Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

HM-Funktechnik GmbH
Zum Handenberg 3
Primstal, D-6620
Germany

MODEL: 70TX-S
FCC ID: PUX-70TX-S

July 10, 2003

STANDARDS REFERENCED FOR THIS REPORT	
PART 2: 2001	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
PART 15: 2001	RADIO FREQUENCY DEVICES - §15.109: RADIATED EMISSIONS LIMITS
PART 22: 2001	PUBLIC MOBILE SERVICES
PART 74: 2001	EXPERIMENTAL RADIO AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES
PART 90: 2001	PRIVATE LAND MOBILE RADIO SERVICES
PART 95: 2001	PERSONAL 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
ANSI/TIA/EIA –102.CAAA; 1999	DIGITAL C4FM/CQPSK TRANSCEIVER MEASUREMENT METHODS
RSS-119; Issue 6; 2000	LAND MOBILE AND FIXED RADIO TRANSMITTERS AND RECEIVERS 27.41 TO 960.0 MHZ

Frequency Range	Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
421-510 MHz	0.0120	-4.436	16K0F1D

REPORT PREPARED BY TEST ENGINEER: DESMOND FRASER

Document Number: 2003075/ QRTL03-776

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1 GENERAL INFORMATION

The following Type Certification Report is prepared on behalf of HM-Funktechnik GmbH in accordance with the Federal Communications Commission and Industry Canada Rules and Regulations. The Equipment Under Test (EUT) was Model # 70TX-S; FCC ID: PUX-70TX-S. 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-210, 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, 2000, submitted to and approved by the Federal Communications 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.

2 CONFORMANCE STATEMENT

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: 2001	PUBLIC MOBILE SERVICES
PART 74: 2001	EXPERIMENTAL RADIO AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES
PART 90: 2001	PRIVATE LAND MOBILE RADIO SERVICES
PART 95: 2001	PERSONAL RADIO SERVICES
PART 22: 2001	PUBLIC MOBILE SERVICES
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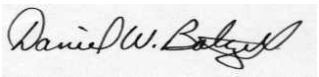
Frequency Range	Output Power (W) Conducted	Frequency Tolerance (ppm)	Emission Designator
421-510MHz	0.0120	--4.436	16K0F1D

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 above standards for Certification methodology.

Signature:  Date: July 10, 2003

Typed/Printed Name: Desmond Fraser Position: President

Signature:  Date: July 10, 2003

Typed/Printed Name: Daniel Baltzell Position: Test Engineer

NVLAP *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 are 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)

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	FCC ID	CABLE DESCRIPTIONS	RTL BAR CODE
Transmitter Module (EUT) (421.0000-423.1875 MHz)	HM-Funktechnik GmbH	70 TX-S	318227	PUX-70TX-S	N/A	15198
Transmitter Module (EUT) (462.5625 - 467.7125 MHz)	HM-Funktechnik GmbH	70 TX-S	317240	PUX-70TX-S	N/A	15316
Transmitter Module (EUT) (506.8125 - 510.0000 MHz)	HM-Funktechnik GmbH	70 TX-S	318228	PUX-70TX-S	N/A	15197
PCB Interface Card	HM-Funktechnik GmbH	HM1640	D-66620 Primstal	N/A	0.2 m Unshielded switch to power	15165
AC Adapter	ICOM, Inc	481210O O3CO	0017	N/A	1 m. Unshielded power	12425
17mm wire Whip antenna	HM-Funktechnik GmbH	N/A	N/A	N/A	17mm wire	15166

