



TEST SPECIFICATION:

FCC "Rules and Regulations", Part 74,
Experimental Radio, Auxiliary, Special Broadcast and Other Program
Distribution Services for Operation in the

614 to 806 MHz Band

Subpart H, Low Power Auxiliary Stations
Sections 74.801 to 74.882

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name: UC Wireless Series Transmitter

Kind of Equipment: Wireless Microphone (Hand-held)

Test Configuration: Transmitting (modulated carrier)

Emission Designator: 120KF3B

Transmitter FCC ID: DD4UC2B

Model Number: UC2B

Serial Number: NA

Dates of Test: April 28, 29 & May 4, 1999

Test Conducted for: Shure Brothers, Inc.

222 Hartrey Avenue

Evanston, Illinois 60202

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Report No. 7354
07/27/99

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Lab Manager

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Brian J. Mattson
General Manager

Company Official:

Shure Brothers, Inc.

NVLAP

Certificate of Accreditation

(Available upon request)

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Scope of Accreditation

(Available upon request)



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1.0 SUMMARY OF TEST REPORT

It was found that the UC Wireless Series Transmitter S/N NA meets the radio interference emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Sections 74.801 to 74.882 for Low Power Auxiliary Stations operating in the 692 to 716 MHz Frequency Band.

2.0 INTRODUCTION

On April 28, 29 & May 4, 1999, a series of radio frequency interference measurements were performed on Wireless Microphone (Hand-held), S/N NA. The tests were performed according to the procedures of FCC as stated in Part 2 Subpart J, Equipment Authorization Procedures of the Code of Federal Regulations 47, by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Sections 74.801 to 74.882 for Low Power Auxiliary Stations operating in the 692 to 716 MHz Frequency Band.

4.0 TEST SET-UP

All radiated emission tests were performed at D.L.S. Electronic Systems, Inc. The radiated tests were made with the test item placed on a wooden turntable located in the Test Room with the receive antenna placed at one or three meters from the device under test.



5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All data was automatically plotted using peak detector function. This information was then used to determine the frequencies of maximum emissions. Manual measurements were performed on those frequencies using a peak detector function of the Analyzer with the bandwidths specified by the FCC. From 200 MHz to 1000 MHz a bandwidth of 100 kHz was used (except for Occupied Bandwidth), and above 1000 MHz, wide enough bandwidths were used, depending upon the test being made, to ensure proper measurement of the narrowband signal. A list of the equipment used can be found in Table 1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

6.0 RF POWER OUTPUT - PART 2.1046

As stated in PART 74.861 (e-1), the output power should not exceed 250 milliwatts (24 dBm). The UC Wireless Series Transmitter was tuned according to the tune-up procedures specified in Part 2.1033 (c-8), and adjusted for its maximum output power. The RF output power was measured in the open field, using the following test method:

Substitution Method:

The radiated signal from the EUT was measured. The EUT was then substituted with a signal generator and a tuned dipole antenna. The output of the signal generator was increased until the level received by the tuned dipole equaled that of the previous measurement from the EUT.

Measurement made: **119 dBuV** which equals **0.0159 watts**

MARGIN:

$$0.25 \text{ watts} - 0.0159 \text{ watts} = 0.234 \text{ watts}$$

NOTE:

See the following pages for the graphs of the actual measurements made:



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GRAPHS TAKEN OF THE RF POWER

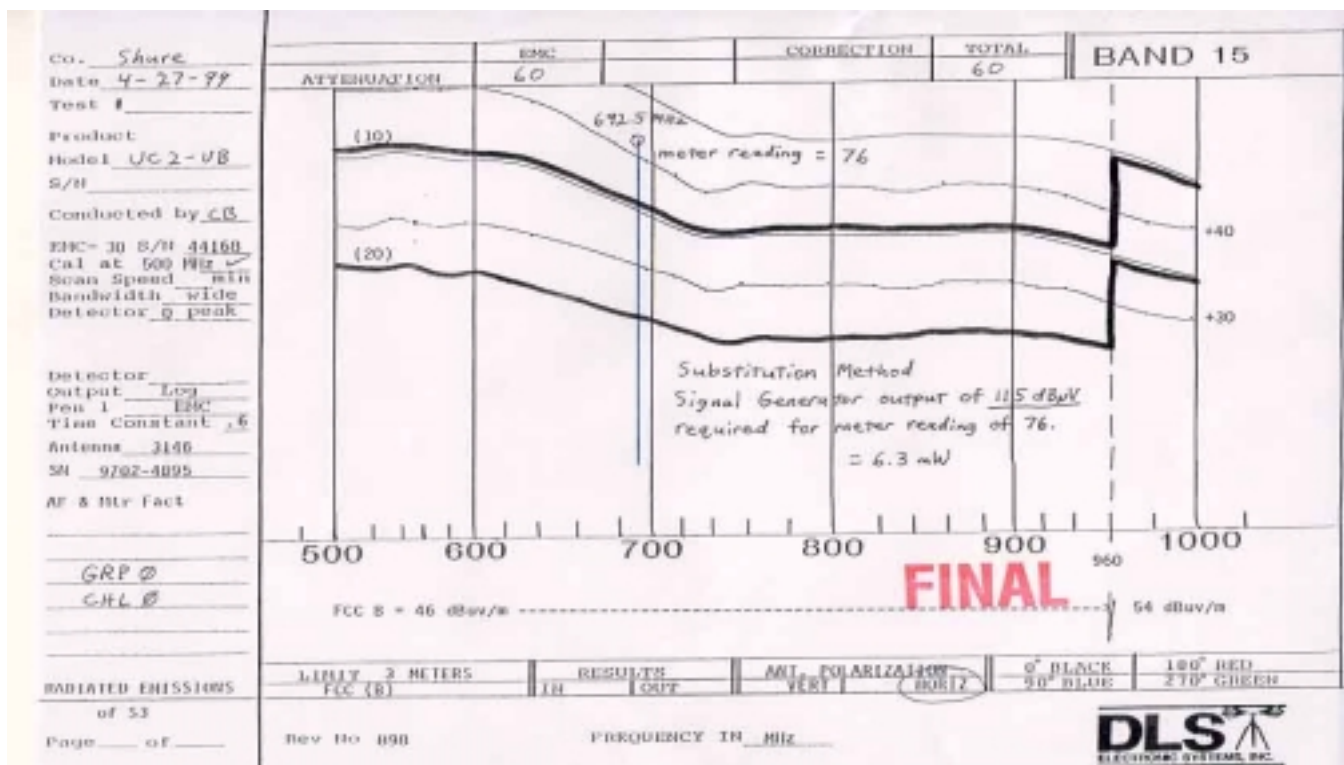
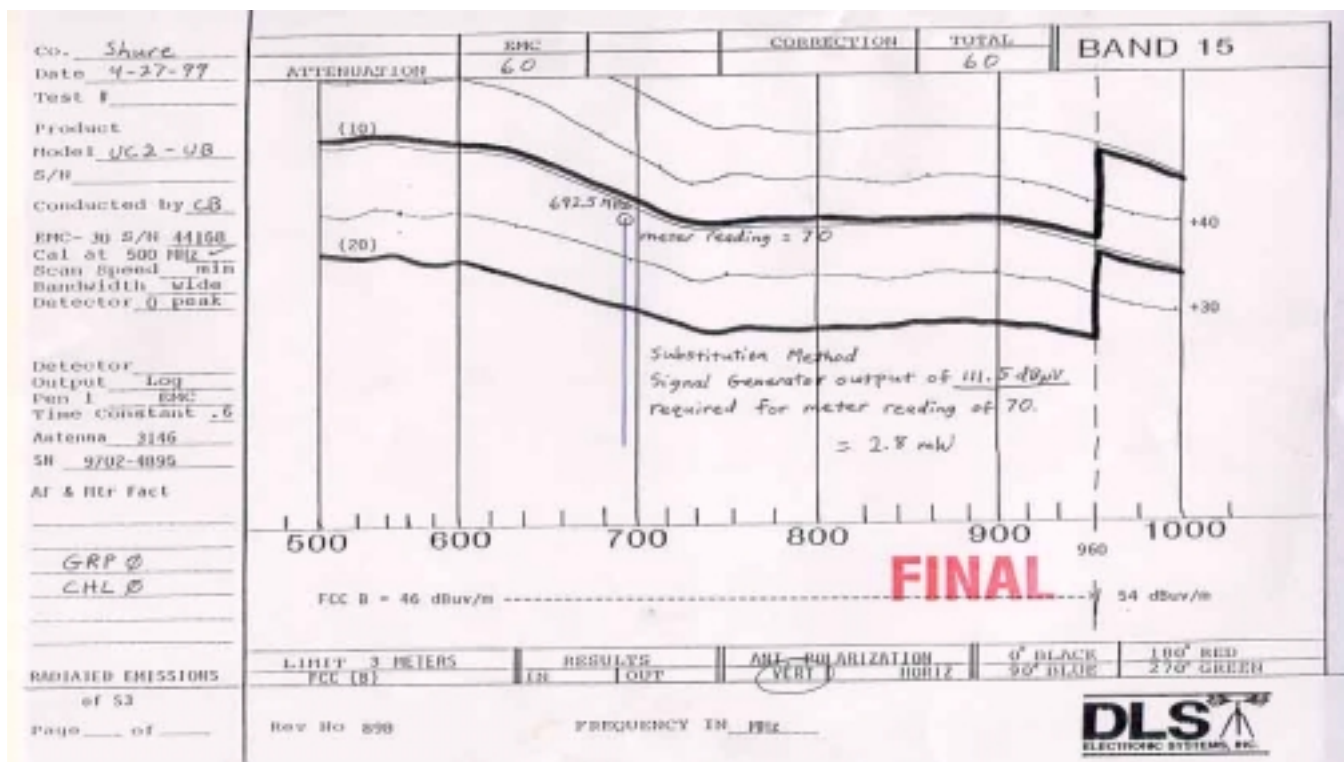
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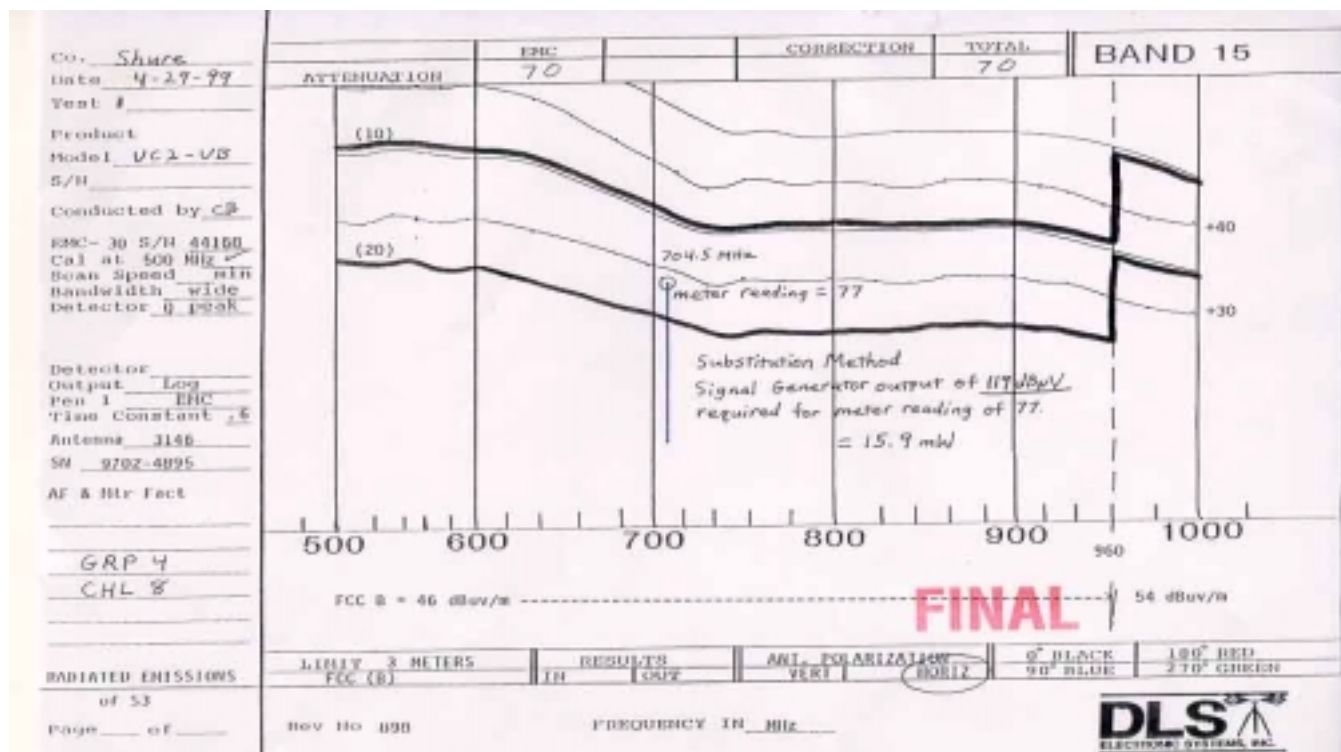
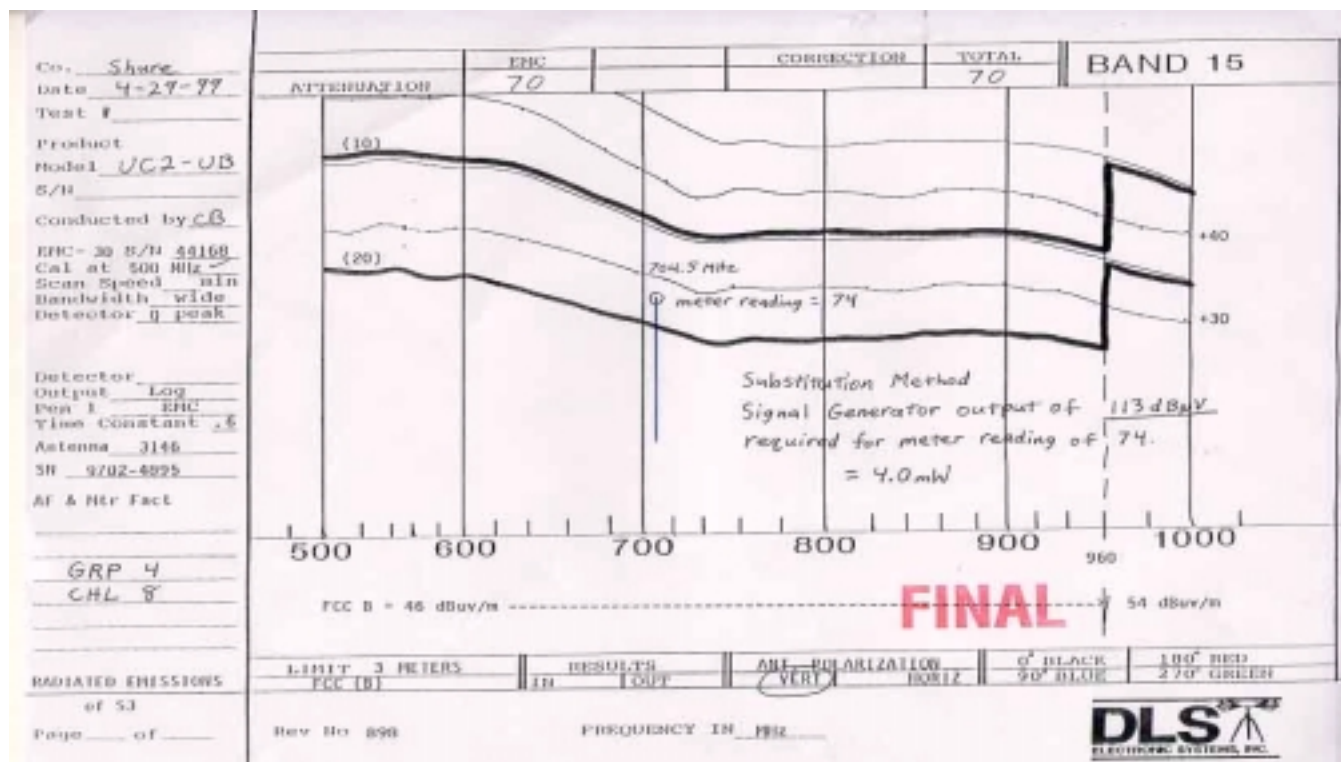
PART 2.1046



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7.0 Modulation Characteristics - Part 2.1047

a. Voice modulated communication equipment

A curve showing the frequency response of the audio modulating circuit over a range of 50 Hz to 20000 Hz is submitted with this report.

b. Equipment which employs modulation limiting

A family of curves showing the percentage of modulation versus the modulation input voltage with sufficient information showing the modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

NOTE:

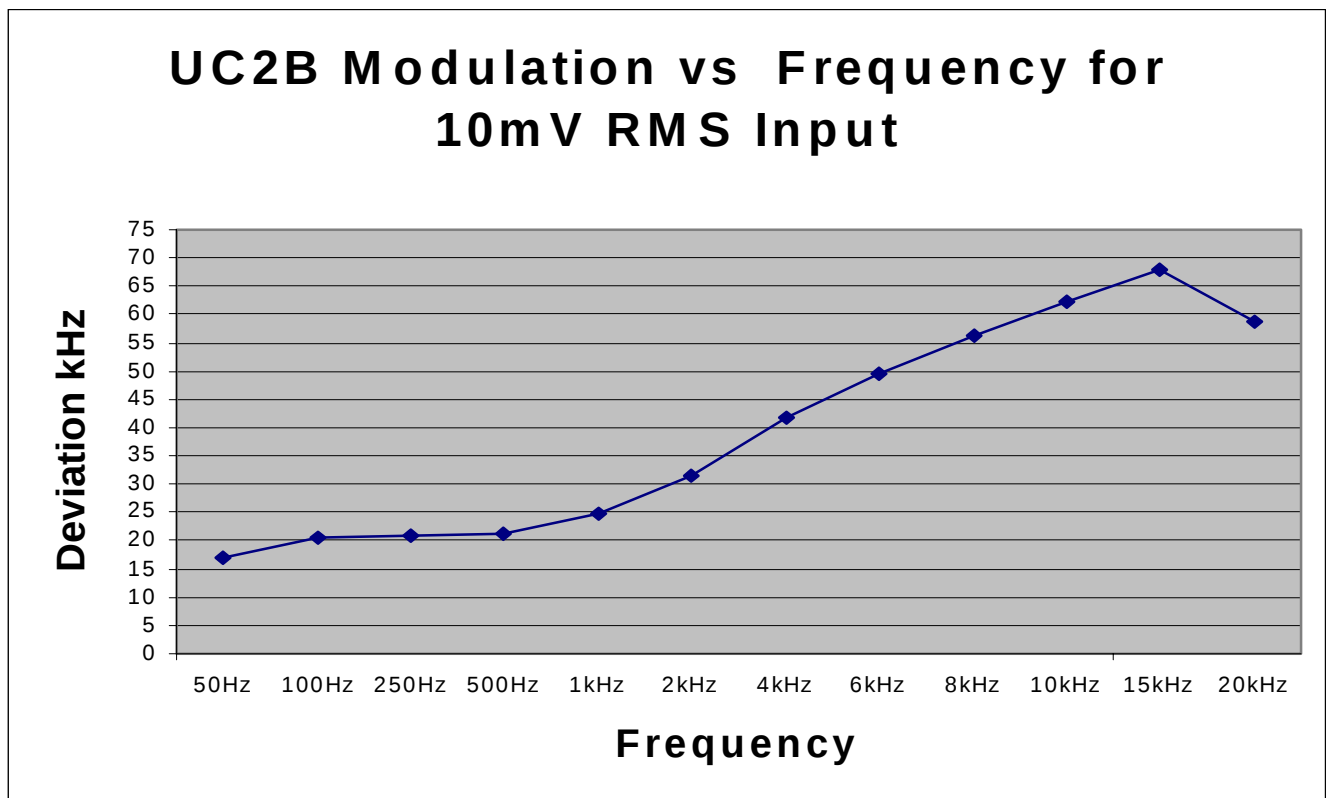
See the following pages for the graphs of the actual measurements made:

GRAPHS TAKEN SHOWING THE FREQUENCY

RESPONSE OF THE

AUDIO MODULATING CIRCUIT

PART 2.1047





8.0 OCCUPIED BANDWIDTH – PART 2.1049

The frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to .5% of the total mean power radiated by a given emission.

As stated in Part 2.1049 c-1 the UC Wireless Series Transmitter was modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. This input level was established at the frequency of maximum response of the audio modulating circuit.

Part 74.882, Paragraph e-5 states that the maximum authorized bandwidth shall be 200 kHz for all emissions inside these frequency bands.

