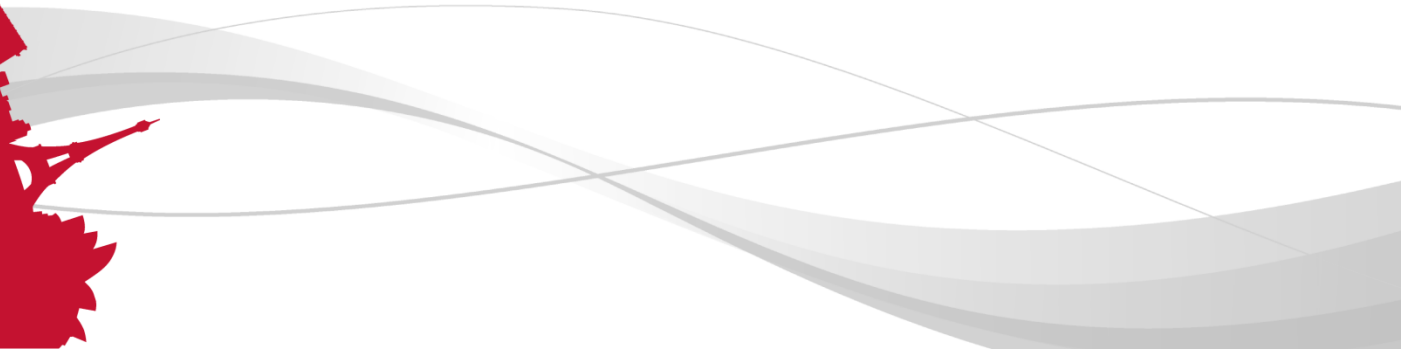




DragonWave Gigabit Solutions

BUILDING BETTER BACKHAUL
EVERYWHERE



Gigabit Circuit Demand

- Good News: Demand for Gigabit Circuits is increasing!
 - Education
 - Business
 - Energy
 - Government

- More Money!

- Bad News: Providing Gigabit Circuits via wireless has its challenges.

Three Possibilities

- **Unlicensed**
 - 5.x doesn't have enough bandwidth
 - 24 GHz is useful but rain sensitivity limits range
 - 60 GHz and Free Space Optics are options
 - Distance Limitations-one mile or less

- **Light Licensed**
 - 70-80 Gbps (E-band)
 - Distance Limitations of one mile or so.

- **FCC Licensed**
 - Requires multiple channels
 - Distance scalable 1 to 20 miles (or more)

Some Math

- 30 MHz 6 GHz, 11 GHz
- 40 MHz 11 GHz
- 50 MHz 18 GHz
- 60 MHz Lower 6 GHz
- 80 MHz 11 GHz, 18 GHz

- 40 MHz Channel @256 QAM 274 Mbps
 - @1048 QAM 318 Mbps
 - @2048 QAM 345 Mbps

- 30 MHz channel @256 QAM 190 Mbps
 - @1012 QAM 230 Mbps
 - @2048 QAM 250 Mbps

Tradeoffs

- Figuring out how to provide a 1 Gbps service requires balancing tradeoffs:
 - Location (RF Performance, Frequency Availability)
 - Distance (Antenna Size, Cost)
 - Availability Requirement (SLA)
 - Revenue Potential

- The Best Solution will need to be engineered to the specific case.

Unique Differentiators for DragonWave

- Highest Capacity & Spectral Efficiency:
 - **Bandwidth Accelerator**
 - Wire speed bulk data compression for up to 100% capacity gains within existing channels
 - **Dual channel radios**
 - Support two carrier channels over a single radio and antenna
 - **2048 QAM operation**
 - 37% increase over 256 QAM
 - **4-Channel XPIC**
 - 4 channels over a single antenna for up to 4 Gbps using 2 carrier channels

Horizon Quantum

- Dual channel support within a single radio
- XPIC support
- SyncE and 1588v2 support
- Hitless Automatic Adaptive Modulation
- Hitless space/frequency diversity
- Integrated ring/mesh switching
- 6XGigE + 2 SFP Ports
- Smallest footprint IDU and Radio
- Pay-as-you-grow capacity
- Comprehensive Ethernet OAM support (802.3ah, 802.1ag, Y.1731)
- Advanced QoS support with 8 levels of prioritization
- Multiple remote network management options

