BIT ERROR RATE
TEST PROCEDURE
04 November 1990

Reference: HAL Drawing C1431

1. Connect equipment as shown in C1431.

2. Use shielded BNC cables for all audio and noise connections.

3. Plug all instrument AC power cords into same AC outlet strip.

4. Be sure to use an RMS meter (HP3400A not HP400FL).

5. Set attenuator for 10 dB minimum insertion. This assures a 600 ohm match to the source (ST-8000) and load (mixer).

6. Set Mark and Space frequencies of source (ST-8000) and Demodulator Under Test (1280A/M or ST-8000) to be the same.

7. Set Demodulator Under Test baud rate to match that to be tested (in HP4951C BERT).

8. Set mixer switch to "Noise Only" and adjust noise output for -10 dBm on the RMS meter (HP3400A).

9. Set mixer switch to "Signal Only" and adjust FSK Modulator (ST-8000) output to -10 dBm on the RMS meter (HP3400A).

10. Set attenuator to -10 dB (0 dB S/N) and mixer switch to S/N. RMS meter (HP3400A) should read approximately -7 dBm (+3 dB from -10 dBm).

11. Set BERT (HP4951C) parameters:

Pattern = 2047 bits
Block Size = 1000 bits
Duration = 10^4 bits (or other length to be tested)
Bits/Sec = 75 (or other data rate to be tested)
Framing = None

Parity = None

12. Make some test runs to be sure data synchronizing works and to determine S/N range to be tested.

a. Set mixer switch to "SIG" (no noise) and attenuator to 0 dB S/N (10 dB attenuation). Run BERT (10,000 bits). Test should run with no errors. Re-run, but use "INSERT ERROR" feature - make sure that errors are counted.
b. Establish lowest S/N to be tested. This will vary with each demodulator and the data rate chosen. Use test runs of 10,000 bits; adjust S/N so that approximately 100 errors are counted over the run (BER of approximately 1E-2). Suggested guidelines:

75 baud: -9 or -10 dB
150 baud: -6 or -7 dB
300 baud: -3 or -4 dB
600 baud: 0 or -1 dB
1200 baud: +3 or +2 dB

13. Run BER tests starting at the lowest S/N. Start with 10,000 bit runs. Run at least 3 runs at the same S/N setting; run more if error counts vary widely (more than 2:1).

14. As S/N is increased, number of errors decrease. Adjust total number of bits so that at least 10 errors are counted in each run. The total time required for a run is a function of the number of bits and the data rate. Some guidelines:

BITS	75BD	150BD	300BD	600BD	1200BD
1E4	2m13s	1m7s	33sec	17sec	8sec
1E5	22m13s	11m7s	5m33s	2m47s	1m23s
1E6	3h42m13s	1h51m7s	55m33s	27m47s	13m53s
1E7	37h2m13s	18h31m7s	9h15m33s	4h37m47s	2h18m53s

15. SPECIAL NOTE FOR LOW DATA RATES: Long runs take a long time. Be sure to re-check the noise source level (-10 dBm) and FSK source level (-10 - S/N dBm) before and after each run that will take longer than 10 minutes.

16. SPECIAL NOTE FOR HIGH DATA RATES: Higher S/N ratios are required at high data rates. Try to maintain at least a "10 dB pad" in the attenuator at even the highest S/N to be tested. This will no doubt require increasing the "minimum attenuator setting" to 15 or 20 dB. If so, increase the Modulator (ST-8000) output to maintain -10 dBm at the attenuator output (0 dB S/N).

17. Data plots:

Both the "raw" and average data is of interest. Prepare one plot file that includes all error data runs for each S/N. Plot these are "symbol" points with no interconnecting lines.

Determine the "average error" for each S/N and plot this as a line on the same graph. The graph therefore shows both the "average" BER and the spread of the actual data collected.

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