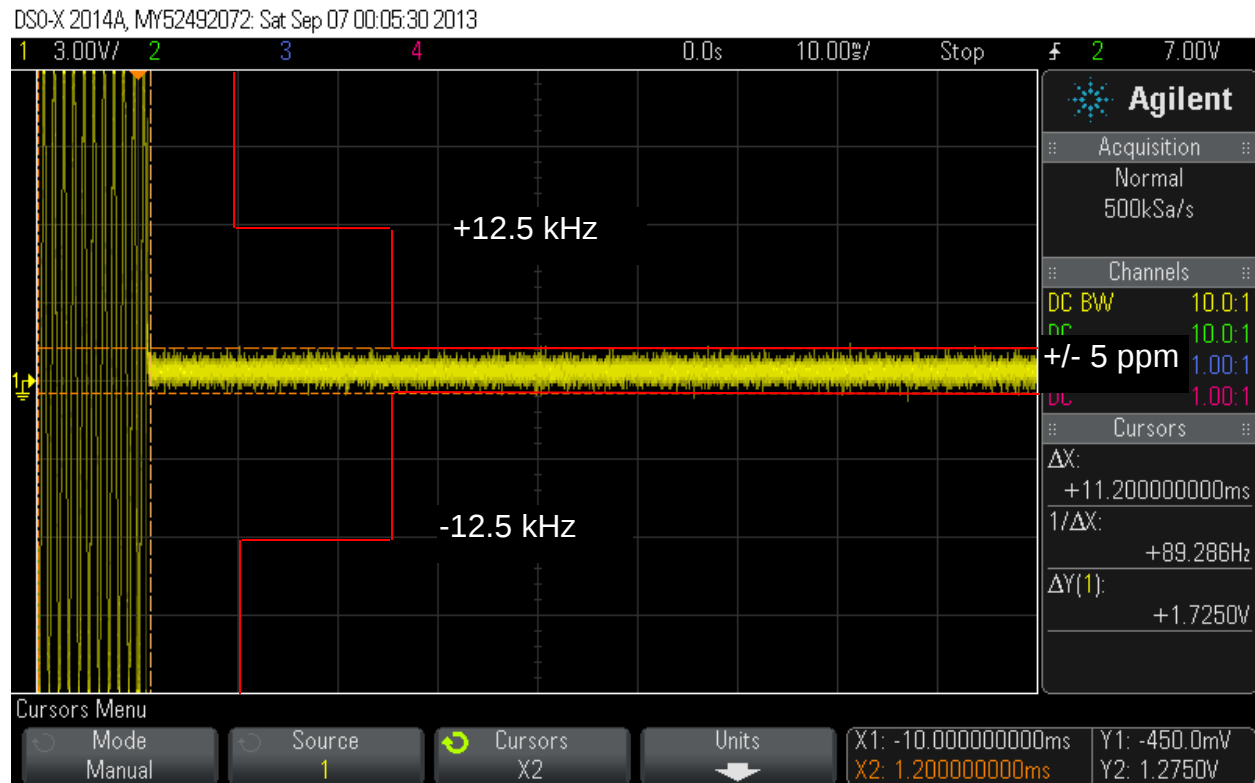
Measurement Uncertainty: +/- 2 ppm

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Test Data – Transient Frequency Behavior

