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APPLICANT: TEKCOM INDUSTRIES LTD.

FCC ID: KLLTM-338

TEST REPORT:

EXHIBIT CONTAINING:

GENERAL_INFORMATION_REQUIRED
FOR_TYPE_ACCEPTANCE

2.1033(c) TEKCOM INDUSTRIES LTD. will sell the FCC ID: KLLTM-338 VHF Marine transmitter in quantity, for use under FCC RULES PART 80.

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

2.1033(c) TECHNICAL_DESCRIPTION

(4) Type of Emission: 13K5G3E/13K5F3E

Bn = 2M + 2DK
M = 3000
D = 3.75 kHz (Peak Deviation)
K = 1
Bn = 2(3000) + 2(3750)(1) = 6000 + 7500 = 13.5 k

80.205(A) ALLOWED AUTHORIZED BANDWIDTH = 20.00 kHz.

(4) Type of Emission: 13K5G2B

Bn = 2M + 2DK
M = 3000
D = 3.75 kHz (Peak Deviation)
K = 1
Bn = 2(3000) + 2(3750)(1) = 6000 + 7500 = 13.5 k

80.205(A) ALLOWED AUTHORIZED BANDWIDTH = 20.00 kHz.

2.1033(c)(5) Frequency Range: 156.05 - 157.425 MHz

2.1033(c)(6) Power Range and Controls: There is a user Power switch for High/Low Power.
Maximum Output Power Rating:
High - 23 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 = 5.66 A.	Ice = 1.51
Pin = 76.97 Watts	Pin = 20.53 Watts

Function of each electron tube or semiconductor device or other active circuit device: - SEE EXHIBIT# 7

2.1033(c)(10) Complete Circuit Diagrams: The circuit diagram is included as EXHIBIT 7A-7C. The block diagram is included as EXHIBIT 6A-5E.

2.1033(c)(3) Instruction book. The instruction manual is included as EXHIBIT #8.

2.1033(c) (9) Tune-up procedure. The tune-up procedure is given in EXHIBIT #9.

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

2.1033(c) (13) 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 13.6 V, and the transmitter properly adjusted the RF output measures:

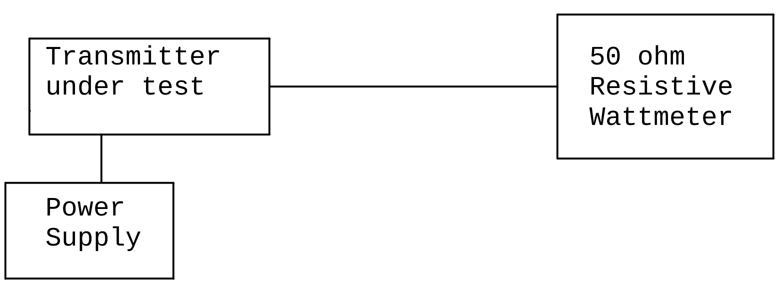
POWER OUTPUT
INPUT POWER: (13.6V)(5.66A) = 75.97 Watts
OUTPUT POWER: LOW - 1 WATTS
HIGH – 23 WATTS

80.911 (d)(5)For primary supply voltages, measured in accordance with the procedures in this paragraph, greater than 11.5 volts, but less than 12.6 volts, the required transmitter output power shall be equal or greater than the value calculated below.

P=4.375(V)-35.313.
For 12.0 volts this equals 17.2 watts.

The measured power at this voltage is

METHOD OF MEASURING RF POWER OUTPUT



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 minute 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 unmodulated 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 23 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 23 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 23 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 23 Watts output power to 22.8 Watts output power

