Voice, Video, and Data Quality Testing Solutions



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Topics

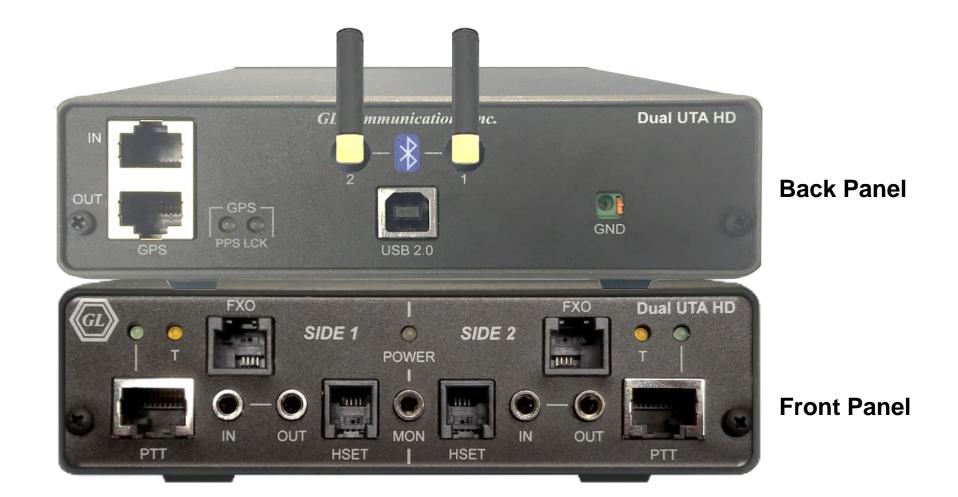
- Hardware Platforms VQuad[™] and vMobile[™]
- Voice Analysis Tool (VAT[™])
- Voice Quality Testing (VQT) POLQA and PESQ
- AutoVQT™
- Testing Environments Mobile Phones, Analog, Radios, VoIP SIP
- Available Metrics
- WebViewer[™] Web Based Client for Voice and Data Quality Testing
- Data Testing
- Video Testing



Hardware Platforms



Dual UTA HD Hardware Unit



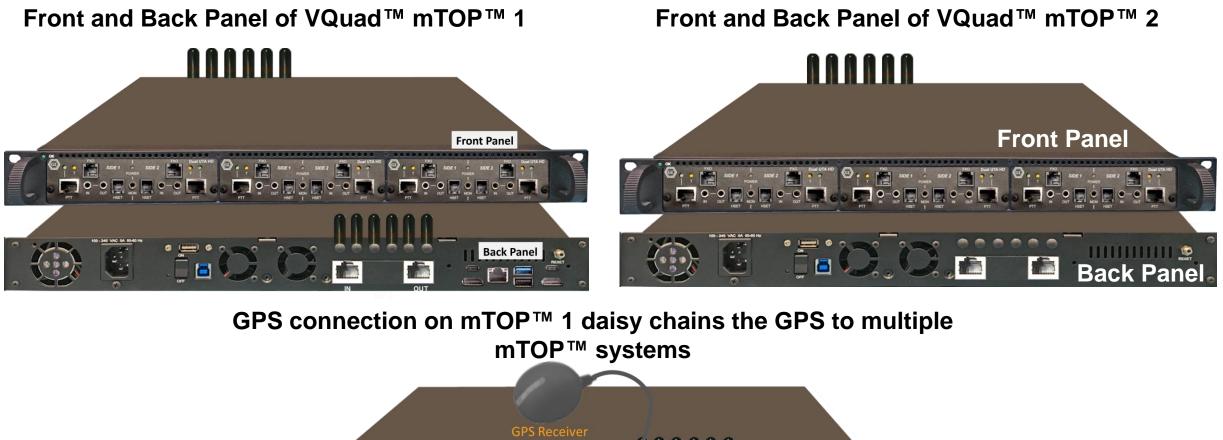


VQuad[™] Probe HD





VQuad™ mTOP™ Specifications







Current GL Mobile Test Hardware Platforms



Dual UTA HD

Communications

vMobile[™] Hardware Unit

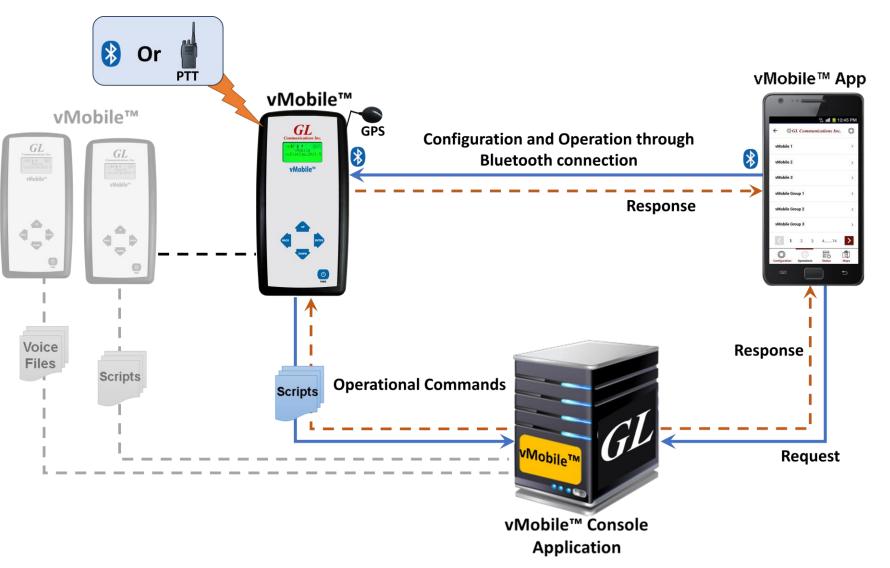
- Fully Automated
- Mobile Phone and Mobile Radio Testing
- Both Bluetooth and Analog modes
- Drive and Walk Testing
- Voice Quality Testing
- Delay Testing
- Solution supports GL WebViewer™
- Works with GL VQuad[™], Voice Analysis Tool (VAT[™]) and Voice Quality Testing (VQT) solutions
- GPS/WiFi Clock sync, High Precision Clock
 Oscillator with 40 ms daily precision





vMobile[™] Configuration and Operation using Console and Console App

- The vMobile[™] Console can run from any web-browser or using the Console App from any Android/IOS device
- Used to Monitor, Configure, and Operate the individual vMobile[™] units
- vMobile[™] Console can be used to create and edit vMobile[™] scripts as well as upgrade the vMobile[™] software when available
- Multiple vMobile[™] units can be controlled from a single Console or Console App
- Remotely Upgrade vMobile[™] software and audio files
- vMobile[™] Error logs can be accessed from the Console or Console App





vMobile[™] Control and Operation

vMobile™ **Console APP**

					vMobile	e™ Console				2:28	⁰₩♀┉◢▮
GL Communications In	ıc.									GL C	OMMUNICATIONS INC.
obile Status	Γ.	vMobile Status								Select a	an Available vMobile to view REFRESH
Mobile Operation		vMobile Name	1	Wi-Fi Network 1	Side 1	Side 1 Script	Side 2	Side 2 Script	GPS Latitude - Longitude	GLIndia_De Mode : Blueto	ooth
Mobile Configuration	C	GLIndia_Dev_Unit	12	♥DSPTeam ♥glmesh	 160073Dev1 (MotoPhone1) US107Test1 (VELVET) 	answercaliside1.vms central3000txrxwbside1.vms	 160073Dev2 (motoPhone2) US107Test2 (RobGalaxy) 	wbtxrxside2.vms	 ♀ 12.911302 , 77.89264 ♀ 39.143362 , -77.215513 	v5p1-VM10 Mode : Blueto Biside 1 : Idl	07-5G poth
og Configuration lanage Scripts <	C	v5p1-160106-India2		중DSPTeam	-	waiteventreceivetestside1.vms side1r.vms	3 US109Test2 (Q6) NA	answercall.vms	9 12.926155 , 77.601742 9 12.926363 , 77.601412	v5p1-16010 Mode : Blueto È Side 1 : Idl	ooth
pgrade vMobile aps	C	V5p1-VMPTT Zhiyong22			USPTTTest1 (Not Yet Connected)	Central3000txrxwbside1.vms	BTTest213 (Zhi5g)	answercallside2.vms	9 39.1434 , -77.215535 9 39.143375 , -77.215552 9 39.14334 , -77.215473	v5p1-16010 Mode : PTT È Side 1 : Idl	PTT Status : On
ser Configuration <	c	RobvMobile3 v5p1-VM101-rob Sonny50m	-1	 ⇒glmesh ⇒glmesh ⇒GURUMNARA 	ULTEST1 (RobGalaxy)	answercallrunscriptside1.vms side1r.vms	US160101Test2 (RobGalaxy) US160101Test2 (RobGalaxy) US160101Test2 (GalaxyJ7Prime)	Tunscriptoptionside2.vms Side2m.vms	· · · · · · · · · · · · · · · · · · ·	v5p1-VMPT Mode : Blueto È Side 1 : Idi	poth
› qi				* 		Configuratio	on and Operation			Main Log	Contiguest. BTOperation Upgrade App Into
						through Inte	ernet connection		8 Configur	ration and C Bluetooth co	



≡ ⊛a VMot

III vMo S vMo

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Map:

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Help

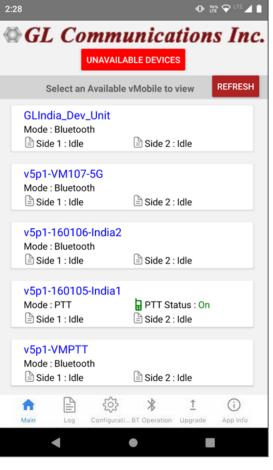


4 **.**

vMobile[™] Status

■ @GL Communications Inc.								
VMobile Status	I≣ vMobile Status							
vMobile Operation								
k vMobile Configuration	vMobile Name ^{↑↓}	î↓	Wi-Fi Network 1	Side 1 ^{↑↓}	Side 1 Script ^{↑↓}	Side 2 ^{↑↓}	Side 2 Script î↓	GPS Latitude - Longitude
	GLIndia_Dev_Unit		≈DSPTeam	160073Dev1 (MotoPhone1)	answercallside1.vms	160073Dev2 (motoPhone2)	B wbtxrxside2.vms	♀ 12.911302 , 77.89264
Console App	v5p1-VM107-5G	2	∕≂glmesh	US107Test1 (VELVET)	central3000txrxwbside1.vms	US107Test2 (RobGalaxy)	answercallside2.vms	♀ 39.143362 , -77.215513
Log Configuration	v5p1-160106-India2	1.2	중DSPTeam	8 US109Test1 (Q6)	waiteventreceivetestside1.vms	8 US109Test2 (Q6)	answercall.vms	♀ 12.926155 , 77.601742
B Manage Scripts <	v5p1-160105-India1		⇒DSPTeam	TT On	ill side1r.vms	NA	NA	€ 12.926363 , 77.601412
Upgrade vMobile	v5p1-VMPTT		∕≑glmesh	USPTTTest1 (Not Yet Connected)		USPTTTest2 (Not Yet Connected)		♀ 39.1434 , -77.215535
Maps	C Zhiyong22	2		BTTest113 (RobG8)	Central3000txrxwbside1.vms	BTTest213 (Zhi5g)	answercallside2.vms	9 39.143375 , -77.215552
User Configuration <	RobvMobile3	-1	∕≂glmesh	UTest1 (RobGalaxy)		UTest2 (ZDBTtest1)	Ĩ	♥ 39.14334 , -77.215473
ITS <	v5p1-VM101-rob		∕≑glmesh	US160101Test1 (VELVET)	answercallrunscriptside1.vms	US160101Test2 (RobGalaxy)	runscriptoptionside2.vms	♥ 39.1434 , -77.215525
) Help <	Sonny50m		∕≑GURUMNARA	UTest1 (SonnysiPhone)	iside1r.vms	UTest2 (GalaxyJ7Prime)	🖹 side2m.vms	♥ 39.104778 , -77.227892

