Alcatel·Lucent

Alcatel-Lucent 9500 Microwave Cross-Connect

The Alcatel-Lucent 9500 Microwave Cross-Connect (MXC) is a flexible, multiservice wireless transport platform for medium- to high-capacity mixed traffic. Offering a new generation of digital, point-to-point microwave radio capabilities, the 9500 MXC provides an effective way to meet the growing demand for high-capacity applications.

9500 MXC terminal with indoor unit
(here using Intelligent Node Unit [INU] with
up to 4 card slots) and Outdoor Unit (ODU)

9500 MXC node with ODU and INU

Extended Intelligent Node Unit (INUe)
with up to 10 card slots

The compact Alcatel-Lucent 9500 MXC supports SDH/SONET and "super PDH" applications with higher flexibility afforded by its integrated cross-connection capabilities. It can also support fixed applications such as DSL and WiMAX backhauling, due to its multiple interfaces, including PDH, SDH and Ethernet with integrated Layer-2 switching. The 9500 MXC is a reliable, complete, homogeneous series, from 6 GHz to 38 GHz. Its unique network management capabilities serve both small and large networks, and its compact design enables easy installation while ensuring that maximum commonality is achieved across frequencies and capacities.

Benefits

- Spectrum efficiency to support increasing broadband traffic
- High reliability
- Reduced costs – with a modular design and cost-optimized IDUs for SDH and Ethernet applications
- Easy installation and reduced cabling
- Enhanced customer satisfaction with QoS management

Applications

- Wireless point-to-point
- Mobile, private and carrier network infrastructures
- SDH, high-capacity PDH and Ethernet radio transmissions
- Local traffic aggregation
- High-capacity aggregation
- Backhauling for DSL, WiMAX and PC networks

Features

- High-capacity transport for mixed data and TDM traffic
  - ¬ SDH capacity up to 2xSTM-1
  - ¬ PDH capacity up to 106xE1 or 8xE3
  - ¬ Ethernet capacity up to 200 Mb/s full-duplex
  - ¬ Gigabit Ethernet capacity up to 600 Mb/s with link aggregation and Layer 2 switch integrated
- High-integration design that delivers high reliability
- Terminal Integrated Solution (IDU) for 1xSTM-1, 20xE1 or Fast Ethernet + 8xE1 configurations

- Node configuration and integrated cross-connect functionalities (using Intelligent Node Unit [INU] or extended Intelligent Node Unit [INUe])
  - ¬ Flexible aggregate capacity sharing between E1s and Ethernet
  - ¬ Powerful embedded traffic routing with E1 cross-connect
  - ¬ Nodal capabilities supporting up to six radio paths (with INUe)

- Universal ODU (16, 32, 64, 128 and 256 QAM; 64 Mb/s to 311 Mb/s)
- Java™-based craft terminal
- Full software configurable modulation and capacity
- Highly modular architecture

Technical specifications

Configurations
- Unprotected
- 1+1 hot-standby
- 1+1 space diversity
- 1+1 frequency diversity
- Co-channel cross-pol operation (XPIC)
- Repeater with traffic add-drop
- 3-, 4-, 5- and 6-way nodal configuration with traffic routing
- E1 and STM-1 line protection

System-level specifications
- Operating frequencies: 6, 7, 8, 10.5, 11, 13, 15, 18, 23, 26, 28 and 38 GHz
- Modulation options: QPSK, 16, 32, 64, 128 and 256 QAM
- Capacity ranges: 32, 40, 48, 52, 64, 75, 93 and 106 E1; 1, 2, 3, 4, 5, 6, 7 and 8 E3; 1 and 2 STM-1

Power requirements
- Input voltage range: -40 V DC to -60 V DC
- Power consumption
  - ¬ IDU: 10 W
  - ¬ INU and INUe: dependent on cards installed:
    - Radio Access Card: 6 W
    - Digital Access Card: 3 W
    - Node Control Card: 4 W
    - Node Protection Card: 4 W
    - Fan Unit: 2 W
  - ¬ ODU: 50 W maximum

Dimensions
IDU and INU
- Height: 44.5 mm (1.75 in.)
- Width: 480 mm (18.9 in.)
- Depth: 300 mm (11.8 in.)
INUe
- Height: 89 mm (3.50 in.)
- Width: 480 mm (18.90 in.)
- Depth: 300 mm (11.81 in.)
ODU
- Height: 284 mm (11.18 in.)
- Width: 284 mm (11.18 in.)
- Depth: 162 mm (6.38 in.)

