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

Transmitter Certification

of

FCC ID: FRW2000-UHF2
Model: P2000-UHF2

to

Federal Communications Commission

Rule Part(s) 90, 90.210, Confidentiality

Date of report: September 30, 2003

On the Behalf of the Applicant:

Wulfsberg Electronics Division

At the Request of: P.O. Part of 13188

Wulfsberg Electronics Division
6400 Wilkinson Drive
Prescott, AZ 86301-6164

Attention of: Main: (928) 708-1550; Fax: (928) 541-7627
Scott Hovelsrud, Tactical Communications Product Line Mgr.
Direct (928) 708-1505
Email: scott.hovelsrud@wulfsberg.com
Mary Beaumont, Principal RF Engineer
Direct (928) 708-1543
Email: mary.beaumont@wulfsberg.com

Supervised by: Morton Flom, P. Eng.

List of Exhibits

(FCC **Certification** (Transmitters) - Revised 9/28/98)

Applicant: Wulfsberg Electronics Division

FCC ID: FRW2000-UHF2

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
Parts List	x
Active Devices	x
5. Part 90.203(e) & (g) Attestation	x
6. Confidentiality Request	x
7. MPE Report	x

By M.F.A. Inc.:

A. Testimonial & Statement of Certification

The Applicant has been cautioned as to the following:

15.21 **Information to the 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

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

a) **Test Report**

b) Laboratory: (FCC: 31040/SIT) (Canada: IC 2044)	M. Flom Associates, Inc. 3356 N. San Marcos Place, Suite 107 Chandler, AZ 85225
c) Report Number:	d0390095
d) Client:	Wulfsberg Electronics Division 6400 Wilkinson Drive Prescott, AZ 86301-6164
e) Identification:	P2000-UHF2 FCC ID: FRW2000-UHF2
EUT Description:	UHF 450-512MHz Transceiver
f) EUT Condition:	Not required unless specified in individual tests.
g) Report Date: EUT Received:	September 30, 2003 August 11, 2003
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.

List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,
Volume II, Part 2 and to

90, 90.210, Confidentiality

Sub-part 2.1033

(c)(1): **Name and Address of Applicant**:

Wulfsberg Electronics Division
6400 Wilkinson Drive
Prescott, AZ 86301-6164

Manufacturer:

Applicant

(c)(2): **FCC ID**: FRW2000-UHF2

Model Number: P2000-UHF2

(c)(3): **Instruction Manual(s):**

Please see attached exhibits

(c)(4): **Type of Emission**: 16K0F3E, 11K0F3E, 8K10F1E, 8K10F1D, 20K0F1E

(c)(5): **Frequency Range, MHz**: 450 to 512

(c)(6): **Power Rating, Watts**: 1 to 10

x Switchable ____ Variable ____ N/A

(c)(7): **Maximum Power Rating, Watts**: 300

DUT Results: Passes x Fails _____

Please Note: The Applicant is submitting four applications for transmitters, which use four distinct Motorola manufactured, and previously certified Integrated Transceiver Modules (ITMs). In this case, Wulfsberg FCC ID: FRW2000-UHF2 uses Motorola module FCC ID: AZ489FT4821. A copy of the Grant has been uploaded with the exhibits.

Information for Push-To-Talk Devices

Type and number of antenna to be used for this device:
AT-462 (manufactured by Comant)

Maximum antenna gain for antenna indicated above:
3 dBd

Can this device sustain continuous operation with respect to its hardware capabilities and allowable operating functions?
No, 50% Duty Cycle

Other hardware or operating restrictions that could limit a person's RF Exposure:
None

Source-based time-averaging (see 2.1093 of rules) applicable to reduce the average output power:
No

If device has headset and belt-clip accessories that would allow body-worn operations, what is the minimum separation distance between the antenna and the user's body in this operating configuration?
No

Can device access wire-line services to make phone calls, either directly or through an operator?
No

Can specific operating instructions be given to users to eliminate any potential RF Exposure concerns for both front-of-the-face and body-worn operating configurations?
See Manual

Other applicable information the applicant may provide that can serve as effective means for ensuring RF Exposure compliance:
See Manual

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

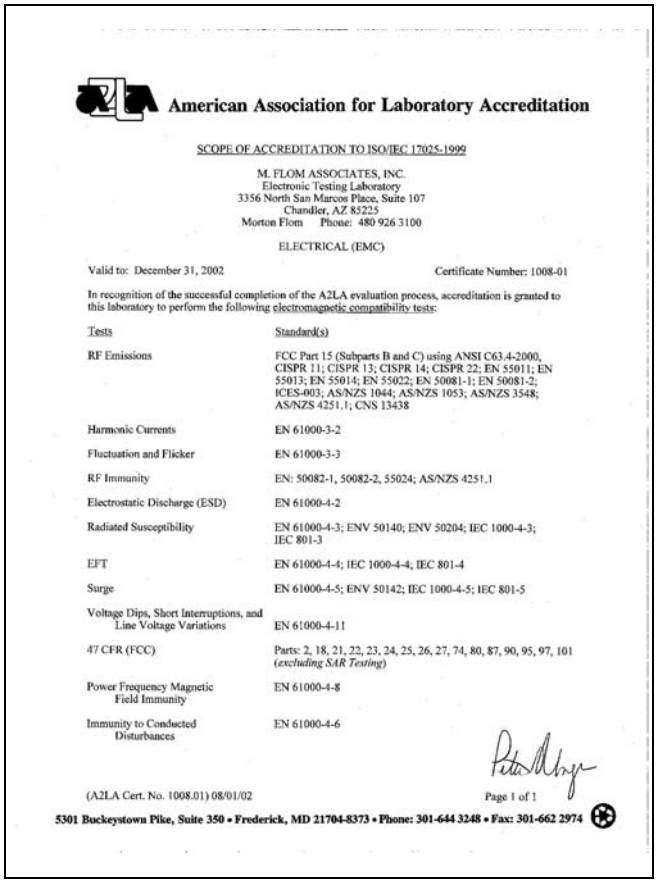
Electrical (EMC) Testing

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.

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Subpart 2.1033 (continued)
(c)(8): Voltages & currents in all elements in final RF stage, including final transistor or solid-state device:

Collector Current, A	=	0.357
Collector Voltage, Vdc	=	28
Supply Voltage, Vdc	=	28

(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 Number 6 of 54.

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
_____ 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 Radio Beacons (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)
_____ 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.

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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 RF Power Meter.

2. Measurement accuracy is ±3%.

Measurement Results
(Worst case)

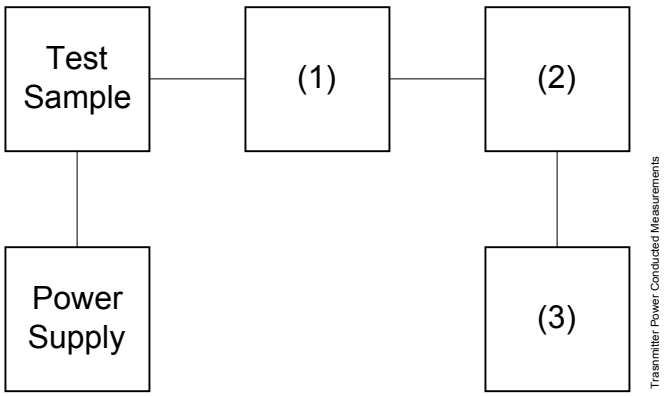
Frequency of Carrier, MHz = 485.025, 450.025, 511.975
Ambient Temperature = 22°C ± 3°C

Power Setting	RF Power, Watts
Low	1
High	10

Performed by: David Lee

Transmitter Power Conducted Measurements

Test A. RF Power Output
Test B. Frequency Stability



Asset (as applicable)	Description	s/n
(1) **Coaxial Attenuator**		
i00122	Narda 766-10	7802
i00123	Narda 766-10	7802A
i00231	Pasternack (30 dB)	N/A
i00232	Pasternack (30 dB)	N/A
(2) **Power Meters**		
i00020	HP 8901A Power Mode	2105A01087
(3) **Frequency Counter**		
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	=	485.025, 450.025
Spectrum Searched, GHz	=	0 to 10 x F_C
Maximum Response, Hz	=	2820
All Other Emissions	=	≥ 20 dB Below Limit

Performed by: David Lee

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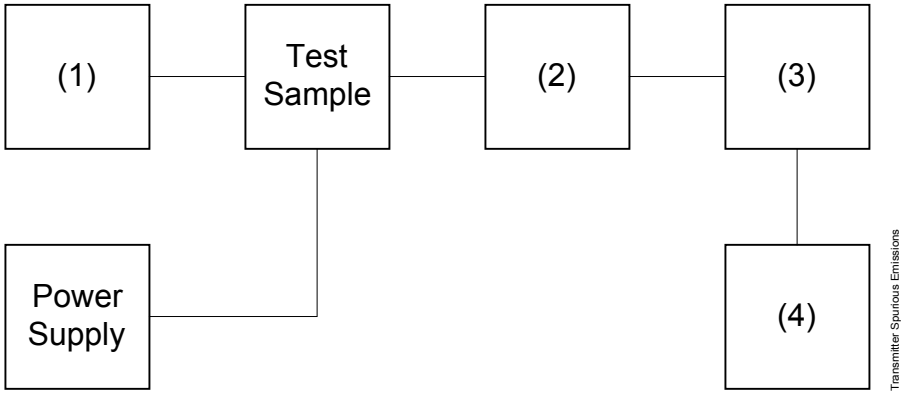
Transmitter Spurious Emission

Test A. Occupied Bandwidth (In-Band Spurious)
Test B. Out-Of-Band Spurious



Asset (as applicable)	Description	s/n
(1) **Audio Oscillator/Generator**		
i00017	HP 8903A	2216A01753
(2) **Coaxial Attenuator**		
i00122	Narda 766-10	7802
i00123	Narda 766-10	7802A
i00231	Pasternack (30 dB)	N/A
i00232	Pasternack (30 dB)	N/A
(3) **Filters; Notch, HP, LP, BP**		
i00126	Eagle TNF-1	100-250
i00124	Eagle TNF-1	250-850
(4) **Spectrum Analyzer**		
i00048	HP 8566B	2511A01467
i00029	HP 8563E	3213A00104

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Name of Test: Unwanted Emissions (Transmitter Conducted)

