RCP DEPLOYMENT AND IMPLEMENATION CONSIDERATIONS

ZCOMAX WIRELESS
Your Wireless Networking Connection

The Unique Rural Connectivity Platform

Rural broadband connectivity, bringing the internet and other high speed communications to remote areas or out of the way locales, has long posed a challenge for today's technological leaders. Whether it's connecting a school in an isolated locality in Africa or connecting a village in India to medical care many miles away, topography, distance and power issues are only a few problems that have thwarted previous attempts to bring connectivity to such places. To solve this problem, Intel© Corporation has teamed with Z-COM, a wireless Original Design Manufacturer (ODM), to develop a high-bandwidth, low cost, low-power consuming, scalable and robust long distance wireless point to point backhaul solution with, available, local WiFi capabilities.

The purpose of this document is to familiarize you with the technology used in the Zcom RCP product line as well as the ways that this technology can best be implemented. The Zcom RCP series of units are not just another set of customer premise equipment and are not limited to the constraints that traditional hot-spots and other outdoor wireless equipment are currently. Rather they advance the technology and take it farther than was previously possible. The Zcom RCP is a new way to communicate with places that had, until this point, presented too many obstacles to reach, with the ability to achieve real-world communications of 9Mbps at 40km.

Technology

The RCP boasts an impressive array of advantages over common wireless technology to overcome the unique challenges posed in the rural connectivity market. Here is a brief overview of the key features that set the Zcom RCP in a category of its own:

- Intel IXP platform
- Variable WiFi transmission power from 6.5dBM to 23dBM
- Built in 23dBi antenna
- Capability to add an external antenna.
- CSMA for short to medium range connections
- TDMA for long range connections
- IEEE 802.11b/g/a
- Multi-hop relaying capability
- Local hotspot coverage.
- Solar power support

The key advantage of the Zcom RCP comes from its use of TDMA technology. Intel has modified this previously existing technique and configured it to achieve longer distance, fast and reliable wireless connections. This was handled by replacing the MAC layer of communication with a unique TDMA scheme that increased channel access availability and reduces collisions, enabling more robust connections that overcome the shortcomings of CSMA in long distance applications.

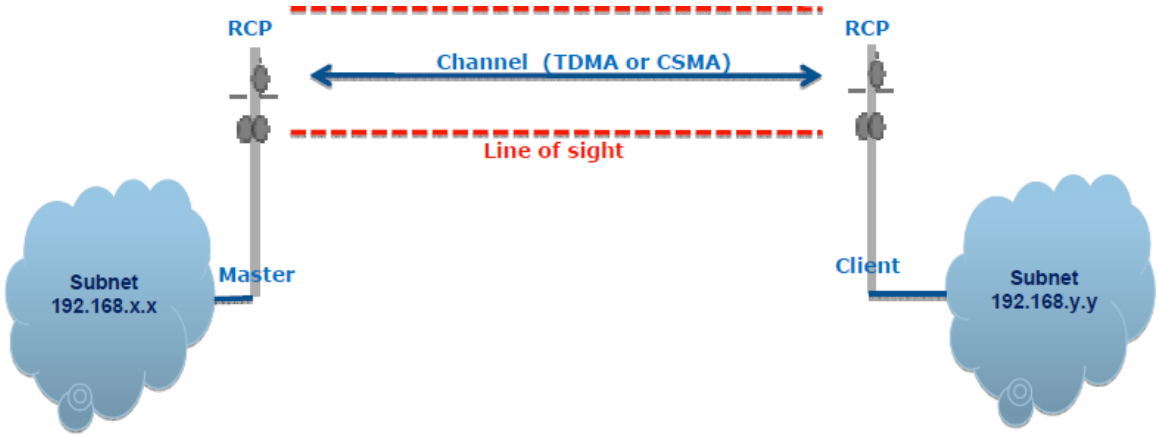
Along with the innovative use of TDMA technology, the Zcom RCP has adjustable output power and low power consumption, enabling more efficient and available power sources to be used, such as solar power. The Zcom RCP also works within the confines of already allocated frequency ranges in the ISM spectrum, alleviating the need to obtain special licensing or permits for their use. Another feature is the ability to use the “link aggregation” feature, with the R2 Extender, to enhance throughput by the use of 2 radios and 2 antennas acting as a component.

