

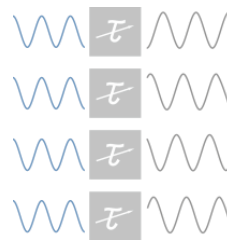
4 Channel Programmable Delay Line 250 ... 4000 MHz

Features

- wideband
- four independent RF channels
- web capability
- cascadable
- synchronous operation

Applications

- antenna Beamforming
- radio Monitoring
- direction Finding



Overview

QDLL is a 4-channel programmable step delay line suitable for the frequency range from 250 MHz up to 4000 MHz in 50 Ohms technology. Each channel has a delay range from 0 ps up to 1700 ps adjustable in 5 ps steps. QDLL is the cost-efficient solution for automated test systems. It offers the remote control interfaces USB, LAN and an optional IEEE488 interface for control via ASCII strings. Additionally, QDLL can be operated manually via MMI on the front panel and a web interface.

Multi-Channel Capability

QDLL is equipped with four independent channels. All channels offer ~90 dB isolation over the full frequency range.

Cascadable

The high isolation allows the cascading of the channels. Up to all four paths can be cascaded to achieve an even greater delay range of up to 6800 ps, adjustable in 5 ps steps.

Highest Accuracy

QDLL achieves a delay accuracy of ~2 ps over all cellular bands like GSM, UMTS or LTE.

Synchronous Operation

Like many other products of Becker Nachrichtentechnik GmbH (BNT), QDLL offers a TRIGGER IO port. This Interface provides a precise trigger pulse which complies with the physical execution of the applied switching command. On the other hand, external pulses can be applied to this port in order to trigger the execution of queued switching commands. Therefore it is possible to link multiple devices to a synchronous switching compound.

Web Capability

A special feature of QDLL is the control via web interface. This allows location-independent operation of the device regardless of the user's operating system.



RF Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
impedance	Z_{in} / Z_{out}		50		Ohm	
low frequency	f_{min}		100	250	MHz	
high frequency	f_{max}	4000	5000		MHz	
number of inputs	n_{in}	4				
connector type		N female				
input return loss	S_{11}		-15	-10	dB	$250 \text{ MHz} \leq f \leq 700 \text{ MHz}$
input return loss	S_{11}		-20	-15	dB	$700 \text{ MHz} < f \leq 3000 \text{ MHz}$
input return loss	S_{11}		-12	-9	dB	$f \geq 3000 \text{ MHz}$
number of outputs	n_{out}	4				
connector type		N female				
power	P_{in}			+32	dBm	no damage, any RF port
1dB compression	P_{1dB}	+29	31		dBm	any RF port
insertion loss	S_{21}	-7.5	-6.5		dB	$f < 1800 \text{ MHz}$
	S_{21}	-9	-8		dB	$1800 \text{ MHz} \leq f < 2800 \text{ MHz}$
	S_{21}	-14	-12		dB	$2800 \text{ MHz} \leq f < 4000 \text{ MHz}$
delay setting range		0		1700	ps	single channel
		0		6800	ps	four channels cascaded
step size (LSB)			5.083		ps	based on phase delay measurements; 0.8 - 2.8 GHz
accuracy	*		± 2	± 6	ps	single channel; 0.8 - 2.8 GHz
RF commands processing rate			500		cmd/s	setting a single channel in MASTER or OUT mode without additional system load (e.g. web interface)
switching speed			60		ns	between delay steps

Note 1: for 2 n *LSB

TRIGGER IO Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
connector type		BNC female				
function type		open collector, wired AND				positive edge = trigger
		low state = BUSY				mode "SLAVE"
logic high level	U_H	2.0	5.0	5.5	V	
logic low level	U_L	-0.5	0.0	1.2	V	
pulse width	T_{high}		50		μs	
rise time	T_R		0.1^1	0.5^2	μs	
sinking current	I_S			60	mA	
passive pull up			1		k Ω	
active pull up			10		mA	only in mode "MASTER" & "OUT", bus acceleration @ $U \geq 0.78\text{V}$
drivable capacitance	C_D			2	nF	
load capacitance			110		pF	mode "SLAVE"
trigger offset*	t_O	-500^2	$+0^1$		ns	50% trigger signal to 50% RF-switching (trigger mode "OUT")
trigger offset*	t_O	+10	+60	+200	ns	50% trigger signal to 50% RF-switching (trigger mode "MASTER" or "SLAVE")