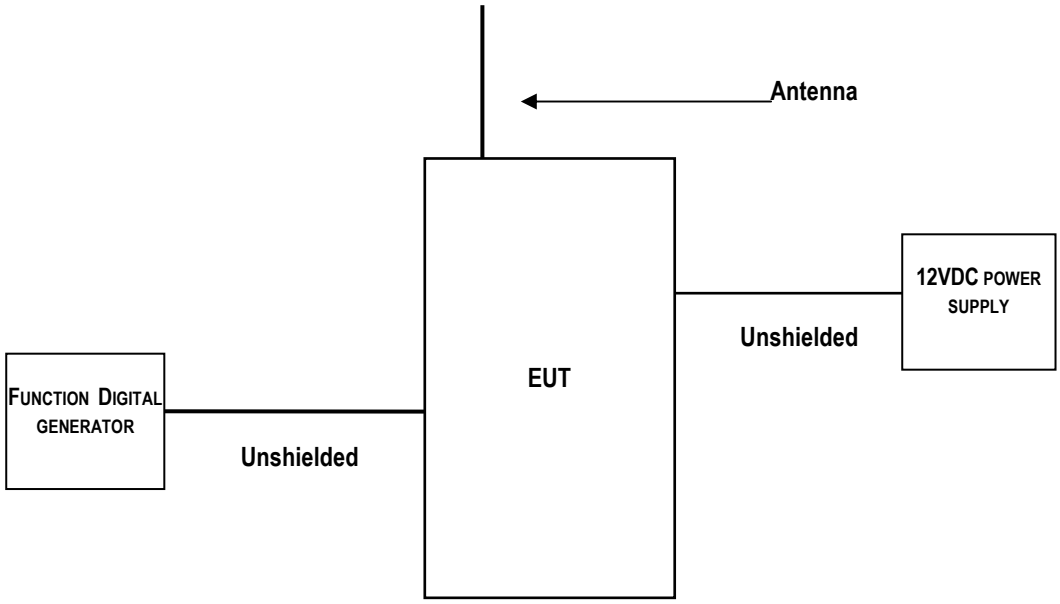


FIGURE 3-1: CONFIGURATION OF TESTED SYSTEM

4 FCC RULES AND REGULATIONS PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED

4.1 TEST PROCEDURE

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

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

4.2 TEST DATA

The carrier (in MHz) was tested: 421MHz, 462 MHz, and 510 MHz

TABLE 4-1: RF POWER OUTPUT: CARRIER OUTPUT POWER (UNMODULATED)

Frequency (MHz)	RF Power Measured (Watt)*
421	0.0069
462	0.0055
510	0.0120

* Measurement accuracy: +/- .02 dB (logarithmic mode)

TABLE 4-2: RF POWER OUTPUT (RATED POWER)

Rated Power (W)
0.0012

TABLE 4-3: TEST EQUIPMENT USED FOR TESTING (RF POWER OUTPUT - CONDUCTED)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900770	Hewlett Packard	437B	Power Meter	2949A02966	02/19/04
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	06/14/04
900937	Hewlett Packard	8482H	Power Sensor	3318A08961	02/01/04
901184/901186	Agilent	E4416A/E9323A	Power Meter / Sensor	GB41050573/US40410380	07/19/04

TEST PERSONNEL:

DESMOND FRASER		MAY 15, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

5 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

5.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, Section 2.2.13: The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

ANSI/TIA/EIA-603-1992, section 2.2.11 and TIA/EIA-102.CAAA-1999 section 2.2.5

Device with audio modulation: Transmitter was modulated with a 2,500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1,000 Hz.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps; a voltage of 3.3Vpp with an offset of 1.65V was used to produce standard deviation.

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: Mask B (dBm): P(dBm) – (43+10xLOG P(W))

The carrier was investigated at 421MHz, 462MHz, and 510MHz. The worse case (unwanted emissions) data are shown below. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 5-1: CONDUCTED SPURIOUS EMISSIONS CARRIER – 421 MHZ
(421 MHz); Conducted power = 0.0069 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
232.1	64.5	21.4	43.1
842.00	67.0	21.4	45.6
1263.0	42.5	21.4	21.1
2105.0	41,1	21.4	19.7
2526.0	32.1	21.4	10.7
2947.0	42.4	21.4	21.0
3367.9	47.4	21.4	26.0
3788.9	51.7	21.4	30.3
4209.9	63.0	21.4	41.6

TABLE 5-2: CONDUCTED SPURIOUS EMISSIONS CARRIER – 462 MHZ

(462 MHz); Conducted power = 0.0055 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
231.0	66.4	20.4	46.0
924.0	59.8	20.4	39.4
1386.0	70.9	20.4	50.5
1848.0	58.0	20.4	37.6
2310.0	65.8	20.4	45.4
2772.2	68.4	20.4	48.0

TABLE 5-3: CONDUCTED SPURIOUS EMISSIONS CARRIER – 510 MHZ

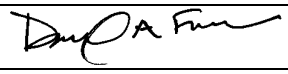
(510 MHz); Conducted power = 0.012 W

Frequency (MHz)	Level (dBc)	Limit (dBc)	Margin(dB)
255.0	78.1	23.8	54.3
1020.0	41.4	23.8	17.6
1530.0	68.6	23.8	44.8
2040.0	47.3	23.8	23.5
2550.0	37.1	23.8	13.3
3060.0	43.5	23.8	19.7
3570.0	47.0	23.8	23.2
4080.0	57.0	23.8	33.2
4590.0	61.2	23.8	37.4
5100.0	57.8	23.8	34.0

TABLE 5-4: TEST EQUIPMENT USED FOR TESTING (CONDUCTED SPURIOUS EMISSIONS)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8564EM	EMC Analyzer (9 kHz - 12.8 GHz)	3826A00144	08/23/03
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	07/31/04
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	08/31/03
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz – 6.5 GHz)	3325A00159	12/05/04

TEST PERSONNEL:

DESMOND FRASER		MAY 12, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

6 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): FIELD STRENGTH OF SPURIOUS RADIATION

6.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.12; the transmitter is terminated with a 50 Ω load. The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. The signal generator level was then corrected by subtracting the cable loss between the substitution antenna and the signal generator. The gain of the antenna was further corrected to a half wave dipole.

ANSI/TIA/EIA-603-1992, section 2.2.11 and TIA/EIA-102.CAAA-1999 section 2.2.5

Device with audio modulation: Transmitter was modulated with a 2,500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1,000 Hz.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps; a voltage of 3.3Vpp with an offset of 1.65V was used to produce standard deviation.

