Frame/Signalling Analyzer

The PA-41 Frame/Signalling Analyzer is a field service instrument designed for commissioning, maintenance and trouble-shooting 2Mbit/s circuits. It is a combined frame and signalling analyzer and has two receivers allowing both directions of a 2 Mbit/s circuit to be monitored simultaneously. The instrument also has one transmitter for frame generation.

PA-41 offers a wide range of applications, including
– Framed monitoring in both directions simultaneously
– Framed end-to-end testing
– Drop and insert testing
– Multiplexer/Demultiplexer testing
– Digital Cross Connnect testing
– Automatic Protection Switch testing
– Unframed end-to-end testing
– Clock slips measurements
– Round trip delay measurements

The PA-41 provides a versatile, future-proofed test platform which can easily be enhanced with future test functions by the use of software options.
Field upgrade packages allow the user to upgrade the PA-41 base software functions without the need to send the instrument to a service center.

PA-41 software options include:
– Channel Associated Signalling simulation and analysis
  (MFC R2, DTMF, DECADIC)
– Signalling System No. 7 protocol analysis
  (TUP, ISUP and national variants)
– ISDN-PRI D-CHANNEL protocol analysis (7 variants)
– DASS/DPNSS signalling analysis
– M.2100 (BER) analysis
– ETSI V5.1/V5.2 analysis

PC cards
PC cards can be inserted into the PA-41. The RAM card provides the capability to store test results for further analysis on a PC or on another PA-41. Instrument set-ups can also be stored.
The ROM card provides the capability to load option software into the PA-41. This povides flexibility, enabling extra applications, features and upgrades to be added in the future.
PC card files may be copied to/from a PC or another PA-41 using the PC Link utility software and serial cable.

Remote Operation
Complete remote operation of the PA-41 is possible via the V.24 interface. Additionally, a delayed start and test duration can be set-up using the programmable timer.

WG TSM-10 Remote Operation Software
TSM-10 software provides remote operation of test equipment through a visual faceplate representation of the selected remote test unit (RTU). More than one RTU of the same type can be operated with a single version of TSM-10 using multiple windows. For more information, please refer to WG TSM family.

WG TSM-15 Test Set Manager Software
TSM-15 is a full remote test system manager. Multiple test sessions can be controlled by TSM-15 over remote links. For more information, please refer to WG TSM family.

Generator

Interface G.703
Framed Modes . . . . Internal, Through, Unframed
Outputs . . . . Balanced 3-pin CF connector
Unbalanced Universal Versacon 9 connector
adaptable to all commercially available
connector systems
Digital Line Codes . . . . .HDB3, AMI, NRZ
Bit Rate . . . . 2048 kbit/s
Co-directional bit rate . . . . 64 to 512 kbit/s
Clook Source . . . . .Internal
External
from received Signal RxA or RxB
Clock deviation. . . . . $\pm$ 150 ppm in 1 ppm steps

Test Patterns
Pseudo random bit sequences . . . . 2^9–1, 2^{11}–1
2^{15}–1, 2^{20}–1
Alternating 1's and 0's 1010
All 1's. 1111
All 0's. 0000
8 and 16 bit word
Logic sense . . . . Normal or inverted

Digital representation of sinusoidal signals:
Frequency range . . . . 5 Hz to 3998 Hz in steps of 5 Hz
Level Range . . . . – 55 dBm0 to + 3 dBm0 in steps of 1 dB

Internal and Through modes
Framing. . . . . . . .PCM30, PCM30 CRC, PCM31, PCM31 CRC
Test pattern insertion . . . . .n $\times$ 64 kbit/s timeslots
Idle code . . . . 8-bit programmable word
Signalling code. . . . . 4-bit programmable word
Drop . . . . n $\times$ 64 kbit/s timeslots to both V.11 interfaces
(Interfaces A&B)
Drop and insert. . . . . n $\times$ 64 kbit/s timeslots from/to
V.11 interface A