Note 1: capacitive load < 100 pF

Note 2: capacitive load ≤ 2 nF



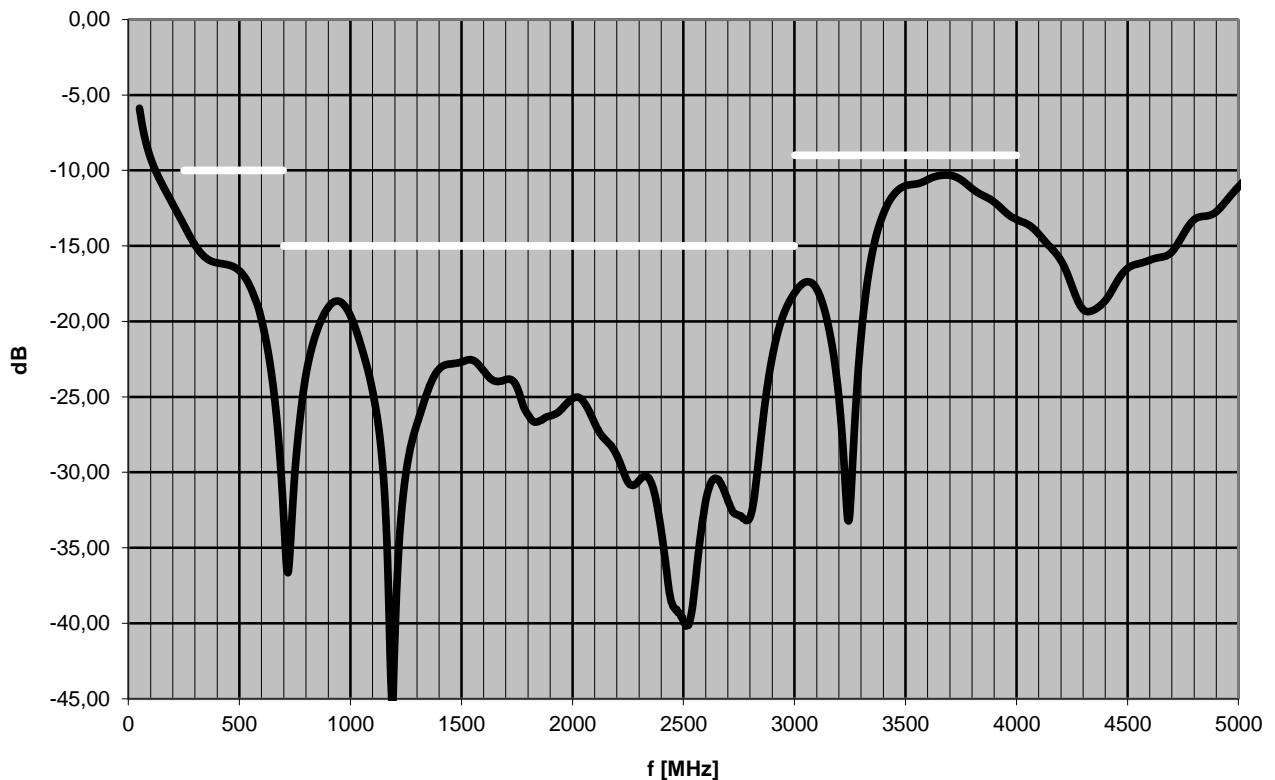
Common Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
supply voltage	U_{AC}	90	230	260	V	
power consumption	P		9		VA	
dimensions	L x W x H	approx. 210 x 482 x 44			mm	
weight	m		2800		g	
operating temp. range	T_o	+5		+40	°C	
storage temp. range	T_s	-40		+70	°C	
EMC		in line with EN55011 class B EN 61326-1 (industrial environment) EN 61326-2-1				
remote control interfaces						
Ethernet / LAN		RJ 45 10/100 Base-T				
USB		2.0 (high speed)			USB Type B	
ordering information	QDLL	1303.4002.1				
option IEEE488		GBIP IEEE-488.2			24 pin Amphenol type 57 series female	
ordering information	QDLL	1303.4002.2			IEEE488 option installed	