6.2 TEST DATA

6.3 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 6-1: FIELD STRENGTH OF SPURIOUS HARMONIC-CARRIER AT 421 MHZ

Radiated Spurious Emissions; Carrier 421 MHz; Limit = 43 + 10 Log P = 43 dBc; Conducted Power = 0.0069W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Limit (dBc)	Margin (dB)
842.0	70.3	-48.0	2.1	-1.2	53.0	14.7	-38.3
1263.0	67.5	-50.0	2.5	2.4	51.8	14.7	-37.1
1684.0	61.5	-53.7	3.0	4.7	53.6	14.7	-38.9
2105.0	38.8	-54.0	3.3	4.9	54.1	14.7	-39.4
2526.0	38.7	-53.6	3.7	5.2	53.8	14.7	-39.2
2947.0	31.2	-59.3	4.1	6.1	58.9	14.7	-44.3
3368.0	30.8	-59.6	4.4	6.0	59.7	14.7	-45.0
3789.0	31.5	-57.3	4.7	5.9	57.8	14.7	-43.1
4210.0	30.2	-55.1	4.9	6.4	55.3	14.7	-40.7

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 6-2: FIELD STRENGTH OF SPURIOUS HARMONIC-CARRIER AT 462 MHZ

Radiated Spurious Emissions; Carrier 462 MHz; Limit = 43 + 10 Log P = 43 dBc; Conducted Power = 0.0055W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Limit (dBc)	Margin (dB)
924.0	43.0	-74.8	2.2	-1.2	83.0	17.8	-65.2
1386.0	51.8	-65.7	2.7	3.6	69.6	17.8	-51.8
1848.0	36.8	-76.8	3.1	4.8	79.9	17.8	-62.1
2310.0	30.8	-62.7	3.4	5.0	65.9	17.8	-48.1
2772.0	31.3	-61.2	4.0	5.8	64.2	17.8	-46.5
3234.0	31.7	-58.9	4.2	6.1	61.8	17.8	-44.1
3696.0	30.3	-58.9	4.6	5.9	62.3	17.8	-44.6
4158.0	32.3	-54.0	4.9	6.2	57.4	17.8	-39.7
4620.0	31.5	-55.8	5.2	7.0	58.7	17.8	-41.0

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 6-3: FIELD STRENGTH OF SPURIOUS HARMONIC-CARRIER AT 510 MHZ

Radiated Spurious Emissions; Carrier 510 MHz; Limit = 43 + 10 Log P = 43 dBc; Conducted Power = 0.012W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBc)	Limit (dBc)	Margin (dB)
1020.0	59.8	-60.7	2.3	0.0	70.2	20.2	-50.0
1530.0	60.3	-55.4	2.8	4.7	60.7	20.2	-40.5
2040.0	59.0	-54.3	3.2	4.9	59.9	20.2	-39.7
2550.0	38.5	-53.3	3.8	5.2	59.0	20.2	-38.8
3060.0	35.8	-54.4	4.2	6.2	59.5	20.2	-39.3
3570.0	35.8	-53.5	4.6	5.9	59.4	20.2	-39.2
4080.0	36.8	-50.5	4.8	6.0	56.5	20.2	-36.3
4590.0	33.8	-53.2	5.1	7.0	58.5	20.2	-38.3
5100.0	32.0	-55.0	5.4	6.9	60.7	20.2	-40.5

*This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.

TABLE 6-4: TEST EQUIPMENT USED FOR TESTING (FIELD STRENGTH OF SPURIOUS RADIATION)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	06/11/04
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	N/A
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	07/02/04
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	04/19/04
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 - 20 GHz)	3610A00866	06/19/04

TEST PERSONNEL:

DAN BALTZELL		MAY 17, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

7 FCC RULES AND REGULATIONS PART 2 §2.1053 (A): RADIATED ERP

7.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.12; the transmitter is terminated with a 50 Ω load. The spurious emissions levels were measured and the device under test was replaced by a substitution antenna connected to a signal generator. The signal generator level was then corrected by subtracting the cable loss between the substitution antenna and the signal generator. The gain of the antenna was further corrected to a half wave dipole.

ANSI/TIA/EIA-603-1992, section 2.2.11 and TIA/EIA-102.CAAA-1999 section 2.2.5

Device with audio modulation: Transmitter was modulated with a 2,500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1,000 Hz.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps; a voltage of 3.3Vpp with an offset of 1.65V was used to produce standard deviation.

