RDS Configuration Options

Radio Dot System

Description

1/1551-FGB 101 0308/1 Uen E3A

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Contents

1 Introduction

This document provides information for the Radio Dot System deployment scenarios.

1.1 Intended Audience

This document is intended for system administrators and other users assigned to install and commission the Radio Dot System environment.

Personnel working on Ericsson products or systems must have training and competence required to perform their work correctly.

Note: System operation and maintenance (O&M) is only to be performed by authorized personnel.

1.2 Prerequisite Knowledge

It is required that the user of this document meets the following prerequisites:

- Good understanding of the RDS.
- Good knowledge of O&M of the network management system. For high-level overview information, refer to the following documents:
  - Operations Support Systems Radio and Core (OSS-RC):
    - *Introduction to OSS-RC*, 1555-AOM 901 166
    - *OSS-RC System Administration Guide*, 1543-AOM 901 166
  - Ericsson Network Manager (ENM):
    - *ENM Product Description*, 1/1551-AOM 901 151
    - *ENM System Administrator Guide*, 1/1543-AOM 901 151
- Necessary access and authorization to the network management system and Network Elements (NEs). For information on security management controls and functions, refer to the following documents:
  - OSS-RC:
    - *Overall Security Administration in OSS-RC*, 3/1543-APR 901 911
  - ENM:
    - *ENM Security System Administrator Guide*, 2/1543-AOM 901 151.

— Verified the IP address for remote O&M access to the node.

2 Overview

This section provides a brief description of deployment configurations offered by the Radio Dot System.

For detailed information on RDS-specific feature configurations, refer to the following documents:

— *Combined Cell*, 7/1553-FGB 101 0308/1

— *Carrier Aggregation*, 6/1553-FGB 101 0308/1

— *Multi-Standard Mixed Mode*, 8/1553-FGB 101 0308/1

— *Distributed IRU Configuration*, 155/1543-FGB 101 0308/1

— *4x4 MIMO on Radio Dots*, 12/1553-FGB 101 0308/1-V1

— *Multi-Operator RAN*, 14/1553-FGB 101 0308/1

3 RDS Configuration Deployments

The following sections address the different configurations supported in RDS.

Note: An IRU cannot connect to different types of Radio Dots at the same time.

3.1 Radio Dot Interface (RDI) Cable

The Radio Dot Interface (RDI) is the cabling between the IRU and the Radio Dots. It is composed of the Patch cable + Feeder cable + Jumper cable.

For information on the certifying testing and the maximum length, refer to the RDI Cabling Guidelines, 15/1553-FGB 101 0308/1.

3.1.1 Radio Dot Interface Overview

The RDI is all cables and connectors between the Indoor Radio Unit (IRU) and the Radio Dot. This link is either analog or digital depending on the equipment deployed. It begins at the IRU to the end at the Radio Dot.

The RDI can be divided into three parts:

— RDI feeder cables - RDI permanent link. Between the patch panel and the connection box (optional)

— RDI patch cables - cables between IRU and patch panel

— RDI jumper cables - patch cables between Radio Dot and connection box (optional)

[unresolved external reference] shows an example of the possible configurations. Option one (1) shows an RDI link with patch panel and no connection box. Options two (2) shows an RDI link with patch panel and connection box.

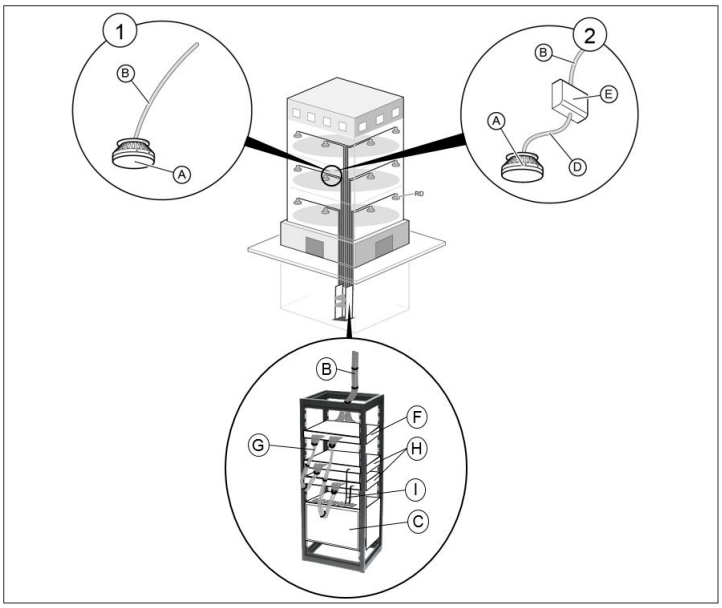

Figure 1 RDI Overview, Example Configurations

Table 1 RDI Components

Position	Component
A	Radio Dot
B	RDI Feeder Cable
C	RBS cabinet with 8U subrack for Baseband 5212, Baseband 5216, IDU 5205 and IDU 5209. It also supports IRU 2242. Baseband 6620 and Baseband 6630 are mounted directly in the 19 inch rack.
D	RDI Jumper Cable (optional)
E	Connection Box (optional)
F	Patch Panel
G	RDI Patch Cables
H	IRU 8844, IRU 8846, IRU 8884. IRU 2242 is located within the RBS cabinet or a Remote IRU Enclosure 2242.
I	CPRI cables between IRU and Baseband

The typical deployment requires a patch panel. The patch panel is of the type without ports already installed to allow for the terminated feeder cable to clip into it. For supplemental details on the patch panel and the termination of the feeder cable, refer to Cable Termination and Patch Panel Guidelines, 9/1553-FGB 101 0308/1.

3.2 Star Configuration

The star configuration is implemented for medium to large building deployments. The Digital Unit (DU) or Baseband unit and the Indoor Radio Unit (IRU) are co-located with Radio Dots deployed in a star configuration. This is a common configuration for single tenant enterprise buildings. The DU or Baseband unit and the IRU are connected through a digital or a fiber CPRI cable in the equipment room and the IRU is connected to the Radio Dots using CAT 6A cables through risers and horizontal plenums.

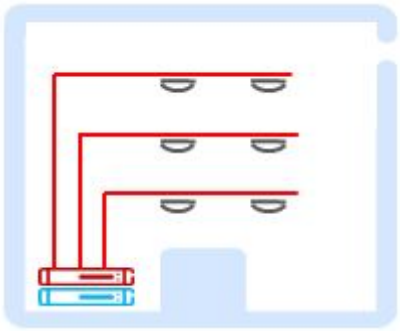

Figure 2 Star Configuration

3.3 Distributed IRU Configuration

In the distributed deployment configuration, the DU or Baseband unit is centrally located in the building. Generally, this is the equipment room. The IRUs are distributed to different floors or building segment levels. The IRUs are connected to the DU or Baseband unit using optical fibers. Each IRU (floor or building segment) is connected to the Radio Dots for that segment.

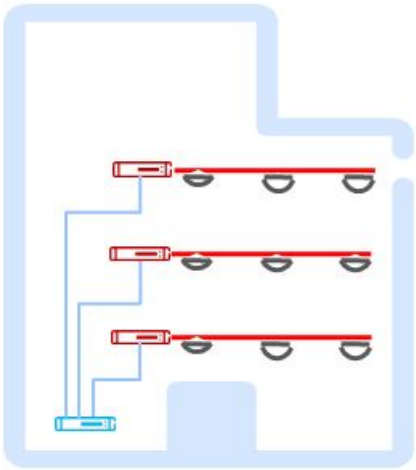

Figure 3 Distributed Configuration

3.4 Cascaded IRU Configuration

The cascaded IRU configuration takes advantage that the limiting number of ports on the DU or Baseband unit can be exceeded by cascading sub-tending additional IRUs from a primary IRU. The IRU limit is then dependent on the CPRI speed (2.5, 4.9, or 9.8 Gbps), the configuration chosen, and the DU or Baseband unit type. The first hop from DU or Baseband unit to IRU is 4.9 or 9.8 Gbps depending on the bandwidth used downstream.

