MAPS™ APS and ALS

Analog Phone/Line Simulator

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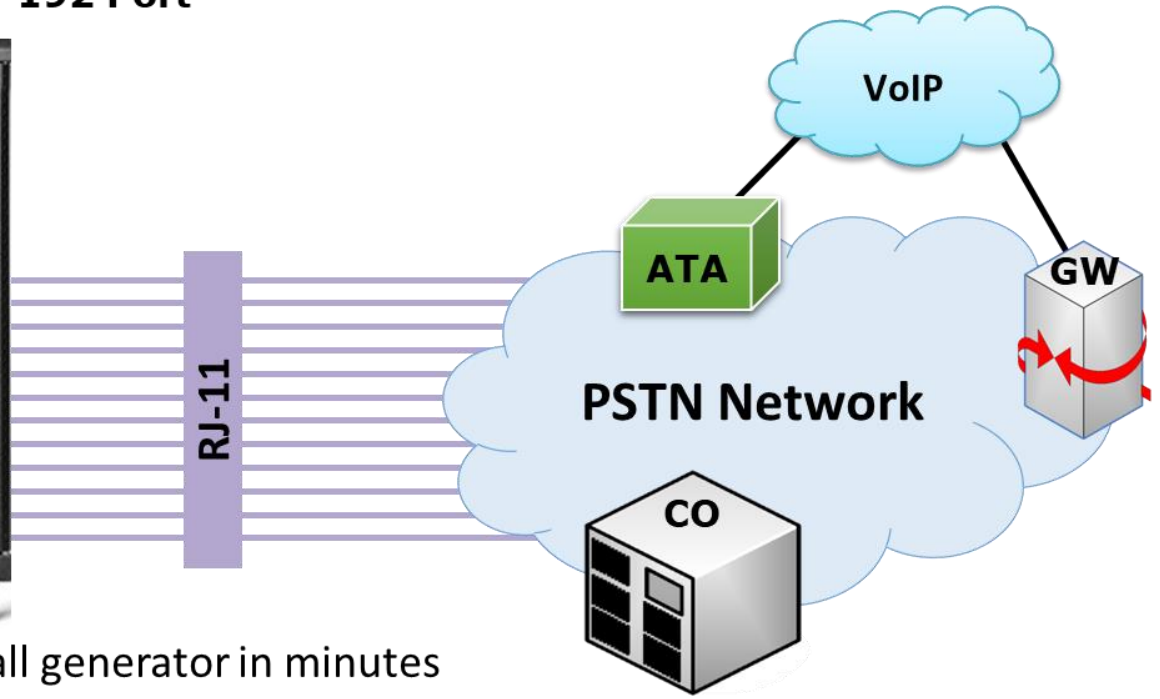
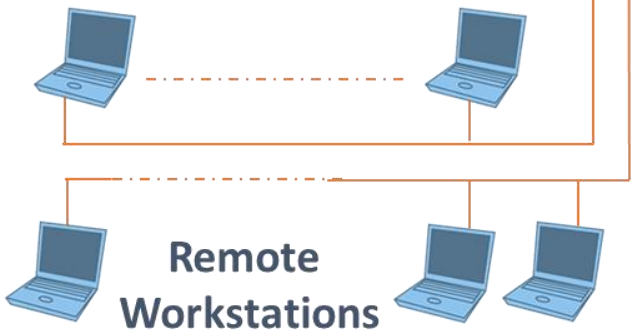
Website: https://www.gl.com

MAPS™ Analog Phone Simulator

MAPS™ APS-24, 48, 96, or 192 Port

GL solution simulates these endpoint devices





- Bulk call generator in minutes
- FXO and FXS Capabilities
- Plug and play
- Assessment of Voice Quality, Fax Quality
- Tones and Digits Detection
- Scalable from hundreds to thousands of calls
- Remoting, Automation, Scripting, Reporting

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Main Features

- Up to 192 independent FXO ports per system
- Test Central Office, PBX, Gateway, Analog, Digital, and VoIP networks
- Manual and Automated Bulk Analog call generation
- Call monitoring and call recording
- Concurrent users and tests per system
- API support (Python, Java) for integration with automation frameworks
- Supports E&M (Type I, II, III, IV, V) signaling – immediate start, wink start, delay start
- Full FXO and FXS Functionality via flexible scripts
- Scalable to support up to 1000s of calls
- Supports Supplementary Service Testing and Interactive Voice Response (IVR) using Speech Transcription Server
- Voiceband Measurement Tests using VF Ports
- Provides high-density connection to any 2-wire analog interface for fully automated custom testing

GL Communications

Functional Specifications

FXO Capabilities

- Up to 96 independent FXO ports per 1U MAPS™ APS (More can be achieved by scaling)
- Supports Loop Start and Ground Start signaling
- Full FXO Functionality via flexible scripts
- Supported call scenarios
  - Caller ID
  - Two-way Calling
  - Three-way Conference Calling
  - Three-way Calling with Calling Party Number ID
  - VMWI – Voice Mail with MWI (message waiting indicator), SDT (stutter dial tone) and SIT (special information tone)
  - Call Waiting – Detect tone, Call ID, Flash to accept call
  - Call Forwarding

FXS Capabilities

- Up to 96 independent FXS ports per 1U MAPS™ APS (more can be achieved by scaling, requires FXS voice cards)
- Central office simulation with two-way calling
- Supports Loop Start and Ground Start signaling
- User-programmable call progress tone generation for different countries/regions:
  - Dial tone
  - Ringback tone
  - Busy tone
  - Reorder tone
  - Howler tone (extended off-hook signal)
  - Ring generation with programmable ring cadence

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Functional Specifications (Contd.)

Reporting

- Multi-User, Multi-Test, Multi-Reporting
- Executed test cases
- Successful test cases
- Call Failure events
- Call Completion events
- Call Drop (sustain calls) events
- Voice Quality Test MOS Scores
- Delay Measurements (OWD, PDD)
- Pass/Fail Status
- Summarization
- Failure Details Sufficient to determine Root Cause
- PDF and CSV file formats
- Central Database of events/results/errors

Traffic Functionalities

- Basic Telephony functions - On-hook, Off-hook, Detect ringing signal, Dial, Hook flash
- Digit related functions - Send and Detect digits
- File transfer functions - Send and Receive file
- Tone related functions - Detect busy tone, call waiting tone, dial tone, reorder tone, ring-back tone, special dial tone, Send and Detect test tone, tones
- Fax related Functions - Send and Receive fax
- FSK related functions - Detect Caller ID, Detect VMWI
- VQT (Optional) - MOS, E-Model, PESQ, POLQA Scores

Command Line Interface (CLI) Capabilities

- TCP/IP based Client Server application
- Script-based call simulation and control
- Comprehensive API for call flow control and feature testing
- Support for Python and Java clients
- Allows multiple clients to be connected simultaneously
- Reserve/release analog lines through API
- Independent execution available for all lines

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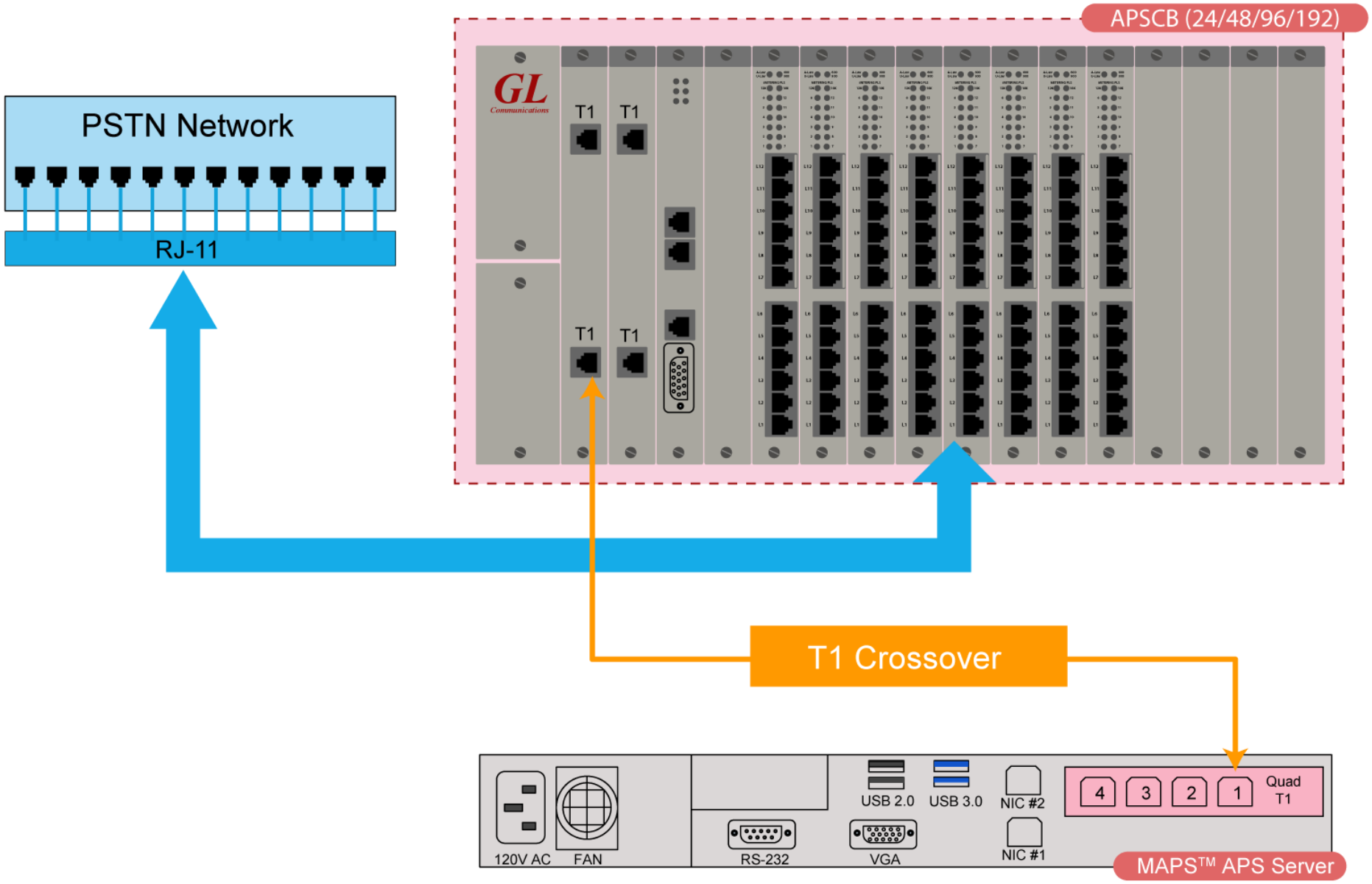
Working Principle



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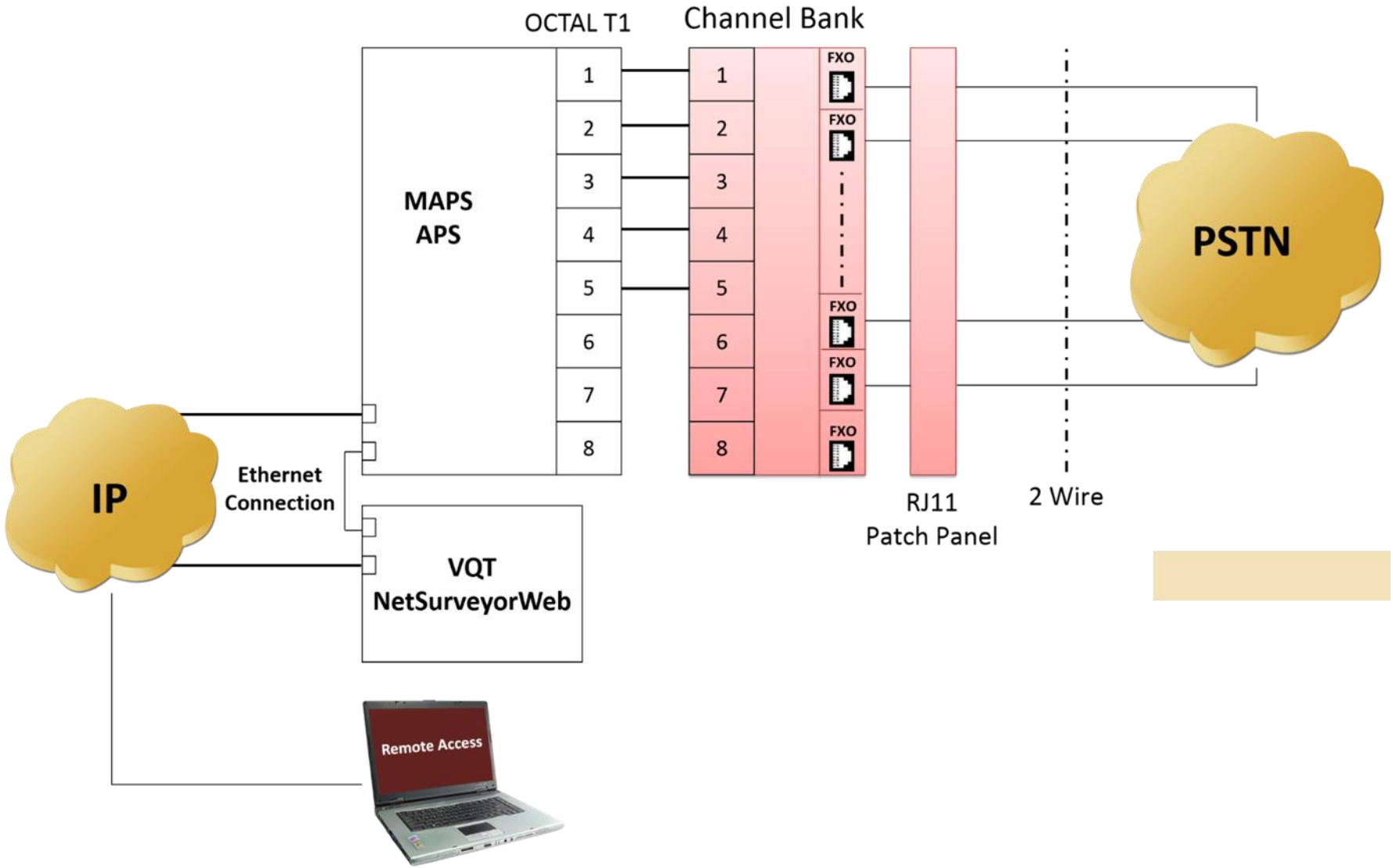
Test Configuration 1



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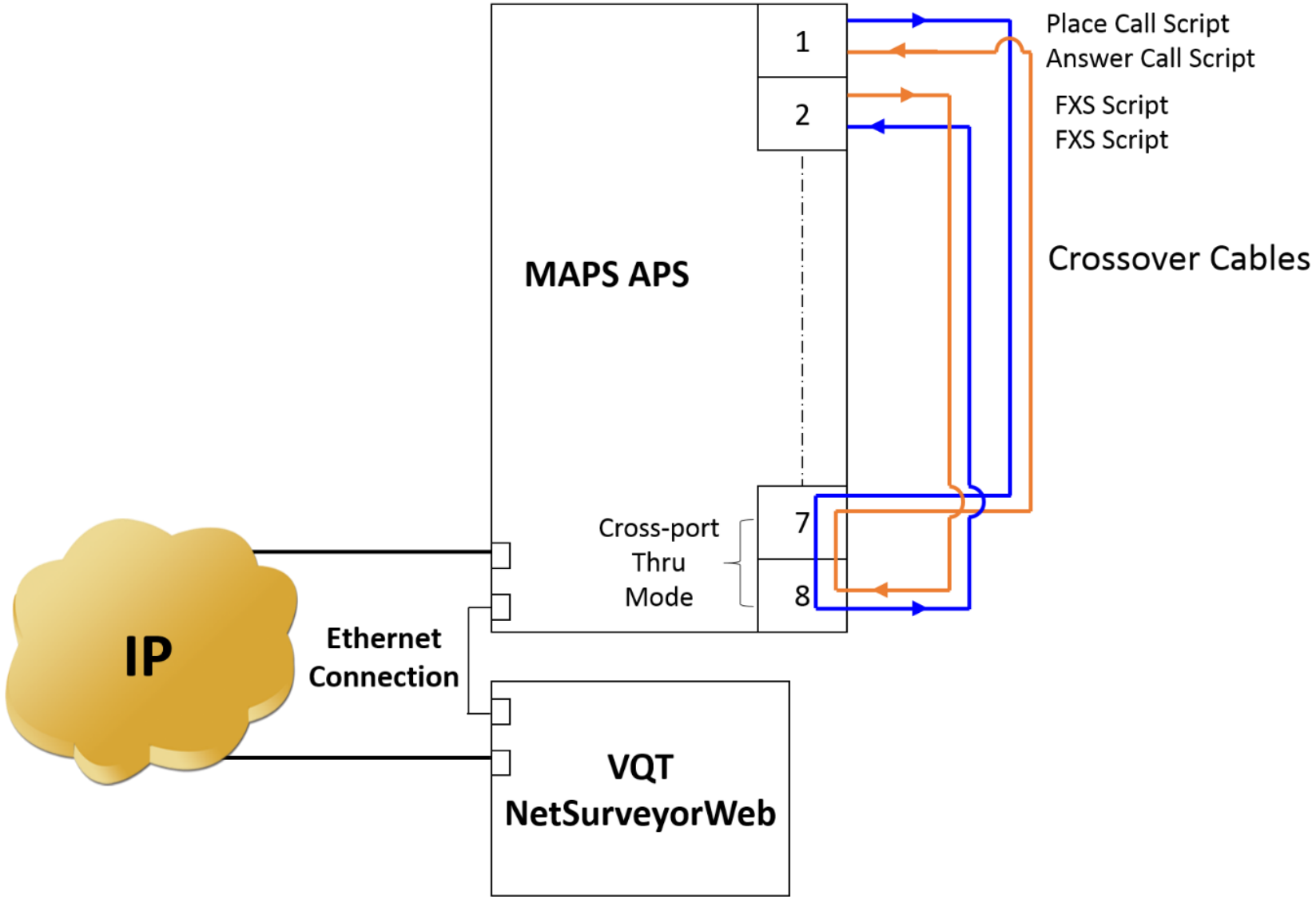
Test Configuration 2



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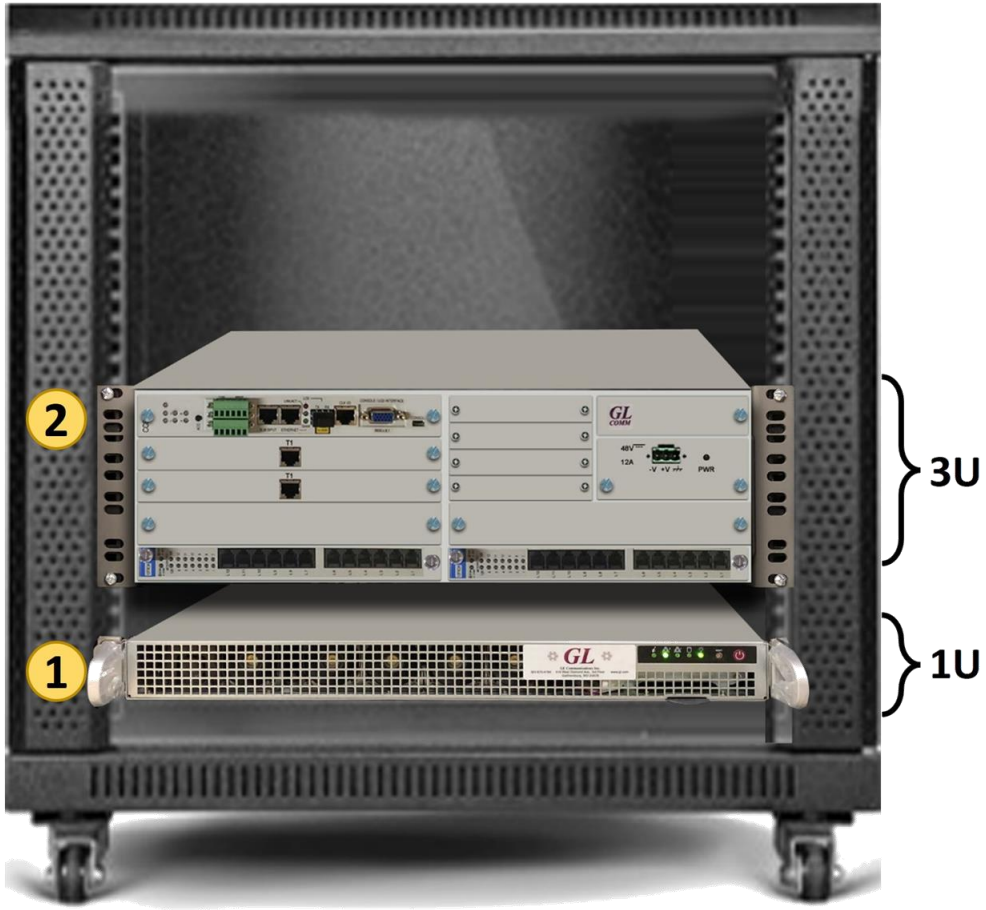
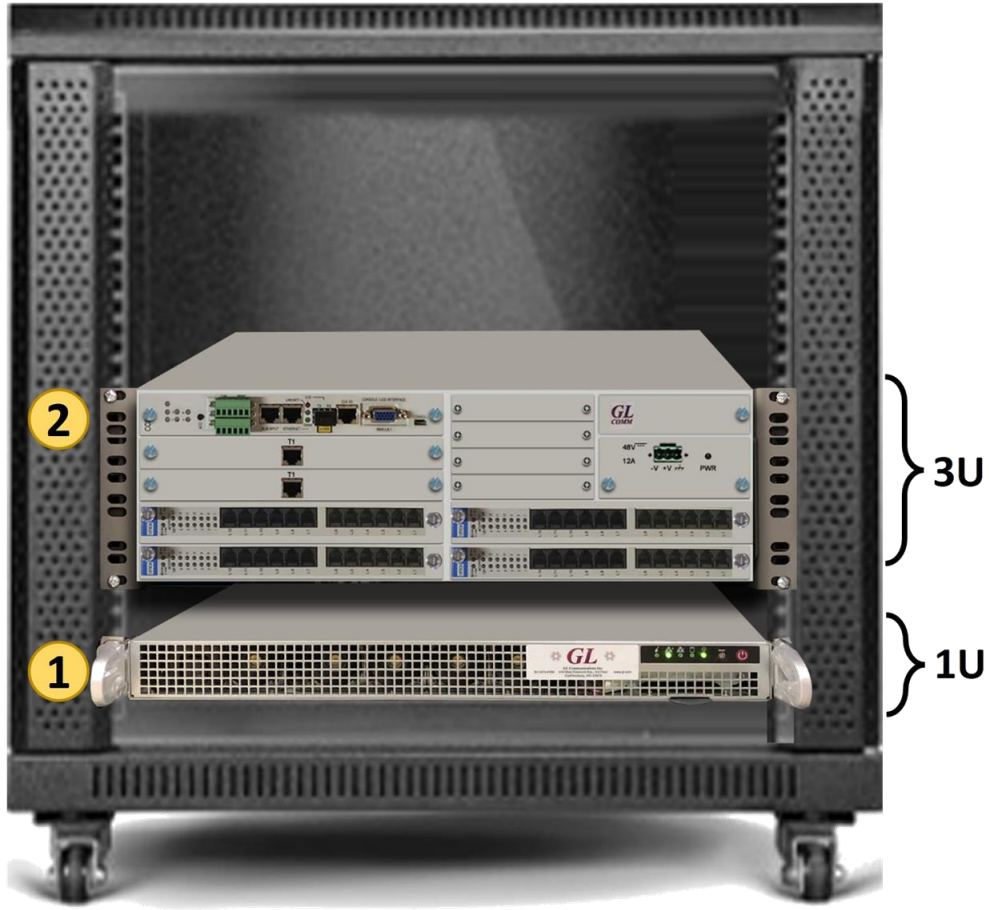
MAPS™ APS Ports

