

# TIMCO ENGINEERING INC.

849 NW State Road 45

Newberry, Florida 32669

<http://www.timcoengr.com>

888.472.2424 F 352.472.2030 email: [sid@timcoengr.com](mailto:sid@timcoengr.com)

## Test Report

Product Name: HX270S MARINE HT RADIO

FCC ID: K6630073X20

Applicant:

**VERTEX STANDARD CO., LTD.  
4-8-8 NAKAMEGURO, MEGURO-KU  
TOKYO 153-8644  
JAPAN**

**Date Receipt: MAY 24, 2004**

**Date Tested: JUNE 15, 2004**

APPLICANT: VERTEX STANDARD CO., LTD.

FCC ID: K6630073X20

REPORT #: V\VERTEX\732AUT4\732AUT4TestReport.doc

COVER SHEET

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### EXHIBITS INCLUDING:

REQUEST FOR CONFIDENTIALITY LETTER  
BLOCK DIAGRAM  
SCHEMATIC  
PARTS LIST  
USERS MANUAL  
LABEL SAMPLE & LOCATION  
EXTERNAL PHOTOGRAPHS  
INTERNAL PHOTOGRAPHS  
ALIGNMENT PROCEDURE  
OPERATIONAL DESCRIPTION  
TEST SET UP PHOTOGRAPHS

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## GENERAL INFORMATION

2.1033(c) VERTEX STANDARD CO., LTD. will sell the FCC ID: K6630073X20 VHF Marine transmitter in quantity, for use under FCC RULES PART 80.

## 2.1033(c) TECHNICAL DESCRIPTION

(4) Type of Emission: 16K0G3E/16K0F3E

$$B_n = 2M + 2DK$$

$$M = 3000$$

$$D = 4.6\text{KHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(3.0K) + 2(4.6K)(1) = 6.0K + 9.2 = 15.2K$$

80.205 (a) ALLOWED AUTHORIZED BANDWIDTH = 20.00KHz.

2.1033(c)(6) Frequency Range: 156.025 - 157.425 MHz

2.1033(c)(7) Power Range and Controls: There is a user Power switch for High/Low Power. Maximum Output Power Rating: High PWR Watts, PWR1 Watt into a 50 ohm resistive load.

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

POWER INPUT

FINAL AMPLIFIER ONLY

**High**

$$V_{ce} = 7.2 \text{ Volts}$$

$$I_{ce} = 1.53 \text{ A.}$$

$$P_{in} = 11.02 \text{ Watts}$$

**Low**

$$V_{ce} = 7.2 \text{ Volts}$$

$$I_{ce} = 0.61 \text{ A.}$$

$$P_{in} = 4.29 \text{ Watts}$$

Function of each electron tube or semiconductor device or other active circuit device is included in the parts list exhibit.

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- 2.1033(c)(9) Complete Circuit Diagrams: The circuit diagrams and block diagrams are included.
- 2.1033(c)(10) Instruction book. The instruction manual is included.
- 2.1033(c)(11) Tune-up procedure. The tune-up procedure is included.

Description of all circuitry and devices provided for determining and stabilizing frequency is included in the circuit description

- 2.1033(c)(11) Digital modulation. This unit does NOT use digital modulation.

The data required by 2.1046 through 2.1055 is submitted below.

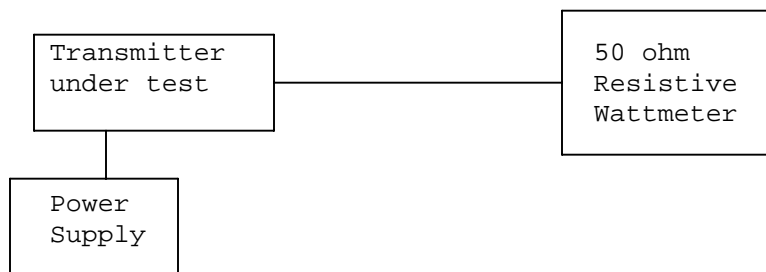
- 2.1046(a)
- 80.215 (e)(1)

## RF power output.

RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage of 7.2 V, and the transmitter properly adjusted the RF output measures:

OUTPUT POWER: HIGH: 5.0 W CONDUCTED  
LOW: 1.0 W CONDUCTED

## METHOD OF MEASURING RF POWER OUTPUT



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## TECHNICAL DATA:

80.203 (b)

**External Controls:** The transmitter is capable of changing frequency between 156.025 - 157.425 MHz by external control. The available channels are shown in the User Manual description Channel List. These channels are preprogrammed by the manufacturer and change of frequency is inaccessible to the station operator.

