

TEST REPORT #041099

STANDARD: FCC PART 15

SUBPART B--UNINTENTIONAL RADIATORS
SECTION 15.249 OPERATION WITHIN THE BANDS
902-928 Mhz, 2400-2483.5 Mhz,
5725-5875 Mhz and 24.0-24.25 Ghz

EQUIPMENT TESTED:

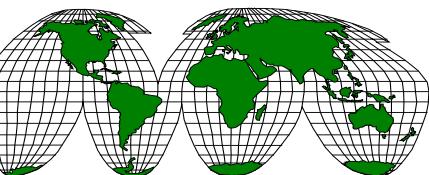
EWAVE, INC.

MODEL: RF10K

RF TRANSCEIVER

TEST DATE: 04 OCTOBER 1999

1100 Falcon Avenue
Glencoe, MN 55336



INTERNATIONAL
CERTIFICATION SERVICES, INC.

Tele: 320-864-4444
Fax: 320-864-6611

Prepared for: Ewave, Inc.
7419 Gracefield Ln.
Dallas, TX 75248

Test agent: International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336
Tele: 320-864-4444
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Test location: International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336
Tele: 320-864-4444
Fax: 320-864-6611

Prepared by: International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336

International Certification Services represents to the client that testing is done in accordance with standard procedures applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy.

- This report only applies to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Certification Services shall have no liability for any deductions, inferences or generalizations drawn by the client or others from this report.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.

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1.0 TEST SUMMARY

TEST REPORT: #041099	
COMPANY:	Ewave, Inc.
AGENT:	International Certification Services, Inc.
PHONE:	320-864-4444
TEST DATE:	04 October, 1999
EQUIPMENT UNDER TEST: RF Transceiver	
GENERAL TEST SUMMARY: The testing was performed at International Certification Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336	
VERIFICATION / CERTIFICATION STATUS:	The RF Transceiver was found to be in compliance with the FCC Part 15 Subpart B, Section 15.249 requirements.
MODIFICATIONS NECESSARY: None	

TESTED BY

Gerald Heinen

WRITTEN BY

Duane R. Bagdons

2.0 Applicable Standards

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2.1 Referenced Standards

ANSI C63.4-1992 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 Khz to 40 Ghz.

2.2 Equipment Units Tested

The equipment tested was an RF Transceiver which operates in the frequency range of 902 to 928 Mhz. The transmitter is a VCO tuned for a 902 to 928 Mhz band. The analog data stream is fed directly into the VCO for frequency modulation. The receiver is of a traditional Superheterodyne design. The first LO operates at the receiving frequency, plus 14.32 Mhz. The second mixer combines the 14.32 Mhz IF with 13.865 Mhz to generate a 455 Khz IF. The 455 Khz IF filter has a 30 Khz bandwidth, and the output is fed to a standard detection circuit, comprised of a MC3361 Motorola IC. The fundamental transmit frequency and the first LO frequency for the RX circuit are generated with a M64084 Mitsubishi dual PLL chip.

2.3 Equipment and Cable Configuration

See photos of the EUT pc board and schematic and test configuration setup in Attachment A

2.4 List of Test Equipment

<u>Test Equipment</u>	<u>Model</u>	<u>S/N</u>	<u>Calibration Date</u>
Spectrum Analyzer Preamp	Hewlett-Packard 8566B MiniCircuits ZKL-2R7 EMCO 3146	2421A00458 N/A	3/10/99 6/1/99
Log Periodic Antenna (200-1000 MHz) Horn Antenna (1000-18000 Mhz)		9111-3280 5697	6/16/99 3/5/99
	EMCO 3115		

Measurement cable losses, and antenna correction factors are included in the data sheets. Average detection methods were used in the measurements. The Resolution BW was set at 1 Mhz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements.

2.5 Units of Measurement.

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All measurements were taken in dBuV/m with the antenna located at 3 meters distance from the EUT. Frequency measurements are recorded in Mhz. Input power to the intentional radiator was not recorded---only the radiated emissions with the internal transmitting antenna were recorded.

2.6 Location of Test Site

The open area test site (OATS) measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave in Glencoe, MN 55336. This site has been certified to be in spec of the normalized site attenuation per ANSI C63.4-1992. See letter of compliance from FCC dated July 23, 1998. (FCC 31040/SIT 1300F2)

2.7 Measurement Procedures

TRANSMITTER:

The antenna was placed at a distance of 3 meters from the EUT. The EUT was set on an insulating table in the OATS site and rotated through 360 degrees to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the transmitter frequencies from the fundamental to the 10th harmonic.

