



Flom Test Labs
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268
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Date: May 25, 2006

Federal Communications Commission
Via: Electronic Filing

Attention: Authorization & Evaluation Division

Applicant: Wulfsberg Electronics Division
Equipment: RT-5000A
FCC ID: FRWRT-5000A
FCC Rules: 80.379, 87, 87.187(l), 90, 90.210

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,

Michael Schafer, President

enclosure(s)
cc: Applicant
MS/del



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Transmitter Certification

of

Model: RT-5000A
FCC ID: FRWRT-5000A

to

Federal Communications Commission

Rule Part(s) 80.379, 87, 87.187(l), 90, 90.210

Date of report: May 13, 2006

On the Behalf of the Applicant:

Wulfsberg Electronics Division

At the Request of:

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

Attention of:

Main: (928) 708-1550; Fax: (928) 541-7627
Dave Auer, Project Manager
Direct (928) 708-1576
Email: dave.auer@wulfsberg.com

Prepared by:

David E. Lee, FCC/IC Compliance Manager

Supervised by:

Sam Baum, Technical Manager

List of Exhibits

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

Applicant: Wulfsberg Electronics Division

FCC ID: FRWRT-5000A

By Applicant:

1. Letter of Authorization
2. Confidentiality Request: 0.457 And 0.459
3. Part 90.203(e) & (g) Attestation
4. Identification Drawings, 2.1033(c)(11)
 - Label
 - Location of Label
 - Compliance Statement
 - Location of Compliance Statement
5. Photographs, 2.1033(c)(12)
6. Documentation: 2.1033(c)
 - (3) User Manual
 - (9) Tune Up Info
 - (10) Schematic Diagram
 - (10) Circuit Description
 - Block Diagram
 - Parts List
 - Active Devices
7. MPE Report

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.

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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: d0650012

d) Client: Wulfsberg Electronics Division
6400 Wilkinson Drive
Prescott, AZ 86301-6164

e) Identification: RT-5000A
FCC ID: FRWRT-5000A
EUT Description: VHF/UHF Tactical Transceiver

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

g) Report Date: May 13, 2006
EUT Received: April 8, 2006

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:



David E. Lee, FCC/IC Compliance Manager

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.

Accessories used during testing:

Type	Quantity	Manufacturer	Model	Serial No.	FCC ID
Control Unit	1	Wulfsberg	C-5000	-	No Required
Interface	1	Wulfsberg	TS-1	-	-

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
- ☒ 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 C63.4-2003, 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.

Calibration List

Asset	Description	s/n	Cycle	
i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232	NCR	-
i00122/3	NARDA 766 (10 dB)	7802 or 7802A	NCR	-
i00020	HP 8901A Power / Frequency Modes	2105A01087	12 mo.	May-05
i00017	HP 8903A Audio Analyzer	2216A01753	12 mo.	Aug-05
i00002	HP 3336B Synthesizer / Level Gen.	1931A01465	12 mo.	May-05
i00048	HP 8566B Spectrum Analyzer	2511A01467	24 mo.	Sep-04
i00029	HP 8563E Spectrum Analyzer	3213A00104	12 mo.	Jan-06
i00088	EMCO 3109-B 25MHz-300MHz	2336	24 mo.	Oct-05
i00089	Apriel 2001 200MHz-1GHz	001500	24 mo.	Oct-05
i00103	EMCO 3115 1GHz-18GHz	9208-3925	24 mo.	Oct-05
i00028	HP 8449A	2749A00121	12 mo.	Jun-05
i00033	HP 85462A	3625A00357	24 mo.	Oct-05
i00067	HP 8920A Communication TS	3345U01242	24 mo.	May-05
i00207	HP 8753D Network Analyzer	3410A08514	24 mo.	May-06
i00021	HP 8954A Transceiver Interface	2146A00159	NCR	-
i00159	HP 8470B Crystal Detector	1822A10054	NCR	-
i00030	HP 54502A Digital Oscilloscope	2927A00209	12 mo.	May-05
i00001	HP 3586B Selective Level Meter	1928A01360	12 mo.	Jul-05
i00027	Tenney Temp. Chamber	9083-765-234	NCR	-

List of General Information Required for Certification

In Accordance with FCC Rules and Regulations,
Volume II, Part 2 and to 80.379, 87, 87.187(l), 90, 90.210

Sub-part 2.1033

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

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

Manufacturer:

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

(c)(2): **FCC ID:**

FRWRT-5000A

Model Number:

RT-5000A

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

Please see attached exhibits

(c)(4): **Type of Emission:**

See List Next Page

(c)(5): **Frequency Range, MHz:**

See List Next Page

(c)(6): **Power Rating, Watts:**

 X Switchable Variable

See List Next Page

 N/A

FCC Grant Note:

BD

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

300

DUT Results:

Passes X Fails

The equipment comprises the main RT and two of the auxiliary transceivers;

Transceiver 1 (Main Transceiver):

Frequency Range	Power Levels	Frequency Tolerance	Emission Designator
29.7 – 50 MHz	10W/1W	5.0 PPM	16K0F3E
118 – 137 MHz	15W/7.5W	7.0 PPM	6K00A3E
136 – 174 MHz	10W/1W	2.5 PPM	16K0F3E, 11K0F3E
403 – 520 MHz	10W/1W	2.5 PPM	16K0F3E, 11K0F3E
806 – 870 MHz	10W/1W	1.5 PPM	16K0F3E, 11K0F3E
896 – 940 MHz	10W/1W	1.5 PPM	11K0F3E

Transceiver 2 (FCC ID: AZ489FT3804):

136 – 174 MHz	10W/1W	2.5 PPM	16K0F3E, 11K0F3E, 20K0F1E, 8K10F1E, 8K10F1D
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Transceiver 3 (FCC ID: AZ489FT4855):

380 – 470 MHz	10W/1W	2.5 PPM	16K0F3E, 11K0F3E, 20K0F1E, 8K10F1E, 8K10F1D
---------------	--------	---------	---

Transceiver 4 (FCC ID: AZ489FT4864):

450 – 520 MHz	4W/1W	2.5 PPM	16K0F3E, 11K0F3E, 20K0F1E, 8K10F1E, 8K10F1D
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Transceiver 5 (FCC ID: AZ489FT5806):

764 – 870 MHz	3W/1W	1.5 PPM	16K0F3E, 11K0F3E, 20K0F1E, 8K10F1E, 8K10F1D
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Supply Voltage: +28 V nominal, aircraft supply

Information for Push-To-Talk Devices

Type and number of antenna to be used for this device:

Dual Feed Multi-band Omni Aircraft Antenna (AT-5000)

Maximum antenna gain for antenna indicated above:

0dBi

Can this device sustain continuous operation with respect to its hardware capabilities and allowable operating functions?

No

Other hardware or operating restrictions that could limit a person's RF Exposure:

Controlled use on board aircraft

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?

Mobile

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?

Yes

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

Operated only by trained aircrew

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	=	max 6.0 (varies by mode / power)
Collector Voltage, Vdc	=	12.0 (varies by mode / power)
Supply Voltage, Vdc	=	28.0

(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
☒ N/A

(c)(14): **Test and Measurement Data:**

Follows

Name of Test: Carrier Output Power (Conducted)

Specification: 47 CFR 2.1046(a)

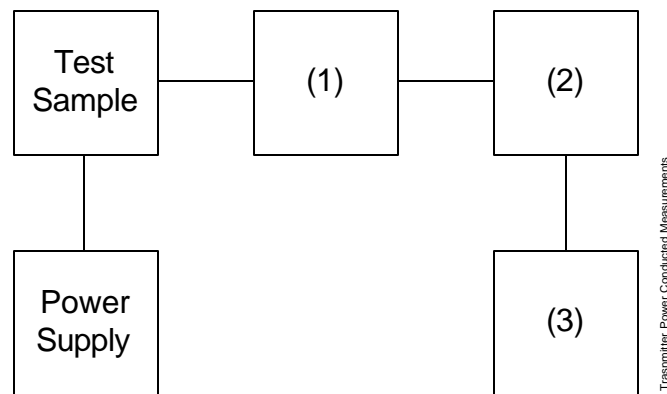
Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

A) 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.

B) Measurement accuracy is $\pm 3\%$.

Transmitter Test Set-Up: RF Power Output



Asset	Description	s/n
(1)	Coaxial Attenuator	
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
i00122/3	NARDA 766 (10 dB)	7802 or 7802A
(2)	Power Meters	
X i00020	HP 8901A Power Mode	2105A01087
(3)	Frequency Counter	
X i00020	HP 8901A Frequency Mode	2105A01087

Name of Test: Carrier Output Power (Conducted)

Measurement Results
(Highest reading in each sub-band)

RT-5000A Transceiver 1

Frequency of Carrier, MHz = 40.025
Ambient Temperature = 23°C ± 3°C

Power Setting	RF Power, dBm	RF Power, Watts
High	40.0	10.0
Low	30.0	1.0

Frequency of Carrier, MHz = 128.025
Ambient Temperature = 23°C ± 3°C

Power Setting	RF Power, dBm	RF Power, Watts
High	41.8	15.0
Low	38.9	7.5

Frequency of Carrier, MHz = 158.025
Ambient Temperature = 23°C ± 3°C

Power Setting	RF Power, dBm	RF Power, Watts
High	40.0	10.0
Low	30.0	1.0

Frequency of Carrier, MHz = 430.025
Ambient Temperature = 23°C ± 3°C

Power Setting	RF Power, dBm	RF Power, Watts
High	40.0	10.0
Low	30.0	1.0

Frequency of Carrier, MHz = 820.025
Ambient Temperature = 23°C ± 3°C

Power Setting	RF Power, dBm	RF Power, Watts
High	40.0	10.0
Low	30.0	1.0

Name of Test: Carrier Output Power (Conducted)

Frequency of Carrier, MHz = 937.025
 Ambient Temperature = 23°C ± 3°C

Power Setting	RF Power, dBm	RF Power, Watts
High	40.0	10.0
Low	30.0	1.0

The RF Conducted power of each auxiliary transceiver is detailed in the individual reports.



Performed by: David E. Lee, FCC/IC Compliance Manager

Name of Test: RF Power Output (Radiated)

Specification: 47 CFR 2.1046(a)

The unit is intended for installation in an aircraft, fixed or rotary wing, to allow communications on aviation, public safety and marine bands.

The antenna(s) to be used will be determined by the aircraft configuration. Two RF connectors are provided one matched for use below 350MHz and one matched for above 350MHz.