Error injection
Bit, Code, FAS*, CRC* errors. . . . . .Single
continuous or burst:
1E-3, 1E-4, 1E-5, 1E-6
2E-3, 2E-4, 2E-5, 2E-6
5E-3, 5E-4, 5E-5, 5E-6
Burst Length . . . . 16, 32, 64, 128, 256 errored bits
* Internal & Through modes only

Receivers

Interface G.703
Framed Modes . . . . Internal, Through, Unframed
Inputs . . . . Balanced 3-pin CF connector
Impedance 120 Ω or HI-Z
Unbalanced Universal Versacon 9 connector
adaptable to all commercially available
connector systems
Impedance 75 Ω or HI-Z
Input Sensitivity . . . . G.703, 0 to –30 dB
Digital Line Codes . . . . .HDB3, AMI, NRZ
Bit Rate . . . . 2048 kbit/s
Co-directional bit rate . . . . 64 to 512 kbit/s
Test Patterns. . . . . as Generator
Jitter . . . . To CCITT Rec. G.823

Display & Printout of Framed/Unframed Test Results

		Framed	Unframed
Display	BER results	Totals of: Test time, bits, bit errors, BER, BLER, block errors, bit rate, code error ratio, code errors	Totals of: Test time, bits, bit errors, BER, BLER, block errors, bit rate, code error ratio, code errors
	G.821 results	% and number of error free seconds, errored seconds, severely errored seconds, degraded minutes, available time, unavailable time, plus: pass/fail indication of HRX error performance objectives	% and number of error free seconds, errored seconds, severely errored seconds, degraded minutes, available time, unavailable time, plus: pass/fail indication of HRX error performance objectives
	Alarm results	Seconds of: No signal, AIS, All ones, All zeros, Sync loss, Byte Sync loss, Slips	Seconds of: No signal, AIS, All ones, All zeros, Sync loss, Slips
	Frame results	Seconds of: Frame sync loss, Distant MF, MF sync loss, Distant frame Totals of: Multiframes, CRC errors, Frames, Equivalent BER, FAS errors	
	Level/ Freq.	Level (dBm0), Peak Code, Frequency (Hz), Coder offset	
	Frame Digital Words	FAS, NFAS, MFAS, NMFAS plus 8-bit digital code word in any selected timeslot	
Printouts	Num- erical results	BER result totals, G.821 results plus: non-severely errored seconds, non-degraded minutes, current time and date, date and time of start of test, instrument configuration, alarm and error totals	BER result totals, G.821 results plus: non-severely errored seconds, non-degraded minutes, current time and date, date and time of start of test, instrument configuration, alarm and error totals
Display/Printouts	Histo- grams	Bit errors, No signal, AIS, MF sync loss, Distant alarm, Distant MF alarm, Slips Frame sync loss, Sync loss, Code errors, FAS errors, CRC errors, Byte sync	Bit errors, No signal, AIS, Sync loss, Slips, Code errors
	Inst. Setups	Instrument configuration G.821 parameter thresholds, HRX weighting factor, autoprint setups, alarm/error set-ups	Instrument configuration G.821 parameter thresholds, HRX weighting factor, autoprint setups, alarm/error set-ups
	Menus	All menus may be printed using [PRINT] key	All menus may be printed using [PRINT] key
Autoprint	Num- erical results	% of: error free seconds, errored seconds, severely errored seconds, degraded minutes, available time, unavailable time, plus: BER, time and date, HRX pass/fail, bit errors, code errors, FAS errors, CRC errors	% of: error free seconds, errored seconds, severaly errored seconds, degraded minutes, available time, unavailable time, plus: BER, time and date, HRX pass/fail, bit errors, code errors
	Alarm events	No signal, AIS MF sync loss, Distant alarm, Distant MF alarm, Sync loss, Frame sync loss, Slips, All ones, All zeros, Byte sync loss.	No signal, AIS, All zeros, Sync loss, Slips

