



Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

Funktechnik GmbH
Zum Handenberg 3
Primstal, D-6620
Germany

MODEL: 70 TX – M1/70 RX – M1

FCC ID: PUX-70TX-M1

August 3, 2001

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 1999	§15.109: RADIATED EMISSIONS LIMITS
PART 22: 1998	PUBLIC MOBILE SERVICES
PART 74: 1998	LOW POWER AUXILIARY STATION
PART 90: 1998	PRIVATE LAND MOBILE RADIO SERVICES
PART 95 (A): 1998	GENERAL MOBILE RADIO SERVICES
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS
ANSI/TIA/EIA603- 1992	LAND MOBILE FM OR PM COMMUNICATIONS EQUIPMENT MEASUREMENT AND PERFORMANCE STANDARDS
ANSI/TIA/EIA 603-1-1998	ADDENDUM TO ANSI/TIA/EIA 603-1992
RSS-119; Issue 6: 2000	LAND MOBILE AND FIXED RADIO TRANSMITTERS AND RECEIVERS, 27.41 TO 960 MHZ
RSS-102; Issue 1: 1999	EVALUATION PROCEDURE FOR MOBILE AND PORTABLE RADIO TRANSMITTERS WITH RESPECT TO HEALTH CANADA'S SAFETY CODE 6 FOR EXPOSURE OF HUMANS TO RADIO FREQUENCY FIELDS

Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
420-510	0.013		16K0F1D

REPORT PREPARED BY:

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Document Number: 2001218 / QRTL01- 227 / QRTL01-228

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1 GENERAL INFORMATION

The following Report of a Type Certification is prepared on behalf of **HM-Funktechnik GmbH** in accordance with the Federal Communications Commissions and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was the **70 TX-M1/70 RX-M1, FCC ID: PUX-70TX-M1**. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47, Industry Canada RSS-119, and ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated March 3, 1994, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.2 RELATED SUBMITTAL(S)/GRANT(S)

This is an original application report.



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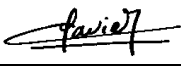
2 CONFORMANCE STATEMENT

STANDARDS REFERENCED FOR THIS REPORT	
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Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
420-510	0.013		16K0F1D

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the FCC Part 2, FCC Part 90 and Canadian RSS-119 Certification methodology.

Signature: 

Date: August 3, 2001

Typed/Printed Name: Bruno Clavier

Position: Vice President of Operations
(NVLAP Signatory)

Signature: 

Date: August 3, 2001

Typed/Printed Name: Daniel W. Baltzell

Position: Test Engineer

 Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 200061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.



3 TESTED SYSTEM DETAILS

Listed below is the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

TABLE 3-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
TRANSMITTER WITH BUILT IN WIRE ANTENNA (420.025 MHz)	HM-FUNKTECHNIK GMBH	70 TX-M1	03	N/A	N/A	013565
TRANSMITTER	HM-FUNKTECHNIK GMBH	70 TX-M1	02	N/A	N/A	013564
TRANSMITTER	HM-FUNKTECHNIK GMBH	70 TX-M1	01	N/A	N/A	013563
TRANSMITTER WITH BUILT IN WIRE ANTENNA (420.025 MHz)	HM-FUNKTECHNIK GMBH	70 TX-M1	08	N/A	N/A	013571
TRANSMITTER	HM-FUNKTECHNIK GMBH	70 TX-M1	09	N/A	N/A	013569
TRANSMITTER	HM-FUNKTECHNIK GMBH	70 TX-M1	07	N/A	N/A	013570
TRANSMITTER WITH BUILT IN WIRE ANTENNA (465.000 MHz)	HM-FUNKTECHNIK GMBH	70 TX-M1	04	N/A	N/A	013577
TRANSMITTER	HM-FUNKTECHNIK GMBH	70 TX-M1	05	N/A	N/A	013576
TRANSMITTER	HM-FUNKTECHNIK GMBH	70 TX-M1	06	N/A	N/A	013575
RECEIVER WITH BUILT IN WIRE ANTENNA (509.975 MHz)	HM-FUNKTECHNIK GMBH	70 RX-M1	03	N/A	N/A	013572
RECEIVER	HM-FUNKTECHNIK GMBH	70 RX-M1	02	N/A	N/A	013573
RECEIVER	HM-FUNKTECHNIK GMBH	70 RX-M1	01	N/A	N/A	013574
RECEIVER WITH BUILT IN WIRE ANTENNA (465.000 MHz)	HM-FUNKTECHNIK GMBH	70 RX-M1	04	N/A	N/A	013568
RECEIVER	HM-FUNKTECHNIK GMBH	70 RX-M1	05	N/A	N/A	013567
RECEIVER	HM-FUNKTECHNIK GMBH	70 RX-M1	06	N/A	N/A	013566
RECEIVER WITH BUILT IN WIRE ANTENNA (509.975 MHz)	HM-FUNKTECHNIK GMBH	70 RX-M1	09	N/A	N/A	013580
RECEIVER	HM-FUNKTECHNIK GMBH	70 RX-M1	07	N/A	N/A	013579
RECEIVER	HM-FUNKTECHNIK GMBH	70 RX-M1	08	N/A	N/A	013578
WHIP ANTENNA	HM-FUNKTECHNIK GMBH	N/A	N/A	N/A	N/A	013582
WHIP ANTENNA	HM-FUNKTECHNIK GMBH	N/A	N/A	N/A	N/A	013581

