7.0 MEASUREMENT PROCEDURES AND TEST EQUIPMENT USED – Pursuant to 47CFR 2.947

7.1 RF Power Out - Pursuant to 47 CFR 2.1046

The transmitter was operated under normal conditions and at the nominal DC supply voltage of +28V. Before measuring the RF output power, the transmitter was adjusted in accordance with the factory tune-up procedure. The values of current and voltage on the final RF amplifying device are recorded in exhibit 6.1. The RF output was connected through a 50Ω, 100W, 30 dB attenuator to the RF power meter. All losses in the RF path were measured at each frequency and entered into the power meter as a correction factor. The power level was recorded at the high and low power settings as shown in exhibit 6.1.

7.2 Audio Frequency Response – Pursuant to 47 CFR 2.1047(a)

The audio source output section of the HP8903B audio analyzer was connected to the microphone input of the control head, C-5000 as shown in Section 7.8. Audio deviation was reduced to assure that limiting does not occur at any frequency in the 300 Hz to 3 kHz range. A zero dB reference was established at the 1kHz tone. The audio input frequency was varied over the range of 50 Hz to 5 kHz with the audio input level held constant. The audio input level was monitored with the multimeter and the oscilloscope.

The RF output of the transmitter was connected to the HP8901B modulation analyzer through the 30 dB attenuator. Demodulated audio was measured on the modulation analyzer. The data is graphed in exhibit 6.2.

7.3 Modulation Limiting – Pursuant to 47 CFR 2.1047(b)

With the same setup as section 7.2, the audio input level was varied from 10mV up to a level exceeding 20 dB above that giving 50% of rated system deviation at 1kHz. Modulation deviation was measured for various input levels. The limiting audio responses at frequencies of 300, 1000 and 3000 Hz were measured for standard and narrow band operation. The data is graphed in exhibit 6.3.

7.4 Occupied Bandwidth – Pursuant to 47 CFR 2.1049

An audio oscillator – HP8903B - is connected to the microphone input. An audio input frequency of 2.5 kHz with a level 16db greater than that required to produce 50% of rated system deviation was applied. The transmitter RF output was connected, via a 30 dB attenuator, to a HP70000 System spectrum analyzer, as shown in section 7.8.

The transmitted spectrum was investigated with a 50 kHz span for FM channels and a 150 kHz span for the AM channel using a resolution bandwidth of 100 Hz. First, the level of the unmodulated carrier was set to the full scale reference line of the spectrum analyzer. This was used as the 0 dB reference line for the emission masks. Then the modulated signal was applied and plotted. The plots for standard and narrow band operation are shown in exhibit 6.4.

7.5 Conducted Spurious Emissions at Antenna Terminals – Pursuant to 47 CFR 2.1051

A HP70000 System spectrum analyzer was connected to the transmitter RF output through a 30 dB attenuator to allow the spurious emission levels to be measured directly. The transmitter is modulated with a 2.5 kHz audio signal, 16 dB above the level required to produce 50% of rated system deviation. This audio signal was provided by the HP8903B audio analyzer. Spurious emissions were measured from the lowest radio frequency generated in the equipment out through the 10^{th} harmonic. The level of each detected harmonic or other spurious emission is tabulated in exhibit 6.5.

7.6 Radiated Spurious Emissions – Pursuant to 47 CFR 2.1053

Radiated field strength measurements were conducted on the equipment by DNB Engineering Inc., Riverside, CA. Their report is included as Appendix A. The test data is in exhibit 6.6.

7.7 Frequency Stability – Pursuant to 47 CFR 2.1055

The transceiver reference oscillator, a Temperature Compensated Crystal Oscillator (TCXO) was adjusted at +25 °C per the factory instructions. A one minute warm-up period was allowed before the data was taken at each temperature.

