



CWave™ One High-Performance Networking Technology Achieving Multiple FCC Goals



Presentation Overview

- Company highlights
- CWave technology basics
- Upgrade path
- Compelling technology that can meet multiple FCC objectives
 - School wiring for high broadband
 - Upgrades to bandwidth in rural cable systems
 - Bringing broadband to MDUs
 - Other Applications

Pulse~LINK Highlights

- Located in Carlsbad, CA
- Ultrawideband pioneer led by storied inventor John Santhoff
- \$100m + invested. Over a decade of R&D
- More than 300 patents derived from Pulse~LINK team
- Wired and wireless UWB solution
- One chipset serves multiple markets

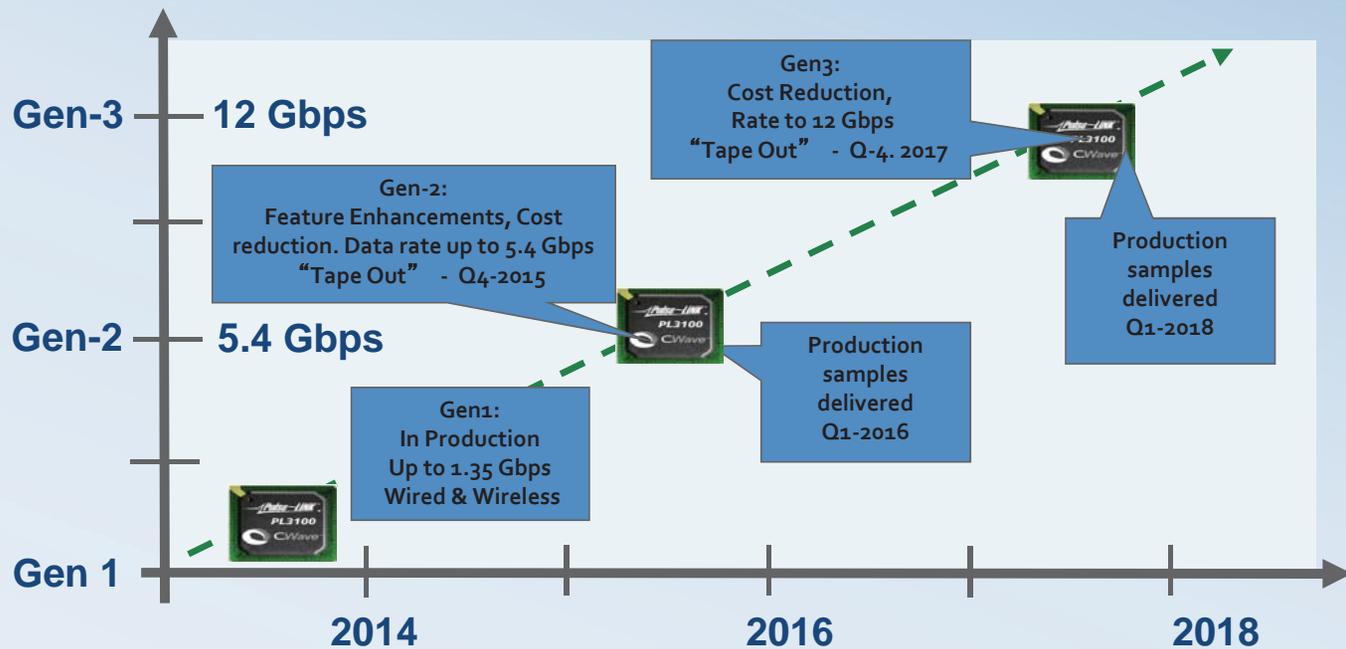


CWave Technology

- Inexpensive upgrade to existing networks
- Unique Ultrawideband (UWB) Implementation
- FCC authorized UWB wireless operation in 3.1 to 10.6 GHz RF spectrum in February 2002 (FCC 02-48)
- Single chipset capable of wireless and wired operation
- Highly scalable: current raw data rates of 1.35 Gbps; roadmap to 12 Gbps+
- Supports Asynchronous and Isochronous data streaming with Full QoS
- Compatible over Coax with Cable TV and DOCSIS (incl. 3.1), Satellite, MoCA
- Compatible over Twisted Wire Pair with Voice and all DSL flavors

