



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:	Shure UT2 Vocal Artist Transmitter
Kind of Equipment:	Handheld wireless microphone transmitter
Test Configuration:	Single Channel Crystal Controlled
Emission Designator:	120KF3E
Transmitter FCC ID:	DD4UT2
Model Number:	UT2
Serial Number:	NA
Dates of Test:	August 16, 20 & 25, 1999
Test Conducted For:	Shure, Inc.
	222 Hartrey Avenue
	Evanston, Illinois 60202-3696

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Report No. 7584
09/22/99

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Shure, Inc.

United States Department of Commerce
National Institute of Standards and Technology



ISO/IEC GUIDE 25:1990
ISO 9002:1987

Certificate of Accreditation



D.L.S. ELECTRONIC SYSTEMS, INC.
WHEELING, IL

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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS FCC

September 30, 1999

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For the National Institute of Standards and Technology

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Scope of Accreditation



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ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

NVLAP LAB CODE 100276-0

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NVLAP Code Designation / Description

International Special Committee on Radio Interference (CISPR) Methods

12/CIS22 IEC/CISPR 22:1993: Limits and methods of measurement of radio disturbance characteristics of information technology equipment

Federal Communications Commission (FCC) Methods

12/F01 FCC Method - 47 CFR Part 15 - Digital Devices
12/F01a Conducted Emissions, Power Lines, 450 KHz to 30 MHz
12/F01b Radiated Emissions

Australian Standards referred to by clauses in AUSTEL Technical Standards

12/T51 AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment

September 30, 1999

Effective through

A handwritten signature in black ink, appearing to read "John L. Galt".

For the National Institute of Standards and Technology



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1.0 SUMMARY OF TEST REPORT

It was found that the Shure UT2 Vocal Artist 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 740 to 752 MHz Frequency Band.

2.0 INTRODUCTION

On August 16, 20 & 25, 1999, a series of radio frequency interference measurements were performed on Handheld wireless microphone transmitter, 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 740 to 752 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 one meter 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 these 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 Shure UT2 Vocal Artist Transmitter was tuned according to the tune-up procedures specified in Part 2.1033 (c-9), 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: **113.2 dBuV** which equals **0.0042 watts**

MARGIN:

$$0.01 \text{ watts} - 0.0042 \text{ watts} = 0.0058 \text{ watts}$$

LIMIT:

$$\begin{aligned} \text{Manufacturer's rated output power} &= 0.01 \text{ watts} \\ \text{Tolerance} &= .005\% \end{aligned}$$

NOTE:

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



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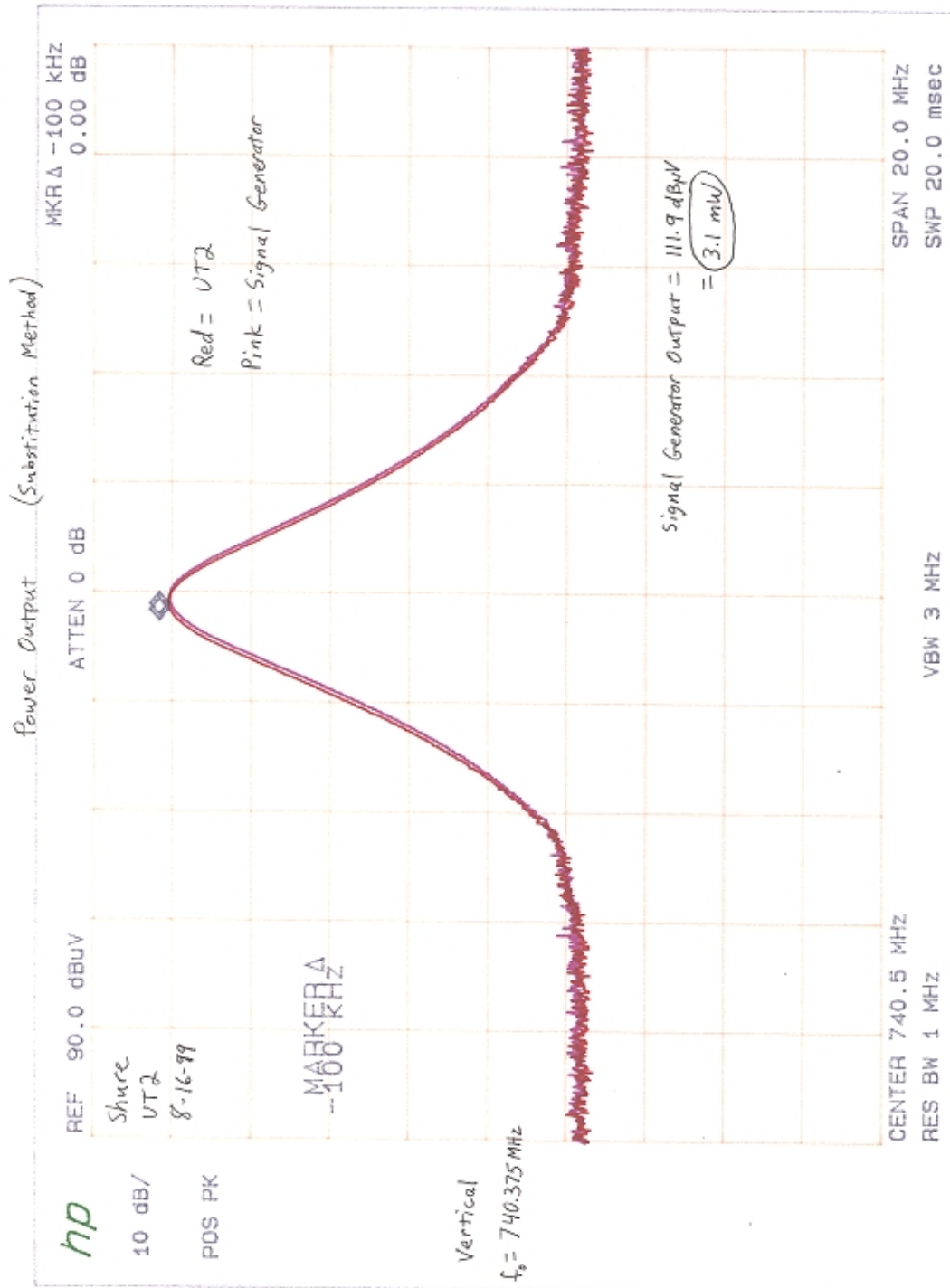
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GRAPHS TAKEN OF THE RF POWER

