TABLE OF CONTENTS LIST

APPLICANT: TOPAZ3, LLC

FCC ID: O7KML3215

TEST REPORT:

EXHIBITS CONTAINING:

GENERAL_INFORMATION_REQUIRED
FOR_TYPE_ACCEPTANCE

2.1033(c)(1)(2) TOPAZ3, LLC will manufacture the FCCID: O7KML3215 VHF TRANSCEIVER in quantity, for use under FCC RULES PART 90.

TOPAZ3, LLC
10828 NW AIRWORLD DRIVE
KANSAS CITY, KS 64153

2.1033 (c) TECHNICAL_DESCRIPTION

2.1033(c)(3) Instruction book. A draft copy of the instruction manual is included as EXHIBIT 5.

2.1033(c) (4) Type of Emission: 10K6F3E
90.209

Bn = 2M + 2DK
M = 3000
D = 2300
Bn = 2(3000)+2(2300) = 10.6K

90.217(b) Authorized Bandwidth 11.25 kHz

2.1033(c) (4) Type of Emission: 15K0F3E
90.209

Bn = 2M + 2DK
M = 3000
D = 4500
Bn = 2(3000)+2(4500) = 15.0K

90.217(b) Authorized Bandwidth 20 kHz

2.1033(c)(5) Frequency Range: 148-174 MHz
90.205(d)

2.1033(c)(6)(7) Power Output shall not exceed 45 Watts into a 50 ohm
90.205 resistive load. There are no user power controls.

2.1033(c)(8) DC Voltages and Current into Final Amplifier:
POWER INPUT:

FINAL AMPLIFIER ONLY
Vce = 13.6 Volts
IC LOW = 1.38 A
IC HIGH = 5.91 A

2.1033(c)(9) Tune-up procedure. The tune-up procedure is included in Exhibit 8.

2.1033(c)(10) Complete Circuit Diagrams: The circuit diagram is included as EXHIBIT 4. The block diagram is included as EXHIBIT 3.

2.1033(c)(11) A photograph or a drawing of the equipment identification label is included as Exhibit #1.

2.1033(c)(12) Photographs(8"X 10") of the equipment of sufficient clarity to reveal equipment construction and layout, including meters, labels for controls, including any view under shields - See EXHIBIT 6-7.

2.1033(c)(13) Digital modulation is not allowed.

2.1033(c)(14) The data required by 2.1046 through 2.1057 is submitted below.

2.1046(a) RF power output.

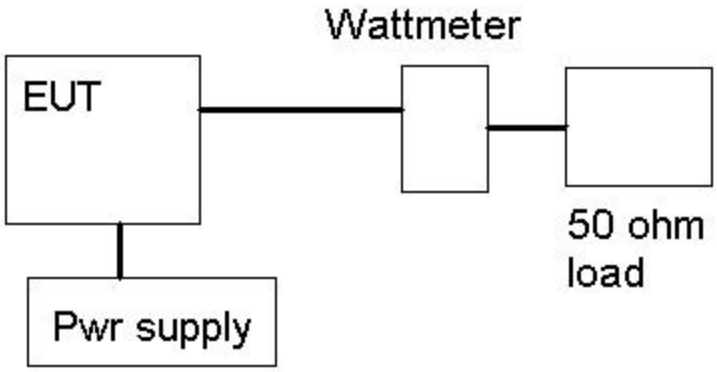
90.205 RF power is measured by connecting a 50 ohm, Resistive wattmeter to the RF output connector. With a nominal battery voltage of 13.6 VDC, and the Transmitter properly adjusted, the RF output measures:

INPUT POWER: HIGH: (13.6V)(5.91A) = 80.37 Watts
INPUT POWER: LOW: (13.6V)(1.38A) = 18.76 Watts

OUTPUT POWER: HIGH: 45 Watts
LOW: 2 Watts

Signal Generator

METHOD OF MEASURING RF POWER OUTPUT

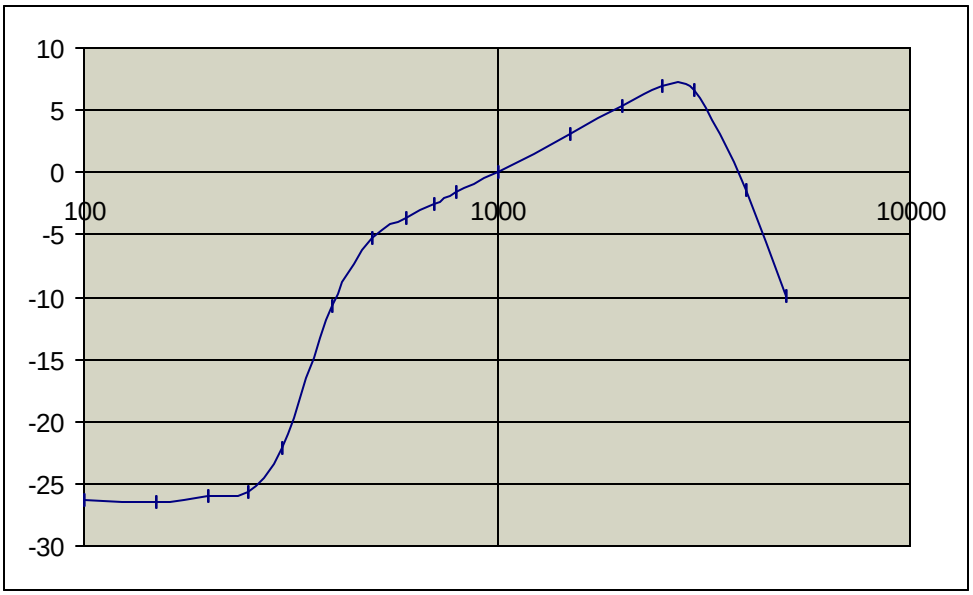


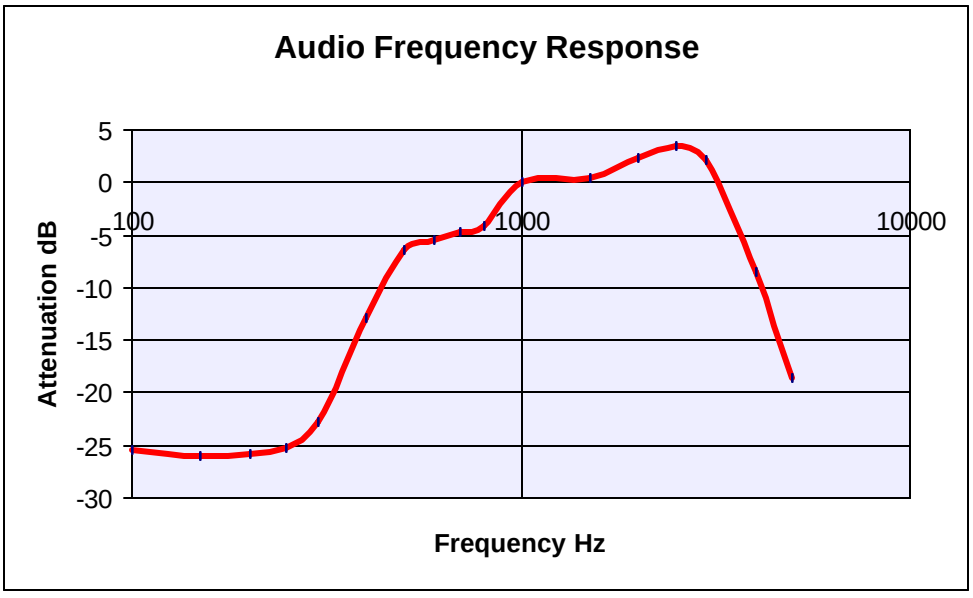
2.1047(a)(b) Modulation characteristics:

AUDIO FREQUENCY RESPONSE

The audio frequency response was measured in accordance with TIA/EIA Specification 603. The audio frequency response curve is shown below.

The audio signal was fed into a dummy microphone circuit and into the microphone connector. The input required to produce 30 percent modulation level was measured.