Carson's Rule:

Section 2.202 (g)

$B_n = 2M_2DK, K=1$ B_n = Bandwidth

$M = 15 \text{ kHz},$ M = Maximum Modulating Frequency

$D = 45 \text{ kHz},$ D = Peak Deviation

$B_n = 2(15) + 2(45)(1) = 120 \text{ kHz}$

NOTE: See the following pages for the graphs of the actual measurements made:

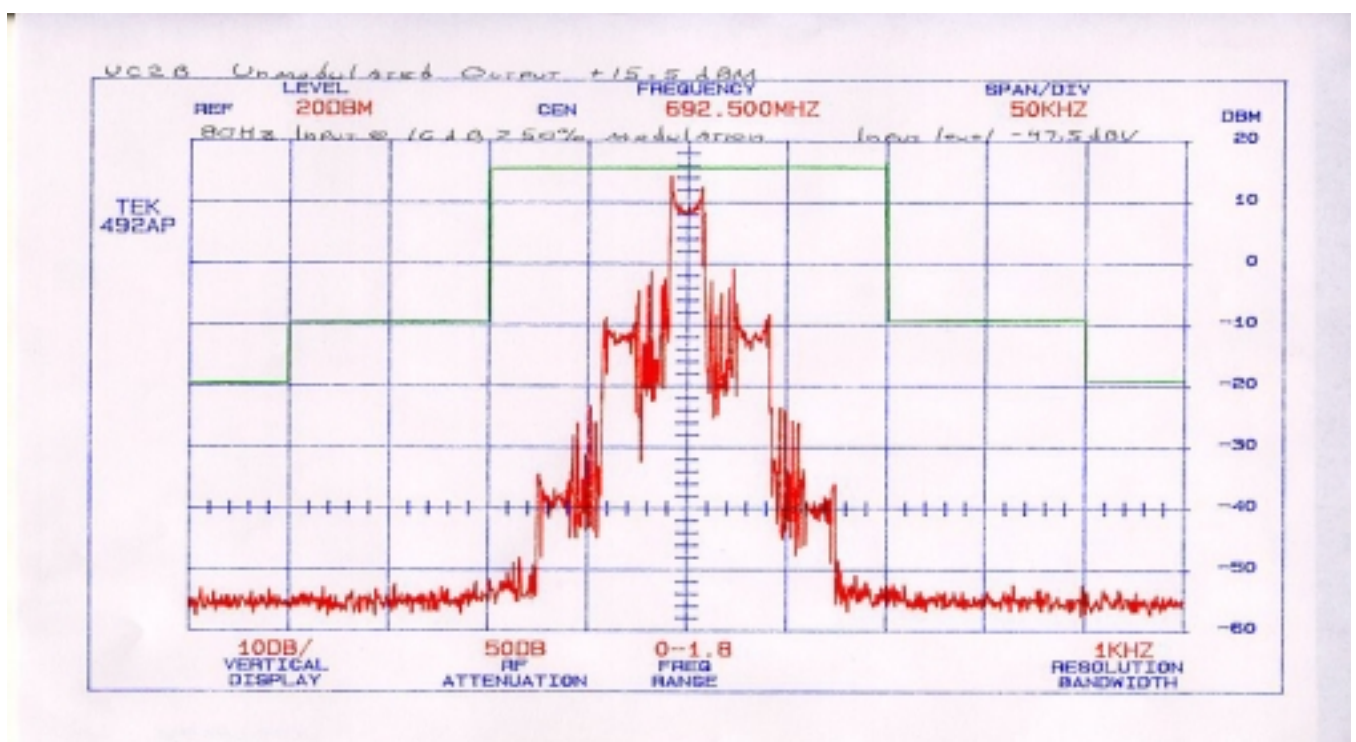
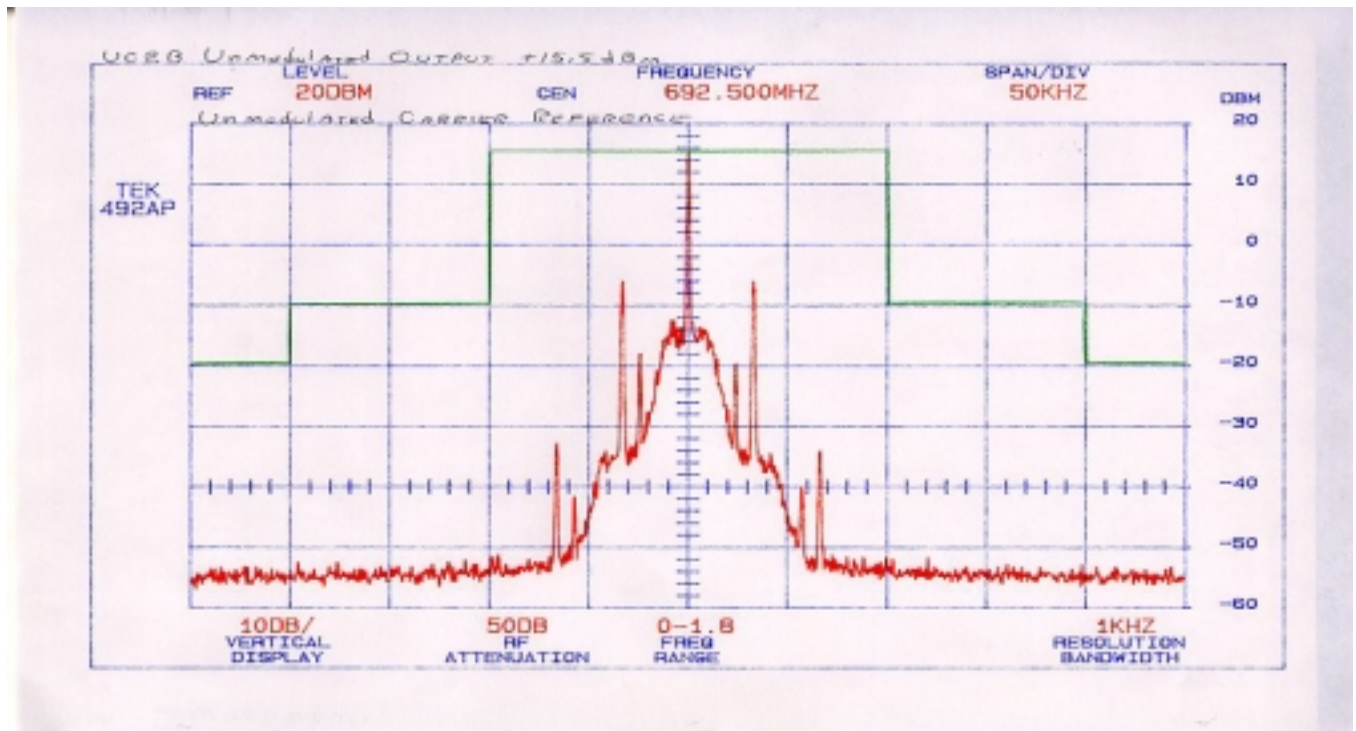


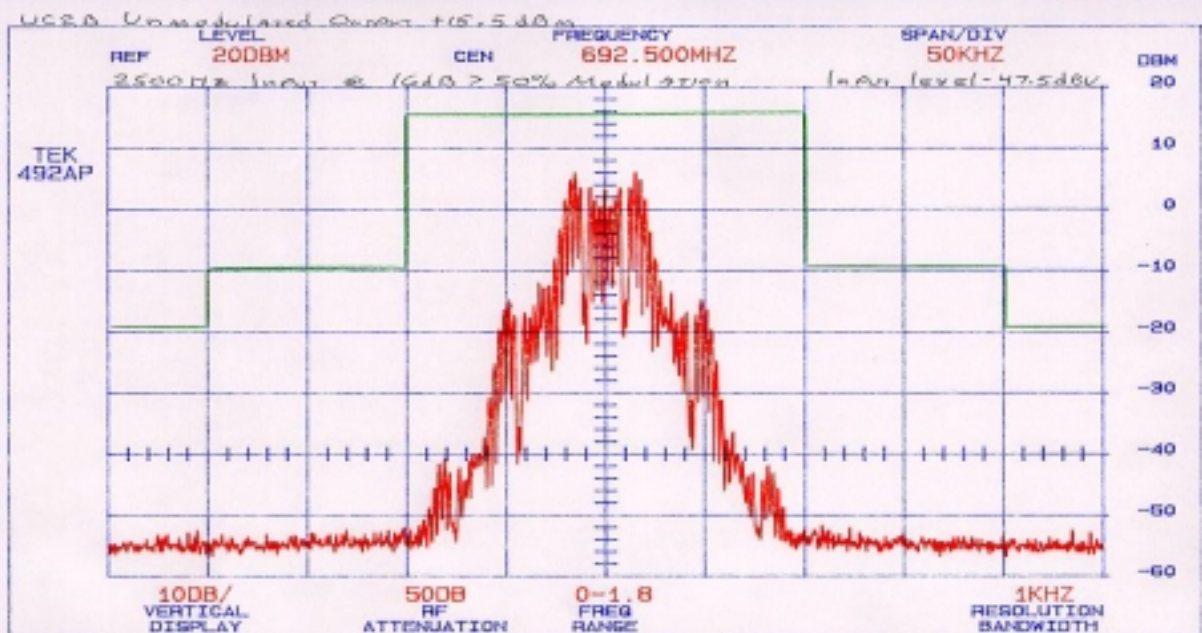
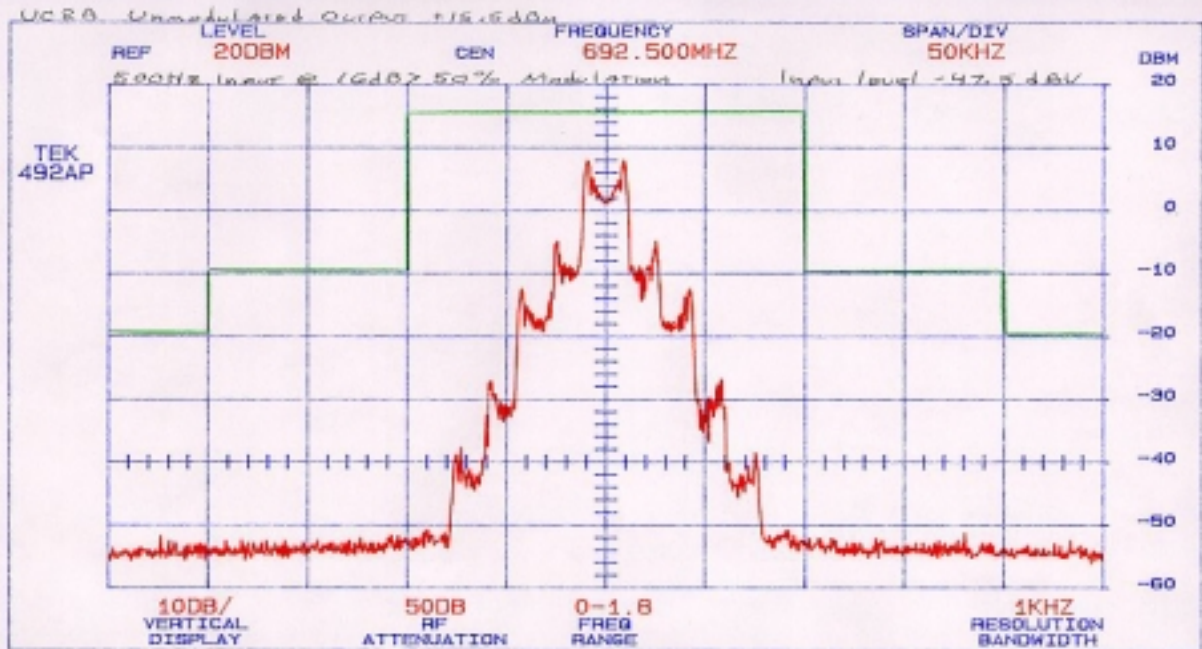
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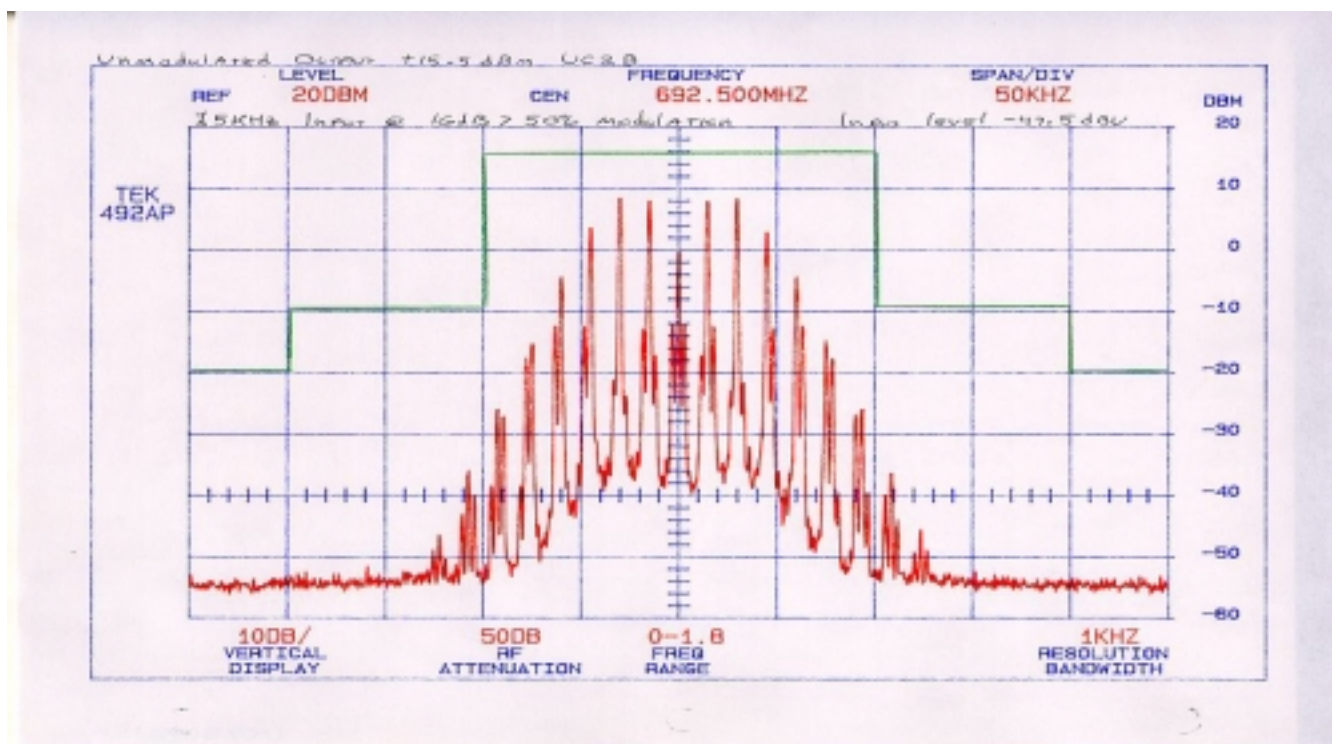
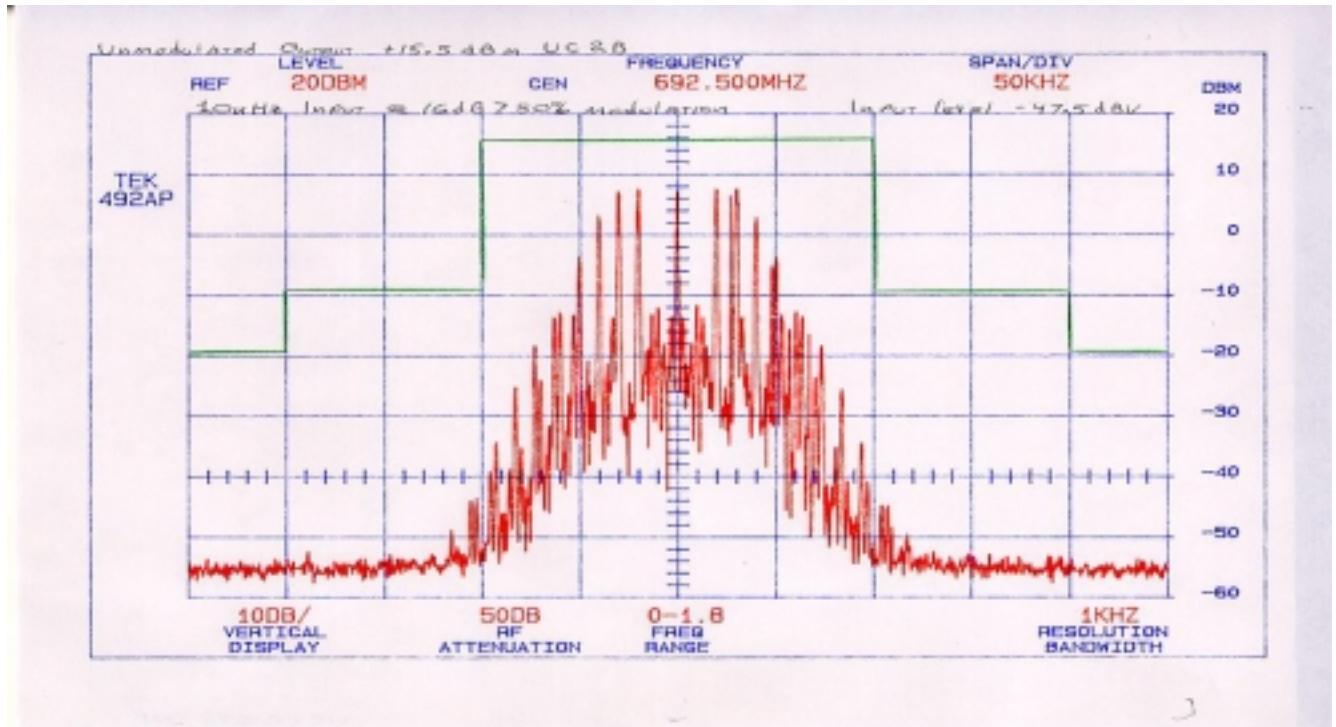
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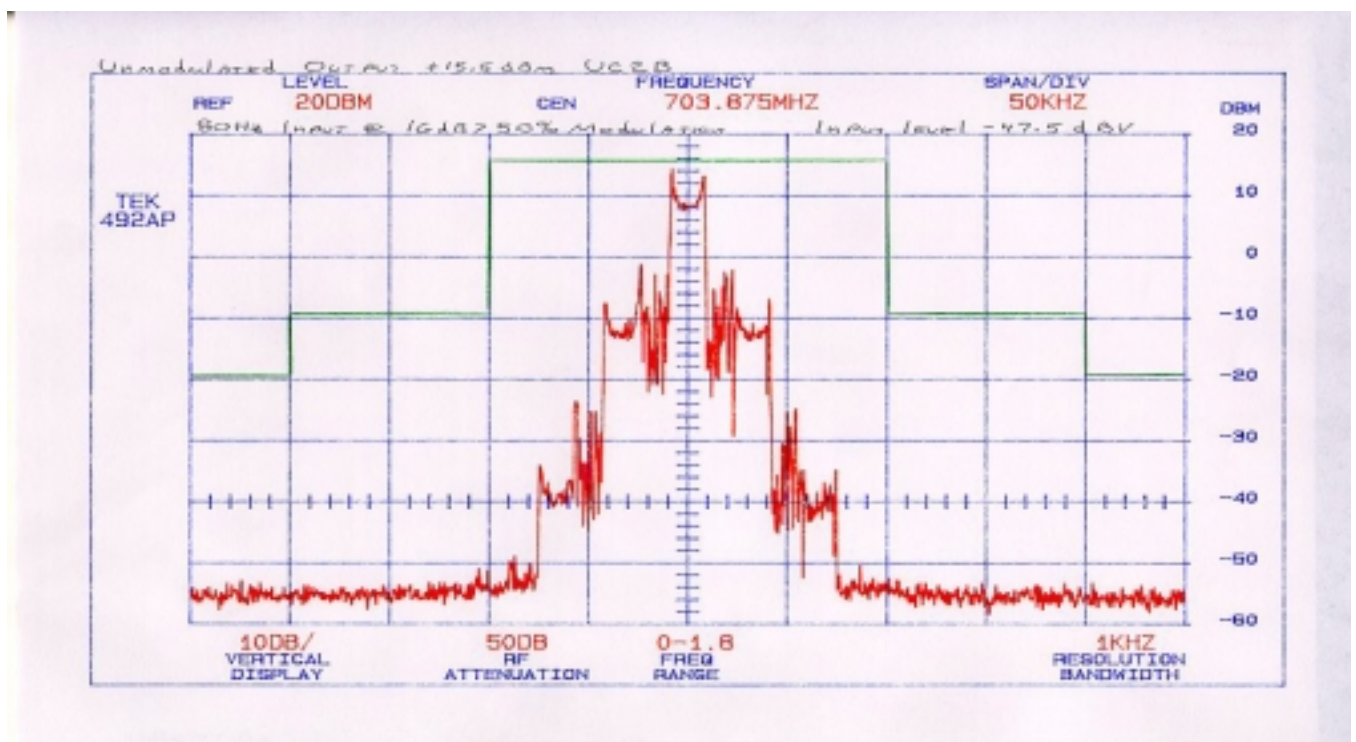
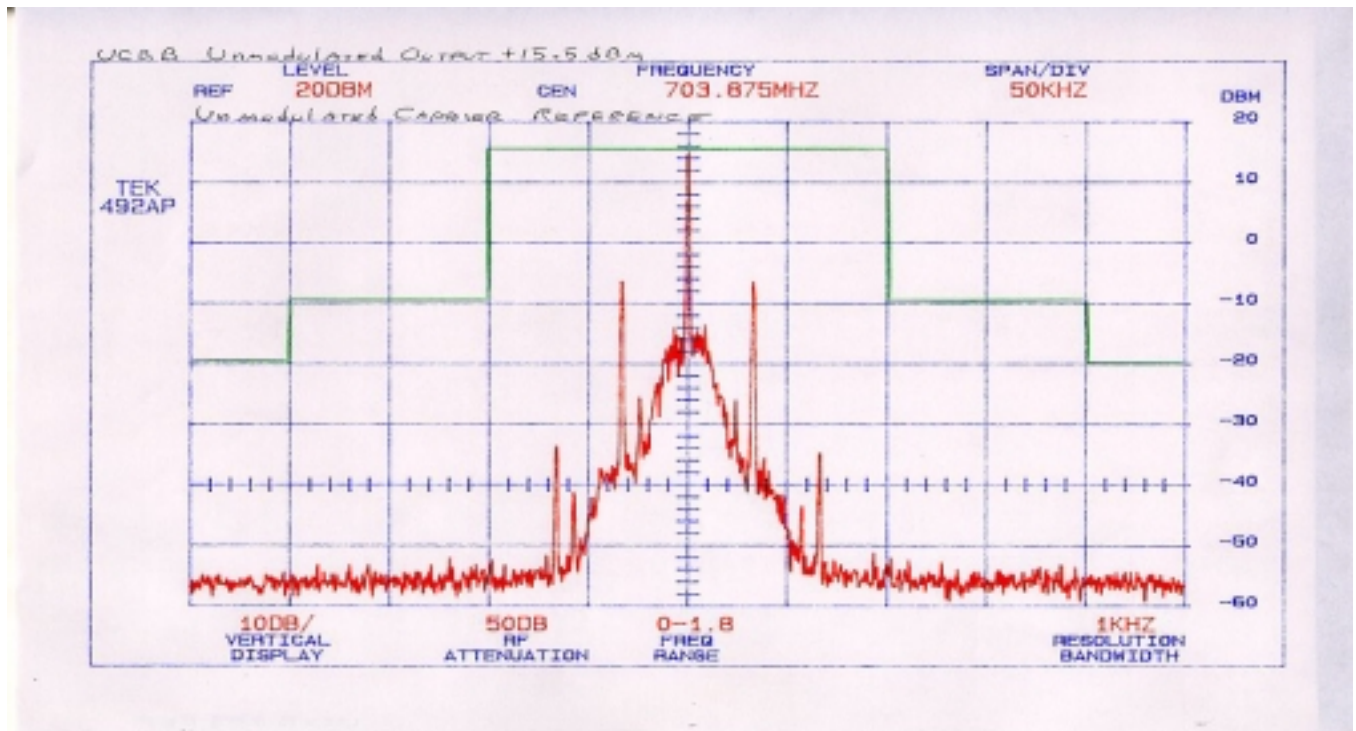
GRAPHS TAKEN OF THE OCCUPIED BANDWIDTH

