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

Test Report

Product Name: MARINE TRANSCEIVER

FCC ID: KLLTM-366

Applicant:

TEKCOM INDUSTRIES LTD.
BLOCK C, 9/F., KAISER ESTATE, PHASE 1
41 MAN YUE STREET
HUNGHOM, KOWLOON FO TAN, N.T.
HONG KONG

Date Receipt: 9/29/2005

Date Tested: 10/16/05

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APPLICANT: TEKCOM INDUSTRIES LTD.

FCC ID: KLLTM-366

TEST REPORT:

EXHIBITS INCLUDING:

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GENERAL_INFORMATION

2.1033(c) TEKCOM INDUSTRIES LTD. will sell the FCC ID: KLLTM-366 VHF Marine transmitter in quantity, for use under FCC RULES PART 80.

2.1033(c) **TECHNICAL_DESCRIPTION**

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

Bn = 2M + 2DK
M = 3000
D = 4.8KHz (Peak Deviation)
K = 1
Bn = 2(3.0K) + 2(4.8K)(1) = 6.0K + 10.0 = 16.0K

80.205 (a) ALLOWED AUTHORIZED BANDWIDTH = 20.00KHz.

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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= 25 Watts, Low= 1 Watt into a 50 ohm resistive load.

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

POWER INPUT

FINAL AMPLIFIER ONLY

High	Low
Vce = 13.6 Volts	Vce = 13.6 VDC
Ice = 4.05 A.	Ice = 0.88
Pin = 55.08 Watts	Pin = 11.97 Watts

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

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.

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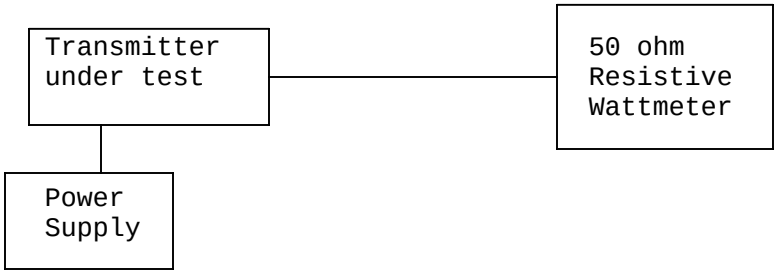
2.1046(a)
80.215 (e)(1)

RF_power_output.

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

OUTPUT POWER: HIGH: 25 W CONDUCTED
LOW: 1 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 156.05 – 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.
80.203 (n)	This radio complies with the requirement for DSC capability in the 156 – 162 MHz band and in accordance with 80.225.
80.873; 80.956	Transmitter G3E emission capability: The transmitter was connected to 50 ohm resistive wattmeter and the frequency was set to 156.300 and to 156.800 MHz. With normal modulation, the output power displayed was 25 Watts at the high power setting and 1 watt at low power setting, consistent with previous measurements. The transmitter has been demonstrated to be capable, with normal operating voltages applied, of delivering 25 watts of carrier power into a 50 ohm resistive load over the specified frequencies.
80.911 (a)	80.956 G3E Transmissions: This radio is capable of G3E emission on 156.300 and 156.800 MHz
80.911 (c)	With 13.6 VDC applied and with the radio connected to a 50 ohm resistive wattmeter, the output power was measured at 156.300 and 156.800 MHz with a measured reading of 25 Watts under normal speech modulation.
80.911 (d)(2)	80.959 With the power supply set to 13.6 VDC, and the output of the transmitter terminated in a 50 ohm matching artificial load, the transmitter output power was monitored over a 10 minute continuous operational period while in full power. The output power varied from the nominal 25 Watts output power to 24.8 Watts output power