ON Condition



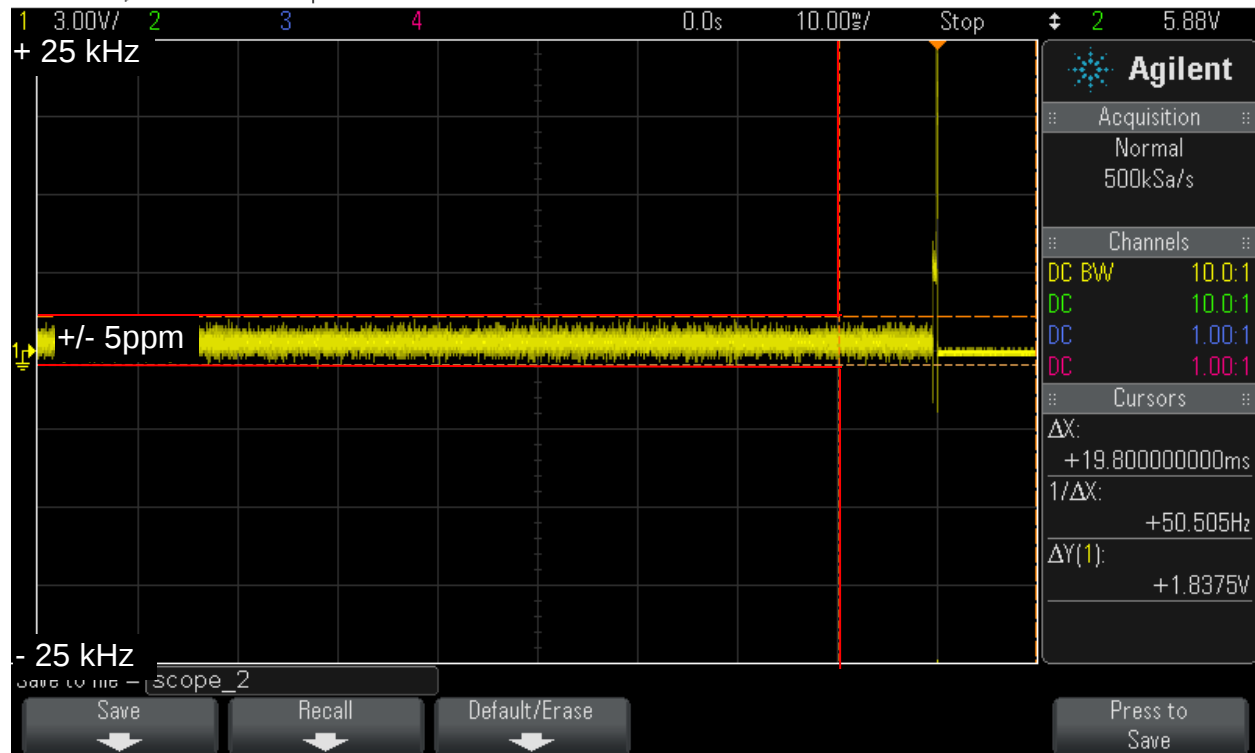
EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Test Data – Transient Frequency Behavior

OFF Condition

DSO-X 2014A, MY52492072: Sat Sep 07 00:34:14 2013



EQUIPMENT: TX-9560**PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**

Section 9. Test Equipment List

Asset Tag	Description	Manufacturer	Model	Serial #	Last Cal	Next Cal
993	Antenna, Horn	A.H. Systems	SAS-200/571	162	22-Sep-2011	22-Sep-2013
1016	Preamplifier	Hewlett Packard	8449A	2749A00159	20-Aug-2013	20-Aug-2014
1025	Preamplifier, 25dB	Nemko USA, Inc.	LNA25	399	05-Mar-2013	05-Mar-2014
1036	Spectrum Analyzer	Rohde & Schwartz	FSEK30	830844/006	15-Jul-2013	15-Jul-2015
1082	Cable, 2m	Astrolab	32027-2- 29094-72TC		N/R	
1472	Attenuator,	Omni Spectra	20600-20db		N/R	
1763	Antenna, Bilog	Schaffner	CBL 6111D	22926	07-Mar-2013	07-Mar-2014
1767	Receiver	Rohde & Schwartz	ESIB26	837491/0002	19-Dec-2012	19-Dec-2013
1783	Cable Assy,	Nemko	Chamber		26-Sep-2012	26-Sep-2013

ANNEX A - TEST METHODOLOGIES

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**NAME OF TEST:** RF Power Output**PARA. NO.:** 2.985

Minimum Standard: Para. No. 90.205(a). The maximum allowable station ERP is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table 1 of 90.205(d).

