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APPLICANT: RAYMARINE INC.

FCC ID: PJ5RAY215

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GENERAL INFORMATION REQUIRED
FOR TYPE ACCEPTANCE

2.1033 (c) (1,2) RAYMARINE INC. will sell the
FCC ID: PJ5RAY215 VHF Marine transmitter in
quantity, for use under FCC RULES PART 80.

2.202 (c) TECHNICAL DESCRIPTION
2.1033 (c) (4)

(1) Type of Emission: 13K6G3E/13K6F3E For 20 kHz
For 25kHz

Bn = 2M + 2DK

M = 3000

D = 3.8 kHz (Peak Deviation)

K = 1

Bn = 2(3.0k) + 2(3.8k)(1) = 6.0 + 7.6 = 13.6 k

80.205(A) ALLOWED AUTHORIZED BANDWIDTH = 20.00 kHz.

2.1033 (c) (5)

(2) Frequency Range: 156.025-157.425 MHz

80.215 (e)

(3) Power Range and Controls: There is a user Power switch for
High/Low Power.

2.1033 (c) (6,7)

(4) Maximum Output Power Rating:

High 25.0 Watts,

Low 1.0Watt

into a 50 ohm resistive load.

(5) DC Voltages and Current into Final Amplifier:

POWER INPUT

FINAL AMPLIFIER ONLY

High

Vce = 13.2 Volts

Ice = 3.9 A.

Pin = 51.48 Watts

Efficiency = 48 %

Low

Vce = 13.2 VDC

Ice = 1.4 A.

Pin = 18.48 Watts

= 00.05 %

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- 2.1033(c)(10) (7) Complete Circuit Diagrams: The circuit diagram is included as EXHIBIT 6A-6C. The block diagram is included as EXHIBIT 5A-5C.
- 2.1033 (c) (3)(8) Instruction book. The instruction manual is included as EXHIBIT #7.
- 2.1033(c)(9) (9) Tune-up procedure. The tune-up procedure is given in EXHIBIT #7.
- 2.1033(c)(10) (10) 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) (11) Digital modulation. This unit does NOT use digital modulation.

The data required by 2.1046 through 2.1047 is submitted below.

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2.1033(c)(6) RF_power_output.
80.215(e)(1)

RF power is measured by connecting a 50 ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage of 13.2V, and the transmitter properly adjusted the RF output measures:

POWER OUTPUT

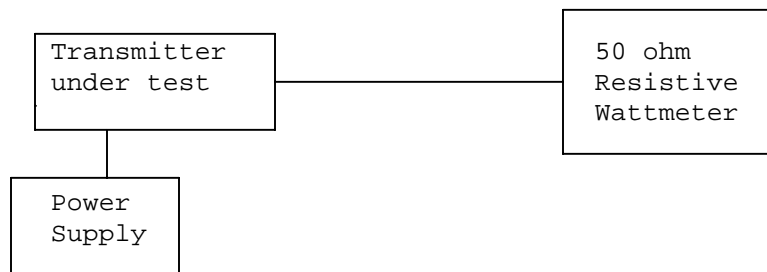
HIGH POWER:

OUTPUT POWER: 25.0 Watts

LOW POWER:

OUTPUT POWER: 1.0 Watt

METHOD OF MEASURING RF POWER OUTPUT



2.1047(a) Voice Modulation characteristics:

(a) AUDIO_FREQUENCY_RESPONSE See next page.

80.213 (e) AUDIO_LOW_PASS_FILTER
The audio low pass filter is included and the plot is shown in page 7. Rules 80.213(e) for ship stations with a low pass filter.

80.213(d) Audio input versus modulation A plot of the audio input versus deviation is shown in in Pages 5-6.

