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

# T R A N S M I T T E R  C E R T I F I C A T I O N

of

FCC ID: K66HX470SA
MODEL: HX470S

to

FEDERAL COMMUNICATIONS COMMISSION

Rule Part(s) 2, 80, 95, Confidentiality

DATE OF REPORT: May 20, 2003

ON THE BEHALF OF THE APPLICANT:

Vertex Standard Co., Ltd.

AT THE REQUEST OF: P.O. Email 05/19/2003

Vertex Standard USA Inc.
10900 Walker Street
Cypress, CA 90630

Attention of: Mikio Maruya, Executive Vice President
(800) 255-9237; FAX: (800) 477-9237
(714) 827-7600; FAX: -8100
m.maruya@vxstdusa.com

SUPERVISED BY: Morton Flom, P. Eng.

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

APPLICANT: Vertex Standard Co., Ltd.

FCC ID: K66HX470SA

BY APPLICANT:

1. LETTER OF AUTHORIZATION x

2. IDENTIFICATION DRAWINGS, 2.1033(c)(11)
   - x LABEL
   - x LOCATION OF LABEL
   - x COMPLIANCE STATEMENT
   - x LOCATION OF COMPLIANCE STATEMENT

3. PHOTOGRAPHS, 2.1033(c)(12) x

4. DOCUMENTATION: 2.1033(c)
   - (3) USER MANUAL x
   - (9) TUNE UP INFO x
   - (10) SCHEMATIC DIAGRAM x
   - (10) CIRCUIT DESCRIPTION x
   - BLOCK DIAGRAM x
   - ACTIVE DEVICES x

5. PART 90.203(e) & (g) ATTESTATION x

6. REQUEST FOR CONFIDENTIALITY x

7. SAR REPORT x

BY M.F.A. INC.

A. TESTIMONIAL & STATEMENT OF CERTIFICATION

B. STATEMENT OF QUALIFICATIONS

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


| RULE | DESCRIPTION | PAGE |
|---|---|---|
| | Test Report | 1 |
| 2.1033(c) | General Information Required | 2 |
| 2.1033(c)(14) | Rule Summary | 5 |
| | Standard Test Conditions and Engineering Practices | 6 |
| 2.1046(a) | Carrier Output Power (Conducted) | 7 |
| 2.1046(a) | ERP Carrier Power (Radiated) | 9 |
| 2.1051 | Unwanted Emissions (Transmitter Conducted) | 10 |
| 2.1053(a) | Field Strength of Spurious Radiation | 15 |
| 2.1049(c)(1) | Emission Masks (Occupied Bandwidth) | 19 |
| 2.1047(a) | Audio Low Pass Filter (Voice Input) | 27 |
| 2.1047(a) | Audio Frequency Response | 31 |
| 2.1047(b) | Modulation Limiting | 34 |
| 2.1055(a)(1) | Frequency Stability (Temperature Variation) | 37 |
| 2.1055(b)(1) | Frequency Stability (Voltage Variation) | 40 |
| 2.202(g) | Necessary Bandwidth and Emission Bandwidth | 42 |

PAGE NO. 1 of 42.

*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: d0350037

d) Client: Vertex Standard USA Inc.
10900 Walker Street
Cypress, CA 90630

e) Identification: HX470S
FCC ID: K66HX470SA
EUT Description: Non-broadcast Transceiver held to face

f) EUT Condition: Not required unless specified in individual tests.

g) Report Date: May 20, 2003
EUT Received: December 3, 2002

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.

PAGE NO. 2 of 42.

LIST OF GENERAL INFORMATION REQUIRED FOR CERTIFICATION

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

2, 80, 95, Confidentiality

Sub-part 2.1033

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

Vertex Standard Co., Ltd.
4-8-8 Nakameguro, Meguro-Ku
Tokyo 153-8644 Japan

MANUFACTURER:

Applicant

(c)(2): FCC ID: K66HX470SA

MODEL NO: HX470S

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

PLEASE SEE ATTACHED EXHIBITS

(c)(4): TYPE OF EMISSION: 16K0F3E, 11K0F3E

(c)(5): FREQUENCY RANGE, MHz: 156 to 157
462.5 to 467.7

(c)(6): POWER RATING, Watts: 5 MARINE (Part 80)
0.5 FRS (Part 95)

___ Switchable x Variable ___ N/A

FCC GRANT NOTE: BD - The output power is continuously variable from the value listed in this entry to 10%-15% of the value listed.

(c)(7): MAXIMUM POWER RATING, Watts: 300

DUT RESULTS: Passes x Fails _____

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

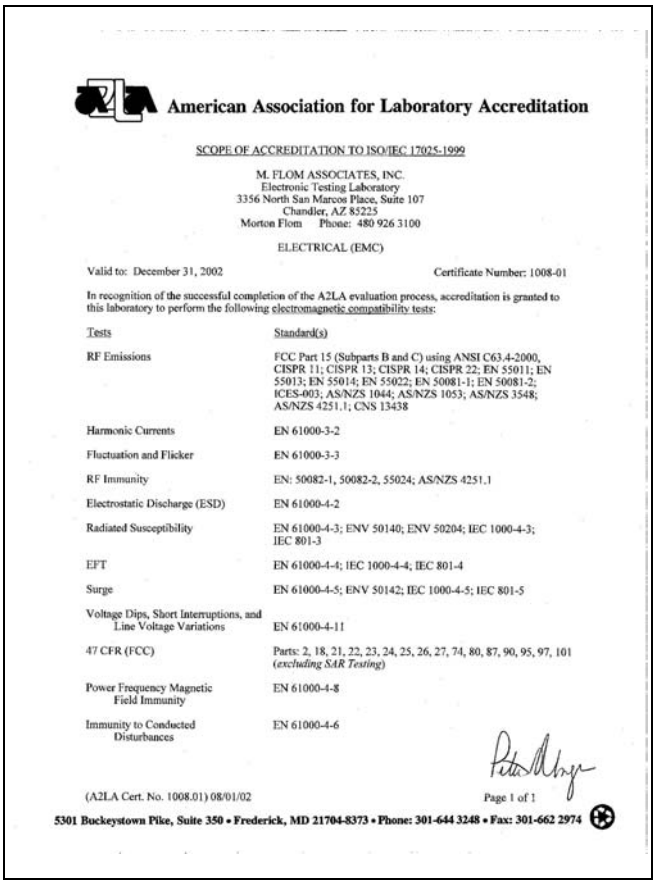
**Electrical (EMC) Testing**

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 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing. Testing and calibration laboratories that comply with this International Standard also operate in accordance with ISO 9001 or ISO 9002.

Presented this 2nd day of March, 2001.

President
For the Accreditation Council
Certificate Number 1008.01
Valid to December 31, 2002

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 17025-1999

M. FLOM ASSOCIATES, INC.
Electronic Testing Laboratory
3356 North San Marcos Place, Suite 107
Chandler, AZ 85225
Morton Flom Phone: 480 926 3100

ELECTRICAL (EMC)

Valid to: December 31, 2002 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 C63.4-2000, CISPR 11; CISPR 13; CISPR 14; CISPR 22; EN 55011; EN 55013; EN 55014; EN 55022; EN 50081-1; EN 50081-2; ICES-003; AS/NZS 1044; AS/NZS 1053; AS/NZS 3548; AS/NZS 4251.1; CNS 13438 |
| Harmonic Currents | EN 61000-3-2 |
| Fluctuation and Flicker | EN 61000-3-3 |
| RF Immunity | EN: 50082-1, 50082-2, 55024; AS/NZS 4251.1 |
| Electrostatic Discharge (ESD) | EN 61000-4-2 |
| Radiated Susceptibility | EN 61000-4-3; ENV 50140; ENV 50204; IEC 1000-4-3; IEC 801-3 |
| 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 |
| Voltage Dips, Short Interruptions, and Line Voltage Variations | EN 61000-4-11 |
| 47 CFR (FCC) | Parts: 2, 18, 21, 22, 23, 24, 25, 26, 27, 74, 80, 87, 90, 95, 97, 101 *(excluding SAR Testing)* |
| Power Frequency Magnetic Field Immunity | EN 61000-4-8 |
| Immunity to Conducted Disturbances | EN 61000-4-6 |

(A2LA Cert. No. 1008.01) 08/01/02 Page 1 of 1

5301 Buckeystown Pike, Suite 350 • Frederick, MD 21704-8373 • Phone: 301-644 3248 • 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. 4 of 42.

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 = 1.45
COLLECTOR VOLTAGE, Vdc = 7.4
SUPPLY VOLTAGE, Vdc = 7.4

(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

PAGE NO. 5 of 42.

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
_x_ 95 Subpart E - Family Radio Service
____ 95 Subpart F - Interactive Video and Data Service (IVDS)
____ 97 - Amateur Radio Service
____ 101 – Fixed Microwave Services

# STANDARD TEST CONDITIONS and ENGINEERING PRACTICES

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

In accordance with ANSI C63.4-1992/2000 Draft, 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.

PAGE NO. 7 of 42.

