Engineering Test Report Supplement
for
Certification Testing
of
A Safety Warning Transmitter
Manufactured by MPH Industries, Inc.
Model No. Programmable
Serial No. ENGR002
FCC ID: CJR-SWS-K90XMIT

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on
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Following is a list of test items to supplement the original Engineering Test Report prepared by Hart Microwave consultant for the certification testing of the SWS transmitter. The tests are numbered to correspond with the enumerated requests for additional information contained in a letter from Chief Kenneth Nichols of the FCC dated February 18, 2000. This report is accompanied by a letter that addresses each of the requests item by item. Only the responses requiring tests, measurements, or calculations are contained in this document.

ITEM (3)

Necessary Bandwidth Calculation: The transmitter is frequency modulated with digital information as described in the "Functional Description of the SWS Transmitter" document submitted with the original application. In essence, the transmitter is frequency modulated with digital information at a 2 KHz rate, with the maximum frequency excursion about the carrier of 2.5 MHz. The transmission is single channel (no multiplexing) and has no error correction. These characteristics put the transmitter into the classification indicated in Section 2.202, Part (c), (1), which refers to a table for the various types of modulation in (g). Section III-A Part (1) of the table applies to the modulation used in the SWS transmitter.

The formula for calculating the necessary bandwidth is:

$$B_n := 2\,M + 2\,DK$$

where: M = baud rate/2, K = 1.2, and D = peak frequency deviation

Substituting in the values for the baud rate and deviation, the result of the calculation is a necessary bandwidth of 6.002 MHz. This rounded off to three significant figures with the units designator as the decimal place holder is: 6M00

ITEM (4)

Frequency Deviation Measurments: Since the frequency deviation of the transmitter cannot be readily measured while it is being modulated, a measurement and analysis of the spectrum plot is used to determine the deviation. Solving the formula in item three above for D (deviation) as a function of the necessary bandwidth (measured occupied bandwidth) and baud rate we obtain:

$$D := \frac{\left(B_n - 2\,M\right)}{2\,K}$$

where: M = baud rate/2, K = 1.2, and D = peak frequency deviation,
Bn = necessary bandwidth

The spectrum plot and measurement setup are depicted in Item (7) of this report. The spectrum analyzer was set up in a peak hold storage mode for 10 seconds with the bandwidth and sweep rates as indicated on the plot. The peak hold mode was used to capture and store the entire modulated spectrum for plotting. The 23 dB bandwidth spectrum measured from the plot is 6.5 MHz. Substituting the values in the above equation results in a deviation calculation of 2.63 MHz.

ITEM (5)

Frequency Stability with Temperature: FCC Rules Section 2.1055 (b). Frequency and power stability with temperature testing was done in the original Engineering Test Report, but data points were taken +/- 1 degree around the maximum 10 degree increments. Following is a chart with the frequency and power *interpolated* points for the 10 degree increments:

Frequency and Power Interpolations with Temperature

Temperature Cent.	Frequency MHz	Power (Relative dB)
-30	24,110.4	+0.4
-20	24,109.1	+0.5
-10	24,108.1	+0.4
0	24,107.6	+0.2
10	24,105.8	+0.1
20	24,103.8	0.0
30	24,102.5	-0.2
40	24,101.5	-0.5
50	24,098.9	-0.5
60	24,096.1	-0.8

The peak to peak frequency drift totaled 14.3 MHz. or 594 ppm (fo = 24,100 MHz)

Item (6)

Frequency Stability with Power Supply Voltage Variations: The set up for this test is depicted in figure 1 below. The equipment used to take the readings has current calibration certification back to NIST standards. The transmitter was turned on and allowed to temperature stabilize before the frequency pushing with power supply voltage test was run. This was done to prevent frequency drift with temperature corruption that could occur with the barely measureable pushing characteristic. Following is a table of the measurements taken:

Input Voltage	Center Frequency (MHz)
10.2	24,100.1
10.7	24,100.1
12.6	24,100.1
14.5	24,100.2
16.0	24,100.2