Console Status



Console App Status



vMobileTM Configuration, Status and Operation via Bluetooth

- Console App can be used to configure, get the status and operate vMobile[™] via Bluetooth easily
- This feature helps the user to operate, configure, or view status during slow internet/no internet areas



Console App on Smartphone (Android/iOS)

vMobile™



VQuad[™] GUI with Script Editor

🗇 GL VQuad(TM)							
File View Functions Setup W	· · · · · · · · · · · · · · · · · · ·						
GL 🍕 🦠 🏽 👬 👖	SI 😣 😲	🚍 GL VQuad(TM) Script Editor — 🗆 🗙					
Configure Start/Stop	GL VQuad(TM) Script View	File Edit Help					
Setup Devices	Terminal:	D 🖻 🔒 👗 🖻 🙈	👪 🔯 🧿 Call Control 🤇 Site Script 🔿 Super Script				
	set bt sco nowbs						
	Reset WRAP THOR AI (5.0.2 build 992)	Script File Name: C:\Program Files	s (x86)\GL Communications Inc\VQuad\Profiles\Demo_scripts\Demo\BT_Bidirectional_FileTxRx_POLQA.scp				
🖶 😣 RealBT1(MotoPhone1)	Copyright (c) 2003-2013 Bluegiga Technologies Inc.	Components:	Script:				
Auto Config:	READY	E components.	# Script Item				
Device Settings		Dual UTA Device Operations	13 Set Global1: Device ID=?+1;				
⊕ 🧿 RealBT2(motoPhone2)	AT command:		14 Continuous Run Marker 15 //Load / Run Answer call script				
i ⊕ 🔄 DataTesting1 i ⊕ 😲 UA1	Device Name: 👔 RealBT1 🔹		16 Stop Script: Device ID=Global1;				
🗄 🖓 PTTside1	Scripts Global Device Start Variables Events:	Mobile/Bluetooth Device	 Load Script: Device ID=?+1;Path=C:\Program Files\GL Communications Inc\VQuad\Profiles\Univers //www.Note: If user has Windws 7 64 bit system then he needs to provide the following path to load Vq 				
± 5 Mg PTTside2	Clear All Variables	i ∰Analysis ∰Data Testing	19 //Start the script on far end device to answer the call				
	Wait Event Event=Connect Indication;Interval=30; //Checking for a connection	Misc / Reports	20 Run Script: Device ID=Global1; 21 //If call drops prematurally, goto Break Point				
	If: Connect Indication Received; TxRxSync Done		22 Set Event Watch: Event=Call Dropped; Break=True; 23 Pause Timer: Interval=3;				
	Pause Timer: Interval=4; //Modify iterations to change number of bidirectional tr: Clear Preset Variabl	External Operations Emme Remote VQuad Operations	24 //Identifying which device in Dual UTA				
	Clear Event Watch: Event=Call Connected; TxRxSync Done		25 Create Call IDs: Call IDs=NBPOLQATESTIndia; 26 Send Call ID: Device ID=?; Direction=Outbound;				
	Do: Iterations=2; TxRxSync Done //Fem1: transmit far-side to local TxRxSync Done		27 Send Call ID: Device ID=Global1; Direction=Inbound;				
	Tx/Rx File Sync: RxFile1=C:\/QT_Degraded\0\fem1		28 //Place call to other side 29 //**** Note, modify the Place Call number as desired				
	Tx/Rx File Sync: DeviceId2=Global1;TxFile2=C:\VQT 🗸		30 Place Call: TEL=5551212;Device ID=?;				
			31 Wait Event: Event=Connect Indication;Interval=30; 32 //Checking for a connection				
	🙀 🌮 🚺 📴 🖓 🖉 🖓 🖓 🖓 🖓 🖓 🖓 🖓		33 If: Connect Indication Received;				
	C:\Program Files (x86)\GL Communications Inc\VQuad\Profiles\Demo scripts\Demo\BT Bidirection		34 Pause Timer: Interval=4; 35 //Modify iterations to change number of bidirectional transfers.				
	Ready Ready		36 Clear Event Watch: Event=Call Connected;				
			37 Do: Iterations=2; 38 //Fem1: transmit far-side to local				
			39 Tx/Rx File Sync: RxFile1=C:\VQT_Degraded\0\fem1PolqaNB.pcm;Deviceld2=Global1;File0pl 40 Tx/Rx File Sync: Deviceld2=Global1;TxFile2=C:\VQT_Reference\VQuad_Auto\PDLQANB\fe				
			41 Pause Timer: Interval=15;				
			42 //male1: transmit local to far-end 43 Tx/Rx File Sync: DeviceId2=Global1;RxFile2=C:\VQT_Degraded\0\male1PolqaNB.pcm;File0;				
			44 Tx/Rx File Sync: TxFile1=C:\VQT_Reference\VQuad_Auto\POLQANB\male1POLQA.pcm;De				
			45 Pause Timer: Interval=15; 46 Loop				
			47 //This pause interval is for pasue between bidirectional transfers, modify as necessary				
			48 Pause Timer: Interval=5; 49 Else				
			50 //Call failed, send error				
			51 //You can search the WebViewer database to determine number of failed calls based on this error 52 Clear Event Watch: Event=Call Dropped;				
< >			53 Send Comment: Text=Error: PlaceCall Failed; 54 End If				
Call Auto Vol(Rx) Script			55 //This breakpoint is invoked if at anytime the connection between the far-side and near-side is lost				
1. Idle Stopped Stopped 2. Idle Stopped Stopped			56 Break Point 57 If: Call Dropped;				
3. Idle Stopped Stopped	x'		58 //Call Dropped, send Error				
4. Idle Stopped Stopped	Events Error Events		59 //You can search the WebViewer database to determine number of dropped calls based on this e 60 Send Comment: Text=Error: Call Dropped;				
5. Idle Stopped None	Timestamp Device Name Events		61 End If				
6. Idle Stopped None 7. Connected Stopped Stopped	09/15/2023 12:34:42 PM RealLineFX02 Stop All Traffic 09/15/2023 12:34:42 PM RealLineFX02 TxRxSync Done		62 Clear Event Watch: Event=Call Dropped; 63 Disconnect Call:Device ID=Global1;				
8. Connected Stopped None	09/15/2023 12:34:42 PM RealLineFX02 StopTxRxSync - Local; Device1=2		64 Pause Timer: Interval=2;				
9. Idle N/A Stopped	09/15/2023 12:34:47 PM CentralDB:Request; ID=16 Command=C:\Prog 09/15/2023 12:35:22 PM VAC Socket Error: Connection timed out.		65 Disconnect Call:Device ID=?; 66 Stop Script: Device ID=Global1;				
10. Idle N/A Stopped	09/15/2023 12:35:22 PM VAC Socket End. Connected		67 Pause Timer: Interval=5;				
11. Idle N/A Stopped	Clear Events Show All	1	68 //This pause interval is for inter-call, modify as necessary 69 Pause Timer: Interval=10;				
12. Idle N/A Stopped			70				
CentralDB Connected		11					

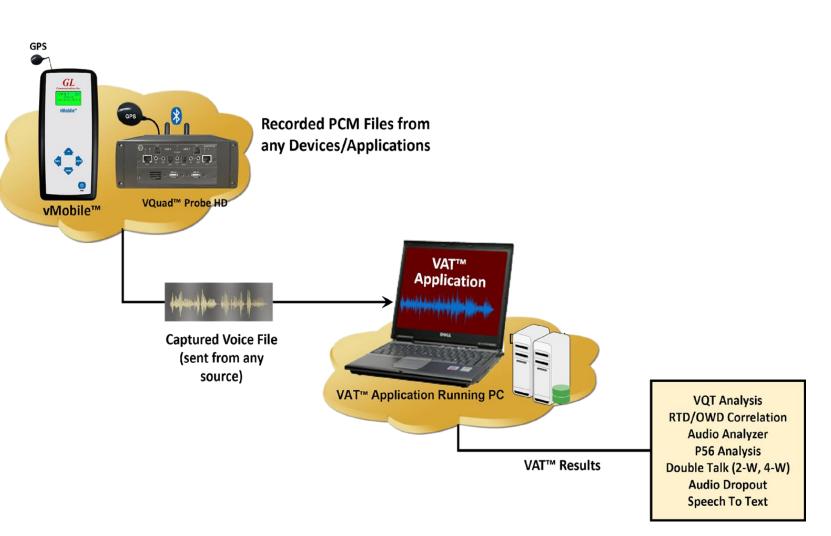


Voice Analysis Tool (VAT™)



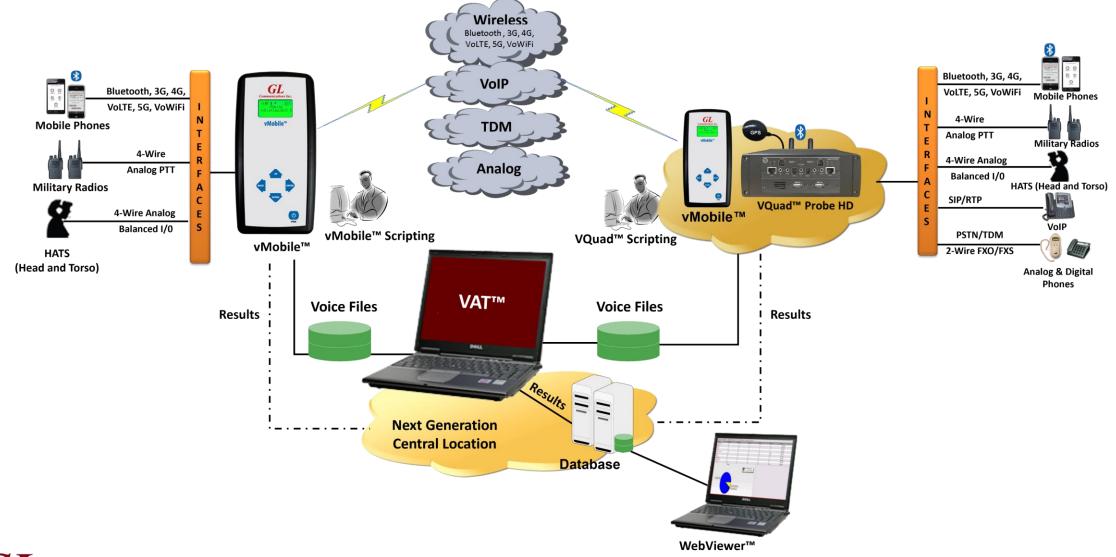
Voice Analysis Tool (VAT™)

- GL VAT[™] supports analyzing any Raw PCM voice file including NB, WB, and SWB. Audio files can be generated from any application including GL VQuad[™] and vMobile[™]
- Fully automated operation with log file containing results and stored in the GL Central Database which can be accessed easily using the GL WebViewer[™]
- VAT[™] CLI (Command Line Interface) supports remote operation
- Audio analysis includes, Round Trip and One Way Delay, Dropout Audio analysis, Double-Talk, Power Level and Frequency Analysis, Speech Activity, Active Speech Level and Noise Level, and DC Offset
- Supports VQT analysis when coupled with the GL VQT software
- Supports multiple analytical tests per individual voice file





VAT™ Operations

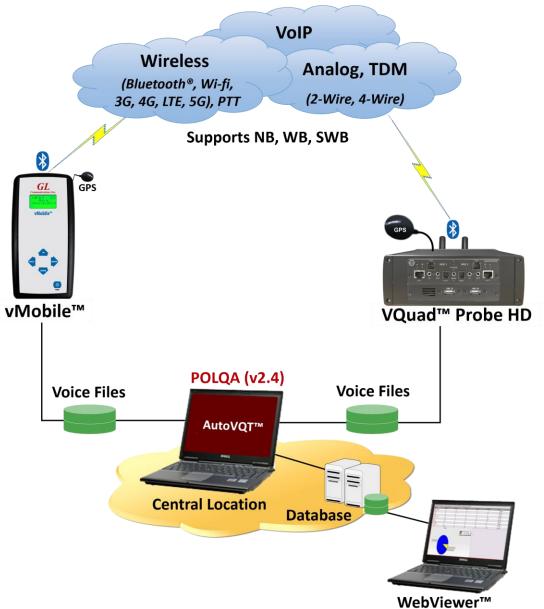




Voice Quality Testing (VQT)



