

MFA **M. Flom Associates, Inc. - Global Compliance Center**
3356 North San Marcos Place, Suite 107, Chandler, Arizona 85225-7176
www.mflom.com general@mflom.com (480) 926-3100, FAX: 926-3598

Date: January 21, 2000

Federal Communications Commission
VIA ELECTRONIC FILING

Attention: Authorization & Evaluation Division

Applicant: Raytheon Marine Company
Equipment: RAY53
FCC ID: ASLRAY53
FCC Rules: 80 Subparts T & U

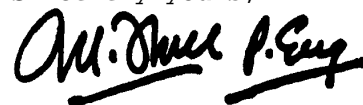
Gentlemen: **PLEASE SEE AGENT AUTHORIZATION FOR NEW ADDRESS**

On behalf of the Applicant, enclosed please find Application Form 731, Engineering Test Report and all pertinent documentation, the whole for approval of the referenced equipment as shown.

Filing fees are attached.

We trust the same is in order. Should you need any further information, kindly contact the writer who is authorized to act as agent.

Sincerely yours,



Morton Flom, P. Eng.

enclosure(s)
cc: Applicant
MF/cvr

LIST OF EXHIBITS
(FCC **CERTIFICATION** (TRANSMITTERS) - REVISED 9/28/98)

APPLICANT: Raytheon Marine Company

FCC ID: ASLRAY53

BY APPLICANT:

1. LETTER OF AUTHORIZATION
2. IDENTIFICATION DRAWINGS, 2.1033(c)(11)
 - ___ LABEL
 - ___ LOCATION OF LABEL
 - ___ COMPLIANCE STATEMENT
 - ___ LOCATION OF COMPLIANCE STATEMENT
3. PHOTOGRAPHS, 2.1033(c)(12)
4. DOCUMENTATION: 2.1033(c)
 - (3) USER MANUAL
 - (9) TUNE-UP/ALIGNMENT PROCEDURE
 - (10) SCHEMATIC DIAGRAM
 - (10) OPERATIONAL DESCRIPTION
 - BLOCK DIAGRAM
 - PARTS LIST
 - ACTIVE DEVICES
5. PART 90.203(e) & (g) ATTESTATION

BY M.F.A. INC.

- A. TESTIMONIAL & STATEMENT OF CERTIFICATION
- B. STATEMENT OF QUALIFICATIONS

MFA **M. Flom Associates, Inc. - Global Compliance Center**
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Sub-part
2.1033(c):

EQUIPMENT IDENTIFICATION

FCC ID: ASLRAY53

NAMEPLATE DRAWING

ATTACHED, EXHIBIT 1.

LOCATION

AS PER LABEL DRAWING(S)

DATE OF REPORT

January 21, 2000

SUPERVISED BY:



Morton Flom, P. Eng.

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.

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Required information per ISO/IEC Guide 25-1990, paragraph 13.2:

- a) TEST REPORT
- b) Laboratory: M. Flom Associates, Inc.
(FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107
(Canada: IC 2044) Chandler, AZ 85225
- c) Report Number: d0010049
- d) Client: Raytheon Marine Company
22 Cotton Road, Unit H
Nashua, NH 03063-4219
- e) Identification: RAY53
FCC ID: ASLRAY53
Description: VHF Marine Band Transceiver
- f) EUT Condition: Not required unless specified in individual tests.
- g) Report Date: January 21, 2000
EUT Received: January 17, 2000
- h, j, k): As indicated in individual tests.
- i) Sampling method: No sampling procedure used.
- l) Uncertainty: In accordance with MFA internal quality manual.
- m) Supervised by: 
Morton Flom, P. Eng.
- n) Results: The results presented in this report relate only to the item tested.
- o) Reproduction: This report must not be reproduced, except in full, without written permission from this laboratory.

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LIST OF GENERAL INFORMATION REQUIRED FOR CERTIFICATION

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

80

Sub-part 2.1033

(c)(1): NAME AND ADDRESS OF APPLICANT:

Raytheon Marine Company
22 Cotton Road, Unit H
Nashua, NH 03063-4219

MANUFACTURER:

Kanematsu Corporation
22nd Floor, Seavans N. Bldg.
2-1, Shibaura 1-Chome
Minato-Ku, Tokyo 105, Japan

(c)(2): FCC ID: ASLRAY53

MODEL NO: RAY53

(c)(3): INSTRUCTION MANUAL(S):

PLEASE SEE ATTACHED EXHIBITS

(c)(4): TYPE OF EMISSION: 16K0G3E

(c)(5): FREQUENCY RANGE, MHz: 156.025 to 163.275

(c)(6): POWER RATING, Watts: 1 to 25
 x Switchable Variable N/A

(c)(7): MAXIMUM POWER RATING, Watts: 25

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Subpart 2.1033 (continued)

(c)(8): 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	=	13.6

(c)(9): TUNE-UP PROCEDURE:

PLEASE SEE ATTACHED EXHIBITS

(c)(10): CIRCUIT DIAGRAM/CIRCUIT DESCRIPTION:

Including description of circuitry & devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation and limiting power.

PLEASE SEE ATTACHED EXHIBITS

(c)(11): LABEL INFORMATION:

PLEASE SEE ATTACHED EXHIBITS

(c)(12): PHOTOGRAPHS:

PLEASE SEE ATTACHED EXHIBITS

(c)(13): DIGITAL MODULATION DESCRIPTION:

 ATTACHED EXHIBITS

 x N/A

(c)(14): TEST AND MEASUREMENT DATA:

FOLLOWS

M. Flom Associates, Inc. is accredited by the American Association for Laboratory Association (A2LA) as shown in the scope below.



THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

M. FLOM ASSOCIATES, INC.
Chandler, AZ

for technical competence in the field of

Electrical (EMC) Testing


The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC Guide 25-1990 "General Requirements for the Competence of Calibration and Testing Laboratories" (equivalent to relevant requirements of the ISO 9000 series of standards) and any additional program requirements in the identified field of testing.

Presented this 24th day of November, 1998.



Peter Abney
President
For the Accreditation Council
Certificate Number 1008.01
Valid to December 31, 2000

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical (EMC) Scope of Accreditation



American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC GUIDE 25-1990 AND EN 45001

M. FLOM ASSOCIATES, INC.
Electronic Testing Laboratory
3356 North San Marcos Place, Suite 107
Chandler, AZ 85224-1571
Morton Flom Phone: 602 926 3100

ELECTRICAL (EMC)

Valid to: December 31, 2000 Certificate Number: 1008-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following **electromagnetic compatibility tests**:

Tests	Standard(s)
RF Emissions	FCC Part 15 (Subparts B and C) using ANSI C63.4-1992; CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; FCC Part 18; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1
RF Immunity	EN 50082-1; EN 50082-2; AS/NZS 4251.1
Radiated Susceptibility	EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3
ESD	EN 61000-4-2; IEC 1000-4-2; IEC 801-2
EFT	EN 61000-4-4; IEC 1000-4-4; IEC 801-4
Surge	EN 61000-4-5; ENV 50142; IEC 1000-4-5; IEC 801-5
47 CFR (FCC)	2, 21, 22, 23, 24, 74, 80, 87, 90, 95, 97

Peter Abney

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8307 • Phone: 301 644 3200 • Fax: 301 662 2974

"This laboratory is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this report have been determined in accordance with the laboratory's terms of accreditation unless stated otherwise in the report."