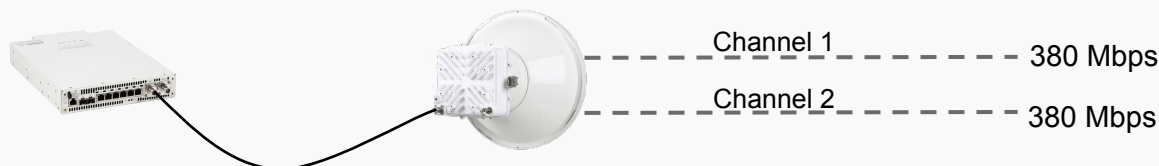


Small Form Factor

- ½ RU width IDU
- 2 to 4 Gbps per 1RU
(with dual 56 MHz channels)

Horizon Quantum 1 Gbps options

**Single IDU
Single Radio**



**1 Gbps with
BAC**

Quantum with two 6 GHz 60 MHz
Channels

**Frequencies
6, 11, 18, 23, 28,
38 GHz available**

Quantum with four 11 GHz 40
MHz Channels

**Dual IDU
Dual Radio**

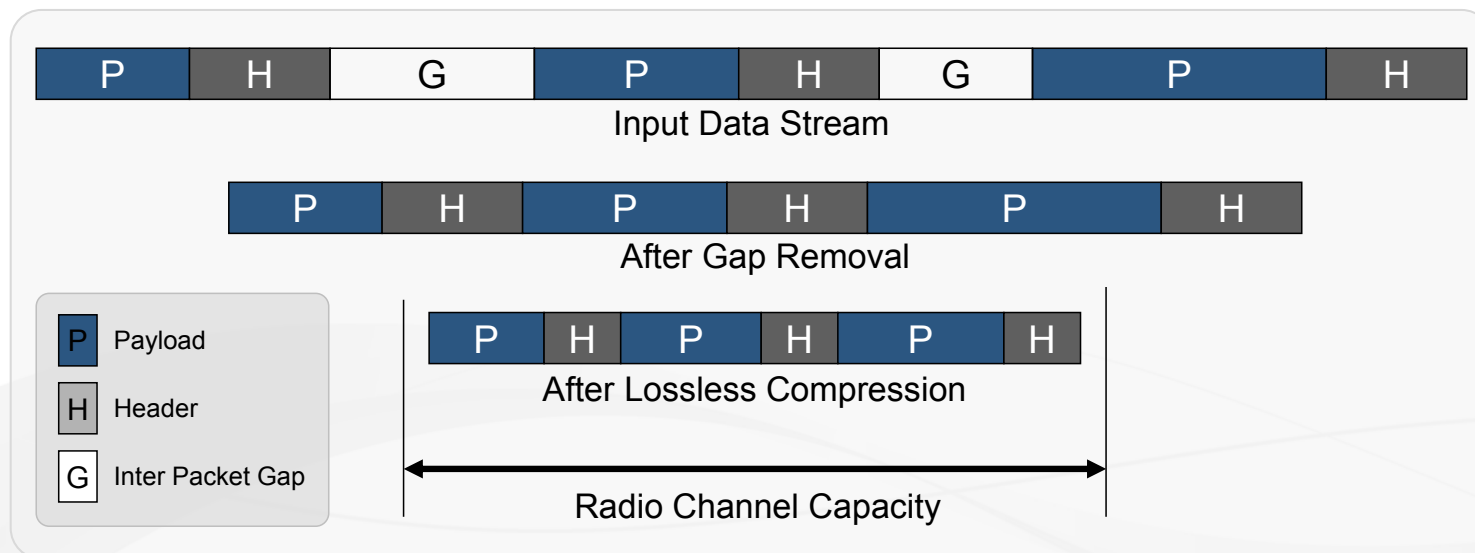


**1.5 Gbps with
BAC**

With XPIC: Channel 1 & 2 Vertical + Channel 1 & 2 Horizontal

Bandwidth Accelerator

- Wire-speed lossless bulk data compression technology
- Typically compression gain of 30-40% and up to 100% depending on traffic mix
- Ethernet frame data is compressed using the Lempel Ziv Ross Williams algorithm
- Existing behavior of the queuing system and air interface is preserved
- This feature can be turned on/off for individual queues



