HARRIS

Microwave Digital Radios

TRuepoint® 5000, 6 to 38 GHz

System Description

P/N IMN-903000-E06

assuredcommunications™

TRUEPOINT® 5000 SERIES

SYSTEM DESCRIPTION
PART NO. IMN-903000-E06
OCTOBER 2006

Revision history

Issue date	Status	Description of change / revision
March 22, 2004	DRN C9650	• First release
October 8, 2004	ECO 22745	• General update • Updated performance tables and added new ones
March 17, 2005	ECO 24037	• General update, new 5200 enclosure • Added new MUX option 28 DS1/DS3 and TIU • Updated performance tables to include 13-23 GHz, for the 5100 and 5200 series.
June 14, 2005	ECO 24705	• Updated General Specifications and Performance values, and added TCM Codings • Added new MUX/SDM options ADM 8 DS1, Mixed Mode, 21 E1 and TIU, and STM-1p • Added information on new Controller options; 64 kbit/s and 10/100BT over 64 kbit/s
April 7, 2006	PCO 25548	• Added New Controller V2 and Dual-Battery Input Modem options, per product Release 6 and 7 • Added Air link capacities for 38 GHz • Recreated New Performance Tables reflecting major changes in performance values
September 2006	PCO 26986	• Added Section on TRuepoint® 5200 N+N Configurations • Added information on The 32 E1 Configuration • Updated Performance tables and reduced their number

Part N° IMN-903000-E06

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WARNING

Making adjustments and/or modifications to this equipment that are not in accordance with the provisions of this instruction manual or other supplementary documentation may result in personal injury or damage to the equipment, and may void the equipment warranty.

AVERTISSEMENT

Tout réglage ou modification faits à cet équipement hors du cadre édicté par ce guide d'utilisation ou par toute autre documentation supplémentaire pourraient causer des blessures ou endommager l'équipement et peut entraîner l'annulation de sa garantie.

WARNUNG

Die an diesen Geräten gemachte Einstellungen und/oder Änderungen, welche nicht gemäß dieser Bedienungsanleitung, oder gemäß anderen zusätzlichen Anleitungen, ausgeführt werden, können Verletzungen oder Materialschäden zur Folge haben und eventuell die Garantie ungültig machen.

ATENCIÓN

Llevar a cabo ajustamientos y/o modificaciones a este equipo, sin seguir las instrucciones provistas por este manual u otro documento adicional, podría resultar en lesiones a su persona o daños al equipo, y anular la garantía de este último.

警告

不按该说明书有关条例或其它补充文件对该设备
所做的调整和／或改型可能会引起人身伤害
或损坏设备，并且设备保修也将失效。

CONTENTS

CHAPTER 4, FUNCTIONAL DESCRIPTION

CHAPTER 5, PERFORMANCE

CHAPTER 6, MANAGEMENT AND CONFIGURATION TOOLS

CHAPTER 7, ACU OPTIONS V/ FREQUENCY PLANS

CHAPTER 8, GLOSSARY

INDEX

PREFACE

ISO 9001 Certification

The Harris Microwave Communications Division is committed to total customer satisfaction and is I.S. EN ISO 9001: 2000 registered for the design, manufacture, installation and service of microwave radio products and systems.

Technical Assistance Center

Our Technical Assistance Center (TAC) is staffed with factory trained and highly qualified Product Support staff whose task is to provide telephone support to resolve complex customer equipment problems quickly and accurately in a timely manner. Customers who completed product training given by Harris Microwave Communications Division and are equipped with proper test equipment and spare parts will experience quick resolution of their equipment problems.

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Harris Microwave Customer Support

Harris provides world-class service for all our valued customers including 24/7 technical support. Your priority calls are handled through our Technical assistance Center (TAC):

Call: 800-227-8332

(outside North America 514-421-8333)

You can also contact us through e-mail at:

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Registered customers can obtain key product information on our Premier Web Site at: https://premier.harris/microwave

Technical Assistance Center

Service Registration Form

Dear Customer,
To facilitate warranty support and to receive product update information, please register on the Harris MCD Premier Customer website:

https://premier.harris.com/microwave

If you are unable to register online, please complete and return the form at the bottom of the page to our customer service department.

By Fax: 514-421-3555

By email: crcmtl@harris.com

By mail: Harris Corporation
Microwave Communications Division
3 Hotel de Ville
Dollard-des-Ormeaux, Quebec
CANADA H9B3G4

PLEASE PRINT:

Company Name: _____

Requestor's Name: _____

Title: _____ Dept: _____

Address: _____

City: _____ State/Province: _____

ZIP/Postal Code: _____ Country: _____

Telephone Number: _____ Fax Number: _____

Email: _____

Original Sales Order/PO Number: _____

Sales order numbers are found in your documentation and are stencilled on the equipment rack base plate, for example, A44044A1.

CHAPTER

1

THE TRUEPOINT® 5000 — AN OVERVIEW

Scope

This document provides answers to typical customer requests for product specifications, and is ***specifically*** tailored for Product Line Managers, Project Managers and Sales Personnel. It neither constitutes a final authority, nor replaces applicable product data sheets or product user manuals. The latest applicable documents should always be consulted to provide a properly documented response to specifications.

This top level document provides a broad overview of the TRuepoint® 5000 platform. It also includes the Theory of Operation, General Specifications, and Performance Tables. In case of conflicts between the content of this document and applicable product data sheets and/or product user manuals, ***the product data sheets and/or product user manuals prevail***.

Using this Manual

This manual has been optimized for fast Web viewing, and text shown in this format identifies navigation links leading to locations that are internal or external to the manual.
For all information pertaining to Installation, System's Configuration and Troubleshooting, refer to the particular sections of the other Related Manuals, as appropriate.

Structure of this Manual

Besides this introductory Chapter, this Manual contains the following:

Chapter 2, General Description

Provides a general description of the system's RFU/Antenna configurations and SPU configurations; current offerings.

Chapter 3, Block Diagrams

Functional diagrams of the SPU configurations, as well as the ACU/Diplexer configurations.

Chapter 4, Functional Description

Description of the features and functions of the RFU, as well as the SPU modules. A brief comparative discussion on SDH and SONET is also presented.

Chapter 5, Performance

Performance tables on Transmit Power, Thresholds, and Bandwidths v/Capacity.

Chapter 6, Management and Configuration Tools

Features and functions of the Management and Configuration tools available to the user.

Chapter 7, ACU Options v/ Frequency Plans

Frequency plans offered through current product releases.

Chapter 8, Glossary

Compilation of common and special terms — and their definitions, where appropriate — used throughout the TRuepoint® user documentation.

Related Manuals

Manual P/N	Title	Comments
Top Level		
IMN-903000-Exx	System Description	***The present document***.
User Manuals (recommended order of use)		
IMN-903001-Exx	RFU Installation	Provides instructions for installing, setting up and troubleshooting the TRuepoint® 5100 and 5200 RFUs.
IMN-903002-Exx	SPU Installation	Provides instructions for installing the SPU and its components (modules). It also provides general setup and basic troubleshooting information.
IMN-903003-Exx	Operator's Interface	Provides advanced system configuration, monitoring, control and troubleshooting information.
Quick Reference		
QRC-903000-Exx	Quick Reference Card	Provides a graphical representation of the TRuepoint® software menus

Executive Summary

Harris' TRuepoint® consist of several platforms that address the

- Mobile infrastructure;
- Backbone Transport;
- Right of Way;
- Competitive Local Exchange Carrier and other applications.

The architecture of the common platform

- handles a wide range of capacities, frequencies and configurations;
- enables faster time-to-delivery and field installation;
- reduces the cost of maintenance, training and spares; and
- provides quick component replacement for system expansion or equipment service.

This System Description document applies to the TRuepoint® ***5000 series***. Capacity configurations presently offered are as follows:

Table 1-1: TRuepoint® 5000 Main Configurations

	ANSI	CEPT
Frequency Range, GHz	6 to 38	6 to 38
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 1+1; MHSB 2+0, 4+0; SD, FD and SD/FD	1+0; 1+1; MHSB 2+0, 4+0; SD, FD and SD/FD

a. Future availability

Figure 1-1: The TRuepoint® 5000 Series Boundary

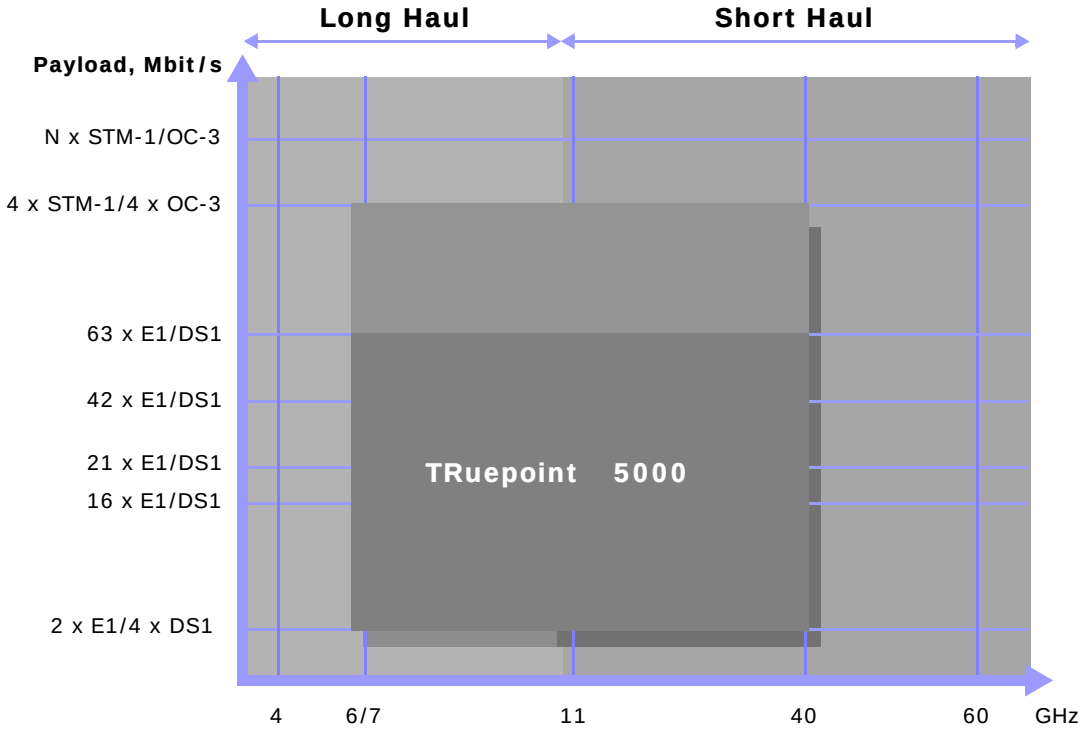
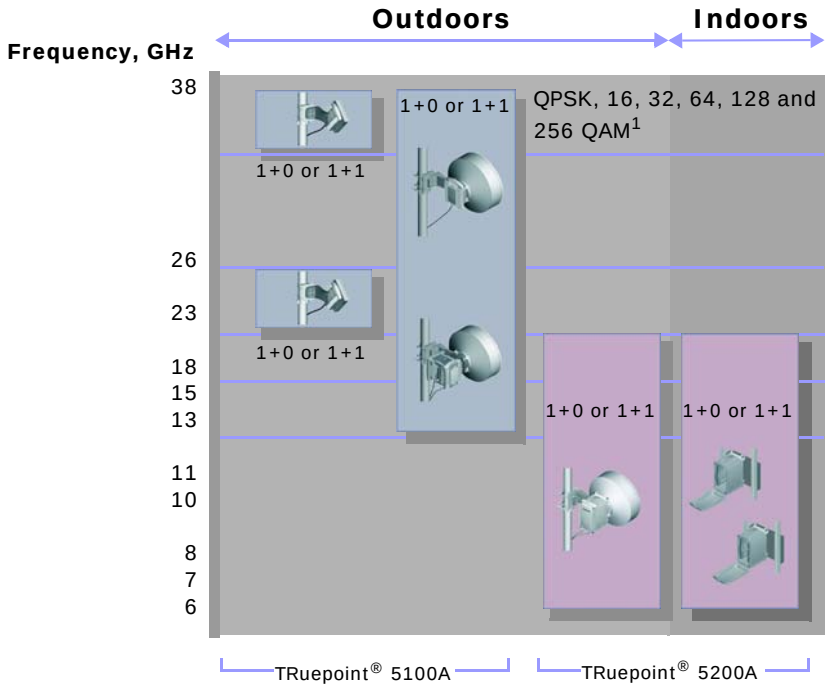
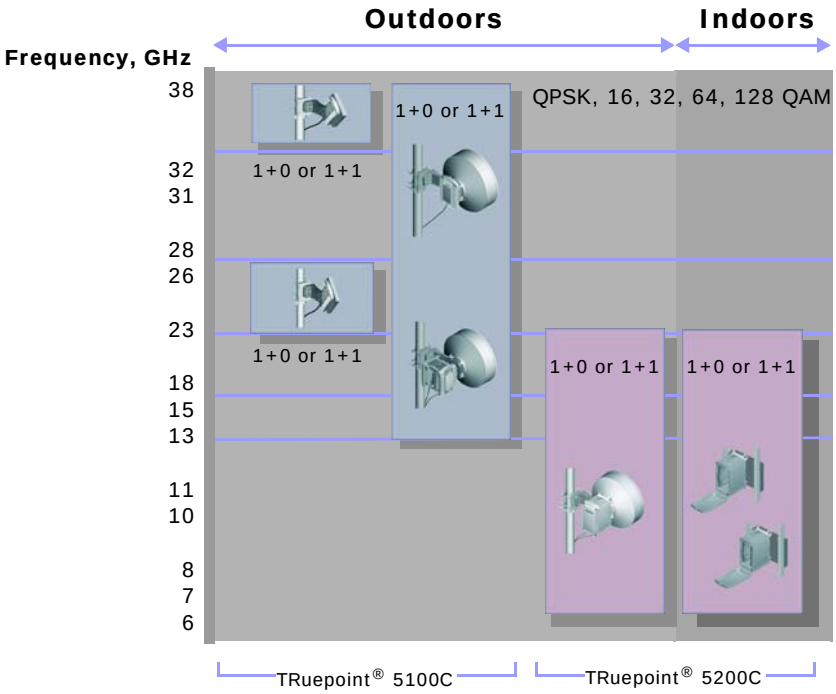


Figure 1-2: RFU Coverage and Architecture — ANSI



1. Future availability

Figure 1-3: RFU Coverage and Architecture — CEPT



Legend for Figure 1-2 and Figure 1-3

Series	Hierarchy	Reference Information
5100A and 5100C	A = ANSI C = CEPT	TRuepoint® 5100 RFU — 13 to 38 GHz, on Page 2-3
5200A and 5200C		TRuepoint® 5200 RFU — 6 to 23 GHz, on Page 2-9

Key Features of Harris' TRuepoint® 5000 Series

- SPU is RF independent
- RFU is capacity independent
- Fully programmable modem, from 4 QAM to 256 QAM[1] and Reed Solomon, or Reed Solomon concatenated with 2 or 4D TCM, depending on system gain and bandwidth requirements
- Optional application-specific modules
- 1 RMS SPU for 1+0 (Unprotected configuration)
- 2 RMS SPU for 1+1 (Protected configuration)
- Optional multiplexer protection, when using the 1+1 SPU.
- In-service performance monitoring with parameters compliant to ITU-T G.826/828 recommendations
- Self-diagnostics/expert system to differentiate the path alarms from the equipment alarms
- Optional digital orderwire (Up to 2 in one IDU)
- Optional 64 kbit/s data interface (Up to 2 in one IDU, future)
- Built-in Asynchronous data channel (19.2 kbit/s); standard offering
- Built-in agent to support SNMP protocol
- FarScan™ support
- Programmable relay contacts for alarm indication or site control
- Site alarms monitoring
- Web-CIT interface for radio maintenance
- Telnet
- E-Keypad
- IP interfaces
- Tributary (local and remote), and IF loopback.
- Transmitter Reverse Channel Switching (RCS)
- Revertive Transmitter Switching
- Errorless Receiver Switching
- Multiplexer Switching
- Demultiplexer Switching
- ATPC and DTPC operation
- Capacity upgrade through hardware key (for 16 x DS1/E1 module), MUX modules swap for other capacities
- Bandwidth selection by software

1. *Future availability*

CHAPTER

2

GENERAL DESCRIPTION

This core radio platform is designed to provide a very reliable link to carry NxE1/ DS1 and higher data rates up to 155 Mbit/s STM-1 / STS-3 / OC-3 data, and 4 DS3[1]. Initially, the RF frequency ranges are from 6 to 38 GHz. Higher frequency range radios will also be developed in the future. This platform offers many different data interfaces to process PDH, SONET/SDH, IP and a mix of the afore mentioned.

Physical Description

A radio system includes an **SPU** (Indoor Unit) and an **RFU** (Outdoor Unit).

A TRuepoint® terminal in a Protected configuration consists of a 2-RMS (Rack Mounting Space) **SPU** and an **RFU** that includes **two** transceivers; each connected by one coaxial cable to one Modem on the SPU.

A TRuepoint® terminal in an Unprotected configuration consists of a 1-RMS SPU and one RFU that contains one transceiver connected to the SPU's Modem through a coaxial cable.

The RFU is a weatherproof housing designed to mount on a mast or tower with an antenna in a Separated or Detachable mount.

The SPU shelf can be mounted in the standard 19" (483 mm) radio relay rack, to occupy one RMS in an Unprotected configuration, and 2 RMS in the 1+1 Protected configuration.
(Refer to section Current SPU Configurations, for more details).

1. *Future availability*

The radio uses the QAM technique that can be selected (bandwidth selection) through software to meet the required spectrum efficiency, ranging from QPSK to 256 QAM[1].
The coding scheme can be set to Reed Solomon concatenated with 2D TCM or with 4D TCM. Bit and byte interleaving associated with Reed Solomon FEC coding is automatically enabled or disabled for system performance enhancement.

The radio is fully programmable in terms of capacity, modulation level, RF frequency channel, and transmit output power level with any given option.

In-service performance monitoring and built-in diagnostics are provided to monitor signal quality and identify path and hardware failures. LEDs and relay contacts provide alarms status. The TRuepoint® 5000 supports the interface with the Network Management System (NMS) and element management system with SNMP protocol. It also supports other legacy protocols such as FarScan™.

Current RFU / Antenna Configurations

The following sections identify the various types of RFU configurations, as to

- Product series,
- Protection type,
- Antenna mount, and
- Service compatibility (frequency, modulation and capacity).

For the RFU functional block diagrams, refer to Chapter 3, beginning with Figure 3-7.
Not all configurations are offered at the time of publishing. Please contact your Harris' Representative for the latest product offerings.

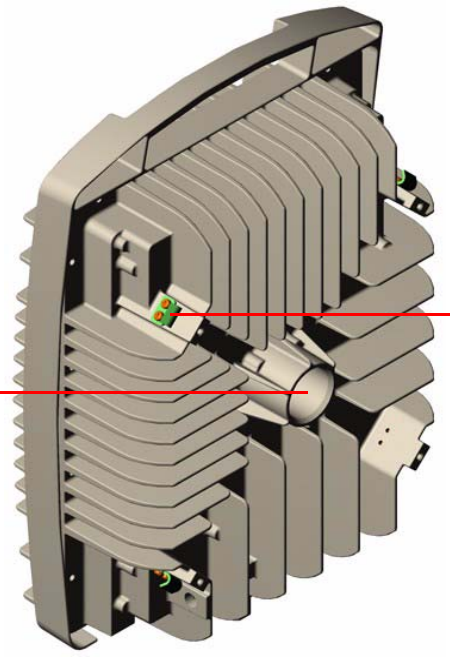
1. *Future availability*

TRuepoint® 5100 RFU — 13 to 38 GHz

The TRuepoint® 5100 radio is optimized for a 1+0 configuration with separate outdoor and indoor components. The following figures illustrate the available configurations.

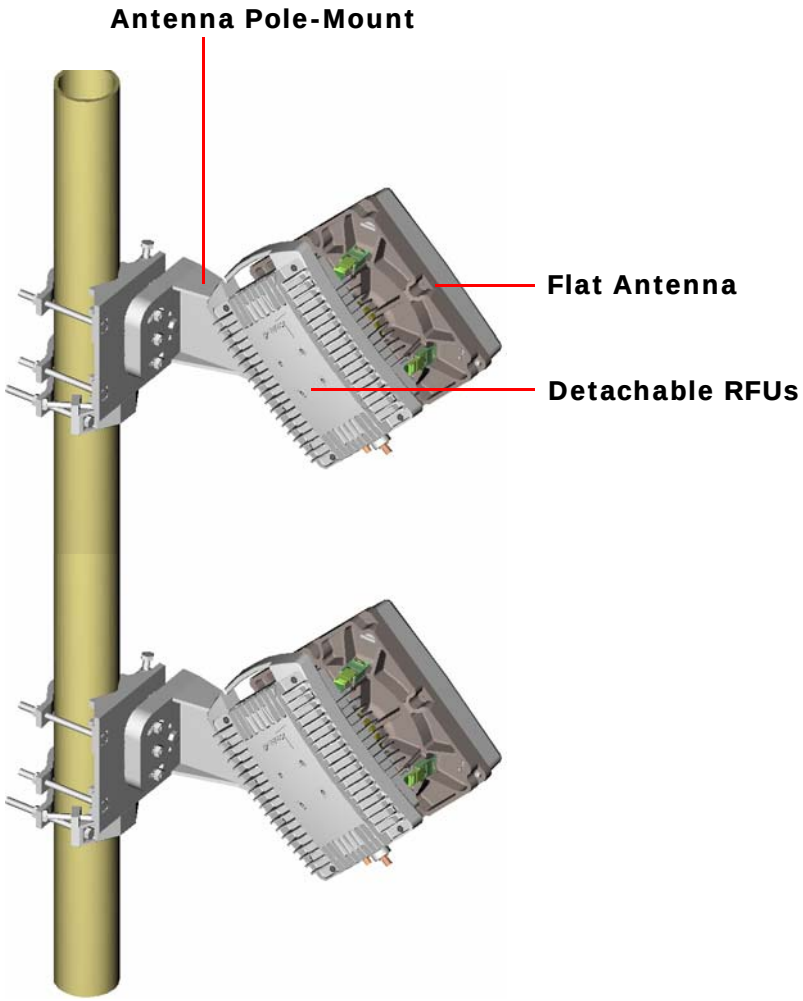
Front View

Rear View



Protected, Detachable RFUs on Flat Antennas

(Block Diagram in Figure 3-9*)*

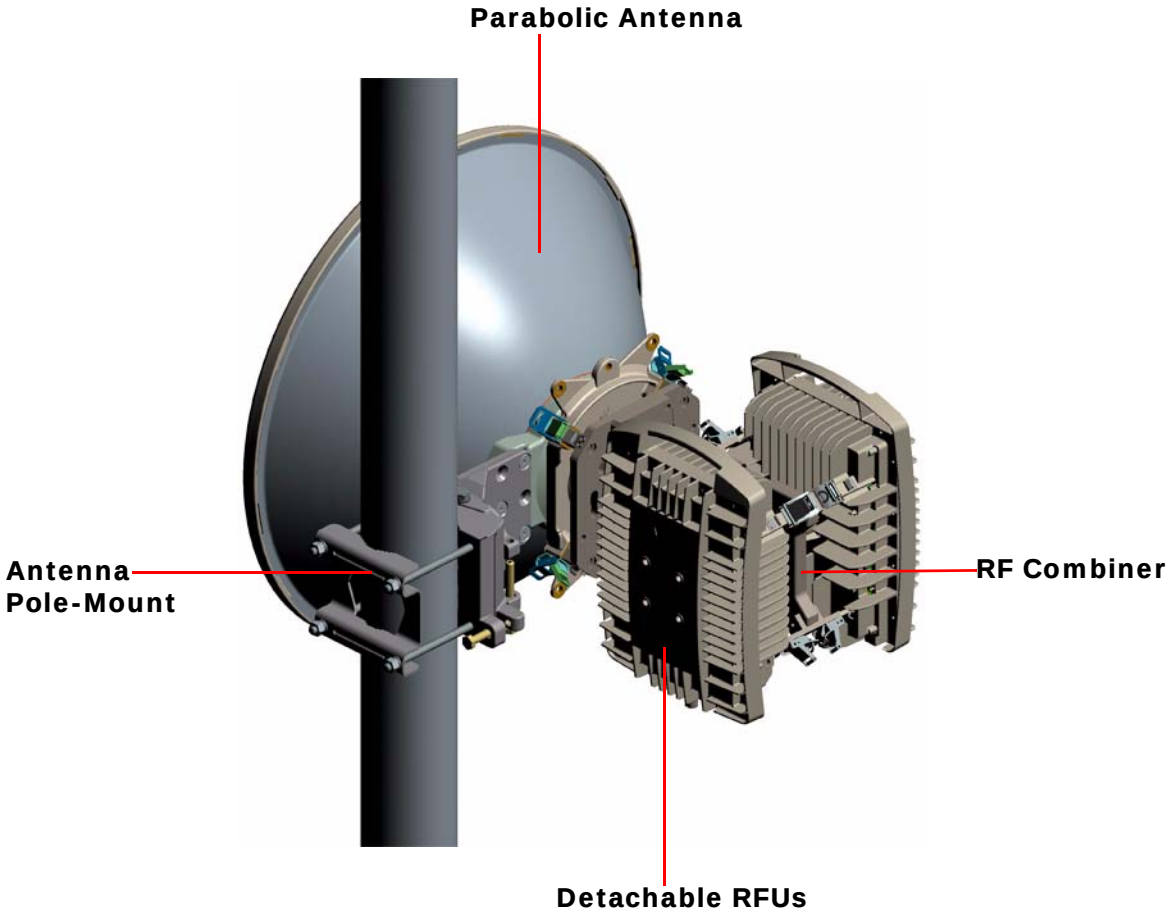


	ANSI	CEPT
Frequency, GHZ		13; 14; 15; 18; 23; 26; 38
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+1 HSB; 2+0	1+1 HSB; 2+0

a. Future availability

Protected, Combiner with Detachable RFUs on Parabolic Antenna

(Block Diagram in Figure 3-8*)*

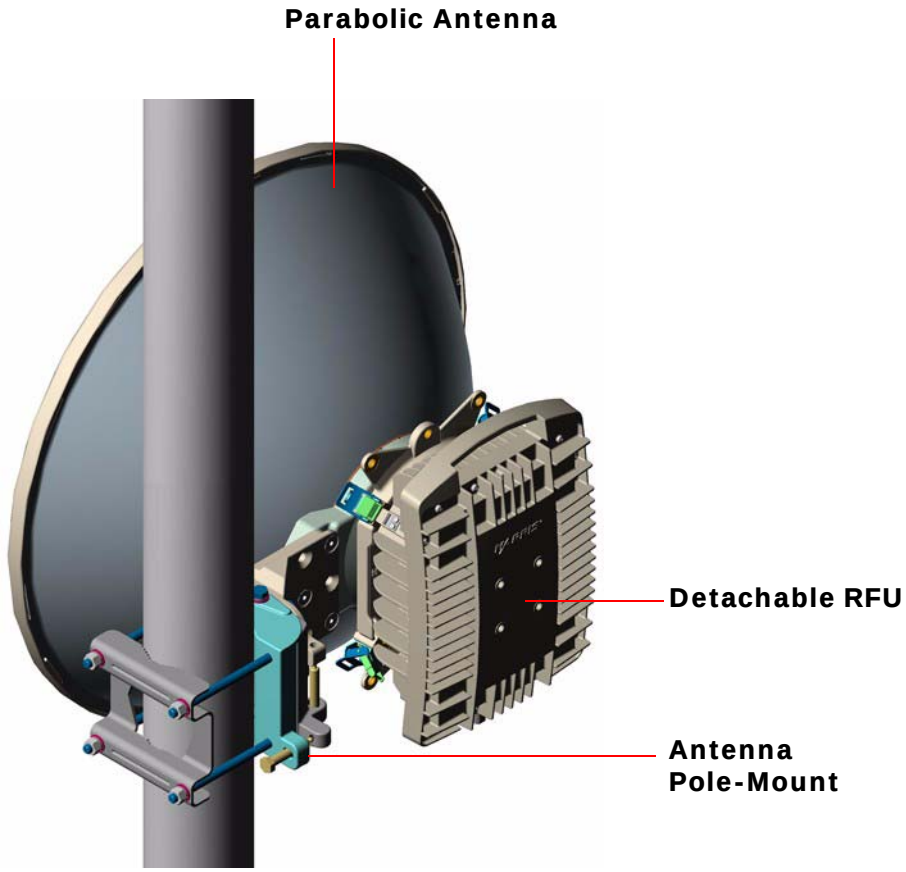


	ANSI	CEPT
Frequency, GHZ	13; 15; 18; 23	13; 14; 15; 18; 23; 26; 38
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+1 HSB	1+1 HSB

a. Future availability

Unprotected, Detachable RFU on Parabolic Antenna

(Block Diagram in Figure 3-7*)*

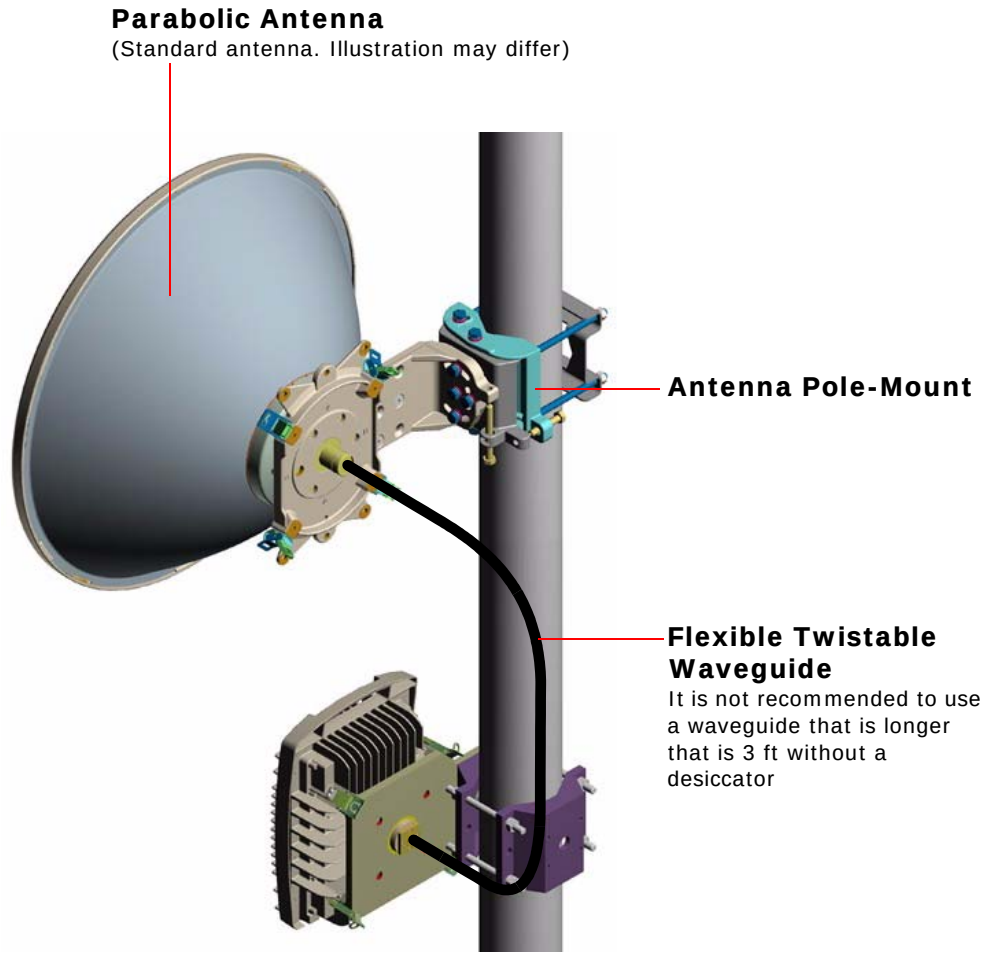


	ANSI	CEPT
Frequency, GHZ	13; 15; 18; 23	13; 14; 15; 18; 23; 26; 38
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 2+0	1+0; 2+0