RECEIVER:

A driving signal was induced into the receiver by using a stick antenna driven by a signal generator. The generator was tuned to 903 Mhz and the output amplitude was set to a very low level (-20 dBm) just enough to excite the receiver. Receiver activity was monitored with an oscilloscope at TP2 on the transceiver pc board.

The receiving antenna was placed at a distance of 3 meters from the EUT. The EUT was set on an insulating table in the OATS site and rotated through 360 degrees to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the frequencies from the fundamental to the 10th harmonic.

2.8 Reporting Measurement Data

See data sheets and plots in Attachment B.

2.9 Radiated Emissions Data

The frequency and amplitude of the tuned frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 3rd harmonic are reported in the data sheets in Attachment B. This information is plotted against the limit of section 15.249 of FCC Part 15 subpart C. Signals above the third harmonic on the transmitter were not recorded because they were in the noise floor of the measuring system. The polarization of the antenna for each measurement is also recorded. Signals above the 2nd harmonic on the receiver were also not recorded because they also were in the noise floor of the measuring system.

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The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.

Example:

<u>Frequency</u> <u>(MHz)</u>	<u>Level</u> <u>(dBuV)</u>	<u>Factor</u> <u>(dB)</u>	<u>Corr Data</u> <u>(dBuV/m)</u>	<u>FCC Limit</u> <u>(dBuV/m)</u>	<u>Margin</u> <u>(dB)</u>
100.0	20.6	+ 11.0	= 31.6	- 43.5	= -11.9

2.10 Operating Frequency Data for Intentional Radiators

All operating frequencies and harmonic frequencies and ambient temperature at which all data was taken at is recorded in the data sheets in Attachment B.

2.11 Summary of Results

The EUT passed the requirements of FCC Part 15 Subpart B, Section 15.249 with a minimum passing margin of **-5.259 dBuV/m at 902.968 MHz** for the transmitter part of the transceiver and **-57.3 dBuV at 1777.319 MHz** from the receiver part of the transceiver. No modifications were necessary to accomplish this compliance.