A typical antenna is the AT-5000, which has the following characteristics;

- 1) Frequency: 29.7 - 960 MHz
- 2) VSWR: 2.5:1 maximum
- 3) Radiation Pattern: Omni-directional in azimuth
- 4) Polarization: Vertical
- 5) Impedance: 50 ohms
- 6) Power: 20 Watts
- 7) Gain:
 - 30 MHz, -15 dBi
 - 88 MHz, -7.5 dBi
 - 118-174 MHz, -3 dBi
 - 225-960 MHz, 0 dBi
- 8) Temperature: -55°C to + 70°C
- 9) Altitude: 55,000 feet

Power specified in the filing is conducted, no radiated power is quoted as antenna gain is 0dBi or less across the band.



Attested by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Unwanted Emissions (Transmitter Conducted)

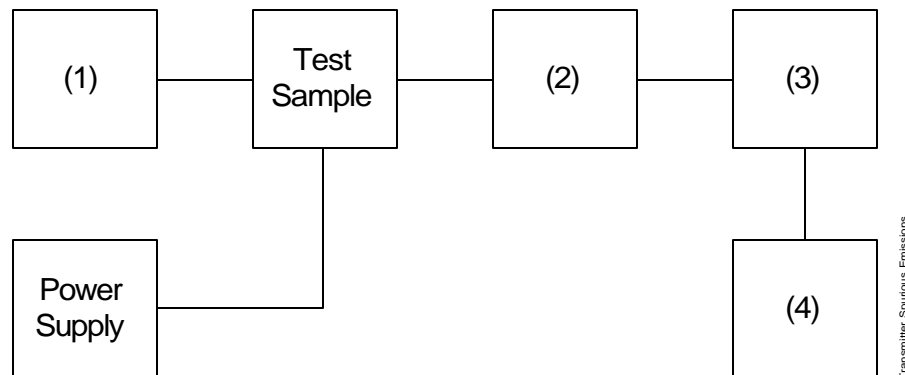
Specification: 47 CFR 2.1051

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) The emissions were measured for the worst case as follows:
- 1). within a band of frequencies defined by the carrier frequency plus and minus one channel.
 - 2). 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.
- B) The magnitude of spurious emissions that are attenuated more than 20 dB below the permissible value need not be specified.

Transmitter Test Set-Up: Spurious Emission



Asset	Description	s/n
(1) Audio Oscillator/Generator		
X i00017	HP 8903A Audio Analyzer	2216A01753
i00002	HP 3336B Synthesizer / Level Gen.	1931A01465
(2) Coaxial Attenuator		
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
i0012/3	NARDA 766 (10 dB)	7802 or 7802A
(3) Filters; Notch, HP, LP, BP		
	None required	
(4) Spectrum Analyzer		
X i00048	HP 8566B Spectrum Analyzer	2511A01467
i00029	HP 8563E Spectrum Analyzer	3213A00104

Name of Test: Unwanted Emissions (Transmitter Conducted)

Measurement Results
(Worst Case Combinations)

Summary:

Frequency of carrier, MHz	=	See Tuned Frequency
Spectrum Searched, GHz	=	0 to 10 x F _C
Maximum Response, Hz	=	2510
All Other Emissions	=	= 20 dB Below Limit
Limit(s), dBc		-43 for 25kHz
		-50 for 12.5kHz

Tabulated Results follow:

Measurement Results

g0650041: 2006-May-04 Thu 11:10:00

STATE: 2:High Power

Ambient Temperature: 23°C ± 3°C

Frequency Tuned, MHz	Frequency Emission, MHz	ERP, dBm	ERP, dBc Ref 1W	Margin, dB (-50dBc)
40.025000	80.070000	-67.20	-97.20	-47.20
40.025000	120.095000	-67.50	-97.50	-47.50
40.025000	160.120000	-63.70	-93.70	-43.70
40.025000	200.145000	-64.60	-94.60	-44.60
40.025000	240.170000	-61.20	-91.20	-41.20
40.025000	280.195000	-68.00	-98.00	-48.00
158.025000	316.070000	-56.70	-86.70	-36.70
40.025000	320.220000	-61.40	-91.40	-41.40
40.025000	360.245000	-61.70	-91.70	-41.70
40.025000	400.270000	-58.70	-88.70	-38.70
158.025000	474.095000	-59.60	-89.60	-39.60
158.025000	632.120000	-54.80	-84.80	-34.80
158.025000	790.145000	-55.80	-85.80	-35.80
430.025000	860.070000	-44.20	-74.20	-24.20
158.025000	948.170000	-50.40	-80.40	-30.40
511.025000	1022.050000	-50.40	-80.40	-30.40
158.025000	1106.195000	-54.30	-84.30	-34.30
158.025000	1264.220000	-55.30	-85.30	-35.30
430.025000	1290.075000	-47.40	-77.40	-27.40
158.025000	1422.245000	-53.50	-83.50	-33.50
511.025000	1533.075000	-46.70	-76.70	-26.70
158.025000	1580.270000	-56.00	-86.00	-36.00
820.025000	1640.050000	-41.40	-71.40	-21.40
860.025000	1720.050000	-39.60	-69.60	-19.60
430.025000	1720.100000	-40.30	-70.30	-20.30
897.025000	1794.050000	-51.20	-81.20	-31.20
937.025000	1874.050000	-45.50	-75.50	-25.50

Name of Test: Unwanted Emissions (Transmitter Conducted)

Frequency Tuned, MHz	Frequency Emission, MHz	ERP, dBm	ERP, dBc Ref 1W	Margin, dB (-50dBc)
937.025000	1874.050000	-45.50	-75.50	-25.50
511.025000	2044.100000	-47.50	-77.50	-27.50
430.025000	2150.125000	-50.80	-80.80	-30.80
820.025000	2460.075000	-42.40	-72.40	-22.40
511.025000	2555.125000	-44.30	-74.30	-24.30
860.025000	2580.075000	-35.30	-65.30	-15.30
430.025000	2580.150000	-46.40	-76.40	-26.40
897.025000	2691.075000	-39.70	-69.70	-19.70
937.025000	2811.075000	-38.00	-68.00	-18.00
820.025000	2921.397500	-43.80	-73.80	-23.80
511.025000	2921.397500	-40.80	-70.80	-20.80
430.025000	3010.175000	-47.20	-77.20	-27.20
511.025000	3432.424375	-46.20	-76.20	-26.20
860.025000	3440.100000	-40.30	-70.30	-20.30
430.025000	3440.200000	-44.40	-74.40	-24.40
897.025000	3588.100000	-38.30	-68.30	-18.30
820.025000	3741.424000	-44.80	-74.80	-24.80
937.025000	3748.100000	-40.20	-70.20	-20.20
430.025000	3870.225000	-44.20	-74.20	-24.20
511.025000	3943.449375	-45.20	-75.20	-25.20
860.025000	4300.125000	-36.70	-66.70	-16.70
430.025000	4300.250000	-42.40	-72.40	-22.40
511.025000	4454.474000	-42.30	-72.30	-22.30
897.025000	4485.125000	-41.80	-71.80	-21.80
820.025000	4561.449000	-41.70	-71.70	-21.70
937.025000	4685.125000	-38.70	-68.70	-18.70
511.025000	4965.499000	-40.50	-70.50	-20.50
860.025000	5160.150000	-38.80	-68.80	-18.80
820.025000	5381.474000	-38.90	-68.90	-18.90
897.025000	5382.150000	-38.70	-68.70	-18.70
511.025000	5476.524000	-38.40	-68.40	-18.40
937.025000	5622.150000	-37.10	-67.10	-17.10
860.025000	6020.175000	-36.50	-66.50	-16.50
820.025000	6201.499000	-35.20	-65.20	-15.20
897.025000	6279.175000	-35.60	-65.60	-15.60
937.025000	6508.597500	-36.30	-66.30	-16.30

All other emissions are more than 20dB below limit



Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Field Strength of Spurious Radiation

Specification: 47 CFR 2.1053(a)

Guide: ANSI/TIA/EIA-603-C, 47 CFR 22.917

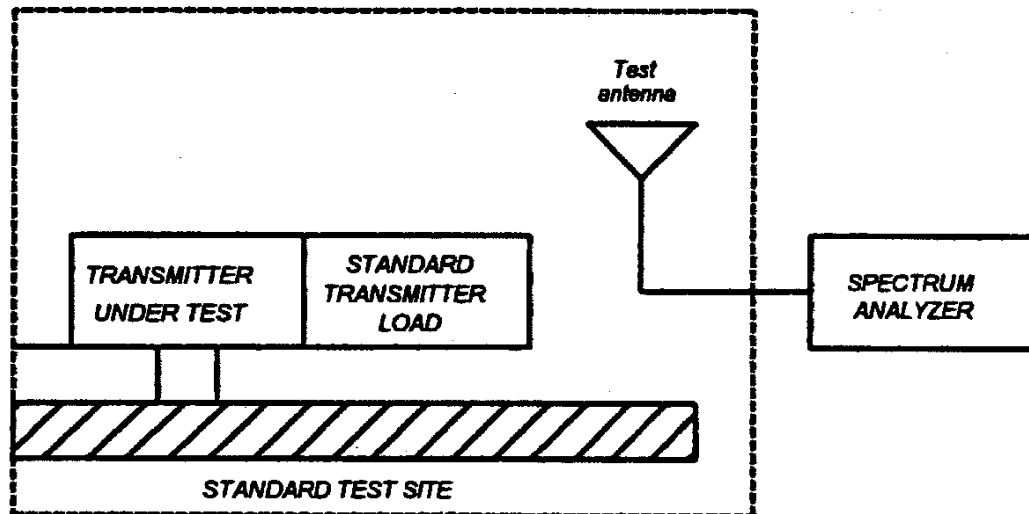
Measurement Procedure

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.

