Operation & Maintenance
Of
Digital Microwave

SYSTEMS

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Digital Microwave Radio Systems

- Unit 1: Digital Microwave Radio Systems Introduction
- Unit 2: MicroStar® TYPE II MHSB 1+1 (7 & 13 GHz) System
- Unit 3: MicroStar® TYPE III MHSB 1+1 (7 GHz) System
- Unit 4: Truepoint 5200 MHSB 1+1 (7 & 13 GHz) System

UNIT 1

Digital Microwave Radio Systems Introduction

Objective:

In this section you will learn about the principals and the basics technical information of ***Digital Microwave Radio Systems as:***

- Path Calculation for survey and instillation a new radio link.
- Frequency planning
- Type of modulation and code that used in radio equipments.
- Type of protected configuration as Hot Standby, Frequency Diversity, and Space Diversity systems.

Contents:

Chapter 1 Digital Radio Principals	Chapter 2 Path Calculations	Chapter 3 Basics Technical Information
. Kind of Digital Microwave Systems . Digital Microwave radio Definition . Microwave Antennas Types . Antennas Polarization . Half Power BeamWidth (HPBW) . Elliptical Waveguide . Cable Grounds and Surge Suppressor	. Wavelength Speed Calculation . Receive signal level calculation . Free Space Loss Calculation . Antenna Gain calculation . Fade Margin Calculation . Using dB's	. Technical Definitions . Transmission Encoding . Modulation Types . Frequency Planning . Type of protected configuration systems
Unit Exercises		

CHAPTER 1

Digital Radio Principals

- *Kind of Digital Microwave Systems*
- *Digital Microwave radio Definition*
- *Microwave Antennas Types*
- *Antennas Polarization*
- *Half Power BeamWidth (HPBW)*
- *Elliptical Waveguide*
- *Cable Grounds and Surge Suppressor*

Kind of Digital Microwave Systems

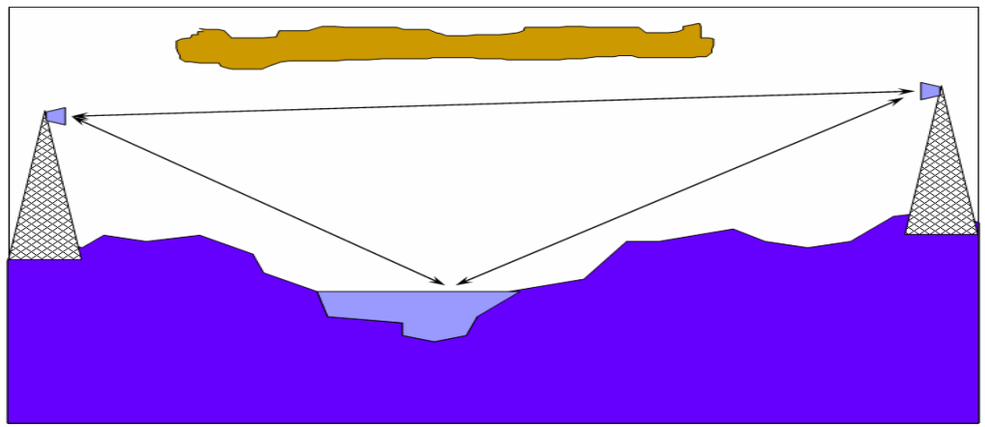
Public Telecommunication Corporation (PTC) uses much different type of digital microwave systems.
The table below shows the most type of digital microwave radio systems that use in the field.

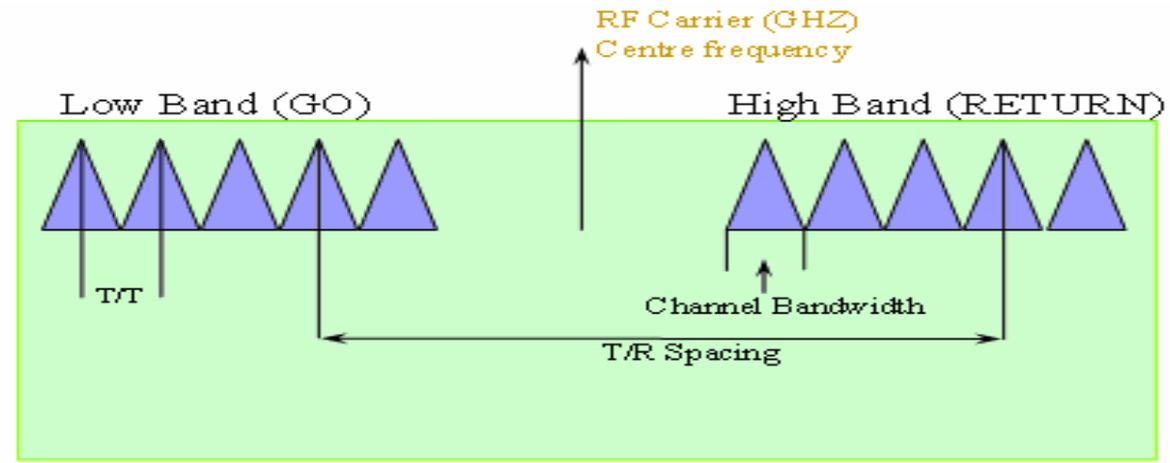
System type	Frequency band (GHz)	Capacity	Configuration
ALCATEL:-			
DM 46U6	6.4 ***to*** 7.1	140 Mbit/s	N+1 up to 11+1
DM 41U6	6.4 ***to*** 7.1	140 Mbit/s	N+1 up to 11+1
9411 LH *(TELETTERA)*	10.7 ***to*** 11.5	140 Mbit/s	2+1 up to 11+1
DM 3007	7.1 ***to*** 7.7	34 Mbit/s	N+1 up to 11+1
DM 3007	7.1 ***to*** 7.7	8 Mbit/s	1+1
NEC :			
PASOLINK PDH	7.1 ***to*** 7.7	4x2 Mbit/s	1+1 HSB
PASOLINK PDH	7.1 ***to*** 7.7	16 x2 Mbit/s	1+1 HSB
PASOLINK+ SDH	7.1 ***to*** 7.7	STM-1	1+1 HSB
HARRIS:			
MICROSTAR TYPE 2	7.1 ***to*** 7.7	2/4/8/16 E1	1+1 HSB
MICROSTAR TYPE 2	12.75 ***to*** 13.25	2/4/8/16 E1	1+1 HSB
MICROSTAR TYPE 3	7.1 ***to*** 7.7	4/8/16 E1	1+1 HSB
TRUEPOINT 5200	7.1 ***to*** 7.9	2/4/8/16 E1	1+1 HSB
TRUEPOINT 5200	12.75 ***to*** 13.25	2/4/8/16 E1	1+1 HSB
STRATEX:			
Eclipse Node ODU 100	7.1 ***to*** 7.9	2/4/8/16 E1	1+1 HSB
Eclipse Node ODU 300	12.75 ***to*** 13.25	2/4/8/16 E1	1+1 HSB
Eclipse Terminal ODU100	7.1 ***to*** 7.9	5/10/20 E1	1+1 HSB
Eclipse Terminal ODU100	12.75 ***to*** 13.25	5/10/20 E1	1+1 HSB

Digital Microwave Radio Definition

Digital Microwave is a Point to point radio system operating from 2 GHz to 60 GHz in duplex mode with a symmetrical channel plan using digital modulation**.**

Point to Point Radio is Duplex (symmetrical)





Point-Point Microwave Frequency Bands

Electromagnetic waves vary in length from the very short to the very long.
The microwave region is considered to be frequencies between 1 and 250 GHz. The wavelengths at these frequencies are 30.5 cm to 1.27 mm.
For high frequency systems such as microwave, frequency is commonly measured in gigahertz, and wavelength is expressed in centimeters. At Radio Waves, we specialize in the design and manufacturing of innovative microwave and broadband wireless antennas from 1 to 60 GHz.

Long & Medium distance:
2 GHz, 1.4 GHz, 2.6 GHz, 4 GHz, 6 GHz, 7 / 8 GHz.
Short distance:

13 GHz, 15 GHz, 18 GHz, 23 GHz, 26 GHz, 28 GHz, 32 GHz, 38 GHz.

There are several basic “types” of microwaves antennas. Each type has certain advantages and disadvantages for particular applications in microwave and broadband wireless networks.

Antenna type: The prefix defines the antenna type:

Antenna type	
Use	**Description**
DP	Deep Dish Parabolic, Plane Polarized
DPD	Deep Dish Parabolic, Dual Polarized
HPCPE	HP Discriminator™ Series Plane Polarized
HPLP	HP Low Profile Shielded, Plane Polarized
HPLPD	HP Low Profile Shielded, Dual Polarized
HP	HP Shielded, Plane Polarized
HPD	HP Shielded, Dual Polarized
SP	SP Unshielded, Plane Polarized
SPD	SP Unshielded, Dual Polarized

Antenna Diameter: The number selected will determine the antenna size in feet:

1ft (0.3m)
2 ft (0.6m)
3 ft (0.9m)
4 ft (1.2m)
6 ft (1.8m)
8 ft (2.4m)

Types of Antennas that PTC Using

Grid Parabolic Antennas

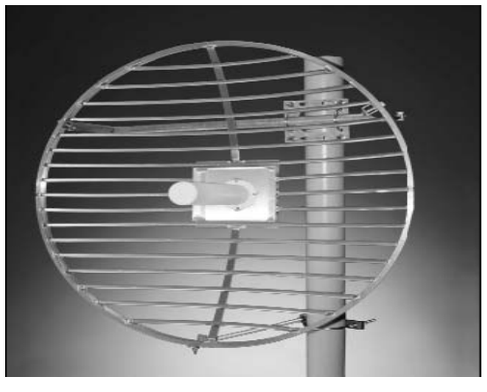
At lower frequencies, ***below 3 Gigahertz,*** a parabolic reflector can be simulated by a “grid” of reflective elements. This arrangement greatly reduces wind loading on a tower or other mounting structure. Grid antennas have a lower front-to-back ratio than solid parabolic antennas. They are also limited to a single polarization. They are ideal in applications where the best performance is not required and tower and wind loading are the main concern.

Standard Parabolic Antennas

Standard microwave antennas consist of a parabolic shaped reflector spun from a sheet of aluminum. The parabolic shape focuses energy at the feed point of the antenna. These parabolic antennas have a narrow focused beam of energy and relatively high gain compared to many other types of antennas. These antennas will have a mounting system to attach the antenna to a pipe, tower leg and/or a specific radio, in some cases.

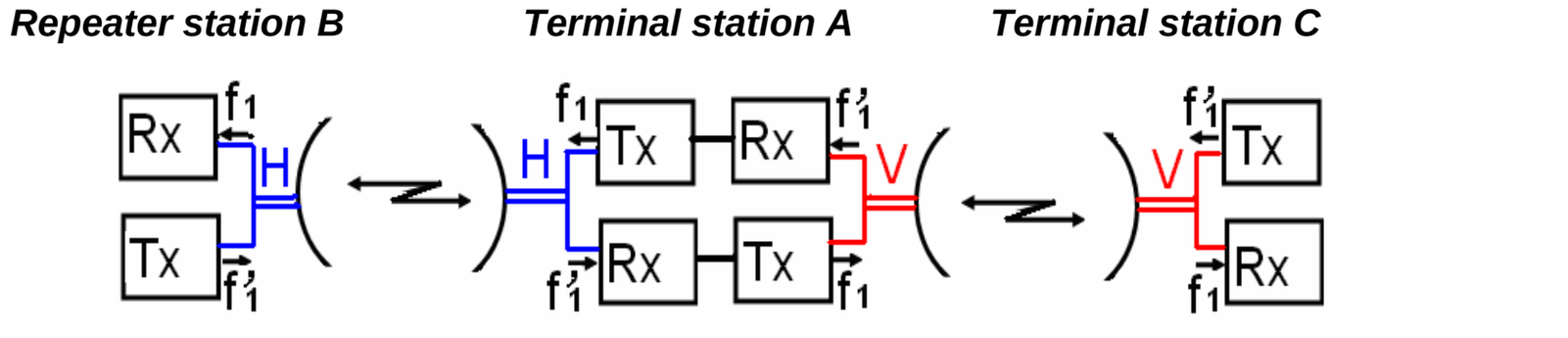
High Performance Antennas

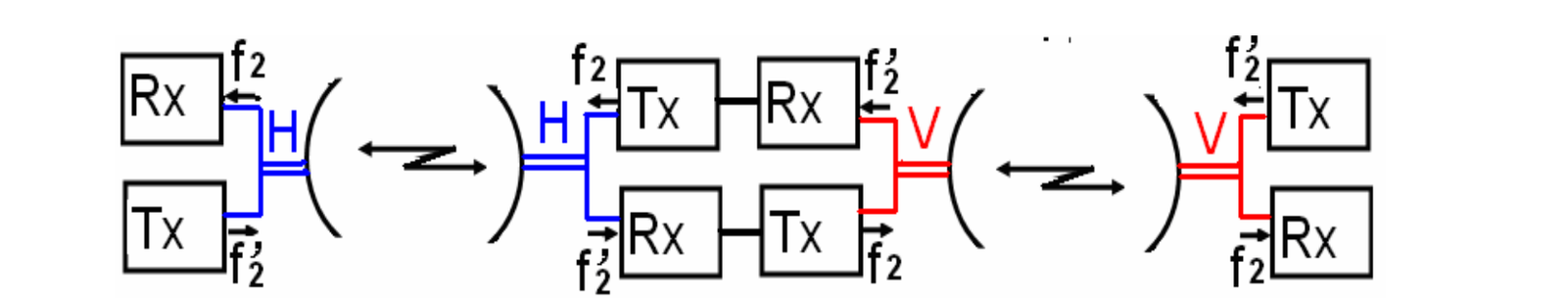
High Performance antennas are formed of aluminum, which is spun to precise tolerances. Then a shroud is also fabricated of aluminum and fitted with a planar radome to protect the feed and provide for a significant reduction in side lobes. Often manufacturers will utilize absorber material to improve the pattern performance of the side lobes and front-to-back ratio.
The exception is the DicriminatorTM series from Radio Waves, which utilizes a molded plastic reflector that is shaped for optimum side lobe performance.



Antennas Polarization

The orientation of the electric field vector as measured from a distance from the antenna. The propagation modes of electromagnetic waves are measured in planes: Vertical, Horizontal, Circular and Elliptical.





Tx / Rx Frequency spacing: the difference frequency between f1 and f1'
Horizontal polarization: **H**
Vertical polarization: **V**

Cross-Polarization:

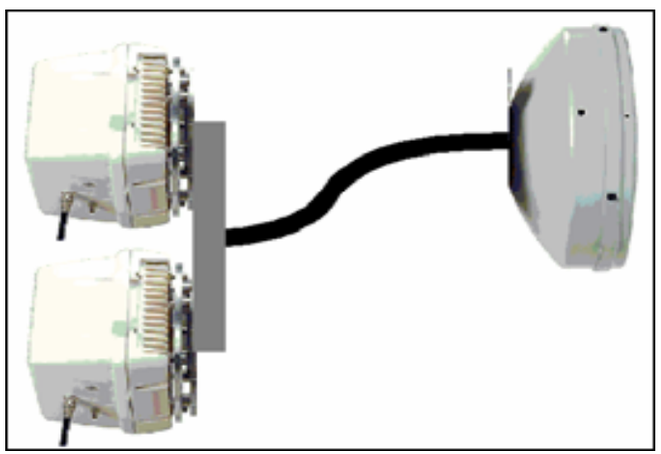
The intended polarization for which the antenna is intended to radiate.
The difference in dB between the peak of the co-polarized main beam and a cross-polarized signal, typically indicated as the difference between the vertical and horizontal polarization planes. The higher the value, the greater the discrimination protection from a signal of perpendicular polarization.

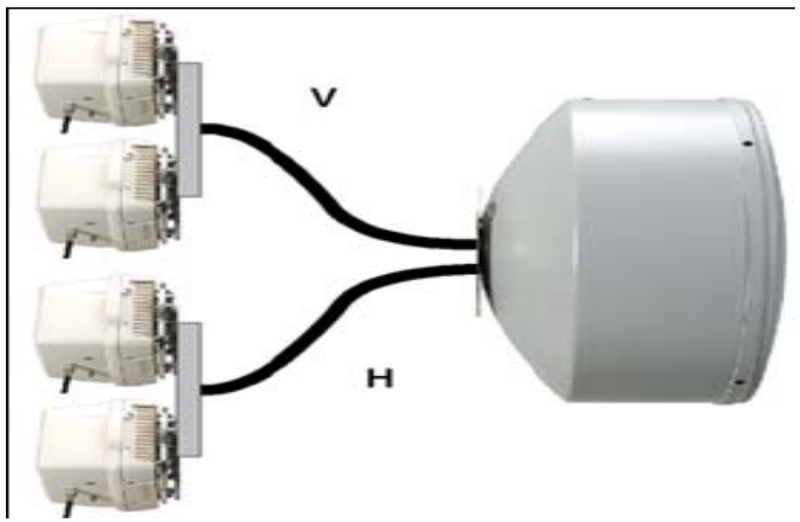
1. Plane Polarized Feeds

The angular orientation of a microwave signal can be fixed in either a vertical or horizontal electrical plane. A plane polarized microwave feed, also known as a single polarized feed, sends and receives signals oriented in just one of two planes. A single polarized feed set in a vertical orientation will pass vertically polarized signals, while electrically suppressing any other microwave signals that are 90 degrees off plane in a horizontal orientation.

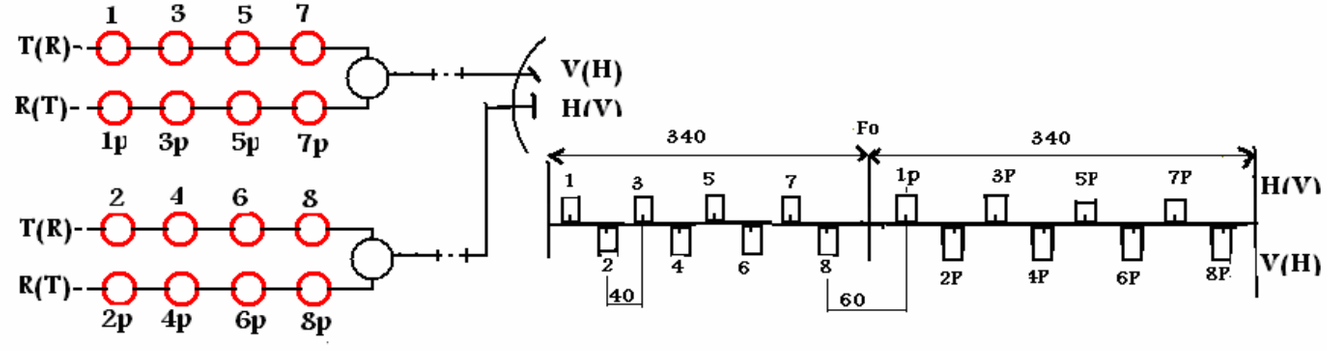
2. Dual Polarized Feeds

Dual Polarized feeds can detect both vertical and horizontal signal polarizations separately but simultaneously, while keeping each signal polarization isolated from the other. A dual polarized antenna system performs the same function as two separate single plane polarized antennas, reducing infrastructure costs and tower congestion. Two feed inputs are provided, one each for the vertical and horizontal polarizations.