Level and Frequency Measurements

Coding law . . . . A-law to CCITT Rec. G.711
Level measurements . . . . – 80 dBm0 to + 5 dBm0
Frequency measurements. . . . . 0.1 kHz to 3.99 kHz

Clock difference measurements

Line rate resolution. . . . . .1 bit/s
Line rate difference resolution . . . . .0.125 bit/s
Bar graphs . . . . .0 to 8 UI
Count of . . . . bit slips, frame slips

Round trip delay

Delay measurement resolution . . . . 1 µs
Max. delay measurements . . . . 10 s

Error and Alarm Indication

Audio and separate LED indication of the following alarms
and errors for both receivers:
– No signal, AIS, Frame Sync loss, MF Sync loss, Distant
  Alarm, Distant MF alarm
Two LED's, one for each receiver, are programmable for the
following alarms and errors:
– FAS errors, Code errors, CRC errors, All ones, All zeros,
  Sync loss, Slips, Byte Sync loss
Four separate LED's, one for each abcd bit, are provided for
each receiver.

Printer and Remote Control

Interface . . . . V.24 9-pin DTE
Clock rates 300, 600, 1200, 2400
                                          4800, 9600, 19200 baud
Code . . . . CCITT 5 (ASCII)
Bits per character. . . . . 7 or 8
Flow control . . . . . . none, CTS, XON/XOFF, slow (8 char/sec)
Parity . . . . 7 bits per char: none, odd, even, mark or space
                  8 bits per char: none, odd or even

Front Panel

Display . . . . 42 char. × 16 line 'black on white' LCD
                                                    with backlight
Keyboard . . . . Hex, keypad, 4 cursor keys, 6 softkeys
            backlight, PRINT, security, MAIN MENU, EXIT
                                            ON and OFF keys
Contrast . . . . 2 dedicated keys

BERT Stores/Memory

10 test results stores each containing numeric results and
histograms.
Histogram storage capacity . . . . 60 days with 1 hour
                        resolution, or 60 hours with 1 minute resolution
10 configuration stores each containing instrument set-up
configurations

RAM/ROM Card Interface

RAM or ROM cards conforming to JEIDA version 4.0 and
above can be inserted into the PA-41. The RAM card provides
the capability to store test results. The ROM card provides the
capability to load application software into the PA-41.

PC Link

The PA-41 may be connected to a PC using the serial port for
file transfer to/from the PC.

General Specifications

Power Supply
Batteries, rechargeable (fitted) . . . . 6 × Ni-Cd, C-size cell
Operating Time (using fully
charged batteries) . . . . 5 hrs approx. (in Monitor mode)
                                    2 hrs approx. (in BERT mode)
Charging time . . . . .14 hrs approx. (instrument off)
Battery Low . . . . warning before auto switch-off
Auto switch-off . . . . 4 minutes after last action
                                        (not if test running or
                                LNT-6 connected) or battery very low
External supply. . . . . from LNT-6

Temperature range . . . . Operating: 0 to + 50 °C
                                        Storage: – 20 to + 60 °C

Languages
Either. . . . . English, German, French, Italian
or . . . . English, German, French, Spanish

Dimensions
(height × depth × width) . . . . 115 × 245 × 206 mm
Weight . . . . 3 kg approx.

Ordering information

PA-41 Frame/Signalling Analyzer [1] [2]	**BN 4532/15**	Equipment Case	BN 4527/00.02
		with cut-out for PA-41, LNT-6 and telephone handset	

Accessories (available at extra cost)

Printer Cable	K 1524
RAM card 512 k	BN 4532/00.21
RAM card 1 MB	BN 4532/00.22
Telephone Handset	BN 4527/00.03

Equipment Case   BN 4527/00.01
with cut-out for PA-41, LNT-6, telephone handset,
printer and A.C. mains charger

1) complete with a. c. adaptor/charger LNT-6 and shoulder strap.
  Please specify the required mains type plug when ordering:

European type plug	BN 4529/00.01
UK type plug	BN 4529/00.02
US type plug	BN 4529/00.03
Australian type plug	BN 4529/00.04

2) Fitted with the Versacon 9 basic connector and BNC insert. If other
  types of insert are required – see Versacon 9 specification sheet – specify
  when placing your main order.