NAME OF TEST: Carrier Output Power (Conducted)

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
(Worst case)

FREQUENCY OF CARRIER, MHz = 156.8, 156.05, 157.425, 462.6375, 467.6375

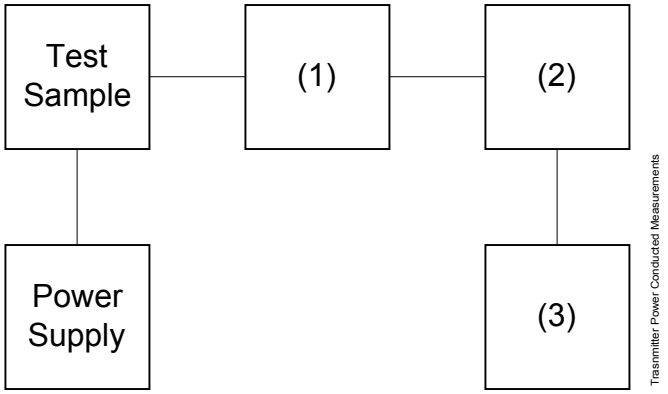
| POWER SETTING | R. F. POWER, WATTS |
|---|---|
| High (Marine) | 5 |
| High (FRS) | 0.5 |

PERFORMED BY: David Lee

PAGE NO. 8 of 42.

## TRANSMITTER POWER CONDUCTED MEASUREMENTS

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




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

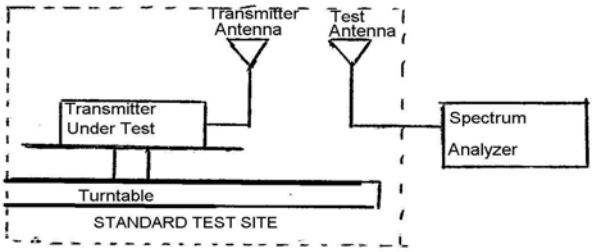
PAGE NO. 9 of 42.

NAME OF TEST: ERP Carrier Power (Radiated)

SPECIFICATION: TIA/EIA 603A (Substitution Method)

2.2.17.1 Definition: The average radiated power of a licensed device is the equivalent power required, when delivered to a half-wave dipole or horn antenna, to produce at a distant point the same average received power as produced by the licensed device.

2.2.17.2 Method of Measurement:
a) Connect the equipment as illustrated. Place the transmitter to be tested on the turntable in the standard test site.




b) Raise and lower the test antenna from 1m to 6 m with the transmitter facing the antenna and record the highest received signal in dB as LVL.

c) Repeat step b) for seven additional readings at 45˚ interval positions of the turntable.

d) Replace the transmitter under test with a half-wave or horn vertically polarized antenna. The center of the antenna should be at the same location as the transmitter under test. Connect the antenna to a signal generator with a known output power and record the path loss in dB or LOSS.

e) Calculate the average radiated output power from the readings in step c) and d) by the following:

average radiated power = $10 \log_{10} \Sigma\ 10^{(LVL - LOSS)/10}$ (dBm)

RESULTS

| | MARINE 156.7 MHz | | FRS 462.638 MHz | |
|---|---|---|---|---|
| | LVL, dbm | Path Loss, db | LVL, dbm | Path Loss, db |
| 0˚ | 35.6 | -1.6 | 26.1 | -1.2 |
| 45˚ | 36.0 | -1.6 | 26.8 | -1.2 |
| 90˚ | 35.2 | -1.6 | 26.9 | -1.2 |
| 135˚ | 35.9 | -1.6 | 26.7 | -1.2 |
| 180˚ | 35.8 | -1.6 | 26.0 | -1.2 |
| 225˚ | 36.0 | -1.6 | 25.8 | -1.2 |
| 270˚ | 35.5 | -1.6 | 25.6 | -1.2 |
| 315˚ | 35.8 | -1.6 | 26.3 | -1.2 |

| | MARINE 156.7 MHz | FRS 462.638 MHz |
|---|---|---|
| Av. Radiated Power: | 27.7 dbm | 25.08 dbm |

PAGE NO. 10 of 42.

NAME OF TEST: Unwanted Emissions (Transmitter Conducted)

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

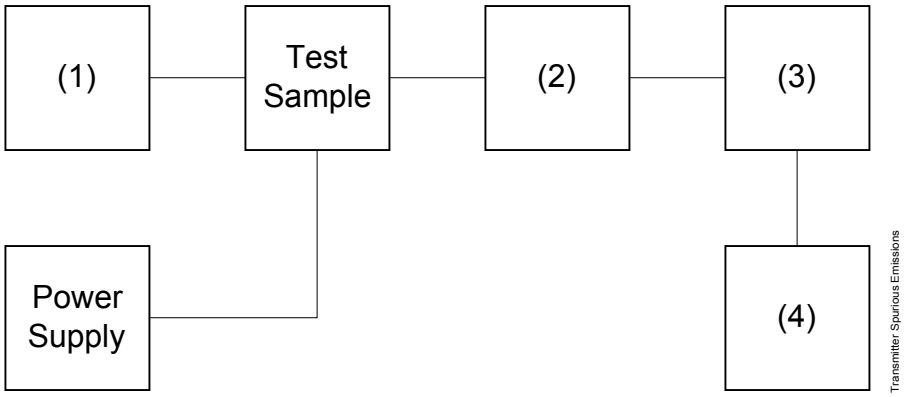
| | | |
|---|---|---|
| FREQUENCY OF CARRIER, MHz | = | 156.8, 156.05, 157.425, 462.6375, 467.6375 |
| SPECTRUM SEARCHED, GHz | = | 0 to 10 x $F_C$ |
| MAXIMUM RESPONSE, Hz | = | 2510 |
| ALL OTHER EMISSIONS | = | ≥ 20 dB BELOW LIMIT |

PERFORMED BY: David Lee

PAGE NO. 11 of 42.

## TRANSMITTER SPURIOUS EMISSION

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




| Asset | Description (as applicable) | s/n |
|---|---|---|
| (1) | AUDIO OSCILLATOR/GENERATOR | |
| i00010 | HP 204D | 1105A04683 |
| i00017 | HP 8903A | 2216A01753 |
| i00012 | HP 3312A | 1432A11250 |
| (2) | COAXIAL ATTENUATOR | |
| i00122 | Narda 766-10 | 7802 |
| i00123 | Narda 766-10 | 7802A |
| i00069 | Bird 8329 (30 dB) | 1006 |
| i00113 | Sierra 661A-3D | 1059 |
| (3) | FILTERS; NOTCH, HP, LP, BP | |
| i00126 | Eagle TNF-1 | 100-250 |
| i00125 | Eagle TNF-1 | 50-60 |
| i00124 | Eagle TNF-1 | 250-850 |
| (4) | SPECTRUM ANALYZER | |
| i00048 | HP 8566B | 2511A01467 |
| i00029 | HP 8563E | 3213A00104 |

PAGE NO. 12 of 42.

NAME OF TEST: Unwanted Emissions (Transmitter Conducted)

LIMIT, dBc
-(43+10xLOG P) = -50 (5 Watts)
Marine Low Power g02c0208: 2002-Dec-11 Wed 10:31:00

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | LEVEL, dBm | LEVEL, dBc | MARGIN, dB |
|---|---|---|---|---|
| 156.050000 | 312.094000 | -36.7 | -67 | -23.7 |
| 156.800000 | 313.594000 | -36.8 | -67.1 | -23.8 |
| 157.425000 | 314.842000 | -37.1 | -67.4 | -24.1 |
| 156.050000 | 468.144000 | -28.1 | -58.4 | -15.1 |
| 156.800000 | 470.393500 | -28.7 | -59 | -15.7 |
| 157.425000 | 472.278500 | -28.8 | -59.1 | -15.8 |
| 156.050000 | 624.189000 | -43.2 | -73.5 | -30.2 |
| 156.800000 | 627.188000 | -43.3 | -73.6 | -30.3 |
| 157.425000 | 629.713500 | -42.9 | -73.2 | -29.9 |
| 156.050000 | 780.277500 | -51.7 | -82 | -38.7 |
| 156.800000 | 784.004500 | -50.5 | -80.8 | -37.5 |
| 157.425000 | 787.110500 | -51 | -81.3 | -38 |
| 156.050000 | 936.316000 | -47.2 | -77.5 | -34.2 |
| 156.800000 | 940.798000 | -47.2 | -77.5 | -34.2 |
| 157.425000 | 944.566500 | -47 | -77.3 | -34 |
| 156.050000 | 1092.313500 | -52.2 | -82.5 | -39.2 |
| 156.800000 | 1097.576500 | -53.1 | -83.4 | -40.1 |
| 157.425000 | 1101.772000 | -53.3 | -83.6 | -40.3 |
| 156.050000 | 1248.174000 | -53.5 | -83.8 | -40.5 |
| 156.800000 | 1254.304500 | -53.1 | -83.4 | -40.1 |
| 157.425000 | 1259.256500 | -52.9 | -83.2 | -39.9 |
| 156.050000 | 1404.243000 | -53.8 | -84.1 | -40.8 |
| 156.800000 | 1411.300500 | -53.1 | -83.4 | -40.1 |
| 157.425000 | 1417.018500 | -53.4 | -83.7 | -40.4 |
| 156.050000 | 1560.501000 | -52.8 | -83.1 | -39.8 |
| 156.800000 | 1568.090500 | -53.8 | -84.1 | -40.8 |
| 157.425000 | 1574.443500 | -52.3 | -82.6 | -39.3 |
| 156.050000 | 1716.309000 | -52.9 | -83.2 | -39.9 |
| 156.800000 | 1724.857500 | -53.5 | -83.8 | -40.5 |
| 157.425000 | 1731.669000 | -53.2 | -83.5 | -40.2 |
| 156.050000 | 1872.589000 | -52.3 | -82.6 | -39.3 |
| 156.800000 | 1881.555000 | -53.1 | -83.4 | -40.1 |
| 157.425000 | 1888.996000 | -52.9 | -83.2 | -39.9 |
| 156.050000 | 2028.611000 | -52.9 | -83.2 | -39.9 |
| 156.800000 | 2038.549000 | -52.4 | -82.7 | -39.4 |
| 157.425000 | 2046.532000 | -52.9 | -83.2 | -39.9 |
| 156.050000 | 2184.454500 | -52.1 | -82.4 | -39.1 |
| 156.800000 | 2195.361000 | -52.3 | -82.6 | -39.3 |
| 157.425000 | 2203.781000 | -52.4 | -82.7 | -39.4 |
| 156.050000 | 2340.983500 | -51.9 | -82.2 | -38.9 |
| 156.800000 | 2351.998500 | -51.9 | -82.2 | -38.9 |
| 157.425000 | 2361.308000 | -51.6 | -81.9 | -38.6 |

PAGE NO. 13 of 42.

