NN-20500-235

Wireless Service Provider Solutions

W-CDMA

Alcatel-Lucent 9341 Remote Radio Head 60W

Technical Description

NN-20500-235 03.03/EN Preliminary July 2009

Alcatel·Lucent

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1 About this publication

This publication is generic. It describes the Alcatel-Lucent 9341 Remote Radio Head 60W. Its short name is 9341 RRH60.

There are different variants of the 9341 RRH60, depending on the bandwidth:

- 9341 RRH60-21 for 2100 MHz
- 9341 RRH60-19 for 1900 MHz
- 9341 RRH60-09 for 900 MHz
- 9341 RRH60-08 for 850 MHz

Note: For convenience, the terms RRH60-XX or RRH60 are also used in this publication.

Applicability

This publication applies to UA07.0.

Audience

This publication is for operations and maintenance personnel, and anyone interested in learning more about the 9341 RRH60.

Related documentation

The following documents are related to this publication:

- *Alcatel-Lucent 9341 Remote Radio Head 60W - Maintenance Guide (NN-20500-236)*
- *Alcatel-Lucent 9326 digital 2U Node B V2 - Technical Description (NN-20500-203)*
- *Alcatel-Lucent 9396 digital 2U Node B W-CDMA UA07 - Technical Description (401-382-964UA07)*
- *Alcatel-Lucent Node B - Commissioning & Fault Management User Manual: TIL (NN-20500-019)*
- *Alcatel-Lucent 9300 W-CDMA Product Family* documentation:
  - *Node B Alarms Reference Guide (NN-20500-018)*
  - *Terminology (NN-20500-002)*

Document structure

This document is structured as follows:

- The first part explains what this publication is about.
- The second part indicates the roadmap to UTRAN documentation.
- The third part lists what is new in this publication.
- The fourth part provides the RRH60 regulatory information.

- The fifth part gives an introduction to UTRAN.
- The sixth part describes the RRH60 basic characteristics.
- The seventh part describes the RRH60 connectors.
- The eighth part lists the Node B/RRH60 configurations available in UA07.0.
- The last part is about RRH60 optional equipment.

Vocabulary conventions

For a list of the terms used in this document, see *Alcatel-Lucent 9300 W-CDMA Product Family - Terminology (NN-20500-002).*

Safety regulations

To guarantee the safety of personnel and equipment, operators must take into account general personnel and equipment safety instructions.

The following precautionary message indicates a risk of impact on equipment.

CAUTION
Impact on equipment

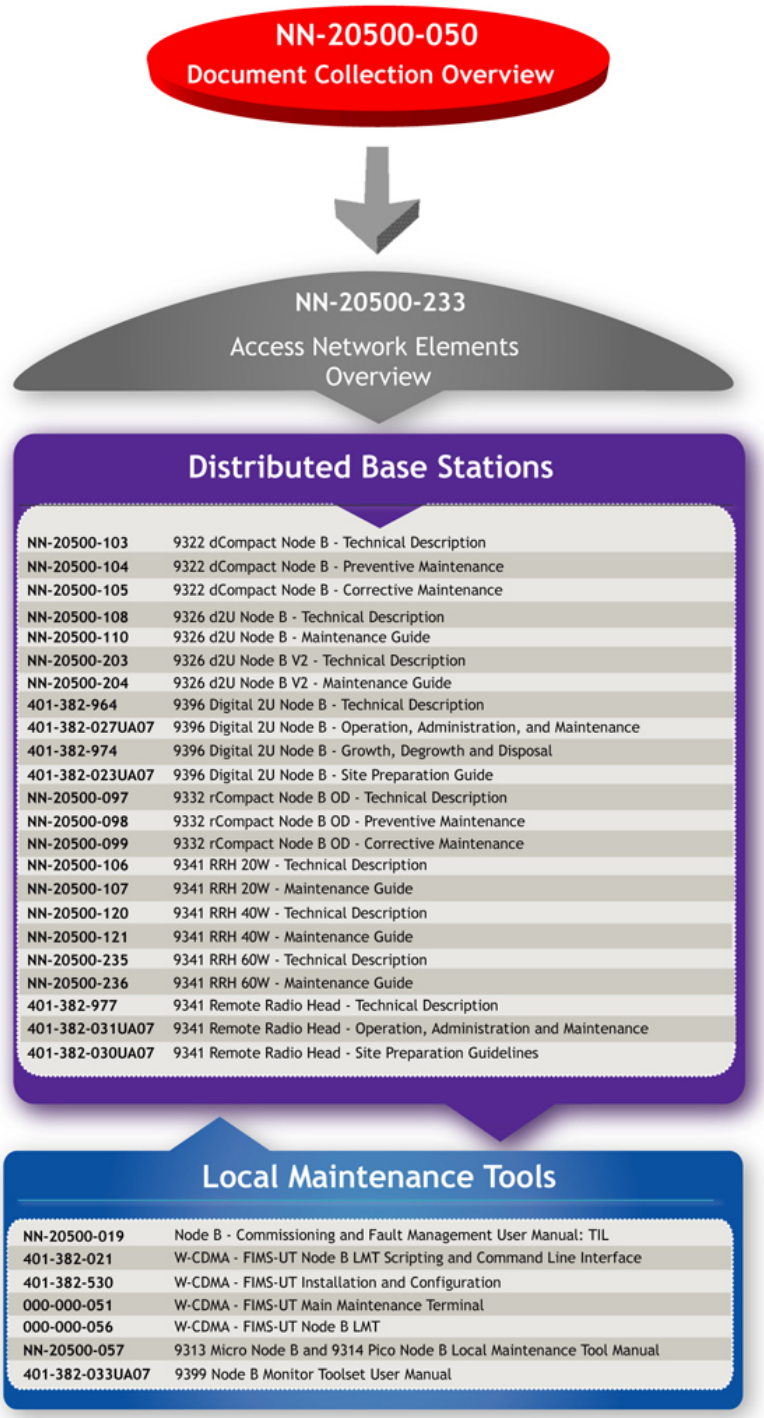
2 Roadmap to Distributed Base Stations documentation

The following figure shows where the current document stands within the W-CDMA Customer Documentation.

Note: For a global view of the W-CDMA Customer Documentation, see Roadmap chapter in:

- *Alcatel-Lucent 9300 W-CDMA Product Family - Document Collection Overview (NN-20500-050)*
- *Alcatel-Lucent 9300 W-CDMA Product Family - Access Network Elements Overview (NN-20500-233)*

Figure 1 Roadmap to Distributed Base Stations documentation



3 New in this release

The following sections detail what is new in *Alcatel-Lucent 9341 Remote Radio Head 60W - Technical Description* for UA07.0.