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ATTACHMENT A

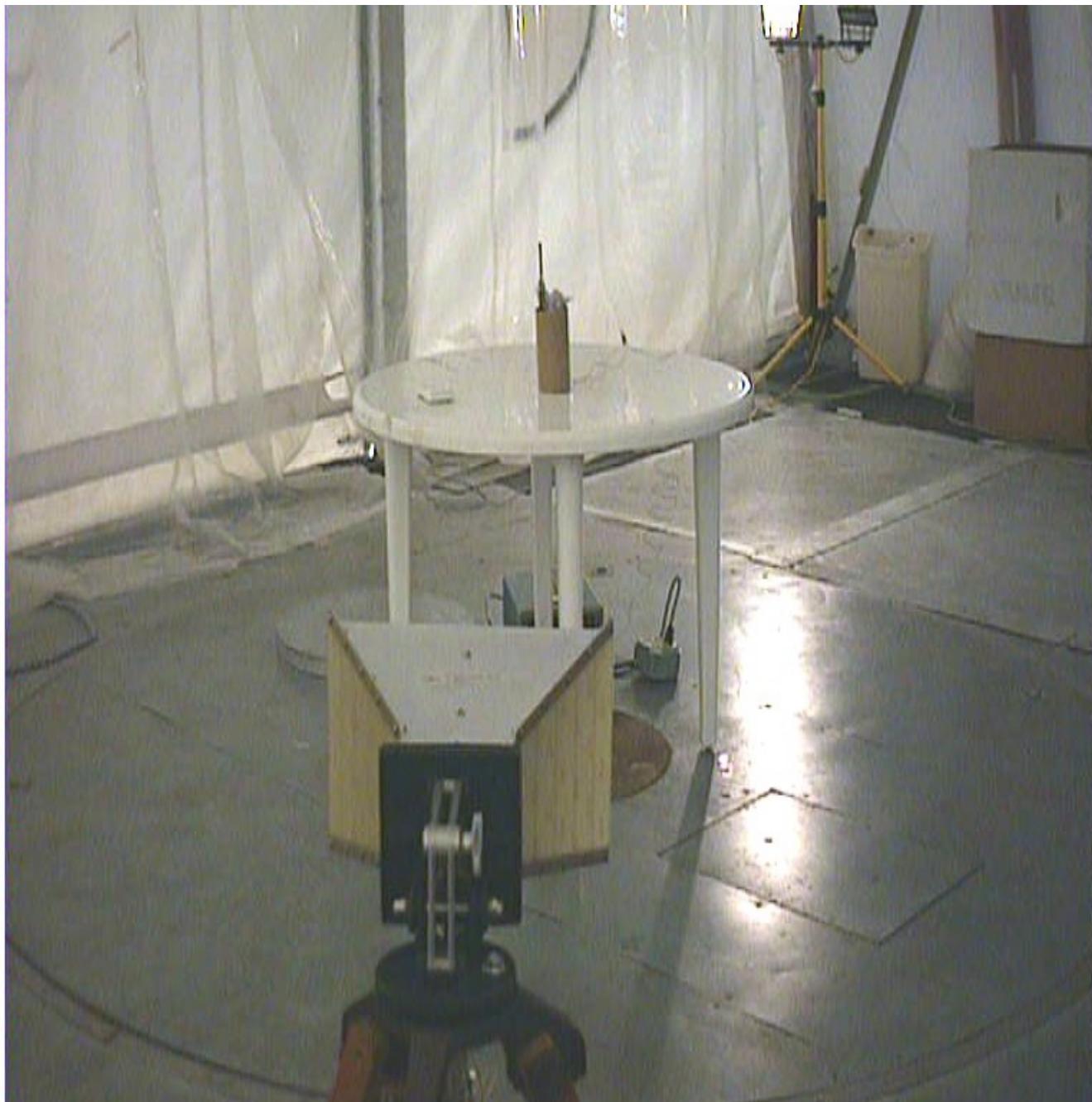
RADIATED MEASUREMENT PHOTOS AND, SCHEMATIC

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Ewave, Inc.
Model: RF10K Transceiver
FCC Part 15.249 Radiated Emissions
Test Configuration