FREQUENCY PUSHING TEST SETUP

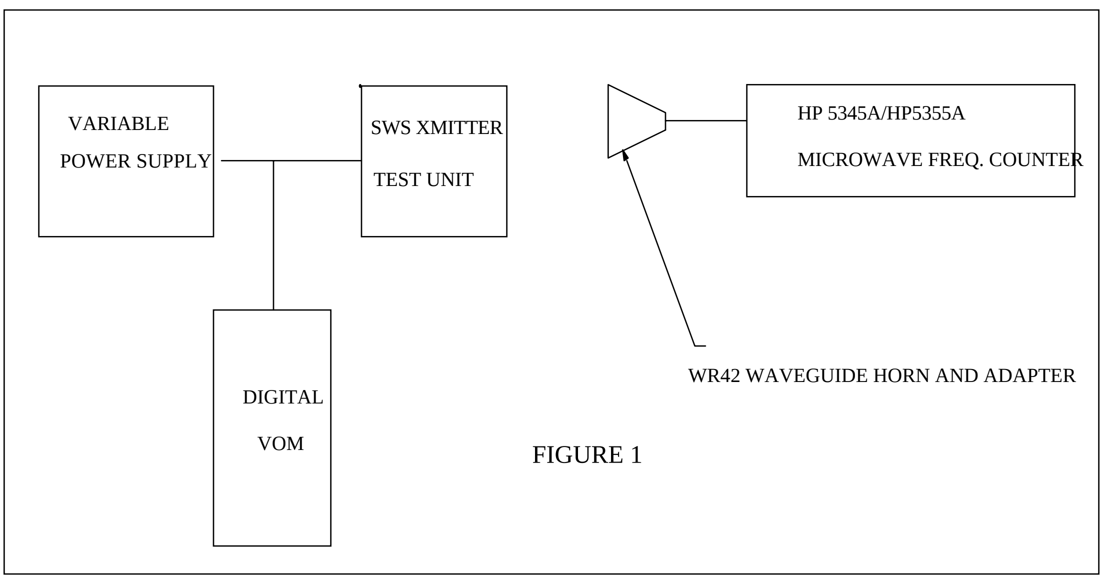

FIGURE 1

ITEM (7)

<u>Transmitter Modulated Spectrum Plot</u>: . The spectrum analyzer was set up in a peak hold storage mode for 10 seconds with the bandwidth and sweep rates as indicated on the plot. The peak hold mode was used to capture and store the modulated spectrum for plotting. This method was used to capture the modulated spectrum since the bandwidth and sweep rate settings of the analyzer would not allow the whole spectrum to be captured in one

sweep. The test setup is depicted in figure 2. The equipment used for the test measurements has current calibration certification back to NIST standards.

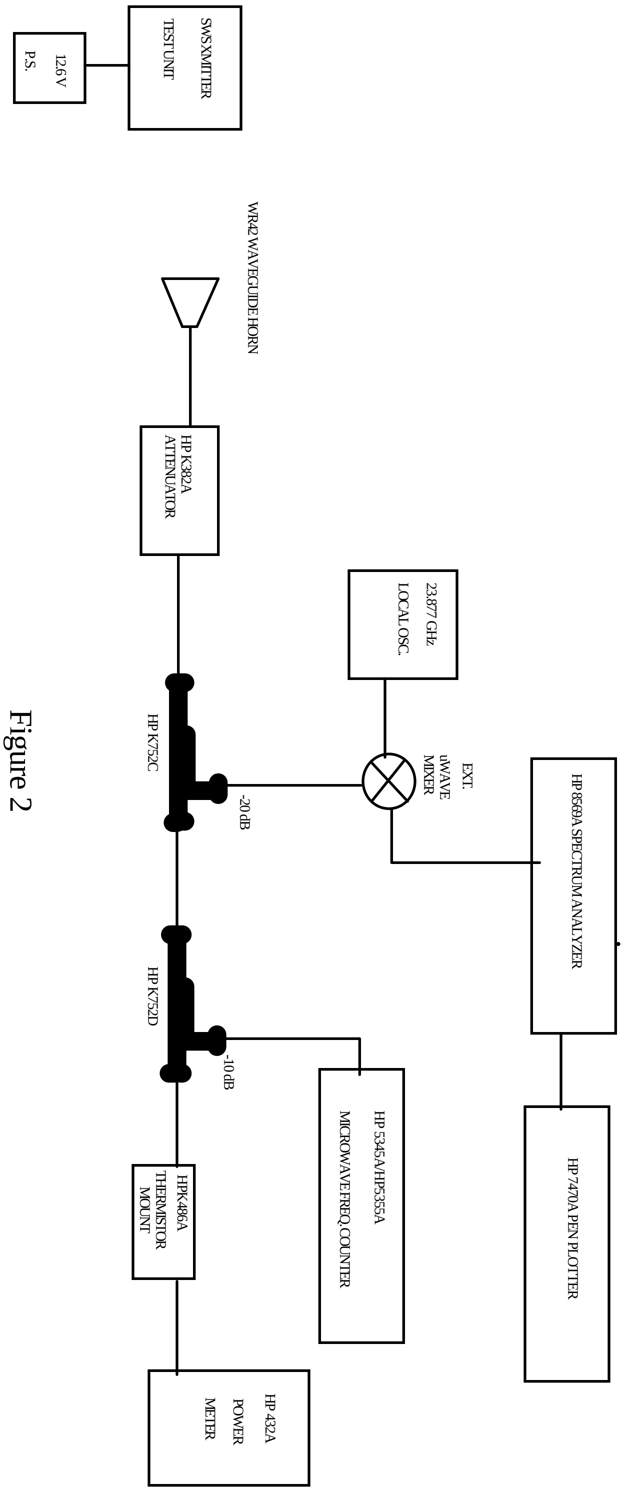

Figure 2