Engineering and Testing for EMC and Safety Compliance

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TYPE CERTIFICATION REPORT

MINIATURE TRANSMITTER

AeroComm, Inc.
464 Hudson Terrace
Englewood Cliffs, NJ 07632
(201) 227-0066

Model: 50757TX-F

FCC ID: PJ6-5075TX-F90

March 12, 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 90: 1998	PRIVATE LAND 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

FCC Rules Parts	Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
90	956MHz	0.1	N/A	48K0F1D

REPORT PREPARED BY:

Test Engineer: Daniel Baltzell
Administrative Writer: Melissa Carter

Document Number: 2001007 / QRTL00-1020 {REV-1}

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1 GENERAL INFORMATION

The following Report of a Type Certification, is prepared on behalf of ***AeroComm, Inc.*** in accordance with the Federal Communications Commissions Rules and Regulations Part 90 and Part 2. The Equipment Under Test (EUT) was the ***Miniature Transmitter Model: 50757TX-F***. The test results reported in this document relate only to the item that was tested. The digital portion of this transmitter was tested and found in compliance with Part 15 subpart B. A test report is available upon request.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47 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 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.

2 CONFORMANCE STATEMENT

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PART 2: 1999	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
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FCC Rules Parts	Frequency Range	Output Power (W)	Freq. Tolerance	Emission Designator
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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 Certification methodology.

Signature: ____________________ Date: March 12, 2001

Typed/Printed Name: Bruno Clavier Position: Vice President of Operations (NVLAP Signatory)

Signature: ____________________ Date: March 12, 2001

Typed/Printed Name: Daniel Baltzell Position: Test Engineer

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.

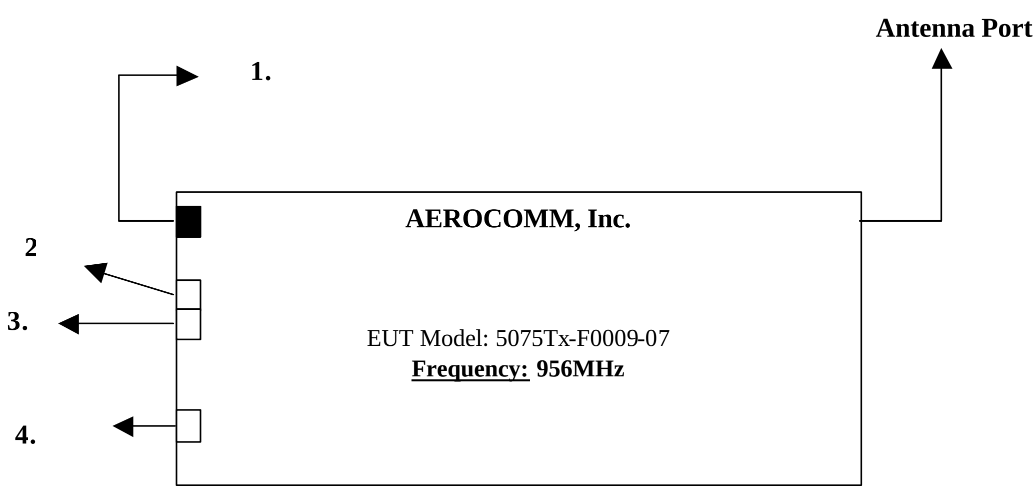
TABLE 1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
TRANSMITTER	AERO COMM, INC.	50757TX-F (956 MHZ)	0009-04	SAMPLE	N/A	012914

TABLE 2: ANTENNA INFORMATION

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
ANTENNA PART	AERO COMM, INC.	ANTENNA ASSEMBLY	800044-01	N/A	N/A	012962

FIGURE 1: CONFIGURATION OF TESTED SYSTEM



1. to 5V power supply
2. to 12V power supply
3. TX key (connected to 12V)
4. Data key (connected to function generator)

4 TEST MYTHOLOGY

4.1 Conducted Measurement

The device is NOT powered from a low voltage public network. It is typically powered from a high voltage electric lines (e.g. 25kV AC/DC converted). Therefore, conducted emissions are not required.

4.2 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.