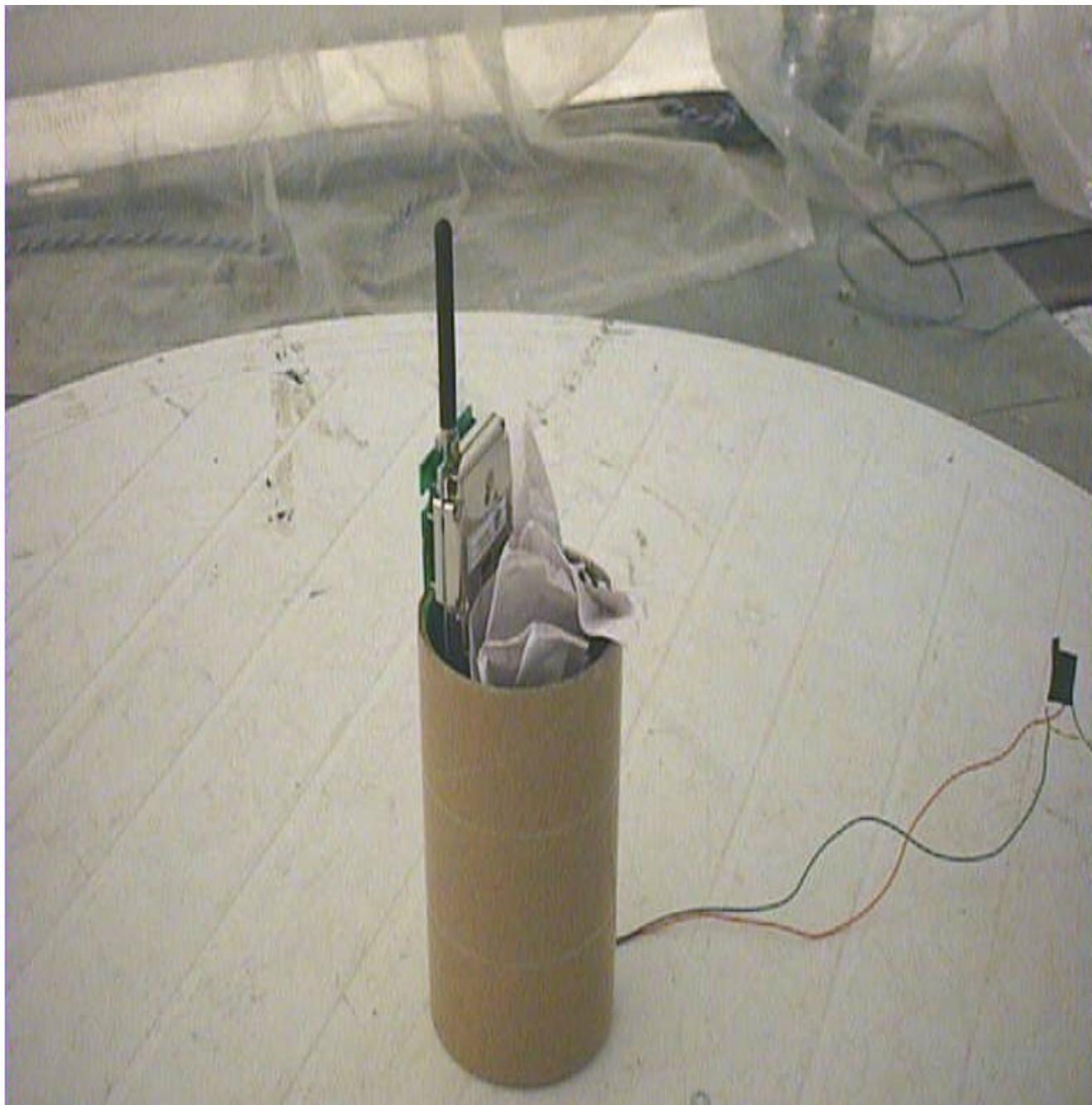


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Ewave, Inc.
Model: RF10K Transceiver
FCC Part 15.249 Radiated Emissions
Test Configuration



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Ewave, Inc.
Model: RF10K Transceiver
Top Level Assembly
Front View



Ewave, Inc.
Model: RF10K Transceiver
Top Level Assembly
Front View

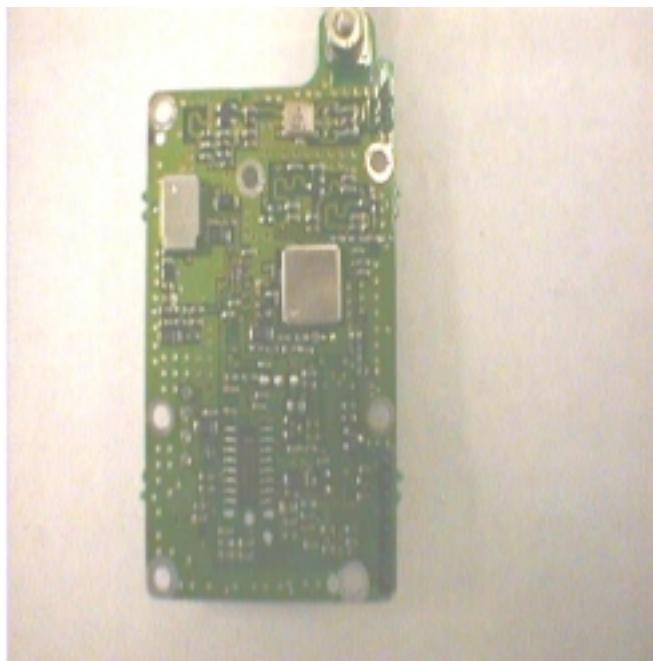


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Ewave, Inc.
Model: RF10K Transceiver
PC Board
Top View



Ewave, Inc.
Model: RF10K Transceiver
PC Board
Bottom View



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Ewave, Inc.
Model: RF10K Transceiver
Built In Antenna



