# 40/43 Gbit/s SONET/SDH TEST SYSTEM

## 1. Introduction

This document contains the description, specifications, and other requirements for a one JDSU 40/43 Gb/s SONET/SDH Network Test System, **OR EQUAL**, to be delivered to the Naval Research Laboratory in Washington, DC.

## 2. Overview

This request is for proposals for acquisition of a 40/43 Gbit/s SONET/SDH Test System, to be delivered to the Naval Research Laboratory (NRL) in Washington, DC. The delivered system must contain the following components, or equal: a) three ONT-506 Optical Network Testers; b) one 40Gb/s SDH/SNET with jitter plug and play module for ONT-506; c) one 43 Gb/s plug and play OTN module for ONT-506/512; d) one 43 Gb/s Jitter option; e) one 40/43 Gb/s wander option; f) one OSA-303 plug and play module for ONT-506/512; g) one NewGen 2.5 G-B plug and play module for ONT-506-512; h) three MultiChannel extension plug and play modules for ONT-506/512; i) one DSn/PDH Single Port plug and play module for ONT-506/512; j) one Differential interface plug and play module for ONT-506/512; k) one Mixed Ethernet plug and play module for ONT-506/512; l) three PoS/IP processing for SONET/SDH, OTN and NewGen test modules; m) one GFP-T processing for NewGen 2.5G-B module; n) one carrying case for ONT-506; o) three measuring adapters: FC-PC, FC-APC; p)six measuring adapters: SC-PC, SC-APC; q) six measuring adapters: LC-F-3000, (-PC, _APC); r) one MAP Master Chassis; s) one MAP cassette containing two variable optical attenuators with inline power monitors; t) one MAP cassette containing two optical power meters; u) one Integrating Sphere for MAP optical power meter; v) one MAP cassette containing two 2x2 optical switches with FC/APC Connectors; w) one MAP cassette containing an EDFA; and x) one MAP cassette containing a tunable laser. The required system shall also include documentation in the form of operating manuals in either hardcopy of electronic format.

Each of the required system components shall be capable of meeting the performance specifications as documented in Section 5 of this specification. All proposed systems, as a whole, shall comply with the requirements in Section 6 of this specification.

## 3. Evaluation Criteria

As stated in the synopsis/solicitation, the specific technical evaluation criteria to be used shall include (a) technical capability of the item offered to meet the Government's minimum needs, (b) past performance, and (c) price. The technical evaluation will consider the Offeror's overall approach to, understanding of, and capability to provide the requirements listed below. Technical scores will be based on an evaluative

determination of whether the Offeror's proposal meets, does not meet, or, as proposed, is more advantageous than the Government's minimum requirements.

## 4. 40/43 Gbit/s SONET/SDH Test System

THE REQUIRED SYSTEM WILL BE USED TO perform automated testing of network systems and components. The system will be used to conduct performance testing of transmitters, repeaters, and receivers for networks using DsN/PDH, SONET/SDH, Ethernet over SONET, Ethernet MAC and OTN. The transmitters, repeaters, and receivers will be tested for error performance, jitter tolerance, jitter generation, and jitter transfer. These tests will be conducted using multiple mappings of OTN and SONET/SDH, including mixed mappings and mappings with FEC using a Reed Solomon (255,239) algorithm. Bit error and overhead testing of the payloads within these mixed mappings will be performed. The system will be used to test receiver and repeater optical input power sensitivities as well as OSNR tolerances at data rates up to 43 Gb/s. The system will test the performance of transmitters, receivers and repeaters used in 10/100/1000 Mb Ethernet links. The system will also be used to test components with differential electrical input and outputs.

The system will be used in combination with existing NRL fiber test links to perform testing of network components over long transmission distances. The system will also be used to test the performance of new fiber span designs. The system will be used to characterize and test various optical components used in the links including amplifiers, modulators and distortion compensators. The system will be reconfigured repeatedly for changes in testing design and will be used to perform simultaneous testing of components running at different data rates (for example: two repeaters, one operating at 43 Gbit/s and one repeating a 2.5 Gbit/s SONET signal with a mixed mapping).