Environmental
- IDU and INU: -5°C to +45°C (23°F to 113°F)
- INUe: -50°C to +65°C (-58°F to +149°F)
- ODU: -33°C to +55°C (-27°F to +131°F)

Standards compliance
- EMC: EN 301 489
- Operation
  - ¬ ODUs: ETS 300 019, Class 4.1
  - ¬ IDUs: ETS 300 019, Class 3.2
- Storage: ETS 300 019, Class 1.2
- Transportation: ETS 300 019, Class 2.3
- Radio frequency: EN 302 217
- Safety: EN 60950
- Water ingress (ODUs) IEC 60529 (IPX6)

Modulation scheme:
- QPSK, 16 QAM, 32 QAM, 64 QAM, 128 QAM, 256 QAM (software selectable)

Capacity
- PDH ETSI: 20,40, 52, 64, 75, 93 and 106 E1
- SDH: STM-1, 2xSTM-1 single-carrier at 56 MHz, 2xSTM-1 XPIC
- LAN: 4x 10/100 BASE-T(X), 1000 BASE-LX, 3x1000 BASE-T

Channel spacing (MHz) and modulation options
- 7 (5 E1), 14 (10 E1), 28 (20 E1) for QPSK
- 3, 5 (E1), 7 (10 E1), 14 (20 E1), 28 (3 2E1), 28(40 E1), 56 (64 E1), 56 (75 E1), 56 (STM-1) for 16 QAM
- 14 (27 E1), 28 (52 E1) for 32 QAM
- 7 (16 E1), 14 (32 E1), 28 (64 E1), 56 (100 E1), 40 (STM-1) for 64 QAM
- 28 (75 E1), 28 (STM-1), 28 (1xSTM1 + 1xE1), 56 (2xSTM-1) for 128 QAM
- 28 (93 E1) for 256 QAM

Configurations
- 1+0, 1+1 HSB/SD/FD, 1+1 HSB XP, 2+0

System gain
- 68,8 - 98,4 dB

Table 1. RF, Tx and Rx specifications (Part 1)

ODU300hp RF SPECIFICATIONS				L6/U6 GHz	7 GHz	8 GHz	10,5 Gz	11 GHz	13 GHz
SYSTEM									
Frequency Range, GHz				5.925 - 6.425 6.425 - 7.11	7.125 - 7.9	7.725 - 8.5	10.0 - 10.68	10.7 - 11.7	12.75 - 13.25
T-R Spacings supported, MHz				252.04 340	154, 161, 168, 196, 245	119, 126, 151.614, 266, 311.32	91, 230, 143.5, 350	490, 530	266
Maximum Tuning Range (dependent upon T-R spacing), MHz				56	56	140	165	165	84
TRANSMITTER SPECIFICATIONS			MODULATION						
Power Output, nominal (dBm)			QPSK	28.5	28.5	28.5	26	24	23
			16 QAM	26.5	26.5	26.5	24	22	21
			32 QAM	26	26	26	23.5	21.5	20.5
			64 QAM [2]	25.5	25.5	25.5	23	21	20
			128 QAM	24.5	24.5	24.5	22	20	19
			256 QAM	22.5	22.5	22.5	20	18	17
RECEIVER SPECIFICATIONS [1] [3]	**CAPACITY**	**CHANNEL**	**MODULATION**						
Threshold at 10^{-6} BER (dBm) for RACs/IDUs:									
RAC30	5xE1	7 MHz	QPSK	-92	-92	-92	-91.5	-91.5	-91.5
RAC30	10xE1	13.75 / 14 MHz	QPSK	-89	-89	-89	-88.5	-89	-89
RAC30	20xE1	27.5 / 28 MHz	QPSK	-86	-86	-86	-85.5	-86	-86
RAC30	10xE1	7 MHz	16 QAM	-85.5	-85.5	-85.5	-85	-85	-85
RAC30	20xE1	13.75 / 14 MHz	16 QAM	-82.5	-82.5	-82.5	-82	-82	-82
RAC30	32xE1	13.75 / 14 MHz	64 QAM	-75.5	-75.5	-75.5	-75	-75.5	-75.5
RAC30	40xE1	27.5 / 28 MHz	16 QAM	-79.5	-79.5	-79.5	-79	-79	-79
RAC30	52xE1	27.5 / 28 MHz	32 QAM	-76	-76	-76	-75.5	-75.5	-75.5
RAC30	64xE1	27.5 / 28 MHz	64 QAM	-72.5	-72.5	-72.5	-72	-72.5	-72.5
RAC 3X/40	64xE1	27.5 / 28 MHz	64 QAM	-74	-74	-74	-73.5	-73.5	-73.5
RAC3X	75xE1[3], 1xSTM1	55 / 56 MHz	16 QAM	-76.5	-76.5	-76.5			-76
RAC3X	75xE1, 1xSTM1	40 MHz	64 QAM	-74			-73.5	-74	
RAC30	75xE1, 1xSTM1	27.5 / 28 MHz	128 QAM	-69.5	-69.5	-69.5	-69	-69.5	-69.5
RAC 40	75xE1, 1xSTM1	27.5 / 28 MHz	128 QAM	-71	-71	-71	-70.5	-70.5	-70.5
RAC3X	1xSTM1	27.5 / 28 MHz	128 QAM	-71	-71	-71	-70.5	-70.5	-70.5
RAC3X	93xE1	27.5 / 28 MHz	256 QAM	-65.5	-65.5	-65.5	-65	-65	-65
RAC3X	106xE1	55 / 56 MHz	64 QAM						
RAC3X	2xSTM1	55 / 56 MHz	128 QAM	-66	-66	-66			-66

