KTL Test Report:	0L0437RUS2
Applicant:	VXT, L.L.C. 3750 Industrial Court Suite H Suwanee, GA 30024
Equipment Under Test: (E.U.T.)	B-45C1-01 Base Radio
FCC ID:	PBPB-45C1-01
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:	 Tom Tidwell, EMC/Wireless Group Manager
Date:	1/27/01
Total Number of Pages:	34

Table of Contents

Section 1. Summary of Test Results

Manufacturer: XY Golf

Model No.: B-45C1-01

Serial No.: S01

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: 100426-0

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	90.205	100 W	1.5 W	Complies
Audio Frequency Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Audio Low-Pass Filter Response	TIA EIA-603.3.2.6	N/A	N/A	N/A
Modulation Limiting	TIA EIA-603.3.2.6		+/-0.19 kHz	Complies
Occupied Bandwidth	90.210	Mask D	Mask D	Complies
Spurious Emissions at Antenna Terminals	90.210	50+10Log(P)	-66.07 dB (-34.4 dBm)	Complies
Field Strength of Spurious Emissions	90.210	50+10Log(P)	-dBm erp	Complies
Frequency Stability	90.213	5 ppm	0.4 ppm	Complies
Transient Frequency Behavior	90.214			Complies

Footnotes:

1. This transmitter does not have a provision for voice modulation.

.

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input:	3.6 Vdc battery
Frequency Range:	450 - 480 MHz
Necessary Bandwidth:	12 kHz

Type(s) of Modulation:

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

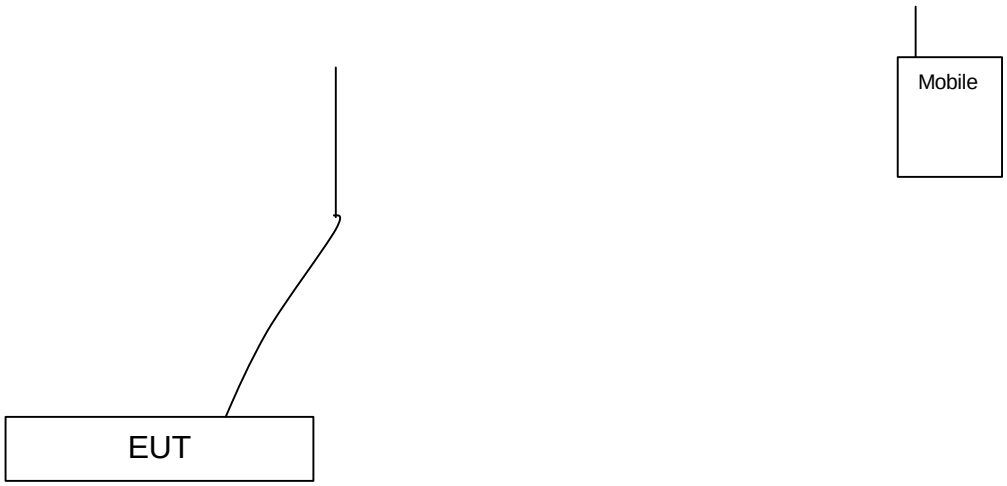
Data Rate(s)	4800, 9600 bps
Internal/External Data Source:	Internal
Emission Designator:	20K0
Output Impedance:	50 ohms
RF Power Output (rated):	2 W
Duty Cycle:	One transmission per minute
Channel Spacing(s):	12.5 kHz
Operator Selection of Operating Frequency:	Set in software
Power Output Adjustment Capability:	Not adjustable by user

System Description

The EUT is a base data radio that is used on a golf course to communicate with a mobile unit (Model M-45C1-01). This system allows course data to be transmitted to the golfer. The handheld unit includes a GPS receiver to coordinate the location of the golfer. This information is transmitted back to the base unit.

These radios operate in the 450 - 480 MHz band on 12.5 kHz channels.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: D. LightTom Tidwell & Debbie Jensen	DATE: 1/4/01

Measurement Results: Complies.

Measurement Data:

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
450	33	33	0
465	33	33	0
480	33	33	0

Measurement Conditions:

Temperature: 22 °C
Humidity: 50 %

Measurement Uncertainty: +/- 0.62 dB

Section 4. Modulation Characteristics

NAME OF TEST: Modulation Characteristics	PARA. NO.: 2.987
TESTED BY: D. LightTom Tidwell & Debbie Jensen	DATE: 1/14/01

Measurement Results: Complies.

