

MBB

Huawei Technologies Co.,Ltd.

SingleRAN Wireless Marketing

AAU REDEFINES SITE ARCHITECTURE

Active Antenna Unit (AAU) is the trend in the Mobile Broadband (MBB) Era.





CHALLENGES FACED BY OPERATORS IN THE MBB ERA

In the Mobile broadband (MBB) era, the volume of data being carried on cellular networks is growing rapidly.

In such an era, what are the most challenging MBB issues which need to be solved? Are operators ready to face these challenges?

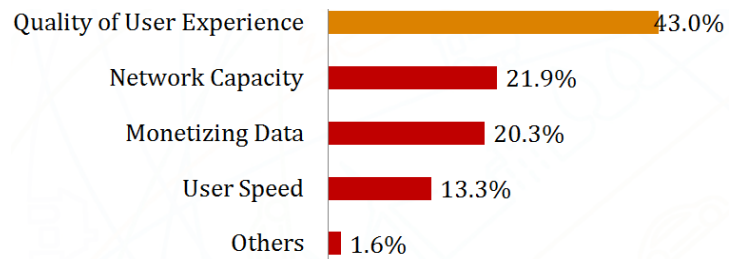
At the Huawei 2013 User Group Meeting, more than 300 participants from 103 operators /organizations voted on several issues.

The result indicates the most important issue being that the MBB network needs to provide a good

quality user experience as shown in **Figure 1**, which implies anywhere, anytime with xMbps throughput.

To achieve this, the MBB network requires more sites, bands and advanced technologies. With the development of 2G, 3G, 4G and 4.5G networks, it becomes increasingly difficult to add additional bands and sites due to site space limitation and site acquisition challenges, complicated deployment and also difficulties in supporting advanced technologies.

Figure 1: Most Important Issue in MBB Era



1. High Site Rental Fee

Site rental fee always relates to the size of occupied space.

When employing traditional solutions to support multiple bands and modes, operators have to rent large space.

Figure 2: Multiple Boxes for 5 Bands and 3 Modes



Above picture is an example of the site with 5 bands and 3 modes; operator has to pay rental fee for multiple boxes.

2. Network Should Response to Service Fast to Guarantee User Experience

Service has to be launched rapidly in order to guarantee good user experience. Traditional solutions always require more hardware and longer time for new bands or modes, which can affect user experience

3. More Connections Require Multiple Channels

Future networks will exist in a better connected world. Connections gradually extend from man and machine to machine and machine. Large connectivity is becoming a necessity. Networks are required to support multiple channels, such as Massive MIMO, a challenge when using traditional solutions.

4. Increasing Sites Aggravate Interference, Requiring Precise Coverage

With the increasing number of sites and bands/modes, multiple layers of networks co-exist. Coverage should be more precise if we are to successfully reduce interference. Beamforming is a technology which provides precise coverage, but is hard to support when using traditional solutions.

AAU meets the network requirements of the MBB era.

Base stations have evolved from macro sites to distributed sites, which separated the base band processing part from the radio part as shown in Figure 3.

The latest version combined the radio part with the antenna part and is capable of integrating multiple bands, creating the AAU solution. AAU supports more advanced functions such as Massive MIMO and Beamforming.

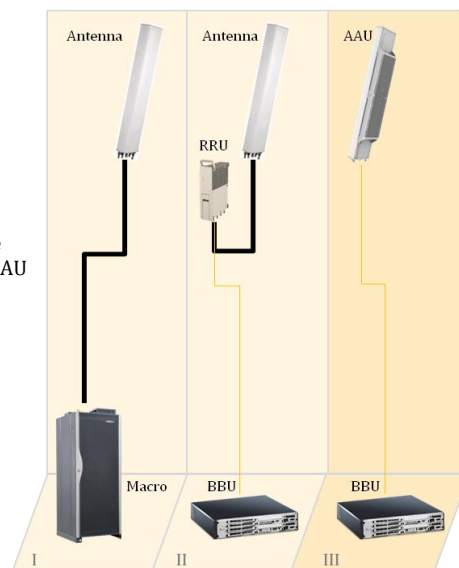


Figure 3: Evolution of Base Station, No feeder loss in AAU

The solution and benefits of the AAU are detailed in next chapter.



