

# <u>Audio Quality Testing:</u> <u>VoIP/SIP and mobile calls using POLQA (Advanced Setup)</u>

**Goal**: Evaluate the voice/speech audio quality made between VoIP-SIP and mobile calls through POLQA scoring server where both the endpoints are located at different locations.

### Consider an example:

LANforge-A (LF resource system, Ferndale location) makes 20 multiple single calls using VoIP-SIP towards mobile phone device which is connected to LANforge-B (LF resource system, New York location). Both of the LANforge resources are connected together to the LANforge manager cloud instance. LANforge-A plays a reference audio file over the VoIP-SIP call. The call is being recorded by LANforge-B from the mobile device using Bluetooth or audio cable. After the call completes, both the reference audio file and recorded audio file are evaluated by LANforge manager (Cloud) using the POLQA server which is installed on LANforge-B. The POLQA server scores the recording based on audio quality loss during the call. Multiple location resources can be further clustered from LANforge manager for mesh testing (optional).



- 1. Requirements:
  - A. LANforge systems (version 5.4.8). One cloud manager and minimum two resources.
  - B. LANforge licenses.
  - C. POLQA server with required licenses
  - D. POLQA standard reference audio files.

- E. Bluetooth USB dongle.
- F. Analog sound card and audio cables. (If testing over analog audio cable)
- G. VoIP service provider. (Customer provided)
- H. Mobile device (Android or IOS) having Bluetooth and active SIM/eSIM card. (Customer provided)
- I. Mobile network like VoLTE, VoNR, etc. (Customer provided)
- J. Internet access. (Customer provided)

### 2. Configurations:

- A. Clustering between one LANforge manager (Cloud) towards two or multiple LANforge resources should be done till here.
- B. LANforge and POLQA licenses are installed.
- C. AQ configuration: Follow /home/lanforge/audio-bluetooth/README.txt on all LANforge resources.
- D. Then reboot all the systems.
- E. On the LANforge manager (cloud), open the GUI. Under VoIP/RTP tab, select Create.

0	Create/Modify Cross Connect								
	Cross Connect Information								
	CX Name:	VoIP-Mobile	Rpt Timer: fast	(1 s)	▼ Test Manager	default_tm	▼ CX Type: Voice - SIP ▼		
	Multi-Call	<ul> <li>Directed</li> </ul>	Min Call Duration (s)	File (0 sec)	<ul> <li>Max Ring Time (s):</li> </ul>	5 (5 sec)	▼ Codec: G.711u ▼		
	<ul> <li>Continuous Call</li> </ul>	Use Gateway	Max Call Duration (s)	File (0 sec)	Min Inter-Call Gap (s	): 5 (5 sec)	▼ Start Delay: 3 (3 sec) ▼		
	Save Call Records	Don't Send RTP	Number Of Calls	20 (20)	Max Inter-Call Gap (s	;): 5 (5 sec)	▼ Quiesce: 45 (45 sec) ▼		
	PingPong Number Of AQ Reports None (0)								
Endo Name:	VoIP-Mobile-A		Bind SIP	LIDP Port		Tx File	/home/lanforge/media/AmEnglish NB m1s1 f2	52.85 way	
Sholf:	1		Record	SIP Port	5060	Destination		2_05.00	
Posourco:	1 (=1(01)			IRToC	Post Effort (0)	Phone #	CIP phone details		
Resource.				Tr 105.		Coll Cohours	CID asteurov details		
Port:			Play to speaker	Socket Priority:	0	Call Gateway:			
IP Addr:	AUTO	No Fast Start	VAD	VAD Delay(ms)	250	Record File	/dev/null		
Auth User Name:	SIP User Info	Single Codec	Override SDP	VAD Force Send	3000	Scoring Server:	127.0.0.1:3998		
Display Name:	VoIP-A	Mobile	Play Audio	Jitter Buffer:	8	Quiesce:	45 (45 sec)	-	
Mobile BT MAC	AUTO		Pluetooth	Reg Expire:	300 💌	Speaker	/dev/audio	-	
Audio Band	Narrow Band (0)	•							
				RX Endpoi	nt (endpoint B)			1	
Endp Name:	VoIP-Mobile-B	UnManaged	Bind SIP	UDP Port		Tx File	/home/lanforge/media/AmEnglish_NB_m1s1_f2	s2_8s.wav	
Shelf:	1	<ul> <li>Don't Answer</li> </ul>	Record	SIP Port		Destination:	Αυτο		
Resource:	1 (sk01)	Rcv Call	Enable Scoring	IP ToS:	Best Effort (0) 🔻	Phone #	Mobile-A Number		
Port:	1 (eth1)	No Tunneling	Play to speaker	Socket Priority:		Call Gateway:			
IP Addr:	AUTO	No Fast Start	VAD	VAD Delay(ms)		Record File	/home/lanforge/tmp/		
Auth User Name:	AUTO	Single Codec	Override SDP	VAD Force Send		Scoring Server:	127.0.0.1:3993		
Display Name:	Mobile-A	Mobile	🗌 Play Audio	Jitter Buffer:		Quiesce:	45 (45 sec)	-	
Mobile BT MAC	##:##:##:##:##		Bluetooth	Reg Expire:	300 💌	Speaker	/dev/audio	-	
Audio Band	Audio Band Narrow Band (0) 🔻								
		Apply	OK	Pofrach	Ratch Create	Const			
		Арру	ŪK	kerre <u>s</u> n	Datch-create		=		

