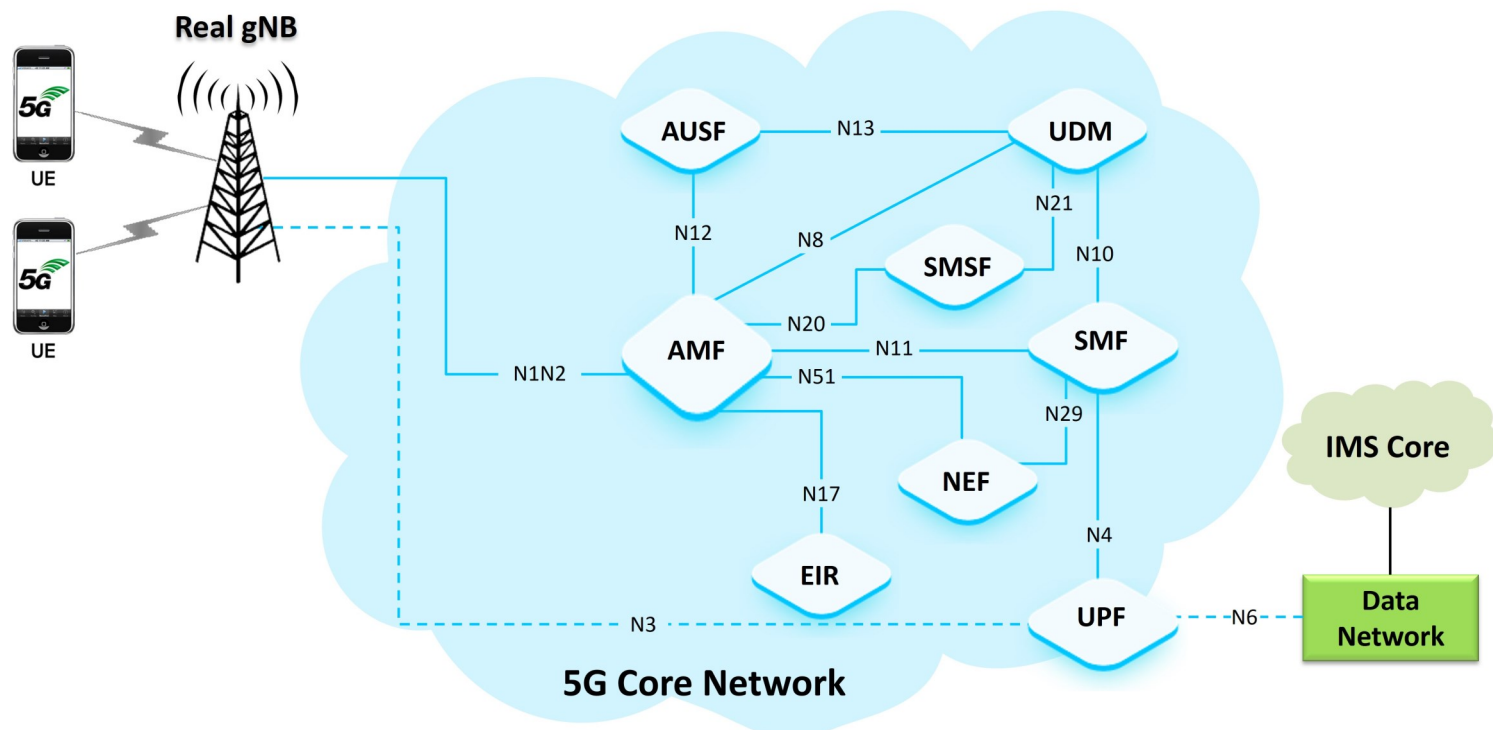


PacketScan™ 5G Protocol Analyzer



Overview

5G is a fifth generation mobile technology for cellular networks. 5G covers three main verticals namely, Enhanced Mobile Broadband (eMBB), Massive Machine Type Communications (mMTC), and Ultra Reliable Low Latency Communications (URLLC) to support a wide variety of use cases such as Smart cities, AR/VR, self-driving cars, IOT etc.

GL's [5G Protocol Analyzer](#) offers comprehensive monitoring capabilities for 5G networks. It captures, decodes, and collects statistics over the N1N2, N4, N8, N10, N11, N12, and N13 interfaces, providing valuable insights into network performance and behavior.

The 5G Protocol Analyzer is an optional application for [PacketScan™](#). PacketScan™ is a protocol analysis software supporting a large range of protocols and codecs. PacketScan™ is deployed on Windows® PCs and uses the host PC's network interface card to capture Ethernet / IP traffic. The PC should be connected to a network tap or a monitor port on a switch. PacketScan™ can also open packet captures offline and intelligently build call detail records, compute statistics on the calls, create graphs and ladder diagrams and more.

PacketScan™ includes the [Packet Data Analysis](#) (PDA) tool allowing users to monitor live IP/TDM networks including capture, analysis, and reporting of every phone call in detail. It also provides graphical presentation of analysis, including ladder diagrams of call flows.

For more details, refer to [5G Protocol Analyzer](#) webpage.



