



**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

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Date: May 21, 2003

Federal Communications Commission  
Via: Electronic Filing

Attention: Authorization & Evaluation Division

Applicant: Kenwood USA Corporation

Equipment: TK-3160-1

FCC ID: ALH36423110

FCC Rules: 2, 80, 90, 90.210, 95, Confidentiality

Gentlemen:

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

Filing fees are attached.

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

Sincerely yours,

A handwritten signature in black ink, appearing to read 'M. Flom P. Eng.' The signature is fluid and cursive, with 'M. Flom' on top and 'P. Eng.' on the line below.

Morton Flom, P. Eng.

enclosure(s)

cc: Applicant

MF/jmm

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

APPLICANT: Kenwood USA Corporation

FCC ID: ALH36423110

BY APPLICANT:

1. LETTER OF AUTHORIZATION	x
2. IDENTIFICATION DRAWINGS, 2.1033(c) (11)	
<input checked="" type="checkbox"/> LABEL	
<input checked="" type="checkbox"/> LOCATION OF LABEL	
<input checked="" type="checkbox"/> COMPLIANCE STATEMENT	
<input checked="" type="checkbox"/> 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 BY CELLTECH LABS	x

BY M.F.A. INC.

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



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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: ALH36423110

MODEL: TK-3160-1

to

FEDERAL COMMUNICATIONS COMMISSION

Rule Part(s) 2, 80, 90, 90.210, 95, CONFIDENTIALITY

DATE OF REPORT: May 20, 2003

ON THE BEHALF OF THE APPLICANT:

Kenwood USA Corporation

AT THE REQUEST OF:

P.O. JB-F-006

Kenwood USA Corporation  
Communications Division  
3975 Johns Creek Court, Suite 300  
Suwanee, GA 30024

Attention of: Joel E. Berger, Research & Development  
JBerger@kenwoodusa.com  
(678) 474-4722; FAX: -4731

SUPERVISED BY:



Morton Flom, P. Eng.

THE APPLICANT HAS BEEN CAUTIONED AS TO THE FOLLOWING:

15.21 INFORMATION TO USER.

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

15.27(a) SPECIAL ACCESSORIES.

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

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

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

a)

TEST REPORT

b) Laboratory: M. Flom Associates, Inc.  
(FCC: 31040/SIT) 3356 N. San Marcos Place, Suite 107  
(Canada: IC 2044) Chandler, AZ 85225

c) Report Number: d0350018

d) Client: Kenwood USA Corporation  
Communications Division  
3975 Johns Creek Court, Suite 300  
Suwanee, GA 30024

e) Identification: TK-3160-1  
EUT Description: FCC ID: ALH36423110  
UHF FM Transceiver

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

g) Report Date: May 20, 2003  
EUT Received: April 18, 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.

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LIST OF GENERAL INFORMATION REQUIRED FOR CERTIFICATIONIN ACCORDANCE WITH FCC RULES AND REGULATIONS,  
VOLUME II, PART 2 AND TO

2, 80, 90, 90.210, 95, Confidentiality

Sub-part 2.1033

(c) (1): NAME AND ADDRESS OF APPLICANT:Kenwood USA Corporation  
Communications Division  
3975 Johns Creek Court, Suite 300  
Suwanee, GA 30024MANUFACTURER:Kenwood Electronics Technologies PTE Ltd.  
1 Ang Mo Kio Street 63  
Singapore 569110(c) (2): FCC ID: ALH36423110MODEL NO: TK-3160-1(c) (3): INSTRUCTION MANUAL(S):

PLEASE SEE ATTACHED EXHIBITS

(c) (4): TYPE OF EMISSION: 16K0F3E, 11K0F3E(c) (5): FREQUENCY RANGE, MHz: 450 to 490(c) (6): POWER RATING, Watts: 1 to 4  
\_\_\_\_ Switchable  Variable  N/A

FCC GRANT NOTE: BG - The output power is continuously variable from the value listed in this entry to 25%-30% of the value listed.

(c) (7): MAXIMUM POWER RATING, Watts: 300DUT RESULTS: Passes  Fails

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INFORMATION FOR PUSH-TO-TALK DEVICES

Type and number of antenna to be used for this device:  
 $\frac{1}{4}$  wave

Maximum antenna gain for antenna indicated above:  
0 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:

See User Manual

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?

See User Manual

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 User Manual

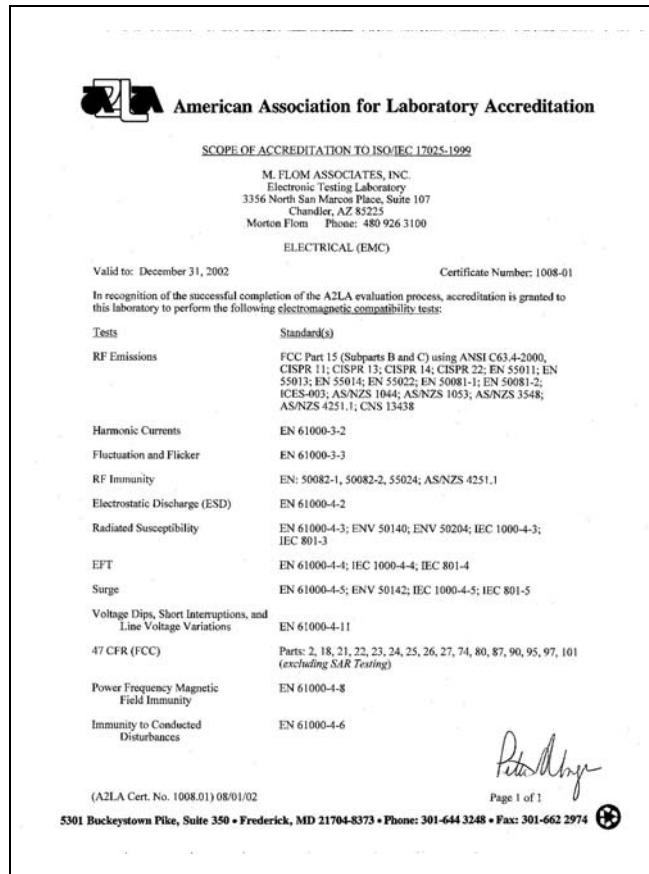
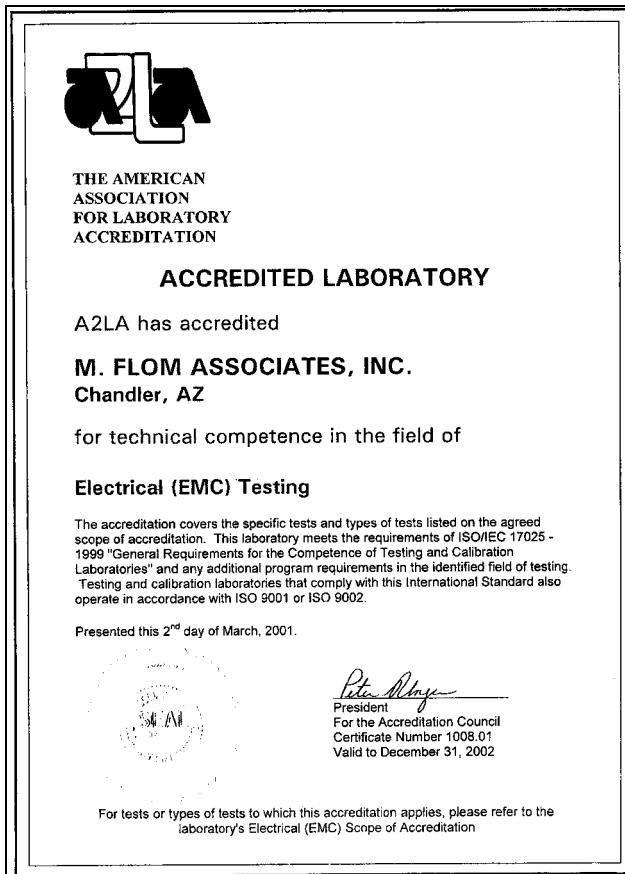
Other applicable information the applicant may provide that can serve as effective means for ensuring RF Exposure compliance:

See User Manual

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



"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 be covered by this laboratory's A2LA accreditation.