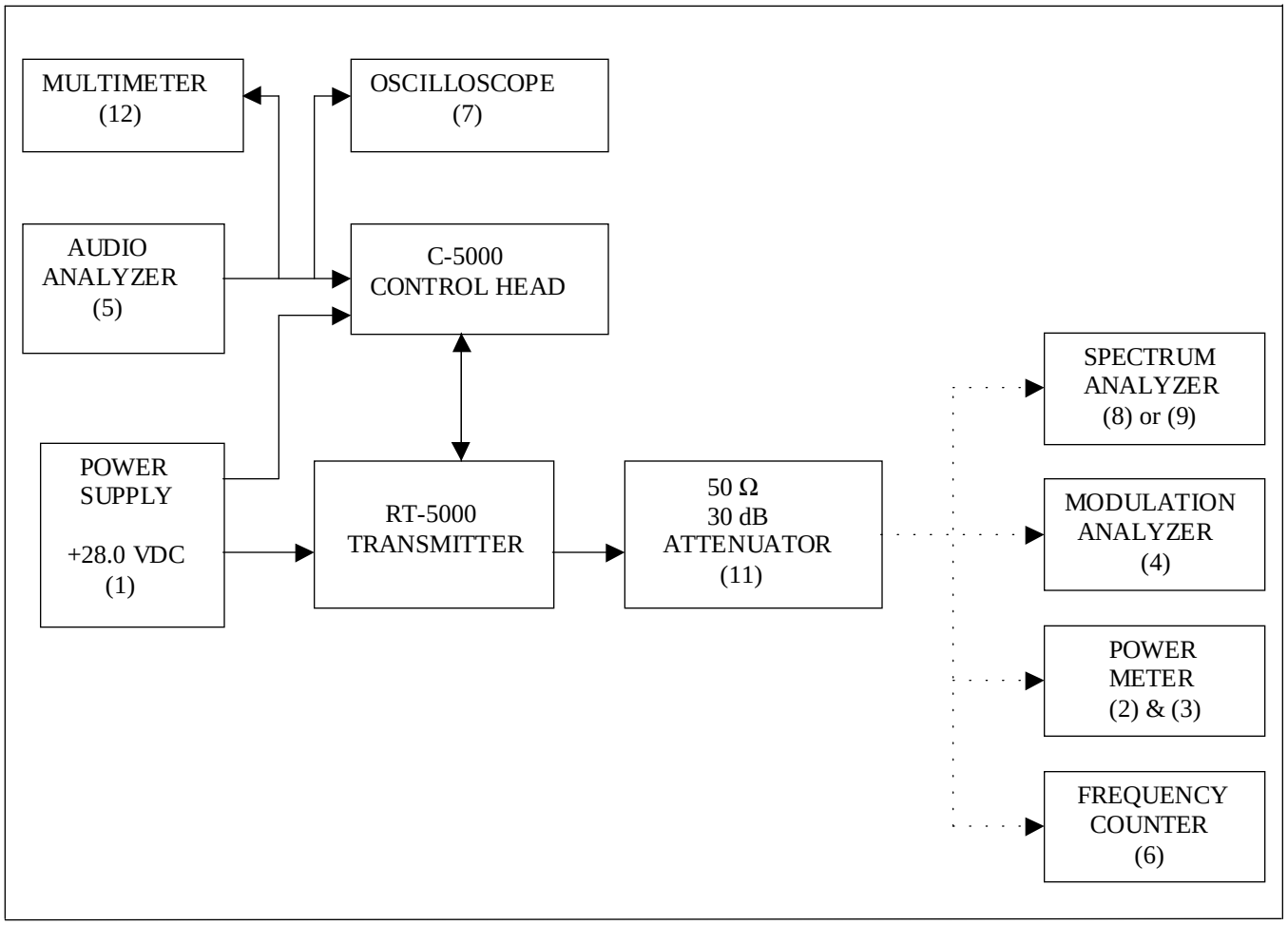
7.7.1 Frequency Stability with Variation in Temperature – Pursuant to 47 CFR 2.1055(a)

The RT-5000 was placed inside a temperature chamber and powered by an external DC supply. The RF output was connected to an external frequency counter through a 30 dB attenuator. Frequency measurements were made from –30 °C to +60 °C at intervals of 10 °C. With the unit powered off, sufficient time was allowed at each temperature for the circuit components to stabilize. When stabilization was verified, the unit was powered on and the transmitter keyed for at least 5 seconds before the measurement was taken. The highest frequency of each transmitter was measured as this will result in the greatest error accumulation. The error in ppm from the ideal frequency is graphed in exhibit 6.7.1.