a. Future availability

Unprotected, RFU in a Separated Antenna-Mount

(Block Diagram in Figure 3-7*)*

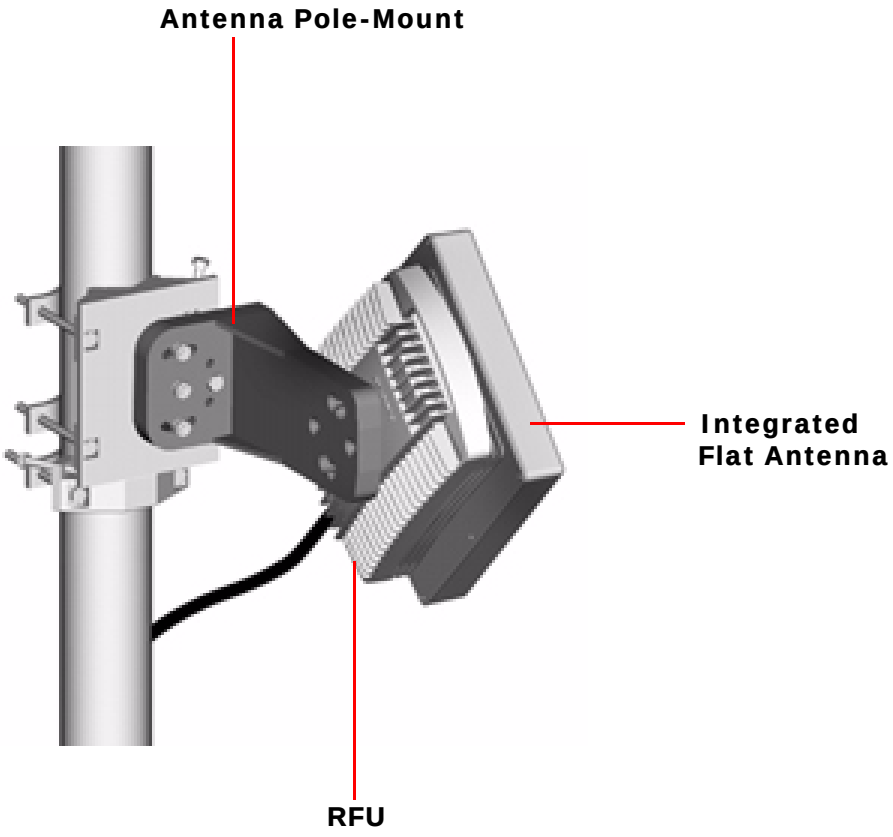


	ANSI	CEPT
Frequency, GHZ	13; 15; 18; 23	13; 14; 15; 18; 23; 26; 38
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 2+0	1+0; 2+0

a. Future availability

Unprotected, RFU on Integrated Flat Antenna

(Block Diagram in Figure 3-7*)*



	ANSI	CEPT
Frequency, GHZ		13; 14; 15; 18; 23; 26; 38
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 2+0	1+0; 2+0

a. Future availability

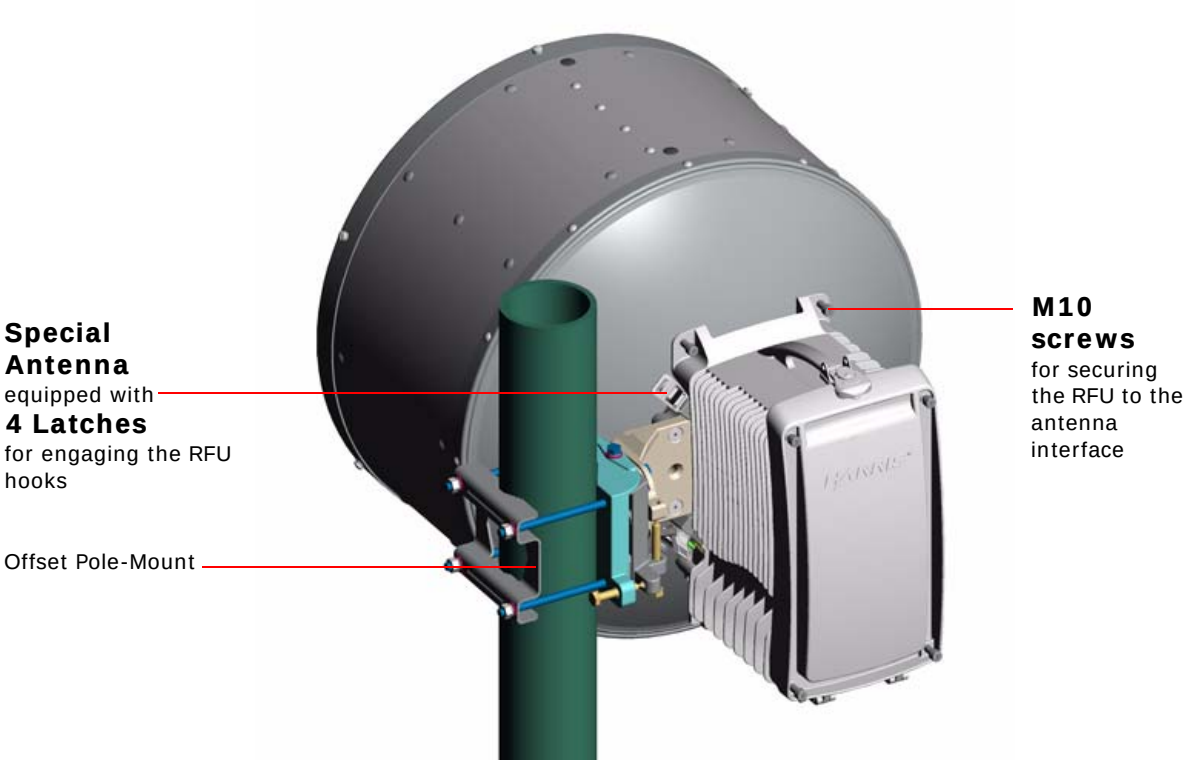
TRuepoint® 5200 RFU — 6 to 23 GHz

The TRuepoint® **5200** radio uses an RFU architecture optimized for a 1+1 configuration, suited for an Outdoor/Indoor ***Separate*** mount. The RFU can also be mounted ***directly*** to a special outdoor pole-mounted antenna, as a ***Detachable*** mount. The following illustrations provide an overview of such configurations.

This RFU configuration (1 or 2 E-bends) is suitable for indoor **rack-mounting** and outdoor **Separate mounting only.**

Protected, Detachable RFU on Parabolic Antenna

(Block Diagram in Figure 3-10*)*

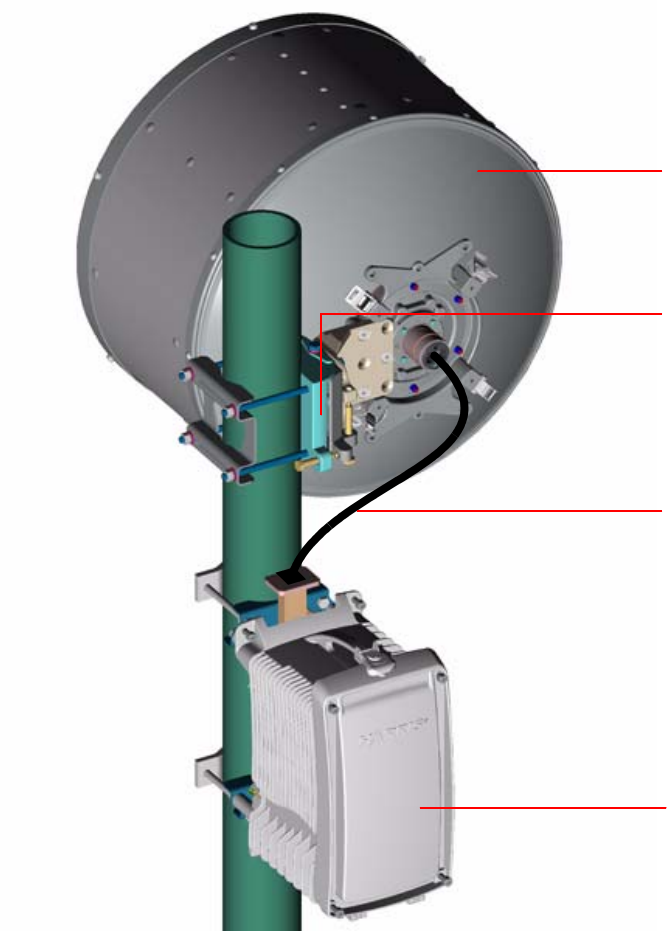


	ANSI	CEPT
Frequency, GHz	L6; U6; 7; 8; 10; 11; 13; 15; 18; 23	L6; U6; 7; 8; 10; 11
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 1+1; MHSB 2+0; 2+2; 4+0; SD, FD and SD/FD	1+0; 1+1; MHSB 2+0, 2+2; 4+0; SD, FD and SD/FD

a. Future availability

Unprotected, Separate Mounting RFU and Antenna

(Block Diagram in Figure 3-11*)*



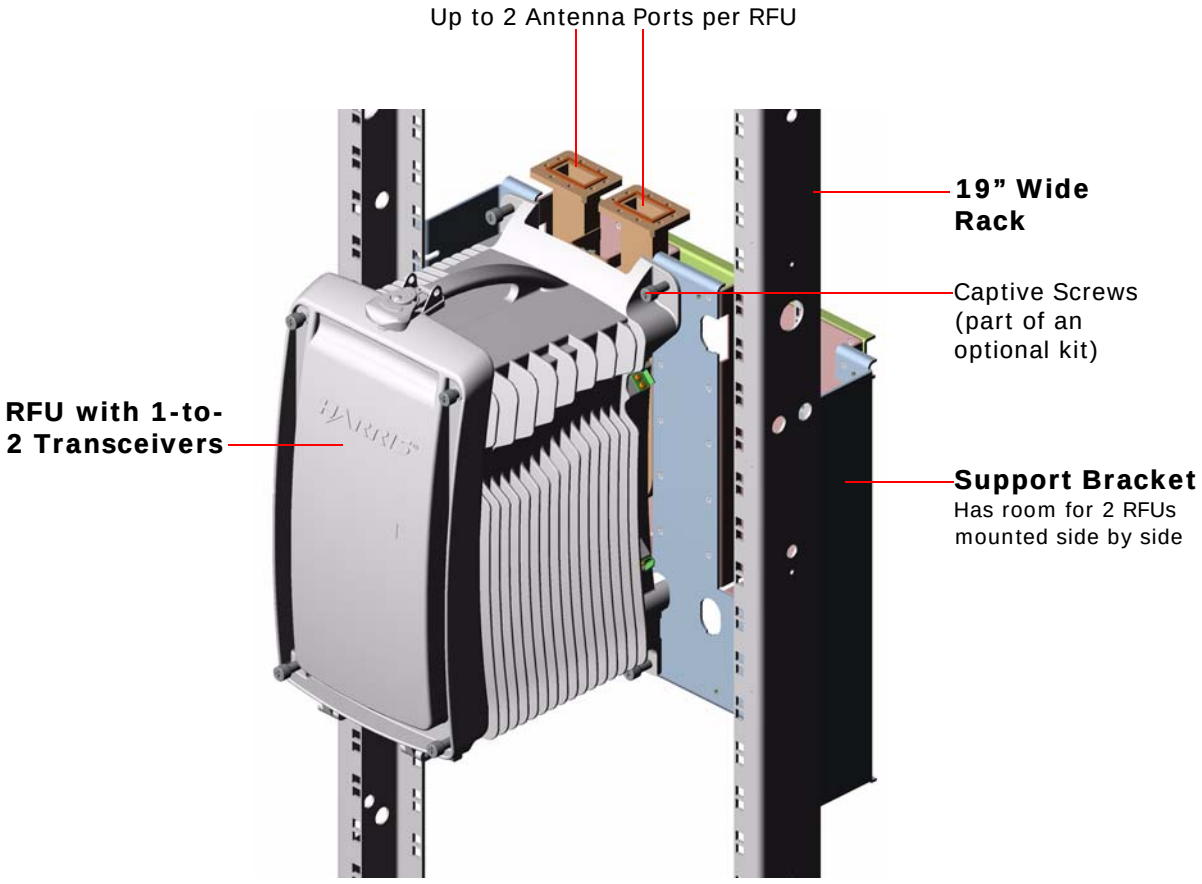
	ANSI	CEPT
Frequency, GHz	L6; U6; 7; 8; 10; 11; 13; 15; 18; 23	L6; U6; 7; 8; 10; 11
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 1+1; MHSB 2+0, 2+2; 4+0; SD, FD and SD/FD	1+0; 1+1; MHSB 2+0, 2+2; 4+0; SD, FD and SD/FD

a. Future availability

Protected/Unprotected, Indoor Rack-mounted RFU

(Up to 4+0, with 2 transceivers, as described in Table below. Block Diagrams in Figure 3-11, 3-12, 3-14, 3-16 *and* 3-17*)*

6 GHz RFU shown



	ANSI	CEPT
Frequency, GHZ	L6; U6; 7; 8; 10; 11; 13; 15; 18; 23	L6; U6; 7; 8; 10; 11
Airlink Capacity	• 4/8/12/16 DS1 • 28 DS1 + 1 DS1 • DS3 + DS1 • 3 DS3 + 3 DS1 • OC-3+1 DS1	• 2/4/8/16 E1 • E3+E1 • 21 E1+1 E1 • STM-1+1 E1
Modulation, QAM	QPSK; 16; 32; 64; 128; 256[a]	QPSK; 16; 32; 64; 128
Configuration	1+0; 1+1; 2+0; 2+2; 4+0 Unpr/Protected Repeaters	1+0; 1+1; 2+0; 2+2; 4+0 Unpr/Protected Repeaters

a. Future availability

TRuepoint® 5200 N+N Configurations

This Section provides typical block diagrams illustrating applications that combine different RFU options offered in 3 main configurations. You can build variants to these configurations by combining multiple configurations, such as a Fully expanded 4+0 Configuration, on page 2-15 and a 2+0 configuration (Figure 3-17), for example.

Special Considerations

- In N+N systems, (1+1 optimized, in 6-11 GHz), the antenna return loss must be a ***minimum of 24 dB***.
- For N+N systems, we strongly recommend keeping to a ***minimum*** the length of the flexible waveguide mounted on the Antenna Port. Such a waveguide will generate an Inter-modulation Distortion (IMD) that could fall in the receiver band, depending on the frequency pairs selection.

Figure 2-1: MHSB, 2+2, 2 Frequencies, in 2 Outdoor Enclosures with One Antenna, Single Port Expansion

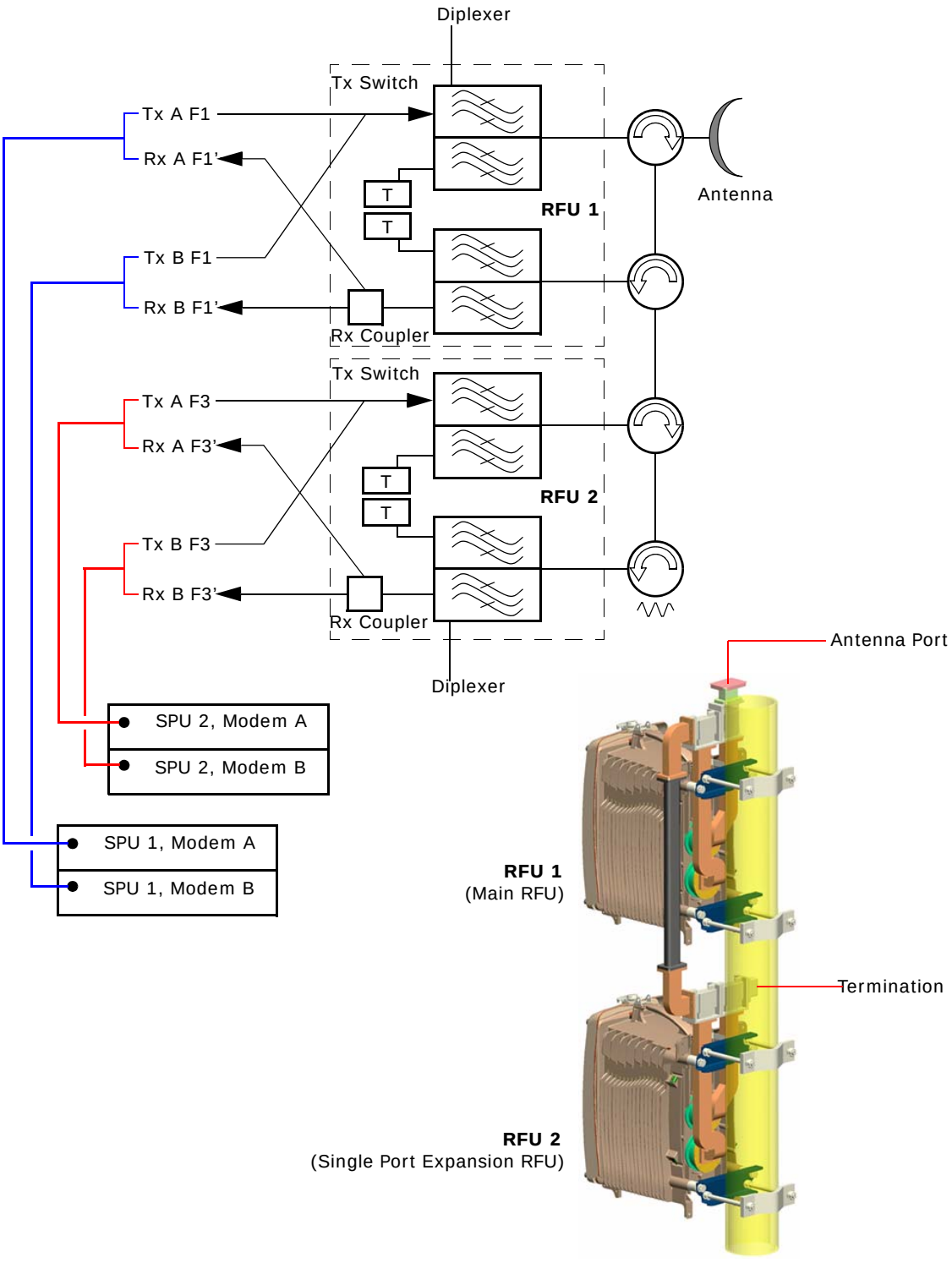
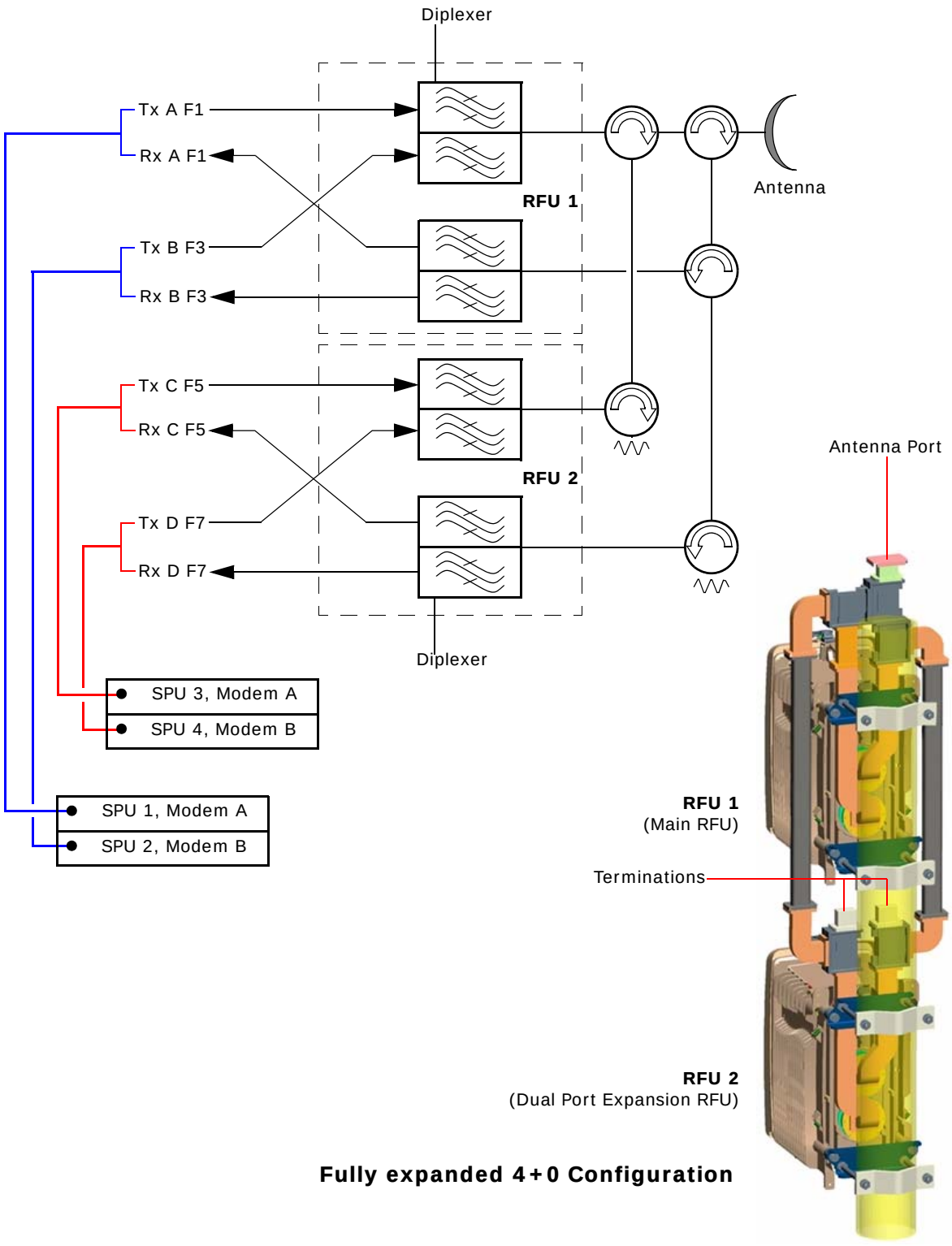
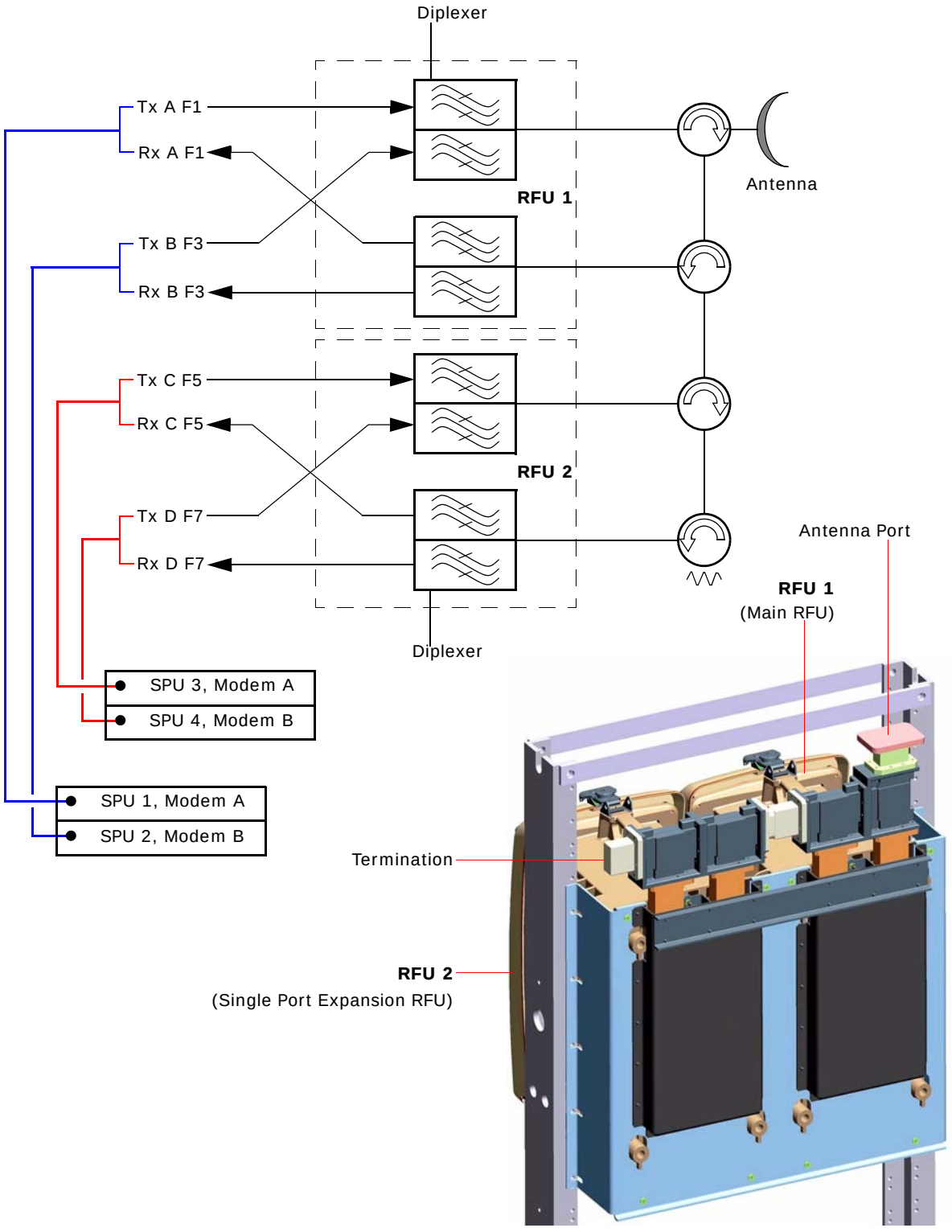


Figure 2-2: FD, 4+0, 4 Frequencies, in 2 Outdoor Enclosures with One Antenna, Dual Port Expansion



Fully expanded 4+0 Configuration

Figure 2-3: FD, 2+2, 4 Frequencies, in 2 Indoor Enclosures with One Antenna, Single Port Expansion



Current SPU Configurations

The 1-RMS SPU

The SPU in an Unprotected Configuration houses the main modules: Modem, Multiplexer, and Controller. It can also include additional optional modules, such as: the Orderwire (4W and 2W); Relays/Alarms; 64 kbps synchronous data; or 10/100BASE-T mapped into 64 kbps data.

The 2-RMS SPU

The SPU in a Protected Configuration, in addition to the main modules, (Modem A, Multiplexer A and Controller), contains a redundant Modem module, an optional redundant Multiplexer module, and an optional SDM. The Signal Distribution Module is equipped only, (exception of 2, 3 and 4 DS3) when the Multiplexer is protected or in a configuration that is Unprotected Expandable.

When the Multiplexer is not protected, (Protected Light configuration), the power supply (located in Modem B) provides power to Multiplexer A.

All modules composing the 2-RMS SPU connect to the same 2-RMS back plane. The following figures identify the current SPU configurations.

Unprotected

(1-RMS SPU)

STM-1/STS-3 Configuration shown, (electric interface)

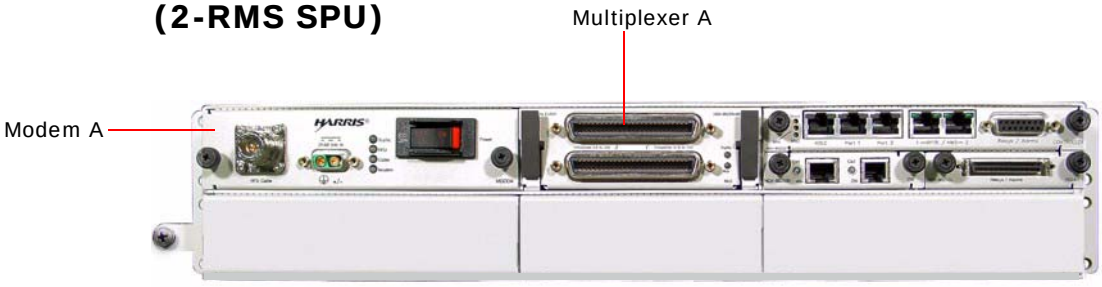
NxE1/DS-1 Configuration shown

(2-RMS SPU)

32 E1 Configuration shown

Unprotected Expandable

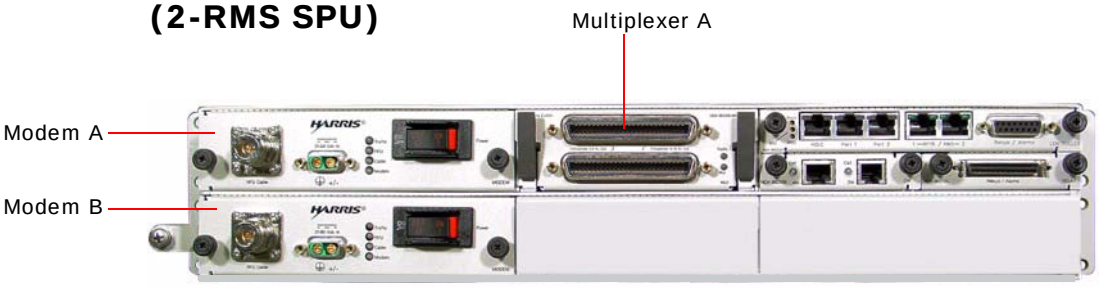
(2-RMS SPU)



NxE1/DS-1 Configuration shown: unprotected and wired for expansion. SDM bay is blanked, but may be equipped with SDM

Protected Light

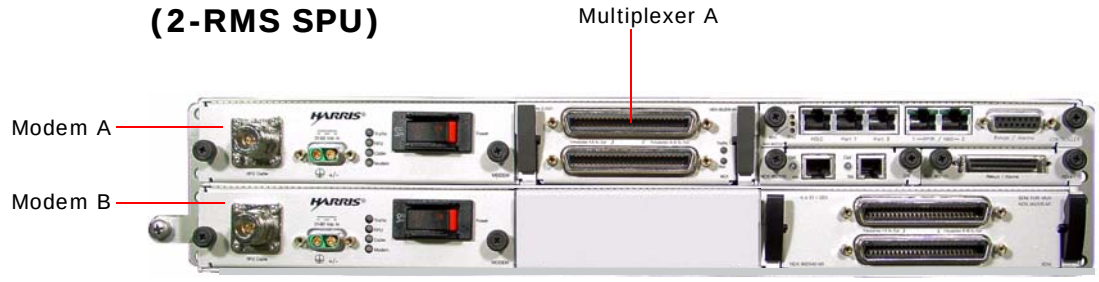
(2-RMS SPU)



NxE1/DS-1 Configuration shown: SDM bay is blanked, but may be equipped with SDM. MUX A received power from both modems.

