

KTL Test Report: 0L0483RUS1

Applicant: SUBSITE ELECTRONICS
1950 WEST FIR STREET
PERRY, OKLAHOMA 73077

**Equipment Under Test:
(E.U.T.)** 750 Tracker

In Accordance With: **FCC Part 90, Subpart I**
Private Land Mobile Transmitter

Tested By: KTL Dallas Inc.
802 N. Kealy
Lewisville, TX 75057-3136

Authorized By:

A handwritten signature in blue ink, appearing to read "John F. Smith", is written over the "Authorized By:" label.

Date: 2/4/01

Total Number of Pages: 36

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EQUIPMENT: 750 Tracker

Section 1. Summary of Test Results

Manufacturer: Subsite Electronics

Model No.: 750 Tracker

Serial No.: 066449

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.



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".

**NVLAP LAB CODE:**TESTED BY: David Light DATE: 1/5/01

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EQUIPMENT: 750 Tracker

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.217	120 mW	100 mW	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A	N/A ₁
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A	N/A ₁
Modulation Limiting	TIA EIA-603.3.2.6	N/A	N/A	N/A ₁
Occupied Bandwidth	90.217(a)	90.217(a)	See plots	Complies
Spurious Emissions at Antenna Terminals	90.217(a)	90.217(a)	See plots	Complies
Field Strength of Spurious Emissions	90.217(a)	-13 dBm	-35.8 dBm	Complies
Frequency Stability	90.213	5 ppm	0.424 ppm	Complies
Transient Frequency Behavior	90.214	N/A	N/A	N/A

Footnotes:

- 1) There is no provision for voice modulation in this equipment.

EQUIPMENT: 750 Tracker

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input: 7.2 VDC (nominal)

Frequency Range: 450 - 480 MHz

Tunable Bands: 1

Necessary Bandwidth: 11.2 kHz

Type(s) of Modulation:

F3E (Voice)	F1D	F2D	D7W (QAM)	Other
☐	☒	☐	☐	☐

Emission Designator: 11K2F1D
Necessary bandwidth calculation
Nominal frequency deviation: 3.2 kHz
Data rate: 4.8 kbps
 $(\text{Deviation} \times 2) + ((\text{data rate}/2) \times 2) = 11.2 \text{ kHz}$

Output Impedance: 50 ohms

RF Power Output (rated): 100 mW eirp

Duty Cycle: 50 %, 30 sec. maximum transmit

Channel Spacing(s): 25 kHz

Operator Selection of Operating Frequency: User selects from pre-programmed channels

Power Output Adjustment Capability: None

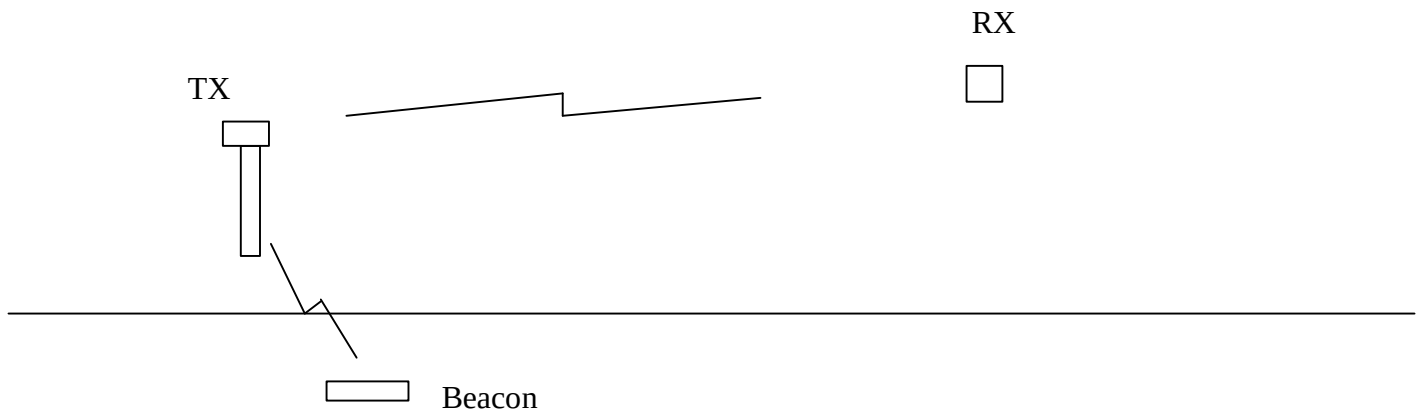
EQUIPMENT: 750 Tracker

System Description

The 750 Tracker is a device used to detect and track a beacon that is placed on a drill head. The beacon emanates a low frequency emission. The Tracker detects this emission and determines where the beacon is located, its depth, pitch, and roll.

This information is sent via UHF transmission to a receiver where the information can be logged. The wireless transmission is in the 450 - 480 MHz range and is transmitted at a power level of 100 mW.

System Diagram



EQUIPMENT: 750 Tracker

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 01/03/2001

Measurement Results: Complies. The maximum power output is 100 mW.
The rf output power is not adjustable by the user.

Measurement Data:

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
450.0 Channel 1	20.0	20	0.0
460.0 Channel 2	20.1	20	0.1

Antenna gain (eirp): 0 dB

Measurement Conditions:

Temperature: 22 °C
Humidity: 50 %

Measurement Uncertainty: +/- 0.6 dB

EQUIPMENT: 750 Tracker

Section 4. Modulation Characteristics

NAME OF TEST: Modulation Characteristics	PARA. NO.: 2.987
TESTED BY: David Light	DATE: 01/03/2001

Measurement Results: Complies.**Measurement Data:** See following pages

Description of modulation: The transmitter carrier is modulated with a data baseband signal. There is no provision for voice modulation. The carrier is frequency shift keyed.

Description of baseband filtering: There is no low-pass audio filter.

EQUIPMENT: 750 Tracker

Section 4.1 Modulation Limiting

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(b)
TESTED BY: David Light	DATE: 01/03/2001

Maximum deviation for non-voice modulation +/- 3.2 kHz.

