EMC COMPLIANCE ENGINEERING AND TESTING

NVLAP Accredited

APPLICATION FOR FCC CERTIFICATION

UNLICENSED LOW POWER TRANSMITTER

Telean Technology, Ltd
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MODEL: UAHTX-RF02-49 Transmitter

FCC ID: MQ5-FM-04-TX

December 15, 1999

This report concerns (check one): **Equipment Type**: **Transmitter**	**Original Grant:** X	**Class II Change:**
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? **If yes, defer until:**	**Yes:** ____________ ***Date***	**No**: X
Company name agrees to notify the Commission by: ____________(date) of the intended date of announcement of the product so that the grant can be issued on that date.		

REPORT PREPARED BY:

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1.0 GENERAL INFORMATION

The following Application for FCC Certification of a Unlicensed Low Power Transmitter is prepared on behalf of Telean Technology, Ltd in accordance with Part 2, and Part 15, Subparts A and C of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the UAHTX-RF02-49 Transmitter, FCC ID: MQ5-FM-04-TX. 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 ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conform with the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instruments. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated and conducted emission measurements were performed manually at Rhein Tech Laboratories, Inc. The radiated emission measurements required by the rules were performed on the 3/10 meter open field test ranges maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission.

Since the device is battery operated power line conducted measurements were not required. Conducted measurement with a connection to analyzer soldered to PCB at the antenna location for both the transmitter and receiver portions. The 9 kHz – 30 MHz receiver plot was taken at max hold and turned at the lowest frequency of 48 MHz and the highest frequency of 51 MHz, and no noticeable signals were seen.

1.1 RELATED SUBMITTAL(S)/GRANT(S)/DOC(S)

This is an original submission for Certification.

1.3 TEST SYSTEM DETAILS

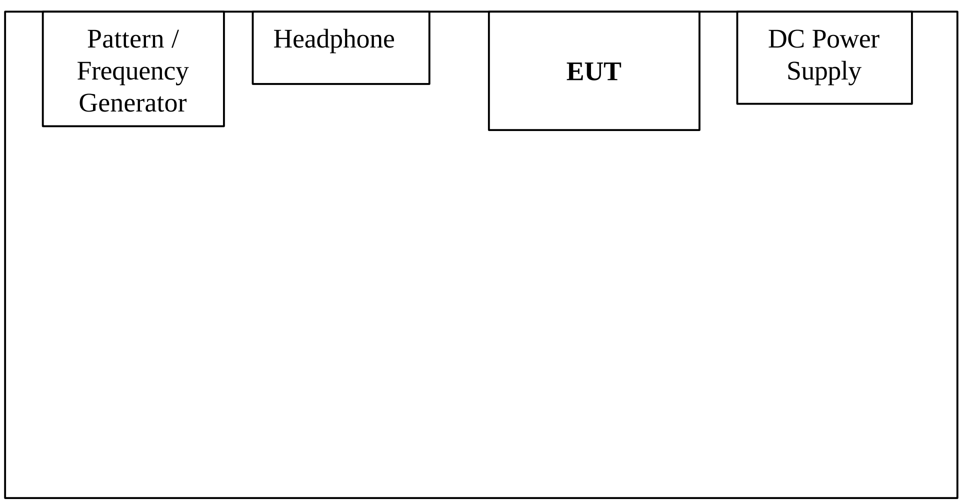
Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test.

TABLE 1: TEST SYSTEM DETAILS

External Components

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
POWER SUPPLY	HEWLETT PACKARD	6291	1928A05385	N/A	UNSHIELDED POWER	900773
PATTERN GENERATOR	PHILIPS	PM 5418 TDS	LO 604891	N/A	UNSHIELDED I/O UNSHIELDED POWER	900660
HEADPHONE (EUT)	**TELEAN TECHNOLOGY LTD**	**RF-777DV-RX 49MHZ**	**TTL-ES9911377**	**N/A**		**011302**
TRANSMITTER(EUT)	**TELEAN TECHNOLOGY LTD**	**FM-04-TX**	**TTL-ES9911365**	**N/A**	**UNSHIELDED I/O UNSHIELDED POWER**	**011301**

1.4 CONFIGURATION OF TESTED SYSTEM



1.5 TEST METHODOLOGY

Radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of one and three meters. The one meter test distance was used when there were strong ambient signals or extremely low spurious emissions that inhibited measuring at three meters per FCC 15.31 *f* (2). Section 3.1 contains other clocks and oscillators measured. FCC 15.227 average limit was used to determine the transmitter carrier amplitude. FCC 15.31 *f* (2) the square of an inverse linear distance extrapolation factor was used to extrapolate the new limit whenever an EUT to antenna distance other than the given FCC test distance for frequencies below 30 MHz per FCC 15.209 general radiation emission limit. Conducted emission testing was not performed on the host computer power line since the EUT does not have a power supply. The EUT's DC power is provided by an external 12V DC source.