7.7.2 Frequency Stability with Variation in Primary Supply Voltage – Pursuant to 47 CFR 2.1055(d)

The variation of frequency with DC supply voltage was measured at room temperature. The voltage was varied from 85% to 115% of the nominal input value. Voltage was measured at the output of the DC power supply. The radio was put into transmit and the output frequency was measured. The error in ppm from the ideal frequency is graphed in exhibit 6.7.2.

7.8 Test Setup - Pursuant to 47 CFR 2.947:



7.9 Test Equipment List – Pursuant to 47 CFR 2.947(d):

1. HP6038 or Leader 735-10D DC Power Supply

2. HP438A RF Power Meter

3. HP8482A RF Power Sensor

4. HP8901B Modulation Analyzer

5. HP8903B Audio Analyzer

6. HP5342A Frequency Counter

7. Tektronix TDS3052 Digital Oscilloscope

8. HP70000 System Spectrum Analyzer:
   - HP70004A Display
   - HP70310A Precision Frequency Reference
   - HP70904A RF Section
   - HP70621A Pre-Amplifier
   - HP70902A IF Section
   - HP70900B Local Oscillator
   - HP70001A Mainframe

9. HP70000 System Spectrum Analyzer:
   - HP70205A Display
   - HP70902A IF Section
   - HP70900A Local Oscillator
   - HP70905A RF Section
   - HP70001A Mainframe

10. Tenny Versa Tenn III Temperature Chamber

11. Weinschel 68-30-34 30db, 100W attenuator

12. Fluke 177 True RMS Multimeter

13. Fluke 52 Thermometer

Appendix A: Radiated Spurious Emissions - Performed by DNB Engineering

Electromagnetic Compatibility
Test Report To
U.S. CFR 47 Part 2.1053

for the

Wulfsberg Electronics Division

Device: Avionics Transceivers
Model #: RT-5000
FCC ID #: FRWRT-5000

Test Report Number RV28071

Prepared For:
Wulfsberg Electronics Division

Prepared by:

DNB Engineering, Inc.
5969 Robinson Avenue
Riverside, CA 92503

Prepared By		Date	6 Feb 2002
Test Engineer		Date	6 Feb 2002
Test Dept Manager		Date	6 Feb 2002
Quality Assurance		Date	6 Feb 2002

LIST OF REVISIONS

Revision Number	Page Changed	Description	Page Added

TABLE OF CONTENTS

A P P E N D I C E S

Electromagnetic Compatibility Test Completion Record

for

Wulfsberg Electronics Division

Avionics Transceivers

Model #: RT-5000

Test Start Date: 7 Jan 2002 Test Completion Date: 12 Jan 2002

****

Test Completion Record:

The EUT was tested in accordance with the requirements of CFR 47 Para 2.1053

Transmitter Parameters

Spurious Emissions **Pass [X] Fail [ ] N/A [ ]**

Receiver Parameters

Spurious Radiation **Pass [X] Fail [ ] N/A [ ]**

1.0 *INTRODUCTION*

Electromagnetic Compatibility (EMC) tests were performed on a representative sample of a Wulfsberg Electronics Division, *Avionics Transceiver*, Model # RT-5000. The purpose of this test was to demonstrate compliance of the EUT with the applicable limits listed in Section 4.0 of this report. The test results have been summarized herein, and all data sheets have been incorporated in Appendix C.

2.0 *TEST REQUIREMENTS*

For the receiver portion of this device it was tested in accordance with the requirements CFR 47 Part 15 Subpart B for a Class B device.

For the transmitter portion of the device it was tested in accordance with the requirements of CFR 47 Part 2 subparagraph 2.1053 Measurement Required: Field Strength of Spurious Radiation.