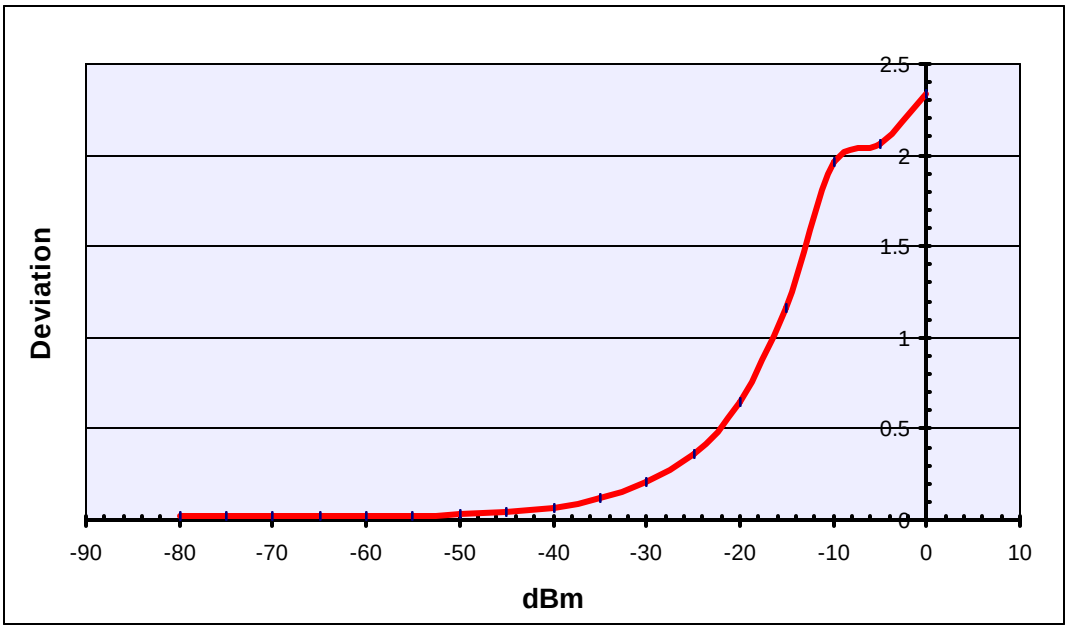


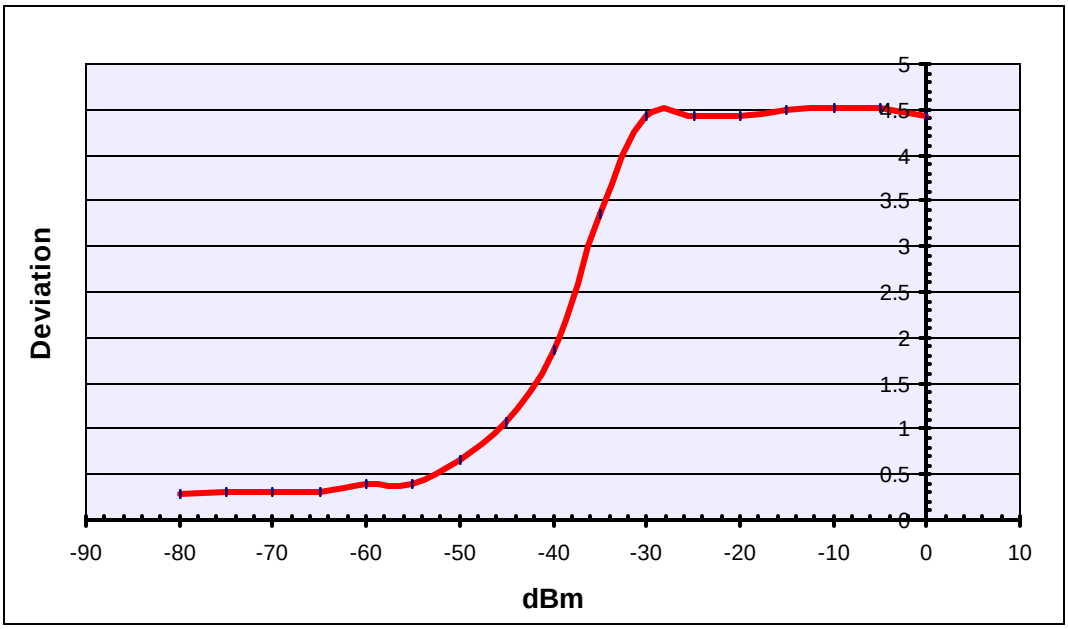
2.1047(a)(b) Modulation characteristics

2.1047(b) Audio input versus modulation

The audio input level needed for a particular per-percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are shown in pages 6-8. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