Limit(s), dBc

-(50+10xLOG P) = -50 (1 Watt)
-(50+10xLOG P) = -60 (10 Watts)

g0380043: 2003-Aug-14 Thu 15:57:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C

Frequency Tuned, MHz	Frequency Emission, MHz	Level, dBm	Level, dBc	Margin, dB
450.025000	900.136500	-84	-80.5	-64
485.025000	970.272000	-82.7	-79.2	-62.7
511.975000	1023.759500	-83.7	-80.2	-63.7
450.025000	1349.897500	-82.6	-79.1	-62.6
485.025000	1455.212000	-82.3	-78.8	-62.3
511.975000	1535.833500	-83.3	-79.8	-63.3
450.025000	1800.144500	-82.4	-78.9	-62.4
485.025000	1940.107000	-82.3	-78.8	-62.3
511.975000	2047.953500	-82.4	-78.9	-62.4
450.025000	2249.888500	-82	-78.5	-62
485.025000	2425.246000	-81.8	-78.3	-61.8
511.975000	2559.649500	-83.7	-80.2	-63.7
450.025000	2700.221000	-83.3	-79.8	-63.3
485.025000	2910.134500	-84.2	-80.7	-64.2
511.975000	3071.701500	-85	-81.5	-65
450.025000	3149.960500	-83.5	-80	-63.5
485.025000	3395.109500	-84.5	-81	-64.5
511.975000	3583.780500	-85.1	-81.6	-65.1
450.025000	3600.258500	-84.7	-81.2	-64.7
485.025000	3880.327000	-84.6	-81.1	-64.6
450.025000	4049.980000	-85	-81.5	-65
511.975000	4095.625500	-85.7	-82.2	-65.7
485.025000	4365.126500	-83.9	-80.4	-63.9
450.025000	4500.224000	-85.1	-81.6	-65.1
511.975000	4608.021000	-84.1	-80.6	-64.1
485.025000	4850.177500	-83.5	-80	-63.5
450.025000	4950.336000	-84.5	-81	-64.5
511.975000	5119.741500	-84.6	-81.1	-64.6
485.025000	5335.172500	-84.5	-81	-64.5
450.025000	5400.475500	-84.4	-80.9	-64.4
511.975000	5631.652000	-85.1	-81.6	-65.1
485.025000	5820.501500	-77.4	-73.9	-57.4
450.025000	5850.337500	-78.6	-75.1	-58.6
511.975000	6143.682500	-77.9	-74.4	-57.9
450.025000	6300.152600	-78	-74.5	-58
485.025000	6305.293600	-77.9	-74.4	-57.9
511.975000	6655.646600	-78.1	-74.6	-58.1
450.025000	6750.467400	-78.2	-74.7	-58.2
485.025000	6790.163500	-78.1	-74.6	-58.1
511.975000	7167.765100	-78.5	-75	-58.5
485.025000	7275.551900	-78.8	-75.3	-58.8
511.975000	7679.732200	-78.1	-74.6	-58.1

Name of Test: Unwanted Emissions (Transmitter Conducted)

Limit(s), dBc

-(50+10xLOG P) = -50 (1 Watt)

-(50+10xLOG P) = -60 (10 Watts)

g0380042: 2003-Aug-14 Thu 15:56:00

State: 2:High Power Ambient Temperature: 22°C ± 3°C

Frequency Tuned, MHz	Frequency Emission, MHz	Level, dBm	Level, dBc	Margin, dB
450.025000	900.058000	-66.7	-75.4	-46.7
485.025000	970.050500	-68.2	-76.9	-48.2
511.975000	1023.956000	-71.8	-80.5	-51.8
450.025000	1350.081500	-65.1	-73.8	-45.1
485.025000	1455.081500	-67.2	-75.9	-47.2
511.975000	1535.925500	-66.9	-75.6	-46.9
450.025000	1799.871000	-73.4	-82.1	-53.4
485.025000	1939.883000	-72.7	-81.4	-52.7
511.975000	2047.678000	-70.5	-79.2	-50.5
450.025000	2250.356000	-72.5	-81.2	-52.5
485.025000	2424.981000	-72.2	-80.9	-52.2
511.975000	2559.865500	-74.5	-83.2	-54.5
450.025000	2699.940500	-73.4	-82.1	-53.4
485.025000	2910.333000	-73.7	-82.4	-53.7
511.975000	3071.825000	-74.6	-83.3	-54.6
450.025000	3150.274000	-74.7	-83.4	-54.7
485.025000	3394.937500	-74.2	-82.9	-54.2
511.975000	3583.626500	-75	-83.7	-55
450.025000	3600.127500	-73.6	-82.3	-53.6
485.025000	3880.080000	-75.1	-83.8	-55.1
450.025000	4050.358500	-74.1	-82.8	-54.1
511.975000	4096.014000	-75.1	-83.8	-55.1
485.025000	4365.008000	-75.3	-84	-55.3
450.025000	4500.147000	-74.1	-82.8	-54.1
511.975000	4607.857000	-75	-83.7	-55
485.025000	4850.117000	-74.3	-83	-54.3
450.025000	4950.239000	-74.6	-83.3	-54.6
511.975000	5119.587000	-75.2	-83.9	-55.2
485.025000	5335.107500	-73.3	-82	-53.3
450.025000	5400.050000	-74.4	-83.1	-54.4
511.975000	5631.669500	-74.8	-83.5	-54.8
485.025000	5820.446000	-69.3	-78	-49.3
450.025000	5850.370300	-68.5	-77.2	-48.5
511.975000	6143.503500	-68.5	-77.2	-48.5
450.025000	6300.419400	-66.7	-75.4	-46.7
485.025000	6305.503300	-68.3	-77	-48.3
511.975000	6655.445900	-68.1	-76.8	-48.1
450.025000	6750.135900	-68.4	-77.1	-48.4
485.025000	6790.436300	-69.4	-78.1	-49.4
511.975000	7167.807700	-67.9	-76.6	-47.9
485.025000	7275.150700	-67.9	-76.6	-47.9
511.975000	7679.550400	-68	-76.7	-48

Name of Test: Field Strength of Spurious Radiation

Specification: 47 CFR 2.1053(a)

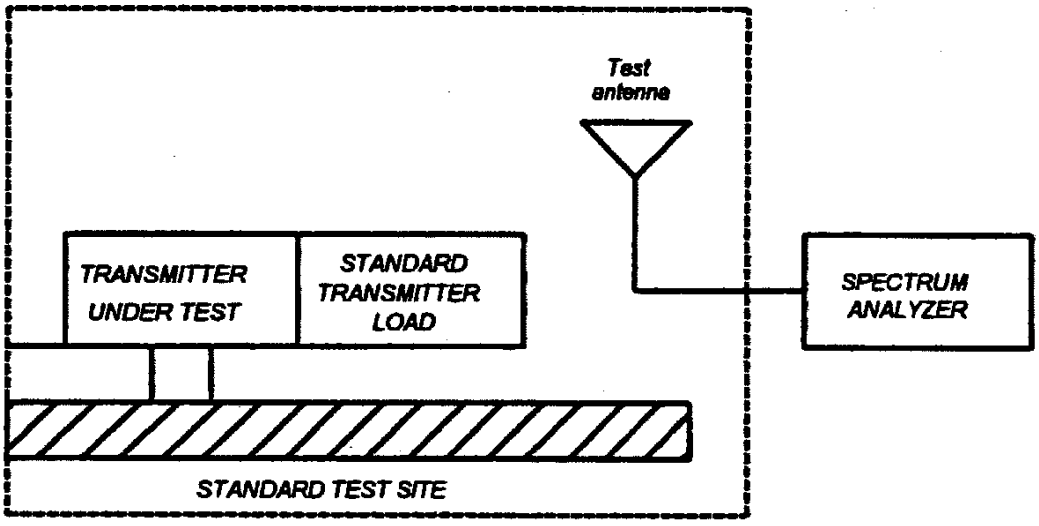
Guide: ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917

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.

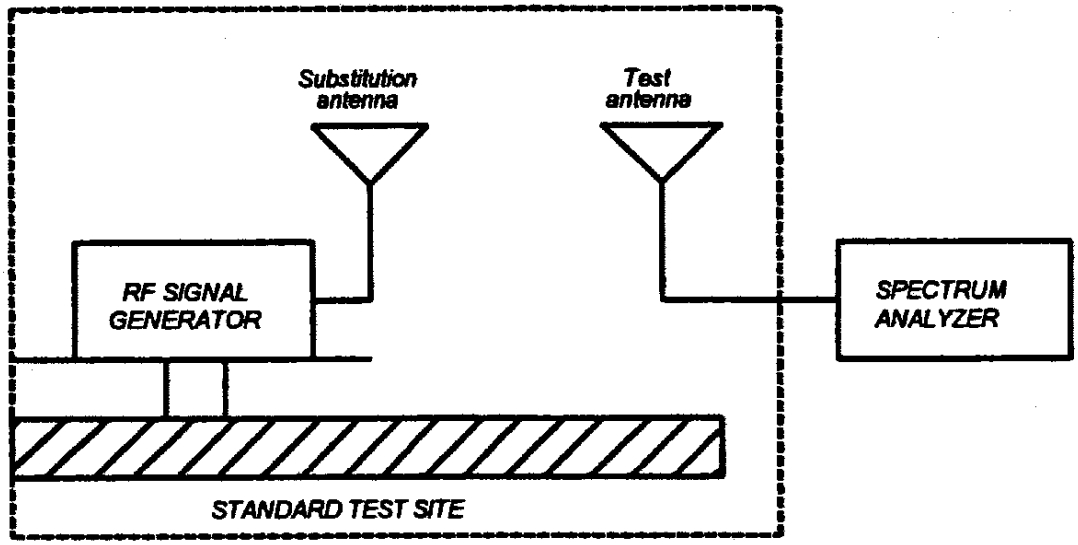


Name of Test: Field Strength of Spurious Radiation (Cont.)

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.