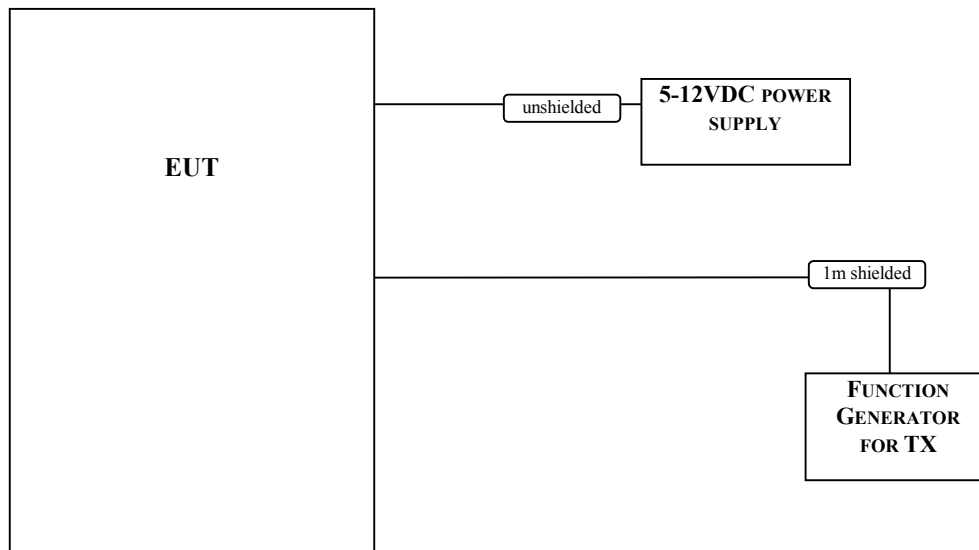


FIGURE 3-1: CONFIGURATION OF TESTED SYSTEM



4 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI(\text{dBuV/m}) = SAR(\text{dBuV}) + SCF(\text{dB/m})$$

FI = Field Intensity

SAR = Spectrum Analyzer Reading

SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$SCF(\text{dB/m}) = -PG(\text{dB}) + AF(\text{dB/m}) + CL(\text{dB})$$

SCF = Site Correction Factor

PG = Pre-amplifier Gain

AF = Antenna Factor

CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(\text{uV/m}) = 10^{FI(\text{dBuV/m})/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3 \text{ dBuV} - 11.5 \text{ dB/m} = 37.8 \text{ dBuV/m}$$

$$10^{37.8/20} = 10^{1.89} = 77.6 \text{ uV/m}$$



5 CONDUCTED EMISSIONS

5.1 CONDUCTED MEASUREMENT

No conducted measurements are required since the unit is DC battery operated.

6 RADIATED EMISSIONS

6.1 RADIATED MEASUREMENT

Before final measurements of radiated emissions were made on the open-field three meter range, the EUT was scanned indoors at a three meter distance in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.



