New PMP Solutions

Simon Staddon
Lead Regional Technical Manager EMEA
Affordable, Reliable Wireless Connectivity

World-class Wireless Networks

- cnPilot® R190W
- E600
- E501S
- cnMaestro®
- ePMP™ 2000
- PMP 450m
- PTP 700

Wi-Fi

Distribution Access & Backhaul
Cambium Networks – 2 meters to 245 kilometers

Cloud Management

*cnMaestro*

*AutoPilot*

**Backhaul**

- **Point-to-Point**
  - PTP820, PTP670, PTP450(450i), ePTP
  - 900 MHz, 2.4, 4.9, 5, 6-23 GHz

**Access**

- **Point-to-Multipoint**
  - PMP450b/d/i/m, ePMP
  - 900 MHz, 2.4, 3, 4.9, 5 GHz

**WiFi**

- **Residential/Small Office**
  - R190/200/201
- **Enterprise**
  - E400/410/600/500/501S
- 802.11n & 802.11ac

**IIoT**

- **Industrial Internet of Things**
  - cnReach
  - 450, 700, 900 MHz

**On-Premise Management**

- **Access Points (AP)**
- **Subscriber Modules (SM)**
Zettabyte

36 Million years of HD quality video
1.4 Zetabytes

71%
Ever Increasing Bandwidth Demand

….Especially Video Traffic
# cnReach™ 450 MHz Narrow-Band Radio

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>Licensed Frequency: 406 – 430 MHz &amp; 450 – 470 MHz</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>FCC: 50 mW to 8 W (17 dBm to 39 dBm)</td>
</tr>
<tr>
<td></td>
<td>ETSI: 50 mW to 2 W (17 dBm to 33 dBm)</td>
</tr>
<tr>
<td><strong>Channel Sizes</strong></td>
<td>12.5 / 25 kHz</td>
</tr>
<tr>
<td><strong>Capacity</strong></td>
<td>FCC: 10 kbps to 76 kbps</td>
</tr>
<tr>
<td></td>
<td>ETSI: 9 – 102 kbps</td>
</tr>
<tr>
<td><strong>Modulations</strong></td>
<td>FCC: Up to 32QAM</td>
</tr>
<tr>
<td></td>
<td>ETSI: Up to 64QAM</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>70 miles</td>
</tr>
<tr>
<td><strong>Encryption</strong></td>
<td>128/256-bit AES</td>
</tr>
<tr>
<td><strong>I/O</strong></td>
<td>2 x 10/100 Ethernet</td>
</tr>
<tr>
<td></td>
<td>2 x Serial Port</td>
</tr>
<tr>
<td></td>
<td>Optional Digital/Analog I/O</td>
</tr>
</tbody>
</table>
### cnReach™ I/O Expander

| **Application** | No radio included. Used to add serial and/or I/O connectivity to a broadband SM or PTP radio via an Ethernet connection. |
| **Power** | 10-32 VDC |
| **I/O** | 2 x 10/100 Ethernet  
2 x Serial Port  
Optional Digital/Analog I/O |
<table>
<thead>
<tr>
<th>High Speed</th>
<th>802.11ac, 802.11ax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget, Budget</td>
<td>Cloud, autoPilot, AP €</td>
</tr>
<tr>
<td>Unmanaged SMB</td>
<td>Multi-tenant, RBA, ...</td>
</tr>
</tbody>
</table>
## The cnPilot Solution

<table>
<thead>
<tr>
<th>ENTERPRISE</th>
<th>ENTERPRISE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INDOOR 802.11ac</strong></td>
<td><strong>OUTDOOR 802.11ac</strong></td>
</tr>
<tr>
<td><strong>E400</strong></td>
<td><strong>E500</strong></td>
</tr>
<tr>
<td>2x2 Omni 802.11ac wave 1</td>
<td>2x2 Omni 802.11ac wave1</td>
</tr>
<tr>
<td><strong>E410</strong></td>
<td><strong>E501</strong></td>
</tr>
<tr>
<td>2x2 Omni 802.11ac wave2</td>
<td>2x2 30° Sector 802.11ac wave1</td>
</tr>
<tr>
<td><strong>E600</strong></td>
<td><strong>E430W</strong></td>
</tr>
<tr>
<td>4x4 Omni 802.11ac wave2</td>
<td>2x2 Wallplate 802.11ac wave2</td>
</tr>
<tr>
<td><strong>E430W</strong></td>
<td><strong>E502</strong></td>
</tr>
<tr>
<td>2x2 Wallplate 802.11ac wave2</td>
<td>2x2 30° Sector 802.11ac wave1</td>
</tr>
</tbody>
</table>