7.2 TEST DATA

TABLE 7-1: RADIATED ERP

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Signal Generator Level (dBm)	ERP (mW)
421.0	84.3	3.7	1.4	-0.6	1.7	1.5
462.0	87.5	6.8	1.5	-0.6	4.8	3.0
510.0	89.5	9.3	1.6	-0.6	9.3	8.5

TABLE 7-2: TEST EQUIPMENT USED FOR TESTING (FIELD STRENGTH OF SPURIOUS RADIATION)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901053	Schaffner-Chase	CBL6112	Antenna (25 MHz – 2 GHz)	2648	06/11/04
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	N/A
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	07/02/04
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	04/19/04
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 - 20 GHz)	3610A00866	06/19/04

TEST PERSONNEL:

DAN BALTZELL		MAY 17, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

8 FCC RULES AND REGULATIONS PART 2 §2.1049 (C) (1): OCCUPIED BANDWIDTH

OCCUPIED BANDWIDTH - COMPLIANCE WITH THE EMISSION MASKS

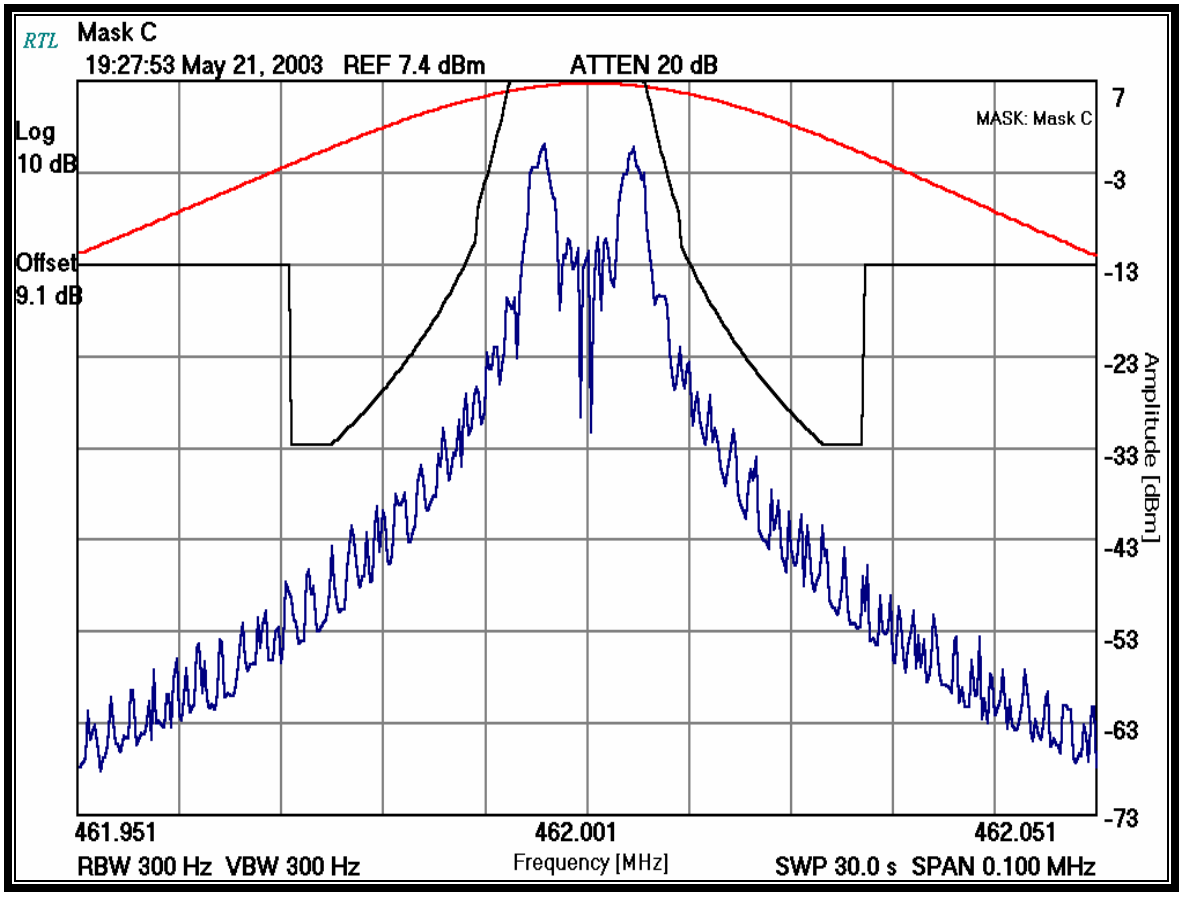
8.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.11 and TIA/EIA-102.CAAA-1999 section 2.2.5

Device with audio modulation: Transmitter was modulated with a 2,500 Hz sine wave at an input level of 16 dB greater than that required to produce 50% of rated system deviation at 1,000 Hz.

Device with digital modulation: Modulated to its maximum extent using a pseudo random data sequence – 9600-bps; a voltage of 3.3Vpp with an offset of 1.65V was used to produce standard deviation.