Should this report contain any data for tests for which we are not accredited, or which have been undertaken by a subcontractor that is not A2LA accredited, such data would not covered by this laboratory's A2LA accreditation.

PAGE NO.

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Sub-part

2.1033(c)(14):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 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057 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
- x 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
- 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
- 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)
- 97 - Amateur Radio Service
- 101 - Fixed Microwave Services

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STANDARD TEST CONDITIONS
and
ENGINEERING PRACTICES

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

In accordance with ANSI C63.4-1992, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT 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.

VHF RADIOTELEPHONE FREQUENCIES

CH	TX FREQ.	POWER		CH	TX FREQ.	POWER	
		LOW	HIGH			Low	High
1	156.050	X	X	61	156.075	X	X
2				62			
3	156.150	X	X	63	156.175	X	X
4				64	156.225	X	X
5	156.250	X	X	65	156.275	X	X
6	156.300	X	X	66	156.325	X	X
7	156.350	X	X	67	156.375		X
8	156.400	X	X	68	156.425	X	X
9	156.450	X	X	69	156.475	X	X
10	156.500	X	X	70	156.525		
11	156.550	X	X	71	156.575	X	X
12	156.600	X	X	72	156.625	X	X
13	156.650		X	73	156.675	X	X
14	156.700	X	X	74	156.725	X	X
15				75			
16	156.800	X	X	76			
17	156.850		X	77	156.875		X
18	156.900	X	X	78	156.925	X	X
19	156.950	X	X	79	156.975	X	X
20	157.000	X	X	80	157.025	X	X
21	157.050	X	X	81	157.075	X	X
22	157.100	X	X	82	157.125	X	X
23	157.150	X	X	83	157.175	X	X
24	157.200	X	X	84	157.225	X	X
25	157.250	X	X	85	157.275	X	X
26	157.300	X	X	86	157.325	X	X
27	157.350	X	X	87	157.375	X	X
28	157.400	X	X	88	157.425	X	X

PAGE NO. 8 of 41.
NAME OF TEST: R.F. Power Output
SPECIFICATION: 47 CFR 2.1046(a)
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.1
TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

1. The EUT 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, WATTS	
		LO	HI
156.300	06	1	25
156.550	11	1	25
156.600	12	1	25
156.650	13* Mobile Only	1	**1/25
156.700	14	1	25
156.750	15	1	25
156.800	16	1	25
156.850	17* Mobile Only	1	**1/25
156.875	67* Mobile Only	1	**1/25

*Automatic switching to low power.

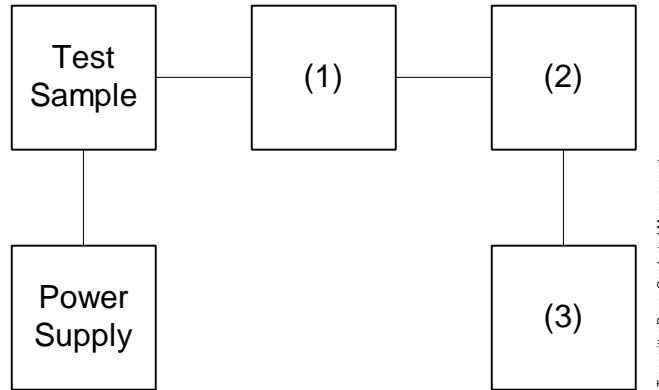
**High power with manual over-ride, see attached manual.

SUPERVISED BY:

Morton Flom, P. Eng.

TRANSMITTER POWER CONDUCTED MEASUREMENTS

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



Asset	Description	s/n
(as applicable)		
(1)	<u>COAXIAL ATTENUATOR</u>	
i00122	Narda 766-10	7802
i00123	Narda 766-10	7802A
i00069	Bird 8329 (30 dB)	1006
i00113	Sierra 661A-3D	1059
(2)	<u>POWER METERS</u>	
i00014	HP 435A	1733A05836
i00039	HP 436A	2709A26776
i00020	HP 8901A POWER MODE	2105A01087
(3)	<u>FREQUENCY COUNTER</u>	
i00042	HP 5383A	1628A00959
i00019	HP 5334B	2704A00347
i00020	HP 8901A FREQUENCY MODE	2105A01087

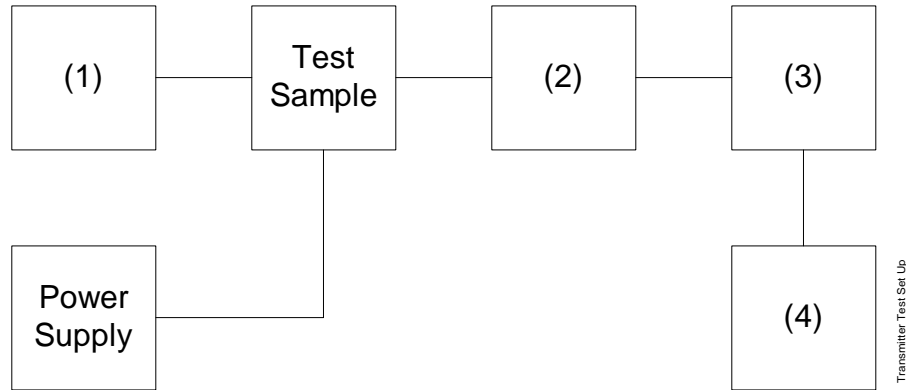
PAGE NO. 10 of 41.
NAME OF TEST: Audio Frequency Response
SPECIFICATION: 47 CFR 2.1047(a)
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.6
TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

1. The EUT 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 EUT.
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