MAPS™ APS 24 Ports



1. MAPS™ APS Server (Optional VQT Analysis)
2. APSCB-24 x 1

MAPS™ APS 48 Ports



1. MAPS™ APS Server (Optional VQT Analysis)
2. APSCB-48 x 1

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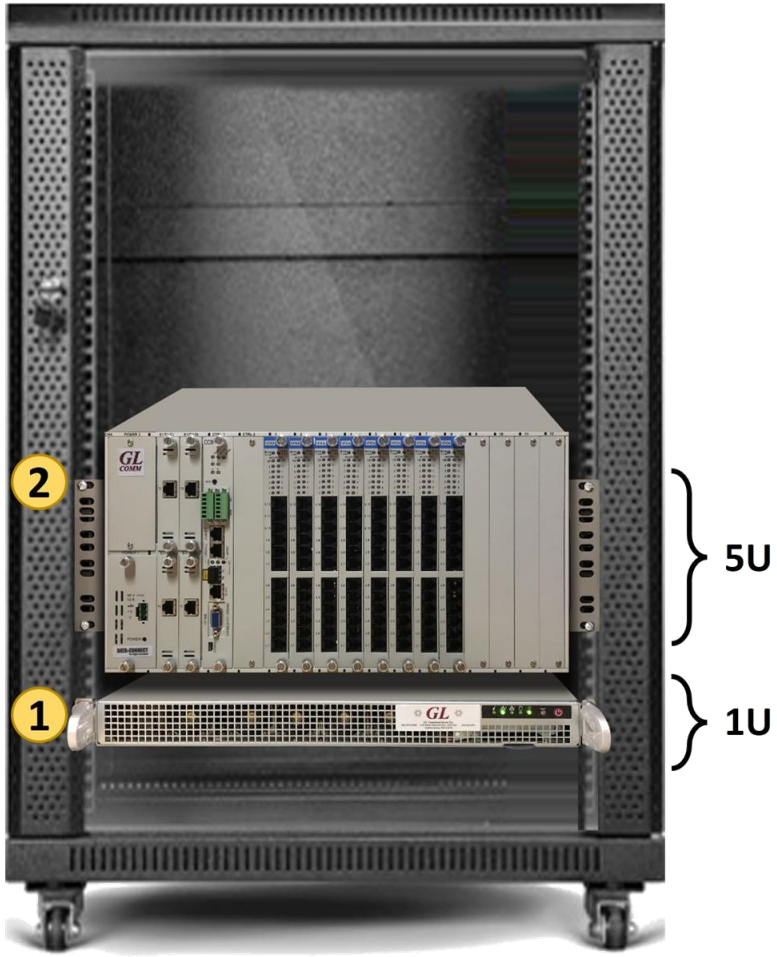
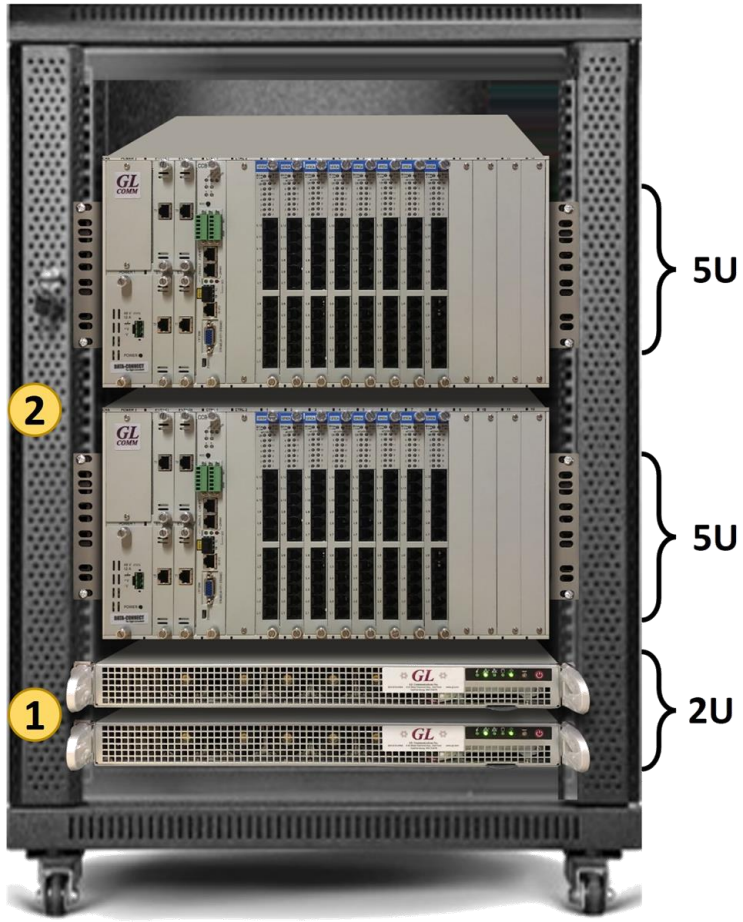
MAPS™ APS Ports (Contd.)

MAPS™ APS 96 Ports



1. MAPS™ APS Server (Optional VQT Analysis)
2. APSCB-96 x 1

MAPS™ APS 192 Ports



1. MAPS™ APS Server (Optional VQT Analysis)
2. APSCB-96 x 2

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24-Port VQuad™ HD Analog Phone Emulator

VQuad™ HD 24-Port (WB FXO)
(Supports NB, WB)

1. VQuad™ System w/24 FXO HD Ports
2. VQT Central System
(WebViewer w/Oracle DB, PESQ, POLQA)

Features	High-Density WB Solution VQuad™ 24 Port HD
Space Considerations	2U multi-VQuad™ system with total 12 Dual UTA HD units
Ports	24 Analog FXO ports accessed via 50 Pin Amphenol connector
FXO Audio	NB and WB (HD) Audio Supported
Operation	Fully Independent FXO Ports with full control between VQuad™ systems
Bulk Call	Fully Supported via VQuad™ Scripting
Remote Control	Fully Supported via CLI, API or WebViewer™
Traffic	Voice, Digits, Tones, Fax
Voice Quality	POLQA (including NB and WB), and PESQ

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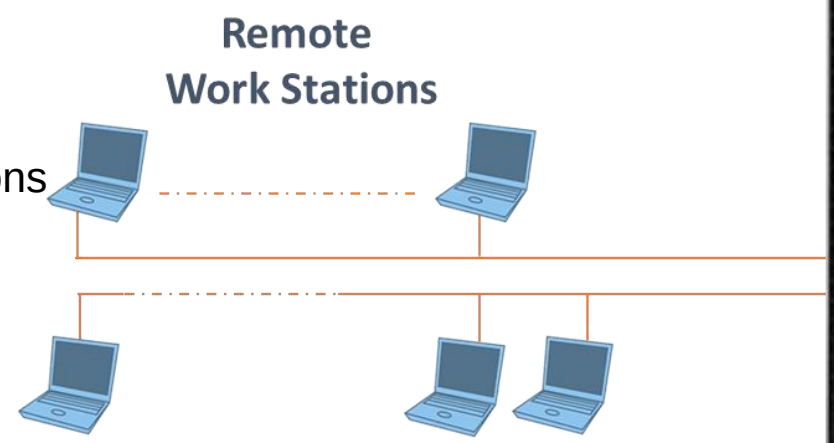
CLI APIs

- Available in Python and Java
- Basic telephony functions
  - On-hook
  - Off-hook
  - Detect ringing signal
  - Dial
  - Flash
- Detect related functions
  - Send digits
  - Detect digits
- File transfer functions
  - Send file
  - Receive file
- Fax related functions
  - Send fax
  - Receive fax
- Tone related functions
  - Detect busy tone
  - Detect call waiting tone
  - Detect dial tone
  - Detect reorder tone
  - Detect special dial tone
  - Detect test tone
  - Send tone
  - Send test tone
- FSK related functions
  - Detect caller ID
  - Detect VMWI



Python and Java CLI Clients for Remote Access

MAPS™ APS-24, 48, 96, or 192 Port

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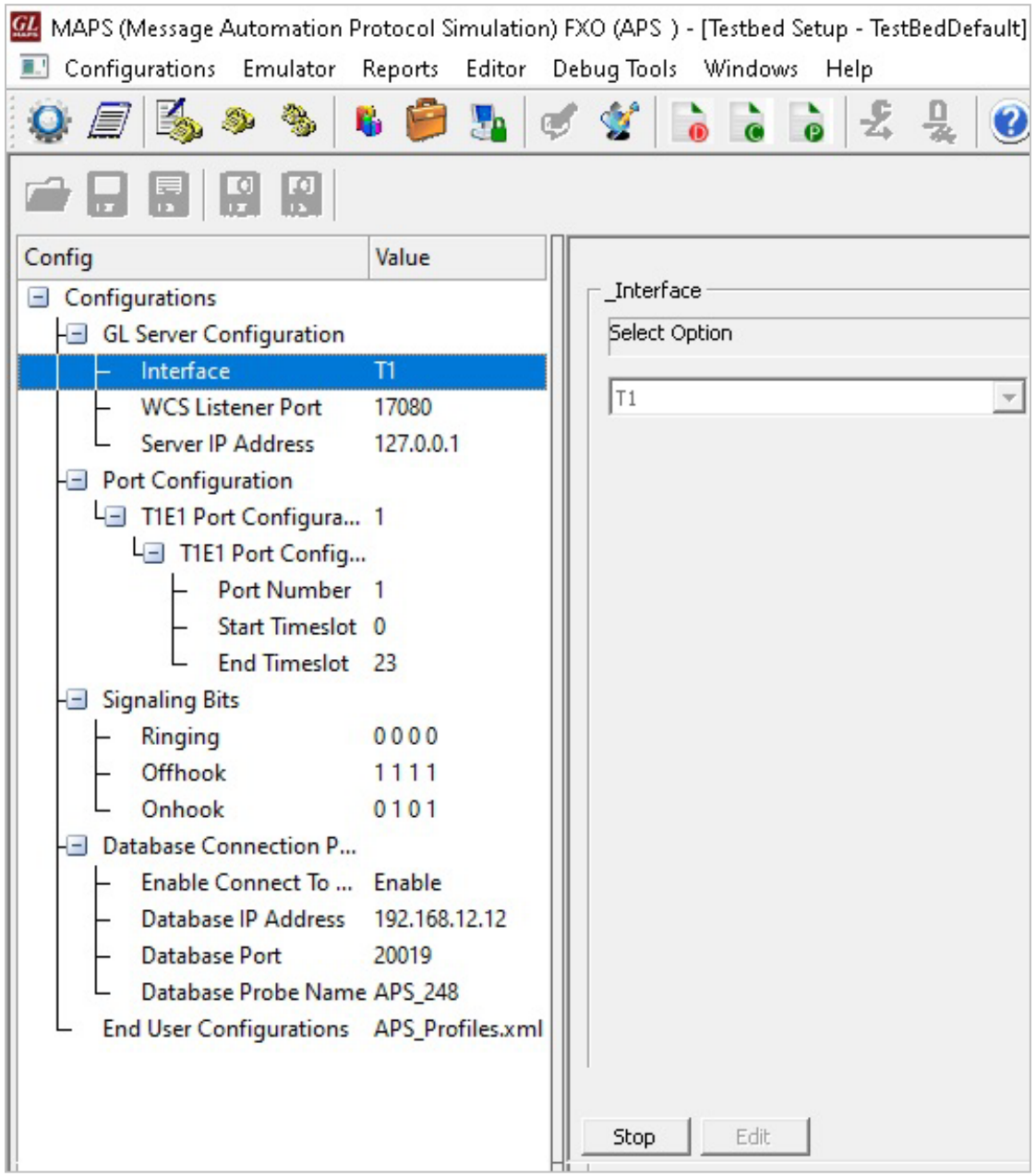
MAPS™ Features

Testbed Configuration



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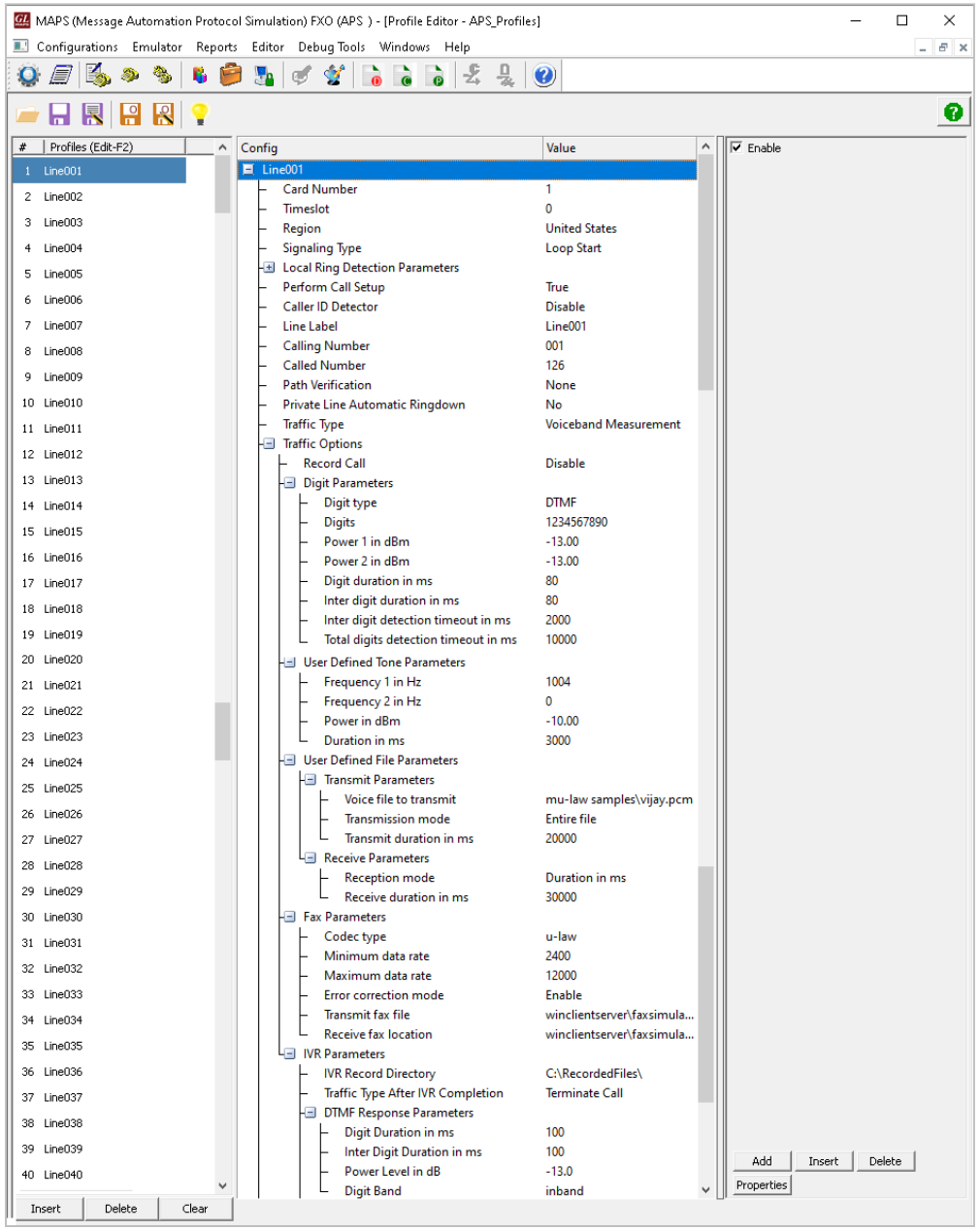
Profile Configuration



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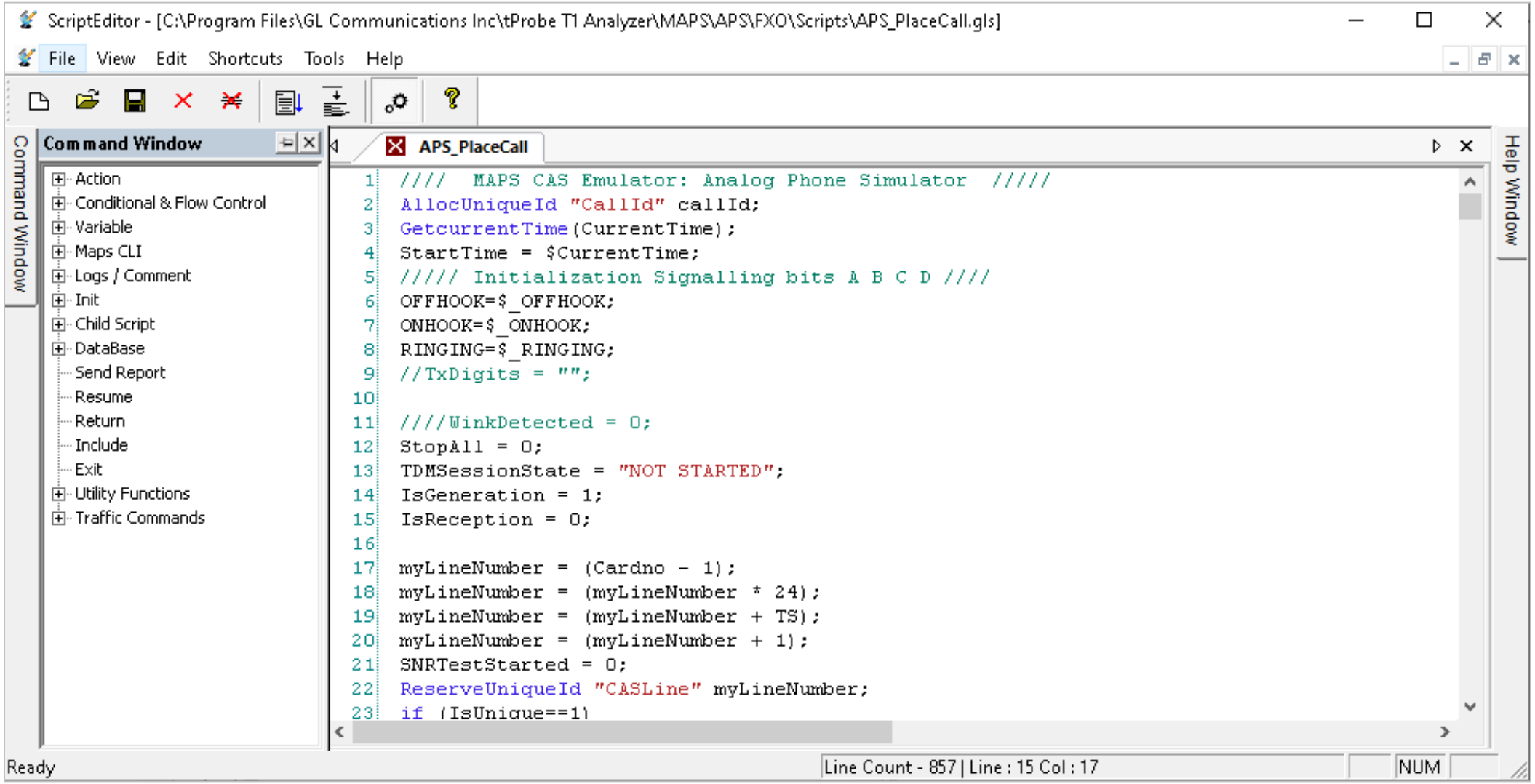
Script Editor



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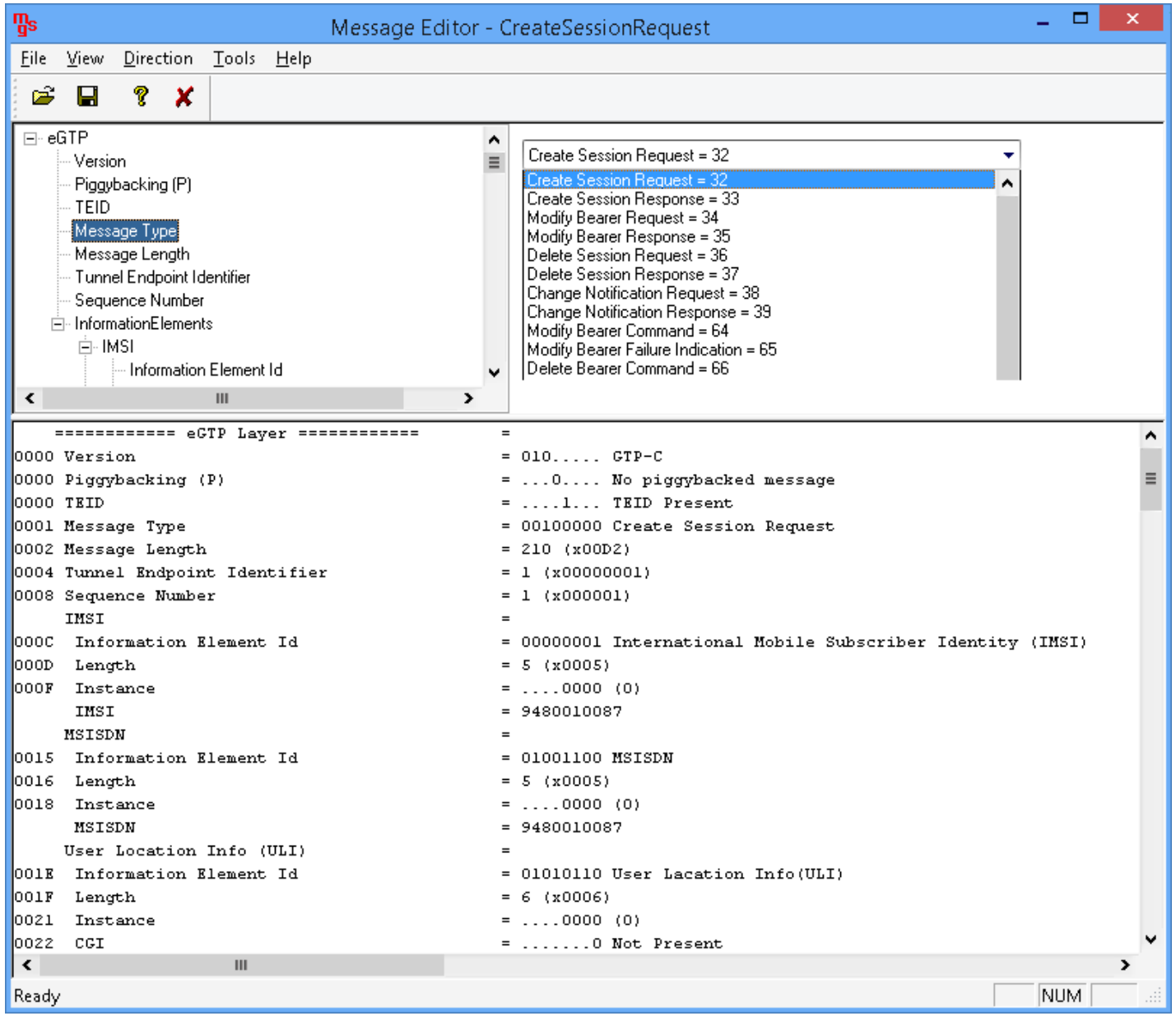
Message Editor



