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 RADIO

FCC ID: EP78TQSX-35DSC

Applicant:

PONY ELECTRIC CORPORATION
NO. 202, 6-28, AKASAKA 9-CHOME
MINATO-KU, TOKYO 107
JAPAN

Date Receipt: JUNE 24, 2004

Date Tested: JULY 14, 2004

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TEST REPORT:

EXHIBITS INCLUDING:

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GENERAL_INFORMATION

2.1033(c) PONY ELECTRIC CORPORATION will sell the FCC ID: EP78TQSX-35DSC VHF Marine transmitter in quantity, for use under FCC RULES PART 80.

2.1033(c) **TECHNICAL_DESCRIPTION**

(4) Type of Emission: 16K0G3E/16K0F3E For 20KHz

Bn = 2M + 2DK
M = 3000
D = 4.6KHz (Peak Deviation)
K = 1
Bn = 2(3.0K) + 2(4.6K)(1) = 6.0K + 10.0 = 16.0K

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 25 Watt into a 50 ohm resistive load.

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

POWER INPUT
FINAL AMPLIFIER ONLY (CHANNEL 1)

High	Low
Vce = 13.5 VDC	Vce = 13.5 VDC
Ice = 4.30 A.	Ice = .970 A.
Pin = 58.05 Watts	Pin = 13.10 Watts

POWER INPUT
FINAL AMPLIFIER ONLY (CHANNEL 88)

High	Low
Vce = 13.5 VDC	Vce = 13.5 VDC
Ice = 4.17 A.	Ice = .940 A.
Pin = 56.30 Watts	Pin = 12.69 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.

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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 13 V, and the transmitter properly adjusted the RF output measures:

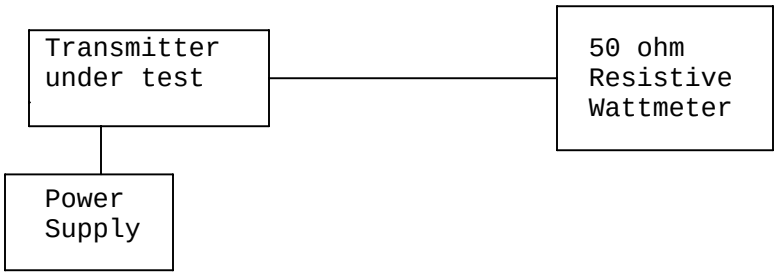
OUTPUT POWER: HIGH: 20 W CONDUCTED
LOW: 0.7 W CONDUCTED

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 12V this equals 17.2W)

12.6 Volts	19.0 Watts
12.0 Volts	18.0 Watts
11.5 Volts	17.5 Watts

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 must deliver between 8 and 25 Watts: 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 20 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 20 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 20 Watts output power to 18 Watts output power

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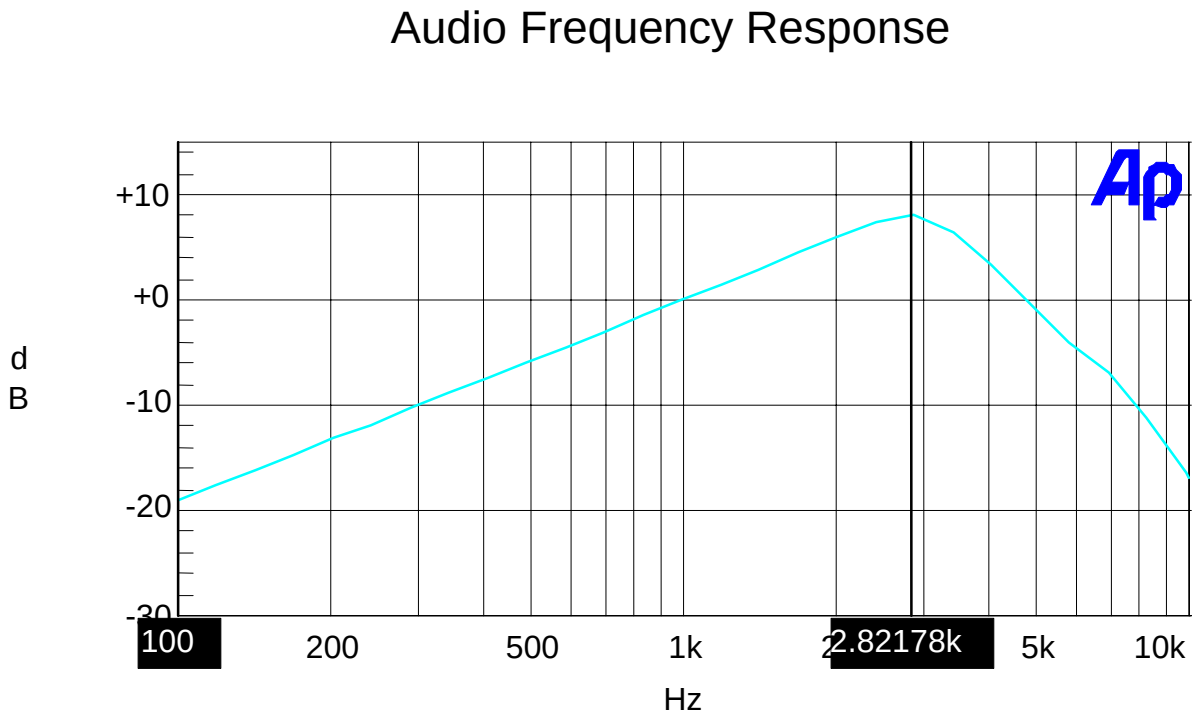
2.1047(a) **Voice Modulation characteristics:**

