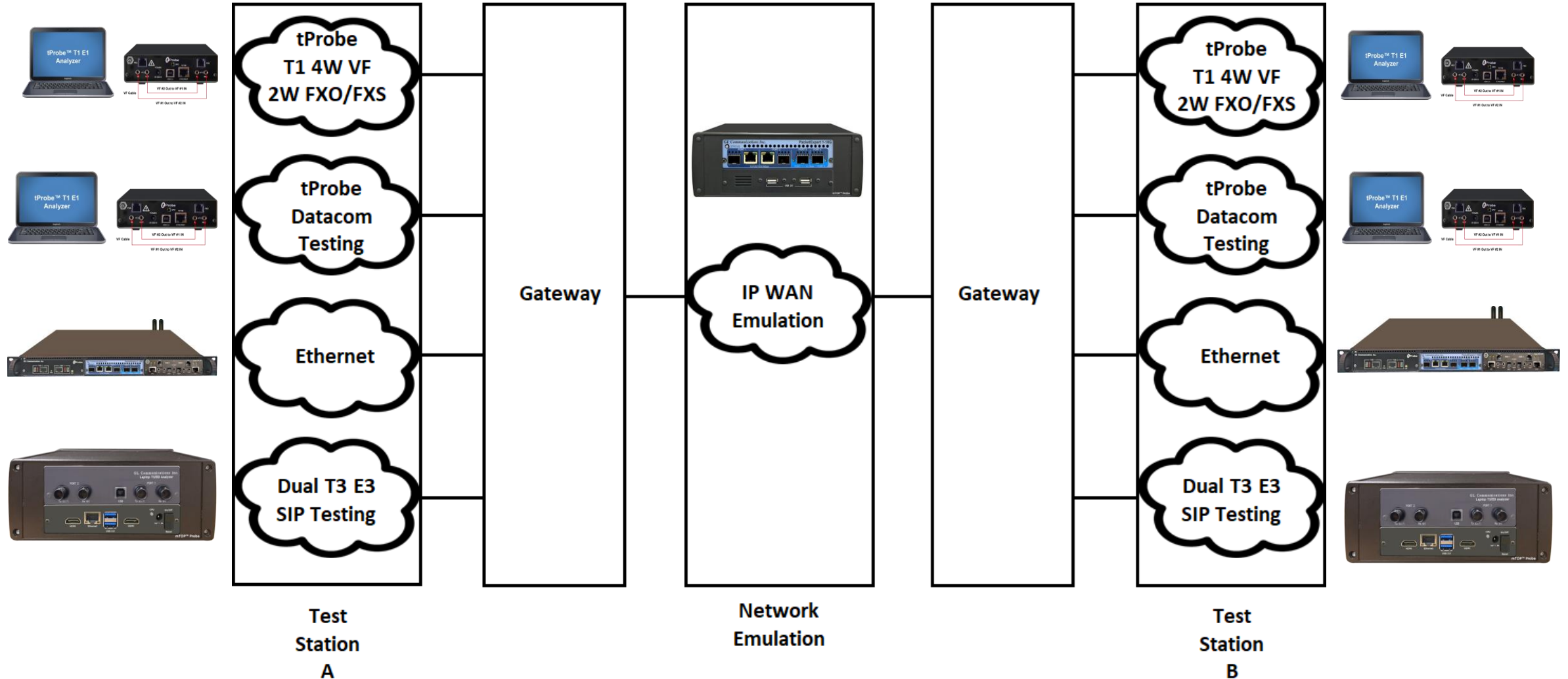

Voiceband Measurements Using 4-Wire VF and 2-Wire FXO FXS Interfaces for VG3 and VG6



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Overall Scope of FENS Testing



Connecting 4-Wire VF Ports on tProbe™ in Self Test

- The test procedure requires tProbe™ T1 Analyzer and optional MAPS™ APS Emulator licenses
- tProbe T1 Analyzer should be installed on the system
- Cross-connect VF ports with VF audio cables as shown below for self test

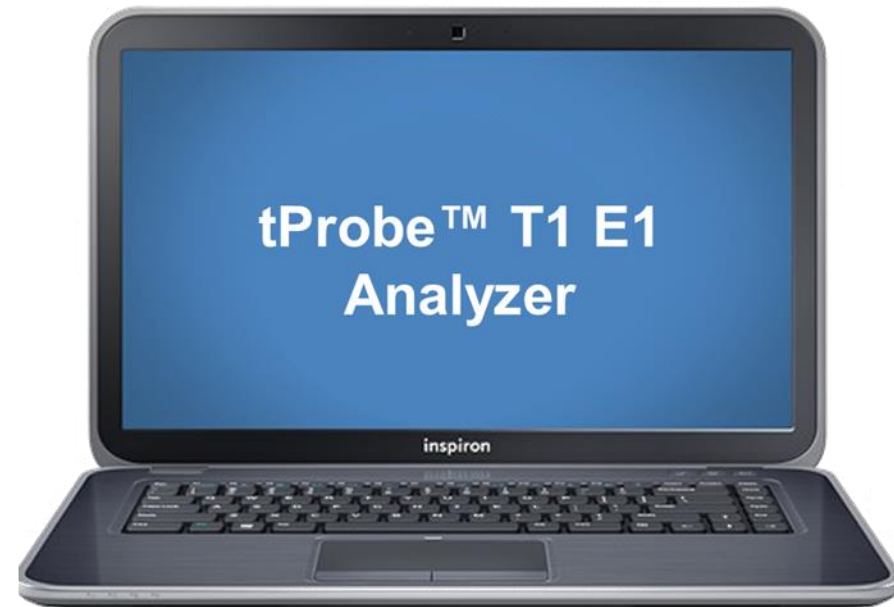
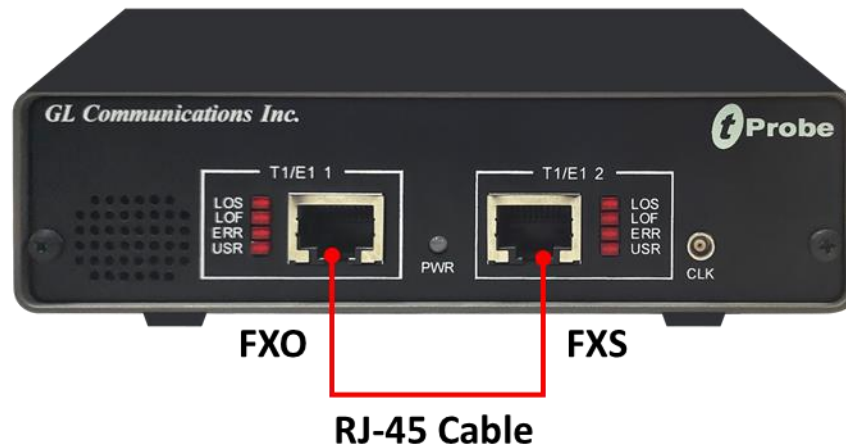
VF1 IN → VF2 OUT

VF2 IN → VF1 OUT



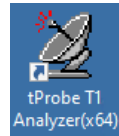
Connecting 2-Wire FXO FXS Ports on tProbe™ in Self Test

- The test procedure requires tProbe™ T1 Analyzer and optional MAPS™ APS Emulator licenses
- tProbe T1 Analyzer should be installed on the system
- Cross-connect FXO FXS ports with RJ-45 cable as shown below for self test



Invoking tProbe™ T1 Analyzer

- Invoke **tProbe T1 Analyzer** from the shortcut icon



created on the desktop or from the following path

C:\Program Files\GL Communications Inc\tProbe T1 Analyzer\UsbNGT1.exe

The screenshot shows the T1 tProbe Analyzer 64-bit software interface. The window title is "T1 tProbe Analyzer 64-bit". The menu bar includes File, Config, View, Monitor, IntrusiveTest, Special Applications, Window, and Help. The main area is divided into several sections:

- Port Configuration Table:**

Port	Framing	Loopback	Termination	Clock	B8ZS	Cross-port
1	ESF (193E)	No Loopback	Terminate	Internal	On	Normal
2	ESF (193E)	No Loopback	Terminate	Internal	On	Normal

- T1/E1 Alarms Table:**

Reset	All Ports	#1	#2
Sync Loss	✗	✓	✗
Bipolar Violation	✓	✓	✓
Carrier Loss	✗	✓	✗
Frame Error	✓	✓	✓
Blue Alarm	✓	✓	✓
Yellow Alarm	H	H	✓
AIS	✓	✓	✓

- T1/E1 Statistics Table:**

Frequency (Hz)	Level (dBdsx)	#1	#2
1543999	0.115	----	----
BPV Errors	0	0	0
CRC Errors	0	0	0
Frame Errors	0	0	0
Transmit Under Run	0	0	0
Receive Over Run	0	0	0
==Bit/Frame Clock Slip==			

- T1/E1 Alarms Logging** (empty table)
- Card 1 Configuration:** VF (Audio), Tx (VF In) Gain(dB) 0.0 dB, TS, Insert, Speaker, Rx (VF Out) Gain(dB) 0.0 dB, Drop, Speaker, Set 0-dB.
- Central Panel:** A red banner for "tProbe™ T1 Analyzer" featuring the GL Communications Inc. logo, contact information (818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878, USA), and copyright notice (Copyright © 2018 GL Communications Inc. All rights reserved.).

Invoking GL Server

Start GL Server

- Open the WCS Server: **Special Applications** → **Windows Client Server (WCS)** → **WCS Server**
- WCS server allows automation of voiceband testing measurements

The screenshot shows the T1 tProbe Analyzer 64-bit (Administrator) software interface. The 'Special Applications' menu is open, showing 'Windows Client Server (WCS)' selected, with a sub-menu showing 'WCS Server' selected. The interface includes a table for T1/E1 Alarms, T1/E1 Statistics, and T1/E1 Alarms Logging.

Port	Framing	Loopback
1	ESF (193E)	No Loopback
2	ESF (193E)	No Loopback

T1/E1 Alarms		
Reset	All Ports	#1
Sync Loss		✓
Bipolar Violation		✓
Carrier Loss		✓
Frame Error		✓
Blue Alarm		✓
Yellow Alarm		✓
AIS		✓

T1/E1 Statistics		
Frequency (Hz)	154399	1000000
Level (dBdsx)	0.172	0.058
BPV Errors	0	0
CRC Errors	0	0
Frame Errors	0	0
Transmit Under Run	0	0
Receive Over Run	0	0
==Bit/Frame Clock Slip==		

T1/E1 Alarms Logging	
<input type="checkbox"/> Alarm Logging	C:\Program Files\GL Communications Inc\tProbe T1 /

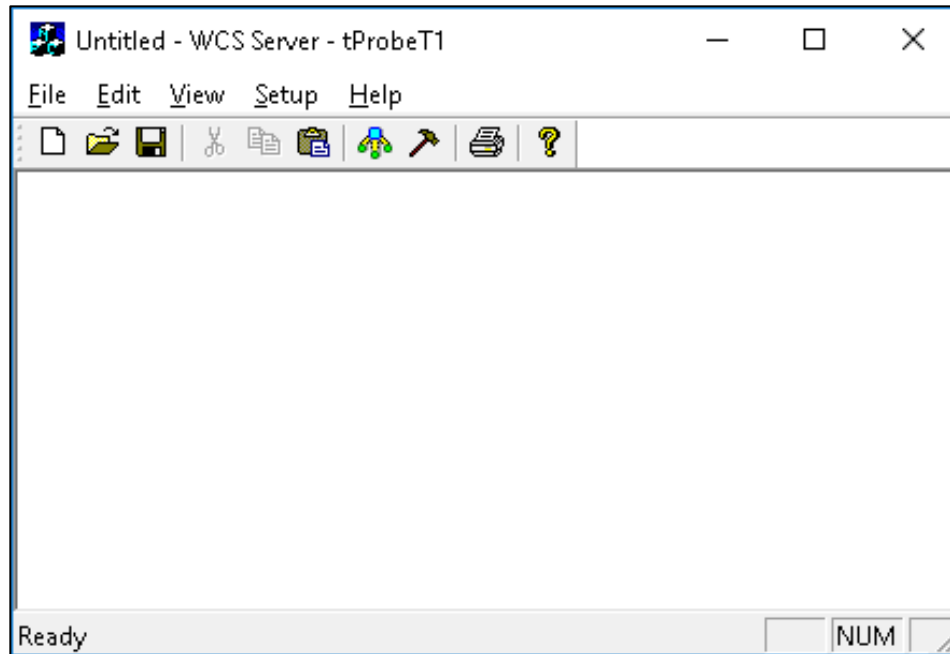
Graph	
<input type="checkbox"/> Online Graph	<input type="checkbox"/> Offline Graph
<input type="checkbox"/> Enable Event Graph	

Launch WCS Server

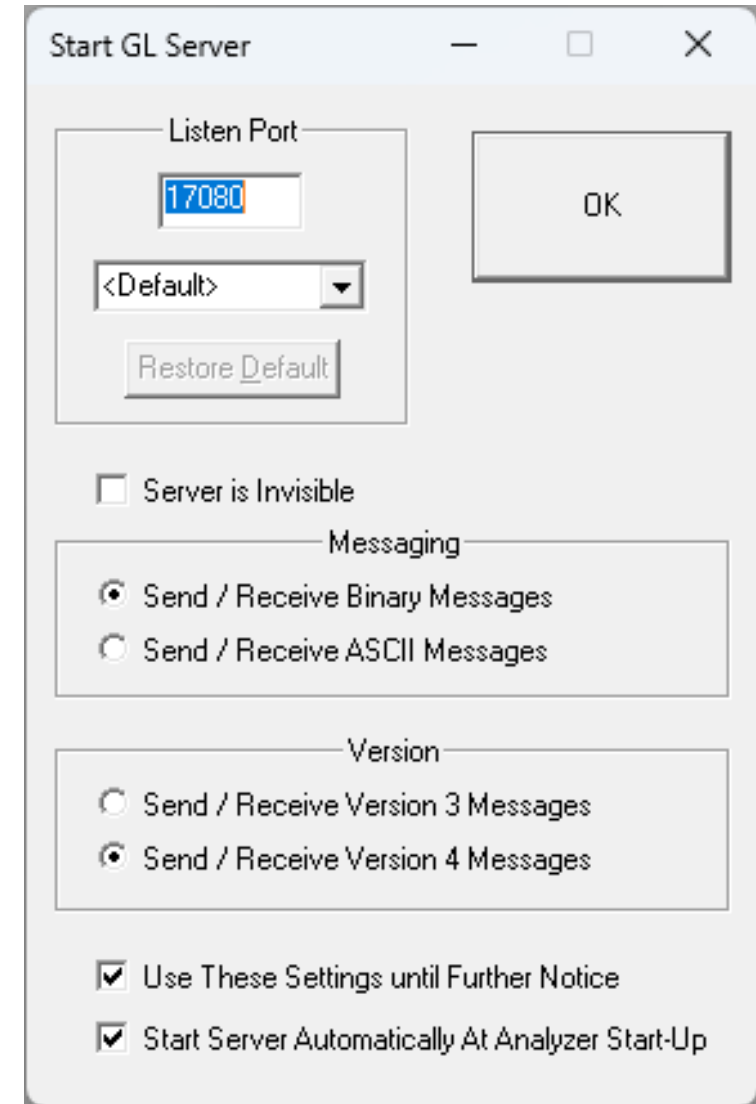
GL Server Settings

Start GL Server

- Listen Port = 17080 for T1 (17090 for E1)
- Messaging = Binary
- Version = 4
- Click OK to start GL server



WCS Server Window



Invoke MAPS™ APS Emulator (Client)

- From the **tProbe T1 Analyzer**, select **Special Applications** → **Protocol Emulation** → **MAPS APS Emulator** to invoke MAPS APS Emulator (client)
- This client passes commands to the WCS server

The screenshot shows the T1 tProbe Analyzer 64-bit (Administrator) interface. The 'Special Applications' menu is open, and 'MAPS - APS Emulator' is selected. The interface includes a table for port configuration, T1/E1 Alarms, T1/E1 Statistics, and T1/E1 Alarms Logging.

Port	Framing	Loopback
1	ESF (193E)	No Loopback
2	ESF (193E)	No Loopback

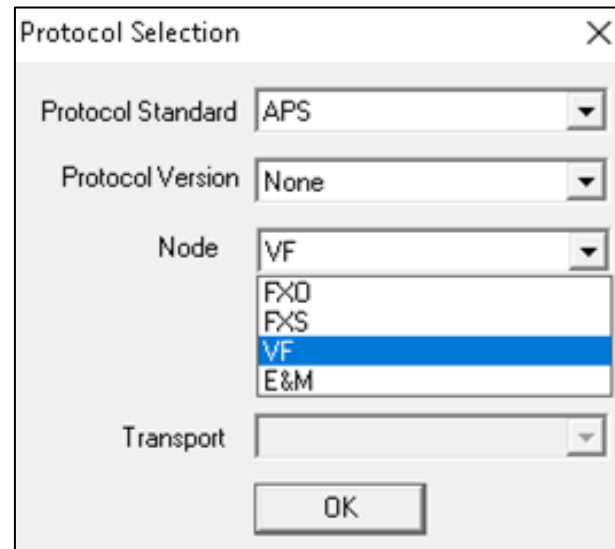
T1/E1 Alarms		
Reset	All Ports	#1
Sync Loss	✓	✓
Bipolar Violation	✓	✓
Carrier Loss	✓	✓
Frame Error	✓	✓
Blue Alarm	✓	✓
Yellow Alarm	✓	✓
AIS	✓	✓

T1/E1 Statistics		
Frequency (Hz)		15439%
Level (dBdsx)		0.34
BPV Errors		
CRC Errors	0	0
Frame Errors	0	0
Transmit Under Run	0	0
Receive Over Run	0	0
==Bit/Frame Clock Slip==		

Procedure for 4-Wire VF Voiceband Measurement Test

Protocol Selection 4-Wire VF

- Protocol Selection window is prompted after invoking **MAPS™ APS Emulator**, select the following:
 - Protocol Standard - APS
 - Protocol Version - None
 - Node - VF
- Click **OK** to continue



Configure Testbed in MAPS™ APS Emulator

- By default, it will display Testbed Setup window
- Observe that default Testbed Setup is displayed. Verify the highlighted settings to get started with the testing
- Click on **Start** to start the Testbed setup

MAPS (Message Automation Protocol Simulation) VF (APS) - [Testbed Setup - TestBedDefault]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config	Value	<input checked="" type="checkbox"/> Enable
Configurations		
GL Server Configuration		
Interface	T1	
WCS Listener Port	17080	
Server IP Address	127.0.0.1	
Port Configuration		
T1E1 Port Configuration	2	
T1E1 Port Configurati...		
Port Number	1	
T1E1 Port Configurati...		
Port Number	2	
Database Connection Param...		
Enable Connect To Datab...	Enable	
Database IP Address	192.168.12.81	
Database Port	20019	
Database Probe Name	APS_248	
End User Configurations	VF_Profiles.xml	

Procedure to Load and Configure the Global Profile

- Global Profiles is used to configure test parameters for all VF lines
- On the MAPS Client main GUI, select **Configurations** → **Global Configuration**
- Click on open icon and select **GlobalProfile_VBM_FENS** and click on **OK**
- In the Global configuration window, select the required test. Test parameters can be configured for all the tests
- **VG6 or VG3 circuit** can be selected. The selection will be applied for all the tests
- **VG6 and VG3 Pass/Fail** Requirement are configured in Global profiles for all the tests. User can edit the Pass/Fail criteria

MAPS (Message Automation Protocol Simulation) VF (APS) - [Global Configuration - Globalprofile]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config Value

Config	Value
Global Configuration	
Digit Parameters	
Type Of Digit	DTMF
Digit On Time in msec	80
Digit Off Time in msec	80
Power1 in db	-10
Power2 in db	-10
Receive file naming convention	DateT...
Voiceband Measurement	
Traffic Options	
Record Call	Disable
VG6 VG3 circuit Selection	VG6
Voiceband Measurement Parameters	
Tone 1004 Hz Net Loss Test Parameters	
Tone Power in dBm	-13
Tone Duration in ms	10000
Report Frequency in ms	1000
VG3 Pass Fail Requirement	
Min Pass Power	1.00
Max Pass Power	1.00
VG6 Pass Fail Requirement	
Min Pass Power	1.50
Max Tone Power	1.50
Attenuation Distortion Parameters	
Tone Power in dBm	-13.0
Tone Duration in ms	2000
VG3 Pass Fail Requirement	
Min Pass Power	1.00

_VG6VG3Selection

Select Option

VG6

Apply Edit

Initialisati

Procedure to Load and Configure Global Profile (Contd.)

- Auto Measurement Test parameters allow users to automate voiceband measurement tests and select which test(s) to run. Call disconnects automatically upon completion
- After making changes to Global Profile, Click on **Apply** icon
- Close the Global Profile window

MAPS (Message Automation Protocol Simulation) VF (APS) - [Global Configuration - Globalprofile]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config

Config	Value
Min Pass Power	1.00
Max Pass Power	1.00
VG6 Pass Fail Requirement	
Min Pass Power	0.00
Max Pass Power	1.50
VQT Parameters	
Reference File	C:\VQT_Reference\VQuad_Aut...
Degraded File Path	C:\VQT_Degraded\1u\
VQT Server IP Address	127.0.0.1
One Way Delay Measurement	Enable
Auto Measurement Test	
Enable Auto Measurement	False
Disconnect Call on Test Completi...	Enable
Tone 1004 Hz Net Loss	Enable
Attenuation Distortion	Enable 504-2504 Hz
Three Tone Slope	Enable
CNN Test	Enable
Intermodulation Distortion	Enable
Group Delay	Disable
Phase Jitter	Disable
Impulse Noise	Enable
Signal to Noise Test	Enable
VQT	Enable
Log Results	Enable
Log Path	MAPS\APS\VF\Log\Voiceband...
VQT Parameters	
VQT Database Path	\\127.0.0.1\DataImport\VQT.mdb
VQT Type	POLQA

_EnableAutoVBM
Select Option
False

Apply Edit

Initialisat

Procedure to Start MAPS™ APS VF

- Click on **Start All** button to start both VF_Originating.gls and VF_Terminating.gls
- Observe that both the scripts are started (indicating Green color) and the VF_Originating status is displayed as “Select Voiceband Measurement Test”
- Now, user clicks on the required test button. For example, click on ‘Impulse Noise’ button to run the Impulse Noise test

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result	Total Iterations	Completed
1	VF_Originating.gls	Port01	1,1	Stop	Select Voiceband Measurement Test	OutboundReleaseCall		Pass	1	
2	VF_Terminating.gls	Port02	2,1	Stop	Ready for Voiceband Measurement	InboundReleaseCall		Pass	1	

Control Panel Buttons: Add, Delete, Insert, Refresh, Start, Start All, Stop, Stop All, Abort, Abort All

Test Selection Buttons: 1004 Hz Net Loss, 3-Tone Slope, CNN, IMD, Group Delay, Phase Jitter, Impulse Noise, S/NR, VQT

Procedure to Perform Voiceband Measurement Tests

- The **VF_Originating.gls** and **VF_Terminating.gls** will set up a call between **Port01** and **Port02**
- **VF_Originating.gls** script has the options to perform various voiceband measurement tests
- Click on any of the voiceband measurement test buttons to start a test. Note the **VF_Originating.gls** status indicates “Select Voiceband Measurement Test” and the **VF_Terminating.gls** status indicates “Ready for Voiceband Measurement”
- Voiceband Measurement tests can only be started from the **VF_Originating.gls**

The screenshot displays the MAPS (Message Automation Protocol Simulation) VF (APS) interface. The top window shows the test execution table with the following data:

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events...	Result	Total Iterations	Completed Iterations
1	VF_Originating.gls	Port01	Port01.1.1.1	Stop	Select Voiceband Measurement Test	OutboundReleaseCall		Pass	1	0
2	VF_Terminating.gls	Port02	Port02.2.2.1	Stop	Ready for Voiceband Measurement	InboundReleaseCall		Pass	1	0

The main window shows a message sequence diagram between MAPS and DUT. The sequence includes:

- MAPS sends VBM_3TONE_SLOPE to DUT at 15:40:47.015000.
- DUT sends ACK to MAPS at 15:40:48.800000.
- MAPS sends 3-Tone Slope :: 404Hz @ Level :: -13.0 dBm to DUT at 15:40:56.328000.
- MAPS sends 3-Tone Slope :: 1004Hz @ Level :: -13.0 dBm to DUT at 15:41:03.349000.
- MAPS sends 3-Tone Slope :: 2804Hz @ Level :: -13.0 dBm to DUT at 15:41:10.368000.
- DUT sends VBM_3TONE_SLOPE to MAPS at 15:41:17.296000.
- DUT sends ACK to MAPS at 15:41:17.612000.
- MAPS sends Freq = 405 Hz, Power Level = -13.9 dBm to DUT at 15:41:22.131000.
- MAPS sends Freq = 1005 Hz, Power Level = -13 dBm, 404Hz Gain Slope = 0.9 to DUT at 15:41:29.130000.
- MAPS sends Freq = 2806 Hz, Power Level = -12.9 dBm, 2804Hz Gain Slope = -0.1 to DUT at 15:41:36.131000.
- DUT sends FIN to MAPS at 15:41:42.145000.
- DUT sends ACK to MAPS at 15:41:42.451000.

The right panel shows the details of the selected event: Frequency :: 1153 Hz, Power :: -13.0 dBm, Duration :: 300 ms.

Test Results

- Test results are shown in the respective tabs as shown in the screenshot

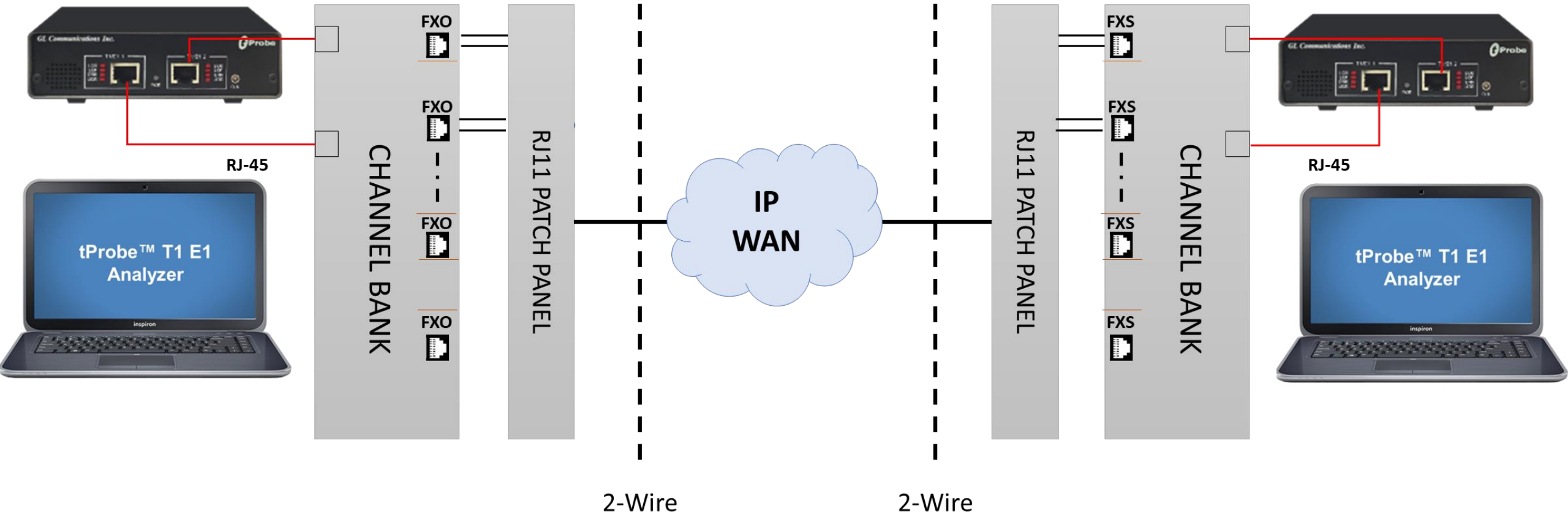
Date/Time	Circuit Selected	Freq (Hz)	Power (dBm)	404Hz Gain Slope	2804Hz Gain Slope	VG3(6) Criteria	VG3(6) Test Result
2024-3-5 15:41:22	VG3	405	-13.90			Pass Power -14 to -9 dBm	Pass
2024-3-5 15:41:29	VG3	1005	-13.00	0.90		Pass Power -14 to -9 dBm	Pass
2024-3-5 15:41:36	VG3	2806	-12.90		-0.10	Pass Power -14 to -9 dBm	Pass

Navigation tabs: Scripts, Message Sequence, Event Config, Script Flow, Capture Events, 1004 Hz Net Loss Report, Attenuation Distortion Test Report, **3-Tone Slope Test Report**, Signal/C-Notch Noise Test Report, Intermodulation Distortion T

Status: Initialisation Errors, Error Events, Captured Errors, Link Status Up=0 Down=0

Procedure for 2-Wire FXO FXS Voiceband Measurement Test

MAPS™ APS 2-Wire FXO FXS Setup



Invoke MAPS™ APS Emulator (Client)

- From the **tProbe T1 Analyzer**, select **Special Applications** → **Protocol Emulation** → **MAPS APS Emulator** to invoke MAPS™ APS Emulator (client)
- This client passes commands to the WCS server

The screenshot shows the T1 tProbe Analyzer 64-bit (Administrator) interface. The 'Special Applications' menu is open, and 'MAPS - APS Emulator' is selected. The interface includes a menu bar (File, Config, View, Monitor, IntrusiveTest, Special Applications, Window, Help), a table of ports, T1/E1 Alarms, T1/E1 Statistics, T1/E1 Alarms Logging, and a Graph section.