Features

This publication is based on the following features:

- UMTS 900 MHz antenna sharing, feature 33651, see Dual Duplexer Sharing Module (DDSM)
- RRH 60W 2100MHz, feature 34417
- RRH 60W 1900MHz, feature 75100
- RRH 60W 900MHz, feature 75941
- RRH 60W 850MHz, feature 75099

Other changes

The following changes were made to this publication:

- RRH60 status LEDs
- new Roadmap chapter

4 RRH60 regulatory information

This part provides the regulatory information concerning the 9341 RRH60. It covers the following items:

- European regulatory requirement compliance
- compliances for other regions/countries
- operation conditions
- cable specifications
- product labelling

European regulatory requirement compliance

The 9341 RRH60 falls under the requirements of the Radio and Telecom Terminal Equipment (RTTE) European directive 1999/5/EEC. The RTTE directive covers requirements in the following areas:

- protection of the Health and Safety of users and all other persons, including objectives with respect to safety requirements contained in the Low Voltage Directive (73/23/EEC)
- Electromagnetic compatibility (EMC) protection requirements contained in Directive 89/336/EEC.

  This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it can interfere with radio communications. However, there is no guarantee that interferences do not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on. The user is encouraged to correct any interference problems.

  EMC requirements have been selected to ensure an adequate level of compatibility for apparatus in residential, commercial, and light industrial environments. Compatibility levels, however, do not cover extreme cases that can occur in any location, but that have a low probability of occurrence. In particular, they may not cover cases where a source of interference that is producing repeated transient or continuous phenomena is permanently present. This could include, for example, a radar or broadcast site in the near vicinity. In these cases, it may be necessary to limit the source of interference, and/or apply special protection to the interfered part.

  Note: For operation or maintenance inside Alcatel-Lucent systems, the operator must always wear the antistatic wrist strap to maintain the integrity of the product.
- effective use of the Radio spectrum allocated to terrestrial/space radio communication and orbital resources to avoid interference. The routes and standards used to demonstrate compliance with these requirements are outlined in the following paragraphs.

  — **Node B EMC**

  Compliance with essential EMC requirements was demonstrated using EN301489-1 & -23.

— **Node B radio compliance**

Compliance with the requirements of effective use of the radio spectrum was demonstrated using EN301908-1 & -3.

— **Node B safety**

Compliance with essential safety requirements was demonstrated using EN 60950.

— **Node B health protection**

Compliance with essential health requirements was demonstrated using EN50385.

European Union Environmental Directives (EUED)

The 9341 RRH60 is manufactured according to the following two European Union Environmental Directives:

- Restriction of Hazardous Substances (RoHS), 2002/95/EC.

  The RoHS directive restricts the use of lead, mercury, cadmium, hexavalent chromium, poly-brominated biphenyls (PBB) and poly-brominated diphenyl ethers (PBDE) in electrical and electronic products. This directive applies to all electrical and electronic products placed on the European Union (EU) and European Economic Area (EEA) markets after July 1, 2006, with certain exemptions, including an exemption for lead solder in network infrastructure equipment.

- Waste of Electrical and Electronic Equipment (WEEE), 2002/96/EC.

  The WEEE directive mandates the necessary treatment of such equipment when it enters end-of-life. It specifically identifies requirements for recycling, reuse, and disposal.

Compliances for other regions/countries

It is impossible to list all the applicable approvals/compliances as they depend on the markets and products concerned.

Note: For more information, contact your local Alcatel-Lucent representative.

Operating conditions

The product compliance standards mentioned above are based on the following operating conditions:

- doors must be closed and/or covers must be in place
- external cables must be of the same type as specified by Alcatel-Lucent
- the mechanical and electrical characteristics of the product must not be modified in any way

Any changes or modifications made to the product without written approval from Alcatel-Lucent releases Alcatel-Lucent from responsibility regarding standards compliance.

Cable specifications

Compliance with these standards was verified using cables as specified by Alcatel-Lucent. The continued compliance of the product relies upon use of the correct cabling scheme as well as use of identical type cables as specified by Alcatel-Lucent. Refer to the installation guides for details on cable specifications.

Product labelling

The product label can be located on the inside or the outside of the product, provided that the operation and/or maintenance personnel have the information when working on the product.

Node B labelling for European countries

To indicate compliance with the European RTTE Directive, the 9341 RRH60 bears the following label in a visible location:

- Manufacturer name
- Equipment designation
- Nominal voltage operating range and maximum rated current

Labelling for other regions/countries

Product labels appear for other regions and countries as appropriate and required by the local regulatory framework.

5 UTRAN introduction

The UMTS Terrestrial Radio Access Network (UTRAN) is composed of at least one Radio Network Subsystem (RNS). An RNS covers a certain geographical area. It is equivalent to the GSM BSS. Each RNS is composed of one Radio Network Controller (RNC) and one or more Node Bs. RNSs are interconnected through the Iur interface of each RNC to form a network.

Alcatel-Lucent UTRAN

The Alcatel-Lucent UTRAN solution is based on the following components:

- RNC
- Node B
- WMS for the OAM part

RNC

The Alcatel-Lucent RNC is 3GPP-compliant. It is based on the Multiservice Switch platform.

RNC main functions

The main functions of the RNC are to control and manage:

- Radio Access Network (RAN)
- signaling between Core Network (CN) components and Radio Network System (RNS)
- Node Bs and their radio resources

RNC interfaces

The RNC provides the following interfaces:

- Iub towards a Node B
- Iu towards the Core Network
- Iur towards another RNC
- Iupc towards an Standalone A-GPS SMLC (SAS)

Node B

The Alcatel-Lucent Node Bs are 3GPP-compliant. The Alcatel-Lucent Node B portfolio includes:

- conventional unitary base stations
- digital base stations
- radio base stations
- radio heads

- base station routers

Node B main functions

The Node B supports the following main functions:

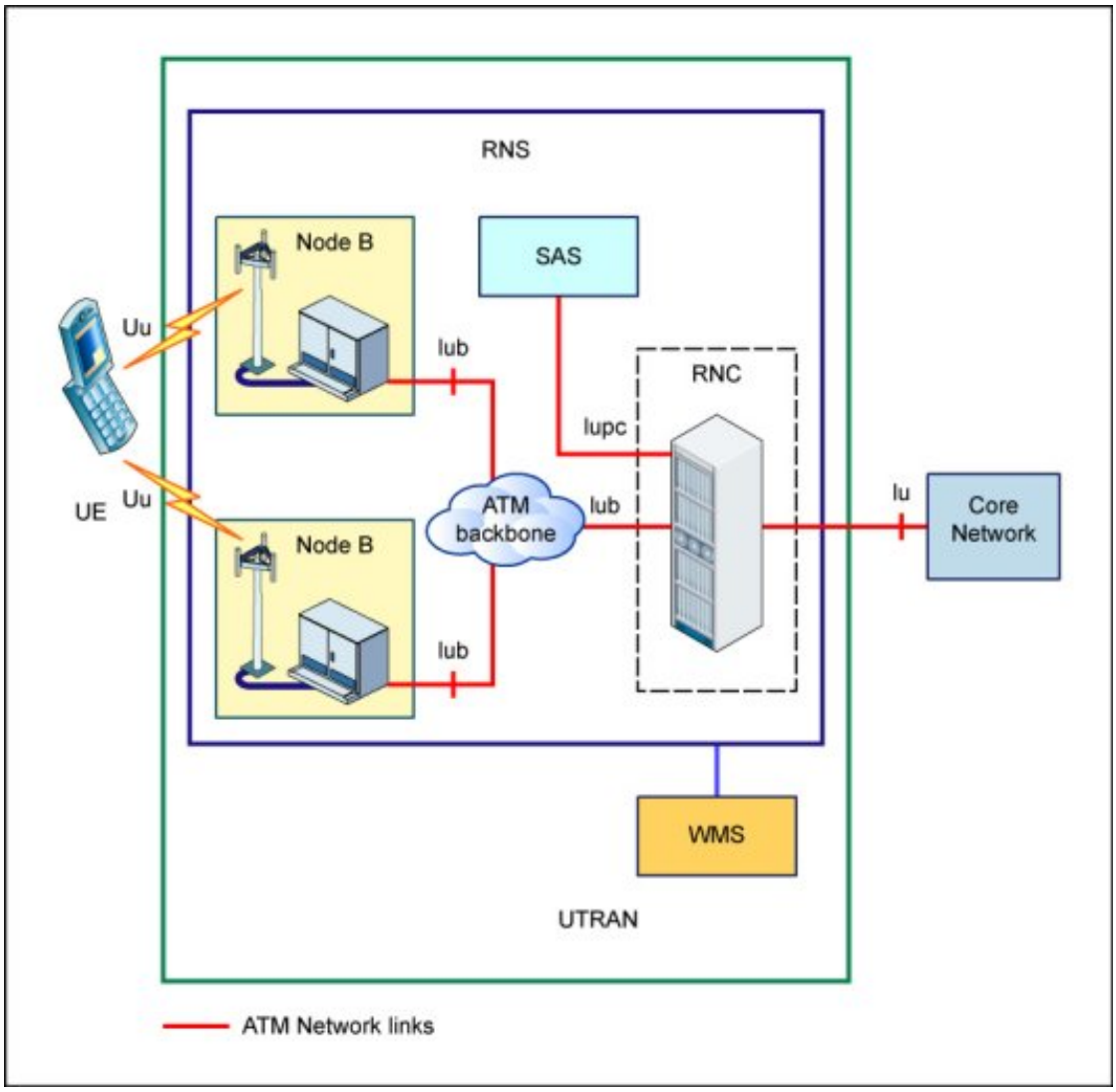
- network interface management
- radio access
- call processing
- configuration and supervision
- synchronization
- performance monitoring

Node B interfaces

The Node B provides the following interfaces:

- Iub towards an RNC
- Uu towards a User Equipment (UE)

Figure 2 Alcatel-Lucent UTRAN architecture example



Note: This is a generic example, with Macro Node Bs Outdoor connected to antennas.

WMS

The Wireless Management System (WMS) delivers an integrated UMTS management platform through which all Network Elements (NE) can be monitored and controlled.

It plays an important role in providing the foundation of a complete end-to-end management solution for UMTS networks. The WMS manages the entire UMTS network, which is divided into:

- the UTRAN

- the Core Network (circuit-switched and packet-switched networks)

Access Network OAM main functions

The Access Network OAM manages the UTRAN part of the network.

The main functions of Access Network OAM are the following:

- fault management
- configuration management
- performance management

NSP

The Network Services Platform (NSP) is a graphical user interface to the Access Network providing a common platform for navigation and control. The NSP interfaces with NEs through a Common Object Request Broker Architecture (CORBA). This vendor-independent architecture links computer applications across different networks.

6 RRH60 basic characteristics

This part describes the basic characteristics of the 9341 RRH60.

6.1 RRH60 introduction

The Alcatel-Lucent 9341 RRH60 solution is based on the remote RF block concept, and involves two sites:

- the centralized Node B site
- the remote RRH site

In the RRH60 solution, the transceiver, power amplifier, and filter functions are located as close as possible to the antennas, on the remote RRH site, far away (500 m to 20 km) from a main Node B cabinet located on the centralized Node B site. The remote RF part interfaces with the digital rack of main Node B cabinet via an optical fiber link.

The RRH60 solution provides operators with a suitable solution whatever the site constraints. It is particularly suitable for macro-cellular application in dense areas, where site acquisition is difficult, and on sites where installation constraints prevent the use of regular full size macro Node Bs (9311 Macro OD or 9311 Macro ID).

The RRH60 solution is compliant with the Common Protocol Radio Interface (CPRI).

The RRH60 operates within the following bandwidths:

- 2100 MHz (RRH60-21)
- 1900 MHz (RRH60-19)
- 900 MHz (RRH60-09)
- 850 MHz (RRH60-08)

An RRH60 delivers 60W nominal composite RF power at antenna port, and can support up to four contiguous frequency carriers:

- 60W x 1 frequency carrier
- 30W x 2 frequency carriers
- 20W x 3 frequency carriers (only RRH60-21 and RRH60-19, since UA06.0)
- 15W x 4 frequency carriers (only RRH60-21, in a future release)

Overview of the RRH60 solution

The RRH60 family consists of single-sector self-contained radio modules designed to be connected to the following Node B cabinets via an optical fiber link:

- 9326 d2U V2 Phase 2
- 9396 d2U (with RRH60-19/RRH60-08)

The RRH60 family includes the following variants:

- RRH60-21 SM (see note below)
- RRH60-21 MM

- RRH60-19 SM
- RRH60-19 MM
- RRH60-09 SM
- RRH60-09 MM
- RRH60-08 SM
- RRH60-08 MM

Note:

SM stands for Single-Mode optical fiber: a single fiber is used for both uplink and downlink signals.

MM stands for Multi-Mode dual optical fibers: one fiber is used for downlink signals, another is used for uplink signals.

