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FIBER OPTIC REFERENCE FREQUENCY DISTRIBUTION TO REMOTE BEAM WAVEGUIDE ANTENNAS

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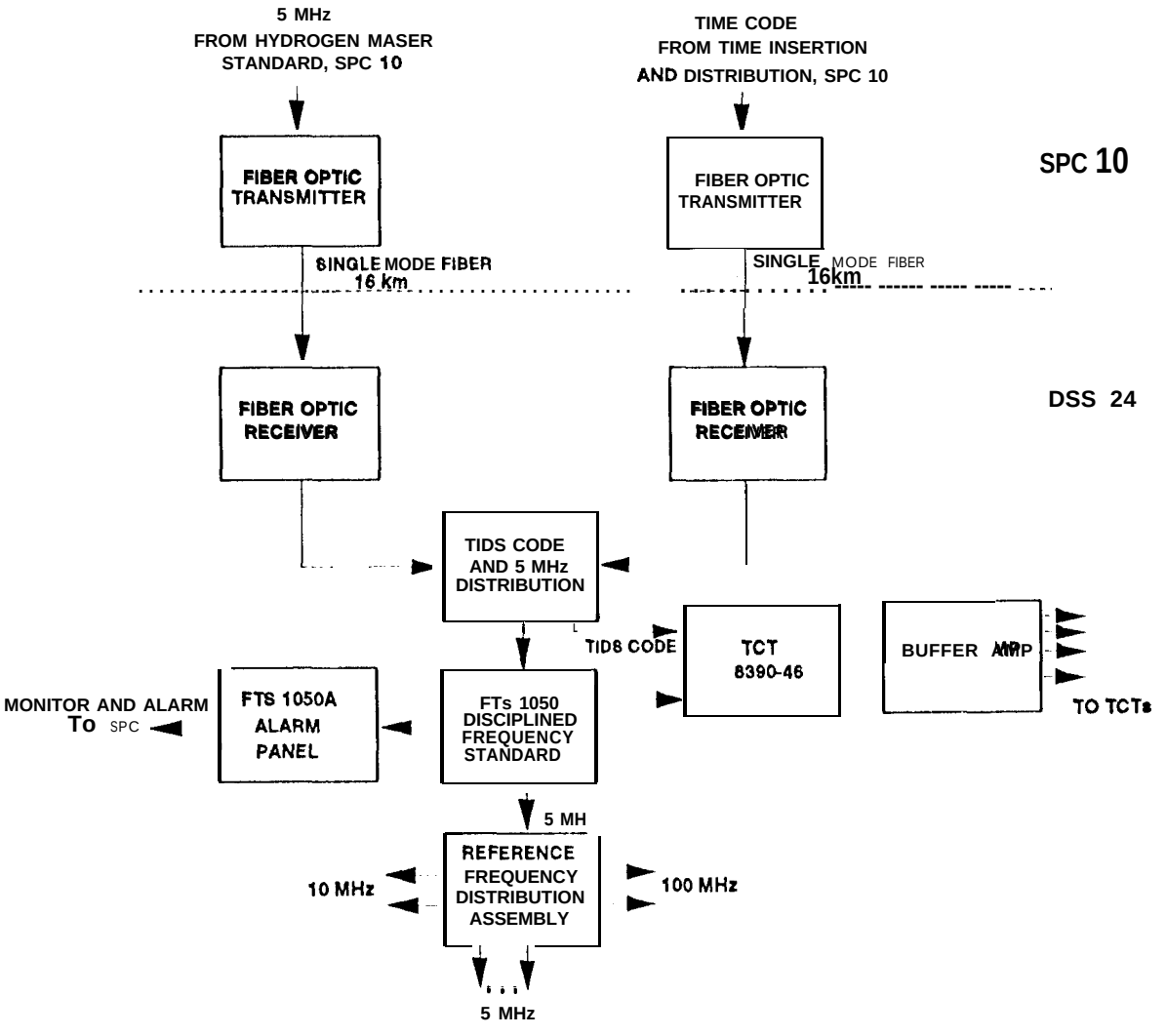
OBJECTIVES

- FTS SUPPORT OF DSS 24 FOR TRACKING UNMANNED SPACECRAFT AND SUPPORTING SCIENTIFIC EXPERIMENTS
  - PROVIDE REFERENCE FREQUENCIES AND TIME CODE TO REMOTE BEAM WAVEGUIDE ANTENNAS LOCATED APPROXIMATELY 16 km FROM REFERENCE SOURCE
  - MINIMUM DEGRADATION OF HYDROGEN MASER STABILITY AND PHASE NOISE
  - USE STANDARD SINGLE MODE FIBER OPTIC CABLE BURIED AT A DEPTH OF 1.5 METERS
  - UTILIZE COMMERCIAL OFF-THE-SHELF EQUIPMENT IN ORDER TO MEET COST CONSTRAINTS