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
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.	Mar-03
i00048	HP 8566B	2511AD1467	12 mo.	Jul-03

Microphone, Antenna Port, and Cabling

Microphone	No	Cable Length	N/A		
Antenna Port Terminated	Yes	Load	50 ohms	Antenna Gain	3 dBd
All Ports Terminated by Load	No	Peripheral	N/A		

Name of Test: Field Strength of Spurious Radiation
g0380037: 2003-Aug-14 Thu 08:34:00
STATE: 2:High Power Ambient Temperature: 22°C ± 3°C

Frequency Tuned, MHz	Frequency Emission, MHz	ERP, dBm	ERP, dbc
450.025000	900.050833	-56.3	≤ -86.4
450.025000	1350.265834	-56.2	≤ -86.4
450.025000	1800.100000	-54.7	≤ -86.4
450.025000	2250.074167	-52.9	≤ -86.4
450.025000	2700.129167	-53.7	≤ -86.4
450.025000	3150.407500	-48.6	≤ -86.4
450.025000	3600.099167	-49.6	≤ -86.4
450.025000	4050.257500	-50.2	≤ -86.4
450.025000	4500.059167	-46.4	≤ -86.4

Supervised by: David Lee

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.

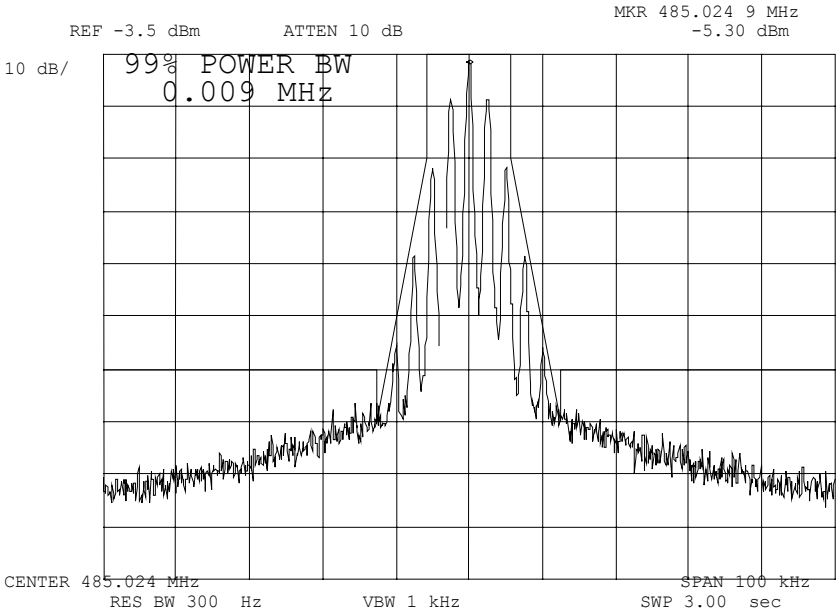
2. For EUTs supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for ±2.5/±1.25 kHz deviation (or 50% modulation). With level constant, the signal level was increased 16 dB.

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

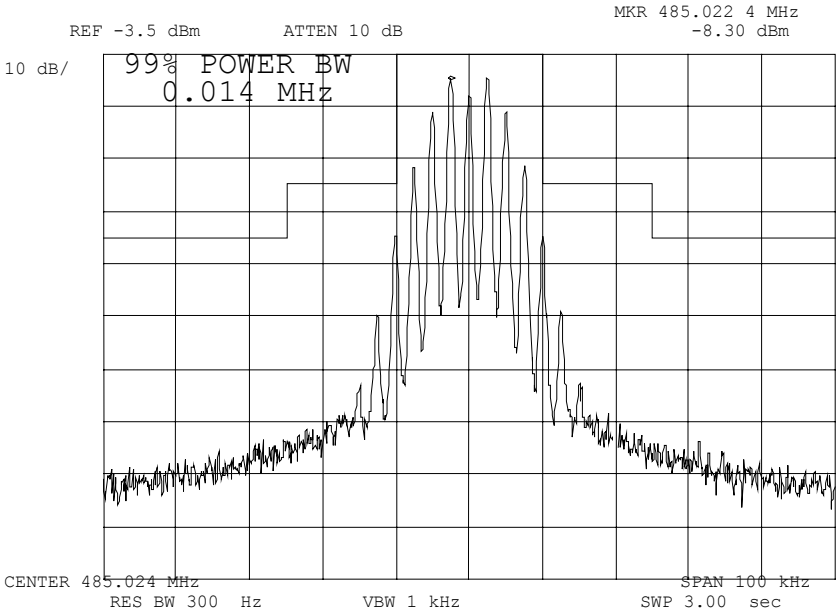
Name of Test: Emission Masks (Occupied Bandwidth)
g0380052: 2003-Aug-13 Wed 11:58:00
State: 2:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: VOICE: 2500 Hz SINE WAVE
12.5KHZ DEV

Performed by: David Lee

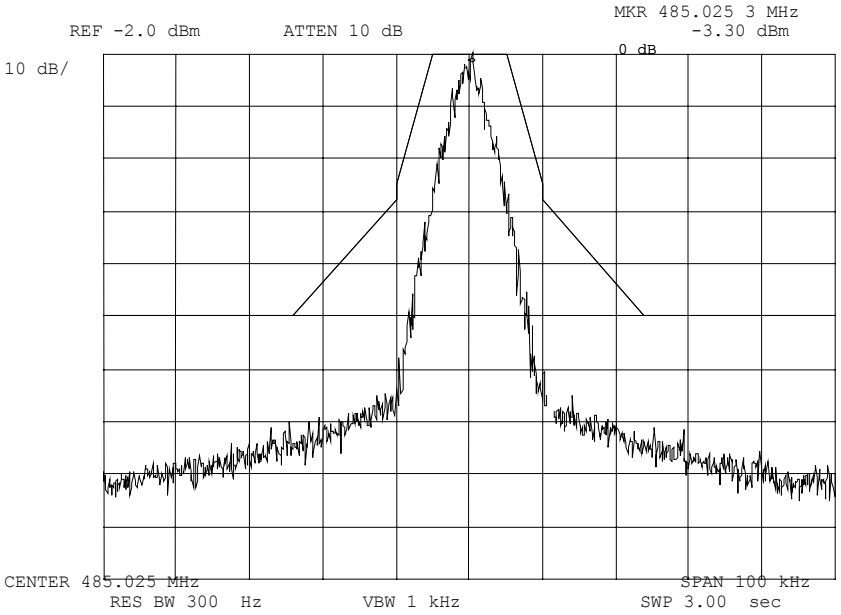
Name of Test: Emission Masks (Occupied Bandwidth)
g0380053: 2003-Aug-13 Wed 11:59:00
State: 2:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

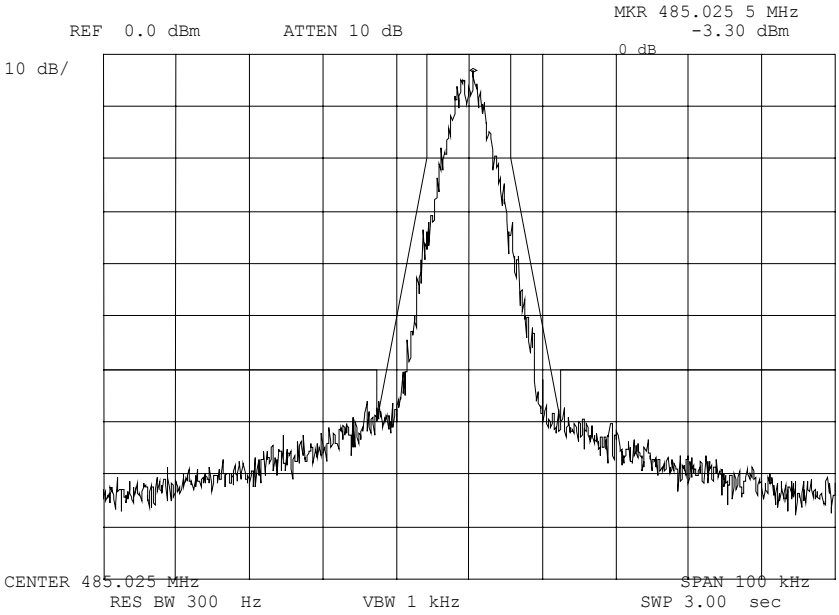
Name of Test: Emission Masks (Occupied Bandwidth)
g0390137: 2003-Sep-26 Fri 13:24:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: VOICE: 2500 Hz SINE WAVE + 16 dB
MASK: C, VHF/UHF 25kHz, no LPF
20K0F1E, 20 kHz Digital Voice

Performed by: David Lee

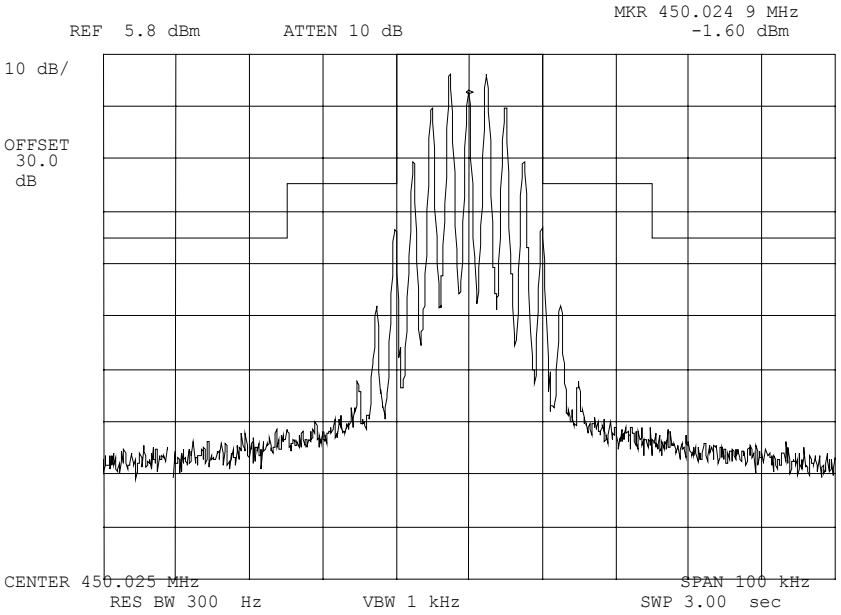
Name of Test: Emission Masks (Occupied Bandwidth)
g0390138: 2003-Sep-26 Fri 13:27:00
State: 1:Low Power Ambient Temperature: 22°C ± 3°C