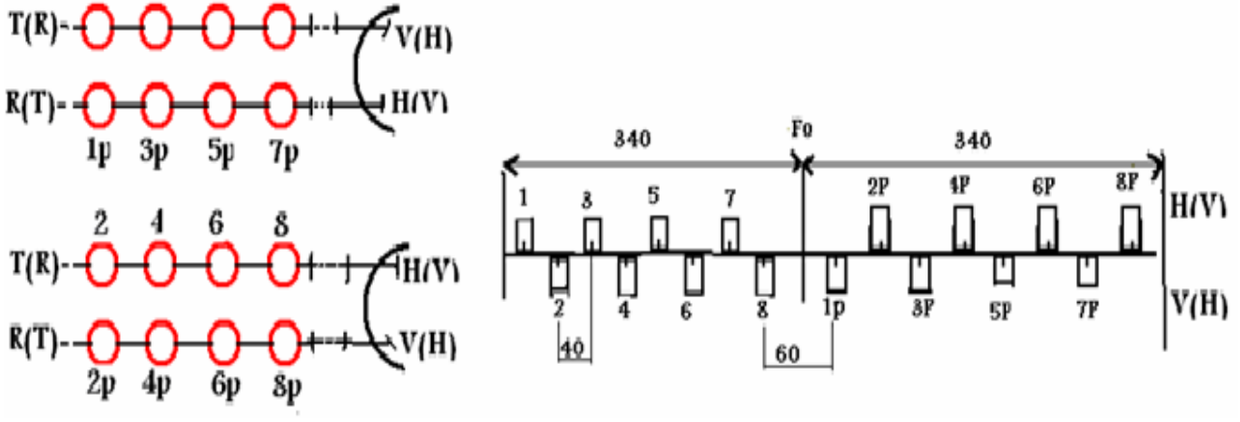




8 channels on one double polarized antenna (6 GHz)

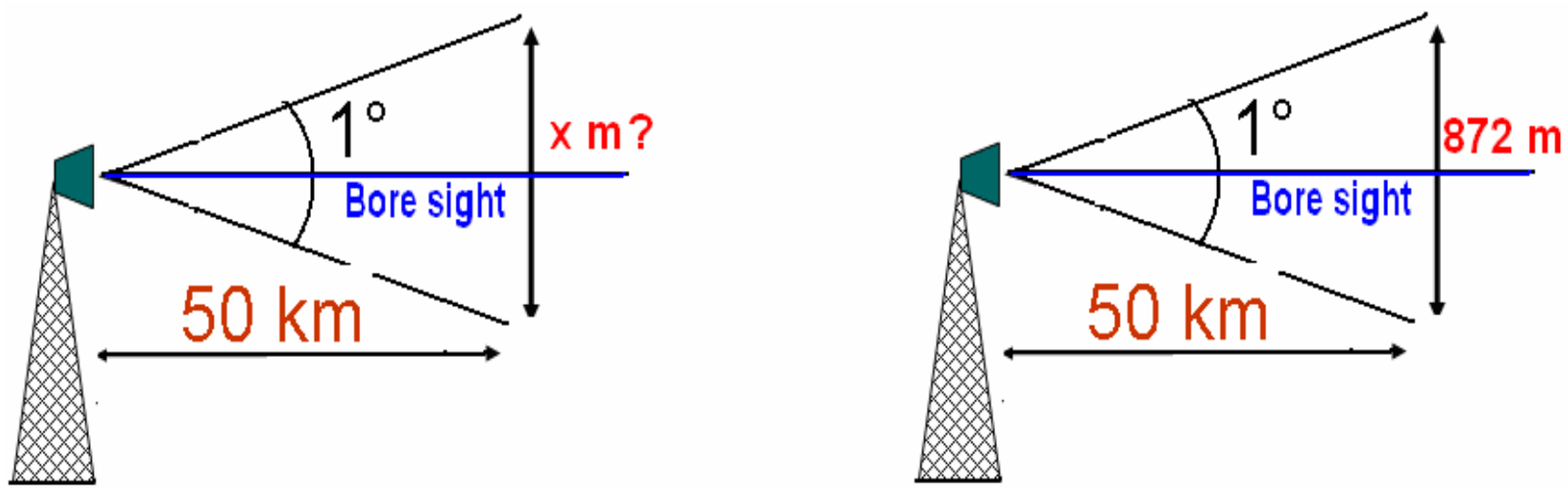


8 channels on two double polarized antennas (6 GHz)



Half Power Beam Width (HPBW)

Half Power BeamWidth is the nominal angular width of the main beam between its -3 dB points (half power). Measured in degrees from the center of the main beam, the value is typically nominal and stated as the minimum performance value for the operating frequency band. Beamwidth typically decreases as antenna gain increases. A system's maximum beamwidth is dependent on its required coverage area, while complying with system design to keep all unnecessary signal interference to a minimum from any adjacent microwave systems.



$$Y = d \times \tan 0.5^{o}$$

d *= distance in meter (m)*

What is 1 degree beamwidth at 50 km?

d = 50 km = 50000 m

Y= d x tan 0.5^{o}

Y = 50000 x tan 0.5^{o} = 436 m

1 degree beamwidth at 50 km *2 y = 872 m*

Introduction:

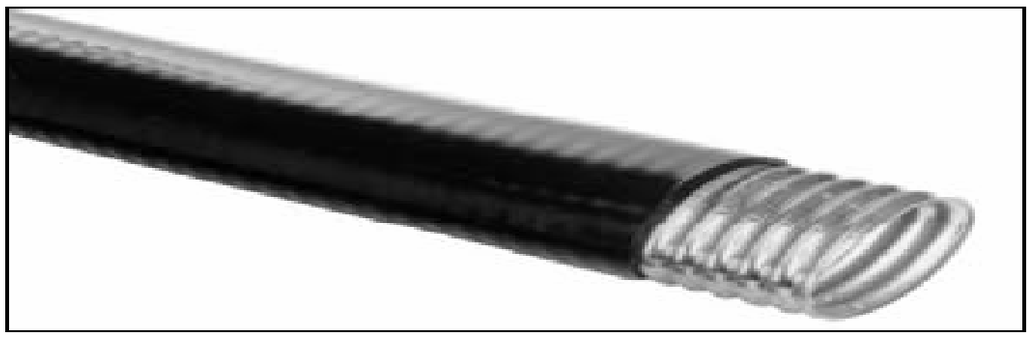
Elliptical waveguide is the premium choice for 5.9-13 GHz range microwave antenna transmission line systems where the radios are mounted indoors. The elliptical waveguide manufacturing process is continuous, so waveguide can be supplied in long lengths. The waveguide is constructed of highly conductive copper, which uses a special process to corrugate and form into an elliptical shape. The copper waveguide is then covered with a black polyethylene jacket for protection that makes the cable rugged and resistant to the full range of outdoor environmental conditions, as well as installation and transportation. The waveguide can be supplied cut to length with factory-attached connectors, or supplied in continuous lengths for termination at the site.

Installation and Service:

Corrugated walls allow the waveguide to offer high crush strength, extreme flexibility, and a low weight for superior handling and forming during the installation process. The copper walls and black polyethylene coating allow for a long service life, which translates into a cost effective system performance.

Elliptical Waveguide Selection:

Types of elliptical waveguide, ranging from 5.9 GHz to 13 GHz frequency bands. The standard elliptical waveguide is equivalent to the rectangular waveguide, WR137 to WR75. The standard waveguide connectors mate with popular MIL, EIA and IEC flanges. Standard waveguide connectors are non-tunable.
Premium waveguide offers an improved VSWR compared to the standard elliptical waveguide. The premium differs only in testing, and optimizes the VSWR for the specific operational band. Premium waveguide connectors can be fixed-tuned or pre-tuned to meet low VSWR performance specifications, eliminating the field tuning.

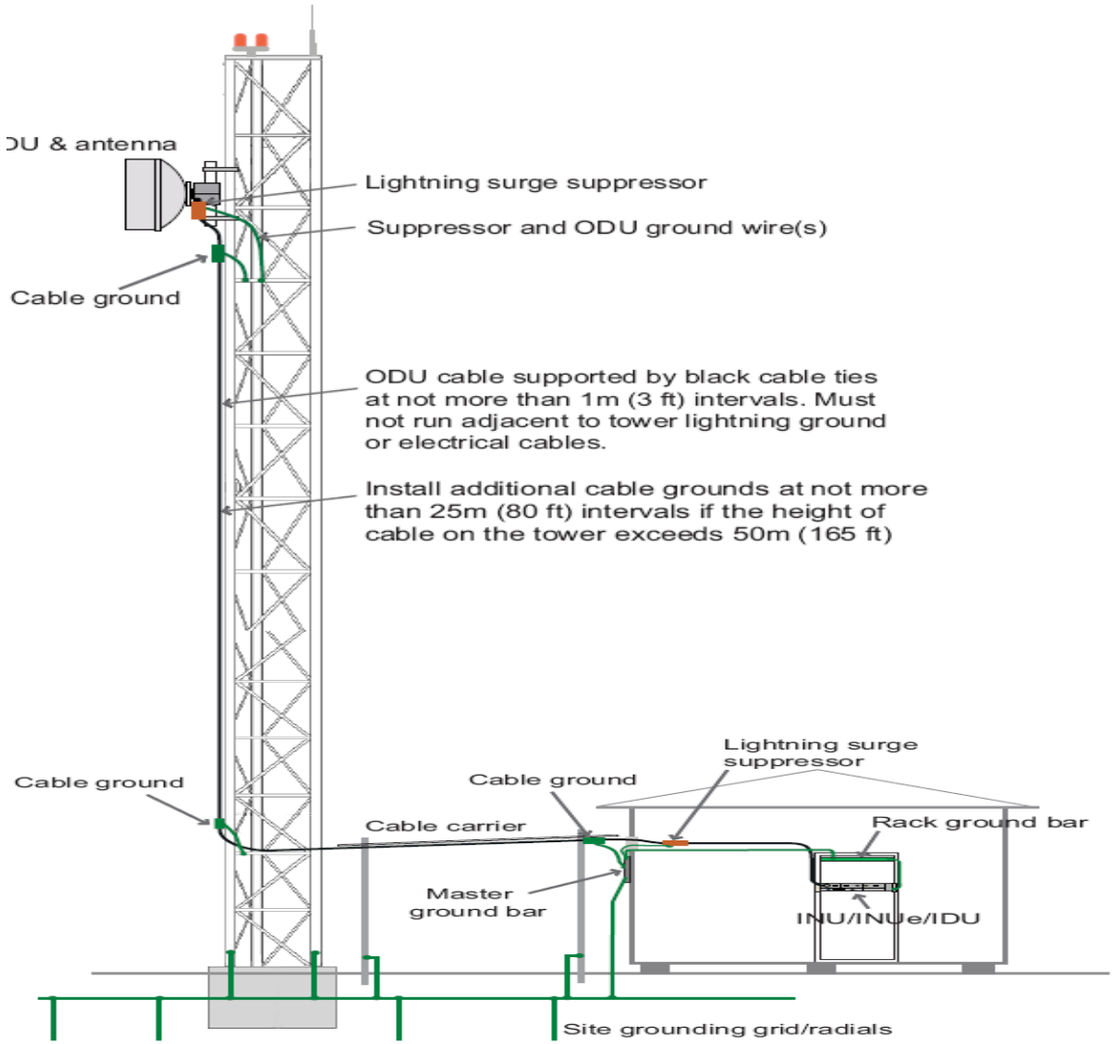


1. Grounding Kits

A properly grounded system helps reduce static due to noise, and reduces the probability of a lightening strike to your system. It is highly recommended that a minimum of three grounding kits are utilized at each installation: one at the top of the tower or vertical run, one at the bottom of the run and prior to entry in the building or shelters

2. Grounding Cable.

For tower/mast installations the ODU cable *must* be grounded at:
- The point where it comes on to the tower from the ODU
- The point where it leaves the tower to go to the equipment building
- Not more than 25 m (80 ft) intervals on the tower if the height on the tower exceeds 50 m (165 ft)
- A point just prior to building entry. If the building-end lightning surge suppressor is installed prior to the cable entering the building, the ground kit must be installed on the tower side of the suppressor



CHAPTER 2

Path Calculations

- ***Wave Velocity Calculation***
- ***Receive Signal Level (RSL) Calculations***
- ***Fade Margin Calculation***
- ***Using dBs***

Wave Velocity Calculation

One can easily observe how electromagnetic energy behaves by observing light energy or by observing waves generated by a rock thrown into a pond of water. The term wavelength refers to the distance the wave travels during the time of one cycle. In free space, these electromagnetic waves travel 300 million meters per second, which we call the “speed of light.”

The equation for calculating this speed is: $c = f \times \lambda$

Where:

C = the speed of light (3×10^8 meters per second)*

f = the frequency in hertz**

λ = the wavelength in meters***

For high frequency systems such as microwave, frequency is commonly measured in gigahertz and wavelength is expressed in centimeters. At Radio Waves, we specialize in the design and manufacturing of innovative microwave and broadband wireless antennas from 2 to 60 GHz.

Velocity of signal = c (speed of light)* *{Velocity = 3×10^8 m/s}***

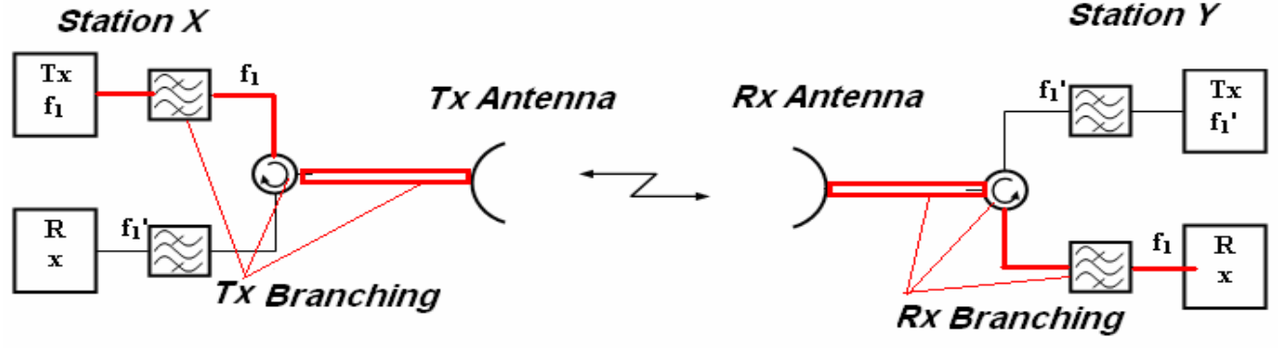
Frequency is number of cycles per second. Recall that Period = No. of seconds per cycle measured in Hertz or 10^6 Hertz (MHz) or 10^9 Hertz (GHz)* ***{f = 1/T}

****Wavelength: is length (distance) of ONE cycle* ***{λ = C/F}***

The factors effecting receive power are:

- Equipment characteristics (output power, coupling losses and waveguide losses).
- Path losses (through "free space").
- Antennas gain (the required diameter / gain are chosen).

Path losses (through "free space")



Receive signal level (RSL) calculation Equation:

RSL (dBm) = Tx P + Tx BL + Tx AG + FSL + Rx AG + Rx BL

RSL	Receive Signal Level (dBm)
TX P	Transmit Power (dBm)
Tx BL	Transmit Branching Losses (dB)
Tx AG	Transmitter Antenna Gain (dB)
FSL	Free Space Losses (dB)
Rx AG	Receiver Antenna Gain (dB)
Rx BL	Receive Branching Losses (dB)

1. Free Space Loss Calculation

The Free Space Path Loss: $FSL = 20 \log 4\pi d / \lambda$

Or F.S.L. Calculation Equation is: **Free Space Loss = *20 log F + 20 log D + A***

A: is a constant value = 92.4 dB when **F** measured in ***GHz***
Or = 32.4 dB if **F** measured in ***MHz***

D: is a distance between transmit station and receive station measured in ***Km***

2. Antenna Gain calculation:

Comparing the electrical field strength of an antenna to that of a reference antenna provides a gain figure measured in dB. The gain of an antenna is a measure of how well the antenna concentrates its radiated power in a given direction. When the free-space reference is an isotropic antenna, the gain is expressed in dBi, and when the reference antenna is a half-wave dipole, the gain figure is expressed in dBd. Microwave antennas are typically specified in dBi. Antennas are usually measured at three frequencies: the bottom, middle and top of the band. Antenna gain is a measurement of how well an antenna focuses energy, and generally the higher the gain, the narrower the beamwidths.

Antenna Gain calculation

The gain of parabolic antenna with respect to an isotropic is given below:

$G_{dB/iso} = 10 \log k.\ 4\pi S / \lambda^2$

$G\ dBi = 10 \log k.\ 4\pi D^2 / \lambda^2$

S *Aperture area (m)*

D *Diameter of the reflector*

λ *Wavelength in the same unit as* ***S*** *or* ***D***

K *Reflection coefficient of the reflector, normally* ***K= 0.5***

Antenna Gain calculation Equation: ***Antenna Gain (dBi) = 20 log F + 20 log D + B***

F: Frequency in GHz.

D: Diameter of Antenna

B: Is a constant value =17.8 dBi ***when*** **D** measured in meters ***Or*** =7.5 dBi ***when*** **D** measured in feet

3. RF Branching Losses

The Tx & Rx branching losses include RF filter insertion loss, cable loss, circulator loss and waveguide length loss.