Centralized Voice Quality Testing





18

• POLQA, PESQ LQ/LQO/WB

• E-Model, SNR, Signal Level

٠

• Call Events - Progress & Failures

• Delay Measurements – RTD, OWD

• Echo Measurements - ERL, Delay QoS, Timeouts, Retransmissions

• MOS, Jitter, Clipping, Speech and Noise Levels

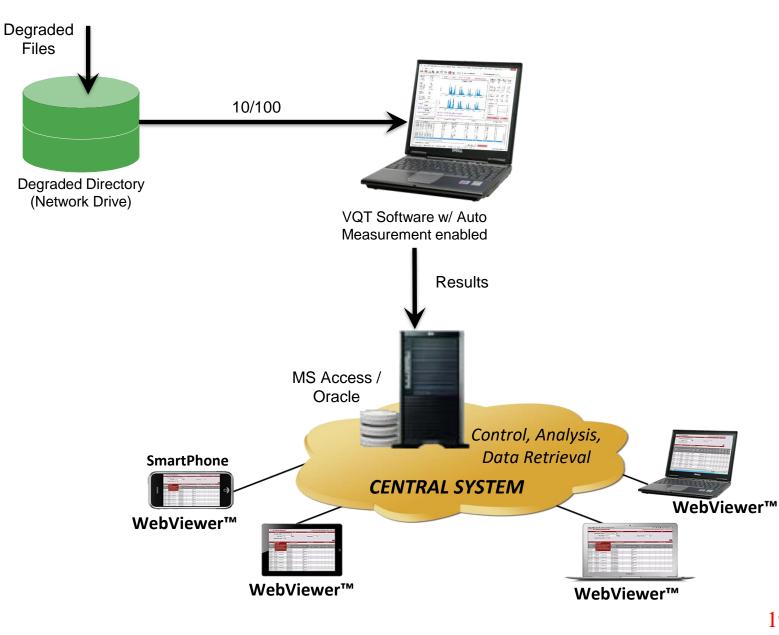
• Data Testing - Wired and Wireless Networks

Google Mapping and Indoor Tracking System

• Fax Events - Encoding, Resolution, ECM

Auto Measurement

- Automatically analyze the degraded files using **GL VQT Software**
- Detailed results including Jitter (min / max / avg), Clipping (front/back/all), Latency, and Noise / Signal Measurements (activity / peak)
- VQT uses the File Monitor to perform ٠ automated measurements on remote locations **VQT** Solutions





Voice Quality Test Software

L 📄 🤅	🕑 🖬 🕸		Sp 😮 Sp	eech Quality Mea	surements	•	PESQ Normal(P86	2.1): ON	
Metrics	Scores A		C PSQM O I	PESQ • POLO	QAV3 Connec	ted	Metrics Max	Min	Av ^
POLOAV3	2.97						POLQAV3 4.5	1.04	2.
EMODEL	57.54			P.863 : 2.	97		EMODEL 100	10.38	58
DECO	51/5						PESQ N/A	N/A	N/
PESQ	N/A						PESQ LQ N/A		N/
PESQ LQ	N/A						PESQ LOO N/A		N/
PESQ LQO	N/A	8	1 A A A A A A A A A A A A A A A A A A A						
PESQ WB	N/A	2					PESQ WB N/A		N/
PESQ IE	N/A	Reference		I HILLING IN			PESQ IE N/A	N/A	N/
PAMS LE	N/A						PAMS LE N/A	N/A	N/
PAMS LQ	N/A	0.0 1.0	2.0 3.0 4.0 5.	0 6.0 7.0 8.0	9.0 10.0 11.0	12.0 13.0	PAMS LQ N/A	N/A	N/
	N/A V						PSQM M N/A	N/A	N/ ~
<	>						<		>
Rating				1					
-	air	Degraded					Rating Count -		
F	all	<u>B</u>		A DATE			Excellent		300
User ID		ď							4470
Fema	ale_NB						Good		1178
							Fair		2946
-Speech Leve	l Gain (dB) ——	0.0 1.0	2.0 3.0 4.0 5.	0 6.0 7.0 8.0	9.0 10.0 11.0	12.0 13.0	Poor		5
-2	.86								
	(16)	Deg. File =	C:\VQT_Degraded\6	\fem 1Polga_2024	0207143416_N129	•55'48", ⊈))	Disregard		0
-Noise Level G									
12	2.54	Ref. File =	C:\VQT_Reference\\	/Quad_Auto\POL	QANB \fem 1POLQA	.pcm 🕼	Reset Statistic	s	> File
Measure	ement Results		Manual Measurement		Analysis		Ratin	g Criteria	
VQT Times	tamp	POLQAV3	EModel	PESQ	PESQ LQ	PESQ LQ	O PESQ WB	PAMS	LA
	7 2:30:00 Pt		100	N/A	N/A	N/A	N/A	N/A	
	7 2:30:19 Pt		68.72	N/A	N/A	N/A	N/A	N/A	
	7 2:30:38 Pt		94.67	N/A	N/A	N/A	N/A	N/A	
2024/02/0	7 2:30:58 Pt	4 2.96	57.3	N/A	N/A	N/A	N/A	N/A	
2024/02/0	7 2:31:16 P		100	N/A	N/A	N/A	N/A	N/A	
2024/02/0	7 2:31:35 P		66.77	N/A	N/A	N/A	N/A	N/A	
2024/02/0 2024/02/0	7 2:32:55 P		94.77	N/A	N/A	N/A	N/A	N/A	
2024/02/0 2024/02/0 2024/02/0	7 2:33:14 P		56.27	N/A	N/A	N/A	N/A	N/A	
2024/02/0 2024/02/0 2024/02/0 2024/02/0			100	N/A	N/A	N/A	N/A	N/A	
2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0	7 2:33:32 P		67.81 98.26	N/A	N/A	N/A	N/A	N/A	
2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0	7 2:33:52 Pt			N/A N/A	N/A N/A	N/A N/A	N/A N/A	N/A N/A	
2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0	7 2:33:52 Pt 7 2:34:11 Pt		57.54		11/1	in y a	17/0	11/1	~
2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0	7 2:33:52 Pt		57.54						
2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0 2024/02/0	7 2:33:52 Pt 7 2:34:11 Pt		57.54						>



VQT Highlights

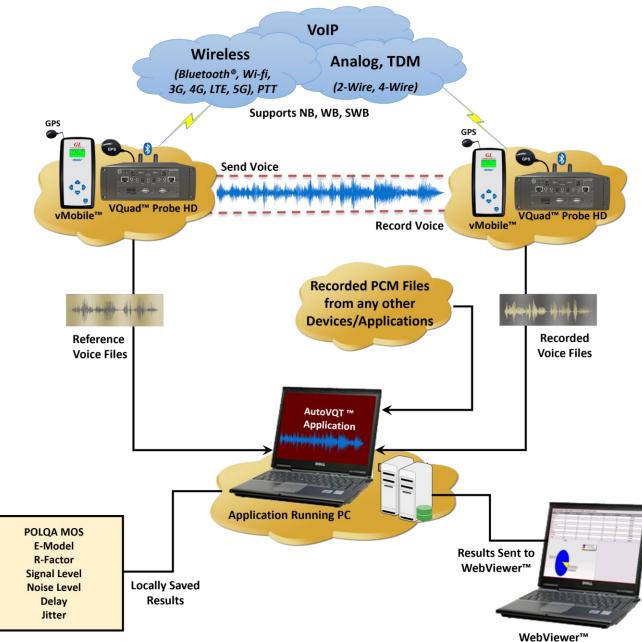
- Supports ITU Standards (POLQA, PESQ LQ/ LQO / WB)
- Supports NB, WB and SWB codecs
- Auto-Measurement Capabilities
- Detailed Results / Statistics
- Criteria Rating System
- Remote Access Capabilities
- Delay Measurement
- Jitter (Min, Max, Average per Utterance)
- Clipping (front, back, all)
- Noise/Signal Levels (Activity, Peak, etc.)



AutoVQT™



AutoVQT™ Operations





AutoVQT[™] Analysis Time

 The following table summarizes the average time taken to analyze PCM files when they are provided at the same time using Windows® 11 Pro 64-bit operating system, equipped with a 12th generation Intel® Core™ i9-12900K processor at 3.20 GHz and on 32 GB of RAM

РСМ Туре	Approximate Time Required to Process 1000 PCM Files Simultaneously (Min : Sec)	Approximate Time Required to Process 1 PCM File (Sec)			
Narrowband (NB)	02:01	0.12			
Wideband (WB)	02:13	0.13			
Super wideband (SWB)	02:26	0.14			

• On average, when the application is required to analyze multiple PCM files with different sampling rates (300 NB, 300 WB, and 400 SWB files), the total time taken to analyze all the 1000 PCM files at the same time is approximately **02 minutes and 31 seconds**

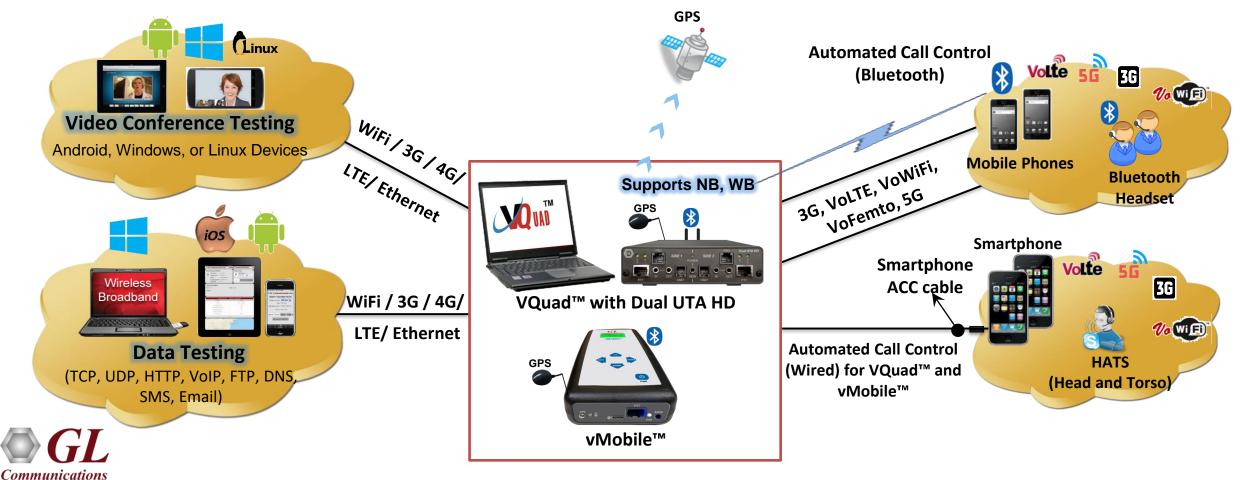


Testing Environments



Wireless Phone Network

- Connectivity Bluetooth® NB & WB, PTT, GPS, Wired Headset Smartphone ACC, 4-wire Balanced I/O Interfaces on Dual UTA HD and vMobile™
- Devices Military/Mobile Radios, 5G/4G/3G/WiFi Smartphones (all Mobile phones), Bluetooth® Headsets/Car Kits, Mobile devices with Smartphone ACC

