HYSPEC MEMO NO. 10

SUMMARY OF SPECTROMETER LABORATORY TESTS - June 30, 1986 - September 26, 1986

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The 1/8-of-final spectrometer was tested by A. Dowd in the Tucson laboratory on overnight integrations of typically 16-hour duration. An unswitched I.F. noise generator was used as a signal source while the spectrometer was switched so that a zero (within theoretical noise limits) signal-reference spectrum should result. The only variable during the tests was the switch rate which was varied between .016 and 5 Hz.

For each integration a pair of plots is produced. The upper plot is the spectrum produced as a result of the entire integration; the lower plot is the ratio of experimental RMS value (with mean taken over frequency) to theoretical RMS value (as given in HYSPEC Memo #6) as a function of integration time.

All of the results are presented in Figures 1 and 2 in the form of a pair of plots for each integration arranged so that date increases from left to right and switch frequency increases from bottom to top. Figure 1 shows the high switch-frequency data and for comparison some very low switch-frequency data across the bottom. Figure 2 contains data at intermediate switch frequencies and is of less interest.

The data support the following conclusions:

1) For a given switch rate, the data are fairly consistent with time.

2) The measured RMS increases with switch rate especially at 5 Hz; this was not the case for earlier tests in Charlottesville.

3) There is no significant variation of RMS with switch rate in the range of .016 Hz to 1 Hz.

4) All spectra show approximately zero mean over the band of one filter. This shows that the square-law detector + V/F converter sub-system is not causing an increase in RMS. The increase is largely due to slopes in the spectrum within each filter; the slopes are consistent in time but their cause is unknown.

Recommendations for the next test period are as follows:

1) The high RMS at 5 Hz switch rate is the clearest case of improper operation, and we should concentrate on finding a cause. One possibility is a small error which occurs at switch time; another is a beating of the switch frequency and some interfering frequency such as 60 Hz. (DC supply voltages should be examined with an oscilloscope.)

At 5 Hz switch rate we should vary other parameters such as blanking time (4 ms has been used; let's try 8 ms and 2 ms) and cycles per dump (300 has been used; let's try 310 and 301). If these produce no change, the correlator clock frequency should be varied a small amount - say, 0.1%.

2) After the 5 Hz problem is identified (or if we are making no progress in finding it), we should return to an investigation of double-switching. An implementation which allows synchronization with the telescope on-off switching should be devised and tested. (All tests in Charlottesville with double-switching gave very good results until the last few days before shipment.)

3) All tests should be recorded with the same scales (± .0001 for spectra, 0 to 2, 0 to 27 hours for RMS) to allow easier comparison. If a test runs off scale, a second copy at reduced scale should be made. The date rather than day of the week should be printed above the plot.

4) Investigations of baseline offset when a large signal is applied within one filter should be performed.