Measurement Data: See following pages

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

Measurement Uncertainty: +/- .01 kHz

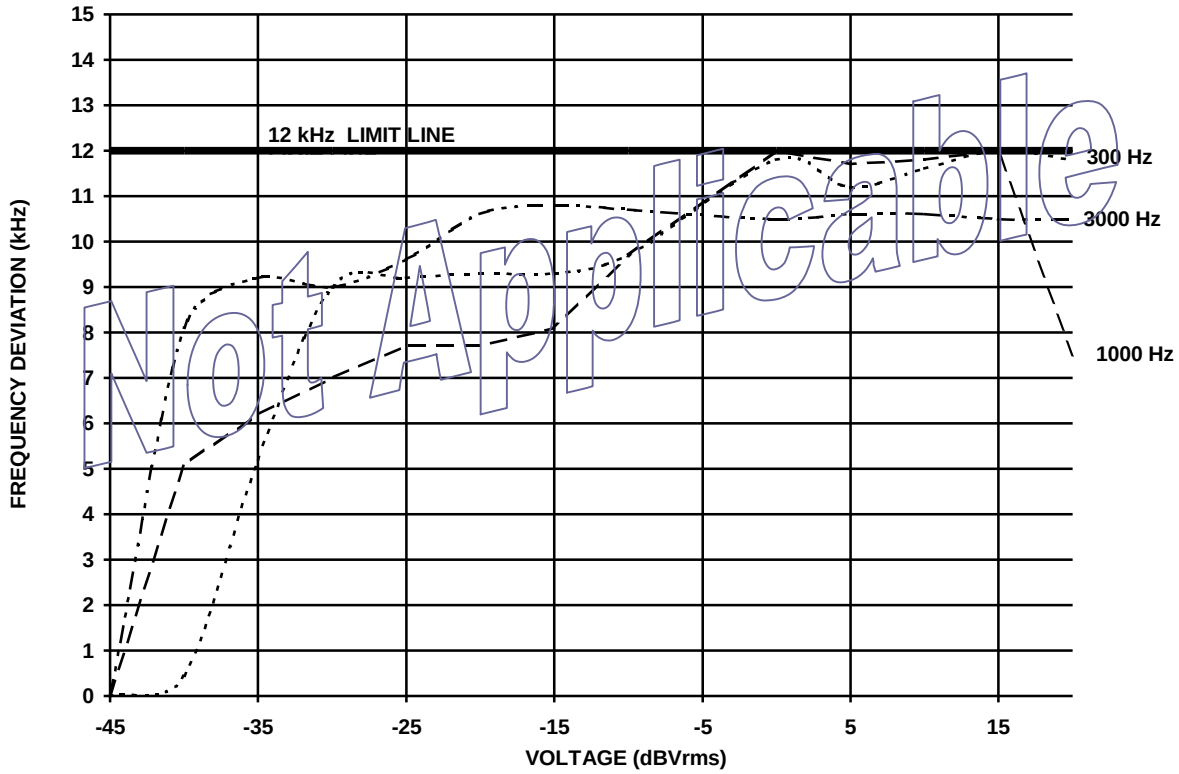
Description of modulation: The carrier is frequency modulated with a single channel of digital information with the use of a modulating sub-carrier.

Description of baseband filtering: The transmitter does not use a low-pass filter.

Section 4.3 Modulation Limiting

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.987(b)
TESTED BY: Tom TidwellTom Tidwell & Debbie Jensen	DATE: 12/29/00

Maximum deviation for non-voice modulation: +/-.19 kHz.



Section 5. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: Tom TidwellTom Tidwell & Debbie Jensen	DATE: 12/29/00

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 23 °C
Humidity: 25 %

Measurement Uncertainty: +/- 0.6 dB

Test Data - Occupied Bandwidth

Data Plot **Occupied Bandwidth**

Page 1 of 1 Complete X

Job No.: 0L0437R Date: 12/29/00 Preliminary

Specification: CFR 47, 90.210(D) Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 25

E.U.T.: B-45C1-01 Base Unit

Configuration: TX at center frequency

Sample Number: S01

Location: Lab 1 RBW: 300 Hz

Detector Type: Peak VBW: 300 Hz

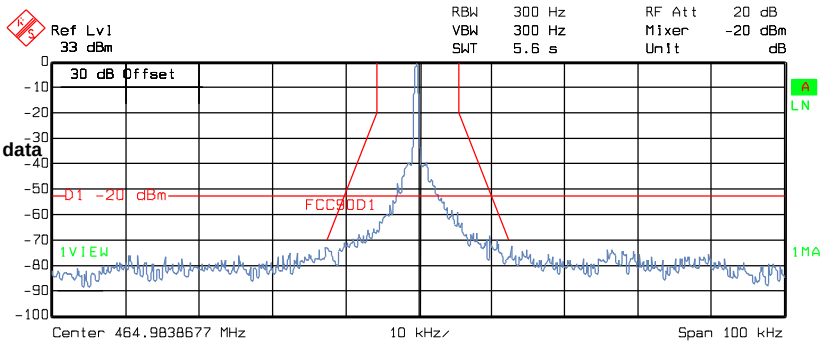
Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1045
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1604	Cable #4:	
Attenuator #2:	1477	Mixer:	

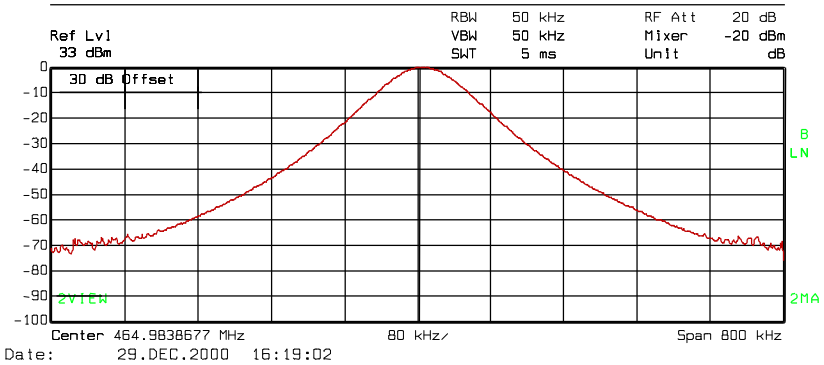
Additional equipment used:

Measurement Uncertainty: +/-.6 dB

Modulated 9600bps ASCII data



Unmodulated



Notes: Transmit mid channel

Section 6. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.991
TESTED BY: Tom TidwellTom Tidwell & Debbie Jensen	DATE:12/29/00

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: Temperature: 23 °C
Humidity: 25 %

Measurement Uncertainty: +/- 0.6 dB

Test Data - Spurious Emissions at Antenna Terminals

Data Plot **Antenna Port Spurious Emissions**

Page 1 of 2 Complete X

Job No.: 0L0437R Date: 12/29/00 Preliminary

Specification: CFR 47, 90.210(D) Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 25