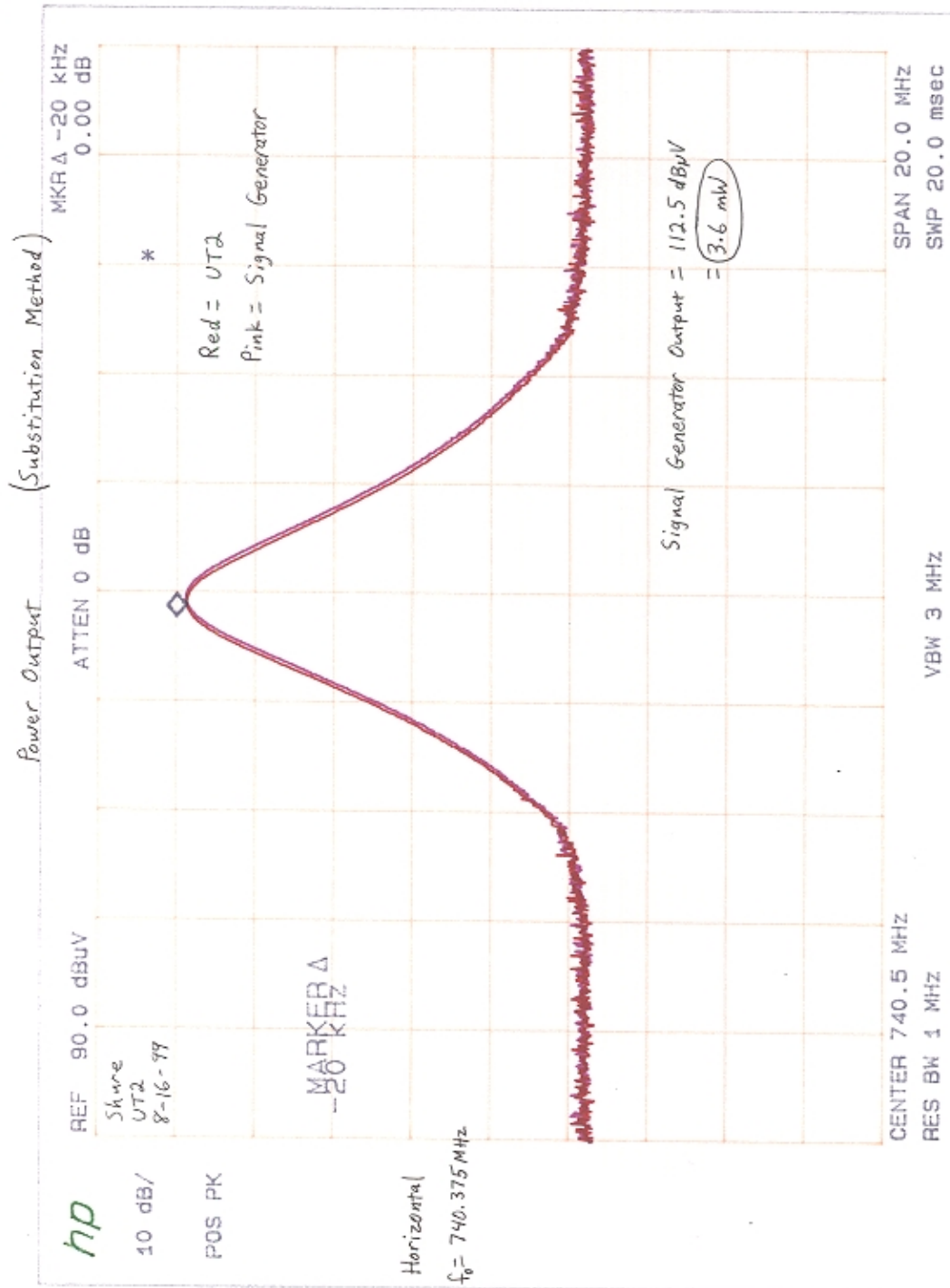
OUTPUT MEASUREMENTS

PART 2.1046

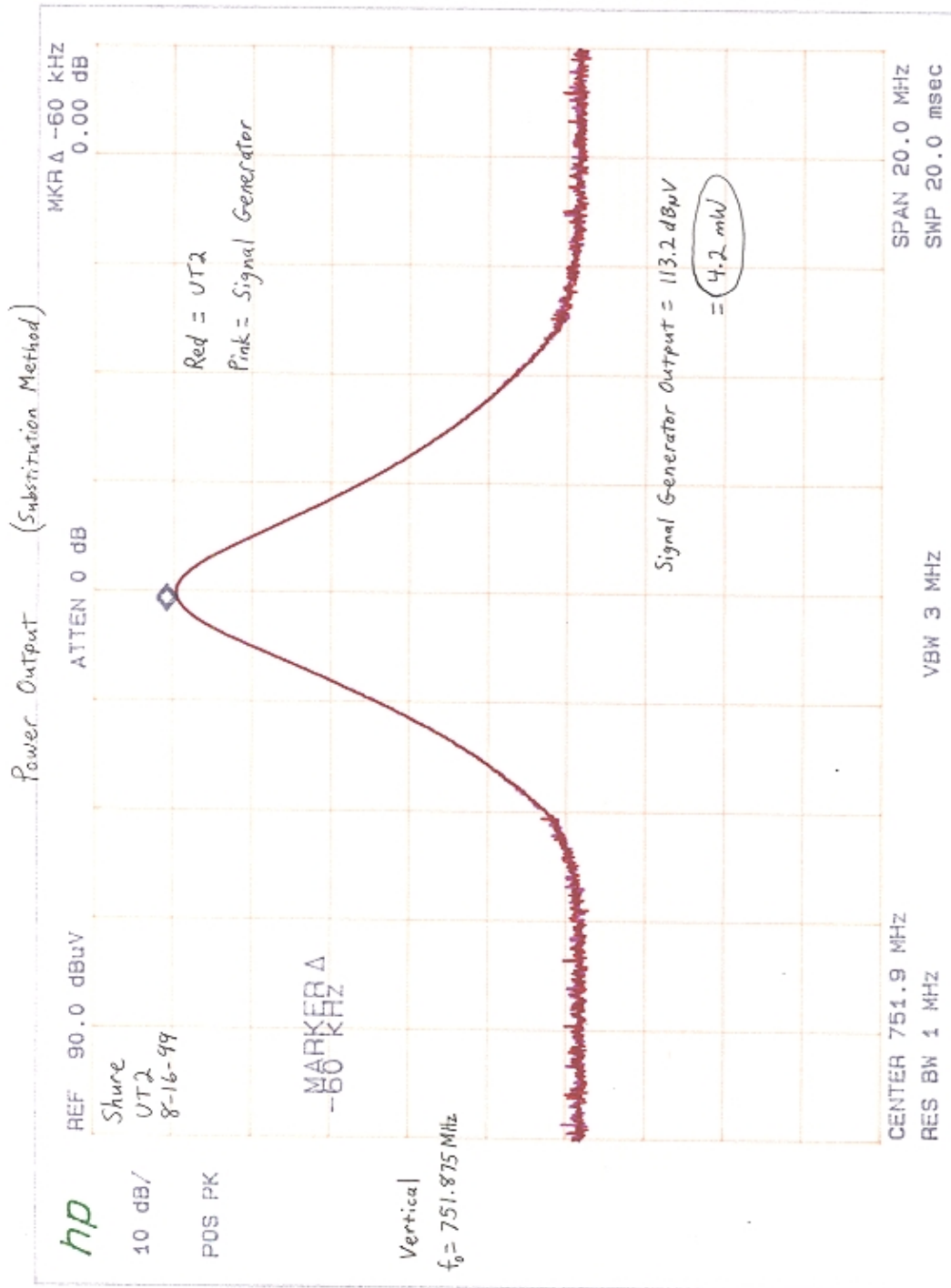
HP 8566B SN:2240A02041



