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Wireless Networks

DualMode Metrocell

Cell Site Description

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NORTEL

NORTHERN TELECOM

Wireless Networks

DualMode Metrocell

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About this document

This publication is one of a set of documents that provide Northern Telecom (Nortel) customers with information and suggestions on the planning and maintenance of their DualMode Metrocell system. This set of documents includes the following manuals:

- DualMode Metrocell Functional Description Manual
  - — DualMode Metrocell Cell Site Description
  - — DualMode Metrocell Common Equipment (CE) Frame Description
  - — DualMode Metrocell Radio Frequency (RF) Frame Description
- DualMode Metrocell Planning and Engineering Guidelines
- DualMode Metrocell Installation Manual
- DualMode Metrocell Operation and Maintenance Manual
- DualMode Metrocell Troubleshooting Guidelines

The manual suite for the DualMode Metrocell provides information on cell site configurations, hardware components, planning and installation procedures, as well as maintenance and troubleshooting methods.

Intended audience for this publication

The intended audience for this set of manuals is the cell site technicians and the planning engineers who require information in the maintenance and planning of a DualMode Metrocell. The Functional Description Manual provides a technical reference foundation for the other documents in the documentation suite and is written for all.

The Planning and Engineering Guidelines is written for system planning personnel in implementing new cells or expanding existing cell sites in a cellular system.

The Operation and Maintenance Manual and the Troubleshooting Guidelines that provide information on problem recognition and preventive maintenance are written for cell site technicians to assist them in troubleshooting and performing their routine work.

The document suite assumes that the reader possesses a basic knowledge of the cellular system and radio propagation and is familiar with measurement units incorporated in the system. Therefore, this document will not provide detailed information on the theory of switching and radio propagation.

How this publication is organized

This publication is organized to present the following information:

- an introduction to the DualMode Metrocell Cell Site
- the Metrocell cell site configurations; omni, 120° STSR and 60° STSR
- the equipment layouts, block diagrams and transmit and receive cabling for each configuration
- the cell site components required for each configuration
- the power and grounding requirements for a Metrocell cell site
- information on datafilling a Metrocell.

Applicability of this publication

This publication is generically applicable to MTX01 feature functionality, yet captures some BCS-independent environment and implementation issues.

List of terms

A-Band

The lower 333 channels (Channel 1 - 333) of the cellular band, normally assigned to a non-wireline operator in the US and Canada.
The Expanded Spectrum provides 83 more channels, 50 (Channel 667 - 716) in the A'-Band and 33 (channel 991 - 1023) in the A"-Band.

ACU

Alarm Control Unit. A unit that provides discrete alarm monitoring, reporting and control functions at the cell site. It concentrates all alarm input points at the cell site and updates the MTX of any status change over redundant data links.

AMPS

Advanced Mobile Phone Service. Analog cellular phone service.

ATC

AutoTune Combiner. A cavity/isolator combiner featuring an automatic tuning system which monitors the transmitted RF and automatically tunes itself to that frequency.

B-Band

The upper 333 channels (Channel 334 - 666) of the cellular band, normally assigned to a wireline operator in the US and Canada.
The Expanded Spectrum provides 83 more channels (Channel 717 - 799) in the B'-Band.

BER

Bit Error Rate. The ratio of error bits to the total number of transmitted bits. It is a measurement of quality of the digital connection.

Carrier (RF)

An unmodulated radio signal. Normally, it is a pure sine wave of steady frequency, amplitude, and phase.

CCH

Control Channel, sometimes referred to as the Signaling Channel which is always in use to enable call setup and registration.

Cell

By theoretical design, it is the geographical representation of the cellular coverage area or service area defining both the associated size and shape.

CSM2

Cell Site Monitor 2. A unit that provides analog testing and monitoring capabilities at the cell site.

dBm

Decibels above a milliwatt. Unit of power measurement popular in wireless telephony, general telephony, audio, and microwave.

dBW

Decibels above a watt. Unit of measurement for radio power

DCC

Digital Color Code. An identifying code associated with the control channel of the cellular base transmitter which is used to enhance call processing in the cellular infrastructure.

DLR

Digital Locate Receiver. The TDMA equivalent of the Locating Channel Receiver. See LCR.

DMS-MTX

The acronym for Nortel's family of cellular switches: Digital Multiplex Switch - Mobile Transmission Exchange.

DPA

Dual Power Amplifier. A module which contains two discrete power amplifiers that provide amplification of the RF signal for the two corresponding Transmit Receive Units (TRU) on the same TRU/DPA shelf.

DRUM

DualMode Radio Unit Monitor. A test and monitor unit capable of radio communications with any Voice Channel of the local Transmit Receive Units (TRU) in the digital mode.

Duplexer

A device that consists of two pass or pass/reject filters configured to provide a common output port for both transmit and receive frequencies.

DVCC

Digital Verification Color Code. The TDMA equivalent of DCC.

ES

Expanded Spectrum. The additional frequency spectrum assigned to the cellular band. The Expanded Spectrum in the A-Band consists of the A'-Band and the A"-Band while the B'-Band is the Expanded Spectrum for the B-Band. The Expanded Spectrum provides a total of 416 channels to each of the two bands.

FDMA

Frequency Division Multiple Access. A frequency assignment arrangement whereby all users share the total frequency allotment and each frequency is assigned to a given user at access on a multiple user access basis.

Filter

A frequency selective device which is tuned to pass some frequencies and attenuate others. Common filter types include high-pass, low pass, band-pass, and notch filters

FM

Frequency Modulation. A modulation technique that causes the frequency of the carrier to vary above and below its resting frequency; the rate of which is determined by the frequency of the modulating signal and the deviation of which is determined by the magnitude of the modulating signal.

Forward path

The path from cell site to cellular subscriber.

HSMO

High Stability Master Oscillator. A unit that provides a highly stable 4.8 MHz reference for synchronizing the Transmit Receive Unit (TRU).

ICP

Intelligent Cellular Peripheral. A switch site peripheral that provides an interface between the cell site and the switch. The ICP also oversees the operations of the cell site.

ICRM

Integrated Cellular Remote Module. A cell site peripheral that serves as an interface between the Intelligent Cellular Peripheral (ICP) and the radio transmission subsystems. The ICRM is designed to support both analog and digital Radio Frequency (RF) equipment.

IM

Intermodulation. A type of interaction between signals in a nonlinear medium which produces phantom signals at sum and difference frequencies. These phantom signals may interfere with reception of legitimate signals occupying the frequencies upon which they happen to fall.

Isolation

The attenuation (expressed in dB) between any two signal or radiation points.

LCR

Locating Channel Receiver. A radio receiver which is frequency agile and is used to measure and report the received signal strength, in dBm, of a channel.

Loss

A magnitude of attenuation, expressed in dB, for a given path between any two points.

Modulation

The process of placing information on an RF carrier. The modulation technique may involve changing the amplitude, frequency, or phase of the carrier determined by the modulation index.

NES

Non-expanded Spectrum. The frequency spectrum initially assigned to the cellular band. The Non-expanded Spectrum provides 333 channels to each of the two bands, the A-Band and the B-Band.

Omni

An antenna design which permits radiation in essentially all H-Plane azimuths. In cell sites, an Omni configuration means a single set of omni antennas is used for all channels.

π/4 DQPSK

Variation of Differential Quadrature Phase Shift Keying used in D_AMPS IS-54 TDMA for improved spectral characteristics and phase resolution. Permissible phase changes are integral multiples of π/4 radians (45 degrees). π/4 is used to reduce the peak to root mean square ratio requirements for linear PAs.

Return loss

A logarithmic relationship of the incident signal to the reflected signal as expressed, in dB, by the following relationship:

$$\text{Return Loss} = 10 \log \left(\frac{P_r}{P_i} \right)$$

where Pi = incident power in watts
Pr = reflected power in watts

The strength of the signal, expressed in dB, reflected by a load back into a transmission line due to impedance mismatch. -14 dB corresponds to a VSWR of 1.5:1.

Reverse path

The path from cellular subscriber terminal to cell site.

RF

Radio Frequency. Electromagnetic energy of the frequency range just above the audible frequencies and extending to visible light.

RIP

Rack Interface Panel. The RIP is the interface between the cell site power supply and the cell site equipment.

RMC

Receive Multicoupler. A device for amplifying the input received from a single antenna and providing multiple outputs for a group of receivers.

RSSI

Received Signal Strength Indicator. A measurement of the received RF signal strength measured at the base station or the subscriber terminal. It is expressed in dBm.

SAT

Supervisory Audio Tone. A tone of 5970, 6000, or 6030 Hz which modulates the AMPS voice channel along with voice audio. It is generated by the cell site and is repeated by the mobile back to the cell site. The repeated SAT is checked by the cellular system to confirm the continuity of the complete RF path from the cell site to the subscriber terminal and back to the cell site.

SCC

SAT Color Code. The datafill values corresponding to the various SATs: 00 for 5970 Hz, 01 for 6000 Hz, 10 for 6030 Hz.

Sector

A theoretical wedge-shaped part of the coverage area of one cell site, served by a specific group of directional antennas on specific channels.

Sectorization

A cell site configuration that consists of two or more sectors in which a different control and voice channel assignment is given for each sector. In this arrangement, the datafill and channel assignments for each sector are tailored to meet the system operational requirements, providing more flexibility in the cell site configuration compared to an omni configuration but with a decrease in trunking efficiency.

Signal (RF)

Radio frequency energy associated with a particular or desired frequency.

SINAD

A standard measurement of detected audio quality that is related to signal-to-noise plus distortion of the RF signal strength at the receiver input terminal. 12 dB SINAD is the commonly used threshold for receiver sensitivity measurements to determine the weakest-practical analog RF input, in dBm, required by the receiver. A SINAD of 20 dB is considered good quality and defines the RF input level needed to fully quiet the receiver.

S/N

Signal-to-Noise ratio. The ratio of signal power to noise power on a radio channel.

ST

Signaling Tone. In AMPS cellular, a 10 kHz tone transmitted on the Reverse Voice Channel (RVC) as a precursor to messaging activity, and for certain call-processing functions (acknowledgments, call termination). Presence of the tone mutes normal conversational audio.

STSR

Sectored-Transmit/Sectored-Receive. A cell configuration in which a different control and voice frequency assignment is designated for each sector. A directional antenna system is required for each sector.

TDMA

Time Division Multiple Access. A modulation and transmission format that allows a number of digital conversations (three in TDMA-3) to occur within the same Radio Frequency (RF) channel. Mobile units take turns transmitting/receiving data on specific time slots of a TDMA frame.

TRU

Transmit Receive Unit. The TRU is a Digital Signal Processing (DSP) based transceiver capable of two modes of operation, analog (AMPS) and digital (TDMA).

VCH

Voice Channel. A Radio Frequency (RF) channel used to transmit cellular voice conversations. The VCH is also an integral part of call setup, handoff, and disconnect.

VSWR

Voltage Standing Wave Ratio. A measure of the mismatch between the transmitter source impedance and the load impedance to which it is connected. It is defined by the following relationship:

$$\text{VSWR} = \frac{1 + \sqrt{\dfrac{\text{Reflected Power}}{\text{Forward Power}}}}{1 - \sqrt{\dfrac{\text{Reflected Power}}{\text{Forward Power}}}}$$

Introduction

Northern Telecom's DualMode Metrocell

As cellular systems evolve to the digital format, service providers and mobile subscribers are confronted by a mixture of analog and digital technologies. Northern Telecom (Nortel)'s dual mode cellular product allows a smooth transition from analog to digital technology. It uses Time Division Multiple Access (TDMA) technology for digital systems and Advanced Mobile Phone Service (AMPS) technology for analog systems. This evolutionary strategy enables service providers to gradually upgrade their cellular systems to digital while providing support of existing analog equipment.

The Nortel cellular system supporting dual mode service includes the following components:

- the DMS-MTX switch containing the Intelligent Cellular Peripheral (ICP) unit at the mobile switching office
- dual mode cell sites with the configurable DualMode Radio Units (DRU) on a Radio Frequency (RF) Frame and the Integrated Cellular Remote Module (ICRM), on a Common Equipment (CE) Frame at the cell site
- external and internal interface links.

The Nortel DualMode Metrocell serves as the intelligent interface between a Digital Multiplex Switch - Mobile Telephone Exchange (DMS-MTX) and its registered cellular mobiles. It is a dual mode cell that works in both the analog (AMPS) mode and the digital (TDMA) mode.

The Metrocell is designed for high density, small radius cells in areas where large traffic capacity is required. It can exist independently or it can be added to existing cells for increased coverage. The Metrocell provides a reduced power output for urban applications. The typical power output of the Power Amplifier (PA) is 22 watts (43.5 dBm).

Figure 1-1 shows the architecture of a DualMode Metrocell system and Figure 1-2 is a block diagram of the product of the system.

Figure 1-1
System architecture of a DualMode Metrocell

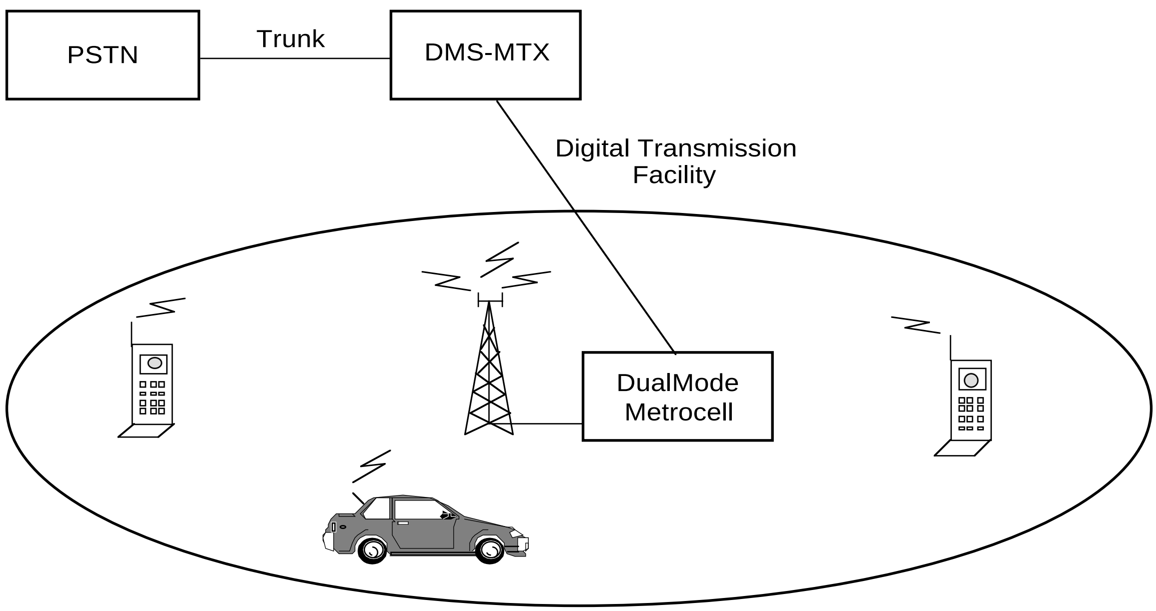
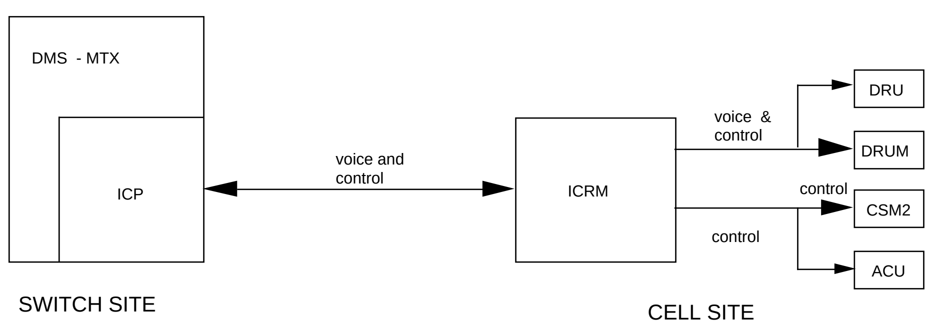
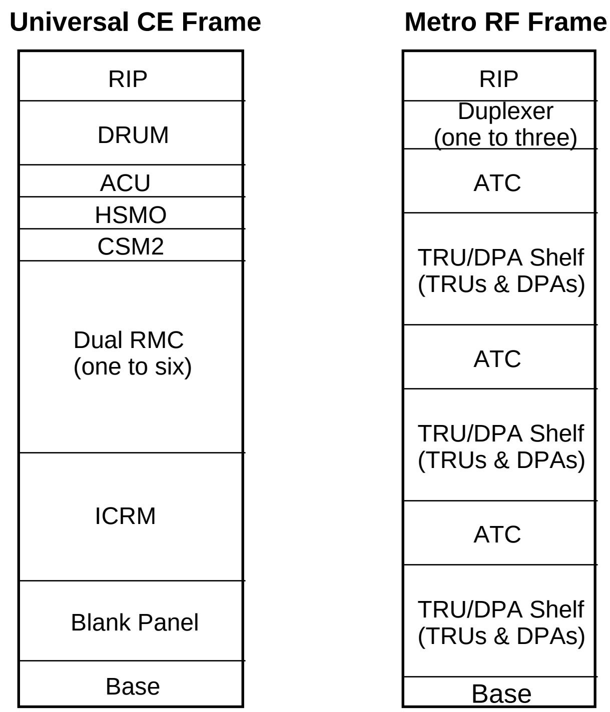


Figure 1-2
Digital ready cellular product



There are at least two equipment frames in a Metrocell, a Universal Common Equipment (CE) Frame and a Metro Radio Frequency (RF) Frame. The cell site can be expanded or sectorized by adding more Metro RF frames as traffic grows. The number of Metro RF frames is determined by the cell site configuration and the channel capacity. Figure 1-3 shows the frames and the components of a DualMode Metrocell.

Figure 1-3
Basic components of a DualMode Metrocell



Legend:

RIP	Rack Interface Panel
DRUM	DualMode Radio Unit Monitor
ACU	Alarm Control Unit
HSMO	High Stability Master Oscillator
CSM2	Cell Site Monitor 2
RMC	Receive Multicoupler
ICRM	Integrated Cellular Remote Module
ATC	AutoTune Combiner
TRU	Transmit Receive Unit
DPA	Dual Power Amplifier

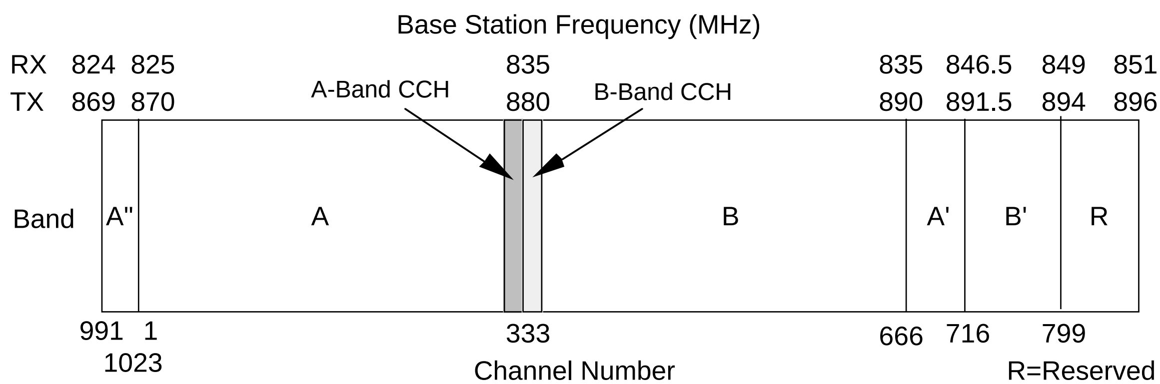
The 800 MHz cellular band

In an 800 MHz North American cellular system, a frequency spectrum of 50 MHz is available for service. Operating from 824 to 894 MHz, including the expanded spectrum, the system conforms to the AMPS IS-54 protocol. Typically this range is divided into 832 radio frequency (RF) channels. The 832 RF channels are divided into two bands,A and B. The two bands are identified as follows:

- Band A—for Non-Wireline Operators
- Band B—for Wireline Operators.

Each frequency band has 416 RF channels. Of these 416 RF channels, typically 21 (depending on the frequency plan) are assigned as the Control Channels (CCH) and the remaining 395 are Voice Channels (VCH). See Figure 1-4 and Table 1-1.