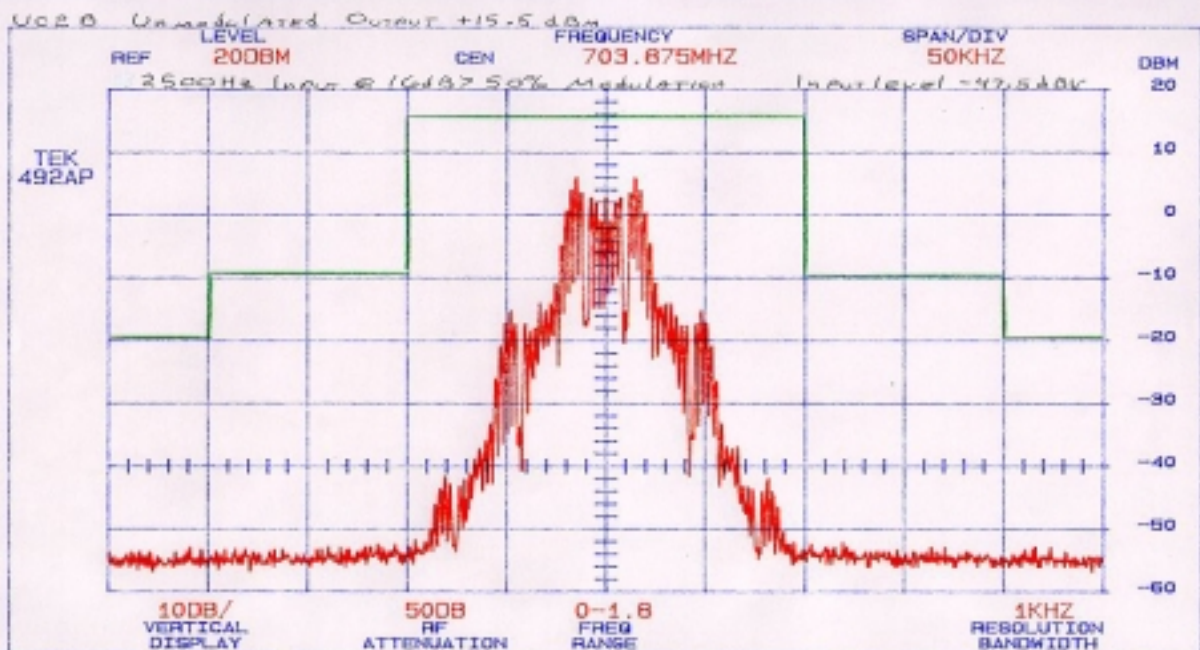
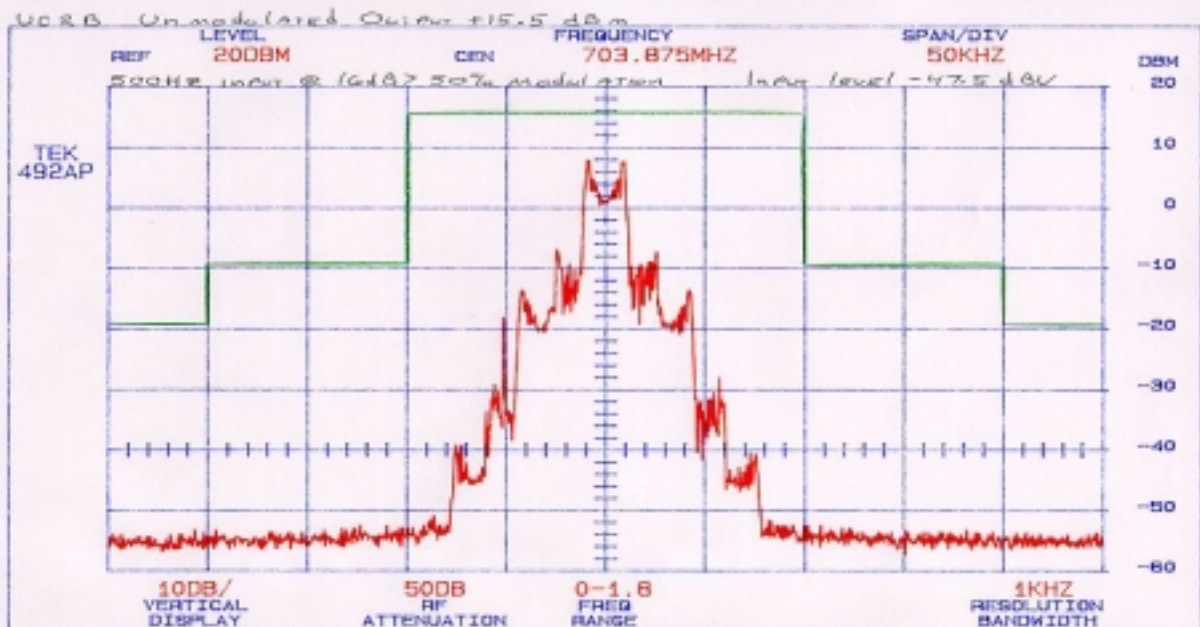
PART 2.1049

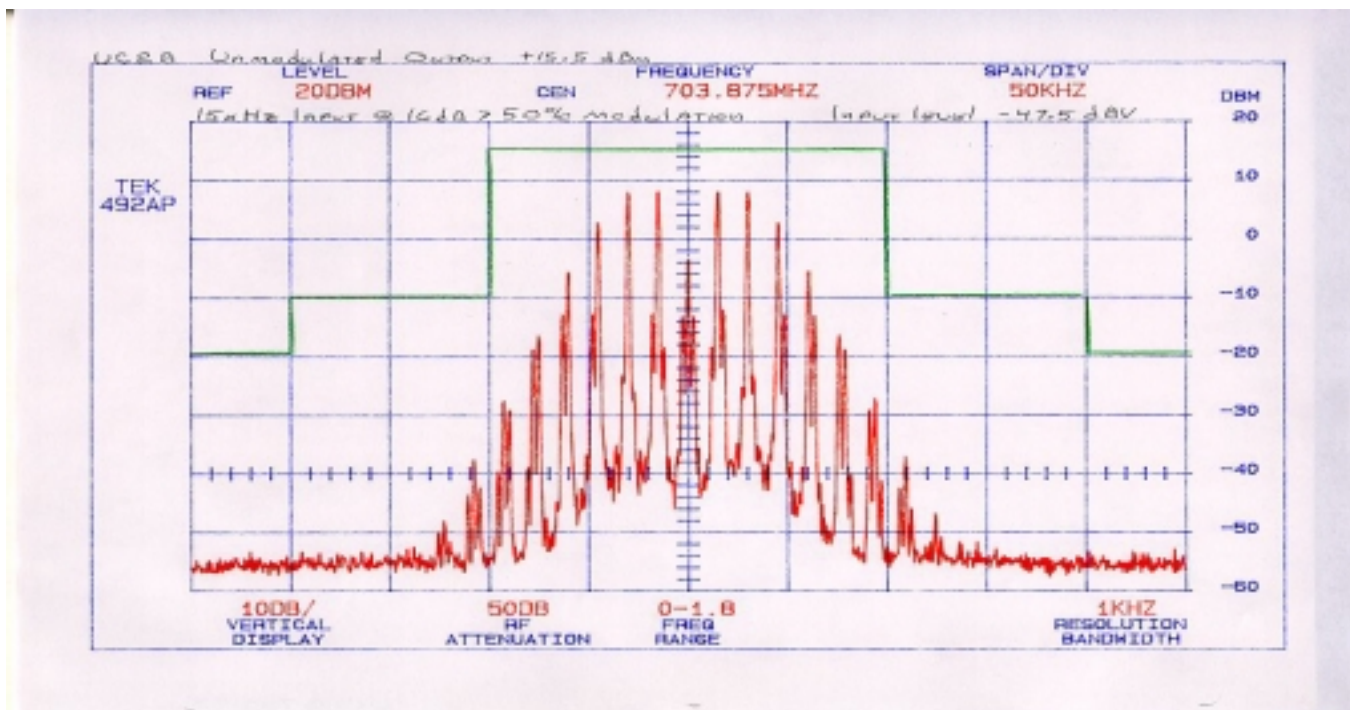
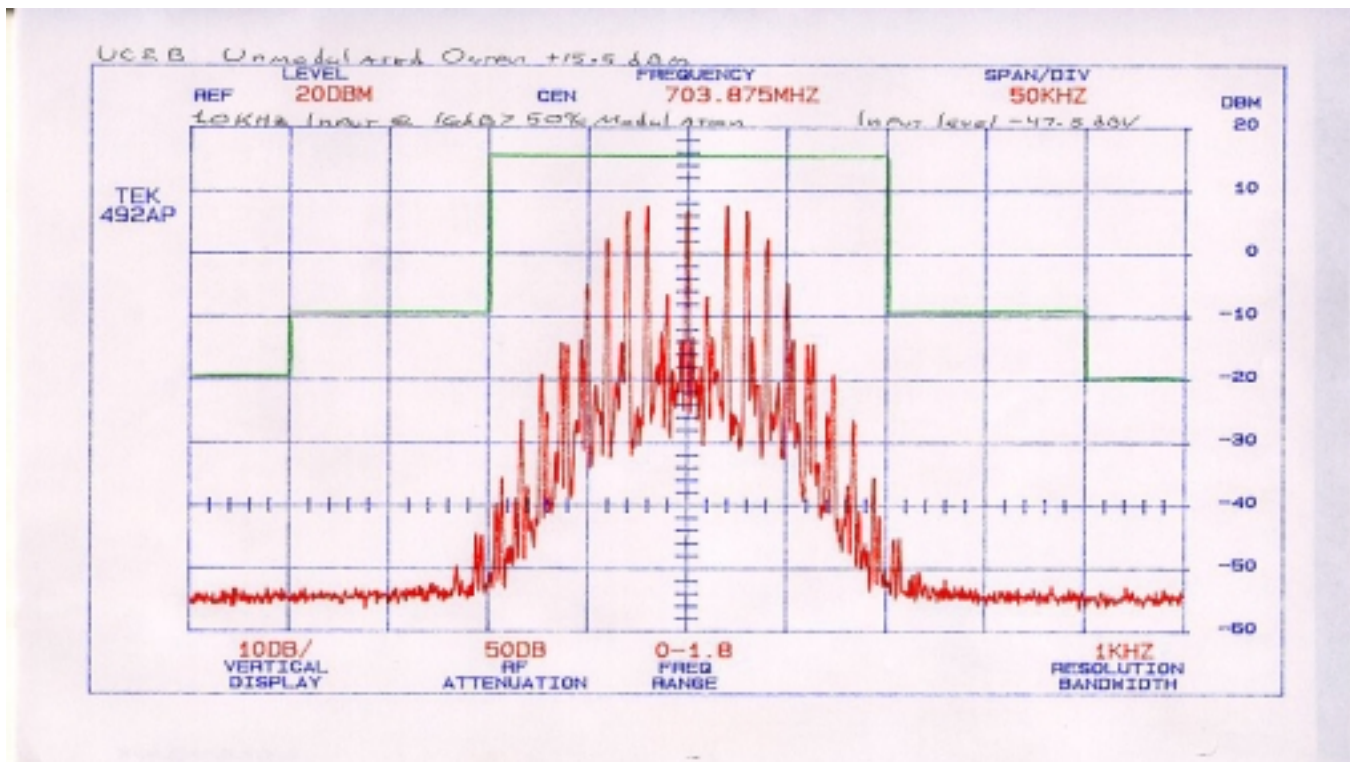


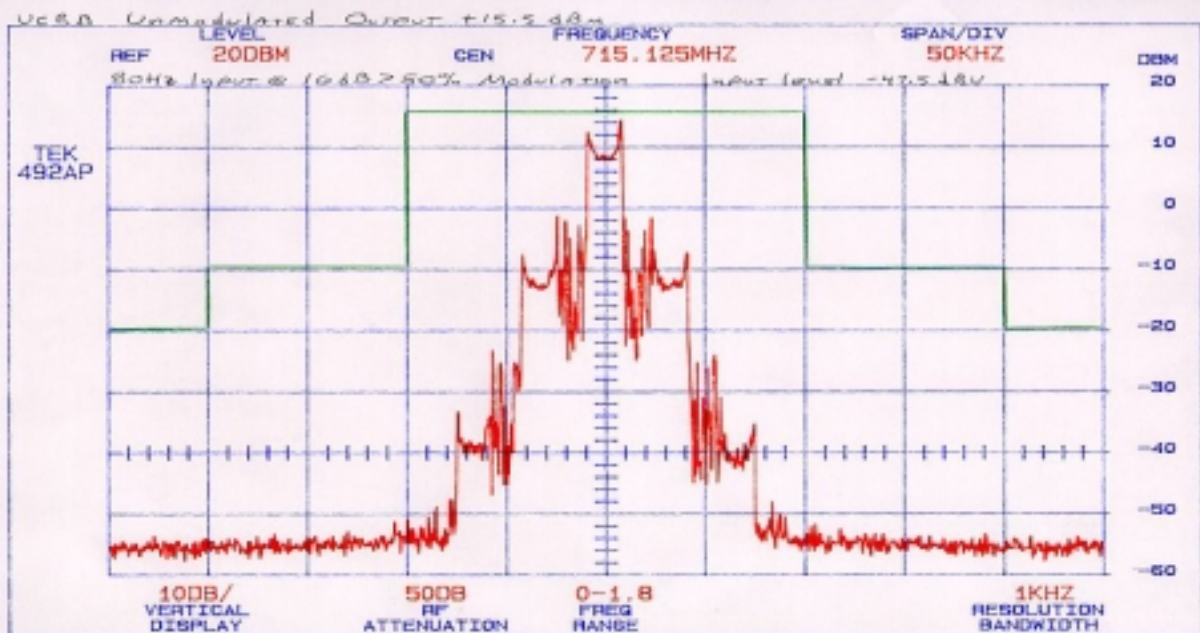
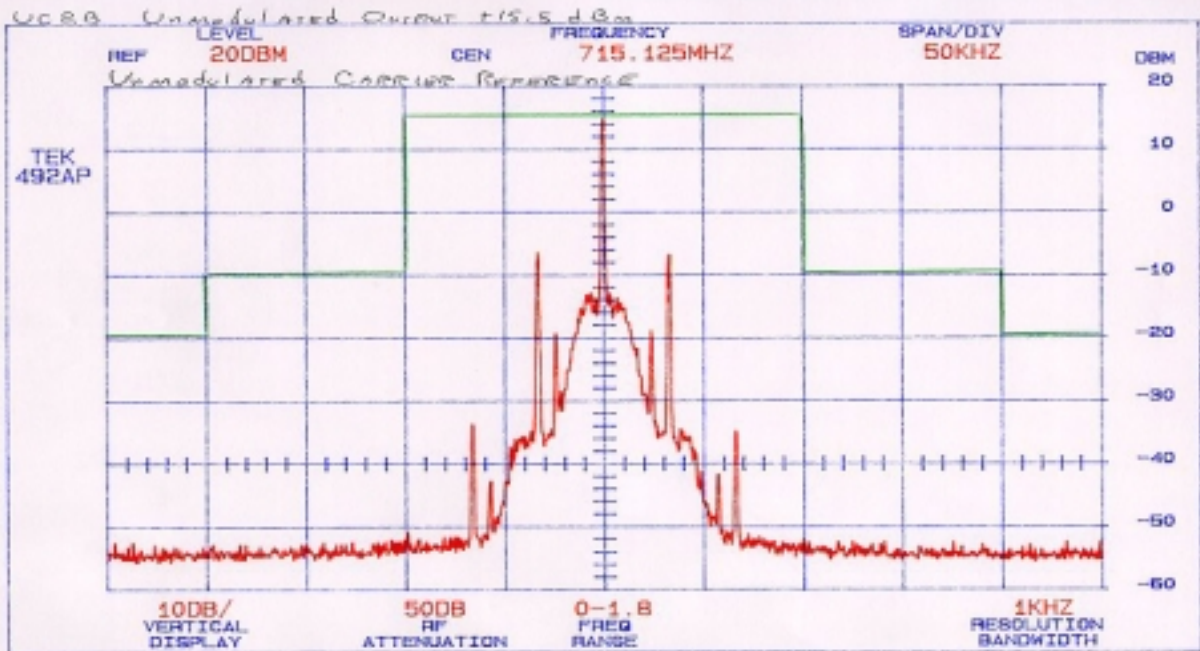