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Subpart 2.1033 (continued)

(c) (8): VOLTAGES & CURRENTS IN ALL ELEMENTS IN FINAL R. F. STAGE,  
INCLUDING FINAL TRANSISTOR OR SOLID STATE DEVICE:

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

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Sub-part

2.1033(c) (14) : TEST AND MEASUREMENT DATA

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2, Sub-part J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1079, 2.1051, 2.1053, 2.1055, 2.1057 and the following individual Parts:

- \_\_\_\_ 21 - Domestic Public Fixed Radio Services
- \_\_\_\_ 22 - Public Mobile Services
- \_\_\_\_ 22 Subpart H - Cellular Radiotelephone Service
- \_\_\_\_ 22.901(d) - Alternative technologies and auxiliary services
- \_\_\_\_ 23 - International Fixed Public Radiocommunication services
- \_\_\_\_ 24 - Personal Communications Services
- \_\_\_\_ 74 Subpart H - Low Power Auxiliary Stations
- \_\_\_\_ x 80 - Stations in the Maritime Services
- \_\_\_\_ 80 Subpart E - General Technical Standards
- \_\_\_\_ 80 Subpart F - Equipment Authorization for Compulsory Ships
- \_\_\_\_ 80 Subpart K - Private Coast Stations and Marine Utility Stations
- \_\_\_\_ 80 Subpart S - Compulsory Radiotelephone Installations for Small Passenger Boats
- \_\_\_\_ 80 Subpart T - Radiotelephone Installation Required for Vessels on the Great Lakes
- \_\_\_\_ 80 Subpart U - Radiotelephone Installations Required by the Bridge-to-Bridge Act
- \_\_\_\_ 80 Subpart V - Emergency Position Indicating Radiobeacons (EPIRB'S)
- \_\_\_\_ 80 Subpart W - Global Maritime Distress and Safety System (GMDSS)
- \_\_\_\_ 80 Subpart X - Voluntary Radio Installations
- \_\_\_\_ 87 - Aviation Services
- \_\_\_\_ x 90 - Private Land Mobile Radio Services
- \_\_\_\_ 94 - Private Operational-Fixed Microwave Service
- \_\_\_\_ x 95 Subpart A - General Mobile Radio Service (GMRS)
- \_\_\_\_ 95 Subpart C - Radio Control (R/C) Radio Service
- \_\_\_\_ 95 Subpart D - Citizens Band (CB) Radio Service
- \_\_\_\_ 95 Subpart E - Family Radio Service
- \_\_\_\_ 95 Subpart F - Interactive Video and Data Service (IVDS)
- \_\_\_\_ 97 - Amateur Radio Service
- \_\_\_\_ 101 - Fixed Microwave Services

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STANDARD TEST CONDITIONS  
and  
ENGINEERING PRACTICES

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

In accordance with ANSI C63.4-1992/2000 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 R. F. Power Meter.
2. Measurement accuracy is  $\pm 3\%$ .

MEASUREMENT RESULTS  
(Worst case)

FREQUENCY OF CARRIER, MHz = 470.05, 450.05, 489.95  
 AMBIENT TEMPERATURE =  $22^{\circ}\text{C} \pm 3^{\circ}\text{C}$

POWER SETTING	R. F. POWER, WATTS
Low	1
High	4

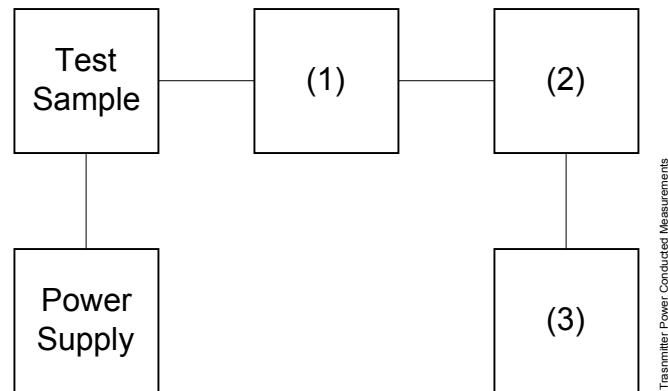
PERFORMED BY:  David Lee

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TRANSMITTER POWER CONDUCTED MEASUREMENTS

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



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

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NAME OF TEST:

ERP Carrier Power (Radiated)

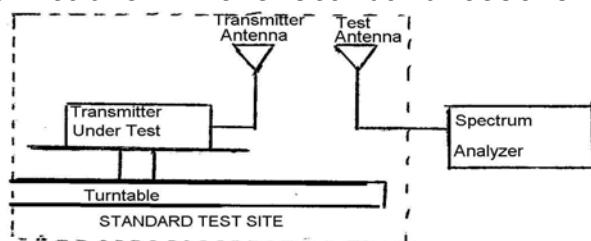
SPECIFICATION:

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:

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

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NAME OF TEST:

ERP Carrier Power (Radiated)

	450.05 MHz		470.05 MHz		489.950 MHz	
	LVL, dBm	Path Loss, dB	LVL, dBm	Path Loss, dB	LVL, dBm	Path Loss, dB
0°	37.2	1.2	35.9	1.3	31.5	1.0
45°	37.2	1.2	35.8	1.3	32.3	1.0
90°	36.9	1.2	36.2	1.3	31.4	1.0
135°	36.9	1.2	36.3	1.3	31.9	1.0
180°	36.9	1.2	36.3	1.3	32.3	1.0
225°	36.9	1.2	37.0	1.3	32.0	1.0
270°	36.8	1.2	36.6	1.3	32.4	1.0
315°	37.2	1.2	36.6	1.3	33.8	1.0
Av. Radiated Power:	450.05 MHz		470.05 MHz		489.950 MHz	
	38.2 dBm		37.64 dBm		33.2 dBm	

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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 = 470.05, 450.05, 489.95

SPECTRUM SEARCHED, GHz = 0 to 10  $\times$   $F_c$

MAXIMUM RESPONSE, Hz = 2820

ALL OTHER EMISSIONS =  $\geq$  20 dB BELOW LIMIT

PERFORMED BY:

David Lee

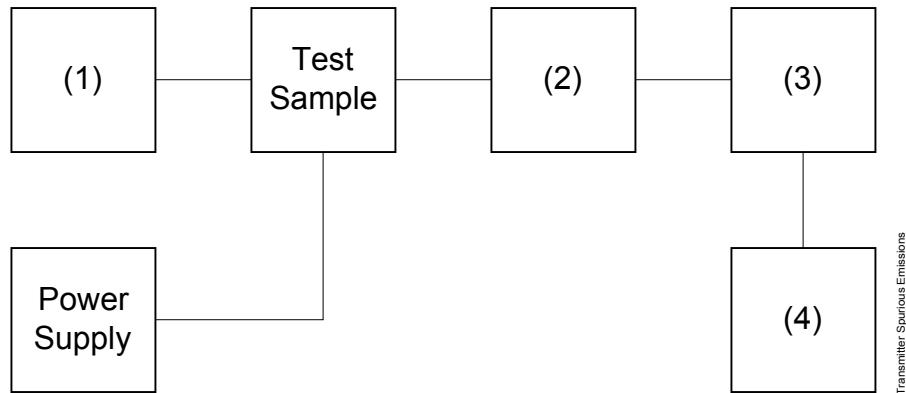


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TRANSMITTER SPURIOUS EMISSION

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



Asset Description (as applicable)	s/n
(1) <u>AUDIO OSCILLATOR/GENERATOR</u>	
i00010 HP 204D	1105A04683
i00017 HP 8903A	2216A01753
i00012 HP 3312A	1432A11250
(2) <u>COAXIAL ATTENUATOR</u>	
i00122 Narda 766-10	7802
i00123 Narda 766-10	7802A
i00069 Bird 8329 (30 dB)	1006
i00113 Sierra 661A-3D	1059
(3) <u>FILTERS; NOTCH, HP, LP, BP</u>	
i00126 Eagle TNF-1	100-250
i00125 Eagle TNF-1	50-60
i00124 Eagle TNF-1	250-850
(4) <u>SPECTRUM ANALYZER</u>	
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) = -56 (4 Watts)