Figure 1-4
Channel assignment for 800 MHz cellular systems



Channel assignment	Band A (416 channels)	Band B (416 channels)
Control channels	313 - 333 (21)	334 - 354 (21)
Optional—TDMA secondary control channels	688 - 708 (21)	737 - 757 (21)
Voice channels	001 - 312 (312) 667 - 716 (50) 991 - 1023 (33)	355 - 666 (312) 717 - 799 (83)

Table 1-1
Channel designation and frequency assignment

System	Channel	Cell site receive frequency (MHz)	Cell site transmit frequency (MHz)
Not used	990	824.010	869.010
A"	991 - 1023	824.040 - 825.000	869.040 - 870.000
A	1 - 333	825.030 - 834.990	870.030 - 879.990
B	334 - 666	835.020 - 844.980	880.020 - 889.980
A’	667 - 716	845.010 - 846.480	890.010 - 891.480
B’	717 - 799	846.510 - 848.970	891.510 - 893.970

The relationship between the channel number (N) and the frequency is:

Channel number: $1 \leq N \leq 799$

Receiver frequency (in MHz) = 0.03N + 825.000

Transmit frequency (in MHz) = 0.03N +870.000

Channel number: $990 \leq N \leq 1023$

Receiver frequency (in MHz) = 0.03(N - 1023) + 825.000

Transmit frequency (in MHz) = 0.03(N - 1023) + 870.000

Both non-expanded and expanded spectrums are shown in Appendix B for the N=7 and N=4 frequency groups.

Important

For ALL Metrocell cell site configurations, the frequency plan used should have a minimum of 21 channel spacing (630 kHz) between the RF channels.

Cell Site Configurations

Overview

The DualMode Metrocell can be configured in the following ways:

- Omni-directional transmit/receive
- 120° Sectored Transmit Sectored Receive (STSR)
- 60° Sectored Transmit Sectored Receive (STSR)

The majority of systems may begin as Omni-directional to minimize startup costs. As the subscriber traffic increases, the Omni configuration may reach its maximum traffic capacity. At that time it will be necessary to provide additional capacity through expanded spectrum, 120 degree sectorization, 60 degree sectorization, or frequency borrowing.

It is important that the operator selects a frequency plan before the Omni configuration is installed. If not, future expansions will be very difficult. The most common frequency plans are:

- 7 Cell Cluster (N=7)—This frequency plan allows proper expansion from Omni to 120 degree sectorization (see Figure 2-1 and Figure 2-2).
- 4 or 12 Cell Cluster (N=4 or N=12)—This frequency plan allows proper expansion from Omni to 60 degree sectorization (see Figure 2-3).

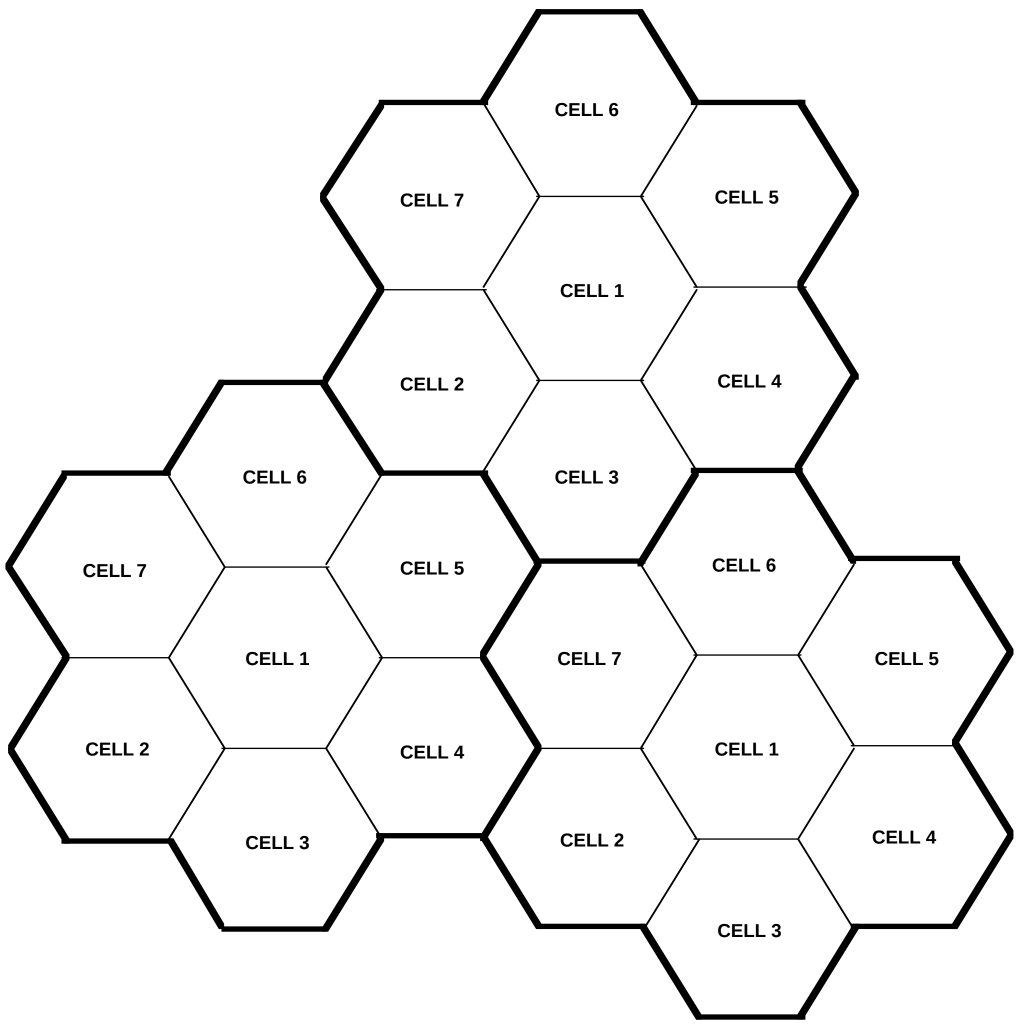
Both non-expanded and expanded spectrums are shown in Appendix B for the N=7 and N=4 frequency groups.

Omni configuration

In an Omni (N=7) configuration, the 416 RF channels are divided among a group of seven cells (often known as a cluster). Each cell consists of a maximum of 59 or 60 RF channels (four cells with 59 channels and three cells with 60 channels, where three of the 59 or 60 channels are Control channels). The RF channels are reused by other cell clusters. Frequency reuse refers to the use of RF channels on the same carrier frequency in different areas which are separated from one another by the greatest possible distance so that co-channel interference is minimized.

Figure 2-1 shows the layout of an Omni (N=7) frequency reuse plan;. The RF channels used in Cell 1 of a cluster are reused in Cell 1 of other clusters, channels in Cell 2 are reused in Cell 2 of other clusters and so on.

Figure 2-1
Omni (N=7) frequency reuse plan



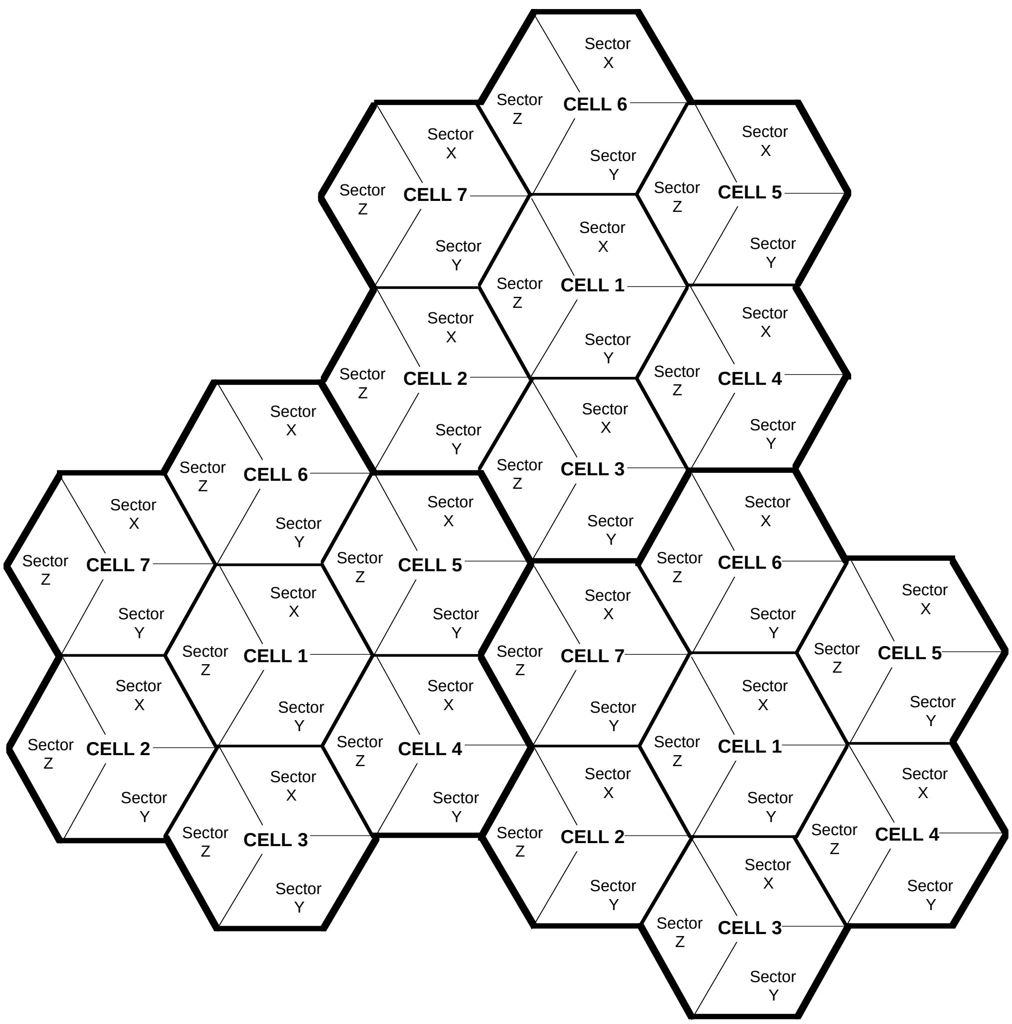
120° sectorized configuration

In a 120° (N=7) sectorized configuration, the 416 RF channels are divided among a cluster of seven cells. Each cell contains a maximum of 59 or 60 RF channels, with three Control channels for each cell. Since each cell is further divided into three sectors, each sector will contain a maximum of 19 or 20 RF channels, with one Control channel for each sector. The available RF channels are reused by other groups of cells within the system.

Figure 2-2 shows the layout of a 120° (N=7) sectorized frequency reuse plan. The RF channels used in Cell 1 of a cluster are reused in Cell 1 of other clusters, channels in Cell 2 are reused in Cell 2 of other clusters and so on. This arrangement will have the RF channels using the same carrier frequency in different areas to be separated from one another by the greatest possible distance to minimize co-channel interference.

However, sectorization (by virtue of the modified coverage areas and directional antenna usage) permits greater reuse of frequencies for a given C/I ratio.

Figure 2-2
120° (N=7) sectorized frequency reuse plan



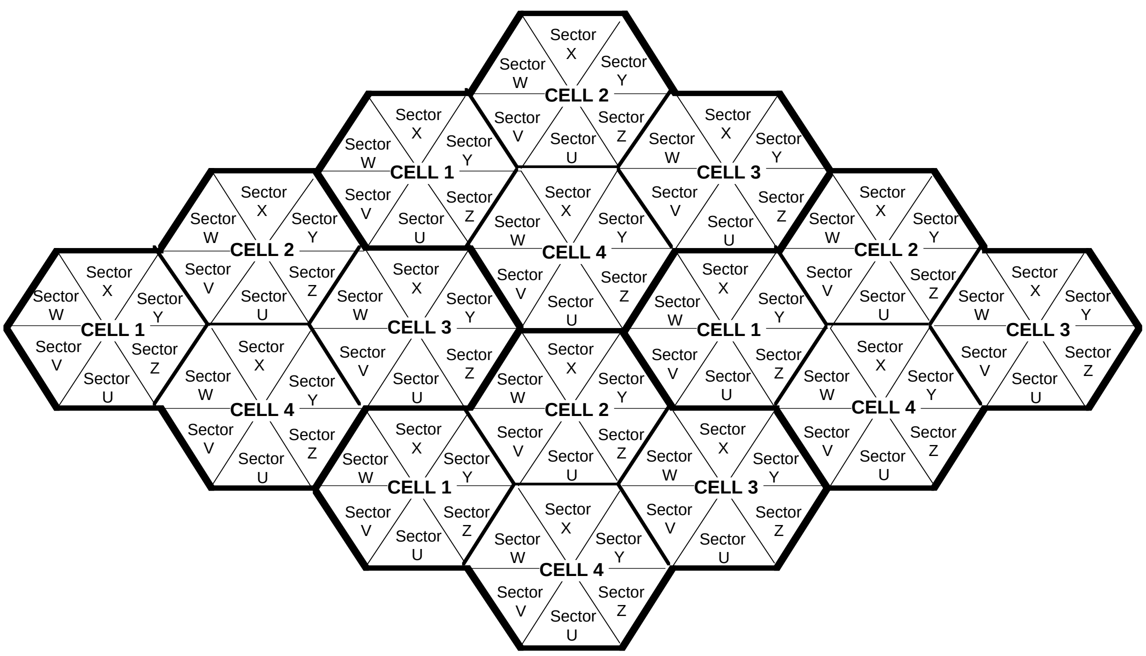
60° sectorized configuration

In a 60° (N=4) sectorized configuration, the 416 RF channels are divided among a group of four cells. Each cell contains a maximum of 104 RF channels, with six Control channels for each cell. Since each cell is further divided into six sectors, each sector will contain a maximum of 16 or 17 RF channels, with one Control channels for each sector. The RF channels are reused by other groups of cells.

Figure 2-3 shows the layout of a 60° (N=4) sectorized frequency reuse plan. The RF channels used in Cell 1 of a cluster are reused in Cell 1 of other clusters, channels in Cell 2 are reused in Cell 2 of other clusters and so on. This arrangement will have the RF channels on the same carrier frequency in different areas to be separated from one another by the greatest possible distance so that co-channel interference is minimized.

However, 60° sectorization is difficult to expand and optimize due to a more demanding environment of frequency re-use.

Figure 2-3
60° (N=4) sectorized frequency reuse plan



Cell Site Layouts

This chapter provides information on the layout and cabling of the different DualMode Metrocell configurations.

Important

For ALL Metrocell cell site configurations, the frequency plan used should have a minimum of 21 channel spacing (630 kHz) between the channels in one RF Frame.

Note: The DualMode Metrocell supports only Transmit Receive Units (TRU) with Product Engineering Code (PEC) NTAX98AA. No other radios can be used. The NTAX98AA TRU supports full digital and analog transmissions in accordance with IS-54 and IS-41 standards.

Omni cell site configuration

The Metrocell in an omni configuration uses at least two equipment frames, one CE Frame and one RF frame (see Figure 3-1). With only one RF frame, the maximum number of Voice Channels (VCH) supported by the cell site is 22 since two of the 24 TRUs have to be assigned as the Control Channel (CCH) and the Locate Channel Receiver (LCR). As traffic grows, four additional RF frames can be added to the site to accommodate up to a maximum of 120 channels, including the CCH and the LCR.

An RF Frame with up to 20 channels requires only one duplexer in the RF Frame and one TX/RX antenna. The outputs of the three AutoTune Combiners (ATC) are combined through one phasing transformer (located at ATC 2) and then connected to Duplexer position 2. This configuration requires a RX only antenna for the diversity receive function of the cell. See Figure 3-2.

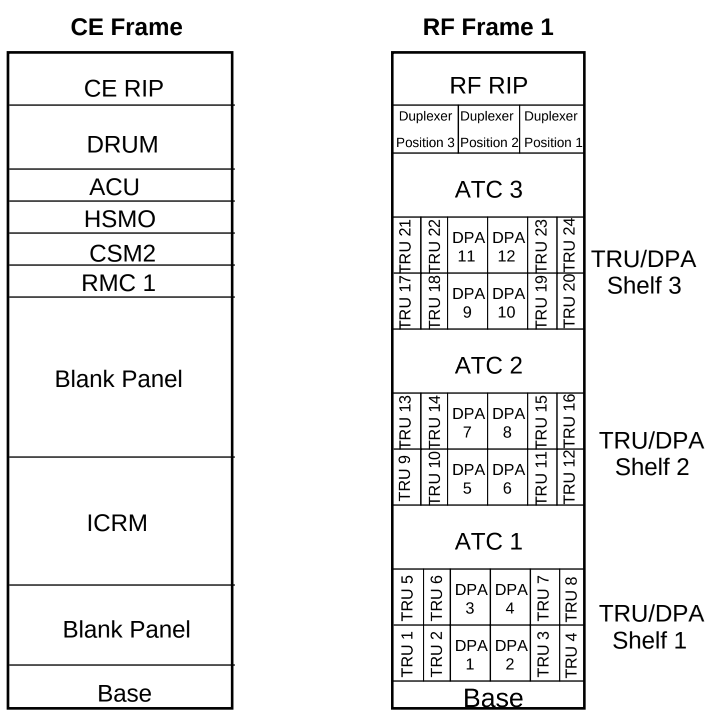
An RF Frame with 21 channels or more requires two duplexers in the RF Frame and two TX/RX antennas. The outputs of the lower and middle ATCs

(ATC 1 and ATC 2) are combined through one phasing transformer (located at ATC 2) and then connected to Duplexer position 2 and the main TX/RX Antenna. The output of the upper ATC (ATC 3) is connected to Duplexer position 3 and the diversity TX/RX Antenna. This arrangement is used to meet the requirement of a minimum of 21 channel spacing (630 kHz) between the channels in one RF Frame. This configuration requires a TX/RX antenna to perform the diversity receive function of the cell. See Figure 3-3.

Control Channel redundancy

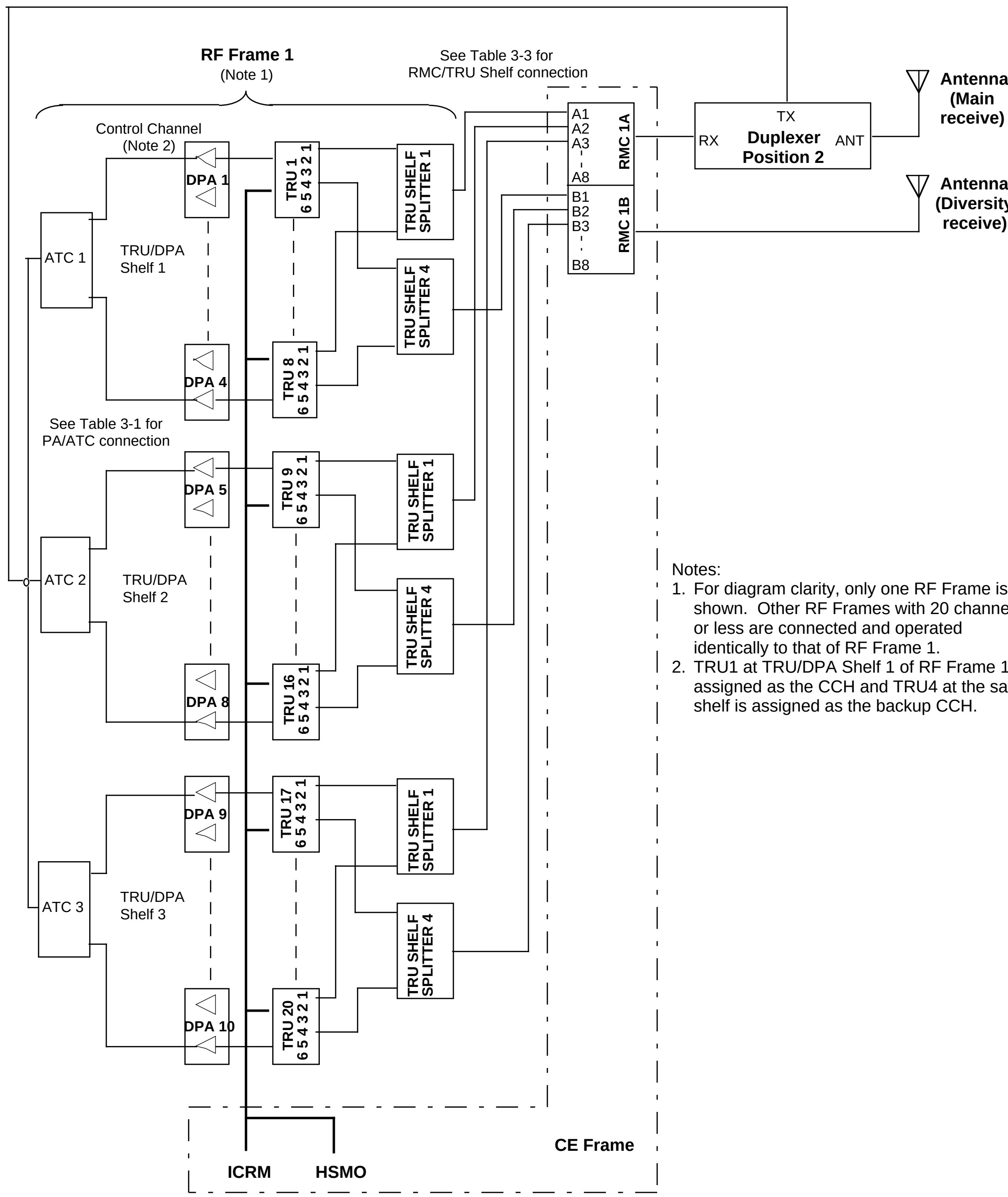
Control Channel (CCH) redundancy is commonly provided with a Locate Channel Receiver (LCR) backup. The CCH is assigned to position 1 on the TRU/DPA Shelf 1 and the LCR is assigned to position 4 on the same shelf. This arrangement will have the CCH and the LCR supplied on a different DC power feed and a TCM card. No RF coaxial switch is required since the cavity of the LCR position on the ATC will tune to the CCH frequency when backup is required.