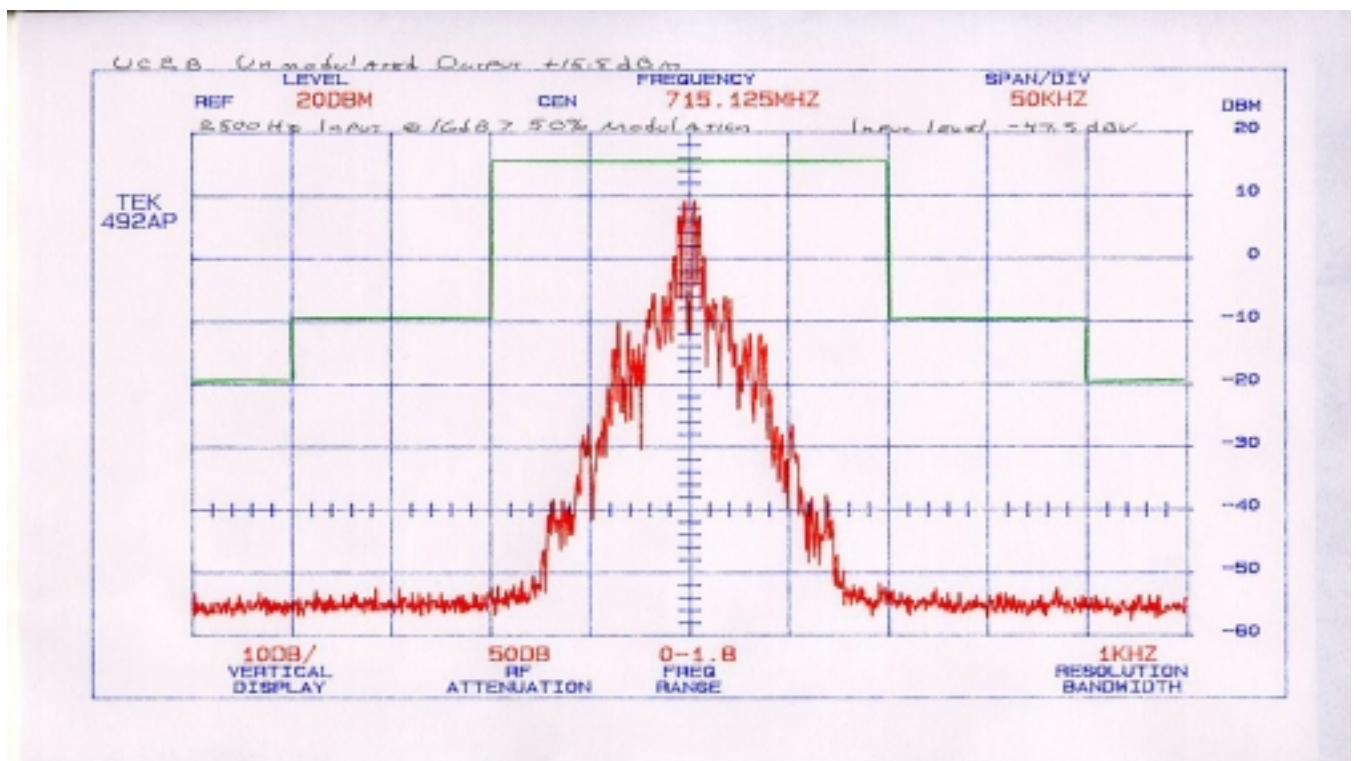
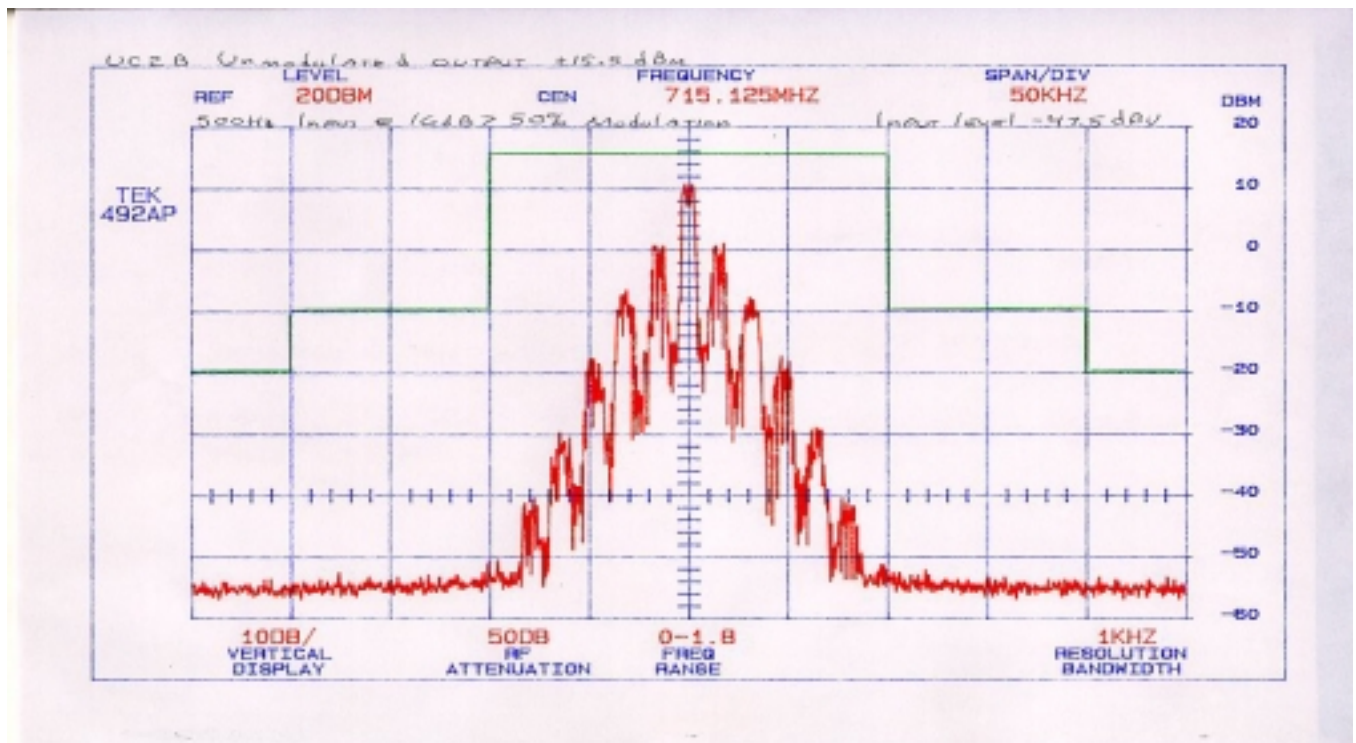


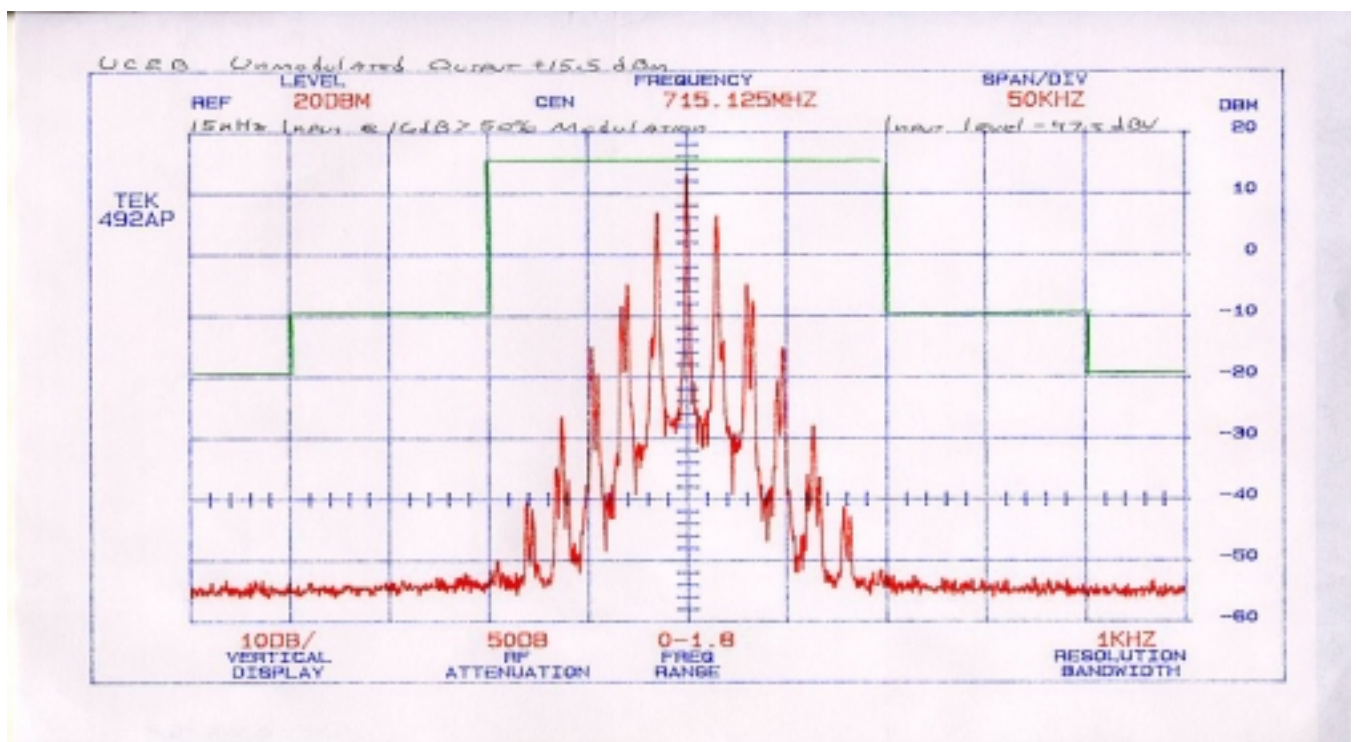
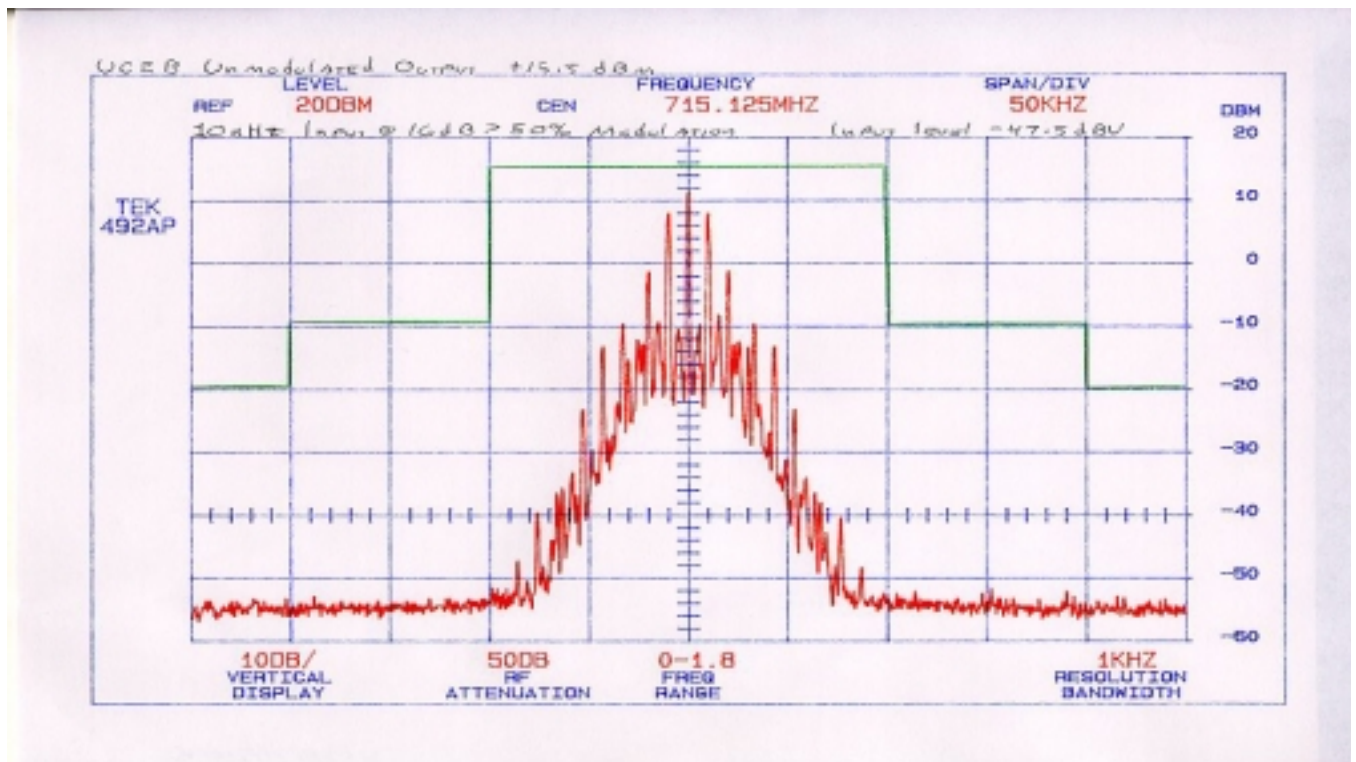














9.0 Frequency Deviation and Tolerance - PART 74.861

Paragraph e-3 states that the maximum authorized deviation shall be 75 kHz for all frequency modulation emissions in the frequency bands 692 to 716 MHz.

Paragraph e-4 states that the frequency tolerance of the transmitter shall be .005 percent.

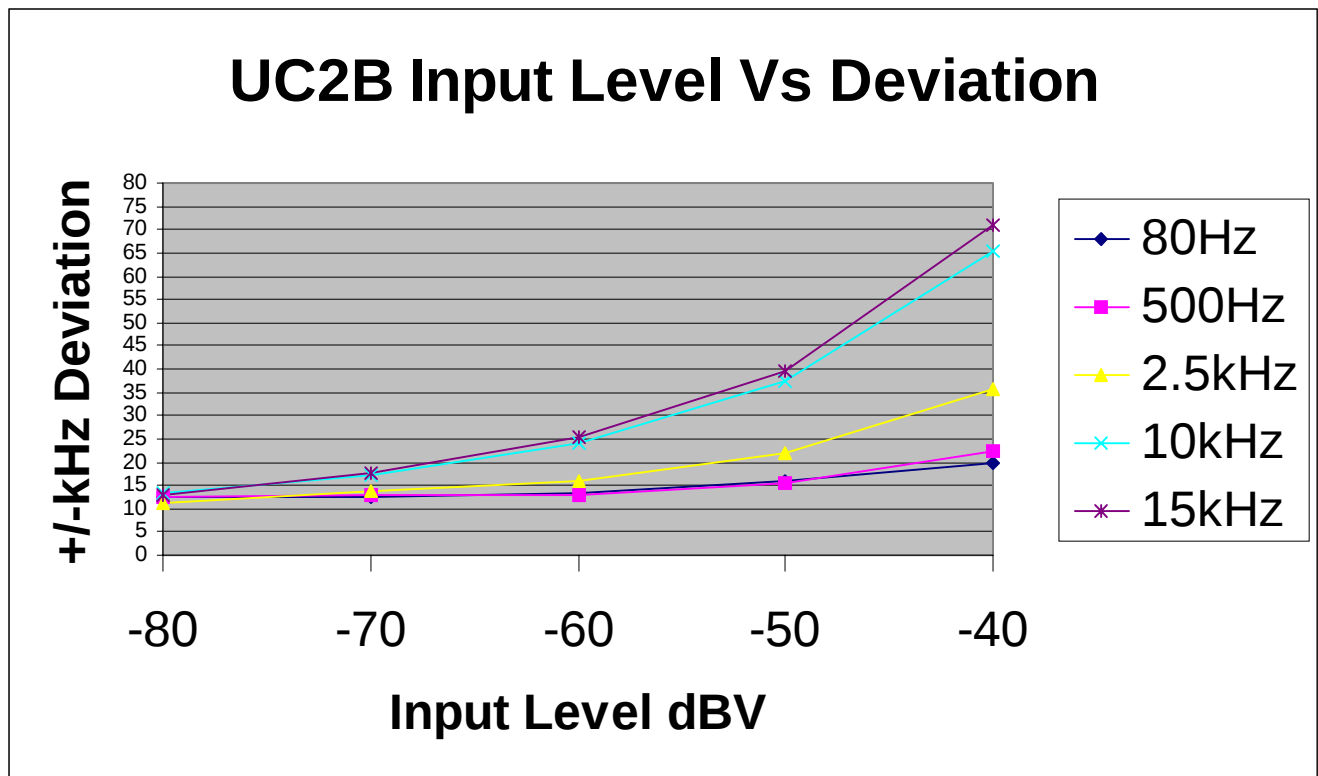
NOTE:

See the following pages for the graphs of the actual measurements made:

GRAPHS TAKEN OF THE FREQUENCY DEVIATION

WITH MODULATION

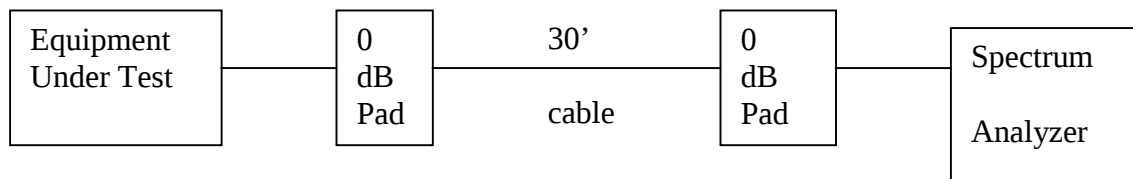
PART 2.1049



10.0 SPURIOUS CONDUCTED EMISSION MEASUREMENTS AT ANTENNA TERMINALS PART 2.1051

Spurious conducted emissions were measured at the antenna terminals using an artificial load. Plots were made showing the amplitude of each harmonic emission with the equipment operated as specified in 2.1051. As shown by the radiated charts there was no reason to believe that there were any spurious emissions other than the harmonics that were than individually investigated when doing the conducted test at the antenna terminals. Measurements were made up to the 10th Harmonic of the fundamental. The following setup was used showing placement of the attenuators:

NOTE: This test was not run because there is no antenna port.



The allowed emissions for transmitters operating in the 692 to 716 MHz bands for UC Wireless Series Transmitter equipment are found under Part 74, Section 74.861, Paragraph e-6 for Low Power Auxiliary Stations. This paragraph states the mean power of the emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
- (2) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
- (3) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10\log_{10}$ (mean output power in watts) dB.

NOTE: See the following pages for the data and graphs of the actual measurements made:



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CONDUCTED EMISSION DATA TAKEN FOR
SPURIOUS EMISSION MEASUREMENTS MADE
AT THE ANTENNA TERMINALS

PART 2.1051

NOTE: This test was not run because there is no antenna port.



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CONDUCTED EMISSION GRAPHS TAKEN FOR

SPURIOUS EMISSION MEASUREMENTS MADE

AT THE ANTENNA TERMINALS

PART 2.1051

NOTE: This test was not run because there is no antenna port.

11.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS PART 2.1053

Radiated measurements were performed at a 1 or 3 meter test distance automatically scanning the frequency range from 200 MHz to 10000 MHz, depending upon the fundamental frequency.

For the UC Wireless Series Transmitter, the highest fundamental frequency is 704 MHz so the scans were made up to 10000 MHz, to cover the tenth harmonic.

All signals in the frequency range of 30 MHz to 200 MHz were measured with a Biconical Antenna and from 200 MHz to 1000 MHz a Log Periodic Antenna was used as the pickup devices. From 1000 MHz to 10000 MHz, a Double Ridge Horn Antenna was used. The cables and equipment were placed and moved within the range of positions likely to find their maximum emissions. Tests were made in both the horizontal and vertical planes of polarization.

The allowed emissions for transmitters operating in the 692 to 716 MHz bands for UC Wireless Series Transmitter equipment are found under Part 74, Section 74.861, Paragraph e-6 for Low Power Auxiliary Stations. This paragraph states the mean power of the emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

- (1) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
- (2) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
- (3) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10 \log_{10}$ (mean output power in watts) dB.



11.0 FIELD STRENGTH OF SPURIOUS EMISSION MEASUREMENTS (CON'T) PART 2.1053

As stated in Part 74, Section 74.861 (e-1 iii) the limit is 250 mW in the frequency range 614 to 806 MHz.

