



M. Flom Associates, Inc. - Global Compliance Center

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Transmitter Certification

of

FCC ID: RY9GST900

Model: GST-900

to

Federal Communications Commission

Rule Part(s) 24D, Confidentiality

Date of report: April 6, 2004

On the Behalf of the Applicant:

Space Data Corporation

At the Request of:

P.O. 20610

Space Data Corporation
460 S. Benson Lane, Suite 11-12
Chandler, AZ 85224

Attention of:

Gerard J. Quenneville, Vice President Engineering
(480) 722-2100; FAX: (480) 403-0021
jerryq@spacedata.net
Bill McCullough

Supervised by:

A handwritten signature in black ink that reads 'M. Flom P. Eng.' The signature is stylized with a large 'M' and a prominent 'F'.

Morton Flom, P. Eng.

List of Exhibits

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

Applicant: Space Data Corporation

FCC ID: RY9GST900

By Applicant:

- | | |
|---|---|
| 1. Letter of Authorization | x |
| 2. Confidentiality Request: 0.457 And 0.459 | x |
| 4. Identification Drawings, 2.1033(c)(11) | |
| <u>x</u> Label | |
| <u>x</u> Location of Label | |
| <u>x</u> Compliance Statement | |
| <u>x</u> Location of Compliance Statement | |
| 5. Photographs, 2.1033(c)(12) | x |
| 6. 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 |
| 7. MPE Report | x |

By M.F.A. Inc.:

- A. Testimonial & Statement of Certification

The Applicant has been cautioned as to the following:**15.21 Information to the User.**

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

15.27(a) Special Accessories.

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

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

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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: d0440008

d) Client: Space Data Corporation
460 S. Benson Lane, Suite 11-12
Chandler, AZ 85224

e) Identification: GST-900
FCC ID: RY9GST900

EUT Description: Base Station

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

g) Report Date: April 6, 2004
EUT Received: March 22, 2004

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 Certification

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

24D, Confidentiality

Sub-part 2.1033**(c)(1): Name and Address of Applicant:**

Space Data Corporation
460 S. Benson Lane, Suite 11-12
Chandler, AZ 85224

Manufacturer:

Applicant

(c)(2): FCC ID:

RY9GST900

Model Number:

GST-900

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

Please see attached exhibits

(c)(4): Type of Emission:

10K0F1D

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

901 to 902

(c)(6): Power Rating, Watts:☐ Switchable☒ Variable

7.0 ERP

☐ N/A**FCC Grant Note:**

BE - The output power is continuously variable from the value listed in this entry to 15%-20% of the value listed.

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

7.0

(Defined as mobile per FCC MOO
DA01-2132 dtd September 12, 2001)

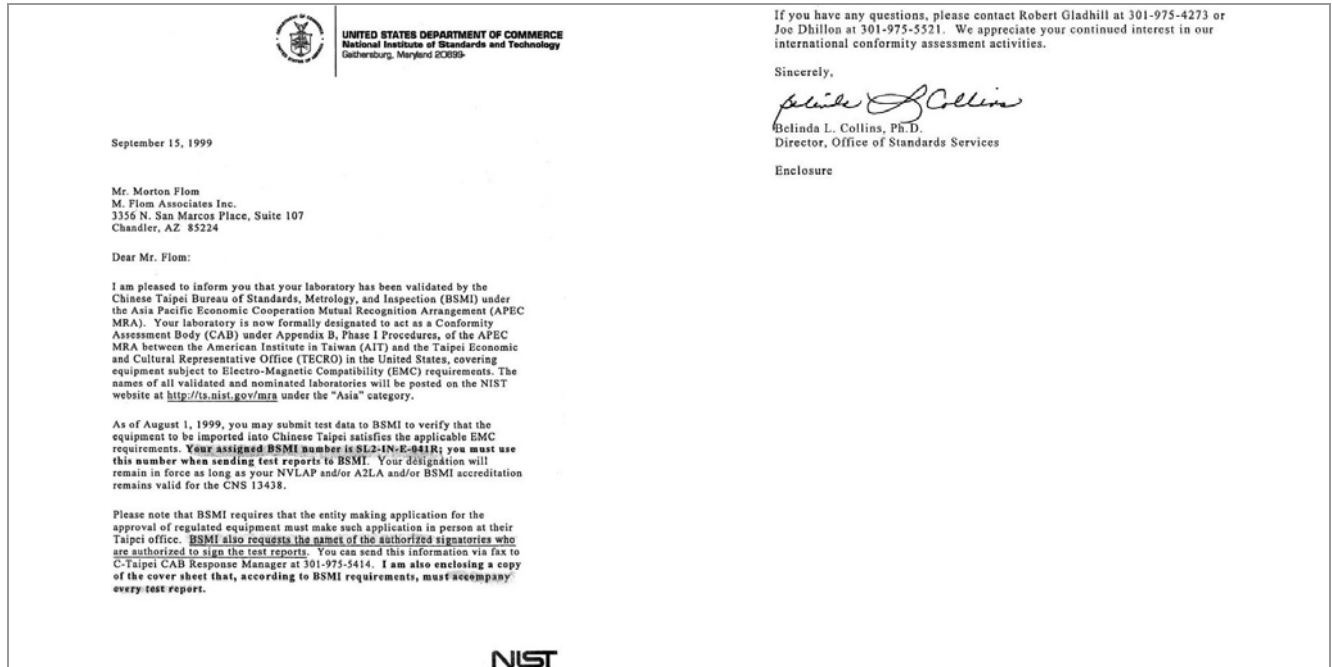
DUT Results:

