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 IDU and ODU

9500 MXC node with outdoor unit (ODU) and indoor unit (INU)

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

The compact Alcatel-Lucent 9500 MXC supports SDH/SONET and "super PDH" applications — up to 75 E1 — 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 solutions for 1xSTM-1, 20xE1 or Fast Ethernet + 8xE1 configurations

- Node configuration and integrated cross-connection functionalities
  - ¬ 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 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
- INUe: -50°C to +65°C
- ODU: -33°C to +55°C

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)

Table 1. Technical summary (Part 1)

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							
	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), 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							
ODU300hp RF SPECIFICATIONS				**L6/U6 GHz**	**7.0 GHz**	**8.0 GHz**	**10.5 GHz**	**11.0 GHz**
SYSTEM								
Frequency range, GHz				5.925 to 6.425 6.425 to 7.11	7.125 to 7.9	7.725 to 8.5	10.0 to 10.68	10.7 to 11.7
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
Maximum tuning range (dependent upon T-R spacing), MHz				56	56	140	165	165
TRANSMITTER SPECIFICATIONS								
Power output, nominal (dBm)			QPSK	28.5	28.5	28.5	26.0	24.0
			16 QAM	26.5	26.5	26.5	24.0	22.0
			32 QAM	26.0	26.0	26.0	23.5	21.5
			64 QAM [2]	25.5	25.5	25.5	23.0	21.0
			128 QAM	24.5	24.5	24.5	22.0	20.0
			256 QAM	22.5	22.5	22.5	20.0	18.0
RECEIVER SPECIFICATIONS [1] [3]	**CAPACITY**	**CHANNEL**	**MODULATION**					
Threshold at 10^{-6} BER (dBm)	5xE1	7.0 MHz	QPSK	-92.0	-92.0	-92.0	-91.5	-91.5
	10xE1	13.75/14.0 MHz	QPSK	-89.0	-89.0	-89.0	-88.5	-89.0
	20xE1	27.5/28.0 MHz	QPSK	-86.0	-86.0	-86.0	-85.5	-86.0
	10xE1	7.0 MHz	16 QAM	-85.5	-85.5	-85.5	-85.0	-85.0
	20xE1	13.75/14.0 MHz	16 QAM	-82.5	-82.5	-82.5	-82.0	-82.0
	27xE1	13.75/14.0 MHz	32 QAM	-78.5	-78.5	-78.5	-78.0	-78.0
	32xE1	27.5/28.0 MHz	16 QAM	-80.5	-80.5	-80.5	-80.0	-80.0
	32xE1	13.75/14.0 MHz	64 QAM	-75.5	-75.5	-75.5	-75.0	-75.5
	40xE1	27.5/28.0 MHz	16 QAM	-79.5	-79.5	-79.5	-79.0	-79.0
	52xE1	27.5/28.0 MHz	32 QAM	-76.0	-76.0	-76.0	-75.5	-75.5
	64xE1	27.5/28.0 MHz	64 QAM	-72.5	-72.5	-72.5	-72.0	-72.5
RAC 3X/40	64xE1	27.5/28.0 MHz	64 QAM	-74.0	-74.0	-74.0	-73.5	-73.5
	75xE1, 1xSTM1	55.0/56.0 MHz	16 QAM	-76.5	-76.5	-76.5		
	75xE1, 1xSTM1	40.0 MHz	64 QAM	-74.0			-73.5	-74.0
	75xE1, 1xSTM1	27.5/28.0 MHz	128 QAM	-69.5	-69.5	-69.5	-69.0	-69.5
RAC 3X/40	75xE1, 1xSTM1	27.5/28.0 MHz	128 QAM	-71.0	-71.0	-71.0	-70.5	-70.5
	93xE1	27.5/28.0 MHz	256 QAM	-65.5	-65.5	-65.5	-65.0	-65.0
	106xE1	55.0/56.0 MHz	64 QAM					
	8xE3, 2xSTM1	55.0/56.0 MHz	128 QAM	-66.0	-66.0	-66.0		

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 2dB 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 64QAM value indicated.
[3] Receiver threshold values are for BER=10^{-6}. Values for BER = 10^{-3} are improved by 1 dB.

Table 1. Technical summary (Part 2)