E.U.T.: B-45C1-01 Base Unit

Configuration: TX at center frequency

Sample Number: S01

Location: Lab 1

Detector Type: Peak

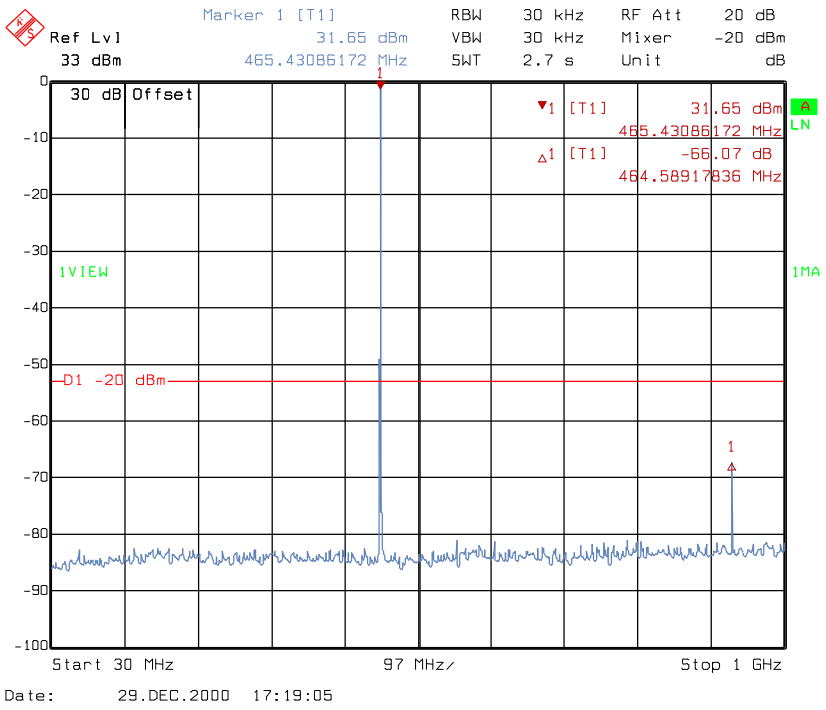
Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1045
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1	1604	Cable #4:	
Attenuator #2:	1477	Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-.6 dB

Modulated 9600bps ASCII data



Notes: Transmit mid channel

Test Data - Spurious Emissions at Antenna Terminals

Data Plot t Spurious Emissions

Page 2 of 2

Job No.: 0L0437R Date: 12/29/00

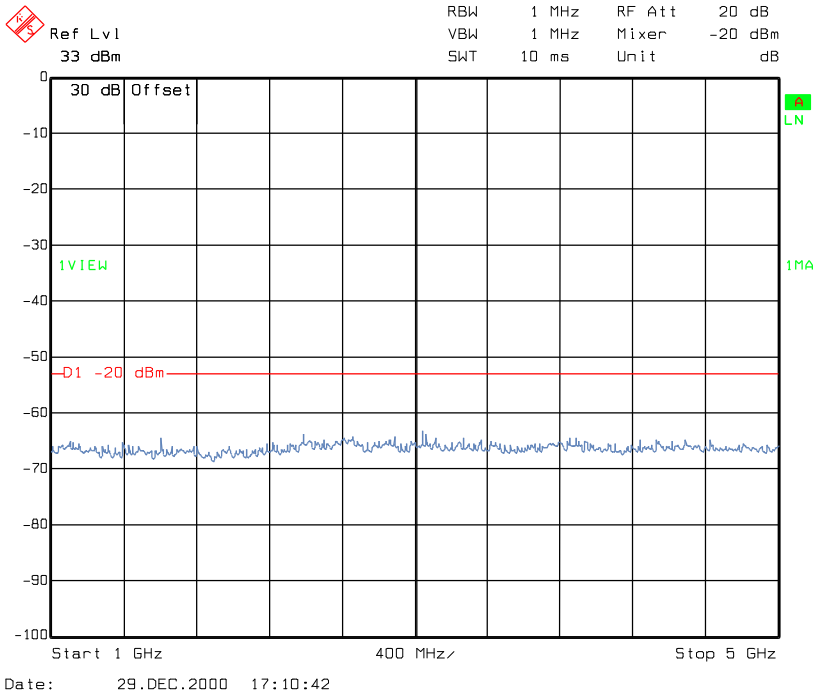
Specification: CFR 47, 90.210(D) Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 25

E.U.T.: B-45C1-01 E

Configuration: TX at center frequency

Modulated 9600bps ASCII data



Notes: Transmit mid channel

Section 7. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.993
TESTED BY: Chinda PoyTom Tidwell & Debbie Jensen	DATE: 01/09/01

Measurement Results: Complies.

Measurement Data: See attached data

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

Measurement Uncertainty: +/- 3.6 dB

Test Data - Radiated Emissions – Model B-45C1-01 BaseTransmitter

KTL Dallas, Inc.