Protected-Ready

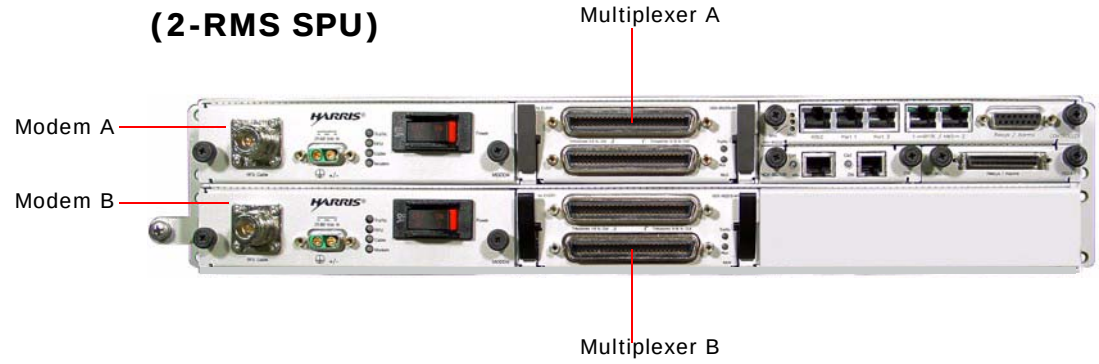
(2-RMS SPU)



NxE1/DS-1 Configuration shown. With tributaries connected to the SDM, inserting a second MUX in this shelf will not cause hits on traffic.

2+0

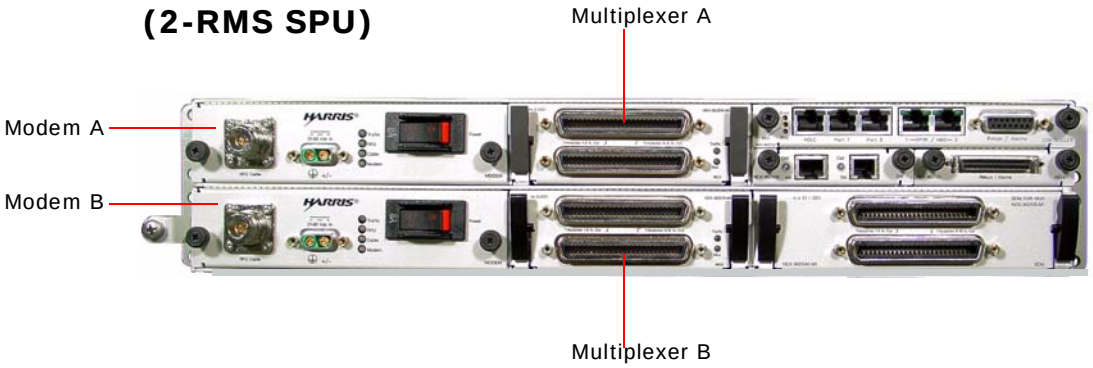
(2-RMS SPU)



SDM bay is blanked, and cannot be equipped.

Protected

(2-RMS SPU)



NxE1/DS-1 Configuration shown

32 E1 Configuration shown — Protected Modem

The 32 E1 Configuration

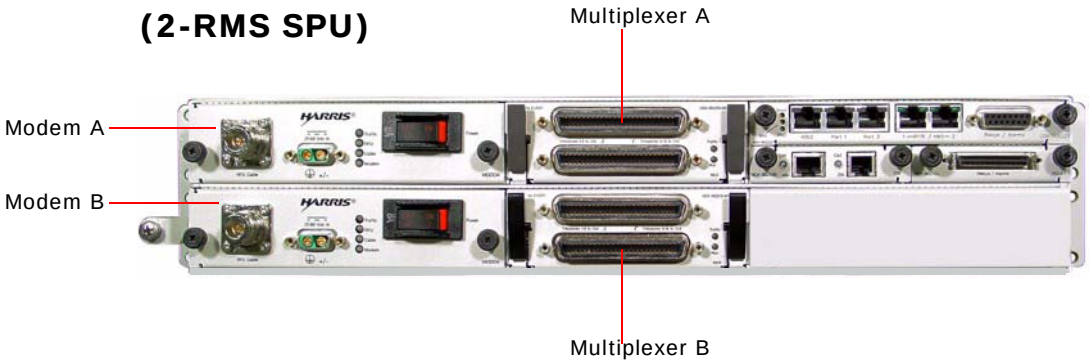
Main Features

- Combines two “NxE1+2x10-100BASE-T” muxes.
  Payloads from the two muxes are multiplexed in the SPU, then sent through a single RF carrier over the air. The ***first*** 16 E1 tributaries connect to the ***upper*** mux, and the other 16 E1 tributaries connect to the lower mux.
- Possible SPU configurations are: Unprotected and Protected.
  The Mux ***cannot*** be protected.
- Total air link is 64 Mbit/s.
  Can split traffic in any mix of E1’s + Ethernet for a total of 64 Mbit/s.
- Requires a special SPU equipped with a Controller V2, a special backplane, and a new version of MUX NxE1+2x10/100BASE-T.
- Requires:
  - Software version 7.5.1 and up; and
  - a “32 E1 dual mux” software capacity key that will co-exist with the original software capacity key, if one is already present, making it possible for the user to revert back to the original capacity key, if desired.

The SPU in a 2+0 Configuration

The SPU in a 2+0 Configuration can carry two unprotected independent traffics. In this case, Modem A and Multiplexer A will carry one set of tributaries and Modem B and Multiplexer B will carry another set of tributaries. However, all other data-carrying services (orderwire data channel and NMS) are still in the 1+1 protected scheme. Only one Controller will be used in the shelf. In this case, no SDM is required.

(2-RMS SPU)



SDM bay is blanked, and cannot be equipped.

Chapter 3, Block Diagrams, provides Functional diagrams of the current SPU configurations, as well as the RFU configurations.

CHAPTER

3

BLOCK DIAGRAMS

SPU Configurations

This section provides typical block diagrams illustrating the functions of the different SPU options offered through 3 main configurations.

Figure 3-1: 1-RMS SPU, 1+0

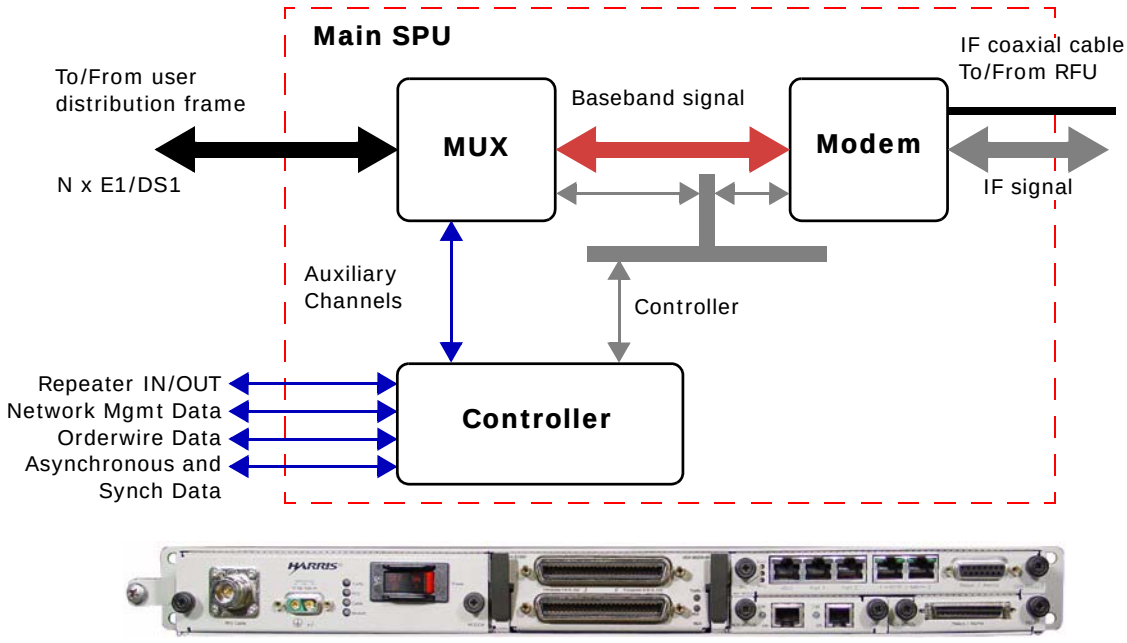
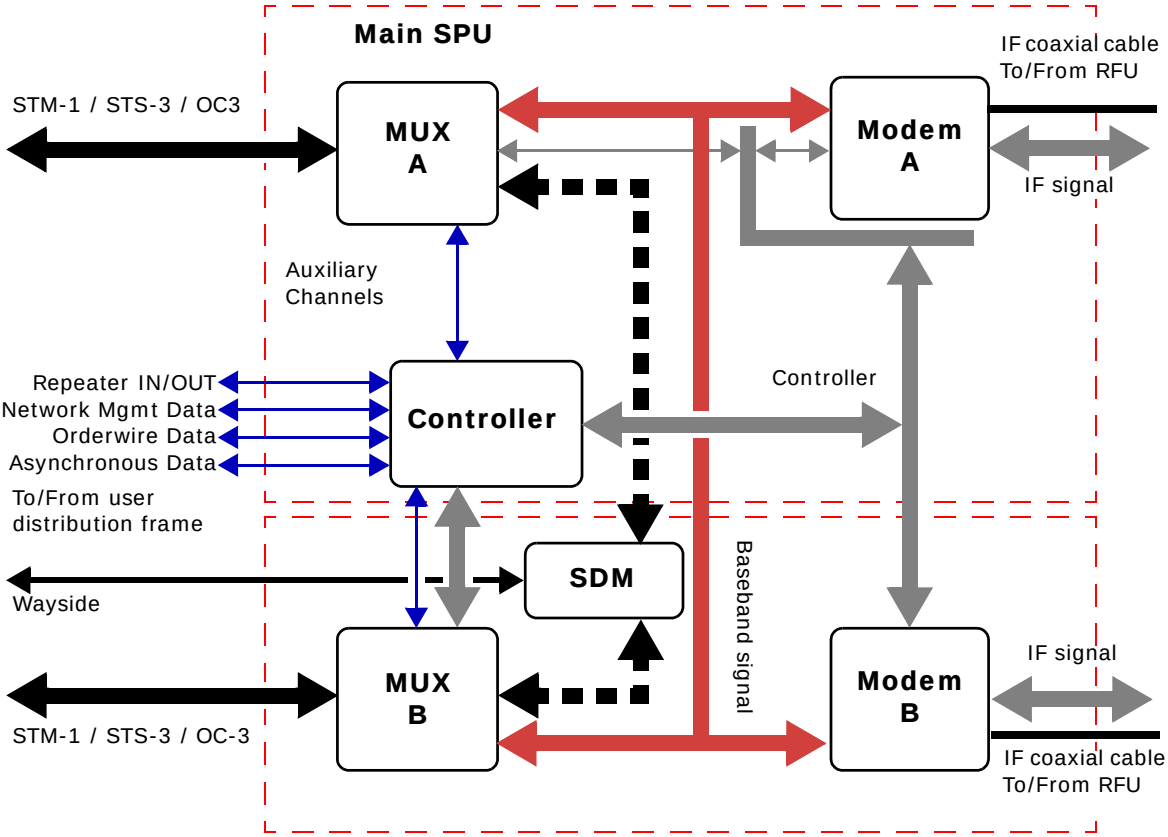
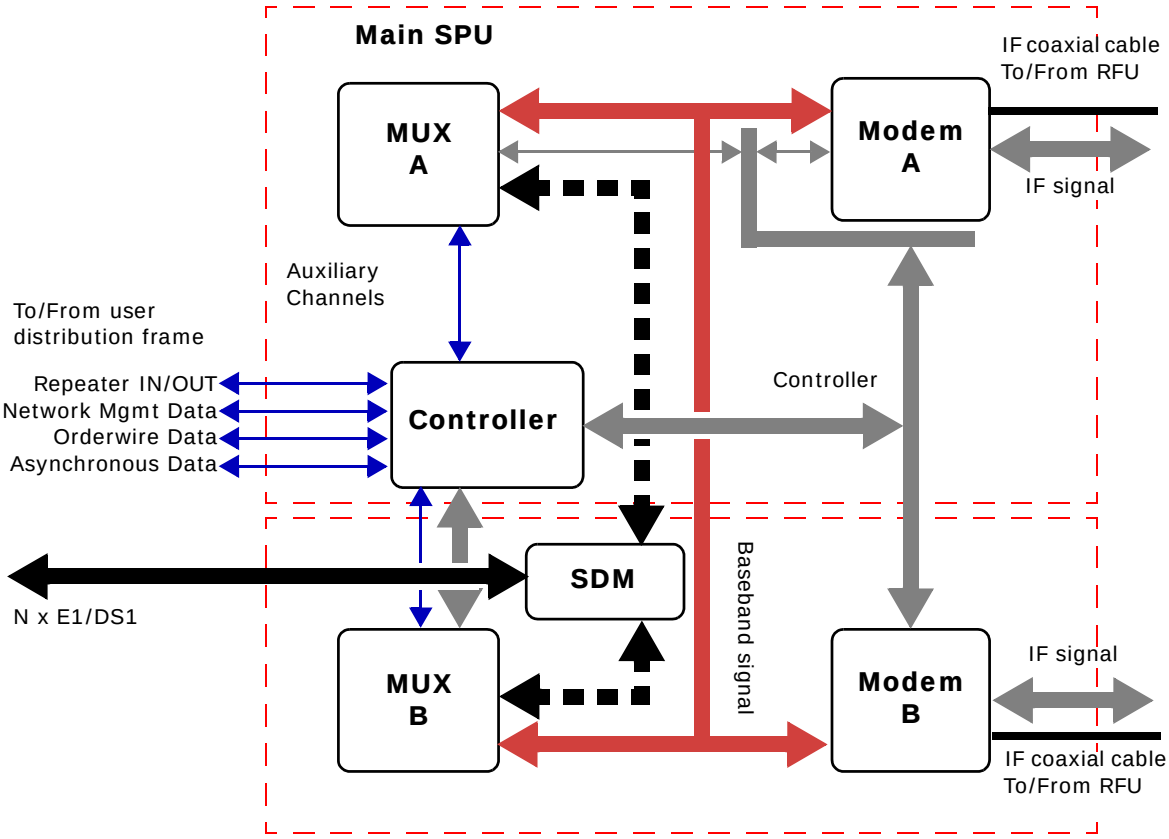


Figure 3-2: 2-RMS SPU 1+1, Protected MUX — STM-1 / STS-3 / OC-3



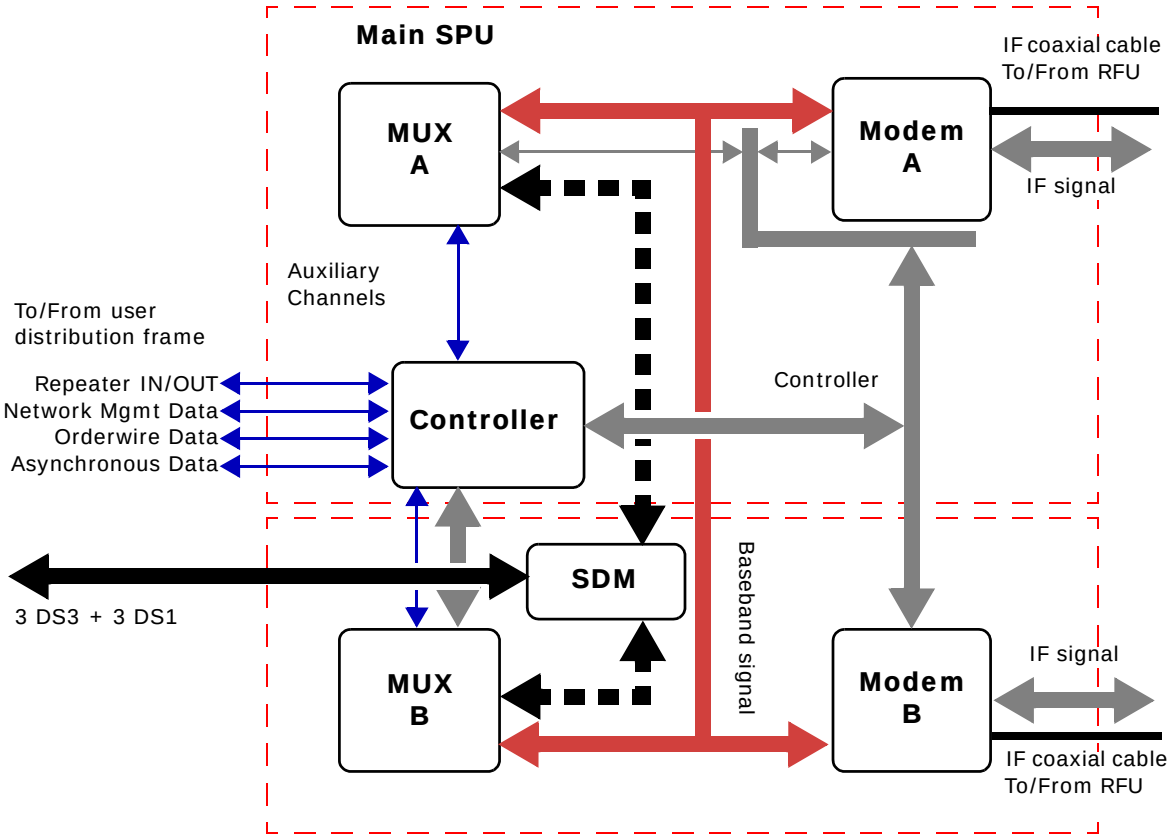
STM-1 / STS-3

Figure 3-3: 2-RMS SPU 1+1, Protected MUX — N x E1 / DS1



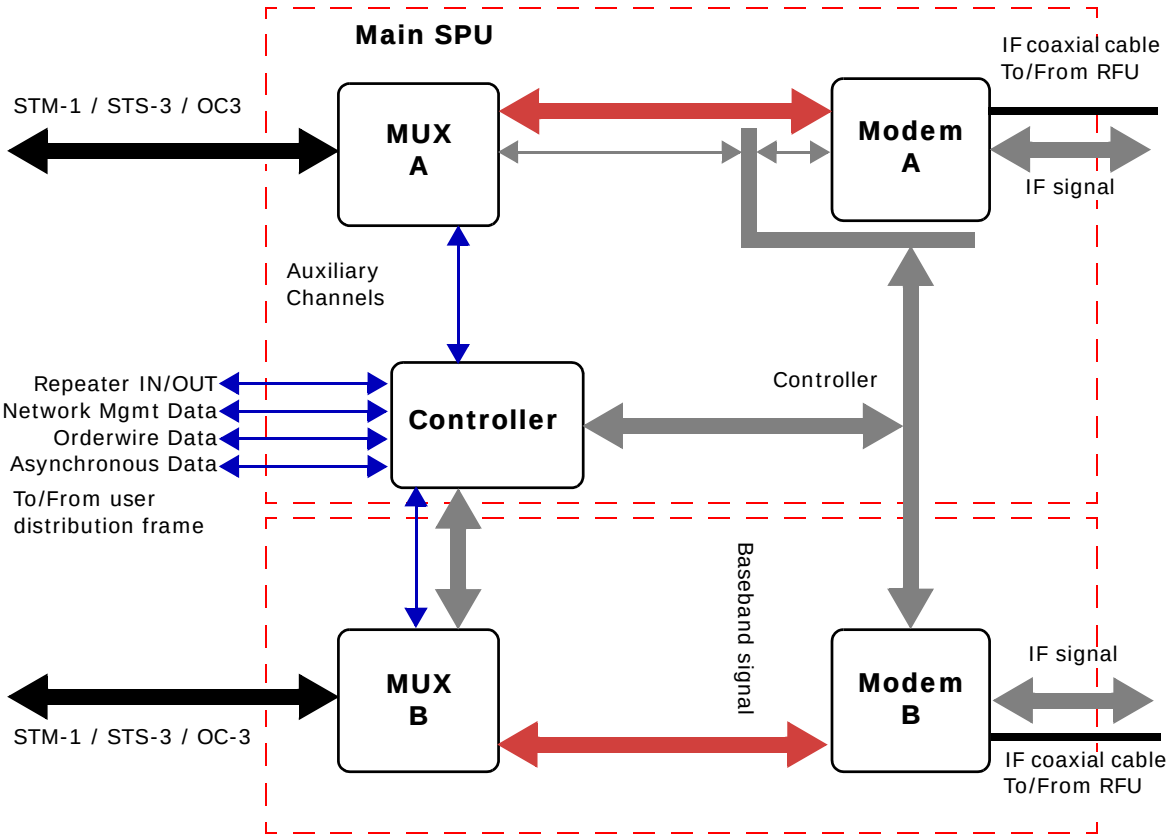
N x E1 / DS1

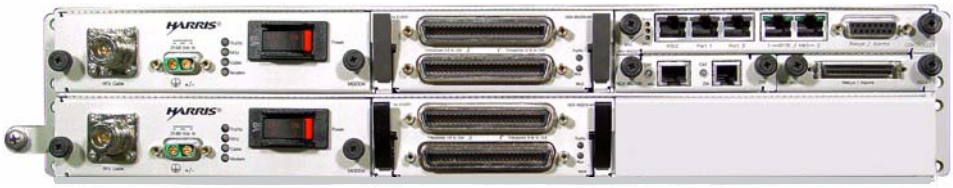
Figure 3-4: 2-RMS SPU 1+1, Protected MUX, or 1+0 Unprotected MUX — 3 DS3 + 3 DS1



3 DS3 + 3 DS1

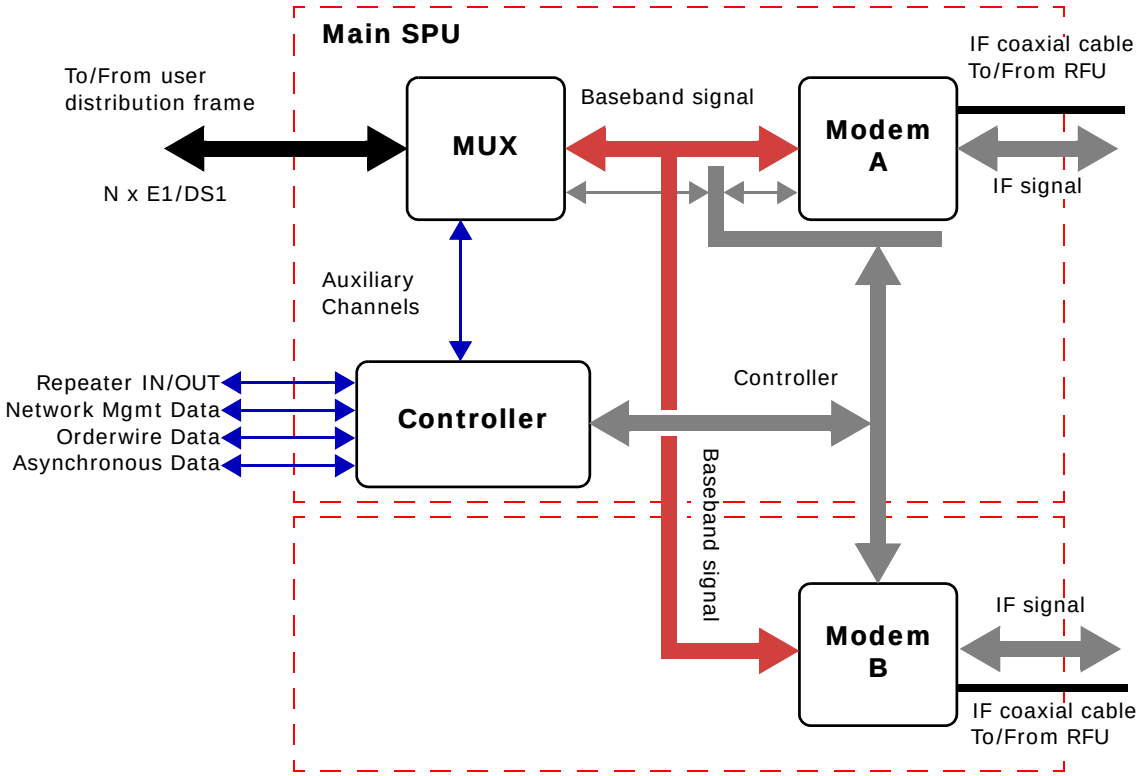
Figure 3-5: 2-RMS SPU 2+0





2+0

Figure 3-6: Protected SPU 1+1, Unprotected MUX —
(Bays for MUX B and SDM are blanked)



N x E1/DS1

RFU Configurations — ACU / Diplexer Options

This section describes the functional principles of the TRuepoint® RFU through typical block diagrams that illustrate the current ACU and Diplexer Configuration options.

TRuepoint® 5100 Series, 13 to 38 GHz

Figure 3-7: Unprotected 1+0, Outdoor

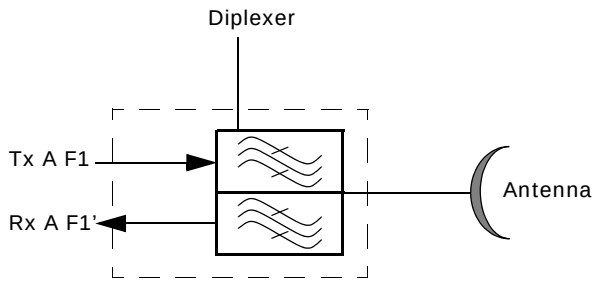


Figure 3-8: RFUs in 1+1, 2+0 or F/D Outdoor with RF Combiner

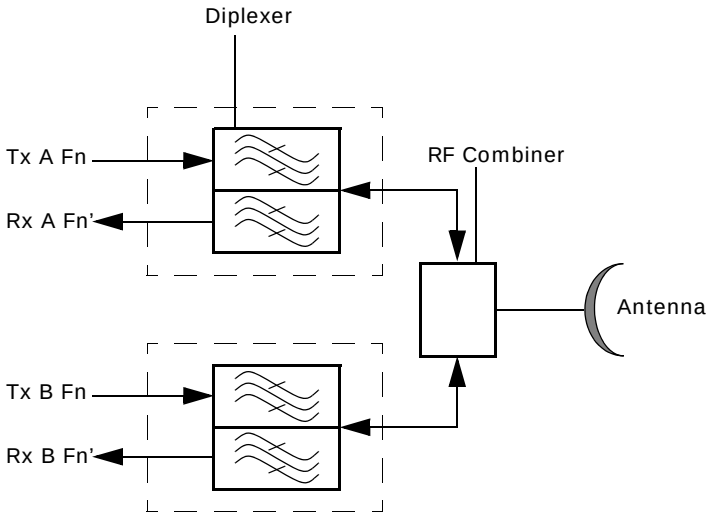
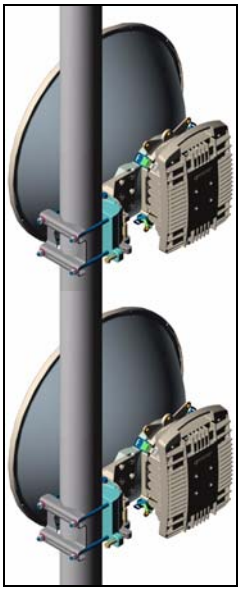
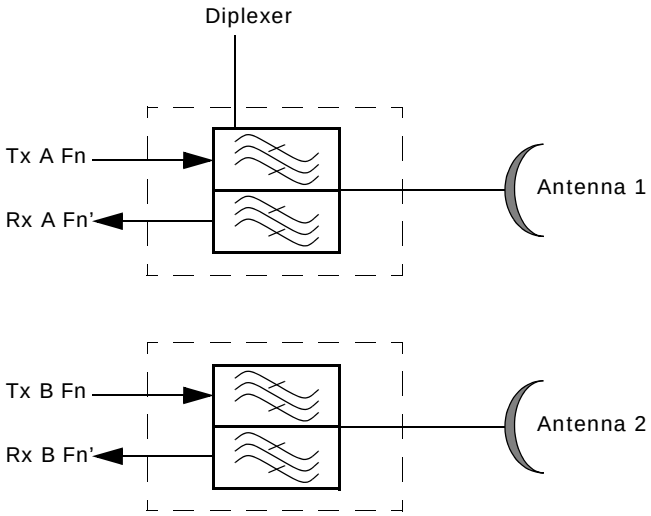


Figure 3-9: MHSB, 2+0 or FD/SD, Outdoor





Tx A or Tx B muted when other channel active, except for 2+0 or FD/SD configurations.

TRuepoint® 5200 Series, lower 6 to 23 GHz

Antennas shown are for illustration purposes only. Actual sizes and types vary according to frequencies. Refer to the ***RFU Installation*** Manual IMN-903001-exx for specific information.