Depending on the distance, an electrical or fiber CPRI cable can be used for cascading IRUs. For information on selecting and handling Small Form-Factor Pluggable (SFP) modules, refer to the following documents:

— *SFP Module Selector Guide* 3/006 51-HRB 105 601.

— *Handling SFP Modules and Optical Cables* 55/1553-LZA 701 6009/1.

Attention!

A maximum of 12 IRUs can be supported by a Digital Unit or a maximum of 24 IRUs can be supported on a Baseband unit with the proper licenses. This must be considered when planning IRU cascading.

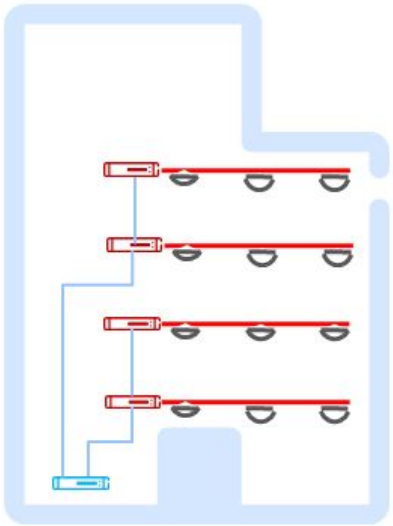

Figure 4 Cascaded Configuration

In the cascaded IRU configuration, Port 1 of the primary IRU receives the CPRI link from the DU or Baseband unit. Port 2 of the primary IRU is connected to Port 1 of the secondary IRU to propagate the CPRI link.

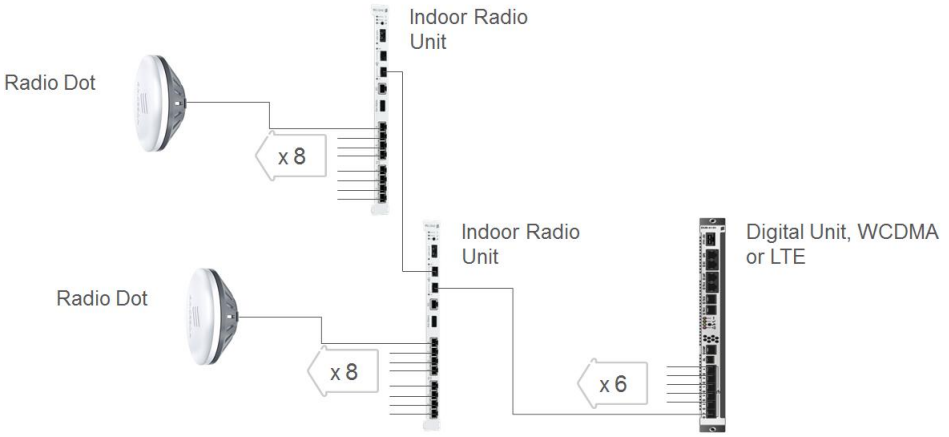

Figure 5 Cascaded IRU Connectivity

Cascading can take a few configurations depending on the technology and how many ports are used on the DUS/DUW.

The first configuration applies to both LTE and WCDMA. It has the IRUs cascaded in groups of two levels at the most. This implies that all the ports of the Digital Unit are utilized (12 IRUs total).

The following figures represent the different configuration options supported:

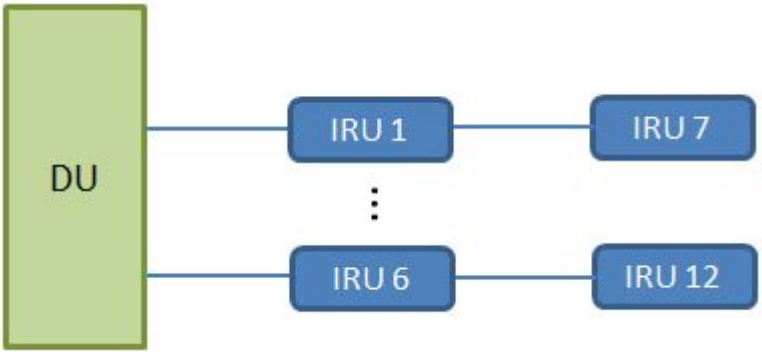

Figure 6 IRU Cascading One Level Single DU Single Mode

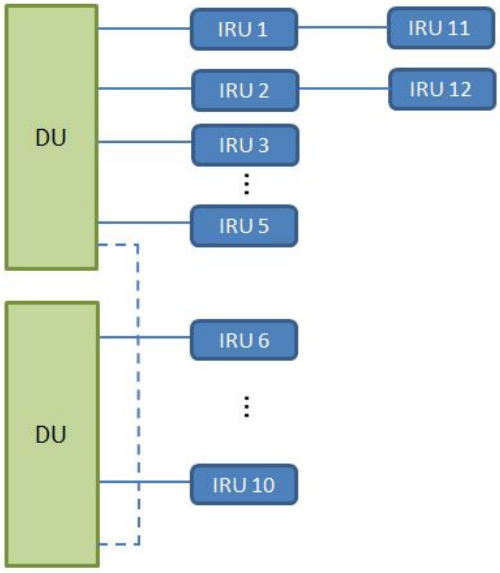

Figure 7 IRU Cascading One Level Dual DU Cascading Single Mode

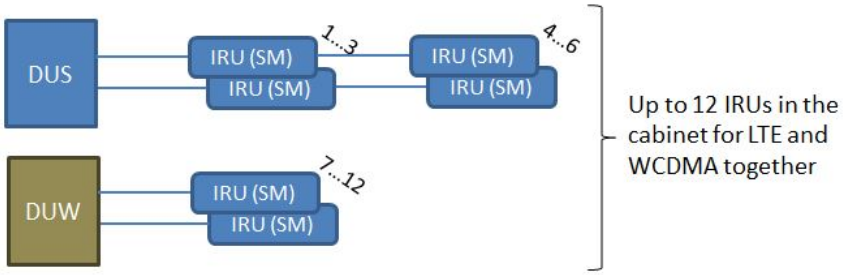

Figure 8 IRU Cascading One Level Single Mode

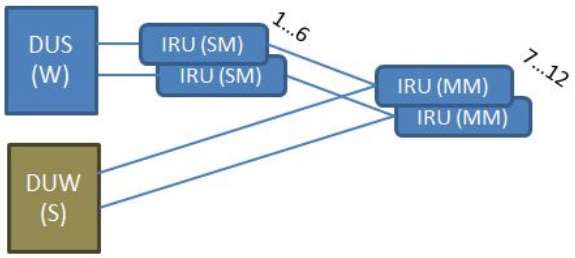

Figure 9 IRU Cascading One Level Single Mode - Mixed Mode

Baseband 5216, Baseband 6630 and IDU 5209 can support up to 6 Level cascading. This value is dependent on factors such as, but not limited to, instantaneous bandwidth of the Baseband, the number of carriers, the number of cells, and the radio access technology used for the carriers.

4 Level cascading and above require a 19 to 24 Cells Support feature license and using an Enhanced IRU as primary IRU.

The following figure shows an example with 4 Level cascading.