Power: LOW
Modulation: VOICE: 2500 Hz SINE WAVE + 16 dB
MASK: D, VHF/UHF 12.5kHz BW
8K10F1E, 12.5 Digital Voice

Performed by: David Lee

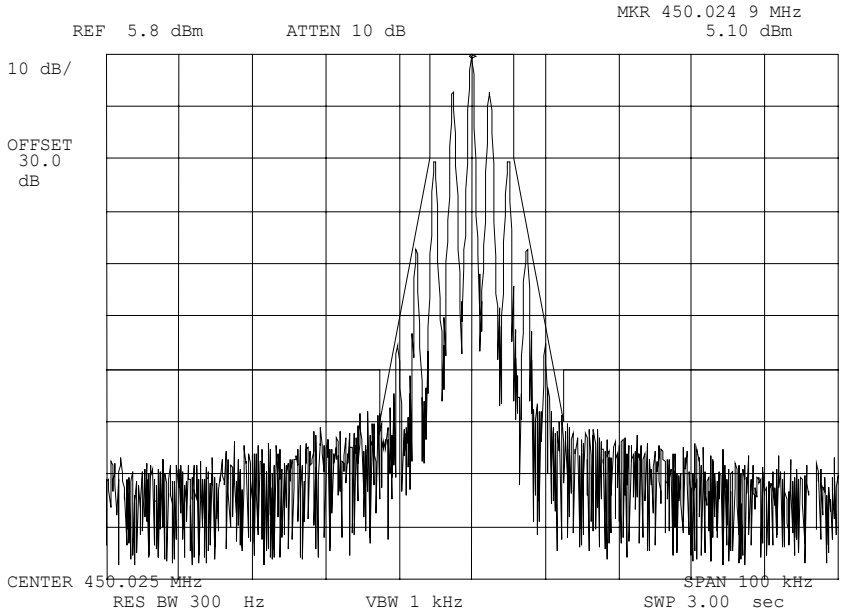
Name of Test: Emission Masks (Occupied Bandwidth)
g0380010: 2003-Aug-12 Tue 11:08:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

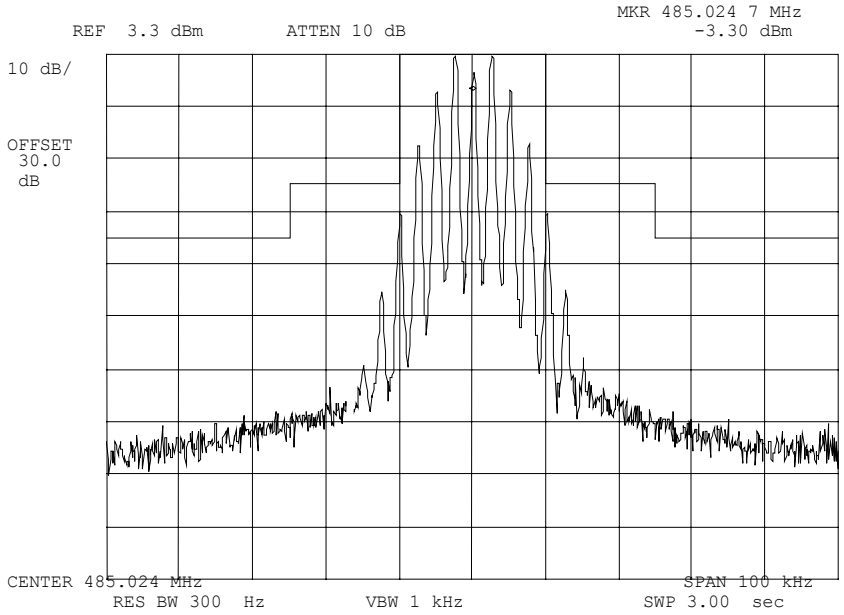
Name of Test: Emission Masks (Occupied Bandwidth)
g0380011: 2003-Aug-12 Tue 11:13:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
12.5KHZ DEV

Performed by: David Lee

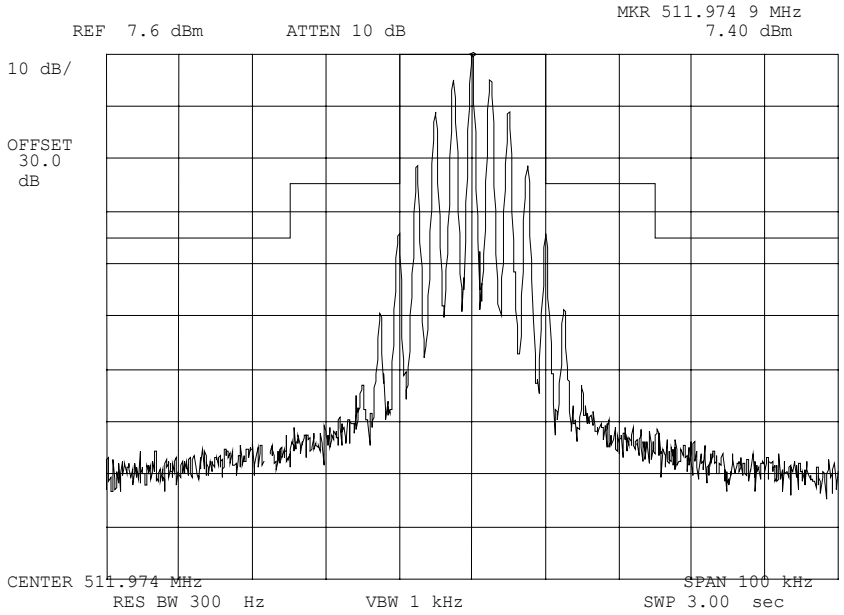
Name of Test: Emission Masks (Occupied Bandwidth)
g0380019: 2003-Aug-12 Tue 11:38:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

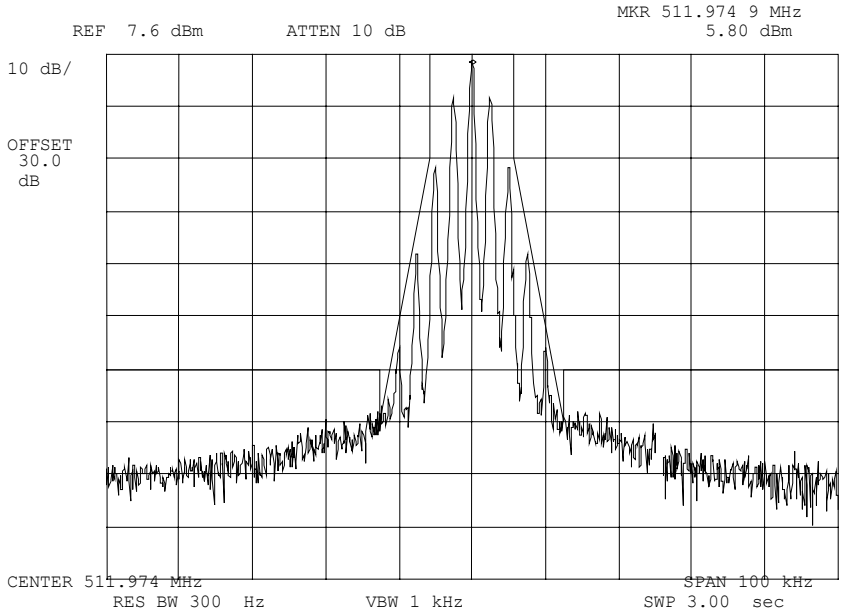
Name of Test: Emission Masks (Occupied Bandwidth)
g0380020: 2003-Aug-12 Tue 11:39:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

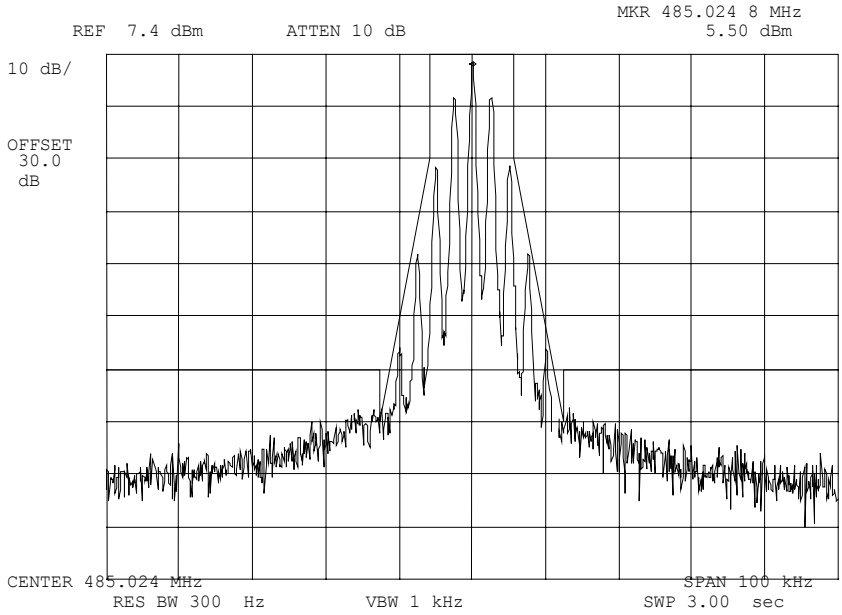
Name of Test: Emission Masks (Occupied Bandwidth)
g0380021: 2003-Aug-12 Tue 11:40:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

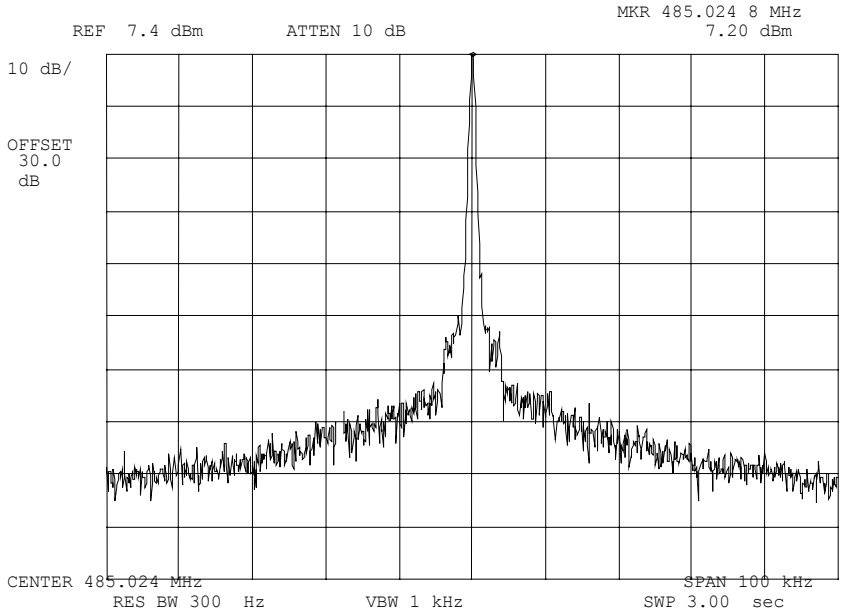
Name of Test: Emission Masks (Occupied Bandwidth)
g0380022: 2003-Aug-12 Tue 11:41:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