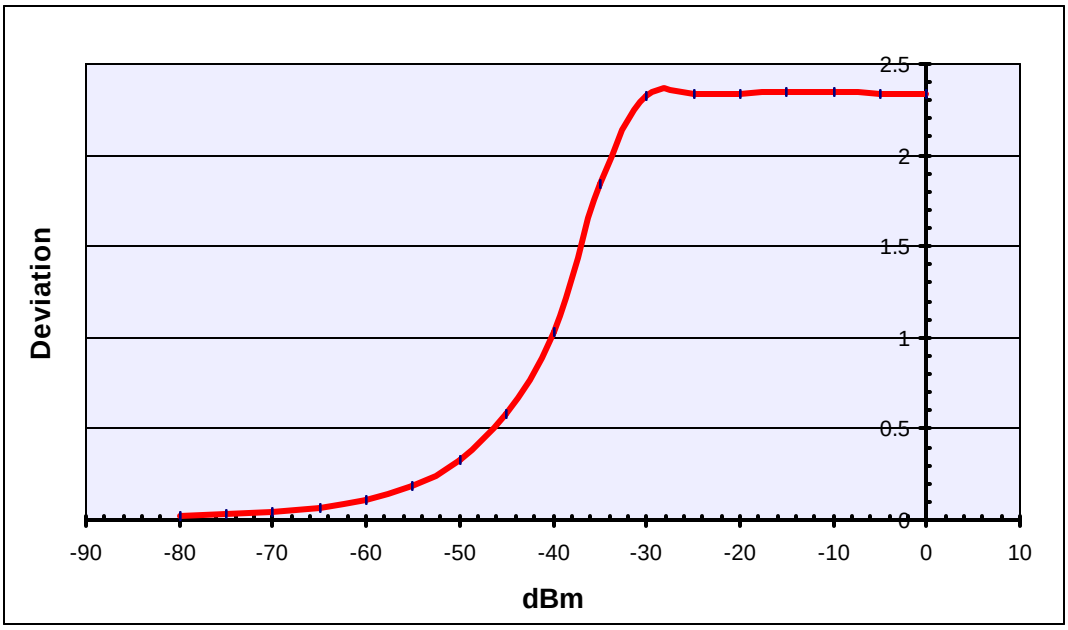
300Hz

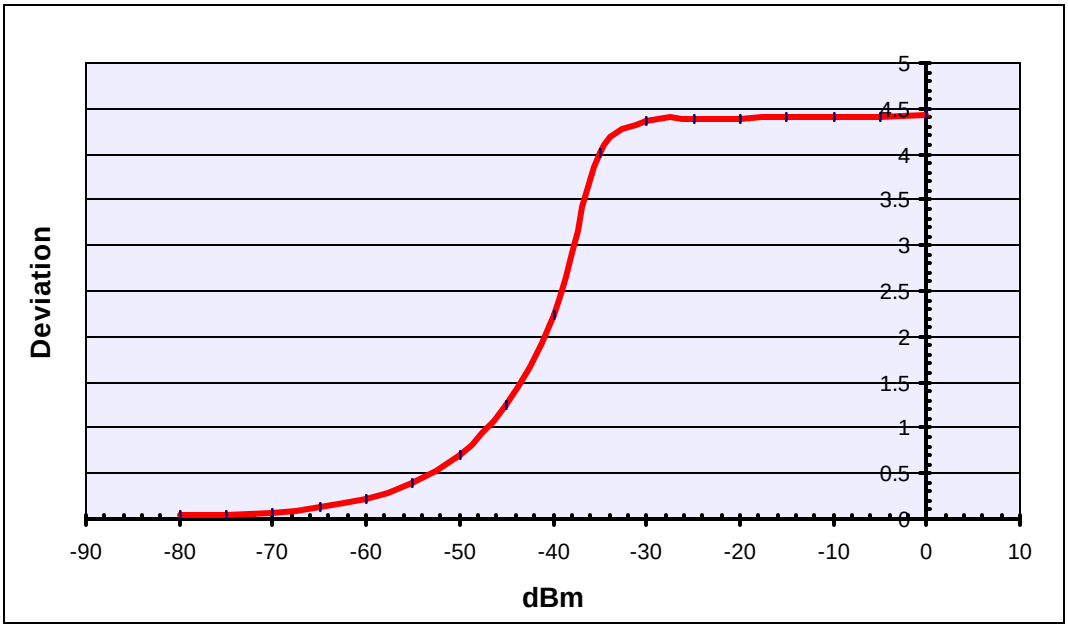




Modulation Limiting for 300Hz

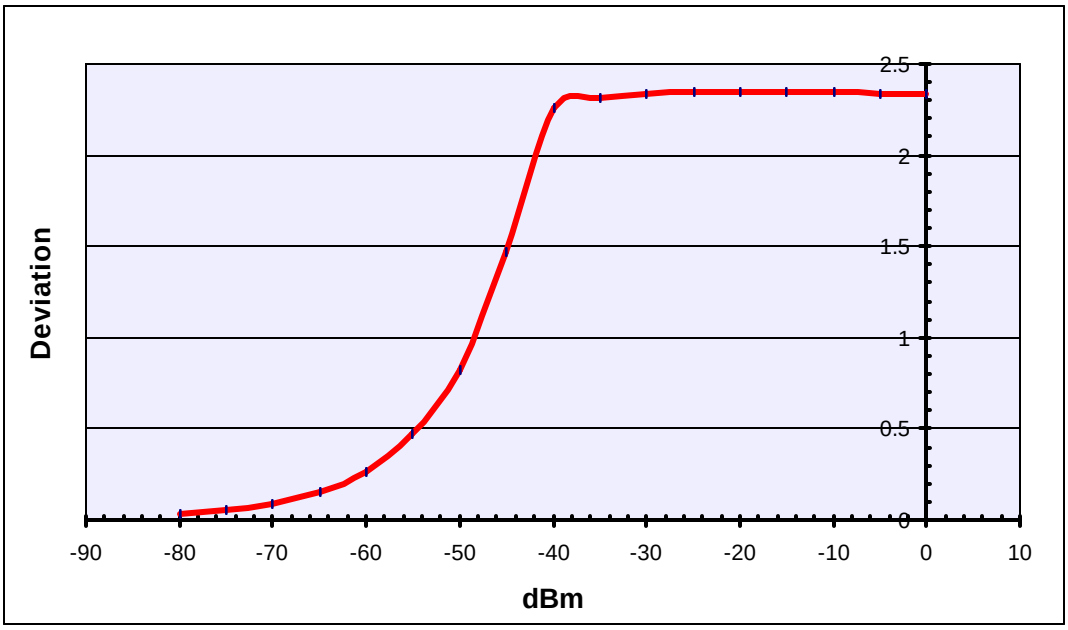
1000Hz

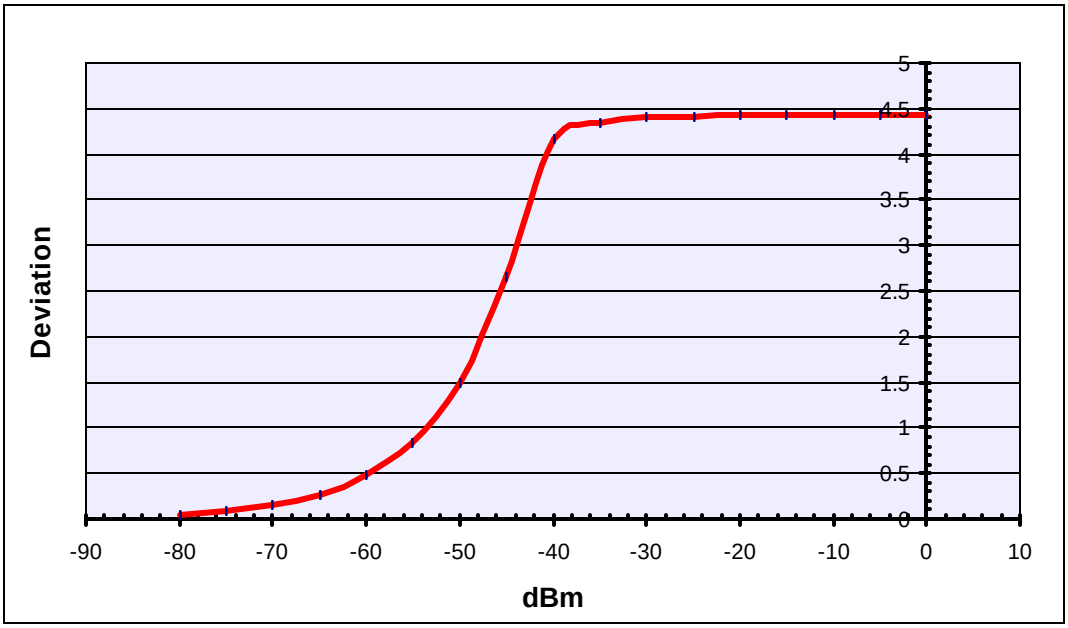




Modulation Limiting for 1000Hz

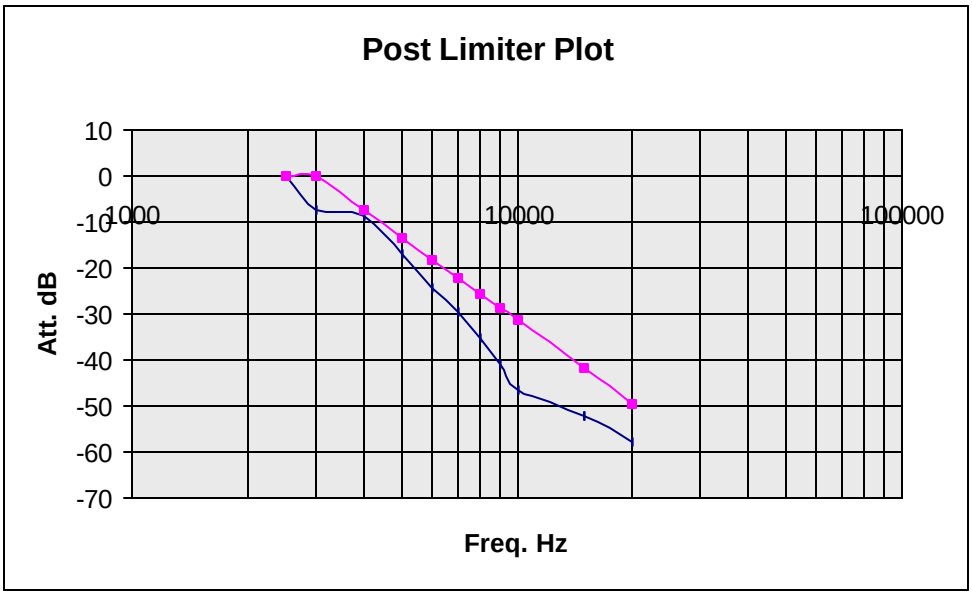
2500Hz





Modulation Limiting for 2500Hz

Post Limiter Filter The filter must be between the modulation limiter and the modulated stage. At any frequency between 3 & 20 kHz the filter must have an attenuation of 60log (f/3) greater that the attenuation at 1KHz. See the plot; page 9.



2.1049(c)
90.210(d)

EMISSION BANDWIDTH:

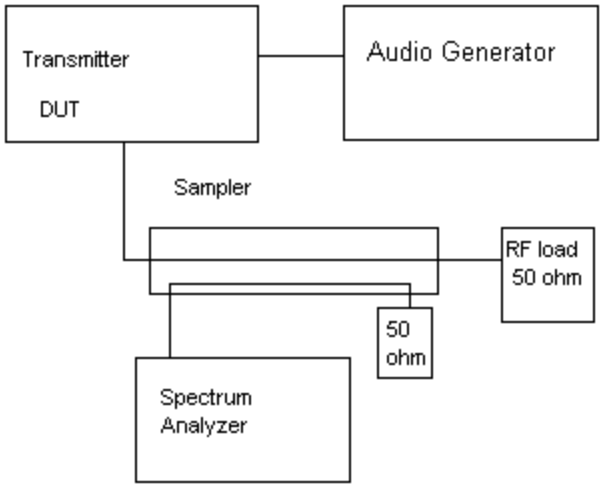
Emission Mask D- 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows: (1) On any frequency from the center of the authorized bandwidth Fo to 5.625 kHz removed from F0: Zero dB. (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (Fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: at least 7.27 (Fd – 2.88 kHz) dB. (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (Fd in kHz) of more than 12.5 kHz: At least 50 + 10 log(P)dB or 70 dB, whichever is the lesser attenuation. The test procedure diagram follows. See the occupied bandwidth plots; pages 9, 10.

Radiotelephone transmitter with modulation limiter.

