



# Capacity Optimization for CDMA Networks

## Ditech Platform

Ditech's CDMA Capacity solution is available on the following platforms:



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



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

Ditech Networks' innovative CDMA Capacity solution enables carriers to optimize the forward-link capacity of existing CDMA networks, maximizing the value of network equipment.

This solution features Ditech's Voice Quality Assurance (VQA™) software, which also significantly improves the end-user listening experience by providing background noise reduction, acoustic echo control, background noise compensation, and speech enhancement.

## CDMA and Background Noise

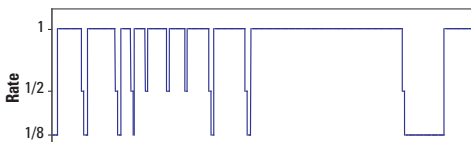
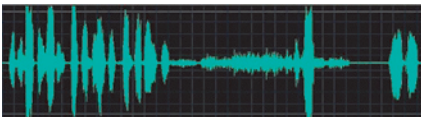
As the number of CDMA subscribers grows and average minutes per month increase, more and more mobile calls originate and terminate in noisy, urban environments. The background noise does more than degrade voice quality; it also impacts network capacity. CDMA's Rate Determination Algorithm (RDA) is designed to select Rate 1 (9.6 kbps) for speech and Rate 1/8 (1.2 kbps) for non-speech. Unfortunately, impairments such as background noise and acoustic echo are often misinterpreted by the RDA as voice, consuming unnecessary network bandwidth.

## Realizing CDMA Capacity

Ditech's bidirectional noise cancellation leads the industry with advanced multi-band spectral processing that adaptively reduces all forms of noise by up to 21 dB. Ditech's acoustic echo cancellation automatically removes all forms of acoustic echo with delays from 0 to 400 ms in both directions, providing maximum performance in today's converged networks.

When deployed at the MSC, Ditech's CDMA Capacity solution prevents noise and acoustic echo from entering the RDA, reducing the average forward-link data rate generated by the vocoder by an average of 20% in noisy conditions. Figure 1 illustrates how Ditech's solution influences the Rate selected by the RDA in the Enhanced Variable Rate Codec (EVRC).

### Without VQA Technology



### With VQA Technology

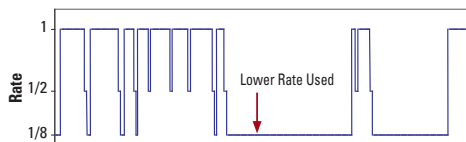


Figure 1 :: Illustration of Noise and Acoustic Echo Reduction and Selected Rate

## Bit Rate Reduction and Increased Capacity

Figure 2 shows the distribution of Rates 1, 1/2, and 1/8 measured during live EVRC network tests in noisy conditions with and without VQA technology. In these tests, the average bit rate was reduced from 6.9 to 5.5 kbps – a 20% reduction – which, as shown in Figure 3, corresponds to a 25% capacity increase. In field deployments in noisy conditions, Ditech typically improves forward-link capacity by 10% to 30%.

## Improved Voice Quality

In addition to the capacity benefit, Ditech's VQA technology improves overall voice quality by removing background noise and acoustic echo and by improving speech clarity with features such as Enhanced Voice Intelligibility. In live CDMA network trials where subscribers were asked to make and evaluate large numbers of phone calls, VQA technology significantly improved voice quality by an average of 0.4 MOS points, as shown in Figure 4. Improved voice quality can facilitate the migration of voice traffic to wireless networks and drive additional revenue, as well as differentiate service from competitors.

## Features Providing Capacity Optimization

### Noise Cancellation

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.

**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.

### 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.

**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.

**Frame Loss Handling:** Voice quality enhancement features automatically accommodate for frame erasure in wireless networks to ensure consistent sound quality before and after the loss condition.

### Acoustic Echo Control

Addresses the echo that is common from handsets and hands free 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.

## Additional Voice Quality Features

**Enhanced Voice Intelligibility:** Rebalances spectral signature when listening in noisy conditions, improving understanding of the human voice.

**Adaptive or Dynamic Level Control:** Provides optimal response to any network voice level condition and listening environment.

**Experience Intelligence™ (EXi):** Provides continuous, non-intrusive measurement and reporting of a full range of voice quality metrics on every call.

Ditech also has CDMA solutions that include Hybrid Echo Cancellation (HEC). For more information, contact your local sales representative or Ditech's headquarters at the phone number and address below.

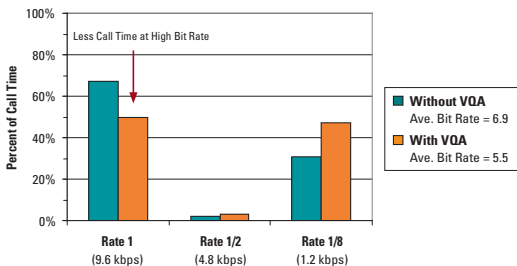


Figure 2 :: Typical Effect of VQA Technology on Forward-Link Bit Rate

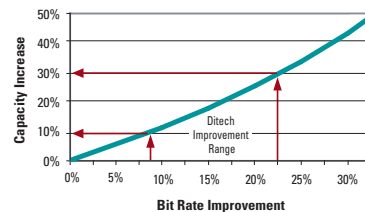


Figure 3 :: Bit Rate and CDMA Capacity [Source: Andrew Viterbi and Vijay K. Garg]



Figure 4 :: Effect of VQA Technology on Mean Opinion Score (MOS)



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