NAME OF TEST: Unwanted Emissions (Transmitter Conducted)

LIMIT, dBc
-(43+10xLOG P) = -50 (5 Watts)

Marine High Power g02c0207: 2002-Dec-11 Wed 10:28:00

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | LEVEL, dBm | LEVEL, dBc | MARGIN, dB |
|---|---|---|---|---|
| 156.050000 | 312.094500 | -29.7 | -66.8 | -16.7 |
| 156.800000 | 313.599000 | -29.6 | -66.7 | -16.6 |
| 157.425000 | 314.848000 | -29.4 | -66.5 | -16.4 |
| 156.050000 | 468.141000 | -25.4 | -62.5 | -12.4 |
| 156.800000 | 470.393500 | -26.6 | -63.7 | -13.6 |
| 157.425000 | 472.265000 | -26.9 | -64 | -13.9 |
| 156.050000 | 624.202500 | -38.2 | -75.3 | -25.2 |
| 156.800000 | 627.197500 | -38.5 | -75.6 | -25.5 |
| 157.425000 | 629.709500 | -38.5 | -75.6 | -25.5 |
| 156.050000 | 780.270500 | -37.9 | -75 | -24.9 |
| 156.800000 | 783.994000 | -39.4 | -76.5 | -26.4 |
| 157.425000 | 787.137500 | -38.7 | -75.8 | -25.7 |
| 156.050000 | 936.316000 | -38.9 | -76 | -25.9 |
| 156.800000 | 940.783000 | -43.4 | -80.5 | -30.4 |
| 157.425000 | 944.554500 | -41.3 | -78.4 | -28.3 |
| 156.050000 | 1092.364500 | -40.6 | -77.7 | -27.6 |
| 156.800000 | 1097.617000 | -38.9 | -76 | -25.9 |
| 157.425000 | 1101.952500 | -40.3 | -77.4 | -27.3 |
| 156.050000 | 1248.161000 | -43.5 | -80.6 | -30.5 |
| 156.800000 | 1254.631500 | -43.5 | -80.6 | -30.5 |
| 157.425000 | 1259.390500 | -43.3 | -80.4 | -30.3 |
| 156.050000 | 1404.412000 | -43 | -80.1 | -30 |
| 156.800000 | 1410.999500 | -43.6 | -80.7 | -30.6 |
| 157.425000 | 1416.973500 | -42.3 | -79.4 | -29.3 |
| 156.050000 | 1560.427000 | -43.4 | -80.5 | -30.4 |
| 156.800000 | 1567.947500 | -44.3 | -81.4 | -31.3 |
| 157.425000 | 1574.346500 | -43 | -80.1 | -30 |
| 156.050000 | 1716.782500 | -43.1 | -80.2 | -30.1 |
| 156.800000 | 1724.846500 | -43.7 | -80.8 | -30.7 |
| 157.425000 | 1731.869000 | -43 | -80.1 | -30 |
| 156.050000 | 1872.588500 | -43.9 | -81 | -30.9 |
| 156.800000 | 1881.633000 | -43.2 | -80.3 | -30.2 |
| 157.425000 | 1889.240000 | -43.1 | -80.2 | -30.1 |
| 156.050000 | 2028.898500 | -41.9 | -79 | -28.9 |
| 156.800000 | 2038.456500 | -43 | -80.1 | -30 |
| 157.425000 | 2046.373500 | -43.6 | -80.7 | -30.6 |
| 156.050000 | 2184.614000 | -43 | -80.1 | -30 |
| 156.800000 | 2195.420000 | -42.5 | -79.6 | -29.5 |
| 157.425000 | 2203.917000 | -41.8 | -78.9 | -28.8 |
| 156.050000 | 2340.654500 | -43 | -80.1 | -30 |
| 156.800000 | 2351.778000 | -42.9 | -80 | -29.9 |
| 157.425000 | 2361.567500 | -42.1 | -79.2 | -29.1 |

PAGE NO. 14 of 42.

NAME OF TEST: Unwanted Emissions (Transmitter Conducted)

LIMIT, dBc
-(43+10xLOG P) = -40 (0.5 Watt)

FRS g02c0209: 2002-Dec-11 Wed 10:50:00

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | LEVEL, dBm | LEVEL, dBc | MARGIN, dB |
|---|---|---|---|---|
| 462.637500 | 925.273500 | -39.2 | -66.8 | -26.2 |
| 467.637500 | 935.273500 | -40.3 | -67.9 | -27.3 |
| 462.637500 | 1387.911000 | -49.5 | -77.1 | -36.5 |
| 467.637500 | 1402.916500 | -48.1 | -75.7 | -35.1 |
| 462.637500 | 1850.631200 | -51.5 | -79.1 | -38.5 |
| 467.637500 | 1870.406600 | -50.6 | -78.2 | -37.6 |
| 462.637500 | 2312.948900 | -50.9 | -78.5 | -37.9 |
| 467.637500 | 2338.338600 | -50.6 | -78.2 | -37.6 |
| 462.637500 | 2775.879600 | -53.2 | -80.8 | -40.2 |
| 467.637500 | 2805.835900 | -53.4 | -81 | -40.4 |
| 462.637500 | 3238.504600 | -53.1 | -80.7 | -40.1 |
| 467.637500 | 3273.444200 | -53.7 | -81.3 | -40.7 |
| 462.637500 | 3701.272900 | -54.6 | -82.2 | -41.6 |
| 467.637500 | 3741.319300 | -53.9 | -81.5 | -40.9 |
| 462.637500 | 4163.655200 | -54.2 | -81.8 | -41.2 |
| 467.637500 | 4208.505300 | -54.6 | -82.2 | -41.6 |
| 462.637500 | 4626.609200 | -54.4 | -82 | -41.4 |
| 467.637500 | 4676.233300 | -53.4 | -81 | -40.4 |
| 462.637500 | 5088.868100 | -54 | -81.6 | -41 |
| 467.637500 | 5144.112200 | -53.4 | -81 | -40.4 |
| 462.637500 | 5551.652000 | -52 | -79.6 | -39 |
| 467.637500 | 5611.684800 | -53.8 | -81.4 | -40.8 |
| 462.637500 | 6014.532000 | -47.7 | -75.3 | -34.7 |
| 467.637500 | 6079.073800 | -46.5 | -74.1 | -33.5 |
| 462.637500 | 6476.797100 | -47.9 | -75.5 | -34.9 |
| 467.637500 | 6547.063100 | -48 | -75.6 | -35 |
| 462.637500 | 6939.526500 | -48 | -75.6 | -35 |
| 467.637500 | 7014.395500 | -47.4 | -75 | -34.4 |

PERFORMED BY: David Lee

PAGE NO. 15 of 42.

NAME OF TEST: Field Strength of Spurious Radiation

SPECIFICATION: 47 CFR 2.1053(a)

GUIDE: ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917

MEASUREMENT PROCEDURE

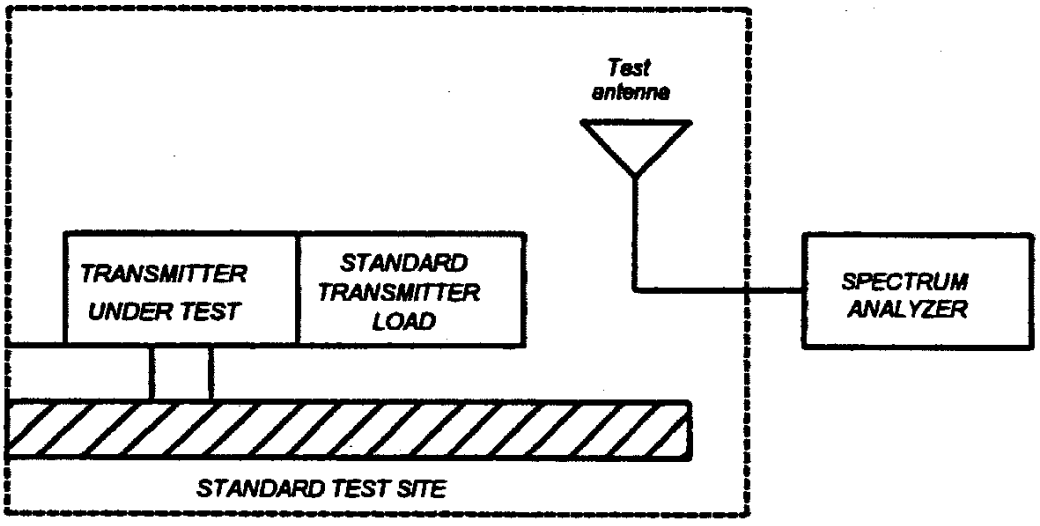
1.2.12.1 Definition: Radiated spurious emissions are emissions from the equipment when transmitting into a non-radiating load on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

1.2.12.2 Method of Measurement

A) Connect the equipment as illustrated

B) Adjust the spectrum analyzer for the following settings:
1) Resolution Bandwidth 100 kHz (<1 GHZ), 1 MHZ (> 1GHz).
2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz (22.917)
3) Sweep Speed ≤2000 Hz/second
4) Detector Mode = Mean or Average Power

C) Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load which is placed on the turntable. The RF cable to this load should be of minimum length.



