



# N1660A Dual DS1/0 Test Module Specifications



## GENERAL SPECIFICATIONS

The N1660A Dual DS1/0 Tester module provides comprehensive T1, Nx56 kbps and Nx64 kbps fractional T1 test capability for the Service Advisor family. An optionally available function (opt 010) provides channel scan, digit capture and dialing capability for E&M, ground start, loop start and mixed trunks.

The pulsemask measurement option (020) provides pulsemask measurement and comparison with industry standard masks.

## RELEVANT STANDARDS

ANSI T1.403,  
TR-TSY-00008  
ITU-T Rec 703  
T1.102  
G.703  
Pub 62411

## MODES

**Normal:** Tx originates line code, framing and BERT pattern on full T1 span. Rx synchronizes to input.  
**Internal Loop:** Tx and Rx internally looped  
**CSU:** Responds to CSU loop codes. Sends framed All 1's until looped. T1 monitoring available.  
**Remote Loop:** Equivalent to hardware looping. Data is regenerated. T1 monitoring available.  
**Drop/Insert with Pass Thru:** Single or multiple timeslots are dropped and inserted internally, the remaining time slots are passed thru

## T1 TRANSMITTERS

- Number:** 2 fully independent transmitters  
**Line Code:** B8ZS, AMI  
**Impedance:** 100 ohms  $\pm$  5%  
**Level:** 0, -7.5, -15, -22.5 dB and 0, 266, 399, 533 and 655ft of line build out  
**Pulse Shape:** Meets T1X1.403 for cross connects  
**Jitter:** Intrinsic jitter meets ITU-T Rec 703 section 2  
**Tx Clock Sources:** Rx1 recovered, Rx2 recovered, internal  
**Internal Tx Clock:** 1.544 Mb/s  $\pm$  10ppm  
**Framing:** None, D4, ESF, SLC-96  
**Fractional:** Nx56 or Nx64,  $1 \leq n < 24$ , contiguous or non-contiguous  
**Idle Channel:** all 1's or user bit programmable byte  
**BERT's:** 2 fully independent  
**Alarm Generation:** LOS, AIS, yellow, CDI (no LAPD processing)  
**Error Injection**
- **Frame:** single, 2 to 6 consecutive frames, and a burst of 25
  - **BPV and Pattern:** single, 1E-1, 1E-2, 1E-3, 1E-4, 1E-5, 1E-6, 1E-7, and a burst of 1 to 9,999
  - **CRC:** single, and the following rates which are equivalent to an error rate of 2.17E-3, 1E-4, 1E-5, 1E-6, 1E-7 bit errors, and a burst of 1 to 9,999
  - **Bit:** 1E-1, 1E-2, 1E-3, 1E-4, 1E-5, 1E-6, 1E-7, and a burst of 1 to 9,999
- Loop Codes**
- **Standard:** CSU, NIU, NIU4, NIU6, FDL line, FDL payload, V.54
  - **DDS:** V.54, OCU DP, OCU ALT, DSU ALT, CSU DP, CSU ALT, DSU DP
  - **User Programmable:** Four out-of-band (0xxx xxx0 1111 1111), four in-band (3 to 8 bits)
  - **Transmit Times:** until received
  - **Framing Bit Overwrite:** on/off

**CODEC:**  $\mu$ LAW

### Tone Generation

- 200 Hz through 3950 Hz in 1 Hz steps with level adjustable from +3dBm to -35dBm in 1dB steps
  - Preprogrammed Choices: 404, 1000, 1004 and 2804
  - Three tone slope (404Hz, 1004Hz, 2804Hz) with level adjustable from +3dBm to -35dBm in 1dB steps, and duration adjustable 1 to 9,999 seconds in 1 second steps
- Audio Input:** audio from the handset can be encoded onto a single user-selectable DS0 timeslot instead of a tone
- Signaling Bit Control:** Simultaneous AB or ABCD signaling bits are user settable for all 24 channels



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## T1 TRANSMITTERS (cont'd.)