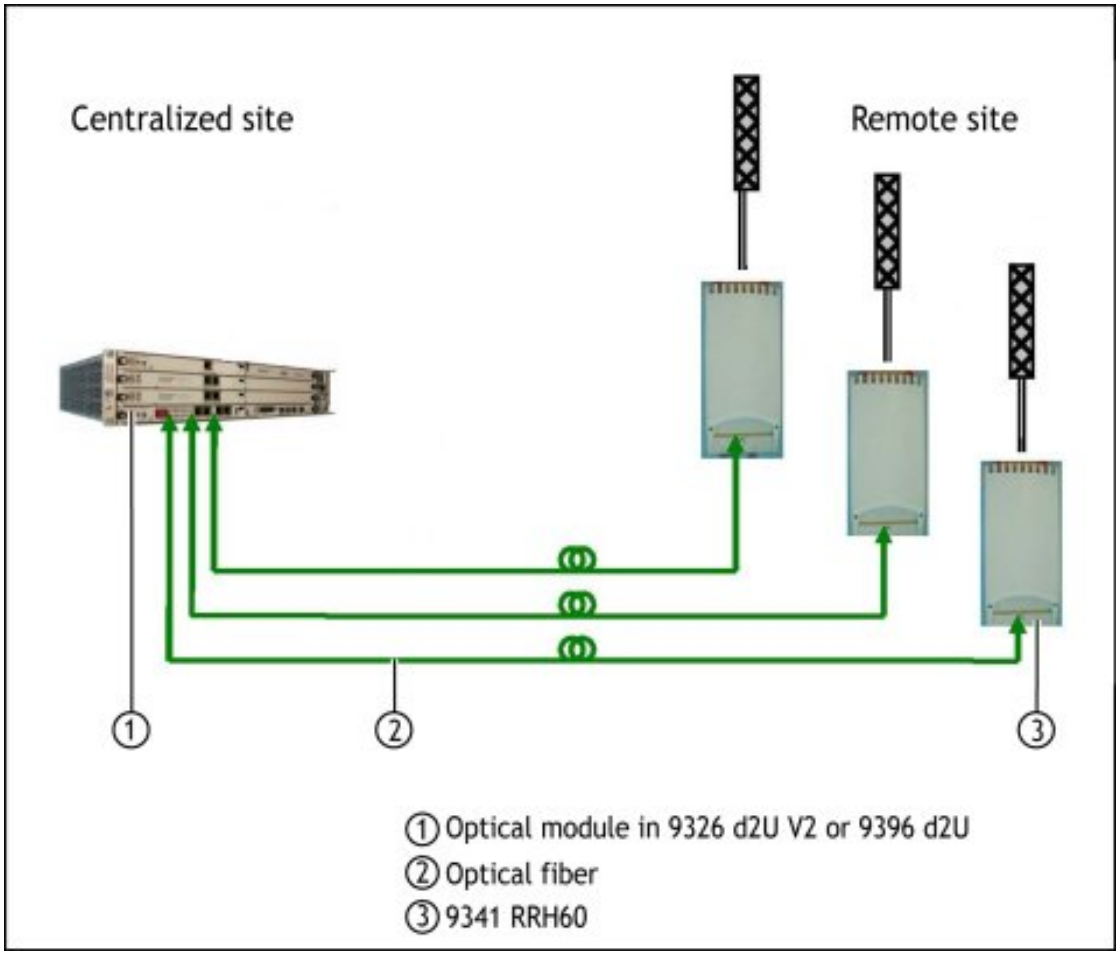
The RRH60 solution is based on the following hardware components:

- RRH60s located on the remote RRH site
- an optical module housed in a digital Node B (9326 d2U V2/9396 d2U) located on the centralized Node B site. See Node B/RRH60 configurations for detailed information.

These two components are linked by optical fibers carrying UMTS downlink and uplink (main and diversity) base-band digital signals and OAM information.

The following figure illustrates the RRH60 solution.

Figure 3 RRH60 solution with 9326 d2U V2 or 9396 d2U

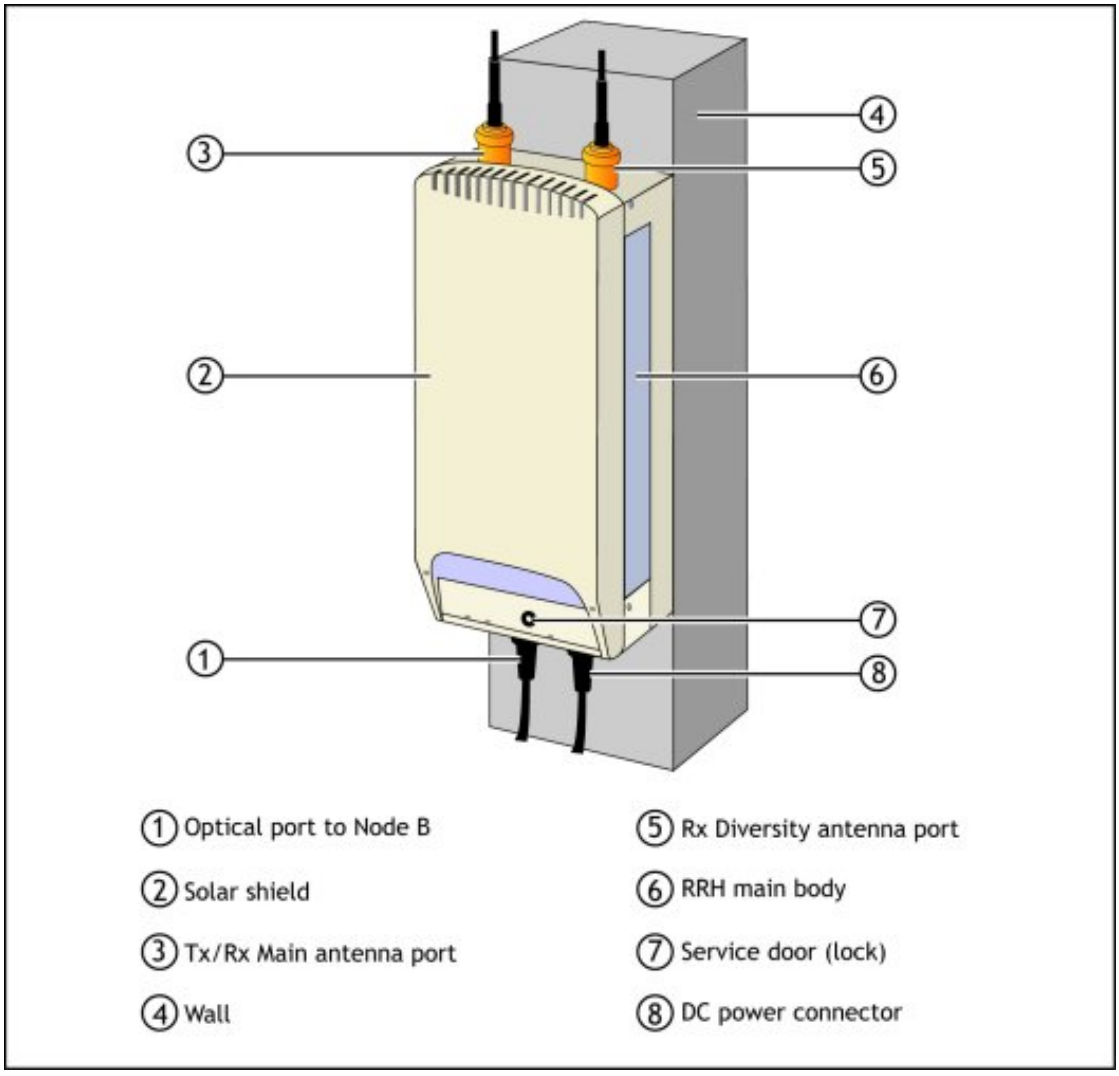


Note: Up to six RRH60s can be connected to a 9326 d2U V2 Phase 2.