8.2 TEST DATA



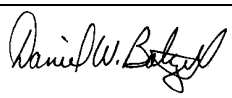
PLOT 8-1: OCCUPIED BANDWIDTH; DIGITAL MODULATION

8.3 TEST EQUIPMENT USED FOR TESTING

TABLE 8-1: TEST EQUIPMENT USED FOR TESTING (OCCUPIED BANDWIDTH)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM (9 kHz - 12.8 GHz)	EMC Analyzer	3826A00144	08/23/04
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	06/14/04

TEST PERSONNEL:

DAN BALTZELL		MAY 21, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

9 FCC RULES AND REGULATIONS PART 2 §2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

Necessary Bandwidth and Emission Bandwidth:

Type of Emission: F1D

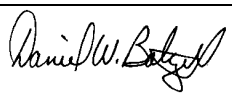
Necessary Bandwidth and Emission Bandwidth:
25kHz (WB channel): Bn = 16K0F1D

Calculation:
Max modulation(M) in kHz : 3
Max deviation (D) in kHz: 5
Constant factor (K) : 1
Bn = 2xM+2xDK

TABLE 9-1: TEST EQUIPMENT USED FOR NECESSARY AND EMISSION BANDWIDTH MEASUREMENTS

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900913	Hewlett Packard	8546	EMI Receiver	3325A00159	12/05/04
900914	Hewlett Packard	85460	RF Filter Section	3330A00107	12/05/04

TEST PERSONNEL:

DAN BALTZELL		JULY 10, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

10 FCC RULES AND REGULATION PART 2 §2.1055: FREQUENCY STABILITY

10.1 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 +60°C.

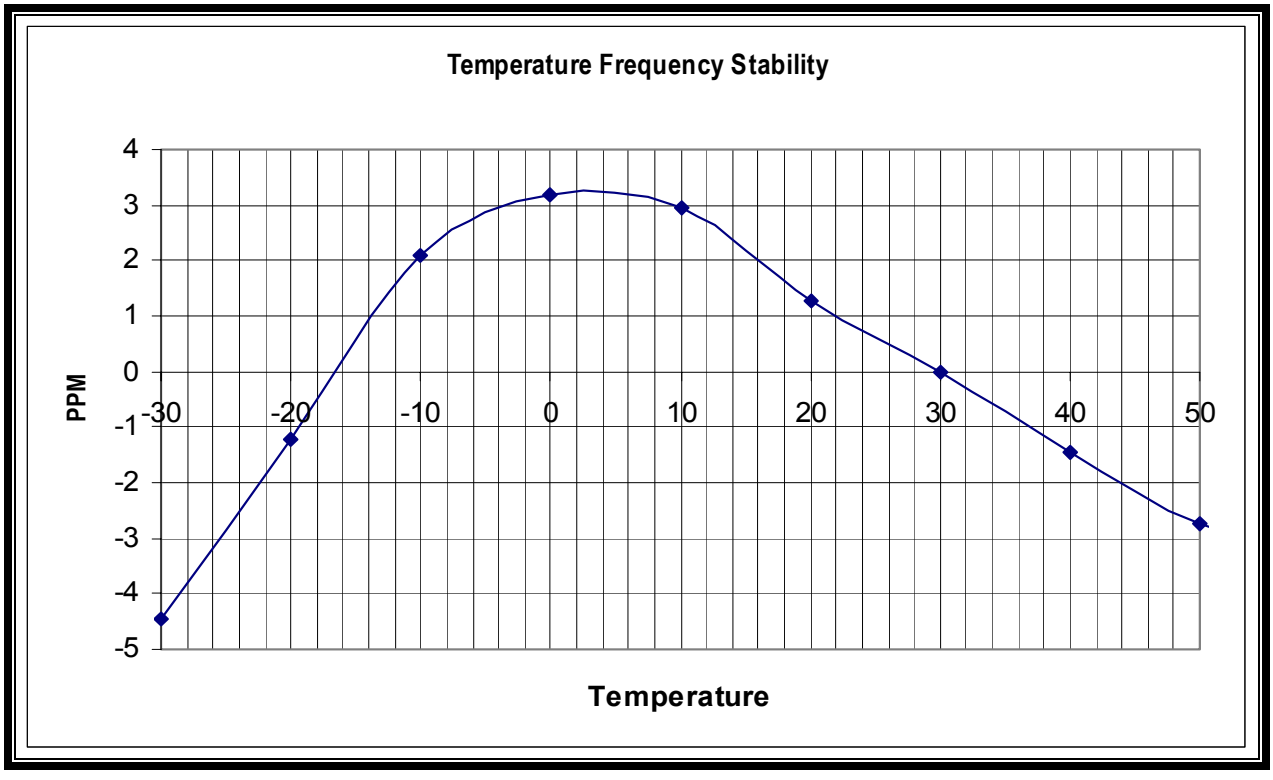
The temperature was initially set to -30°C and a 2-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A half 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 the battery end point to maximum voltage.

The worst-case test data are shown in Table 11-1.

10.2 TEST DATA

10.3 FREQUENCY STABILITY/TEMPERATURE VARIATION

Worst-case deviation was found to be -4.436 ppm at -30°C.