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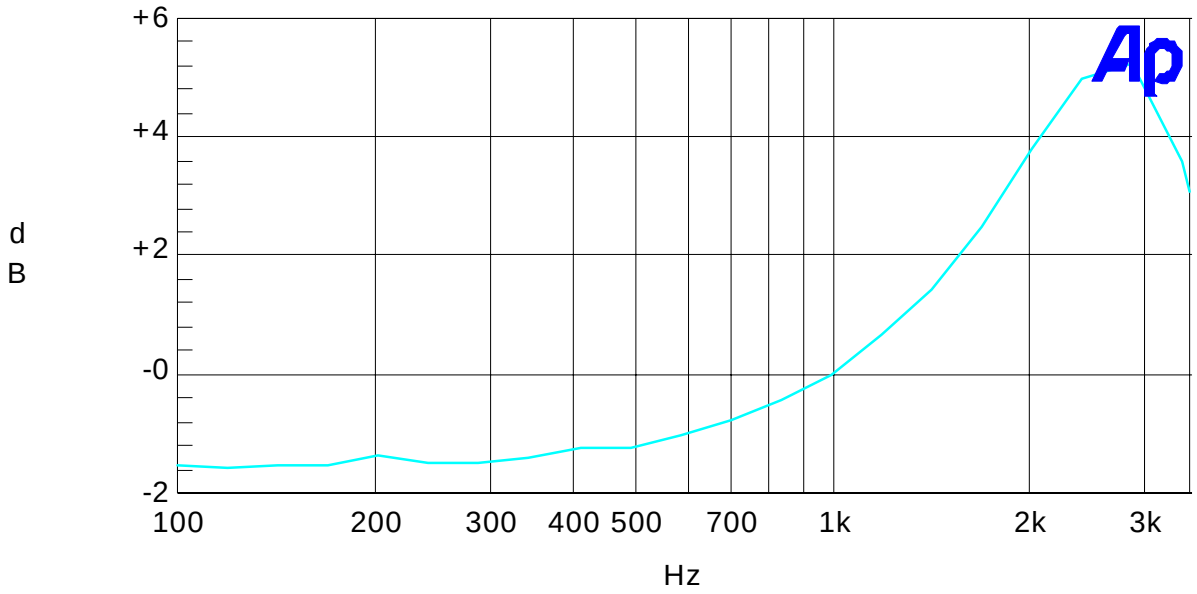
2.1047(a) Voice Modulation_characteristics:

(b) AUDIO_FREQUENCY_RESPONSE See the following plot.

Audio Frequency Response



Color	Line Style	Thick	Data	Axis
Cyan	Solid	1	Anlr.Level A!Normalize	Left

MaxFreq.at1

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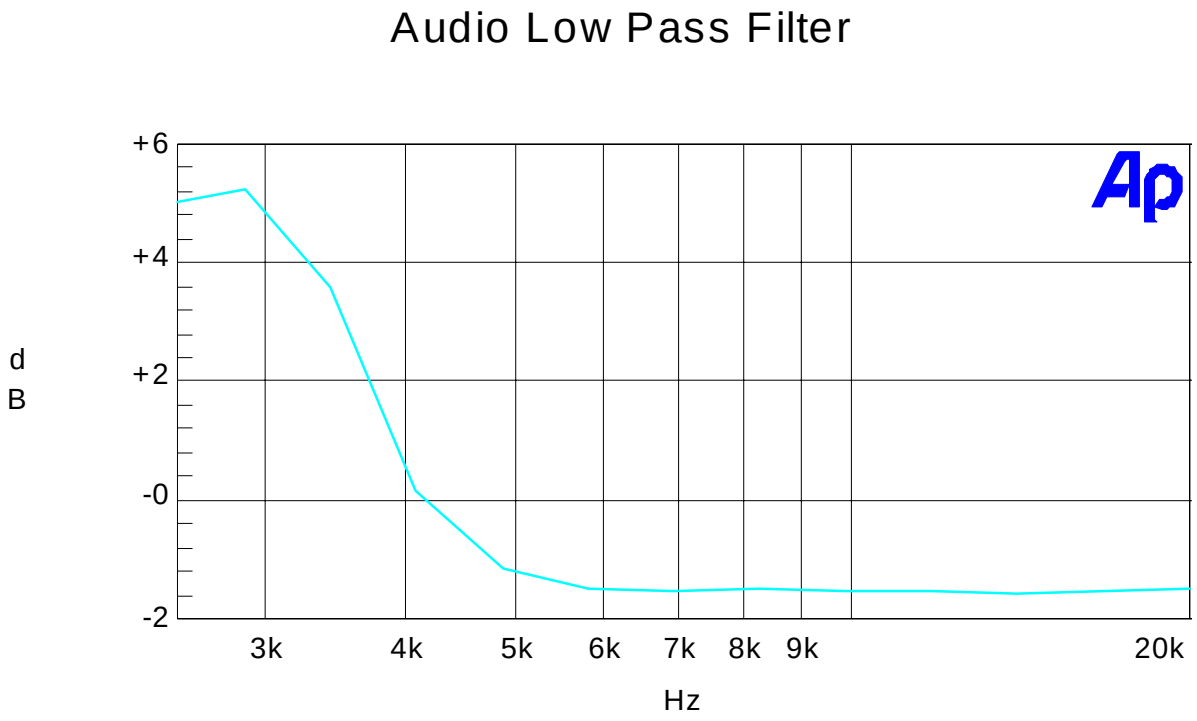
2.1047(a) AUDIO_LOW_PASS_FILTER