Measurement Conditions: Temperature: 22 °C
 Humidity: 50 %

Measurement Uncertainty: +/- 1 Hz

EQUIPMENT: 750 Tracker

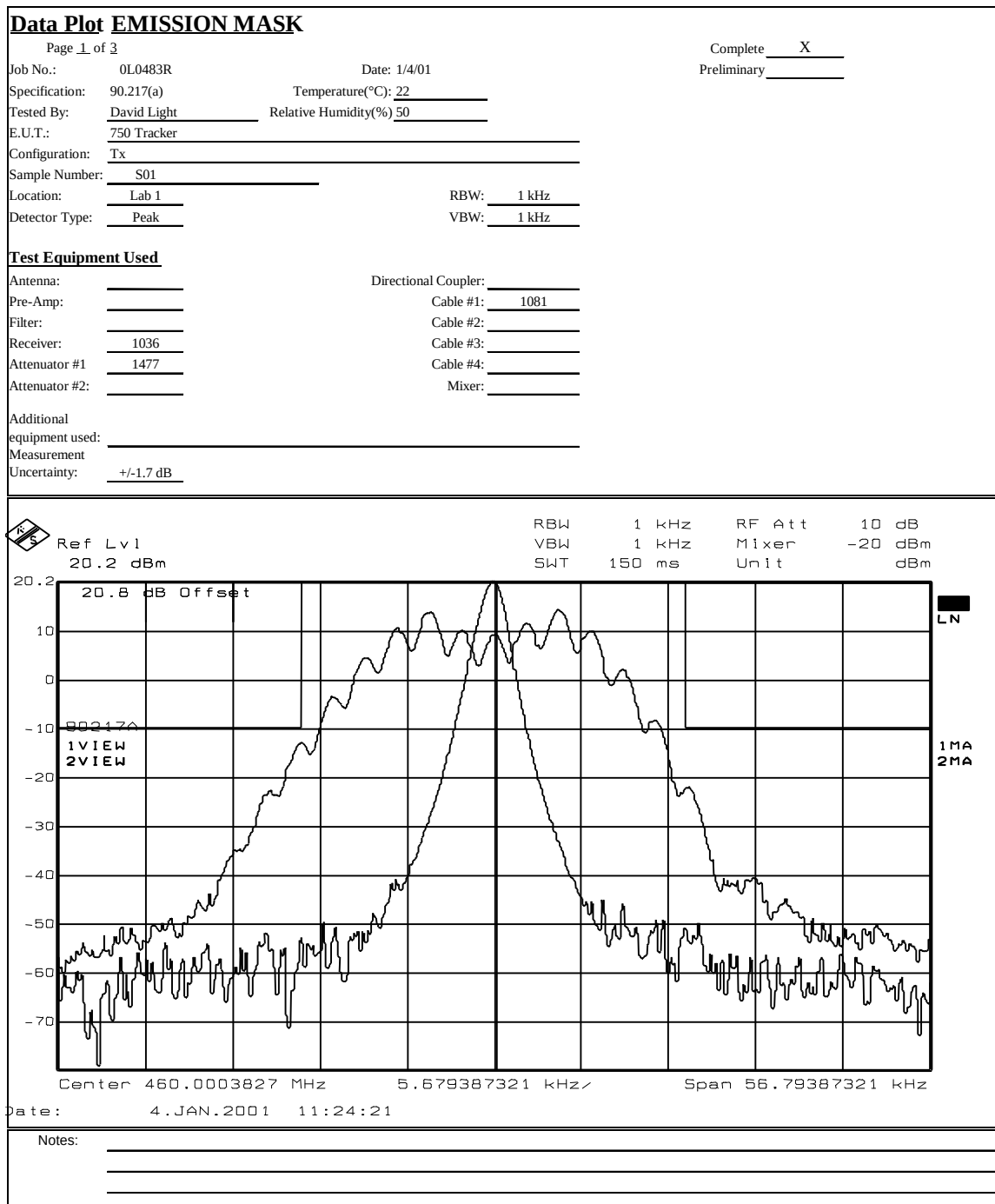
Section 5. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.217(a)
TESTED BY: David Light	DATE: 01/04/2001

Measurement Results: Complies.**Measurement Data:** See attached data**Measurement Conditions:**
 Temperature: 22 °C
 Humidity: 50 %**Measurement Uncertainty:** +/- 1.7 dB, +/- 1 x 10⁻⁷ ppm