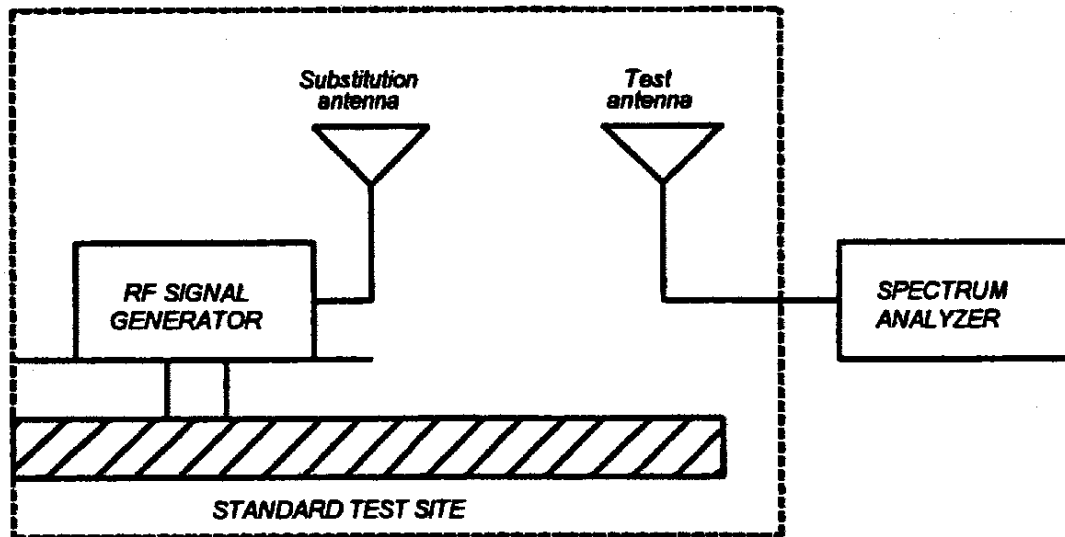
Method of Measurement:

- 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 that 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 \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.

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 =

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

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

Test Equipment

Asset	Description	s/n
Transducer		
i00088	EMCO 3109-B 25MHz-300MHz	2336
X i00089	Aprel 2001 200MHz-1GHz	001500
X i00103	EMCO 3115 1GHz-18GHz	9208-3925
Amplifier		
X i00028	HP 8449A	2749A00121
Spectrum Analyzer		
X i00029	HP 8563E	3213A00104
X i00033	HP 85462A	3625A00357
Substitution Generator		
X i00067	HP 8920A Communication TS	3345U01242
i00207	HP 8753D Network Analyzer	3410A08514
Microphone, Antenna Port, and Cabling		
Microphone	<u>No</u>	Cable Length <u>-</u> Meters
Antenna Port Terminated	<u>Yes</u>	Load <u>Yes</u> Antenna Gain <u>-</u>
All Ports Terminated by Load	<u>Yes</u>	Peripheral <u>-</u>

Name of Test: Field Strength of Spurious Radiation

Measurement Results

g0650040: 2006-May-04 Thu 09:24:00

STATE: 2:High Power

Ambient Temperature: 29°C ± 3°C

Frequency Tuned, MHz	Frequency Emission, MHz	ERP, dBm	ERP, dBc Ref 1W
40.025000	80.100000	-66.80	-96.80
40.025000	120.125000	-65.90	-95.90
40.025000	160.015000	-61.90	-91.90
40.025000	200.040000	-65.40	-95.40
40.025000	240.065000	-67.20	-97.20
128.025000	256.075000	-66.30	-96.30
40.025000	280.200000	-62.10	-92.10
158.025000	316.075000	-56.90	-86.90
40.025000	320.245000	-60.90	-90.90
40.025000	360.270000	-62.00	-92.00
128.025000	384.100000	-60.60	-90.60
40.025000	400.295000	-58.70	-88.70
158.025000	474.100000	-60.00	-90.00
128.025000	512.125000	-62.80	-92.80
158.025000	632.125000	-54.30	-84.30
128.025000	640.150000	-59.50	-89.50
128.025000	768.175000	-56.50	-86.50
158.025000	790.150000	-59.60	-89.60
430.025000	860.075000	-47.40	-77.40
128.025000	896.200000	-52.80	-82.80
158.025000	948.175000	-50.30	-80.30
511.025000	1022.075000	-53.90	-83.90
128.025000	1024.225000	-50.40	-80.40
158.025000	1106.200000	-49.40	-79.40
128.025000	1152.250000	-50.60	-80.60
158.025000	1264.225000	-51.30	-81.30
128.025000	1280.275000	-51.10	-81.10
430.025000	1290.088000	-43.80	-73.80
430.025000	1290.100000	-48.90	-78.90
158.025000	1422.250000	-49.10	-79.10
511.025000	1533.100000	-48.30	-78.30
158.025000	1580.275000	-49.10	-79.10
820.025000	1640.075000	-48.00	-78.00
860.025000	1720.075000	-40.90	-70.90
430.025000	1720.125000	-46.80	-76.80
430.025000	1720.125000	-43.00	-73.00
897.025000	1794.065000	-48.60	-78.60
937.025000	1874.065000	-43.80	-73.80
511.025000	2044.125000	-49.40	-79.40
430.025000	2150.150000	-46.70	-76.70
430.025000	2150.150000	-51.70	-81.70

Name of Test: Field Strength of Spurious Radiation

Frequency Tuned, MHz	Frequency Emission, MHz	ERP, dBm	ERP, dBc Ref 1W
820.025000	2460.100000	-45.30	-75.30
511.025000	2555.150000	-51.70	-81.70
860.025000	2580.090000	-33.30	-63.30
430.025000	2580.175000	-44.30	-74.30
430.025000	2580.175000	-42.50	-72.50
897.025000	2691.090000	-39.00	-69.00
937.025000	2811.090000	-38.90	-68.90
430.025000	2921.397563	-47.10	-77.10
430.025000	2921.397563	-47.90	-77.90
511.025000	3066.175000	-43.50	-73.50
820.025000	3280.125000	-40.40	-70.40
430.025000	3351.422563	-46.70	-76.70
430.025000	3351.422563	-45.40	-75.40
860.025000	3440.115000	-40.00	-70.00
511.025000	3577.200000	-41.20	-71.20
897.025000	3588.115000	-38.10	-68.10
937.025000	3748.115000	-40.50	-70.50
430.025000	3781.447563	-45.10	-75.10
430.025000	3781.447563	-43.30	-73.30
511.025000	4088.225000	-43.20	-73.20
820.025000	4100.150000	-42.60	-72.60
430.025000	4211.472563	-42.00	-72.00
430.025000	4211.472563	-40.90	-70.90
860.025000	4300.140000	-37.50	-67.50
897.025000	4485.140000	-42.00	-72.00
511.025000	4599.250000	-42.40	-72.40
430.025000	4641.497563	-42.40	-72.40
430.025000	4641.497563	-42.60	-72.60
937.025000	4685.140000	-38.20	-68.20
820.025000	4920.175000	-38.60	-68.60
511.025000	5110.275000	-39.20	-69.20
860.025000	5160.165000	-38.60	-68.60
897.025000	5382.165000	-38.20	-68.20
937.025000	5622.165000	-38.40	-68.40
820.025000	5740.200000	-37.90	-67.90
860.025000	6020.190000	-36.30	-66.30
897.025000	6279.190000	-34.30	-64.30
937.025000	6508.597538	-35.40	-65.40
820.025000	6508.597563	-34.90	-64.90

All other emissions are more than 20dB below limit



Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Emission Masks (Occupied Bandwidth)

Flom Test Labs
 3356 North San Marcos Place, Suite 107
 Chandler, Arizona 85225-7176
 (866) 311-3268 phone, (480) 926-3598 fax

Page 19 of 48
 FCC ID: FRWRT-5000A
 MFA p0640009, d0650012

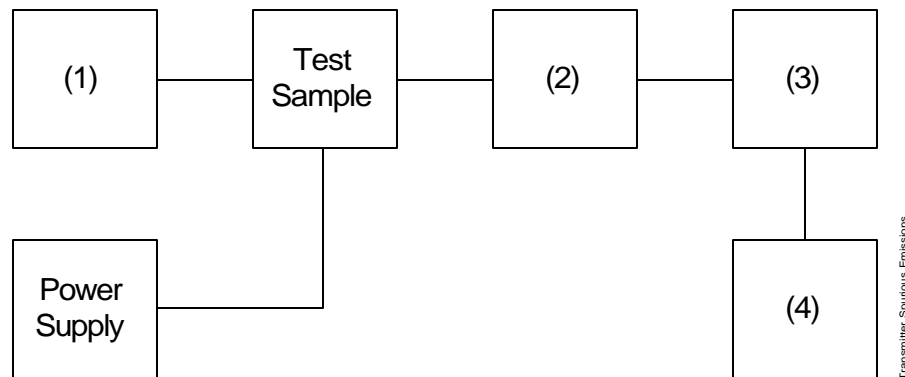
Specification: 47 CFR 2.1049(c)(1)

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) The EUT and test equipment were set up as shown below
- B) 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.
- C) For EUTs supporting digital modulation, the digital modulation mode was operated to its maximum extent.
- D) The Occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.

Transmitter Test Set-Up: Occupied Bandwidth



Asset	Description	s/n
(1) Audio Oscillator/Generator		
X i00017	HP 8903A Modulation Meter	2216A01753
(2) Coaxial Attenuator		
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
i00123	NARDA 766 (10 dB)	7802A
(3) Interface		
X i00021	HP 8954A Transceiver Interface	2146A00159
(4) Spectrum Analyzer		
X i00048	HP 8566B Spectrum Analyzer	2511A01467
i00029	HP 8563E Spectrum Analyzer	3213A00104

Name of Test: Emission Masks (Occupied Bandwidth)

Measurement Results

Attached as Annex A (High Power) and Annex B (Low Power)

Reference levels taken with SA set RBW = 3MHz

Plots taken with SA set RBW = 100Hz, VBW = 300Hz, Span = 50kHz

Mask B used for 25kHz Channels, Mask D used for 12.5kHz Channels

See individual auxiliary transceiver reports for addition plots



Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Transient Frequency Behavior

Specification: 47 CFR 90.214

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) The EUT was setup as shown on the attached page, following TIA/EIA-603 steps a, b, and c as a *guide*.
- B) The transmitter was turned on.
- C) 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.
- D) The transmitter was turned off.
- E) 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 C) above, measured at the output of the combiner. This level was then fixed for the remainder of the test.
- F) 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).
- G) 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.
- H) 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.

