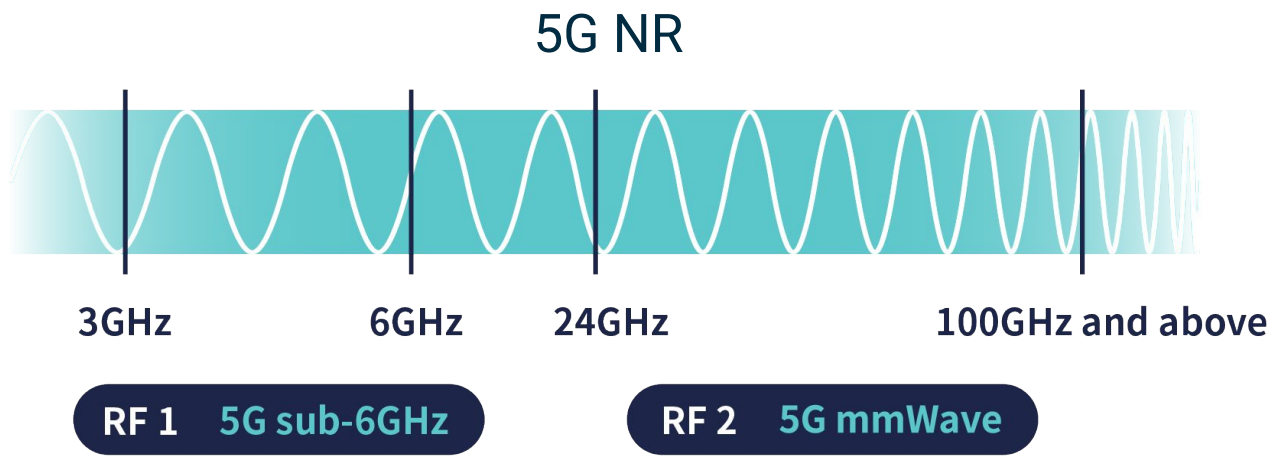
TMYTEK

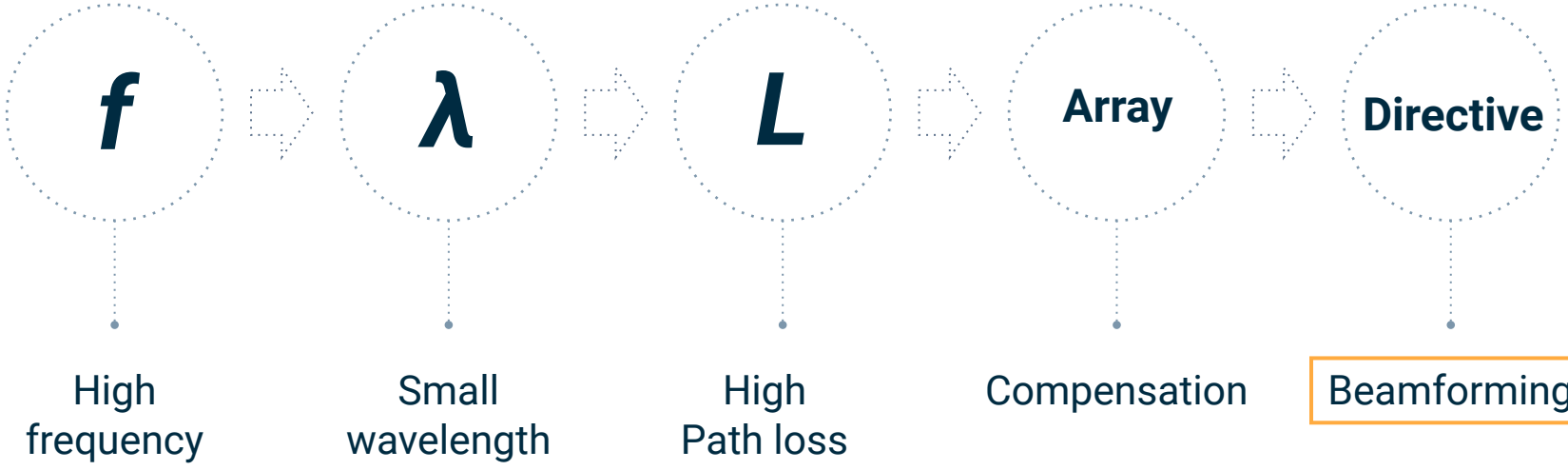
# BBox Introduction & Applications

V2.1

# 5G mmWave & Beamforming




**Beamforming** is necessary on 5G mmWave



# Beamformer Box

# BBox One

Beamformer with Detachable antenna

**2D Beamforming / 16 RF Channels**

| Antenna Designer | System Designer | Algorithm Designer |
|---|---|---|

TMYTEK

# BBox One Brief Introduction

- Two-dimensional Beam steering  control
- Detachable antenna array
- Amplitude and phase control for each channel
- Windows control GUI & provide API

| 28 GHz | 39 GHz |
|---|---|
| Frequency range 26.5-29.5 GHz | Frequency range 37-40 GHz |
| Support n257, n261 | Support n260 |
| Beam Range : -45° ~ 45° | Beam Range : -40° ~ 40° |
| AA kits 4x4 | |