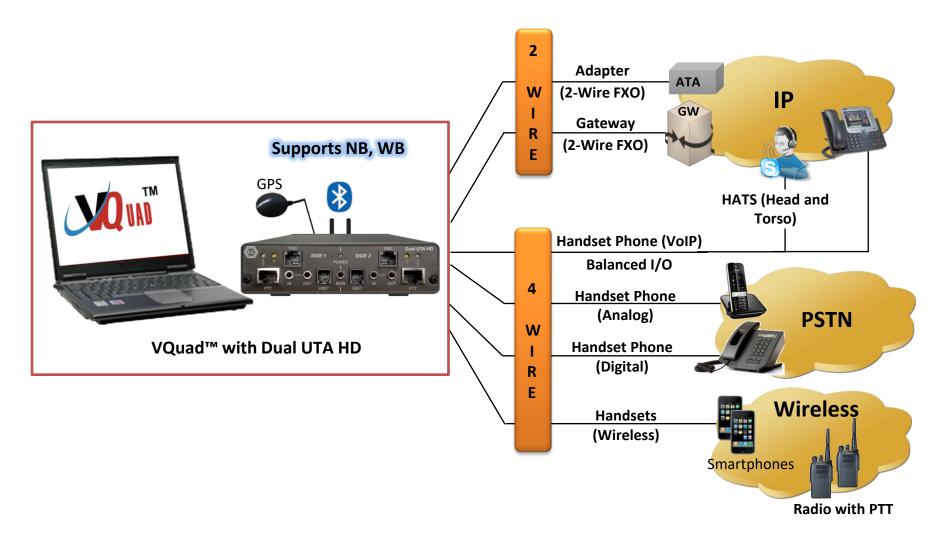


Analog Network (2-wire FXO and 4-wire)

• Connectivity – 2-Wire FXO, 4-Wire Balanced I/O, HSET Interfaces on Dual UTA HD

Communications

• Devices – Analog Phones, Next Generation Gateways, PBX, ATAs over PSTN network

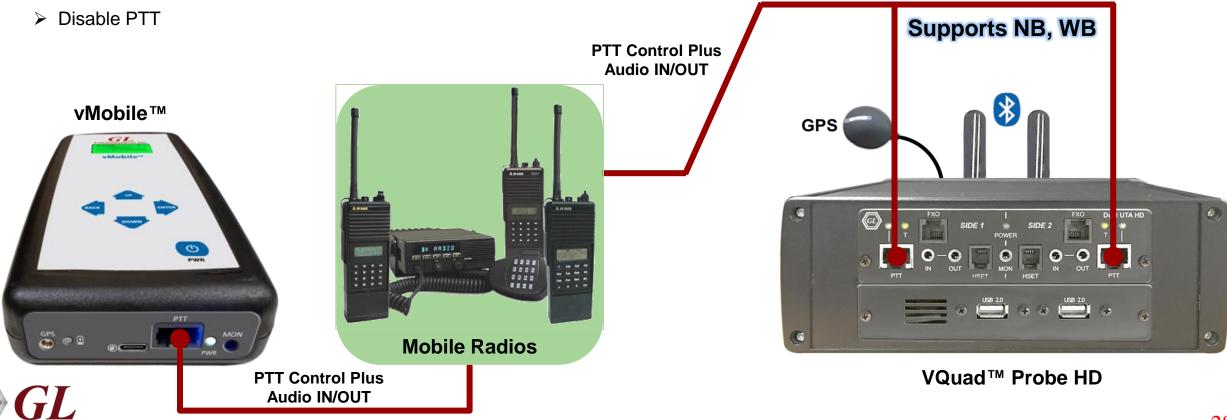


Mobile Radios (PTT)

- The vMobile[™] and Dual UTA HD provides a contact-closure control to support the push-to-talk (PTT) function of a mobile radio
- Software (VQuad[™]/vMobile[™]) Script:
 - Enable PTT

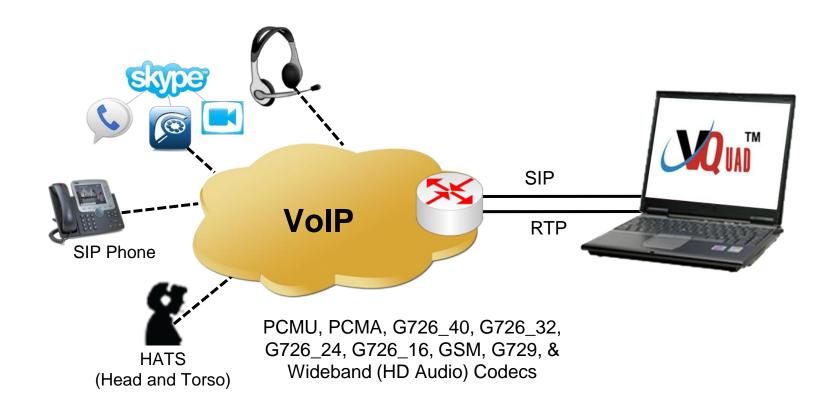
Communications

- Pause for User-Defined Period
- > Send Audio (VQT Reference) File
- Pause for User-Defined Period



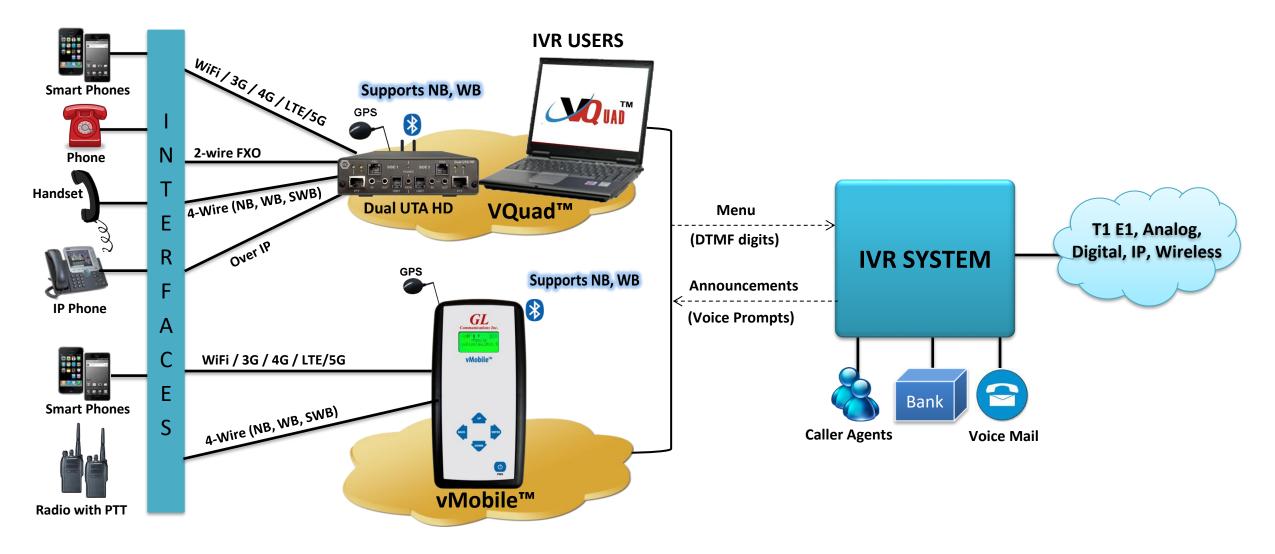
VoIP (SIP) Interface, Digital VoIP Phones, VoIP Softphones

- Connectivity Internal SIP cores within VQuad[™] (SIP Signaling Does not require Dual UTA HD), 4-wire Balanced I/O, HSET Interfaces on Dual UTA HD
- Devices VoIP Phones, Soft Phone, HATS





Interactive Voice Response (IVR) Systems

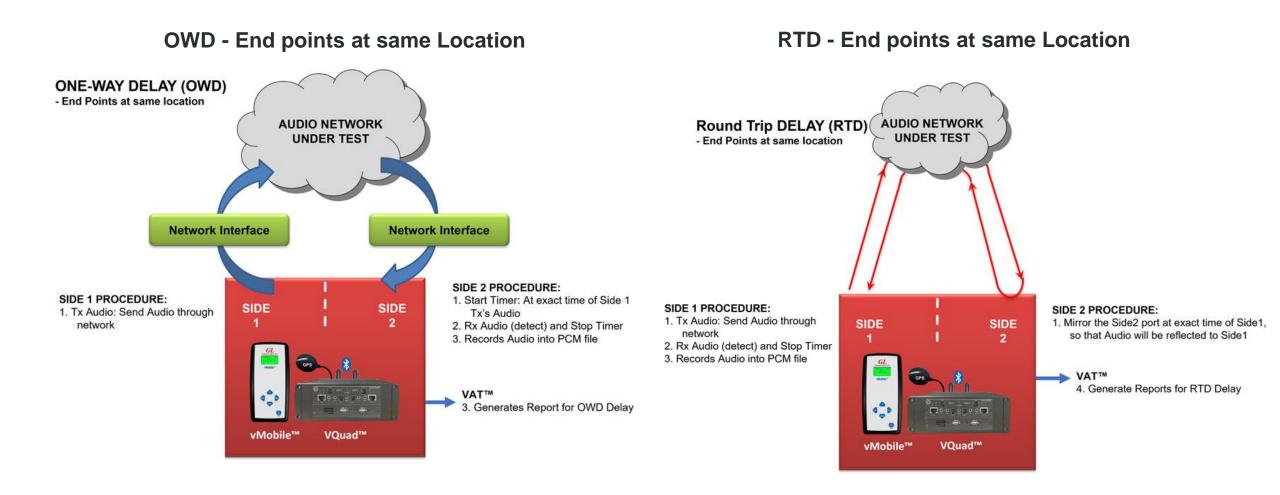




Available Metrics



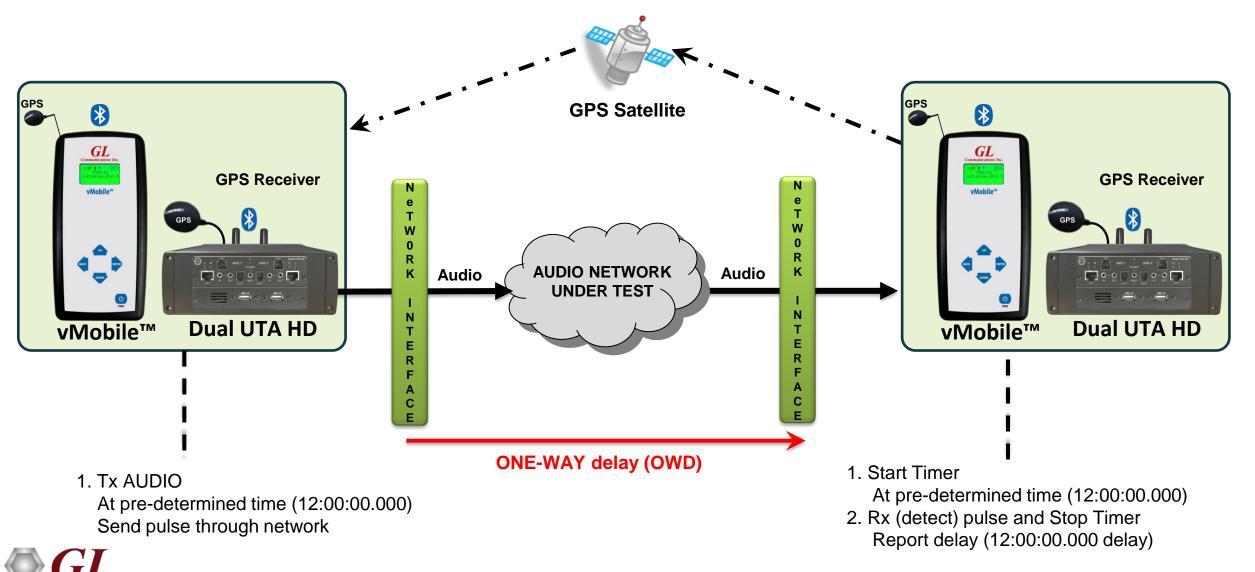
Delay Measurements





One Way Delay (OWD)

