Airspan Networks: Overview

• Leading provider of Wireless Access solutions since 1995

• ~250 people in 12 locations, R&D centric organization

• Headquartered in Boca Raton, Florida, USA

• Focused on 4G Carrier and Vertical markets

• R&D in the UK, Israel and Finland

• Scalable global supply chain

• Sales and Support Offices in Australia

• Major shareholder: Oak Investment Partners
## 4G Radio Access Networks

<table>
<thead>
<tr>
<th>Base Station Type and Interfaces</th>
<th>MicroMAX</th>
<th>AirSynergy</th>
<th>Air4Gs</th>
<th>Air4G (MacroMAXe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact Pico Base Station 16d WiMAX</td>
<td>Pico Base Station 16d, 16e WiMAX and LTE</td>
<td>Micro Base Station 4G WiMAX (LTE later)</td>
<td>Macro Base Station 4G WiMAX and LTE</td>
<td></td>
</tr>
<tr>
<td><strong>Tx power and Typ. EiRP</strong></td>
<td>1x27dBm or 1x30dBm ~20 Watts</td>
<td>2x27dBm or 2x30dBm 40 Watts</td>
<td>2 x 33 dBm 160 Watts</td>
<td>Up to 2 x 40 dBm 1-2 kW</td>
</tr>
<tr>
<td><strong>Frequency Bands</strong></td>
<td>650 MHz to 6 GHz, inc. 1.4 GHz, 1.8 GHz, 2.3 GHz</td>
<td>400 MHz to 6 GHz, inc. 1.4 GHz, 1.8 GHz, 2.3 GHz</td>
<td>1.4 GHz, 2.3 GHz and 3.x GHz</td>
<td>700 MHz, 1.4 GHz, 1.8 GHz, 2.x GHz, 3.x GHz</td>
</tr>
<tr>
<td><strong>Tx and Rx Paths</strong></td>
<td>1 / 1</td>
<td>2 / 2 or 4</td>
<td>2 / 2 or 4</td>
<td>2 / 4</td>
</tr>
<tr>
<td><strong>Typical Antenna Configuration</strong></td>
<td>Vertical</td>
<td>Dual or Quad Slant</td>
<td>Dual Slant</td>
<td>Quad Port or Dual Slant</td>
</tr>
<tr>
<td><strong>MAC/PHY per sector</strong></td>
<td>1 x MAC/PHY</td>
<td>2 x MAC/PHY</td>
<td>Single MAC/PHY</td>
<td>Dual MAC/PHY</td>
</tr>
<tr>
<td><strong>Channel sizes</strong></td>
<td>1.5 to 10 MHz</td>
<td>3 to 10 MHz</td>
<td>3 to 10 MHz</td>
<td>3 to 2*10 MHz</td>
</tr>
</tbody>
</table>

**Comprehensive 4G Product Portfolio designed for implementing 4G-Advanced Networks**
### 4G Devices and CPE Products

<table>
<thead>
<tr>
<th>End Point Type</th>
<th>MiMAX Pro</th>
<th>Mobile Radio Terminal</th>
<th>Embedded Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor CPEs, designed for Residential, Business, Enterprise and Vertical Apps, Wi-Fi Option</td>
<td>Rugged Mobile Terminal for Vehicle based Applications, supports Wi-Fi and Ethernet</td>
<td>Modules for embedding inside other devices / Terminal Stations</td>
<td></td>
</tr>
</tbody>
</table>

| Tx power and Typ. EiRP (W) | 2x24dBm Up to 20 Watts | 2 x 24dBm ~4 Watts | 2x24dBm Up to 20 Watts |

| Frequency Bands | 400 MHz to 6 GHz, inc. 1.4 GHz, 1.8 GHz, 2.3 GHz, and 3.65 GHz | 400 MHz to 6 GHz, inc. 1.4 GHz, 1.8 GHz, 2.3 GHz, and 3.65 GHz | 1.4 GHz, 1.8 GHz, 2.3 GHz, 2.5 GHz and 3.65 GHz |

| Tx and Rx Paths | 2 Tx and 2 Rx | 2 Tx and 2 Rx | 2 Tx and 2 Rx |

| Typical Antenna Configuration | X-Pol or Dual Omnis | Dual Omnis | X-Pol or Dual Omnis |


| Channel sizes | 3 to 10 MHz | 3 to 10 MHz | 3 to 10 MHz |

**Different form-factors support a range of applications**
Introducing Air4G

- **Air4G** is a Compact, All-in-One, All-Outdoor, High Power, **4G LTE** and **4G WiMAX** Base Station
  - Dual Mode and migration to/from WiMAX/LTE is supported
- Industry leading “Size to Tx Power” Ratio
  - RF + Baseband + GPS + Power Supply + Sector Data Aggregation
  - 2 x 40dBm (10W) in 2.x GHz Bands
  - 2 x 43dBm (20W) in 700/800 MHz Bands
  - 17kg per sector
- Advanced MAC and PHY capabilities
  - 3 or 4 separate MAC/PHY engines
  - Supports up to 3 x 20 MHz (FDD or TDD)
  - MIMO and SFR/FFR (field proven)
- Beyond the “Standard”
  - Ethernet and IP CS
  - VLAN tagging / pass through
  - Stand Alone mode for fixed application
  - Extended Range
Macro Cell Networks augmented with Pico cells

- Macro Base Stations provide "day 1" coverage
  - Typically Tri-sectored cells, running from existing macro cells sites

- These cell sites provide footprint coverage for low bit rate voice services, but are not spaced to provide high capacity broadband services
  - In 3G and 4G deployments the capacity at the edge of cell is up to 10 times lower

- Air-Synergy Pico cells complement the Macro coverage and increase capacity at the cell edge
  - Where Macro capacity is low

- Combinations of Macro and Pico nodes massively increase the aggregate Mbit/s available in the network
Covering Rural Broadband Not-Spots

- Fibre and wire-line technologies require a certain customer density and up-take to make them economically viable.
- As you move into rural broadband not-spot regions, the customer density reaches a point where a wireless extension is the only cost effective solution.
- A wireless solution that extends the reach of an existing fibre/wireline network can be a powerful component within an operators “toolkit” when looking to cover low density rural broadband not-spots.
- The solution should be easy to deploy (low CAPEX) and provide a sustainable OPEX business model as part of an overall broadband service offering.