Flat Fade Margin Calculation

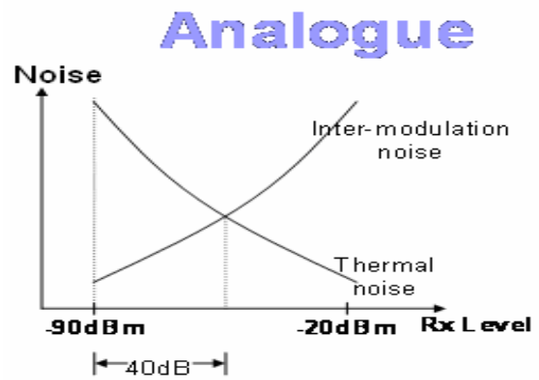
The amount of attenuation a link can suffer before link performance is effected.
The amount of fade margin available on an operation link can be calculated as follows:

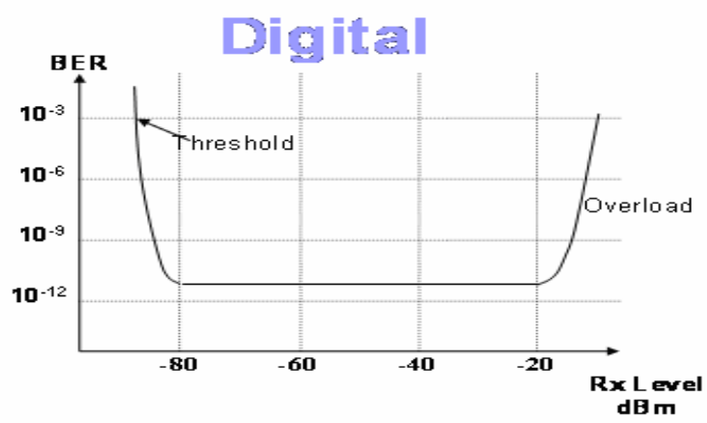
Fade margin calculation Equation

Flat fade margin (dB)= Rec. power – Rec. threshold at BER 10^{-6} or 10^{-3}

Receive Threshold

The receive threshold is a measure of the sensitivity of the receiver.
In digital system: It is the power, at the antenna port, of a faded signal that causes bit error rates of $1x10^{-3}$ and $1x10^{-6}$.
In Analogue system: It is the power, at the antenna port, of a faded signal that causes noise.





System Gain Calculation

Radio system gain is the amount of amplification that a receive – transmit radio pair provides to a signal.
The system gain is measured from antenna port to antenna port.

System Gain calculation Equation

System Gain (dB) = TX Power - Rec. threshold at BER 10^{-6} or 10^{-3}

The decibel was developed to make life easier to calculate gains and losses especially where we have a string of amplifiers. Instead of multiplying the numbers together, we can just add the dB's.

Log (A*B) = (log A + log B) Bels

dB = 10 . Log (A*B) = 10 log A + 10 log B

A common application of the dB is Power Gain:

dB = 10 log Po/Pi (output power/input power)

To improve round off error, in Telecomms we use the deci-Bel.

If the output is double the input, then Po = 2 Pi

dB = 10 log 2 = 3 dB

Another application for dB's is to reference one parameter, creating a level (as opposed to a gain, or a ratio)

If Pi = 1 mW, then we have a unit called dBm.

If output power is 1000 mW (1W), the level is dBm ***= 10 log 1000 = 30 dBm***

If output power is less than input power, then dB's become negative.

Eg: Pi = 0.5 mW, dBm = 10 log 0.5 = - 3 dBm

If the reference used is Watts, we use dBW***.***

Assume Po = 1 W, dBW = 10 log 1 = 0 dBW.

. It is important to realise that if the parameter is squared, doubling will result in 6 dB increase, not 3 dB***.***

. For example: P = V2/Z

. dB = 10 log (Vo2/Vi2) assuming impedance (Z) is the same.

. dB = 10 log (Vo/Vi)2

= 20 log (Vo/Vi)

Microwave signal strength falls off as the square of the distance, hence if you double the distance the signal level falls by 6 dB! Antenna gain is proportional to the square of the antenna aperture, therefore if you double the size of a microwave dish the gain will increase by 6 dB. On the other hand, if the output power of the transmitter is doubled, the signal increases by 3dB.

CHAPTER 3

Basics Technical Information

- *Technical definitions*
- *Transmission encoding*
- *Modulation types*
- *Frequency Planning*
- *Type of Protected Configuration Systems*

T-R Spacing

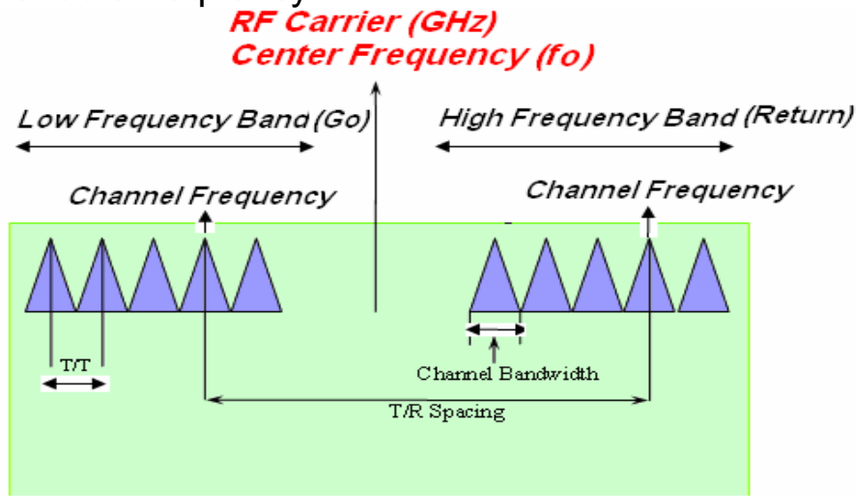
The amount of tuning space in MHz between transmit radio frequency and receive radio frequency.

Channel Bandwidth

A part of radio frequency band occupied for RF channel signal bandwidth from the RF frequency band. This channel bandwidth has different values depending on tributary channel capacity.

Example:

The channel bandwidth with the following capacities will be: 2E1=3.5 MHz, 4E1=7 MHZ, 8E1=14 MHz and 16E1=26 MHz.



Diplexer

A RF filter device used to separate the Tx and Rx signals at the transceiver antenna feed port available on an operation link can be calculated as follows: (RX sensitivity – RSSI).

Forward Error Correction (FEC) beam width

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.

The beam width of an antenna is defined as the angle between the two half-power (-3 dB) points on either side of the main lobe of radiation (half power beam width).

In data transmission, a system of error control for data transmission where the receiving device any character or code block that contains fewer than a predetermined number of symbols and corrects them by adding bits using a predetermined algorithm. XP4 Plus 2x.4x. and 4x/8x radios are capable of correcting 2 bits in a 512 bit block. DS3 and E3/16E1 XP4 Plus radios are capable of correcting 8 bytes in a frame of 255 bytes.

Automatic Gain Control (AGC) voltage

A process that automatically adjusts gain as a function of a specified parameter, such as received signal level.

Automatics Gain Control associated with the ODU receiver; the DC voltage equivalent to the received RF signals level.

Automatic Transmitter Power Control (ATPC)

Automatic Transmitter Power Control is a feature of the radio that allows the output power to automatically adapt to changing path conditions.
This feature reduces interference with neighboring systems and permits greater link density.

Alarm Indication Signal (AIS)

The code generated by a regenerator upon loss of input signal or loss of frame. In a E1 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.

Demultiplexer

Circuitry that accepts a frequency division or time division and produces as an output two or more separate information carrying channels.

Multiplexer

Circuitry that combines two or more information carrying channels for transmission over one channel, by using frequency division or time division techniques.

Indoor Unit (IDU)

Indoor Unit the part of the microwave radio located indoors to which the customer connects their equipment.

Outdoor Unit (ODU)

Outdoor Unit; the part of the microwave radio located outdoors, that connects to the antenna.

Hitless Receive Switching

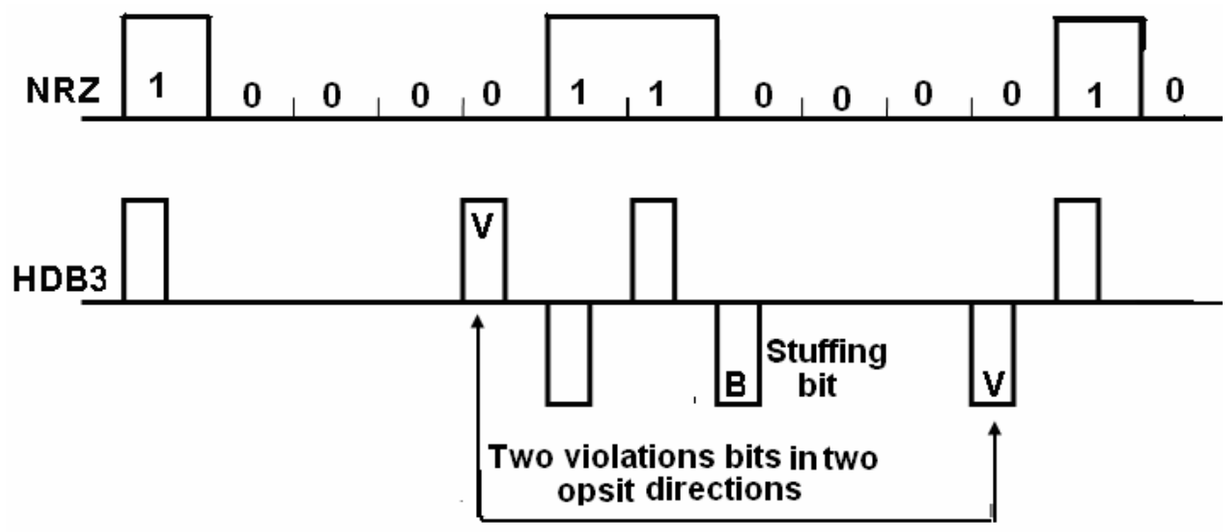
A protected system configuration whereby a fault occurs in the receiving end of the link, the traffic is switched to the standby radio without causing errors.

1.High Density Bipolar Order 3 (HDB3)

The factory default method of encoding transmissions for E1(2 Mbit/s) and E3 (34 Mbit/s) radios. Substitutes a 1 for every 3 zeros.

Transform the NRZ code to HDB3 code

NRZ: 100001100001

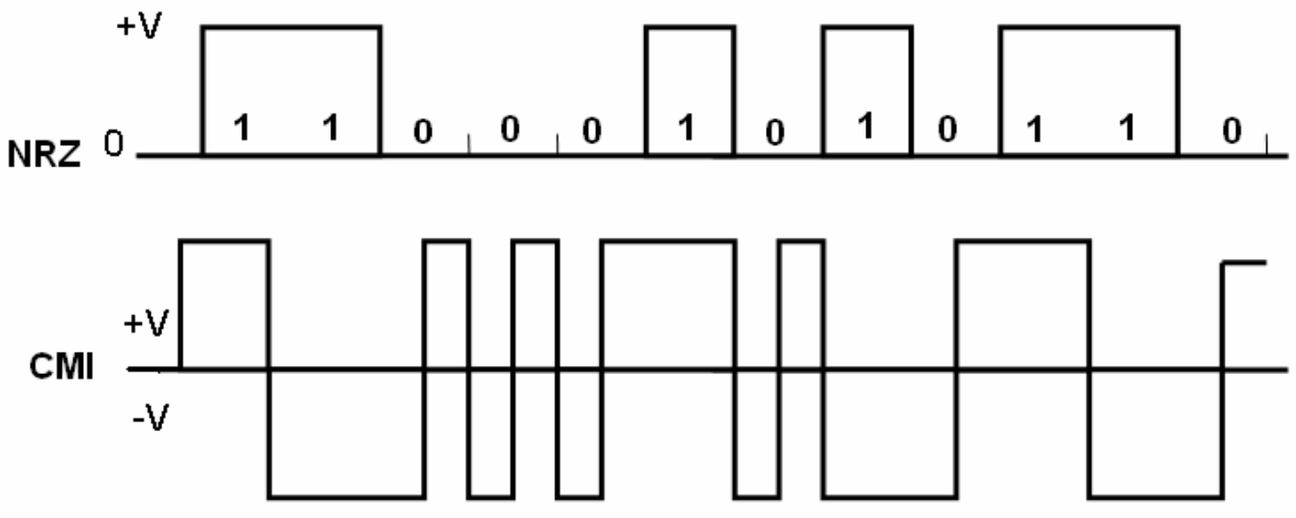


2. Code Mark Inversion (CMI)

The factory default method of encoding transmissions for high capacity such as STM-1 or 140 Mbit/s and higher radios.

Transform the NRZ code to CMI code

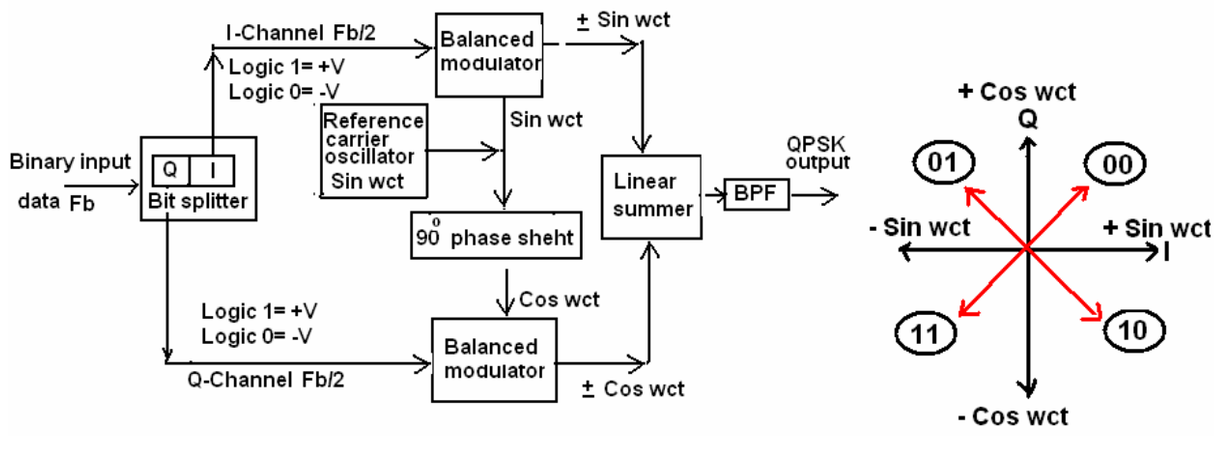
Input signal: *NRZ code*	Output signal: *CMI code*
1	+V Alternatively -V
0	+V First half elementary time



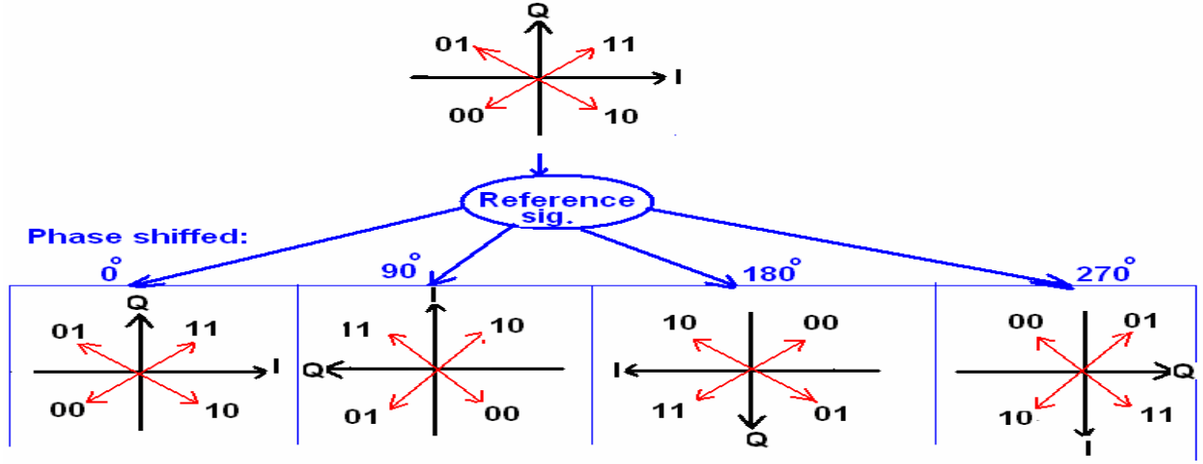
1. Quadrature Phase Shift Keying (QPSK)

A digital frequency modulation technique used for sending data over coaxial cable networks.

QPSK Modulation



QPSK Demodulation



2. Quadrature Amplitude Modulation (QAM)

A method of combining two amplitude modulated signals into a single channel, thereby doubling the effective bandwidth

1. Frequencu Plan 6 GHz Band Rec ITU-RF. 384-6 (CEPT/ERC 14-02E)

** DM 46 U 6 System is using this frequency plan B. & ** DM 41 U 6 (FH-270) System is using this frequency plan*

Rec. ITU-R F.384-6 6425-7110 MHz*			
f o (MHz):	6770		
Channel Spacing (MHz):	40		
T/R Spacing (MHz):	340		
T/R Minimum (MHz):	60		
Channel	*f* (MHz)	Channel	*f'* (MHz)
Plan A			
1	6460	1'	6800
2	6500	2'	6840
3	6540	3'	6880
4	6580	4'	6920
5	6620	5'	6960
6	6660	6'	7000
7	6700	7'	7040
8	6740	8'	7080
Plan B*			
1	6440	1'	6780
2	6480	2'	6820
3	6520	3'	6860
4	6560	4'	6900
5	6600	5'	6940
6	6640	6'	6980
7	6680	7'	7020
8	6720	8'	7060

Rec. ITU-R F.384-6 6425-7110 MHz* *			
f o (MHz):	6770		
Channel Spacing (MHz):	20		
T/R Spacing (MHz):	340		
T/R Minimum (MHz):	60		
Channel	*f*(MHz)	Channel	*f'* (MHz)
1	6440	1'	6780
2	6460	2'	6800
3	6480	3'	6820
4	6500	4'	6840
5	6520	5'	6860
6	6540	6'	6880
7	6560	7'	6900
8	6580	8'	6920
9	6600	9'	6940
10	6620	10'	6960
11	6640	11'	6980
12	6660	12'	7000
13	6680	13'	7020
14	6700	14'	7040
15	6720	15'	7060
16	6740	16'	7080

Channels Frequencies Calculation Equation in 6 GHz Band:

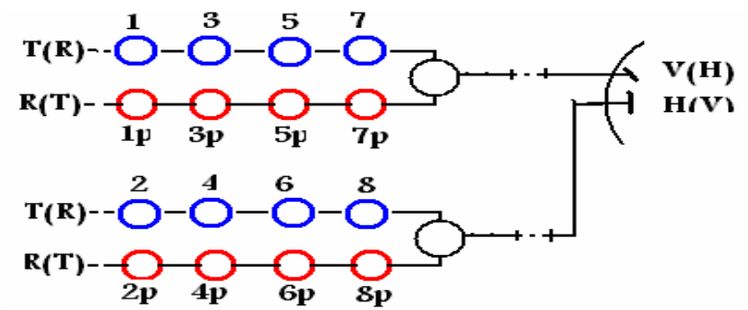
$$Fn = F0 - 350 + 40 \times n$$

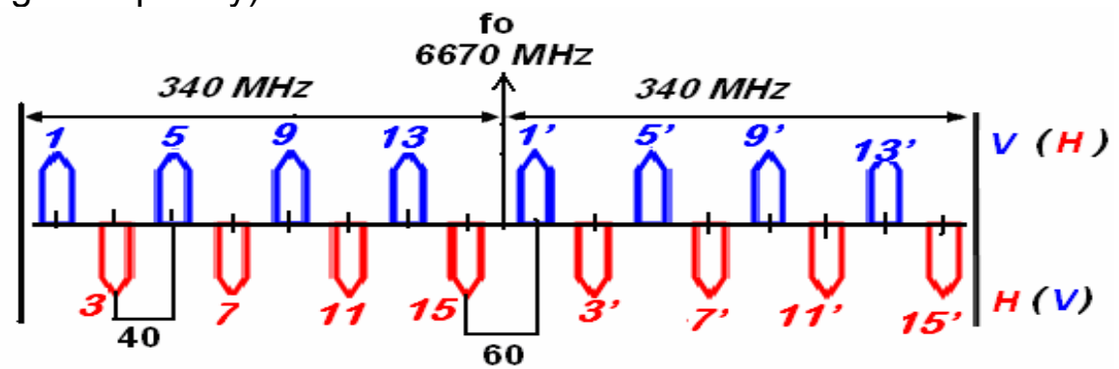
n: Is a number of channels from channel 1 to channel 8 (Low Frequency).
F0: F0 = 6770 MHz (Center Frequency).

