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.

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 |

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.

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 = 7.5

(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

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
x 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
x 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
x 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)
___ 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, 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)

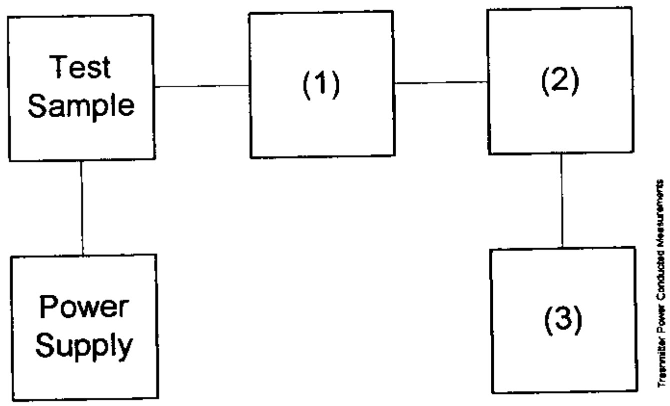
FREQUENCY OF CARRIER, MHz = 162.02, 150.02, 173.98

| POWER SETTING | R. F. POWER, WATTS |
|---|---|
| Low | 0.5 |
| High | 4 |

SUPERVISED BY: Morton Flom, P. Eng.

## TRANSMITTER POWER CONDUCTED MEASUREMENTS

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




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

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 = 162.02, 150.02, 173.98

SPECTRUM SEARCHED, GHz = 0 to 10 x $F_C$

MAXIMUM RESPONSE, Hz = 3160

ALL OTHER EMISSIONS = ≥ 20 dB BELOW LIMIT

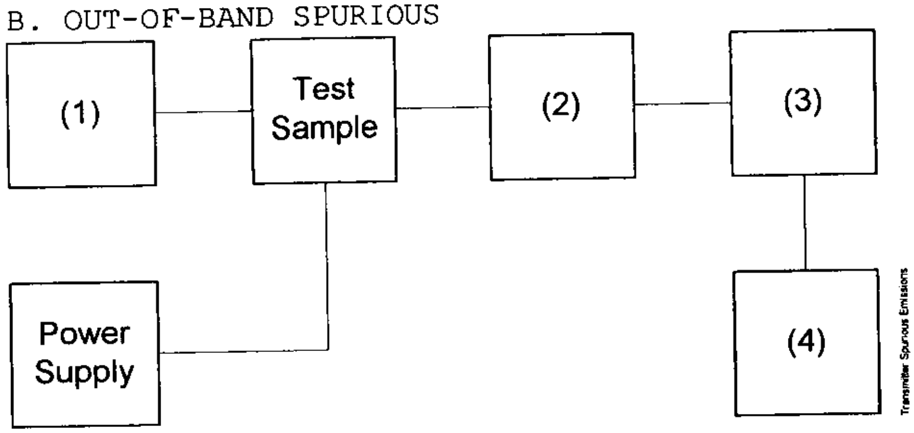
LIMIT(S), dBc

-(50+10xLOG P) = -47 (0.5 Watts)
-(50+10xLOG P) = -56 (4 Watts)

SUPERVISED BY: Morton Flom, P. Eng.

## TRANSMITTER SPURIOUS EMISSION

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




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

NAME OF TEST: Unwanted Emissions (Transmitter Conducted)
g9960241: 1999-Jun-24 Thu 08:24:00
STATE: 1:Low Power

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | LEVEL, dBm | LEVEL, dBc | MARGIN, dB |
|---|---|---|---|---|
| 150.020000 | 300.039000 | -41.2 | -68.2 | -21.2 |
| 162.020000 | 324.038000 | -40.4 | -67.4 | -20.4 |
| 173.980000 | 347.966000 | -42.9 | -69.9 | -22.9 |
| 150.020000 | 450.072000 | -45.2 | -72.2 | -25.2 |
| 162.020000 | 486.060000 | -43.9 | -70.9 | -23.9 |
| 173.980000 | 521.937000 | -41.5 | -68.5 | -21.5 |
| 150.020000 | 600.092000 | -55.1 | -82.1 | -35.1 |
| 162.020000 | 647.983000 | -56 | -83 | -36 |
| 173.980000 | 695.585000 | -57.2 | -84.2 | -37.2 |
| 150.020000 | 749.815000 | -57.9 | -84.9 | -37.9 |
| 162.020000 | 809.677000 | -56.2 | -83.2 | -36.2 |
| 173.980000 | 870.074000 | -57.3 | -84.3 | -37.3 |
| 150.020000 | 899.823000 | -57.1 | -84.1 | -37.1 |
| 162.020000 | 972.290000 | -56.5 | -83.5 | -36.5 |
| 173.980000 | 1044.323000 | -56.7 | -83.7 | -36.7 |
| 150.020000 | 1049.899000 | -57.2 | -84.2 | -37.2 |
| 162.020000 | 1133.799000 | -56.5 | -83.5 | -36.5 |
| 150.020000 | 1200.344000 | -57.1 | -84.1 | -37.1 |
| 173.980000 | 1218.100000 | -57.4 | -84.4 | -37.4 |
| 162.020000 | 1296.161000 | -56.3 | -83.3 | -36.3 |
| 150.020000 | 1350.053000 | -56.5 | -83.5 | -36.5 |
| 173.980000 | 1391.660000 | -56.9 | -83.9 | -36.9 |
| 162.020000 | 1458.656000 | -56.4 | -83.4 | -36.4 |
| 150.020000 | 1500.060000 | -57.3 | -84.3 | -37.3 |
| 173.980000 | 1566.308000 | -57.2 | -84.2 | -37.2 |
| 162.020000 | 1619.741000 | -56.2 | -83.2 | -36.2 |
| 150.020000 | 1649.895000 | -55.8 | -82.8 | -35.8 |
| 173.980000 | 1739.433000 | -57.2 | -84.2 | -37.2 |
| 162.020000 | 1782.686000 | -56.5 | -83.5 | -36.5 |
| 150.020000 | 1800.201000 | -55.8 | -82.8 | -35.8 |
| 173.980000 | 1913.534000 | -55.7 | -82.7 | -35.7 |
| 162.020000 | 1944.554000 | -56.9 | -83.9 | -36.9 |
| 150.020000 | 1949.898000 | -56.3 | -83.3 | -36.3 |
| 173.980000 | 2088.011000 | -56.1 | -83.1 | -36.1 |
| 150.020000 | 2100.141000 | -56.5 | -83.5 | -36.5 |
| 162.020000 | 2106.665000 | -57.2 | -84.2 | -37.2 |
| 150.020000 | 2250.278000 | -56.7 | -83.7 | -36.7 |
| 173.980000 | 2262.160000 | -56 | -83 | -36 |
| 162.020000 | 2268.047000 | -54.9 | -81.9 | -34.9 |
| 162.020000 | 2430.695000 | -55.8 | -82.8 | -35.8 |
| 173.980000 | 2436.166000 | -55.4 | -82.4 | -35.4 |
| 173.980000 | 2609.786000 | -57.9 | -84.9 | -37.9 |

NAME OF TEST: Unwanted Emissions (Transmitter Conducted)
g9960240: 1999-Jun-24 Thu 08:13:00
STATE: 2:High Power