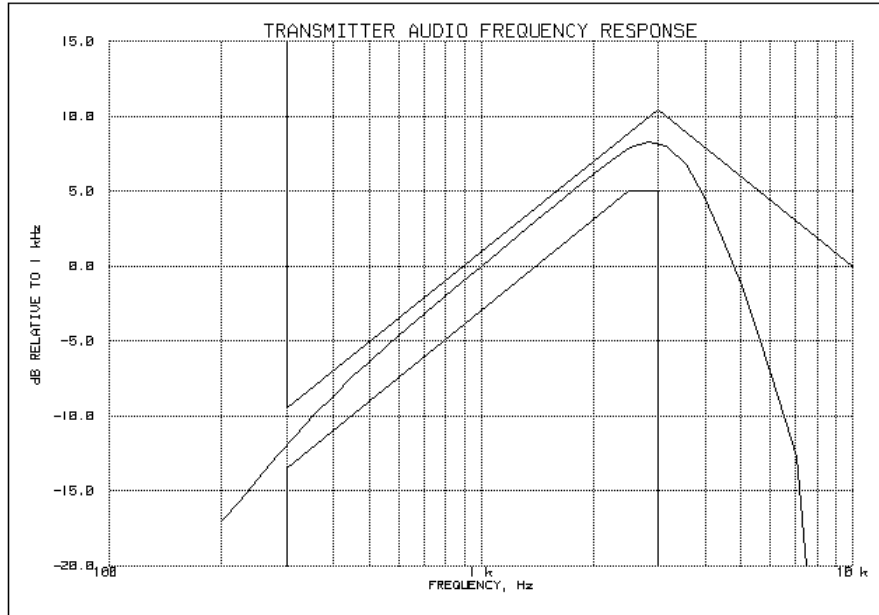


Asset	Description (as applicable)	s/n
(1)	<u>Audio Oscillator</u>	
i00010	HP 204D	1105A04683
i00017	HP 8903A	2216A01753
i00118	HP 33120A	US36002064
(2)	<u>COAXIAL ATTENUATOR</u>	
i00122	NARDA 766-10	7802
i00123	NARDA 766-10	7802A
i00113	SIERRA 661A-3D	1059
i00069	BIRD 8329 (30 dB)	10066
(3)	<u>MODULATION ANALYZER</u>	
i00020	HP 8901A	2105A01087
(4)	<u>AUDIO ANALYZER</u>	
i00017	HP 8903A	2216A01753

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NAME OF TEST: Audio Frequency Response
 g0010129: 2000-Jan-17 Mon 14:10:00
 STATE: 0:General



Additional points:

FREQUENCY, Hz	LEVEL, dB
300	-12.00
20000	-29.04
30000	-29.07
50000	-28.76

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Morton Flom, P. Eng.

PAGE NO. 13 of 41.
NAME OF TEST: Audio Low Pass Filter (Voice Input)
SPECIFICATION: 47 CFR 2.1047(a)
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.15
TEST EQUIPMENT: As per previous page

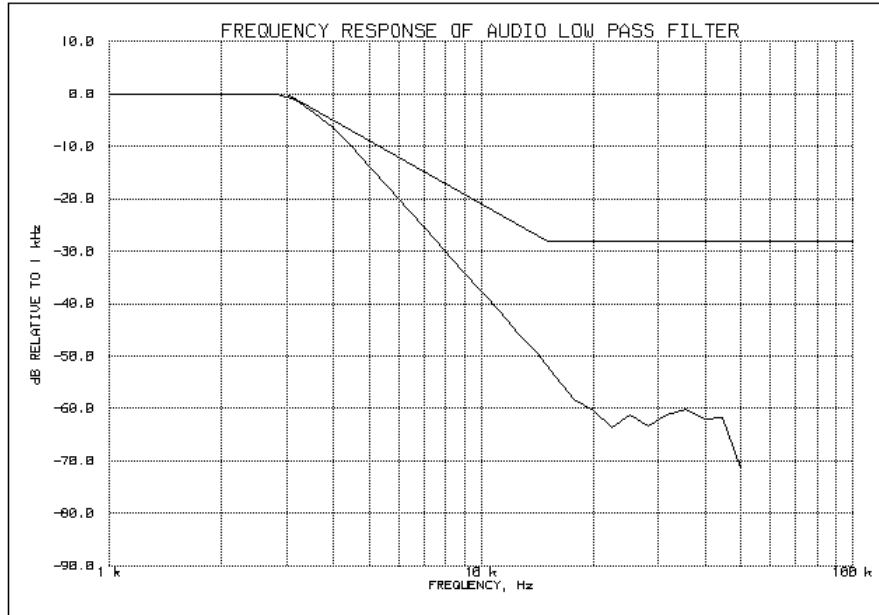
MEASUREMENT PROCEDURE

1. The EUT 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

PAGE NO.

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NAME OF TEST: Audio Low Pass Filter (Voice Input)
g0010130: 2000-Jan-17 Mon 14:15:00
STATE: 0:General



SUPERVISED BY:

Morton Flom, P. Eng.

PAGE NO. 15 of 41.
NAME OF TEST: Modulation Limiting
SPECIFICATION: 47 CFR 2.1047(b), 80.211, 80.213
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.3
TEST EQUIPMENT: As per previous page

MEASUREMENT PROCEDURE

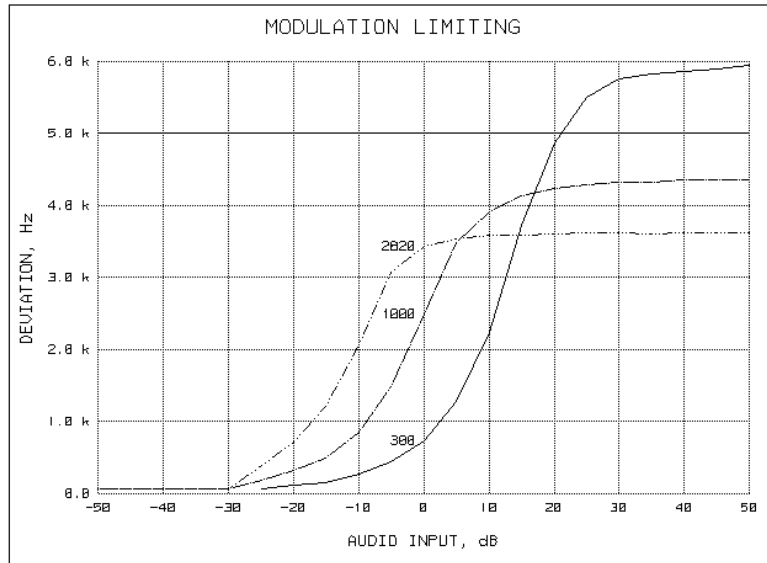
1. The signal generator was connected to the input of the EUT as for "Frequency Response of the Modulating Circuit."
2. The modulation response was measured for each of three frequencies (one of which was the frequency of maximum response), and the input voltage was varied and was observed on an HP 8901A Modulation Analyzer.
3. The 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

PAGE NO.

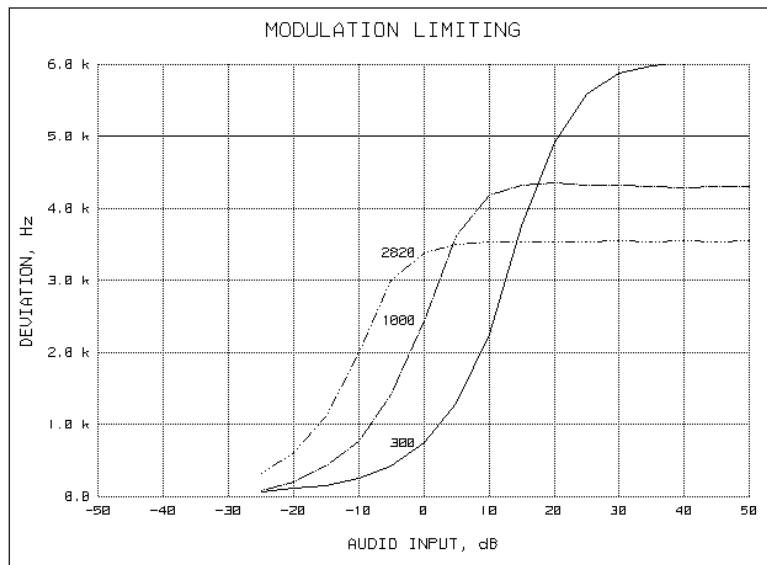
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NAME OF TEST: Modulation Limiting
g0010136: 2000-Jan-17 Mon 15:15:00
STATE: 0:General

Positive
Peaks:



Negative
Peaks:



SUPERVISED BY:

Morton Flom, P. Eng.