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

Field Strength of Spurious Emissions

Page 1 of 1 Complete X

Job No.: 0L0437R Date: 1/9/01 Preliminary

Specification: Part 90 Temperature(°C): 22

Tested By: Chinda Poy Relative Humidity(%) 50

E.U.T.: Base Unit

Configuration: Transmit Data Continuously

Sample Number: S01

Location: AC 3 RBW: 100 kHz < 1 GHz, 1 MHz > 1 GH Measurement

Detector Type: Peak VBW: 100 kHz < 1 GHz, 1 MHz > 1 GH Distance: 3 m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:	1016	Cable #1:	1484
Filter:		Cable #2:	1485
Receiver:	1464	Cable #3:	
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	

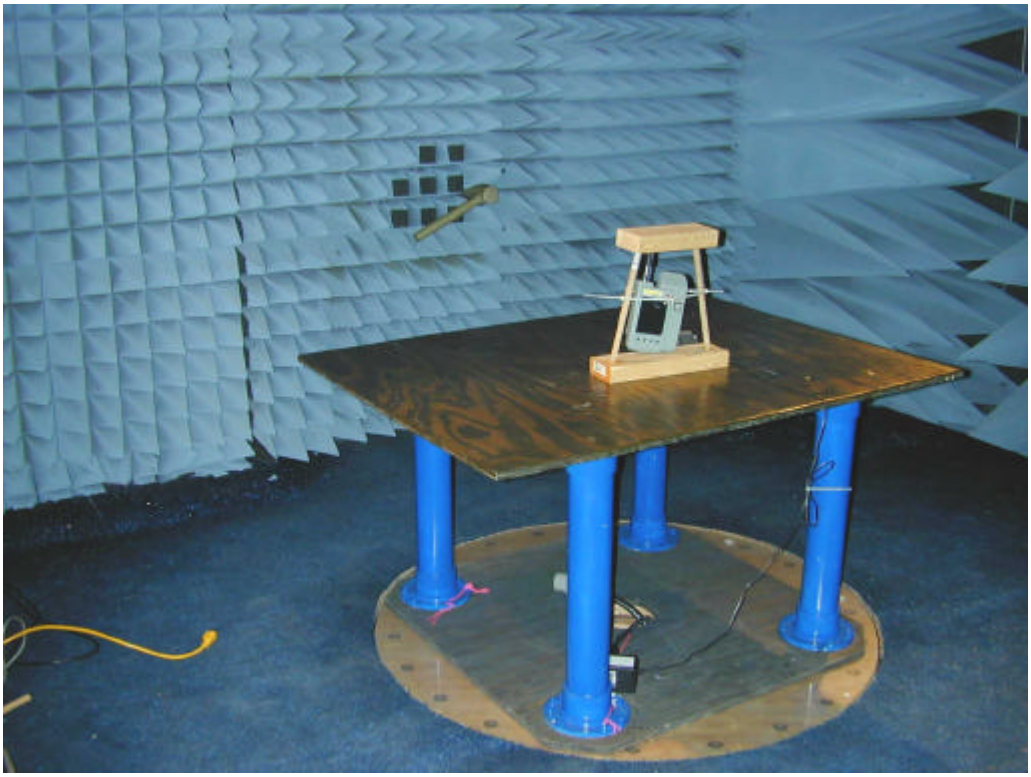
Additional equipment used:

Measurement Uncertainty: +/-3.6 dB

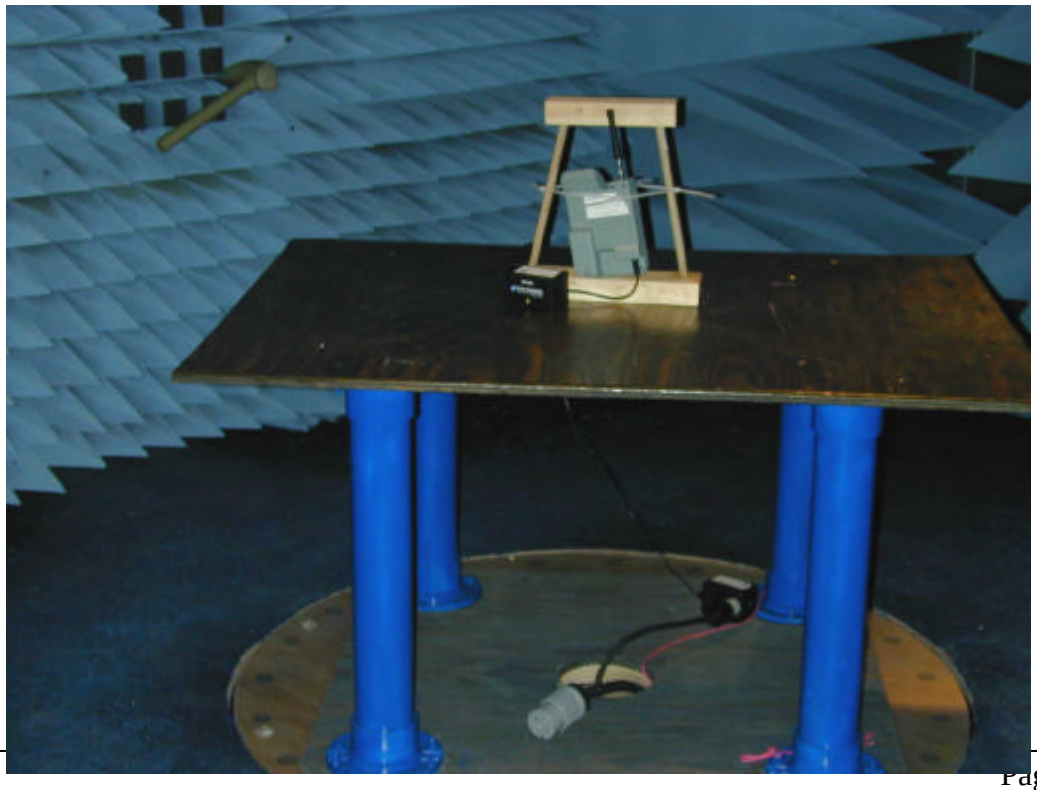
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)		ERP (dBm)	ERP (mW)	Polarity	Comments
930	-71.3	29.8		0	3.7		-37.8	0.000165	V	NF
1395	-61.8	31.5		32.8	4.8		-58.4	0.000001	V	NF
1860	-59.6	29.9		32.9	6.4		-56.3	0.000002	V	NF
2325	-62.1	34.1		33.1	6.9		-54.3	0.000004	V	NF
2790	-58.6	35.6		33.6	8.0		-48.7	0.000014	V	NF
3255	-62.8	37.1		33.7	8.1		-51.3	0.000007	V	NF
3720	-61.5	40.4		33.3	8.0		-46.4	0.000023	V	NF
4185	-63.5	42.8		33.2	7.9		-46.0	0.000025	V	NF
4650	-62.3	41.2		33.2	9.2		-45.2	0.000031	V	NF
930	-73.1	30.4		0	3.7		-39.0	0.000126	H	NF
1395	-50.6	31.1		32.8	4.8		-47.6	0.000018	H	
1860	-60.8	32.7		32.9	6.4		-54.7	0.000003	H	NF
2325	-61.0	36.7		33.1	6.9		-50.6	0.000009	H	NF
2790	-59.8	34.6		33.6	8.0		-50.8	0.000008	H	NF
3255	-61.0	35.8		33.7	8.1		-50.8	0.000008	H	NF
3720	-62.3	34.3		33.3	8.0		-53.3	0.000005	H	NF
4185	-62.8	35.2		33.2	7.9		-52.9	0.000005	H	NF
4650	-62.3	35.5		33.2	9.2		-50.8	0.000008	H	NF