Implementation

Due to the wide range of implementations that the flexibility of the Zcom RCP allows, there are no hard and fast rules about how, when and where it should be used. Here are a few sample implementations and uses. Please also visit our web page for actual case studies using the Zcom RCP series.

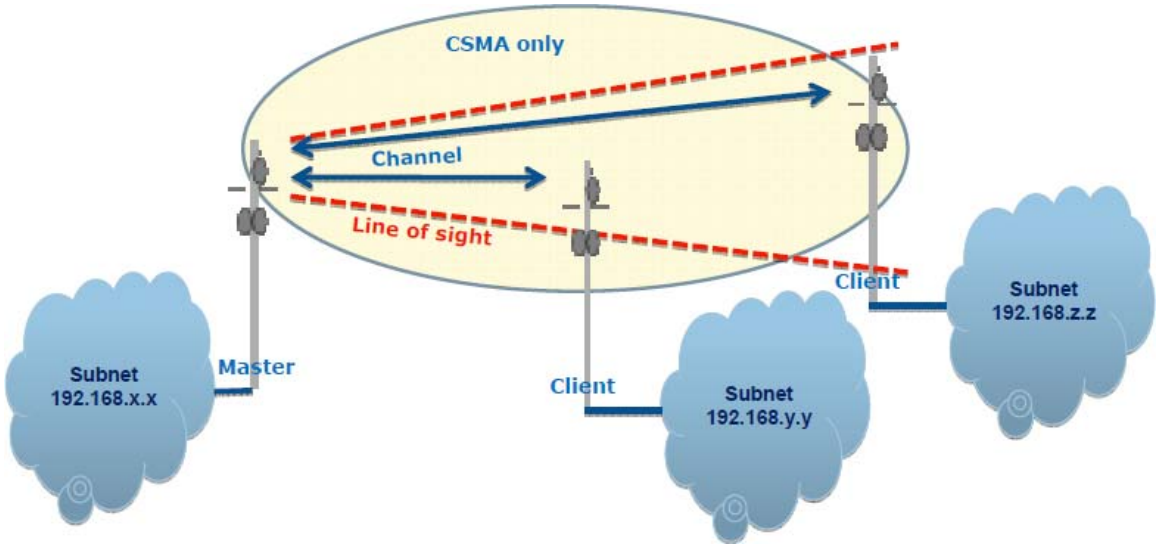
Point to Point Connectivity

Depending on the distance involved, the RCP can utilize either a CSMA or TDMA connection to bridge two networks in a simple peer to peer link.



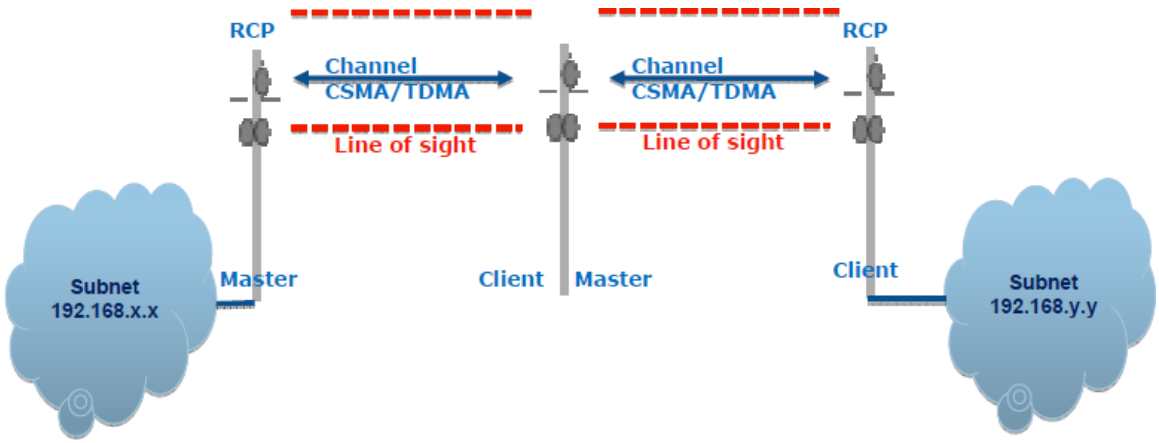
Point to Multi-Point Connectivity

This configuration allows a single unit to provide connectivity or bridging to multiple sites.