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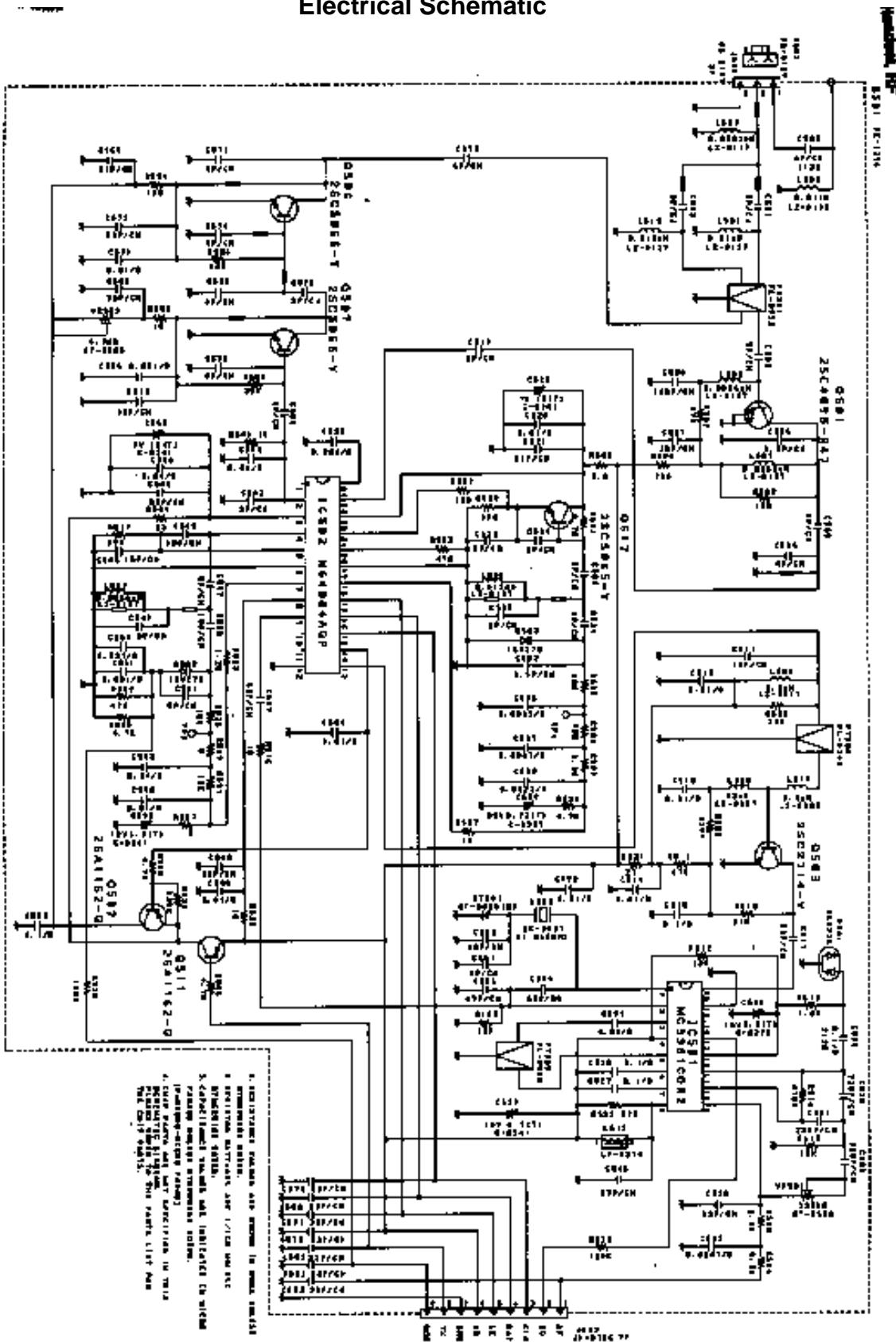


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Model: RF10K Transceiver

Electrical Schematic



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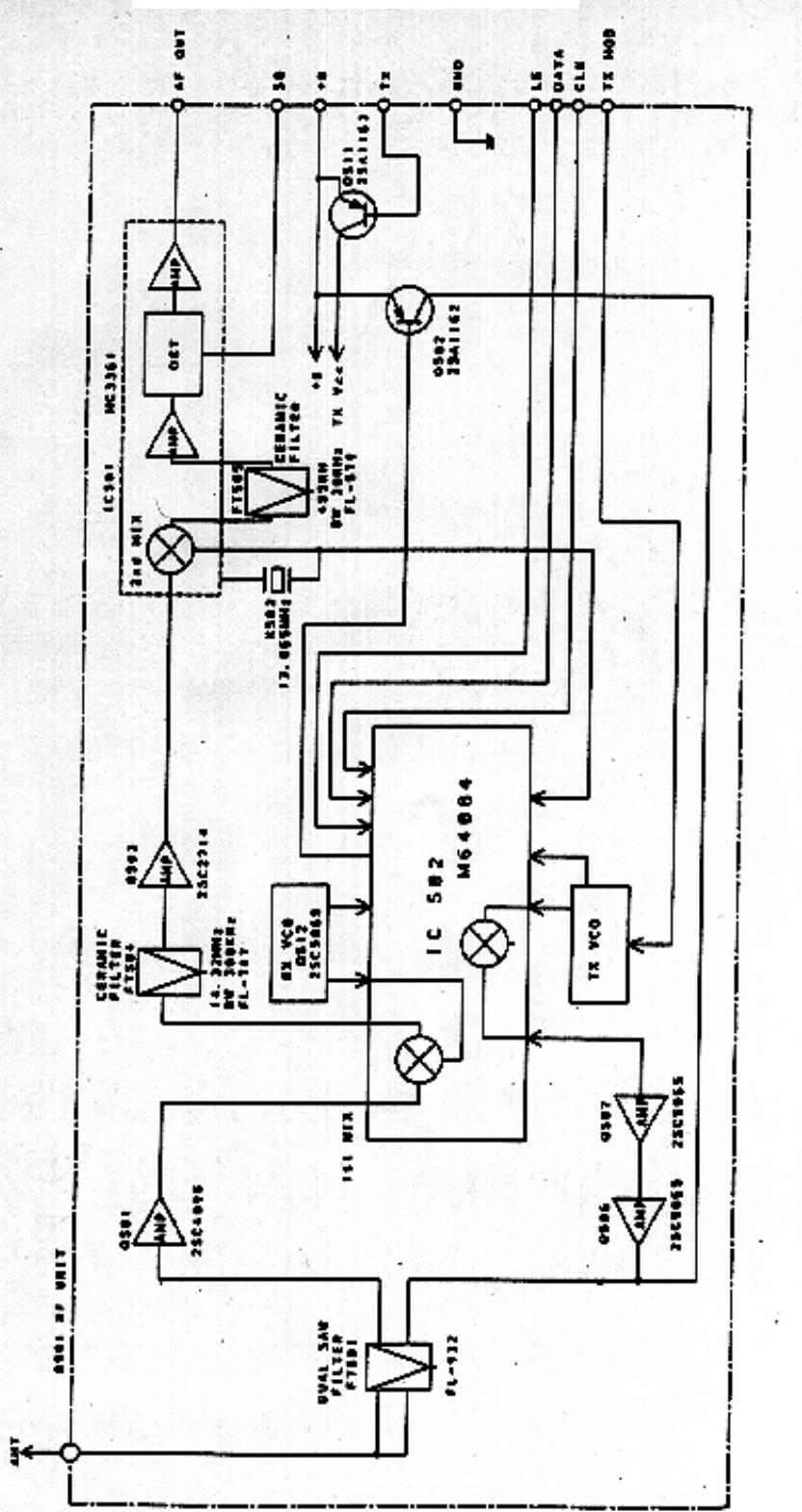