Passes ☒ Fails ☐

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NIST



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Subpart 2.1033 (continued)

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

Collector Current, A	=	per manual
Collector Voltage, Vdc	=	per manual
Supply Voltage, Vdc	=	115 vac

(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

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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
- ☐ 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 C63.4-1992/2000 Draft, section 6.1.9, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104 °F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst-case measurements.

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Name of Test: Carrier Output Power (Conducted)

Specification: 47 CFR 2.1046(a)

Guide: ANSI/TIA/EIA-603-1992, Paragraph 2.2.1

Test Equipment: As per attached page

Measurement Procedure

1. The EUT was connected to a resistive coaxial attenuator of normal load impedance, and the unmodulated output power was measured by means of an RF Power Meter.
2. Measurement accuracy is $\pm 3\%$.

Measurement Results (Worst case)

Frequency of Carrier, MHz = 901-902
 Ambient Temperature = $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Power Setting		RF Power, Watts
High	For 3dBi Omni	3.5
Low	For 10dBi Yagi	0.7

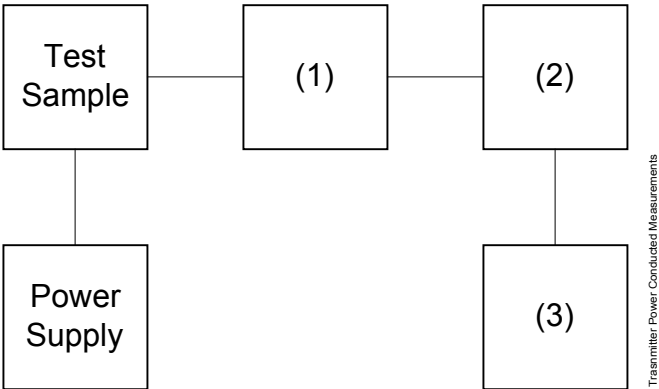


Performed by:

David E. Lee, Lab Manager

Transmitter Power Conducted Measurements

Test A. RF Power Output
Test B. Frequency Stability



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

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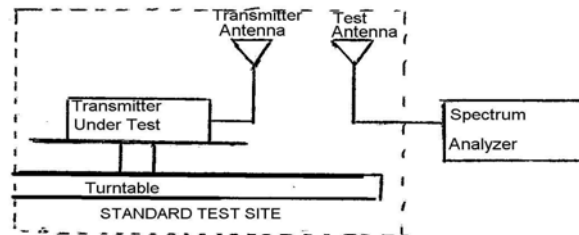
Name of Test: ERP Carrier Power (Radiated)

Specification: TIA/EIA 603A (Substitution Method)

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.

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:

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

Results attached.

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Results for 3 dBi Omni Antenna

State: High Power

Ambient Temperature: 23°C ± 3°C

	901.366MHz LVL, dbm	Path Loss, db
0°	42.3	
45°	41.7	
90°	43.7	
135°	43.6	-4.20
180°	41.5	
225°	41.3	
270°	42.9	
315°	44.2	
	940.3675MHz	
Av. Radiated Power:	38.45 dbm	6.9W

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Name of Test: RF Power Output (Radiated)

Specification: 47 CFR 2.1046(a)

Test Equipment: As per attached page

Measurement Procedure (Radiated)

1. The EUT was placed on an open-field site and its radiated field strength at a known distance was measured by means of a spectrum analyzer. Equivalent loading was calculated from the equation $P_t = ((E \times R)^2 / 49.2)$ watts, where $R = 3m$.
2. Measurement accuracy is ± 1.5 dB.