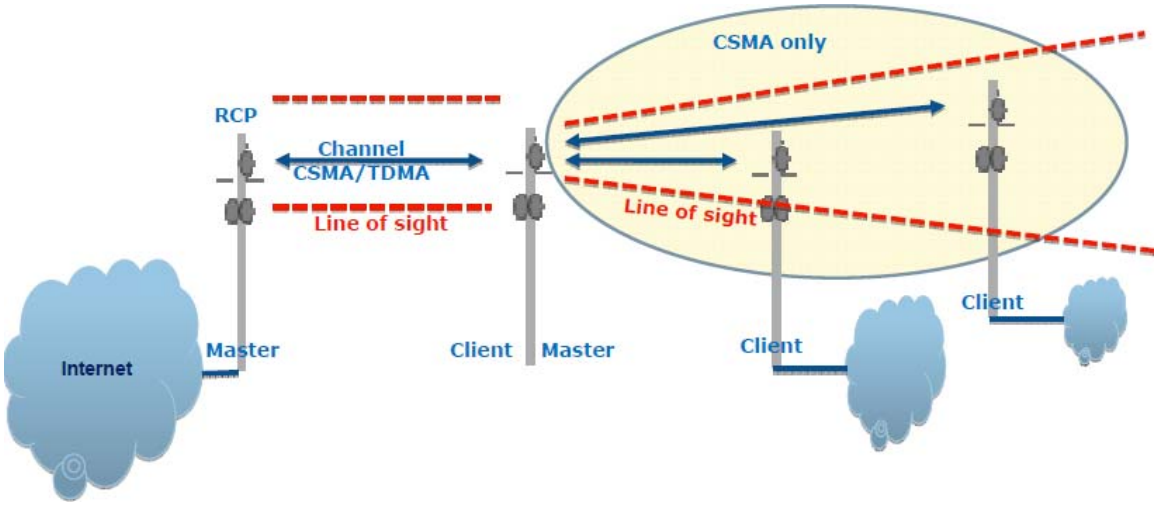


Relay Connectivity

When line of site or a geographical obstacle presents a problem, the RCPs can be daisy-chained together via relays, allowing the network to skirt those types of issues.

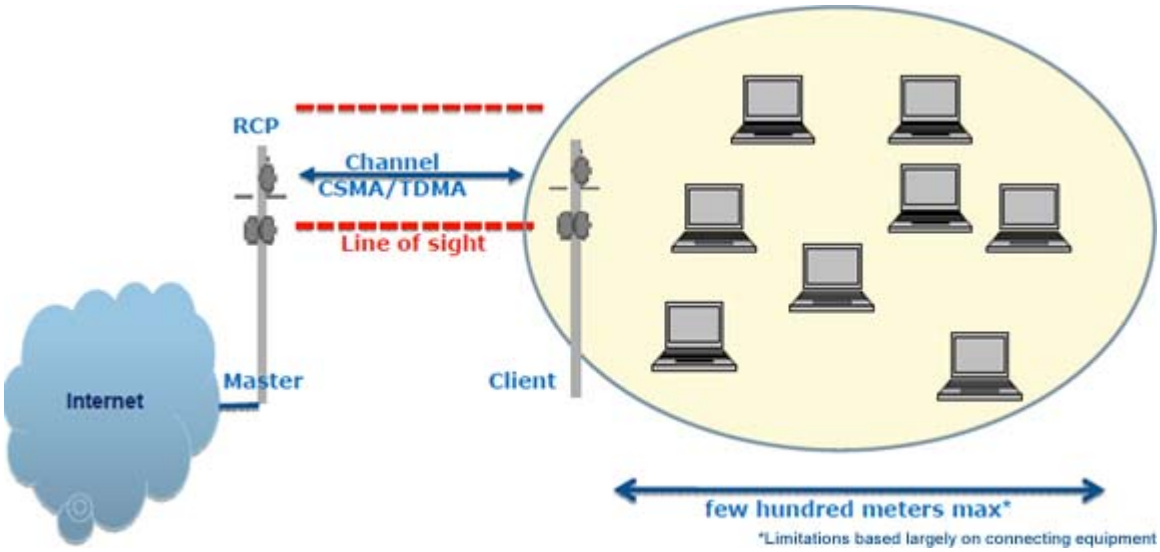


Configurations can also be combined. For instance, the relays can also, themselves, be used to transmit to multiple points.



