

AIE-4X4ER

4X4 Channel Air Interface Emulator 400 ... 6000 MHz, 50 Ω

Features

- wideband
- 95.25 dB attenuation range
- LAN and USB Remote Interface
- Trigger interface
- 19", 3 U device

Applications

- Air Interface Emulation
- MIMO emulation
- GSM, UMTS, LTE, 5G
- Handover testing
- Fading simulation

At a Glance

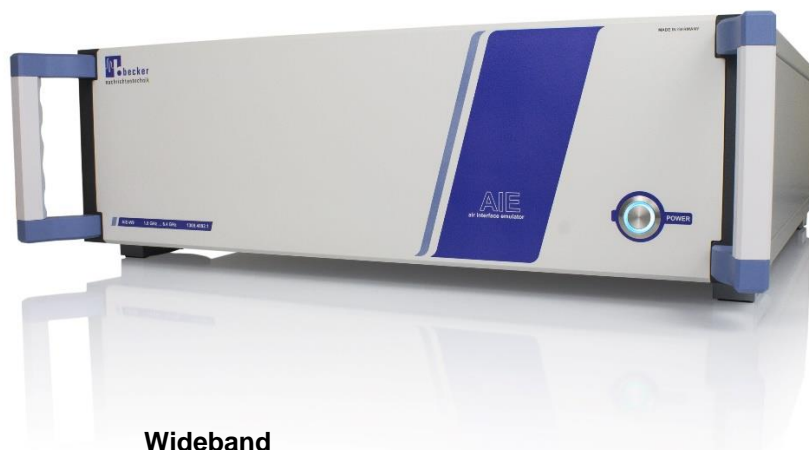
The AIE-4X4ER air interface emulator enables real emulation of RF levels for radio communication between mobile devices and a wireless networks. It has 4 RF Ports for base stations and 4 ports for DUTs like cellular phones. All signal paths are bidirectional. Every of the 4 DUT ports can be fed with a composite RF signal that is individually composed of a programmable mix of the 4 signals coming from the base station ports. The variation of levels can be done in a wide dynamic range with internal precision attenuators.

The AIE-4X4ER allows to recreate a realistic air interface, whereby the DUTs receives a multiple cellular stations simultaneously with varying propagation loss. In particular it allows the simulation of handovers between cellular base stations and cellular phones.

The reproducible emulation of air interface scenarios in laboratory environment saves time and cost in product development and verification.

Matrix Function

The AIE-4X4ER can also be used as non-blocking matrix. Every output has free access to each input. Attenuators between the signal paths allow also the emulation of fading effects. With a fast attenuator response time, the device is an efficient and fast solution for automatic testing systems.



Wideband

The operating frequency range covers 400 MHz to 6000 MHz. Therefore the AIE-4X4ER is useable for all cellular standards and Wi-Fi standards including 5G (FR1).

High Dynamic

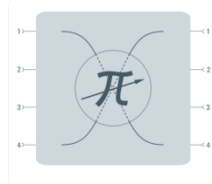
The setting range of the digitally controlled attenuators covers 95.25 dB and is adjustable in 0.25 dB steps. This allows test scenarios with highest requirements for dynamics and accuracy. All RF ports of the air emulation system allow signals levels of up to 2 Watts.

Synchronous Operation

For remote control the AIE-4X4ER offers LAN and USB interfaces. AIE-4X4ER offers additional 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.

The attenuator configuration of the emulator can be preloaded with SCPI oriented ASCII strings via LAN interface without execution. After a positive TTL pulse slope at the trigger input, the preloaded attenuator configuration will be executed only by hardware in micro seconds.

Principle Diagram



RF Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
impedance	Z_{in} / Z_{out}		50		Ohm	
low frequency	f_{min}		300	400	MHz	
high frequency	f_{max}	6000			MHz	
number of RF inputs	n_{IN}		4			bi-directional
number of RF outputs	n_{OUT}		4			bi-directional
return loss	S_{11}, S_{22}		-12		dB	
insertion loss ¹	S_{21}		-17		dB	$f \leq 1$ GHz
	S_{21}		-19		dB	$1 \text{ GHz} \leq f \leq 3 \text{ GHz}$
	S_{21}		-22		dB	$3 \text{ GHz} < f \leq 5 \text{ GHz}$
	S_{21}		-24		dB	$5 \text{ GHz} < f \leq 6 \text{ GHz}$
isolation	S_{21}		-40		dB	between channels ATT = 0 dB
attenuation range	ΔS_{21}	0.00		95.25	dB	
attenuation resolution	dS_{21}		0.25		dB	
attenuation accuracy	ATT_{ERR}		± 0.50		dB	@ 3 GHz, ATT = 63.25 dB
attenuator settling time	t_{ASET}		1		μs	
atten. response time	t_{ARSP}		1		ms	
DC voltage	U_{DC}			20	V	all RF ports
ESD discharge resistor	R_{ESD}		4.7		k Ω	all RF ports
input power	P_{RF}			+33	dBm	CW
RF connector	X_{RF}		N female			rear side

