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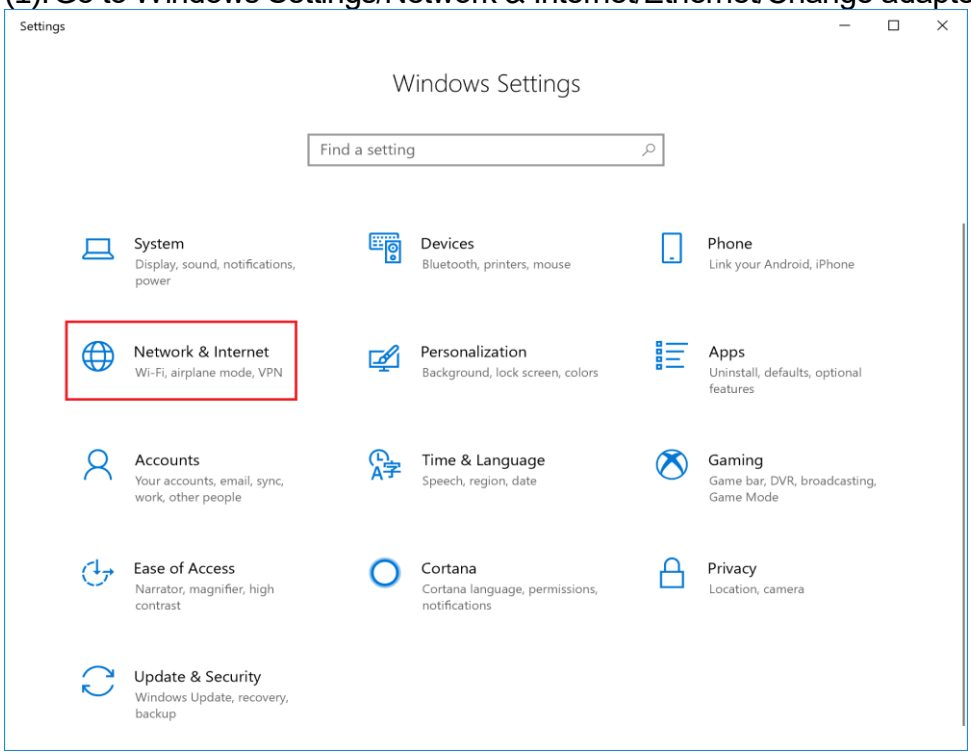
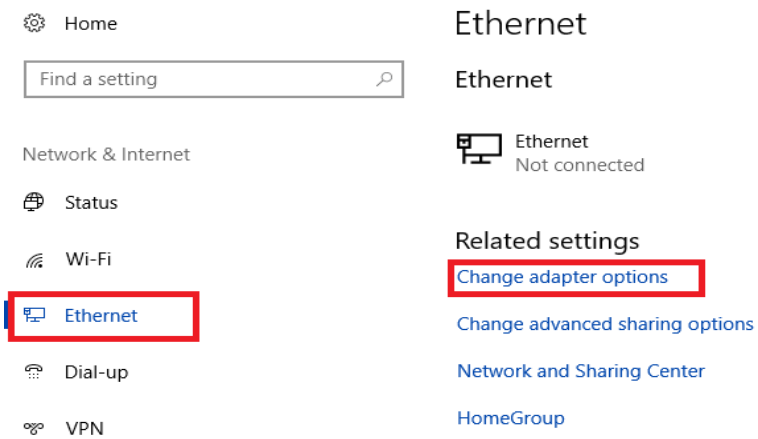
0. Network Environment Setup

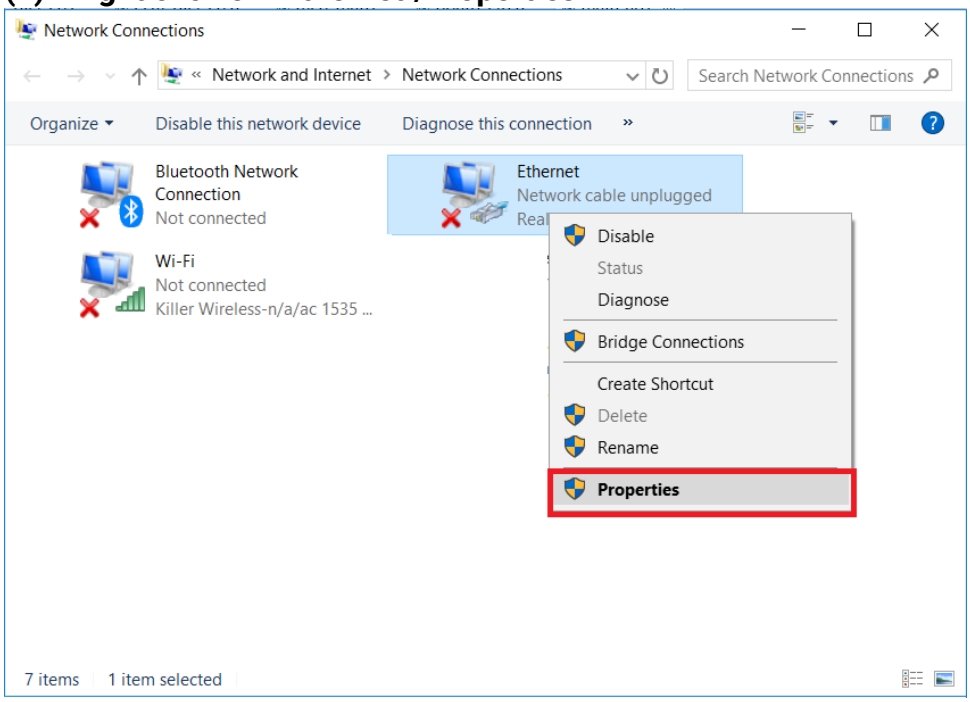
- Network environment settings: If the IP address of the device and PC is assigned by DHCP, this step can be skipped. If the IP address cannot be obtained through DHCP, the domain must be set to 192.168.100.xxx.

(1). Go to Windows Settings/Network & Internet/Ethernet/Change adapter options.

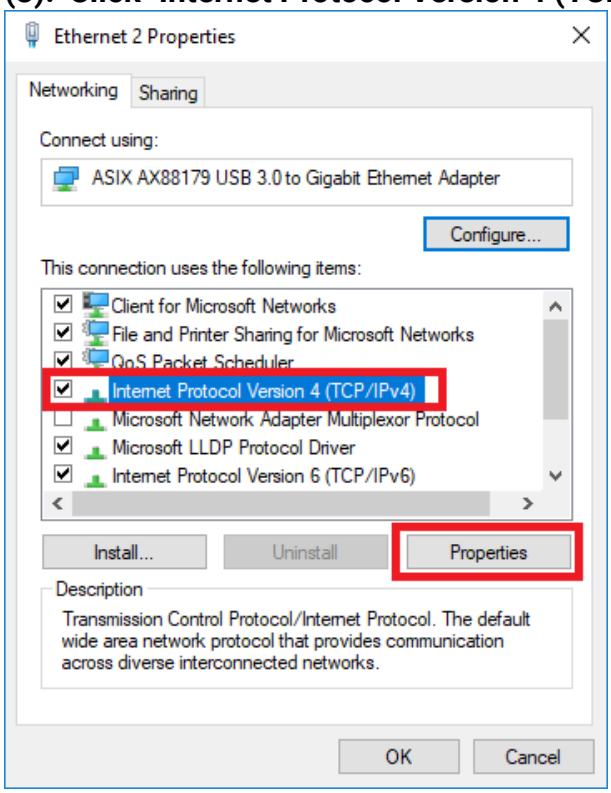




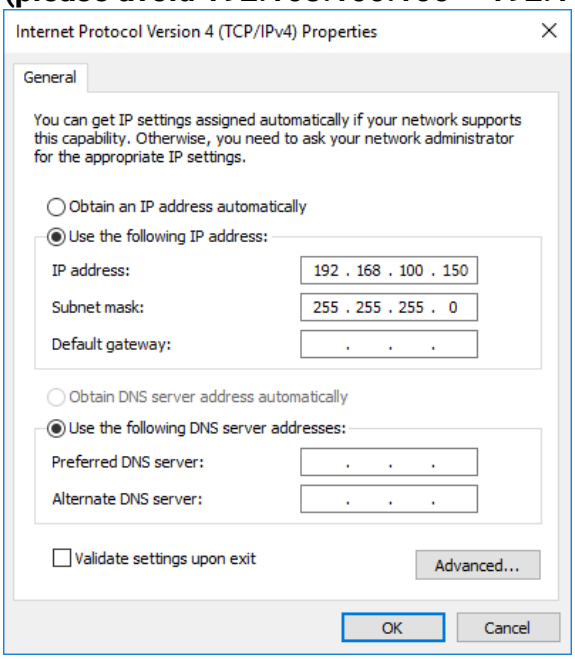
(2). Right click on "Ethernet"/Properties



(3). Click "Internet Protocol Version 4 (TCP/IPv4)", and then click "Properties".

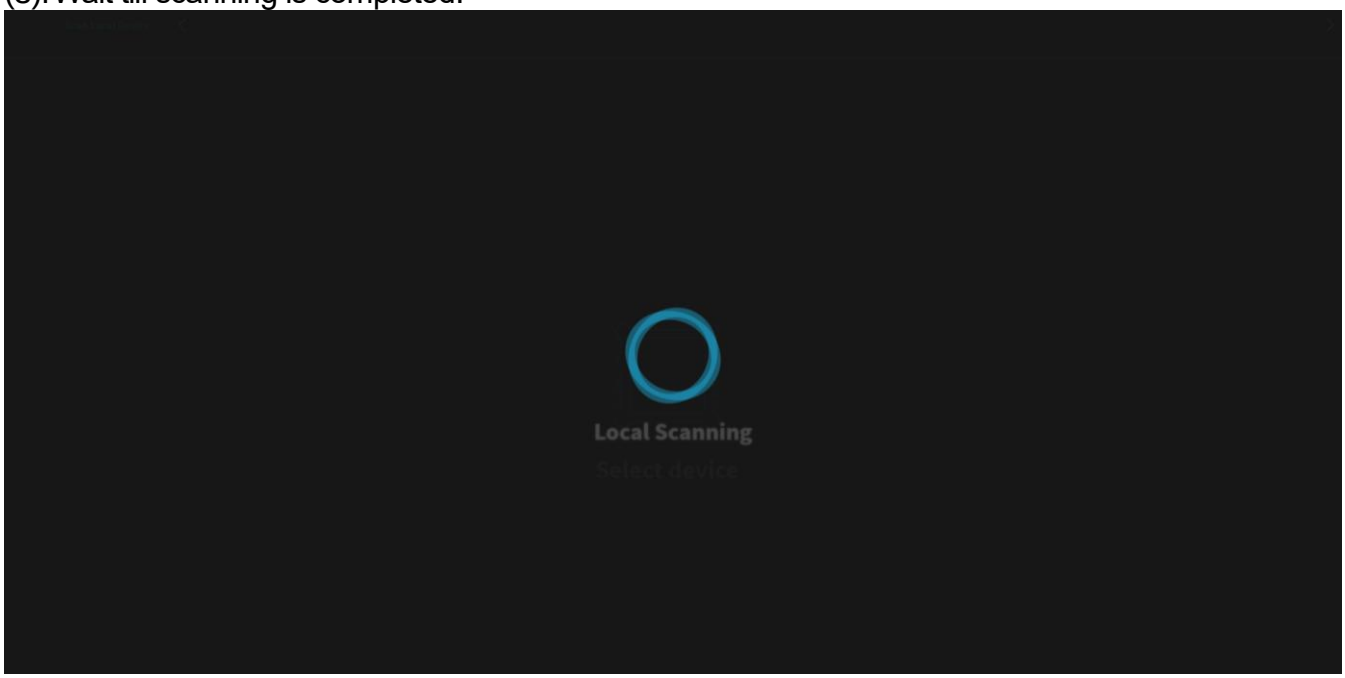


(4). Enter the IP address 192.168.100.xxx
(please avoid 192.168.100.100 ~ 192.168.100.120)

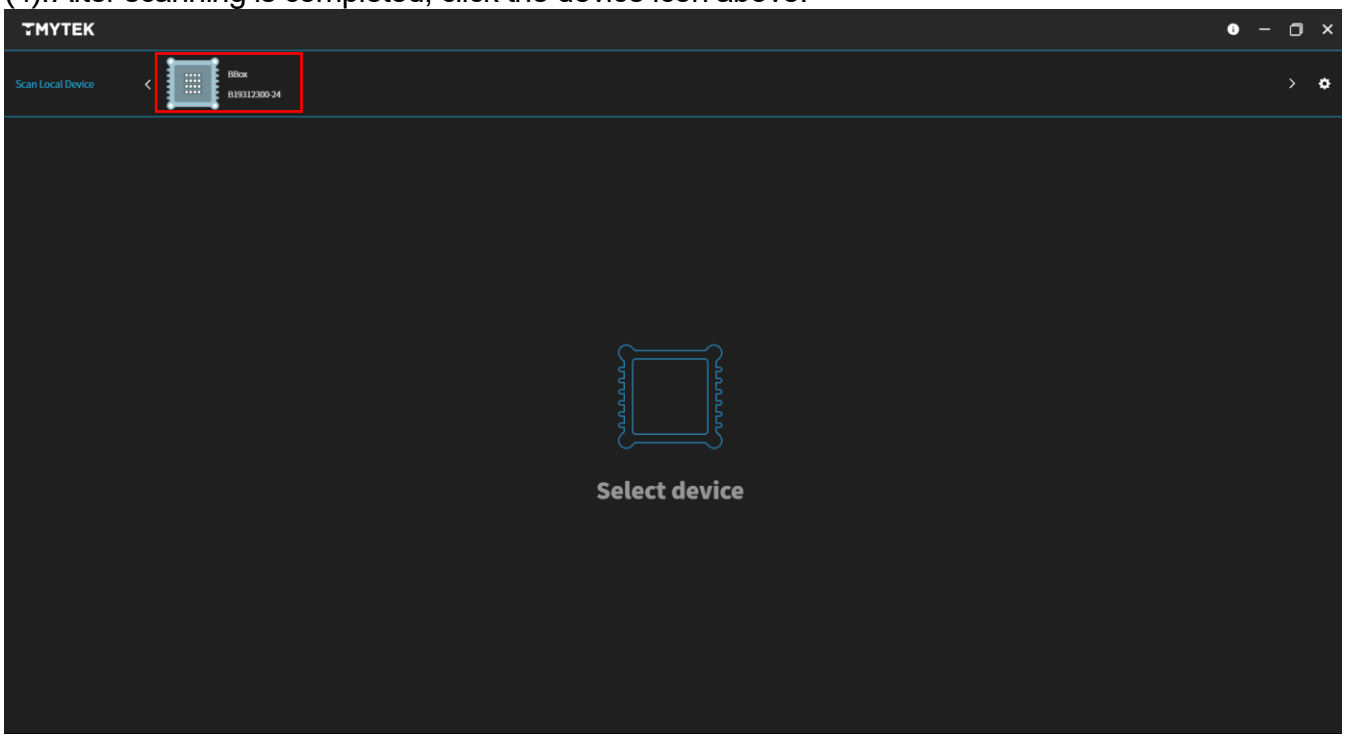


1. BBox One

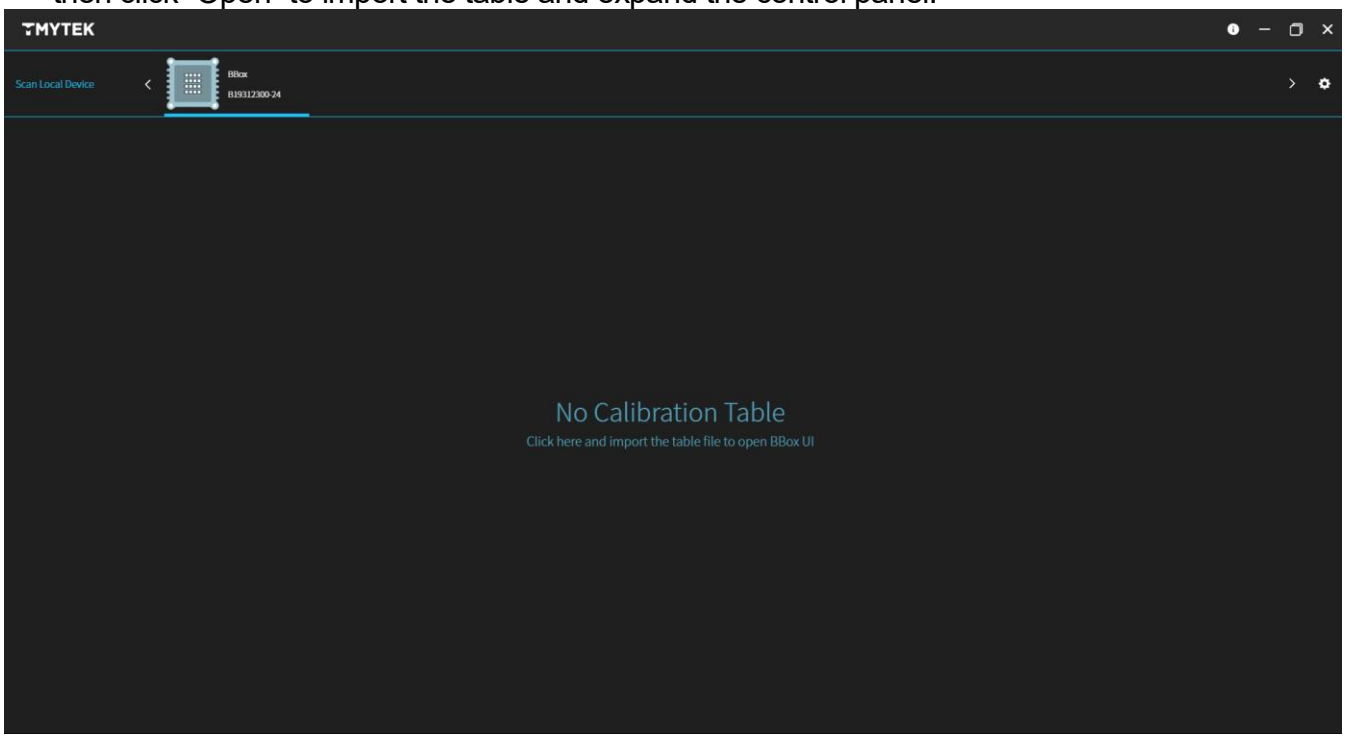
(1). Connect BBox One and PC with Ethernet, and then turn on the power of BBox One.
(2). Open TMXLAB Kit.
(3). Wait till scanning is completed.

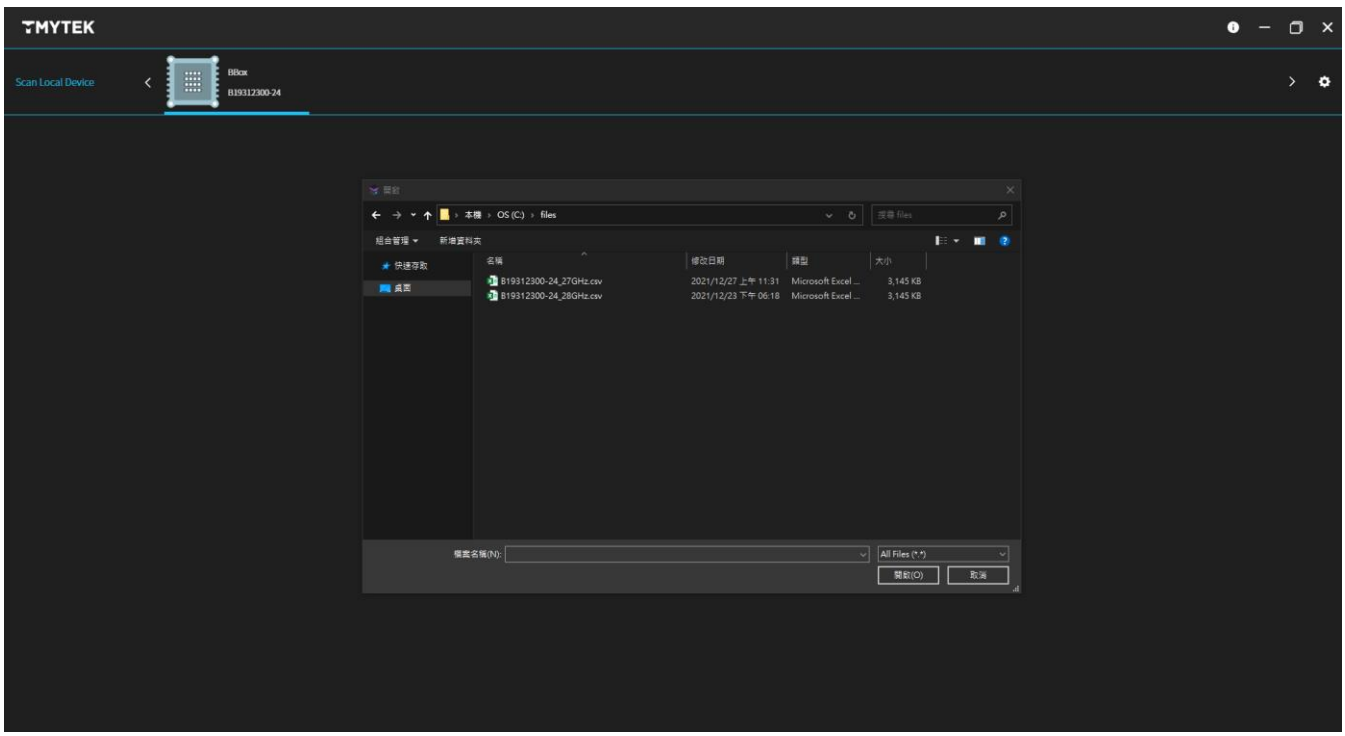


(4). After scanning is completed, click the device icon above.

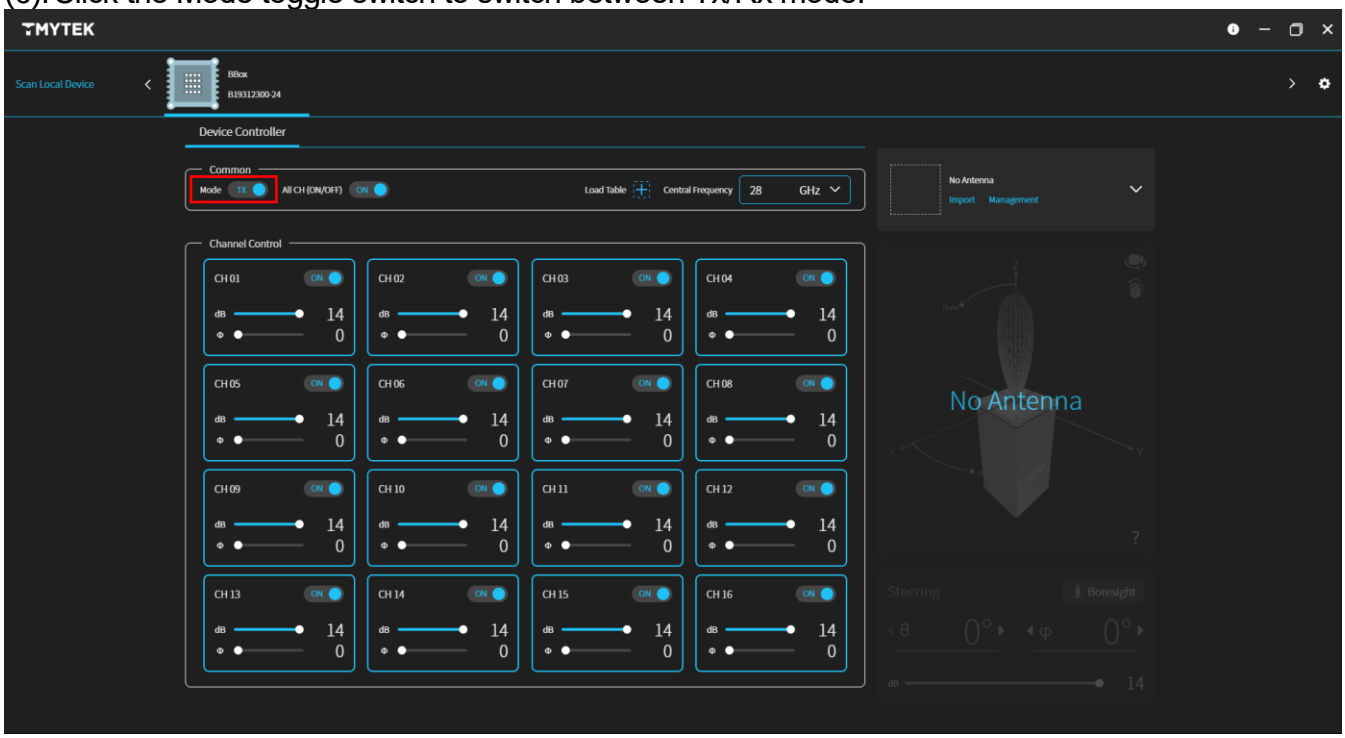


(5). If the table of the clicked device has not been imported, the screen will show “No Calibration Table.” Click anywhere to open the file selection window, choose the file(s) to be imported, and then click “Open” to import the table and expand the control panel.

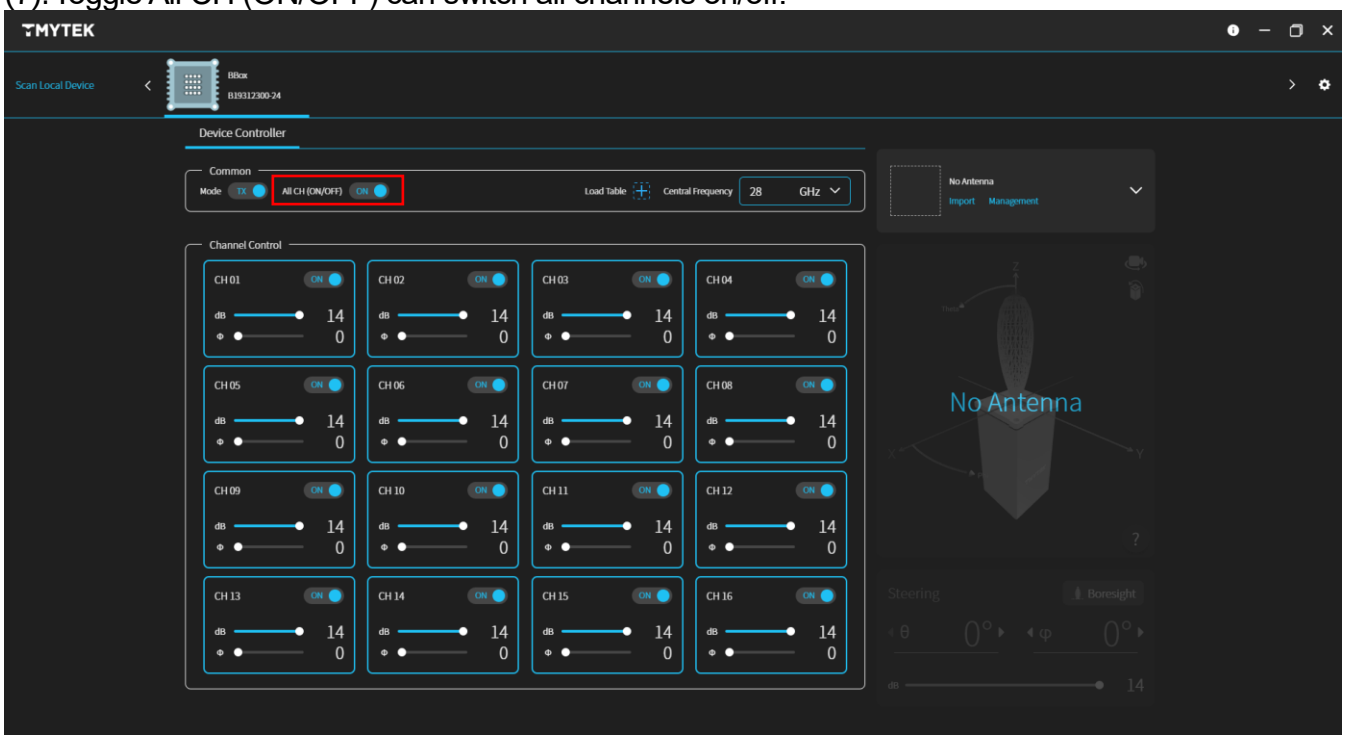




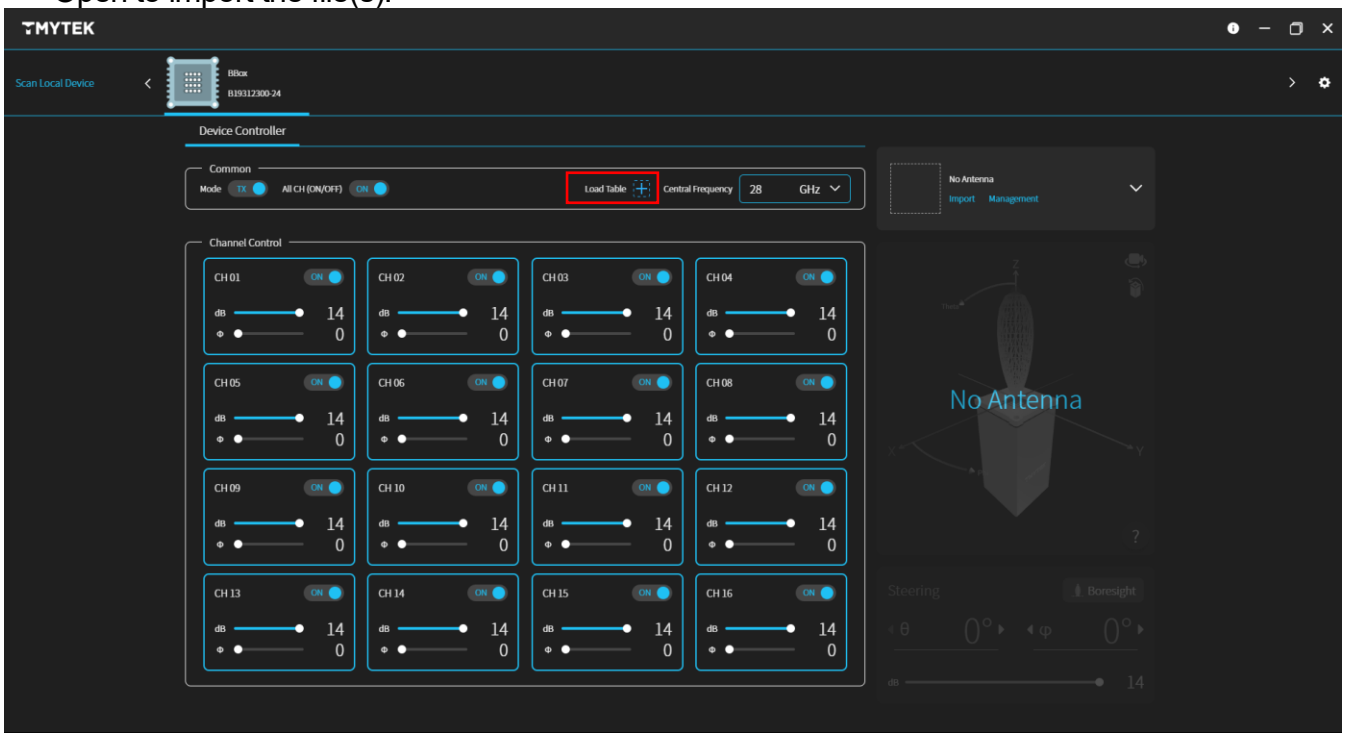
(6). Click the Mode toggle switch to switch between Tx/Rx mode.



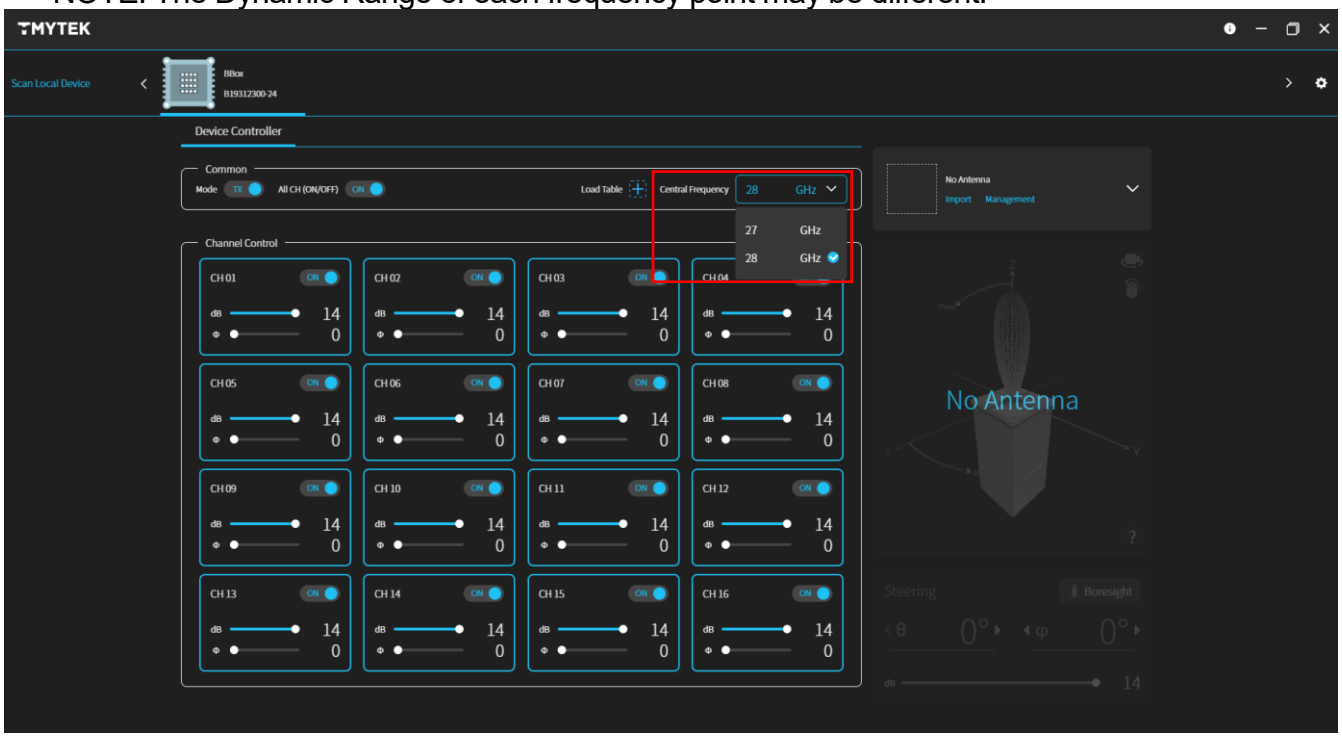
(7). Toggle All CH (ON/OFF) can switch all channels on/off.



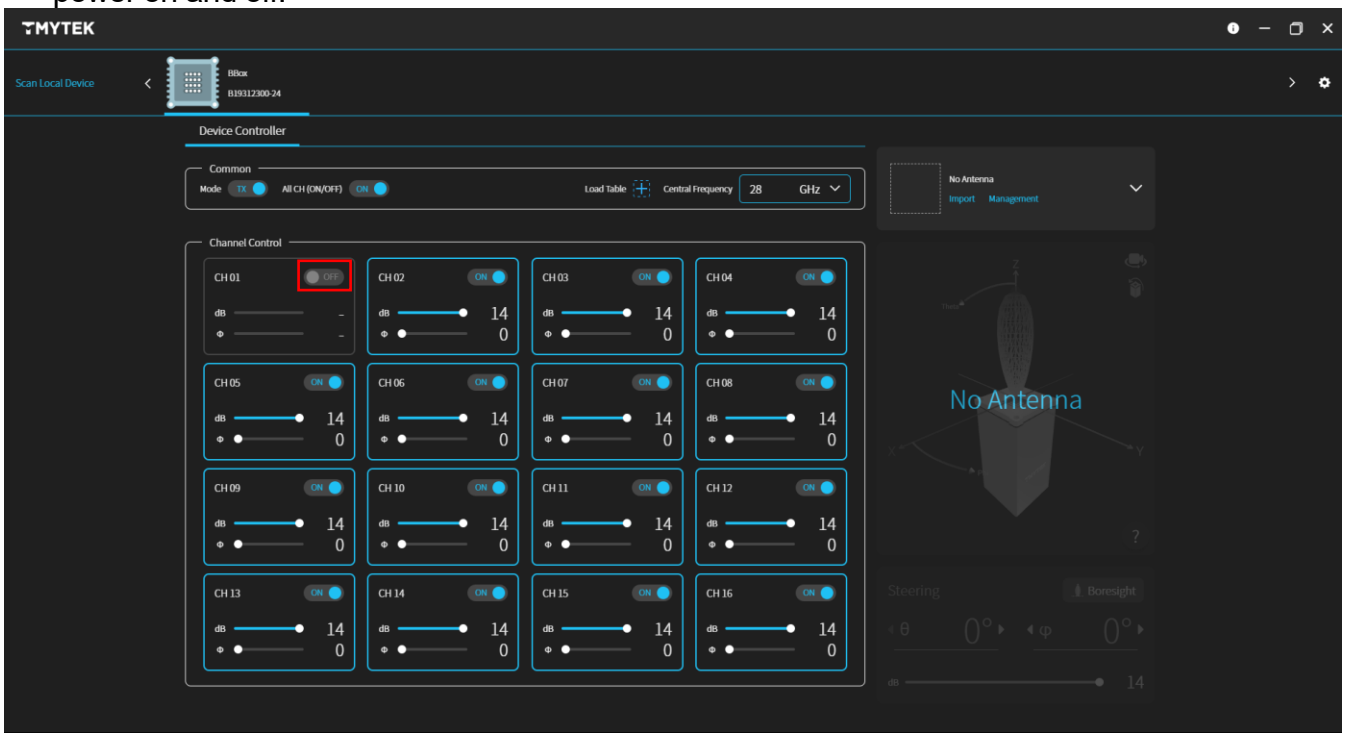
(8). Click "Load Table" to import the calibration table. After selecting the file(s) to be imported, click Open to import the file(s).



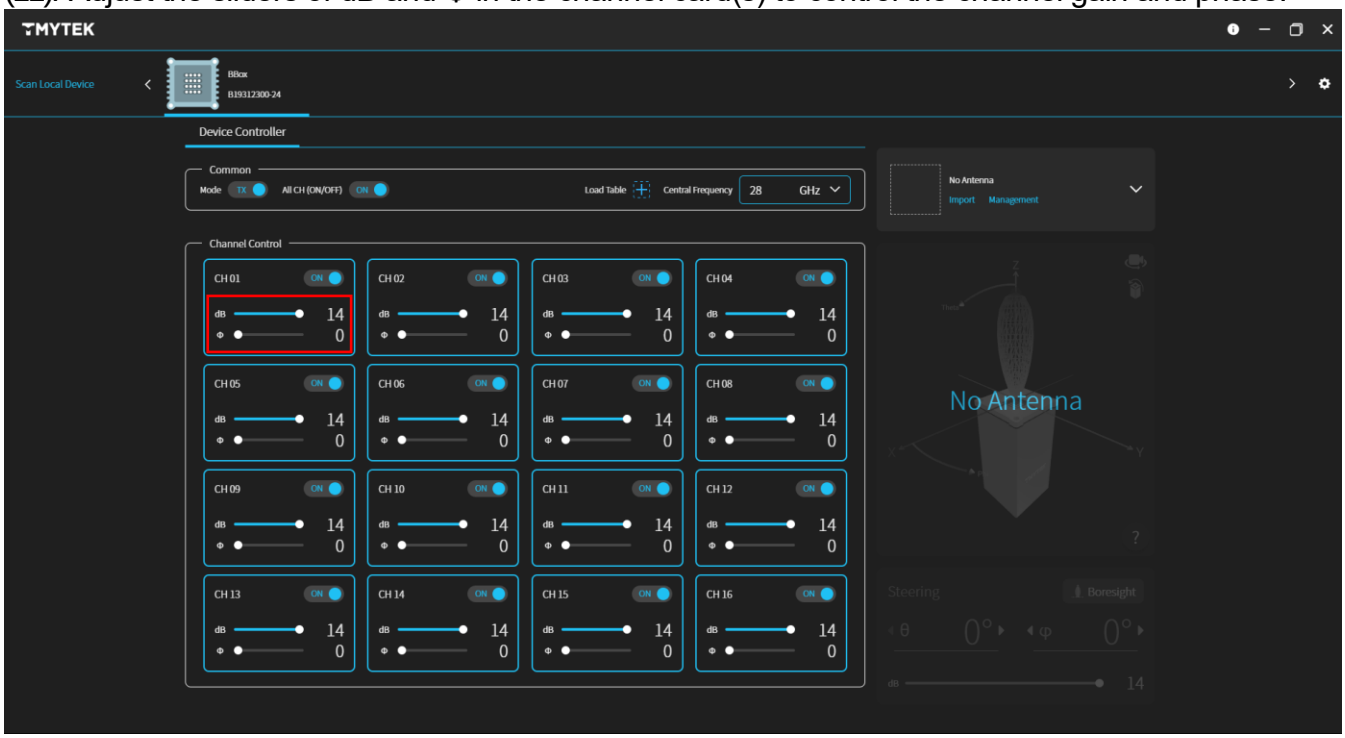
(9). All available frequency points are listed in the Central Frequency drop-down menu. You can choose the desired one.
NOTE: The Dynamic Range of each frequency point may be different.



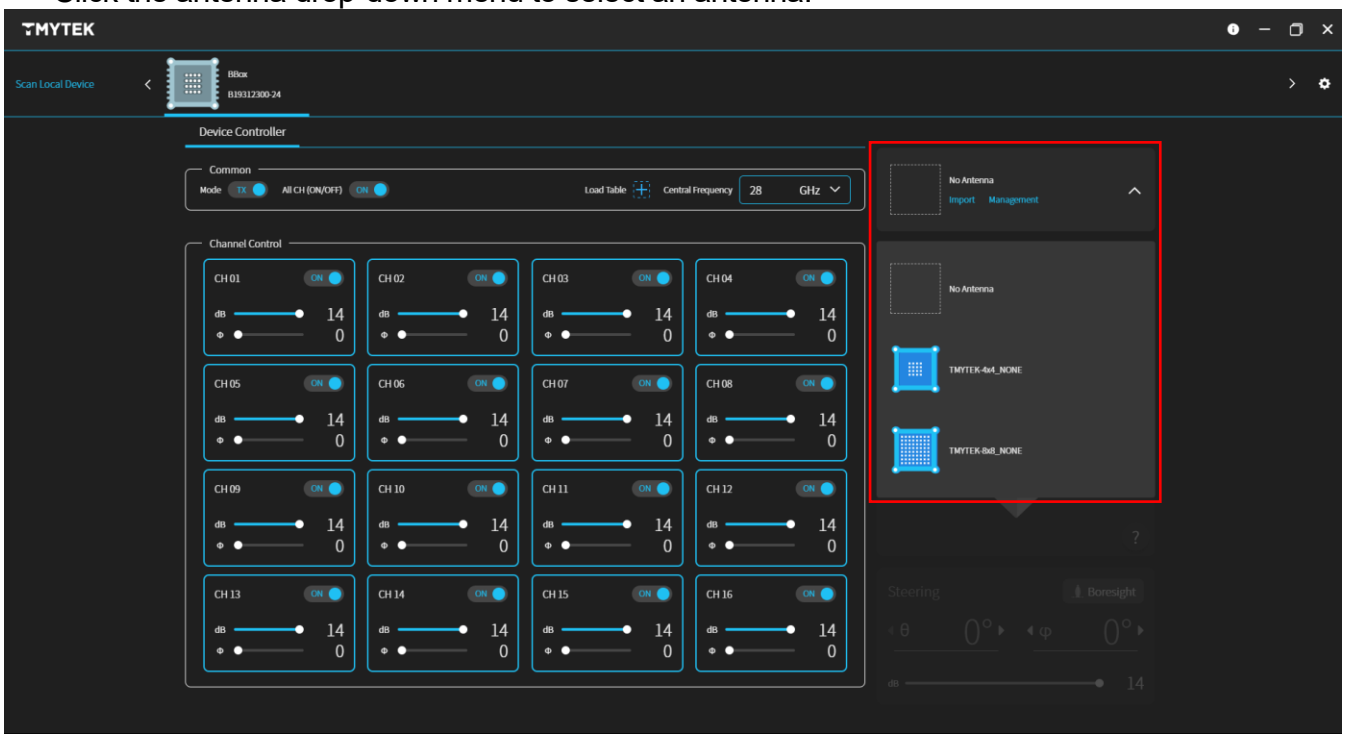
(10). Click the toggle switch in the upper right corner of the channel card(s) to switch the channel power on and off.



