

## AC9000 INTELLIGENT FIBRE OPTIC PLATFORM



The AC9000 is an intelligent 4 output optical node of ACx product family. It is based on fixed platform but flexible modular solution, supporting up to two optical receivers, four optical transmitters and dual power supplies. The optical receivers can act as 2 independent nodes or in 1+1 backup operation.

The 4 independent upstream inputs are connected to optical transmitters via a configurable signal routing matrix which allows flexible backup operations.

The AC9000 has a slot for transponder module, allowing remote configuration and management of the node. The transponder unit also measures the DS and US signal levels used by the automatic alignment function. Forward and return path automatic alignment function increases the reliability of the node to a even higher level. Fully configurable automatic level control (ALC) keeps output level constant and automatic ingress blocking reacts to unwanted return path signals.

### Features

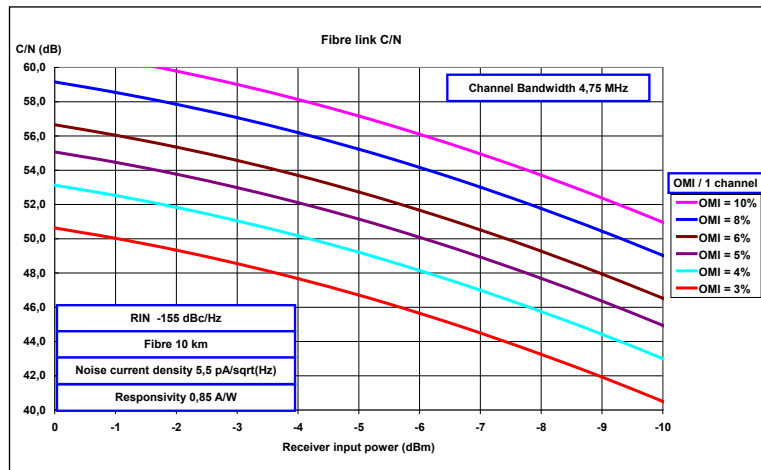
- 1 GHz
- Amplifiers stages use GaN HEMT and GaAs pHEMT technology
- Innovative splice organizing
- Redundant power supplies
- Full electrical controls
- Automatic alignment for both forward and return path
- Automatic power saving operation mode
- Downstream and upstream spectrum analyser function as an option
- Flexible electrically controlled downstream and upstream signal routing
- Support for digital return path transmitters
- Wide range of upstream laser technologies available
- Efficient surge and ESD protection

**Technical specifications**

Parameter	Specification	
<b>Downstream signal path</b>		
Light wavelength	1290...1610 nm	
Optical input power range	- 7...0 dBm	
Frequency range	70...1006 MHz	
Return loss	20 dB	1)
Gain limited output level	4 x 112 dB $\mu$ V / 2 x 116 dB $\mu$ V	2)
1 <sup>st</sup> interstage gain control	0...-16 dB	3)
2 <sup>nd</sup> interstage gain control	0...-13 dB	4)
Level offset, outputs 2 and 4	0...-15 dB	5)
Slope control	0...20 dB	6)
Isolation between DS paths	> 60 dB	7)
Flatness	$\pm$ 0.5 dB	8)
Group delay	2 ns	9)
Test point	-20 dB	10)
Transponder connection	-19 dB	
Noise current density	5.5 pA/ $\sqrt$ Hz	11)
CTB 41 channels	116.0 dB $\mu$ V	12)
CSO 41 channels	116.0 dB $\mu$ V	12)
XMOD 41 channels	112.5 dB $\mu$ V	12)
CTB 105 / 72 channels	78.0 / 85.0 dB	13)
CSO 105 / 72 channels	74.0 / 81.0 dB	13)
XMOD 105 / 72 channels	68.0 / 76.0 dB	13)
<b>Upstream signal path</b>		
Frequency range	5...85 MHz	
Return loss	18 dB	
Ingress switching	0 / -6 / < -45 dB	
Input level	57.0 dB $\mu$ V	14)
CINR	> 52 dBc	15)
OMI adjustment	0...-20 dB	
OMI test point	-5 dB	16)
Transponder connection	-37 dB	17)
Isolation between US paths	> 55 dB	18)
<b>General</b>		
Power consumption	39...61 W	19)
Supply voltage	30...65 V <sub>AC</sub>	
Maximum current feed through	12.0 A / port	
Hum modulation	70 dB	20)
Optical connectors	SC/APC, FC/APC, E-2000	
Output connectors	PG11	
Test point connectors	F female	
Dimensions	33(36) x 31(35) x 14 cm	h x w x d
Weight	10 kg	
Operating temperature	-40...+55 °C	
Class of enclosure	IP 54	
EMC	EN50083-2	
ESD	4 kV	21)
Surge	6 kV (EN 60728-3)	