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Main Features

- Capture, decode, and analyze calls in the 5G Network
- Supported protocols include Non Access Stratum (NAS), Next Generation Application Protocol (NGAP), Packet Forwarding Control Protocol (PFCP), XnAP, SCTP, UDP, TCP, and IP
- Decode [Enhanced Common Public Radio Interface](#) (eCPRI) protocol
- Following interfaces are supported in Packet Data Analyzer:
- Following interfaces are supported in Packet Data Analyzer:
 - N1N2 Interface - gNodeB (also called Next Generation RAN), and AMF (Access and Mobility Management Function) nodes
 - N4 Interface - Session Management Function (SMF) and User Plane Function (UPF) elements
 - N8 Interface - Unified Data Management (UDM) and Access and Mobility Management Function (AMF)
 - N10 Interface - Unified Data Management (UDM) and Session Management Function (SMF)
 - N11 Interface - Mobility Management Function (AMF) and Session Management Function (SMF)
 - N12 Interface - Authentication Server Function (AUSF) and Access and Mobility Management Function (AMF)
 - N13 Interface - Authentication Server Function (AUSF) and User Data Management (UDM)
- Provides VoNR call statistics such as caller, callee, MOS scores, discarded packets and voice storage
- Save calls to PCAP (Wireshark® format) and in HDL (GL Proprietary format)
- PDA Packetscan™ provides a complete call flow of a 5G session
- Advanced filtering and search based on user selected protocol fields
- Add any protocol field to the summary view, filtering, and search features. This flexibility allows users to monitor the specific protocol fields they need
- Trigger intelligent actions based on signaling and traffic conditions
- Displays Summary, Detail, Hex dump, Statistics, and Call Detail Views
- Hex dump View displays the frame information in HEX and ASCII format, the contents of this view can also be copied to clipboard
- Statistics View displays statistics based on frame count, byte count, frames/sec, bytes/sec etc. for the entire capture data
- Call Detail View displays called/ calling number, released calls, call status, and more
- Provides a consolidated interface for all the important settings required in the analyzer. All the configuration settings done in any of these options can be saved to a file, loaded from a configuration file



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Supported Protocol Stack

PacketScan™ supports below 5G stack.