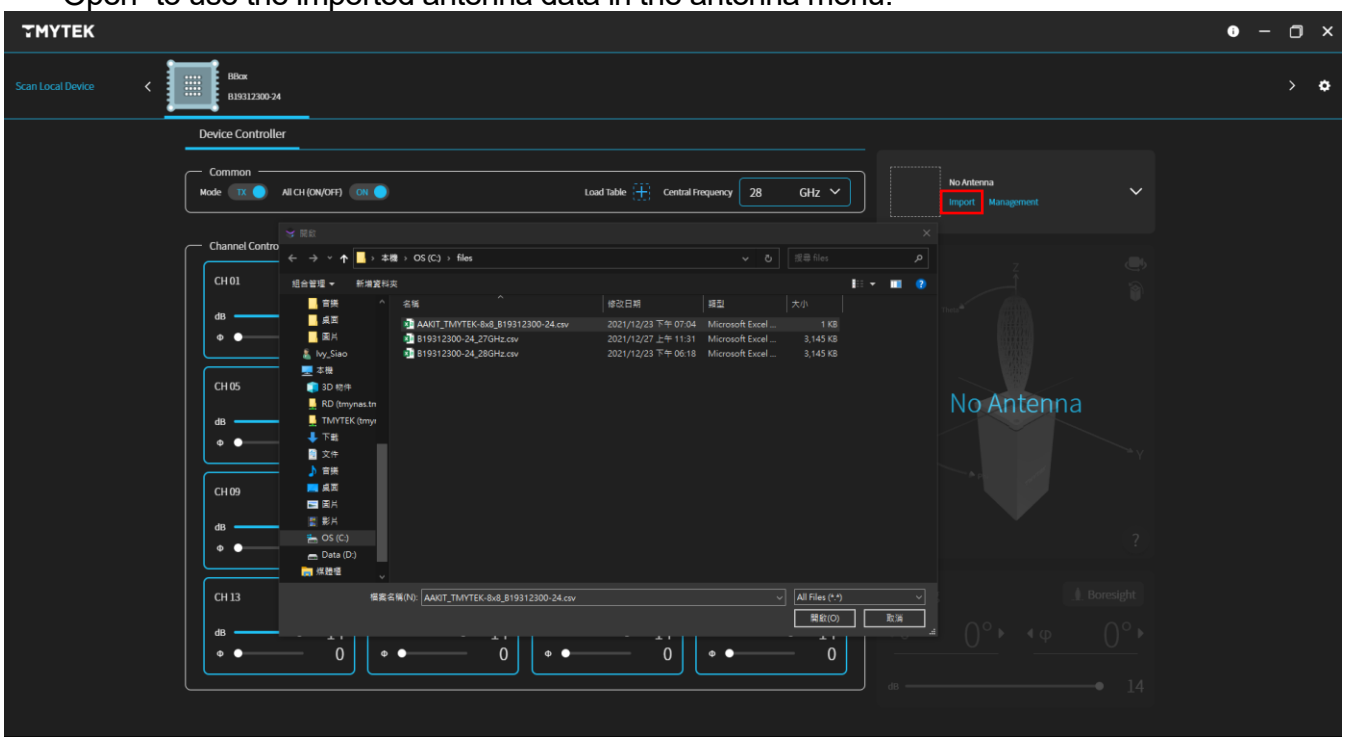
(11). Adjust the sliders of dB and Φ in the channel card(s) to control the channel gain and phase.



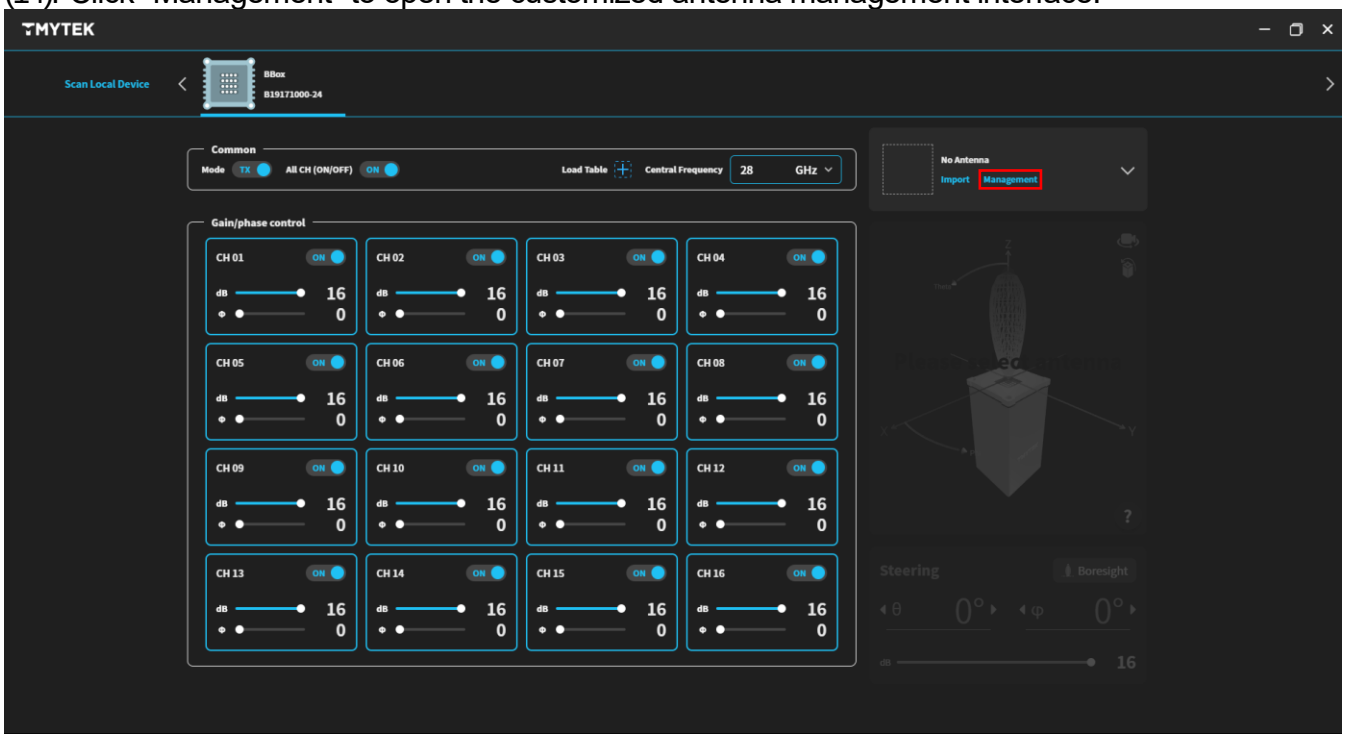
(12). If no antenna is selected, only the channel control mode is functional. The beam steering function is only available after an antenna is selected.
Click the antenna drop-down menu to select an antenna.



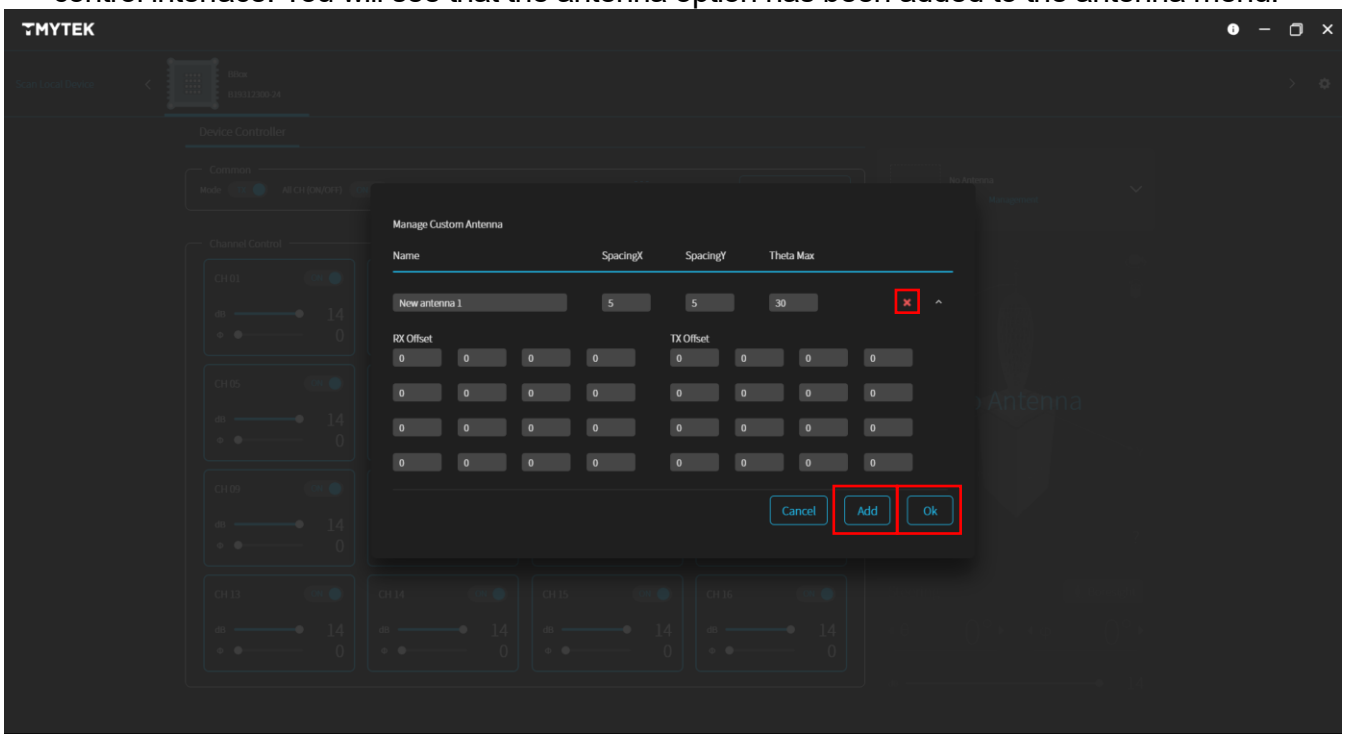
(13). Click “Import” to open the file selection window. Select the file(s) to be imported and click “Open” to use the imported antenna data in the antenna menu.



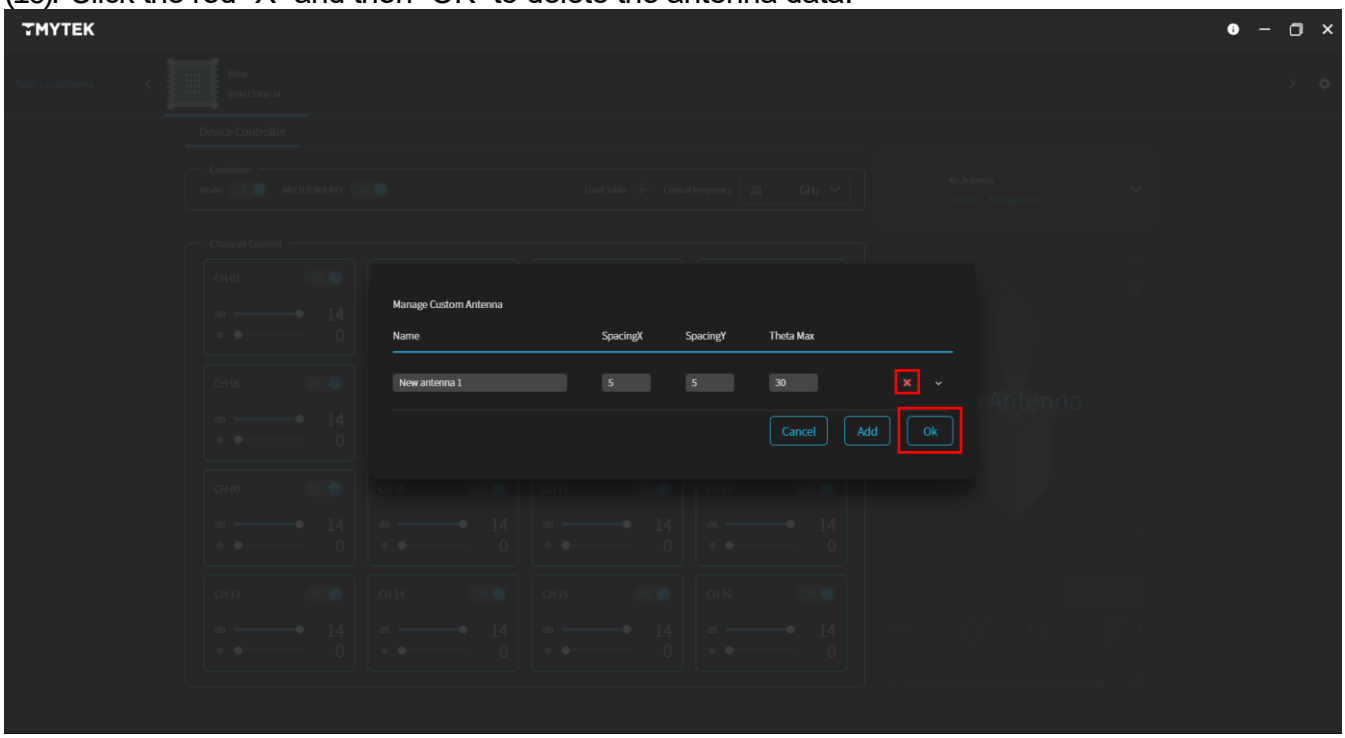
(14). Click "Management" to open the customized antenna management interface.



(15). Click "Add" to enter the add mode.
Enter following in order: antenna name (for identification, the name cannot be repeated), SpacingX (the pitch-to-pitch spacing between two adjacent antenna elements on the X-coordinate, Unit: mm), SpacingY (the pitch-to-pitch spacing between two adjacent antenna elements on the Y-coordinate, Unit: mm), theta max angle, and phase offset of each channel. Click the arrow on the right to expand/collapse the offset input box.
After completing the above action, click "Ok" to save the input data and return to the main control interface. You will see that the antenna option has been added to the antenna menu.



(16). Click the red "X" and then “OK” to delete the antenna data.

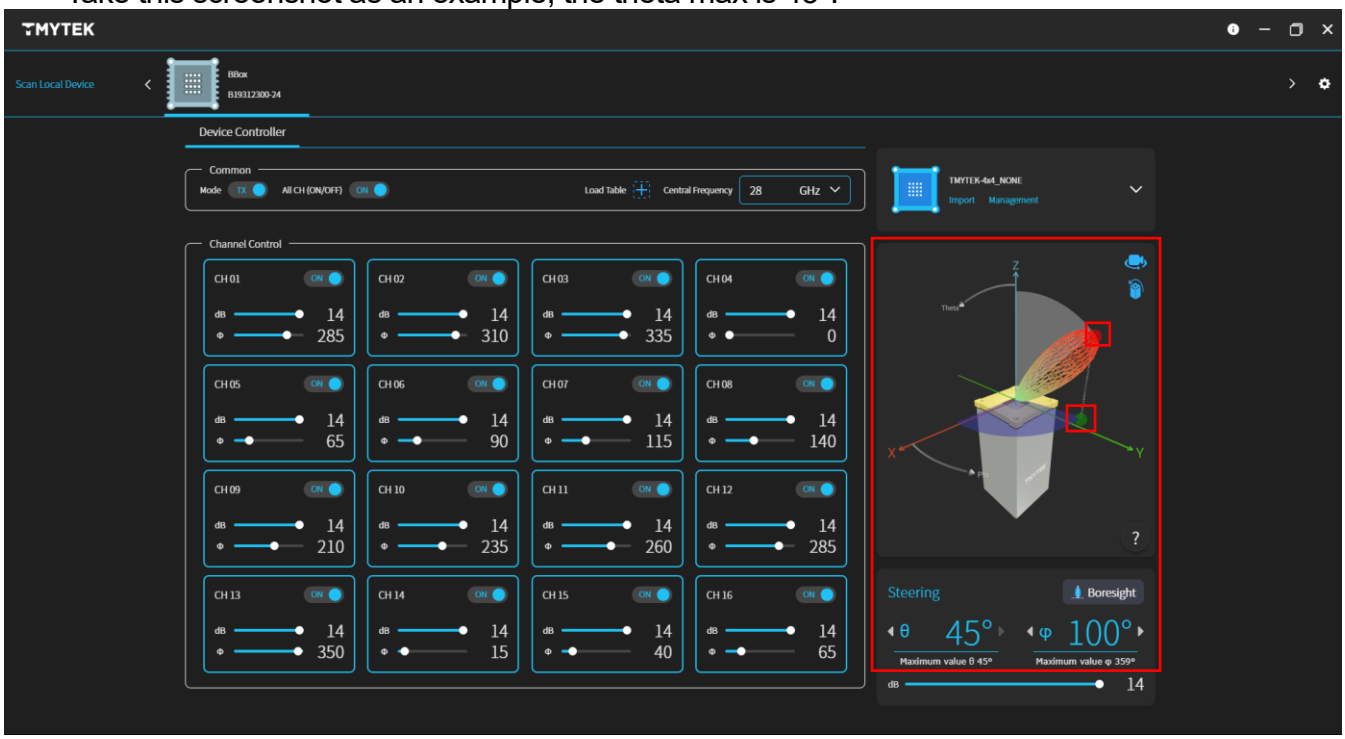


(17). Press and hold the red dot on the tip of the Beam to rotate the Beam and adjust θ and φ. Press and hold the green dot on the xy-plane to adjust φ.

NOTE: θ is the angle between the positive Z-axis and the vector in question (0 ≤ θ ≤ Theta max angle).

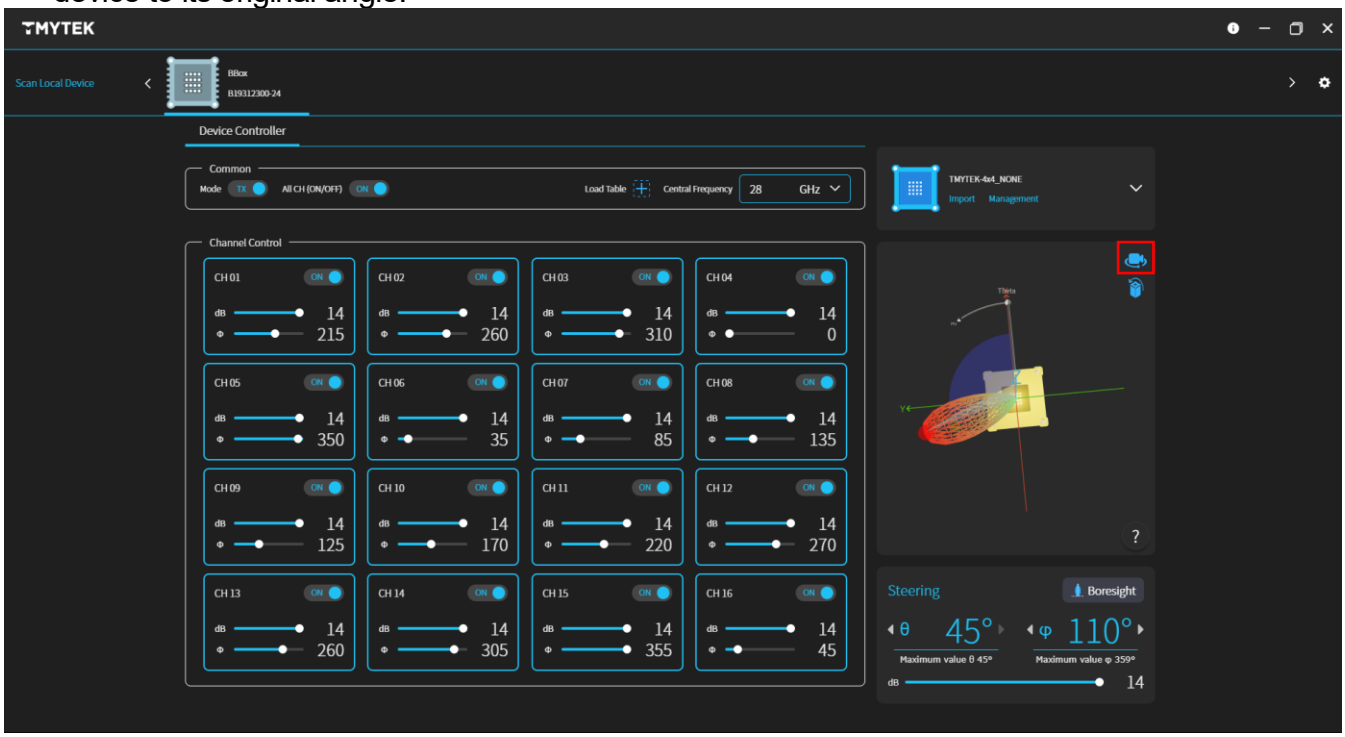
φ is the angle between the projection of the vector onto the xy-plane and the positive X-axis (0 ≤ φ < 360°).

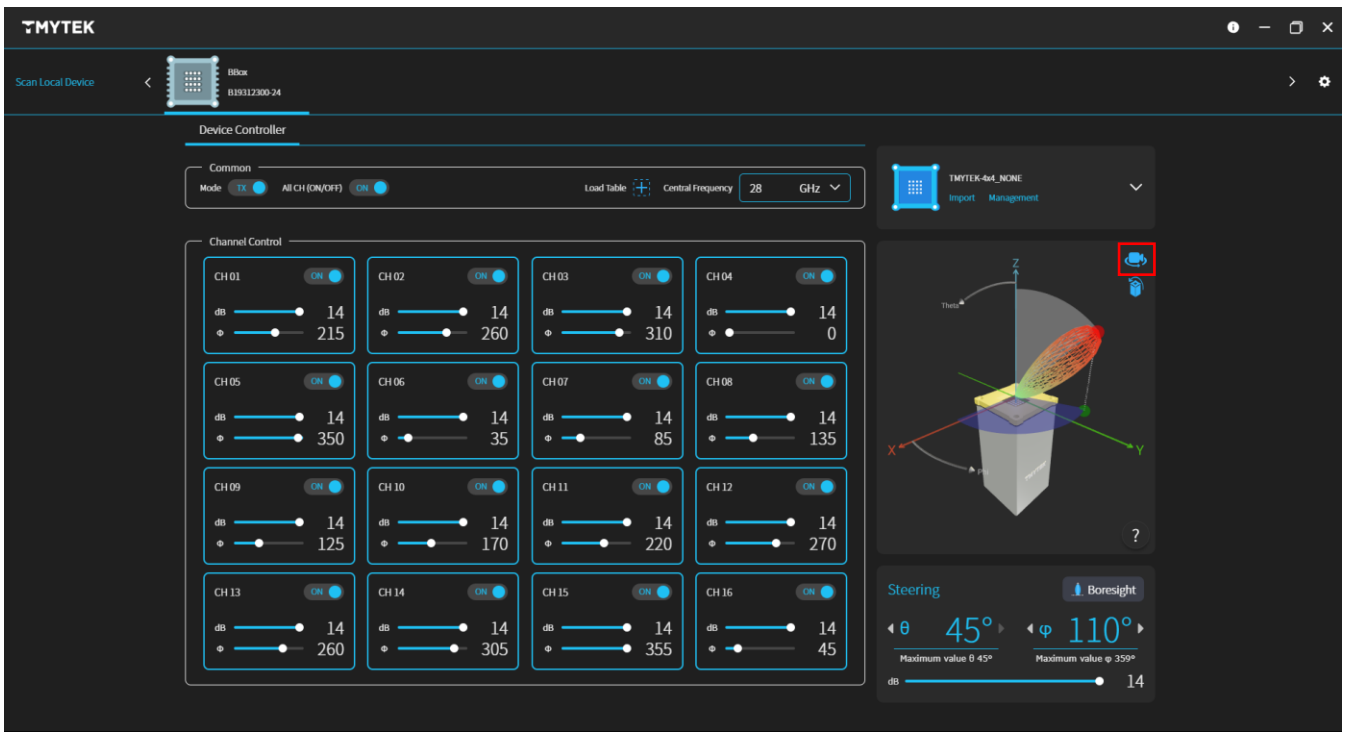
Take this screenshot as an example, the theta max is 45°.



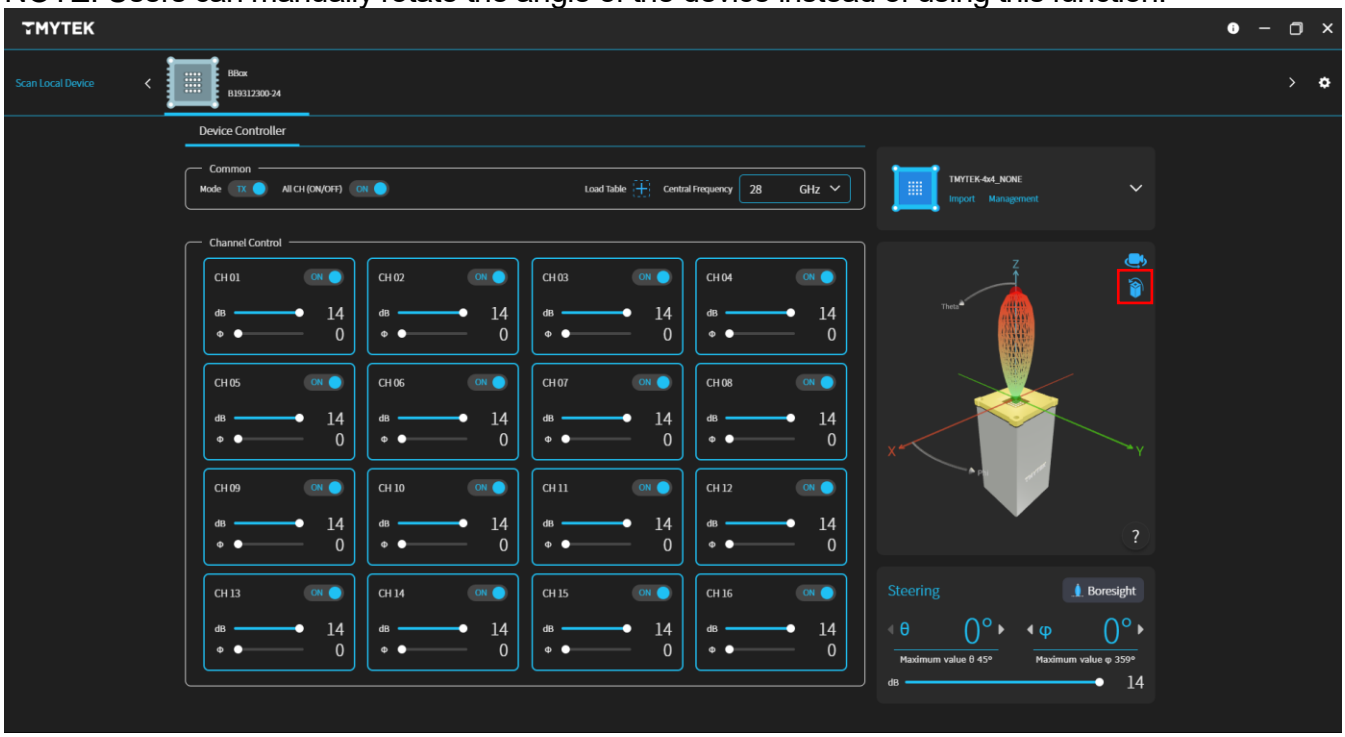
(18). Pressing "Boresight" can set θ and φ back to 0 degree.

(19). When the device is rotated to an arbitrary angle, pressing the "Reset Angle" button can set the device to its original angle.

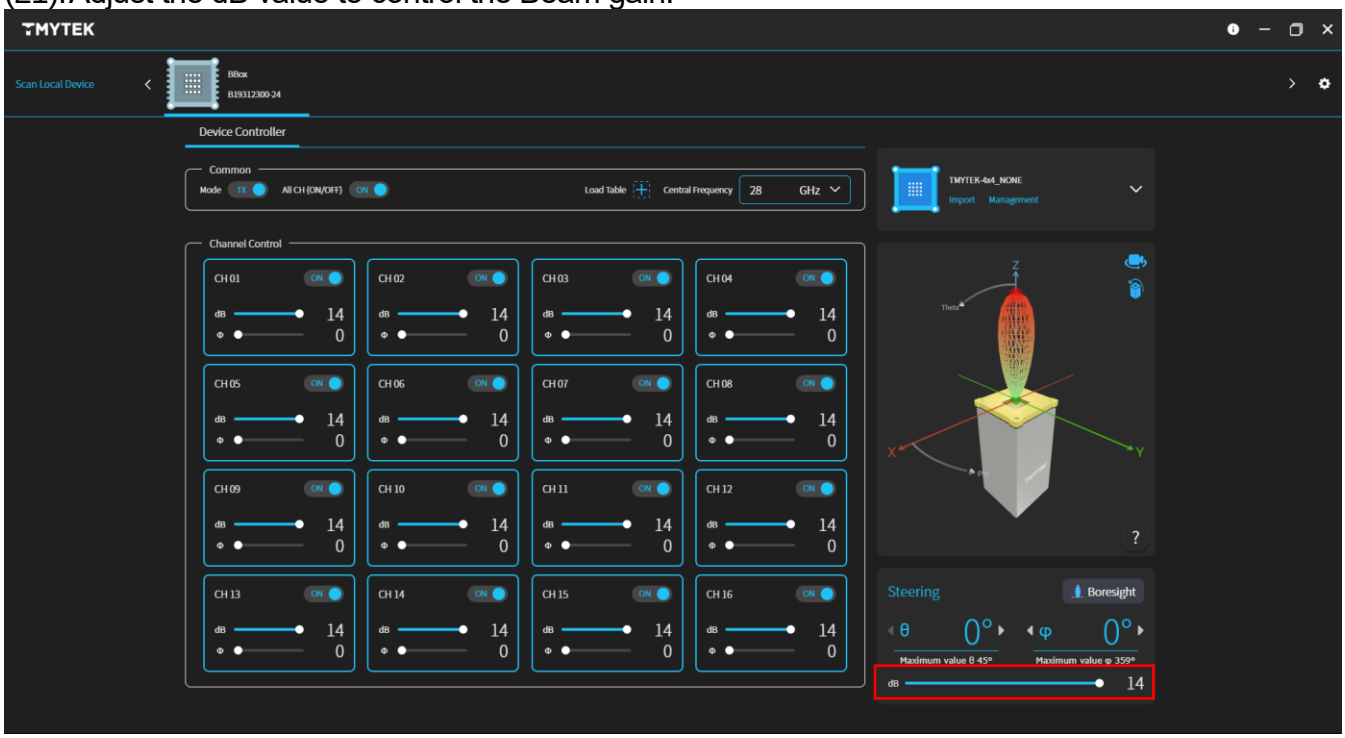




(20). This button can quickly adjust the device to the upright or horizontal position.
NOTE: Users can manually rotate the angle of the device instead of using this function.

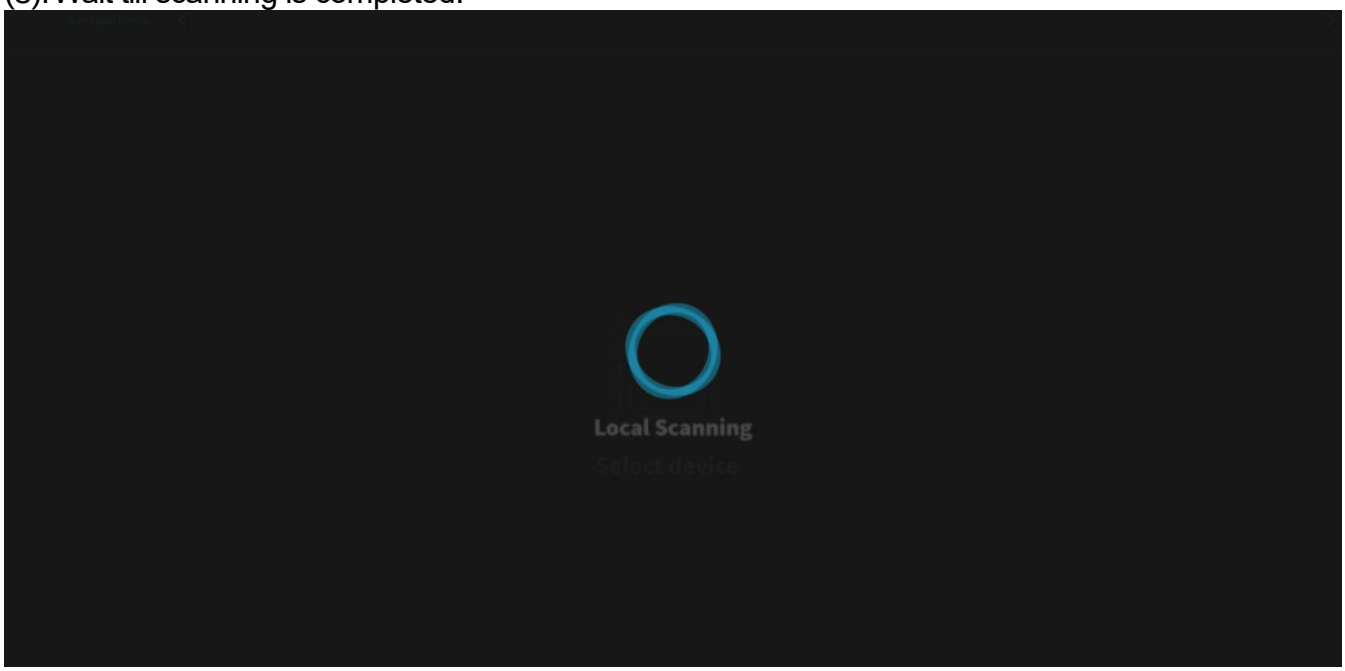


(21). Adjust the dB value to control the Beam gain.

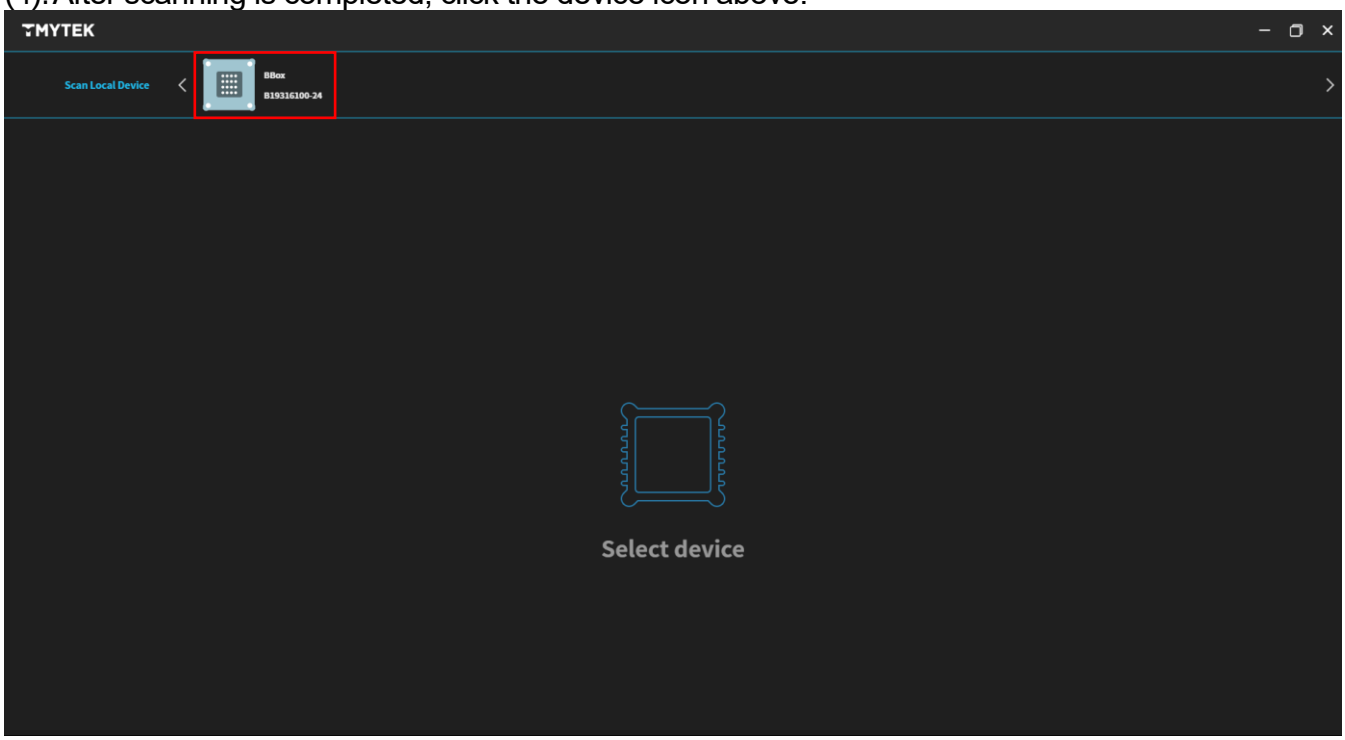


2. BBox One 5G

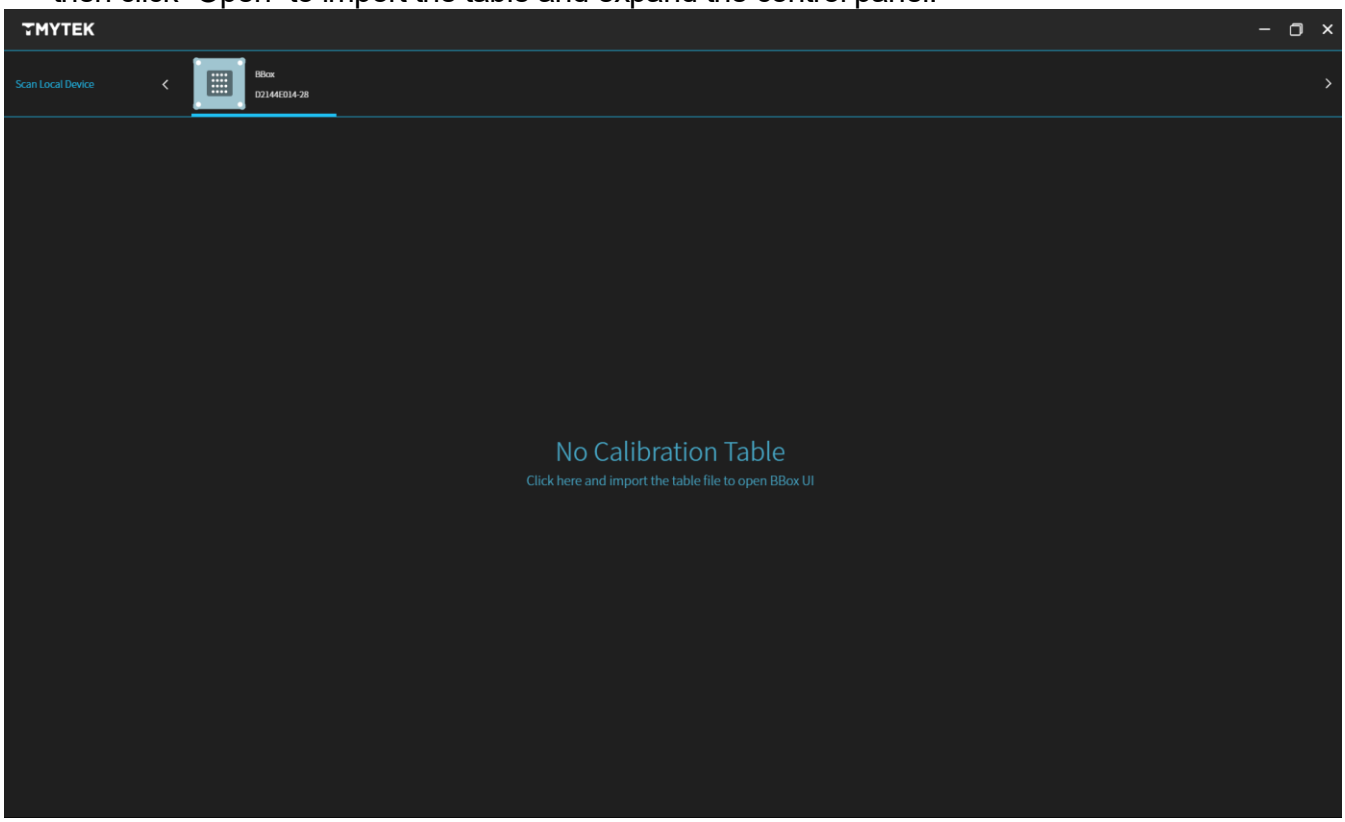
(1). Connect BBox One and PC with Ethernet, and then turn on the power of BBox One.
(2). Open TMXLAB Kit.
(3). Wait till scanning is completed.

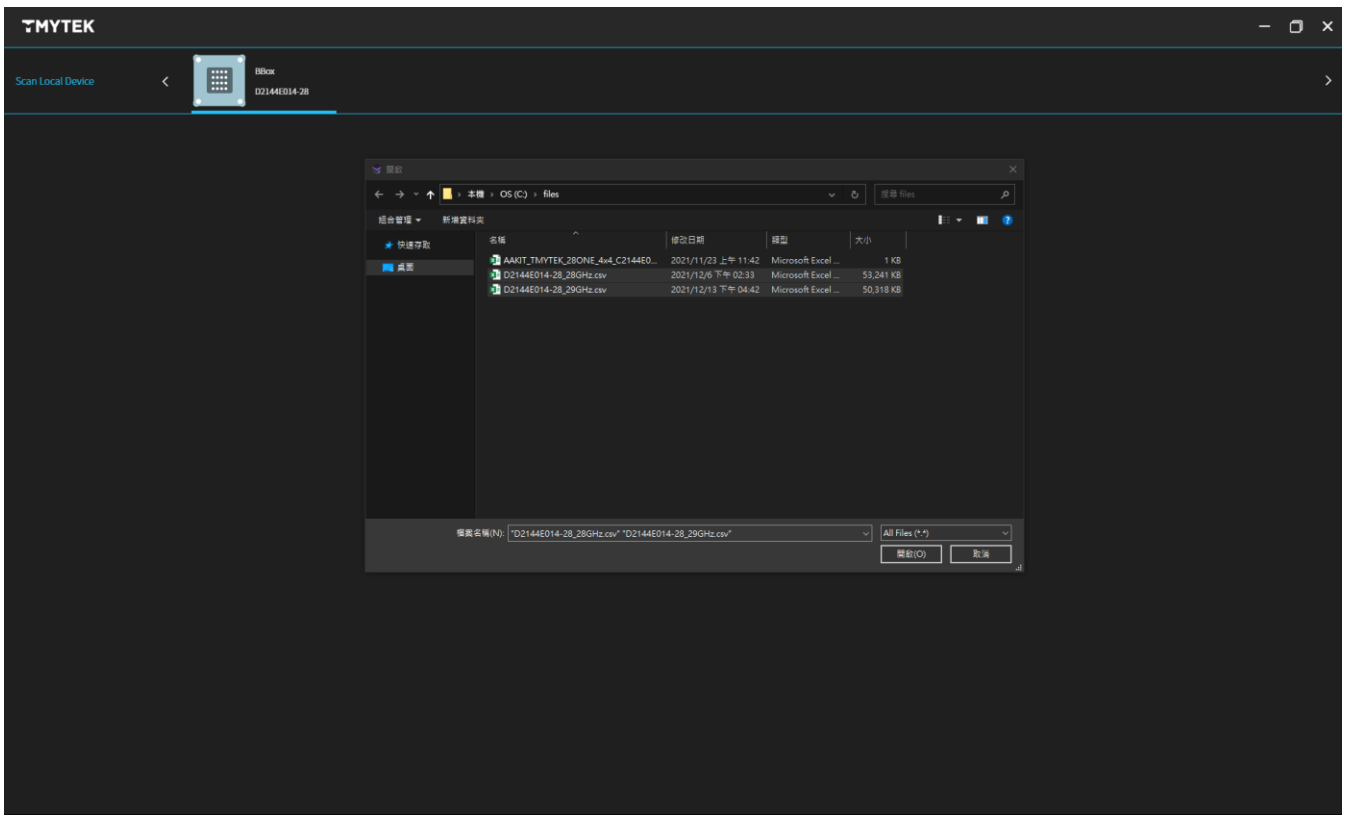


(4). After scanning is completed, click the device icon above.



