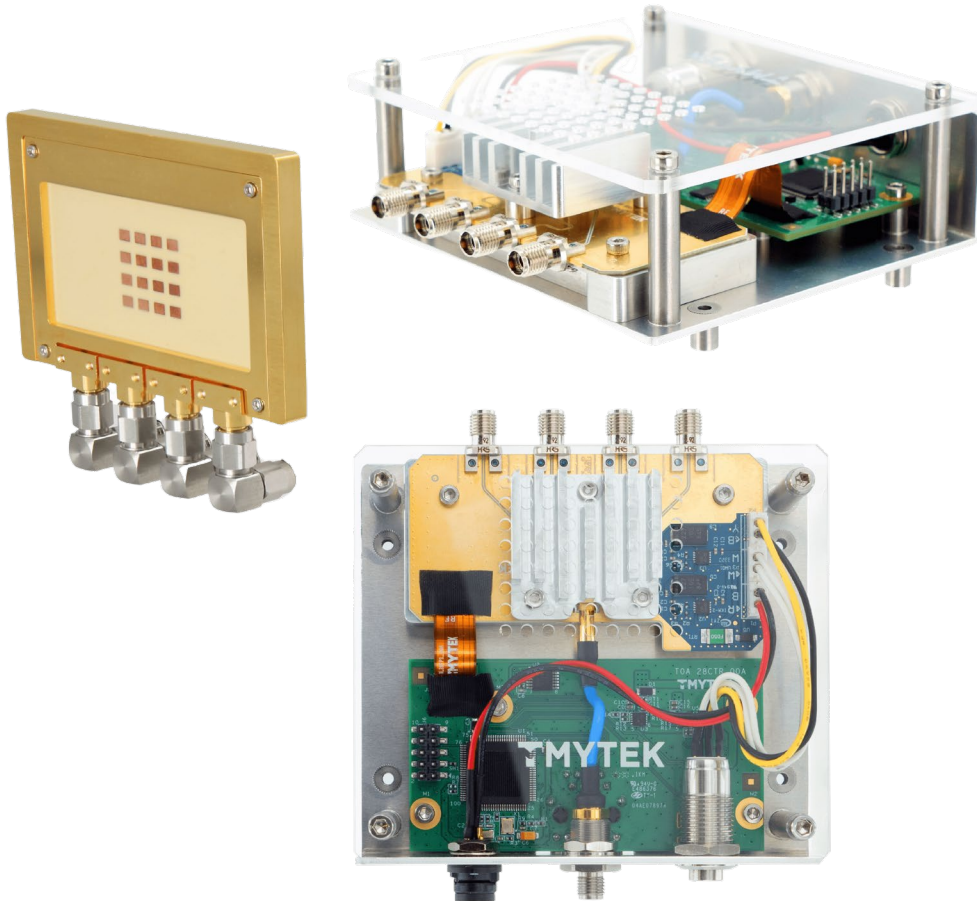




Your supplier for RF/microwave components

BBoard 5G Beamforming Board by TMYTEK



BBoard Beamforming Board – 5G/B5G Beamforming Educational Kit

for frequency range 28 GHz and 39 GHz

support 5G NR FR2

mmWave Beamformer

4 Channels

perfect for Education & Research

www.bq-microwave.de

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Comparison of TMYTEK beamformer

Parameter		BBox One	BBox Lite	BBoard
Frequency (GHz)	Series 28	26.5 - 29.5	26.5 - 29.5	26.5 - 29.5
	Series 39	37.0 - 40.0	37.0 - 40.0	37.0 - 40.0
RF Channels		4 x 4	1 x 4	1 x 4
Dimensions (mm)		156x62x62	125x102x110	74.5x46x46
Antenna kit		•	•	Optional ^[1]
Thermal Design		•	•	
Phase Calibration		•	•	Optional ^[2]
Gain Calibration		•	•	Optional ^[2]
Linearity		•	•	•
Aluminum Housing		•	•	
Advanced GUI		•	•	

a 1x4 serial patch array antenna with 15dB Gain is available.
Please contact us for more details.