All specifications are referenced to the ODU antenna flange, and are typical values unless otherwise stated, and are subject to change without notice. For guaranteed values (over time and operational range) subtract 2 dB from power output, add 2 dB to threshold values, and subtract 4 dB from system gain values.

[1] System gain and receiver threshold values are for BER = 10^{-6}. Values for BER = 10^{-3} are improved by 1 dB.
[2] Transmit power output values for 64xE1 64 QAM will be reduced by 1 dB from the 64 QAM value indicated.
[3] Receiver threshold values are for BER=10^{-6}. Values for BER = 10^{-3} are improved by 1 dB.

For complete list of Capacity/Channel/Modulation profiles, refer to 9500MXC User Manual

Table 1. RF, Tx and Rx specifications (Part 2)

ODU300hp RF SPECIFICATIONS				15 GHZ	18 GHZ	23 GHZ	26 GHZ	28 GHZ	32 GHZ	38 GHZ
SYSTEM										
Frequency Range, GHz				14.4 - 15.35	17.7 - 19.7	21.2 - 23.632	24.52 - 26.483	27.5 - 29.5	31.8 - 33.4	37.0 - 9.46
T-R Spacings supported, MHz				315, 420, 490, 644, 728	1010, 1092.5	1008, 1200, 1232	1008	1008	812	1260
Maximum Tuning Range (dependent upon T-R spacing), MHz				245	380	370	360	360	370	340

TRANSMITTER SPECIFICATIONS			MODULATION	15 GHZ	18 GHZ	23 GHZ	26 GHZ	28 GHZ	32 GHZ	38 GHZ
Power Output, nominal (dBm)			QPSK	22	19.5	19.5	15.5	15	18	17.5
			16 QAM	20	17.5	17.5	13.5	13	16	15.5
			32 QAM	19.5	17	17	13	12.5	15.5	15
			64 QAM [2]	19	16.5	16.5	12.5	12	15	14.5
			128 QAM	18	15.5	15.5	11.5	11	14	13.5
			256 QAM	16	13.5	13.5	9.5	9	12	11.5

RECEIVER SPECIFICATIONS [1] [3]	CAPACITY	CHANNEL	MODULATION	15 GHZ	18 GHZ	23 GHZ	26 GHZ	28 GHZ	32 GHZ	38 GHZ
Threshold at 10⁻⁶ BER (dBm) for RACs :										
RAC30	5xE1	7 MHz	QPSK	-91.5	-91	-91	-90	-89	-89	-88.5
RAC30	10xE1	13.75 / 14 MHz	QPSK	-88.5	-88.5	-88	-87	-86.5	-86	-86
RAC30	20xE1	27.5 / 28 MHz	QPSK	-85.5	-85.5	-85	-84	-83.5	-83	-83
RAC30	10xE1	7 MHz	16 QAM	-85	-84.5	-84.5	-83.5	-82.5	-82	-82
RAC30	20xE1	13.75 / 14 MHz	16 QAM	-82	-81.5	-81.5	-80.5	-79.5	-79	-79
RAC30	32xE1	13.75 / 14 MHz	64 QAM	-75	-75	-74.5	-73.5	-72.5	-72	-72
RAC30	40xE1	27.5 / 28 MHz	16 QAM	-79	-78.5	-78.5	-77.5	-76.5	-76	-76
RAC30	52xE1	27.5 / 28 MHz	32 QAM	-75.5	-75	-75	-74	-73	-72.5	-72.5
RAC30	64xE1	27.5 / 28 MHz	64 QAM	-72	-72	-71.5	-70.5	-69.5	-69	-69
RAC 3X/40	64xE1	27.5 / 28 MHz	64 QAM	-73.5	-73	-73	-72	-70.5	-70.5	-70
RAC3X	75xE1, xSTM1	55 / 56 MHz	16 QAM	-76	-76	-75.5	-74.5	-73.5	-73	-73
RAC3X	75xE1, xSTM1	40 MHz	64 QAM							
RAC30	75xE1, xSTM1	27.5 / 28 MHz	128 QAM	-69	-69	-68.5	-67.5	-66	-65.5	-65.5
RAC 40	75xE1, xSTM1	27.5 / 28 MHz	128 QAM	-70.5	-70	-70	-69	-67	-67	-66.5
RAC 3X	1xSTM1	27.5 / 28 MHz	128 QAM	-70.5	-70	-70	-69	-67	-67	-66.5
RAC3X	93xE1	27.5 / 28 MHz	256 QAM	-65	-64.5	-64.5	-62.5	-61.5	-61.5	-60.5
RAC3X	106xE1	55 / 56 MHz	64 QAM		-71.5	-71	-69.5	-69	-68.5	-68.5
RAC3X	2xSTM1	55 / 56 MHz	128 QAM	-65.5	-65.5	-65	-64	-62.5	-62	-62