DSS 24 Frequency and Timing Distribution Block Diagram

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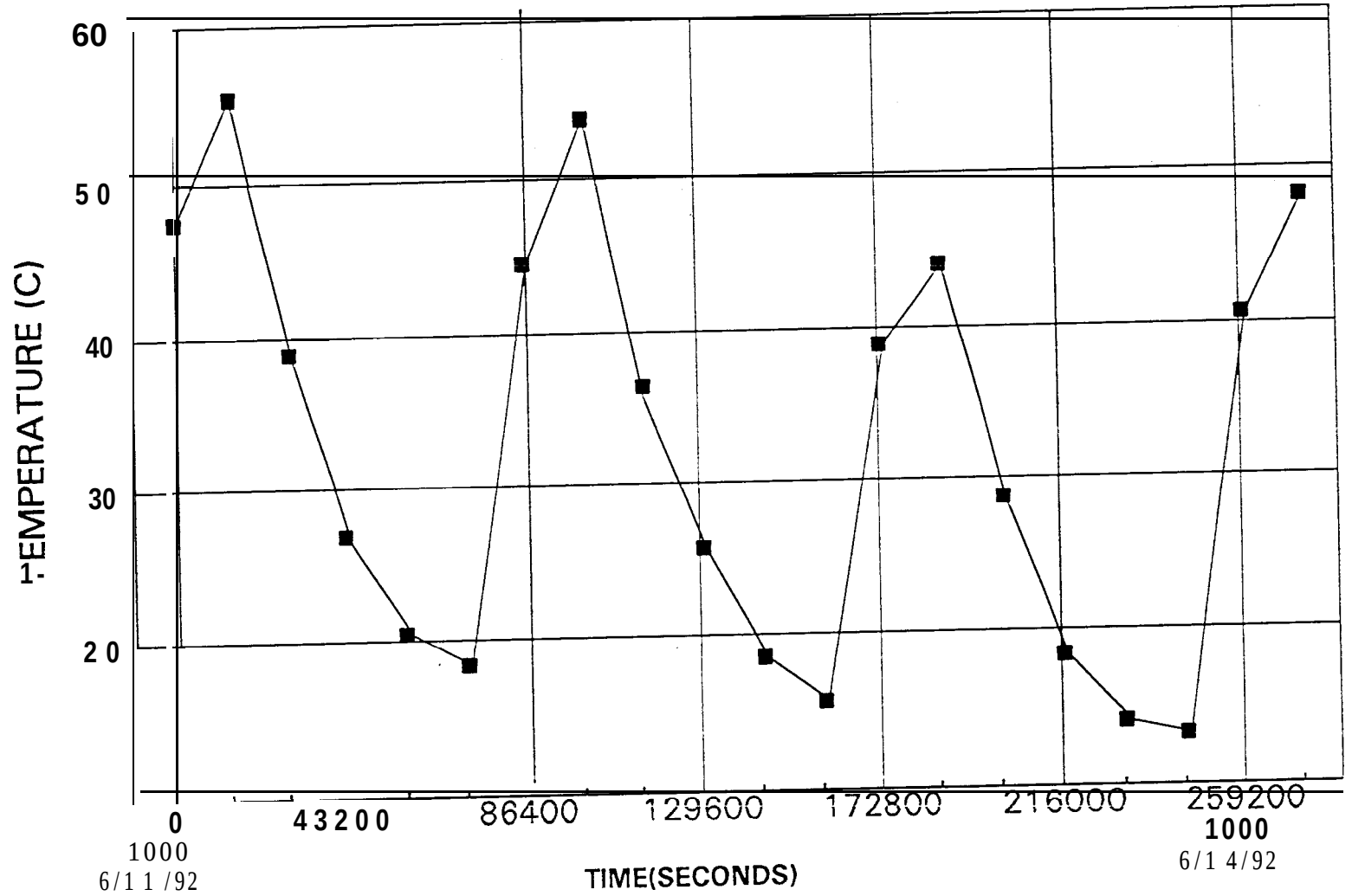
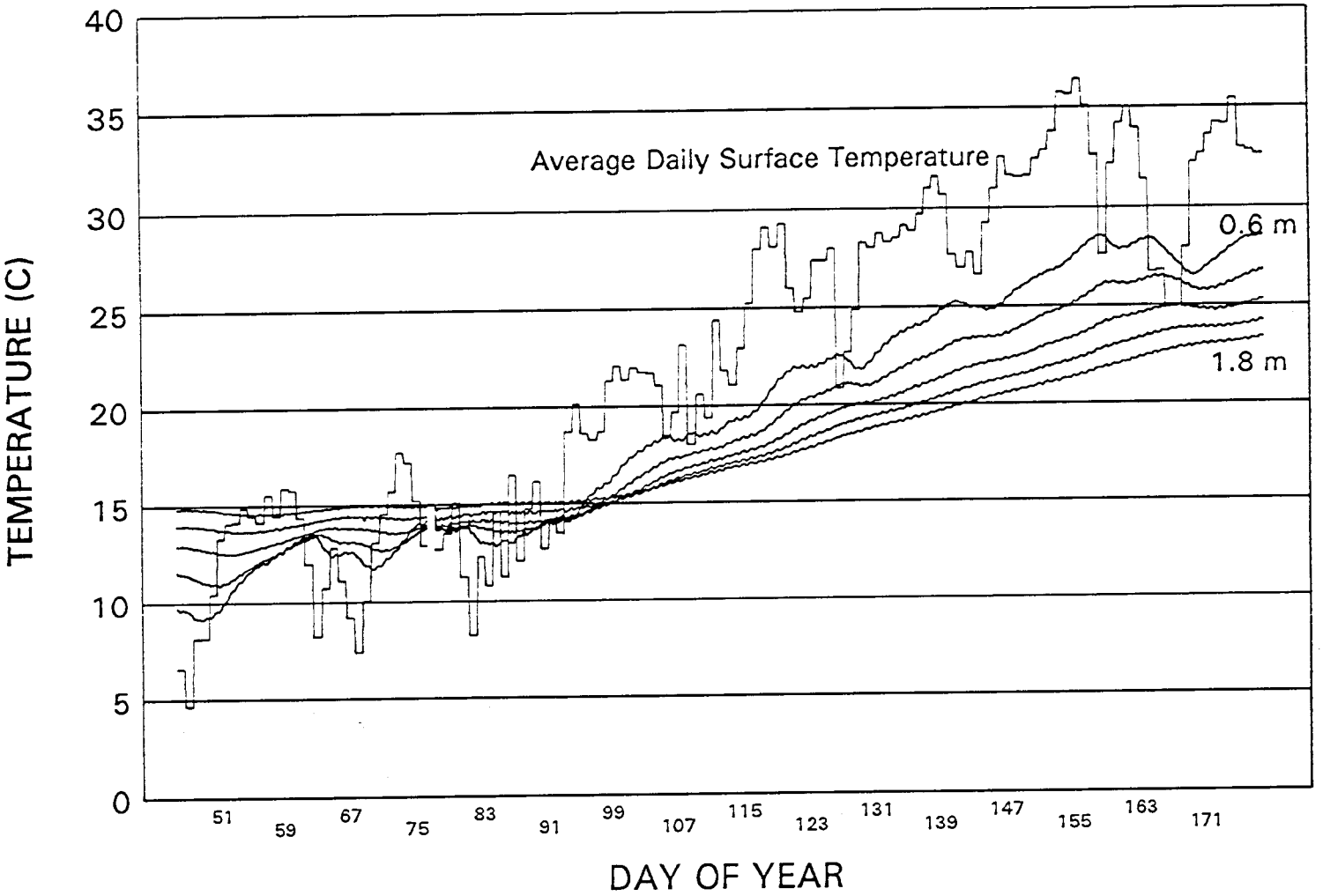
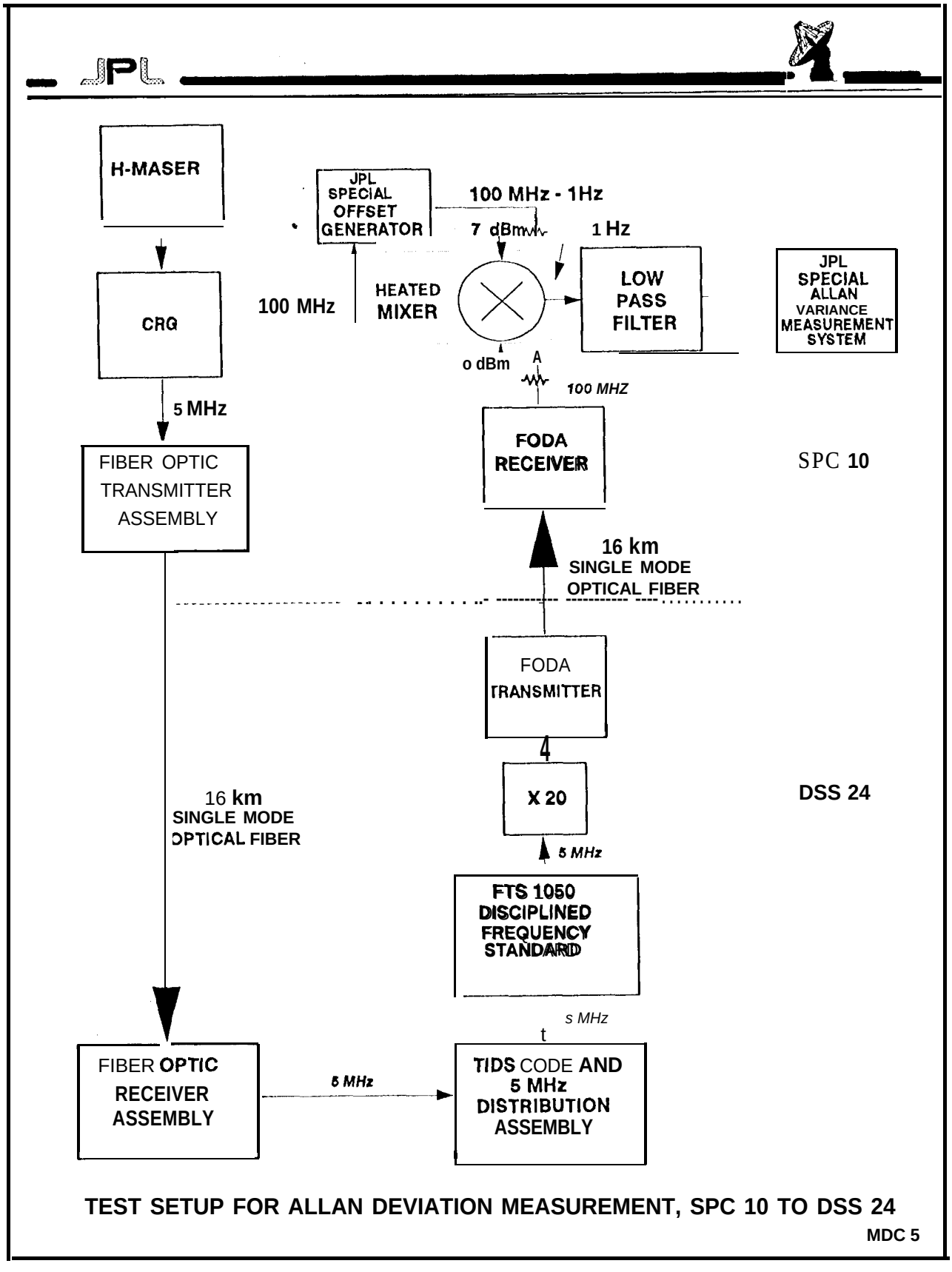