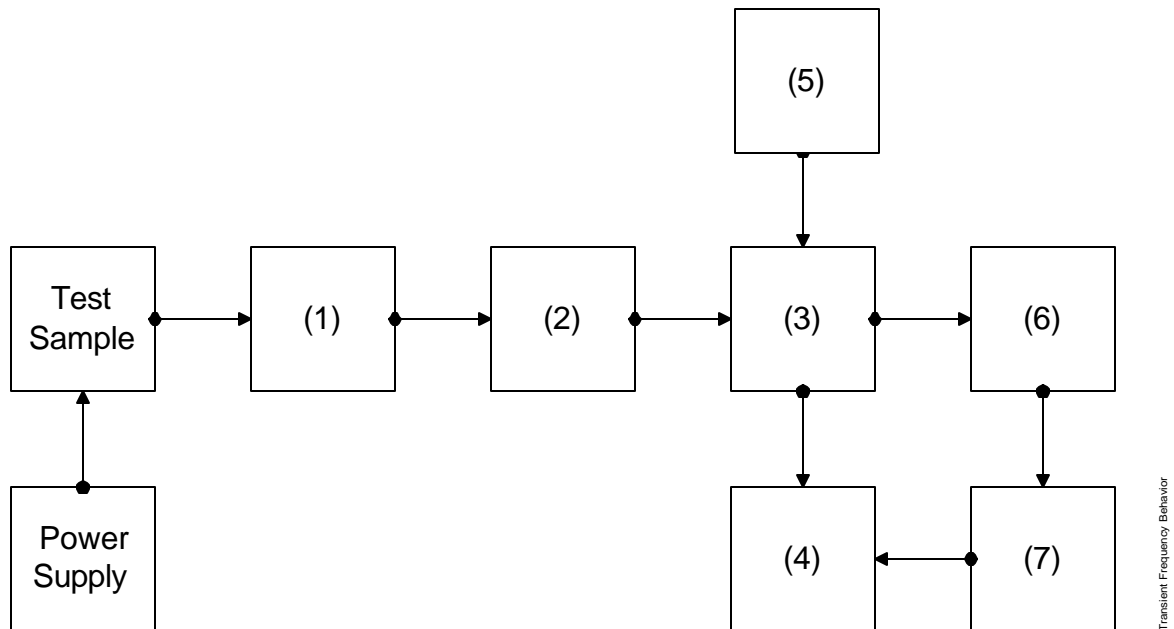


Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Transient Frequency Behavior

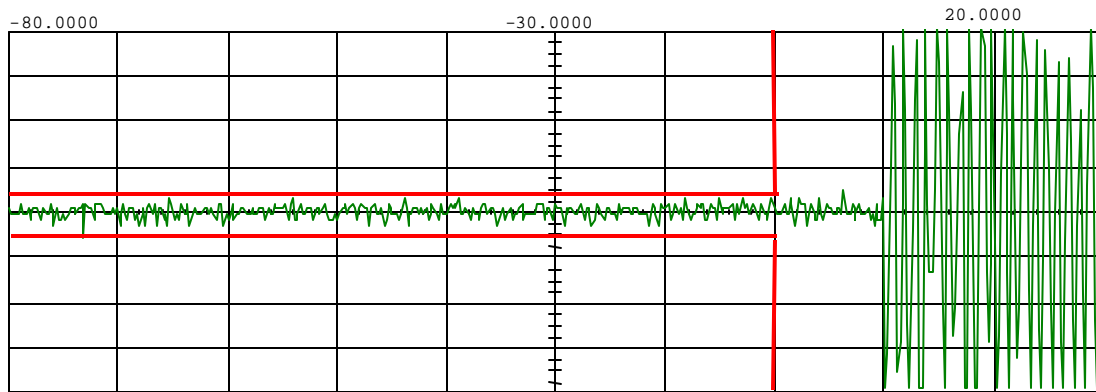
Transmitter Set-Up



Asset	Description	s/n
(1) Attenuator	(Removed after 1st step)	
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
(2) Attenuator		
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
i00122/3	NARDA 766 (10 dB)	7802 or 7802A
(3) Combiner		
X i00154	4 x 25 Ω Combiner	154
(4) Crystal Decoder		
X i00159	HP 8470B Crystal Detector	1822A10054
(5) RF Signal Generator		
X i00067	HP 8920A Communication TS	3345U01242
(6) Modulation Analyzer		
X i00020	HP 8901A Modulation Meter	2105A01087
(7) Oscilloscope		
X i00030	HP 54502A Digital Oscilloscope	2927A00209

Name of Test: Transient Frequency Behavior

State: Ambient Temperature: 23°C ± 3°C



Main	Timebase 10.0 ms/div	Delay/Pos -30.0000 ms	Reference Center	Measurements V p-p (c2) = 0.00000 V V rms (c2) = 0.00000 V
Channel 2	Sensitivity 75.0 mV/div	Offset 0.00000 V	Probe 1.000 :1 dc	

Trigger mode :
On Positive Edge Of
Trigger
Ext1 = -125.000 mV (noise reject)
Holdoff = 60.000

Transceiver:
Channelization:
Description:

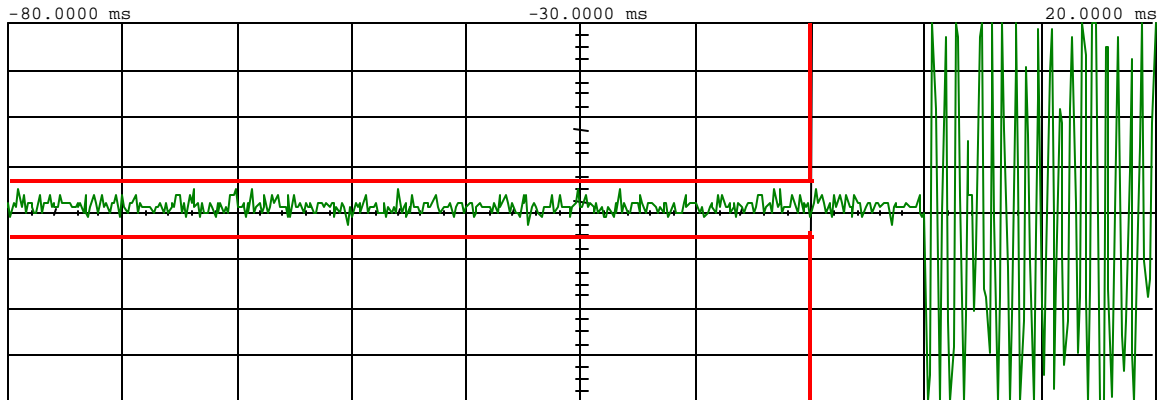
Main (RT-5000)
25kHz
Carrier On

Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Transient Frequency Behavior

State: Ambient Temperature: 23°C ± 3°C



Main	Timebase 10.0 ms/div	Delay/Pos -30.0000 ms	Reference Center	Measurements V p-p (c2) = 18.750 mV V rms (c2) = 3.215 mV
Channel 2	Sensitivity 75.0 mV/div	Offset 0.00000 V	Probe 1.000 :1 dc (1M)	

Trigger mode :
On Positive Edge Of Ext1
Trigger
Ext1 = -125.000 mV (noise reject)
Holdoff = 60.000

Transceiver:
Channelization:
Description:

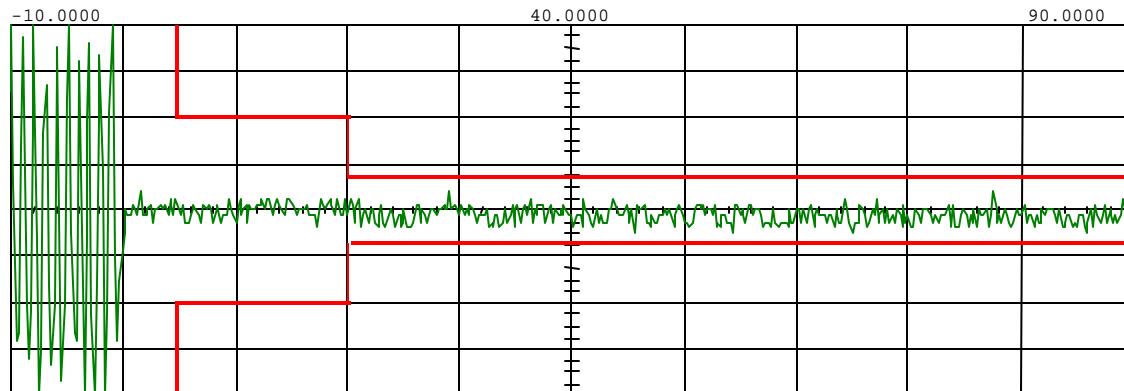
Main (RT-5000)
12.5kHz
Carrier On

Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Transient Frequency Behavior

State: Ambient Temperature: 23°C ± 3°C



Main	Timebase 10.0 ms/div	Delay/Pos 40.0000 ms	Reference Center	Measurements V p-p (c2) = 0.00000 V V rms (c2) = 0.00000 V
Channel 2	Sensitivity 75.0 mV/div	Offset 0.00000 V	Probe 1.000 :1 dc	

Trigger mode :
On Negative Edge Of
Trigger
Ext1 = -125.000 mV (noise reject)
Holdoff = 60.000

Transceiver:
Channelization:
Description:

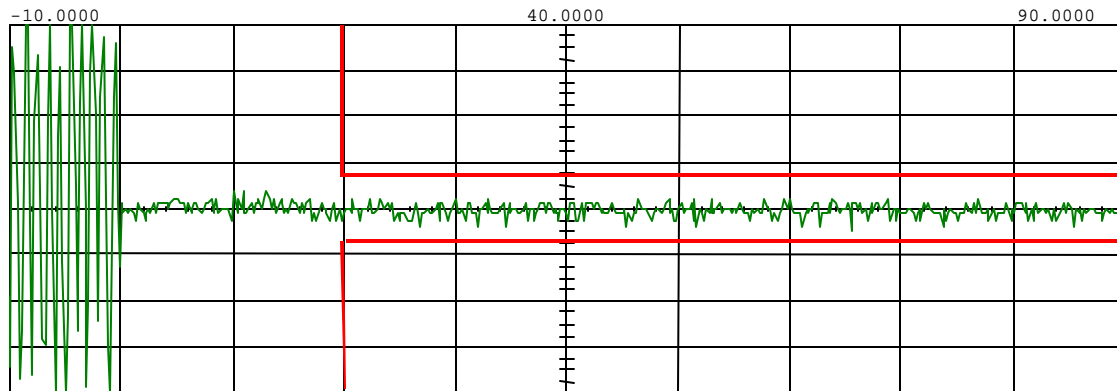
Main (RT-5000)
25kHz
Carrier Off

Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Transient Frequency Behavior

State: Ambient Temperature: 23°C ± 3°C



Main	Timebase 10.0 ms/div	Delay/Pos 40.0000 ms	Reference Center	Measurements V p-p (c2) = 0.00000 V V rms (c2) = 0.00000 V
Channel 2	Sensitivity 75.0 mV/div	Offset 0.00000 V	Probe 1.000 :1 dc	

Trigger mode :
On Negative Edge Of
Trigger
Ext1 = -125.000 mV (noise reject)
Holdoff = 60.000

Transceiver:
Channelization:
Description:

Main (RT-5000)
12.5kHz
Carrier Off

Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Audio Low Pass Filter (Voice Input)

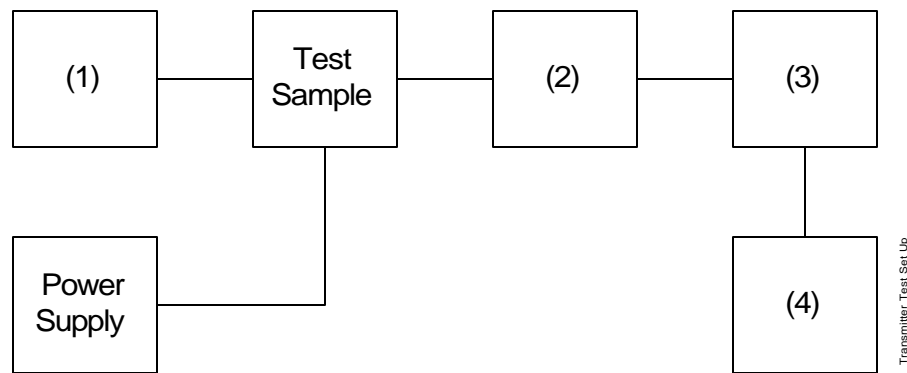
Specification: 47 CFR 2.1047(a)

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) 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.
- B) The audio output was connected at the output to the modulated stage.