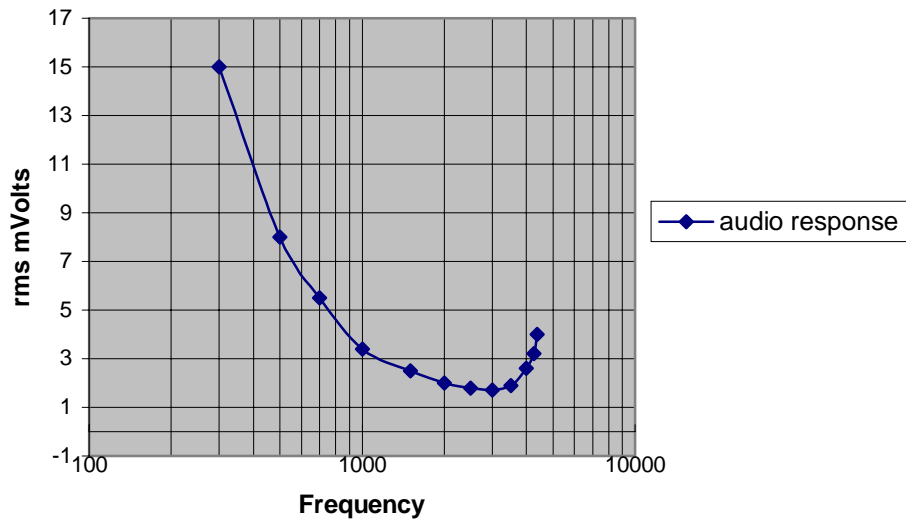
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Raymarine Company
RAY215

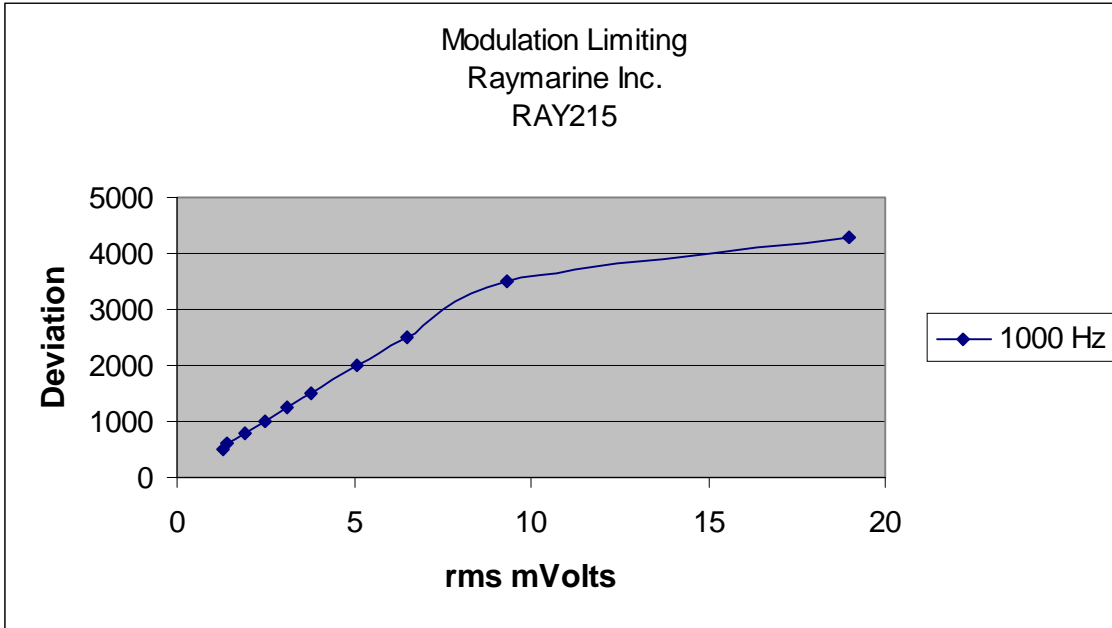
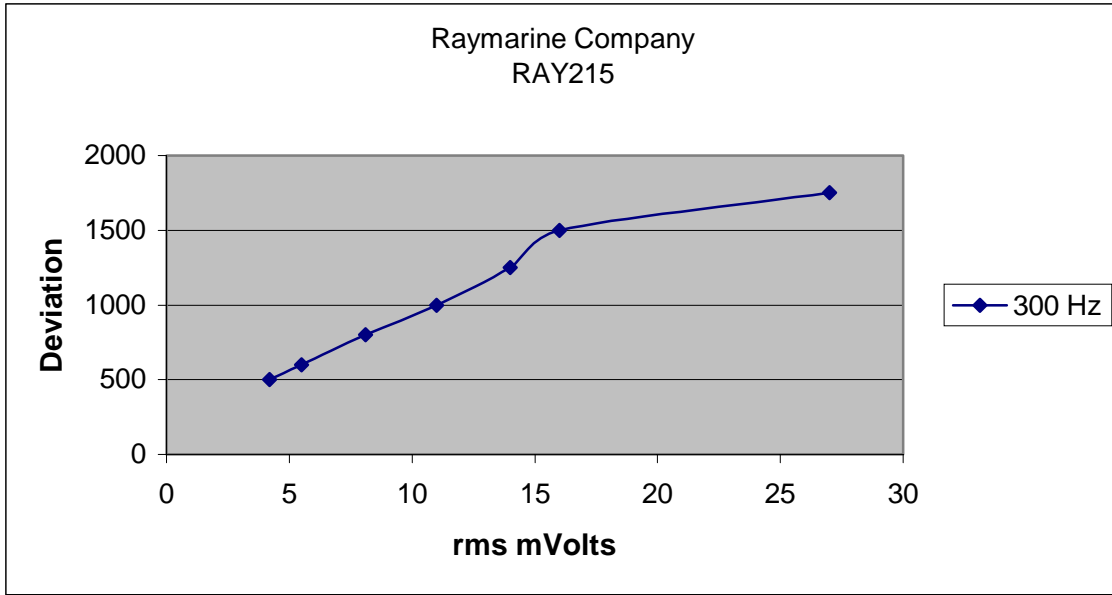


