



Engineering and Testing for EMC and Safety Compliance

TYPE CERTIFICATION REPORT

Funktechnik GmbH
Zum Handenberg 3
Primstal, D-6620
Germany

MODEL: 70 RX – M1

FCC ID: PUX-70RX-M1

October 3, 2001

STANDARDS REFERENCED FOR THIS REPORT	
PART 15: 1999	§15.109: RADIATED EMISSIONS LIMITS
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

Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
420-510	N/A	N/A	N/A

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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 RX-M1, FCC ID: PUX-70RX-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. 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 and conducted data is located at Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and 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	
PART 15: 1999	§15.109: RADIATED EMISSIONS LIMITS, §15.111: ANTENNA CONDUCTED SPURIOUS EMISSIONS
ANSI C63.4-1992	STANDARD FORMAT MEASUREMENT/TECHNICAL REPORT PERSONAL COMPUTER AND PERIPHERALS

Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
420-510	N/A	N/A	N/A

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 Certification methodology.

Signature: 

Date: October 4, 2001

Typed/Printed Name: Bruno Clavier

Position: Vice President of Operations
(NVLAP Signatory)

Signature: 

Date: October 4, 2001

Typed/Printed Name: Daniel W. Baltzell

Position: Test Technician

 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
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
ANTENNA	HM-FUNKTECHNIK GMBH	LAFAYETTE	N/A	N/A	N/A	013582
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
ANTENNA	HM-FUNKTECHNIK GMBH	LAFAYETTE	N/A	N/A	N/A	013581
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
ANTENNA	HM-FUNKTECHNIK GMBH	LAFAYETTE	N/A	N/A	N/A	N/A

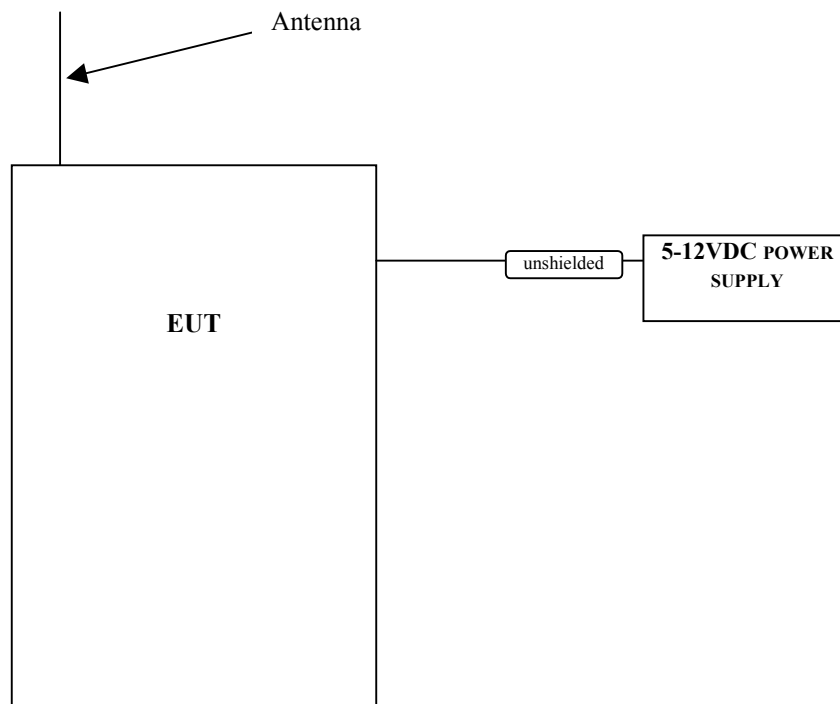


FIGURE 3-1: CONFIGURATION OF TESTED SYSTEM



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 PART 15.107 - CONDUCTED EMISSIONS – AC POWER LINES

5.1 CONDUCTED MEASUREMENT

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

6 PART 15.109 - 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.



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

6.3 TEST PROCEDURE

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

The frequencies 420.025, 465.000, 509.975 MHz were generated using an external antenna and a signal generator which was modulated with a tone to active the receiver LO circuitry to measure the receiver frequencies.

6.4 TEST DATA

The frequency range of measurement is per FCC Part 15.33. The following channels, LO, and IF frequencies were investigated: 420.025 MHz, 465.000 MHz, 509.975 MHz, 398.6 MHz, 443.6 MHz, 488.575 MHz, 21.4 MHz, 12.45 MHz, 13.84 MHz, 15.26 MHz, and 455 kHz. The worse case (unwanted emissions) channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

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

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
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 2.1051 AND PART 15.111: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1 TEST PROCEDURE; CONDUCTED MEASUREMENT

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

The receiver was terminated with a 50 Ω load and interfaced with a spectrum analyzer.

7.2 TEST DATA

Frequency range of measurement per FCC Part 15.33

The following channels, LO, and IF frequencies were investigated: 420.025 MHz, 465.000 MHz, 509.975 MHz, 398.6 MHz, 443.6 MHz, 488.575 MHz, 21.4 MHz, 12.45 MHz, 13.84 MHz, 15.26 MHz, and 455 kHz.

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

TABLE 7-1: 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

TABLE 7-2: 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



TABLE 7-3: 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


SIGNATURE

AUGUST 3, 2001
DATE OF TEST

TABLE 7-4: TEST EQUIPMENT USED

RTL Asset #	Manufacturer	Model	Part Type	Serial Number
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 KHz – 6.5 GHz)	3325A00159