Figure 3-1
Frame layout of an omni Metrocell with one RF frame (front view)



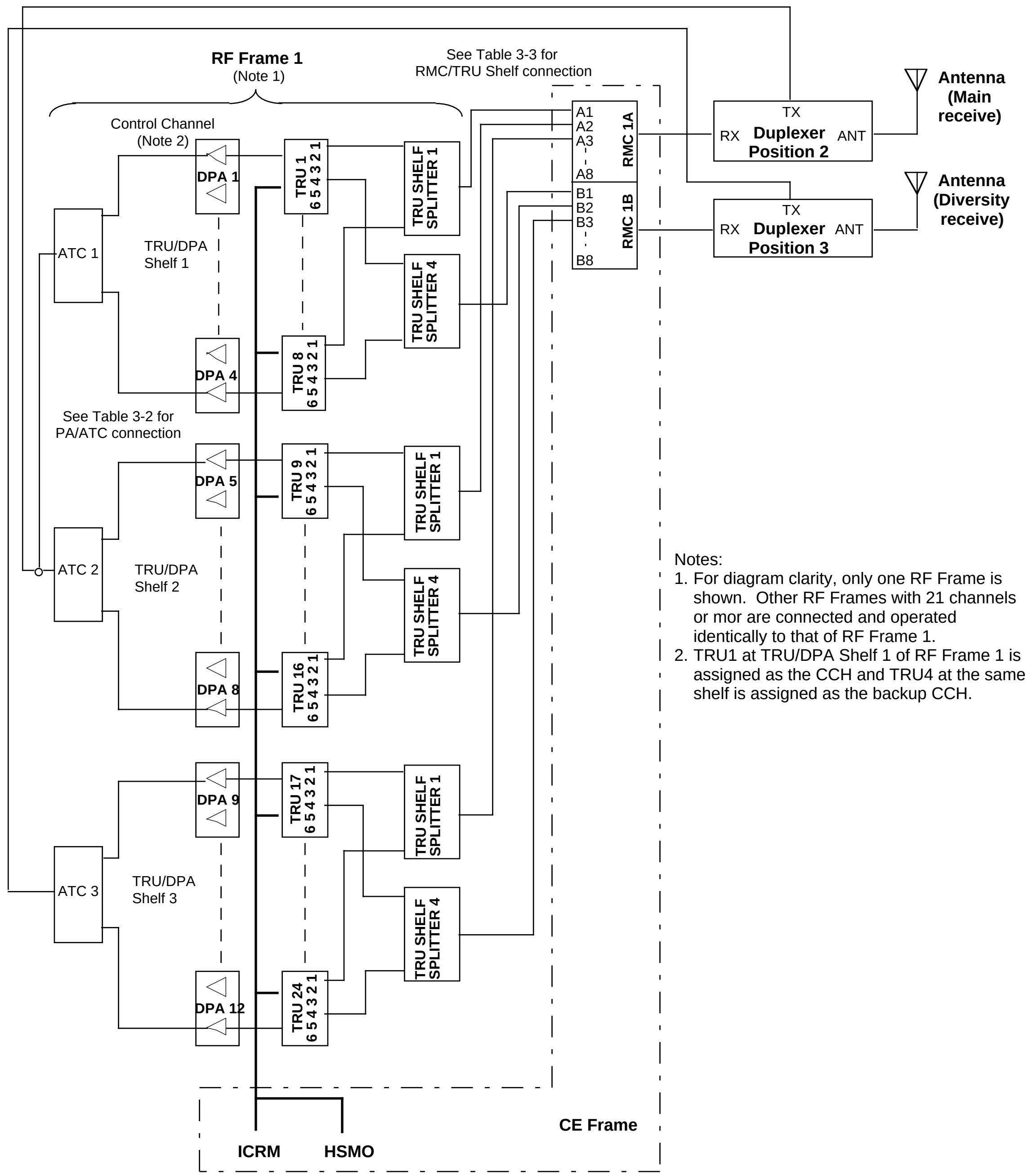
Note: For a frame with up to 20 channels, only one duplexer (located in position 2) is required.
For a frame with 21 channels or more, two duplexers (located in positions 2 and 3) are required.

Figure 3-2
Block diagram of an omni Metrocell with up to 20 channels in one RF Frame



Notes:
1. For diagram clarity, only one RF Frame is shown. Other RF Frames with 20 channels or less are connected and operated identically to that of RF Frame 1.
2. TRU1 at TRU/DPA Shelf 1 of RF Frame 1 is assigned as the CCH and TRU4 at the same shelf is assigned as the backup CCH.

Figure 3-3
Block diagram of an omni Metrocell with 21 to 24 channels in one RF Frame



Notes:
1. For diagram clarity, only one RF Frame is shown. Other RF Frames with 21 channels or mor are connected and operated identically to that of RF Frame 1.
2. TRU1 at TRU/DPA Shelf 1 of RF Frame 1 is assigned as the CCH and TRU4 at the same shelf is assigned as the backup CCH.

Transmit cabling

In the transmit path, the output of each Transmit Receive Unit (TRU) is connected to the input of each corresponding power amplifier (PA) on the Dual Power Amplifier (DPA) module. The output of each power amplifier (PA) is input to an 8-channel AutoTune Combiner (ATC).

The output of the ATC is connected to the Transmit (TX) port of the duplexer. For RF Frames using more than one ATC, the outputs of the ATCs are combined together and connected to the TX port of the duplexer. The duplexer serves as the interface between the antenna system and the RF frame. Table 3-1 lists the connection between the PAs and the ATC for an RF Frame with up to 20 channels. Table 3-2 lists the connection between the PAs and the ATC for an RF Frame with 21 channels or more.

Table 3-1
RF Frame 1 PA to ATC connection for an omni Metrocell with up to 20 channels

From		Through		To	
TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	ATC Shelf 1	ATC1 - Port 1	Duplexer Position 2	Antenna (Main receive)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCH)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
TRU/DPA Shelf 2	DPA 5 - Port1	ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
TRU/DPA Shelf 3	DPA 9 - Port1	ATC Shelf 3	ATC3 - Port 1		
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		

Note: Additional RF Frames with 20 channels or less are connected to their respective TX/RX antennas in the same way as RF Frame 1.

Table 3-2
RF Frame 1 PA to ATC connection for an omni Metrocell with 21 channels or more

From		Through		To	
TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	ATC Shelf 1	ATC1 - Port 1	Duplexer Position 2	Antenna (Main receive)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCH)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
TRU/DPA Shelf 2	DPA 5 - Port1	ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
TRU/DPA Shelf 3	DPA 9 - Port1	ATC Shelf 3	ATC3 - Port 1	Duplexer Position 3	Antenna (Diversity receive)
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port 2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port2		ATC3 - Port 8		

Note: Additional RF Frames with 21 channels or more are connected to their respective TX/RX antennas in the same way as RF Frame 1.

Receive cabling

In the reverse path, the receive signal from the main antenna is connected to the A-input of the Receive Multicoupler (RMC) through the receive port of the duplexer. The diversity antenna connects directly to the B-input of the RMC. Distribution of the reverse path frequencies is accomplished by RF splitters within each RF frame.

Table 3-3 shows the connection between the RMC and the splitters.

Table 3-3
RMC to splitter connections for an Omni Metrocell

From	Through	To	
Main antenna	RMC 1A - A1	TRU Shelf 1	Splitter 1
Diversity antenna	RMC 1B - B1	TRU Shelf 1	Splitter 4
Main antenna	RMC 1A - A2	TRU Shelf 2	Splitter 1
Diversity antenna	RMC 1B - B2	TRU Shelf 2	Splitter 4
Main antenna	RMC 1A - A3	TRU Shelf 3	Splitter 1
Diversity antenna	RMC 1B - B3	TRU Shelf 3	Splitter 4

Component requirement

Table 3-4 lists the components required for a Metrocell with one to five RF Frames. An omni cell site requires only one Receive Multicoupler (RMC).

Table 3-4
Component requirement for an omni Metrocell

	No. of RF Frames	No. of TRUs	No. of ATCs	Duplexer per frame	ICRM TCM Port cards	No. of antennas
Configuration with up to 20 channels per RF Frame	1	3 to 20	1 to 3	1	2	1 TX/RX, 1 RX
	2	21 to 40	4 to 6	1	4	2 TX/RX
	3	41 to 60	7 to 9	1	6	2 TX/RX, 1 TX
	4	61 to 80	10 to 12	1	6	2 TX/RX, 2 TX
	5	81 to 100	13 to 15	1	8	2 TX/RX, 3 TX
Configuration with up to 24 channels per RF Frame	1	3 to 24	1 to 3	2	2	2 TX/RX
	2	25 to 48	4 to 6	2	4	2 TX/RX, 2 TX
	3	49 to 72	7 to 9	2	6	2 TX/RX, 4 TX
	4	73 to 96	10 to 12	2	6	2 TX/RX, 6 TX
	5	97 to 120	13 to 15	2	8	2 TX/RX, 8 TX

Note: An additional TCM port card is required for the DRUM, the ACU and the CSM2.

120° STSR cell site configuration

The Metrocell in a 120° STSR configuration uses at least two equipment frames, one CE Frame and one RF frame (see Figure 3-4). Each TRU/DPA Shelf and its associated ATC on the RF frame support one of the three sectors. With only one RF frame, the maximum number of Voice Channels (VCH) supported by each sector is six since two of the eight TRUs on the TRU shelf have to be assigned as the Control Channel (CCH) and the Locate Channel Receiver (LCR). A 120° STSR Metrocell with one RF Frame requires six antennas; one TX/RX antenna and one RX only antenna for each sector (see Figure 3-6). As traffic grows, two additional RF frames can be added to accommodate more VCHs (see Figure 3-5).

A 120° STSR Metrocell with three RF Frames requires six antennas. It may be three TX/RX antennas and three RX only antennas or six TX/RX antennas depending on the number of channels in each RF Frame. An RF Frame with 20 channels or less in one sector requires one duplexer in the RF Frame and one TX/RX antennas for that sector. The outputs of the three combiners are combined through one phasing transformer (located at ATC 2) and connected to Duplexer position 2 in that RF Frame. The output of the duplexer is then connected to the main TX/RX Antenna of that sector).

An RF Frame with 21 channels or more in one sector requires two duplexers in the RF Frame and two TX/RX antennas for that sector. The outputs of ATC 1 and ATC 2 are combined through one phasing transformer (located at ATC 2) and connected to Duplexer position 2 in that RF Frame. The output of the duplexer is then connected to main TX/RX Antenna of that sector. The output of ATC 3 is connected to Duplexer position 3 and then to the diversity TX/RX Antenna of that sector. This arrangement is used to meet the requirement of a minimum of 21 channel spacing (630 kHz) between the channels in one RF Frame. Figure 3-5 shows the frame layout and Figure 3-7 shows the block diagram of a 120° STSR Metrocell with three RF Frames.

Control Channel redundancy

Control Channel (CCH) redundancy is commonly provided with a Locate Channel Receiver (LCR) backup. With one RF Frame, the CCH of each sector is assigned to position 1 on the TRU/DPA Shelf of that sector and the LCR is assigned to position 4 on the same shelf. With three RF Frames, the CCH of each sector is assigned to position 1 on TRU/DPA Shelf 1 of that sector and the LCR is assigned to position 4 on the same shelf. This arrangement will have the CCH and the LCR supplied on a different DC power feed and a TCM card. No RF coaxial switch is required since the cavity of the LCR position on the ATC will tune to the CCH frequency when backup is required.

Figure 3-4
Frame layout of a 120° STSR Metrocell site with one RF frame (front view)

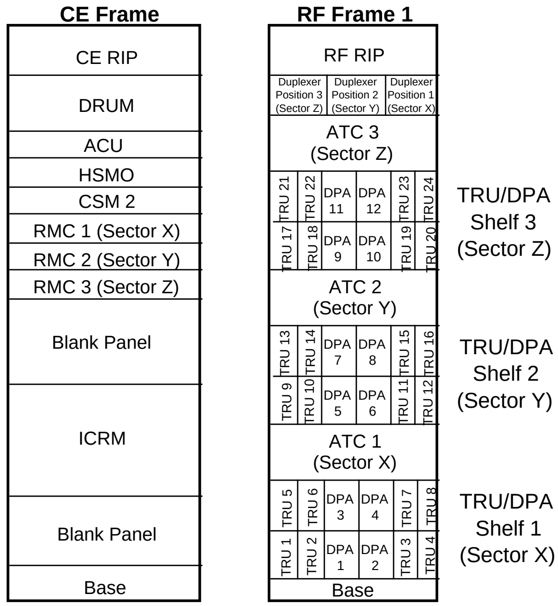
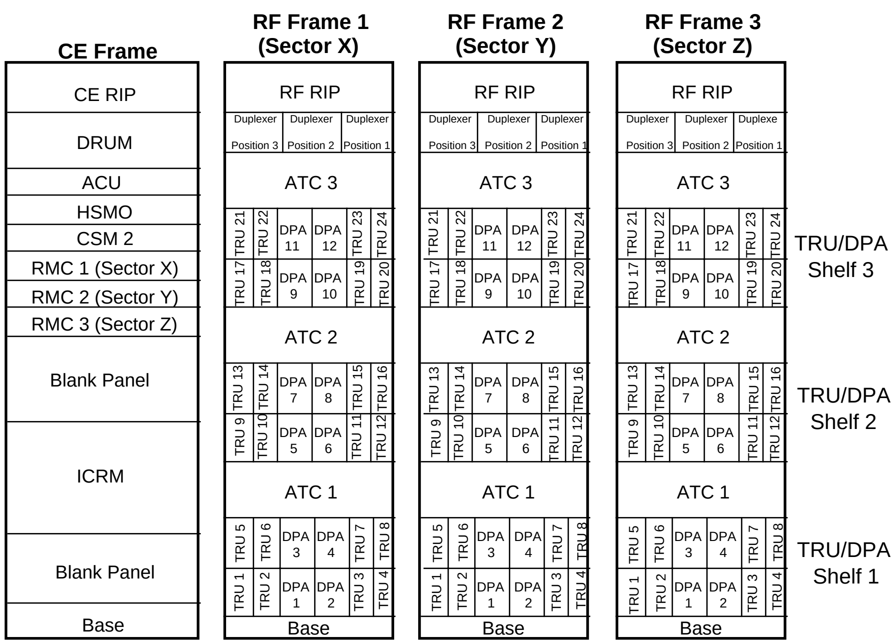


Figure 3-5
Frame layout of a 120° STSR Metrocell site with three RF frames (front view)



Note:
For a frame with up to 20 channels, only one duplexer (located in position

2) is required.
For a frame with 21 channels or more, two duplexers (located in positions 2 and 3) are required.

Figure 3-6
Block diagram of a 120° STSR Metrocell using one RF Frame

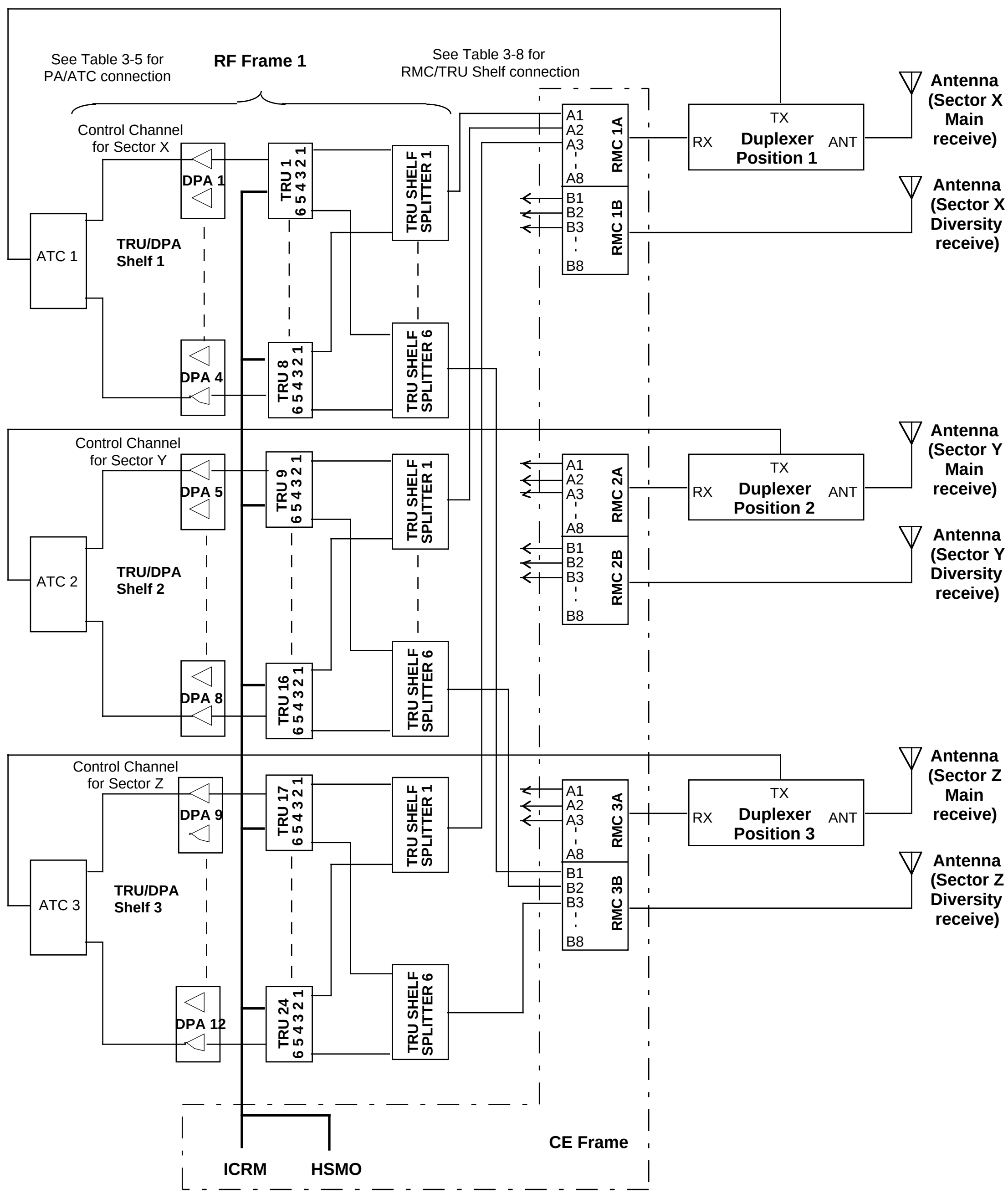
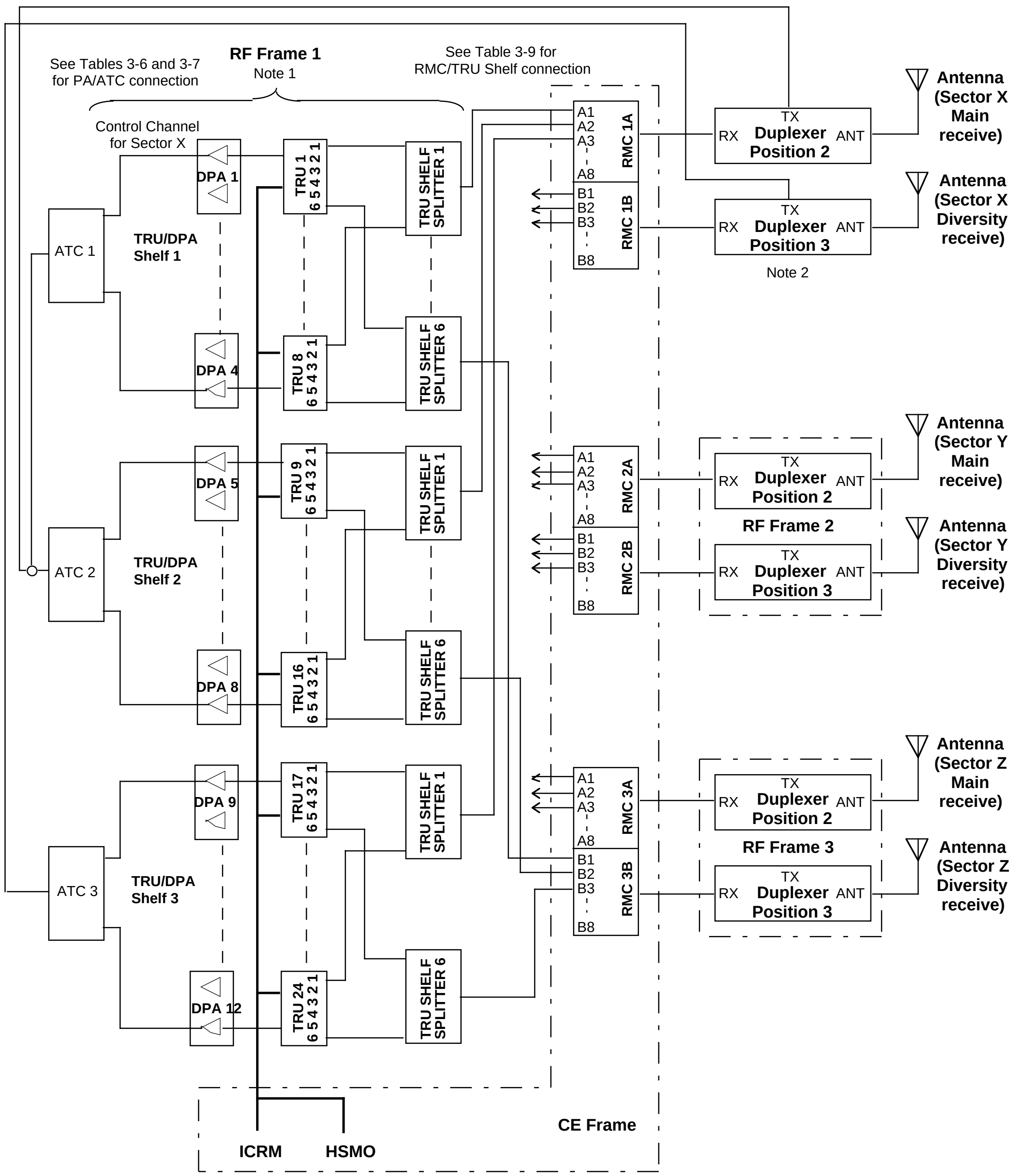


