

## Product Bulletin

# Telinnovation™ Echo Canceller Software

Texas Instruments Telinnovation Echo Canceller Solution is a robust industry standard solution to echo cancellation compatible with a variety of TI DSPs. TI's Telinnovation software provides industry leading channel densities and unparalleled performance.

### **Echo Detection and Cancellation**

The physical media used in today's telephony systems requires a conversion from a 2-wire to 4-wire operation. Each conversion calls for a hybrid. These hybrids do not perfectly match impedances resulting in echo. The goal of the echo canceller is to detect and cancel this echo as quickly as possible. The inherent challenges require that the echo canceller not only distinguish the location of the echo, but also be able to distinguish the echo from double talk and other events.

### **Echo Tail**

The length of time over which echo is expected to arrive is referred to as the echo tail length. The echo itself is normally only about 6ms to 8ms in length and can occur at any time during the "echo tail". The primary factor in determining how much echo tail is required for a specific application is the distance and delay expected for the voice signals – the longer the delay the

longer the echo tail. The delay is measured between the hybrid location and the speaker. The maximum echo tail length in use today is 128ms although some 192ms applications exist.

### **Echo Canceller Requirements**

The amount of time required to effectively locate and cancel the echo is referred to as convergence time. The convergence algorithm is executed independently for each call that is established. Throughout the duration of a call the echo canceller must monitor for certain events that can require re-convergence such as adding or dropping a party to a conference call, redundancy switching in the transmission network that alters delay characteristics, generation of tones meant to activate special features or signaling tones. The echo canceller must also detect and respond to double talk (both parties talking at the same time). Each of these situations requires that the echo canceller respond in an appropriate way.

### **Key Metrics**

The key metrics for judging the effectiveness of any echo canceller are:

- Compliance with G.168-2004
- Ability to adapt echo tail length to application
- Fast convergence
- Re-convergence

### **Key Benefits**

- DSP Based solution (versus ASIC) – Allows ANY critical functionality to be solved with software, fast and efficiently
- Field Proven Solution – Over 20 million ports in service.
- Comprehensive Product Testing and Support
- Breadth of Deployment – Fixed and Mobile Carriers and Enterprises
- Fast Convergence
- Long Tail Cancellation (up to 192ms)
- Time to Market
- Industry leader in DSP Technology

- Double talk detection
- Ability to handle various signaling protocols
- Support of wireless infrastructure
- Ability to adapt to changing network requirements

### **The TI Solution**

TI's Telinnovation echo canceller is G.168-2004 compliant and has been certified for use across carrier, enterprise, and wireless telecommunications networks. Convergence times for today's high quality echo cancellers range from 150ms to 300ms. Through a patented dual canceller algorithm the Telinnovation echo canceller can converge and suppress echoes within 25ms 90% of the time. For times when this is not possible the Telinnovation echo canceller is comparable to other carrier-class echo cancellers. This same algorithm provides for superior double talk detection.

### **Product Portfolio**

The Telinnovation echo canceller is available as either an IMAGE or FUNCTION. An IMAGE is a “standalone” DSP application/executable. A FUNCTION is C-callable function and is the identical code to that found in the IMAGE. Users are required to integrate the FUNCTION into their own framework for productization. Both the IMAGE and FUNCTION are available in a bundled silicon + software solution for selected DSPs as well as by Licensed Units.

### **Standard Features**

The standard feature set for either the Telinnovation IMAGE or FUNCTION includes the following:

- G.168 – 2004 Echo Cancellation on all supported channels
- Echo Tail – settings up to 192ms planned
- G.169 Automatic Level Control (ALC) – Programmable from -23 to -15 dBm0
- High Level Compensation (HLC)- allows for receive level attenuation where needed
- Comfort Noise Generation
  - Tone Detection (Modem disable tones)
  - Programmable Idle Code
  - Tone Detection –
  - Mid Call Trigger (MCT) – Detects DTMF “#” for feature activation
  - C7 Bypass
  - C7 Generate/ Detect/Measure
  - C5 Bypass
  - C5 Generate/Detect (Legacy)

### **Wireless Infrastructure Support (Voice Quality Enhancements – VQE)**

Wireless infrastructure presents a different set of challenges from traditional telephony. The following critical features are supported in the Telinnovation™ echo canceller for wireless networks:

- Adaptive Noise Reduction (ANR) – High quality, high precision noise abatement algorithm specifically tailored to wireless applications
- Acoustic Echo Control – Removes acoustic echo coming from the cell phone
- Adaptive Listener Enhancement – Raises the target ALC level toward the cell phone in response to noise coming from the cell phone
- Tandem Free Operation (TFO) Detection – Disables the Echo Canceller for mobile to mobile calls
- A-Interface Detection – Disables the Echo Canceller in the presence of high speed data (48 kbps) as seen on the GSM A-Interface

### **Support and Quality Assurance**

The Telinnovation echo canceller was the first DSP based echo canceller commercially available in the early 1980's. The database of problems and solutions for this 20 year period provides an invaluable resource for both testing of the product and fault isolation when required. The Telinnovation echo canceller has been constantly improved since

that time and has evolved to meet the every changing requirements of a today's dynamic networks. The Telinnovation IMAGE has often been incorporated into customer designs in under three weeks. This is possible because of comprehensive documentation and the experience of our support staff.

### **Echo Quality Index (EQI)**

The Telinnovation echo canceller used on the C64x+ devices will optionally include the TI proprietary Echo Quality Index that provides an indication of the propensity for echo on any given channel. This statistic will be made available via the software's Application Interface.

### **Active Roadmap**

The Telinnovation echo canceller will be updated in the future to include a 192ms echo tail as well as TDM over IP interfaces such as iTDM and CESoIP.

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