PLOT 10-1: TEMPERATURE FREQUENCY STABILITY

TABLE 10-1: TEMPERATURE FREQUENCY STABILITY CARRIER AT 462 MHZ

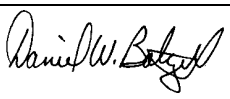
Temperature C	Measured Frequency (MHz)	ppm
-30	462.560448	-4.436
-20	462.561940	-1.211
-10	462.563460	2.075
0	462.563965	3.167
10	462.563860	2.940
20	462.563080	1.254
30	462.562490	-0.022
40	462.561833	-1.442
50	462.561233	-2.739
60	462.561088	-3.053
70	462.561878	-1.345
80	462.563278	1.682

Reference frequency: 462.562500 MHz

TABLE 10-2: TEST EQUIPMENT USED FOR TESTING (FREQUENCY STABILITY/TEMPERATURE)

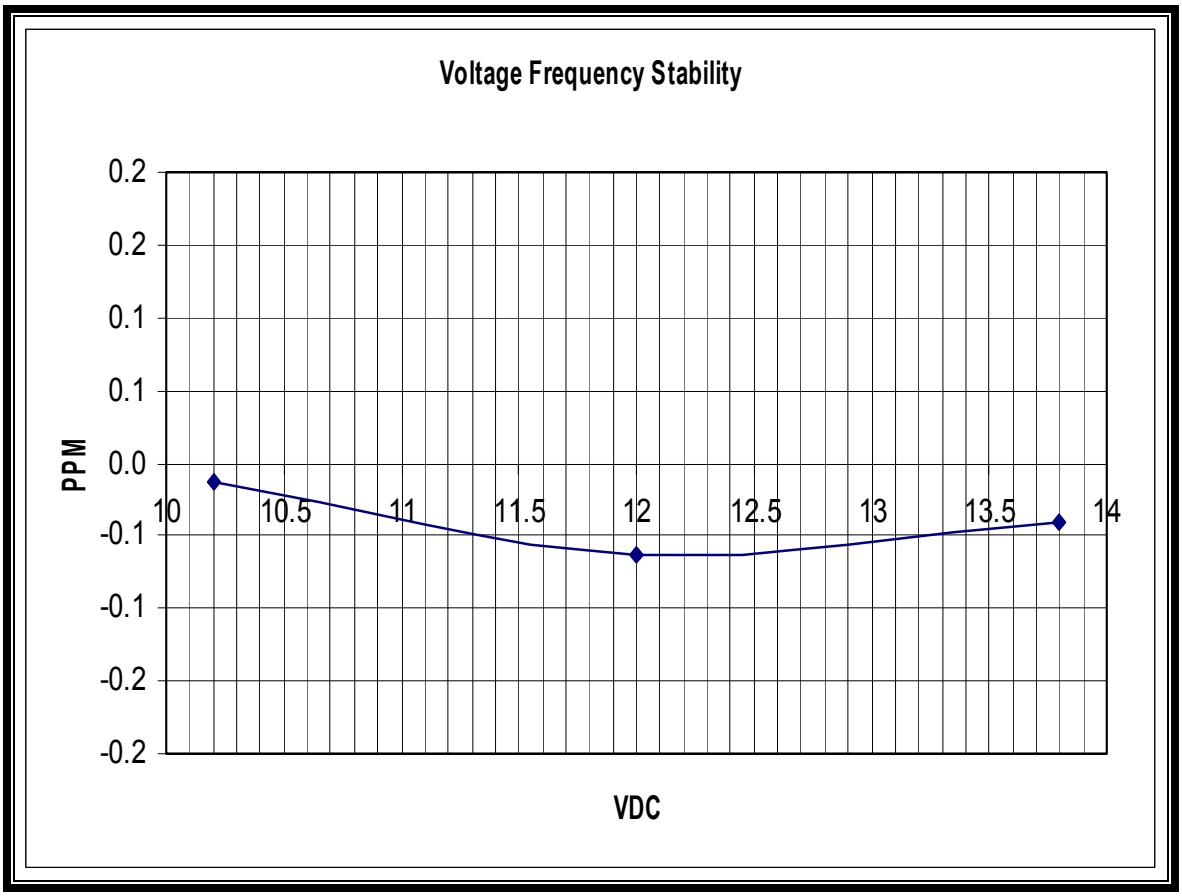
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	12/16/03
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	06/14/04

TEST PERSONNEL:

DAN BALTZELL		JULY 1, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

10.4 FREQUENCY STABILITY/VOLTAGE VARIATION

Worst-case variation is -0.063 ppm at the 12.0 VDC.