Figure 3-7
Block diagram of a 120° STSR Metrocell using three RF Frames



Notes:
1. For diagram clarity, only RF Frame 1 is shown. RF Frames 2 and 3 are connected and operated identically to that of RF Frame 1.
2. For RF Frames with 20 channels or less, the Duplexer in position 3 is not required. The outputs of the three ATCs are combined together and connected to the Duplexer in position 2. See Table 3-6.

Transmit cabling

In the transmit path, the output of each Transmit Receive Unit (TRU) is connected to the input of each corresponding power amplifier (PA) on the Dual Power Amplifier (DPA) module.

For a 120° STSR cell site with one RF Frame, each TRU/DPA Shelf and its associated ATC and duplexer serve for one of the three sectors; TRU/DPA Shelf 1, ATC 1 and Duplexer 1 for Sector X, TRU/DPA Shelf 2, ATC 2 and Duplexer 2 for Sector Y and TRU/DPA Shelf 3, ATC 3 and Duplexer 3 for Sector Z. The output of each power amplifier (PA) is input to an 8-channel AutoTune Combiner (ATC). The output of each 8-channel ATC is connected to the Transmit (TX) port of each corresponding duplexer. Table 3-5 lists the connection between the PAs and the ATC for a 120° STSR cell site using one RF Frame for three sectors.

For a 120° STSR cell site with three RF Frames, each frame serves for one of the three sectors; RF Frame 1 for Sector X, RF Frame 2 for Sector Y and RF Frame 3 for Sector Z. With an RF Frame holding up to 20 channels, only one duplexer is required. With 21 or more channels in one RF Frame, two duplexers are required. Table 3-6 lists the connection between the PAs and the ATC for an RF Frame with up to 20 channels. Table 3-7 lists the connection between the PAs and the ATC for an RF Frame with 21 channels or more.

Table 3-5
PA to ATC connection for a 120° Metrocell with one RF Frame

From		Through		To	
TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	ATC Shelf 1	ATC1 - Port 1	Duplexer Position 1	Antenna (Main receive for Sector X)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
TRU/DPA Shelf 2	DPA 5 - Port1 (CCH)	ATC Shelf 2	ATC2 - Port 1	Duplexer Position 2	Antenna (Main receive for Sector Y)
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2 (LCR)		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		

Table 3-5
PA to ATC connection for a 120° Metrocell with one RF Frame (continued)

From		Through		To	
TRU/DPA Shelf 3	DPA 9 - Port1 (CCH)	ATC Shelf 3	ATC3 - Port 1	Duplexer Position 3	Antenna (Main receive for Sector Z)
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2 (LCR)		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port2		ATC3 - Port 8		

Table 3-6
PA to ATC connection for a 120° Metrocell with 20 channels or less per RF frame for one sector

From		Through		To	
RF Frame 1 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 1 ATC Shelf 1	ATC1 - Port 1	RF Frame 1 Duplexer Position 2	Antenna (Main receive for Sector X)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 1 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 1 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 1 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 1 ATC Shelf 3	ATC3 - Port 1		
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		

Table 3-6
PA to ATC connection for a 120° Metrocell with 20 channels or less per RF frame for one sector (continued)

From		Through		To	
RF Frame 2 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 2 ATC Shelf 1	ATC1 - Port 1	RF Frame 2 Duplexer Position 2	Antenna (Main receive for Sector Y)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 2 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 2 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 2 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 2 ATC Shelf 3	ATC3 - Port 1		
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
RF Frame 3 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 3 ATC Shelf 1	ATC1 - Port 1	RF Frame 3 Duplexer Position 2	Antenna (Main receive for Sector Z)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 3 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 3 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		

Table 3-6
PA to ATC connection for a 120° Metrocell with 20 channels or less per RF frame for one sector (continued)

From		Through		To	
RF Frame 3 TRU/DPA Shelf 2	DPA 8 - Port1	RF Frame 3 ATC 2	ATC2 - Port 7	RF Frame 3 Duplexer Position 2	Antenna (Main receive for Sector Z)
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 3 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 3 ATC Shelf 3	ATC3 - Port 1		
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		

Table 3-7
PA to ATC connection for a 120° Metrocell with 21 channels or more per RF frame for one sector

From		Through		To	
RF Frame 1 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 1 ATC Shelf 1	ATC1 - Port 1	RF Frame 1 Duplexer Position 2	Antenna (Main receive for Sector X)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 1 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 1 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 1 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 1 ATC Shelf 3	ATC3 - Port 1	RF Frame 1 Duplexer Position 3	Antenna (Diversity receive for Sector X)
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
	DPA 11- Port1		ATC3 - Port 5		
	DPA 11- Port 2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port2		ATC3 - Port 8		

Table 3-7
PA to ATC connection for a 120° Metrocell with 21 channels or more per RF frame for one sector (continued)

From		Through		To	
RF Frame 2 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 2 ATC Shelf 1	ATC1 - Port 1	RF Frame 2 Duplexer Position 2	Antenna (Main receive for Sector Y)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 2 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 2 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 2 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 2 ATC Shelf 3	ATC3 - Port 1	RF Frame 2 Duplexer Position 3	Antenna (Diversity receive for Sector Y)
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
	DPA 11- Port1		ATC3 - Port 5		
	DPA 11- Port 2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port2		ATC3 - Port 8		
RF Frame 3 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 3 ATC Shelf 1	ATC1 - Port 1	RF Frame 3 Duplexer Position 2	Antenna (Main receive for Sector Z)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 3 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 3 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		

Table 3-7
PA to ATC connection for a 120° Metrocell with 21 channels or more per RF frame for one sector (continued)

From		Through		To	
RF Frame 3 TRU/DPA Shelf 2	DPA 6 - Port2	RF Frame 3 ATC Shelf 2	ATC2 - Port 4	RF Frame 3 Duplexer Position 2	Antenna (Main receive for Sector Z)
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 3 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 3 ATC Shelf 3	ATC3 - Port 1	RF Frame 3 Duplexer Position 3	Antenna (Diversity receive for Sector Z)
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
	DPA 11- Port1		ATC3 - Port 5		
	DPA 11- Port 2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port2		ATC3 - Port 8		

Receive cabling

In the reverse path, the receive signal from the main antenna of each sector is connected to the A-input of the Receive Multicoupler (RMC) through the receive port of the duplexer of that sector. The diversity antenna connects directly to the B-input of the RMC. Distribution of the reverse path frequencies is accomplished by RF splitters within each RF frame.

Table 3-8 lists the connection between the RMCs and the RF splitters in a 120° STSR Metrocell with one RF Frame. Table 3-9 lists the connection between the RMCs and the RF splitters in a 120° STSR Metrocell using three RF frames.

Table 3-8
RMC to splitter connections for a 120° STSR Metrocell with one RF Frame

	From	Through	To	
Sector X	Main antenna, Sector X	RMC 1A - A1	TRU shelf 1	Splitter 1
	Main antenna, Sector Y	RMC 2A - A1		Splitter 2
	Main antenna, Sector Z	RMC 3A - A1		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B1		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B1		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B1		Splitter 6

Table 3-8
RMC to splitter connections for a 120° STSR Metrocell with one RF Frame

	From	Through	To	
Sector Y	Main antenna, Sector X	RMC 1A - A2	TRU shelf 2	Splitter 1
	Main antenna, Sector Y	RMC 2A - A2		Splitter 2
	Main antenna, Sector Z	RMC 3A - A2		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B2		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B2		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B2		Splitter 6
Sector Z	Main antenna, Sector X	RMC 1A - A3	TRU shelf 3	Splitter 1
	Main antenna, Sector Y	RMC 2A - A3		Splitter 2
	Main antenna, Sector Z	RMC 3A - A3		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B3		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B3		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B3		Splitter 6

Table 3-9
RMC to splitter connections for a 120° STSR Metrocell with three RF Frames

	From	Through	To	
Sector X	Main antenna, Sector X	RMC 1A - A1	RF Frame 1 TRU shelf 1	Splitter 1
	Main antenna, Sector Y	RMC 2A - A1		Splitter 2
	Main antenna, Sector Z	RMC 3A - A1		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B1		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B1		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B1		Splitter 6
	Main antenna, Sector X	RMC 1A - A2	RF Frame 1 TRU shelf 2	Splitter 1
	Main antenna, Sector Y	RMC 2A - A2		Splitter 2
	Main antenna, Sector Z	RMC 3A - A2		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B2		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B2		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B2		Splitter 6
	Main antenna, Sector X	RMC 1A - A3	RF Frame 1 TRU shelf 3	Splitter 1
	Main antenna, Sector Y	RMC 2A - A3		Splitter 2
	Main antenna, Sector Z	RMC 3A - A3		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B3		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B3		Splitter 5

Table 3-9
RMC to splitter connections for a 120° STSR Metrocell with three RF Frames (continued)

	From	Through	To	
Sector X	Diversity antenna, Sector Z	RMC 3B - B3	RF Frame 1 TRU Shelf 3	Splitter 6
Sector Y	Main antenna, Sector X	RMC 1A - A4	RF Frame 2 TRU shelf 1	Splitter 1
	Main antenna, Sector Y	RMC 2A - A4		Splitter 2
	Main antenna, Sector Z	RMC 3A - A4		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B4		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B4		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B4		Splitter 6
	Main antenna, Sector X	RMC 1A - A5	RF Frame 2 TRU shelf 2	Splitter 1
	Main antenna, Sector Y	RMC 2A - A5		Splitter 2
	Main antenna, Sector Z	RMC 3A - A5		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B5		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B5		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B5		Splitter 6
	Main antenna, Sector X	RMC 1A - A6	RF Frame 2 TRU shelf 3	Splitter 1
	Main antenna, Sector Y	RMC 2A - A6		Splitter 2
	Main antenna, Sector Z	RMC 3A - A6		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B6		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B6		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B6		Splitter 6
Sector Z	Main antenna, Sector X	RMC 1A - A7	RF Frame 3 TRU shelf 1	Splitter 1
	Main antenna, Sector Y	RMC 2A - A7		Splitter 2
	Main antenna, Sector Z	RMC 3A - A7		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B7		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B7		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B7		Splitter 6
	Main antenna, Sector X	RMC 1A - A8	RF Frame 3 TRU shelf 2	Splitter 1
	Main antenna, Sector Y	RMC 2A - A8		Splitter 2
	Main antenna, Sector Z	RMC 3A - A8		Splitter 3
	Diversity antenna, Sector X	RMC 1B - B8		Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B8		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B8		Splitter 6
	Main antenna, Sector X	RMC 1A - A9	RF Frame 3 TRU shelf 3	Splitter 1
	Main antenna, Sector Y	RMC 2A - A9		Splitter 2
	Main antenna, Sector Z	RMC 3A - A9		Splitter 3

Table 3-9
RMC to splitter connections for a 120° STSR Metrocell with three RF Frames (continued)

	From	Through	To	
Sector Z	Diversity antenna, Sector X	RMC 1B - B9	RF Frame 3 TRU shelf 3	Splitter 4
	Diversity antenna, Sector Y	RMC 2B - B9		Splitter 5
	Diversity antenna, Sector Z	RMC 3B - B9		Splitter 6

Component requirement

Table 3-10 lists the components required for a 120° STSR Metrocell with one RF Frame and Table 3-11 lists the components required for a 120° STSR Metrocell with three RF Frames. Both configurations require three Receive Multicouplers (RMC).

Table 3-10
Component requirement for a 120° STSR Metrocell with one RF Frame

No. of TRUs per Sector	No. of TRUs	No. of ATCs	No. of Duplexers	No. of ICRM TCM Port cards	No. of antennas
3 to 8	9 to 24	3	3	2	3 TX/RX, 3 RX

Note: An additional TCM port card is required for the DRUM, the ACU and the CSM2.

Table 3-11
Component requirement for a 120° STSR Metrocell with three RF Frames

No. of TRUs per Sector	No. of TRUs	No. of ATCs	No. of Duplexers	No. of ICRM TCM Port cards	No. of antennas
3 to 20	9 to 60	9	3	6	3 TX/RX, 3 RX
21 to 24	63 to 72	9	6	6	6 TX/RX

Note: An additional TCM port card is required for the DRUM, the ACU and the CSM2.

60° STSR cell site connection

The Metrocell in a 60° STSR configuration uses at least three equipment frames, one CE Frame and two RF frames (see Figure 3-8). Each TRU/DPA Shelf and its associated ATC on one of the two RF frames support one of the six sectors. With only two RF frames, the maximum number of Voice Channels (VCH) supported by each sector is six since two of the eight TRUs on the TRU shelf have to be assigned as the Control Channel (CCH) and the Locate Channel Receiver (LCR). A 60° STSR Metrocell with two RF Frames requires twelve antennas; one TX/RX antenna and one RX only antenna for each sector (see Figure 3-10). As traffic grows, two additional RF frames can be added to accommodate more VCHs per sector (see Figure 3-9).

A 60° STSR Metrocell with four RF Frames has 16 channels for one sector (including the CCH and the LCR) and each sector requires two TRU/DPA shelves and two ATCs. It also requires twelve antennas; one TX/RX antenna and one RX only antenna for each sector. The outputs of the two ATCs for each sector are combined through one phasing transformer and connected to a duplexer. The output of duplexer is then connected to the main TX/RX Antenna of that sector. The diversity RX antenna of each sector is connected directly to the Receive Multicoupler (RMC) of that sector. Figure 3-9 shows the frame layout and Figure 3-11 shows the block diagram of a 60° STSR Metrocell with four RF Frames.

Control Channel redundancy

Control Channel (CCH) redundancy is commonly provided with a Locate Channel Receiver (LCR) backup. With two RF Frames, the CCH of each sector is assigned to position 1 on the TRU/DPA Shelf of that sector and the LCR is assigned to position 4 on the same shelf. With four RF Frames, a typical assignment of the CCH and LCR for each sector is listed below:

	Control Channel	Locate Channel Receiver
Sector X	RF Frame 1/TRU Shelf 1/Position 1	RF Frame 1/TRU Shelf 1/Position 4
Sector Y	RF Frame 2/TRU Shelf 1/Position 1	RF Frame 2/TRU Shelf 1/Position 4
Sector Z	RF Frame 2/TRU Shelf 3/Position 1	RF Frame 2/TRU Shelf 3/Position 4
Sector U	RF Frame 3/TRU Shelf 1/Position 1	RF Frame 3/TRU Shelf 1/Position 4
Sector V	RF Frame 4/TRU Shelf 1/Position 1	RF Frame 4/TRU Shelf 1/Position 4
Sector W	RF Frame 3/TRU Shelf 3/Position 1	RF Frame 3/TRU Shelf 3/Position 4

This arrangement will have the CCH and the LCR supplied on a different DC power feed and a TCM card. No RF coaxial switch is required since the cavity of the LCR position on the ATC will tune to the CCH frequency when backup is required.