Figure 3-10: Unprotected 1+0, Indoor or Outdoor

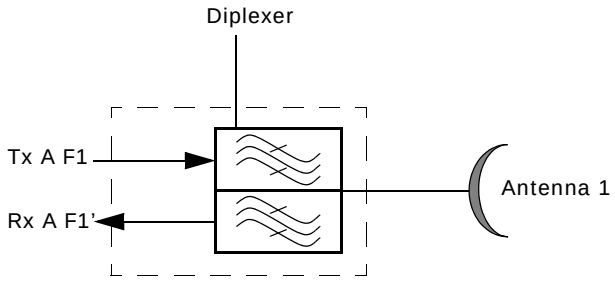
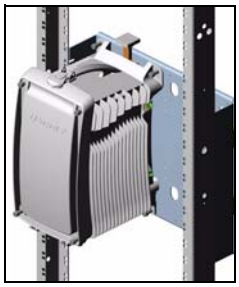


Figure 3-11: MHSB 1+1, Indoor or Outdoor with Equal or Unequal Split



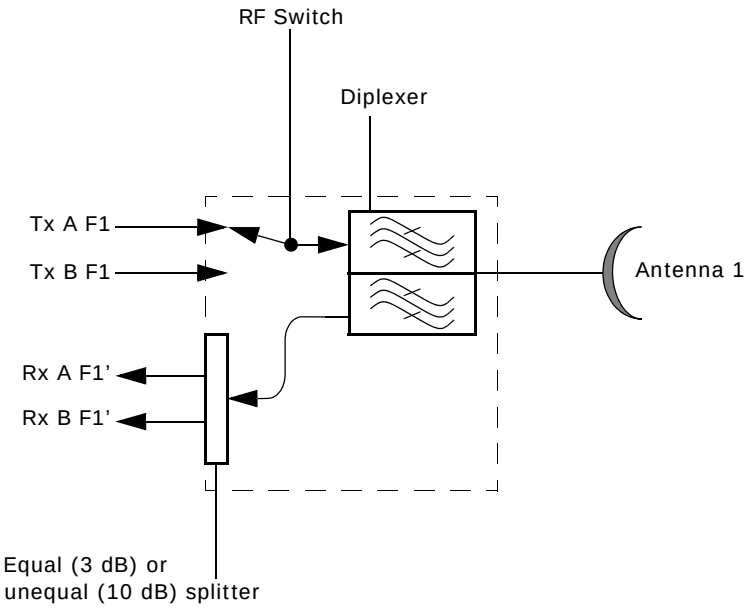


Figure 3-12: MHSB/Space Diversity 1+1, Indoor only, Single Enclosure

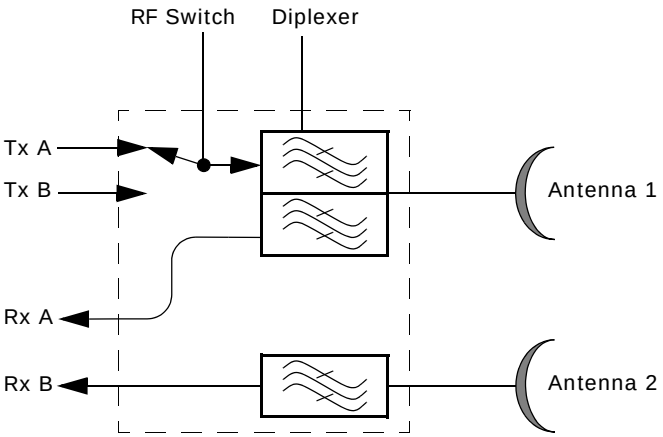
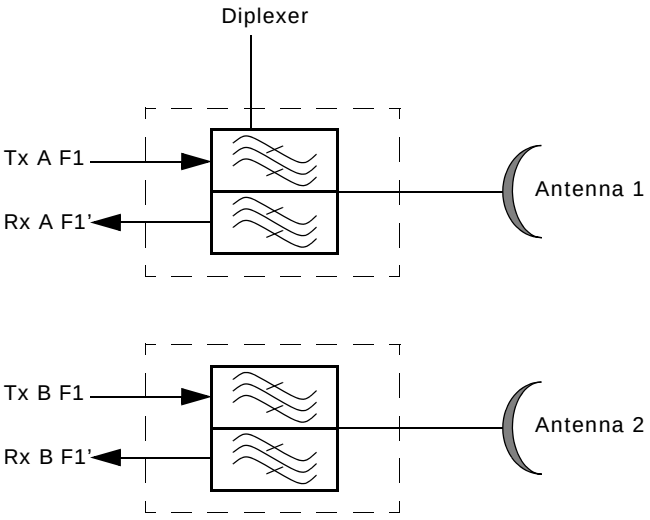
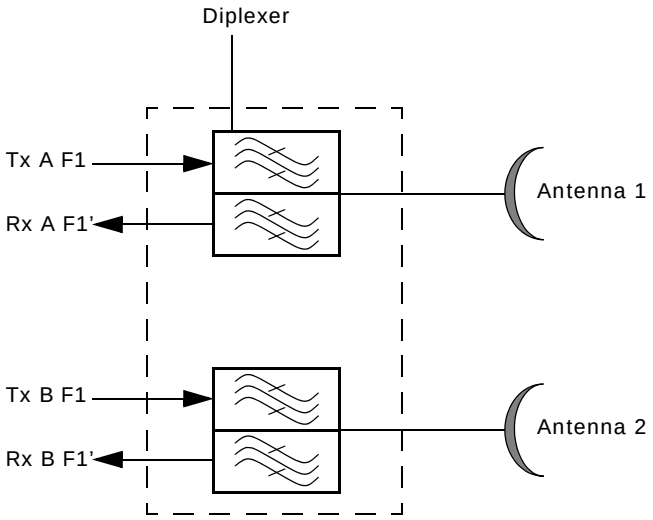


Figure 3-13: Space Diversity 1+1, Outdoor, with 2 Enclosures



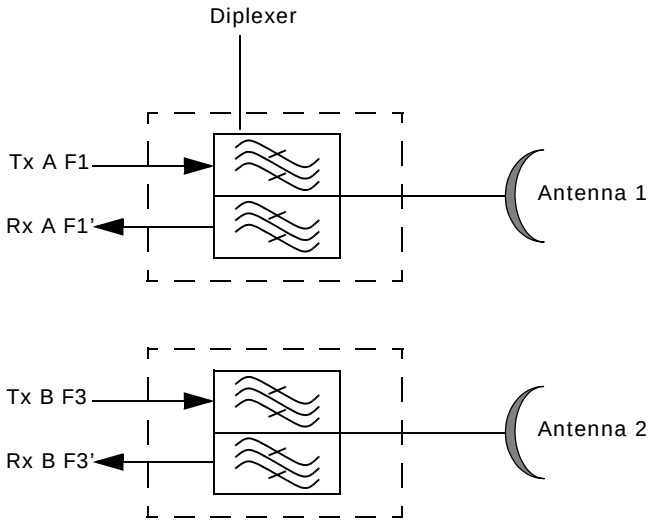
Tx A or Tx B muted when other channel active.

Figure 3-14: Space Diversity 1+1, Indoor, Single Enclosure



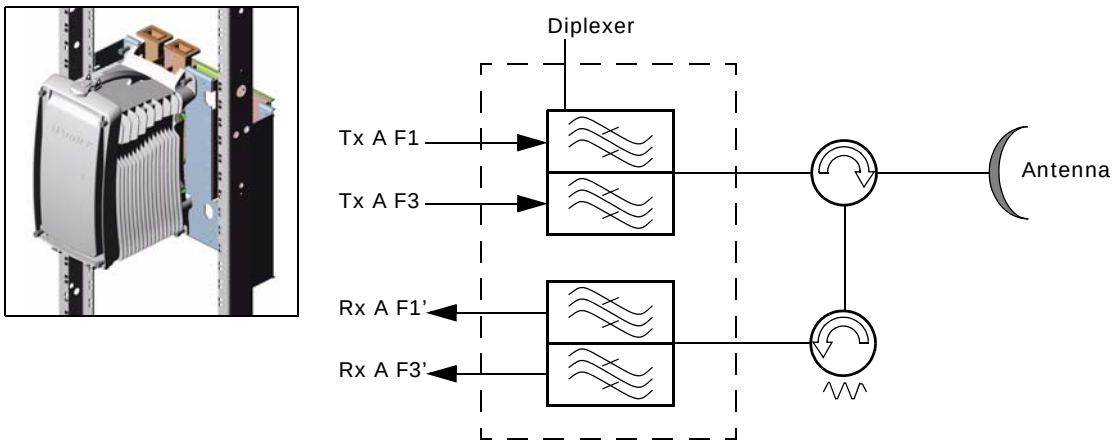
Tx A or Tx B muted when other channel active.

Figure 3-15: Frequency/Space Diversity 1+1, Outdoor, with 2 Enclosures



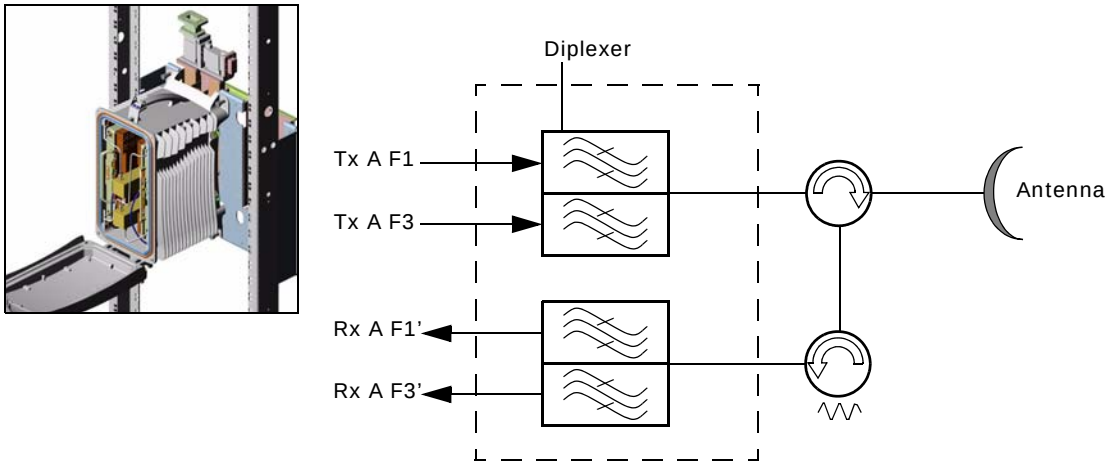
BLOCK DIAGRAMS

Figure 3-16: Frequency Diversity 1+1, Indoor or Outdoor, Single Enclosure



Outdoor configuration does not support the detachable RFU option. Supports only an antenna-separated mount.

Figure 3-17: Dual Frequencies, 2+0, Indoor or Outdoor, Single Enclosure



Outdoor configuration does not support the detachable RFU option. Supports only an antenna-separated mount.

CHAPTER

4

FUNCTIONAL DESCRIPTION

The SPU (Indoor Unit)

Refer to Figure 3-1 through Figure 3-6 for the SPU's functional block diagrams.

The modular architecture of the SPU allows for housing the following plug-in modules:

- the Controller and optional sub-modules,
- the Modem, and
- the Multiplexer.

The Controller and the Modem modules are common to all the capacities and applications. The Multiplexer module offers many different capacities and interfaces to accommodate the PDH, SDH/SONET, and IP applications. A combination of PDH and IP interfaces is also offered. The SPU contains the customer's ports for the tributary signals, network management, battery etc.

Physical characteristics

The partitioning of the SPU into functional modules has required specific labelling and identification markings. This allowed us to introduce individual alarms and status indicators in each module.

The Modem module

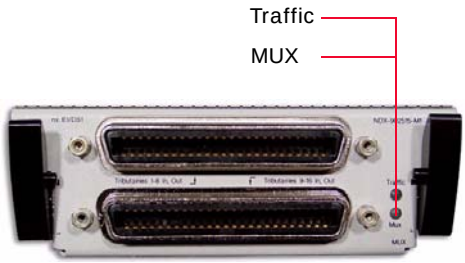
In addition to the Standard Module, the TRuepoint® radio offers an optional Modem with Dual-Battery Input ports. Each Modem's faceplate provides the following information through 4 LEDs; TRAFFIC, RFU, CABLE and MODEM, from top to bottom.

Standard Module **Dual-Battery Input**

The Muldex module

The Muldex (Multiplexer/demultiplexer) module is equipped with 2 LEDs, TRAFFIC and MUX. Markings on the Muldex's face plate provide the functional description of each port, the index number and the name of the board (MUX).

The following are some of the Muldex options. Refer to the ***SPU Installation*** manual for the current releases.



N x E1/DS1

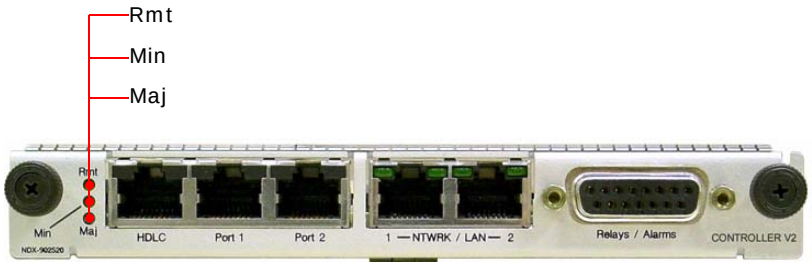
STM-1 OC-3

28 DS1/DS3 + DS1

STM-1 STS-3

The Controller module

The Controller module has 3 LED's, MAJ, MIN and RMT, from top to bottom. Markings on the Controller's face plate provide the functional description of each port, the index number and the name of the board (CONTROLLER).



Controller V2 shown

Table 4-1: Indicator Light Display Description

Module	Label	Color	Meaning
Modem	TRAFFIC	Green	The module is on-line
		Off	No traffic passing
	RFU	Green	The RFU is operating properly
		Red	The RFU has failed
	CABLE	Green	The cable connecting the IDU to the RFU is working properly
		Red	The cable connecting the IDU to the RFU has failed
	MODEM	Green	The modem is operating properly
		Red	The modem is faulty
MUX	TRAFFIC	Green	The module is on-line
		Off	No traffic passing
	MUX	Green	The MUX is operating properly
		Red	The MUX is faulty
Controller	RMT	Off[a]	The remote site is operating properly
		Yellow	Problem with the remote site
	MIN	Off	The System is operating properly
		Yellow	Traffic has been manually forced to one of the two channels, or other minor alarms
	MAJ	Green	The System is operating properly
		Red	Major Alarm. There is a problem that has interrupted traffic

a. All LEDs OFF indicate a Controller malfunction

FUNCTIONAL DESCRIPTION

Modules' Functional Description

The Modem

The Modem module contains **circuits** for the

- IF line transceiver;
- modulation;
- demodulation;
- power supply for the SPU;
- FEC encoder and decoder; and the
- DADE, enabling errorless receiver switching.

The Modem connects to the transceiver through a single standard coaxial cable (RG-8 or equivalent), with a N-type connector. The maximum length of the cable varies upon the quality of the cable and the DC voltage feed of the system.

The Modem's transmit IF and receive IF are 310 and 70 MHz, respectively.

The modulator can be programmed (through bandwidth selection) to provide QPSK, 16 QAM, 32 QAM, 64 QAM, 128 QAM and 256 QAM[1] with 2-Dimensional TCM, or 4-Dimensional TCM concatenated with Reed Solomon (high capacity) and Reed Solomon only for some capacities.

The Modem module contains the power supply that will provide the voltage for its respective shelf (main SPU or protection unit). The battery voltage for the RFU is routed through the cable interface circuit in this module. The power supply accepts a wide DC voltage input ranging from 21 to 60 V_{dc}, positive or negative battery DC voltage, (Auto-detection).

Dual battery input modem

This Dual-Battery Input Modem allows the user to configure the polarity of the input voltage: the user can strap one of 2 terminals located on the modem card (Positive or Negative) to connect the required input voltage.

Power supply alarm

Apart from a built-in protection against wrong polarity, a dedicated alarm circuitry, set at power-up, monitors and raises an alarm in the following conditions:

- when the modem's battery input voltage drops below 19.5V +/- 0.5 V; and
- when the polarity of the battery input does not match the polarity configured with the strapping option.

The alarm is cleared when the input voltage exceeds 23 V.

1. *Future availability*

The Multiplexer

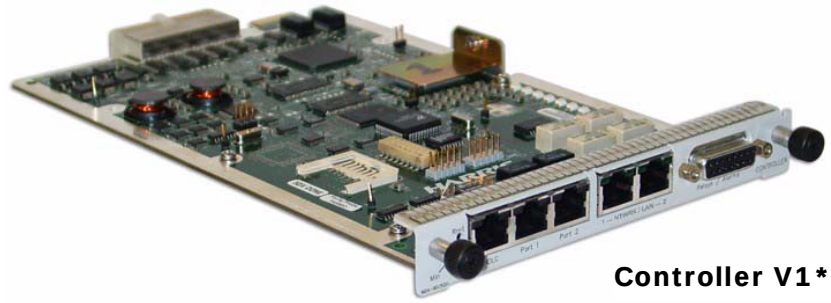
The Multiplexer module provides many different interfaces to accommodate the PDH, SDH, SONET, and the IP applications. We offer combinations of interface applications, such as PDH and IP. The protection of the MUX in a 1+1 shelf is optional. The following interfaces, planned per release, will be implemented as plug-in modules in the SPU.

The Controller

The Controller consists of one main module that provides standard features and two expansion bays to provide for optional functions such as Orderwire, 64 kbit/s data, additional relay contacts. Table 4-3 provides details on these options.

Current product offerings provide two Controller Types, as shown in Figure 4-1 and Table 4-2.

Figure 4-1: Current Controller Types (Main Card)



Controller V1*

Controller V2* *Earlier product releases, up to Release 4*

Controller V2

FUNCTIONAL DESCRIPTION

Table 4-2: Features Comparison by Controller Type

Feature	Controller V1	Controller V2
Memory card format, size	• MMC, 128 MB (earlier: 32 MB)	• CF (CompactFlash®), 128 MB
On board SDRAM	• 16 MB	• 64 MB
Software version	• Up to Version 4.x; • Not compatible with 6.X and later	• 6.x and later; • Not compatible with 4.X and earlier
Software Feature keys[a]	• No	• Yes
Software Capacity keys[a]	• No	• Presently, available for NxE1/DS1 and NxE1/DS1+2x10-100BASE-T
Supported Muxes	• NxE1 or DS1, E3 or DS3 • STM-1/OC-3/STS-3 • 28 DS1, 21 E1 or STM-1p • 2x10-100BASE-T over 34 or 45 Mbps • NxE1/ DS1+2x10-100BASE-T • 8 DS1 ADM over DS3	• NxE1 or DS1, E3 or DS3 • STM-1/OC-3/STS-3 • 28 DS1, 21 E1 or STM-1p • 2x10-100BASE-T over 34 or 45 Mbps • NxE1/ DS1+2x10-100BASE-T • 8 DS1 ADM over DS3 • SMX (ADM 28 DS1 or 21 E1), future • Any future Mux
Optional Cards	• Orderwire, ***or*** 10/100BASE-T over 64 Kbps, ***or*** V11/G703 64 Kbps data channel, plus 1 Alarm/Relay card	• Any two (no more than 1 Orderwire per site)
Bidirectional Switching	• No	• Yes (later)
Revertive Channel Switching	• No	• Yes
Real time clock (on-board backup power)	• No	• Yes
Performance monitoring G826/G828	• From boot time or last reset	• New options of 15 min. per day per month windows (on SMX only)
Ring protection	• 8 DS1 ADM only	• 8 DS1 ADM, and later on SMX
Spanning Tree Protocol (STP)	• No	• Yes (later)
Arboreal Routing Protocol	• No	• Yes (later), includes Orderwire Loop detection and resolution
Link ID	• No	• Yes
Customer banner	• No	• Yes
Number of PCR history records	• 16384 (max)	• 32768 (max)

Table 4-2: Features Comparison by Controller Type, *(continued)*

Feature	Controller V1	Controller V2
Event Logging and Auto Dump of Event Logger Files	• No	• Yes, up to 3000 logged events[b]
Time synchroniza-tion (SNTP)	• No in SW 3.x and below; • Yes in 4.X	• Yes[b]
WebCIT	• Yes	• Yes[b]
VT-100 over Telnet	• No, except 4.x which allow this feature	• Yes[b]
Strong security (Secure protocols)	• No	• Optional (must be purchased) • SNMPv3 • WebCIT over HTTPS • FTPS • VT-100 over a Telnet secured connection • RADIUS client for user login authentication using company centralized authentication server

a. Allows purchasing additional features or capacity above maximum set at factory (at time of purchase/shipping)

b. If not readily available, features can be enabled through Harris Customer Support

Main functions

The Controller monitors all modules in the radio terminal, by indicating occurred alarms through LEDs located on the module's face plate. Associated relay contacts (default association) are also provided in this module. The Controller also displays the status of the radio upon request through the HHT, the Web-CIT, the **Element Manager** (such as StarView™), or another **Network Management System** (NMS). The Controller allows radio configuration and control via the same tools.

Auxiliary Channel

The Controller provides an auxiliary channel data that consists of the network communication (Net_Comm) data. This Net_Comm protocol encapsulates the SCAN (FarScan™), Orderwire, data channel, NMS and some additional services in order to transport this information in the radio's overhead, except for synchronous hierarchy, which has this Net_Comm embedded into the RSOH and MSOH non-used bytes.

This payload is dynamically allocated to each service that is in use. As an example, if the two orderwires are not in use (on-hook), the 2x64 kbit/s payload will be automatically allocated to any other service in the Net_Comm; (for example, to the NMS).

The **minimum** payload of the auxiliary channel is 338 kbit/s up to 532 kbit/s, depending on the capacity of the radio and bandwidth optimization.

The physical services that a customer can access for his own purposes are

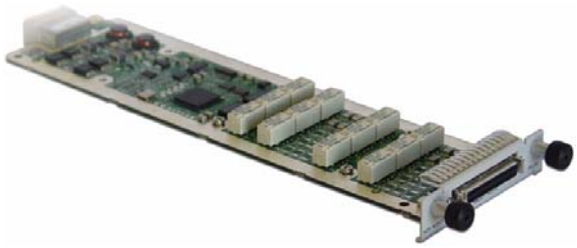
- a 2 x 64 kbit/s payload and,
- an asynchronous data channel (RS-232) of up to 19.2 kbit/s, through a maximum 56 kbit/s interface, as part of the basic offering.

The 2x64 kbit/s payload can be accessed through one of the two bays located below the Controller. These bays can accommodate the optional modules (below) with descriptions provided in Table 4-3.

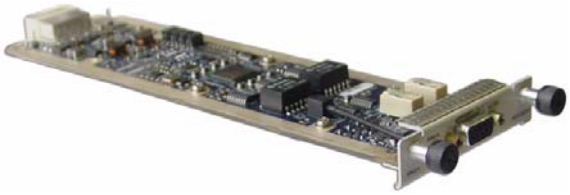
Figure 4-2: Optional Modules

2W / 4W Orderwire

10/100BASE-T / 64 kbps



Relays / Alrms



64 kbps Data Channel

Table 4-3: Optional Controller Modules Description

Optional module	Functions provided
2W / 4W Orderwire	Voice capability to the TRuepoint® microwave network
Co-directional or Contra-directional V.11 64 kbit/s data	Point-to-point 64 kbps Data Channel within a hop of TRuepoint® radios
Co-directional or Contra-directional G.703 64 kbit/s data	
Relays / Alrms	In addition to the basic 4 relays and 2 inputs on the Controller, the module provides either 12 relays and 12 inputs or 6 relays and 30 inputs
10/100BASE-T / 64 kbps	Additional dedicated 10/100BASE-T point to point channel for the customer's own use (NMS or inter-sites LAN connectivity)

The Signal Distribution Module

For Multiplexer-protected systems only, the SDM provides a customer's access point for their tributary signals, (except when the tributary signal interface is STM-1/OC-3). At the transmit end, the SDM accepts the tributary signals and distributes them to both MUX A and B. At the receive end, under a command from the Controller, one of the DEMUXes is selected to provide tributary signals for the user.

SDH and SONET

The TRuepoint® series is designed to be compatible with SDH. For ANSI rates, the radio can carry OC-3 or STS-3, and for CEPT rates, it can carry a Single STM-1 or sub-STM-1 (21 E1). Refer to Table 4-4 for hierarchy equivalence. All these rates can form part of a synchronous network (Linear or Ring loop), or be used as a spur link from a core network. Owing to the high flexibility of the modulator, the bandwidth efficiency is variable and can be adapted to most of the bandwidth requirements.

As designed, the radio can work as a **regenerator** section or as a **multiplexing** section under given conditions.

The STM-1/OC-3/STS-3 module provides the required interface for system capacities of STM-1 or OC-3 or STS-3. Three interface options are available for this module: electrical, optical multimode, and optical single mode. One E1 or one DS1 wayside is also available.

Regenerator section

We consider the radio as providing a 155 Mbit/s interface, in SONET or STM-1, as a **regenerator** section that can be used as

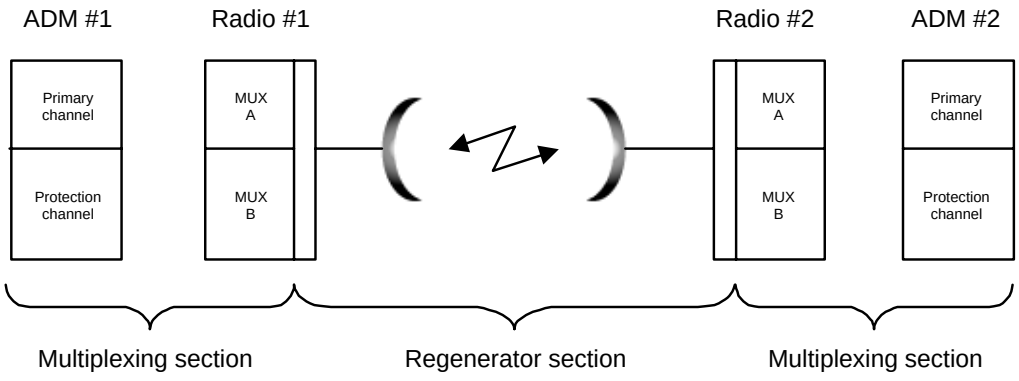
- a ring-loop closure;
- a linear system; or
- a spur.

If the radio's MUX is 1+1 protected and connected to a 1+1 protected SDH/SONET ADM, the radio multiplexers together with the ADM are treated as **Multiplexer** sections in protection switching, for alarm and status monitoring purposes. In this case, the messages exchanged between the ADM and the radio Multiplexer are carried through the K1 and K2 bytes in the LOH/MSOH of the SONET/SDH frame. Based on the protocol established by the SONET/SDH Standard Recommendations, the radio link by itself behaves like a **Regenerator** (Figure 4-3). However, the K1 and K2 information is not transferred to the far end of the link. At the far end, the 1+1 protected radio Multiplexer is treated as a **Multiplexer** section also when connected to the 1+1 protected ADM, and their message exchanges follow the same rules as described above.

Table 4-4: Rates Equivalence between SONET and SDH

Optical Level	Electrical Level	Aggr. Bit Rate (Mbit/s)	SDH Equivalent
OC-1	STS-1	51.840	STM-0
OC-3	STS-3	155.520	STM-1

Figure 4-3: Multiplexing and Regenerator Sections



In 1+0 Multiplexer system configuration, the radio link is a regenerator and its LOH/MSOH bytes pass through the radio link transparently if there is no alarm in the radio link. However, when signal outage occurs, bits 6-to-8 of the K2 byte are used to convey the alarm messages (AIS-L/MS-AIS and RDI-L/MS-RDI) between the radio Multiplexer and its locally-connected ADM.

1. In a **linear** mode, the system supports the 1+0; 2+0 and 1+1 protected MUX (APS/MPS for both SDH and SONET).

   a. In 1+1, the signal of Radio MUX A is connected to the ADM **primary** channel, and the signal from Radio MUX B is connected to the ADM **protection** channel. K1-K2 bytes in the Line overhead/MS Overhead exchange information between the ADM and the locally connected radio MUX.

   b. In 1+1, MUX protection supports unidirectional switching. Bidirectional switching will be supported. Please contact your Harris Representative for availability.

2. **Unidirectional Path Switch Ring** (UPSR-SONET) and Subnetwork Connection Protection (SNCP-SDH) are supported. In this mode, the radio's MUX is always unprotected.

Interoperation with some ADMs/routers

The TRuepoint® radio operates with ADMs that comply fully to the unidirectional APS. Some ADMs/routers require that the transmit and receive signals be selected as a pair, even in a unidirectional mode. As a work around to this condition, the ADM/router might send a short L-AIS upstream of the radio on the active line to trigger a radio switch. The TRuepoint® radio would then respond to this trigger and initiate a TX switch accordingly. The switch action also results in a modem resynchronization at the far-end. In such condition, the TRuepoint® radio's behaviour is normal.
Also, some ADMs/routers provide a user-selectable option for enabling/disabling the scrambler within the ADM. For optimal interoperation with the TRuepoint® radio, we recommend **enabling** this scrambler.

Integrated Multiplexing Functions Section

TRuepoint® radios support the ADM 21 E1[1] and 21 E1/STM-1p capacities. The 21 E1 terminal will support 2 modes of operations:

a. The first mode is a full end-to-end MUX, such that
   - the microwave link uses 21 E1 at each end;
   - the tributary is available directly to the end user; and
   - the air payload will be 55.296 Mbit/s, including 1 E1 wayside, auxiliary channel and radio overhead.

b. The second mode behaves as follows:
   - 21 E1 at the local end, and STM-1 at the far end;
   - the STM-1 interface will allow the customer to interconnect the STM-1 directly to a synchronous system. (If the STM-1 of the Network's entry port is an ADM, refer to the above-mentioned Regenerator section, for the inter-operability with the ADM.
   - the STM-1 can also be a partially filled STM-1.

The STM-1/OC-3/STS-3 Frame Overhead

Auxiliary channel	MS1, MS2, MS3, MS4, E1, F1 (Include SCAN, NMS, 19.2-AUX1, AUX2, AUX3...)
Wayside DS1	N3, N4, MS5, MS6, U1-U8, U11-U14, U17-U20, U23-U26, N5, N6
Wayside E1	C1/N1, N3, N4, MS5, MS6, U1-U26, N5, N6

SONET/SDH Synchronization and Framing

A system with an OC-3/STS-3/STM-1 interface behaves as follows:

- the 155.52 Mbit/s data and clock are recovered from the incoming electrical or optical signal;
- the regenerated data and clock are fed into STM-1/OC-3 framer gate array. The STM-1/OC-3/STS-3 section/transport overhead bytes are processed in this framer as required;
- the Wayside channel data and the Auxiliary Channel data are inserted into unused bytes in the section/transport overhead of the STM-1/OC-3/STS-3 frame. Refer to Table 4-5;
- when there is no input signal, a local clock (+/- 20 ppm) generates the frame. The 155.52 Mbit/s data and clock are then fed to the modem module.

1. *Future availability*

In 21 E1 systems,

- the system generates the frame by multiplexing the 21 E1 data into 55.296 Mbit/s (including 1 E1 wayside, auxiliary channel and radio overhead) data through a locally-generated clock (better than (+/- 4.6 ppm), or a clock derived from an external 2048 kHz synchronization clock. (Specific access is available on the MUX board or SDM for 1+1 systems).

In 1+1 protected system with redundant MUXes,

- the data and clock of only one MUX will be selected to feed both modem modules. This selection is part of the transmitter switching;
- likewise, only one of the auxiliary channel clocks will be selected from the redundant MUX as part of the transmitter switching.