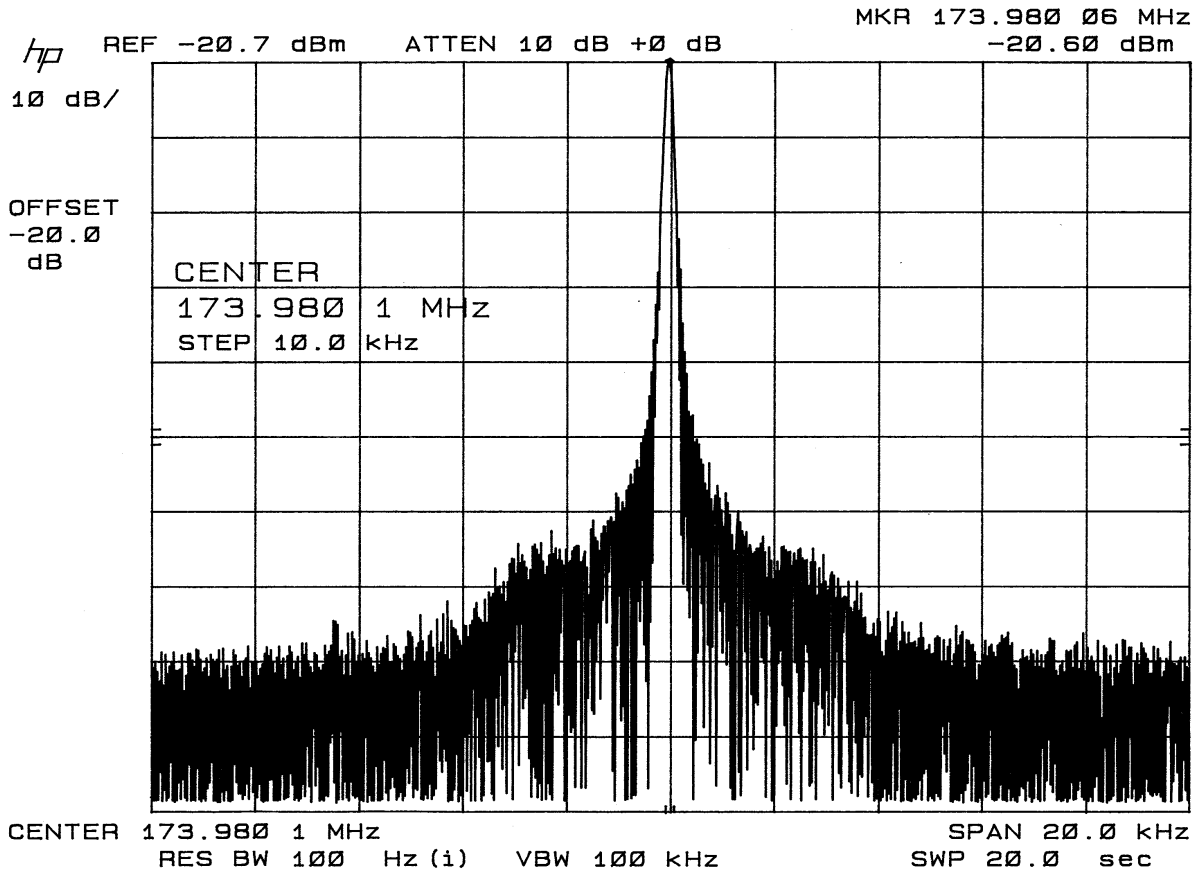
Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