g0340231: 2003-Apr-25 Fri 15:20:00

STATE: 1:Low Power

AMBIENT TEMPERATURE: 22°C ± 3°C

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	MARGIN, dB
450.050000	899.879167	-40.6	-71.8	-20.6
470.050000	939.888333	-41	-72.2	-21
489.950000	979.922500	-41	-72.2	-21
450.050000	1350.055833	-41.3	-72.5	-21.3
470.050000	1410.384167	-41.5	-72.7	-21.5
489.950000	1469.737500	-40.8	-72	-20.8
450.050000	1800.045833	-41.1	-72.3	-21.1
470.050000	1879.968333	-40.6	-71.8	-20.6
489.950000	1959.568333	-41.1	-72.3	-21.1
450.050000	2250.485000	-40.1	-71.3	-20.1
470.050000	2350.316667	-40.1	-71.3	-20.1
489.950000	2449.992500	-40.6	-71.8	-20.6
450.050000	2700.210833	-40	-71.2	-20
470.050000	2820.518333	-40.5	-71.7	-20.5
489.950000	2939.910000	-41.6	-72.8	-21.6
450.050000	3150.503333	-41.3	-72.5	-21.3
470.050000	3290.375833	-41.8	-73	-21.8
489.950000	3429.839167	-41.5	-72.7	-21.5
450.050000	3600.154167	-42.1	-73.3	-22.1
470.050000	3760.469167	-42	-73.2	-22
489.950000	3919.775833	-42	-73.2	-22
450.050000	4050.428333	-41.8	-73	-21.8
470.050000	4230.527500	-42.8	-74	-22.8
489.950000	4409.719167	-42.3	-73.5	-22.3
450.050000	4500.497500	-42.5	-73.7	-22.5
470.050000	4700.572500	-42.3	-73.5	-22.3
489.950000	4899.253333	-42.5	-73.7	-22.5
450.050000	4950.351667	-42.6	-73.8	-22.6
470.050000	5170.716667	-41.8	-73	-21.8
489.950000	5389.523333	-43.3	-74.5	-23.3
450.050000	5400.442500	-43	-74.2	-23
470.050000	5640.649167	-43	-74.2	-23
450.050000	5850.428333	-42.3	-73.5	-22.3
489.950000	5879.284167	-42.8	-74	-22.8
470.050000	6110.620000	-42.6	-73.8	-22.6
450.050000	6300.465000	-43.1	-74.3	-23.1
489.950000	6369.392500	-41.6	-72.8	-21.6
470.050000	6580.807500	-41.1	-72.3	-21.1
450.050000	6750.680833	-41.5	-72.7	-21.5
489.950000	6859.539167	-41.3	-72.5	-21.3
470.050000	7050.608333	-40.8	-72	-20.8
489.950000	7349.113333	-39.3	-70.5	-19.3

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NAME OF TEST: Unwanted Emissions (Transmitter Conducted)

LIMIT(S), dBc - (50+10xLOG P) = -50 (1 Watt)  
 - (50+10xLOG P) = -56 (4 Watts)

g0340230: 2003-Apr-25 Fri 15:07:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22°C ± 3°C

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	LEVEL, dBm	LEVEL, dBc	MARGIN, dB
450.050000	900.137500	-40	-76.5	-20
470.050000	940.095000	-39.3	-75.8	-19.3
489.950000	979.833333	-38.7	-75.2	-18.7
450.050000	1350.100833	-39.3	-75.8	-19.3
470.050000	1410.292500	-38.3	-74.8	-18.3
489.950000	1469.720000	-40	-76.5	-20
450.050000	1800.305833	-38.8	-75.3	-18.8
470.050000	1880.325000	-38.3	-74.8	-18.3
489.950000	1959.870833	-39.5	-76	-19.5
450.050000	2250.466667	-38.5	-75	-18.5
470.050000	2350.038333	-39.5	-76	-19.5
489.950000	2449.559167	-39	-75.5	-19
450.050000	2700.147500	-39	-75.5	-19
470.050000	2820.230833	-38.3	-74.8	-18.3
489.950000	2939.542500	-39.8	-76.3	-19.8
450.050000	3150.575833	-39.8	-76.3	-19.8
470.050000	3290.538333	-40.5	-77	-20.5
489.950000	3429.572500	-39.5	-76	-19.5
450.050000	3600.338333	-40.2	-76.7	-20.2
470.050000	3760.164167	-40.2	-76.7	-20.2
489.950000	3919.521667	-40.3	-76.8	-20.3
450.050000	4050.503333	-39.7	-76.2	-19.7
470.050000	4230.221667	-40.5	-77	-20.5
489.950000	4409.631667	-40.7	-77.2	-20.7
450.050000	4500.608333	-40.5	-77	-20.5
470.050000	4700.746667	-40.5	-77	-20.5
489.950000	4899.682500	-40.5	-77	-20.5
450.050000	4950.481667	-39.8	-76.3	-19.8
470.050000	5170.505833	-39.8	-76.3	-19.8
489.950000	5389.682500	-39.8	-76.3	-19.8
450.050000	5400.606667	-40.5	-77	-20.5
470.050000	5640.672500	-40.2	-76.7	-20.2
450.050000	5850.435833	-39.7	-76.2	-19.7
489.950000	5879.300833	-40.5	-77	-20.5
470.050000	6110.506667	-40.8	-77.3	-20.8
450.050000	6300.893333	-40.7	-77.2	-20.7
489.950000	6369.370833	-39.3	-75.8	-19.3
470.050000	6580.780000	-39.7	-76.2	-19.7
450.050000	6750.985833	-39.3	-75.8	-19.3
489.950000	6859.281667	-39.2	-75.7	-19.2
470.050000	7050.697500	-39.7	-76.2	-19.7
489.950000	7349.444167	-39.2	-75.7	-19.2

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NAME OF TEST: Field Strength of Spurious Radiation

SPECIFICATION: 47 CFR 2.1053(a)

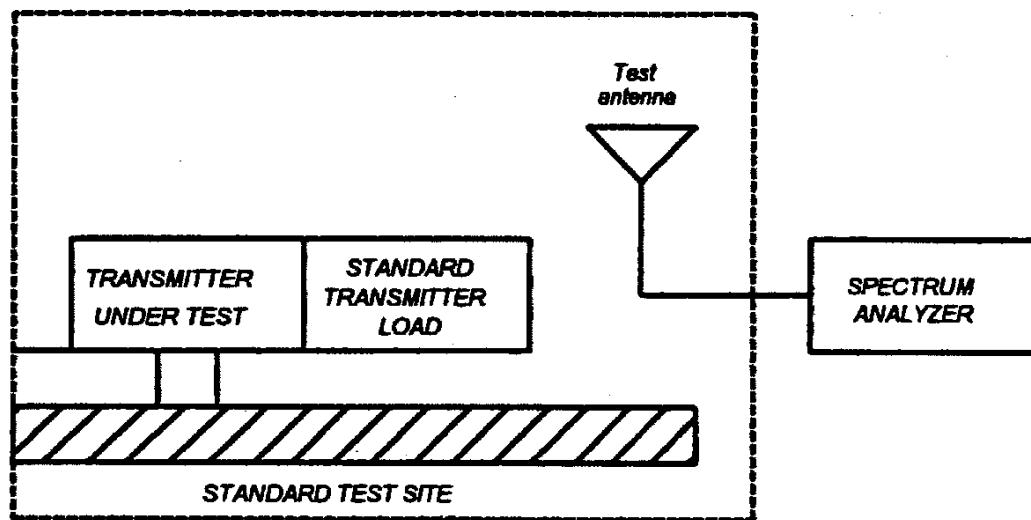
GUIDE: ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917

#### 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  $\geq$  3 times Resolution Bandwidth, or 30 kHz (22.917)
  - 3) Sweep Speed  $\leq$  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.

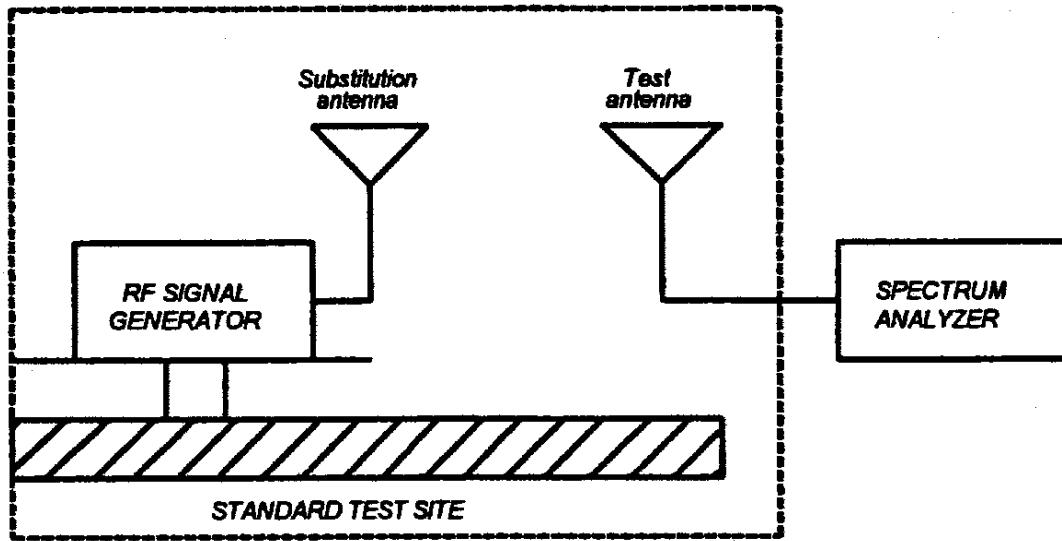
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NAME OF TEST: Field Strength of Spurious Radiation (Cont.)