Further options for the PA-41 Frame/Signalling Analyzer

SS7 (Australian Telephone User Part – ATUP) Analysis
provides signalling analysis and decoding to level 4 of the
Australian variant of the signalling system number 7 telephone
user part (TUP). This option provides call tracing on the called
party telephone number and access to the signalling network
over the 2 Mbit/s G.703 and 64 kbit/s interfaces.

SS7 (Chinese Telephone User Part – CTUP) Analysis
provides signalling analysis and decoding to level 4 of the Chinese
variant of the signalling system number 7 telephone user part
(TUP). This option includes decoding of the network management
and test messages as well as call tracing.

SS7 ISDN User Part (ISUP) analysis (ITU-T Blue Book)
provides signalling analysis and decoding to level 4 of the SS7
ISDN user part according to the ITU-T Blue Book. This option
offers mass storage of recorded data direct to the PCMCIA card
offering up to 8 MB of storage.

MFC-R2 Simulation & Analysis
provides monitoring and call simulation using MFC-R2 signalling.
A survey mode allows the line status of all 30 telephone channels
to be displayed simultaneously and a scan mode automatically
searches for and records an active call. Provides call state
decoding.

ISDN D Channel PRA Analysis to level 3
providing monitoring and analysis of the ISDN D-channel to level
3. This option offers mass storage of recorded data direct to the
PCMCIA card offering up to 8 MB of storage. On-line trigger and
filter features are provided together with X.25 packet type and
TEI management message decoding.

M.2100
provides Bit Error Ratio testing (BERT) and link performance
analysis to ITU-T M.2100. Testing on 2 Mbit/s and $n \times 64$ kbit/s as
per M.2110. Comprehensive set of alarm and error parameters are
monitored and results displayed in numerical or histogram format.

DASS2 (BTNR 190) Analysis to level 3
provides monitoring and display of DASS2 (Digital Access
Signalling System) messages to level 3. On-line triggering and
compelled filter reduce clutter in the data buffer. Off-line find
and filter functions assist analysis.

DPNSS (BTNR 188) Analysis to level 3
provides monitoring and display of DPNSS (Digital Private
Network Signalling System number 1) messages to level 3.
On-line triggering and compelled filter reduce clutter in the data
buffer. Off-line find and filter functions assist analysis.

MFC-R2 (Generic) Simulation and Analysis
The MFC-R2 (Generic) signalling analysis option for the PA-41
provides a high level of decode and fault finding functionality. It is
for testing when installing and commissioning networks or fault
finding on live networks. It is ideal for MFC-R2 signalling in which
the line signalling conforms to ITU-T recommendations and the
register signalling conforms to a national specification.

ETSI V5.1/V5.2 Analysis
The PA-41 provides a convenient means of fault finding and
commissioning V5 equipment. The PA-41 ETSI V5.1/V5.2 analysis
package complements other Wavetek Wandel Goltermann test
products to provide a complete family of test equipment to cover
a wide range of telecom testing requirements. PA-41 offers mass
storage of V5 frames with frame acquisition filtering and triggering
features to minimise the amount of unwanted data being recorded
in the buffer. V5 call progress can be monitored on-line and
detailed analysis of signalling messages may be made off-line
using the powerful buffer search and filter facilities. Selected
ranges of messages can be stored for later analysis.
The instrument may be connected to a V5 data link with both the
forward and backward signal paths being monitored at the same
time. Provision is made for access at the 2.048 Mbit/s interfaces
with user selectable 64kbit/s timeslots.