Measurement Results

State: Low Power

Ambient Temperature: $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

With 10dBi Yagi Antenna

Frequency Tuned, MHz	Frequency Emission, MHz	Meter, dBuV/m	CF, dB	ERP, dBm	ERP, Watts
901.368	901.3663	106.1	34.0	42.70	7.0

Path Loss at 901.365 = -4.2dB

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Name of Test: Field Strength of Spurious Radiation

Specification: 47 CFR 2.1053(a)

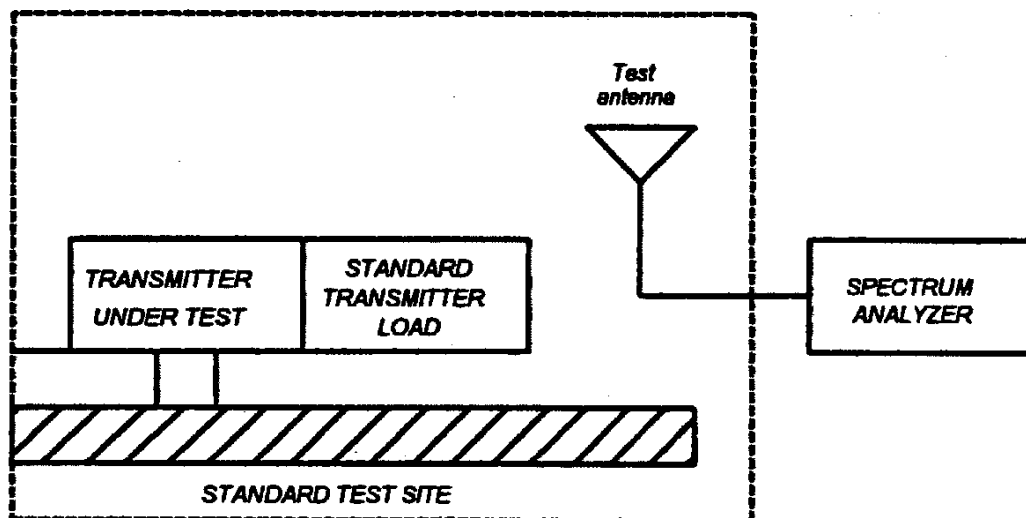
Guide: ANSI/TIA/EIA-603-1992/2001, Paragraph 1.2.12 and Table 16, 47 CFR 22.917

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 ≥ 3 times Resolution Bandwidth, or 30 kHz (22.917)
 - 3) Sweep Speed ≤ 2000 Hz/second
 - 4) Detector Mode = Mean or Average Power
- C) Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load which is placed on the turntable. The RF cable to this load should be of minimum length.