### BERT Patterns

- **Standard:** QRSS,  $2^{23-1}$ ,  $2^{20-1}$ ,  $2^{15-1}$ , all 1's, all 0's, 63, 511, 2047, 1:1, 1:7, 3:24, live (Tx=QRSS and Loss of Pattern and bit error counting disabled)
- **Octet:** OCT 53, NET55, OCT55, Daly 55, OCT52, OCT54, OCT72, OCT96, 120 octet
- **User:** 4 user programmable bit patterns (3 to 16 bits) and 4 user programmable byte patterns (up to 1024 bytes)
- **Density:** 1in4, 1in6, 1in8, 2in9, 2in10, 2in11, 2in12, 2in13, 2in14, 3in18, 3in20, 3in21, 3in22
- **DDS:** DDS1, DDS2, DDS3, DDS4, DDS5, DDS6
- Invert all patterns

### PRM Generation

Normal, Internal and Drop/Insert modes, the following events can be selected and sent:

- **G1** (CRC Error Event =1),
- **G2** (CRC Event >1 but <=5),
- **G3** (CRC Event >5 but <=10),
- **G4** (CRC Event >10 but <=100),
- **G5** (CRC Event >100 but <=319),
- **G6** (CRC Event >=320),
- **SE** (Severely Errored Framing Event >=1),
- **FE** (Frame Synchronization Error Event >=1),
- **LV** (Line Code Violation Event >=1),
- **SL** (Slip Event >=1) and
- **LB** (Payload Loopback Activated)
- **CSU Mode:** events received are encoded and sent

### DDS Rates/User Channel

- **DSOA:** 2400, 4800, 9600, 19200, 38400, 56000, 64000 bps
- **DSOB:** 2400 (1-20 user), 4800 (1-10 user), 9600 (1-5 user), 19200 (1-2 user)

## T1 RECEIVERS

**Number:** 2 fully independent receivers with individual BERT

**Line Code:** B8ZS, AMI (Once a B8ZS code is detected, B8ZS will be declared until LOS is detected or AutoSetup)

### Impedance

- **Terminate or Monitor:** 100 ohms  $\pm 5\%$
- **Bridge:** 1000  $\pm 5\%$  ohms bridged

**Framing:** D4, ESF, SLC-96 and none

**Fractional:** Nx56 or Nx64,  $1 \leq n < 24$ , contiguous or non-contiguous

### Audio Output

- A single user-selectable DS0 timeslot can be dropped to
  - The internal speaker (signal can be turned on/off and volume adjusted)
  - Handset jack with normal telephone output level

**Signal Loss Criteria:** No pulses for 192 bit times

**Density Violations Criteria:** Excess zeros or ones in accordance with ANSI T1.403.

**D4 Alarm Criteria:** Frame loss when 2 out of 5 Ft bits are in error. Yellow alarm when bit 2 of each DS0 has been zero for 255 consecutive channels.

**ESF Alarm Criteria:** Frame loss when 2 out of 5 Ft bits are in error. Yellow alarm when alternating eight ones and eight zeros has been detected in data link.

**Pattern Loss Criteria:** Greater than 100 errors in 1000 bits.

**Jitter Tolerance:** Input typically tolerates a signal modulated with sinusoidal jitter having an amplitude/frequency relationship defined in ITU-T Rec 703 section 3

## T1 MEASUREMENTS

**Level:** Volts and dBdsx

- **Resolution:**  $\pm 1$ dB
- **Accuracy:**  $\pm 5\%$
- **Range**
  - **Terminate:** 0 to -35dBdsx
  - **Monitor:** -17 to -30dB flat loss relative to 0dBdsx

### Simplex Current

- **Resolution:** 1ma
- **Accuracy:**  $\pm 5\%$
- **Range:** 1 to 200mA

**Frequency:** Max, min and current during the test period.

- **Resolution:**  $\pm 1$  Hz.
- **Accuracy:**  $\pm 2$ Hz
- **Range:** 1.544MHz  $\pm 250$ ppm

### Slips

- **Modes:** RX1/RX2, TX1/RX1, TX2/RX2
- **Results:** relative frequency, total, estimated frame

**Status Indicators (green soft LEDs):** Signal, Frame sync, Pattern sync

**Alarm Indicators (red soft LEDs):** Signal Loss, Frame Loss, Pattern Loss, Density Violations, AIS Signal, Yellow Alarm, CDI

**Alarms:** Signal loss seconds and counts, Loss of frame seconds and counts, Density violations count, AIS seconds and count, Yellow alarm seconds and count, CDI seconds and count (no LAPD processing), Pattern loss seconds and count

**Pattern Errors:** Count, Rate, Errored Seconds (ES), Severely Error Seconds (SES), Consecutively Severely Errored Seconds (CSES), UnAvailable Seconds (UAS), Error Free Seconds (EFS), %ES, %SES, %CSES, %UAS, %EFS