### Controler

- **cnMaestro** Cloud Controller
- **cnMaestro** On-Premises
- **autoPilot** AP controller

### ISP Managed Residential Routers

- **R201** 802.11ac Dual band Router
- **R200P** 802.11n single band PoE Router
- **R190W**, **R190V** 802.11n single band Router
Zero touch Deployment – ROI, Installation

1. Centralize provisioning
   Scan, Own, setup Config

2. Install later
   Minimize installer training

3. Zero touch fast onboarding
   Auto config, Auto Upgrade
Return on Investment

- **ROI - $$**
  - ATA offer option for voice service
  - ISPs may lease routers to customers

- **Money Saved $$**
  - ezDetect cnMaestro wireless troubleshooting
Frictionless Rapid Operations – ezDetect

Layer 2 deep dive

Quick end to end view

Real-time scans

Wireless Clients

Associated Clients

Up

100 Mbps FULL

Downlink
MCS: 15
(Excellent)

Uplink
MCS: 12
(Good)

0.15 Km
Latency 13 ms

Throughput
DL: 1.44 Kbps
UL: 0.87 Kbps

100 Mbps FULL

Layer 2 deep dive

Real-time scans

Export

Export

Network Connectivity

WiFi Analyzer

Client Health

Unconnected Clients

Packet Capture

Packet Capture

1.4 MB

1.5 MB

5.0 MB

3.9 MB

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I
When new dual band MU joins the network, cnPilot selects the best suited band for optimum performance of the network and MU.

In the dynamic RF environment, cnPilot changes channels optimizing performance and avoiding the interference not only at client but also at various MUs.

**CONTROLLER-LESS**

When the central AP dies the neighboring APs increase their power to cover the hole.
cnMaestro: Single Window for Managed Services

- **Single Managed services Window**
- Multiple tenant accounts across Different verticals
- **Role based Multi-tenancy**
  Secure, Custom controlled access
- **Branded MSP page for tenants**
- **Cloud access**
  available anytime, anywhere
  “Manage from the beach”
Infogamer, Croatia: High capacity Wi-Fi for Gaming event

- 6 Halls. 15,000 m². 70,000 visitors.
- Connecting convention center, gaming areas, Common areas
- cnPilot Indoor & outdoor APs

"... huge ... simultaneous
users connections connected
wirelessly ... Cambium delivered spot
on in every single aspect –
reliability, capacity and easy
management”
Adaptive Architecture – Flexibility for various deployments

1. **Cloud**
   - cnMaestro
   - cnPilot APs
   - Local breakout or tunnel
   - Freedom!

2. **Local Controller**
   - Tunnel or Local break out
   - LocalMaestro controller or external Gateway
   - Full control

3. **autoPilot**
   - Local breakout or tunnel
   - Autonomous

Clients → Internet
ePMP Value Proposition

✓ Frequency re-use with GPS Synchronization

✓ Solve your #1 network challenge that is in your control: Self Interference

✓ Solve external interference: Affordable ePMP2K with Beamforming and Dynamic filtering
ePMP Value Proposition

- Deterministic system supporting highest performance in interference
- Scalability without compromise
  - Go beyond 20 Subs per AP (No more weak SM impacting sector)
- Application delivery support from the ground up – CCTV, IPTV, VOIP
- End to end management
The world before ePMP
Scalability: The world after ePMP 1000
ePMP Past, Present & Future

**ePMP 1000**

**GPS Sync**

**Self interference solved**
Industries most affordable solution with frequency re-use, scalability, performance under interference
There is also overall interference from local RF pollution and noise.
Intelligent Filtering
• Dealing with adjacent channel interference
• Available in the ePMP2k unit

Smart Beamforming
• Available as an optional accessory
• Uplink Beamforming working against co-channel interference
ePMP Past, Present & Future

- **ePMP 1000**
  - **GPS Sync**
  - **Self interference solved** (Industries most affordable solution with frequency re-use, scalability, performance under interference)