(b) **AUDIO_FREQUENCY_RESPONSE** See the following plot.



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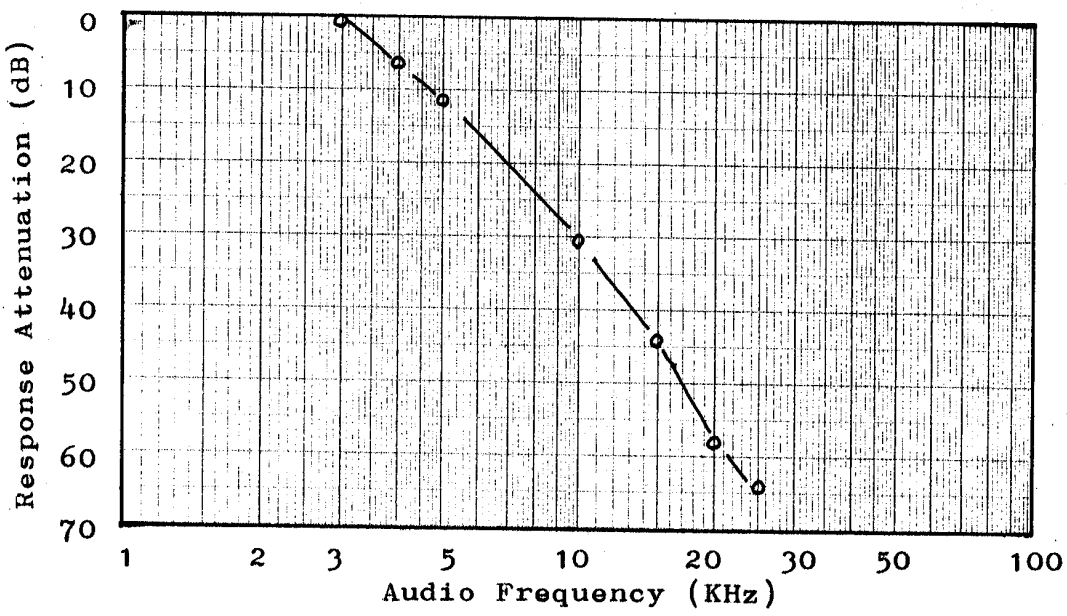
2.1047(a)
80.213(e)

AUDIO_LOW_PASS_FILTER

The audio low pass filter shown in the following plot.