**BPV Errors:** Count, Rate, ES, SES, CSES, UAS, EFS, %ES, %SES, %CSES, %UAS, %EFS

**CRC Errors (ESF only):** Count, Rate, ES, SES, CSES, UAS, EFS, %ES, %SES, %CSES, %UAS, %EFS

**Frame Errors:** Count, Rate, ES, SES, CSES, UAS, EFS, %ES, %SES, %CSES, %UAS, %EFS

### Round Trip Delay

- **Resolution:**  $\pm 1$  bit time
- **Accuracy:**  $\pm 2$  bit times
- **Measurement Range (pattern dependent)**
  - $2^{15}$ : 0 to 21msec
  - $2^{20}$ : 0 to .68sec
  - **QRSS:** 0 to .68sec
  - $2^{23-1}$ : 0 to 5.4sec

**Tone:** Timeslot demultiplexed and level and frequency measured

**AB(CD) Bits:** Simultaneously display AB(CD) bits in all 24 channels for either receivers

**Timeslot Data Displayed:** 8 bit

**3 Tone Slope (average value of tone in dBm,  $\pm 1\%$  frequency acceptance bandwidth)** for 404 Hz, 1004 Hz and 2804 Hz

**PRM - total counts for:** G1, G2, G3, G4, G5, G6, SE, FE, LV, SL and LB, Error Free Seconds and total CRC Events

### DDS Measurements

- DDS Frame Sync
- Control code capture including code, description, data count, duration

## SIGNALING (OPTION 010)

### Signaling Types Supported

- E&M immediate
- E&M wink start
- Ground start
- Loop start
- Data
- Mixed
- Individual timeslots can be programmed as E&M immediate, E&M wink start, ground start, wink start

### Operating Modes

- AB(CD) decode
- Call Monitor Logging
- Dial
- Program stored number

### Modes

- Monitor both Central Office (CO) and Customer Interface (CI),
- Emulate CO,
- Emulate CI

**Channel Selection:** 1 to 24

### Status Indicators for a Selected Channel

- **CO:** on hook, off hook, ringing
- **CI:** on hook, off hook, ringing

### AB(CD) Decode

- Displays signaling state (on-hook, off-hook or ringing) and AB(CD) signaling bits for RX1 or RX2 depending upon signaling type and mode

### Call Monitor Logging

- **Modes**
  - Selected channel
  - Scan and monitor until hang-up
  - Scan and monitor until time out (5, 10, 15, 30, 60 seconds)
- **Decodes:** DTMF, MF, or DP digits
- **Resolution:** 1 sec

### Dial Mode

- **Channel Selection:** 1 to 24
- **DTMF Dial Strings**
  - **Digits:** 0, 1, 2, ..., 8, 9, \*, #, A, B, C, D, Pause, Go Off Hook, Go On Hook
  - **Digit and Interdigit Time:** 50ms typical
- **MF Dial Strings**
  - **Digits:** 0, 1, 2, ..., 8, 9, KP, ST, ST1, ST2, ST3, Pause, Go Off Hook, Go On Hook
  - **Digit Time:** 70msec typical
  - **KP Time:** 100msec typical
  - **Interdigit Time:** 50msec typical
- **DP Dial Strings**
  - **Digits:** 0, 1, 2, ..., 8, 9, Pause, Go Off Hook, Go On Hook
  - **% Break:** 50%
  - **Period:** 500ms

• **Controls:** "Go On Hook Now", "Go Off Hook Now"

### Program Stored Number

- Program up to 9 digit strings (SN1 - SN9) with MF, DTMF or DP digits or pause

## PULSEMASK (OPTION 020)

- **Masks:** T1.102, T1.403, G.703, Pub 26411
- **Capture Data**
  - **Line:** 1 or 2
  - **Acquire:** Positive, negative, both
- **Mask tolerance:** 0%, 3%, 6%
- **Measurements (for both positive and negative):** pass/fail, amplitude (mV), rise time (ns), fall time (ns), width (ns), overshoot (%), undershoot (%), imbalance ratio

## OTHER SPECIFICATIONS

### AUTO SETUP

Synchronizes to the input signal line code, framing and pattern

- **Detailed:** tests all patterns, normal and inverted
- **Standard:** tests only “Standard” patterns (see T1 Transmitters - BERT patterns)

