MFA **M. Flom Associates, Inc. - Global Compliance Center**
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www.goodnet.com/~mflom, (602) 926-3100, FAX: 926-3598

Sub-part
2.983 (f):

EQUIPMENT IDENTIFICATION

FCC ID: ASLRAY100

NAMEPLATE DRAWING

ATTACHED, EXHIBIT 1.

LOCATION

AS PER LABEL DRAWING(S)

DATE OF REPORT

June 12, 1998

M. Flom P. Eng.
MORTON FLOM, P. Eng.

SUPERVISED BY:
MF:glk

THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

The users manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) SPECIAL ACCESSORIES.

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

TABLE OF CONTENTS

LIST OF GENERAL INFORMATION REQUIRED FOR TYPE ACCEPTANCE

IN ACCORDANCE WITH FCC RULES AND REGULATIONS,
VOLUME II, PART 2 AND TO

80 T, U, DSC

Sub-part
2.983(a): NAME AND ADDRESS OF APPLICANT:

Raytheon Marine Company

VENDOR:

Raytheon Marine Company
676 Island Pond Rd.
Manchester, NH 03109-5420

2.983(b): FCC ID: ASLRAY100

MODEL NO: RAY100

2.983(c): QUANTITY PRODUCTION PLANNED.

2.983(d): TECHNICAL DESCRIPTION: SEE ATTACHED EXHIBITS

(1): TYPE OF EMISSION: 16K0G3E

(2): FREQUENCY RANGE, MHz: 156 to 157.5

(3): POWER RATING, Watts: 1, 5
SWITCHABLE x ADJUSTABLE ___ N/A ___

(4): MAXIMUM POWER RATING, Watts: 25

2.983(d)
(5): VOLTAGES & CURRENTS IN ALL ELEMENTS IN FINAL R. F. STAGE, INCLUDING FINAL TRANSISTOR OR SOLID STATE DEVICE:

COLLECTOR CURRENT, A = per manual
COLLECTOR VOLTAGE, Vdc = per manual
SUPPLY VOLTAGE, Vdc = 6

(6): FUNCTION OF ACTIVE CIRCUIT DEVICES:

PLEASE SEE ATTACHED EXHIBITS

(7): CIRCUIT DIAGRAM:

PLEASE SEE ATTACHED EXHIBITS

(8): MANUAL:

PLEASE SEE ATTACHED EXHIBITS

(9): TUNE-UP PROCEDURE:

PLEASE SEE ATTACHED EXHIBITS

(10): DESCRIPTION OF CIRCUITRY & DEVICES PROVIDED FOR DETERMINING AND STABILIZING FREQUENCY:

PLEASE SEE ATTACHED EXHIBITS

(11): DESCRIPTION OF CIRCUITS OR DEVICES EMPLOYED FOR
(a) SUPPRESSION OF SPURIOUS RADIATION,
(b) LIMITING MODULATION,
(c) LIMITING POWER:

PLEASE SEE ATTACHED EXHIBITS

(12): DIGITAL MODULATION DESCRIPTION:

ATTACHED EXHIBITS ___
N/A x

2.983(e): TEST AND MEASUREMENT DATA:

FOLLOWS

2.983(f): LABEL INFORMATION:

PLEASE SEE ATTACHED EXHIBITS

2.983(g): PHOTOGRAPHS:

PLEASE SEE ATTACHED EXHIBITS

Sub-part
2.983(e): TEST AND MEASUREMENT DATA

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.981, 2.983, 2.985, 2.987, 2.989, 2.991, 2.993, 2.995, 2.997, 2.999 and the following individual Parts:

___ 21 - Domestic Public Fixed Radio Services
___ 22 - Public Mobile Services
___ 22 Subpart H - Cellular Radiotelephone Service
___ 22.901(d) - Alternative technologies and auxiliary services
___ 23 - International Fixed Public Radiocommunication services
___ 24 - Personal Communications Services
___ 74 Subpart H - Low Power Auxiliary Stations
___ 80 - Stations in the Maritime Services
___ 80 Subpart E - General Technical Standards
___ 80 Subpart F - Equipment Authorization for Compulsory Ships
___ 80 Subpart K - Private Coast Stations and Marine Utility Stations
___ 80 Subpart S - Compulsory Radiotelephone Installations for Small Passenger Boats
_x_ 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
_x_ 80 Subpart U - Radiotelephone Installations Required by the Bridge-to-Bridge Act
___ 80 Subpart V - Emergency Position Indicating Radiobeacons (EPIRB'S)
___ 80 Subpart W - Global Maritime Distress and Safety System (GMDSS)
___ 80 Subpart X - Voluntary Radio Installations
___ 87 - Aviation Services
___ 90 - Private Land Mobile Radio Services
___ 94 - Private Operational-Fixed Microwave Service
___ 95 Subpart A - General Mobile Radio Service (GMRS)
___ 95 Subpart C - Radio Control (R/C) Radio Service
___ 95 Subpart D - Citizens Band (CB) Radio Service
___ 95 Subpart E - Family Radio Service
___ 95 Subpart F - Interactive Video and Data Service (IVDS)

STANDARD TEST CONDITIONS and ENGINEERING PRACTICES

Except as noted herein, the following conditions and procedures were observed during the testing:

ROOM TEMPERATURE	= 25±5°C
ROOM HUMIDITY	= 20-50%
D.C. SUPPLY VOLTAGE, Vdc	= 6
A.C. SUPPLY VOLTAGE, Vac	= N/A
A.C. SUPPLY FREQUENCY, Hz	= N/A

Prior to testing, the E.U.T. was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst case measurements.

NAME OF TEST: R. F. POWER OUTPUT

PARAGRAPH: 47 CFR 2.985 (a)

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: STANDARD TEMPERATURE & HUMIDITY

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. was connected to a resistive coaxial attenuator of normal load impedance, and the unmodulated output power was measured by means of an R. F. Power Meter.

2. Measurement accuracy is ±3%.

MEASUREMENT RESULTS

NOMINAL, MHz	CHANNEL	R.F. POWER OUTPUT, WATTS	
		Lo	Hi
156.300	06	1	5
156.550	11	1	5
156.600	12	1	5
156.700	14	1	5
156.750	15	1	5
156.800	16	1	5

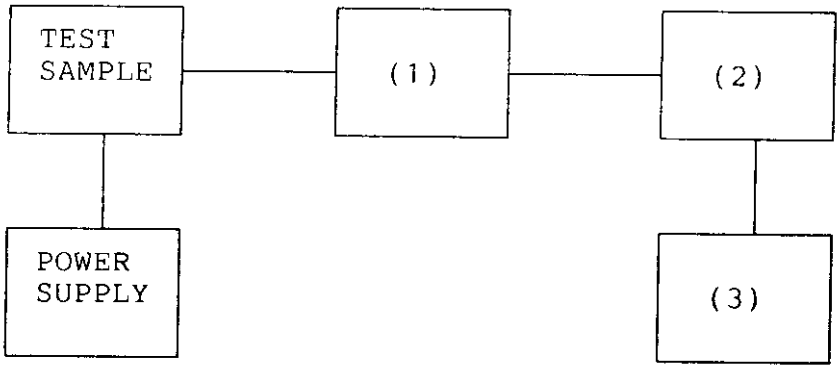
*Automatic switching to low power mode.

SUPERVISED BY:

MORTON FLOM, P. Eng.

R.F. POWER OUTPUT (A.M. OR F.M.)

TEST 1: R. F. POWER OUTPUT
TEST 2: FREQUENCY STABILITY



(1) COAXIAL ATTENUATOR

NARDA 766-10	___
SIERRA 661A-30	x
BIRD 8329 (30 dB)	___
_____	___

(2) POWER METERS

HP 435A	___
HP 436A	x
HP 8901A	x
_____	___

(3) FREQUENCY COUNTER

HP 5383A	___
HP 5334B	x
HP 8901A FREQUENCY MODE	x
_____	___

NAME OF TEST: MODULATION CHARACTERISTICS - FREQUENCY RESPONSE OF AUDIO MODULATING CIRCUIT

PARAGRAPH: 47 CFR 2.987 (a)

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. and test equipment were set up as shown on the following page.

2. The audio signal generator was connected to the audio input circuit/microphone of the E.U.T.

3. The audio signal input was adjusted to obtain 50% modulation at 1 kHz, and this point was taken as the 0 dB reference level.

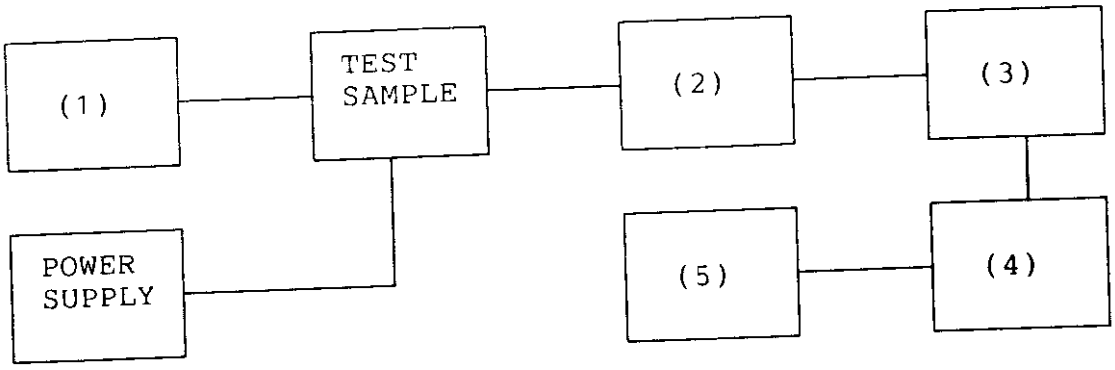
4. With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 100 Hz to 50 kHz.

5. The response in dB relative to 1 kHz was then measured, using the HP 8901A Modulation Analyzer.

6. MEASUREMENT RESULTS: ATTACHED

TRANSMITTER TEST SET-UP

TEST A. MODULATION CAPABILITY/DISTORTION
TEST B. AUDIO FREQUENCY RESPONSE
TEST C. HUM AND NOISE LEVEL
TEST D. RESPONSE OF LOW PASS FILTER
TEST E. MODULATION LIMITING