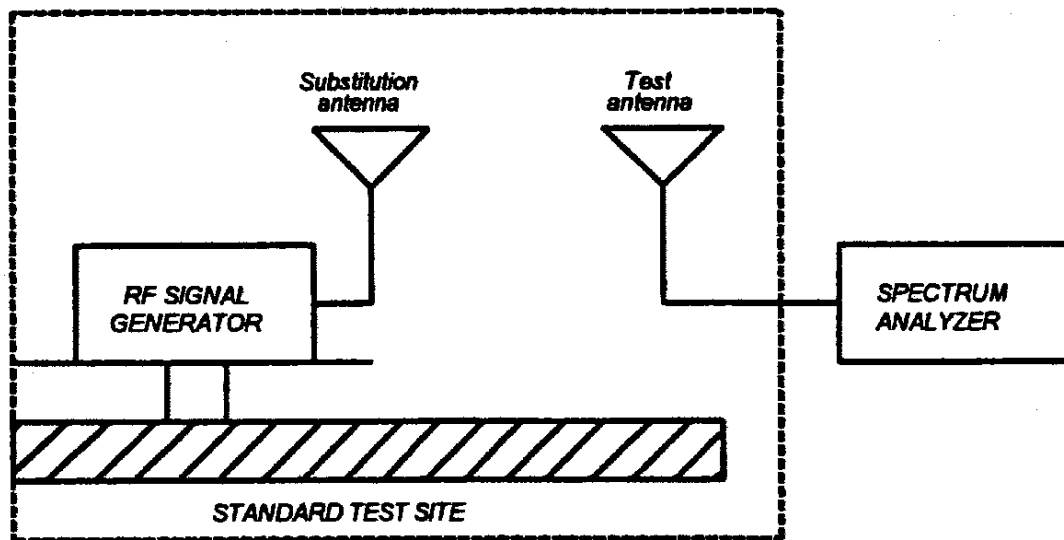


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Name of Test: Field Strength of Spurious Radiation (Cont.)

- 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:

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

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

Test Equipment:

Asset	Description	s/n	Cycle	Last Cal
Transducer				
	i00088 EMCO 3109-B 25MHz-300MHz	2336	12 mo.	Sep-03
X	i00089 Aprl 2001 200MHz-1GHz	001500	12 mo.	Sep-03
X	i00103 EMCO 3115 1GHz-18GHz	9208-3925	12 mo.	Jan-03
Amplifier				
X	i00028 HP 8449A	2749A00121	12 mo.	May-03
Spectrum Analyzer				
X	i00029 HP 8563E	3213A00104	12 mo.	May-03
X	i00033 HP 85462A	3625A00357	12 mo.	Aug-03
Substitution Generator				
X	i00067 HP 8920A Communication TS	3345U01242	12 mo.	Oct-03
	i00207 HP 8753D Network Analyzer	3410A08514	12 mo.	Jul-03

Microphone, Antenna Port, and Cabling

Microphone	_____	Cable Length	_____	Meters
Antenna Port Terminated	_____	Load	_____	Antenna Gain
All Ports Terminated by Load	_____	Peripheral	_____	

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Name of Test: Field Strength of Spurious Radiation

g0430073: 2004-Mar-23 Tue 13:22:00

STATE: 2:High Power

Ambient Temperature: 23°C ± 3°C

Frequency Tuned, MHz	Frequency Emission, MHz	ERP, dBm	ERP, dBc
901.367500	1802.735000	-46.3	
901.367500	2704.101500	-47.3	
901.367500	3605.469000	-59.2	
901.367500	4506.836500	-58.8	
901.367500	5408.204000	-59.6	≤-89.0
901.367500	6309.571500	-49.7	
901.367500	7210.939000	-49.8	
901.367500	8112.306500	-49.3	
901.367500	9013.674000	-61.5	



Performed by:

David E. Lee, Lab Manager

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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 Number

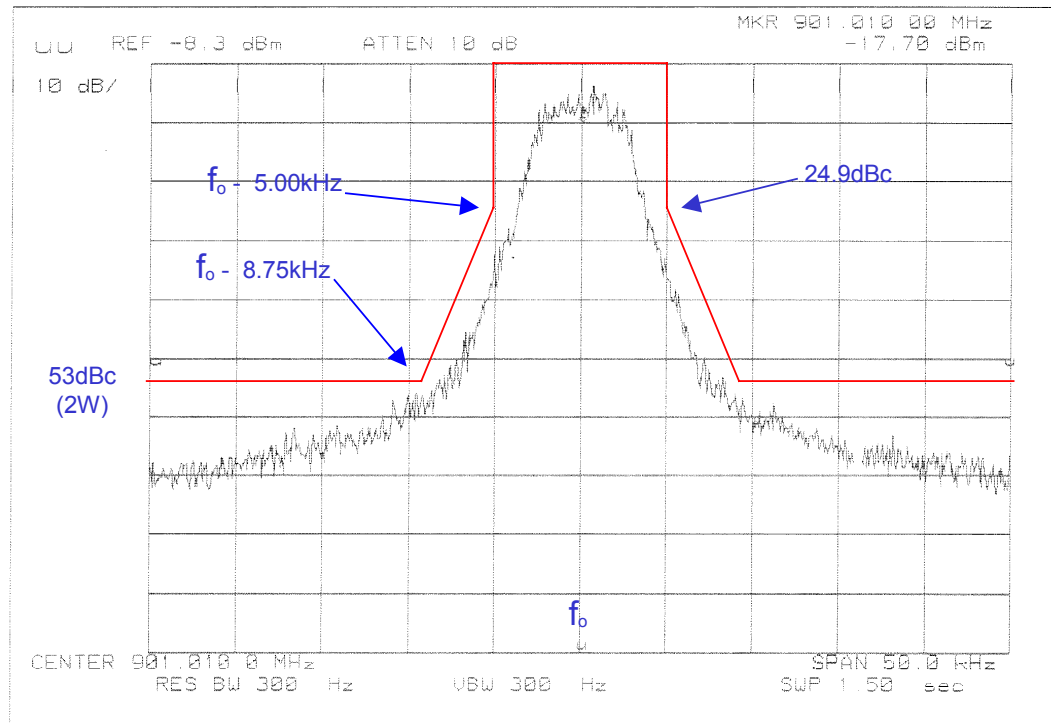
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Name of Test: Emission Masks (Occupied Bandwidth)