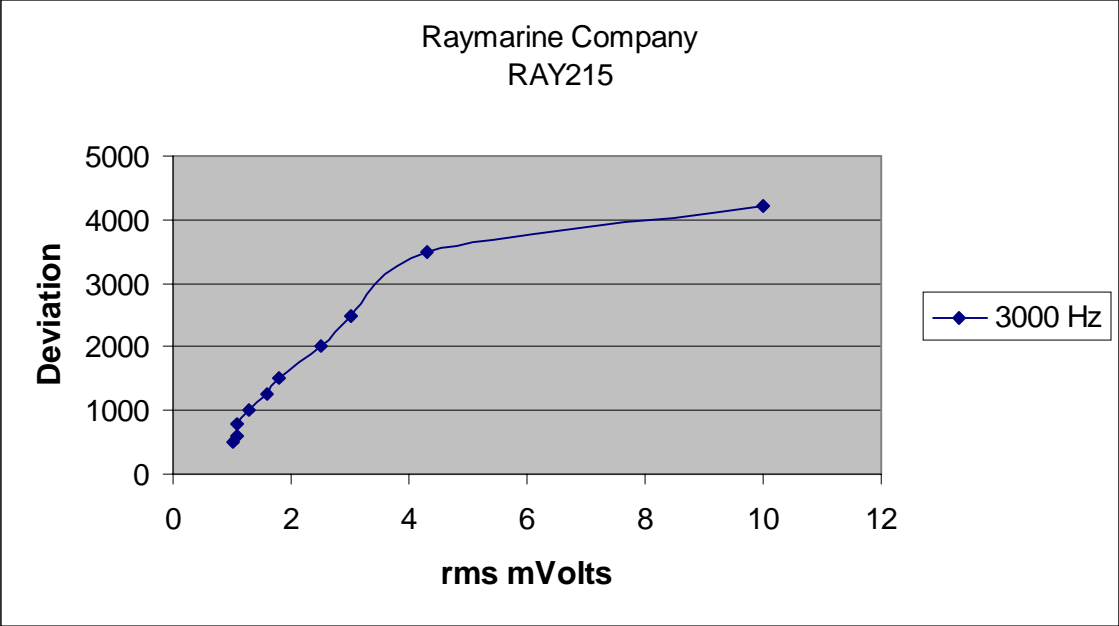
APPLICANT: RAYMARINE, INC.