Port	Framing	Loopback
1	ESF (193E)	No Loopback
2	ESF (193E)	No Loopback

T1/E1 Alarms		
Reset	All Ports	#1
Sync Loss	✓	✓
Bipolar Violation	✓	✓
Carrier Loss	✓	✓
Frame Error	✓	✓
Blue Alarm	✓	✓
Yellow Alarm	✓	✓
AIS	✓	✓

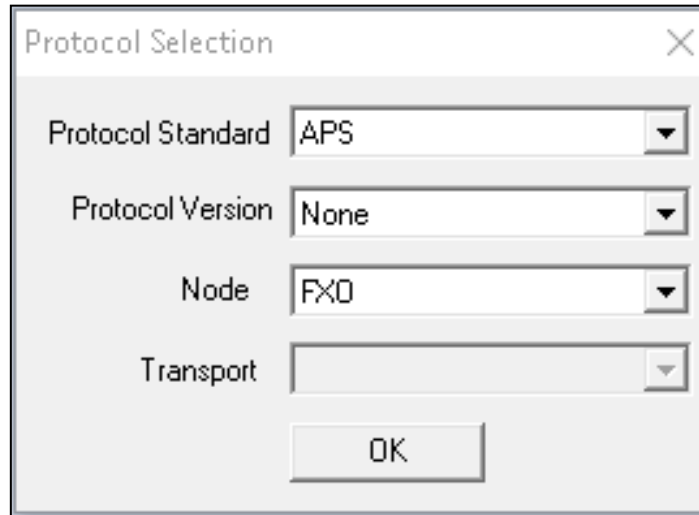
T1/E1 Statistics		
Frequency (Hz)		154399
Level (dBdsx)		0.34
BPV Errors		
CRC Errors	U	U
Frame Errors	0	0
Transmit Under Run	0	0
Receive Over Run	0	0
==Bit/Frame Clock Slip==		

T1/E1 Alarms Logging	
<input type="checkbox"/> Alarm Logging	C:\Program Files\GL Communications Inc\tProbe T1 Analyzer\

Graph	
<input type="checkbox"/> Online Graph	<input type="checkbox"/> Offline Graph
<input type="checkbox"/> Enable Event Graph	

Protocol Selection 2-Wire FXO

- Protocol Selection window is prompted, select the following:
 - Protocol Standard - **APS**
 - Protocol Version - **None**
 - Node - **FXO**
- Click **OK** to continue



The image shows a screenshot of a 'Protocol Selection' dialog box. The dialog box has a title bar with the text 'Protocol Selection' and a close button (X) on the right. Inside the dialog, there are four dropdown menus arranged vertically. The first dropdown is labeled 'Protocol Standard' and is set to 'APS'. The second dropdown is labeled 'Protocol Version' and is set to 'None'. The third dropdown is labeled 'Node' and is set to 'FXO'. The fourth dropdown is labeled 'Transport' and is currently empty. Below the dropdown menus is an 'OK' button.

Configure Testbed in FXO

- By default, it will display Testbed Setup window
- Observe that default Testbed Setup is displayed. Verify the highlighted settings to get started with the testing
- Click on **Start** to start the Testbed setup

Config	Value	<input checked="" type="checkbox"/> Enable
Configurations		
- GL Server Configuration		
Interface	T1	
WCS Listener Port	17080	
Server IP Address	127.0.0.1	
- Port Configuration		
T1E1 Port Configuration	1	
T1E1 Port Configuration 1		
Port Number	1	
Start Timeslot	0	
End Timeslot	23	
- Signaling Bits		
Ringing	0000	
Offhook	1111	
Onhook	0101	
End User Configurations	APS_Profiles.xml	

Procedure to Load and Configure the Global Profile

- Global Profiles is used to configure test parameters for all FXO lines
- On the MAPS Client main GUI, select **Configurations** → **Global Configuration**
- Click on open icon and select **GlobalProfile_VBM_FENS** and click on **OK**
- In the Global configuration window, select the required test. Test parameters can be configured for all the tests
- **VG6 or VG3 circuit** can be selected. The selection will be applied for all the tests
- **VG6 and VG3 Pass/Fail Requirement** are configured in Global profiles for all the tests. User can edit the Pass/Fail criteria

MAPS (Message Automation Protocol Simulation) FXO (APS) - [Global Configuration - Globalprofile_VBM...]

Configurations Emulator Reports Editor Debug Tools Windows Help

Config	Value
Random Inter Call Duration	
Minimum inter call duration in ms	3000
Maximum inter call duration in ms	6000
Receive File Naming Convention	DateTimeStamp
Voiceband Measurement	
Traffic Options	
Record Call	Disable
VG6 VG3 Circuit Selection	VG6
Voiceband Measurement Parameters	
Tone 1004 Hz Net Loss Test Parameters	
Tone Power in dBm	-13
Tone Duration in ms	10000
Report Frequency in ms	1000
VG3 Pass Fail Requirement	
Min Pass Power	1.50
Max Pass Power	1.50
VG6 Pass Fail Requirement	
Min Pass Power	1.50
Max Tone Power	1.50
Attenuation Distortion Parameters	
Tone Power in dBm	-13.0
Tone Duration in ms	2000
VG3 Pass Fail Requirement	
Min Pass Power 304 to 3004 Hz	1.30
Max Pass Power 304 to 3004 Hz	5.00
Min Pass Power 404 to 2804 Hz	1.30
Max Pass Power 404 to 2804 Hz	3.00
Min Pass Power 504 to 2504 Hz	1.30
Max Pass Power 504 to 2504 Hz	3.00
VG6 Pass Fail Requirement	
Min Pass Power 304 to 3004 Hz	1.30

_VG6VG3Selection

Select Option

VG6

Apply Edit

Initialisation Errors Error Events C

Procedure to Load and Configure Global Profile (Contd.)

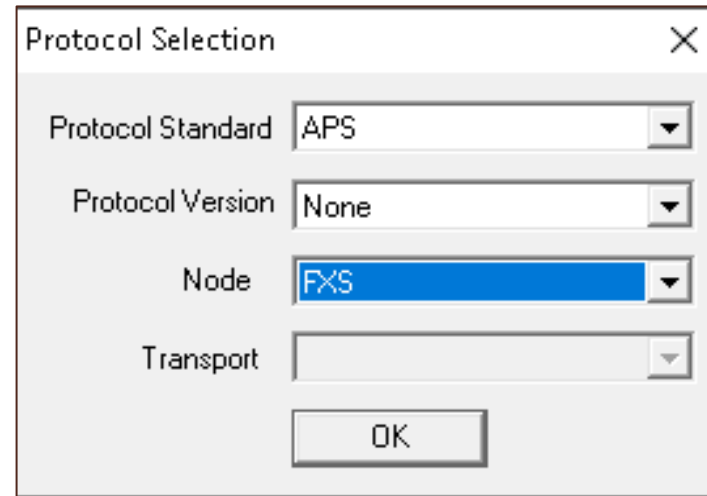
- Auto Measurement Test parameters allow users to automate voiceband measurement tests and select which test to run. Call disconnects automatically upon completion
- After making changes to Global Profile. Click on **Apply** icon
- Close the Global Profile window

The screenshot displays the MAPS (Message Automation Protocol Simulation) FXO (APS) - [Global Configuration - Globalprofile_VBM...] window. The window title bar includes the application name and standard window controls. The menu bar contains 'Configurations', 'Emulator', 'Reports', 'Editor', 'Debug Tools', 'Windows', and 'Help'. The toolbar features various icons for file operations and help. The main area is divided into a 'Config' tree on the left and a detailed view on the right. The 'Config' tree shows a hierarchy of parameters, with 'Auto Measurement Test' expanded. The 'Enable Auto Measurement' parameter is selected and highlighted in blue, with its value set to 'True'. Other parameters include 'VG6 Pass Fail Requirement' (Min Pass Power: 1.50, Max Pass Power: 1.50), 'VQT Parameters' (Reference File, Degraded File Path, VQT Server IP Address, One Way Delay Measurement), 'Log Results', 'Log Path', 'VQT Parameters' (VQT Database Path, VQT Type), and 'Speech to Text' (Status, Database Path, Report Generation). The detailed view on the right shows the 'EnableAutoVBM' parameter set to 'True'. The 'Apply' button is highlighted with a red box.

Config	Value
VG6 Pass Fail Requirement	
Min Pass Power	1.50
Max Pass Power	1.50
VQT Parameters	
Reference File	C:\VQT_Reference\VQuad_Aut...
Degraded File Path	C:\VQT_Degraded\1u\
VQT Server IP Address	127.0.0.1
One Way Delay Measurement	Enable
Auto Measurement Test	
Enable Auto Measurement	True
Disconnect Call on Test Completion	Enable
Tone 1004 Hz Net Loss	Enable
Attenuation Distortion	Enable 304-3004 Hz
Three Tone Slope	Enable
CNN Test	Enable
Intermodulation Distortion	Enable
Group Delay	Disable
Phase Jitter	Disable
Impulse Noise	Enable
Signal to Noise Test	Enable
VQT	Disable
Log Results	Enable
Log Path	MAPS\APS\VF\Log\Voiceban...
VQT Parameters	
VQT Database Path	\\127.0.0.1\DataImport\VQT.m...
VQT Type	POLQA
Speech to Text	
Status	Disable
Database Path	C:\Program Files\GL Commu...
Report Generation	Enable

Protocol Selection 2-Wire FXS

- From the tProbe T1 Analyzer, select **Special Applications** → **Protocol Emulation** → **MAPS APS Emulator** to invoke MAPS APS Emulator (client)
- Protocol Selection window is prompted, select the following:
 - Protocol Standard - **APS**
 - Protocol Version - **None**
 - Node - **FXS**
 - Click **OK** to continue



Configure Testbed in FXS

- By default, it will display Testbed Setup window
- Observe that default Testbed Setup is displayed. Verify the highlighted settings to get started with the testing
- Click on **Start** to start the Testbed setup

The screenshot shows the MAPS (Message Automation Protocol Simulation) FXS (APS) - [Testbed Setup - ...] window. The window has a menu bar with 'Configurations', 'Emulator', 'Reports', 'Editor', 'Debug Tools', 'Windows', and 'Help'. Below the menu bar is a toolbar with various icons. The main area is divided into two panes. The left pane shows a configuration tree with the following structure:

Config	Value
Configurations	
GL Server Configuration	
Interface	T1
WCS Listener Port	17080
Server IP Address	127.0.0.1
Port Configuration	
T1E1 Port Configuration	1
T1E1 Port Configurati...	
Port Number	2
Start Timeslot	0
End Timeslot	23
Interface	FXS
End User Configurations	APS_Profiles.xml
Region	North America

The right pane is titled '_Interface' and contains a 'Select Option' dropdown menu with 'T1' selected. At the bottom right of the window, there are two buttons: 'Start' (highlighted with a red box) and 'Edit'.

Configuring Call Generation Window in FXS

- On MAPS™ APS FXS, select **Emulator** → **Call Generation**. This will invoke Call Generation window
- Click on **Open** icon, select **Default**, and click **OK**. This will load the Default configuration
- Now, select **Line025** to **Line048** (These belong to **T1 Port 2**)
- Click on **Start** to start FXS lines

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Ever
25	FXS_gls	Line025	2,0,125	Stop	Idle	Terminate	
26	FXS_gls	Line026	2,1,126	Stop	Idle	Terminate	
27	FXS_gls	Line027	2,2,127	Stop	Idle	Terminate	
28	FXS_gls	Line028	2,3,128	Stop	Idle	Terminate	
29	FXS_gls	Line029	2,4,129	Stop	Idle	Terminate	
30	FXS_gls	Line030	2,5,130	Stop	Idle	Terminate	
31	FXS_gls	Line031	2,6,131	Stop	Idle	Terminate	
32	FXS_gls	Line032	2,7,132	Stop	Idle	Terminate	
33	FXS_gls	Line033	2,8,133	Stop	Idle	Terminate	
34	FXS_gls	Line034	2,9,134	Stop	Idle	Terminate	
35	FXS_gls	Line035	2,10,135	Stop	Idle	Terminate	
36	FXS_gls	Line036	2,11,136	Stop	Idle	Terminate	
37	FXS_gls	Line037	2,12,137	Stop	Idle	Terminate	
38	FXS_gls	Line038	2,13,138	Stop	Idle	Terminate	
39	FXS_gls	Line039	2,14,139	Stop	Idle	Terminate	
40	FXS_gls	Line040	2,15,140	Stop	Idle	Terminate	
41	FXS_gls	Line041	2,16,141	Stop	Idle	Terminate	
42	FXS_gls	Line042	2,17,142	Stop	Idle	Terminate	

Procedure to Start Voiceband Measurement Tests in FXO

- On MAPS™ APS FXO GUI, select **Emulator** → **Call Generation**. This will invoke Call Generation window
- Click on **Open** icon, select **Default**, and click **OK**. This will load the Default configuration
- Now, select **Line001** and verify that it is loaded with **APS_PlaceCall.gls** script
- Similarly, **Line013** should be loaded with **APS_AnswerCall.gls** script
- Click on **Start** button to start both PlaceCall and AnswerCall script
- Observe that both the scripts are started (indicating Green color) and the PlaceCall status is displayed as “Select Voiceband Measurement Test”
- Now, user clicks on the required test button. For example, click on ‘3-Tone Slope’ button, to run the 3-Tone Slope test

The screenshot shows the 'Call Generation - singlecall' window. It features a toolbar with icons for file operations and a table with the following data:

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events Profile	Result
1	APS_PlaceCall.gls	Line001	Line001,1,1,0	Stop	Select Voiceband Measurement Test	OutboundRelease...		Pass
2	APS_AnswerCall.gls	Line013	Line013,13,1,12	Stop	Ready for Voiceband Measurement	InboundReleaseCall		Pass

Below the table is a toolbar with buttons: Add, Delete, Insert, Refresh, Start, Start All, Stop, Stop All, Abort, Abort All. A red box highlights the test buttons: 1004 Hz Net Loss, 3-Tone Slope, CNN, IMD, Group Delay, Phase Jitter, Impulse Noise, and S/NR.

Procedure to Start Voiceband Measurement Tests in FXO (Contd.)

- On MAPS™ APS FXO GUI, select **Emulator** → **Call Generation**. This will invoke Call Generation window
- Click on **Open** icon, select **Default**, and click **OK**. This will load the Default configuration
- Now, select **Line001** and verify that it is loaded with **APS_PlaceCall.gls** script
- Similarly, **Line002** should be loaded with **APS_AnswerCall.gls** script
- Click on **Start** button to start both PlaceCall and AnswerCall script
- Observe that both the scripts are started (indicating Green color) and the PlaceCall status is displayed as “Select Voiceband Measurement Test”
- Now, under **Events** column, user can select the required test. For example, select ‘3-Tone Slope’ to run the 3-Tone Slope test

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events...	Result	Total Iterations	Completed Iterations
1	APS_PlaceCall.gls	Line001	Line001,1,1,0	Stop	Select Voiceband Measurement Test	OutboundReleaseCall	OutboundReleaseCall		1	0
2	APS_AnswerCall.gls	Line002	Line002,2,1,1	Stop	Ready for Voiceband Measurement	InboundReleaseCall	OutboundReleaseCall			0

1004 Hz Net Loss 3-Tone Slope

S/NR VQT

Save Column Width Show Latest

MAPS DUT Fin

Procedure to Start Voiceband Measurement Tests in FXO (Contd.)

- The **APS_PlaceCall.gls** and **APS_AnswerCall.gls** will set up a call between **Line001** and **Line002**
- **APS_PlaceCall.gls** script has the options to perform various voiceband measurement tests
- Click on any of the voiceband measurement test buttons to start a test. Note that **APS_PlaceCall.gls** status indicates “Select Voiceband Measurement Test” and the **APS_AnswerCall.gls** status indicates “Ready for Voiceband Measurement”
- Voiceband Measurement tests can only be started from the **APS_PlaceCall.gls**

The screenshot displays the MAPS (Message Automation Protocol Simulation) FXO (APS) software interface. The main window shows a table of test execution results and a message sequence diagram.

Sr No	Script Name	Profile	Call Info	Script Execution	Status	Events	Events...	Result	Total Iterations	Completed Iterations
1	APS_PlaceCall.gls	Line001	Line001,1,1,0	Stop	Select Voiceband Measurement Test	OutboundReleaseCall		Pass	1	0
2	APS_AnswerCall.gls	Line002	Line002,2,1,1	Stop	Ready for Voiceband Measurement	InboundReleaseCall		Pass	1	0

The message sequence diagram shows the interaction between MAPS and DUT (Device Under Test) over time:

- Onhook :: 0, 1, 0, 1 (15:11:40.739000)
- Offhook :: 1, 1, 1, 1 (15:11:42.748000)
- Tone Detected :: Dial Tone (15:11:48.346000)
- Dialing :: 126 (15:11:48.350000)
- Tone Detected :: Ringback Tone (15:11:51.187000)
- Tone Detected :: Ringback Tone (15:11:57.181000)
- Path Verification (15:12:04.709000)
- Path Verification Ack (15:12:11.214000)

The right-hand pane shows the state of the DUT:

```
State :: Idle
Signaling Bits :: 0, 1, 0, 1
Transmitting On Card :: 1 Timeslot :: 0
```

The bottom of the interface shows various test reports and status indicators:

- Message Sequence
- Event Config
- Script Flow
- 1004 Hz Net Loss Report
- Attenuation Distortion Test Report
- 3-Tone Slope Test Report
- Signal/C-Notch Noise Test Report
- Intemodu
- Initialisation Errors
- Error Events
- Captured Errors
- Link Status Up=0 Down=0

Test Results

- Test results are shown in the respective tabs as shown in the screenshot

Date/Time	Circuit Selected	Freq (Hz)	Power (dBm)	404Hz Gain Slope	2804Hz Gain Slope	VG3(6) Criteria	VG3(6) Test Result
2020-7-16 14:48:07	VG3	405	-12.96			Pass Power -14 to -9	Pass
2020-7-16 14:48:14	VG3	1005	-12.97	-0.00		Pass Power -14 to -9	Pass
2020-7-16 14:48:21	VG3	2806	-12.97		-0.00	Pass Power -14 to -9	Pass

Navigation tabs: **3-Tone Slope Test Report** | Signal/C-Notch Noise Test Report | Intermodulation Distortion Test Report | Impulse Noise Test Report | S/NR/Net Loss vs Level Test Report | VQT T...

Summary: ● Initialisation Errors | ● Error Events | ● Captured Errors | ● Link Status Up=0 Down=0

Voiceband Measurements

Voiceband Measurements

Voiceband measurement includes below tests:

- Signal-to-Noise Ratio and Level
- Three Tone Slope (Gain Slope)
- 23-Tone Test
- Signal-to-C-Notched Noise Test
- Attenuation Distortion
- 1004 Hz tone
- Intermodulation Distortion (IMD)
- Impulse Noise
- VQT

Synchronization Codes

- Frequencies are used by MAPS™ APS FXO scripts to synchronize the transmit and receive actions of each test

S/NR/Net Loss vs Level Synchronization Tones	
S/NR Sync	Send tone @ 853Hz to indicate the start of S/N test
S/NR Ack	Send tone @ 2351Hz to indicate the S/N measurement has been started
S/NR Ack Next Tone	Send tone @ 1004Hz to send next tone level for the S/N test
CNN Synchronization Tones	
CNN	Send Tone @ 1049Hz to indicate the start of CNN test
CNN Ack	Send tone @ 2351Hz to indicate 3-Tone Slope measurements has been started
3-Tone Synchronization Codes	
3-Tone Slope	Send tone @ 1153Hz to indicate the start of 3-Tone Slope test
3-Tone Slope Ack	Send tone @ 2351Hz to indicate 3-Tone Slope measurements has been started
Attenuation Synchronization Tones	
Attenuation Distortion Test (304Hz to 3004Hz)	Send tone @ 1249Hz to indicate the start of Attenuation Distortion test
Attenuation Distortion Test (404Hz to 2804Hz)	Send tone @ 1361Hz to indicate the start of Attenuation Distortion test
Attenuation Distortion Test (504Hz to 2504Hz)	Send tone @ 1549Hz to indicate the start of Attenuation Distortion test
Attenuation Distortion Test Ack	Send tone @ 2351Hz to indicate Attenuation Distortion measurements has been started

Synchronization Codes (Contd.)

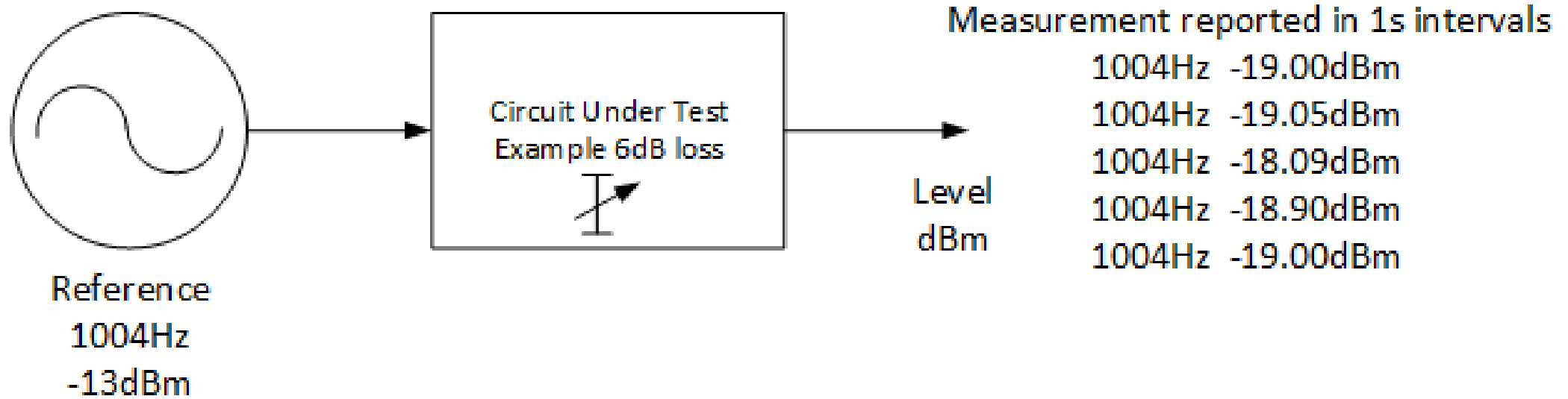
1004Hz Net Loss Synchronization Tones	
1004Hz Net Loss	Send Tone @ 1657Hz to indicate the start of 1004Hz tone test
1004Hz Net Loss Ack	Send tone @ 2351Hz to indicate 1004Hz tone measurements has been started
IMD Synchronization Tones	
IMD Sync	Send tone a2 1741Hz” to indicate start of IMD test
IMD Sync Ack	Send tone @ 2351Hz to acknowledge start of IMD test
Impulse Noise Synchronization Tones	
Impulse Noise Sync	Send tone @ 1867Hz to indicate the start of Impulse Noise test
Impulse Noise Ack	Send tone @ 2351Hz to indicate that Impulse test has been started
VQT Synchronization Tones	
VQT Sync	Send tone @ 751Hz to indicate the start of Voice Quality Testing
VQT Ack	Send tone @ 2351Hz to indicate that Voice Quality Testing has been started
23 - Tone Synchronization Tones	
23-Tone	Send tone @ 1781Hz to indicate the start of 23-Tone Test
23-Tone Ack	Send tone @ 2351Hz to indicate that 23-Tone has been started

Synchronization Codes (Contd.)

Common Synchronization Tones to end the Voice Measurement Test	
FIN	Send tone @1949 to indicate the end of the current voice measurement test
FIN Ack	Send tone @ 2351Hz to acknowledge the end of current voice measurement test
Common Synchronization Tones to complete the Voice Measurement Test	
Complete	Send tone @2251 to indicate the complete of the transmission from source to destination or destination to source
Common Synchronization Tones to Continue the Voice Measurement Test	
Continue	Send tone @2153 to indicate the continuation of next tone from source to destination or destination to source

1004 Hz Tone Test

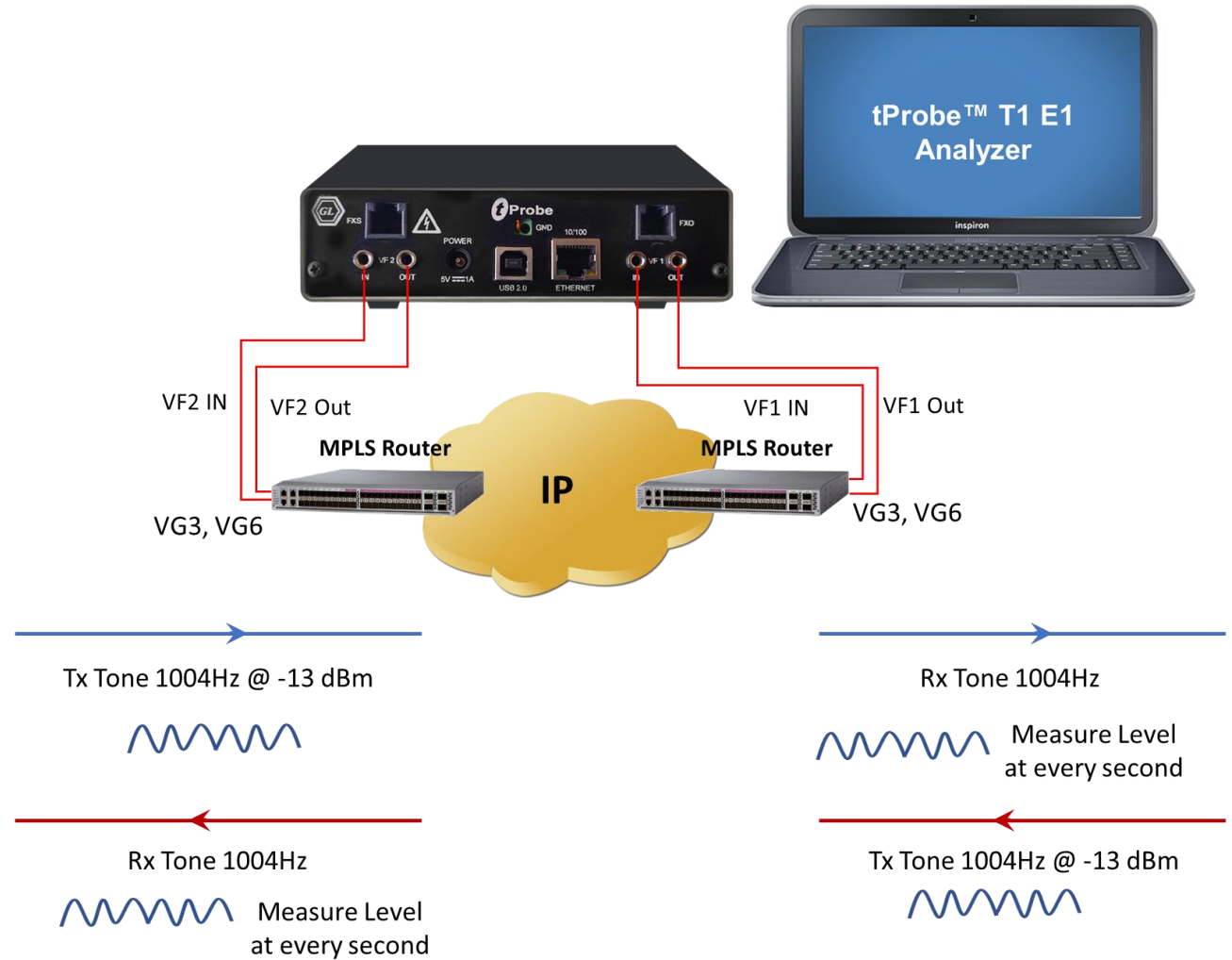
1004 Hz Tone Test



Pass if ± 1.5 dB of the reference signal level.

