TABLE 1-1 *Specifications*

LEVEL/FREQUENCY

TRANSMITTER

Frequency Range:	20 Hz to 5000 Hz, 20Hz to 300KHz
Resolution:	1 Hz
Accuracy:	1.0 Hz
Output Steps:	1 Hz, 10 Hz, 100 Hz, or 1000 Hz steps
Frequency Sweep:	Single or Continuous with selectable bounds, level and step size.
Level Range:	- 60 dBm to + 12 dBm
Resolution:	0.1 dB
Accuracy:	0.1 dB @ 1004 Hz (0 to -19 dBm),
Flatness:	0.2 dB (200 Hz to 5 kHz referenced to level at 1 KHz)
Distortion:	- 70 dB @ 1004 Hz, 0 dBm

RECEIVER

Frequency Range:	20 Hz to 5000 Hz, 20Hz to 300KHz
Resolution:	1 Hz
Accuracy:	1.0 Hz
Level Range:	- 50 dBm to + 12 dBm
Resolution:	0.1 dB
Accuracy:	0.1 dB @ 1004 Hz (0 to -19 dBm), 0.2 dB @ 200 Hz to 5 khz

NOISE MEASUREMENTS

Input:	Balanced or Noise-to-Ground
Weighting Filters:	C-MSG, C-NOTCH,3 KHz Flat15K,PROG,50K
Notch Filter:	1010 Hz (995 Hz to 1025 Hz Notch); > 60 dB Notch depth
Range:	10 dBrn to 100 dBrn (Balanced) 50 dBrn to 130 dBrn (Noise-to-Ground)
Resolution:	1.0 dB
Accuracy:	0.5 dB

TABLE 1-1 *Specifications (con't)*

SIGNAL-TO-NOISE MEASUREMENT

Level Range:	-50 dBm to +10 dBm
Noise Range:	10 dBrn to 90 dBrn
S/N Range:	10 dB to 50 dB
Accuracy:	0.5 dB
Resolution:	1.0 dB

RETURN LOSS MEASUREMENT

Modes:	ERL, SRL-Low, SRL-High or Sinewave (OSCillator mode)
Transmitted Signal:	Meets the specifications of Bell Publication 41009 (Tables D, E and F, page 13) and IEEE Standard 743-1984

2-WIRE RETURN LOSS

Transmitter Level:	-10 dBm0
Receiver Range:	0 dB to 40 dB
Resolution:	1.0 dB
Accuracy:	0.5 dB
Internal Hybrid Impedance:	600 or 900 Ohms 0.1% in series with 2.16 uF 1%

4-WIRE RETURN LOSS

Impedance:	150, 600, 900, or 1200 Ohms
Transhybrid Loss Compensation:	- 30 dB to + 30 dB
Transmitter Level:	- 10 dBm0 In OSCillator mode the level is 0 dBm relative to the TLP
Receiver Range:	-10 dB to 50 dB
Resolution:	1.0 dB
Accuracy:	0.5 dB

TABLE 1-1 *Specifications (con't)*

SUPERVISORY SIGNALING

WINK TIMING

Resolution:	5 msecs.
Accuracy:	5 msecs.
Wink Fail Event:	Fails for wink period >600 msecs.
Off-Hook Fail Event:	Fails for Off-Hook period <600 msecs.

E/M SUPERVISION

Types:	I, II, III, IV, V
Battery:	- 48 VDC current limited to 200 mA

Threshold Voltages:

	E Lead	M Lead
On-hook	< - 16 V.	> - 16 V.
Off-hook	> - 16 V.	< - 16 V.

LOOP SUPERVISION

Types:	2- and 4-wire Loop Start, Ground Start, Loop Reverse Battery, and SX supervision.
Battery:	- 48 VDC series limited to 120 mA

MF AND DTMF SENDER

Frequency Accuracy:	0.1% of Bell Standard Frequencies
Adjustment Range:	Tone Frequencies adjustable in 0.1% steps to 10% of standard Bell frequencies for Margin Testin.
Level:	Automatically adjusted to -7 dBm0
Level Adjustment Range:	Tone level adjustable in 0.1 dB steps from - 60.0 dBm to + 6.0 dBm

TABLE 1-1 *Specifications (con't)*

Resolution:	0.1 dB
Accuracy:	0.2 dB
Timing:	MF: 70 ms Tone On and Tone Off (KP is 100 mS Tone On) DTMF: 50 ms Tone On and Tone Off
Timing Adjustment Range:	Tone On and Tone Off times adjustable in 1 ms steps from 13 msecs. to 267 msecs.
Resolution:	1 msecs.
Accuracy:	1.0 msecs.