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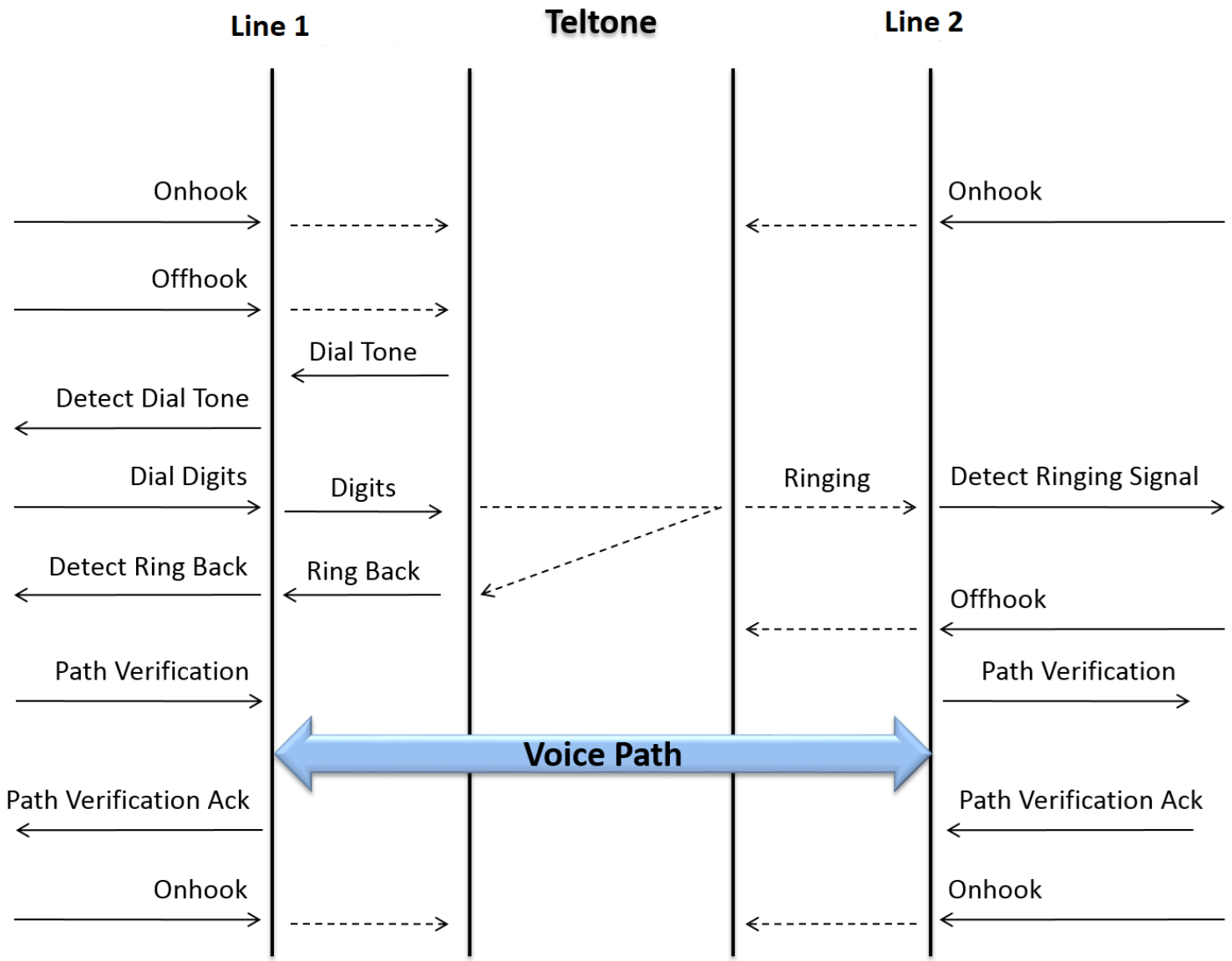
Basic Call Emulation using Teltone Switch



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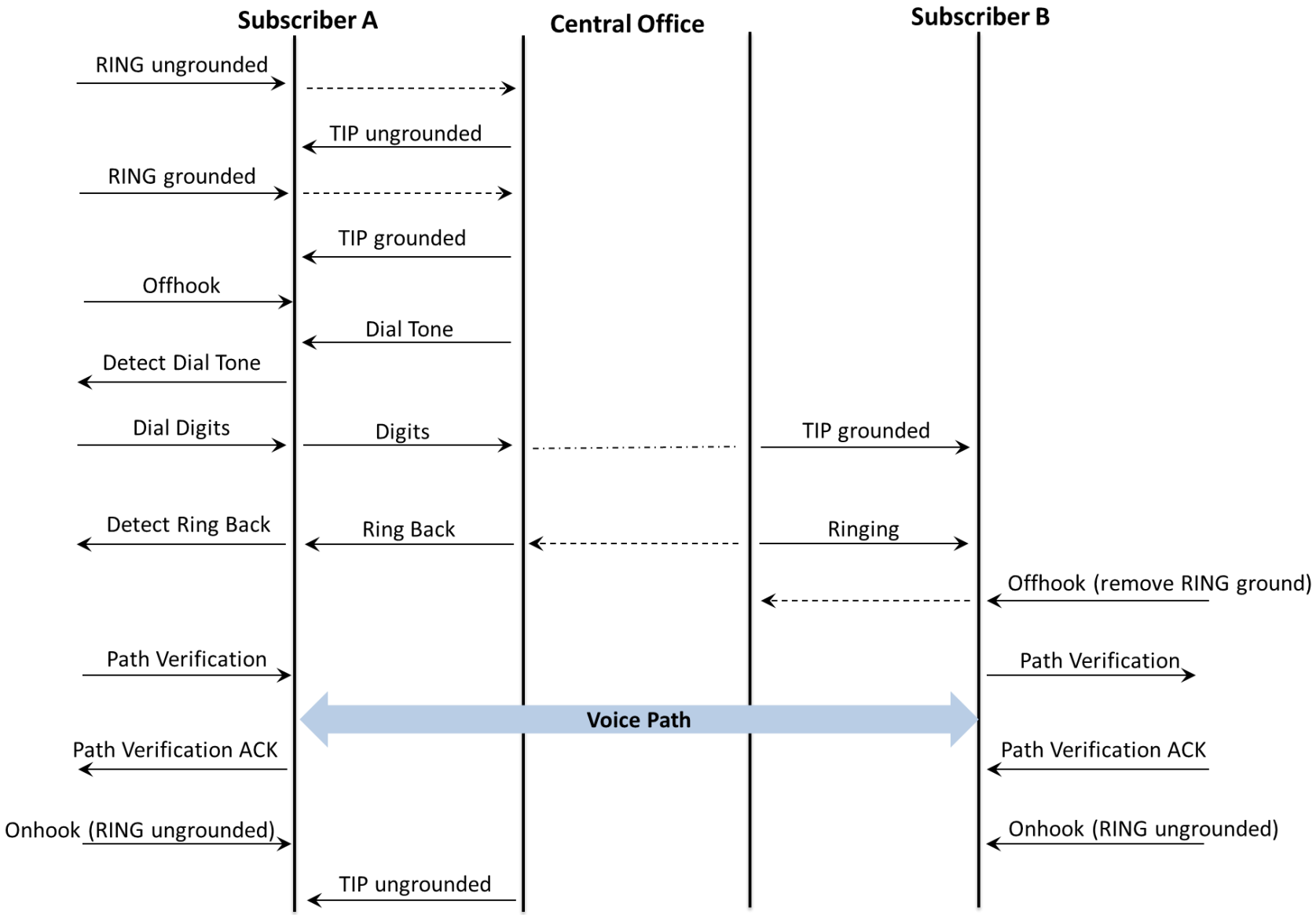
Call Flow Scenario – Ground Start signaling



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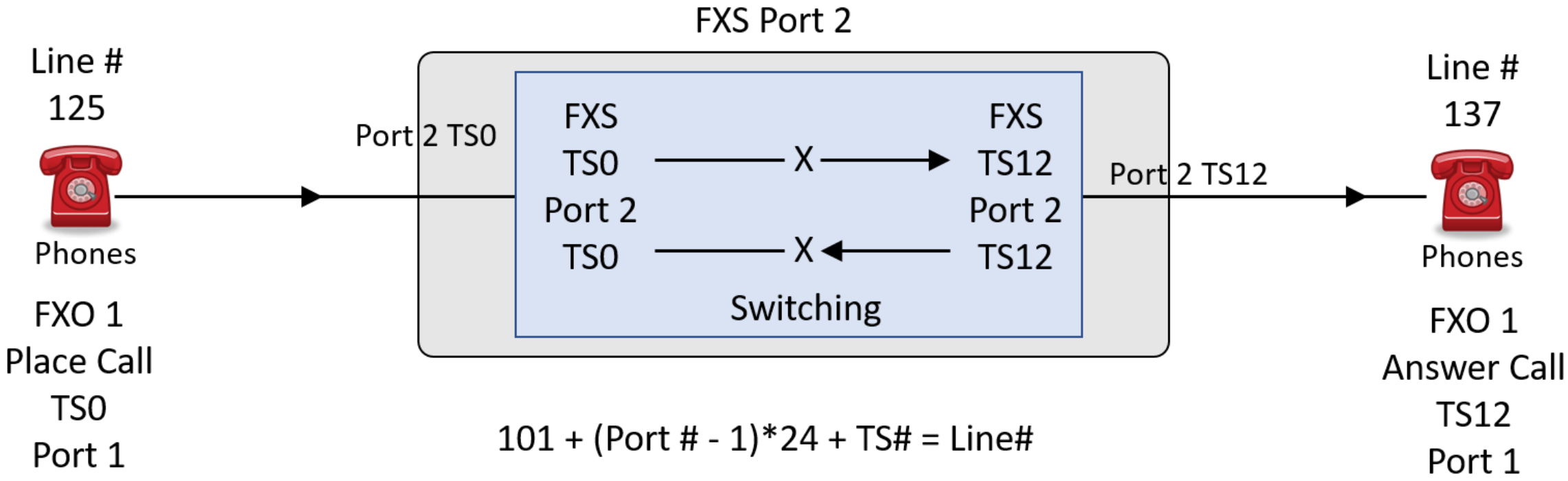
FXS Time Slot Switching



101 + (Port # - 1)*24 + TS# = Line#

1	0	= 101
4	23	= 196
1	23	= 124
5	23	= 220

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Timeslots

Port#¤	Timeslot¤	Line#¤	¤	Port#¤	Timeslot¤	Line#¤	¤	Port#¤	Timeslot¤	Line#¤
1¤	0¤	101¤	¤	2¤	8¤	133¤	¤	3¤	16¤	165¤
1¤	1¤	102¤	¤	2¤	9¤	134¤	¤	3¤	17¤	166¤
1¤	2¤	103¤	¤	2¤	10¤	135¤	¤	3¤	18¤	167¤
1¤	3¤	104¤	¤	2¤	11¤	136¤	¤	3¤	19¤	168¤
1¤	4¤	105¤	¤	2¤	12¤	137¤	¤	3¤	20¤	169¤
1¤	5¤	106¤	¤	2¤	13¤	138¤	¤	3¤	21¤	170¤
1¤	6¤	107¤	¤	2¤	14¤	139¤	¤	3¤	22¤	171¤
1¤	7¤	108¤	¤	2¤	15¤	140¤	¤	3¤	23¤	172¤
1¤	8¤	109¤	¤	2¤	16¤	141¤	¤	4¤	0¤	173¤
1¤	9¤	110¤	¤	2¤	17¤	142¤	¤	4¤	1¤	174¤
1¤	10¤	111¤	¤	2¤	18¤	143¤	¤	4¤	2¤	175¤
1¤	11¤	112¤	¤	2¤	19¤	144¤	¤	4¤	3¤	176¤
1¤	12¤	113¤	¤	2¤	20¤	145¤	¤	4¤	4¤	177¤
1¤	13¤	114¤	¤	2¤	21¤	146¤	¤	4¤	5¤	178¤
1¤	14¤	115¤	¤	2¤	22¤	147¤	¤	4¤	6¤	179¤
1¤	15¤	116¤	¤	2¤	23¤	148¤	¤	4¤	7¤	180¤
1¤	16¤	117¤	¤	3¤	0¤	149¤	¤	4¤	8¤	181¤
1¤	17¤	118¤	¤	3¤	1¤	150¤	¤	4¤	9¤	182¤
1¤	18¤	119¤	¤	3¤	2¤	151¤	¤	4¤	10¤	183¤
1¤	19¤	120¤	¤	3¤	3¤	152¤	¤	4¤	11¤	184¤
1¤	20¤	121¤	¤	3¤	4¤	153¤	¤	4¤	12¤	185¤
1¤	21¤	122¤	¤	3¤	5¤	154¤	¤	4¤	13¤	186¤
1¤	22¤	123¤	¤	3¤	6¤	155¤	¤	4¤	14¤	187¤
1¤	23¤	124¤	¤	3¤	7¤	156¤	¤	4¤	15¤	188¤
2¤	0¤	125¤	¤	3¤	8¤	157¤	¤	4¤	16¤	189¤
2¤	1¤	126¤	¤	3¤	9¤	158¤	¤	4¤	17¤	190¤
2¤	2¤	127¤	¤	3¤	10¤	159¤	¤	4¤	18¤	191¤
2¤	3¤	128¤	¤	3¤	11¤	160¤	¤	4¤	19¤	192¤
2¤	4¤	129¤	¤	3¤	12¤	161¤	¤	4¤	20¤	193¤
2¤	5¤	130¤	¤	3¤	13¤	162¤	¤	4¤	21¤	194¤
2¤	6¤	131¤	¤	3¤	14¤	163¤	¤	4¤	22¤	195¤
2¤	7¤	132¤	¤	3¤	15¤	164¤	¤	4¤	23¤	196¤

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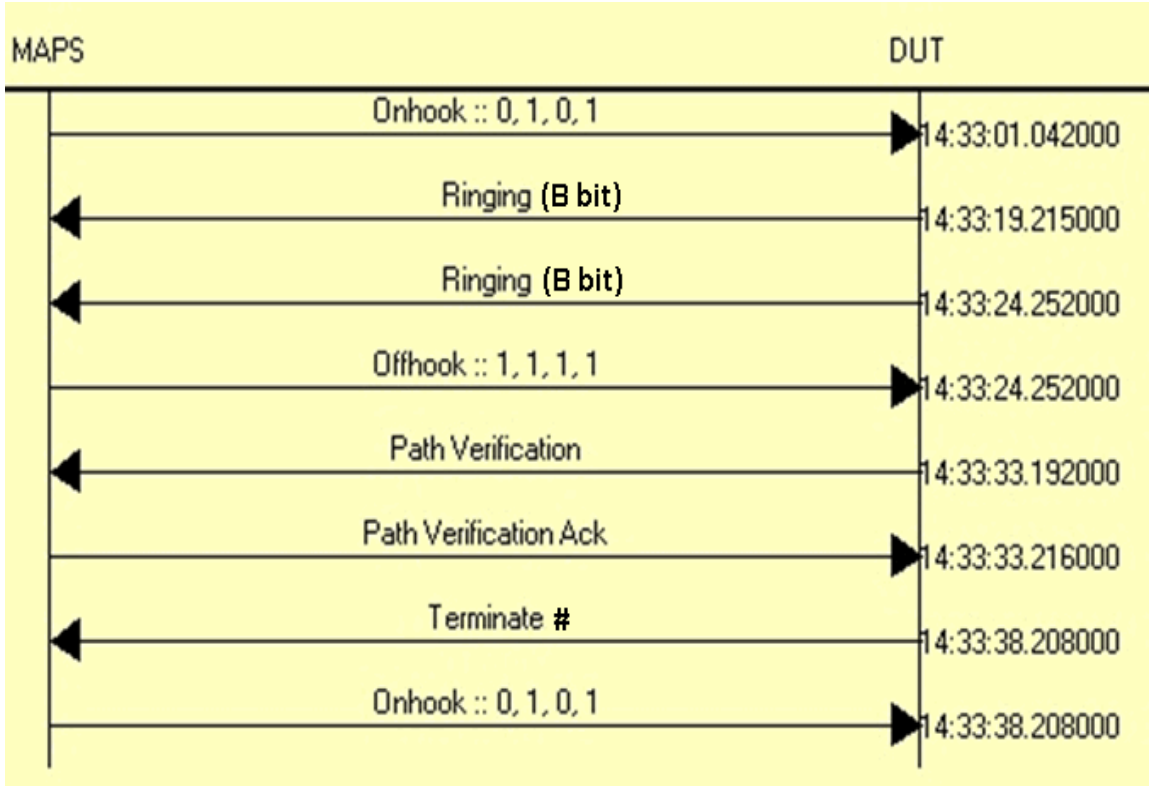
Signaling with Path Verification (PV)

Answer Call Ladder Diagram

- Initially both sides are Onhook
- An incoming call is detected by “B” bit following the cadence of the “ringing” voltage, which is 1 second ON, and 4 seconds OFF
- When the call is answered on the second ring, an Off-Hook is sent
- The “ringing” ceases, and signaling returns to 0,1,0,1 idle sequence
- A 1 second path verification noise burst at -10 dBm is received
- After a 1 second delay this is acknowledged by a 1.5 sec noise burst at -10 dBm also
- A DTMF digit of “#” is received to indicate that call is terminated



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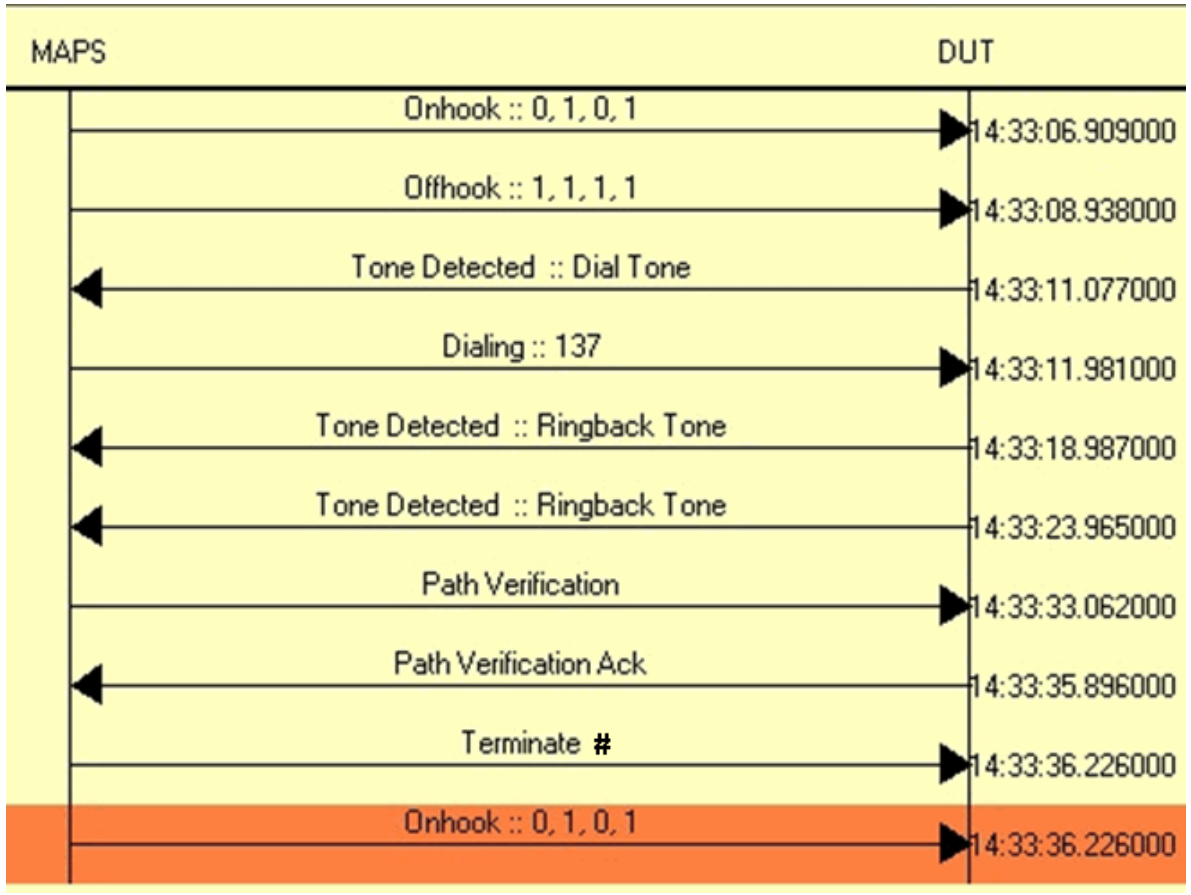
Place Call Ladder Diagram

- Initially both sides are Onhook
- An outgoing call is initiated sending Offhook (1,1,1,1) and waits for dial tone
- When the dial tone is detected, the Place call side dials the digits, and waits for ring back tone
- Once the ring back tone stops and the ceases, the call goes to connected state (call answered), following which the path verification is initiated
- A 1 second path verification noise burst at -10 dBm is sent from the Place Call side
- After a 1 second delay this is acknowledged by a 1.5 sec noise burst at -10 dBm from the Answer call side
- A DTMF digit of “#” is sent to indicate that call will be terminated