TMYTEK provides calibration services for both phase and gain.
Please contact sales@tmytek.com for more details.

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Datasheet

5G mmWave Developer Kit

BEK-BP-28-G

Understanding mmWave beamforming is essential for the next generation of wireless communication engineering students. The 5G mmWave development kit provides all the necessary RF components, including tools for 5G FR2 beamforming up to 40 GHz, essential for mmWave innovation. The experiment guide streamlines teaching preparation, allowing engineering students to establish 5G communication systems, observe beamforming results, and creatively research antenna design and protocols using the kit. It also includes instructional software for teaching principles like phased arrays, beamforming, and beam control.

Contents

- 5G FR2 Beamformer - BBoard x 1
- Signal Source - Phase Locked Oscillator x 1
- Power Detector x 1
- 5G FR2 Array Antenna x 1
- 28 GHz COCO Antenna x 1
- 20 GHz – 40 GHz Amplifier x 1
- 40 GHz RF Cable x 4
- 25 GHz – 31 GHz Combiner/ Splitter x 1

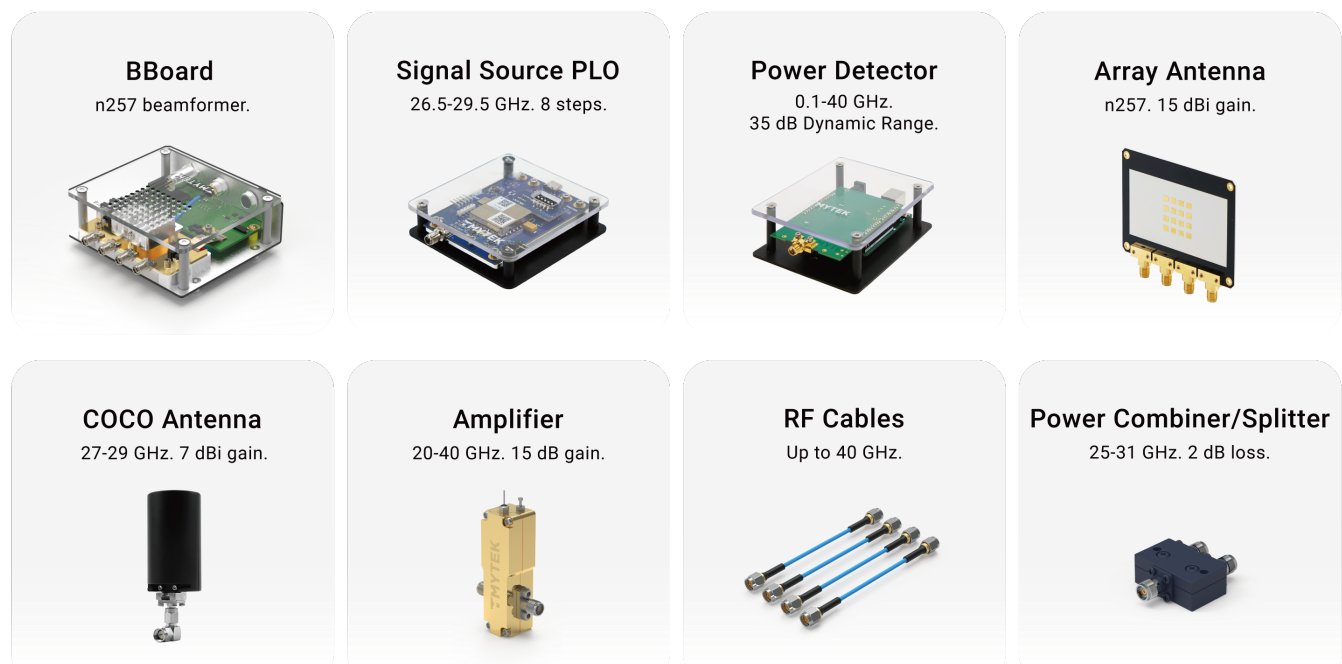


Figure 1. List of Developer Kit

5G FR2 Beamformer - BBoard

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range	Without antenna	GHz	26.5	28	29.5
Maximum Gain	Tx Mode	dB	15	18	---
	Rx Mode	dB	11	14	---
Noise Figure	Rx Mode	dB	---	14	17
OP1dB	Tx Mode	dBm	8	10	12
IP1dB	Rx Mode	dBm	-23	-21	-19
Phase Shifting Range		deg	---	360	---
Phase Shifting Step		deg	---	5.625	---
RMS Phase Error		deg	---	4	8
Gain Control Range		dB	---	15	---
Gain Control Resolution	Common Gain	dB	---	1	---
	Channel Gain	dB	---	0.5	---
RMS Attenuation Error		dB	---	0.4	---
Return Loss	RF Port (Tx)	dB	---	10	---
	RF Port (Rx)	dB	---	10	---
	COM Port	dB	---	7	---
Channel-to-Channel Isolation	Maximum gain setting-Tx	dB	---	25	---
	Maximum gain setting-Rx	dB	---	30	---

Signal Source - Phase Locked Oscillator

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	26.5	---	29.5
Output Power	26.5 GHz to 29.5 GHz	dBm	+8	---	+10
Phase noise	100 kHz offset @ 28 GHz	dBc/Hc	---	-87	---
Load Impedance		ohm	---	50	---

Power Detector

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	0.1	---	40
Dynamic Range		dB		35	

5G FR2 Array Antenna

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	26.5	---	29.5
Array Antenna Gain		dBi	---	15	---
Beam Steering Range	Vertical	Deg	---	Fixed	---
	Horizontal	deg	---	±45	---

CoCo Antenna