DIAL PULSE SENDER

PPS

Range:	2 to 50 PPS
Resolution:	0.1 PPS
Accuracy:	1.0% at 10 PPS

% BREAK

Range:	5 to 95%
Resolution:	0.1%
Accuracy:	1.0% for 25% to 75% BRK @ 10 PPS

INTERDIGIT TIMING

Range:	40 to 990 msecs.
Resolution:	10 msecs.
Accuracy:	5 msecs.

TABLE 1-1 *Specifications (con't)*

GENERAL

Impedances:	150, 600, 900, 1200 Ohms and > 50 KOhms Bridging
Maximum DC Blocking:	160 VDC
Audio Bandwidth:	3.0 dB 300 Hz to 3.0 kHz
Audio Volume:	Adjustable by front panel control
Longitudinal Balance:	90 dB at 60 Hz
Receiver Return Loss:	> 30 dB 200 Hz to 5 kHz (600, 900, 1200 Ohms) > 30 dB 800 Hz to 5 kHz (150 Ohms)
Display:	40 character vacuum fluorescent plus 4 LED's for ON/OFF-hook status
AC Power Supply:	115 VAC 10%, 60 Hz
Operating Temperature:	0° C to 50° C
Storage Temperature:	- 40° C to 70° C
Dimensions:	5.79" H. x 14.33" W. x 14.25" D
Weight:	16 to 18 lbs. depending upon options

OPTIONS

MF/DTMF/DP RECEIVER AND ANALYZER (OPTION 930A-01)

MF AND DTMF

Input Level Range:	-25 dBm to 0 dBm
Accuracy:	0.2 dB
Resolution:	0.1 dB
Input Frequency Range:	10% of AT&T standard frequencies for MF and DTMF tones
Accuracy:	0.1%
Resolution:	1 Hz
Input Tone ON/OFF Range:	35 msecs. to 250 msecs. Tone ON 35 msecs. to 250 msecs. Tone OFF
Accuracy:	5 msecs.
Resolution:	1 msecs.

TABLE 1-1 *Specifications (con't)*

DIAL PULSE (DP) RECEIVER AND ANALYZER (OPTION 930A-01)

PPS Range:	5 PPS to 30 PPS
Accuracy:	2% @ 10 PPS
Resolution:	0.1 PPS
% Break:	10% to 90%
Accuracy:	2% (25% to 75% break at 10 PPS)
Resolution:	0.1%
Interdigit Timing Range:	50 msecs. to 990 msecs.
Accuracy:	5 msecs.
Resolution:	1 msec.

SF SUPERVISION (OPTION 930A-02)

SF Oscillator:	2604 Hz 1.0 Hz
Send Level:	-36 dBm0 On-hook, -13 dBm0 pulse
Receiver Sensitivity:	-42 dBm0

PEAK TO AVERAGE RATIO (P/AR) (OPTION 930A-06)

Transmit Level Range:	0 dBm to -40 dBm
Resolution:	0.1 dB
Receive Level Range:	-40 dBm to +12 dBm
Resolution:	0.1 dB
P/AR Measurement Range:	0 to 120 P/AR units
Resolution:	1 P/AR unit
Accuracy:	1 P/AR unit

3-LEVEL IMPULSE NOISE (OPTION 930A-07)

Weighting Filter:	C-Notch,C-Msg,15K,PROG,50KB
Threshold Range:	30 dBrnC to 106 dBrnC
Accuracy:	1.0 dB
Threshold Spread:	2, 4, 6, or 8 dB steps
Timer:	1 min. to 99 mins. or continuous
Counter Capacity:	0 to 9999 for LO, MD and HI.
Measurements Range:	7 to 99 measurements per second

TABLE 1-1 *Specifications (con't)*

DS-1 PCM DROP/INSERT OPTIONS (OPTIONS 930A-08E AND -09E)

