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FRACTIONS ±					DECIMALS .XX ± .XXX ±			
ANGLES ±					DNB ENGINEERING RADIATED OPEN FIELD REPORT (VC-401B 8.33 kHz)			
 Wulfsberg Electronics Division A Chelton Group Company Prescott, AZ 86301 U.S.A.					SIZE	CAGE CODE	DWG . NO.	REV
					A	1B7G3	150-040630	A
					SCALE			

1 Measurement of Radiated Spurious Emissions per CFR 47, § 2.993

1.1 Introduction

This report and data was produced by:

DNB Engineering, Inc.
3535 W. Commonwealth Avenue
Fullerton, CA 92833
Telephone 714-870-7781

1.2 Requirement

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or other intermediate circuit elements under normal conditions on installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

All spurious emissions shall be 60 dB below the mean power of the transmitter.

Emissions up to and including the tenth harmonic of the fundamental shall be measured.

1.3 Modulation

For this test, single-sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of 2.989, as appropriate. The applicable sub-paragraph of 2.989 (c) is paragraph (1), which states:

"Other than single-sideband or independent sideband transmitters - when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulating circuit."

The item under test attained 50% modulation at 100 mV rms. 16 dB above this level is 630 mV rms. This was the modulation level used for test.

1.4 Test Method

The spurious signals are measured in a three-meter semi-anechoic room that meets the site attenuation requirements of ANSI C63.4. The equipment under test is placed on a non-metallic table 80 cm above a turntable. Support equipment is placed below the table. The receive antenna is mounted on an elevator platform that can be positioned between 1 and 4 meters. At each spurious emission frequency, the turntable and antenna position is adjusted to obtain the maximum signal level. Emissions are recorded for both horizontal and vertically polarized antennas. Equipment is positioned in a manner similar to its final installation.

A block diagram of the test setup is shown in Figure 1.

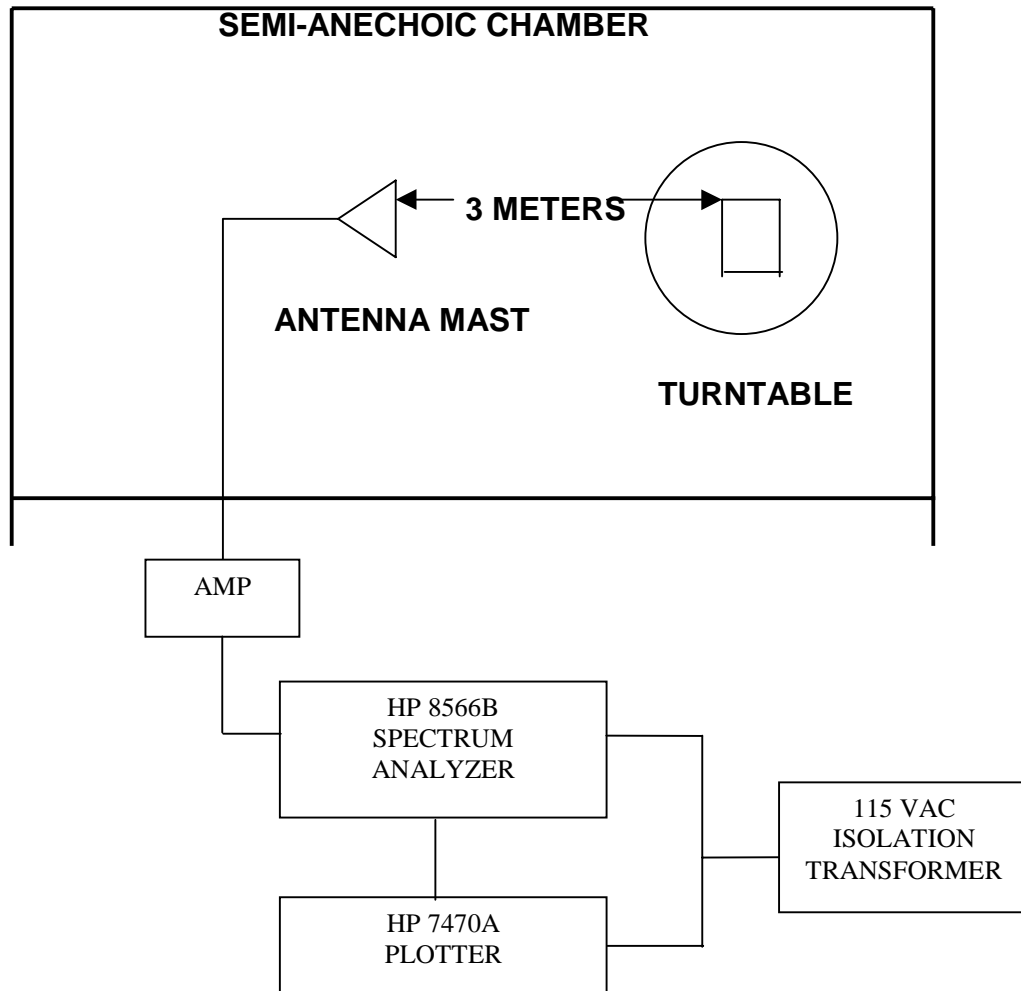


Figure 1 Three meter test setup.