(1) AUDIO OSCILLATOR/GENERATOR

HP 204D	___
HP 8903A	x
HP 3312A	___
_____	___

(2) COAXIAL ATTENUATOR

NARDA 766-10	___
SIERRA 661A-30	x
BIRD 8329 (30 dB)	___
_____	___

(3) MODULATION ANALYZER

HP 8901A	x
_____	___

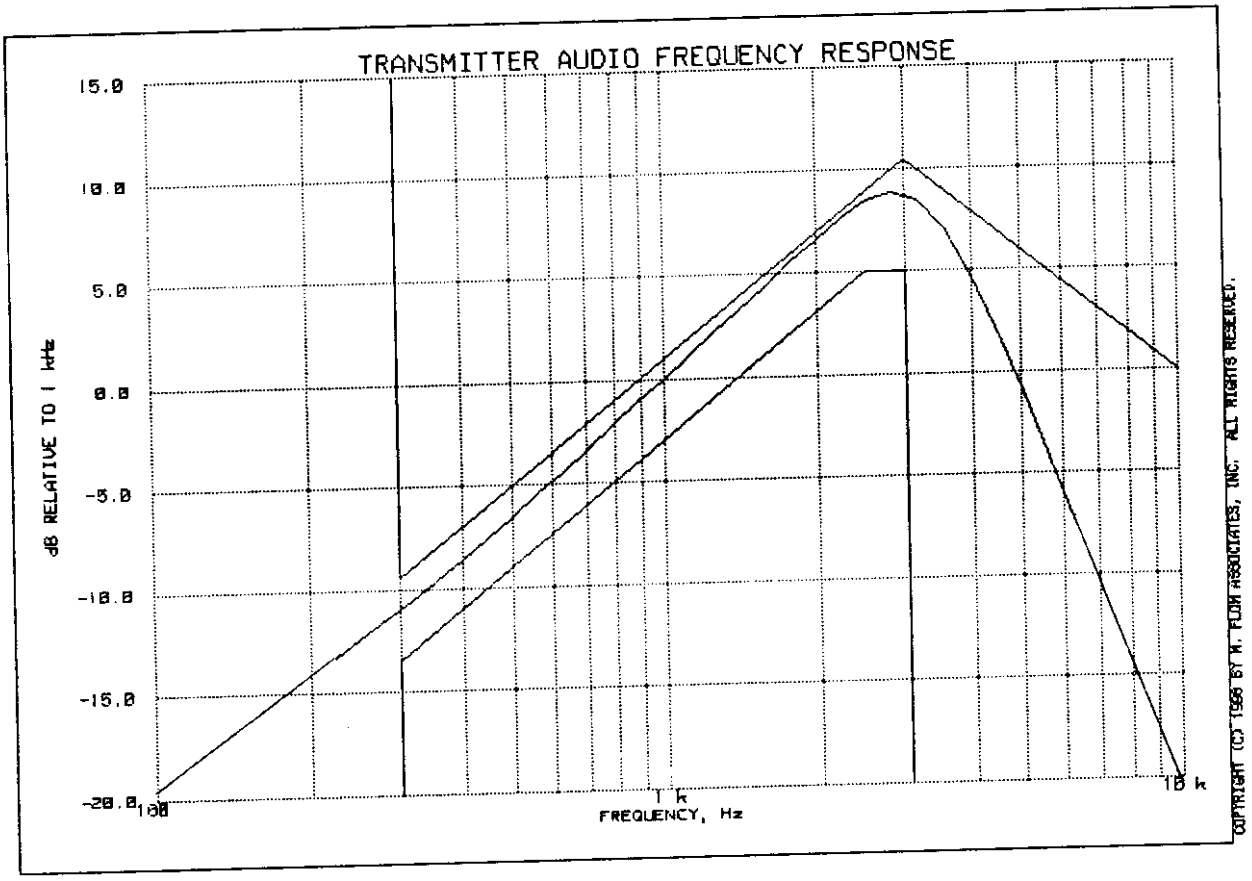
(4) AUDIO ANALYZER

HP 8903A	x
_____	___

(5) SCOPE

HP 1741A	___
HP 181T	___
TEK 935	___
_____	___

PAGE 10.
TRANSMITTER AUDIO FREQUENCY RESPONSE
RAYTHEON, Ray 100
26 MAY 1998, 07:55



PEAK AUDIO FREQUENCY, Hz: 2820

TABLE VALUES:

FREQUENCY, Hz	LEVEL, dB	FREQUENCY, Hz	LEVEL, dB	FREQUENCY, Hz	LEVEL, dB
300	-9.7	30000	-15.4		
20000	-15.6	50000	-15.7		

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: MODULATION CHARACTERISTICS - FREQUENCY RESPONSE OF AUDIO LOW PASS FILTER

PARAGRAPH: 47 CFR 2.987 (a)

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT PROCEDURE

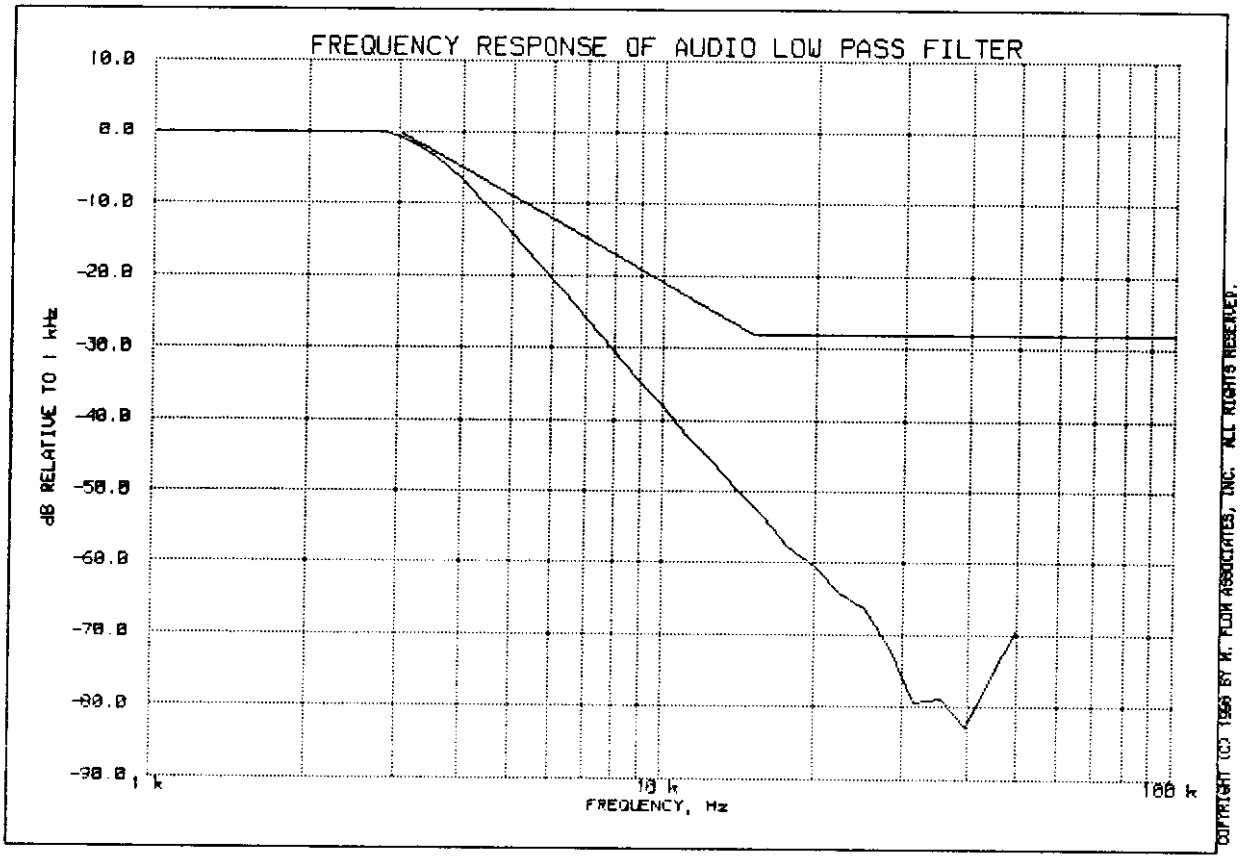
1. The E.U.T. and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage.

2. The audio output was connected at the output to the modulated stage.

3. MEASUREMENT RESULTS: ATTACHED

ASLRAY100

FREQUENCY RESPONSE OF AUDIO LOW PASS FILTER
RAYTHEON, Ray 100
26 MAY 1998, 08:00



PEAK AUDIO FREQUENCY, Hz: 2820

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: MODULATION CHARACTERISTICS - MODULATION LIMITING

PARAGRAPH: 47 CFR 2.987 (b), 80.211, 80.213

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT PROCEDURE

1. The audio signal generator was connected to the audio input circuit/microphone of the E.U.T. as for "Frequency Response of the Audio Modulating Circuit."

2. The modulation response was measured for each of three tones (one of which was the frequency of maximum response), and the input voltage was varied and was observed on an HP 8901A Modulation Analyzer.

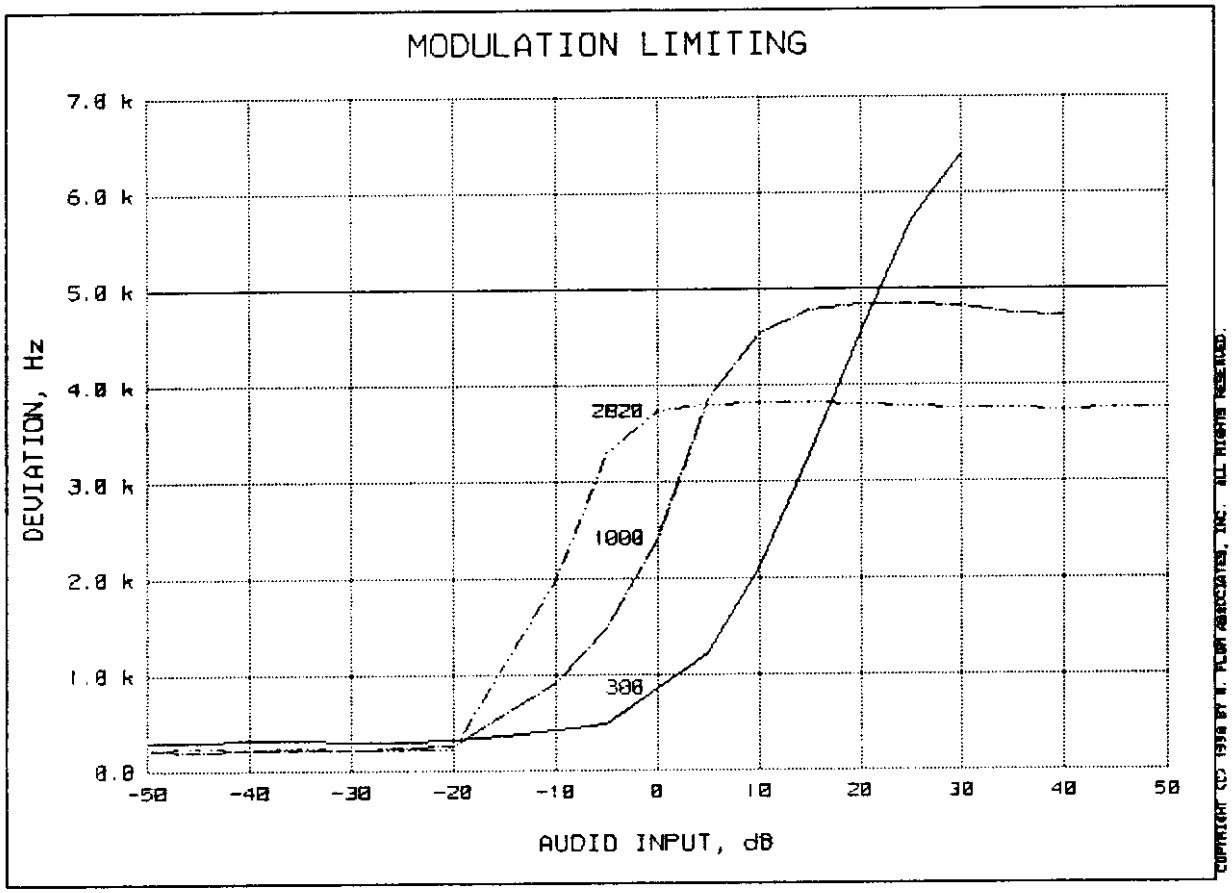
3. The audio input level was varied from 30% modulation (±1.5 kHz deviation) to at least 20 dB higher than the saturation point.