SURFACE TEMPERATURE MEASURED AT GOLDSTONE TRACKING STATION



GROUND TEMPERATURE MEASURED AT GOLDSTONE TRACKING STATION



TEST SETUP FOR ALLAN DEVIATION MEASUREMENT, SPC 10 TO DSS 24

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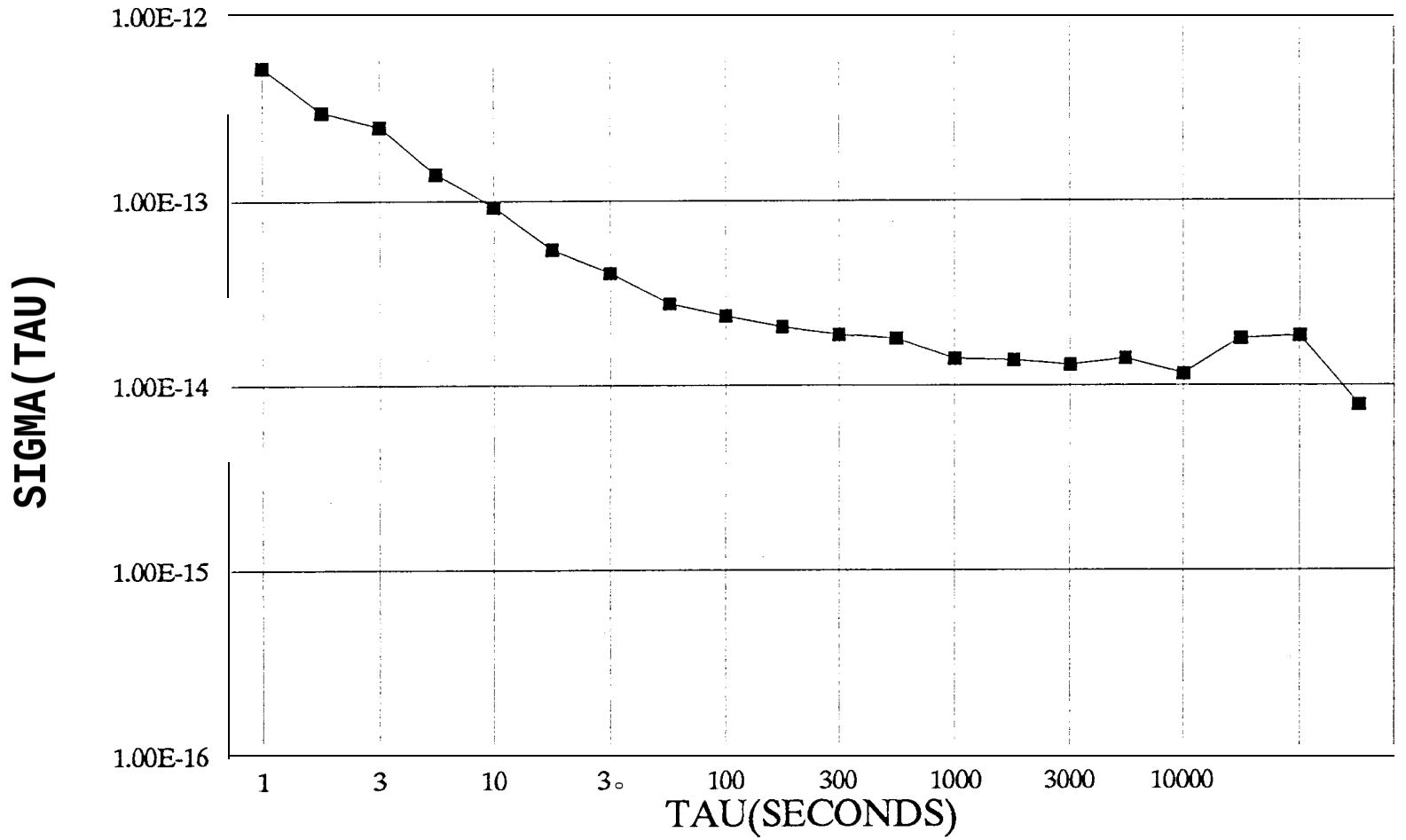
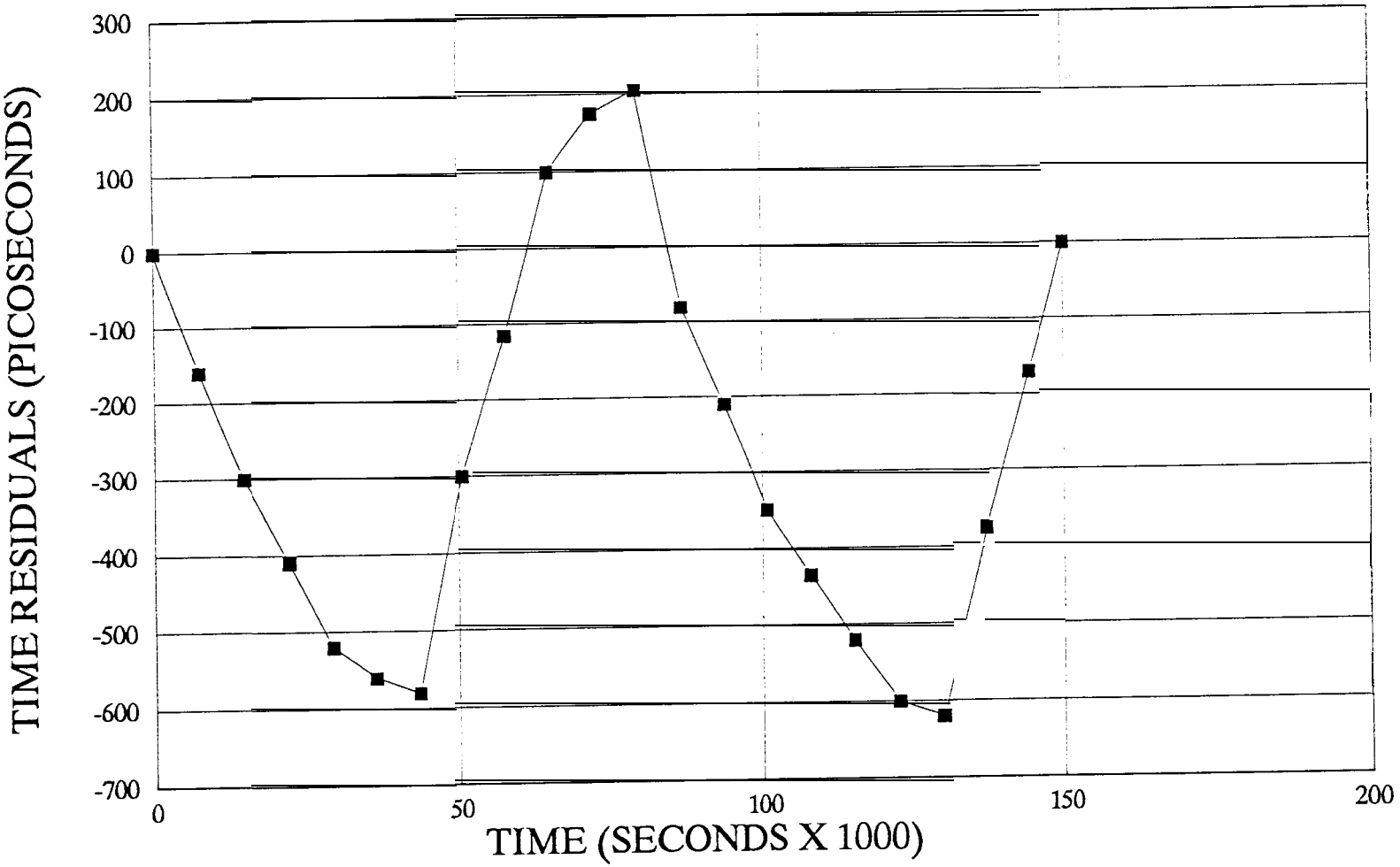