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  $\pm$  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.

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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 =  
 $10\log_{10}(\text{TX power in watts}/0.001) - \text{the levels in step l})$

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

Test Equipment:

Asset	Description (as applicable)	s/n	Cycle	Last Cal	
Per ANSI C63.4-1992/2000 Draft, 10.1.4					
<u>TRANSDUCER</u>					
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	
<u>AMPLIFIER</u>					
i00028	HP 8449A	2749A00121	12 mo.	Mar-03	
<u>SPECTRUM ANALYZER</u>					
i00029	HP 8563E	3213A00104	12 mo.	Jan-03	
i00033	HP 85462A	3625A00357	12 mo.	Jan-03	
i00048	HP 8566B	2511AD1467	6 mo.	Jan-03	
<u>MICROPHONE, ANTENNA PORT, AND CABLING</u>					
Microphone	Yes	Cable Length	1.0	Meters	
Antenna Port Terminated	Yes	Load	No	Antenna Gain	0 dBd
All Ports Terminated by Load	Yes	Peripheral	No		

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NAME OF TEST: Field Strength of Spurious Radiation

g0340215: 2003-Apr-23 Wed 11:23:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22 °C ± 3 °C

FREQUENCY TUNED, MHz	FREQUENCY EMISSION, MHz	ERP, dBm	ERP, dBc
470.050000	940.101500	-40.8	<-71.3
470.050000	1410.147000	-45	<-71.3
470.050000	1880.171300	-45.2	<-71.3
470.050000	2350.276000	-40	<-71.3
470.050000	2820.275000	-35.2	<-71.3
470.050000	3290.348333	-47.8	<-71.3
470.050000	3760.398333	-45.5	<-71.3
470.050000	4230.422000	-50.8	<-71.3

SUPERVISED BY:

David Lee



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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  $\pm 2.5/\pm 1.25$  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.

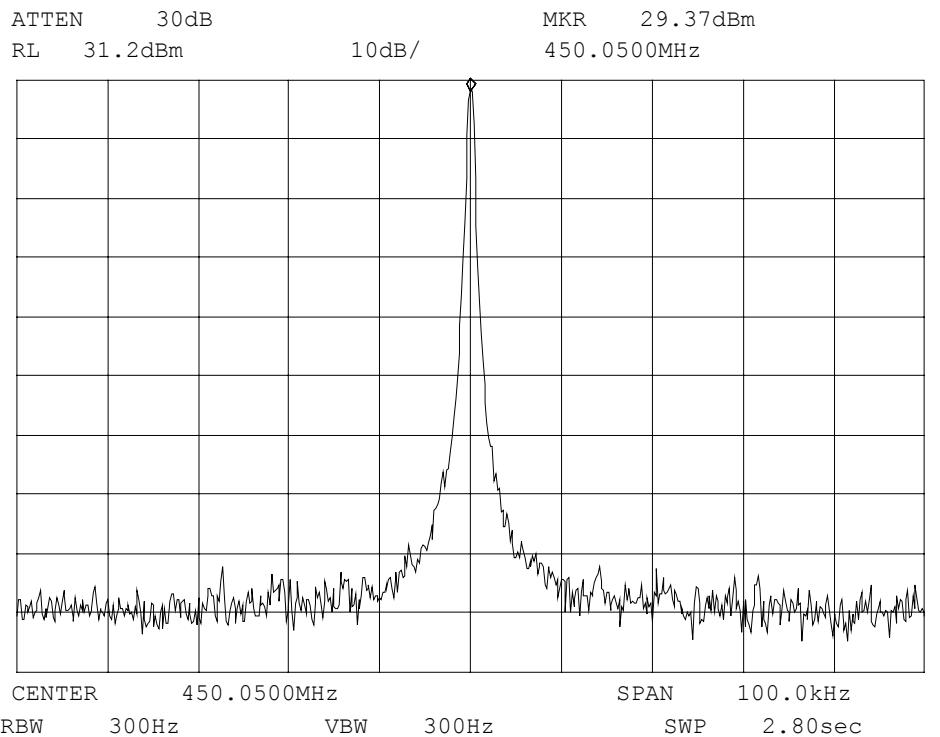
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NAME OF TEST: Emission Masks (Occupied Bandwidth)

g0340223: 2003-Apr-25 Fri 14:06:00

STATE: 1:Low Power

AMBIENT TEMPERATURE: 22 °C ± 3 °C

POWER: LOW  
MODULATION: NONE

PERFORMED BY:

David Lee

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NAME OF TEST: Emission Masks (Occupied Bandwidth)

g0340224: 2003-Apr-25 Fri 14:11:00

STATE: 1:Low Power

AMBIENT TEMPERATURE: 22 °C ± 3 °C

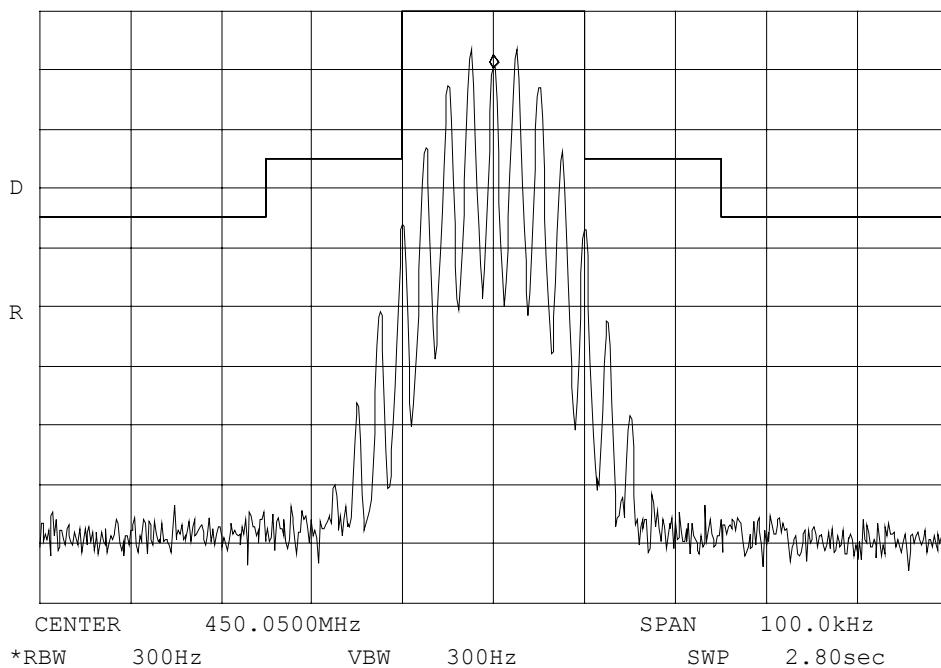
ATTEN 30dB

RL 31.2dBm

10dB/

MKR 21.53dBm

450.0500MHz



\*RBW 300Hz VBW 300Hz SWP 2.80sec

POWER:

LOW

MODULATION:

VOICE: 2500 Hz SINE WAVE

MASK: B, VHF/UHF 25kHz,

w/LPF

PERFORMED BY:

David Lee

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NAME OF TEST: Emission Masks (Occupied Bandwidth)