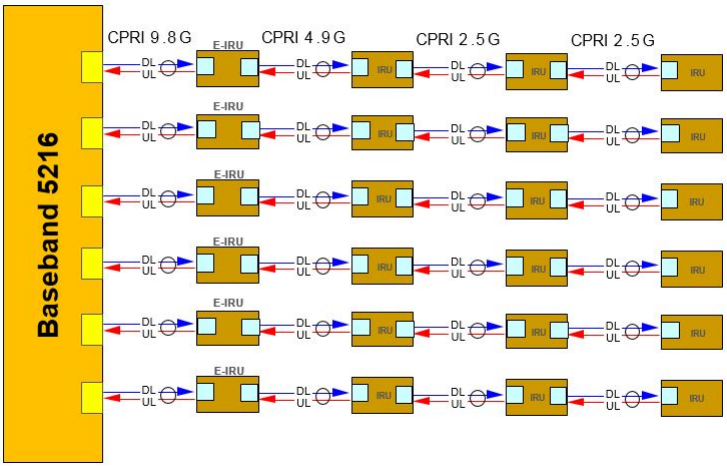

Figure 10 4 Level Cascading

For more information on cascading and IRU configurations, refer to:

— *RBS Configurartions*, 24/1551-LZA 701 6001/1.

— *IDU Description IDU 5205, IDU 5209*, 59/1551-LZA 701 6001/1.

3.5 18 Cell Support with One Baseband

The 18 Cells Support with one Baseband only applies to LTE. The 18 Cells Support configuration supports up to 18 IRUs on one LTE Baseband 5216 or Baseband 6630 with or without one Baseband R503. In a cascaded configuration, the first IRU in the cascaded chain must be an Enhanced IRU (E-IRU). The speed of the aggregated CPRI is entirely dependent on the capability of the baseband and the carrier bandwidth used. For more information on cascaded IRU configuration, refer to RDS Configuration Options, 1/1551-FGB 101 0308/1 and RBS Configurations, 24/1551-LZA 701 6001/1.

Note: Baseband R503 is an optional hardware unit that increases connectivity for new and existing radio units in large radio system configurations. It is a platform for CPRI rearrangement, for instance, multiplexing / de-multiplexing as well as media conversion (electrical to and from optical).

The following features must be enabled for 18 Cells Support:

— 6 Cell Support, FAJ 121 1821

  For information on this feature, refer to 6 Cell Support, 53/221 04-LZA 701 6014/1.

— 7-12 Cell Support, FAJ 121 3020

  For information on this feature, refer to 7-12 Cell Support, 171/221 04-LZA 701 6014/1.

— 13-18 Cell Support, FAJ 121 4242

  For information on this feature, refer to 13-18 Cell Support, 4/221 04-LZA 701 6014/1.

The following figures are examples of 18 IRU Support configuration:

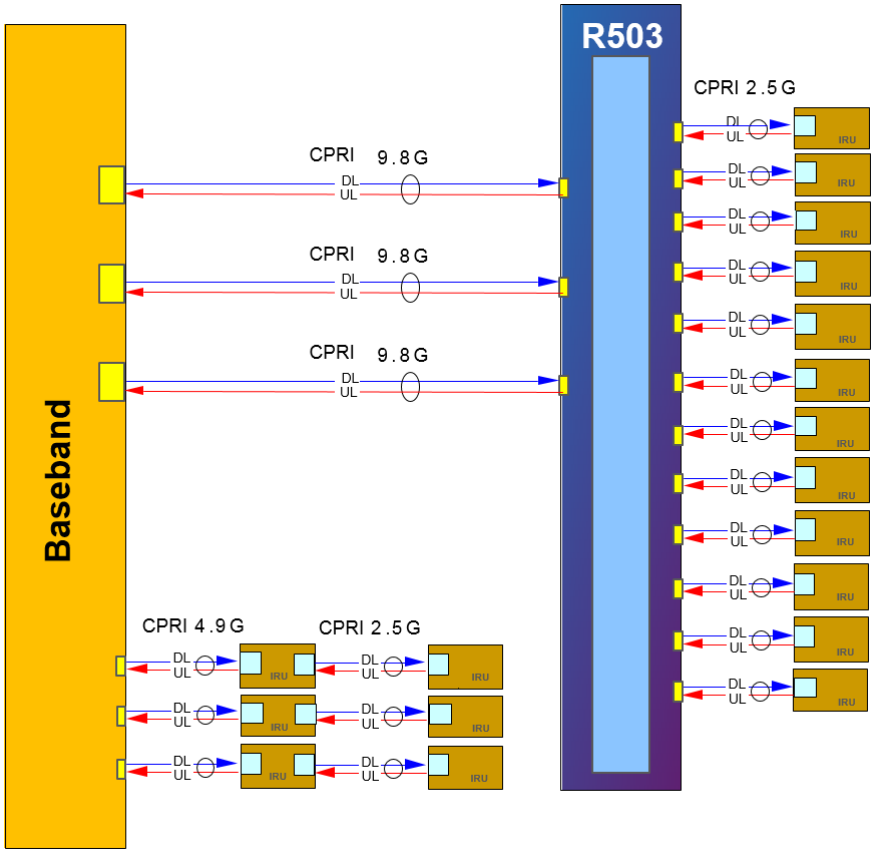

Figure 11 18 Cells Support with Baseband R503

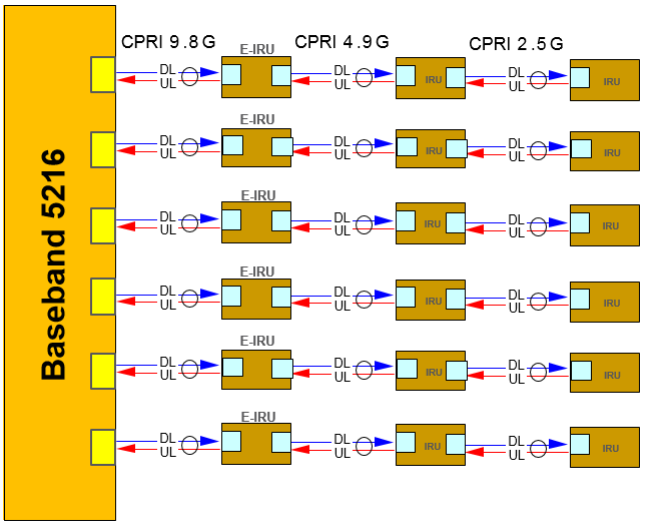

Figure 12 18 Cells Support with Baseband 5216 and Cascaded IRU

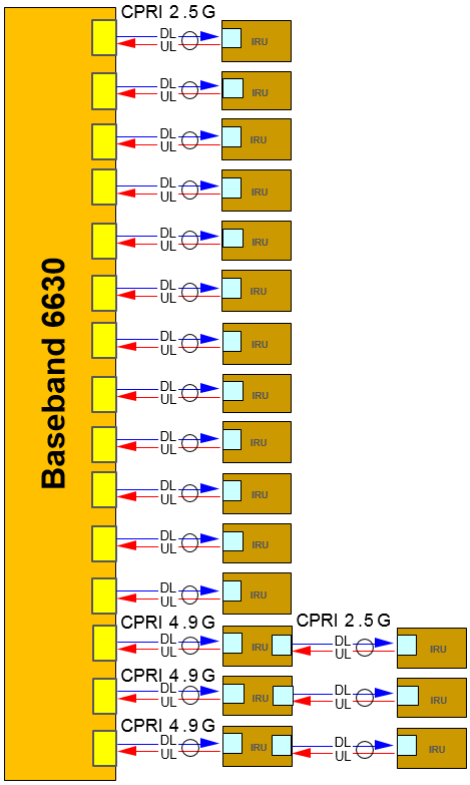

Figure 13 18 Cells Support with Baseband 6630

3.6 24 Cell Support with One Baseband

The 24 Cells Support with one Baseband only applies to LTE. The 24 Cells Support configuration supports up to 24 IRUs on one LTE Baseband 5216 or Baseband 6630 with or without one Baseband R503. In a cascaded configuration, the first IRU in the cascaded chain must be an Enhanced IRU (E-IRU). The speed of the aggregated CPRI is entirely dependent on the capability of the baseband and the carrier bandwidth used. For more information on cascaded IRU configuration, refer to RDS Configuration Options, 1/1551-FGB 101 0308/1 and RBS Configurations, 24/1551-LZA 701 6001/1.

