ENGINEERING REPORT

FOR

TYPE ACCEPTANCE

FCC ID	:	**FRW4WJRT-138F**
APPLICANT	:	**Global-Wulfsberg Systems** **Division of Sundstrand Data Control Inc.** **6400 Wilkinson Drive,** **PRESCOTT, Arizona U.S.A. 86301**
EQUIPMENT	:	**VHF/FM Aircraft Transceiver**
BRAND NAME	:	**FLEXCOMM**
MODEL NO.	:	**RT-138F**
SERVICE OR RULE	:	**F.C.C. Rules and Regulations** **Parts 2, 74 and 90 (Title 47 C.F.R.)**
TESTING LABORATORY	:	Tele-Radio Systems Limited 1536 Columbia Street, North Vancouver, B.C. CANADA V7J 1A4 TEL : 604-985-0511 FAX : 604-985-1072 ENVOY: TELERADIO.VCR GRZ1388
CERTIFYING ENGINEER	:	W. R. Tracey, P.E.
PROJECT	:	**89-05**
DATE	:	**March, 1989**

3.1 QUALIFICATIONS OF CERTIFYING ENGINEER

CURRICULUM VITAE — William R. Tracey

DATE OF BIRTH: **1931 April 04**

ACADEMIC & PROFESSIONAL QUALIFICATIONS:

B.A.Sc (Electrical Engineering)	University of British Columbia, 1955
Registered Professional Engineer (Previously registered in Quebec and Ontario)	Province of British Columbia, 1962

SUMMARY OF EXPERIENCE:

More than thirty years of engineering and management experience in Canada and overseas, in utility operations control, industrial instrumentation application and sales, telephone and data-communication apparatus design and manufacture, radio systems design, telephone system design, consulting in control-system and telecommunication system design in industry and various governments and their agencies. Consulting in strategic planning, forecasting, preparation of new plant facilities for administration and manufacturing.

Positions held include, director, president, vice-president manufacturing, vice-president engineering, chief engineer, manager of engineering.

EMPLOYMENT HISTORY:

May 1983 - Systek Engineering Ltd.
North Vancouver, B.C.
(Systek Engineering until May, 1987)

Principal engineer and president, consulting in telecommunications system design and in corporate management.

September through December, 1985, limited-term faculty member, Simon Fraser University, Burnaby, B.C.

Sep 81 - May 83 — Glenayre Electronics Ltd.
Vancouver, B.C.

Manager of Engineering. Responsible for technical staff of about 60 engineers, scientists and others carrying out the Research and Development and Production Engineering functions of the company.

May 77 - Sep 81 — Tele-Radio Systems Limited
Woodbridge, Ontario

Director and Vice-President Manufacturing, previously Vice-President Engineering Services.

6.4.2 Field Strength Measurement of Spurious Radiations; Para. 2.993:

(a) Below 1000 MHz:

Measurement of spurious radiation from the case of the sample transceiver was conducted essentially in accordance with EIA Standard RS-152B. Details of the test equipment and measurement site are included in "Description of Measurement Facilities Used for Radiated Emission Tests" which has been submitted August 25, 1987, to the F.C.C. laboratory, in connection with an application for a Class B Computing Equipment certification (FCC ID: FZW4N9 328668).

Spectrum Analyzers were the same as used for Antenna Conducted spurious measurements. Tuned dipole (½-wavelength) antennas were used for receiving, and transmitting substitution signals, at each frequency of appreciable radiation (except in the 20 - 200 MHz range where a broad band bi-conical antenna was used for receiving).

The adjustable dipole antennas used with the Field Intensity Receivers were set up at a distance of 100 feet from the sample transceiver for the final measurement. Antenna height and polarization were varied over a 4 to 25 foot elevation and from vertical to horizontal polarization to obtain maximum received signal level.

The transmitter output was fed to a Sierra 185A-150, 50 ohm wattmeter, and the output power noted for reference. The transceiver was mounted in a normal horizontal position on the test stand and was powered by two fully charged 12 volt lead-acid batteries in series. A block diagram of the test set-up is shown in Section 5.4.5 of this report.