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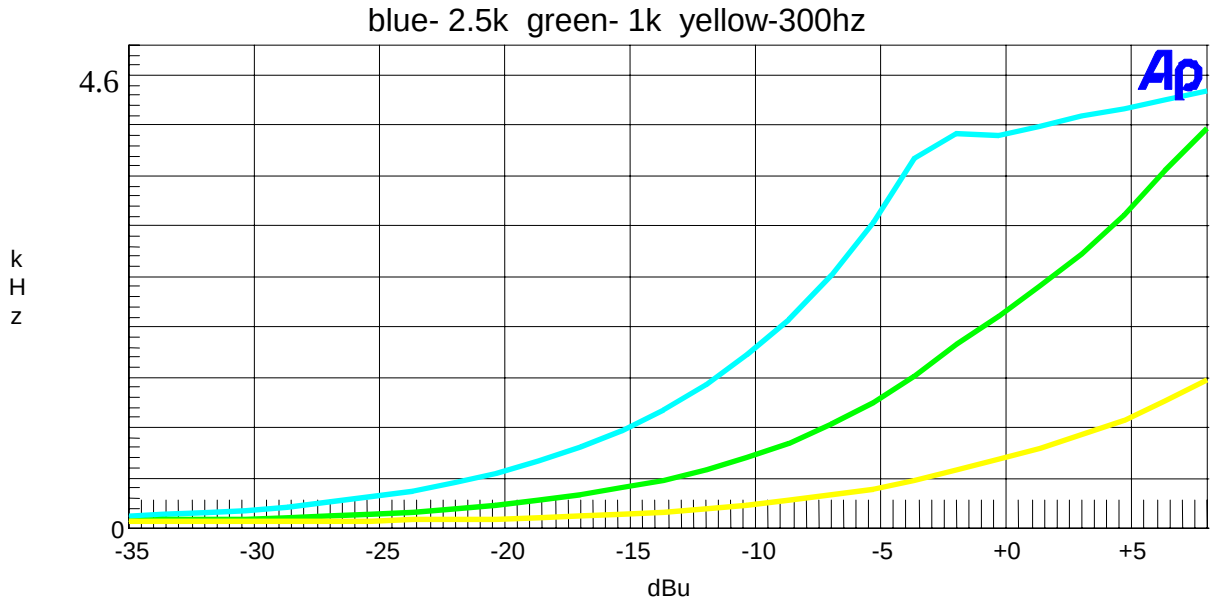
2.1047(b)
80.213 (d)

Audio input versus modulation

A plot of the audio input versus deviation is shown in the following plots.

Modulation Limiting Plot



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2.1049(c)

80.211 (f)

Occupied bandwidth:

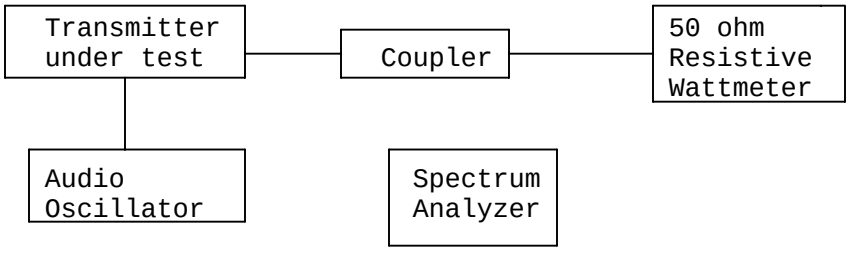
Data in the plots shows that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35dB. On any frequency removed from the assigned frequency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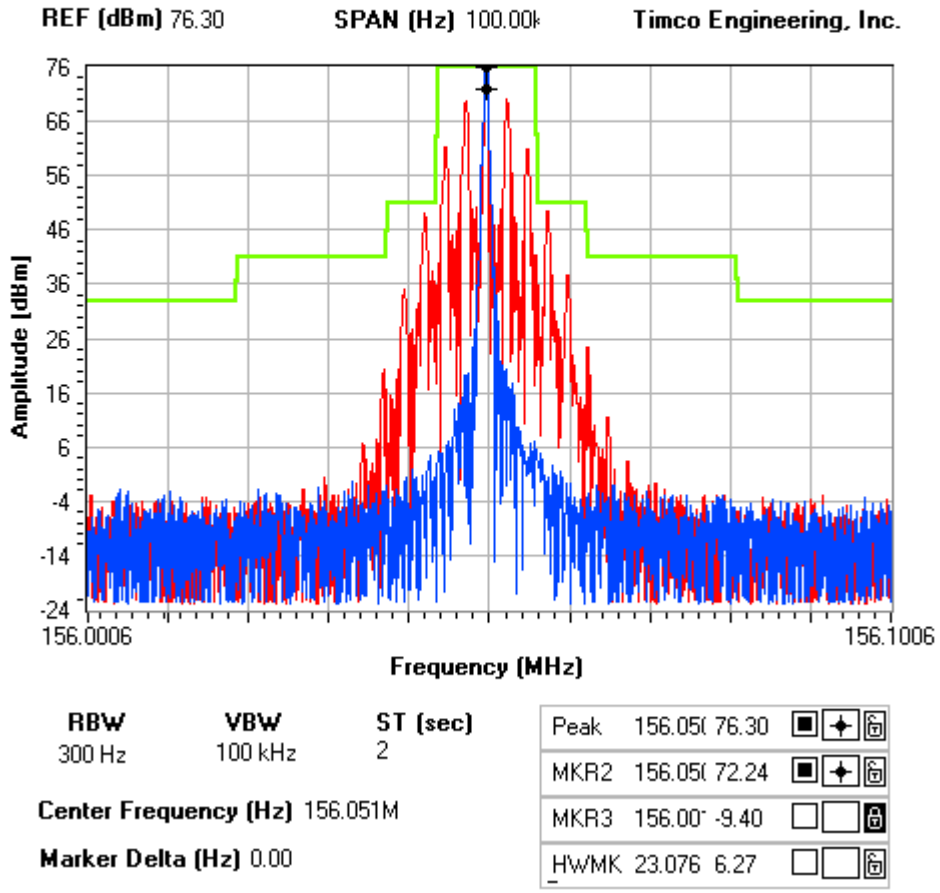
OCCUPIED BANDWIDTH PLOT