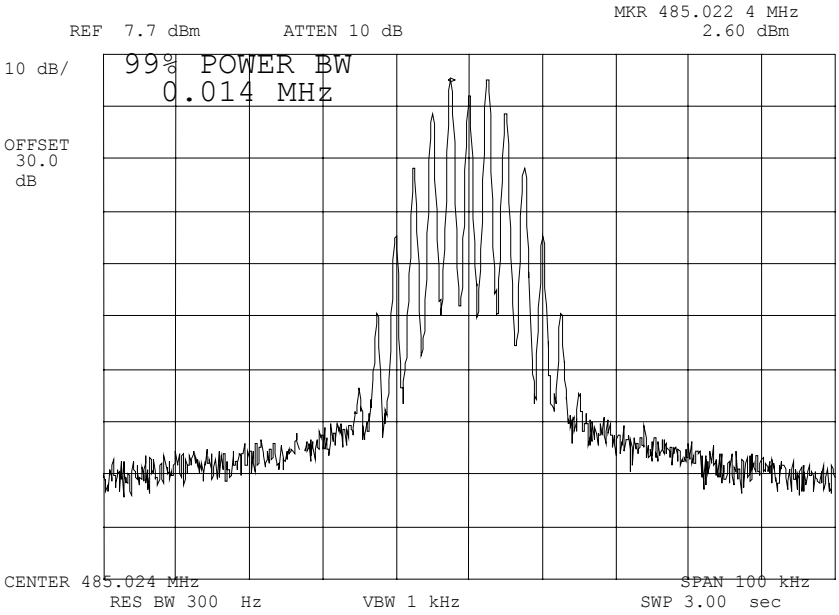
Name of Test: Emission Masks (Occupied Bandwidth)
g0380023: 2003-Aug-12 Tue 11:42:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: NONE
25KHZ DEV

Performed by: David Lee

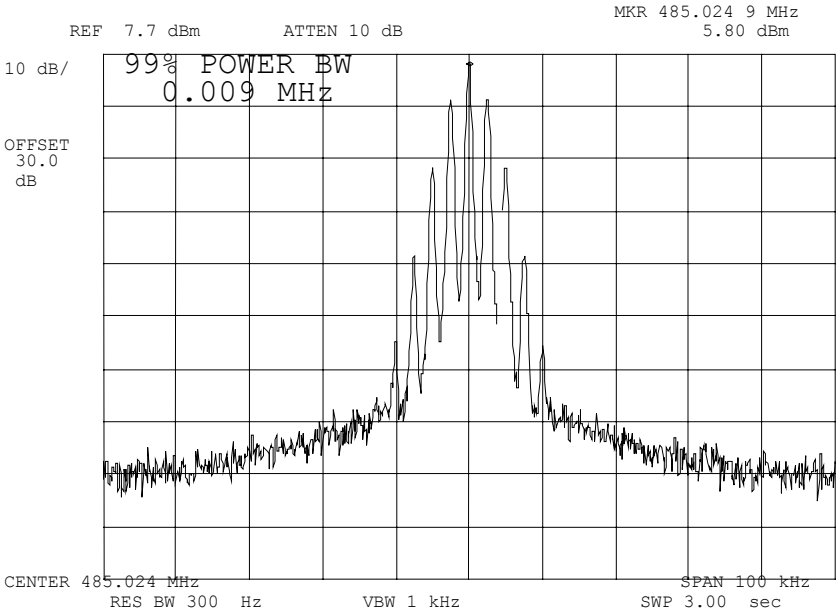
Name of Test: Emission Masks (Occupied Bandwidth)
g0380024: 2003-Aug-12 Tue 12:40:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
25KHZ DEV

Performed by: David Lee

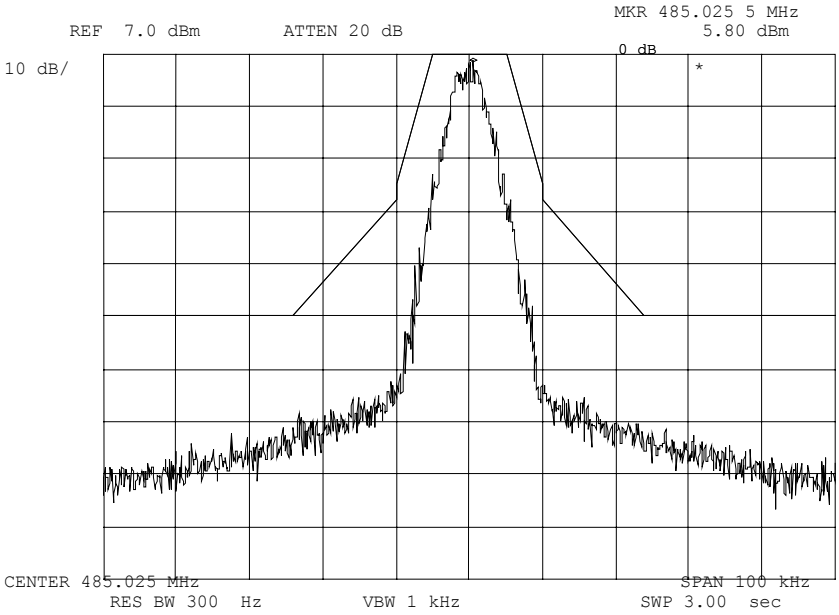
Name of Test: Emission Masks (Occupied Bandwidth)
g0380025: 2003-Aug-12 Tue 12:41:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE
12.5 KHZ DEV

Performed by: David Lee

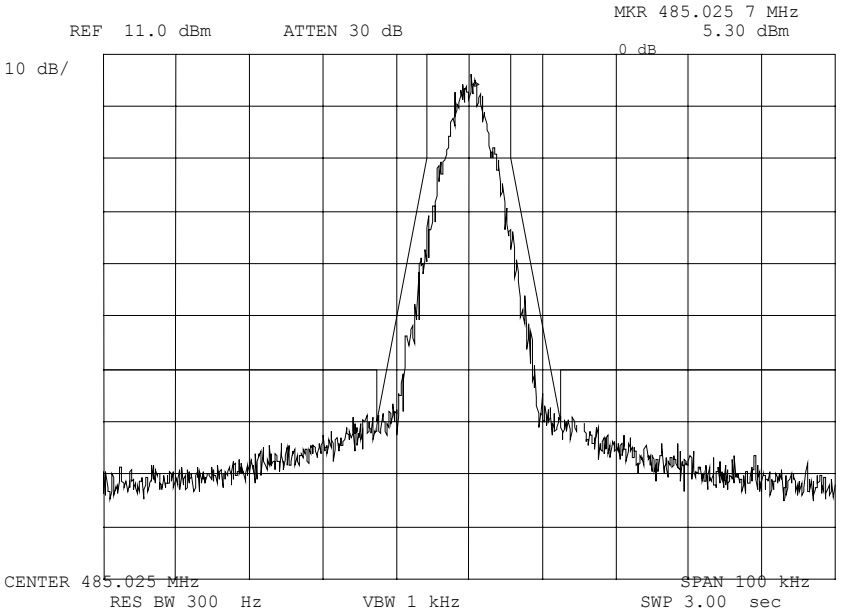
Name of Test: Emission Masks (Occupied Bandwidth)
g0390136: 2003-Sep-26 Fri 13:22:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE + 16 dB
MASK: C, VHF/UHF 25kHz, no LPF
20K0F1E

Performed by: David Lee

Name of Test: Emission Masks (Occupied Bandwidth)
g0390139: 2003-Sep-26 Fri 13:28:00
State: 2:High Power Ambient Temperature: 22°C ± 3°C



Power: HIGH
Modulation: VOICE: 2500 Hz SINE WAVE + 16 dB
MASK: D, VHF/UHF 12.5kHz BW
8K10 F1D, Rule 90.207(l)

Performed by: David Lee

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 noted.

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 noted is step 3, as measured at the output of the combiner. This level was then fixed for the remainder of the test.

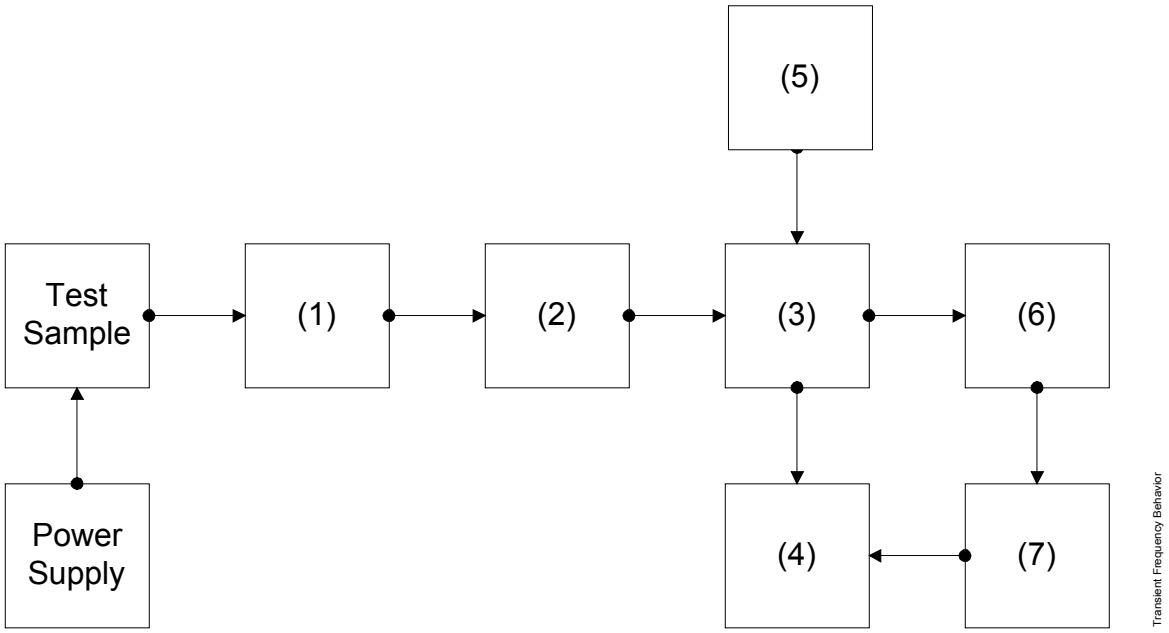
6. The oscilloscope was setup using TIA/EIA-603 steps j and k as a guide, and to either 10 ms/div (UHF) or 5 ms/div (VHF).