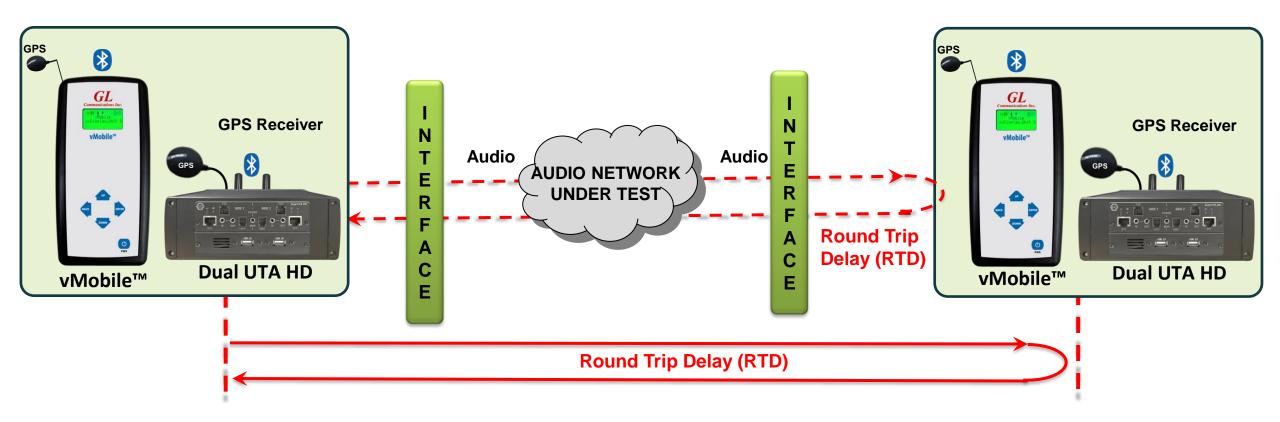
End points at two separate locations



Communications

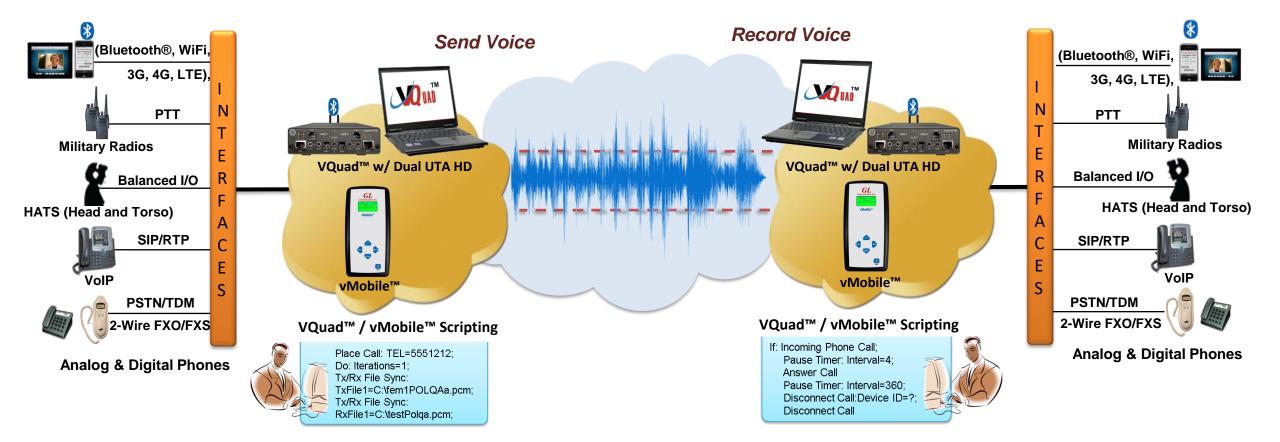
Round Trip Delay Functionality

RTD on two systems (geographically separated)



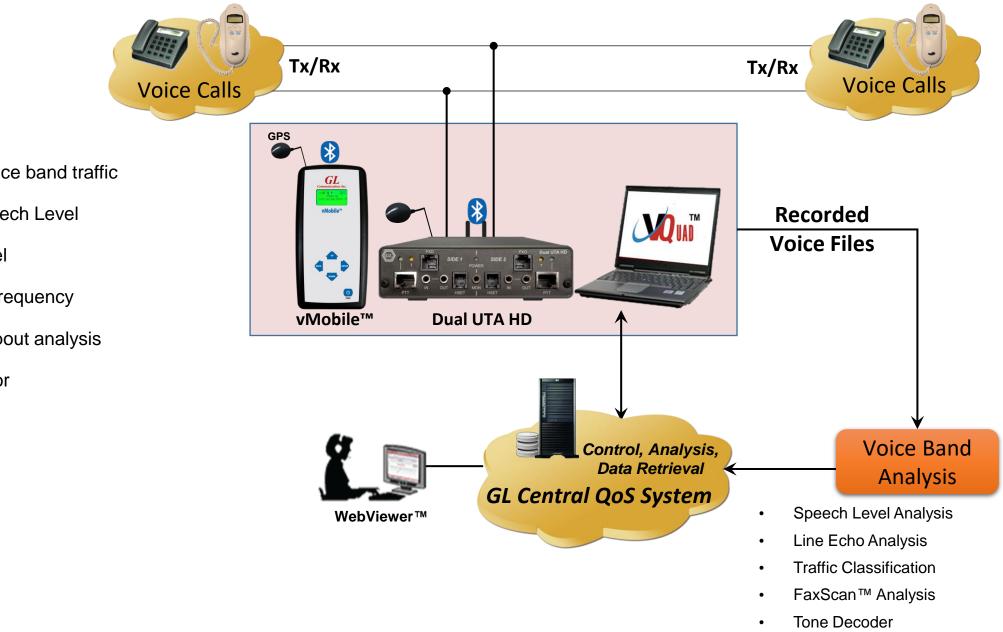


Automated Voice Quality Testing





Voice Band Analysis

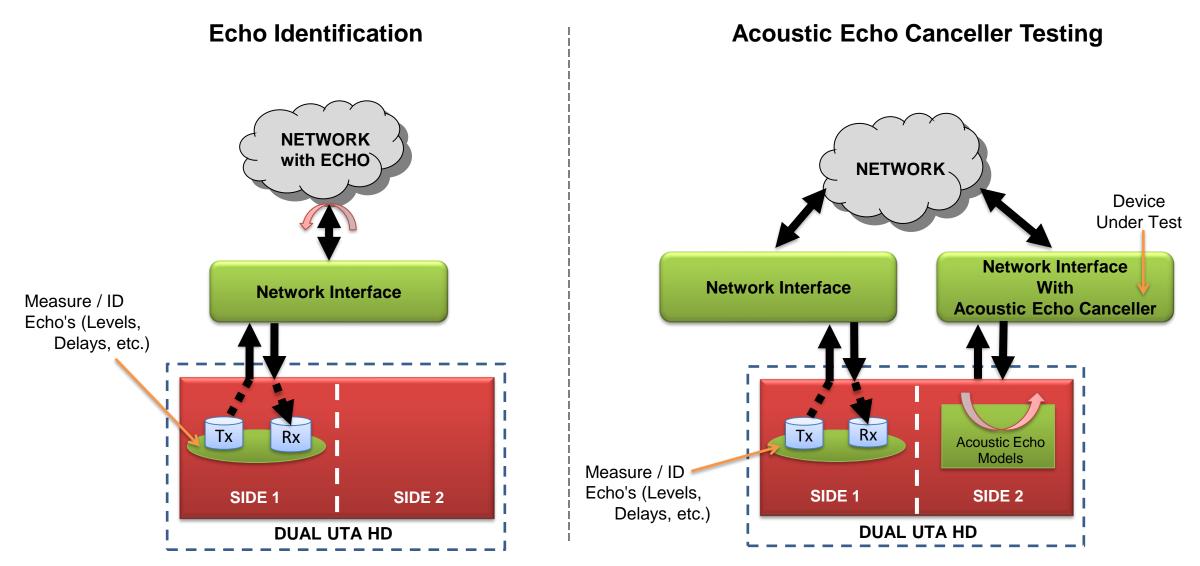


- Monitor voice band traffic
- Active Speech Level
- Noise Level
- Power & Frequency
- Audio Dropout analysis
- RMS Factor
- DC Level

Communications

36

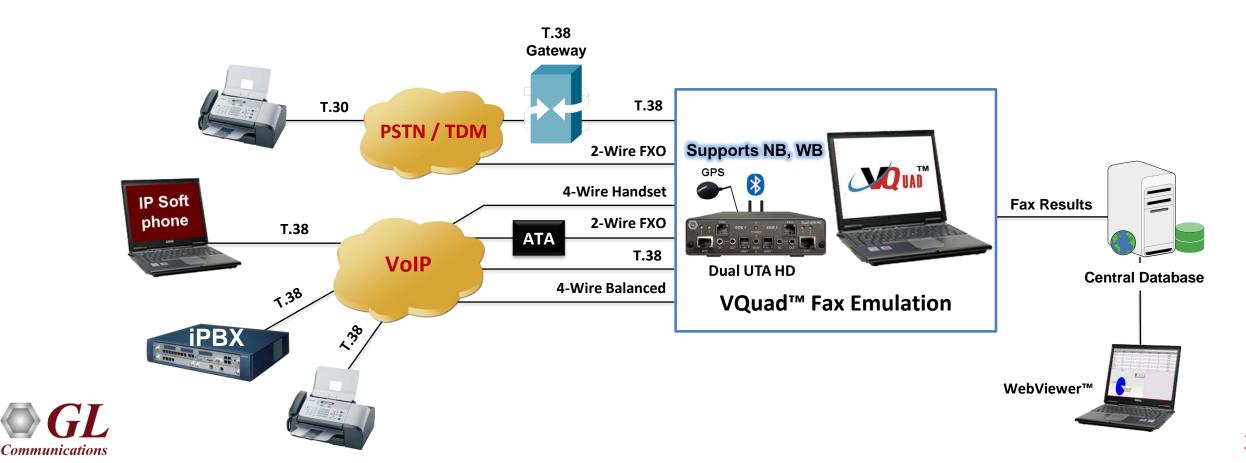
Echo Measurements



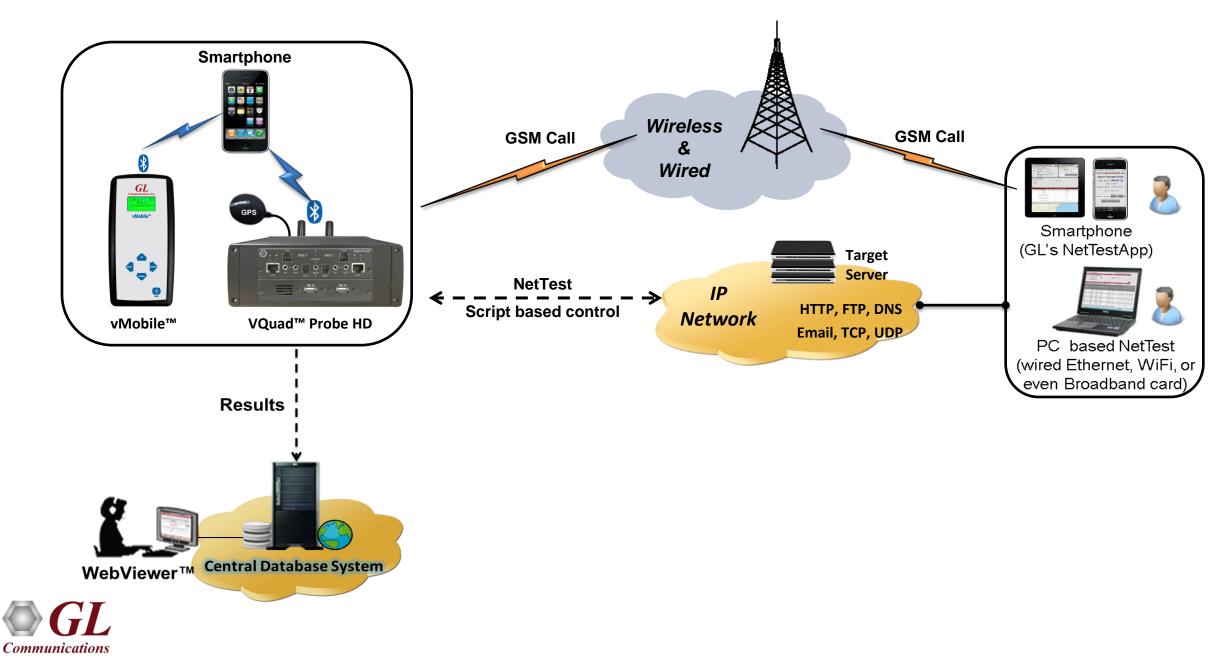


Automated FAX Testing

- Sending and receiving 4 independent and simultaneous T.30 faxes (selectable up to V.34)
- Configurable Tx Rx fax rate from 2400 bps up to 33600 bps (V.34 fully supported)
- Fax Testing using the Dual UTA HD 2-wire FXO or 4-wire analog interfaces
- VQuad[™] Fax events includes messages, summary, and errors log
- Ability to auto save fax (both East and West directions) to PCM file for enhanced analysis using GL Insight[™] and GL Fax Demodulator/Decoder