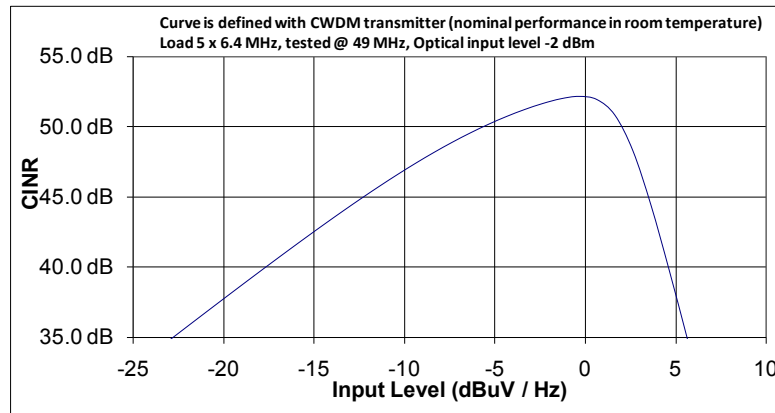
**Notes**

- 1) The limiting curve is defined at 40 MHz -1.5 dB / octave. Return loss is always better than 13 dB.
- 2) This is the gain limited output level when OMI is 4.0 %. The level is available with -7 dBm optical input power (AC66B10). The used wavelength is 1310 nm. Higher output levels are possible if optical input level is higher than -7 dBm.
- 3) Step size is 1 dB.
- 4) Step size is 0.2 dB. This control is used by ALC.
- 5) Step size is 1.0 dB. Adjusted with JDA series attenuators. There is an automatic 0 dB bypass built on motherboard in the case of missing JDA plug.
- 6) Step size is 0.5 dB. Slope is defined between 47...1006 MHz. Flatness spec is guaranteed when slope is less than 16 dB.
- 7) Defined 70...900 MHz. In higher frequencies the limit is 50 dB.
- 8) Typical value in room temperature. Guaranteed value is  $\pm 0.75$  dB.
- 9)  $F > 125$  MHz, BW 4.43 MHz.
- 10) TP has  $\pm 0.75$  dB tolerance between 70...862 MHz and  $\pm 1.0$  dB between 862...1006 MHz.
- 11) This is a typical value at 862 MHz and the value can be used for C/N calculations. Typical C/N curves can be seen in the picture.



- 12) EN50083-3. In 2 output mode (=not splitted). Node output 8 dB cable equivalent sloped and optical input level -7 dBm. All results are typical values in room temperature. XMOD is measured at the lowest channel.  
The highest recommended output level for the node is 116 dB $\mu$ V with 41 channels.
- 13) In 2 output mode (=not splitted). Measured with 72 and 105 NTSC channels. The output 11 dB linearly sloped and the used levels at 120 / 550 / 750 / 862 MHz 36.0 / 42.5 / 45.5 / 47.0 dBmV. All results are typical values in room temperature, which can be used in system calculations. XMOD is measured at the lowest channel.  
The highest recommended output level for the node is 54 dBmV with 105 channels and 56 dBmV with 72 channels.
- 14) Nominal input level for 4.0 % OMI. Defined at the output connector of the node.

15)



Nominal performance when 65 MHz US channel is in use.

- 16) - 5 dB is valid if ingress switch and US input attenuator are set to 0 dB.  
The nominal value at this TP is 52 dBuV 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) Defined 5...65 MHz.
- 19) 61 W: single PSU, transponder, 4 \* optical CWDM TX, 2 \* optical RX, full RF performance.  
39 W: single PSU, 1 \* optical CWDM TX, 1 \* optical RX, power save mode.
- 20) 70 dB hum value is valid at any frequency from 10 to 1006 MHz, when the remote current is less than 8.0 A/port. Hum modulation is 65 dB, if 12.0 A is fed.  
20.0 A is the maximum current which can be locally injected into all ports together.
- 21) EN61000-4-2, contact discharge to enclosure and RF-ports.