The audio low pass filter shown in the following plot.



Color	Line Style	Thick	Data	Axis
Cyan	Solid	1	Anlr.Level A!Normalize	Left

MaxFreq.at1

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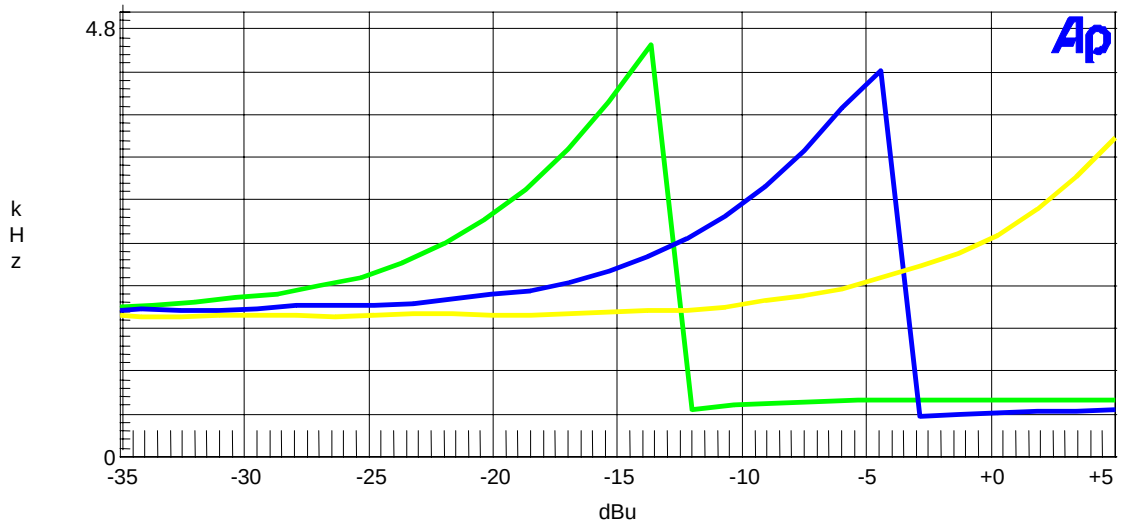
2.1047(b) Audio_input_versus_modulation
80.213 (d) A plot of the audio input versus deviation is shown in the following plots.

Modulation Limiting Plot:
2.5KHz (Green), 1.0KHz (Blue), and 300Hz (Yellow)



Color	Line Style	Thick	Data	Axis
Green	Solid	3	Anlr.Level A	Left
Blue	Solid	3	Anlr.Level A	Left
Yellow	Solid	3	Anlr.Level A	Left

modulation limiting.at1

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2.1049(c) **Occupied bandwidth:**

80.213 (b)