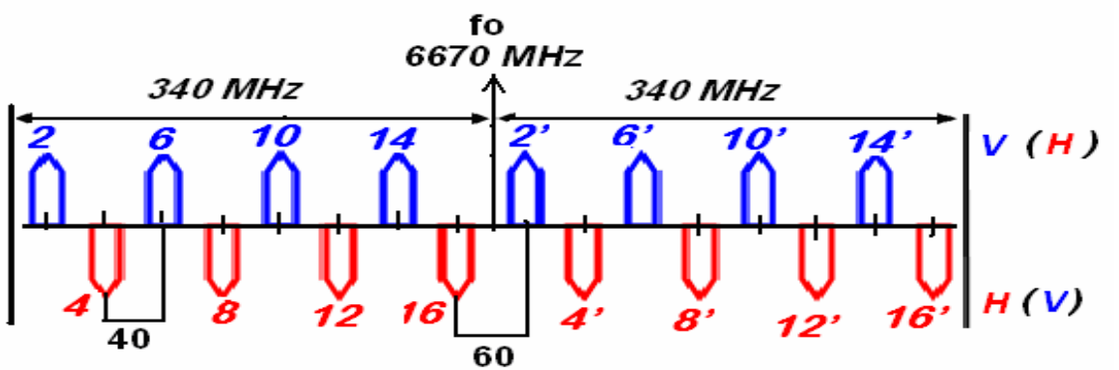
$$Fn' = F0 - 10 + 40 \times n'$$

n': Is a number of channels from channel 1' to channel 8' (High Frequency).
F0: Fo = 6770 MHz (Center Frequency)

8 channels on one double polarized antenna (6 GHz)







2. Frequency Plans (7 GHz Band)

Rec. ITU-R F.385-6* 7125-7425 MHz			
f o (MHz):	7275		
Channel Spacing(MHz):	7		
T/R Spacing(MHz):	161		
T/R Minimum(MHz):	28		
Channel	*f* (MHz)	Channel	*f'*(MHz)
1	7128	1'	7289
2	7135	2'	7296
3	7142	3'	7303
4	7149	4'	7310
5	7156	5'	7317
6	7163	6'	7324
7	7170	7'	7331
8	7177	8'	7338
9	7184	9'	7345
10	7191	10'	7352
11	7198	11'	7359
12	7205	12'	7366
13	7212	13'	7373
14	7219	14'	7380
15	7226	15'	7387
16	7233	16'	7394
17	7240	17'	7401
18	7247	18'	7408
19	7254	19'	7415
20	7261	20'	7422

Rec. ITU-R F.385-6* 7425-7725 MHz			
f o (MHz):	7575		
Channel Spacing(MHz):	7		
T/R Spacing(MHz):	161		
T/R Minimum(MHz):	28		
Channel	*f* (MHz)	Channel	*f'* (MHz)
1	7428	1'	7589
2	7435	2'	7596
3	7442	3'	7603
4	7449	4'	7610
5	7456	5'	7617
6	7463	6'	7624
7	7470	7'	7631
8	7477	8'	7638
9	7484	9'	7645
10	7491	10'	7652
11	7498	11'	7659
12	7505	12'	7666
13	7512	13'	7673
14	7519	14'	7680
15	7526	15'	7687
16	7533	16'	7694
17	7540	17'	7701
18	7547	18'	7708
19	7554	19'	7715
20	7561	20'	7722

*

Frequency Plans 7 GHz Band *continue* **** fo:*** *can be 7275, 7400, 7575 or 7700* ***MHz***

Rec. ITU-R F.385-6*
7250-7550 MHz

f o (MHz):	7400
Channel Spacing(MHz):	7
T/R Spacing(MHz):	161
T/R Minimum(MHz):	28

Channel	*f* (MHz)	Channel	*f'* (MHz)
1	7253	1'	7414
2	7260	2'	7421
3	7267	3'	7428
4	7274	4'	7435
5	7281	5'	7442
6	7288	6'	7449
7	7295	7'	7456
8	7302	8'	7463
9	7309	9'	7470
10	7316	10'	7477
11	7323	11'	7484
12	7330	12'	7491
13	7337	13'	7498
14	7344	14'	7505
15	7351	15'	7512
16	7358	16'	7519
17	7365	17'	7526
18	7372	18'	7533
19	7379	19'	7540
20	7386	20'	7547

Rec. ITU-R F.385-6*
7550-7850 MHz

f o (MHz):	7700
Channel Spacing(MHz):	7
T/R Spacing(MHz):	161
T/R Minimum(MHz):	28

Channel	*f* (MHz)	Channel	*f'* (MHz)
1	7553	1'	7714
2	7560	2'	7721
3	7567	3'	7728
4	7574	4'	7735
5	7581	5'	7742
6	7588	6'	7749
7	7595	7'	7756
8	7602	8'	7763
9	7609	9'	7770
10	7616	10'	7777
11	7623	11'	7784
12	7630	12'	7791
13	7637	13'	7798
14	7644	14'	7805
15	7651	15'	7812
16	7658	16'	7819
17	7665	17'	7826
18	7672	18'	7833
19	7679	19'	7840
20	7686	20'	7847

Channels Frequencies Calculation Equation in 7 GHz:

1 - Low Frequency

$$Fn = F0 - 154 + 7xn$$

n: Is a number of channels from channel 1 to channel 20 (Low Frequency).
F0: Center Frequency:
Low ban Fo=7275 MHz
Medium band Fo=7400 MHz
Upper band Fo=7575 MHz
High band Fo=7700 MHz

2 - High Frequency

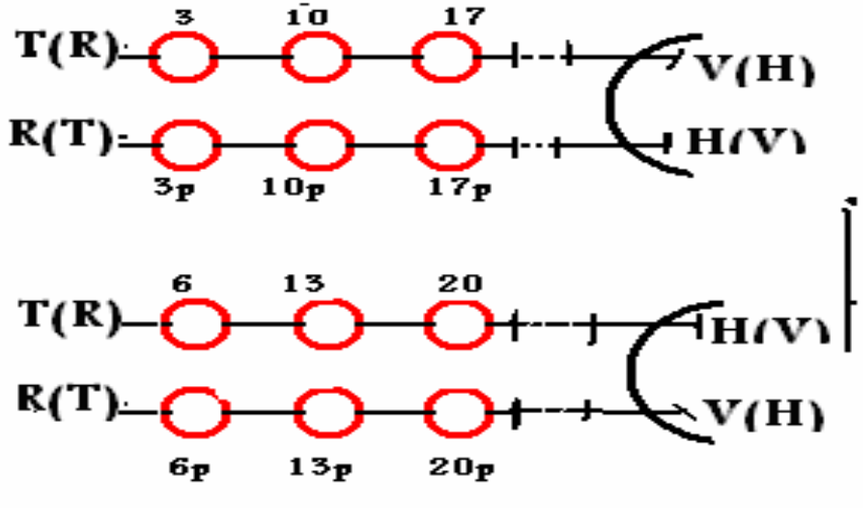
$$Fn' = F0 + 10 + 7xn'$$

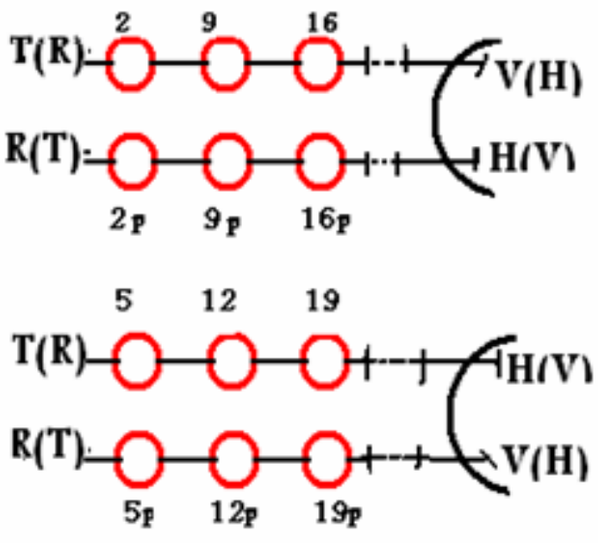
n' : Is a number of channels from channel 1' to channel 20' (High Frequency).

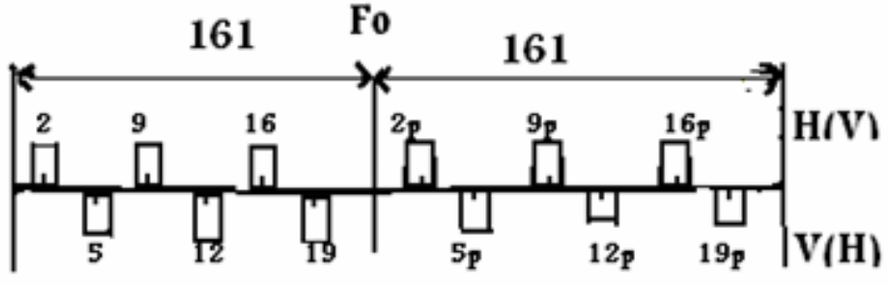
F0: Fo = 6770 MHz (Center Frequency).

Frequency Planning (continued)

- **Low band:** 7128 to 7422 MHz Fo = 7275 MHz
- ***Medium band:*** *7253 to 7547 MHz Fo = 7400 MHz*
- **High band:** 7742 to 7722 MHz Fo = 7575 MHz
- **Carrier or channel arrangement:** ITU-R Rec. 385-6
- **Number of two-way channels:** 20
- **Minimum spacing with cross-polarization:** 28 MHz
- **Tx / Rx Frequency spacing:** 161 MHz
- **Tx / Tx freq. spacing:** -for capacity up to 8xE1: 28 MHz & -for capacity 16E1: 56 MHz







3. Frequency Plans (13 GHz) Band

ITU Rec/CEPT;	F 497-5/CEPT
Band MHz:	12750-13250
Number of Channels	8
Channel Bandwidth	28 MHz
T/R Spacing	266 MHz
Guard Band	42 MHz
Band Edges	
Low/Low	12751 MHz
Low/High	12975 MHz
High/Low	13017 MHz
High/High	13241 MHz

ITU-R Rec. 497-5 ITU-R Rec. 497-5 Annex 1
12.75-13.25 MHz

f o (MHz):	12996
Channel Spacing (MHz):	28
T/R Spacing (MHz):	266
T/R Minimum (MHz):	70

Channel	*f* (MHz)	Channel	*f'* (MHz)
1	12765	1'	13031
2	12793	2'	13059
3	12821	3'	13087
4	12849	4'	13115
5	12877	5'	13143
6	12905	6'	13171
7	12933	7'	13199
8	12961	8'	13227

Channel band width: 28 MHz /16 E1 & 14 MHz /8 E1 & 7 MHz /4 E1
Tx – Rx spacing: 266 MHz
Tx / Tx freq. spacing: for capacity up to 8 E1 : 28 MH & for capacity 16E1: 56 MHz

ODUs Frequency Coverage Range (13 GHz)

1. ODUs of Microwave Harris System: Frequency Coverage Range: ***114 MHz***

Sub band 1: -Low Frequency TX (Rx): 12751 ***to*** 12865 MHz
-High Frequency Rx (Tx): 13017 ***to*** 13131 MHz
Sub band 2: -Low Frequency Tx (Rx): 12863 ***to*** 12977 MHz
-High Frequency Rx (Tx): 13129 ***to*** 13243 MHz

2. ODUs of Microwave Stratex System: Frequency Coverage Range: ***84 MHz***

Sub band 1: -Low Frequency TX (Rx): 12751 ***to*** 12835 MHz
-High Frequency Rx (Tx): 13017 ***to*** 13101 MHz
Sub band 2: -Low Frequency Tx (Rx): 12863 ***to*** 12977 MHz
-High Frequency Rx (Tx): 13129 ***to*** 13243 MHz
Sub band 3: -Low Frequency Tx (Rx): 12751 ***to*** 12865 MHz
-High Frequency Rx (Tx): 13017 ***to*** 13131 MHz

3. ODUs of Microwave NEC System: Frequency Coverage Range: ***54.25 MHz***

Sub band A: -Low Frequency TX (Rx): CH 1= 12754.50 ***to*** CH 32= 12808.75 MHz
-High Frequency Rx (Tx): CH 1'= 13020.50 ***to*** CH 32'= 13074.75 MHz
Sub band B: -Low Frequency TX (Rx): CH 1= 12810.50 ***to*** CH 32= 12864.75 MHz
-High Frequency Rx (Tx): CH 1'= 13076.50 ***to*** CH 32'=13130.75 MHz
Sub band C: -Low Frequency Tx (Rx): CH 1= 12866.50 ***to*** CH 32= 12920.75 MHz
-High Frequency Rx (Tx): CH 1'= 13132.50 ***to*** CH 32'= 13186.75 MHz
Sub band D: -Low Frequency TX (Rx): CH 1= 12922.50 ***to*** CH 32= 12976.75 MHz
-High Frequency Rx (Tx): CH 1'= 13188.50 ***to*** CH 32'= 13242.75 MHz

Notes: 1. *Frequency spaces between these channels should be kept in: • 4 MB System: 3.5 MHz & • 8 MB System: 7 MHz & • 17 MB System: 14 MHz & • 34 MB System: 28 MHz*

2. *For 17 MB system, radio frequency assignment can be applied to channels from CH 3 to CH 27 (CH 3' to CH 27').*

3. *For 34 MB system, radio frequency assignment can be applied to channels from CH 7 to CH 23 (CH 7' to CH 23').*

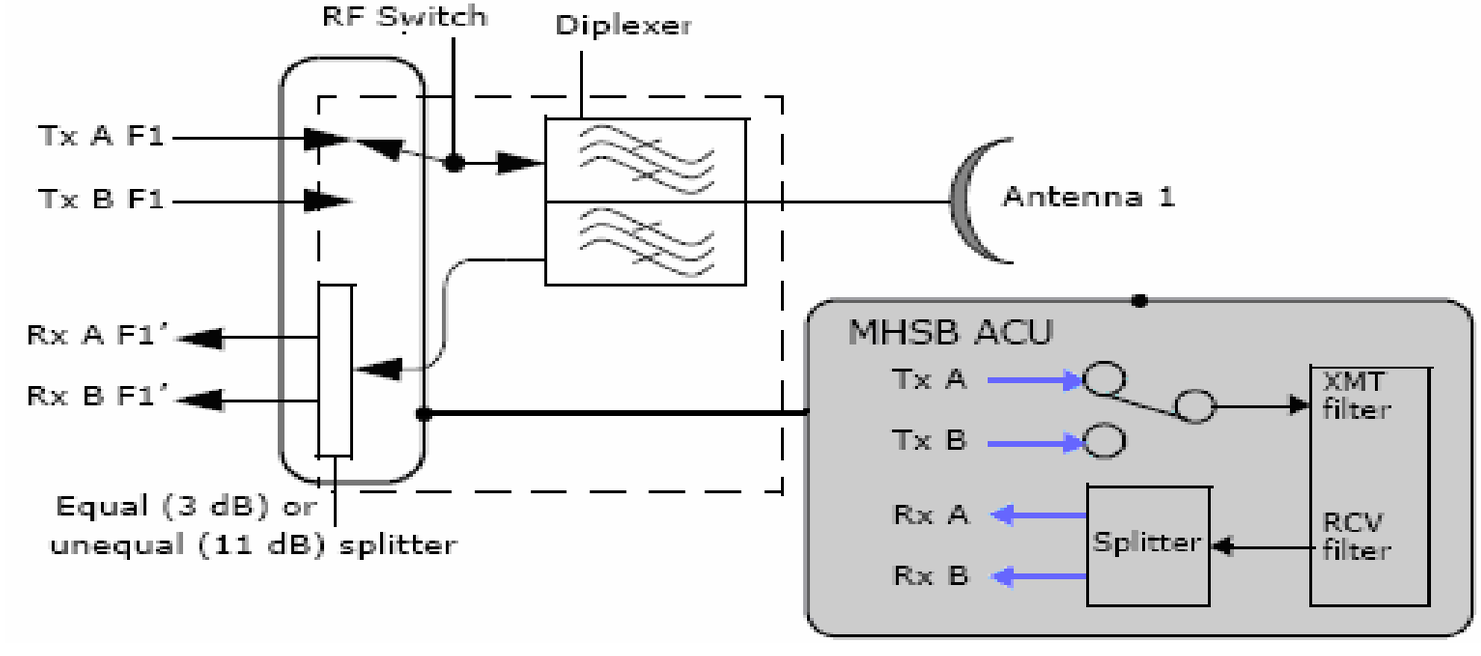
Protected System:

Two ODUs and two IDUs are used at each end of a link to protect against transmission failure. If a data transmission fails on the operating ODU/IDU, it is transferred to the backup ODU/IDU

1. Hot Standby (HSB)

A protected terminal, also known as 1+1, provides two redundant Transmission paths, but only one is active at any one time. A hot standby (HSB) terminal consists of two ODUs and two IDUs. Each transceiver operates on a single frequency, with the online transmitter active while the offline unit is operational with the transmitter muted. With the offline transmitter constantly on, traffic can be restored in a matter of milliseconds if the online unit fails, without any warm-up time. In the receive path, the incoming signal is split between the two receivers. The system software automatically selects the receiver with the better quality signal. An HH configuration is normally chosen when traffic carried is critical in nature

