



Introduction to DragonWave's Next Generation Microwave Solutions: Harmony Enhanced & Harmony Enhanced MC

A red silhouette of a city skyline is positioned on the left side of the slide, featuring various architectural elements like domes and spires.

BUILDING BETTER BACKHAUL
EVERYWHERE

Decorative wavy lines in shades of gray and white flow across the bottom of the slide, creating a sense of movement and connectivity.

DragonWave Profile

- Canadian company headquartered in Ottawa
 - Founded in 2000
 - 200 employees globally, 50% in R&D
 - History of “industry-first” technologies
- Publicly Traded on TSX & NASDAQ
- 24x7 global support center in Ottawa
- 25% market share in NA
- Established global customer base - Hundreds of carrier, enterprise and government customers



Packet Radios

Horizon Compact+
6-60 GHz



Horizon Quantum
6-38 GHz



Harmony Enhanced
6-42 GHz



Harmony Enhanced MC
6-42 GHz



Harmony E-Band
70/80 GHz



Hybrid / Switch

Hub 800 & First Mile 200
Hybrid / Full-packet / Dual Traffic



Small Cell

Avenue /Harmony Lite
Microcellular Backhaul
Sub-6 GHz



Avenue Link
Microcellular Backhaul
24-60 GHz



Long Haul

Harmony Trunk
Trunking Radio



Harmony Trunk-C
All-outdoor Trunking Radio

NetViewer Network Management



**Harmony
Enhanced**



**Harmony
Enhanced^{MC}**

Harmony Enhanced Brings Differentiated Value



Industry leading output power and system gain



Driving more capacity and spectral efficiency per wireless link



Simplifying installation and management



Capital and operational cost impacts

Evaluating a Next Generation Microwave Solution



Leading output power and system gain



Driving more capacity and spectral efficiency per wireless link



Simplifying installation and management



Capital and operational cost impacts

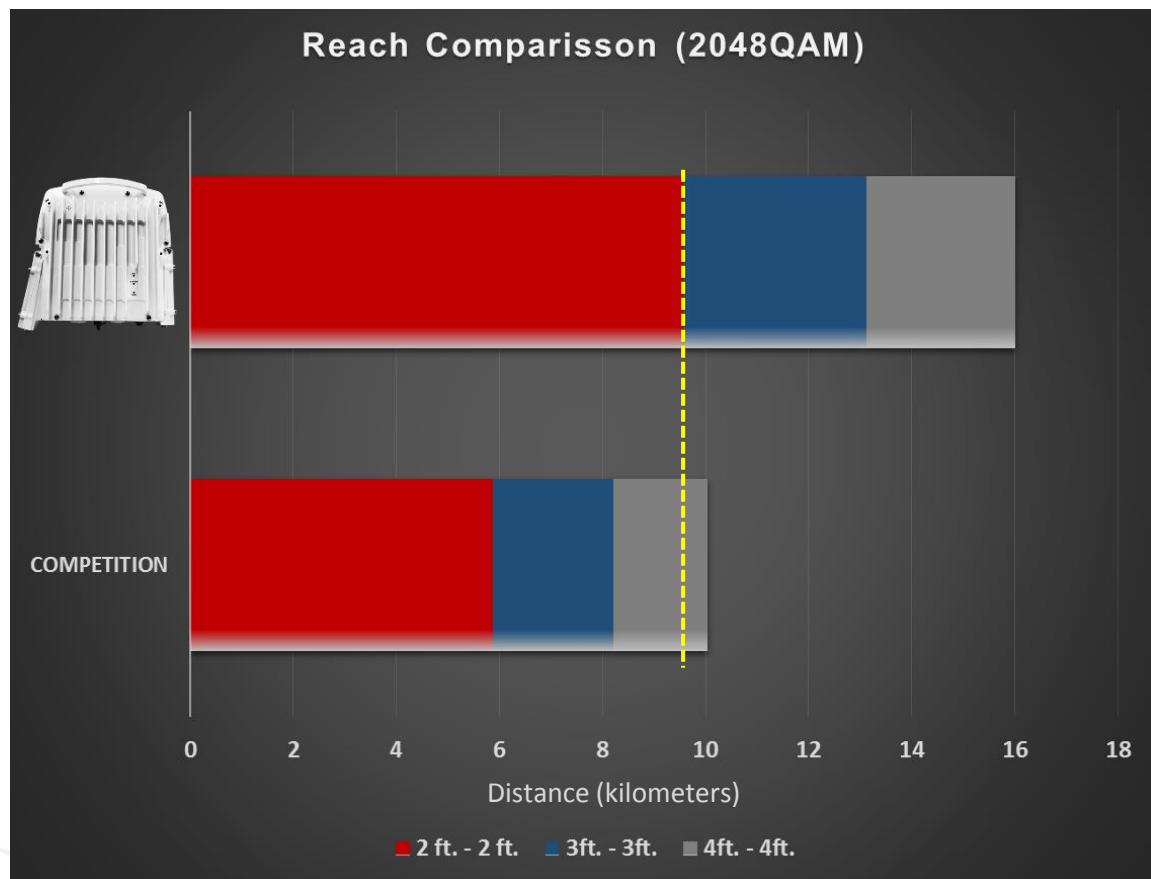
Highest Power All-Outdoor Radio

Competing
all-outdoor
radios 21-27dBm

- Longer paths
- Smaller dishes
- Improved link availability
- Reduced site leasing cost

Harmony
Enhanced &
Enhanced^{MC} **31-34dBm**

High Power - Impact on Reach & Dish Size



- Higher transmit power allows for 50% reduction in dish size: 4' down to 2' in this example
- Dish capital + shipping savings
- Reduced tower load
- Significant ongoing operational & site leasing savings

Assumptions:

- 11GHz, 40MHz channels
- 99.995% availability

Evaluating a Next Generation Microwave Solution



Leading output power and system gain



Driving more capacity and spectral efficiency per wireless link



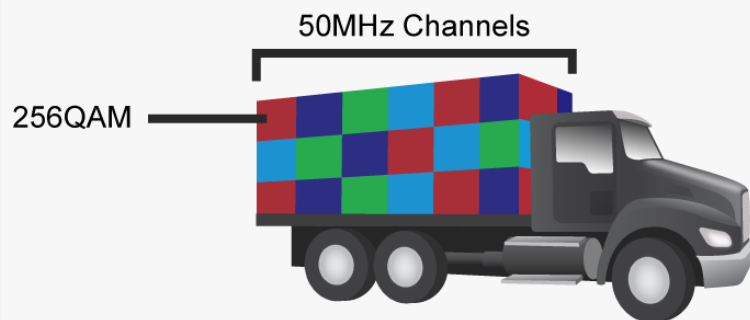
Simplifying installation and management



Capital and operational cost impacts

Higher Modulations and Wider Channels

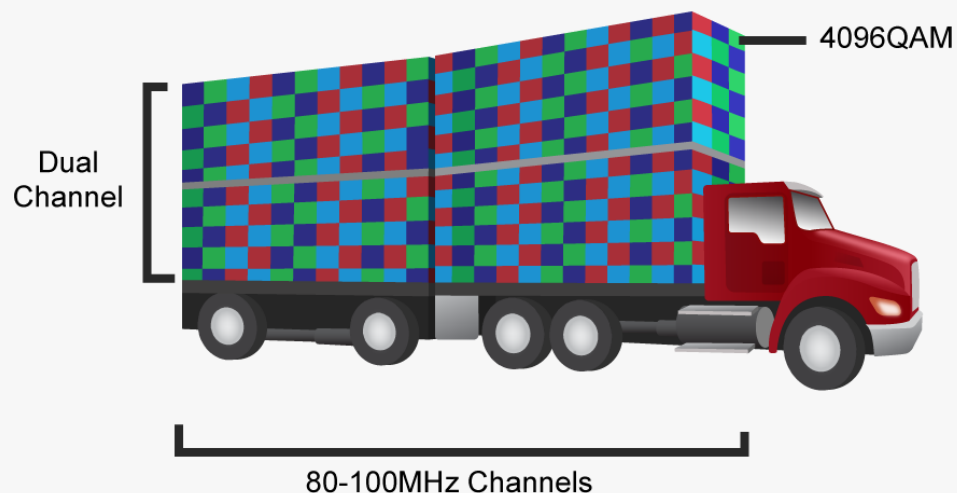
Previous Generation Microwave



- 256QAM modulating support
- Narrow channels
- Single channel per radio



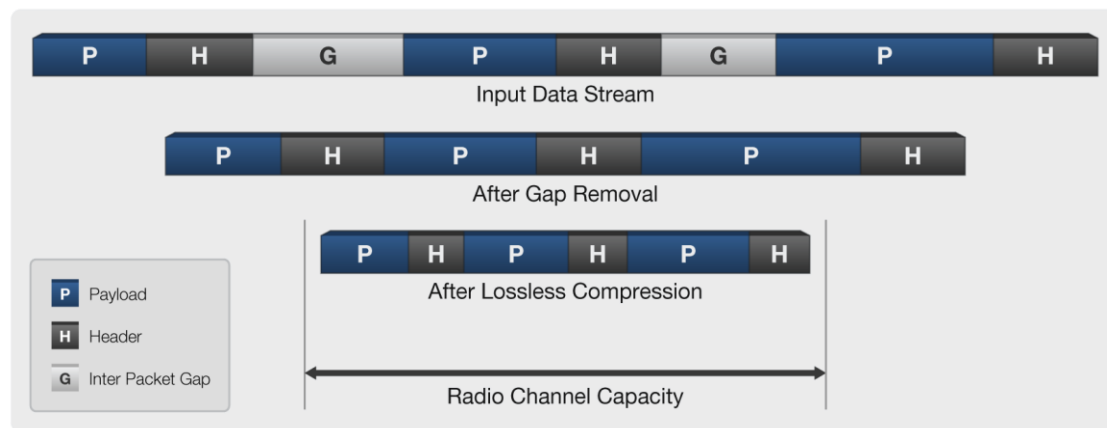
Today



- 4096QAM
- Wide channels (up to 100MHz)
- Multi-channel system

Increasing Spectral Efficiency

Payload Compression:
 Typical compression gain of 30-40%



Microwave Capacity Evolution

MIMO	<ul style="list-style-type: none"> Multiple-input multiple-output technology Requires second set of radios & dishes 	8 Gbps
2+0	<ul style="list-style-type: none"> Dual radio solution Mounted to a single dish via coupler 	4 Gbps
Payload Compression	<ul style="list-style-type: none"> Wire-speed bulk data compression (header + payload) for 1.4X capacity gain 	2 Gbps
Dual Channel	<ul style="list-style-type: none"> Second channel for 2X capacity gain (co-pole, cross-pole or XPIC) Can be done without additional hardware in some PtP products 	1.5 Gbps
Wider Channels	<ul style="list-style-type: none"> 80 MHz channel bandwidth 	750 Mbps
Higher Order Modulations	<ul style="list-style-type: none"> 4096QAM modulation 50 MHz Channel 	500 Mbps
Base Capacity	<ul style="list-style-type: none"> 256QAM modulation 50 MHz Channel 	350 Mbps
		Link Capacity

Evaluating a Next Generation Microwave Solution



Leading output power and system gain



Driving more capacity and spectral efficiency per wireless link



Simplifying installation and management



Capital and operational cost impacts

Cables, Connectors and Interfaces

■ Connector Housing

- Standard connectors and cabling
- Increased durability
- Simplified installation
- Copper and fiber interfaces in the same unit for reduced sparing



Harmony Enhanced

■ 10GbE Interface (HEMC)