Method Of Measurement:Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**NAME OF TEST: Audio Frequency Response****PARA. NO.: 2.987(a)****Test Method:** TIA/EIA-603**Minimum Standard:** TIA/EIA-603, Para. 3.2.6 from 300 Hz to 3000 Hz.
Thetransmitter audio frequency response shall have a nominal 6
dB per octave pre-emphasis characteristic.**NAME OF TEST: Audio Low-Pass Filter Frequency
Response****PARA. NO.: 2.987(a)****Test Method:** TIA/EIA-603**Minimum Standard:** TIA/EIA-603**NAME OF TEST: Modulation Limiting****PARA. NO.: 2.987(a)****Test Method:** TIA/EIA-603**Minimum Standard:** TIA/EIA-603

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**NAME OF TEST: Occupied Bandwidth****PARA. NO.: 2.989****Minimum Standard:**
mask.

Para. No. 90.210, see table 1 below for applicable

Table 1

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

Test Method:

RBW: 1% of emission bandwidth in 0 - 1 GHz range. 1 MHz at frequencies above 1 GHz.

VBW: $\Rightarrow$ RBW

The spectrum is search up to 10 times the fundamental frequency.

EQUIPMENT: TX-9560PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1**NAME OF TEST: Field Strength of Spurious****PARA. NO.: 2.993****Minimum Standard:**

Para. No. 90.210, see table 1 for applicable mask.

Test Method:

The substitution antenna method was used to measure erp of spurious emissions. This method is described in EIA/TIA 603.

The field strength of the emission is measured and recorded. The EUT is then replaced with a substitution antenna of known gain against a dipole. The substitution antenna is fed with a calibrated signal which is adjusted until the previously recorded value is repeated. The erp of the spurious signal is the level required to repeat the previously measured level. If the substitution antenna gain is calibrated and expressed as dBi (referenced to an isotropic radiator instead of a dipole), the result is adjusted by 2.15 dB so that the result is erp not eirp.

EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

NAME OF TEST: Frequency Stability**PARA. NO.: 2.995****Minimum Standard:**
shall remainPara. No. 990.213. The transmitter carrier frequency
within the assigned frequency below in ppm.**Table 2**

Frequency Band (MHz)	Fixed And Base Stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
Above 2450	-	-	-

NAME OF TEST: Transient Frequency Behaviour**PARA. NO.: 2.214****Minimum Standard:****Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels**

Time intervals ^{1,2}	Maximum Frequency difference ³ (kHz)	Frequency ranges (MHz) All equipment					
		Base station and portable radios			Mobile Radios		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₁ ⁴	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t ₂	± 12	20.0	25.0	50.0	20.0	25.0	20.0
t ₃ ⁴	± 25	5.0	10.0	10.0	5.0	10.0	5.0

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

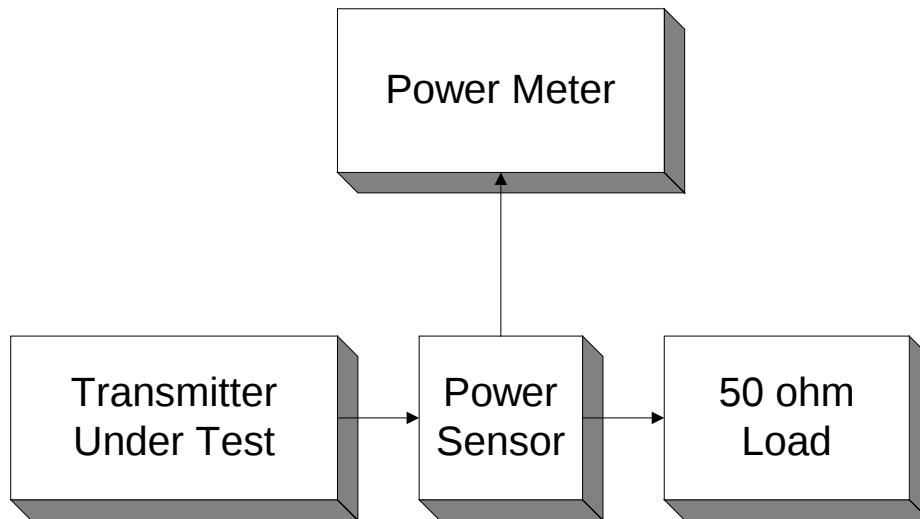
Time intervals ^{1,2}	Maximum Frequency difference ³ (kHz)	Frequency ranges (MHz) All equipment		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₁ ⁴	± 12.5 / ± 6.25	5.0	10.0	20.0
t ₂	± 6.25 / ± 3.125	20.0	25.0	50.0
t ₃ ⁴	± 12.5 / ± 6.25	5.0	10.0	10.0