TMYTEK

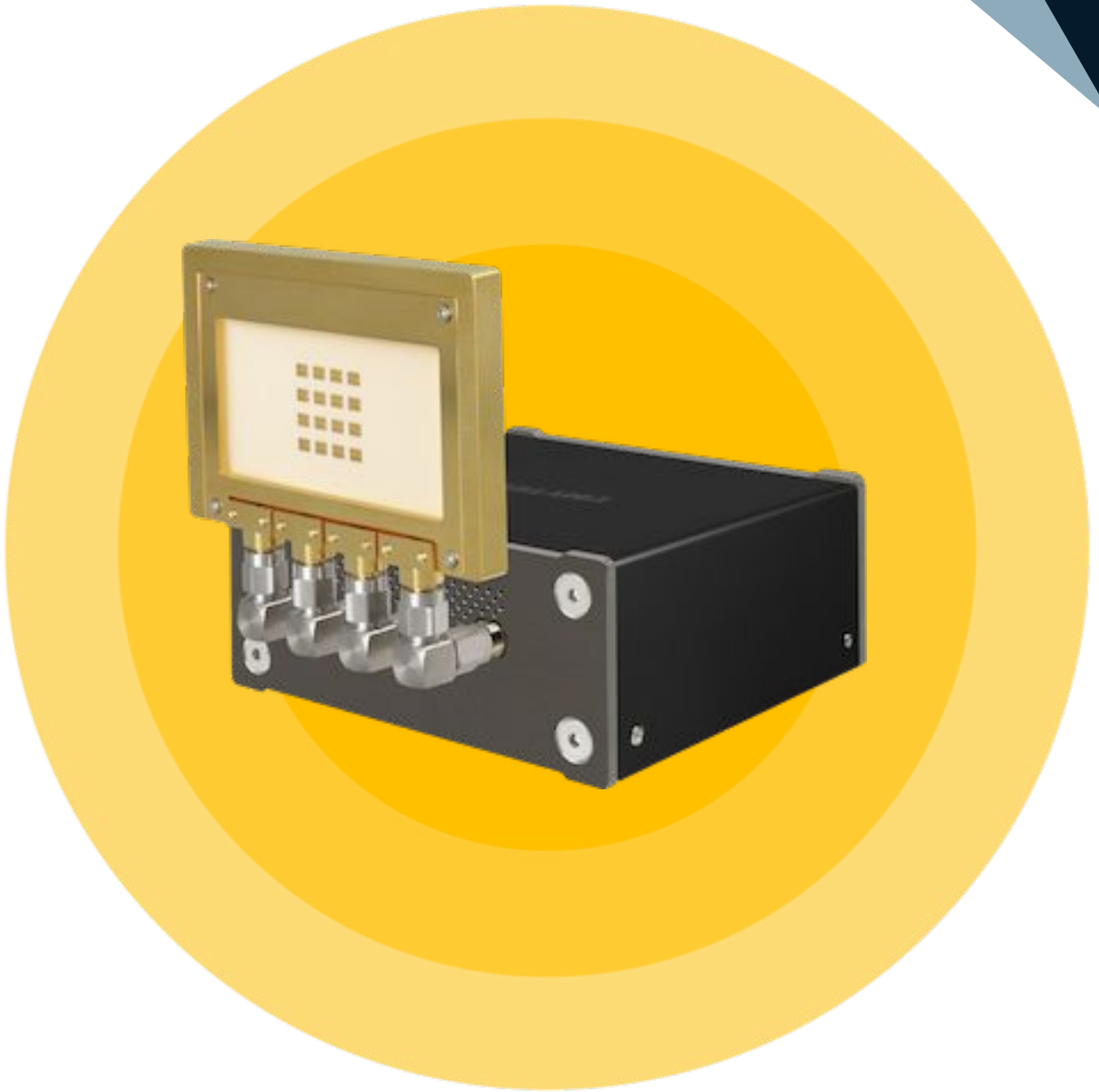
# Beamformer Box

# BBox Lite

Beamformer with Detachable antenna

**1D Beamforming / 4 RF Channels**

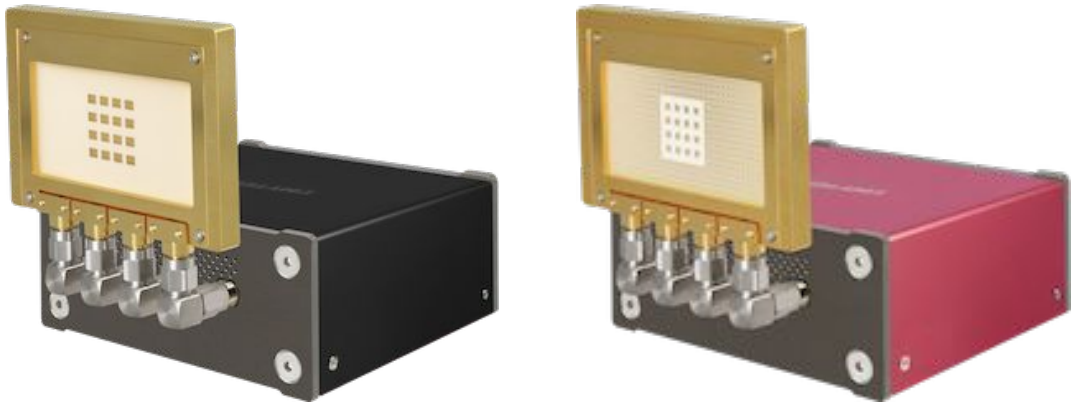
| Antenna Designer | System Designer | Algorithm Designer |
|---|---|---|



TMYTEK

# BBox Lite Brief Introduction

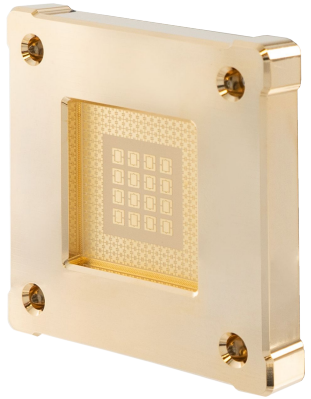
- One-dimensional Beam steering  control
- Detachable antenna array
- Amplitude and phase control for each channel
- Windows control GUI & provide API



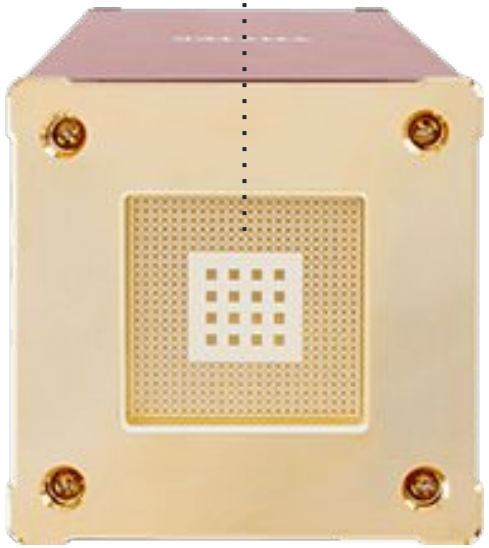
| 28 GHz | 39 GHz |
|---|---|
| Frequency range 26.5-29.5 GHz | Frequency range 37-40 GHz |
| Support n257, n261 | Support n260 |
| Beam Range : -45° ~ 45° | |

TMYTEK

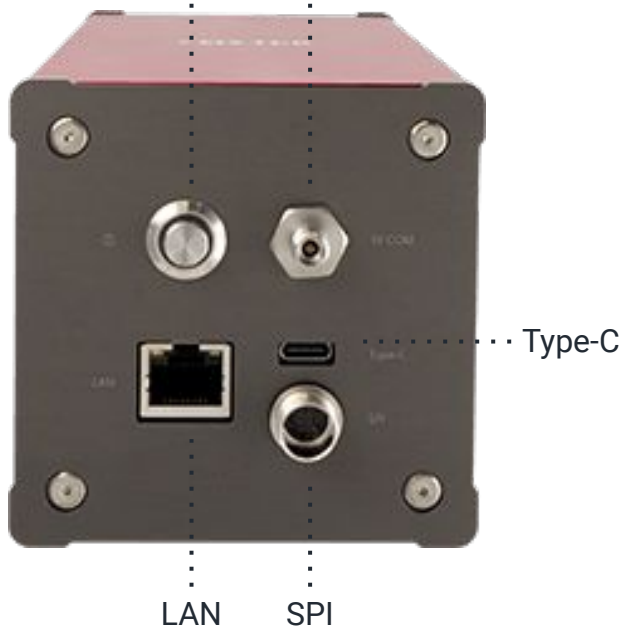
# BBox One



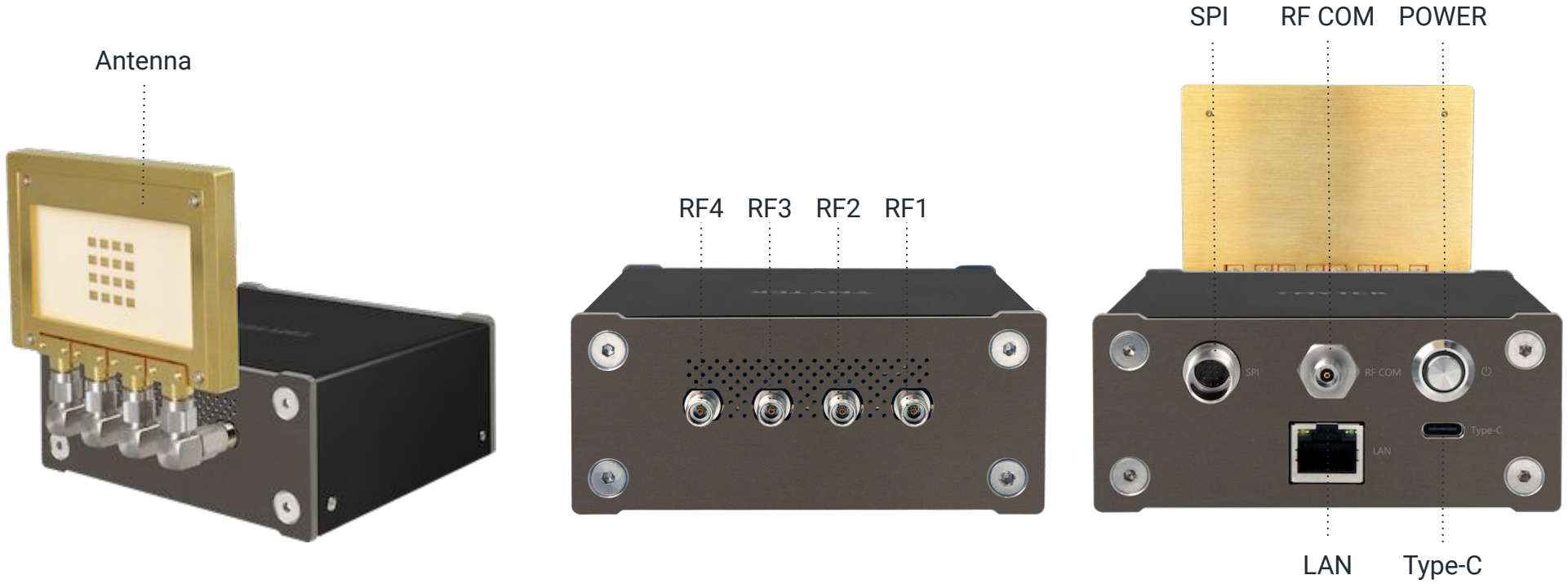
**AAkit**







# BBox Lite



# BBox Brief Introduction

**BBox Lite**

- 4 ports, emulate UE
- 1D beamforming & steering
- Compact Size: 117.4 x 100 x 99.2 $mm^3$
- Control Interface: RJ45/SPI