As for traditional Macro Node B sites, the RRH60 combined with a 9326 d2U V2/9396 d2U Node B, delivers high UMTS radio performances and supports the enhanced High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA) solutions through easy software upgrade.

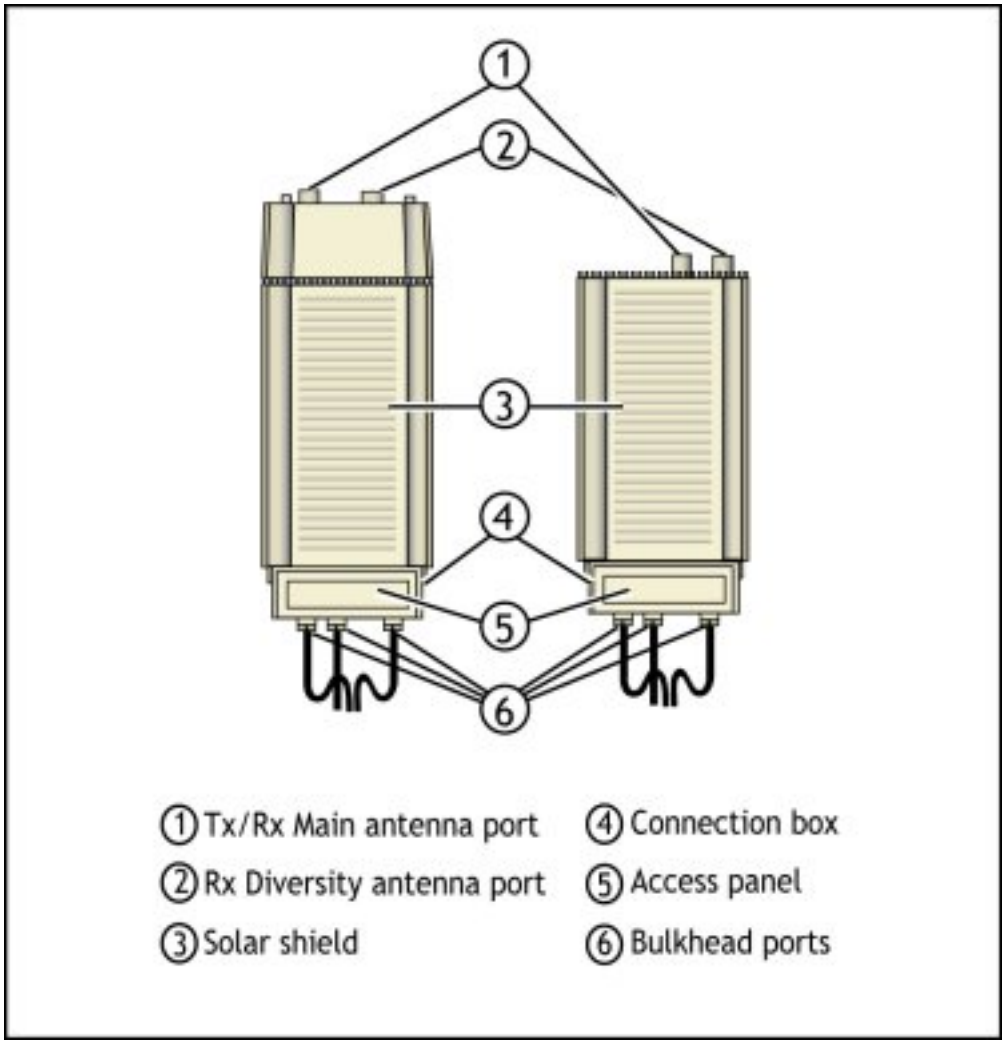
The following figure is a view of the RRH60-21/RRH60-09.

Figure 4 RRH60-21/RRH60-09 wall-mounted with solar shield



The following figure is a view of the RRH60-08 and the RRH60-19.

Figure 5 RRH60-08 and RRH60-19 with solar shield



Note: The RRH60-08 is on the left.

Benefits of the RRH60 solution

Compared to full size macro Node Bs, the RRH60 solution provides the following main benefits:

- easier site acquisition and installation, due to:
  - small footprint
  - low weight
- significantly reduced RF losses in uplink/downlink as optical fibers replace coaxial feeders
- reduced power consumption and increased efficiency as the RRH60 can be located closer to the antenna

- reduced acoustic noise, due to natural convection cooling
- longer battery backup time
- reduced maintenance requirements

6.2 RRH60 features and functions

The RRH60 supports the following functions:

- radio access and modem
- optical access
- configuration, supervision, alarm and failure monitoring
- part of call processing

Radio access and modem

The radio functions are the following:

- up-sampling, frequency up-conversion, amplification, and filtering
- filtering, low noise amplification, frequency down-conversion and down-sampling

The modem functions are the following:

- channel coding, modulation, summing and filtering
- filtering, demodulation and channel decoding

Optical access

This function provides duplex optical communication towards the Node B site through optical fibers using Single-Mode or Multi-Mode propagation:

- in Single-Mode propagation, one fiber carries both downlink and uplink signals using Coarse Wavelength Division Multiplexing (CWDM)
- in Multi-Mode propagation, one fiber carries the downlink signal, and another fiber carries the uplink signal

Configuration/supervision

This function is in charge of configuring and supervising the modules as well as ensuring inventory information reporting. The remote inventory functionality allows the UMTS OAM access to determine the state of the RRH60.

Call processing

The call processing function is in charge of radio resource management inside the base station equipment.

Call processing manages:

- UMTS services as described in 3GPP standards
- internal configuration and implementation services

The call processing function is also in charge of:

- channel setup and management for both common and dedicated channels
- cell management, power control, handover, and measurement processing

6.3 RRH60 external interfaces

The RRH60 is equipped with four main types of external interface:

- optical interface
- radio interface
- power supply interface
- Remote Electrical Tilt Automatic (RETA) interface

Optical interface

The optical interface consists of two optical links:

- one for communication between the RRH60 and the optical module of a d2U Node B, or the **previous** RRH60 in a daisy-chain configuration (future release)
- one for communication between the RRH60 and the **next** RRH60 in a daisy-chain configuration (future release)

Base-band data and OAM signals related to downlink and uplink are transmitted through one optical line (Single-Mode) or a pair of optical lines (Multi-Mode).

Radio interface

The radio interface consists of two RF ports that correspond to the connection to the Tx/Rx Main and Rx Diversity antennas for one sector only.

The following table lists the available frequency bands for the RRH60.