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | LEVEL, dBm | LEVEL, dBc | MARGIN, dB |
|---|---|---|---|---|
| 150.020000 | 300.046000 | -38.9 | -74.9 | -18.9 |
| 162.020000 | 324.031000 | -37.8 | -73.8 | -17.8 |
| 173.980000 | 347.954000 | -36.5 | -72.5 | -16.5 |
| 150.020000 | 450.069000 | -44.3 | -80.3 | -24.3 |
| 162.020000 | 486.079000 | -41.2 | -77.2 | -21.2 |
| 173.980000 | 521.942000 | -29.9 | -65.9 | -9.9 |
| 150.020000 | 600.110000 | -46.1 | -82.1 | -26.1 |
| 162.020000 | 648.204000 | -45.1 | -81.1 | -25.1 |
| 173.980000 | 695.755000 | -45.8 | -81.8 | -25.8 |
| 150.020000 | 750.336000 | -44.1 | -80.1 | -24.1 |
| 162.020000 | 810.046000 | -44.4 | -80.4 | -24.4 |
| 173.980000 | 869.935000 | -44.4 | -80.4 | -24.4 |
| 150.020000 | 900.076000 | -44.9 | -80.9 | -24.9 |
| 162.020000 | 971.710000 | -45.9 | -81.9 | -25.9 |
| 173.980000 | 1043.449000 | -45.4 | -81.4 | -25.4 |
| 150.020000 | 1050.060000 | -45.3 | -81.3 | -25.3 |
| 162.020000 | 1134.205000 | -45.5 | -81.5 | -25.5 |
| 150.020000 | 1199.967000 | -43.2 | -79.2 | -23.2 |
| 173.980000 | 1218.222000 | -45.3 | -81.3 | -25.3 |
| 162.020000 | 1296.095000 | -44.3 | -80.3 | -24.3 |
| 150.020000 | 1349.871000 | -45.4 | -81.4 | -25.4 |
| 173.980000 | 1392.264000 | -45.4 | -81.4 | -25.4 |
| 162.020000 | 1457.686000 | -45.5 | -81.5 | -25.5 |
| 150.020000 | 1499.758000 | -45 | -81 | -25 |
| 173.980000 | 1565.406000 | -45 | -81 | -25 |
| 162.020000 | 1620.625000 | -45.2 | -81.2 | -25.2 |
| 150.020000 | 1649.819000 | -46 | -82 | -26 |
| 173.980000 | 1739.780000 | -45.1 | -81.1 | -25.1 |
| 162.020000 | 1781.916000 | -43.7 | -79.7 | -23.7 |
| 150.020000 | 1800.157000 | -44.7 | -80.7 | -24.7 |
| 173.980000 | 1913.380000 | -44.6 | -80.6 | -24.6 |
| 162.020000 | 1944.064000 | -44 | -80 | -24 |
| 150.020000 | 1950.108000 | -43.7 | -79.7 | -23.7 |
| 173.980000 | 2088.107000 | -44 | -80 | -24 |
| 150.020000 | 2100.179000 | -44.8 | -80.8 | -24.8 |
| 162.020000 | 2106.020000 | -44.7 | -80.7 | -24.7 |
| 150.020000 | 2250.181000 | -44.4 | -80.4 | -24.4 |
| 173.980000 | 2262.132000 | -43.6 | -79.6 | -23.6 |
| 162.020000 | 2268.151000 | -44.2 | -80.2 | -24.2 |
| 162.020000 | 2430.616000 | -43.7 | -79.7 | -23.7 |
| 173.980000 | 2435.421000 | -44.5 | -80.5 | -24.5 |
| 173.980000 | 2609.965000 | -46.4 | -82.4 | -26.4 |

PAGE NO. 13 of 42.

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 2.948, 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.

   The cables were oriented in order to obtain the maximum response. At each emission frequency, the turntable was rotated and the search antennas were raised and lowered vertically.

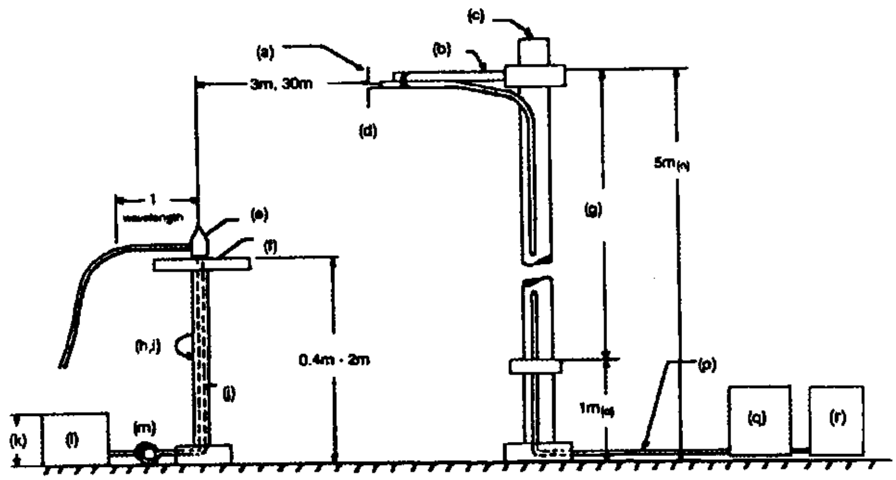
4. The emission was observed with both a vertically polarized and a horizontally polarized search antenna and the worst case was used.

6. The field strength of each emission within 20 dB of the limit was recorded and corrected with the appropriate cable and transducer factors.

7. The worst case for all channels is shown.

8. Measurement results: ATTACHED FOR WORST CASE

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 | Description | s/n | Cycle | Last Cal<br>Per ANSI C63.4-1992, 10.1.4 |
|---|---|---|---|---|---|
| TRANSDUCER | | | | | |
| ___ | i00065 | EMCO 3109B 100Hz-50MHz | 2336 | 12 mo. | |
| ___ | i00033 | Singer 94593-1 10kHz-32MHz | 0219 | 12 mo. | |
| x | i00088 | EMCO 3109-B 25MHz-300MHz | 2336 | 12 mo. | Oct-98 |
| x | i00089 | Aprel 2001 200MHz-1GHz | 001500 | 12 mo. | Oct-98 |
| x | i00103 | EMCO 3115 1GHz-18GHz | 9208-3925 | 12 mo. | Oct-98 |
| ___ | i00085 | EMCO 3116 10GHz-40GHz | 2076 | 12 mo. | |
| AMPLIFIER | | | | | |
| ___ | i00028 | HP 8449A | 2749A00121 | 12 mo. | Mar-99 |
| SPECTRUM ANALYZER | | | | | |
| ___ | i00029 | HP 8563E | 3213A00104 | 12 mo. | Aug-98 |
| x | i00033 | HP 85462A | 3625A00357 | 12 mo. | Dec-98 |
| ___ | i00048 | HP 8566B | 2511AD1467 | 6 mo. | Dec-98 |

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 | <-60 | <-65 |

SUPERVISED BY: Morton Flom, P. Eng.