Notes: Scanned to 10th harmonic

Photographs of Test Setup - Model B-45C1-01 Base Transmitter
FRONT VIEW



REAR VIEW



Section 8. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: D. LightTom Tidwell & Debbie Jensen	DATE: 1/11/01

Measurement Results: Complies.

Measurement Data: See attached data

Measurement Conditions: See data

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

Test Data - Frequency Stability

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

Frequency Stability

Client: XY GOLF W.O.# 0L0437R

EUT: BASE UNIT S/N: S01

Date: 1/11/01 Tech: 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

Section 9. Transient Frequency Behavior

NAME OF TEST: Transient Frequency Behaviour	PARA. NO.: 90.214
TESTED BY: D. LightTom Tidwell & Debbie Jensen	DATE: 1/08/01

Measurement Results: Complies.

Measurement Data: See attached data

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

Measurement Uncertainty: +/- .5 kHz

Test Data - Transient Frequency Behavior

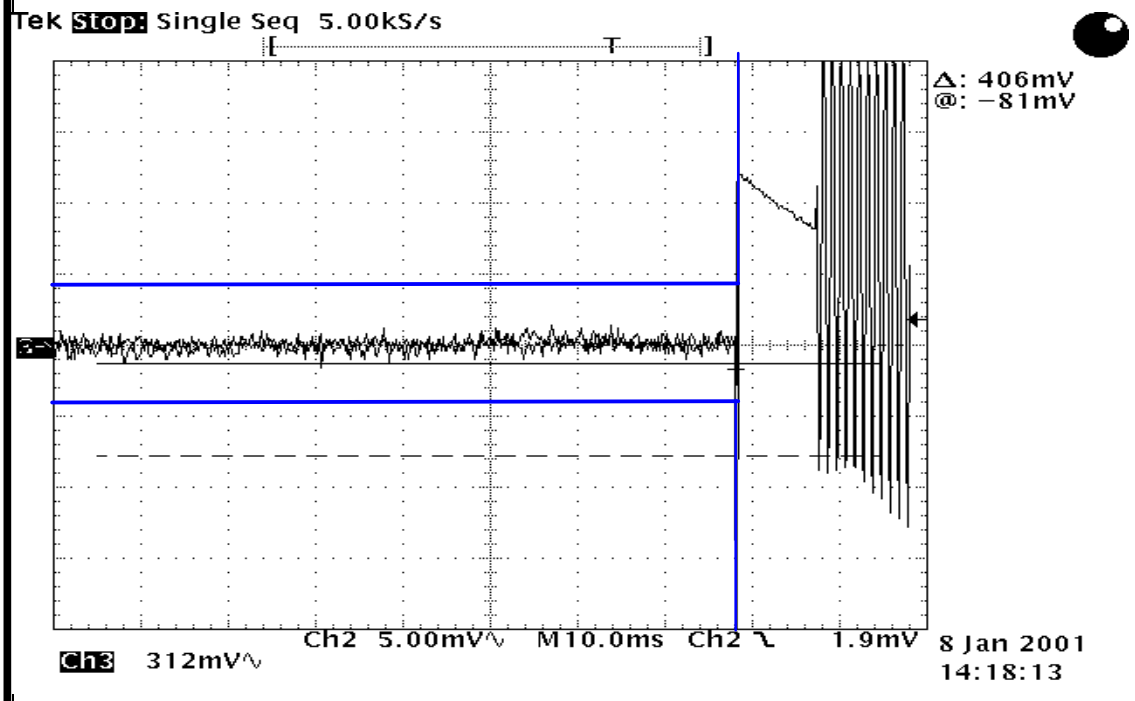
Data Plot **Transient Frequency Behavior**

Page 1 of 2 Complete ____
Job No.: 0L0437R Date: 1/8/01 Preliminary ____
Specification: PART 90 Temperature(°C): 22
Tested By: Tom Tidwell Relative Humidity(%) 50
E.U.T.: Base
Configuration: TX at mid channel
Sample Number: S01
Location: Lab 1 RBW: #N/A
Detector Type: ____ VBW: ____