Transmitter Test Set-Up: Response of Low Pass Filter



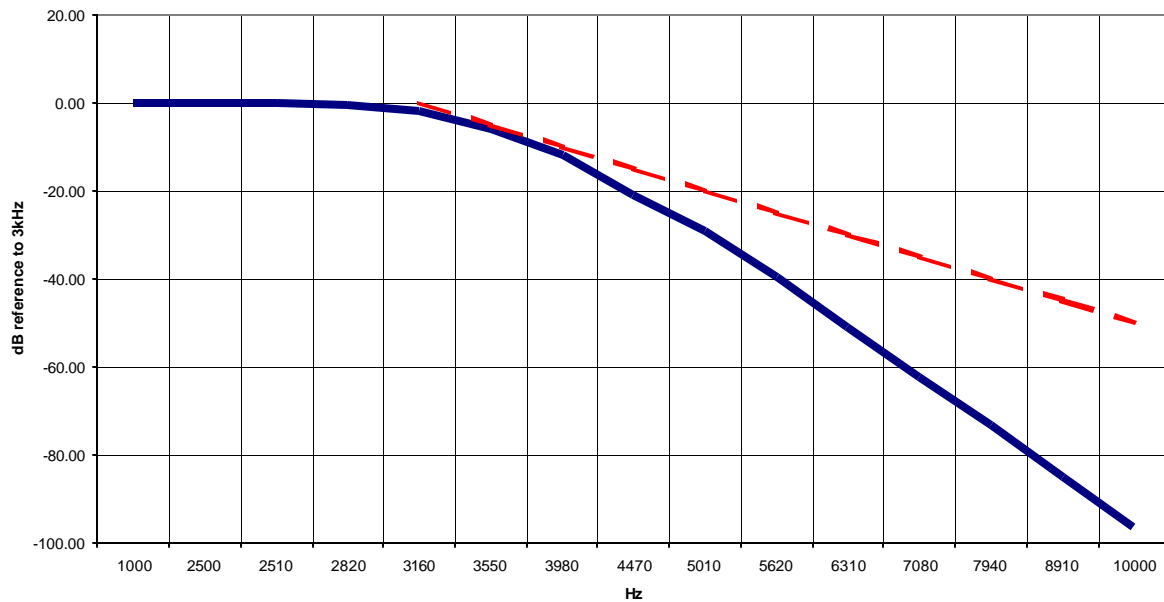
Asset	Description	s/n
(1) Audio Oscillator		
X i00002	HP 3336B Synthesizer / Level Gen.	1931A01465
(2) Coaxial Attenuator		
i00122/3	NARDA 766 (10dB)10	7802 or 7802A
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
(3) Modulation Analyzer		
X i00020	HP 8901A Modulation Meter	2105A01087
(4) Audio Analyzer		
X i00001	HP 3586B Selective Level Meter	1928A01360

Name of Test: Audio Low Pass Filter (Voice Input)

Measurement Results

State: Ambient Temperature: 23°C ± 3°C

Low Pass Filter



Main Transceiver (RT-5000)

Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Audio Frequency Response

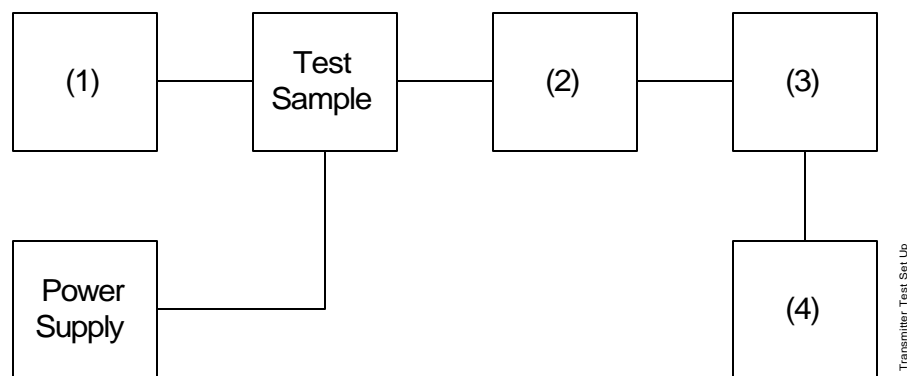
Specification: 47 CFR 2.1047(a)

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) The EUT and test equipment were set up as shown below.
- B) The audio signal generator was connected to the audio input circuit/microphone of the EUT.
- C) The audio signal input was adjusted to obtain 20% modulation at 1 kHz, and this point was taken as the 0 dB reference level.
- D) With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 100 Hz to 50 kHz.
- E) The response in dB relative to 1 kHz was measured, using the HP 8901A Modulation Meter.

Transmitter Test Set-Up: Audio Frequency Response



Asset	Description	s/n
(1) Audio Oscillator		
X i00017	HP 8903A Audio Analyzer	2216A01753
(2) Coaxial Attenuator		
i00122/3	NARDA 766-(10 dB)	7802 or 7802A
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
(3) Modulation Analyzer		
X i00020	HP 8901A Modulation Meter	2105A01087
(4) Audio Analyzer		
X i00017	HP 8903A Audio Analyzer	2216A01753

Name of Test: Audio Frequency Response

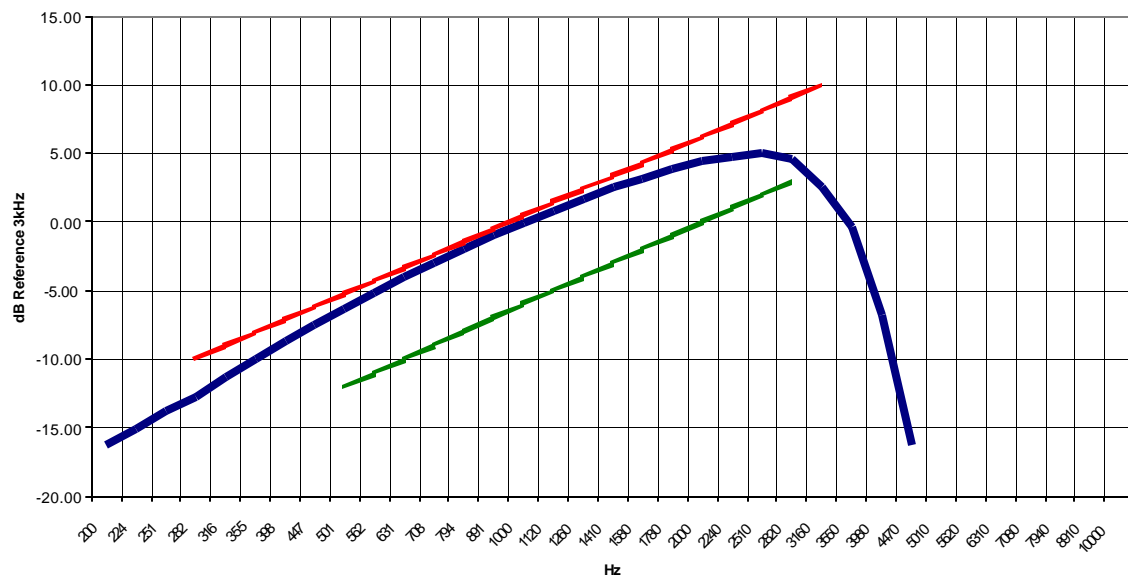
Measurement Results

Transceiver 1 (Main Module)

State:

Ambient Temperature: 23°C ± 3°C

Audio



Frequency of Maximum Audio Response, Hz = 2510

Additional points:

Frequency, Hz	Level, dB
300	-11.95
20000	-57.34
30000	-59.37
50000	-64.40

Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Modulation Limiting

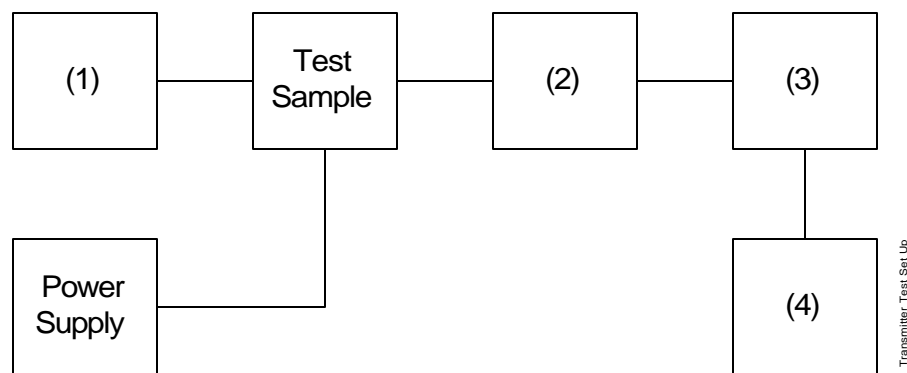
Specification: 47 CFR 2.1047(b)

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) The signal generator was connected to the input of the EUT as shown below.
- B) 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.
- C) The input level was varied from 30% modulation (± 1.5 kHz deviation) to at least 20 dB higher than the saturation point.
- D) Measurements were performed for both negative and positive modulation and the respective results were recorded.

