

Octasic Inc. OCT6100 versus Ditech Corp. Quad-T1 Card and Tellabs IEC-64MC2B

Test Summary

Echo Cancellation Voice Quality Competitive Evaluation

Premise: When deploying next-generation network elements such as voice over packet (VoP) equipment, one of the greatest concerns is voice quality. The goal of VoP is to improve the experience of customers using traditional circuit-switched equipment while maintaining acceptable levels of voice quality. With echo cancellation required on all channels today in many deployments, carriers are demanding the capability to accommodate long echo tails. Echo cancellation is a very demanding challenge when providing this level of quality. When a compromise is made to minimize power and space, this can have a very negative effect on echo cancellation.

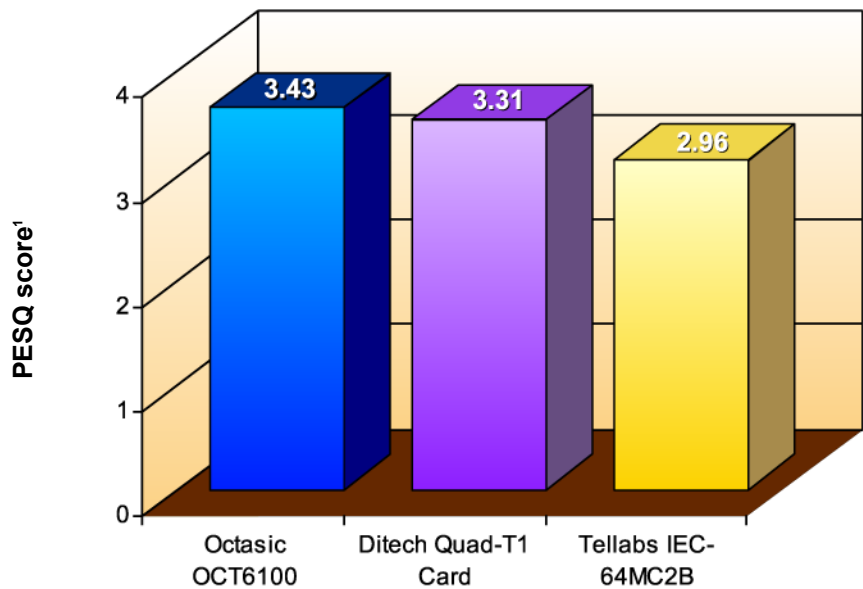
Octasic Inc. commissioned The Tolly Group to evaluate its OCT6100 Series Echo Canceller for voice quality performance in benchmark tests against two competitive offerings – a Ditech Corp. Quad-T1 Echo Canceller Card and a Tellabs Inc. IEC-64MC2B echo cancellation board. Tolly Group engineers tested Octasic’s OCT6100 Series Echo Canceller beta software before the product is packaged in its final ASIC form factor.

Engineers subjected all three products to voice quality measurements using the Perceptual Evaluation of Speech Quality (PESQ) metric. PESQ is based upon the ITU-T P.862 standard, which defines the algorithms used to compare reference speech samples with test samples to measure voice quality degradation due to distortion. Under PESQ, voice quality is measured on a scale of one to five, with one representing the lowest quality, and five representing excellent voice quality. Voice

Test Highlights

- Demonstrates superior voice quality over rival offerings when evaluated across 150 impaired voice samples
- Delivers highest PESQ voice quality score of products tested – almost a half grade higher than the Tellabs IEC-64MC2B
- Achieves the lowest standard deviation of PESQ scores ensuring reliability and consistency of voice quality during echo cancellation

**Average PESQ Voice-Quality Scores
 Based on 150 Voice Samples as Reported by Malden SPA**



¹ PESQ scores range from 0 (poor voice quality) to 5 (excellent voice quality).

Source: The Tolly Group, April 2002

Figure 1

quality measurements were derived from the average PESQ scores taken from 150 voice samples. The voice samples consisted of both male and female recordings in a variety of languages that were highly impaired with echo. (See the Test Methodology section for details.) Although PESQ is not designed specifically for evaluation of echo cancellers and residual echo, it provides a reliable measure of the improvement in voice quality when samples are subjected to each echo canceller. Testing was performed from January 2002 through March 2002.

Test results show that Octasic's OCT6100 prevailed with superior performance in every test conducted.