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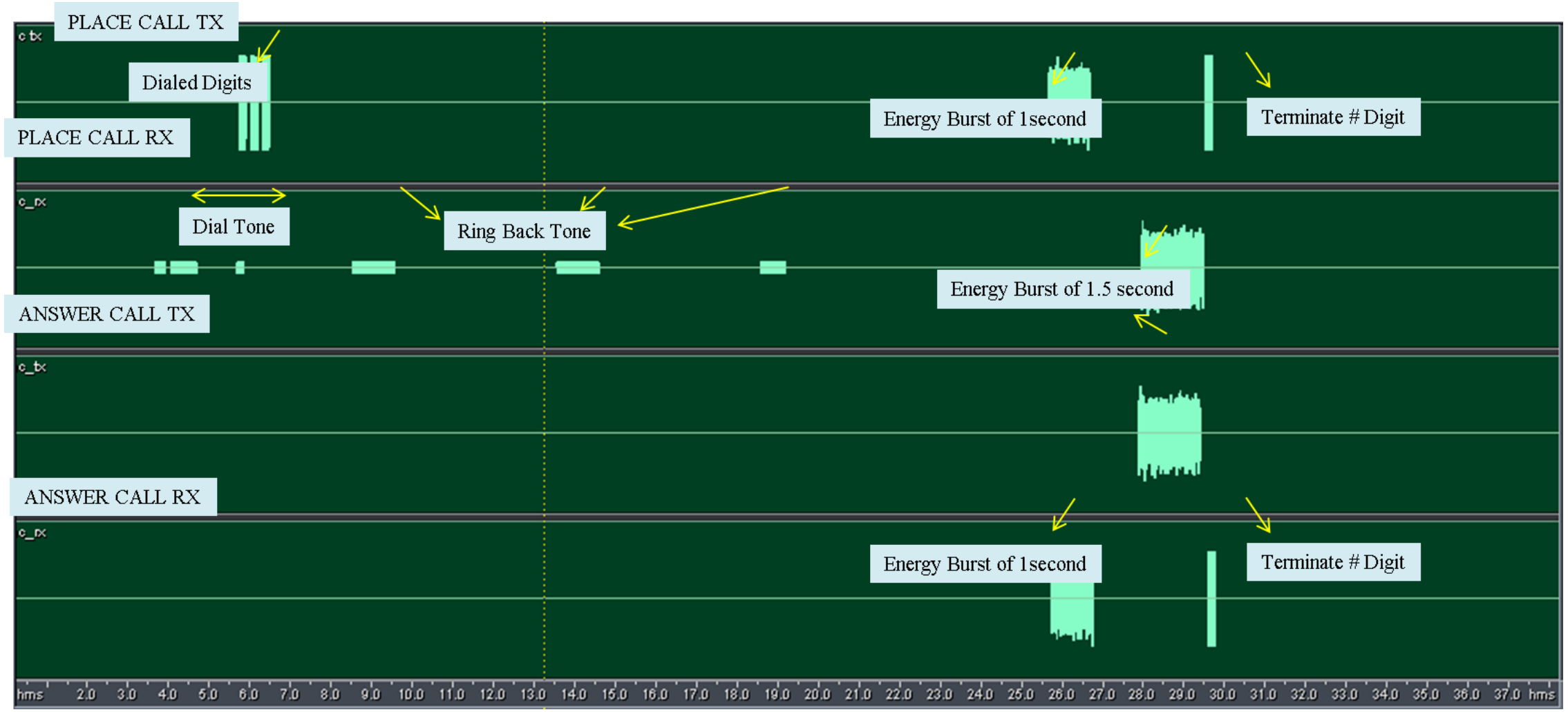
Signaling and Path Verification Call Captures



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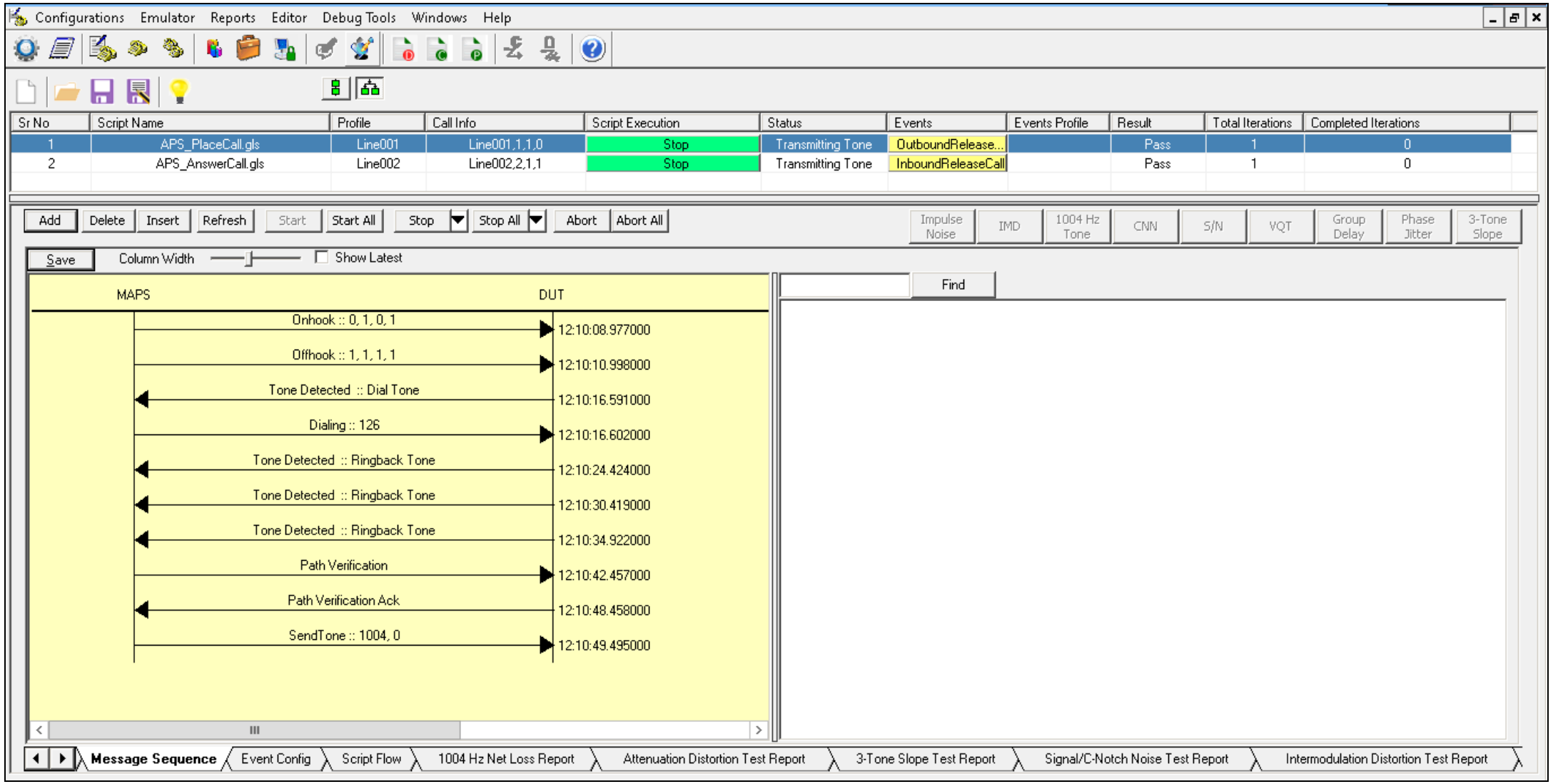
Call Generation FXO APS



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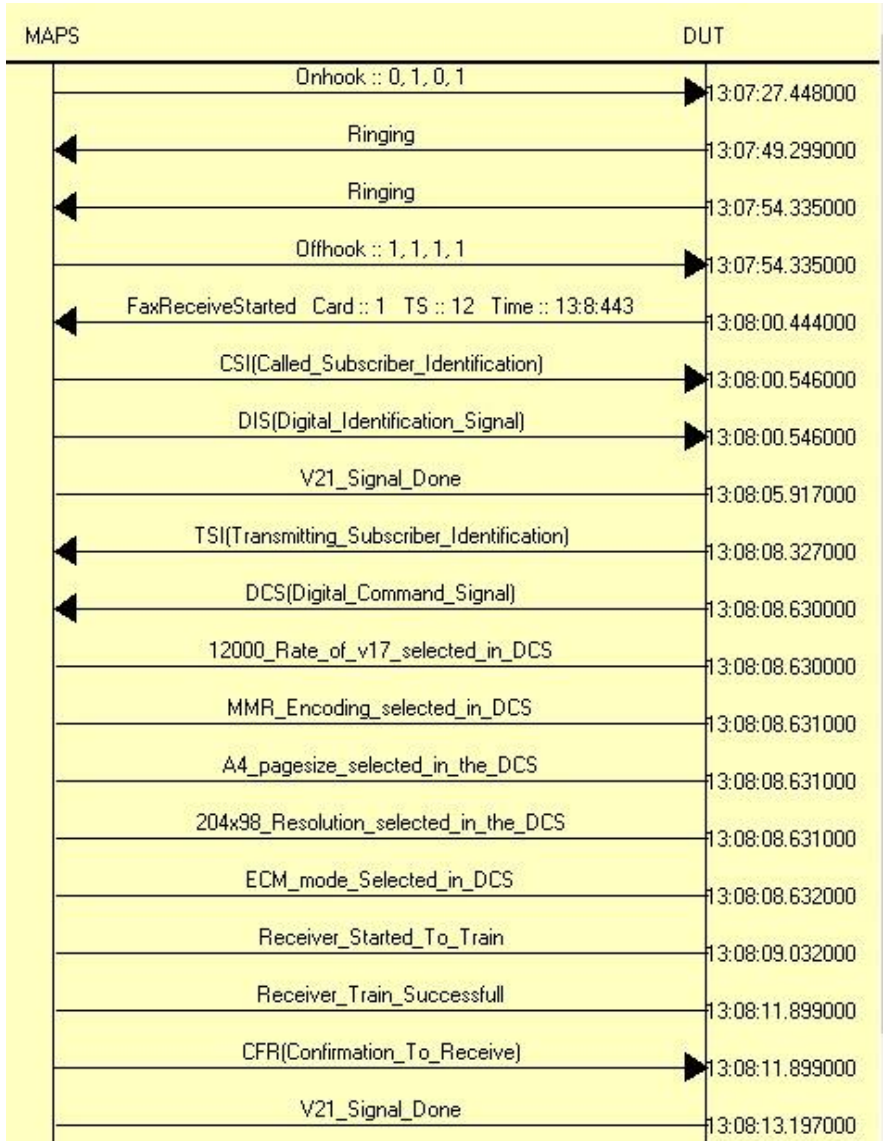
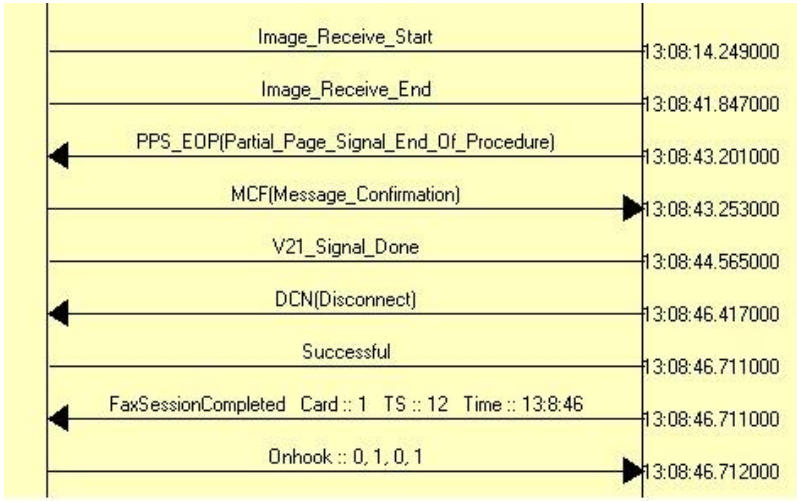
Signaling with FAX

Ladder Diagram of Answer Call for FAX

- All signaling states follow the same procedures as in Place Call and Answer call sides
- Once the call flow reaches connected state, the fax receive action starts from the Answer call side
- All fax signaling parameters are negotiated, and on successful negotiation, the TIFF image is received and acknowledged

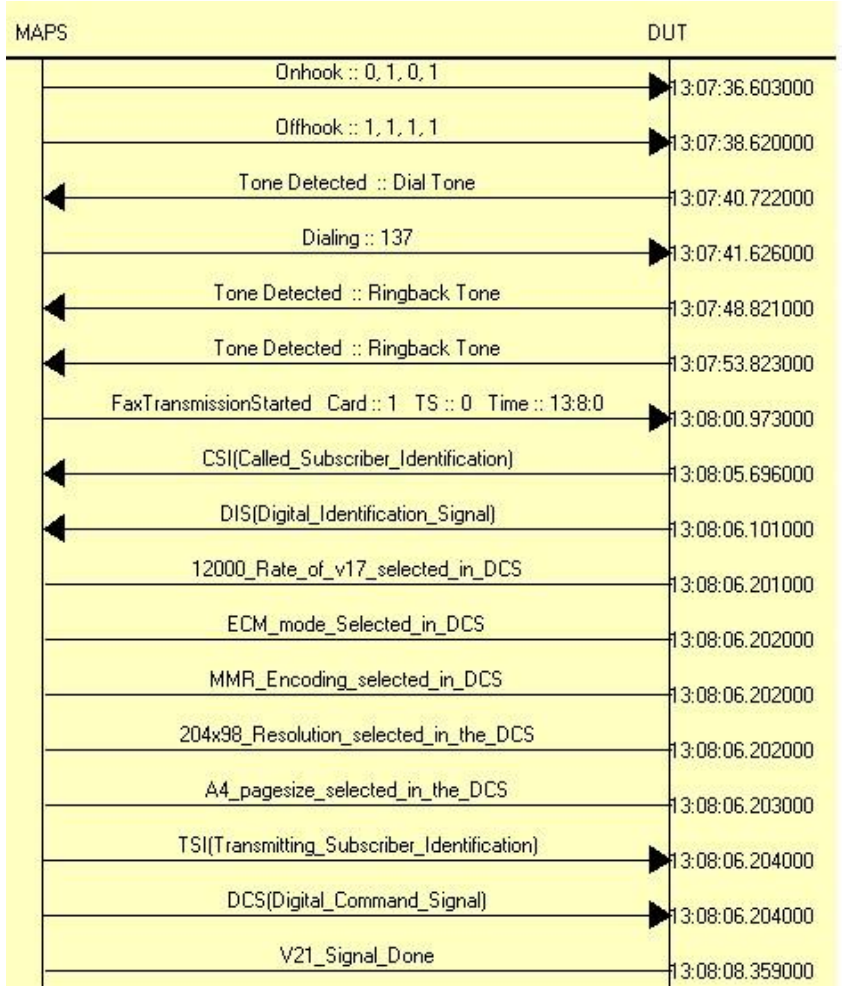




GL Communications

Ladder Diagram of Place Call for FAX

- All signaling states follow the same procedures as in Place Call and Answer call sides
- Once the call flow reaches connected state, the fax transmit action starts from the Place call side
- All fax signaling parameters are negotiated, and on successful negotiation, the TIFF image is transmitted and fax status from remote side is acknowledged



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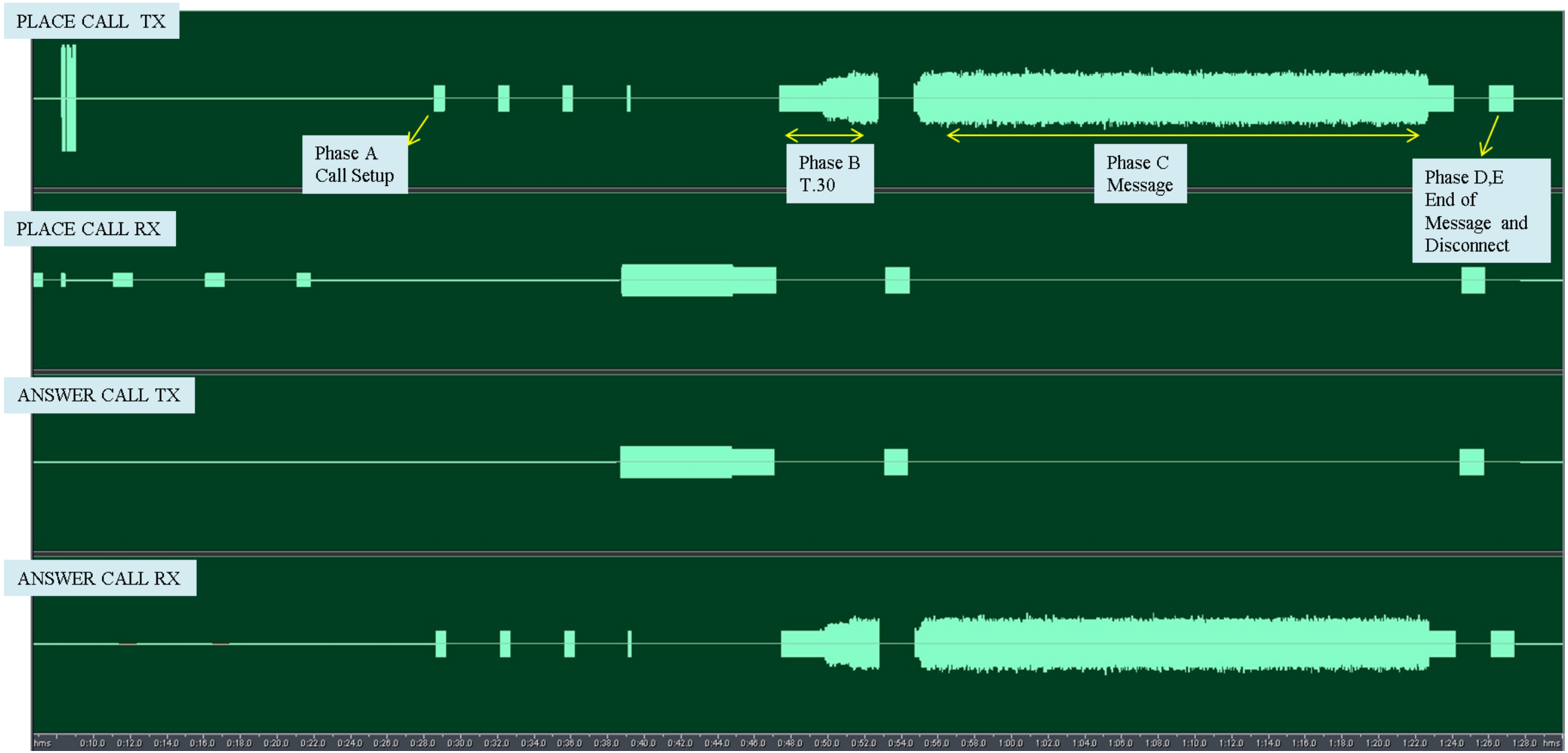
FAX Call Captures



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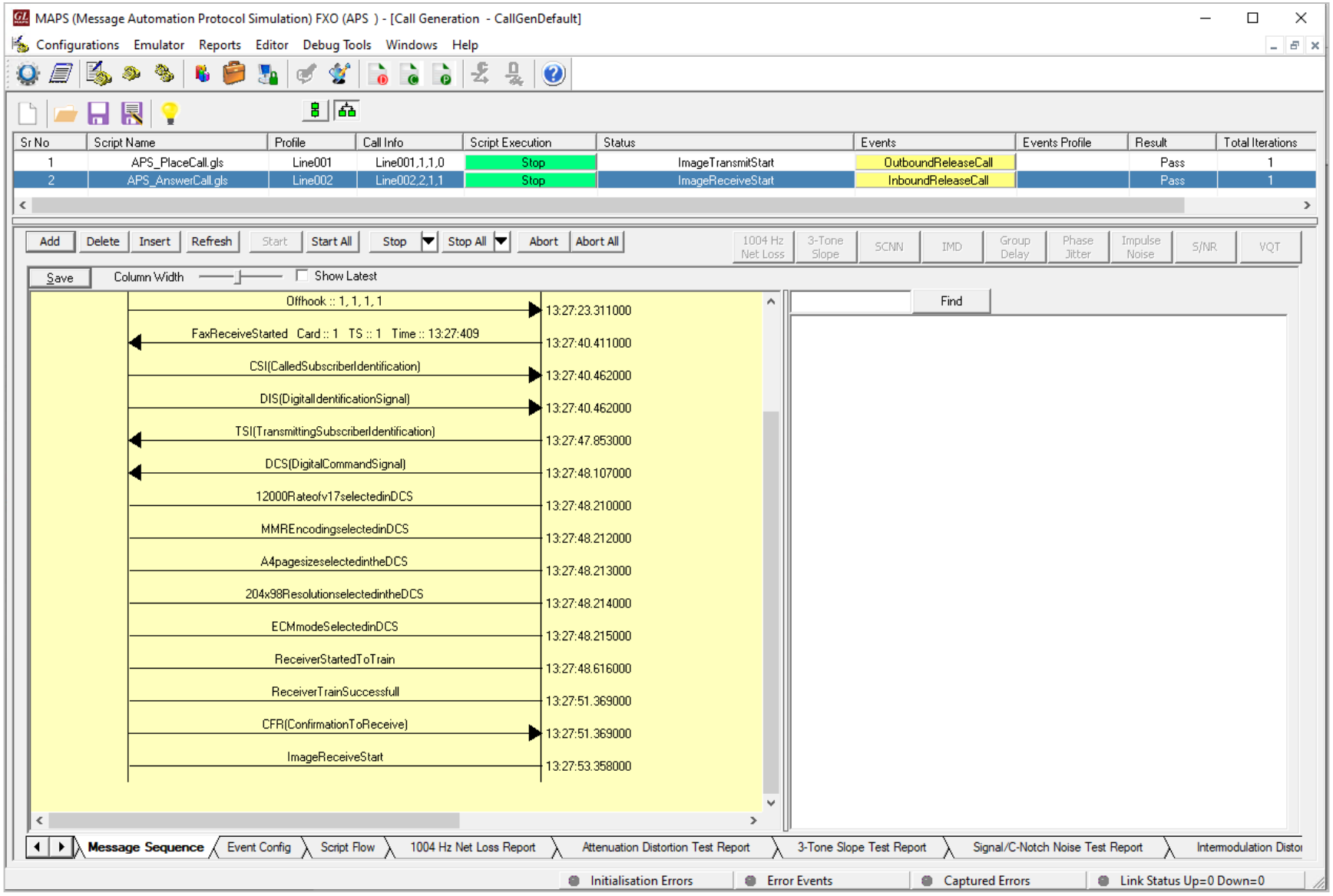
Call Generation Sending and Receiving Fax