(5). If the table of the clicked device has not been imported, the screen will show “No Calibration Table.” Click anywhere to open the file selection window, choose the file(s) to be imported, and then click “Open” to import the table and expand the control panel.

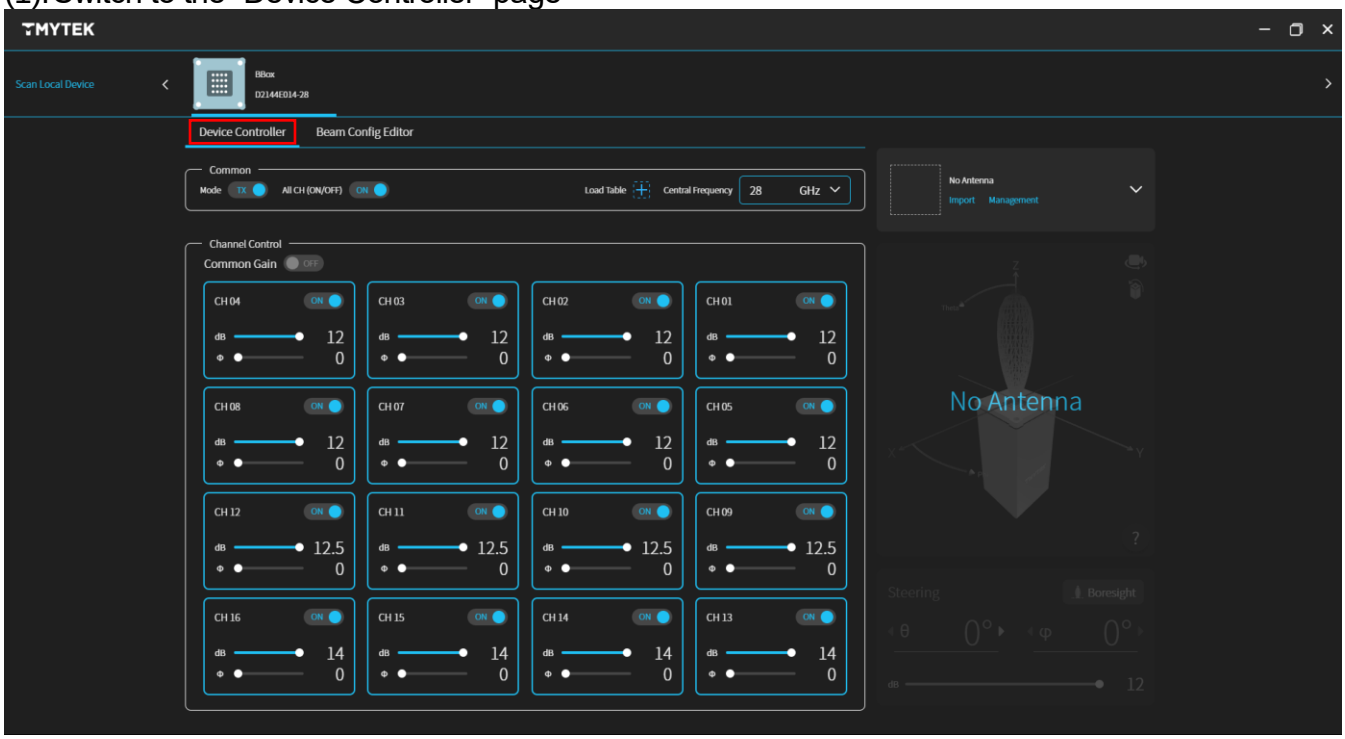




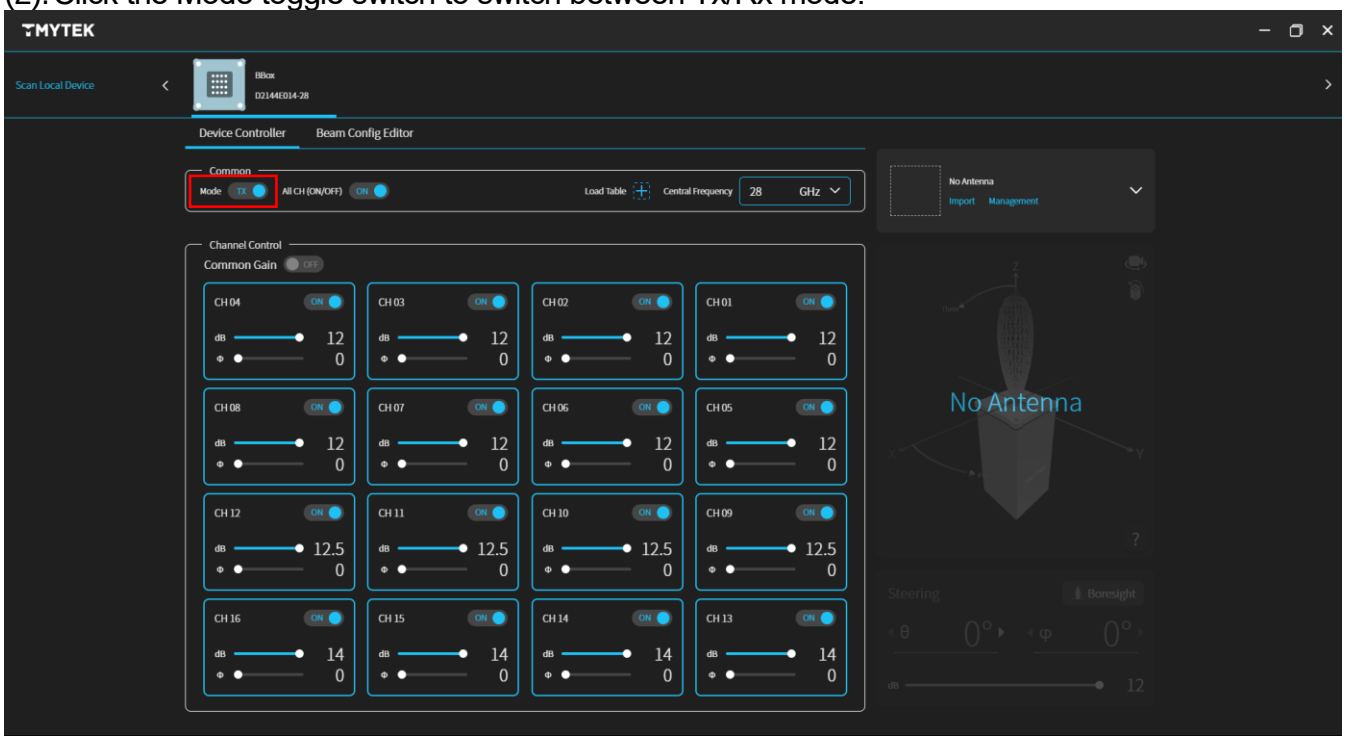
2.1 Device Controller

- The device controller is designed to switch between Tx/Rx mode, change central frequency, control the power/gain/phase of each channel and set beam angle.

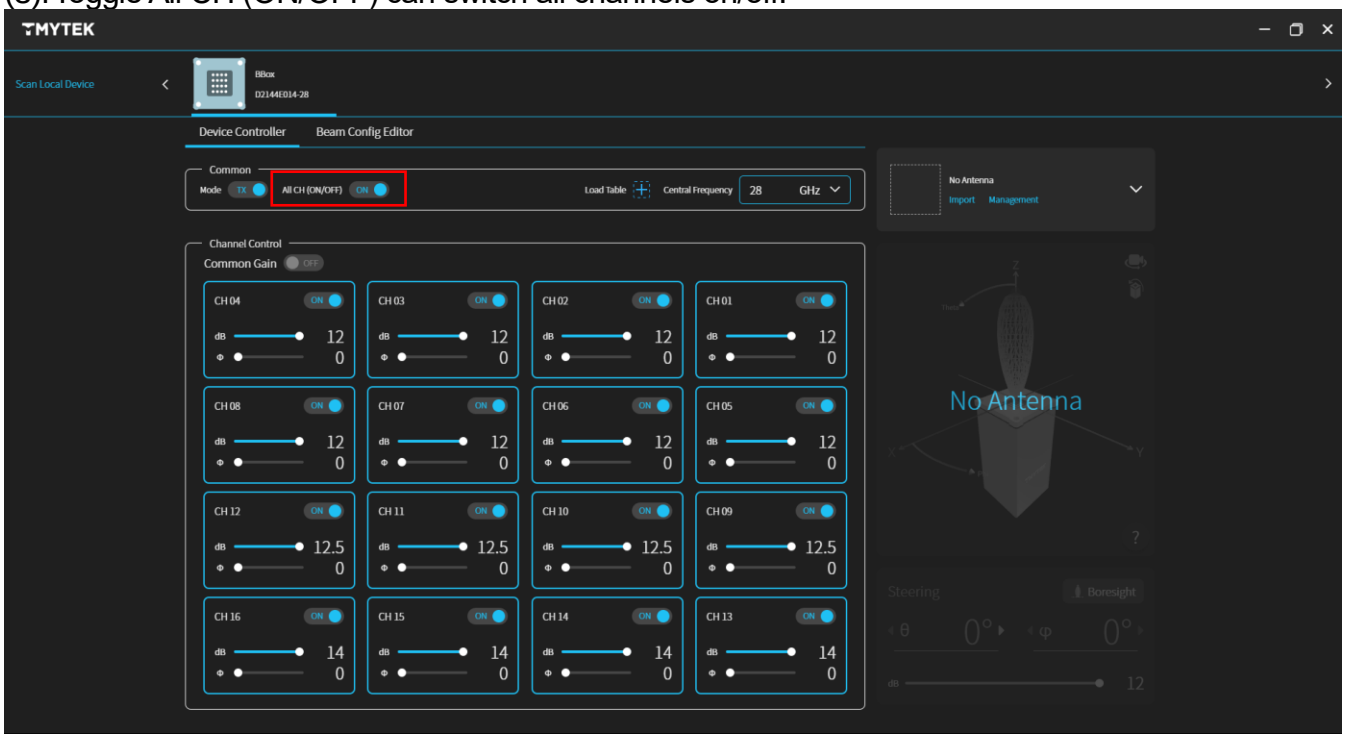
(1). Switch to the “Device Controller” page



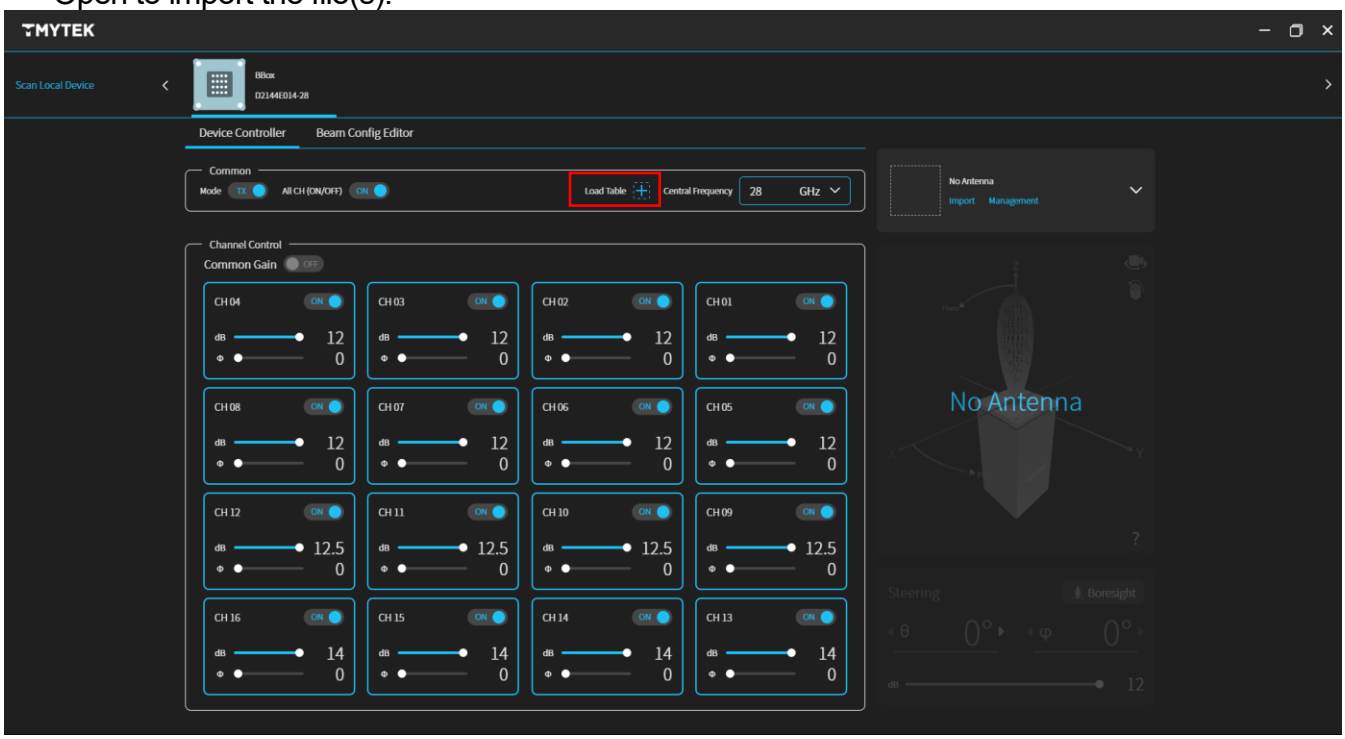
(2). Click the Mode toggle switch to switch between Tx/Rx mode.



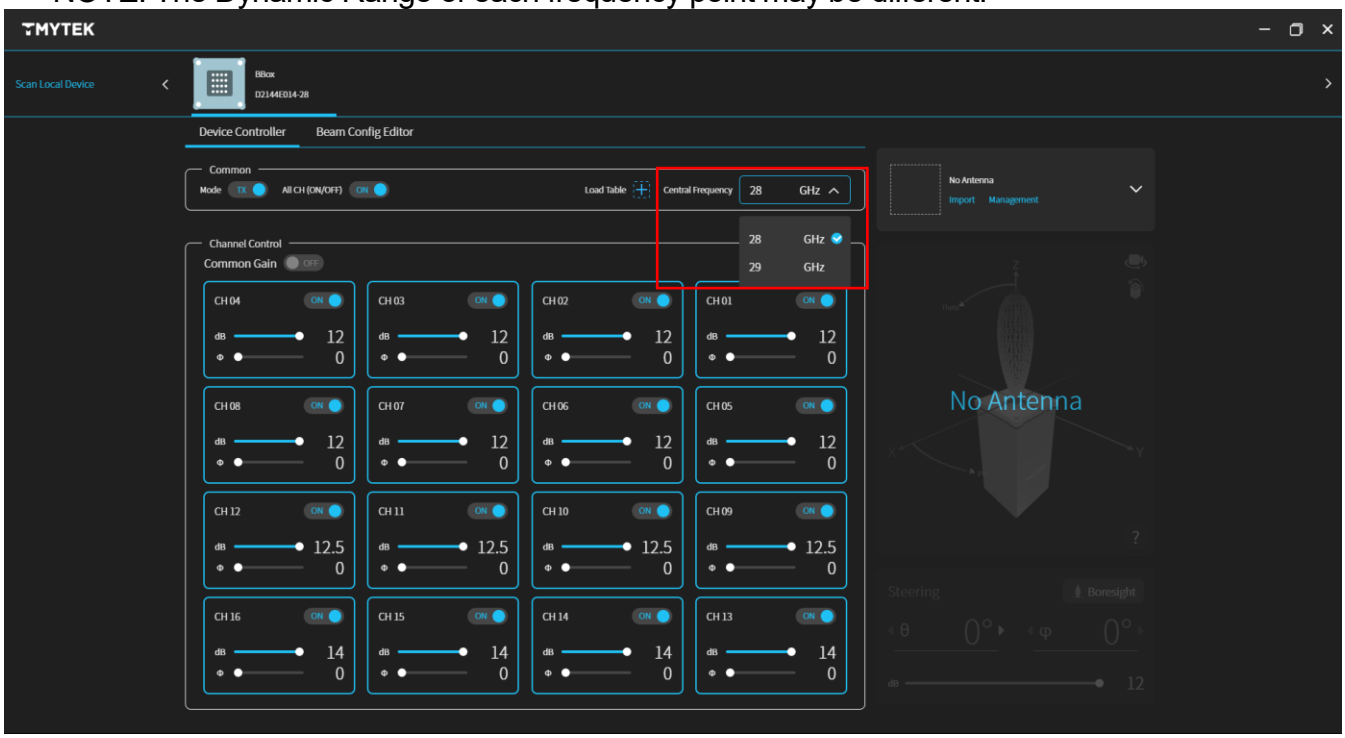
(3). Toggle All CH (ON/OFF) can switch all channels on/off.



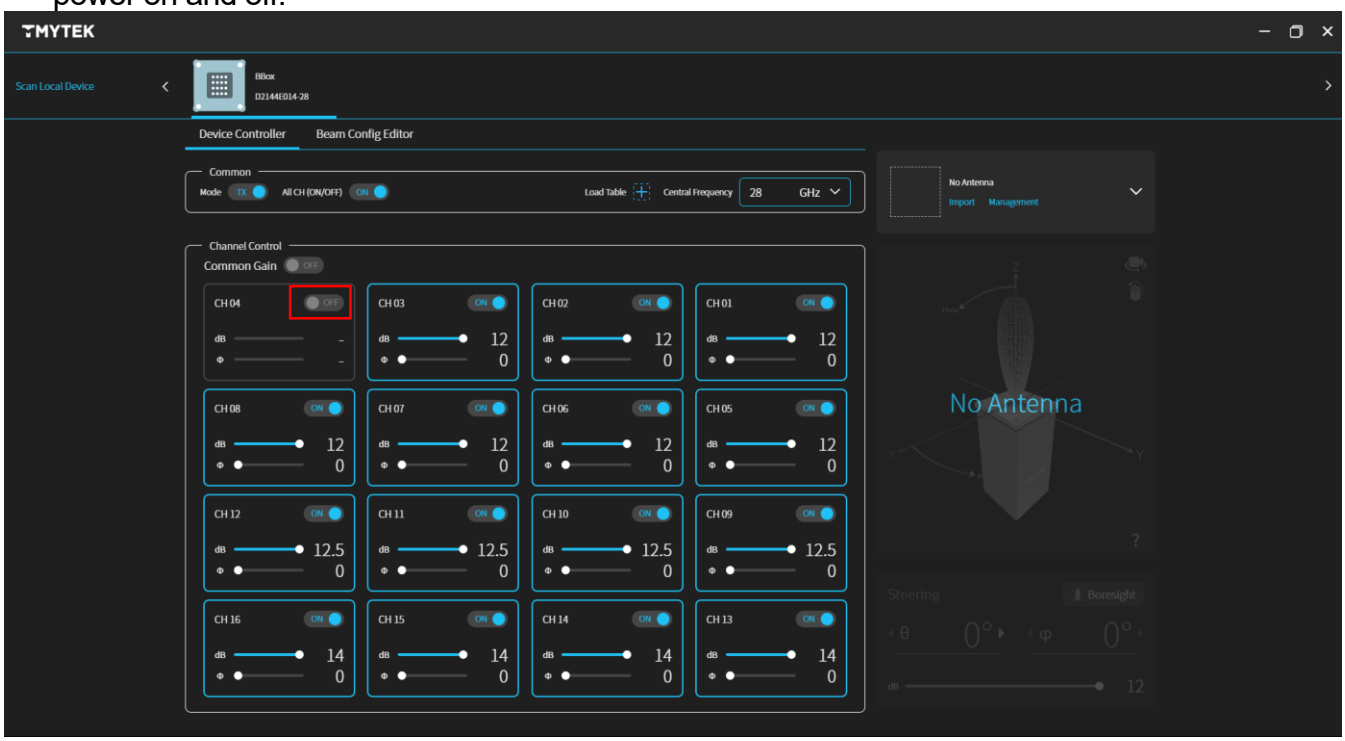
(4). Click "Load Table" to import the calibration table. After selecting the file(s) to be imported, click Open to import the file(s).



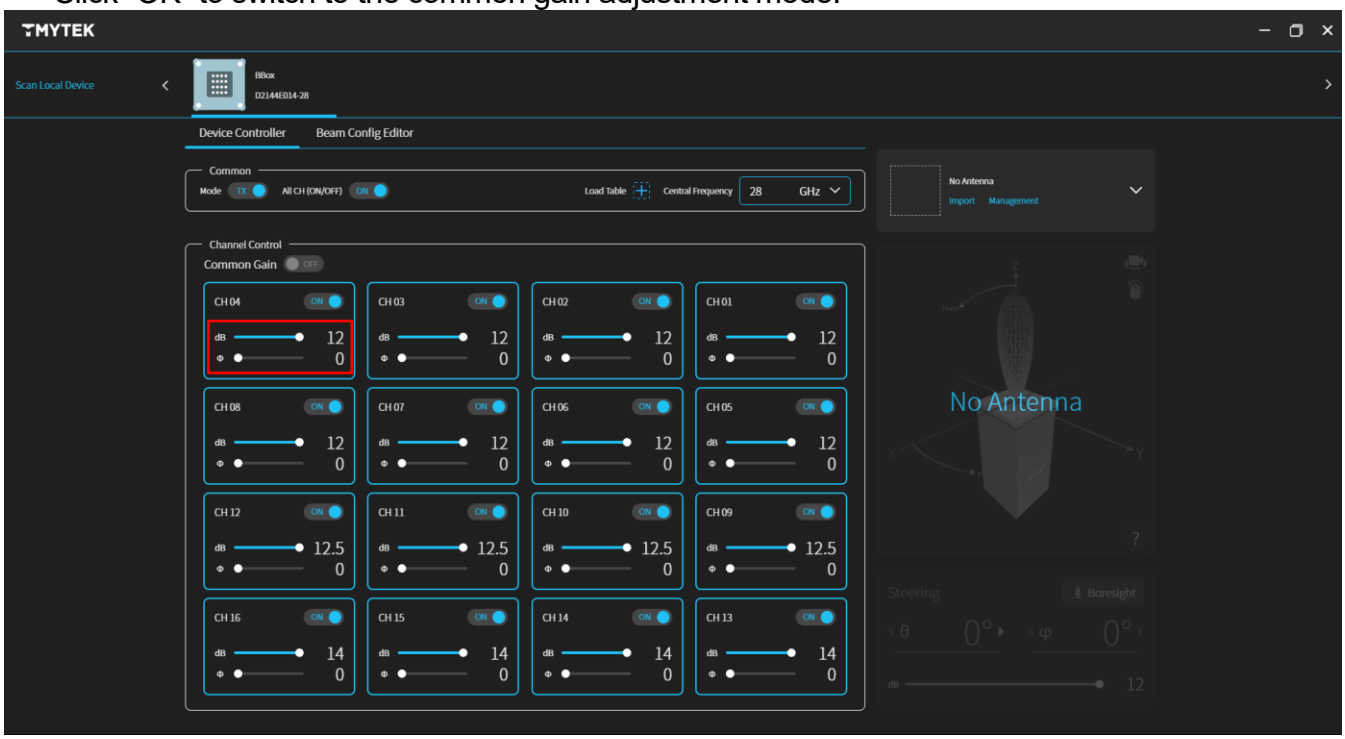
(5). All available frequency points are listed in the Central Frequency drop-down menu. You can choose the desired one.
NOTE: The Dynamic Range of each frequency point may be different.

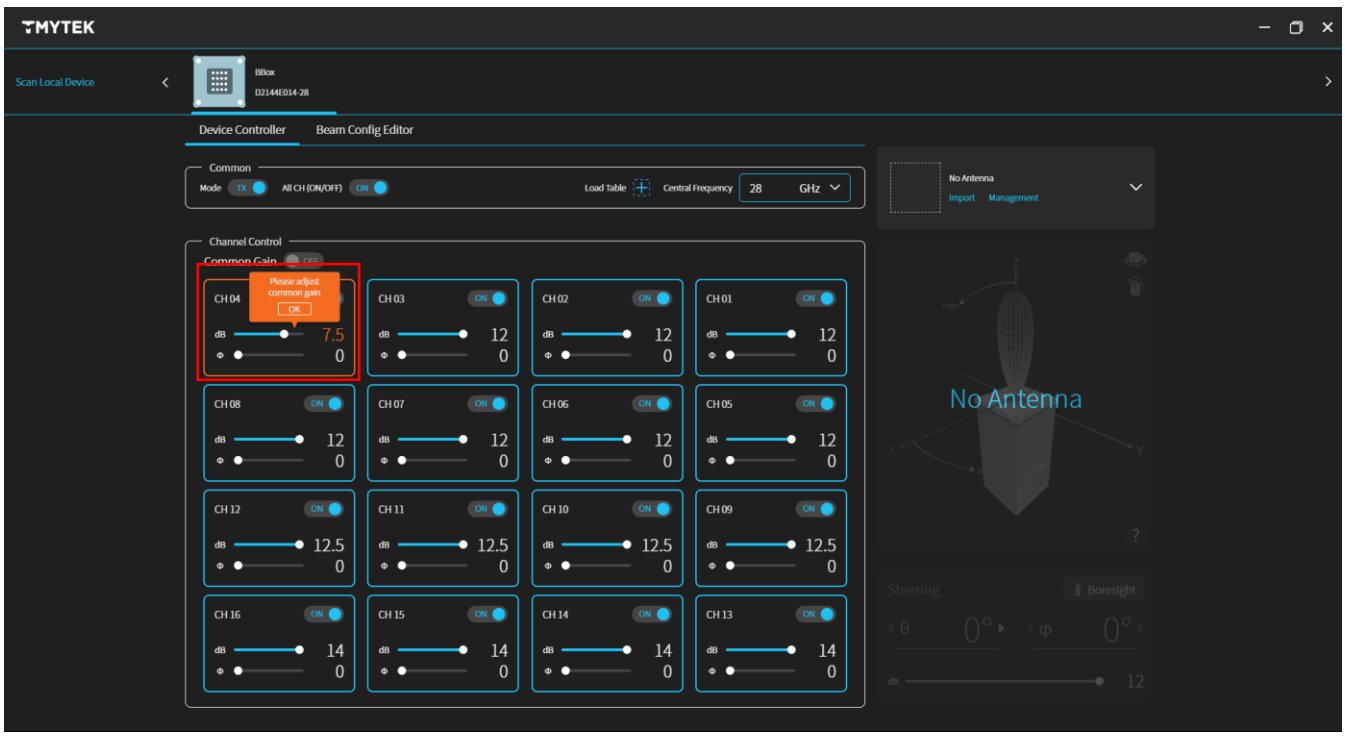


(6). Click the toggle switch in the upper right corner of the channel card(s) to switch the channel power on and off.

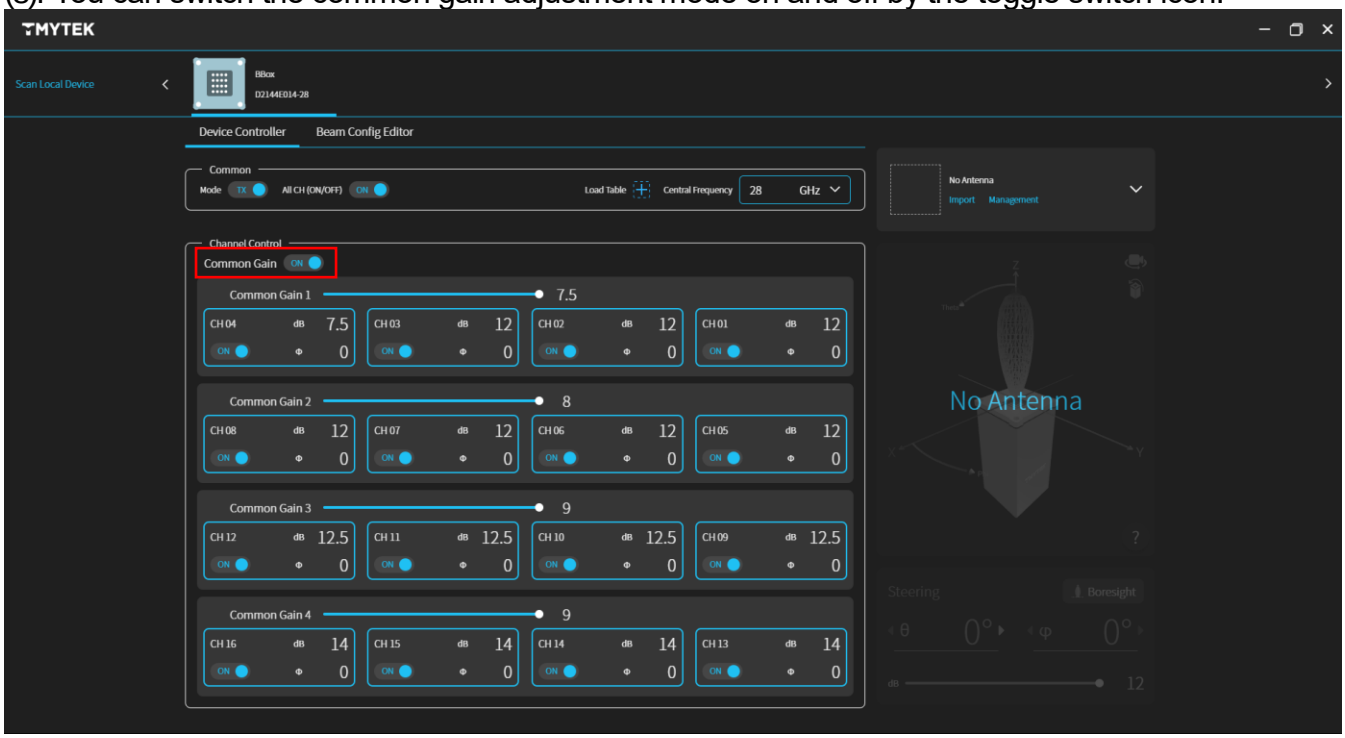


(7). Adjust the sliders of dB and Φ in the channel card(s) to control the channel gain and phase. When the element gain is minimal/maximal, the screen will show “Please adjust common gain.” You need to adjust the common gain before you can continue to lower/higher the channel gain. Click “OK” to switch to the common gain adjustment mode.

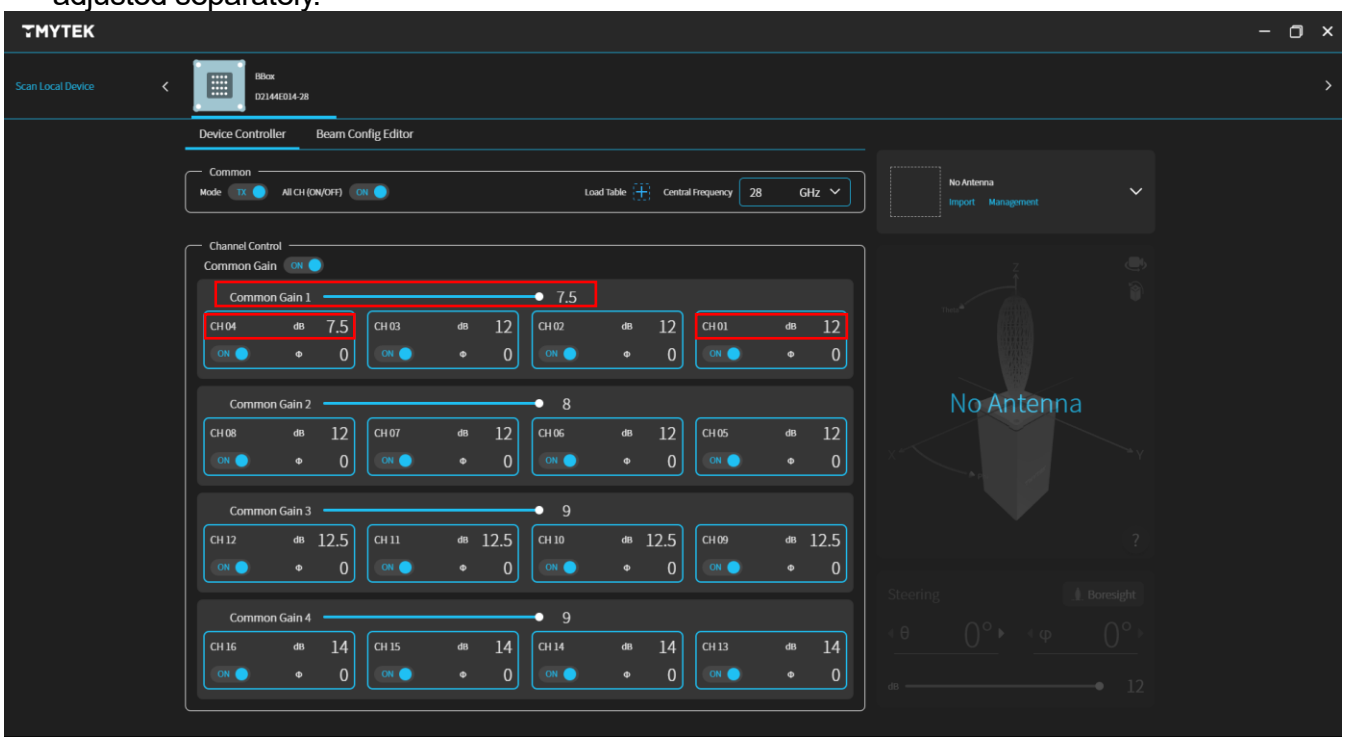




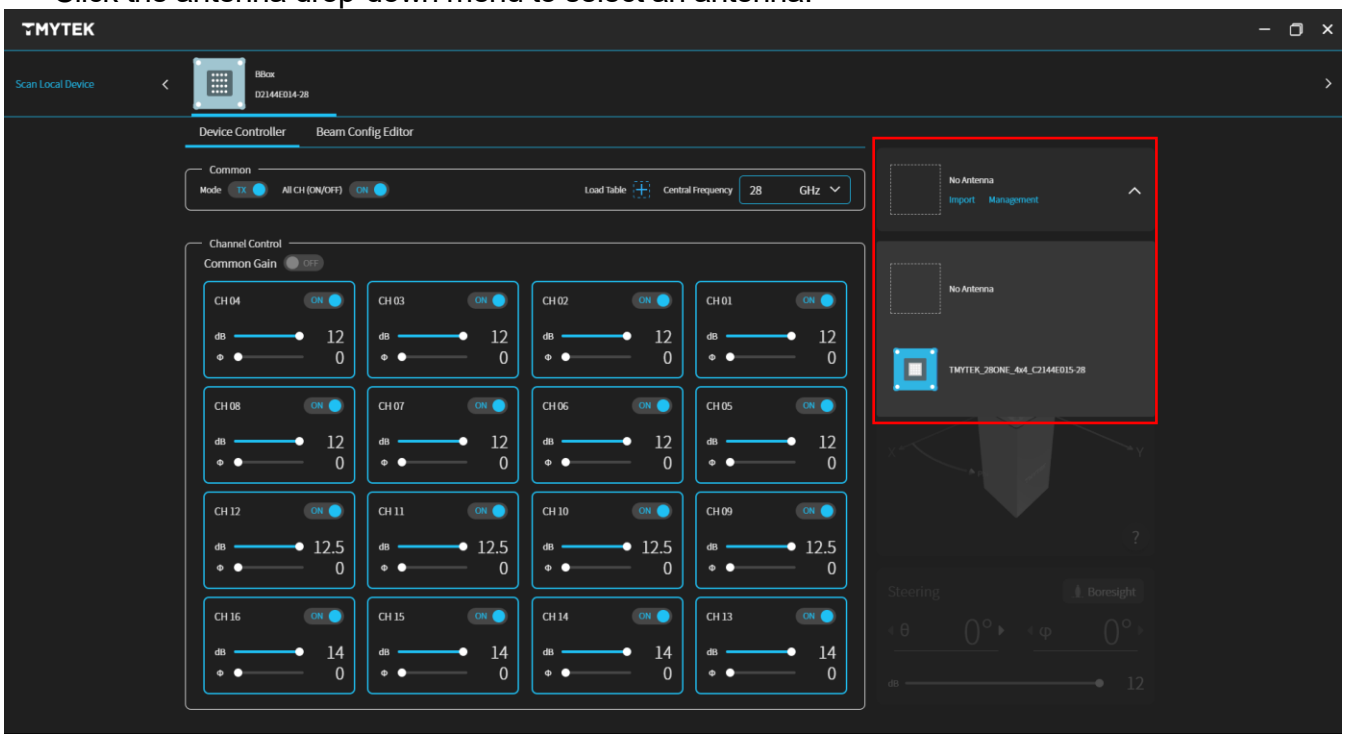
(8). You can switch the common gain adjustment mode on and off by the toggle switch icon.



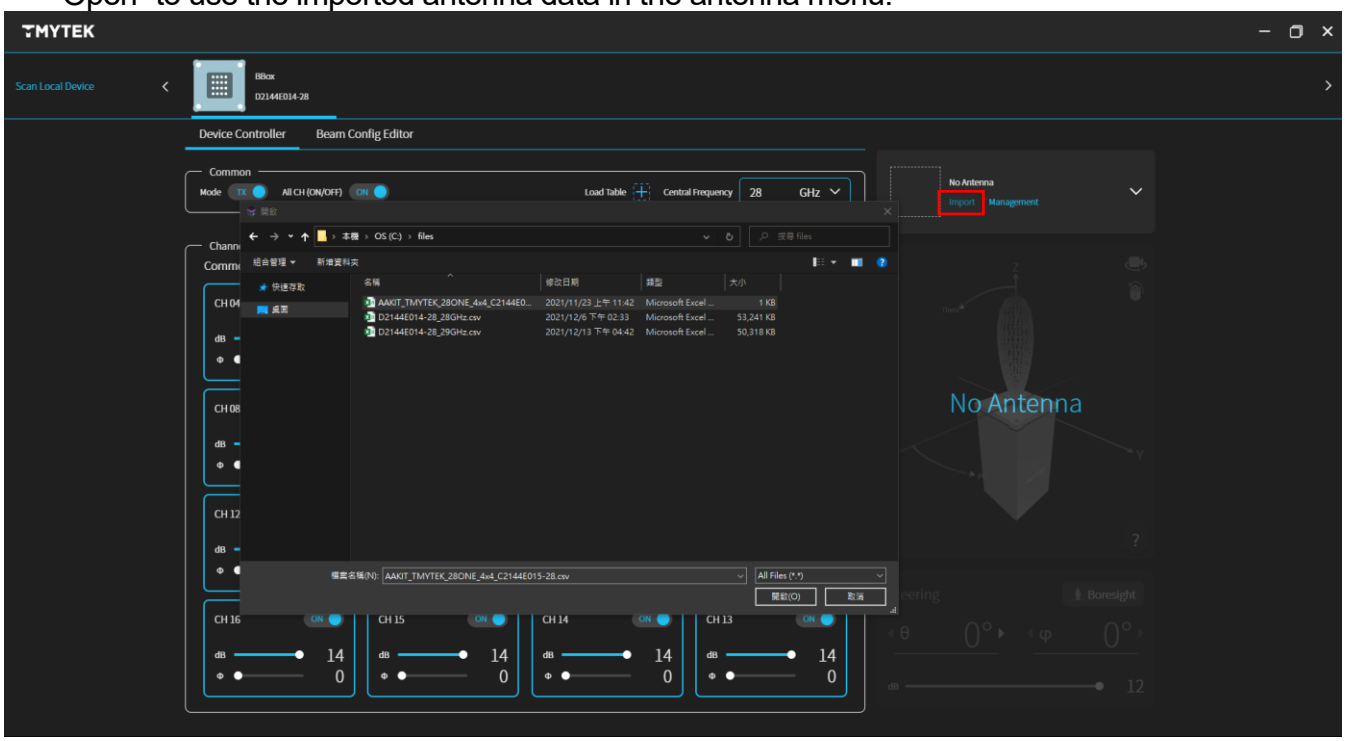
(9). Adjusting the common gain will simultaneously affect the gain of the 4 channels on the board. Take this screenshot as an example, if the common gain is changed to 0, the Channel01 is 4.5 dB, Channel04 is 0 dB. Then, the common gain and channel gain can be adjusted separately.



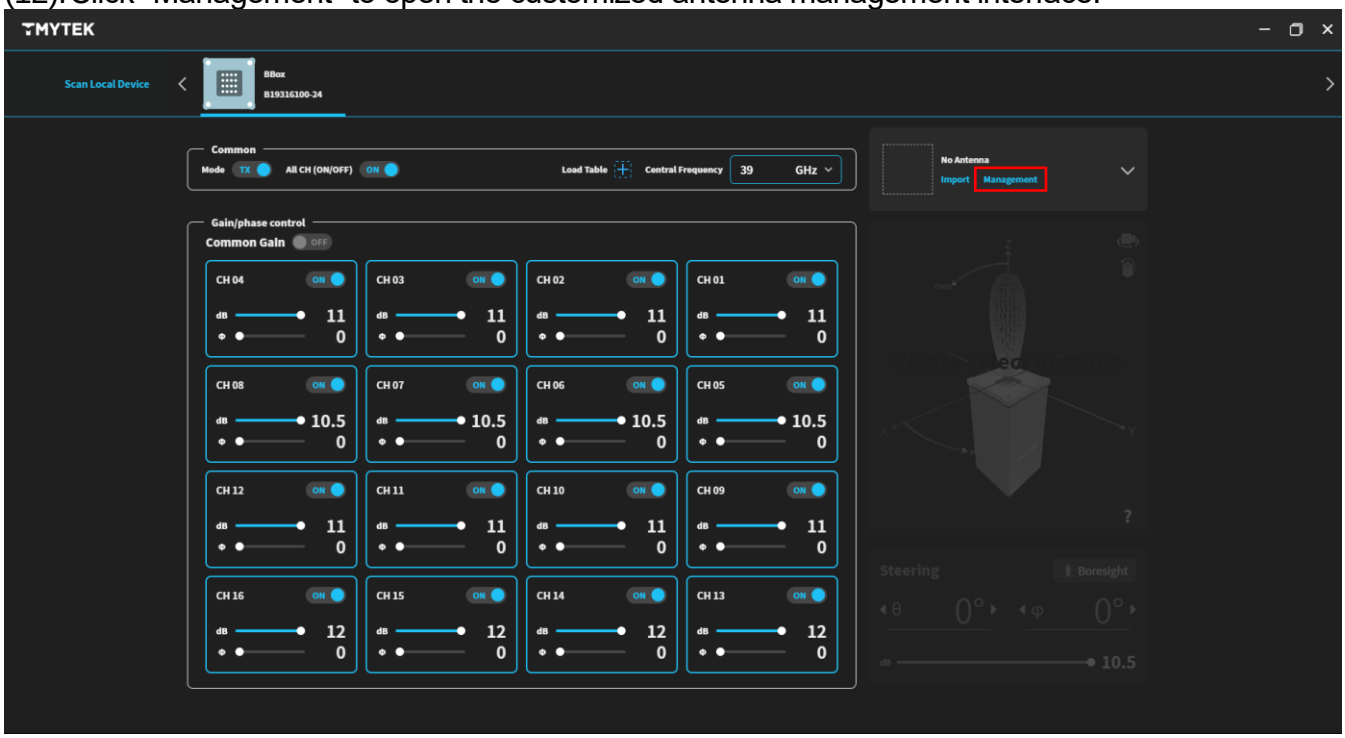
(10). If no antenna is selected, only the channel control mode is functional. The beam steering function is only available after an antenna is selected.
Click the antenna drop-down menu to select an antenna.



(11). Click “Import” to open the file selection window. Select the file(s) to be imported and click “Open” to use the imported antenna data in the antenna menu.