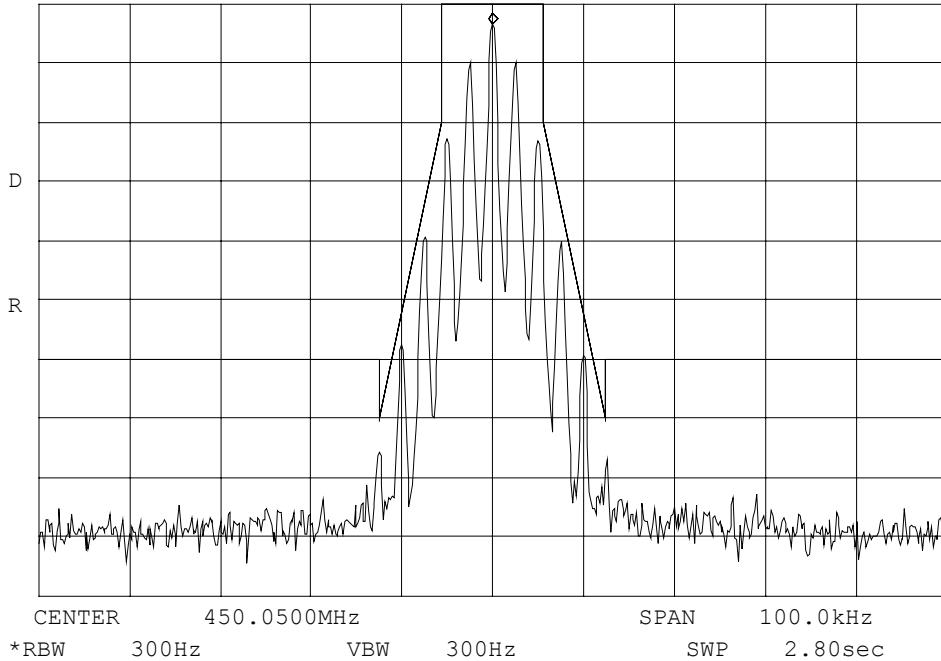
g0340229: 2003-Apr-25 Fri 14:31:00

STATE: 1:Low Power

AMBIENT TEMPERATURE: 22 °C ± 3 °C

ATTEN 30dB  
RL 31.2dBm

10dB/

MKR 27.53dBm  
450.0500MHz

\*RBW 300Hz VBW 300Hz

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

PERFORMED BY:

David Lee

PAGE NO.

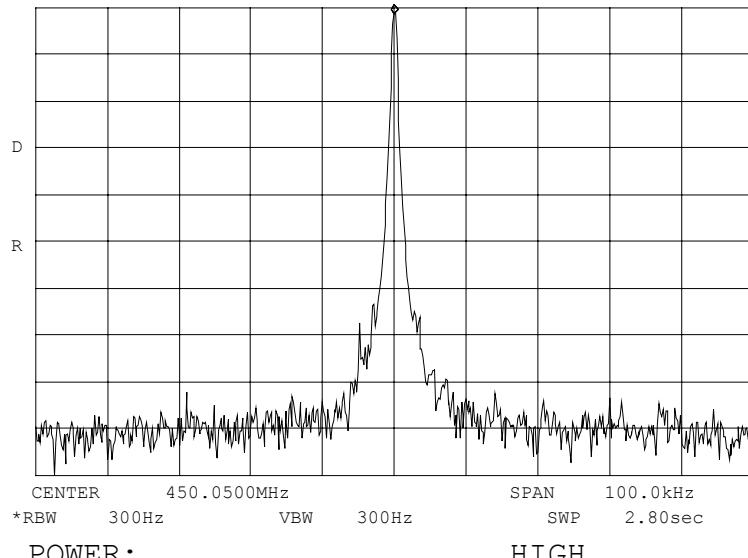
24 of 43.

NAME OF TEST: Emission Masks (Occupied Bandwidth)  
 g0340222: 2003-Apr-25 Fri 14:05:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22 °C ± 3 °C

ATTEN	30dB	MKR	35.00dBm
RL	36.5dBm	450.0500MHz	
	10dB/		



POWER:	HIGH
MODULATION:	NONE

PERFORMED BY:

David Lee

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NAME OF TEST: Emission Masks (Occupied Bandwidth)

g0340225: 2003-Apr-25 Fri 14:12:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22°C ± 3°C

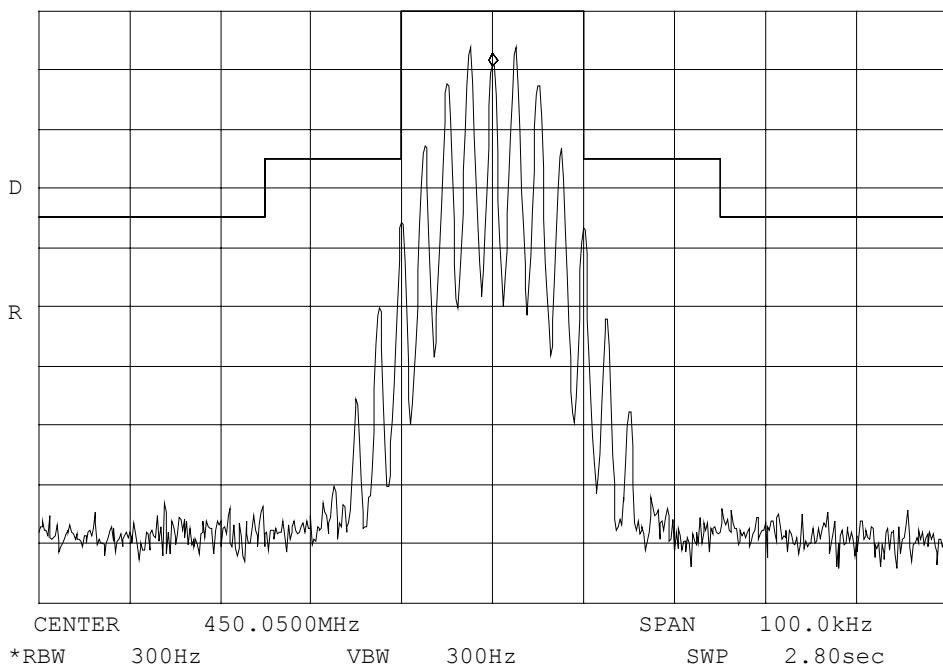
ATTEN 30dB

RL 36.5dBm

10dB/

MKR 27.17dBm

450.0500MHz



## POWER:

## MODULATION:

## HIGH

VOICE: 2500 Hz SINE WAVE

MASK: B, VHF/UHF 25kHz,

w/LPF

PERFORMED BY:

David Lee

MFA p0340008, d0350018

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NAME OF TEST: Emission Masks (Occupied Bandwidth)

g0340226: 2003-Apr-25 Fri 14:14:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22 °C ± 3 °C

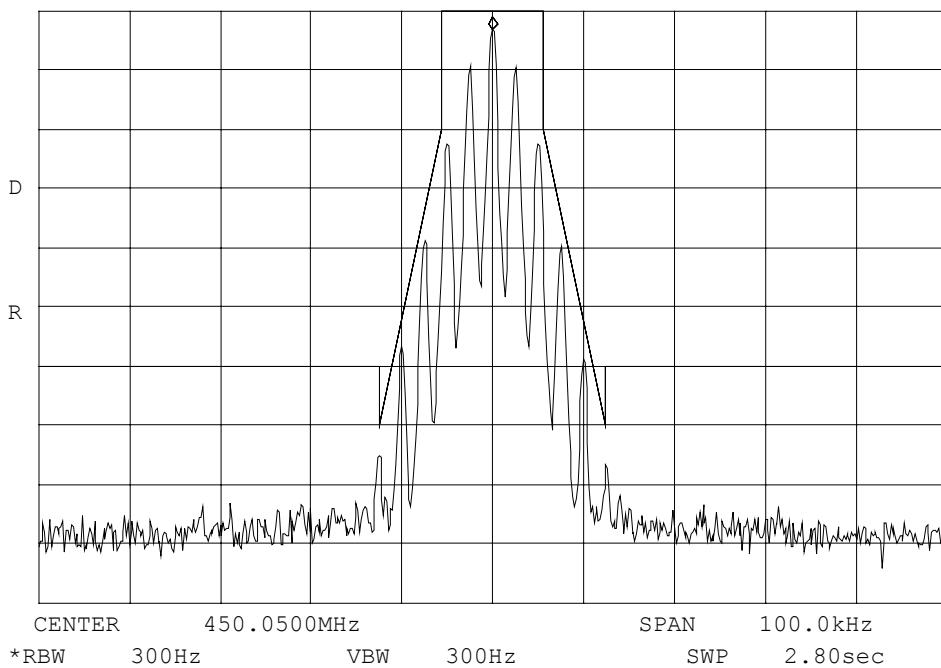
ATTEN 30dB

RL 36.5dBm

10dB/

MKR 33.33dBm

450.0500MHz



POWER:

HIGH

MODULATION:

VOICE: 2500 Hz SINE WAVE

MASK: D, VHF/UHF 12.5kHz BW

PERFORMED BY:

David Lee

PAGE NO. 27 of 43.