EQUIPMENT: 750 Tracker

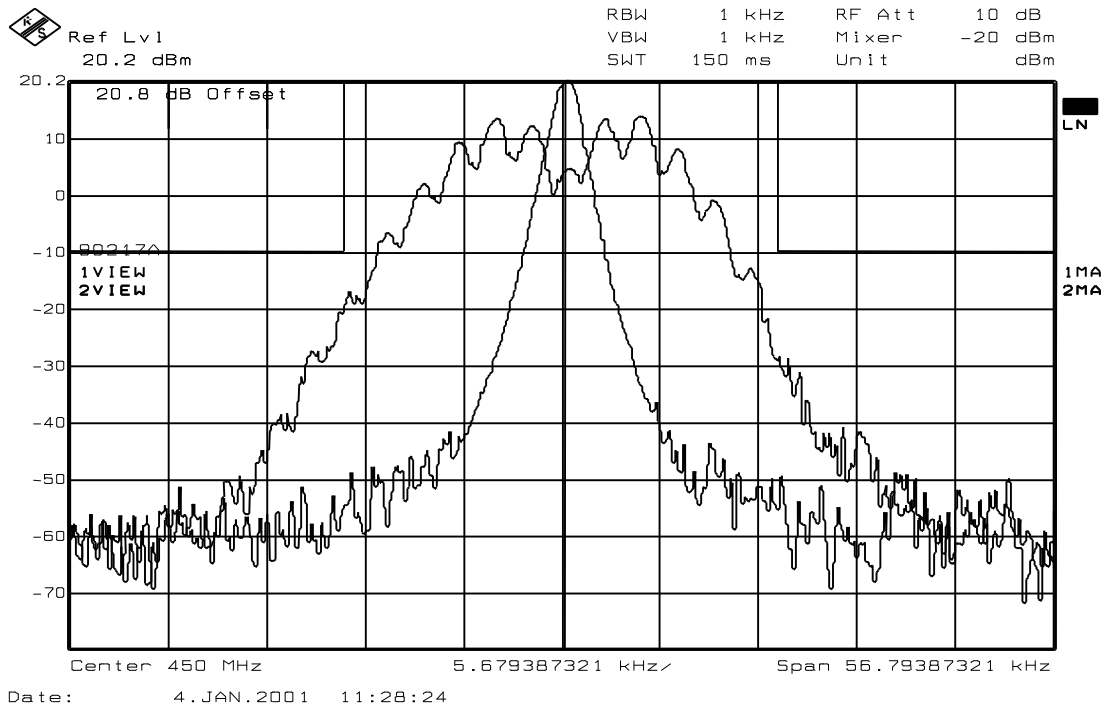
Test Data - Occupied Bandwidth



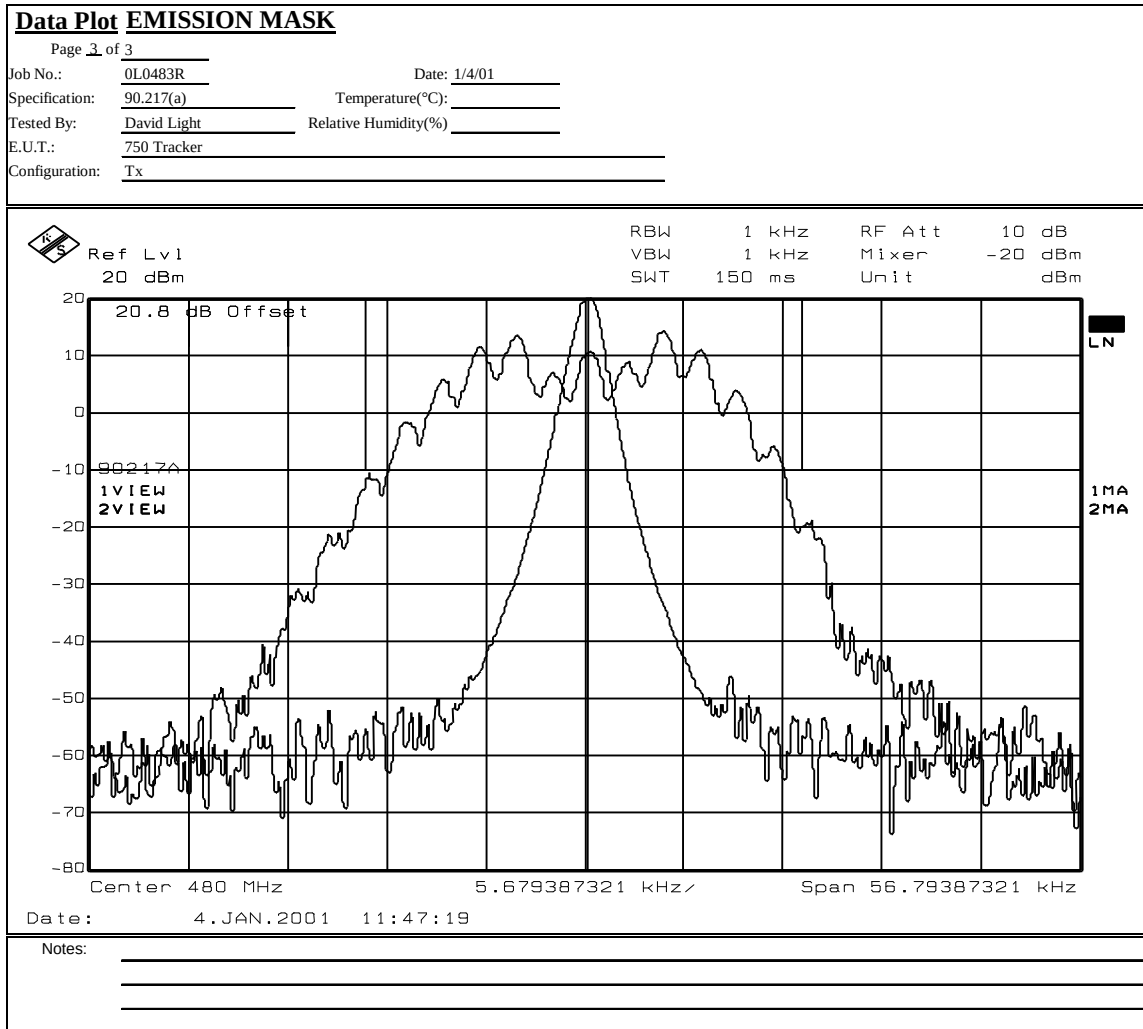
EQUIPMENT: 750 Tracker**Test Data - Occupied Bandwidth****Data Plot SION MASK**

Page 2 of 3

Job No.: 0L0483R Date: 1/4/01
Specification: 90.217(a) Temperature(°C): 22
Tested By: David Light Relative Humidity(%) 50
E.U.T.: 750 Tracker
Configuration: Tx



Notes:

EQUIPMENT: 750 Tracker**Test Data - Occupied Bandwidth**

EQUIPMENT: 750 Tracker

Section 6. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.217(a)
TESTED BY: David Light	DATE: 01/04/2001

Measurement Results: Complies.