All specifications are referenced to the ODU antenna flange, and are typical values unless otherwise stated, and are subject to change without notice. For guaranteed values (over time and operational range) subtract 2 dB from power output, add 2 dB to threshold values, and subtract 4 dB from system gain values.

[1] System gain and receiver threshold values are for BER = 10⁻⁶. Values for BER = 10⁻³ are improved by 1 dB.
[2] Transmit power output values for 64xE1 64 QAM will be reduced by 1 dB from the 64 QAM value indicated.
[3] Receiver threshold values are for BER=10⁻⁶. Values for BER = 10⁻³ are improved by 1 dB.

For complete list of Capacity/Channel/Modulation profiles, refer to 9500MXC User Manual

Table 2. Dispersive Fade Margin

All specifications provided in this table are typical values unless otherwise stated, and are subject to change without notice.

DISPERSIVE FADE MARGIN (DFM)				
CAPACITY	GROSS BIT RATE (Mb/s) [1]	MODULATION OPTIONS	APPROX. SYMBOL RATE (Mbaud)	DFM (dB)
5xE1	11.5	QPSK (16 QAM)	5.8 (2.9)	76 (78)
8xE1	18.8	QPSK (16 QAM)	9.4 (4.7)	71.5
10xE1	22.8	QPSK (16 QAM)	11.6 (5.8)	72 (74)
16xE1	37.6	QPSK (16 QAM/64 QAM)	18.3 (9.2 / 5.9)	71 (75/67)
20xE1	44.9	QPSK (16 QAM)	22.9 (11.5)	69 (67)
27xE1	61.3	32 QAM	11.9	59
32xE1	75.2	16 QAM (64 QAM)	18.1 (12.0)	64 (64)
40xE1	88.9	16 QAM	22.7	58
52xE1	116.6	32 QAM	23.7	54
64xE1	142.4	64 QAM	23.8	52
75xE1	167.8	128 QAM (16 QAM/64 QAM)	24.5 (41.8 / 28)	49 (52/52)
93xE1	208.8	256 QAM	26.1	46
100xE1	229.4	32 QAM	32.8 (45.9)	50 (51)
106xE1	250.8	64 QAM	41.8	45
1xSTM1	167.0	128 QAM (16 QAM/64 QAM)	24.4 (41.6 / 30.5)	49 (52/52)
2xSTM1	334.0	128 QAM (256 QAM)	47.6 (43.8)	42 (40)

[1] Gross bit rate includes usable customer payload plus radio overhead for FEC, NMS, AUX traffic, among others.

Table 3. Standards compliance

EMC	INU/INUe		EN 301 489-1, EN 301 489-4 (EN 55022 Class A)
	IDU		EN 301 489-1, EN 301 489-4 (EN 55022 Class B)
Operation	ODUs		ETS 300 019, Class 4.1
Operation	INU/INUe/IDU		ETS 300 019, Class 3.2
Storage			ETS 300 019, Class 1.2
Transportation			ETS 300 019, Class 2.3
Safety			IEC 60950-1/EN 60950-1
Radio frequency			EN 302 217 Classes 2, 4 and 5B
Water ingress	ODU		IEC 60529 (IPX6)
ENVIRONMENTAL			
Operating temperature	INU/INUe/IDU	Guaranteed	-5°C to +45°C (23°F to 113°F)
	INU/INUe/IDU	Extended [1]	-5°C to +55°C (23°F to 131°F)
	ODU	Guaranteed	-33°C to +55°C (-27°F to +131°F)
	ODU	Extended [1]	-50°C to +65°C (-58°F to +149°F)
Humidity	INU/INUe/IDU	Guaranteed	0% to 95%, non-condensing
	ODU	Guaranteed	0% to 100%
Altitude		Guaranteed	500 meters (15,000 ft)

[1] Over full extended operating temperature, the 9500 MXC may be subject to reduced performance. Contact Alcatel-Lucent for more details.

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