

## 4 Channel Programmable Delay Line 250 ... 4000 MHz 0...1700 ps in 5ps steps

### Features

- 4 independent RF channels
- attenuation range 0 ... 1700 ps in 5 ps steps
- MMI for local control
- LAN and USB remote interface
- intuitive graphic user interface (GUI)
- trigger port for synchronous operation
- compact 19", 1 U design



### Applications

- air interface emulations
- antenna beam forming
- product testing and validation
- cellular and wireless
- broadcast and GNSS

### Scope

QDLL is a 4-channel programmable step delay line suitable for the frequency range from 250 MHz up to 4000 MHz. It is designed in 50 Ohms technology. Each channel has a delay range settable from 0 ps up to 1700 ps adjustable in 5 ps steps.

QDLL is designed in 19" technology for an easy installation into 19" system racks. It is also suitable as table top unit for laboratory use.

### Versatile Control Modes

QDLL has a MMI (Man Machine Interface) for local operation.

For remote control use the device offers LAN and USB interfaces. The control occurs via ASCII strings.

Additional QDLL has a graphic user interface (GUI) for an intuitive control via LAN interface. The GUI enables a location-independent operation regardless of the user's operating system also with multiple devices in a single network.



Appearance of QDLL web interface

### Synchronous Operation

Like many other products of Becker Nachrichtentechnik, 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 synchronously.

**RF Specification**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
impedance	$Z_{in} / Z_{out}$		50		Ohm	
number of channels	$n_{CH}$		4			
low frequency	$f_{min}$		100	250	MHz	
high frequency	$f_{max}$	4000	5000		MHz	
return loss	$S_{11}, S_{22}$		-15	-10	dB	$250 \text{ MHz} \leq f \leq 700 \text{ MHz}$
	$S_{11}, S_{22}$		-20	-15	dB	$700 \text{ MHz} < f \leq 3000 \text{ MHz}$
	$S_{11}, S_{22}$		-12	-9	dB	$f \geq 3000 \text{ MHz}$
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	$2800 \text{ MHz} \leq f < 4000 \text{ MHz}$
channel isolation	$S_{23}$		-100		dB	
delay setting range		0		1700	ps	single channel
		0		6800	ps	four channels cascaded
step size (LSB)			5		ps	$800 \text{ MHz} \leq f < 2800 \text{ MHz}$
accuracy			$\pm 2.5$		ps	$800 \text{ MHz} \leq f < 2800 \text{ MHz}$
1dB compression	$P_{1dB}$	+29	+31		dBm	
RF commands processing rate	PR		500		cmd/s	setting a single channel in MASTER or OUT mode without additional system load (e.g. web interface)
switching speed	$t_{SW}$		60		ns	between delay steps
DC voltage	$U_{DC}$			20	V	all RF ports
ESD discharge resistor	$R_{ESD}$		4.7		k $\Omega$	all RF ports
input power	$P_{RF}$			+32	dBm	CW, no damage
RF connectors	$X_{RF}$		N female			

**TRIGGER IO Specification**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
connector type		BNC female				
function type		open collector, wired AND				positive edge = trigger
		low state = BUSY				"SLAVE" mode
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	$T_W$		50		$\mu\text{s}$	
rise time	$T_R$		$0.1^1$	$0.5^2$	$\mu\text{s}$	
sinking current	$I_S$			60	mA	
passive pull up	$R_{PU}$		1		k $\Omega$	
active pull up	$I_{PU}$		10		mA	"MASTER" & "OUT" mode
drivable capacitance	$C_D$			2	nF	
load capacitance	$C_L$		110		pF	mode "SLAVE"
trigger offset*	$t_o$	-500 <sup>2</sup>	+0 <sup>1</sup>		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 &lt; 100 pF