Attachments

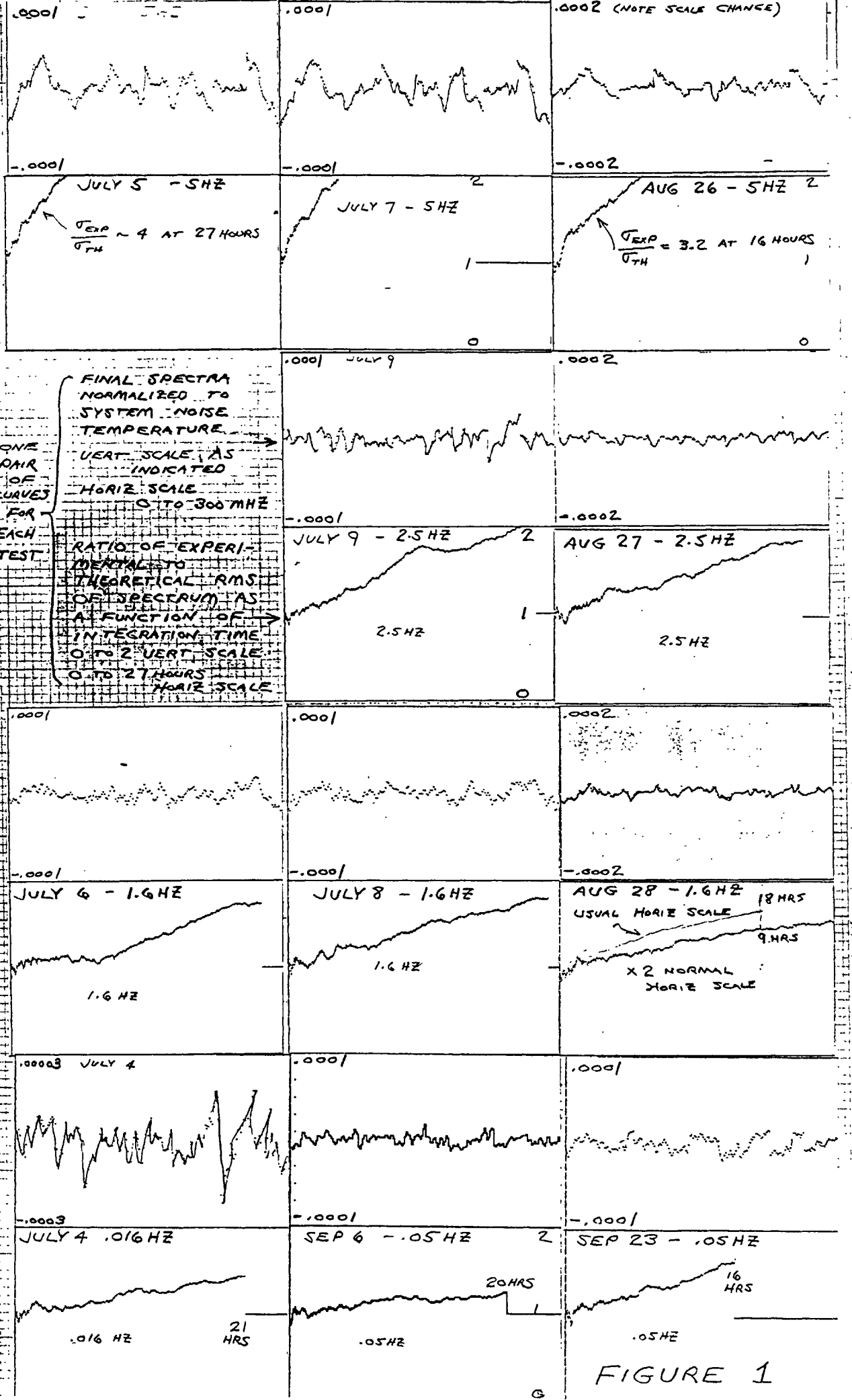
.0001
-.0001
.0001
-.0001
.0002 (NOTE SCALE CHANGE)
-.0002
JULY 5 - 5HZ
$\frac{\sigma_{EXP}}{\sigma_{TH}}$ ~ 4 AT 27 HOURS
JULY 7 - 5HZ
AUG 26 - 5HZ
$\frac{\sigma_{EXP}}{\sigma_{TH}}$ = 3.2 AT 16 HOURS
ONE PAIR OF CURVES FOR EACH TEST
FINAL SPECTRA NORMALIZED TO SYSTEM NOISE TEMPERATURE
VERT SCALE AS INDICATED
HORIZ SCALE 0 TO 300 MHZ
RATIO OF EXPERIMENTAL TO THEORETICAL RMS OF SPECTRUM AS A FUNCTION OF INTEGRATION TIME
0 TO 2 VERT SCALE
0 TO 27 HOURS HORIZ SCALE
.0001 JULY 9
-.0001
.0002
-.0002
JULY 9 - 2.5HZ
2.5 HZ
AUG 27 - 2.5HZ
2.5 HZ
.0001
-.0001
.0001
-.0001
.0002
-.0002
JULY 6 - 1.6HZ
1.6 HZ
JULY 8 - 1.6HZ
1.6 HZ
AUG 28 - 1.6HZ
USUAL HORIZ SCALE
18 HRS
9 HRS
X2 NORMAL HORIZ SCALE
.00003 JULY 4
-.0003
.0001
-.0001
.0001
-.0001
JULY 4 .016HZ
.016 HZ
21 HRS
SEP 6 - .05HZ
20HRS
.05HZ
SEP 23 - .05HZ
16 HRS
.05HZ