Note: Baseband R503 is an optional hardware unit that increases connectivity for new and existing radio units in large radio system configurations. It is a platform for CPRI rearrangement, for instance, multiplexing / de-multiplexing as well as media conversion (electrical to and from optical).

The following features must be enabled for 18 Cells Support:

— 6 Cell Support, FAJ 121 1821

  For information on this feature, refer to 6 Cell Support, 53/221 04-LZA 701 6014/1.

— 7-12 Cell Support, FAJ 121 3020

  For information on this feature, refer to 7-12 Cell Support, 171/221 04-LZA 701 6014/1.

— 13-18 Cell Support, FAJ 121 4242

  For information on this feature, refer to 13-18 Cell Support, 4/221 04-LZA 701 6014/1.

— 19-24 Cell Support, FAJ 121 4426

  For information on this feature, refer to 19-24 Cell Support, 347/221 04-LZA 701 6014/1.

The following figures are examples of 24 IRU Support configuration:

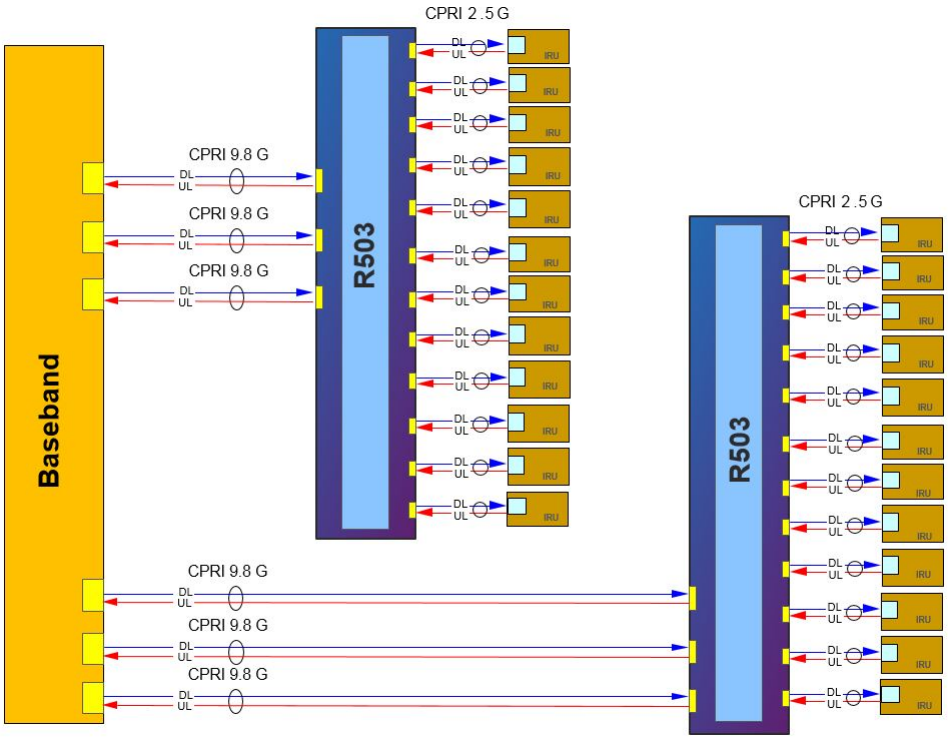

Figure 14 24 Cells Support with Baseband R503

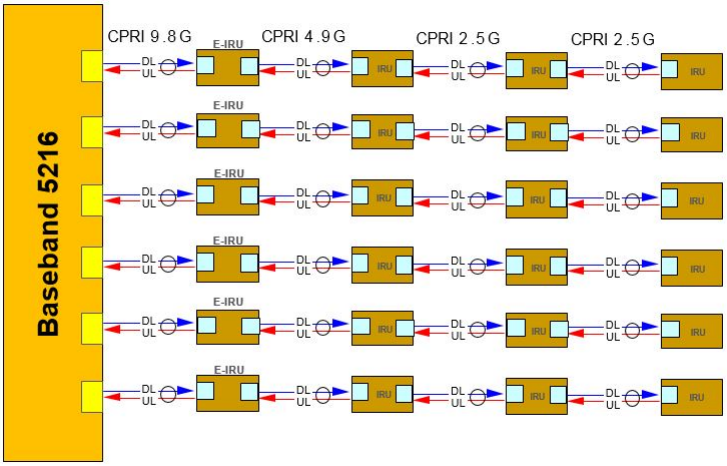

Figure 15 24 Cells Support with Baseband 5216 and Cascaded IRU

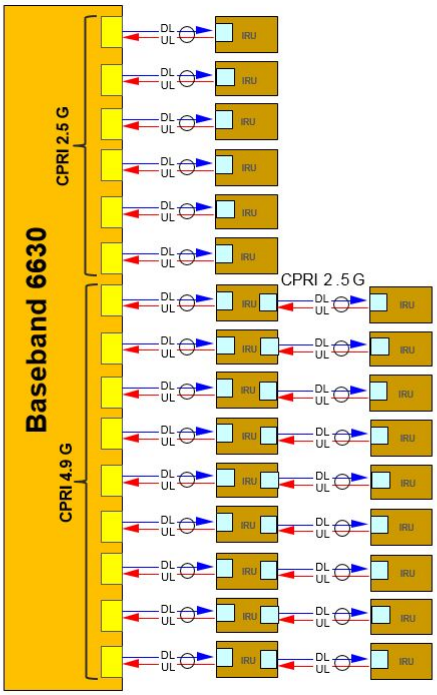

Figure 16 24 Cells Support with Baseband 6630

3.7 Multi-Standard Managed Element (MSME) Baseband

A Multi-Standard Managed Element (MSME) is a Baseband radio node ME which runs two Radio Access Technologies (RATs) simultaneously, using a single Baseband unit (Baseband 5216 or Baseband 6630). It is possible to use a combination of single mode and mixed mode IRUs. The IRU can be shared with two different RATs or a single IRU can have a single RAT.

The feature license and activation of the feature Mixed Mode Baseband is required for each RAT to operate a mixed mode ME:

— Mixed Mode Baseband LTE, FAJ 121 4565

— Mixed Mode Baseband WCDMA, FAJ 121 4566

The feature license and activation of the feature Mixed Mode Radio is required for each RAT for sharing radio units.

— Mixed Mode Radio LTE, FAJ 121 0906

— Mixed Mode Radio WCDMA, FAJ 121 1553

The feature license and activation of the feature 7-12, 13-18 or 19-24 Cell Support is required when the configuration exceeds six cells.

A maximum number of 12 IRUs can be connected to one MSME Baseband.