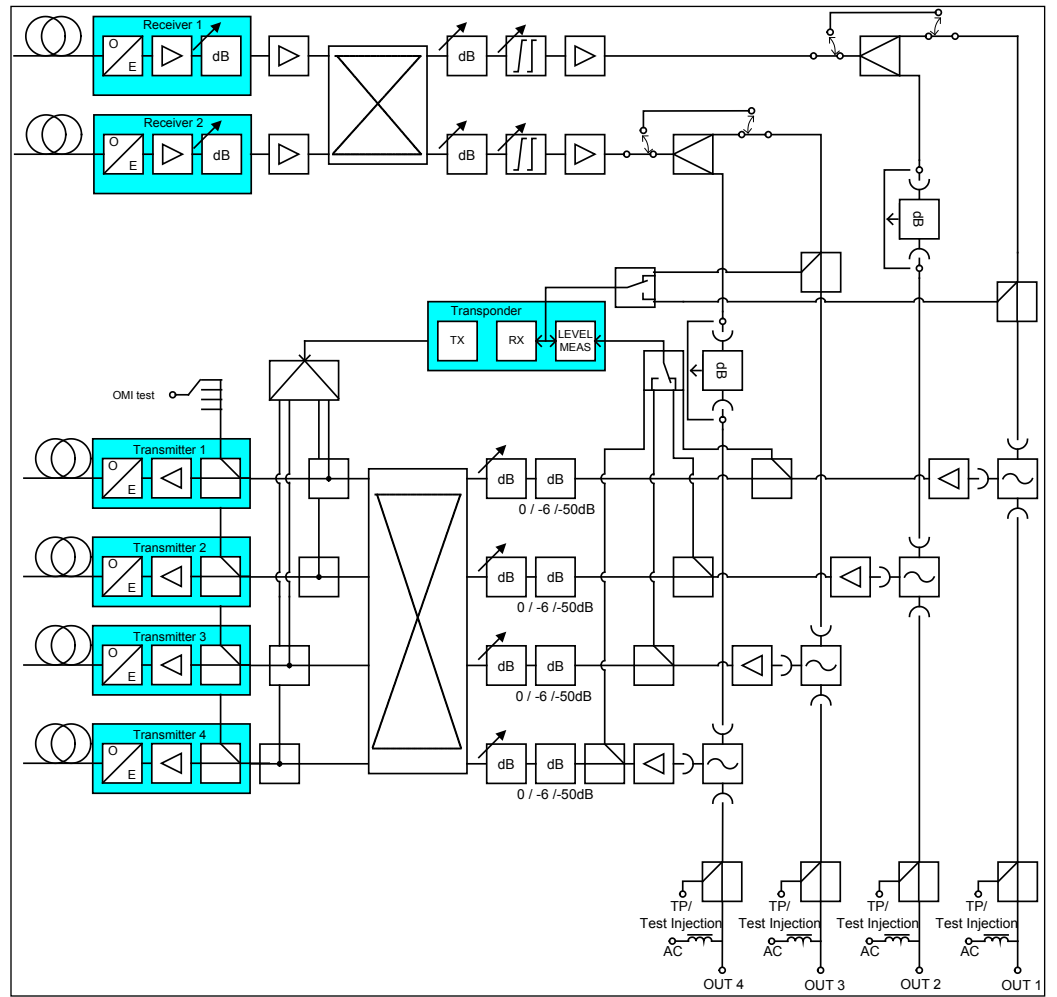
**Monitoring functions**

- Status LED for alarm indication
- Return path ingress switches on / attenuated / off control
- 65 VAC voltage measurement with alarms
- Local +12 V and +24 V 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
- User notes can be stored into amplifier memory
- Fully user configurable alarm limits, severities, enabling and delays
- Alarm log stored into non-volatile memory for easy troubleshooting
- Node configuration and accessory information stored in amplifier memory
- Fast local software update via USB also without power supply
- Optical receiver input power measurement with alarms
- Optical transmitter laser bias current monitoring with alarms
- Automatic or manual optical receiver selection
- Optical transmitter pilot generator enabling and frequency control
- Return path signal combining / separation control with automatic backup

