

TMYTEK has developed a small and compact development tool to help our customers in moving onto 5G beamforming developments and tests with ease. We call it the BBox™ Lite. Our BBox™ Lite is the lighter version of our BBox™ series. It consists of 4 channel RF control, standard antenna kit and API software control through ethernet interface.

Similar to our BBox™ series products, our Lite version governs the phase and amplitude control of 4 channels. It is most suitable for manufacturing tests, OTA chamber development, or for educational purposes.

Features

- Operating Frequency: 26.5 to 29.5 GHz
- Designed for 5G n257 band (including n261 band)
- Up to 4 controllable RF channels with patch antenna
- Each channel provides:
 - 360° phase coverage with 5° per step
 - RMS phase error: 4° (typical)
 - 15 dB attenuation range with 0.5 dB per step
 - RMS attenuation error: 0.35 dB (typical)
- T/R half duplex operation
- T/R mode switching time (typical) : 2 ms)/ 10ns (GPIO) *1
- Beamsteering time (typical) : 2 ms (Ethernet)/2 us (SPI Interface) *2
- PC software control via RJ-45 Ethernet interface
- FPGA/ SDR control via SPI interface
- RoHS/REACH/WEEE compliant
- CE/FCC/UKCA/ISED/KC certificates compliant

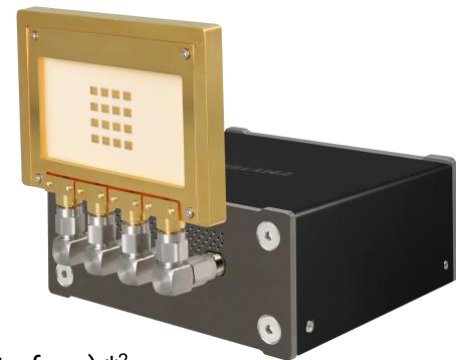


Figure 1. BBox™ Lite 5G 28 GHz

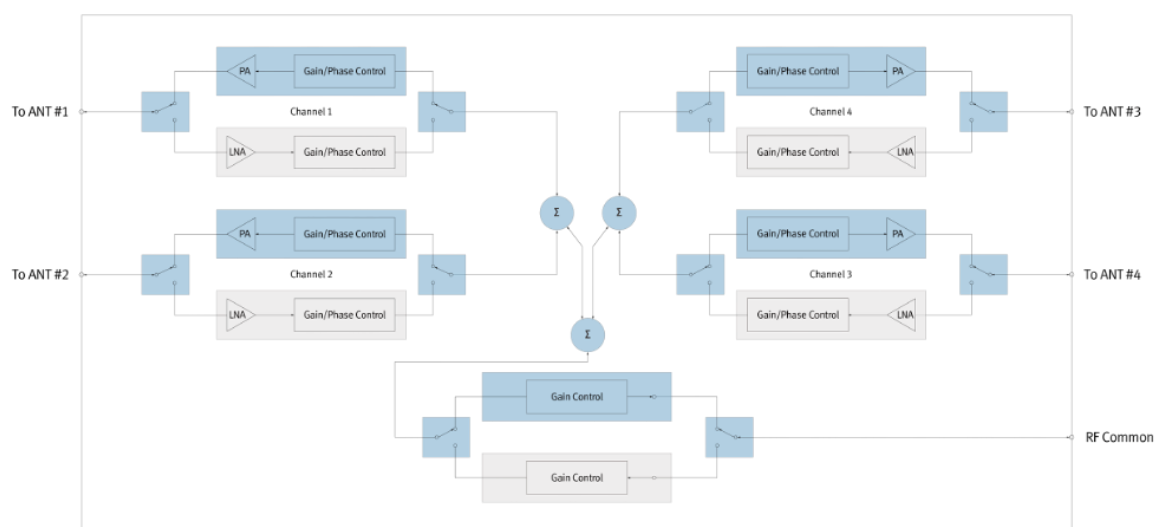


Figure 2. 5G Beamformer RF Diagram (4 channels)

*1 Depends on host GPIO

*2 The definition of beam steering time : It takes for all channels' gain and phase to change to reflect the new beamforming angle. The time here is dependent on the control host in which the control interface (UI or API) is running on.