7. The 30 dB attenuator was removed, the transmitter was turned on.

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.

Performed by: David Lee

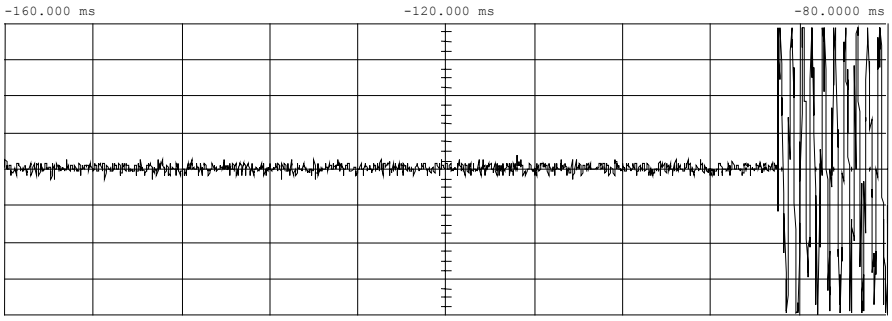
Transient Frequency Behavior



Asset (as applicable)	Description	s/n
(1) **Attenuator** (Removed after 1st step)		
i00112	Philco 30 dB	989
i00231	Pasternack (30 dB)	N/A
i00232	Pasternack (30 dB)	N/A
(2) **Attenuator**		
i00122	Narda 10 dB	7802
i00123	Narda 10 dB	7802A
i00231	Pasternack (30 dB)	N/A
i00232	Pasternack (30 dB)	N/A
(3) **Combiner**		
i00154	4 x 25 Ω Combiner	154
(4) **Crystal Decoder**		
i00159	HP 8470B	1822A10054
(5) **RF Signal Generator**		
i00031	HP 8656A	2402A06180
i00067	HP 8920A	3345U01242
(6) **Modulation Analyzer**		
i00020	HP 8901A	2105A01087
(7) **Scope**		
i00030	HP 54502A	2927A00209

Name of Test: Transient Frequency Behavior

State: Carrier Off Time Ambient Temperature: 22°C ± 3°C



	Timebase	Delay/Pos	Reference	Mode
Main	8.00 ms/div	-120.000 ms	Center	Realtime (EXTENDED)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	8.00 mV/div	5.000 mV	1.000 :1	dc (1M ohm)

Trigger mode : Edge
On Positive Edge Of Chan2
Trigger Level
Chan2 = -175.000 mV (noise reject ON)
Holdoff = 40.000 ns

Power: High

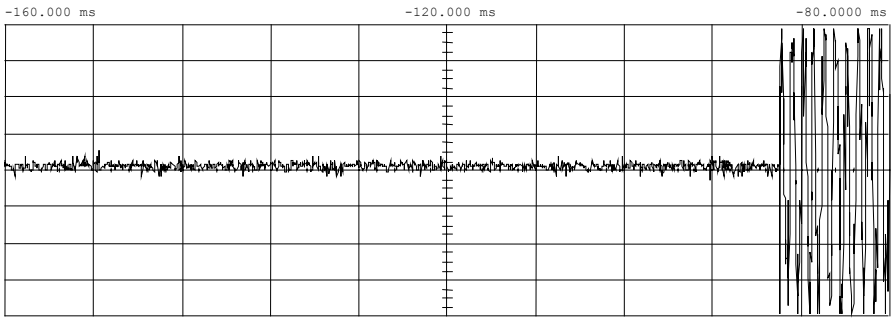
Modulation: 12.5 kHz Deviation

Performed by: David Lee

Page Number 37 of 54.

Name of Test: Transient Frequency Behavior

State: Carrier Off Time Ambient Temperature: 22°C ± 3°C



	Timebase	Delay/Pos	Reference	Mode
Main	8.00 ms/div	-120.000 ms	Center	Realtime (EXTENDED)

	Sensitivity	Offset	Probe	Coupling
Channel 1	8.00 mV/div	5.000 mV	1.000 :1	dc (1M ohm)

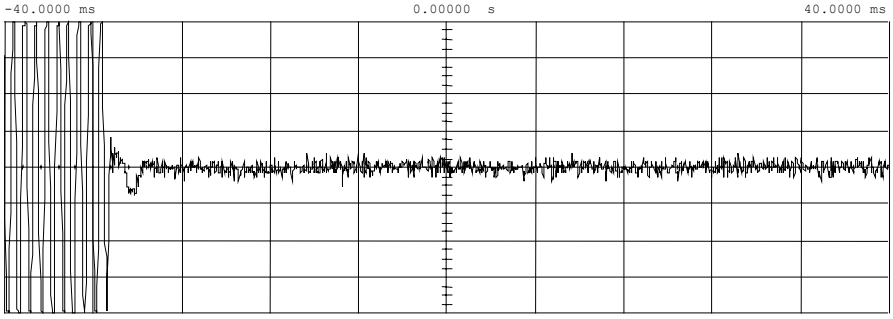
Trigger mode : Edge
On Positive Edge Of Chan2
Trigger Level
Chan2 = -175.000 mV (noise reject ON)
Holdoff = 40.000 ns

Power: High
Modulation: 25 kHz Deviation

Performed by: David Lee

Name of Test: Transient Frequency Behavior

State: Carrier On Time Ambient Temperature: 22°C ± 3°C



	Timebase	Delay/Pos	Reference	Mode
Main	8.00 ms/div	-40.0000 ms	Left	Realtime (EXTENDED)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	6.00 mV/div	4.000 mV	1.000 :1	dc (1M ohm)

Trigger mode : Edge
On Negative Edge Of Chan2
Trigger Level
Chan2 = -325.000 mV (noise reject ON)
Holdoff = 40.000 ns

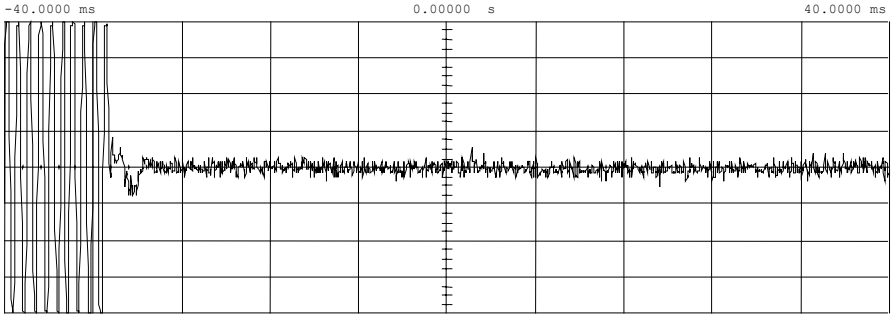
Power: High

Modulation: 25 kHz Deviation

Performed by: David Lee

Name of Test: Transient Frequency Behavior

State: Carrier On Time Ambient Temperature: 22°C ± 3°C



	Timebase	Delay/Pos	Reference	Mode
Main	8.00 ms/div	-40.0000 ms	Left	Realtime (EXTENDED)
	Sensitivity	**Offset**	**Probe**	**Coupling**
Channel 1	6.00 mV/div	4.000 mV	1.000 :1	dc (1M ohm)

Trigger mode : Edge
On Negative Edge Of Chan2
Trigger Level
Chan2 = -325.000 mV (noise reject ON)
Holdoff = 40.000 ns

Power: High

Modulation: 12.5 kHz Deviation

Performed by: David Lee

Page Number 40 of 54.

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

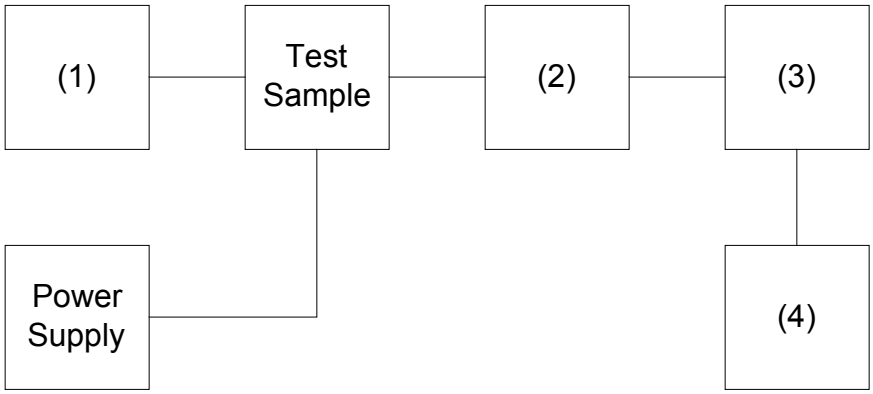
1. The EUT and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage.