80.203 (c)

Five minutes continuous transmission test. The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. An external timer digital clock was used to observe the duration of the un-modulated transmission. The transmitter turned off and the radio went to receive mode at 4 minutes, 58 seconds as displayed by the external digital clock.

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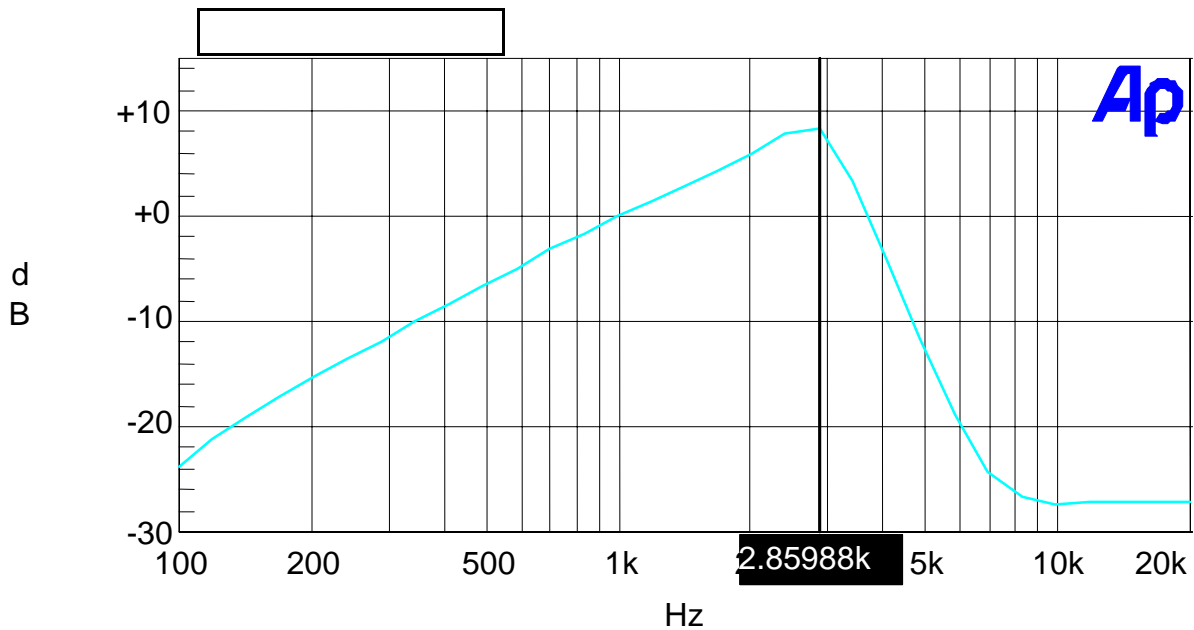
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2.1047(a) Voice Modulation characteristics:

(b) AUDIO FREQUENCY RESPONSE

See the following plot.

