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

- **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**

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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 8 MHz channel. With an additional radio module in the client station, use of two 8 MHz channels would deliver end-user throughputs—twice that of the 8 MHz channel. Note that the OTA data rate has to be divided between uplink and downlink, e.g., if 80/20, then 36 Mbps = 29 DL and 7 UL.

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 the contention ratio (typically 6). For example, Base cap = 32 x 3 = 96Mb/s. 48 CPEs x 6 = 96/288 = 3Mbps for 48 active CPE’s.

<table>
<thead>
<tr>
<th>Modulation and Coding</th>
<th>OTA Data Rate in Mbps</th>
<th>Range in km*</th>
<th>Base-Ant Gain in dBi</th>
<th>CPE-Ant Gain in dBi</th>
<th>Frequency in MHz</th>
<th>Base EIRP in dbm</th>
<th>Free Space Loss in db</th>
<th>RX Signal in dbm</th>
<th>CPE Sens in dbm</th>
<th>Link Margin in db **</th>
<th>Reflash Fading %</th>
</tr>
</thead>
<tbody>
<tr>
<td>QPSK 3/4</td>
<td>7.2</td>
<td>33</td>
<td>7.8</td>
<td>10.3</td>
<td>569</td>
<td>28.5</td>
<td>118.0</td>
<td>-79.7</td>
<td>-95.2</td>
<td>15.5</td>
<td>98.21</td>
</tr>
<tr>
<td>16QAM 3/4</td>
<td>14.4</td>
<td>10</td>
<td>16.7</td>
<td>10.3</td>
<td>545</td>
<td>28.5</td>
<td>111.3</td>
<td>-73.0</td>
<td>-88.2</td>
<td>15.1</td>
<td>98.07</td>
</tr>
<tr>
<td>64QAM 5/6</td>
<td>24</td>
<td>5</td>
<td>7.8</td>
<td>10.3</td>
<td>521</td>
<td>28.5</td>
<td>100.8</td>
<td>-62.5</td>
<td>-77.9</td>
<td>15.3</td>
<td>98.13</td>
</tr>
<tr>
<td>256QAM 5/6</td>
<td>32</td>
<td>2.5</td>
<td>7.8</td>
<td>10.3</td>
<td>473</td>
<td>28.5</td>
<td>94.0</td>
<td>-55.7</td>
<td>-71.0</td>
<td>15.3</td>
<td>98.14</td>
</tr>
</tbody>
</table>

*The distance is optimized for 99% availability

**If the path is unobstructed

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**GENERAL SYSTEM SPECIFICATIONS**

- **System Architecture**: 3 Independent IEEE 802.11af Base Station Radios
- **Aggregate Data Capacity**: 96 Mbps
- **Frequency Bands**: UHF 470-790 MHz (ETSI)
- **Channel Spacing**: 8 MHz (ETSI)
- **Round Trip Ping Latency**: 5-35 ms, depending on user load
- **Data Rate Control**: Adaptive or fixed
- **ACP and Spectrum Mask**: Meets FCC and ETSI specifications

**BASE STATION**

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

**POWER - OUTDOOR TOWER MOUNT**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>100-240 VAC, 50-60 Hz or 24-48 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Idle: 6W, Rx: 10W, Tx: 25W</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ 45 POE</td>
</tr>
</tbody>
</table>

**MECHANICAL SPECIFICATIONS**

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

---

**NETWORK SPECIFICATIONS**

- **RX Blocking Resistance**: -48 dB TV transmission on chan N+2
- **Operating Mode**: CSMA (TDMA optional)
- **User Ports**: 10/100 baseT Ethernet
- **Management**: Web-based, SNMP (NMS & Billing opt)

**ENVIRONMENTAL SPECIFICATIONS**

- **Operating Temperature**: 30° to 55° C
- **Operating Humidity**: Up to 95%, non-condensing
- **Shock and Vibration**: MIL-STD-810
- **Security**: WPA2 - PSK (156 AES)

---

**CPE CLIENT STATION**

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

**POWER**

<table>
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<tr>
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<th>100-240 VAC, 50-60 Hz or 24-48 VDC</th>
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</thead>
<tbody>
<tr>
<td>Power</td>
<td>Idle: 3.8W, Rx: 6.5W, Tx: 10.3W</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ 45 POE</td>
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</tbody>
</table>

**MECHANICAL SPECIFICATIONS ODU**

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**U.S. Patent No. 9,849,844 on RuralConnect® Gen 3**

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www.carlsonwireless.com

ITU Region 1 EURO Version
Last edit date: March 22, 2018
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 96 Mbps per base station
• 32 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 24.0 Mbps using 64 QAM 5/6
• OTA data rate as high as 14.4 Mbps 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

RURALCONNECT® THE BEST NLOS SOLUTION

<table>
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<tr>
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<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>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Affordable CAPEX</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Heavy NLOS Performance</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Large amount of available free spectrum</td>
<td>Yes</td>
<td>No</td>
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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.

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
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