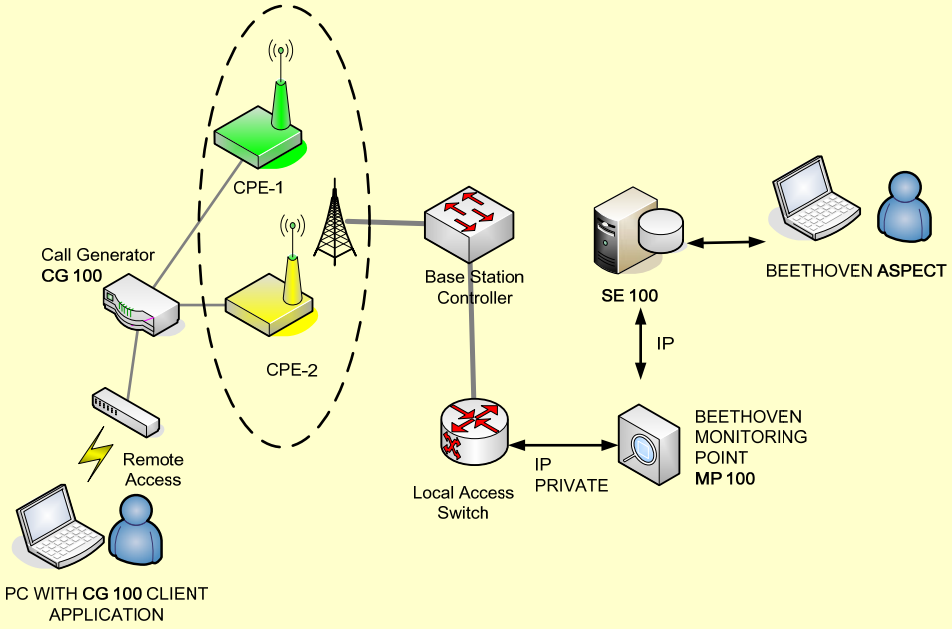
Objective CPE Comparison

CPE Comparison for use on Fixed Wireless Access Network

The Challenge

After narrowing the field of potential Customer Premise Equipment (CPE) terminals down to two, based on price and features only one question remained unanswered. How do they compare in terms of voice quality? To answer this question Calyptech was approached and asked to perform a voice quality comparison of the CPE devices on the customer's Fixed Wireless Network using elements from the Beethoven solution.

So how is voice quality objectively compared for the two CPE device types?



- **CUSTOMER:** Tier 1 Network Operator
- **LOCATION:** Australia
- **RESULT:** Objective evidence of the superiority of one type of CPE.

The Test Setup

The figure above shows the two types of CPE in operation along with the surrounding Beethoven components. In order to run the tests Beethoven CG100, Aspect, SE 100 and MP100 were employed, in the field context.

Calls to each of the CPE devices were generated using the CG100 , controlled from the CG100 Client Application. The calls were analysed by the Beethoven Monitoring Point, MP100, with the results stored on the SE100. Beethoven Aspect was then used to remotely view the results of the analysis.

"With Beethoven we were given objective answers to a very subjective problem..."

Objective Measurements

In the case of this study five objective measurements were chosen; Mean Opinion Score (MOS), Echo Return Loss (ERL), Echo Path Delay (EPD), Active Speech Level and Background Noise.

MOS is a term used to describe quality scores that give objective results to the quality of voice, based on listening and conversational criteria. This can be a value between 1 and 5, 1 being the worst quality and 5 being the best. There are several types of MOS measurements, and the objectives of the testing must be carefully evaluated to determine the most relevant in the context.

Echo Return Loss is a measure of the difference in power between the caller's speech level and the echo that comes back. The higher this value is the lower the volume of the echo compared to the volume of the speech.

Echo Path Delay is a measure of how long it took the echo to come back. If this is value is

small the echo is not noticeable. If it is large it becomes obvious to the caller that their utterances are coming back to them, when the echo cancellation is not functioning correctly.

The Active Speech Level is a measure of the loudness of the caller's speech.