To determine the **LIMIT** for Spurious Emissions the following method was used:

Mean output power in watts:

Measured **15.9 mW**

Converted to 3 meter test distance using the Free Space Formula equals
.294822 volts/meter or 109.39 dBuV/m. So, the Fundamental at three meters
equals 109.39 dBuV, the emissions must be reduced by:

$$43 + 10 * \text{LOG}_{10}(0.0159 \text{ watts}) = 25.01 \text{ dB}$$

Therefore, the **LIMIT** at three meters equals:

109.39 dBuV/m extrapolated level for 0.0159 watts
-25.01 dB required reduction below the unmodulated fundamental
84.38 dBuV/M maximum spurious emissions allowed



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RADIATED DATA TAKEN FOR FIELD STRENGTH

SPURIOUS EMISSION MEASUREMENTS

PART 2.1053



SUMMARY DATA SHEET OF **RADIATED EMISSIONS >1000 MHz**

TEST DATE:----- April 27, 1999
MANUFACTURER:----- Shure Brothers, Inc.
MODEL NO:----- UC2B
S/N:----- NA
CONFIGURATION:----- **GPP 0, CHL 0**
RATED POWER:----- **0.0200**

TEST SPECIFICATION INDUSTRY CANADA / "RADIO STANDARDS SPECIFICATION"
RSS-123, ISSUE 1, --- 24 FEBRUARY 1996
SECTION 6.3.1 (c) / TRANSMITTERS

******LOW POWER AUXILIARY STATIONS******

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: RADIATED EMISSIONS USING **VERTICAL** POLARIZATION

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	ANTENNA PLUS CABLE	PRE-AMP GAIN dB	TOTAL dBuV	ANTENNA DISTANCE IN METERS	LIMIT dBuV	MARGIN dB
1385.62	39.72	28.88	0.00	68.60	3	84.46	15.86
2768.00	41.10	32.90	0.00	74.00	1	94.00	20.00
5546.43	30.20	41.20	0.00	71.40	1	94.00	22.60
6235.95	34.22	41.58	0.00	75.80	1	94.00	18.20



SUMMARY DATA SHEET OF **RADIATED EMISSIONS >1000 MHz**

TEST DATE:----- April 27, 1999
MANUFACTURER:----- Shure Brothers, Inc.
MODEL NO:----- UC2B
S/N:----- NA
CONFIGURATION:----- **GPP 0, CHL 0**
RATED POWER:----- **0.0200**

TEST SPECIFICATION INDUSTRY CANADA / "RADIO STANDARDS SPECIFICATION"
RSS-123, ISSUE 1, --- 24 FEBRUARY 1996
SECTION 6.3.1 (c) / TRANSMITTERS

******LOW POWER AUXILIARY STATIONS******

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: RADIATED EMISSIONS USING **HORIZONTAL** POLARIZATION

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	ANTENNA PLUS CABLE	PRE-AMP GAIN dB	TOTAL dBuV	ANTENNA DISTANCE IN METERS	LIMIT dBuV	MARGIN dB
1385.62	45.32	28.88	0.00	74.20	3	84.46	10.26
2080.29	38.50	29.70	0.00	68.20	1	94.00	25.80
3463.82	35.94	37.66	0.00	73.60	1	94.00	20.40
4155.91	32.32	38.68	0.00	71.00	1	94.00	23.00
4851.22	36.18	39.52	0.00	75.70	1	94.00	18.30



SUMMARY DATA SHEET OF **RADIATED EMISSIONS >1000 MHz**

TEST DATE:----- April 29, 1999
MANUFACTURER:----- Shure Brothers, Inc.
MODEL NO:----- UC2B
S/N:----- NA
CONFIGURATION:----- **GPP 4, CHL 8**
RATED POWER:----- **0.0200**

TEST SPECIFICATION INDUSTRY CANADA / "RADIO STANDARDS SPECIFICATION"
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SECTION 6.3.1 (c) / TRANSMITTERS

******LOW POWER AUXILIARY STATIONS******

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: RADIATED EMISSIONS USING **VERTICAL** POLARIZATION

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	ANTENNA PLUS CABLE	PRE-AMP GAIN dB	TOTAL dBuV	ANTENNA DISTANCE IN METERS	LIMIT dBuV	MARGIN dB
1409.00	39.30	28.70	0.00	68.00	3	84.46	16.46
2817.00	39.50	33.10	0.00	72.60	1	94.00	21.40
4930.00	36.40	38.50	0.00	74.90	1	94.00	19.10
6338.00	32.30	43.10	0.00	75.40	1	94.00	18.60



SUMMARY DATA SHEET OF **RADIATED EMISSIONS >1000 MHz**

TEST DATE:----- April 29, 1999
MANUFACTURER:----- Shure Brothers, Inc.
MODEL NO:----- UC2B
S/N:----- NA
CONFIGURATION:----- **GPP 4, CHL 8**
RATED POWER:----- **0.0200**

TEST SPECIFICATION INDUSTRY CANADA / "RADIO STANDARDS SPECIFICATION"
RSS-123, ISSUE 1, --- 24 FEBRUARY 1996
SECTION 6.3.1 (c) / TRANSMITTERS

******LOW POWER AUXILIARY STATIONS******

TEST EQUIPMENT: Spectrum Analyzer ----- HP 8566B
Quasi Peak Adapter ----- HP 85650A

TYPE OF TEST: RADIATED EMISSIONS USING **HORIZONTAL** POLARIZATION

THE FOLLOWING ARE SIGNIFICANT RADIATED LEVELS FOUND:

FREQ IN MHz.	METER READING dBuV	ANTENNA PLUS CABLE	PRE-AMP GAIN dB	TOTAL dBuV	ANTENNA DISTANCE IN METERS	LIMIT dBuV	MARGIN dB
1409.81	45.00	28.70	0.00	73.70	3.00000	84.46	10.76
2817.00	39.80	33.10	0.00	72.90	1.00000	94.00	21.10
4227.00	37.00	35.90	0.00	72.90	1.00000	94.00	21.10
4930.00	39.50	38.50	0.00	78.00	1.00000	94.00	16.00
6338.00	35.30	43.10	0.00	78.40	1.00000	94.00	15.60



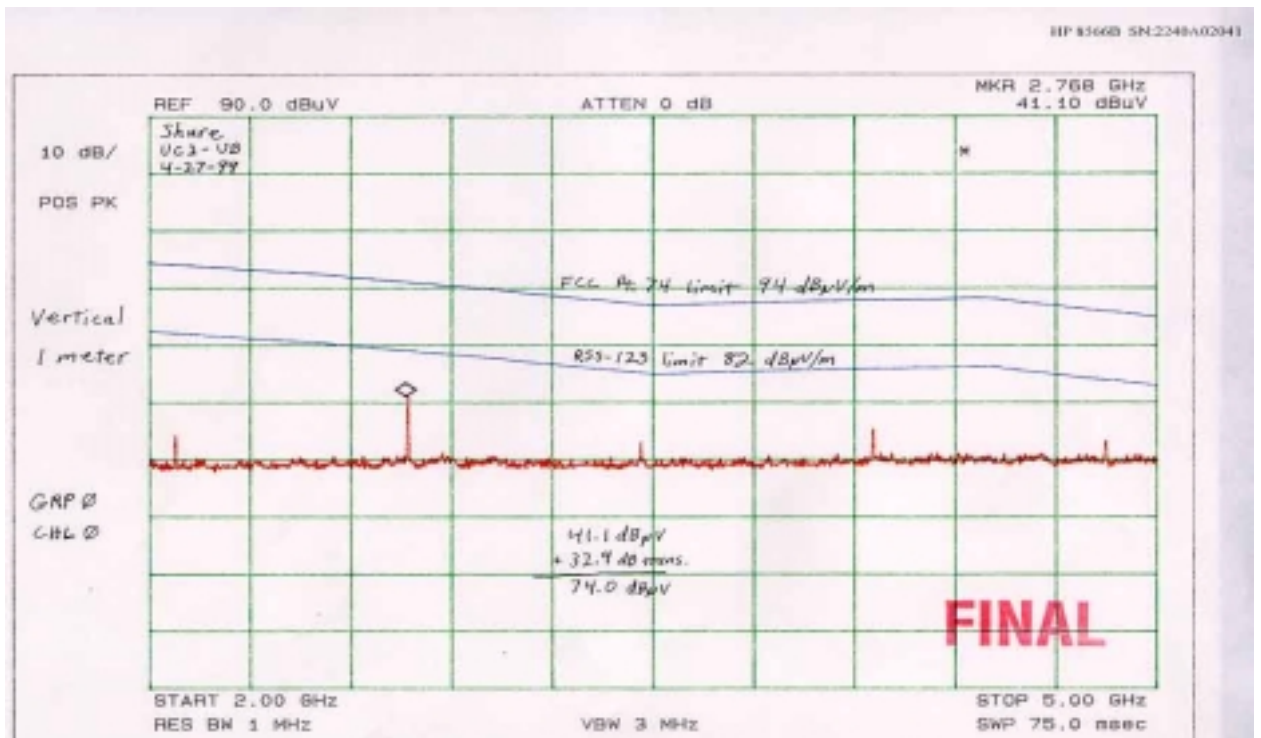
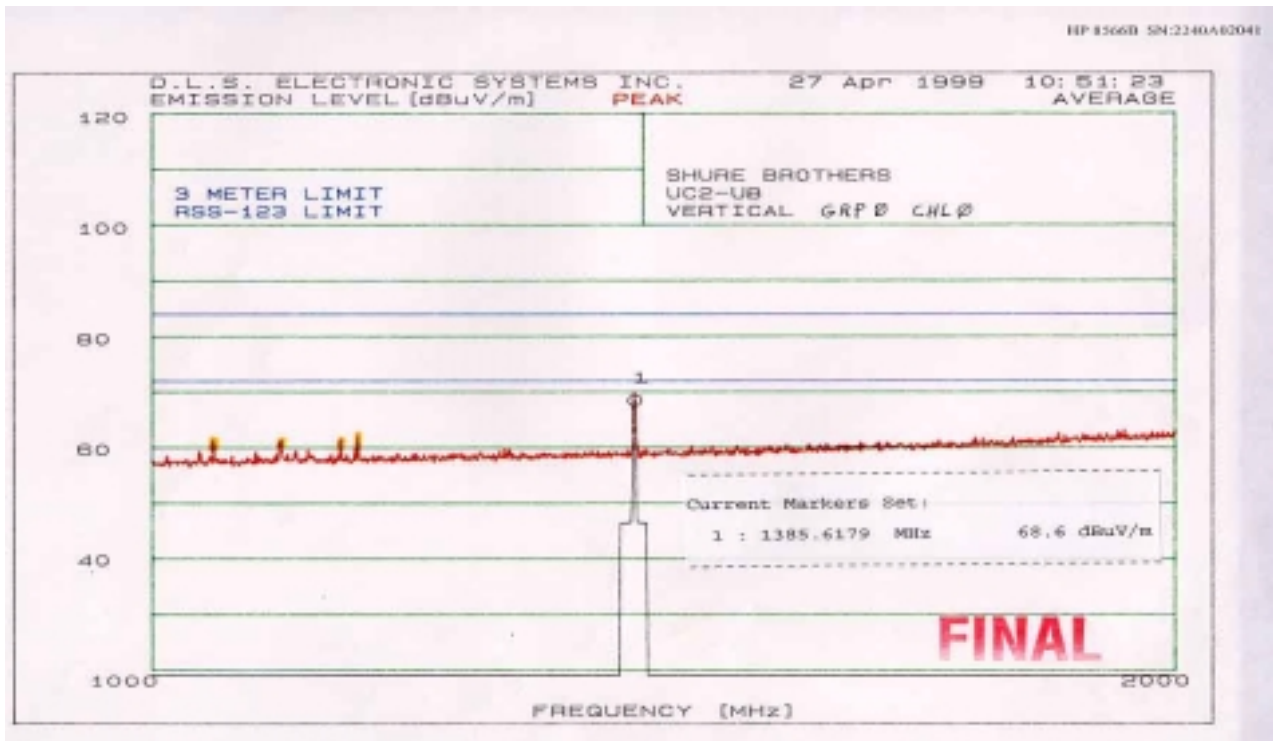
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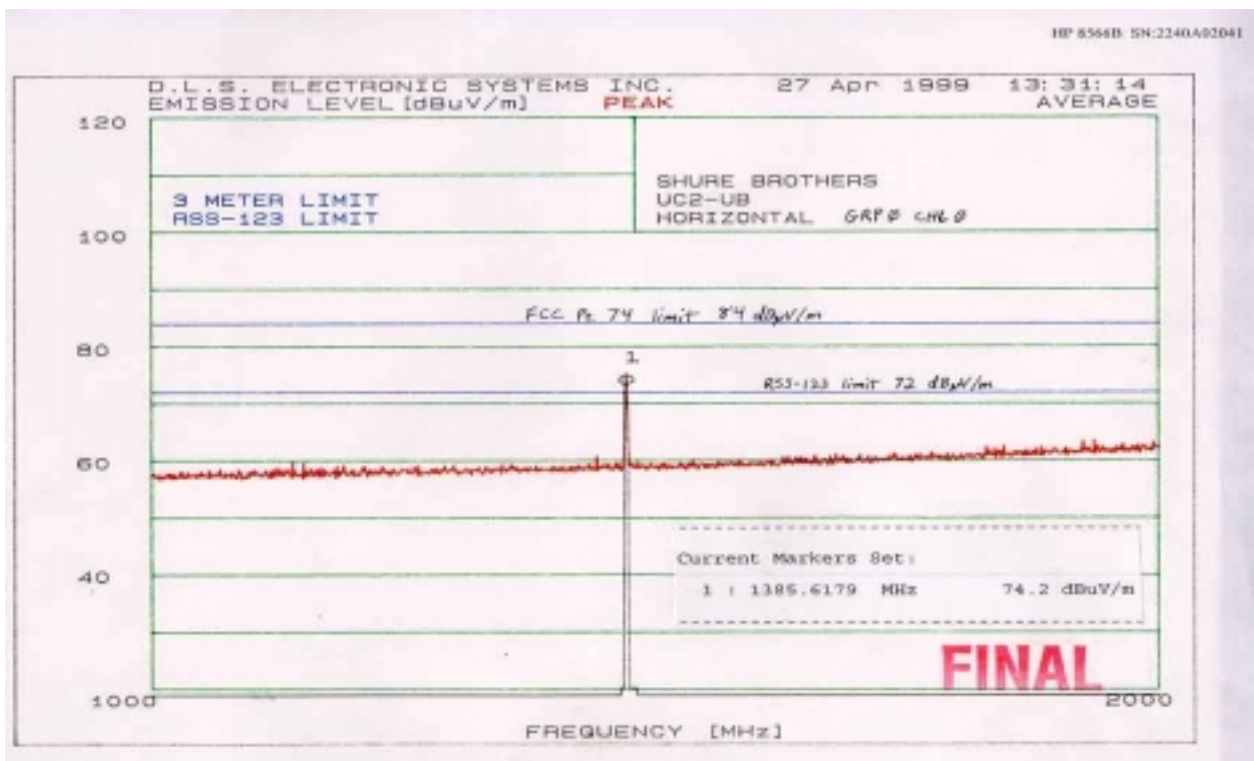
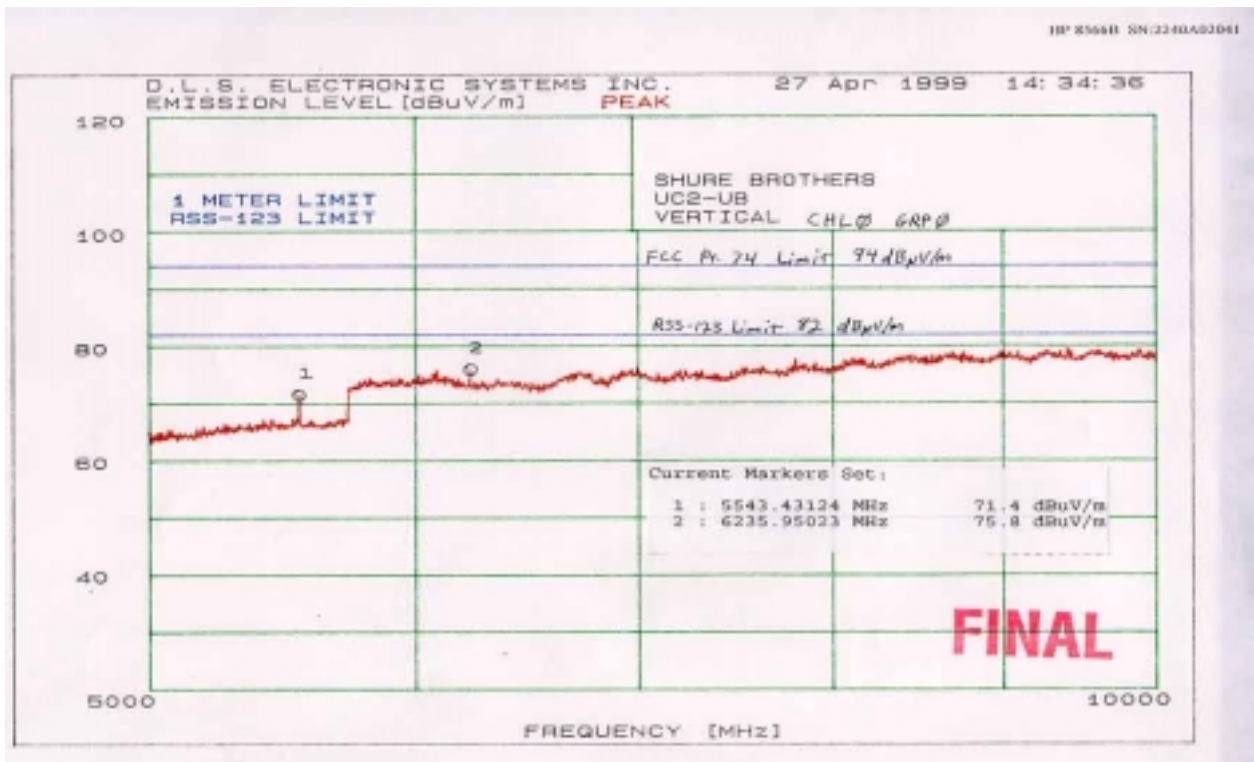
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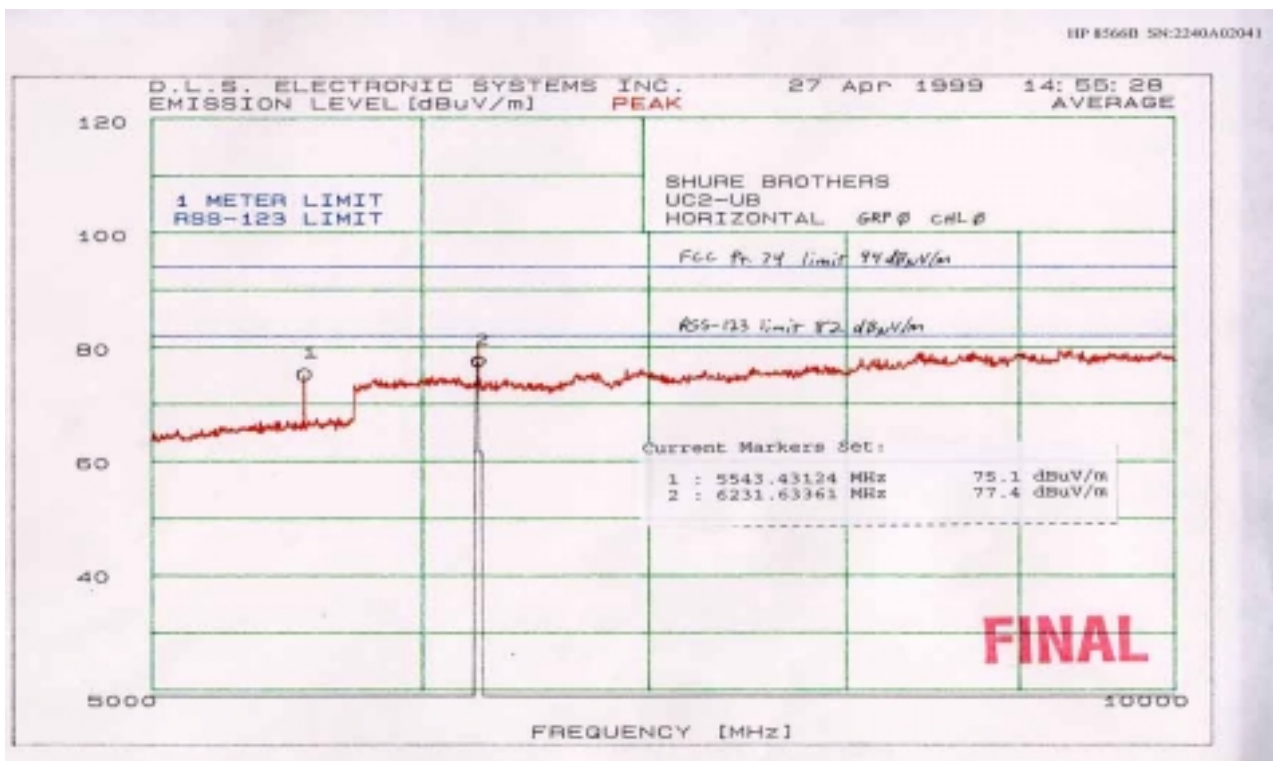
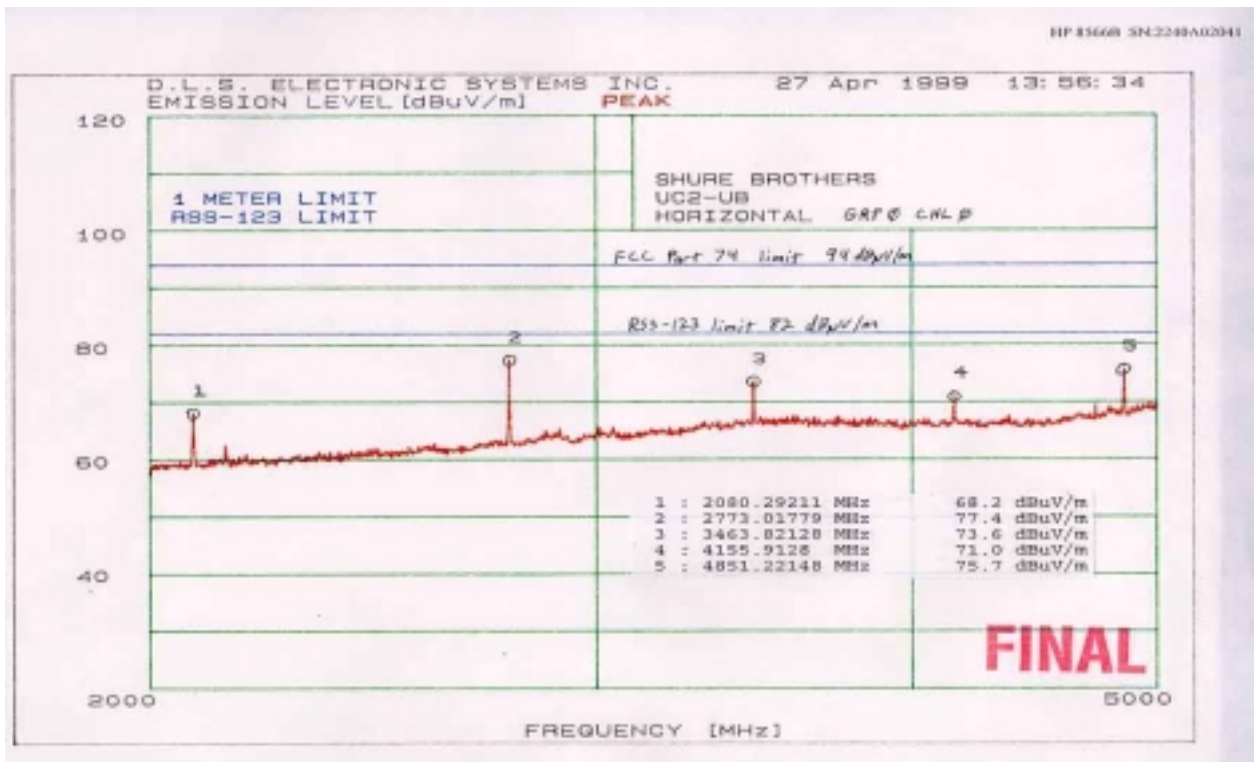
RADIATED GRAPHS TAKEN FOR FIELD STRENGTH