Note 2: capacitive load  $\leq 2$  nF

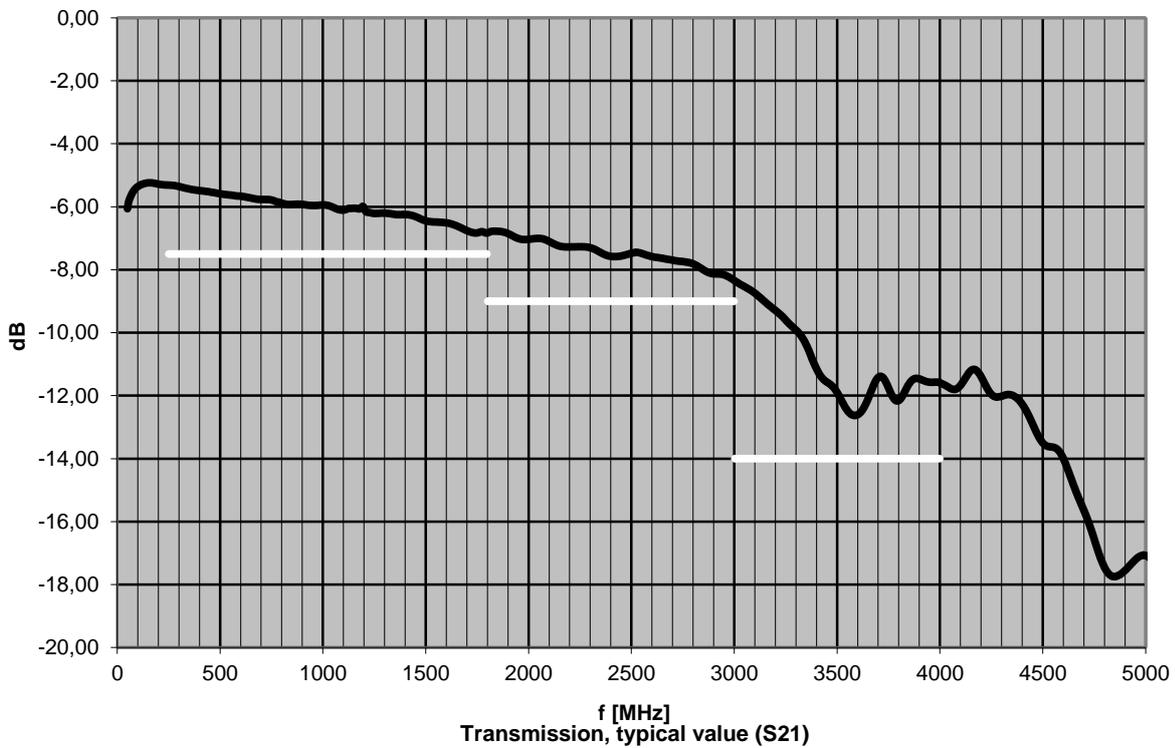
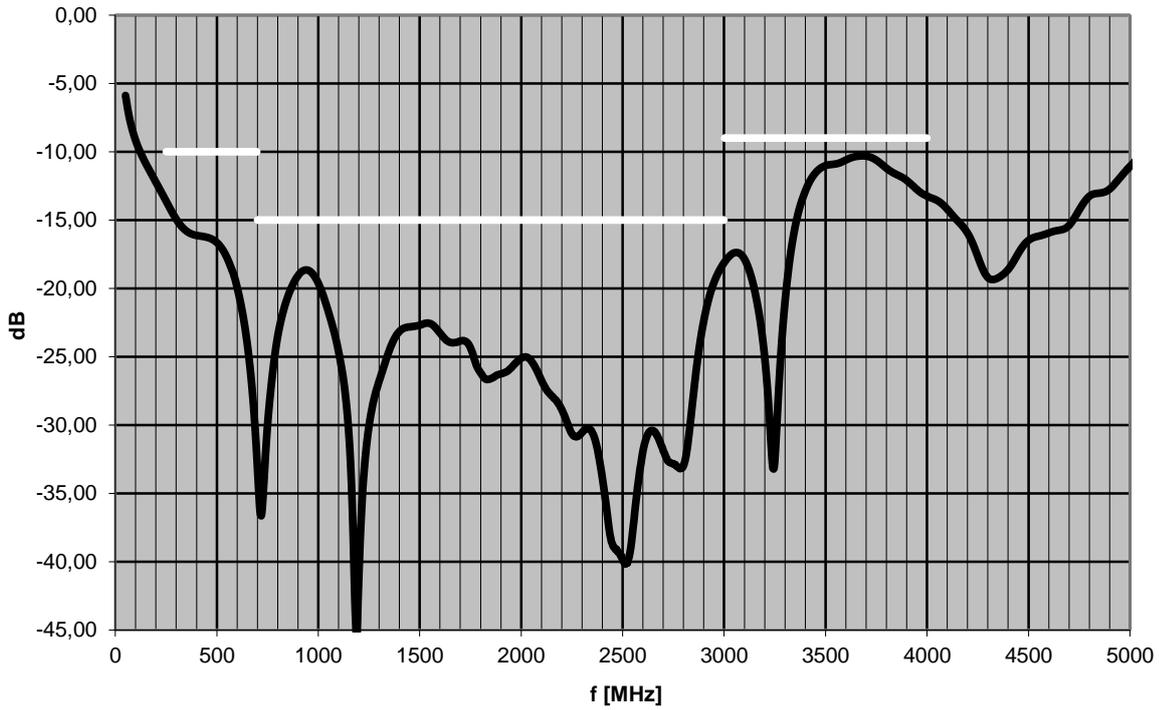
**Common Specification**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
voltage supply range	$U_{AC}$	90	230	260	V	50 / 60 Hz AC
power consumption	$P_{AC}$		9		W	
power socket	$X_{AC}$	IEC-60320 C14				country specific mains cable
<b>Dimensions and weight</b>						
dimensions	W x H x D	approx. 482 x 44 x 210			mm	19" 1 U, without connectors and handles
weight	m		2.8		kg	
<b>Environment conditions</b>						
operating temp. range	$T_o$	+5		+45	°C	
storage temp. range	$T_s$	-40		+70	°C	
<b>Remote interfaces</b>						
remote ports	LAN	10/100BaseT	TCP/IP			RJ45
	USB	2.0 (high speed)				USB type B
<b>Product conformity</b>						
Electromagnetic compatibility	EU: in line with EMC directive (2014/30/EC)					applied harmonized standards: EN 61326-1 (for use in industrial environment), EN 61326-2-1, EN 55011 (class B), EN 61000-3-2, EN 61000-3-3
Electrical safety	EU: in line with low voltage directive (2014/35/EC)					applied harmonized standard: EN 61010-1
<b>Ordering information</b>	QDLL		P/N: 1303.4002.1			