Single Channel RF Specifications

Tested conditions: single channel, $f_{RF} = 28 \text{ GHz}$, $Z_{Sys} = 50 \Omega$ and $T_{AMB} = 25^\circ\text{C}$

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency	Without antenna	GHz	26.5	28	29.5
Maximum Gain	Tx Mode	dB	16	18	---
	Rx Mode	dB	12	14	---
Noise Figure	Rx Mode	dB	---	14	16
OP1dB	Tx Mode	dBm	9	10.5	12
IP1dB	Rx Mode	dBm	-22.5	-21	-19.5
Phase Shifting Range		deg	---	360	---
Phase Shifting Step		deg	---	5	---
RMS Phase Error		deg	---	4	---
Attenuator Range	Common Gain + Channel gain	dB	---	15	---
	Common Gain	dB	6.5	7.5	8
	Channel Gain	dB	6.5	7.5	8
Attenuator Step		dB	---	0.5	---
RMS Attenuation Error		dB	---	0.35	---
Return Loss	RF Port (Tx)	dB	7	10	---
	RF Port (Rx)	dB	7	10	---
	COM Port	dB	---	7	---
Channel-to-Channel Isolation	Maximum gain setting-Tx	dB	---	25	---
	Maximum gain setting-Rx	dB	---	30	---

System RF Specifications

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency	With AA-Kit, compliant with n257 and n261 band	GHz	26.5		29.5
Number of Controllable Channels			---	4	---
Antenna Array Gain		dB	11	12	---
Transmitter Maximum Gain		dB	34	37	---
Transmitter EIRP		dBm	26	29	---
Maximum Input Power	Tx Mode	dBm	---	-8	---
Receiver Maximum Gain		dB	30	33	---
Beamsteering Range	Vertical	deg	---	Fixed	---
	Horizontal	deg	---	± 45	---
3dB Beamwidth	Boresight	deg	---	25	30

DC and Control Specifications

Parameter	Conditions	Unit	Min.	Typ.	Max.
Power Consumption	Tx Mode	W	---	---	4.5
	Rx Mode	W	---	---	3
Supply Voltage		Vdc	---	5	---
T/R Switching Time via Ethernet Control	Between Tx and Rx modes	ms	---	2	---
Beamsteering Time via Ethernet Control	Dependent on CPU speed	ms	---	2	---
Channel ON/OFF Time via Ethernet Control		ms	---	2	---

AC Specifications

Parameter	Conditions	Unit	Min.	Typ.	Max.
Adapter Input Voltage		Vac	100	---	240
Adapter Input Current Consumption		A	---	---	0.8

Software Control Interface

The BBox™ Lite software interface offers both UI and API control which are completely designed in house. Our patented software algorithm offers better accuracy and easier control on the beam angles. Both the UI and API are available for our customers to access and download from the [link](#). The user interface shows the 4-channel phase and amplitude control block diagram as depicted below. To control the parameters, please drag the dB and Φ slide bars on the desired channel to make the changes. The left portion of the interface shows the beam steering angle. This can be used together with our standard antenna kit to control the steering angle.