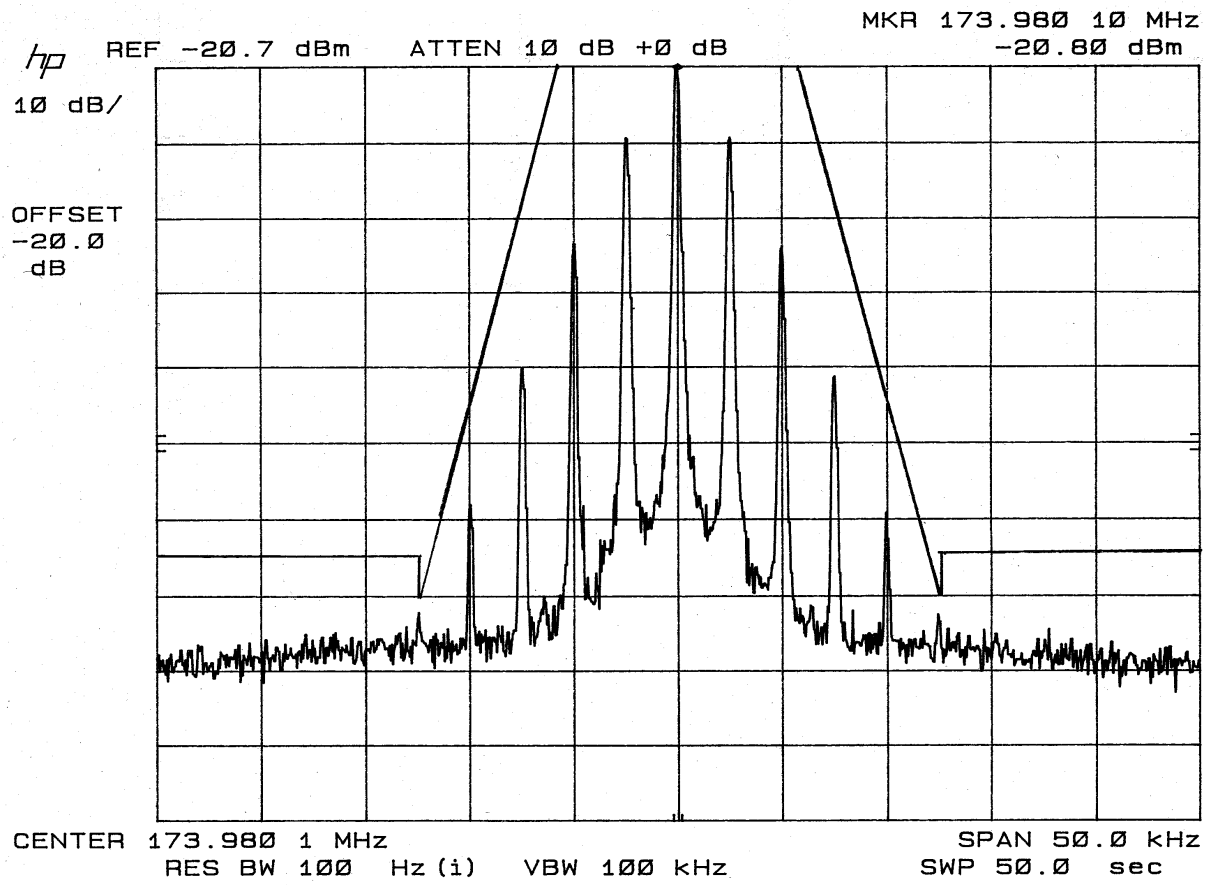
Occupied BW Test Equipment Setup



OCCUPIED BANDWIDTH PLOT – CW

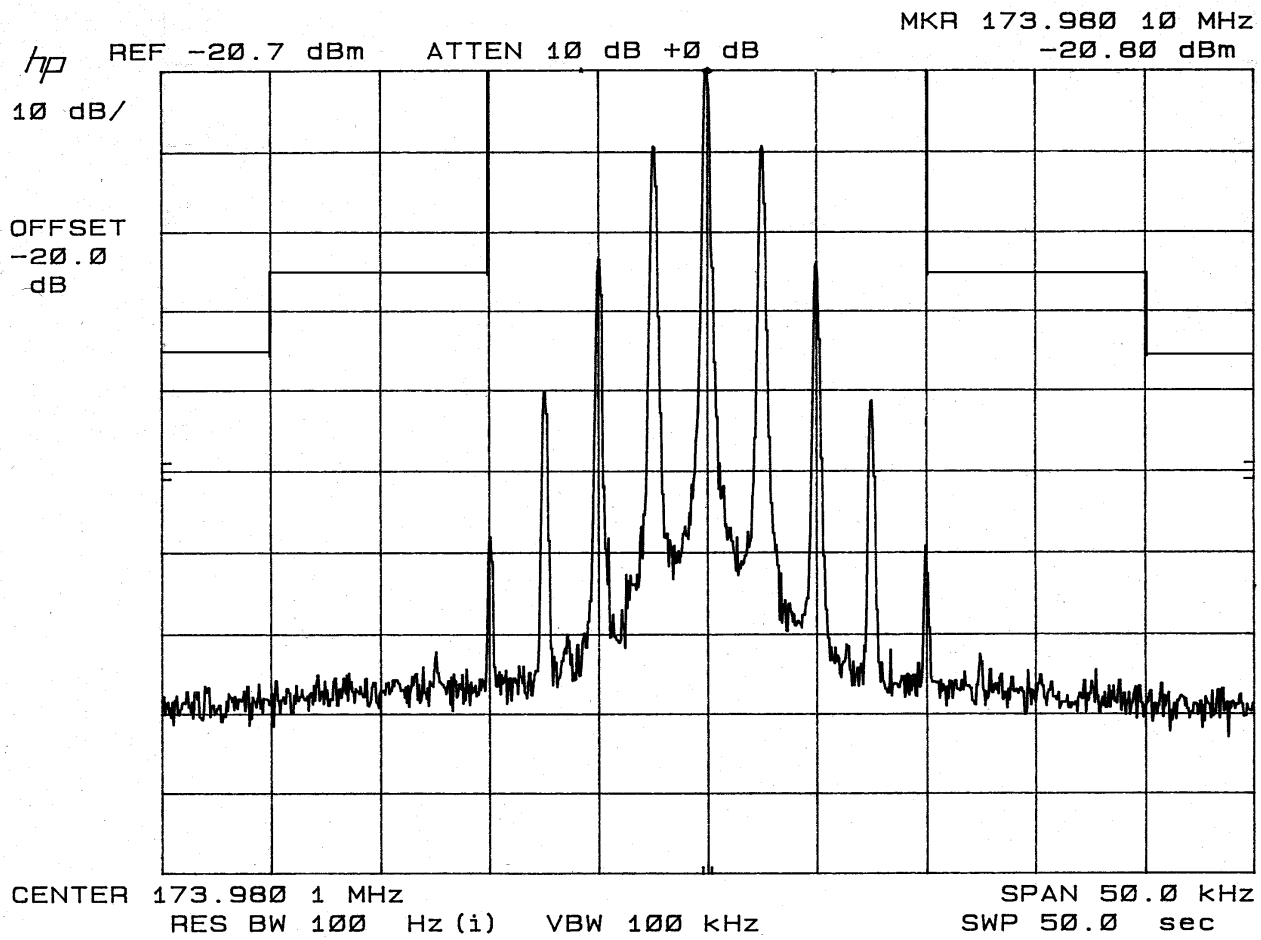


OCCUPIED BANDWIDTH PLOT



For a 12.5 kHz channel

OCCUPIED BANDWIDTH PLOT



For a 25 kHz channel

2.1051 Spurious emissions at antenna terminals(conducted): Data on the following page shows the level of conducted spurious responses. 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 TIA/EIA-603.

REQUIREMENTS: Emissions must be 50 +10log(Po) dB below the mean power output of the transmitter.

HIGH POWER – 50 + 10log(45) = 67 dB
LOW POWER - 50 + 10log(2) = 53 dB

EMISSION FREQUENCY MHz	dB BELOW CARRIER	dB BELOW CARRIER
	LOW POWER	HIGH POWER
148	00.0	00.0
296	54.7	68.7
444	74.8	69.5
592	76.5	82.4
740	79.1	77.0
888	78.9	87.2
1036	87.1	87.5
1184	77.4	84.7
1332	84.2	89.4
1480	82.7	87.7

EMISSION FREQUENCY MHz	dB BELOW CARRIER	dB BELOW CARRIER
	LOW POWER	HIGH POWER
165	00.0	00.0
330	56	68
495	70	76
660	78	81
825	87	84
990	90	96
1155	76	83
1320	84	93
1485	84	82
1650	86	86

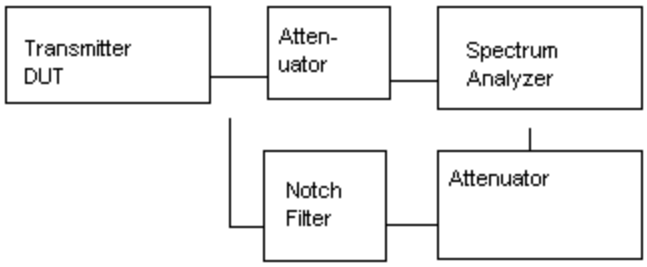
REQUIREMENTS: Emissions must be 50 +10log(Po) dB below the mean power output of the transmitter.

HIGH POWER – 50 + 10log(45)= 67 dB
LOW POWER - 50 + 10log(2) = 53 dB

EMISSION FREQUENCY MHz	dB BELOW CARRIER	dB BELOW CARRIER
	LOW POWER	HIGH POWER
174	00.0	00.0
348	54.5	68.3
522	69.9	83.6
696	74.4	87.9
870	78.1	98.2
1044	89.5	85.1
1218	78.3	84.6
1392	101.6	89.5
1566	89.6	91.1
1740	97.5	92.0

Method of Measuring Conducted Spurious Emissions

Spurious Emissions at
Antenna Terminals



METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. An audio generator was connected to the UUT through a dummy microphone circuit and the output of the transmitter connected to a standard load and from the standard load through a pre-selector filter of the spectrum analyzer. The spectrum was scanned from 400 kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer. The measurements were made using the shielded room located at TIMCO ENGINEERING INC. 849 N.W. State Road 45, Newberry, Florida 32669.

2.1053 Field strength of spurious emissions:

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be 50 +10log(Po) dB below the mean power output of the transmitter.

HIGH POWER – 50 + 10log(45) = 67 dB
LOW POWER - 50 + 10log(2) = 53 Db

TEST DATA:

EF HIGH POWER	M reading	Db below carrier	dBm	Margin dB
148	144	0	46.5	0.00
296	74	70	-24	3.00
444	77	70	-24	3.00
592	70	74	-28	7.00
740	71	73	-27	6.00
888	65	79	-33	12.00
1036	62	82	-36	15.00
1184	64	80	-34	13.00
1332	67	77	-31	10.00
1480	71	73	-27	6.00

EF LOW POWER	M reading	dB below carrier	dBm	Margin dB
148	130	0	33	0.00
296	74	56	-23	3.00
444	68	62	-29	9.00
592	62.9	67	-34	14.00
740	62	68	-35	15.00
888	54	76	-43	23.00
1036	61	69	-36	16.00
1184	57	73	-40	20.00
1332	57	73	-40	20.00
1480	62	68	-35	15.00

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be 50 +10log(Po) dB below the mean power output of the transmitter.

HIGH POWER – 50 + 10log(45) = 67 dB
LOW POWER - 50 + 10log(2) = 53 dB

EF HIGH POWER	M reading	dB below carrier	dBm	Margin dB
165	144	0	46.5	0.00
330	76	68	-22	1.00
495	77	68	-22	1.00
660	72	72	-26	5.00
825	68	76	-30	9.00
990	68	76	-30	9.00
1155	67	77	-31	10.00
1320	64	80	-34	13.00
1485	66	80	-18	13.00
1650	64	80	-34	13.00

EF LOW POWER	M reading	dB below carrier	dBm	Margin dB
165	130	0	33	0
330	76	55	-22	2.00
495	67	63	-30	10.00
660	67	63	-30	10.00
825	58	72	-39	19.00
990	52	78	-45	25.00
1155	58	72	-39	19.00
1320	58	72	-39	19.00
1485	67	63	-30	10.00
1650	57	73	-40	20.00

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be 50 +10log(Po) dB below the mean power output of the transmitter.

