



# Voice Enhancement for VoIP-PSTN Gateways

## Ditech Platform

Ditech's VoIP-PSTN Gateway solutions are available with or without Hybrid Echo Cancellation (HEC) on the following platforms:



**BVP Flex f600**  
OC-3/DS-3/STS-1/STM-1



**QVP E800/T800 Carrier Shelf**  
E1/T1



**QVP E800/T800 Enterprise Shelf**  
E1/T1

The quality of voice calls is a critical consideration in making an investment in VoIP technology. Service providers are hesitant to migrate customers to VoIP unless they can deliver the same high-quality calls that customers have come to expect with the traditional TDM network. Unfortunately, VoIP networks introduce a new set of voice quality challenges, such as mismatched speech levels and longer transport delays, which can cause a dramatic increase in the amount of echo experienced. Also, for customers using low bitrate VoIP codecs, such as those accessing service via home DSL or cable modem connections, background noise can have an additional detrimental effect on voice quality due to the inability of those low bitrate codecs to accurately represent the resultant complex speech signal.

Ditech Networks' IP Gateway solution with Voice Quality Assurance (VQA™) addresses key impairments to VoIP speech quality. An advanced set of algorithms balances mismatched speech levels, removes background noise, cancels hybrid and acoustic echoes, and improves the fidelity of low bitrate VoIP calls through an Enhanced Voice Intelligibility feature that helps compensate for lost or attenuated speech formants.

Ditech's solutions lead the industry in performance with 192 ms hybrid echo tail delays, bidirectional acoustic echo cancellation, and up to 21 dB noise reduction for excellent speech quality and clarity for all calls, providing service providers with the assurance that their customers can continue to experience high-quality calls as their networks transition to VoIP.

With Ditech's Experience Intelligence™ (EXi), service providers can monitor the customer experience with continuous, non-intrusive measurement and reporting of a full range of voice quality metrics on every call.

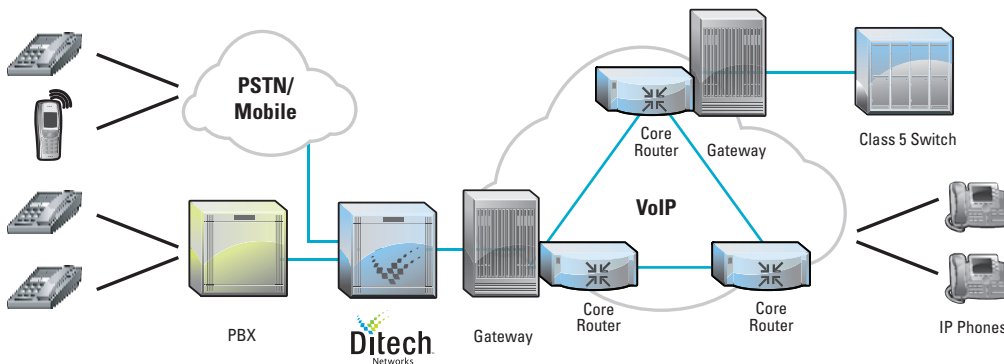


Figure 1 :: Typical IP Gateway VQA Application

Ditech's VQA solutions are tested and proven to dramatically improve voice quality by enhancing speech intelligibility and removing impairments, such as background noise, acoustic echo, and level mismatch, through the use of specialized DSP algorithms.

Measurements in live networks using test systems compliant with the emerging ITU-T G.160 specification show significant improvement in signal-to-noise ratio (SNR) and total noise reduction, well in excess of values recommended by G.160. These measurements correspond with the results of subjective user tests, proving the perceived voice quality is significantly improved with Ditech's VQA technology.

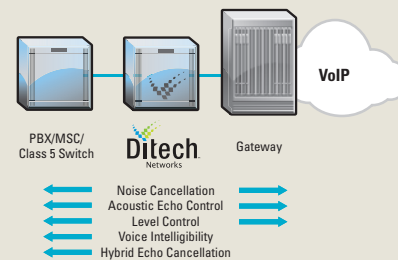


Figure 2 :: IP Gateway VQA Features

## Noise Cancellation Features

Reduces background noise without suppressing voice volume to improve the sound quality of calls.

**Industry-Leading Performance:** Advanced multi-band spectral processing techniques remove up to 21 dB of noise during both speech and pauses, providing a dramatic increase in quality for calls placed from noisy environments.