ANNEX B - TEST DIAGRAMS

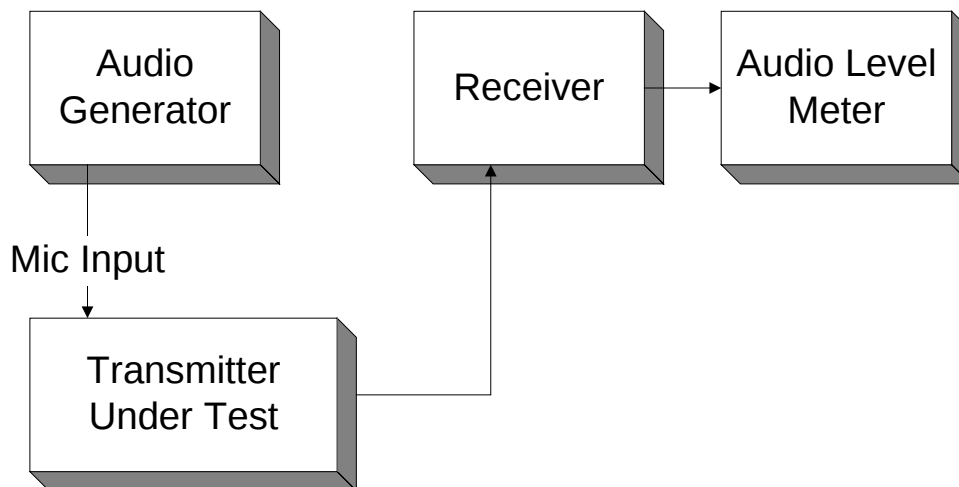
EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Para. No. 2.985 - R.F. Power Output



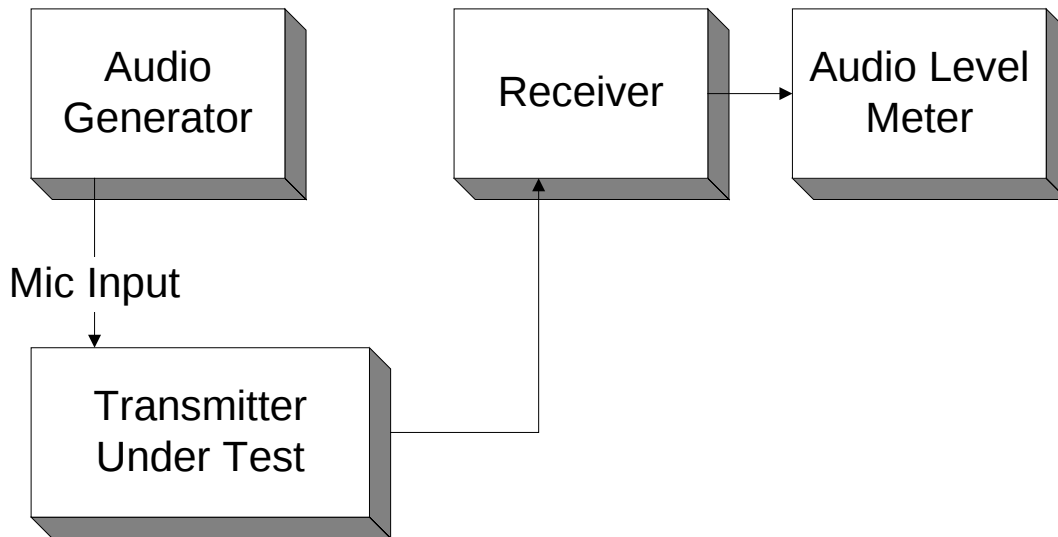
Para. No. 2.987(a) - Audio Frequency Response