Channel Associated Signalling (CAS) simulation & analysis
provides both monitoring of DECADIC and DTMF dialling and
telephone call simulation. ABCD line states and higher level call
states information is recorded and decoded. Up to 1024 signalling
states can be stored in a circular buffer. On-line trigger and filter
options are also offered.

Specifications for the PA-41 Software Options

SS7 (ITU-T Rec. Q.700 series Blue Book – TUP) Analysis

Channels . . . . 2 × 64 kbit/s user selectable channels
Interpretation to ITU-T . . . . TUP, Statistics
Rec. Q.700 Blue Book
Capture Filter . . . . Channels 1 and/or 2
Any selected SU/MSU type
Any combination of FISU,
LSSU, MSU on either channel
Trigger . . . . User specified SU/MSU type
User specified address
External
Instrument setup/result storage . . . . In PA-41 RAM
On RAM card

Display of SS7 Parameters

Link Level Statistics On-/Off-line	Link Status, Signal Unit Errors, Signal Unit Error Rate Monitor, Alignment errors, Alignment Error Rate Monitor, FISU count, LSSU count, Traffic, Retransmissions, Delay
Level 2 Decode On-/Off-line	FISU, LSSU, MSU, Backward Sequence Number, Backward Indicator Bit, Forward Sequence Number, Forward Indicator Bit, FCS
Level 3 Decode On-/Off-ine	LSSU, MSU, Service Information Octet, Service, Destination Point Code, Origination Point Code, Circuit ID Code, Heading Code, Message Type
Level 4 Decode Off-line	Message Type, Message Decode (expressed as per Blue Book text)

SS7 (ITU-T Rec. Q.763 Blue Book) ISUP Analysis

Interface . . . . G.703 (2 Mbit/s)
Channels . . . . 2 × 64 kbit/s user selectable channels
Interpretation to ISUP protocol variant . . . . ISUP, Statistics
Rec. Q.700 Blue Book
Capture filter . . . . Channels 1 and/or 2
Any selected SU/MSU type
Any combination of FISU,
LSSU, MSU on either channel
Trigger . . . . User specified SU/MSU type
External
Buffer . . . . RAM card file with up to 4 MB capacity
Instrument setup/result storage . . . . On RAM card
On remote PC

Display of SS7 Parameters

Link Level Statistics On-/Off-line	Link Status, Signal Unit Errors, SU Count, FISU Count, LSSU Count, MSU Count, Traffic, Retransmissions.
Level 2 Decode On-/Off-line	Level/Alarms, FISU, LSSU, MSU, Backward Sequence Number, Backward Indicator Bit, Forward Sequence Number, Forward Indicator Bit.
Level 3 Decode On-/Off-ine	Level/Alarms, LSSU, MSU, Service Information Octet, Service, Destination Point Code, Origination Point Code, Circuit ID Code, Heading Code, Message Type.
Level 4 Decode On-/Off-line	Message Type, Message Decode (expressed as per protocol variant text)

MFC-R2 Signalling Analysis Options

Several different MFC-R2 options for specific requirements
Test modes:
Survey . . . . Monitoring and decoding of line signalling for all 30 channels simultaneously (both directions)
Monitor . . . . Monitoring and decoding of line and register signalling of 1 channel (both directions)
Simulate . . . . Simulation of incoming or outgoing register operation with user-programmable line and register signalling sequence
Scan . . . . . . Monitoring and decoding of all 30 channels until a user-defined line state occurs on a particular channel. Monitoring and decoding of line and register signalling on that channel is then recorded. The complete test is automatically repeatable.
Line signalling decoding . . . . can decode up to 32 unique line states as specified in the signalling map
Register signalling decoding . . . . . . decodes national variants or ITU-T as specified in the signalling map
Tone transmitter . . . . to ITU-T Q.454
Tone receivers . . . . to ITU-T Q.454
Forward frequencies . . . . 1380, 1500, 1620, 1740, 1860, 1980 Hz
Backward frequencies . . . 1140, 1020, 900, 780, 660, 540 Hz
Instrument setup/results storage . . . . In PA-41 RAM, On RAM card, On remote PC