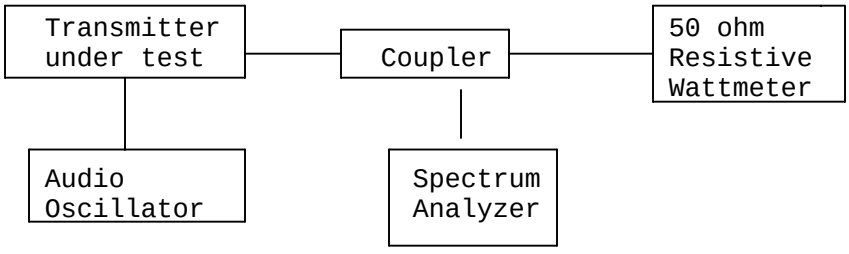
Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB. On any frequency removed from the assigned frequency 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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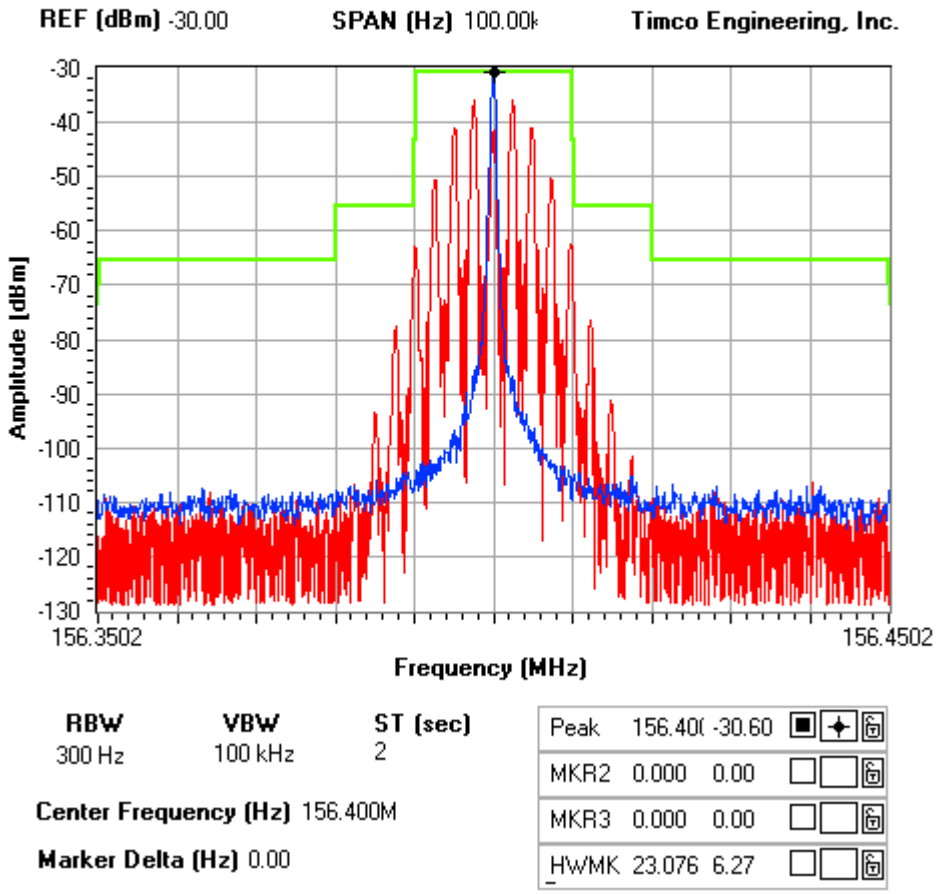
OCCUPIED BANDWIDTH PLOT

NOTES:
TEKCOM INDUSTRIES LTD. - FCC ID: KLLTM-366
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 + 10log(Po) dB below the mean power output of the transmitter.

43 + 10log(25) = 57 **43 + 10log(1) = 43**

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
	156.37	0		156.37	0
	312.74	91.4		312.74	101.6
	469.11	99.3		469.11	101.7
	625.48	96.7		625.48	96.2
	781.85	100.4		781.85	101.2
	938.22	101		938.22	110.6
	1094.59	91.9		1094.59	99.4
	1250.96	89.3		1250.96	90.6
	1407.33	91.6		1407.33	103.8
	1563.7	90.9		1563.7	104.3

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
	157.4	0		157.4	0
	314.8	94.8		314.8	90.7
	472.2	99.7		472.2	94.2
	629.6	95.7		629.6	96.9
	787	97.3		787	98.6
	944.4	113.2		944.4	101.8
	1101.8	97.5		1101.8	91.9
	1259.2	91.2		1259.2	89.5
	1416.6	100.6		1416.6	92
	1574	105.4		1574	92.3

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Method of Measuring Conducted Spurious Emissions

METHOD OF MEASUREMENT: The procedure used was TIA/EIA-603 STANDARD without any exceptions. 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:**

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

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

TEST DATA:

HIGH POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
156.40		0
312.80	V	102.45
469.20	V	104.22
625.60	V	91.56
782.00	V	102.23
938.40	V	82.09
1251.20	H	95.41

LOW POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
156.40		0
312.80	V	87.65
469.20	H	93.62
625.60	H	88.66
782.00	H	94.83
938.40	V	67.79