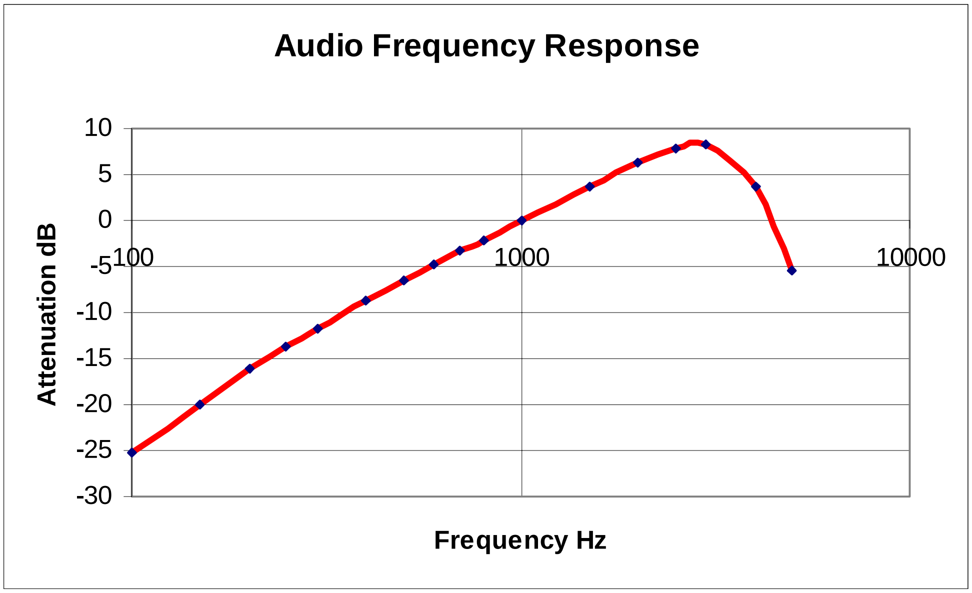
80.911(d)(5); 80.959 The primary supply voltage shall be set between 11.5-12.6 VDC. For a primary power of 12.0 volts, the output power shall be equal or greater than the value calculated from the following formula:

$$P=4.375(12.0)-35.313 \text{ or } 17.2 \text{ Watts.}$$

The actual power was measured to be: XXXX Watts.

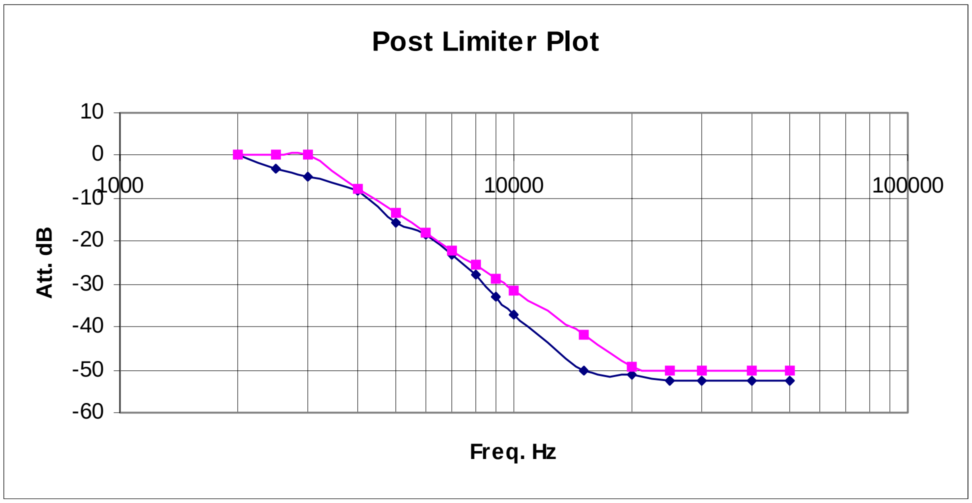
2.1047(a) Voice Modulation_characteristics:

(b) **AUDIO_FREQUENCY_RESPONSE**



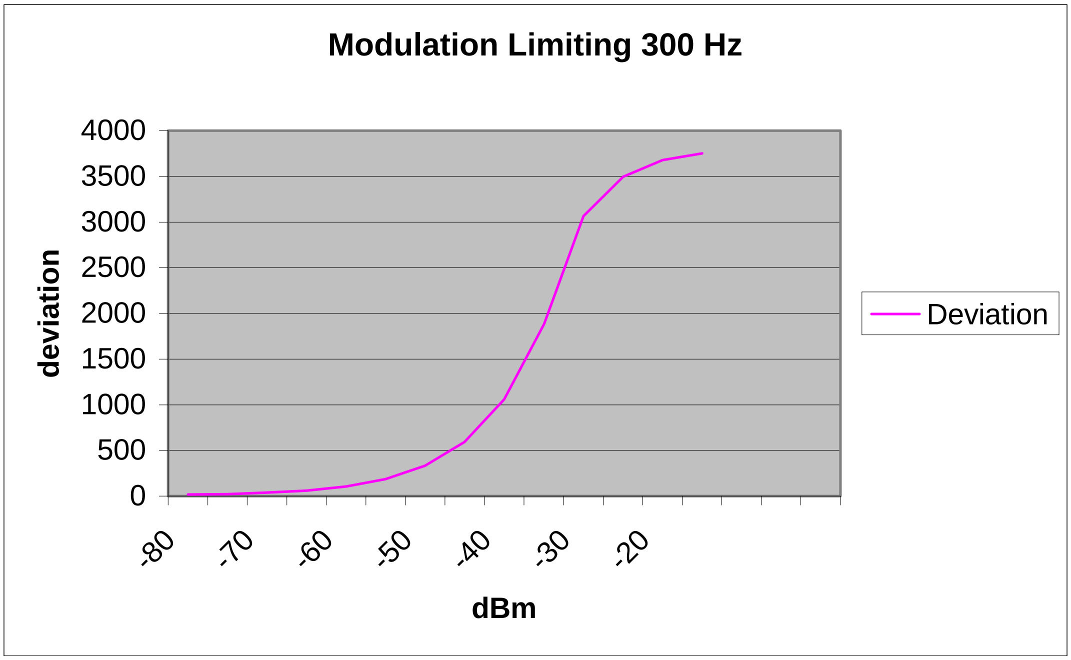
2.1047(a) AUDIO_LOW_PASS_FILTER

The audio low pass filter is included and the plot is shown as EXHIBIT #9. Rules 80.213(e) for ship stations with a low pass filter.

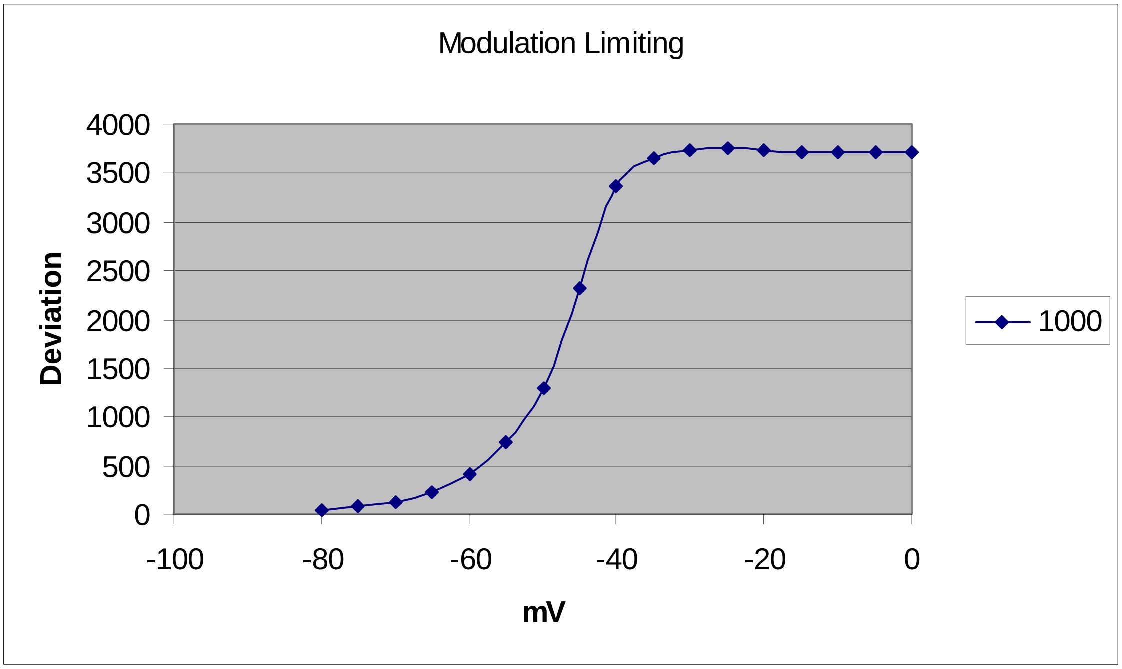


2.1047(b) <u>Audio_input_versus_modulation</u>
80.213(d)