PAGE NO. 17 of 41.

NAME OF TEST: Emission Masks (Occupied Bandwidth)

SPECIFICATION: 47 CFR 2.1049(c)(1)

GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.11

TEST EQUIPMENT: As per previous page

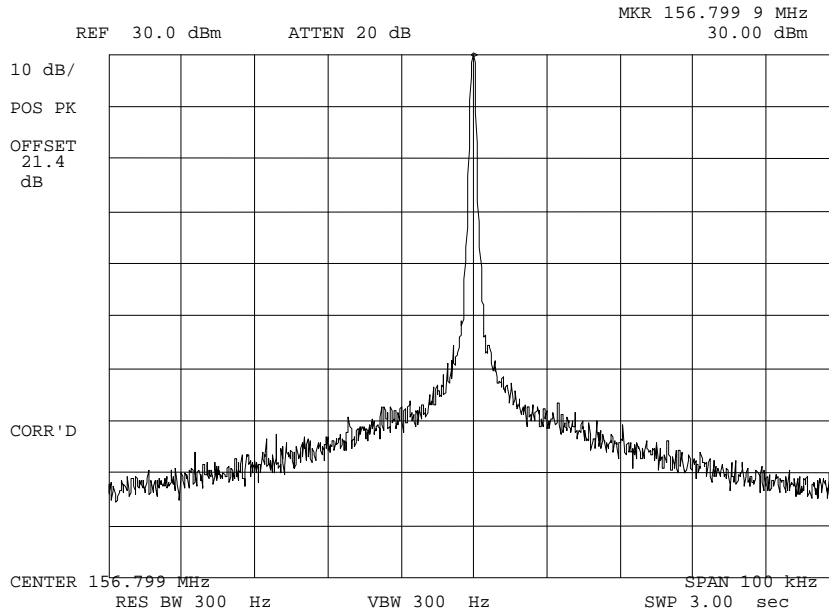
MEASUREMENT PROCEDURE

1. The EUT and test equipment were set up as shown on the following page, with the Spectrum Analyzer connected.
2. For EUTs supporting audio modulation, 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). With level constant, the signal level was increased 16 dB.
3. For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.
4. The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.
5. MEASUREMENT RESULTS: ATTACHED

PAGE NO.

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NAME OF TEST: Emission Masks (Occupied Bandwidth)
g0010171: 2000-Jan-18 Tue 10:11:00
STATE: 1:Low Power



POWER: LOW
MODULATION: NONE

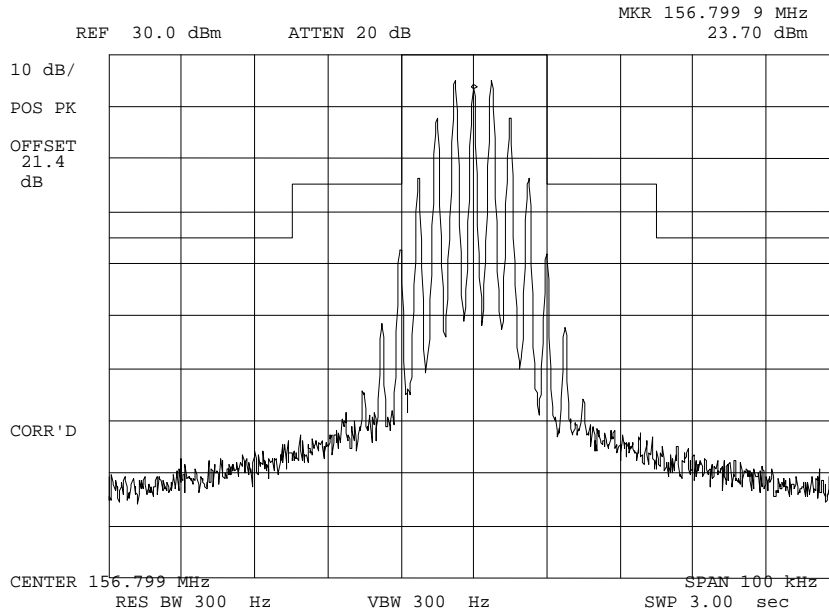
SUPERVISED BY:

Morton Flom, P. Eng.

PAGE NO.

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NAME OF TEST: Emission Masks (Occupied Bandwidth)
g0010172: 2000-Jan-18 Tue 10:17:00
STATE: 1:Low Power



POWER:
MODULATION:

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

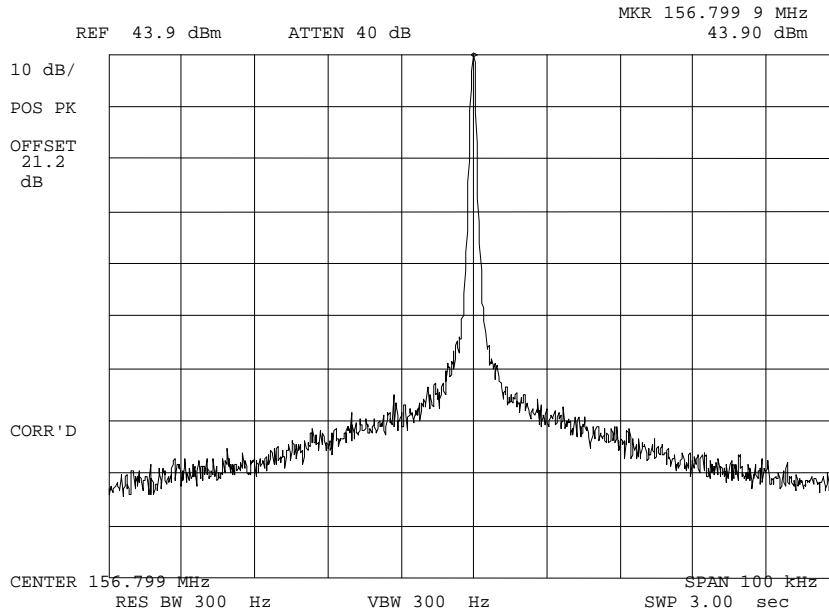
SUPERVISED BY:

Morton P. Eng
Morton Flom, P. Eng.