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	27	---	29
Antenna Gain		dBi	---	7	---

20 GHz - 40 GHz Amplifier

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	20	---	40
Gain	20 to 30 GHz	dB	15	---	20
	30 to 40 GHz	dB	18	---	23
Output P1dB	20 GHz	dBm	---	21	---
	30 GHz	dBm	---	21	---
	40 GHz	dBm	---	18	---
Noise Figure		dB		7	

40 GHz RF Cable

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	DC		40
Insertion Loss	28 GHz	dB		1	

25 GHz – 31 GHz Combiner/ Splitter

Parameter	Conditions	Unit	Min.	Typ.	Max.
Operating Frequency Range		GHz	25	---	31
Insertion Loss		dB		2	
Isolation		dB		15	

TMYTEK's UD Kit is a comprehensive solution merging TMYTEK's UDBoard and signal generator to meet seamless communication needs in advanced RF systems. Together, they comprise an up/down converter with synchronized LO, offering a straightforward control method via a slide switch and Python commands. The UDBoard offers half-duplex capability with Tx single-sideband up-conversion and Rx image-reject down-conversion, along with a frequency multiplier for easy integration with external PLLs. With 11.5 dB conversion gain in transmit mode and 8 dB gain with 12 dBm IIP3 in receive mode, the UDBoard ensures robust signal transmission and reception. Complementing this, TMYTEK's signal generator spans from 180 MHz to 18 GHz with 10 kHz frequency resolutions and 12 distinct output power levels, boasting commendable phase noise characteristics and extensive bandwidth coverage.

Contents

- Up/ Down Frequency Converter Board (UDBoard) x 2
- Signal Generator (180 MHz – 18 GHz) x 1
- Adaptors x 2

Features

Up/ Down Frequency Converter

- Up/ Down conversion
- Multi-band RF operation
- Wideband IF range
- Tx/ Rx half duplex operation
- X4 LO frequency multiplier



Figure 1. Up/ Down Frequency Converter board

Signal Generator

- Wide frequency coverage up to 18 GHz
- Ultra low phase noise
- 10 kHz resolution
- Dual Outputs



Figure 2. Signal Generator

Up/ Down Frequency Converter Board - UDBOARD

Parameter	Condition	Units	Min	Typ	Max
RF Frequency Range		GHz	23		30
IF Frequency Range		GHz	2.6		5.8
LO Frequency Range (Low Side Injection)	External LO x 4 Multiplier	GHz	4.75		6.75
LO Input Power Range		dBm	-10	-5	0
Transmit Up Conversion Mode					
Conversion Gain		dB		11.5	
Output P1dB		dB		11.5	
Noise Figure		dB		16	
Power Consumption		W		1.6	
Receive Down Conversion Mode					
Conversion Gain		dB		8	
IIP3		dB		12	
Noise Figure		dB		16.5	
Power Consumption		W		1.4	