- **ePMP 2000**
  - **+ Hypure + Beamforming**
  - **+ External Interference** (Industries most affordable solution with beam steering, intelligent filtering and all the benefits of GPS sync)
  - **Backward Compatible with ePMP 1000**
Reliable backhaul for WiFi

Compared to traditional methods

- Longer Distances
- Less Interference - directional transmission
- Significant cost savings vs digging trench
- Lower latency
New Products - ePMP Bridge in a Box

- Pre-packaged ePMP Force 180 point to point link
- Nothing extra and minimal RF and IP knowledge needed
- Pre-programmed to connect out of the box and extend links to:
  - CCTV backhaul
  - Building to building connectivity
  - WiFi Backhaul
  - And many more
- Interference resiliency built in with proprietary protocol

**Feature** | **Specification**
--- | ---
Wireless Standard | ePTMP proprietary protocol. Supports longer range, lower latency and performance. Optional Wi-Fi mode
Interface wired | Gige/100T Ethernet
Functions | Prioritization, WEP
Traffic prioritization using quality of service (QoS)
Power | 24-56V POE (100V POE power supply provided)
Transmit power | Up to 30 dBm
Environmental | Outdoor IP55
Environmental temperature | -20 to +55°C
Antenna | 16dBi Integrated antenna
Mount | Flexible pole mount. Supports diameter 1-3" Security | AES128 Cbits Encryption and Radius Based Authentication

Preconfigured long range outdoor wireless bridge

CAMBIUM NETWORKS, LTD. CONFIDENTIAL RESTRICTED
New Products – F190

Force 190

- 22 dBi
- 2X2 MIMO
- 8 Degree beamwidth
- 10/100 Ethernet
- Compact packaging
- MSRP $109

Available now
What is ePMP Elevate?

- Allows ePMP Elevate software to run on non-Cambium Networks 802.11n-based subscriber modules
- ePMP Elevate subscribers function as ePMP subscribers – with all the ePMP benefits
- Comparable performance to all-ePMP networks, despite different subscriber hardware; industry-first hardware-agnostic networks

Cloud based floating license with 3.5 (In Beta)

Managed by cnMaestro™
The challenges of migration
**ePMP Past, Present & Future**

**ePMP 1000**
- GPS Sync
- Self interference solved
  - Industries most affordable solution with frequency re-use, scalability, performance under interference

**ePMP 2000**
- + Hypure + Beamforming
- + External Interference
  - Industries most affordable solution with beam steering, intelligent filtering and all the benefits of GPS sync
- Backward Compatible with ePMP 1000
- All ePMP 2000 features and functionality
- Backwards compatibility with non Cambium SMs
ePMP3000 – Interference resilience + greater speeds
ePMP3000 – Doubling sector throughput + Beam forming

**ePMP 3000**
- 1.8GHz dual Core ARM+RF chip
- Beam Steering
- 4X4MUMIMO
- Dynamic filtering
- Double the sector tput

**F300**
- 25dBi dish ~500Mbps (80MHz + 256QAM) PTP + MUMIMO Client
- Narrow beamwidth
- WiFi mgmt.
- Always on spectrum analyzer

**F220**
- 16dBi Integrated (500Mbps, 80MHz + 256QAM) PTP/Bridge in a box + MUMIMO Client
- WiFi mgmt.
- Always on spectrum analyzer

Epmp3000 4X4 MUMIMO +BSA+4X4 Antenna
### ePMP Past, Present & Future

<table>
<thead>
<tr>
<th>Model</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ePMP 1000</strong></td>
<td>GPS Sync&lt;br&gt;Self interference solved&lt;br&gt;Industries most affordable solution with frequency reuse, scalability, performance under interference</td>
</tr>
<tr>
<td><strong>ePMP 2000</strong></td>
<td>+ Hypure + Beamforming&lt;br&gt;+ External Interference&lt;br&gt;Industries most affordable solution with beam steering, intelligent filtering and all the benefits of GPS sync&lt;br&gt;Backward Compatible with ePMP 1000</td>
</tr>
<tr>
<td><strong>ePMP 3000</strong></td>
<td>802.11ac Wave2 chipset&lt;br&gt;All ePMP 2000 features and functionality&lt;br&gt;+ Higher Throughput in real world noisy environment&lt;br&gt;Backwards compatibility with non Cambium SMs</td>
</tr>
<tr>
<td><strong>ePMP 4000</strong></td>
<td>802.11ax chipset&lt;br&gt;+ Higher Throughput in real world noisy environment&lt;br&gt;Backward compatible with ePMP 3000</td>
</tr>
</tbody>
</table>

**ePMP 2000** +<br>**ePMP 3000** +<br>**ePMP 4000** +

- High processing power<br>- Beam Steering<br>- 4X4MUMIMO<br>- Dynamic filtering
- 8X8 MUMIMO<br>- LTE like OFDMA PHY<br>- Increased spectral efficiency<br>- MUMIMO + OFDMA
Increase ARPU with ePMP

• ePMP Solution provides so much consistent performance that operators are planning IPTV deployments over wireless!