### 732aut4 audio frequency response



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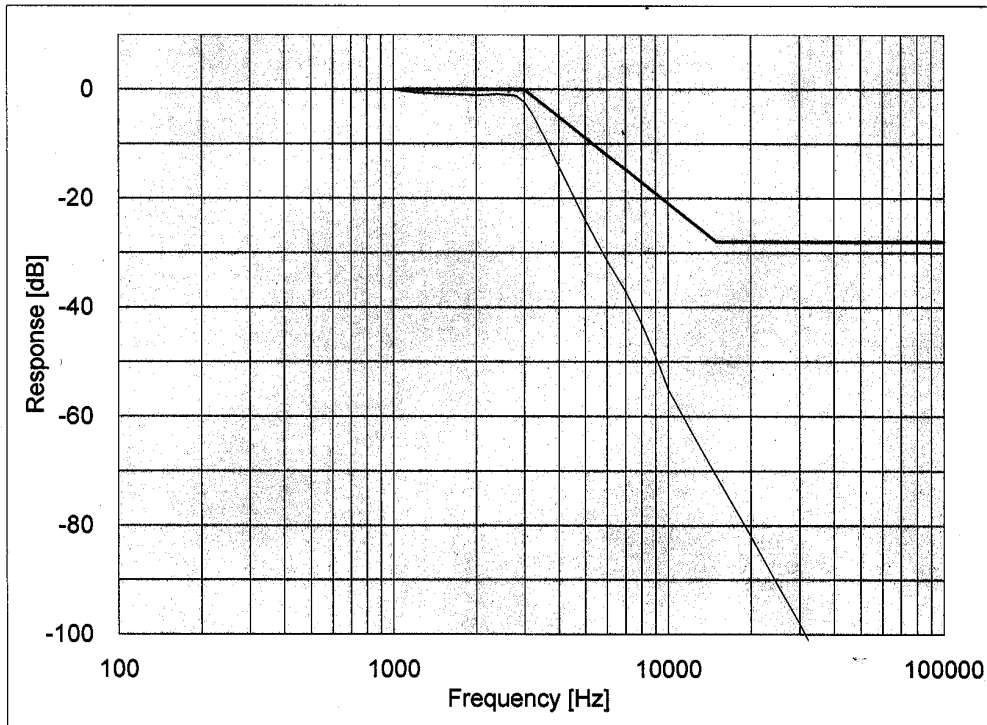
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2.1047(a)  
80.213(e)

## AUDIO LOW PASS FILTER

The audio low pass filter shown in the following plot.

STATE: 0 : General



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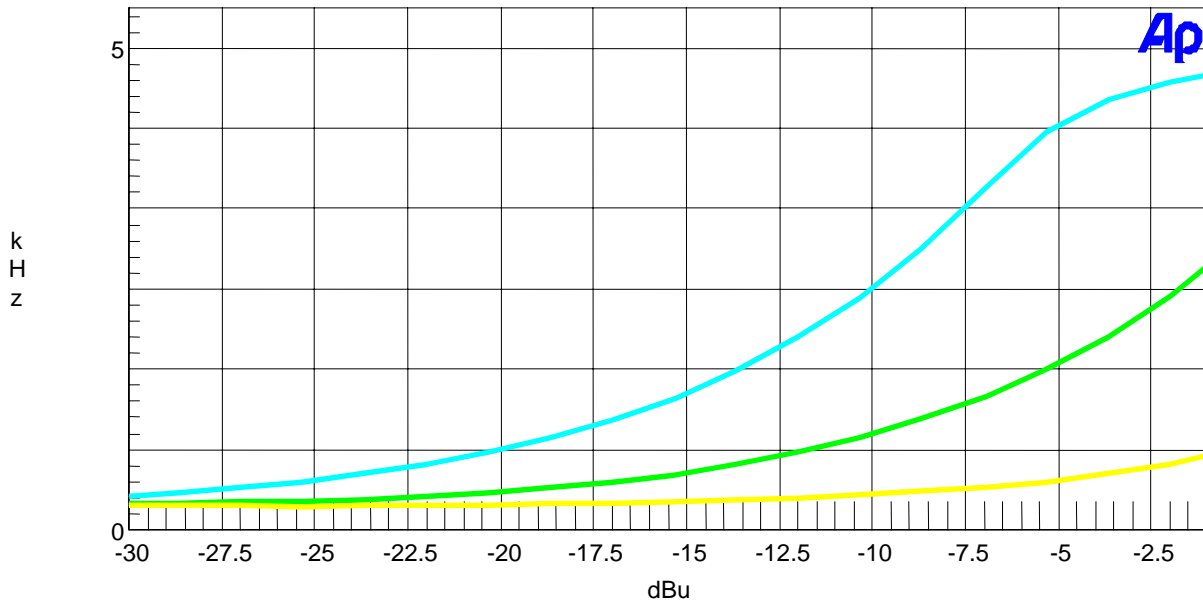
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2.1047(b)                    Audio input versus modulation  
80.213 (a)(2)                A plot of the audio input versus deviation is  
   shown in the following plots.