**Bidirectional Operation:** Operates in both uplink and downlink directions simultaneously, providing excellent speech quality for both parties.

**Excellent Speech Quality:** Advanced noise suppression techniques function only when noise is present, resulting in excellent clean speech performance with no speech degradation.

**Rapid Convergence:** Dynamically adapts to changes in noise spectrum, in real time, converging or re-converging in less than 200 ms.

**SNR Adaptive Noise Cancellation:** Automatically adjusts noise reduction performance to match changing noise levels, providing callers with consistent noise reduction for both tandem (on-net mobile to mobile) and off-net (mobile to PSTN) calls.

**Enhanced VAD Post-Processor:** Unique two-pass algorithm provides an extremely accurate determination of speech vs. noise, providing excellent noise reduction performance under all noise conditions.

**Adjustable Noise Floor:** Spectrally-matched comfort noise can be customized by the operator to provide high or low levels of residual comfort noise in accordance with subscriber preferences.

## Acoustic Echo Control Features

Addresses the echo that is common from handsets and handsfree units.

**Bidirectional Echo Cancellation:** Unique bidirectional solution removes acoustic echo from both near- and far-end sources, resulting in excellent conversational quality for both parties.

**Industry-Leading Performance:** Selectable WAEPL from 45 dB to an industry-leading 15 dB ensures protection from even the strongest echo sources, while maintaining excellent double-talk performance.

**Converged-Network Ready:** Effectively removes acoustic echo with delays up to 400 ms in each direction, providing maximum performance for wireless, wireline, and VoIP environments.

**Adaptive Delay Mode:** Automatically adjusts to actual detected delay on a per-call, per-channel basis, avoiding the need to configure a fixed bulk delay for each channel in advance.

**Spectral Comfort Noise Match:** Automatically generates comfort noise to match actual background noise levels and spectral characteristics, providing improved conversational call quality without an annoying "dead air" effect.

## Level Control Features

Automatically adjusts volume to bring voice to a comfortable listening level.

**Adaptive Level Control:** Automatically adjusts input signal levels up to  $\pm 15$  dB to meet configured target level of between -3 and -24 dBm0.

**Dynamic Level Control:** Advanced design provides amplification of speech independently of noise, providing increased SNR and improved subjective speech quality compared to traditional linear gain control methods.

**High Level Compensation:** Prevents clipping or codec distortions by automatically attenuating input signal levels that are too high, while maintaining integrity of low-level signals.

**Low Level Compensation:** Automatically raises low-level input signals by up to 15 dB to ensure comfortable listening level.

**Automatic Listener Enhancement:** Applies up to 9 dB gain to output signal level in response to high background noise level in the listener's environment, automatically increasing volume in loud listening environments.

## Voice Intelligibility Features

Enables callers to more easily distinguish and understand voice in loud environments.

**Enhanced Voice Intelligibility:** Rebalances spectral signature of input signals to enhance critical speech formants, providing increased clarity and improved speech recognition.

**Unvoiced Speech Enhancement:** Selectively enhances unvoiced speech formants (soft sounds such as "th", "f", etc.) for improved subjective speech quality, especially in the presence of high ambient noise environments.

**Ambient Noise Level Adaptation:** Dynamically adjusts the degree of spectral enhancement to compensate for the ambient noise characteristics of the listener's environment.

## Optional Hybrid Echo Cancellation

Completely eliminates hybrid echo from wireline sources.

**Industry's Longest Tail Delay:** Leading hybrid echo cancellation solution compensates for network delays up to 192 ms, ensuring consistently clear, echo-free calls, even in the face of network migration of TDM to VoIP.

**Fast, Stable Convergence:** Less than 50 ms, with 30 dB or better ERL+ERLE.

**Industry-Leading Performance:** Cancels echo with ERL up to 0 dB; >35 dB ERLE (with 6 dB ERL) at -10 dBm0 input.

**Residual Echo Control:** >65 dB ERLE, with NLP enabled.

## Voice Quality Monitoring Features

Ditech Networks' Experience Intelligence (EXi) delivers an essential set of voice quality statistics, including:

- Speech and noise levels
- Echo delay and return loss
- R factors
- Mean Opinion Scores (MOS)

The data are collected continuously and non-intrusively on a per-call basis, providing the industry's most comprehensive assessment of call quality.

## Standards Compliance

- G.164
- G.165
- G.168-2002
- G.169
- DTMF Transparency
- Designed for G.160 Compliance



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