1.5 Test Results

The measured RF output power from the EUT was measured to be 20 Watts.

The electric field at the fundamental frequency was calculated based on the accepted formula:

$(1/3) * (R * P)^{1/2}$ where:

R = 50 ohms

P = 20 Watts

This field level is 10.54 V/m or approximately 140.5 dBuV/m.

Hence, all spurious emissions to be compliant must be less than 80.5 dBuV/m

All emissions recorded were less than 80.5 dBuV/m or 60 dBc (decibels below carrier).

Photographs of the actual test setup are shown in Figure 2.

The eleven highest measurements are provided in Figure 3.

The complete data set is included on the attached EXCEL spreadsheet in Figure 4.

Plots of the peak emissions recorded at each significant emission frequency are provided in the attached plots.

1.6 TEST EQUIPMENT LOG

The following log is equipment used by DNB Engineering for the radiated measurements.

Date: 02/07/00

Test Procedure: Spurious

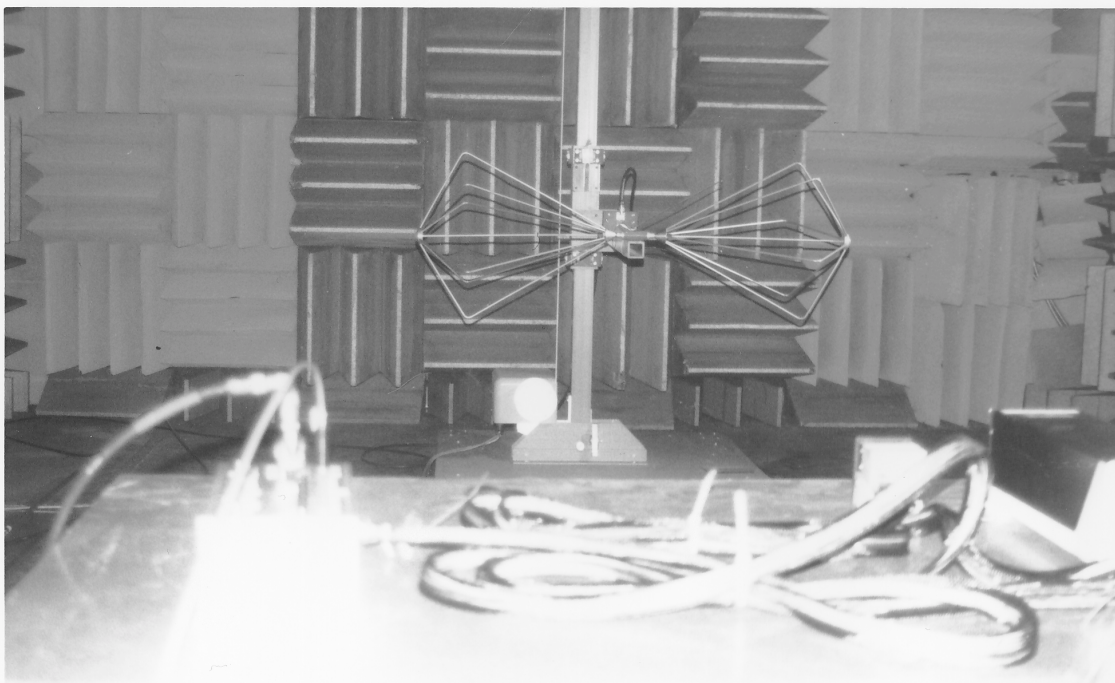
EUT: VC-40A Comm System

Part #: 064-1047-65 (XCVR), 071-1341-50 (CH)

Serial #: E1001 (XCVR), E1002 (CH)

Test Engineer: Fred Gurule

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DUE DATE
Amplifier	MCL	ZFL-2000 (2 MHz to 2 GHz)	5/7/00
Antenna, Biconical	A.H. Systems	SAS 200/540/528	07-14-00
Antenna, Log-Periodic	A.H. Systems	SAS 200/512/371	07-04-00
Non-Radiating Load	Coaxial Dynamics	85/245	Customer supplied
Signal Generator	Marconi	2024	Reference
Spectrum Analyzer	Hewlett Packard	8568B, 11403992180013/14	08/06/00
Tower	EMCO	1050, 1196	Cal prior to use
Turntable	EMCO	1060C, 1017	Cal prior to use