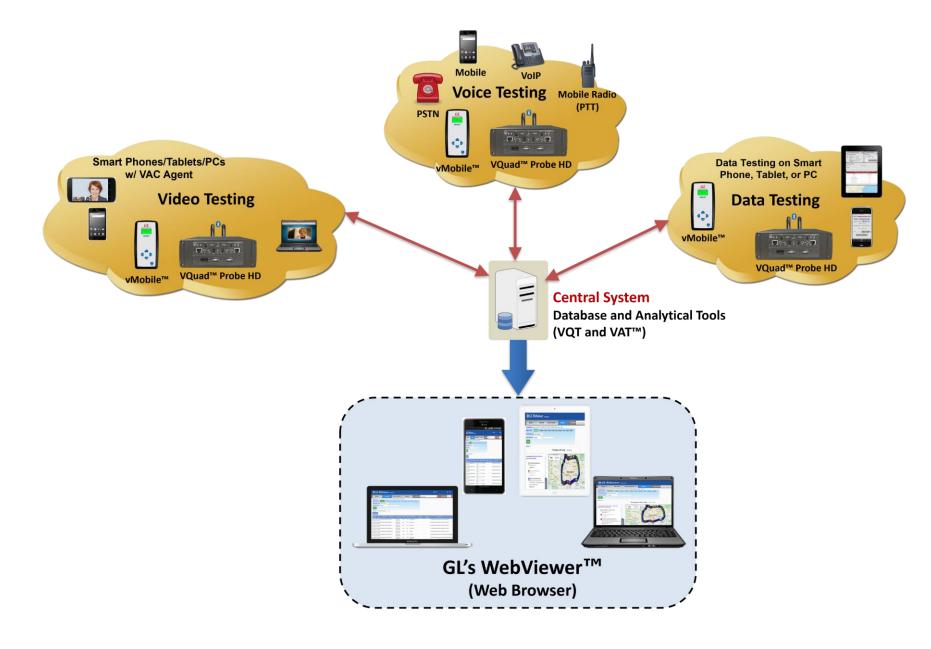
End-to-End SMS Testing



WebViewer[™] (Web Based Client for Voice and Data Quality Testing)



GL WebViewer™





GL WebViewer[™] Records

- Accessible remotely via any browser-based clients
- Database (MySQL or Oracle) stores the realtime and historic data

🚳 GL Web	viewe	r Version 6.1							,	Note : For th	ie best exp	erience, pr		Refresh 🤇 F5 after in		new versi		dmin / He to refrest	
Results 🔻	Call	Events	Status & Si	tatistics 🔻		Report	5 🔻	Load Fi	ilters: <mark>Se</mark>	elect Filter				-	OFF	Live Up	dates: 👩	sec 👻	OFF
/QT-POLQA Results betwe	en 08/16/202	3 05:21:17 and	02/16/2024 05:21	:17 (Last 6	Months)														
Date & Time Stand	ard 10 Min	utes 1 Hour 1	2 Hours 24 Hours	Today Ye	sterday 7	Days 1 Mo	nth 6 Months												
Timestamp Type VQuad	/ vMobile Times	stamp 👗																	
Event ID Filter Contain	15 "	-																	
Apply																			
Actions Records Per	r Page: 2	100 🗸 😮																	
Timestamp Call Timestamp	Call ID	Device ID	GPS	Latitude	Longitude	Degraded Filename	Rating	POLQA v3 MOS	POLQA MOS	EModel (R-factor)	Speech Level Gain (dB)	Noise Level Gain (dB)	Active Speech Level - Ref (dBm)	Active Speech Level -) Deg (dBm)	Mean Noise Level - Ref (dBm)	Mean Noise Level -) Deg (dBm)	SNR - Ref (dB)	SNR - Deg (dB)	Act Spe Rat Ref
02/16/202-02/16/202-GLRo 05:18:38 05:15:41	bFaxVQTTestF	RobFXO2	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent		4.11	82.32	-14.83	-13.7	-24.28	-39.11	-62.79	-76.48	38.51	37.37	57
2/16/202402/16/2024GLRo 5:18:25 05:15:41	bFaxVQTTestF	RobFXO1	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent		4.29	88.13	-12.58	-12.67	-24.28	-36.86	-62.79	-75.46	38.51	38.6	57
2/16/202402/16/2024GLRo 5:18:10 05:15:41	bFaxVQTTestR	RobFXO2	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent	_	4.18	84.4	-14.85	-13.42	-24.28	-39.13	-62.79	-76.21	38.51	37.08	57
2/16/202-02/16/2024GLRo 5:17:57 05:15:41	bFaxVQTTestR	RobFXO1	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent		4.21	85.43	-12.58	-12.67	-24.28	-36.86	-62.79	-75.46	38.51	38.6	57
2/16/202402/16/2024GLRo 5:14:45 05:11:53	bFaxVQTTestF	RobFXO2	N39º08'37" W077º12'56"	39.14	-77.22	fem1POLQ/	Excellent		4.33	89.77	-14.84	-13.55	-24.28	-39.12	-62.79	-76.34	38.51	37.22	57
2/16/202402/16/2024GLRo 5:14:32 05:11:53	bFaxVQTTestF	RobFX01	N39º08'36" W077º12'56"	39.14	-77.22	fem1POLQ/	Excellent		4.42	93.98	-12.59	-12.3	-24.28	-36.87	-62.79	-75.08	38.51	38.21	57
2/16/202402/16/2024GLRo 5:14:16 05:11:53	bFaxVQTTestF	RobFXO2	N39º08'36" W077º12'56"	39.14	-77.22	fem1POLQ/	Excellent		4.16	83.88	-14.85	-13.39	-24.28	-39.13	-62.79	-76.17	38.51	37.04	57
1/16/202402/16/2024GLRo 1/16/202402/16/2024GLRo	bFaxVQTTestF	RobFX01	N39º08'37" W077º12'56"	39.14	-77.22	fem1POLQ/	Excellent		4.24	86.28	-12.58	-12.42	-24.28	-36.86	-62.79	-75.21	38.51	38.35	57
2/16/202402/16/2024GLRo 5:10:57 05:08:06	bFaxVQTTestF	RobFXO2	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent		4.33	89.68	-14.83	-14.01	-24.28	-39.11	-62.79	-76.8	38.51	37.69	57
2/16/202402/16/2024GLRo 5:10:44 05:08:06	bFaxVQTTestF	RobFXO1	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent		4.23	86.07	-12.59	-12.79	-24.28	-36.87	-62.79	-75.58	38.51	38.71	57
1/16/202402/16/2024GLRo 10:28 05:08:06	bFaxVQTTestR	RobFXO2	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Good		3.76	73.49	-14.82	-13.99	-24.28	-39.1	-62.79	-76.78	38.51	37.68	57
10:28 05:08:06 1/16/202402/16/2024GLRo 10:16 05:08:06	bFaxVQTTestF	RobFX01	N39º08'37" W077º12'57"	39.14	-77.22	fem1POLQ/	Excellent		4.29	87.96	-12.61	-12.93	-24.28	-36.89	-62.79	-75.73	38.51	38.84	57
2/16/202402/16/2024GLRo	bFaxVQTTestR	RobFXO2	N39º08'37"	39.14	-77.22	fem1POLQ/	Excellent		4.31	89.02	-14.84	-13.44	-24.28	-39.12	-62.79	-76.24	38.51	37.12	57
5:07:10 05:04:09			W077º12'57"																



Network Status and Remote Access

- Displays status of all the VQuad[™] probes (along with script running status), vMobile[™], MDC, VQT, and File Monitor application status
- The VQuad[™] and vMobile[™] connected to the WebViewer[™] can be accessed or controlled remotely through the web interface
- Various options are available to operate and control the systems remotely such as Load desired scripts along with script parameters, Start/Stop the scripts, and make configuration changes to the VQuad[™] systems

vo	luad	vMobile	MDC (Ne	et T est)	VQT File	e Monitor]												
	- Node	e Connecte	ed 🕑	- Node	e Connected an	id Runnir	ng Scripts	8-1	Node Disconnecte	d 🨑 - Node Out of s	ervice								
		PC Name	e Ver	rsion	VQuad Name	Latitude	Longitude	Devices Count	IP Address	Central IP Addresses	Location				Dual UTA	Last Active	Use BT Name	Grab Mac	Actions
	^ <	GLIN-23	V10. Rele		aga	12.93	77.6	7	AUTO GET LOCAL IP	PRIMARY IP	Fixed	Firmwa	are versior	: 6/23/21 v72	Serial number: 157412 HV2	6/26/2023 7:43:46 AM	OFF	OFF	c 🗵
	~ <	ROBTOW	ER V10.	.7.7 RE	BICHOFFTESTPC	39.14	-77.22	6	USE THIS AS LOCAL IN	PRIMARY IP	Fixed	Firmwa	are versior	: 6/23/21 v72	Serial number: 157214 HV2	6/26/2023 7:43:46 AM	OFF	OFF	c 🗵
				VQ	uad Device	Script I	Running	Statu	s										
		evice Type De	vice Nam	e	Scr	ript Name	3		Call Call Status Type	Global Device & Start Variables	Start/ Scr		Script Status	Actions					
	DuF	xo Rob	FXO1	TestSc	hedule1					Variables	Sto	Р	0	ľ					
	DuF	xo Rob	FXO2	VQuad	l Fax Emulation_F	XOAnswer	rCall			Variables	Sto	Р	⊘	ľ					
	NetT	Test PCN	letTest	VQuad	l Fax Emulation_F	XOAnswer	rCall		IDLE	Variables	🕞 Sta	rt	0	ď					
	NetT	Test Ace	NetTest- r	UserEv	ventTest_Control				IDLE	Variables	💽 Sta	rt	0	ď					
	NetT	Test VQI	NetTest-5	PCNet	Test				IDLE	Variables	🕞 Sta	rt	0	ľ					
	NetT	Test MDI	NetTest-GS	S VACTe	st1				IDLE	Variables	🕞 Sta	rt	0	ľ					
	Bluet	tooth/FXO																	
	^ 8	GLIN-07	V10.	.7.4 GI	LIN-07			2	AUTO GET LOCAL IP	PRIMARY IP	Fixed	Firmwa	are versior	: 11/28/16 v2	0 Serial number: 156648 HV1	4/4/2023 3:45:12 PM	OFF	OFF	B



Filters

CLOSE		Modify fi	lters			
Select Filter	'QT_POLQA	×				
Select dates Ran	ge	Select Map Region	- Omit	Failed Calls	Call Direction (Inboun	d / Outbound)
03/13/2023 01:00:0	00 03/15/2023 01:00:00	Clear Select		set to browser Timezone	Both	L
Results List	Operators	Criteria				
VQuad Call ID	Starts with	Input	Save Criteria			
Saved criteria Audio/Delay	Note: Click on any row in the belo	w table to Edit In range of	0	400	AND	Ō
VQT POLQA	Active Speech Ratio - Deg (%)		50		AND	X
VQT POLQA	Active Speech Ratio - Ref (%)	Equals	57		AND	
VQT POLQA	POLQA MOS	Greater than or equals	4		AND	×
VQT POLQA	Active Speech Level - Ref (dBr	n) Equals	-24.28		AND	×
VQT POLQA	POLQA OWD (ms)	Greater than or equals	600		AND	×
VQT POLQA	Jitter Ave (ms)	Less than or equals	2		AND	
	VQuad DeviceID	Contains	FXO1		OR	
	VQuad Call ID	Contains	FXOPOLQATest		OR	
Save Filter	Delete Filter Upda	ted successfully				