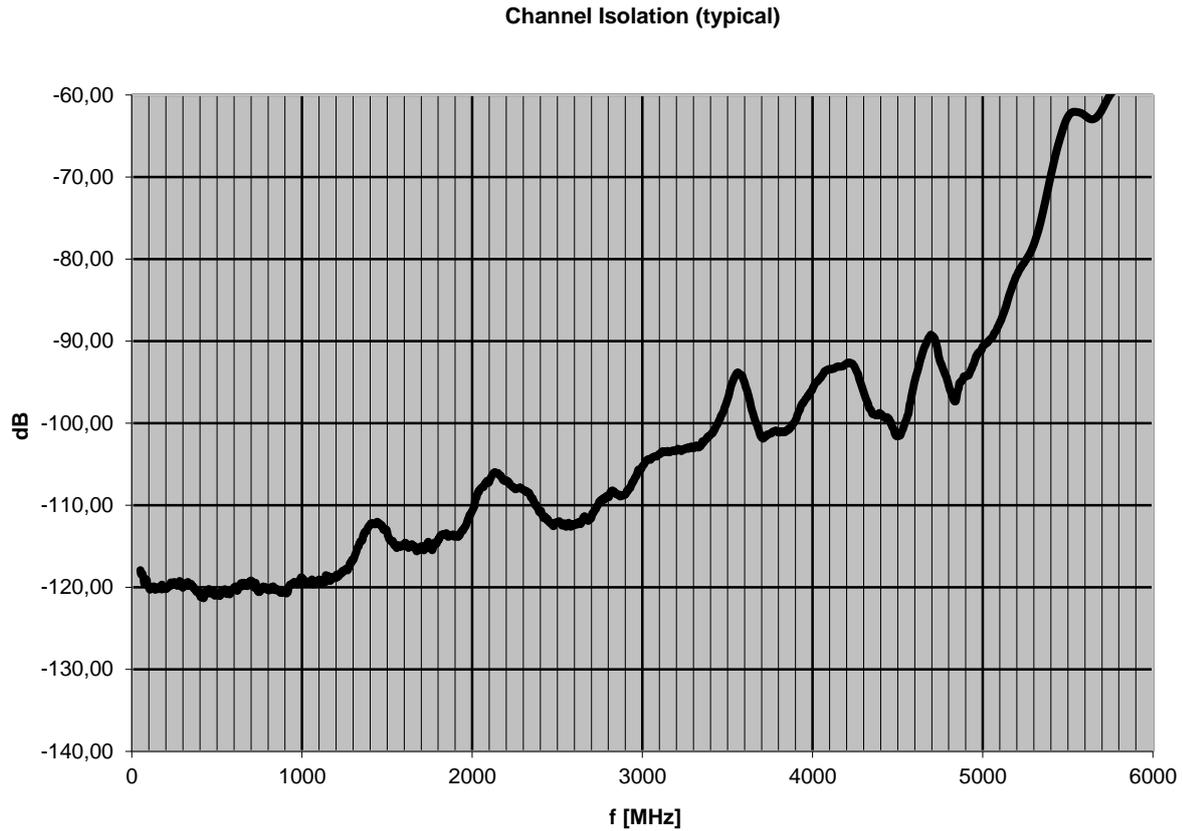


S-Parameters (typical responses)

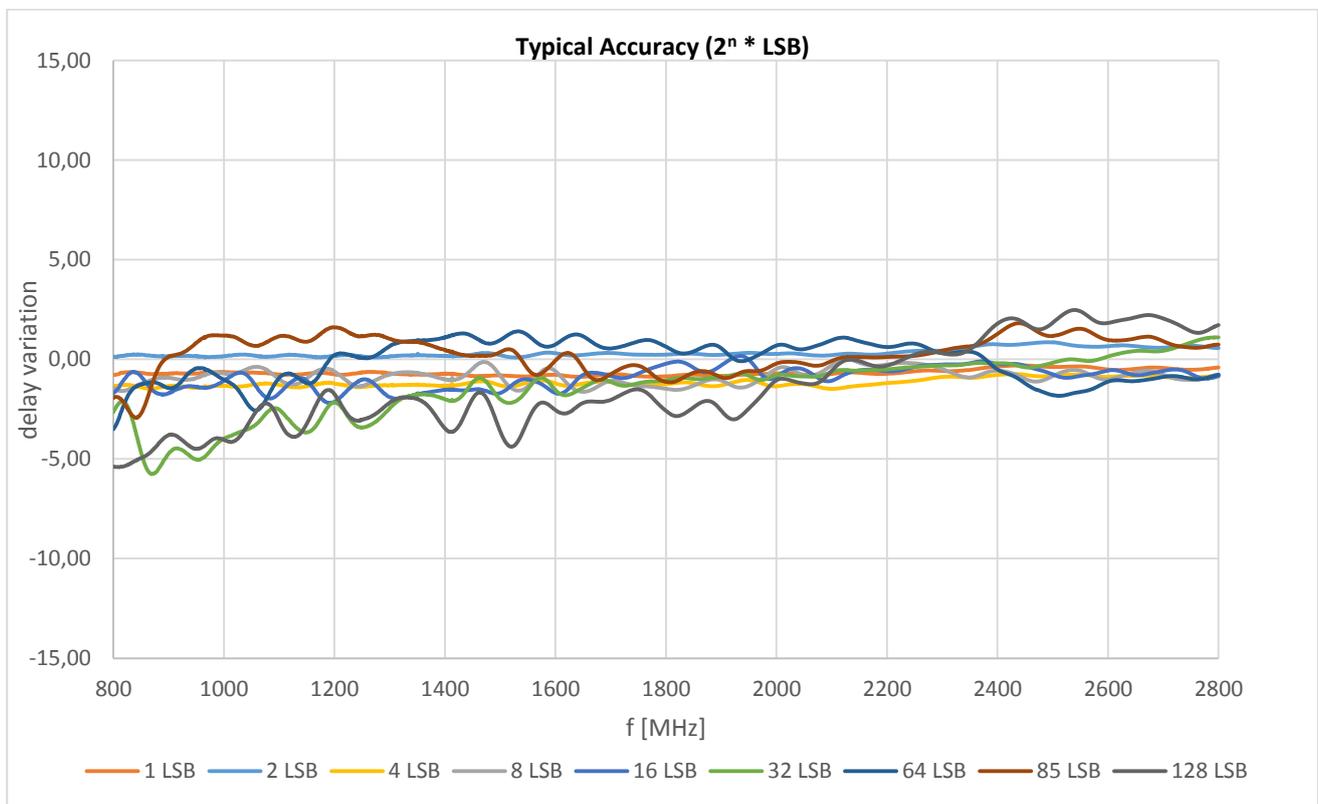
Input Return Loss, typical value (S11)