Format:	DS-1 AMI or B8ZS Line Code
DS-1Input Frequency:	1.544 Mbps 15 kbps
Jitter Tolerance:	Exceeds Bell Pub 43802 Requirements
Channel Numbering Sequence:	D1D, D2, D3/D4/D5
Signaling Mode:	NORM (Robbed Bit) or CCIS
Framing Format:	D4 Superframe, Extended Superframe or SLC-96
Selection:	Automatic or manual selection of frame format-D4/SF or ESF
Input Mode:	Terminated: 100 Ohms nominal Bridging: >1000 Ohms
Input Level:	200 mV to 6.0 V. base-to-peak
Input Level Measurement:	200 mV to 6.0 V. 50 mV base-to-peak or -23 dBdsx to +3 dBdsx 1 dB
DS-1 Output:	1.544 Mbps 40 bps (Stratum 4) in INTERNAL Clock mode. Output rate equal to input rate in LOOP-TIMED mode
Frequency Skew:	Output frequency can be shifted by 100 bps in INTERNAL Clock mode to verify far-end loop-timed status
Output Pulse Level:	3.0 V. nominal base-to-peak into 100 Ohms resistive load
Output Imbalance:	Positive and Negative pulses are within 0.2 V. base-to-peak
Channel Selection:	Any one of 24 selectable from keypad
PCM Supervision Displays:	40 character vacuum fluorescent display shows A and B bit signaling states for all 24 channels (Menu Option #20) simultaneously. In ESF mode A, B, C and D bits are displayed. 4 LED's show status of ON/OFF-hook supervision of selected time slot

TABLE 1-1 *Specifications (con't)*

Operating Modes:	TERMINATE: selected channel is connected to channel generator and receiver. Other 23 channels send IDLE code (7F) MONITOR: monitor selected channel in one or both directions. All 24 channels pass through unchanged. Framing is regenerated. DROP&INSERT: dual-direction only. Selected channel dropped out for testing. Other 23 channels pass through unchanged. (Option 930A-09E)
Pattern Simulation:	Idle Code (7F), Received PCM Optional patterns require Option 930A-22 Bit Error Rate testing
Frame Loss Criteria:	Loss of frame occurs when 2 out of 4 F_t bits are in error for Superframe and SLC-96. Loss of frame for ESF occurs when 2 out of 4 FPS bits are in error
Error Displays:	Detects and counts Frame Errors, Bipolar Violations, Frame Slips and CRC Errors (ESF Only).
Alarms:	Sends Blue Alarm (All Ones) or Yellow Alarm (ALL Bit#2=0) on Superframe and sent on Facility data Link for ESF
Alarm Displays:	Detects and displays Frame Loss, Carrier Loss, Excess 0's, Yellow and Blue Alarm.

PCM CHANNEL ENCODER

Analog Tone Generation:	20 Hz to 3904 Hz selectable in 1.0 Hz steps from keypad
Tone Level:	+3.0 dBm to -50.0 dBm in 0.1 dB steps selectable from keypad
Frequency Response:	0.1 dB (20 Hz to 3904 Hz)

Basic Accuracy:

Accuracy	Level
0.1 dB	+3.0 dBm0 to -30 dBm0
0.2 dB	-30 dBm0 to -40 dBm0
0.5 dB	-40 dBm0 to -50 dBm0

TABLE 1-1 *Specifications (con't)*

Supervision: NORMAL (E&M), USER DEFINED states of A and B bits (C and D bits in ESF). FXO/FXS simulation (Option 930A-25)

Signaling: MF, DTMF and DP

PCM CHANNEL DECODER

Recovered Analog Tones: 20 Hz to 3904 Hz 1 Hz

Recovered Level: +3.0 dBm to -40.0 dBm (Average and RMS)

Basic Accuracy: 0.1 dB with Digital Milliwatt

Accuracy	Input Level
0.1 dB	+3.0 dBm0 to -30 dBm0
0.2 dB	-30 dBm0 to -40 dBm0
0.5 dB	-40 dBm0 to -50 dBm0

Frequency Response: 0.1 dB @ 204 Hz to 3904 Hz with 0 dBm applied.