4.3 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:

$$FI(dBuV/m) = SAR(dBuV) + SCF(dB/m)$$

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:

$$SCF(dB/m) = -PG(dB) + AF(dB/m) + CL(dB)$$

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:

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

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:

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

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

TABLE 3: RADIATED EMISSIONS (DIGITAL DEVICE)

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)
53.110	Qp	V	350	1.0	56.3	-22.0	34.3	40.0	-5.7
79.661	Qp	V	30	1.0	55.8	-22.3	33.5	40.0	-6.5
106.216	Qp	V	350	1.0	52.0	-15.7	36.3	43.5	-7.2
132.784	Qp	V	350	1.0	37.4	-15.5	21.9	43.5	-21.6
185.894	Qp	V	90	1.0	49.6	-17.6	32.0	43.5	-11.5
200.000	Qp	H	0	4.0	28.3	-17.8	10.5	43.5	-33.0
212.441	Qp	V	30	1.0	49.3	-17.4	31.9	43.5	-11.6
238.996	Qp	V	0	1.0	53.6	-15.8	37.8	46.0	-8.2
265.551	Qp	V	20	1.0	37.8	-14.2	23.6	46.0	-22.4
300.000	Qp	H	0	4.0	28.3	-13.5	14.8	46.0	-31.2
955.987	Qp	V	15	1.0	43.5	-2.5	41.0	46.0	-5.0
1433.980	Av	V	0	1.0	33.7	2.5	36.2	54.0	-17.8

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

5.1 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.

5.2 Test Equipment

Power Meter	HP437B	s/n 2949A02966
	HP 8901A	s/n 2545A04102 (power mode)
Power Sensor	HP8481B	s/n 2702A05059
Frequency Counter	HP8901A	s/n 2545A04102 (Frequency mode)

5.3 Test Data

The following channel (in MHz) was tested: 956.000
The worst-case Output Power (highest) levels are shown.

TABLE 4: CARRIER OUTPUT POWER (UNMODULATED)

Power Setting	RF Power measured (Watt)*
High	0.1

*Measurement accuracy: +/- 3%

TABLE 5: RATED POWER:

Power Setting	Rated Power (W)
High	0.1

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

6.1 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. The transmitter is modulated to its maximum extent 9,600bps.

6.2 Test Equipment

Audio Generator:
Synthesized Level Generator HP3336B s/n 2127A00559
Audio Signal Analyzer Tektronix ASG 100 s/n B032374

Spectrum Analyzer:
HP8564E s/n 3943A01719
HP8546A s/n 3525A00159

6.3 Test Data

CFR Part 90 Requirements: Part 90.217 (a) and (b). Frequency range of measurement per Part 2.1057: 9kHz to 10 x Fc. Limit: -30 dBc

The following channel (in MHz) was investigated: 956.0. 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.

TABLE 6: SPURIOUS EMISSIONS

Frequency (MHz)	Emissions (dBc)	Limit (dBc)	Margin (dB)
478.0	-60.5	-30.0	-30.5
956.0	0.0	N/A	N/A
1912.0	-59.7	-30.0	-29.7
2868.0	-54.3	-30.0	-24.3
3824.0	-61.2	-30.0	-31.2
4780.0	-59.3	-30.0	-29.3
5736.0	-44.3	-30.0	-14.3
6692.0	-52.8	-30.0	-22.8
7648.0	-60.7	-30.0	-30.7
8604.0	-61.5	-30.0	-31.5
9560.0	-58.7	-30.0	-28.7

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

7.1 Test Procedure

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

The transmitter is terminated with a 50 Ω load and is modulated to its maximum extent. Refer to section "Radiated Measurement" in this report for further information.

7.2 Test Equipment

Antenna:	CHASE CBL6112	s/n 2099
Amplifier:	HP8449B	s/n 3008A00505
Spectrum analyzer:	HP8564E	s/n 3943A01719
RF Signal Generator	HP8648C	s/n 3537A01741
Synthesized Sweeper	HP83752A	s/n 3610A00846

7.3 Test Data

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.