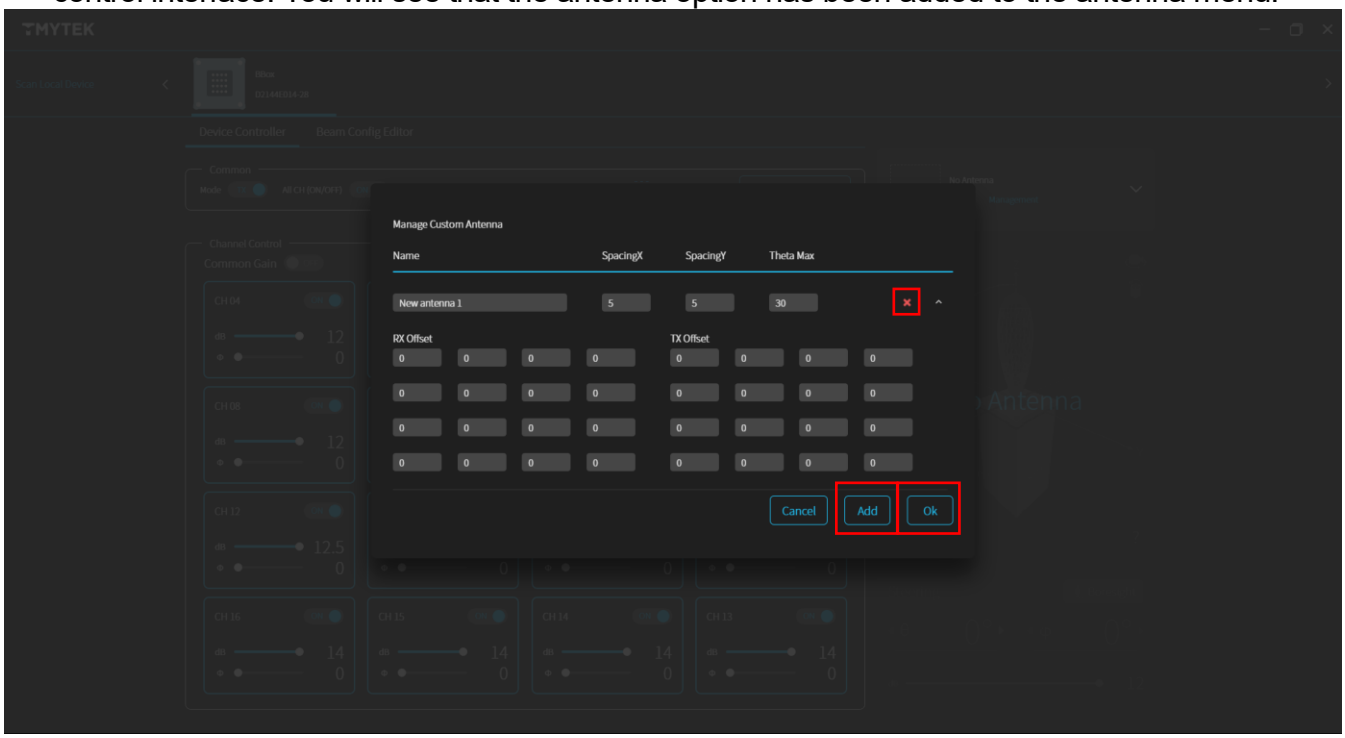
(12). Click "Management" to open the customized antenna management interface.

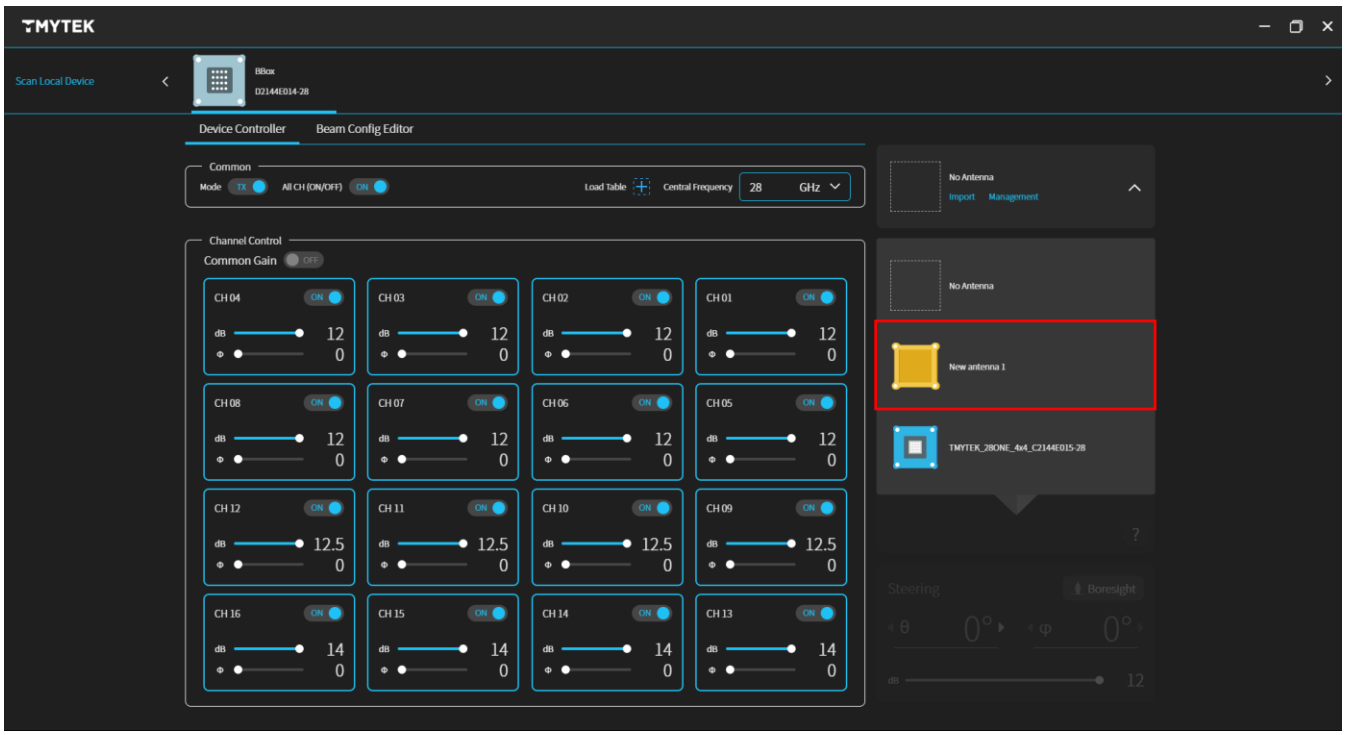


(13). Click "Add" to enter the add mode.

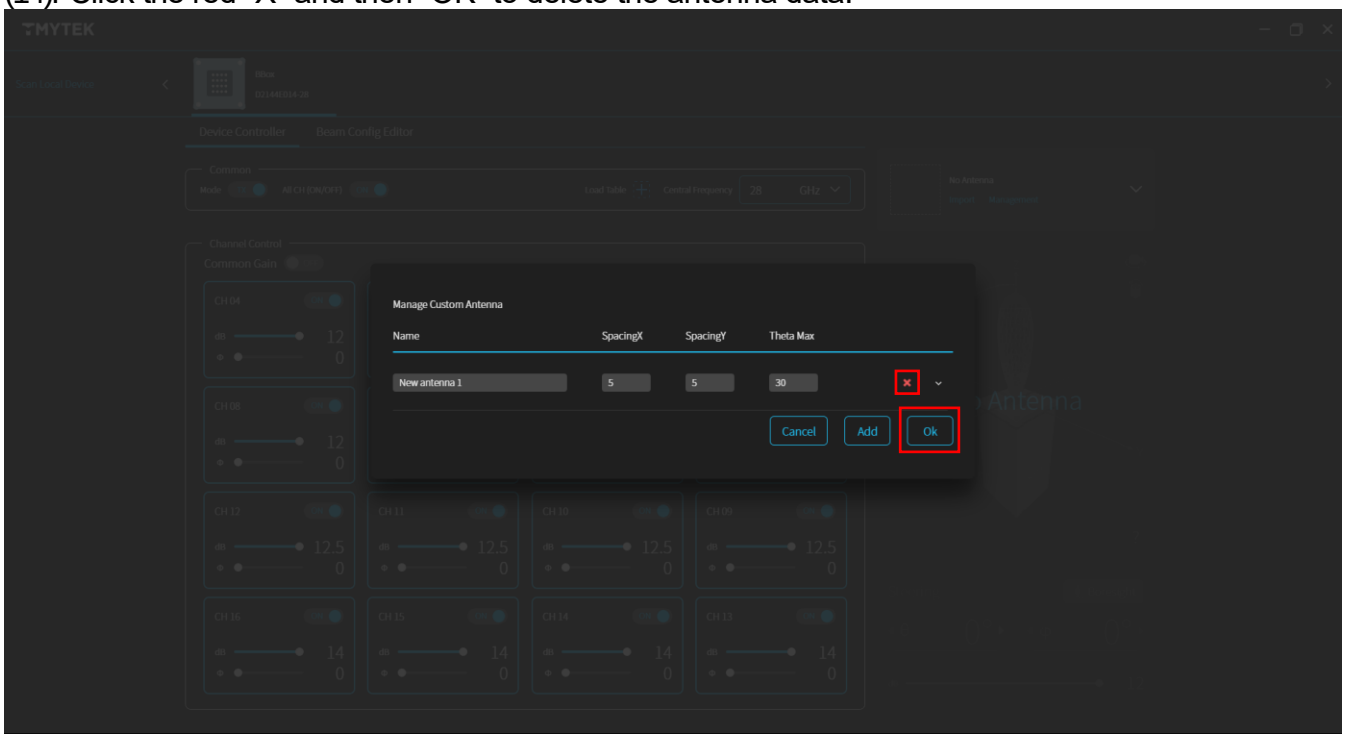
Enter following in order: antenna name (for identification, the name cannot be repeated), SpacingX (the pitch-to-pitch spacing between two adjacent antenna elements on the X-coordinate, Unit: mm), SpacingY (the pitch-to-pitch spacing between two adjacent antenna elements on the Y-coordinate, Unit: mm), theta max angle, and phase offset of each channel. Click the arrow on the right to expand/collapse the offset input box.

After completing the above action, click "Ok" to save the input data and return to the main control interface. You will see that the antenna option has been added to the antenna menu.





(14). Click the red "X" and then “OK” to delete the antenna data.

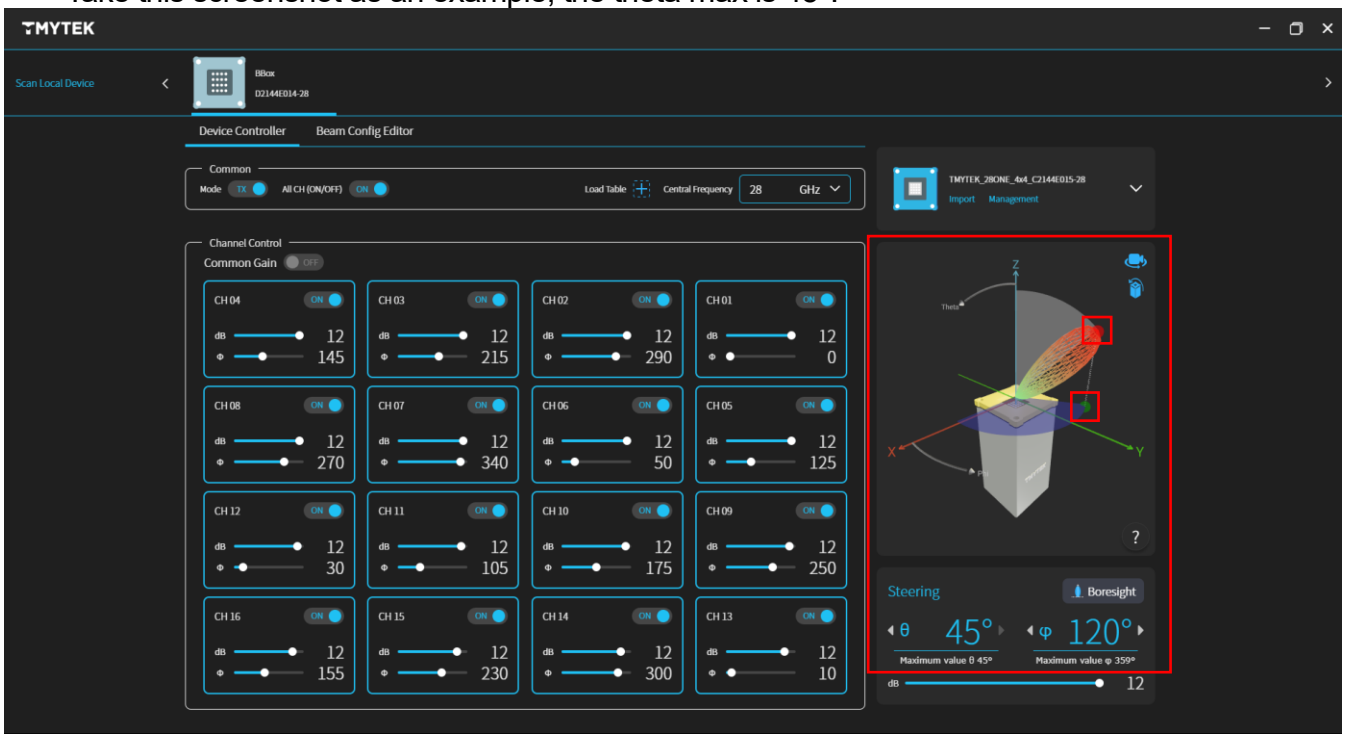


(15). Press and hold the red dot on the tip of the Beam to rotate the Beam and adjust θ and φ. Press and hold the green dot on the xy-plane to adjust φ.

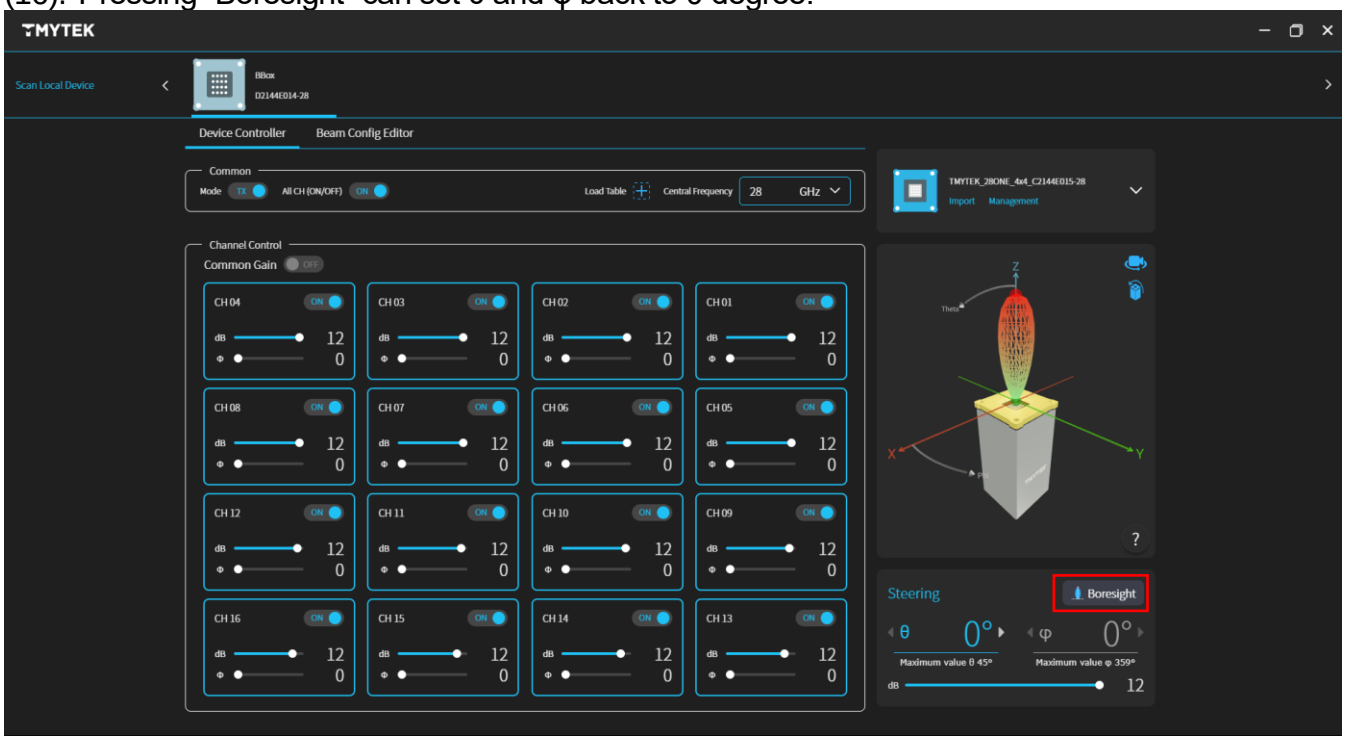
NOTE: θ is the angle between the positive Z-axis and the vector in question (0 ≤ θ ≤ Theta max angle).

φ is the angle between the projection of the vector onto the xy-plane and the positive X-axis (0 ≤ φ < 360°).

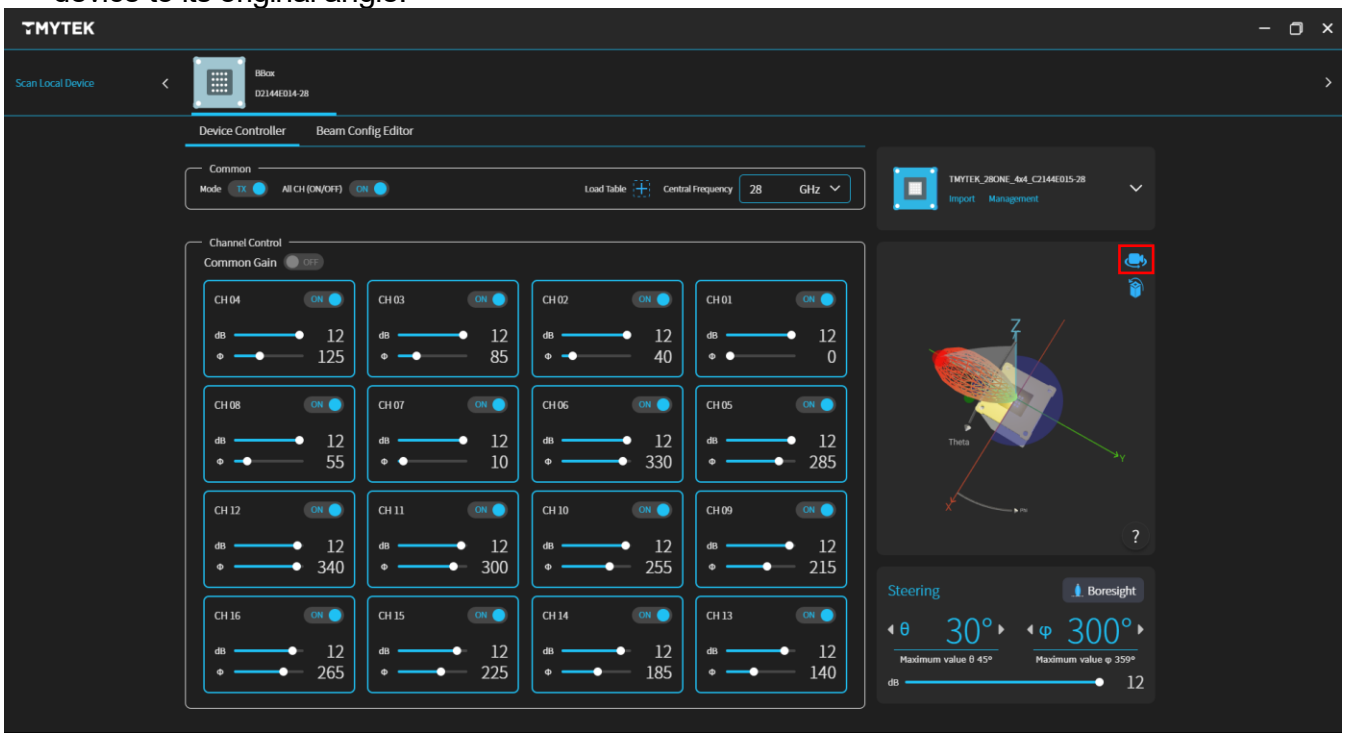
Take this screenshot as an example, the theta max is 45°.

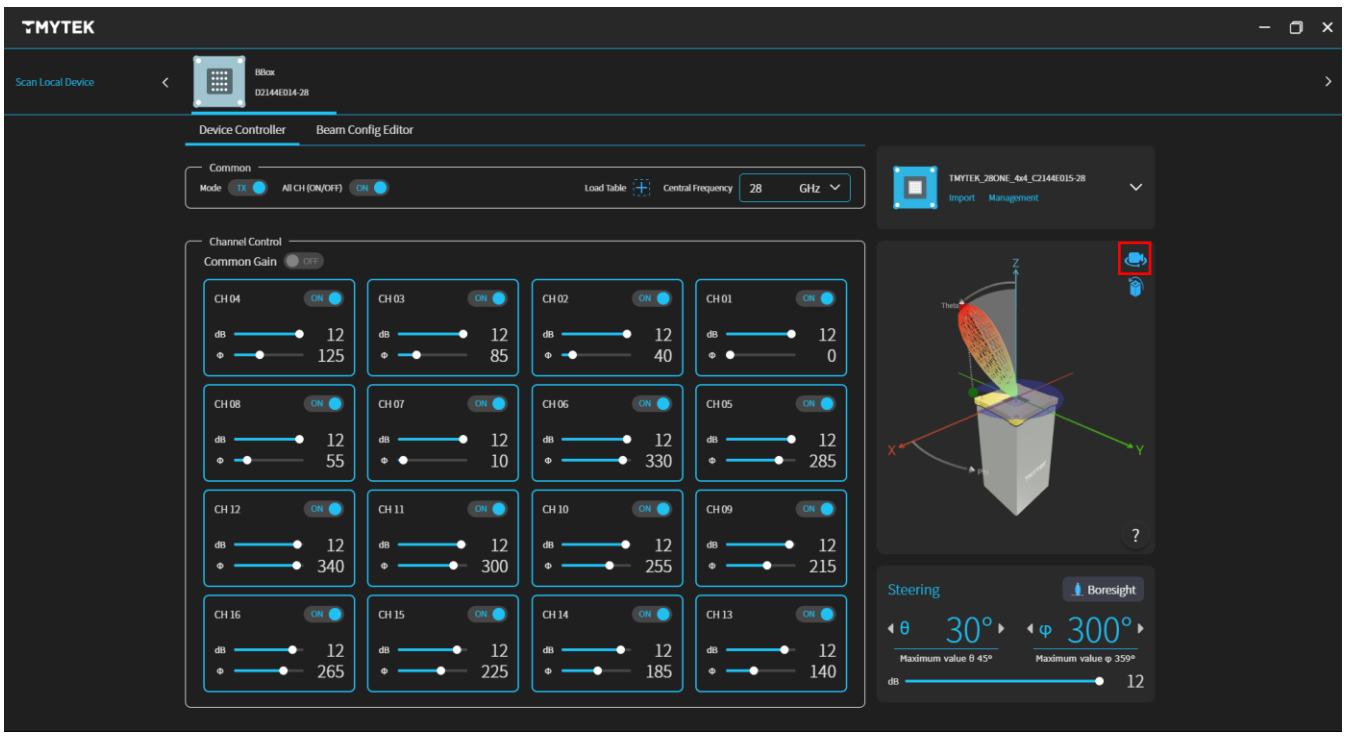


(16). "Pressing "Boresight" can set θ and φ back to 0 degree.

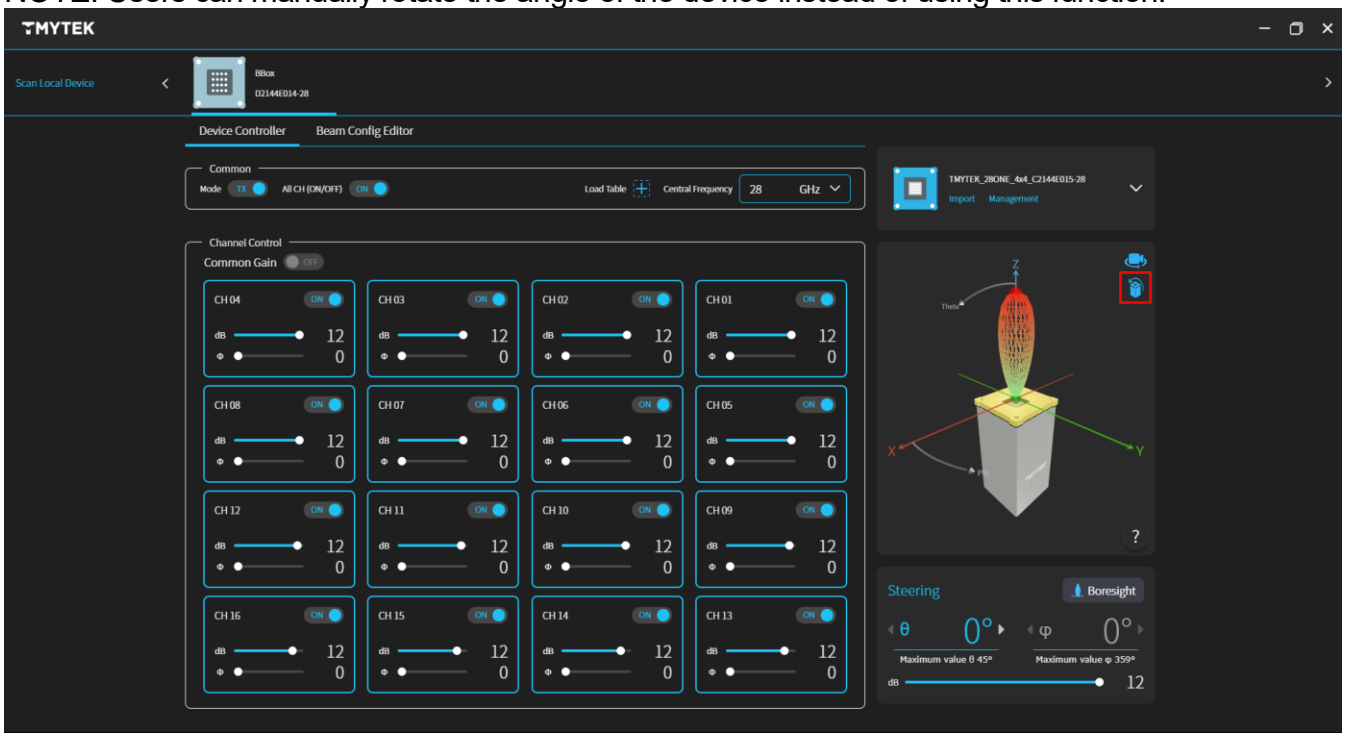


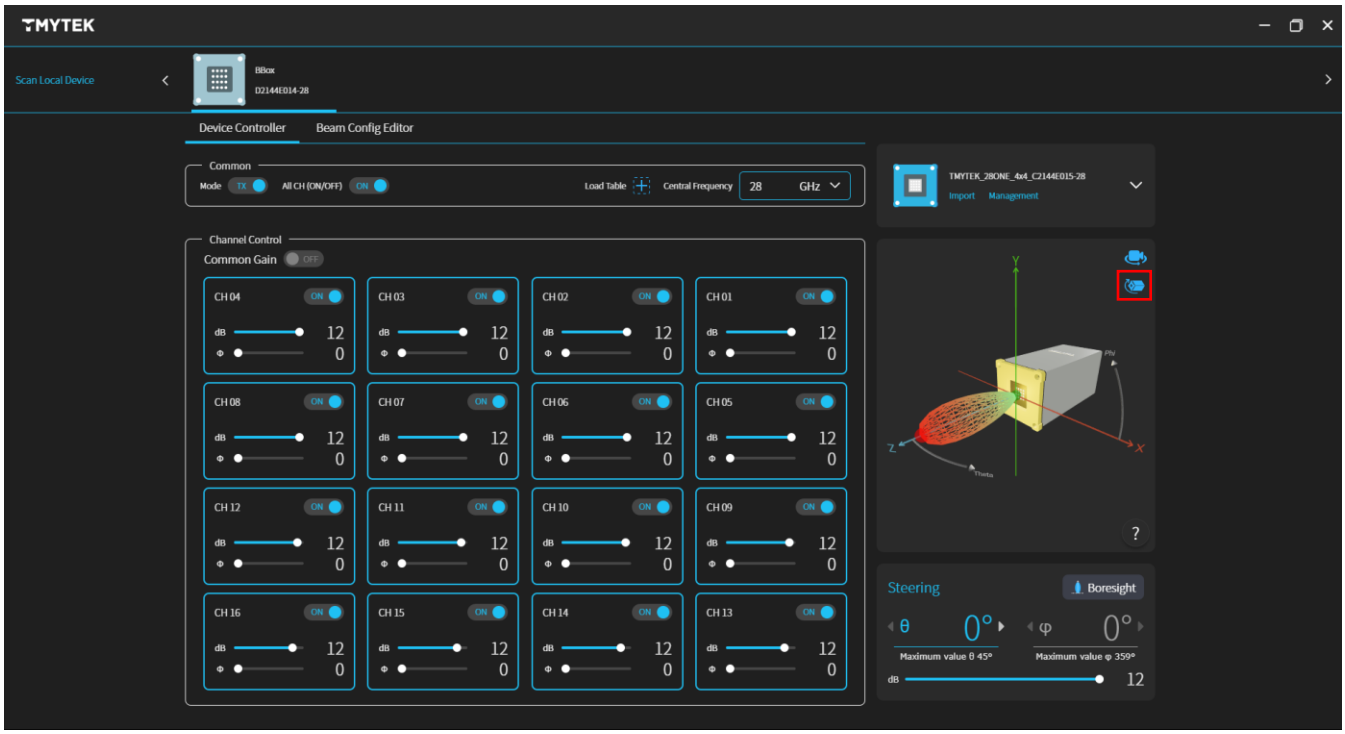
(17). When the device is rotated to an arbitrary angle, pressing the "Reset Angle" button can set the device to its original angle.



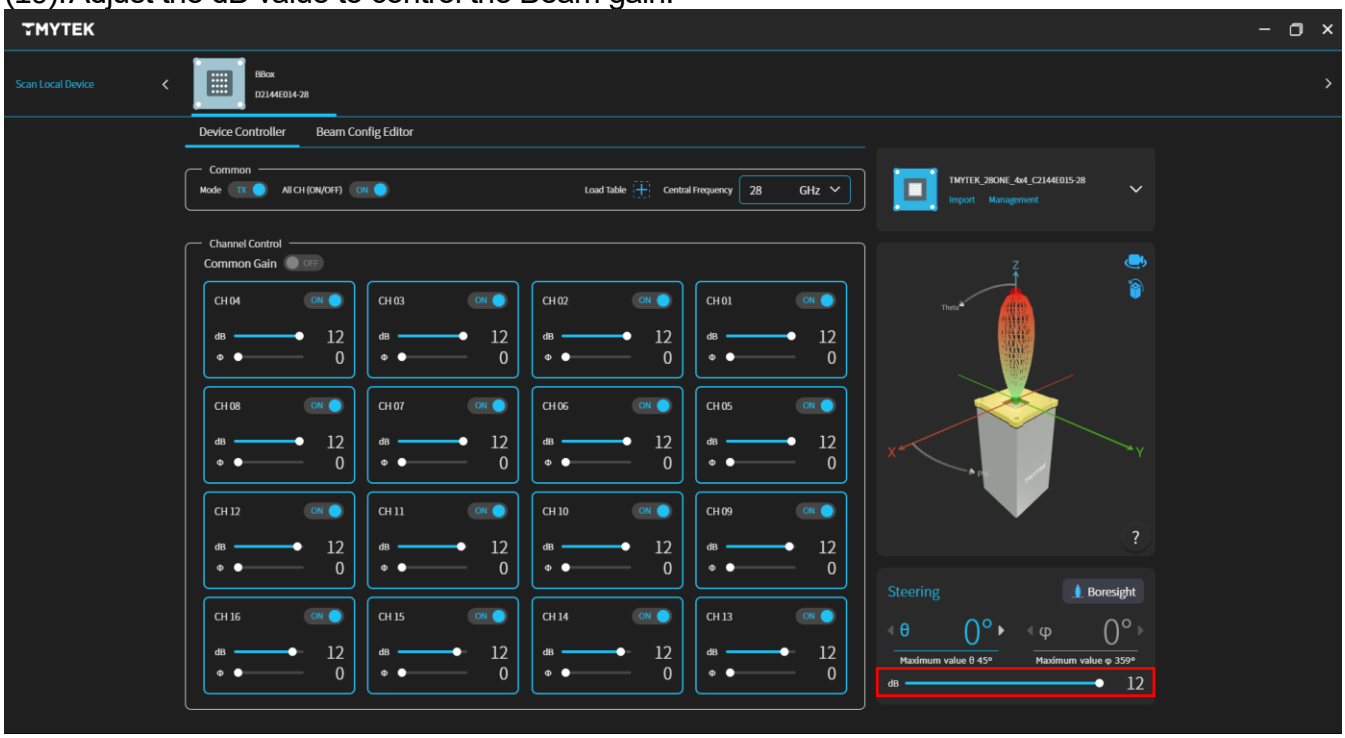


(18). This button can quickly adjust the device to the upright or horizontal position.
NOTE: Users can manually rotate the angle of the device instead of using this function.





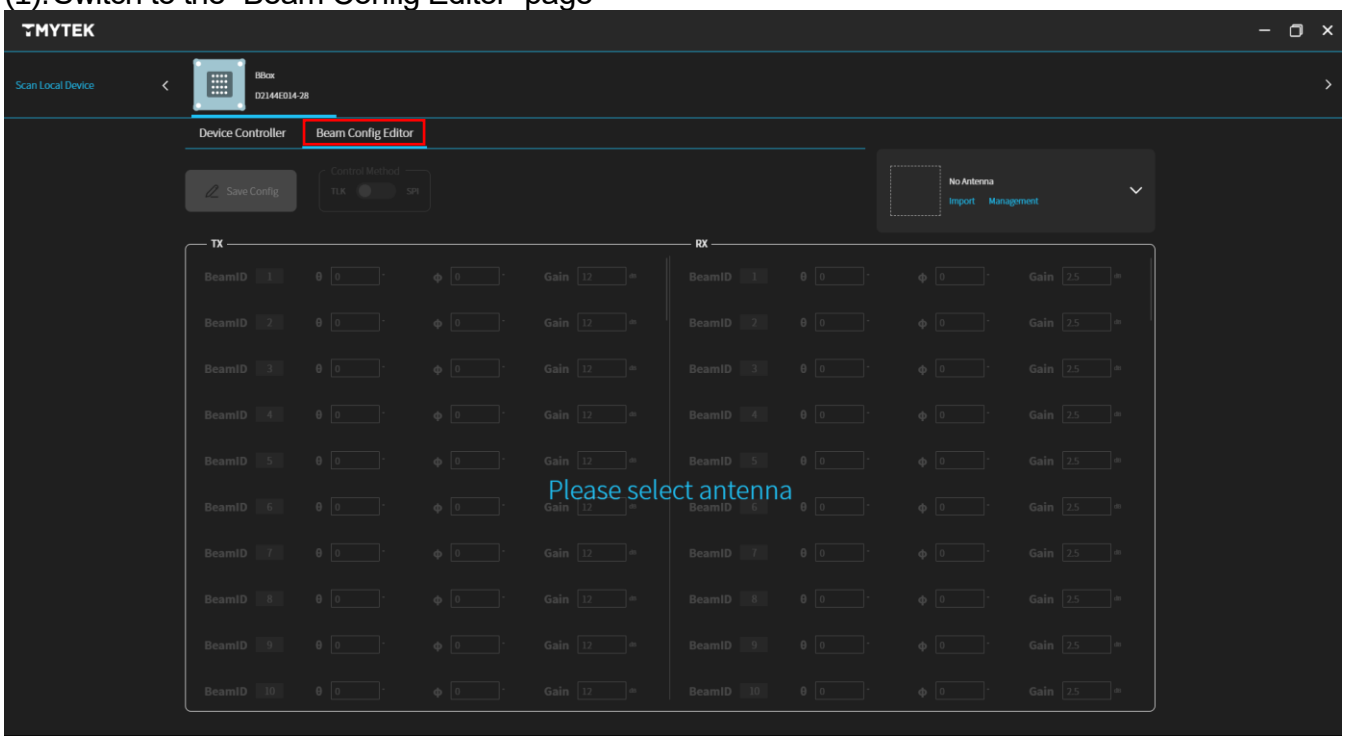
(19). Adjust the dB value to control the Beam gain.



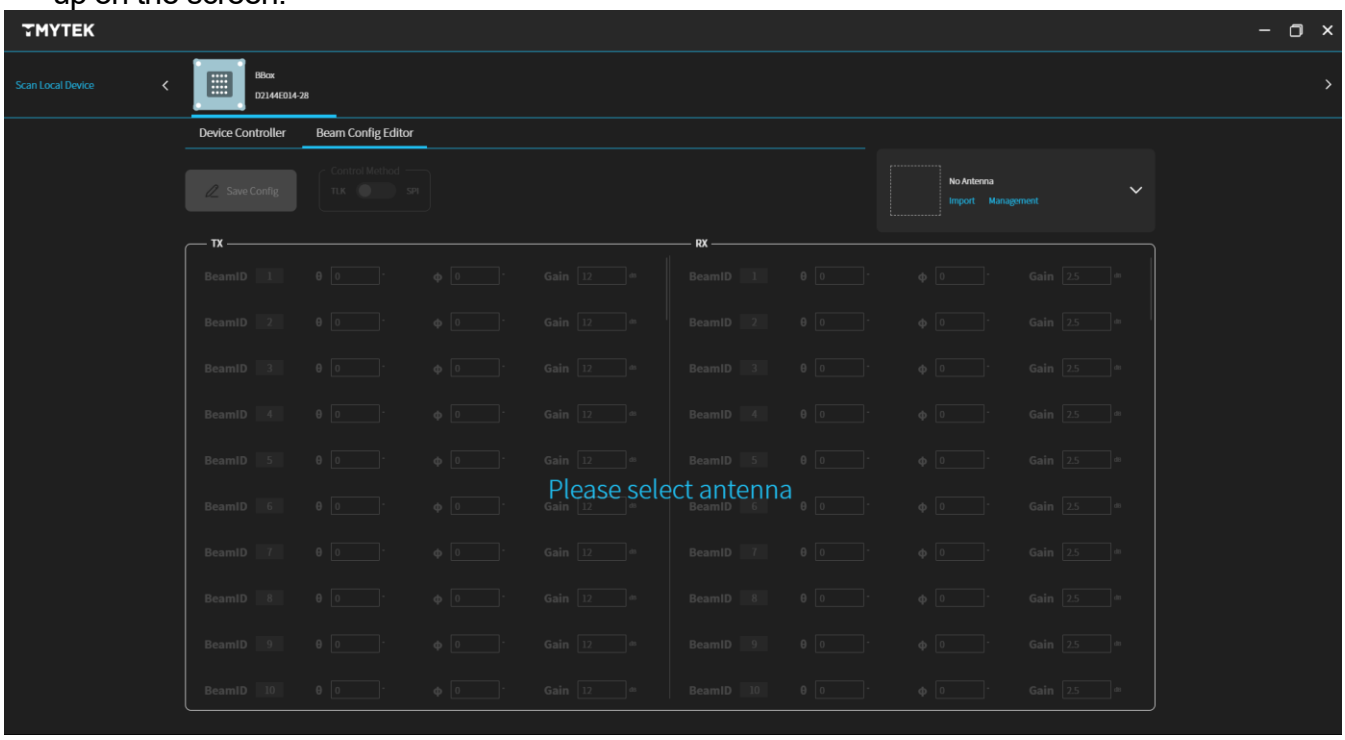
2.2 Beam Config Editor

- The Beam Config Editor can pre-edit up to 64 sets of beams in Tx/Rx mode each, and can write the beam table into the BBox. In the same power cycle, the user can switch the pre-written beam ID through the SPI interface.

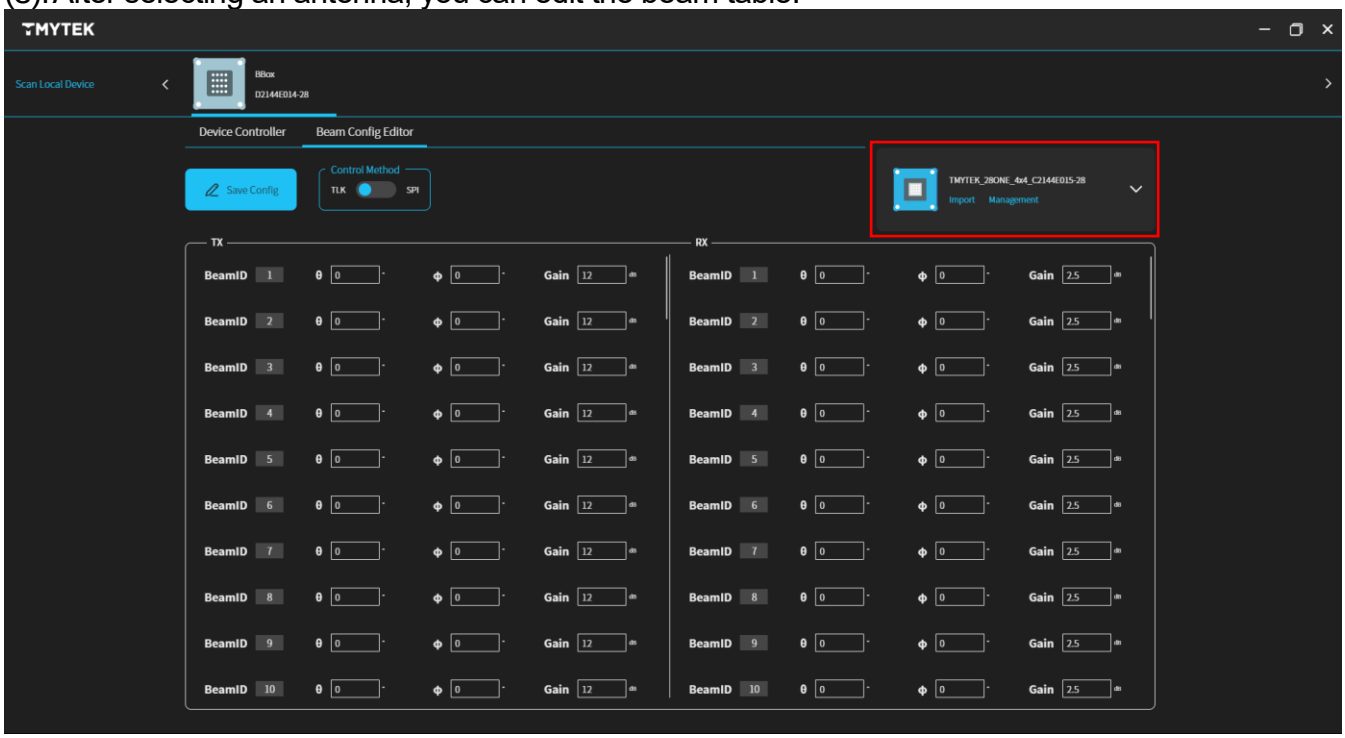
(1). Switch to the “Beam Config Editor” page



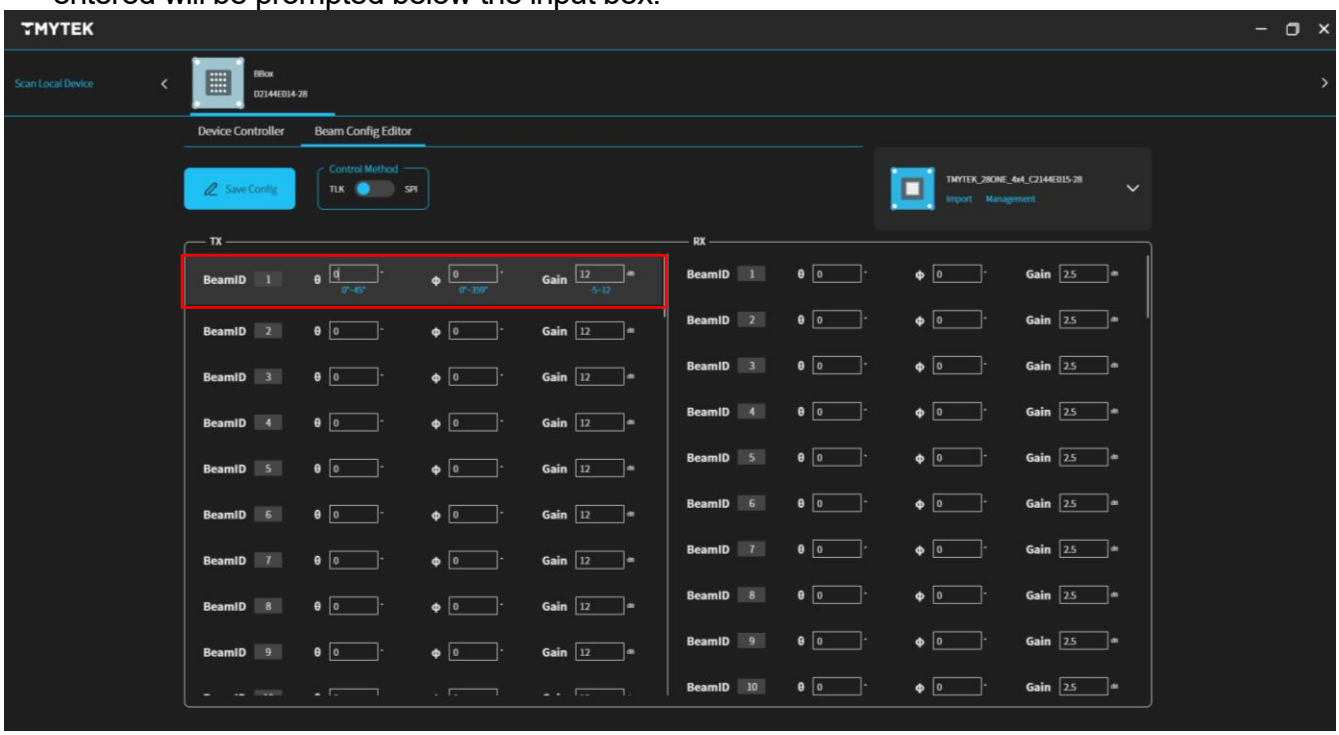
(2). If no antenna is selected, the beam table cannot be edited, and “Please select antenna” will pop up on the screen.