AAU SOLUTION AND BENEFITS TO OPERATORS

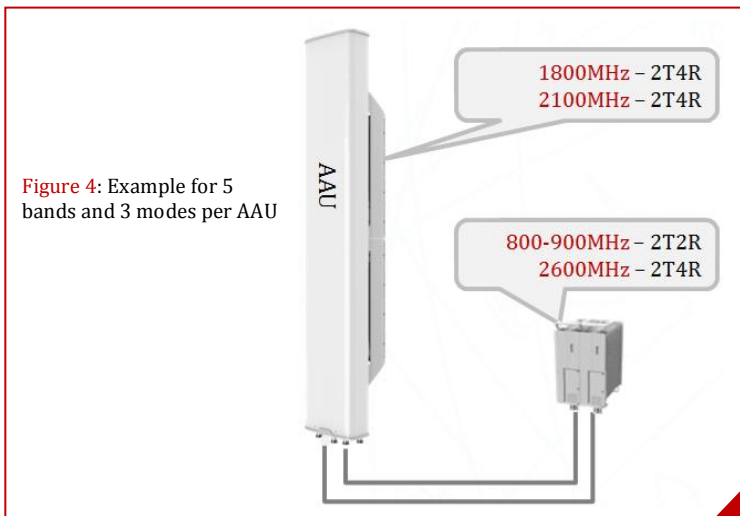
1. AAU ENABLES FLEXIBLE NETWORK AND BETTER CONNECTED WORLD

Network Is Flexible with AAU

AAU is the best solution to support 5 bands and 3 modes simultaneously, and is easy to define the network with different bands or modes by software. It's flexible.

AAU supports both low band (690-960MHz) and high band (1710-2690MHz). The antenna system in the AAU contains 2 functions: active and passive. The active antenna

works with the radio unit embedded in the AAU, while the passive antenna works with the external radio unit. Currently, 2 active bands and 3 passive bands are supported.



Due to it being able to support the full range of main stream bands and its compact design, AAU can be deployed in various scenarios. Some operators deployed it throughout their entire network, others have deployed it in hot spots, and some use it to replace old sites. All these scenarios have been applied in several countries.

In these applications, sites are extensively simplified compared to the traditional solution as shown in **Figure 5**.

Better Coverage by No Feeder Loss

As shown above, neither feeder nor jumper is required with the AAU, which leads to zero feeder loss compared with traditional solution, thus coverage is increased by 10%.

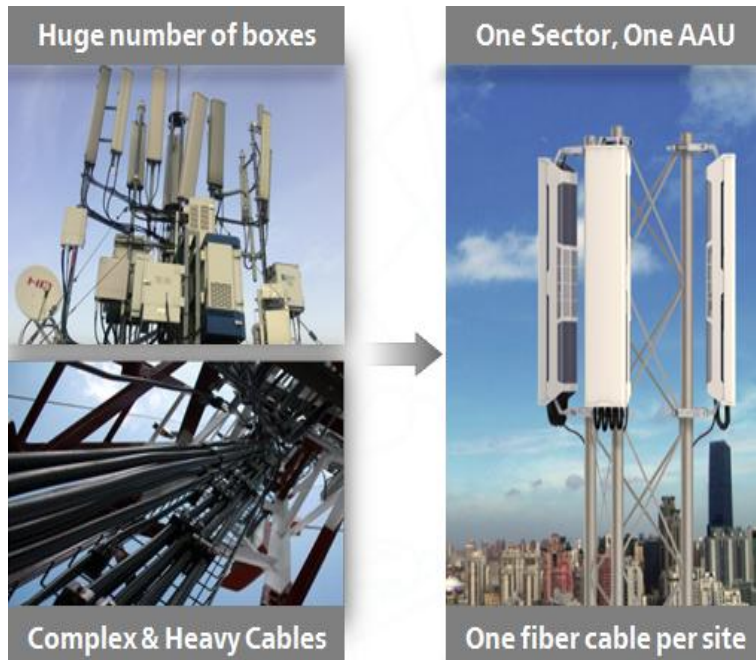
UE standby time is also extended by 7-16% due to better coverage.