**Additional features available with AC6991 transponder:**

- Remote access to all AC9000 settings and monitored parameters
- ALSC and modem LEDs for alarm indication
- CATVisor and HMS compatible remote connection for monitoring and control
- Interstage gain control by ALC mode with saturation alarm
- ALC pilot frequencies, types, back-offs 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 single button
- Lid status monitoring with alarm
- Service terminal connection monitoring with alarm
- Node 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
- Remote software update to multiple units simultaneously
- Return path 4 pilot generator with user programmable frequencies and levels

Block diagram



Ordering information

AC9000 configuration map

AC9000	1- 1 2 3	2- 1 2 3 4 5 6	3- 1 3	4- 1 3	5- 1	6- 1 3 4 6	7- 1 3	8- 1 3 4 6	9- 1 3	10- 1	11- 1	12- 1 2 3	13- 1 2
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<p><b>1-1 Platform type</b> A Standard 1 GHz</p> <p><b>1-2 Power supply</b> A Single PSU, 65 VAC B Double PSU, 65 VAC</p> <p><b>1-3 Fiber organizing</b> A Standard fibre organiser</p>	<p><b>6-4 Digital return path transmitter TX1</b> 27 +5 dBm CWDM 1270 nm (AC7727) 29 +6 dBm CWDM 1290 nm (AC7729) 31 +5 dBm CWDM 1310 nm (AC7731) 33 +5 dBm CWDM 1330 nm (AC7733) 35 +6 dBm CWDM 1350 nm (AC7735) 37 +5 dBm CWDM 1370 nm (AC7737) 39 +5 dBm CWDM 1390 nm (AC7739) 41 +5 dBm CWDM 1410 nm (AC7741) 43 +5 dBm CWDM 1430 nm (AC7743) 45 +6 dBm CWDM 1450 nm (AC7745) 47 +5 dBm CWDM 1470 nm (AC7747) 49 +5 dBm CWDM 1490 nm (AC7749) 51 +6 dBm CWDM 1510 nm (AC7751) 53 +5 dBm CWDM 1530 nm (AC7753) 55 +5 dBm CWDM 1550 nm (AC7755) 57 +5 dBm CWDM 1570 nm (AC7757) 59 +5 dBm CWDM 1590 nm (AC7759) 61 +5 dBm CWDM 1610 nm (AC7761) XX None</p> <p><b>6-3 Optical connector for Digital transmitter TX1</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>	<p><b>8-4 Digital return path transmitter TX2</b> 27 +5 dBm CWDM 1270 nm (AC7727) 29 +6 dBm CWDM 1290 nm (AC7729) 31 +5 dBm CWDM 1310 nm (AC7731) 33 +5 dBm CWDM 1330 nm (AC7733) 35 +6 dBm CWDM 1350 nm (AC7735) 37 +5 dBm CWDM 1370 nm (AC7737) 39 +5 dBm CWDM 1390 nm (AC7739) 41 +5 dBm CWDM 1410 nm (AC7741) 43 +5 dBm CWDM 1430 nm (AC7743) 45 +6 dBm CWDM 1450 nm (AC7745) 47 +5 dBm CWDM 1470 nm (AC7747) 49 +5 dBm CWDM 1490 nm (AC7749) 51 +6 dBm CWDM 1510 nm (AC7751) 53 +5 dBm CWDM 1530 nm (AC7753) 55 +5 dBm CWDM 1550 nm (AC7755) 57 +5 dBm CWDM 1570 nm (AC7757) 59 +5 dBm CWDM 1590 nm (AC7759) 61 +5 dBm CWDM 1610 nm (AC7761) XX None</p> <p><b>8-3 Optical connector for Digital transmitter TX2</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>