4. Measurements were performed for both negative and positive modulation and the respective results were recorded.

5. MEASUREMENT RESULTS: ATTACHED

MODULATION LIMITING
RAYTHEON, Ray 100
1998-MAY-26, 08:05

ASLRAY100

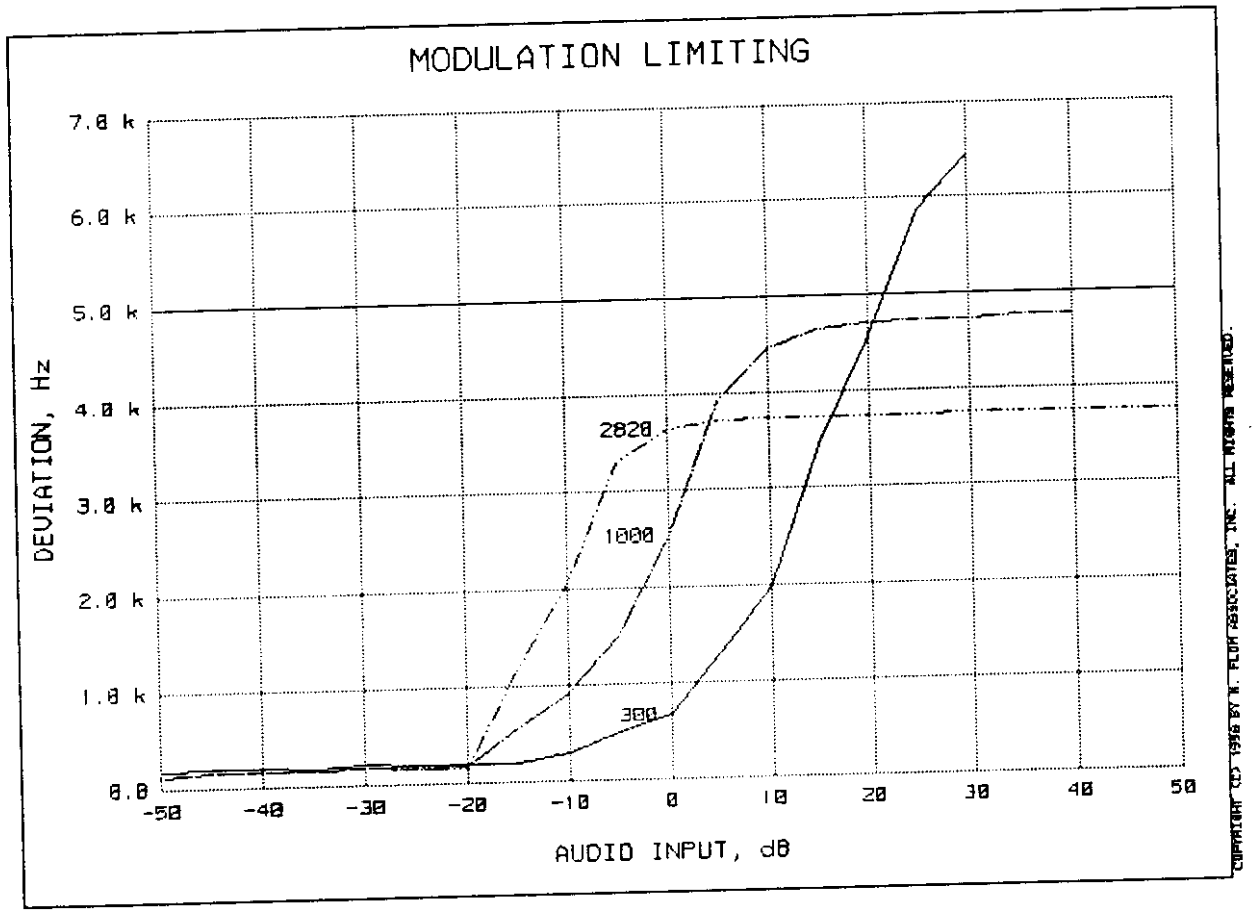


REFERENCE DEVIATION, kHz	= 2.5
REFERENCE MODULATION, Hz	= 1000
PEAKS	= POSITIVE
AUDIO AMPLITUDE, mV	= 4.46

SUPERVISED BY:

MORTON FLOM, P. Eng.

PAGE 14.2.
MODULATION LIMITING
RAYTHEON, Ray 100
1998-MAY-26, 08:05



REFERENCE DEVIATION, kHz	= 2.5
REFERENCE MODULATION, Hz	= 1000
PEAKS	= NEGATIVE
AUDIO AMPLITUDE, mV	= 4.78

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: OCCUPIED BANDWIDTH

PARAGRAPH: 47 CFR 2.989 (c)(1), 80.205

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.

2. The audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5 kHz deviation (or 50% modulation).

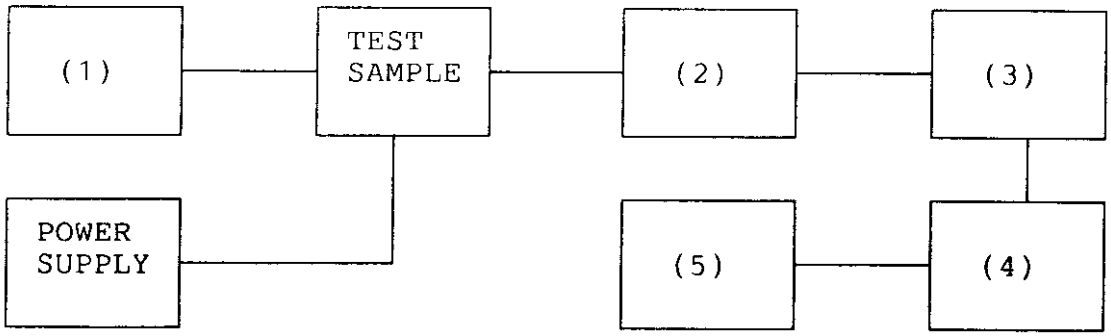
3. With level constant, the frequency was set at 2.5 kHz, then the signal level was increased 16 dB.

4. The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

5. MEASUREMENT RESULTS: ATTACHED

TRANSMITTER SPURIOUS EMISSION

TEST A. OCCUPIED BANDWIDTH (IN-BAND SPURIOUS)
TEST B. OUT-OF-BAND SPURIOUS



(1) AUDIO OSCILLATOR/GENERATOR

HP 204D	___
HP 8903A	x
HP 3312A	___
_____	___

(2) COAXIAL ATTENUATOR

NARDA 766-10	___
SIERRA 661A-30	x
BIRD 8329 (30 dB)	x
_____	___

(3) FILTERS; NOTCH, HP, LP, BP

CIRQTEL FHT	___
EAGLE TNF-1	x
PHELPS DODGE PD-495-8	___
_____	___

(4) SPECTRUM ANALYZER

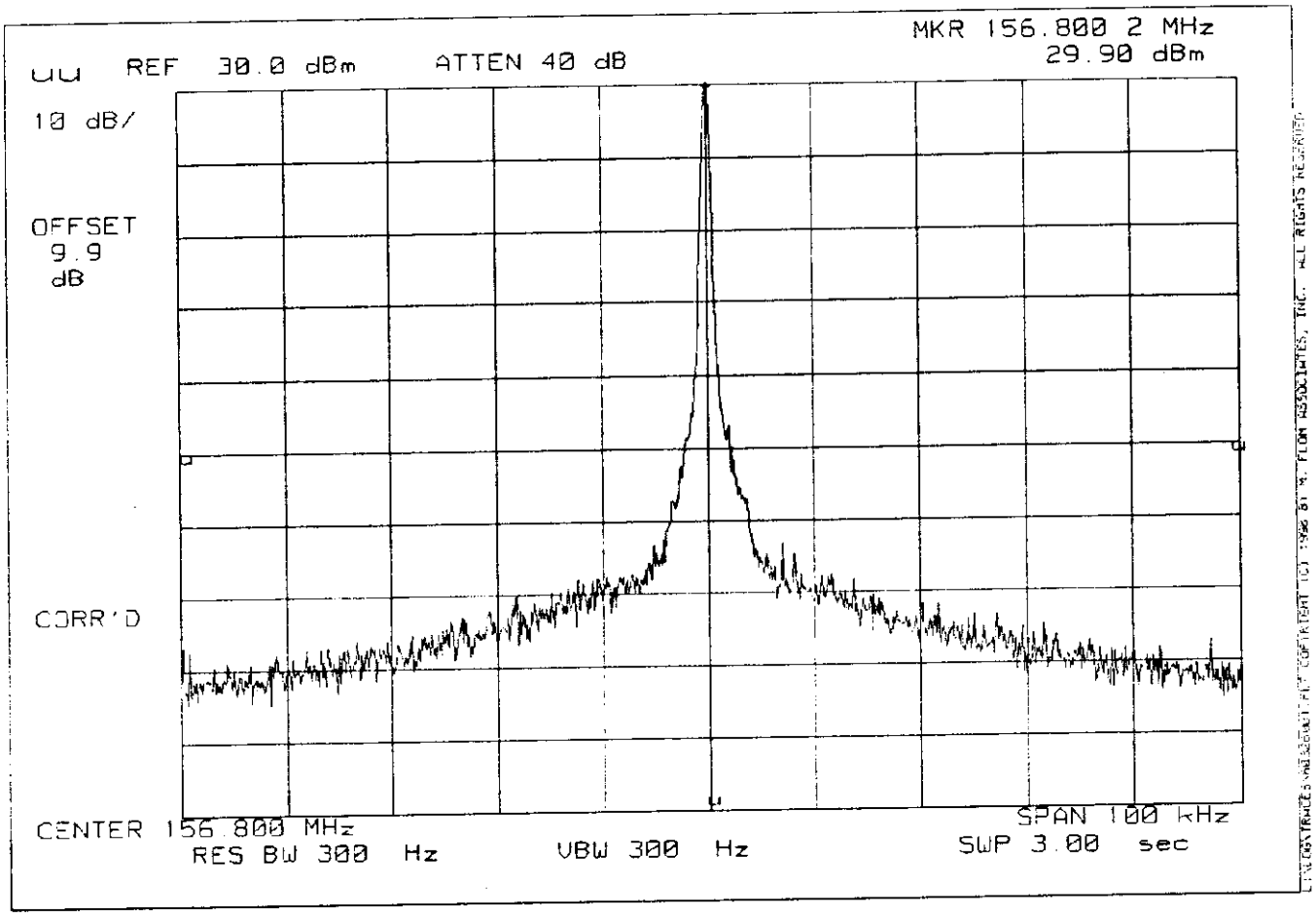
HP 8566B	x
HP 8563E	___
_____	___

(5) SCOPE

HP 1741A	___
HP 181T	___
TEK 935	___
_____	___

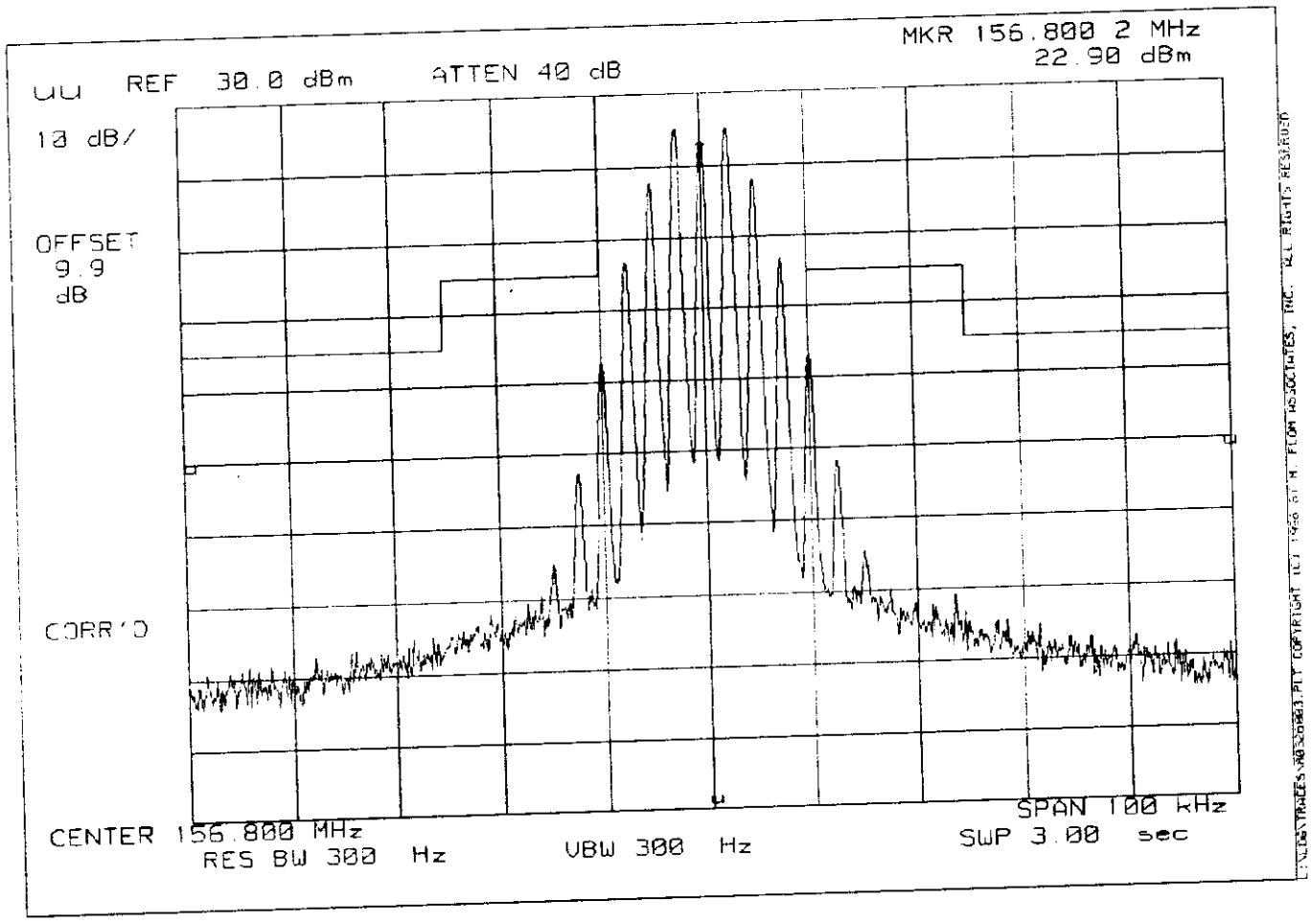
PAGE 17.1.
SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-MAY-26, 08:26, TUE