Table 4-5: SONET and SDH Format

SONET/SDH Overhead								
A1	A1	A1	A2	A2	A2	C1	C1/N1	C1/N1
B1	MS1	MS2	E1	MS5	U1	F1	N3	N4
D1	MS3	MS4	D2	MS6	U2	D3	U3	U4
H1	H1	H1	H2	H2	H2	H3	H3	H3
B2	B2	B2	K1	U5	U6	K2	U7	U8
D4	U9	U10	D5	U11	U12	D6	U13	U14
D7	U15	U16	D8	U17	U18	D9	U19	U20
D10	U21	U22	D11	U23	U24	D12	U25	U26
Z1	Z1	Z1	Z2	Z2	Z2	E2	N5	N6

Ancillary Units — TIUs

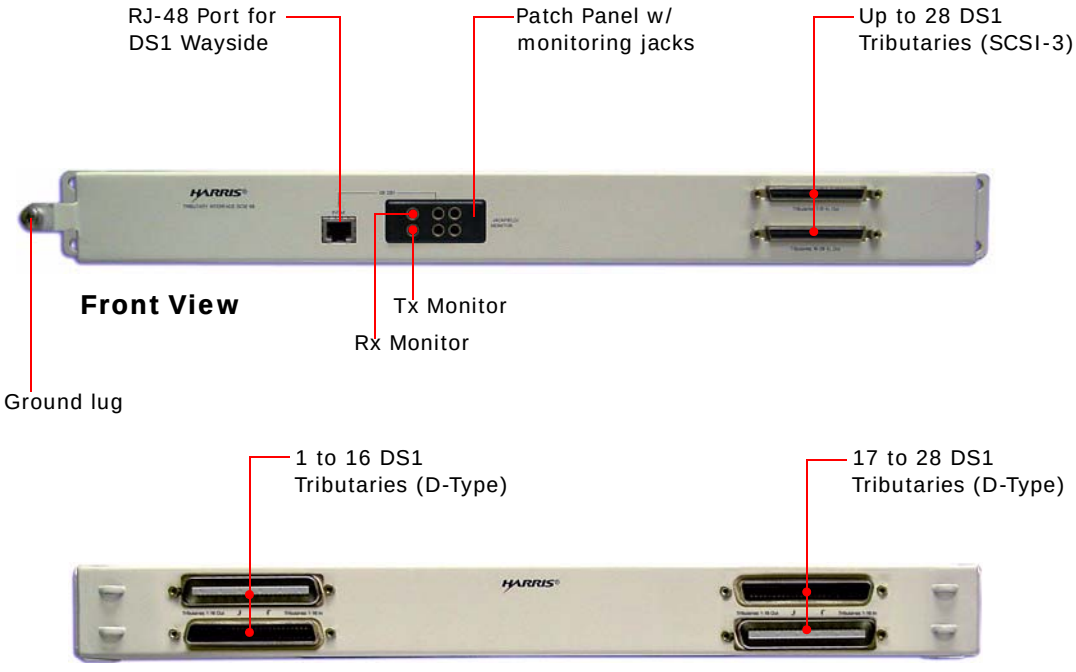
The TIU (Tributary Interface Unit) is an additional 1-RMS shelf — an independent module from the SPU — that allows customers to connect their tributary lines to a standard density connector or a balanced termination, when that is not possible on the MUX or SDM modules.

This unit is offered in 2 versions;

- an ANSI version, supporting 28 DS1 + 1 DS1 wayside, and
- a CEPT version, supporting 21 E1 + 1 E1 wayside.

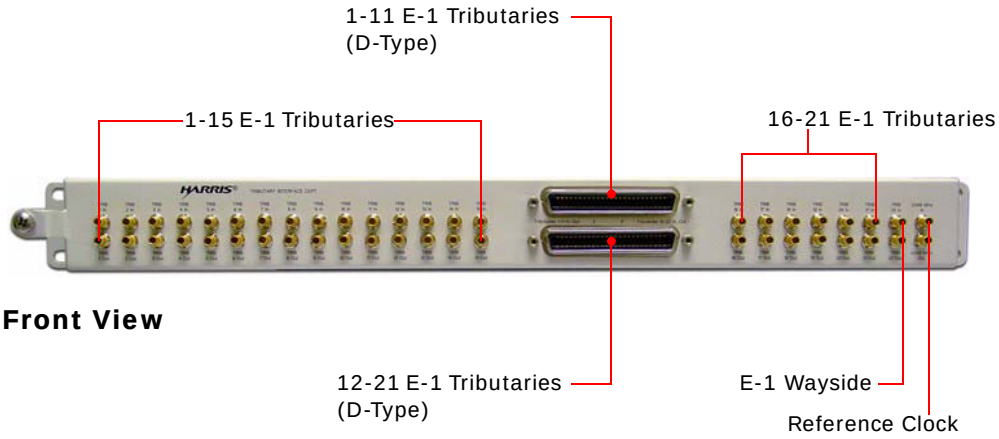
The following figures depict views of each TIU version, identifying ports and connectors.

Figure 4-4: The TIU — ANSI Version



Refer to the SPU Installation Manual IMN-903002-Exx for detailed information on the TIU.

Figure 4-5: The TIU — CEPT Version



Features of the ANSI version

- One double-stacked SCSI connector (consisting of two 68-pin connectors),
- one RJ48C port, and
- one jackfield patch panel with monitoring jacks for the wayside (DS1) channel.

The back panel contains four 50-pin connectors (D-Type, 2 females for Rx data and 2 males for Tx data), that offer the following features:

- convenient conversion from SCSI connectors on the TRuepoint® MUX to standard 50 pin D-type connectors on current Harris and OEM jackfield panels,
- conformance to ANSI 655 foot cross-connect specification,
- can be fitted with wire-wrap adapters to provide such an interface, if required.

Features of the CEPT Version

- Two 50-pin D-Type connectors (D-Type),
- total of 46 coaxial connectors (1.0/2.3 series),
- provides up to 22 tributaries (including the wayside), and an external reference clock in an unbalanced configuration.
- each tributary meets the continuity requirements with a loss of 6dB @ 1.024 MHz due to cable loss,
- the input reference clock shall be in accordance with specifications part of the ITU-T G.703 document.

The RFU

Current RFU options are described in a section titled RFU Configurations — ACU/Diplexer Options, on page 3-7.

The RFU consists of

- A transceiver module, and
- An ACU.

Transceiver

With the exception of the synthesizer/local oscillator and diplexer, the transceiver module providers the RFU functions that include:

- Power supply
- Radio processor
- Cable interface
- Transmit IF
- Up-converter
- Power amplifier
- LNA
- Down-converter
- Receive IF AGC amplifier.

Synthesizer/L.O. module

Transmit and receive Synthesizer/Local Oscillator sources are packaged into one module. There are several options of this module to cover frequency bands from 6 to 38 GHz. In general, each L.O. module covers only one frequency band. All Synthesizer/L.O. modules have the same dimension and footprint.

Antenna coupling unit, ACU

The ACU incorporates a diplexer integrating transmit and receive filtering. In a 1+1 MHSB system, the ACU contains also the RF switch and splitter.

In most cases, the usable RF filter bandwidth is approximately one-half the T/R spacing. However, in some cases, such as the Frequency Diversity system, the RF filter bandwidth is a lot narrower than ½ the T/R spacing.

Refer to Table 4-6 for details on the RFU Design Features.

RFU Optimization and Usage

The following table outlines the major RFU design features specific to each TRuepoint® series.

Table 4-6: Major RFU Design Features

Features	TRuepoint® 5100	TRuepoint® 5200
RFU Optimized for	• 1+0; for 13-38 GHz	• 1+1; for L6-23 GHz
Antenna Configuration	• 1+1; MHSB, 2 redundant RFUs on RF Combiner with one antenna • 1+1; MHSB, FD[a], SD, 2 redundant RFUs on 2 antennas	• 1+1; MHSB, 2 redundant transceivers in same enclosure with one antenna, coaxial cables, relay switch and diplexer • 1+1; MHSB, FD • 1+1; SD with 2 enclosures and 2 antennas
ACU Design	• 1+0; diplexer and spacer • 1+1; diplexer, spacers and RF combiner with one antenna	• 1+0; diplexer, • 1+1; combination of RF switch and diplexer, with receive splitter. In special cases[b], discrete filters may be preferred to a diplexer
Protection Switching	• Standby transmitter muted	• RF switch with diplexer selects active transmitter (transmit side); splitter (eq/uneq) distributes receive signals to both receivers (receive side) • SD with 2 antennas, standby transmitter muted

a. In 13 GHz only

b. Unpaired frequencies, i.e., non-standard T/R spacings

RFU optimized for 1+1 in a (2+0) configuration

The RFU optimized for 1+1 can be configured as a **2+0 system**. In this case, the two transceivers carry two independent traffic streams. The ACU arrangement for this 2+0 configuration is similar to the 1+1 protected Frequency Diversity system.

ATPC and DTPC

The TRuepoint® 5000 radio uses two features that minimize the interference and to ease frequency coordination:

- ATPC (Automatic Transmit Output Power Control); and
- DTPC (Dynamic Transmit Output Control).

The ATPC function allows the system to adjust it's transmitter output power to a level which suits the far-end targeted RSL (Receive Signal Level) objective as configured by the user.

When engaged, the ATPC mechanism continuously

- adjusts (regulates within the ATPC range) the output power of the local transmitter based on the remote RSL reporting, and
- boosts the power when the remote receive signal fades.

When the ATPC power regulation is activated because an RSL low threshold is reached, a single 15 dB up step (or maximum step available) is applied, and the ATPC time counter is set.

This mechanism is disabled when

- the configured ATPC elapsed time is reached, or
- the target RSL is restored.

Regulatory limits may exist as far as total allowed ATPC usage time, and a period counter can be set to halt the ATPC mechanism and raise an alarm when this limit is reached.

In DTPC mode, the transmit power level is dynamically adjusted to maintain a constant RSL at the other end.

Remote Transmit Power Control (RTPC)

The RTPC feature allows an operator to configure, locally or remotely, a ***fixed*** transmit output power level that is ***lower*** than that of its nominal level. This is done through either the HHT or Web-CIT. The RTPC tolerance is +/- 2 dB.

This feature is accessible through the following:

Menu path: CONFIGURATION / SYSTEM / OUTPUT POWER / TX A(B) STAT ATTEN.

Residual Bit Error Rate (RBER)

BER is a function of the received signal level (RSL). As this RSL increases, the error rate will fall to a very low level or floor, known as “residual” bit error rate, (RBER). The Residual BER performance is primarily a function of the combined system's sources phase noise and power amplifier non-linearity impairments.

The RBER is characterized typically at an RSL level that is **10 dB** above the 10^{-6} receive threshold. The RBER with FEC On is typically less than 1.0×10^{-12}.

Transmit Mask Considerations

During radio operation, the TRuepoint® radio is guaranteed to meet the transmit mask for all values of ATPC and RTPC which, in combination, place the output power within **10 dB**[1] of the maximum transmit power level. For instance, if ATPC is disabled, the mask will be met with RTPC attenuation levels from 0 to 10 dB. This corresponds to a transmit power ranging from the maximum transmit power level, down to 10 dB below the maximum. If ATPC is enabled, then the mask is still met for any power level within 10 dB of the maximum, but the decrease in transmit power (from the maximum) is partially due to RTPC and partially due to ATPC.

Transmitter Switching

Function	Protection mechanism triggered automatically in case of • a hardware failure in the modem transmit section, or • the RFU transmit section, including the power amplifier.
Initiation	• Can be initiated manually or automatically.
Characteristics	When transmit switching occurs, the following circuits will switch: • Modulator, Transmitter, and • Master clock to multiplexer, (PDH systems).

1. Value of this range is 8 dB for 13 GHz systems with 155 Mbit/s

Revertive Transmitter Switching

Function	Protection mechanism that allows for switching back automatically from Transmitter B to Transmitter A	
Recommended Configurations	Revertive	Non-revertive
	• 1+1 Space Diversity with two antennas, revertive to transmitter A, on the highest-mounted antenna	
	• To Transmitter A, MHSB, when equipped with unequally-split combiner. • Controller selects always Transmitter A when: - Transmitter A is not in alarm - There is no active command to force switch or manually switch to Transmitter B	• When equipped with two antennas, (except for Space Diversity) or • When equipped with one antenna on equally-split combiner
Enabling / Disabling	Disabled	
	• If Transmitter reverse channel switching (RCS) is enabled	

Transmitter Reverse Channel Switching (RCS)

Function	• Protection against transmitter silent failure.
Enabling / Disabling	• Default value for the RCS configuration point: Disabled.
Initiation	• When enabled, RCS is initiated from the ***receive*** end. • If both receivers at the ***receive*** end are in alarm condition for a certain period, the receive end controller initiates RCS at the corresponding ***transmit*** end.
Characteristics	• Default value for Transmitter RCS configuration point: No RCS. • In a 1+1 MHSB or Space Diversity system, the Transmitter RCS is initiated from the receive end as a mean to mitigate hardware silent failure at the transmit end.

Receiver Switching

Function	Protection mechanism triggered automatically in case of • a hardware failure in the radio receiver chain (LNA to demodulator), or • a path outage.
Initiation	• Can be initiated manually or automatically.
Characteristics	• Occurs at the DADE circuit in the modem module. • Non-revertive. • Triggers are executed according to higher priority requests. • Errorless, with anticipatory switching algorithm for path protection.

Multiplexer Switching

Function	Protection mechanism initiated manually, or automatically. It is triggered automatically in case of • a hardware failure in the multiplexer transmit circuitry; or • a degraded incoming signal.
Characteristics	• In a 1+1 system with a **protected** Mux, the clock of only one service channel is selected from the two multiplexers to generate the packet data at the ***transmit*** end. • In a 1+1 system with a **protected** Mux carrying Ethernet traffic, the switching mode is ***bidirectional***[a].

a. Switching decisions carried out simultaneously by both the user equipment and the TRuepoint® radio.

Demultiplexer Switching

Function	Protection mechanism initiated manually, or automatically. It is triggered automatically in case of a hardware failure • in the Modem DADE circuitry, or • in the receiver circuitry of the demultiplexer.
Characteristics	• In a 1+1 system with an **unprotected** Mux, the Controller selects one of the input data from demodulator A and B to feed it to the Demultiplexer for further processing. • When switching occurs in a 1+1 system with a **protected** Mux, the Controller will select, via the Signal Distribution Module (SDM), the tributary signals from the standby multiplexer, and the service channel data coming from the standby multiplexer. At the ***receive*** end, the service channel signal is selected from one of the two demultiplexers. • For a multiplexer carrying Ethernet traffic, the switching mode is ***bidirectional***[a].

a. Switching decisions carried out simultaneously by both the user equipment and the TRuepoint® radio.

Theory of Operation

Transmitting

In the transmit direction, Figure 3.1, a traffic signal from the user's distribution frame enters the IDU through the Multiplexer Module or Signal Distribution Module (when the MUX is 1+1 protected). The signal is then handled in the sequence described in Table 4-7.

Table 4-7: Transmit Signal Handling

Seq.	Module	Component	Signal Handling Description
1	MUX (SPU)	Line Transceiver Circuit	• Converts incoming tributary signal (bipolar) to an NRZ data • Recovers the clock from the incoming signal • Uses the clock to regenerate the binary signal • In ANSI, allows for selecting individual line coding (for DS1, AMI or B8ZS)
2	MUX (SPU)	Multiplexer (PDH)	• Uses bit stuffing to synchronize the incoming tributaries • Multiplexes the tributaries together with the auxiliary channel data coming from the Controller to an aggregate data rate • Provides auxiliary channel clock to the Controller
3	Modem (SPU)	FEC Circuit	• Scrambles data with the algorithm that provides maximum pattern sequence • The scrambled data is then FEC encoded • The FEC encoder type is programmable to be either Reed Solomon with or without Interleaver, 2D or 4D TCM concatenated with Reed Solomon • The FEC code rate is programmable and added to overhead to form the aggregate data rate • Generates the clock for the Multiplexer in PDH case)
4	Modem (SPU)	Modulator	• Maps the FEC-encoded signal corresponding to the specified modulation which is programmable to be QPSK, 16/32/64/128/256 QAM[a] • Does spectrum shaping through FIR raised cosine Nyquist filter at transmit and receive base bands • Generates modulated IF signal with specified modulation type
5	Modem (SPU)	Cable interface (SPU's)	• Combines transmit IF and telemetry signals, which are transmitted through OOK (On/Off Keying), between SPU and RFU • Inserts the received modulated signal in the coaxial cable connecting the SPU to the corresponding Transceiver in the RFU • Carries DC power for the RFU through the coaxial cable • Inserts all-ones during the controller's absence to prevent the radio from muting otherwise (defective telemetry/controller)

Table 4-7: Transmit Signal Handling , *(continued)*

Seq.	Module	Component	Signal Handling Description
6	Controller (SPU)	Controller	• Generates a telemetry signal to configure and control the radio unit • Feeds the auxiliary channel packet data to the Multiplexer. This packet data is multiplexed together with the main tributary signals and other data, such as wayside channel in the MUX module • Monitors all modules and indicates the alarm when it occurs with LEDs, and associated programmable relay contacts • Makes switching decisions in 1+1 protected system
7	Transceiver (RFU)	Cable interface (RFU's)	• Extracts the modulated IF signal, the telemetry signal, and the DC power from the composite signal in the coaxial cable
8	Transceiver (RFU)	Upconverter block	• Converts the modulated signal to a higher frequency in a two-stage mixer and regulates its amplitude
9	Transceiver (RFU)	Transmitter module	• Up-converts the signal to the transmit frequency and amplifies it
10	ACU (RFU)	Diplexer / RF filters	• Carries the final signal through to the antenna

a. Future availability

Receiving

When it reaches the receiver in the coordinating radio, the transmit signal enters through the antenna as shown in Figure 3-1. The signal is then handled in the sequence described in Table 4-8.

Table 4-8: Receive Signal Handling

Seq.	Module	Component	Signal Handling Description
1	ACU (RFU)	Diplexer / RF filters	• Keeps the in-coming signal separate from the out-going transmit signal and removes unwanted frequencies
2	Transceiver (RFU)	Receiver module	• Amplifies the signal and down-converts it to a lower frequency • Down-converts the signal to the 70 MHz IF frequency • Controls the signal level with the AGC circuits
3	Transceiver (RFU)	Cable interface (RFU's)	• Inserts the IF signal in the coaxial cable along with the modulated telemetry data going to the corresponding SPU
4	Modem (SPU)	Cable interface (SPU's)	• Extracts the receive IF and telemetry signals from the composite signal in the coaxial cable

Table 4-8: Receive Signal Handling, *(continued)*

Seq.	Module	Component	Signal Handling Description
5	Modem (SPU)	Demodulator	• Using it's IF AGC circuit, compensates the SPU/RFU cable loss • Using an IF filter, eliminates the adjacent interference signals • Uses an FIR filter for eliminating out-of-band noise and interference signal, and completing the optimum spectrum shaping in conjunction with the transmit FIR filter • With a slope equalizer, compensates the slope through long SPU/RFU interconnection cable • Contains an Adaptive Time Domain Equalizer (ATDE) to mitigate the signal distortion through multi-path and certain equipment imperfection • Recovers the carriers from the IF signal and regenerates the clock and data streams • Sends the signal to the FEC circuit
6	Modem (SPU)	FEC Circuit	• Uses the correction codes embedded in the signal to correct it, as necessary
7	Modem (SPU)	DADE Circuits	• Receives the FEC-decoded signal and aligns the traffic's phase in each channel with the other channel's traffic phase • At this point, the Controller can switch traffic between channels as needed to maintain traffic
8	MUX (SPU)	Demultiplexer	• Receives the FEC-decoded signal, recovers, and separates it from the network control, utility data, digitized voice frequency, and traffic • De-jitterizes the traffic data and converts it to a bipolar signal conforming to ITU-T recommendations, then sends it to the tributary signal connector or SDM in the Protection Unit • Regenerates auxiliary channel packet data and sends it to the Controller
9	Controller (SPU)	Controller	• Receives auxiliary channel packet data and clock from DEMUX • Recovers the respective data and sends it to the respective data ports or circuits for further processing

General Specifications

System Characteristics		
Capacity		
	ANSI	**CEPT**
	4, 8, 12, 16, 28 DS1+DS1; DS3; DS3+DS1; 3 DS3, 3 DS3+3 DS1; OC-3+1 DS1; 4 DS3 (future)	2, 4, 8, 16 E1; E3+1 E1, 21 E1; STM-1+1E1
Modulation		
	4, 16, 32, 64, 128 and 256 QAM[a]	
FEC		
	Low Capacity	Reed-Solomon
	Medium / High Capacity	Reed-Solomon concatenated with 2D or 4D TCM, depending on bandwidth and system gain requirement
Frequency Step Size **(local oscillator)**		
	≠ 13 GHz	250 kHz
	10 and 11 GHz	125 kHz
	£ 8 GHz	5 kHz maximum
Digital Interfaces		
	ANSI	**CEPT**
	• DS1 (110 W) • DS3 (75 W) • OC-3/STS-3 (75 W,OMM and OSM) • 10BASE-T, and 100BASE-T	• E1 (75 or 120 W) • E3 (75 W) • STM-1 (electrical 75 W, OMM and OSM) • 10BASE-T, and 100BASE-T
Frequency Source		
	All RFUs are tunable within the full frequency range of all bands except the 18/23/26/32 and 38 GHz bands, which are split into two or more bands	
Frequency Stability		
	6 - 38 GHz; ± 5 ppm including aging	
Auxiliary Channels		
	Standard	AUX1 (auxiliary channel 1): 19.2 kbit/s asynchronous (RS-232)
	Optional	AUX2 and AUX3: Orderwire or (future) Data Channel 64 kbit/s, synchronous co/contra-directional V.11 or G.703
Configurations		
	TRuepoint® 5100	1+0, 1+1 (HSB, SD), 2+0
	TRuepoint® 5200	1+0; 1+1 (MHSB, FD, SD); 2+0; (*Future SD N+N Configurations:* 3+0; 4+0; and 2+2; 3+3; and 4+4)

FUNCTIONAL DESCRIPTION

System Characteristics *(continued)*		
Network Management	FarScan™, StarView™, NetBoss™, SNMP Manager	
Control Monitoring Tools	Web-CIT, VT-100, Harris HHT, NMS	
Alarms		
Programmable relay alarms	4 basic relays, 2 input (Controller)	
Optional	Additional 12 relays/12 inputs, or 6 relays/30 inputs, or a combination of two relay and alarm modules in optional bays	
Operating Temperature Range	**Indoor, °C**	**Outdoor, °C**
Guaranteed Performance	-5 to +50	-33 to +55
Operational	-10 to +55	-40 to +55
Humidity	95% max	
Power Source	21 to 60 V_{dc} negative or positive ground (auto detection)	
Power Consumption	Refer to Table 4-15 and Table 4-16, for detailed information	

Regulatory Information *(Summary)*	
Frequency Plans	
ANSI	**CEPT**
Refer to Table 4-9 and Table 4-10.	Refer to Table 4-11 and Table 4-12
Antenna Flanges	
ANSI	**CEPT**
Refer to Table 4-13	Refer to Table 4-14
Digital Interfaces	
ANSI	**CEPT**
GR-499-CORE, GR-253-CORE	Rec. G.703 (E1, E3, STM0, STM-1)
Electromagnetic Compatibility	
ANSI	**CEPT**
• FCC Part 15, Subpart B (Class B) • GR-1089-CORE, ICES-003 (Class B)	• EN 301 489-4, EN 301 489-1 • Complies with the latest ETSI and R&TTE directive and European Harmonized EN 302 217

Mechanical Characteristics					
Connections	SPU to RFU, coaxial cable with N-Type connectors				
Physical Description					
	Unit	**Height, mm**	**Width, mm**	**Depth, mm**	**Weight, kg**
	1-RMS SPU	45	483	258	3.3
	2-RMS SPU	90	483	258	5.2
	5100 RFU	358	245	122	6.0
	5200 RFU (6 GHz)	442	216	300	19.65, max.
	5200 RFU (7-38 GHz)	442	216	300	18 (2 TRs)
Antenna Characteristics					
Integrated, Flat Antenna *(using Harris' unique flat antenna)*					
	23/26 GHz	16.5" (419 mm), 35 dBi			
	38 GHz	12.0" (305 mm), 38 dBi			
Detachable, Parabolic Antenna					
	Detachable RFU, direct slip fit with latches for connection to the antenna				
Detachable, Separate Antenna					
	Detachable RFU, waveguide or flexible twistable to interconnect RFU and antenna. The radio flange interfaces are specified under Flange for Separated Configuration (EIA) and Waveguide, starting on page 4-37				

a. Future availability

Table 4-9: Regulatory Information: ANSI Plans, 6-11 GHz

ANSI Frequency Planning — TRuepoint® 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
L6	5.915-6.425	SRSP 305.9	29.65	252.04
L6	5.925-6.425	FCC part 101	2.5	251.875/ 252.04
L6	5.925-6.425	FCC part 101	3.75, 5, 10, 30	252.04
U6	6.425-6.930	SRSP 306.4 Issue 4	10, 20, 30	90, 100, 340
U6	6.425-6.930	SRSP 306.4 Issue 5	2.5, 5, 10, 20, 30	90, 100, 250, 340
U6	6.425-6.525	FCC part 74.602	20 (25 allocated)	N/A
U6	6.425-7.125	China	30	345
U6	6.430-7.110	Malaysia MCMC SRSP-513	20, 40	340

Table 4-9: Regulatory Information: ANSI Plans, 6-11 GHz, *(continued)*

ANSI Frequency Planning — TRuepoint® 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
U6	6.430-7.125	Brazil Norma 028/94, Pakistan	20, 30	340
U6	6.430-7.125	ITU-R Rec. F.384-9	10, 20, 30, 40	340
U6	6.525-6.875	FCC part 101	2.5	345
U6	6.525-6.875	FCC part 101	3.75, 5, 10	160 (170/180)
U6	6.590-6.770	SRSP 306.5	20	N/A
U6	6.875-7.125	FCC part 74.602	20 (25 alloc)	N/A
7	7.11-7.425	Malaysia MCMC SRSP-514	28	168
7	7.125-7.725	SRSP 307.1 Issue 4	2.5, 5, 10, 20, 30	175 sub-plan 1 150 sub-plan 2
7	7.435-7.750	ITU-R Rec. F.385-8 annex 2	5, 10, 20	160
7	7.450-7.895	NTIA	3.75, 5, 10, 30	180, 270
8	7.725-8.275	SRSP 307.7 Issue 4, ITU-R F.386-7 (annex 2, draft)	10, 20, 30	300
8	7.725-8.275	SRSP 307.7 Issue 4	10, 20, 30	300
8	8.030-8.500	NTIA	3.75, 5, 10, 30	180
8	8.275-8.500	SRSP 308.2	18.75	
10.5/11	10.55-10.68	FCC part 101.147	2.5, 3.75, 5	65
10.5/11	10.55-10.68	ITU-R Rec. F.747 annex 2	2.5	65
10.5/11	10.55-10.68	SRSP 310.5 Issue 1	2.5, 5	65
10.5/11	10.696-11.71	FCC part 101 (2000 version)	2.5, 3.75, 5, 10, 30, 40	500/490
10.5/11	10.696-11.71	China	20, 40	530
10.5/11	10.696-11.71	SRSP 310.7 (Issue 1)	2.5, 3.75, 5, 10, 20, 40	490

Table 4-10: Regulatory Information: ANSI Plans, 13-38 GHz

ANSI Frequency Planning — TRuepoint® 5100 and 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
13	12.70-13.25	FCC CFR47 part 74.602	10, 20 (25 allocated)	N/A
14	14.200-14.500	FCC 14.2-14.4		
15	14.5-15.35	ITU-R Rec. F.636-3 annex 2	2.5	640
15	14.5-15.35	SRSP 314.5 issue 2	5, 10, 20, 40	475
15	14.5-15.35	NTIA	2.5, 3.75, 5, 10, 30	
18	17.700-19.700	FCC part 101	5, 10, 20, 40	340 1560 (340) 1560
18	17.700-19.700	Proposed FCC (FWCC)	2.5, 5, 30	1560
18	17.7-19.7	ITU-R Rec. F.595-8 annex 2 (North America)	5, 10, 20, 40	1560/340
18	17.7-19.7	Malaysia MCMC SRSP-527	40	1000
18	17.7-19.7	ITU Rec. F 595-8 annex 4 Co-channel and interleaved	2.5, 5, 27.5 (interleave)	1010
18	17.7-19.7	Argentina	20	120
18	17.70-18.14, 19.26-19.70	SRSP 317.7 (issue 1)	10, 20, 40	1560
18	18.58-18.82, 18.92 -19.16	SRSP 318.5 (issue 2)	5, 10, 20	340
18	18.58-19.160	Brazil Norma 004/91	5, 10	340
23	21.2-23.6	FCC part 101		1200
23	21.2-23.6	ITU-R Rec. F637-3 annex 4 (North America)	50	1200
23	21.8-22.4, 23.0-23.6	SRSP 321.8 (Issue 1) Replace SRSP 321.2	2.5, 5, 10, 15, 20, 40, 50	1200
38	38.6-40.0	FCC part 101 SRSP 338.6 Issue 1	2.5, 5, 10, 15, 20, 30, 50 (50)	700

Table 4-11: Regulatory Information: CEPT Plans, 6-23 GHz

CEPT Frequency Planning — TRuepoint® 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
L6	5.925-6.425	ITU-R Rec. F.383-7 CEPT Rec. 14-01 China Brazil Res.105 France	29.65	252.04
L6	5.915-6.425	Malaysia MCMC SRSP-512	29.65	252.04
L6	5.925-6.425	Nicaragua	3.5, 7, 14, 28	
L6	5.925-6.425	Bosnia	28, 40	252.04
L6	5.925-6.425	ITU-R Rec. F.383-7 annex 1	40	240
U6	6.425-7.125	China	40	340
U6	6.425-7.125	France (CEPT14-02 ITU-R 384)	40	340
U6	6.425-7.125	CEPT 14-02	20, 40	340
U6	6.425-7.125	Nicaragua	3.5, 7, 14, 28	
U6	6.430-7.125	ITU-R Rec. F.384-8	20, 40, 30	340
7	7.110-7.750	ITU-R Rec. F.385-8 annex 3	28	168, 196
7	7.125-7.725	DRAFT ECC/REC/(02)06	3.5, 7, 14,28	154
7	7.125-7.425	China	28	154
7	7.250-7.550	ITU-R Rec. F.385-8 annex 5	3.5, 7, 14, 28	161
7	7.250-7.550	Russia (ITU)	3.5, 7, 14, 28	161
7	7.350-7.842	Dominican Republic Dom56	27	276
7	7.375-7.750	France (ITU-R F.385-8)		
7	7.425-7.725	ITU-R Rec. F.385-8 (f0=7575)	7, 14, 28	161
7	7.425-7.725	Malaysia MCMC SRSP-515	7, 14, 28	161
7	7.425-7.725	Malaysia MCMC SRSP-515	28	154
7	7.425-7.725	ITU-R Rec. F.385-8 (f0=7575)	For f0=7.275, 7.400, or 7.700; Used by agreement with the administration concerned	
7	7.425-7.725	ITU-R Rec. F.385-8 annex 1 China	28	154
7	7.425-7.725	ITU -R Rec. F.385-8 annex 1	28	182
7	7.425-7.725	Argentina	7, 14, 28	161
7	7.425-7.725	Argentina	28	154
7	7.425-7.725	Brazil Norma 001/95	3.5, 7, 14, 28	154