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NAME OF TEST: Emission Masks (Occupied Bandwidth)
g0010170: 2000-Jan-18 Tue 10:09:00
STATE: 2:High Power



POWER: HIGH
MODULATION: NONE

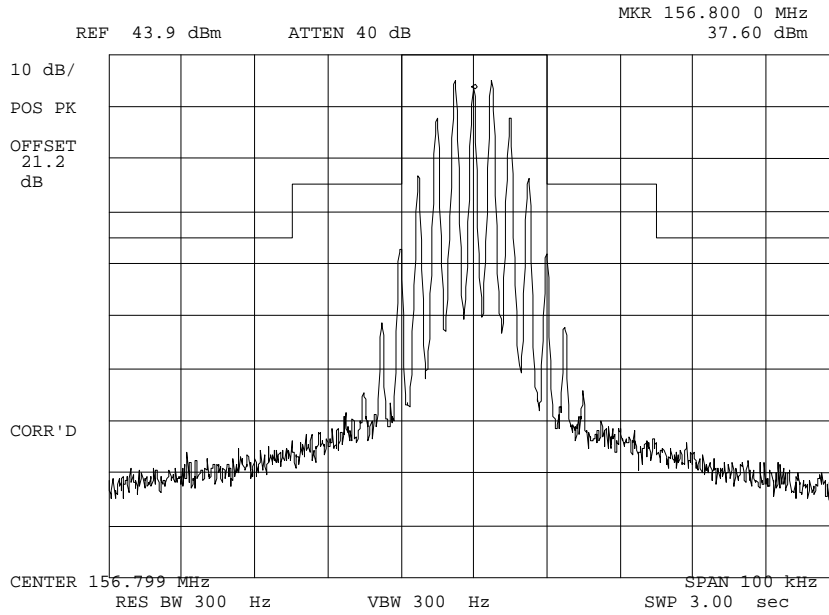
SUPERVISED BY:

Morton Flom, P. Eng.

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NAME OF TEST: Emission Masks (Occupied Bandwidth)
g0010173: 2000-Jan-18 Tue 10:18:00
STATE: 2:High Power



POWER:
MODULATION:

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

SUPERVISED BY:

Morton Flom, P. Eng.

PAGE NO. 22 of 41.

NAME OF TEST: Spurious Emissions at Antenna Terminals

SPECIFICATION: 47 CFR 2.1051

GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.13

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 EUT and to at least the 10th harmonic of the carrier frequency, or 40 GHz, whichever is lower.
2. The magnitude of spurious emissions that are attenuated more than 20 dB below the permissible value need not be specified.

3. MEASUREMENT RESULTS: ATTACHED FOR WORST CASE

FREQUENCY OF CARRIER, MHz	=	157.425, 156.05, 156.8
SPECTRUM SEARCHED, GHz	=	0 to 10 x F _c
MAXIMUM RESPONSE, Hz	=	2820
ALL OTHER EMISSIONS	=	= 20 dB BELOW LIMIT
LIMIT(S), dBc		
	- (43+10xLOG P) =	-43 (1 Watt)
	- (43+10xLOG P) =	-57 (25 Watts)

Morton Flom P. Eng.

SUPERVISED BY:

Morton Flom, P. Eng.

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NAME OF TEST: Spurious Emissions at Antenna Terminals
g0010176: 2000-Jan-18 Tue 10:41:00
STATE: 1:Low Power

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	MARGIN, dB
156.050000	312.102000	-48.9	-78.9	-35.9
156.800000	313.597000	-49	-79	-36
157.425000	314.838000	-49.4	-79.4	-36.4
156.050000	468.133000	-51.4	-81.4	-38.4
156.800000	470.406000	-53.9	-83.9	-40.9
157.425000	472.277000	-53.1	-83.1	-40.1
156.050000	624.192000	-46.1	-76.1	-33.1
156.800000	627.191000	-46.8	-76.8	-33.8
157.425000	629.726000	-47.1	-77.1	-34.1
156.050000	780.421000	-53.8	-83.8	-40.8
156.800000	784.003000	-52.3	-82.3	-39.3
157.425000	787.479000	-53.5	-83.5	-40.5
156.050000	936.569000	-53.2	-83.2	-40.2
156.800000	940.805000	-53	-83	-40
157.425000	944.583000	-53.8	-83.8	-40.8
156.050000	1092.471000	-53.9	-83.9	-40.9
156.800000	1097.905000	-53.9	-83.9	-40.9
157.425000	1102.351000	-53.1	-83.1	-40.1
156.050000	1248.066000	-53.4	-83.4	-40.4
156.800000	1254.540000	-53.4	-83.4	-40.4
157.425000	1259.891000	-53	-83	-40
156.050000	1404.685000	-53.3	-83.3	-40.3
156.800000	1411.339000	-52.6	-82.6	-39.6
157.425000	1416.477000	-53.2	-83.2	-40.2
156.050000	1560.355000	-52.3	-82.3	-39.3
156.800000	1568.252000	-52.2	-82.2	-39.2
157.425000	1574.045000	-53.5	-83.5	-40.5
156.050000	1716.553000	-52.7	-82.7	-39.7
156.800000	1724.327000	-52.3	-82.3	-39.3
157.425000	1731.596000	-53	-83	-40
156.050000	1873.059000	-53	-83	-40
156.800000	1881.580000	-52.9	-82.9	-39.9
157.425000	1888.920000	-52.1	-82.1	-39.1
156.050000	2028.465000	-53	-83	-40
156.800000	2038.529000	-52.2	-82.2	-39.2
157.425000	2046.866000	-52.6	-82.6	-39.6
156.050000	2184.712000	-52.2	-82.2	-39.2
156.800000	2195.482000	-51.8	-81.8	-38.8
157.425000	2203.963000	-51.9	-81.9	-38.9
156.050000	2340.692000	-52.6	-82.6	-39.6
156.800000	2351.667000	-51.3	-81.3	-38.3
157.425000	2361.380000	-49.4	-79.4	-36.4

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NAME OF TEST: Spurious Emissions at Antenna Terminals
g0010174: 2000-Jan-18 Tue 10:32:00
STATE: 2:High Power

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	MARGIN, dB
156.050000	312.302000	-34	-77.9	-21
156.800000	314.078000	-34.5	-78.4	-21.5
157.425000	314.430000	-33.3	-77.2	-20.3
156.050000	468.161000	-31.9	-75.8	-18.9
156.800000	470.388000	-31.8	-75.7	-18.8
157.425000	472.571000	-33.4	-77.3	-20.4
156.050000	624.192000	-33.8	-77.7	-20.8
156.800000	627.555000	-34	-77.9	-21
157.425000	629.737000	-32.7	-76.6	-19.7
156.050000	780.470000	-32.9	-76.8	-19.9
156.800000	783.502000	-33.9	-77.8	-20.9
157.425000	787.060000	-33	-76.9	-20
156.050000	936.129000	-33.8	-77.7	-20.8
156.800000	941.235000	-33.8	-77.7	-20.8
157.425000	944.388000	-33.7	-77.6	-20.7
156.050000	1092.047000	-34	-77.9	-21
156.800000	1097.724000	-34.1	-78	-21.1
157.425000	1101.952000	-33.8	-77.7	-20.8
156.050000	1248.057000	-33.5	-77.4	-20.5
156.800000	1254.248000	-33.3	-77.2	-20.3
157.425000	1259.554000	-32.6	-76.5	-19.6
156.050000	1404.684000	-33	-76.9	-20
156.800000	1411.194000	-33.9	-77.8	-20.9
157.425000	1416.523000	-34	-77.9	-21
156.050000	1560.711000	-34	-77.9	-21
156.800000	1568.195000	-33.5	-77.4	-20.5
157.425000	1574.385000	-32.3	-76.2	-19.3
156.050000	1716.912000	-33.1	-77	-20.1
156.800000	1724.745000	-33.3	-77.2	-20.3
157.425000	1731.893000	-33.7	-77.6	-20.7
156.050000	1872.609000	-32.7	-76.6	-19.7
156.800000	1881.980000	-33.9	-77.8	-20.9
157.425000	1889.157000	-33.5	-77.4	-20.5
156.050000	2028.344000	-32.6	-76.5	-19.6
156.800000	2038.807000	-32.3	-76.2	-19.3
157.425000	2046.924000	-32.4	-76.3	-19.4
156.050000	2185.015000	-33	-76.9	-20
156.800000	2195.663000	-30.8	-74.7	-17.8
157.425000	2204.151000	-32.5	-76.4	-19.5
156.050000	2340.516000	-32.3	-76.2	-19.3
156.800000	2352.497000	-32.7	-76.6	-19.7
157.425000	2361.635000	-32.7	-76.6	-19.7