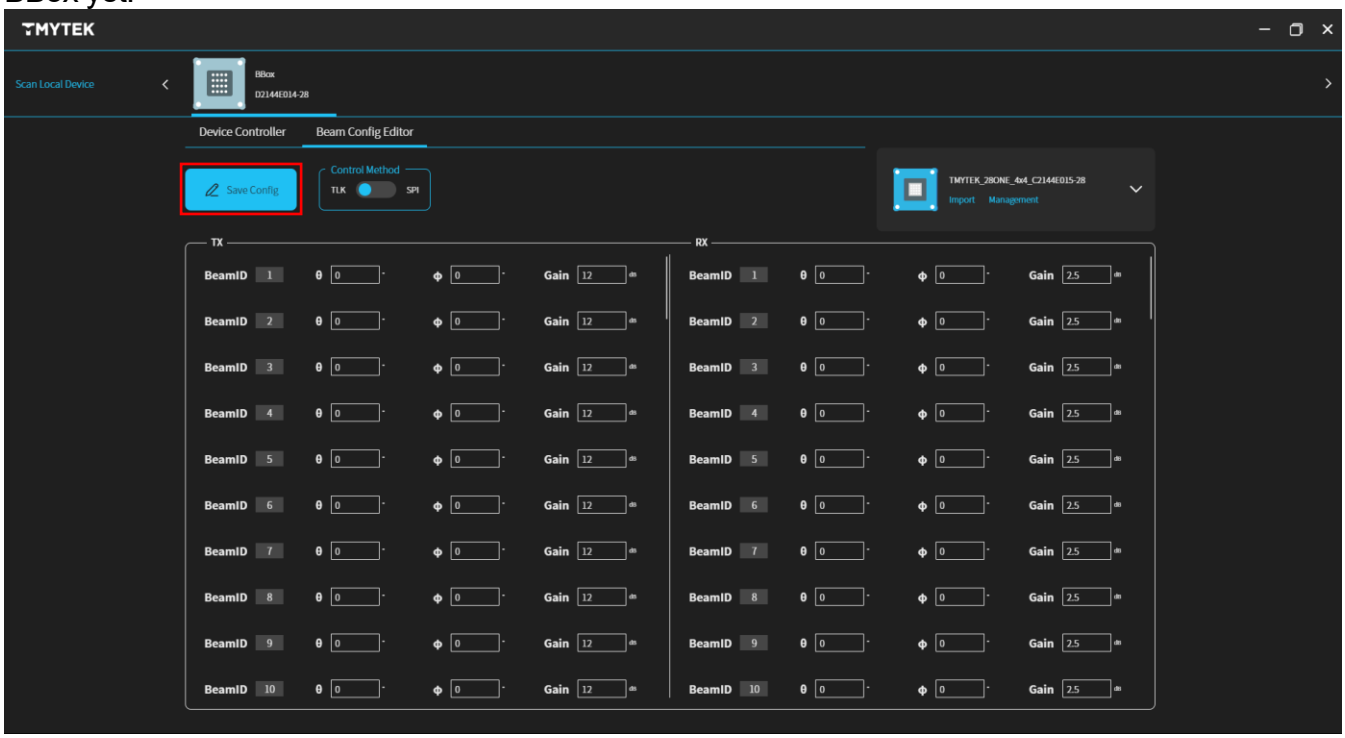
(3). After selecting an antenna, you can edit the beam table.



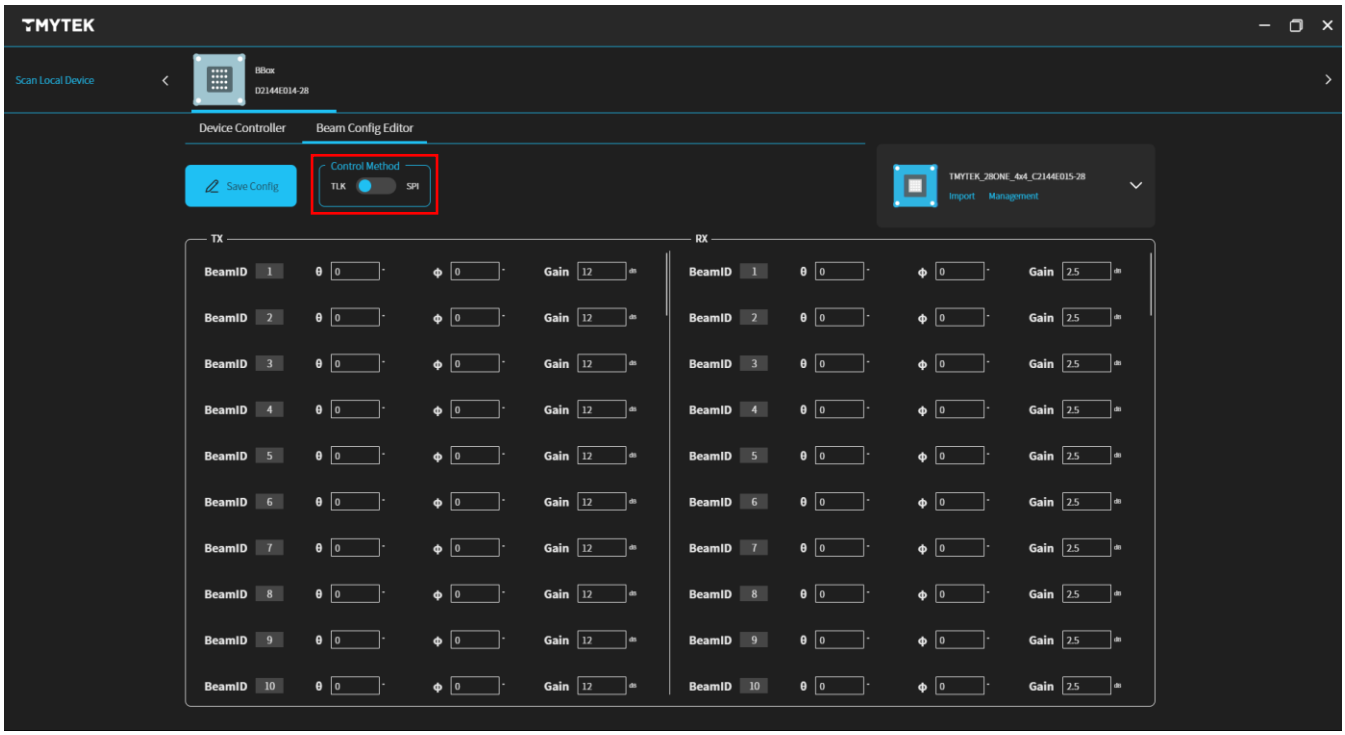
(4). 64 sets of beams can be stored in the Tx/Rx mode each, and the range of values that can be entered will be prompted below the input box.



(5). After editing, click "Save Config" to save the configuration file.
NOTE: At this moment, the configuration file is only written on the PC and has not been written to BBox yet.

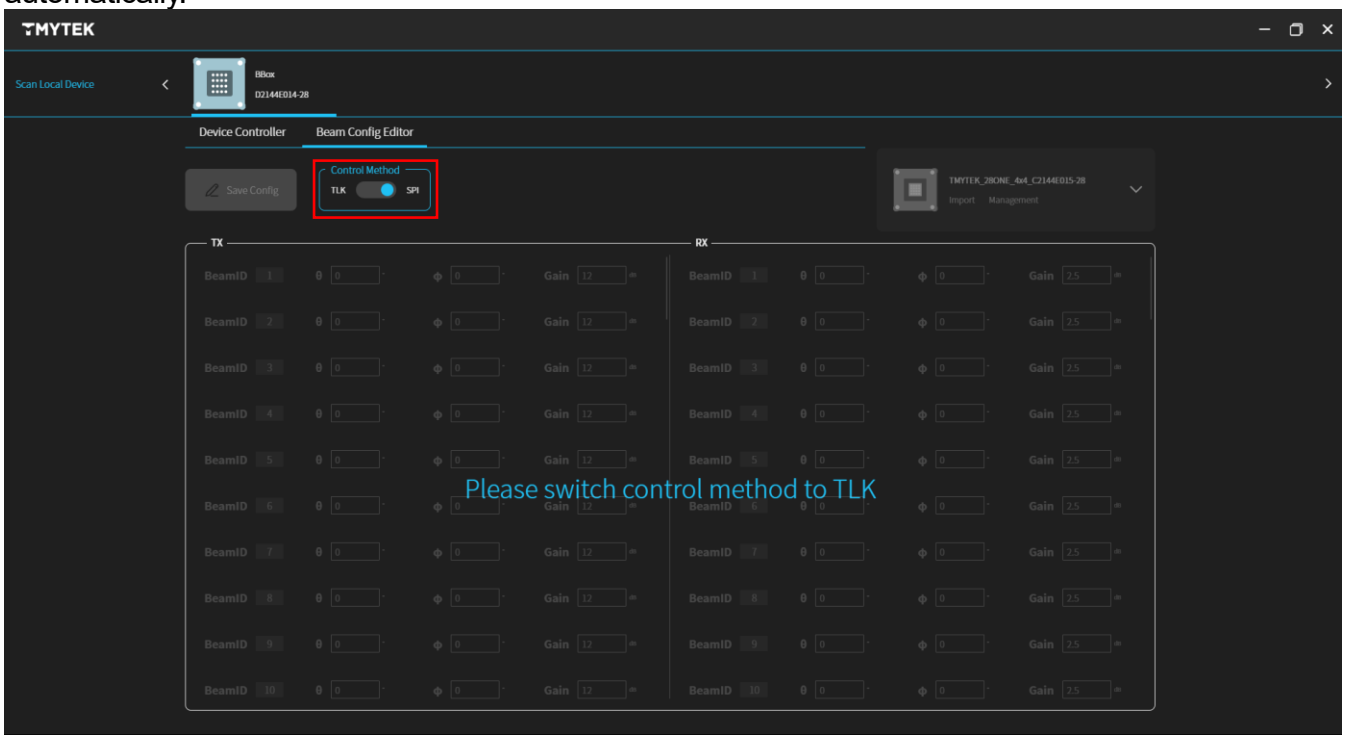


(6). Control Method shows how BBox is controlled. In the “TLK” mode, the device is controlled by Ethernet.



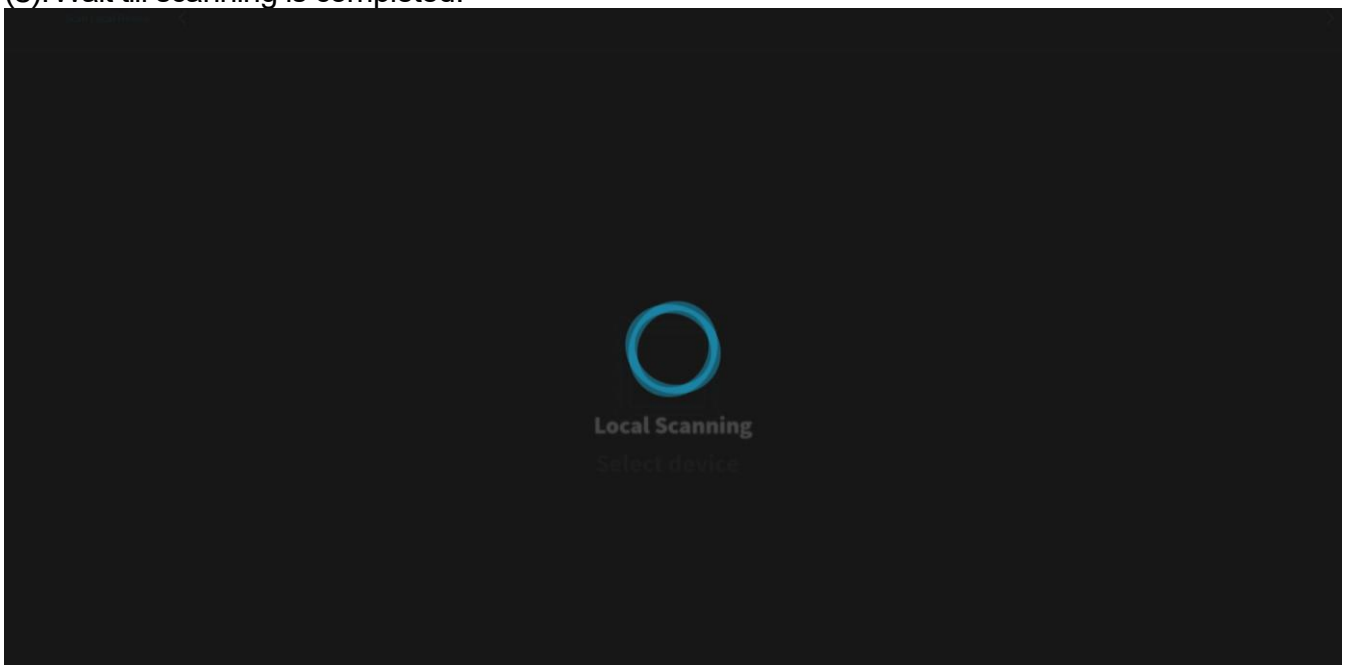
(7). Toggling the Control Method button can switch the control method of BBox. In the “SPI” mode, Beam Config is written to BBox and BBox cannot be controlled by TLK. All function is locked and “Please switch control method to TLK” will pop up on the screen.

NOTE: If you switch to the “Device Controller” page now, the Control Method will be set to “TLK” automatically.

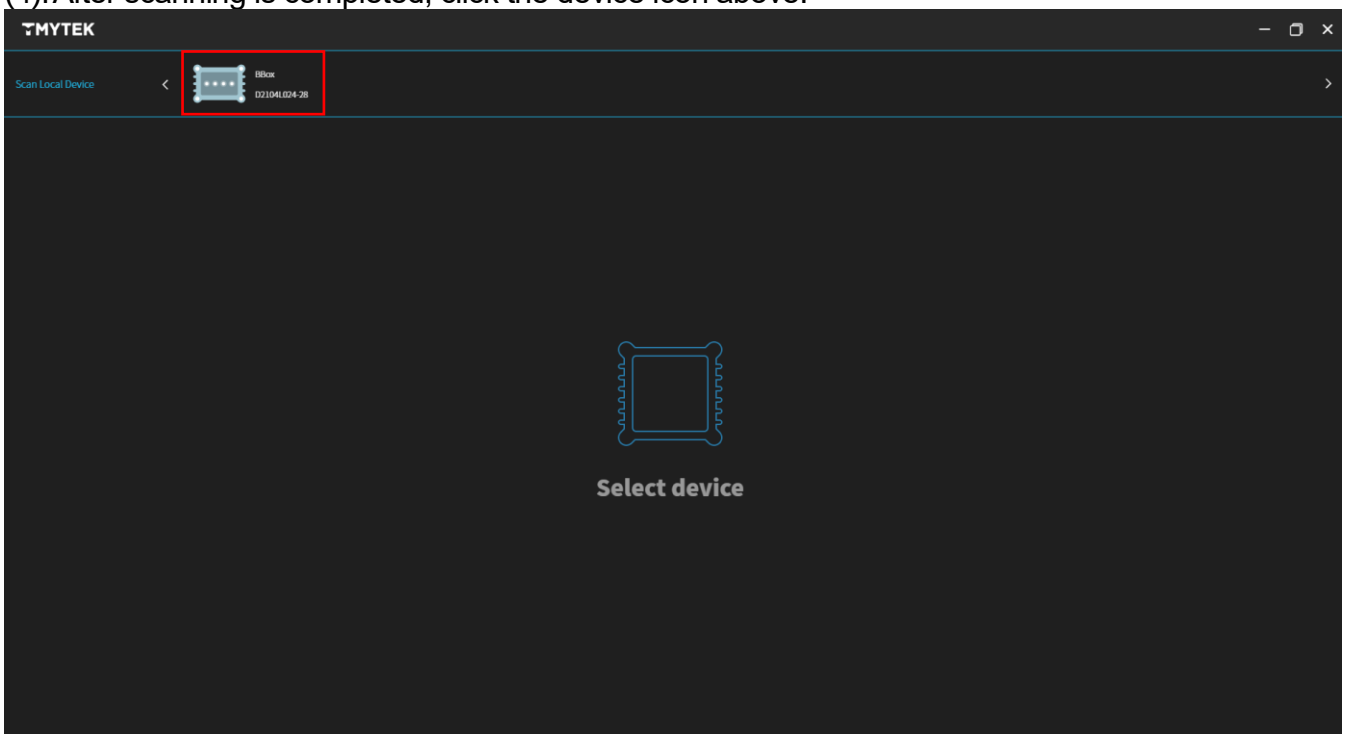


3. BBox Lite

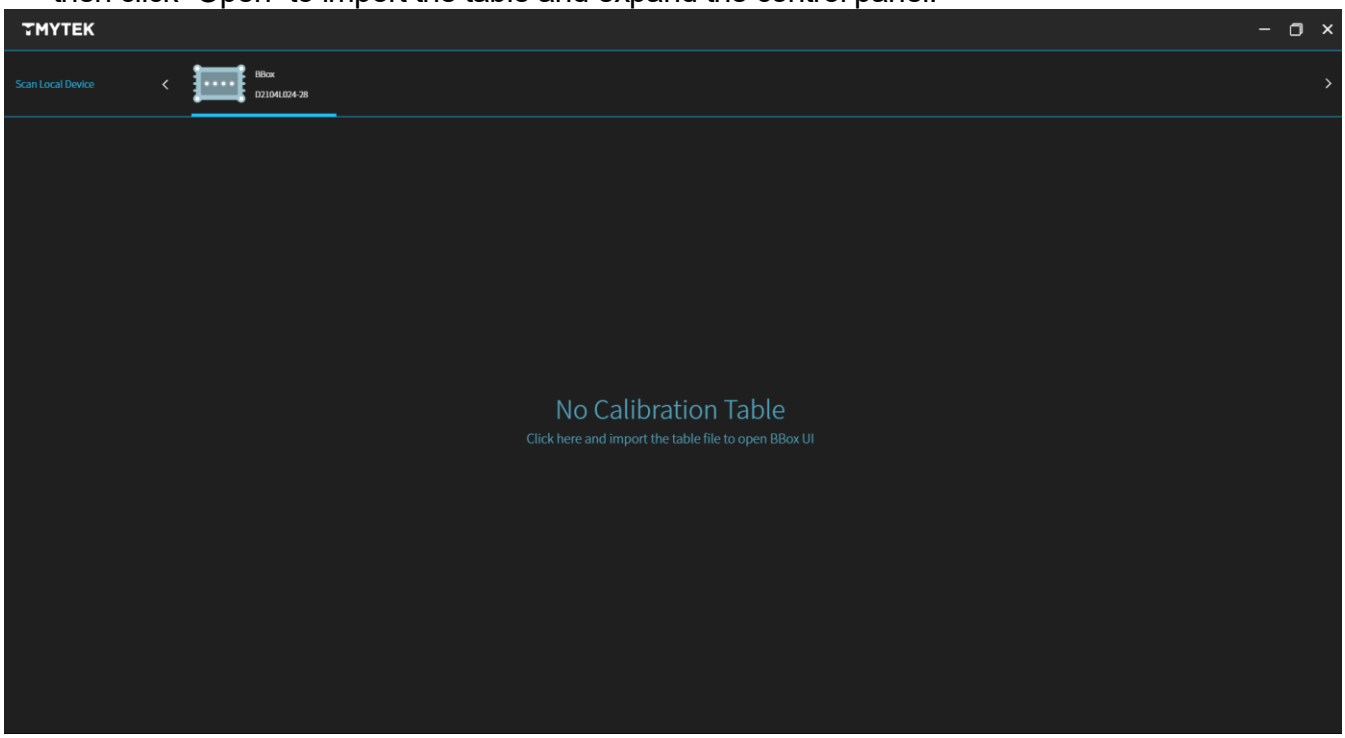
(1). Connect BBox Lite and PC with Ethernet, and then turn on the power of BBox Lite.
(2). Open TMXLAB Kit.
(3). Wait till scanning is completed.

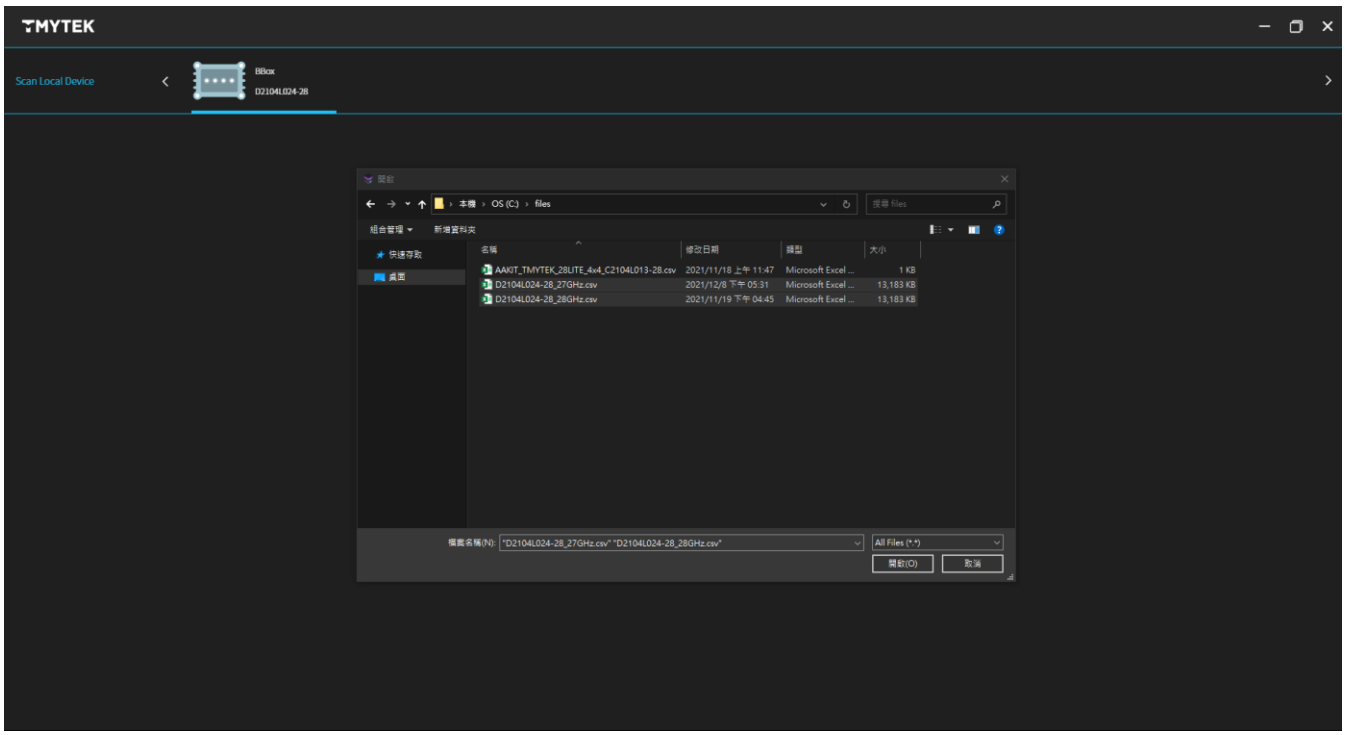


(4). After scanning is completed, click the device icon above.



(5). If the table of the clicked device has not been imported, the screen will show “No Calibration Table.” Click anywhere to open the file selection window, choose the file(s) to be imported, and then click “Open” to import the table and expand the control panel.

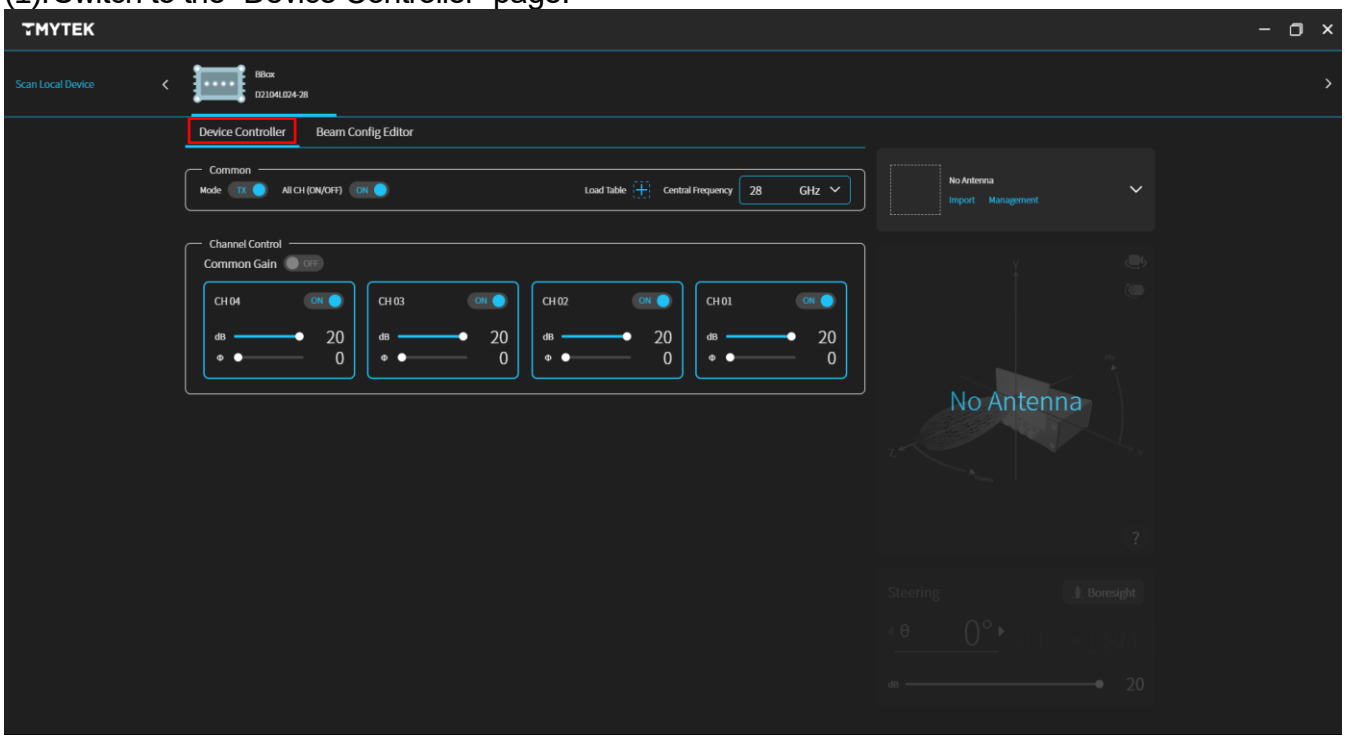




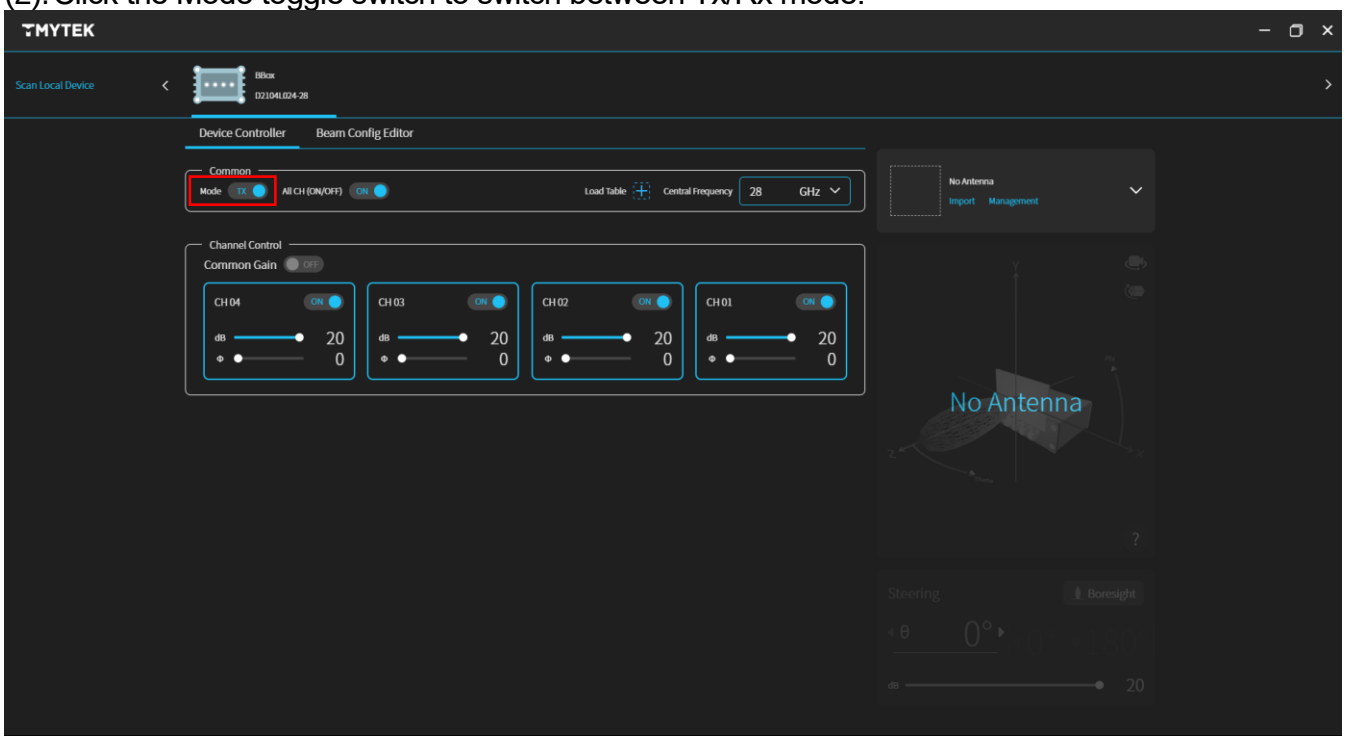
3.1 Device Controller

- The “Device Controller” is designed to switch between Tx/Rx mode, change central frequency, control the power/gain/phase of each channel and set beam angle.

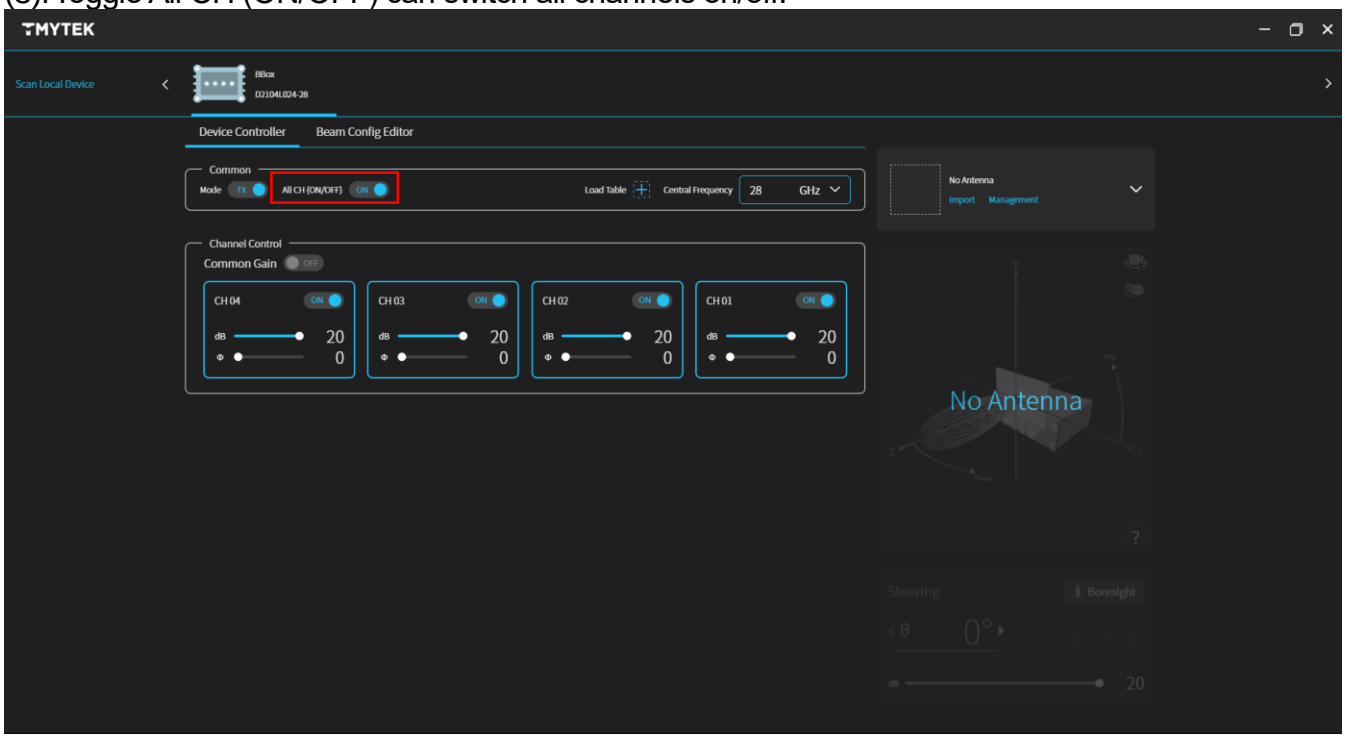
(1). Switch to the “Device Controller” page.



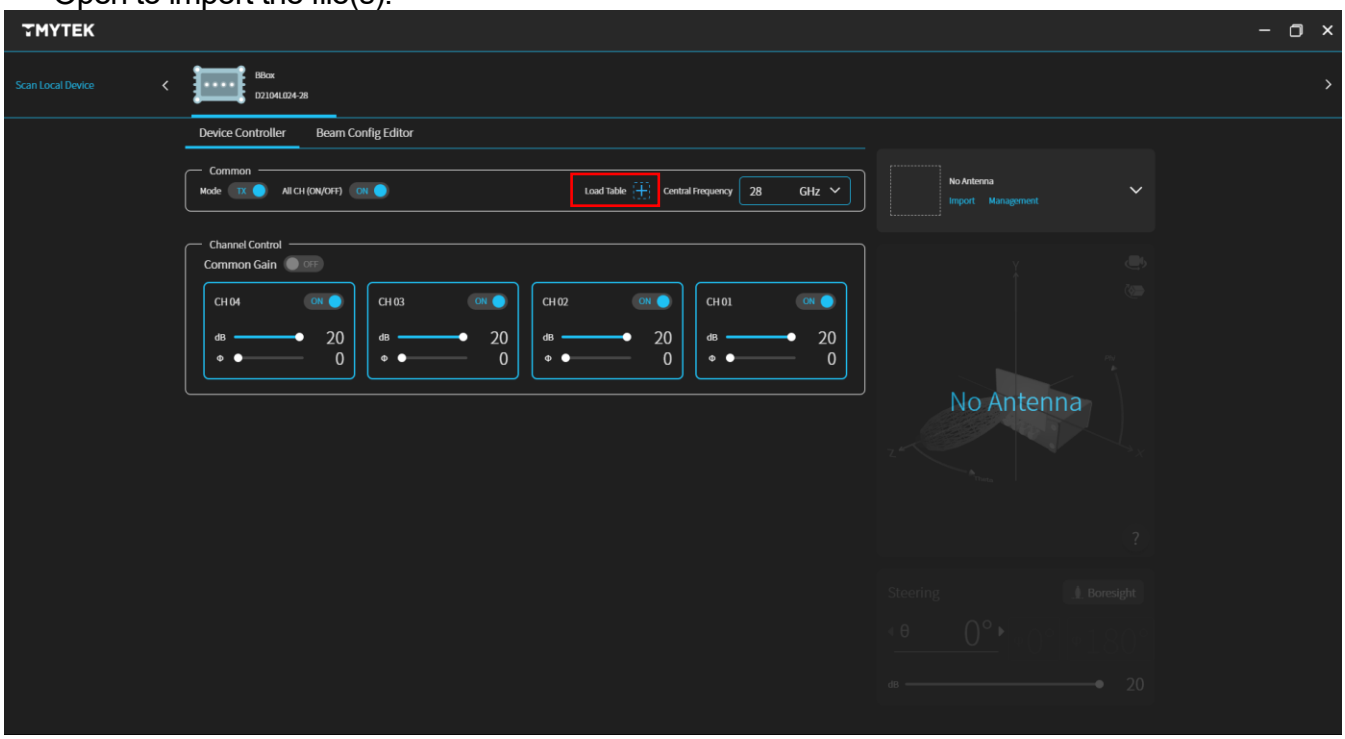
(2). Click the Mode toggle switch to switch between Tx/Rx mode.



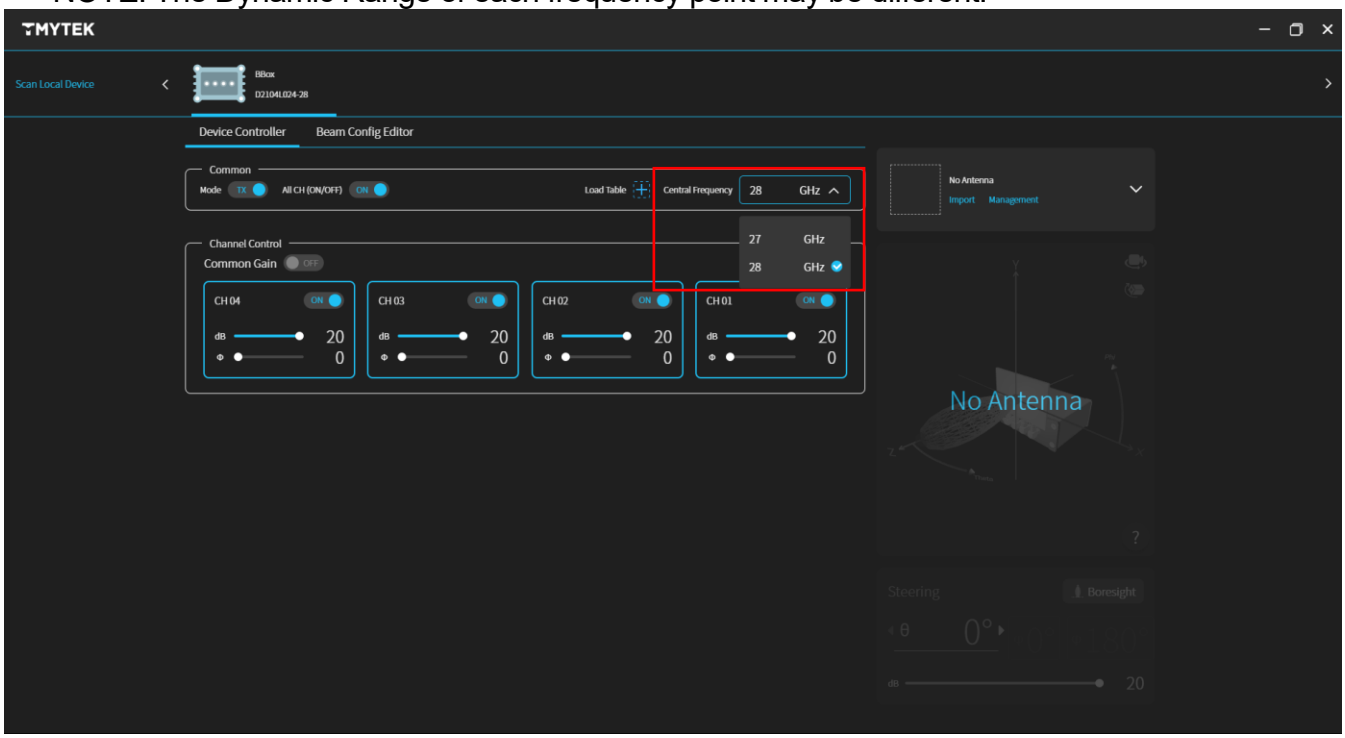
(3). Toggle All CH (ON/OFF) can switch all channels on/off.



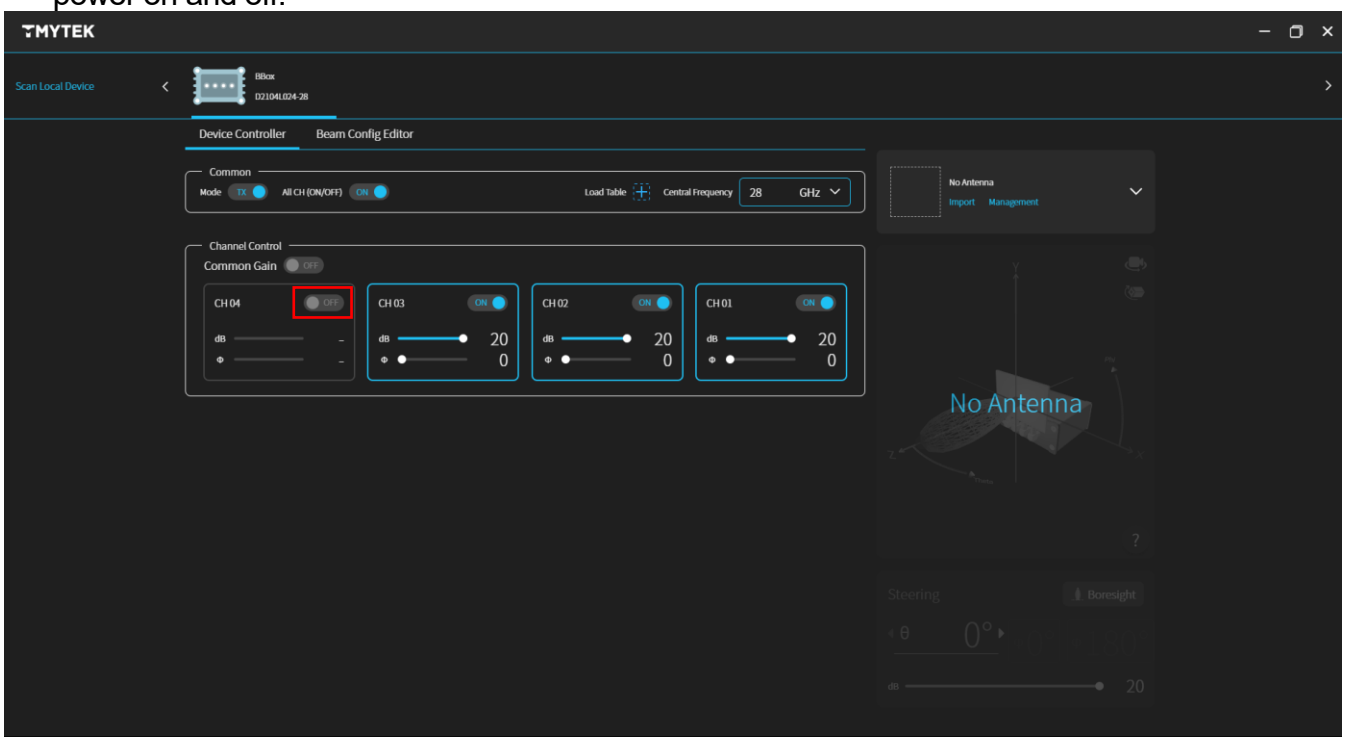
(4). Click "Load Table" to import the calibration table. After selecting the file(s) to be imported, click Open to import the file(s).



