



# NEW GENERATION ALTAI A8N AND C1N SUPER WIFI PRODUCTS FOR RURAL WIRELESS BROADBAND DEPLOYMENT

## WHITE PAPER

One of the most difficult problems a service provider may encounter during planning for their broadband service provisioning in rural areas is a sparsely distributed population over a large area and the deployment of wired Internet access is prohibitively high if not impossible. This white paper will show how the Altai A8n series and C1n can be deployed for rural broadband service using its patented wireless technologies to achieve an economical, scalable and reliable wireless coverage over a long range.

## 1. Overview





One of the most difficult problems a Service Provider may encounter during planning for their broadband service provisioning in rural areas is a sparsely distributed population over a large area and the deployment of wired Internet access is prohibitively high if not impossible. To deal with this situation, wireless broadband may be the most feasible solution to provide Internet access over the target areas. This white paper will show how the Altai A8n and C1n can be deployed for rural wireless broadband service by taking the advantages of high 11n throughput 8x8 MIMO smart antenna technologies to achieve an economical, scalable and reliable wireless coverage over a long range.

## 2. Benefits of Using A8n and C1n for Rural Wireless Broadband Deployment

- Large throughput– up to 300 Mbps data rate or 160 Mbps throughput
- Large client capacity – up to 512 maximum or 100 typical concurrent users per radio
- 2.4 and 5 GHz dual bands service –with similar coverage in design
- Long range coverage –up to 4 km LOS with a C1n CPE
- Superior interference mitigation capability –designed for complicated large area NLOS environment e.g. rural deployment
- Save site costs and fast deployment –by co-location with 2G/3G/LTE cellular sites if available, e.g. for mobile operator

## 3. High Throughput and Coverage Performance

Various combinations of A8n and A8-Ein used directly with a client or in conjunction with a C1n CPE are possible to suit various coverage scenarios. The range, throughput and other key network benchmarks are summarized below:

|                         |                              |  |  |  |
|-------------------------|---|---|--|---|
| <b>Configuration</b>    | A8-Ein + C1n  | A8n + C1n   | A8-Ein   | A8n   |
| <b>Range, 2.4 GHz</b>   | 4 km LOS,<br>1.8 km NLOS  | 2.7 km LOS,<br>1.3 km NLOS  | 1.7 km LOS,<br>800 m NLOS  | 1 km LOS,<br>500 m NLOS   |
| <b>Beamwidth</b>        | 80-100°   | 360°  | 80-100°  | 360°  |
| <b>Throughput</b>       | Up to 160 Mbps at near end (at HT40),<br>~20 Mbps at far end as stated in the above (at HT20)                   |   |  |   |
| <b>Concurrent users</b> | 512 users at 2.4 GHz plus 512 users at 5GHz (maximum),<br>100 users at 2.4 GHz plus 50 users at 5 GHz (typical) |   |  |   |
| <b>SSID</b>             | 16  |   |  |   |
| <b>Port</b>             | 10/100/1000 Mbps  |   |  |   |

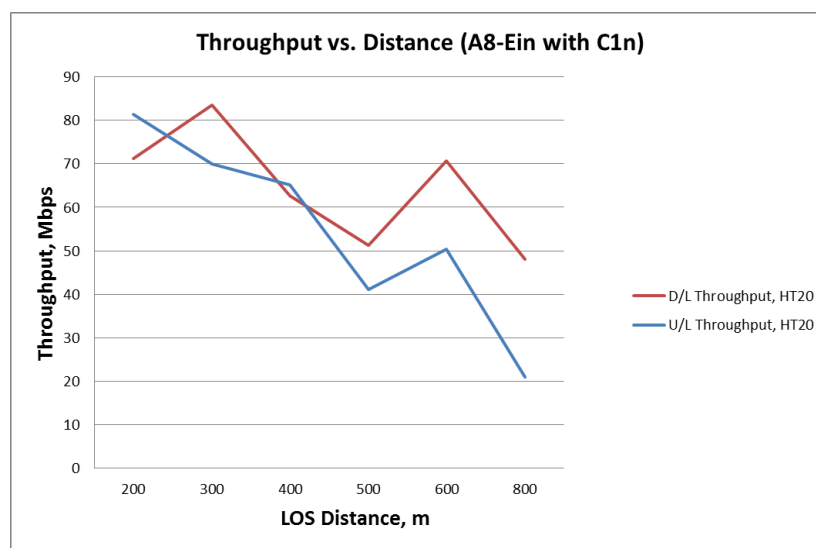
## 4. Cost Implications

The cost savings by using the Altai Super WiFi solution are summarized below with comparisons to standard AP's found in the market:

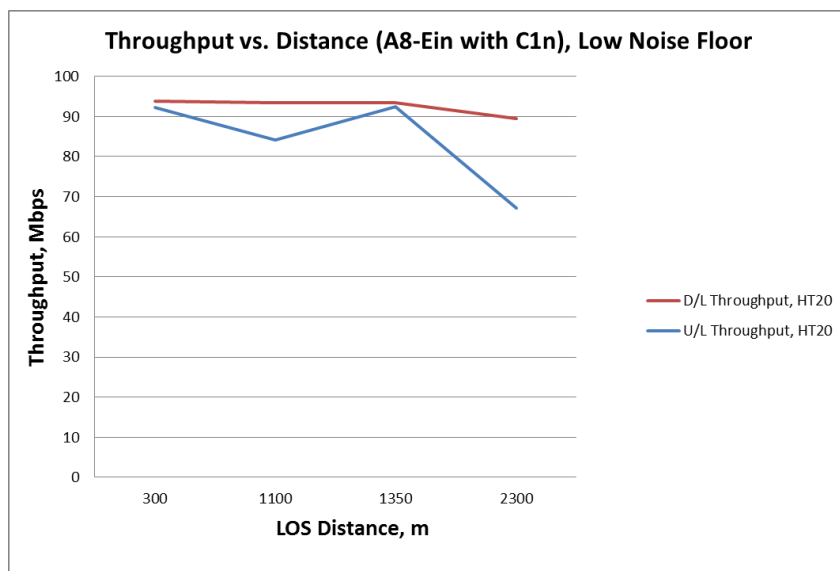
| Cost Factor   | Performance Index  | Rationale   |
|---|--|---|
| <b>Time to deploy</b><br>(rate of return)                 | Much faster and simpler  | Plug-and-play deployment using cellular site co-location  |
| <b>Equipment cost</b><br>(initial investment)             | Just 10 to 20% of standard AP  | 5 to 10 times in coverage   |
| <b>TCO</b><br>(total cost of ownership)                   | As high as 70% saving  | Top 2 cost elements - site (35%) and backhaul (25%) can be eliminated or highly reduced             |
| <b>Ease to deploy</b><br>(engineering & maintenance cost) | Can be deployed as close as 50 cm to 3G/LTE cellular antenna                       | Superior design in low spurious emissions and high quality in-band filters to mitigate interference |
| <b>Service plan</b><br>(ARPU & revenue)                   | Using A8n series can provide 5X median throughput vs. standard 11n AP              | More throughput per subscriber or more subscribers per backhaul throughput can be supported         |
| <b>Customer satisfaction</b><br>(subscriber growth)       | 3X the throughput a client can obtain during congestion as compared to standard AP | The Altai AiFi™ throughput optimization software  |

## 5. Field Test Results

To illustrate the typical performance of the A8n-C1n combination, a field test was conducted in a LOS environment with average noise floor of -81 dBm and equipment setting at HT20. The UL/DL throughputs were recorded at distances from 200 to 800m. From the results below we can see that at 200 m near end 81 Mbps D/L and 71 Mbps U/L are achievable; while at 800 m far end 48 Mbps D/L and 21 Mbps U/L throughputs were recorded.



To illustrate how far the equipment can be pushed to the extreme, the same test was conducted in a clean LOS environment with the noise floor below -90 dBm and equipment setting at HT20. The throughputs results were recorded at distances from 300 m to 2.3 km. We can see that at 2.3 km far end, 89 Mbps D/L and 67 Mbps U/L were recorded!

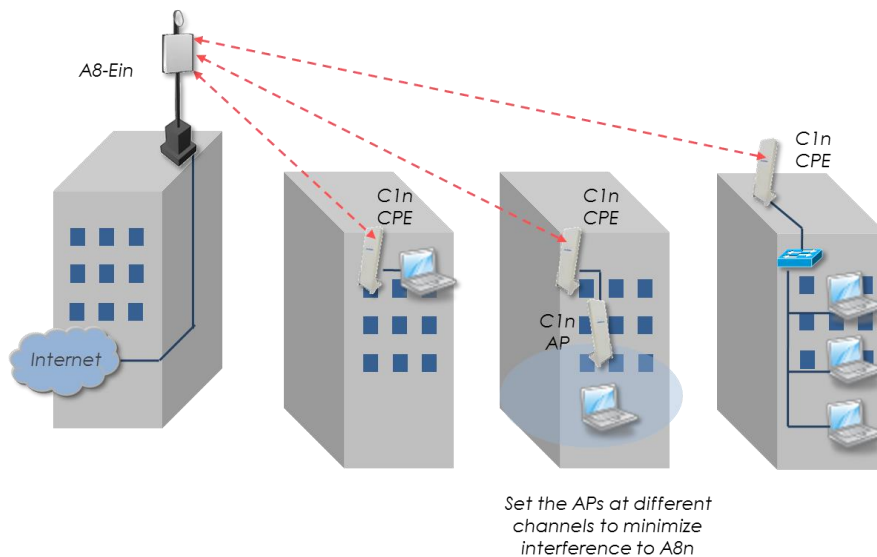


Such clean environments can be found in many rural areas where no WiFi service has been deployed before and such environments are ideal for deploying WiFi as a rural wireless broadband service.