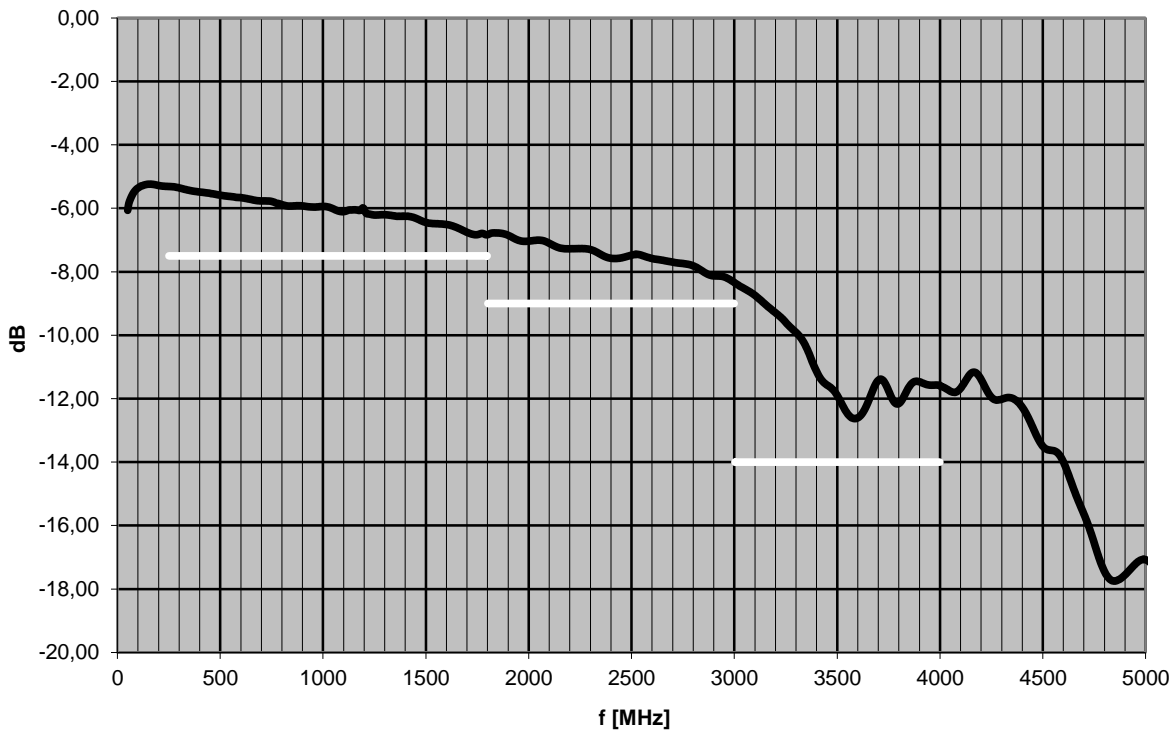
All statements regarding setting and accuracy of the delay values are based on phase delay measurements in the frequency range 800 MHz ... 2800 MHz.

S-Parameters (typical responses)

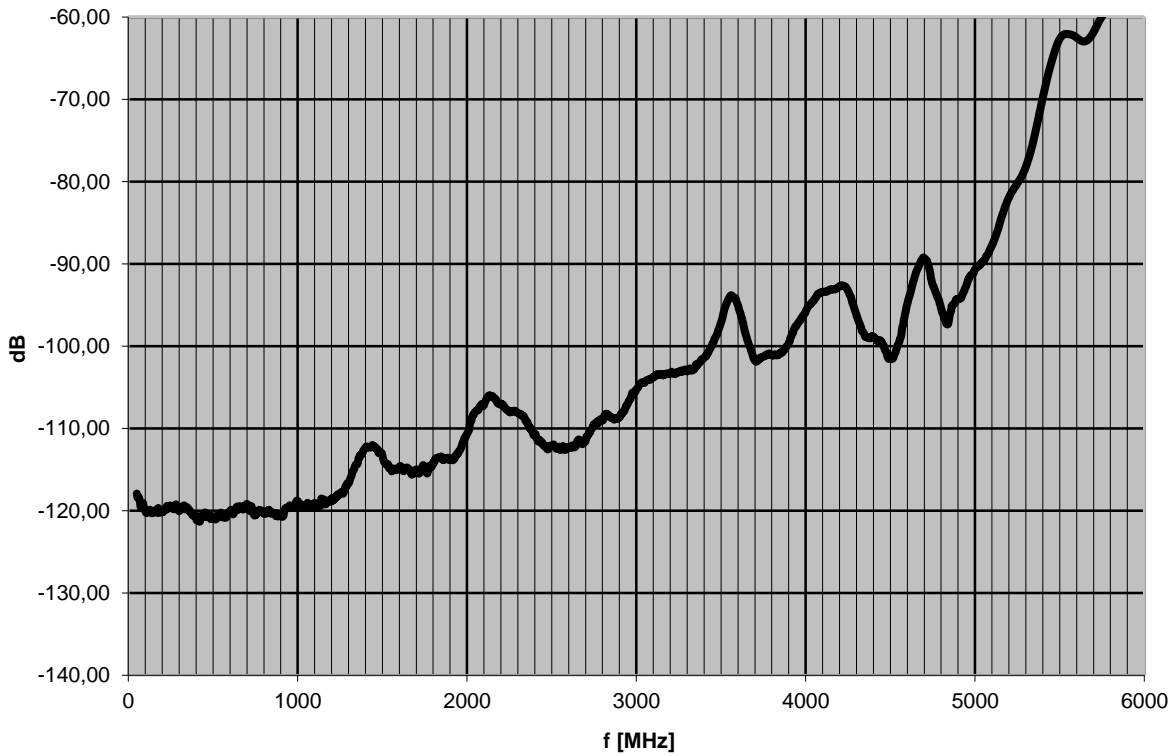
Input Return Loss, typical value (S11)