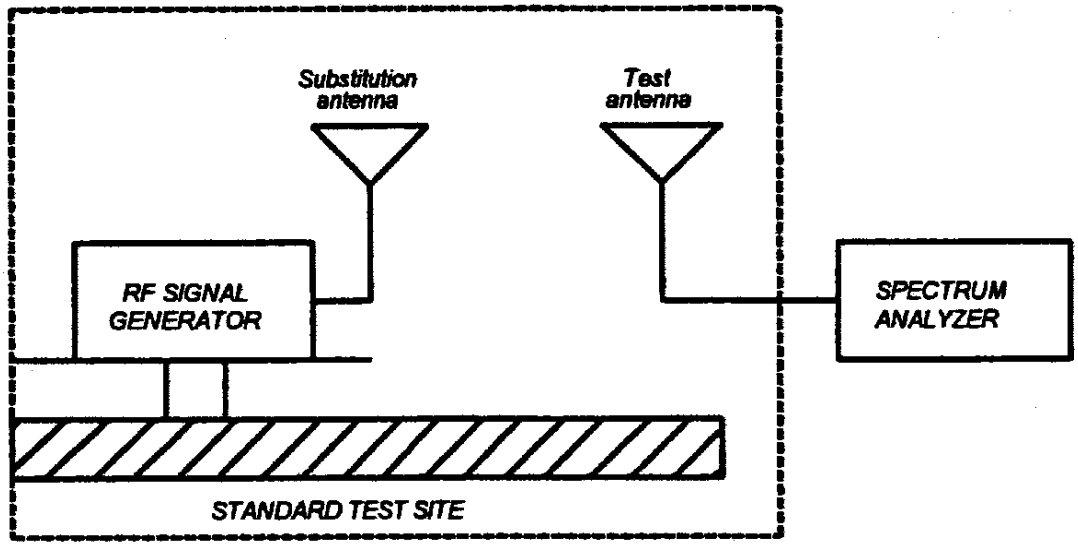
PAGE NO. 16 of 42.

NAME OF TEST: Field Strength of Spurious Radiation (Cont.)

D) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth (see section 1.3.4.4).

E) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

F) Repeat step E) for each spurious frequency with the test antenna polarized vertically.




G) Reconnect the equipment as illustrated.

H) Keep the spectrum analyzer adjusted as in step B).

I) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.

PAGE NO. 17 of 42.

NAME OF TEST: Field Strength of Spurious Radiation (Cont.)

J) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

K) Repeat step J) with both antennas vertically polarized for each spurious frequency.

L) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps J) and K) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.

M) The levels recorded in step L) are absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

Radiated spurious emissions dB =
$10\log_{10}$(TX power in watts/0.001) – the levels in step l)

NOTE: It is permissible that other antennas provided can be referenced to a dipole.

Test Equipment:

| Asset (as applicable) | Description | s/n | Cycle (Per ANSI C63.4-1992/2000 Draft, 10.1.4) | Last Cal |
|---|---|---|---|---|
| TRANSDUCER | | | | |
| i00088 | EMCO 3109-B 25MHz-300MHz | 2336 | 12 mo. | Sep-02 |
| i00065 | EMCO 3301-B Active Monopole | 2635 | 12 mo. | Sep-02 |
| i00089 | Aprel 2001 200MHz-1GHz | 001500 | 12 mo. | Sep-02 |
| i00103 | EMCO 3115 1GHz-18GHz | 9208-3925 | 12 mo. | Sep-02 |
| AMPLIFIER | | | | |
| i00028 | HP 8449A | 2749A00121 | 12 mo. | Mar-03 |
| SPECTRUM ANALYZER | | | | |
| i00029 | HP 8563E | 3213A00104 | 12 mo. | Jan-03 |
| i00033 | HP 85462A | 3625A00357 | 12 mo. | Jan-03 |
| i00048 | HP 8566B | 2511AD1467 | 6 mo. | Jan-03 |

MICROPHONE, ANTENNA PORT, AND CABELING

| | | | |
|---|---|---|---|
| Microphone | Yes | Cable Length | 1.0 Meters |
| Antenna Port Terminated | Yes | Antenna Gain | 0 dBd |
| All Ports Terminated by Load | Yes | Peripheral | No |

PAGE NO. 18 of 42.

NAME OF TEST: Field Strength of Spurious Radiation

MARINE STATE: 2:High Power g02c0227: 2002-Dec-19 Thu 08:44:00

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | ERP, dBm | ERP, dbc |
|---|---|---|---|
| 156.700000 | 313.398800 | -36 | ≤ -59.4 |
| 156.700000 | 470.097500 | -29.1 | ≤ -59.4 |
| 156.700000 | 626.807500 | -41.5 | ≤ -59.4 |
| 156.700000 | 783.515000 | -46.4 | ≤ -59.4 |
| 156.700000 | 940.215000 | -42.6 | ≤ -59.4 |
| 156.700000 | 1096.894169 | -70.9 | ≤ -59.4 |
| 156.700000 | 1253.579169 | -60.3 | ≤ -59.4 |
| 156.700000 | 1410.308336 | -64.7 | ≤ -59.4 |
| 156.700000 | 1566.995003 | -63.7 | ≤ -59.4 |

FRS STATE: 2:High Power g02c0228: 2002-Dec-19 Thu 09:12:00

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | ERP, dBm | ERP, dbc |
|---|---|---|---|
| 462.637500 | 925.273800 | -38.4 | ≤ -65.39 |
| 462.637500 | 1387.900000 | -40.8 | ≤ -65.39 |
| 462.637500 | 1850.549167 | -63.5 | ≤ -65.39 |
| 462.637500 | 2313.171667 | -55.2 | ≤ -65.39 |
| 462.637500 | 2775.820833 | -55.4 | ≤ -65.39 |
| 462.637500 | 3238.460833 | -48.8 | ≤ -65.39 |
| 462.637500 | 3701.098333 | -57.3 | ≤ -65.39 |
| 462.637500 | 4163.736667 | -54.2 | ≤ -65.39 |
| 462.637500 | 4626.374167 | -56.2 | ≤ -65.39 |

SUPERVISED BY: David Lee

PAGE NO. 19 of 42.

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/±1.25 kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.

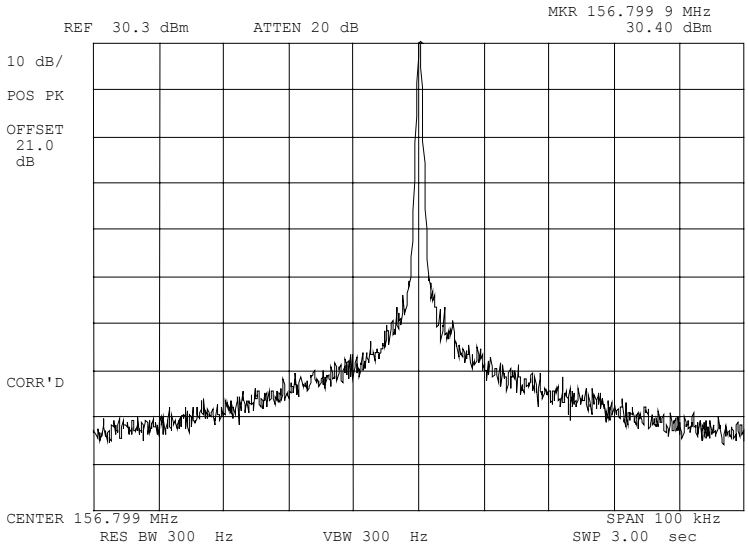
3. For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.