## 732AUT4 Modulation Limiting





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2.1049(c) **Occupied bandwidth:**

80.211 (f)

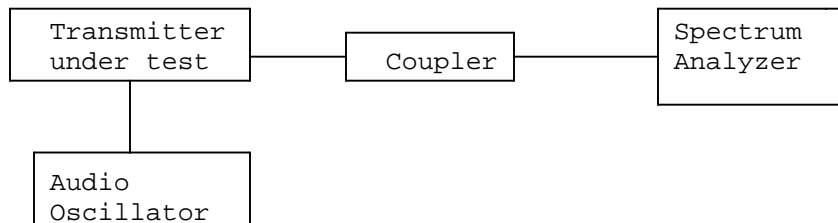
Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB. On any frequency removed from the assigned frequency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

## **Radiotelephone transmitter with modulation limiter.**

Test procedure: TIA/EIA-603 para 2.2.11, with the exception that various tones were used.

Test procedure diagram

### **OCCUPIED BANDWIDTH MEASUREMENT**



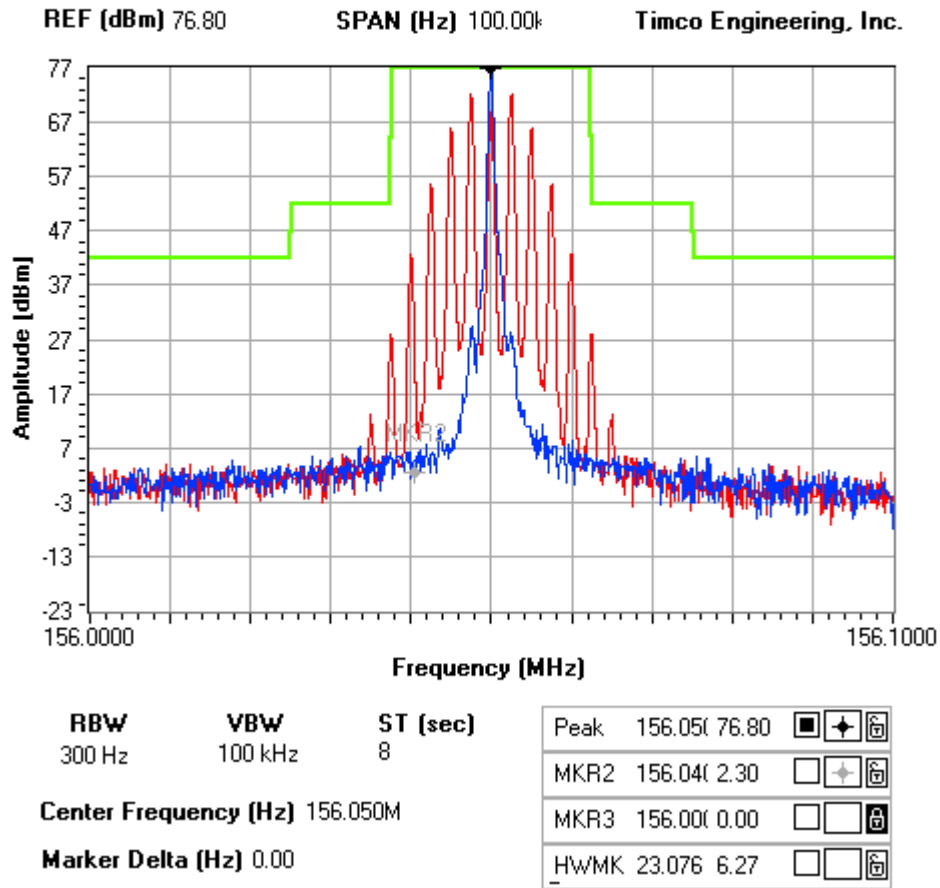
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## OCCUPIED BANDWIDTH PLOT

### NOTES:

732aut4-occupied bandwidth plot



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2.1051  
 80.211

**Spurious emissions at antenna terminals(conducted):**

The data on the following page shows the level of conducted spurious responses. The carrier was modulated 100% using a 2500Hz 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  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

**$43 + 10\log(5) = 50$**

**$43 + 10\log(1) = 43$**

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
156	156	0.0	156	156	0.0
	312	91.0		312	82.5
	468	79.0		468	78.4
	624	83.2		624	84.2
	780	87.6		780	88.3
	936	94.6		936	93.9
	1092	95.1		1092	95.1
	1248	97.2		1248	93.4
	1404	97.4		1404	95.5
	1560	96.7		1560	97.0

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
157	157	0.0	157	157	0.0
	314	90.0		314	81.8
	471	79.3		471	78.5
	628	83.4		628	84.7
	785	89.8		785	89.3
	942	94.5		942	94.4
	1099	95.2		1099	95.1
	1256	99.7		1256	93.8
	1413	98.4		1413	96.1
	1570	96.0		1570	98.8

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## Method of Measuring Conducted Spurious Emissions



**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 400kHz 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 STATE ROAD 45, NEWBERRY FLORIDA 32669.