g0430061: 2004-Mar-22 Mon 10:51:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

When operating in a 12.5kHz assigned channel the power is to be limited to 2W ERP. This is a commanded level of 30dBm with the omni antenna and 23dBm with the Yagi.

Modulation:

6400 4FSK
12.5KHZ MASK

Performed by:

David E. Lee, Lab Manager

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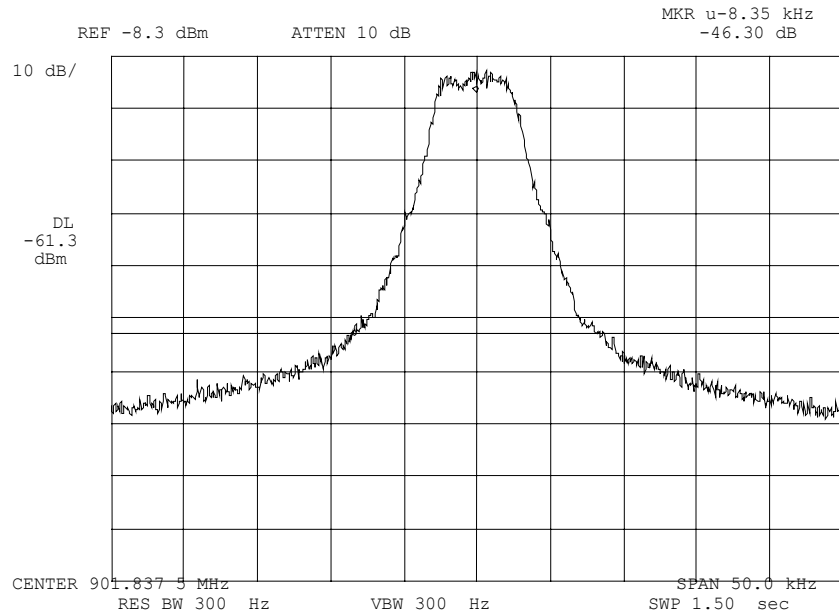
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Name of Test: Emission Masks (Occupied Bandwidth)

g0430063: 2004-Mar-22 Mon 11:19:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:
Modulation:

HIGH
6400 4FSK
INTERSECTION -53DBC 8.75KHZ

Performed by:

David E. Lee, Lab Manager

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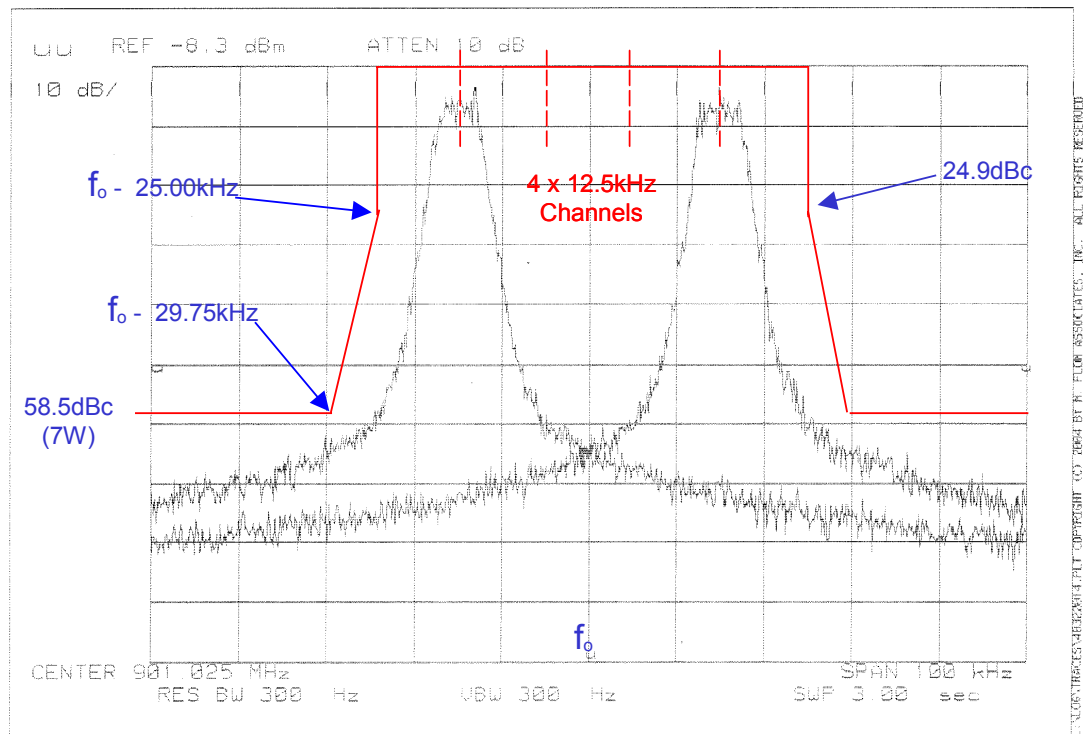
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Name of Test: Emission Masks (Occupied Bandwidth)

g0430047: 2004-Mar-22 Mon 10:11:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

Modulation:

Proposed channel plan uses one of 4 carriers for each 50kHz channel allocation. GST-900 stations in different locations may use channels in the same 50kHz allocation without interference to other Part 24D users or each other.

HIGH

6400 4FSK GAUSSIAN FILTER
BOTH CHANNELS OF A CHANNEL
ALLOCATION

(Example of Mask for 50kHz Channels
with 7W ERP Limit)

Performed by:

David E. Lee, Lab Manager

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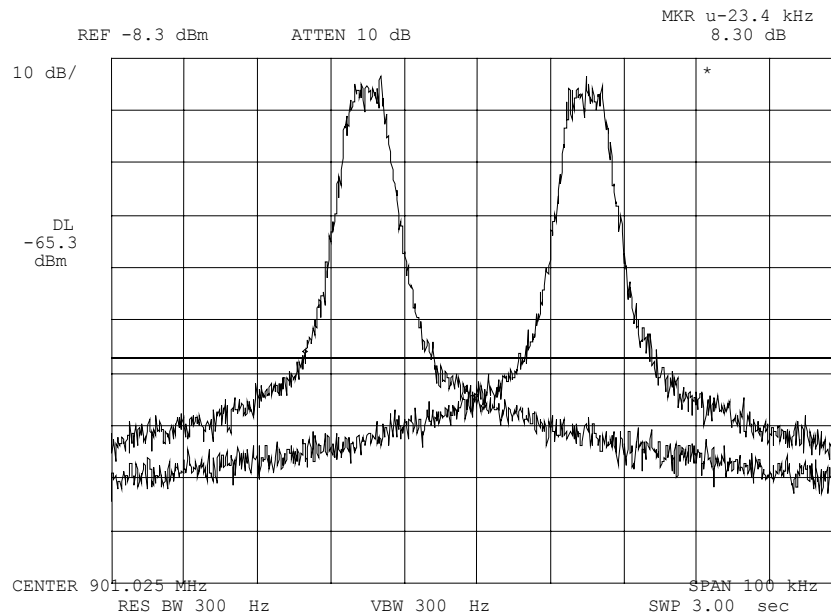
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Name of Test: Emission Masks (Occupied Bandwidth)

g0430065: 2004-Mar-22 Mon 11:29:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:
Modulation:

HIGH
6400 4FSK
INTERSECTION -53DBC 8.75KHZ ON
UPPER & LOWER 50kHz CHANNEL
EDGES

Performed by:

David E. Lee, Lab Manager

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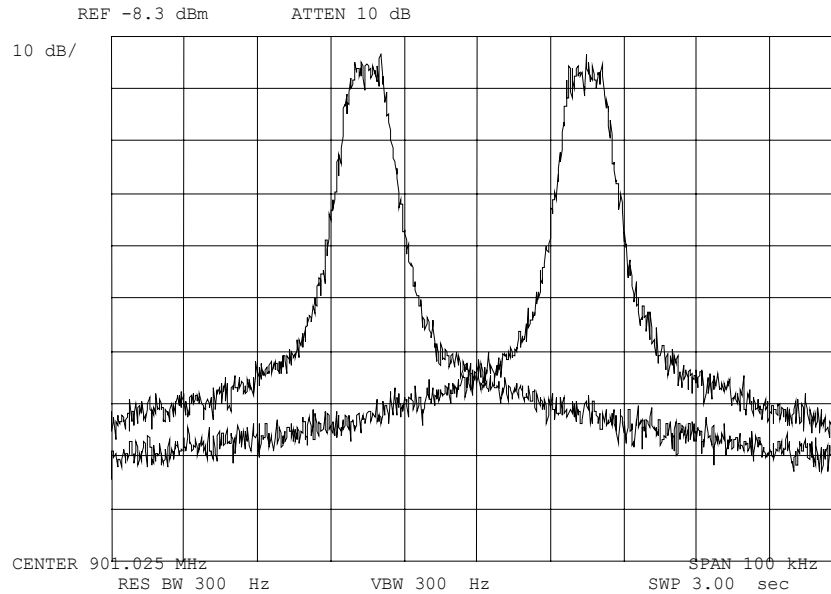
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Name of Test: Emission Masks (Occupied Bandwidth)

g0430064: 2004-Mar-22 Mon 11:26:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

6400 4FSK

FREQUENCIES 1 & 4 OF LOWEST
901MHz CHANNEL ALLOCATION

Performed by:

David E. Lee, Lab Manager

Page Number

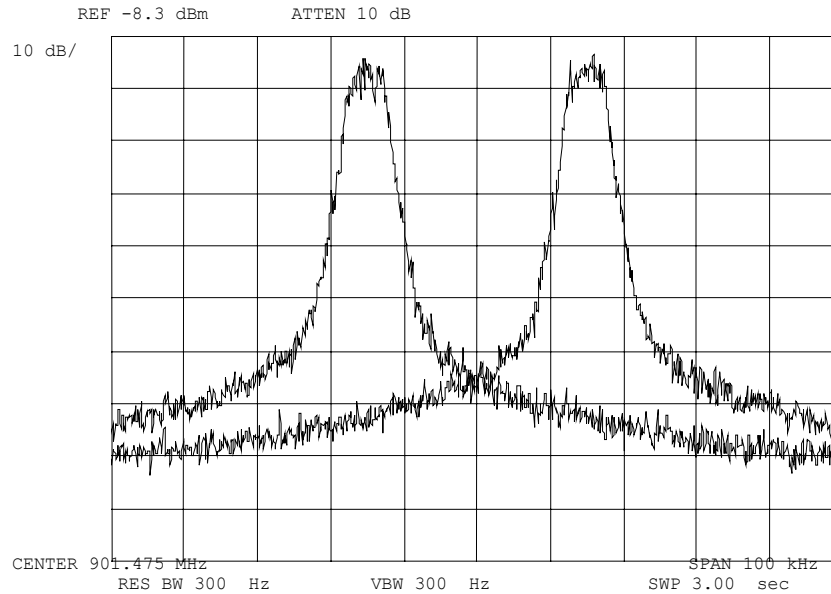
22 of 27.

Name of Test: Emission Masks (Occupied Bandwidth)

g0430066: 2004-Mar-22 Mon 11:31:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

Modulation:

HIGH

6400 4FSK

FREQUENCIES 1 & 4 OF MIDDLE
901MHz CHANNEL ALLOCATION

Performed by:

David E. Lee, Lab Manager

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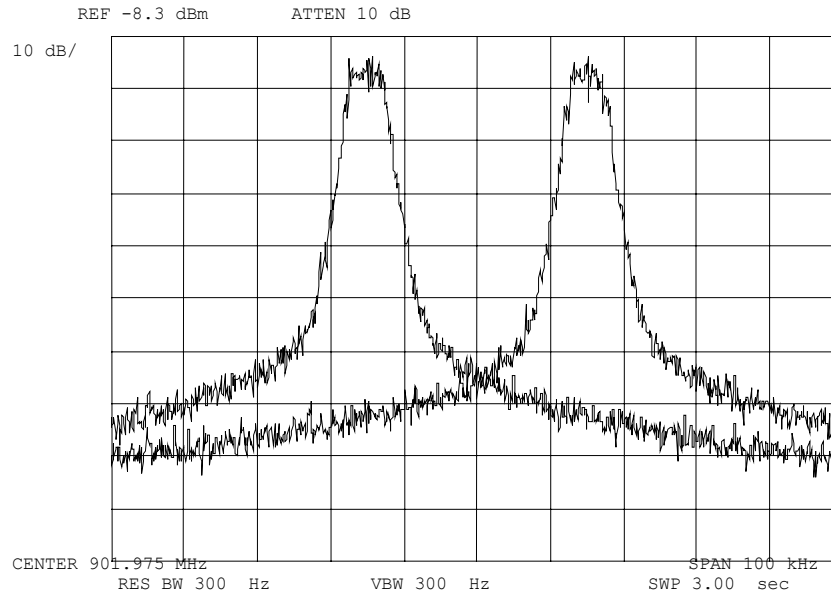
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Name of Test: Emission Masks (Occupied Bandwidth)

g0430067: 2004-Mar-22 Mon 11:33:00

State: 2:High Power

Ambient Temperature: 23°C ± 3°C



Power:

HIGH

Modulation:

6400 4FSK

FREQUENCIES 1 & 4 OF HIGHEST
901MHz CHANNEL ALLOCATION

Performed by:

David E. Lee, Lab Manager

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Name of Test: Frequency Stability (Temperature Variation)

Specification: 47 CFR 2.1055(a)(1)

Guide: ANSI/TIA/EIA-603-1992, Paragraph 2.2.2

Test Conditions: As Indicated

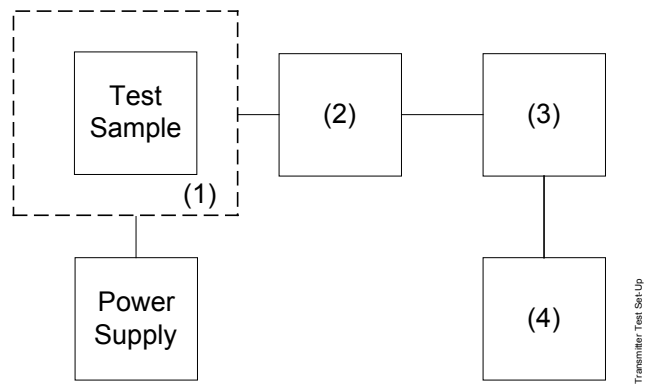
Test Equipment: As per previous page

Measurement Procedure

1. The EUT and test equipment were set up as shown on the following page.
2. With all power removed, the temperature was decreased to -30°C and permitted to stabilize for three hours. Power was applied and the maximum change in frequency was noted within one minute.
3. With power OFF, the temperature was raised in 10°C steps. The sample was permitted to stabilize at each step for at least one-half hour. Power was applied and the maximum frequency change was noted within one minute.
4. The temperature tests were performed for the worst case.
5. Measurement Results: Attached

Transmitter Test Set-Up

Frequency Stability: Temperature Variation
Frequency Stability: Voltage Variation



Asset	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

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Name of Test: Frequency Stability (Temperature Variation)

Ambient Temperature: 23°C ± 3°C

Temperature, °C	Frequency	Offset (Hz)	Offset (ppm)	Notes
-30	901.367498	2	0.002	
-20	901.367474	26	0.029	
-10	901.367469	31	0.034	
0	901.367467	33	0.037	
10	901.367465	35	0.037	
20	901.367464	36	0.040	
25	901.367464	36	0.040	Ambient
30	901.367464	36	0.040	
40	901.347463	37	0.041	
50	901.367464	36	0.040	



Performed by:

David E. Lee, Lab Manager

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Name of Test: Necessary Bandwidth and Emission Bandwidth

Specification: 47 CFR 2.202(g)

Modulation = 11K0F3E

Necessary Bandwidth Calculation:

Maximum Modulation (M), kHz	= 2.5
Maximum Deviation (D), kHz	= 2.5
Constant Factor (K)	= 1
Necessary Bandwidth (B_N), kHz	= $(2 \times M) + (2 \times D \times K)$
	= 10.0



Performed by:

David E. Lee, Lab Manager

END OF TEST REPORT

MFA p0430010, d0440008

**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:

A handwritten signature in black ink, reading "M. Flom P. Eng." with a stylized, cursive script.

Morton Flom, P. Eng.