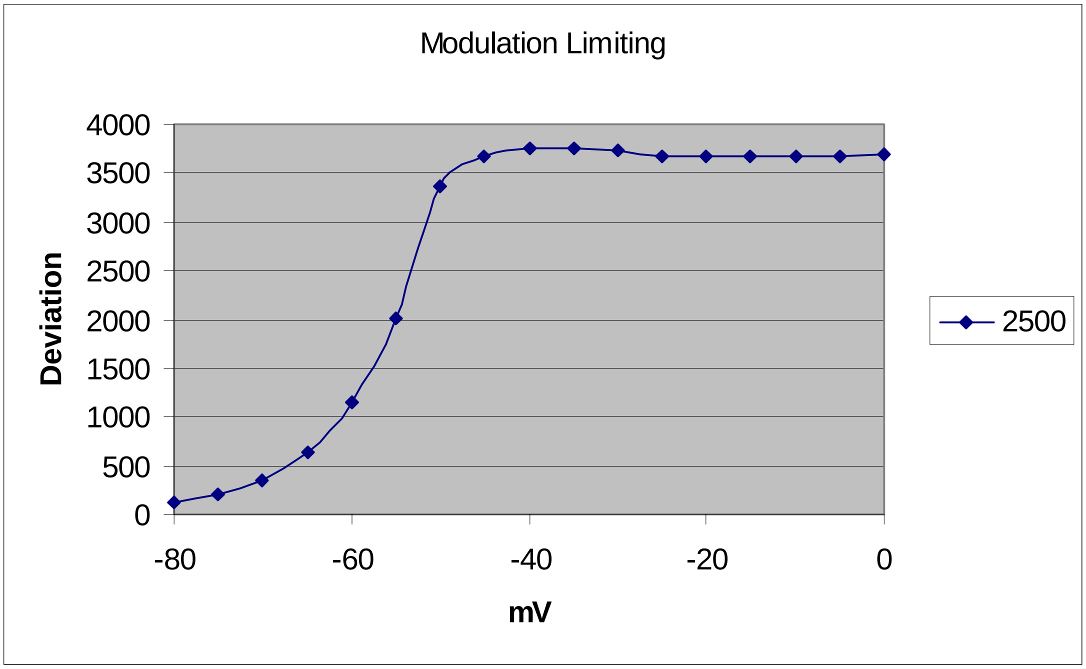
MODULATION LIMITING PLOT – 300 Hz



MODULATION LIMITING PLOT – 1000 Hz



MODULATION LIMITING PLOT – 2500 Hz



2.1047 With modulation frequencies of 300, 1000, and 2500 Hz respectively,
80.213(a)(2) System deviation must not exceed + or – 5kHz when using phase or Frequency modulation.

2.1049(c) Occupied_bandwidth:

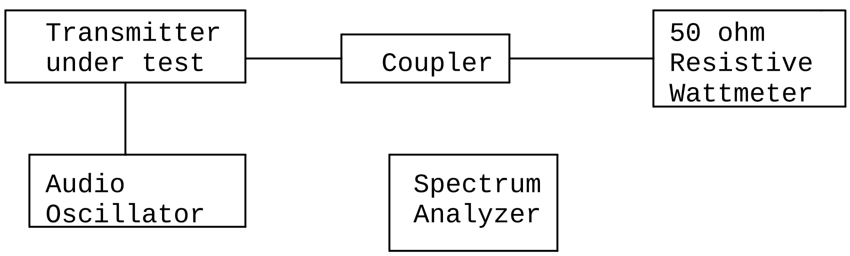
80.213(b)
Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB. On any frequency removed from the assigned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

