

# mmWave Beamforming and Massive MIMO



## Background

In the process of building 5G communications into the mmWave frequency band, how to use beamforming and massive MIMO technology to be applied to the operation of base stations has become an important topic. Due to the high attenuation characteristics of mmWave, beamforming becomes a key technology for mmWave communication. It has the advantages of increasing transmission distance and reducing interference between different RF channels. And it still needs improvement, such as high temperature, power consumption, hardware cost, etc.

MmWave massive MIMO systems need to combine a large number of antennas, complex algorithms, and beam steering control. Based on a large number of antennas, the radio signals are concentrated in a small space area to form a narrower beam for specific users. This can significantly improve transmission capacity and reduce interference to neighboring users. With the design of 5G NR networks, massive MIMO has become critical to 5G NR deployment. As the number of antennas increases, the Base station and user equipment implement more complex designs to coordinate MIMO operations. All these advancements are improving the user's 5G experience.

## Solution

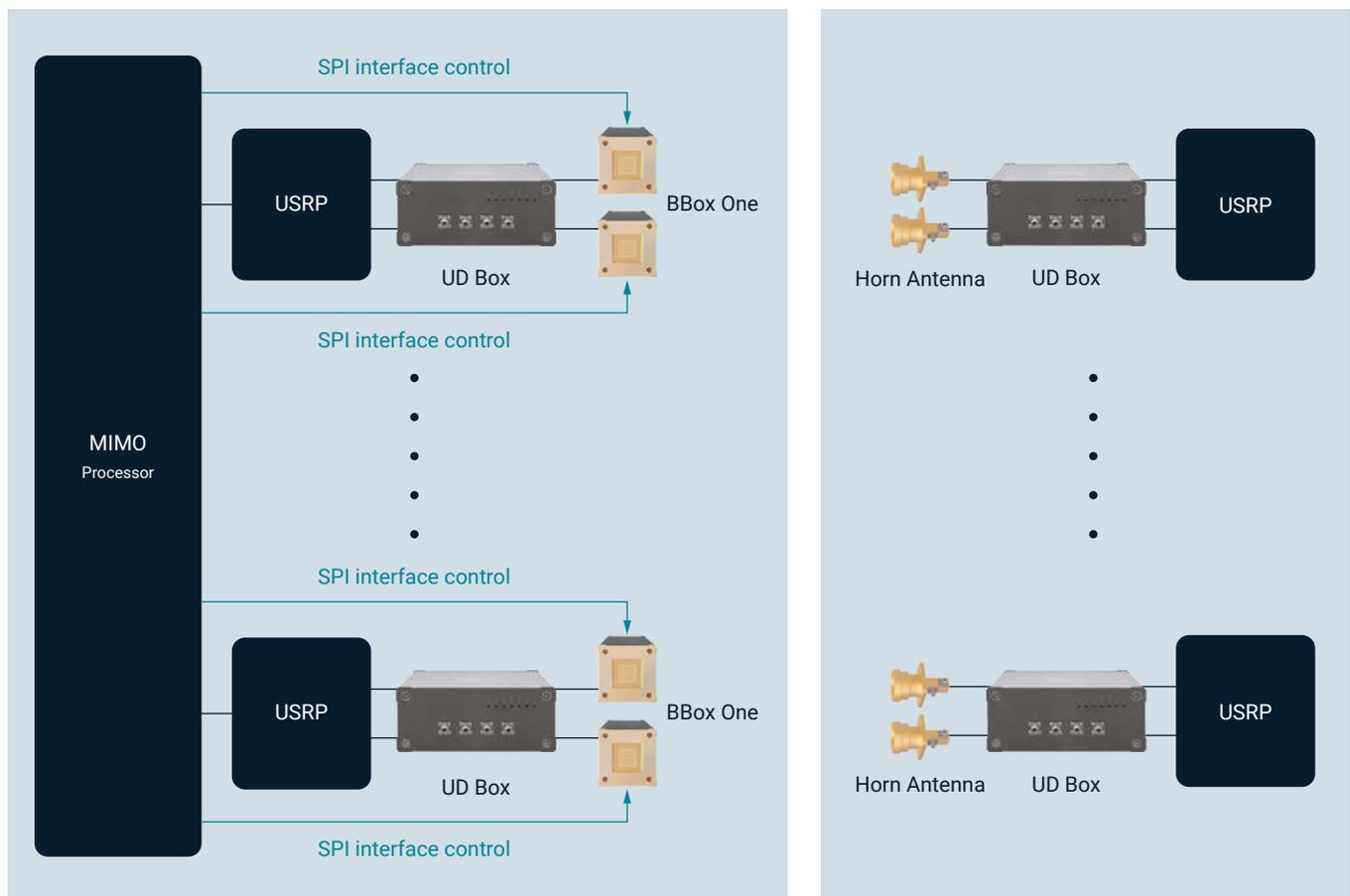


Figure 1. TMY mmWave Massive MIMO total solution, on the left is the base station (a) and on the right is user equipment (b).

As shown in Figure 1, the mmWave massive MIMO solution package provided by TMY and NI cooperation. This system consists of four parts, beamformer (or horn antenna), up/down converter, RF transceiver, and MIMO processor. This system currently supports up to 128 channels at the base station and can support 12 users at the same time. And can do fast three-dimensional beamforming control.

The beamformer and up/down converter provided by TMY are named BBox One& UD Box. BBox One has 16 independent RF channels. By controlling the phase and amplitude of each channel, it can achieve beam control in the horizontal and vertical ranges of 90 degrees. It is shown in Figure 2(a) below. We have two frequency versions, 28GHz and 39GHz. Another product UD BOX is a broadband up-down frequency converter. Its range is from 0.01~14GHz to 24~44 GHz and shown in Figure 2(b) below. Of course, we also have horn antenna as shown in Figure 2(c) if you need.



Figure 2(a). BBox One  
[Learn more about BBox](#)



Figure 2(b). UD Box  
[Learn more about UD Box](#)



Figure 2(c). Horn Antenna  
[Learn more about Horn Antenna](#)

## Benefit

TMY believes that the accumulation of knowhow of Massive MIMO is a key technology of 5G/B5G mmWave communication system. So TMY hope to build a prototype of mmWave massive MIMO, which can provide research and system development to use. This system will be used in a wide range of research fields, including algorithm research, millimeter wave field data collection and verification, RU system development...etc. This system will be of great help.