ISDN D-Channel Analysis Option

Channels . . . . 2 × 64 kbit/s user selectable channels
Interpretation to associated protocol
variant . . . . Layers 1/2/3, Statistics
Capture filter . . . . N → T, N ← T
User specified frame/message
Block filter on frame type
Independent filters on each direction
Trigger . . . . User specified frame/message type
External
Buffer . . . . RAM card file up to 8 MB capacity
Instrument setup/results storage . . . . On RAM card
On remote PC

Display of ISDN D-Channel Parameters
Link Level Statistics On-/Off-line
Counts of Aborted, Errored, REJ, FRMR,
D-Channel Call Control and X.25 service frames.
Layer 2/3 Decode
On-/Off-line
SAPI (Service Access Point Identifier),
TEI/LIC, Frame Type.
Message Type Call Reference Value,
Logical Channel Number, TEI Management messages,
Action indicator, Reference Number
Layer 3 Zoom
On-/Off-line
Full text decode of Layer 3 according to protocol variant.

M.2100 Software Option

Interface . . . . G.703 (2 Mbit/s)
Framing. . . None, PCM30, PCM30CRC, PCM31, PCM31CRC
G.703 digital line codes . . . . HDB3, AMI
G.703 jitter, tolerance and transfer . . . . . . to ITU-T Rec. G.823
Results analysis in accordance with ITU-T Draft Rec. M.2100
(October 1993) and M.2110 (October 1992)

Clocking
Clock source transmitter G.703 (2048kbit/s) internal or
external (via V.11) from the received signal
Test Pattern . . . . all timeslots, single timeslot,
n × 64 kbit/s timeslots programmable Si, Sa,
A and E bits, and NMFAS

Test Patterns
Pseudo Random Bit Sequences (PRBS) . . 2^9–1, 2^{11}–1, 2^{15}–1
Alternating '1s' and '0s' 1010
All '1s' 1111
All '0s' 0000
8- and 16-bit programmable word
Logic sense . . . . normal or inverted
Signalling code . . . . 4-bit programmable word
PCM idle code . . . . 8-bit programmable word

Error Injection
Bit, FAS and CRC errors . . . . Single or ratio
Ratios 1E-3, 1E-4, 1E-5, 1E-6
2E-3, 2E-4, 2E-5, 2E-6
5E-4, 5E-5, 5E-6, 5E-7
Stores/Memory
10 configuration stores each containing instrument setup
configurations.10 test result memories each containing
numeric results, alarm history and histograms.
Alarm history storage capacity . . . . 5000 events
shared between the 10 test result memories

DASS2 (BTNR 190 June 1987) analysis

Channels . . . . 2 × 64 kbit/s user selectable channels
Interpretation to BTNR 190 Issue 1 as amended by
Addendum to BTNR 190, Issue 1 . . . . this includes
all amendments up to Issue 10 of BT/IND-DASS CP(85) 10
Filter . . . . .Channels 1 and/or 2
User specified frame
Compelled filtering
Trigger. . . . . .Channels 1 and/or 2
User specified frame
External
Instrument setup/results storage . . . . In PA-41 RAM
On RAM card
On remote PC
Display of DASS information
Layer 2 . . . . Timeslot (LAP) number,
Frame type, Sequence number, Frame Check Sequence
Layers 2 and 3 . . . . Timeslot (LAP) number,
Frame type, Sequence number, Frame Check Sequence,
Message type, Message fields

DPNSS (BTNR 188) analysis

Channels . . . . 2 × 64 kbit/s user
selectable channels
Interpretation to BTNR 188 Issue 05

