Software Control Interface

The BBox™ One software interface offers both UI and API control which are completely designed in house by our software team. Our patented software algorithm offers better accuracy and easier control on the beam angles. The module can be controlled by RJ-45 ethernet cable. Both the UI and API are available for our customers to access and download from the Web. The user interface is included in our TMXLAB Kit software tool which is also used to control BBox™ Lite and UD Box. The BBox™ One interface shows the 16-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 right hand 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. BBox™ One User Interface

BBox™

Build for All 5G Developers

5G era is coming soon. Massive deployment is expected in 2021 worldwide. IMT-2020 defines eMBB, URLLC and mMTC which are keys to successful 5G communications. TMYTEK has developed a compact but development tool to help our customers in moving onto 5G beamforming developments and tests with ease. We call it the BBox™ One. It consists of 16 channel RF control, standard antenna kit and API software control through ethernet interface.

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/TMY technology

Version: 2021-01

BBox™ One

5G NR mmWave Beamforming Development Kit

www.tmytek.com

BBox™ One BB-ONE-JF-28-(4x4/8x8)

Features

- Module Operating Frequency: 25 to 31 GHz
- Antenna is designed for 5G n261 band
- Up to16 controllable RF channels with the choice of 4x4 or 8x8 series patch antenna
- Each channel provides:
  - › 360˚ phase shifter coverage with 5˚ per step
  - › RMS phase error: 3˚ (typical)
  - › 15 dB attenuation range with 0.5 dB per step
  - › RMS attenuation error: 0.2 dB (typical)
  - › Input / Output matching: -10 dB (typical)
- T/R half duplex operation
- 8 ms T/R mode mode switching time (typical)
- 15 ms beamsteering time (typical) *1
- PC software control via RJ-45 Ethernet interface

System RF Specifications

Parameter	Conditions	Unit	Typ.	Typ.
Antenna Array Size			4x4	8x8
Operating Frequency Range	With antenna, compliant with n261 band	GHz	27.5-28.35	
Number of Controllable Channels			16	16
Antenna Array Gain		dB	17	22
Transmitter Maximum Gain		dB	44	49
Transmitter EIRP		dBm	36	41
Maximum Input Power	Tx Mode	dBm	-8	-8
Receiver Maximum Gain		dB	34	39
Beamsteering Range	Horizontal	deg	±45	±25
	Vertical	deg	±60	±25
3dB Beamwidth (Broadside)	Horizontal	deg	±14	±7.5
	Vertical	deg	±13	±6.5

Operating Condition

Parameter	Absolute Maximum
Operating Temperature	-40˚C to +65˚C
Storage Temperature	-40˚C to +85˚C

Single Channel RF Specifications

TX Mode

Operation conditions: 16 channels, f_{RF} = 28 GHz, $Z_S = Z_L$ = 50 Ω and T_{AMB} = 25˚C

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range	Without antenna	GHz	25	28	31
Maximum Gain		dB	13.5	15	---
Output P1dB		dBm	5.5	7	---
Maximum Input Power		dBm	---	-8	---
Phase Shifting Range		deg	---	360	---
Phase Shifting Step		deg	---	5	---
RMS Phase Error		deg	---	3	3.5
Attenuator Range		dB	13.5	15	---
Attenuator Step		dB	---	0.5	---
RMS Attenuation Error		dB	---	0.2	0.4
Return Loss		dB	7	8	---
Channel-to-Channel Isolation	Maximum gain setting	dB	25	28	---

RX Mode

Operation conditions: 16 channels, f_{RF} = 28 GHz, $Z_S = Z_L$ = 50 Ω and T_{AMB} = 25˚C

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range	Without antenna	GHz	25	28	31
Maximum Gain		dB	3.5	5	---
Noise Figure		dB	---	8.5	10
Input P1dB		dBm	-24.5	-23	---
Phase Shifting Range		deg	---	360	---
Phase Shifting Step		deg	---	5	---
RMS Phase Error		deg	---	3	---
Attenuator Range		dB	18.5	20	---
Attenuator Step		dB	---	0.5	---
RMS Attenuation Error		dB	---	0.2	0.4
Return Loss		dB	7	10	---
Channel-to-Channel Isolation	Maximum gain setting	dB	25	35	---

DC Specifications

Parameter	Conditions	Unit	Min.	Typ.	Max.
Power Consumption		W		---	6
Current Consumption		mA		---	600
Supply Voltage		Vdc		12	---
T/R Switching Time	Between Tx and Rx modes	ms		8	---
Beamsteering Time*1	Dependent on CPU speed	ms		15	---

*1 *Beamsteering time is the time it takes for all 16 channels' gain and phase to change to reflect the new beamforming angle. The time here is dependent on the CPU speed of the PC in which the control interface (UI or API) is running on.*

AC Specifications

Parameter	Conditions	Unit	Min.	Typ.	Max.
Adapter Input Voltage		Vac	100	---	240
Adapter Input Current Consumption		A			2

Connector Specifications

Parameter	Location	Type and Function
RF1, RF2, ..., RF16	Front Panel	16 channel RF ports with SMPM connectors
Ethernet RJ-45	Back Panel	Control port (including UI and API control)
DC IN	Back Panel	3-pin DC input (12Vdc max. 2A adapter included)
RF COM	Back Panel	RF common port with K-type connector
Switch Button	Back Panel	ON/OFF Switch

Package

TMYTEK's compact connectorized packaging:

Module	Material	Length	Width	Height	Unit
BBox™ One with antenna kit	Aluminum	62.30	62.30	156.09	mm
BBox™ One without antenna kit	Aluminum	62.30	62.30	146.50	mm
Antenna Kit	Aluminum with gold plating	62.30	62.30	9.59	mm

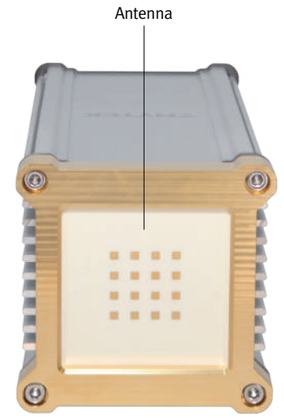

Figure 1. BBox™ One Front Panel

Figure 2. BBox™ One Back Panel