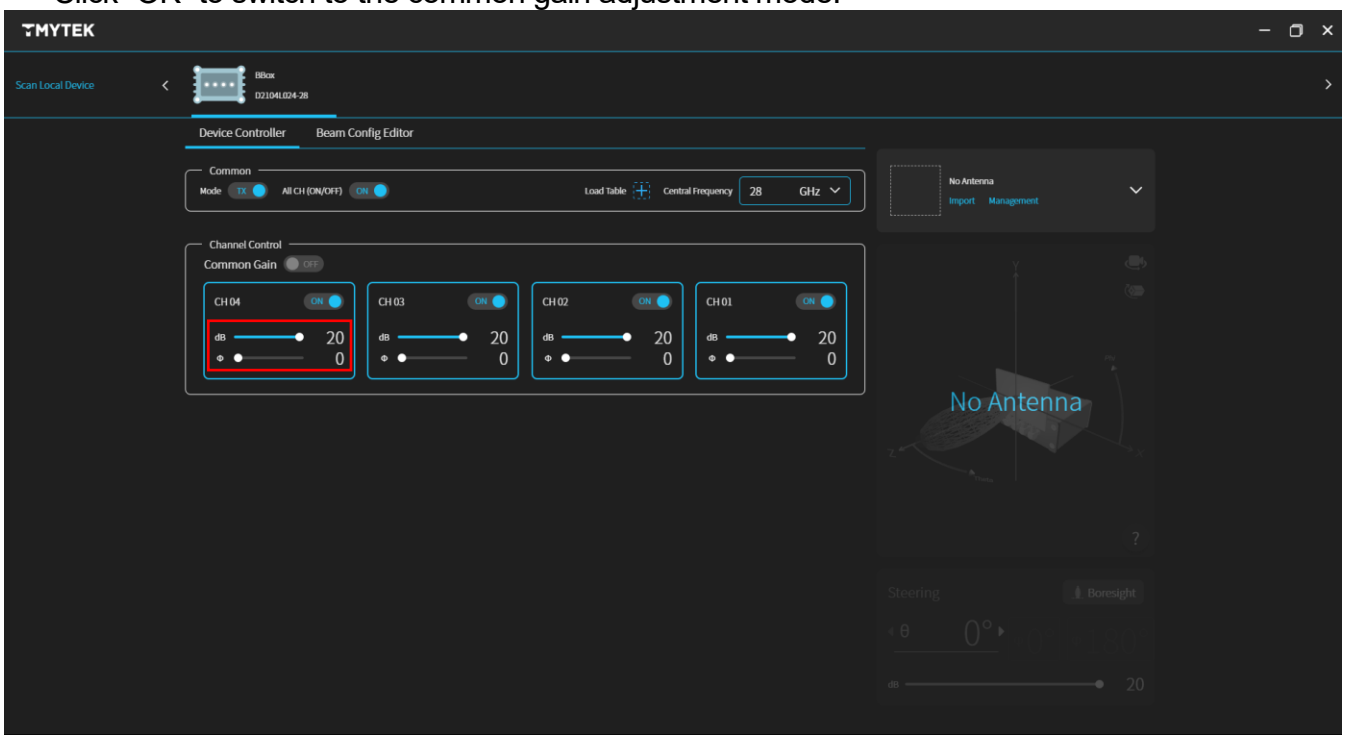
(5). All available frequency points are listed in the Central Frequency drop-down menu. You can choose the desired one.
NOTE: The Dynamic Range of each frequency point may be different.

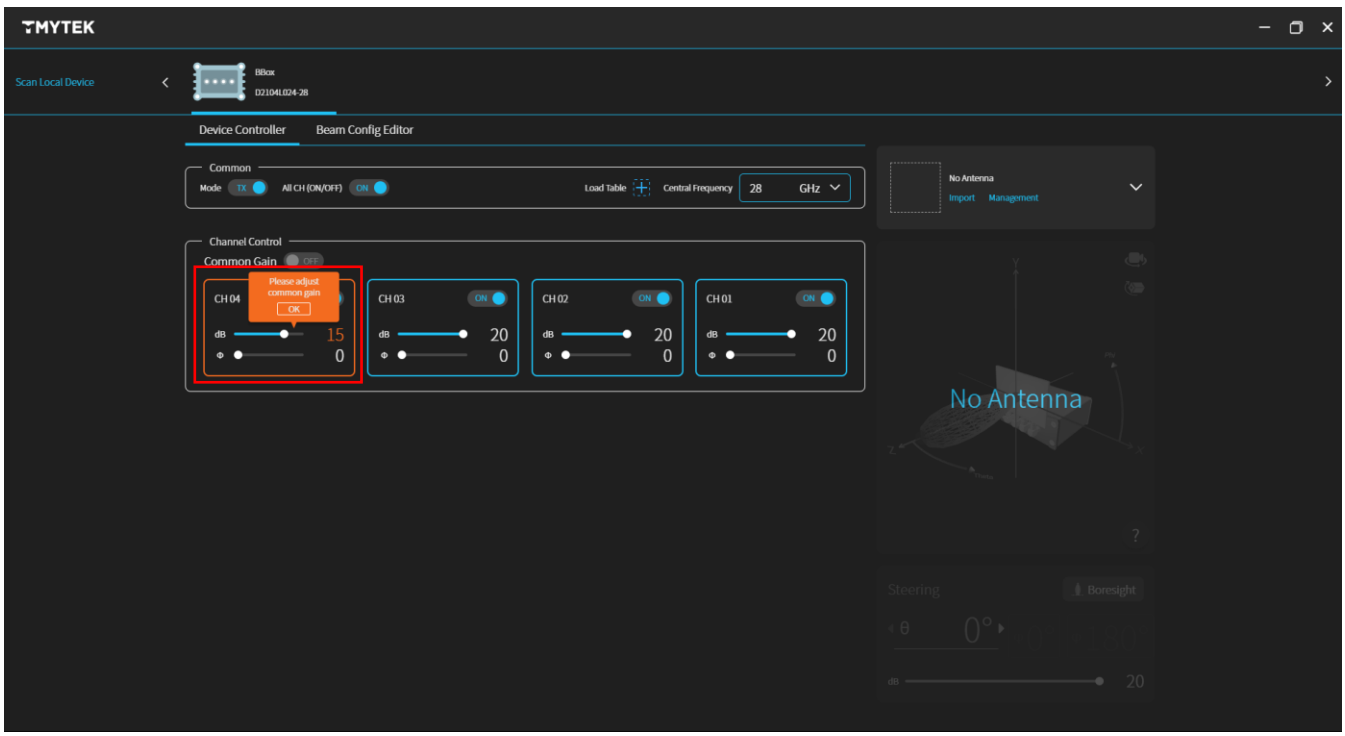


(6). Click the switch button in the upper right corner of the channel card(s) to switch the channel power on and off.

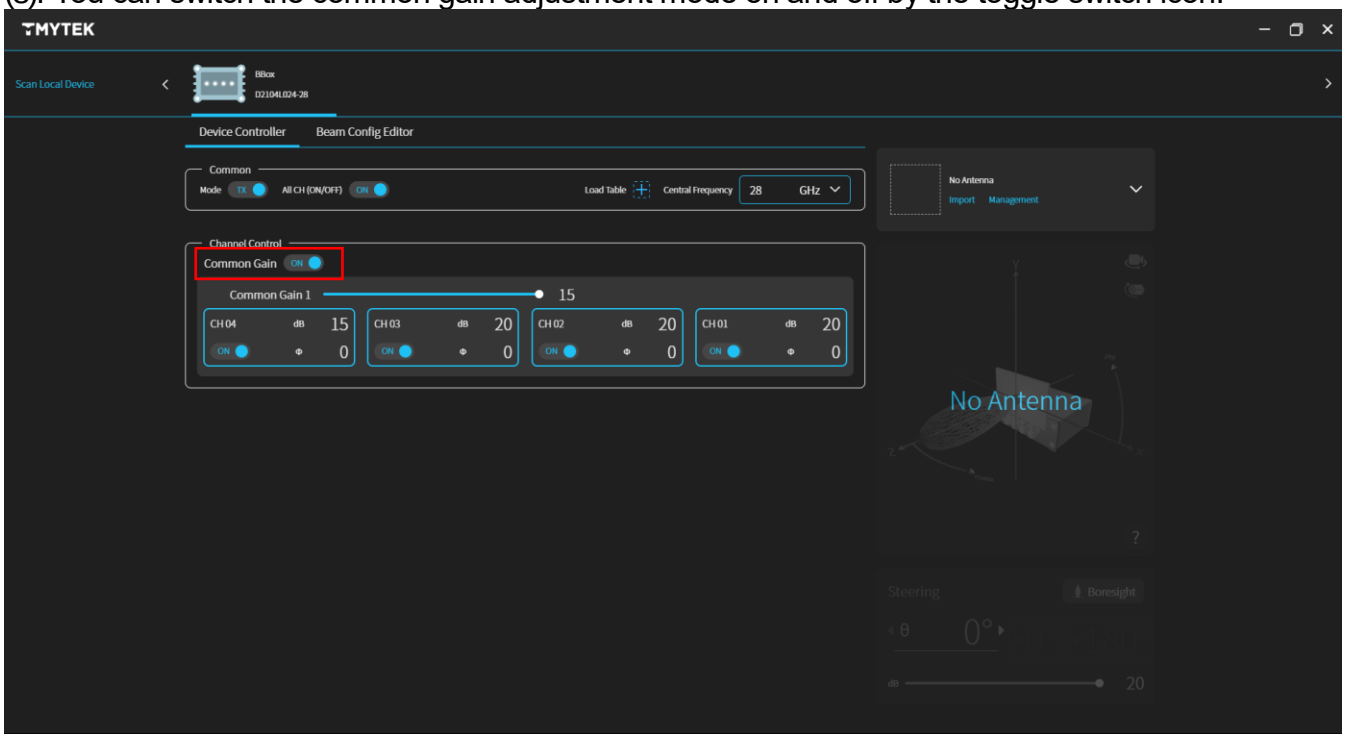


(7). Adjust the sliders of dB and Φ in the channel card(s) to control the channel gain and phase. When the element gain is minimal/maximal, the screen will show “Please adjust common gain.” You need to adjust the common gain before you can continue to lower/higher the channel gain. Click “OK” to switch to the common gain adjustment mode.

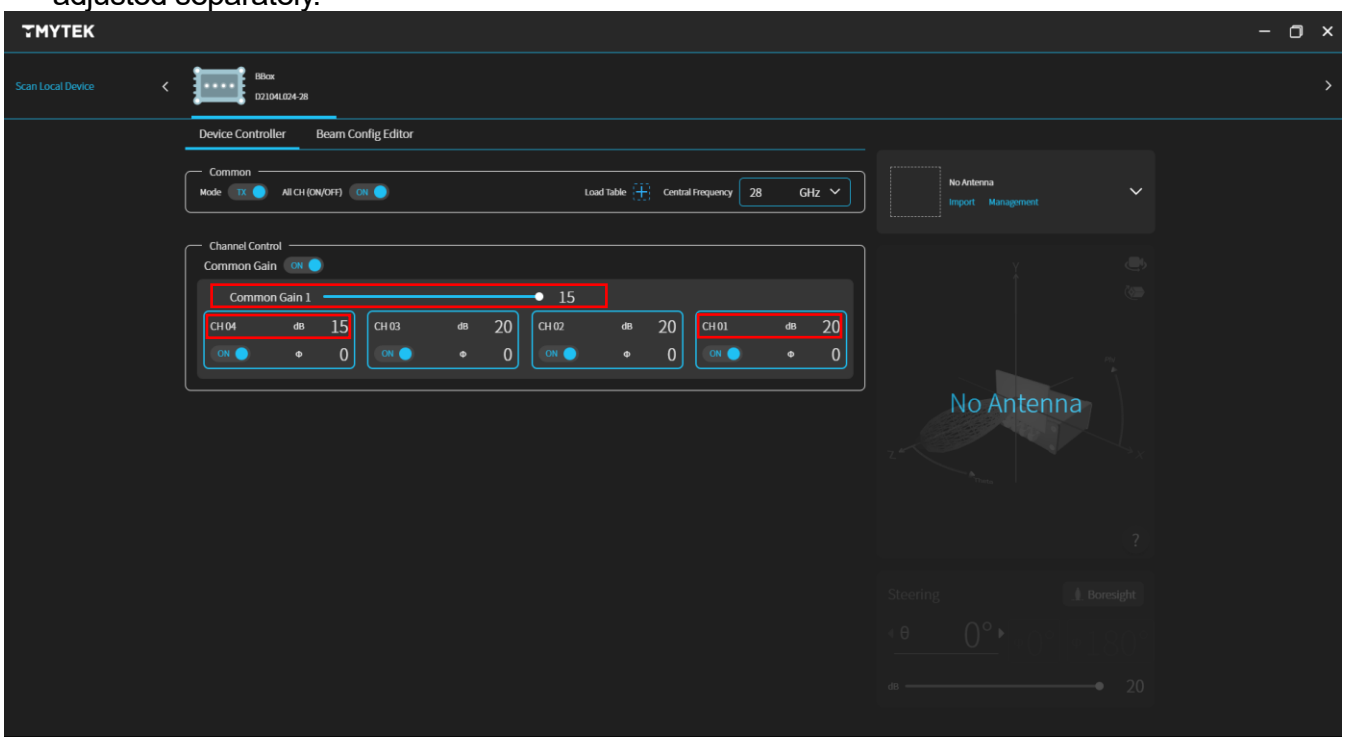




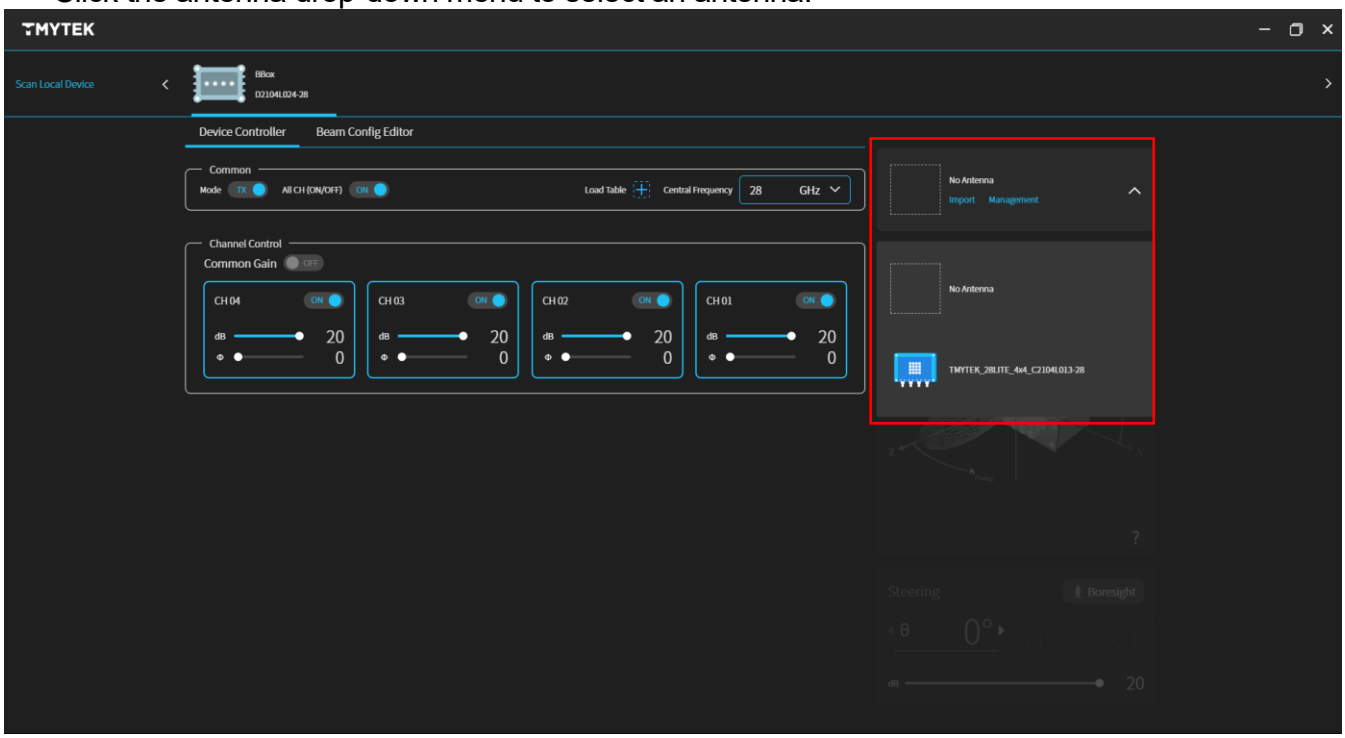
(8). You can switch the common gain adjustment mode on and off by the toggle switch icon.



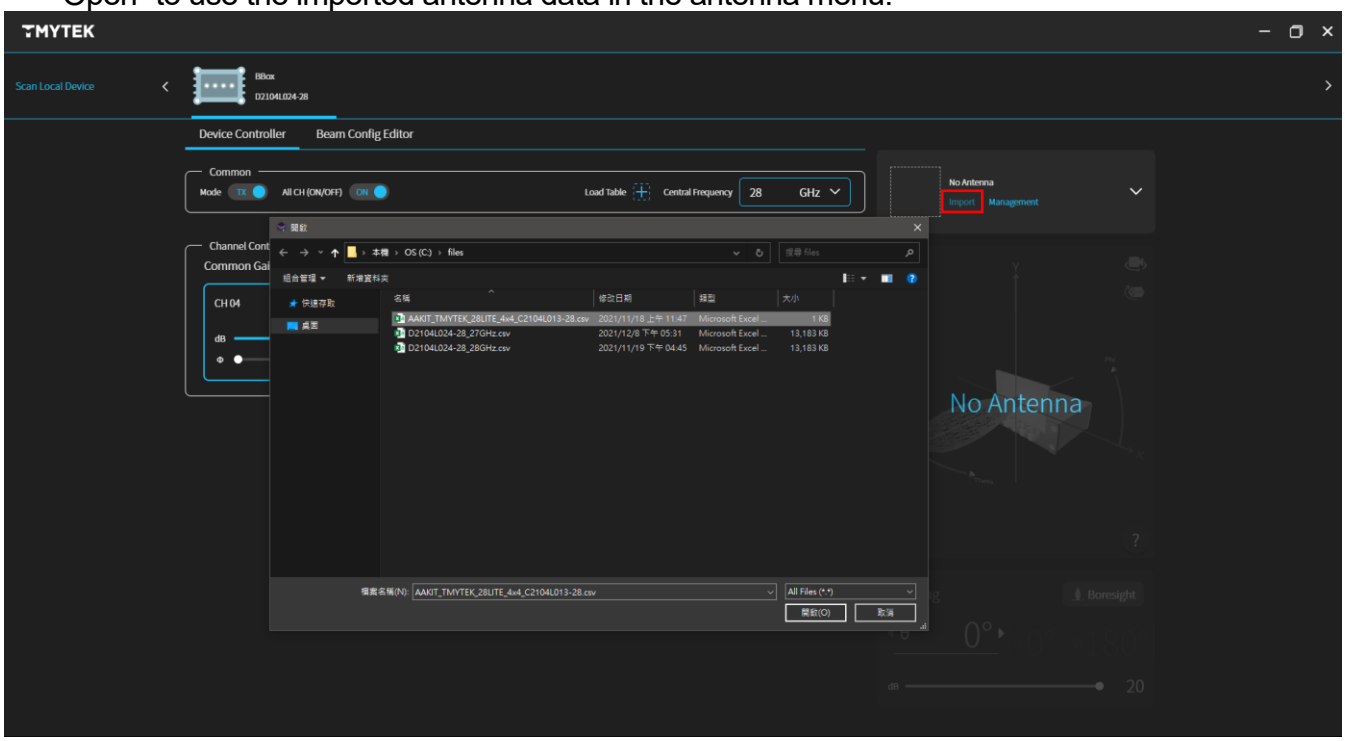
(9). Adjusting the common gain will simultaneously affect the gain of the 4 channels on the board. Take this screenshot as an example, if the common gain is changed to 0, the Channel01 is 5 dB, Channel04 is 0 dB. Then, the common gain and channel gain can be adjusted separately.



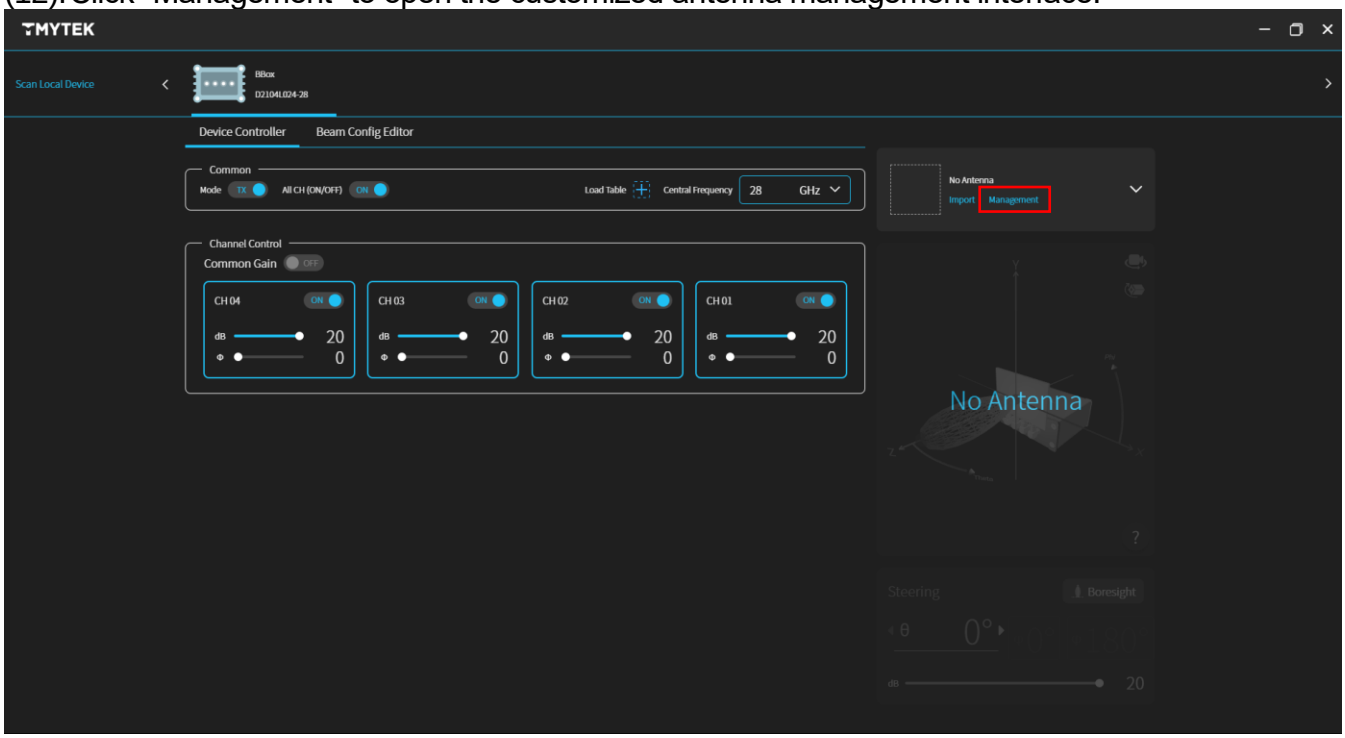
(10). If no antenna is selected, only the channel control mode is functional. The beam steering function is only available after an antenna is selected.
Click the antenna drop-down menu to select an antenna.



(11). Click “Import” to open the file selection window. Select the file(s) to be imported and click “Open” to use the imported antenna data in the antenna menu.



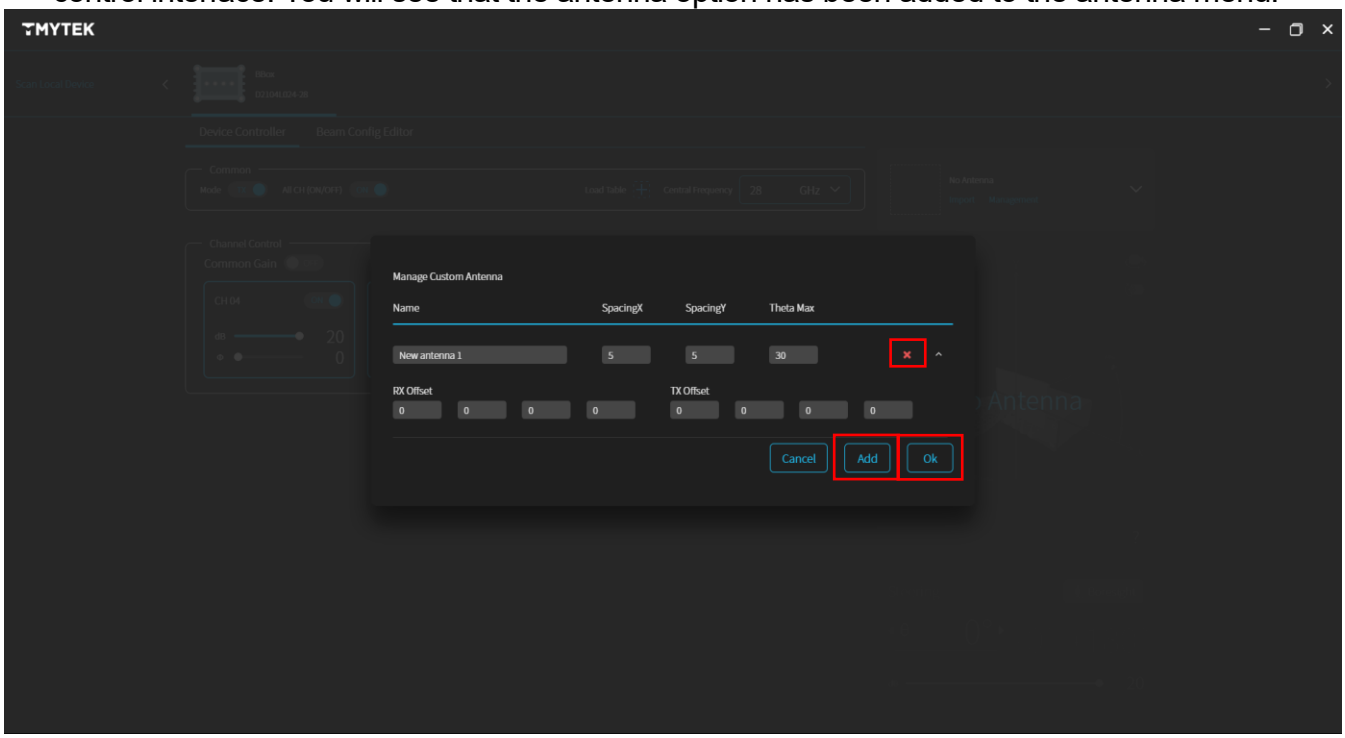
(12). Click "Management" to open the customized antenna management interface.

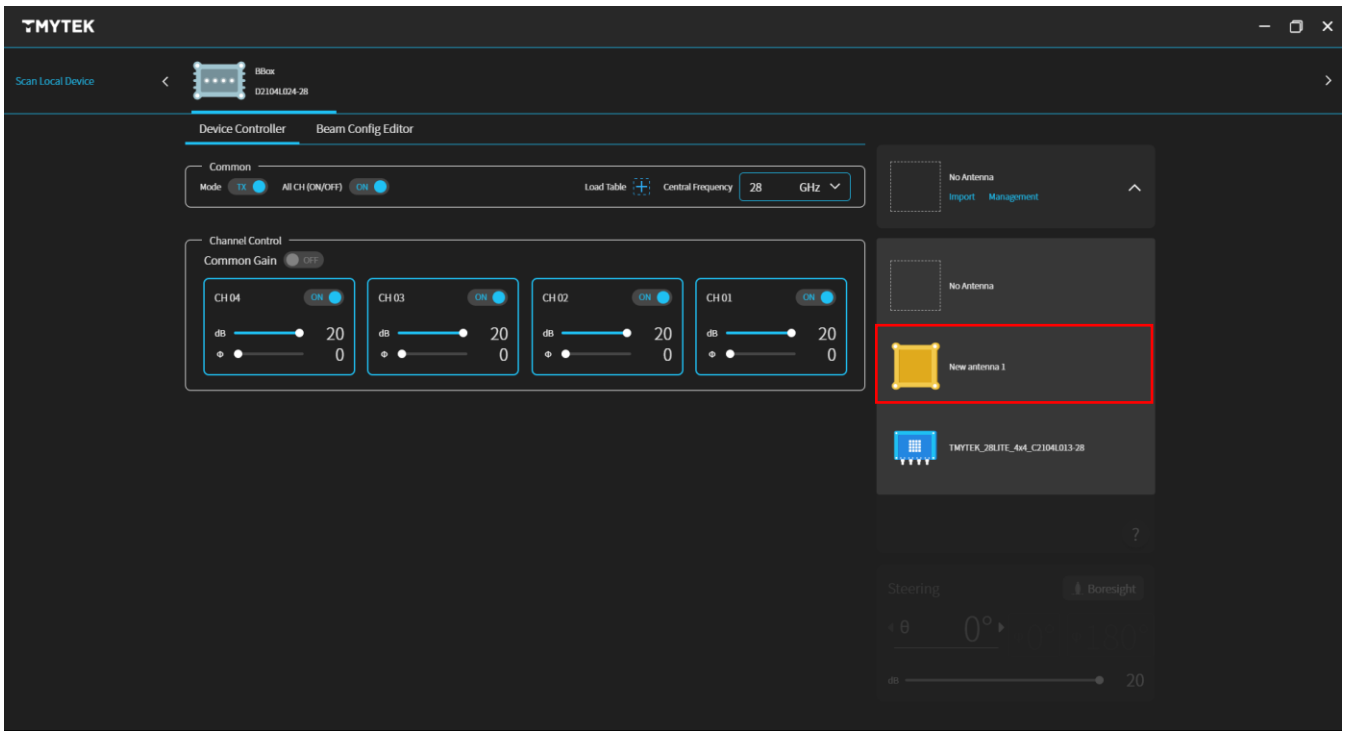


(13). Click "Add" to enter the add mode.

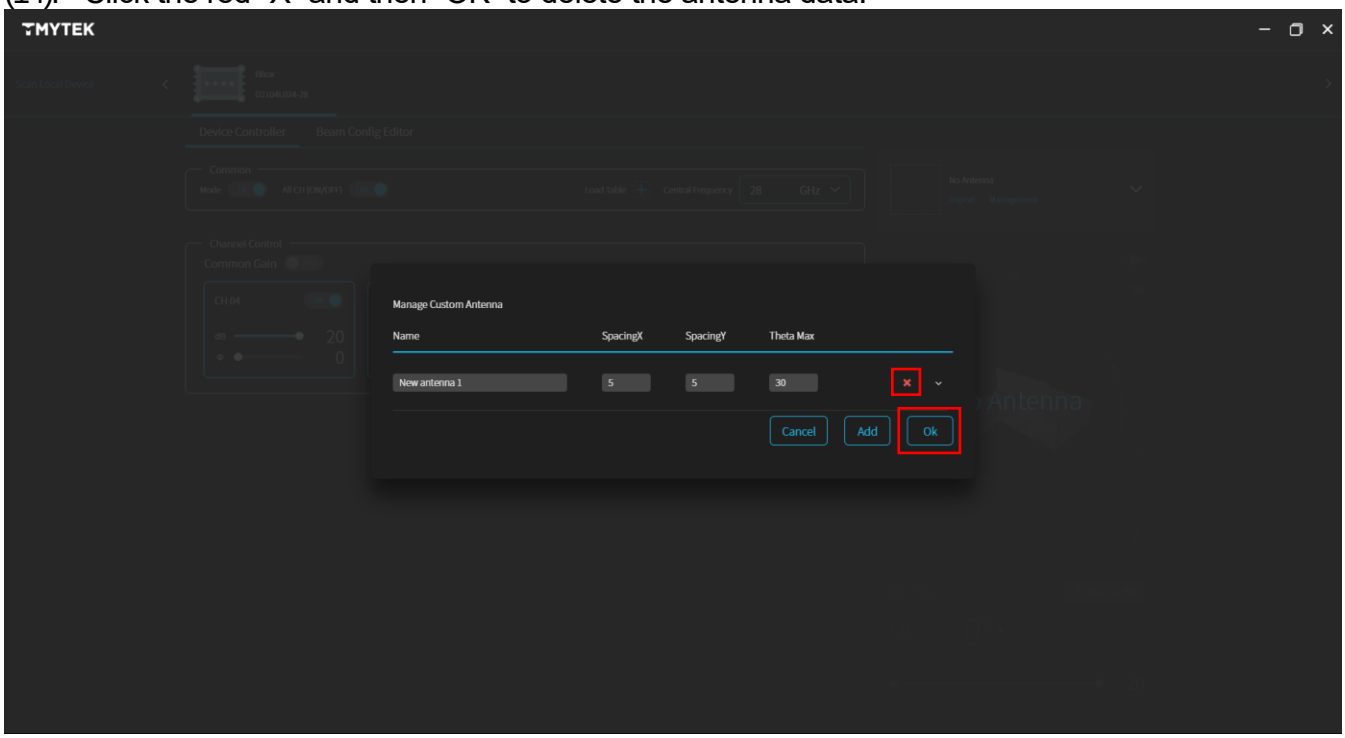
Enter following in order: antenna name (for identification, the name cannot be repeated), SpacingX (the pitch-to-pitch spacing between two adjacent antenna elements on the X-coordinate, Unit: mm), SpacingY (the pitch-to-pitch spacing between two adjacent antenna elements on the Y-coordinate, Unit: mm), Beam steering range, and phase offset of each channel. Click the arrow on the right to expand/collapse the offset input box.

After completing the above action, click "Ok" to save the input data and return to the main control interface. You will see that the antenna option has been added to the antenna menu.





(14). Click the red "X" and then “OK” to delete the antenna data.

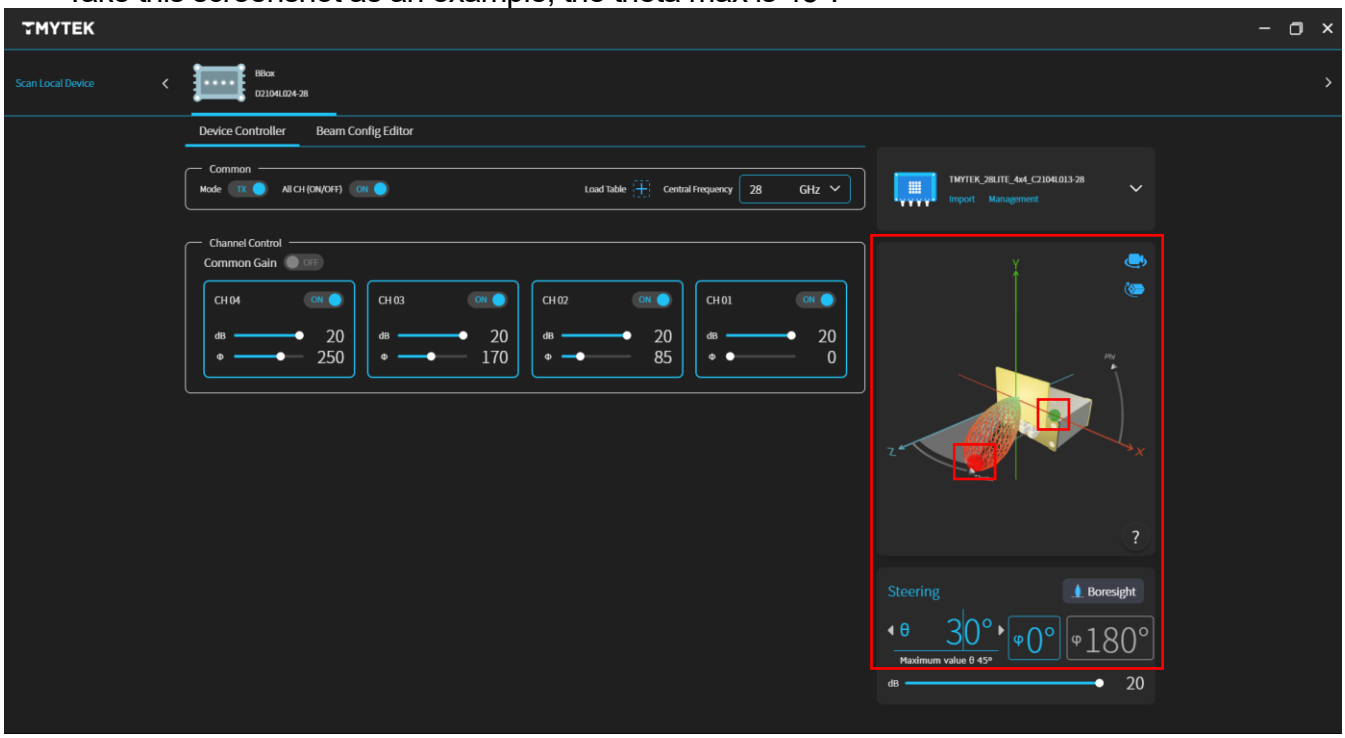


(15). Press and hold the red dot on the tip of the Beam to rotate the Beam and adjust θ and φ. Press and hold the green dot on the xy-plane to adjust φ.

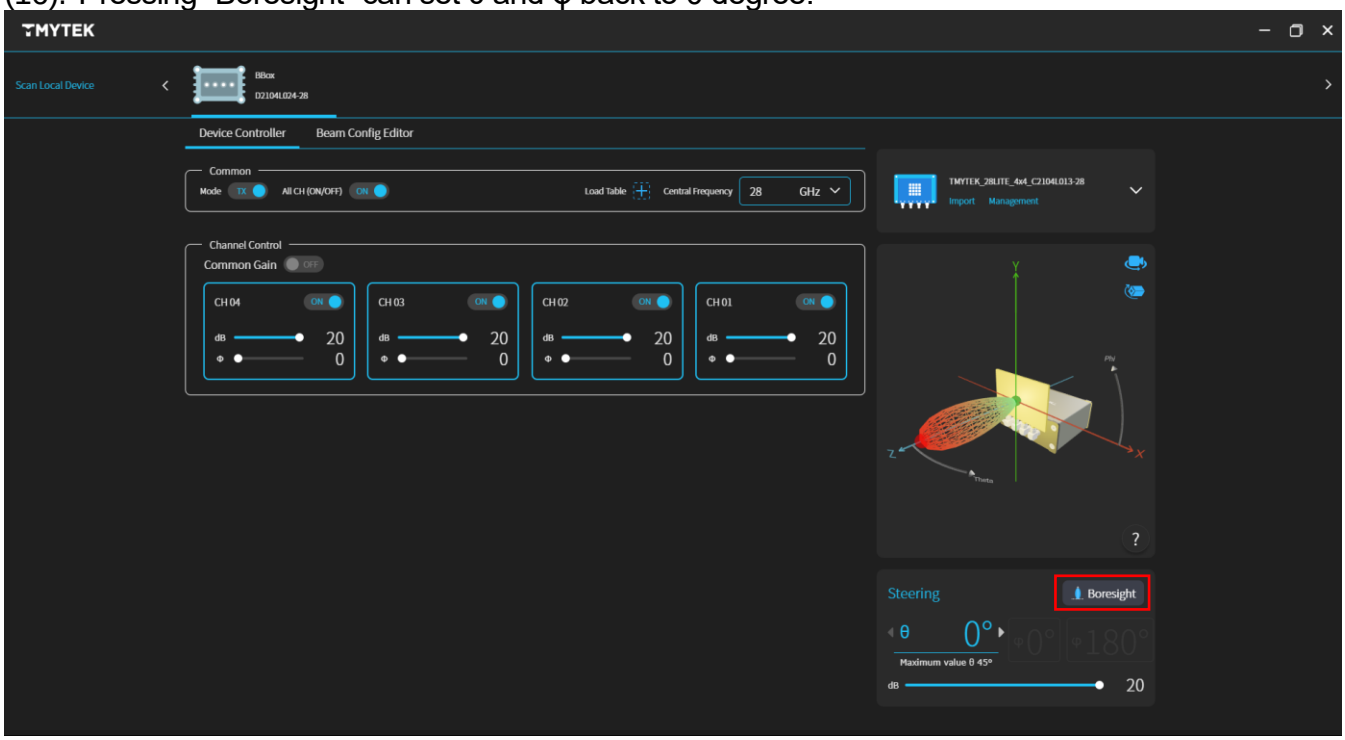
NOTE: θ is the angle between the positive Z-axis and the vector in question (0 ≤ θ ≤ Theta max angle).

φ is the angle between the projection of the vector onto the xy-plane and the positive X-axis (0 ≤ φ < 360°).

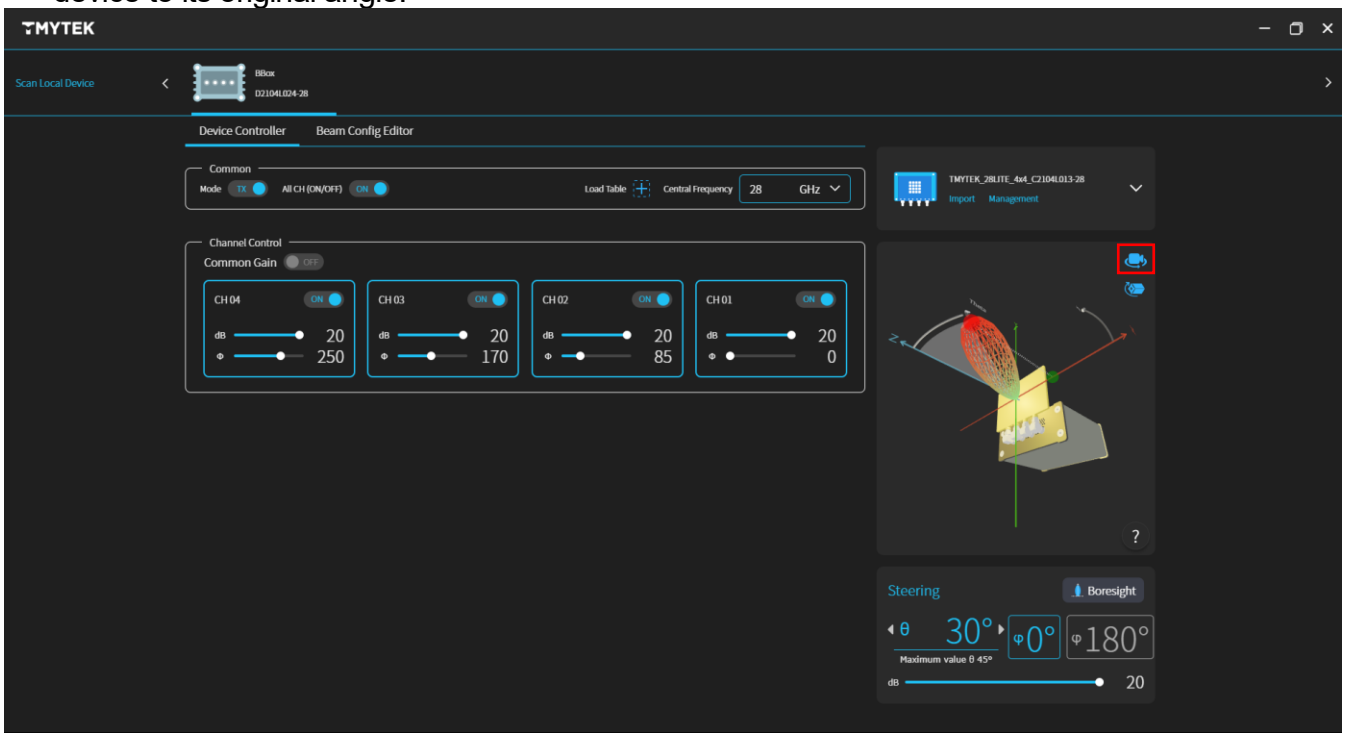
Take this screenshot as an example, the theta max is 45°.