CWave™ ASIC Technology Roadmap

- **Gen-1:** Existing Chipset. Single Band operation, BPSK, 1.35 Gbps raw data rate
- **Gen-2:** Add PCI-e, Gig-E, Apps Processor, DAC for TX, Dual Band operation, QPSK, 5.4 Gbps
- **Gen-3:** All-In-One ASIC SOI, Tri-Band Operation, 8PSK, 12 Gbps raw data rate



❖ Raw Data rate Calculation: 1-Band is 1.35 GHz. BPSK = 1 bit-per-Hz (bpHz), QPSK = 2 bpHz, 8PSK = 3bpHz Thus: 3 bands @ 1.35GHz = 4GHZ of RF spectrum x 3bpHz = 12Gbps

US Schools Failing to Meet Bandwidth Recommendations

- FCC Chairman supports ConnectED goals
- \$2 Billion in additional USF funding approved on July 11.
- Docket WC 13-184 identified problem – expense of bringing bandwidth from school wiring closet to classroom
- Most schools wired with coaxial cable but not with category 5 cable

CWave Solves FCC's School Broadband Objectives

- Wiring schools with Cat5/6 cable costs \$50k - \$100k+
- Significant cost saving by using CWave over existing Coax
- Minimized disruption to students and staff and can install during school year
- Stretches Schools and Libraries program funding to cover more schools
- Coexists with DOCSIS (incl. 3.1), traditional cable and satellite
- CWave™ comfortably meets 100 Mbps target and can meet the 1 Gbps target
- Roadmap to 12+ Gbps

Inadequate Rural Data Speeds

- FCC considering to redefine the definition of broadband
- Experimental grant program suggests that might be 25 Mbps download
- The primary technology serving most rural town is cable modem
- Outdated rural cable technology underperforms urban cable systems
- Cable companies do not want to invest in the expensive upgrades of the DOCSIS path for smaller rural systems
- Small town America being left on the wrong side of digital divide

CWave Solves Slow Rural Cable Bandwidth

- CWave can be overlaid as second Ethernet path onto any cable system
- CWave upgrade far less costly than traditional path
- CWave allows rural cable systems to match or even surpass of metropolitan cable speeds
- Operates in RF Spectrum normally considered unusable for traditional cable TV
- Enables access to RF spectrum above 2 GHz on legacy HFC plant without changing amplifier spacing
- Enables Gigabits of additional data capacity without upstream limits imposed by DOCSIS
- Out-of-band with all legacy HFC plant signals - guarantees coexistence

Experimental Broadband Grant Program

- Only July 11 the FCC approved \$100 million for experimental broadband grants.
- Pulse~LINK has tested this technology at a California cable company and is considering filing a grant application to bring the solution to a whole rural cable system.
- This slide was added just to provide full disclosure for this meeting. This was not planned to be in the presentation until the very recent FCC decision.

Rewiring Costs Prevent Fiber Speeds in MDUs

- Bringing fiber to MDUs requires significant and costly rewiring
- Estimate that 85% of MDUs are not pre-wired with category 5 cable
- Universal problem affecting Verizon FiOS, Google, AT&T, Municipalities, ILECs
- Nobody spending money to rewire buildings
- Prime example: Verizon controversy serving NY City

CWave Solves MDU Bandwidth Conundrum

- CWave delivers gigabit speeds without rewiring MDUs
- CWave works on existing coaxial cable without disturbing incumbent cable provider
- MDU wiring typically belongs to landlord not cable company
- CWave significantly lower cost than rewiring
- Minimal disruption to residents
- Fiber providers can selectively service MDU residents

Hospitals Need More Bandwidth

- Hospitals need additional bandwidth to support new applications
- Problem is getting bandwidth to where it's needed in the building
- Most hospitals are wired with coaxial cable – many older & rural hospitals don't have category 5 cable
- FCC oversees funding for rural tele-medicine through Universal Service Fund