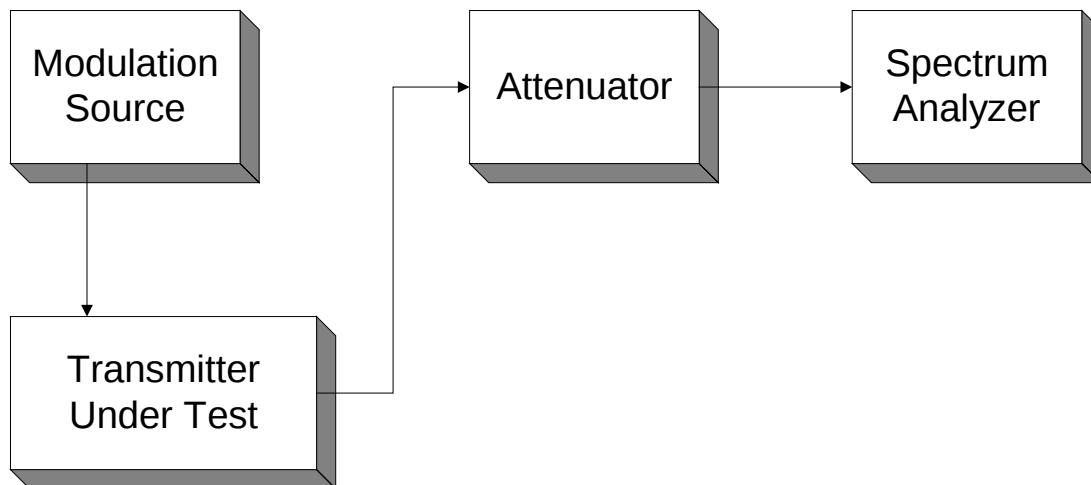
EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