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Model: RF10K Transceiver

Block Diagram



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ATTACHMENT B

DETAILED TEST DATA SHEETS

Each radiated emissions plot indicates the receiving antenna measurement distance in meters and the emission amplitudes with respect to their applicable limits. The associated tabulation for each radiated plot lists the emission frequency, the final emission level, and the margin from the limit.

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Ewave, Inc.

Model: RF10K RF Transceiver

Temperature: 66 Deg F.

Humidity: 49 % R.H.

Test Technician: Gerald Heinen

Preliminary tests were performed on antenna polarities of Vertical and Horizontal. Vertical was the worst case so all data was taken with an antenna polarity of Vertical.

Certification testing was performed at the OATS site with an antenna distance of 3 meters.

TRANSMITTER:

The limit for section 15.249 is 50 mV/m. All data is taken with the required Quasi-Peak or Average Detector. This limit converted to dBuV is the limit shown in the next table.

Freq (Mhz)	Ampl (dbuV)	Ant Corr Fac	Preamp Gain (dB)	Cable Corr Fac	Corr Data (dBuV)	FCC 15.249 limit	Margin
902.968	98.1	23.1	33	0.52	88.72	93.979	-5.259
1805.947	48.2	23.1	33	0.6	38.9	93.979	-55.079
2708.915	25.5	23.1	33	0.68	16.28	93.979	-77.699

NOTE: All signals above 2708 Mhz were in the noise floor. The noise floor was measured at 24.7 dBuV.

RECEIVER:

The limit for section 15.109 is 100 uV/m from 30-88 Mhz, 150 uV/m from 88-216, 200 uV/m from 216-960 Mhz and 500 uV/m above 960 Mhz. All data is taken with the required Quasi-Peak Detector. This converted to dBuV is the limit shown in the next table.

Freq (Mhz)	Ampl (dbuV)	Ant Corr Fac	Preamp Gain (dB)	Cable Corr Fac	Corr Data (dBuV)	FCC 15.109 limit	Margin
902.99	69.4	23.1	33	0.52	60.02	46.02	← Note 1
1777.319	52	23.1	33	0.6	42.7	100	-57.3

NOTE 1: This is the signal from the signal generator to stimulate the Local Oscillator in the receiver. It was not radiated emissions from the receiver itself.

All signals above 2708 Mhz were in the noise floor. The noise floor was measured at 24.7 dBuV.