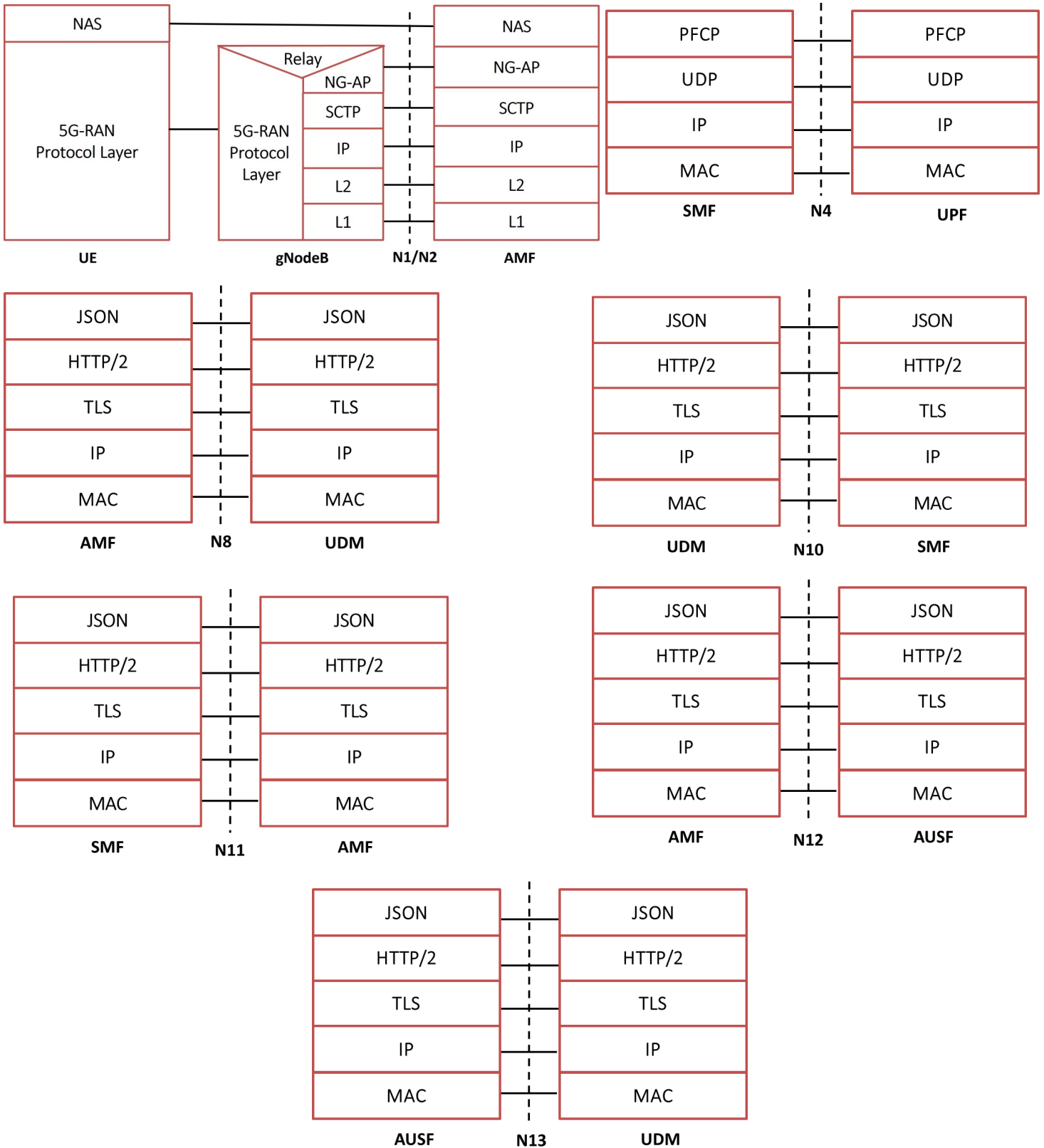


Figure: 5G Protocol Stack

Supported Protocol Standards

Supported Protocols	Standard / Specification
System Architecture for the 5G	3GPP TS 23.501
NG Application Protocol (NGAP)	3GPP TS 38.413
Non-Access-Stratum (NAS)	3GPP TS 24.501
GPRS Tunneling Protocol for User Plane (GTP-U)	3GPP TS 29.281
NR and NG-RAN Overall Description	3GPP TS 28.300
Packet Forwarding Control Protocol (PFCP)	3GPP TS 29.244
UDP	IETF RFC 768
IPv4	IETF RFC 791 [5]
IPv6	IETF RFC 2460 [6]
JavaScript Object Notation (JSON)	IETF RFC 8259
HTTP/2	IETF RFC 7231 IETF RFC 7540/RFC 7541
TLS	IETF RFC 8446
TCP	IETF RFC 793

Figure: 5G Protocol Specifications

Summary and Detail View of 5G NGAP Layer

User can select a frame in Summary View to analyze and decode each 5G frame in the Detail View. The detail view of 5G call displays the following:

- MAC Layer
- IPv4 Layer
- SCTP Layer
- NGAP Layer
- NAS Layer

The screenshot displays the PacketScan 64-bit interface. The top section shows a summary table of captured packets. The bottom section provides a detailed view of the selected packet (Frame # 61), highlighting the NGAP layer structure.

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type MAC	Packet Type MAC	Source IP Address IPv4	Destination IP Address IPv4
✓ 0	54	00:00:04.071183000	60		ARP			
✓ 0	55	00:00:04.078905000	60		ARP			
✓ 0	56	00:00:04.530010000	217		Internet IP(IPv4)		192.168.12.10	239.255.255.250
✓ 0	57	00:00:04.530250000	217		Internet IP(IPv4)		192.168.12.11	239.255.255.250
✓ 0	58	00:00:04.679183000	158		Internet IP(IPv4)		192.168.13.101	192.168.13.106
✓ 0	59	00:00:04.756884000	60		ARP			
✓ 0	60	00:00:04.763177000	130		Internet IP(IPv4)		192.168.13.106	192.168.13.101
✓ 0	61	00:00:04.779202000	126		Internet IP(IPv4)		192.168.13.101	192.168.13.106


```

0030 Length = 112 (x0070)
0032 TSN = 448 (x000001C0)
0036 Stream Identifier = 0 (x0000)
0038 Stream Sequence Number = 448 (x01C0)
003A Payload Protocol Identifier = x0000003C NGAP
===== NGAP Layer =====
NGAP-PDU = CHOICE
Extensibility Marker = 0
Choice Index = 0
InitiatingMessage = SEQUENCE
ProcedureCode = INTEGER
Contents = 15 id-InitialUEMessage
procedureCriticality = ENUMERATOR
Contents = 0 reject(0)
Value = Open Type
Length = 92
InitialUEMessage = SEQUENCE
Extensibility Marker = 0
ProtocolIE-Container = SEQUENCE OF
Iteration Count = 6
ProtocolIE-Container = Instance 0
ProtocolIE-Field = SEQUENCE
ProtocolIE-ID = INTEGER
Contents = 85 id-RAN-UE-NGAP-ID
procedureCriticality = ENUMERATOR
Contents = 0 reject(0)
Value = Open Type
Length = 2
RAN-UE-NGAP-ID = INTEGER
Length Determinant = 1
Contents = 36
ProtocolIE-Container = Instance 1
ProtocolIE-Field = SEQUENCE
ProtocolIE-ID = INTEGER
Contents = 38 id-NAS-PDU
procedureCriticality = ENUMERATOR
Contents = 0 reject(0)
Value = Open Type
Length = 44
NAS PDU = SEQUENCE
NAS-PDU = OCTET STRING
  
```

At the bottom of the window, the status bar shows: Capture Rate: 0.02 Mbps, C:\Program Files\GL Communications Inc\Packe Captured 10 242 frames, Missed Frames: 0.

Figure: Detail View of NGAP Layer

Detail View of 5G NAS Layer

The screenshot displays the PacketScan 64-bit interface. At the top, there is a menu bar (File, View, Capture, Statistics, Database, Call Detail Records, Configure, Help) and a toolbar with various icons. Below this is a table of captured packets with columns for Device, Frame#, TIME (Relative), Length (Bytes), Error, Length/Protocol Type MAC, Packet Type MAC, Source IP Address IPv4, and Destination IP Address IPv4.

Device	Frame#	TIME (Relative)	Length (Bytes)	Error	Length/Protocol Type MAC	Packet Type MAC	Source IP Address IPv4	Destination IP Address IPv4
✓ 0	54	00:00:04.071183000	60		ARP			
✓ 0	55	00:00:04.078905000	60		ARP			
✓ 0	56	00:00:04.530010000	217		Internet IP(IPv4)		192.168.12.10	239.255.255.250
✓ 0	57	00:00:04.530250000	217		Internet IP(IPv4)		192.168.12.11	239.255.255.250
✓ 0	58	00:00:04.679183000	158		Internet IP(IPv4)		192.168.13.101	192.168.13.106
✓ 0	59	00:00:04.756884000	60		ARP			
✓ 0	60	00:00:04.769177000	130		Internet IP(IPv4)		192.168.13.106	192.168.13.101
✓ 0	61	00:00:04.779202000	126		Internet IP(IPv4)		192.168.13.101	192.168.13.106