Supervision: On-hook and Off-hook supervision are user definable as any combination of A, C and B, D bits (i.e., 0, 1, or "don't care"). FXO/FXS supervision available with Option 930A-25

Signal to Total Distortion:

Input	7 5/6 Sgnlng	CCIS
0 to -30 dBm0	38 dB	40 dB
-30 to -40 dBm0	36 dB	36 dB
-40 to -50 dBm0	32 dB	32 dB

Gain Tracking Error:

Input	Max. Deviation
+3.0 to -30 dBm0	0.1 dB
-30 to -40 dBm0	0.2 dB
-40 to -50 dBm0	0.5 dB

Intrinsic Noise: 10 dBrnC (with Idle Code received)

TABLE 1-1 *Specifications (con't)*

PHASE/AMPLITUDE JITTER AND HITS (OPTION 930A-18)

Phase and Amplitude Jitter Measurement

Received Holding Tone Level:	+10 dBm to -40 dBm (Metallic) 0.0 dBm to -40 dBm (PCM)
Holding Tone Frequency Range:	990 Hz to 1030 Hz
Phase Jitter Measurement:	0.0° to 30.0° peak-to-peak
Accuracy:	5%, 0.2°
Amplitude Jitter Measurement:	0.0% to 30.0% peak
Accuracy:	5%, 0.2%
Weighting Filter Bandpass:	4 Hz to 300 Hz, and 20 Hz to 300 Hz

Transients (Hits) Measurements*

Phase Hits:	5° to 50° peak in 1° steps
Gain Hits:	1 to 10 dB in 1 dB steps
Dropouts:	Tone level drops below 12 dB 1 dB
Guard Interval:	Per IEEE STD. 743-1984 Figs. 6 and 7
Timer:	Same as Impulse Noise
Count Rate:	Same as Impulse Noise
Counter Capacity:	Same as Impulse Noise

* Option 930A-18 requires that Option 930A-07 (Impulse Noise) be installed as well. The Impulse Noise counts are interlocked with the transient measurements in accordance with IEEE specifications.

ENVELOPE DELAY DISTORTION MEASUREMENT (OPTION 930A-19)

Modes:	SEND and REPEAT (Master and Slave)
Transmitter:	50% AM signal at modulation frequency of $83^{1}/_{3}$ HzCarrier Frequency: 304 Hz to 3504 Hz 2 Hz
Carrier Level:	0.0 dBm to -40 dBm (Metallic) 0.0 dBm to -40 dBm (PCM)
Flatness:	0.2 dB (304 to 3504 Hz)

TABLE 1-1 *Specifications (con't)*

Receiver Input Level:	+10 dBm to -40 dBm (Metallic) 0.0 dBm to -40 dBm (PCM)
Distortion Measurement Range:	+9000, -3000 seconds
Accuracy:	10 s 604 Hz to 3504 Hz 30 s 304 Hz to 603 Hz

INTERMODULATION DISTORTION (OPTION 930A-20) *

Transmitter Spectrum:	Four equal level tones (857, 863, 1372 and 1388 Hz)
Harmonic Distortion:	>35 dB below tone level
Transmitter Level Range:	0 dBm to -40 dBm RMS (Metallic) -6 dBm to -40 dBm RMS (PCM)
Accuracy:	1 dB
Receiver Input Level:	0 dBm to -40 dBm RMS (Metallic) -6 dBm to -40 dBm RMS (PCM)
Distortion Products:	2nd Order centered at 520 and 2240 Hz 3rd Order centered at 1900 Hz
Distortion Range:	10 dB to 70 dB below signal-2nd Order 10 dB to 70 dB below signal-3rd Order
Resolution:	1 dB
Accuracy:	1 dB
Signal-to-Noise Test:	Removes Low Tone pair and increases level of remaining tone pair by 3 dB.