POWER: LOW
MODULATION: NONE



PAGE 17.2.
SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-MAY-26, 08:30, TUE

POWER: LOW
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF



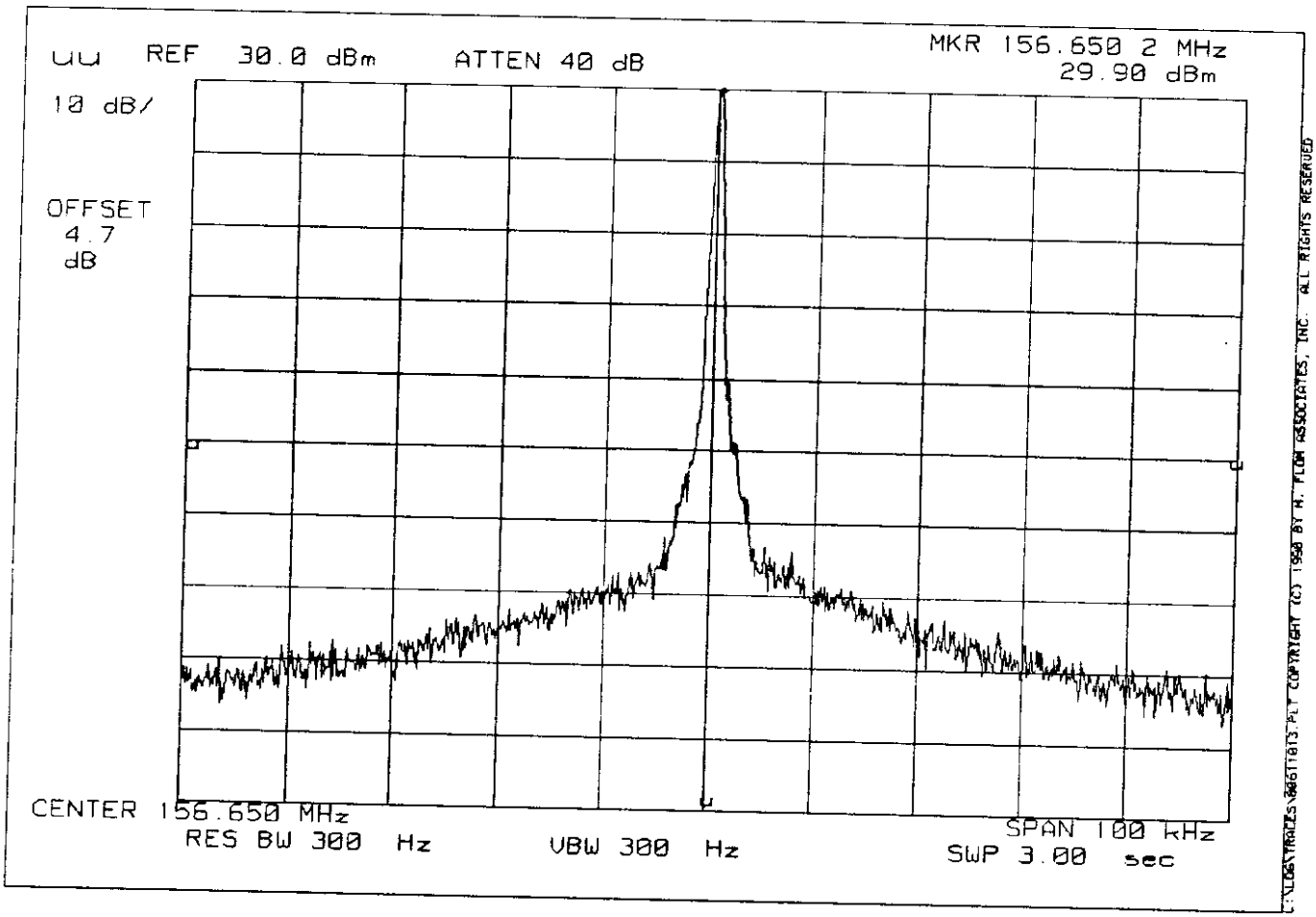
PAGE 17.3.

ASLRAY100

SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-JUN-11, 10:52, THR

POWER: LOW
MODULATION: NONE

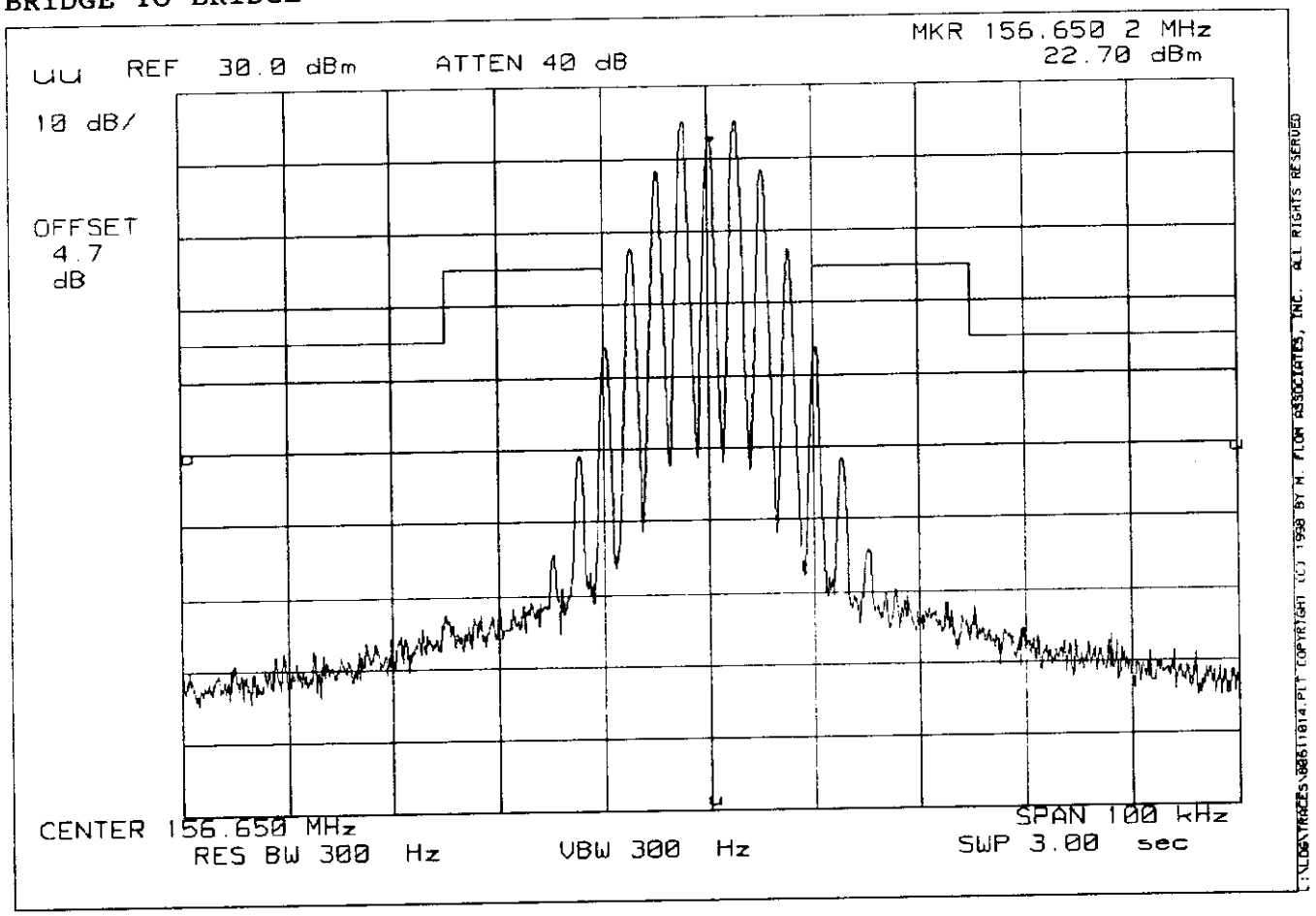
BRIDGE TO BRIDGE



PAGE 17.4.
SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-JUN-11, 10:53, THR