NAME OF TEST: Field Strength of Spurious Radiation
g9960249: 1999-Jun-25 Fri 08:15:00
STATE: 2:High Power

| FREQUENCY TUNED, MHz | FREQUENCY EMISSION, MHz | METER, dBuV | CF, dB | uV/m @ 3m | ERP, dBm | MARGIN, dB |
|---|---|---|---|---|---|---|
| 162.020000 | 324.046000 | 38.88 | 19.7 | 849.18 | -38.75 | -18.8 |
| 162.020000 | 486.058000 | 40.77 | 23.72 | 1676.87 | -32.85 | -12.9 |
| 162.020000 | 648.079000 | 33.07 | 27.84 | 1110.45 | -36.45 | -16.5 |
| 162.020000 | 810.101000 | 21.95 | 29.93 | 392.64 | -45.45 | -25.5 |
| 162.020000 | 972.124000 | 21.72 | 36.99 | 861.99 | -38.65 | -18.7 |
| 162.020000 | 1134.148000 | 11.62 | 33.54 | 181.13 | -52.25 | -32.2 |
| 162.020000 | 1296.165000 | 9.59 | 35.41 | 177.83 | -52.35 | -32.4 |
| 162.020000 | 1458.182000 | 10.41 | 37.09 | 237.14 | -49.85 | -29.9 |
| 162.020000 | 1620.208000 | 7.09 | 38.63 | 193.2 | -51.65 | -31.7 |

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.

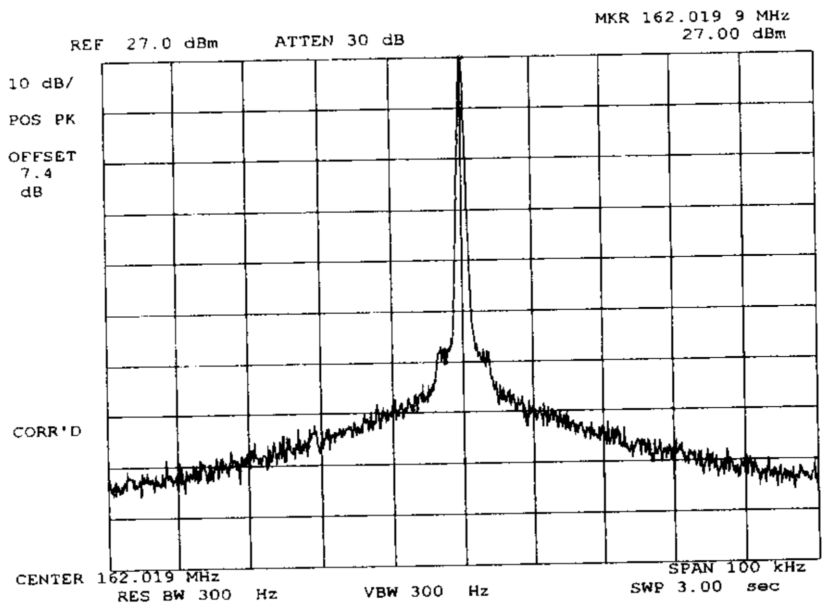
2. For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5 kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.

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

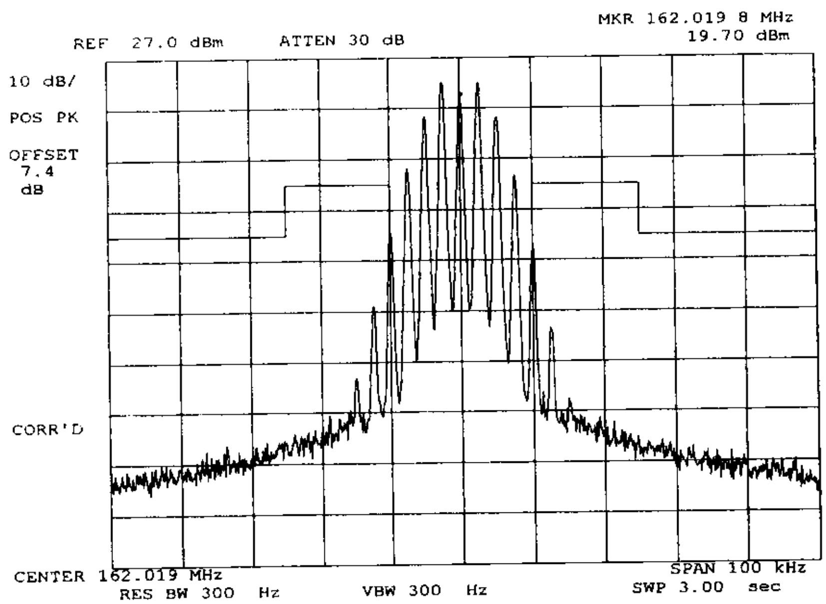
NAME OF TEST: Emission Masks (Occupied Bandwidth)
g9960235: 1999-Jun-24 Thu 08:01:00
STATE: 1:Low Power




POWER: LOW
MODULATION: NONE

SUPERVISED BY: Morton Flom, P. Eng.

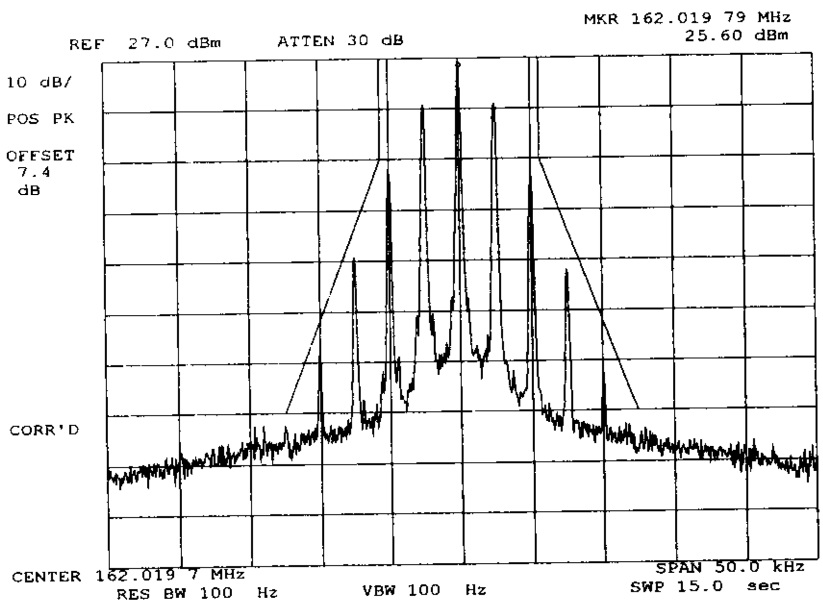
NAME OF TEST: Emission Masks (Occupied Bandwidth)
g9960237: 1999-Jun-24 Thu 08:04:00
STATE: 1:Low Power




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

SUPERVISED BY: Morton Flom, P. Eng.