Transmitter Test Set-Up: Modulation Limiting



Asset	Description	s/n
(1) Audio Oscillator		
X i00017	HP 8903A Audio Analyzer	2216A01753
(2) Coaxial Attenuator		
i0012/23	NARDA 766-(10 dB)	7802 or 7802A
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
(3) Modulation Analyzer		
X i00020	HP 8901A Modulation Meter	2105A01087
(4) Audio Analyzer		
X i00017	HP 8903A Audio Analyzer	2216A01753

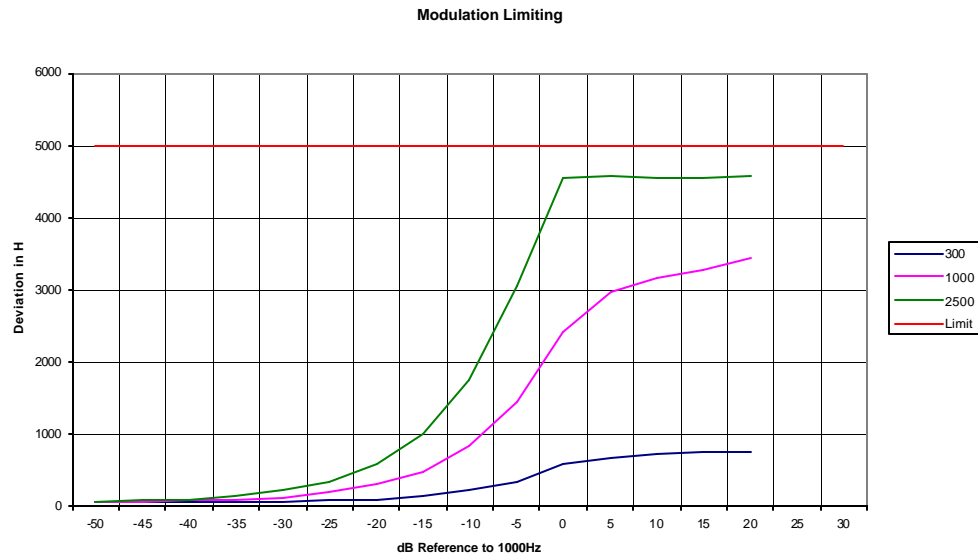
Name of Test: Modulation Limiting

Measurement Results

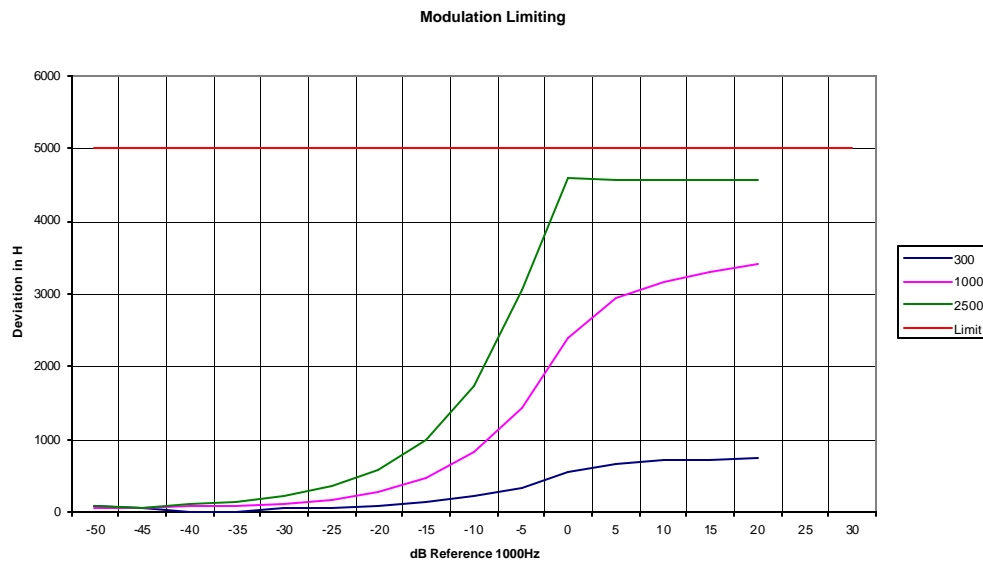
State: 25kHz Main Transceiver (RT-5000)

Ambient Temperature: 23°C ± 3°C

Positive
Peaks:



Negative
Peaks:



Performed by:

David E. Lee, FCC/IC Compliance Manager

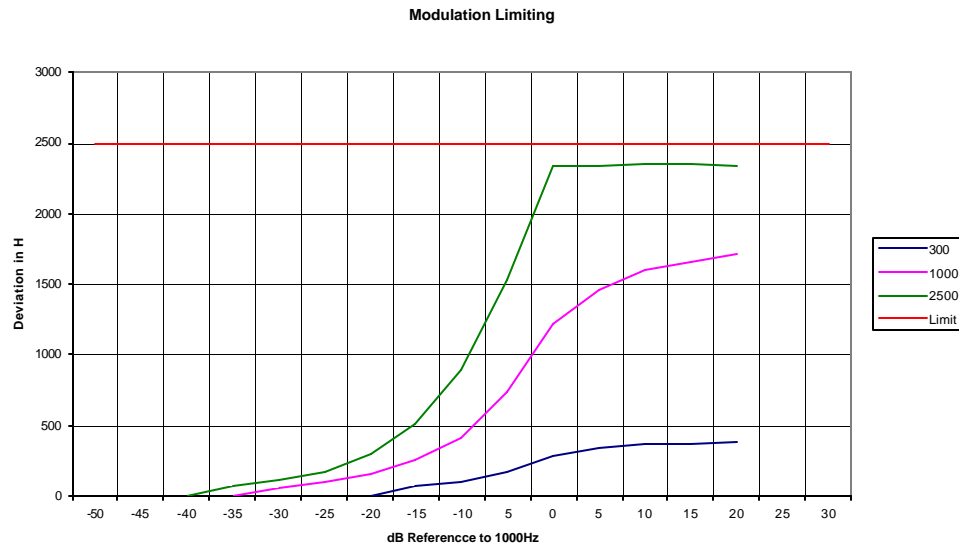
Name of Test: Modulation Limiting

Measurement Results

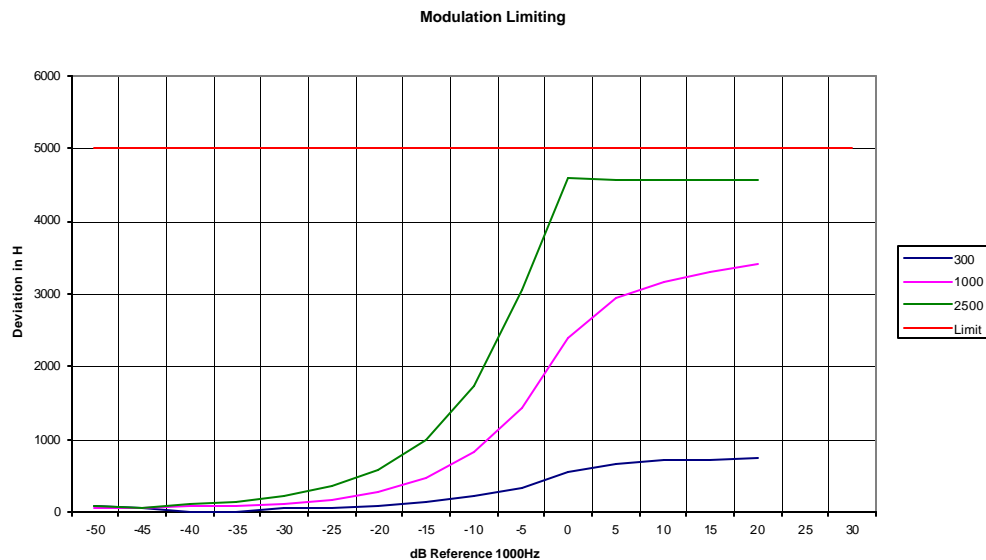
State: 12.5kHz Main Transceiver (RT-5000)

Ambient Temperature: 23°C ± 3°C

Positive
Peaks:



Negative
Peaks:



Performed by:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Frequency Stability (Temperature Variation)

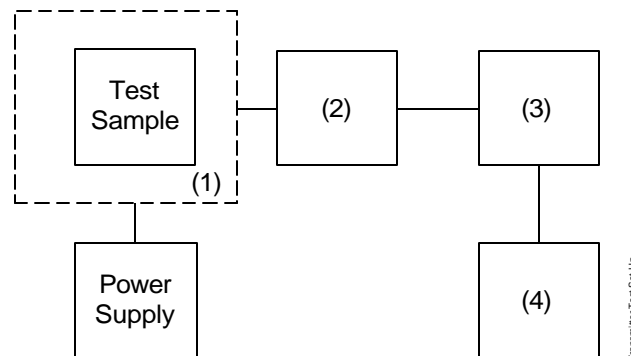
Specification: 47 CFR 2.1055(a)(1)

Guide: ANSI/TIA/EIA-603-C

Measurement Procedure

- A) The EUT and test equipment were set up as shown on the following page.
- B) 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.
- C) 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.
- D) The temperature tests were performed for the worst case.

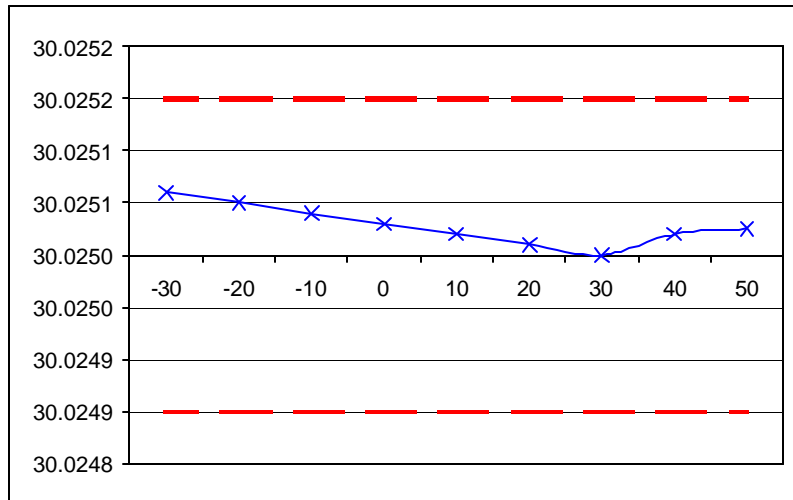
Transmitter Test Set-Up: Temperature Variation