3.0 *TEST EQUIPMENT*

The test equipment utilized in the performance of this test, along with current calibration information, is listed in the Test Equipment Log of Appendix A.

4.0 *SUMMARY OF TEST RESULTS (Transmitter)*

4.1 Spurious Emissions (Intentional Radiator) Pass[X] Fail[ ] N/A[ ]

Unless otherwise specified, to measure radiated emissions, the EUT was placed upon the 3 meter open air test site (OATS). The EUT is placed on a non-conductive table resting upon a metal top flush mount turntable. The top of the table is elevated above the ground as prescribed by the applicable standard, and the turntable can be rotated 360 degrees. For each frequency measured, the antenna is raised and lowered 1 to 4 meters for both horizontal and vertical antenna polarities to obtain the maximum reading on the spectrum analyzer. The turntable is also rotated throughout the 360 degrees in azimuth to determine the position of the maximum emissions.

For this standard the antenna substitution method was used in determining the effective radiated power. Once the maximum emission profile has been determined, either a half wave tuned dipole antenna or a double ridge guide antenna is substituted in place of the EUT and driven with a signal generator until the same amplitude at each frequency has been obtained. Very short high quality low loss cables are used between the signal generator and the reference transmit antenna. The amplitude of the signal from the signal generator is then recorded as the effective field strength at the given harmonic. This recorded level is then compared to the maximum allowable level as required by the most restrictive standard in that frequency range.

Maximum allowable levels are: For 25.0kHz channel spacing: -13dBm
For 12.5kHz channel spacing: -20dBm

The respective antenna and preamplifier were connected to an HP 8566B Spectrum Analyzer. Preamplifiers were used for all ranges to achieve the needed dynamic range. A list of the equipment used in this test is included in Appendix A.

All data from this test was recorded and is included in Appendix C.

4.0 *SUMMARY OF TEST RESULTS (Receiver)*

4.2 Spurious Radiation (Unintentional Radiator) Pass[X] Fail[ ] N/A[ ]

To measure radiated emissions, the EUT was set up on the 3 meter open air test site (OATS). The EUT is placed on a wooden table resting on a metal top flush mount turntable. The top of the table is one meter above the ground, and the turntable can be rotated 360 degrees. For each frequency measured, the antenna is raised and lowered for both horizontal and vertical polarities to obtain the maximum reading on the analyzer. The turntable is also rotated throughout the 360 degrees in azimuth to determine the position of the maximum emissions. The applicable frequency range is searched using the antennas listed below. The respective antenna and preamplifier were connected to an HP 8568B Spectrum Analyzer. Preamplifiers were used for all ranges to achieve the needed dynamic range. A list of the equipment used in this test is included in Appendix A. Photographs of this test set up are included in Appendix B.

5.0 CONCLUSIONS

The Wulfsberg Electronics Division, *Avionics Transceiver*, Model # RT-5000 was tested in accordance with the requirements listed herein. Pass/Fail status for each test is listed in Section 4.0. At the completion of testing the EUT and support equipment were returned to representatives of Wulfsberg Electronics Division.