Air-Synergy directly addresses this challenge.
The Need For Small Cells

- Airspan recognizes how the deployment of small cells can improve a user’s wireless broadband experience by enabling a Rural Broadband Carrier to deliver broadband service where it’s needed:
  - Locating nodes close to users enables usage of high order modulations and MIMO techniques present in 4G technologies.
  - Off-loading data traffic from the macro network to relieve congestion.
  - Deploying on existing street furniture (e.g., telegraph poles) to save site acquisition costs and ongoing OPEX.
  - Solving coverage constraints due to challenging terrain in rural applications.

- Air-Synergy is Airspan’s new multi-standard, multi-frequency outdoor picocell solution with two key characteristics to overcome the challenges of getting small nodes close to the user base:
  - Deployable form factor & low skill installation.
  - Embedded wireless backhaul.
Introducing AirSynergy

- Air-Synergy is an economic & sustainable solution for coverage in rural broadband not-spots
- Multi-Standard SDR enabling a flexible future proof deployment
- Integrated Wireless Backhaul & Relay enabling the use of any installation location.
- Simple form factor and smart plug-n-play features provide low skill deployment.
- Choice of form factor for rural application.
- Covers Licensed and “Whitespace” spectrum allocations.
  - Deployment options include 700MHz WiMAX Access plus 3.x or 2.6GHz TDD for iBridge backhaul/relay
  - NMS integration with Spectrumbridge
Introducing AirSynergy

- **AirSynergy** is a new generation of Software Defined Base Station
  - An evolution of Airspan’s commercially deployed Macro SDR technology (Air4G)

- Optimised for mounting on Utility Poles, Lamp Posts, Vertical Assets
  - Avoids expensive site builds and cell-site rentals

- Integrates Access and Backhaul into single product
  - One node contains two radio systems,

- Operates in Licensed Spectrum (400 MHz to 6.0 GHz)
  - Free from interference providing high levels of service availability (FDD and TDD)

- Supports multiple RAN Standards
  - 4G **WiMAX** and 4G **LTE** for delivering 10’s of Mbit/s per customer
  - 2G & 3G (HSPA) optional SW loads - * Future Development

- Low power consumption
  - 120W per node - Access and Backhaul Node

- Supports various deployment topologies
  - Pico layer of a heterogeneous network
  - Point to Multipoint
  - Relay distribution topologies
Air-Synergy for Rural Not-Spot Coverage

• Air-Synergy supports integrated wireless backhaul.
• It’s dual purpose antenna provides user access omni coverage as well as supporting a switched array to self connect to the nearest backhaul node. It is then able to act as a relay for other Air-Synergy nodes further down the pole run.
• This functionality enables a wireless topology as shown below:

![Diagram showing Air-Synergy for Rural Not-Spot Coverage](image-url)
Air-Synergy supports any type of 4G radio access interface (WiMAX or LTE)

- iBridge backhaul can be in-band (with TDD access) or out of band (with TDD & FDD access)
- Air-Synergy iBridge backhaul technology operates from the same hardware as access air-interface
- Network supported by standard 4G Core Networks
- iBridge “SON” provides real-time optimisation of backhaul and access radio links
Airspan’s iBridge is an intelligent network that delivers backhaul functionalities utilising advanced point to multi-point access techniques in the sub 6 GHz frequency band.

- Self-discovery and auto-registration allowing low skill rapid Node installations.
- Fully managed end to end QoS
- High order, high efficiency MIMO techniques
- Smart Beam Switching antenna techniques for rapid deployment and resilience modes.
- Low Latency & latency control
- Centrally coordinated interference avoidance and network efficiency optimisation (iBridge SON Server)
- Airspan has a large set of intellectual property and patents that cover this technology
Typical Urban Scene – spot the AirSynergy!

*refer to product mgt for details of verified devices
Improved Styling

• The AirSynergy form factor has been improved for Dual RF Synergy-3 nodes providing access and backhaul:

• Changes are in order to help the unit blend in with its environment and to look less like a base station.

• This helps with local authorities providing permission to mount on lamp posts and other street furniture.

• There is a styled cover shrouding the overall unit.
  • The switched antenna for backhaul (iBridge) is hidden behind the cover.
  • The cover houses a wrap around antenna for WiMAX or LTE access.

*refer to product mgt for details of verified devices
Conclusion: 4G Networks for Operators

- By combining the strengths of both 4G technologies Operators get;
  - Fixed and/or Mobile Networks for their customer base
  - Wide-Area Network for connectivity for aggregation nodes (*Private WiMAX and Public 2G, 3G and LTE*)
  - Next generation solutions (*Public* or *Private LTE or WiMAX*)
    - For Broadband, Data and Voice
  - Airspan Networks can help Operators construct their own *Private* Networks using both 4G standards.