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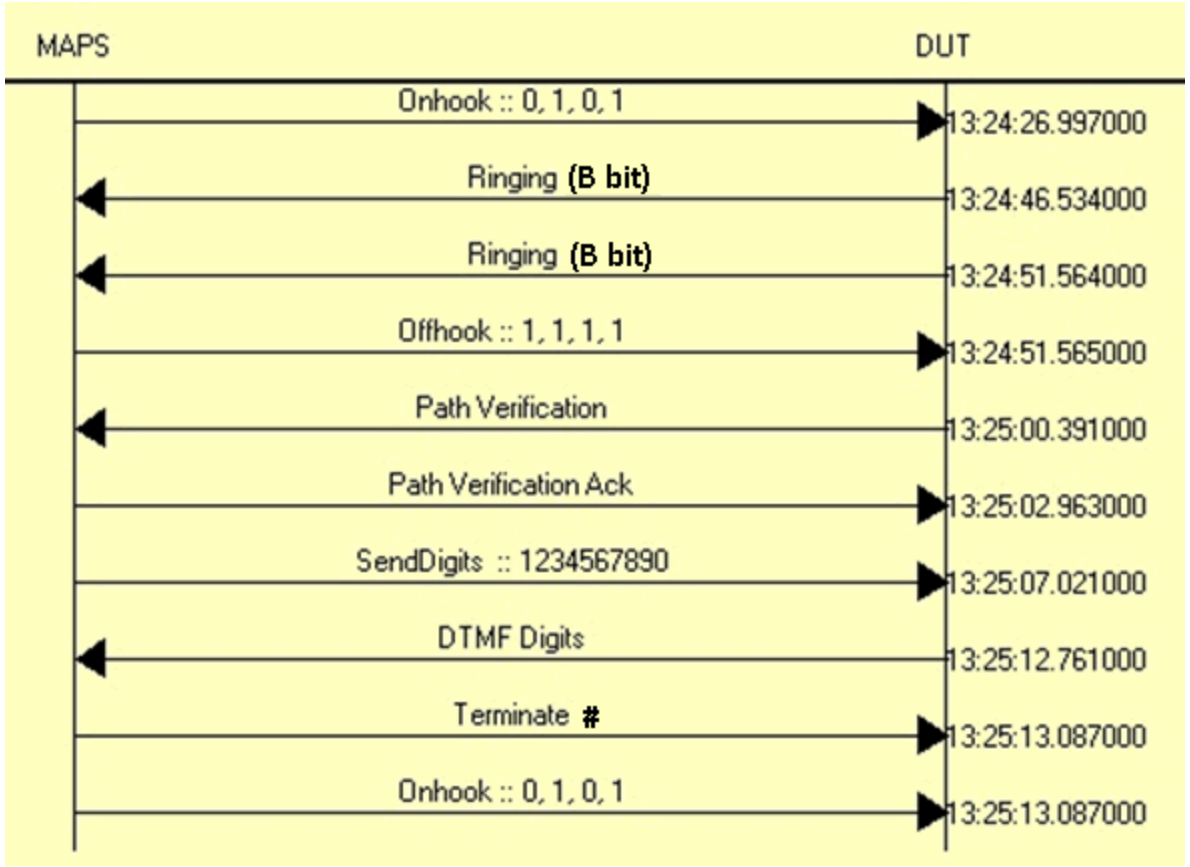
Signaling with Digits

Ladder Diagram of Answer Call for Digit

- All signaling states follow the same procedures as in Place Call and Answer call sides
- Once the call flow reaches connected state and after path verification procedure, the digits detect action starts from the Answer call side
- The Answer call side waits for digit transmission indication (digit 2) from the place call side. Once this is received, the answer call sends DTMF digits
- The Answer Call side terminates the call by sending the # DTMF digit, and subsequently sending On Hook



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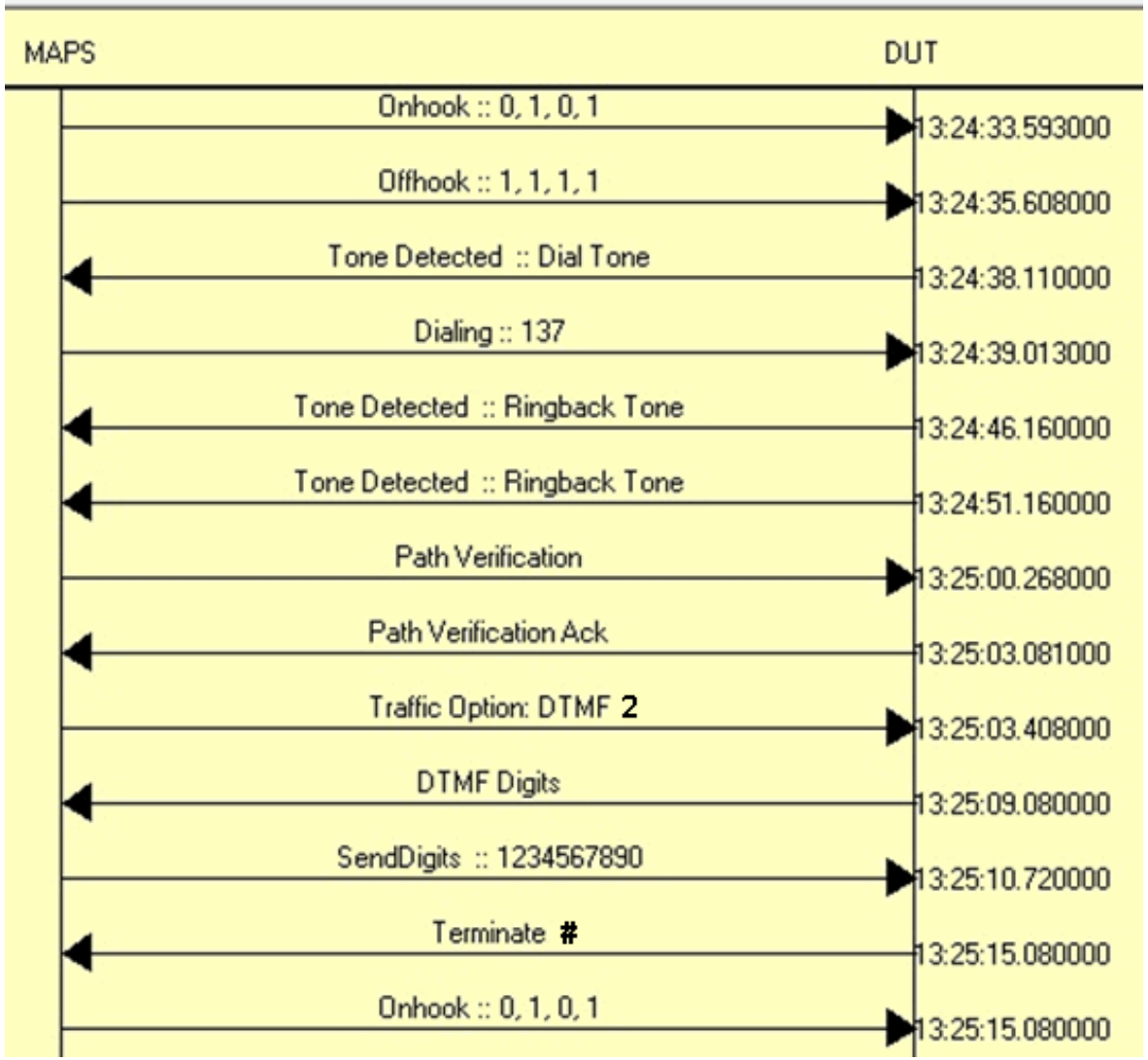
Ladder Diagram of Place Call for Digit

- All signaling states follow the same procedures as in Place Call side
- Once the call flow reaches connected state and after path verification procedure, a digit ‘2’ is transmitted to indicate the start of transmission process
- The Place call side then receives the DTMF digits from the Answer call side
- A DTMF digit of “#” is received to indicate that call will be terminated



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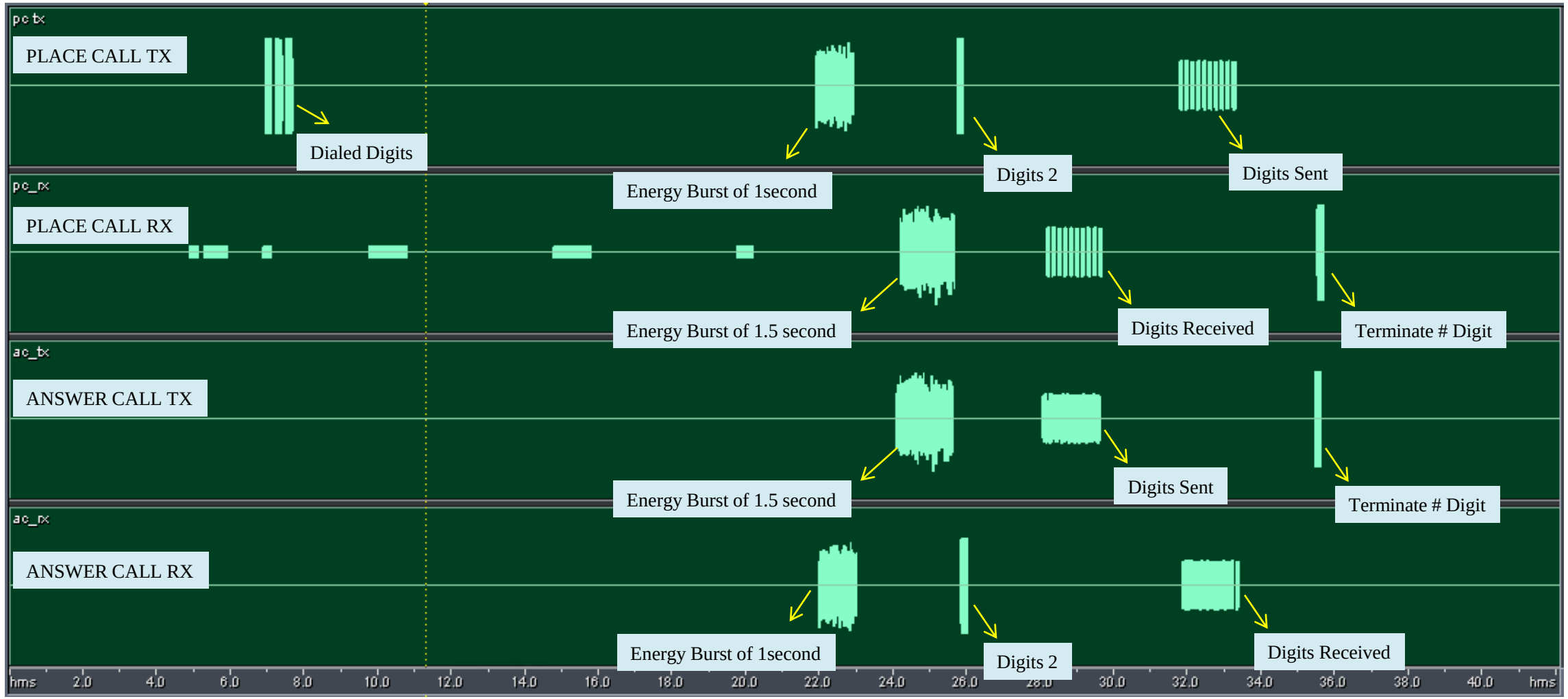
Digit Capture



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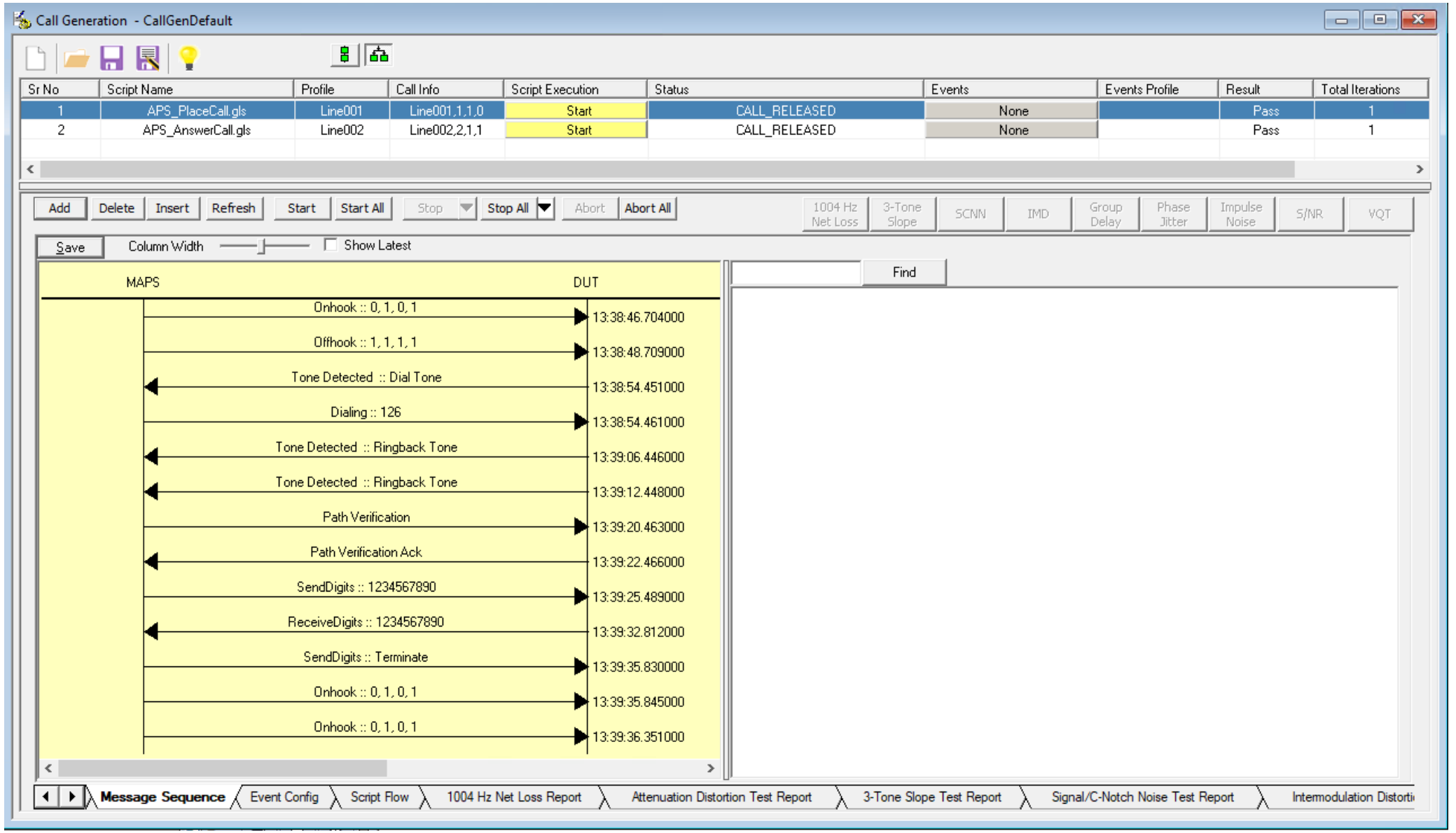
Call Generation of Sending Digits



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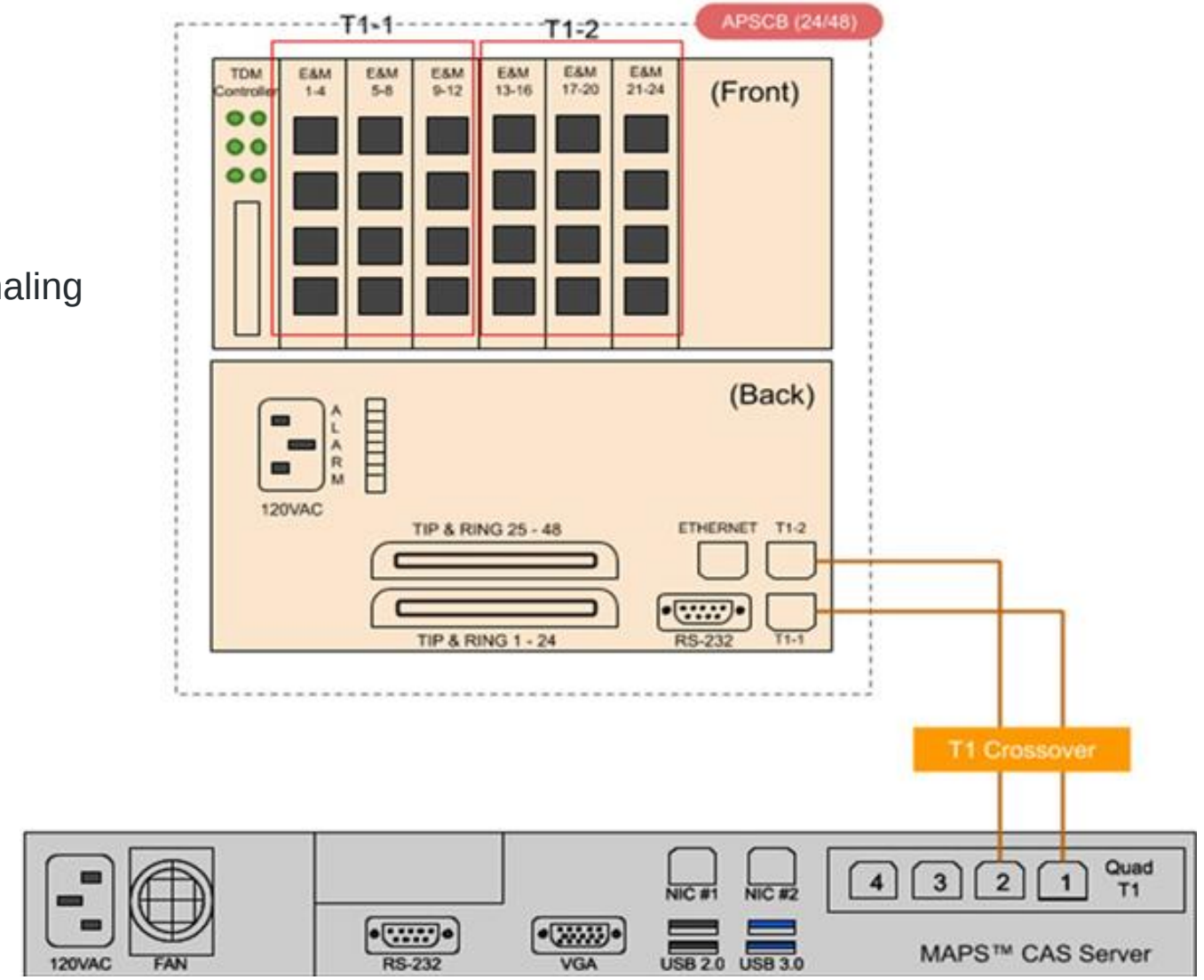
MAPS™ E&M

- A channel bank is required to provide analog 4-wire E&M interfaces
- Without a channel bank, MAPS APS will perform the signaling required to emulate E&M signaling



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MAPS™ E&M (Contd.)

- Each E&M service card provides four female RJ-45 connectors
- Each T1 supports 3 E&M service cards for a total of 12 E&M interfaces
- The pin-out for the RJ-45 connector is below. E&M Signaling Types I, II, III, IV, and V are supported by the E&M service card

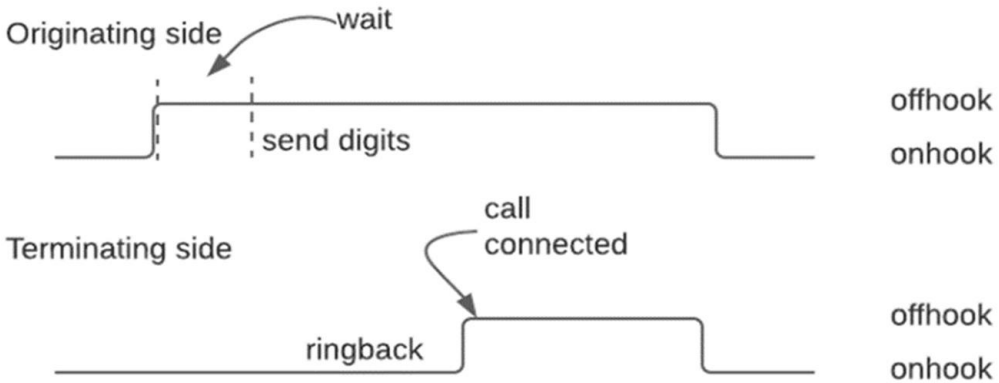
Normal Mode (Terminating/Channel Equipment)		Tandem Mode (Originating/Switching Equipment)	
Pin	Name	Pin	Name
1	SG (Signal Ground)	1	SG (Signal Battery)
2	E	2	M
3	R1	3	R1
4	R	4	R
5	T	5	T
6	T1	6	T1
7	M	7	E
8	SB (Signal Battery)	8	SG (Signal Battery)

GL Communications

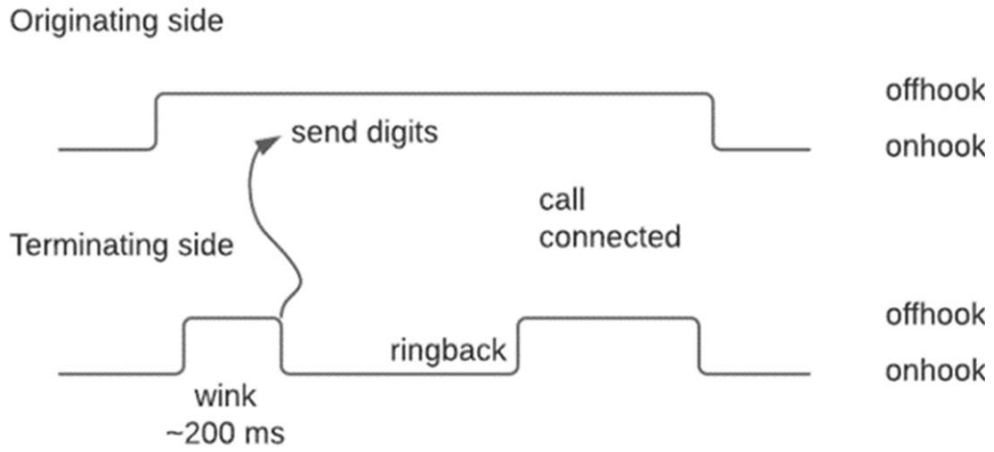
Dial Supervision Signaling

- Three types of start dial supervision signaling are supported and can be selected via the E&M Profiles in MAPS APS