UMTS Standard	Uplink frequency band	Downlink frequency band
UMTS 2100 (band I)	1920-1980 MHz	2110-2170 MHz
UMTS 1900 (band II)	1850-1910 MHz	1930-1990 MHz
UMTS 850 (band V)	824-849 MHz	869-894 MHz
UMTS 900 (band VIII)	880-915 MHz	925-960 MHz

The radio interface impedance is 50 ohm.

Power supply interface

The RRH60 is supplied with a -48 V DC power supply.

RETA interface

The RRH60 is equipped with an interface for controlling the RETA. All physical and electrical specifications related to the RETA interface comply with the Antenna Interface Standards Group (AISG).

6.4 RRH60 equipment

The pieces of equipment described below concern the RRH60 variants.

The RRH60 main body mechanics is equipped with the following pieces of equipment:

- Solar shield

  The solar shield protects the RRH60 from solar radiation. It is factory-assembled to the RRH60 main body.

- Connection box (also called cable box)

  The connection box protects the RRH60 bottom connectors from climatic conditions. These bottom connectors are reachable through an access panel.

  Note: Caps are also used to protect connectors.

- Mounting kit

  A mounting kit is required to install the RRH60 on a wall, a pole, or a floor.

- Handle

  The handle facilitates installation. This handle is factory-assembled to the RRH60 main body and should be removed after installation.

6.5 RRH60 physical and environmental characteristics

The RRH60 has the following physical and environmental characteristics.

Physical characteristics

Note: The following figures are estimates (less or equal) from Feature Requirements Specifications.

	RRH60-21	RRH60-19	RRH60-09	RRH60-08
Height (mm)	520	470	500	592
Width (mm)	250	300	250	270
Depth (mm)	180	246	200	246
Weight[1] (kg)	20	21.8	20	24.2

[1]Solar shield included. Target: 16 kg

Environment

The RRH60 is designed to support an external temperature range of -40°C to +50°C (up to +55°C with solar shield), with an absolute humidity between 0.03 g/m^3 and 36 g/m^3.

The RRH60 has no fan and uses natural convection cooling.

The maximum amount of solar radiated energy on the external surfaces of the RRH60 enclosure is 1120 W/m^2.

7 RRH60 connectivity

All RRH60 ports are weatherized, allowing quick plug-and-play connections.

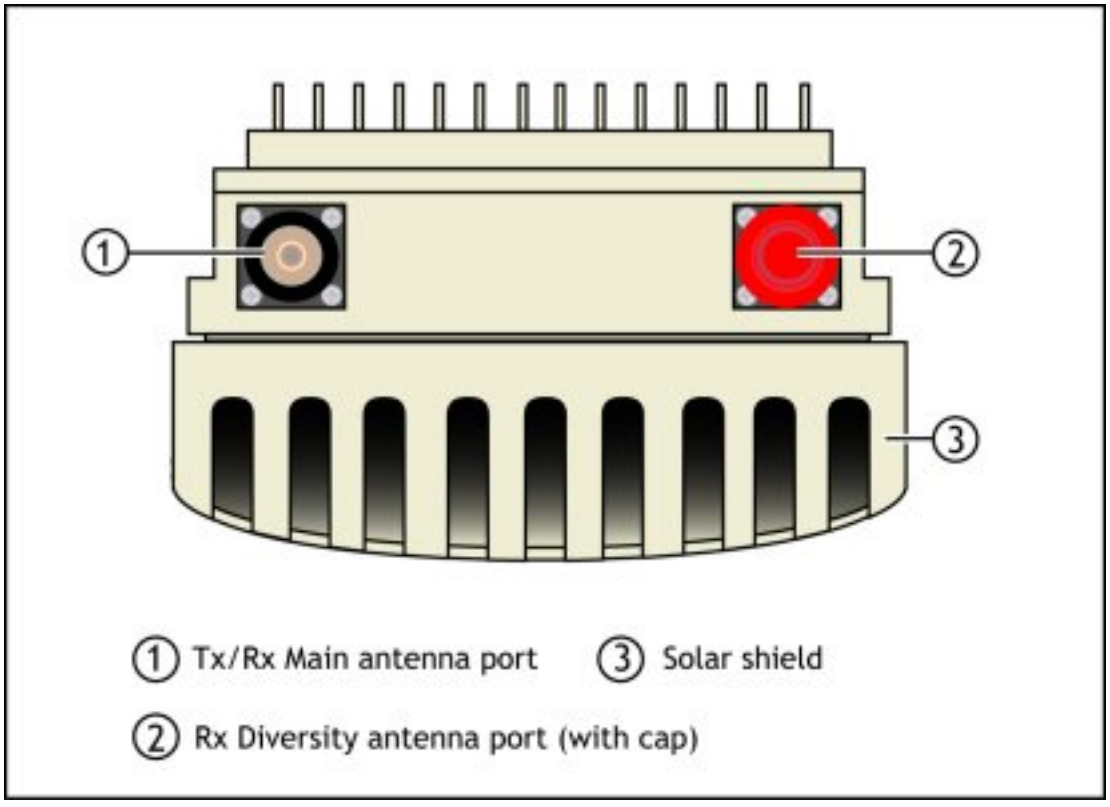
RRH60 top connectivity description

The following ports are available on top of the RRH60 main body:

- 7/16 female port for connection to Tx/Rx Main antenna (1)
- 7/16 female port for connection to Rx Diversity antenna (2)

The following figure details the connectivity on top of the RRH60-21/RRH60-09.

Figure 6 RRH60-21/RRH60-09 top connectivity



RRH60 bottom connectivity description

The bulkhead stands at the bottom of the RRH60 main body. It provides the following ports:

- an optical port for daisy-chain configuration (in a future release) (2)
- an optical port for connection to a Node B (10)
- a DC power port (7)

- an alarm port to report up to six external alarms (with RRH60-08) to the OMC (5)
- an AISG port (RS-485 protocol) for AISG RETA equipment (6)
- an Ethernet/RS-232 debug port (behind the service door) (4)