The maximum capacity for an MSME Baseband 5216 or an MSME Baseband 6630 is:

— LTE: 12 cells with 20 MHz carrier

— WCDMA: 12 cell carrier with 5 MHz carrier

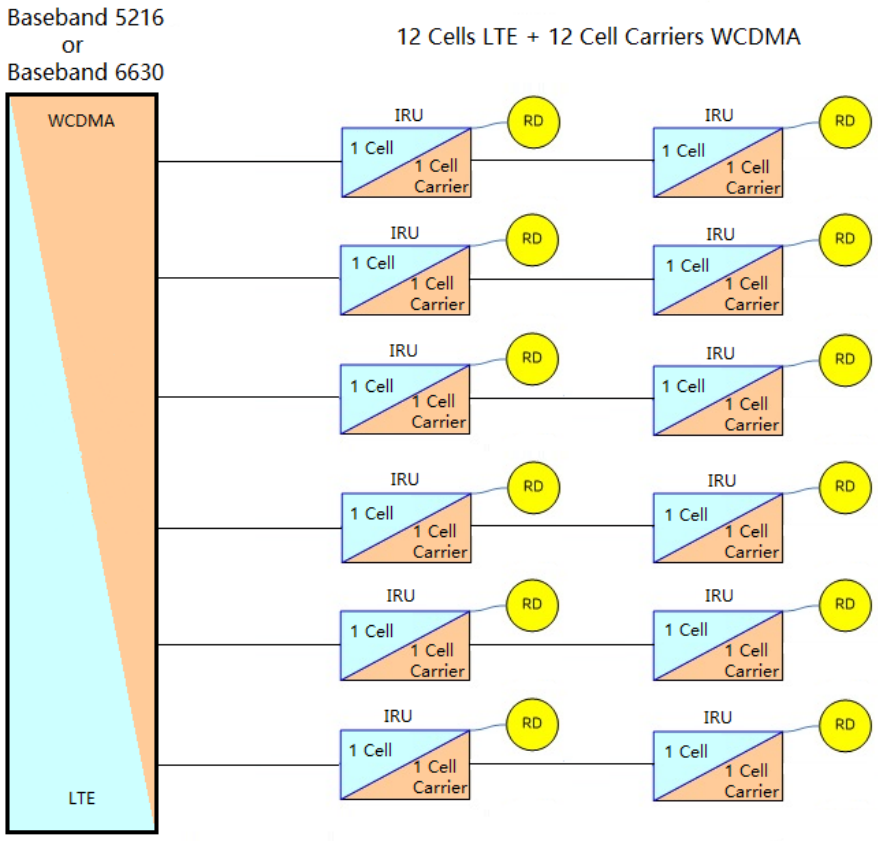

Figure 17 MSME Baseband - LTE and WCDMA

For more information on managing Mixed Mode Managed Element and Mixed Mode Radio, refer to the following documents:

— Manage Mixed Mode Managed Element, 63/1553-LZA 701 6014/1

— Manage Mixed Mode Radio, 53/1553-LZA 701 6014/1

3.8 Deployment Layout

Radio signal leakage between floors of a building can be quite strong (as low as 10 dB isolation), if the floors exhibit low penetration loss. This creates an Radio Dot layout dependency on whether adjacent floors are fed from the same cell:

— If adjacent floors are fed from a different cell/IRU: The Radio Dots must be placed in line. This allows the Radio Dots on one floor to counter the interference from the adjacent floor without creating handover boundaries or affecting the Signal-to-Noise Ratio (SINR).

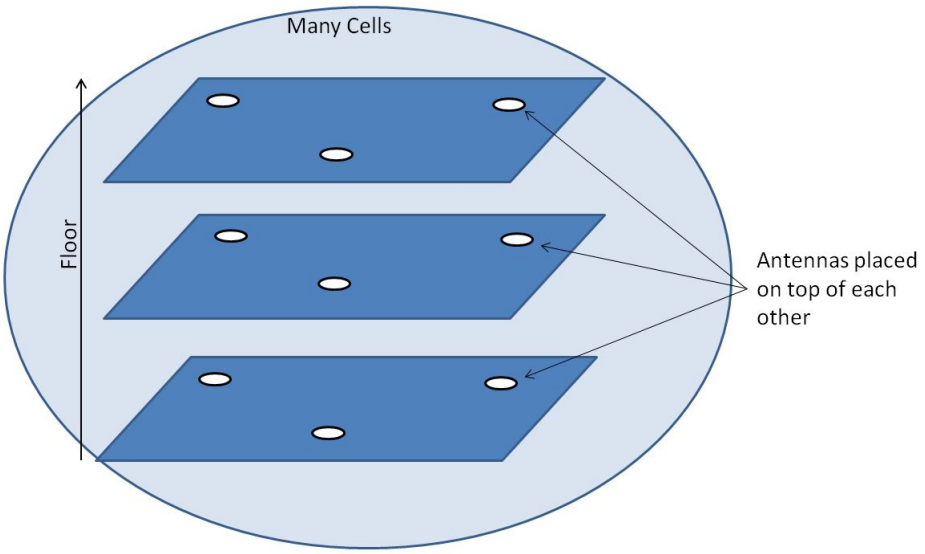

Figure 18 Combined Cell - Many Cells

— If adjacent floors are fed from the same cell (same IRU or Combined Cell): Radio Dots must be placed in a zig-zag pattern. This allows Radio Dots from the adjacent floor to fill in "cold" spots. Since they belong to the same cell, no handover boundary is created.

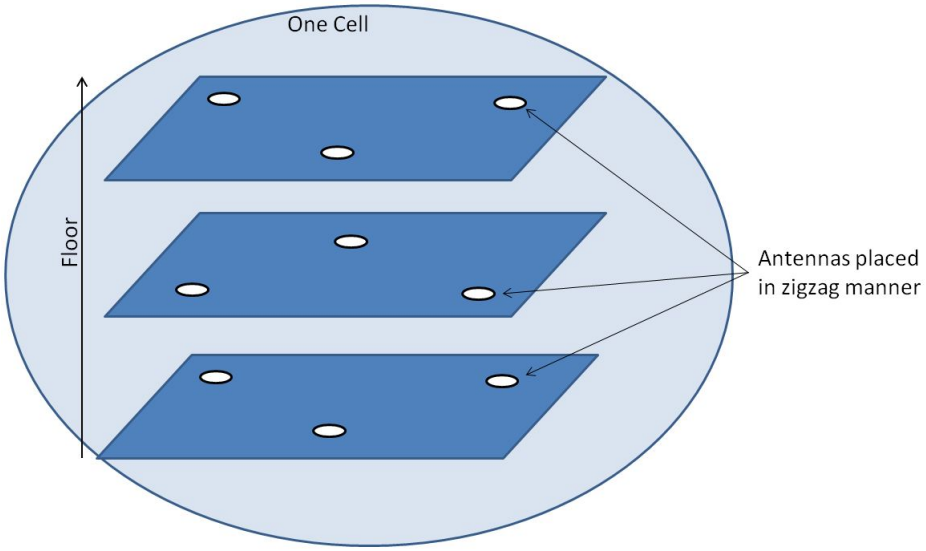

Figure 19 Combined Cell - One Cell

3.9 Mixed Mode Configuration

RDS supports Multi-Standard Mixed Mode (MSMM) configurations. By definition, this means LTE + WCDMA technologies are within the same RBS.

3.9.1 MSMM Power

In the MSMM configuration, the RBS hosts both the WCDMA as a primary DU or Baseband unit and the LTE as a secondary DU or Baseband unit. When planning, ensure that each branch does not exceed 50 mW of transmit power. For example, in the following figure, the total sum of the transmit power for W1, W2, and L1 on branch A must be within 50 mW (17 dBm).

Note: In WCDMA, transmit power is referred to in decibel absolute value (dBm) on the RNC and in milliwatts (mW) on the NodeB. In LTE, transmit power is referred to in mWs. Also, WCDMA applies the transmit power value to the branch level (the whole branch) and LTE applies the transmit power to the Radio Dot (both branches).