ALLAN DEVIATION WITH 420 METERS OF EXPOSED CABLE



TIME RESIDUALS WITH 420 METERS OF EXPOSED FIBER OPTIC CABLE

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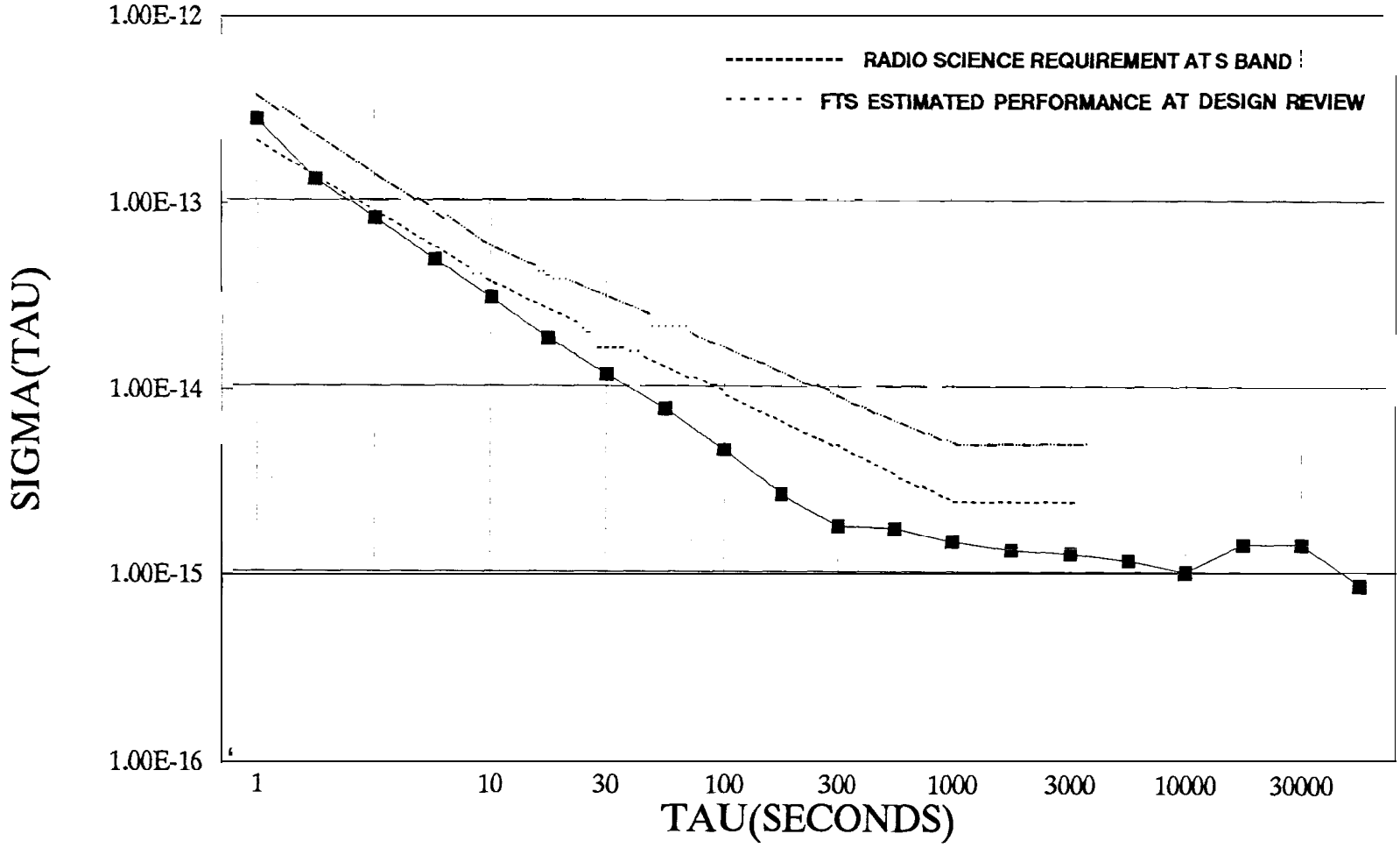