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

5. MEASUREMENT RESULTS: ATTACHED

PAGE NO. 20 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g02c0197: 2002-Dec-09 Mon 13:11:00
STATE: 1:Low Power MARINE

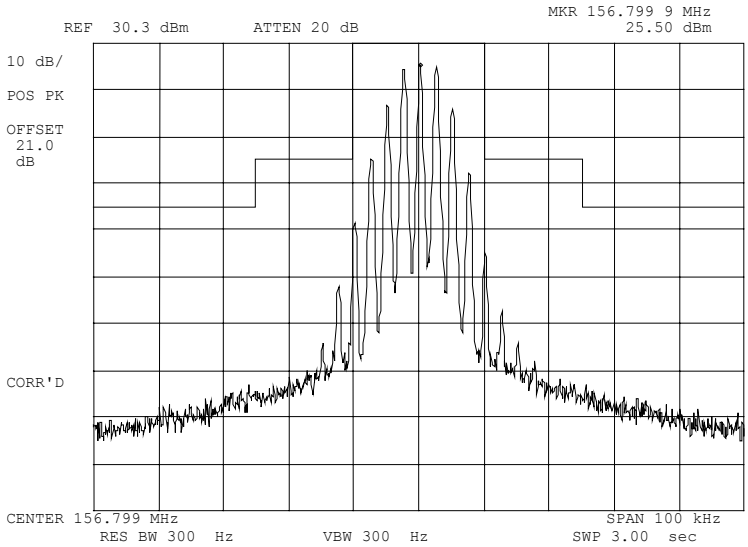



POWER: LOW
MODULATION: NONE

PERFORMED BY: David Lee

PAGE NO. 21 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g02c0200: 2002-Dec-09 Mon 13:18:00
STATE: 1:Low Power MARINE

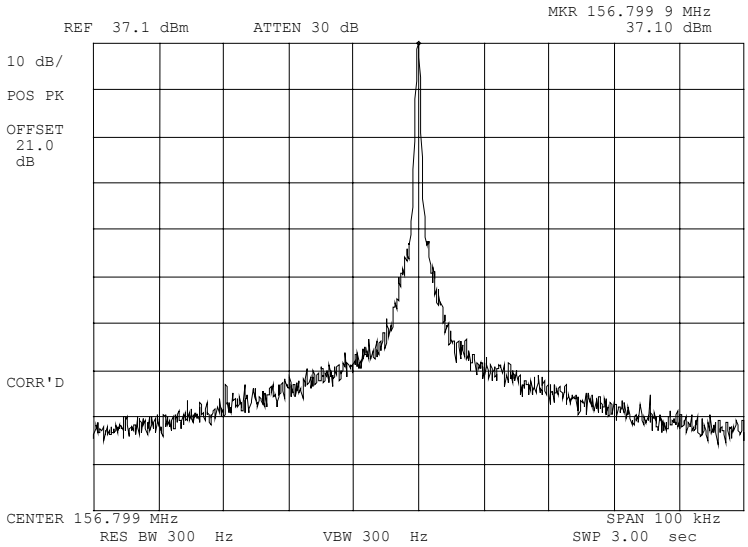



| | |
|---|---|
| POWER: | LOW |
| MODULATION: | VOICE: 2500 Hz SINE WAVE<br>MASK: B, VHF/UHF 25kHz, w/LPF |

PERFORMED BY: David Lee

PAGE NO. 22 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g02c0198: 2002-Dec-09 Mon 13:15:00
STATE: 2:High Power MARINE

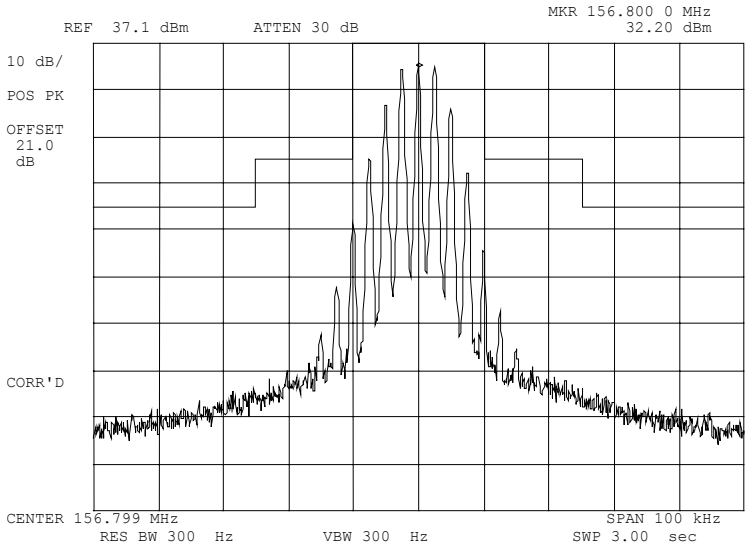



POWER: HIGH
MODULATION: NONE

PERFORMED BY: David Lee

PAGE NO. 23 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g02c0199: 2002-Dec-09 Mon 13:16:00
STATE: 2:High Power MARINE

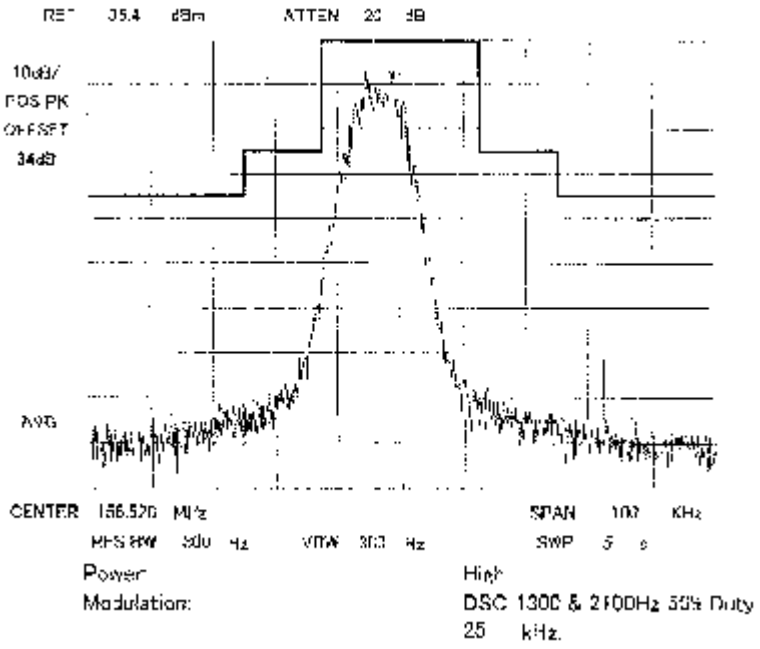



POWER: HIGH
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF

PERFORMED BY: David Lee

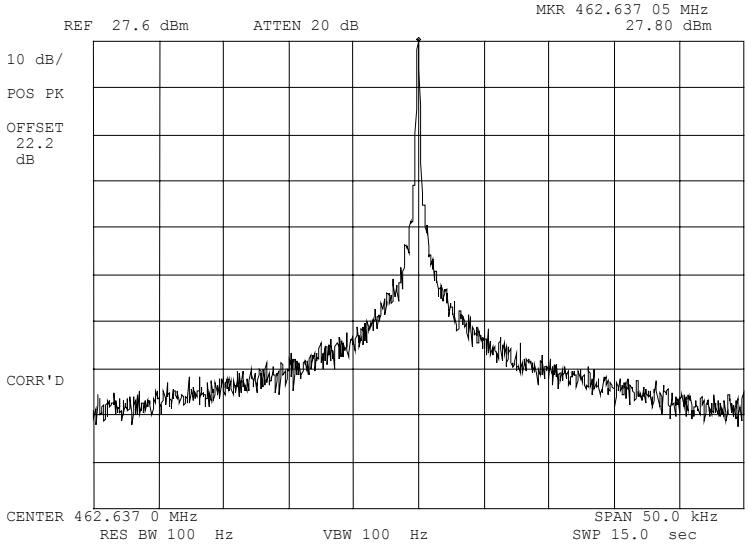
PAGE NO. 24 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
STATE: 2:High Power MARINE



PAGE NO. 25 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g02c0201: 2002-Dec-09 Mon 14:20:00
STATE: 2:High Power FRS

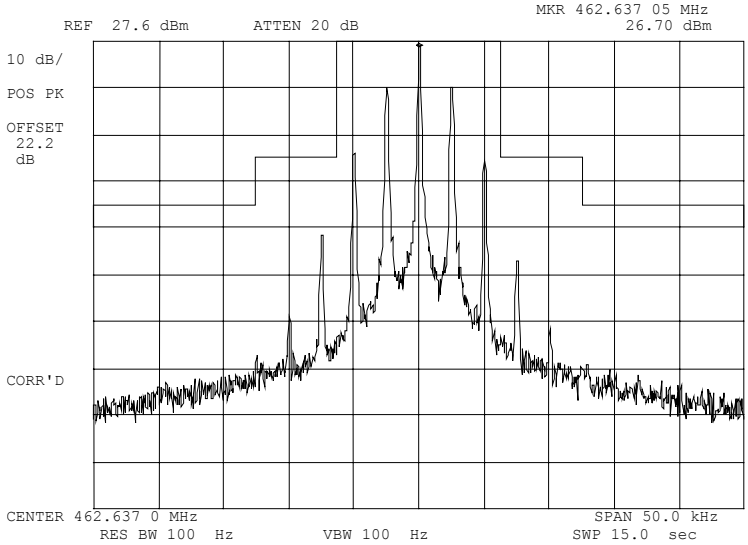



POWER: HIGH
MODULATION: NONE

PERFORMED BY: David Lee

PAGE NO. 26 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g02c0202: 2002-Dec-09 Mon 14:23:00
STATE: 2:High Power FRS




POWER: HIGH
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: FRS, 95.633(c)

PERFORMED BY: David Lee

PAGE NO. 27 of 42.

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 attached 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.