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

3. Measurement Results: Attached

Transmitter Test Set-Up

Test A. Audio Frequency Response
Test B. Response of Low Pass Filter
Test C. Modulation Limiting



Asset (as applicable)	Description	s/n
(1) **Audio Oscillator**		
i00017	HP 8903A	2216A01753
(2) **Coaxial Attenuator**		
i00122	NARDA 766-10	7802
i00123	NARDA 766-10	7802A
i00231	Pasternack (30 dB)	N/A
i00232	Pasternack (30 dB)	N/A
(3) **Modulation Analyzer**		
i00020	HP 8901A	2105A01087
(4) **Audio Analyzer**		
i00017	HP 8903A	2216A01753

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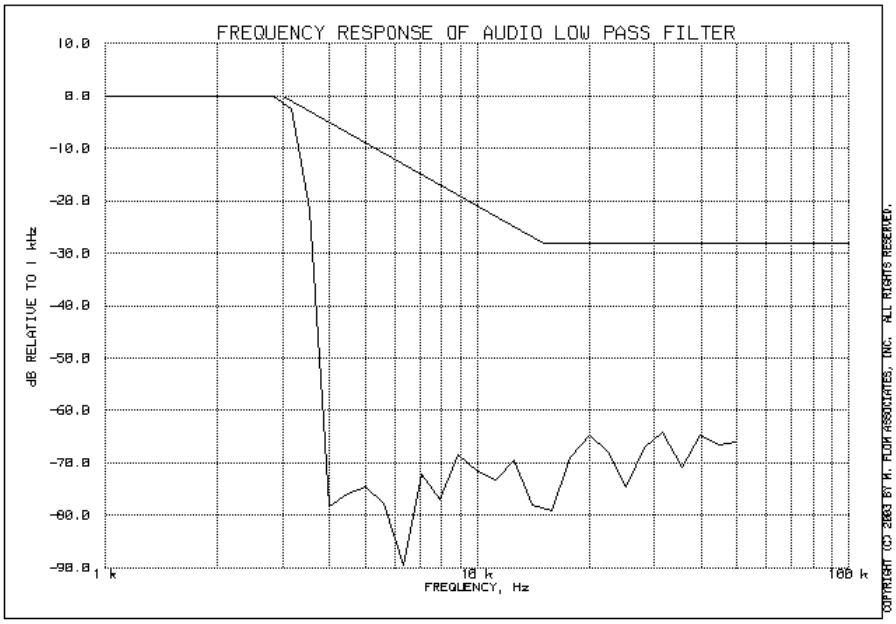
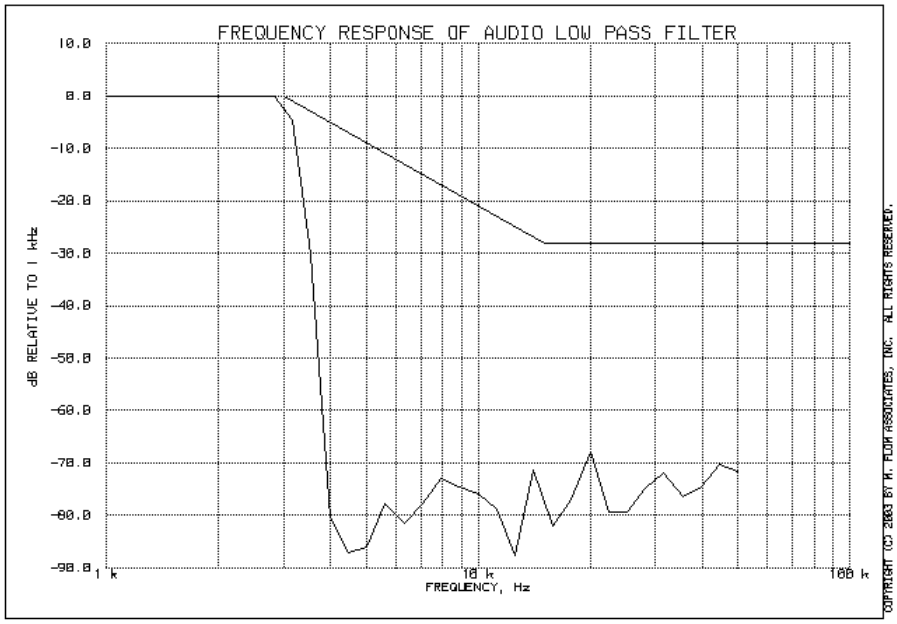
Name of Test: Audio Low Pass Filter (Voice Input)
g0380212: 2003-Aug-12 Tue 08:55:00
State: 0:General 12.5 kHz Ambient Temperature: 22°C ± 3°C



Performed by: David Lee

Page Number 43 of 54.

Name of Test: Audio Low Pass Filter (Voice Input)
g0380213: 2003-Aug-12 Tue 08:59:00
State: 0:General 25 kHz Ambient Temperature: 22°C ± 3°C



Performed by: David Lee

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.

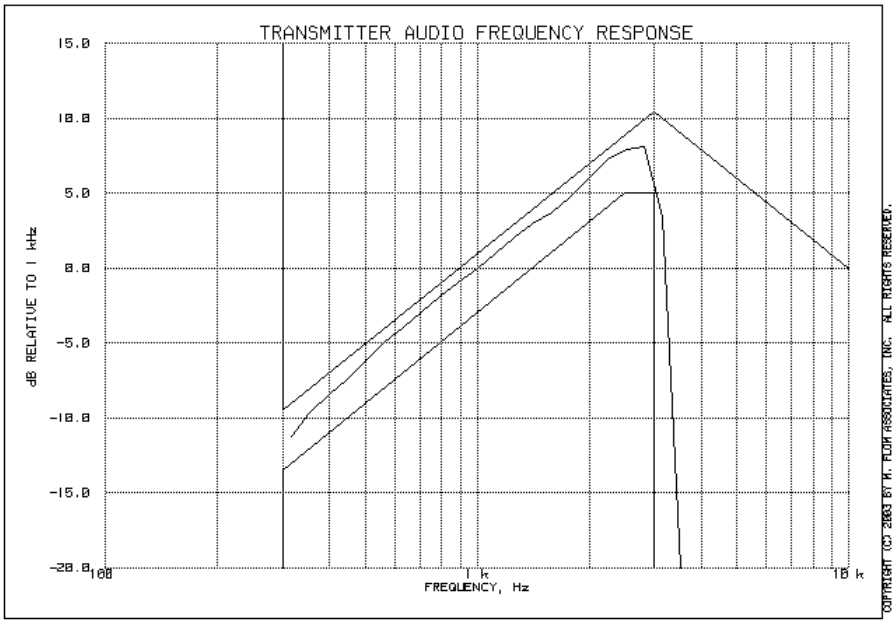
3. The audio signal input was adjusted to obtain 20% modulation at 1 kHz, and this point was taken as the 0 dB reference level.

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
g0380195: 2003-Aug-11 Mon 14:09:00
State: 0:General Ambient Temperature: 22°C ± 3°C



Frequency of Maximum Audio Response, Hz = 2820

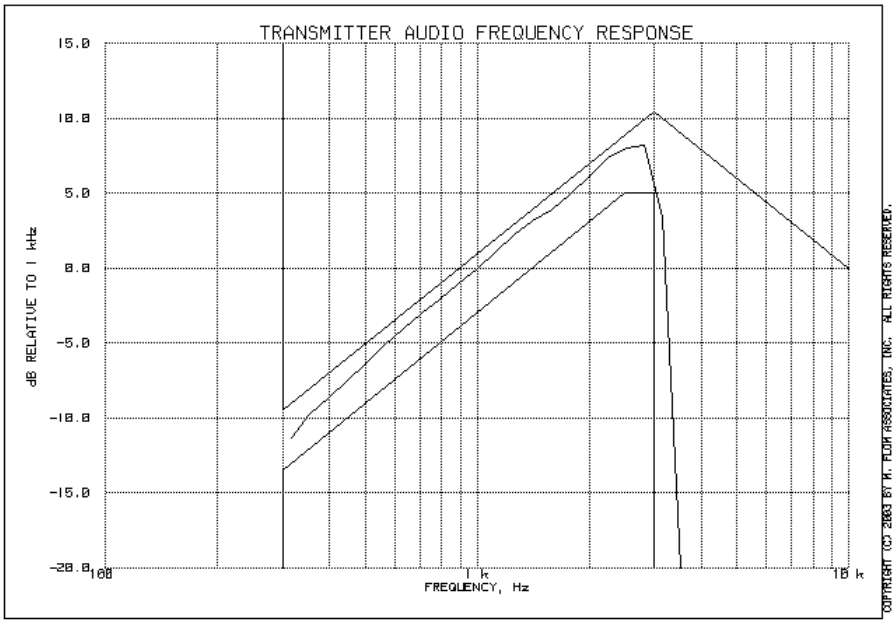
Additional points:

Frequency, Hz	Level, dB
300	-11.80
20000	-29.08
30000	-28.94
50000	-29.06

Performed by: David Lee

Page Number 46 of 54.

Name of Test: Audio Frequency Response
g0380196: 2003-Aug-11 Mon 14:11:00
State: 0:General Ambient Temperature: 22°C ± 3°C



Frequency of Maximum Audio Response, Hz = 2820

Additional points:

Frequency, Hz	Level, dB
300	-11.96
20000	-31.05
30000	-31.00
50000	-30.96

Performed by: David Lee

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

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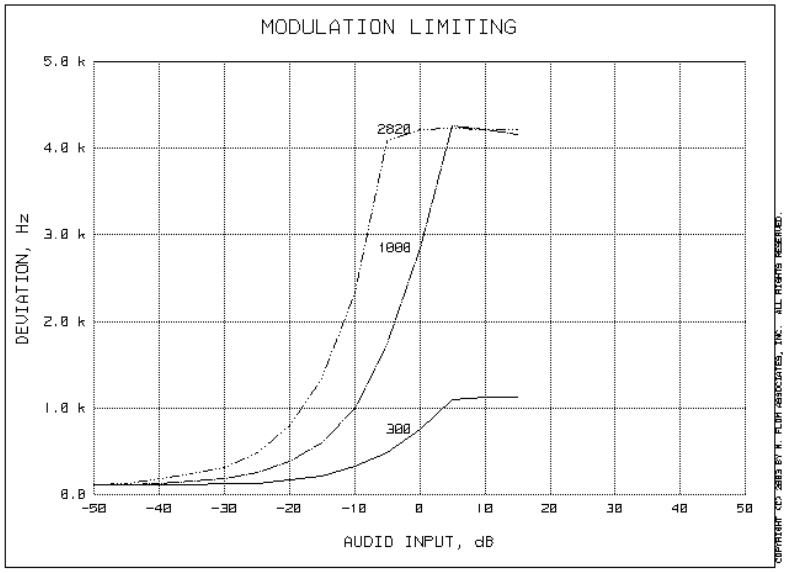
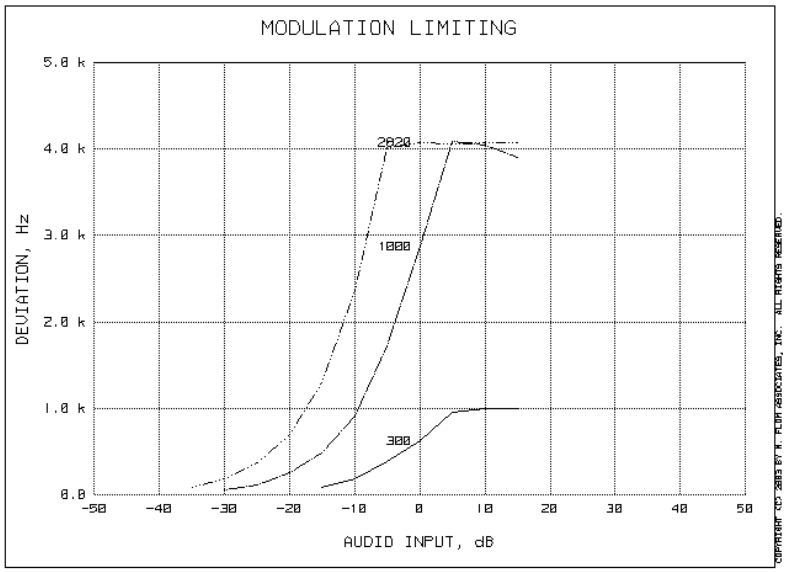
Name of Test: Modulation Limiting
g0380214: 2003-Aug-12 Tue 09:05:00
State: 0:General 25 kHz Ambient Temperature: 22°C ± 3°C