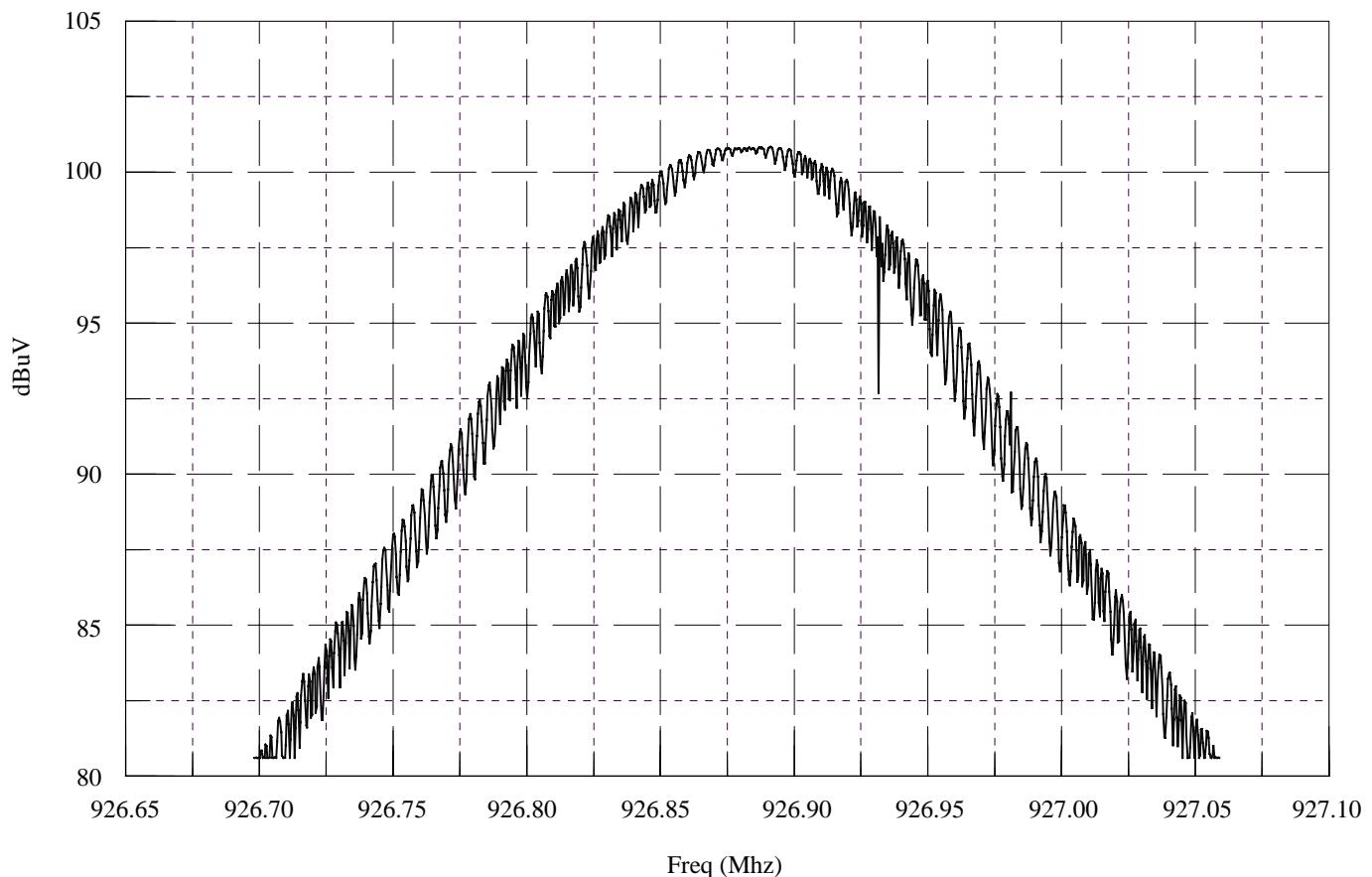
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Ewave, Inc.
Model: RF10K Transceiver
Transmitter Output Waveform

EWave, Inc.
927 Mhz Transponder Transmitter
Transmitter waveform



International Certification Services, Inc.