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6.2 TEST DATA: FCC PART 15 §15.109 (A): RADIATED EMISSIONS (CLASS B LIMITS)

TABLE 6-1: RADIATED EMISSIONS CLASS B LIMITS

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
398.625	Qp	H	0	1.0	30.7	-10.2	20.5	46.0	-25.5
443.600	Qp	H	40	1.2	30.5	-9.0	21.5	46.0	-24.5
488.575	Qp	H	155	1.1	26.0	-8.2	17.8	46.0	-28.2
797.250	Qp	H	120	1.0	30.4	-3.5	26.9	46.0	-19.1
887.200	Qp	H	100	1.3	30.3	-2.2	28.1	46.0	-17.9
977.150	Qp	H	270	1.2	26.7	-1.7	25.0	54.0	-29.0
1195.875	Av	H	285	1.0	29.7	0.3	30.0	54.0	-24.0
1330.800	Av	H	270	1.2	29.4	1.7	31.1	54.0	-22.9
1465.725	Av	H	0	1.0	25.4	3.4	28.8	54.0	-25.2
1594.500	Av	H	35	1.3	29.9	4.3	34.2	54.0	-19.8
1774.400	Av	H	20	1.0	30.1	5.2	35.3	54.0	-18.7
1954.300	Av	H	255	1.0	29.7	8.8	38.5	54.0	-15.5

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER


SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 6-2: TEST EQUIPMENT USED FOR TESTING (RADIATED EMISSIONS)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900931	HP	8566B	Spectrum Analyzer (100Hz – 22 GHz)	3138A07771	03/27/02
900999	HP	8596EM Analyzer	Spectrum Analyzer (9KHz - 12.5GHz)	3826A00144	03/25/02
901053	Schaffner@Chase	CBL6112B	Bilog antenna (20 MHz - 2 GHz)	2648	05/24/02
900321	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020	N/A
900323	EMCO	3161-03	Horn Antennas (4-8,2GHz)	9508-1020	N/A
900772	Electro Metrics	RGA 60	Horn Antenna	2310	03/25/02
900889	HP	85685A	RF Preselector for HP 8566B or 8568B (20Hz-2GHz)	3146A01309	11/08/01
900800	EMCO	3301B	Active monopole antenna (30 Hz – 50 MHz)	9809-4071	05/02/02



7 FCC PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED

7.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

7.2 TEST DATA

The following channels (in MHz) were tested: 450.0125, 460.0125, 470.0125, 489.9875
The worst-case Output Power (highest) levels are shown.

CARRIER OUTPUT POWER (UNMODULATED)

TABLE 7-1: RF POWER OUTPUT

Frequency (MHz)	Power measured (dBm)	RF Power measured (mWatt)*
420.025	11.1	13.0
465.000	10.8	12.1
509.975	10.4	11.1

* Measurement accuracy: +/- 3%

TABLE 7-2: RF POWER OUTPUT (RATED POWER)

Rated Power (W)
0.010

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER


SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 7-3: TEST EQUIPMENT USED FOR TESTING (RF POWER OUTPUT - CONDUCTED)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900770	Hewlett Packard	437B	Power Meter	2949A02966
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102
900769	Hewlett Packard	8481B	Power Sensor	2702A05059
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102



8 FCC PART 2 §2.1046 (A) RF POWER OUTPUT: RADIATED - ERP

8.1 TEST PROCEDURE

Substitution Method:

The EUT was setup at an antenna to EUT distance of 3 meters on an open area test site. The EUT was placed on a nonconductive turntable approximately 0.8 meters above the ground plane. The physical arrangement of the EUT and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The worst-case, maximum radiated emission was recorded and used as reference for the ERP measurement. The EUT was then replaced by an $\frac{1}{2}$ wave dipole antenna and polarized in accordance with the EUT's antenna polarization. The $\frac{1}{2}$ wave dipole antenna was connected to a RF signal generator with a coaxial cable. The search antenna height, and search antenna polarity was set to levels that produced the maximum reading obtained in step 3. The signal generator was adjusted to a level that produced the radiated emission level obtained in step 3. The signal generator level was recorded and corrected 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 $\frac{1}{2}$ wave dipole antenna. The signal generator corrected level is the ERP level

8.2 TEST DATA

Settings:

- Power: 0.01 Watt delivered to antenna*
- Radiated power measurements (3 meter)

TABLE 8-1: RADIATED – ERP RF POWER OUTPUT (WHIP ANTENNA)