Limit: -30 dBc Absolute limit level: -10 dBm

TABLE 7: FIELD STRENGTH OF SPURIOUS RADIATION {SUBSTITUTION METHOD}

Carrier 100 mW = 20 dBm

Frequency (MHz)	Signal Generator Level (dBm)	Cable Loss (dB)	Corrected RX Antenna Gain	Corrected Signal Generator (dBm)	Limit (dBm)	Margin (dB)
1911.968	-44.9	7.9	***4.9	-47.9	-10.0	-37.9
2867.952	-28.1	12	***6.0	-34.1	-10.0	-24.1
3823.936	-45.9	16.3	***5.9	-56.3	-10.0	-46.3
4779.92	-42.5	21.5	***7.0	-57.0	-10.0	-47.0
5735.904	-37.4	21.4	***6.6	-52.2	-10.0	-42.2
6691.888	-37.7	20.8	***7.8	-50.7	-10.0	-40.7
7647.872	NF					
8603.856	NF					
9559.84	NF					

- **Cable Loss** - This insertion loss corresponds to the cable connecting the RF Signal Generator to the ½ wave dipole antenna.
- **NF** - Noise floor
- **Corrected RX Antenna Gain** - Difference in gain between the substitution antenna relative to a ½ wave dipole

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

Device with audio modulation: N/A

Device with digital modulation: Operation to its maximum extent 9,600 bps.

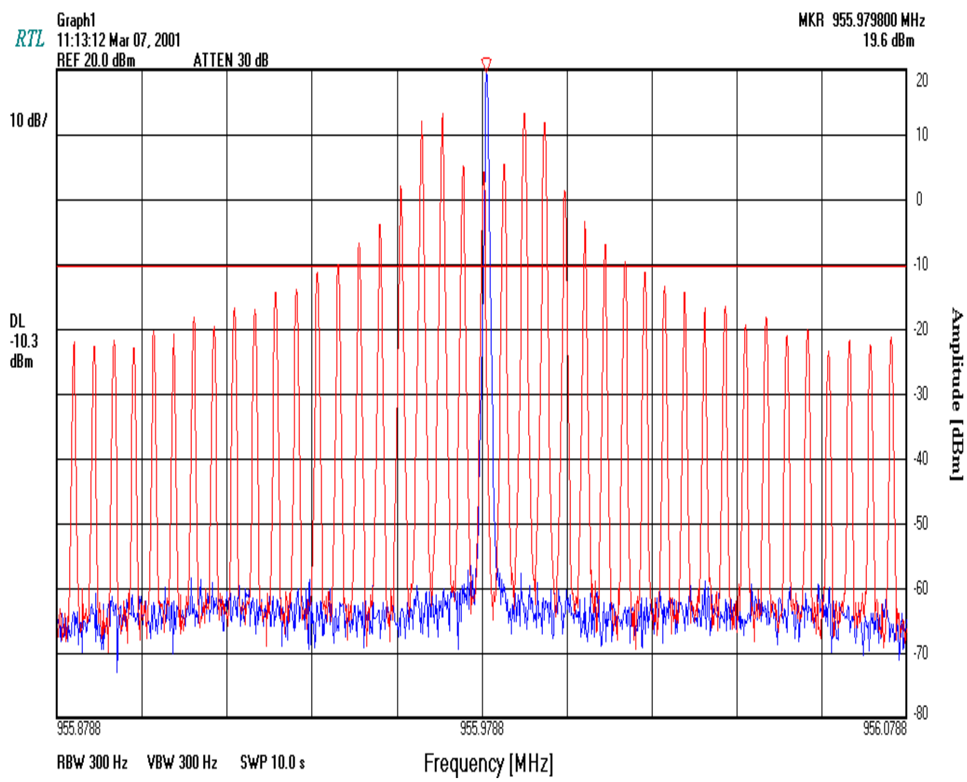
8.2 Test Equipment

Spectrum Analyzer HP8564E s/n 3943A01719

8.3 Test Data

Channel Spacing/Bandwidth 25 kHz.

PLOT 1: OCCUPIED BANDWIDTH



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

9.1 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.
Note: Com Net Ericsson has requested that the range be extended 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 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.