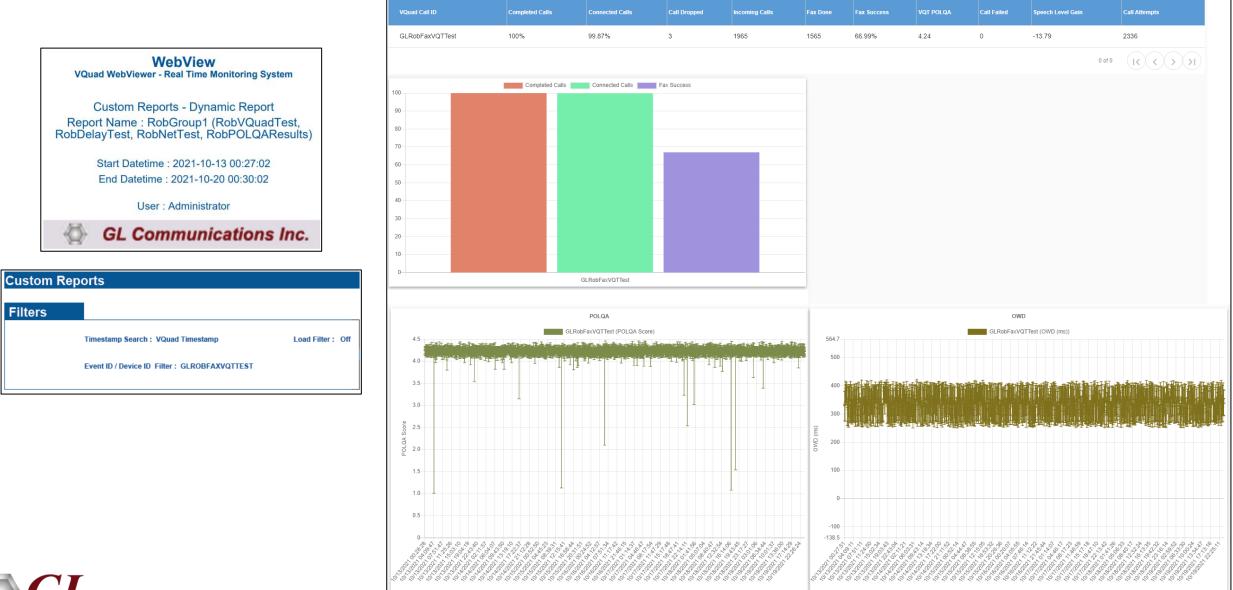
Report Generation

- The user can save the search results to a local PC in *.xls / *.csv / *.pdf formats. Custom reports are generated using DataImport for Events and Statistics, which can be saved to text or Excel output files via WebViewer™
- Google Maps plotting of various test results (VQT, VBA, VAC, EMU, NetTest, FAX, Call Control)
- Console View customizing the threshold values for the test result parameters to populate the consolidated Average, Min, Max results in tabular format and plot corresponding graphics statistics

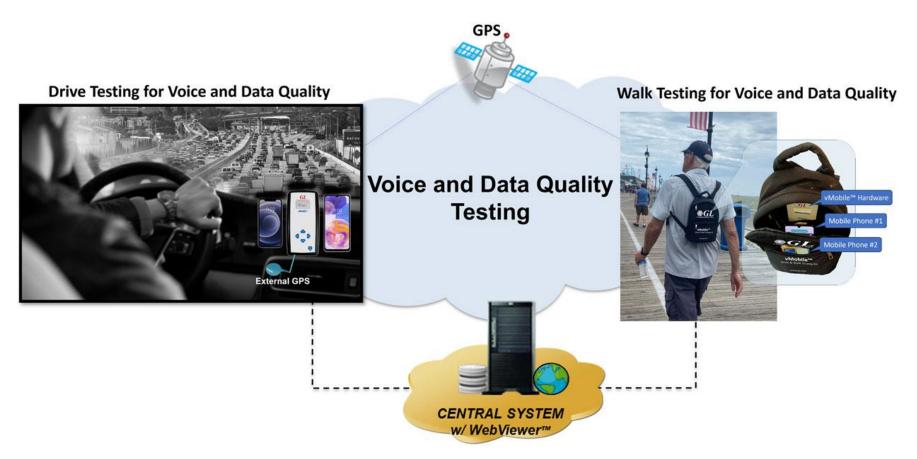
🚳 GL Webv	viewer Version	n 6.1.11				Note : For	the best experie	nce, press Ctrl ·	Refresh 🕢 + F5 after installation / 1	admin /	
Results 🛨	Call Events	Status & Stati	istics 👻	Reports 🔺	Loi	ad Filters: <mark>Se</mark> l	▼ OFF	Live Updates: 5 sec	·		
Custom Reports between 02 Date & Time Standard		02/16/2024 06:03:20 • 12 Hours 24 Hours		Call Process Graphics	6 Months						
Timestamp Type VQuad / vl	Mobile Timestamp 🔻			Analysis Graphics							
Event ID Filter Contains	•	(,	Custom Reports							
Actions 🔻				Google Maps							
Method of Filtering	Aggregate I	Based Results 🔵 Tim	nestamp Basec	ITS Viewer	Results						
Select Reports Records Per Page	RobVQuadTe	est		Console View							
VQuad Call ID	Completed Calls	Connected Calls	Call Dropped	I Incoming Calls	Fax Done	Fax Success	VQT POLQA	Call Failed	Speech Level Gain	Call Attempts	
GLRobFaxVQTTest	100%	100%	0	2441	2437	99.88%	4.23	0	-13.69	2440	



Call Events and Scheduling the Reports



Drive and Walk Testing for Wireless Networks

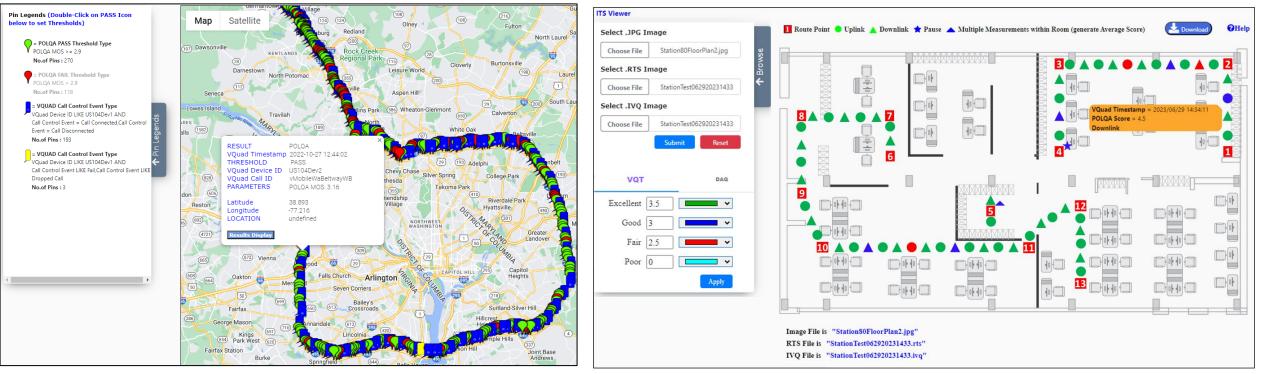


• Drive test with any Wireless device with real-time GPS mapping

Communications

- GPS connectivity for recording timing and location of tests performed
- The GPS mapping records and adds the real-time GPS information to all test results and vMobile[™] call control
- GPS Location includes stamping each result with Latitude, Longitude, and GPS Time Stamp
- GPS information is automatically sent to central database and accessed via Google Maps feature in WebViewer™

Real-time GPS and ITS Plotting



Real-time GPS Plotting

Real-time ITS Plotting

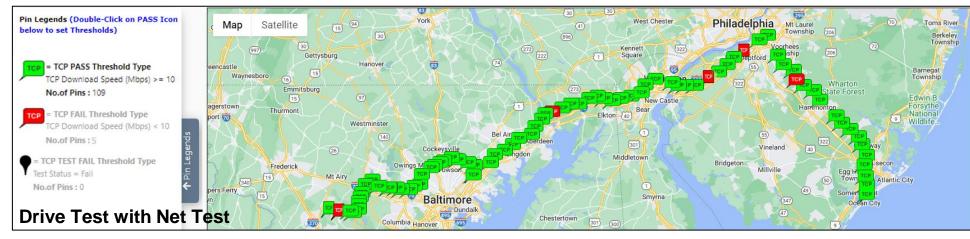


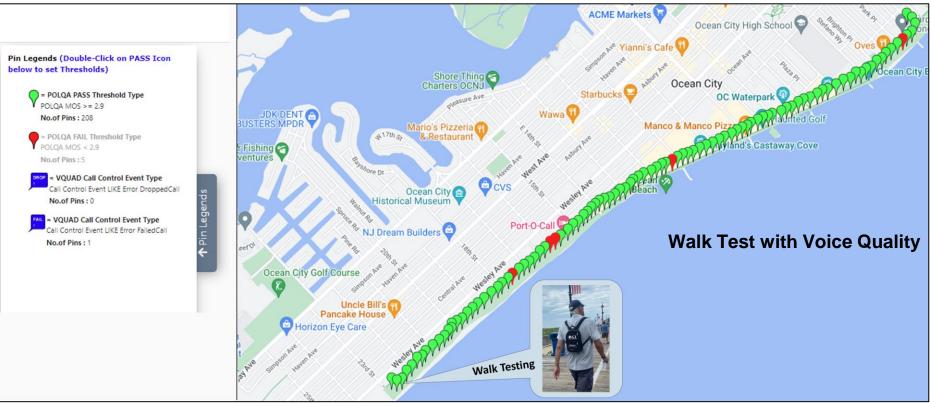
Results in WebViewer™ - Custom Reports





Results in WebViewer™ - From Drive and Walk Test



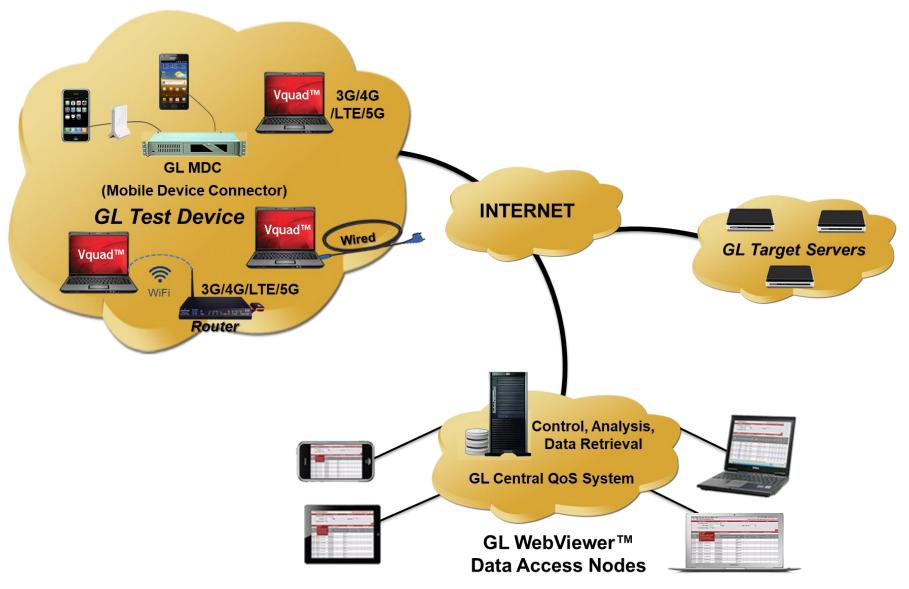




GL NetTest - Data Testing



Automated Data Testing over Wired & Wireless (Bluetooth®, WiFi, 3G, LTE, 5G) Networks