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NAME OF TEST: Field Strength of Spurious Radiation

SPECIFICATION: 47 CFR 2.1053(a)

GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.12

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. Excess power leads were coiled near the power supply.

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

PAGE NO. 26 of 41.
NAME OF TEST: Field Strength of Spurious Radiation
SPECIFICATION: 47 CFR 2.1053(a)
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.12
TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE (CONT.)

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

$$\text{SPURIOUS LEVEL, dB} = 10 \text{ LOG} \left(\frac{\text{Calculated Spurious Power}}{\text{TX Power (Wattmeter)}} \right) \quad \text{[From Para. 7].}$$

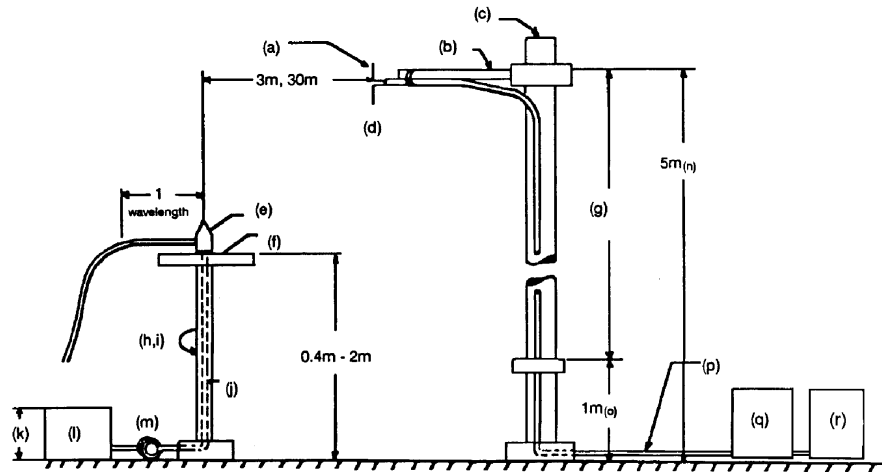
9. The worst case for all channels is shown.

10. Measurement summary:

FREQUENCY OF CARRIER, MHz	=	157.425, 156.05, 156.8
SPECTRUM SEARCHED, GHz	=	0 to 10 x F _c
ALL OTHER EMISSIONS	=	= 20 dB BELOW LIMIT
LIMIT, dBc	=	57

11. 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', 1m normally
- (p) Calibrated Cable at least 10m in length
- (q) Amplifier (optional)
- (r) Spectrum Analyzer

Asset (as applicable)	Description	s/n	Cycle	Last Cal
<u>TRANSDUCER</u>				
i00088	EMCO 3109-B 25MHz-300MHz	2336	12 mo.	Sep-99
i00089	Apral 2001 200MHz-1GHz	001500	12 mo.	Sep-99
i00103	EMCO 3115 1GHz-18GHz	9208-3925	12 mo.	Sep-99
<u>AMPLIFIER</u>				
i00028	HP 8449A	2749A00121	12 mo.	Mar-99
<u>SPECTRUM ANALYZER</u>				
i00029	HP 8563E	3213A00104	12 mo.	Aug-99
i00033	HP 85462A	3625A00357	12 mo.	May-99
i00048	HP 8566B	2511AD1467	6 mo.	May-99

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NAME OF TEST: Field Strength of Spurious Radiation

ALL OTHER EMISSIONS = = 20 dB BELOW LIMIT

EMISSION, MHz/HARMONIC	SPURIOUS LEVEL, dBc	
	Low	High
2nd to 10th	<-70	<-70

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NAME OF TEST: Frequency Stability (Temperature Variation)

SPECIFICATION: 47 CFR 2.1055(a)(1)

GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2

TEST CONDITIONS: As Indicated

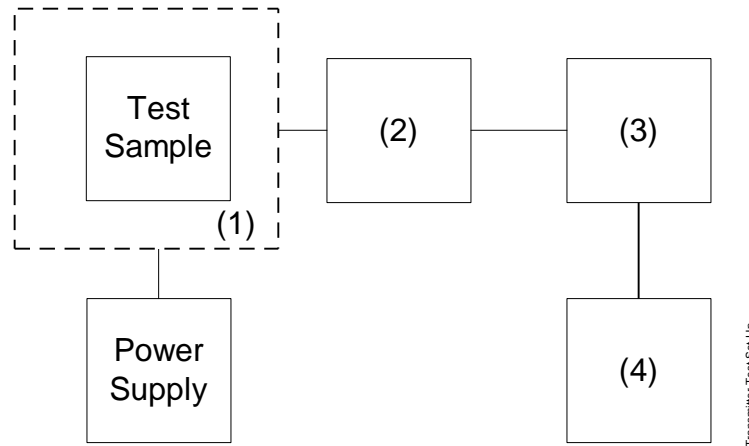
TEST EQUIPMENT: As per previous page

MEASUREMENT PROCEDURE

1. The EUT 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

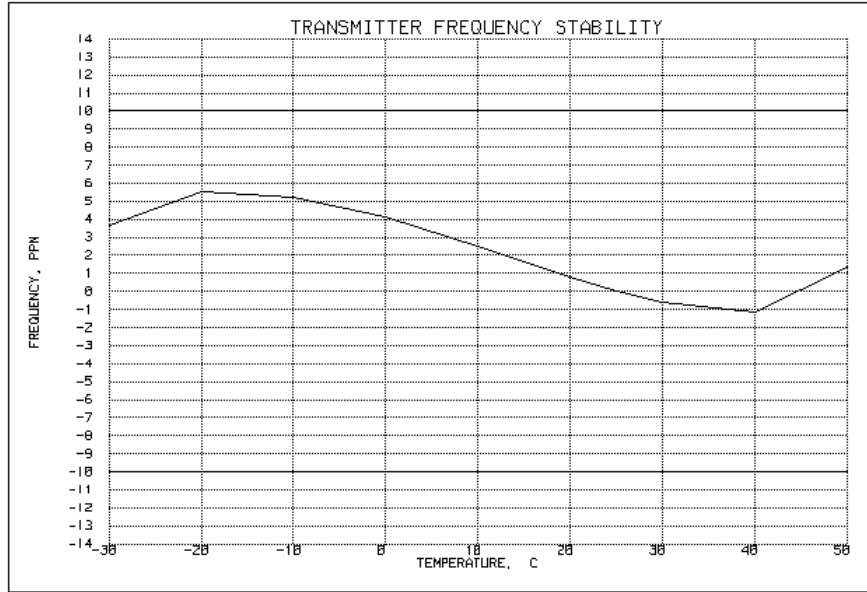


Asset	Description	s/n
(as applicable)		
(1)	<u>TEMPERATURE, HUMIDITY, VIBRATION</u>	
i00027	Tenny Temp. Chamber	9083-765-234
i00	Weber Humidity Chamber	
i00	L.A.B. RVH 18-100	
(2)	<u>COAXIAL ATTENUATOR</u>	
i00122	NARDA 766-10	7802
i00123	NARDA 766-10	7802A
i00113	SIERRA 661A-3D	1059
i00069	BIRD 8329 (30 dB)	10066
(3)	<u>R.F. POWER</u>	
i00014	HP 435A POWER METER	1733A05839
i00039	HP 436A POWER METER	2709A26776
i00020	HP 8901A POWER MODE	2105A01087
(4)	<u>FREQUENCY COUNTER</u>	
i00042	HP 5383A	1628A00959
i00019	HP 5334B	2704A00347
i00020	HP 8901A	2105A01087

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NAME OF TEST: Frequency Stability (Temperature Variation)
g0010137: 2000-Jan-17 Mon 16:34:00
STATE: 0:General



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PAGE NO. 32 of 41.
NAME OF TEST: Frequency Stability (Voltage Variation)
SPECIFICATION: 47 CFR 2.1055(b)(1)
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2
TEST EQUIPMENT: As per previous page

MEASUREMENT PROCEDURE

1. The EUT 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 EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

RESULTS: Frequency Stability (Voltage Variation)
g0010162: 2000-Jan-17 Mon 15:40:18
STATE: 0:General

LIMIT, ppm = 10
LIMIT, Hz = 1568
BATTERY END POINT (Voltage) = 7.3

% of STV	Voltage	Frequency, MHz	Change, Hz	Change, ppm
85	11.73	156.799990	-10	-0.06
100	13.8	156.800000	0	0.00
115	15.87	156.800000	0	0.00
53	7.3	156.799990	-10	-0.06

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PAGE NO. 33 of 41.
NAME OF TEST: User Controls
SPECIFICATION: 47 CFR 80.203(b)

STATEMENT

The external controls of the 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 personnel.

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

PAGE NO. 34 of 41.
NAME OF TEST: Automatic Deactivation (Time-Out Timer)
SPECIFICATION: 47 CFR 80.203(c)

(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 © of this section except when used as described in 80.141.

THE TRANSMITTER MEETS THESE REQUIREMENTS

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PAGE NO. 35 of 41.
NAME OF TEST: Power Output Over Time
SPECIFICATION: 47 CFR 80.959(c)(1)(2)&(3)

MEASUREMENT PROCEDURE

1. The EUT 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. Measurements summary:

TIME, Min.	SUPPLY VOLTAGE, vdc	R.F. Power Output, Watts
0	13.8	25
10	13.8	25

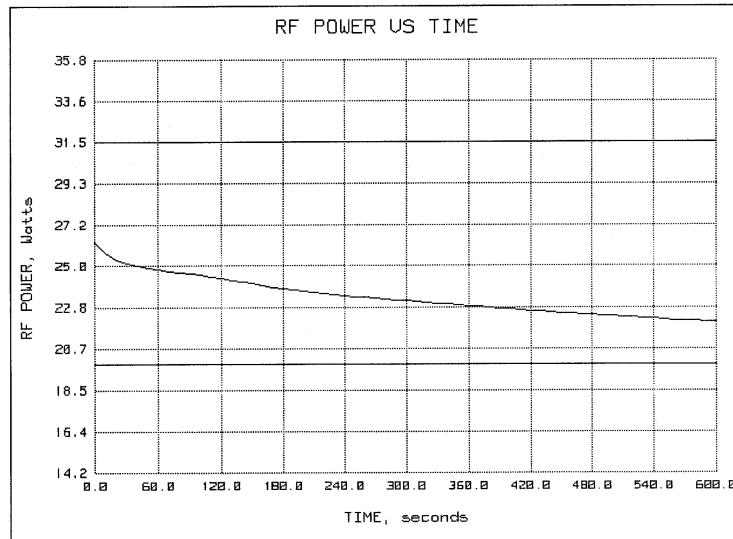
Measurement Results: Attached



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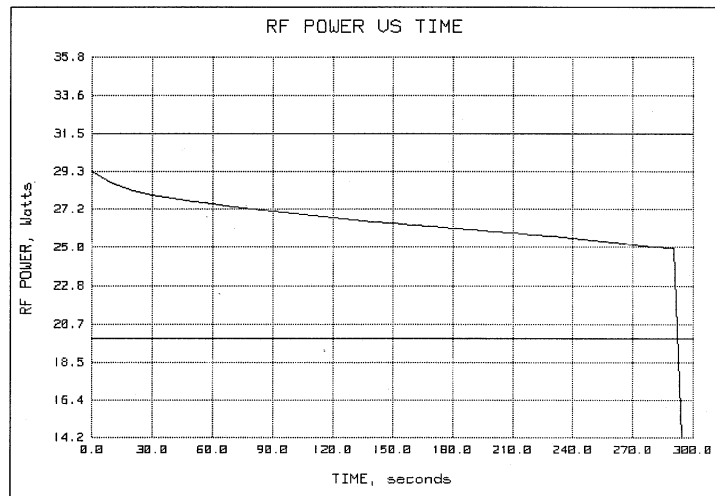
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RF POWER VS TIME
 RAYTHEON, RAY53
 2000-JAN-17, 13:36



NOMINAL, Watts = 25
 UPPER LIMIT, dB = 1.0
 UPPER LIMIT, Watts = 31.5
 LOWER LIMIT, dB = 1.0
 LOWER LIMIT, Watts = 19.9

RF POWER VS TIME
 RAYTHEON, RAY53
 2000-JAN-17, 13:30



NOMINAL, Watts = 25
 UPPER LIMIT, dB = 1.0
 UPPER LIMIT, Watts = 31.5
 LOWER LIMIT, dB = 1.0
 LOWER LIMIT, Watts = 19.9

PAGE NO. 37 of 41.

NAME OF TEST: Requirements for DSC

SPECIFICATION: 47 CFR 80.225

This section specifies the requirements for voluntary digital selective calling (DSC) equipment and selective calling equipment installed in ship and coast stations. Reference to any CCIR Recommendation in this section is to the most recent CCIR approved Recommendation that does not prevent the use of existing equipment.