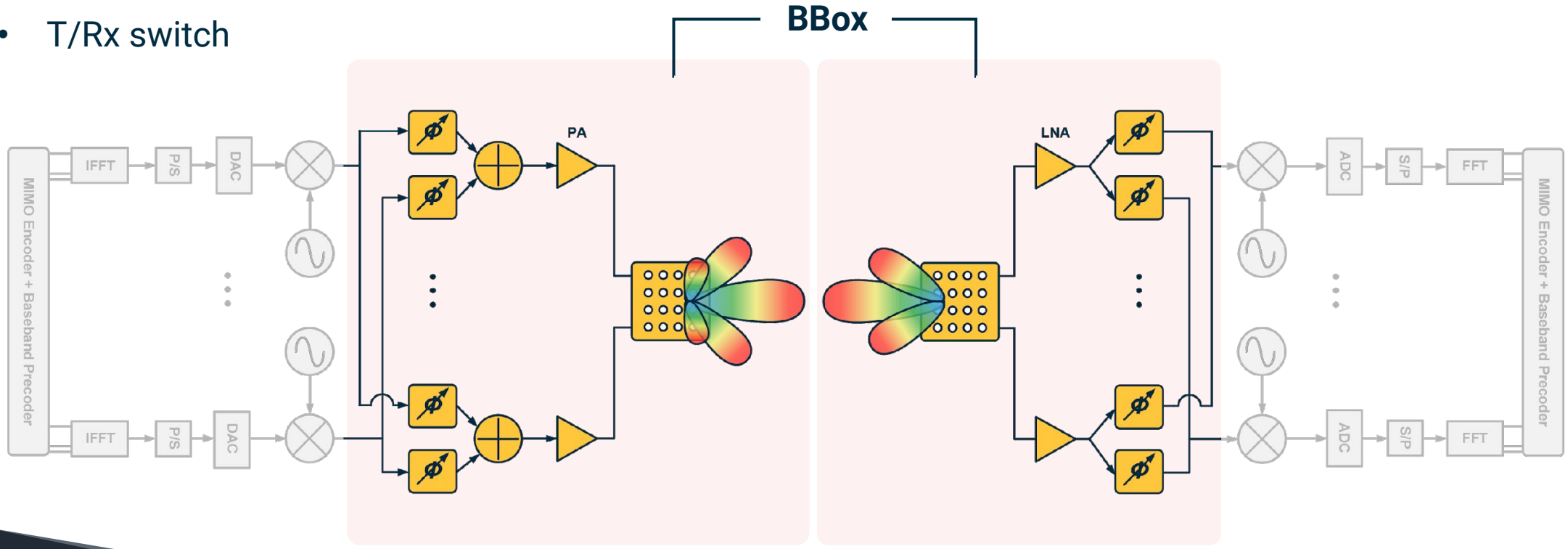
**BBox One**

- 16 ports, emulate BS
- 2D beamforming & steering
- Compact Size: 153.8 x 80 x 80 $mm^3$
- Control interface: RJ45/SPI

TMYTEK

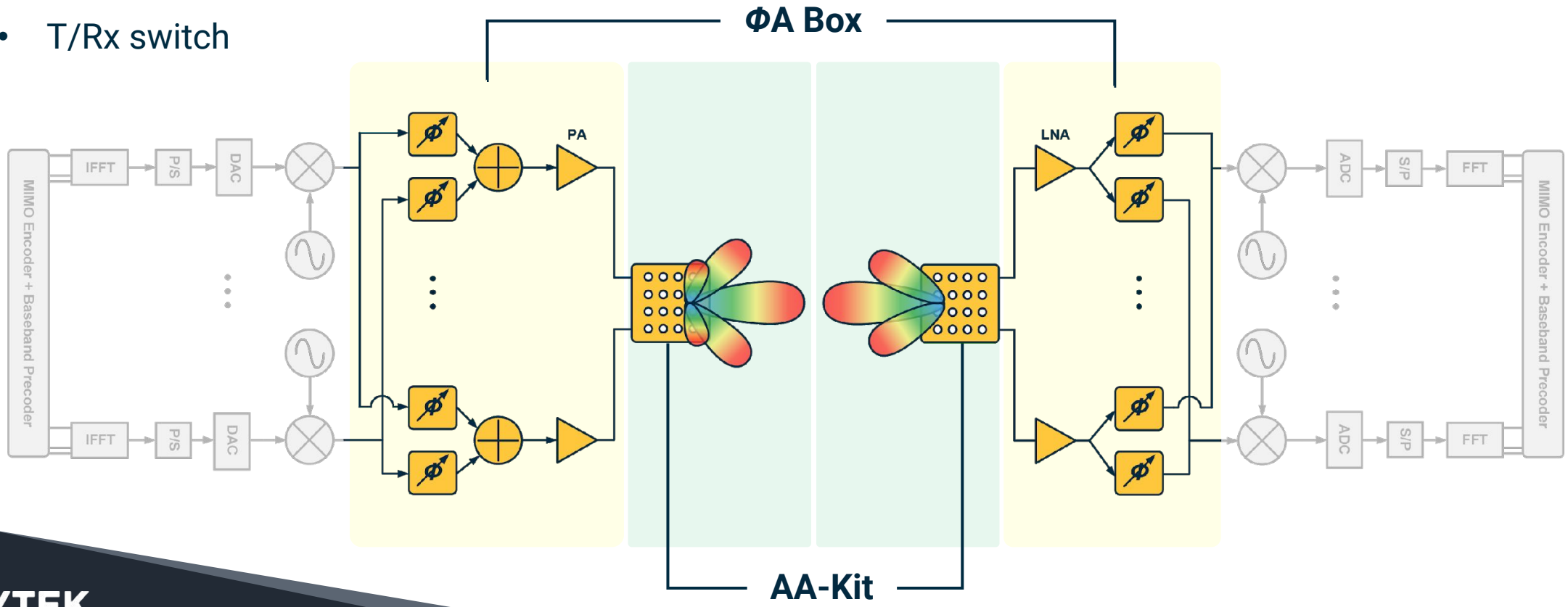
# BBox Architecture

- A ready-to-use 5G mmWave front end
- Antenna array can be designed separately
- Comprehensive system for antenna researchers and 5G protocol developers
- T/Rx switch



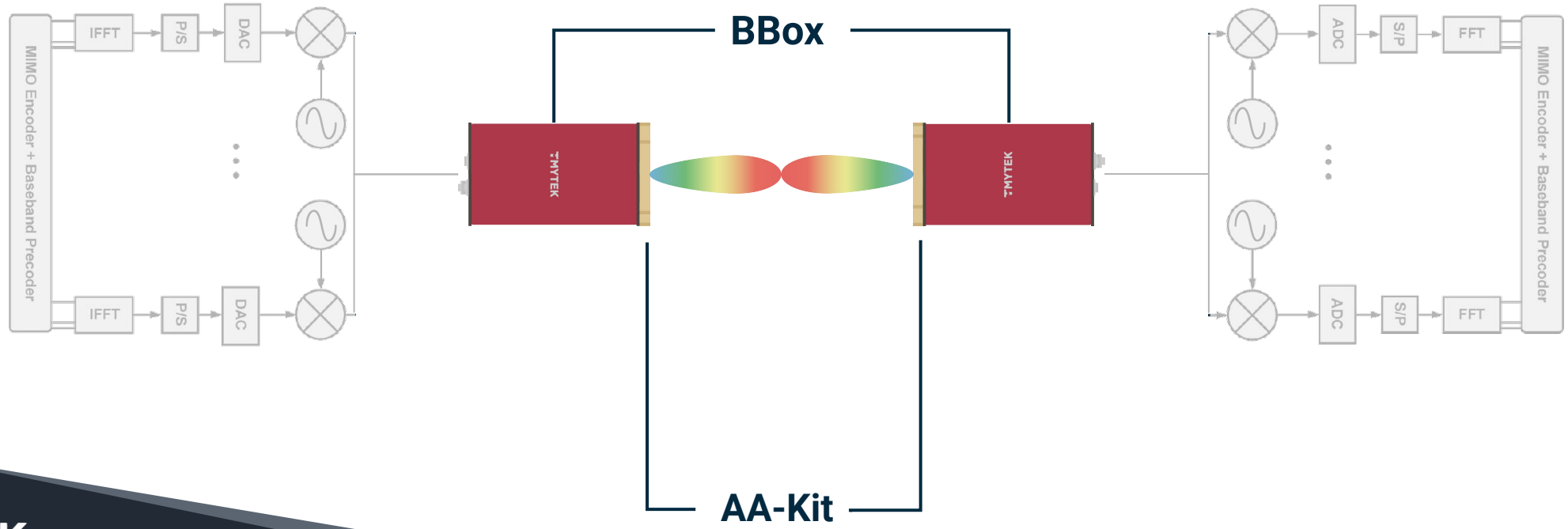
# BBox Architecture

- A ready-to-use 5G mmWave front end
- Antenna array can be designed separately
- Comprehensive system for antenna researchers and 5G protocol developers
- T/Rx switch