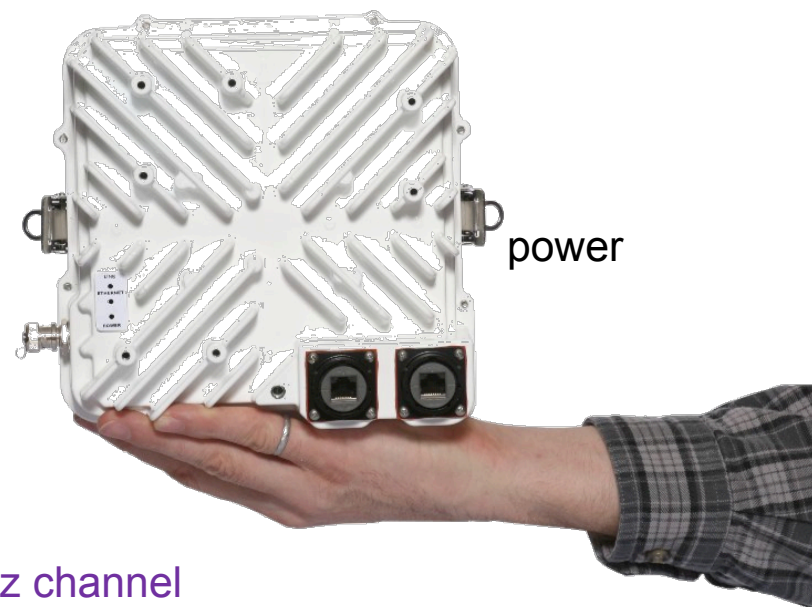
Horizon Compact+

■ Zero Footprint Packet Microwave

- Radio and modem are integrated into a single outdoor unit
- Reduced rack congestion, collocation costs, consumption, cabling
- Rapid deployment

■ Unmatched All-Outdoor Performance

- Flexible operation from 6 to 60 GHz
- Supports 60 MHz mapping into 80 MHz 11 GHz channel
 - Yields 469 Mbps at 2048 QAM per channel
- Bulk compression with DragonWave's Bandwidth Accelerator
- Service Aware Hitless Automatic Adaptive Modulation (HAAM)
- Network synchronization with SyncE & 1588v2 support
- Pay-as-you-grow with automatic remote scalability
- Advanced security with integrated 256-bit AES encryption; FIPS 140-2 compliant
- Comprehensive Ethernet OAM support (802.3ah, 802.1ag, Y.1731)
- Advanced QoS support with 8 levels of prioritization



Horizon Compact+ Options

■ Unprotected (1+0)

- Can provides > 99.995% availability
- Well-suited for last mile hub and spoke applications



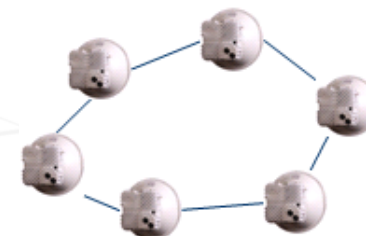
■ Dual Interface Load Sharing (2+0)

- Horizontal and Vertical Channels
- Requires External Switch



■ Ring/Mesh Network Protection

- Lower Cost Protection
- Reduced antenna size requirements
- 50 ms protection switching with RLS and sub-tending Ethernet switch



Harmony Eband

Designed to simplify ODU deployments addressing fronthaul and backhaul applications

- True “all in” ODU platform
 - Integrated non-blocking Ethernet switch
 - Standard CAT5E connectors, field connectorized
 - Integrated CPRI/OBSAI interface
 - Direct mount antenna interface
- Compact, lightweight, low power
 - Industry-leading form factor
- Environmentally hardened to withstand the toughest conditions
 - -40 to +55C
 - IP66 & ETSI300-019 compliant
- Designed for rapid deployment