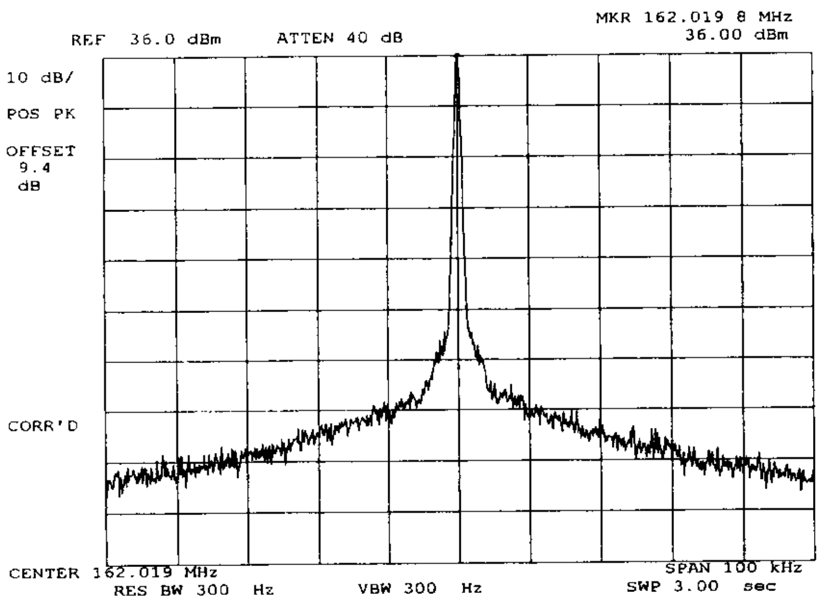
NAME OF TEST: Emission Masks (Occupied Bandwidth)
g9960239: 1999-Jun-24 Thu 08:11:00
STATE: 1:Low Power




POWER: LOW
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: D, VHF/UHF 12.5kHz BW

SUPERVISED BY: Morton Flom, P. Eng.

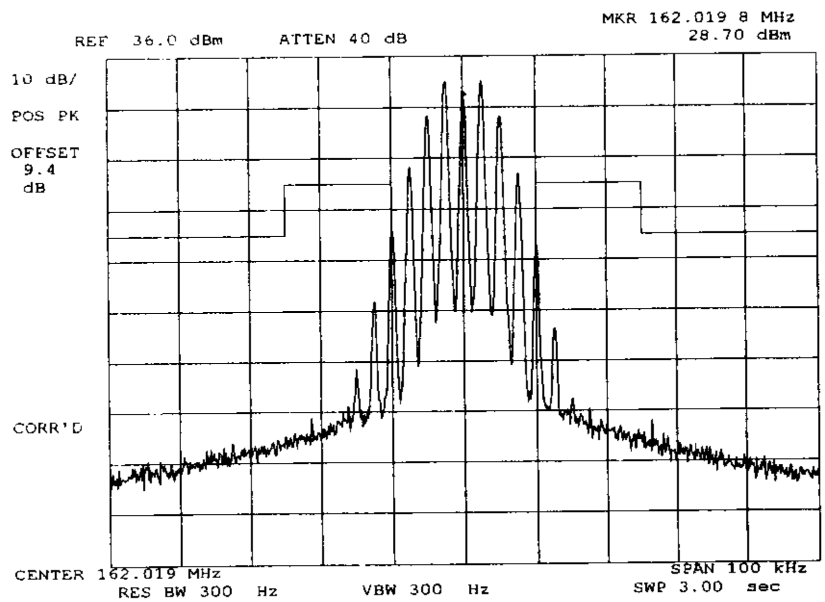
NAME OF TEST: Emission Masks (Occupied Bandwidth)
g9960234: 1999-Jun-24 Thu 07:58:00
STATE: 2:High Power




POWER: HIGH
MODULATION: NONE

SUPERVISED BY: Morton Flom, P. Eng.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g9960236: 1999-Jun-24 Thu 08:03:00
STATE: 2:High Power

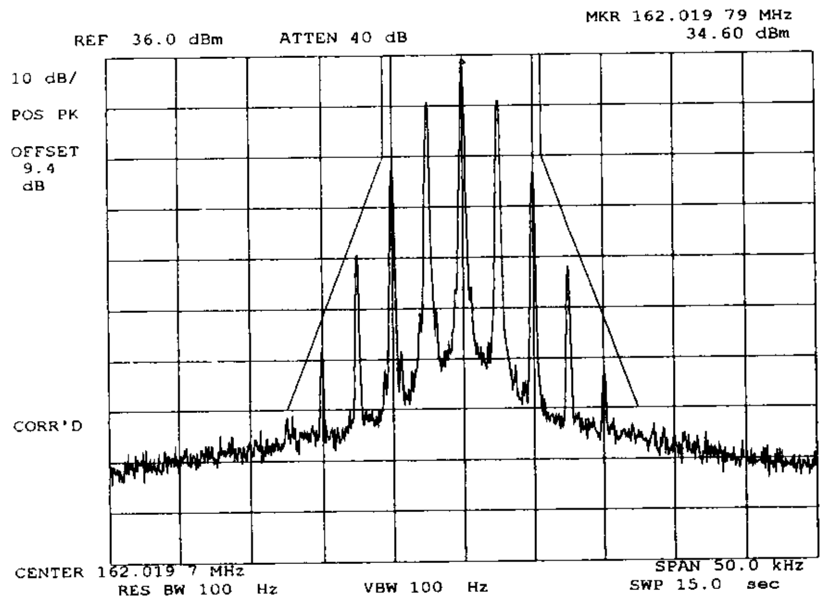



POWER: HIGH
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: B, VHF/UHF 25kHz, w/LPF

SUPERVISED BY: Morton Flom, P. Eng.

PAGE NO. 23 of 42.

NAME OF TEST: Emission Masks (Occupied Bandwidth)
g9960238: 1999-Jun-24 Thu 08:08:00
STATE: 2:High Power




POWER: HIGH
MODULATION: VOICE: 2500 Hz SINE WAVE
MASK: D, VHF/UHF 12.5kHz BW

SUPERVISED BY: Morton Flom, P. Eng.

PAGE NO. 24 of 42.

NAME OF TEST: Transient Frequency Behavior

SPECIFICATION: 47 CFR 90.214

GUIDE: ANSI/TIA/EIA-603-1992, Paragraph 2.2.19

TEST EQUIPMENT: As per attached page

MEASUREMENT PROCEDURE

1. The EUT was setup as shown on the attached page, following TIA/EIA-603 steps a, b, and c as a *guide*.

2. The transmitter was turned on.

3. Sufficient attenuation was provided so that the transmitter carrier level measured at the output of the combiner was 40 dB below the maximum input level of the test receiver. This level was recorded as step f.

4. The transmitter was turned off.

5. An RF signal generator (1) modulated with a 1 kHz tone at either 25, 12.5, or 6.25 kHz deviation, and set to the same frequency as the assigned transmitter frequency, (2) was adjusted to a level -20 dB below the level recorded for step f, as measured at the output of the combiner. This level was then fixed for the remainder of the test and is recorded at step h.

6. The oscilloscope was setup using TIA/EIA-603 steps j and k as a guide, and to either 10 ms/div (UHF) or 5 ms/div (VHF).

7. The 30 dB attenuator was removed, the transmitter was turned on, and the level of the carrier at the output of the combiner was recorded as step l.

8. The carrier on-time as referenced in TIA/EIA-603 steps m, n, and o was captured and plotted. The carrier off-time as referenced in TIA/EIA-603 steps p, q, r, and s was captured and plotted.