Figure 3-8
Frame layout of a 60° STSR Metrocell with two RF frames (front view)

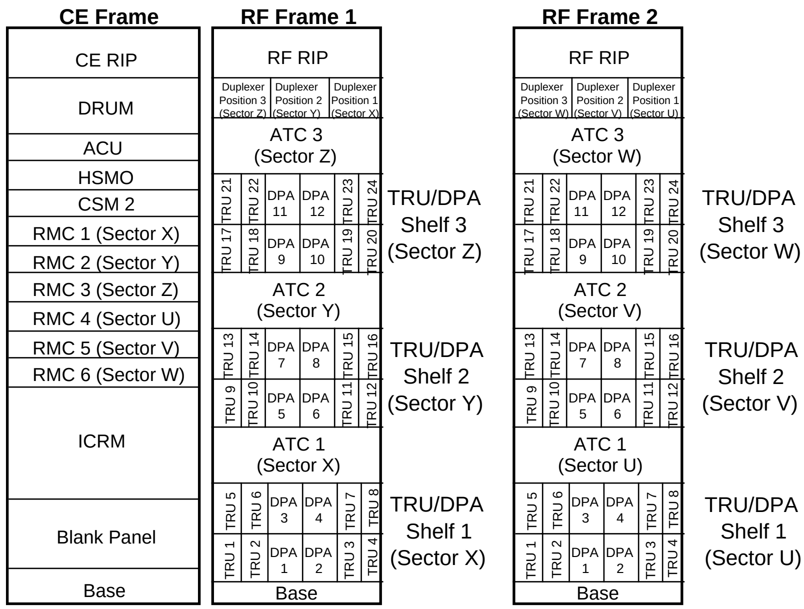
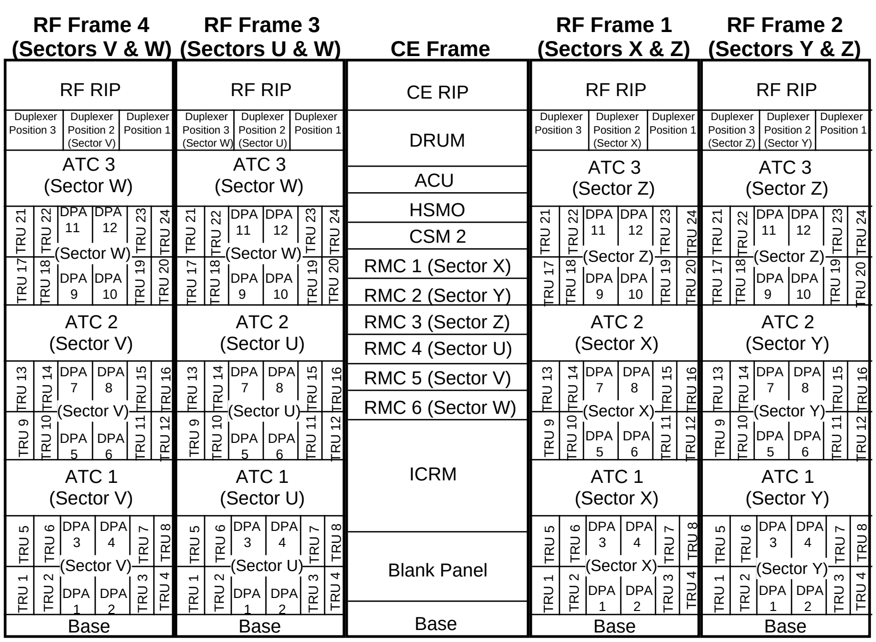
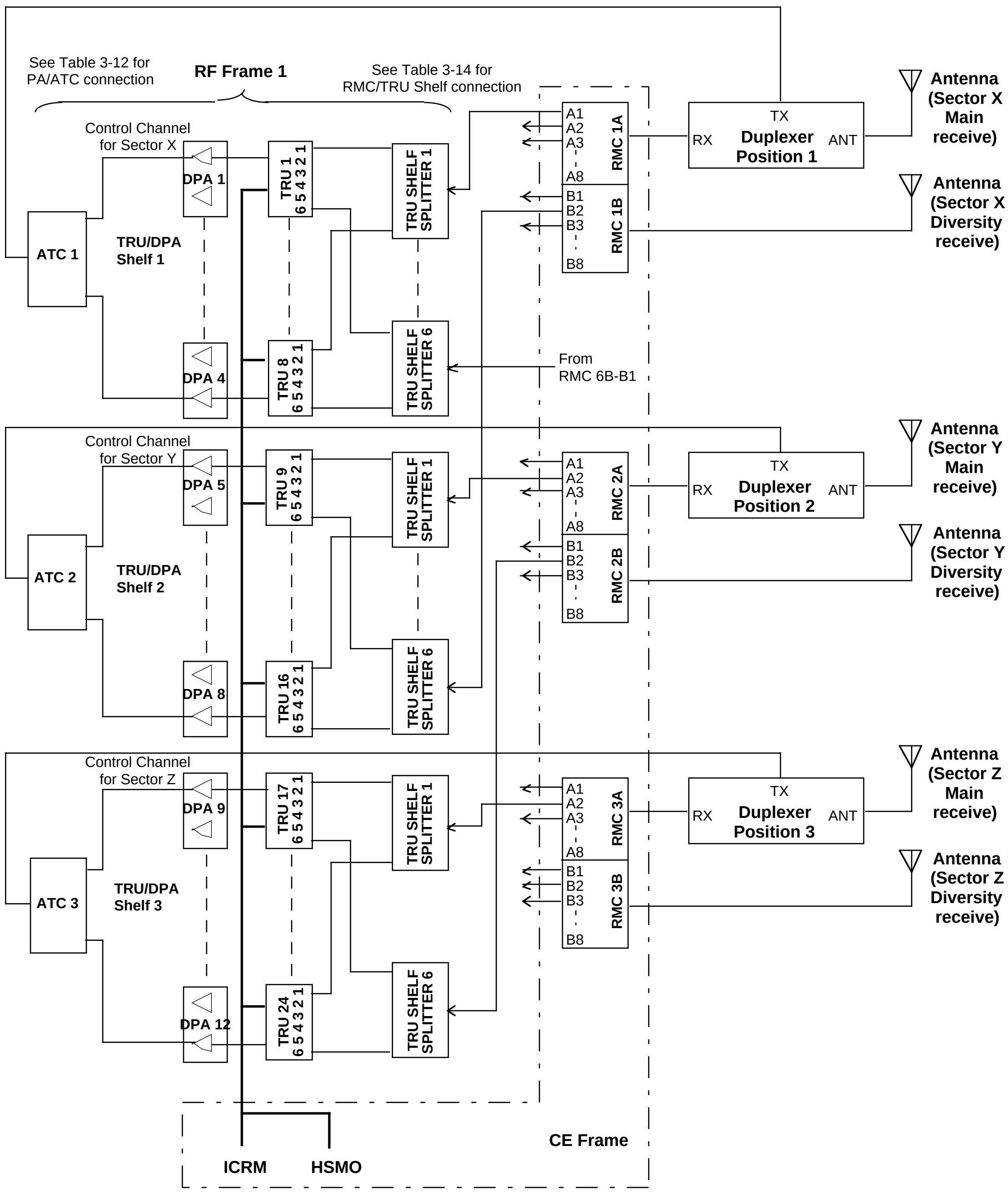


Figure 3-9
Typical frame layout of a 60° STSR Metrocell with four RF frames (front view)



Note: A fifth RF Frame can be added for expanding three of the sectors to 24 channels.

Figure 3-10
Block diagram of a 60° STSR Metrocell with two RF Frames



- continued -

Figure 3-10
Block diagram of a 60° STSR Metrocell with two RF Frames (continued)

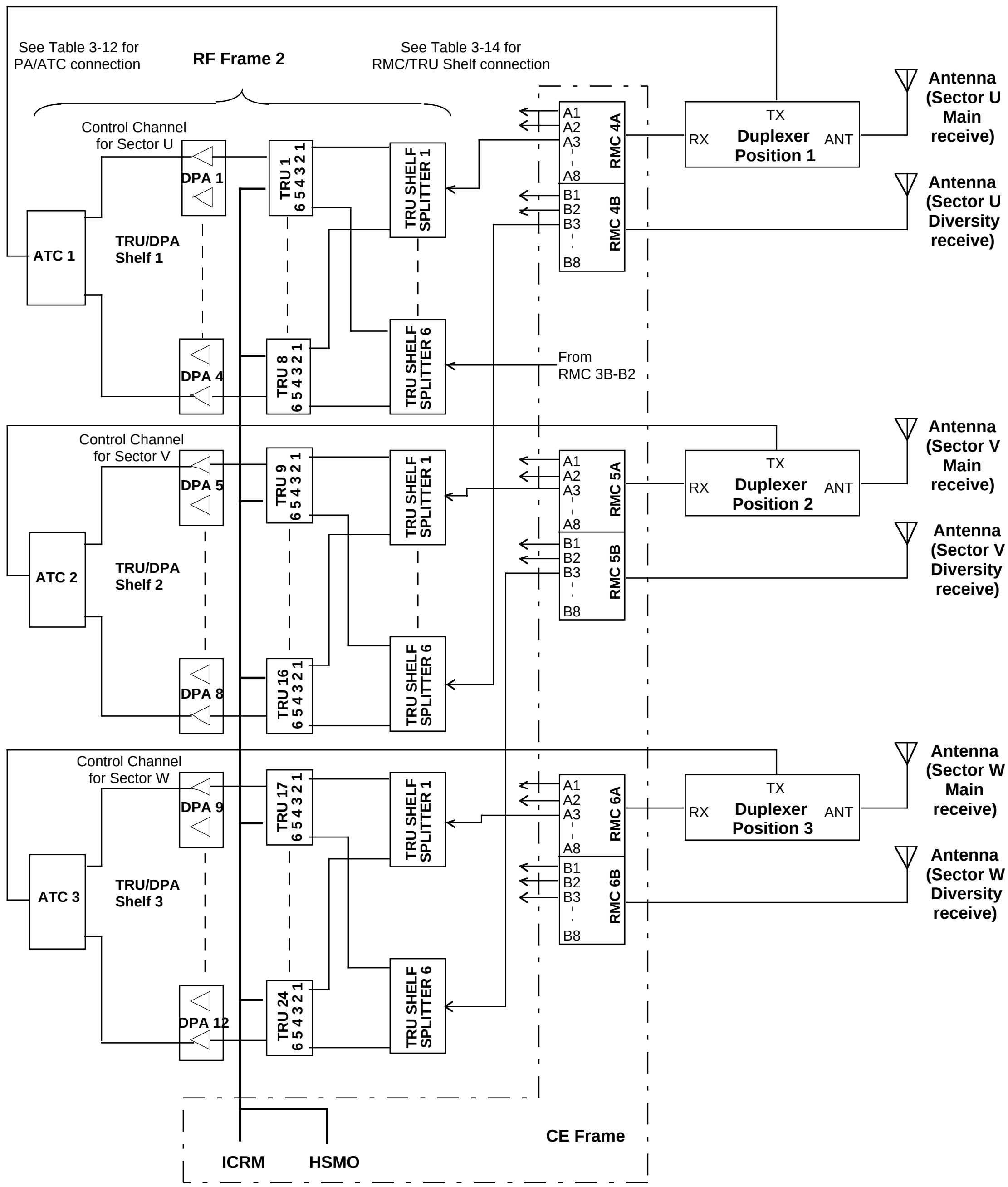
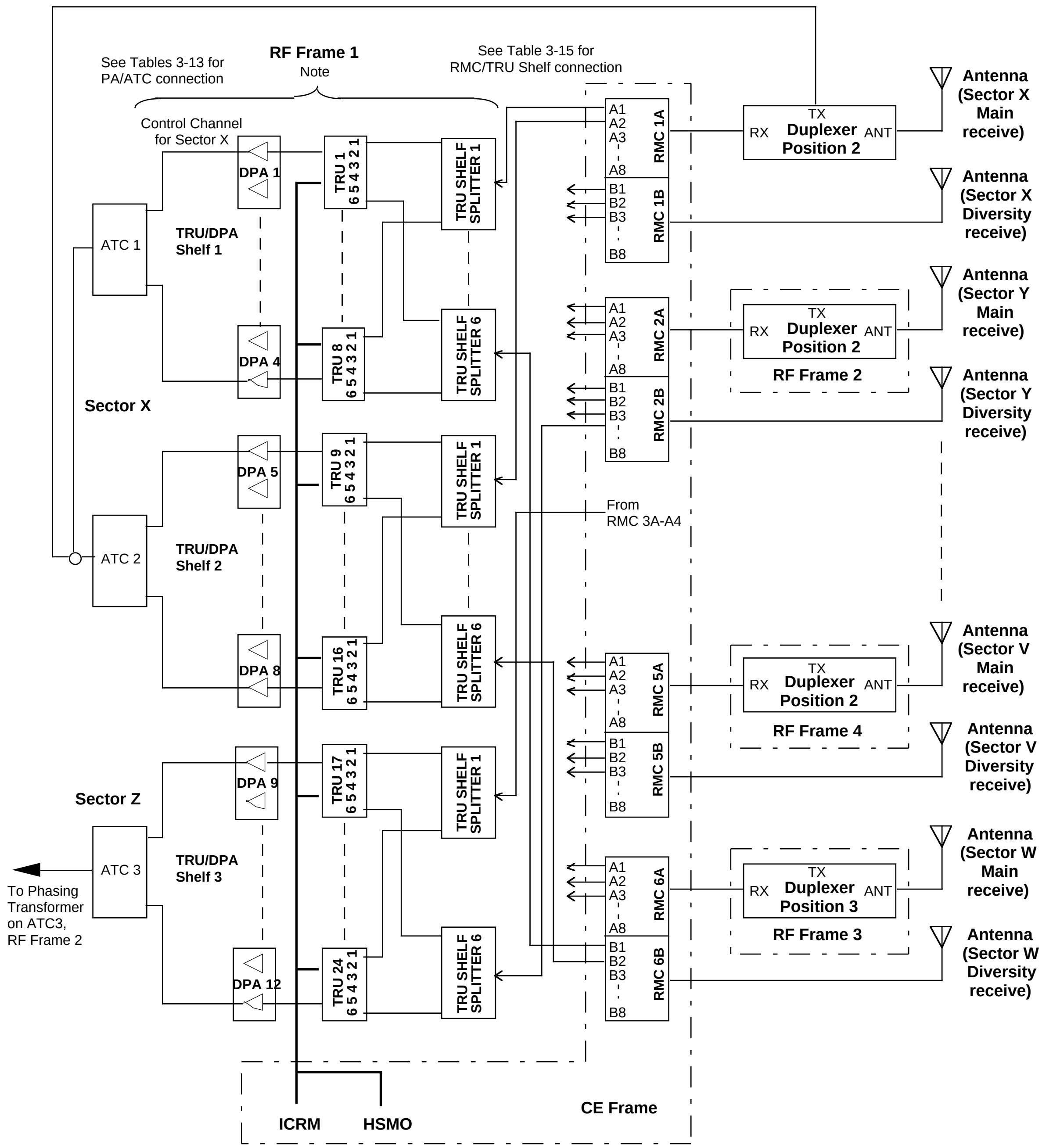


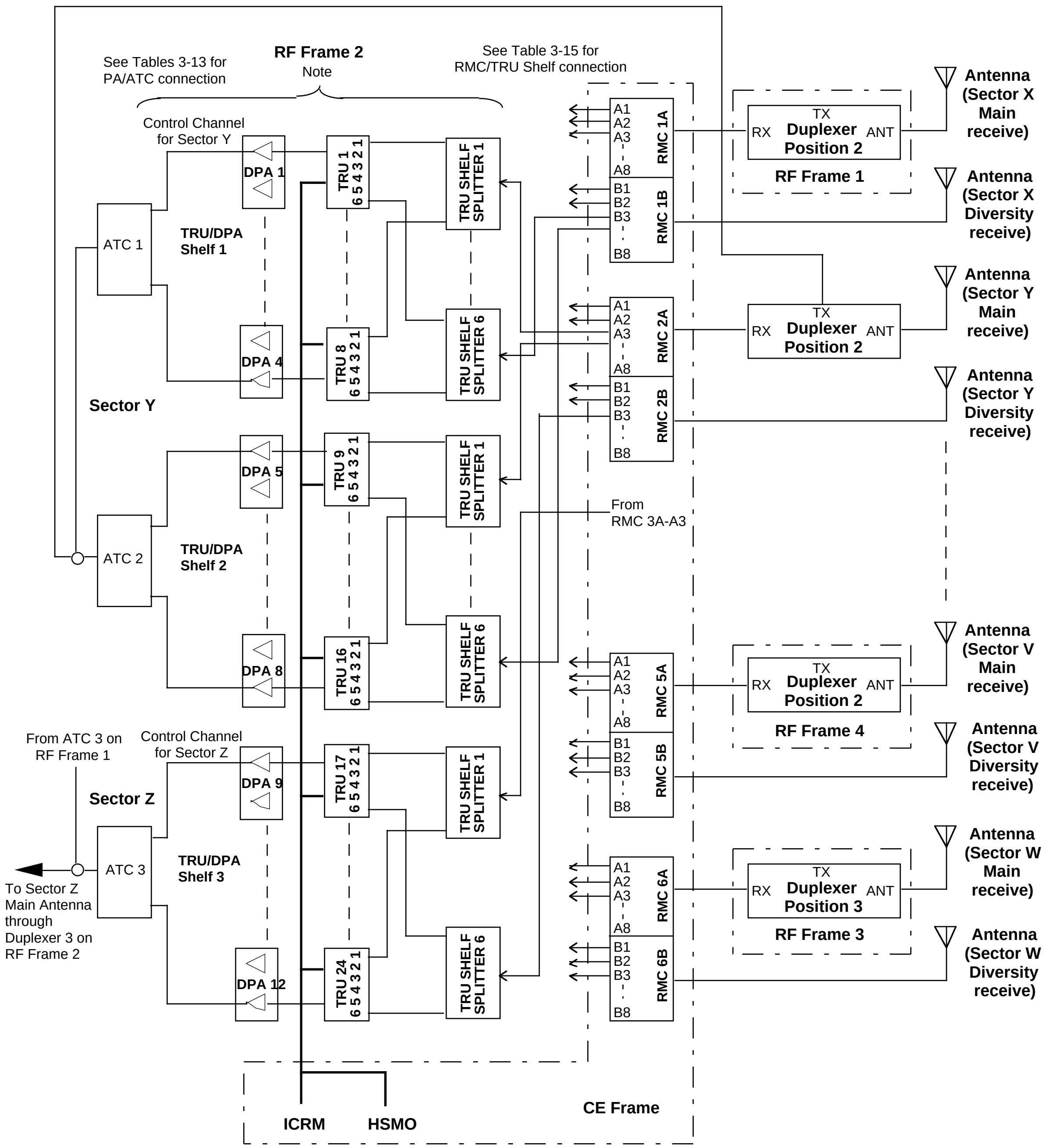
Figure 3-11
Block diagram of a 60° STSR Metrocell with four RF Frames



Note:
For diagram clarity, only RF Frames 1 and 2 are shown. RF Frames 3 and 4 are connected and operated identically to that of RF Frames 1 and 2 respectively for Sectors U, V and W. Refer to Tables 3-13 and 3-15 for the complete cabling information.

- continued -

Figure 3-11
Block diagram of a 60° STSR Metrocell with four RF Frames (continued)



Note:
For diagram clarity, only RF Frames 1 and 2 are shown. RF Frames 3 and 4 are connected and operated identically to that of RF Frames 1 and 2 respectively for Sectors U, V and W. Refer to Tables 3-13 and 3-15 for the complete cabling information.

Transmit cabling

In the transmit path, the output of each Transmit Receive Unit (TRU) is connected to the input of each corresponding power amplifier (PA) on the Dual Power Amplifier (DPA) module.

For a 60° STSR cell site with two RF Frames, each TRU/DPA Shelf and its associated ATC and duplexer serve for one of the six sectors as listed below:

- Sector X RF Frame 1—TRU/DPA Shelf 1, ATC 1 and Duplexer 1
- Sector Y RF Frame 1—TRU/DPA Shelf 2, ATC 2 and Duplexer 2
- Sector Z RF Frame 1—TRU/DPA Shelf 3, ATC 3 and Duplexer 3
- Sector U RF Frame 2—TRU/DPA Shelf 1, ATC 1 and Duplexer 1
- Sector V RF Frame 2—TRU/DPA Shelf 2, ATC 2 and Duplexer 2
- Sector W RF Frame 2—TRU/DPA Shelf 3, ATC 3 and Duplexer 3

The output of each power amplifier (PA) is input to an 8-channel AutoTune Combiner (ATC). The output of each 8-channel ATC is connected to the Transmit (TX) port of each corresponding duplexer. Table 3-12 lists the connection between the PAs and the ATC for a 60° STSR cell site using two RF Frame for six sectors.

For a 60° STSR cell site with four RF Frames, the assignment of the equipment for each sector is as listed below:

- Sector X RF Frame 1 —TRU/DPA Shelf 1, ATC 1
TRU/DPA Shelf 2, ATC 2 and Duplexer 2
- Sector Y RF Frame 2 —TRU/DPA Shelf 1, ATC 1
TRU/DPA Shelf 2, ATC 2 and Duplexer 2
- Sector Z RF Frame 1 —TRU/DPA Shelf 3, ATC 3
RF Frame 2 —TRU/DPA Shelf 3, ATC 3 and Duplexer 3
- Sector U RF Frame 3 —TRU/DPA Shelf 1, ATC 1
TRU/DPA Shelf 2, ATC 2 and Duplexer 2
- Sector V RF Frame 4 —TRU/DPA Shelf 1, ATC 1
TRU/DPA Shelf 2, ATC 2 and Duplexer 2
- Sector W RF Frame 3 —TRU/DPA Shelf 3, ATC 3 and Duplexer 3
RF Frame 4 —TRU/DPA Shelf 3, ATC 3

By adding one more RF Frame to this configuration, three of the six sectors can be expanded to provide up to 24 channels (including the CCH and LCR). With this additional RF Frame, the equipment and cabling may need to be reassigned and rearranged. Table 3-12 lists the connection between the PAs and the ATC for a 60° STSR configuration with two RF Frames and Table 3-13 lists the connection between the PAs and the ATC for a 60° STSR configuration with four RF Frames.