Table 4-11: Regulatory Information: CEPT Plans, 6-23 GHz, *(continued)*

CEPT Frequency Planning — TRuepoint® 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
7	7.425-7.900	ITU-R Rec. F.385-8 annex 4	7, 14, 28	245
7		Switzerland	3.5, 7, 14, 28	151.614
8	7.725-8.275	China	14.825, 29.65	311.32
8	7.725-8.275	ITU-R Rec. F.386-6 annex 1 Brazil Reg. 005/96 Malaysia MCMC SRSP-516	29.65	311.32
8	7.900-8.400	ITU-R Rec. F.386-6 annex 4 Russia	7,14,28	266
8	7.900-8.500	DRAFT ECC/REC/(02)06	3.5, 7, 14, 28	310
8	8.025-8.500	France (Decision 97-390)	3.5	213.5
8	8.025-8.500	France (Decision 99-37)	7, 14, 28	208
8	8.200-8.500	Argentina	14	119
8	8.200-8.500	Argentina	7	126
8	8.275-8.500	China & Dom57 (Dominican Republic) Brazil Res. 106 ITU-R Rec. F.386-6 annex 3 Malaysia MCMC SRSP-517	14	119
8	8.275-8.500	China & Dom57 (Dominican Republic) Brazil Res. 106 ITU-R Rec. F.386-6 annex 3 Malaysia MCMC SRSP-517	7	126
8	8.275-8.500	ITU-R Rec. F.386-6	11.662	151.614
10	10.0-10.68	Italy	28	350
10	10.15-10.68	CEPT Rec. 12-05	3.5, 7, 14, 28	350
10	10.15-10.65	Brazil Res. 191, Argentina secc27	5 blocks- 28/30	350
10.5/11	10.5-10.68	ITU-R Rec. F.747 annex 1	7	91
10.5/11	10.5-10.68	France (ITU 747)	7	
10.5/11	10.5-10.68	Argentina	7	91
10.5/11	10.55-10.68	France	14, 28	84

Table 4-11: Regulatory Information: CEPT Plans, 6-23 GHz, *(continued)*

CEPT Frequency Planning — TRuepoint® 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
10.5/ 11	10.696-11.71	France (12*40 CEPT)	40	490
10.5/ 11	10.696-11.71	ITU-R Rec. F.387-9 ITU-R Rec. F.387-9 Annex 1 Argentina, Russia Brazil Norma 016/94 Dom59 (Dominican republic) Malaysia MCMC SRSP-518	40	530
10.5/ 11	10.696-11.71	CEPT Rec. 12-06	40	530/490
10.5/ 11	10.696-11.71	ITU-R Rec. F387-9 Annex 2	40	490
13	12.70-13.25	Argentina	7, 28	266
13	12.70-13.25	ITU-R Rec. F.497-6	3.5, 7, 14, 28	266
13	12.70-13.25	France	3.5, 7	266
13	12.70-13.25	Russia (ITU)	3.5, 7, 28	266
13	12.70-13.25	Malaysia MCMC SRSP-525	3.5, 7, 28	266
13	12.70-13.25	CEPT Rec. 12-02 China	3.5, 7, 14, 28	266
14	14.200-14.500	China 14.2-14.5	3.5, 7, 14, 28,	140
14	14.200-14.500	ITU-R F.746 annex 5	3.5, 7, 14, 28,	140
14	14.250-14.500	France	14	
15	14.4-15.35	ITU-R Rec. F.636-3 Malaysia MCMC SRSP-526	3.5, 7, 14, 28	490
15	14.4-15.35	Russia (ITU)	14, 28	490
15	14.4-15.35	ITU-R Rec. F.636-3	3.5, 7, 14, 28	420
15	14.4-15.35	Russia (ITU)	14, 28	420
15	14.5-15.35	Australia (FX3, App.1)	7, 14, 28	644
15	14.5-15.35	Argentina	7, 14	728
15	14.5-15.35	Argentina	28	322
15	14.5-15.35	CEPT Rec. 12-07	3.5, 7, 14, 28, 56	728
15	14.5-15.35	Brazil Res. 129	3.5, 7, 14	420
15	14.5-15.35	China	3.5, 7, 14, 28	420
15	14.5-15.35	Dominican Republic Dom60	27	840

Table 4-11: Regulatory Information: CEPT Plans, 6-23 GHz, *(continued)*

CEPT Frequency Planning — TRuepoint® 5200				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
15	14.501-15.341	BAPT 211 ZV 038/15 GHz	3.5, 7, 14	728
15	15.25-15.35	France	10	
15		Mexico	3.5, 7, 14, 28	315
18	17.700-19.700	ITU-R Rec. F.595-8 Malaysia MCMC SRSP-527	27.5, 55	1010
18	17.7-19.7	Mexico	27.5	1615
18	17.7-19.7	Russia (ITU)	27.5, 55	1010
18	17.7-19.7	CEPT Rec.12-03 France	13.75, 27.5, 55	1010
18	17.7-19.7	China	55	1120
18	17.7-19.7	China	27.5	1092.5
18	17.7-19.7	ITU Rec. F 595-8 annex 3 (UK)	3.5	1008
18	17.7-19.7	Malaysia MCMC SRSP-527	7	1006
18	17.7-19.7	ITU Rec. F 595-8 annex 5	3.5, 7	1010
18	17.7-19.7	Brazil (Norma 15/96)	27.5, 55	1560
18	17.7-19.7	Argentina	27.5	1010
23	21.2-23.6	Malaysia MCMC SRSP-528	3.5, 5, 14, 28, 56	1232
23	21.2-23.6	ITU-R Rec. F 637-3 annex 1 (UK)	3.5, 7, 14, 28	1232
23	21.2-23.6	ITU-R Rec. F637-3 annex 3	3.5, 7, 14, 28, 56	1008
23	21.2-23.6	ITU-R Rec. F637-3 annex 5 (Germany)	3.5, 7, 14, 28, 56	1008
23	21.2-23.6	Russia	3.5, 7, 14, 28, 56	1232
23	21.2-23.6	Argentina China	3.5, 7, 14, 28	1232
23	21.2-23.6	France (22-22.6 & 23-23.6) (CEPT)	3.5, 7, 14, 28	1008
23	21.2-23.6	France (22.6-23)	3.5, 7, 14, 28	252
23	21.8-23.6	Brazil	3.5, 5, 14, 28, 56	1232
23	22.0-23.6	CEPT T/R 13-02 Annex A	3.5, 7, 14, 28, 56	1008

Table 4-12: Regulatory Information: CEPT Plans, 13-38 GHz

CEPT Frequency Planning — TRuepoint® 5100				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
13	12.70-13.25	Argentina	7, 28	266
13	12.70-13.25	ITU-R Rec. F.497-6	3.5, 7, 14, 28	266
13	12.70-13.25	France	3.5, 7	266
13	12.70-13.25	Russia (ITU)	3.5, 7, 28	266
13	12.70-13.25	Malaysia MCMC SRSP-525	3.5, 7, 28	266
13	12.70-13.25	CEPT Rec. 12-02 China	3.5, 7, 14, 28	266
14	14.200-14.500	China 14.2-14.5	3.5, 7, 14, 28,	140
14	14.200-14.500	ITU-R F.746 annex 5	3.5, 7, 14, 28,	140
14	14.250-14.500	France	14	
15	14.4-15.35	ITU-R Rec. F.636-3 Malaysia MCMC SRSP-526	3.5, 7, 14, 28	490
15	14.4-15.35	Russia (ITU)	14, 28	490
15	14.4-15.35	ITU-R Rec. F.636-3	3.5, 7, 14, 28	420
15	14.4-15.35	Russia (ITU)	14, 28	420
15	14.5-15.35	Australia (FX3, App.1)	7, 14, 28	644
15	14.5-15.35	Argentina	7, 14	728
15	14.5-15.35	Argentina	28	322
15	14.5-15.35	CEPT Rec. 12-07	3.5, 7, 14, 28, 56	728
15	14.5-15.35	Brazil Res. 129	3.5, 7, 14	420
15	14.5-15.35	China	3.5, 7, 14, 28	420
15	14.5-15.35	Dominican Republic Dom60	27	840
15	14.501-15.341	BAPT 211 ZV 038/15 GHz	3.5, 7, 14	728
15	15.25-15.35	France	10	
15		Mexico	3.5, 7, 14, 28	315
18	17.700-19.700	ITU-R Rec. F.595-8 Malaysia MCMC SRSP-527	27.5, 55	1010
18	17.7-19.7	Mexico	27.5	1615
18	17.7-19.7	Russia (ITU)	27.5, 55	1010
18	17.7-19.7	CEPT Rec.12-03 France	13.75, 27.5, 55	1010
18	17.7-19.7	China	55	1120

Table 4-12: Regulatory Information: CEPT Plans, 13-38 GHz, *(continued)*

CEPT Frequency Planning — TRuepoint® 5100				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
18	17.7-19.7	China	27.5	1092.5
18	17.7-19.7	ITU Rec. F 595-8 annex 3 (UK)	3.5	1008
18	17.7-19.7	Malaysia MCMC SRSP-527	7	1006
18	17.7-19.7	ITU Rec. F 595-8 annex 5	3.5, 7	1010
18	17.7-19.7	Brazil (Norma 15/96)	27.5, 55	1560
18	17.7-19.7	Argentina	27.5	1010
23	21.2-23.6	Malaysia MCMC SRSP-528	3.5, 5, 14, 28, 56	1232
23	21.2-23.6	ITU-R Rec. F 637-3 annex 1 (UK)	3.5, 7, 14, 28	1232
23	21.2-23.6	ITU-R Rec. F637-3 annex 3	3.5, 7, 14, 28, 56	1008
23	21.2-23.6	ITU-R Rec. F637-3 annex 5 (Germany)	3.5, 7, 14, 28, 56	1008
23	21.2-23.6	Russia	3.5, 7, 14, 28, 56	1232
23	21.2-23.6	Argentina China	3.5, 7, 14, 28	1232
23	21.2-23.6	France (22-22.6 & 23-23.6) (CEPT)	3.5, 7, 14, 28	1008
23	21.2-23.6	France (22.6-23)	3.5, 7, 14, 28	252
23	21.8-23.6	Brazil	3.5, 5, 14, 28, 56	1232
23	22.0 -23.6	CEPT T/R 13-02 Annex A	3.5, 7, 14, 28, 56	1008
26	24.5-26.5	France (ART 99-831)	14, 28, 56	1008
26	24.5-26.5	Malaysia MCMC SRSP-509	28	1008
26	24.5-26.5	CEPT T/R 13-02 Annex B ITU-R Rec. F 748-4 Annex 1 China (ITU)	3.5, 7, 14, 28, 56	1008

Table 4-12: Regulatory Information: CEPT Plans, 13-38 GHz, *(continued)*

CEPT Frequency Planning — TRuepoint® 5100				
Band	**Frequency Range, GHz**	**Regulatory Information**	**Channel Spacing, MHz**	**T/R Spacing, MHz**
38	36.0-37.0	ITU-R F.749-2 Annex 2	3.5, 7, 14, 28, 56	462
38	37.0-40.0	E-rate in Argentina (secc27, 37.14-40.0), Peru (37.0-40.0)	3.5, 7, 14, 28	700
38	37.0-39.5	CEPT T/R 12-01 annex A ITU-R F.749-2 Annex 1 Russia (ITU) Brazil Reg. 002/96 China (ITU)	3.5, 7, 14, 28, 56	1260
38	37.000-39.500	France	3.5, 7, 14	1260

Flange and Waveguide Specifications

Antenna flanges are CPR or equivalent US Mil. Flanges to be specified at the time of ordering. The radio flanges have threaded holes to mate with the waveguide or flex-twist flange through-holes.

Table 4-13: ANSI Frequency Planning

TRuepoint® 5200 Only		
Band, GHz	**Flange for Separated Configuration (EIA)**	**Waveguide**
L6	CPR 137G	WR 137
U6	CPR 137G	WR 137
7	CPR 112G	WR 112
8	CPR 112G	WR 112
10.5-10.68	CPR 90G	WR 90
11	CPR 90G	WR 90
TRuepoint® 5100 and 5200		
13	UG Choke	WR 75
15	UG 541A/U	WR 62
18	UG 596A/U	WR 42
23	UG 596A/U	WR 42
TRuepoint® 5100 Only		
38	UG 600 A/U	WR 28

Table 4-14: CEPT Frequency Planning

Band, GHz	Flange for Separated Configuration (EIA)		Waveguide
	IEC	EIA/US Mil	
TRuepoint® 5200 Only			
L6	PDR 70	CPR 137G	WR 137
U6	PDR 70	CPR 137G	WR 137
7	PDR 84	CPR 112G	WR 112
8	PDR 84	CPR 112G	WR 112
10	PDR 100	CPR 90G	WR 90
11	PDR 100	CPR 90G	WR 90
TRuepoint® 5100 and 5200			
13	PBR 120	UG Choke	WR 75
15	PBR 140	UG 541A/U	WR 62
18	PBR 220	UG 596A/U	WR 42
23	PBR 220	UG 596A/U	WR 42
TRuepoint® 5100 Only			
26	PBR 220	UG 596A/U	WR 42
38	PBR 320	UG 600A/U	WR 28

Table 4-15: SPU Power Consumption, (Watts)

Module		Maximum	Typical
Controller		7	7
Modem		10	9
Mux			
	• Nx16 E1/DS1	6.25	4
	• 28 DS1	11.25	6.25
	• OC3/STM1	5	4
SDM			
	• Nx16 E1/DS1	3.75	1.25
	• 28 DS1	3.75	2
	• OC3/STM1	3.75	0.1
Optional cards: • Orderwire		5	3.5

Table 4-16: RFU Power Consumption, (Watts)

RFU — (Freq, GHz)	Maximum[a]	Typical[b]
6	70.5	63
7	70.5	63
8	70.5	63
10.5	70.5	63
11	70.5	63
13	51	46
14	48	43
15	48	43
18	54	50
23	42	38
38	46	40.5

a. Maximum: as measured at 21V_{DC}

b. Typical: At 48V_{DC}

Equipment ITU Emissions Designators

Table 4-18 provides the ITU Emission Designators applicable to currently released Multiplexers, per Table 4-17.

Table 4-17: Compatibility Table

Compatible		
MUX	**SDM**	**Description**
902515	902540	2-16 E1 / DS1
902517	902585	STM-1 / STS-3 Electrical Interface
902517	902585	STM-1 / OC-3 Optical Interface MM
902517	902585	STM-1 / STS-3 Electrical Interface
902517	902585	STM-1 / OC-3 Optical Interface MM
902550	902585	E3 or DS3 + E1 or DS1
902550	902585	2X10 100BT over E3 or DS3 + E1 or DS1
902555	902587	28 DS1 over DS3 + DS1
902558	902535	21 E1 + E1
902573	902543	3 DS3 + 3 DS1
902582	902593	ADM 8 DS1 over DS3 + DS1 (Opt. 501)
902582	902593	N-16 E1/DS1 + 2x10/100BASE-T (Opt. 502/503)

Table 4-18: ITU Emission Designators

MUX	Description	Airlink Capacity	B/W, MHz	Mod./ QAM	Designator
902515 MUX					
902515	2-16 E1 / 4-16 DS1	4DS1	5.0	QPSK	5M00G7W
902515	2-16 E1 / 4-16 DS1	4DS1	2.5	16	2M50D7W
902515	2-16 E1 / 4-16 DS1	8DS1	10.0	QPSK	10M0G7W
902515	2-16 E1 / 4-16 DS1	8DS1	5.0	16	5M00D7W
902515	2-16 E1 / 4-16 DS1	8DS1	3.75	32	3M75D7W
902515	2-16 E1 / 4-16 DS1	12DS1	5.0	32	5M00D7W
902515	2-16 E1 / 4-16 DS1	16DS1	20.0	QPSK	20M0G7W
902515	2-16 E1 / 4-16 DS1	16DS1	10.0	16	10M0D7W
902515	2-16 E1 / 4-16 DS1	16DS1	5.0	128	5M00D7W
902515	2-16 E1 / 4-16 DS1	2E1	3.5	QPSK	3M50G7W
902515	2-16 E1 / 4-16 DS1	4E1	7.0	QPSK	7M00G7W
902515	2-16 E1 / 4-16 DS1	4E1	3.5	16	3M50D7W
902515	2-16 E1 / 4-16 DS1	8E1	14.0	QPSK	14M0G7W
902515	2-16 E1 / 4-16 DS1	8E1	13.75	QPSK	13M7G7W
902515	2-16 E1 / 4-16 DS1	8E1	7.0	16	7M00D7W
902515	2-16 E1 / 4-16 DS1	16E1	28.0	QPSK	28M0G7W
902515	2-16 E1 / 4-16 DS1	16E1	29.65	QPSK	29M6G7W
902515	2-16 E1 / 4-16 DS1	16E1	27.0	QPSK	27M0G7W
902515	2-16 E1 / 4-16 DS1	16E1	27.5	QPSK	27M5G7W
902515	2-16 E1 / 4-16 DS1	16E1	11.662	16	11M6D7W
902515	2-16 E1 / 4-16 DS1	16E1	14.0	16	14M0D7W
902515	2-16 E1 / 4-16 DS1	16E1	13.75	16	13M7D7W

Table 4-18: ITU Emission Designators, *(continued)*

MUX	Description	Airlink Capacity	B/W, MHz	Mod./ QAM	Designator
902517 MUX					
902517	STM-1/STS3 Electrical	OC-3	29.65	128	29M6D7W
902517	STM-1/STS3 Electrical	OC-3	30.0	128	30M0D7W
902517	STM-1/STS3 Electrical	OC-3	40.0	64	40M0D7W
902517	STM-1/STS3 Electrical	OC-3	50.0	32	50M0D7W
902517	STM-1/OC3 Optical (SM, MM)	OC-3	29.65	128	29M6D7W
902517	STM-1/OC3 Optical (SM, MM)	OC-3	30.0	128	30M0D7W
902517	STM-1/OC3 Optical (SM, MM)	OC-3	40.0	64	40M0D7W
902517	STM-1/OC3 Optical (SM, MM)	OC-3	50.0	32	50M0D7W
902517	STM-1/STS3 Electrical	STM-1	55.0	32	55M0D7W
902517	STM-1/STS3 Electrical	STM-1	56.0	32	56M0D7W
902517	STM-1/STS3 Electrical	STM-1	40.0	64	40M0D7W
902517	STM-1/STS3 Electrical	STM-1	27.0	128	27M0D7W
902517	STM-1/STS3 Electrical	STM-1	27.5	128	27M5D7W
902517	STM-1/STS3 Electrical	STM-1	28.0	128	28M0D7W
902517	STM-1/STS3 Electrical	STM-1	29.65	128	29M6D7W
902517	STM-1/STS3 Electrical	STM-1	30.0	128	29M6D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	55.0	32	55M0D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	56.0	32	56M0D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	40.0	64	40M0D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	27.0	128	27M0D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	27.5	128	27M5D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	28.0	128	28M0D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	29.65	128	29M6D7W
902517	STM-1/OC3 Optical (SM, MM)	STM-1	30.0	128	29M6D7W

Table 4-18: ITU Emission Designators, *(continued)*

MUX	Description	Airlink Capacity	B/W, MHz	Mod./ QAM	Designator
902550 MUX					
902550	E3 DS3 + 1E1 1DS1	DS3+DS1	30.0	QPSK	30M0G7W
902550	E3 DS3 + 1E1 1DS1	DS3+DS1	40.0	QPSK	40M0G7W
902550	E3 DS3 + 1E1 1DS1	DS3+DS1	15.0	16	15M0D7W
902550	E3 DS3 + 1E1 1DS1	DS3+DS1	20.0	16	20M0D7W
902550	E3 DS3 + 1E1 1DS1	DS3+DS1	10.0	64	10M0D7W
902550	E3 DS3 + 1E1 1DS1	DS3	10.0	64	10M0D7W
902550	E3 DS3 + 1E1 1DS1	E3+E1	28.0	QPSK	28M0G7W
902550	E3 DS3 + 1E1 1DS1	E3+E1	29.65	QPSK	29M6G7W
902550	E3 DS3 + 1E1 1DS1	E3+E1	27.0	QPSK	27M0G7W
902550	E3 DS3 + 1E1 1DS1	E3+E1	27.5	QPSK	27M5G7W
902550	E3 DS3 + 1E1 1DS1	E3+E1	14.0	16	14M0D7W
902550	E3 DS3 + 1E1 1DS1	E3+E1	13.75	16	13M7D7W
902550	2X10 100BT over E3 DS3	DS3+DS1	30.0	QPSK	30M0G7W
902550	2X10 100BT over E3 DS3	DS3+DS1	40.0	QPSK	40M0G7W
902550	2X10 100BT over E3 DS3	DS3+DS1	15.0	16	15M0D7W
902550	2X10 100BT over E3 DS3	DS3+DS1	20.0	16	20M0D7W
902550	2X10 100BT over E3 DS3	DS3+DS1	10.0	64	10M0D7W
902550	2X10 100BT over E3 DS3	DS3	10.0	64	10M0D7W
902550	2X10 100BT over E3 DS3	E3+E1	28.0	QPSK	28M0G7W
902550	2X10 100BT over E3 DS3	E3+E1	29.65	QPSK	29M6G7W
902550	2X10 100BT over E3 DS3	E3+E1	27.0	QPSK	27M0G7W
902550	2X10 100BT over E3 DS3	E3+E1	27.5	QPSK	27M5G7W
902550	2X10 100BT over E3 DS3	E3+E1	14.0	16	14M0D7W
902550	2X10 100BT over E3 DS3	E3+E1	13.75	16	13M7D7W
902555 MUX					
902555	28 DS1 over DS3 + 1DS1	DS3+DS1	30.0	QPSK	30M0G7W
902555	28 DS1 over DS3 + 1DS1	DS3+DS1	40.0	QPSK	40M0G7W
902555	28 DS1 over DS3 + 1DS1	DS3+DS1	15.0	16	15M0D7W
902555	28 DS1 over DS3 + 1DS1	DS3+DS1	20.0	16	20M0D7W
902555	28 DS1 over DS3 + 1DS1	DS3+DS1	10.0	64	10M0D7W
902555	28 DS1 over DS3 + 1DS1	DS3	10.0	64	10M0D7W

Table 4-18: ITU Emission Designators, *(continued)*

MUX	Description	Airlink Capacity	B/W, MHz	Mod./ QAM	Designator
902558 MUX					
902558	21 E1 over STM-1p + 1E1	21E1	40.0	QPSK	40M0G7W
902558	21 E1 over STM-1p + 1E1	21E1	56.0	QPSK	56M0G7W
902558	21 E1 over STM-1p + 1E1	21E1	28.0	16	28M0D7W
902558	21 E1 over STM-1p + 1E1	21E1	29.65	16	29M6D7W
902558	21 E1 over STM-1p + 1E1	21E1	30.0	16	30M0D7W
902558	21 E1 over STM-1p + 1E1	21E1	27.0	16	27M0D7W
902558	21 E1 over STM-1p + 1E1	21E1	27.5	16	27M5D7W
902558	21 E1 over STM-1p + 1E1	21E1	20.0	16	20M0D7W
902558	21 E1 over STM-1p + 1E1	21E1	14.0	32	14M0D7W
902558	21 E1 over STM-1p + 1E1	21E1	13.75	32	13M7D7W
902573 MUX					
902573	3 DS3 +3 DS1 (Harris Frame)	3DS3+3DS1	50.0	16	50M0D7W
902573	3 DS3 +3 DS1 (Harris Frame)	3DS3+3DS1	40.0	32	40M0D7W
902573	3 DS3 +3 DS1 (Harris Frame)	3DS3+3DS1	29.65	128	29M6D7W
902573	3 DS3 +3 DS1 (Harris Frame)	3DS3+3DS1	30.0	128	30M0D7W
902582 MUX					
902582	ADM 8 DS1 over DS3 + 1DS1	DS3+DS1	30.0	QPSK	30M0G7W
902582	ADM 8 DS1 over DS3 + 1DS1	DS3+DS1	40.0	QPSK	40M0G7W
902582	ADM 8 DS1 over DS3 + 1DS1	DS3+DS1	15.0	16	15M0D7W
902582	ADM 8 DS1 over DS3 + 1DS1	DS3+DS1	20.0	16	20M0D7W
902582	ADM 8 DS1 over DS3 + 1DS1	DS3+DS1	10.0	64	10M0D7W

Modulation and FEC Codings

Codings, QPSK

Airlink Capacity, ANSI	Bandwidth, MHz	Modulation + FEC
4 DS1	5	QPSK + RS
8 DS1	10	QPSK + RS
16 DS1	20	QPSK + RS
DS3 + DS1	30	QPSK + RS
29 DS1	30	QPSK + RS
DS3 + DS1	40	4 TCM 4D + RS
29 DS1	40	4 TCM 4D + RS

Airlink Capacity, CEPT	Bandwidth, MHz	Modulation + FEC
2 E1	3.5	QPSK + RS
4 E1	7	QPSK + RS
8 E1	14	QPSK + RS
16 E1	27.5; 28; 29.65	QPSK + RS
E3 + E1	27.5; 28; 29.65	QPSK + RS
21 E1/STM0	40	QPSK + RS
21 E1/STM0	56	QPSK + RS

Codings, 16 QAM

Airlink Capacity, ANSI	Bandwidth, MHz	Modulation + FEC
4 DS1	2.5	16 QAM + RS
8 DS1	5	16 QAM + RS
16 DS1	10	16 TCM 4D + RS
DS3	15	16 QAM + RS
DS3 + DS1	15	16 QAM + RS
29 DS1	15	16 QAM + RS
29 DS1	18.75	16 TCM 4D + RS
DS3 + DS1	18.75	16 TCM 4D + RS
DS3 + DS1	20	16 TCM 2D + RS
29 DS1	20	16 TCM 2D + RS
58 DS1	29.65; 30	16 QAM + RS
100BASE-T + 4 DS1	40	16 TCM 4D + RS
58 DS1	40	16 TCM 2D + RS
3 DS3 + 3 DS1	50	16 TCM 4D + RS
87 DS1	50	16 TCM 4D + RS

Airlink Capacity, CEPT	Bandwidth, MHz	Modulation + FEC
4 E1	3.5	16 QAM + RS
8 E1	7	16 TCM 4D + RS
16 E1	11.662	16 QAM + RS
16 E1	14	16 TCM 4D + RS
E3 + E1	14	16 TCM 4D + RS
35 E1	27.5; 28; 29.65; 30	16 TCM 4D + RS

Codings, 32 QAM

Airlink Capacity, ANSI	Bandwidth, MHz	Modulation + FEC
8 DS1	3.75	32 QAM + RS
12 DS1	5	32 QAM + RS
DS3 + DS1	12.5	32 QAM + RS
29 DS1	12.5	32 QAM + RS
3 DS3 + 3 DS1	40	32 TCM 4D + RS
87 DS1	40	32 TCM 4D + RS
STS3/OC3	50	32 TCM 2D + RS
100 DS1	50	32 TCM 2D + RS

Airlink Capacity, CEPT	Bandwidth, MHz	Modulation + FEC
21 E1	14	32 QAM + RS
2 STM0	27; 27.5; 28; 29.65	32 QAM + RS
100BASE-T + 4 E1	27; 27.5; 28; 29.65	32 QAM + RS
50 E1	28	32 QAM + RS
21 E1/STM0	27; 28; 29.65; 30	32 TCM 4D + RS
50 E1	27; 28; 29.65	32 TCM 4D + RS
STM1	55	32 TCM 2D + RS
75 E1	55	32 TCM 2D + RS

Codings, 64 QAM

Airlink Capacity, ANSI	Bandwidth, MHz	Modulation + FEC
DS3	10	64 QAM + RS
DS3 + DS1	10	64 QAM + RS
29 DS1	10	64 QAM + RS
58 DS1	18.75	64 QAM + RS
58 DS1	20	64 QAM + RS
87 DS1	29.65; 30	64 TCM 4D + RS
OC-3/STS-3	40	64 TCM 2D + RS
100 DS1	40	64 TCM 2D + RS

Airlink Capacity, CEPT	Bandwidth, MHz	Modulation + FEC
16 E1	7	64 QAM + RS
STM-1	40	64 TCM 2D + RS
75 E1	40	64 TCM 2D + RS

Codings, 128 QAM

Airlink Capacity, ANSI	Bandwidth, MHz	Modulation + FEC
16 DS1	5	128 QAM + RS
100BASE-T + 4 DS1	20	128 QAM + RS
OC-3/STS-3	29.65; 30	128 TCM 4D + RS
3 DS3 + 3 DS1	30	128 TCM 2D + RS
100 DS1	30	128 TCM 4D + RS

Airlink Capacity, CEPT	Bandwidth, MHz	Modulation + FEC
35 E1	14	128 TCM 4D + RS
75 E1	27.5	128 QAM + RS
STM-1	27.5	128 QAM + RS
STM-1	28; 29.65; 30	128 TCM 4D + RS
75 E1	28; 29.65; 30	128 TCM 4D + RS

CHAPTER

5

PERFORMANCE

Product Range

The product range offers 2 platforms; each one optimized for better performance for their application definition.

1. The **5100 series** addresses the typical access applications in the **13-38 GHz** range and favors the direct slip-fit to the antenna in an unprotected configuration. The product can still provide protection by using a combiner and a mute function on the standby transmit channel.
2. The **5200 series** addresses also access applications in the **6-23 GHz** range, but carries an additional mandate in the lower frequencies and longer haul application. In a 1+1 MHSB protected system, one radio enclosure houses 2 transceivers. The radio's enclosure uses a relay switch in the ACU; the standby channel is connected to a load when non-active.

Performance Values for both ANSI and CEPT of the TRuepoint® **5100** can be determined as follows: TRuepoint® **5200** Transmit power +0.5 dBm, and TRuepoint® **5200** Thresholds -0.5 dBm.

Performance Tables — ANSI Rates

This Section provides current ANSI Performance data for the TRuepoint® **5200**. Tables in this Section are grouped as follows.

Assumptions for values reported in tables

- Transmit power is measured at the antenna port.
- Receive threshold is the power measured at the antenna port of a faded signal that causes a bit error rate (**BER)** of **$1x10^{-6}$**
- Values apply to the ***Unprotected Configuration only.***

For the Additional ACU Losses, refer to Tables 5-9 and 5-10.