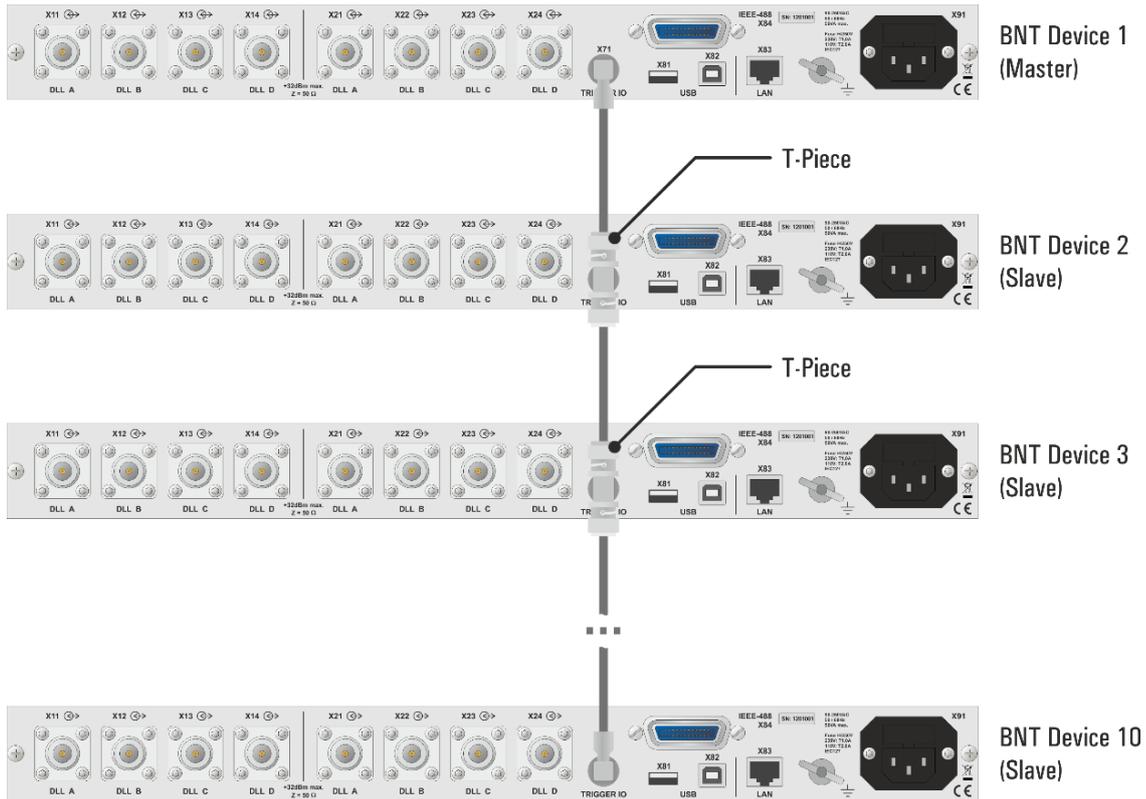
**Isolation (typical response)**



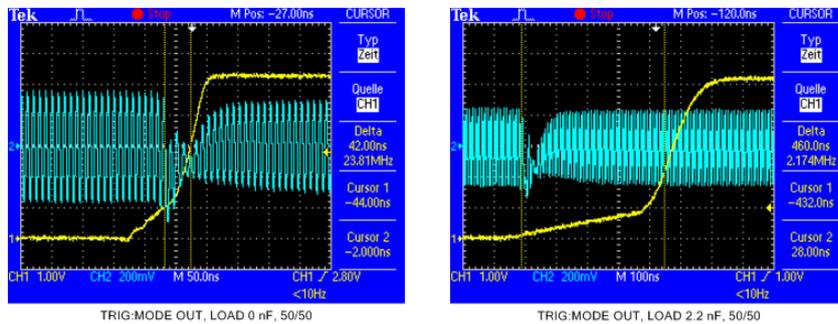
**Accuracy (typical response)**



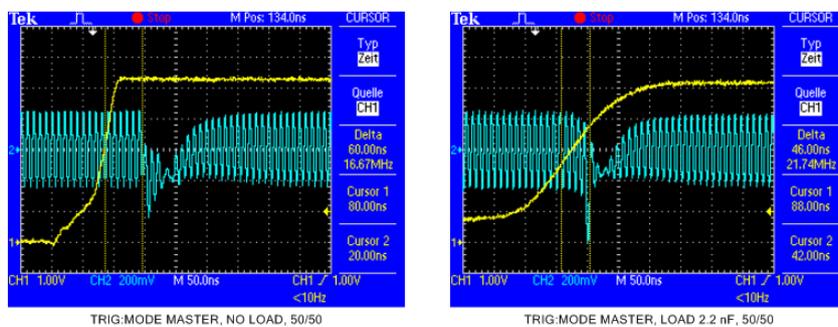
### Trigger I/O Connection



### 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



## Appearances

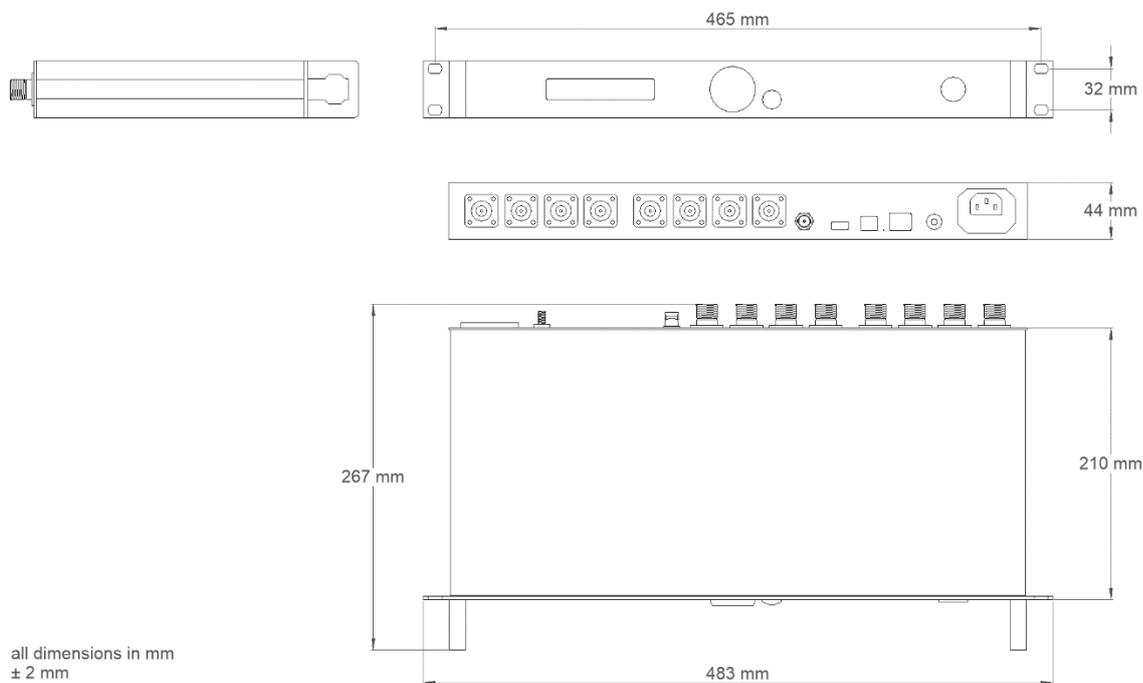
### Front View



### Rear View



### Dimensions



### Related Products

Product	Description	P/N
QATT-7G	4 Channel Step Attenuator 100 kHz ... 7000 MHz, 0 ... 95.25 dB, 0.25 dB steps	1302.4702.1
QATT	4 Channel Step Attenuator 100 kHz ... 4000 MHz, 0 ... 100 dB, 0.5 dB steps	1302.4702.1
QDLL	4 Channel Programmable Delay Line 250 MHz ... 4000 MHz, 0 ... 1700 ps	1303.4002.1
AIE-4X4ER	4X4 Channel Air Interface Emulator 400 ... 6000 MHz	1201.4902.1
AIE-W9R	9 Port Air Interface Emulator 1800 ... 6400 MHz	1309.4029.1
AIE-W5ER	5 Port Air Interface Emulator 400 ... 6000 MHz	1309.4052.1