PLOT 10-2: VOLTAGE FREQUENCY STABILITY

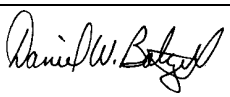
TABLE 10-3: FREQUENCY STABILITY/VOLTAGE VARIATION CARRIER AT 462 MHZ

Voltage (Vdc)	Measured Frequency (MHz)	ppm
10.2	462.562494	-0.013
12.0	462.562471	-0.063
13.8	462.562481	-0.041

TABLE 10-4: TEST EQUIPMENT USED FOR TESTING (FREQUENCY STABILITY/VOLTAGE)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901215	Hewlett Packard	8596EM (9 kHz - 12.8 GHz)	EMC Analyzer	3826A00144	08/23/03
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	06/14/04

TEST PERSONNEL:

DAN BALTZELL		MAY 17, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

11 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE

11.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.6

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

The input audio level at 1000 Hz was set to produce 20% of the rated system deviation. This point is shown as the 0 dB reference level, noted DEVref. The audio signal generator was varied from 100 Hz to 5 kHz with the input level held constant. The deviation in kHz was recorded using a modulation analyzer as DEVfreq. The response in dB relative to 1 kHz was calculated as follows:

Audio Frequency Response = 20 LOG (DEVfreq/DEVref)

11.2 TEST DATA

Not applicable; **the EUT transmits data only**.

12 FCC PART 2 §2.1047 (A): MODULATION CHARACTERISTICS – AUDIO LOW PASS FILTER

12.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, 2.2.15

The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

12.2 TEST DATA

Not applicable; the EUT does not contain an audio low pass filter. **The EUT transmits only data.**

13 FCC RULES AND REGULATIONS PART 2 §2.1047 (B): MODULATION CHARACTERISTICS - MODULATION LIMITING

13.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.3

The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level as a reference (0dB) the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz. The system deviation obtained as a function of the input level was recorded. Both positive and negative peak deviations were recorded.

13.2 TEST DATA

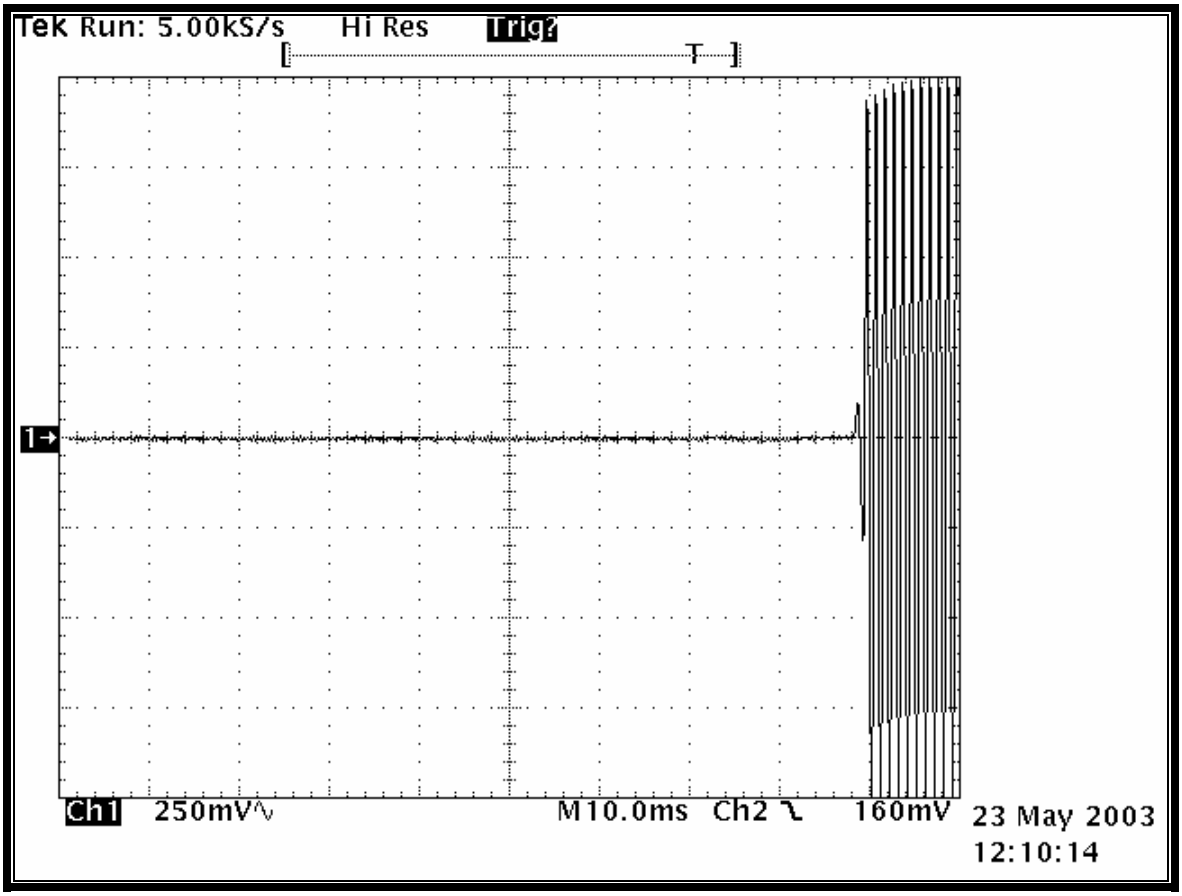
Not applicable; the EUT does not contain modulation limiting circuitry. **The EUT transmits only data.**