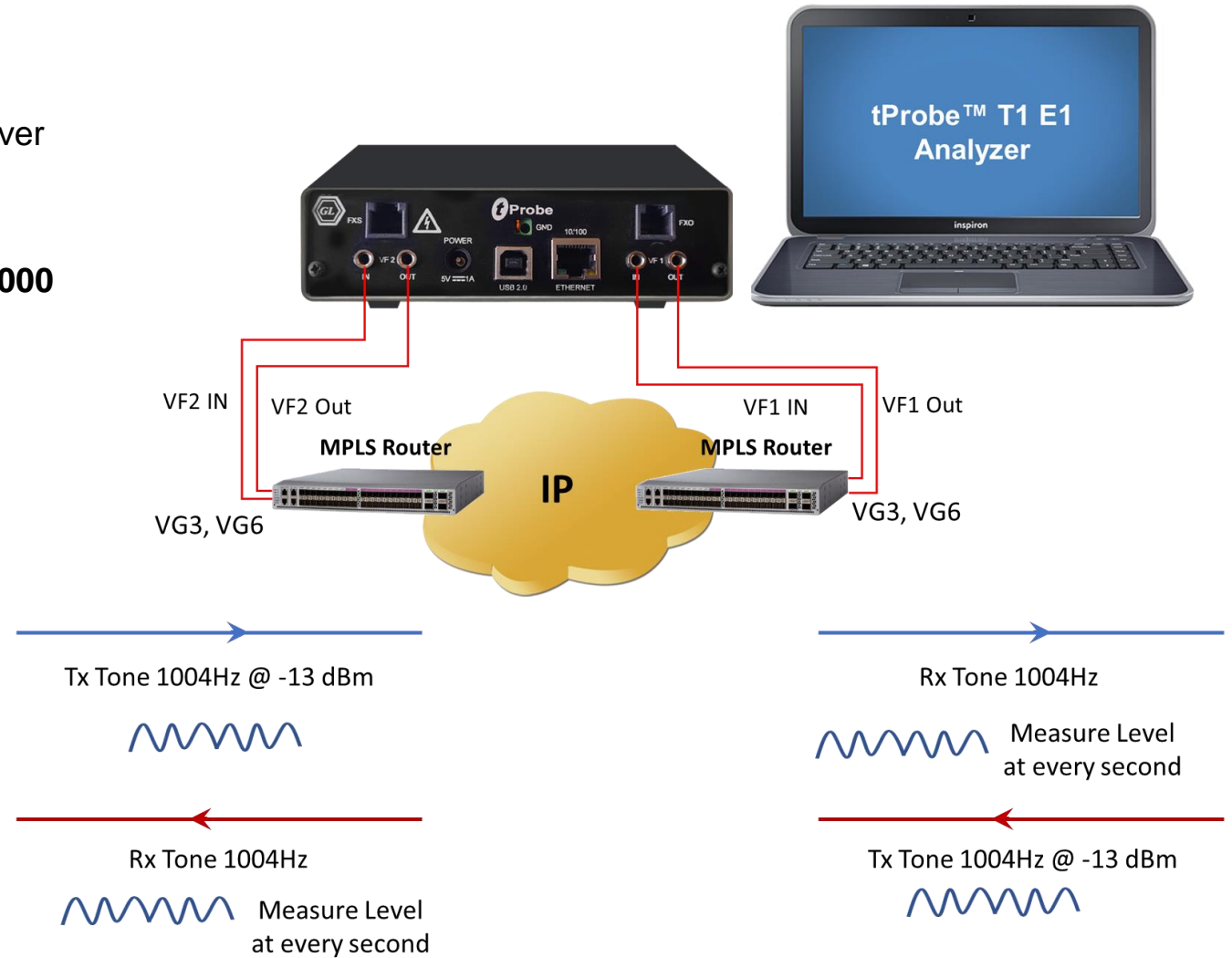
1004 Hz Tone Test

- This test is used to test 1004 Hz net loss and periodically report received tone level of a continuous 1004 Hz tone
- This is a measure of the change in net loss as the frequency of a signal on the line varies across the Voice Frequency (VF) bandwidth
- Tone (1004 Hz, -13 dBm) is sent and monitored at the receiver side. Below are the WCS commands to send and receive tones
 - **monitor freq window 500 msec # 2 : 5 report 1000 msec;**
 - **tx tone(1004,-13.000000) #1:1 10000 msec;**



WCS Commands and Tasks used for 1004 Hz Tone Test

- Tone (1004 Hz,-13 dBm) is sent and monitored at the receiver side
- Below are the WCS commands to receive and send tones
 - **monitor freq window 500 msec # 2 : 5 report 1000 msec ;**
 - **tx tone(1004,-13.000000) #1:1 10000 msec;**



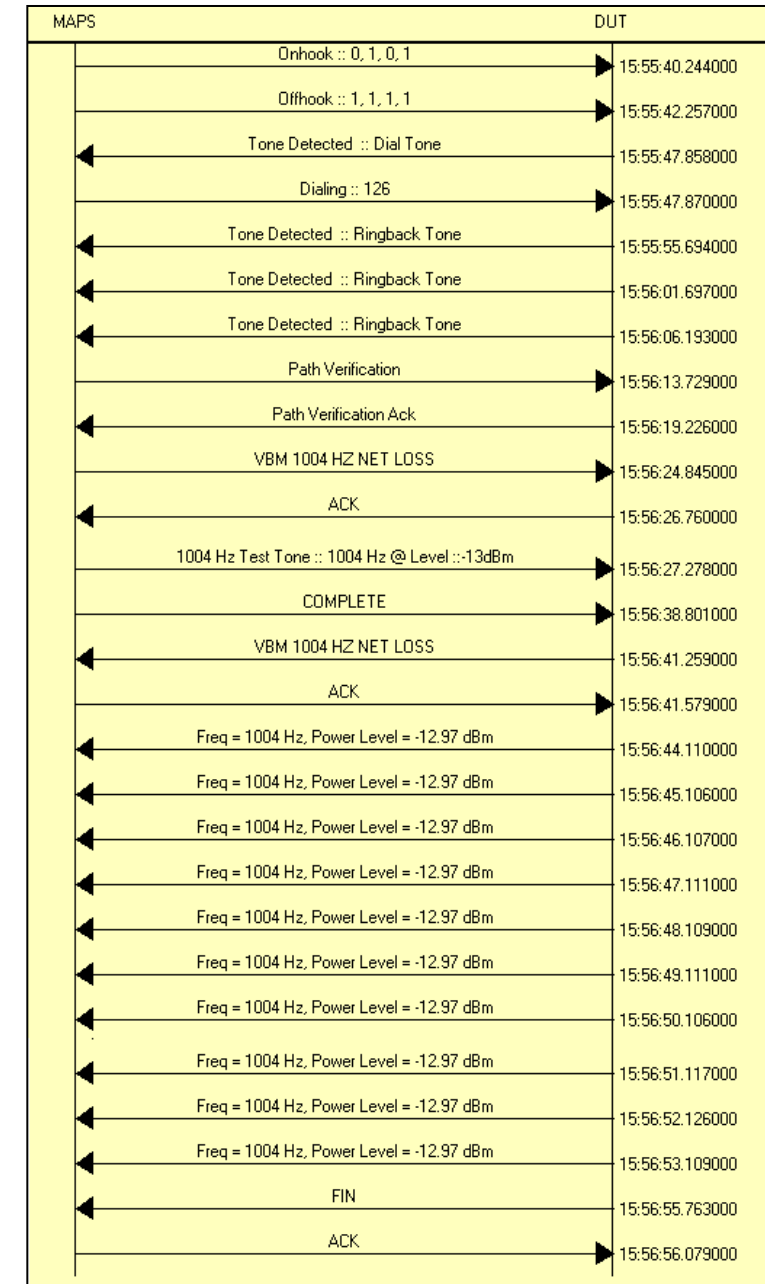
1004 Hz Net Loss Test Configuration

- The following parameters can be configured in the **Global profile** for 1004 Hz Net Loss Test:
 - Tone Power in dBm
 - Tone Duration in ms
 - Report Frequency in ms
- VG3 Pass Fail Requirement
 - Min Pass Power in dBm
 - Max Pass Power in dBm
- VG6 Pass Fail Requirement
 - Min Pass Power
 - Max Pass Power e.g. Pass criteria for -13 dBm Tone Power is -14.5 to -11.5 dBm

[-] Tone 1004 Hz Net Loss Test Parameters	
Tone Power in dBm	-13
Tone Duration in ms	10000
Report Frequency in ms	1000
[-] VG3 Pass Fail Requirement	
Min Pass Power	1.50
Max Pass Power	1.50
[-] VG6 Pass Fail Requirement	
Min Pass Power	1.50
Max Tone Power	1.50

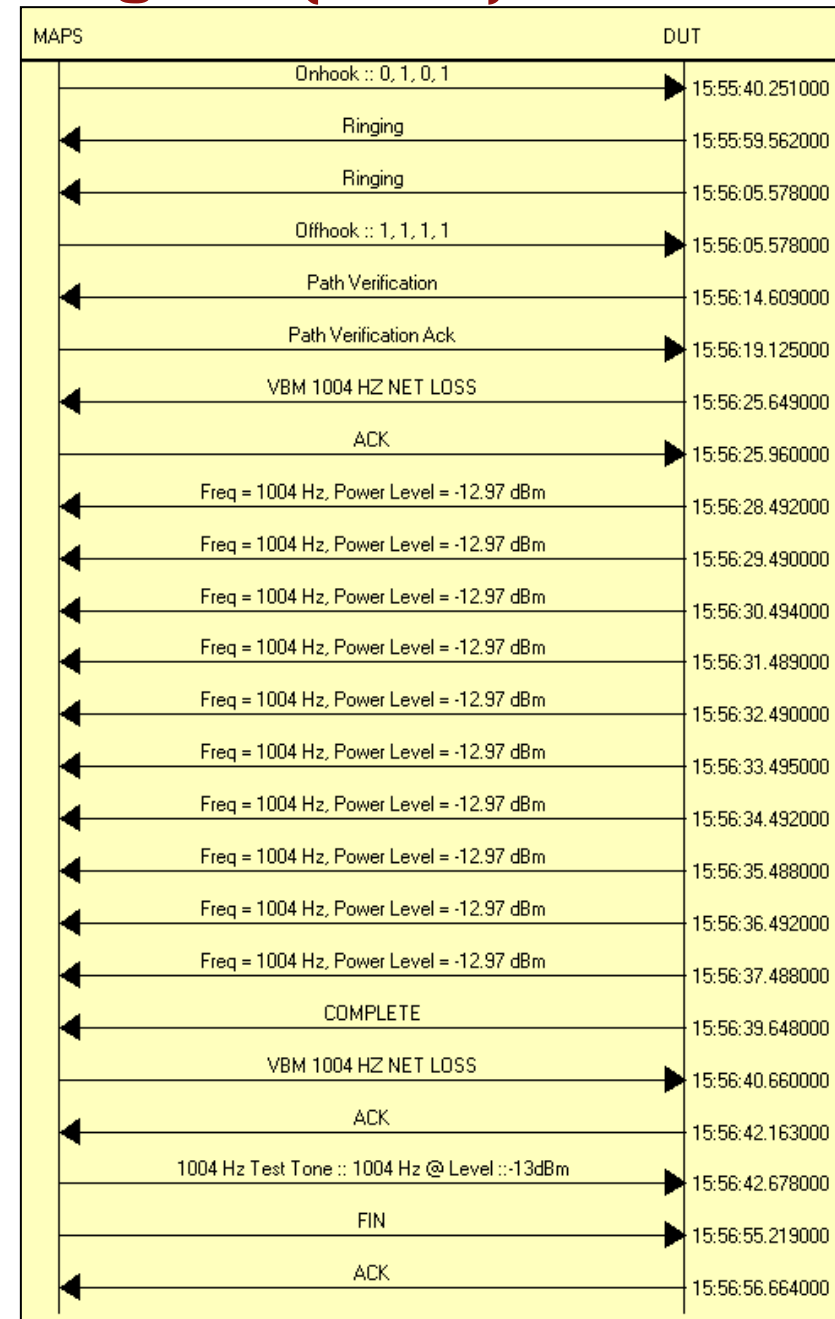
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under **Events** column, right-click on the select **1004Hz Tone Test** then **VBM 1004HZ NET LOSS** request tone (**Frequency:1657Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving the **ACK** (**Frequency:2351Hz, Power: -13dBm and Duration:300ms**) PlaceCall side sends the **1004HZ** test tone
- Finally, a **FIN** (**Frequency:1949Hz, Power: -13dBm and Duration:300ms**) is received to end the test and subsequently an **ACK** is sent to indicate that call will be terminated



VF_Terminating.gls Call Ladder Diagram (Slave)

- Initially both sides are On-Hook
- An incoming call is detected, When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack Answercall side receives **VBM 1004HZ NET LOSS** request tone (**Frequency: 1657Hz, Power: -13dBm and Duration: 300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power: -13dBm and Duration: 300ms**)
- Then AnswerCall side measures the **1004HZ** test tone and keeps the result in the **1004Hz Tone Test Report** tab
- After receiving **COMPLETE** (**Frequency: 2251Hz, Power: -13dBm and Duration: 300ms**) tone, AnswerCall side sends **VBM 1004HZ NET LOSS** request tone and receives the **ACK**
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency: 1949Hz, Power: -13dBm and Duration: 300ms**), and subsequently sending **ACK**



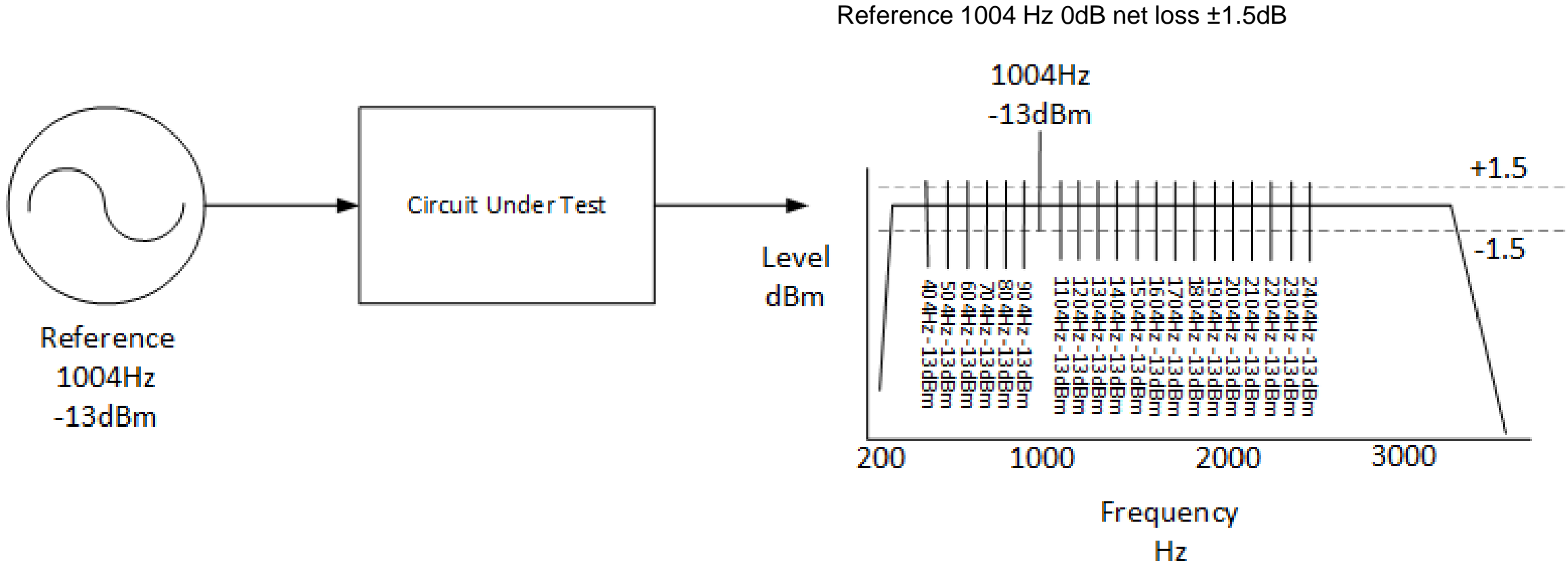
1004 Hz Net Loss Test Results

- 1004 Hz measurement results are logged in the “1004 Hz Tone Test Report” tab for the current test. Results include the received frequency and power level

Date/Time	Circuit Selected	Freq (Hz)	Power (dBm)	VG3(6) Criteria	VG3(6) Test Result
2020-7-21 14:14:04	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:05	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:06	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:07	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:08	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:09	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:10	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:11	VG6	1004	-12.98	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:12	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:14:13	VG6	1004	-12.97	Pass Power -14.5 to -11.5 dBm	Pass

Attenuation Distortion Test

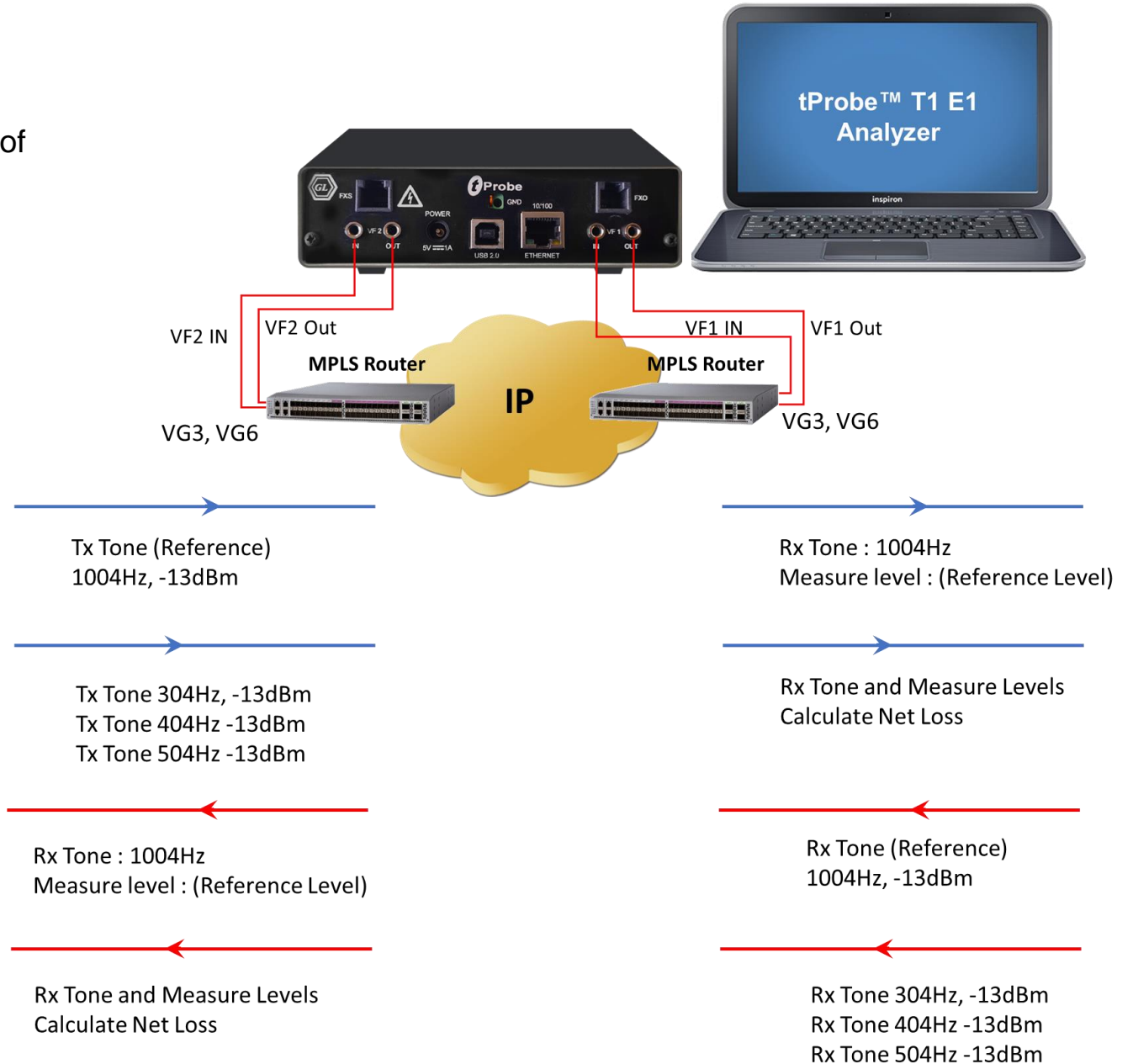
Attenuation Distortion



Pass if all points from 404 - 2804 Hz are between -1dB to +4dB of Reference level

Attenuation Distortion Test

- This is a measure of the change in net loss as the frequency of a signal on the line varies across the Voice Frequency (VF) bandwidth
- Reference tone is sent with (1004 Hz, -13 db) and level is monitored at receiver side. This will be the reference level to calculate net loss with the received level with the different frequencies



WCS Commands and Tasks used for Attenuation Distortion Test

- WCS Commands to monitor and transmit reference tone
 - **monitor tones ("MAPS\APS\VFMTD Files/AttenuationDistortion.mtd") # 2 : 5 ;**
 - **tx tone(1004,-13.000000) #1:1 2000 msec;**
- Tone is sent with the different frequencies but with the same level and the net loss is calculated
- Commands to send tones with the difference of 100 Hz
 - **tx tone(304,-13.000000) #1:1 2000 msec;**
 - **tx tone(404,-13.000000) #1:1 2000 msec;**
 - **tx tone(504,-13.000000) #1:1 2000 msec;**

Attenuation Distortion Test Configuration

- The following parameters can be configured in the **Global profile** for Attenuation Distortion Test:
 - Tone Power in dBm
 - Tone Duration in ms
- VG3 Pass Fail Requirement
 - Min Pass Power
 - Max Pass Power
- VG6 Pass Fail Requirement
 - Min Pass Power
 - Max Pass Power e.g. For Frequency range 304 to 3004 Hz
 - If send level is 1004 Hz, -13 dBm and received level is -13.24 dBm (reference level)
 - For: (Min 1.3, Max 5 dBm), the pass criteria is -14.54 to -8.24 dBm

Attenuation Distortion Parameters	
Tone Power in dBm	-13.0
Tone Duration in ms	2000
VG3 Pass Fail Requirement	
Min Pass Power 304 to 3004 Hz	1.30
Max Pass Power 304 to 3004 Hz	5.00
Min Pass Power 404 to 2804 Hz	1.30
Max Pass Power 404 to 2804 Hz	3.00
Min Pass Power 504 to 2504 Hz	1.30
Max Pass Power 504 to 2504 Hz	3.00
VG6 Pass Fail Requirement	
Min Pass Power 304 to 3004 Hz	1.30
Max Pass Power 304 to 3004 Hz	5.00
Min Pass Power 404 to 2804 Hz	1.30
Max Pass Power 404 to 2804 Hz	4.00
Min Pass Power 504 to 2504 Hz	1.30
Max Pass Power 504 to 2504 Hz	3.00

VF_Originating.gls Ladder Diagram (Master)

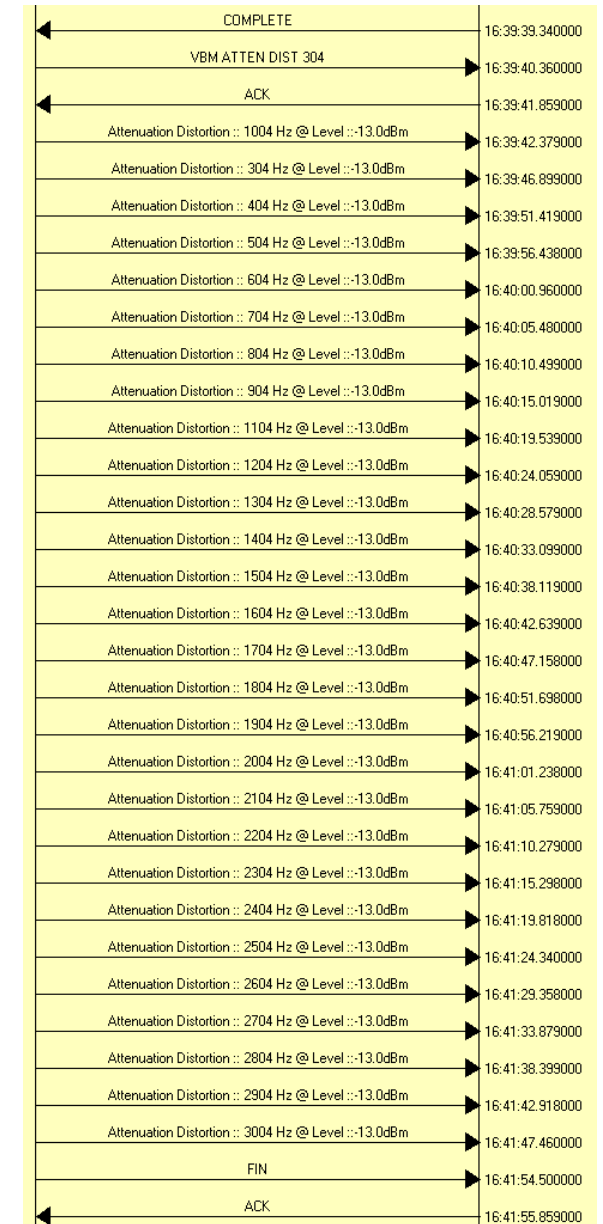
- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and **Path Verification** is done
- Waiting for user input. Under **Events** column, right-click and select the **Attenuation Distortion Test** (i.e. 304 – 3004Hz, 404 – 2804Hz, or 504 – 2504Hz) then **VBM ATTEN DIST 304 request tone** (Frequency: 1249Hz, Power: -13dBm and Duration: 300ms) is sent
- After receiving **ACK** (Frequency: 2351Hz, Power: -13dBm and Duration: 300ms), PlaceCall sends the **Attenuation Distortion** test tones
- After receiving **COMPLETE** (Frequency: 2251Hz, Power: -13dBm and Duration: 300ms) tone, AnswerCall side will send **VBM ATTEN DIST 304** request tone and receives the **ACK**
- After receiving the **ACK**, Answercall sends the Attenuation Distortion test tones
- Finally, a **FIN** (Frequency: 1949Hz, Power: -13dBm and Duration: 300ms) is received to end the test and subsequently an **ACK** is sent to indicate that call will be terminate

MAPS	DUT
Onhook :: 0, 1, 0, 1	16:36:16.434000
Offhook :: 1, 1, 1, 1	16:36:18.439000
Tone Detected :: Dial Tone	16:36:24.039000
Dialing :: 126	16:36:24.053000
Tone Detected :: Ringback Tone	16:36:31.869000
Tone Detected :: Ringback Tone	16:36:37.868000
Tone Detected :: Ringback Tone	16:36:42.370000
Path Verification	16:36:49.907000
Path Verification Ack	16:36:55.405000
VBM ATTEN DIST 304	16:37:25.891000
ACK	16:37:27.431000
Attenuation Distortion :: 1004 Hz @ Level :: -13.0dBm	16:37:27.939000
Attenuation Distortion :: 304 Hz @ Level :: -13.0dBm	16:37:32.459000
Attenuation Distortion :: 404 Hz @ Level :: -13.0dBm	16:37:36.978000
Attenuation Distortion :: 504 Hz @ Level :: -13.0dBm	16:37:41.500000
Attenuation Distortion :: 604 Hz @ Level :: -13.0dBm	16:37:46.020000
Attenuation Distortion :: 704 Hz @ Level :: -13.0dBm	16:37:50.538000
Attenuation Distortion :: 804 Hz @ Level :: -13.0dBm	16:37:55.059000
Attenuation Distortion :: 904 Hz @ Level :: -13.0dBm	16:37:59.599000
Attenuation Distortion :: 1104 Hz @ Level :: -13.0dBm	16:38:04.119000
Attenuation Distortion :: 1204 Hz @ Level :: -13.0dBm	16:38:08.638000
Attenuation Distortion :: 1304 Hz @ Level :: -13.0dBm	16:38:13.159000
Attenuation Distortion :: 1404 Hz @ Level :: -13.0dBm	16:38:18.178000
Attenuation Distortion :: 1504 Hz @ Level :: -13.0dBm	16:38:23.199000
Attenuation Distortion :: 1604 Hz @ Level :: -13.0dBm	16:38:27.719000
Attenuation Distortion :: 1704 Hz @ Level :: -13.0dBm	16:38:32.239000
Attenuation Distortion :: 1804 Hz @ Level :: -13.0dBm	16:38:36.758000
Attenuation Distortion :: 1904 Hz @ Level :: -13.0dBm	16:38:41.779000
Attenuation Distortion :: 2004 Hz @ Level :: -13.0dBm	16:38:46.298000
Attenuation Distortion :: 2104 Hz @ Level :: -13.0dBm	16:38:51.319000
Attenuation Distortion :: 2204 Hz @ Level :: -13.0dBm	16:38:56.358000
Attenuation Distortion :: 2304 Hz @ Level :: -13.0dBm	16:39:01.380000
Attenuation Distortion :: 2404 Hz @ Level :: -13.0dBm	16:39:05.899000
Attenuation Distortion :: 2504 Hz @ Level :: -13.0dBm	16:39:10.419000
Attenuation Distortion :: 2604 Hz @ Level :: -13.0dBm	16:39:15.439000