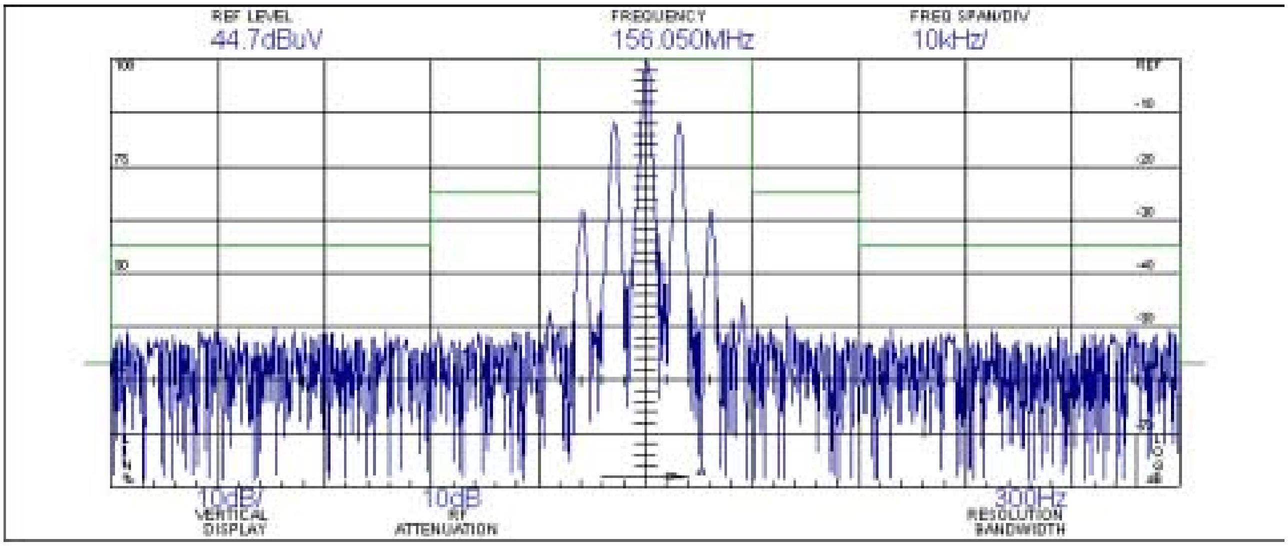
Test procedure diagram

OCCUPIED BANDWIDTH MEASUREMENT

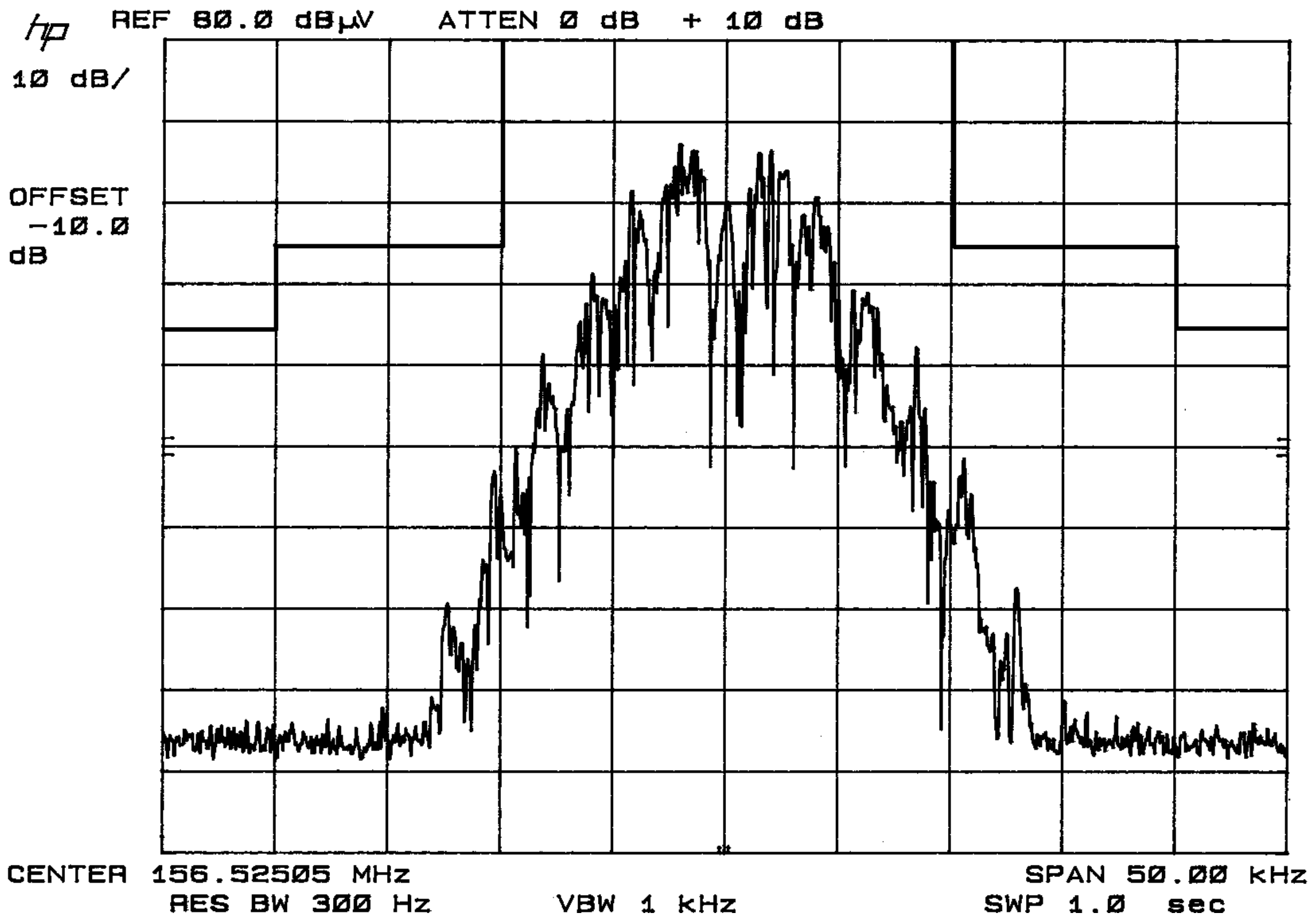


OCCUPIED BANDWIDTH PLOT

G3E



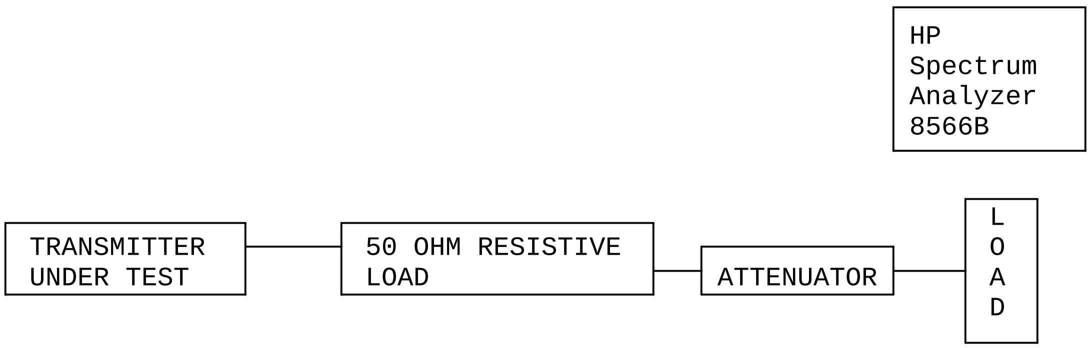
G2B


hp REF 80.0 dBµV ATTEN 0 dB + 10 dB
10 dB/
OFFSET
-10.0
dB
CENTER 156.52505 MHz
SPAN 50.00 kHz
RES BW 300 Hz
VBW 1 kHz
SWP 1.0 sec

2.1051 Spurious_emissions_at_antenna_terminals(conducted):

80.211 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.

Method of Measuring Conducted Spurious Emissions



2.1051 Continued Spurious_Emissions_at_the_Antenna_Terminals:

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

HIGH POWER 43 + 10log(25) = 43+ 13.98 = 57.0dB
LOW POWER 43 + 10log(1) = 43 + 0 = 43dB

HIGH POWER

TF	EF	dB below carrier
156	156	0
	312	77.9
	468	75.4
	624	97.5
	780	95
	936	106.1
	1092	102.3
	1248	97.1
	1404	101.9
	1560	98.5

LOW POWER

TF	EF	dB below carrier
156	156	0
	312	79.8
	468	87.5
	624	92.8
	780	91.1
	936	107.1
	1092	96.6
	1248	95.6
	1404	94
	1560	95.3

HIGH POWER

TF	EF	dB below carrier
157.4	157.4	0
	314.8	82
	472.2	77.6
	629.6	101.2
	787	95.7
	944.4	107.5
	1101.8	103.2
	1259.2	97.1