### BERT Sequences

- **Bridgetap:** 1:1, 1:3, 1:5, 1:7, 2:8, 2:9, 2:10, 2:11, 2:12, 2:13, 2:14, 3:18, 3:19, 3:20, 3:21, 3:22, 3:23, 3:24, QRSS
- **Multipattern:** Ones, 1:8, 2:8, 3:24, QRSS
- **User 1-3:** any pattern can be used (see “T1 Transmitters” - “BERT patterns”)
- **Programmable Parameters**
  - **Line:** RX1/TX1 or RX2/TX2 (D&I: RX1/TX2 or RX2/TX1)
  - **Run Mode:** Once, Continuous
  - **Run Each Pattern For:** 5 to 300 seconds, 1 second steps
- **Sequence Controls:** hold pattern, advance pattern
- **Sequence Results**
  - **Per Pattern:** Status (“Running”, “In Sync”, “—”), total pattern errors, total BPV errors, total frame error, total CRC errors,
  - **Overall:** Number of loops, Number of failed loops, Current pass number

### EVENT LOG STORAGE

- Captures 4096 events from RX1 and/or RX2 with date and time stamp
- **Alarms Stored:** LOS, AIS, Yellow, frame loss, pattern loss, density violations and CDI
- **Errors Stored:** Logic, BPV, frame errors and CRC
- **Events Stored:** Test started or stop, framing type change, pattern type change, line build out change, B8ZS change and Loopcodes detected
- Data stored with 1 second resolution

## TEST PERIOD

### Test Period Control

- Continuous,
- **Fixed:** 15min, 30min, 1hour, 3 hours, 6 hours, 12 hours, 1 day, 3 days, 7 days
- **User-Programmable Time Periods**
  - 1 minute resolution
  - up to 7 days

## ASCII REPORTS

- **Types**
  - Dual Monitor
  - T1 Testing
  - Signaling
  - Event Log
  - BERT Sequences
- Can be generated during a test or at the end of a test
- 75 columns wide
- **User Programmable Fields:** operator ID, customer name, circuit ID, comments
- Reports can stored and printed

## DATA AND FILE MANAGEMENT

- **Local:** Store last configuration, restore last configuration and reset default configuration
- **Remote**
  - Download program Flash-ROM updates

## PRINTING

- Print ASCII report

## REMOTE CONTROL

- SCPI Command Line Interface (option of N1610A Service Advisor Portable Test Tablet)
- Remote Graphical User Interface for PC

## CONNECTORS

- L1 and L2
  - Dual Bantam
- Handset
  - RJ-11
- Ground Lug

## MODULE LEDS

L1 and L2 (one set for each)

- Status (green)
  - Signal
  - Frame
  - Pattern Sync
- Alarm and Error (red)
  - Signal
  - Frame
  - Pattern Sync
  - Error

Other

- History (red)
- Ready (green)

## GENERAL

### Physical (WxHxD)

- **Single Test Module Format**
    - 3.5 x 8.5 x 1 inch
    - 89 mm x 215 mm x 25 mm (64 mm)
- Weight:** 1.5 lbs. (.6 kg)

**Operating Temp:** 0C to 40C (32F to 104F)

**Storage Temp:** -20C to 60C (-4F to 140F)

**Power:** 7W (provided by Service Advisor)

**EMI:** FCC Class

**Mechanical:** HP Handheld Class 2B

## Ordering Information

### N1660A Dual DS1/0 Test Module

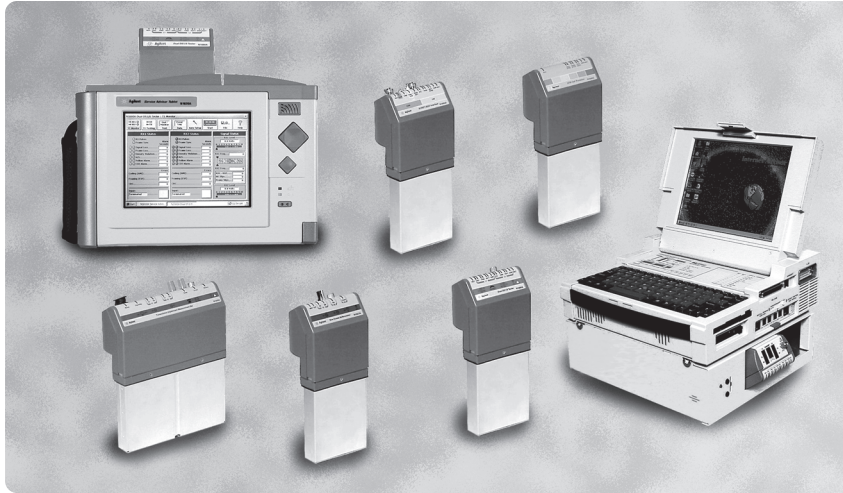
- opt 010: Signaling
- opt 020: Pulsemask Measurement