# BBox Architecture

- A ready-to-use 5G mmWave front end
- Antenna array can be designed separately
- Comprehensive system for antenna researchers and 5G protocol developers
- T/Rx switch



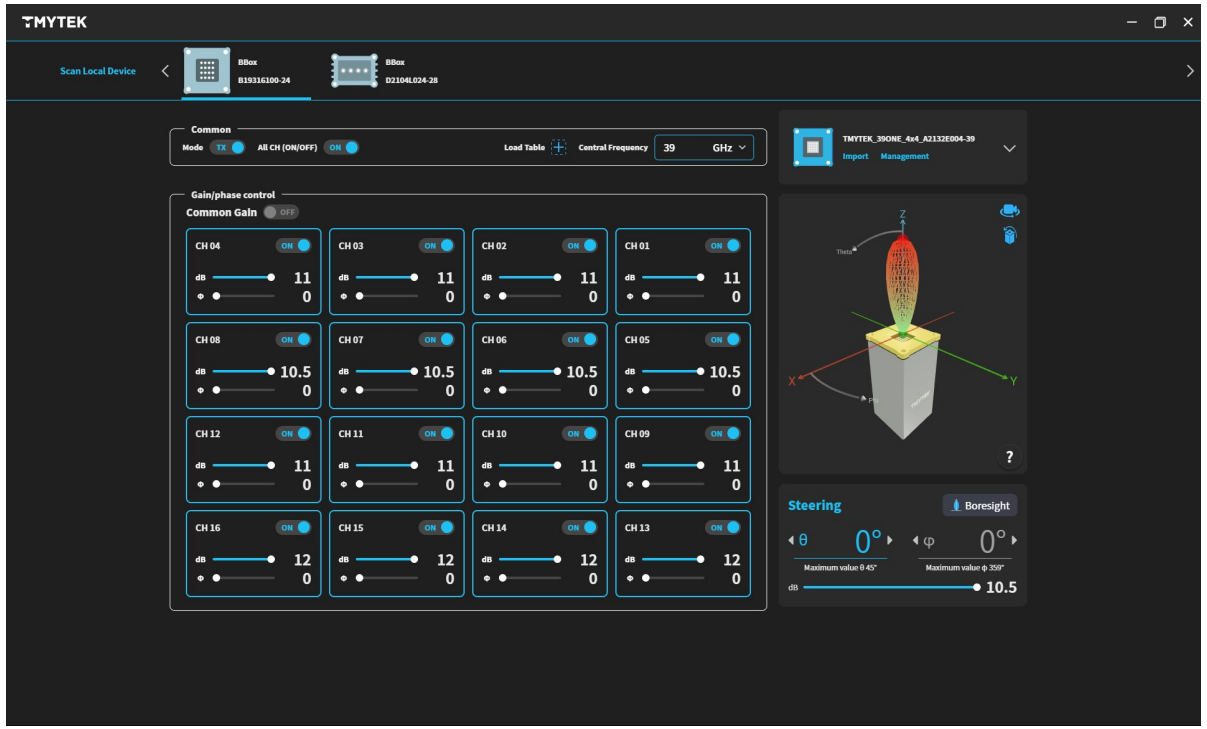
# BBox Brief Introduction

318 x 257 x 152 $mm^3$


TMYTEK

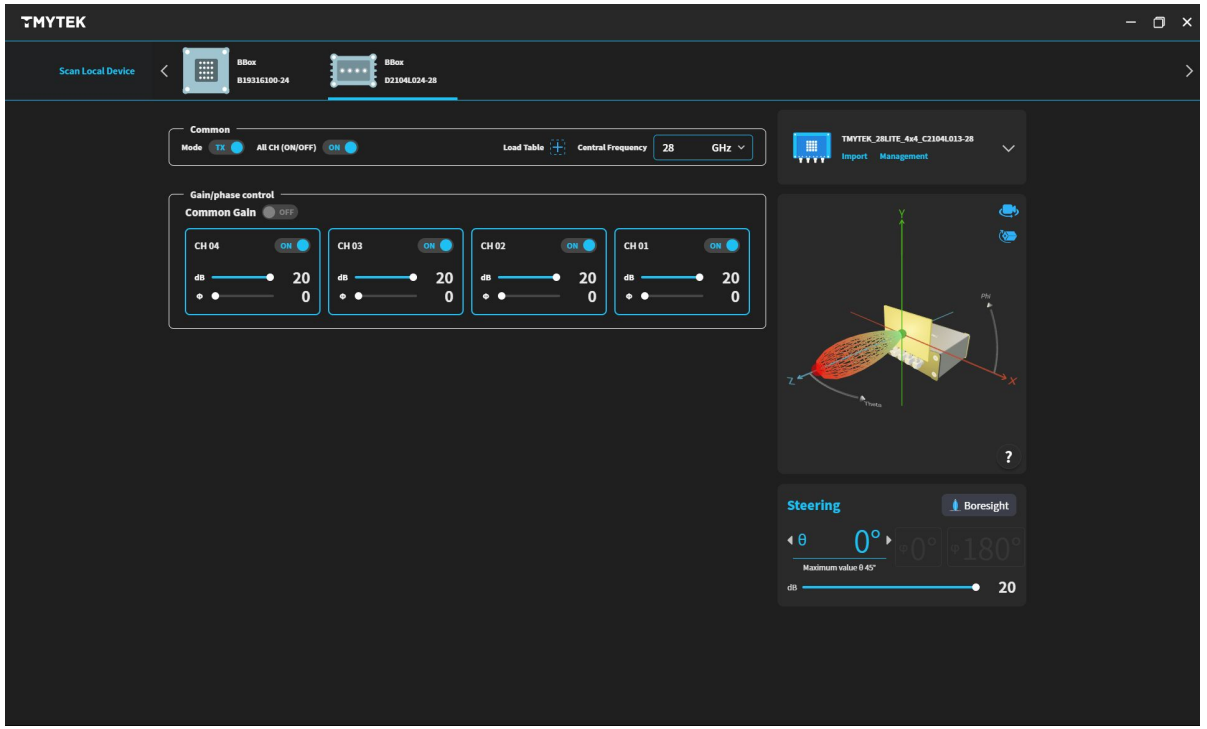
# BBox Software GUI

- Simple beam steering control
- Individual channel control




BBox One

- Customized antenna setting



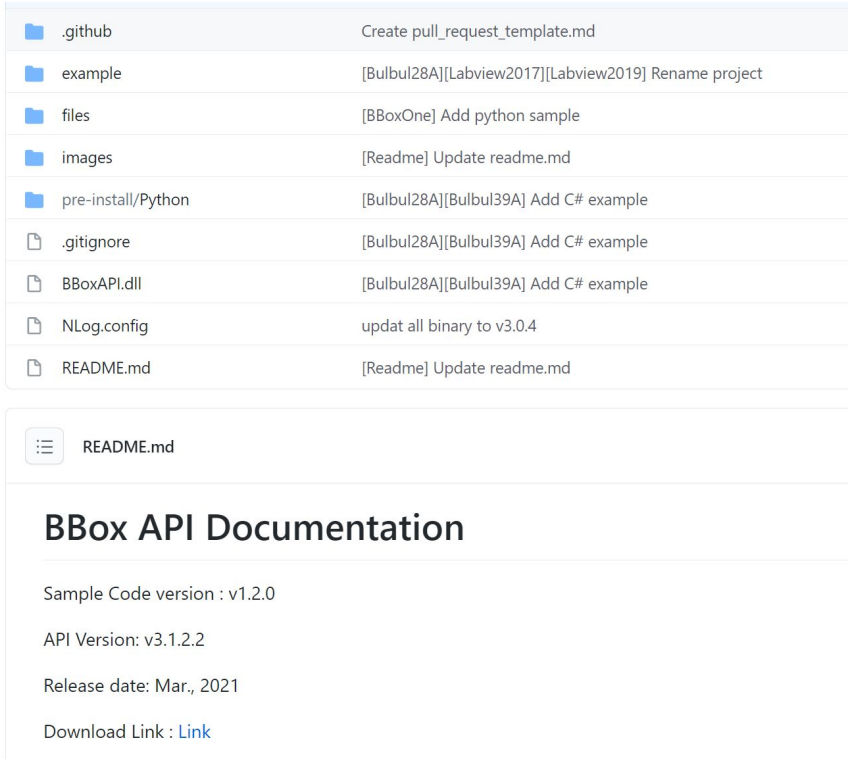

BBox Lite

TMYTEK

# BBox Software API

Sample code : Python, C++, C#, Labview

Website : https://github.com/tmytek/bbox-api



| | |
|---|---|
| .github | Create pull_request_template.md |
| example | [Bulbul28A][Labview2017][Labview2019] Rename project |
| files | [BBoxOne] Add python sample |
| images | [Readme] Update readme.md |
| pre-install/Python | [Bulbul28A][Bulbul39A] Add C# example |
| .gitignore | [Bulbul28A][Bulbul39A] Add C# example |
| BBoxAPI.dll | [Bulbul28A][Bulbul39A] Add C# example |
| NLog.config | updat all binary to v3.0.4 |
| README.md | [Readme] Update readme.md |