1.6 TEST FACILITY

The open area test sites and conducted measurement facility used to collect the radiated data is located on the rear lot of Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400 in Herndon, Virginia. Our open area test sites 1 and 2 are approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

3.0 SYSTEM TEST CONFIGURATION

3.1 JUSTIFICATION

The EUT does not have a power supply for AC power; the conducted emissions measurement was performed on the computer's AC power line. The EUT was also tested in two orthogonal planes, namely vertical and horizontal. The following local oscillators, crystals and IF were investigated and measured:

1 Transmitter channel 1 = 49.1 ± 0.05 MHz,
2 Transmitter channel 2 = 49.7 ± 0.05 MHz,
3 Receiver Low Frequency = 58.7 MHz,
4 Receiver High Frequency = 61.7 MHz
5 Transmitter microcontoller oscillator = 4 MHz
6 Receiver channel 1 = 48.0 ± 0.5 MHz
7 Receiver channel 2 = 51.0 ± 0.5 MHz
8 Receiver IF Amplifier 10.7 MHz

3.2 EUT EXERCISE SOFTWARE

The EUT was powered with an external 12V power supply and a 1 kHz tone applied to the input.

The receiver was powered by 2AA cells (3V) and was tuned to the appropriate frequency.

3.3 OCCUPIED BANDWIDTH AND SPURIOUS NOISE

The EUT was set up as per section 1.4 and the transmitter carrier at channel 1 and channel 2 were measured per ANSI 63.4 occupied bandwidth measurement. The resolution and video bandwidth were set at 10 KHz. The sweeptime was set so that the receiver filters were properly charged. The carrier was on all the time. See the occupied bandwidth plots.

3.4 CERTIFICATION STATEMENT

I, 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 during testing to the equipment in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Signature: Date: December 15, 1999

Typed/Printed Name: Desmond A. Fraser Position: President

(NVLAP Signatory)

Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

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

5.0 RADIATED EMISSION DATA

The following data lists the worst case emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit. Explanation of the Correction Factor is given in paragraph 6.1.

TABLE 2: RADIATED EMISSIONS; CHANNEL 1

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10.247	Qp	V	180	0.0	41.2	-2.6	38.6	69.5	-30.9
49.700	Qp	V	130	1.0	40.6	-21.2	19.4	40.0	-20.6
99.400	Qp	V	180	1.0	46.1	-17.2	28.9	43.5	-14.6
149.100	Qp	V	30	1.0	38.0	-17.3	20.7	43.5	-22.8
198.800	Qp	V	130	1.0	39.7	-17.9	21.8	43.5	-21.7
248.500	Qp	V	10	1.0	37.6	-15.3	22.3	46.0	-23.7
298.200	Qp	V	270	1.0	36.1	-14.3	21.8	46.0	-24.2
347.900	Qp	V	310	1.0	35.7	-11.9	23.8	46.0	-22.2
397.600	Qp	V	180	1.0	35.7	-11.0	24.7	46.0	-21.3
447.300	Qp	V	180	1.0	35.2	-9.6	25.6	46.0	-20.4
497.000	Qp	V	180	1.0	34.8	-8.2	26.6	46.0	-19.4

See Appendix B for Radiated Test Methodology.

TEST PERSONNEL:

Signature: Daniel W. Baltzell

Date: December 10, 1999

Typed/Printed Name: Daniel W. Baltzell

TABLE 3: RADIATED EMISSIONS; CHANNEL 2

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10.123	Qp	V	180	0.0	25.7	-2.6	23.1	69.5	-46.4
49.100	Qp	V	130	1.0	42.2	-21.0	21.2	40.0	-18.8
98.200	Qp	V	180	1.0	47.5	-17.5	30.0	43.5	-13.5
147.300	Qp	V	50	1.0	37.0	-17.3	19.7	43.5	-23.8
196.400	Qp	V	0	1.0	41.5	-17.9	23.6	43.5	-19.9
245.500	Qp	V	180	1.0	35.8	-15.4	20.4	46.0	-25.6
294.600	Qp	V	0	1.0	37.2	-14.3	22.9	46.0	-23.1
343.700	Qp	V	130	1.0	35.0	-12.3	22.7	46.0	-23.3
392.800	Qp	V	180	1.0	36.9	-11.3	25.6	46.0	-20.4
441.900	Qp	V	280	1.0	34.3	-9.7	24.6	46.0	-21.4
491.000	Qp	V	180	1.0	34.2	-8.3	25.9	46.0	-20.1

See Appendix B for Radiated Test Methodology.