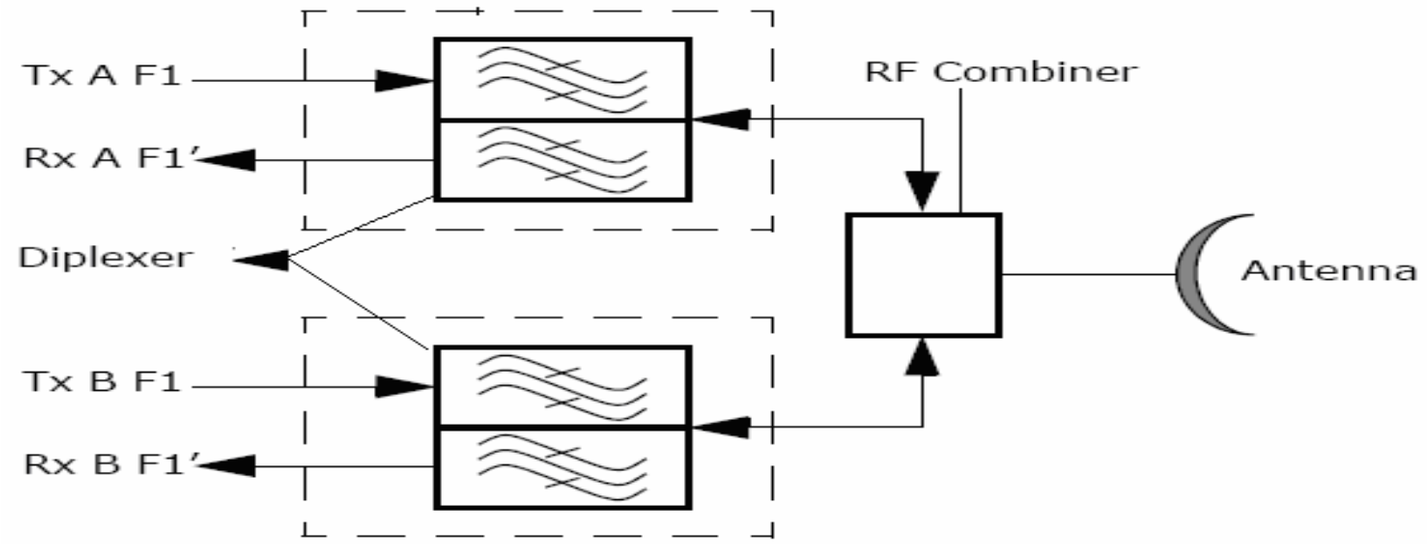
Hot Standby 1+1 Outdoor with Equal or Unequal Split



Hot Standby 1+1 Outdoor with RF Combiner

The system configuration of a radio in which two sets of circuitry are arranged in tandem, with one in back-up mode in case of a failure occurs in the operational circuitry.
A microprocessor monitors the on-line circuitry and switches to the back-up circuitry if a failure is detected. Having the back-up powered-up means it is ready for immediate operational service

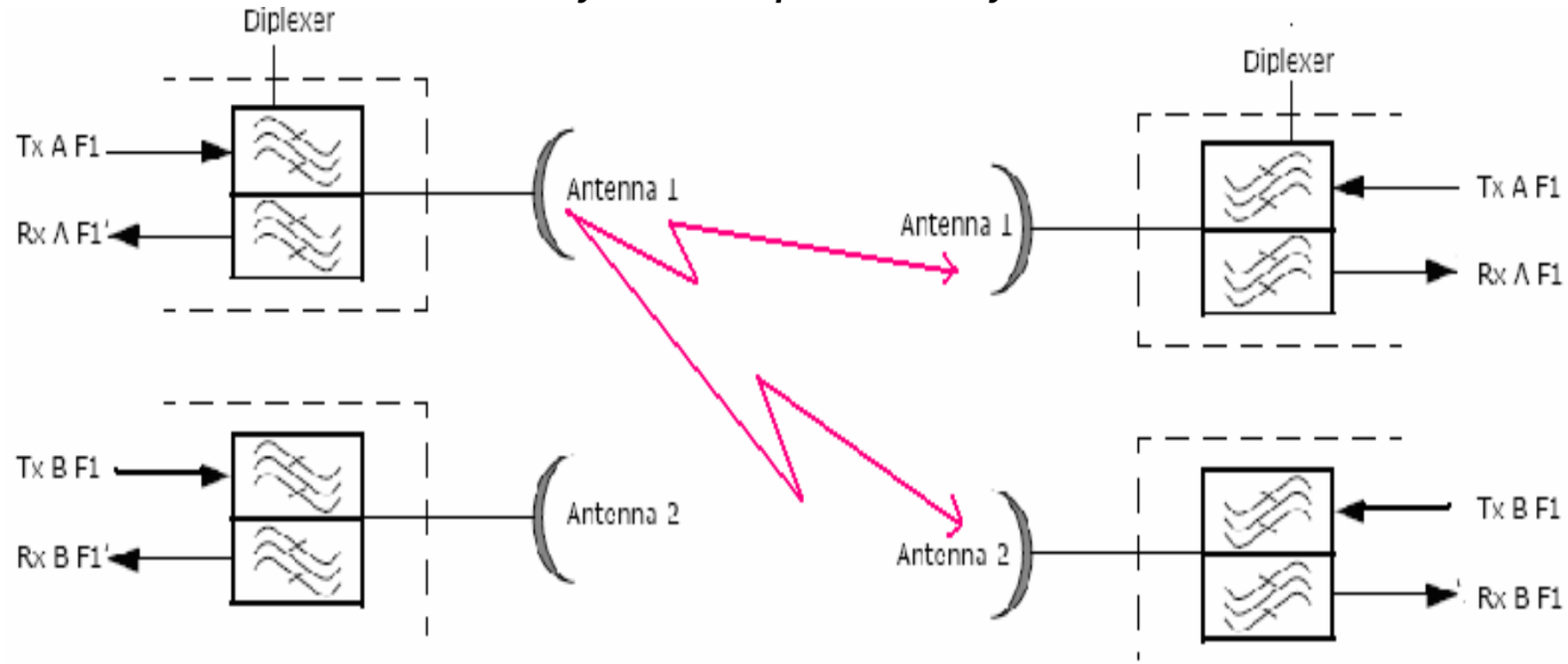
Hot Standby 1+1 Outdoor with RF Combiner



2. Hot Standby (HSB) with Space Diversity (SD)

The main and standby radios are set up in Hot Standby mode, but are connected to their own antennas.
Both antennas, separated by a specific distance, are receiving the signal transmitted from the online radio at the other end of the link. If a fault occurs in the receiving end of the link, the traffic is switched to the standby radio without causing errors (hitless receive switching).
As in Hot Standby mode, a fault detected in the online transmitter causes that transmitter to mute and the standby radio to unmute

Hot Standby 1+1 with Space Diversity



Note: Tx A or Tx B muted when other channel active.

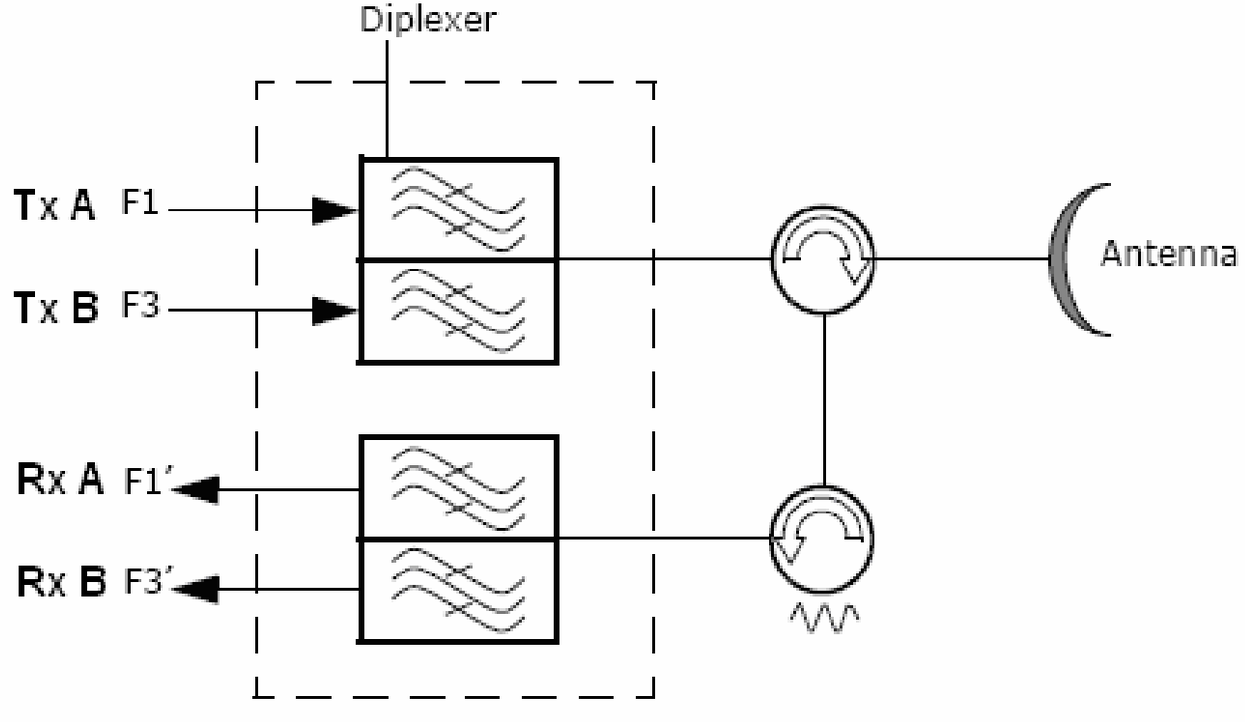
3. Frequency Diversity (FD)

Frequency diversity is a dual-frequency protected configuration, which provides protection against multi-path fading (although less than that provided by space diversity), but requires the use of a single antenna. In FF configuration, the main and redundant radio paths operate on different frequencies, with path selection made again between the two received signals. There is no transmitter switch.
Since an additional frequency is needed in addition to the main traffic channel, FD is often not permitted in regions that experience frequency band congestion.

Frequency Diversity Block Diagram:

The main and standby radios are transmitting simultaneously and are tuned to different frequencies to avoid interference.

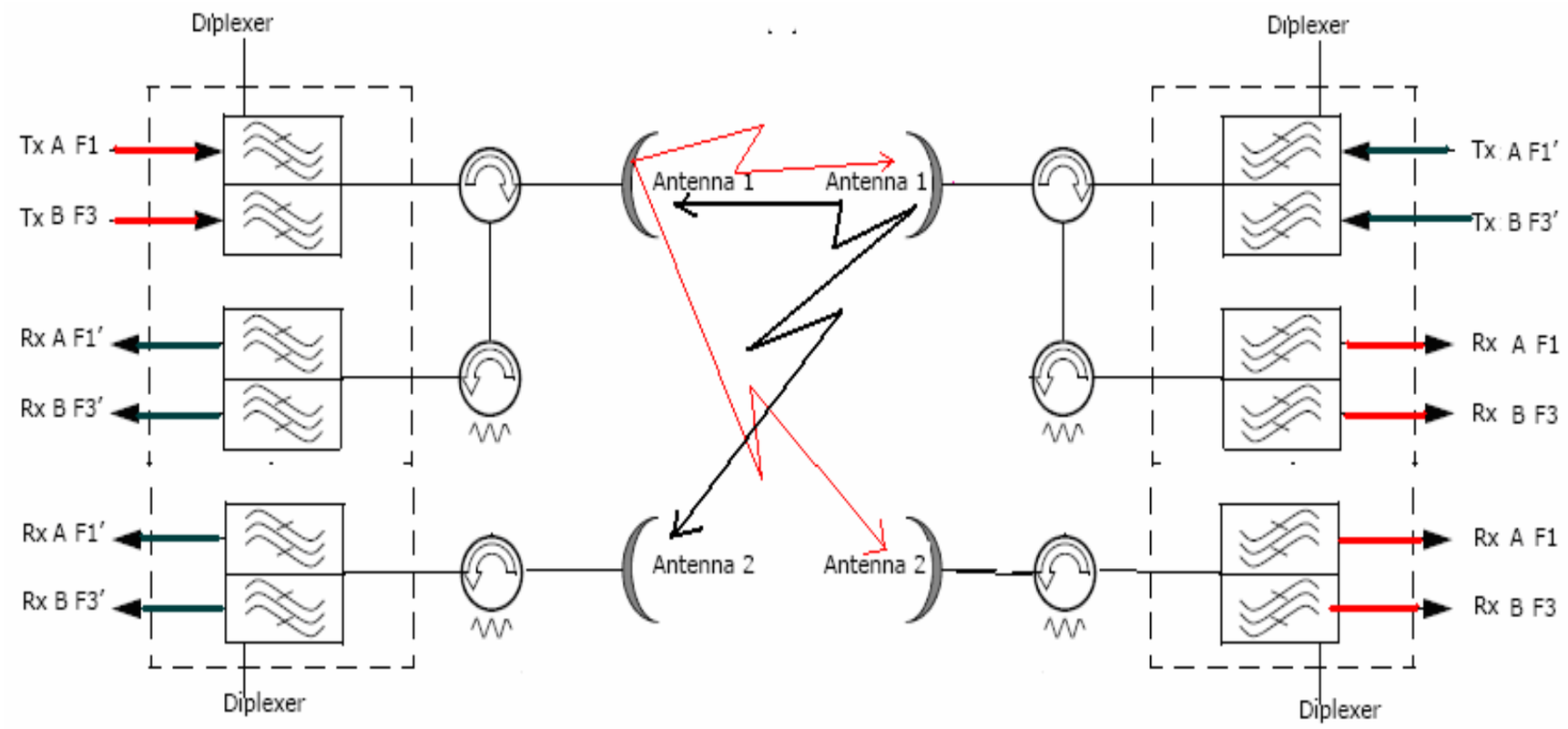
1+1 Frequency Diversity



4. Frequency Diversity (FD) with Space Diversity (SD)

Space Diversity is a special equipment configuration used to reduce the adverse effects caused by multi-path fading. As this only occurs at lower frequencies, this feature is offered in frequencies from 5 to 15 GHz. The diversity operation is realized by receiving the same signal using two antennas, spatially separated (vertically). Each antenna is connected to a receiver. The better quality signal is then selected in the receiver, based upon bit error rate (BER).
The decision to deploy HS depends upon path analysis of the link, and is
influenced by the path length, terrain type and variation, geographical location, and link availability target. Space diversity comes at the expense of additional cost and tower loading of the second, diversity receive antenna.

1+1 Frequency Diversity with Space Diversity Block Diagram



1) What is the main deference between the following systems:-

- ❖ . 1+1 Hot standby & 1+1 frequency diversity?
- ❖ . 1+1 Hot standby &1+1 hot standby with space diversity?

---

2) What is the Tx / Rx frequency spacing that PTC digital radio systems used in the following Frequency Bands (6 GHz, 7GHz and 13 GHz)?

---

3) What is the minimum spacing frequency with cross-polarization in the 6 GHz, 7 GHz and 13 GHz frequency bands?

---

4) If you have point to point radio system with the following information:

- ❖ Transmit power: 27 dBm
- ❖ Channel frequency: 7200 MHz
- ❖ Transmit branching loss: 2.2 dB
- ❖ Receive branching loss: 2.8 dB
- ❖ Distance between two hops: 45 Km
- ❖ Tx & Rx Antenna diameter: 1.8 meters
- ❖ Receive threshold (BER = 10^{-6}): -78 dBm

Calculate the:-

a) Receive Signal Level (RSL) (dBm)?
b) Flat fade margin (dB)?
c) System gain (dB)?

---

5) What is the Gain of the following antennas?

a) . 13 GHz: 0.3 m & 0.6 m
b) . 7 GHz: 0.6 m & 1.2 m

UNIT 2

MicroStar® Type ll MHSB 1+1 (7 & 13 GHz) System

Objective:

In this Unit you will learn about digital microwave {MicroStar® Type ll MHSB 1+1 (7 & 13 GHz) System} and to be able to do the operation and maintenance for this type of digital radio system.