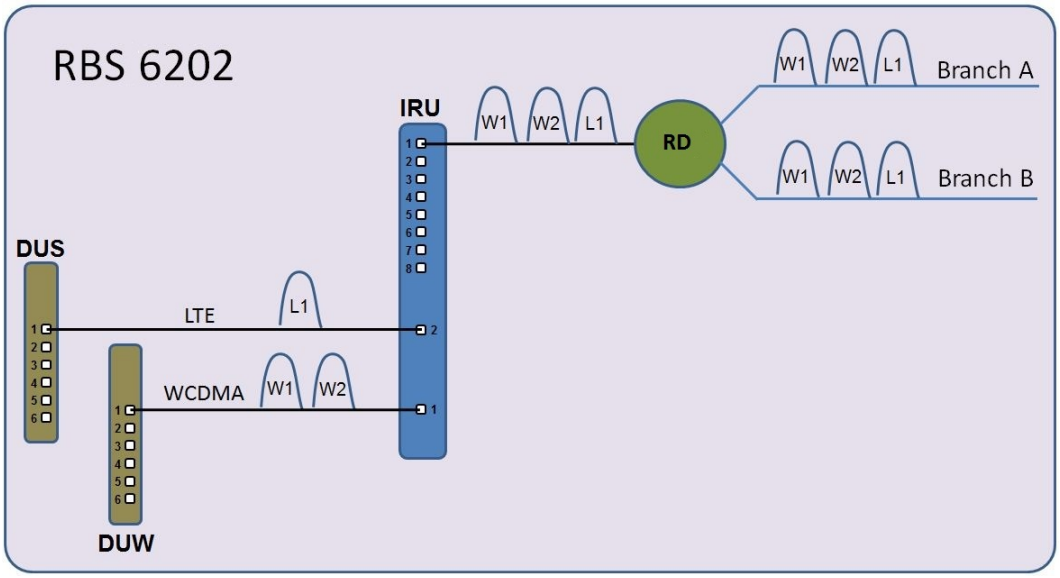

Figure 20 Multi-Standard Mixed Mode

The following example shows three carriers sharing power over a branch:

Example 1 Power Calculation

```
3 carriers = 16.6 mW each
W1 = 16.6 mW = 12.2 dBm
W2 = 16.6 mW = 12.2 dBm
L1 = 16.6 mW
Therefore the configuration will be for:
```

```
WCDMA branch A 16.6 mW and WCDMA branch B 16.6 mW
LTE 33.2 mW (16.6 per branch)
```

3.9.2 MSMM Synchronization

When GPS Receiver configuration is used for synchronization, the Multi-Standard Mixed Mode feature requires the following WCDMA feature to be activated:

```
featureStateAbsoluteTimeSynch
```

3.9.3 MSMM Licenses

The following licenses must be obtained for MSMM to be enabled and operational:

- MSMM for LTE: FAJ 121 0906 for KeyID: CXC 401 1018
- MSMM for WCDMA: FAJ 121 1553 for KeyID: CXC 402 0051
- AbsoluteTimeSynch for WCDMA: FAJ 121 1554

3.10 Multi-Operator RAN Configuration

The purpose of the Multi-Operator RAN is to have two nodes that belong to different operators share the radio units as in a mixed mode configuration. Each node represents different eNodeBs in the LTE RAN. Nodes that are installed in the same cabinet share the support system.

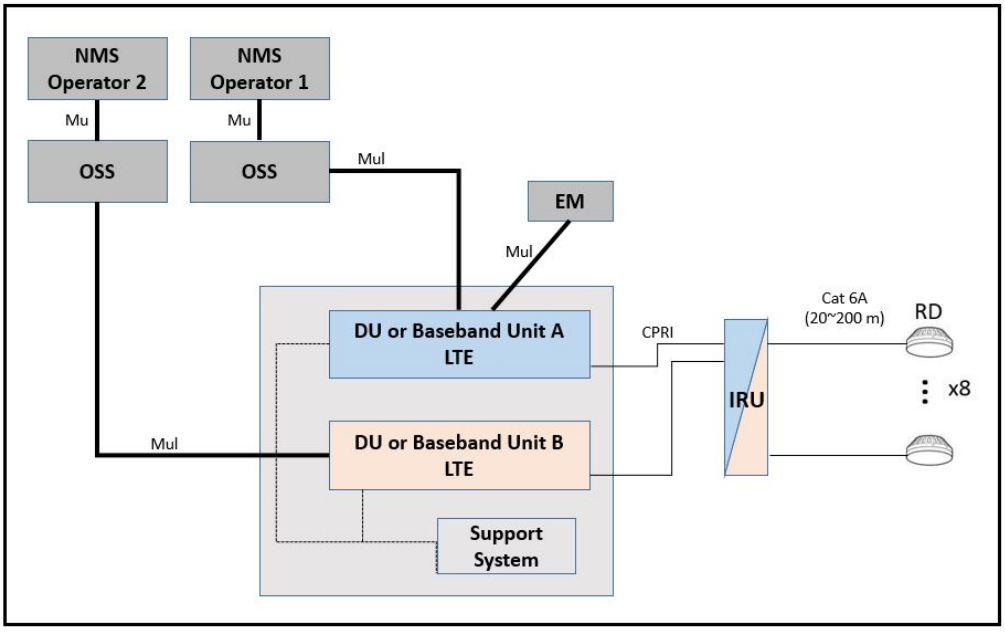

Figure 21 Two LTE Nodes Each Consisting of One DU or Baseband Unit and Belonging to Two Different Operators

For a DU radio node, the following licenses must be obtained, applied, and activated to enable Multi-Operator RAN:

— Mixed Mode Radio, license key CXC 401 1018

— Multi-Operator, license key CXC 401 1512

For a Baseband radio node, the following licenses must be obtained, applied, and activated to enable Multi-Operator RAN:

— Mixed Mode Radio, license key CXC 401 2015

— Multi-Operator, license key CXC 401 1512

For more information on the Multi-Operator RAN feature on the RDS, refer to *Multi-Operator RAN*, 14/1553-FGB 101 0308/1.

3.11 4x4 MIMO on Radio Dots Configuration

A 2x2 MIMO network configuration consists of one IRU with up to 8 Radio Dots installed. To support 4x4 MIMO and achieve stable performance, the RDS requires a second IRU with additional Radio Dots (up to eight) installed. These additional Radio Dots are co-located in close proximity to the Radio Dots connected in the first IRU or distributed throughout the landscape. The two IRUs are configured in the same cell.

Typical RDS 4x4 MIMO greenfield network deployments for Co-Located and Distributed Radio Dots using single band or dual band Radio Dots are shown in the following figures.