Table 3-12
PA to ATC connection for a 60°STSR Metrocell using two RF Frames

From		Through		To	
RF Frame 1 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 1 ATC Shelf 1	ATC1 - Port 1	RF Frame 1 Duplexer Position 1	Antenna (Main receive for Sector X)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCH)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 1 TRU/DPA Shelf 2	DPA 5 - Port1 (CCH)	RF Frame 1 ATC Shelf 2	ATC2 - Port 1	RF Frame 1 Duplexer Position 2	Antenna (Main receive for Sector Y)
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2 (LCH)		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 1 TRU/DPA Shelf 3	DPA 9 - Port1 (CCH)	RF Frame 1 ATC Shelf 3	ATC3 - Port 1	RF Frame 1 Duplexer Position 3	Antenna (Main receive for Sector Z)
	DPA 9 - Port 2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2 (LCH)		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port2		ATC3 - Port 8		
RF Frame 2 TRU/DPA Shelf 1	DPA 13 - Port1 (CCH)	RF Frame 2 ATC Shelf 1	ATC4 - Port 1	RF Frame 2 Duplexer Position 1	Antenna (Main receive for Sector U)
	DPA 13 - Port2		ATC4 - Port 2		
	DPA 14 - Port1		ATC4 - Port 3		
	DPA 14 - Port2 (LCH)		ATC4 - Port 4		
	DPA 15 - Port1		ATC4 - Port 5		
	DPA 15 - Port2		ATC4 - Port 6		
	DPA 16 - Port1		ATC4 - Port 7		
	DPA 16 - Port2		ATC4 - Port 8		

Table 3-12
PA to ATC connection for a 60°STSR Metrocell using two RF Frames (continued)

From		Through		To	
RF Frame 2 TRU/DPA Shelf 2	DPA 17 - Port1 (CCH)	RF Frame 2 ATC Shelf 2	ATC5 - Port 1	RF Frame 2 Duplexer Position 2	Antenna (Main receive for Sector V)
	DPA 17 - Port2		ATC5 - Port 2		
	DPA 18 - Port1		ATC5 - Port 3		
	DPA 18 - Port2 (LCH)		ATC5 - Port 4		
	DPA 19 - Port1		ATC5 - Port 5		
	DPA 19 - Port 2		ATC5 - Port 6		
	DPA 20 - Port1		ATC5 - Port 7		
	DPA 20 - Port 2		ATC5 - Port 8		
RF Frame 2 TRU/DPA Shelf 3	DPA 21 - Port1 (CCH)	RF Frame 2 ATC Shelf 3	ATC6 - Port 1	RF Frame 2 Duplexer Position 3	Antenna (Main receive for Sector W)
	DPA 21 - Port 2		ATC6 - Port 2		
	DPA 22 - Port1		ATC6 - Port 3		
	DPA 22 - Port2 (LCH)		ATC6 - Port 4		
	DPA 23 - Port1		ATC6 - Port 5		
	DPA 23 - Port2		ATC6 - Port 6		
	DPA 24 - Port1		ATC6 - Port 7		
	DPA 24 - Port2		ATC6 - Port 8		

Table 3-13
PA to ATC connection for a 60°STSR Metrocell using four RF Frames

From		Through		To	
RF Frame 1 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 1 ATC Shelf 1	ATC1 - Port 1	RF Frame 1 Duplexer Position 2	Antenna (Main receive for Sector X)
	DPA 1 - Port2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCH)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 1 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 1 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port 2		ATC2 - Port 8		
RF Frame 2 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 2 ATC Shelf 1	ATC1 - Port 1	RF Frame 2 Duplexer Position 2	Antenna (Main receive for Sector Y)
	DPA 1 - Port 2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port 2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 2 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 2 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port 2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port2		ATC2 - Port 8		

Table 3-13
PA to ATC connection for a 60°STSR Metrocell using four RF Frames (continued)

From		Through		To	
RF Frame 1 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 1 ATC Shelf 3	ATC3 - Port 1	RF Frame 2 Duplexer Position 3	Antenna (Main receive for Sector Z)
	DPA 9 - Port2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12- Port2		ATC3 - Port 8		
RF Frame 2 TRU/DPA Shelf 3	DPA 9 - Port1 (CCH)	RF Frame 2 ATC Shelf 3	ATC3 - Port 1		
	DPA 9 - Port2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2 (LCH)		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port 2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port 2		ATC3 - Port 8		
RF Frame 3 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 3 ATC Shelf 1	ATC1 - Port 1	RF Frame 3 Duplexer Position 2	Antenna (Main receive for Sector U)
	DPA 1 - Port 2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port 2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 3 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 3 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port 2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port2		ATC2 - Port 8		

Table 3-13
PA to ATC connection for a 60°STSR Metrocell using four RF Frames (continued)

From		Through		To	
RF Frame 4 TRU/DPA Shelf 1	DPA 1 - Port1 (CCH)	RF Frame 4 ATC Shelf 1	ATC1 - Port 1	RF Frame 4 Duplexer Position 2	Antenna (Main receive for Sector V)
	DPA 1 - Port 2		ATC1 - Port 2		
	DPA 2 - Port1		ATC1 - Port 3		
	DPA 2 - Port2 (LCR)		ATC1 - Port 4		
	DPA 3 - Port1		ATC1 - Port 5		
	DPA 3 - Port 2		ATC1 - Port 6		
	DPA 4 - Port1		ATC1 - Port 7		
	DPA 4 - Port2		ATC1 - Port 8		
RF Frame 4 TRU/DPA Shelf 2	DPA 5 - Port1	RF Frame 4 ATC Shelf 2	ATC2 - Port 1		
	DPA 5 - Port 2		ATC2 - Port 2		
	DPA 6 - Port1		ATC2 - Port 3		
	DPA 6 - Port2		ATC2 - Port 4		
	DPA 7 - Port1		ATC2 - Port 5		
	DPA 7 - Port 2		ATC2 - Port 6		
	DPA 8 - Port1		ATC2 - Port 7		
	DPA 8 - Port2		ATC2 - Port 8		
RF Frame 3 TRU/DPA Shelf 3	DPA 9 - Port1 (CCH)	RF Frame 3 ATC Shelf 3	ATC3 - Port 1	RF Frame 3 Duplexer Position 3	Antenna (Main receive for Sector W)
	DPA 9 - Port2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2 (LCH)		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12- Port2		ATC3 - Port 8		
RF Frame 4 TRU/DPA Shelf 3	DPA 9 - Port1	RF Frame 4 ATC Shelf 3	ATC3 - Port 1		
	DPA 9 - Port2		ATC3 - Port 2		
	DPA 10 - Port1		ATC3 - Port 3		
	DPA 10 - Port2		ATC3 - Port 4		
	DPA 11 - Port1		ATC3 - Port 5		
	DPA 11 - Port 2		ATC3 - Port 6		
	DPA 12 - Port1		ATC3 - Port 7		
	DPA 12 - Port 2		ATC3 - Port 8		

Receive cabling

In the reverse path, the receive signal from the main antenna of each sector is connected to the A-input of the Receive Multicoupler (RMC) through the receive port of the duplexer of that sector. The diversity antenna connects directly to the B-input of the RMC. Distribution of the reverse path frequencies is accomplished by RF splitters within each RF frame.

Table 3-14 lists the connection between the RMCs and the RF splitters in a 60° STSR Metrocell with two RF Frames. Table 3-15 lists the connection between the RMCs and the RF splitters in a 60° STSR Metrocell using four RF frames.

Table 3-14
RMC to splitter connections for a 60° STSR Metrocell with two RF Frames

	From	Through	To	
Sector X	Main antenna, Sector X — primary sector	RMC 1A - A1	RF Frame 1 TRU shelf 1	Splitter 1
	Main antenna, Sector Y — right adjacent sector	RMC 2A - A1		Splitter 2
	Main antenna, Sector U — rear sector	RMC 4A - A1		Splitter 3
	Diversity antenna, Sector X — primary sector	RMC 1B - B1		Splitter 4
	Diversity antenna, Sector U — rear sector	RMC 4B - B1		Splitter 5
	Diversity antenna, Sector W — left adjacent sector	RMC 6B - B1		Splitter 6
Sector Y	Main antenna, Sector Y — primary sector	RMC 2A - A2	RF Frame 1 TRU shelf 2	Splitter 1
	Main antenna, Sector Z — right adjacent sector	RMC 3A - A1		Splitter 2
	Main antenna, Sector V — rear sector	RMC 5A - A1		Splitter 3
	Diversity antenna, Sector Y — primary sector	RMC 2B - B1		Splitter 4
	Diversity antenna, Sector V — rear sector	RMC 5B - B1		Splitter 5
	Diversity antenna, Sector X — left adjacent sector	RMC 1B - B2		Splitter 6
Sector Z	Main antenna, Sector Z — primary sector	RMC 3A - A2	RFFrame 1 TRU shelf 3	Splitter 1
	Main antenna, Sector U — right adjacent sector	RMC 4A - A2		Splitter 2
	Main antenna, Sector W — rear sector	RMC 6A - A1		Splitter 3
	Diversity antenna, Sector Z — primary sector	RMC 3B - B1		Splitter 4
	Diversity antenna, Sector W — rear sector	RMC 6B - B2		Splitter 5
	Diversity antenna, Sector Y — left adjacent sector	RMC 2B - B2		Splitter 6
Sector U	Main antenna, Sector U — primary sector	RMC 4A - A3	RFFrame 2 TRU shelf 1	Splitter 1
	Main antenna, Sector V — right adjacent sector	RMC 5A - A2		Splitter 2
	Main antenna, Sector X — rear sector	RMC 1A - A2		Splitter 3
	Diversity antenna, Sector U — primary sector	RMC 4B - B2		Splitter 4
	Diversity antenna, Sector X — rear sector	RMC 1B - B3		Splitter 5
	Diversity antenna, Sector Z — left adjacent sector	RMC 3B - B2		Splitter 6

Table 3-14
RMC to splitter connections for a 60° STSR Metrocell with two RF Frames (continued)

	From	Through	To	
Sector V	Main antenna, Sector V — primary sector	RMC 5A - A3	RFFrame 2 TRU shelf 2	Splitter 1
	Main antenna, Sector W — right adjacent sector	RMC 6A - A2		Splitter 2
	Main antenna, Sector Y — rear sector	RMC 2A - A3		Splitter 3
	Diversity antenna, Sector V — primary sector	RMC 5B - B2		Splitter 4
	Diversity antenna, Sector Y — rear sector	RMC 2B - B3		Splitter 5
	Diversity antenna, Sector U — left adjacent sector	RMC 4B - B3		Splitter 6
Sector W	Main antenna, Sector W — primary sector	RMC 6A - A3	RFFrame 2 TRU shelf 3	Splitter 1
	Main antenna, Sector X — right adjacent sector	RMC 1A - A3		Splitter 2
	Main antenna, Sector Z — rear sector	RMC 3A - A3		Splitter 3
	Diversity antenna, Sector W — primary sector	RMC 6B - B3		Splitter 4
	Diversity antenna, Sector Z — rear sector	RMC 3B - B3		Splitter 5
	Diversity antenna, Sector V — left adjacent sector	RMC 5B - B3		Splitter 6

Table 3-15
RMC to splitter connections for a 60° STSR Metrocell with four RF Frames

	From	Through	To	
Sector X	Main antenna, Sector X — primary sector	RMC 1A - A1	RFFrame 1 TRU shelf 1	Splitter 1
	Main antenna, Sector Y — right adjacent sector	RMC 2A - A1		Splitter 2
	Main antenna, Sector U — rear sector	RMC 4A - A1		Splitter 3
	Diversity antenna, Sector X — primary sector	RMC 1B - B1		Splitter 4
	Diversity antenna, Sector U — rear sector	RMC 4B - B1		Splitter 5
	Diversity antenna, Sector W — left adjacent sector	RMC 6B - B1		Splitter 6
	Main antenna, Sector X — primary sector	RMC 1A - A2	RFFrame 1 TRU shelf 2	Splitter 1
	Main antenna, Sector Y — right adjacent sector	RMC 2A - A2		Splitter 2
	Main antenna, Sector U — rear sector	RMC 4A - A2		Splitter 3
	Diversity antenna, Sector X — primary sector	RMC 1B - B2		Splitter 4
	Diversity antenna, Sector U — rear sector	RMC 4B - B2		Splitter 5
	Diversity antenna, Sector W — left adjacent sector	RMC 6B - B2		Splitter 6
Sector Y	Main antenna, Sector Y — primary sector	RMC 2A - A3	RFFrame 2 TRU shelf 1	Splitter 1
	Main antenna, Sector Z — right adjacent sector	RMC 3A - A1		Splitter 2
	Main antenna, Sector V — rear sector	RMC 5A - A1		Splitter 3
	Diversity antenna, Sector Y — primary sector	RMC 2B - B1		Splitter 4
	Diversity antenna, Sector V — rear sector	RMC 5B - B1		Splitter 5
	Diversity antenna, Sector X — left adjacent sector	RMC 1B - B3		Splitter 6

Table 3-15
RMC to splitter connections for a 60° STSR Metrocell with four RF Frames (continued)

	From	Through	To	
Sector Y	Main antenna, Sector Y — primary sector	RMC 2A - A4	RFFrame 2 TRU shelf 2	Splitter 1
	Main antenna, Sector Z — right adjacent sector	RMC 3A - A2		Splitter 2
	Main antenna, Sector V — rear sector	RMC 5A - A2		Splitter 3
	Diversity antenna, Sector Y — primary sector	RMC 2B - B2		Splitter 4
	Diversity antenna, Sector V — rear sector	RMC 5B - B2		Splitter 5
	Diversity antenna, Sector X — left adjacent sector	RMC 1B - B4		Splitter 6
Sector Z	Main antenna, Sector Z — primary sector	RMC 3A - A3	RFFrame 2 TRU shelf 3	Splitter 1
	Main antenna, Sector U — right adjacent sector	RMC 4A - A3		Splitter 2
	Main antenna, Sector W — rear sector	RMC 6A - A1		Splitter 3
	Diversity antenna, Sector Z — primary sector	RMC 3B - B1		Splitter 4
	Diversity antenna, Sector W — rear sector	RMC 6B - B3		Splitter 5
	Diversity antenna, Sector Y — left adjacent sector	RMC 2B - B3		Splitter 6
	Main antenna, Sector Z — primary sector	RMC 3A - A4	RFFrame 1 TRU shelf 3	Splitter 1
	Main antenna, Sector U — right adjacent sector	RMC 4A - A4		Splitter 2
	Main antenna, Sector W — rear sector	RMC 6A - A2		Splitter 3
	Diversity antenna, Sector Z — primary sector	RMC 3B - B2		Splitter 4
	Diversity antenna, Sector W — rear sector	RMC 6B - B4		Splitter 5
	Diversity antenna, Sector Y — left adjacent sector	RMC 2B - B4		Splitter 6
Sector U	Main antenna, Sector U — primary sector	RMC 4A - A5	RFFrame 3 TRU shelf 1	Splitter 1
	Main antenna, Sector V — right adjacent sector	RMC 5A - A3		Splitter 2
	Main antenna, Sector X — rear sector	RMC 1A - A3		Splitter 3
	Diversity antenna, Sector U — primary sector	RMC 4B - B3		Splitter 4
	Diversity antenna, Sector X — rear sector	RMC 1B - B5		Splitter 5
	Diversity antenna, Sector Z — left adjacent sector	RMC 3B - B3		Splitter 6
	Main antenna, Sector U — primary sector	RMC 4A - A6	RFFrame 3 TRU shelf 2	Splitter 1
	Main antenna, Sector V — right adjacent sector	RMC 5A - A4		Splitter 2
	Main antenna, Sector X — rear sector	RMC 1A - A4		Splitter 3
	Diversity antenna, Sector U — primary sector	RMC 4B - B4		Splitter 4
	Diversity antenna, Sector X — rear sector	RMC 1B - B6		Splitter 5
	Diversity antenna, Sector Z — left adjacent sector	RMC 3B - B4		Splitter 6

Table 3-15
RMC to splitter connections for a 60° STSR Metrocell with four RF Frames (continued)

	From	Through	To	
Sector V	Main antenna, Sector V — primary sector	RMC 5A - A5	RFFrame 4 TRU shelf 1	Splitter 1
	Main antenna, Sector W — right adjacent sector	RMC 6A - A3		Splitter 2
	Main antenna, Sector Y — rear sector	RMC 2A - A5		Splitter 3
	Diversity antenna, Sector V — primary sector	RMC 5B - B3		Splitter 4
	Diversity antenna, Sector Y — rear sector	RMC 2B - B5		Splitter 5
	Diversity antenna, Sector U — left adjacent sector	RMC 4B - B5		Splitter 6
	Main antenna, Sector V — primary sector	RMC 5A - A6	RFFrame 4 TRU shelf 2	Splitter 1
	Main antenna, Sector W — right adjacent sector	RMC 6A - A4		Splitter 2
	Main antenna, Sector Y — rear sector	RMC 2A - A6		Splitter 3
	Diversity antenna, Sector V — primary sector	RMC 5B - B4		Splitter 4
	Diversity antenna, Sector Y — rear sector	RMC 2B - B6		Splitter 5
	Diversity antenna, Sector U — left adjacent sector	RMC 4B - B6		Splitter 6
Sector W	Main antenna, Sector W — primary sector	RMC 6A - A5	RFFrame 3 TRU shelf 3	Splitter 1
	Main antenna, Sector X — right adjacent sector	RMC 1A - A5		Splitter 2
	Main antenna, Sector Z — rear sector	RMC 3A - A5		Splitter 3
	Diversity antenna, Sector W — primary sector	RMC 6B - B5		Splitter 4
	Diversity antenna, Sector Z — rear sector	RMC 3B - B5		Splitter 5
	Diversity antenna, Sector V — left adjacent sector	RMC 5B - B5		Splitter 6
	Main antenna, Sector W — primary sector	RMC 6A - A6	RFFrame 4 TRU shelf 3	Splitter 1
	Main antenna, Sector X — right adjacent sector	RMC 1A - A6		Splitter 2
	Main antenna, Sector Z — rear sector	RMC 3A - A6		Splitter 3
	Diversity antenna, Sector W — primary sector	RMC 6B - B6		Splitter 4
	Diversity antenna, Sector Z — rear sector	RMC 3B - B6		Splitter 5
	Diversity antenna, Sector V — left adjacent sector	RMC 5B - B6		Splitter 6

Component requirement

Table 3-16 lists the components required for a 60° STSR Metrocell with two RF Frame and Table 3-17 lists the components required for a 60° STSR Metrocell with four RF Frames. Both configurations require six Receive Multicouplers (RMC).

Table 3-16
Component requirement for a 60° STSR Metrocell with two RF Frames

No. of TRUs per Sector	No. of TRUs	No. of ATCs	No. of Duplexers	No. of ICRM TCM Port cards	No. of antennas
3 to 8	18 to 48	6	6	4	6 TX/RX, 6 RX

Note: An additional TCM port card is required for the DRUM, the ACU and the CSM2.

Table 3-17
Component requirement for a 60° STSR Metrocell with four RF Frames

No. of TRUs per Sector	No. of TRUs	No. of ATCs	No. of Duplexers	No. of ICRM TCM Port cards	No. of antennas
3 to 16	18 to 96	12	6	6	6 TX/RX, 6 RX

Note: An additional TCM port card is required for the DRUM, the ACU and the CSM2.

Cell Site Components

This chapter provides information on the description and Product Engineering Codes (PEC) of the major components used in a DualMode Metrocell.