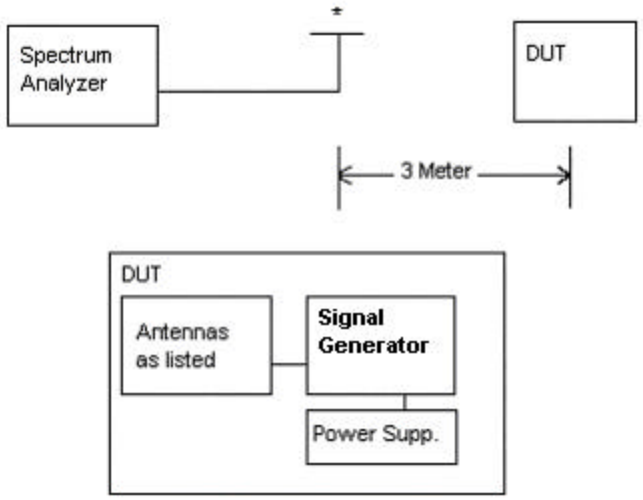
HIGH POWER – 50 + 10log(45) = 67 dB
LOW POWER - 50 + 10log(2) = 53 dB

EF HIGH POWER	M reading	dB below carrier	dBm	Margin Db
174	144	0	46.5	0.00
348	76	68	-22	1.00
522	75	69	-23	2.00
696	67	77	-31	10.00
870	65	79	-33	12.00
1044	69	75	-29	8.00
1218	71	73	-27	6.00
1392	68	76	-30	9.00
1566	72	72	-26	5.00
1740	59	85	-39	18.00

EF LOW POWER	M reading	Db below carrier	dBm	Margin Db
174	130	0	33	0.00
348	76	54	-21	1.00
522	63	67	-34	14.00
696	65	65	-32	12.00
870	58	72	-39	19.00
1044	54	76	-43	23.00
1218	56	74	-41	21.00
1392	62	68	-35	15.00
1566	55	75	-42	22.00
1740	58	72	-39	19.00

METHOD OF MEASUREMENTS: 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. The resolution bandwidth used was 10 kHz for emissions below 1000 MHz, and 1 MHz for emissions above 1000 MHz. This test was conducted per TIA/EIA STANDARD 603 using the substituition method. Measurements were made at the open field test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669.

Method of Measuring Radiated Spurious Emissions



2.1055 Frequency stability:
90.213(a)(4)

Temperature and voltage tests were performed to verify that the frequency remains within the .0005%, 5.0 ppm specification limit. The EUT was placed in the temperature chamber at 25 degrees C and allowed to stabilize for one hour. The transmitter was keyed ON for one minute during which four frequency readings were recorded at 15 second intervals. The worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30 degrees C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for one minute, and again frequency readings were noted at 15 second intervals. The worst case number was recorded for temperature plotting. This procedure was repeated in 10 degree increments up to + 50 degrees C.

Readings were also taken at minus 15% of the battery voltage of 13.6VDC, which we estimate to be the battery endpoint.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 161.025170 MHz

Temperature C	Frequency Mhz	PPM
-30.20	161.025400	1.43
-20.00	161.025393	1.38
-9.60	161.025364	1.20
-0.20	161.025340	1.06
9.90	161.025294	0.77
20.40	161.025170	0.00
30.50	161.025105	-0.40
40.30	161.025105	-0.40
50.10	161.025041	-0.80

Suply voltage %	suply voltage	PPM
1.15	15.64	0.25
1.10	14.96	0.32
1.05	14.28	0.26
0	0	0.00
0.95	13.60	0.05
0.90	12.92	0.08
0.85	12.24	-0.09
0.80	11.56	0.02

2.1055(a)(1) Frequency stability:

90.214 Transient Frequency Behavior

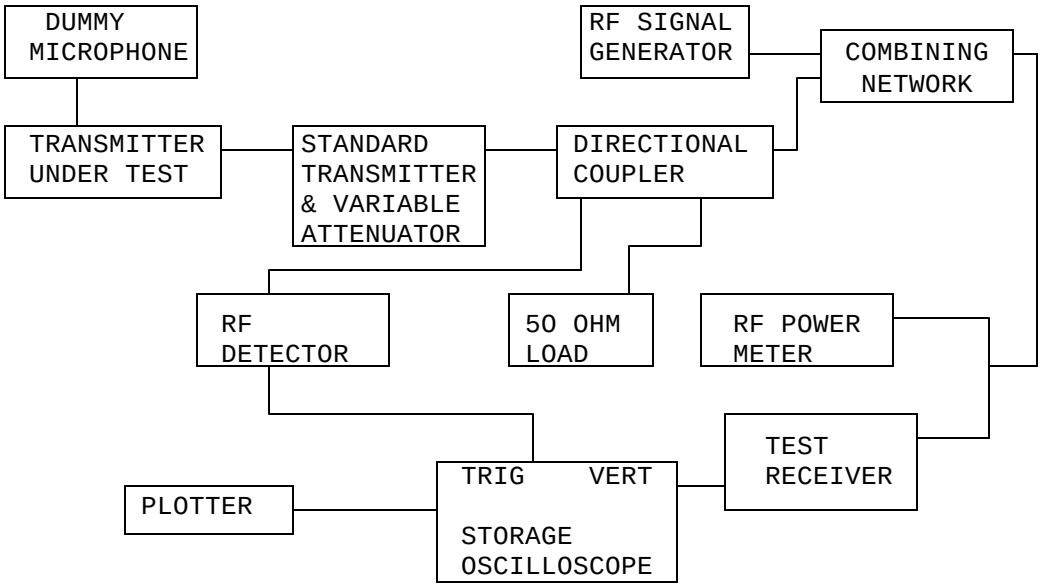
REQUIREMENTS: In the 150-174 MHz frequency band, transient frequencies must be within the maximum frequency difference limits during the time interval indicated below for 12.5kHz Channels:

Time Interval	Maximum Frequency	Portable Radios 150-174 MHz
t1	+12.5 kHz	5.0 ms
t2	+6.25 kHz	20.0 ms
t3,t4	+12.5 kHz	5.0 ms

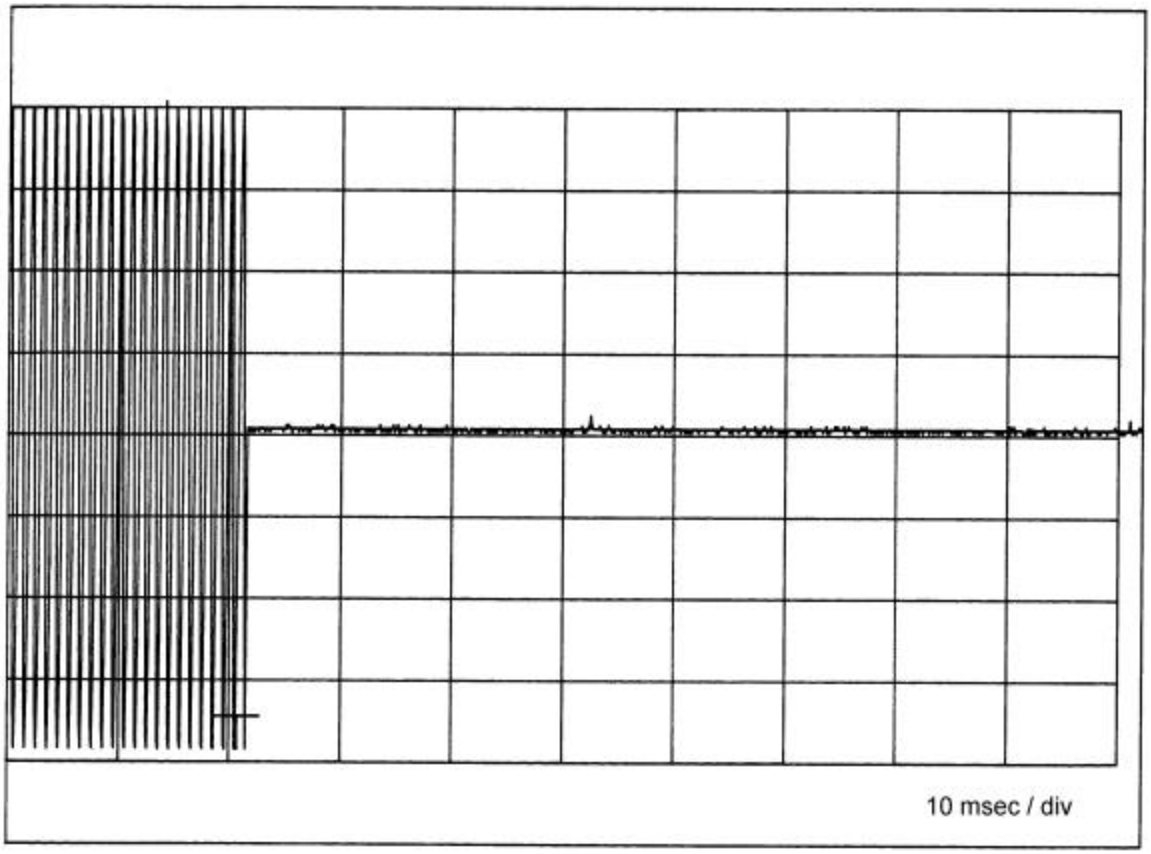
TEST PROCEEDURE: TIA/EIA TS603 PARA 2.2.19, the levels were set as follows;

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 & recorded.