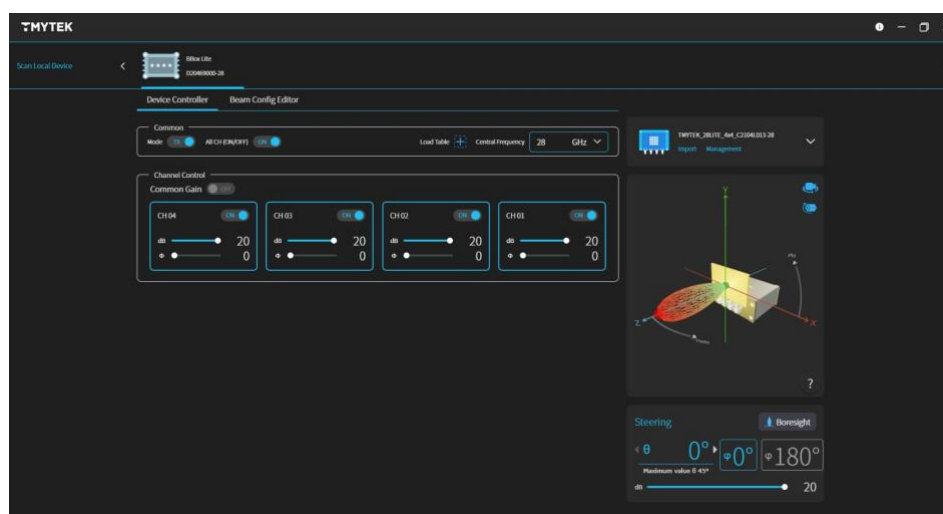


Figure 3. TMXLAB Kit – Software GUI for controlling BBox™ Lite

Connector Specifications

Parameter	Location	Type and Function
RF1, RF2, RF3, RF4	Front Panel	4 channel RF ports with 2.92mm (K) Jack connectors
RJ-45 Ethernet	Back Panel	Control port (including UI and API control)
DC IN	Back Panel	Type-C DC input
RF COM	Back Panel	RF common port with 2.92mm (K) Jack connector
Switch Button	Back Panel	Power ON/OFF
SPI Connector	Back Panel	Option Mode : Register Base Direct Control

Package

TMYTEK's compact connectorized packaging:

Parameter	Condition	Unit	Min	Typ	Max
Dimension	Length	mm	---	119.4	---
	Width	mm	---	102.0	---
	Height	mm	---	101.2	---
Weight	Aluminum	g	---	470	---

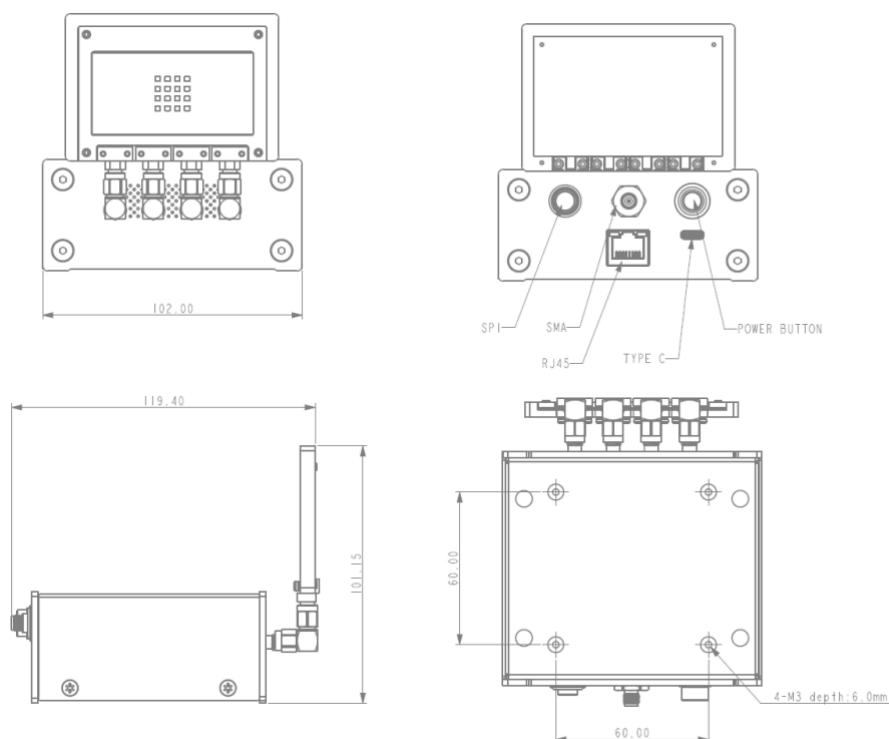


Figure 4. BBox™ Lite Dimension Drawing