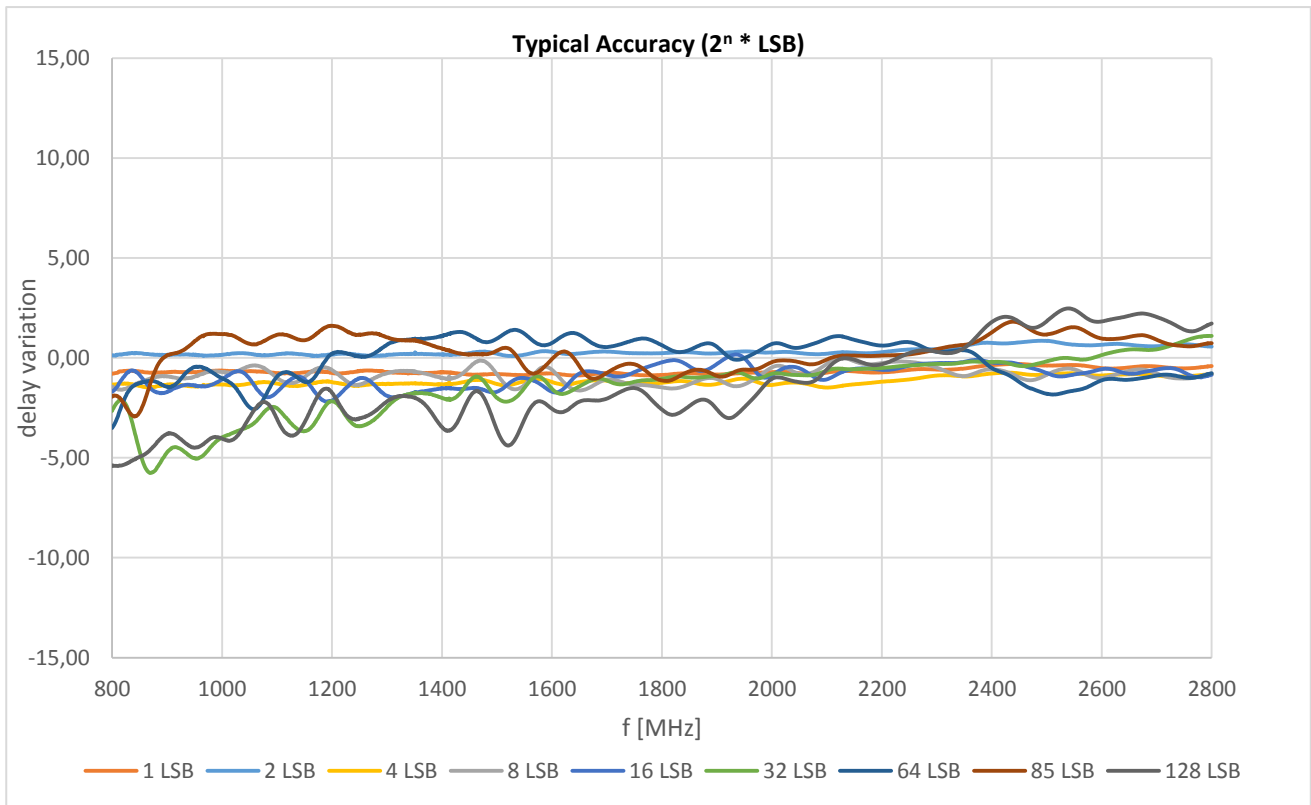


Transmission, typical value (S21)