Table 4-1
Major components of a DualMode Metrocell

Note: FRU = Field Replaceable Unit

Description	**PEC**	
Metro RF Frame	NTFB10AA	
"A" DC Power Cable Harness	NTFB0901	
"B" DC Power Cable Harness	NTFB0902	
Metro RF Rack Interface Panel (RIP) Shelf	NTFB11AA	FRU
Duplexer	NTFB16AA	FRU
AutoTune Combiner (ATC)	NTFB17AA	FRU
ATC Phasing Transformer	NTFB18AA	FRU
ATC Transformer Phasing Cable, A-Band	NTFB1801	FRU
ATC Transformer Phasing Cable, B-Band	NTFB1802	FRU
ATC Phasing Cable, A-Band	NTFB19AA	FRU
ATC Phasing Cable, B-Band	NTFB19AB	FRU
ATC Shorting Stub	NTFB20AA	FRU
ATC-Duplexer Cable 1	NTFB21AA	FRU
ATC-Duplexer Cable 2	NTFB21AB	FRU
ATC-Duplexer Cable 3	NTFB21AC	FRU
TRU/DPA Shelf	NTFB23AA	FRU
TRU/DPA Shelf Fan Module Assembly	NTFB24AA	FRU
PA-ATC Coax Cable Assembly 1-4	NTFB34AA	FRU
PA-ATC Coax Cable Assembly 5-8	NTFB34AB	FRU
TRU/PA- ATC Alarm Cable	NTFB35AA	FRU

Table 4-1
Major components of a DualMode Metrocell

Note: FRU = Field Replaceable Unit

Description	**PEC**	
Cable DATA 25-Pair TRU/DPA Shelf 1	NTFA1004	FRU
Cable DATA 25-Pair TRU/DPA Shelf 2	NTFA1008	FRU
Cable DATA 25-Pair TRU/DPA Shelf 3	NTFA1009	FRU
Transmit Receive Unit (TRU)	NTAX98AA	FRU
Dual Power Amplifier (DPA)	NTFB38AA	FRU
CE Frame Alarm Cable	NTFB41AA	FRU
Universal CE Frame	NT3P64CA	
Universal CE RIP Shelf		
DualMode Radio Unit Monitor (DRUM) —sniffer —whip antenna	 NTAX40DA NTAX40CA	 FRU
Alarm Control Unit (ACU)	NT3P20GA	FRU
Output Contact card	NT3P20EA	FRU
Enhanced ACU Input card	NT3P20FB	FRU
High Stability Master Oscillator (HSMO)	NT3P20JB	FRU
Cell Site Monitor 2 (CSM2)	NT3P70AB	FRU
M6200 Handset	NT3P75AB	FRU
Handset coil cord	NT3P78AB	FRU
Receive Multicoupler (RMC)	NT3P20HP	FRU
Integrated Cellular Remote Module (ICRM)	NTAX8607	FRU
Port (RMDP) card	NTAX47BA	FRU
Controller (RMCP) card	NTAX89AA	FRU
Time Switch (RMTS) card	NTAX88AA	FRU
(RMTC) card	NTAX88CA	FRU
DS1 Interface card	NT6X50AB	FRU
E1 Interface card	NT6X27BB	FRU
Power convertor	NT2X70CA	FRU
ICRM FSP Shelf	NTAX90AB	FRU
Alarm (RMAC) card	NTAX92AA	FRU
TCM-RS232 Conversion (RMTP) card	NTAX91AA	FRU

Customer Service Operations

Most of these components can be ordered from Nortel. Contact the following Nortel Customer Service Operations (CSO) when replacement is required:

For United States customers:

Northern Telecom Inc.
Attn. Customer Service Operations
400 N. Industrial
Richardson, Texas 75081

For Bell Canada customers:

Northern Telecom Canada Ltd.
Customer Service Operations
c/o Wesbell Transport
1630 Trinity Rd., Unit #3, Door #4
Mississauga, Ontario L5T 1L6
Attn.: Replacement and Repair Operations
Dept.: S898

For Mexico customers:

Northern Telecom de Mexico
Toltecas #113
Col. San Pedro De Los Pinos
Casi Esq Calle 4
Mexico

For Asia Pacific customers:

Northern Telecom Asia Pacific Ltd.
Attn.: Technical Assistance Service
Warwick House 17/F
28 Tong Chong Street
Quarry Bay, Hong Kong

For Non-Bell Canada/CALA/International customers:

Northern Telecom Canada Ltd.
Customer Service Operations
c/o Wesbell Transport
1630 Trinity Rd., Unit #3, Door #4
Mississauga, Ontario L5T 1L6
Attn.: Replacement and Repair Operations
Dept.: S898

Power and Grounding Requirements

Cell sites are built to house communication equipment of the cellular telephone network. Cellular equipment can be located in stand-alone sites or in larger buildings in urban areas. Cellular equipment is traditionally powered from a +24 Vdc power plant. Some switching equipment can also be located in a cell site. It is connected with other equipment through CO cables. RF signals are transmitted using coaxial cables through areal antennas. Since cell sites are susceptible to lightning strikes, extra precautions have to take place to ensure the operation.

Safety requirements

Safety standards for installation and maintenance of electrical equipment are the object of the national codes; Canadian Electrical Code (CEC) in Canada and the National Electrical Code (NEC) in the USA. Although these codes do not govern installations of communication equipment under the exclusive control of communication utilities, it is good design and installation practice for the new equipment or system to comply with the intent of the appropriate Code. For systems installed at the customer premises outside of the above communication utilities, compliance with the Code is mandatory.

One of the basic safety rules of the national codes (CEC and NEC) in North America, for example, requires that there shall be no objectionable current on the Framework Ground conductor (grounding conductor). In practice, this usually means no measurable current.

In view of the above, communication equipment shall use a three wire distribution system as required by the codes (system with separated grounding such as Floor Ground and grounded conductor such as Battery Return or the neutral) rather than two wire power distribution system (system with joined grounding and grounded conductor).

> ***Note:*** Countries outside North America may have different safety standards codes. Follow the safety standards for installation and maintenance of electrical equipment in your country accordingly.

Power and grounding requirements

Typical cell site radio equipment is powered by a +24 Vdc power system. However, the primary power for a DualMode Metrocell is +27 Vdc nominal. The reason that +27 Volts is specified as the nominal voltage rather than +24 Volts is to highlight that the system requires the full float voltage level to enable it to deliver its fully rated available transmit RF output power level. When AC power is lost and the voltage level to the system is reduced to the nominal battery (that is, +24 Vdc), the power amplifiers will automatically step down their transmit RF output power. See the Dual Power Amplifier (DPA) section in NTP 411-2021-113*Metrocell Radio Frequency (RF) Frame Description* for details.

The power plant normally consists of a negative grounded 12-cell Valve Regulated Lead-Acid (VRLA) battery plant andAC powered battery charging units commonly referred to as the rectifiers. Under normal operating conditions, that is, when AC power is available, the batteries are maintained within their specified float voltage range via the rectifiers which must supply current to power the system and keep the batteries charged. When an AC outage occurs, the battery plant provides back-up power to the system. However, at this time, the system will experience a step drop in voltage due to a battery plant transition from the float state to the fully charged state. During the battery discharge period, the voltage supplied to the system will gradually drop from its fully charged voltage.

Under normal operating conditions an equalizing charge is not required. An equalizing charge is a special charge given to a battery when non-uniformity in voltage has developed between cells. It is given to restore all units to a fully charged condition by using a charging voltage higher than the normal float voltage and for a specified number of hours as determined by the specific voltage used. An equalize charge is also often applied when a recharge of the batteries is required in a minimum time following an emergency discharge.

A typical operating voltage range at the Power Distribution Plant of a Metrocell should not exceed the range between +22.8 Vdc to +29 Vdc. +22.8 Vdc assumes 1 V drop from the batteries to the Rack Interface Panel (RIP) and 0.8 V from the RIP to the load. The operating voltage range of a specific system could vary.

The power plant supplies two (designated as ‘A’ and ‘B’) power feeds to each Metrocell frame. Table 5-1 lists the performance requirements related to primary DC power in a Metrocell.

Table 5-1
Metrocell DC Power performance requirements

Description	Requirements		
	Maximum	Nominal	Minimum
Module or unit level operating voltage range	29.00 Vdc	27.00 Vdc	21.00 Vdc
Metro RF Frame current draw per feed (A or B) with all PAs transmitting at full RF output power	75 Adc		
Metro RF Frame power distribution voltage drop (from the feed input at the RIP to any module)	0.65 Vdc		
Metro RF Frame power distribution resistance (from the feed input at the RIP to any module)	40 MOhms		
Metro RF Frame operating voltage range (measured at the RIP power feed input)	29.00 Vdc	27.00 Vdc	21.60 Vdc
Metro RF Frame minimum voltage to guarantee maximum PA RF power is available (measured at the RIP power feed input)			26.20 Vdc
Power Plant normal operating "Float" voltage range	27.60 Vdc	27.25 Vdc	27.00 Vdc
Power Plant "Equalize" voltage (one to two days)	29.00 Vdc		
Power Plant voltage drop	0.25 Vdc		
Maximum power feed length (measured from Metro RF Frame RIP to Power Plant breaker #2/0 AWG or Welding Copper Wire #1/0 AWG or Welding Copper Wire	 60 feet 47 feet		
Absolute maximum voltage (no damage, non-operational, applied continuously)	30.50 Vdc		
Transient voltage immunity (Metro RF Frame modules) for 300 µs	40 Vdc		
Noise from battery (system and module immunity) into 600 Ohms from 10 kHz to 20 MHz in 3 kHz BW into 50 Ohms from dc to 100 MHz into Hi-Z	 56 dBmC 100 mV (rms) 250 mV (p-p)		
Noise to battery (system and module emissions) from 300 Hz to 10 kHz (where Ip is the steady state dc current draw) from 10 kHz to 1 MHz Broadband noise	 9+10logIp dBmC Ip**0.5 mV (rms) 250 mV (p-p)		
Battery step (system and module immunity) within nominal operating range with 1 V/ms maximum rate of change)	±3 Vdc		

The input voltage for other communication equipment is typically -48 Vdc nominal. The voltage range at the Power Distribution Centre (or other type of a branch panel) shall not exceed the range between -43.75 Vdc to -55.80 Vdc.

The input power is usually obtained from a centralized plant, which may be shared with other systems or dedicated to the equipment.

Power plant batteries provide backup power for the equipment in case of power outage. The backup time is typically 8 hours at the site with no engine-alternator or 3 hours at the site with an emergency engine-alternator.

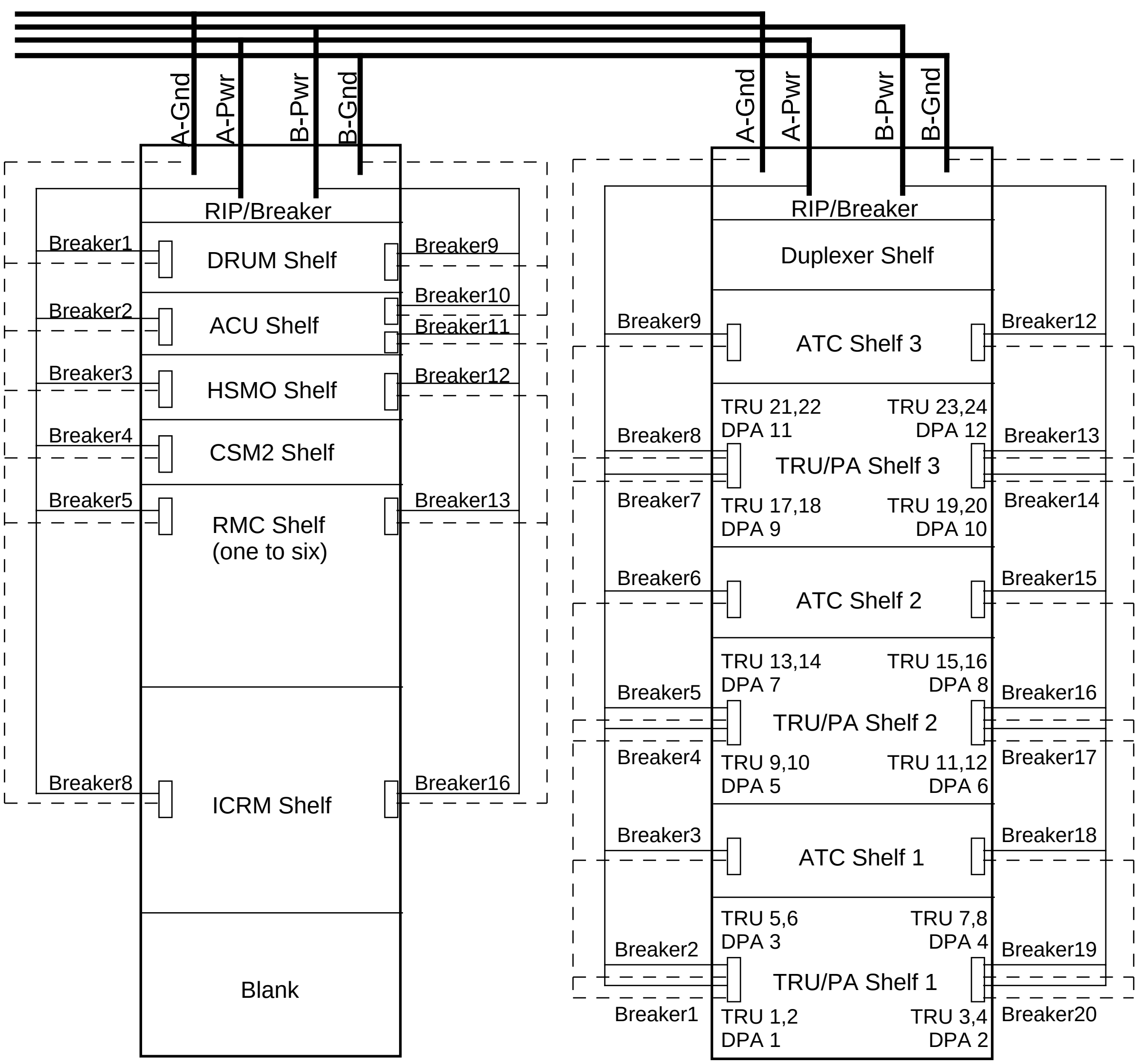
The grounding system of radio and transmission equipment typically conform to the Common Bonding Network (CBN) bonding topology.

Switching equipment conforms to the Isolated Bonding Network (IBN) grounding topology (typically, Star-IBN or Sparse-Mesh-IBN). Some systems also use a Star-IBN bonding topology where the Logic Return (LR) is isolated from the Framework Ground (FG) except at one clearly defined point.

Frame power distribution

Figure 5-1 shows the distribution network for supplying power to the cell site components in the CE and RF Frames.

Figure 5-1
Power distribution for the CE and RF Frames in a Metrocell



System power protection

There are three levels of protection at a Metrocell cell site. The first level is at the power plant which may consist of a hydraulic-magnetic breaker or slow-blow fuse. This stage is not provided by Nortel. The second level of protection is located in the RIP of the frames that consists of a magnetic breaker. In some cases, a third level of protection is implemented in the equipment shelf such as the TRU/DPA shelf fans and the ATC shelf and usually consists of a faster blow fuse. This arrangement isolates faults that occur lower down in the hierarchy from affecting circuits higher up.

Grounding

UL/CSA approval

The North American electrical codes require that there be no current over the grounding conductors (see C22.1 par 10-200 and ANSI/NFPA No. 70 article 250-21) and the safety standards specify that the electrical codes be adhered to. The Metrocell uses a two-wire DC power distribution scheme. In a grounded two-wire system, the return and ground are multiply connected and an unspecified amount of the return current can flow over the grounding conductors in violation of the electrical code rules.

Therefore, each cell site has to be inspected by a safety authority (UL/CSA in North America) such that the codes requirements (refer to UL-1459 par 14.2 and 34.6 and CSA C22.2 No. 225 par 4.5.3.1a) are met in order to obtain an approval from that authority.

UL-1459 par 14.2

A product intended for permanent connection to the branch-circuit supply shall have provision for the connection of one of the wiring methods in accordance with the National Electrical Code, ANSI/NFPA No. 70.

UL-1459 par 34.6

A field-wiring terminal intended solely for connection of an equipment-grounding conductor shall be capable of securing a conductor of the size rated for the application in accordance with the National Electrical Code ANSI/ NFPA No. 70.

CSA C22.2 N0. 225 par 3.5.3.1a

Permanently connected equipment shall be provided with wiring terminals or leads for the connection of conductors not less than 14 AWG and having an ampacity not less than 125% of the rated input current.

UL would not accept the grounding of the battery return when the battery/cell site configuration is not in the same room unless the battery is floating. A dedicated battery/cell site configuration residing in the same equipment room would not raise any concerns. CSA would have no objections to a grounding scheme if the system input power is less than 50V thus not requiring any ground (see CEC par 10-102).

CEC par 10-102
Two wire direct-current systems supplying interior wiring and operating at not more than 300 V or less than 50 V between conductors shall be grounded, unless such system is used for supplying industrial equipment in limited areas and the circuit is equipped with a ground detector.

The interpretation of "objectionable current" is to be aligned with the leakage current limits as defined in CSA 950 (maximum 5% current rating) or CSA 225 (maximum 10% current rating). The NEC definition of "objectionable current" is any current not suitable for a particular installation; which would include leakage current limits, grounding conductor size, electrochemical potential between dissimilar metals, etc.

Grounding requirements for the Metrocell is to keep the total return current on the grounding network below 5% of the total system DC current draw. This is done by:

1. Making the desired return path a much lower resistance than the undesired return path (that is, current divider principle). Eliminating the grounding conductor at the power plant will help discourage return current flow through the supplementary grounding conductor.
2. Minimize equalization currents between frames via the grounding conductors and antenna coax, etc. This is achieved by adhering to an isolated mesh grounding concept. The mesh concept means that all the metal surfaces (frames, shelves, PCP ground planes and module chassis) within the system are bonded together with ideally as little contact resistance as practically possible.

   Isolation means that the system grounding mesh only makes contact with other grounded systems at the local ground reference or BPG. This helps to reduce the chance of ground currents from other systems from flowing through the Metrocell grounding conductors. Isolation from building steel should be facilitated by providing an isolation pad underneath each frame.

DC coupled signals

DC coupled signals are considered undesirable from a grounding point of view for the following reasons:

- If a signal is routed to another system on a separate ground, then isolation is lost due to a connection via the signal return.
- Any noise on the system ground can resistively couple onto the signal potentially causing degradation in system performance (for example, bit errors on digital signals or unwanted noise pick-up on analog signals).

The Metrocell contains the following DC coupled signal links:

- TRU terminal interface (RS-232 data only) — This potentially creates a connection between the system ground and the AC ground in which the connected terminal can affect system performance and damage equipment. A RS-232 opto (for example, Telebyte model 268) is recommended for this connection and this link should only be used in commissioning or doing maintenance and not be connected in normal operations.
- Control signals between the TRU and DPA (TTL/COMS logic levels) — These signals are restricted to the shelf backplane only.
- Alarm signals between the ATC shelf and the TRU/DPA shelf (+27 V) — These signals are restricted between the two shelves on the Metro RF Frame which provides a good low resistance ground to frame.
- Interframe alarm signals (+27V) — These signals are actually opto-isolated at the receive end (that is, at the ACU). The return path is through the system framework ground.
- ATC remote interface (RS-232 or RS-485) — (Future Development.)

Cable Identification

It is a current practice to label or color-code insulated conductors. The following table shows the labeling and colors of insulated wires used in North America.

Table 5-2
Cable identification - North America

Conductor Potential	Function	Label	Color Code (if used)
+24 Vdc	dc power	L+	(typically black with a tag)
0 V (grounded side of the +24 Vdc power supply)	dc power return, battery return, BR conductor	L-	(typically black with a tag)
-48 Vdc /-60 Vdc	dc power	L-	(typically black with a tag)
0 V (grounded side of the -48/-60 Vdc power supply)	dc power return, battery return, BR conductor	L+	(typically black with a tag)
grounded (or bonded to ground)	framework ground, framework bonding conductor	FG	green (50%) yellow (50%)
grounded (or bonded to ground)	ac equipment grounding conductor	none	green (N. America) green + yellow (Europe)

Framework Ground or Framework Bonding conductors are also known as "Protective Earth" as per IEC-950. The 50/50 green yellow ratio must be no less than 30% and no more than 70% for either color.

> ***Note:*** Countries outside North America may have different labeling and color coding of cables. Follow the safety standards for installation and maintenance of electrical equipment in your country accordingly.

Datafilling a Metro Cell Site

Datafill Overview

This section outlines the differences which you should consider when datafilling a Metro site. It makes no attempt at dealing with the entire datafill procedure and assumes that you are familiar with the MTX Cell Site Datafill Procedures. Please refer to *NTP 411-2131-461 ICP Datafill Guide* for information concerning the entire Cell Site Table Datafill.

A Metro Cell site looks for all intensive purposes like any other ICP/ICRM cell site to the MTX. It uses all the same tables, loads, and parameters as do the previous ICP/ICRM methods. The outstanding difference, which is apparent, is that more Trunks and DSPMs will be required to service the additional radios that the Metro RF frame is equipped with. The following datafill tables will be addressed in the view of differences to keep in mind when datafilling a Metro Cell Site:

Table 6-1
Datafill differences of the Metrocell from an NT800DR cell

Table	Metro differences
CLLI	More trunks should be assigned as each RF frame can be equipped with 8 more radios than a standard macrocell frame.
ACUALM	PA Fan Alarms are laid out differently with the new RF frame.
CCHINV	The RF frame location of the DRU should be correctly identified in relation to the ICRM P-side card port number.
LCRINV	The RF frame location of the DRU should be correctly identified in relation to the ICRM P-side card port number.
VCHINV	The RF frame location of the DRU should be correctly identified in relation to the ICRM P-side card port number.

Table CLLI

Table CLLI defines both a name and a quantity to a certain MTX trunk assignment. For the Metro application the number of trunks assigned in TRKGRSIZ should be capable of supporting the additional VCHs supported. The minimum number of trunks required is shown in Table 6-2 for various Metro configurations with the maximum number of DRUs.

Table 6-2
Trunk requirement for different Metrocell configurations

Metro Site Type	Minimum Number of Trunks assigned to Table CLLI field TRKGRSIZ
Omni site	24
120 Sectored (1 RF Frame)	24
60 Sectored (2 RF Frames)	48

> ***Note:*** It is a good practice to assign more trunks than is necessary to prevent from having to backtrack through all the Tables to change the number in Table CLLI.