FIGURE 1

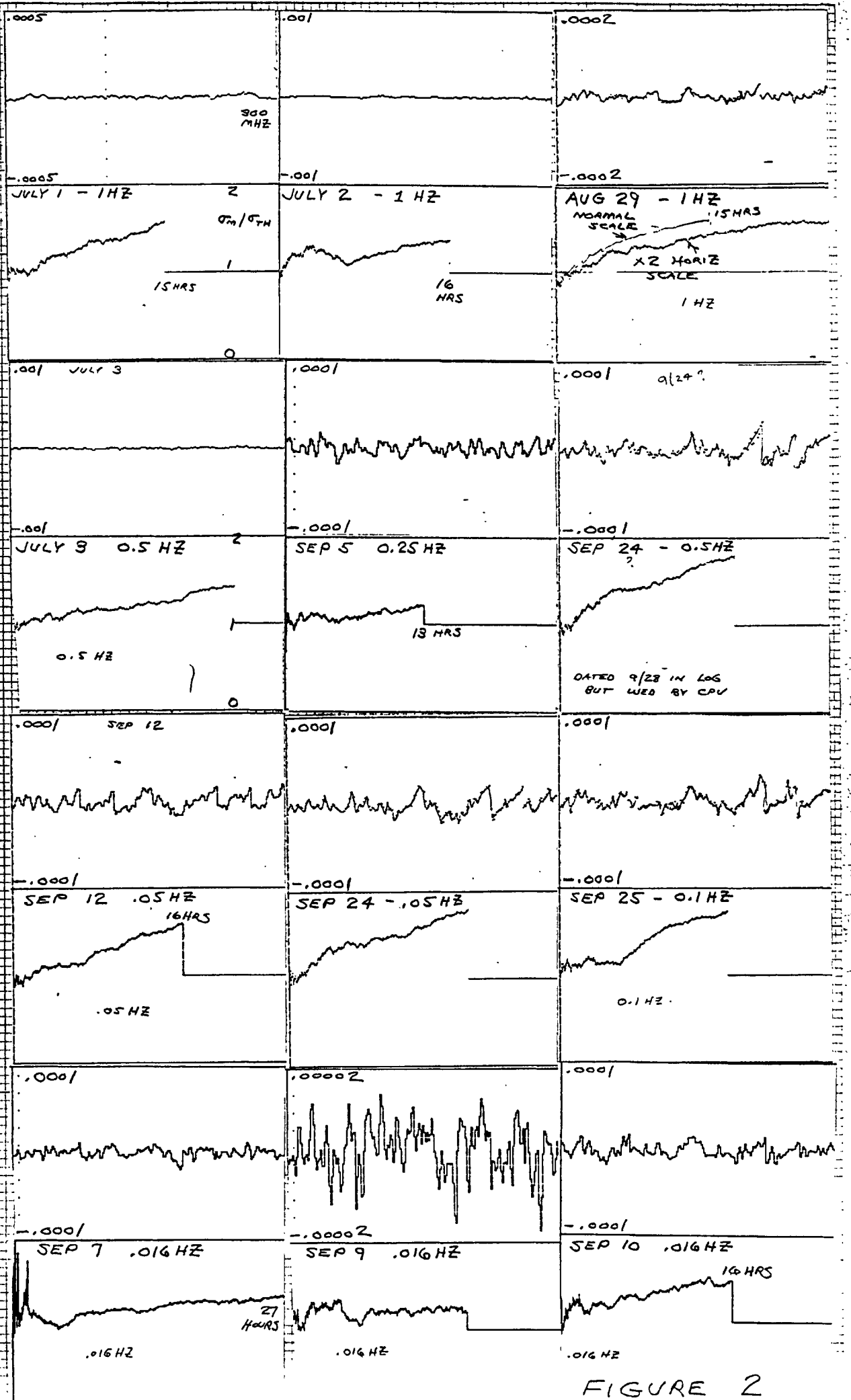
.0005
300 MHZ
-.0005
.001
-.001
.0002
-.0002
JULY 1 - 1HZ
Z
σ_m/σ_{TH}
1
15 HRS
0
JULY 2 - 1 HZ
16 HRS
AUG 29 - 1HZ
NORMAL SCALE
15 HRS
X2 HORIZ SCALE
1 HZ
.001 JULY 3
-.001
.0001
-.0001
9/24?
JULY 9 0.5 HZ
0.5 HZ
SEP 5 0.25 HZ
13 HRS
SEP 24 - 0.5HZ
DATED 9/28 IN LOG BUT USED BY CPU
SEP 12
SEP 12 .05 HZ
16HRS
.05 HZ
SEP 24 - .05HZ
SEP 25 - 0.1 HZ
0.1 HZ
.00002
-.00002
SEP 7 .016 HZ
27 HOURS
.016 HZ
SEP 9 .016 HZ
SEP 10 .016 HZ
16 HRS

FIGURE 2