Below the packet list, the detailed view of the selected packet (Frame 61) is shown. It includes fields like Contents, Value, Length, UEContextRequest, Extensibility Marker, and Contents, with their corresponding values. A blue header indicates the '5G NAS Layer' section.

```

Contents = 0 reject(0)
Value = Open Type
Length = 1
UEContextRequest = ENUMERATOR
Extensibility Marker = 0
Contents = 0 requested(0)
===== 5G NAS Layer =====
0050 Extended Protocol Discriminator = 01111110 SGS Mobility Management Messages
0051 Security Header Type = 00000000 Plain NAS message, not security protected
0052 Message Type = 01000001 Registration Request
    5GS Registration Type and NAS Key Set Identifier =
0053 Registration Type = 00000001 Initial Registration
0053 Follow-On Request = 00000000 No follow-on Request Pending
0053 NAS Key Set Identifier = 11111111 (7)
0053 Type of Security Context Flag (TSC) = 00000000 Native security context (for KSIAMF)
    5GS Mobile Identity =
0054 Length = 13 (x000D)
0056 Type of Identity = 00000001 SUCI
0056 SUPI Format = 00000000 IMSI
0057 MCC = 001
0058 MNC = 01
005A Routing Indicator Digit = 0000
005C Protection Scheme Identifier = 00000000 Null scheme
005D Home Network Public Key Identifier = 0 (x00)
    Scheme output = 3012041631
    5GMM Capability =
0063 Information Element Id = 00010000 5GMM Capability
0064 Length = 1 (x01)
0065 S1 Mode = 00000000 Not Supported
0065 HO Attach = 00000000 Handover request to transfer PDU session from N1 mode to S1 mode not supported
0065 LTE Positioning Protocol (LPP) Capability = 00000000 LPP in N1 mode not supported
    UE Security Capability =
0066 Information Element Id = 00101110 UE Security Capability
0067 Length = 2 (x02)
0068 5GS Encryption Algorithm 5G-EA7 = 00000000 Not Supported
0068 5GS Encryption Algorithm 5G-EA6 = 00000000 Not Supported
0068 5GS Encryption Algorithm 5G-EA5 = 00000000 Not Supported
0068 5GS Encryption Algorithm 5G-EA4 = 00000000 Not Supported
0068 5GS Encryption Algorithm 128-5G-EA3 = 00000000 Not Supported
0068 5GS Encryption Algorithm 128-5G-EA2 = 00000000 Not Supported
0068 5GS Encryption Algorithm 128-5G-EA1 = 00000001 Supported
    
```

At the bottom of the interface, the status bar shows 'Capture Rate: 0.02 Mbps', the file path 'C:\Program Files\GL Communications Inc\PacketScan\...', 'Captured 11 586 frames', and 'Missed Frames: 0'.

Figure: Detail View of 5G NAS Layer

5G N1N2 Call Analysis in PDA View

Displays 5G N1N2 call graph with decode of the selected message displayed to the right of message sequence.