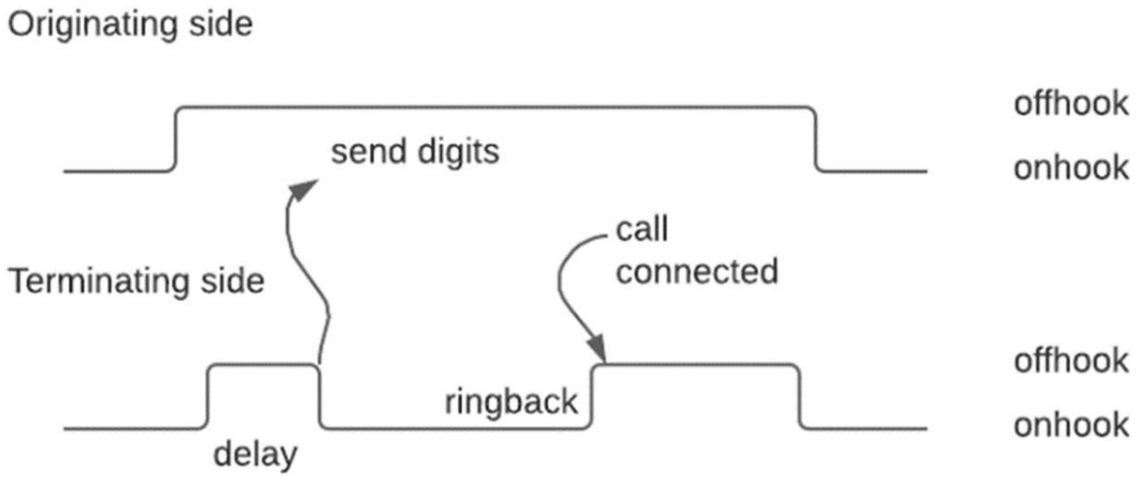
Immediate Start Signaling



Wink Start Signaling

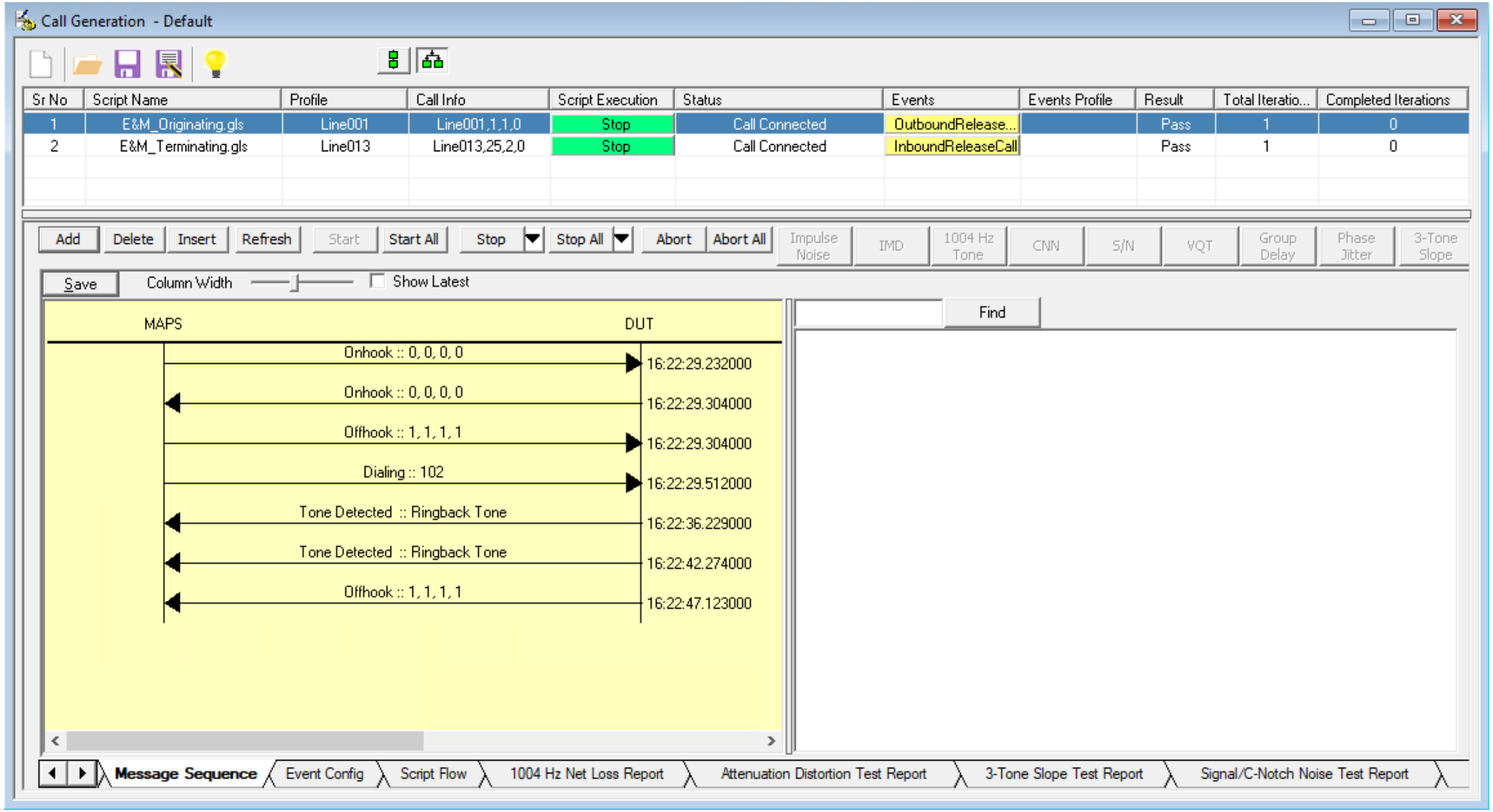


Delay Dial Signaling



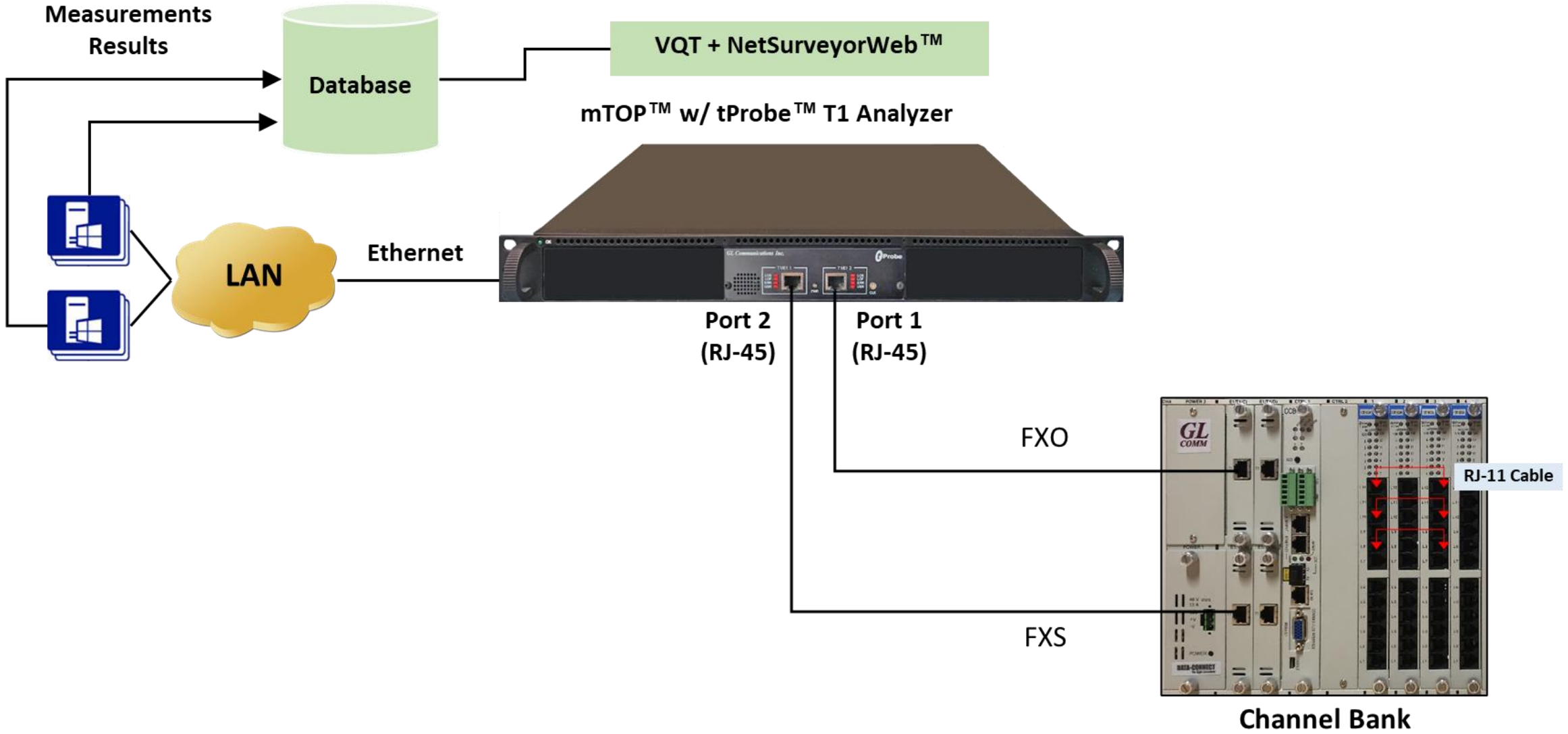
GL Communications

Call Generation E&M



GL Communications

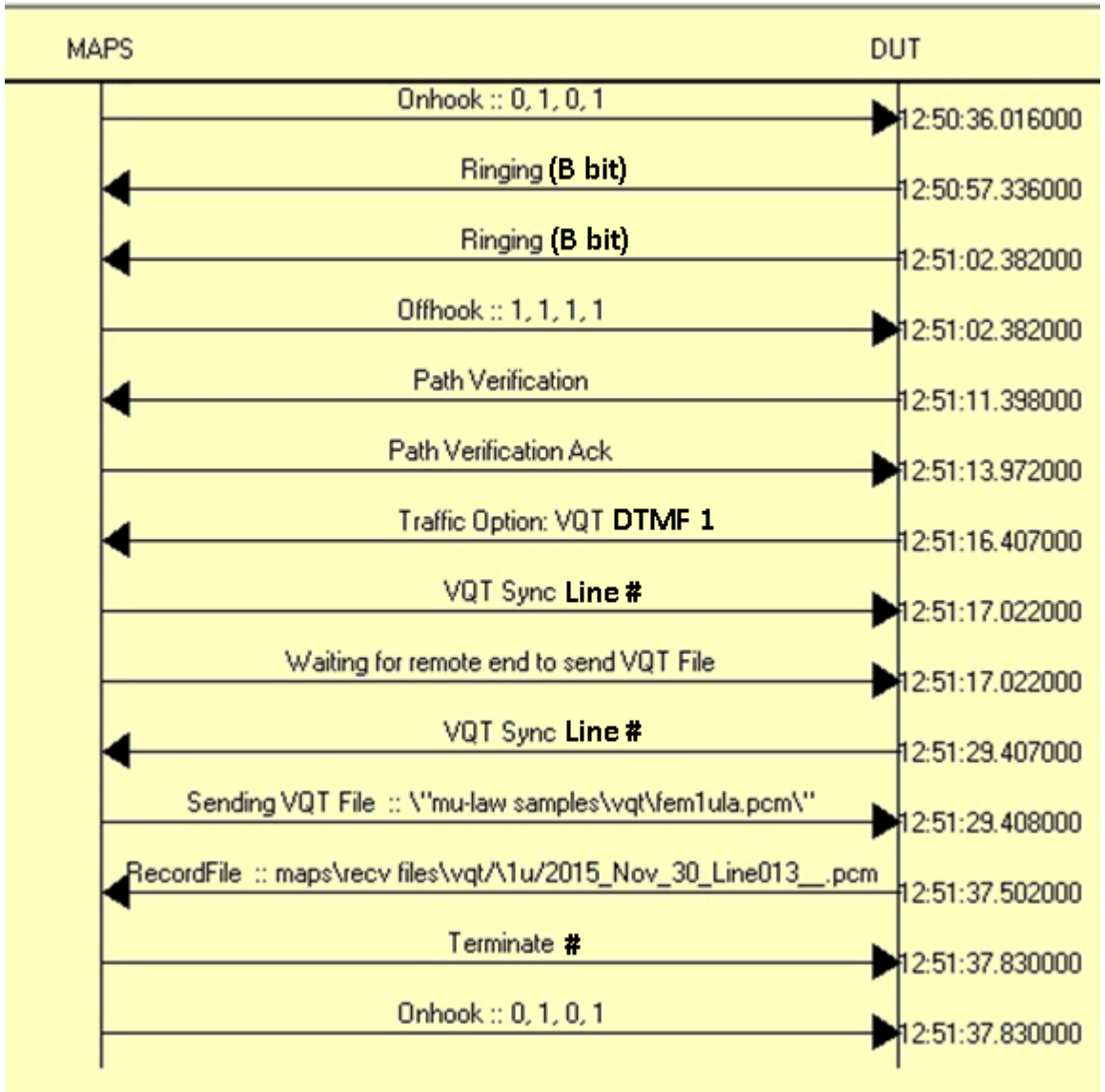
Analyzing results with NetSurveyorWeb™



GL Communications

Answer Call Ladder Diagram

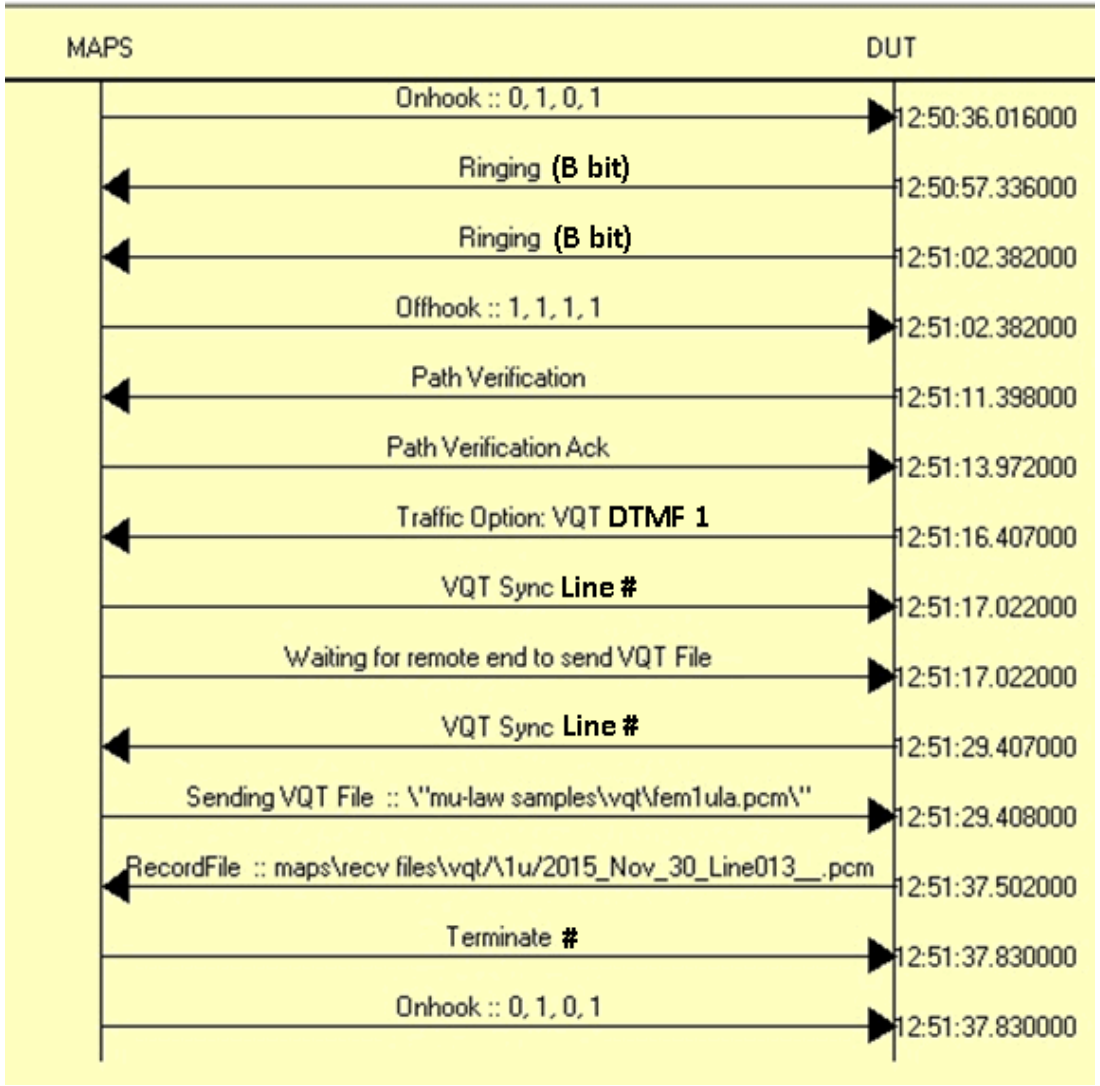
- Initially both sides are On-Hook
- An incoming call is detected by “B” bit following the cadence of the “ringing” voltage, which is 1 second ON, and 4 seconds OFF
- When the call is answered on the second ring, an Off-Hook is sent
- The “ringing” ceases, and signaling returns to 0,1,0,1 idle sequence
- A 1 second path verification noise burst at -10 dBm is received
- After a 1 second delay this is acknowledged by a 1.5 sec noise burst at -10 dBm also
- A DTMF digit of “1” is received to indicate that VQT will proceed



GL Communications

Answer Call Ladder Diagram (Contd.)

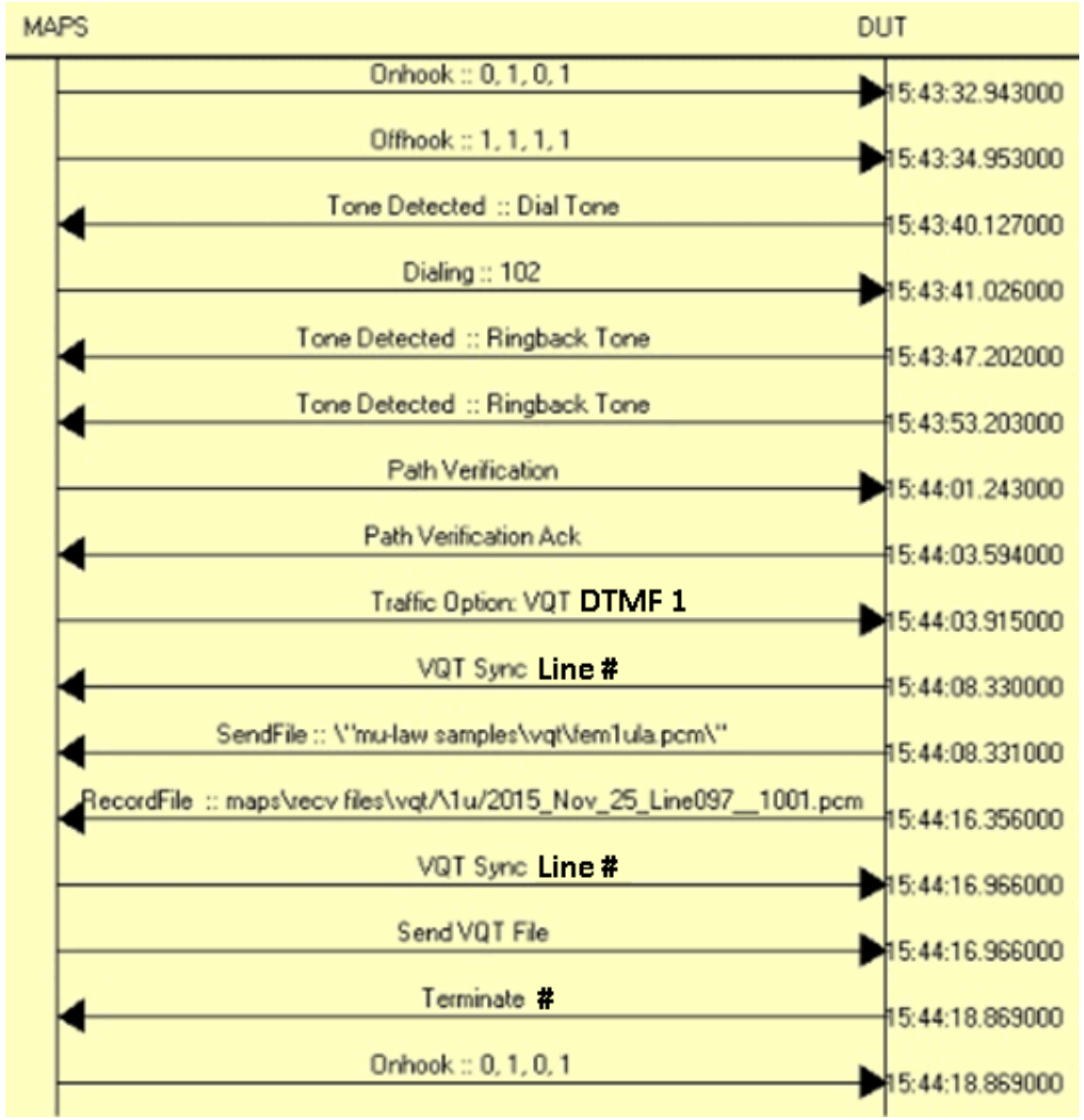
- The Answer Call side returns the line number in DTMF form (for achieving VQT Sync)
- The Place Call side controls the sending of an 8 second VQT file from the answer side line number and simultaneously records at the Place Call side
- The process is reversed – the PlaceCall side sends the line number and the Answer side controls the sending of an 8 second VQT file from the place call line number, and simultaneously records at the Answer Call side
- The Answer Call side terminates the call by sending the # DTMF digit, and subsequently sending On Hook