Table 5-1: Channel Spacing, (MHz) — ANSI, 6-38 GHz

Air Link Capacity	Mod./ (QAM)	Frequency Band, (GHz)									
		L6	U6	7	8	11	13	15	18	23	38
4 DS1	QPSK					5		5	5	5	5
	16	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5
8 DS1	QPSK							10	10	10	10
	16			5				5	5	5	5
	32	3.75	3.75	3.75	3.75	3.75		3.75			
12 DS1	32	5	5	5	5	5		5	5	5	5
16 DS1	QPSK							20	20	20	20
	16					10		10	10	10	10
	128	5	5	5	5	5					
28 DS1	16							15		15	15
	64	10	10	10	10	10	10	10	10	10	10
DS3 + DS1	QPSK	30				30			30		30
	QPSK					40		40	40	40	
	16	20	20				20	20	20	20	20
	64	10	10	10	10	10	10	10	10	10	10
29 DS1	QPSK	30				30			30		30
	QPSK					40		40	40	40	
	16	20					20	20	20	20	20
	64	10	10	10	10	10	10	10	10	10	10
58 DS1	16					40		40	40	40	30
	16	30				30			30		
	64	20	20	20			20	20	20	20	20
100BT + 4 DS1 (107 Mb/s)	16					40		40	40	40	
	128	20	20	20				20	20	20	20
3 DS3 + 3 DS1	16									50	50
	32					40		40	40	40	
	128	29.65/30	30	30	30	30		30	30		30
87 DS1	16									50	50
	32					40		40	40	40	
	64	29.65/30	30	30	30	30		30	30		30
100 DS1	32									50	50
	64					40		40	40	40	
	128	29.65/30	30	30	30	30		30	30	30	30

Table 5-2: Typical Transmit Power, (dBm) — ANSI, 6-38 GHz

Air Link Capacity	Mod./ (QAM)	Frequency Band, (GHz)									
		L6	U6	7	8	11	13	15	18	23	38
4 DS1	QPSK					23.0		26.0	26.0	23.0	21.0
	16	26.5	26.5	25.5	25.0	23.0		23.0	23.0	21.0	19.0
8 DS1	QPSK							26.0	26.0	23.5	22.0
	16			25.5				23.0	23.0	21.0	19.0
	32	26.5	26.5	25.5	25.0	23.0		22.0			
12 DS1	32	24.5	24.5	23.5	23.0	21.0		22.0	22.0	20.0	18.0
16 DS1	QPSK							26.0	26.0	24.0	22.0
	16					21.0		23.0	23.0	21.0	19.0
	128	24.5	24.5	23.5	23.0	21.0					
28 DS1	16							23.0		21.0	19.0
	64	24.5	24.5	23.5	23.0	21.0	17.5	21.0	21.0	19.0	15.5
DS3 + DS1	QPSK	24.5				21.0			26.0		22.0
	QPSK					22.0		26.0	26.0	24.0	
	16	24.5	24.5				20.0	23.0	23.0	21.0	19.0
	64	24.5	24.5	23.5	23.0	21.0	17.5	21.0	21.0	19.0	14.0
29 DS1	QPSK	24.5				21.0			26.0		22.0
	QPSK					22.0		26.0	26.0	24.0	
	16	24.5					20.0	23.0	23.0	21.0	19.0
	64	24.5	24.5	23.5	23.0	21.0	17.5	21.0	21.0	19.0	15.5
58 DS1	16					22.0		23.0	23.0	21.0	19.0
	16	24.5				21.0			23.0		
	64	24.5	24.5	23.5			17.5	21.0	21.0	19.0	15.5
100BT + 4 DS1 (107 Mb/s)	16					22.0		23.0	23.0	21.0	
	128	24.5	24.5	23.5				19.0	19.0	17.0	14.0
3 DS3 + 3 DS1	16									21.0	19.0
	32					22.0		22.0	22.0	20.0	
	128	24.5	24.5	23.5	23.0	21.0		19.0	19.0		14.0
87 DS1	16									21.0	19.0
	32					22.0		22.0	22.0	20.0	
	64	24.5	24.5	23.5	23.0	21.0		21.0	21.0		17.0
100 DS1	32									20.0	18.0
	64					22.0		21.0	21.0	19.0	
	128	24.5	24.5	23.5	23.0	21.0		19.0	19.0	17.0	14.0

Table 5-3: Guranteed Thresholds, (dBm) — ANSI, 6-38 GHz

Air Link Capacity	Mod./ (QAM)	Frequency Band, (GHz)									
		L6	U6	7	8	11	13	15	18	23	38
4 DS1	QPSK					-92.0		-90.0	-90.0	-90.0	-89.0
	16	-88.5	-88.5	-88.5	-88.0	-88.0		-86.0	-86.0	-86.0	-85.0
8 DS1	QPSK							-87.0	-87.0	-87.5	-86.5
	16			-85.5				-83.0	-83.0	-83.5	-82.5
	32	-83.5	-83.5	-83.5	-83.0	-83.0		-81.0			
12 DS1	32	-82.0	-82.0	-82.0	-81.5	-81.5		-79.5	-79.5	-79.5	-78.5
16 DS1	QPSK							-84.5	-84.5	-85.0	-84.0
	16					-83.5		-81.5	-81.5	-82.0	-81.0
	128	-76.5	-76.5	-76.5	-76.0	-76.0					
28 DS1	16							-78.0		-78.5	-77.5
	64	-76.0	-76.0	-76.0	-75.5	-75.5	-74.0	-74.0	-74.0	-74.0	-74.0
DS3 + DS1	QPSK	-84.0				-83.5			-81.5		-80.5
	QPSK					-84.0		-82.0	-82.0	-82.0	
	16	-83.5	-83.5				-80.5	-77.5	-81.0	-81.5	-80.5
	64	-75.5	-75.5	-75.5	-75.0	-75.0	-72.5	-73.0	-73.0	-73.5	-72.5
29 DS1	QPSK	-84.5				-84.0			-82.0		-81.5
	QPSK					-84.0		-82.0	-82.0	-82.5	
	16	-83.5					-80.5	-81.0	-81.0	-81.5	-80.5
	64	-76.0	-76.0	-76.0	-75.5	-75.5	-73.0	-74.0	-74.0	-74.0	-74.0
58 DS1	16					-80.0		-78.5	-78.5	-78.5	-74.5
	16	-77.5				-77.0			-75.0		
	64	-73.5	-73.5	-73.5			-71.0	-71.0	-71.0	-71.0	-71.0
100BT + 4 DS1 (107 Mb/s)	16					-77.0		-75.5	-75.5	-75.5	
	128	-70.0	-70.0	-70.0				-68.0	-68.0	-68.0	-67.0
3 DS3 + 3 DS1	16									-75.0	-74.0
	32					-74.5		-73.0	-73.0	-73.0	
	128	-72.0	-72.0	-72.0	-71.5	-71.5		-70.0	-70.0		-69.0
87 DS1	16									-74.5	-73.5
	32					-75.0		-73.0	-73.0	-73.0	
	64	-72.5	-72.5	-72.5	-72.0	-72.0		-70.0	-70.0		-69.5
100 DS1	32									-75.0	-74.0
	64					-74.0		-72.5	-72.5	-72.5	
	128	-70.5	-70.5	-70.5	-70.0	-70.0		-68.0	-68.0	-68.5	-67.5

Performance Tables — CEPT Rates

This Section provides current CEPT Performance data for the TRuepoint® **5200**. Tables in this Section are grouped as follows, with each group starting on the referenced page.

Assumptions for values reported in tables

- Transmit power is measured at the antenna port.
- Receive threshold is the power measured at the antenna port of a faded signal that causes a bit error rate (**BER)** of **1x10^{-6}**
- Values apply to the ***Unprotected Configuration only.***

For the Additional ACU Losses, refer to Tables 5-9 and 5-10.

Table 5-4: Channel Spacing, (MHz) — CEPT 6-38 GHz

Air Link Capacity	Mod/ QAM	Frequency Band, (GHz)											
		L6	U6	7	8	10	11	13	15	18	23	26	38
2 E1	QPSK	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
4 E1	QPSK	7	7	7	7	7	7	7	7	7	7	7	7
	16	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
8 E1	QPSK	14	14	14	14	14	14	14	14	13.75	14	14	14
	16	7	7	7	7	7	7	7	7	7	7	7	7
16 E1	QPSK	28/ 29.65	28/ 29.65	27/ 28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
	16				11.662								
	16	14	14	14	14	14	14	14	14	13.75	14	14	14
E3 + E1	QPSK	28/ 29.65	28/ 29.65	27/ 28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
	16		14	14	14	14	14	14	14	13.75	14	14	14
21 E1	QPSK						40					40	
	QPSK										56	56	56
	32	28/ 29.65	30	27/ 28	28/ 29.65		28	28	27/ 28	27.5	28	28	28
	32			14	14		14	14	14	13.75	14	14	14
32 E1	16	28/ 29.65		27/ 28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
35 E1	16	28/ 29.65		27/ 28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
	128			14	14	14	14	14	14	13.75	14	14	14
50 E1	32	28/ 29.65		27/ 28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
100BT+ 4 E1 (109 Mb/s)	32	28/ 29.65		27/ 28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
75 E1	32									55	56	56	56
	64	40	40	27			40			27.5		40	
	128	28/ 29.65	30	28	28/ 29.65	28	28	28	27/ 28	27.5	28	28	28
STM-1 + E1	32									55	56	56	56
	64	40	40				40					40	
	128			27					27	27.5			
	128	28/ 29.65	30	28	28/ 29.65	28	28	28	28	27.5	28	28	28

Table 5-5: Nominal Transmit Power, (dBm) — CEPT 6-38 GHz

Air Link Capacity	Mod/ QAM	Frequency Band, (GHz)											
		L6	U6	7	8	10	11	13	15	18	23	26	38
2 E1	QPSK	32.0	32.0	31.0	30.5	28.5	28.5	26.0	26.0	26.0	24.0	24.5	22.0
4 E1	QPSK	32.0	32.0	31.0	30.5	28.5	28.5	26.0	26.0	26.0	24.0	24.5	22.0
	16	28.0	28.0	27.0	26.5	24.5	24.5	23.0	23.0	23.0	21.0	21.5	19.0
8 E1	QPSK	32.0	32.0	31.0	30.5	28.5	28.5	26.0	26.0	26.0	24.0	24.5	22.0
	16	28.0	28.0	31.0	26.5	24.5	24.5	23.0	23.0	23.0	21.0	21.5	19.0
16 E1	QPSK	32.0	32.0	31.0	30.5	28.5	28.5	26.0	26.0	26.0	24.0	24.5	22.0
	16				26.5								
	16	28.0	28.0	27.0	26.5	24.5	24.5	23.0	23.0	23.0	21.0	21.5	19.0
E3 + E1	QPSK	32.0	32.0	31.0	30.5	28.5	28.5	26.0	26.0	26.0	24.0	24.5	22.0
	16		28.0	27.0	26.5	24.5	24.5	23.0	23.0	23.0	21.0	21.5	19.0
21 E1	QPSK						28.5					24.5	
	QPSK										24.0	24.5	22.0
	32	27.0	27.0	26.0	25.5		23.5	22.0	22.0	22.0	20.0	20.5	18.0
	32			26.0	25.5		23.5	22.0	21.0	22.0	20.0	20.5	18.0
32 E1	16	28.0		27.0	26.5	24.5	24.5	23.0	23.0	23.0	21.0	21.5	19.0
35 E1	16	28.0		27.0	26.5	24.5	24.5	23.0	23.0	23.0	21.0	21.5	19.0
	128			23.5	23.0	21.0	21.0	19.0	19.0	19.0	17.0	17.5	14.5
50 E1	32	27.0		26.0	25.5	23.5	23.5	21.0	22.0	22.0	20.0	20.5	18.0
100BT+ 4 E1 (109 Mb/s)	32	27.0		26.0	25.5	23.5	23.5	21.0	22.0	22.0	20.0	20.5	18.0
75 E1	32									22.0	20.0	20.5	18.0
	64	25.5	25.5				22.0					19.5	
	128			23.5						19.0			
	128	24.5	24.5	23.5	23.0	21.0	21.0	19.0	19.0	19.0	17.5	18.0	14.5
STM-1 + E1	32									22.0	20.0	20.5	18.0
	64	25.5	25.5				22.0					19.5	
	128			23.5					19.0	19.0			
	128	24.5	24.5	23.5	23.0	21.0	21.0	19.0	19.0	19.0	17.5	18.0	14.5

Table 5-6: Guaranteed Thresholds, (dBm) — CEPT 6-38 GHz

Air Link Cap.	Mod/ QAM	Frequency Band, (GHz)											
		L6	U6	7	8	10	11	13	15	18	23	26	38
2 E1	QPSK	-94.5	-94.5	-94.5	-94.0	-94.0	-94.0	-92.0	-92.0	-92.0	-92.0	-92.0	-91.0
4 E1	QPSK	-91.5	-91.5	-91.5	-91.0	-91.0	-91.0	-89.0	-89.0	-89.0	-89.5	-89.5	-88.5
	16	-87.5	-87.5	-87.5	-87.0	-87.0	-87.0	-85.5	-85.5	-85.5	-85.5	-85.5	-84.5
8 E1	QPSK	-88.5	-88.5	-88.5	-88.0	-88.0	-88.0	-86.5	-86.5	-86.5	-86.5	-86.5	-85.5
	16	-85.5	-85.5	-85.5	-85.0	-85.0	-85.0	-83.0	-83.0	-83.0	-83.0	-83.0	-82.0
16 E1	QPSK	-86.0	-86.0	-86.0	-85.5	-85.5	-85.5	-83.5	-83.5	-83.5	-83.5	-83.5	-82.5
	16				-81.5								
	16	-83.0	-83.0	-83.0	-82.5	-82.5	-82.5	-80.5	-80.5	-80.5	-80.5	-80.5	-79.5
E3 + E1	QPSK	-85.5	-85.5	-85.5	-85.0	-85.0	-85.0	-83.0	-83.0	-83.0	-83.0	-83.0	-82.0
	16		-82.5	-82.5	-82.0	-82.0	-82.0	-80.0	-80.0	-80.0	-80.0	-80.0	-79.0
21 E1	QPSK						-83.5					-81.5	
	QPSK										-81.5	-81.5	-80.5
	32	-79.0	-79.0	-79.0	-78.5		-78.5	-77.0	-77.0	-77.0	-77.0	-77.0	-76.0
	32			-77.5	-77.0		-77.0	-75.0	-75.0	-75.0	-75.5	-75.5	-74.5
32 E1	16	-79.5		-79.5	-79.0	-79.0	-79.0	-77.0	-77.0	-77.0	-77.0	-77.0	-76.0
35 E1	16	-79.5		-79.5	-79.0	-79.0	-79.0	-77.0	-77.0	-77.0	-77.0	-77.0	-76.0
	128			-74.0	-73.5	-73.5	-73.5	-71.5	-71.5	-71.5	-71.5	-71.5	-70.5
50 E1	32	-75.0		-75.0	-74.5	-74.5	-74.5	-72.5	-72.5	-72.5	-72.5	-72.5	-71.5
100BT+ 4 E1 (109 Mb/s)	32	-74.0		-74.0	-73.5	-73.5	-73.5	-72.0	-72.0	-72.0	-72.0	-72.0	-71.0
75 E1	32									-75.0	-75.0	-75.0	-74.0
	64	-74.5	-74.5				-73.5					-72.5	
	128			-69.5						-66.0			
	128	-69.5	-69.5	-69.5	-69.0	-69.0	-69.0	-67.5	-67.5	-66.0	-67.5	-67.5	-66.5
STM-1 + E1	32									-75.0	-75.0	-75.0	-74.0
	64	-74.5	-74.5				-73.5					-72.5	
	128			-68.0					-66.0	-66.0			
	128	-69.5	-69.5	-69.5	-69.0	-69.0	-69.0	-67.5	-67.5	-66.0	-67.5	-67.5	-66.5

ACU Losses

This section provides the ACU Losses, for the ***Unprotected*** Configurations, that were taken into account in generating Tables 5-2 and 5-3 (ANSI), and 5-5 and 5-6 (CEPT).
Power Output and Thresholds values can also be extrapolated from those tables by applying the ACU Losses for ***Protected*** configurations (1+1) provided in Tables 5-9 and 5-10.

ACU Losses provided herein are for reference only. When configuring a radio or sparing an RFU or transceiver, refer to the RFU and SPU Installation Manuals (IMN-903001 and 903002) for applying the ACU Losses as required.

Table 5-7: ACU Losses, (dB) — 5100 RFU, Unprotected

Freq. Band, GHz	Unprotected, (1+0)	
	Tx	Rx
13	1.0	1.0
15	1.0	1.0
18	1.0	1.0
23	1.0	1.0
26	1.3	1.3
38	1.8	1.8

Table 5-8: ACU Losses, (dB) — 5200 RFU, Unprotected

Freq. Band, GHz	Unprotected, (1+0)	
	Tx	Rx
6	1.0	1.0
7	1.0	1.0
8	1.5	1.5
10	1.5	1.5
11	1.5	1.5
13	1.5	1.5
15	1.5	1.5
18	1.5	1.5
23	1.5	1.5

Table 5-9: Additional Losses[a], (dB) — 5100 RFU, 1+1 Configurations

Freq. Band, GHz	MHSB Eq. Split		MHSB, Unequal Split		
	Tx	Rx	Tx A (only)	Rx B	Rx A
13	3.2	3.2	1.0	10.0	1.0
15	3.2	3.2	1.0	10.0	1.0
18	3.5	3.5	1.0	10.0	1.0
23	3.5	3.5	1.0	10.0	1.0
26	3.5	3.5	1.0	10.0	1.0
38	3.5	3.5	1.2	10.5	1.2

a. Referenced to waveguide and cable runs, combiners etc., on the Customer's side.

Description of Abbreviations showing in Table 5-10	
MHSB, Eq. Split	Monitored Hot Standby, Equal Split
MHSB, Uneq. Split	Monitored Hot Standby, Unequal Split
Space Div., 1 Encl	Space Diversity, with 1 Enclosure
Space Div., 2 Encl	Space Diversity, with 2 Enclosures
SD, 1 Enc, Split Tx/Rx	Space Diversity, with 1 Enclosure, Split Transmit/Receive
FD/SD, 2 Encl.	Frequency/Space Diversity, with 2 Enclosures
Freq. Div., 1 Encl.	Frequency Diversity, with 1 Enclosure

Table 5-10: Additional Losses, (dB) — 5200 RFU, 1+1 Configurations

Freq. Band, GHz	MHSB, Eq. Split		MHSB, Uneq. Split			Space Div., 1 Encl.	
	Tx	Rx	Tx	Rx B	Rx A	Tx	Rx
6	0.4	3.4	0.4	10.1	1.1	0.4	0.0
7	0.4	3.4	0.4	10.1	1.1	0.4	0.0
8	0.4	3.4	0.4	10.1	1.1	0.4	0.0
10	0.4	3.4	0.4	10.1	1.1	0.4	0.0
11	0.4	3.4	0.4	10.1	1.1	0.4	0.0
13	0.7	3.5	0.7	10.2	1.2	0.7	0.0
15	0.7	3.5	0.7	10.2	1.2	0.7	0.0
18	0.9	3.6	0.9	10.3	1.3	0.9	0.0
23	0.9	3.8	0.9	10.8	1.7	0.9	0.0

Freq. Band, GHz	Space Div., 2 Encl.		SD, 1 Enc, Split Tx/Rx		FD/SD, 2 Encl.		Freq. Div., 1 Encl.	
	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx
6	0.4	0.0	0.0	0.0	0.0	0.0	1.0	0.9
7	0.4	0.0	0.0	0.0	0.0	0.0	1.0	0.9
8	0.4	0.0	0.0	0.0	0.0	0.0	0.5	0.4
10	0.4	0.0	0.0	0.0	0.0	0.0	0.6	0.5
11	0.4	0.0	0.0	0.0	0.0	0.0	0.6	0.5
13	0.7	0.0	0.0	0.0	0.0	0.0	0.4	0.6
15	0.7	0.0	0.0	0.0	0.0	0.0	0.4	0.6
18	0.9	0.0	0.0	0.0	0.0	0.0	0.6	0.9
23	0.9	0.0	0.0	0.0	0.0	0.0	0.6	0.9

Table 5-11: Additional ACU Losses, (dB) — 5200 RFU, N+N Configurations

Freq. Band, GHz	MHSB, Eq. and Uneq. Split		Other Configurations	
	Tx	Rx A/B	Tx	Rx A/B
6	0.6	0.6	0.3	0.3
7 to 11	0.7	0.7	0.4	0.4

Table 5-12: Additional Losses, (dB) — 5100 RFU Narrow T/R

Freq. Band, GHz	T/R Spacings, MHz			
	120	315, 322	340	700
15	—	0.3	—	—
18	2.1	—	0.6	—
38	—	—	—	0.8

Table 5-13: Additional Losses, (dB) — 5200 RFU Narrow T/R

Freq. Band, GHz	T/R Spacings, MHz					
	65, 84, 91	98 to 150	120	150 to 300	315, 322	340
10	—	0.5	—	0.2	—	—
11	1.2	—	—	—	—	—
15	—	—	—	—	0.3	—
18	—	—	2.2	—	—	0.4

Resynchronization Time

Following a brief outage (due to transmit switching, path fading etc), when the receive signal is at least 10 dB above a threshold of 10^{-6} BER, the tributary signal will fully functional without error as follows:

Table 5-14: Total Average Resynchronization Time, ms

	Baud Rate, Mbaud/s		
	Up to 10		Higher than 10
Frequency Band, GHz	6-11	13-38	6-38
Resynchronization time, (Traffic restore), ms	60	80	50
Resynchronization time for ADM 8 DS1 and 28 DS1 + WS, (Traffic restore), ms	60	80	60

CHAPTER

6

MANAGEMENT AND CONFIGURATION TOOLS

This chapter describes briefly the features and functions of the Management and Configuration tools available to the user. For complete details related to configuring, operating, and troubleshooting the radio, including all Software-related information, refer to the ***Operator's Interface*** Manual, P/N IMN-903003-Exx.

The Tools

In an TRuepoint® radio, software plays a key role in providing a user-friendly interface, as well as defining and supporting the critical functions of the radio.

Capacity upgrade, modulation selection, frequency and power setting, and many other functions are accessible via software and are inherent to the product.

Table 6-1 provides a general description of these tools.

Table 6-1: Summary Description of Available Tools

Tool/Feature	Benefits
Handheld VT-100 emulation	Allows for the configuration and alarm monitoring of the system for on-site maintenance personnel
***Web*-CIT**	Harris' Web-based management system, running under Microsoft Windows®; allows for complete control and monitoring of the radio system
Auto-configuration	A unique removable off-the-shelf memory card (MMC) that resides on a single board (Controller), for avoiding reconfiguration of the system when any unit is swapped or replaced
Paperless Chart Recorder (PCR)	Eases maintenance and logs the radio and path activities during a long period. (The time period depends on the path activity)
History event-log	Available locally or remotely
Visual and graphical links	Display on the screen of the PC's configuration tool (*Web*-CIT)
SNMP	Remote connectivity through the use of IP Networking to an SNMP-based network management system
Element Manager	• FarScan™ — Harris' proprietary alarm and control tool • StarView™ — Element Management System for managing Harris radio networks from a single-operator Windows NT or Windows 2000 workstation
Network Management	NMS — Connection of the TRuepoint® radio's HDLC port to the Ethernet port of other Harris' radios, using Harris' proprietary SCAN and Net_comm protocols

Harris point-to-point equipment is designed to work with standard protocols over standard media and with Harris legacy products using the proprietary SCAN and Netcom protocols. TRuepoint® supports an IP network (the Web-CIT, SNMP, FTP), a Netcom network, and a SCAN network.

You can connect a TRuepoint® radio to other Harris point-to-point radios via the Ethernet port to another Ethernet port, via the HDLC serial port to a RPTR_IN serial port, or via the serial Port 1 to a SPUR (AUX) port

Auxiliary and Data Services — Radio Overhead

Net_Comm *(Network Communications)*

The Net_Comm protocol carries information inside a Harris equipment network. Its minimum capacity (or bandwidth) allocated in the overhead of the 338 kbit/s, up to 532 kbit/s, depending on capacity.

This protocol encapsulates all the functions like SCAN, Network Management, O/W, Data Channel, (see below). The payload or bandwidth is dynamically allocated to any of these services, meaning that, if the O/W and 19.2 kbit/s data channels are not used; this capacity is then allocated to the Net_Comm that will assign it to the remaining services like NMS and SCAN. In doing so, this will increase the speed of the Network Management System & SCAN.

Net_Comm is carried in the auxiliary channel of the RF link (radio overhead, except in the case of SONET and SDH). The Net_Comm is encapsulated in HDLC-like frames.

The physical interface of Net_Comm is available on the 2 Ethernet (repeater) RJ-45 ports to connect to other Harris equipment. The 2 connectors allow for daisy chain, NMS and *Web*-CIT connections.

Net_Comm[1] supports the following applications:

- Local login
- Remote login
- SCAN
- IP and ARP
- Data channel
- Auxiliary Channel digital bridge
- Object exchange
- Orderwire signalling
- Network topology.

1. *Net_Comm is also available on the HDLC port, for MicroStar® compatibility. However, a MicroStar® network does not support all above-mentioned applications.*

Asynchronous data

The asynchronous data channel is a networking interface intended to transport various network management protocols through a Harris Microwave network. Such protocols are assumed to present the following characteristics:

- Only one piece of equipment can send data on the data channel at any given moment, in a “broadcast” configuration. There is no restriction in a “point-to-point” configuration.
- The interface used is RS-232, with one start bit, one stop bit, and up to 8 bits of data per character.
- No hardware handshake is needed.

The data channel is not intended to carry synchronous or isochronous data.

Harris Hand-held or VT-100 terminals

The Harris Hand-Held terminal (HHT) is a module that allows the configuration and display alarms of the radio. The VT-100 emulation allows the same functionalities on a PC terminal.

The HHT or VT-100 terminal is used to

- Report system alarms,
- Report system status,
- Apply control on the system,
- Display system performances,
- Display or modify the system configuration, and
- Implement password functionality.

The display module communicates with a VT-100 compatible terminal connected to the multiport-auto (Port 1).

The communication characteristics of the VT-100 terminal are the following:

- Serial interface (9600 baud, 8 bits, no parity)
- VT-100 compatible

Password feature (on the HHT or VT-100)

The password feature limits access to the control and configuration menus through the HHT or VT-100 interface. There are 3 passwords:

1. The ***control password*** permits access to the control menu,
2. The ***configuration password*** permits access to both the control and the configuration menus and allows the user to change both the control and the configuration passwords, and
3. The ***master password*** allows access to the control and configuration menus and allows the user to change any of the three passwords.

Performance monitoring

History

The history feature provides the ability to monitor and log events for further analysis. History information can be uploaded through the SCAN protocol. It is stored in a specific record format. Each record (sample shown below) contains alarms, analog values, and a time stamp (100 ms resolution from the boot time). A reboot or a power-off of the Controller does not erase the history information, since it is saved in a non-volatile memory every minute.

Uploadable record
RSL A (dBm)
TX A power (dBm)
RSL B (dBm)
TX B power (dbm)
RX A On-line
TX A On-line
Modem A Rx sync alarm
FEC A alarm
MUX A Sync loss
Err Second alarm
RX B On-line
TX B On-line
Modem B Rx sync alarm
FEC B alarm
MUX B Sync loss
Time stamp

Network Element Management

FarScan™

FarScan™ is a Harris' alarm and control tool that utilizes the Harris proprietary SCAN protocol. As such, it is provided for backward compatibility with legacy equipment.

FarScan™ **allows** the operator to:

- Poll system alarms and status
- Activate or deactivate some controls that do not permanently break the FarScan™ communication link.
- Get some system status and configuration points
- Configure the tributaries
- Interact with legacy networks

FarScan™ polls continuously all the NE's to get their status. This feature is called Auto-Poll. The Auto-Poll works by polling high-level alarms. When one such alarm is active, it will poll a set of child alarms to find the root cause. This process is recursive.

E-Keypad

E-Keypad is an application that is integrated within the FarScan™ software running on a PC. This application displays a pop-up window that shows the HHT, allowing a user from a given site, to control and monitor a remote TRuepoint® 5000 radio, or any other radio that supports the ESCAN protocol on a Harris Microwave network.

Telnet

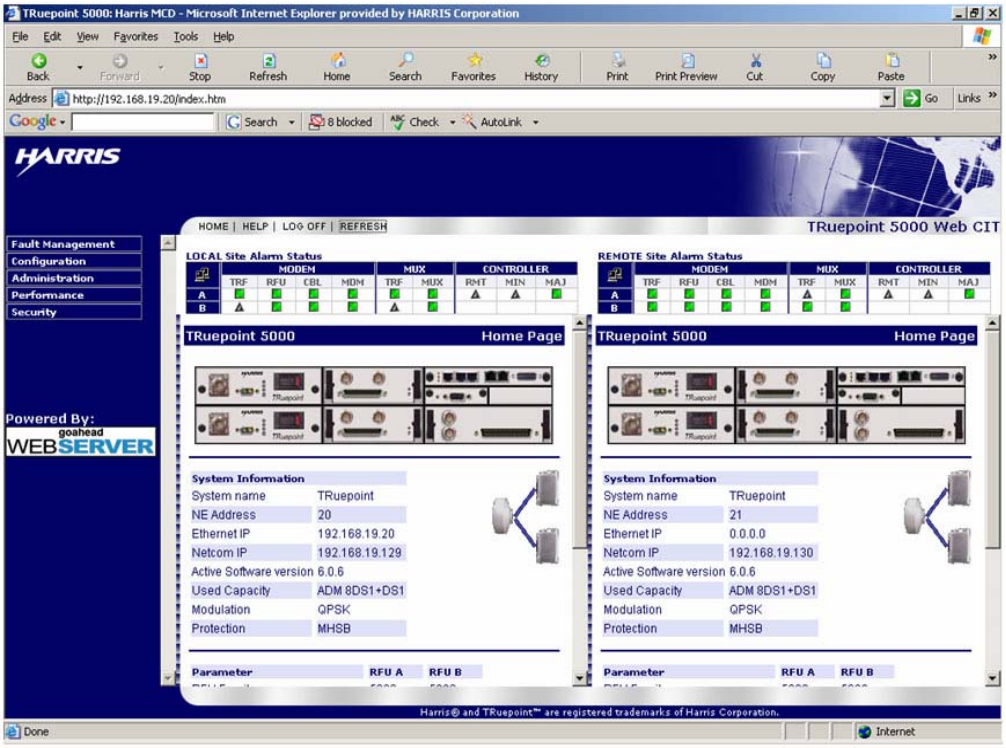
Conditions of use:

Condition	Description
Connection	• Not encapsulated, over NTWRK/LAN ports
Session	• A session does not provide access to a shell • A VT-100 emulation session starts automatically and prompts the user for login information
Interface	• Keypad application only

Web Craft Interface Tool (*Web*-CIT)

The *Web*-CIT is an on-board Web-based CIT providing FCAPS capability, (Fault, Configuration, Administration, Performance, and Security). This tool utilizes web technology to control and monitor the radio system though a direct connect, or remotely through the customers TCP/IP network. Radio pairs (local and remote) are visible to the operator from the same screen and any radio pair on the network can be displayed. The figure provided below depicts a sample SNMP configuration window available through the *Web*-CIT.