Local Coverage Connectivity

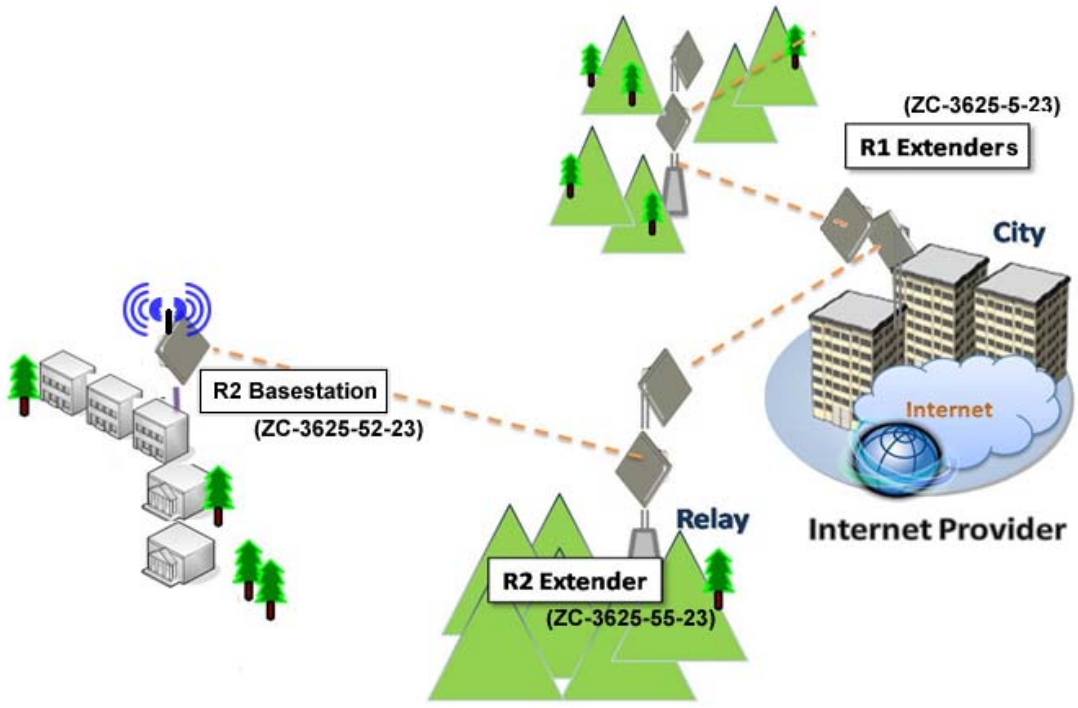
The base station option allows the Zcom RCP to connect to either a point to point or relay station and also provide local WiFi coverage, allowing users at the remote location to use the network resources of the local connection.



Project Implementation

As is demonstrated in the depiction below, the Zcom RCPs can be used in a variety of ways and combined to create networks over vast geographic ranges. This is just one of the ways that the Zcom RCPs might be used and is only used for demonstrative purposes. The details of what each unit is capable of will be discussed later, under hardware types.

In the example below, the Internet service provider uses R1 Extenders to broadcast wireless service to other locations. Relays receive and retransmit the signal over vast distance and around various geographic obstacles, mountains in this instance, to other less populated areas. There, a base station receives the signal and, with it's 2.4GHz capabilities, retransmits to clients nearby. The Zcom RCP at the remote site can also be used to tie into the network via the wired connection for use or redistribution.



Distance and Throughput Considerations

The Zcom RCP series was specifically designed to deliver high performance connections over great distances. It's no wonder, then, that attaining a link of 40km or more is not outside of its abilities. Below is a chart detailing some of the impressive testing results that have been achieved with the Zcom RCP series. As you can see, using TDMA, the units can achieve a solid connection at 40km and using CSMA, they can achieve similar results up to around 20km. Again, these figures should not be considered benchmarks as all setups will be subject to various considerations.