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



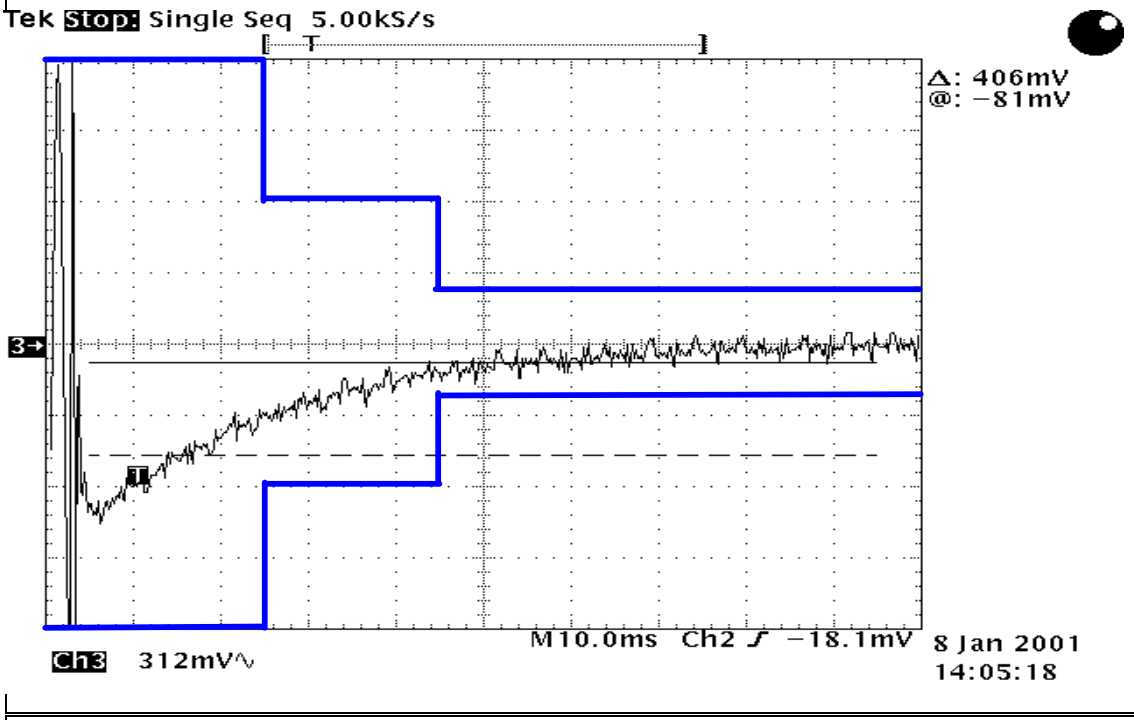
Notes:

Test Data - Transient Frequency Behavior

Data Plot Frequency Behavior

Page 2 of 2

Job No.:	0L0437R	Date:	1/8/01
Specification:	PART 90	Temperature(°C):	22
Tested By:	Tom Tidwell	Relative Humidity(%)	50
E.U.T.:	Base		
Configuration:	TX at mid channel		



Notes:

Section 10. Test Equipment List

ASSET	Description	Manufacturer Model No.	Serial No.	Cal. Date	Cal. Due
406	POWER METER	HP 436A	2512A22082	02/17/00	02/16/01
414	POWER SENSOR (0.0001-4.2 GHz)	HEWLETT PACKARD 8482A (50ohm,0.3uW-100mW)	2349A09820	N/A	N/A
1051	Radio Communication Analyzer	Rhode & Schwarz CMTA-54	835875/002	03/14/00	03/14/01
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/99	06/14/01
1604	ATTENUATOR	NARDA 776B-20	NONE	09/30/00	09/29/01
1477	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W5	NONE	CBU	N/A
1045	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/00	05/23/01
1016	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	05/24/00	05/24/01
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/02/02
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	05/25/00	05/25/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	05/25/00	05/25/01
283	ENVIROMENTAL CHAMBER	ENVIROTRONICS SH27	129010083	04/06/00	04/06/01
1026	FREQUENCY COUNTER	HEWLETT PACKARD 5350B	8232A01493	08/17/00	08/17/01
1091	COMBINER	MINI-CIRCUITS ZA3PD-1.5	NONE	CBU	N/A
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/00	05/23/01
1043	Flexible cable 1m	Astrolab Inc. 32027-2-29094K-1M	0	09/30/00	09/29/01
1054	DUAL DIRECTIONAL COUPLER	NARDA 3020A	34366	Cal Not Req	N/A
1463	Color 4 Ch Digitizing Oscilloscope	Tektronix TDS684A	B010460	04/13/00	04/13/01
411	SIGNAL GENERATOR	MARCONI 2022D	119223029	CNR	N/A

Annex A - Test Methodologies

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

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

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.

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 effective radiated power of the spurious emissions was measured using the substitution antenna method. The EUT is placed on a turntable at three meters distance from the receive antenna. When a spurious emission is detected, the level of the emission is maximized by rotating the turntable and adjusting the height of the receive antenna. The EUT is then replaced with a substitution antenna fed with a signal generator. The level of the signal generator is adjusted until the spurious level previously detected is duplicated. The erp of the spurious emission is the input level to the substitution antenna corrected for any gain of the substitution antenna with reference to a dipole.