The spectrum was viewed over the range from **12.8 to 1000 MHz.** For each frequency where appreciable radiation was measured, the receiving antenna height and polarization were not changed, by the transceiver was replaced by a dipole antenna tuned to the frequency of measurement and fed by a signal generator set to the same frequency. The signal generator output was increased to give the same level as the spurious radiation after the transmitting dipole was first adjusted to give maximum received signal level.

The output levels of the substitution signal generator were recorded in decibels referred to 1 milliwatt. The carrier level of the transmitter was **10 watts or +40 dBm.**

6.4.2 Field Strength
Measurement of Spurious Radiation; Para. 2.993...continued:

(a) Below 1000 MHz...continued:

The attenuation of the spurious emissions in decibels is in accordance with the following formula:

Spurious Attenuation (dB) is calculated as follows:

$$= 10 \log_{10} \frac{\text{Transmitter Power (Wattmeter; 10 watts)}}{\text{Substitute Signal Generator Output}}$$

= (+40 dBm) - (Substitute Signal Generator Output, dBm)

Measured values of spurious radiation by the above method were as follows (all spurious levels higher than 20 dB below the specified FCC limit were noted and recorded).

Spurious Frequency MHz	Substitute Signal Generator Output, dBm	Spurious Level Relative to Carrier, dB	F.C.C. Max. Level Ref. Carrier
12.8 to 1000 MHz	**<-33**	**<-73**	**-53 dB**

All spurious emissions in the range from 12.8 to 1000 MHz were more than 20 dB below the F.C.C. specified limits.

6.4.2 Field Strength Measurements of Spurious Radiation...continued:

(b) Field Strength Measurements of Spurious Emissions in 1000 to 1740 MHz Range Using Calibrated Test Antenna:

Measurements of radiated spurious emissions in the range from **1000 to 1740 MHz** were conducted on the Model **RT-138F** Transceiver using a broadband log periodic antenna with a calibration curve provided by the manufacturer (copy in Section 5.5 of this report).

The field intensity which would be produced by the transmitter carrier, operating into a ½-wavelength dipole antenna (gain: x 1.64), at a distance of 30.5 meters (100 feet) was calculated using the following formula:

$$\text{Field Strength, dB}/\mu\text{V/m} = 20 \log_{10} \left(\frac{\sqrt{30 P_t G}}{D} \right) + 120 \text{ dB}$$

where: P_t is transmitter power, watts; G is 1.64; D is 30.5 meters.

The spurious emissions from the transceiver case and associated wiring were measured at a distance of 3.05 meters (10 feet). Measured levels were extrapolated to 30.5 meters by including a factor of -20 dB. Levels from the calibrated test antenna into the spectrum analyzer were measured in dB over 1 microvolt; the distance factor and antenna factor were then applied to indicate the resultant field at 30.5 meters distance (100 feet), in dB over 1 microvolt per meter. The field strength at 30.5 meters was compared to the calculated carrier level as radiated from a ½-wave dipole and is expressed in the dB in the table of results following.

Spurious levels at 30.5 meters (100 feet) are tabulated on the following page.

The test set-up used for measurement of radiation above 1000 MHz is shown in Section 5.4.6 of this report.

6.4.2 Field Strength Measurements of Spurious Radiation...continued:

(b) Field Strength Measurements above 1000 MHz - Tabulation of Data:

Sample Equipment : **Model RT-138F**

Transmitter Frequency : **156.0 MHz**

Transmitter Power Output : **10 watts**

Field at 30.5 meters from: 10 watts into a ½-wave dipole: **117 dBμV/m**

Distance at which measured: **3.05 meters**

Spurious Frequency MHz	Spurious Level, dB/ μV @ 50 Ohms	Antenna Factor, dB	Distance Factor, dB	Spurious Levels at 30.5 Meters (100 Feet) dB Ref. 1 μV/m	dB Ref. Carrier	F.C.C. Max. Level Ref. Carrier
1000 - 1740	**<+38.5 to <+35**	**+25.5 to +29.0**	**-20**	**<+44**	**<-73**	**-53 dB**

All spurious emissions were more than 20 dB below the F.C.C. specified limits, in the 1000 to 1740 MHz range.