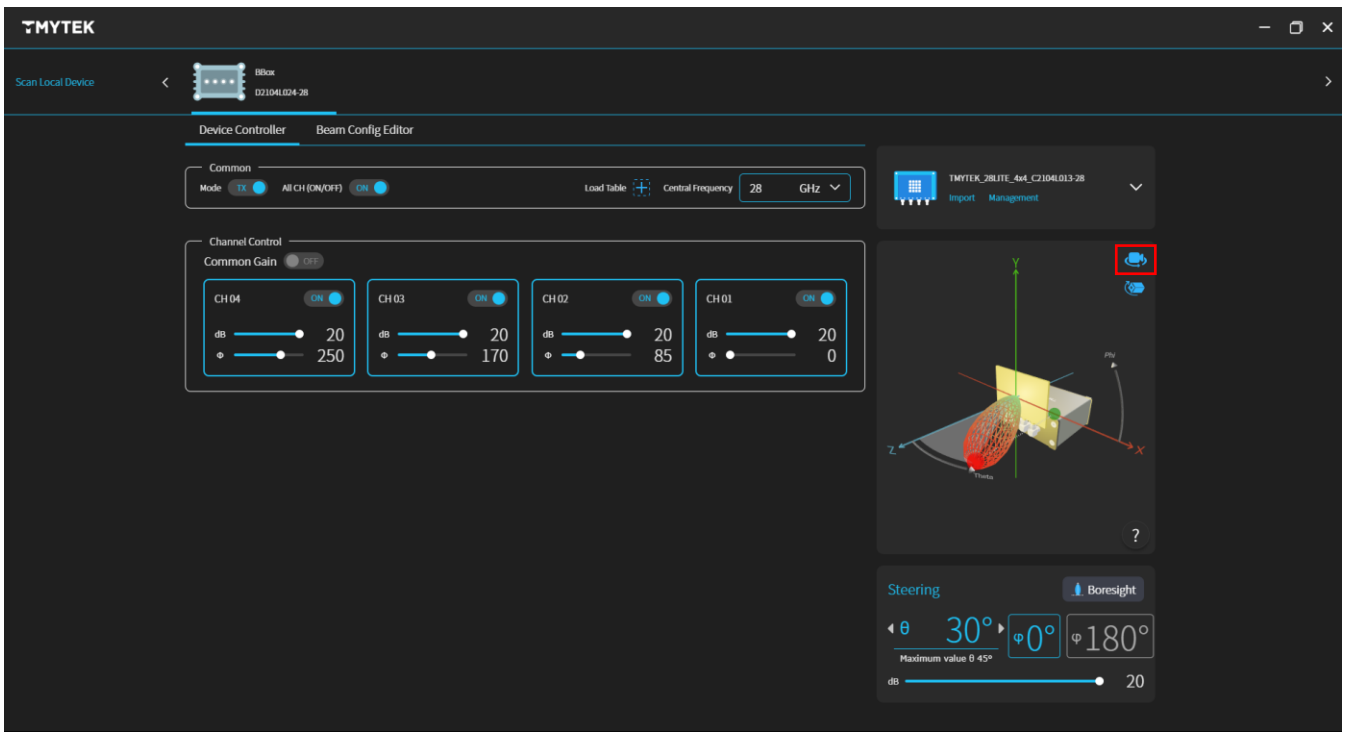


(16). "Pressing "Boresight" can set θ and φ back to 0 degree.

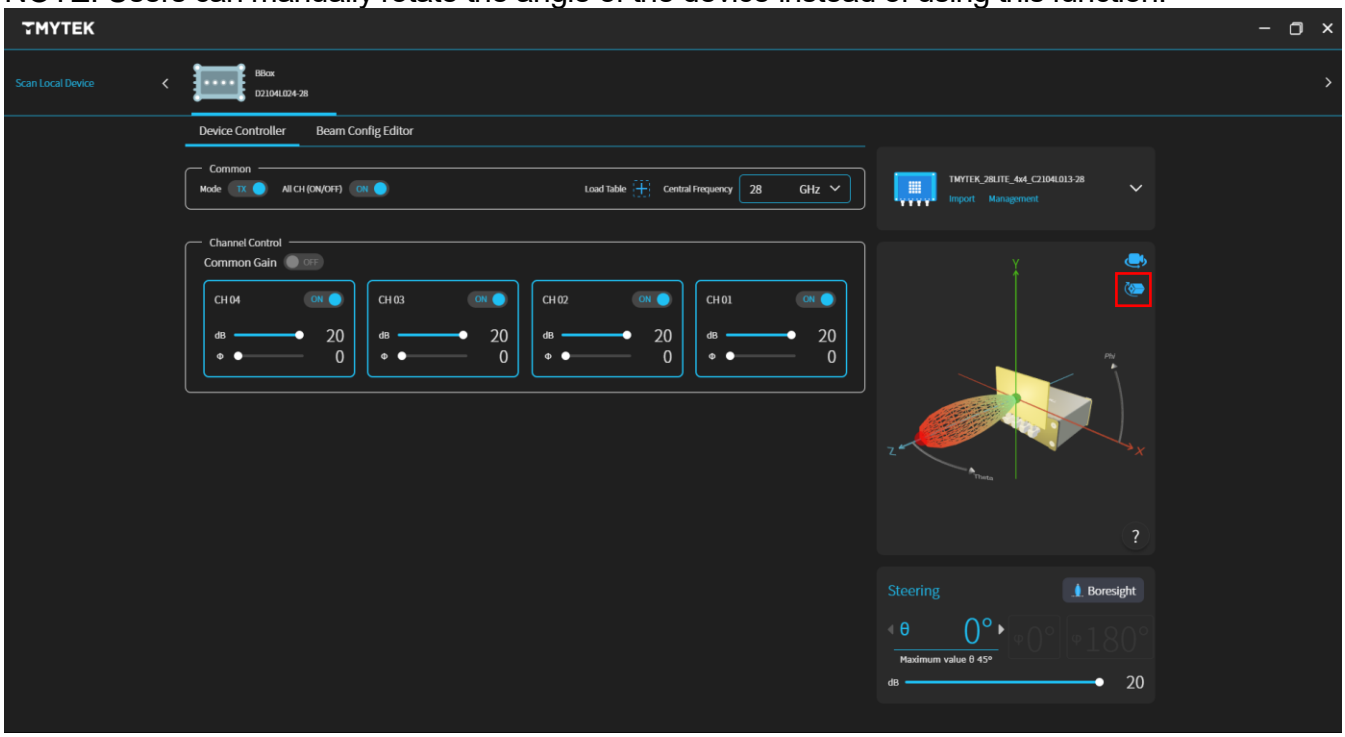


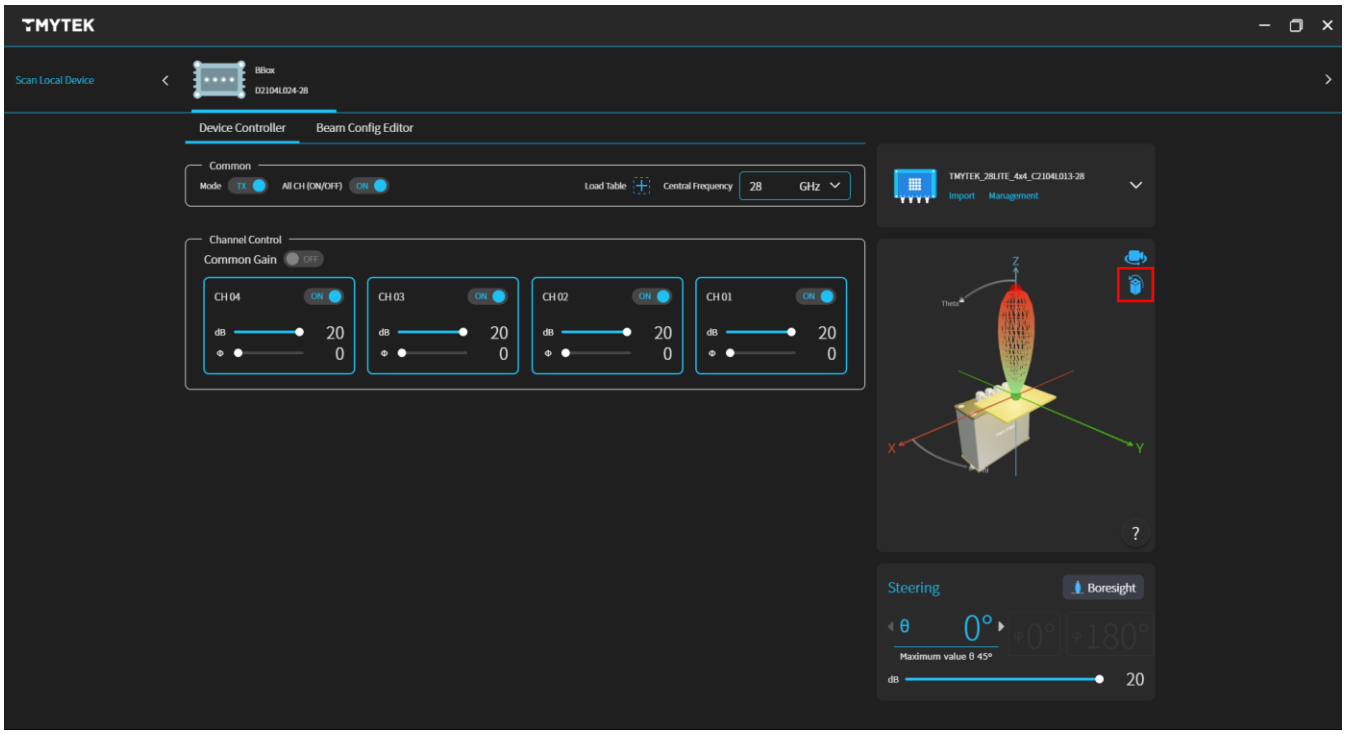
(17). When the device is rotated to an arbitrary angle, pressing the "Reset Angle" button can set the device to its original angle.



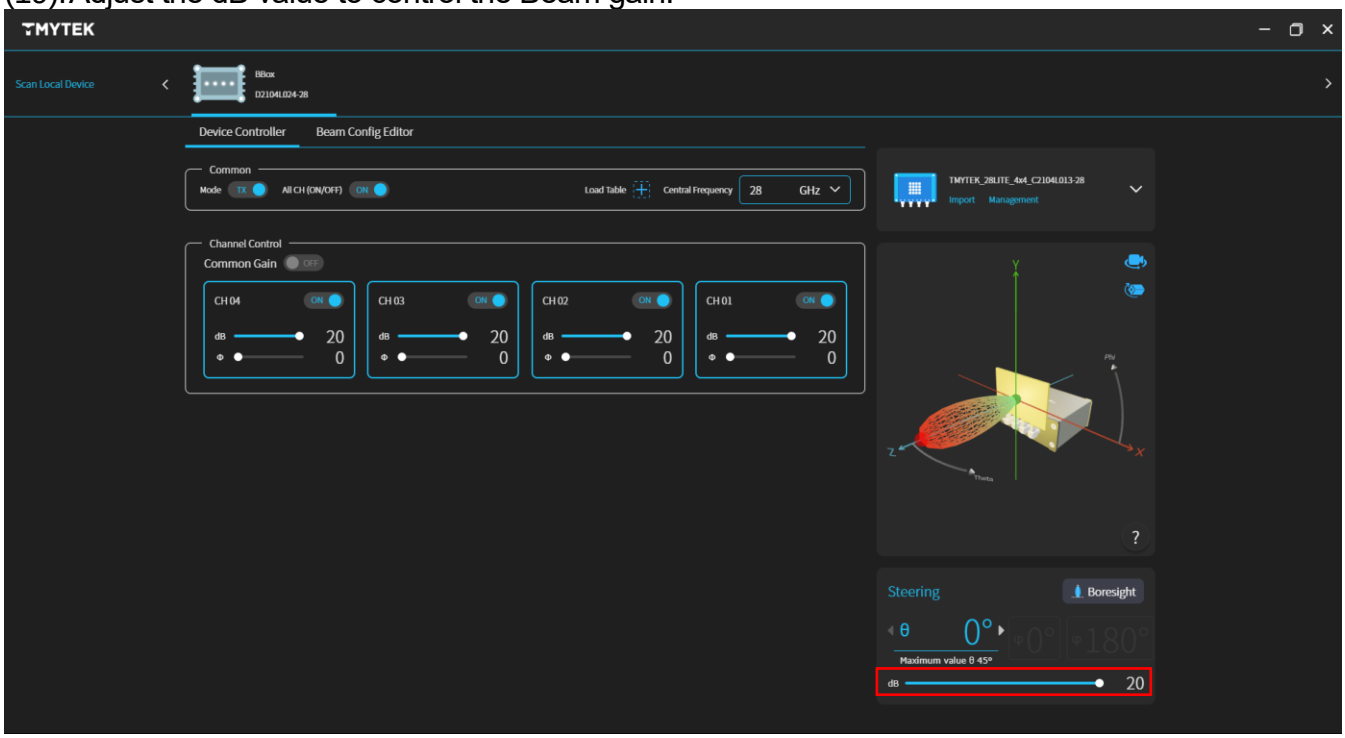


(18). This button can quickly adjust the device to the upright or horizontal position.
NOTE: Users can manually rotate the angle of the device instead of using this function.





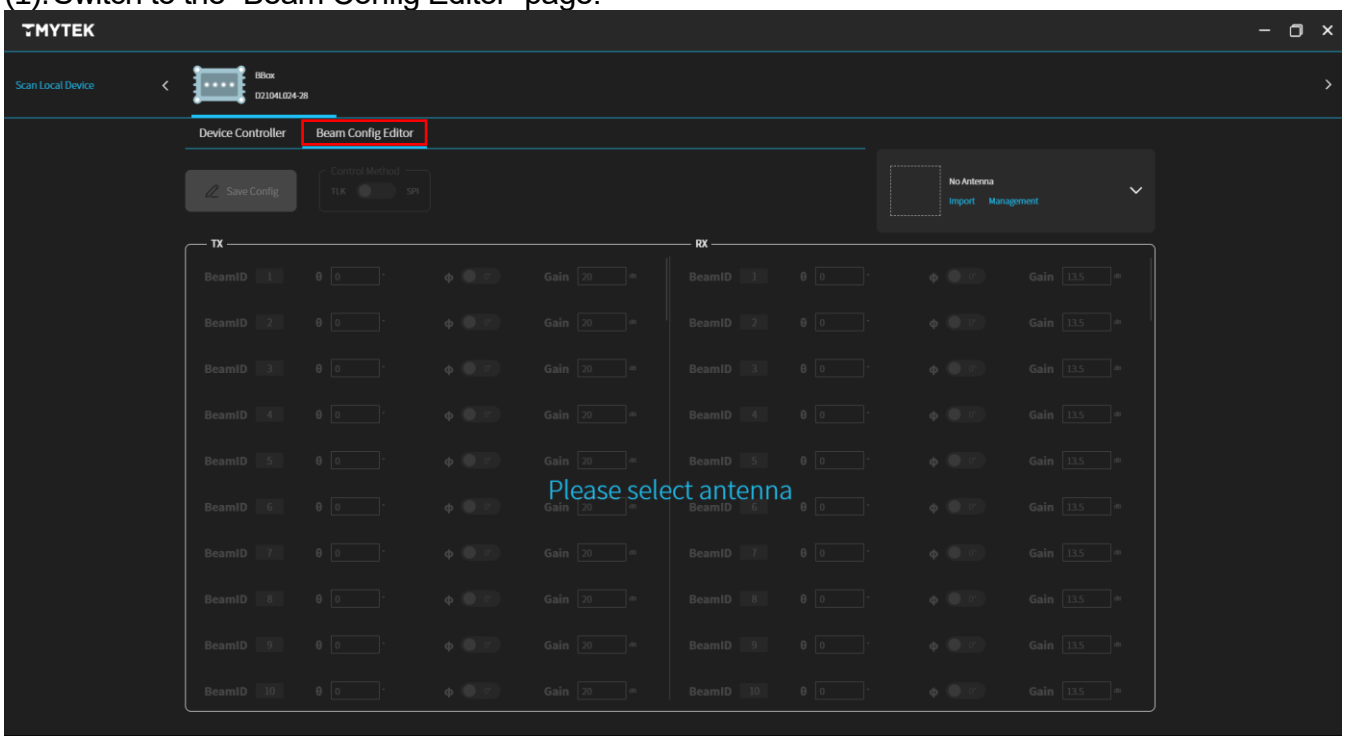
(19). Adjust the dB value to control the Beam gain.



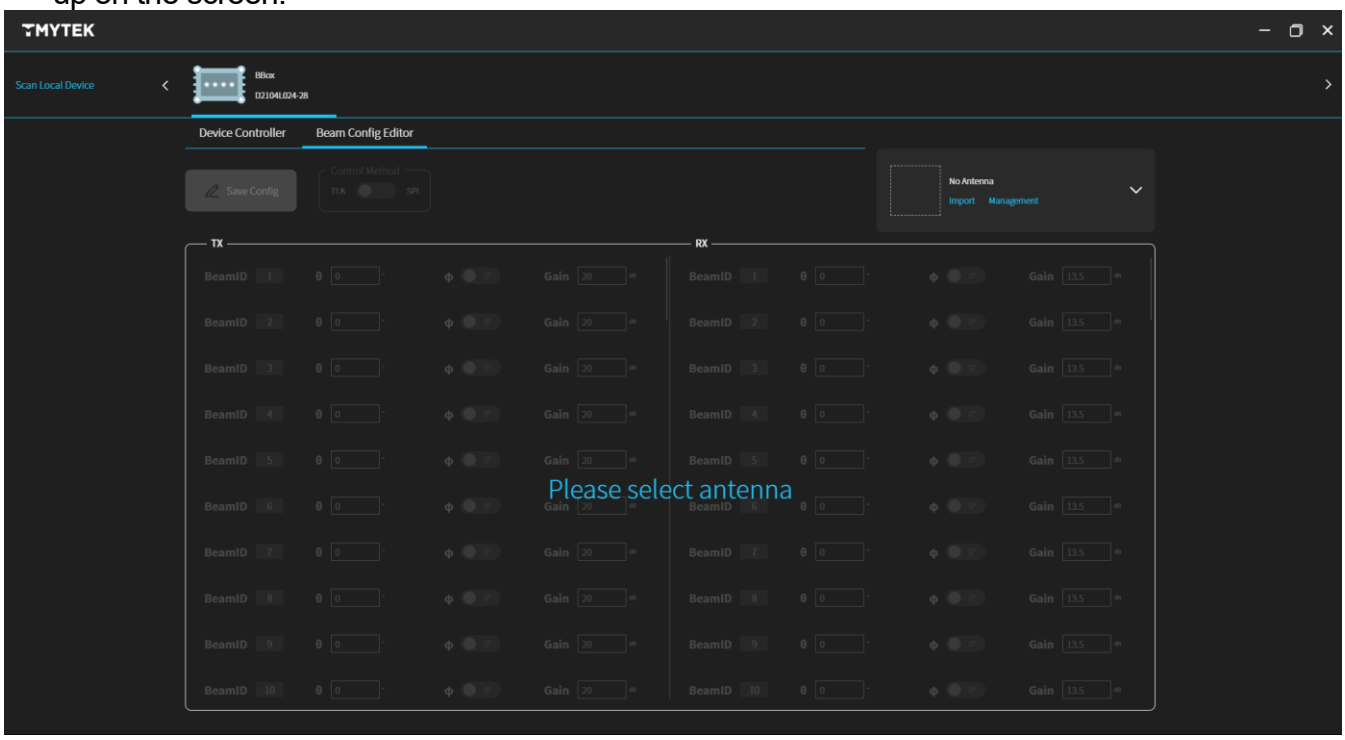
3.2 Beam Config Editor

- The Beam Config Editor can pre-edit up to 64 sets of beams in Tx/Rx mode each, and can write the beam table into the BBox. In the same power cycle, the user can switch the pre-written beam ID through the SPI interface.

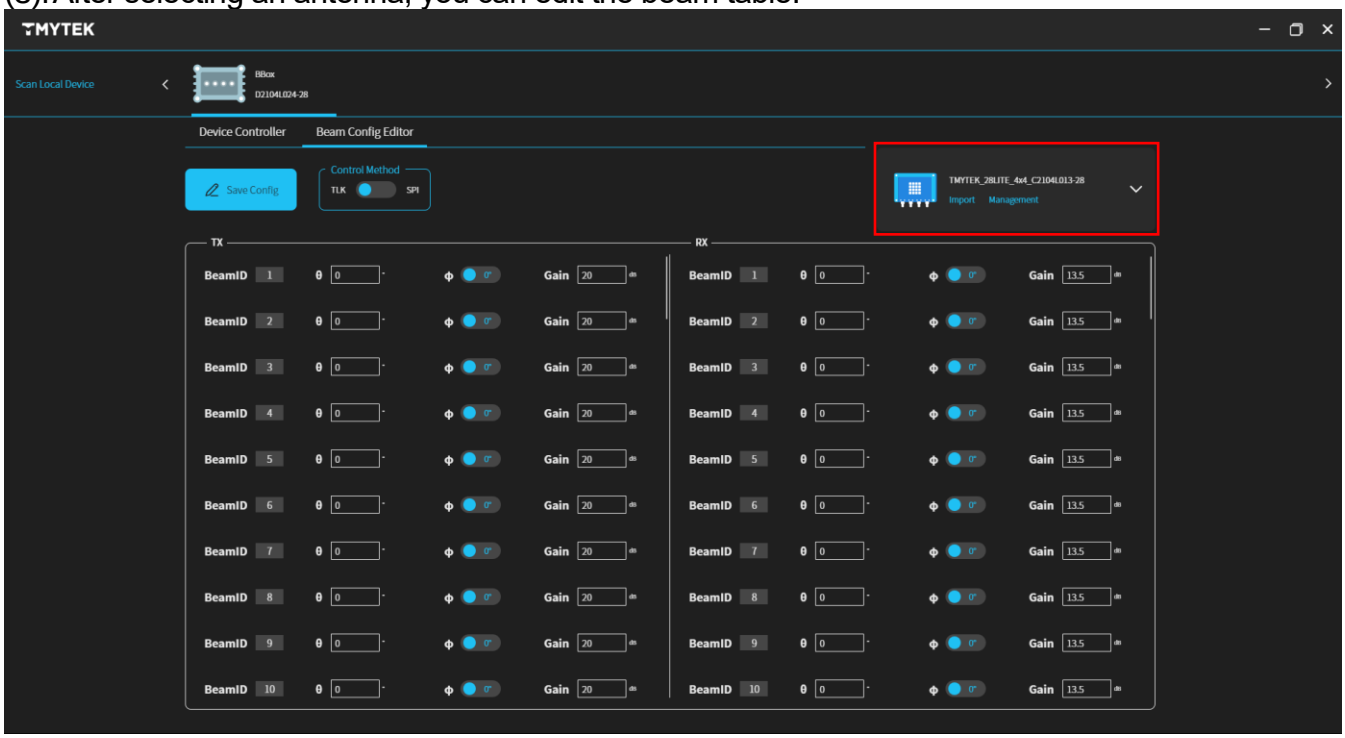
(1). Switch to the “Beam Config Editor” page.



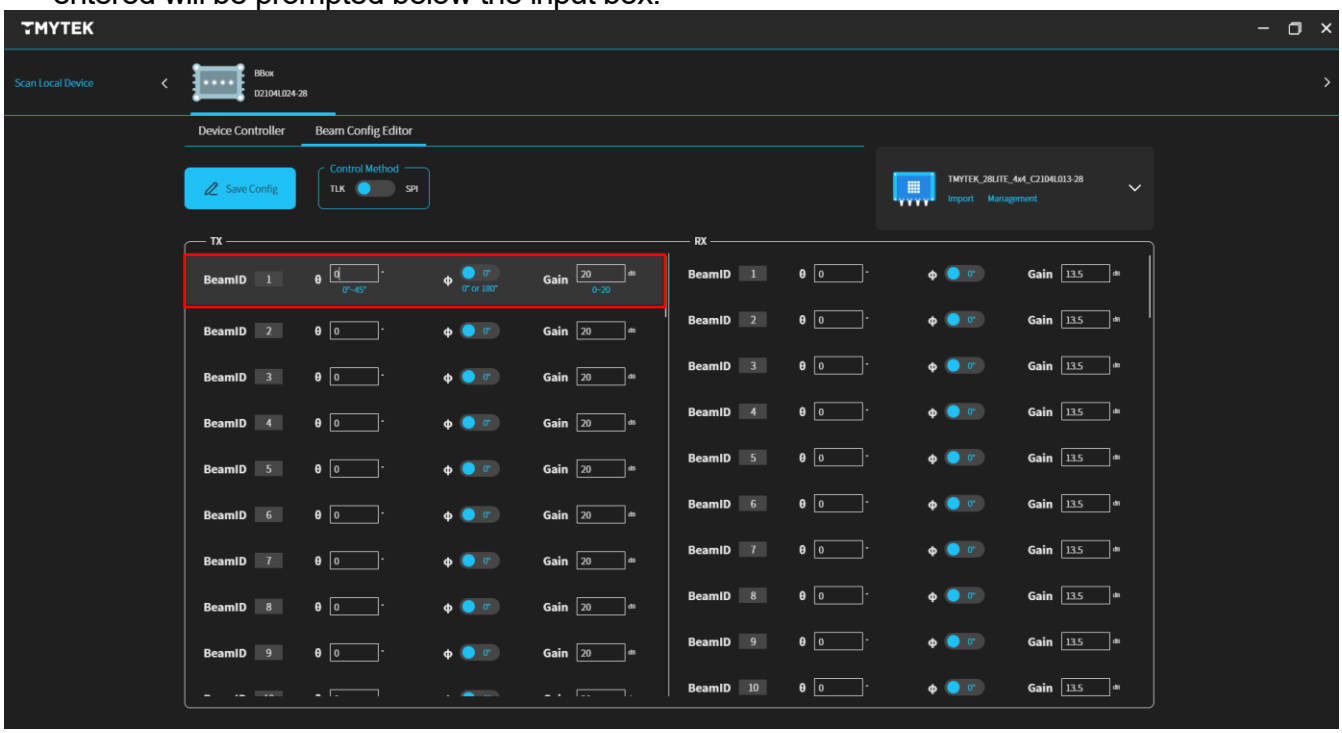
(2). If no antenna is selected, the beam table cannot be edited, and “Please select antenna,” will pop up on the screen.



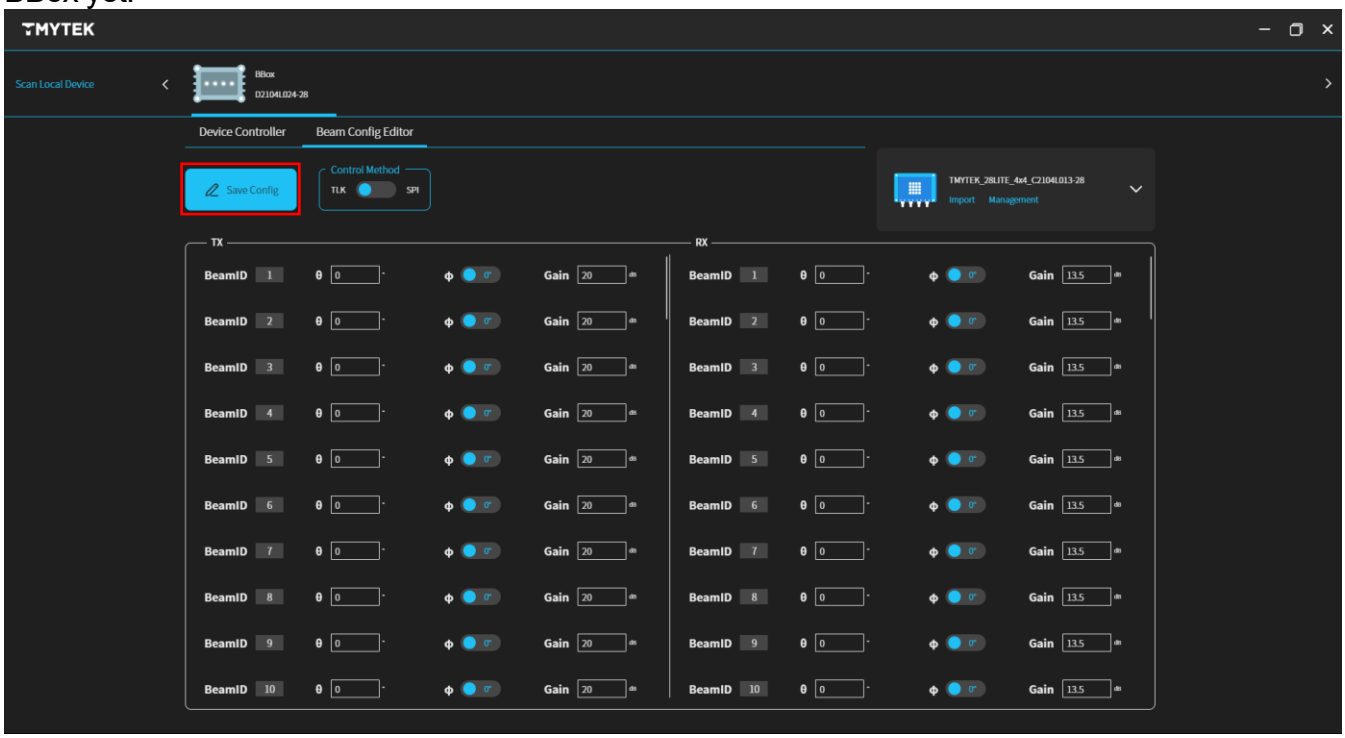
(3). After selecting an antenna, you can edit the beam table.



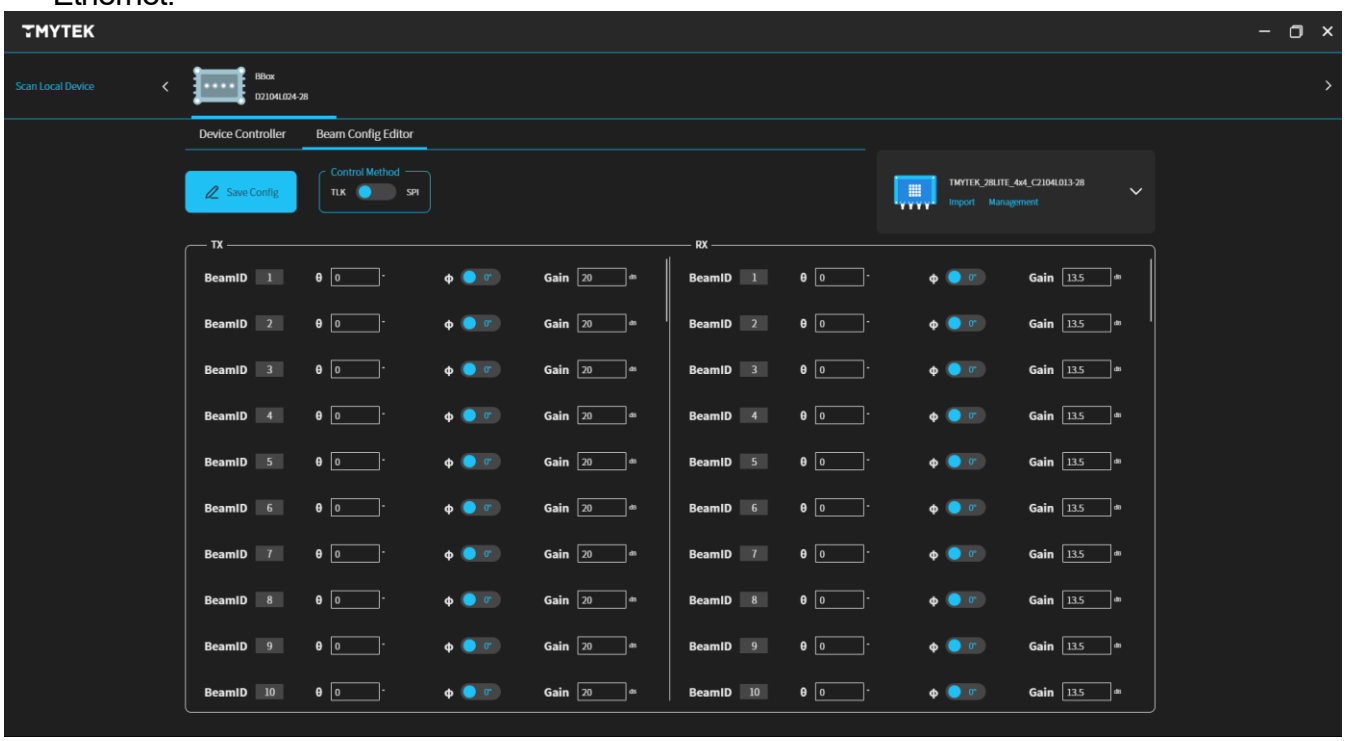
(4). 64 sets of beams can be stored in the Tx/Rx mode each, and the range of values that can be entered will be prompted below the input box.



(5). After editing, click "Save Config" to save the configuration file.
NOTE: At this moment, the configuration file is only written on the PC and has not been written to BBox yet.

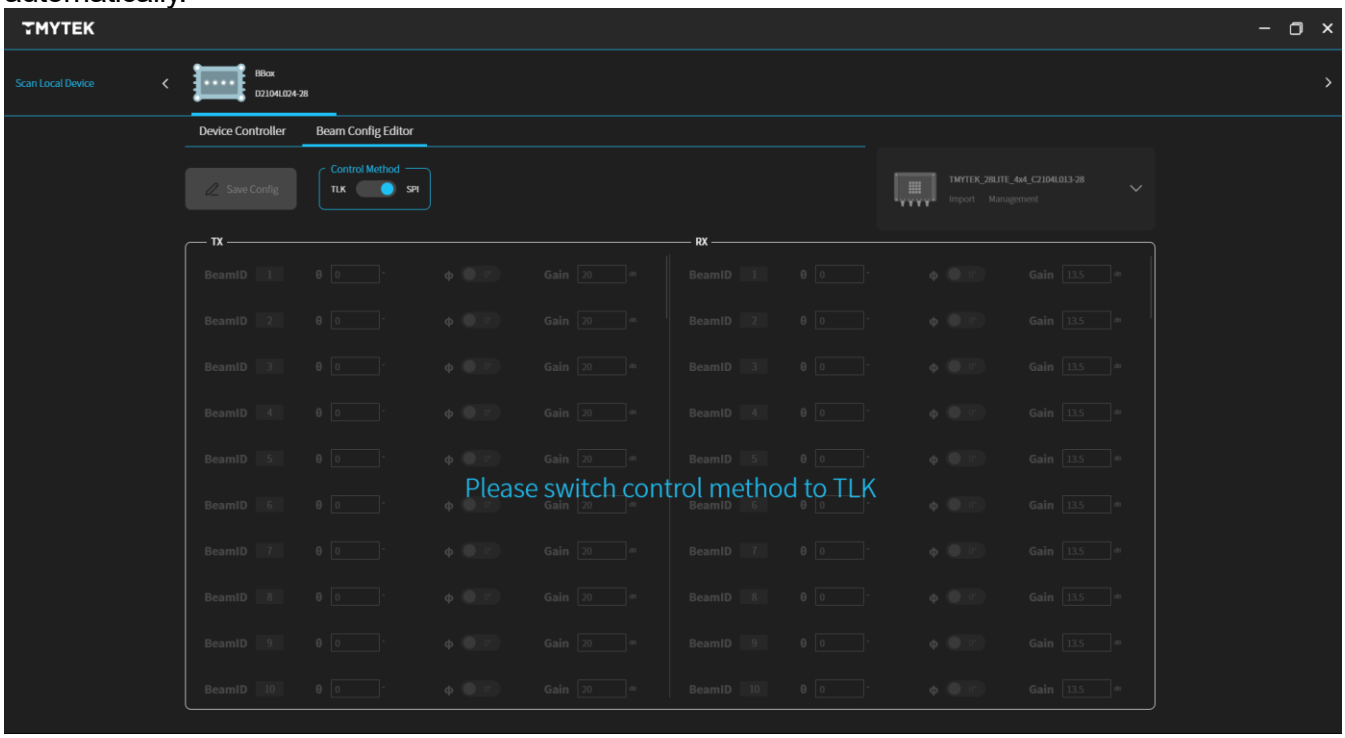


(6). Control Method shows how BBox is controlled. In the “TLK” mode, the device is controlled by Ethernet.



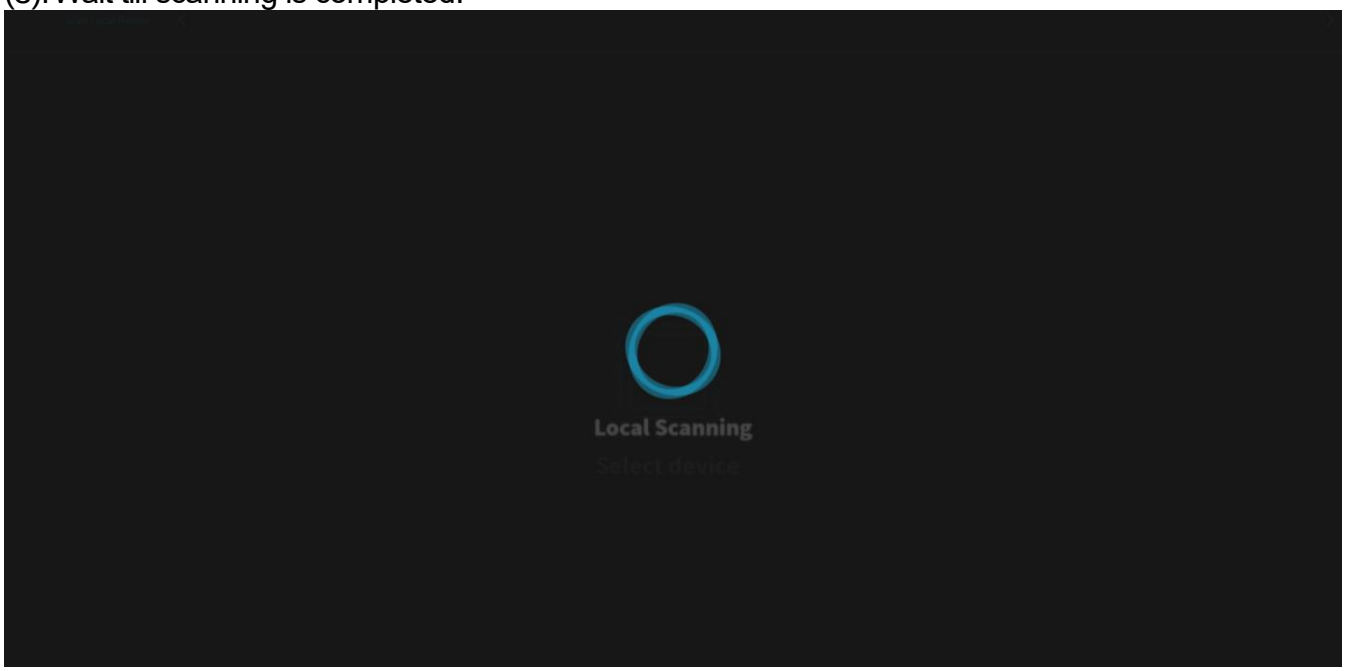
(7). Toggling the Control Method button can switch the control method of BBox. In the “SPI” mode, Beam Config is written to BBox and BBox cannot be controlled by TLK. All function is locked and “Please switch control method to TLK” will pop up on the screen.

NOTE: If you switch to the “Device Controller” page now, the Control Method will be set to “TLK” automatically.

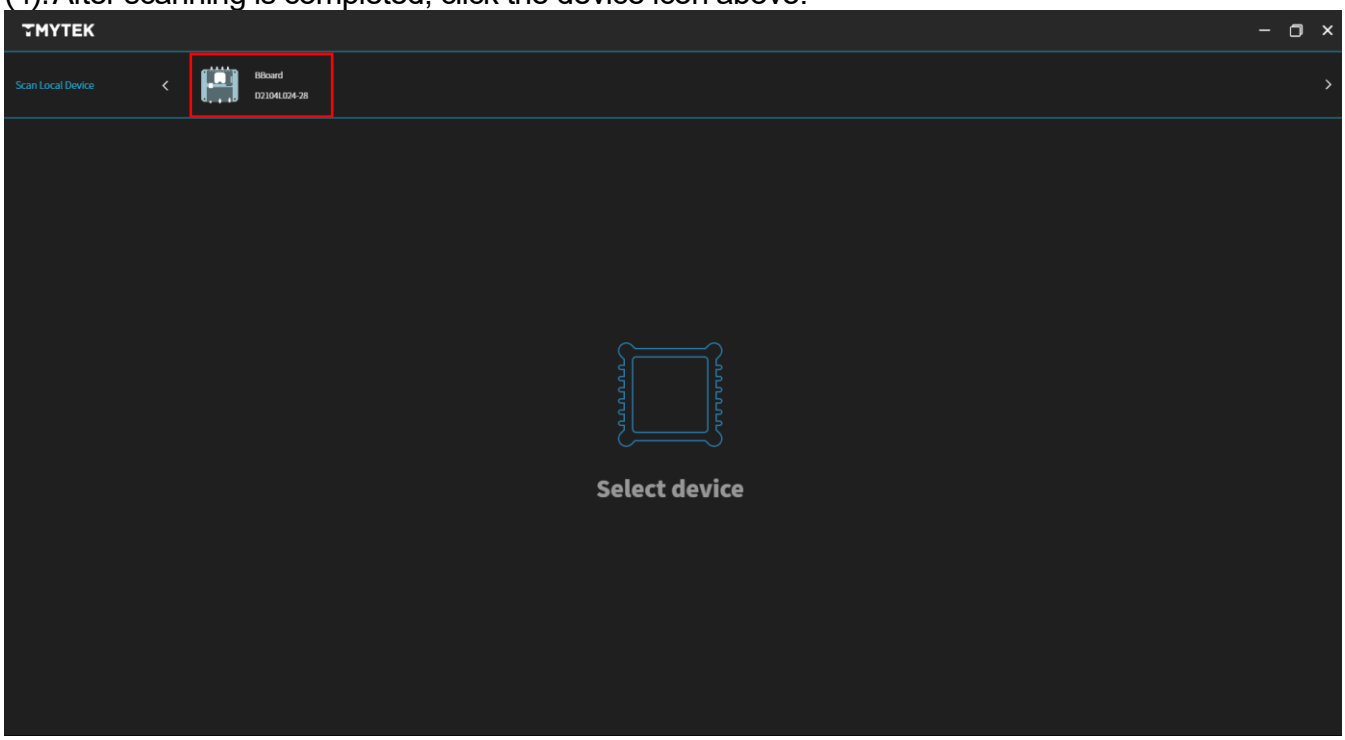


4. BBoard

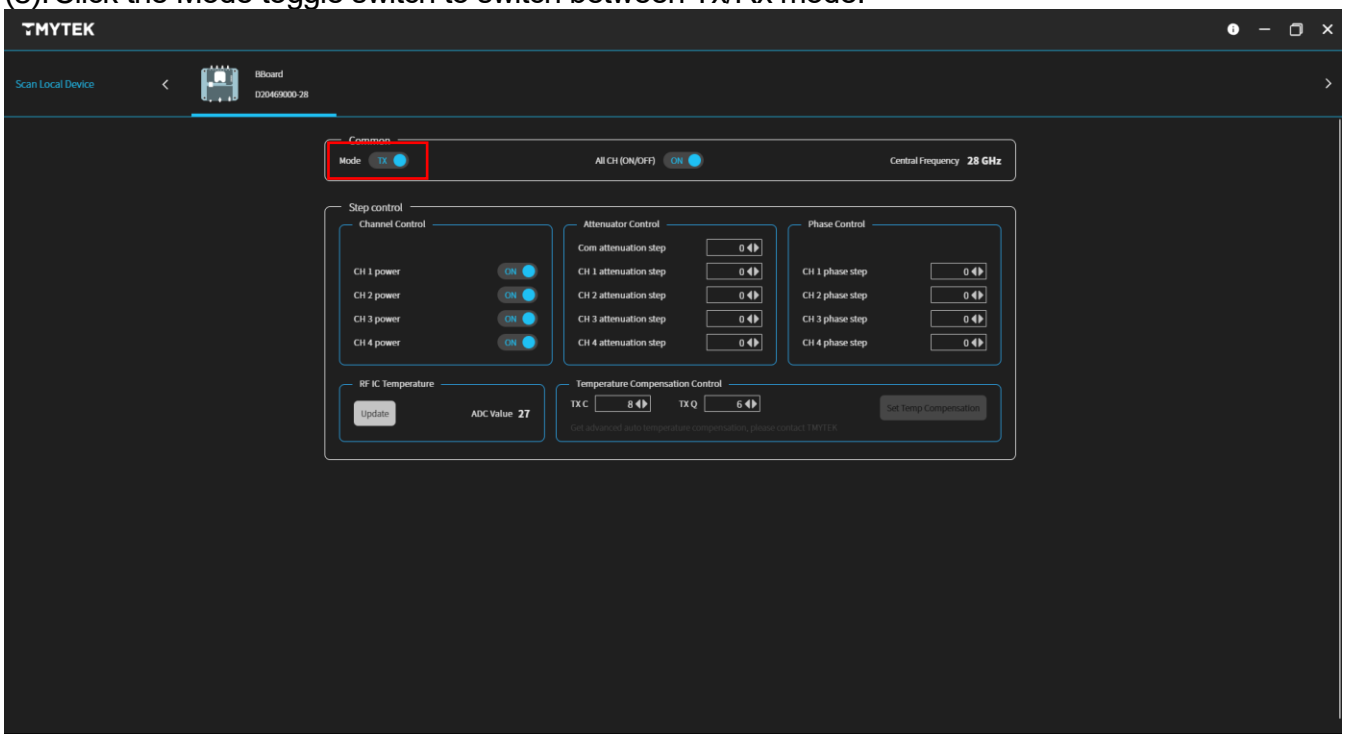
(1). Connect BBoard and PC with Ethernet, and then turn on the power of BBoard.
(2). Open TMXLAB Kit.
(3). Wait till scanning is completed.