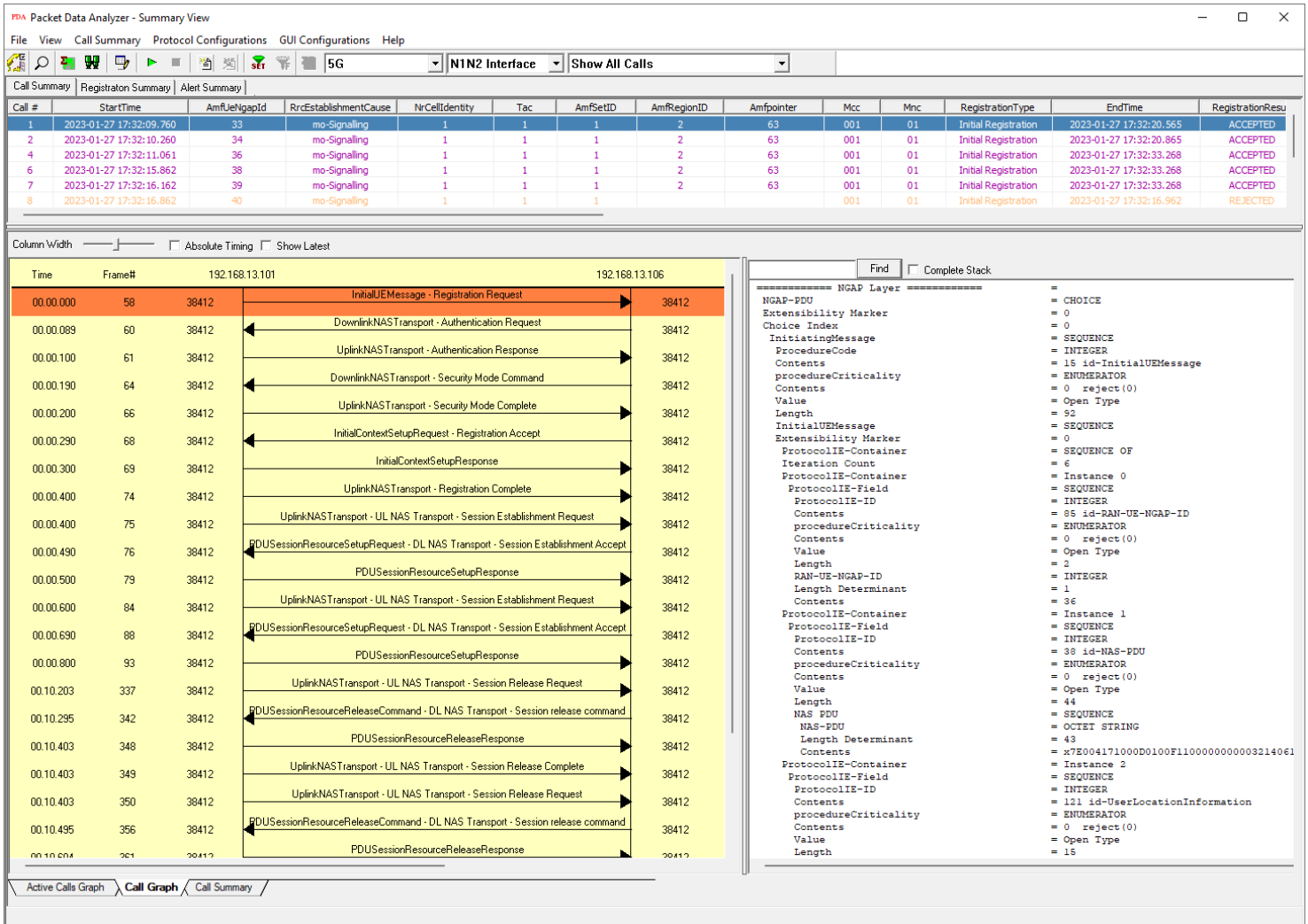


Figure: 5G N1N2 Call Flow Ladder Diagram

5G N4 Call Analysis in PDA View

Displays 5G N4 call graph with decode of the selected message displayed to the right of message sequence.

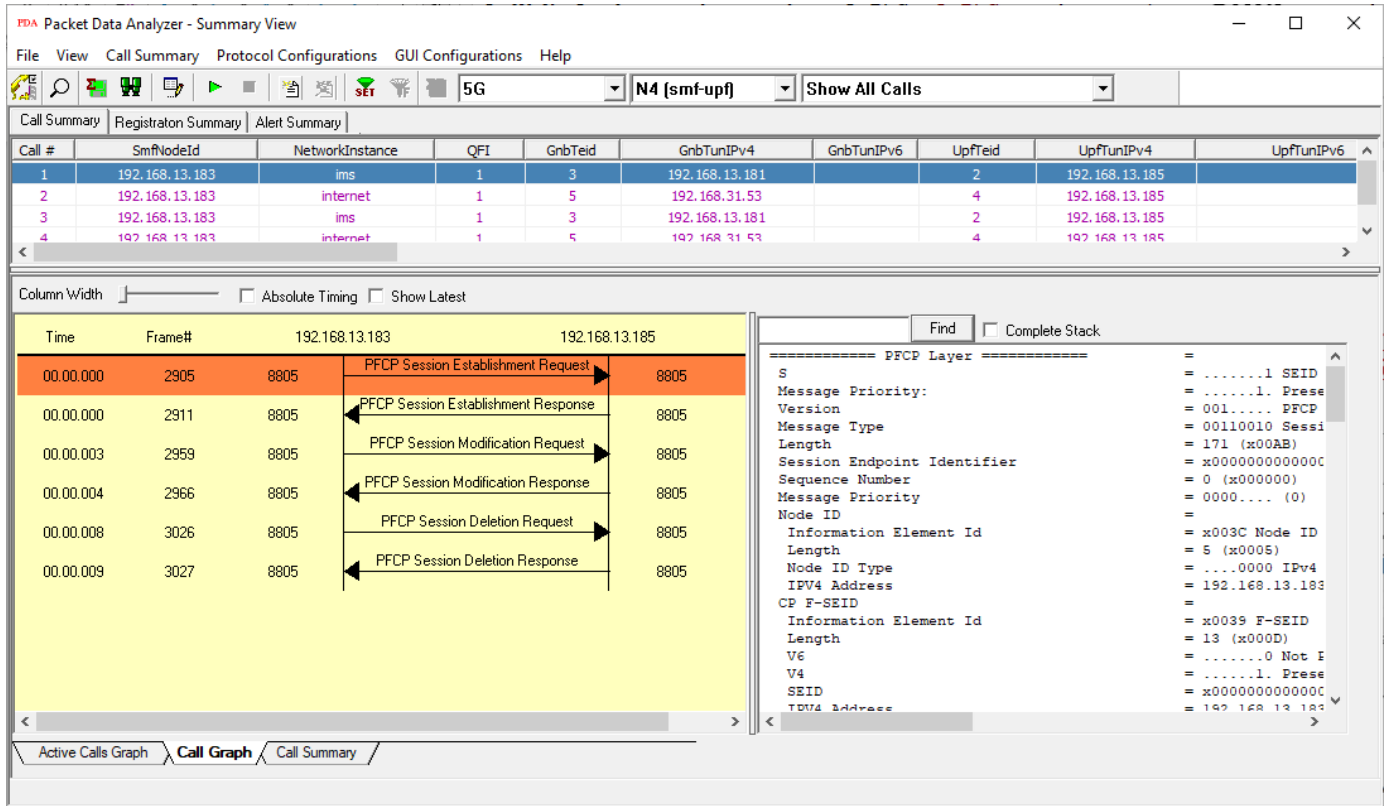


Figure: 5G N4 Call Flow Ladder Diagram

5G N8 Call Analysis in PDA View

Displays 5G N8 call graph with decode of the selected message displayed to the right of message sequence.