Attenuation Distortion :: 2704 Hz @ Level :: -13.0dBm	16:39:20.459000
Attenuation Distortion :: 2804 Hz @ Level :: -13.0dBm	16:39:24.978000
Attenuation Distortion :: 2904 Hz @ Level :: -13.0dBm	16:39:29.500000
Attenuation Distortion :: 3004 Hz @ Level :: -13.0dBm	16:39:34.020000
COMPLETE	16:39:38.540000
VBM ATTEN DIST 304	16:39:40.935000
ACK	16:39:41.241000
Freq = 1005 Hz, Power Level = -12.9717 dBm	16:39:44.776000
Freq = 306 Hz, Power Level = -12.9739 dBm, 1004Hz Net Loss = 0	16:39:49.277000
Freq = 405 Hz, Power Level = -12.9693 dBm, 1004Hz Net Loss = -0.00	16:39:53.780000
Freq = 505 Hz, Power Level = -12.9736 dBm, 1004Hz Net Loss = 0.00	16:39:58.776000
Freq = 604 Hz, Power Level = -12.9715 dBm, 1004Hz Net Loss = -0.00	16:40:03.271000
Freq = 704 Hz, Power Level = -12.9715 dBm, 1004Hz Net Loss = 0.00	16:40:07.777000
Freq = 806 Hz, Power Level = -12.973 dBm, 1004Hz Net Loss = 0.00	16:40:12.777000
Freq = 905 Hz, Power Level = -12.9708 dBm, 1004Hz Net Loss = -0.00	16:40:17.278000
Freq = 1104 Hz, Power Level = -12.971 dBm, 1004Hz Net Loss = 0.00	16:40:21.777000
Freq = 1204 Hz, Power Level = -12.9718 dBm, 1004Hz Net Loss = 0.00	16:40:26.273000
Freq = 1306 Hz, Power Level = -12.9723 dBm, 1004Hz Net Loss = -0.00	16:40:30.775000
Freq = 1405 Hz, Power Level = -12.972 dBm, 1004Hz Net Loss = -0.00	16:40:35.275000
Freq = 1505 Hz, Power Level = -12.973 dBm, 1004Hz Net Loss = -0.00	16:40:40.278000
Freq = 1604 Hz, Power Level = -12.9704 dBm, 1004Hz Net Loss = -0.00	16:40:44.776000
Freq = 1704 Hz, Power Level = -12.9732 dBm, 1004Hz Net Loss = 0.00	16:40:49.276000
Freq = 1806 Hz, Power Level = -12.9677 dBm, 1004Hz Net Loss = -0.00	16:40:54.272000
Freq = 1905 Hz, Power Level = -12.973 dBm, 1004Hz Net Loss = 0.00	16:40:58.778000
Freq = 2005 Hz, Power Level = -12.9711 dBm, 1004Hz Net Loss = -0.00	16:41:03.780000
Freq = 2104 Hz, Power Level = -12.9707 dBm, 1004Hz Net Loss = 0.00	16:41:08.277000
Freq = 2204 Hz, Power Level = -12.9714 dBm, 1004Hz Net Loss = 0.00	16:41:12.776000
Freq = 2306 Hz, Power Level = -12.972 dBm, 1004Hz Net Loss = 0.00	16:41:17.777000
Freq = 2405 Hz, Power Level = -12.9714 dBm, 1004Hz Net Loss = -0.00	16:41:22.277000
Freq = 2505 Hz, Power Level = -12.9722 dBm, 1004Hz Net Loss = 0.00	16:41:26.774000
Freq = 2604 Hz, Power Level = -12.971 dBm, 1004Hz Net Loss = -0.00	16:41:31.778000
Freq = 2704 Hz, Power Level = -12.9732 dBm, 1004Hz Net Loss = 0.00	16:41:36.277000
Freq = 2806 Hz, Power Level = -12.9711 dBm, 1004Hz Net Loss = -0.00	16:41:40.777000
Freq = 2905 Hz, Power Level = -12.9728 dBm, 1004Hz Net Loss = 0.00	16:41:45.276000
Freq = 3005 Hz, Power Level = -12.9723 dBm, 1004Hz Net Loss = -0.00	16:41:49.777000
FIN	16:41:54.931000
ACK	16:41:55.239000

VF_Terminating.gls Ladder Diagram (Slave)

- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack, Answercall side receives **VBM ATTEN DIST 304** request tone (**Frequency:1249Hz, Power: -13 dBm and Duration:300ms**) and acknowledged by sending **ACK**(**Frequency: 2351Hz, Power: -13dBm and Duration:300ms**)
- Then AnswerCall side measures the received Attenuation Distortion tones and keep the result in the **Attenuation Distortion Test Report** tab
- After receiving **COMPLETE** (**Frequency:2251Hz, Power: -13dBm and Duration:300ms**) tone, AnswerCall side will send **VBM ATTEN DIST 304** request tone and receives the ACK
- Now Answercall side sends the **Attenuation Distortion** test tones.
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency: 1949Hz, Power: -13dBm and Duration:300ms**), and subsequently sending an **ACK**



Attenuation Distortion Results

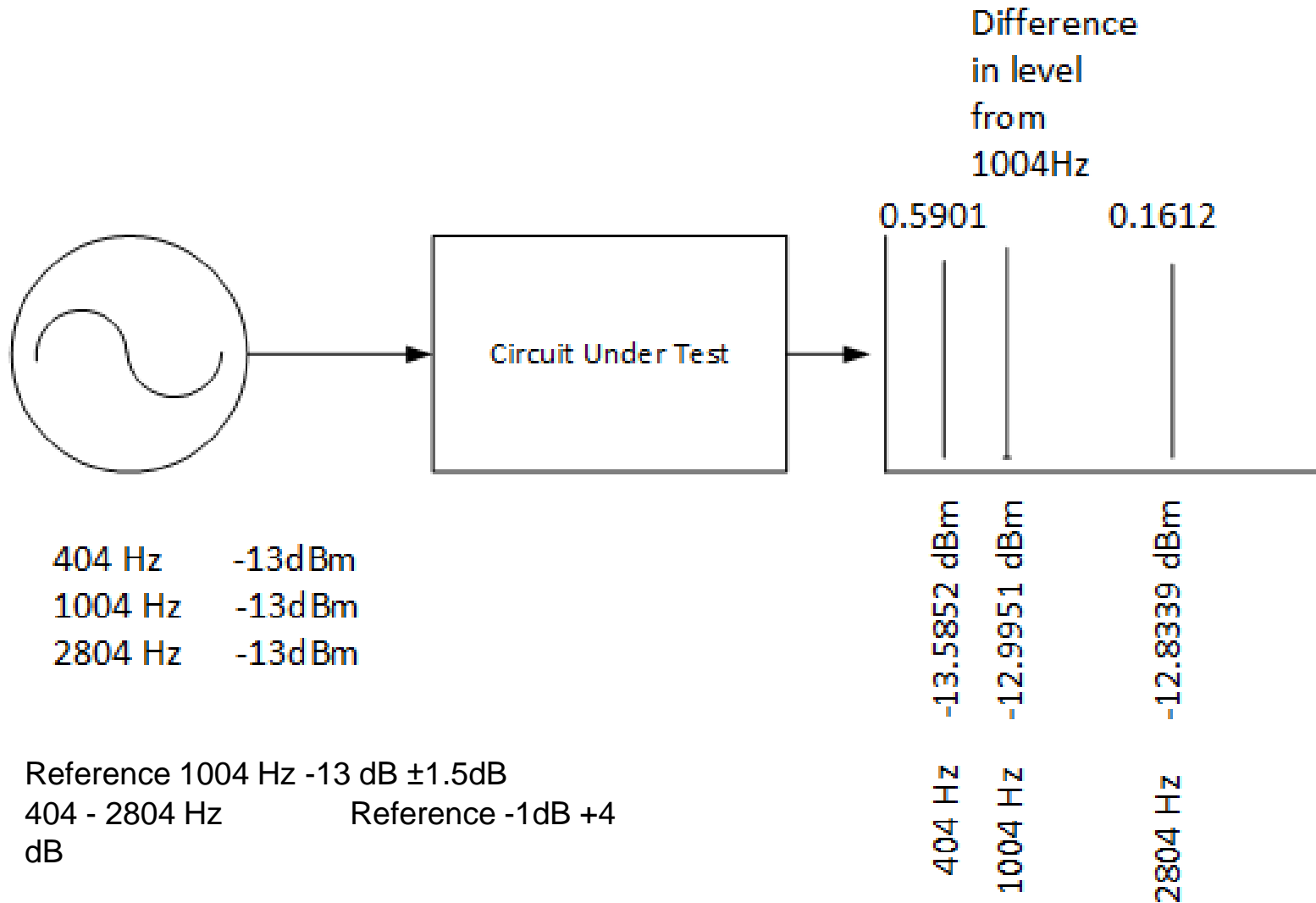
- Attenuation Distortion measurement results are logged in the “Attenuation Distortion Test Report” tab for the current test. Results include the received frequency, power level, and 1004 Hz Net Loss

Date/Time	Circuit Selected	Freq Range	Freq (Hz)	Power (dBm)	1004Hz Net Loss	VG3(6) Criteria	VG3(6) Test Result
2020-7-21 14:16:46	VG6	304-3004	1005	-12.97	0.0237999	Pass Power -14.5 to -11.5 dBm	Pass
2020-7-21 14:16:51	VG6	304-3004	306	-13.79	-0.81	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:16:55	VG6	304-3004	405	-13.49	-0.52	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:00	VG6	304-3004	505	-13.33	-0.36	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:04	VG6	304-3004	604	-13.20	-0.22	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:09	VG6	304-3004	704	-13.12	-0.15	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:14	VG6	304-3004	806	-13.04	-0.06	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:18	VG6	304-3004	905	-12.98	-0.00	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:23	VG6	304-3004	1104	-12.94	0.02	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:27	VG6	304-3004	1204	-12.90	0.06	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:32	VG6	304-3004	1306	-12.89	0.08	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:36	VG6	304-3004	1405	-12.87	0.09	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:41	VG6	304-3004	1505	-12.87	0.10	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:46	VG6	304-3004	1604	-12.85	0.12	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:51	VG6	304-3004	1704	-12.85	0.11	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:17:55	VG6	304-3004	1806	-12.83	0.13	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:18:00	VG6	304-3004	1905	-12.82	0.15	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:18:04	VG6	304-3004	2005	-12.82	0.14	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:18:09	VG6	304-3004	2104	-12.82	0.15	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:18:14	VG6	304-3004	2204	-12.82	0.15	Pass Power -14.27 to -7.97 dBm	Pass
2020-7-21 14:18:18	VG6	304-3004	2306	-12.82	0.14	Pass Power -14.27 to -7.97 dBm	Pass

Attenuation Distortion Test Report
3-Tone Slope Test Report
Signal/C-Notch Noise Test Report
Intermodulation Distortion Test Report
Impulse Noise Test Report
S/NR/Net Loss vs Level Test Report

Three Tone Slope (Gain Slope) Test

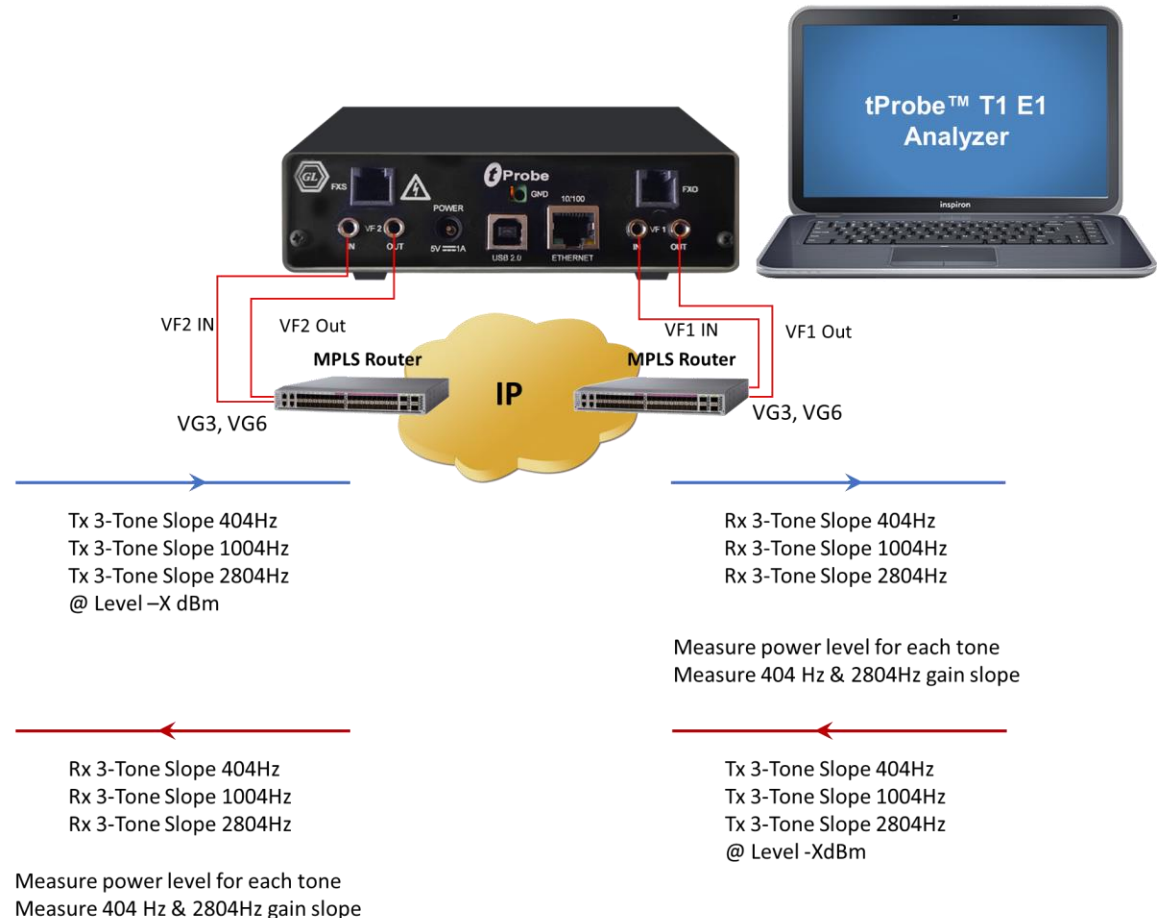
Three Tone Slope (Gain Slope) Test



Three Tone Slope (Gain Slope)

- The measurement of loss or received level vs. frequency while the transmitted level is held constant is referred to as frequency response or attenuation distortion. The specific term gain-slope refers to the measurement of received level at 404 Hz, 1004 Hz, and 2804 Hz and calculation of the difference between levels at 404 Hz and 1004 Hz for 404 Hz gain-slope and the difference between levels at 2804 Hz and 1004 Hz for 2804 Hz gain-slope. Conventionally, + means more loss and - means less loss than the 1004 Hz value. The nominal 4 Hz offset prevents beating problems in level measurements on PCM systems as a result of the test frequencies being small submultiples of the 8 kHz sampling rate
- IEEE Standard Equipment Requirements and Measurement Techniques for Analog Transmission Parameters for Telecommunications, IEEE Std 743-1995

- **Level(1004) - Level(404) = “404Hz” Gain Slope**
- **Level(1004) - Level(2804) = “2804Hz” Gain Slope**



WCS Commands and Tasks used for Three Tone Slope Measurements

To send 404, 1004 and 2804 Hz tone, MAPS™ APS uses the WCS “Tx Tone” command:

tx tone (<Freq> , <Power Level>) # <Card No> : <Timeslot> <Duration> msec ;

MAPS™ APS sends the below commands to WCS server:

tx tone(404,-13.000000) #1:1 3000 msec;

tx tone(1004,-13.000000) #1:1 3000 msec;

tx tone(2804,-13.000000) #1:1 3000 msec;

To measure power level, MAPS™ APS uses the WCS “Monitor Tone” commands. Responses given by WCS Server are presented to in Message Sequence and the **Three Tone Slope Report Tab** in the Call Generation window

monitor tones ("<MTD File Name>") # <Card No> : <Timeslot> ;

Measure “404 Hz” Gain Slope and “2804 Hz” Gain Slope using below formulas:

404Hz Gain Slope = Level(1004) - Level(404)

2804Hz Gain Slope = Level(1004) - Level(2804)

MAPS™ APS sends the below command to WCS server:

monitor tones ("MAPS\APS\VF\MTD Files/3ToneSlope.mtd") # 2 : 5;

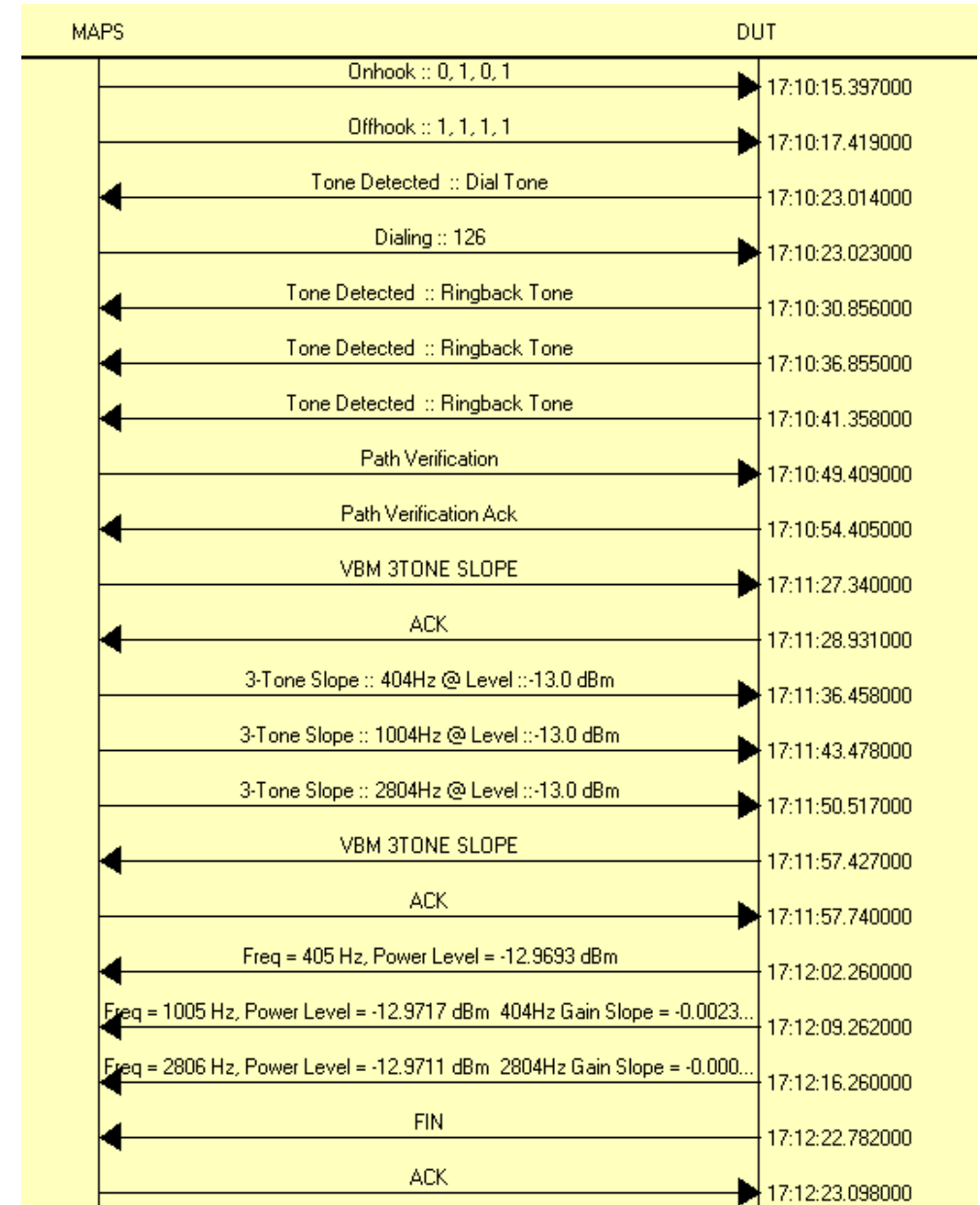
Three Tone Slope Test Configuration

- The following parameters can be configured in the **Global profile** for Three Tone Slope test:
 - Power of three tones in dBm
 - Tone Duration in ms
- VG3 Pass Fail Requirement
 - Max Pass Power of three tones
 - Min Pass Power of three tones e.g. the pass criteria for -13 dBm is -14 to -9 dBm
- VG6 Pass Fail Requirement
 - Min Pass Power
 - Max Pass Power e.g. the pass criteria for -13 dBm is -13.5 to -10.5 dBm

[-] Three Tone Slope Parameters	
Power of 404Hz Tone in dBm	-13.0
Power of 1004Hz Tone in dBm	-13.0
Power of 2804Hz Tone in dBm	-13.0
Tone Duration in ms	3000
[-] VG3 Pass Fail Requirement	
Min Pass Power for 1004Hz	1.00
Max Pass Power for 1004Hz	4.00
Min Pass Power for 404Hz Gain Slope	1.00
Max Pass Power for 404Hz Gain Slope	4.00
Min Pass Power for 2804Hz Gain Slope	1.00
Max Pass Power for 2804Hz Gain Slope	4.00
[-] VG6 Pass Fail Requirement	
Min Pass Power for 1004Hz	0.50
Max Pass Power for 1004Hz	2.50
Min Pass Power for 404Hz Gain Slope	0.50
Max Pass Power for 404Hz Gain Slope	2.50
Min Pass Power for 2804Hz Gain Slope	0.50
Max Pass Power for 2804Hz Gain Slope	2.50

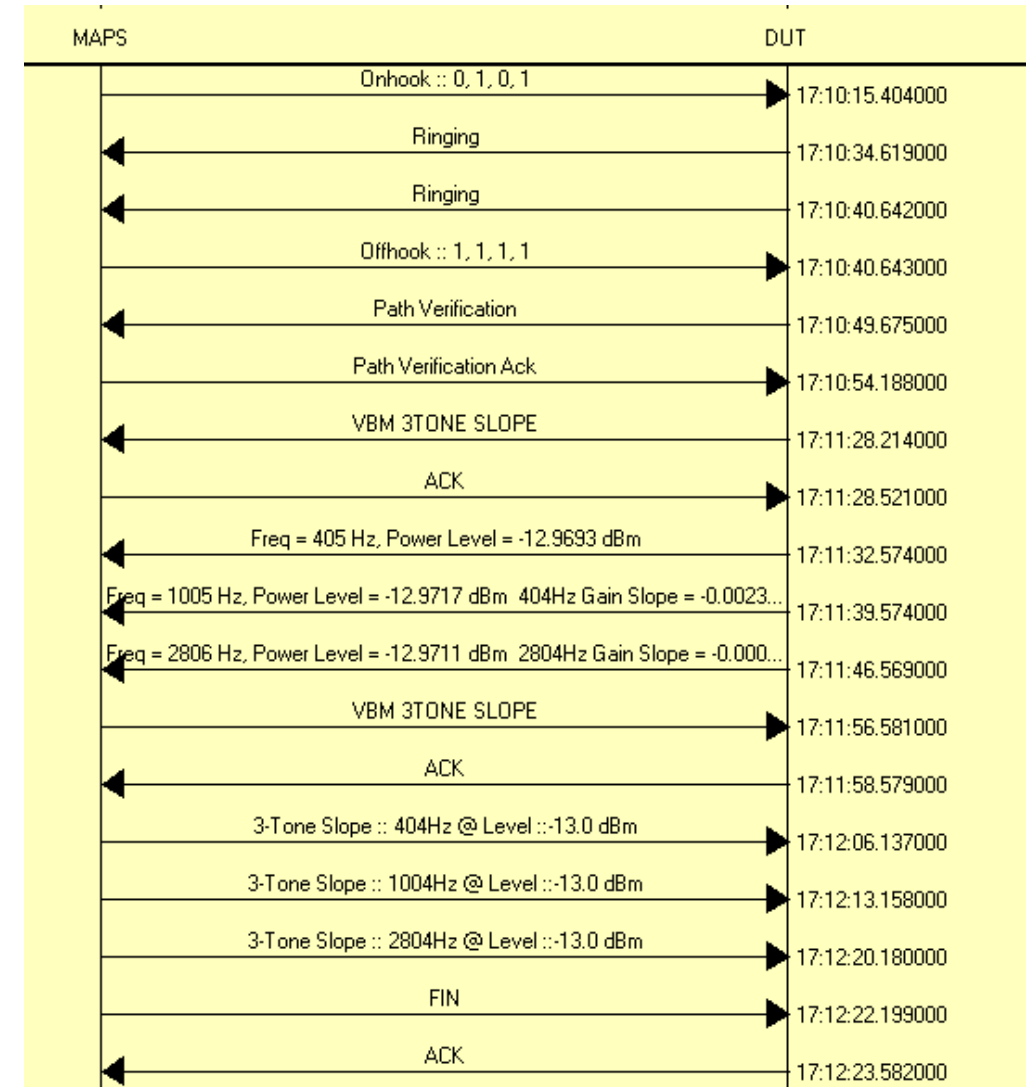
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed, and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under **Events** column, right-click on the call and select the required **3 Tone Slope Test** then **VBM 3TONE SLOPE** request tone (**Frequency:1153Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving the **ACK (Frequency:2351Hz ,Power: -13dBm and Duration:300ms)**, PlaceCall side sends 3-Tone i.e., 404Hz, 1004Hz, 2804Hz at -13dBm
- After receiving the **VBM 3TONE SLOPE** request, **ACK** will be sent to receive the frequencies i.e., **404Hz, 1004Hz, 2804Hz** with Power Level and Gain Slope.
- Finally, a **FIN (Frequency:1949Hz,Power: -13dBm and Duration:300ms)** is received to end the test and subsequently an **ACK** is sent to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram (Slave)

- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack, AnswerCall side receives **VBM 3TONE SLOPE** request tone (**Frequency:1153Hz, Power: -13 dBm and Duration:300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power: -13dBm and Duration:300ms**)
- After receiving the **VBM 3TONE SLOPE** request, **ACK** will be sent to receive the frequencies i.e. 404Hz, 1004Hz, 2804Hz with Power Level and Gain Slope
- After sending the **VBM 3TONE SLOPE** request ACK is received
- Then answercall sends 3-Tone i.e. 404Hz, 1004Hz and 2804Hz at 10dBm
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency: 1949Hz, Power: -13dBm and Duration:300ms**), and subsequently sending an **ACK**



3-Tone Measurement Results

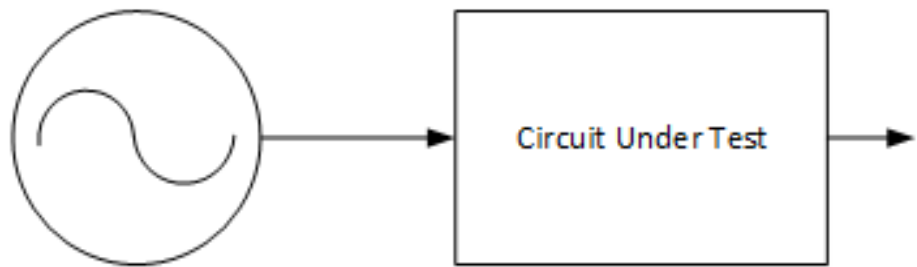
- 3-Tone measurement results are logged in the “**3-Tone Slope Test Report**” tab for the current test. Results include the received frequency, power level, 404Hz Gain Slope, and 2804Hz Gain Slope

Date/Time	Circuit Selec...	Freq (Hz)	Power (dBm)	404Hz Gain Slope	2804Hz Gain Slope	VG3(6) Criteria	VG3(6) Test Result
2020-7-21 11:21:14	VG6	405	-13.37			Pass Power -13.5 to -10.5 dBm	Pass
2020-7-21 11:21:21	VG6	1005	-13.34	0.03		Pass Power -13.5 to -10.5 dBm	Pass
2020-7-21 11:21:28	VG6	2806	-13.32		-0.01	Pass Power -13.5 to -10.5 dBm	Pass

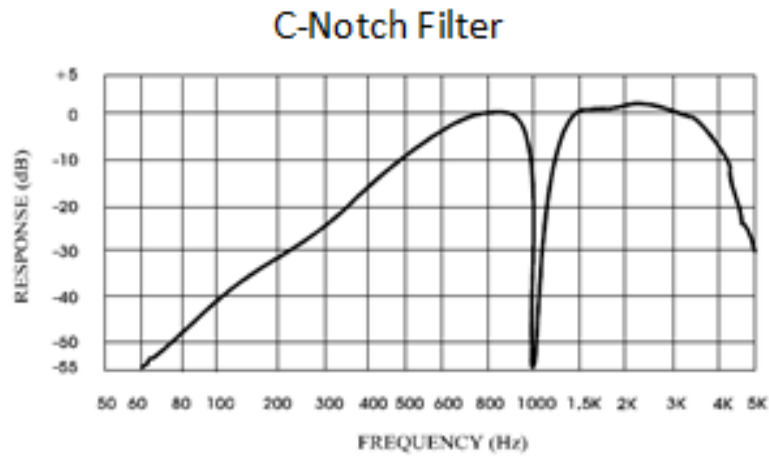
Navigation tabs: 3-Tone Slope Test Report | Signal/C-Notch Noise Test Report | Intermodulation Distortion Test Report | Impulse Noise Test Report | S/NR/Net Loss vs Level Test Report | VQT Test Report