• ePMP Feature provides for reliable Multicast over wireless
PTP Portfolio: Summary

Sub 6 GHz
- PTP 450i
- PTP 550
- PTP 670
- PTP 700

Licensed Microwave
- PTP 820S
- PTP 820C
- PTP 820C HP
- RFU-S-HP
- RFU-C
- RFU-A
- PTP 820G
Sub 6 GHz Backhaul

PTP 450i
Comprehensive Network

PTP 550
High throughput Network

PTP 670
Resilient & Challenging Network
COMMON QUESTIONS:

- Is PTP 670 backward compatible with PTP 600?  
  NO, it is not compatible

- Is PTP 670 backward compatible with PTP PTP650, 650S & 650L?  
  Yes, it is compatible

- Can we have 2 PTP 650 with one firmware on 650-01-44 and another as 650-01-43?  
  YES, it can be configured this way

- When is this backward compatible Firmware releasing?  
  Already released and available on Website

- Is there is special price for this firmware?  
  NO, this firmware is free

- Will this specific firmware be upgrade to tip of firmware eventually?  
  NO, there will be no development firmware releases
PTP Portfolio Analysis

- **PTP 550**
- **PTP 450i**
- **PTP 670**

**Axes:**
- Feature Richness
- Price
PTP Portfolio Analysis

- PTP 450i
- PTP 670
- PTP 550
PTP 550 : High Throughput Network

Frequency Bands/Channels
- 5.1 GHz to 5.9 GHz
- 2 x 20 / 40 / 80 MHz channels

Aggregate Capacity
- Up to 1.36 Gbps

Interfaces
- 1 x Ethernet 100/1000 BaseT with PoE
- 1 x SFP Slot

Adaptive Modulation
- MCS-0 to MCS-9 with two streams(V+H)

Latency
- 3 - 6 ms

Maximum Power & Antenna Gain
- 27 dBm combined output power
- 23 dBi integrated antenna

Physical and Security
- 128-bit AES, HTTPS and SNMPv3
- All Metal enclosure, IP67

Up to 1.36 Gbps Throughput with ARQ

Asymmetric non-contiguous channel aggregation across 5 GHz band

Built-in live spectrum analyzer, Dynamic Spectrum Optimization (DSO) enables to continually scan the band for low interference channels *

Small form factor, IP67 metal housing

TDD Sync using Cambium Sync

Support SFP interface
**ASYMMETRIC CHANNEL BONDING: EXPLAINED**

<table>
<thead>
<tr>
<th>CHANNEL A</th>
<th>CHANNEL B</th>
<th>EXAMPLE SCENARIO</th>
<th>THROUGHPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
<td>HIGH INTERFERENCE</td>
<td>350 Mbps</td>
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<tr>
<td>20</td>
<td>40</td>
<td>ONLY ONE CLEAN CHANNEL</td>
<td>500 Mbps</td>
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<td>ONLY ONE CLEAN CHANNEL</td>
<td>850 Mbps</td>
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<td>TWO CLEAN CHANNEL</td>
<td>700 Mbps</td>
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<td>80</td>
<td>TWO CLEAN CHANNEL</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
<td>TWO FULL CLEAN CHANNEL</td>
<td>1.4 Gbps</td>
</tr>
</tbody>
</table>
Resilient Network & Aggressive Network

CHANNEL A: SAFE and STABLE
RELIABLE/GURANTEED LINK to customers

CHANNEL B: AGGRESSIVE
Strive for better throughput for customers
DFS Network & Non-DFS Network

CHANNEL A: DFS NETWORK
CHANNEL B: NON-DFS NETWORK

All traffic gets rerouted in case of DFS HIT from Channel A to Channel B, after DFS is resolved, radio is restored to original state of shared traffic between CHANNEL A & B.
PTP 550 : KEY DIFFERENTIATING FEATURE