A. Cross Connect details to be filled are:

- I. Cross Connect Information:
  - i. CX name: VolP-Mobile
  - ii. Select Multi-Call checkbox.
  - iii. Select Save Call Records checkbox to save recordings for further analysis.
  - iv. Select **Use Gateway** checkbox.
  - v. Min/Max Call Duration: File
  - vi. Number Of Calls: 20
  - vii. Min/Max Inter Call Gap: 5 sec
  - viii. Rest can remain defaults
- II. TX Endpoint A: Fill the TX Endpoint A with VoIP-SIP details.

- i. **Resource:** *LANforge-A resource Hostname* (Ferndale location system in this example)
- ii. Port: Management Port with Internet access.
- iii. Auth User Name: VolP-SIP User info
- iv. Display Name: VolP-SIP Name
- v. Deselect **Rcv Call** checkbox. (VoIP-SIP is going to make calls and not receive in this case.)
- vi. Deselect **Mobile** checkbox. (VoIP-SIP does not need Mobile checkbox.)
- vii. Tx file: /home/lanforge/media/AmEnglish\_NB\_m1s1\_f2s2\_8s.wav
- viii. Destination: AUTO
- ix. Phone: VoIP-SIP phone number
- x. Call Gateway: VoIP-SIP Call Gateway info
- III. RX Endpoint B: Fill the RX Endpoint B with mobile details.
  - i. **Resource:** *LANforge-B resource Hostname* (New York location system in this example)
  - ii. Port: Management Port with Internet access.
  - iii. Auth User Name: AUTO
  - iv. Display Name: Mobile Name
  - v. Mobile BT MAC: Mobile bluetooth mac address
  - vi. Select **Rcv Call** checkbox.
  - vii. Select **Mobile** checkbox.
  - viii. Select **Record** checkbox.
  - ix. Select Enable Scoring checkbox for POLQA.
  - x. Audio Band: Narrow Band
  - xi. Select **Bluetooth** checkbox. (Deselect this option for analog sound card option.)
  - xii. Tx file: /home/lanforge/media/AmEnglish\_NB\_m1s1\_f2s2\_8s.wav
  - xiii. Destination: AUTO
  - xiv. Phone: Mobile number
  - xv. Record File: Recording folder path
  - xvi. Scoring Server: POLQA Server Address
- B. Select Apply, OK
- 3. Options to start the test:
  - A. Under VoIP/RTP tab, select the test name and click the Start button to begin.

0	LANforge Manager Version(5.4.8)									0	0		
<u>Control</u> <u>Reporting</u>	ontrol Reporting Windows Info Tests												
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	Cross Connects for Selected Test Manager												
Name	Туре	State	Pkt Tx.	A → B P	kt Tx A ← B	Bps Rx B	Bps Rx A	Rx Drop % A	Rx Drop % B	Delay A → B	Delay A ← B	Jitter A $\rightarrow$ B	Jitter A 🗧
VoIP-Mobile	VoIP/Mobile	Stopped		0	0	0	0	0	0	0	0	0	
Mobile-Mobile	Mobile/Mobile	Stopped		0	0	0	0	0	0	0	0	0	
•									•				
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B. Using Command Terminal and get the test results in .csv format.

- A. Open a command terminal as a user
- B. cd /home/lanforge/Documents
- C. git clone https://github.com/greearb/lanforge-scripts
- D. cd lanforge-scripts/py-scripts/
- E. git pull
- F. ./run\_voip\_cx.py --host localhost --cx\_list VoIP-Mobile --csv\_file /home/lanforge/reportdata/my\_test\_reports.csv
- G. This command can be integrated for further automation.
- 4. AQ Test Results:
  - A. Option 01: Under **VoIP/RTP Endp** tab, current results will be shown in column/row structure once started.