GL Communications

Place Call Ladder Diagram

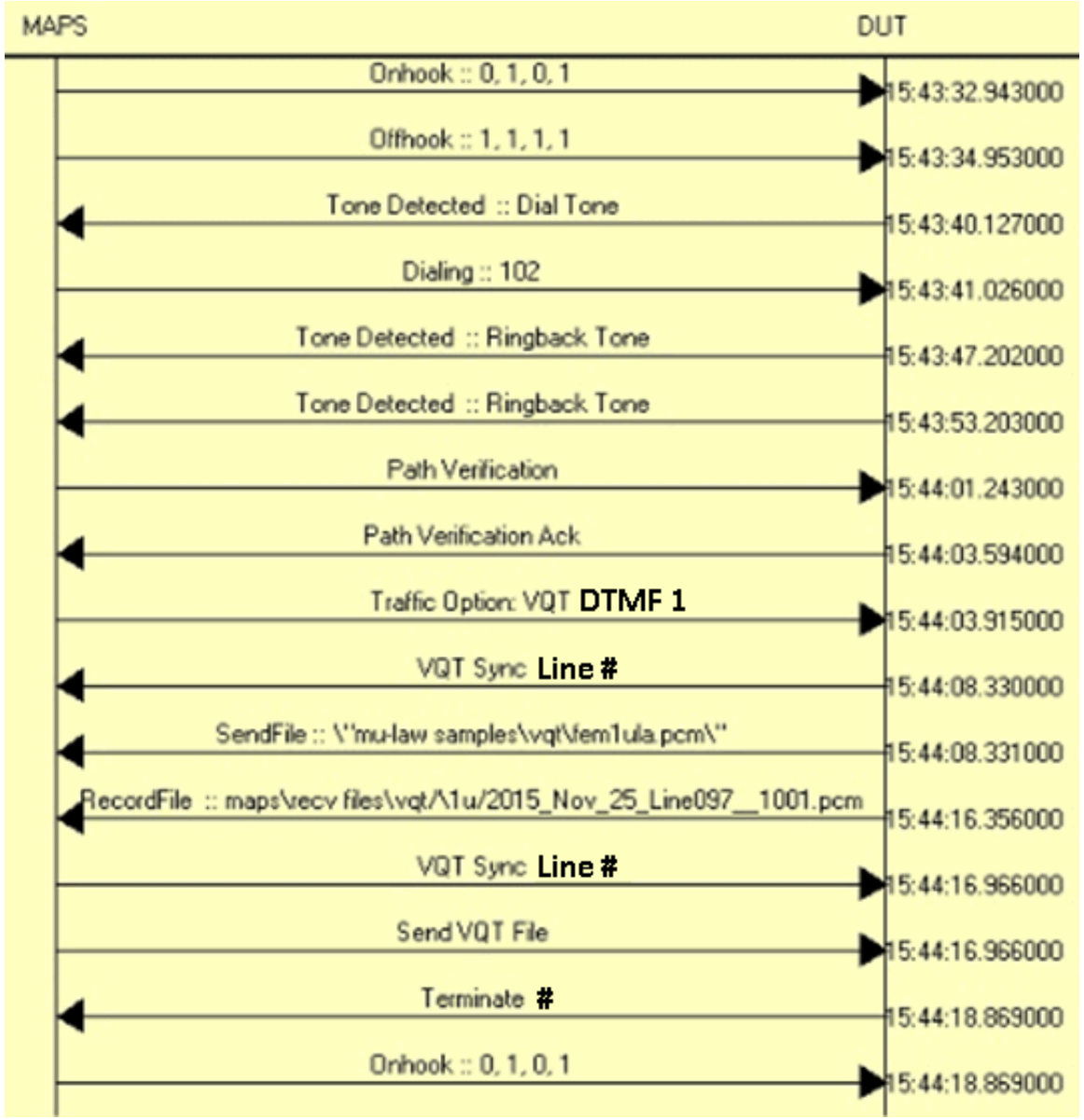
- Initially both sides are On-Hook
- An outgoing call is initiated sending offhook (1,1,1,1) and waits for dial tone. When the dial tone is detected, the Place call side dials the digits, and waits for ring back tone
- Once the ring back tone ceases, the call goes to connected state (call answered), following which the path verification is initiated.
- A 1 second path verification noise burst at -10 dBm is sent from the Place Call side.
- After a 1 second delay this is acknowledged by a 1.5 sec noise burst at -10 dBm from the Answer call side
- A DTMF digit of “1” is sent to indicate that VQT will proceed



GL Communications

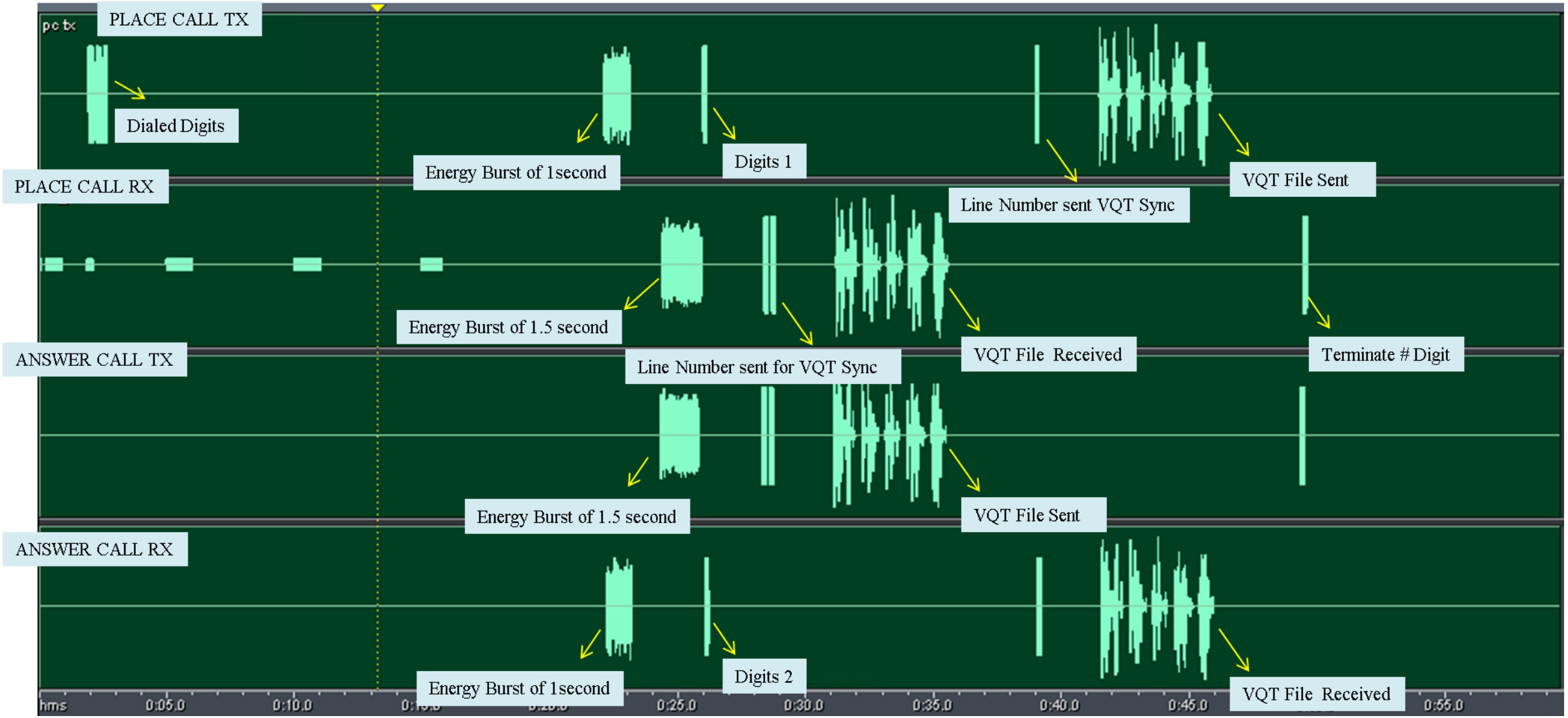
Place Call Ladder Diagram (Contd.)

- The answer call side will send the line number in VQT sync. With this line number, the place call controls sending of an 8 second VQT file from the answer call line number, and simultaneously records at the Place Call side
- On completion of record file, the VQT sync is sent indicating the Place Call line number. Now the answer call will control sending of VQT file from place call line number and simultaneously records at answer call side
- A DTMF digit of “#” is received at the Place call side and call is terminated



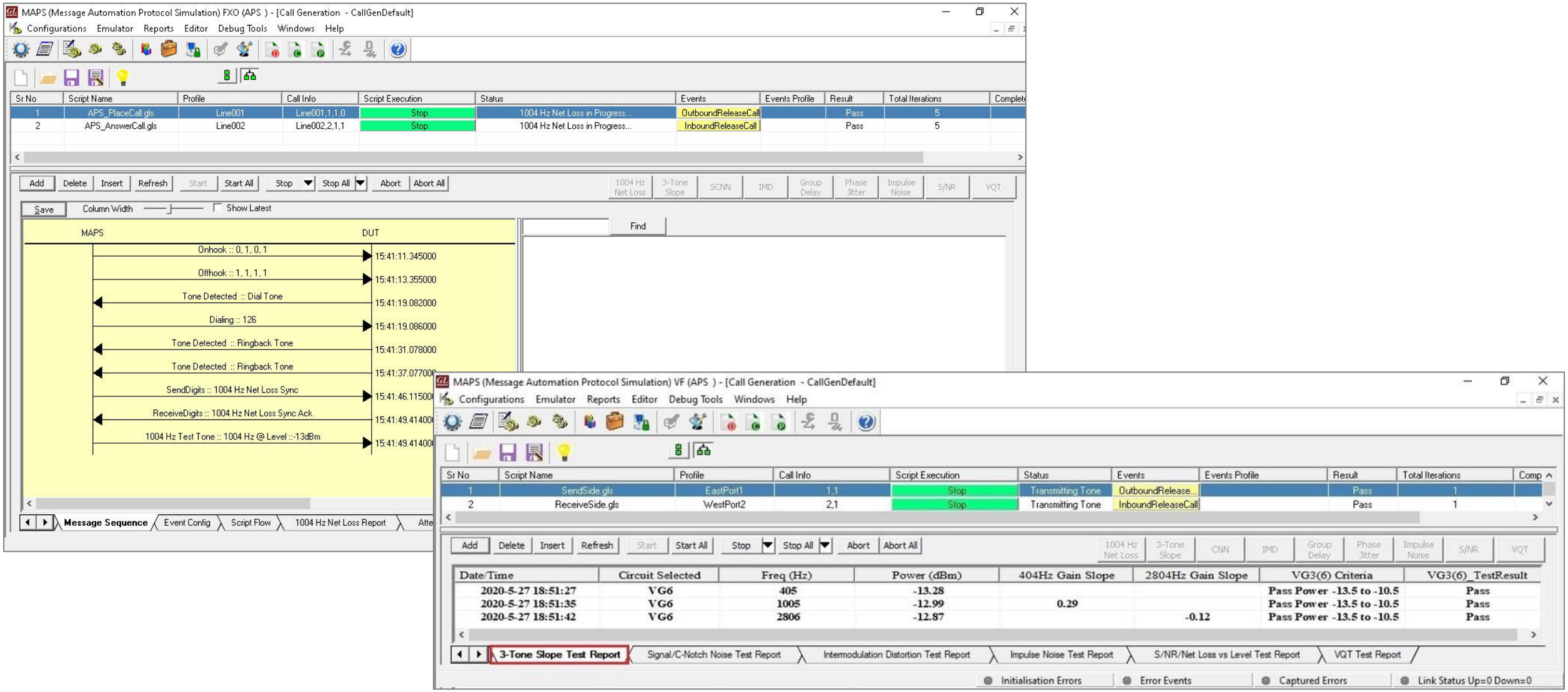
GL Communications

Path Verification and VQT Call Captures



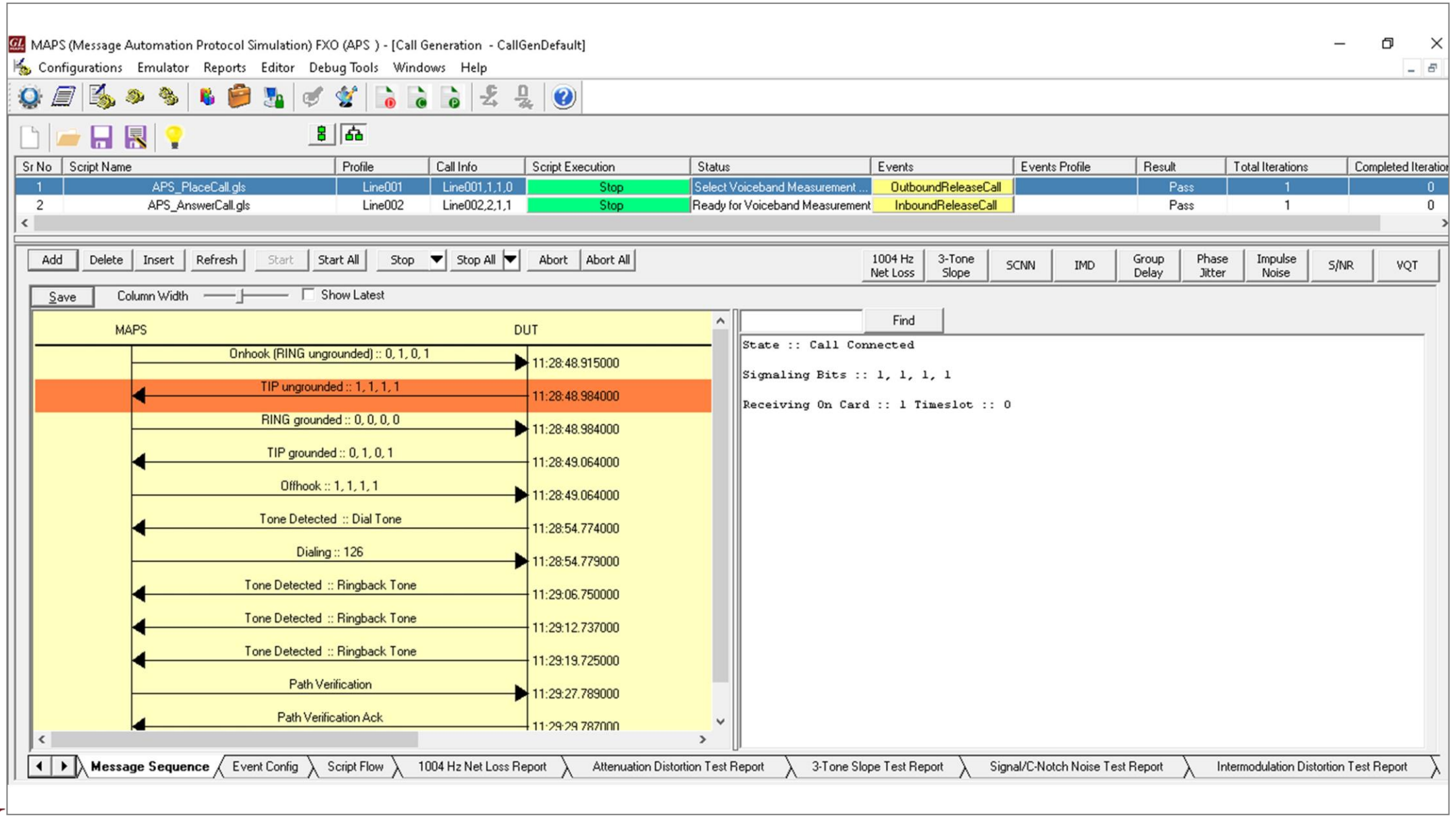
GL Communications

Call Generation Loop Start Signaling



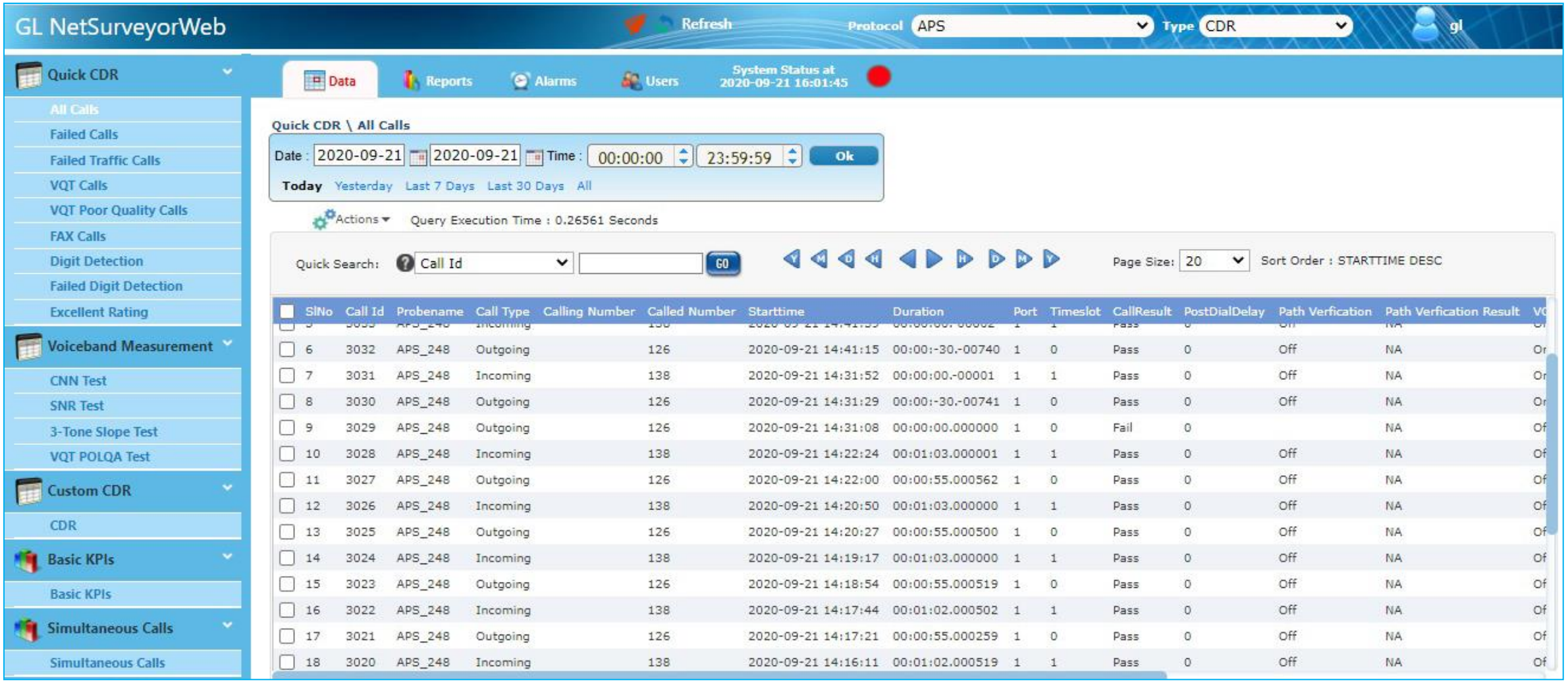
GL Communications

Call Generation Ground Start Signaling



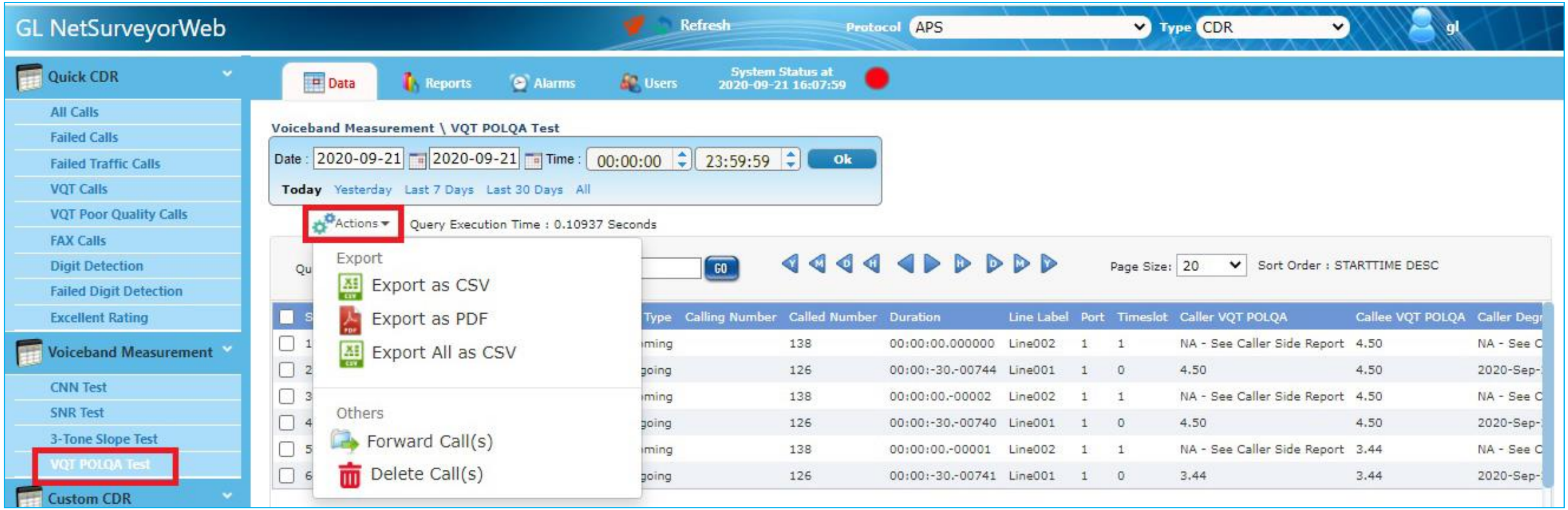
GL Communications

NetSurveyorWeb™ for MAPS™ APS



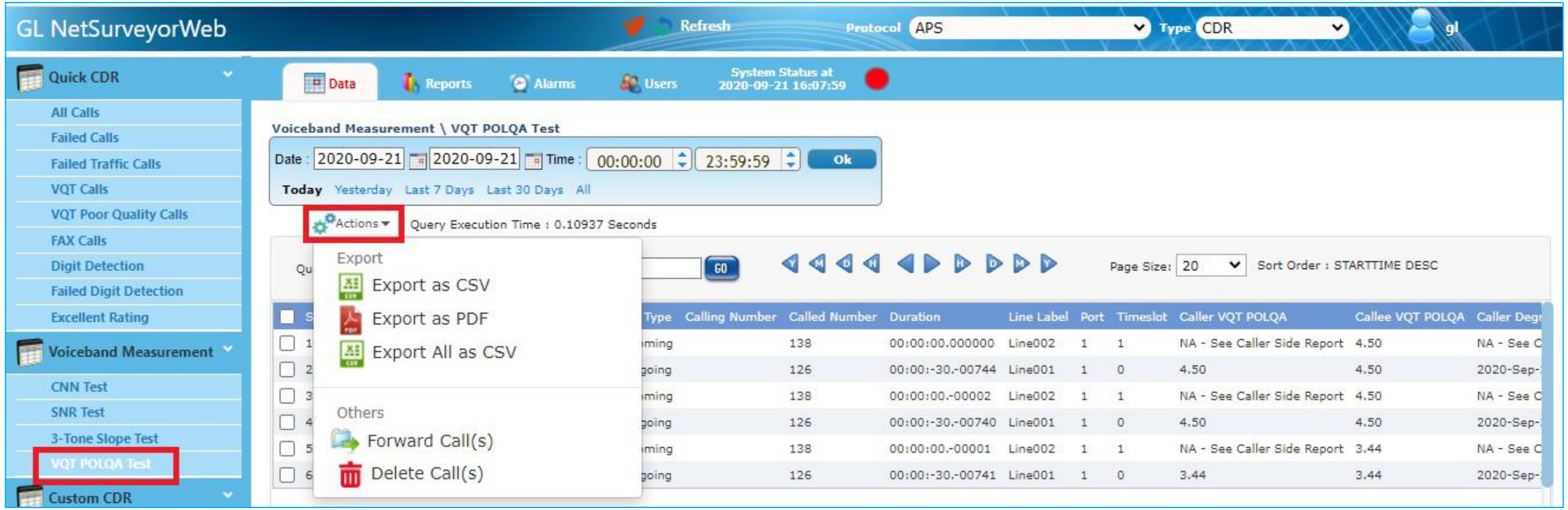
GL Communications

Report Generation



GL Communications

Report Generation (Contd.)