TEST PERSONNEL:

Signature: Date: December 10, 1999

Typed/Printed Name: Daniel W. Baltzell

5.1 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 dBuV - 11.5 dB = 37.8 dBuV/m

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

APPENDIX B: Emissions Equipment List

DESCRIPTION	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. LAB
AMPLIFIER	HEWLETT PACKARD	11975A	2304A00348	TEST EQUITY
AMPLIFIER (S/A 1)	RHEIN TECH	PR-1040	00001	RTL
AMPLIFIER (S/A 2)	RHEIN TECH	RTL2	900723	RTL
AMPLIFIER (S/A 3)	RHEIN TECH	8447F	2944A03783	RTL
AMPLIFIER (S/A 4)	RHEIN TECH	8447D	2727A05397	RTL
BICONICAL/LOG ANTENNA 1	ANTENNA RESEARCH	LPB-2520	1037	LIBERTY LABS
BICONICAL/LOG ANTENNA 2	ANTENNA RESEARCH	LPB-2520	1036	LIBERTY LABS
FIELD SITE SOURCE	EMCO	4610	9604-1313	RTL
FILTER (ROOM 1)	SOLAR	8130	947305	RTL
FILTER (ROOM 2)	SOLAR	8130	947306	RTL
HARMONIC MIXER 1	HEWLETT PACKARD	11970K	2332A00563	TELOGY
HARMONIC MIXER 2	HEWLETT PACKARD	11970A	2332A01199	TELOGY
HORN ANTENNA 1	EMCO	3160-10	9606-1033	EMCO
HORN ANTENNA 2	EMCO	3160-9	9605-1051	EMCO
ROD ANTENNA	EMCO			
HORN ANTENNA 3	EMCO	3160-7	9605-1054	EMCO
HORN ANTENNA 4	EMCO	3160-8	9605-1044	EMCO
HORN ANTENNA 5	EMCO	3160-03	9508-1024	EMCO
LISN (ROOM 1/L1)	SOLAR	7225-1	900727	ACUCAL
LISN (ROOM 1/L2)	SOLAR	7225-1	900726	ACUCAL
LISN (ROOM 2/L1)	SOLAR	7225-1	900078	ACUCAL
LISN (ROOM 2/L2)	SOLAR	7225-1	900077	ACUCAL
PRE-AMPLIFIER	HEWLETT PACKARD	8449B OPT	3008A00505	TELOGY
QUASI-PEAK ADAPTER (S/A 1)	HEWLETT PACKARD	85650A	3145A01599	ACUCAL
QUASI-PEAK ADAPTER (S/A 2)	HEWLETT PACKARD	85650A	2811A01276	ACUCAL
QUASI-PEAK ADAPTER (S/A 3)	HEWLETT PACKARD	85650A	2521A00473	ACUCAL
QUASI-PEAK ADAPTER (S/A 4)	HEWLETT PACKARD	85650A	2521A01032	ACUCAL
RF PRESELECTOR (S/A 1)	HEWLETT PACKARD	85685A	3146A01309	ACUCAL
SIGNAL GENERATOR (HP)	HEWLETT PACKARD	8660C	1947A02956	ACUCAL
SIGNAL GENERATOR (WAVETEK)	WAVETEK	3510B	4952044	ACUCAL
SPECTRUM ANALYZER 1	HEWLETT PACKARD	8566B	3138A07771	ACUCAL
SPECTRUM ANALYZER 2	HEWLETT PACKARD	8567A	2841A00614	ACUCAL
SPECTRUM ANALYZER 4	HEWLETT PACKARD	8567A	2727A00535	ACUCAL
TUNABLE DIPOLE	EMCO	3121	274	LIBERTY LABS

APPENDIX C: Conducted and Radiated Test Methodology

CONDUCTED EMISSIONS MEASUREMENTS

Note: The conducted emissions measurements are not applicable since the device is battery operated.

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 450 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range; the EUT was scanned indoors at one meter distance. This was done 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 at one meter distance 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 open-field test site at an antenna to EUT distance of 1 meter for emissions between 30 MHz and 1000 MHz. Since the EUT transmits at Channel 1 = 27.045 MHz and Channel 2 = 27.145 MHz a vertical rod antenna was used to measure the carrier frequency and all other emissions between 9kHz and 30 MHz per ANSI 63.4. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to 1000 MHz. All other spurious noise with in and outside the restricted band was investigated. The square of inverse linear distance was used to extrapolate the new limit since the limit per FCC 15.209 is given at 30 meters.

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 spectrum analyzer's 6 dB bandwidth was set to 200 Hz for frequencies between 10 kHz and 150 kHz, 9 kHz for frequencies between 150 kHz and 30 MHz, and 120 kHz for frequencies between 30 MHz and 1000 MHz. No video filter less than 10 times the resolution bandwidth was used. When any clock exceeds 108 MHz, the EUT was tested between 1 to 2 Gigahertz in peak mode with the resolution bandwidth set at 1 MHz as stated in ANSI C63.4. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

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.