* Note 1: attenuator settings: 0.00 dB

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		μs	
rise time	T_R		0.1 ¹	0.5 ²	μs	
sinking current	I_S			60	mA	
passive pull up	R_{PU}		1		k Ω	
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 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")

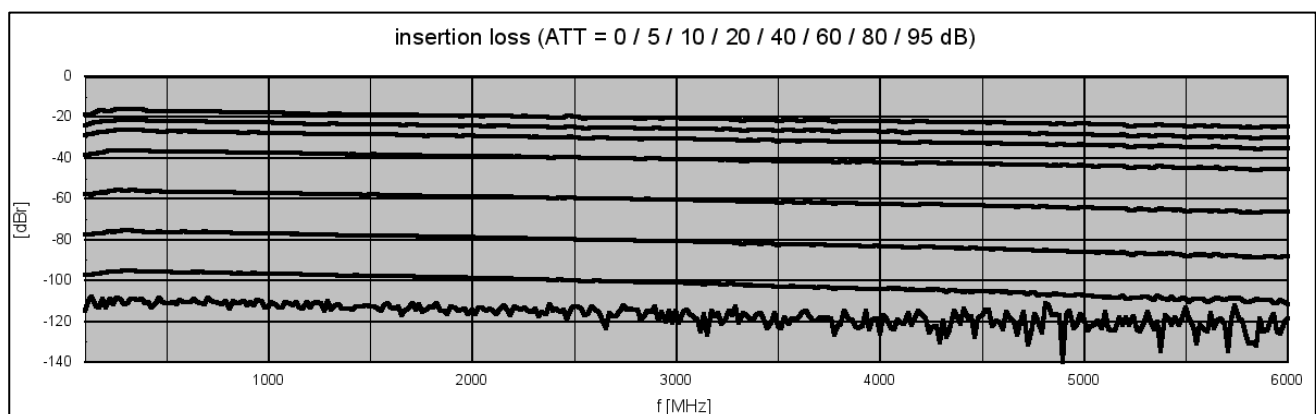
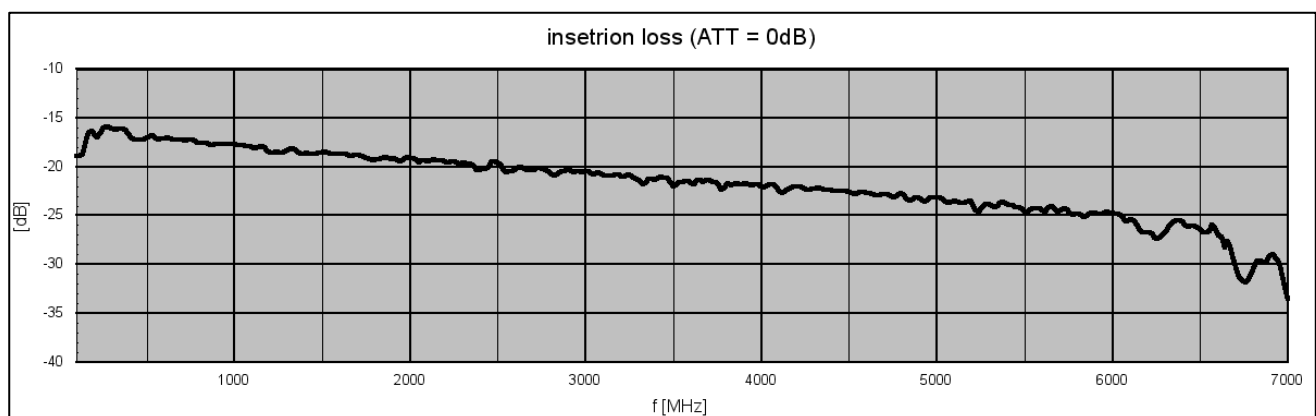
Note 1: capacitive load < 100 pF