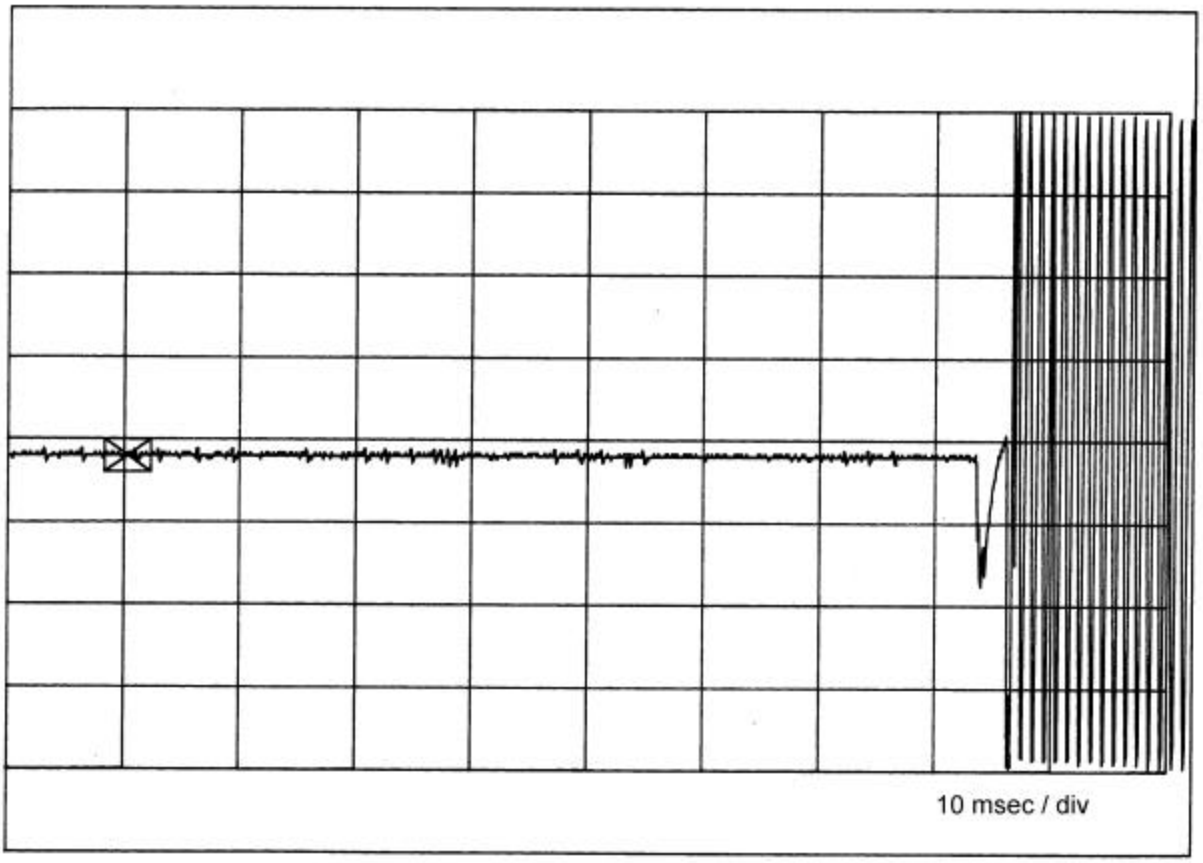
2.1055 Frequency stability:
90.214 Transient Frequency Behavior
(Continued)