<p><b>2-1 Fibre feed-through adapter 1 (left)</b> E 5/8 Adapter (KDC316) G 1-4 fibres (KDO900) X None</p> <p><b>2-2 Fibre feed-through adapter 2 (right)</b> E 5/8 Adapter (KDC316) G 1-4 fibres (KDO900) X None</p> <p><b>2-3 Output 1 connection (first from right)</b> A PG11 B 5/8" C IEC D 5/12 E F X None (PG11 sealing plug)</p> <p><b>2-4 Output 2 connection</b> A PG11 B 5/8" C IEC D 5/12 E F X None (PG11 sealing plug)</p> <p><b>2-5 Output 3 connection</b> A PG11 B 5/8" C IEC D 5/12 E F X None (PG11 sealing plug)</p> <p><b>2-6 Output 4 connection (first from left)</b> A PG11 B 5/8" C IEC D 3.5/12 E F X None (PG11 sealing plug)</p>	<p><b>7-1 Return path transmitter TX2</b> 40 +1 dBm FP 1310 nm (AC67840) 41 +3 dBm CWDM 1430 nm (AC67841) 42 +6 dBm CWDM 1430 nm (AC67842) 43 +3 dBm CWDM 1450 nm (AC67843) 44 +6 dBm CWDM 1450 nm (AC67844) 45 +3 dBm DFB 1310 nm (AC67845) 46 +6 dBm DFB 1310 nm (AC67846) 47 +3 dBm CWDM 1470 nm (AC67847) 48 +6 dBm CWDM 1470 nm (AC67848) 49 +3 dBm CWDM 1490 nm (AC67849) 50 +6 dBm CWDM 1490 nm (AC67850) 51 +3 dBm CWDM 1510 nm (AC67851) 52 +6 dBm CWDM 1510 nm (AC67852) 53 +3 dBm CWDM 1530 nm (AC67853) 54 +6 dBm CWDM 1530 nm (AC67854) 55 +3 dBm CWDM 1550 nm (AC67855) 56 +6 dBm CWDM 1550 nm (AC67856) 57 +3 dBm CWDM 1570 nm (AC67857) 58 +6 dBm CWDM 1570 nm (AC67858) 59 +3 dBm CWDM 1590 nm (AC67859) 60 +6 dBm CWDM 1590 nm (AC67860) 61 +3 dBm CWDM 1610 nm (AC67861) 62 +6 dBm CWDM 1610 nm (AC67862) XX None</p> <p><b>7-3 Optical connector for transmitter TX2</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>	<p><b>9-1 Return path transmitter TX4</b> 40 +1 dBm FP 1310 nm (AC67840) 41 +1 dBm FP 1310 nm (AC67840) 42 +3 dBm CWDM 1430 nm (AC67841) 43 +6 dBm CWDM 1430 nm (AC67842) 44 +3 dBm CWDM 1450 nm (AC67843) 45 +6 dBm CWDM 1450 nm (AC67844) 46 +3 dBm DFB 1310 nm (AC67845) 47 +6 dBm DFB 1310 nm (AC67846) 48 +6 dBm CWDM 1470 nm (AC67848) 49 +3 dBm CWDM 1490 nm (AC67849) 50 +6 dBm CWDM 1490 nm (AC67850) 51 +3 dBm CWDM 1510 nm (AC67851) 52 +6 dBm CWDM 1510 nm (AC67852) 53 +3 dBm CWDM 1530 nm (AC67853) 54 +6 dBm CWDM 1530 nm (AC67854) 55 +3 dBm CWDM 1550 nm (AC67855) 56 +6 dBm CWDM 1550 nm (AC67856) 57 +3 dBm CWDM 1570 nm (AC67857) 58 +6 dBm CWDM 1570 nm (AC67858) 59 +3 dBm CWDM 1590 nm (AC67859) 60 +6 dBm CWDM 1590 nm (AC67860) 61 +3 dBm CWDM 1610 nm (AC67861) 62 +6 dBm CWDM 1610 nm (AC67862) XX None</p> <p><b>9-3 Optical connector for transmitter TX4</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>
<p><b>3-1 Optical receiver RX1</b> 10 RX1 input level -7..0 dBm (AC66810) XX None</p> <p><b>3-3 Optical connector for receiver RX1</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>	<p><b>8-1 Return path transmitter TX3</b> 40 +1 dBm FP 1310 nm (AC67840) 41 +1 dBm FP 1310 nm (AC67840) 42 +3 dBm CWDM 1430 nm (AC67841) 43 +6 dBm CWDM 1430 nm (AC67842) 44 +3 dBm CWDM 1450 nm (AC67843) 45 +6 dBm CWDM 1450 nm (AC67844) 46 +3 dBm DFB 