README.md

## BBox API Documentation

Sample Code version : v1.2.0

API Version: v3.1.2.2

Release date: Mar., 2021

Download Link : Link

## Documentation

### Python

BBoxOne Document

BBoxLite Document

### C++

BBoxOne Document

BBoxLite Document

### C#

BBoxOne Document

BBoxLite Document

### Labview

BBoxLite Document

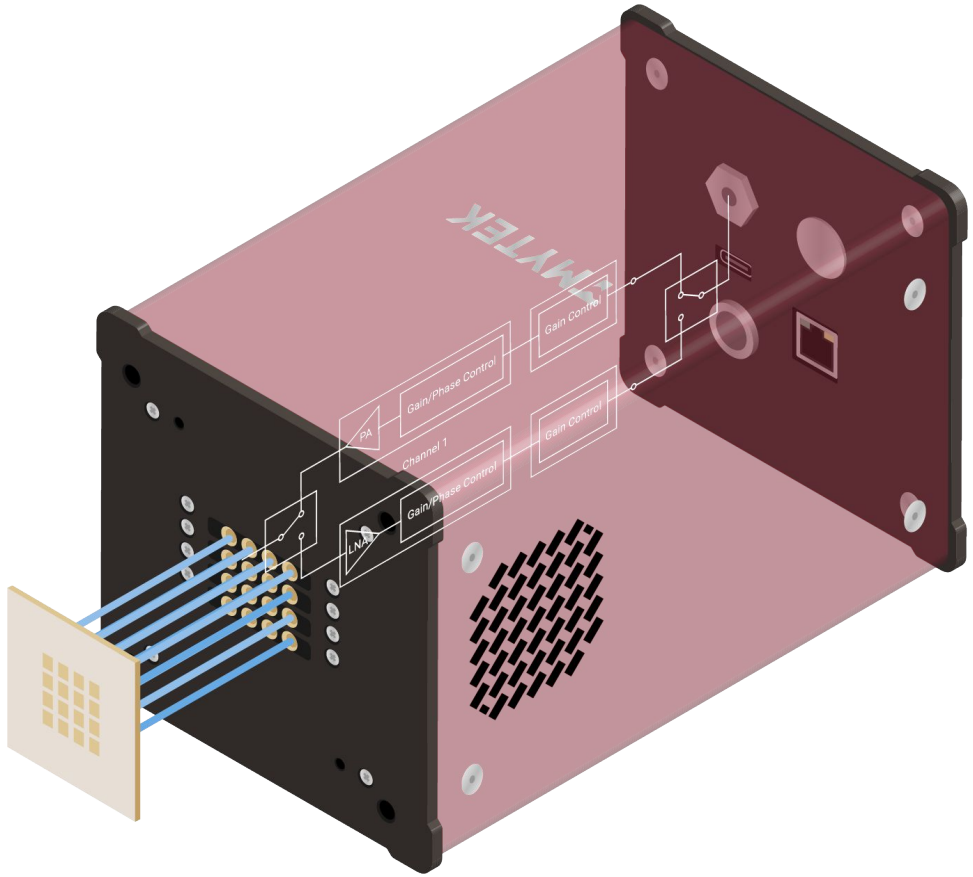
BBoxOne Document

TMYTEK

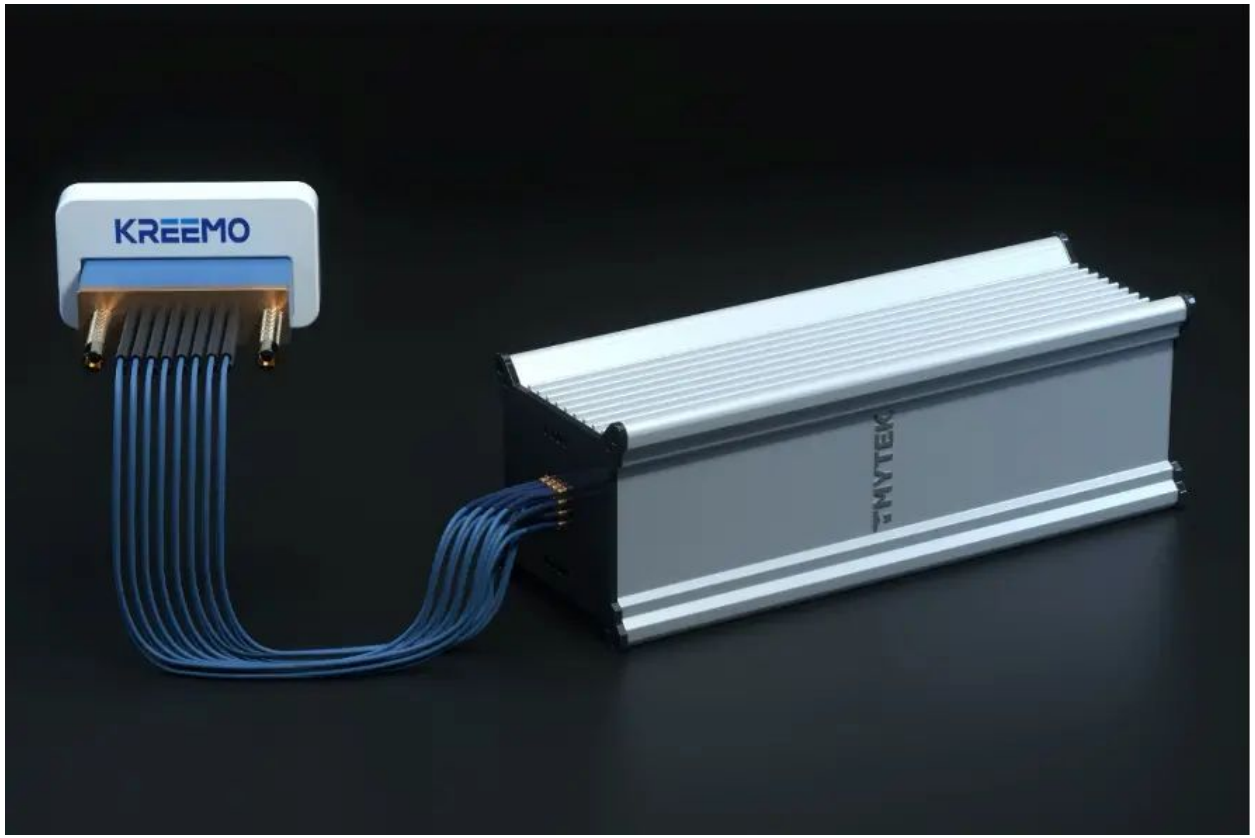
# mmWave Antenna Design

- Built-in 16 independent RF control channels (Switch, PA, LNA, phase shifter)
- Small size SMPM connect is convenient for antenna designers to connect and use

After removing the AA-Kits of the BBox, you can attach **the array antenna of your own design**. The Antenna port reserved by our BBox is of the Male SMPM connector type. There are 16 channels in total, and each channel is independent to adjust the phase and amplitude.