More Channels by 4RX

AAU support 2T4R/4T4R which improves uplink performance by up to 2.6dB. The uplink coverage

improves by over 20% when compared with 2Rx receive diversity. The overall cell capacity also improves by around 30%-65% as a whole and 50%-170% at the cell edge.

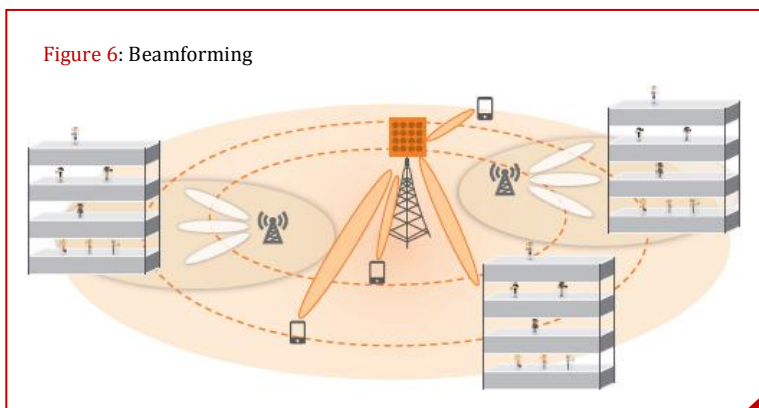
Figure 5: Clean site using AAU solution



Precise Coverage by Beamforming

The use of 3D-beamforming provides finer spatial resolution which enables more users to be multiplexed and hence bring significant spectrum efficiency as well as better user experience.

Figure 6: Beamforming



2. AAU SIMPLIFIES DEPLOYMENT

AAU's compact design simplifies base station deployment and speeds up MBB service time to market.

AAU's compact design and reduced number of packing boxes minimize the required transportation time from warehouse to site, which also speeds up the whole deployment process.

Less Engineering Work

The compact AAU solution simplifies site architecture and reduces the number of packing boxes. For example, in traditional GSM1800MHz + UMTS2100MHz site come with 6 antennas, 6 RRU and related components which are required for 3 sectors. Normally a single site requires **12 boxes** for packing.

Unified Maintenance System with Traditional Network

AAU's maintenance system is unified with traditional one. Engineers who maintain traditional sites are capable of managing AAU sites.

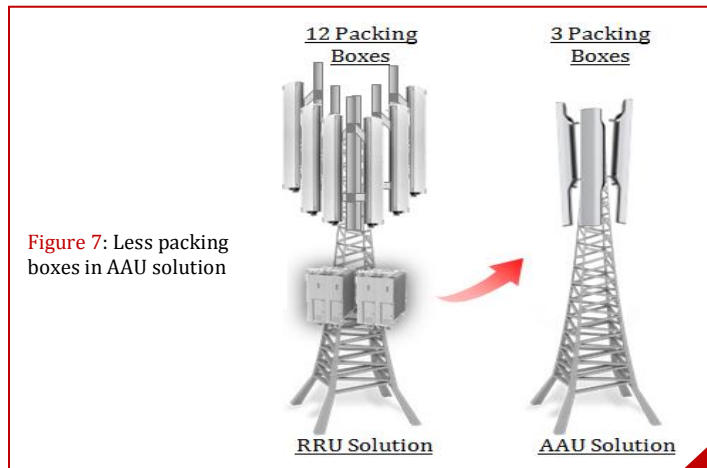


Figure 7: Less packing boxes in AAU solution

But with the AAU solution, only 3 AAU and few components are required for 3 sectors; needing only **3 boxes** for packing as shown in Figure 7.