Filter . . . . Channels 1 and/or 2
User specified frame
Compelled filtering
Trigger. . . . . Channels 1 and/or 2
User specified frame
External
Instrument setup/results storage . . . . In PA-41 RAM
On RAM card
On remote PC
Display of DPNSS information
Layer 2 . . . . DLC, Frame type,
Sequence number, Frame Check Sequence
Layers 2 and 3 . . . . DLC, Frame type,
Sequence number, Frame Check Sequence,
Message type, Message fields

ETSI V5.1/V5.2 Analysis

Channels. . . . . .2 × 64 kbit/s user selectable channels
Interpretation to associated
protocol variant . . . . Layer 1/2/3, Statistics
Capture filter. . . . . A<L, A>L
User specified frame/message
Block filter on frame type
Independent filters on each direction
Trigger. . . . . User specified frame/message type
External
Buffer . . . . RAM card file up to 8 MB capacity
Instrument setup/result storage . . . . On RAM card
On remote PC
Display of V5 parameters
Link level statistics
– On-/Off-Line
– Counts of PSTN, BCC, CONTROL, PROT and
  LCONTROL frames
Layer 2/3 decode
– On-/Off-Line
– EF address, link address, path, frame type, message type
Layer 3 zoom
– On-/Off-Line
– Full text decode of layer 3 according to protocol variant

CAS Analysis and Simulation

Test modes:
Survey . . . . Monitoring and decoding of line signalling
for all 30 channels simultaneously (both directions)
Monitor . . . . Monitoring and decoding of line
signalling and DTMF or decadic/pulse dialling in
1 channel (both directions)
Simulate . . . . .Simulation of incoming or outgoing
register operation wirh user-programmable line/dial
register signalling sequence
Scan . . . . Monitoring and decoding of all 30 channels
until a user-defined line state occurs in any channel
Monitoring and decoding of line and dial signalling
on that channel is then recorded
Line signal decoding . . . . user programmable
Instrument setup/result storage . . . . In PA-41 RAM,
On RAM card,
On remote PC

Ordering information

SS7 (ITU-T Rec. Q.700 series Blue Book – TUP) Software Option	BN 4532/00.02	ISDN D-Channel Software Option PRA QSIG (Inter PBX)	BN 7520/00.21
SS7 (Australian Telephone User Part) Software Option	BN 4532/00.03	ISDN D-Channel Software Option PRA D-REX (French Army Variant)	BN 7520/00.24
SS7 (Chinese Telephone User Part) Software Option	BN 4532/00.12	RAM Card 512 kB RAM Card 1 MB	BN 4532/00.21 BN 4532/00.22
SS7 (ITU-T Rec. Q.763 Blue Book – ISUP) Software Option	BN 4532/00.07	M.2100 Software Option	BN 4532/00.11
MFC-R2 Signalling Analysis Software Option	BN 4532/00.09	DASS2 (BTNR 190) Analyzer	BN 4532/00.06
MFC-R2 (Generic) Signalling Analysis Software Option	BN 4532/00.60	DPNSS Software Option	BN 4532/00.04
ISDN D-Channel Software Option PRA EDSS1 (European Standard)	BN 7520/00.11	ETSI V5.1/V5.2 Analysis Software Option	BN 4532/00.35
ISDN D-Channel Software Option PRA 1TR6 (German Variant)	BN 7520/00.12	CAS Signalling Analysis Software Option	BN 4532/00.08
ISDN D-Channel Software Option PRA VN4 (French Variant)	BN 7520/00.13	PA-41 Frame/Signalling Analyzer (available at extra cost)	BN 4532/15
ISDN D-Channel Software Option PRA TPH 1856 (Australian Variant)	BN 7520/00.15	PA-41E Frame/Signalling Analyzer (available at extra cost)	BN 4593/02
ISDN D-Channel Software Option PRA N-ISDN2 (US Variant)	BN 7520/00.16		
ISDN D-Channel Software Option PRA Q.931 (Generic)	BN 7520/00.19	All Software Options supplied on JEIDA (Version 4.0 and above) 68-pin ROM card.	