• 1.36 Gbps Headline Throughput

• Asymmetric non adjacent Channel Bonding (Scenario Below)
  – DFS and Non-DFS
  – Aggressive and Resilient Network

• Asymmetric modulation between two channel

• Link Resilience:
  – Only 1 channel can move during DSO, hence link is always established

• Small form factor and Metal enclosure : Durable

• SPF port :
  – Commercial and Residential complex have fiber built in, hence easier to deploy

• ARQ supported
Cambium Networks - BUILT TO RUN, BUILT TO LAST

More Than 5 Billion Field Hours in service

Wide Temperature Range
-40° to +140° C
-40° to +60° C

Mean Time Between Failure
MTBF excluding lightning damage > 100 years

Wind Speed Survival
200 mph

Industry Track Record
More than 10 years experience
PMP Platform Performance Evolution

- **2004**
  - PMP 100
  - 14 Mbps
  - 6K PPS

- **2010**
  - PMP 430
  - 48 Mbps
  - 8K PPS

- **2012**
  - PMP 450
  - 190 Mbps
  - 12K PPS

- **2015**
  - PMP 450i
  - 250 Mbps
  - 76K PPS

- **2016**
  - cnMedusa
  - 500 Mbps+
  - 300K+ PPS
PMP 450m

- **Leading-Edge Technical Innovation**
  - More than 3x Capacity vs. 450/450i
    - *cnMedusa™* Massive MU-MIMO technology allows simultaneous communication with up to seven SMs
  - **Supreme Spectral Efficiency**
    - Achieve over 540 Mbps in a 20 MHz channel
    - Over 1.2Gbps in 40MHz
  - **Protect Your Investment**
    - Continue using existing SMs
  - **Enhanced Link Stability**
    - Uplink Interference mitigation due to beamforming
    - Uplink Rx Sensitivity improvements (5-6 dB better)
  - **Advanced Processing Capability**
    - >100k PPS

- **One Simple device to install**
  - Simple Installation and Increased Reliability
  - Integrated 90° sector beam-forming array, **ZERO** RF cables to connect or weatherproof
  - A single Ethernet cable to connect
  - 20” x 25” x 4” (52x65x11 cm)
  - 40 lbs. (18.3 kg)
• Released July 31
• Several bug fixes and stability improvements for entire platform

• 450m Features:
  – 5, 10 and 15 MHz channel support
  – 5.1 GHz and 5.2 GHz support
  – “Demo” mode support – Try a 450m Limited today!
  – Additional Statistics for optimizing the sector
    • Not only grouping information, but the Multiplexing Gain Value
    • Great forum posts (in addition to release notes, of course):
      – Have customers SHARE THEIR RESULTS!
Bridging the Digital Divide

• **Problem:**
  – National Broadband Plan in Ireland requires rural coverage
  – Fiber too costly

• **Solution:** *cnMedusa*

• **Results:** Able to offer high throughput (50 Mbps) packages and increase coverage area *without* forklift subscriber replacements
Growing ROI for the Long Term

• **Problem:**
  - Increasing the ability for the network to return revenue on investment

• **Solution:** *cnMedusa*

• **Results:** *(At a single site)*
  - Reduce amount of spectrum used by 80%
  - *While* Increasing total capacity by 33%
  - Increased customer satisfaction and lower churn rate
Satisfying the Appetite for Bandwidth

• **Problem:**
  – Existing 450 network can’t keep up with subscriber demand for capacity

• **Solution:** *cnMedusa*

• **Results:**
  – Allows GVEC to offer higher (more revenue per user) plans
  – Increase capacity per site, on average 50% more customers per site
Designed for the Future

- Optimized to reduce Total Cost of Ownership (TCO)
- Scales to 40 MHz operation
  - Maximum realistic channel size for outdoor unlicensed PMP
- Future Proof Platform: FPGA/Quad-Core Processor
- *cn*Medusa MU-MIMO on the PMP 450m
  - Extending life of existing deployed PMP 450 SMs
  - Will support future generation of 450 platform devices
  - Commitment to address 3 GHz next
- Rich roadmap options
  - Wider Channel Support (30 and 40 MHz)
  - Downlink Beamforming Mode
  - Uplink MU-MIMO
  - Active Interference Cancellation
  - Re-use of Architecture, Iterative Hardware
    - Support for additional frequencies (3 GHz, 2.5 GHz, ...)
    - Possible additional antenna options (decreased TCO)
    - Continued PPS improvements (beyond 600K)
    - Increased throughput (>1 Gbps Real World Capacity)