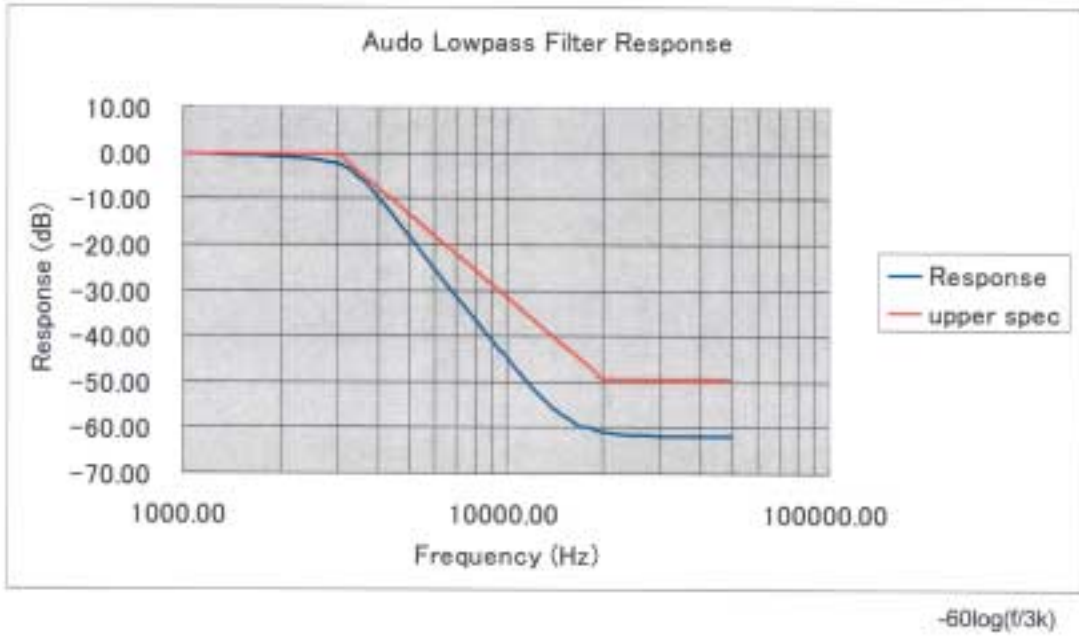
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2.2049(c) Occupied bandwidth:

80.205(a)

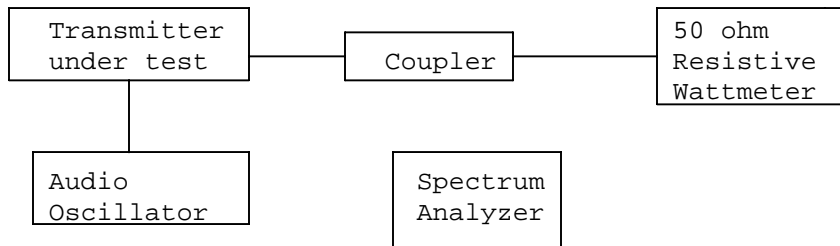
Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB. On any frequency removed from the assigned frequency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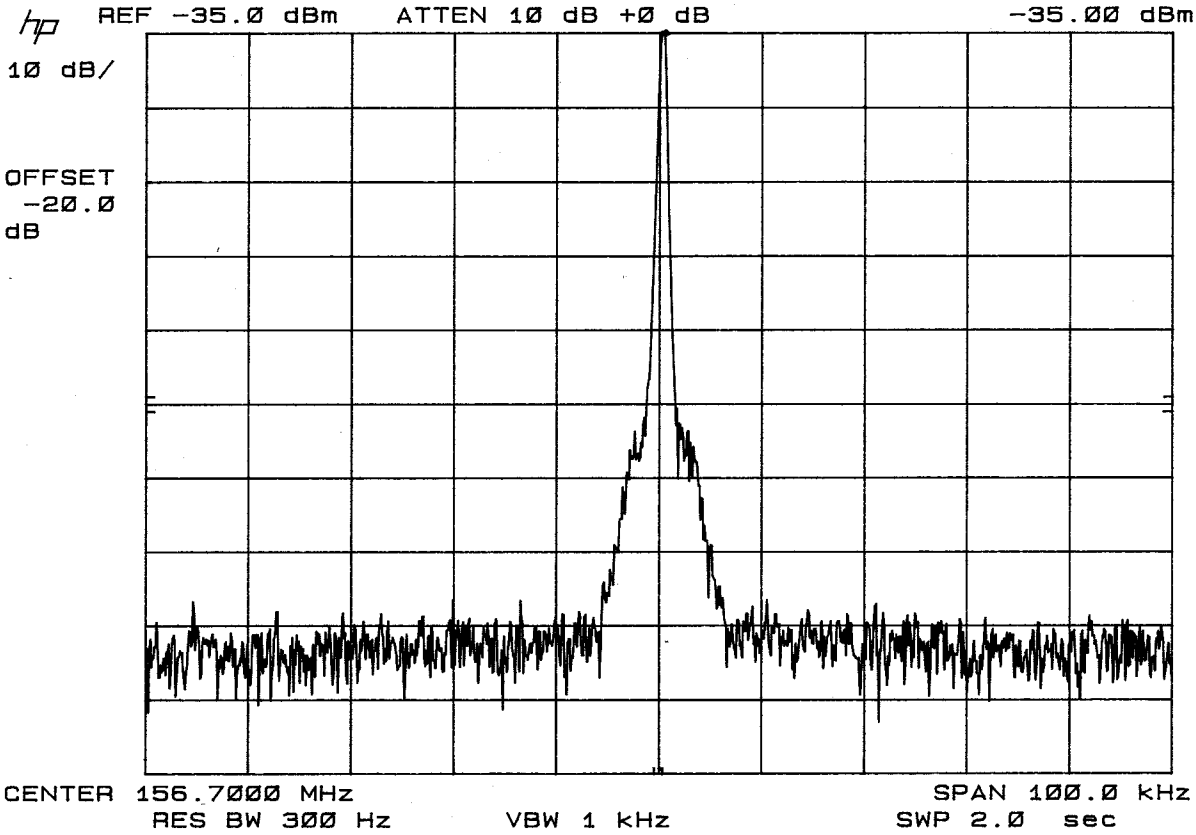
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RAYMARINE, INC.
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OCCUPIED BANDWIDTH PLOT - CW