0	LANforge Manager Version(5.4.8)													
<u>Control</u> <u>Reportin</u>	ontrol Beporting Windows Info Iests													
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				view	0 - 20000	GO	Clea	r Delete	Batch Modi	fy				
			1	1	1	,	All Endpoints			1		1	1	1
Name	Device Type	Phone #	Mobile BT MAC	Channel	Reg State	State	MOS-LQO#	MOS-LQO	Attenuation	Avg Delay	SNR Ref	SNR Deg	PingPong	Audio Band
Mobile-Mobile-A	Mobile	Mobile Number A	AUTO	Bluetooth	Unreg	Stopped	0	0	0	0	0	0	0	Narrow Band
Mobile-Mobile-B	Mobile	Mobile Number B	AUTO	Bluetooth	Unreg	Stopped	0	0	0	0	0	0	0	Narrow Band /
VoIP-Mobile-A	VoIP	SIP phone details	AUTO	Digital	Unreg	Stopped	0	0	0	0	0	0	0	Narrow Band
VoIP-Mobile-B	Mobile	Mobile number	AUTO	Bluetooth	Unreg	Stopped	0	0	0	0	0	0	0	Narrow Band /
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- B. Option 02: Using live graphical reporting.
  - A. Under VolP/RTP tab, right click on the selected AQ test name, and select Audio Quality Reporting.

0	LANforge Manager Version(5.4.8)										
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		Chamber <u>V</u> ie	w	<u>S</u> top All	Re	start Manager		Re <u>f</u> resh	HELP		
VoIP/RTP Endps Resource Mgr Interop Alerts Messages Warnings Wifi-Messages +											
Status	Port Mgr	Extend	ed Port Mgr	Laye	er-3	L3 Endps	L3 Endps Layer 4-7 VoIP/RTP				
Rpt Timer	: fast (1	s) 🔻 Go Te	est Manager al	I <b>v</b>	Sele	ct All Start	+ <u>S</u> top -	Quiesce C	ear		
View	0 - 20000		▼ Go		[	Disp <u>l</u> ay C	r <u>e</u> ate Mo <u>d</u> i	fy Delete			
			Cross Conne	ects for Selecte	d Test Manag	ger —					
Name	Туре	State	Pkt Tx A → B	Pkt Tx A ← B	Bps Rx B	Bps Rx A	Rx Drop % A	Rx Drop % B	Delay A → B		
Mobile-Mobile	Mobile/Mobile	Stopped	0	0	C	0 0	0	0	(		
VoIP-Mobile	VoIP/Mobile	Stopped	Start Selected	-	Plus	0	0	0	(		
			Stop Selected		Minus						
			Clear Selected								
			Modify Selected	b	F						
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•			VoIP Reporting						•		
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B. Select the required configuration and **Start** the monitoring.

0	Audio Quality Reporting		0 0	0
Settings	Refresh Interval: Main Features Show AQ MOS-LQO Value Show AQ Attenuation Show AQ Avg. Delay Show AQ SNR Difference Extra Features Show Average MOS-LQO Value Show Average MOS-LQO Value Show Requested Values	(5 s) ▼		
Test is complete.		gtart	Skip <u>C</u> ancel	

- C. Once started, we see Live view of graphical test monitoring which shows detailed reporting.
- D. Use Save HTML or Save PDF to get detailed report including .csv data when test is finished.
- 5. Sample screenshots of Live AQ Reporting.
  - A. Screenshot 01



#### B. Screenshot 02

Realtime Graph below shows MOS-LQO score from recording endpoints.



Realtime Graph below shows MOS Standard Deviation.



#### C. Screenshot 03

Realtime Graph below shows AQ Attenuation (AGC) from recording endpoints. Unit: dB



Realtime Graph below shows AQ Avg Delay from recording endpoints. Unit: ms





#### D. Screenshot 04

Realtime Graph below shows difference between SNR Reference and SNR Degraded from recording endpoints. Unit: dB



## Requested Values:

Endpoint Name	V-M-A	V-M-B
Resource	1 (sk01)	1 (sk01)
Port	eth0	eth1
Device Type	VoIP	Mobile

- 6. Further analysis: If **Save Call Records** option is true, received audio file along with the reference audio file can be evaluated manually on POLQA server to get more advanced report. Sample Advanced Report
- 7. If you need assistance, you can contact us at support@candelatech.com

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