A P P E N D I X A

Test Equipment Log

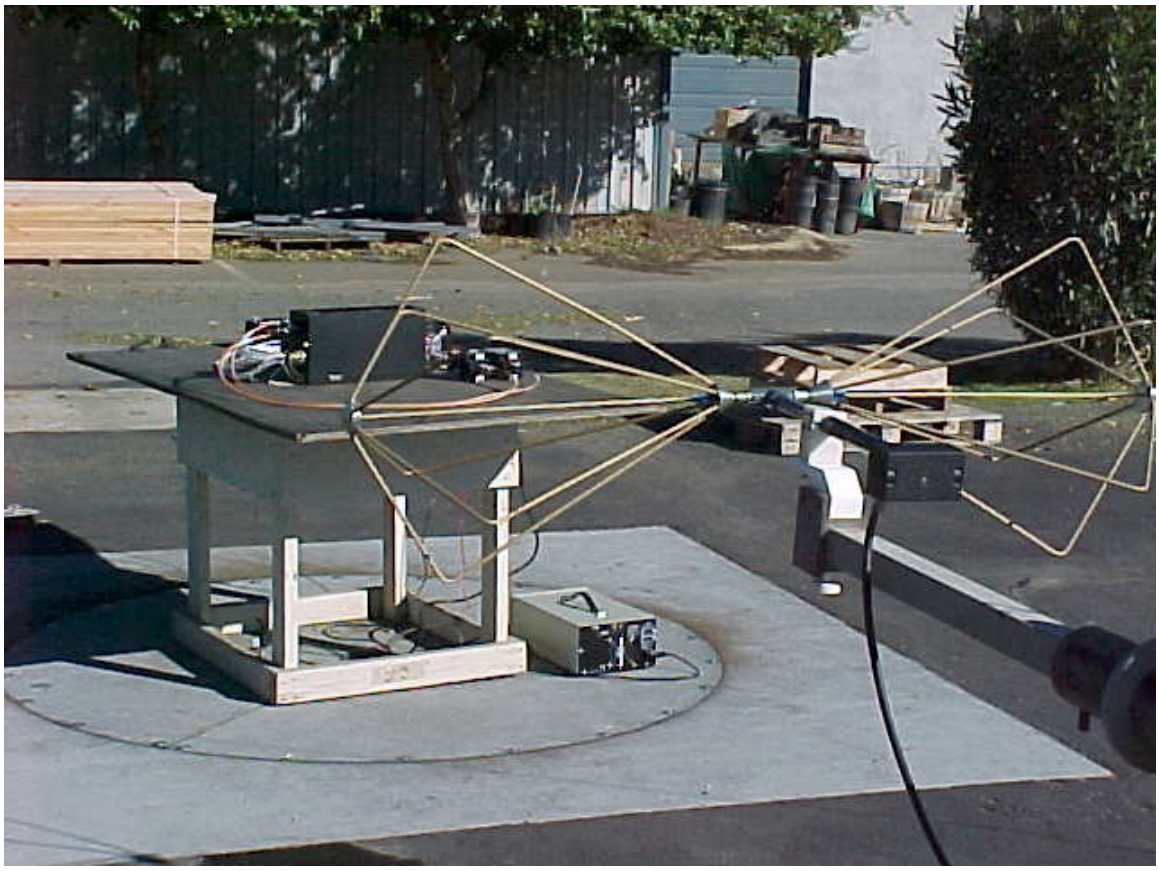
T E S T E Q U I P M E N T L O G					
DESCRIPTION	**MFR**	**MODEL**	**SER. NO.**	**CAL DUE**	**TEST**
Spectrum Analyzer (100Hz – 1.5GHz)	HP	8568B	2330A02791	9/8/02	4.2
Q.P. Adapter	HP	85650A	2811A01240	9/8/02	4.2
R.F. Preselector	HP	85685A	2724A00659	9/8/02	4.2
Spectrum Analyzer (100Hz – 22GHz)	HP	8566B	2407A03212	3/16/02	4.1
Signal Generator	Marconi	2024	112231/034	12/17/02	4.1
Signal Generator	HP	8673E	2821A00434	12/03/02	4.1
Pre-Amplifier 2 –1300 MHz	HP	10885A	00387	12/26/02	4.1, 4.2
Pre-Amplifier 200MHz – 2GHz	MC	ZFL 2000	8350	12/27/02	4.1
Pre-Amplifier 2 – 4 GHZ	MC	JS2-02000400	664011	12/27/02	4.1
Pre-Amplifier 4 – 8 GHz	Miteq	AF03-040080	121391	12/27/02	4.1
Pre-Amplifier 8 – 18 GHZ	Miteq	AFS4-08001800	378064	12/27/02	4.1
Dipole Antennas	CD	Roberts	N/A	Reference	4.1
Biconical Antenna	AH Sys	SAS 200/540	524	12/26/02	4.1, 4.2
Log Periodic Antenna	EMCO	3146	1284	12/26/02	4.1, 4.2
DRG Horn Antenna	EMCO	3115	2281	1/12/02	4.1
DRG Horn Antenna	E.M.	RGA-60	6103	1/12/02	4.1