The Background Noise is a measure of the background hiss that is heard by the caller. The smaller the amount of background noise the less hiss heard by the caller.

Hundreds of test calls were run with standardised test call samples and Calyptech's own speech database containing male and female speakers. The calls were also made on the Public Switched Telephone Network (PSTN) as a neutral reference.

The Results

The charts for the MOS, Echo Return Loss and Echo Path Delay are shown to the right.

The MOS chart shows CPE1 with a MOS of 2.87, CPE2 with a value of 3.39 and the PSTN with a value of 4.12. CPE2 is a clear winner with a 0.5 MOS point advantage indicating a higher listening quality than CPE1.

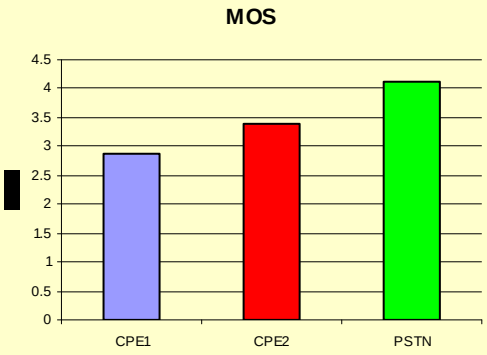
The Echo Return Loss chart shows that the echo levels for CPE1 and the PSTN are roughly equivalent. CPE2 on the other hand did not register any echo at all on Beethoven.

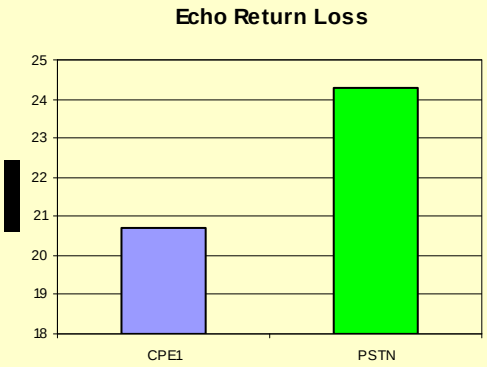
The Echo Path Delay chart shows the big difference between CPE1 and the PSTN. A PSTN EPD of about 5.4 ms is imperceptible to the caller. The quarter of a second delay for CPE1, on the other hand, is very noticeable. Having no echo on CPE2 also means that it also does not have an EPD.

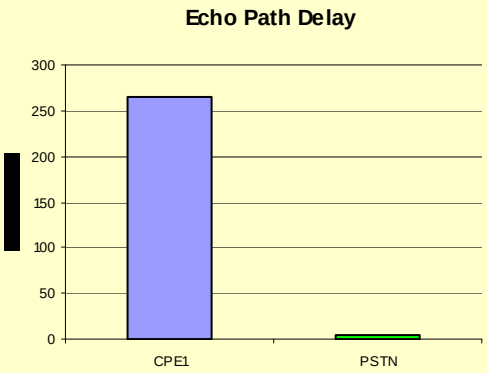
With regards to the Active Speech Levels and Background Noise levels there was negligible difference between the two pieces of equipment.

The Conclusion

With the help of Beethoven the network operator was able to objectively compare types CPE from the perspective of voice quality, and effect a qualified purchase decision for the better CPE device. Given the lack of echo and the enhanced MOS listening quality, CPE2 was clearly superior to CPE1.







Beethoven Voice Quality Assurance Solution

The Beethoven Voice Service Assurance solution gives you a scalable, configurable set of hardware and software components that fully instrument your network to assure the quality of the voice service. Beethoven offers a customizable suite of voice monitoring and analysis capabilities that enables you to optimally manage and control your network from a customer experience perspective.

You save money by quickly identifying and resolving issues resulting in increased network reliability, and a reduction in the cost of maintaining the high level of service demanded by end customers and regulatory authorities.

Increased revenues result from reduced customer churn through better customer service management, and higher customer satisfaction.

About Calyptech

Calyptech is leading electronic product development company, offering turnkey product solutions and complete outsource design services to a diverse global client base in a range of industry segments including Semiconductors, Networking, Telecommunications, Consumer, Defence and Medical applications. For more details visit www.calyptech.com.

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