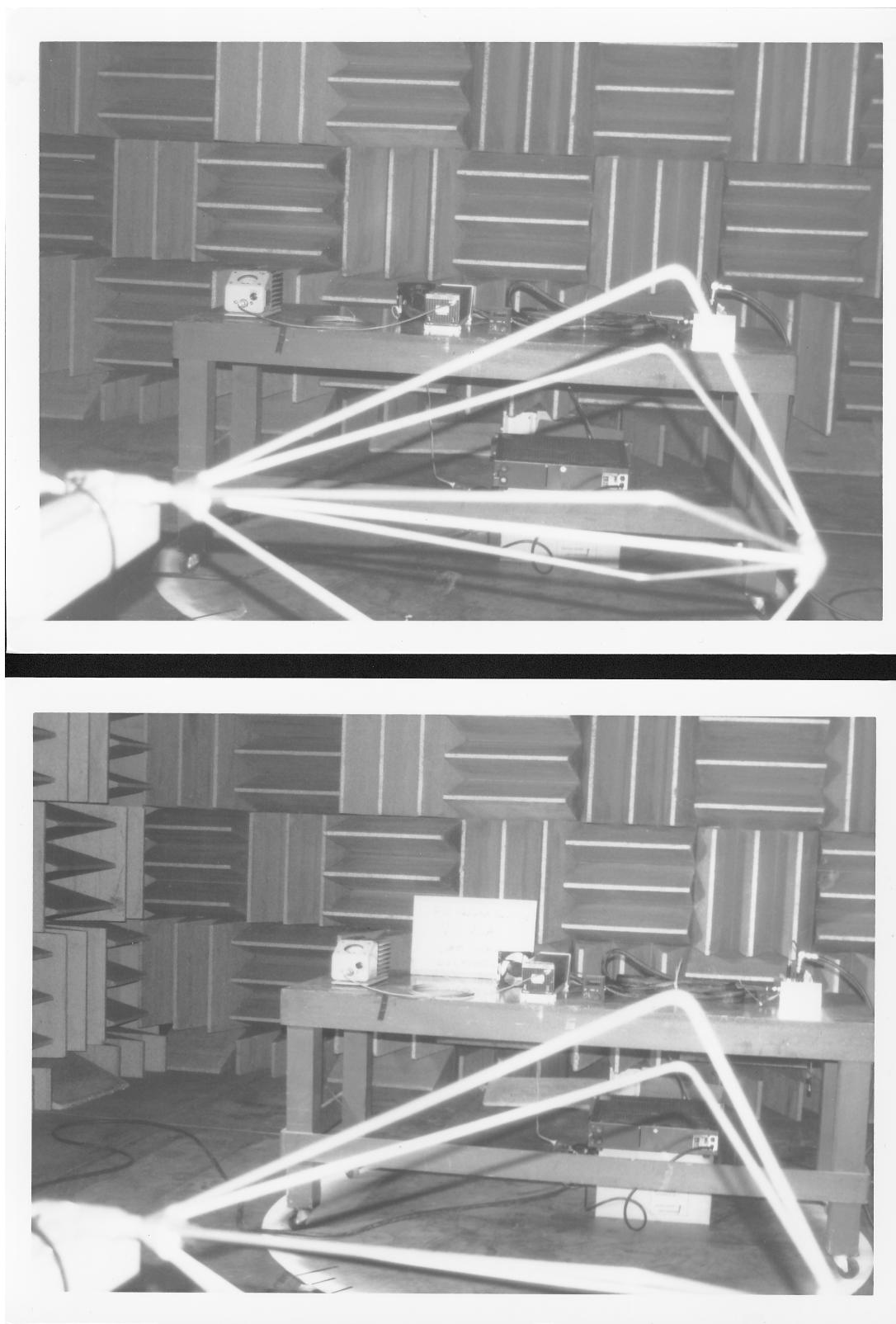


Figure 2 Photos of the DNB test facility.