RESULTS

PESQ VOICE QUALITY TEST

Testing demonstrated that the Octasic OCT6100 echo cancellation algorithm used in the tested software model outperforms both the Ditech Quad-T1 Echo Canceller, and the Telllabs IEC-64MC2B echo cancellation module when placed in a head-to-head survey of 150 separate voice samples tested using PESQ. The echo canceller processed the samples with echo to improve the quality of the voice. Without echo cancellation, these samples would have scored very low at PESQ. For the entire test sample, the OCT6100 provided a PESQ score of 3.43, which the ITU correlates to a voice quality of fair to good (see Figure 1). By contrast, the Ditech Quad-T1 Echo Canceller achieved a voice quality rating of 3.31 and the Telllabs IEC-64MC2B module received a 2.96 PESQ rating, which correlates to a resulting voice quality between fair and poor (see Figure 2 for PESQ score differential results).

VOICE QUALITY STANDARD DEVIATION

Tolly Group engineers also measured the standard deviation of the PESQ voice quality test scores recorded across the range of test iterations. The standard deviation is an indicator that the device under test's (DUT) echo

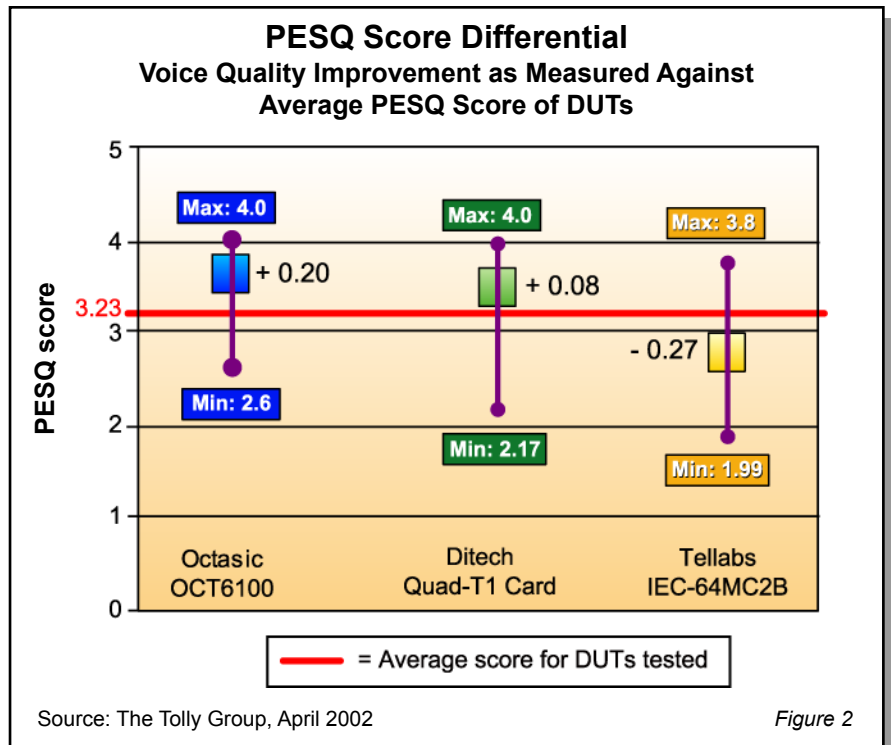


Figure 2

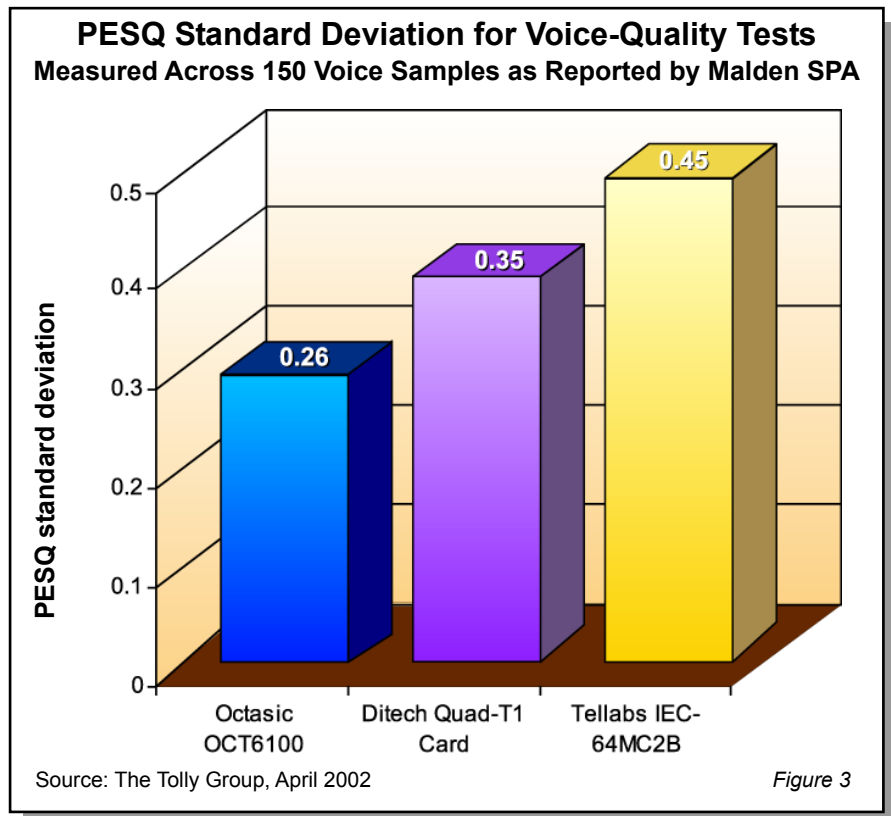


Figure 3

cancellation algorithm keeps a more constant level of echo cancellation than that of competing products, and will provide consistently better voice quality. Here, the OCT6100 achieved the lowest standard deviation of the three

devices tested. The OCT6100 achieved a standard deviation of 0.26, versus 0.35 for the Ditech Quad-T1 echo Canceller, and 0.45 for the Telllabs IEC-64MC2B (see Figure 3).

ANALYSIS

With the development of next-generation VoP equipment, the general public will become more of a factor in the daily usage of IP Telephony. Users of standard telco analog voice equipment have come to expect a certain level of voice quality with their communications. Typical end users will be more likely to adopt and accept packet over voice solutions when the quality level approaches what they are used to with the analog voice network. The next generation of voice quality enhancements, including echo cancellation devices, will bring the end user closer to a large-scale deployment of VoP.

The PESQ tests conducted on the OCT6100 and two rivals products demonstrated that the Octasic echo canceller exceeds the voice quality of traditional production-ready echo cancellers on the market. Moreover, its exceptionally low standard deviation shows that the OCT6100 provides consistent voice quality and high reliability.