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:

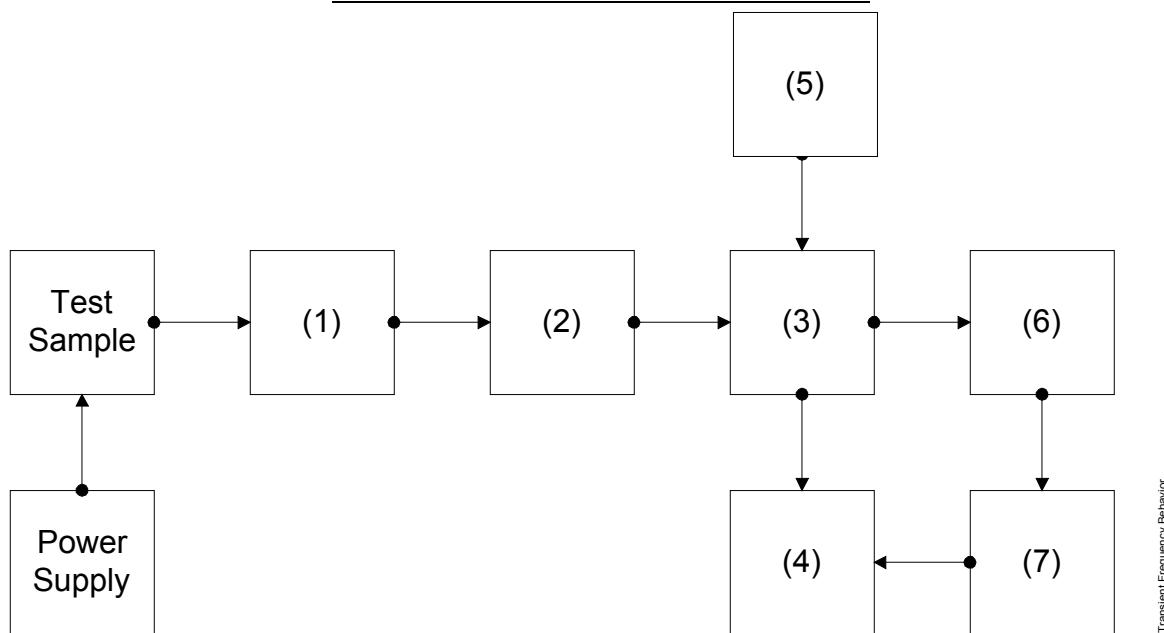
<u>step f</u> , dBm	= -15.80
<u>step h</u> , dBm	= -35.80
<u>step l</u> , dBm	= 14.60



PERFORMED BY:

David Lee

## TRANSIENT FREQUENCY BEHAVIOR



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

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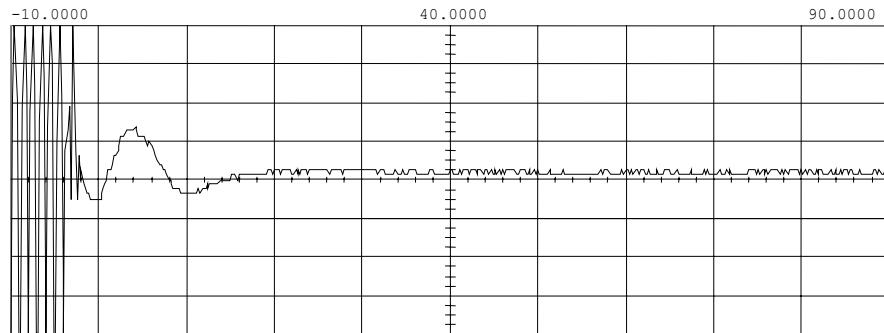
NAME OF TEST:

Transient Frequency Behavior

g0340238: 2003-Apr-28 Mon 10:06:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22°C ± 3°C



Timebase  
Main 10.0 ms/div      Delay/Pos 40.0000 ms      Center  
 Channel 1 Sensitivity 50.0 mV/div      Offset 0.00000 V      Probe 1.000 :1      dc BW  
 Trigger mode :  
 On Negative Edge Of  
 Trigger  
 - Chan2 = -500.000 mV (noise  
 Holdoff= 40.000

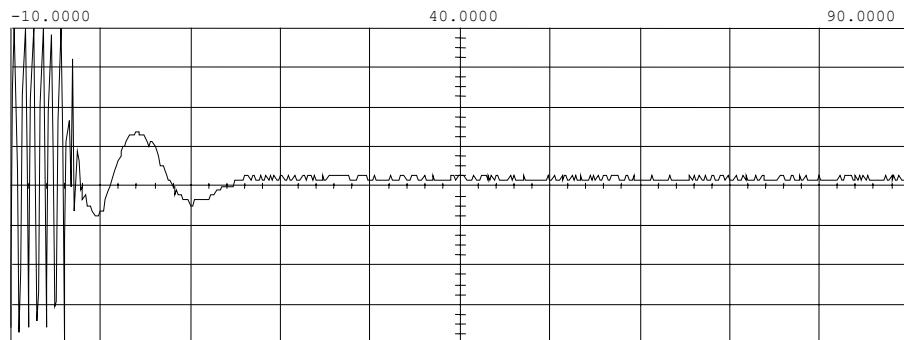
MODULATION:  
DESCRIPTION:

Ref Gen=25 kHz Deviation  
Carrier On-Time

g0340239: 2003-Apr-28 Mon 10:08:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22°C ± 3°C



Timebase  
Main 10.0 ms/div      Delay/Pos 40.0000 ms      Center  
 Channel 1 Sensitivity 50.0 mV/div      Offset 0.00000 V      Probe 1.000 :1      dc BW  
 Trigger mode :  
 On Negative Edge Of  
 Trigger  
 - Chan2 = -500.000 mV (noise  
 Holdoff= 40.000

MODULATION:  
DESCRIPTION:

Ref Gen=12.5 kHz Deviation  
Carrier On-Time

PERFORMED BY:

David Lee

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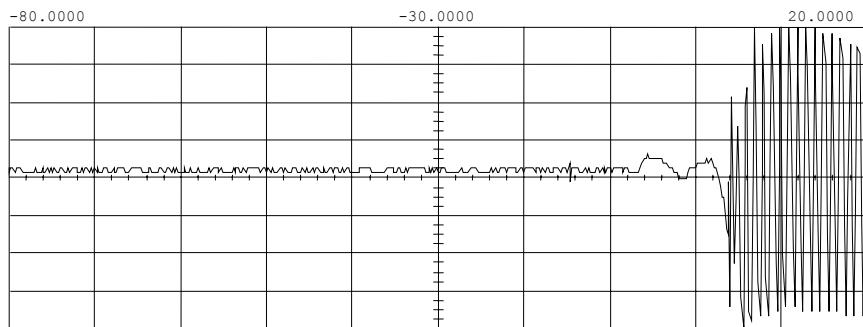
NAME OF TEST:

Transient Frequency Behavior

g0340240: 2003-Apr-28 Mon 11:01:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22°C ± 3°C



Timebase  
Main 10.0 ms/div      Delay/Pos -30.0000 ms      Center  
 Channel 1 Sensitivity 50.0 mV/div      Offset 0.00000 v      Probe 1.000 :1  
 Trigger mode :  
 On Positive Edge Of  
 Trigger  
 - Chan2 = -1.08750 V (noise  
 Holdoff = 40.000

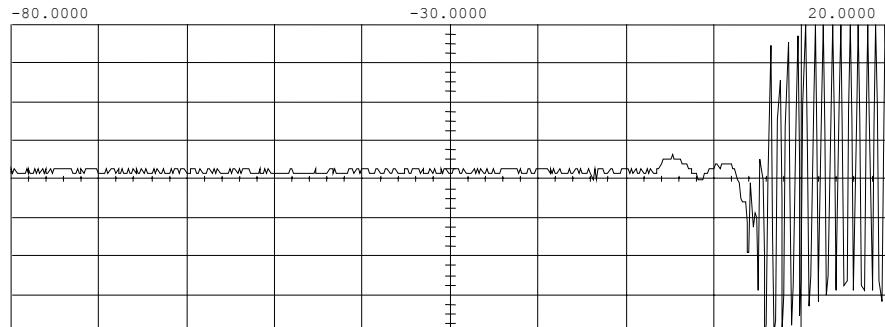
MODULATION:  
DESCRIPTION:

Ref Gen=12.5 kHz Deviation  
Carrier Off-Time

g0340241: 2003-Apr-28 Mon 11:01:00

STATE: 2:High Power

AMBIENT TEMPERATURE: 22°C ± 3°C



Timebase  
Main 10.0 ms/div      Delay/Pos -30.0000 ms      Center  
 Channel 1 Sensitivity 50.0 mV/div      Offset 0.00000 v      Probe 1.000 :1  
 Trigger mode :  
 On Positive Edge Of  
 Trigger  
 - Chan2 = -1.08750 V (noise  
 Holdoff = 40.000

MODULATION:  
DESCRIPTION:

Ref Gen=25 kHz Deviation  
Carrier Off-Time

PERFORMED BY:

David Lee

PAGE NO. 31 of 43.