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2.1053(a) **Field_strength_of_spurious_emissions:**

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

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

HIGH POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
157.40		0
314.80	H	103.25
472.20	H	104.44
629.60	H	86.73
787.00	H	103.14
944.40	H	100.08

LOW POWER

Emission Frequency MHz	Ant. Polarity	dB Below Carrier (dBc)
157.40		0
314.80	H	88.35
472.20	H	94.44
629.60	H	87.83
787.00	H	95.24
944.40	H	90.48

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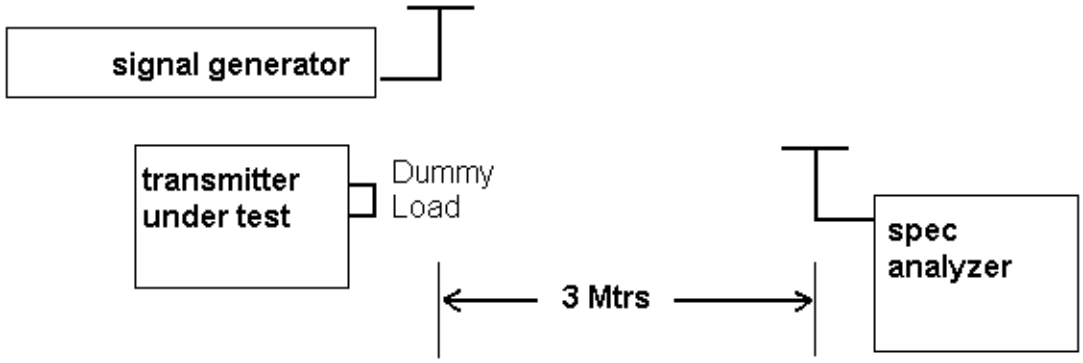
2.1053(a) Continued Field_strength_of_spurious_emissions:

Method of Measuring Radiated Spurious Emissions



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 15% of the battery voltage, which we estimate to be the battery endpoint.

MEASUREMENT DATA:

Ref. Freq.
156.399987

TEMPERATURE °C	FREQUENCY MHz	PPM
-30C	156.398594	-8.91
-20C	156.398798	-7.60
-10C	156.399391	-3.81
0C	156.399789	-1.27
10C	156.400012	0.16
20C	156.400039	0.33
30C	156.399979	-0.05
40C	156.400005	0.12
50C	156.400189	1.29

Batt. Volts	Batt. Data	PPM
-15%	156.400038	0.33
+15%	156.400041	0.35

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

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MPE CALUCATION

$W := 25.0$ power in Watts $D := 1$ Duty Factor in decimal % (1=100%)(FM)

$E := 15$ exposure time in minutes $U := 30$ (use 6 for controlled and 30 for uncontrolled)

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

$PC = 0.5$ percent on time

$Wexp = 12.5$ Watts

$CL := 2.5$ Coax loss in dB

$Po := 11500\,mWatts$ $dBd := 3$ antenna gain $f := 158$ Frequency in MHz

$G := dBd + 2.15 - CL$ gain in dBi

$Gn := 10^{\frac{G}{10}}$ gain numeric $S := .2$ uncontrolled below 300 MHz S is f/1500 for uncontr exposure.

$Gn = 1.841$ $S = 0.2$

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

$R = 91.776$ distance in centimeters required for compliance

$Rinches = 36.132$

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EMC Equipment List

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Audio Generator	B&K Precision	3010	8739686	CHAR 12/1/02	12/1/04
Audio Oscillator	HP	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 8/17/04	8/17/06
Biconnical Antenna	Electro-Metrics	BIA-25	1171	CAL 4/29/05	4/29/07
Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/13/05	4/13/07
Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 8/3/05	8/3/07
Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/13/05	4/13/07
Frequency Counter	HP	5352B	2632A00165	CAL 8/3/04	8/3/06
Frequency Counter	HP	5382A	1620A03535		Out of Service
Frequency Counter	HP	5385A	2730A03025	CAL 4/15/05	4/15/07
Frequency Counter	HP	5385A	3242A07460	CAL 4/19/05	4/19/07
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/04	8/27/06
LISN	Electro-Metrics	EM-7820	2682	CAL 4/28/05	4/28/07
Log-Periodic Antenna	Eaton	96005	1243	CAL 5/8/03	5/8/05