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

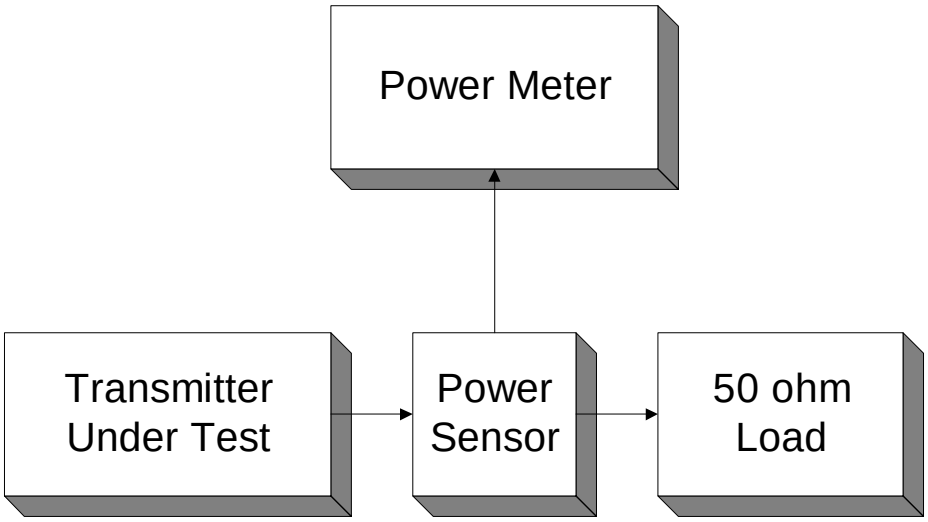
		Frequency ranges (MHz) All equipment					
	Maximum	Base station and portable radios			Mobile Radios		
Time intervals [1,2]	Frequency difference[3] (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1[4]	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t_2	± 12	20.0	25.0	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

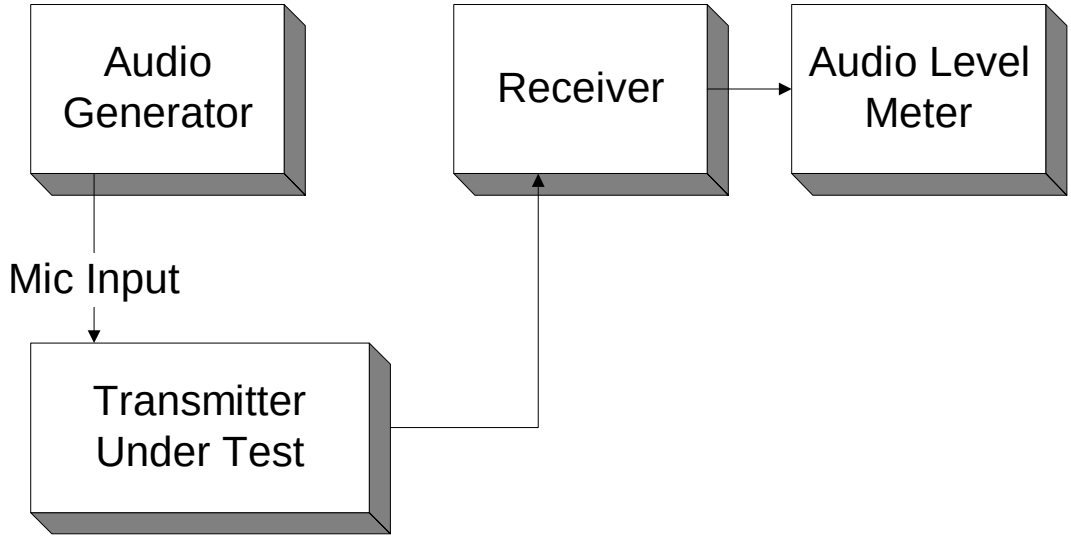
	Maximum	Frequency ranges (MHz) All equipment		
Time intervals [1,2]	Frequency difference[3] (kHz)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t_1[4]	± 12.5 / ± 6.25	5.0	10.0	20.0
t_2	± 6.25 / ± 3.125	20.0	25.0	50.0
t_3[4]	± 12.5 / ± 6.25	5.0	10.0	10.0

Annex B - Test Diagrams

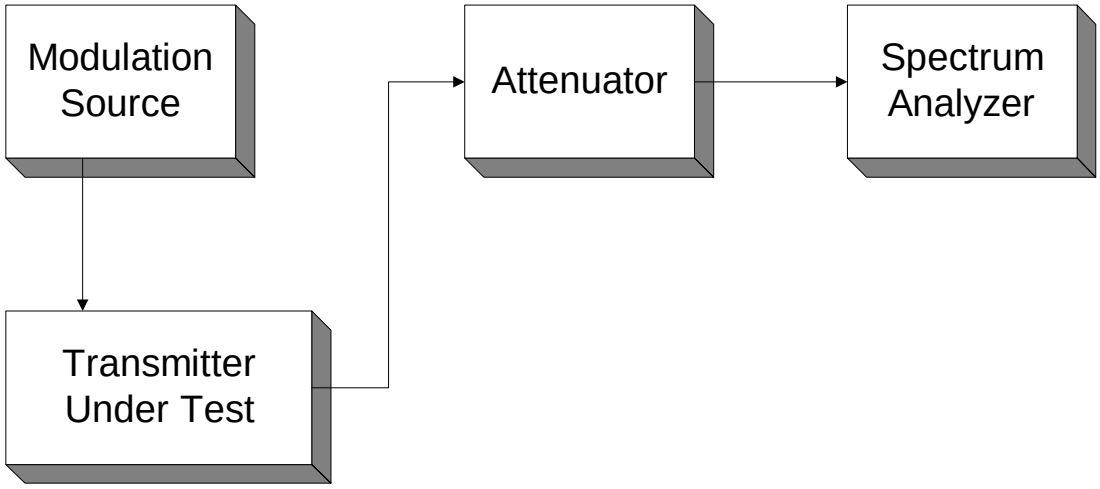
Para. No. 2.985 - R.F. Power Output



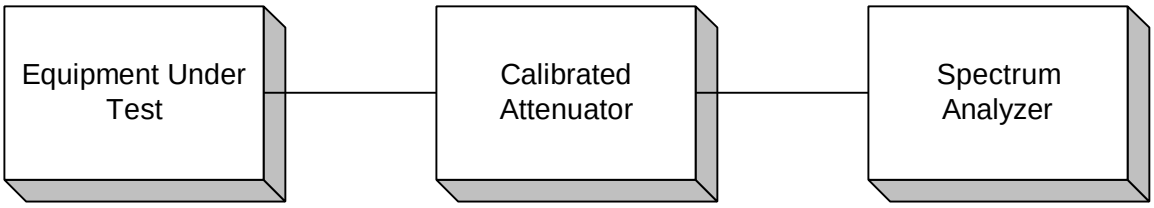
Para. No. 2.987(b) - Modulation Limiting