NOTES:

FCC 80.211(f)



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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(20) = 56.01 **43 + 10log(.7) = 41.45**

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
156.1	156.1	0.0	156.1	156.1	0.0
	312.2	101.0		312.2	89.7
	468.3	97.1		468.3	89.7
	624.4	83.6		624.4	79.2
	480.5	84.9		480.5	78.9
	936.6	99.6		936.6	90.6
	1092.7	89.4		1092.7	80.9
	1248.8	101.3		1248.8	90.7
	1404.9	98.5		1404.9	92.0
	1561.0	84.4		1561.0	86.1

TF HIGH POWER	EF	dB below carrier	TF LOW POWER	EF	dB below carrier
157.4	157.4	0.0	157.4	157.4	0.0
	314.8	99.6		314.8	89.5
	472.2	94.5		472.2	89.9
	629.6	83.7		629.6	78.9
	787.0	94.5		787.0	79.7
	944.4	101.9		944.4	92.4
	1101.8	89.4		1101.8	82.1
	1259.2	100.6		1259.2	91.7
	1416.6	100.8		1416.6	91.6
	1574.0	87.9		1574.0	85.1

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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:**

NAME OF TEST: **RADIATED SPURIOUS EMISSIONS (156 MHz)**

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

HIGH: 43 + 10log(20) = 56.01
LOW : 43 + 10log(0.7) = 41.45

TEST DATA (LOW):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
156.00	H	28.60	0	-0.13	0
312.10	H	-49.90	0	-1.25	79.62
468.10	H	-45.40	0	-0.5224	74.3924
624.20	H	-36.20	0	-0.2564	64.9264
780.20	V	-36.30	0	-1.0332	65.8032
936.60	H	-57.40	0	-0.9856	86.8556
1092.20	V	-50.60	1.01844	3.319	76.7694
1248.20	H	-55.50	1.04964	3.943	81.0766
1404.30	V	-57.80	1.08086	4.567	82.7839
1560.40	V	-53.50	1.11208	4.986	78.0961

TEST DATA (HIGH):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
156.00	H	43.14	0	-0.13	0
312.10	H	-33.60	0	-1.25	77.86
468.10	V	-34.40	0	-0.5224	77.9324
624.20	H	-33.40	0	-0.2564	76.6664
780.20	V	-27.10	0	-1.0332	71.1432
936.60	V	-42.40	0	-0.9856	86.3956
1092.20	V	-45.20	1.01844	3.319	85.9094
1248.20	V	-51.00	1.04964	3.943	91.1166
1404.30	H	-51.00	1.08086	4.567	90.5239
1560.40	V	-44.20	1.11208	4.986	83.3361

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2.1053(a) **Field_strength_of_spurious_emissions:**