Signal Generator

Parameter	Condition	Units	Min	Typ	Max
Frequency	RF Port 1		180 MHz		18 GHz
	RF port 2		180 MHz		18 GHz
Resolution		kHz		10	
Output Power	RF Port 1@ LV8 Power Level	dBm	-4		8
	RF Port 2@ LV8 Power Level	dBm	-4		8
Load Impedance		Ω	---	50	---
Lock Time		ms	---	25	---
Output power level		step		12	
Reference Input Frequency	Frequency	MHz	10	or	100
	Sensitivity	dBm	1	---	10
Reference Output Frequency	Frequency	MHz		10	
	Sensitivity	dBm	1	---	10

DC and Operating Specifications - UDBoard

Parameter	Units	Min	Typ	Max
Bias	Vdc	---	5	
Current Consumption	mA	---	1000	
Working Temperature	°C	-20	---	+85

DC and Operating Specifications – Signal Generator

Parameter	Units	Min	Typ	Max
Bias	Vdc	---	5	
Current Consumption	mA	---	1000	
Working Temperature	°C	-20	---	+85

The EVM Measurement Structure, Using TMYTEK SG as LO

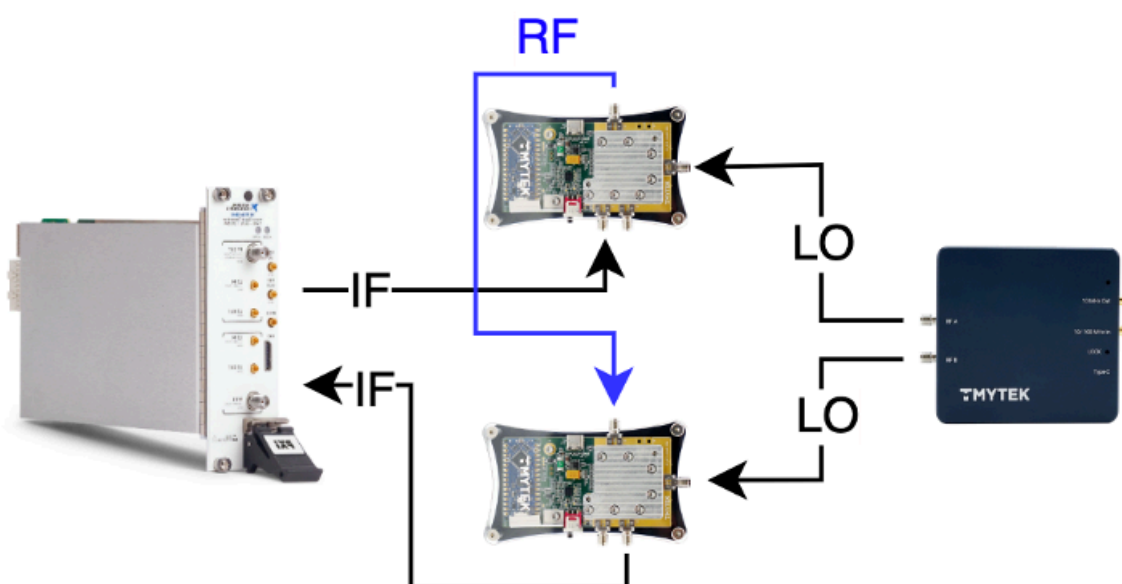


Figure 3. UDBoard EVM Measurement Loopback Diagram

Package Dimension - UDBOARD

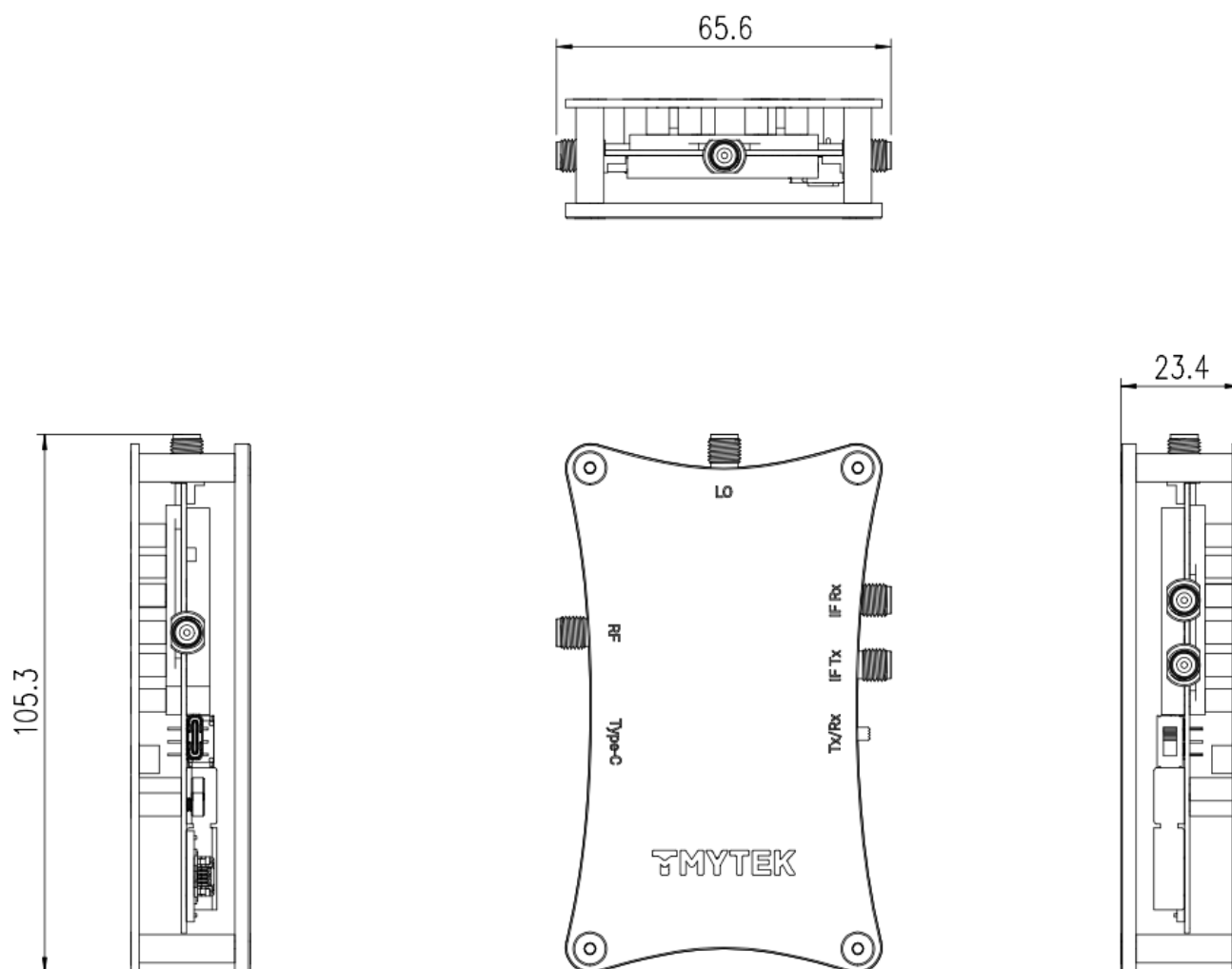


Figure 4. UDBOARD Dimension Drawing

Parameter	Units
RF Port	2.92 mm (K) Jack connector, DC - 40 GHz
LO Port	SMA Jack connector, DC - 18 GHz
IF Tx Port	SMA Jack connector, DC - 18 GHz
IF Rx Port	SMA Jack connector, DC - 18 GHz
DC IN	Type-C DC input