1310 nm (AC67845) 47 +6 dBm DFB 1310 nm (AC67846) 48 +6 dBm CWDM 1470 nm (AC67848) 49 +3 dBm CWDM 1490 nm (AC67849) 50 +6 dBm CWDM 1490 nm (AC67850) 51 +3 dBm CWDM 1510 nm (AC67851) 52 +6 dBm CWDM 1510 nm (AC67852) 53 +3 dBm CWDM 1530 nm (AC67853) 54 +6 dBm CWDM 1530 nm (AC67854) 55 +3 dBm CWDM 1550 nm (AC67855) 56 +6 dBm CWDM 1550 nm (AC67856) 57 +3 dBm CWDM 1570 nm (AC67857) 58 +6 dBm CWDM 1570 nm (AC67858) 59 +3 dBm CWDM 1590 nm (AC67859) 60 +6 dBm CWDM 1590 nm (AC67860) 61 +3 dBm CWDM 1610 nm (AC67861) 62 +6 dBm CWDM 1610 nm (AC67862) XX None</p> <p><b>8-3 Optical connector for transmitter TX3</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>	<p><b>10-1 Optical passive</b> XX None F1 WDM and 1430 nm Add Drop, with 9 deg. SC/APC connectors F2 WDM with 8 deg. SC/APC connectors M1 MUX with SC/APC connectors M2 MUX with SC/APC connectors M3 MUX with SC/APC connectors M4 MUX with SC/APC connectors M5 MUX with SC/APC connectors</p>
<p><b>4-1 Optical receiver RX2</b> 10 RX2 input level -7..0 dBm (AC66810) XX None</p> <p><b>4-3 Optical connector for receiver RX2</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>	<p><b>5-1 Diplexer filter</b> C 50/70 MHz (4 x CXF050) D 65/85 MHz (4 x CXF065) F 55/70 MHz (4 x CXF065 18) G 65/85 MHz (4 x CXF065 18) H 85/108 MHz (4 x CXF065 FM) X None</p>	<p><b>11-1 Transponder module</b> B Transponder and ALSIC module (AC6991) X None</p>
<p><b>6-1 Return path transmitter TX1</b> 40 +1 dBm FP 1310 nm (AC67840) 41 +1 dBm FP 1310 nm (AC67840) 42 +3 dBm CWDM 1430 nm (AC67841) 43 +5 dBm CWDM 1430 nm (AC67842) 44 +3 dBm CWDM 1450 nm (AC67843) 45 +6 dBm CWDM 1450 nm (AC67844) 46 +3 dBm DFB 1310 nm (AC67845) 47 +6 dBm DFB 1310 nm (AC67846) 48 +6 dBm CWDM 1470 nm (AC67848) 49 +3 dBm CWDM 1490 nm (AC67849) 50 +6 dBm CWDM 1490 nm (AC67850) 51 +3 dBm CWDM 1510 nm (AC67851) 52 +6 dBm CWDM 1510 nm (AC67852) 53 +3 dBm CWDM 1530 nm (AC67853) 54 +6 dBm CWDM 1530 nm (AC67854) 55 +3 dBm CWDM 1550 nm (AC67855) 56 +6 dBm CWDM 1550 nm (AC67856) 57 +3 dBm CWDM 1570 nm (AC67857) 58 +6 dBm CWDM 1570 nm (AC67858) 59 +3 dBm CWDM 1590 nm (AC67859) 60 +6 dBm CWDM 1590 nm (AC67860) 61 +3 dBm CWDM 1610 nm (AC67861) 62 +6 dBm CWDM 1610 nm (AC67862) XX None</p> <p><b>6-3 Optical connector for transmitter TX1</b> A SC/APC, 9 deg. B FC/APC, 8 deg. C E-2000 D SC/APC, 8 deg. X None</p>	<p><b>12-1 Application software</b> A CATVisor compatible B HMS compatible</p> <p><b>12-2 Settings</b> X Factory default A Customer specified</p> <p><b>12-3 Product keys (software features)</b> X None A Plug'n'play forward path alignment B Spectrum and ingress analyser functionality C A + B + Return path pilot generator</p>	<p><b>13-1 Installation manual</b> X None A Manual</p> <p><b>13-2 Reserved for future</b> X None</p>