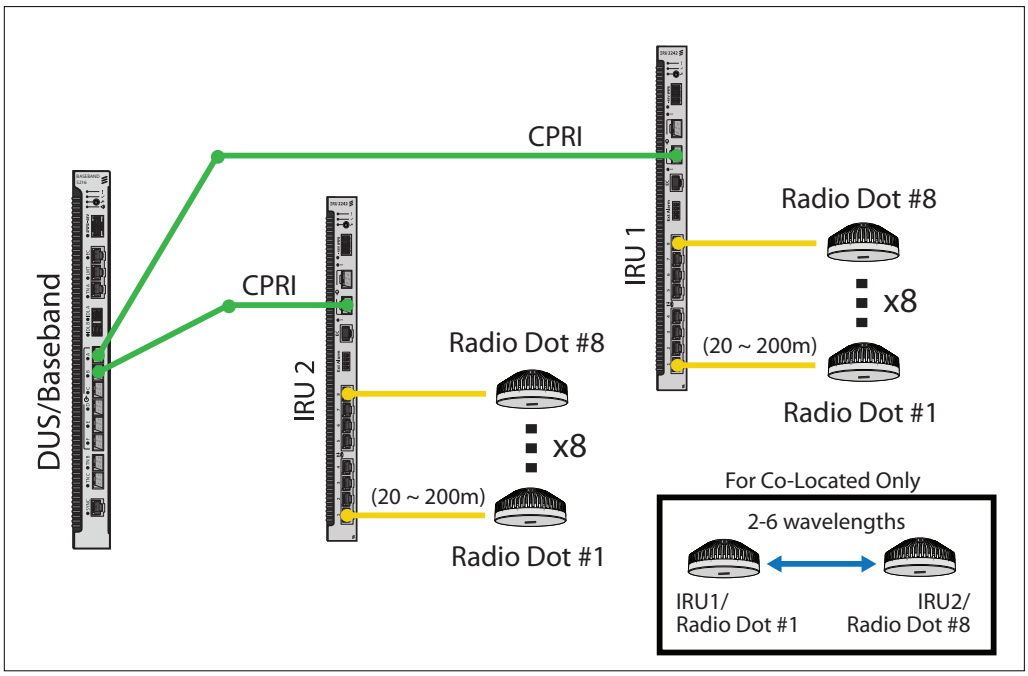

Figure 22 Co-Located and Distributed 4x4 MIMO Configuration (Single Band Radio Dots)

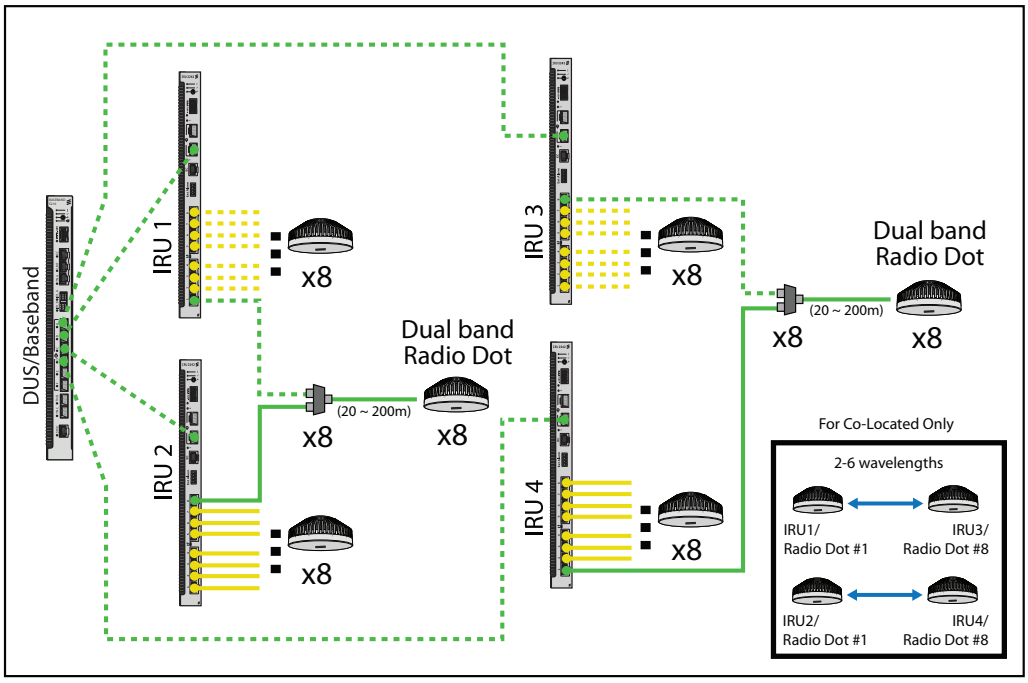

Figure 23 Co-Located and Distributed 4x4 MIMO Configuration (Dual Band Radio Dots)

An existing 2x2 MIMO deployment using single band Radio Dots can be migrated to a Distributed 4x4 MIMO deployment using single band Radio Dots as shown in the following figure. In this case, the existing network requires an additional IRU for each IRU deployed and a re-distribution of the Radio Dots to different IRUs.

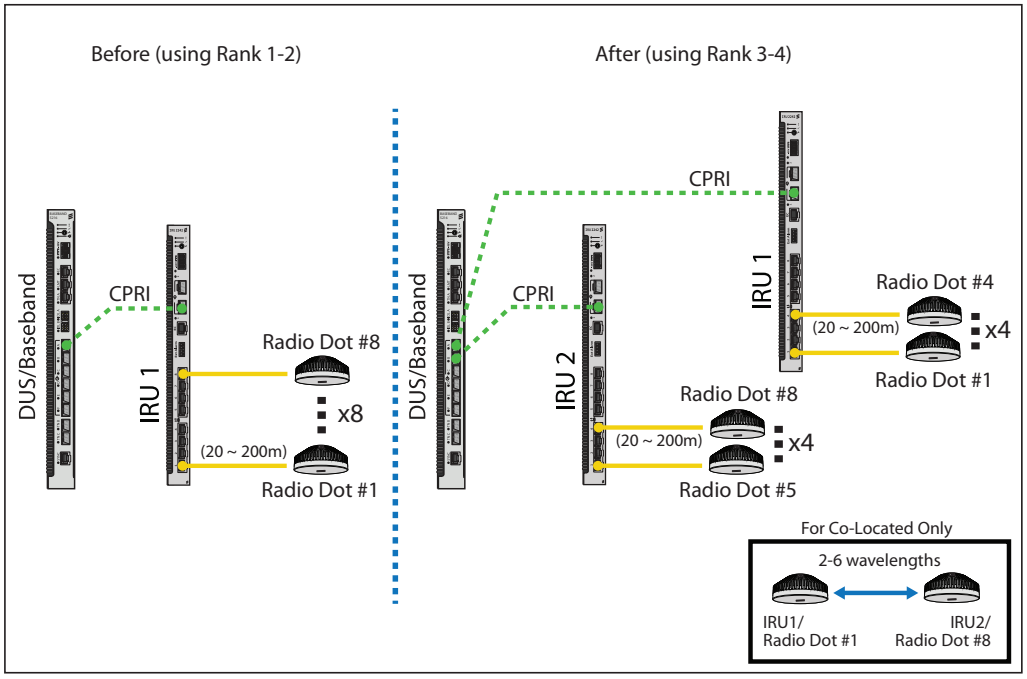

Figure 24 2x2 MIMO (Single Band Radio Dots) Migration to Distributed 4x4 MIMO

For detailed information on 4x4 MIMO, refer to 4x4 MIMO on Radio Dots, 12/1553-FGB 101 0308/1-V1.

3.11.1 Licensing

The following licenses must be obtained, applied, and activated to enable 4x4 MIMO:

— 4x4 Quad Antenna Downlink Performance Package, license key CXC 401 1667. Refer to the 4x4 Quad Antenna Downlink Performance Package, 113/221 04-LZA 701 6014/1 for a description on how to activate the feature.

— 4x2 Quad Antenna Downlink Performance Package, license key CXC 401 1427. Refer to the 4x2 Quad Antenna Downlink Performance Package, 114/221 04-LZA 701 6014/1 for a description on how to activate the feature.

— Dual-Antenna Downlink Performance Package, license key CXC 401 0609. Refer to the Dual-Antenna Downlink Performance Package, 75/221 04-LZA 701 6014/1 for a description on how to activate the feature.

— Quad Antenna Uplink Performance Package, license key CXC 401 1056. Refer to the Quad Antenna Uplink Performance Package, 251/221 04-LZA 701 6014/1 for a description on how to activate the feature.

— 4x4 support of Dot 4479 and Dot 4489 with NR for RDS requires (FAJ 121 5022). Other licenses may be required, refer to NR support of RDS, 2/221 04-FGB 101 0308/1.