	1416.6	103.4
	1574	93.8

LOW POWER

TF	EF	dB below carrier
157.4	157.4	0
	314.8	82.6
	472.2	86.7
	629.6	94.2
	787	92.8
	944.4	106.4
	1101.8	96.2
	1259.2	94
	1416.6	94
	1574	97.2

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 STATE ROAD, NEWBERRY FLORIDA 32669.

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 43 + 10log(23) = 56.62 dB
LOW POWER 43 + 10log(1) = 43.00 dB

TEST DATA:

Emission Frequency MHz	ATTN dBc	dBm
HIGH POWER		
156.05	**0**	**43.6**
312.10	**66**	**-22**
468.10	**80**	**-36**
624.20	**78**	**-34**
780.30	**82**	**-38**
936.30	**91**	**-47**
1,092.40	**87**	**-43**
1,248.40	**71**	**-27**
1,404.50	**77**	**-33**
1,560.60	**76**	**-32**
LOW POWER		
156.05	**0**	**30**
312.10	**66**	**-36**
468.10	**73**	**-43**
624.20	**78**	**-48**
780.30	**72**	**-42**
936.30	**89**	**-59**
1,092.40	**78**	**-48**
1,248.40	**69**	**-29**
1,404.50	**75**	**-45**
1,560.60	**75**	**-45**
HIGH POWER		
157.40	**0**	**43.6**
314.80	**67**	**-23**
472.30	**79**	**-35**
629.70	**79**	**-35**
787.20	**81**	**-37**
944.60	**94**	**-50**
1,102.00	**88**	**-44**
1,259.50	**69**	**-25**
1,416.90	**73**	**-29**
1,574.40	**75**	**-31**