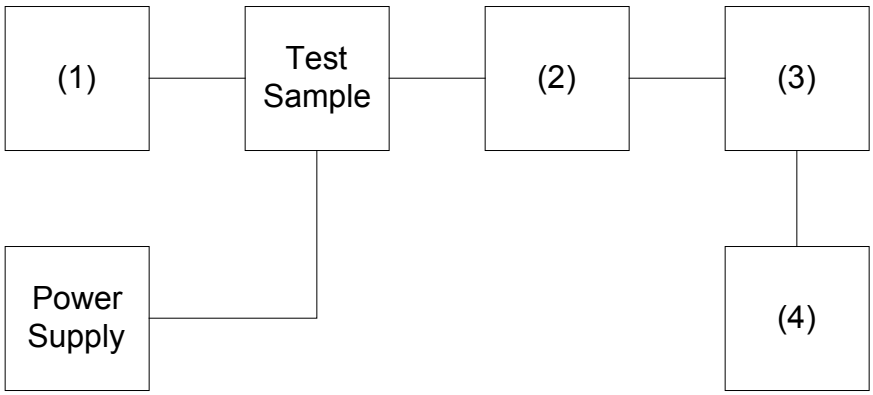
2. The audio output was connected at the output to the modulated stage.

3. MEASUREMENT RESULTS: ATTACHED

PAGE NO. 28 of 42.

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

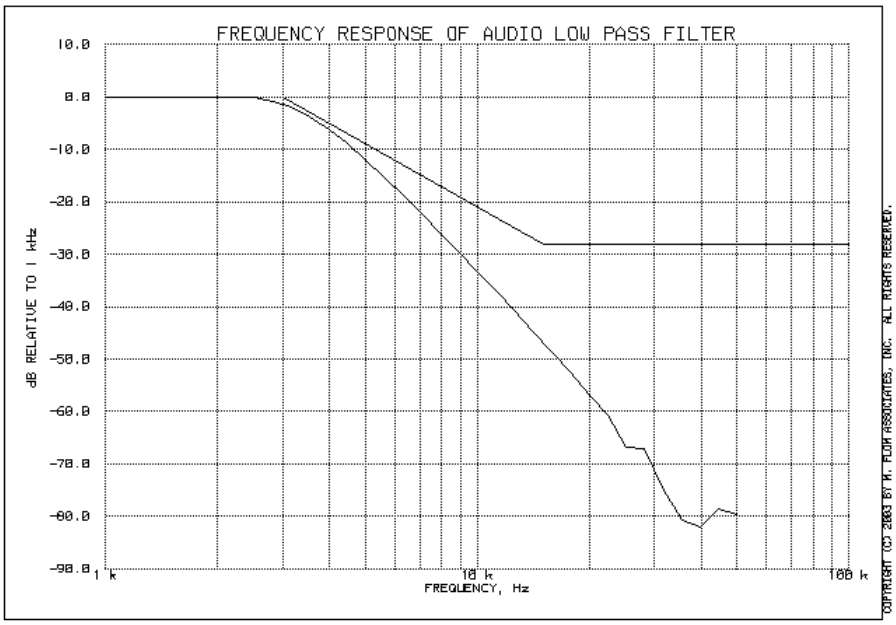



Transmitter Test Set Up

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

PAGE NO. 29 of 42.

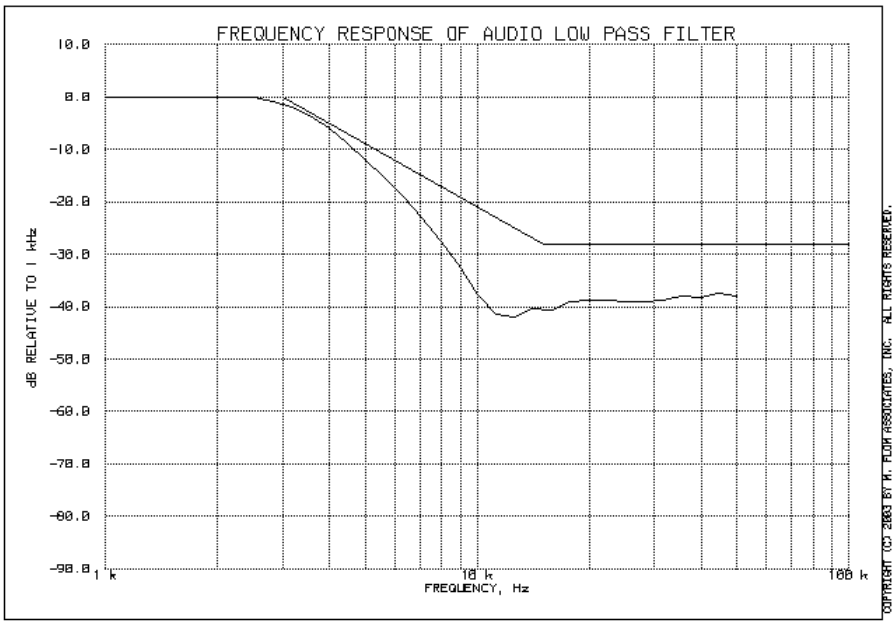
NAME OF TEST: Audio Low Pass Filter (Voice Input)
g02c0008: 2002-Dec-06 Fri 11:08:00
STATE: 0:General MARINE




PERFORMED BY: David Lee

PAGE NO. 30 of 42.

NAME OF TEST: Audio Low Pass Filter (Voice Input)
g02c0014: 2002-Dec-11 Wed 12:02:00
STATE: 0:General FRS




PERFORMED BY: David Lee

PAGE NO. 31 of 42.

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 previous 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 20% modulation at 1 kHz, and this point was taken as the 0 dB reference level.

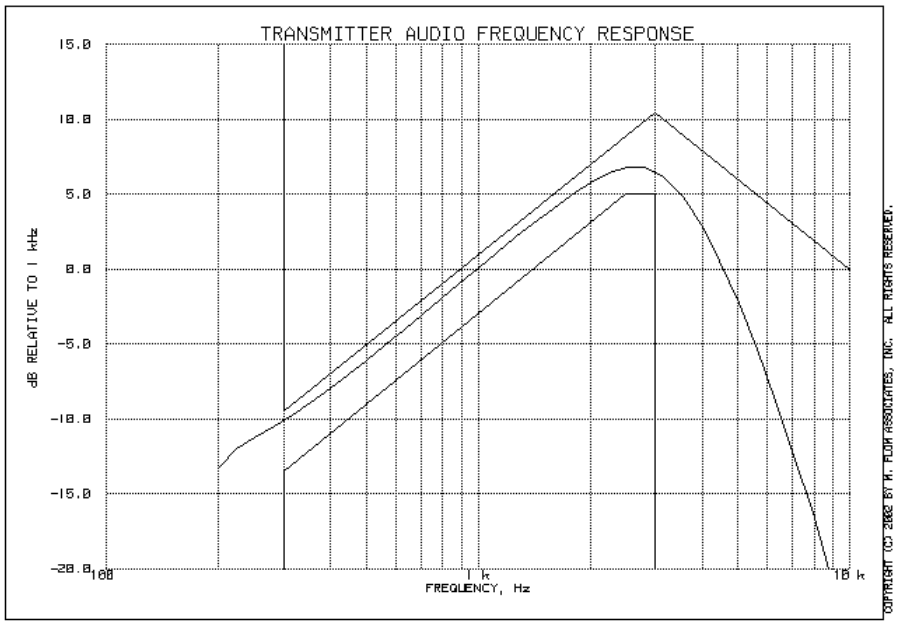
4. With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 100 Hz to 50 kHz.

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

6. MEASUREMENT RESULTS: ATTACHED

PAGE NO. 32 of 42.

NAME OF TEST: Audio Frequency Response
g02c0005: 2002-Dec-06 Fri 11:02:00
STATE: 0:General MARINE




Frequency of Maximum Audio Response, Hz = 2510

Additional points:

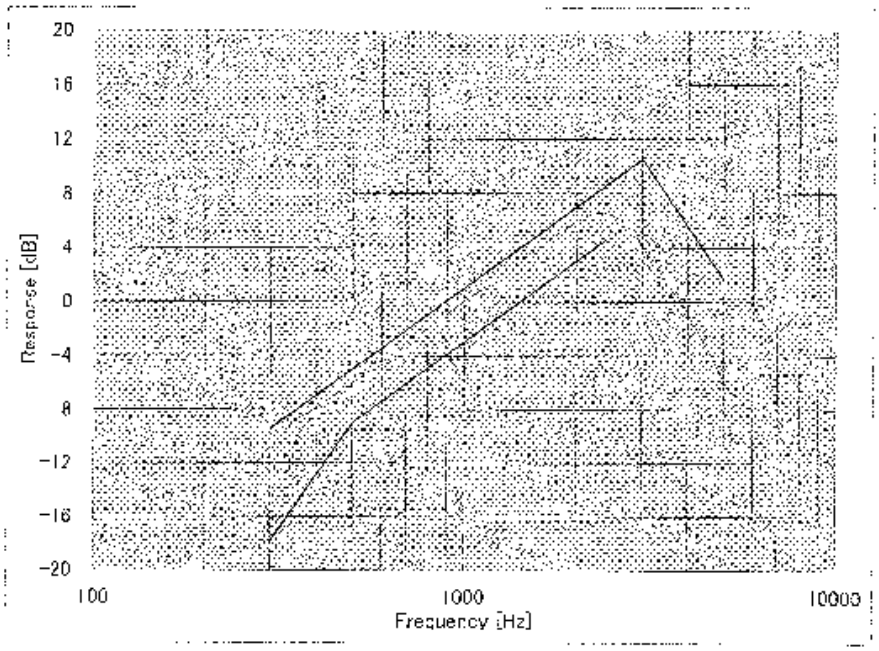
| FREQUENCY, Hz | LEVEL, dB |
|---|---|
| 300 | -9.94 |
| 20000 | -33.41 |
| 30000 | -32.95 |
| 50000 | -32.84 |

PERFORMED BY: David Lee

PAGE NO. 33 of 42.