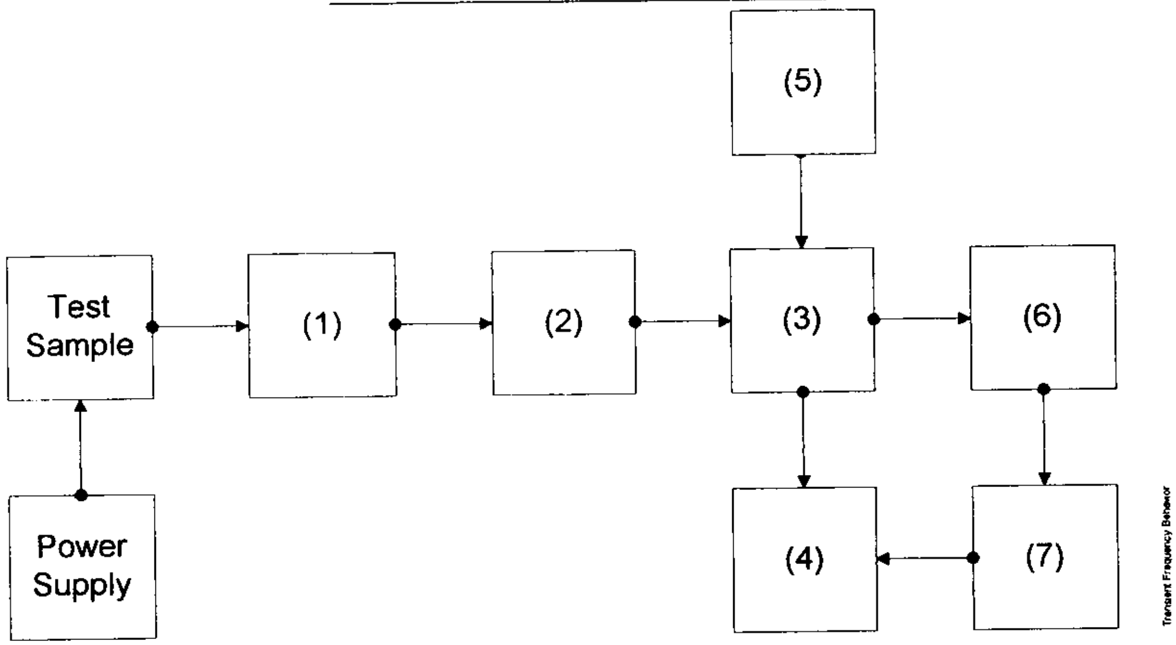
LEVELS MEASURED:

| | |
|---|---|
| step f, dBm | = -16.9 |
| step h, dBm | = -33.8 |
| step l, dBm | = 17.4 |

SUPERVISED BY:

Morton Flom, P. Eng.

TRANSIENT FREQUENCY BEHAVIOR




| Asset | | Description | s/n |
|---|---|---|---|
| (1) | ATTENUATOR (Removed after 1st step) | | |
| x | i00112 | Philco 30 dB | 989 |
| (2) | ATTENUATOR | | |
| | i00112 | Philco 30 dB | 989 |
| | i00172 | Bird 30 dB | 989 |
| x | i00122 | Narda 10 dB | 7802 |
| | i00123 | Narda 10 dB | 7802A |
| | i00110 | Kay Variable | 145-387 |
| (3) | COMBINER | | |
| x | i00154 | 4 x 25 Ω COMBINER | 154 |
| (4) | CRYSTAL DETECTOR | | |
| x | i00159 | HP 8470B | 1822A10054 |
| (5) | RF SIGNAL GENERATOR | | |
| | i00018 | HP 8656A | 2228A03472 |
| | i00031 | HP 8656A | 2402A06180 |
| x | i00067 | HP 8920A | 3345U01242 |
| (6) | MODULATION ANALYZER | | |
| x | i00020 | HP 8901A | 2105A01087 |
| (7) | SCOPE | | |
| x | i00030 | HP 54502A | 2927A00209 |

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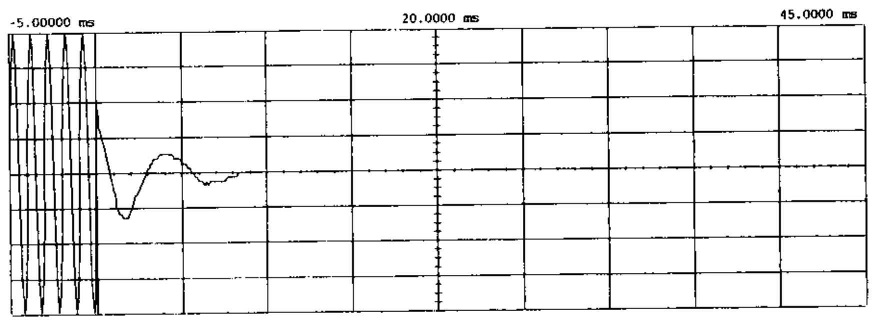
NAME OF TEST: Transient Frequency Behavior
g9960242: 1999-Jun-24 Thu 09:28:00
STATE: 0:General




25

-25

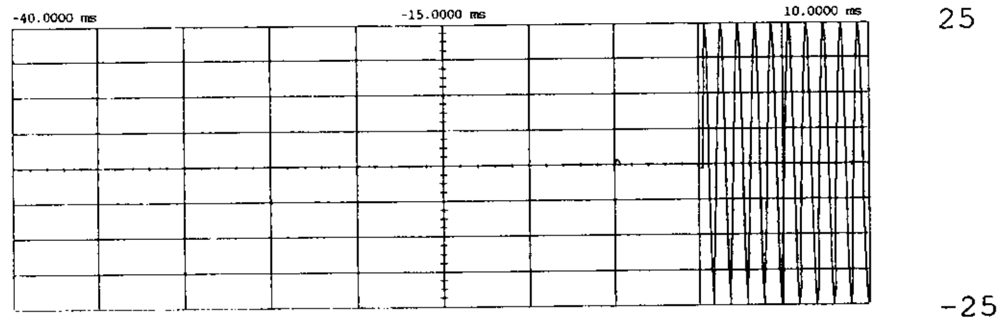
| | Timebase | Delay/Pos | Reference | Mode |
|---|---|---|---|---|
| Main | 5.00 ms/div | 20.0000 ms | Center | Repetitive |
| | Sensitivity | Offset | Probe | Coupling |
| Channel 1 | 600 mV/div | 0.00000 V | 1.000 :1 | dc (1M ohm) |

Trigger mode : Edge
On Negative Edge Of Chan2
Trigger Level
Chan2 = -3.500 mV (noise reject ON)
Holdoff = 40.000 ns

POWER: 4W
MODULATION: Ref Gen=25 kHz Deviation
DESCRIPTION: CARRIER ON TIME

SUPERVISED BY: Morton Flom, P. Eng.