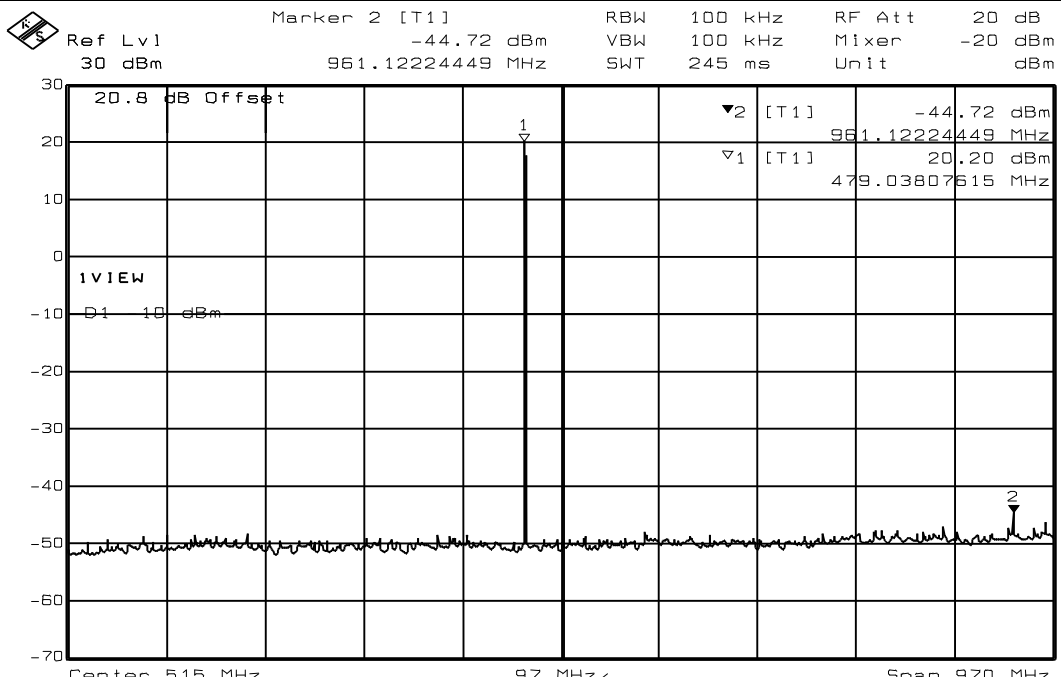
Measurement Data: See attached data

Measurement Conditions: Temperature: 22 °C
 Humidity: 50 %

Measurement Uncertainty: +/- 1.7 dB

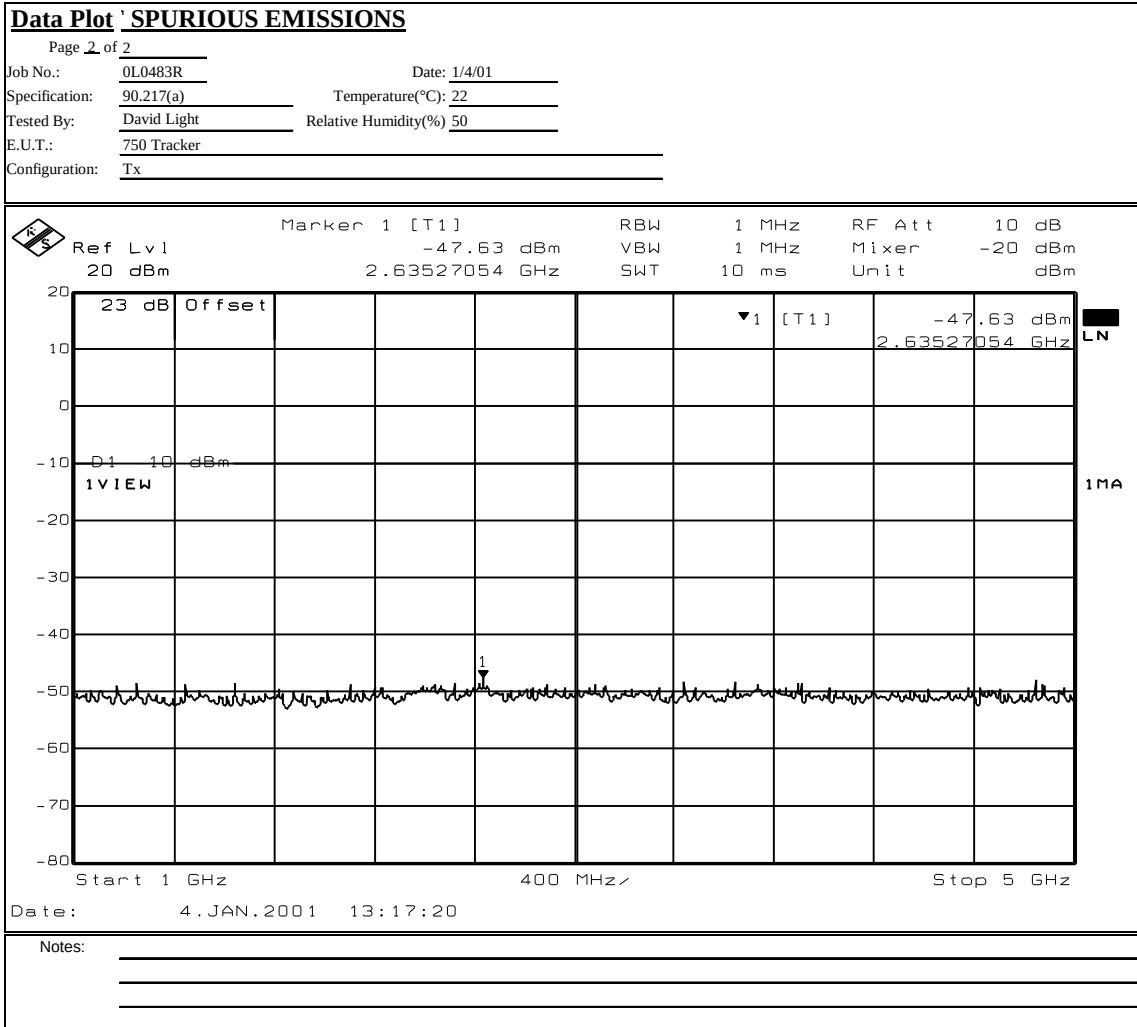
EQUIPMENT: 750 Tracker

Test Data - Spurious Emissions at Antenna Terminals

Data Plot ANTENNA PORT SPURIOUS EMISSIONS			
Page 1 of 2		Complete ☒ X	
Job No.:	0L0483R	Date:	1/4/01
Specification:	90.217(a)	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%):	50
E.U.T.:	750 Tracker		
Configuration:	Tx		
Sample Number:	S05		
Location:	Lab 1	RBW:	1 kHz
Detector Type:	Peak	VBW:	1 kHz
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1081
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1:	1477	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used: _____			
Measurement Uncertainty: +/-1.7 dB			
			