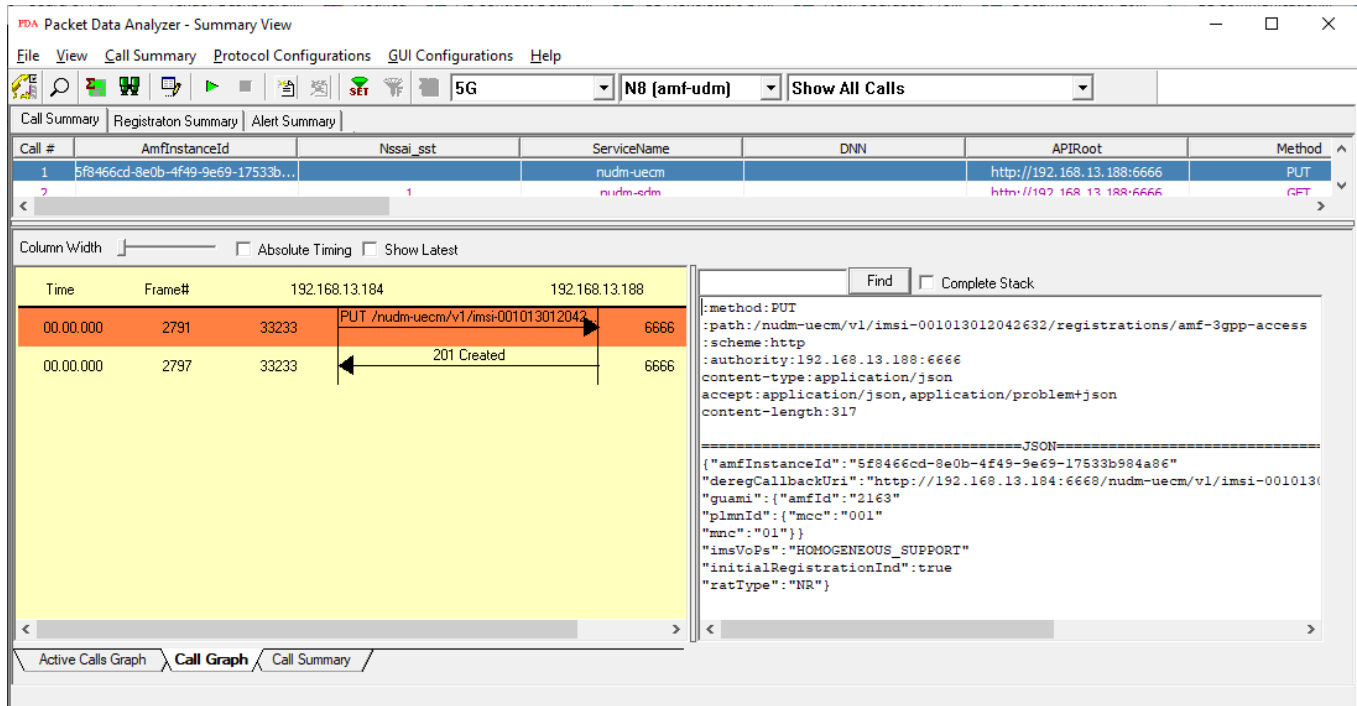


Figure: 5G N8 Call Flow Ladder Diagram

5G N10 Call Analysis in PDA View

Displays 5G N10 call graph with decode of the selected message displayed to the right of message sequence.

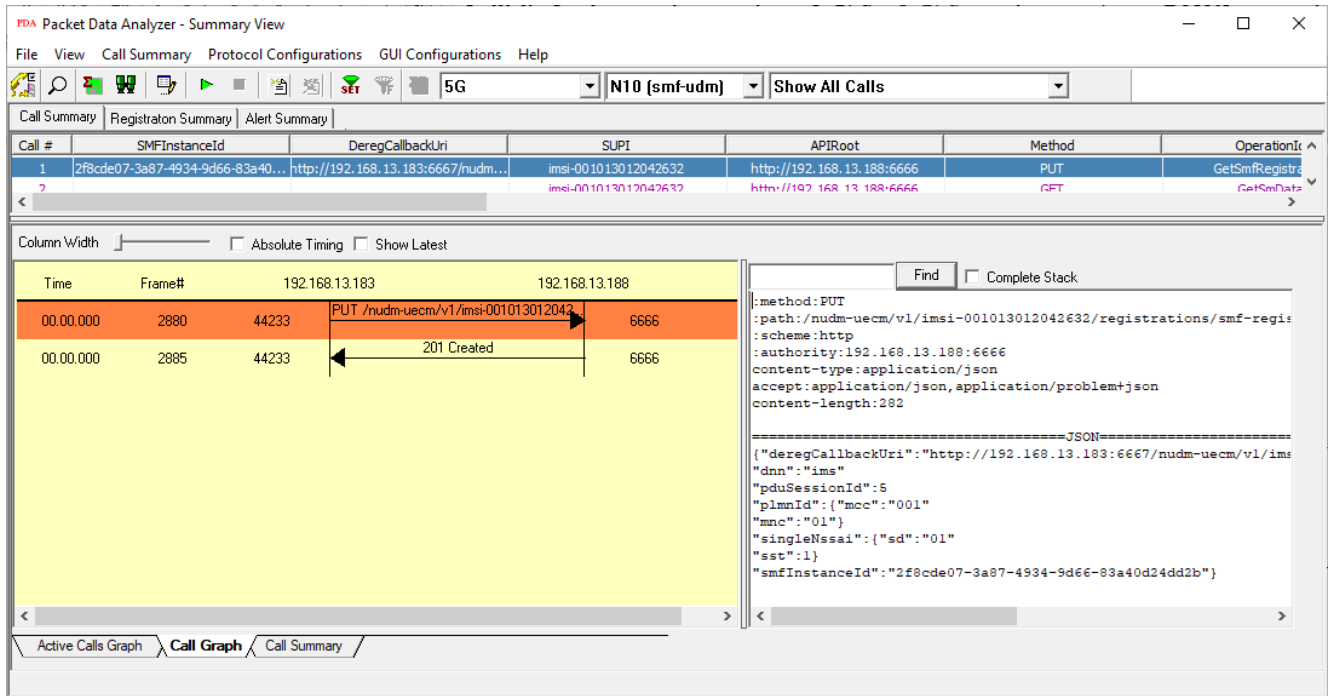


Figure: 5G N10 Call Flow Ladder Diagram

5G N11 Call Analysis in PDA View

Displays 5G N11 call graph with decode of the selected message displayed to the right of message sequence.