NAME OF TEST: Transient Frequency Behavior
g9960243: 1999-Jun-24 Thu 09:33:00
STATE: 0:General




| | Timebase | Delay/Pos | Reference | Mode |
|---|---|---|---|---|
| Main | 5.00 ms/div | -15.0000 ms | Center | Repetitive |
| | Sensitivity | Offset | Probe | Coupling |
| Channel 1 | 600 mV/div | 0.00000 V | 1.000 :1 | dc (1M ohm) |

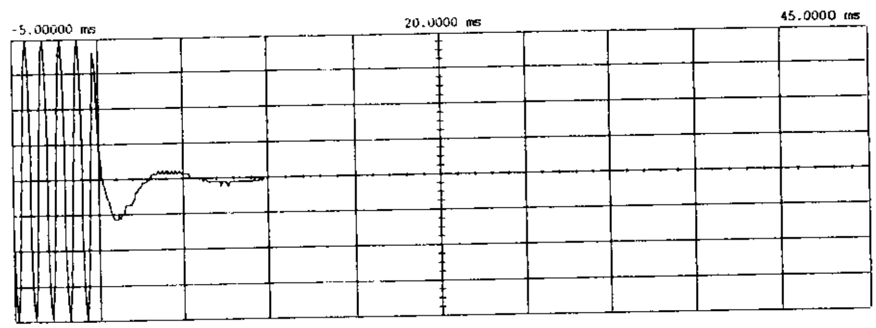
Trigger mode : Edge
On Positive Edge Of Chan2
Trigger Level
Chan2 = -1.80000 V (noise reject ON)
Holdoff = 40.000 ns

POWER: 4W
MODULATION: Ref Gen=25 kHz Deviation
DESCRIPTION: CARRIER OFF TIME

SUPERVISED BY: Morton Flom, P. Eng.

NAME OF TEST: Transient Frequency Behavior
g9960244: 1999-Jun-24 Thu 09:49:00
STATE: 0:General

12.5




-12.5

| | | | | |
|---|---|---|---|---|
| Main | Timebase 5.00 ms/div | Delay/Pos 20.0000 ms | Reference Center | Mode Repetitive |
| Channel 1 | Sensitivity 300 mV/div | Offset 0.00000 V | Probe 1.000 :1 | Coupling dc (1M ohm) |

Trigger mode : Edge
On Negative Edge Of Chan2
Trigger Level
Chan2 = -3.000 mV (noise reject ON)
Holdoff = 40.000 ns

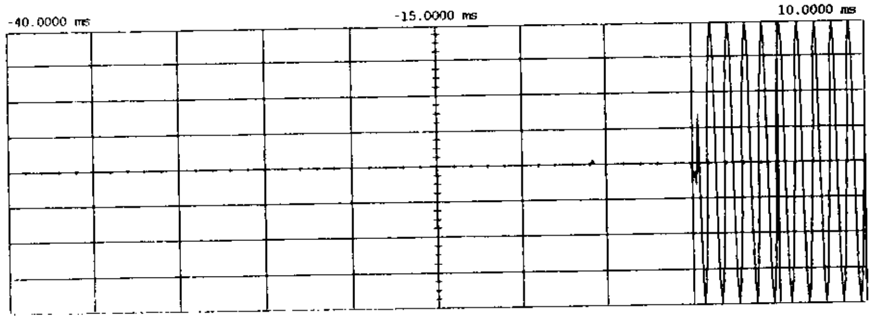
POWER: 4W
MODULATION: Ref Gen=12.5 kHz Deviation
DESCRIPTION: CARRIER ON TIME

SUPERVISED BY:

Morton Flom, P. Eng.

PAGE NO. 29 of 42.

NAME OF TEST: Transient Frequency Behavior
g9960245: 1999-Jun-24 Thu 09:52:00
STATE: 0:General




| | | | | |
|---|---|---|---|---|
| | Timebase | Delay/Pos | Reference | Mode |
| Main | 5.00 ms/div | -15.0000 ms | Center | Repetitive |
| | Sensitivity | Offset | Probe | Coupling |
| Channel 1 | 300 mV/div | 0.00000 V | 1.000 :1 | dc (1M ohm) |

Trigger mode : Edge
On Positive Edge Of Chan2
Trigger Level
Chan2 = -1.12500 V (noise reject ON)
Holdoff = 40.000 ns

POWER: 4W
MODULATION: Ref Gen=12.5 kHz Deviation
DESCRIPTION: CARRIER OFF TIME

SUPERVISED BY: Morton Flom, P. Eng.

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

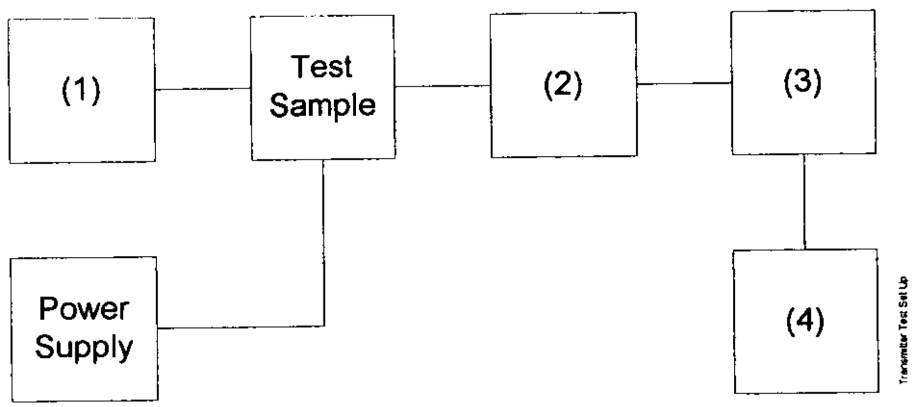
1. The EUT and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage.

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

3. MEASUREMENT RESULTS: ATTACHED

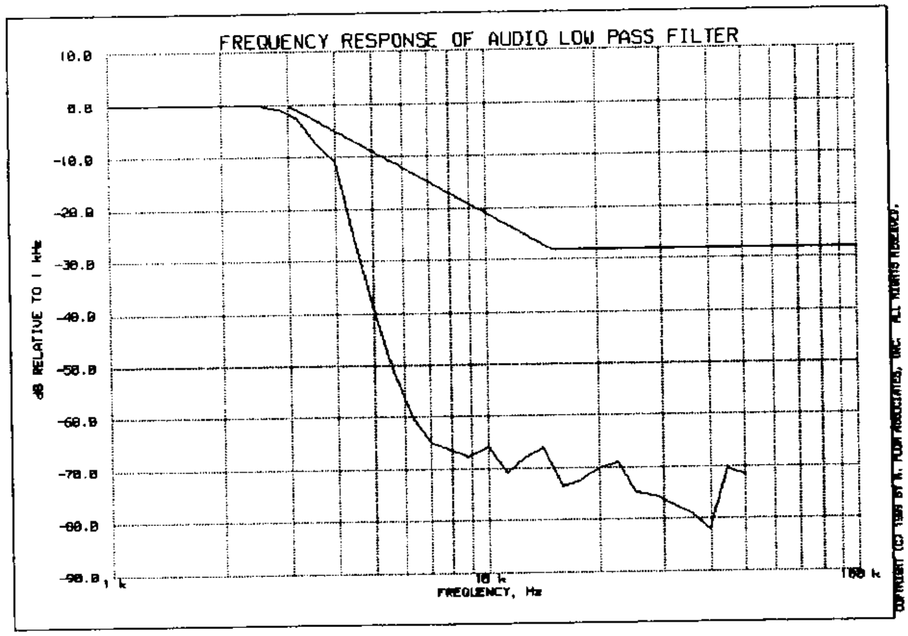
## TRANSMITTER TEST SET-UP

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

NAME OF TEST: Audio Low Pass Filter (Voice Input)
g9960215: 1999-Jun-23 Wed 14:07:00
STATE: 0:General




SUPERVISED BY: Morton Flom, P. Eng.