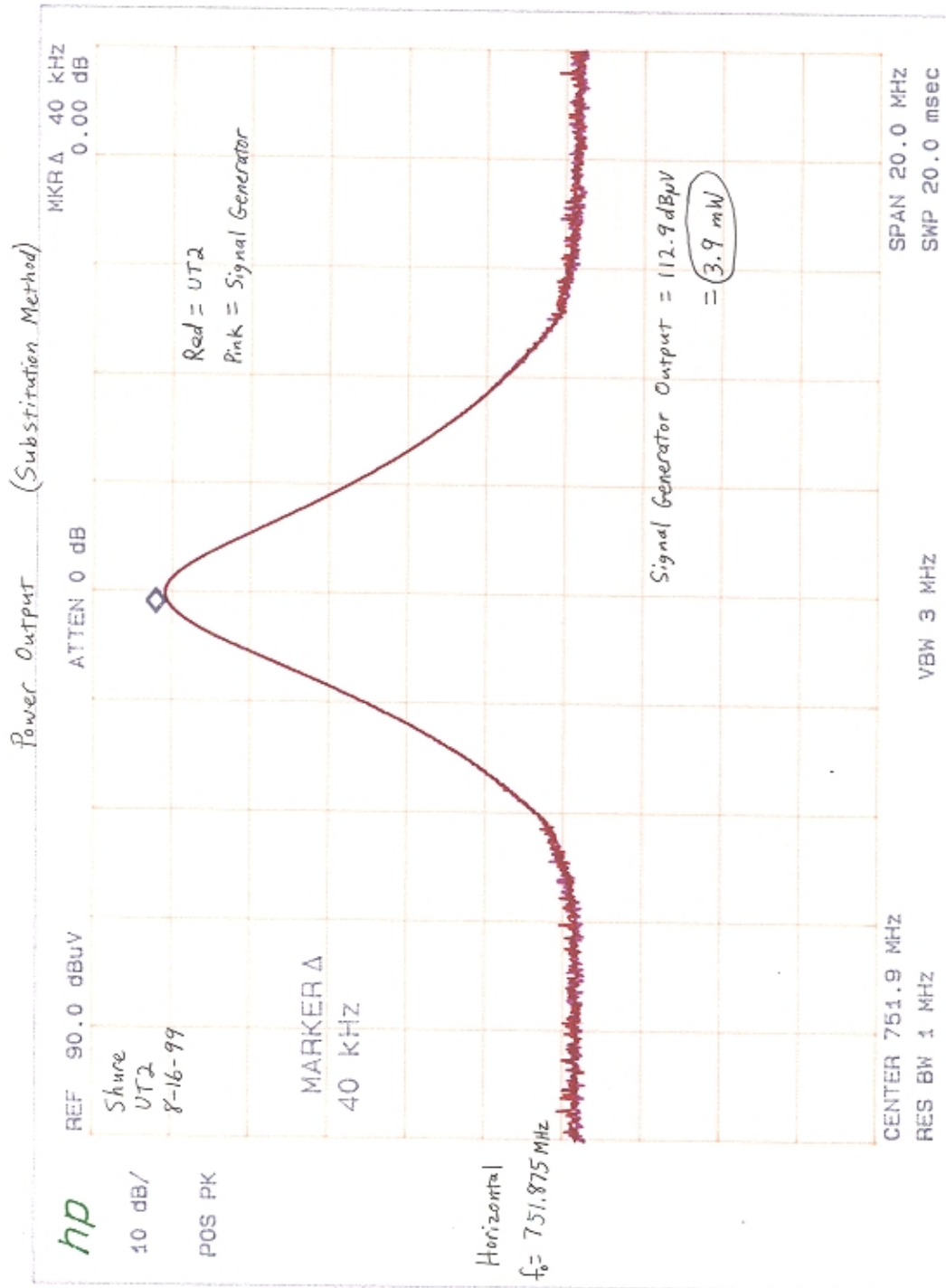
HP 8566B SN:2240A02041



HP 8566B SN:2240A02041



HP 8566B SN:2240A02041





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 100 to 5000 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:



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GRAPHS TAKEN SHOWING THE FREQUENCY