EMC TEST LOG

CUSTOMER: Wulfsberg	TEST SAMPLE: VC-40A Comm.System
TEST ENGINEER: Fred Gurule	CUSTOMER REP: Tom Tammen

DATE	TIME	TEST DESCRIPTION
02/07/2000	8:00	Set-up Equipment to perform test part CFR 47 part 2.993. Modulation per CFR 47 part, 2.989 (C,1) 16.0 dB above 50% modulation (630mV)
	9:30	Performed RX cable calibration
	10:30	Ambient scans, 30 to 200 MHz, 200 to 1500 MHz, Power on (20 W), 30 – 200 MHz, Peak Azimuth 105 degrees, peak height 124 cm, horizontal orientation
	10:45	Power on (20 W), 30-200 MHz, Peak Azimuth 45 degrees, peak height 100 cm, vertical orientation.
	11:00	At 272 MHz, peak height 100 cm., peak Azimuth 162 degrees, horizontal orientation.
	11:15	At 408 MHz, peak height 208 cm., peak Azimuth 154 degrees, horizontal orientation.
	11:30	At 544 MHz, peak height 196 cm., peak Azimuth 310 degrees, horizontal orientation.
	11:45	At 680 MHz, peak height 208 cm., peak Azimuth 341 degrees, horizontal orientation.
	11:55	At 816 MHz, peak height 253 cm., peak Azimuth 8 degrees, horizontal orientation.
	12:00	Break for lunch
	13:00	Resume testing
	13:15	At 952 MHz, peak height 131 cm., peak Azimuth 39 degrees, horizontal orientation.
	13:30	At 1088 MHz, peak height 115 cm., peak Azimuth 327 degrees, horizontal orientation.
	13:45	At 1224 MHz, peak height 116 cm., peak Azimuth 336 degrees, horizontal orientation.
	14:00	At 1360 MHz, peak height 123 cm., peak Azimuth 320 degrees, horizontal orientation.
	14:15	At 272 MHz, peak height 180 cm., peak Azimuth 120 degrees, vertical orientation.
	14:30	At 408 MHz, peak height 150 cm., peak Azimuth 45 degrees, vertical orientation.
	14:45	At 544 MHz, peak height 100 cm., peak Azimuth 182 degrees, vertical orientation.
	15:00	At 680 MHz, peak height 120 cm., peak Azimuth 45 degrees, vertical orientation.
	15:15	At 816 MHz, peak height 211 cm., peak Azimuth 155 degrees, vertical orientation.
	15:30	At 952 MHz, peak height 155 cm., peak Azimuth 346 degrees, vertical orientation.
	15:45	At 1088 MHz, peak height 100 cm., peak Azimuth 243 degrees, vertical orientation.
	16:00	At 1224 MHz, peak height 100 cm., peak Azimuth 240 degrees, vertical orientation.
	16:15	At 1360 MHz, peak height 100 cm., peak Azimuth 54 degrees, vertical orientation.
	16:30	Completed Radiated Spurious Test Unit Passed Test

Figure 3 EMC Test Log.

Spurious Measurement																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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Figure 4 Data set of highest measured emissions.

SPURIOUS RADIATED SIGNAL MEASUREMENTS

(Ref: Part 2, Subpart J, 2.991 & 2.993)

Date 2/7/00 Pass ☒ Fail ☐ (at Freq.)
 EUT VC-40A COM SYSTEM Operating Power 20 W
 Part No. 064-1047-65 (RCVR) Operating Mode Modulated
 Serial No. 1001 (XCVR) Test Engineer John Stanford

Part No: 071-1341-50 (CH)

Serial No 1002 (CH) FREQUENCY TUNED TO 136.0 MHz

HIGHEST READINGS

ANT POL	FREQ MHz	SPECTRUM ANALYZER (dBμV)	ANT. FACTOR (dB)	CABLE LOSS (dB)	AMP GAIN (dB)	dBμV/m	FUND FIELD STRENGTH dBμV/m	SPUR BELOW CARR- IER (dBc)
H	952	76.4	23	2.6	21.8	80.2	140.45	60.25
H	816	76.0	21.9	3.0	21.6	79.3	↑	61.15
V	816	72.9	21.9	3.0	21.6	76.2		64.25
V	1088	68.8	24.9	3.3	22.0	75.0		65.45
H	408	75.5	16.3	2.1	21.2	72.7		67.75
V	544	71.8	18.6	2.1	20.9	71.6		68.85
H	544	70.7	18.6	2.1	20.9	70.5		69.95
V	408	72.8	16.3	2.1	21.2	70.0		70.45
H	1088	64.0	24.9	3.3	22.0	70.2		70.25
V	952	64.4	23.0	2.6	21.8	68.2	↓	72.25
H	1224	55.0	26.5	3.6	22.0	63.1	140.45	77.35

$$\text{Fundamental Field Strength (V/m)} = 1/3 (\text{Ro} \times \text{Po})^{1/2}$$

Ro = Amplifier Output Impedance (Ohms)

Po = Amplifier Output Power (Watts)

$$\text{Conversion from } \mu\text{V/m to dB}\mu\text{V/m} = (\mu\text{V/m}) \log \times 20$$

Figure 5 Spurious radiated signal measurements.

