



CYARA VOICE ASSURE

Voice Quality Measurement & Transcoding Detection

The case for precise, reference-based voice quality measurement

Overview

Delivering clear, reliable voice communications requires complete visibility into how audio quality changes across the entire call path. In modern telecom networks, compression, codec changes, and network conditions can silently degrade call clarity - often without any obvious sign that it is happening.

Cyara Voice Assure uses PESQ and POLQA - ITU-accredited, reference-based algorithms - to objectively measure voice quality and identify transcoding across your telecom infrastructure. These are not estimates. They are scientifically validated measurements that carriers, regulators, and the global telecoms industry recognise as the definitive standard.

What is transcoding?

Transcoding occurs when audio is converted from one codec to another mid-call. A carrier may convert a high-quality G711 stream into a lower-bandwidth codec such as G729 or GSM. While this reduces network load, it compresses the original audio - reducing clarity for the end user.

Transcoding is often invisible. Calls still connect. The issue only becomes apparent when customers complain - or when you measure. By measuring audio quality with PESQ or POLQA, you can see exactly if transcoding occurred, flag it with your carriers, and hold them to account.

ANALOGY

Think of a high-resolution photo of around 5MB. To share it, you compress it and reduce the file size. The image still exists - but detail, sharpness, and richness are lost. The same applies to audio. When a carrier transcodes a call, the audio is compressed to a smaller codec - the call still connects, but quality is degraded.

Why do carriers transcode?

Transcoding is rarely accidental. Based on real-world behavior observed across carrier networks, there are three common reasons it occurs:

- **Bandwidth optimization:** Carriers transcode to lower-bandwidth codecs such as G729 or GSM to reduce the cost and capacity required to carry calls. By compressing audio, their infrastructure can handle significantly more simultaneous calls on the same equipment - at the expense of audio quality for the end user.
- **Underlying carrier codec restrictions:** A carrier's own upstream provider may only accept connections on specific codecs. If the originating call arrives in G711 but the underlying carrier only supports G729, transcoding occurs automatically at the handoff point - often without the originating carrier disclosing this.
- **Internal equipment and configuration:** Transcoding can happen within a carrier's own infrastructure due to how their hardware or software is configured. Gateways, session border controllers, and switching equipment may be set up to transcode by default, regardless of the codec the call arrives on.

KEY INSIGHT

In many cases the carrier itself may not be aware transcoding is occurring; it can be introduced silently by upstream providers or internal equipment configuration. Without reference-based measurement, neither you nor your carrier can prove it happened.

How voice quality is measured

Three of the most widely recognized approaches exist for measuring voice quality. They differ significantly in precision, objectivity, and suitability for carrier accountability:

Mean opinion score (MOS)

MOS is a measure of voice quality, originally based on subjective listener scoring (ITU-T P.800). In most automated monitoring tools today, MOS is estimated from network performance metrics such as packet loss, jitter, and delay, rather than from analysis of the actual audio signal. As a result, MOS estimates can vary and are not scientifically validated against real audio.

Important: When analyzing voice quality using PESQ or POLQA, MOS is already fully covered. PESQ and POLQA output scores on the MOS scale, meaning there is no need to run a separate MOS measurement. Reference-based measurement gives you everything MOS provides, plus objective analysis of the actual audio signal.

Perceptual evaluation of speech quality (PESQ)

An ITU-accredited, reference-based algorithm (ITU-T P.862, superseded by P.863 in January 2024). PESQ compares a known reference audio file against the actual recorded call to produce an objective, repeatable score. It is the recognized standard for **narrowband** voice quality measurement. For wideband and HD voice, POLQA is the correct tool.

Perceptual objective listening quality analysis (POLQA)

This is the **active ITU standard (ITU-T P.863)**, which superseded PESQ in January 2024. POLQA supports narrowband, wideband (HD voice), and super-wideband frequencies up to 14 kHz - the correct measurement tool for modern VoIP, SIP, and mobile networks.

MOS vs. PESQ vs. POLQA at a glance

Capability	MOS	PESQ	POLQA
Analyzes actual audio signal (not only network metrics)	✗	✓	✓
Reference-based: compares reference audio vs. received audio	✗	✓	✓
Objective, consistent, repeatable results	✗	✓	✓
HD / wideband voice (50-7,000 Hz)	✗	✗ ‡	✓
Super-wideband & fullband (up to 14 kHz)	✗	✗	✓
ITU-accredited objective measurement standard	✗	✓	✓
Detects transcoding at codec level	✗	✓	✓
Carrier SLA accountability	✗	✓	✓

‡ PESQ includes a wideband extension (ITU-T P.862.2, 50-7,000 Hz). However it was not widely adopted, contained acknowledged technical limitations, and was superseded by POLQA. POLQA is the correct tool for wideband measurement.