NAME OF TEST: Audio Frequency Response

STATE: 0:General FRS




PEAK AUDIO FREQUENCY : 2400 [Hz]

| Frequency [Hz] | Response [dB] |
|---|---|
| 300 | -9.92 |
| 400 | -7.88 |
| 500 | -6.05 |
| 600 | -4.49 |
| 700 | -3.16 |
| 800 | -1.95 |
| 900 | -0.91 |
| 1000 | 0.04 |
| 1100 | 0.85 |
| 1200 | 1.59 |
| 1300 | 2.31 |
| 1400 | 2.97 |
| 1500 | 3.56 |
| 1600 | 4.12 |
| 1700 | 4.63 |
| 1800 | 5.11 |
| 1900 | 5.53 |
| 2000 | 5.92 |
| 2100 | 6.26 |
| 2200 | 6.55 |

| Frequency [Hz] | Response [dB] |
|---|---|
| 2300 | 6.59 |
| 2400 | 6.60 |
| 2500 | 6.40 |
| 2600 | 6.30 |
| 2700 | 5.80 |
| 2800 | 5.30 |
| 2900 | 4.80 |
| 3000 | 4.25 |
| 3125 | 3.30 |
| 3200 | 3.20 |
| 3400 | 2.20 |
| 3600 | 1.20 |
| 3800 | 0.10 |
| 4000 | -0.90 |
| 4200 | -1.90 |
| 4400 | -2.90 |
| 4600 | -3.90 |
| 4800 | -4.90 |
| 5000 | -5.90 |

PAGE NO. 34 of 42.

NAME OF TEST: Modulation Limiting

SPECIFICATION: 47 CFR 2.1047(b)

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.

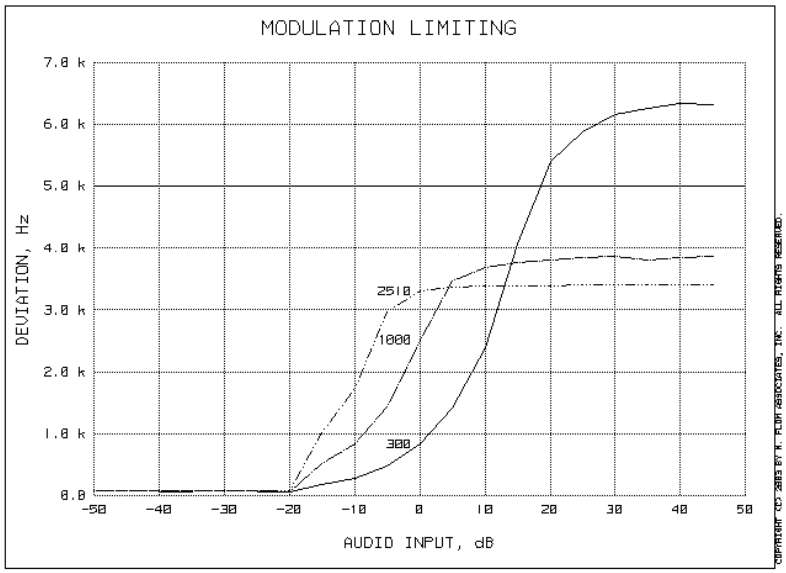
4. Measurements were performed for both negative and positive modulation and the respective results were recorded.

5. MEASUREMENT RESULTS: ATTACHED

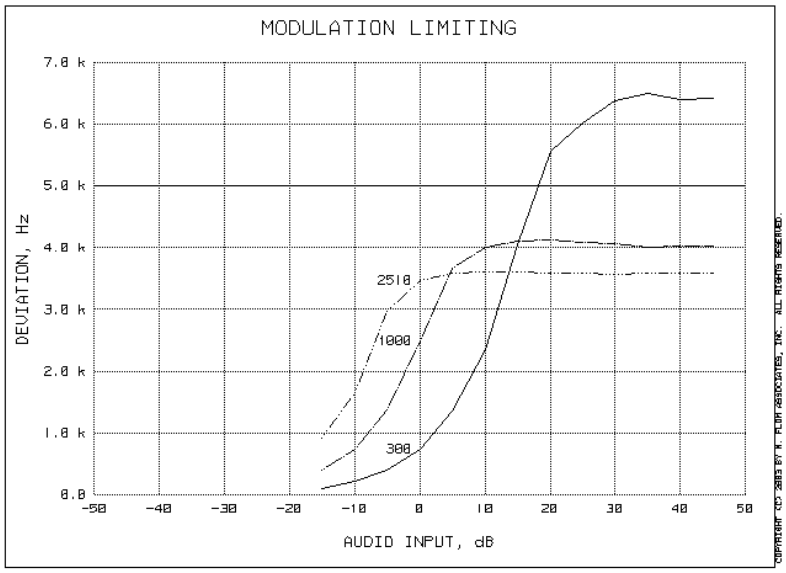
PAGE NO. 35 of 42.

NAME OF TEST: Modulation Limiting
g02c0009: 2002-Dec-06 Fri 11:13:00
STATE: 0:General MARINE

Positive Peaks:




Negative Peaks:

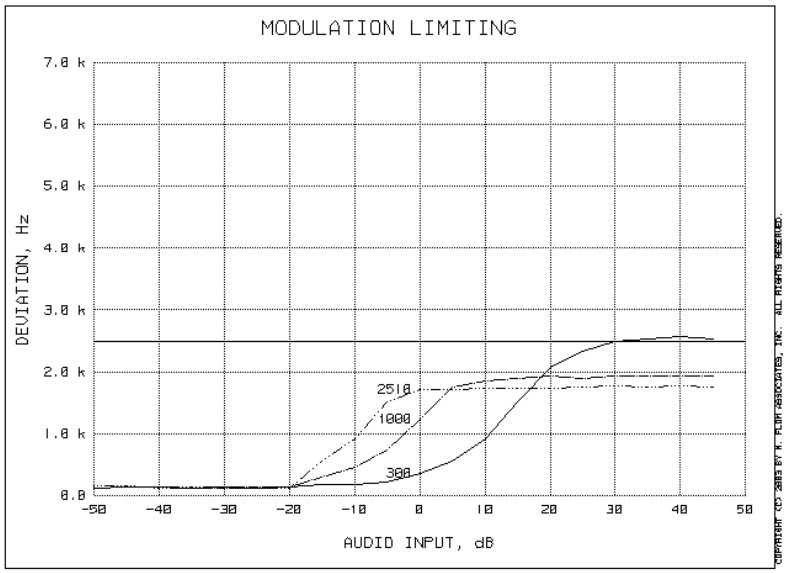



PERFORMED BY: David Lee

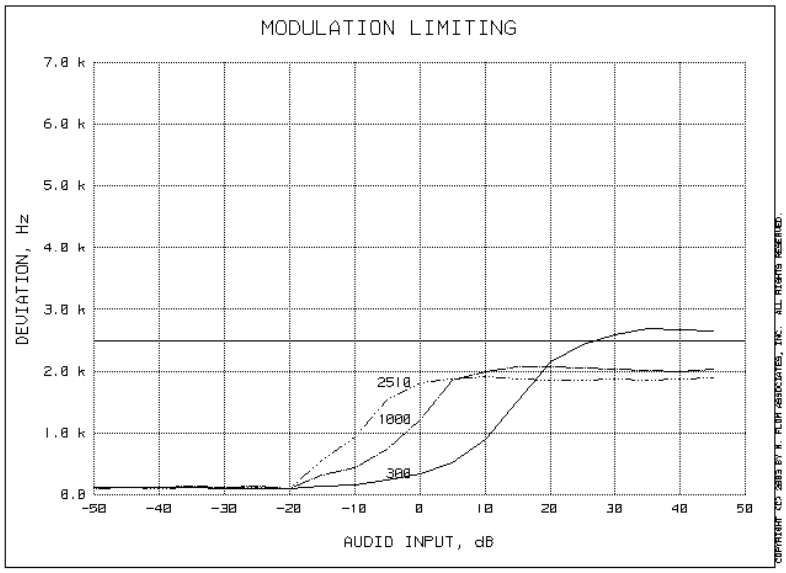
PAGE NO. 36 of 42.

NAME OF TEST: Modulation Limiting
g02c0015: 2002-Dec-11 Wed 12:06:00
STATE: 0:General FRS

Positive Peaks:




Negative Peaks:




PERFORMED BY: David Lee

PAGE NO. 37 of 42.

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.

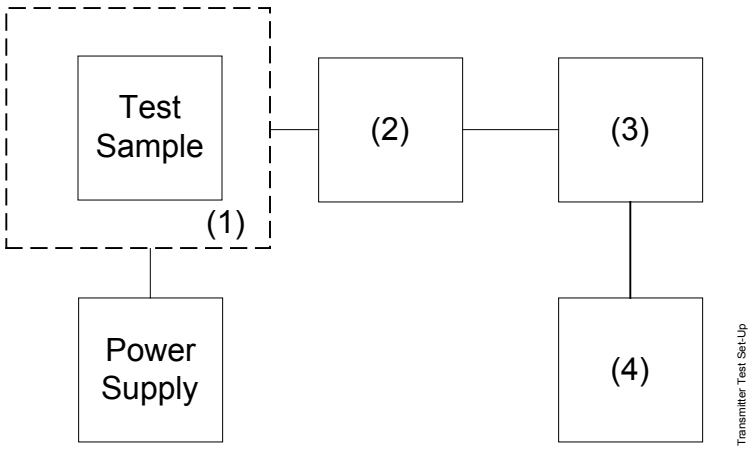
4. The temperature tests were performed for the worst case.