### N1610A Service Advisor Portable Test Tablet

- opt 500: Remote Services

### N1700A Service Advisor Undercradle

## Related Products



All Agilent test modules, including the Dual DS1/0 Module, can be used interchangeably with both Agilent's Service Advisor portable test tablet and Internet Advisor PC platforms. Modules plug directly into the Service Advisor tablet or Agilent's Service Advisor Undercradle, which attaches to the Internet Advisor network analyzer.

### **N1610A Service Advisor Test Tablet**

Agilent's Service Advisor Test Tablet is a lightweight, portable platform that supports a complete range of installation and maintenance testing requirements. The battery-powered tablet features a color touchscreen, and accepts all of the single and dual-slot application modules listed below.

### **N1700A Service Advisor Undercradle**

The Service Advisor Undercradle attaches to Agilent's Internet Advisor network analyzer, allowing Internet Advisor users to share use of single and dual-slot plug-in testing modules. The undercradle allows field organizations to combine physical network and service deployment testing with the Internet Advisor's powerful, higher-layer protocol analysis capabilities.

### **N1640A ATM Cell Processor Test Module**

Combined with the SONET/SDH Test Module, the ATM module provides complete SONET/SDH ATM BER, QoS and VPI/VCI testing capabilities at up to 155 Mbp/s line rates.

### **N1645A SONET/SDH Test Module**

This line interface module provides connectivity and physical layer SONET and SDH testing for OC-1, OC-3c, STM-0 (optical) and STM-1 (optical) lines.

### **N1625A/N1626A xDSL TIMS Test Module**

The double-slot TIMS Test Module supports a complete range of Transmission Impairment Measurements (TIMS) related to line qualification and troubleshooting for a wide range of services from POTS to ADSL.

### **N1629A TDR Test Module**

Agilent's TDR module provides a wide range of easy-to-use, accurate tools for locating faults or measuring span length for any type of metallic cabling, including copper twisted-pair or coaxial wiring.

For more information about Agilent Technologies test and measurement products, applications, services, and for a current sales office listing, visit our web site: <http://www.agilent.com/find/tmdir>

You can also contact one of the following centers and ask for a test and measurement sales representative.

#### **United States:**

Agilent Technologies  
Test and Measurement Call Center  
P.O. Box 4026  
Englewood, CO 80155-4026  
(tel) 1 800 452 4844

#### **Canada:**

Agilent Technologies Canada Inc.  
5150 Spectrum Way  
Mississauga, Ontario  
L4W 5G1  
(tel) 1 877 894 4414

#### **Europe:**

Agilent Technologies  
Test & Measurement  
European Marketing Organisation  
P.O. Box 999  
1180 AZ Amstelveen  
The Netherlands  
(tel) (31 20) 547 9999

#### **Japan:**

Agilent Technologies Japan Ltd.  
Measurement Assistance Center  
9-1, Takakura-Cho, Hachioji-Shi,  
Tokyo 192-8510, Japan  
(tel) (81) 426 56 7832  
(fax) (81) 426 56 7840

#### **Latin America:**

Agilent Technologies  
Latin American Region Headquarters  
5200 Blue Lagoon Drive, Suite #950  
Miami, Florida 33126  
U.S.A.  
(tel) (305) 267 4245  
(fax) (305) 267 4286

#### **Australia/New Zealand:**

Agilent Technologies Australia Pty Ltd  
347 Burwood Highway  
Forest Hill, Victoria 3131  
(tel) 1-800 629 485 (Australia)  
(fax) (61 3) 9272 0749  
(tel) 0 800 738 378 (New Zealand)  
(fax) (64 4) 802 6881

#### **Asia Pacific:**

Agilent Technologies  
24/F, Cityplaza One, 1111 King's Road,  
Taikoo Shing, Hong Kong  
tel: (852)-3197-7777  
fax: (852)-2506-9284

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