POWER: LOW
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF

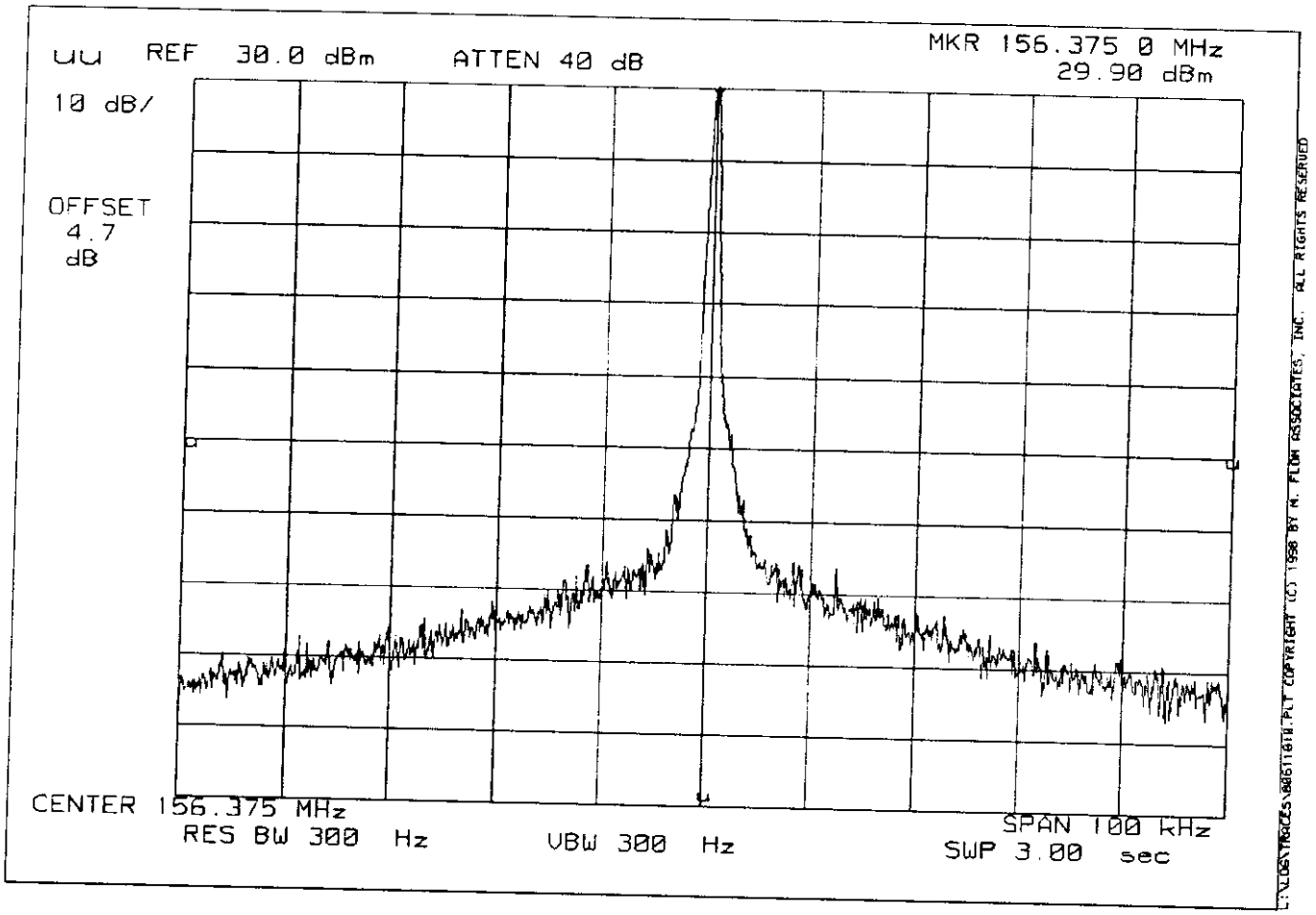
BRIDGE TO BRIDGE



SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-JUN-11, 10:26, THR

POWER: LOW
MODULATION: NONE

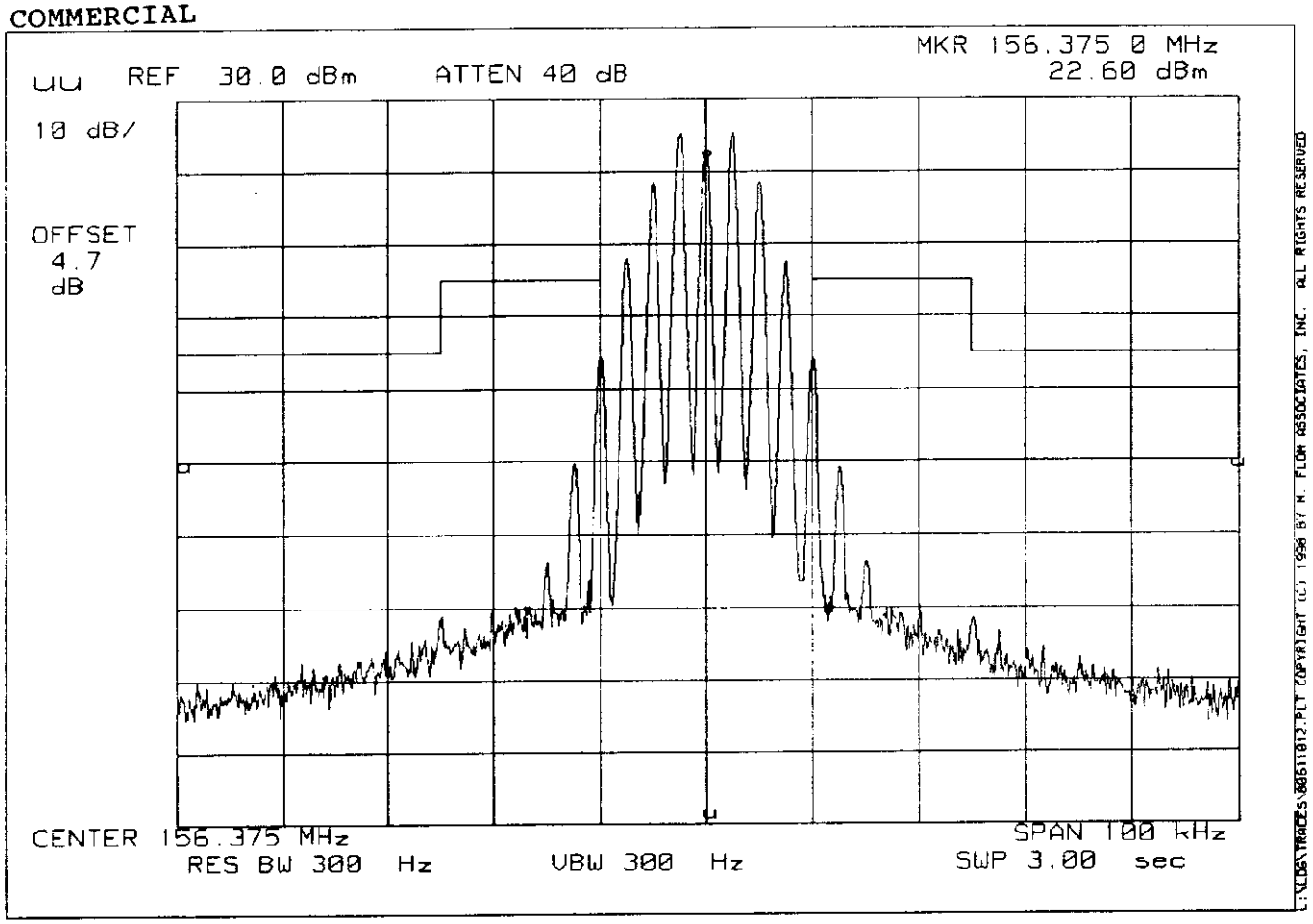
COMMERCIAL



PAGE 17.6.
SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-JUN-11, 10:29, THR

POWER: LOW
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF

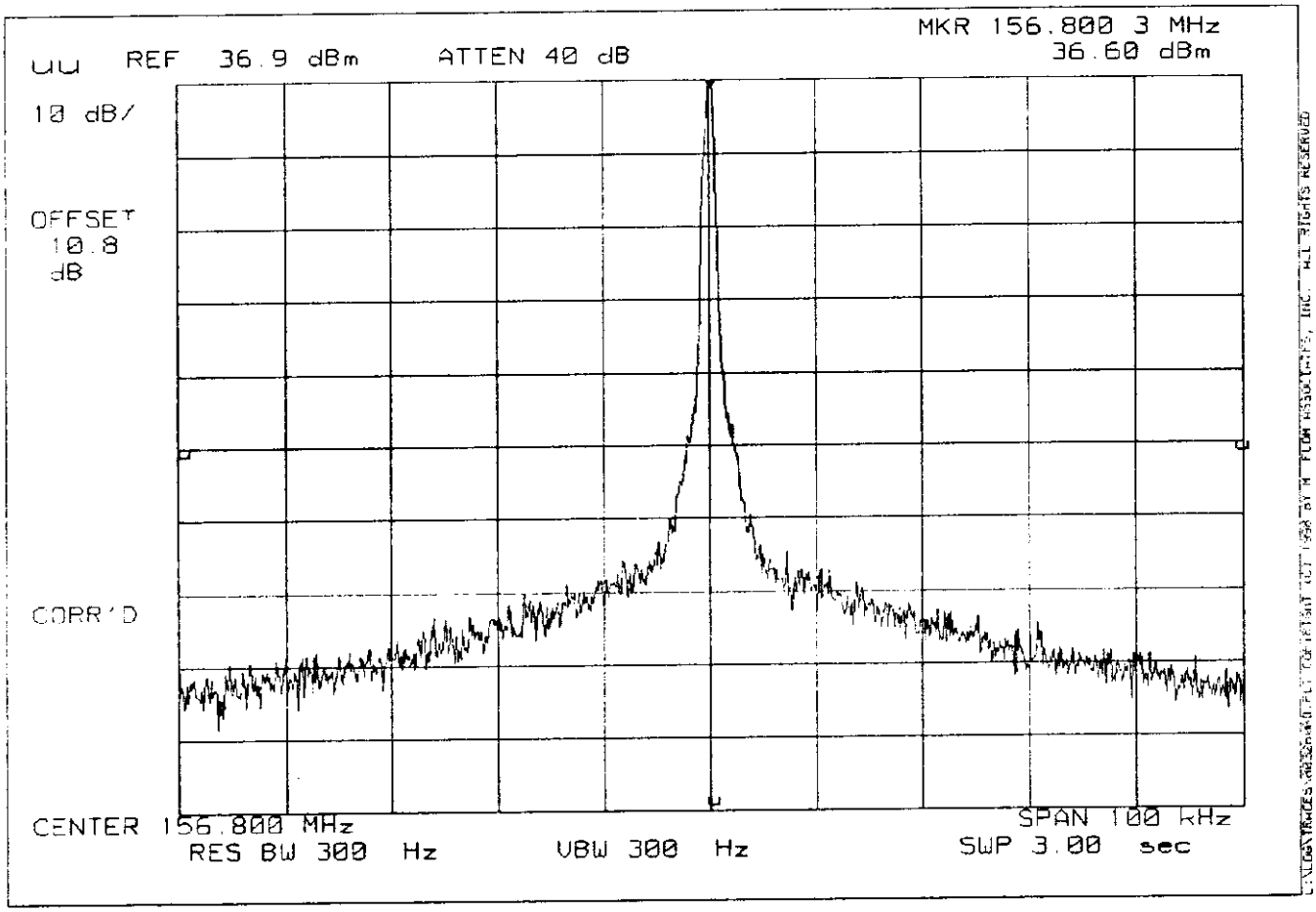
COMMERCIAL



ASLRAY100

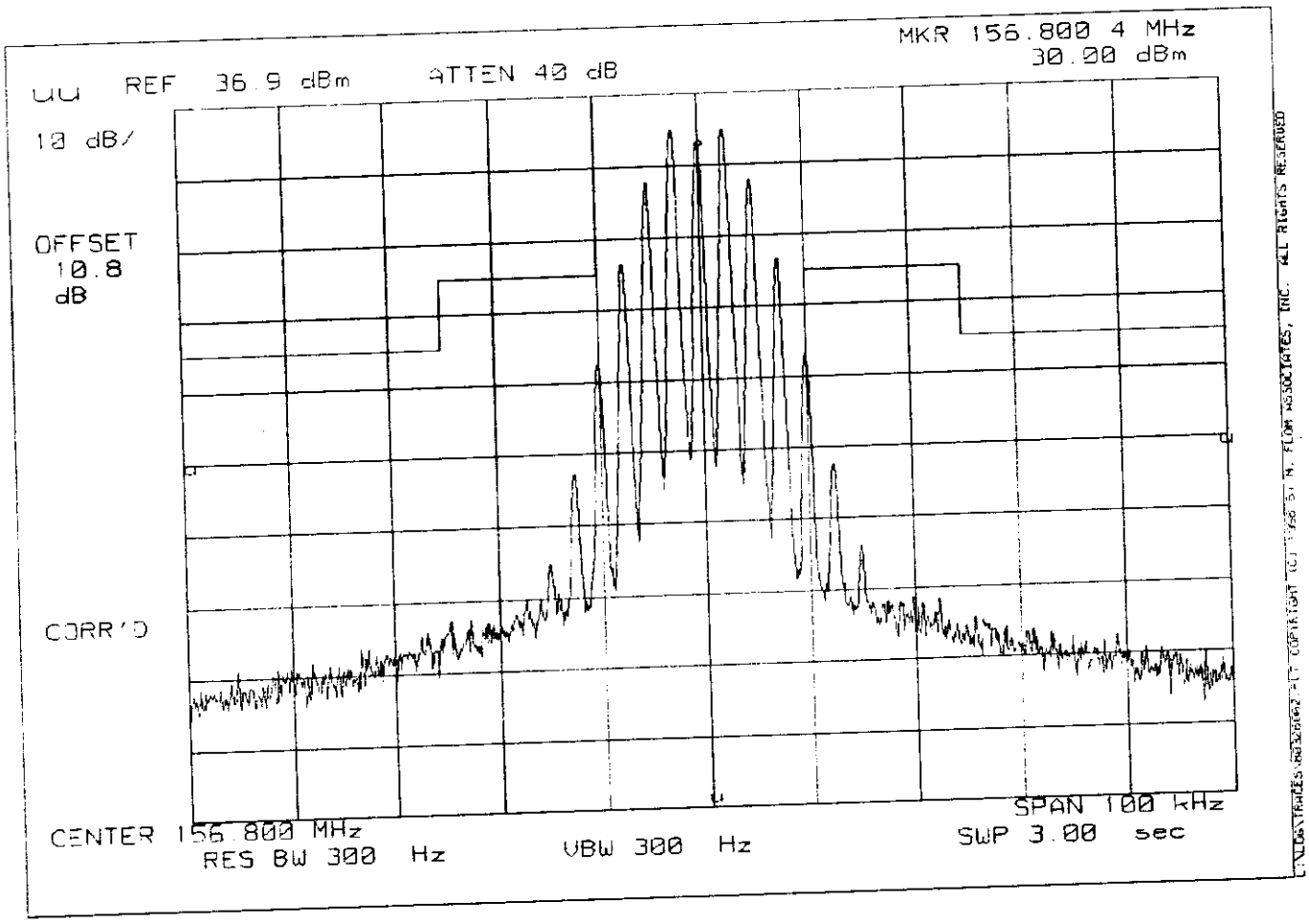
SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-MAY-26, 08:23, TUE