The following license is optional:

— 256-QAM Downlink, license key CXC 401 1969. Although 256-QAM is not required for 4x4 MIMO operation, it can further improve downlink throughput. Refer to 256-QAM Downlink, 163/221 04-LZA 701 6014 for a description on how to activate the feature.

For steps on how to install and apply licenses on the DU or Baseband unit, refer to the *Radio Dot System Configuration Management Guide*, 1/1553-FGB 101 0308/1.

3.12 Indoor Digital Unit Limitations

The Indoor Digital Units (IDU 5205 and IDU 5209) are leveraging the features of the Baseband but have limitations in terms of Instantaneous Bandwidth (IBW), the number of cells and the number of Radio Dots supported. The number of IRUs supported by each of these IDUs depends on factors that compound together. Depending on the need of the deployment architecture, the correct choice of IDU must be made.

The IDU characteristics are described in the following table:

Table 2 IDU 5205 and IDU 5209 Characteristics

IDU	Capacity Data LTE (1)	Supported Radio Interface Connections CPRI
IDU 5205	—Only with IRU —Single Mode LTE or Single Mode WCDMA —24 Radio Dots —3 cells maximum —500 connected users —Up to 400 FDD or 200 TDD VoIP users —120 MHz antenna bandwidth(2) —600 Mbps DL throughput(2) —250 Mbps UL throughput(2)	2.5 Gbps, 4.9 Gbps, 9.8 Gbps(1)
IDU 5209	—Only with IRU —Single Mode LTE	2.5 Gbps, 4.9 Gbps, 9.8 Gbps(1)

IDU	Capacity Data LTE (1)	Supported Radio Interface Connections CPRI
	—Single Mode WCDMA —Mixed Mode LTE + WCDMA —48 Radio Dots —6 cells maximum —1000 connected users —Up to 800 FDD or 400 TDD VoIP users —240 MHz antenna bandwidth(2) —1000 Mbps DL throughput(2) —420 Mbps UL throughput(2)	

(1) Depending on the Software Package

(2) Depending on the Radio Configuration

The following is an example of the interaction of the different parameters showed in the table above that restrict the number of IRUs supported by an IDU:

If the deployment uses the IDU 5205, a maximum of three IRUs is supported. These three IRUs have 40 MHz IBW each and each supports one cell. If the same IDU 5205 supports a combined cell between two IRUs, then the second cell is hosted on the third IRU for a maximum of two cells only. In all, no single parameter threshold can be crossed.

3.13 Y-Splitter Adapter Deployment Option

The Y-splitter is an adapter that enables the sharing of the Radio Dot Interface (RDI) feeder cable. Two Y-splitters are used to enable the connection of two RD 2242s or RD 2243s or RD 2253s to the same RDI feeder cable. One Y-splitter is used to enable the two sides of an RD 4442 or RD 4453 to connect to the same RDI feeder cable.

For more information on the Y-splitter, including recommendations for installation, and how to install the Y-splitter, refer to *Y-Splitter Guidelines*, 11/1553-FGB 101 0308/1.

3.13.1 Deployment Scenarios (Dual Band Radio Dots)

This section provides deployment scenarios that are only applicable to RD 4442 and RD 4453. The following scenarios are examples only and do not reflect all band options.

Note: B40A/B3 Dual Band Radio Dot is only certified for the China market.

The Band 7 option in these deployments is applicable only to RD 4442.

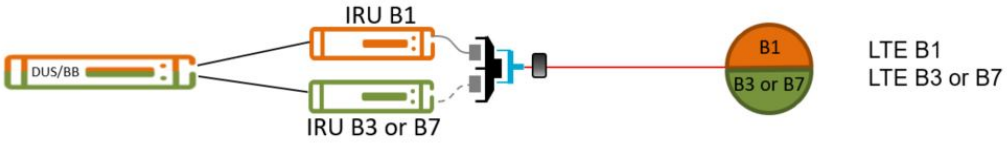

Figure 25 Single Mixed Mode DU/BB

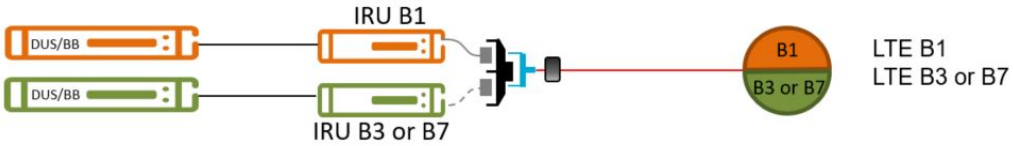

Figure 26 Multi-Operator Capable

In the Multi-Operator configuration, operator 1 can be substituted for Band 1 and Operator 2 can be substituted for Band 3 or 7.

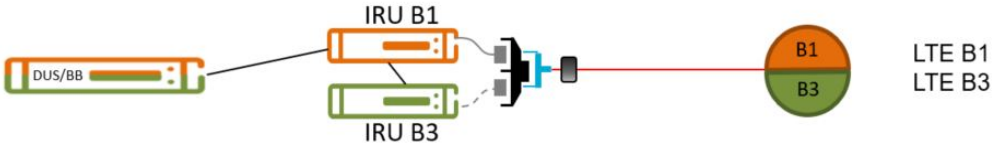

Figure 27 Cascaded Configuration

The following deployment scenarios address Dual Band and Mixed Mode.

Note: The Band 7 option in these deployments is applicable only to RD 4442.

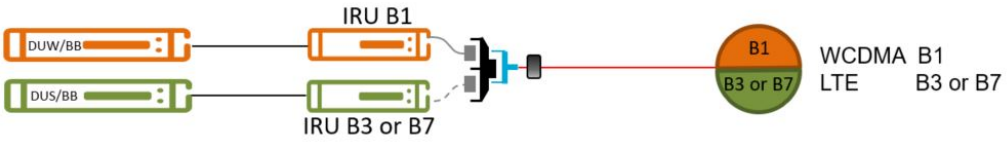

Figure 28 Mixed Mode, Multi-Operator Capable

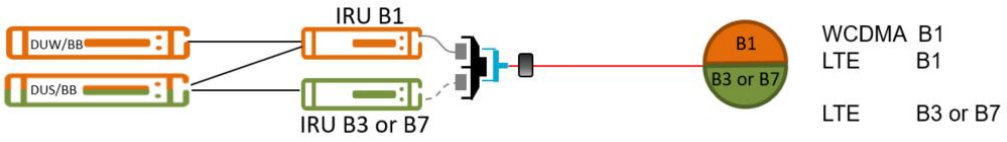

Figure 29 Mixed Mode, Multi-Carrier

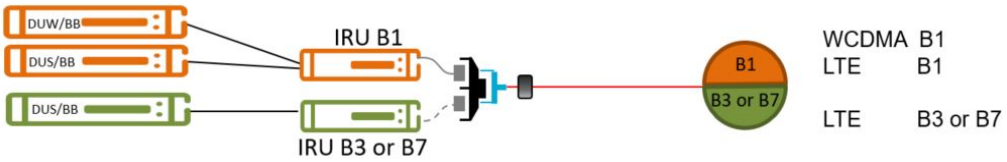

Figure 30 Mixed Mode, Multi-Carrier, Multi-Operator Capable

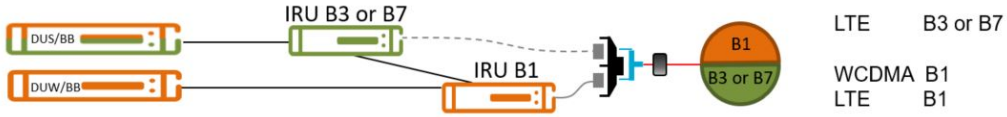

Figure 31 Mixed Mode, Multi-Carrier, Cascaded Configuration