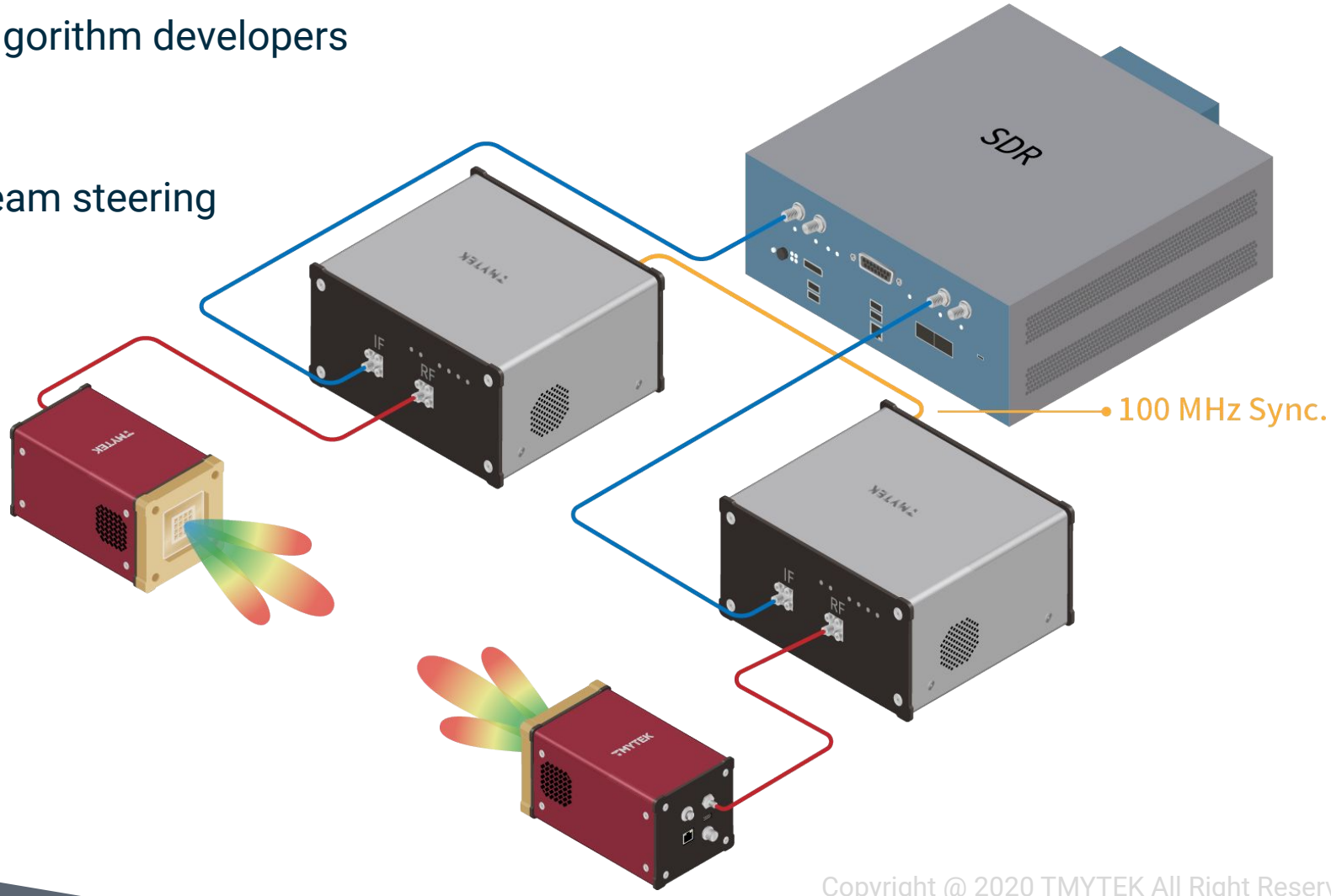


# Application: mmWave Antenna Design

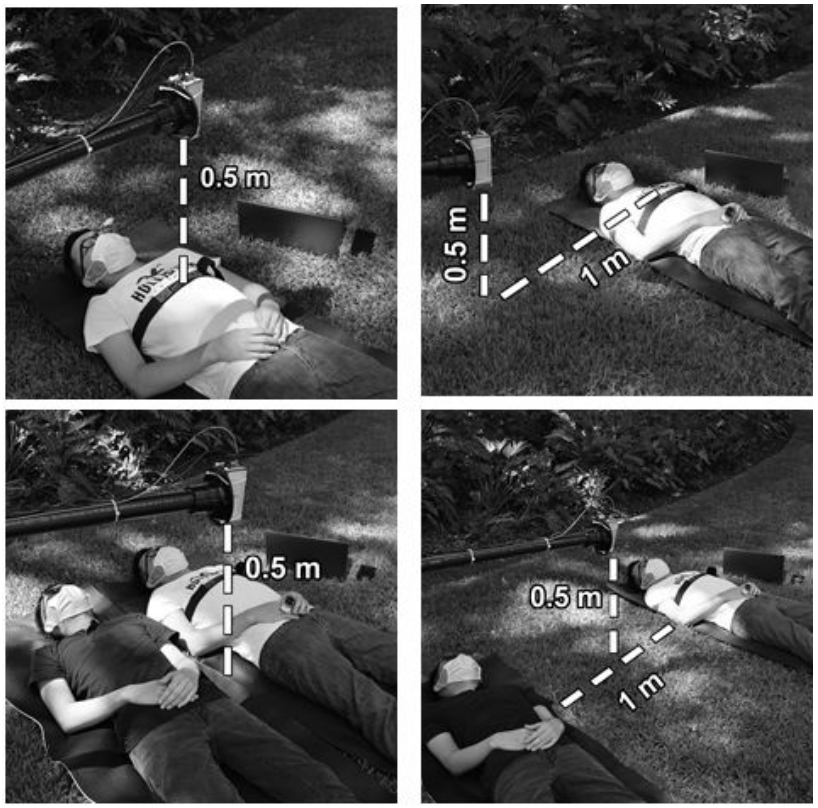



# Beam Steering Algorithm

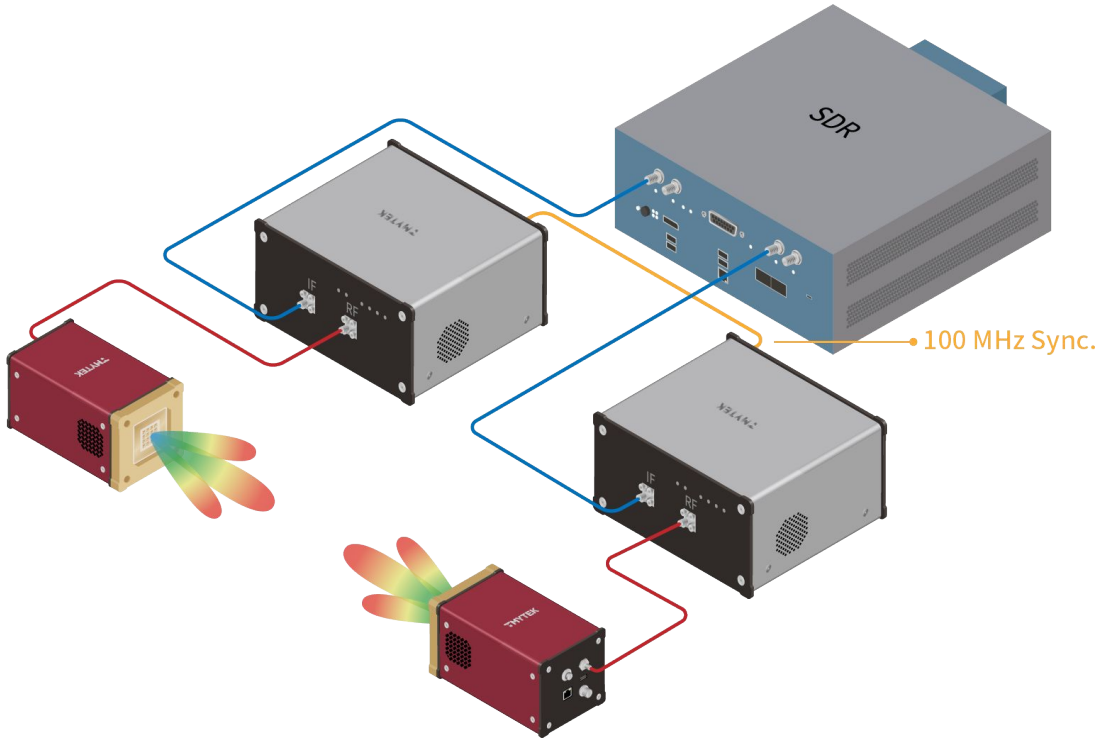
- Provide sample API control for algorithm developers (python, C++, C#, Labview)
- Wide angle and high precision beam steering