POWER: HIGH
MODULATION: NONE



PAGE 17.8.
SPECTRUM ANALYZER PRESENTATION
RAYTHEON, Ray 100
1998-MAY-26, 08:29, TUE

POWER: HIGH
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF



NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

PARAGRAPH: 47 CFR 2.991

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The emissions were measured for the worst case as follows:

   (a): within a band of frequencies defined by the carrier frequency plus and minus one channel.

   (b): from the lowest frequency generated in the E.U.T. and to at least the 10th harmonic of the carrier frequency, or 40 GHz, whichever is lower.

2. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

3. MEASUREMENT RESULTS: ATTACHED

FREQUENCY OF CARRIER, MHz	= 156.8, 156.65, 156.375
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
MAXIMUM RESPONSE, Hz	= 2820
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc: $-(43 + 10 \text{ LOG } P_O)$	= −50 (5 Watts) −43 (1 Watt)

SUPERVISED BY: MORTON FLOM, P. Eng.

G86B001
TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)
POWER: LOW

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	LEVEL, µW
156.375	469.130	-31.8	-61.8	1
156.375	625.495	-32.6	-62.6	1
156.375	781.901	-29.4	-59.4	1
156.375	938.262	-38.4	-68.4	0
156.375	1094.651	-40.0	-70.0	0
156.375	1250.823	-51.0	-81.0	0
156.375	1407.391	-49.0	-79.0	0
156.375	1563.325	-51.0	-81.0	0
156.375	1720.410	-52.2	-82.2	0
156.375	1876.398	-52.6	-82.6	0
156.375	2033.168	-51.1	-81.1	0
156.375	2189.077	-52.4	-82.4	0
156.375	2345.325	-51.4	-81.4	0

G85Q001
TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED)
POWER: HIGH

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	LEVEL, µW
156.800	313.780	-19.3	-56.2	12
156.800	470.387	-38.8	-75.7	0
156.800	627.189	-34.6	-71.5	0
156.800	783.992	-33.9	-70.8	0
156.800	940.776	-35.5	-72.4	0
156.800	1097.623	-40.4	-77.3	0
156.800	1254.375	-43.4	-80.3	0
156.800	1411.050	-43.4	-80.3	0
156.800	1567.951	-43.4	-80.3	0
156.800	1725.144	-44.1	-81.0	0
156.800	1881.590	-42.8	-79.7	0
156.800	2038.233	-42.6	-79.5	0
156.800	2194.890	-42.4	-79.3	0
156.800	2351.660	-41.5	-78.4	0

NAME OF TEST: FIELD STRENGTH OF SPURIOUS RADIATION

PARAGRAPH: 47 CFR 2.993 (a)

GUIDE: SEE MEASUREMENT PROCEDURE BELOW

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. A description of the measurement facilities was filed with the FCC and was found to be in compliance with the requirements of Section 15.38, by letter from the FCC dated March 3, 1997, FILE 31040/SIT. All pertinent changes will be reported to the Commission by up-date prior to March 2000.

2. At first, in order to locate all spurious frequencies and approximate amplitudes, and to determine proper equipment functioning, the test sample was set up at a distance of three meters from the test instrument. Valid spurious signals were determined by switching the power on and off.

3. In the field, the test sample was placed on a wooden turntable above ground at three (or thirty) meters away from the search antenna. The test sample was connected to an R.F. Wattmeter and a 50 ohm dummy load, and adjusted to its rated output.

   In order to obtain the maximum response at each spurious frequency, the turntable was rotated. Also, the Search Antennas were raised and lowered vertically, and all cables were oriented. Excess power lead was coiled near the power supply.

4. A signal generator, connected with a non-radiating cable to a vertically polarized half-wave antenna (for each frequency involved) was substituted for the transmitter. The Search Antenna was raised and lowered to obtain maximum indicated.

5. The signal generator output was adjusted until a signal level indication equal to that from the transmitter was obtained.

6. Steps 4 and 5 were repeated, using a horizontally polarized half-wave antenna. The higher of the two observations was noted.

NAME OF TEST: FIELD STRENGTH OF SPURIOUS RADIATION

PARAGRAPH: 47 CFR 2.993 (a)

MEASUREMENT PROCEDURE (CONT.)

7. Power into the half-wave antenna was calculated from the characteristic impedance of the line, and the voltage output from the signal generator.

8. The level of each spurious radiation with reference to the transmitter power in dB, was calculated from:

$$\text{SPURIOUS LEVEL, dB} = 10 \text{ LOG } \frac{\text{(Calculated Spurious Power) [from para. 7].}}{\text{Tx Power (Wattmeter)}}$$

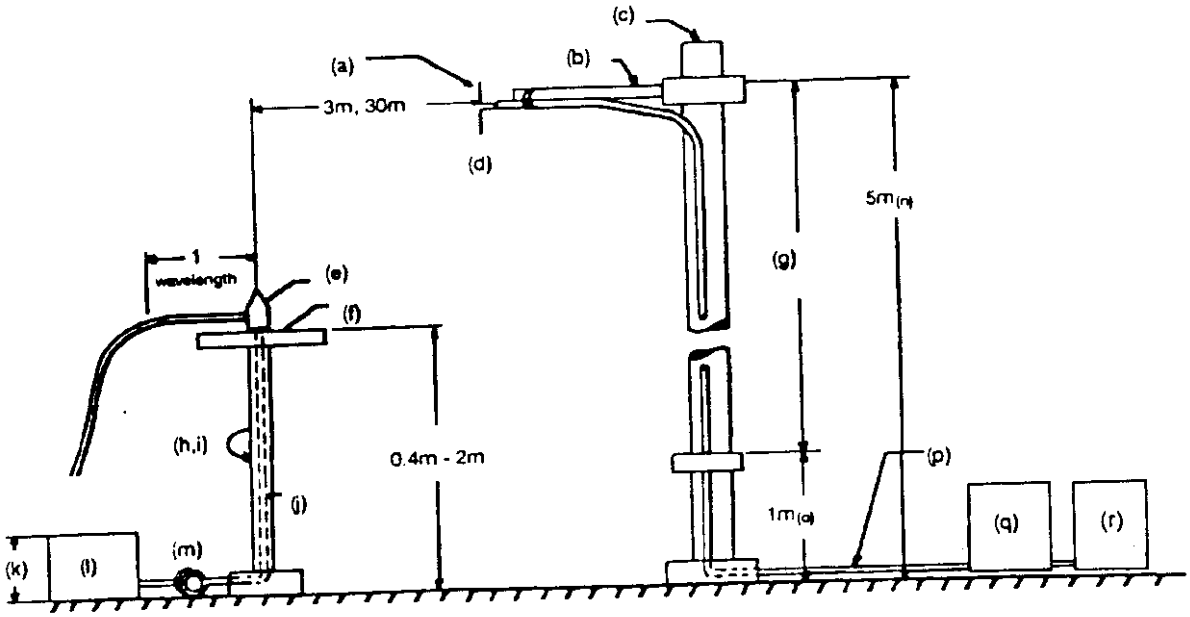
9. The worst case for all channels is shown.

10. Measurement summary:

FREQUENCY OF CARRIER, MHz	= 156.8, 156.65, 156.375
SPECTRUM SEARCHED, GHz	= 0 to 10 x F_C
ALL OTHER EMISSIONS	= ≥ 20 dB BELOW LIMIT
LIMIT, dBc	= −50 (5 Watts) −43 (1 Watt)

10. Measurement results: ATTACHED

RADIATED TEST SETUP



NOTES:

(a) Search Antenna - Rotatable on boom.
(b) Non-metallic boom.
(c) Non-metallic mast.
(d) Adjustable horizontally.
(e) Equipment Under Test.
(f) Turntable.
(g) Boom adjustable in height.
(h) External control cables routed horizontally at least one wavelength.
(i) Rotatable.
(j) Cables routed through hollow turntable center.
(k) 30 cm or less.
(l) External power source.
(m) 10 cm diameter coil of excess cable.
(n) 25 cm (V), 1 m-7 m (V, H).
(o) 25 cm from bottom end of 'V', 1 m normally.
(p) Calibrated Cable at least 10 m in length.
(q) Amplifier (optional).
(r) Spectrum Analyzer.

TRANSMITTER SPURIOUS EMISSIONS (RADIATED FIELD STRENGTH)

ALL OTHER EMISSIONS = ≥ 20 dB BELOW LIMIT

EMISSION, MHz/HARMONIC	SPURIOUS LEVEL BELOW CARRIER, dBc	
	Lo	Hi
2nd to 10th	<-55	<-55

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: FREQUENCY STABILITY - TEMPERATURE VARIATION

PARAGRAPH: 47 CFR 2.995 (a)(1), 80.209

GUIDE: TIA/EIA STANDARD 603

TEST CONDITIONS: AS INDICATED

TEST EQUIPMENT: AS PER ATTACHED PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. and test equipment were set up as shown on the following page.