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2.1053(a) **Field strength of spurious emissions:**  
 80.211  
**NAME OF TEST:** RADIATED SPURIOUS EMISSIONS (156MHz)

**REQUIREMENTS:** Emissions must be  $43 + 10\log(P_o)$  dB below the mean power output of the transmitter.

**HIGH:**  $43 + 10\log(5) = 50$   
**LOW:**  $43 + 10\log(1) = 43$

**TEST DATA:**

**HIGH POWER:**

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
156.00	V	27.20	0	-0.23	0
312.00	H	-34.60	0	-1.25	62.82
468.00	V	-46.20	0	-0.522	73.692
624.10	V	-45.10	0	-0.257	72.327
780.20	V	-48.90	0	-1.308	77.178
936.20	H	-60.20	0	-0.984	88.154
1092.20	V	-58.50	1.12	3.32	83.27
1248.20	V	-52.10	1.5	3.94	76.63
1404.20	V	-55.60	1.18	4.57	79.18
1560.30	H	-57.10	1.21	4.97	80.31

**LOW POWER:**

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
156.00	V	21.70	0	-0.23	0
312.00	H	-41.60	0	-1.25	64.32
468.00	V	-56.40	0	-0.522	78.392
624.10	V	-59.30	0	-0.257	81.027
780.20	H	-51.50	0	-1.308	74.278
936.20	H	-58.40	0	-0.984	80.854
1092.20	V	-61.60	1.12	3.32	80.87
1248.20	V	-61.10	1.5	3.94	80.13
1404.20	V	-62.50	1.18	4.57	80.58

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2.1053(a) **Field strength of spurious emissions:**  
 80.211  
**NAME OF TEST:** RADIATED SPURIOUS EMISSIONS (157MHz)

**REQUIREMENTS:** Emissions must be 43 + 10log(Po) dB below the mean power output of the transmitter.

**HIGH:** 43 + 10log(5) = 50  
**LOW:** 43 + 10log(1) = 43

**TEST DATA:**

**HIGH POWER:**

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
157.40	V	25.30	0	-0.202	0
314.80	H	-36.10	0	-1.25	62.448
742.20	V	-45.20	0	-0.539	70.837
629.60	V	-51.10	0	-0.232	76.43
787.10	H	-52.40	0	-1.144	78.642
944.50	H	-57.00	0	-1.084	83.182
1101.80	V	-60.60	1.0072	3.357	83.3482
1259.20	V	-57.40	1.0368	3.987	79.5478
1416.60	V	-62.00	1.0664	4.616	83.5484