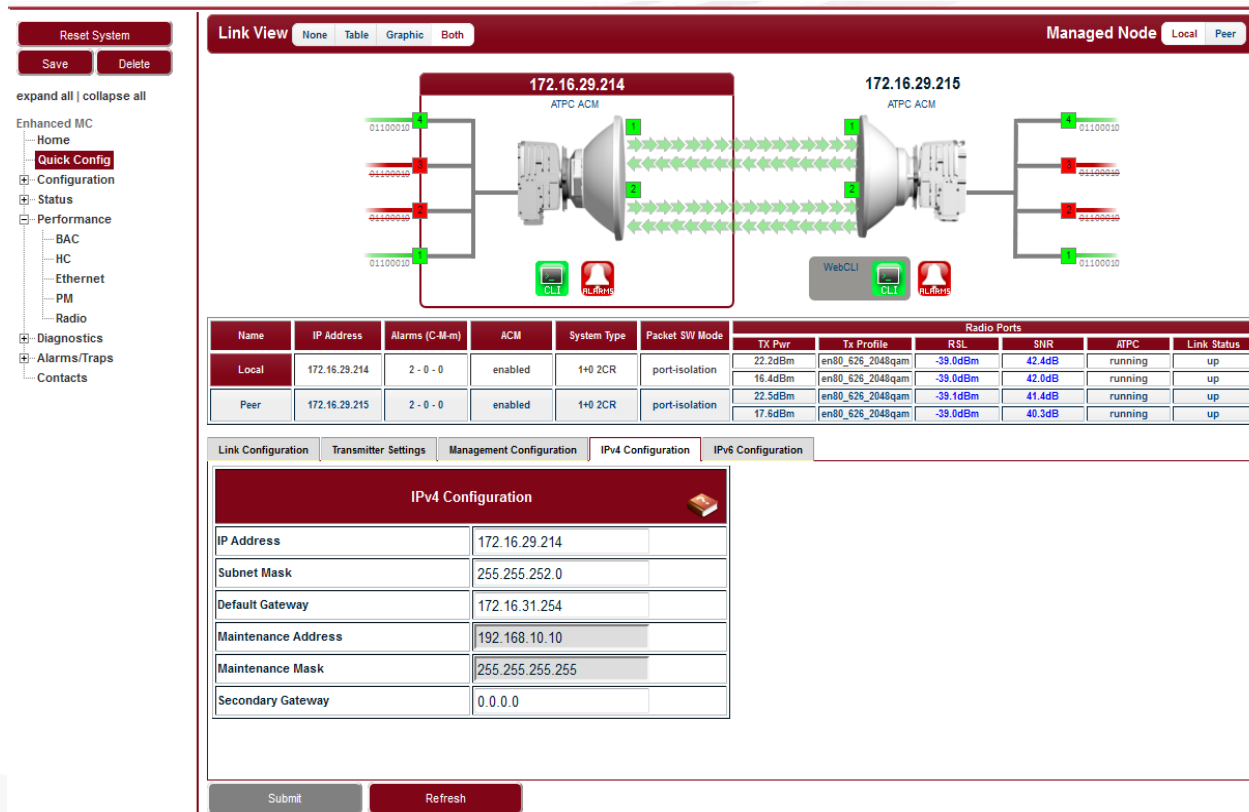
- Fewer cables, no aggregation
- Simplified installation & management

■ Integrated OMT (HEMC)

- No intermediate couplers or adapters
- No branching or other losses
- XPIC in a single ODU
- Ability to easily accommodate cross-pole, co-pole and XPIC channel options

Configuration & Management: Web Interface

- The user interface is often an afterthought in the selection process
- Critical to alignment, configuration & management
- DragonWave's LinkView



The screenshot displays the LinkView web interface. On the left is a navigation menu with options like 'Reset System', 'Save', 'Delete', and a tree view for 'Enhanced MC' including Home, Quick Config, Configuration, Status, Performance (BAC, HC, Ethernet, PM, Radio), Diagnostics, Alarms/Traps, and Contacts.

The main area shows a 'Link View' diagram with two nodes, '172.16.29.214' and '172.16.29.215', both labeled 'ATPC ACM'. The diagram illustrates signal paths between the nodes and their respective radio ports. Below the diagram is a table summarizing the link configuration:

Name	IP Address	Alarms (C-M-m)	ACM	System Type	Packet SW Mode	Radio Ports					
						Tx Par	Tx Profile	RSI	SNR	ATPC	Link Status
Local	172.16.29.214	2 - 0 - 0	enabled	1+0 2CR	port-isolation	22.2dBm	en80_626_2048qam	-39.0dBm	42.4dB	running	up
Peer	172.16.29.215	2 - 0 - 0	enabled	1+0 2CR	port-isolation	16.4dBm	en80_626_2048qam	-39.0dBm	42.0dB	running	up
						22.5dBm	en80_626_2048qam	-39.1dBm	41.4dB	running	up
						17.5dBm	en80_626_2048qam	-39.0dBm	40.3dB	running	up

Below the table are tabs for 'Link Configuration', 'Transmitter Settings', 'Management Configuration', 'IPv4 Configuration', and 'IPv6 Configuration'. The 'IPv4 Configuration' tab is active, showing a form with the following fields:

IPv4 Configuration	
IP Address	172.16.29.214
Subnet Mask	255.255.252.0
Default Gateway	172.16.31.254
Maintenance Address	192.168.10.10
Maintenance Mask	255.255.255.255
Secondary Gateway	0.0.0.0

At the bottom of the configuration form are 'Submit' and 'Refresh' buttons.

