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## ACE8 1.2 GHZ INTELLIGENT OPTICAL NODE



ACE8 is a single active output intelligent node. The node is based on a fixed receiver but modular upstream transmitter. The output amplifier stage uses high performance GaN hybrid, making the usable output level range especially wide.

DOCSIS 3.1 and DVB-C2 requirements have been taken in account in this product. The downstream frequency band reaches 1.2 GHz which ensures fulfilment of all future bandwidth needs. The upstream signal path is flexible and it can be updated to 204 MHz.

ACE8 has an external USB connector for local configuration with a PC. It is also equipped with a plug-in module slot for transponder module. The transponder unit allows full remote monitoring and control of all node parameters. In addition it can measure the levels of both forward and return path signals and enables the automatic forward and return path alignment function.

Fully user configurable automatic level control (ALC) keeps output level constant, while forward path spectrum analyser and return path ingress analyser features aid in network monitoring and troubleshooting.

### Features

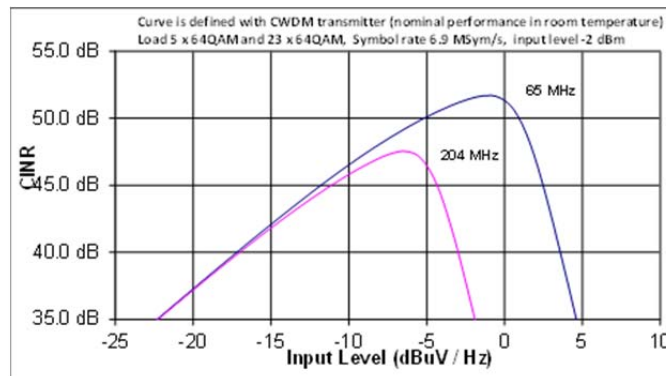
- Automatic alignment of both forward and return path
- 1.2 GHz GaN hybrid technology
- 204 MHz return path
- Wide range of upstream laser technologies available
- Efficient surge and ESD protection
- Electrical level and slope controls
- 862 MHz operation mode
- Power supply with PFC
- With AC6991 / AC6981 transponder module:
  - CATVvisor / HMS (AC6991) or DOCSIS (AC6981) remote connection
  - ALC with fully user programmable pilots
  - Downstream spectrum analyser
  - Upstream signal quality monitoring with automatic ingress control
  - True plug-and-play with single pushbutton alignment
  - Return path pilot generator (AC6991)

Technical specifications

Parameter	Specification	
<b>Downstream signal path</b>		1)
Light wavelength	1290...1610 nm	
Optical input power range	-7...0 dBm	
Frequency range	85...1218 MHz	
Return loss	18 dB	2)
Gain limited output level	118 dB $\mu$ V	3)
Input gain control	0...-20 dB	
Interstage gain control	0...-19 dB	4)
Slope control	0...18 dB	5)
Flatness	$\pm$ 0.5 dB	6)
Group delay	2 ns	7)
Test point	-20 dB	8)
Transponder connection	-19 dB	9)
Noise current density	6.0 pA/ $\sqrt$ Hz	10)
U <sub>max</sub> (112 QAM channels) @ 1.0 GHz	111.5 dB $\mu$ V	11)
U <sub>max</sub> (138 QAM channels) @ 1.2 GHz	108.5 dB $\mu$ V	12)
CTB 41 channels	116.0 dB $\mu$ V	13)
CSO 41 channels	117.0 dB $\mu$ V	13)
<b>Upstream signal path</b>		1)
Frequency range	5... 204 MHz	
Return loss	18 dB	
Ingress switching	0 / -6 / < -45 dB	
Input level	57 dB $\mu$ V	14)
CINR	See curves	15)
OMI adjustment	0...-20 dB	
OMI test point	-5 dB	16)
Transponder connection	-37 dB	17)
<b>General</b>		
Power consumption	23 W	18)
Supply voltage	27...65 Vac / 205...255 Vac	
Maximum current feed through	7 A / port	
Hum modulation	70 dB	19)
Optical connectors	SC/APC, FC/APC, E-2000	
Output connectors	PG11	
Test point connectors	F female	
Dimensions	17 (20) x 23 x 9 cm	h x w x d
Weight	2.3 kg	
Operating temperature	-40...+55 °C	
Class of enclosure	IP54	20)
EMC	EN50083-2	
ESD	4 kV	21)
Surge	6 kV (EN 60728-3)	