2. With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute.

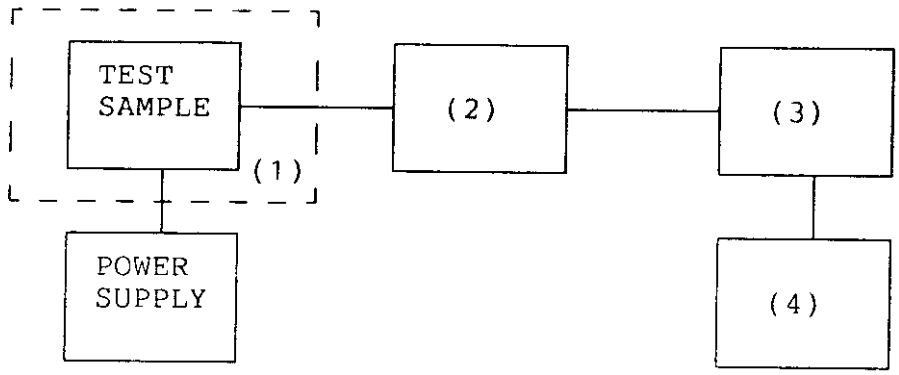
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

4. The temperature tests were performed for the worst case.

5. MEASUREMENT RESULTS: ATTACHED

TRANSMITTER TEST SET-UP

TEST A. OPERATIONAL STABILITY
TEST B. CARRIER FREQUENCY STABILITY
TEST C. OPERATIONAL PERFORMANCE STABILITY
TEST D. HUMIDITY
TEST E. VIBRATION
TEST F. ENVIRONMENTAL TEMPERATURE
TEST G. FREQUENCY STABILITY: TEMPERATURE VARIATION
TEST H. FREQUENCY STABILITY: VOLTAGE VARIATION



(1) TEMPERATURE, HUMIDITY, VIBRATION

TENNEY TEMPERATURE CHAMBER	x
WEBER HUMIDITY CHAMBER	
L.A.B. RVH 18-100	

(2) COAXIAL ATTENUATOR

NARDA 766-10	
SIERRA 661A-30	x
BIRD 8329 (30 dB)	x

(3) R.F. POWER

HP 435A POWER METER	
HP 436A POWER METER	x
HP 8901A POWER MODE	x

(4) FREQUENCY COUNTER

HP 5383A	
HP 5334B	x
HP 8901A	x

Model Name: RAY100
FCC ID :

Serial Number :
Class of Emission: 16K0G3E

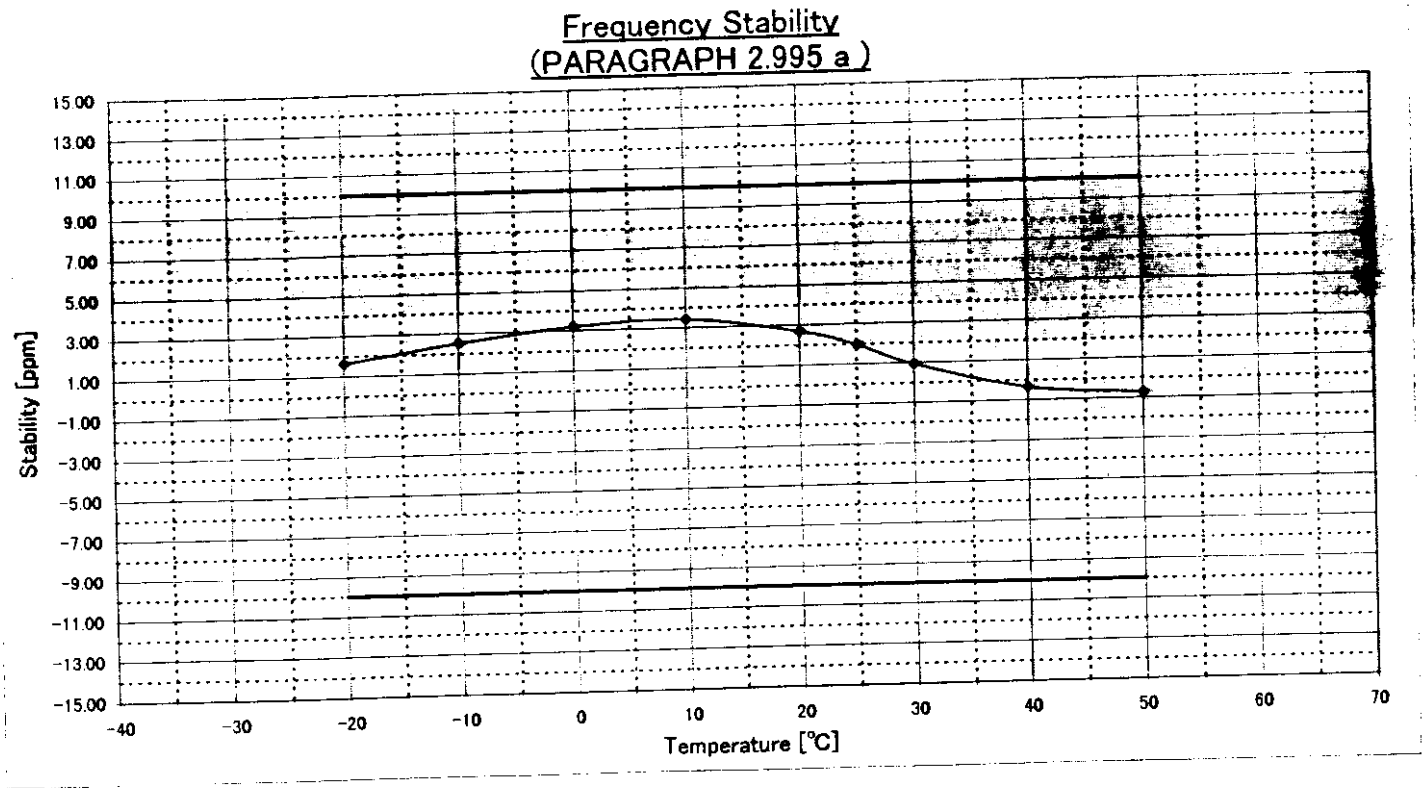
Carrier Frequency Stability-Voltage Variation
(PARAGRAPH 2.995 a)

STV [%]	Voltage [V]	Change in Frequency [MHz]	[Hz]	[ppm]
100.00	6.00	156.800030	29.99999998	0.19
85.00	5.10	156.800000	0	0
115.00	6.90	156.799996	-4.00000002	-0.03

Carrir Frequency Stability - Time
Center Frequency (156.800MHz)

TIME (sec)	Difference (ppm)
0	-0.10
10	-0.15
20	-0.26
30	-0.36
40	-0.45
50	-0.53
60	-0.59
90	-0.73
120	-0.83
150	-0.92
180	-0.99
210	-1.05
240	-1.09
270	-1.13
300	-1.15

Carrier Frequency Stability - Temperature Variation
(PARAGRAPH 2.2.2)



NAME OF TEST: FREQUENCY STABILITY - VOLTAGE VARIATION

PARAGRAPH: 47 CFR 2.995 (b)(1)

GUIDE: SEE MEASUREMENT PROCEDURE BELOW

TEST CONDITIONS: AS SHOWN

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. was placed in a temperature chamber at 25±5°C and connected as for "Frequency Stability - Temperature Variation" test.

2. The power supply voltage to the E.U.T. was varied from 85% to 115% of the nominal value measured at the input to the E.U.T.

3. The variation in frequency was measured for the worst case.

MEASUREMENT RESULTS

LIMIT, ppm = 10
LIMIT, Hz = 1568

STV, %	Vdc	CHANGE IN FREQUENCY, Hz	
85	5.1	156800030	30
100	6.0	156800000	0
115	6.9	156799960	-40
BATTERY END POINT:	4.8	156800030	30

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: USER CONTROLS

PARAGRAPH: 47 CFR 80.203(b)

GUIDE:

TEST CONDITIONS:

TEST EQUIPMENT:

STATEMENT

The external controls of this maritime station transmitter capable of operation in the 156-162 MHz band only provides for selection of maritime channels for which the maritime station is authorized. This transmitter is not capable of being programmed by station operators using external controls to transmit on channels other than those programmed by the manufacturer, service or maintenance personal.

The EUT fully complies with the requirements of 47 CFR 80.203(b).

NAME OF TEST: AUTOMATIC DEACTIVATION (TIME-OUT TIMER)

PARAGRAPH: 47 CFR 80.203(c)

GUIDE:

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

(c) All VHF ship station transmitters that are either manufactured in or imported into the United States, on or after August 1, 1993, or are installed on or after August 1, 1994, must be equipped with an automatic timing device that deactivates the transmitter and reverts the transmitter to the receive mode after an uninterrupted transmission period of five minutes, plus or minus 10 per cent. Additionally, such transmitters must have a device that indicates when the automatic timer has deactivated the transmitter. VHF ship station transmitters initially installed before August 1, 1994, are authorized for use indefinitely at the same maritime station. VHF handheld, portable transmitters are not required to comply with the requirements in paragraph (c) of this section except when used as described in 80.141.

THE TRANSMITTER MEETS THESE REQUIREMENTS

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: POWER OUTPUT OVER TIME

PARAGRAPH: 47 CFR 80.959(c)(1)(2) & (3)

GUIDE:

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT PROCEDURE

1. The E.U.T. was connected to a resistive coaxial attenuator of normal load impedance, and the unmodulated output power was measured by means of an R. F. Power Meter.

2. Measurement accuracy is ±3%.

3. The transmitter was operated continuously.

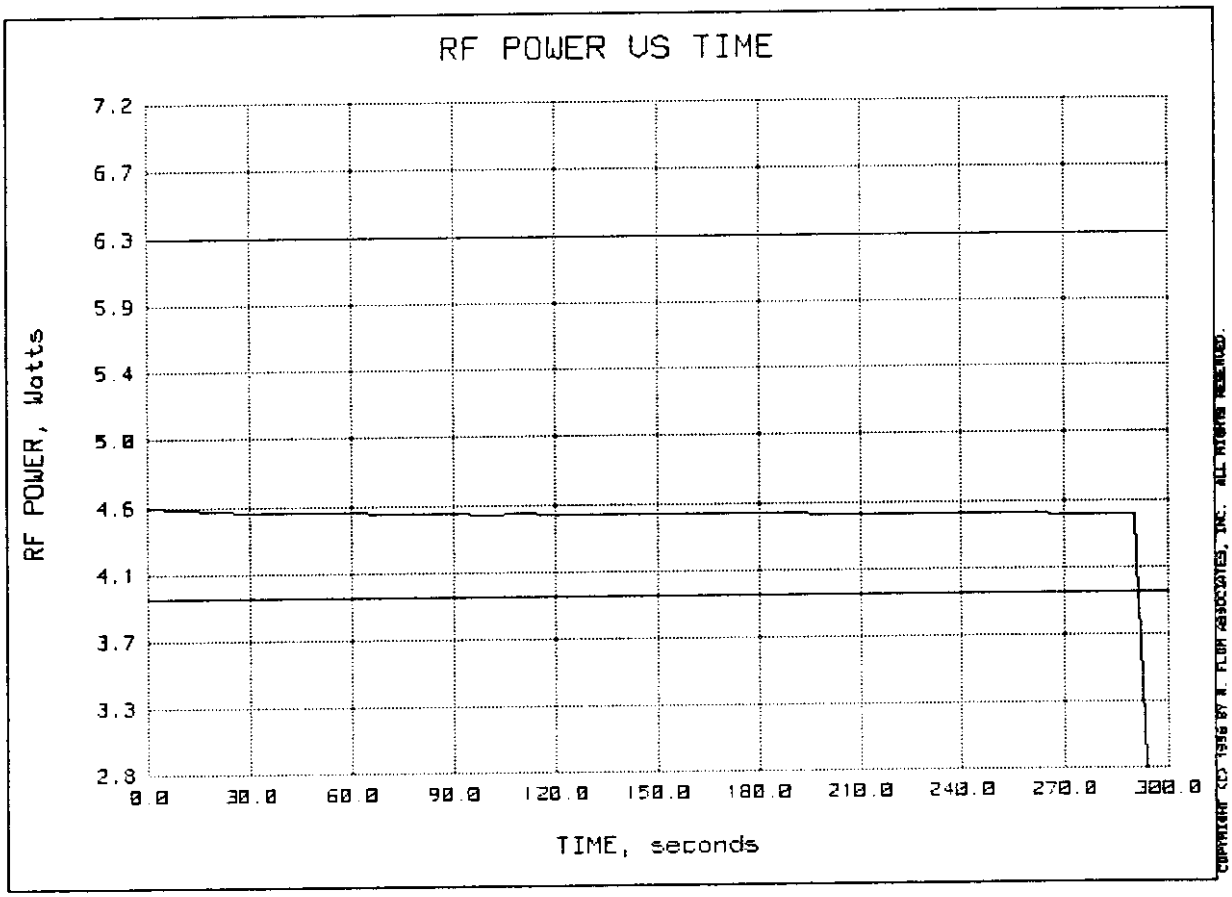
4. MEASUREMENT SUMMARY:

TIME, min.	SUPPLY VOLTAGE, Vdc	R. F. POWER OUTPUT, WATTS
0	13.8	5
5	13.8	5

MEASUREMENT RESULTS: ATTACHED

SUPERVISED BY: MORTON FLOM, P. Eng.