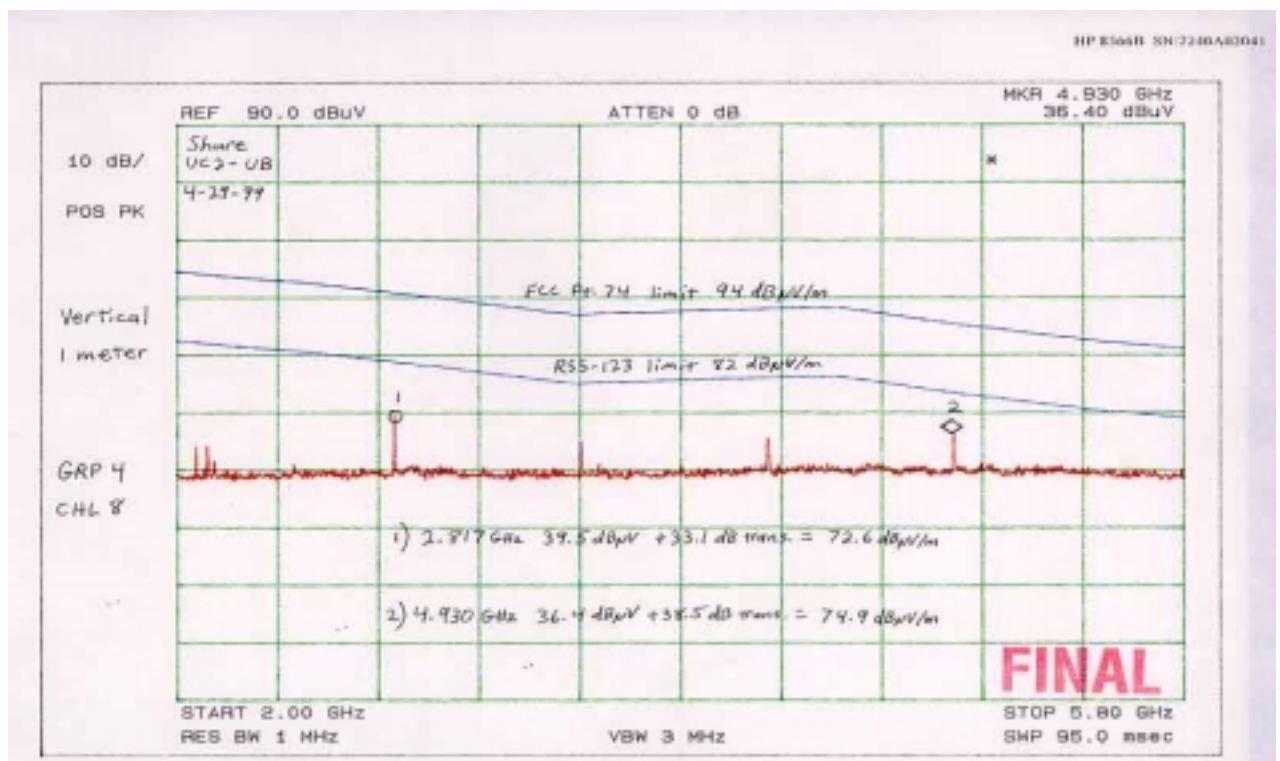
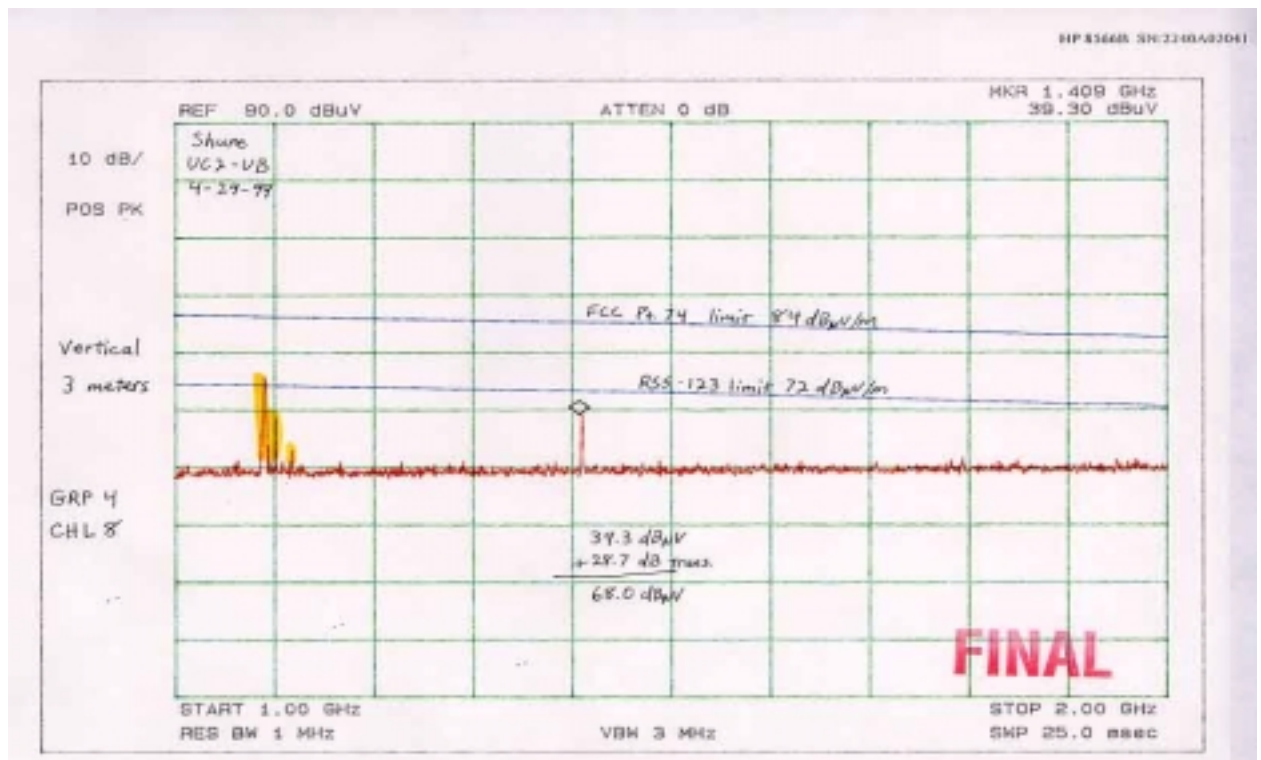
SPURIOUS EMISSION MEASUREMENTS

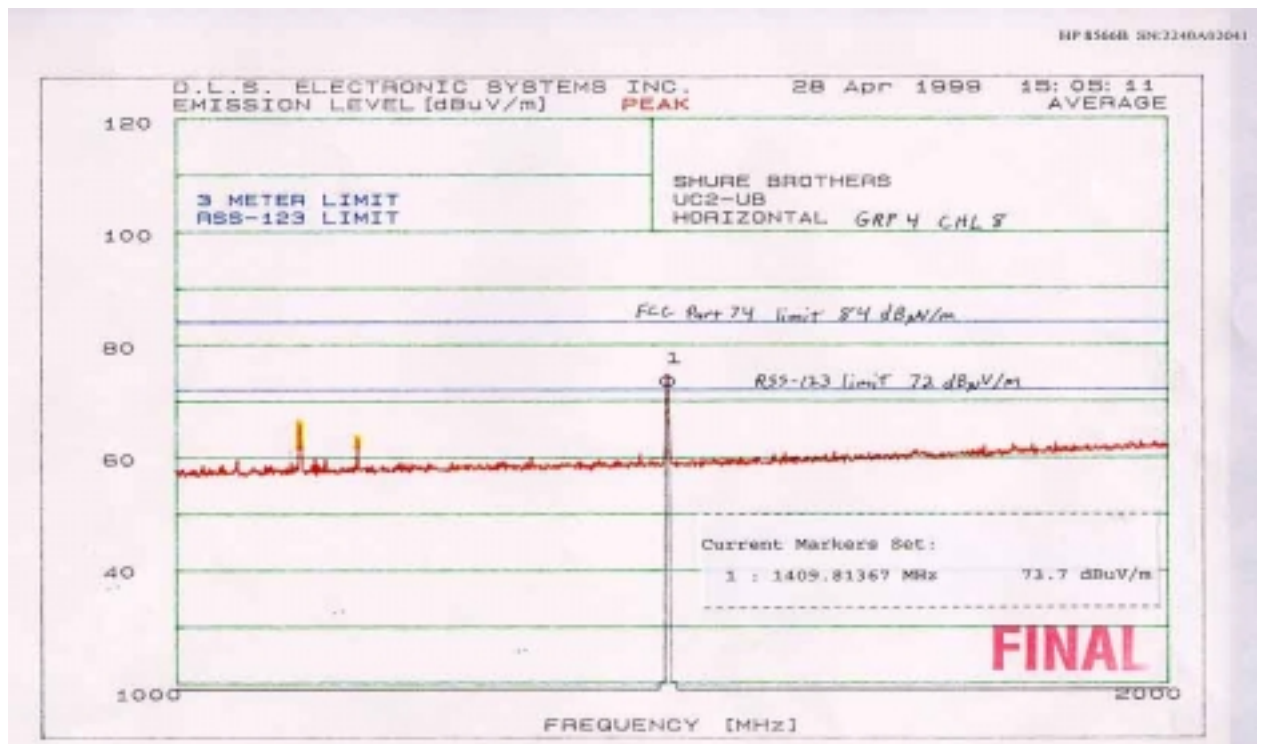
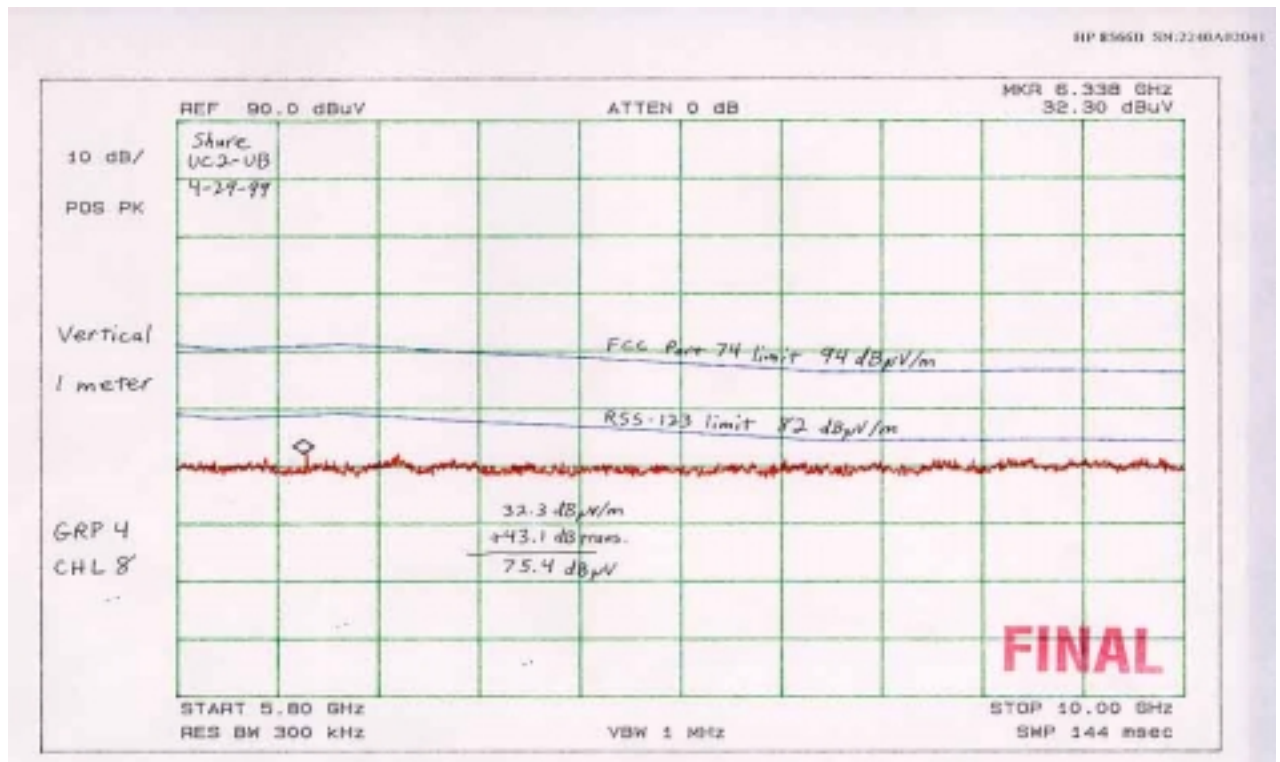
PART 2.1053

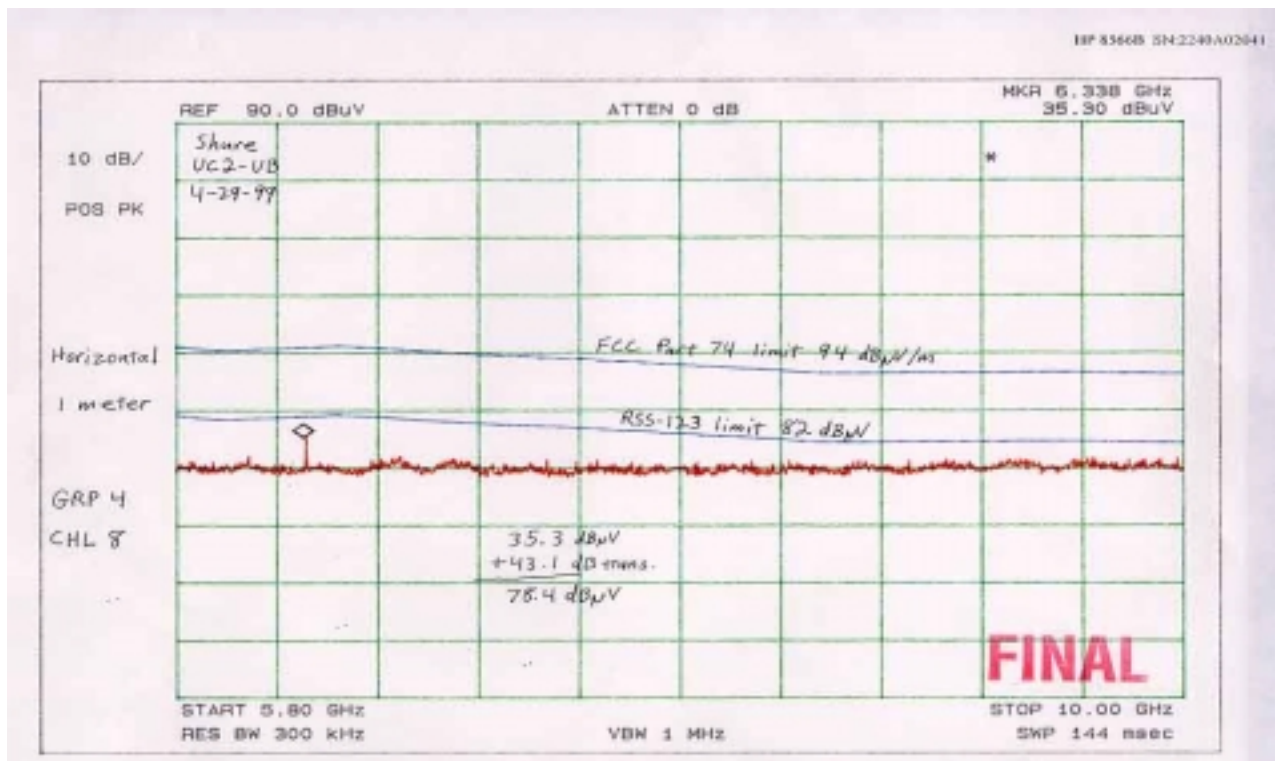
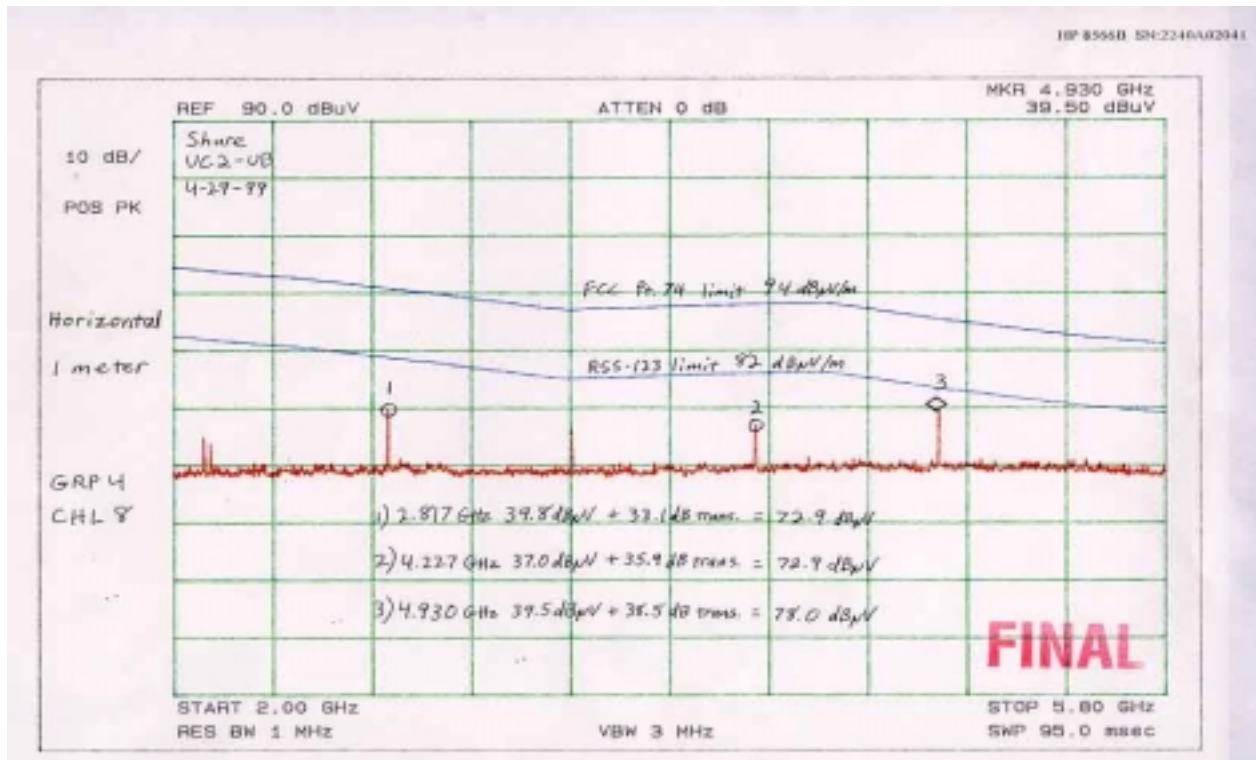












12.0 FREQUENCY STABILITY - PART 2.1055a (Temperature)

The frequency stability was measured from -30° to +50° centigrade at intervals of 10° centigrade throughout the range. Prior to each frequency measurement, the equipment was left alone for a sufficient period of time (approximately 30 minutes or more) to allow the components of the UC Wireless Series Transmitter oscillator circuitry to stabilize. The following information was taken:

FREQUENCY STABILITY FOR TEMPERATURE VARIATION IN MHz:

-30°	704.4918
-20°	704.4926
-10°	704.4941
0°	704.4951
+10°	704.4967
+20°	704.4975
+30°	704.5013
+40°	704.4989
+50°	704.4985

Worst Case Variance:

9500 Hz

As stated in Part 74, Section 74.861 e-4 the Frequency Tolerance and Margin for this range are as follows:

Frequency Tolerance: = **0.005%**

Assigned Frequency: = **704.49956**

704.49956 * 0.005% = **35224.98 Hz**

This is well in the specified limits.