## Notes

- 1) Specified with one out port in use and duplex filter included. Switching to dual output causes typically 4.0 dB attenuation.
- 2) The limiting curve is defined at 40 MHz -1.5 dB / octave. Return loss is always > 12 dB.
- 3) This is the gain limited output level when OMI is 4.0 %. The level is available with the optical input power of -7 dBm . The used wavelength is 1310 nm. Level is valid in single output mode.
- 4) Step size 0.2 dB. This adjustment is used in ALC operation.
- 5) Step size 0.5 dB. Hinge point 1218 MHz. Value defined between 85...1218 MHz. Flatness specification is not valid for >16 dB slope values. When "862 MHz pre-slope" feature (8 dB additional slope between 85...862 MHz) is activated, the slope control range is 0...11 dB.
- 6) Typical value in room temperature. Guaranteed value is  $\pm 0.75$  dB.
- 7) Typical value for 4.43 MHz band. Measured at channel S2 when 65 or 85 MHz return path is in use. At higher frequencies the performance is better.
- 8) TP has a tolerance of  $\pm 0.75$  dB between 85...862 MHz and  $\pm 1.0$  dB between 862...1218 MHz.
- 9) Level difference between transponder connection and output 1. Tolerance  $\pm 0.5$  dB.
- 10) Typical value. CNR is typically > 46.5 dB when optical input level is -7.0 dBm and OMI is 4.0 %.
- 11) Typical value according to IEC60728-3-1. Channels have 13 dB cable equivalent slope between 85...1218 MHz and signal level has been defined at 1002 MHz. BER measurement has been done on the worst channel between 110...1006 MHz.
- 12) Typical value. Channels have 13 dB cable equivalent slope between 85...1218 MHz and signal level has been defined at 1210 MHz. BER measurement has been done on the worst channel between 110...1214 MHz.
- 13) IEC 60728-3. Channels have 8 dB cable equivalent slope between 85...862 MHz and signal level has been defined at 862 MHz. Optical input level -7 dBm. All results are typical values in room temperature.
- 14) Nominal input level for 4.0 % OMI. Defined at output port in single output mode.
- 15) CINR



- 16) Valid when ingress switch and level control are at 0 dB.  
The nominal value at this TP is 52 dB $\mu$ V when OMI is set to 4 %. Tested at 20 MHz.
- 17) This is the level difference between return path input and transponder transmit pin when return path attenuation is 0 dB. This value increases linearly with increasing return path attenuation.
- 18) Power consumption is given with optical CWDM transmitter, but without transponder.
- 19) Valid between 10 and 1218 MHz with <6 A per port. Reduced to 60 dB for >6 A per port. 12 A is the maximum total current which can be locally injected into both ports.
- 20) The housing is tested to be class of IP67 .Ventilation hole was closed.  
However, in standard delivery condition a ventilation hole is open . Then the practical enclosure class is IP54.
- 21) EN61000-4-2, contact discharge to enclosure and RF-ports.