RF POWER VS TIME
RAYTHEON, Ray 100
1998-MAY-26, 09:42



NOMINAL, Watts	= 5
UPPER LIMIT, dB	= 1.0
UPPER LIMIT, Watts	= 6.29
LOWER LIMIT, dB	= 1.0
LOWER LIMIT, Watts	= 3.97

SUPERVISED BY:

MORTON FLOM, P. Eng.

NAME OF TEST: SUBPART T - G3E EMISSIONS

PARAGRAPH: 47 CFR 80.956(a) & (b)

GUIDE:

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT PROCEDURE

1. Each VHF R/T installation must be capable of transmitting and receiving G3E emissions.

MEASUREMENT RESULTS

NOMINAL, MHz	CHANNEL	R.F. POWER OUTPUT, WATTS Lo	Hi
156.300	06	1	1/5
156.550	11	1	5
156.600	12	1	1/5
156.650	13	1	1/5
156.700	14	1	5
156.800	16	1	1/5

*Automatic switching to one Watt or less.

RULE 80.891

CHANNEL RECEIVER FREQUENCY	MHZ	SENSITIVITY, µv
16	156.800	0.176

THE TRANSMITTER AND RECEIVER MEET THESE REQUIREMENTS.

M. Flom P. Eng

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: SUBPART T –
G3E EMISSIONS & RECEIVER SENSITIVITY

PARAGRAPH: 47 CFR 80.961(a) & (b)

GUIDE:

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

MEASUREMENT RESULTS

(a) The receiver is capable of reception of G3E emissions on the required frequencies.

(b) The sensitivity of the receiver at 20 dB SINAD is better than:

SENSITIVITY, dBm = -122.1

SENSITIVITY, μV = 0.176

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: SUBPART U - BRIDGE-TO-BRIDGE ACT

PARAGRAPH: 47 CFR 80.1011, 80.1013

GUIDE:

TEST CONDITIONS: S. T. & H.

TEST EQUIPMENT: AS PER PREVIOUS PAGE

RESULTS

80.1011 Transmitter.

The transmitter is capable of G3E emissions on the navigational frequency 156.650 MHz (Channel 13) and the Coast Guard liaison frequency 157.100 MHz (Channel 22). Additionally the transmitter is capable of transmission of G3E emissions on navigational frequency of 156.375 MHz (Channel 67) while transmitting in any of the applicable waters.

MHz	CHANNEL	Watts, G3E
13	156.650	1/5
22A	157.100	1/5
67	156.375	1/5

80.1013 Receiver.

The receiver is capable of reception of G3E emissions on the navigational frequency of 156.650 MHz (Channel 13) and the Coast Guard liaison frequency 157.100 MHz (Channel 22A). In addition, the receiver is capable of reception of G3E emissions on the navigational frequency of 156.375 MHz (Channel 67) while receiving in any of the applicable waters.

MHz	CHANNEL	Sensitivity, µv
13	156.650	0.176
22A	157.100	0.176
67	156.375	0.176

SUPERVISED BY: MORTON FLOM, P. Eng.

NAME OF TEST: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

PARAGRAPH: 47 CFR 2.202(g)

MODULATION = 16K0G3E

NECESSARY BANDWIDTH CALCULATION:

MAXIMUM MODULATION (M), kHz	= 3
MAXIMUM DEVIATION (D), kHz	= 5
CONSTANT FACTOR (K)	= 1
NECESSARY BANDWIDTH (B_N), kHz	= (2 x M) + (2 x D x K)
	= 16.0

SUPERVISED BY:

M. Flom P. Eng.

MORTON FLOM, P. Eng.

NAME OF TEST: DIGITAL SELECTIVE CALLING (DSC)

PARAGRAPH: 47 CFR 80.373

DSC RECEIVE ONLY

CHANNEL	MHZ	SENSITIVITY, µv
70	156.625	0.176

EUT designed to ITU 493-6(5) & RTCM 56-95/SC101-STD

§ 15.205 Restricted Bands of operation. ASLRAY100

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505 [1]	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

TESTIMONIAL
AND
STATEMENTOF CERTIFICATION

ASLRAY100

THIS IS TO CERTIFY:

1. THAT the application was prepared either by, or under the direct supervision of, the undersigned.

2. THAT the technical data supplied with the application was taken under my direction and supervision.

3. THAT the data was obtained on representative units, randomly selected.

4. THAT, to the best of my knowledge and belief, the facts set forth in the application and accompanying technical data are true and correct.

CERTIFYING ENGINEER:

M.T. Flom P. Eng.

MORTON FLOM, P. Eng.

STATEMENT OF QUALIFICATIONS

EDUCATION:

1. B. ENG. in ENGINEERING PHYSICS, 1949, McGill University, Montreal, Canada.
2. Post Graduate Studies, McGill University & Sir George Williams University, Montreal.

PROFESSIONAL AFFILIATIONS:

1. ARIZONA SOCIETY OF PROFESSIONAL ENGINEERS (NSPE), #026 031 821.
2. ORDER OF ENGINEERS (QUEBEC) 1949. #4534.
3. ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOPHYSICISTS & GEOLOGISTS OF ALBERTA #5916.
4. REGISTERED ENGINEERING CONSULTANT - GOVERNMENT OF CANADA, DEPARTMENT OF COMMUNICATIONS. Radio Equipment Approvals.
5. IEEE, Lifetime Member No. 0417204 (member since 1947).

EXPERIENCE:

1. Research/Development/Senior Project Engineer, R.C.A. LIMITED (4 years).
2. Owner/Chief Engineer of Electronics. Design/Manufacturing & Cable TV Companies (10 years).
3. CONSULTING ENGINEER (over 25 years).

M. Flom P. Eng.

MORTON FLOM, P. Eng.

TEST INSTRUMENTATION LIST

All equipment calibrated within last 90 days

ADAPTER
HP X281 (Coaxial waveguide); HP S281; HP 85659 (Quasi peak)

AMPLIFIER
Pre-amp. HP 10885A (2-1300 MHz); HP 8447D, HP 8447F, HP 8449A

ANTENNA *See end*

ATTENUATOR
Kay 4320; Power, Sierra 661A-30; Narda 76610; Narda 4779-3, -6, -10 dB

AUDIO OSCILLATOR
HP 204D; AIEC DTC-1; Motorola S-1333B; HP 3312A; HP 8903A

BATTERY
Sears Diehard, Stock #4341

CAMERA
Oscilloscope, Tektronix C5A; Polaroid Impulse AF; Kodak DC-50

CAPACITOR
Feed-Thru, 10 µF, Solar 6512-106R; Solar 7525-1

CLOSE FIELD PROBE
HP 11940A, 11941A, HP 11945A

COMPUTER
HP 332; HP Vectra 486/25VL; Various PC COmpatables

CONVERTOR, Down
HP 117 108

COUPLER
Narda 1080, Waveguide; HP S750E (Cross guide); Waveline 274/40; Solar 7415-3; Solar 7835-891 & -896

CURRENT PROBE
Solar 6741-1

DETECTOR
HP 8470B

DIGITAL MULTIMETER
HP 3476A w/H.F. Probe; Fluke 8030A-01; HP 3478A

DISTORTION ANALYZER
HP 334A; HP 8903A

ELECTRONIC COUNTER
HP 5383A; HP 5334B

FILTER
Cirqtel FHT/7-50-57/ 50-1A/1B (HP); Jerrold TLB-1; THB-1, Piezo 5064; Eagle TNF-I Series, Krohn-Hite 3202; Phelps-Dodge #PD-495-8; Newtone #PD6000 Line Protector; 870-890 MHz (Lab Design); 900 MHz (Lab Design); Solar High-Pass s/n 882029

FREQ. DEV. METER
HP 8901A

FREQ. DOUBLER
HP 11721A

FREQUENCY METER
HP 537A; HP 536A

GENERATOR
Solar 6550-1 (power sweep); HP 8640B, GAW 1012, HP 8656A (signal); Solar 8282-1 (spike)

HUMIDITY CHAMBER
Embem Co FW30; Bowser 0

LIMITER, R.F
HP 11867A; HP 11693A; HP 10509A

LISN
Singer 91221-1; Ailtech 94641-1 (50µH)

LOAD, POWER
Telewave TLW-25; Bird 8329

MILLIAMETER
HP 428B

MIXER
HP 10514A; Mini-Circuits TAK-1H

OPEN FIELD SITE
As filed with FCC & IC and kept up-dated.
TURNTABLES:
Up to 2000# capacity
GROUND SCREEN:
Complies with docket 80-284
ANTENNA MAST:
Complies as above

OSCILLOSCOPE
HP 1741A; HP 181T; Tektronix T935; HP 54502A

PHANTOM
M.F.A. Labs Left and Right human head

PLOTTER
HP 7470; HP7475A

POWER METER
AF GR 1840A; HP 435A with 8481A & 8482H Power Sensors; HP 436A; HP 8901A

POWER SUPPLY
HP 6286A; Heathkit 1P 2711; 1P 5220; Honda EM400 (portable gas gen.); HP 6012

PRINTER
Brother HL-8; Brother HL-10V; HP DeskJet 640C

R. F. PRESELECTOR
HP 85685A

RADIATION METER
Narda 8717 w/8010 Amp, 8021B and 8760 probes

RESISTOR, PRECISION
Solar 7144-1.0, 7144-10.0; Solar 8525-1

SCALE
Weigh-Tronix 3632T-50

SCANNER
HP 9190A Scanjet

SCREEN ROOM
Lindgren 22-2/2-0

SIGNAL LEVEL METER
Jerrold 704B

SIGNAL SAMPLER
R. F. Bird 4273-030, 4275-030

SINAD/VOLTMETER
Helper Sinadder

SPECTRUM ANALYZER
HP 8558B, 8557; HP 8563E; HP 853A; HP 8566B/8568B

TEMPERATURE CHAMBER
Tenney, Jr

TEMPERATURE PROBE
Fluke 80T-150C

TERMINATION
Narda 320B Waveguide. Waveline #281

TEST SET
Semi-Automatic: HP 8953A; HP 8954A Interface: Computer / Controller; P.S. Programmer; HP 59501A; RF Communications: HP 8920A

TRANSFORMERS
Audio Isolation: Solar 6220-1A; Impedance: HP 11694A; Isolation: Solar 7032-1; Matching: Solar 7033-1

TRANSMISSION & NOISE MEASURING SET
HP 3555B

VIBRATION CHAMBER
Unholtz-Dickie T 500; Unholtz-Dickie T 4000

VOLTMETER
HP 410C; HP 3478A

WATTMETER
Bird 43, Sierra 174A-2

ANTENNAS

30 - 50 Hz
Emco 7603 M-Field; Emco 7604 M-Field

20 - 200 MHz
Aprel Biconical Model AAB20200

20 - 300 MHz
Emco Biconical H-Field

25 - 1000 MHz
Singer DM-105A; EMCO 3121C

200 - 1000 MHz
Aprel Log Periodic, Model AALP 2001

10 kHz - 30 MHz
Emco 3107B, E-Field; Emco 3101B/1, Rod E-Field

10 kHz - 32 MHz
Singer 94593-1 (Loop)

150 kHz - 32 MHz
Singer 92197-1 (41")

150 kHz - 32 MHz
Singer 93049-1 (9')

1 - 10 GHz
Singer 90794-A Discone

1 - 18 GHz
Horn: Aprel Model AAH-118

18 - 40 GHz
Emco 3116, Horn

40 - 60 GHz
Horn: HP 11970U, HP 11971U, HP 11975A (Lo Drive Amplifier)

50 - 75 GHz
Mixer, HP 11970V, HP 11971V

75 - 110 GHz
Mixer, HP 11970W