Table ACUALM

A Metrocell has input alarm points hardwired to the ACU. The alarm points for the CE Frame remain the same as per the standard NT800DR Macro Cell Site although their numbering scheme is changed. However the Metro RF Frame alarm points differ. The alarm point configuration for each Metro RF Frame has 23 alarm points to be datafilled in Table ACUALM. The alarm points monitor the:

- TRU/DPA cooling fans
- A and B side DC power filters
- ATC: cavities, DC power, and cooling fan

The alarm points are also assigned for each DRU in the frequency assignment tables (CCHINV, LCRINV, VCHINV) of the Metro Cell Site.

The MTX alarm point numbers for the hardwired Metro RF frame alarm points are listed in Table 6-3 and Table 6-4 for the MTX Table ACUALM.

Table 6-3
MTX Datafill Alarm Points for Metro RF Frame

	Metro RF Shelves Fan Alarm Points			
Shelf #	**FAN 1**	**FAN 2**	**FAN 3**	**FAN 4**
1	0	1	2	3
2	4	5	6	7
3	8	9	10	11
4	12	13	14	15
5	32	33	34	35
6	36	37	38	39
7	40	41	42	43
8	44	45	46	47
9	64	65	66	67
10	68	69	70	71
11	72	73	74	75
12	76	77	78	79
13	96	97	98	99
14	100	101	102	103
15	104	105	106	107
16	108	109	110	111
17	160	161	162	163
18	164	165	166	167

	Metro RF Frame ATC Alarm Points		
ATC #	**Cavities**	**Fan**	**Pwr**
1	16	20	21
2	17	22	23
3	18	24	25
4	19	26	27
5	48	52	53
6	49	54	55
7	50	56	57
8	51	58	59
9	80	84	85
10	81	86	87
11	82	88	89
12	83	90	91
13	112	116	117
14	113	118	119
15	114	120	121
16	115	122	123
17	176	180	181
18	177	182	183

Table 6-4
MTX Alarm Points Datafill Numbers for Metro RF Frame

	Metro RF Frame Power Filter Alarm Points	
Metro RF Frame #	**Power Filter A-Side**	**Power Filter B-Side**
1	28	29
2	60	61
3	92	93
4	30	31
5	124	125
6	188	189

The MTX Datafill alarm points for the CE frame are shown in Table 6-5.

Table 6-5
MTX Alarm Points Datafill Numbers for Metro CE Frame components

Alarm name	Alarm point	Alarm name	Alarm point	Alarm name	Alarm point	Alarm name	Alarm point
HSMO +27V A	128	HSMO +27V B	129	HSMO #1	130	HSMO #2	131
CSM2	132						
RMC +27V A1	134	RMC +27V B1	135	RMC +27V A2	136	RMC +27V B2	137
RMC LNA1	138	RMC LNA2	139	RMC LNA3	140	RMC LNA4	141
RMC LNA5	142	RMC LNA6	143	RMC LNA7	144	RMC LNA8	145
RMC LNA9	146	RMC LNA10	147	RMC LNA11	148	RMC LNA12	149
ICRM 1	152	ICRM 2	153	ICRM 3	154	ICRM 4	155

Table VCHINV, CCHINV, LCRINV

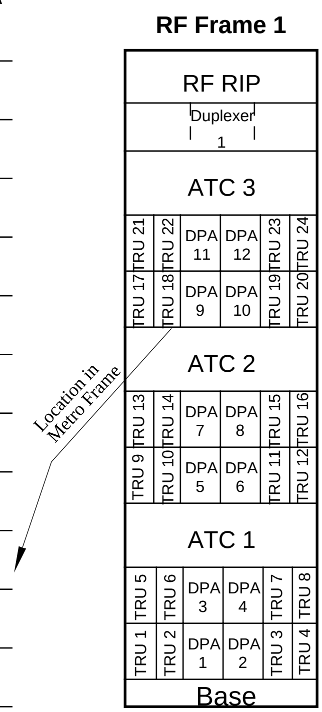
The frequency assignment tables should be datafilled so that the TRU location in the Metro RF Frame with respect to the port card of the ICRM are correctly identified in the datafill tuple. Each physical location in the Metro RF Frame corresponds with a port number of the NT8X47BA Port Card of the ICRM. The datafill of these frequency assignment tables requires that the P-side card and port number be defined. Each NT8X47BA Port Card of the ICRM must be cabled to either J205 or J206 of the Metro RF Frame RIP. Table 6-6 is a matrix of NT8X47BA port connections to the TRU number of the Metro RF frame for each RIP connector.

> ***Note:*** Even though channels can be datafilled on every Port Card and on almost every Port (Exception: Card 8 Port 14, Card 8 Port 15, Card 9 Port 13, Card 9 Port 14, and Card 9 Port 15), it is recommended that the Control Channel and its backup (Locate Receiver, Analog or Digital) be datafilled on separate Port Cards (see Frequency Assignment Example).

Table 6-6
NT8X47BA Port Numbers for Metro TRU locations

RIP Connector J205	
METRO TRU #	**NT8X47BA Port #**
1	0
3	1
5	2
7	3
9	4
11	5
13	6
15	7
17	8
19	9
21	10
23	11

Rip Connector J206	
METRO TRU #	**NT8X47BA Port #**
2	0
4	1
6	2
8	3
10	4
12	5
14	6
16	7
18	8
20	9
22	10
24	11



Frequency Assignment Example

An example configuration is shown in Figure 6-1. In this example The ICRM virtual port card 0 is hardwired to the RIP Connector J205 and virtual port card 1 is hardwired to RIP Connector J206 (see Figure 6-2). Since port card 0 is hardwired to J205 it will be connected to all the TRUs with odd numbered Metro locations (Refer to the Metro RF Frame Figure for the TRU numbering scheme). Hence port card 1, which is hardwired to J206, will be connected to all the TRUs with even numbered Metro locations.

Five datafill tuples are shown in the example figure for:

- a CCH,
- a Digital Locate Receiver (DLR)—serving as the CCH backup in this example,
- an Analog Locate Receiver (ALR)—can be assigned to any TRU, and
- two VCH TRU personalities.

The table in the figure shows the location of the five TRUs with respect to their Metro shelf locations.

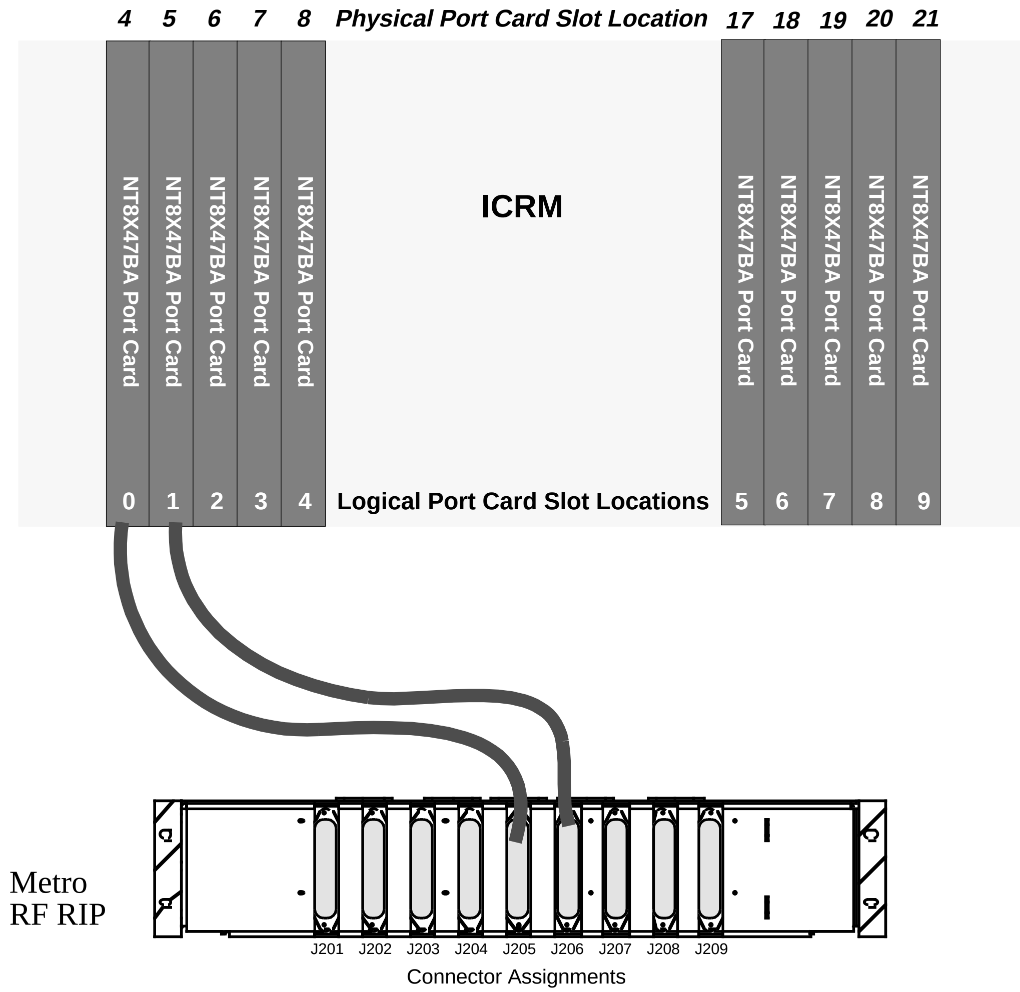
Figure 6-1
Example of Metro TRU datafill

```
Table CCHINV
CCHKEY   CHANNO   BACKUP          MODE      TERMATTR   CARD   PORT   ALRAMPT
49 0      331     Y 0 AUTOTUNE    COMBINED  TRU2AN60    0      0        0

Table LCRINV
LCRKEY   CCHBACKED   ADMODE   TERMATTR   CARD   PORT   ALARMPT   LCRTEST
49 0     Y  0        TDMA3    TRU2AN60    1      1        1         N
49 1        N        ANALOG   TRU2AN60    1      2        2         N

Table VCHINV
VCHKEY CHANNO   ADMODE    GROUP    TRKMEMS     TERMATTR  CARD  PORT  ALARMPT  XCVRSAT
49 1    289     TDMA3     (000) (1)(101)(201) TRU2AN60   0     1       1     DEFAULT
49 4    226  ANALOG_TDMA3 (001) (4)(104)(204) TRU2AN60   1     3       4     DEFAULT
```

Channel and Frequency	ICRM location	RF Frame location
CCH 0 (331)	Card 0 Port 0	TRU Slot 1
LCR 0 (DLR)	Card 1 Port 1	TRU Slot 4
LCR 1 (ALR)	Card 1 Port 2	TRU Slot 6
VCH 1 (289)	Card 0 Port 1	TRU Slot 3
VCH 4 (226)	Card 1 Port 3	TRU Slot 8

Note: J205 and J206 are cabled to the ICRM port cards as shown in Figure 6-2.

Figure 6-2
Example of Metro ICRM/TRU hardwire configuration



Appendix A: DualMode Metrocell Cell Site Specifications

System Configuration

Channel capacity	Up to 120 RF Channels for Omni cell sites
	Up to 8, 16 or 24 RF Channels per sector for 120° STSR cell sites
	Up to 8 or 16 RF Channels per sector for 60° STSR cell sites
Locate capacity	23,077 locates/hr./locate transceiver
Control channel capacity	22,464 messages/hr.

Radio Frequency

Radio frequency band	Receive: 824 to 849 MHz
	Transmit: 869 to 894 MHz
Frequency stability	±0.25 ppm
Channel spacing	30 kHz
Duty cycle	Continuous
PA power: Maximum	43.5 dBm (22.4 Watts) ±0.5 dB
Adjustment range	23.5 to 43.5 dBm (0.22 to 22.4 Watts)

Note: Adjustment range is the range of requested powers which may be typed into the TRU terminal interface.

Transmit path insertion loss (including ATC, duplexer and cable losses):

8 channels	-4.4 dB maximum
16 channels	-4.7 dB maximum
24 channels	-5.0 dB maximum

Minimum antenna input RF power (at the ANT port of the duplexer):

8 channels	38.6 dBm (7.33 watts)
16 channels	38.3 dBm (6.68 watts)
24 channels	38.0 dBm (6.38 watts)

Intermodulation spurious emissions< -60 dBc

Receive path insertion gain (ANT port of duplexer to TRU input port)
+3 dB ±2 dB

Receiver sensitivity for 12 dB SINAD C message weighting:

Analog mode	< -119 dBm
Digital mode	< -113 dBm

Receiver de-sensitization	< 3 dB
Antenna port impedance	50 ohms unbalanced

Audio Interface

Audio impedance	600 ohms balanced
Audio output levels:	Nominal -18 dBm @ ±2.9 kHz Adjustable in fractional units, up to two decimal points, from -28.0 dBm to -10.0 dBm for the transmit path and from -28.0 dBm to -16.0 dBm for the receive path

Alarms

Base station	192 points
Auxiliary alarms	16 assemble points (cabinet, power, tower, etc.)

DC Power Requirements

Grounding	As specified in Northern Telecom's NTP-297-1001-156
Voltage	Nominal +27.0 Vdc ±0.5 Vdc Range +21.0 Vdc to 29.0 Vdc
Ripple	400 millivolts
Spurious 0.005 - 10 MHz	< -55 dBm @ 0.3 to 3.4 kHz
Noise	< 32 dBrnC (600 ohms bridged)
Voltage stability	±1% of pre-set voltage @ 0-100% load
Voltage response	< 600 ms for a step of 10-70% load
Voltage over/under shoot	< 20% of pre-set voltage for a step of 10-70% load

Power Distribution Requirements

Channel/Frames	Current Breakers

Mechanical

Rack dimension	Height 84" (213.4 cm)
	Width 22" (56 cm)
	Depth 24" (61 cm), including cables and excluding unit handles
Clearance and Access	Ceiling 8 feet (7.5 feet. after cable tray installation
	Front aisle 3 feet
	Rear aisle 2 feet
	Building access door are required to be a minimum of 30 inches wide
Weight CE frame	400 lb. @ 80 lb./sq. ft.
RF Frame	950 lb. @ 115 lb./sq. ft.

Paint	Maple Brown # SCP-717-R1
Marking	Nortel Logo

Packaging

Frames	ShockAir bubble sheet and Styrofoam packaging material
Vibration	Styrofoam sandwich pallet
Bracing and support	Wood, 2 x 4 braces
Moisture	5 mil polyethylene
Transport	Air ride shock
Modules	Separate shipping carton

Environmental

Operating temperature

Normal operation	+5°C to +40°C (+41°F to +105°F)
Short-term operation	0°C to +50°C (+32°F to 120°F)

Note: Short-term refers to a period of not more than 72 consecutive hours and a total of not more than 15 days in one year.

Thermal cycling	Capable of withstanding the changes in temperature at the rate of 1°C (1.8°F) in three minutes over the short-term operating temperature range
Operating Relative Humidity	20 to 95% (non-condensing) over nominal temperature range and not to exceed 0.024 lb of water/lb of dry air
Altitude	61 meters (200 feet) below sea level to 4000 meters (13,000 feet) above sea level
Shock and vibration	Screw lock on required modules

Earthquake	Meet earthquake requirements of Zone 1 and Zone 2 as defined by Bellcore TR-NWT-000063

Fixed equipment anchorage.

Thermal dissipation for Metrocell RF Frame:

Component	Dissipation per unit	Maximum number of units	Total dissipation
TRU	27 W	24	648 W
PA	89 W	24	2136 W
Combiner (-4.5 dB)	21 W	24	504 W
Duplexer (-0.7 dB)	9.3 W	3	28 W
		Total	3.3 KW

Regulatory

Electromagnetic Emissions

Cell site equipment complies with the following Regulatory Specification:

- FCC part 22 for 800 MHz frequency
- FCC part 15 Class B for cell site with Universal CE Frame and Metro RF Frame (except for the ICRM, CSM, HSMO and ACU shelves located on the Universal CE Frame)
- DOC RSS-128 Issue 1.0 Dual Mode Capability in Canada

|

Radiated Emissions

Cell site equipment complies with the following Regulatory Specification:

- FCC Part 22 for 800 MHz frequency
- FCC Part 15 Class B for cell site with Universal CE Frame and Metro RF Frame (except for the ICRM, CSM, HSMO and ACU shelves located on the Universal CE Frame)
- Bell Canada Design Standard TAD 8465 of Bellcore TR-NWT-001089 in 10 kHz to 30 MHz and 1 GHz to 10 GHz range for radiated emission

Telecom Compliance

Cell site equipment complies with the following Regulatory Specification:

- CS03, Issue 7, Part 2 (Table 1: Digital Interface Requirement, Type IV)
- FCC Part 68 (TSB31, Table 4.5-2: Test Requirement Matrix)

Product Safety

Cell site equipment complies with the following Safety Specification:

- CSA C22.2 No. 225-M90, Telecommunication Equipment
- CSA C22.2 No. 1, Radio, Television and Electronic Apparatus
- UL-1459, Issue 2.0 Telephone Standard
- UL-1419, Proposed Video and Audio Equipment
- Nortel Standard 9001.00, Product Safety

Appendix B: Frequency Plans

N=7 Frequency plan (Band A)

Group	A1	B1	C1	D1	E1	F1	G1	A2	B2	C2	D2	E2	F2	G2	A3	B3	C3	D3	E3	F3	G3
Channel	**333**	**332**	**331**	**330**	**329**	**328**	**327**	**326**	**325**	**324**	**323**	**322**	**321**	**320**	**219**	**318**	**317**	**316**	**315**	**314**	**313**
Number	312	311	310	309	308	307	306	305	304	303	302	301	300	299	298	297	296	295	294	293	292
	291	290	289	288	287	286	285	284	283	282	281	280	279	278	277	276	275	274	273	272	271
	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250
	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229
	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187
	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166
	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145
	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124
	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103
	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82
	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61
	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40
	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19
	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
																			1023	1022	1021
	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000
	999	998	997	996	995	994	993	992	991												
										716	715	714	713	712	711	710	709	708	707	706	705
	704	703	702	701	700	699	698	697	696	695	694	693	692	691	690	689	688	687	686	685	684
	683	682	681	680	670	678	677	676	675	674	673	672	671	670	669	668	667				

Note: The control channels are indicated in **bold** in these frequency plans (they may be re-assigned as required).

N=7 Frequency plan (Band B)

Group	A1	B1	C1	D1	E1	F1	G1	A2	B2	C2	D2	E2	F2	G2	A3	B3	C3	D3	E3	F3	G3
Channel	**334**	**335**	**336**	**337**	**338**	**339**	**340**	**341**	**342**	**343**	**344**	**345**	**346**	**347**	**348**	**349**	**350**	**351**	**352**	**353**	**354**
Number	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375
	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396
	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417
	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438
	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459
	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501
	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522
	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543
	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564
	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585
	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606
	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627
	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648
	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666			
						717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732
	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753
	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774
	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795
	796	797	798	799																	

N=4 Frequency plan (Band A)

Group	A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3	A4	B4	C4	D4	A5	B5	C5	D5	A6	B6	C6	D6
Channel	**333**	**332**	**331**	**330**	**329**	**328**	**327**	**326**	**325**	**324**	**323**	**322**	**321**	**320**	**219**	**318**	**317**	**316**	**315**	**314**	**313**	**312**	**311**	**310**
Number	309	308	307	306	305	304	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288	287	286
	285	285	283	282	281	280	279	278	277	276	275	274	273	272	271	270	269	268	267	266	265	264	263	262
	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238
	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214
	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190
	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166
	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142
	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118
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	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70
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	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
																						1023	1022	1021
	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997
	996	995	994	993	992	991																		
											716	715	714	713	712	711	710	709	708	707	706	705	704	703
	702	701	700	699	698	697	696	695	694	693	692	691	690	689	688	687	686	685	684	683	682	681	680	679
	678	677	676	675	674	673	672	671	670	669	668	667												

N=4 Frequency plan (Band B)

Group	A1	B1	C1	D1	A2	B2	C2	D2	A3	B3	C3	D3	A4	B4	C4	D4	A5	B5	C5	D5	A6	B6	C6	D6
Channel	**334**	**335**	**336**	**337**	**338**	**339**	**340**	**341**	**342**	**343**	**344**	**345**	**346**	**347**	**348**	**349**	**350**	**351**	**352**	**353**	**354**	**355**	**356**	**357**
Number	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381
	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405
	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429
	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453
	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477
	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501
	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525
	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549
	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573
	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597
	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621
	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645
	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666			
	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740
	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764
	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788
	789	790	791	792	793	794	795	796	797	798	799													

DualMode Metrocell

Cell Site Description

Manual

Wireless Customer Documentation, Manager
Nortel
P.O. Box 833858
Richardson, Texas 75083-3858
Phone: (214) 684-1770 / Fax: (214) 684-3977

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NORTEL
NORTHERN TELECOM