Manufacturers of VoP products, such as gateways and switches, can utilize the OCT6100 with the confidence that the device delivers echo cancellation with the degree of voice quality that is considered between fair and good. By contrast, both offerings from Ditech and Tellabs trailed the OCT6100 in voice quality when performing echo cancellation.

TEST CONFIGURATION AND METHODOLOGY

For performance tests, The Tolly Group tested an Octasic Inc. OCT6100 software model running on a Pentium III PC with 768 Mbytes RAM, running Windows NT4 Workstation SP 6.

Tolly Group engineers also tested a Ditech Corp. Quad-T1 card with D4.00.03 rack-mountable device, which interfaced via a Dialogic Dual T-1 with an Octasic Computer

Telephony Development Board (OCT-T001) operating as the reference board.

Tolly Group engineers also tested a Tellabs, Inc. IEC-64MC2B component board, revision B00, which interfaced directly with an Octasic Computer Telephony Development Board (OCT-T001) operating as the reference board.

Both the Octasic reference boards for the Ditech Quad-T1 card and the Tellabs IEC-64MC2B component board interfaced with a generic Pentium III with one Gbyte RAM, running Windows NT 4 Workstation SP 6.

Engineers created reference voice sample files and added echo via a simple convolution of the far talk with the echo point added to the local talk. The DUT received each echo file in a batch process through a reference board via the PCI bus. The DUT processed each echo file and passed it back to the PC where it was saved as a stereo file before being converted to a mono file via batch process. Each mono file was then compared to its original to compute its PESQ score.

Engineers tested 150 voice samples for a duration of one minute each; results were averaged.

EQUIPMENT ACQUISITION AND SUPPORT

Both the Ditech and Tellabs products were acquired through normal product distribution channels. In accordance with The Tolly Group's Fair Testing Charter, Ditech and Tellabs were invited to provide a higher level of technical support for these tests. Both Ditech and Tellabs initially accepted the invitation and agreed to provide a higher level of technical support, but after each reviewed test methodology, each company declined to participate. The Tolly Group proceeded with testing. No special technical support was necessary to configure the products under test.

Octasic Inc.

OCT6100 Echo Canceller

Competitive Evaluation



Octasic Inc. OCT6100 Echo Canceller Product Specifications*

High channel density

- 672 channel G.168-2000 echo canceller
- 128-ms tail per channel (for all channels)
- ITU G.169 automatic level control
- Fully convergent adaptive filter
- Automatic noise reduction
- Extensive control tone detection
- Audio conferencing
- Large buffer playback capabilities