A P P E N D I X B

Photographs

Photos **Radiated Emissions - Bicon**

Notes:

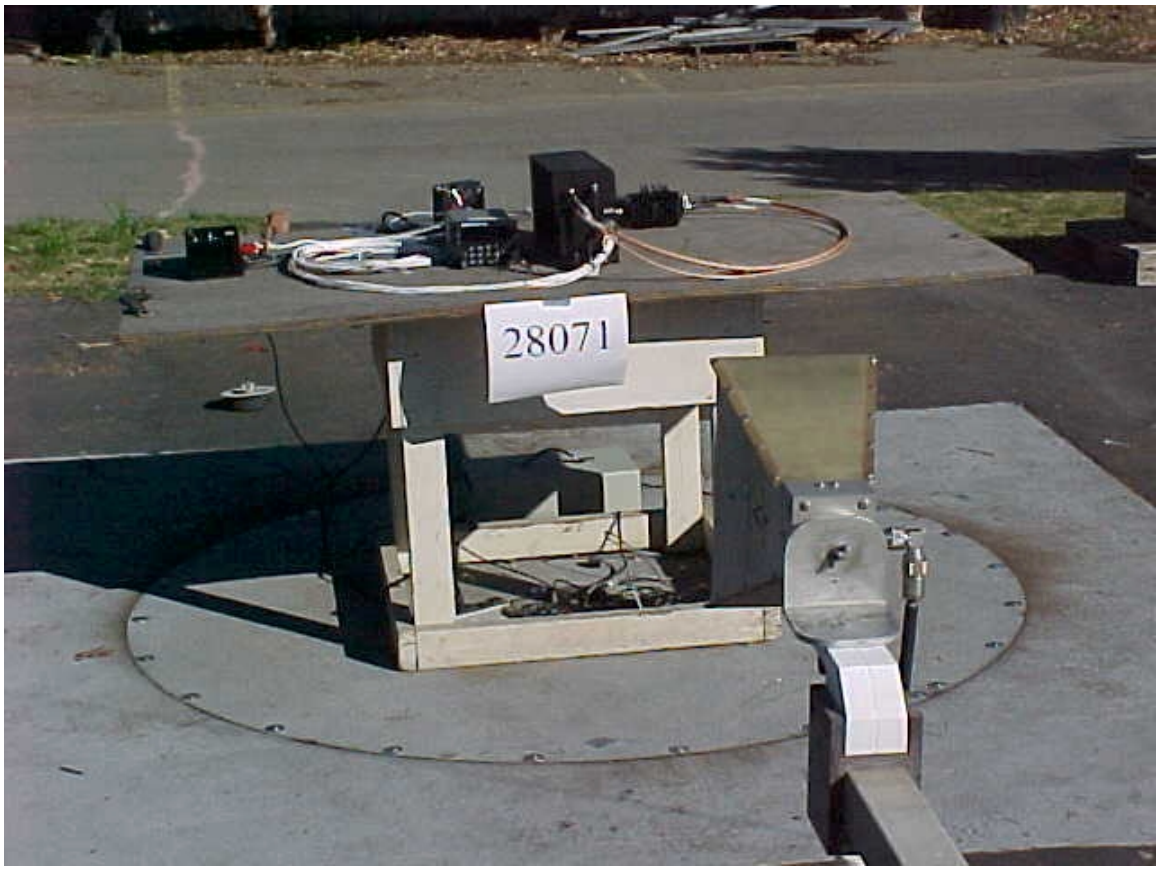


Photos **Radiated Emissions – Log Periodic**

Notes:

Photos **Radiated Emissions – Double Ridge Guide (Horn)**

Notes:



A P P E N D I X C

Test Data

The test data is located in Section 6.6.