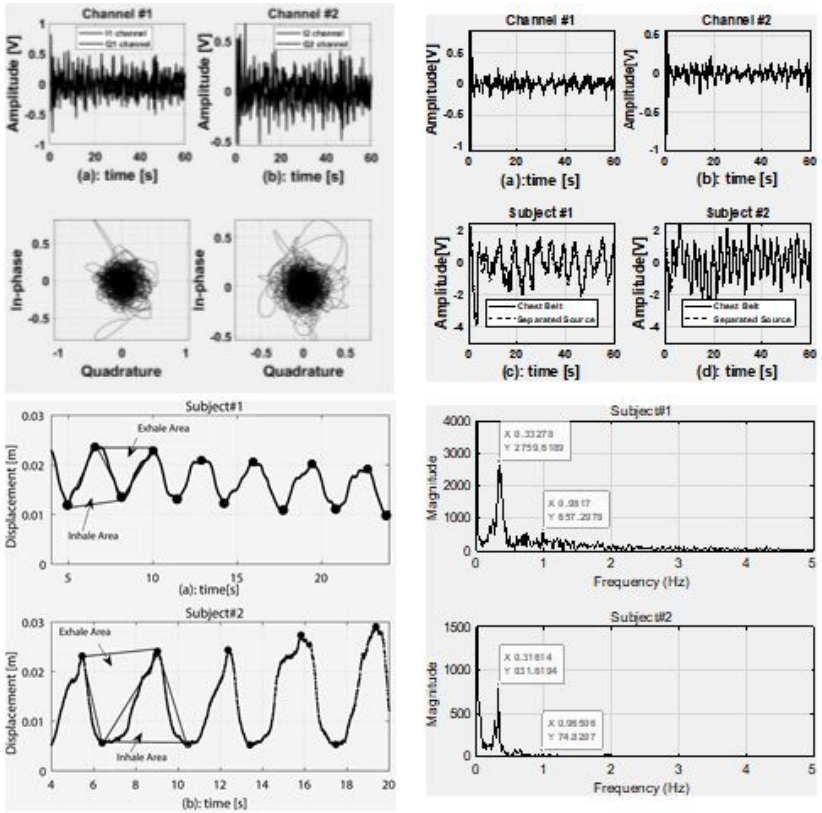
# Application: Non-contact Vital Signal Detection OF COVID-19




Evaluation under single and multiple target scenarios



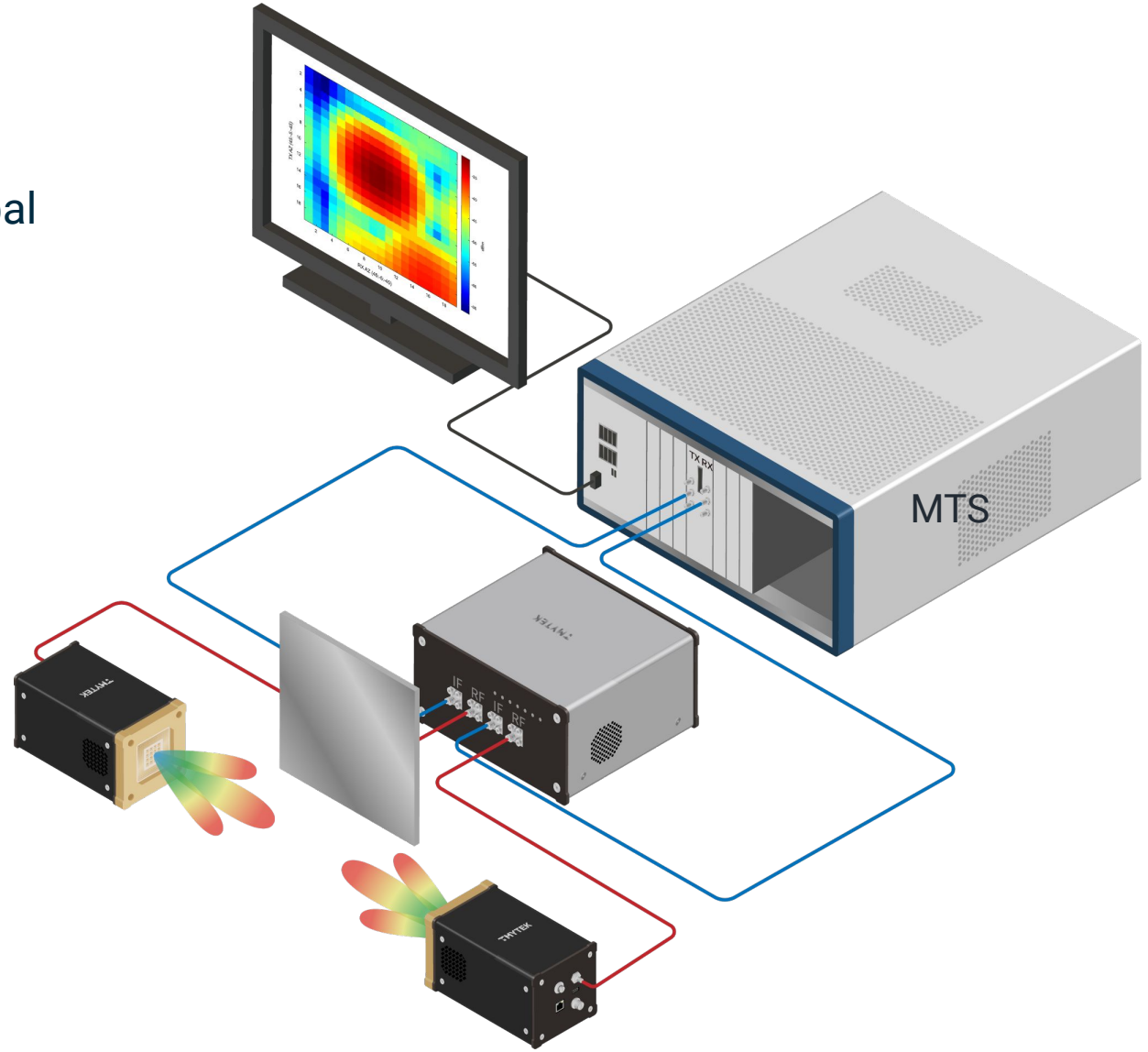
# Application: Non-contact Vital Signal Detection OF COVID-19




Breathing pattern(s) extracted from the channel state information (CSI)

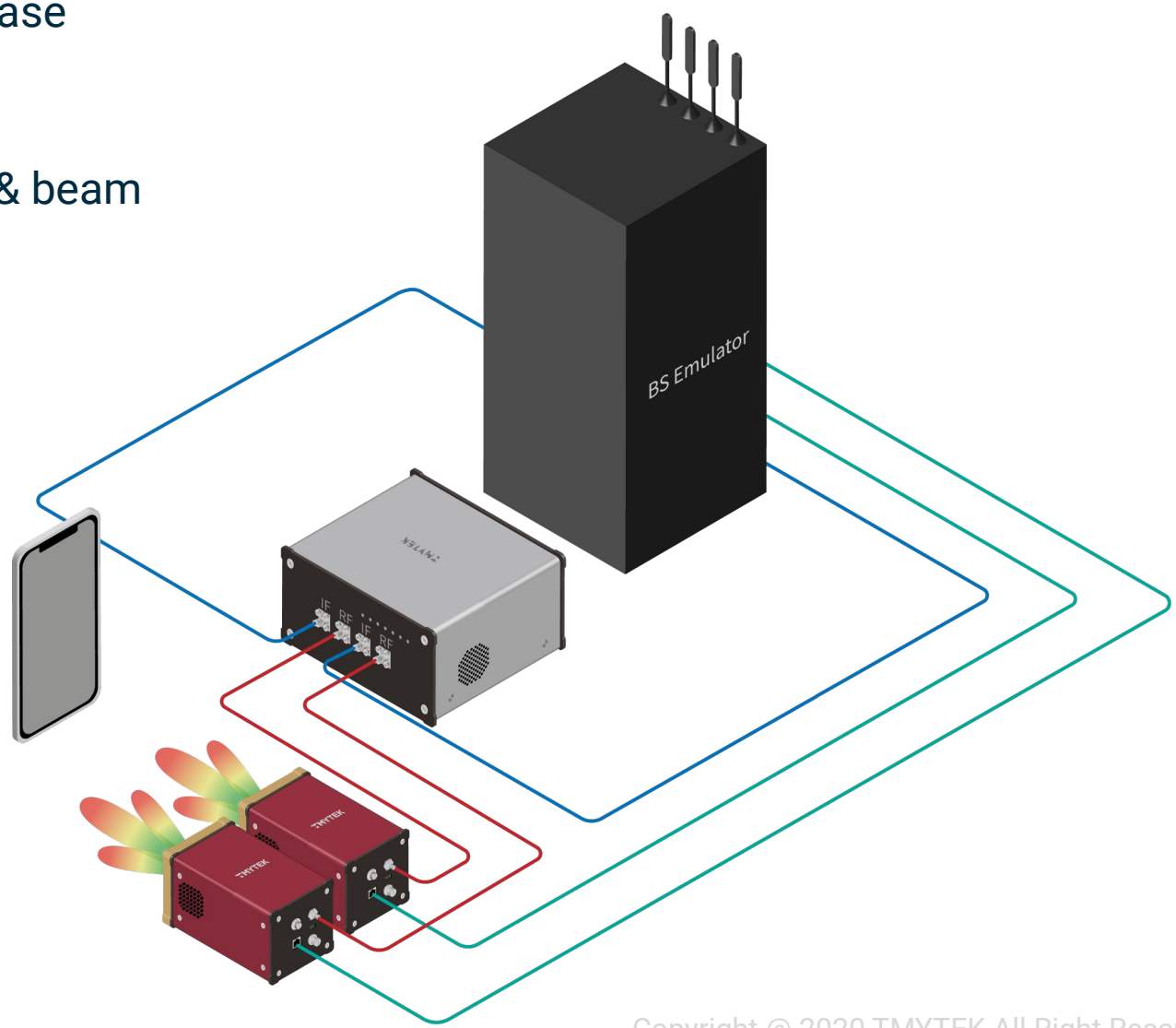
# Channel Sounding

- Faster scanning speed than traditional gimbal
- High resolution and two dimensional scan