GL Communications

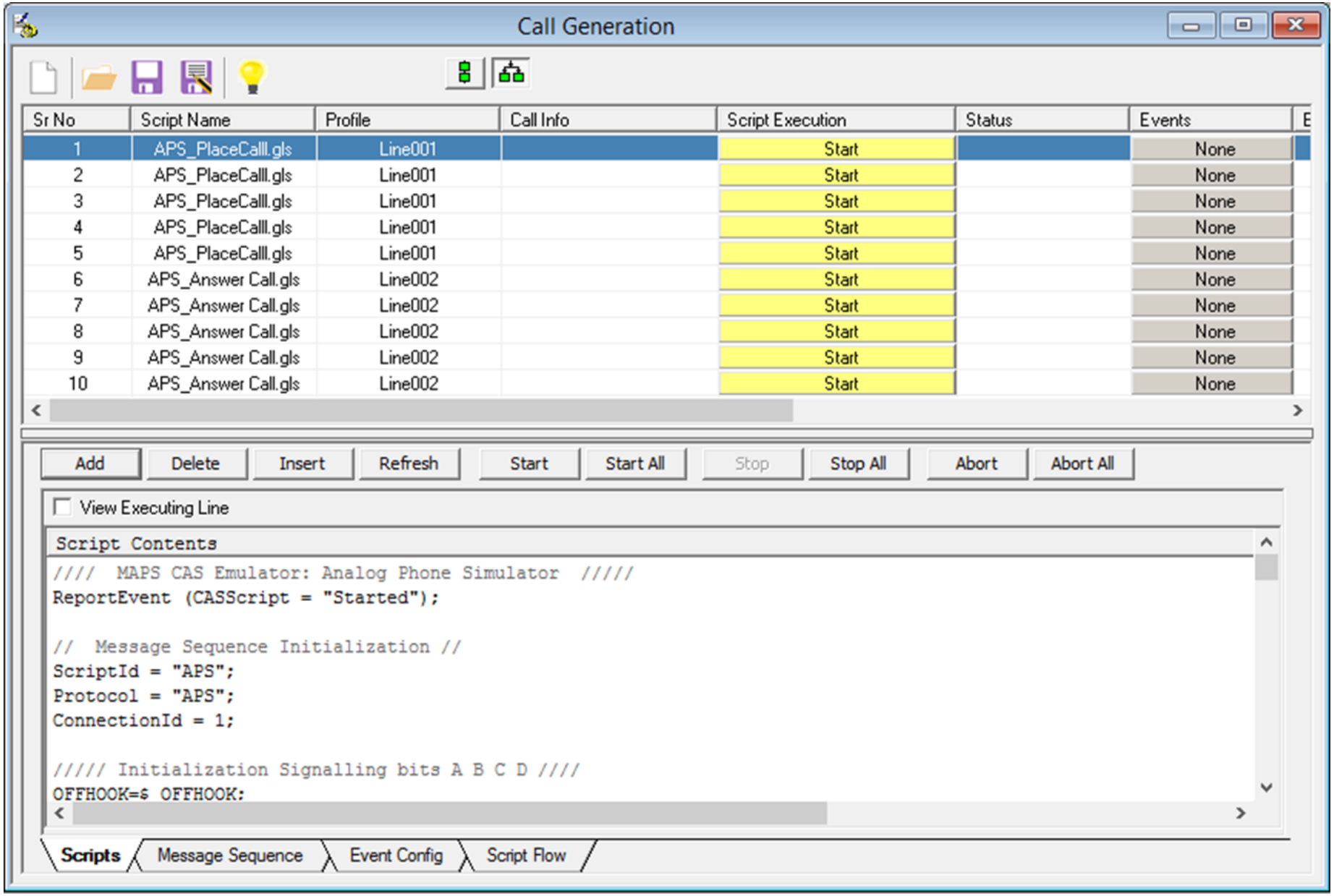
Voice Band Measurements for VG3 and VG6

Voiceband measurement on 4-wire and VF ports includes below tests:

- Signal-to-Noise Ratio and Level
- Three Tone Slope (Gain Slope)
- C Notched Noise (CNN) Test
- Attenuation Distortion
- 1004 Hz Net Loss
- Intermodulation Distortion (IMD)
- Impulse Noise
- Voice Quality Test

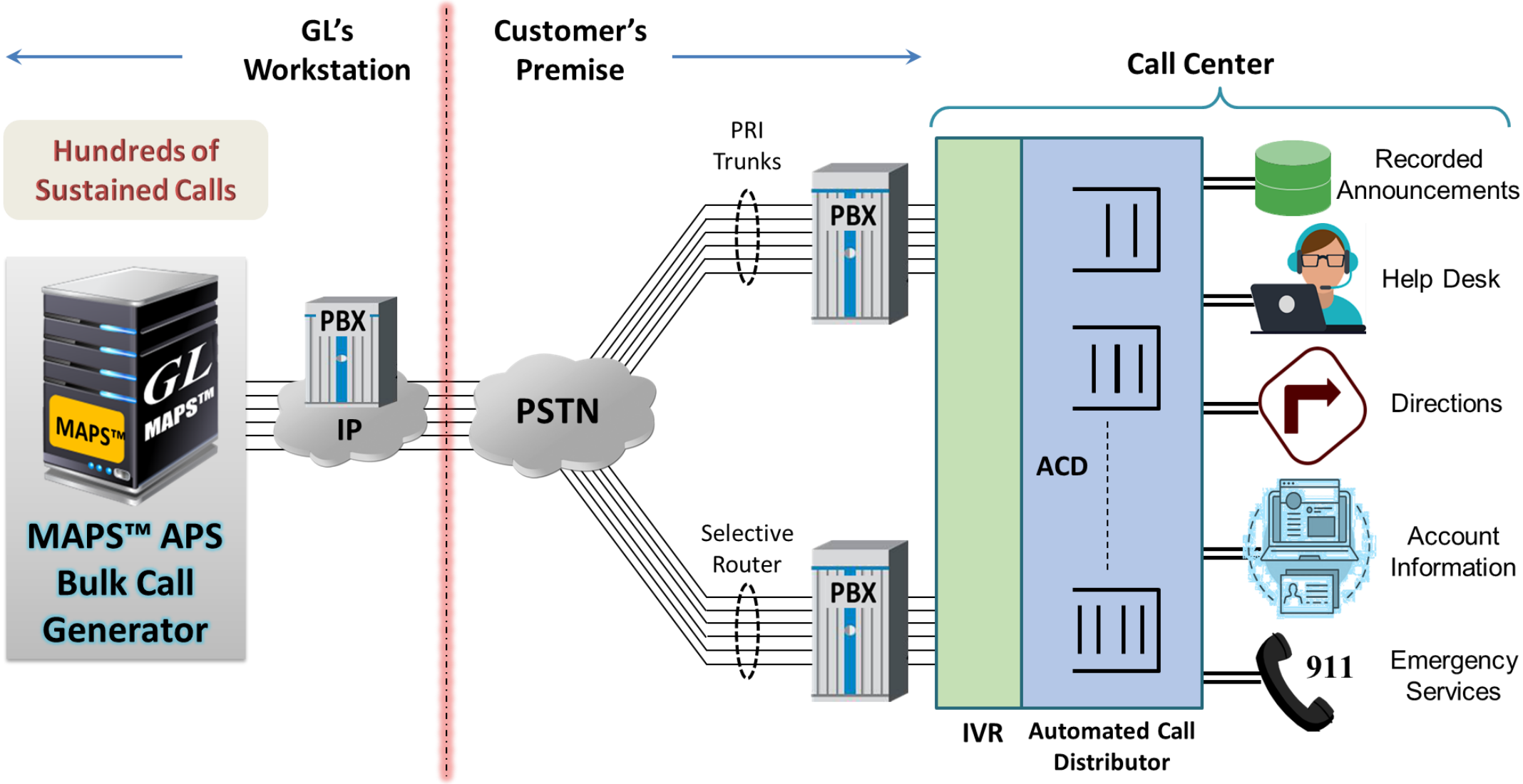
GL Communications

Bulk Call Generation



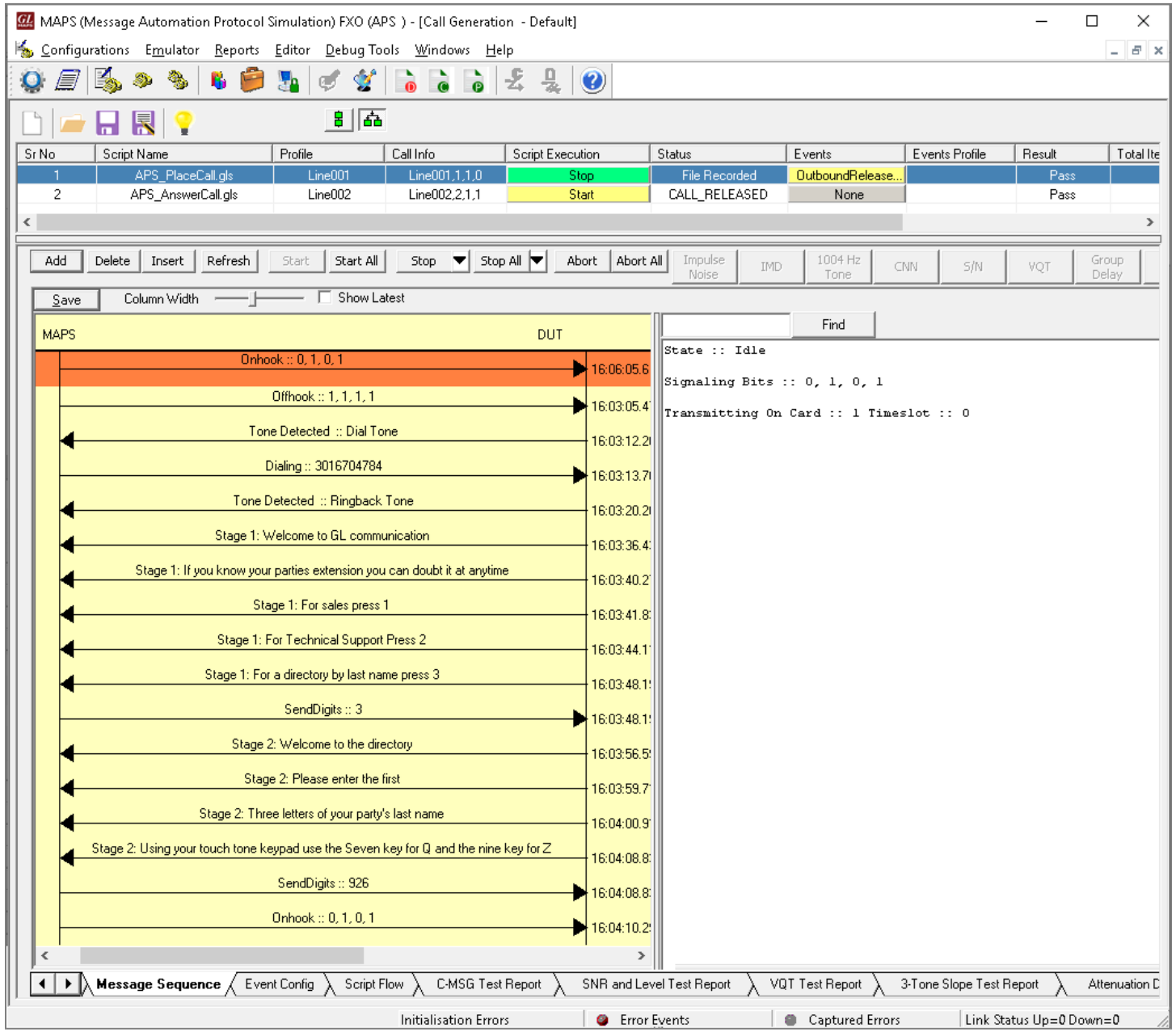
GL Communications

MAPS™ APS Speech to Text IVR



GL Communications

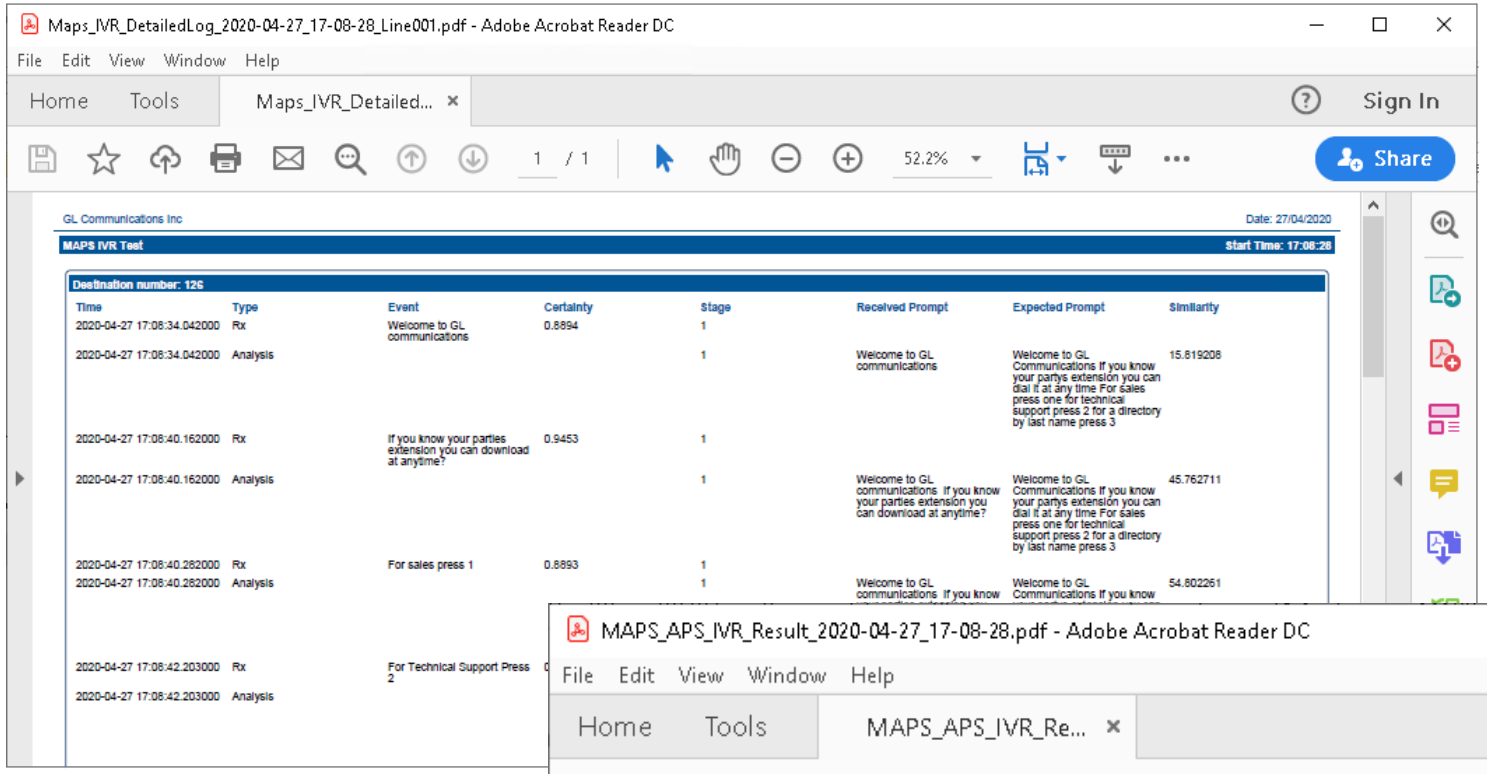
IVR Call Emulation



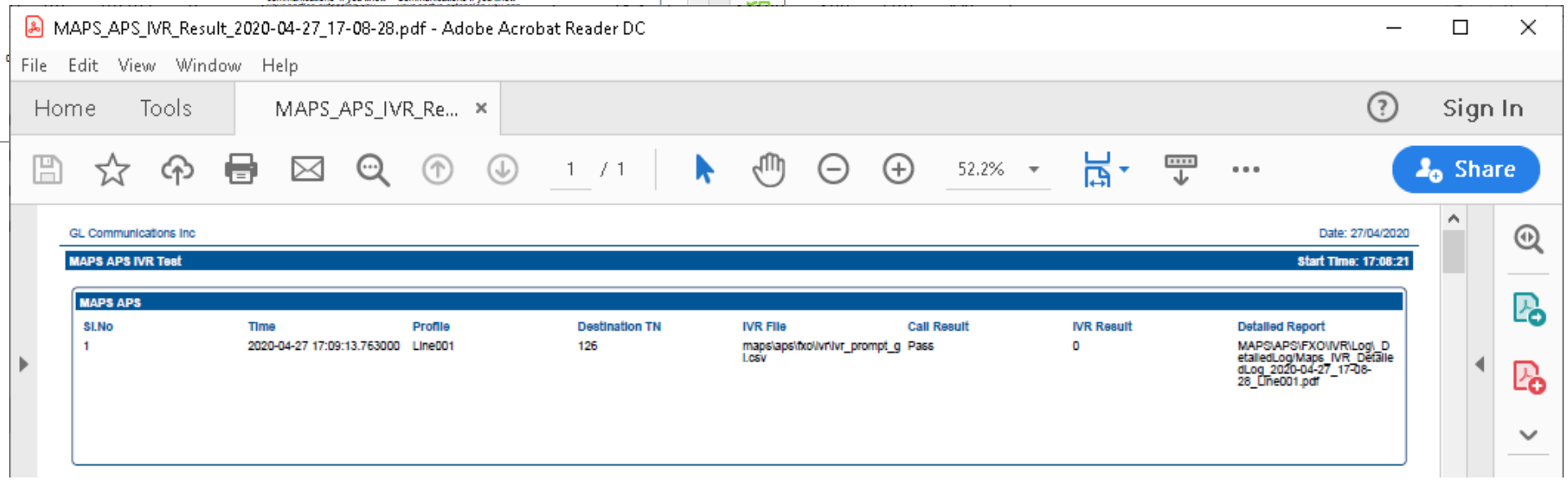
GL Communications

IVR Result Logs

APS IVR Detailed Result Log



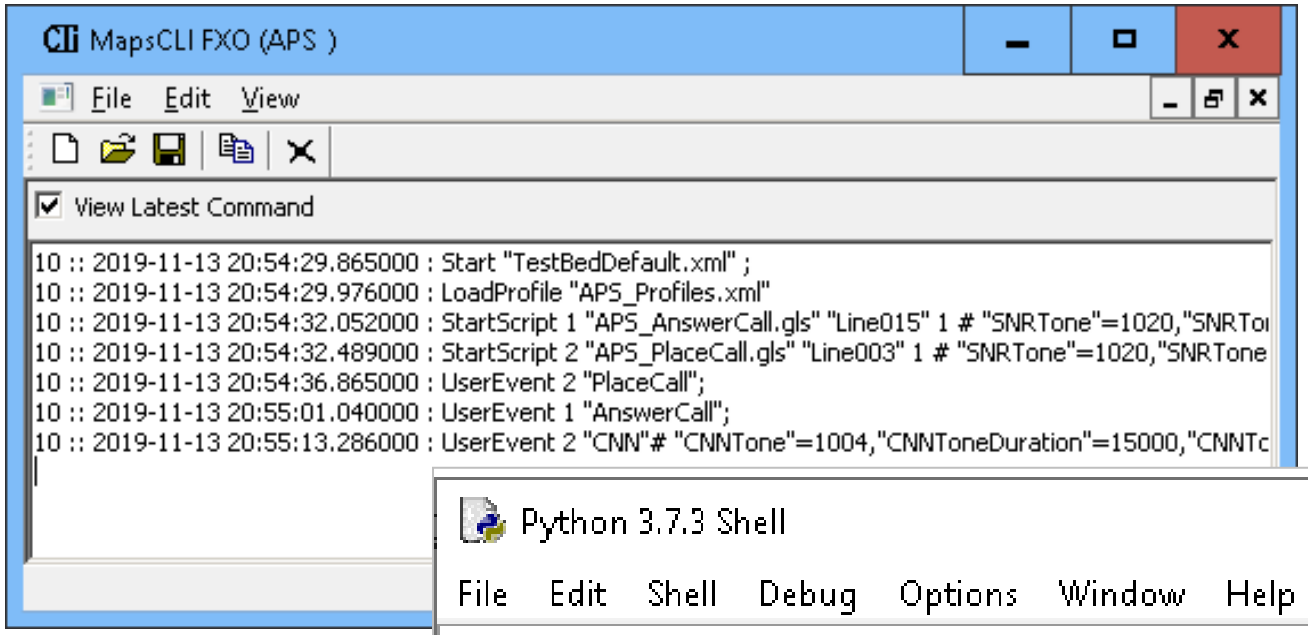
APS IVR Main Result Log



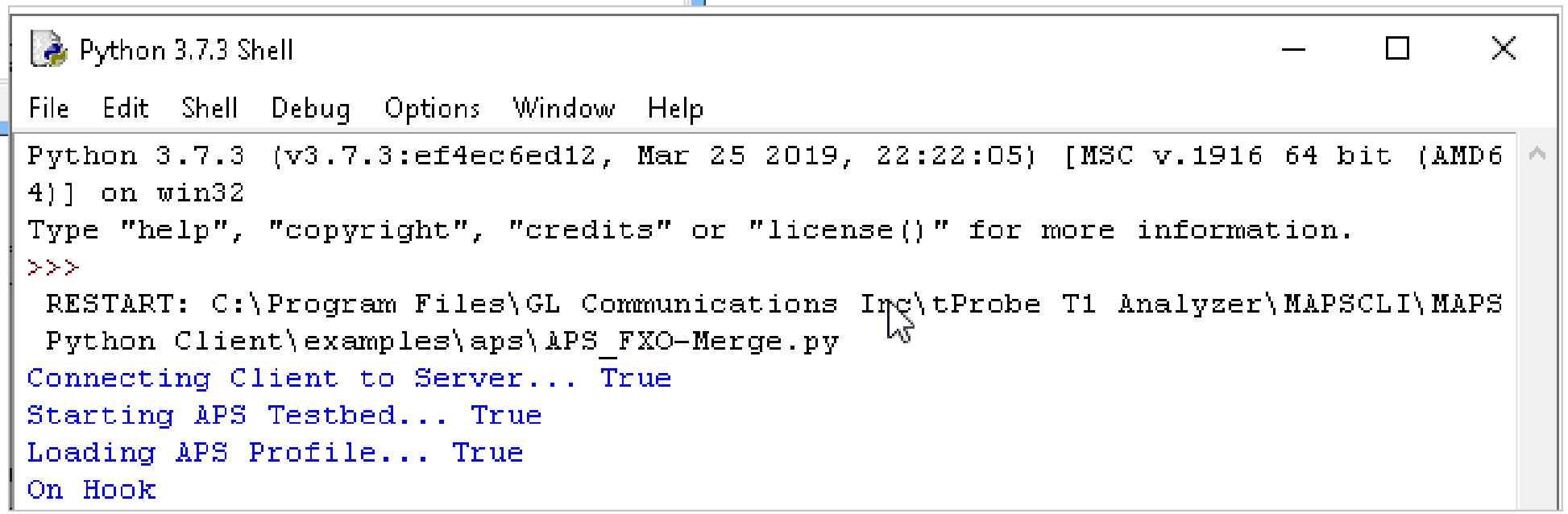
GL Communications

CLI Support

MAPS CLI Server



Sample Python CLI Script



Thank you