Why PESQ and POLQA are the precise choice

PESQ and POLQA are reference-based algorithms, meaning they compare actual audio captured during a test call against a known reference file. This makes them categorically more precise than approaches that estimate quality from network metrics alone.

Complete call quality measurement

PESQ and POLQA measure the audio quality of the complete call from origination to termination, giving you full visibility of the call experience from start to finish.

Objective, repeatable, defensible results

By comparing a known reference file against the recorded test call, results are consistent every time. There is no ambiguity, no subjectivity. Results are the same regardless of who runs the test or when it is run.

ITU-accredited: the global telecoms standard

PESQ and POLQA are ITU-accredited and part of the ITU standards framework. Every major carrier, regulator, and telecom operator worldwide recognizes these measurements. When you present a PESQ or POLQA score, it carries the weight of an internationally accepted standard - not an opinion.

Carrier SLA accountability

Because PESQ and POLQA are universally accepted by the telecoms industry, you can use them directly in SLA conversations and dispute resolution. If a carrier is transcoding your audio or delivering poor quality, you have scientifically validated, internationally recognized proof. This shifts the conversation from opinion to fact.

Transcoding detection at codec level

Reference-based measurement compares the exact audio delivered against what was sent. Any codec change, compression artifact, or quality degradation is immediately visible in the score, giving you clear, objective evidence that transcoding has occurred and the extent of the quality impact.

Support for modern voice technologies

POLQA extends coverage to HD voice, wideband (50-7,000 Hz) and super-wideband frequencies up to 14 kHz, ensuring your quality measurement keeps pace with evolving network and device capabilities including VoIP, SIP, and next-generation carrier infrastructure.

KEY POINT

PESQ and POLQA do not estimate voice quality. They measure it - precisely, objectively, and in a way that every carrier and regulator in the world recognizes. This is the standard that holds your network partners accountable.

Quality scale & codec reference

Both PESQ and POLQA score on the same 1.0 to 4.5 scale. (POLQA super-wideband extends to 4.75.) Transcoding is detected by the **drop in score** between the reference audio and what was received - a G711 call transcoded to G729 will drop from ~4.3 to 3.75 - 3.9 under ideal conditions - and typically 3.0 - 3.5 in real-world deployments, providing objective, measurable evidence of how audio quality was degraded.

Score Range	PESQ Rating	POLQA Rating
3.80 - 4.50	Excellent	Excellent
3.30 - 3.79	Very Good	Very Good
2.80 - 3.29	Good	Good
2.40 - 2.79	Fair	Fair
2.00 - 2.39	Poor	Poor
1.00 - 1.99	Bad	Bad

† POLQA super-wideband (SWB) mode extends to 4.75. Score bands are based on ITU-T P.800 ACR labels.

Code score reference:

The score drop between codecs is what reveals transcoding. Scores shown are approximate under ideal conditions with no packet loss or network impairment:

Codec	Bandwidth	Max PESQ/POLQA Score	Note
G722	64 kBit/s	Up to 4.5 †	WB HD Codec - POLQA WB recommended for wideband analysis
G711	64 kBit/s	4.3 - 4.4	Baseline - full quality
G729	8 kBit/s	3.75 - 3.9	Common transcoding target - audible drop from G711
GSM	13 kBit/s	~3.5	Significant quality loss - clear evidence of transcoding

† When testing G722 calls with PESQ, scores reflect narrowband frequencies only and do not capture the wideband quality that G722 delivers. For a complete picture of G722 performance, POLQA in wideband mode is recommended.

Scores shown are maximum values under ideal, zero packet loss conditions. In real-world deployments, G729 typically scores 3.0-3.5 due to jitter, packet loss, and network delay - making transcoding from G711 significantly more impactful in practice.

What PESQ and POLQA factor in

When generating a quality score, PESQ and POLQA take the following factors into account:

- **Loss of audio sharpness** - degradation in the clarity and definition of the voice signal
- **Reduced volume levels** - attenuation of the audio during transmission
- **Background noise during silent periods** - noise introduced into the call path
- **Audio clipping** - sudden cuts or truncation of audio segments
- **Latency and variable delay** - factored into the alignment process and reflected in the score
- **Line interference** - clicking, distortion, or artifacts introduced by the network

LEARN MORE

To find out how Cyara Voice Assure can help you measure and monitor audio quality across your network, contact us at support@cyara.com or visit cyara.com.