70/80 GHz Product Evolution

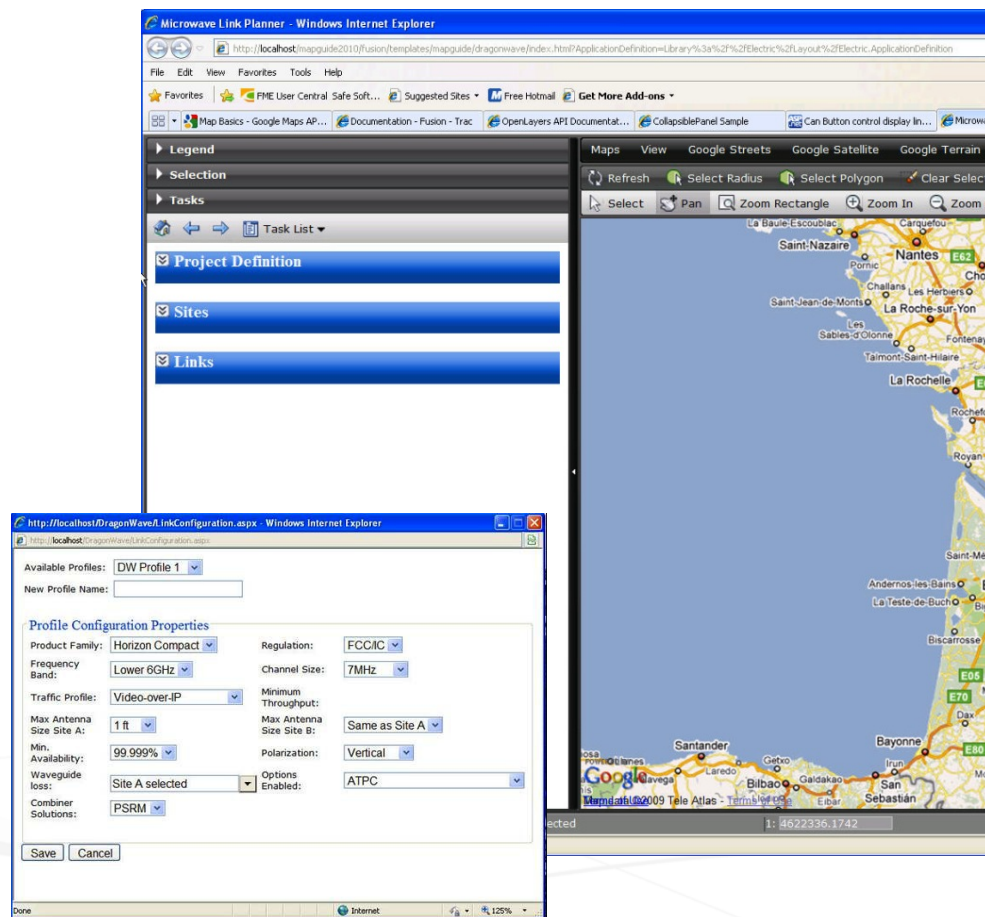
	Yesterday	Today	Tomorrow
Reach	1-3 Km	3-7 Km	
Capacity	Up to 1 G	Up to 2.6 G	Up to 10 G
Modulation	BPSK	64 QAM	256 QAM
Services	GbE	+ CPRI/OBSAI	+ 10GbE
Adaptive Modulation	Static	Yes	
Channel Size	1GHz	250-500 MHz	Up to 1 GHz
MIMO for Reach	No	Yes	
Adaptive Channel Size	Static	Yes	
Latency	Up to 1ms*	Low <10 μ s	
Synchronization	No	1588v2 & SynchE	

- Continued evolution promises immense link capacity gains
- Spectrally efficient to mitigate future spectrum congestion
- Redefining the 70/80 GHz application Space

Planning and Design Resources

- **Expert network planning and design team:**
 - Market data and site information
 - Traffic profile, bandwidth requirements
 - Physical architecture
 - Point to point, ring, mesh
 - RF engineering

- **Horizon Link Planner:**
 - Intuitive online link planning tool
 - Per-Link LoS assessment
 - Link design Wizard
 - Quick link feature
 - Automated license co-ordination
 - Path profile output
 - Google Earth Integration
 - Equipment assignment and parts list output



Summary

- DragonWave offers engineered 1 Gbps solutions from half a mile to 20 miles.
- Paul Frazier
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- www.dragonwaveinc.com



Thank You

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