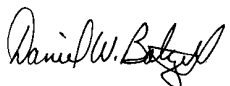
Frequency (MHz)	Signal Generator Level (dBm)*	Cable Loss (dB)	Corrected Antenna Gain (dBi)	Corrected level (dBm)	(Watt)
420.025	9.7	0.6	-0.6	8.5	0.007
465.000	4.2	0.7	-0.6	2.9	0.002
509.975	4.5	0.8	-0.6	3.1	0.002

TABLE 8-2: RADIATED – ERP RF POWER OUTPUT (WIRE ANTENNA)

Frequency (MHz)	Signal Generator Level (dBm)*	Cable Loss (dB)	Corrected Antenna Gain (dBi)	Corrected level (dBm)	(Watt)
420.025	12.3	0.6	-0.6	11.1	0.013
465.000	8.1	0.7	-0.6	6.8	0.005
509.975	6.0	0.8	-0.6	4.6	0.003

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER


SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 8-3: TEST EQUIPMENT USED FOR TESTING (RADIATED – ERP RF POWER OUTPUT)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771
900154	Compliance Design Inc.	Roberts Dipole	Adjustable Elements Dipole Antenna (30-1000MHz)	-



9 FCC PART 2 §2.1051 AND PART 15 §15.111: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

9.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, Section 2.2.13

The transmitter and receiver were terminated with a 50 Ω load and interfaced with a spectrum analyzer. The transmitter is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1000 Hz.

9.2 TEST DATA

Frequency range of measurement per Part 90.217

The following channels (in MHz) were investigated: 420.025, 465.000, 509.975

The worst case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.



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TABLE 9-1: SPURIOUS EMISSIONS (420.025 MHz) TRANSMITTER

Frequency (MHz)	Level (-dBc)	Limit (-dBc)	Margin(dB)
393.772	80.5	30.0	-50.5
446.276	75.0	30.0	-45.0
840.050	64.5	30.0	-34.5
1260.075	77.5	30.0	-47.5
1680.100	75.7	30.0	-45.7
2100.125	72.9	30.0	-42.9
2520.150	57.2	30.0	-27.2
2940.175	62.3	30.0	-32.3
3360.200	70.2	30.0	-40.2
3780.225	67.0	30.0	-37.0
4200.250	72.9	30.0	-42.9

TABLE 9-2: SPURIOUS EMISSIONS (420.025 MHz) RECEIVER

Frequency (MHz)	Level (dBm)	Limit (2nW) (dBm)	Margin (dB)
398.625	-66.7	-57.0	-9.7
797.250	-80.0	-57.0	-23.0
1195.875	-85.2	-57.0	-28.2
1594.500	-84.6	-57.0	-27.6
1993.125	-92.5	-57.0	-35.5

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER


SIGNATURE

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TABLE 9-3: SPURIOUS EMISSIONS (465.000 MHz) TRANSMITTER

Frequency (MHz)	Level (-dBc)	Limit (-dBc)	Margin(dB)
435.937	88.4	30.0	-58.4
479.530	81.7	30.0	-51.7
494.062	80.2	30.0	-50.2
930.000	77.9	30.0	-47.9
1395.000	87.9	30.0	-57.9
1860.000	88.2	30.0	-58.2
2325.000	75.3	30.0	-45.3
2790.000	72.7	30.0	-42.7
3255.000	84.3	30.0	-54.3
3720.000	86.4	30.0	-56.4
4185.000	94.1	30.0	-64.1
4650.000	78.9	30.0	-48.9

TABLE 9-4: SPURIOUS EMISSIONS ((465.000 MHz) RECEIVER

Frequency (MHz)	Level (dBm)	Limit (2nW) (dBm)	Margin (dB)
443.600	-70.2	-57.0	-13.2
887.200	-89.1	-57.0	-32.1
1330.800	-80.5	-57.0	-23.5
1774.400	-88.4	-57.0	-31.4
2218.000	-80.2	-57.0	-23.2