Contents:

Chapter 1: Introduction

1- Performance Characteristics
2- Consists of MicroStar® type ll HSB 1+1 radio
3- Functional Description
4- IDU Interface Terminals and Jacks
5- ODU Interface Terminals and Jacks
6- Theory of operation
  6-1- Transmit direction functions
  6-2- Receive direction functions
  6-3- Protected Terminal

7- Cable Interface

Chapter 2: Operation and maintenance

1- Monitoring, Controlling and Configuration
 By using a Hand-Held Terminal or a VT-100 Terminal

Unit Exercises

CHAPTER 1

MicroStar® type II Introduction

- ***Performance Characteristics***
- ***Consists of MicroStar® type II HSB 1+1 radio***
- ***Functional Description***
- ***IDU Interface Terminals and Jacks***
- ***ODU Interface Terminals and Jacks***
- ***Theory of operation***
- ***Cable Interface***

1. Performance Characteristics

System / Description	Microstar Type 2 (7GHz)	Microstar Type 2 (13GHz)
Frequency band (GHz)	7.1 to 7.7	12.750 to 13.250
Frequency range (MHz)	L. Band: 7128 to 7422 U. Band: 7428 to 7722	L. freq. : 12751 to 12865 U. freq. : 13017 to 13131
Tx – Rx Spacing (MHz)	161	266
Channel bandwidth (MHz)	2x E1 = 3.5 & 4x E1 = 7 & 8x E1= 14 & 16 x E1=28	
Modulation Type	QPSK	
Tx Output Power (dBm)	28	22
Branching loss (dBm)	Tx = 1.5 dB & Rx = 2 dB	
Tx Power Control	30 dB in 1 dB step	
Output power muting	-70 dB from nominal output power	
MHSB 1+1 Rec. threshold at BER 10^{-6} (dBm)	2E1: ch A -89 & ch B -78 4E1: ch A -86 & ch B -75 8E1: ch A -83 & ch B -72 16E1: ch A -80 & ch B -69	2E1: ch A -89 & ch B -84 4E1: ch A -86 & ch B -81 8E1: ch A -83 & ch B -78 16E1:ch A -81 & ch B -76
MHSB 1+1 + S.D. Rec. Threshold at BER 10^{-6} (dBm)	2E1: ch A or ch B= -90 4E1: ch A or ch B= -87 8E1: ch A or ch B= -84 16E1: ch A or ch B= -82	2E1: ch A or ch B = -90 4E1: ch A or ch B = -88 8E1: ch A or ch B = -85 16E1: ch A or ch B = -82
IF Signal (MHz)	Tx IF = 310 & Rx IF = 70 ±200 KHz	
Loopback	- Tributary E1 Far End Loop (local & remote) - MUX Near End Loop (local & remote)	
Control , Configuration & Monitoring	- HHT or VT – 100 - Web CIT	
Tributary signal	2xE1 /4xE1 / 8xE1 / 16 X E1 E1: (2,048 Mb/s) with HDB3 Code 120 ohm impedance unbalanced	

System / Description	Microstar Type 2 (7GHz)	Microstar Type 2 (13GHz)
Residual BER	better than 10^{-12}	
Max. length of coaxial cable	236 meters	
Local oscillator freq. stability	≤ ± 7 ppm	
Local oscillator type	Synthe sizer	
Freq. step size	Freq. setting is programmable with step size 250 KHz	
AGC range	-93 to – 20 dBm	
Recommended RF input level	- 45 dBm	
Max. RF input level	-20 dBm no error & -10 dBm no damage	
RSL range	-30 to -85 ± 4 dBm	
Switching type	Tx sw.: not hitless Rx sw.: hitless or < 10 errors	
Service channel 1 (data channel)	Interface port : RS-232 (V.28) write (96 kbaud) Data bridge : 4 way Max. baud rate: 9.6 k baud	
Service channel 2 VF channel (PCMCIA) 2 wrie telphon sel 4 wrie VF in/out interface	Impedance: 600 ohm blanced input level: -16 or 0 dBm (4 W port) output level: +7 or 0 dBm (4 W port) freq. band width: 300 Hz to 3400 Hz VF- wire bridge: 4-way Signaling other sites: 3 digit to select sites or call all sites	
Consumption power	48 vdc without optional units SPU = 22 watts & PU = 10 watts & RFU = 40 watts	
Temperature range	DU = 0◦C to 50 ◦C ODU=33 ◦C to 55 ◦C	
Warm-up time from cold start	IDU = 5 minutes ODU =10 minutes	

2. Consists of MicroStar® type ll HSB 1+1 radio

MicroStar® Type ll MHSB 1+1 (7& 13 GHz) System consists of:

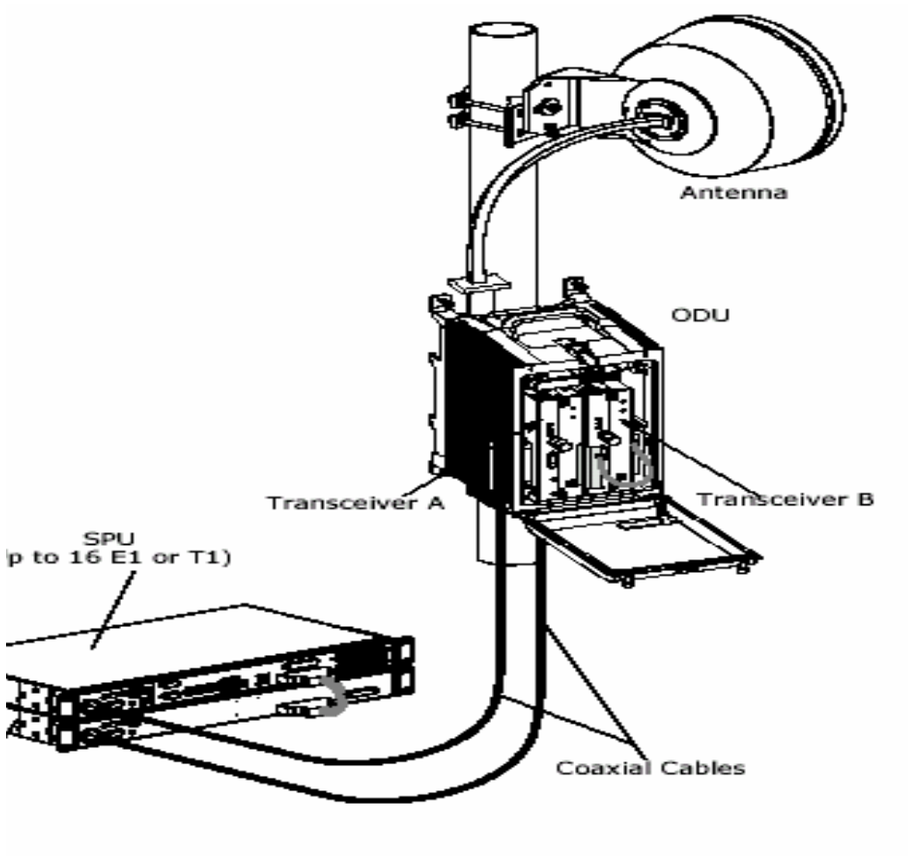
a - An IDU with:

- One Signal Processing Unit (SPU)
- One Protection Unit (PU)

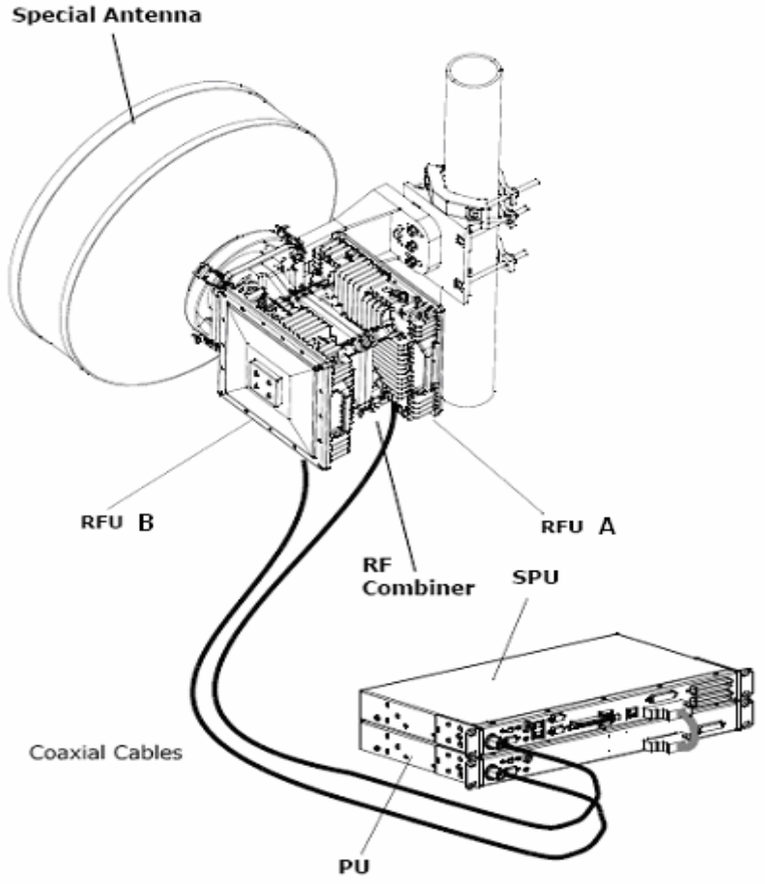
b - An ODU with:

- Two transceivers (for 7 GHz) or tow RFUs,(for 13 GHz) each connected by one coaxial cable to the SPU and the PU.

MicroStar® Type ll MHSB 1+1 (7 GHz) System



MicroStar® Type ll MHSB 1+1 (13 GHz) System



3. Functional Description

A- The SPU performs the following functions:

- signal processing on the tributary data and control data,
- monitoring and controlling the operation of the microwave radio,
- supplying the ODU with power, a modulated IF transmit signal, and a telemetry signal.

B- The PU Protection provides:

- modulation, demodulation, and FEC decoding for channel-B in a monitored hot standby configuration.
- insure that the channel-B signal is in phase with the channel-A signal when they are switched, and
- enable errorless switching.

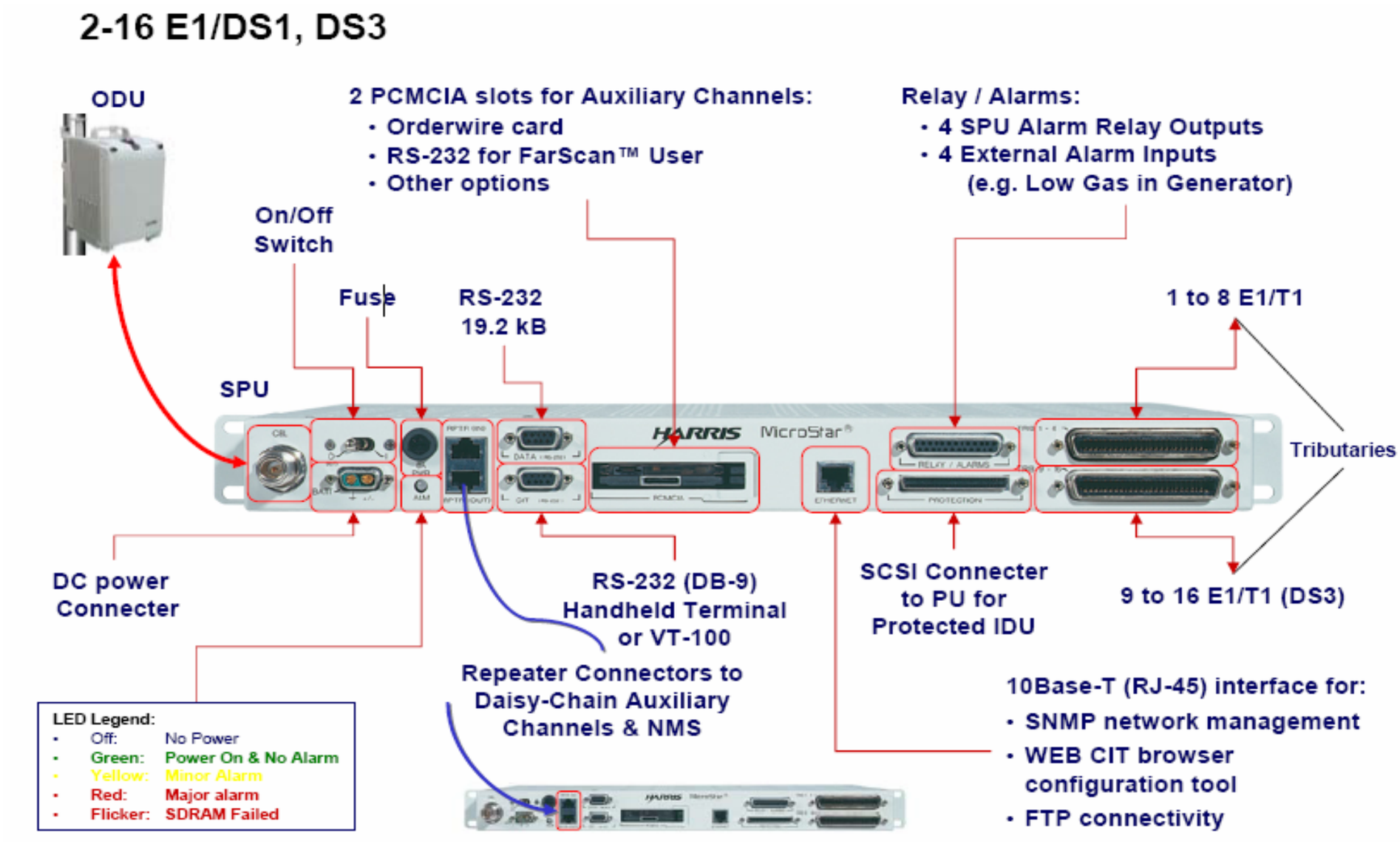
Note 1:
Transmit direction protection switching takes place through the transmit RF switch in the ODU.

Note 2:
Receive direction protection switching takes place in the SPU.
Under the control of the radio controller, the DADE circuit will select the signal coming from either receiver A or receiver B for the demultiplexer to process.

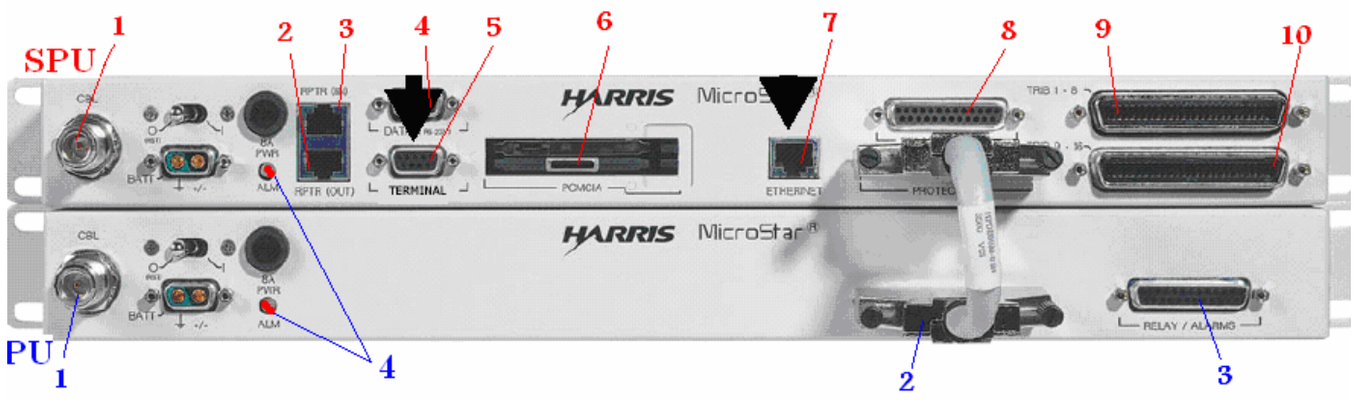
C- The ODU performs the following functions:

- up / down conversion, amplification, filtering and antenna coupling functions.
- supplying the SPU with a modulated IF receive signal and telemetry signal.
  The telemetry signals are used by the controller unit in the SPU to control and monitor the operation of the ODU.

4. IDU Interface Terminals and Jacks



IDU Interface Terminals and Jacks



SPU (Signal Processing Unit):-

1- **CBL:** Connects the IF, power, and telemetry from ODU.
2- **RPTR (OUT):** RJ45 port, connects network data, utility data, and voice frequency data (the Netcom channel) to other radios at the same site.
3- **RPTR (IN):** RJ45 port, connects network data, utility data, and voice frequency data (the Netcom channel) to other radios at the same site.
4- **DATA:** (RS-232):Connects asynchronous utility data channel to user's equipment — supported by software 9.4.10 and higher.
5- **TERMINAL:** connects to a VT-100 or HHT Keypad which can then access the resident control software.
6- **PCMCIA:** Slots for two PCMCIA cards, serial port allowing for optional order wire, 64k data channel (future), and FarScan™ connection
7- **10BASE-T/NMS:** RJ45, connects to operator's PC and provides control access by means of Web CIT and FTP.
8- **RELAYS / ALARMS:** Relay terminals and alarm inputs.
9- **TRIB 1 - 8:** Connects tributaries to user's equipment
10- **TRIB 9 -16:** Connects tributaries to user's equipment.

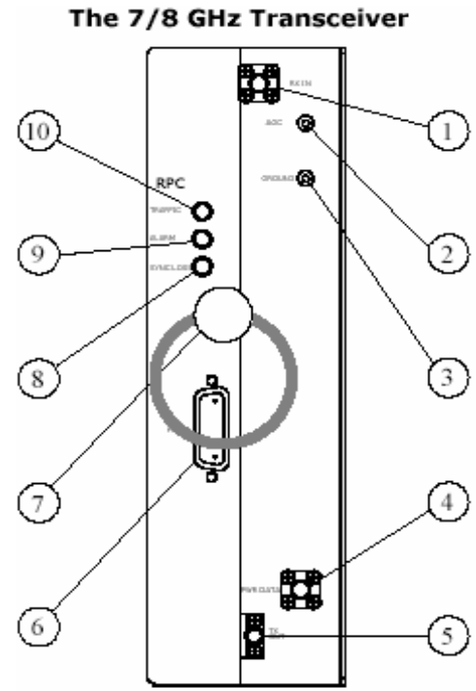
PU (Protection Unit):-

1- **CBL:** Connects traffic, power, and telemetry to ODU.
2- **PROTECTION:** Connects traffic and control lines to the SPU
3- **RELAYS / ALARMS:** Relay terminals and alarm inputs.
4- **ALM:** Three-color LED*: red* = major alarm, *yellow* =minor alarm and *green* = all OK

5. ODU Interface Terminals and Jacks

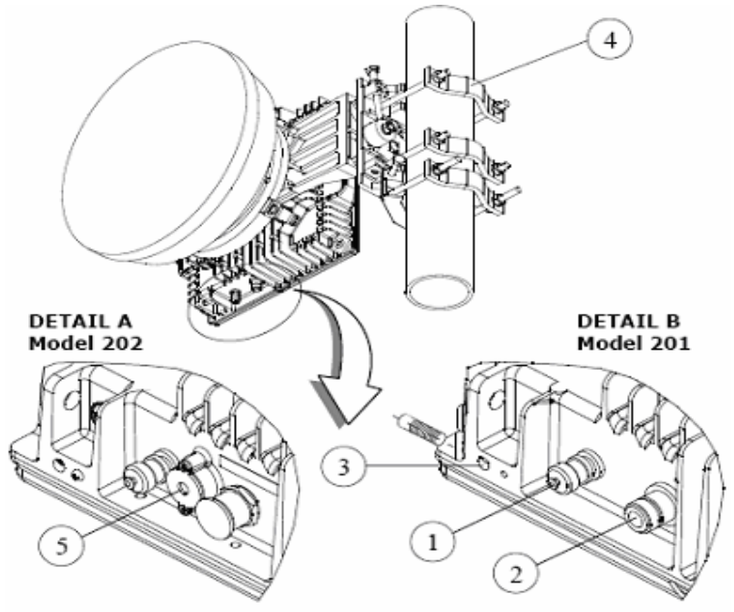
5.1- Transceiver 7GHz

1- RX IN or RX: Connects to the receive RF filter.
2- AGC: test point for the AGC voltage.
3- GND or GROUND:, ground to be used with AGC test point.
4- PWR / DATA or IDU / ODU: Connector on the chassis, to the IDU.
5- TX OUT or TX: Female SMA.
6- HPA: DB15 connects to the HPA (if equipped).
7- Retaining knob; used to secure the transceiver in the ODU.
8- SYNC LOSS: Red LED, indicates that the IDU muldex has lost synchronization.
1- This usually indicates that the radio signal has been lost.
9- ALARM: Red LED. Indicates that the transceiver's radio processor module (RPM)
2- has failed or that there is a problem with the transmitter or receiver.
10- TRAFFIC: Green LED, indicates that traffic has been selected to pass through this transceiver.