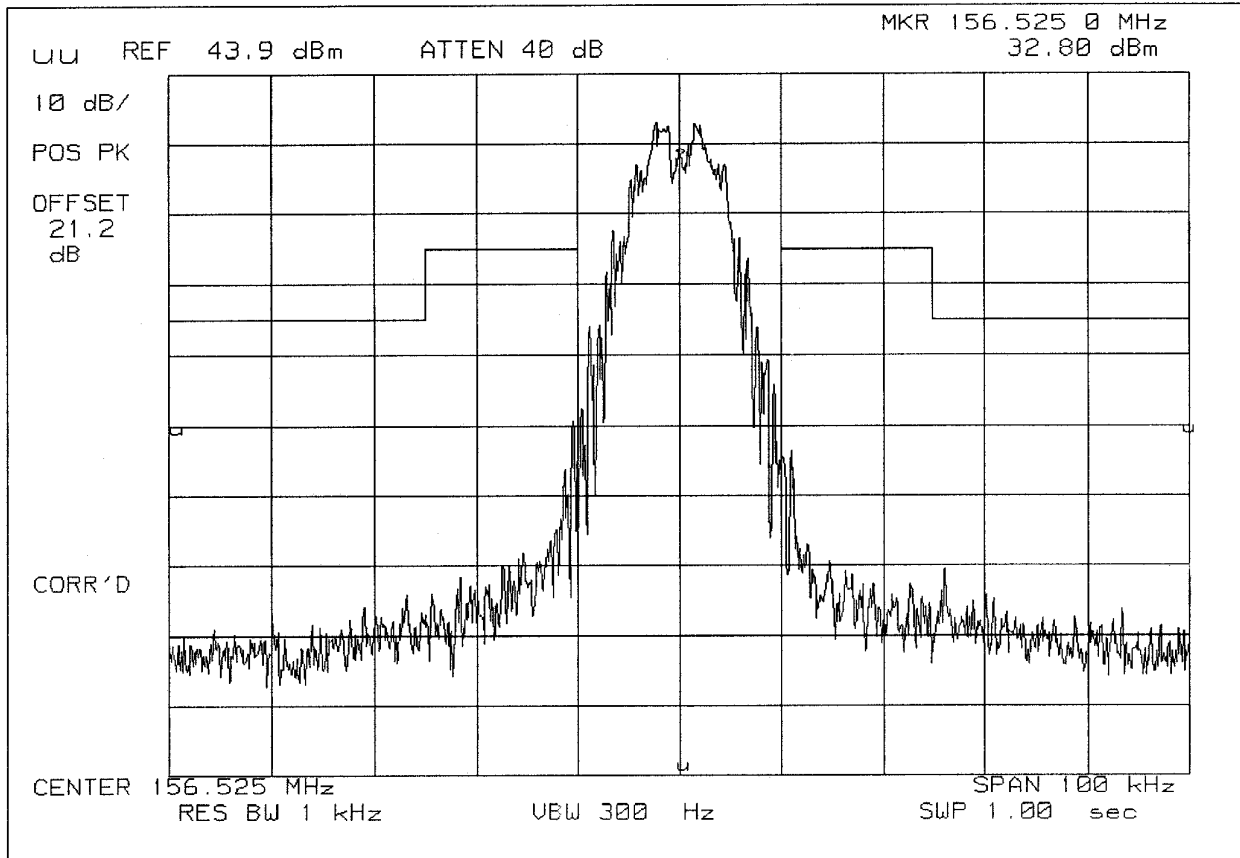
- (a) DSC equipment voluntarily installed in coast or ship stations must meet either the requirements of CCIR Recommendation 493 (including only equipment classes A, B, D, and E) or RTCM Paper 56-5/SC101-STD. DSC equipment must not be used with the sensors referred to in Sec. 80.179(e)(2). DSC equipment used on compulsorily fitted ships must meet the requirements contained in subpart W for GMDSS.
- (b) Manufacturers of Class C DSC equipment to be used on United States vessels must affix a clearly discernible permanent plate or label visible from the operating controls containing the following:

Warning. This equipment is designed to generate digital maritime distress and safety signals to facilitate search and rescue. To be effective as a safety device, this equipment must be used only within communication range of a shore-based VHF marine channel 70 distress and safety watch system. The range of the signal may vary but under normal conditions should be approximately 20 nautical miles.

- (c) Selective calling equipment, other than that designed in accordance with paragraph (a) of this section, is authorized as follows:
 - (1) Equipment used in conjunction with the Automated Maritime Telecommunications System (AMTS) in the band 216-220 MHz,
 - (2) Equipment used to perform a selective calling function during narrow-band direct-printing (NB-DP) operations in accordance with CCIR Recommendation 476 or 625, and
 - (3) Equipment functioning under the provisions of Sec. 80.207(a) includes the brief use of radiotelegraphy, including keying only the modulating audio frequency, tone signals, and other signaling devices to establish or maintain communications provided that:
 - (i) These signaling techniques are not used on frequencies designated for general purpose digital selective calling (DSC) and distress and safety DSC calling as listed in Sec. 80.359;
 - (ii) The authorized radiotelephone emission bandwidth is not exceeded;
 - (iii) Documentation of selective calling protocols must be available to the general public; and,
 - (iv) Harmful interference is not caused to stations operating in accordance with the International Radio Regulations.

SPECTRUM ANALYZER PRESENTATION
 RAYTHEON, RAY53
 2000-JAN-21, 14:25, FRI

POWER: HIGH
 MODULATION: DSC
 MASK: B, VHF/UHF 25kHz, w/LPF



EMISSION DESIGNATOR: G2B
 KEYING FREQUENCY: 1300 & 2100 Hz
 MODULATION RATE: 1200 BAUD
 DEVIATION: ±2700 Hz (1300 Hz)
 ±4100 Hz (2100 Hz)

PAGE NO. 39 of 41.
NAME OF TEST: Subpart T - G3E Emissions
SPECIFICATION: 47 CFR 80.961(a) & (b)

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 = -103
SENSITIVITY, μ V = 1.58

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PAGE NO. 40 of 41.
NAME OF TEST: Subpart U - Bridge-to-Bridge Act
SPECIFICATION: 47 CFR 80.1011, 80.1013
GUIDE: ANSI/TIA/EIA-603-1992, Paragraph
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 the navigational frequency of 156.375 MHz (Channel 67) while transmitting in any of the applicable waters.

80.1013 Receiver.

The receiver is capable of reception of G3E emissions on the navigational frequency 156.650 MHz (Channel 13) and the Coast Guard liaison frequency 157.100 MHz (Channel 22A). Additionally 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.

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NAME OF TEST: Necessary Bandwidth and Emission Bandwidth

SPECIFICATION: 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	=	$(2 \times M) + (2 \times D \times K)$
	=	16.0

SUPERVISED BY:



Morton Flom, P. Eng.

TESTIMONIAL
AND
STATEMENT OF CERTIFICATION

THIS IS TO CERTIFY THAT:

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:



Morton Flom, P. Eng.