Oct 2, 1999

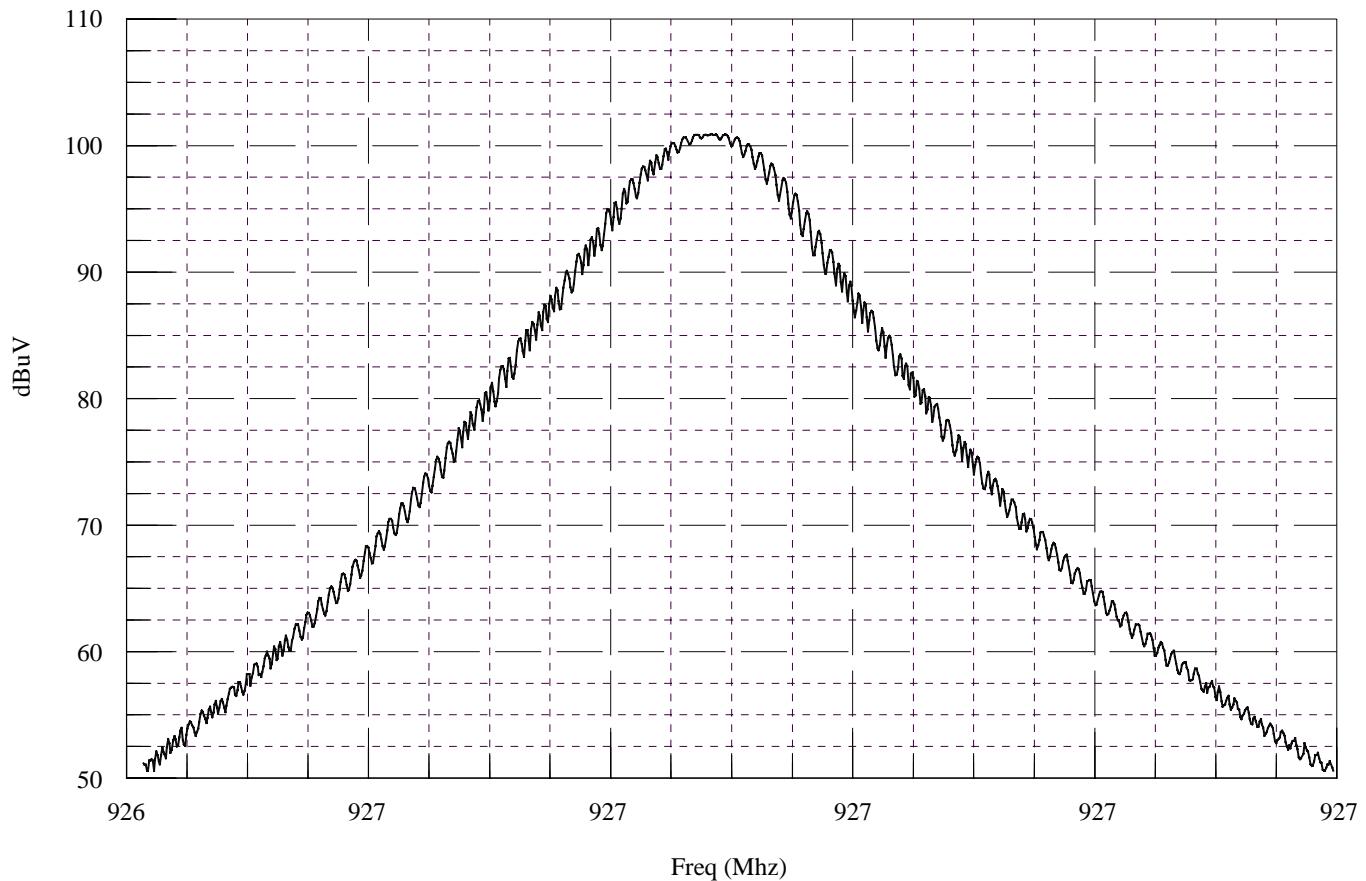
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CERTIFICATION SERVICES, INC.

Ewave, Inc.
Model: RF10K Transceiver
Transmitter Output Waveform

EWave, Inc.
927 Mhz Transponder Transmitter
Transmitter Waveform



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ATTACHMENT C

**PRODUCT DATA SHEET OR PRODUCT INFORMATION FORM AS
SUPPLIED BY THE CUSTOMER**

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CERTIFICATION SERVICES, INC.

COMPANY NAME: Ewave, Inc.

CUSTOMER REPRESENTATIVE: International Certification Services, Inc.

EQUIPMENT DESCRIPTION: RF Transceiver (902-928 Mhz Range)

MODEL NUMBER: RF10K

SERIAL NUMBER: Engineering Unit

TYPE OF TEST: Development
 Initial Design Verification
 Design Change (Please describe exact changes below)
 Production Sample (Audit Test)

Changes made: NONE

OSCILLATOR FREQUENCIES:

13.865 Mhz

PRODUCT SHIELDING PROVISION:

Conductive coated Plastic enclosure

SOFTWARE AND / OR OPERATING MODES:

The Transceiver (EUT) was programmed to constantly transmit so the emitted energy would be easy to detect.

I/O CABLES:

NONE

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