Evaluating a Next Generation Microwave Solution



Leading output power and system gain



Driving more capacity and spectral efficiency per wireless link



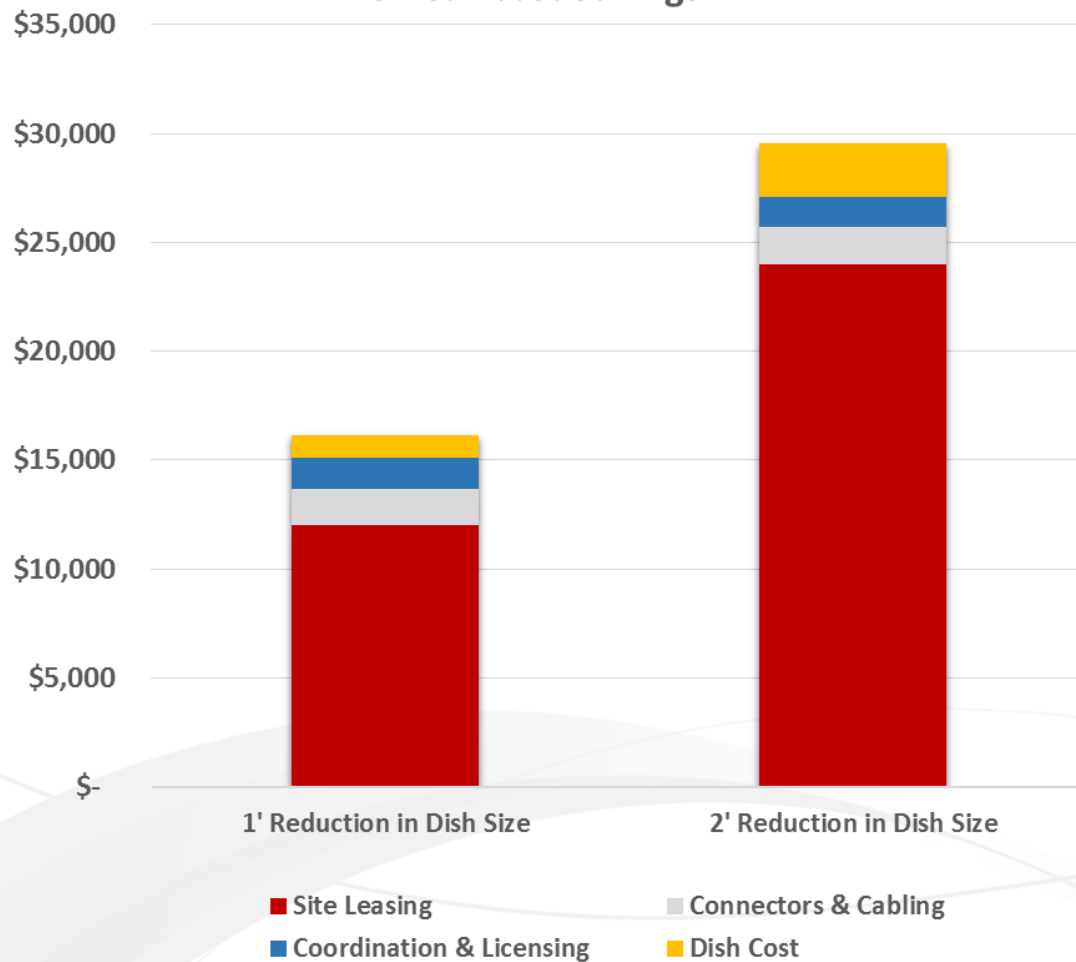
Simplifying installation and management



Capital and operational cost impacts

Sample Cost Savings per Link

Selecting the Right Microwave Solution:
5-Year Cost Savings



■ Assumptions:

- Dish site leasing savings: \$100/ft./mo.
- Cabling and connector savings: \$750 per site
- Dish cost savings: \$525-\$1225
- Coordination and licensing savings: \$1400 per link

■ Additional savings not included here:

- Reduction in sites/towers (remove repeater sites)
- Dish shipping savings
- Shorter installation times
- Dual channel vs. single channel radio in 2+0
- Management efficiency gains
- All-outdoor cost savings vs. indoor

Summary

TRANSMIT POWER



- Up to 34dBm
- Longer paths, smaller dishes
- Improved link availability
- Reduced site leasing cost

CAPACITY



- 4096QAM & wider channels
- Dual channel radios
- Bandwidth Accelerator payload compression
- MIMO

SIMPLICITY



- Connector housing; standard connectors & cables
- 10GbE interface
- Integrated OMT
- Intuitive web GUI

VALUE & TCO

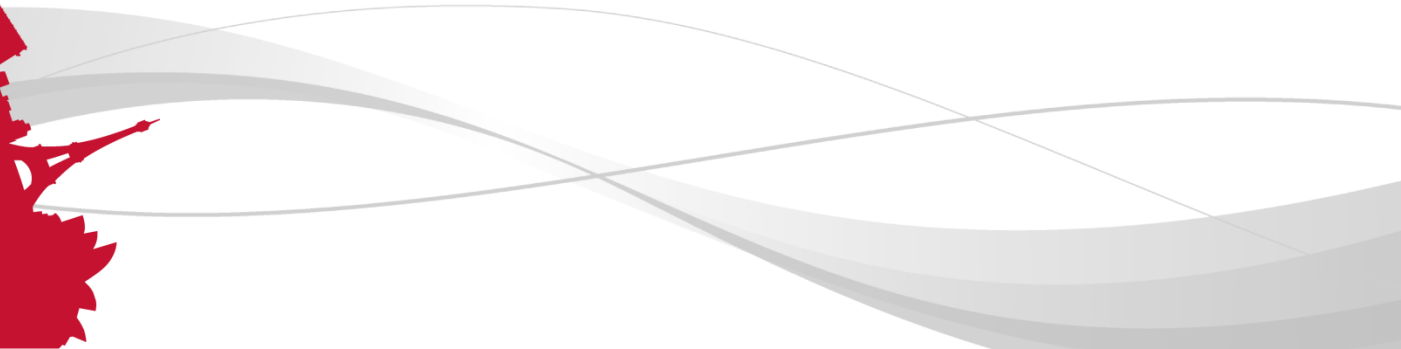


- Reduced site leasing costs due to smaller dishes
- Capital savings on dishes, cabling, connectors
- Simplified installation and management
- Spectrum savings with Bandwidth Accelerator



Thank you

BUILDING BETTER BACKHAUL
EVERYWHERE



Harmony Enhanced & Enhanced MC

Harmony Enhanced

■ Extended Reach Solution

- Standard and high power variants up to 34dBm
- Also allows for reduced antenna size and offers frequency flexibility

■ Higher Capacity & Spectral Efficiency

- Wide channel support (up to 100MHz)
- 4096QAM modulation support
- 750Mbps per radio, 1.5Gbps per link
- Bandwidth Accelerator+ payload compression for 30-40% gain
- MIMO ready

■ Multi-service Solution

- Full featured MEF compliant Carrier Ethernet switch
- 4 x GE interfaces (2 optical & 2 electrical)
- 256bit AES encryption

■ Simplified Installation and Management

- Standard integrated connectors; fiber and copper in same unit
- Intuitive LinkView web interface for alignment, configuration & management
- Simple evolution path for existing DragonWave networks; fully compatible with existing dishes, power injectors, cabling



Harmony Enhanced MC (*Multi-Carrier*)

- DragonWave's **third-generation** multi-carrier product
- Industry-leading **34dBm** transmit power in an all-outdoor unit
- **4096QAM** and wide channel support: 1.5 Gbps per radio and 3 Gbps per link
- Additional capacity gains with **Bandwidth Accelerator** compression
- Integrated **10GbE** MEF compliant switch
- **4x4 MIMO** Ready
- Innovative **connector housing** with copper and fiber interfaces, **standard cable** connections and a **clip-mount** to antenna