## 6. Business Model

Taking the first test as an example, we assess what the network capacity and the return time on investment could be. From the test results we can see that an average throughput of 65 Mbps can be achieved. Assuming a contention ratio of 25, and a maximum number of 100 concurrent users, then the average throughput per user will be  $65 \times 25 / 100$  equal to 16 Mbps. Allowing some throughput degradation when multiple CPEs are used under an AP and operating under NLOS environment, the average throughput can be adjusted to 8 Mbps, or for a guaranteed bandwidth of 4 Mbps per CPE. If the broadband service plan of \$5 per month is affordable, with an oversell ratio of 2 and a total investment budget (AP + CPEs) of \$12,000 per AP site, then the investment return time for the equipment will be  $12,000 / (5 \times 100 \times 2)$  equal to 12 months!

## 7. Deployment Tips in Using A8n Series and C1n for Rural Wireless Broadband Deployments



The A8n – C1n combination can be fully utilized in different rural wireless broadband scenarios to provide indoor or extended outdoor coverage.

### **Scenario 1 – C1n as CPE for each household Internet connection**

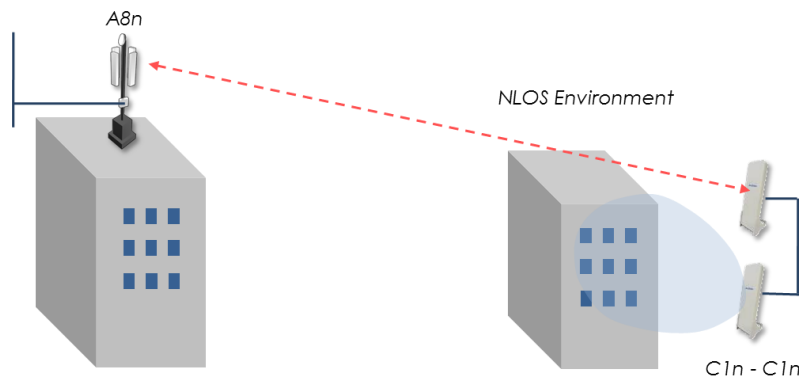
Each household at the remote site can be equipped with a C1n to associate to the A8n directly at a distance as far as 2.7km in LOS and 1.3km in NOS for Internet access; or to the A8-Ein at a distance as far as 4 km LOS and 1.8 km NLOS.

### **Scenario 2 – C1n back-to-back configuration for indoor hotspot provisioning**

Instead of using wired backhaul for indoor hotspot deployment such as shops, households and office, it is more convenient to deploy service by extending outdoor coverage to indoor areas using CPE-AP pairs. One C1n as CPE and another C1n as AP form a back-to-back configuration to provide indoor hotspot services. With its high gain built-in smart antenna, the C1n is able to provide the coverage as far as 600m in LOS and 300m in NLOS. This saves a significant amount of AP installations in a typical sized office or shopping center.

### **Scenario 3 – Outdoor extended coverage**

Apart from providing indoor coverage by the A8n-C1n combination, it can help to extend the coverage over the outdoor NLOS blind spots into shadow areas by using the C1n-C1n back-to-back configuration also.



### **AP and CPE access rights**

Each AP can be set to only allow the pre-assigned CPEs to connect. This is to eliminate illegal users from login or relocating the CPE to another AP. CPE authentication can thus be simplified. Alternatively, each CPE can be set to only allow connection to one or multiple pre-assigned APs. This is to eliminate the CPE from incorrectly connecting to other AP's with weaker signal or to avoid illegal relocation to other AP's.

### **Total outdoor and indoor installation**

Though the CPE is mainly installed indoor, it can be installed outdoor as well because of its IP55 weatherproof design. Appropriate external lightning protector is recommended in high-lightning zones.

## **8. Summary**

The A8n-C1n combination is well proven to be a reliable, scalable and cost-effective solution for a long-range wireless broadband deployment. It can be applied in a variety of complicated environments to suit WISP's in overcoming expensive or scarce wired backhaul and to achieve rural wireless broadband provisioning over their target areas.

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