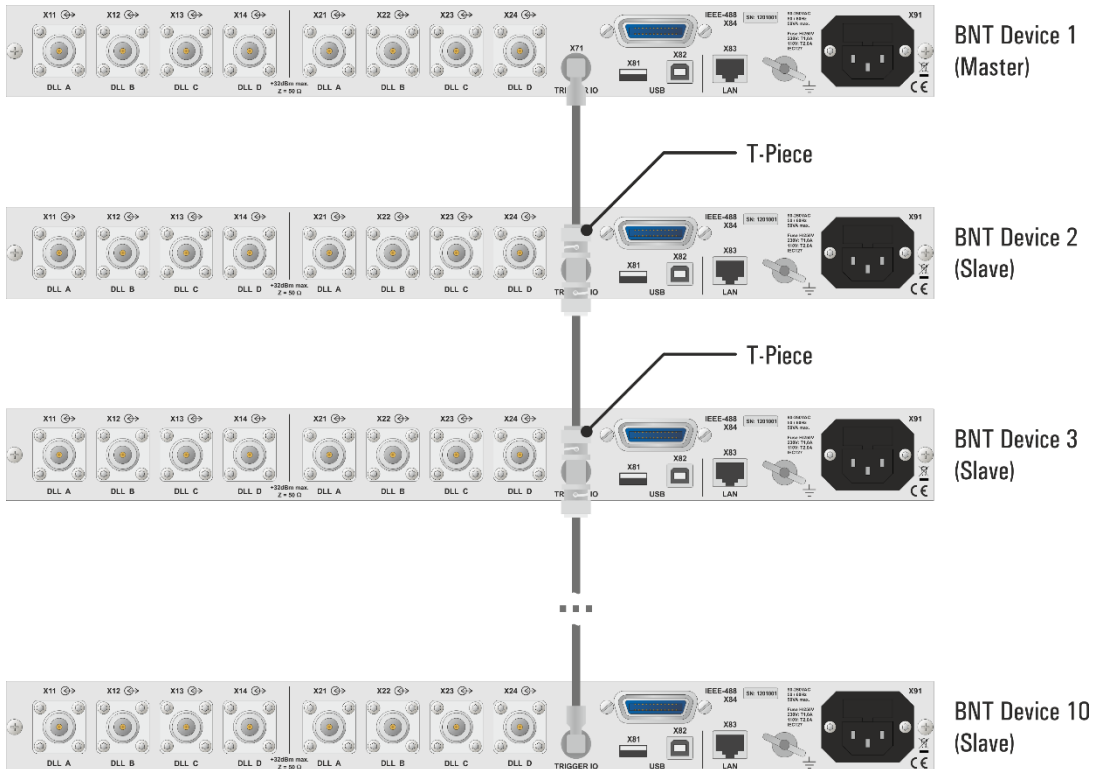


Channel Isolation (typical)

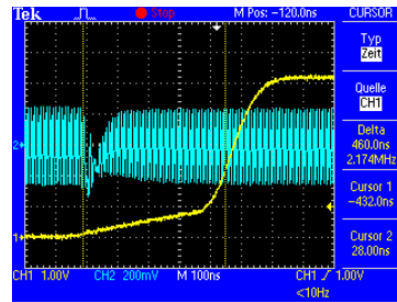
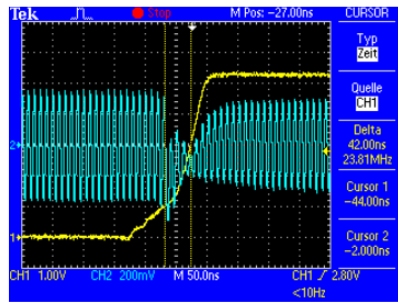




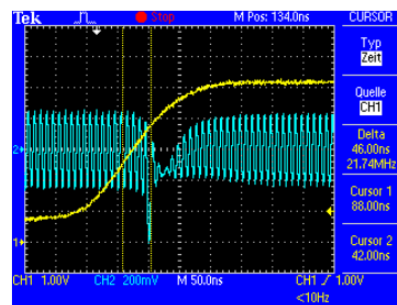
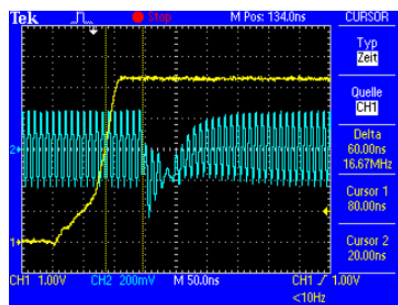
Scheme of a Trigger Compound