Positive Peaks:



Negative Peaks:



Performed by: David Lee

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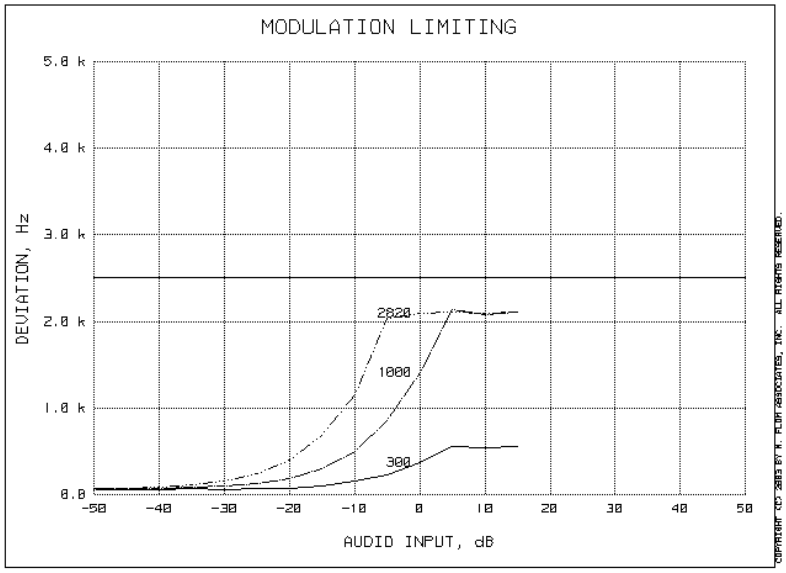
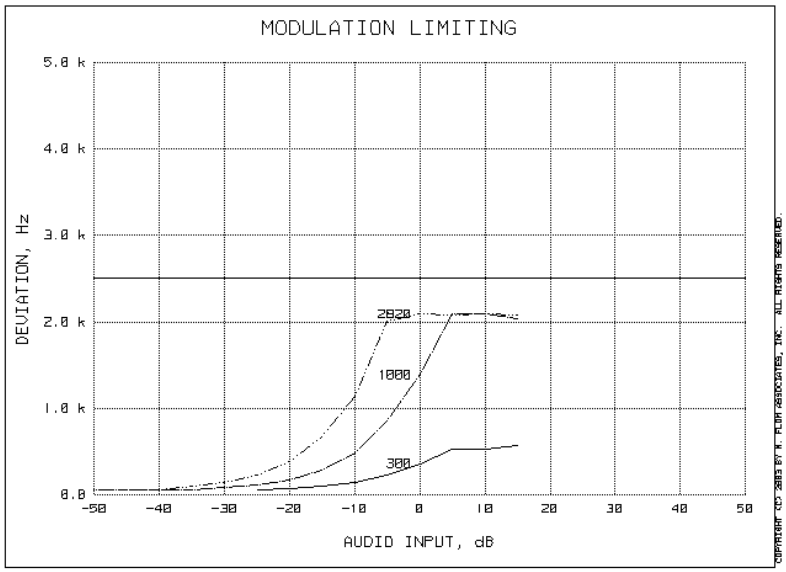
Name of Test: Modulation Limiting
g0380215: 2003-Aug-12 Tue 09:08:00
State: 0:General 12.5 kHz Ambient Temperature: 22°C ± 3°C

Positive Peaks:



Negative Peaks:



Performed by: David Lee

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.

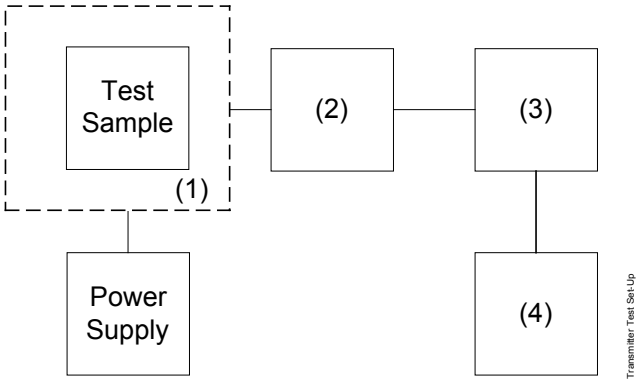
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.

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

5. Measurement Results: Attached

Transmitter Test Set-Up

Frequency Stability: Temperature Variation
Frequency Stability: Voltage Variation



Asset (as applicable)	Description	s/n
(1) **Temperature, Humidity, Vibration**		
i00027	Tenney Temp. Chamber	9083-765-234
(2) **Coaxial Attenuator**		
i00122	NARDA 766-10	7802
i00123	NARDA 766-10	7802A
i00231	Pasternack (30 dB)	N/A
i00232	Pasternack (30 dB)	N/A
(3) **RF Power**		
i00020	HP 8901A Power Mode	2105A01087
(4) **Frequency Counter**		
i00042	HP 5383A	1628A00959
i00019	HP 5334B	2704A00347
i00020	HP 8901A	2105A01087

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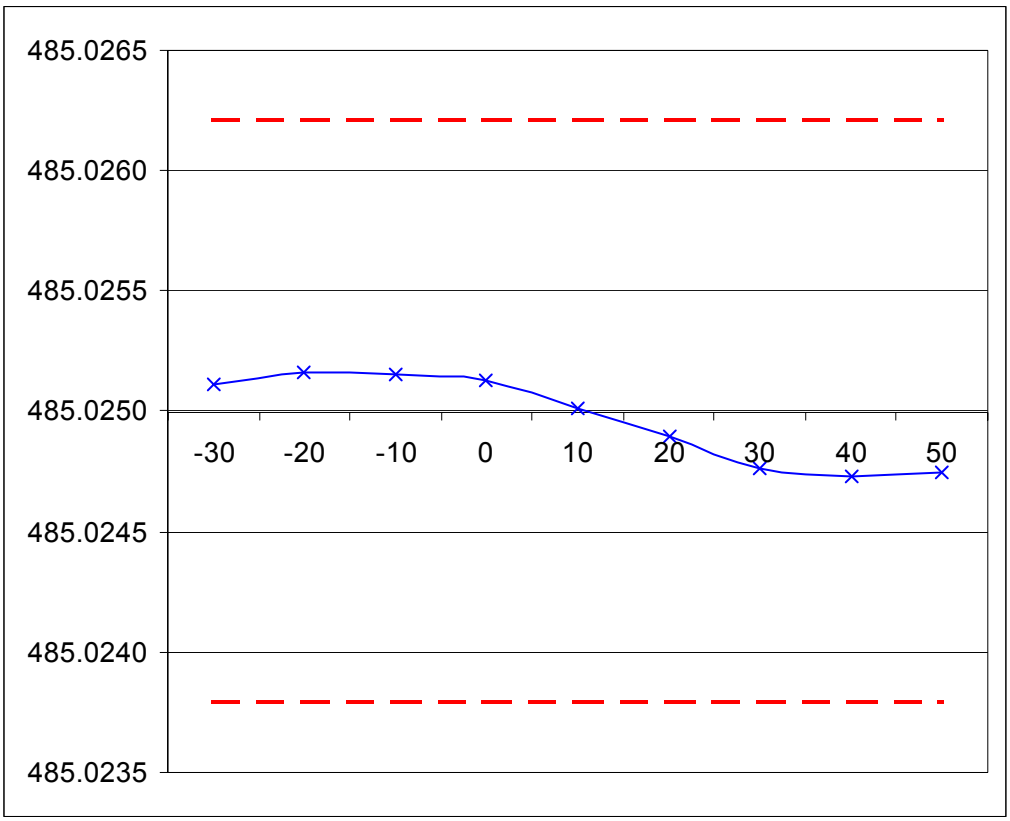
Name of Test: Frequency Stability (Temperature Variation)

Ambient Temperature: 22°C ± 3°C



Performed by: David Lee

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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)

State: Ambient Temperature: 22°C ± 3°C

Limit, ppm	= ± 2.5
Limit, Hz	= 1,125
Battery End Point (Voltage)	= 21.5

% of STV	Voltage	Frequency, MHz	Change, Hz	Change, ppm
115%	32.2	450.02478	-220	>1
100%	28.00	450.024800	-200	>1
85%	23.8	450.02479	-210	>1
B.E.P.	21.5	450.02478	-220	>1

Performed by: David Lee

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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

Modulation = 8K10F1E

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	=	2
Maximum Deviation (D), kHz	=	2
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	8

Modulation = 8K10F1D

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	=	2
Maximum Deviation (D), kHz	=	2
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	8

Modulation = 20K0F1E

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

Performed by: David Lee

END OF TEST REPORT

Testimonial
and
Statement of Certification

This is to Certify:

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

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

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

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

Certifying Engineer: Morton Flom, P. Eng.