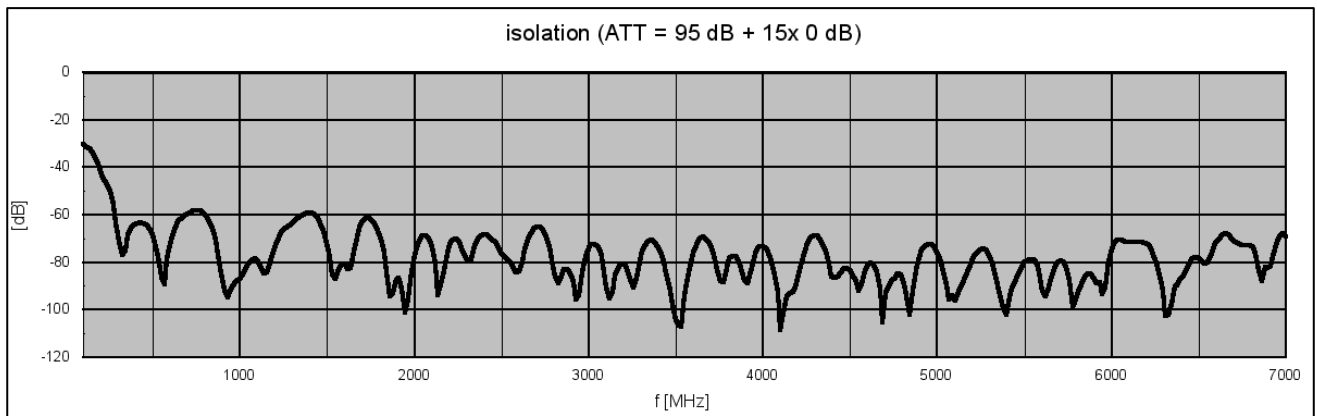
Note 2: capacitive load \leq 2 nF

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}		6		W	
power socket	X_{AC}	IEC-60320 C14				country specific mains cable
Dimensions and weight						
dimensions	W x H x D	approx. 482 x 133 x 390			mm	19" 3 U, without connectors and handles
weight	m		12		kg	
Environment conditions						
operating temp. range	T_o	+5		+45	°C	
storage temp. range	T_s	-40		+70	°C	
Remote interfaces						
remote ports	LAN	10/100BaseT	TCP/IP			RJ45
	USB	2.0 (high speed)				USB type B
Product conformity						
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
Ordering information	AIE-4X4ER		P/N: 1201.4902.1			

S-Parameters (typical responses)

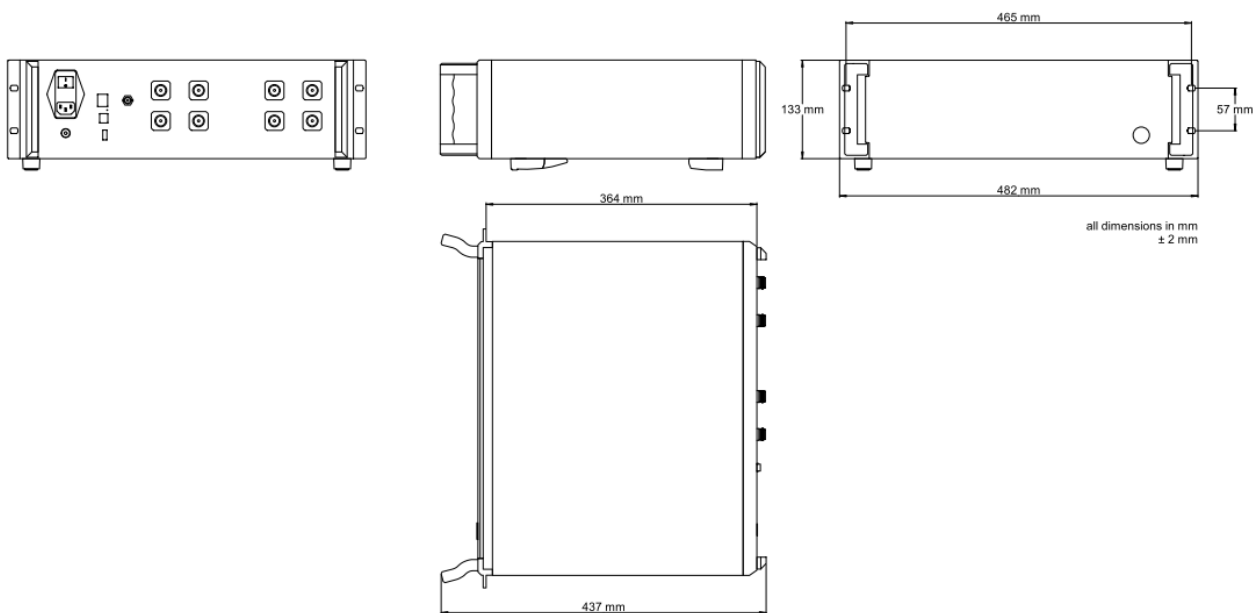




Appearances



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 ... 100.0 dB, 0.5 dB steps	1302.4002.1
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