Trigger IO responses (typical)



External Trigger (yellow) vs. RF Signal (blue), Trigger Mode “OUT”, with and without capacitive load



External Trigger (yellow) vs. RF Signal (blue), Trigger Mode “MASTER”, with and without capacitive load

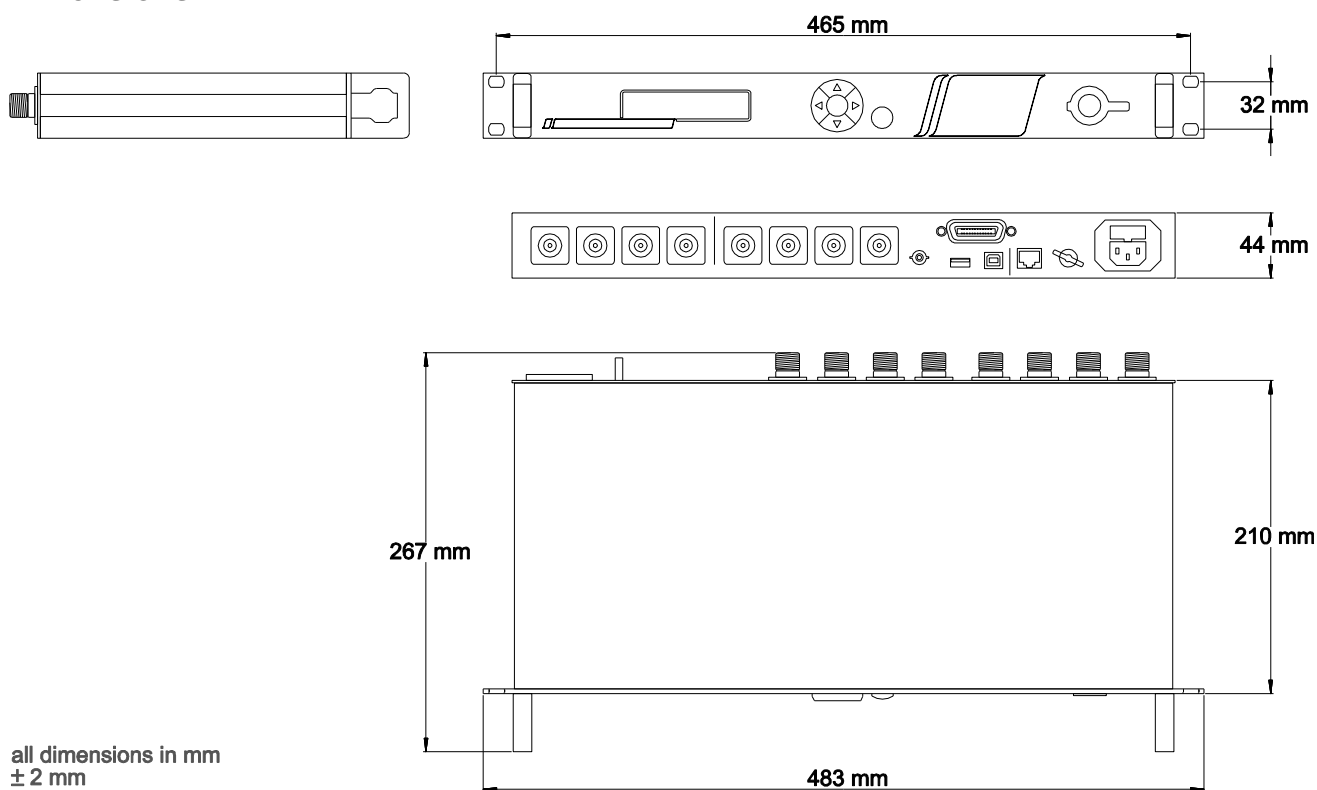
Front View



Rear View



Dimensions



Related Products

Product	Description	P/N
QATT	4 Channel Step Attenuator 100 kHz ... 4000 MHz	1302.4002.1
QATT-7G	4 Channel Step Attenuator 100 kHz ... 7000 MHz	1302.4702.1
AIE4X4	4 Channel Air Interface Emulation System 500 ... 3000 MHz	1201.4002.1
AIE4X4-MIMO	4 Channel Air Interface Emulation System 250 ... 4000 MHz	1308.4502.1
AIE-W9	9 Port Air Interface Emulator 1800 ... 6400 MHz	1309.4029.1