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER



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AUGUST 3, 2001
DATE OF TEST



TABLE 9-5: SPURIOUS EMISSIONS (509.975 MHz) TRANSMITTER

Frequency (MHz)	Level (-dBc)	Limit (-dBc)	Margin(dB)
478.101	74.9	30.0	-44.9
494.038	87.6	30.0	-57.6
525.911	90.2	30.0	-60.2
541.847	84.8	30.0	-54.8
1019.950	91.4	30.0	-61.4
1529.925	80.5	30.0	-50.5
2039.900	71.7	30.0	-41.7
2549.875	61.1	30.0	-31.1
3059.850	66.3	30.0	-36.3
3569.825	69.9	30.0	-39.9
4079.800	83.5	30.0	-53.5
4589.775	71.3	30.0	-41.3
5099.750	95.4	30.0	-65.4

TABLE 9-6: SPURIOUS EMISSIONS (509.975 MHz) RECEIVER

Frequency (MHz)	Level (dBm)	Limit (2nW) (dBm)	Margin (dB)
488.575	-74.4	-57.0	-17.4
977.150	-90.0	-57.0	-33.0
1465.725	-85.5	-57.0	-28.5
1954.300	-91.3	-57.0	-34.3
2442.875	-74.0	-57.0	-17.0

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 9-7: TEST EQUIPMENT USED FOR TESTING (RADIATED – ERP RF POWER OUTPUT)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159



10 FCC PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION

10.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.12

The transmitter is terminated with a 50 Ω load and is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1000 Hz.

Refer to section "Radiated Measurement" in this report for further information.

10.2 TEST DATA

10.2.1 CFR 47 PART 90.210 REQUIREMENTS

The worst-case emissions test data are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 10-1: FIELD STRENGTH OF SPURIOUS RADIATION {(420.025 MHz) SUBSTITUTION METHOD}

Frequency	S/G level (dBm)	Cable Loss*	Difference in gain (ref. To 1/2 wave dipole)	Emission level (-dBc)	Limit (-dBc)	Margin (dB)
840.050	-52.5	-1.2	-1.2	66.0	30.0	-36.0
1260.075	NF					
1680.100	NF					
2100.125	NF					
2520.150	NF					
2940.175	NF					
3360.200	NF					
3780.225	NF					
4200.250	NF					

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the 1/2 wave dipole antenna.
NF is the noise floor of the spectrum analyzer



TABLE 10-2: FIELD STRENGTH OF SPURIOUS RADIATION {(465.000 MHz) SUBSTITUTION METHOD}

Frequency	S/G level (dBm)	Cable Loss*	Difference in gain (ref. To 1/2 wave dipole)	Emission level (-dBc)	Limit (-dBc)	Margin (dB)
930.000	-55.0	-1.2	-1.2	68.2	30.0	-38.2
1395.000	NF					
1860.000	NF					
2325.000	NF					
2790.000	NF					
3255.000	NF					
3720.000	NF					
4185.000	NF					
4650.000	NF					

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the 1/2 wave dipole antenna.
NF is the noise floor of the spectrum analyzer

TABLE 10-3: FIELD STRENGTH OF SPURIOUS RADIATION {(509.975 MHz) SUBSTITUTION METHOD}

Frequency	S/G level (dBm)	Cable Loss*	Difference in gain (ref. To 1/2 wave dipole)	Emission level (-dBc)	Limit (-dBc) Mask D	Margin (dB)
1019.950	-56.2	-1.2	0.0	67.8	30	-37.8
1529.925	NF					
2039.900	NF					
2549.875	NF					
3059.850	NF					
3569.825	NF					
4079.800	NF					
4589.775	NF					
5099.750	NF					

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the 1/2 wave dipole antenna.
NF is the noise floor of the spectrum analyzer

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 10-4: TEST EQUIPMENT USED FOR TESTING (FIELD STRENGTH OF SPURIOUS RADIATION)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
900791	Schaffner@Chase	CBL6112	Antenna (25MHz – 2GHz)	2099
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1-26.5 GHz)	3008A00505
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 KHz to 3200 MHz)	3537A01741
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866



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11 FCC PART 90 §90.217 (A): OCCUPIED BANDWIDTH