Signal/C-Notch Noise Test

Signal/C-Notch Noise Test



Reference
1004Hz
-13dBm



Measurement reported in 1s intervals

C Notched Noise -54.9dBmC

C Notched Noise -54.9dBmC

C Notched Noise -54.9dBmC

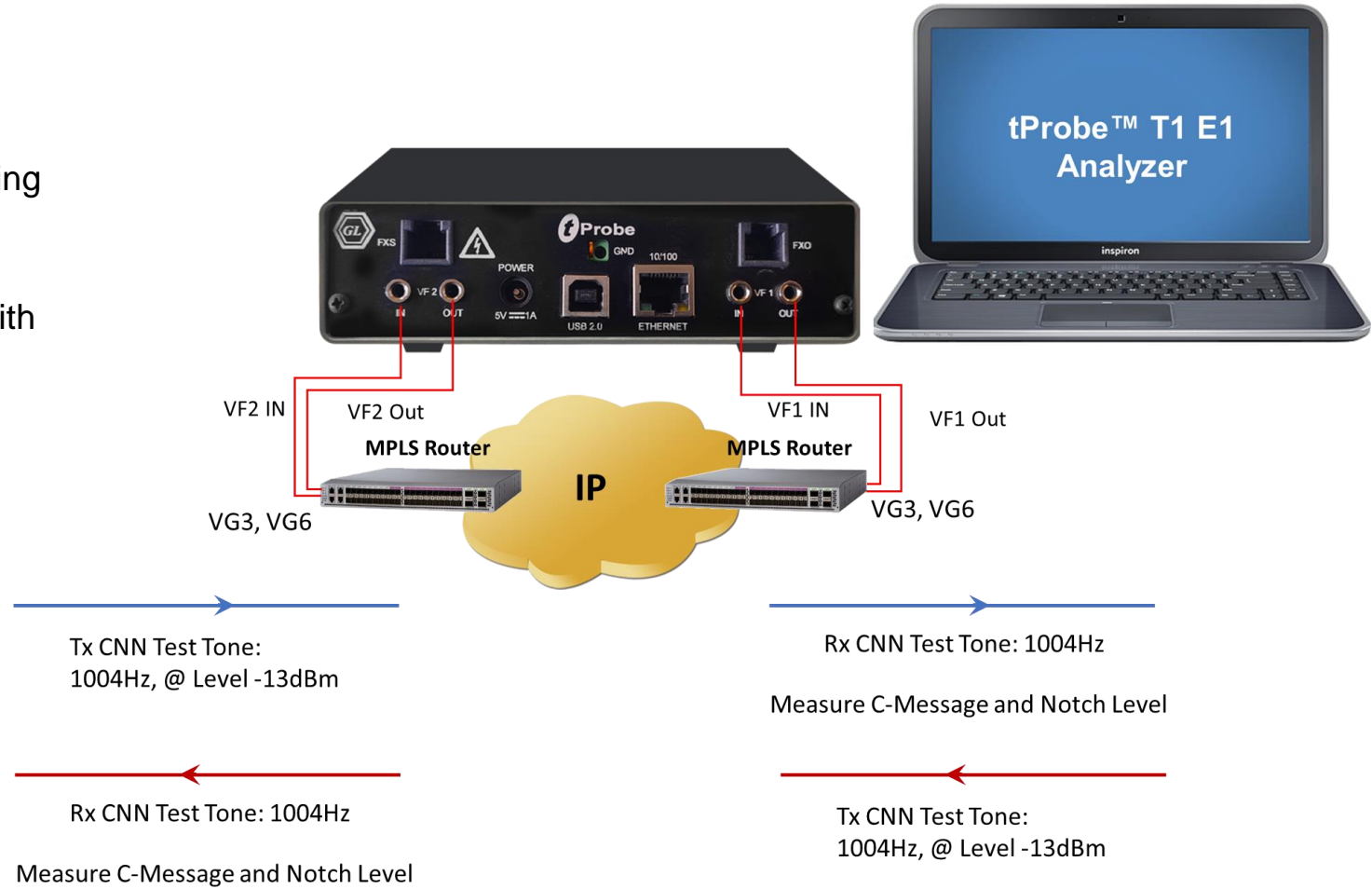
Signal-to-C-notched-noise ratio

Standard 32dB

Pass ≥ 30 dB

S/CNN Test

- **Signal/C-Notched Noise Level (dBrnC)** - The noise power on a channel with a holding tone (signal) at the transmit end, measured through a C-Message weighting filter and a 1004 Hz notch filter in tandem
- The noise level measured in reference to the 0 TLP with C-message weighting has the units dBrnC0
- This test measures that noise level after a 1004 Hz notch filter is applied



WCS Commands and Tasks used for CNN Test

To send 1004 Hz tone at -13 dbm, MAPS APS uses WCS Tx Tone command:

```
tx tone ( <Freq> , <Power Level> ) # <Card No> : <Timeslot> <Duration> msec ;
```

Below are commands sent by MAPS™ APS to WCS server

```
tx tone ( 1004 , -13 ) # 1 : 1 15000 msec ;
```

To measure C-Message and Notch Level MAPS™ APS uses WCS Commands. Here C-Message and Notch Filters are applied to the received data and then Power levels are measured.

```
dspop { NOTCH=filter(rx(#2:5), "filter files\Notch8K.IIR"),CMSG=filter(rx(#2:5), "filter files\cmmessage.IIR"), NOTCHMon=power monitor(NOTCH), NOTCHMon,CMSGMon=power monitor(CMSG), CMSGMon} continuous report events;
```

Signal/C-Notch Noise Test Configuration

The following parameters can be configured in the **Global profile** for Signal/C-Notch Noise test :

- CNN Tone Frequency in Hz
- CNN Test Tone Duration in dBm

VG3 Pass Fail Requirement

- Pass SCNN e.g.: 30 indicates pass criteria is S/CNN ≥ 30

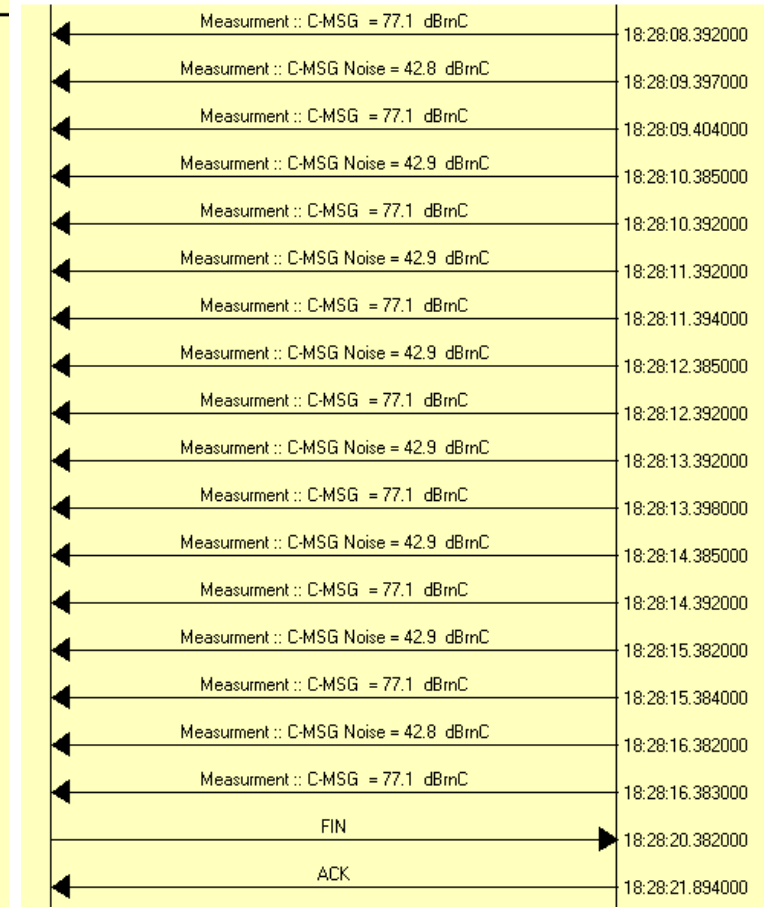
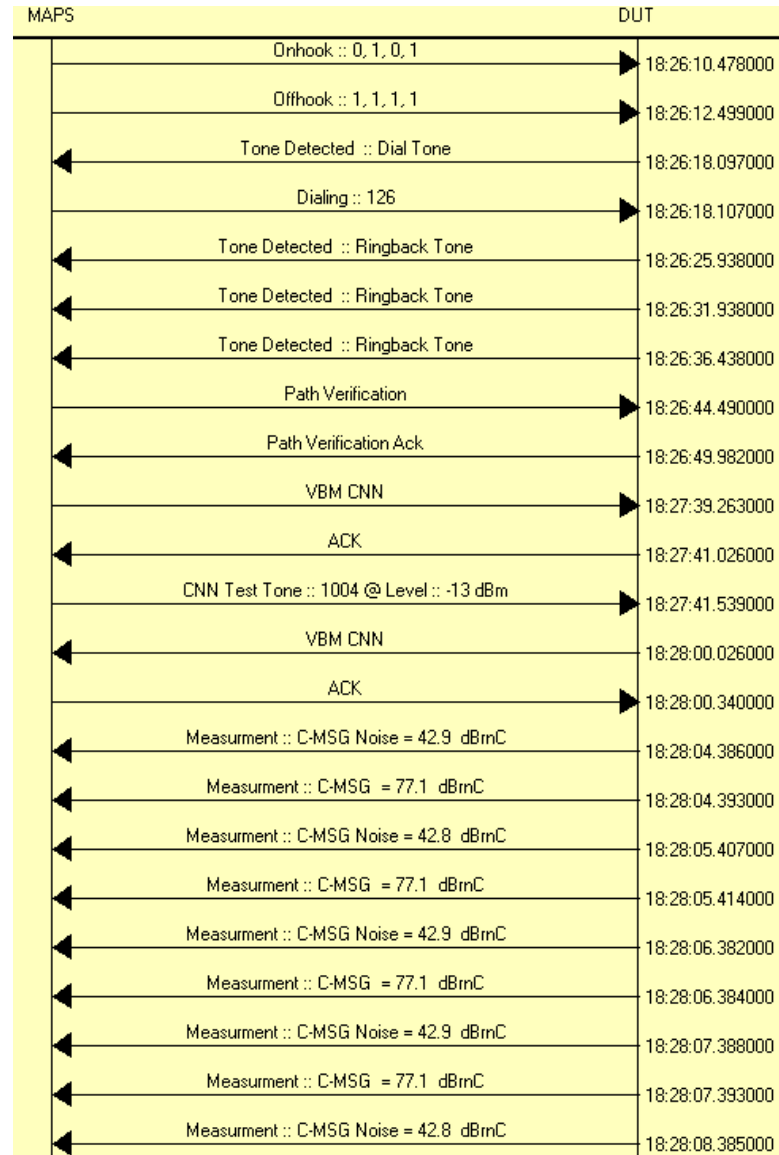
VG6 Pass Fail Requirement

- Pass SCNN e.g.: 30 indicates pass criteria is S/CNN ≥ 30

<input type="checkbox"/>	C MESSAGE and Notched Noise Test Parameters	
	CNN Tone Frequency in Hz	1004
	CNN Test Tone Duration in ms	15000
	CNN Test Tone Level in dBm	-13
<input type="checkbox"/>	VG3 Pass Fail Requirement	
	Pass SCNN	30.00
<input type="checkbox"/>	VG6 Pass Fail Requirement	
	Pass SCNN	30.00

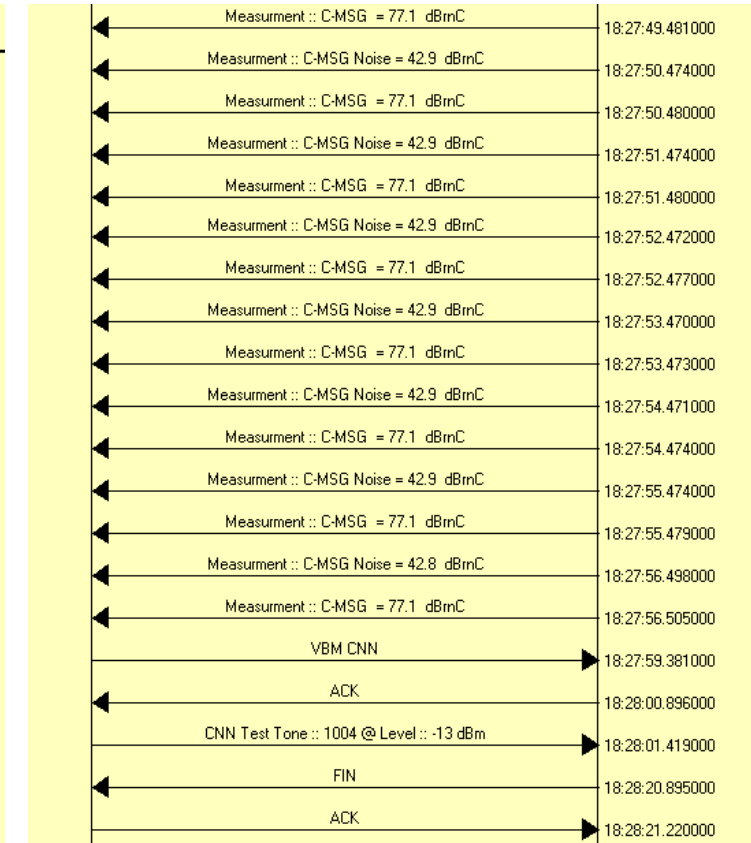
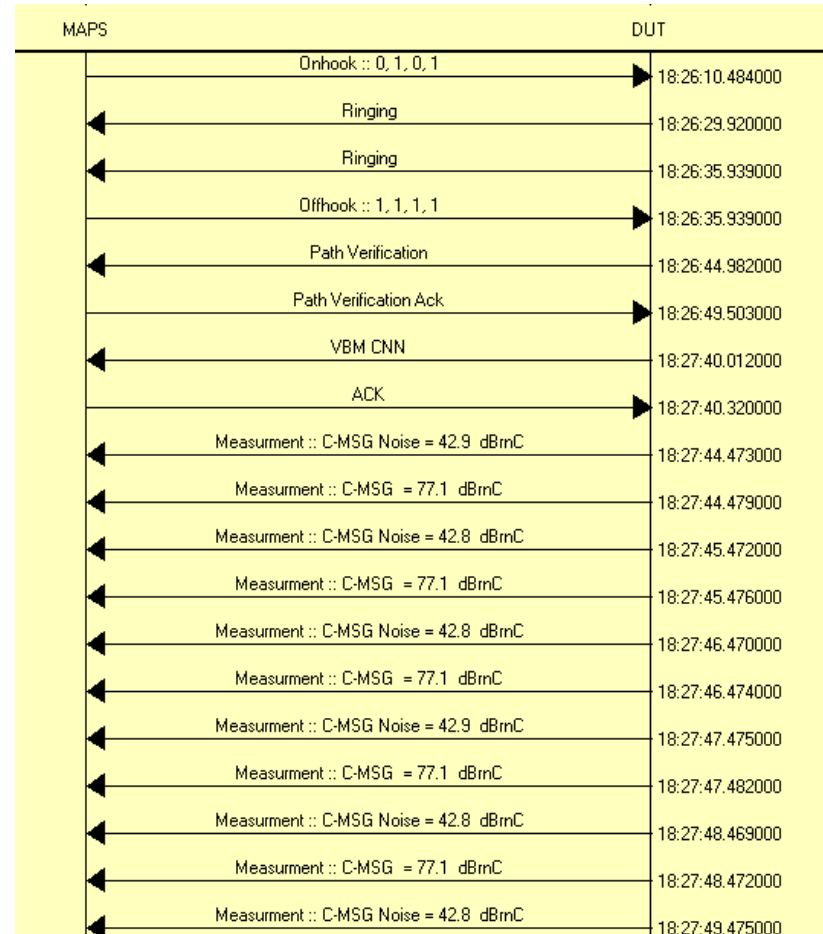
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under **Events** column, right-click and select the **CNN Test** then **VBM CNN** request tone (**Frequency:1049Hz, Power: -13dBm and Duration: 300ms**) is sent
- After receiving the **ACK** (**Frequency: 2351Hz , Power: -13dBm and Duration: 300ms**) PlaceCall side sends **CNN Test Tone 1004Hz** at **-13dBm**
- After receiving the **VBM CNN** request, **ACK** will be sent to receive the C-Messages
- Finally, a **FIN** (**Frequency:1949Hz, Power: -13dBm and Duration: 300ms**) is received to end the test and subsequently an **ACK** is sent to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram (Slave)

- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack Answercall side receives **VBM CNN** request tone (**Frequency:1049Hz, Power: -13 dBm and Duration:300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power: -13dBm and Duration: 300ms**)
- AnswerCall side measures the C Messages and keeps the result in the **C-Message Test Report** tab
- Then AnswerCall side sends **VBM CNN Request** tone and receives the **ACK**
- Now Answercall side sends **CNN Test Tone 1004Hz** at **-13dBm** and is being measured at PlaceCall side
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency: 1949Hz, Power: -13dBm and Duration: 300ms**), and subsequently sending an **ACK**



Signal/C-Notch Noise Test Results

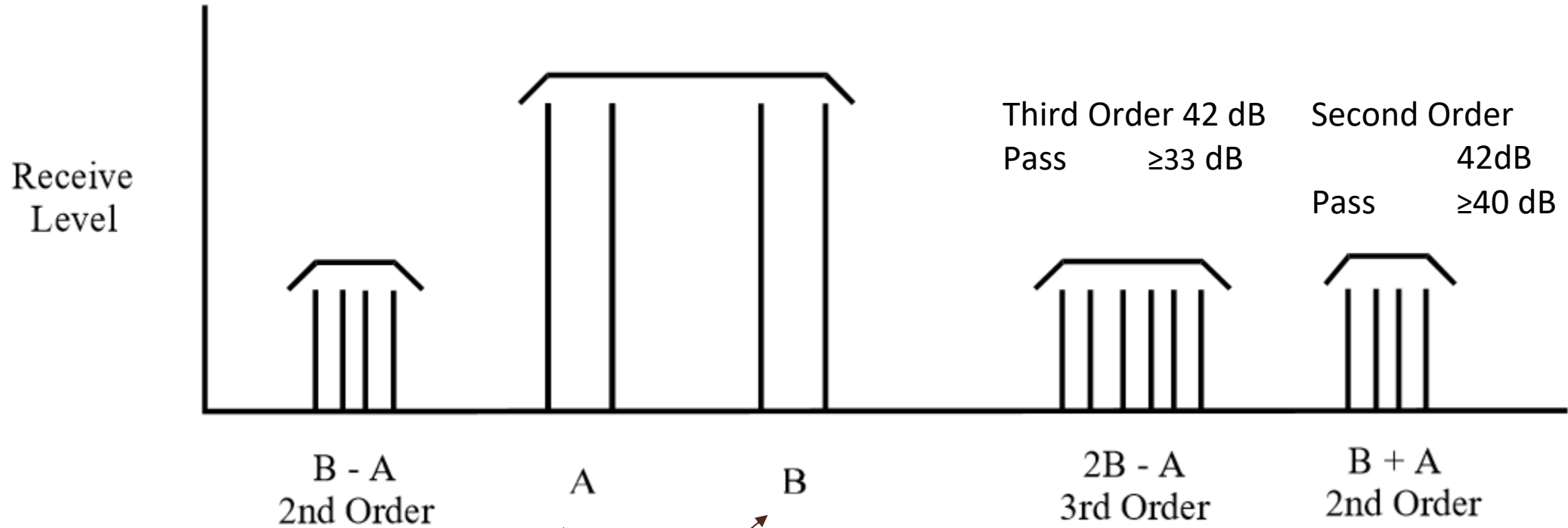
- C-Notch Noise measurement results are logged in the **Signal/C-Notch Noise Test Report** tab for the current test. Results include the received frequency, power level in dBmC, Notched C-message noise levels, and signal to C-Notch Noise level

Date/Time	Circuit Selected	Freq (Hz)	C-MSG Power (dBmC)	C-MSG Noise Power (d...	S/CNN (dB)	VG3(6) Criteria	VG3(6) Test Result
2020-7-21 14:20:36	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:37	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:38	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:39	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:40	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:41	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:42	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:43	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:44	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:45	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:46	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:47	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass
2020-7-21 14:20:48	VG6	1004	77.1	43.3	33.8	S/CNN > 30 dB	Pass

- dBmC - dB relative noise (0dBm=-90dBm) C-weighted

Intermodulation Distortion (IMD) Test

Intermodulation Distortion Test

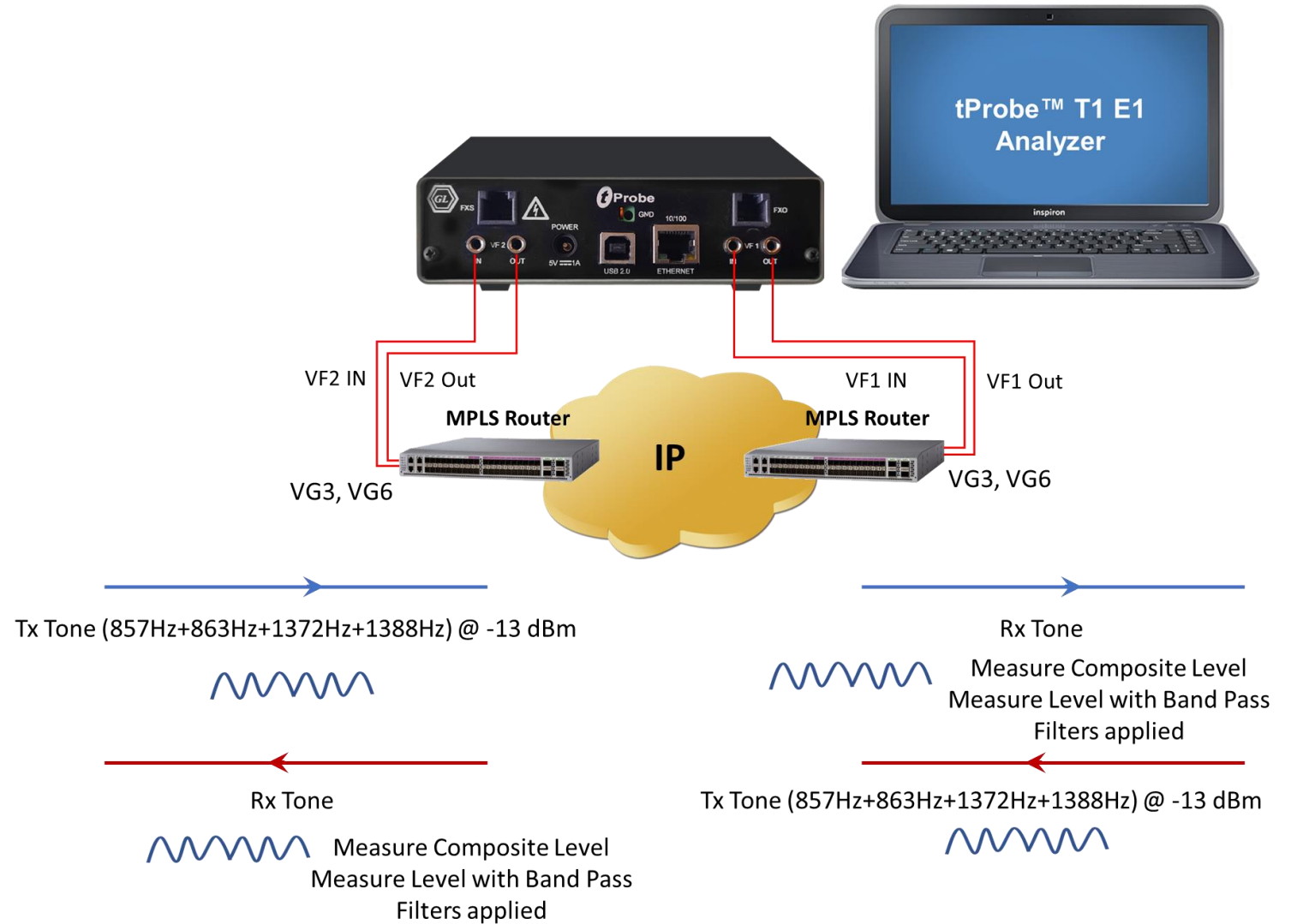


Transmit tones at
VF_Originating.gls

Intermodulation products, if
present

Intermodulation Distortion Test

- Side A sends 4 frequency tone continuously using the below command. User can enter the composite tone level through the profile, and we calculate the individual level in script. In this case the composite level is set to -13 dBm and each tone level is calculated to be -19.0206 dBm
`tx(sum(tone(857, -19.0206), tone(863, -19.0206), tone(1372, -19.0206), tone(1388, -19.0206)), # 1:1) continuous;`
- Side B runs 4 power monitors simultaneously for the following. Power values are reported on every second



Intermodulation Distortion Test

- Monitor Power without filter that looks for the power of the 4 tones (composite tone level around -13 dBm)
- IMD test uses IIR filter
- Power monitor with 505-530 bandpass filter applied. This looks for the power of the 2nd order (B-A product)
- Power monitor with 2225-2255 bandpass filter applied. This looks for the power of the 2nd order (B+A product)
- Power monitor with 1875-1925 bandpass filter applied. This looks for the power of the 3rd order product
 - **dspop {IMD=rx(# 2 : 5), IMD520=filter(rx(# 2 : 5), "filter files\505-530bandpass.IIR"), IMD2240=filter(rx(# 2 : 5), "filter files\2225-2255bandpass.iir"), IMD1900=filter(rx(# 2 : 5), "filter files\1875-1925bandpass.iir"), power monitor(IMD), power monitor (IMD520), power monitor(IMD2240), power monitor(IMD1900)} report event;**
 - Verify power of the 4 tones to be around -13 dBm for 4 seconds
- Then start reporting values in MAPS ladder diagram:
 - Power level of the 4 tones
 - 2nd order signal power and S/IMD when compared to the received power of the 4 tones
 - 3rd order signal power and S/IMD when compared to the received power of the 4 tones

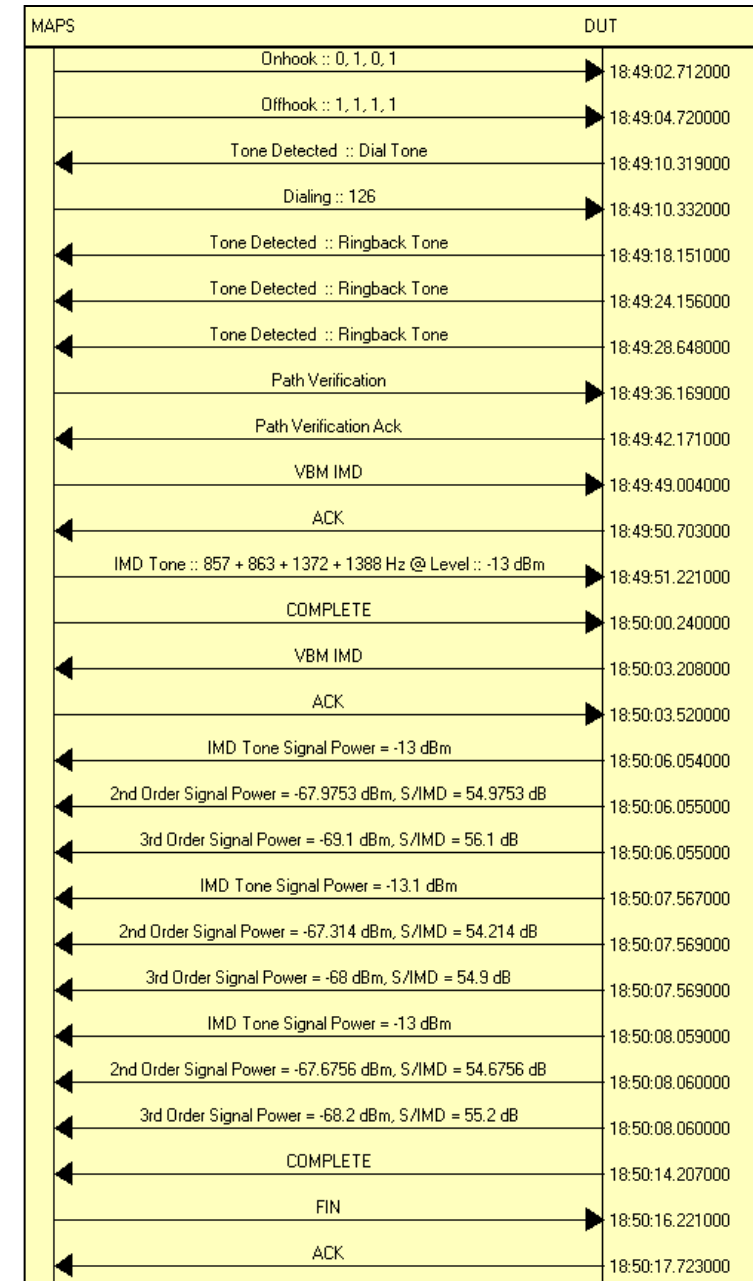
Intermodulation Distortion Test Configuration