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							
				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), 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							
ODU300hp RF SPECIFICATIONS				**13.0 GHz**	**15.0 GHz**	**18.0 GHz**	**23.0 GHz**	**26.0 GHz**	**28.0 GHz**	**32.0 GHz**	**38.0 GHz**
SYSTEM											
Frequency range, GHz				12.75 to 13.25	14.4 to 15.35	17.7 to 19.7	21.2 to 23.632	24.52 to 26.483	27.5 to 29.5	31.8 to 33.4	37.0 to 39.46
T-R spacings supported, MHz				266	315, 420, 490, 644, 728	1010, 1092.5	1008, 1200, 1232	1008	1008	812	1260
Maximum tuning range (dependent upon T-R spacing), MHz				84	245	380	370	360	360	370	340
TRANSMITTER SPECIFICATIONS											
Power output, nominal (dBm)				23.0	22.0	19.5	19.5	15.5	15.0	18.0	17.5
				21.0	20.0	17.5	17.5	13.5	13.0	16.0	15.5
				20.5	19.5	17.0	17.0	13.0	12.5	15.5	15.0
				20.0	19.0	16.5	16.5	12.5	12.0	15.0	14.5
				19.0	18.0	15.5	15.5	11.5	11.0	14.0	13.5
				17.0	16.0	13.5	13.5	9.5	9.0	12.0	11.5
RECEIVER SPECIFICATIONS [1] [3]	**CAPACITY**	**CHANNEL**	**MODU-LATION**								
Threshold at 10^{-6} BER (dBm)	5xE1	7.0 MHz	QPSK	-91.5	-91.5	-91.0	-91.0	-90.0	-89.0	-89.0	-88.5
	10xE1	13.75/14.0 MHz	QPSK	-89.0	-88.5	-88.5	-88.0	-87.0	-86.5	-86.0	-86.0
	20xE1	27.5/28.0 MHz	QPSK	-86.0	-85.5	-85.5	-85.0	-84.0	-83.5	-83.0	-83.0
	10xE1	7.0 MHz	16 QAM	-85.0	-85.0	-84.5	-84.5	-83.5	-82.5	-82.0	-82.0
	20xE1	13.75/14.0 MHz	16 QAM	-82.0	-82.0	-81.5	-81.5	-80.5	-79.5	-79.0	-79.0
	27xE1	13.75/14.0 MHz	32 QAM	-78.0	-78.0	-77.5	-77.5	-76.5	-75.5	-75.0	-75.0
	32xE1	27.5/28.0 MHz	16 QAM	-80.0	-80.0	-79.5	-79.5	-78.5	-77.5	-77.0	-77.0
	32xE1	13.75/14.0 MHz	64 QAM	-75.5	-75.0	-75.0	-74.5	-73.5	-72.5	-72.0	-72.0
	40xE1	27.5/28.0 MHz	16 QAM	-79.0	-79.0	-78.5	-78.5	-77.5	-76.5	-76.0	-76.0
	52xE1	27.5/28.0 MHz	32 QAM	-75.5	-75.5	-75.0	-75.0	-74.0	-73.0	-72.5	-72.5
	64xE1	27.5/28.0 MHz	64 QAM	-72.5	-72.0	-72.0	-71.5	-70.5	-69.5	-69.0	-69.0
RAC 3X/40	64xE1	27.5/28.0 MHz	64 QAM	-73.5	-73.5	-73.0	-73.0	-72.0	-70.5	-70.5	-70.0
	75xE1, 1xSTM1	55.0/56.0 MHz	16 QAM	-76.0	-76.0	-76.0	-75.5	-74.5	-73.5	-73.0	-73.0
	75xE1, 1xSTM1	40.0 MHz	64 QAM								
	75xE1, 1xSTM1	27.5/28.0 MHz	128 QAM	-69.5	-69.0	-69.0	-68.5	-67.5	-66.0	-65.5	-65.5
RAC 3X/40	75xE1, 1xSTM1	27.5/28.0 MHz	128 QAM	-70.5	-70.5	-70.0	-70.0	-69.0	-67.0	-67.0	-66.5
	93xE1	27.5/28.0 MHz	256 QAM	-65.0	-65.0	-64.5	-64.5	-62.5	-61.5	-61.5	-60.5
	106xE1	55.0/56.0 MHz	64 QAM			-71.5	-71.0	-69.5	-69.0	-68.5	-68.5
	8xE3, 2xSTM1	55.0/56.0 MHz	128 QAM	-66.0	-65.5	-65.5	-65.0	-64.0	-62.5	-62.0	-62.0

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 2dB 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 64QAM value indicated.
[3] Receiver threshold values are for BER=10^{-6}. Values for BER = 10^{-3} are improved by 1 dB.

Table 2. Dispersive Fade Margin

DISPERSIVE FADE MARGIN (DFM)					
		GROSS BIT RATE Mbit/s [1]	MODULATION OPTIONS	SYMBOL RATE Mbaud	DFM RAC 30/3X/40
Capacity/modulation	4xE1	9.4	QPSK (16 QAM)	4.7 (2.4)	
	5xE1	11.5	QPSK (16 QAM)	5.8 (2.9)	76 (78)
	8xE1	18.8	QPSK (16 QAM)	9.4 (4.7)	
	10xE1	22.8	QPSK (16 QAM)	11.4 (5.7)	72 (74)
	16xE1/1xE3	37.6	QPSK (16 QAM/64 QAM)	18.8 (9.4)	71 (75/67)
	20xE1	44.9	QPSK (16 QAM)	22.5 (11.2)	69 (67)
	32xE1/2xE3	75.2	16 QAM (64 QAM)	18.8 (9.4)	64 (64)
	40xE1	88.9	16 QAM	22.2	58
	48xE1/3xE3	106.8	32 QAM	21.4	58
	52xE1	116.6	32 QAM	23.3	54
	64xE1	142.4	64 QAM	23.7	52
	75xE1	167.8	128 QAM (16 QAM/64 QAM)	24.0 (42/28)	49 (52/52)
	93xE1		256 QAM		
	100xE1		32 QAM		
	106xE1	250.8	64 QAM	41.8	45
	1xE3	37.6	QPSK (16 QAM)	18.8 (9.4)	71 (75)
	2xE3	75.2	16 QAM (64 QAM)	18.8 (12.5)	67 (61)
	3xE3	112.8	32 QAM	22.6	55
	4xE3	150.4	128 QAM	21.5	51
	1xSTM1	167.0	128 QAM (16 QAM/64 QAM)	23.9 (41.8/27.8)	49 (52/52)
	2xSTM1	334.0	128 QAM (256 QAM)	47.8 (41.8)	42 (40)

All specifications are typical values unless otherwise stated, and are subject to change without notice.
[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.

Alcatel·Lucent