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

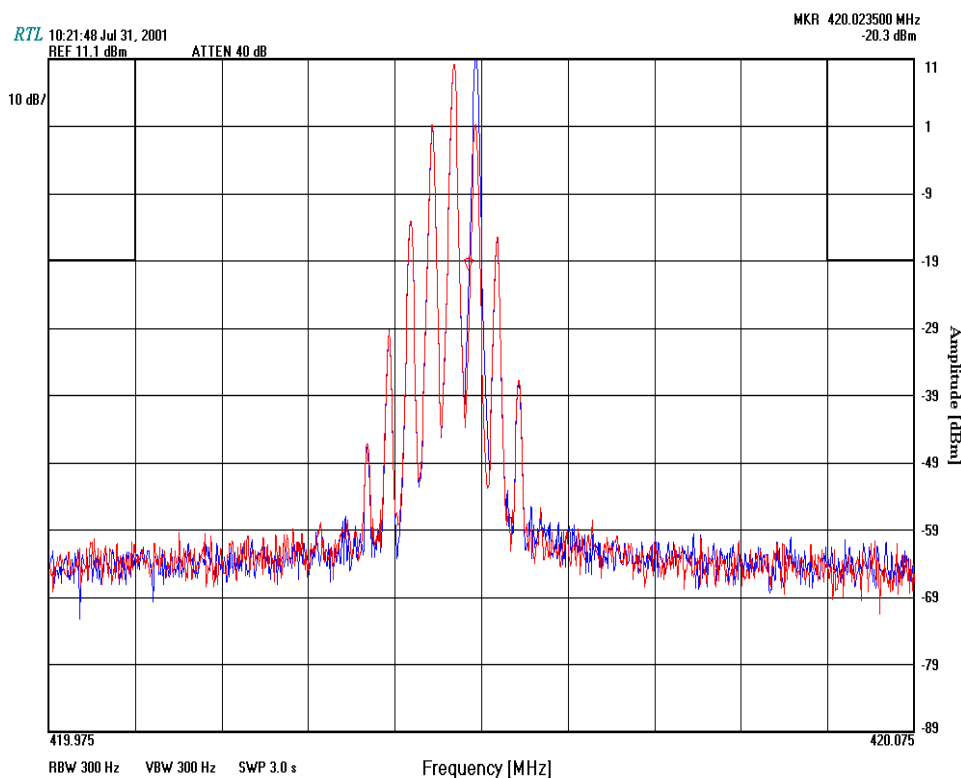
11.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.11

Device with audio modulation: Transmitter is modulated with a 2500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1000 Hz.

11.2 TEST DATA

PLOT 11-1: OCCUPIED BANDWIDTH {25 kHz CHANNEL BANDWIDTH: MASK (DIGITAL MODULATION: 2,500 Hz)}



TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 11-1: TEST EQUIPMENT USED FOR TESTING (OCCUPIED BANDWIDTH)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719



12 FCC PART 2 §2.1055: FREQUENCY STABILITY

12.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +50°C.

The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½ an hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied from 85% to 115% of the nominal voltage.

The worst-case test data are shown.



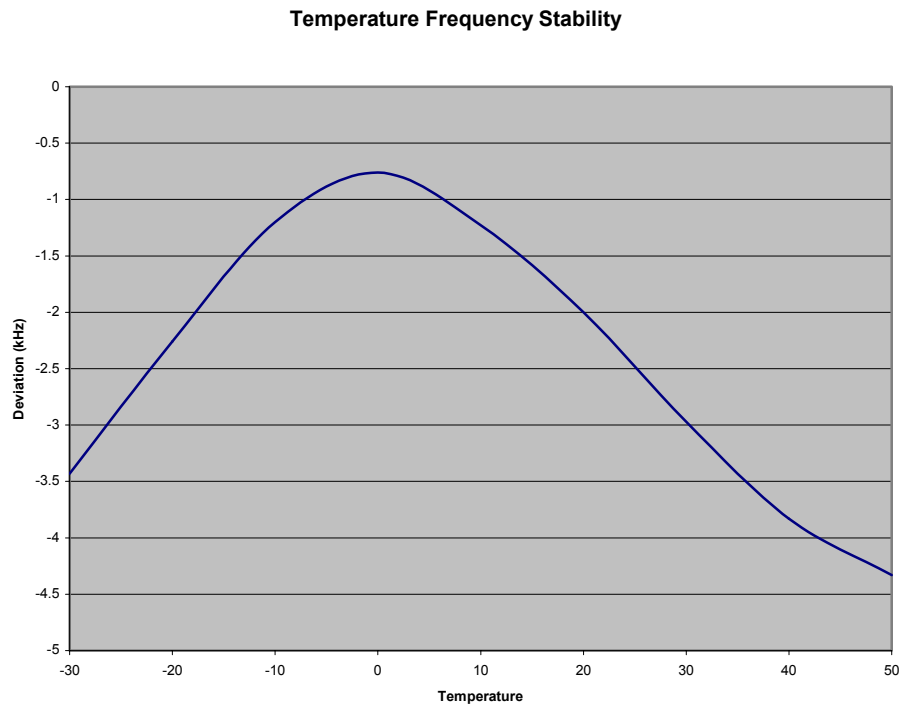
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12.2 TEST DATA

12.2.1 FREQUENCY STABILITY/TEMPERATURE VARIATION

The worst-case temperature deviation is show below.