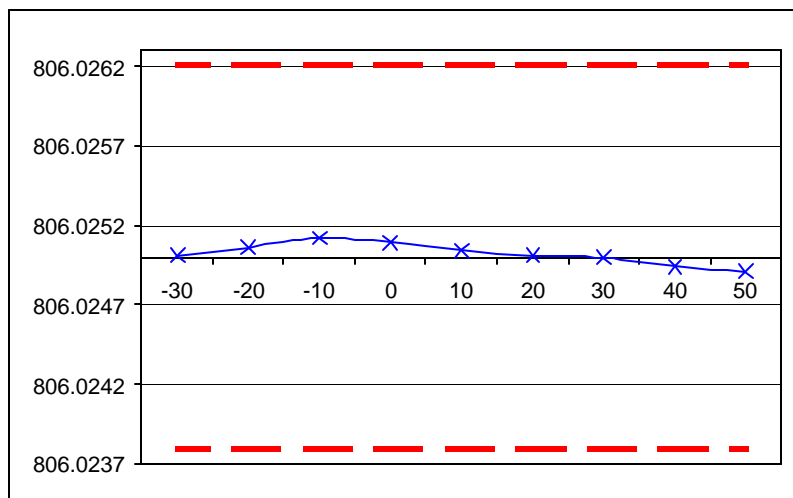
Asset	Description	s/n
(1) Temperature, Humidity, Vibration		
X i00027	Tenney Temp. Chamber	9083-765-234
(2) Coaxial Attenuator		
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
i00122/3	NARDA 766 (10 dB)	7802 or 7802A
(3) RF Power		
X i00067	HP 8920A Communications TS	3345U01242
(4) Frequency Counter		
X i00067	HP 8920A Communications TS	3345U01242

Name of Test: Frequency Stability (Temperature Variation)

Transceiver 1 (Low)



Transceiver 1 (High)

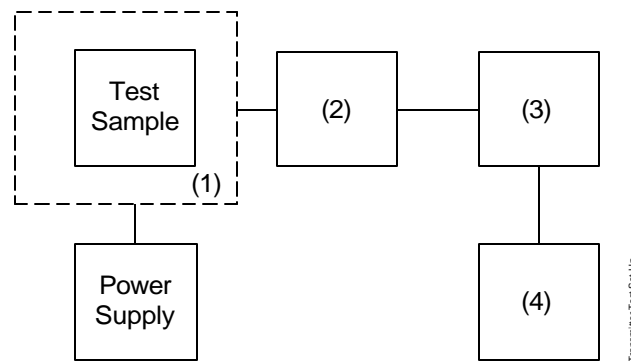


Name of Test: Frequency Stability (Voltage Variation)
Specification: 47 CFR 2.1055(d)(1)
Guide: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2

Measurement Procedure

- A) The EUT was placed in a temperature chamber (if required) at $25 \pm 5^\circ\text{C}$ and connected as shown below.
- B) The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
- C) The variation in frequency was measured for the worst case.

Transmitter Test Set-Up: Voltage Variation



Asset	Description	s/n
(1) Temperature, Humidity, Vibration		
X i00027	Tenney Temp. Chamber	9083-765-234
(2) Coaxial Attenuator		
X i00231/2	PASTERNAK PE7021-30 (30 dB)	231 or 232
i00122/3	NARDA 766 (10 dB)	7802 or 7802A
(3) RF Power		
X i00020	HP 8901A Power Mode	2105A01087
(4) Frequency Counter		
X i00020	HP 8901A Frequency Mode	2105A01087

Results: Frequency Stability (Voltage Variation)

State: Ambient Temperature: 23°C ± 3°C

Transceiver 1 (Low).

Limit, ppm = ±5
Limit, Hz = ±150
Battery End Point (Voltage) = 21.5

% of STV	Voltage	Frequency, MHz	Change, Hz	Change, ppm
115	32.2	30.025060	+60	2.0
100	28.0	30.025040	+40	1.3
85	23.8	30.025030	+30	1.0
BEP	21.5	30.025005	+5	>1.0

Transceiver 1 (High).

Limit, ppm = ±1.5
Limit, Hz = ±1209
Battery End Point (Voltage) = 21.5

% of STV	Voltage	Frequency, MHz	Change, Hz	Change, ppm
85	23.8	806.024940	-60	>1.0
100	28.0	806.024950	-50	>1.0
115	32.2	806.024930	-70	>1.0
B.E.P.	21.5	806.024940	-60	>1.0

Name of Test: Radiated Spurious Emissions

Specification:

- 15.109: Radiated Interference Limits
- 15.209: Radiated Emission Limits; General Requirements
- 15.33: Frequency Range of Radiated Measurements
- 80.217: Suppression of Interference Aboard Ships

Guide: ANSI C63.4-1992/2003

Test Equipment: See attached test setup

Test Configuration of EUT:

1. The equipment was installed in a typical system and configured in accordance with the manufacturer's instructions. It was also operated in a manner which is representative of the typical usage for the EUT.
2. The equipment and I/O cable(s) were re-arranged to maximize each emission. For each change in configuration, the system was rotated through 360°. The antenna height was changed from one to six meters. Both horizontal and vertical polarization scans were used. The worst case is here reported.
3. For EUTs normally operated on top of a table, tests were performed with the EUT on a rotating non-conducting table top of size 1.0 by 1.5 meters, approximately 1.0 meter above the ground plane.
4. EUTs normally placed on the floor, tests were performed with the EUT on a rotating non-conducting platform, approximately 15 cm above the ground plane.

Test Procedure:

1. For AC powered equipment, the EUT was connected to the Public Utility Power Line through a Line Impedance Stabilization Network (LISN), (50 μ H).
2. The test configuration consisted of the aforementioned equipment and peripherals, using ANSI C63.4-1992/2003.
3. Radiation emission tests were performed on all possible combinations.
4. Measurements were made with the EUT:
 - A. POWERED ON and awaiting data input/output (quiescent mode)
 - B. Receiving/sending data in a typical operation.
5. Each emission was maximized by varying the mode of operation, where applicable.

Name of Test: Radiated Spurious Emissions (Continued)

Measurement Distance, Meter	=	3
Height Above Ground, Meters	=	0.8
Spectrum Searched	=	Per 47 CFR 15.33
Resolution Bandwidth, kHz	=	120
Worst Case	=	Vertical
System Sensitivity, dBm	=	-130
Search Antennas	=	See Test Setup
Post Detector Video Filters Used	=	Indicated BY "Q.P."

All Measurements Were Performed Automatically Using:

- a. Sunol turntable with HPIB controls.
- b. EMCO #1053 antenna positioning tower with pneumatic and HPIB controls.

Sample Calculation:

$$\begin{aligned}
 &\text{Emission Frequency, MHz} &&= 33.000000 \\
 &\text{Level} = \text{Log}_{10}^{-1} \left(\frac{15.47 + 5.11}{20} \right) \\
 &\text{Level, } \mu\text{V/m @ 10m} &&= 10.69
 \end{aligned}$$

Test Setup: Attached

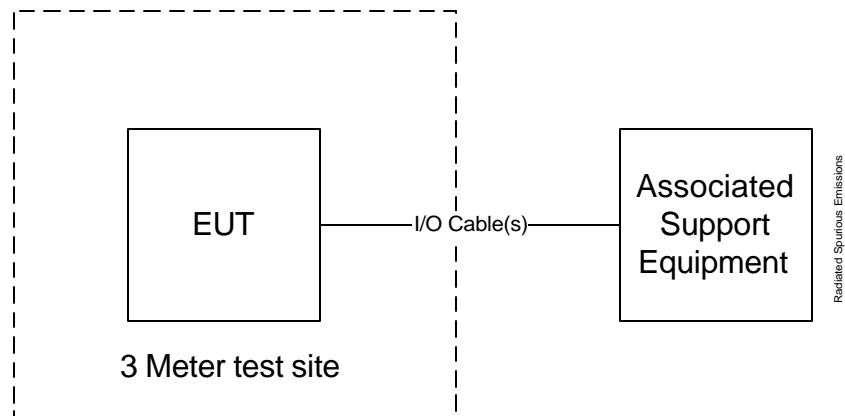
Photographs: Attached

Results: Attached



Performed By: David E. Lee, FCC/IC Compliance Manager

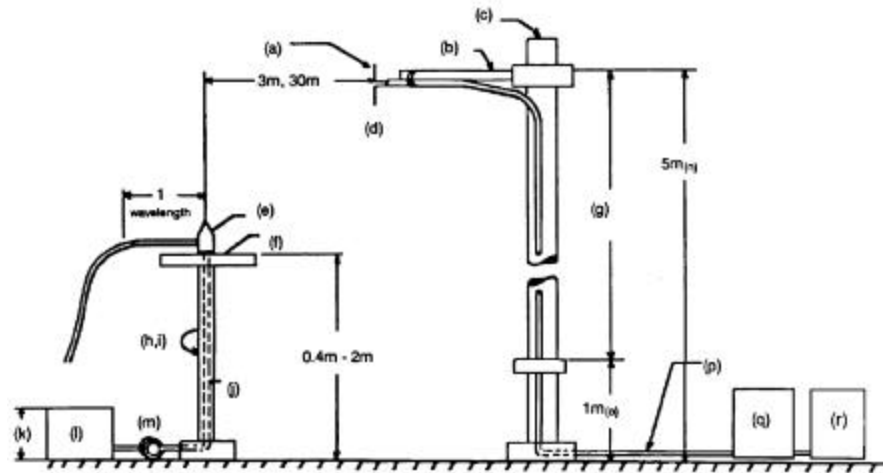
Name of Test: Radiated Spurious Emissions (Continued)



Notes:

1. The Equipment Under Test (EUT) was located 3 meters from the search antenna and placed on a conductive ground plane.
2. The Associated Support Equipment and I/O Cable(s), if used, were placed a minimum of 3 meters from the EUT and measuring antenna.