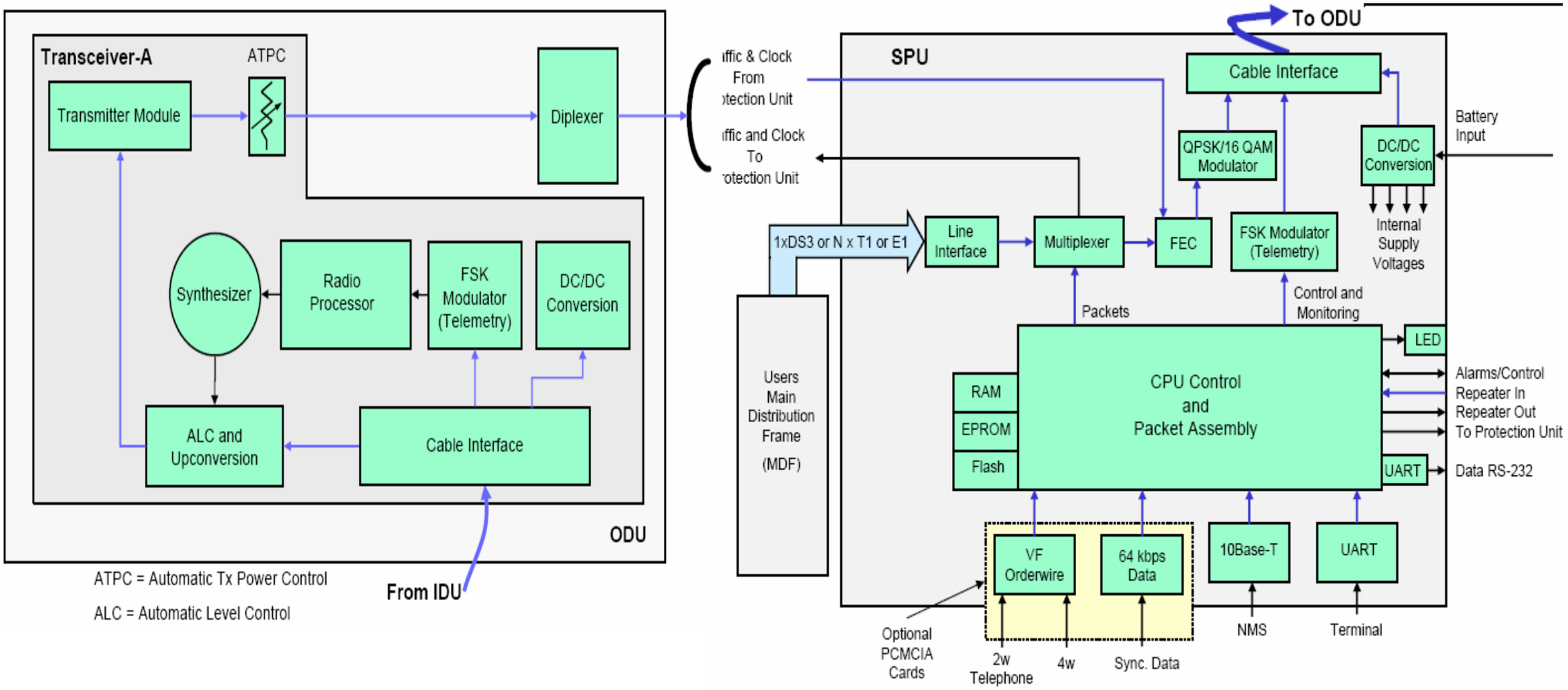
5.2- RFU 13 GHz

1. **BNC connector:** AGC Test point, used for alignment.
2. **N-type connector:** connects traffic, telemetry and power from the SPU.
3. **Grounding port hole:** for receiving grounding cable secured by side set screw.
4. **Pole mounting hardware:**
   • For the separate antenna configuration, it includes the mounting plate and block.
   • For the RFU, the RFU mounts on an antenna on a bracket, which is mounted on the pipe.
5. **LED:** (Detail A) for RFU model 202-92xxxx only.



6. Theory of operation

6-1- Transmit direction functions (Block Diagram — Transmit Direction)



Transmit signal description

1 Line Interface Module:

- Routes the signal to the SPU (Signal Processing Unit)

2 Line interface circuits

- convert the bipolar line coded signal into a binary return to- zero signal
- recover the clock from the incoming signal
- use the clock to regenerate the binary signal

3 low level multiplexer

- uses bit stuffing to synchronize the incoming tributaries
- combines the tributaries into a number of signals, such as:
  - One signal for 4 tributaries
  - Two signals for 8 tributaries, joined and fed directly to the high level multiplexer
  - Four signals for 16 tributaries, combined in one 34 Mbit/s signal, then fed to the high level multiplexer

4 High level multiplexer

- combines data with the network control channel, the utility data channel, and the voice frequency channel (if it is present)

5 FEC (forward error correction) circuit

- scrambles data and adds to it error correction codes
- uses 23/24 convolutional self-orthogonal code hat adds about 4% of overhead to the aggregate data rate

6 Serial-to-Parallel Converter

- converts signal into two bit-streams, the I and the Q signals for QPSK or 16QAM

7 Quadrature Mixers

- combine outputs to generate the QPSK or 16 QAM signal

8 Cable Interface

- receives the modulated signal and inserts it in the coaxial cable connecting the SPM to the corresponding transceiver in the ODU
- carries DC power for the ODU through the coaxial cable

9 Controller / Service Channel Module (CSM)

- generates a telemetry signal to configure and control the radio unit
- inserts this FSK modulated signal through the cable interface

10 Cable Interface (ODU's)

- extracts the modulated IF signal, the telemetry signal, and the DC power from the composite signal in the coaxial cable

11 ALC and Upconverter Block

- converts the modulated signal to a higher frequency in a two-stage mixer and regulates its amplify.

12 Transmitter Module

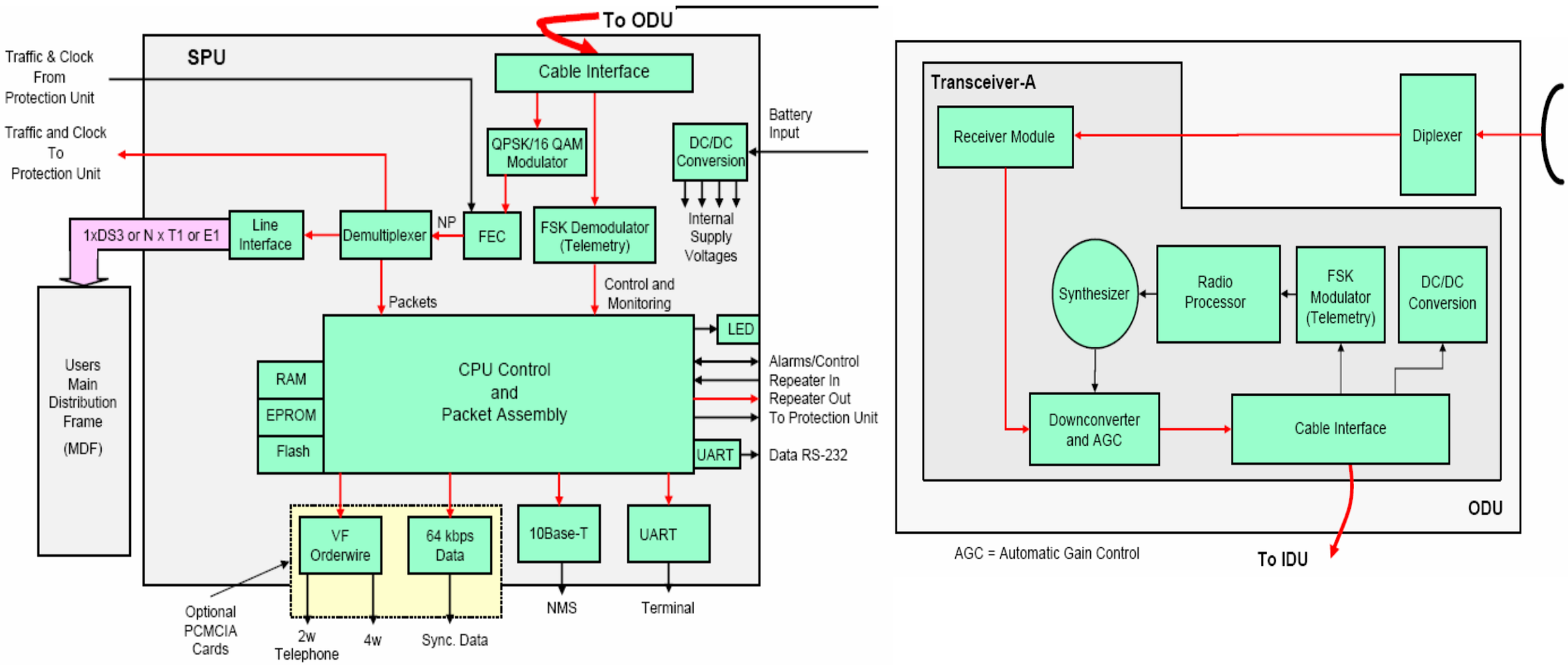
- raises the signal to the transmit frequency and amplifies it.

13 Diplexer

- carries the final signal through to the antenna.

6-2- Receive direction functions

Block Diagram — Receive Direction



Receive signal description

1 Diplexer
- keeps the in-coming signal separate from the out-going transmit signal and removes unwanted frequencies

2 Receive Module
- amplifies the signal and down converts it to a lower frequency

3 Down-converter and AGC Block
- down-converts the signal to the 70 MHz IF frequency
- control the signal level with automatic gain control circuits

4 Cable Interface (ODU's)
- inserts the IF signal in the coaxial cable along with FSK modulated telemetry data going to the corresponding SPM

5 Cable Interface (IDU's)
- extracts the IF and telemetry signals from the composite signal in the coaxial cable

6 FSK Demodulator
- carries telemetry to the controller

7 Demodulator
- carries the IF signal and regenerates the clock and data stream,
- sends the signal to the FEC circuit in the demultiplexing section of the SPM

8 FEC (Forward Error Correction)
- uses the correction codes embedded in the signal to correct it, as necessary

9 DADE Circuits

- receive the FEC decoded signal and align 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

10 High-level Demultiplexer

- receives the FEC decoded signal and separates it from the network control, utility data, digitized voice frequency, and traffic. The traffic is now:
  - one 34 Mbit/s signal (for the 16-tributary version)
  - two 8 Mbit/s signals (for the 8-tributary version)
  - one 8 Mbit/s signal (for the 4-tributary version)

11 Low-level Demultiplexer

- receives the signals and separates the E1 (2 Mbit/s) tributaries

12 Line Interface Driver

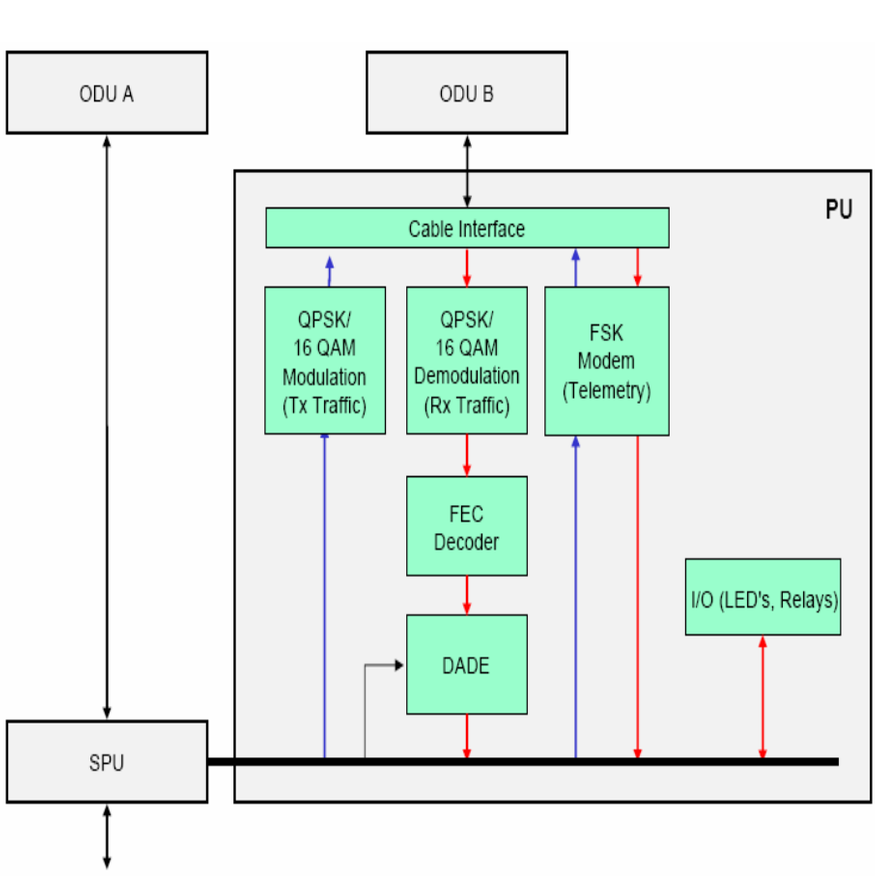
- receives each E1 tributary and converts the binary signal from the demux into either a bipolar HDB3 format

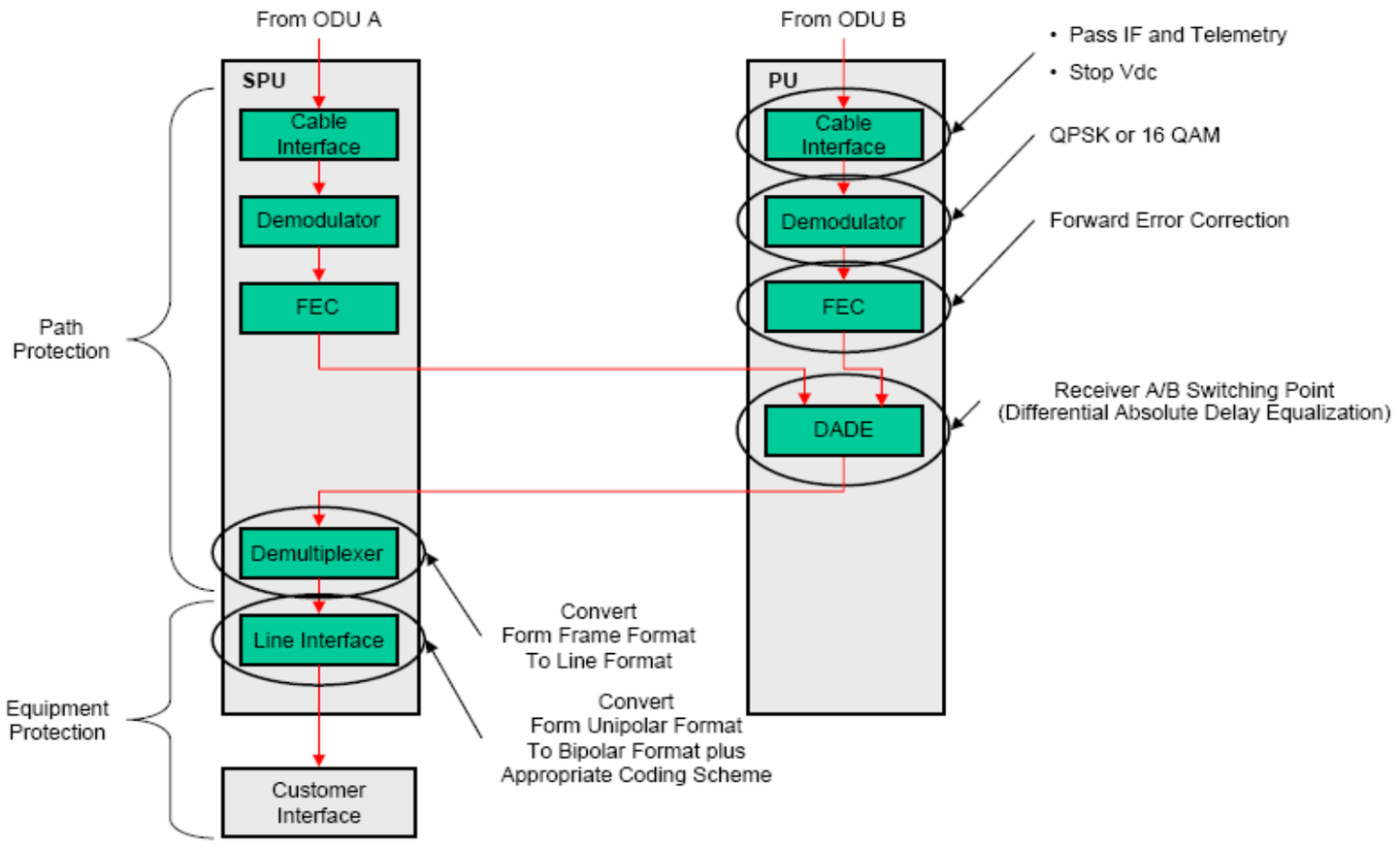
13 Line Interface Module

- contains a switch controlled by the SPU.
- selects the tributaries from one of the two (SPU or PU) in a protected radio and passes them to the output connector

6-3- Protected Terminal

PU Block Diagram

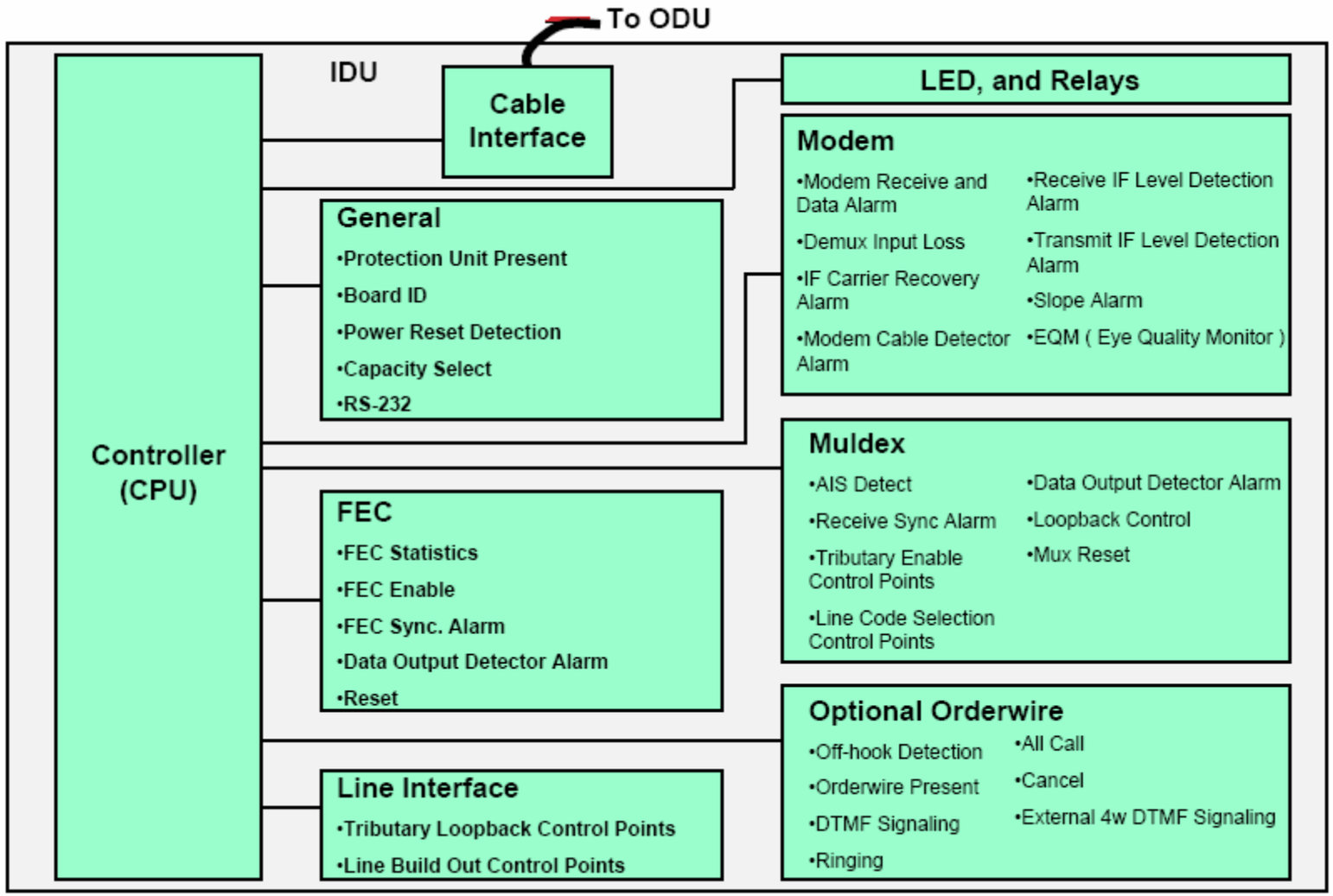




Note: Transmit direction protection switching takes place through the transmit RF switch in the ODU.