Lowest power and space

- Less than 3m w/channel
- 16mm x 16mm

Simplifies your design

- Field upgradeable algorithm improvements
- Integrated debugging and monitoring

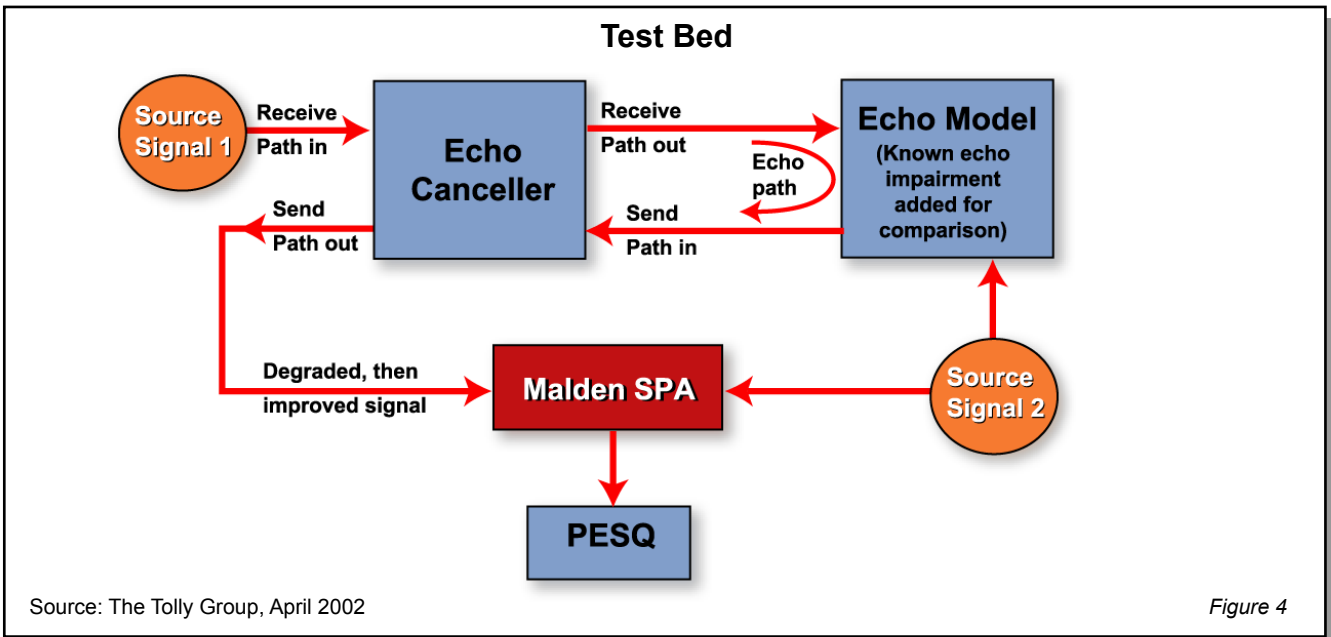
Example Applications

- Voice over packet enabled network elements:
 - SoftSwitch
 - Media Gateway
 - IP/PSTN Gateway
 - Voice/media Applications Server
 - Multi-service Switch
 - Wireless mobile services switching center
 - Echo and voice quality processing network elements

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**Vendor-supplied information not verified by The Tolly Group*



Results were shared with Ditech and Tellabs, each of which neither acknowledged nor disputed their accuracy. For a more complete understanding of the interaction between The Tolly Group, Ditech and Tellabs, check out the

Technical Support Diary for Competitive Products Tested posted on The Tolly Group's World Wide Web site at <http://www.tolly.com> (see document 202117).

The Tolly Group gratefully acknowledges the providers of test equipment used in this project.

Vendor	Product	Web address
Agilent Technologies	VQT	http://www.agilent.com

TOLLY GROUP SERVICES

With more than a decade of testing experience of leading-edge network technologies, The Tolly Group employs time-proven test methodologies and fair testing principles to benchmark products and services with the highest degree of accuracy. Plus, unlike narrowly focused testing shops, The Tolly Group combines its vast technology knowledge with focused marketing services to help clients better position product benchmarks for maximum exposure. The company offers an unparalleled array of reports and services including: Test Summaries, Tolly Verifieds, performance certification programs, educational Webcasts, white paper production, proof-of-concept testing, network planning, industry studies, end-user services, strategic consulting and integrated marketing services. Learn more about The Tolly Group services by calling (732) 528-3300, or send E-mail to info@tolly.com.

For info on the Fair Testing Charter, visit: www.tolly.com/About/ftc.asp



PROJECT PROFILE

Sponsor: Octasic Inc.
Document number: 202117
Product class: Echo Canceller
Products under test:

- OCT6100

Testing window: March through April 2002
Software version tested:

- Version 0.05B

Software status:

- Beta code

Additional information available:

- Technical Support Diaries
- Configuration Files
- Data Files

For more information on this document, visit our Web site at <http://www.tolly.com>, send E-mail to info@tolly.com, or call (732) 528-3300.

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