Package Dimension - Signal Generator

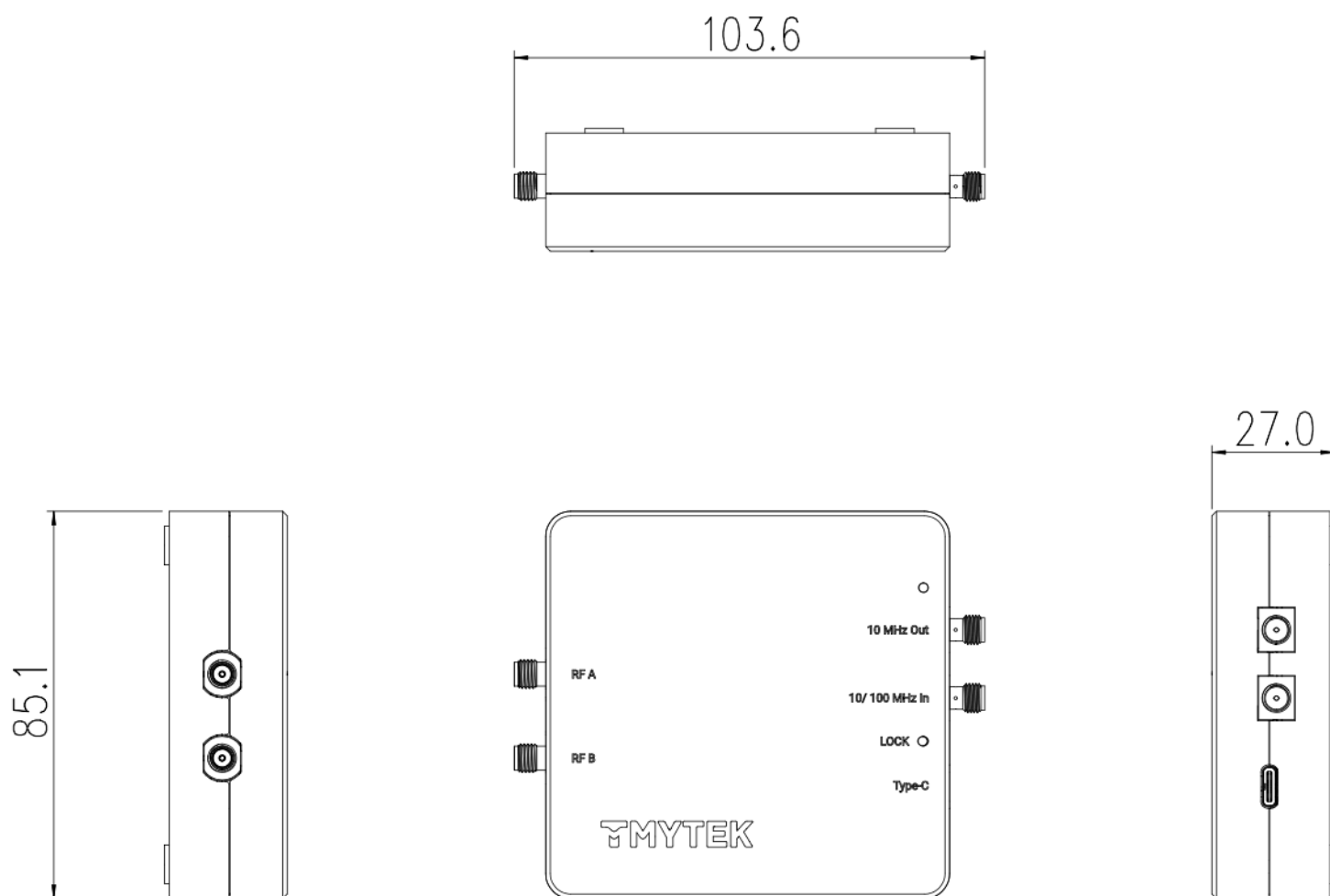


Figure 5. Signal Generator Dimension Drawing

Parameter	Units
RF A Port	SMA Jack connector, DC - 18 GHz
RF B Port	SMA Jack connector, DC - 18 GHz
10 MHz Out	SMA Jack connector, DC - 18 GHz
10/ 100 MHz In	SMA Jack connector, DC - 18 GHz
DC IN	Type-C DC input

*ALL DIMENSIONS ARE IN MILLIMETER.