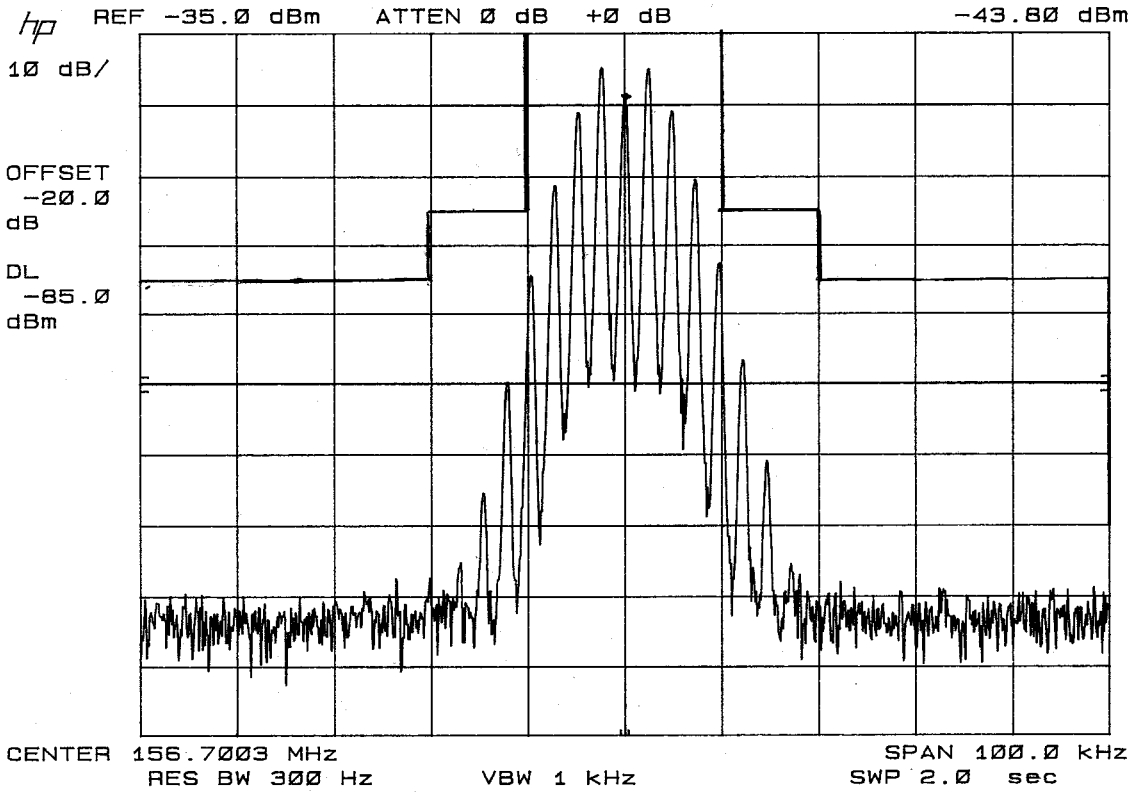
MKR 156.7005 MHz
-35.00 dBm



RAYMARINE, INC.
FCC ID: PJ5RAY215

OCCUPIED BANDWIDTH PLOT

MKR 156.7004 MHz
-43.80 dBm

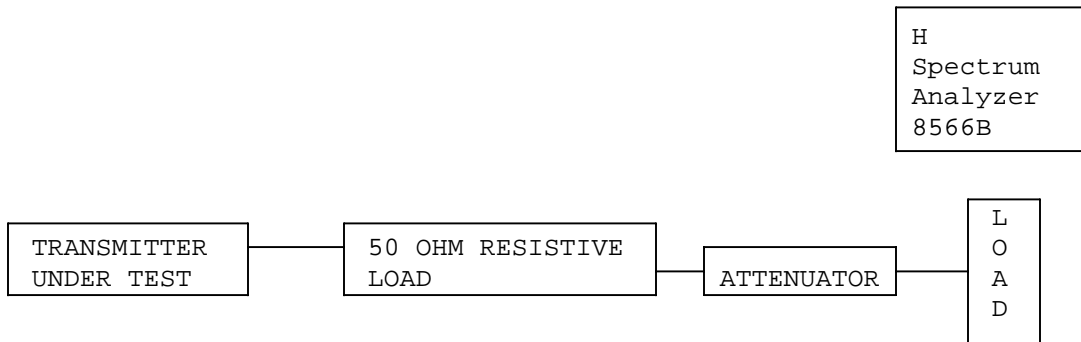


2.1051
80.213

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.

Method of Measuring Conducted Spurious Emissions



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2.1051 Continued Spurious Emissions at the Antenna Terminals:

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

For 20kHz HIGH POWER $43 + 10\log(25) = 43 + 13.98 = 57.0\text{dB}$
 LOW POWER $43 + 10\log(1.0) = 43 + 0 = 43\text{dB}$

**HIGH
POWER**

EMISSION FREQUENCY	dB below carrier
156.6	0
313.2	86.2
469.8	81.4
626.4	90.3
783	89.9
939.6	96.6
1096.2	98.3
1252.8	84.1
1409.4	88.9
1566	86.7

**LOW
POWER**

EMISSION FREQUENCY	dB below carrier
156.38	0
313	44.5
469	42.4
625	56.1
782	53.2
938	98.3
1095	95.8
1251	76.7
1407	88.7
1564	98.7

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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 NW STATE ROAD 45, NEWBERRY FLORIDA 32669.

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2.1053(a)(b) 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(25.0) = 56.98 dB
LOW POWER 43 + 10 LOG(1.0) = 43.00 dB

HIGH POWER

Emission Frequency MHz	Ant. Polarity	Attn. dBc	Margin dB
156.00	H	00.00	00.0
313.30	H	57.47	0.49
470.00	H	61.41	4.43
626.70	H	82.43	25.45
783.40	H	78.58	21.60
940.00	H	77.10	20.12
1,096.70	V	75.62	18.64
1,253.40	V	67.04	10.06
1,410.10	V	61.18	4.20
1,566.80	V	71.62	14.64

LOW POWER

Emission Frequency MHz	Ant. Polarity	Attn. dBc	Margin dB
156.38	H	00.00	00.0
313.00	H	52.01	9.01
469.00	H	45.02	2.02
625.00	H	52.32	9.32
782.00	H	57.12	14.12
938.00	H	78.04	35.04
1,095.00	V	63.26	20.26
1,251.00	V	54.70	11.70
1,407.00	V	67.63	24.63
1,564.00	V	76.38	33.38

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.