Product Name		Throughput	Relay distance	Mode
FCC	R2E Relay	10Mbps	20km	CSMA
		9Mbps	20km+20km	CSMA
		9Mbps	20km+20km+20km	CSMA
		9Mbps	40km	TDMA
		9Mbps	40km+40km	TDMA
		7.9Mbps	40km+40km+40km	TDMA

It should be noted that actual throughput will vary between setups. Many factors affect the throughput other than distance. These factors are outside the scope of this document but the values here, while actual test results, should not be considered the minimum or maximum performance capabilities of the RCP series.

Hardware Types

The Zcom RCP series comes in single or dual radio configuration. All the units and radio configurations offer access point, client and peer-to-peer modes and have the same software functionality. The main difference between the models in the Zcom RCP series are the number of radios used, available external antenna connection and the frequency used by the radios. Please review the following information regarding each of the Zcom RCP models to better understand the benefits and limitations of each.

R1 Extender

(Model: ZC-3625-5-23)

The R1 Extender is the most basic of the Zcom RCP units. The R1 Extender is for point to point or point to multipoint links, as illustrated previously in the Implementation section. Currently the R1 only utilizes a single 5GHz radio and offers only the integrated 23dB antenna. This unit can connect to any of the other Zcom RCP units (using TDMA or CSMA) or any other unit that operate in the same 5GHz frequency range.

Number of radios: 1
Frequency: 5GHz
Antenna: 23dB integrated
External antenna connection: n/a
Connection uses: point to point, point to multi-point

R2 Extender

(Model: ZC-3625-55-23)

The R2 extender includes all the technology and power of the R1 extender and adds another 5GHz radio and an external N-type antenna connection. The additional radio and antenna option allow the signal to be received and then rebroadcast, effectively doubling the range of the connection. Having 2 antennas also allows use of the “link aggregation” function which requires both antennas to be directed at the same source. With the “link aggregation” function active, both antennas are used to enhance throughput performance. The R2 Extender utilizes two 5GHz radios and one integrated 23dB antenna and provides an N-type connector so the customer can attach the antenna of their choice to the second radio. The R2 Extender can connect to any of the other Zcom RCP units (using TDMA or CSMA) or any other units that operate in the same 5GHz frequency range.

Number of radios: 2
Frequency: 5GHz
Antenna: 23dB integrated, optional secondary antenna (sold separately)
External antenna connection: Yes
Connection uses: point to point, point to multi-point, relay, relay to multi-point

R2 Base Station

(Model: ZC-3625-52-23)

The R2 Base Station was created to bring WiFi connectivity to network end-points. The second 5GHz radio in the R2 Extender is replaced with a powerful 2.4GHz radio, connected to the external, N-type antenna connection. With this configuration, the service that was brought to the remote location via the 5GHz RCP connection can be made available for use to any local 2.4GHz equipped devices, such as laptops and other mobile computing devices, directly, without the need for costly, intermediary hardware. The R2 Extender brings true flexibility to the Zcom RCP line. The R2 extender can connect to any of the other Zcom RCP units (using TDMA or CSMA) and any other units (using CSMA) that are operating in the same 5GHz or 2.4GHz range.

Number of radios: 2
Frequency: 1 @ 5GHz, 1 @ 2.4GHz
Antenna: 23dB integrated, optional secondary antenna (sold separately)
External antenna connection: Yes
Connection uses: point to point, point to multi-point, point to point with local coverage, point to multi-point with local coverage

Skyport Series

The Skyport series of units are the end link to a rural connectivity network. Available in multiple software and antenna configurations and with different weatherproof enclosures, the Skyport series brings the ease of implementation full circle. With both Base Station and Client functionality and with a 802.11n capabilities available, these units can provide both local area coverage or point-to-point extensibility. All models come with external antenna connectors for implementation flexibility and affordability to ensure that the correct antenna is selected for a specific deployment. Skyport is the new standard for low-cost, high-performance wireless connectivity.

Number of radios: 1
Frequency: 2.4GHz , 5GHz (model specific)
Antenna: integrated directional panel (not all models have integrated antennas - gain is model specific)
External antenna connection: Yes
Connection uses: end point from RCP backhaul, base station, point to point, point to multi-point, client