Figure 8: Deployment Scenarios of Easy Macro™

Neither feeder nor jumper is required. Installation time is saved by 30%.

What's more, Easy Macro™ is a compact small (150mm*750mm) and light (15kg) AAU. This can be easily installed on a lamp post or a wall, and is environmentally-friendly as shown in Figure 8.



3. AAU SAVES TCO

CAPEX

Based on its advanced design as detailed above, the AAU can save CAPEX in:

1) Site rental fee is reduced as site space requirement is reduced; 2) Installation fees are reduced; 3) Transport fees reduced due to reduction in materials and packing boxes;

For example, in Peru Nextel project, compared with a traditional RRU+Antenna solution, the AAU solution savings of:

40% in site and tower rental fees

26% in engineering fees

30% in transport fees

OPEX

SOFTWARE DEFINED BAND AND RAT

AAU supports ultra wide band, eliminating the need to change or to add radio units if deploying different bands in the future.

Different band or modes can be defined by using software. Engineering fee is saved.

EASY MAINTAINENCE

Due to its advanced connector design (QDIN type), the embedded radio unit does not require waterproofing. And radio unit can be dismantled independently.

So it saves time and reduces cost for both installation and replacement.



CONCLUSION

As mentioned above, quality of user experience is the most important issue in MBB era. But to achieve this target, conflicts always happen between network **requirements** and its **challenges**. AAU is the solution to appease the conflict. Following table shows the common conflicts and its AAU solutions as well as some cases.

Table 1: AAU plays its role in the conflicts between requirements and challenges

	Requirement	Challenge	AAU Solution	Case
1	Build new sites	High TCO	Build new sites with AAU to simplify site construction and save TCO	Vodafone
2	Add new bands	Limited tower space; Limited antenna ports	1. Change old antenna by AAU; 2. Reuse existing radio unit and connect to AAU.	Peru, Nextel
3	Expand sites	Hard site acquisition	1. Use multi-bands AAU for more capacity and less site number; 2. Use big output power AAU for larger coverage and less site number.	Turkey, Vodafone
4	High traffic in hot spot area	Limited space for new sites	Use Easy Macro™ (a member of AAU) to absorb traffic with zero foot print.	Thailand, AIS; China Mobile; China Unicom; China Telecom
5	Quick service to market	Long engineering time	Use AAU to reduce engineering time.	Russia, MegaFon
6	Improve coverage and capacity	Lack of spectrum	Use 2T4R/4T4R for better coverage and capacity.	South Africa, Vodacom; TELUS, Canada
7	Better experience	Limited by advanced technology;	Use Beamforming for precise coverage.	Netherland, T-Mobile
8	Better VoLTE	Voice quality at cell edge	Use 4Rx to achieve better VoLTE quality at cell edge	China Mobile

OPERATORS' VOICE

Active antennas are a must for site simplification;

Huawei is leading the roadmap of Active Antenna System and offers the best solution for site simplification currently.

--- Vodafone

The Installation of AAU costs less because it is very simple to install, only baseband and antenna. The reduction in the cost of infrastructure is approximately 30%.

--- Nextel, Peru

We are delighted to use HUAWEI's advanced AAS technology during the Sochi Winter Olympic Games. This is a green Olympic Games.

--- MegaFon, Russia

AAU PROGRESS IN INDUSTRY

In 2012, Vodafone and Dutch Telecom started the first commercial trial.

In 2013, Nextel, Peru, deployed 12,000 AAU pcs representing the largest AAU network in South American.

In 2014, in Saudi Arabia, AAU helps Mobily build a Smart City.

In 2014, Megafon selected AAU for Winter Olympic Games held in Sochi.

In 2014, TELUS Canada selected AAU as the right solution for Multi-Frequency and Multi-RAT.

In 2014, Vodafone deployed AAU in Spain, Italy, Egypt, Turkey and South Africa.