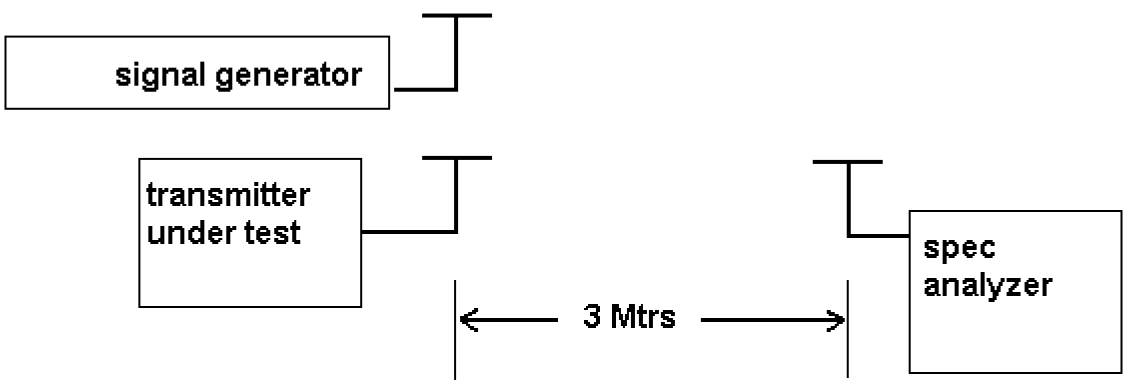
TEST DATA CONTINUED:

LOW POWER		
157.40	**0**	**30**
314.80	**67**	**-37**
472.30	**74**	**-44**
629.70	**78**	**-48**
787.20	**72**	**-42**
944.60	**89**	**-59**
1,102.00	**77**	**-47**
1,259.50	**69**	**-39**
1,416.90	**72**	**-42**
1,574.40	**74**	**-44**

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.

2.1053(a) Continued <u>Field_strength_of_spurious_emissions:</u>

Method of Measuring Radiated Spurious Emissions



Frequency_stability:

2.1055(a)(2)
80.209(a)

Temperature and voltage tests were performed to verify that the frequency remains within the .005%, 5.0 ppm specification limit, for 20kHz spacing. The test was conducted as follows: The transmitter 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 13.6 V, which we estimate to be the battery endpoint.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 156.050 000 MHz

TEMPERATURE_C	FREQUENCY_MHz	PPM
REFERENCE______________	156.050 000	00.0
-30_____________	156.049 429	-3.66
-20_____________	156.049 058	0.37
-10_____________	156.05 054	3.46
0_____________	156.050 657	4.21
+10_____________	156.050 518	3.32
+20_____________	156.04 988	1.59
+30_____________	156.049 603	-0.77
+40_____________	156.049 603	-2.54
+50_____________	156.049 714	-1.83
11.5VDC 0.85% Battery Voltage		
	156.050 155	0.99
	156.050 174	1.12

RESULTS OF MEASUREMENTS: The maximum frequency variation over the temperature range was -3.66 to 4.21 ppm. The maximum frequency variation over the voltage range was 1.12 ppm.

FCC RF Exposure Requirements

General information:

FCCID:
Device category: Mobile per Part 2.1091
Environment: General Population/Uncontrolled Exposure

Antenna:

The manufacturer does not specify any antenna to be used with this device.

This device has provisions for operation in a boat.

Configuration	Antenna p/n	Type	Max. Gain (dBi)
Boat	Any	-	5 dBi (3 dBd)

Operating configuration and exposure conditions:

Part 2.1091 states that devices are excluded from routine evaluation if the EIRP is less than 2.46 Watts (or 1.5 WERP).

A 50% on time (15 minutes transmitting over a 30 minute period) is used to average over .

Boat Operation: Cable length = 32 ft exposed and 3 feet internal to radom = 35 ft. Total. 35 feet cable loss including connector insertion loss at 156 MHz is 2.5 dB. The maximum antenna gain that can be used is 5 dBi (3 dBd).

MPE CALCULATION

$W := 23.0$ 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)

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

$$PC := \frac{E}{U}$$

$PC = 0.5$ percent on time

$Wexp = 11.5$ 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

$Gn = 1.841$ $S = 0.2$

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

$$Rinches := \frac{R}{2.54}$$

$R = 91.776$ distance in centimeters required for compliance

$Rinches = 36.132$

Conclusion:

The device complies with the MPE requirements for a typical transceiver with 50 % transmit time by providing a safe separation distance of 91 cm between the antenna, including any radiating structure, and any persons when normally operated .