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

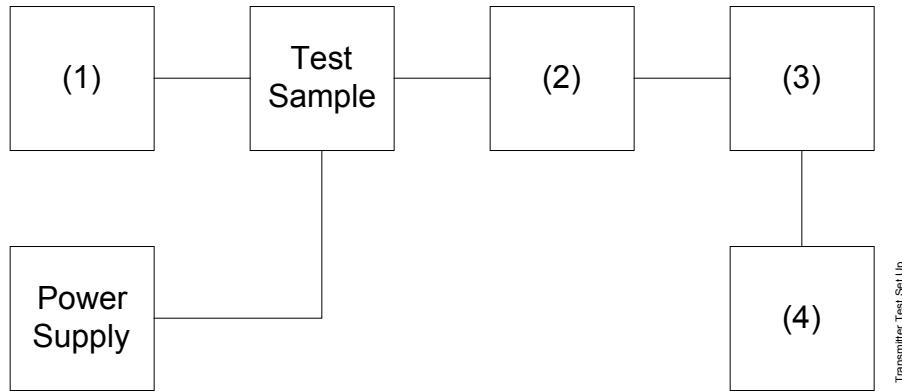
1. The EUT and test equipment were set up such that the audio input was connected at the input to the modulation limiter, and the modulated stage.
2. The audio output was connected at the output to the modulated stage.
3. MEASUREMENT RESULTS: ATTACHED

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TRANSMITTER TEST SET-UP

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



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

PAGE NO.

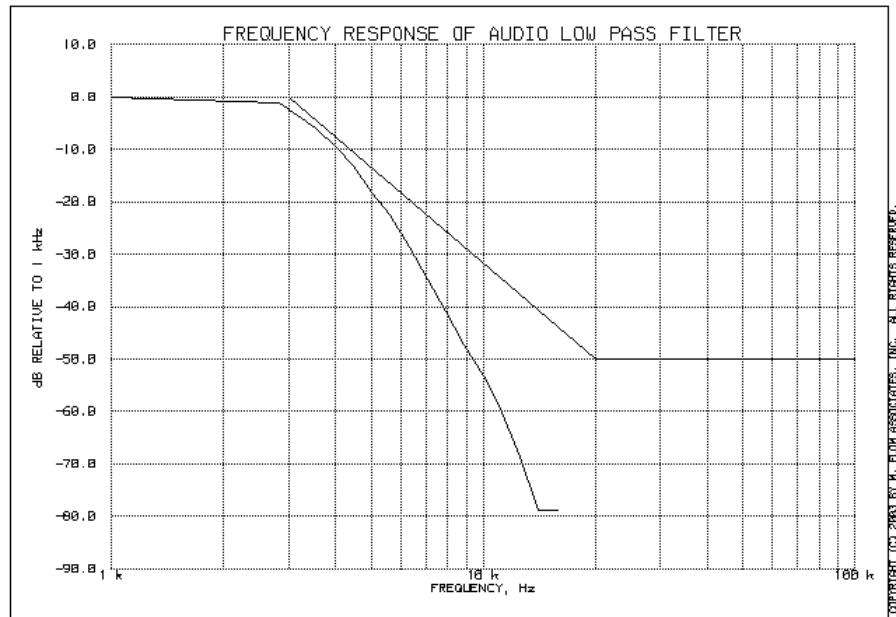
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NAME OF TEST: Audio Low Pass Filter (Voice Input)

g0340161: 2003-Apr-28 Mon 09:06:00

STATE: 0:General

AMBIENT TEMPERATURE: 22 °C ± 3 °C



PERFORMED BY:

David Lee

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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.

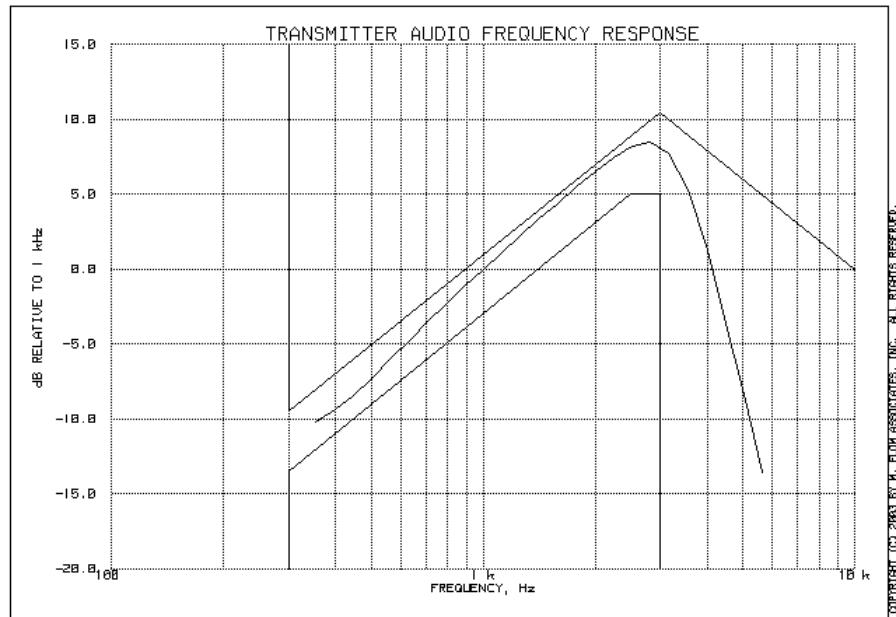
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NAME OF TEST: Audio Frequency Response

g0340159: 2003-Apr-28 Mon 09:01:00

STATE: 0:General

AMBIENT TEMPERATURE: 22 °C ± 3 °C



Frequency of Maximum Audio Response, Hz = 2820

Additional points:

FREQUENCY, Hz	LEVEL, dB
300	-12.01
20000	-22.05
30000	-22.09
50000	-22.13

PERFORMED BY:

David Lee

PAGE NO. 36 of 43.

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 ( $\pm 1.5$  kHz deviation) to at least 20 dB higher than the saturation point.
4. Measurements were performed for both negative and positive modulation and the respective results were recorded.

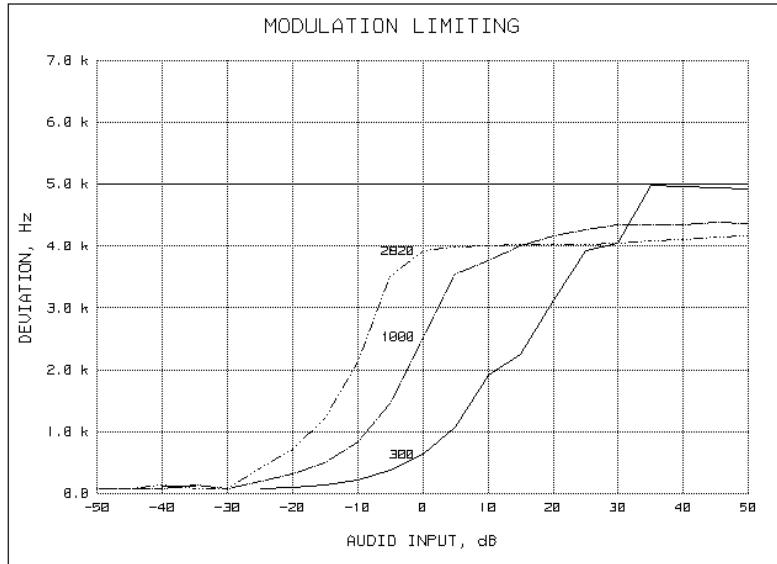
5. MEASUREMENT RESULTS: ATTACHED

PAGE NO.