Para. No. 2.987(b) - Modulation Limiting



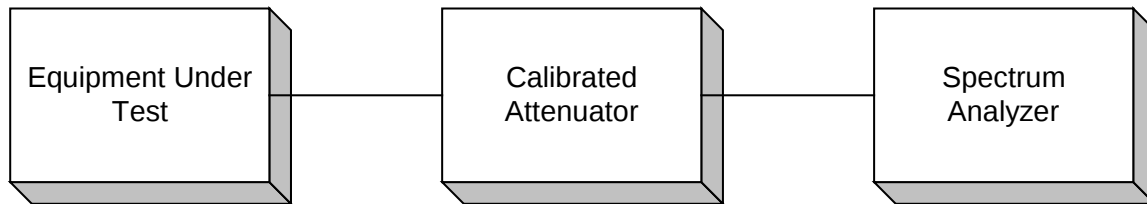
Para. No. 2.989 - Occupied Bandwidth



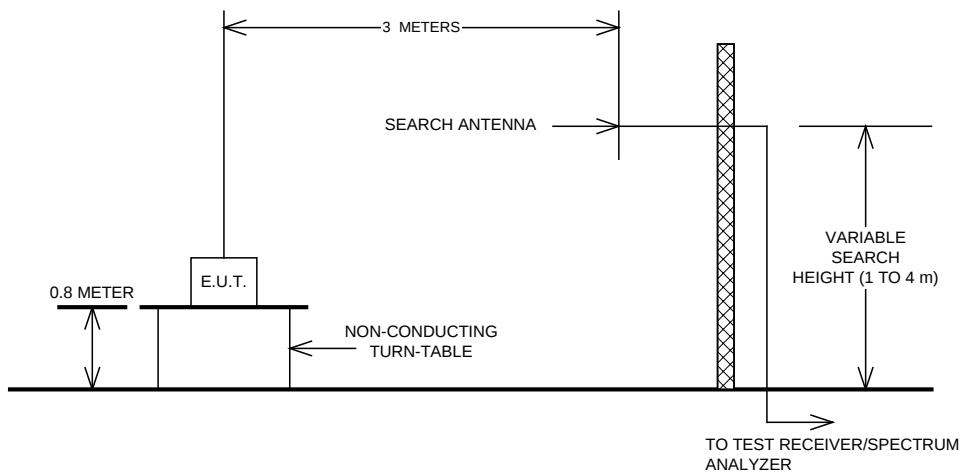
EQUIPMENT: TX-9560

PROJECT NO.: 10248775_TRF_FCC90-RSS119_Rev1

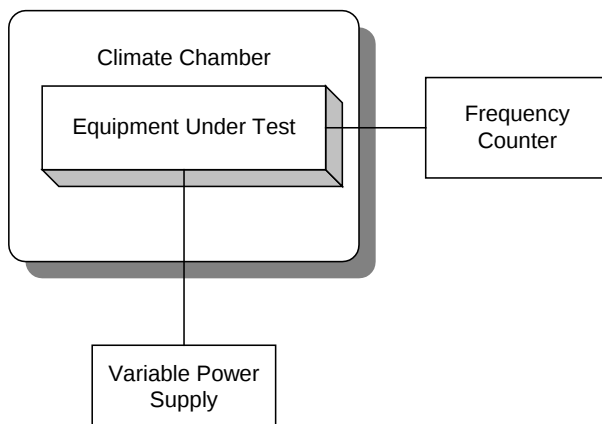
Para. No. 2.991 - Spurious Emissions at Antenna Terminals

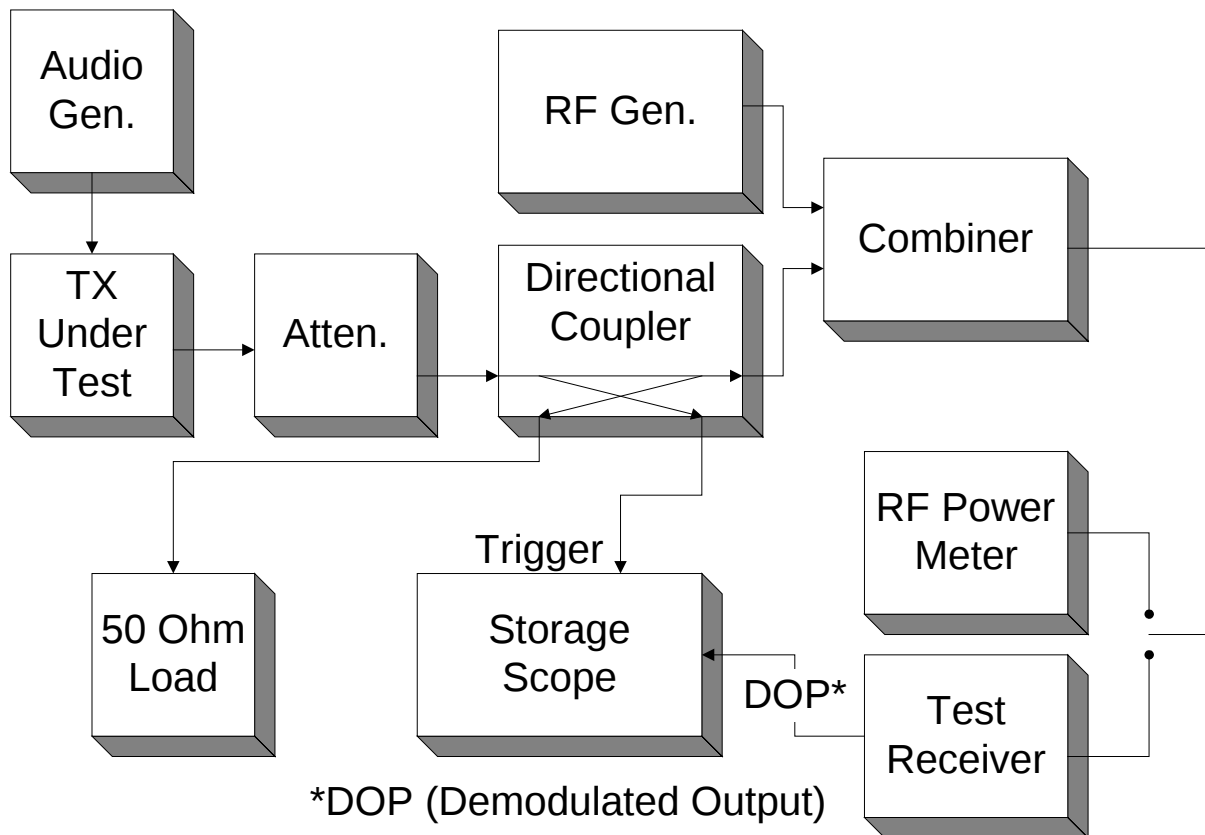


Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability



Para. No. 90.214 - Transient Frequency Behavior**Voice**

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters

Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

Data

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).