- The following parameters can be configured in the **Global profile** for IMD Test:
 - IMD Tone Tx Level
- VG3 Pass Fail Requirement
 - Second Order IMD pass dB loss
 - Third Order IMD pass dB loss e.g.: Pass criteria for -13 dBm is “Second Order S/IMD >33 AND Third Order S/IMD>40”
- VG6 Pass Fail Requirement
 - Second Order IMD pass dB loss
 - Third Order IMD pass dB loss e.g.: Pass criteria for -13 dBm indicates, “Second Order S/IMD >33 AND Third Order S/IMD>40”

[-] Intermodulation Distortion Parameters	
IMD Tone Tx Level	-13.00
[-] VG3 Pass Fail Requirement	
Second Order IMD pass dB loss	33.00
Third Order IMD pass dB loss	40.00
[-] VG6 Pass Fail Requirement	
Second Order IMD pass dB loss	33.00
Third Order IMD pass dB loss	40.00

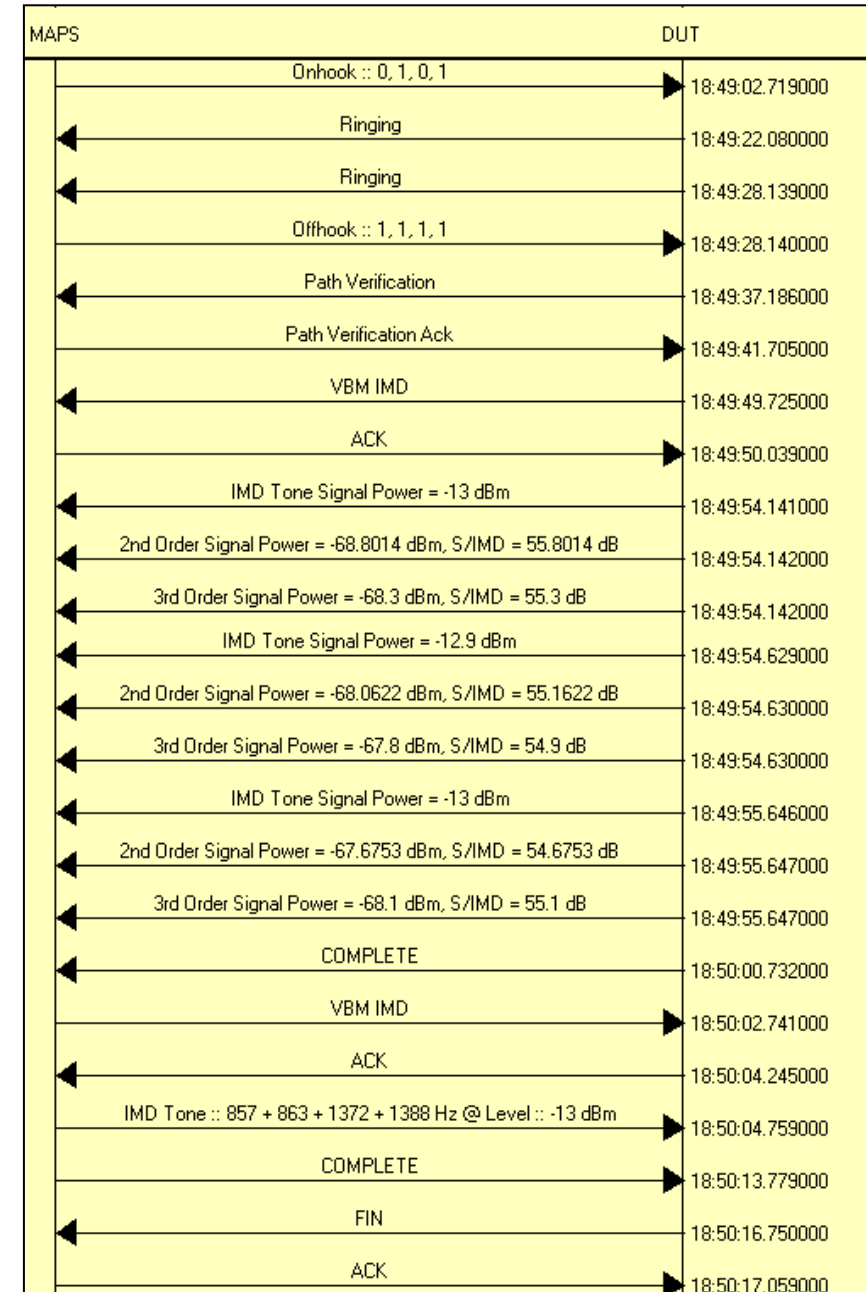
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed, and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under **Events** column, right-click and select the required IMD Test then VBM IMD request tone (**Frequency:1741Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving the **ACK (Frequency: 2351Hz, Power: -13dBm and Duration: 300ms)**, PlaceCall sends 4 tones at **-13dBm** power
- The Composite signal level, 2nd and 3rd order intermodulation power measurement and S/IMD ratio are measured at AnswerCall side
- Finally, PlaceCall side receives **COMPLETE (Frequency: 2251Hz,Power: -13dBm and Duration: 300ms)** tone, sends **FIN (Frequency:1949Hz,Power: -13dBm and Duration: 300ms)** and subsequently **ACK** is received to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram (Slave)

- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack AnswerCall side receives **VBM IMD** request tone (**Frequency:1741Hz, Power: -13dBm and Duration:300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power: -13dBm and Duration: 300ms**)
- Measures level of composite tone, calculates 2nd and 3rd order Intermodulation product levels and S/IMD ratio which are displayed on the arrows in the ladder diagram and send these measurements to **IMD Test Report Tab**
- Then AnswerCall side sends 4 tones and **COMPLETE** (**Frequency:2251Hz, Power: -13dBm and Duration:300ms**) tone
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency: 1949Hz, Power: -13dBm and Duration: 300ms**), and subsequently sending an **ACK**



IMD Test Results

- Intermodulation Distortion measurement results are logged in the “Intermodulation Distortion Test Report” tab for the current test. Results include the received power level, 2nd Order IMD Power in dB, 2nd Order S/IMD in dB, 3rd Order IMD Power in dB, and 3rd Order S/IMD in dB

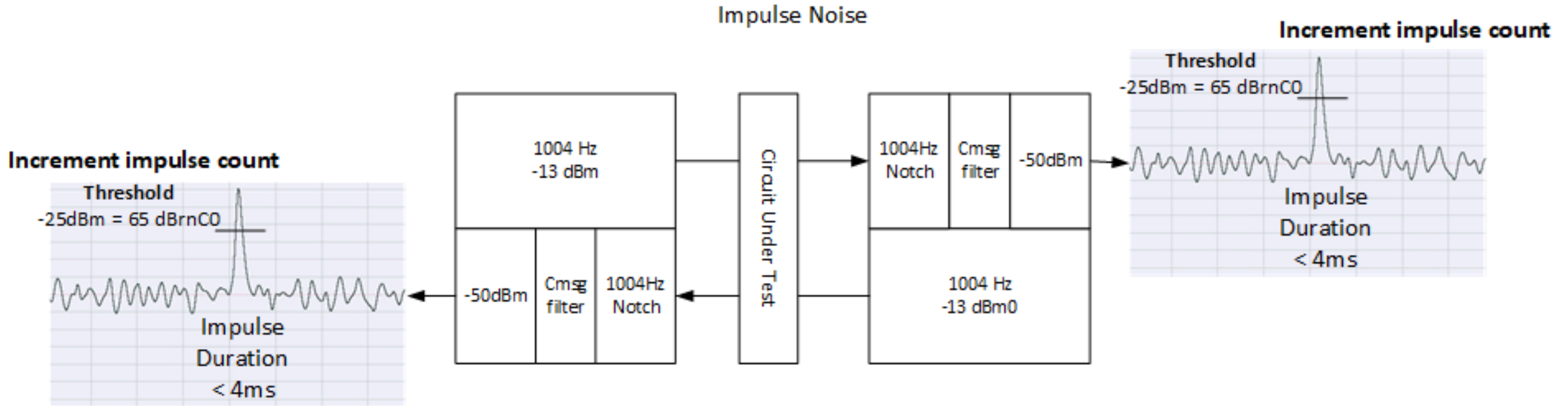
IMD Tone Power...	2nd Order IMD ...	2nd Order S/IMD (dB)	3rd Order IMD Power (dBm)	3rd Order S/IMD (dB)	VG3(6) Criteria	VG3(6) Test Resu
-13.00	-68.89	55.89	-64.69	51.69	2nd Order S/IMD > 33 dB and 3rd Order S/IMD > 40 dB	Pass
-13.00	-68.44	55.44	-64.90	51.90	2nd Order S/IMD > 33 dB and 3rd Order S/IMD > 40 dB	Pass
-13.00	-69.00	56.00	-64.69	51.69	2nd Order S/IMD > 33 dB and 3rd Order S/IMD > 40 dB	Pass

< | >

3-Tone Slope Test Report | Signal/C-Notch Noise Test Report | **Intermodulation Distortion Test Report** | Impulse Noise Test Report | S/NR/Net Loss vs Level Test Report | VQT Test Report

Impulse Noise Test

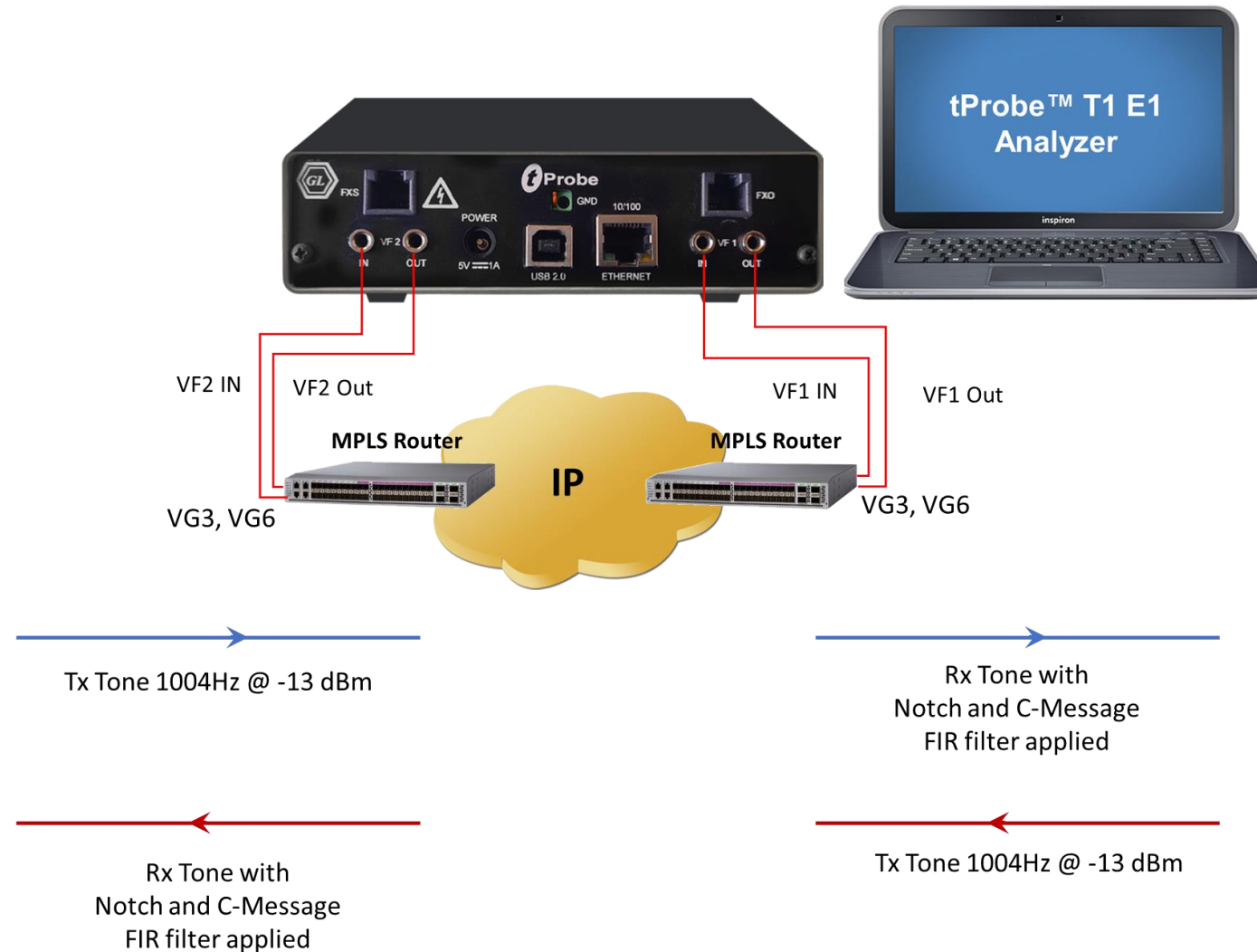
Impulse Noise Test



Pass criteria - No more than 15 counts in 15 minutes at -25 dBm (65 dBmCO)

Impulse Noise Test (Contd.)

- Impulse Noise as any momentary occurrence of the noise on a line significantly exceeding the normal noise peaks. It is analyzed by counting the number of occurrences that exceed a threshold during a specified period of time



Impulse Noise Test Configuration

- The following parameters can be configured in the **Global profile** for Impulse Noise Test:
 - Monitor Duration in sec
 - Threshold level in dBnC
 - Impulse Noise file selection for Verification
 - Impulse Noise file
 - Hold tone level in dBm
- VG3 Pass Fail Requirement
 - Pass count within 15 mins e.g.: The pass criteria is “Impulse Noise count \leq 15” within duration of 15 mins
- VG6 Pass Fail
 - Pass count within 15 mins e.g.: The pass criteria is “Impulse Noise count \leq 15” within duration of 15 mins

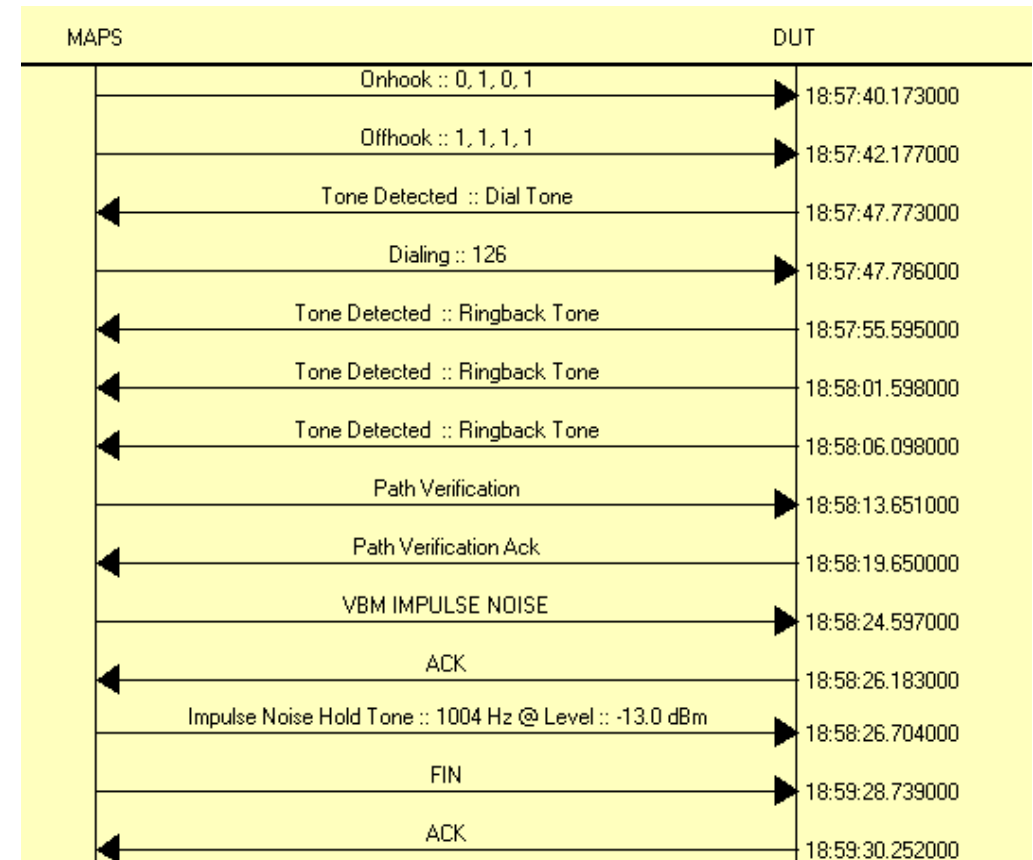
<input type="checkbox"/> Impulse Noise Parameters		
Monitor Duration in sec		900
Threshold level in dBnC		67.00
Impulse Noise file selection for Verification		Disable
Impulse Noise file		16min_16clilcks
Hold tone level in dBm		-13.0
<input type="checkbox"/> VG3 Pass Requirement		
Pass count within 15 Mins		15
<input type="checkbox"/> VG6 Pass Fail Requirement		
Pass count within 15 Mins		15

WCS Commands and Tasks for Impulse Noise Test

- Start impulse noise detector at side **A** and **B**
 - **dspop {ImpulseNoise=dtmfdigitmonitor(mulaw(filter(filter(rx(# 2 : 5), "filter files\CMessage8K.XFR"), "filter files\Notch8K.FIR"), compress), "configini\1004HzWithPops.ini")}** report events;
- Send 1004 Hz hold tone from both sides
- Report every burst event which meets below conditions
 - A) Exceeds the threshold level (65 dBnC configured in Profile Editor)
 - B) Did not occur during the 125 ms blanking interval, then increase impulse noise counter
- Monitor until the Monitor Duration is satisfied, (default duration configured in Profile Editor is 900 sec)

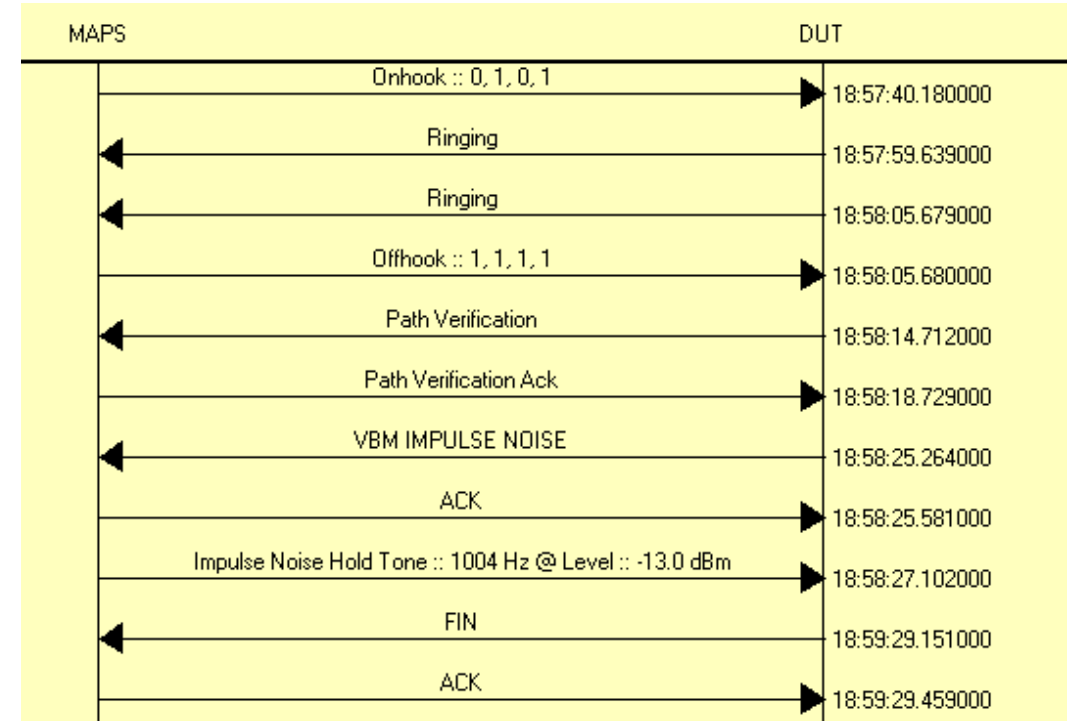
VF_Originating.gls Ladder Diagram

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under **Events** column, right-click and select the **VBM Impulse Noise Test** then VBM IMPULSE NOISE request tone (**Frequency:1867Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving the **ACK (Frequency:2351Hz ,Power: -13dBm and Duration: 300ms)** PlaceCall side sends **Holding** tone (**1004Hz, -13dBm**) and monitors Impulse Noise for the configured interval of time
- Finally, a **FIN (Frequency: 1949Hz, Power: -13dBm and Duration: 300ms)** is received to end the test and subsequently an **ACK** is sent to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram

- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack, Answercall side receives **VBM IMPULSE NOISE** request tone (**Frequency:1867Hz, Power: -13dBm and Duration:300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power: -13dBm and Duration: 300ms**)
- Then AnswerCall side sends **Holding tone (1004Hz -13.dBm)** and monitors Impulse Noise for the configured interval of time.
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency:1949Hz, Power: -13dBm and Duration:300ms**), and subsequently sending an **ACK**



Impulse Noise Test Results

- Intermodulation Distortion measurement results are logged in the “Impulse Noise Test Report” tab for the current test. Results will be empty if no impulse hits occur. When there are counts it will report the received noise level and total counts

Date/Time	Circuit Selected	dBrnC	Count	VG3(6) Criteria	VG3(6) Test Result
2020-7-21 14:36:46	VG6	N/A	0	Pass Count <= 15 in 15 m...	Pass

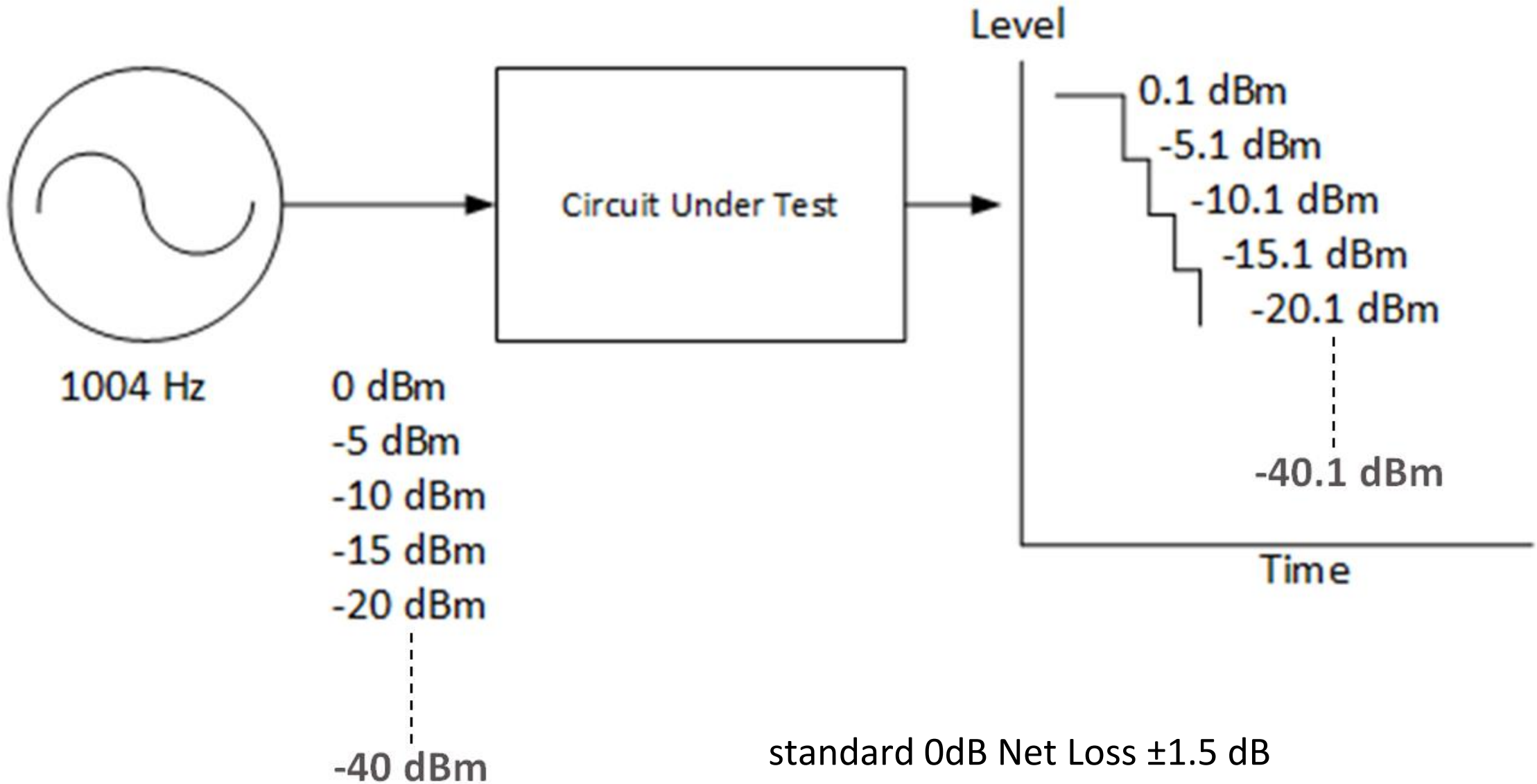
◀ ▶ 3-Tone Slope Test Report | Signal/C-Notch Noise Test Report | Intermodulation Distortion Test Report | **Impulse Noise Test Report** | S/NR/Net Loss vs Level Test Report | VQT Test Report

Date/Time	Circuit Selected	dBrnC	Count	VG3(6) Pass Criteria	VG3(6) TestResult
2020-5-26 16:32:56	VG6	75	1	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:33:56	VG6	75.1	2	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:34:56	VG6	75	3	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:35:56	VG6	75	4	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:36:56	VG6	75	5	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:37:56	VG6	75.1	6	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:38:56	VG6	74.9	7	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:39:56	VG6	74.9	8	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:40:56	VG6	75	9	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:41:56	VG6	74.8	10	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:42:56	VG6	74.9	11	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:43:56	VG6	74.8	12	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:44:56	VG6	74.9	13	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:45:56	VG6	71.9	14	Pass Count <= 15 in 15 mins	Pass
2020-5-26 16:46:56	VG6	75	15	Pass Count <= 15 in 15 mins	Pass

◀ ▶ 3-Tone Slope Test Report | Signal/C-Notch Noise Test Report | Intermodulation Distortion Test Report | **Impulse Noise Test Report** | S/NR/Net Loss vs Level Test Report | VQT Test Report

