

## **SPECIFICATION FOR OTN/SONET/SDH DIGITAL COMMUNICATIONS NETWORK TESTER SYSTEM**

### **1. INTRODUCTION**

The Naval Research Laboratory analyzes, develops, tests, evaluates, and uses fiber optic digital communications networks. Some of the networks and components are developed at the Laboratory, while others are purchased from private industry, and many of them follow commercial standards, such as the Optical Transport Network (OTN), Synchronous Optical Network (SONET), and Synchronous Digital Hierarchy (SDH) standards. The Laboratory's work with such hardware includes but is not limited to:

- Verifying that networks and components comply with recommendations, standards, and specifications from the American National Standards Institute (ANSI), the International Telecommunication Union (ITU), and Telcordia Technologies.
- Verifying that networks and components from different sources, whether industry or the Laboratory itself, operate correctly together.
- Evaluating how Laboratory and industrial hardware responds to network signals with various structures and payloads and with optional errors and alarms, and analyzing such signals generated by network hardware.

To support this work, the Laboratory requires a digital communications network tester system.

### **2. SCOPE**

This procurement is for a digital communications network tester system capable of testing OTN, SONET, and SDH networks at speeds up to 10.7 Gb/s. The system must be able to generate and analyze jitter and wander and must have optical and electrical interfaces.

### **3. TECHNICAL REQUIREMENTS**

The contractor shall provide a digital communications network tester system that meets or exceeds the desired specifications described below.

#### **3.1. Performance Specifications**

- SONET/SDH
  - Generate and analyze SONET/SDH signals with bit rates of 9953, 2488, 622, 155, and 52 Mb/s.
  - Generate and analyze VT1.5/2/6 and STS-1/3c/12c/48c/192c SONET mappings.

- Generate and analyze VC-12, VC-11, VC-2, VC-3, VC-4, and VC-4-4c/16c/64c AU-4 SDH mappings and VC-12, VC-11, VC-2, and VC-3 AU-3 SDH mappings.
- Generate and analyze PRBS  $2^{15} - 1$ , PRBS  $2^{23} - 1$ , PRBS  $2^{31} - 1$ , and 16-bit user word test patterns.
- Insert bit, B1, B2, B3, FAS, BIP, and REI errors.
- Insert SONET/SDH alarms.
- Detect and report SONET/SDH errors.
- Detect and report SONET/SDH alarms with 100 ms resolution.
- Detect and report user-selectable SONET/SDH errors and alarms with 0.1 ms resolution. The selectable errors and alarms must include payload errors plus SEF/OOF, LOF, AIS, RDI, FAS, B1, B2, B3, and REI.
- OTN
  - Generate and analyze OTU-1 and OTU-2 signals with bit rates of 10709 and 2666 Mb/s.
  - Generate the following client signals: SONET/SDH, PRBS  $2^{23} - 1$ , PRBS  $2^{31} - 1$ , and 16-bit user word.
  - Insert OTN errors and alarms.
  - Insert correctable FEC errors (up to and including the maximum number of correctable errors), uncorrectable FEC errors, and FEC errors at a user-specified position in the frame.
  - Analyze OTU-1 and OTU-2 signals, both with and without applying FEC.
  - Detect and report OTN errors and alarms.
- Jitter and Wander
  - Generate jitter and wander at 10709, 9953, 2666, 2488, 622, and 155 Mb/s in compliance with ITU-T Recommendations O.172 and O.173.
  - Analyze jitter and wander at 10709, 9953, 2666, 2488, 622, and 155 Mb/s in compliance with ITU-T Recommendations O.172 and O.173 and with error no greater than  $\pm 20$  mUIpp.
  - For jitter, measure phase hits, jitter transfer function (JTF), and maximum tolerable jitter (MTJ).
  - For wander, measure time interval error (TIE), maximum time interval error (MTIE), and time deviation (TDEV).

### **3.2. Interface Specifications**

- Optical:
  - The transmitter(s) must emit a nominal wavelength of 1550 nm.
  - The receiver(s) must accept wavelengths from 1260 to 1360 nm and from 1430 to 1580 nm.
  - The system must include adapters sufficient to connect all ports to FC, SC, and LC optical connectors.
- Electrical: The system must have single-ended and differential electrical interfaces for both transmit and receive covering 51 Mb/s to 10.7 Gb/s.
- Local control: The system must have a built-in user interface for local control.
- Remote control: The system must have either an Ethernet or GPIB interface (or both) over which it may be controlled by a remote computer.

### **3.3. General Specifications**

- Size: The volume must not exceed 80 000 cm<sup>3</sup>. Neither the height, width, nor depth shall exceed 0.75 m.
- Mass/weight: 35 kg or 77 lbs. maximum.
- The system must be supplied with either a case or cover(s) for transportation.
- Power: The system must accept 110 to 220 V at 50 to 60 Hz and dissipate 750 VA maximum.
- Temperature: The system must operate within specifications at temperatures of 10 to 40 °C.

## **4. SOFTWARE**

The system must be supplied with all driver or user interface software and licenses which are either necessary to allow remote control or customarily provided to the public in a commercial transaction.

## **5. DOCUMENTATION**

The system must be supplied with hardware and software user manuals as well as any other documentation customarily provided to the public in a commercial transaction.

## **6. WARRANTY**

The contractor shall provide a standard commercial warranty for the system.