9.2 Test Equipment

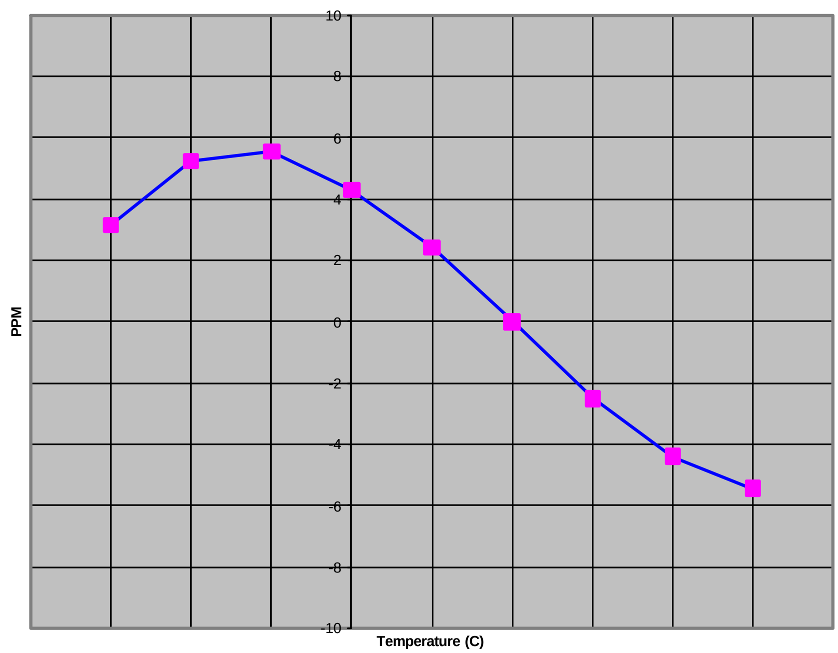
Temperature Chamber	Tenney TH65	s/n 11380
Frequency Counter	HP8901A (Frequency Mode)	s/n 2545A04102

9.3 Test Data

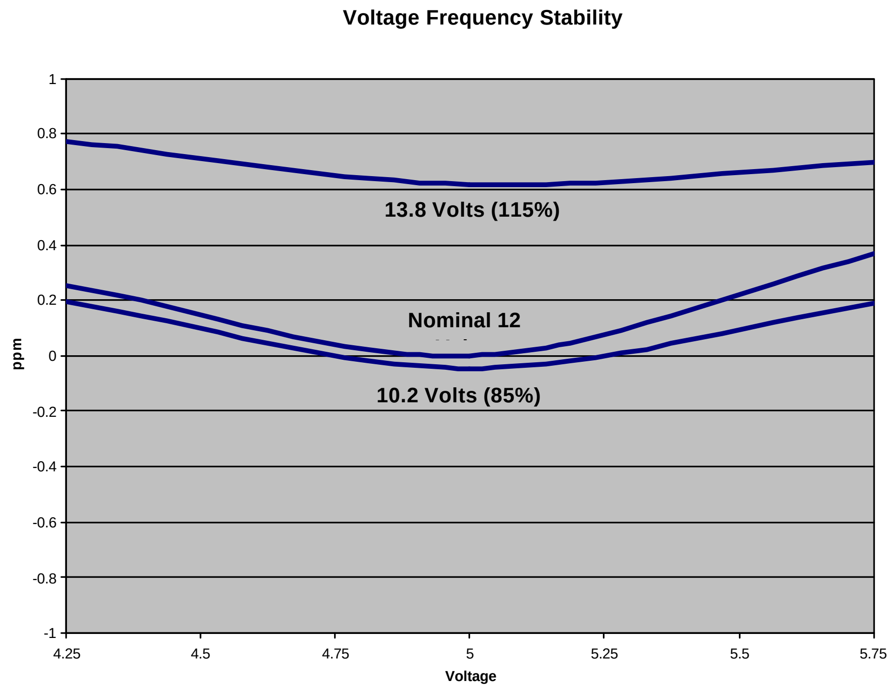
PLOT 2: FREQUENCY STABILITY/FREQUENCY VARIATION

The worst-case temperature deviation is as follows.
Assigned Frequency 956 MHz

Temperature Frequency Stability



PLOT 3: FREQUENCY STABILITY/VOLTAGE VARIATION



10 FCC RULES AND REGULATIONS PART 2.202: NECESSARY BANDWIDTH AND EMISSION BANDWIDTH

The transmitter is modulated to its maximum extent with an information rate of 9,600bps.

Type of Emission: F1D

Necessary Bandwidth and Emission Bandwidth (measured at 99% Power Bandwidth):
Bn = 48.0 kHz

Emission designator: 48K0F1D