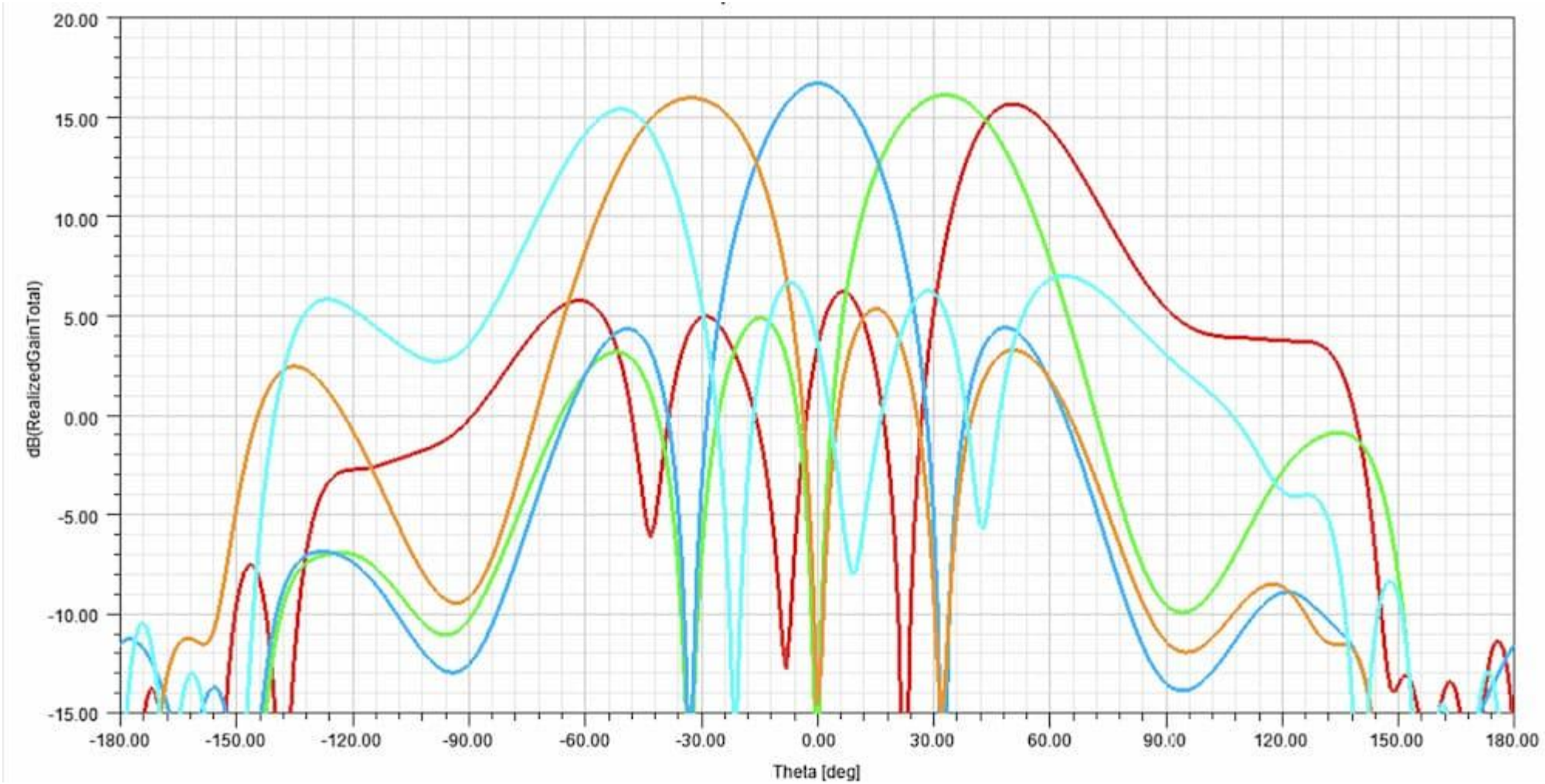
# Base Station Emulator

- Emulate the beamforming behavior between base station and UE communication
- Provide sample API control for beam tracking & beam steering



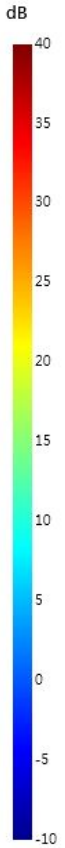

UE
(Smart Phone, CPE, Tablet…)

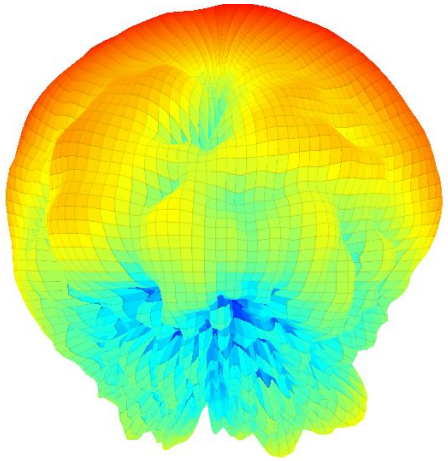
# Beam Pattern Measurement



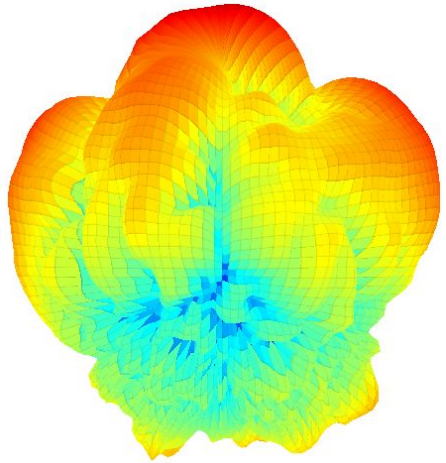

-45° 0° 45°

# Beam Pattern Measurement

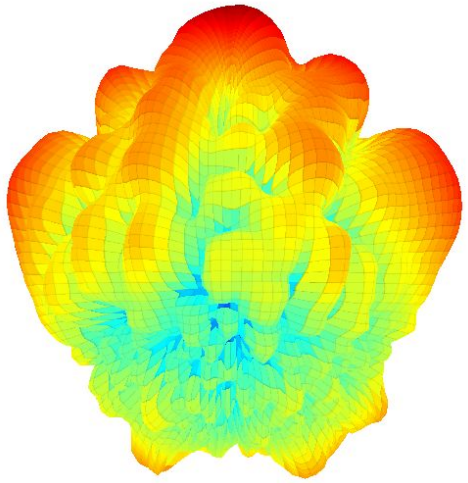


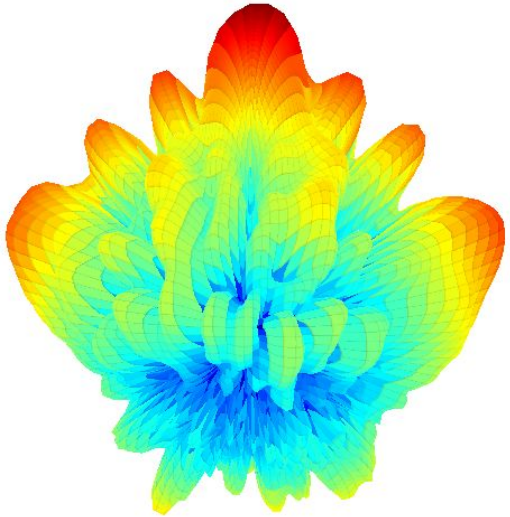
Single Patch



1x2 Array



1x3 Array



1x4 Array

TMYTEK

# THANK YOU!


/TMYTEK

/TMY Technology

www.tmytek.com

886-2-8226-9168

Sales@tmytek.com

Rm. E, 3F., No. 3, Yuandong Rd., Banqiao Dist., New Taipei City 220, Taiwan (R.O.C.)