ALLAN DEVIATION SPC1 O TO DSS 24 WITH 1 6 km OF BURIED CABLE

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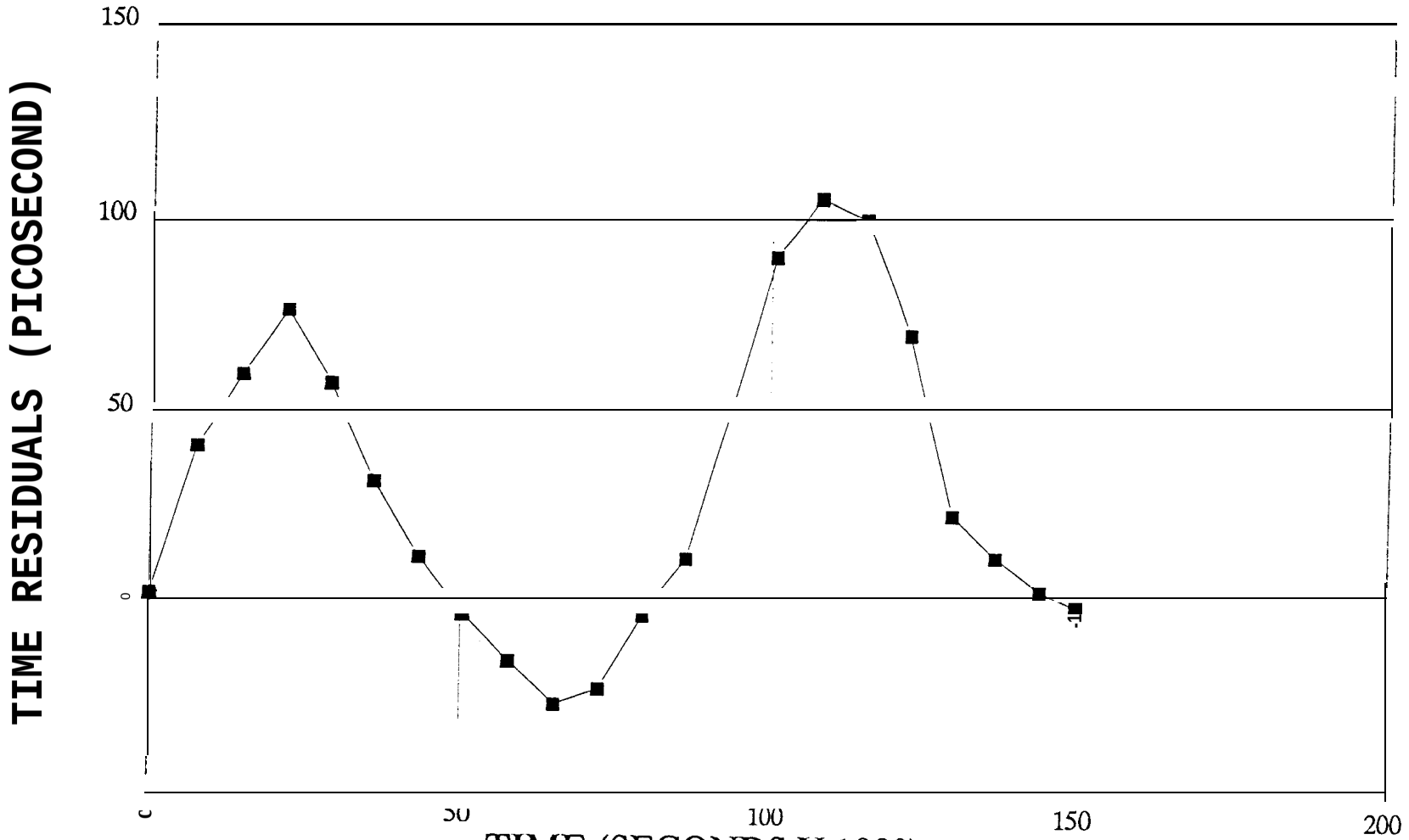
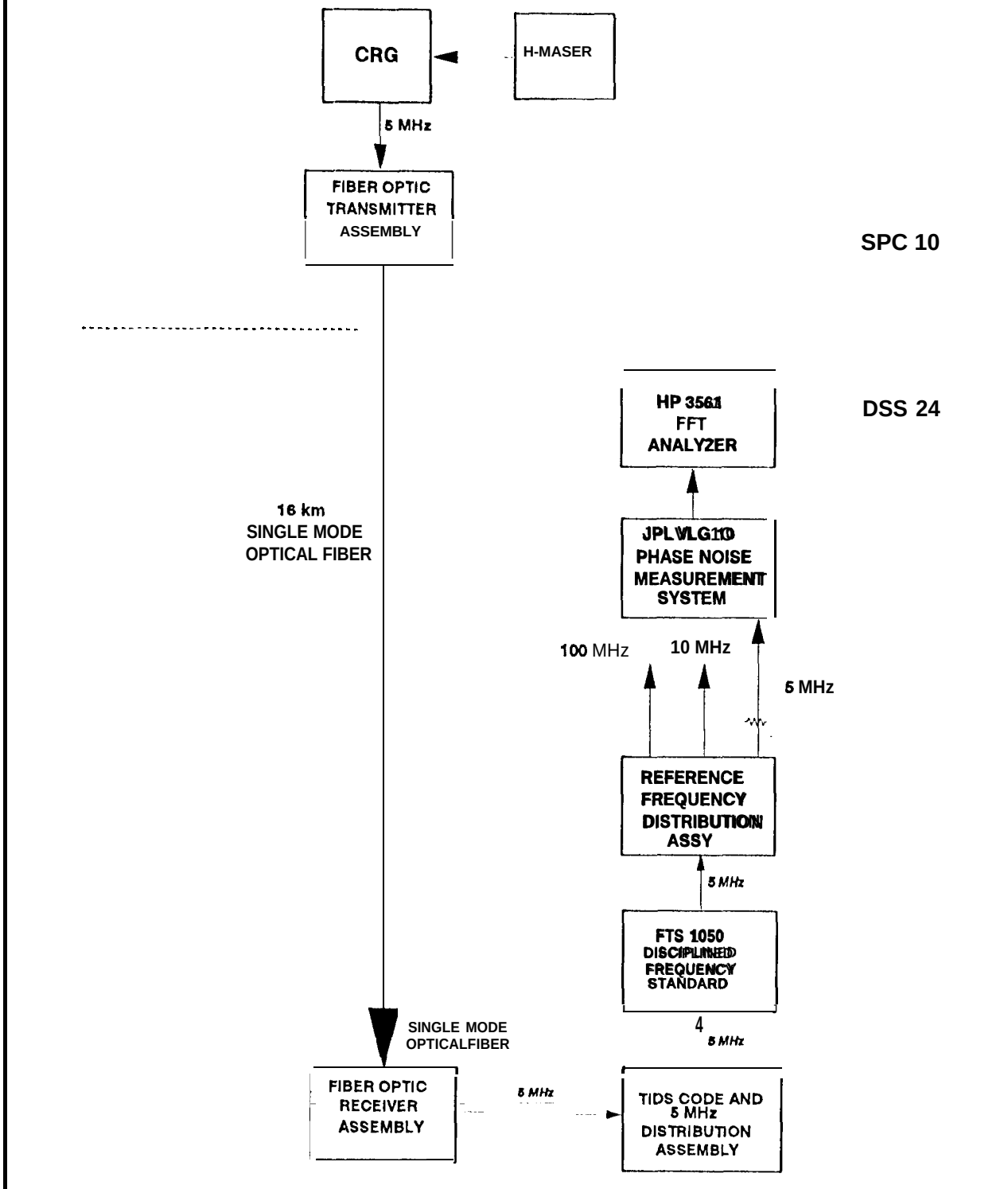