S/N Ratio and Net Loss Vs Level

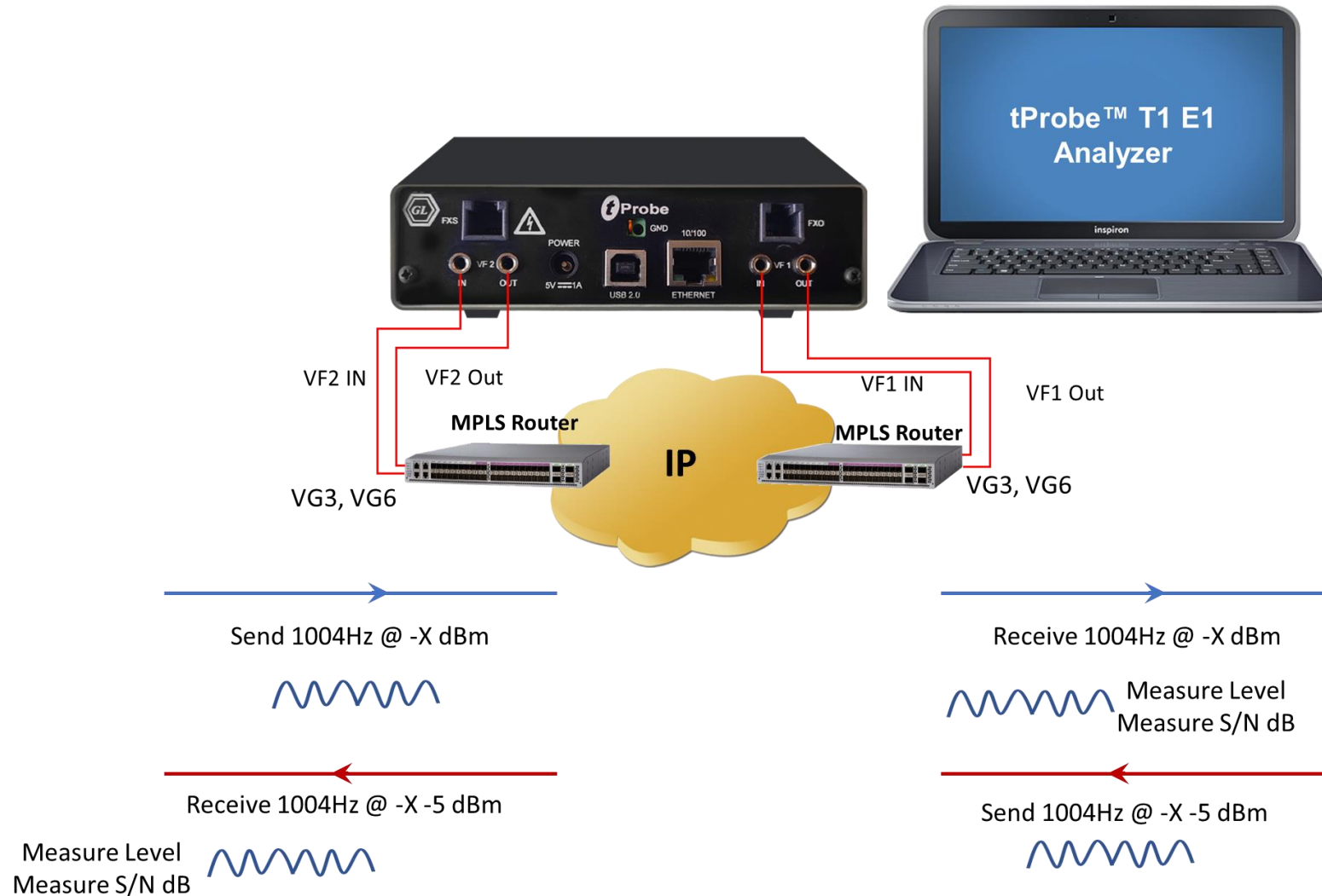
S/N Ratio and Net Loss Vs Level



standard 0dB Net Loss ± 1.5 dB

S/N Ratio and Net Loss Vs Level

- **Signal-to-Noise Ratio and Level** - Transmission of 1004 Hz (reference tone) with incrementing level of the tone at every iteration (example, by 5 dBm). At the reception side, measure levels and S/N ratio. This can be done in both the directions in a single test



WCS Commands and Tasks used for SNR Measurements

- To send 1004 Hz tone with different levels, MAPS APS uses WCS Tx Tone command
tx tone (<Freq> , <Power Level>) # <Card No> : <Timeslot> <Duration> msec ;
- Below is the command sent by MAPS APS to WCS server
tx tone (1004 , -45) # 1 : 1 3000 msec ;
- To Measure SNR Level and Signal to Noise Ratio, MAPS APS uses WCS Monitor Tone and Monitor SNR commands respectively. Responses given by WCS Server are presented to user In Ladder Diagram and SNR Report Tab in the Call Generation window
monitor tones ("<MTD File Name>") # <Card No> : <Timeslot> ;
monitor s/n ratio # <Card No> : <Timeslot> ;
- Below are commands sent by MAPS APS to WCS server
monitor tones ("MAPS\APS\VF\MTD Files/Voicebandsignal.mtd") # 2 : 5 ;
monitor s/n ratio # 2

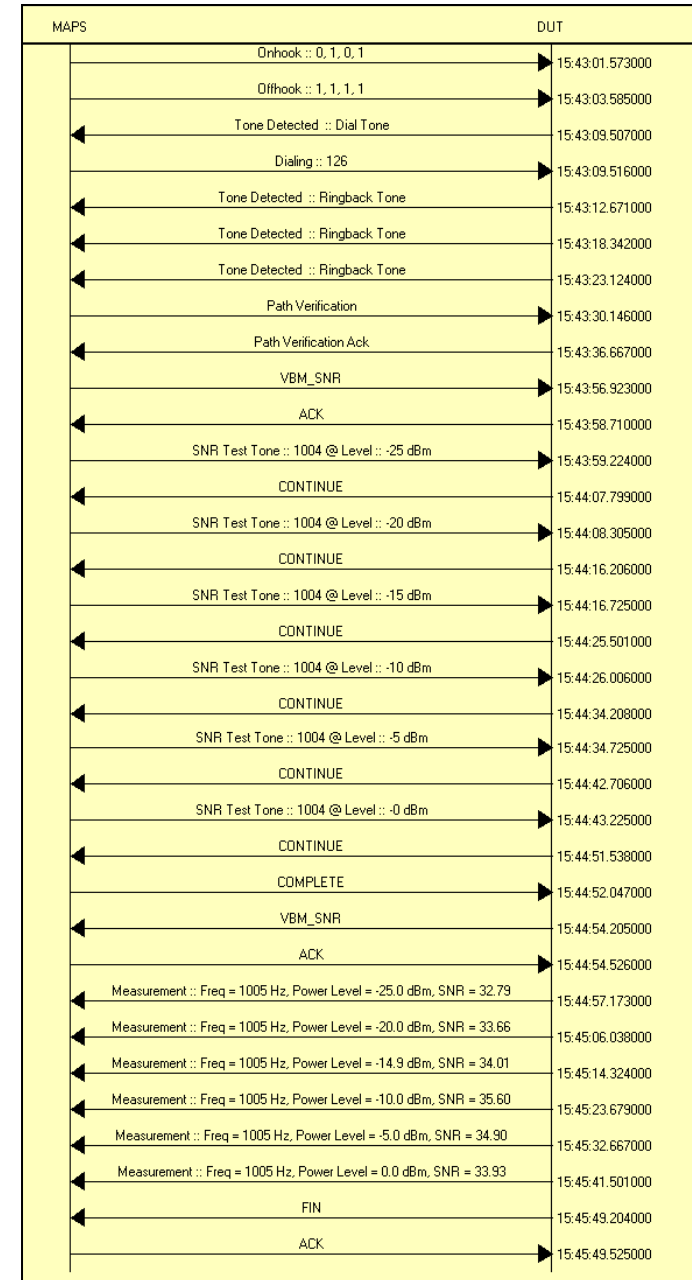
S/N Ratio Net Loss vs Level Test Configuration

- The following parameters can be configured in the **Global profile** for SNR test:
 - SNR Tone Frequency
 - SNR Tone Duration
 - SNR Tone Minimum (starting) Level
 - SNR Tone Level step: tone levels are increased at this defined step
- VG3 Pass Fail Requirement
 - Min Pass Power in dBm
 - Max Pass Power in dBm e.g.: Pass criteria for -45 dBm is -46 to -44 dBm
- VG6 Pass Fail Requirement
 - Min Pass Power
 - Max Pass Power e.g.: Pass criteria for -45 dBm is -46.5 to -43.5 dBm

[-] Signal to Noise and Level Test Parameters	
SNR Tone Frequency in Hz	1004
SNR Tone Duration in ms	3000
SNR Tone Minimum Level in dBm	-45.0
SNR Tone Level Step Size in dBm	5
[-] VG3 Pass Fail Requirement	
Min Pass Power	1.00
Max Pass Power	1.00
[-] VG6 Pass Fail Requirement	
Min Pass Power	1.50
Max Pass Power	1.50

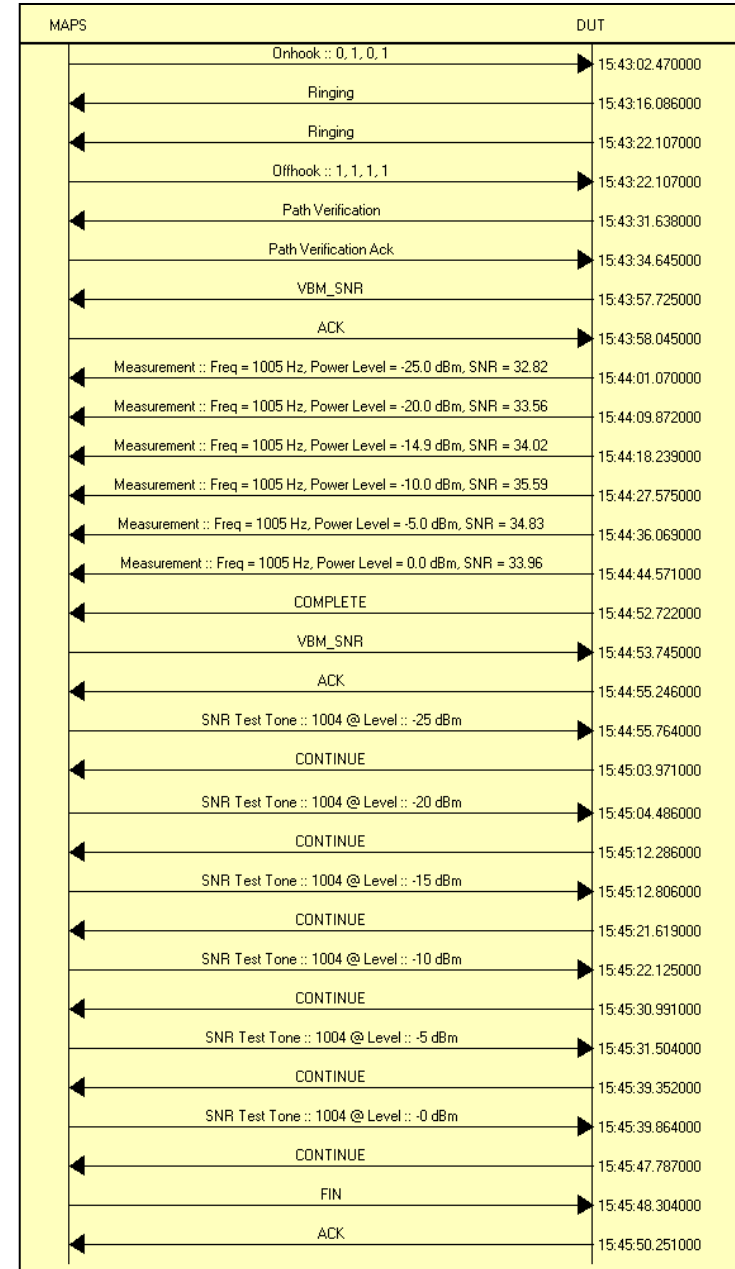
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under Events column, right-click and select the **SNR** then **VBM SNR** request tone (**Frequency:853Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving the **ACK (Frequency:2351Hz ,Power: -13dBm and Duration:300ms)** PlaceCall sends **SNR Test Tone of 1004Hz at -25dBm**
- After receiving **CONTINUE (Frequency:2153Hz, Power: -13dBm and Duration:300ms)** tone, it sends **1004Hz at -20dBm** Similarly, send the next tone by incrementing 5dBm till 0dBm
- After receiving **COMPLETE (Frequency:2251Hz, Power: -13dBm and Duration:300ms)** tone, the other end will send **VBM SNR (Frequency: 853Hz, Power: -13dBm and Duration:300ms)** to indicate start of **SNR** test in the reverse direction and start sending tone of **1004Hz** from **-25dBm** incrementing by 5dBm at each level
- Finally, a **FIN (Frequency: 1949Hz, Power: -13dBm and Duration:300ms)** is received to end the test and subsequently an **ACK** is sent to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram (Slave)

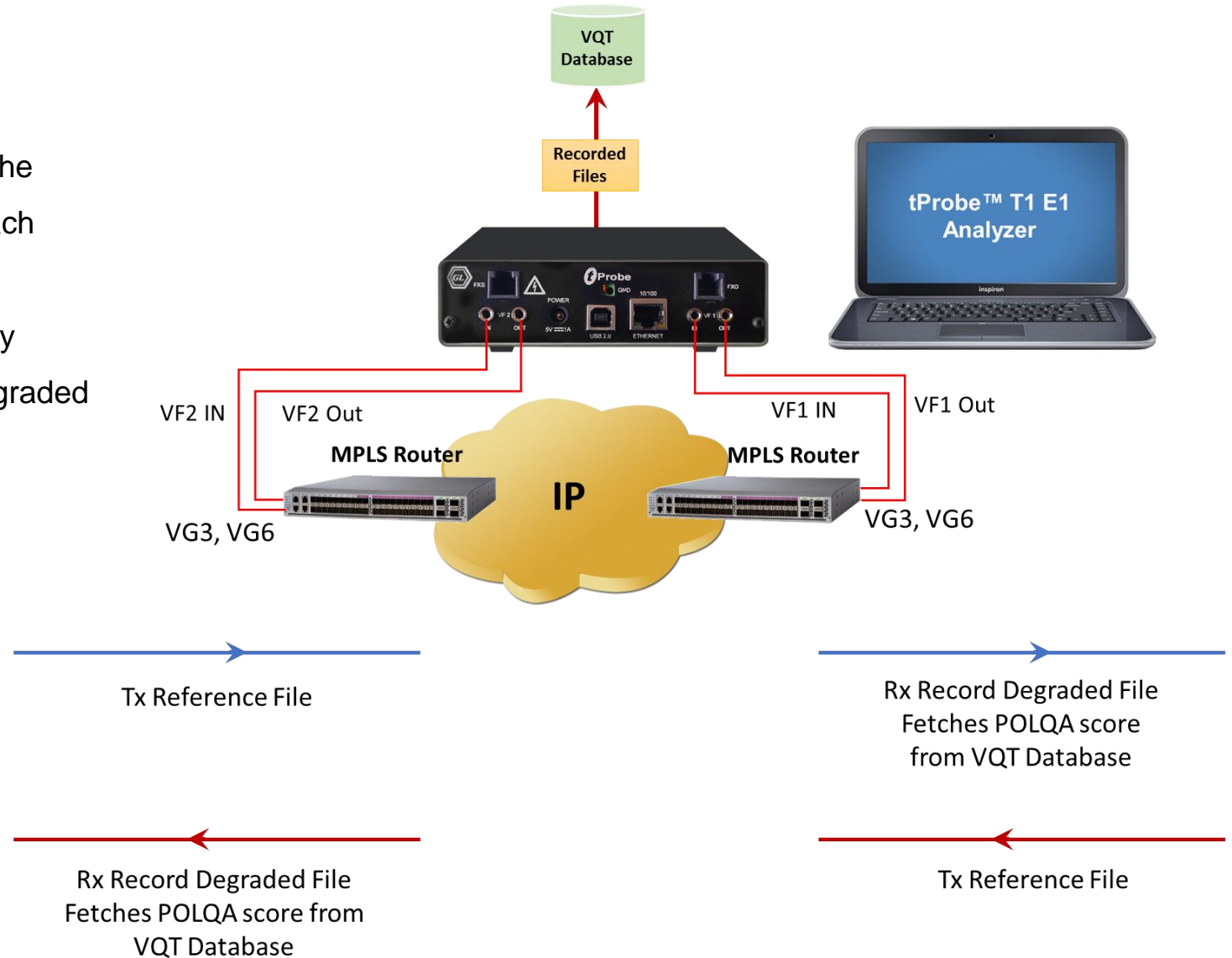
- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack AnswerCall side receives **VBM_SNR (Frequency:853Hz, Power: -13 dBm and Duration:300ms)** and acknowledged by sending **ACK (Frequency: 2351Hz, Power: -13dBm and Duration:300ms)** and it starts monitoring tones and **Signal to Noise Ratio**
- Then AnswerCall side measures **SNR Test Tone of 1004Hz** is received at **-25dBm, Signal to Noise Ratio** measurements are started and requesting for the next level of tone by sending **CONTINUE (Frequency:2153Hz,Power: -13dBm and Duration:300ms)** tone. Now, the tones are constantly being received incremented by **5dBm till 0dBm**
- After receiving **COMPLETE (Frequency:2251Hz,Power: -13dBm and Duration:300ms)** tone from PlaceCall to indicate the test is completed
- Now AnswerCall side will start the test from reverse direction and **SNR Test** tone is sent from **-25 dBm** and incremented by **5dBm** till **0dBm**
- AnswerCall side terminates the call by receiving the **FIN (Frequency: 1949Hz, Power: -13dBm and Duration: 300ms)**, and subsequently sending an **ACK**



Voice Quality Testing (VQT)

VQT Test

- **Voice Quality Test (VQT)** - This test involves transmission of reference file and recording of the degraded file in two sequential tests, one for each direction
- The VQT software calculates a POLQA score by comparing and analyzing the reference and degraded files



VQT Test Configuration

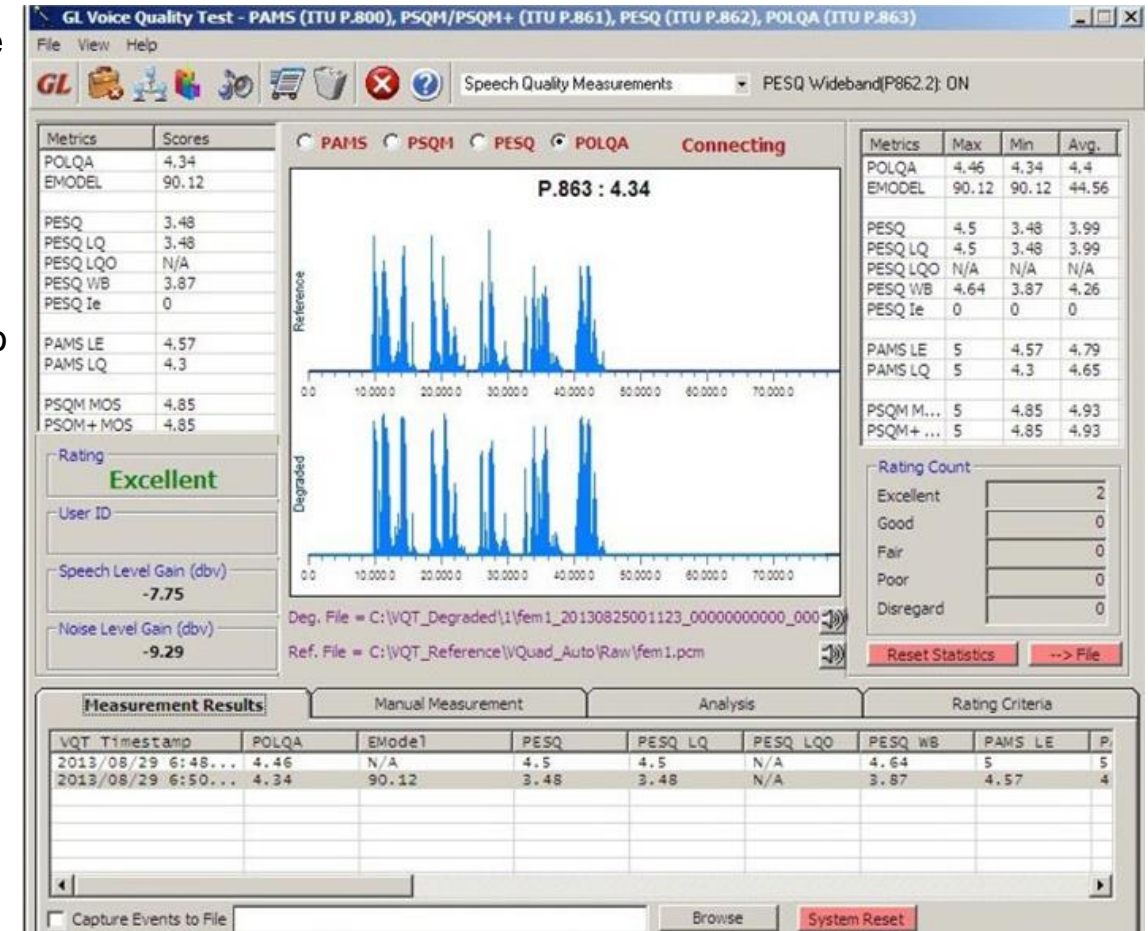
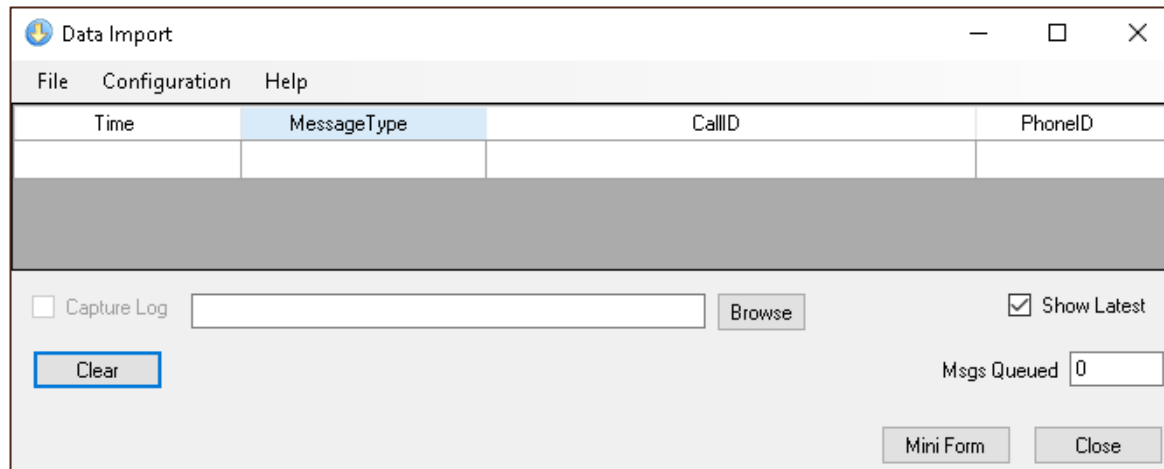
- The following parameters can be configured in the **Global profile** for VQT Test:
 - VQT parameters such as the reference file and degraded file path can be configured in the Global Configuration
 - Reference file is a ITU standard reference voice file. File path should exist on the Server system under C:\VQT_Reference
 - Degraded File Path defines where the recorded files are stored
 - VQT Database Path is the location of the VQT.mdb database file where VQT results are stored. This is typically under C:\Program Files (x86)\GL Communications Inc\DataImport\VQT.mdb

VQT Parameters	
Reference File	C:\VQT_Reference\VQuad_Auto\POLQ..
Degraded File Path	C:\VQT_Degraded\1u\
VQT Server IP Address	127.0.0.1
One Way Delay Measurement	Enable

VQT Parameters	
VQT Database Path	\\127.0.0.1\DataImport\VQT.mdb
VQT Type	POLQA

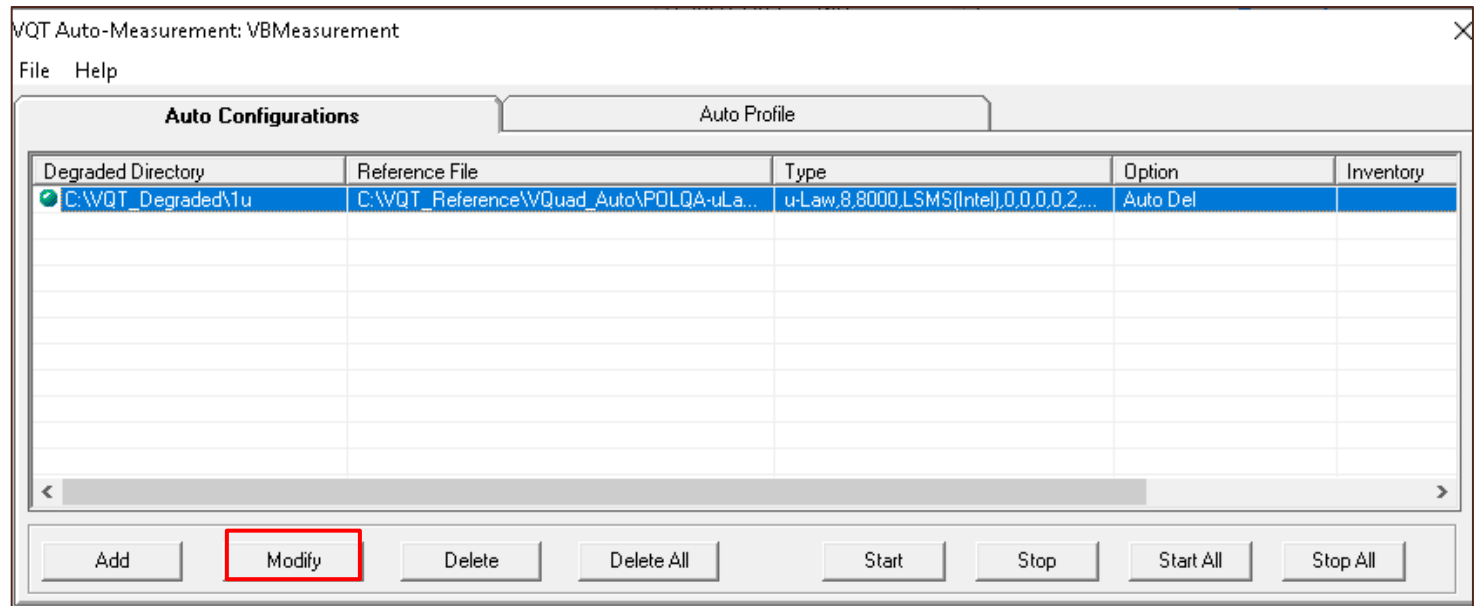
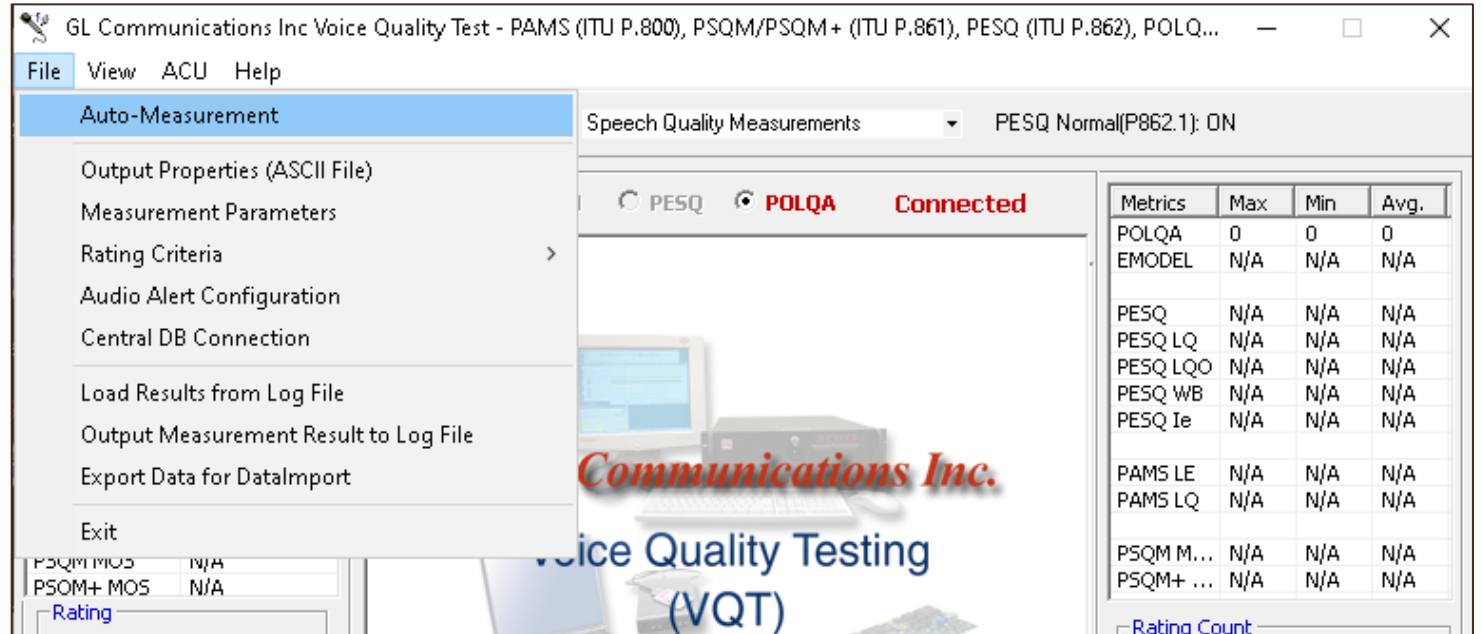
VQT Test

- Double-click on the GL VQT shortcut icon created on the desktop to invoke the application
- Double click on Data Import shortcut icon created on the desktop to start the database
- MAPS™ APS records degraded files into designated directories. VQT Auto Measurement automatically performs analysis when new degraded file is detected
- POLQA results are stored into a database via Data Import and results are read by MAPS™ APS



VQT Test Parameters

- On the VQT application, click on **File** → **Auto-Measurement** to invoke VQT Auto-Measurement window
- Click on **Modify** to configure Auto-Measurement parameters



VQT Test Parameters

- Degraded File Path should match the Degraded Directory defined in the MAPS™ APS VQT parameters in profiles
- Reference File should match the Reference File specified in the MAPS™ APS VQT parameters
- After configuring, click on **Start**
- VQT Auto Measurement monitors files recorded to that directory and automatically performs POLQA analysis. VQT scores are stored in a database which is read by MAPS™

VQT Auto-Measurement: bhushan

File Help

Auto Configurations | Auto Profile

Degraded Directory	Reference File	Type	Option	Inventory	User ID	Counts
✓ C:\WQT_Degraded\1u\	C:\WQT_Reference\WQuad_Auto\POLQA-uLa...	u-La...	Auto Del		tprobe1	2

Add Modify Delete Delete All Start Stop Start All Stop All

Options

Degraded Directory * C:\WQT_Degraded\1u\

Reference File * C:\WQT_Reference\WQuad_Auto\POLQA-uLa...