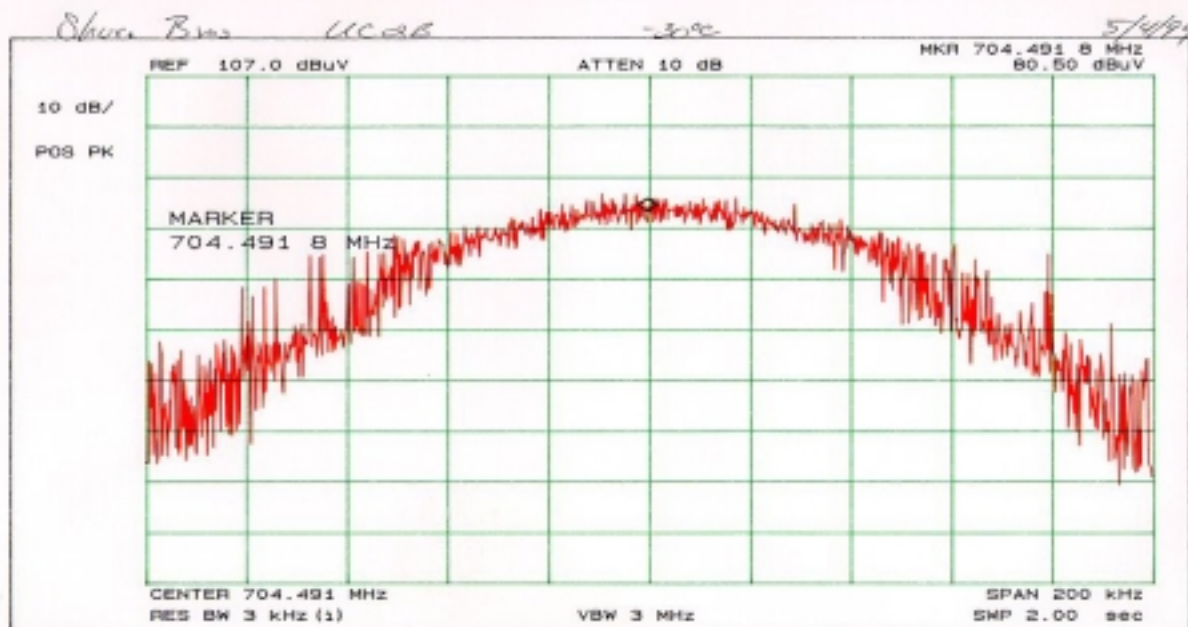
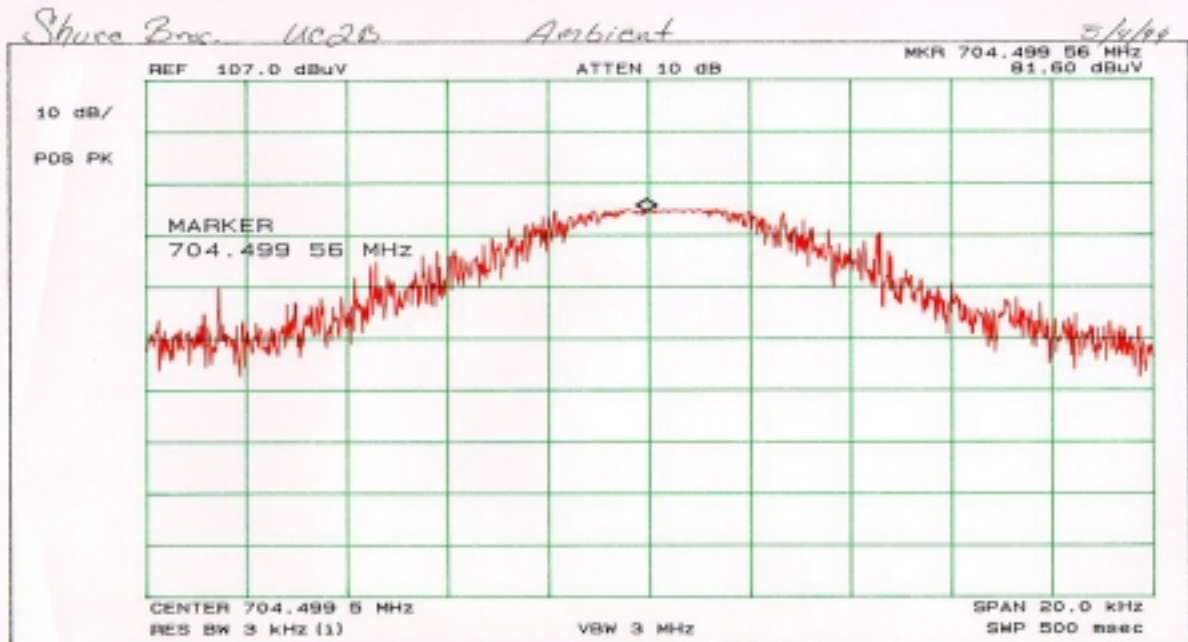
EMC Test Services
1250 Peterson Drive, Wheeling, Illinois 60090, USA

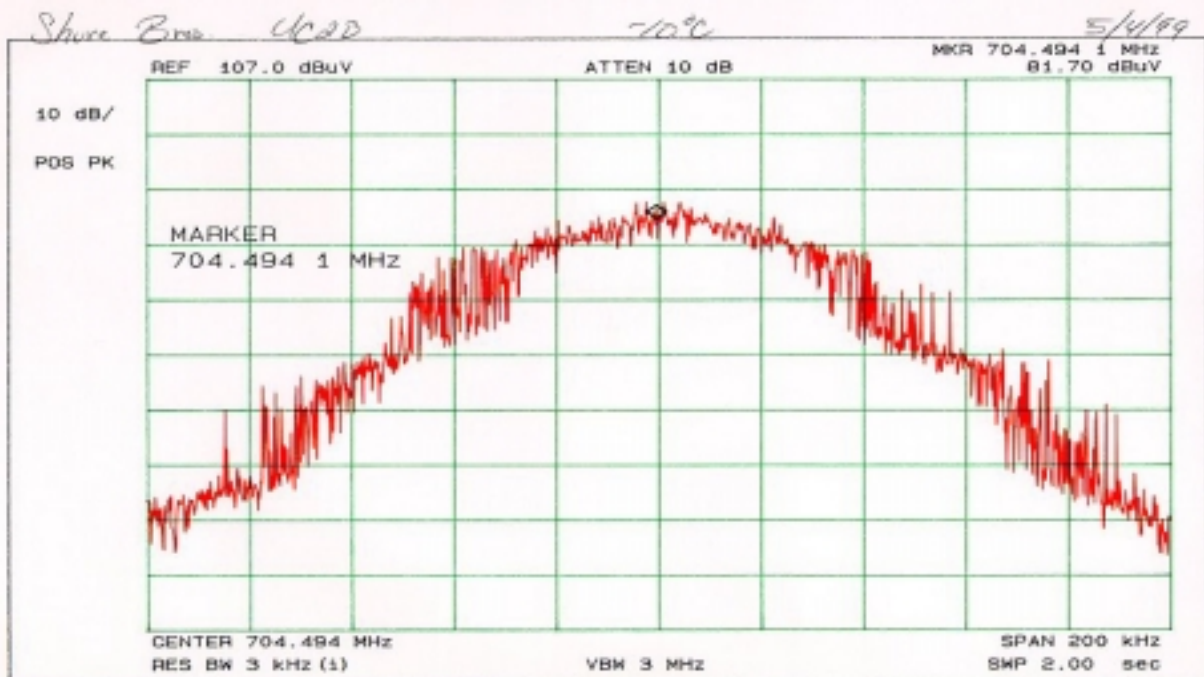
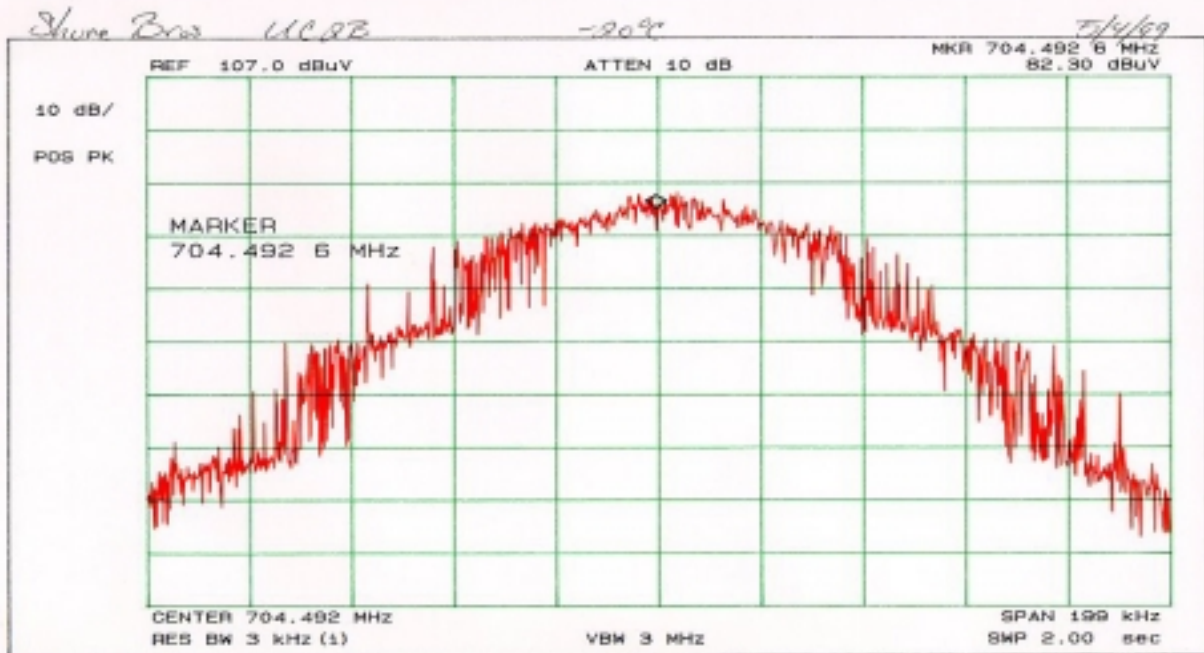
Report No. 7354
07/27/99

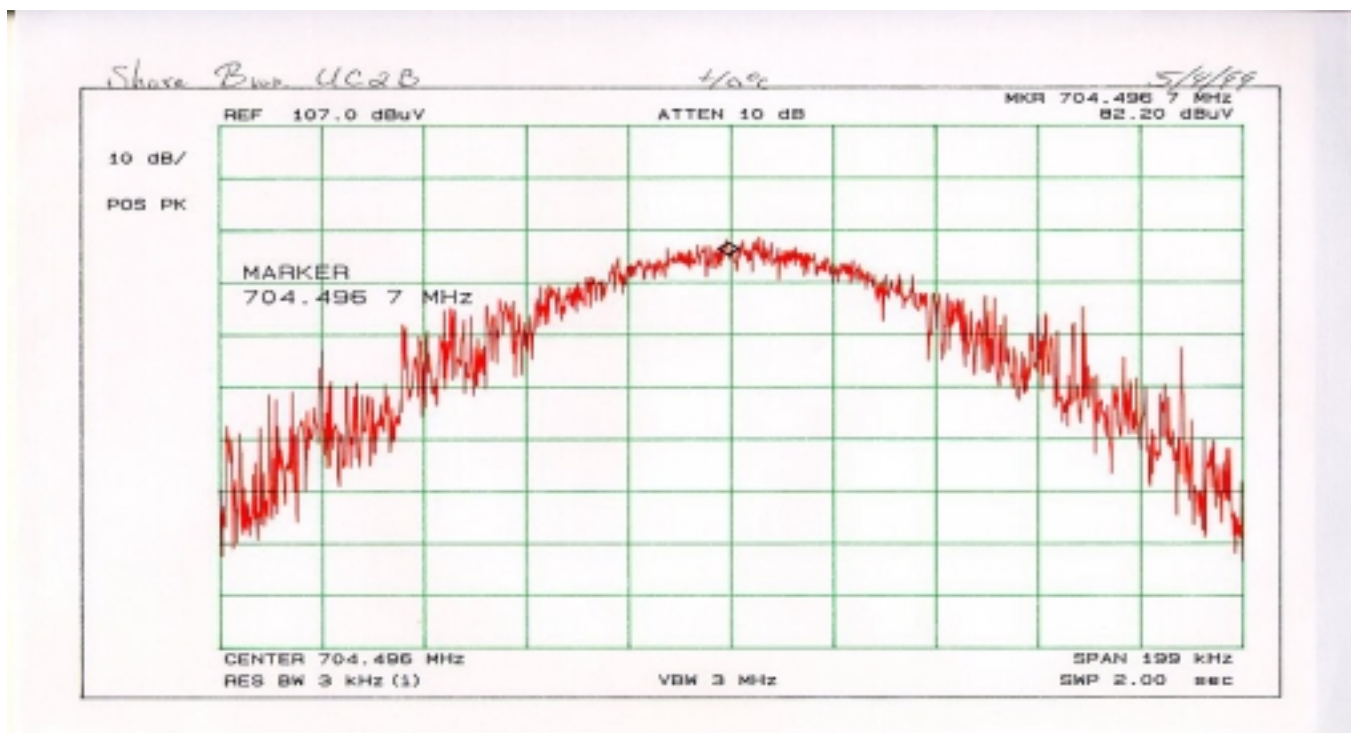
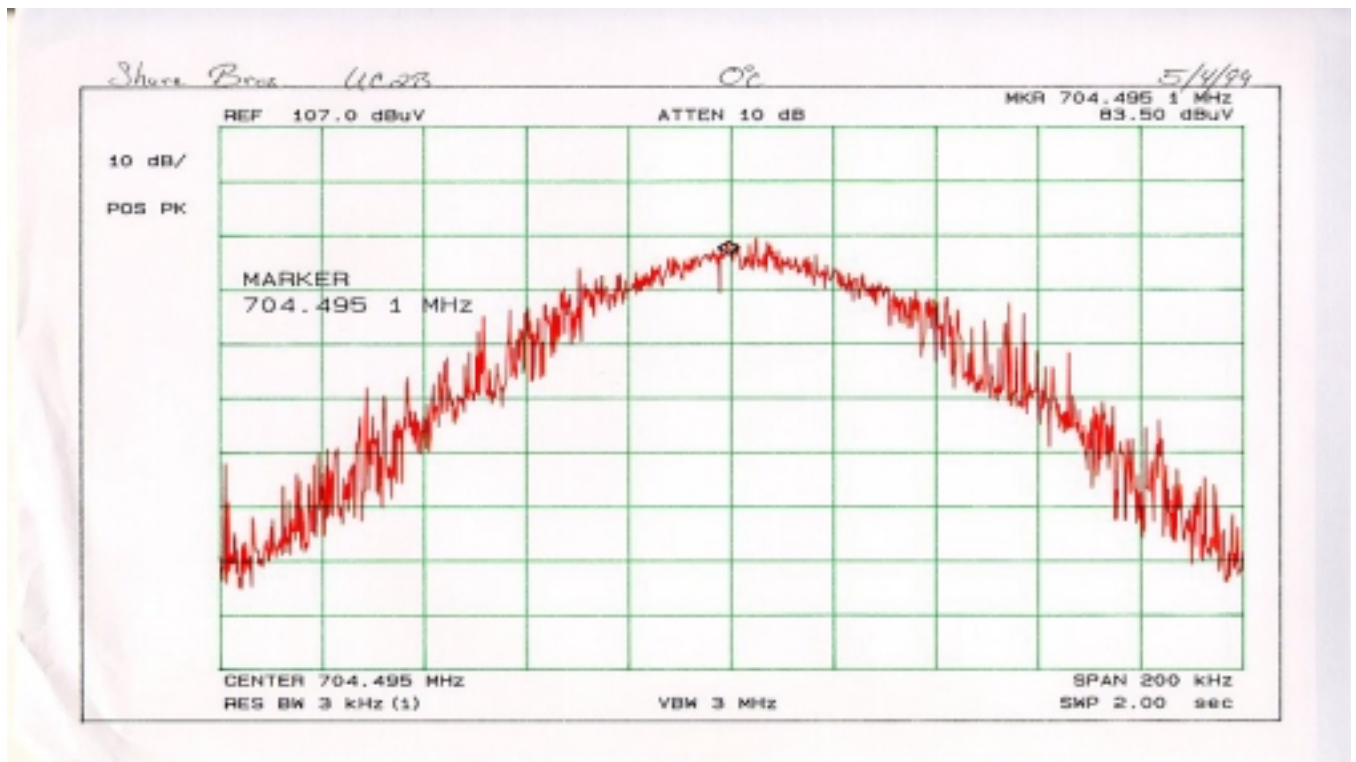
GRAPHS TAKEN FOR FREQUENCY