NAME OF TEST: **RADIATED SPURIOUS EMISSIONS (157.4 MHz)**

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

HIGH: 43 + 10log(20) = 56.01
LOW : 43 + 10log(0.7) = 41.45

TEST DATA (LOW):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
157.40	H	28.60	0	-0.202	0
314.80	H	-46.20	0	-1.25	75.848
472.20	H	-43.00	0	-0.5388	71.9368
629.70	H	-45.20	0	-0.2312	73.8292
787.10	V	-38.10	0	-1.1436	67.6416
944.60	H	-55.70	0	-1.0852	85.1832
1102.00	H	-49.30	1.0204	3.358	75.3604
1259.50	V	-55.90	1.0519	3.988	81.3619
1416.90	V	-56.50	1.08338	4.6176	81.3638
1574.40	V	-52.00	1.11488	4.99494	76.5179

TEST DATA (HIGH):

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
157.40	H	43.10	0	-0.202	0
314.80	H	-35.80	0	-1.25	79.948
472.20	H	-32.70	0	-0.5388	76.1368
629.70	H	-33.50	0	-0.2312	76.6292
787.10	V	-26.60	0	-1.1436	70.6416
944.60	H	-39.90	0	-1.0852	83.8832
1102.00	H	-47.20	1.0204	3.358	87.7604
1259.50	V	-48.90	1.0519	3.988	88.8619
1416.90	V	-48.40	1.08338	4.6176	87.7638
1574.40	V	-42.20	1.11488	4.99494	81.2179

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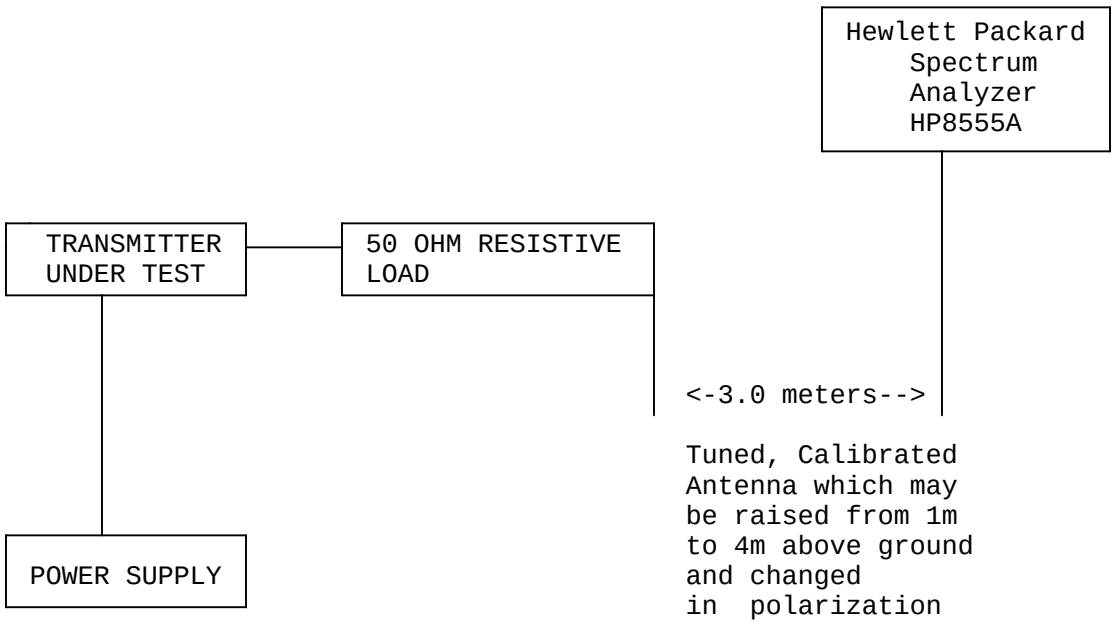
2.1053(a) **Field_strength_of_spurious_emissions:**

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 15% of the battery voltage of 13.5 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	156.049 085	- 5.86
-20	156.049 068	- 5.97
-10	156.049 54	- 2.95
0	156.049 867	- 0.85
+10	156.050 075	+ 0.48
+20	156.050 12	+ 0.77
+30	156.050 148	+ 0.95
+40	156.050 251	+ 1.61
+50	156.050 525	+ 3.36

	VOLTS	Batt. Data	Batt. PPM
-15%	11.475	156.050 12	+ 0.77

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	1/12/06
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 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	CAL 4/27/04	4/27/06
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