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.

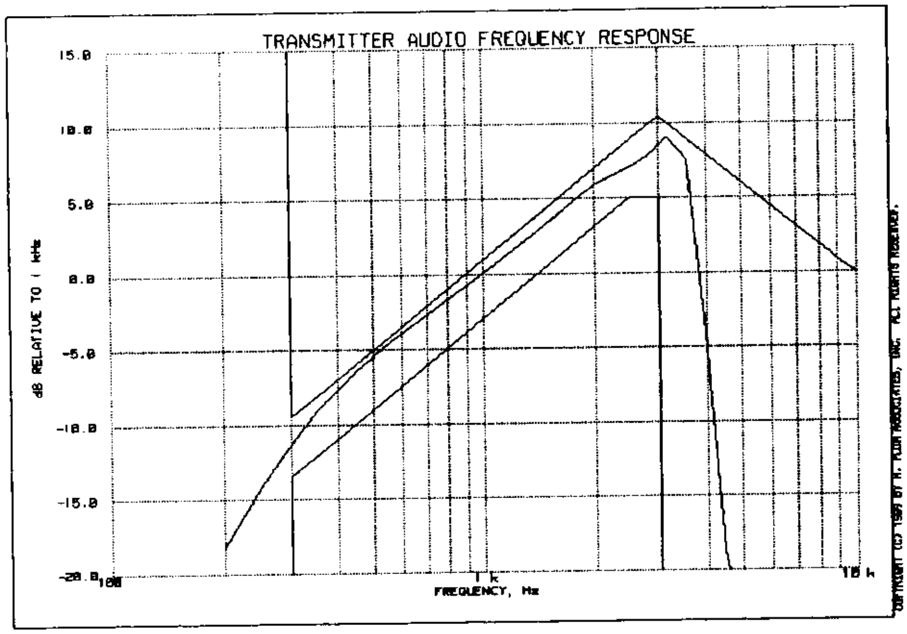
3. The audio signal input was adjusted to obtain 20% modulation at 1 kHz, and this point was taken as the 0 dB reference level.

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

NAME OF TEST: Audio Frequency Response
g9960216: 1999-Jun-23 Wed 14:12:00
STATE: 0:General




Additional points:

| FREQUENCY, Hz | LEVEL, dB |
|---|---|
| 300 | -11.38 |
| 20000 | -31.97 |
| 30000 | -31.69 |
| 50000 | -32.50 |

SUPERVISED BY:

Morton Flom, P. Eng.

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.

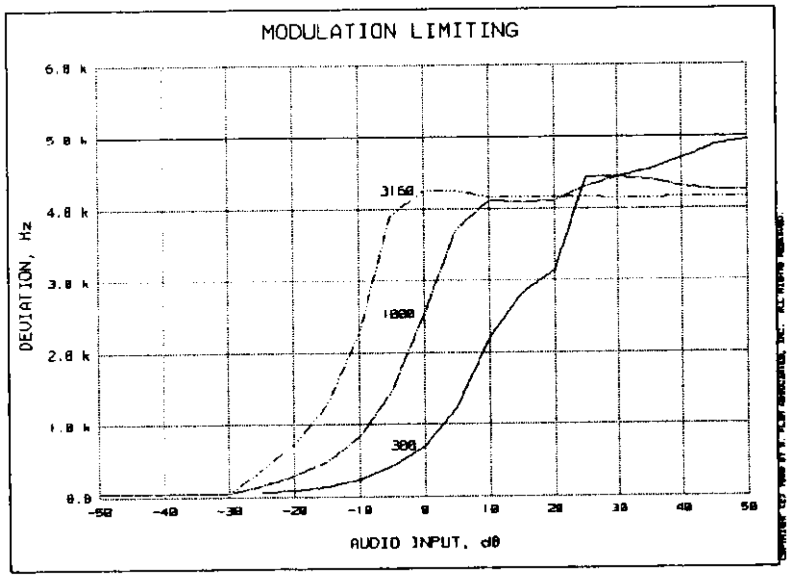
3. The input level was varied from 30% modulation (±1.5 kHz deviation) to at least 20 dB higher than the saturation point.

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

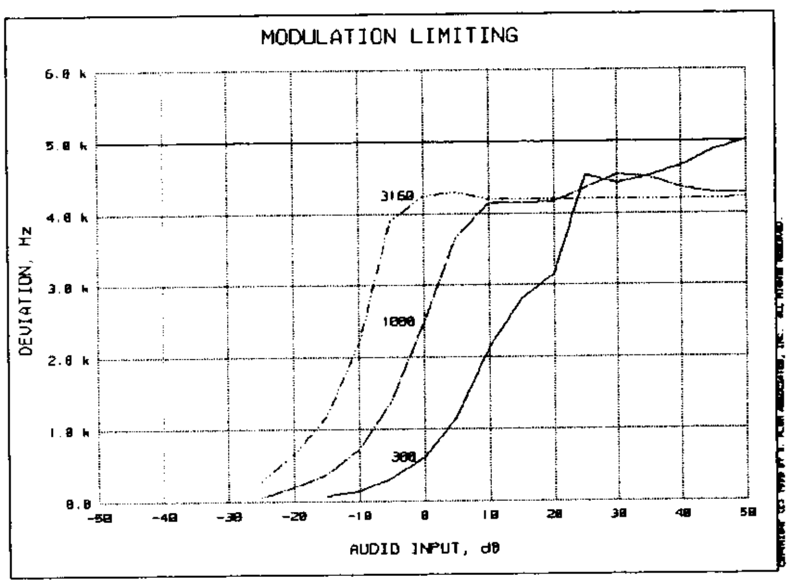
5. MEASUREMENT RESULTS: ATTACHED

NAME OF TEST: Modulation Limiting
g9960217: 1999-Jun-23 Wed 14:15:00
STATE: 0:General

Positive Peaks:



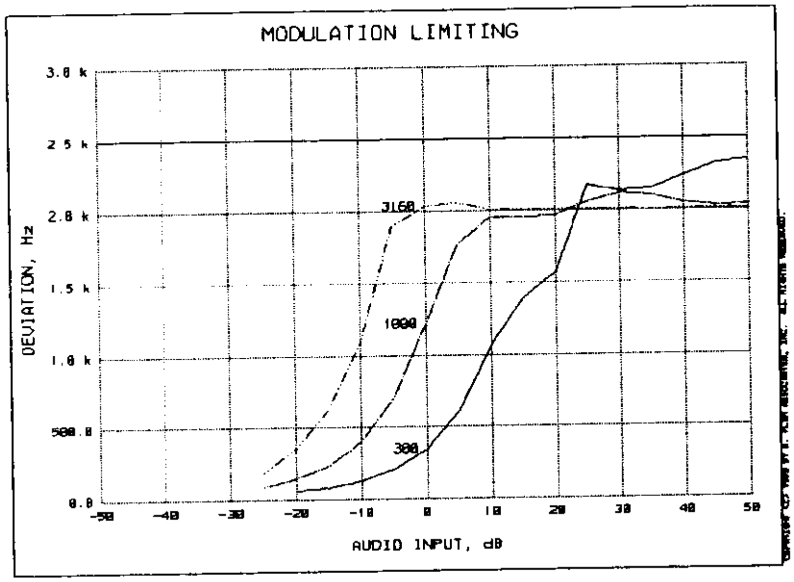

Negative Peaks:



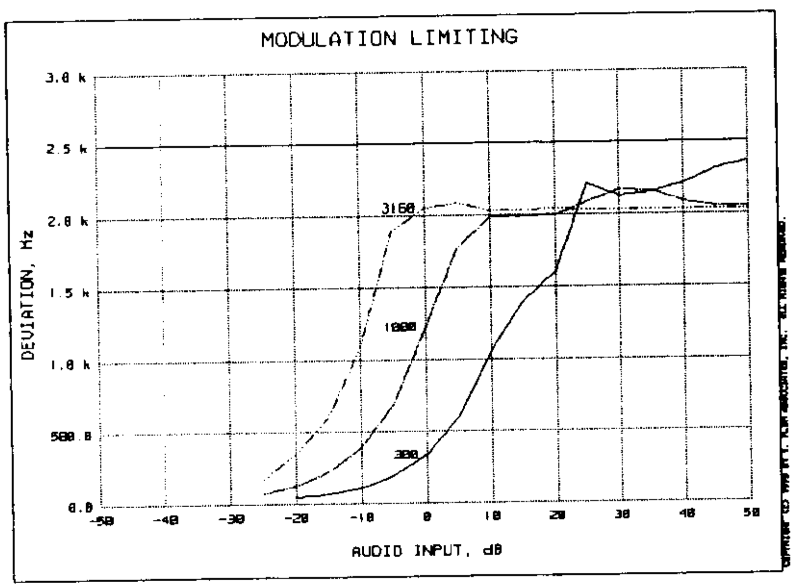

SUPERVISED BY: Morton Flom, P. Eng.

NAME OF TEST: Modulation Limiting
g9960218: 1999-Jun-23 Wed 14:19:00
STATE: 0:General

Positive Peaks:




Negative Peaks:




SUPERVISED BY:

Morton Flom, P. Eng.

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.

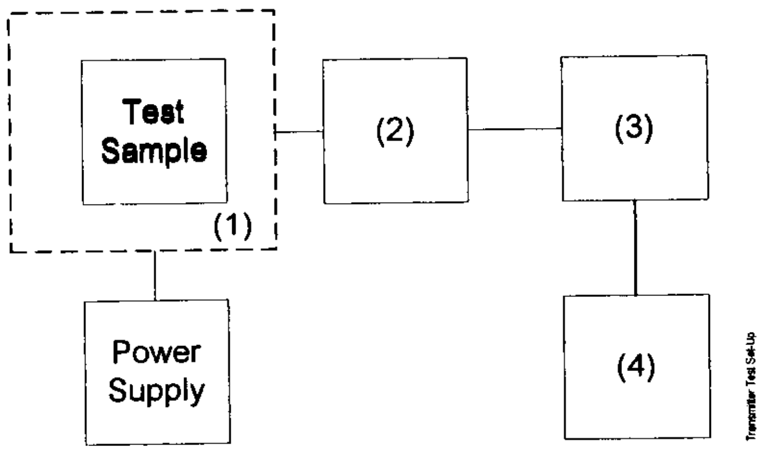
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

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

5. MEASUREMENT RESULTS: ATTACHED

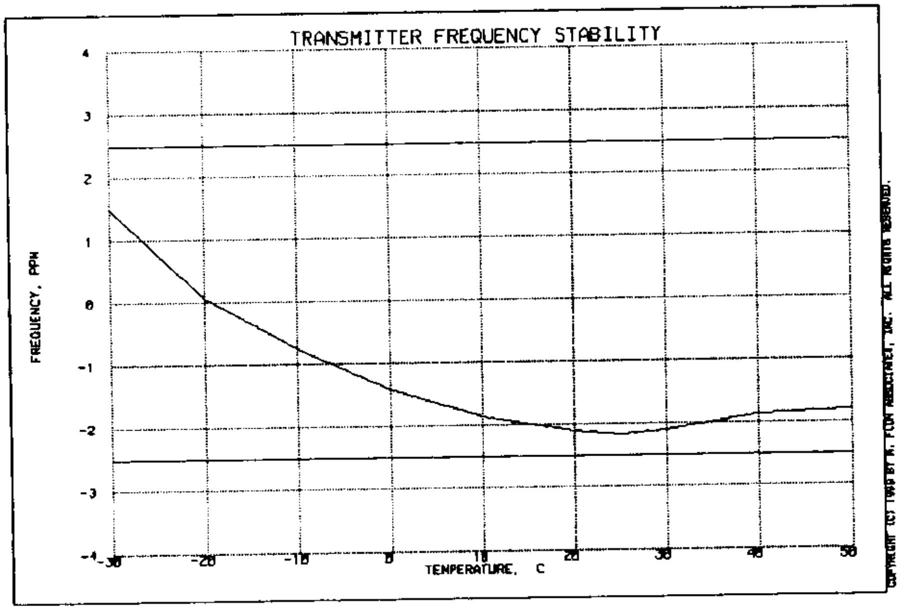
## TRANSMITTER TEST SET-UP

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 |
|---|---|---|---|
| (1) | | TEMPERATURE, HUMIDITY, VIBRATION | |
| x | i00027 | Tenny 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 |
| x | i00113 | SIERRA 661A-3D | 1059 |
| | i00069 | BIRD 8329 (30 dB) | 10066 |
| (3) | | R.F. POWER | |
| | i00014 | HP 435A POWER METER | 1733A05839 |
| x | i00039 | HP 436A POWER METER | 2709A26776 |
| x | i00020 | HP 8901A POWER MODE | 2105A01087 |
| (4) | | FREQUENCY COUNTER | |
| | i00042 | HP 5383A | 1628A00959 |
| x | i00019 | HP 5334B | 2704A00347 |
| x | i00020 | HP 8901A | 2105A01087 |

NAME OF TEST: Frequency Stability (Temperature Variation)
g9960219: 1999-Jun-24 Thu 10:42:00
STATE: 0:General




SUPERVISED BY: Morton Flom, P. Eng.

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)
g9960225: 1999-Jun-23 Wed 14:40:24
STATE: 0:General

LIMIT, ppm = 2.5
LIMIT, Hz = 405
BATTERY END POINT (Voltage) = 6.4

| % of STV | Voltage | Frequency, MHz | Change, Hz | Change, ppm |
|---|---|---|---|---|
| 85 | 6.37 | 162.019990 | -10 | -0.06 |
| 100 | 7.5 | 162.020000 | 0 | 0.00 |
| 115 | 8.62 | 162.020010 | 10 | 0.06 |
| 85 | 6.4 | 162.020000 | 0 | 0.00 |

SUPERVISED BY: Morton Flom, P. Eng.

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 | = (2 x M) + (2 x D x K) |
| | = 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 | = (2 x M) + (2 x D x K) |
| | = 11.0 |

SUPERVISED BY: M. Flom P. Eng

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.

M. Flom P. Eng

CERTIFYING ENGINEER: 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. #45 34.

3. ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOPHYSICISTS & GEOLOGISTS OF ALBERIA #5916.

4. REGISTERED ENGINEERING CONSULTANT - INDUSTRY CANADA, Certification & Engineering Bureau.

5. IEEE, Lifetime member no. 041/204 (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.