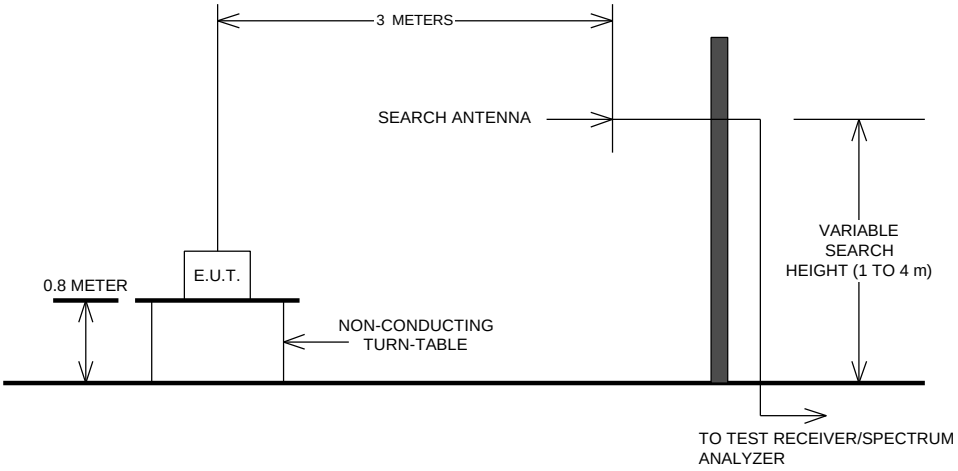
Para. No. 2.989 - Occupied Bandwidth



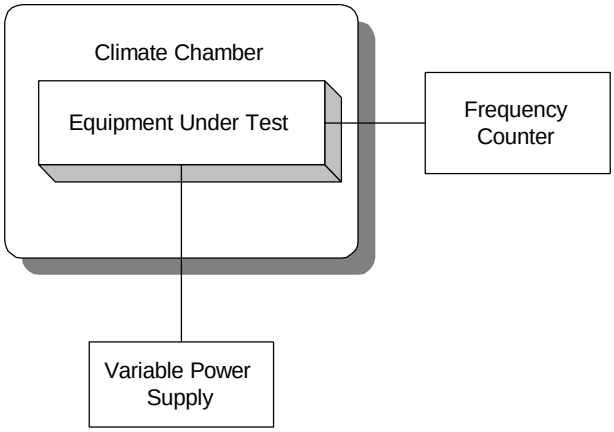
Para. No. 2.991 - Spurious Emissions at Antenna Terminals



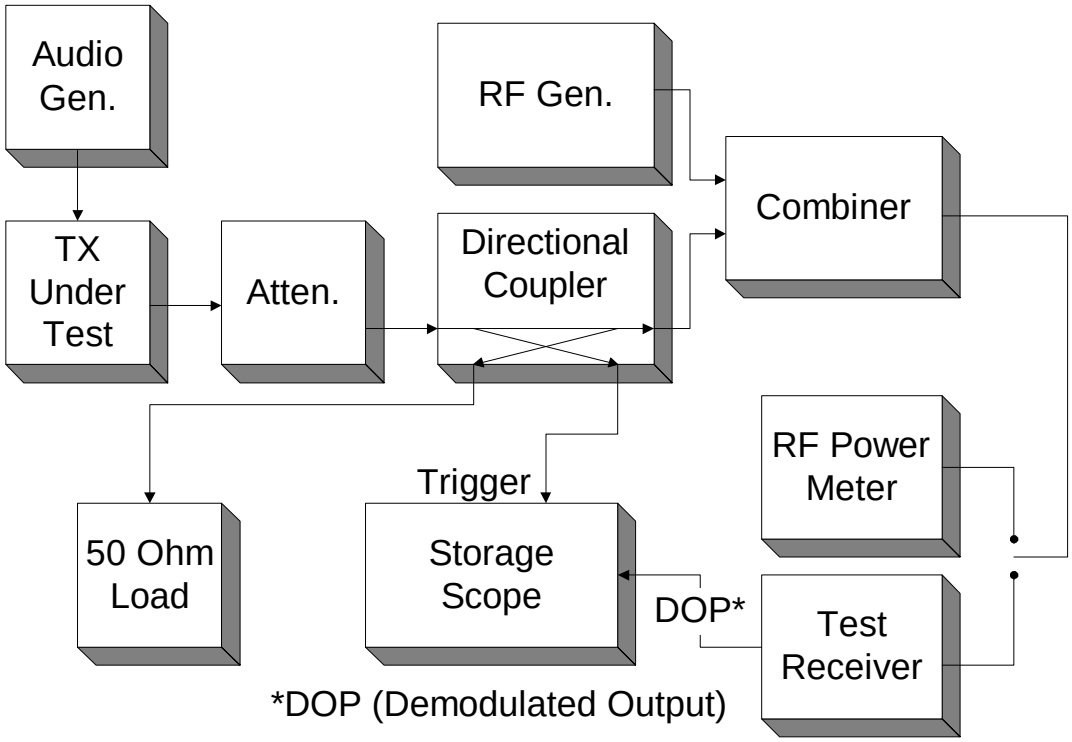
Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability



Para. No. 90.214 - Transient Frequency 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).