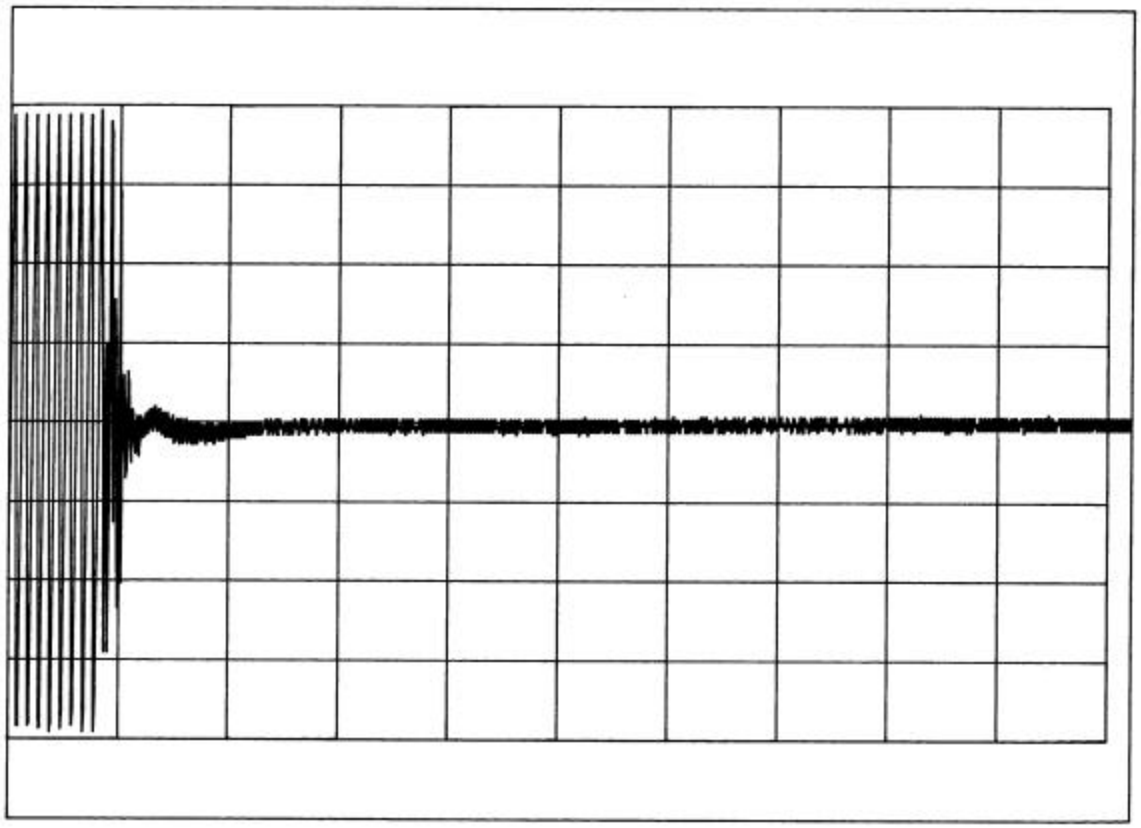
TRANSIENT FREQUENCY RESPONSE PLOT – LOW POWER – TURN ON – 12.5 kHz



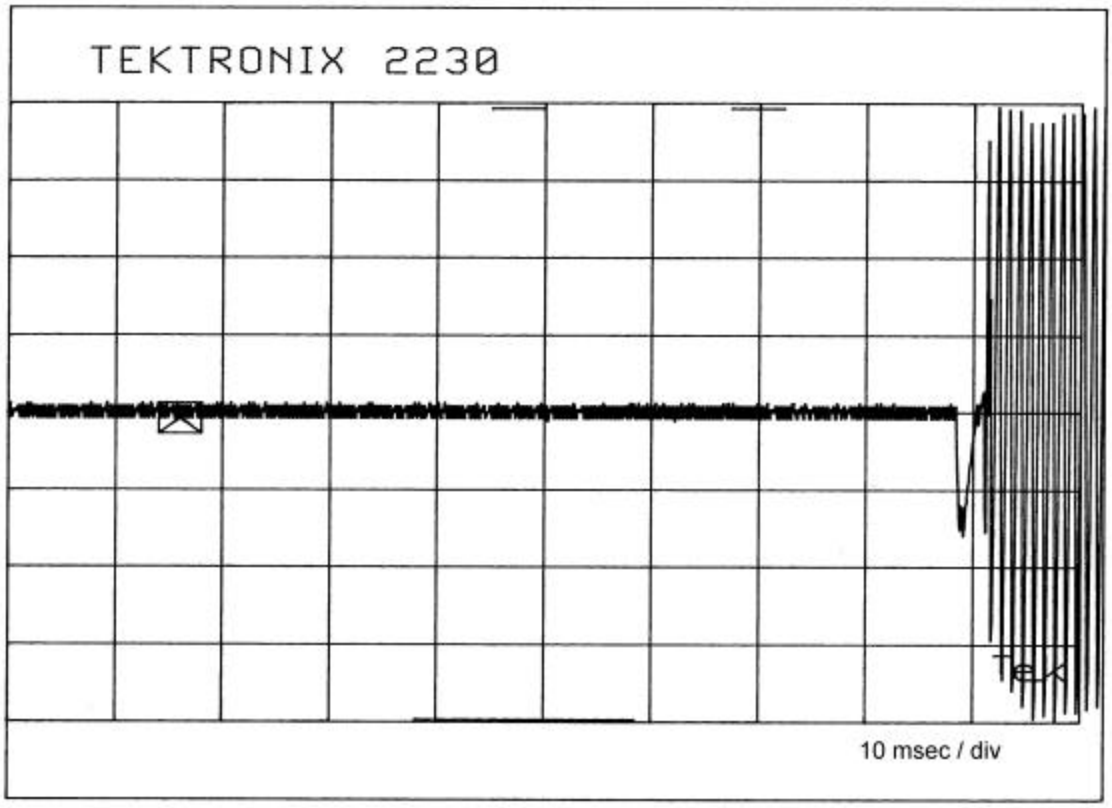
TRANSIENT FREQUENCY RESPONSE PLOT – LOW POWER – TURN OFF – 12.5 kHz



TRANSIENT FREQUENCY RESPONSE PLOT – HIGH POWER – TURN ON – 12.5 kHz



TRANSIENT FREQUENCY RESPONSE PLOT – HIGH POWER – TURN OFF – 12.5 kHz



POWER OUTPUT: 45 Watts
DUTY FACTOR: 50%
FREQUENCY RANGE: 148-174 MHz
ANTENNA GAIN: 0 dBd
Uncontrolled exposure environment
Pwr guide OET 65: S = 0.2

$W := 45.0$ power in Watts $D := 1$ Duty Factor in decimal % (1=100%)

$E := 3$ exposure time in minutes $U := 6$ (use 6 for controlled and 30 for uncontrolled)

$$Wexp := W \cdot D \cdot \left(\frac{E}{U}\right) \qquad PC := \frac{E}{U}$$

$PC = 0.5$

$Wexp = 22.5$ Watts

$P\% := PC \cdot 100$

$P\% = 50$ percent on time

$Po := 22500$ mWatts $dBd := 0$ antenna gain $f := 300$ Frequency for S=0.2

$G := dBd + 2.15$ gain in dBi

$Gn := 10^{\frac{G}{10}}$ gain numeric $S := \frac{f}{1500}$ S is f/1500 for uncontrolled exposure. (S=0.2)

$Gn = 1.641$ $S := 0.2$

$$R := \sqrt{\frac{(Po \cdot Gn)}{(4 \cdot \pi \cdot S)}} \qquad Rinches := \frac{R}{2.54}$$

$R = 121.191$ distance in centimeters required for compliance at 156 MHz and S=0.2

$Rinches = 47.713$

EMC Equipment List

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
X	3-Meter OATS	TEI	N/A	N/A	Listed 12/22/99	12/22/02
	3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
	Receiver, Beige Tower					
	Spectrum Analyzer (Tan)	HP	8566B Opt 462	3138A07786 3144A20661	CAL 8/31/01	8/31/03
	RF Preselector (Tan)	HP	85685A	3221A01400	CAL 8/31/01	8/31/03
	Quasi-Peak Adapter (Tan)	HP	85650A	3303A01690	CAL 8/31/01	8/31/03
X	Receiver, Blue Tower					
X	Spectrum Analyzer (Blue)	HP	8568B	2928A04729 2848A18049	CHAR 10/22/01	10/22/03
X	RF Preselector (Blue)	HP	85685A	2926A00983	CHAR 10/22/01	10/22/03
X	Quasi-Peak Adapter (Blue)	HP	85650A	2811A01279	CHAR 10/22/01	10/22/03
X	Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
	Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
	Biconnical Antenna	Eaton	94455-1	1057	CHAR 3/15/00	3/15/02
	BiconiLog Antenna	EMCO	3143	9409-1043		
X	Log-Periodic Antenna	Electro-Metrics	LPA-25	1122	CAL 10/2/01	10/2/03
	Log-Periodic Antenna	Electro-Metrics	EM-6950	632	CHAR 10/15/01	10/15/03
	Log-Periodic Antenna	Electro-Metrics	LPA-30	409	CHAR 10/16/01	10/16/03
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	152	CAL 3/21/01	3/21/04
	Dipole Antenna Kit	Electro-Metrics	TDA-30/1-4	153	CHAR 11/24/00	11/24/03
	Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 12/19/01	12/19/03
	Horn Antenna	Electro-Metrics	EM-6961	6246	CAL 3/21/01	3/21/03
	Horn Antenna	ATM	19-443-6R	None	No Cal Required	
	Passive Loop Antenna	EMC Test Systems	EMCO 6512	9706-1211	CHAR 7/10/01	7/10/03

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Line Impedance Stabilization . . .	Electro-Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03
	Line Impedance Stabilization . . .	Electro-Metrics	EM-7820	2682	CAL 3/16/01	3/16/03
	Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 5/25/99	5/25/01
	Termaline Wattmeter	Bird Electronic Corporation	6104	1926	CAL 12/12/01	12/12/03
	Oscilloscope	Tektronix	2230	300572	CHAR 2/1/01	2/1/03
X	Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
X	AC Voltmeter	HP	400FL	2213A14499	CAL 10/9/01	10/9/03
	AC Voltmeter	HP	400FL	2213A14261	CHAR 10/15/01	10/15/03
	AC Voltmeter	HP	400FL	2213A14728	CHAR 10/15/01	10/15/03
X	Digital Multimeter	Fluke	77	35053830	CHAR 1/8/02	1/8/04
	Digital Multimeter	Fluke	77	43850817	CHAR 1/8/02	1/8/04
	Digital Multimeter	HP	E2377A	2927J05849	CHAR 1/8/02	1/8/04
	Multimeter	Fluke	FLUKE-77-3	79510405	CAL 9/26/01	9/26/03
	Peak Power Meter	HP	8900C	2131A00545	CHAR 1/26/01	1/26/03
	Digital Thermometer	Fluke	2166A	42032	CAL 1/16/02	1/16/04
	Thermometer	Traulsen	SK-128		CHAR 1/22/02	1/22/04
X	Temp/Humidity gauge	EXTech	44577F	E000901	CHAR 1/22/02	1/22/04
	Frequency Counter	HP	5352B	2632A00165	CAL 11/28/01	11/28/03
	Power Sensor	Agilent Technologies	84811A	2551A02705	CAL 1/26/01	1/26/03
	Service Monitor	IFR	FM/AM 500A	5182	CAL 11/22/00	11/22/02
	Comm. Serv. Monitor	IFR	FM/AM 1200S	6593	CAL 5/12/02	5/12/04
	Signal Generator	HP	8640B	2308A21464	CAL 11/15/01	11/15/03
	Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03
	Near Field Probe	HP	HP11940A	2650A02748	CHAR 2/1/01	2/1/03

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	BandReject Filter	Lorch Microwave	5BR4-2400/ 60-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	6BR6-2442/ 300-N	Z1	CHAR 3/2/01	3/2/03
	BandReject Filter	Lorch Microwave	5BR4-10525/ 900-S	Z1	CHAR 3/2/01	3/2/03
	High Pas Filter	Microlab	HA-10N		CHAR 10/4/01	10/4/03
	Audio Oscillator	HP	653A	832-00260	CHAR 3/1/01	3/1/03
	Frequency Counter	HP	5382A	1620A03535	CHAR 3/2/01	3/2/03
	Frequency Counter	HP	5385A	3242A07460	CHAR 12/11/01	12/11/03
	Preamplifier	HP	8449B-H02	3008A00372	CHAR 3/4/01	3/4/03
	Amplifier	HP	11975A	2738A01969	CHAR 3/1/01	3/1/03
	Egg Timer	Unk			CHAR 8/31/01	8/31/03
	Measuring Tape, 20M	Kraftixx	0631-20		CHAR 2/1/02	2/1/04
	Measuring Tape, 7.5M	Kraftixx	7.5M PROFI		2/1/02	2/1/04
	Coaxial Cable #51	Insulated Wire Inc.	NPS 2251-2880	Timco #51	CHAR 1/23/02	1/23/04
	Coaxial Cable #64	Semflex Inc.	60637	Timco #64	CHAR 1/24/02	1/24/04
	Coaxial Cable #65	General Cable Co.	E9917 RG233/U	Timco #65	CHAR 1/23/02	1/23/04
	Coaxial Cable #106	Unknown	Unknown	Timco #106	CHAR 1/23/02	1/23/04