Radiated Test Setup



Notes:

- | | |
|--|---|
| (a) Search Antenna - Rotatable on boom | (j) Cables routed through hollow turntable center |
| (b) Non-metallic boom | (k) 30 cm or less |
| (c) Non-metallic mast | (l) External power source |
| (d) Adjustable horizontally | (m) 10 cm diameter coil of excess cable |
| (e) Equipment Under Test | (n) 25 cm (V), 1 m-7 m (V, H) |
| (f) Turntable | (o) 25 cm from bottom end of 'V', 1m normally |
| (g) Boom adjustable in height. | (p) Calibrated Cable at least 10m in length |
| (h) External control cables routed horizontally at least one wavelength. | (q) Amplifier (optional) |
| (i) Rotatable | (r) Spectrum Analyzer |

Asset	Description	s/n
(as applicable)		
Transducer		
X i00088	EMCO 3109-B 25MHz-300MHz	2336
X i00089	April 2001 200MHz-1GHz	001500
Amplifier		
i00028	HP 8449A	2749A00121
Spectrum Analyzer		
i00029	HP 8563E	3213A00104
X i00033	HP 85462A	3625A00357
Miscellaneous		
Microphone	No	
Antenna	No	
All Ports Terminated	Yes	

Test Setup Photos:

Radiated Emissions

State:



State:



Name of Test: Radiated Spurious Emissions

47 CFR 15.109(a) Class A Radiated Limits

Frequency of Emission, MHz	Field Strength, $\mu\text{V/m}$ @ 10m	Field Strength, $\mu\text{V/m}$ @ 3m
30 - 88	90	284
88 - 216	150	474
216 - 960	210	664
Above 960	300	949

Frequency Emission, MHz	Level, dBuV @ m	C.F., dB	$\mu\text{V/m}$ @ m	Margin, dB
33.000000	15.47 3	5.11	10.69 10	-18.5
36.864000	17.30 3	5.30	13.49 10	-16.5
40.550400	17.13 3	5.22	13.11 10	-16.8
44.236800	15.97 3	5.38	11.68 10	-17.8
48.000000	15.80 3	4.60	10.47 10	-18.7
55.296000	19.30 3	4.05	14.71 10	-15.8
64.000000	21.97 3	3.12	17.97 10	-14.0
69.564949	23.13 3	1.98	18.01 10	-14.0
72.000000	20.13 3	1.63	12.25 10	-17.3
73.728000	18.30 3	1.40	9.66 10	-19.4
80.000000	23.80 3	0.60	16.60 10	-14.7
147.456000	17.13 3	6.72	15.58 10	-19.7
154.828800	18.13 3	6.94	17.93 10	-18.4
165.000000	17.13 3	7.17	16.41 10	-19.2
184.320000	18.13 3	7.98	20.21 10	-17.4
191.692800	18.63 3	8.37	22.39 10	-16.5
192.000000	20.80 3	8.39	28.81 10	-14.3
206.438400	16.47 3	9.10	18.99 10	-17.9
208.000000	15.30 3	9.16	16.71 10	-19.0
213.811200	14.30 3	9.42	15.35 10	-19.8
216.000000	18.13 3	9.51	24.10 10	-15.9
240.000000	16.47 3	10.51	22.34 10	-19.4
243.302400	13.97 3	10.64	17.00 10	-21.8
250.675200	15.80 3	11.06	22.03 10	-19.5
256.000000	15.63 3	12.31	24.95 10	-18.5
258.048000	14.30 3	12.79	22.62 10	-19.3
264.000000	17.47 3	14.15	38.11 10	-14.8
264.000000	13.97 3	14.15	25.47 10	-18.3
265.420800	15.30 3	14.47	30.80 10	-16.6
272.793600	16.47 3	16.11	42.56 10	-13.8
280.166400	14.97 3	17.70	43.00 10	-13.7
287.539200	11.30 3	19.30	33.88 10	-15.8
294.912000	16.13 3	20.85	70.63 10	-9.4
297.000000	14.30 3	21.29	60.19 10	-10.8
324.398400	15.63 3	11.47	22.65 10	-19.3
330.000000	14.63 3	11.86	21.11 10	-19.9
331.771200	16.80 3	11.98	27.48 10	-17.6

Name of Test: Radiated Spurious Emissions

Frequency Emission, MHz	Level, dBuV	@ m	C.F., dB	μV/m	@ m	Margin, dB
336.000000	14.97	3	12.25	22.96	10	-19.2
339.144000	14.30	3	12.46	21.78	10	-19.6
346.516800	15.30	3	12.94	25.82	10	-18.2
353.889600	14.13	3	13.40	23.80	10	-18.9
360.000000	15.63	3	13.78	29.55	10	-17.0
361.262400	15.80	3	13.85	30.37	10	-16.8
363.000000	15.80	3	13.93	30.65	10	-16.7
368.635200	16.97	3	14.24	36.35	10	-15.2
376.008000	13.97	3	14.61	26.85	10	-17.8
383.380800	15.97	3	14.99	35.32	10	-15.4
384.000000	16.80	3	15.01	38.95	10	-14.6
390.753600	15.30	3	15.35	34.08	10	-15.8
396.000000	18.47	3	15.61	50.58	10	-12.3
398.126400	15.80	3	15.71	37.63	10	-14.9
405.499200	15.80	3	15.81	38.06	10	-14.8
408.000000	14.47	3	15.81	32.66	10	-16.1
412.872000	13.30	3	15.82	28.58	10	-17.3
420.244800	15.13	3	15.83	35.32	10	-15.4
429.000000	15.13	3	15.85	35.40	10	-15.4
432.000000	17.80	3	15.85	48.14	10	-12.8
434.990400	14.80	3	15.86	34.12	10	-15.7
442.363200	14.47	3	15.87	32.89	10	-16.1
449.736000	14.80	3	15.88	34.20	10	-15.7
456.000000	15.47	3	15.88	36.94	10	-15.1
457.108800	15.47	3	15.88	36.94	10	-15.1
461.983333	16.13	3	15.88	39.86	10	-14.4
462.000000	15.47	3	15.88	36.94	10	-15.1
471.854400	14.47	3	15.89	32.96	10	-16.0
480.000000	14.13	3	15.90	31.73	10	-16.4
486.600000	15.13	3	15.90	35.60	10	-15.4
494.983333	16.80	3	15.90	43.15	10	-13.7
501.345600	15.97	3	15.95	39.45	10	-14.5
504.000000	14.63	3	16.05	34.20	10	-15.7
516.091200	13.30	3	16.47	30.80	10	-16.6
527.983333	13.80	3	16.88	34.20	10	-15.7
528.000000	15.13	3	16.88	39.86	10	-14.4
530.836800	16.63	3	16.98	47.92	10	-12.8
538.209600	16.30	3	17.23	47.48	10	-12.9
552.000000	15.47	3	17.70	45.55	10	-13.2
552.955200	13.63	3	17.74	37.03	10	-15.0
567.700800	16.97	3	18.38	58.55	10	-11.1
582.446400	15.47	3	18.99	52.84	10	-11.9
597.192000	16.30	3	19.59	62.30	10	-10.5

Name of Test: Radiated Spurious Emissions

Frequency Emission, MHz	Level, dBuV	@ m	C.F., dB	μV/m	@ m	Margin, dB
600.000000	15.63	3	19.70	58.41	10	-11.1
611.937600	15.13	3	19.79	55.72	10	-11.5
624.000000	14.30	3	19.88	51.17	10	-12.2
626.683200	14.30	3	19.89	51.23	10	-12.2
641.428800	14.97	3	20.00	56.04	10	-11.4
648.000000	14.30	3	20.05	52.18	10	-12.1
656.174400	15.97	3	20.13	63.83	10	-10.3
659.983333	14.13	3	20.17	51.88	10	-12.1
672.000000	14.63	3	20.31	55.85	10	-11.5
685.665600	14.63	3	20.45	56.75	10	-11.3
696.000000	11.47	3	20.56	39.95	10	-14.4
700.411200	14.97	3	20.60	60.05	10	-10.8
715.156800	14.97	3	20.87	61.94	10	-10.6
720.000000	6.97	3	20.95	24.89	10	-18.5
729.902400	15.80	3	21.12	70.15	10	-9.5
744.000000	10.63	3	21.36	39.76	10	-14.4
744.648000	16.30	3	21.37	76.47	10	-8.7
752.020800	14.47	3	21.49	62.81	10	-10.4
758.983333	9.13	3	21.58	34.32	10	-15.7
768.000000	9.47	3	21.70	36.18	10	-15.2
774.139200	10.30	3	21.78	40.18	10	-14.3
788.884800	7.63	3	21.97	30.20	10	-16.8
792.000000	10.13	3	22.00	40.41	10	-14.3
816.000000	6.63	3	22.05	27.16	10	-17.7
818.376000	12.63	3	22.04	54.14	10	-11.7
824.983333	8.63	3	22.02	34.08	10	-15.8
833.121600	11.47	3	22.00	47.15	10	-12.9
840.000000	9.97	3	21.98	39.58	10	-14.5
847.867200	8.97	3	21.95	35.16	10	-15.5
857.983333	10.63	3	21.99	42.76	10	-13.8
862.612800	9.63	3	22.01	38.19	10	-14.8
864.000000	5.97	3	22.01	25.06	10	-18.4
888.000000	10.13	3	22.14	41.07	10	-14.1
890.983333	4.80	3	22.16	22.28	10	-19.4
892.104000	7.30	3	22.16	29.72	10	-16.9
906.849600	9.30	3	22.89	40.69	10	-14.2
912.000000	9.47	3	23.40	44.00	10	-13.5
921.595200	10.63	3	24.36	56.17	10	-11.4
923.983333	10.13	3	24.59	54.45	10	-11.7
936.000000	11.80	3	25.77	75.60	10	-8.8
936.340800	11.30	3	25.81	71.70	10	-9.3
951.086400	9.63	3	27.23	69.66	10	-9.5

Name of Test: Radiated Spurious Emissions

Frequency Emission, MHz	Level, dBuV	@ m	C.F., dB	$\mu\text{V/m}$	@ m	Margin, dB
956.983333	6.97	3	27.76	54.51	10	-11.7
960.000000	7.97	3	28.04	63.17	10	-10.4
965.832000	11.80	3	28.58	104.47	10	-9.1
980.577600	11.30	3	29.91	114.95	10	-8.3
984.000000	10.47	3	30.21	108.14	10	-8.8
989.983333	10.30	3	30.74	112.72	10	-8.5
995.323200	11.47	3	31.20	135.99	10	-6.8

All other emissions in the required measurement range were more that 20 dB below the required limits.



Performed By:

David E. Lee, FCC/IC Compliance Manager

Name of Test: Necessary Bandwidth and Emission Bandwidth

Specification: 47 CFR 2.202(g)

Modulation = 16K0F3E

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	3.0
Maximum Deviation (D), kHz	= 5.0
Constant Factor (K)	= 1
Necessary Bandwidth (B _N), kHz	= (2xM)+(2xDxK)
	= 16.0

Modulation = 11K0F3E

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	3.0
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	2.0
Maximum Deviation (D), kHz	= 2.0
Constant Factor (K)	= 1
Necessary Bandwidth (B _N), kHz	= (2xM)+(2xDxK)
	= 8.1

Modulation = 8K10F1D

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	2.0
Maximum Deviation (D), kHz	= 2.0
Constant Factor (K)	= 1
Necessary Bandwidth (B _N), kHz	= (2xM)+(2xDxK)
	= 8.1

Modulation = 20K0F1E

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	6.0
Maximum Deviation (D), kHz	= 4.0
Constant Factor (K)	= 1
Necessary Bandwidth (B _N), kHz	= (2xM)+(2xDxK)
	= 20.0



Performed by:

David E. Lee, FCC/IC Compliance Manager

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:

Sam Baum, Technical Manager