Date: 4 JAN 2001 13:11:48			
Notes: MARKER 1 = CARRIER			
MARKER 2 = EMISSIONS			

EQUIPMENT: 750 Tracker

Test Data - Spurious Emissions at Antenna Terminals



EQUIPMENT: 750 Tracker

Section 7. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 1/5/01

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 22 °C
 Humidity: 50 %

Measurement Uncertainty: +/- 3.6 dB

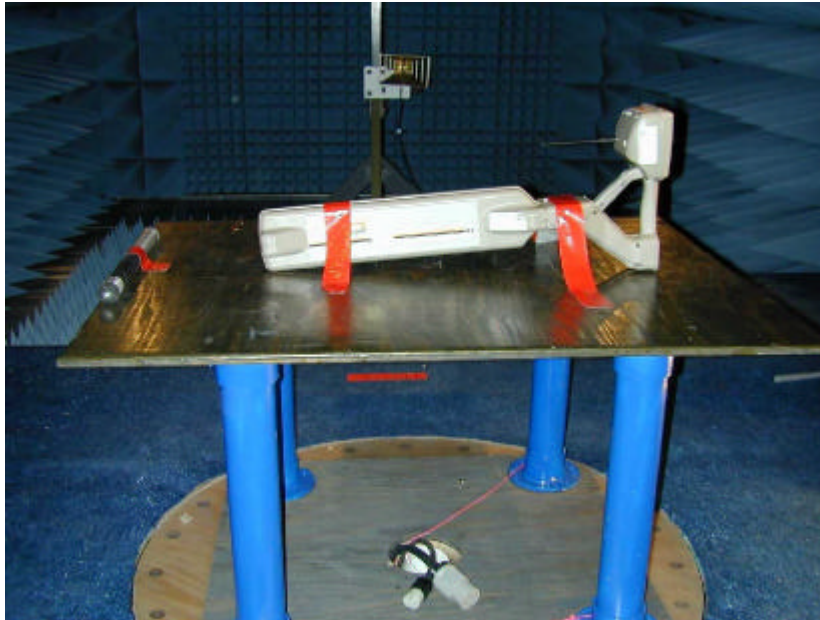
Test Data - Radiated Emissions

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EQUIPMENT: 750 Tracker

Photographs of Test Setup

FRONT VIEW



REAR VIEW



EQUIPMENT: 750 Tracker

Section 8. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: David Light	DATE: 01/11/20001

Measurement Results: Complies. The maximum frequency drift is 195 Hz (0.424 ppm).
The maximum allowable frequency drift is 5 ppm.

Measurement Data: See attached data

Measurement Uncertainty: +/- 1×10^{-7} ppm

EQUIPMENT: 750 Tracker**Dallas Headquarters:**

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Frequency StabilityClient: SubsiteW.O.# 0L0483REUT: BASE UNITS/N: S01Date: 1/11/01Tech: D. LIGHT

Assigned Frequency: 460.000000 MHz

Test Equipment used: 283-1026

Temperature	Voltage	Frequency Error (Hz)
20 °C	115 VAC (Nominal)	+184
20 °C	98 VAC	+188
20 °C	132	+188
10 °C	115 VAC	+190
0 °C	115 VAC	+195
-10 °C	115 VAC	+98
-20 °C	115 VAC	-121
-30 °C	115 VAC	-191
30 °C	115 VAC	+32
40 °C	115 VAC	-73
50 °C	115 VAC	-119

EQUIPMENT: 750 Tracker

Section 9. Transient Frequency Behaviour

NAME OF TEST: Transient Frequency Behaviour	PARA. NO.: 90.214
TESTED BY: David Light	DATE: 01/08/2001

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 22 °C
Humidity: 50 %

Measurement Uncertainty: +/- 0.01 ppm, +/- 1 µsec.

EQUIPMENT: 750 Tracker

Data Plot

Page 1 of 2

Job No.: 0L0483R

Date: 1/8/01

Specification: PART 90

Temperature(°C): 22

Tested By: D. Light

Relative Humidity(%): 50

E.U.T.: Tracker 750

Configuration: TX at mid channel

Sample Number: S01

Location: Lab 1

RBW: #N/A

Detector Type:

VBW:

Complete X

Preliminary

Test Equipment Used

Antenna:

Directional Coupler:

Pre-Amp:

Cable #1:

Filter:

Cable #2:

Receiver:

Cable #3:

Attenuator #1:

Cable #4:

Attenuator #2:

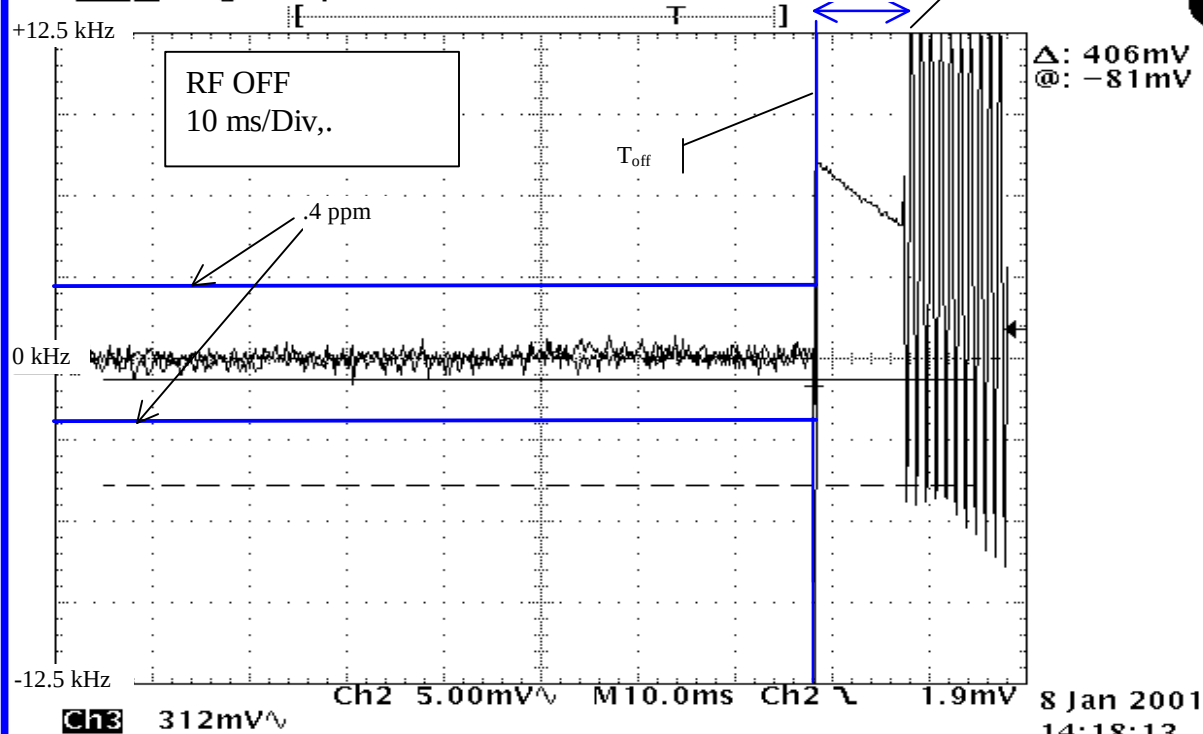
Mixer:

Additional

equipment used: 1091 1051 1081 1043 1054 1463 411

Measurement

Uncertainty: +/-3.6 dB

Tek **Stop:** Single Seq 5.00kS/s

Notes:

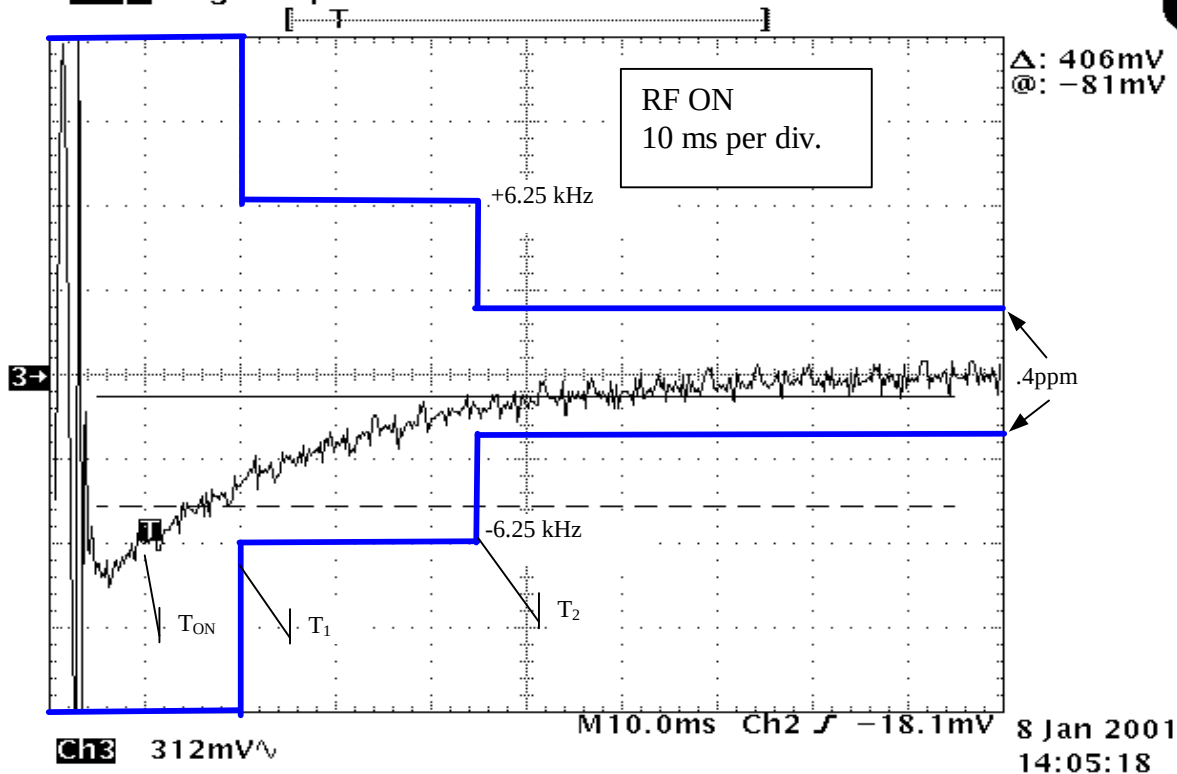
EQUIPMENT: 750 Tracker

Data Plot

Page 2 of 2

Job No.:	0L0483R	Date:	1/8/01
Specification:	PART 90	Temperature(°C)	22
Tested By:	D. Light	Relative Humidity(%)	50
E.U.T.:	Tracker 750		
Configuration:	TX at mid channel		

Tek **Stop:** Single Seq 5.00kS/s



Notes:

EQUIPMENT: 750 Tracker

Section 10. Test Equipment List

KTL ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1037	POWER METER	WAVETEK 8531	1911	08/16/00
1070	SENSOR,RF POWER	WAVETEK 85310	2310	08/16/00
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/99 2 yr cycle
1477	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W5	NONE	CBU
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/00
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/99 2 yr cycle
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	05/25/00
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	05/25/00

ANNEX A - TEST METHODOLOGIES

EQUIPMENT: 750 Tracker

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.

Integral Antenna:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

EQUIPMENT: 750 Tracker

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. The transmitter 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: 750 Tracker

NAME OF TEST: Occupied Bandwidth**PARA. NO.: 2.989****Minimum Standard:** Para. No. 90.210, see table 1 below for applicable mask.**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: 750 Tracker

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:** TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

MASK	Spurious Limit
A,B,C,G,H,I	-13dBm
D,J	-20dBm
E,F,K	-25dBm

EQUIPMENT: 750 Tracker**NAME OF TEST: Frequency Stability****PARA. NO.: 2.995**

Minimum Standard: Para. No. 990.213. The transmitter carrier frequency shall remain 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**

	Maximum	Frequency ranges (MHz) All equipment					
		Base station and portable radios			Mobile Radios		
Time intervals ^{1,2}	Frequency difference ³ (kHz)	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

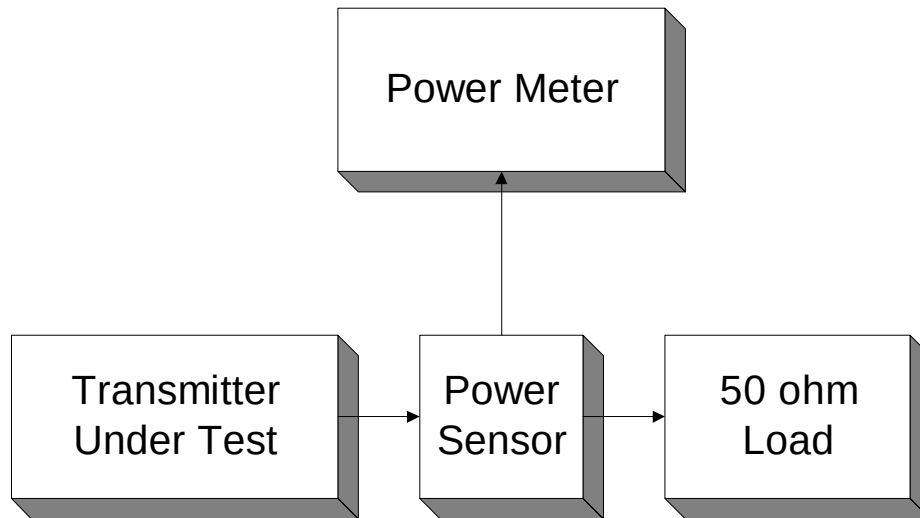
Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