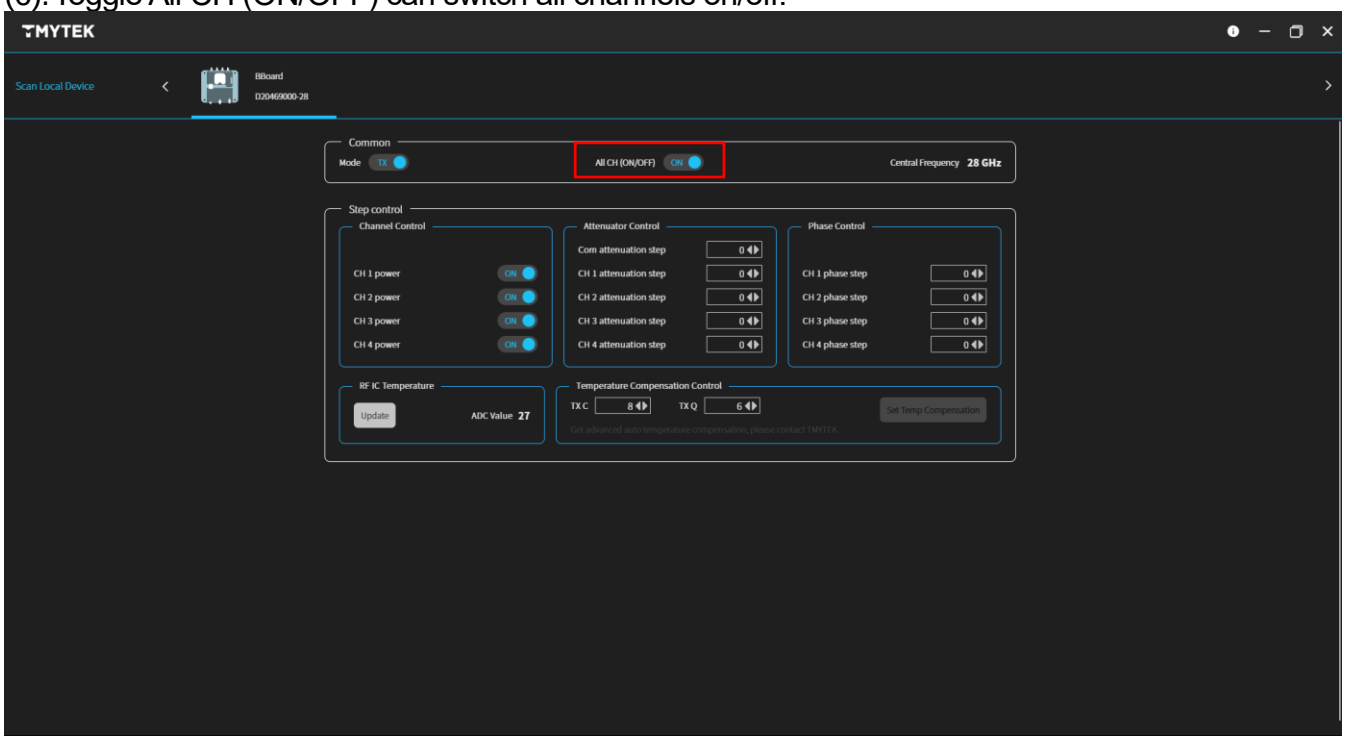
(4). After scanning is completed, click the device icon above.



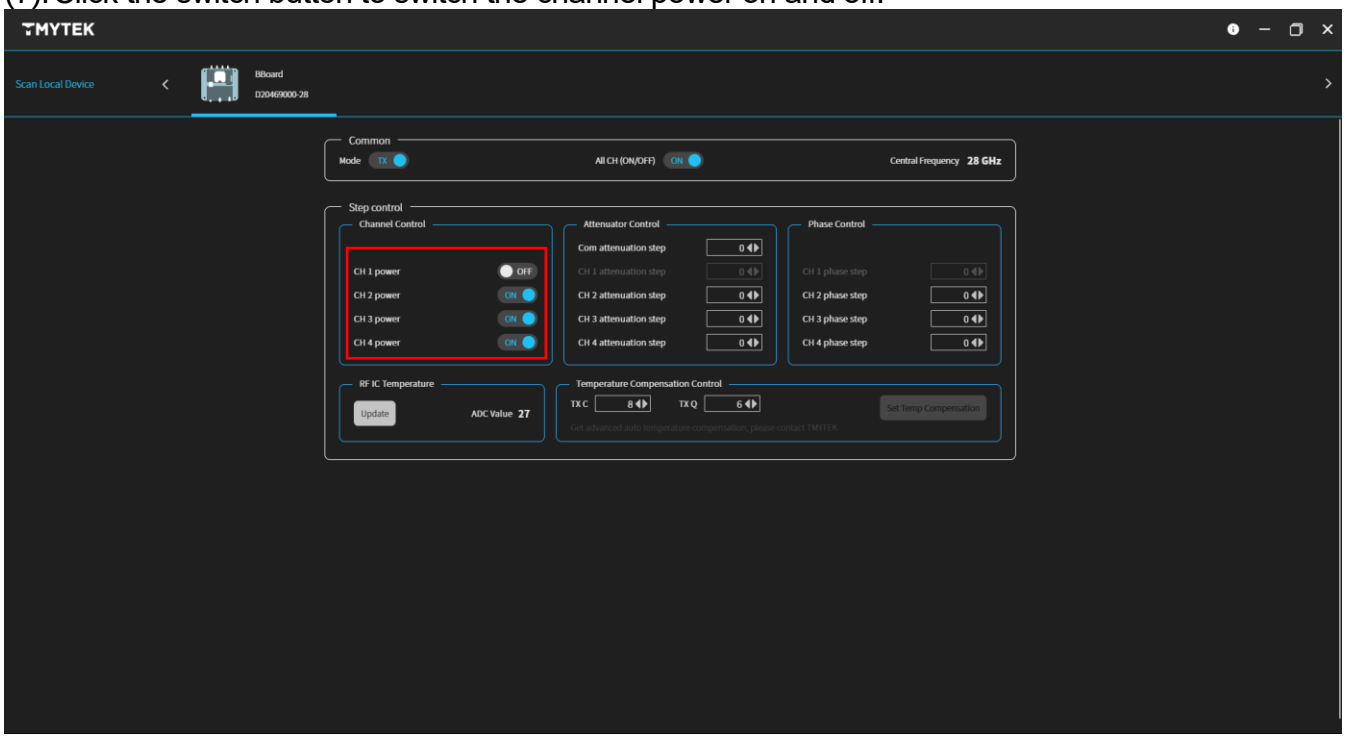
(5). Click the Mode toggle switch to switch between Tx/Rx mode.



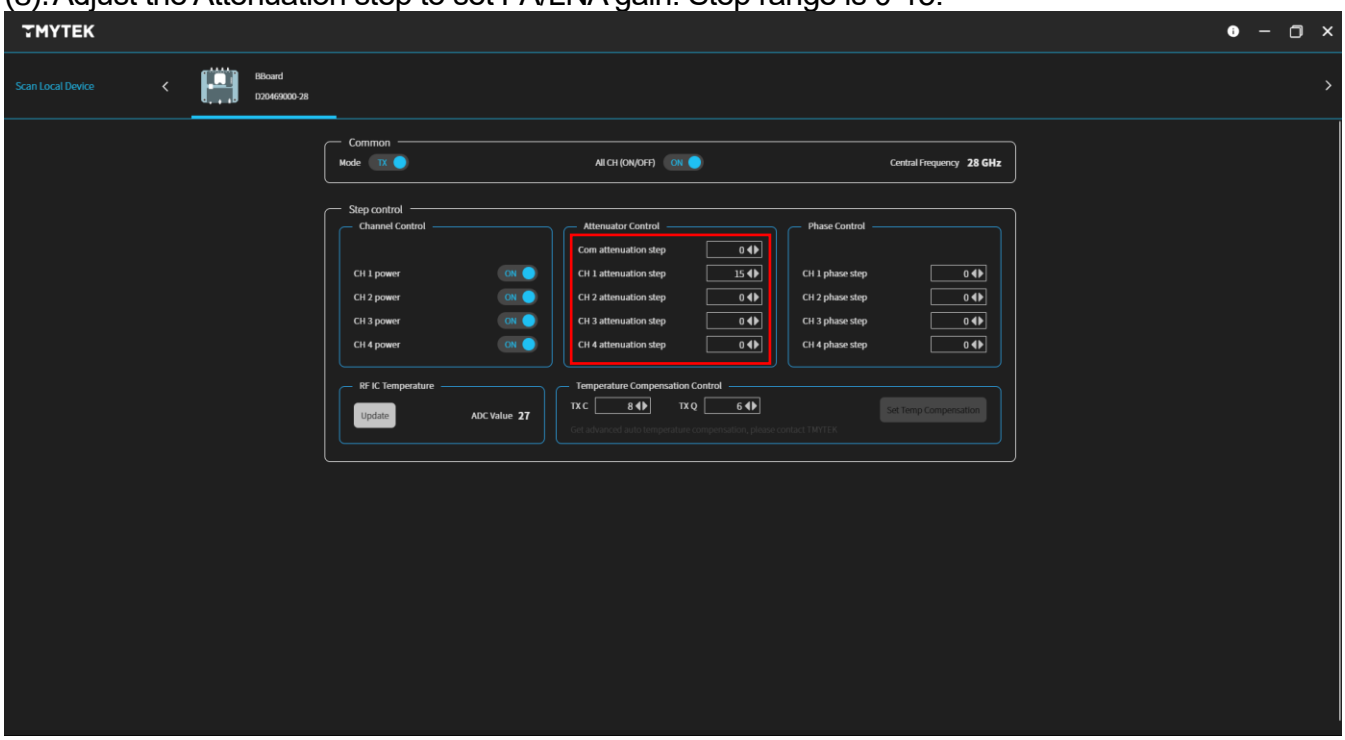
(6). Toggle All CH (ON/OFF) can switch all channels on/off.



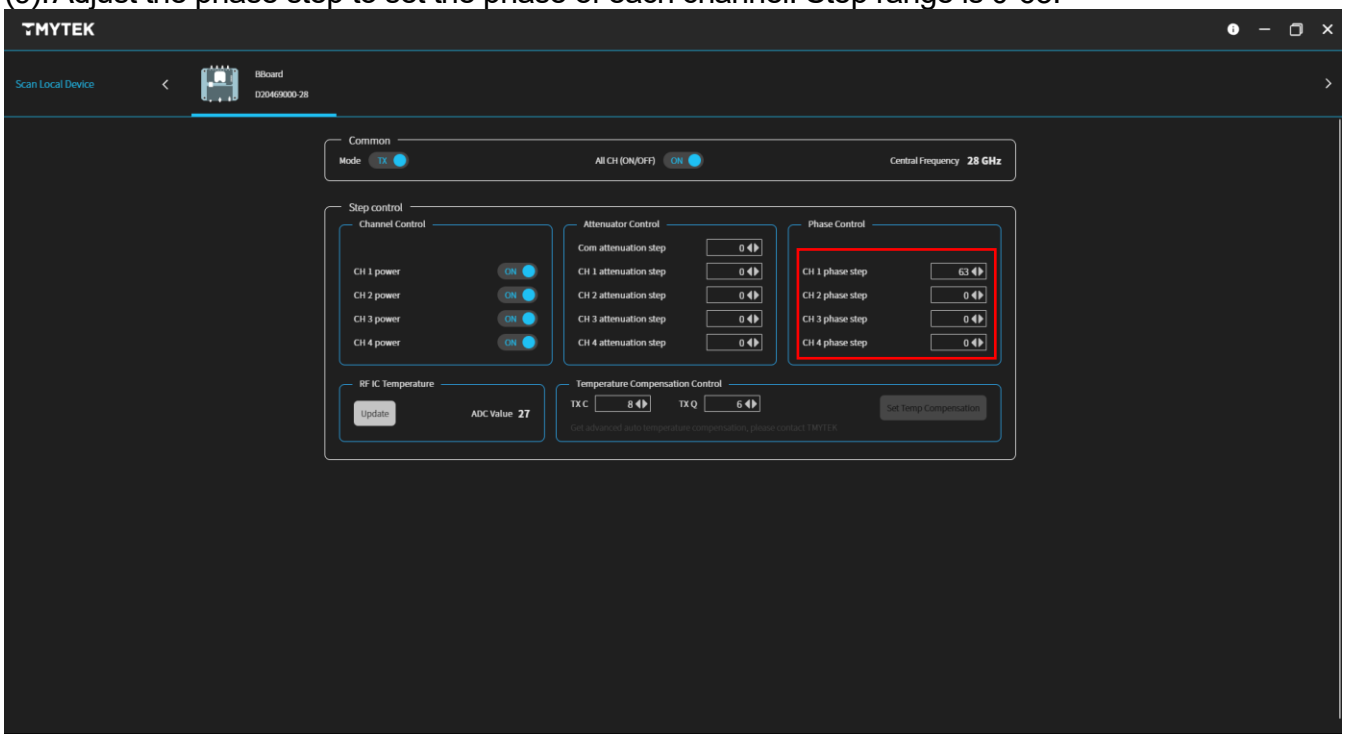
(7). Click the switch button to switch the channel power on and off.



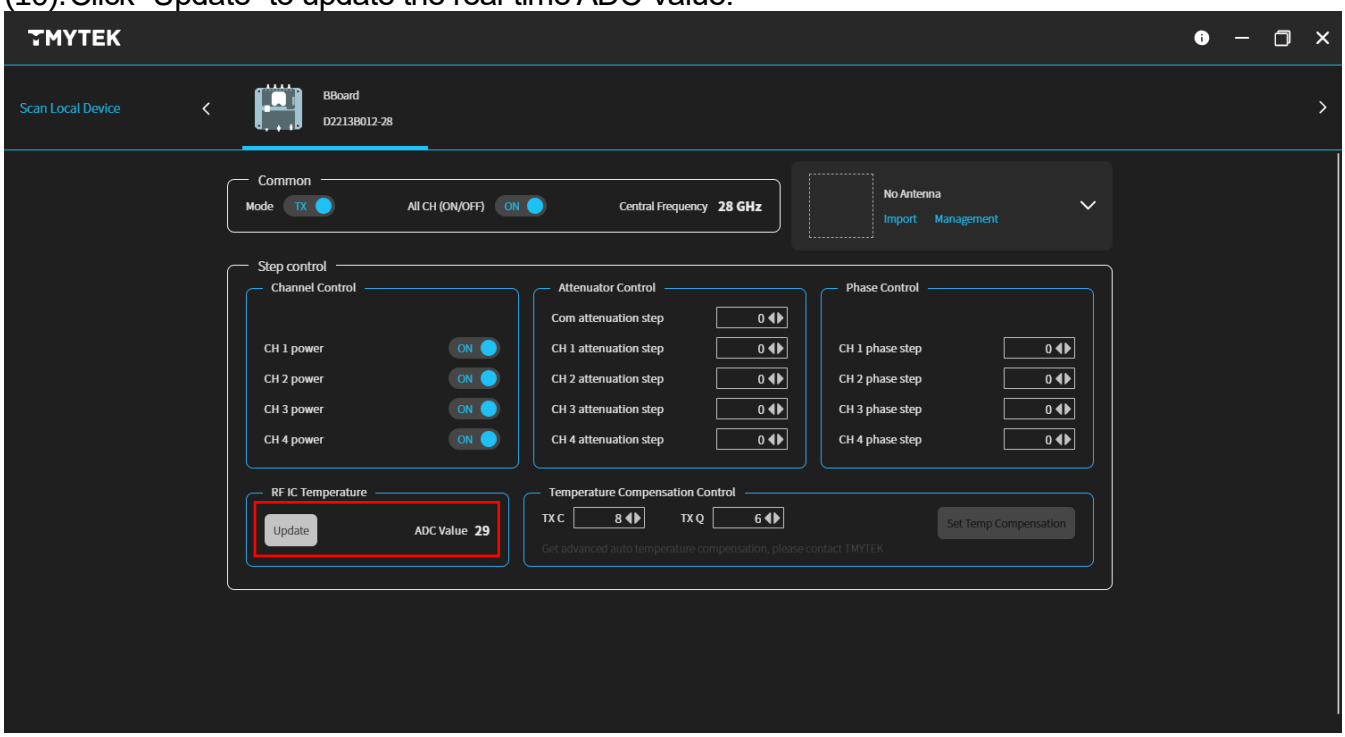
(8). Adjust the Attenuation step to set PA/LNA gain. Step range is 0-15.



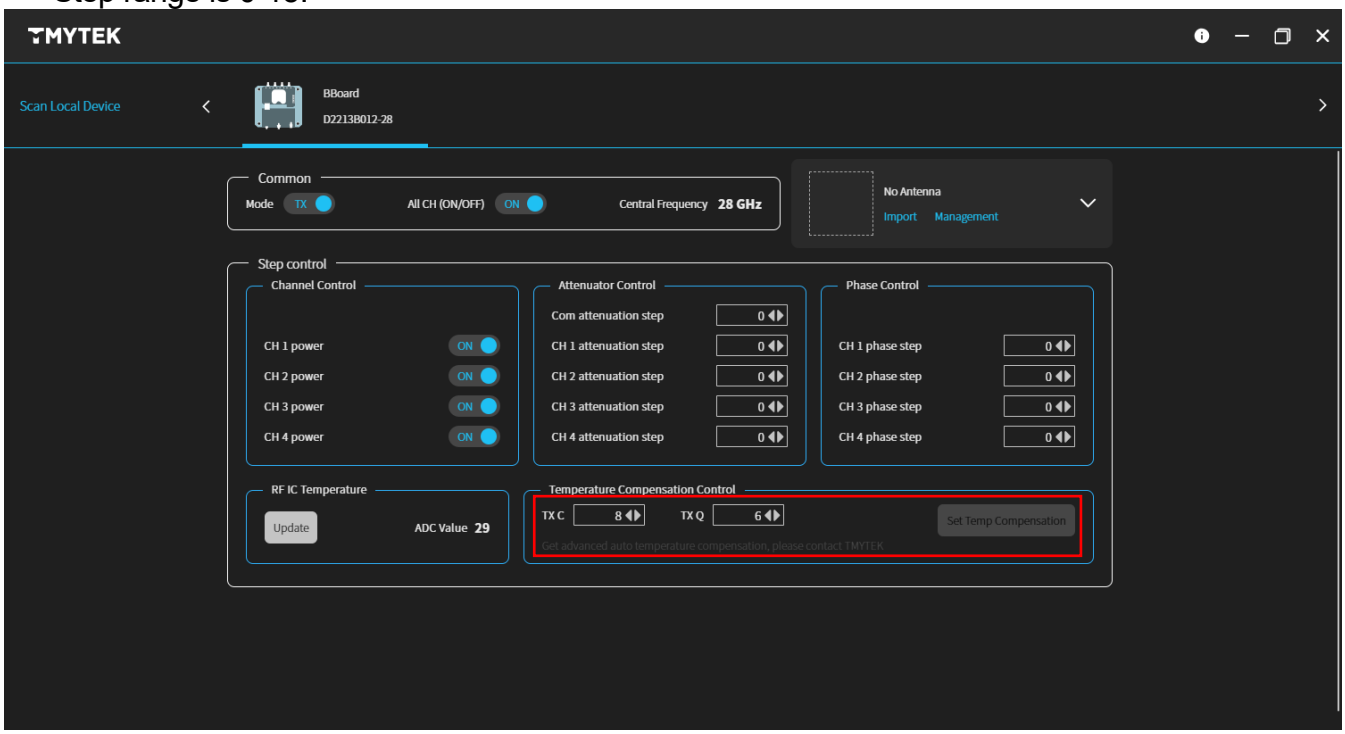
(9). Adjust the phase step to set the phase of each channel. Step range is 0-63.



(10). Click “Update” to update the real-time ADC Value.

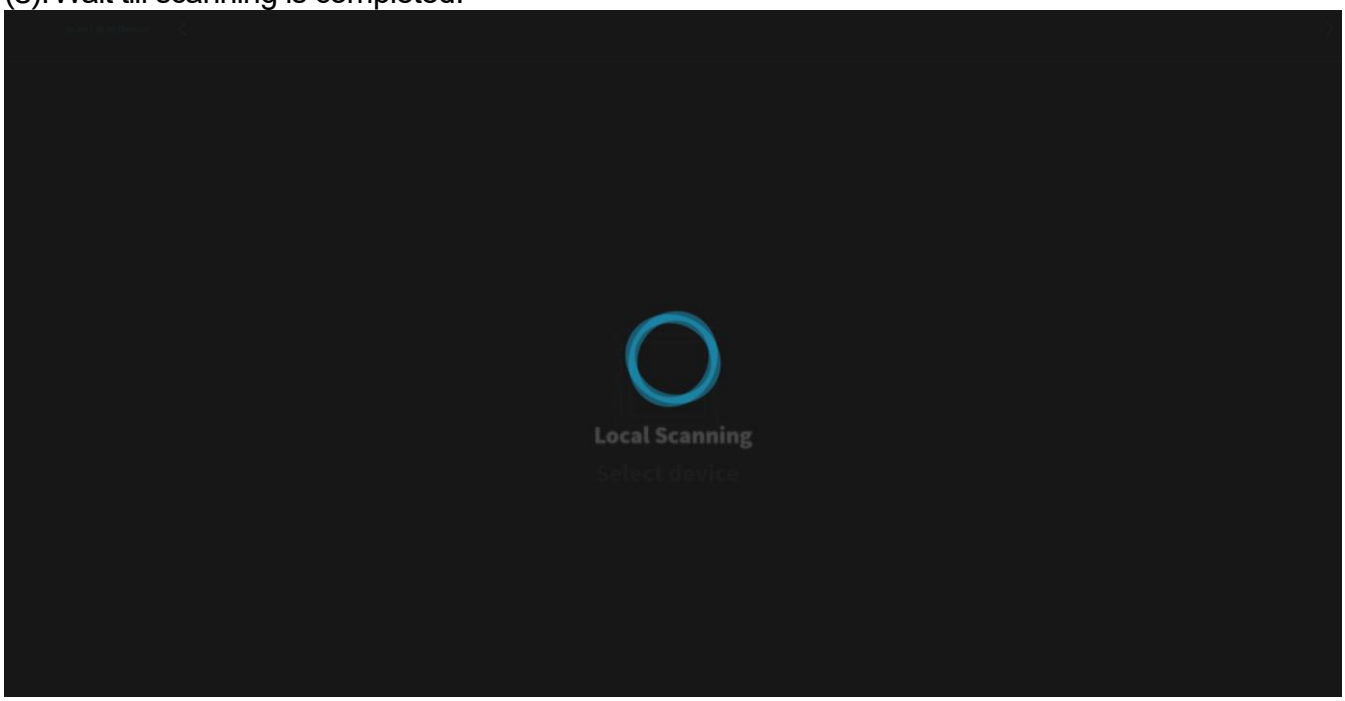


(11). TX C/TX Q (Tx mode) and RX C/RX Q (Rx mode) are temperature compensation coefficients. TX C and RX C contribute about 1dB gain, and TX Q and RX Q contribute about 0.5 dB gain. Step range is 0-15.

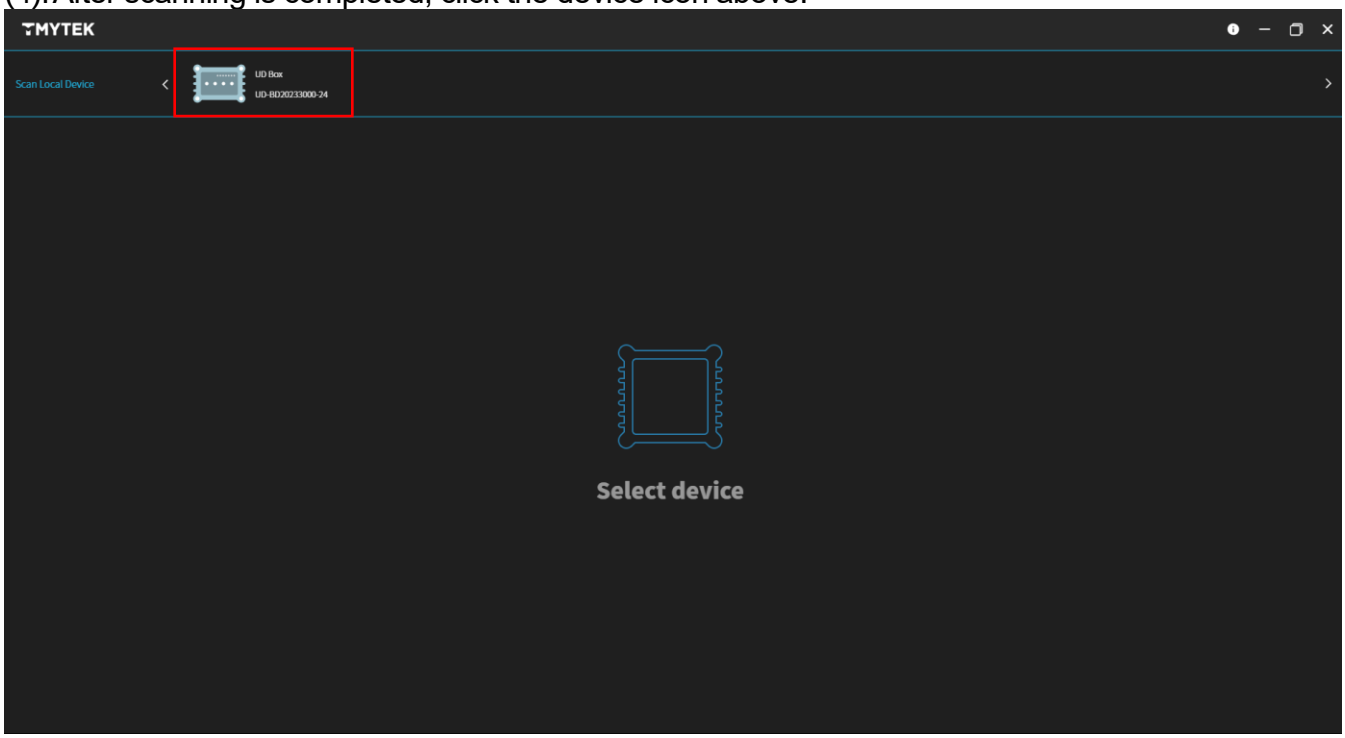


5. UD Box 5G

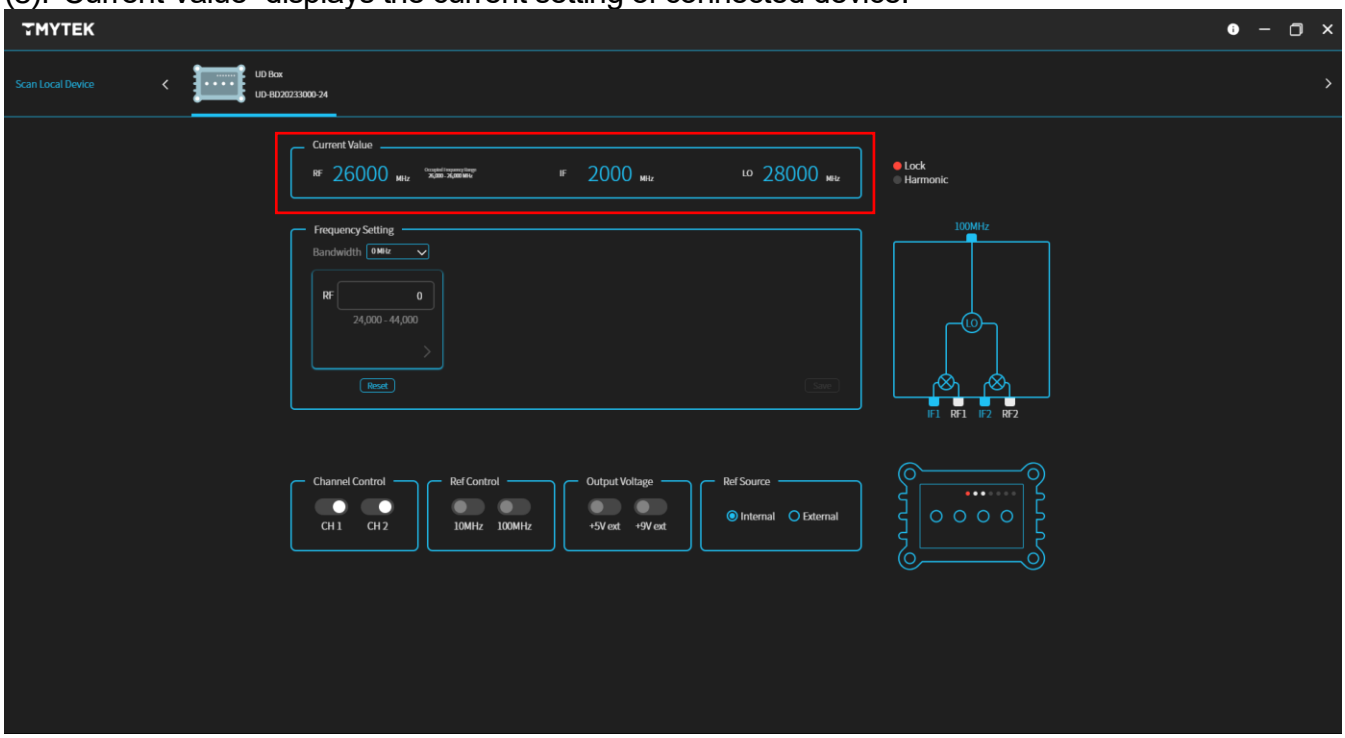
(1). Connect the UD Box and PC with Ethernet, and then turn on the power of the UD Box.
(2). Open TMXLAB Kit.
(3). Wait till scanning is completed.



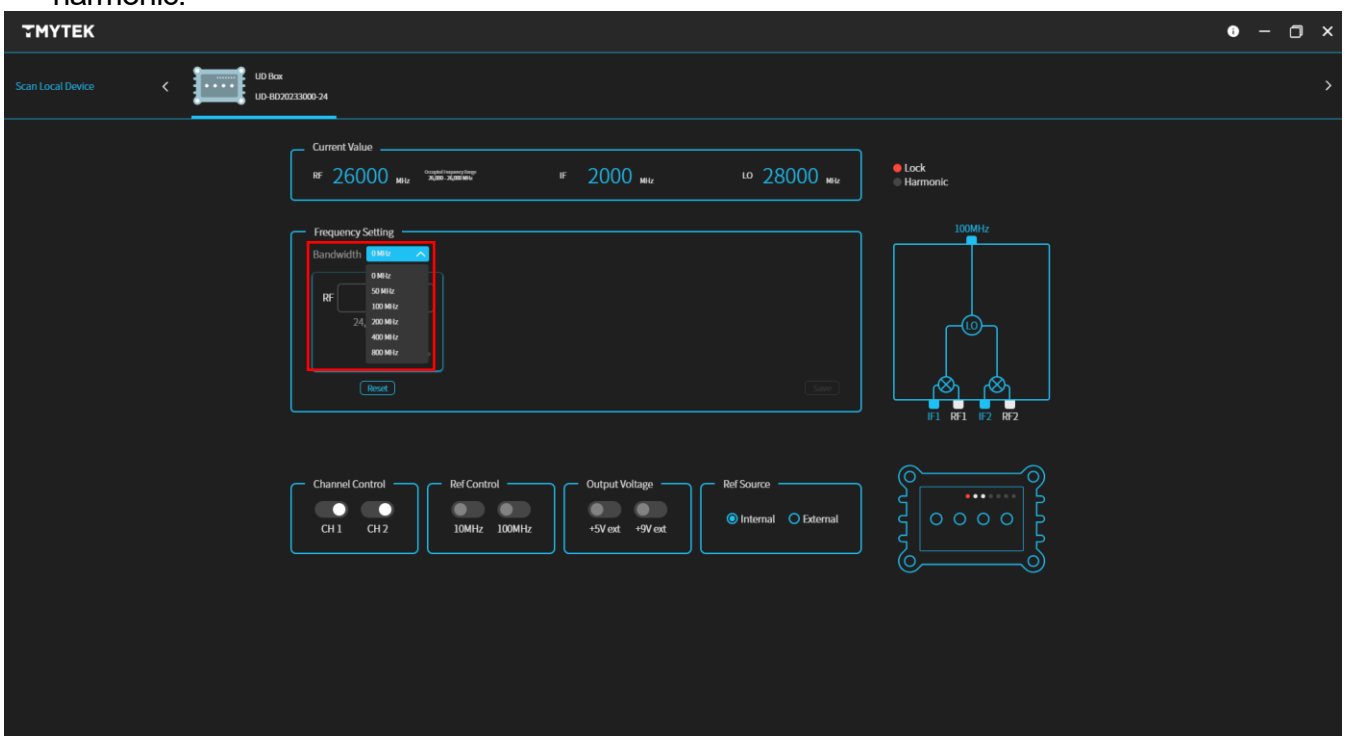
(4). After scanning is completed, click the device icon above.



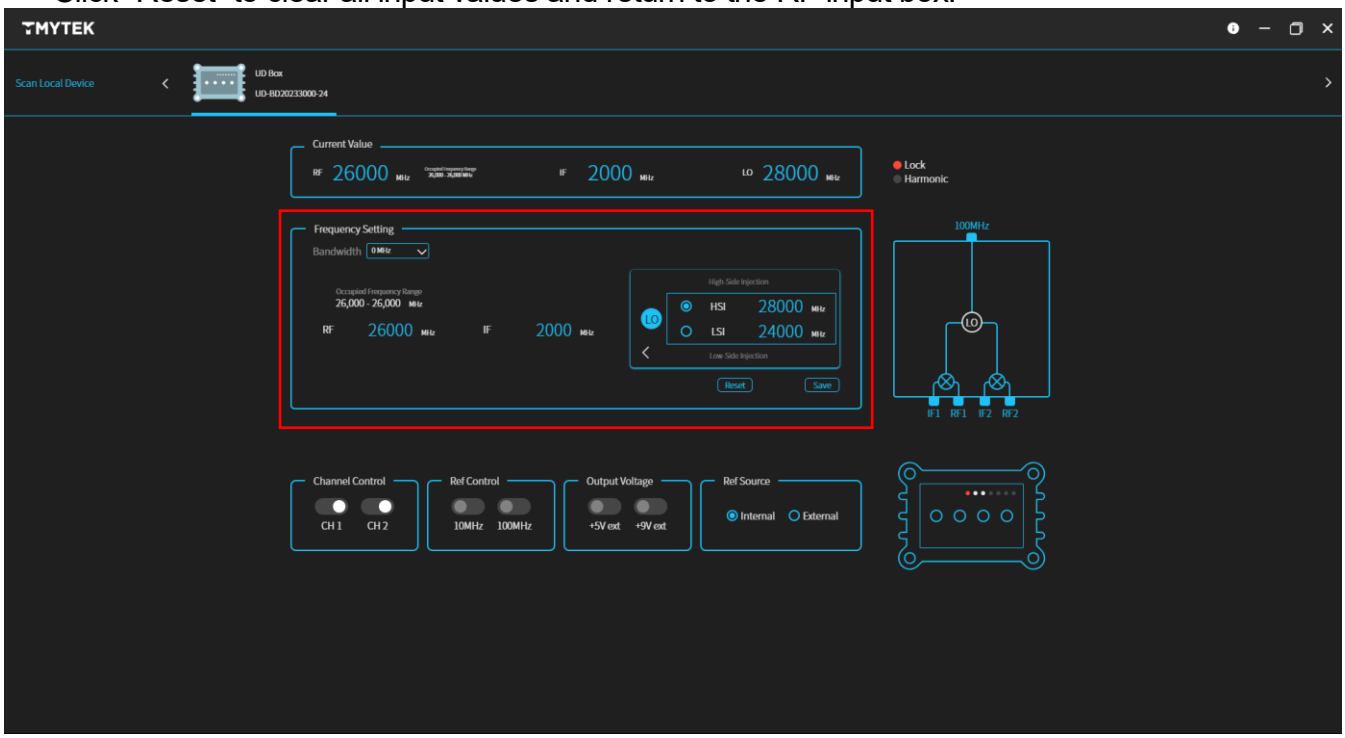
(5). “Current Value” displays the current setting of connected device.



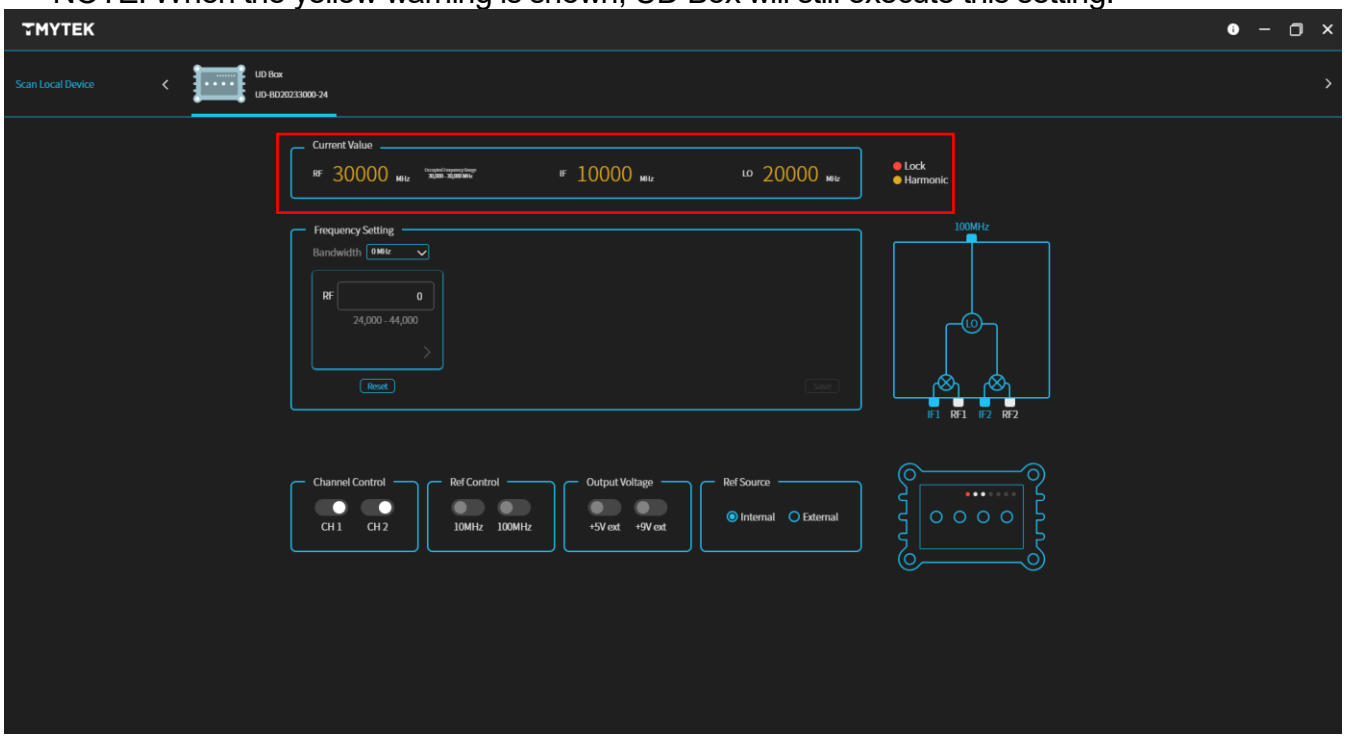
(6). Changing the value in the bandwidth drop-down list would modify the value in the calculation of harmonic.



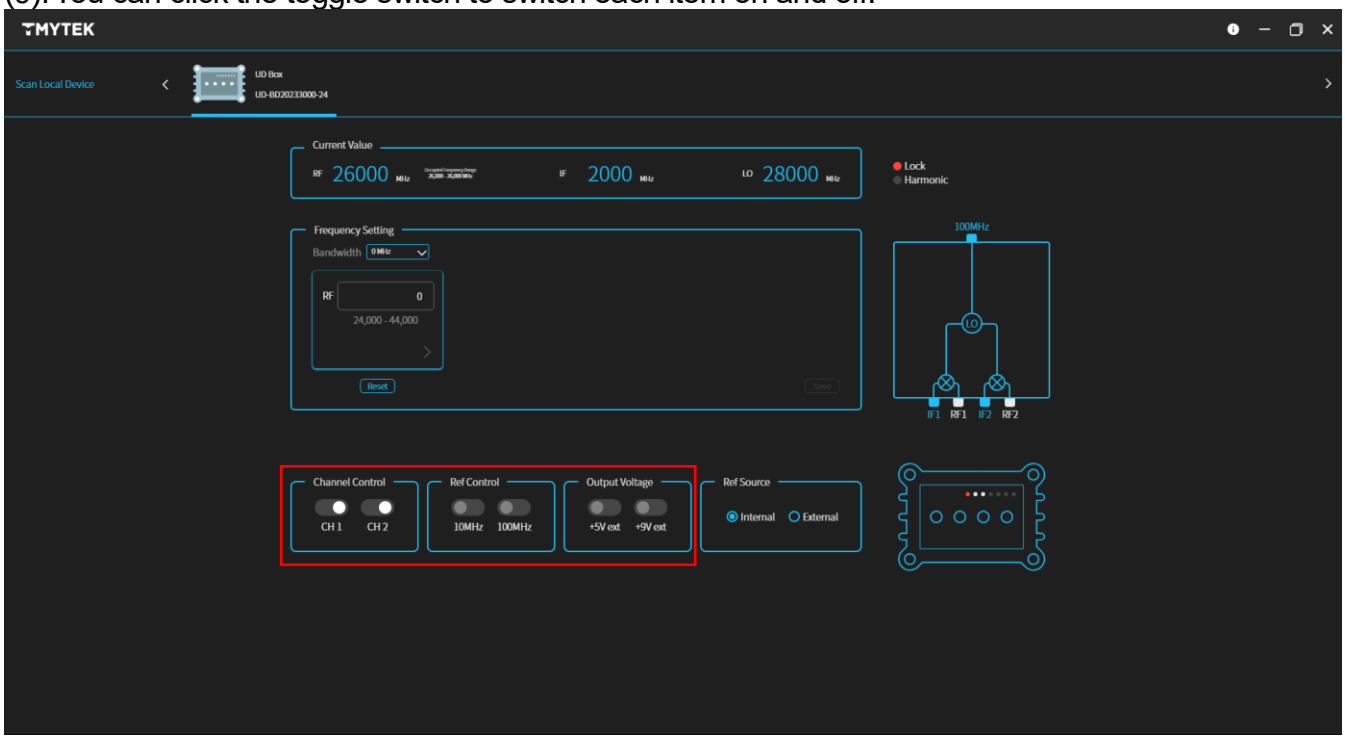
(7). The LO frequency can be set in the Frequency Setting.
After entering RF, click the arrow below or Enter to enter the IF input box.
After entering the IF, click the arrow below or Enter to automatically compute LO, and Bandwidth will be used to calculate the reference value of frequency range. Click “Save” to set the UD Box.
Click “Reset” to clear all input values and return to the RF input box.



(8). If the input frequency is the same the in-band harmonics, the Current Value will turn yellow and the Harmonic icon in the upper right corner will also turn yellow to signal warning.
NOTE: When the yellow warning is shown, UD Box will still execute this setting.



(9). You can click the toggle switch to switch each item on and off.



(10). You can choose either internal source or external source in the Ref Source section.