## 5. Component Performance Specifications

### 5.1 ONT-506 Optical Network Tester (quantity: 3)

- Desktop Mainframe with six configurable slots and 15" TFT display
- Supported interfaces: USB, VGA, CD/DVD R/W drive, external keyboard.
- Hardware modules are plug-and-play and field-exchangeable between ONT-506/-512 mainframes.
- Control computer and hard drive are field replaceable.
- Multiple ports, simultaneous users and applications are supported.

### 5.2 Part # 3061/91.61 (quantity: 1)

**40 Gb/s SDH/SONET with jitter plug and play module for ONT-506**

- Optical output with wavelength in the range of 1530 to 1565 nm
- Optical receiver with a sensitivity of -5 dBm to +3 dBm
- Electrical clock and data output with 2.92 mm connectors
- Electrical clock and data input with 2.92 mm connectors
- Eye clock output with 9.953 GHz frequency and SMA connector

- Built in Jitter generator with accuracy 40 mUIpp (16 MHz to 320 MHz)
- Provides Jitter analysis in accordance with the standards:
  ITU-T O.172, ITU-T O.173, ITU-T G.825, ITU-T G.8251
- Generation and testing of STM-256 signal according to ITU-TG.707
- Generation and testing of OC-768 signal according to ANSI T1.105
- Supports the following mappings:
  SDH: VC-4-256c, VC-4-64c, VC-4-16c, VC-4-4c, VC-4, VC-3
  SONET: STS-768c SPE, STS-192c SPE, STS-48c SPE,
  STS-21c SPE, STS-3c SPE, STS-1 SPE
- Provides PRBS test patterns (2^23-1 & 2^31-1) and programmable
- word of up to 32 bits
- Supports single or periodic error insertion in the following bits:
  SDH: Random, FAS, B1, B2, B3, MS-REI, HP-REI, data bits
  SONET: Random, FAS, B1, B2, B3, REI-L, REI-P, data bits
- Provides standard alarm generation for SONET and SDH
- Provides analysis and control of the overhead:
  Programmable bytes, display of the overhead, trace identifiers,
  Generation of pointer actions at the AU/STS level
- Provides G.828 and G.829 Performance monitoring

**5.3 Part # 3061/91.52 (quantity: 1)**
**43 Gb/s plug and play OTN module for ONT-506/512**

- Allows generation and analysis of an OTM0.3 signal
- Generates OPU3 mappings with SDH/SONET signals, PBRS signals or Digital words
- Provides overhead monitoring and programming of overhead bytes
- Supports error insertion and standard alarm generation
- Provides FEC according to the Reed-Solomon (255,239) algorithm
- Allows FEC error insertion and

**5.4 Part # 3061/91.62 43 Gb/s Jitter option (quantity: 1)**

- Enables 43 Gb/s jitter testing in accordance with the standards:
  ITU-T O.172, ITU-T O.173, ITU-T G.825, ITU-T G.8251

**5.5 Part # 30361/93.93 (quantity: 1)**
**40/43 Gb/s wander option**

- Provides 40/43 Gb/s Wander analysis that complies with ITU-T.O.172

**5.6 Part # 30361/91.34 (quantity: 1)**
**OSA-303 plug and play module for ONT-506/512**

- Optical spectrum analyzer with two optical input ports,
- wavelength range of 1250 to 1650 nm,
- resolution bandwidth (FWHM): 60 pm, 10.7 Gb/s channel drop

**5.7 Part # 30361/90.43 (quantity: 1)**

**NewGen 2.5 G-B plug and play module for ONT-506/512**

- Outputs : optical 1550 nm, optical 1310 nm, and electrical
- Inputs: optical and electrical.
- Supports 2.5 Gb/s testing of Ethernet over SONET, Ethernet MAC, and SONET/SDH
- Supports VCat mappings in accordance with ITU-T G.707, G783, and ANSI T1.105-2001
- Provides PRBS test patterns (2^23-1 & 2^31-1) and programmable word of up to 16 bits
- Supports single or periodic error insertion
- Provides differential delay analysis
- Implements link capacity adjustment scheme in accordance with ITU-T G.7042, G.707, and ANSI T1.105.02-2001

**5.8 Part # 30361/80.82 (quantity: 3)**
**MultiChannel extension plug and play module for ONT-506/512**

- Provides mixed mappings for OTN, SONET/SDH and NewGen testing modules
- Fills up an OC-1/3/12/48 or STM-0/1/4/16 signal with any combination of valid mappings
- OC-48 or STM-16 mappings may be duplicated to fill higher bandwidth test signals
- Capable of bit error testing on all payloads simultaneously.
- Supports service disruption tests, alarm and error messaging tests, error insertion, and pointer evaluation.