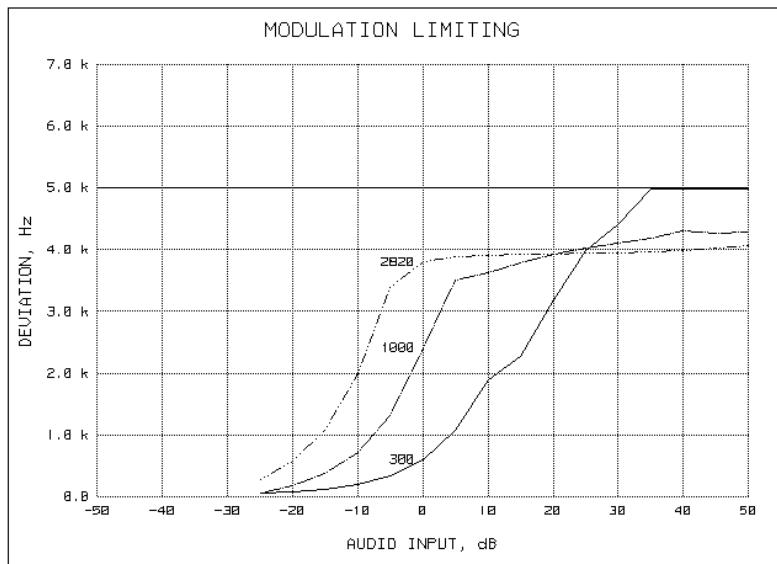
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NAME OF TEST: Modulation Limiting  
 g0340164: 2003-Apr-28 Mon 09:25:00  
 STATE: 0:General AMBIENT TEMPERATURE: 22 °C ± 3 °C

Positive Peaks:



Negative Peaks:



PERFORMED BY:

David Lee

PAGE NO.

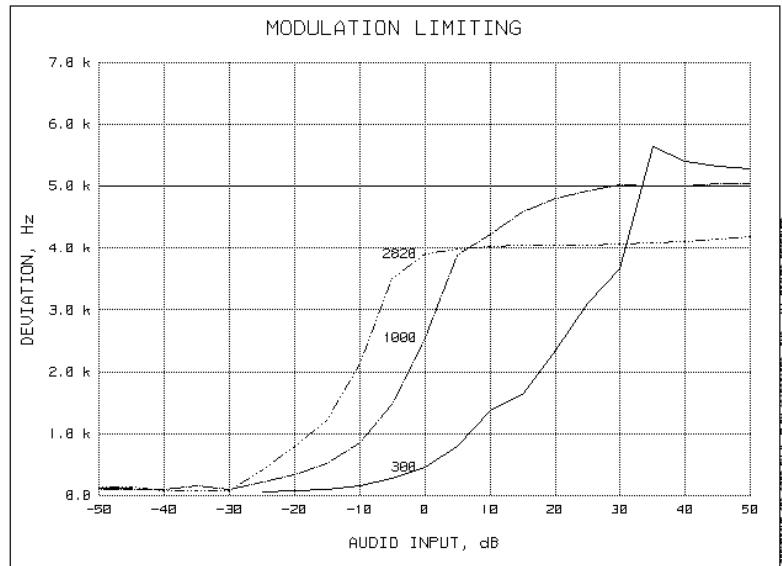
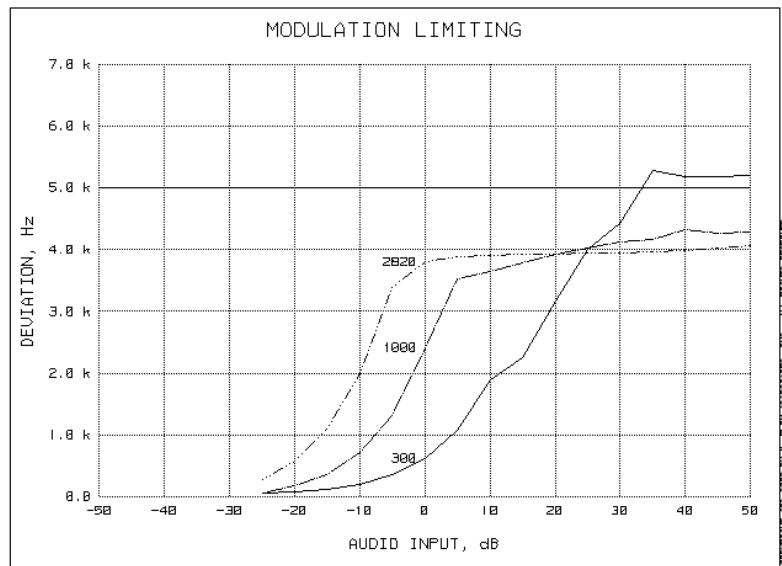
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NAME OF TEST: Modulation Limiting

g0340163: 2003-Apr-28 Mon 09:21:00

STATE: 0:General

AMBIENT TEMPERATURE: 22 °C ± 3 °C

Positive  
Peaks:Negative  
Peaks:

PERFORMED BY:

David Lee

PAGE NO. 39 of 43.

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

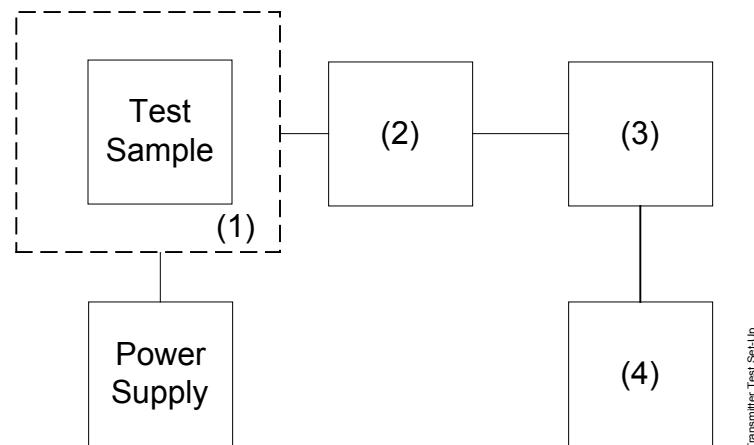
1. The EUT and test equipment were set up as shown on the following page.
2. With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute.
3. With power OFF, the temperature 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

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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 Description (as applicable)		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

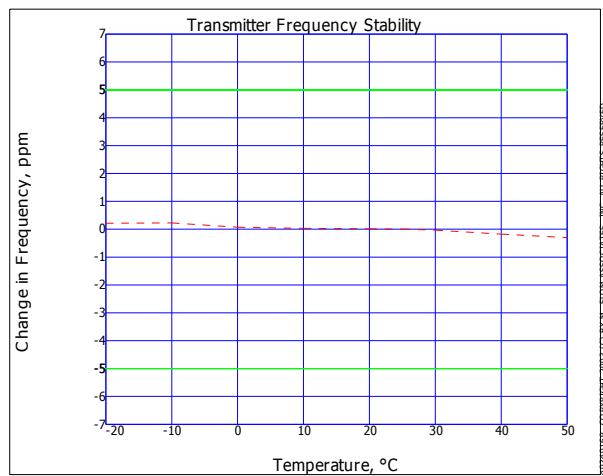
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NAME OF TEST: Frequency Stability (Temperature Variation)

g0340169: 2003-Apr-28 Mon 14:28:43

STATE: 0:General

AMBIENT TEMPERATURE:  $22^{\circ}\text{C} \pm 3^{\circ}\text{C}$ 

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  $25\pm5^{\circ}\text{C}$  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)

g0340237: 2003-Apr-25 Fri 16:34:34

STATE: 0:General

AMBIENT TEMPERATURE:  $22^{\circ}\text{C} \pm 3^{\circ}\text{C}$

LIMIT, ppm	=	5
LIMIT, Hz	=	2350
BATTERY END POINT (Voltage)	=	6.2

% of STV	Voltage	Frequency, MHz	Change, Hz	Change, ppm
85	6.37	470.050000	0	0.00
100	7.5	470.050000	0	0.00
115	8.62	470.050000	0	0.00
83	6.2	470.050000	0	0.00

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 <sub>N</sub> ), 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 <sub>N</sub> ), 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.