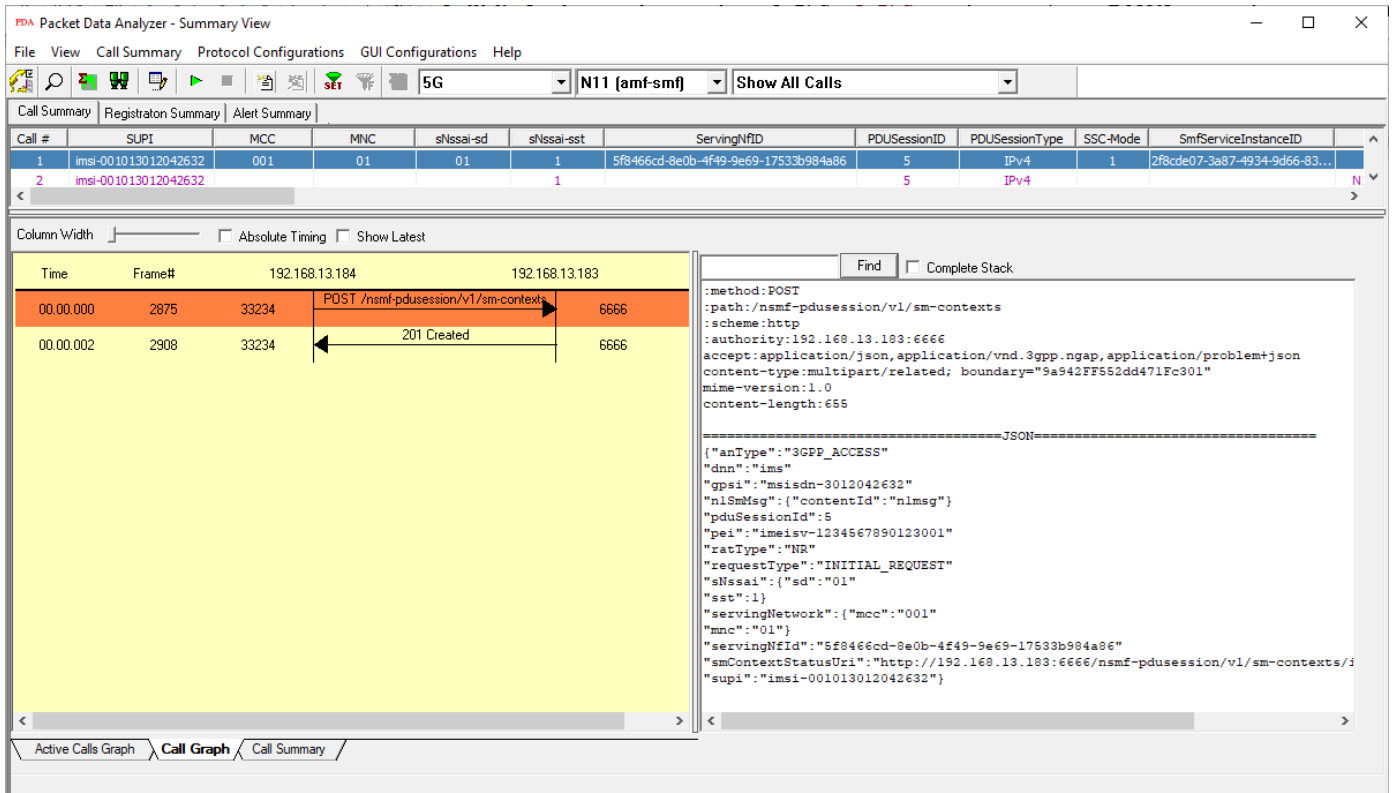


Figure: 5G N11 Call Flow Ladder Diagram

5G N12 Call Analysis in PDA View

Displays 5G N12 call graph with decode of the selected message displayed to the right of message sequence.

