With an additional radio module in the client station, use of two 6 MHz channels would deliver end-user throughputs ~twice that of the 6 MHz channel. For example, Base cap = 24 x 3 = 72Mb/s.

To understand how many CPE’s can be used with a Base station, divide the base station capacity by the number of CPE’s multiplied by 6 MHz channel. Note that the OTA data rate has to be divided between uplink and downlink, e.g., if 80/20, then 24 Mbps = 19 DL and 5 UL.

Below are examples of different distances and modulation settings to show throughputs and link margin in a single 6 MHz channel.

With an additional radio module in the client station, use of two 6 MHz channels would deliver end-user throughputs ~twice that of the 1 GHz channel. For example, Base cap = 72 x 3 = 216Mb/s.

To understand how many CPE’s can be used with a Base station, divide the base station capacity by the number of CPE’s multiplied by 2 x 6 MHz channel. Note that the OTA data rate has to be divided between uplink and downlink, e.g., if 80/20, then 216 Mbps = 172.8 DL and 14.4 UL.

Below are examples of different distances and modulation settings to show throughputs and link margin in a single 2 x 6 MHz channel.
BREAKTHROUGH: GREATER NLOS PERFORMANCE AND LOWER BUILD-OUT COST

Broadband solutions to serve non-line-of-sight customers and rural areas
- Low-band signal penetrates through trees, foliage, walls, and weaves around hills
- 900 MHz and fixed LTE systems cannot deliver as robust NLOS or provide large & ubiquitous coverage area
- “Clean” TV White Space spectrum avoids 900 MHz overcrowding and scarcity/costs of 3.5 GHz licenses

Single base station serves hundreds of subscribers
- Aggregate throughput of 72 Mbps per base station
- 24 Mbps combined DL/UL per subscriber
- Very low latency (25 to 35 ms round trip) for video streaming, VoIP, and gaming
- Delivers sustained rate of 10/1 Mbps for up to 30 subscribers
- Optional second radio module per CPE doubles the subscriber’s throughput using proprietary link aggregation.
- OTA data rates as high as 18.0 Mbps per sector using 64 QAM 5/6
- OTA data rate as high as 10.8 Mbps per sector using 16 QAM 3/4

Leverages Reliability and Capability of IEEE 802.11af standard
- Leading edge standard with multiple enhanced features, including auto-negotiation/modulation
- IEEE 802.11af developed from 20 years of “know how” based on WLAN IEEE 802.11

In a NLOS environment, much lower deployment costs than the alternatives, including fixed LTE, 900 MHz, or LOS networks
- Fewer backhaul links, fewer towers, lower operational and maintenance costs
- Lower CPE and base station prices than any TV White Space manufacturer
- Single outdoor base station unit in rugged enclosure simplifies time & expense of installation and setup

Large coverage areas: 10 to 15 km radius from a single base station
- Reach distances as far as 25 km LOS, 5 to 10 km NLOS with obstructions

3rd Generation RuralConnect® TV White Space Radio
Uses TV White Space technology for signals strong enough to penetrate through hills, trees, and foliage to provide broadband services to communities in rural remote locations.

RURALCONNECT® THE BEST NLOS SOLUTION

<table>
<thead>
<tr>
<th>Feature</th>
<th>RuralConnect (TVWS)</th>
<th>900 MHz</th>
<th>Fixed LTE</th>
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<tr>
<td>Great speed/low latency</td>
<td>Yes</td>
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<td>Yes</td>
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<td>Affordable CAPEX</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Heavy NLOS Performance</td>
<td>Yes</td>
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<td>No</td>
</tr>
<tr>
<td>Large amount of available free spectrum</td>
<td>Yes</td>
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USE CASES
- Rural Broadband Internet Access and VoIP for Homes and Businesses
- WLAN Hotspot Backhaul
- Schools & Libraries Broadband Access
- Internet of Things Monitoring
- Point to Point Backhaul
- Public Safety & Border Patrol
- Video Surveillance and Security
- M2M SCADA Communications
- Smart Grid & Metering
- Positive Train Control
- Oil & Gas Well and Pipeline
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### GEN 3 RURALCONNECT® SPECIFICATIONS

Below are examples of different distances and modulation settings to show throughputs and link margin in a single 6 MHz channel.