TIME RESIDUALS WITH 32 km OF BURIED FIBER OPTIC CABLE



PHASE NOISE TEST SETUP, SPC 10 TO DSS 24

MDC 10

PHASE NOISE TEST RESULTS
SPC 10 TO DSS 24 FIBER OPTIC REFERENCE FREQUENCY DISTRIBUTION

PHASE NOISE TEST RESULTS AT DSS 24

FREQUENCY OFFSET FROM CARRIER (Hz)	REQUIRED PERFORMANCE AT X BASD (dBc)	MEASURED @ 5 MHz (dBc)	MEASURED @ 100 MHz (dBc)	EQUIVALENT @ X BAND (L(f) @ 5 MHz -64 d B) (dBc)
1	-56	-121	-96	-57
10	-66	-140	-115	-76
100	-66	-14s	-123	-84
1000	-66	-150	-125	-86
10000	-66	-151	-125	-87
100000	-66	-154	-126	-90

TIMING

- MODIFIED IRIG-G TIME CODE FROM SPC 10 MASTER CLOCK VIA 16 km FIBER OPTIC LINK
- TIME OFFSET FROM SPC 10 LESS THAN 100 NANOSECONDS
- JITTER LESS THAN 2 NANOSECONDS
- 82 MICROSECONDS OF DELAY REMOVED AT DSS 24 TCT

SUMMARY

- INSTALLATION **AND TESTING COMPLETE**
- **TIME CODE AND H-MASER REFERENCE FREQUENCY TRANSMITTED** VIA 16 km **FIBER OPTIC** LINK
- ASSEMBLY UTILIZES COMMERCIAL FIBER OPTIC LASER TRANSMITTERS AND RECEIVERS AS WELL AS A COMMERCIAL DISCIPLINED FREQUENCY STANDARD
- 5, 10, AND **100** MHz REFERENCE FREQUENCY PERFORMANCE EXCEEDS PHASE **NOISE SPECIFICATION**
- **ASSEMBLY DELIVERS A QUALITY TIME CODE SIGNAL**
- **HYDROGEN MASER STABILITY IS DEGRADED SLIGHTLY BY COMMERCIAL FIBER** OPTIC EQUIPMENT AND LONG RUN OF **FIBER OPTIC** CABLE