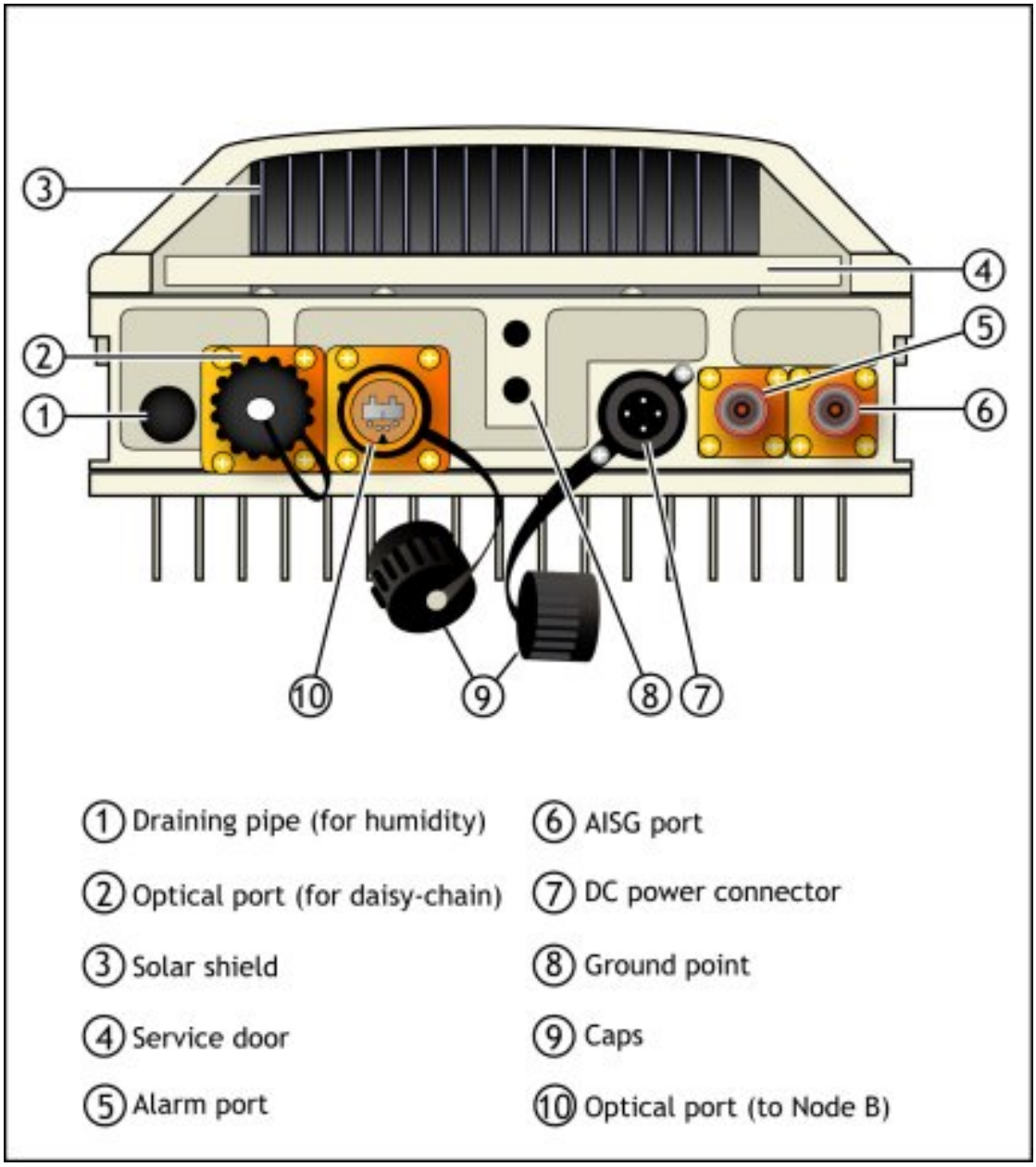
Three LEDs located beneath the service door (from left to right) indicate the RRH60 status.

Table 1 RRH60 status LEDs

LED 1	LED 2 (CPRI 0)	LED 3 (STATUS)	RRH60 status
OFF	OFF	OFF	Not powered
GREEN	GREEN	OFF	Link good
OFF	OFF	GREEN	Transmitting
OFF	OFF	GREEN BLINKING	Download in progress
RED	RED	OFF	No link
OFF	OFF	RED	Fault
OFF	OFF	AMBER	Powering-up
OFF	OFF	AMBER BLINKING	Waiting RAC configur-ation

The following figure details the connectivity at the bottom of the RRH60-21/RRH60-09.

Figure 7 RRH60-21/RRH60-09 bottom connectivity



Note: The optical port for daisy-chain (2) is not used since UA06.0.

8 Node B/RRH60 configurations

The Alcatel-Lucent 9341 RRH60 solution involves the following hardware components:

- RRH60s on the remote site
- an optical module on the Node B site

Implementation of the RRH60 solution

The implementation of the RRH60 solution in UA07.0 allows to connect, in **star configuration**, a maximum of six RRH60s to a d2U V2 Node B. Each RRH60 provides service to a single sector, which supports either a single-cell or a twin-cell configuration, allowing a maximum of two managed cells per RRH60. As a result, a maximum of twelve remote cells can be provisioned with six RRH60s.

In a future release, more cells will be provisioned by **daisy-chaining** three RRH60s to a single fiber link coming from the Node B.

Node B hardware requirements for RRH60 support

The following Node Bs are programmed to support RRH60s:

- 9326 d2U V2 Phase 2
- 9396 d2U (with RRH60-19/RRH60-08)

The following optical modules can be housed in a digital Node B connected to RRH60s.

Optical module	digital Node B	Optical ports	RRH60s (in star configuration)
extended Core Controller Module-U (xCCM-U)	9326 d2U V2 Phase 2	Six	Six
OneBTS CPRI Module (OCM-II)	9396 d2U	Three	Three RRH60-19 or RRH60-08

Each optical module is equipped with either Single-Mode (SM) or Multi-Mode (MM) optical transceivers.

Note:

SM stands for Single-Mode optical fiber: a single fiber is used for both uplink and downlink signals.

MM stands for Multi-Mode dual optical fibers: one fiber is used for downlink signals, another is used for uplink signals.

SM interfaces and single fibers allow the associated RRH60 to be located up to **20 km** from the Node B site.

MM interfaces and dual fibers allow the associated RRH60 to be located up to **500 m** from the Node

B site.

9 RRH60 optional equipment

This part presents the optional equipment supported by the RRH60.

9.1 Dual Duplexer Sharing Module (DDSM)

The DDSM is part of an antenna sharing solution which consists in reusing a GSM antenna system (antennas + feeders + TMA) when combining a UMTS 900 Node B (here, a 9341 RRH60) with a GSM 900 BTS (9100 MBI or 9100 MBO).

The DDSM (PEC: NTUM40MA) operates within the 900 bandwidth (DDSM 900):

- 925-960 MHz in downlink
- 880-915 MHz in uplink

Main functions

The DDSM is made of one Transmit (Tx) filter and two Receive (Rx) filters.

The DDSM is inserted on the antenna diversity path.

Note: It can only be used when the antenna diversity path is not used for GSM Tx path.