With an additional radio module in the client station, use of two 6 MHz channels would deliver end-user throughputs ~twice that of the 6 MHz channel. For example, Base cap = 24 x 3 = 72Mbps. 48 CPEs x 6 = 72/244 = 2.5Mbps for 48 active CPE’s.

To understand how many CPE’s can be used with a Base station, divide the base station capacity by the number of CPE’s multiplied by 6 MHz channel. Note that the OTA data rate has to be divided between uplink and downlink, e.g., if 80/20, then 24 Mbps = 19 DL and 5 UL.

Below are examples of different distances and modulation settings to show throughputs and link margin in a single 6 MHz channel.

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#### GENERAL SYSTEM SPECIFICATIONS

- **System Architecture**: 3 Independent IEEE 802.11af Base Station Radios
- **Aggregate Data Capacity**: 72 Mbps
- **Frequency Bands**: UHF 470-696 MHz (US)
- **Channel Spacing**: 6 MHz (US)
- **Round Trip Ping Latency**: 5-35 ms, depending on user load
- **Data Rate Control**: Adaptive or fixed
- **ACP and Spectrum Mask Standardization**: Meets FCC and ETSI specifications
- **IEEE 802.11af Fully Compliant**

#### BASE STATION

- **RF Transmit Power**: +21dBm within +/- 1dB
- **Antenna Connector**: F type female 75 Ohms

#### POWER - OUTDOOR TOWER MOUNT

- **Voltage**: 100-240 VAC, 50-60 Hz or 24-48 VDC
- **Power**: Idle: 4W, Rx: 8W, Tx: 20W
- **Connector**: RJ 45 POE

#### MECHANICAL SPECIFICATIONS

- **Unit Dimensions**: 7.5” x 3.25” x 9”
- **Enclosure Material**: Painted anodized aluminum
- **Weight**: 6 lbs. 4 oz.
- **Mounting**: 1” to 2” vertical mast

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#### CPE CLIENT STATION

- **RF Transmit Power**: +21dBm within +/- 1dB
- **Antenna Connector**: F type female 75 Ohm

#### POWER

- **Voltage**: 100-240 VAC, 50-60 Hz or 24-48 VDC
- **Power**: Idle: 1.8W, Rx: 6.5W, Tx: 10.3W
- **Connector**: RJ 45 POE

#### MECHANICAL SPECIFICATIONS DDU

- **Unit Dimensions**: 7.5” x 3.25” x 9”
- **Enclosure Material**: Painted anodized aluminum
- **Weight**: 5 lbs. 8 oz.
- **Mounting**: 1” to 2” vertical mast

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**U.S. Patent No. 9,859,844 on RuralConnect® Gen 3**

Prior to FCC equipment certification, RuralConnect® Gen 3 will be available in U.S. only under FCC approved experimental licenses. The RuralConnect® Gen 3 products have not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained. Accordingly, a conditional sales contract between Carlson Wireless and service-provider customers, wholesalers, or retailers is permitted under FCC rules provided that delivery is contingent upon compliance with the applicable FCC equipment authorization and technical requirements. In 2013, Carlson Wireless obtained FCC equipment certifications for its RuralConnect® Gen 2 devices.

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**BROADBAND SOLUTIONS TO SERVE NON-LINE-OF-SIGHT CUSTOMERS**

- **Gen3 RuralConnect® TV White Space System**
  - Great NLOS throughput & low latency for video streaming/ gaming & VoIP
  - Much lower CAPEX than 900 MHz or Fixed LTE networks
  - Large & ubiquitous NLOS coverage areas
  - Unlicensed & uncongested spectrum in rural markets

Since the 1990’s, Carlson Wireless has provided wireless equipment to ISPs and telecom carriers that deliver high-quality broadband and telephony to rural and remote areas throughout the world. CWT’s leading-edge TV White Space products have been deployed in over 30 countries since entering the market in 2011.