Mobile Device Controller (MDC) GUI

GL's Mobile Device Controller

 application and the supporting
 downloadable apps on the Smartphones
 (iPhone, Android), can remotely perform
 the data tests when the phone is within a
 voice call or outside a voice call

Help									
Phone	App Server IP: 127.0.0.	1	Auto	Test Paramete		Server Di	in a second		
THOME	spp server in . Therease			Call ID	MDCAutoTest		SCOTISTICS	_	
	Command: Start Au	toTest	•	Loop 0	Continuous 💌 🕂	Perform	Function		
	-							-	
Device	Name (UUID): U3NP	- iphone3GS	▼ Time	Interval (s)	5 🗄	Refresh F	Phone Lis	t j	
Te	est Parameters: TCP 122	2.181.135.187:81 80	000 Both Off On		- 1	+ · Manage	Devices	1	
0.004	· · · · · · · · · · · · · · · · · · ·		~~~~					_	
Ph	one List	Events		Client	List	Received Message	•		Audit Log
PhoneID	Device Name (UUID)	Phone Number	Device Model	Device G	Romete IP:Devi	Test Status	Pr	A	Last Activity
000003	2925 - Nexus	NA	Nexus S	12.927,7		PhoneIdleAutoTest		5	08/05/2014 12:00:12
000005	8960 - iBall	NA	iBall Slide 3G Q	12.927,7		PhoneIdle		5	08/04/2014 18:48:08
000008	DKPJ - GL'siPad	No Sim	iPad2 Wifi	12.926,7	LocalHost	PhoneIdleAutoTest		5	08/05/2014 12:00:09
000004	U3NP - iphone3GS	No Sim	iPhone3GS	12.926,7		PhoneIdleAutoTest		5	08/05/2014 12:00:09
000007	7047 - GT	NA	GT-19060	0.0,0.0		PhoneSuspended		900	08/05/2014 11:45:59
000011	hYU= - Nokia 630	NA	NOKIA RM-976	0.0,0.0	LocalHost	PhoneIdle		5	08/05/2014 12:00:13
1 000002	DTD0 - GLiphone4s	No Sim	iPhone4S	12.916,7	122.181.135.18	PhoneIdle		5	08/03/2014 22:13:18
000012	0452 - motoe	NA	XT1022	12.926,7	LocalHost	PhoneIdle			08/05/2014 12:00:10
000009	3018 - HTC	NA	HTC Desire 60	12.927,7	LocalHost	PhoneIdle		5	08/04/2014 12:31:05
000006	5103 - LG	NA	LG-P936	0.0,0.0		PhoneIdle		5	08/05/2014 11:49:24
1 000014	e0dc - Nexus7Tab	NA	Nexus 7	0.0,0.0		PhoneIdle		5	08/04/2014 19:15:33
d									
entral Datab	ase Settings				1.1 - A 1	-	25	-	
Send M	anual Results to Central I	Database Ce	ntral Database IP: 👖	22.181.135.18	7 💌	Clear Local Event Lo	og 🗍		Resend Phone Info
						-		-	



VQuad[™] NetTest Events Log

 Mobile Device NetTest and PC based NetTest Statistics and complete results are relayed back to VQuad[™], which can be access via WebViewer[™]

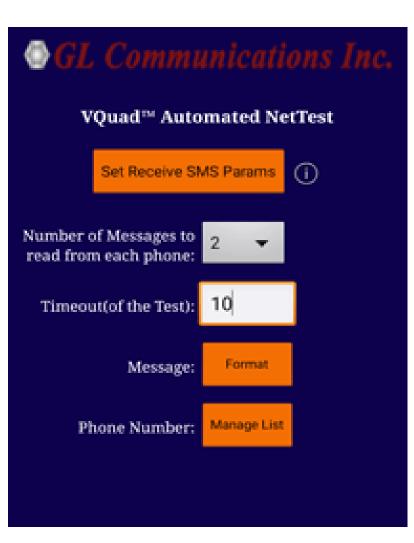
Note: NetTest requires a GL Data Server at each target location, and the mobile device requires a GL deployed app (Apple or Android based) for operation

Status	Ĩ	Results	γ	Audit Log	Manual MDNe	test
		TTO TURE	-	rivan uvy	ris da rie in	
Timestamp	Phone ID	GPS	Test Type	Results		
11/10/2011 2:27:01 PM	RobMDNetTest2	N39*08'40" W77*13'19"	TCP	Upload Window Probes Receive		
11/10/2011 2:27:01 PM 11/10/2011 2:27:01 PM	RobMDNetTest2 RobMDNetTest2	N39f08'40" W77f13'19" N39f08'40" W77f13'19"	TCP TCP	Upload Zero Window Updates S	ent=0	
11/10/2011 2:27:01 PM	RobMDNetTest2	N3910840" W7711319" N3910840" W7711319"	TCP	Upload Bytes Lost=0 Max Route Speed(Mbps)=4		
1/10/2011 2:27:01 PM	RobMDNetTest2	N3908'40" W77*13'19"	TCP	Round Trip Time(ms)+123		
1/10/2011 2:27:16 PM	RobNetTest	N39*08'36" W077*12'57"	UDP	Download Capacity(Mbps)=92.3	240	
1/10/2011 2:27:16 PM	RobNetTest	N39f08'36" W077f12'57"	UDP	Download QOS(%)=96.8		
1/10/2011 2:27:16 PM	RobNetTest	N39108'36" W077112'57"	UDP	Download Packet size(Bytes)=1		
1/10/2011 2:27:16 PM	RobNetTest	N39908'36" W077#12'57"	UDP	Download kilopackets/sec=8.93	26	
¢ [
				in the second		
Clear Result Capt	ure Result			\$		Show lat
evice Id Phone Nam	e Test Type	Status		Test Progress		
- L T M						Get
obiesti j	S 512					-
						Get
						Get
lobTest2		Bunning Bullet				
lobTest2		Running				Gue
bNetTest "PCNetTest		Running	******			Get
RobTest1 RobTest2 obNetTest PCNetTest MDNetTest RobAndroi		Anna Anna	******			-



Data Tests running on Android and Apple Devices using GLNetTest App

GL Commu	ications Inc.
VQuad™ Auton	nated NetTest
Set FTP	Params (j
FTP IP:	205.234.11
Port:	21
User Name:	customer
Password:	customer
Put File Size:	240
Directory:	
Mode:	Passive ①

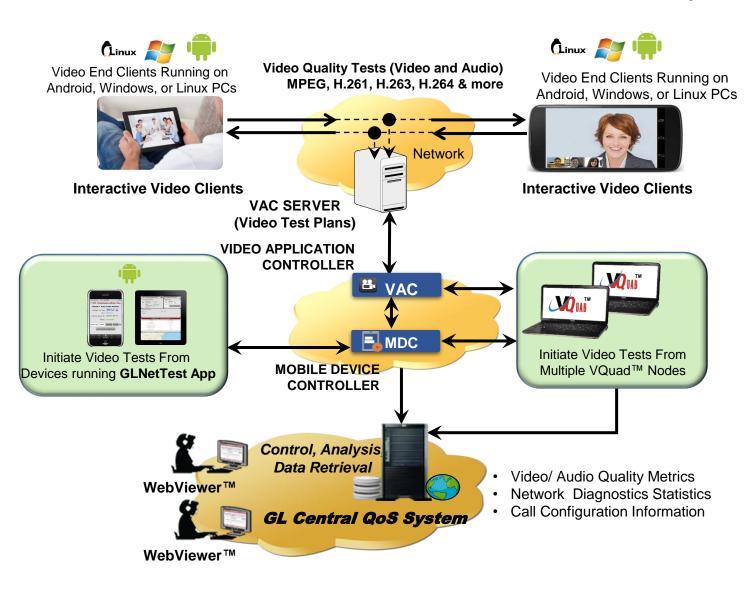




Video Testing



Automated and Manual Video Quality Testing (Android, Windows® and Linux Interface)





Video Test Results in WebViewer™

		V	IDEO QUAI	LITY			AUDIO QUALITY						O-VIDEO		IP NETWORK HEALTH CALL CONFIG INFO				CALL CONFIG INFO							
Absolute MOS-V	Relative MOS-V	Video Frame Rate (Frames per Second)	I Frames (%)	Impaired B/P Frames (%)	d Loss Rate within B/P Frames (%)	Р	Relative MOS-A	Audio Bitrate (kbps)	Audio Bandwidth (kHz)	Signal h Level (dBm0)	Noise Level (dBm0)	Relative MOS-AV	End	Network Packet Loss Rate (%)	Packet	Mean Burst Loss Rate (%)	Mean Burst Length (Packets)	Loss Rate (%)	p Mean Gap e Length (Packets)	(PPDV)	Image Resolution (Pixels)	GoP Length	Audio Codec Type	Audio Sample Rate	Video Codec PLC Type	Audio Codec PLC Type
4.38	4.5	30	0	0	0	36.9	3.84	5	3.5	-23	-61	3.69	166	0	0	0	0	0	8886	0.75	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.38	4.5	30	0	0	0	36.06	3.84	5	3.5	-23	-61	3.66	166	0	0	0	0	0	8893	0.5	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.37	4.49	30	0	0	0	36.8	3.84	5	3.5	-23	-61	3.69	166	0	0	0	0	0	8847	0.81	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.31	4.43	30	0	0	0	35.94	3.84	5	3.5	-23	-61	3.64	166	0	0	0	0	0	8840	0.75	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
3.86	4.16	30	0	0	0	34.02	4.2	64	3.5	-23	-61	3.46	113	0	0	0	0	0	83088	0.06	704 X 480		G.711 µ-law PLC 64Kbps	8000		G.711 °-law PL(64Kbps
3.86	4.16	30	0	0	0	34.02	4.2	64	3.5	-23	-61	3.46	113	0	0	0	0	0	82549	0.06	704 X 480	15	G.711 µ-law PLC 64Kbps	8000		G.711 º-law PL(64Kbps
4.3	4.3	30	0	0	0	34.95	4.2	64	3.5	-23	-61	3.77	166	0	0	0	0	0	38439	0.62	1920 X 1080		G.711 µ-law PLC 64Kbps	8000		G.711 º-law PL(64Kbps
4.27	4.27	30	0	0	0	35.05	4.2	64	3.5	-23	-61	3.81	166	0	0	0	0	0	38389	0.56	1920 X 1080		G.711 µ-law PLC 64Kbps	8000		G.711 º-law PL(64Kbps
4.34	4.46	30	0	0	0	36.45	3.84	5	3.5	-23	-61	3.66	166	0	0	0	0	0	8783	0.56	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.31	4.43	30	0	0	0	36.45	3.84	5	3.5	-23	-61	3.64	166	0	0	0	0	0	8735	0.56	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.32	4.44	30	0	0	0	36.45	3.84	5	3.5	-23	-61	3.64	166	0	0	0	0	0	8792	0.5	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.37	4.49	30	0	0	0	36.45	3.84	5	3.5	-23	-61	3.66	166	0	0	0	0	0	8849	0.63	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.34	4.46	30	0	0	0	36.38	3.84	5	3.5	-23	-61	3.65	166	0	0	0	0	0	8902	0	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.37	4.48	30	0	0	0	36.45	3.84	5	3.5	-23	-61	3.66	166	0	0	0	0	0	8941	0.31	1280 X 720	15	AMR-NB 5.9Kbps	8000	standard	AMR-NB 5.9Kbp
4.65	4.65	30	0	0	0	39.06	4.2	64	3.5	-23	-61	4.16	146	0	0	0	0	0	76238	0.25	1920 X 1080	15	G.711 µ-law PLC 64Kbps	8000		G.711 º-law PL(64Kbps



Thank you!

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