Figure 6-1: The *Web*-CIT Main Screen



The *Web*-CIT pages are HTML based and are executable from either Microsoft® Internet Explorer V5.5 and higher, or Netscape® Navigator 7.0 and higher.

SNMP

Because many of our products are dedicated to the PCS market, the Network Management has to deal with particular network configurations:

- Several hundred sites to be monitored.
- Several hundred sub-networks not interconnected.

In addition, it has been identified that:

The customer needs a fast notification when problems occur on any site of any sub-network.

The customer wants to manage all his equipment (from different providers) using a common platform.

SNMP provides these additional attributes to the radio. The SNMP requires the use of a MIB to handle configuration, alarm and radio status. The SNMP management interface is a standard SNMP interface, accessible through either PPP or 10BASE-T/Ethernet/UDP. This feature rich SNMP interface can be utilized by Harris network management systems (StarView™, NetBoss™) or any SNMP standard system through an on-board RJ-45 connector. SNMP connectivity can be accomplished utilizing the customers TCP-IP network to allow remote LAN or WAN network management capability.

The ***MIB*** is utilized by SNMP management systems to manage SNMP OBJECTS, and stands for Management Information Base (MIB). Objects in the MIB are defined using Abstract Syntax Notation One (ASN.1). Each type of object (termed an object type) has a name, a syntax, and an encoding. The name is represented uniquely as an OBJECT IDENTIFIER. An OBJECT IDENTIFIER is an administratively assigned name.

OBJECTS define the following parameters in the radio.

Table 6-2: Objects Definition and Function

Parameter	Function
Alarm	Defines the status of a piece of hardware or software, which can be in alarm or not in alarm. An alarm usually requires immediate attention
Control	A temporary setting of a value in a system. A control can be set or cleared
Status	Designates the status of a piece of hardware or software. A status can be in any format required. A status is informative and usually does not require immediate attention
Configuration	Designates the permanent setting of a value in the system

CompactFlash™

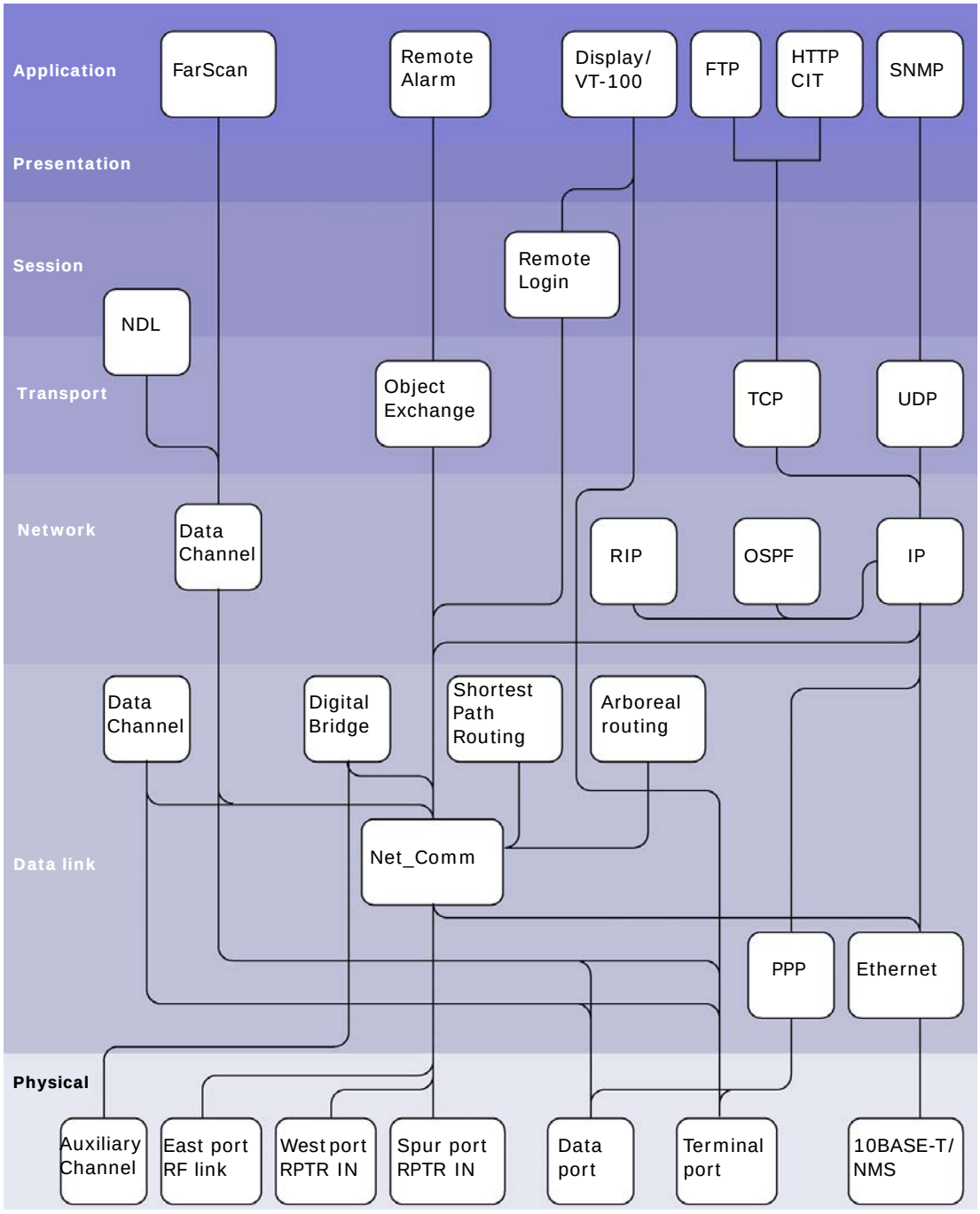
The Auto-Configuration feature allows the replacement of units without loosing their configuration. This is achieved through the use of a removable non-volatile memory in the SPU Controller (a CompactFlash™ card).

This MMC also includes the software for LCT/SNMP and SPU/RFU. Migration to higher capacities is allowed as the software evolves.

User characteristics

The following diagram illustrates the major user applications, the physical interfaces as well as the network communication layers between the applications and the system interfaces. The OSI protocol layers nomenclature is used.

Figure 6-2: User Characteristics - Major User Applications



Upgrade and Scalability

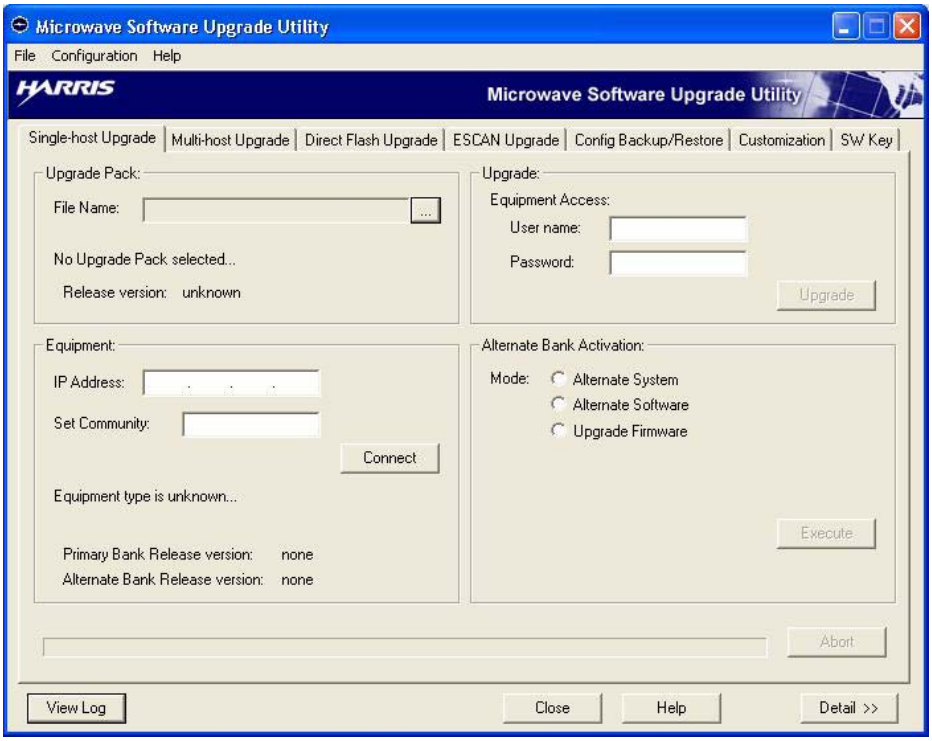
Software and Firmware Upgrades

The TRuepoint® software package is provided on a separate CD. This package contains various software utilities and applications, such as:

- Microwave Software Upgrade Utility (MSUU),
- ESCAN download utility,
- RFU Boot software and application
- SPU software application
- MIB (Management Information Base) file
- Firmware modem FPGA

The main utility MSUU, Figure 6-3, offers multiple options for upgrading the radio's software and firmware. For more information, refer to the ***Operator's Interface*** Manual, IMN-903003-Exx.

Figure 6-3: MSUU



Feature Upgrades with Software Keys

Features and Functions

- An encrypted (software key) file in the radio's embedded file system provides access to software keys that allow for Enhanced features.
- Software keys are loaded from that file at boot time.
- In the absence of such a file, no capacity upgrade or other enhanced features are available to the user.
- Enhanced features
  (software key required, unless noted otherwise)

Strong Security	• Optional, software key must be purchased
Event Logger	• If not readily available, (error message displays), features can be enabled through Harris Customer Support
Time Synchronization	
WebCIT	
VT-100 over Telnet	

- These upgrades can only be handled through the MSUU, according to the following procedure[1].

Updating a Customer Key File

1. Harris' support requests the key file from a customer.
2. Customer retrieves the key file from the radio using the MSUU.
3. Customer e-mails the key file to Harris' support.
4. Harris' support updates the key file using a proprietary application.
5. Harris' support e-mails the updated key file to the customer.
6. Customer downloads the key file to the radio using the MSUU.
7. Customer softboots the radio to turn on the new features. without traffic interruption.

1. *For complete details on applying this procedure, refer to the **Operator Interface** manual, IMN-903003-Exx*

CHAPTER

7

ACU OPTIONS V/ FREQUENCY PLANS

Released Frequency Plans

This Chapter identifies the **ACU Options** available per ***released*** frequency plans, at the time of publishing this manual. The Chapter is subject to further revisions, to reflect future released plans and options in due time. All values in tables are given in MHz, unless noted otherwise.

Lower 6 GHz, 5915-6425 MHz

TRuepoint® 52L6

Table 7-1: ACU / Diplexer Options — 5.9 to 6.4 GHz Frequency Plan, Bandwidths = 29.65 and 40 MHz

ACU	Low Frequency Diplexer Tuning Range, (MHz)		High Frequency Diplexer Tuning Range, (MHz)		BW (MHz)	T/R, (MHz)
	*f*c min	*f*c max	*f*c min	*f*c max		
ACU1	5915	6425	5915	6425	40	240 to 260
ACU2	5915	6425	5915	6425	29.65	73
ACU3	5915	6425	5915	6425	40	80
ACU4	5915	6425	5915	6425	29.65	133
ACU5	5915	6425	5915	6425	40	160

Configurations offered with ACU1

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

Configurations offered with ACU2 and ACU3

- Frequency Diversity or 2+0

Configurations offered with ACU4 and ACU5

- Frequency and Space Diversity Indoor
- Frequency and Space Diversity Outdoor

Upper 6 GHz, 6425-7125 MHz

TRuepoint® 52U6

Table 7-2: ACU / Diplexer Options — 6.4 to 7.1 GHz Frequency Plan, Bandwidths = 30 and 40 MHz

ACU	Low Frequency Diplexer Tuning Range, (MHz)		High Frequency Diplexer Tuning Range, (MHz)		BW (MHz)	T/R, (MHz)
	*f*c min	*f*c max	*f*c min	*f*c max		
ACU1	6540	6875	6540	6875	40	160 to 180
ACU2	6425	7125	6425	7125	40	340, 345
ACU3	6580	6780	6580	6780	40	90, 100
ACU4	6425	7125	6425	7125	30	70
ACU5	6425	7125	6425	7125	40	100
ACU6	6425	7125	6425	7125	30	130
ACU7	6425	7125	6425	7125	40	180

Configurations offered with ACU1, ACU2 and ACU3

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

Configurations offered with ACU4 and ACU5

- Frequency Diversity or 2+0

Configurations offered with ACU6 and ACU7

- Frequency and Space Diversity Indoor
- Frequency and Space Diversity Outdoor

7 GHz, 7100-7900 MHz

TRuepoint® 5207

Table 7-3: ACU / Diplexer Options — 7.1 to 7.9 GHz Frequency Plan, Bandwidths = 30 and 40 MHz

ACU	Low Frequency Diplexer Tuning Range, (MHz)		High Frequency Diplexer Tuning Range, (MHz)		BW (MHz)	T/R, (MHz)
	*f*c min	*f*c max	*f*c min	*f*c max		
ACU1	7100	7600	7250	7750	40	150 to 200
ACU2	7400	7900	7400	7900	40	245 only
ACU3	7100	7750	7100	7750	30	63 to 200
ACU4	7400	7900	7400	7900	30	63 to 245
ACU5	7100	7750	7100	7750	30	119 to 200
ACU6	7400	7900	7400	7900	30	119 to 245

Configurations offered with ACU1 and ACU2

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

Configurations offered with ACU3 and ACU4

- Frequency Diversity or 2+0

Configurations offered with ACU5 and ACU6

- Frequency and Space Diversity Indoor
- Frequency and Space Diversity Outdoor

8 GHz, 7725-8500 MHz

TRuepoint® 5208

Table 7-4: ACU / Diplexer Options — 7.7 to 8.5 GHz Frequency Plan, Bandwidths = 30 and 40 MHz

ACU	Low Frequency Diplexer Tuning Range, (MHz)		High Frequency Diplexer Tuning Range, (MHz)		BW (MHz)	T/R, (MHz)
	*f*c min	*f*c max	*f*c min	*f*c max		
ACU1	7725	8275	7725	8275	40	300 to 312
ACU2	7900	8500	7900	8500	40	180 to 310
ACU3	8200	8500	8200	8500	40	115 to 130
ACU4	7725	8275	7725	8275	30	63 to 312
ACU5	7900	8500	7900	8500	30	63 to 310
ACU6	7725	8275	7725	8275	30	119 to 312
ACU7	7900	8500	7900	8500	30	119 to 310

Configurations offered with ACU1 through ACU3

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

Configurations offered with ACU4 and ACU5

- Frequency Diversity or 2+0

Configurations offered with ACU6 and ACU7

- Frequency and Space Diversity Indoor
- Frequency and Space Diversity Outdoor

10/11 GHz, 10500-11710 MHz

TRuepoint® 5211

Table 7-5: ACU / Diplexer Options — 10.5 to 11.71 GHz Frequency Plans, Bandwidths = 10, 28, and 40 MHz

ACU	Low Frequency Diplexer Tuning Range, (MHz)		High Frequency Diplexer Tuning Range, (MHz)		BW (MHz)	T/R, (MHz)
	*f*c min	*f*c max	*f*c min	*f*c max		
ACU1	10500	10680	10500	10680	10	65
ACU2	10500	10680	10500	10680	28	84, 91
ACU3	10695	11710	10695	11710	40	490, 500, 530

Configurations offered with ACU1 through ACU3

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

13 GHz, 12700-13243 MHz

TRuepoint® 5113 and 5213

Table 7-6: Diplexer Options — 12.70 to 13.25 GHz Frequency Plan, Bandwidth = 114 MHz

Sub-Band	Low Frequency Filter		High Frequency Filter		BW (MHz)	T/R, (MHz)
	Freq. Range, (MHz)		Freq. Range, (MHz)			
	min.	*max.*	*min.*	*max.*		
1	12751	12865	13017	13131	114	266
2	12863	12977	13129	13243	114	266
3	12700	12814	12966	13080	114	266

Configurations offered for TRuepoint® 5113

- Unprotected
- HSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor
- 2+0

Configurations offered for TRuepoint® 5213

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

15 GHz, 14500-15350 MHz

TRuepoint® 5115 and 5215

Table 7-7: Diplexer Options — 14.5 to 15.35 GHz Frequency Plan, Bandwidths = 147, 154, 215, 231, 232 and 233 MHz

Sub-Band	Low Frequency Filter		BW, (MHz)	High Frequency Filter		BW, (MHz)	T/R, (MHz)
	Freq. Range, (MHz)			Freq. Range, (MHz)			
	min.	*max.*		*min.*	*max.*		
1	14501	14732	231	14921	15152	231	420
2	14697	14928		15117	15348		
3	14500	14732	232	15117	15350	233	640, 644, 728
4	14620	14767	147	14935	15089	154	315, 322
5	14760	14907		15075	15229		
6	14403	14634	231	14893	15124	231	490
7	14627	14858		15117	15348		
8	14500	14715	215	14975	15190	215	475
9	14660	14875		15135	15350		

Configurations offered for TRuepoint® 5115

- Unprotected
- HSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor
- 2+0

Configurations offered for TRuepoint® 5215

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

18 GHz, 17700-19705 MHz

TRuepoint® 5118 and 5218

Table 7-8: Diplexer Options — 17.7 to 19.7 GHz Frequency Plan, Bandwidths = 40, 123, 510, 520 and 525 MHz

Sub-Band	Low Frequency Filter		High Frequency Filter		BW (MHz)	T/R, (MHz)
	Freq. Range, (MHz)		Freq. Range, (MHz)			
	min.	*max.*	*min.*	*max.*		
1	17700	18220	18700	19220	520	1000, 1008, 1010
2	18175	18700	19185	19705	520	
3	17700	18210	19185	19705	510, 520	1560, 1615
4	18580	18703	18920	19043	123	340
5	18700	18823	19040	19163		
6	18580	18620	18700	18740	40	120
7	18620	18660	18740	18780		
8	18660	18700	18780	18820		
9	17700	18210	18795	19305	510	1092.5
10	18090	18610	19185	19705	520	

Configurations offered for TRuepoint® 5118

- Unprotected
- HSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor
- 2+0

Configurations offered for TRuepoint® 5218

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

23 GHz, 21200-23600 MHz

TRuepoint® 5123 and 5223

Table 7-9: Diplexer Options — 21.25 to 23.6 GHz Frequency Plan, Bandwidths = 600, 616 and 648 MHz

Sub-Band	Low Frequency Filter		BW, (MHz)	High Frequency Filter		BW, (MHz)	T/R, (MHz)
	Freq. Range, (MHz)			Freq. Range, (MHz)			
	min.	*max.*		*min.*	*max.*		
1	21200	21816	616	22400	23048	648	1200, 1232
2	21800	22400	600	23000	23600	600	
3	22000	22600	600	23000	23600	600	1008, 1010

Configurations offered for TRuepoint® 5123

- Unprotected
- HSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor
- 2+0

Configurations offered for TRuepoint® 5223

- Unprotected
- Unprotected, Wired MHSB Equal or Unequal
- MHSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor

38 GHz, 37000-40000 MHz

TRuepoint® 5138

Table 7-10: Diplexer Options — 37.0 to 40.0 GHz Frequency Plan, Bandwidths = 78, 100, 200 250, 280, 300, 350 and 620 MHz

Sub-Band	Low Frequency Filter		High Frequency Filter		BW (MHz)	T/R, (MHz)
	Freq. Range, (MHz)		Freq. Range, (MHz)			
	min.	*max.*	*min.*	*max.*		
1	38600	38950	39300	39650	350	700
2	38950	39300	39650	40000		
3	37000	37620	38260	38880	620	1260
4	37618	38238	38878	39498		
5	37640	37740	38340	38440	100	700
6	37300	37550	38000	38250	250	
7	37140	37340	37840	38040	200	700
8	39100	39300	39800	40000		
9	38240	38540	39500	39800	300	1260
10	37540	37618	38800	38878	78	1260
11	37618	37898	38878	39158	280	1260

Configurations offered for TRuepoint® 5138

- Unprotected
- HSB Equal or Unequal
- Space Diversity Indoor
- Space Diversity Outdoor
- 2+0

CHAPTER

8

GLOSSARY

This chapter provides an expanded description (as appropriate) of most of the acronyms used in this manual.

ACU *Antenna Coupling Unit*

ADM *Add/Drop Multiplexer* — A Digital multiplexing equipment that adds/removes individual signals to/from a collection of multiplexed signals in a network.

AGC *Automatic Gain Control*

AIS *Alarm Indication Signal* — In a DS1 system, a transmitted all-ones signal replacing the normal signal to maintain transmission continuity indicating to the receive terminal that there is a transmission fault located either at, or upstream from, the transmitting terminal.

AMI *Alternate Mark Inversion*

APS *Automatic Protection Switching* — A feature that allows a radio to recover automatically from failures.

ATM *Asynchronous Transfer Mode* — A dedicated connection switching technology that organizes digital data into 53-byte cell units and transmits them over a physical medium using digital signal technology. Relative to other related cells, each cell is processed asynchronously and queued before being multiplexed over the transmission path.

ATPC *Automatic Transmit Power Control* — A feature of digital microwave radio equipment that adjusts the transmitter output power based on path fading detected at the receiver.

B1 *Bit Interleaved Parity-8 (BIP-8)* — An RSOH byte for error checking the complete STM-1 signal at the end of a regenerator section.

B2	*Bit Interleaved Parity-24 (BIP-24)* — MSOH bytes for error checking an STM-1 signal (minus the RSOH) at the end of the multiplexer section.
B8ZS	*Bipolar 8 Zero Substitution*
CLEC	*Competitive Local Exchange Carrier* — A service provider that builds and operates communication networks in metropolitan areas, thus providing customers with an alternative to local telephone companies.
CompactFlash®	A compact, removable standard for storing and retrieving digital information in small, low-power devices. Such cards use flash technology for reusable recording, and ROM technology for read-only applications. Replaces the MMC (MultiMediaCard), as of Product Release 6.0
DACS	*Digital Access and Crossconnect System*
DADE	*Differential Absolute Delay Equalization* — An adjustment to render a protected system hitless.
DHCP	*Dynamic Host Configuration Protocol*
DTMF	*Dual Tone Multifrequency* — Tones generated when a button is pressed on a telephone, primarily used in North-America.
DTPC	*Dynamic Transmit Power Control* — A feature enabling the regulation of a target receive signal level by remotely and proportionally controlling the corresponding transmitter output power level.
ESCAN	*Extended SCAN Protocol* — A Harris proprietary protocol that is more efficient and allows for faster communications than the SCAN protocol, also from Harris.
ESD	*Electrostatic Discharge* — A rapid discharge of static electricity from one conductor to another of a different potential.
FD	*Frequency Diversity*
FEC	*Forward Error Correction* — A communication technique that compensates for a noisy transmission channel by sending, along with the primary data payload, additional information to correct for errors that occur in transmission.
FIR	*Finite Impulse Response* filter — Designates one of two primary types of digital filters used in Digital Signal Processing applications.
FTP	*File Transfer Protocol*
HDB3	*High Density Bipolar order 3*
HDLC	*High-level Data Link Control* — A bit-oriented synchronous data link layer protocol developed by ISO. HDLC specifies a data encapsulation method on synchronous serial links using frame characters and checksums.
HHT	*Hand-held terminal* — A Harris' user interface device (also known as a display keypad). It allows the user to configure and monitor the radio when not using CIT or Web-CIT.
IF	Intermediate Frequency
IP	*Internet Protocol* — A method or protocol by which data is sent from one computer to another on the Internet.

K1 and K2 — In an SDH system, K1 and K2 are MSOH bytes used for controlling the multiplexer section protection switching, signalling Alarm Indication Signal (AIS), Far End Remote Failure (FERF), and signalling Automatic Protection Switching (APS) alarms, when implemented.

LAN — *Local-area Network* — A data network located on a user's premises within a limited geographical area. Widely used technology standards in LANs are Ethernet, FDDI, and Token Ring.

LIU — *Line Interface Unit* — An integrated circuit that interfaces to the physical cabling. The LIU provides clock recovery, pulse shaping and error detection functions.

LOH — *Line Overhead* — Contains the media's framing, routing protocol, and network-layer protocol overhead.

MHSB — *Monitored Hot Standby*

MSOH — *Multiplexer Section Overhead* — As part of an SDH frame (multiplexer), refers to the processing time required by codes for error checking and control of transmissions.

MSUU — *Microwave Software Upgrade Utility* — A Harris' proprietary software utility for upgrading the software and firmware of the TRuepoint® radios. Uses Microsoft Windows 2000® Service Pack 4 or later.

MUX — *Multiplexer* — A circuitry that combines two or more information-carrying channels for transmission over one channel, by using frequency division or time division techniques

NMS — *Network Management System* — such as Harris' StarView™.

OC-*n* — *Optical Carrier Level n* — The optical signal that results from an optical conversion of a synchronous transport signal *n* (STS-n). This is the signal that will form the basis of the interface.

OMM — *Optical Multimode*

OSM — *Optical Single Mode*

PDH — *Plesiosynchronous Digital Hierarchy* — A complex multiplexing scheme of bit stuffing and byte interleaving. It multiplexes the lower level 64 kbit/s circuits into a successively higher order 2 Mbit/s, 34 Mbit/s, 140 Mbit/s and 565 Mbit/s aggregate rates.

PPP — *Point-to-Point Protocol* — A TCP/IP routing protocol that allows communications over serial communications lines without the use of other adapters, such as modems.

QAM — *Quadrature Amplitude Modulation* — A method of combining two amplitude-modulated signals into a single channel, thereby doubling the effective bandwidth.

QPSK — *Quadrature Phase Shift Keying* — A digital frequency modulation technique used for sending data over coaxial cable networks.

RDI-L — Remote Defect Indication - Line

RCS — *Reverse Channel Switching* — A rich feature set that provides protection against potential far-end transmitter silent failure.

Restricted Area A location qualified in accordance with IEC Standard 60950-1 as providing an access that can only be gained by Skilled Persons or users who have been instructed about the reasons for the restriction applied to the location and about any precautions to be taken; and
access achieved through the use of a Tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.

RFCOH *Radio Frame Complementary Overhead* — Refers to data that is added to a data transmission unit, (such as Netcom data packets).

RFU *Radio Frequency Unit* — The radio unit that is installed mainly outdoors.

RIP *Routing Information Protocol*

RMS *Rack Mounting Space*

RPC *Radio Processing Card*

RS *Revertive Switching* — A process that sends traffic back to the original working card after the card returns online.

RSL *Received Signal Level*

RSOH *Regenerator Section Overhead* — As part of an SDH frame (regenerator), refers to the processing time required by codes for error checking and control of transmissions.

RSSI *Received Signal Strength Indicator* - A parameter returned from a transceiver that gives a measure of the RF signal strength, either uplink or downlink.

SD *Space Diversity*

SDH *Synchronous Digital Hierarchy* — An international standard for synchronous data transmission on optical media. SDH uses a multiplexing structure that enables direct access to individual 2 Mbit/s data streams from within the higher order aggregate line signals, which lays the foundation for benefits of distributed traffic switching and protection.

SDLC *Synchronous Data Link Control* — A bit-oriented, full-duplex serial protocol that has spawned numerous similar protocols, including HDLC and LAPB.

SDM *Signal Distribution Module* — An optional module used in conjunction with a redundant multiplexer, as part of the protection unit that is integrated with the SPU.

Skilled Person A ***skilled person*** is considered to have the necessary knowledge and practical experience of electrical and radio engineering to appreciate the various hazards that can arise from working on radio transceivers, and takes appropriate precautions to ensure the safety of personnel.
This individual is considered to be a ***skilled person*** only if he/she is competent to take responsibility for both his/her safety and for that of unskilled personnel under his/her immediate supervision, when working on the transceiver.
Training requirements for a ***skilled person*** should not only be confined to technical matters and, preferably, should include first-aid treatment, especially methods of artificial resuscitation: respiration and cardiac compression (heart massage).

SNCP — *Subnetwork Connection Protection* — Designates path-switched SDH rings that employ redundant, fiber-optic transmission facilities. Organized in pairs, one fiber transmits in one direction while the backup fiber transmits in the other. If the primary ring fails, the backup takes over.

SNMP — *Simple Network Management Protocol* — A protocol used to facilitate network management by exchanging information between equipment on a network.

SONET — *Synchronous Optical Network* — An ANSI standard for synchronous data transmission on optical media that is the equivalent of SDH, described above.

SPU — *Signal Processing Unit* (Also referred to as IDU) — The indoor rack-mounted unit that contains plug-in modules for handling and processing the signal received from the RFU.

STM-*n* — *Synchronous Transport Module* — A data unit transmitted within a fixed time slot of 125 ms, also known as frame. SDH transport defines a range of frames, STM-1...STM-64, each corresponding to a particular transmission rate, such as STM-1 (155 Mbit/s), STM-4 (622 Mbit/s), STM-16 (2.5 Gbps), and STM-64 (10 Gbps).

STP — *Spanning Tree Protocol* — A link management protocol that provides path redundancy while preventing undesirable loops in a network that are created by multiple active paths between stations.

STS-*n* — *Synchronous Transport Signal, Level* n— The basic logical building block signal of a SONET. The STS-1 (level 1) signal has a rate of 51.840 Mbit/s. The international equivalent of this rate is the STM.

TCM — *Trellis-Coded Modulation* — A bandwidth-efficient scheme that combines error-correction coding with modulation. The redundancy thus introduced by the coding does not expand the bandwidth, since the parity bits are absorbed by the extended signal constellation. Two-dimensional (2D) TCM uses dependency between in-phase and quadrature symbols, while four-dimensional (4D) TCM introduces dependency between symbols of two successive intervals.

TCP/IP — *Transmission Control Protocol/Internet Protocol* — A standard that provides connectivity across computer platforms ranging from mainframes to Macintoshes. These computers can exchange data when connected over a compatible network scheme, such as Ethernet or X.25. Originally developed by the Department of Defense in the 70's, these protocols are now a de facto industry standard.

UDP — *User Datagram Protocol* — A TCP/IP protocol that describes how messages reach application programs within a destination computer.

UPSR — *Unidirectional Path-Switched Ring* — A survivable, closed-loop, transport architecture that protects against fiber cuts and node failures by providing duplicate, geographically diverse paths for each circuit.

WAN — *Wide-area Network* — A network that provides telecommunication services to a geographic area larger than that served by a local area network or a metropolitan area network.

***Web*-CIT** — *Web-Craft Interface Tool* — A Harris' proprietary software utility for monitoring and controlling the operation and configuration of the TRuepoint® radios. Located on the TRuepoint® Controller, any of the two **NTWRK/LAN** ports allows for connecting a PC running the *Web*-CIT server that is embedded in the radio. This web server stores HTML pages and applets that provide a user interface for monitoring and controlling any TRuepoint® Network Element, using the Microsoft® Internet Explorer, version 5.5 and later.

INDEX

P

R

S

T

U

W

Z