* Licensed under Hekimian Laboratories, Inc. Patent No. 3, 862, 380

TABLE 1-1 *Specifications (con't)*

DS-0/DS-1 BIT ERROR RATE TESTING (OPTION 930A-22)

DS-1 BERT SPECIFICATIONS

Input:	See Option 930A-08E/09E specifications
Output:	See Option 930A-08E/09E specifications
Framing:	Patterns may be framed (D4 or ESF) or unframed
Test Patterns:	Pseudo-random bit sequences (PRBS) of the following lengths may be sent and received: 2^9-1 (511) 2^{11}-1 (2047) 2^{15}-1 2^{20}-1 QRSS (2^{20}-1 with 14 zero suppression) 2^{23}-1
Stress Patterns:	3 in 24 bits (100010001000000000000000) 1 : 7 bits (10000000) 1 : 1 bits (1010) All 1's 55 OCTETS (440 bit pattern for Multiplexer Testing)
User-Defined Patterns:	User may input any bit sequence length from 1 to 24 bits (even numbers from 18 to 24). Pattern will continuously repeat
Loop-back Codes:	Send and Receive CSU loop codes: Loop-Up= 10000 continuous for 8 seconds Loop-Down= 100 continuous Other Loop codes can be sent and received by editing the above patterns
Error Injection:	Inject single logic errors, bipolar violations, frame errors (D4 mode) or CRC errors (ESF mode)

TABLE 1-1 *Specifications (con't)*

DS-1 BERT SPECIFICATIONS (Continued)

PRBS Receiver Sync:	128 consecutive error-free bits must be received to achieve synchronization. BER of greater than 10^{-1} for 320 milliseconds causes sync loss and resync attempt
Pattern Sync:	386 consecutive bits with less than 10^{-2} error rate must be received to achieve pattern sync. BER of greater than 10^{-2} for 2 milliseconds causes sync loss and resync attempt
Measurements:	Measures and displays: Bit (Logic) Errors, Bit Error Rate, Bit Slips, Bipolar Violations (BPV), Frame Errors, Frame Losses, Frame Slips, CRC Errors (ESF mode), Errored Seconds, % Errored Seconds, Error Free Seconds, % Error Free Seconds, Severely Errored Seconds, % Severely Errored Seconds, Failed Seconds, % Failed Seconds, Unavailable Seconds, % Unavailable Seconds, % Availability, No PCM, Test Length, Clock Time/Date, Elapsed Time
Test Length:	Timed or continuous
Timed Test Length:	15 minutes, 1 hour or 24 Hours

DS-0 BERT SPECIFICATIONS

56 kBps Mode:	Selected when 930A is in Option 56. Least significant bit of channel under test is always set to 1.
64 kBps Mode:	Selected when 930A is in Option 56 Requires change to CCIS Signalling
Test Patterns:	Pseudo-random bit sequences (PRBS) of the following lengths may be sent and received: 2^9-1 (511) 2^{11}-1 (2047)

Stress Patterns:	1 : 7 bits (10000000) 1 : 1 bits (1010) All 1's USER
User-Defined Patterns:	User may input any bit sequence length from 1 to 8 bits Pattern will continuously repeat
Loop-Back Codes:	Send and Receive CSU/DSU/OCU loop codes in 56 kBps mode. LSB of selected channel byte is always set to 0. Cannot be used with switched 56 kBps channels using robbed bit signaling.
Error Counters:	All DS-1 errors (i.e., BPV errors, frame errors, CRC errors, Slips, etc.) are recorded for the entire DS-1 Bit Errors and Bit Error Rate are calculated on the received DS-0 channel selected. CCITT G.821 Error statistics are based on the bit errors of the selected DS-0 channel received
Measurements:	Bit Errors, Bit Error Rate, No Sync, Error Free Seconds, % Error Free Seconds, Errored Seconds, % Errored Seconds, Severely Errored Seconds, % Severely Errored Seconds, Failed Seconds, % Failed Seconds, Available Seconds, % Available Seconds, Unavailable Seconds, % Unavailable Seconds and Elapsed Test Time
Error Injection:	Inject single bit errors

APS TEST SPECIFICATIONS (MENU OPTION 47)

Error Injection:	Injects controlled rate of BPV errors for specific time to test Automatic Protection Switches or enables user to send a fixed rate of BPVs
APS Test:	Injects $0.9X10^{-3}$ BPVs for 20 seconds then $1.1X10^{-3}$ BPVs for 20 seconds and finally $0.9X10^{-4}$ BPVs for 20 seconds
Fixed Error Rates:	$0.9X10^{-3}$, $1.0X10^{-3}$, or $1.1X10^{-3}$ BPVs