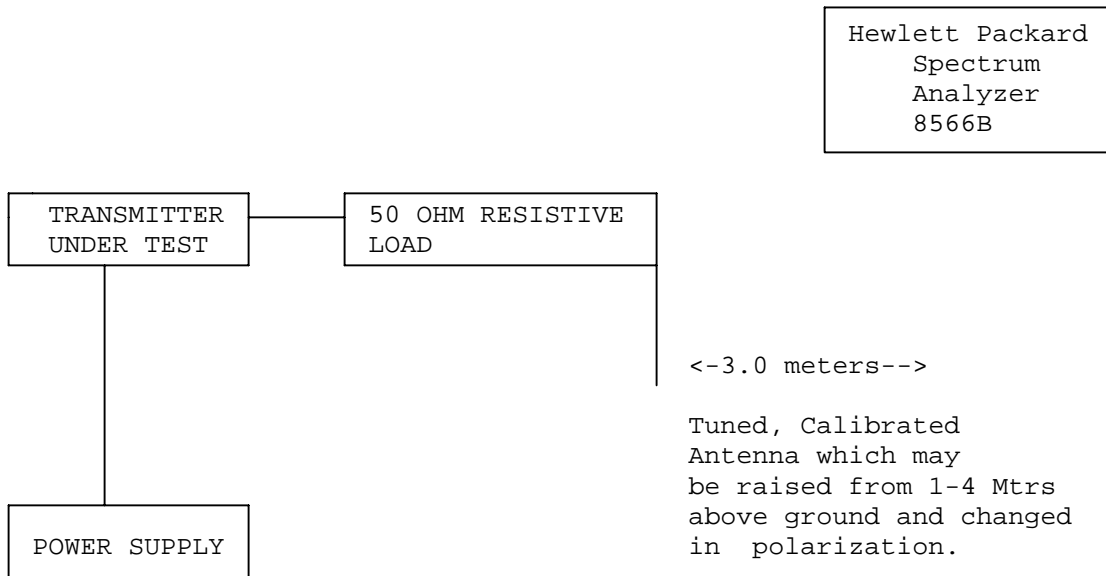
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Method of Measuring Radiated Spurious Emissions



Equipment placed 80 cm above ground on a rotatable platform.

Frequency stability:

2.1055(a)(2)

80.209(a)

Temperature and voltage tests were performed to verify that the frequency remains within the .0010%,10.0 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 -20 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 25% of the battery voltage of 13.2VDC, which we estimate to be the battery endpoint.

MEASUREMENT DATA:

Assigned Frequency (Ref. Frequency): 156.375 000

TEMPERATURE_C	FREQUENCY_MHz	PPM
REFERENCE_____	156.375 000	00.0
-30_____	156.375 007	+0.04
-20_____	156.375 081	+0.52
-10_____	156.375 257	+1.65
0_____	156.375 306	+1.96
+10_____	156.375 219	+1.40
+20_____	156.375 151	+0.97
+30_____	156.375 122	+0.78
+40_____	156.375 269	+1.72
+50_____	156.375 618	+3.96
15% Battery Voltage 15.18 VDC	156.375 211	+1.35
-15% Battery Voltage 11.22 VDC	156.375 159	+1.02

RESULTS OF MEASUREMENTS: The maximum frequency variation over the temperature range was 3.96 ppm. The maximum frequency variation over the voltage range was 1.35 ppm.

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TEST EQUIPMENT LIST

1. Spectrum Analyzer: HP 8566B-Opt 462, S/N 3138A07786, w/ preselector HP 85685A, S/N 3221A01400, Quasi-Peak Adapter HP 85650A, S/N 3303A01690 & Preamplifier HP 8449B-OPT H02, S/N 3008A00372
2. Biconnical Antenna: Eaton Model 94455-1, S/N 1057
3. Biconnical Antenna: Electro-Metrics Model BIA-25, S/N 1171
4. Log-Periodic Antenna: Electro-Metrics Model EM-6950, S/N 632
5. Log-Periodic Antenna: Electro-Metrics Model LPA-30, S/N 409
6. Double-Ridged Horn Antenna: Electro-Metrics Model RGA-180, 1-18 GHz, S/N 2319
7. 18-26.3GHz Systron Donner Standard Gain Horn #DBE-520-20
8. Horn 40-60GHz: ATM Part #19-443-6R
9. Line Impedance Stabilization Network: Electro-Metrics Model EM-7820, w/NEMA Adapter S/N 2682
10. Temperature Chamber: Tenney Engineering Model TTRC, S/N 11717-7
11. Frequency Counter: HP Model 5385A, S/N 3242A07460
12. Peak Power Meter: HP Model 8900C, S/N 2131A00545
13. Open Area Test Site #1-3meters
14. Signal Generator: HP 8640B, S/N 2308A21464
15. Signal Generator: HP 8614A, S/N 2015A07428
16. Passive Loop Antenna: EMCO Model 6512, 9KHz to 30MHz, S/N 9706-1211
17. Dipole Antenna Kit: Electro-Metrics Model TDA-30/1-4, S/N 153
18. AC Voltmeter: HP Model 400FL, S/N 2213A14499
19. Digital Multimeter: Fluke Model 8012A, S/N 4810047
20. Digital Multimeter: Fluke Model 77, S/N 43850817
21. Oscilloscope: Tektronix Model 2230, S/N 300572

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