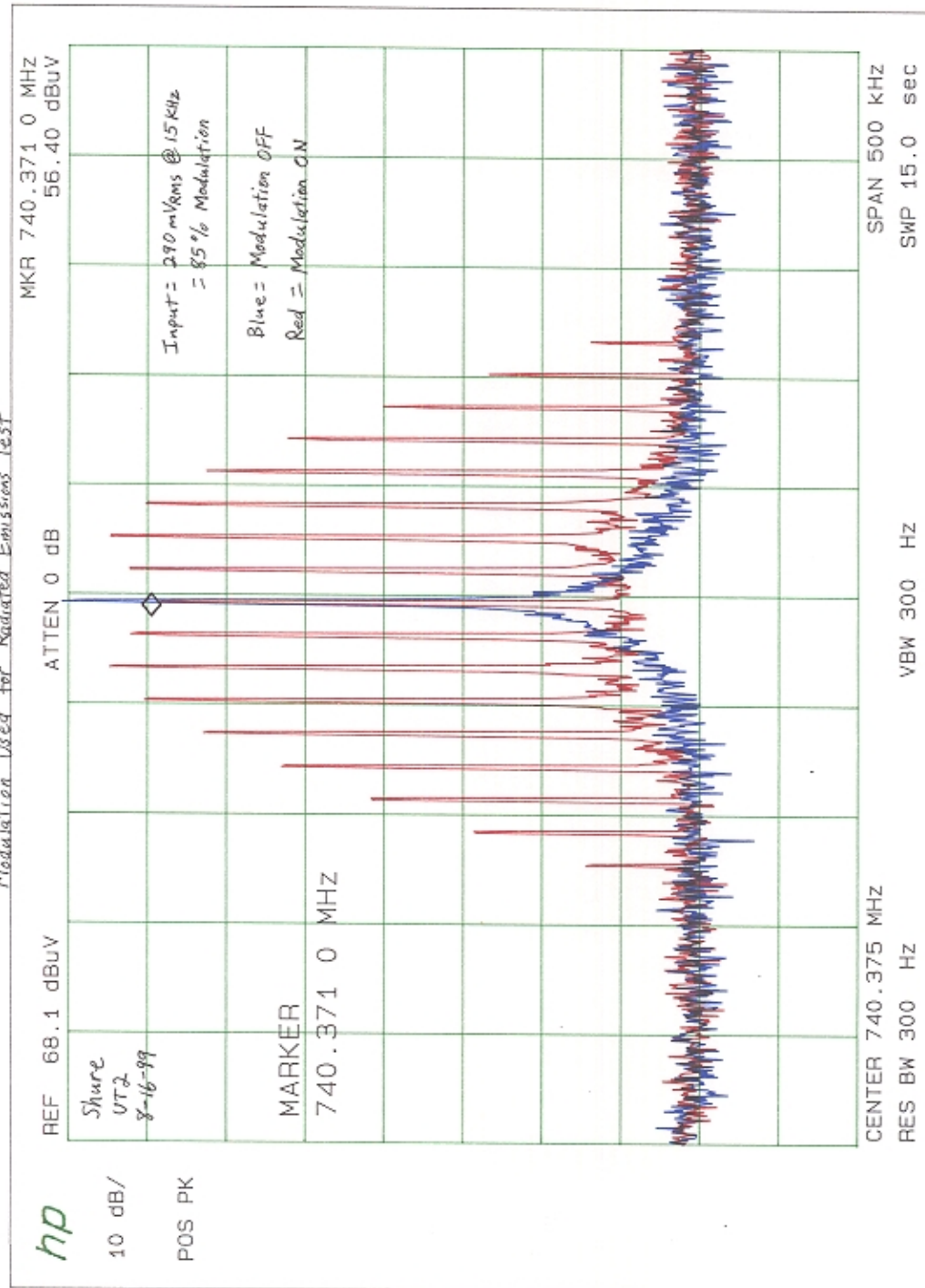
RESPONSE OF THE

AUDIO MODULATING CIRCUIT

PART 2.1047

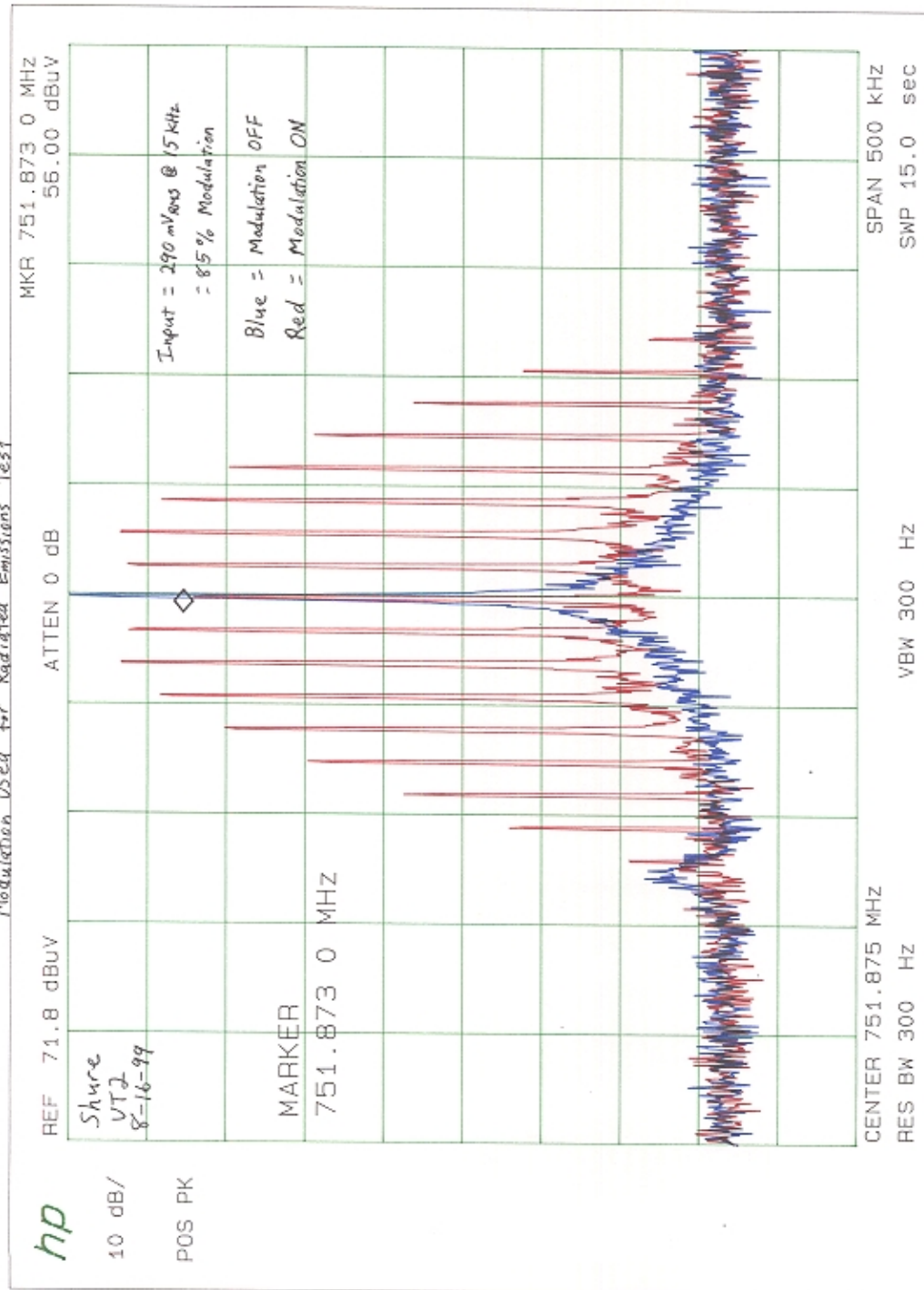
HP 8566B SN:2240A02041

Modulation Used for Radiated Emissions Test



HP 8566B SN:2240A02041

Modulation Used for Radiated Emissions Test





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 Shure UT2 Vocal Artist 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.

The Shure UT2 Vocal Artist Transmitter uses the same frequency range as television broadcast monaural transmitters so the test was also run using a 15 kHz input signal modulated by 85% as stated in Part 2.1049 e-6.

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:

The Occupied Bandwidth data measurements were not made at DLS.



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GRAPHS TAKEN OF THE OCCUPIED BANDWIDTH

PART 2.1049

NOTE:

Charts showing the Occupied Bandwidth measurements were not made at DLS.



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 740 to 752 MHz.

Frequency Deviation used:

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

NOTE:

The Frequency Deviation data measurements were not made at DLS.



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GRAPHS TAKEN OF THE FREQUENCY DEVIATION WITH MODULATION

PART 2.1049

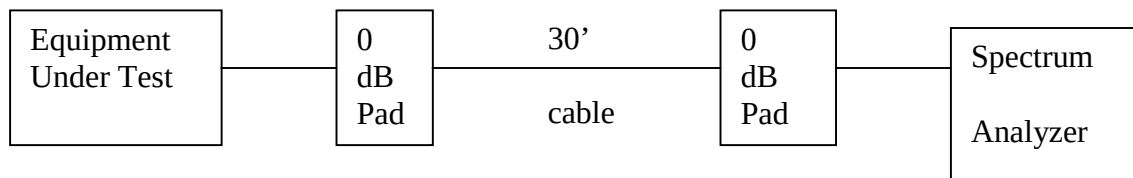
NOTE:

The Frequency Deviation Charts were not made at DLS.

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 2.1049. 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:



The allowed emissions for transmitters operating in the 740 to 752 MHz bands for Shure UT2 Vocal Artist 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:



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.



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.