5. MEASUREMENT RESULTS: ATTACHED

PAGE NO. 38 of 42.

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



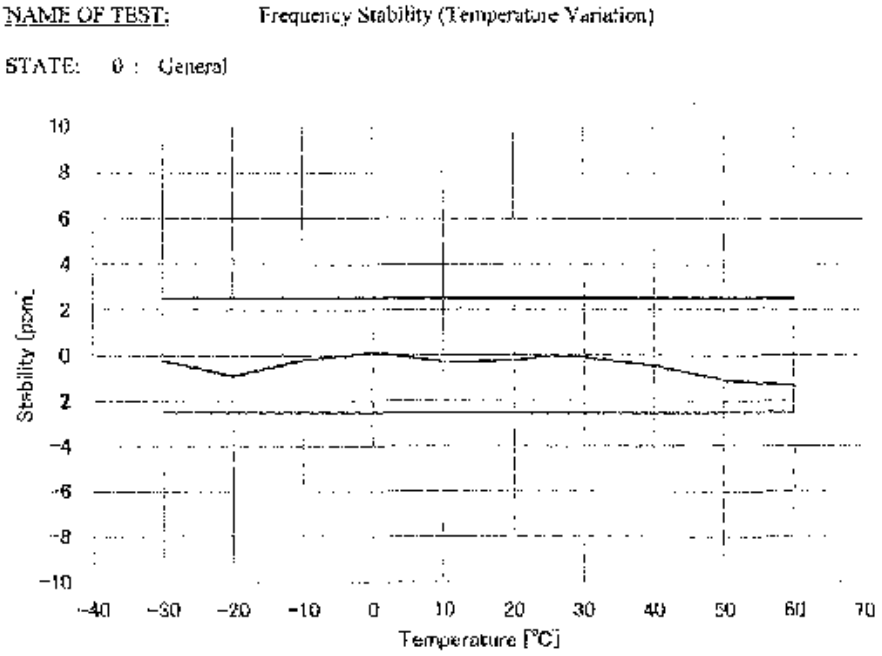
Transmitter Test Set-Up

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

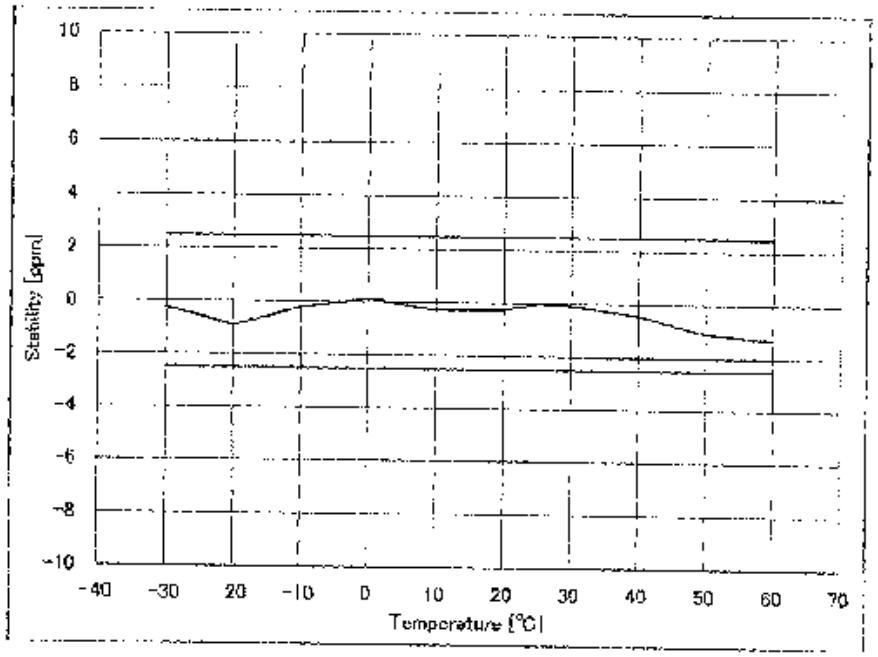
PAGE NO. 39 of 42.

NAME OF TEST: Frequency Stability (Temperature Variation)

MARINE




FRS



PAGE NO. 40 of 42.

NAME OF TEST: Frequency Stability (Voltage Variation)

SPECIFICATION: 47 CFR 2.1055(d)(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.

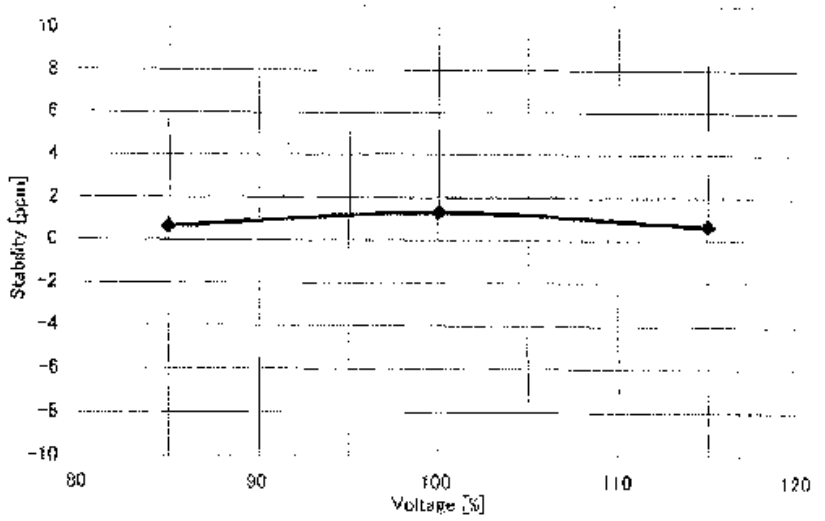
3. The variation in frequency was measured for the worst case.

RESULTS: Frequency Stability (Voltage Variation)

MARINE

LIMIT, ppm = 2.5
LIMIT, Hz = 392

| % of STV | Voltage | Frequency, MHz | Change, Hz | Change, ppm |
|---|---|---|---|---|
| 85 | 6.29 | 156.800100 | 100 | 0.64 |
| 100 | 7.40 | 156.800200 | 200 | 1.28 |
| 115 | 8.51 | 156.800100 | 100 | 0.64 |



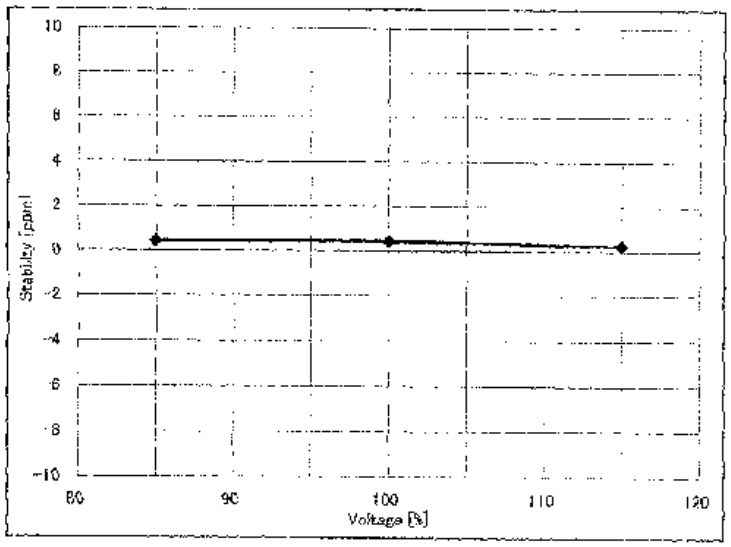
PAGE NO. 41 of 42.

RESULTS: Frequency Stability (Voltage Variation) (Cont.)

FRS

LIMIT, ppm = 2.5
LIMIT, Hz = 1157

| % of STV | Voltage | Frequency, Mhz | Change, Hz | Change, ppm |
|---|---|---|---|---|
| 85 | 6.29 | 462.712700 | 200 | 0.43 |
| 100 | 7.40 | 462.712700 | 200 | 0.43 |
| 115 | 8.51 | 462.712500 | 100 | 0.22 |



PAGE NO. 42 of 42.

NAME OF TEST: Necessary Bandwidth and Emission Bandwidth

SPECIFICATION: 47 CFR 2.202(g)

MODULATION = 16K0F3E

NECESSARY BANDWIDTH CALCULATION:

| | |
|---|---|
| MAXIMUM MODULATION (M), kHz | = 3 |
| MAXIMUM DEVIATION (D), kHz | = 5 |
| CONSTANT FACTOR (K) | = 1 |
| NECESSARY BANDWIDTH ($B_N$), kHz | = (2xM)+(2xDxK) |
| | = 16.0 |

MODULATION = 11K0F3E

NECESSARY BANDWIDTH CALCULATION:

| | |
|---|---|
| MAXIMUM MODULATION (M), kHz | = 3 |
| MAXIMUM DEVIATION (D), kHz | = 2.5 |
| CONSTANT FACTOR (K) | = 1 |
| NECESSARY BANDWIDTH ($B_N$), kHz | = (2xM)+(2xDxK) |
| | = 11.0 |

PERFORMED BY: David Lee

END OF TEST REPORT

# 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.