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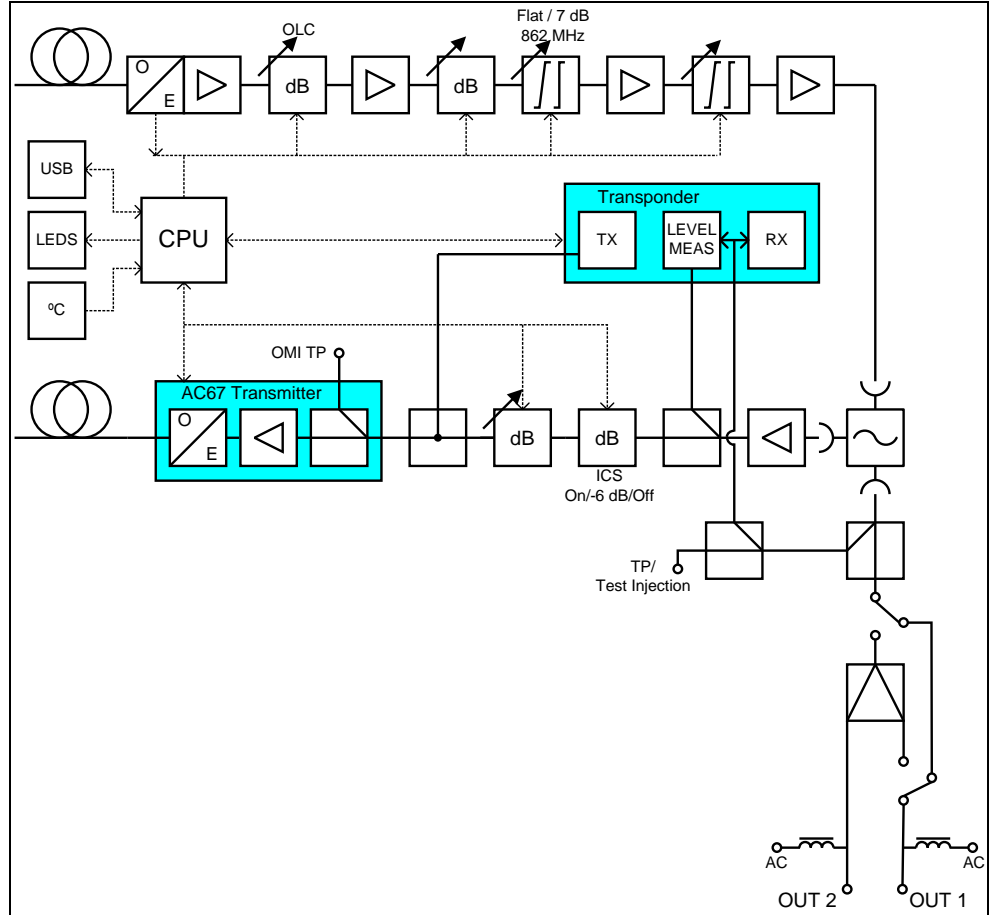
## Monitoring functions

- Status LED for alarm indication
- Return path ingress switch on / attenuated / off control
- Remote AC voltage measurement with alarms
- Local voltage measurements with alarms
- Internal temperature measurement with alarms
- Full electrical control of all forward and return path alignments
- OMI based forward path automatic alignment
- OMI based return path automatic alignment
- Uptime, total uptime and reset counters for power outage statistics
- Fully user configurable alarm limits, severities and enabling
- User notes can be stored into non-volatile memory
- Alarm log stored into non-volatile memory for easy troubleshooting
- Node configuration and accessory information stored in non-volatile memory
- Local software update and settings transfer via USB also without powering
- Optical receiver input power measurement with alarms
- Optical transmitter laser bias current measurement with alarms
- Optical transmitter pilot generator enabling and frequency control

### **Additional features available with AC6991 / AC6981 transponder:**

- Remote access to all ACE8 settings and monitored parameters
- ALC and modem LEDs for alarm indication
- CATVisor and HMS compatible remote connection (AC6991)
- DOCSIS compatible remote connection (AC6981)
- Interstage gain control by ALC mode with saturation alarm
- ALC pilot frequencies, types and decision levels are user programmable
- Automatic reserve pilot switching
- User configurable all pilots lost behaviour
- Pilot based forward path automatic alignment
- Full forward and return path automatic alignment with a single button
- User configurable automatic alignment procedures
- Lid status monitoring with alarm
- Service terminal connection monitoring with alarm
- Configuration change monitoring with alarm
- Spectrum analyser for forward path level measurement with alarm
- Ingress analyser for return path level measurement with alarms
- Automatic ingress switch activation and deactivation based on detected ingress with alarms and user configurable delays
- Modem receive and transmit signal level monitoring with alarms (AC6991)
- Return path pilot generator with 4 user programmable pilot frequencies and levels (AC6991)

Block diagram



Compatibility

All accessories that will be used together with this product, should use the latest version available. By using only up-to-date accessories a proper operation can be ensured.