*Roadmap features mentioned subject to change at any time*
What’s Next?
R15.1 Features

• Native Ethernet IP
  – When this option is enabled, a device connected to the LAN port of the device can always access the device via default IP

• Ping Test and Ping Watchdog
  – This allows Ping Tests to be performed via the GUI, and can set up a watchdog so if device becomes “unreachable” it will reset

• 40 MHz Channels

• ATEX/HAZLOC Support for 450i
15, 30 and 40 MHz Channel Bandwidth

- 15 MHz channel available on 900 MHz
- 30 and 40 MHz Channels brings additional throughput

PTP mode, with 5ms frames, 50/50 duty cycle
-- Nearly 300 Mbps throughput!

PMP mode, with 2.5ms frames, 75/25 duty cycle -- 270 Mbps throughput!
PMP 450b

- Two Form Factors:
  - Integrated mid-gain antenna (17 dBi) similar to Force 180
  - High Gain integrated antenna (25 dBi), similar to Force 200

- New FPGA / SoC architecture
  - Next-gen processor, Enhanced Packet Processing
  - Better support for wider channels → more throughput
  - Wideband support (4.9 – 5.925 GHz)

- I/O changes
  - Single Gigabit Ethernet port
  - Audio jack for alignment tone

- Re-use of 30 VDC Power scheme
  - Same power supply as current 450 SM
  - Polarity Agnostic – Can use “Canopy” or “UBNT” 30 VDC PSU

- Expected Prices (MSRP):
  - $299 for mid-gain version
  - $349 for Integrated dish version

Available in Sept, 2017

Available in Jan, 2018
• What Is It?
  – Android App compatible with 450 platform devices
  – iOS, other product support to follow

• What Does It Do?
  – Pre-Configure all required parameters
  – SM Alignment
  – Upgrade Device Software
  – Complete SM Configuration
  – Record baseline performance of installed link

• Why Do You Want It?
  – Reduce Installation Time
  – Reduce Installation Tasks
  – Eliminate warehouse pre-configuration
  – Eliminate Configuration/Deployment Errors
  – Eliminate requirement for laptop and SM GUI
3 GHz 450m

Matt Mangriotis
Director of Product Management
CBRS and New 3 GHz Spectrum

Opportunity
- 150 MHz
- 50 MHz
- 6.5 MHz

Tiered Flexible Use
- IA
- PAL
- GAA

Establishing a New Common Band
- 3.4 GHz
- 3.6 GHz
- 3.8 GHz
- Band 42 (TDD)
- Band 43 (TDD)
- Band 48 (TDD)
- 3.55 GHz
- 3.7 GHz

Incumbents
- DoD Radars (coastal areas)
- Satellite Earth Stations

Priority Access Licenses (PAL)
- Up to 70 MHz of spectrum licensed by auction

General Authorized Access (GAA)
- At least 80 MHz nationwide
CBRS and New 3 GHz Spectrum

- Ensure 450 platform readiness by working with several SAS providers

- Hardware support for the frequency with all models
- cnMaestro will bridge the communication from Radio to SAS
  - See the demo at the booth

- Increased spectral availability can be taken advantage of by…
3 GHz - PMP 450m

• **Leading-Edge Technical Innovation**
  - 8x8 MU-MIMO
  - 47 dbm (52 dbm design goal)
  - 2-3X Capacity vs. 450/450i
    * cnMedusa Massive Multi-User MIMO
  - **Supreme Spectral Efficiency**
    * Achieve >750 Mbps in a 40 MHz channel
  - **Enhanced Link Stability**
    * Uplink Interference mitigation due to beamforming
    * Uplink Rx Sensitivity improvements (5-6 dB better)
  - **Advanced Processing Capability**
    * >100k PPS
  - **One Simple device to install**
    * Integrated 90° sector beam-forming array
    * ZERO RF cables to connect or weatherproof
    * ≈ 611 x 692 x 175 mm
    * ≈ 18kg

• **Investment Protection**
  - Provides capacity and spectral efficiency increases for existing 450 customers
  - Extend the useful life of existing networks and support SM density growth