	Maximum	Frequency ranges (MHz) All equipment		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
Time intervals ^{1,2}	Frequency difference ³ (kHz)			
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

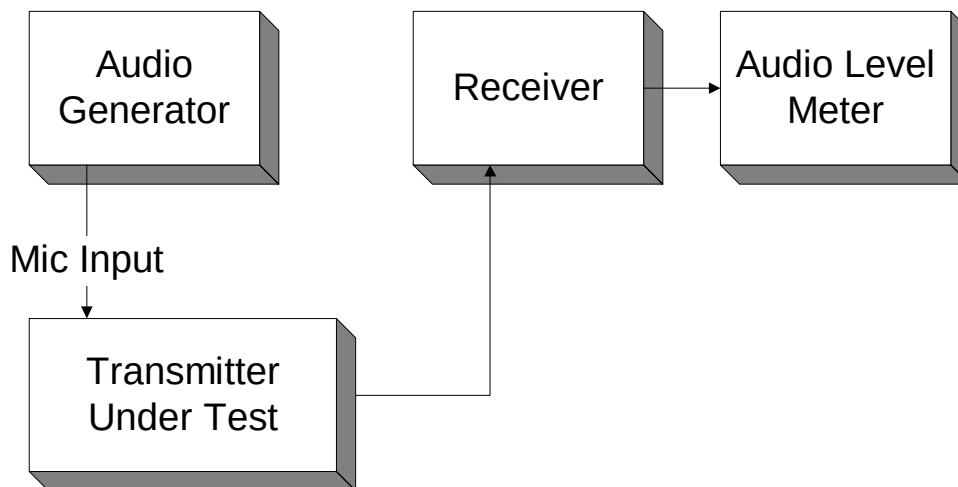
ANNEX B - TEST DIAGRAMS

EQUIPMENT: 750 Tracker

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

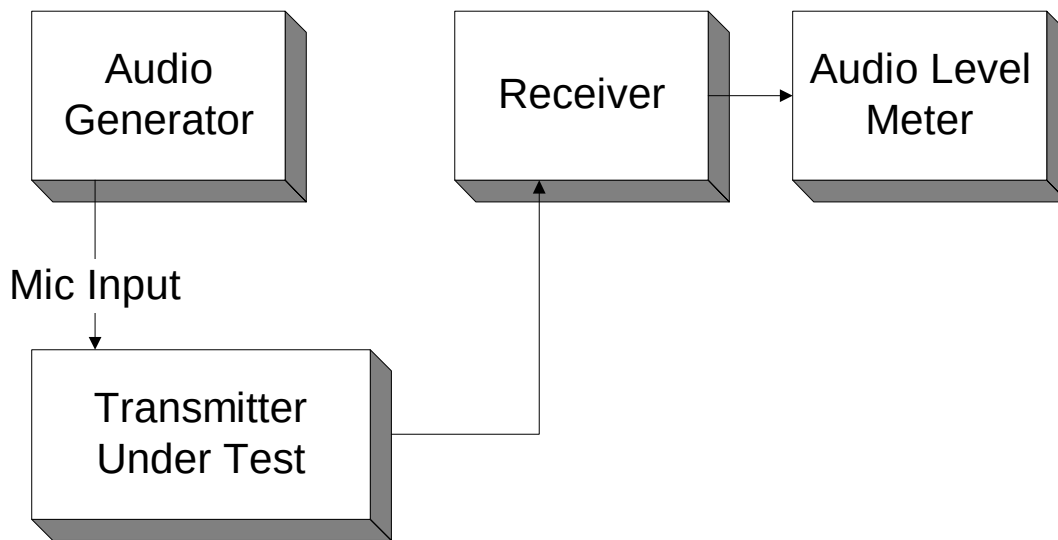


Para. No. 2.987(a) - Audio Frequency Response

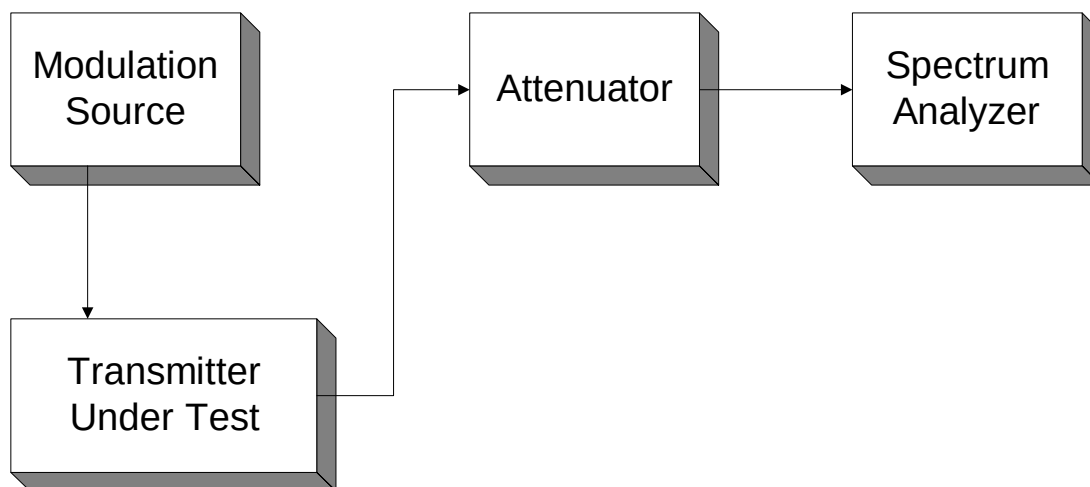


EQUIPMENT: 750 Tracker