**5.9 Part # 3061/90.61 (quantity: 1)**
**DSn/PDH Single Port plug and play module for ONT-506/512**

- Provides framed and unframed DS1/E1/E3/DS3/E4 signals with overhead access, error and alarm insertion, and analysis.

**5.10 Part # 3061/90.94 (quantity: 1)**
**Differential interface plug and play module for ONT-506/512**

- Provides differential electrical jitter testing at rates up to 12.5 Gb/s for XFP transceivers

**5.11 Part # 3061/90.72 (quantity: 1)**
**Mixed Ethernet plug and play module for ONT-506/512**

- 1G Ethernet optical signals at 1310 and 850 nm
- 10/100/1000M Ethernet electrical ports
- Supports link layer and MAC layer internet testing

**5.12 Part # 3061/93.03 (quantity: 3)**
**PoS/IP processing for SONET/SDH, OTN and NewGen test modules**

**5.13 Part # 3061/93.08 (quantity: 1)**

**GFP-T processing for NewGen 2.5G-B module**

**5.14 Part # 3062/92.45 (quantity: 1)**
**Carrying case for ONT-506**

**5.15 Part # 2060/00.51 (quantity: 3)**
**Measuring adapter: FC-PC, FC-APC**

**5.16 Part # 2060/00.58 (quantity: 6)**
**Measuring adapter: SC-PC, SC-APC**

**5.17 Part # 2060/00.59 (quantity: 6)**
**Measuring adapter: LC-F-3000, (-PC,-APC)**

**5.18 Part # MAP + 2M00 (quantity: 1)**
**MAP Master Chassis**

- Rack-mountable chassis with color display and 8 slots for hot swappable instrument cassettes.
- RS-232 and GPIB interfaces for remote control of all instruments in chassis
- Control unit, power supply, keypad and display are field replaceable

**5.19 Part # MVOA-A1DSM (quantity: 1)**
**MAP cassette containing two variable optical attenuators with inline power monitors.**

- < 1.7 dB insertion loss, wavelength range: 1260 to 1650 nm,
- 70 dB attenuation range, attenuation setting resolution: 0.001 dB.

**5.20 Part # MAPM+2PS11 (quantity: 1)**
**MAP cassette containing two optical power meters.**

- Wavelength range: 800 to 1650 nm, 3mm InGaAs sensor elements,
- measurement range: -80 to 10 dBm

**5.21 Part # AC330 (quantity: 1)**
**Integrating sphere for MAP optical power meter**

**5.22 Part # MAPS+2W732A1FAL (quantity: 1)**
**Map cassette containing two 2x2 optical switches with FC/APC Connectors, switching time: 8 ms, insertion loss <1 dB.**

**5.23 Part # MAPO+1E15500FA00 (quantity: 1)**
**MAP cassette containing an EDFA**

- 14 dBm output power, <3.3 dB noise figure, 37 dB small signal gain
- operating wavelength range of 1528 to 1565 nm. FC/APC connectors

**5.24 Part # MAPL+2T1FA (quantity: 1)**
**MAP cassette containing a tunable laser.**

- 8 dBm peak output power, tuning range of 1519 to 1630 nm,
- line width of < 150 kHz,
- Side mode suppression ratio: 45 dB ; RIN: -140 dB/Hz

## 6. Fully Operational, Functional and Integrated System

**6.1** The Contractor shall provide a fully operational, fully functional, and fully-integrated system.

**6.2** For the purpose of this solicitation, a fully operational, fully functional, fully integrated system is defined as a family of sub-elements (materials, parts, assemblies and subassemblies, components and subcomponents, hardware, software, firmware, etc.,) which, when assembled, form an integrated complex whole that is structured so that its constituent parts perform in a functionally and operationally compatible manner.