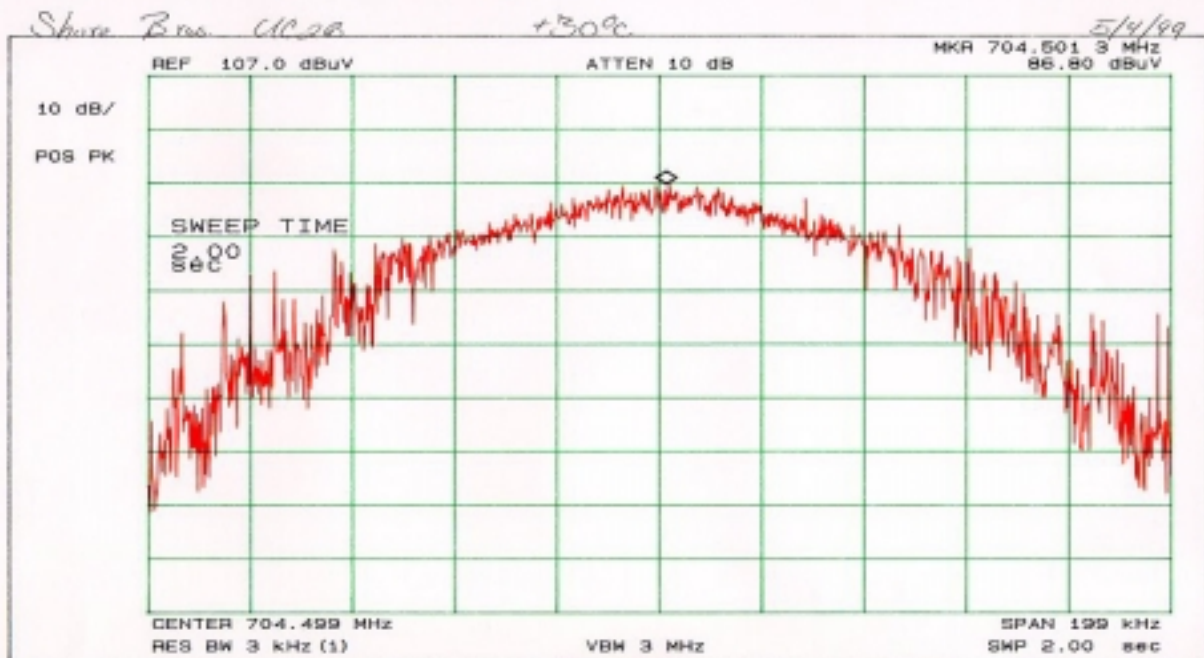
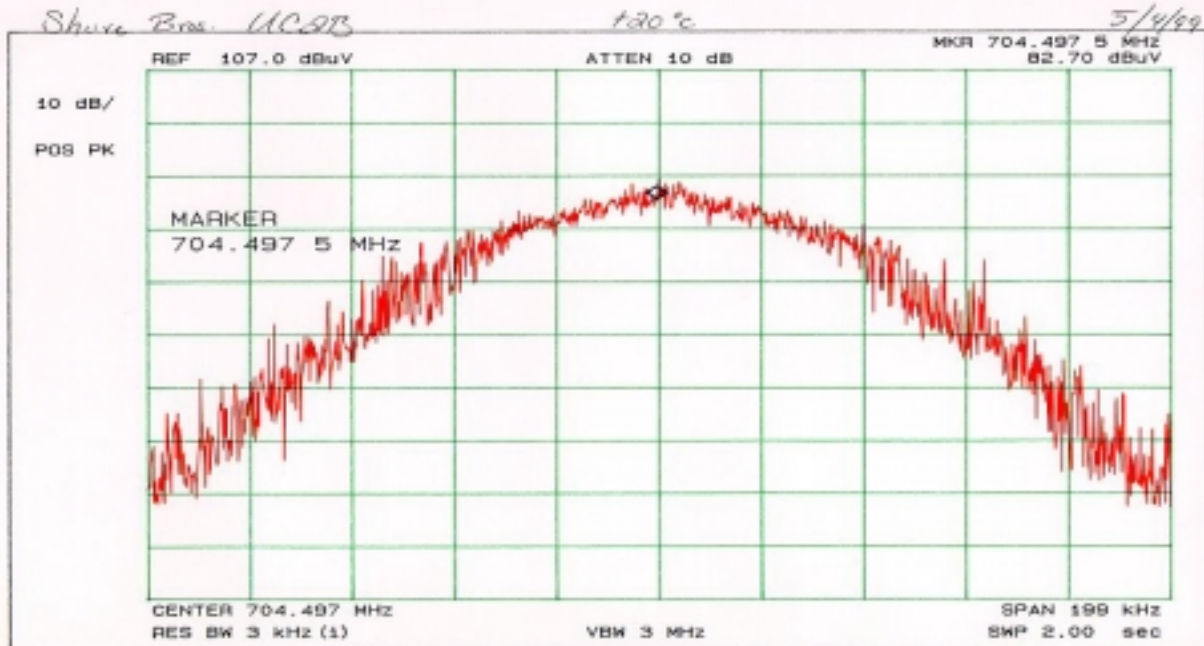
STABILITY WHEN VARYING THE TEMPERATURE

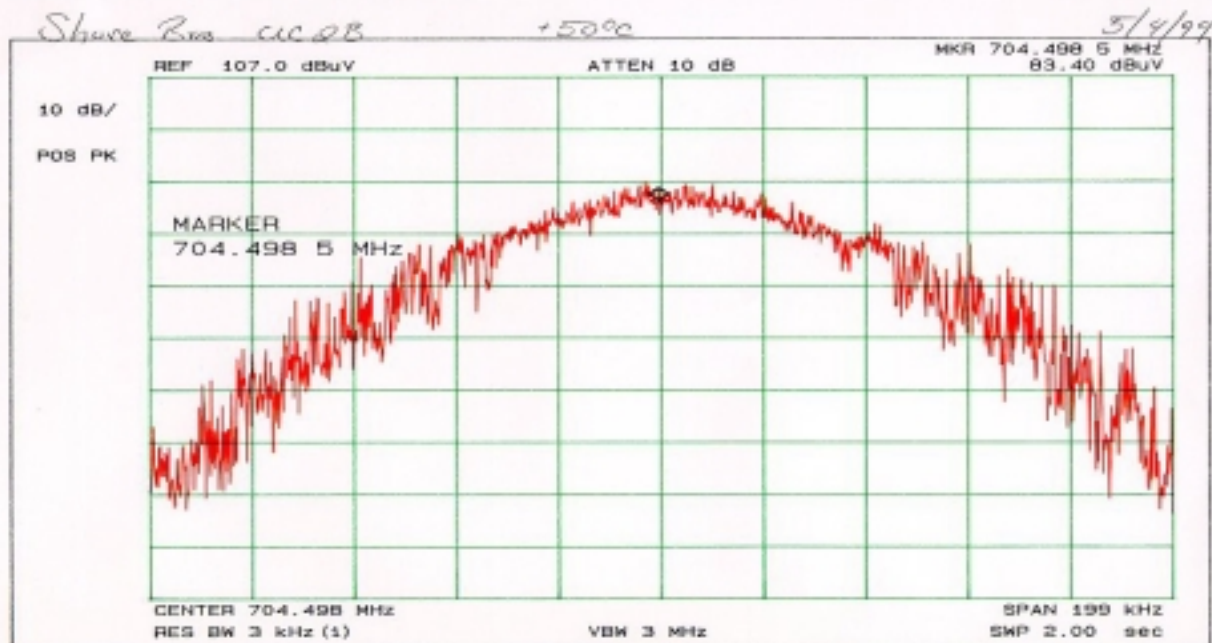
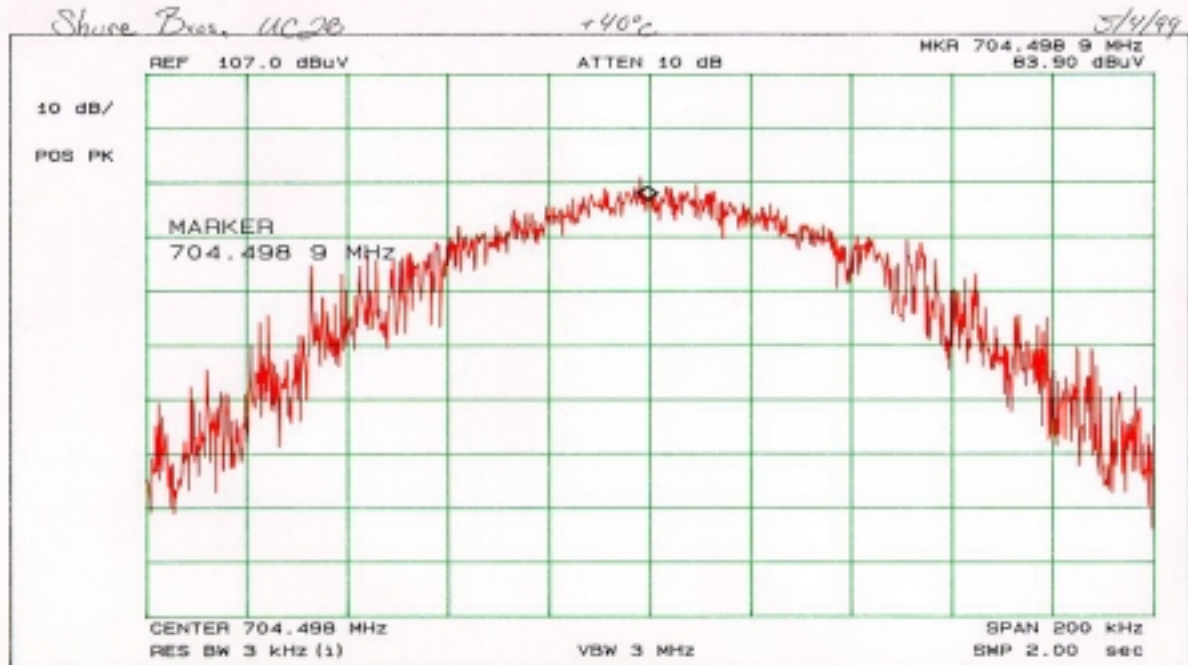
PART 2.1055a













13.0 FREQUENCY STABILITY - PART 2.1055d (Voltage)

The frequency stability of UC Wireless Series Transmitter was measured by varying the primary supply voltage from 85% to 115% of nominal value for all equipment other than hand carried battery equipment.

FREQUENCY STABILITY FOR VOLTAGE VARIATION:

85%	0
100%	0
115%	0

FREQUENCY STABILITY FOR HAND HELD DEVICES:

For hand carried, battery powered equipment, the supply voltage was reduced to the battery operating end point specified by the manufacturer. Readings were taken at the reduced end point and with a fresh battery:

Fresh Battery verses Battery end point:

Frequency #1 **704.3743 Hz**
Frequency #2 **704.37424 Hz**
Frequency #3 **704.37427 Hz**
Frequency #4 **704.37426 Hz**
Frequency #5 **704.37422 Hz**
Frequency #6 **704.37415 Hz**

As stated in Part 74, Section 74.861 e-4 the Frequency Tolerance and Margin for this range are as follows:

Frequency Tolerance: 0.005%

Limit: 35224.98 Hz

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14.0 PHOTO INFORMATION AND TEST SET-UP

The test set-up can be seen on the accompanying photo page.

Item 0 UC Wireless Series Transmitter
FCC ID#: DD4UC2B SN: NA

Item 1

Item 2

Item 3

Item 4

Item 5

Item 6

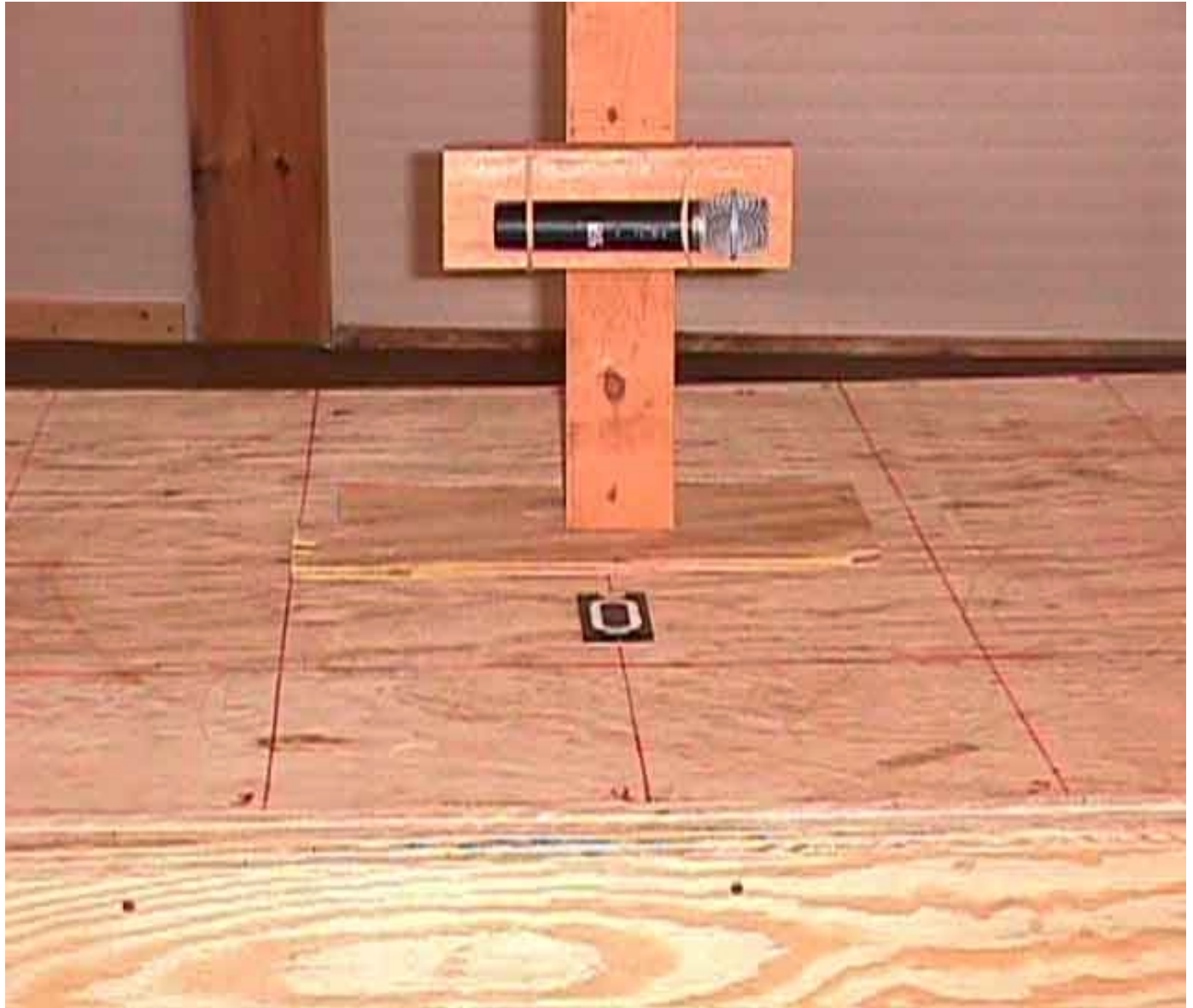
Item 7

Item 8

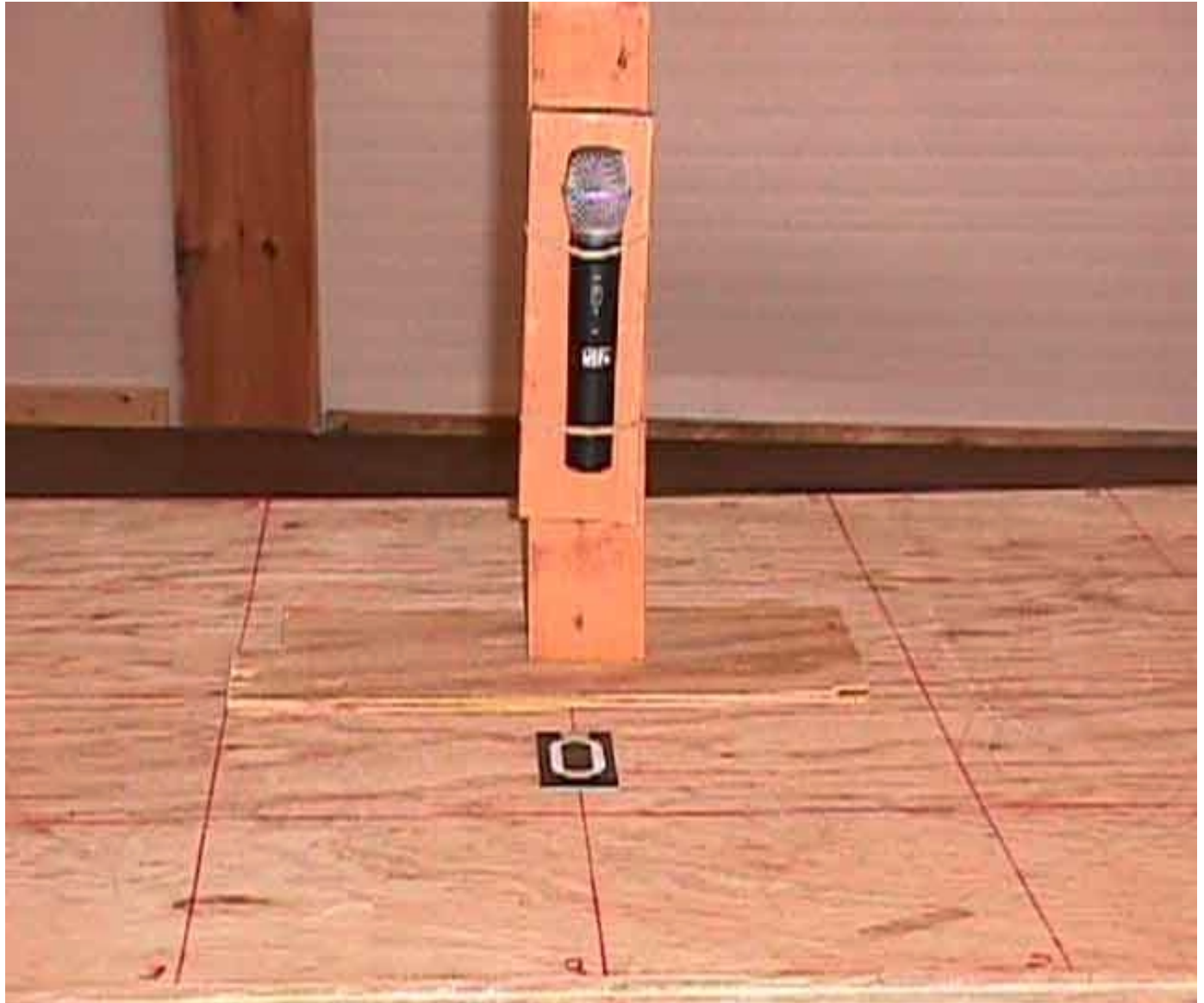
Item 9

Item 10

15.0 RADIATED PHOTOS TAKEN DURING TESTING.



15.0 RADIATED PHOTOS TAKEN DURING TESTING





16.0 CHANGE INFORMATION

The following changes were implemented during the testing and must be incorporated into the production units to ensure compliance.

Change 1. There were no changes made at D.L.S. Electronic Systems, Inc.

Change 2.

Change 3.

Change 4.

Change 5.



16.0 CHANGE INFORMATION (CON'T)

Change 6.

Change 7.

Change 8.

Change 9.

Change 10.

The responsibility of implementing the changes listed in this report is accepted or I certify that no changes were made

by _____
Signature Title

for _____
Company Name Date



17.0 RESULTS OF TESTS

The emission test results can be seen on pages at the end of this report. Data sheets indicating the open field radiated measurements can also be found with this report. Those points on the radiated charts shown with a yellow mark are background frequencies that were verified during the test.

18.0 CONCLUSION

It was found that the Wireless Microphone (Hand-held), Model Number UC2B, S/N NA meets the radio interference emission requirements of the FCC "Rules and Regulations", Part 74, Subpart H, Sections 74.801 to 74.882 for Low Power Auxiliary Stations operating in the 614 to 806 MHz Frequency Band. This test report relates only to the items tested.

This report contains the following number of pages.

Text: 33 pages

Data Summary: 4 pages

Charts: 22 pages

TABLE 1 - EQUIPMENT LIST

Test Equipment	Manufacturer/Description	Model Number	Serial Number	Frequency Range	Cal Due Date
*Spectrum Analyzer	Hewlett/Packard	8566B	2240A 02041	25 Hz – 22 GHz	11/99
Quasi-Peak Adapter	Hewlett/Packard	85650A	2043A 00121	10 kHz – 1 GHz	11/99
***Spectrum Analyzer	Hewlett/Packard	8591A	3009A 00700	9 kHz- 1.8 GHz	3/00
Receiver	Electrometrics	EMC-25 Mark-III	772	.01-1000 MHz	10/99
Meter Module	Electrometrics	CRM-25	162	.01-1000 MHz	10/99
Receiver	Electrometrics	EMC-25 Mark-III	804	.01-1000 MHz	10/99
Meter Module	Electrometrics	CRM-25	138	.01-1000 MHz	10/99
Receiver	Electrometrics	EMC-25 Mark-III	645	.01-1000 MHz	
Meter Module	Electrometrics	CRM-25	116	.01-1000 MHz	
Receiver	Electrometrics	EMC-30 Mark-III	44168	.01-1000 MHz	
Antenna	Electrometrics	BIA-25	2453	20 - 200 MHz	10/99
Antenna	Electrometrics	LPA-25	1114	200 - 1000 MHz	10/99
Antenna	Electrometrics	BIA-25	2614	20 - 200 MHz	10/99
Antenna	Electrometrics	LPA-25	1205	200 - 1000 MHz	10/99
Antenna	Electrometrics	BIA-25	4785	20 - 200 MHz	
Antenna	Electrometrics	LPA-25	4895	200 - 1000 MHz	
Antenna	EMCO	3115	2479	1 – 18 GHz	

*Firmware Version 29.9.86 Software Version 85864C Rev A

**Firmware Version 14.1.85 Software Version 85864C Rev A

***Firmware Version 5.1.3 Software Version 82301-12029 Rev C

I/O Initial Calibration Only