EMC Equipment List

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
X	3-Meter OATS	TEI	N/A	N/A	Listed 1/13/03	1/13/06
	3/10-Meter OATS	TEI	N/A	N/A	Listed 3/26/01	3/26/04
	Receiver, Beige Tower Spectrum Analyzer RF Preselector Quasi-Peak Adapter	 HP HP HP	 8566B Opt 462 85685A 85650A	 3138A07786 3144A20661 3221A01400 3303A01690	 CAL 8/31/01 CAL 8/31/01 CAL 8/31/01	 8/31/03 8/31/03 8/31/03
X X X X	Receiver, Blue Tower Spectrum Analyzer RF Preselector Quasi-Peak Adapter	 HP HP HP	 8568B 85685A 85650A	 2928A04729 2848A18049 2926A00983 2811A01279	 CAL 4/15/03 CAL 4/15/03 CAL 4/15/03	 4/15/05 4/15/05 4/15/05
	Receiver, Silver/Grey Tower Spectrum Analyzer RF Preselector Quasi-Peak Adapter Preamplifier	 HP HP HP HP	 8566B Opt 462 85685A 85650A 8449B	 3552A22064 3638A08608 2620A00294 3303A01844 3008A01075	 CAL 10/14/02 CAL 10/14/02 CAL 10/14/02 CHAR 1/28/02	 10/14/04 10/14/04 10/14/04 1/28/04
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	CAL 3/18/03	3/18/05
	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

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Log-Periodic Antenna	Electro-Metrics	LPA-30	409	CAL 3/4/03	3/4/05
	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	CAL 9/26/02	9/26/05
	Double-Ridged Horn Antenna	Electro-Metrics	RGA-180	2319	CAL 2/17/03	2/17/05
	Horn Antenna	Electro-Metrics	EM-6961	6246	CAL 3/31/03	3/31/05
	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
	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 3/12/03	3/12/05
	Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 5/25/99	5/25/01
	Termaline Wattmeter	Bird Electronic Corporation	6104	1926	CHAR 12/12/01	12/12/03
	Oscilloscope	Tektronix	2230	300572	CHAR 2/1/01	2/1/03
	System One	Audio Precision	System One	SYS1-45868	CHAR 4/25/02	4/25/04
	Temperature Chamber	Tenney Engineering	TTRC	11717-7	CHAR 1/22/02	1/22/04
	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	CHAR 9/26/01	9/26/03

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	Peak Power Meter	HP	8900C	2131A00545	CHAR 1/26/01	1/26/03
	Power Meter	HP	432A	1141A07655	CAL 4/15/03	4/15/05
	Power Meter And Sensor	Bird	4421-107 4022	0166 0218	CAL 4/16/03	4/16/05
	Power Sensor	HP	478A	72129	CAL 4/15/03	4/15/05
	Digital Thermometer	Fluke	2166A	42032	CAL 1/16/02	1/16/04
	Thermometer	Traulsen	SK-128		CHAR 1/22/02	1/22/04
	Thermometer	Extech	4028	14871-2	CAL 3/7/03	3/7/05
X	Hygro-Thermometer	Extech	445703	0602	CAL 10/4/02	10/4/04
	Frequency Counter	HP	5352B	2632A00165	CAL 11/28/01	11/28/03
	Frequency Counter	HP	5385A	2730A03025	CAL 3/7/03	3/7/05
	Power Sensor	Agilent Technologies	84811A	2551A02705	CHAR 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 2/15/02	2/15/04
	Sweep Generator	Wiltron	6648	101009	CAL 4/15/03	4/15/05
	Sweep Generator	Wiltron	6669M	007005	CAL 3/3/03	3/3/05
	Modulation Analyzer	HP	8901A	3435A06868	CAL 9/5/01	9/5/03
	Modulation Meter	Boonton	8220	10901AB	CAL 4/15/03	4/15/05
	Near Field Probe	HP	HP11940A	2650A02748	CHAR 2/1/01	2/1/03
	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

	DEVICE	MFGR	MODEL	SERNO	CAL/CHAR DATE	DUE DATE or STATUS
	BandReject Filter	Lorch Microwave	5BR4-10525/ 900-S	Z1	CHAR 3/2/01	3/2/03
	High Pass Filter	Microlab	HA-10N		CHAR 10/4/01	10/4/03
	High Pass Filter	Microlab	HA-20N		CHAR 2/7/03	2/7/05
	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	CAL 3/7/03	3/7/05
	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