User ID tprobe1 Prohibit Graphic Redraw (save processor power)

POLQA Only

Enable Level Alignment High Accuracy Mode ITU Version 2

Analyze 12-bit Degraded files (Reference files will remain 16-bit)

File Format

Encoding u-Law Samples Per Second 8000

Byte Order LSMS(Intel) Bits Per Sample 8

Auto-delete the degraded file after measurement

Save degraded files to the inventory directory after measurement

Inventory Directory*

Saving Criteria (optional)

Excellent Good Fair Poor

PESQ + POLQA PESQ Only POLQA Only

PESQ WB POLQA SWB

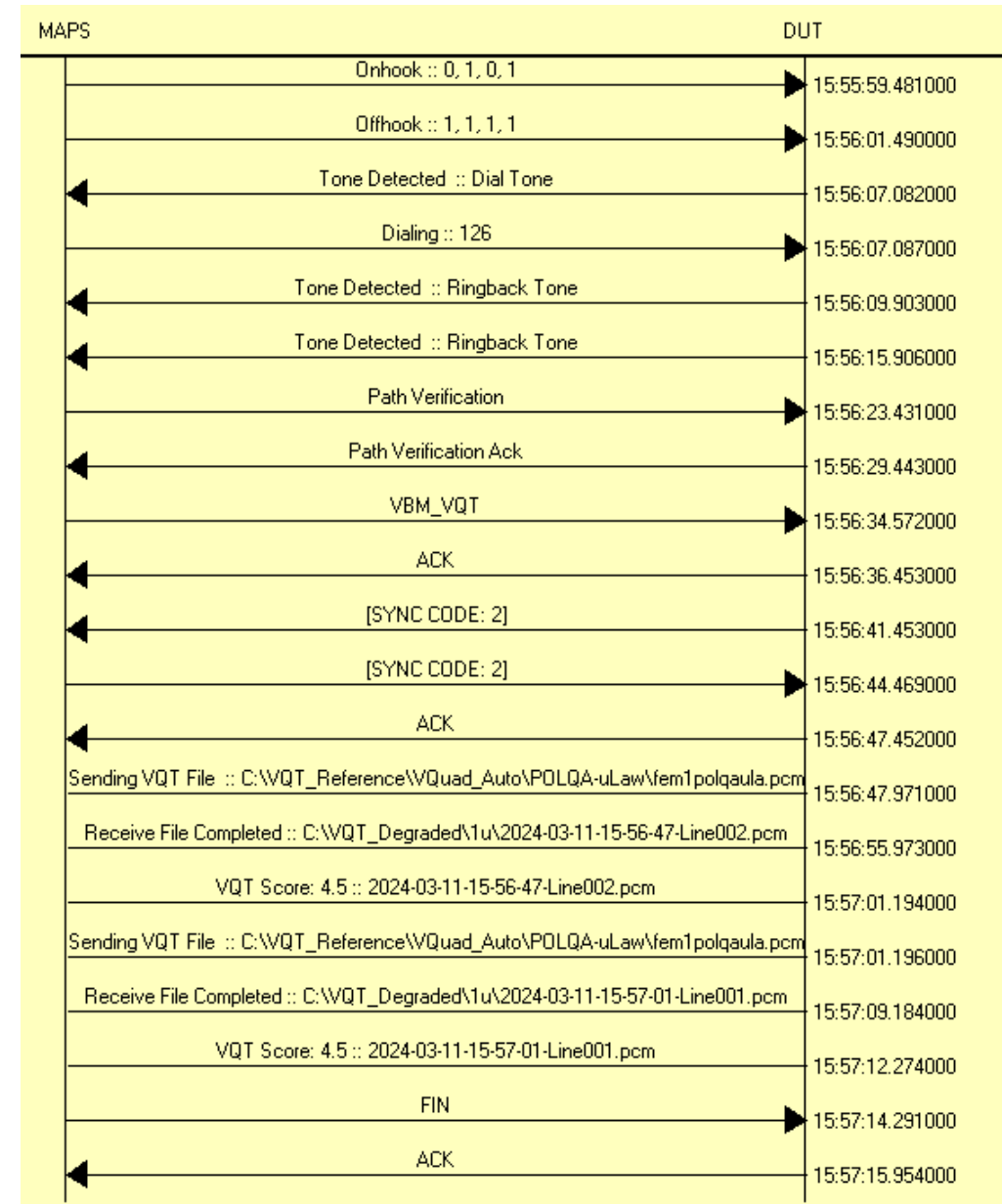
Start: 1 End: 1 ?

Note *: Use "?" in reference fields to hold the Number

Quick Modify Quick Default Save Changes Cancel

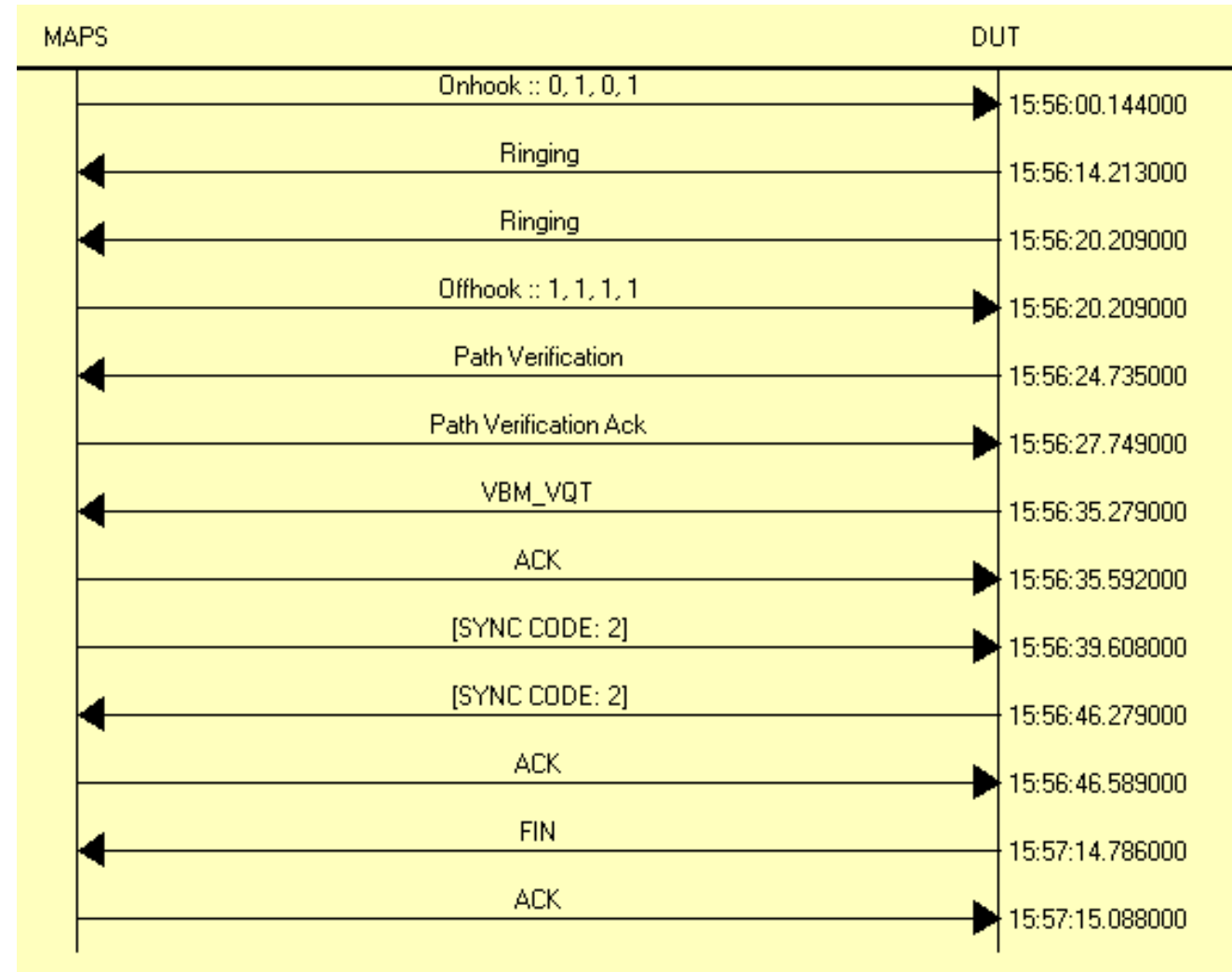
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under **Events** column, right-click and select the **VQT Test** then **VBM VQT** request tone (**Frequency:751Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving the **ACK (Frequency:2351Hz , Power: -13dBm and Duration: 300ms)** PlaceCall sends a reference file
- Test the reverse direction: After receiving the **VBM VQT** request, **ACK** will be sent to receive the Degraded files and calculates the POLQA Score and Retrieve VQT results from VQT database
- Finally, a **FIN (Frequency:1949Hz,Power: -13dBm and Duration:300ms)** is received to end the test and subsequently an ACK is sent to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram (Slave)

- Initially both sides are on-hook
- An incoming call is detected When the call is answered on the second ring, an Off-Hook is sent.
- After the Path Verification Ack AnswerCall side receives **VBM VQT** request tone (**Frequency:751Hz, Power: -13 dBm and Duration:300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power:-13dBm and Duration:300ms**)
- After sending the **VBM VQT** request, **ACK** is received, and then AnswerCall sends reference file
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency:1949Hz, Power:-13dBm and Duration:300ms**), and subsequently sending an **ACK**



Test Results

- VQT measurement results are logged in the **VQT Test Report** tab for the current test. VQT test report contains Caller POLQA Score, Callee to Caller Delay (in msec), Callee Degraded File Name, Callee POLQA Score, and Caller to Callee Delay (in msec)

Date/Time	Caller Degraded File Name	Caller POLQA Sc...	Callee to Caller Delay (msec)	Callee Degraded File Name	Callee POLQA Score	Caller to Callee Delay (msec)	
2020-5-11 09:44:55	2020-May-11-Line001#6881493.pcm	4.13	70.75	2020-May-11-Line002#6881493.pcm	4.19	70.62	


◀ ▶ ↻

SNR and Level Test Report **VQT Test Report** 3-Tone Slope Test Report Attenuation Distortion Test Report 1004 Hz Tone Test Report Intermodulation Distortion Test Report Impulse Noise Test Report

Twenty-Three Tone Test

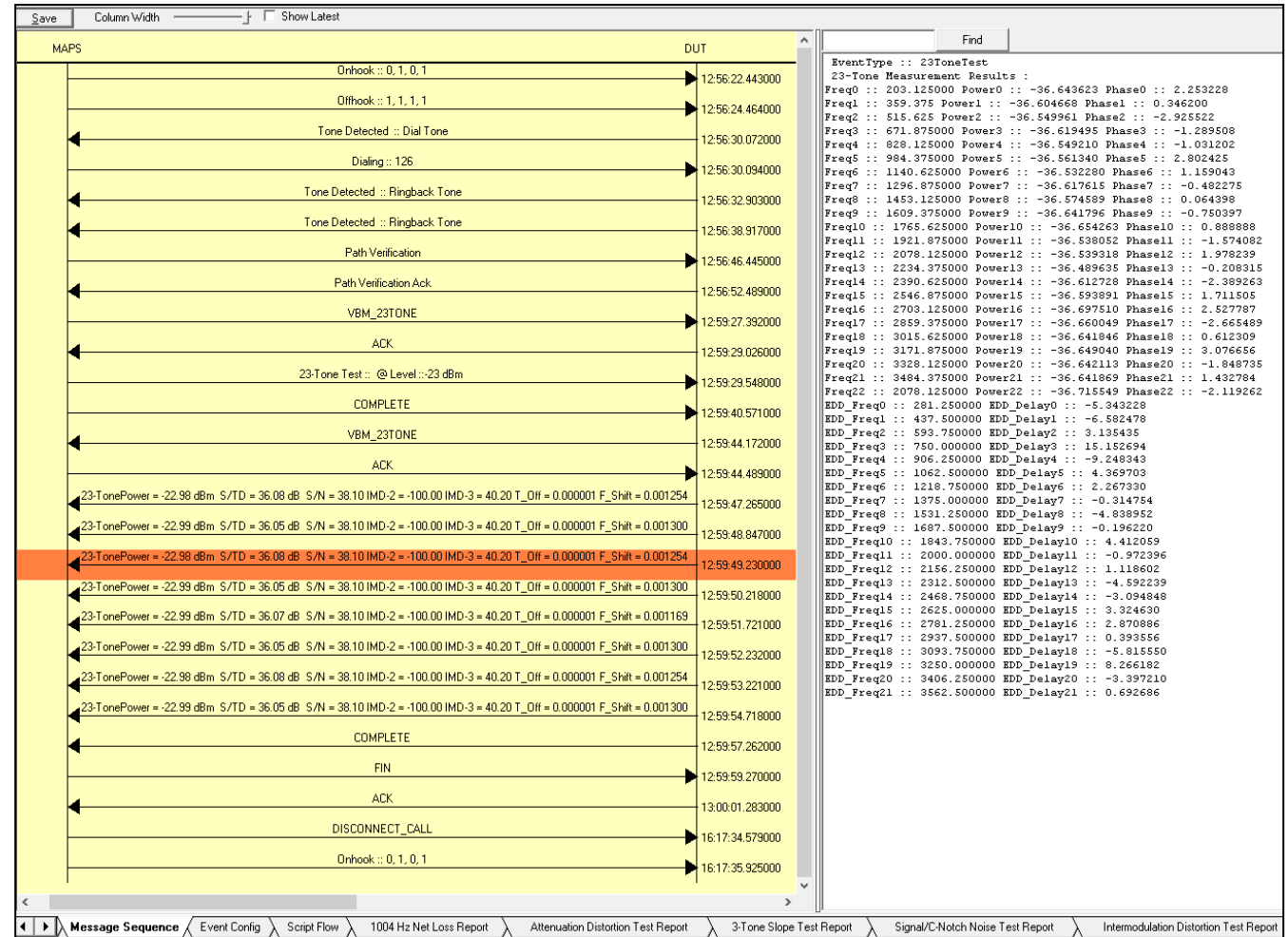
Twenty-Three Tone Test

- The Twenty-Three test signal consists of 23 equally spaced tones from 203.125Hz to 3640.625Hz with known phase relationships. Since the phases of the 23 tones are known, straightaway envelope delay distortion measurements made at 22 frequencies. At the same time, the frequency response (or attenuation distortion) at the 23 transmitted frequencies measured along with other measurements
- The following parameters can be configured in the Global profile for Twenty-Three Tone Test Parameters:
 - Twenty-Three Tone Test Duration in ms
 - Report Frequency in ms
 - Twenty-Three Test Tone Level in dBm

 Twenty Three Tone Test Parameters	
├── Twenty Three Test Tone Duration in ms	10000
├── Report Frequency in ms	1000
└── Twenty Three Test Tone Level in dBm	-23

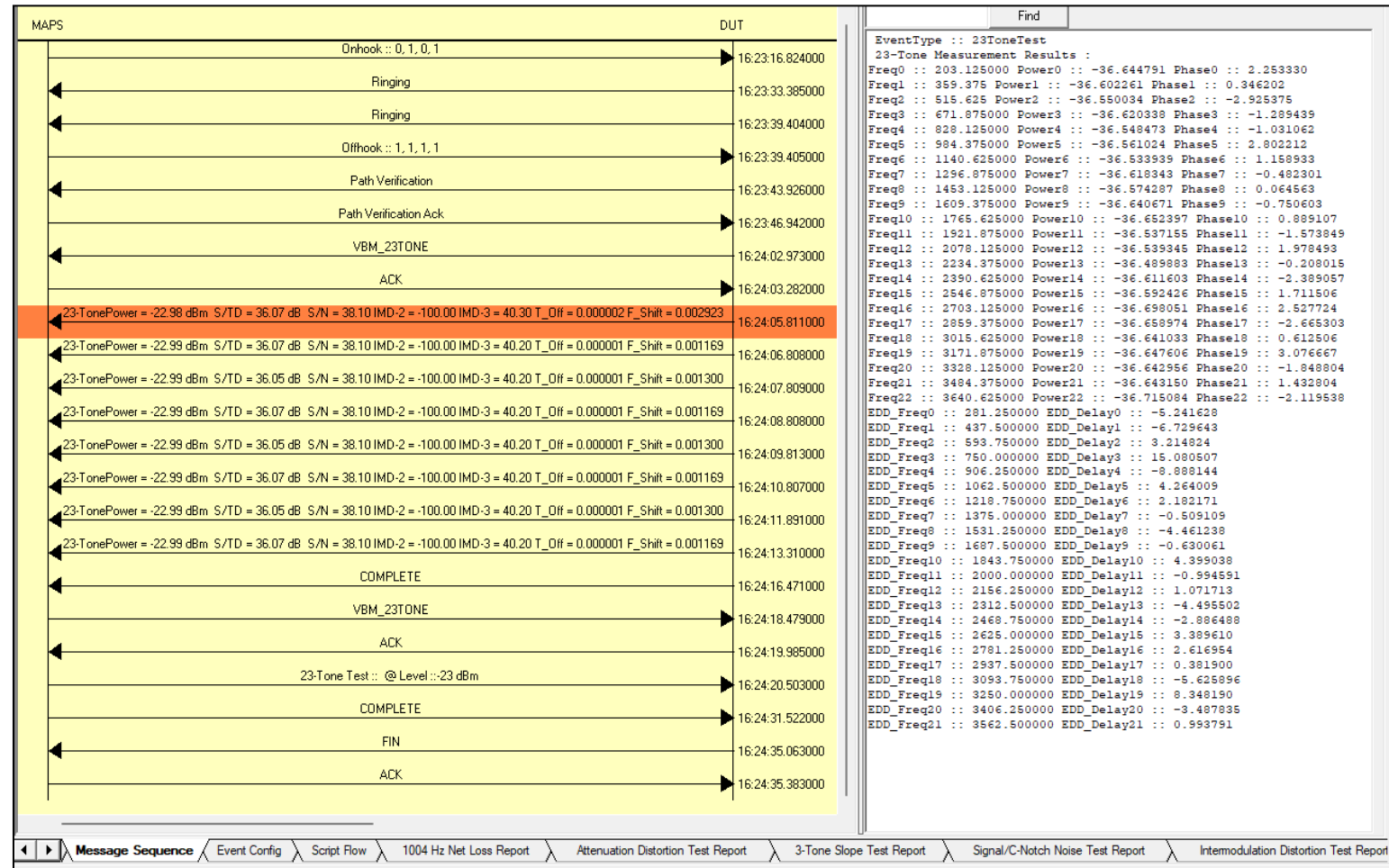
VF_Originating.gls Ladder Diagram (Master)

- Initially both sides are On-Hook
- When it goes Off hook, dial tone is detected, the number is dialed and ring back tone is received
- Connection is established and Path Verification is done
- Waiting for user input. Under Events column, right-click on the running call and select the required **23 Tone Test** then **VBM-23 Tone** request tone (**Frequency: 1781Hz, Power: -13dBm and Duration:300ms**) is sent
- After receiving **ACK (Frequency: 2351Hz, Power: -13dBm and Duration:300ms)**, PlaceCall sends the 23 tone test.
- After receiving **COMPLETE (Frequency:2251Hz,Power: -13dBm and Duration:300ms)** tone, AnswerCall side will send **VBM 23 Tone** request tone and receives the ACK
- After receiving the ACK, Answercall sends the 23 tone test.
- Finally, a **FIN (Frequency: 1949Hz, Power: -13dBm and Duration:300ms)** is received to end the test and subsequently a **ACK (Frequency: 2351Hz, Power: -13 dBm and Duration:300ms)** is sent to indicate that call will be terminated



VF_Terminating.gls Ladder Diagram (Slave)

- Initially both sides are On-Hook
- An incoming call is detected. When the call is answered on the second ring, an Off-Hook is sent
- After the Path Verification Ack, Answercall side receives **VBM 23 Tone** request tone (**Frequency:1781Hz, Power: -13 dBm and Duration:300ms**) and acknowledged by sending **ACK** (**Frequency: 2351Hz, Power: -13dBm and Duration:300ms**)
- Then AnswerCall side detects the received **23** tone at **-23dBm** level for duration of 10sec and keep the result in the **23 Tone Test Report** tab
- After receiving **COMPLETE** (**Frequency:2251Hz, Power: -13dBm and Duration:300ms**) tone, AnswerCall side will send **VBM 23 Tone** request tone and receives the **ACK**
- Now Answercall side sends the 23 tone test.
- AnswerCall side terminates the call by receiving the **FIN** (**Frequency: 1949Hz, Power: -13dBm and Duration:300ms**), and subsequently sending an **ACK**



Test Results

- The 23-Tone tab results are as follows:

Date/Time	Total Signal P...	Total 23-Tone Power (...)	S/TDR	SNR	IMD 2nd Order	IMD 3rd Order	T_Off	F_Shift	Freq0	Power0	Phase0	Freq1	Power1	Phase1	Freq2	Power2	Phase2	Freq3	Power3	Phase3
2024-3-1 12:59:31	-22.988426	-22.989771	36.085354	38.160557	-100.000000	40.288956	0.000001	0.001254	203.125000	-36.643623	2.253228	359.375	-36.604668	0.346200	515.625	-36.549961	-2.925522	671.875000	-36.619495	-1.289500
2024-3-1 12:59:32	-22.988659	-22.990009	36.058861	38.134090	-100.000000	40.262421	0.000001	0.001300	203.125000	-36.644096	2.253417	359.375	-36.603668	0.346299	515.625	-36.550247	-2.925542	671.875000	-36.620953	-1.289489
2024-3-1 12:59:33	-22.988426	-22.989771	36.085354	38.160557	-100.000000	40.288956	0.000001	0.001254	203.125000	-36.643623	2.253228	359.375	-36.604668	0.346200	515.625	-36.549961	-2.925522	671.875000	-36.619495	-1.289500
2024-3-1 12:59:34	-22.988947	-22.990295	36.071377	38.149170	-100.000000	40.270748	0.000001	0.001169	203.125000	-36.642929	2.253314	359.375	-36.606075	0.346297	515.625	-36.550179	-2.925689	671.875000	-36.620110	-1.28954
2024-3-1 12:59:35	-22.988947	-22.990295	36.071377	38.149170	-100.000000	40.270748	0.000001	0.001169	203.125000	-36.642929	2.253314	359.375	-36.606075	0.346297	515.625	-36.550179	-2.925689	671.875000	-36.620110	-1.28954
2024-3-1 12:59:36	-22.988947	-22.990295	36.071377	38.149170	-100.000000	40.270748	0.000001	0.001169	203.125000	-36.642929	2.253314	359.375	-36.606075	0.346297	515.625	-36.550179	-2.925689	671.875000	-36.620110	-1.28954
2024-3-1 12:59:37	-22.988426	-22.989771	36.085354	38.160557	-100.000000	40.288956	0.000001	0.001254	203.125000	-36.643623	2.253228	359.375	-36.604668	0.346200	515.625	-36.549961	-2.925522	671.875000	-36.619495	-1.289500
2024-3-1 12:59:38	-22.988659	-22.990009	36.058861	38.134090	-100.000000	40.262421	0.000001	0.001300	203.125000	-36.644096	2.253417	359.375	-36.603668	0.346299	515.625	-36.550247	-2.925542	671.875000	-36.620953	-1.289489

Phase3	Freq4	Power4	Phase4	Freq5	Power5	Phase5	Freq6	Power6	Phase6	Freq7	Power7	Phase7	Freq8	Power8	Phase8	Freq9	Power9	Phase9	Freq10	Power10
-1.289508	828.125000	-36.549210	-1.031202	984.375000	-36.561340	2.802425	1140.625000	-36.532280	1.159043	1296.875000	-36.617615	-0.482275	1453.125000	-36.574589	0.064398	1609.375000	-36.641796	-0.750397	1765.625000	-36.65426
-1.289480	828.125000	-36.549305	-1.031278	984.375000	-36.560146	2.802326	1140.625000	-36.533222	1.159161	1296.875000	-36.619900	-0.482354	1453.125000	-36.574665	0.064586	1609.375000	-36.642254	-0.750467	1765.625000	-36.65445
-1.289508	828.125000	-36.549210	-1.031202	984.375000	-36.561340	2.802425	1140.625000	-36.532280	1.159043	1296.875000	-36.617615	-0.482275	1453.125000	-36.574589	0.064398	1609.375000	-36.641796	-0.750397	1765.625000	-36.65426
-1.289549	828.125000	-36.550041	-1.031418	984.375000	-36.560459	2.802540	1140.625000	-36.531563	1.159270	1296.875000	-36.619171	-0.482328	1453.125000	-36.574970	0.064422	1609.375000	-36.643379	-0.750260	1765.625000	-36.65632
-1.289549	828.125000	-36.550041	-1.031418	984.375000	-36.560459	2.802540	1140.625000	-36.531563	1.159270	1296.875000	-36.619171	-0.482328	1453.125000	-36.574970	0.064422	1609.375000	-36.643379	-0.750260	1765.625000	-36.65632
-1.289549	828.125000	-36.550041	-1.031418	984.375000	-36.560459	2.802540	1140.625000	-36.531563	1.159270	1296.875000	-36.619171	-0.482328	1453.125000	-36.574970	0.064422	1609.375000	-36.643379	-0.750260	1765.625000	-36.65632
-1.289508	828.125000	-36.549210	-1.031202	984.375000	-36.561340	2.802425	1140.625000	-36.532280	1.159043	1296.875000	-36.617615	-0.482275	1453.125000	-36.574589	0.064398	1609.375000	-36.641796	-0.750397	1765.625000	-36.65426
-1.289480	828.125000	-36.549305	-1.031278	984.375000	-36.560146	2.802326	1140.625000	-36.533222	1.159161	1296.875000	-36.619900	-0.482354	1453.125000	-36.574665	0.064586	1609.375000	-36.642254	-0.750467	1765.625000	-36.65445

Phase10	Freq11	Power11	Phase11	Freq12	Power12	Phase12	Freq13	Power13	Phase13	Freq14	Power14	Phase14	Freq15	Power15	Phase15	Freq16	Power16	Phase16	Freq17	Power17	Phase17	Freq18
0.888888	1921.875000	-36.538052	-1.574082	2078.125000	-36.539318	1.978239	2234.375000	-36.489635	-0.208315	2390.625000	-36.612728	-2.389263	2546.875000	-36.593891	1.711505	2703.125000	-36.697510	2.527787	2859.375000	-36.660049	-2.665489	3015.625000
0.888954	1921.875000	-36.538307	-1.573882	2078.125000	-36.538395	1.978411	2234.375000	-36.489132	-0.208278	2390.625000	-36.613186	-2.389193	2546.875000	-36.592304	1.711459	2703.125000	-36.699184	2.527588	2859.375000	-36.661018	-2.665371	3015.625000
0.888888	1921.875000	-36.538052	-1.574082	2078.125000	-36.539318	1.978239	2234.375000	-36.489635	-0.208315	2390.625000	-36.612728	-2.389263	2546.875000	-36.593891	1.711505	2703.125000	-36.697510	2.527787	2859.375000	-36.660049	-2.665489	3015.625000
0.888735	1921.875000	-36.539204	-1.574114	2078.125000	-36.538368	1.978157	2234.375000	-36.488888	-0.208578	2390.625000	-36.614307	-2.389398	2546.875000	-36.593769	1.711458	2703.125000	-36.698643	2.527651	2859.375000	-36.662094	-2.665557	3015.625000
0.888735	1921.875000	-36.539204	-1.574114	2078.125000	-36.538368	1.978157	2234.375000	-36.488888	-0.208578	2390.625000	-36.614307	-2.389398	2546.875000	-36.593769	1.711458	2703.125000	-36.698643	2.527651	2859.375000	-36.662094	-2.665557	3015.625000
0.888735	1921.875000	-36.539204	-1.574114	2078.125000	-36.538368	1.978157	2234.375000	-36.488888	-0.208578	2390.625000	-36.614307	-2.389398	2546.875000	-36.593769	1.711458	2703.125000	-36.698643	2.527651	2859.375000	-36.662094	-2.665557	3015.625000
0.888888	1921.875000	-36.538052	-1.574082	2078.125000	-36.539318	1.978239	2234.375000	-36.489635	-0.208315	2390.625000	-36.612728	-2.389263	2546.875000	-36.593891	1.711505	2703.125000	-36.697510	2.527787	2859.375000	-36.660049	-2.665489	3015.625000
0.888954	1921.875000	-36.538307	-1.573882	2078.125000	-36.538395	1.978411	2234.375000	-36.489132	-0.208278	2390.625000	-36.613186	-2.389193	2546.875000	-36.592304	1.711459	2703.125000	-36.699184	2.527588	2859.375000	-36.661018	-2.665371	3015.625000

Thank you