14 FCC RULES AND REGULATIONS PART 90 §90.214: TRANSIENT FREQUENCY BEHAVIOR

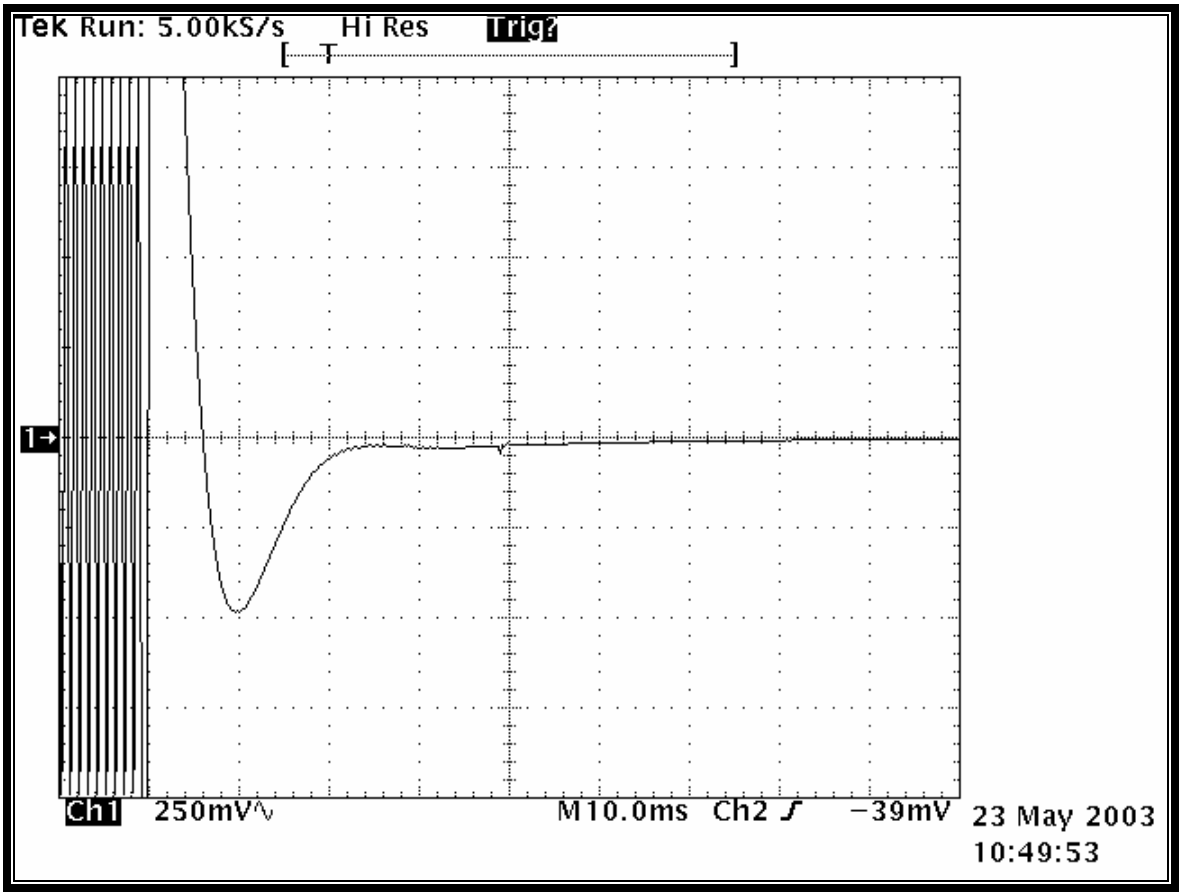
14.1 TEST PROCEDURE

ANSI/TIA/EIA-603-1992, section 2.2.3

14.2 TEST DATA



PLOT 14-1: TRANSIENT FREQUENCY BEHAVIOR – 462 MHZ; HIGH POWER; NARROW BAND; CARRIER OFF TIME



PLOT 14-2: TRANSIENT FREQUENCY BEHAVIOR – 462 MHZ; HIGH POWER; NARROW BAND; CARRIER ON TIME

TABLE 14-1: TEST EQUIPMENT USED FOR TESTING (TRANSIENT FREQUENCY BEHAVIOR)

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900917	Hewlett Packard	8648C	Signal Generator	3537A01741	04/19/04
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	06/14/04
900561	Tektronix	TDS540B	Oscilloscope	B020129	4/19/04
900352	Werlatone	C1795	Directional Coupler	4989	N/A

TEST PERSONNEL:

DANIEL BALTZELL		MAY 23, 2003
TEST TECHNICIAN/ENGINEER	SIGNATURE	DATE OF TEST

15 CONCLUSION

The data in this measurement report shows that the Funktechnik, GmbH, Inc., Model **#** -70TX-S**,** FCC ID: PUX-70TX-S complies with all the requirements of Parts 2, 15, 22, 74, 90 and 95 of the FCC Rules, and Industry Canada RSS-119, Issue 6, 2000.