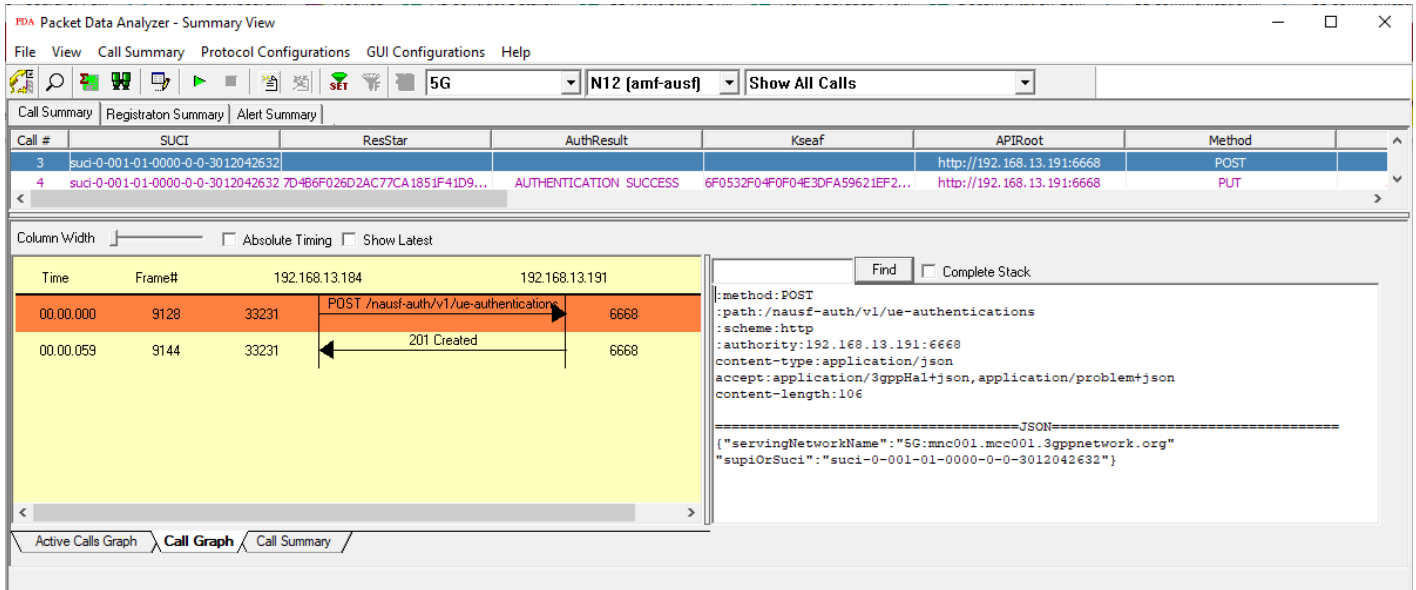


Figure: 5G N12 Call Flow Ladder Diagram

5G N13 Call Analysis in PDA View

Displays 5G N13 call graph with decode of the selected message displayed to the right of message sequence.

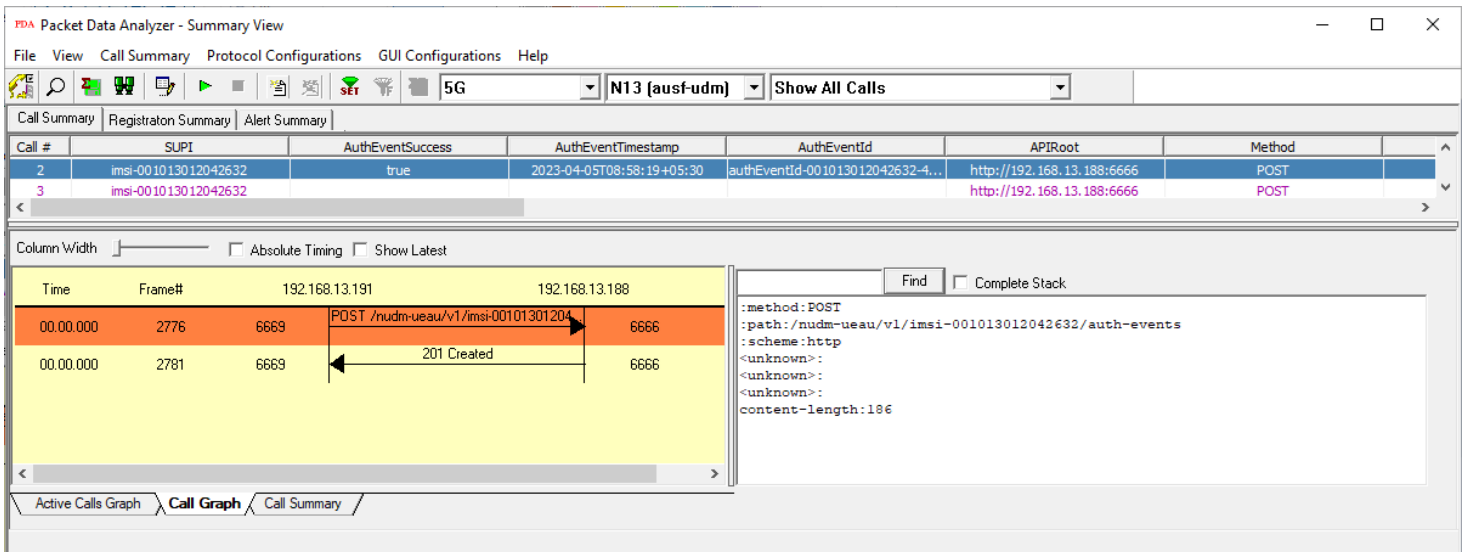


Figure: 5G N13 Call Flow Ladder Diagram

Buyer's Guide

Item No	Product Description
PKV112	5G Analyzer (Optional with PacketScan™)
PKV113	Offline 5G Analyzer (Optional with Offline PacketScan™ and NetSurveyorWeb™)
PKV100	PacketScan™ (Real-time and Offline)
PKV101	PacketScan™ - Offline
PKV120	PacketScan™ HD – includes PKV100 – Online (not Offline) for temporary audio codec support
PKV301	LAN Switch w/ Mirror Port
PKV104	FaxScan™ - Decodes Fax images in TIFF format from PCAP files
PCD103	AMR Codec for PacketScan™
PCD104	EVRC Codec for PacketScan™
PCD105	EVRC-B Codec for PacketScan™
PCD106	EVRC-C Codec for PacketScan™
PKV170	NetSurveyorWeb™ (Network Surveillance Software) for IP Network

For more details, refer to [5G Protocol Analyzer](#) webpage.



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