CWave Brings Wired and Wireless Solution to Hospitals

- Utilizes existing Coax wiring
- Out-of-band to cable TV, Wi-Fi and other medical RF
- Both Wired and Wireless Solution
- High data rate wireless for patient monitoring
- Significant less cost than rewiring with cat 5 cable
- 12 Gbps roadmap upgrade path

Other CWave Applications

GFast

- GFast is latest technology serving legacy twisted pair networks
- CWave can double bandwidth and/or double distance of GFast link
- CWave doubles number of homes served by one GFast DSLAM

MoCA

- MoCA delivers television signals and data between multiple set top boxes
- MoCA requires 200 MHz spectrum notch for DOCSIS 3.1 (on 1.7 GHz implementation)
- CWave out-of-band to ALL cable and satellite services
- CWave roadmap to 12 Gbps

Summary

- Meets FCC Chairman's goal of bringing gigabit speeds to classrooms
- Cost effective solution to enable rural cable systems to match metropolitan cable speeds
- Promotes urban competition by bringing a gigabit MDU solution
- Can supply needed bandwidth for rural hospitals
- PULSE~LINK FIRMLY BELIEVES CWAVE PROVIDES A COMPELLING SOLUTION TO FCC'S CURRENT BROADBAND OBJECTIVES



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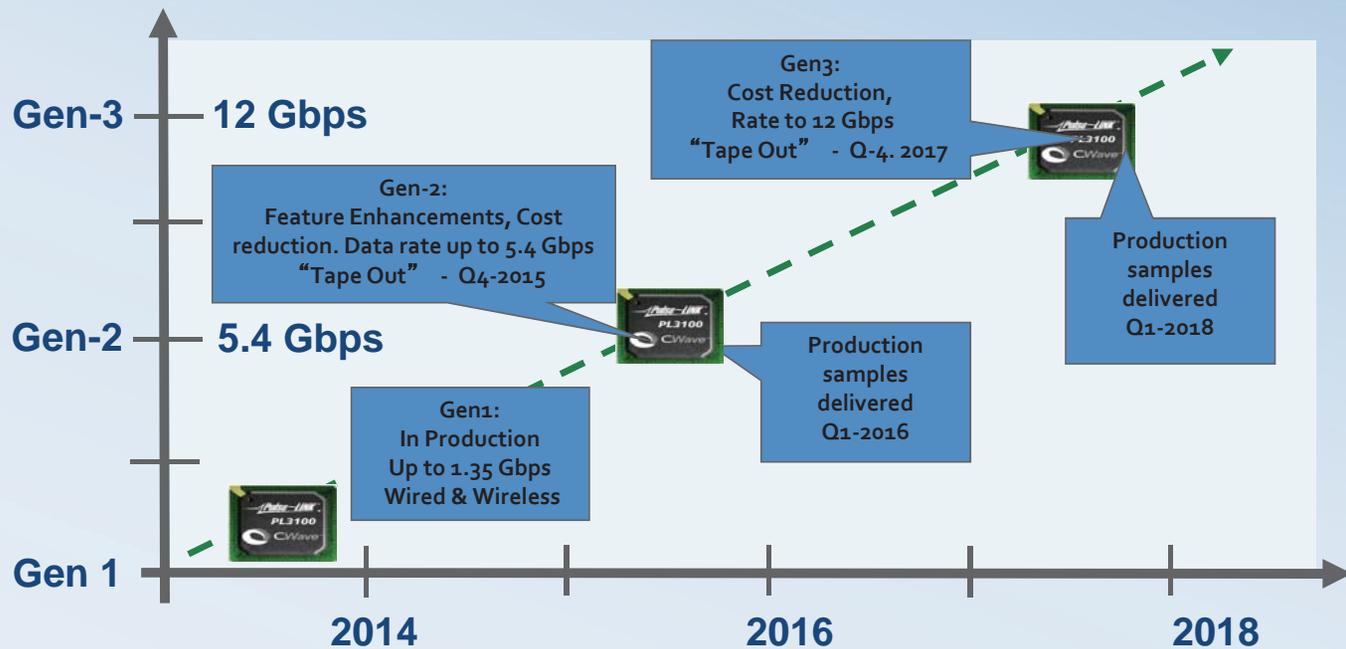


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