Para. No. 2.987(b) - Modulation Limiting

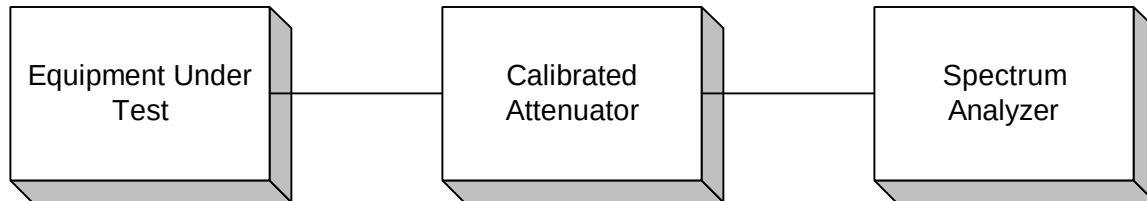


Para. No. 2.989 - Occupied Bandwidth

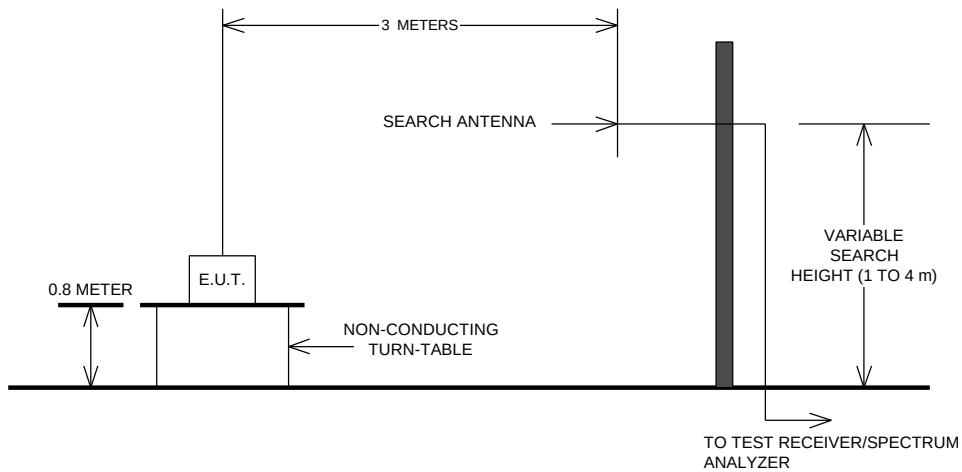


EQUIPMENT: 750 Tracker

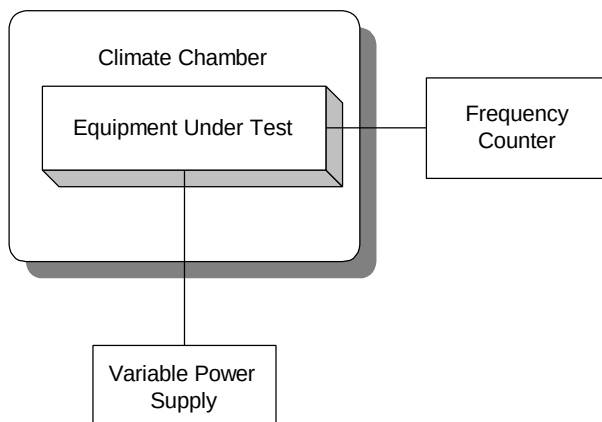
Para. No. 2.991 - Spurious Emissions at Antenna Terminals

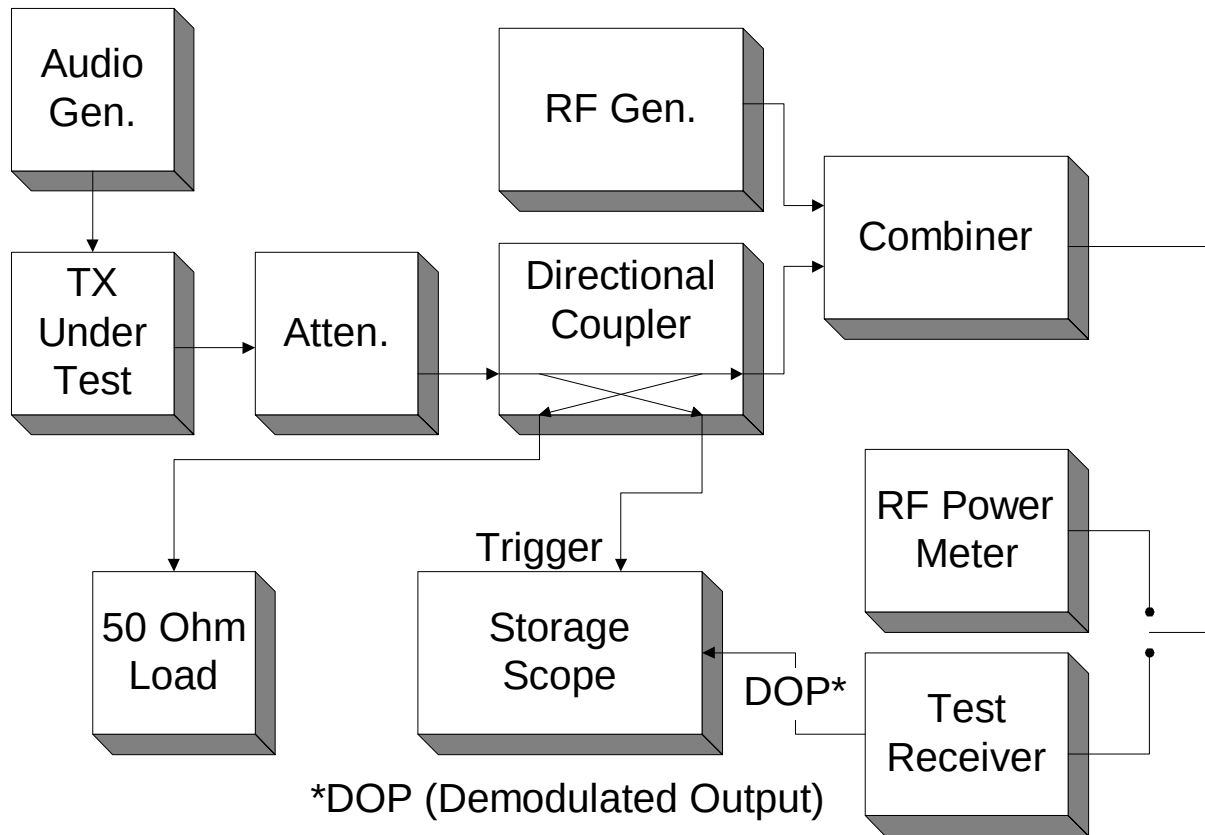


Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability



*EQUIPMENT: 750 Tracker***Para. No. 90.214 - Transient Frequency Behaviour****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).