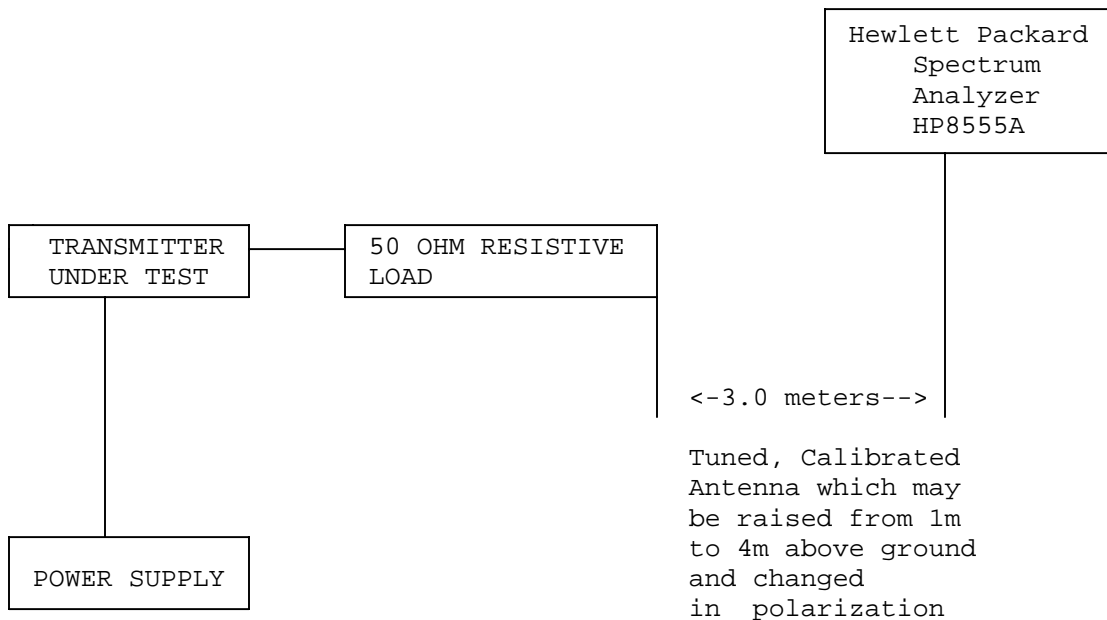
**LOW POWER:**

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
157.40	V	20.10	0	-0.202	0
314.80	H	-36.10	0	-1.25	57.248
742.20	V	-64.00	0	-0.539	84.437
629.60	V	-53.80	0	-0.232	73.93
787.10	H	-49.30	0	-1.144	70.342
944.50	V	-57.40	0	-1.084	78.382
1101.80	V	-62.60	1.0072	3.357	80.1482
1259.20	V	-61.80	1.0368	3.987	78.7478
1416.60	V	-62.80	1.0664	4.616	79.1484

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## Method of Measuring Radiated Spurious Emissions



Equipment placed 80 cm above ground on a rotatable platform.

**METHOD OF MEASUREMENT:** The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method. Measurements were made at the open field test site of TIMCO ENGINEERING, INC. located at 849 N.W. State Road 45, Newberry, FL 32669.

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## Frequency stability:

2.1055(a)(2)

80.209 (a)

Temperature and voltage tests were performed to verify that the frequency remains within the .0010%, 10.0ppm specification limit, for 20kHz spacing. The test was conducted as follows: The transmitter was placed in the temperature chamber at 25° 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° 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 sec intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10-degree increments up to + 50° C.

Readings were also taken at minus 25% of the battery voltage of 7.2 V, which we estimate to be the battery endpoint.

## MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 156.050 002 MHz

<u>TEMPERATURE_C</u>	<u>FREQUENCY MHz</u>	<u>PPM</u>
REFERENCE	156.050 002	00.0
-30	156.049 653	-2.24
-20	156.049 762	-1.54
-10	156.049 786	-1.38
0	156.049 864	-0.88
+10	156.049 893	-0.70
+20	156.049 97	-0.21
+30	156.050 022	0.13
+40	156.050 088	0.55
+50	156.050 148	0.94

	<u>VOLTS</u>	<u>Batt. Data</u>	<u>Batt. PPM</u>
-15%	6.12	156.050 022	0.13

**RESULTS OF MEASUREMENTS:** The test results indicates that the EUT meets the requirements.



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## EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/27/04	3/26/07
3-Meter OATS	TEI	N/A	N/A	Listed 1/13/03	1/13/06
Audio Generator	B&K	3010	8739686	CHAR 12/1/02	12/1/04
Audio Oscillator	Precision	653A	832-00260	CHAR 12/1/02	12/1/04
Biconnical Antenna	Eaton	94455-1	1057	CAL 3/18/03	3/18/05
Biconnical Antenna	Eaton	94455-1	1096	CAL 10/1/01	10/1/03
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/26/01	4/26/03
Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/15/03	4/15/05
Blue Tower RF Preselector	HP	85685A	2620A00294		out for Cal
Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/15/03	4/15/05
Frequency Counter	HP	5352B	2632A00165	CAL 11/28/01	11/28/03
Frequency Counter	HP	5382A	1620A03535	CHAR 3/2/01	Out of Service
Frequency Counter	HP	5385A	2730A03025	CAL 3/7/03	3/7/05
Frequency Counter	HP	5385A	3242A07460	CAL 3/7/03	3/7/05
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/9/01	10/9/03
LISN	Electro-Metrics	EM-7820	2682	CAL 3/12/03	3/12/05
Log-Periodic Antenna	Eaton	96005	1243	CAL 5/8/03	5/8/05