PLOT 12-1: TEMPERATURE FREQUENCY STABILITY



TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER



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TABLE 12-1: TEMPERATURE FREQUENCY STABILITY

Temperature (C)	Frequency Measured (MHz)	Deviation (kHz)
-30	420.021570	-3.43
-20	420.022740	-2.26
-10	420.023800	-1.20
0	420.024240	-0.76
10	420.023770	-1.23
20	420.023000	-2.00
30	420.022030	-2.97
40	420.021170	-3.83
50	420.020670	-4.33

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 12-2: TEST EQUIPMENT USED FOR TESTING (FREQUENCY STABILITY/TEMPERATURE)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	11/07/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01



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PLOT 12-2: FREQUENCY STABILITY/VOLTAGE VARIATION

Battery Endpoint = 4.0 VDC

Voltage Frequency Stability (5 VDC nominal, 4 VDC Battery endpoint)

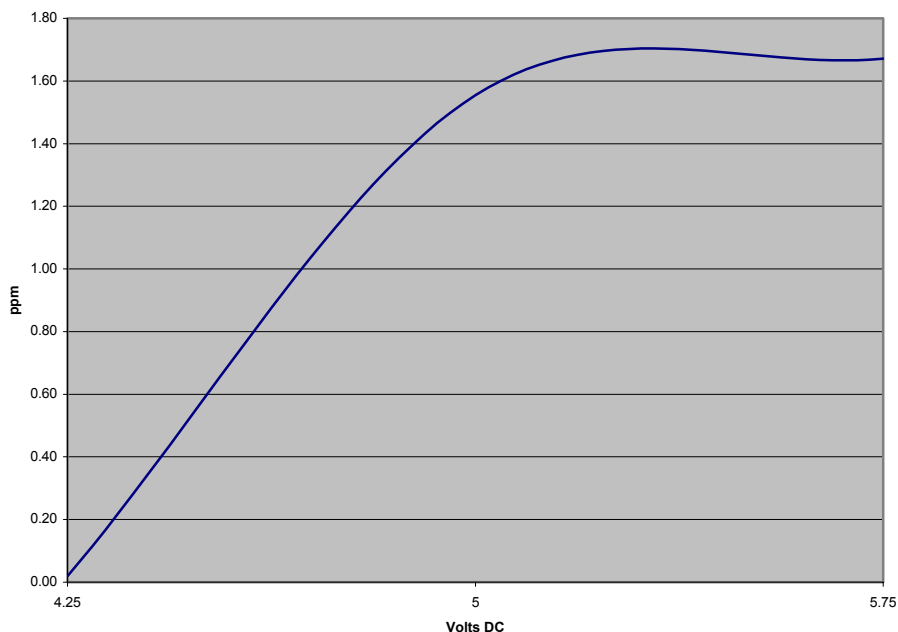


TABLE 12-3: FREQUENCY STABILITY/VOLTAGE VARIATION

Voltage (VDC)	Frequency Measured (MHz)	ppm
4.25	420.025008	0.02
5.00	420.025653	1.55
5.75	420.025702	1.67

TEST PERSONNEL:

DANIEL BALTZELL
TEST TECHNICIAN/ENGINEER

SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 12-4: TEST EQUIPMENT USED FOR TESTING (FREQUENCY STABILITY/VOLTAGE)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	11/07/01
901055	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2545A04102	06/08/01



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13 FCC PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

Type of Emission: F1D

Necessary Bandwidth and Emission Bandwidth:
25kHz (WB channel): $B_n = 16K0F1D$

Calculation:

Max modulation(M) in kHz : 3

Max deviation (D) in kHz: 5

Constant factor (K) : 1

$B_n = 2xM + 2xDK$