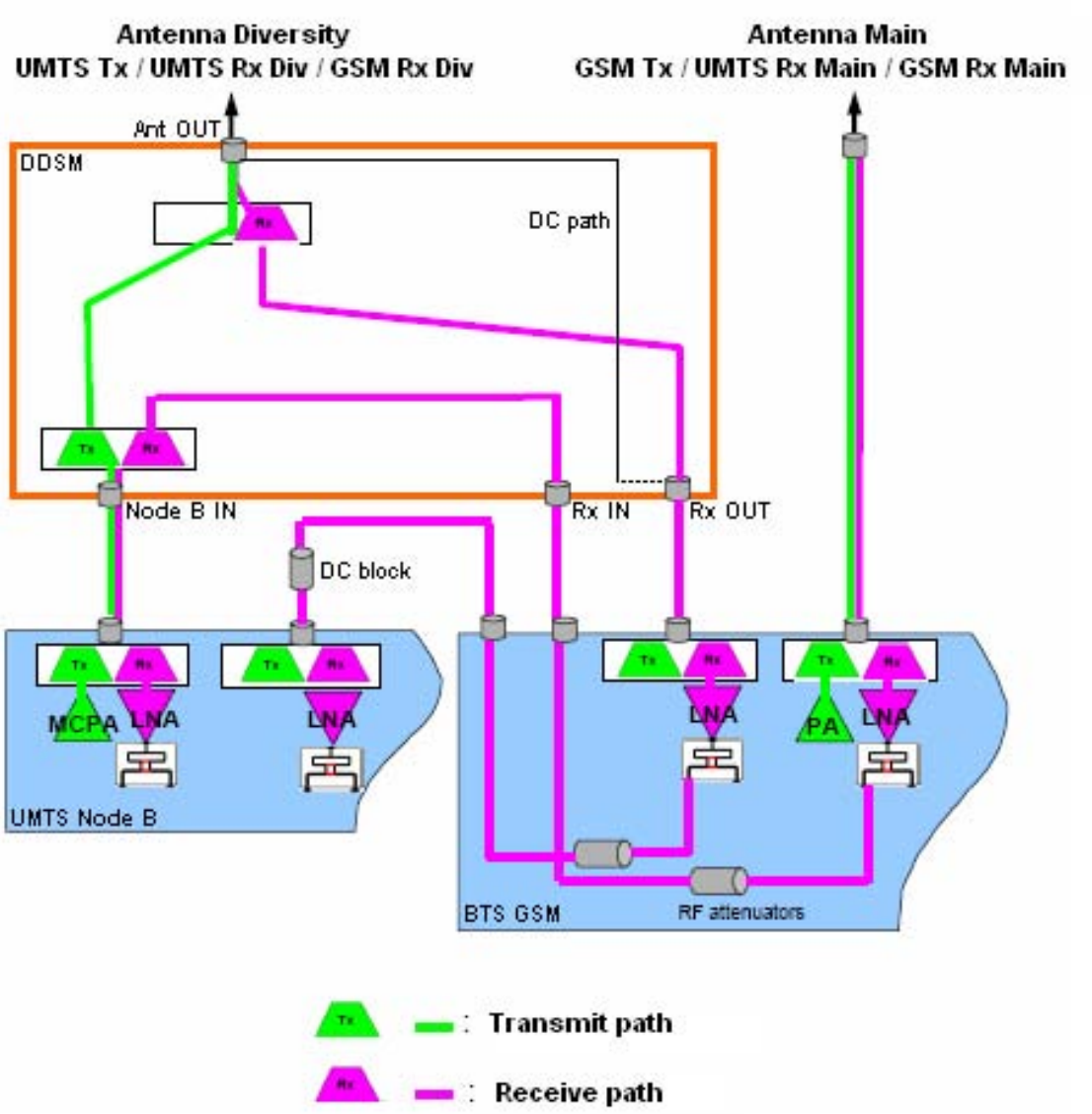
On the Tx path, the downlink signal is distributed through the DDSM, from the Node B IN port to the Antenna OUT port.

On the Rx path, the uplink signal is distributed in two ways:

- through the DDSM (from the Antenna OUT port to the Rx OUT port) and then through the GSM Rx Div path

  Note: There is a DC path between the Antenna OUT port and the Rx OUT port to support a GSM TMA.
- through the GSM Rx Main path, and then through the DDSM (from the Rx IN port to the Node B IN port)

Figure 8 DDSM block diagram



Hardware description

The DDSM is equipped with the following connectors:

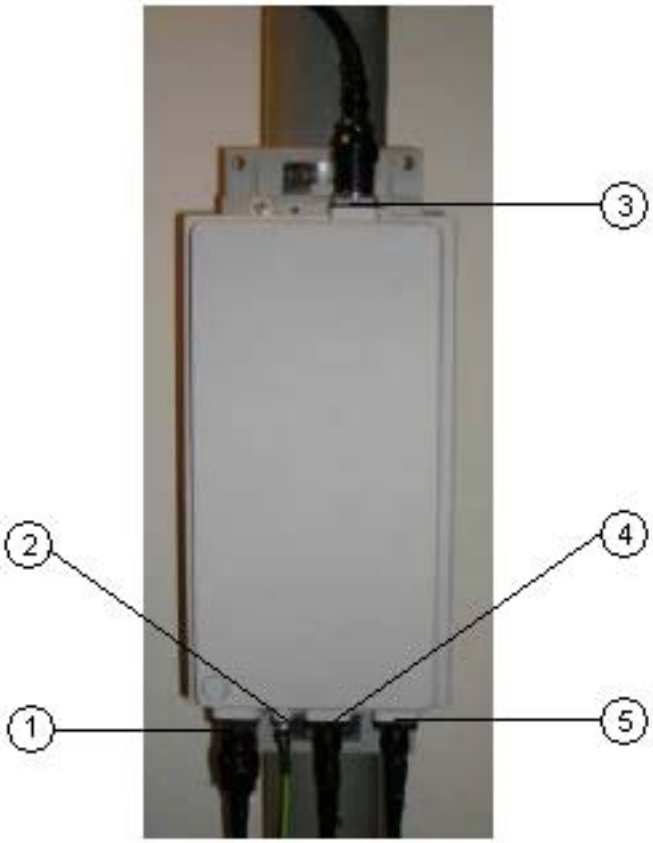
- one Node B input port (7/16 female connector)
- one ground port (N female connector)
- one antenna diversity output port (7/16 female connector)

- one Rx input port (N female connector)
- one Rx output port (N female connector)

The following figure shows the different connectors of a DDSM cabled and fixed on a pole (50-140 mm).

Note: The DDSM can also be fixed on a wall.

Figure 9 DDSM front view



1. Node B IN port
2. Ground port
3. Antenna OUT port
4. Rx IN port
5. Rx OUT port

The DDSM has the following characteristics:

- Height x Width x Depth: 461 x 201 x 102 mm
- Weight: 5.8 kg

- Operating temperature range: -40°C/+50°C
- Convection: Natural
- Power consumption: None (passive module)

9.2 RF lightning protector

An optional lightning protection can be connected to the outside of the RRH60, on each 7/16 female RF connector.

Wireless Service Provider Solutions
W-CDMA
Alcatel-Lucent 9341 Remote Radio Head 60W
Technical Description

Alcatel-Lucent - Internal - Proprietary - Use pursuant to Company instruction

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