Ordering information

ACE8 configuration map

	1-			2-			3-	4-	5-			6-	7-	8-			9-	
	1	2	3	1	2	3	1	1	1	3	1	1	1	2	3	1	2	
ACE8				-			-	-			-	-	-			-		

<b>1-1 Platform type</b>	
A	1.2 GHz GaN
C	1.2 GHz GaN, ventilation hole closed
<b>1-2 Power supply</b>	
A	Local powering, euro plug (230 VAC)
B	Remote powering with cable clamp (65 VAC)
C	Local powering, UK plug (230 VAC)
D	Remote powering with cable clamp (90 VAC)
<b>1-3 Fiber organizing</b>	
A	Standard fibre organiser

<b>2-1 Fibre feed-through adapter</b>	
A	5/8 Adapter (KDC316)
B	1-2 fibres (KDO900)
X	None
<b>2-2 Output 2 connection</b>	
A	PG11
B	5/8"
C	IEC
D	3.5/12
E	F
X	None (PG11 sealing plug)
<b>2-3 Output 1 connection (first from right)</b>	
A	PG11
B	5/8"
C	IEC
D	3.5/12
E	F

<b>3-1 Optical connector for receiver</b>	
A	SC/APC, 9 deg.
C	E-2000
D	SC/APC, 8 deg.
F	FC/APC > SC/APC adapter

<b>4-1 Diplexer</b>	
A	65/85 MHz (CXF065)
B	85/105 MHz (CXF085)
C	204/258 MHz (CXF204)
X	None

<b>5-1 Return path transmitter</b>	
40	+1dBm FP 1310 nm (AC6740)
41	+3 dBm CWDM 1430 nm (AC6741)
42	+6 dBm CWDM 1430 nm (AC6742)
43	+3 dBm CWDM 1450 nm (AC6743)
44	+6 dBm CWDM 1450 nm (AC6744)
45	+3 dBm DFB 1310 nm (AC6745)
46	+6 dBm DFB 1310 nm (AC6746)
47	+3 dBm CWDM 1470 nm (AC6747)
48	+6 dBm CWDM 1470 nm (AC6748)
49	+3 dBm CWDM 1490 nm (AC6749)
50	+6 dBm CWDM 1490 nm (AC6750)
51	+3 dBm CWDM 1510 nm (AC6751)
52	+6 dBm CWDM 1510 nm (AC6752)
53	+3 dBm CWDM 1530 nm (AC6753)
54	+6 dBm CWDM 1530 nm (AC6754)
55	+3 dBm CWDM 1550 nm (AC6755)
56	+6 dBm CWDM 1550 nm (AC6756)
57	+3 dBm CWDM 1570 nm (AC6757)
58	+6 dBm CWDM 1570 nm (AC6758)
59	+3 dBm CWDM 1590 nm (AC6759)
60	+6 dBm CWDM 1590 nm (AC6760)
61	+3 dBm CWDM 1610 nm (AC6761)
62	+6 dBm CWDM 1610 nm (AC6762)
XX	None
<b>5-3 Optical connector for transmitter</b>	
A	SC/APC, 9 deg.
C	E-2000
D	SC/APC, 8 deg.
F	FC/APC > SC/APC adapter
X	None

<b>6-1 Optical filter 1</b>	
F1	WDM filter 1310 / 1550 nm with 8 deg. SC/APC connectors (AC6570D)
F2	WDM filter 1310 nm / CWDM with 8 deg. SC/APC connectors (AC6572D)
XX	None

<b>7-1 Transponder module</b>	
E	Transponder and ALSC module (AC6992)
G	DOCSIS transponder (AC6981)
X	None

<b>8-1 Communication protocol / application software</b>	
X	None
A	CAT/Visor compatible
B	HMS/SNMP compatible
C	Customer specific
<b>8-2 Settings</b>	
X	Factory default
A	Customer specified (ECML file)
<b>8-3 Product keys (software features)</b>	
X	None
C	Auto alignment, spectrum and ingress analyser, pilot generator

<b>9-1 Installation manual</b>	
X	None
A	Manual
<b>9-2 Customer specific selections</b>	
B	Customer specific option
W	Customer specific option
X	None