Note: Receive direction protection switching takes place in the SPU. Under the control of the radio controller, the DADE circuit will select the signal coming from either receiver A or receiver B for the demultiplexer to process.

Control and Monitoring



7. Cable Interface

The Cable Interface in the IDU performs the following functions:

1. Combines:

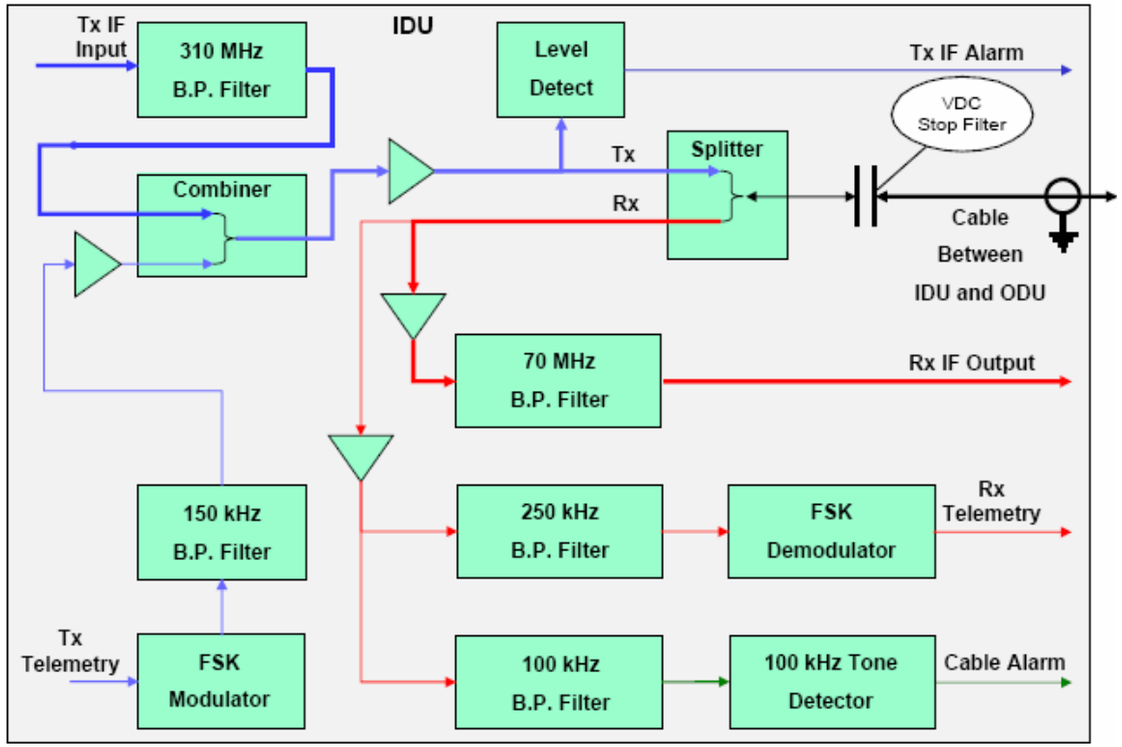
- 310 MHz Transmit IF
- IDU to ODU FSK Telemetry data
- -48 Vdc Battery to be sent to the ODU regulator

2. Decouples:

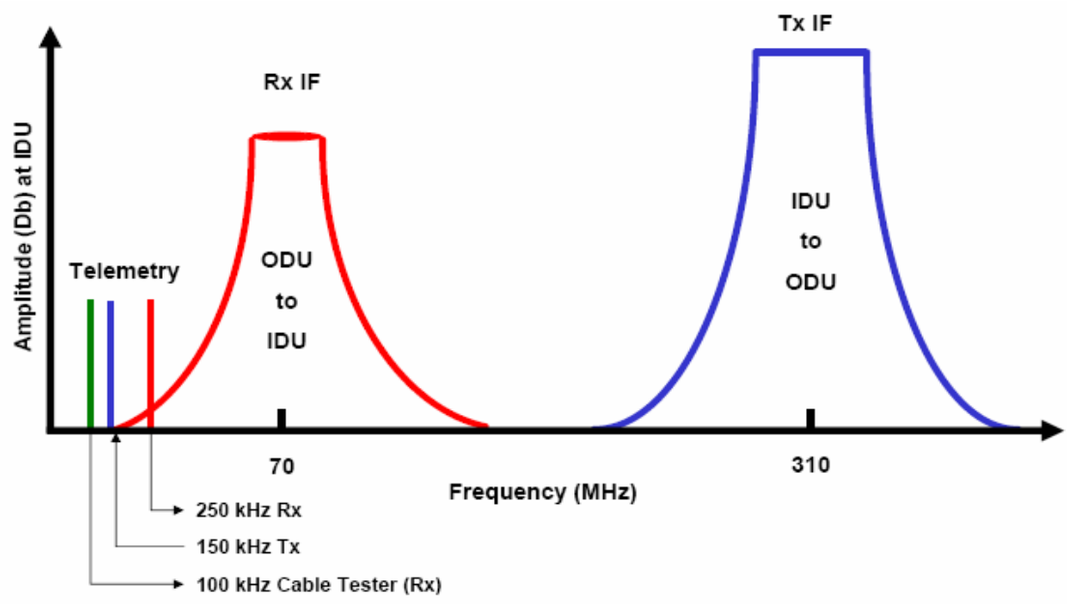
- 70 MHz Receive IF signal
- ODU to IDU FSK Telemetry data
- Prevent -48 Vdc Battery form entering the IDU

3. Provides alarms for:

- Transmit IF level
- Cable open circuit or short circuit



Cable RF Signal Spectrum



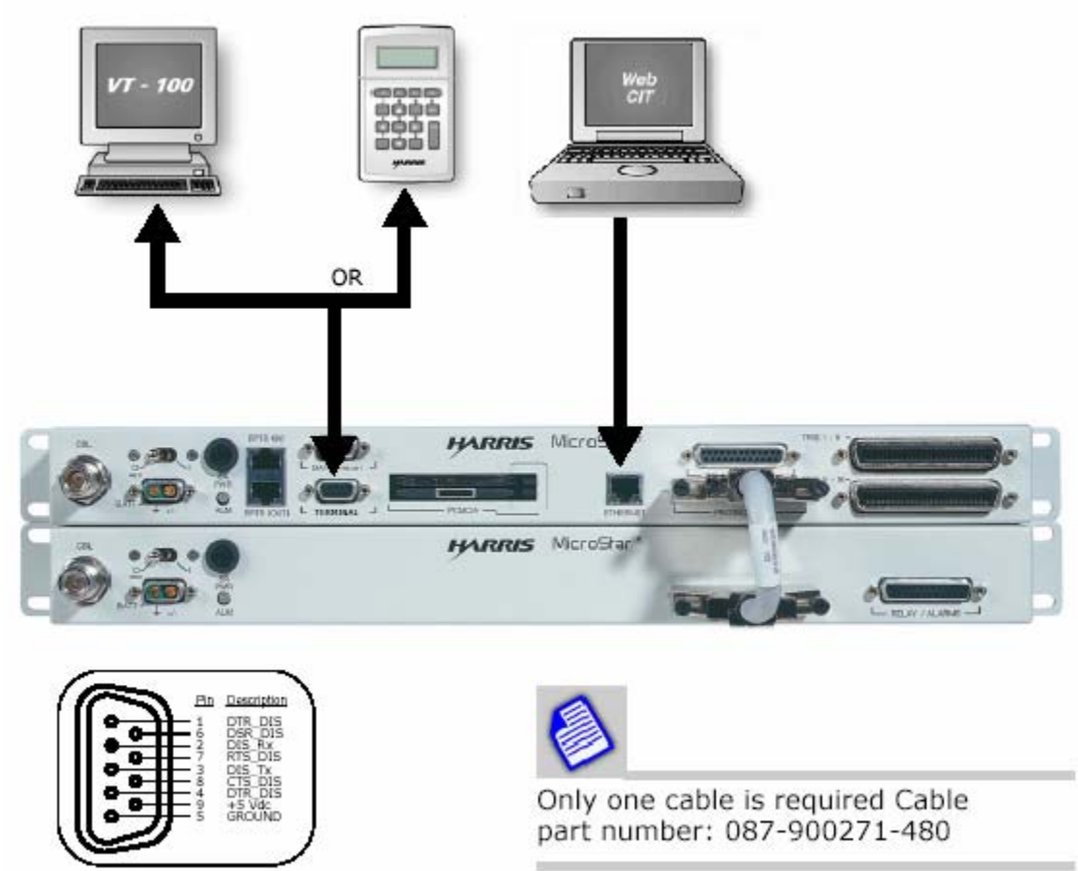
CHAPTER 2

Operation and Maintenance

- ***Monitoring, Controlling and Configuration***
- ***By using a Hand-Held Terminal or a VT-100 Terminal***
- ***Menu Tree (Main Menu)***
  - ***NE ADDRESS***
  - ***ALARM***
  - ***STATUS***
  - ***CONTROL***
  - ***PERFORMANCE***
  - ***CONFIGURATION***
  - ***SYSTEM DESCRIPTION***
  - ***SHUTDOWN***

Monitoring, Controlling and Configuration

There are two different way to use the Control, Configuration & Monitoring:
1- By using a ***Hand-Held Termina***l or a ***VT-100*** Terminal method
2- By using a ***web CIT*** method



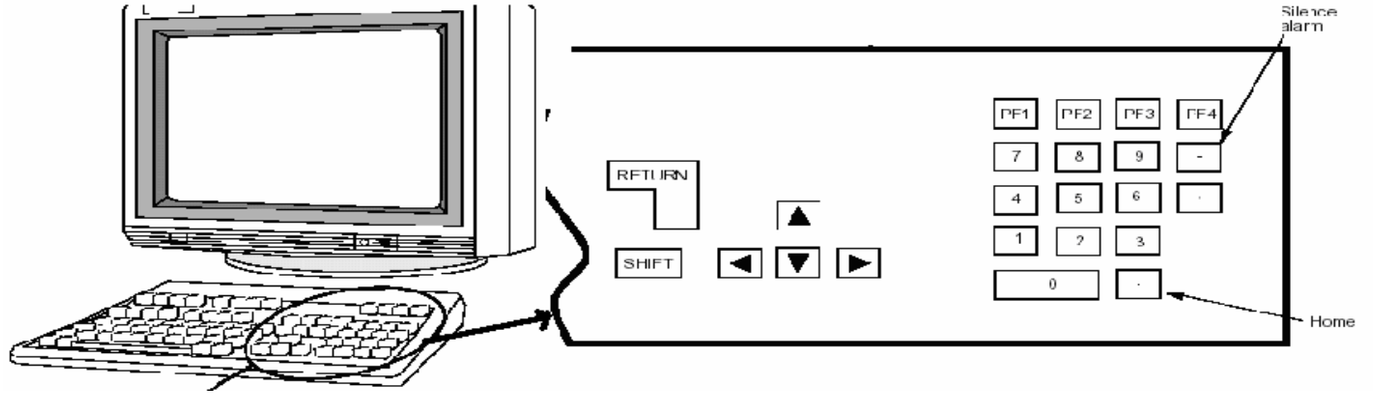
1- By using a Hand-Held Terminal or a VT-100 Terminal

A- Hand-Held Terminal

Connect the hand-held terminal to the TERMINAL port on the SPU shown in, the hand-held terminal has an 11-key keypad, four function keys, and a 4-line by 20-column alphanumeric readout (display).
The numeric keys (keys 0 through 9) are used for keying in numeric values
They are also used for the following functions:
• The 2, 4, 6, and 8 numeric keys are also used as arrow keys and are used to scroll up (8 key), down (2 key), page-up (4 key), and page-down (6 key) through the menus. Page-up and page-down move the display four lines up and down respectively.
• The 5 numeric key is used as a HOME key, which closes the existing menu and returns to the MAIN menu.
The ENTER key is used to initiate the execution of a selected menu function or register a numeric value.
The function keys (F1, F2, F3, and F4) are used to execute menu functions that appear as “soft keys” on the last line in applicable menus.
Function key F1 corresponds to the first “soft key” selection, F2 to the second, F3 to the third, and F4 to the fourth. Refer to for the location of the “soft keys” in the display.

B- VT-100 Terminal

Connect the VT-100 terminal to the TERMINAL port on the SPU as shown in the craft interface tool (TERMINAL) port can be used with a standard VT-100 terminal. A VT-100 terminal is a widely used type of computer terminal manufactured by DEC (DIGITAL EQUIPMENT Corporation). Many terminals from other manufacturers can emulate the VT-100, and software is available that allows an ordinary PC to emulate a VT-100.



The VT-100 communications port must be configured as follows:

Mode: ANSI
Local echo: OFF
Control: INTERPRET
Host port: RS232C (modem port)
Port speed: 9600 baud
Data bits: 8
Stop bit: 1
Parity: OFF

The RETURN key is used to initiate the execution of a selected menu function or to register a numeric value.
The period key (.) is used as the HOME key.
The dedicated arrow keys are used to move through the menus as follows:

scroll up ↑ Scroll down ↓ ← Page up → Page down

The PF1, PF2, PF3, and PF4 keys serve as the four function keys that represent the “soft keys” in the display. The soft key EXIT will return the display back to the previous menu.

Menu Tree (*Main Menu*)

- **NE ADDRESS**
- **ALARM**
- **STATUS**
- **CONTROL**
- **PERFORMANCE**
- **CONFIGURATION**
- **SYSTEM DESCRIPTION**
- **SHUTDOWN**

The displays below are not on the menu tree, but appear under certain circumstances, replacing the current display from the menu tree.

CAN'T MODIFY
- Appears when a modify instruction cannot be carried out.

CANNOT BE APPLIED FROM A REMOTE SITE
- Appears when a control instruction cannot be carried out from a remote site.

CANNOT BE MODIFIED FROM A REMOTE SITE
- Appears when a configuration value cannot be modified out from a remote site.

CONTROL ABORTED
- Appears when a control instruction cannot be carried out.

NOT INSTALLED
- Appears when all items of a menu are Unequipped

S/W CORRUPTED
- Appears if the software in the ODU is corrupted.

INVALID VALUE
- Appears for 2s when a configuration value is rejected. The actual configuration value is not modified.

Alarm Branch

1. IDU ALARM
SPU ALARM
PU ALARM
MODEM PARAM MISSING
FPGA LOAD MISSING
SPU/PU MISMATCH
SPU GENERAL FAILURE
SPU POWER ALARM
PU GENERAL FAILURE
PU ABSENT
NO ALARMS

1.1 SPU ALARM
TRANSMIT ALARM
RECEIVE ALARM
NO ALARMS

1.2 PU ALARM
TRANSMIT ALARM
RECEIVE ALARM
NO ALARMS

2. ODU ALARM
ODU ALARM A
ODU ALARM B
ODU PARAM MSSING
ODU MISMATCH
ODU SOFT NOT FOUND
NO ALARMS

2.1 ODU ALARM A
TRANSMIT ALARM
RECEIVE ALARM
EEPROM ALARM
SOFTWARE CORRUPTED
DOWNLOAD FAILED
HPA EEPROM ALARM
HPA ALARM
NO ALARMS

2.2 ODU ALARM B
TRANSMIT ALARM
RECEIVE ALARM
EEPROM ALARM
SOFTWARE CORRUPTED
DOWNLOAD FAILED
HPA EEPROM ALARM
HPA ALARM
NO ALARMS

3. CABLE ALARM
CABLE A ALARM
CABLE B ALARM
PROT CABLE ALARM
NO ALARMS

4. .RX TRAFFIC ALARM
BER ALARM
SYNC LOSS
RSL LOW
NO ALARMS

5. TRIBUTARY ALARM
TRIBUTARY 1 ALARM1
TRIBUTARY 2 ALARM
.
.
.TRIBUTARY n ALARM
NO ALARMS
OR TRIBUTARY T3 ALARM

5.1 TRIBUTARY n ALARM
INPUT LOSS
CODE ERROR
AIS INPUT
AIS RECEIVED
TRANSMIT OFF2
RECEIVE OOF2
NO ALARMS

6. REMOTE ALARM
REMOTE SYNC LOSS
REMOTE COMM FAIL
LINK ID VIOLATION
NO ALARMS

7. SOFTWARE ALARM
ODU A ALARM
COMM IDU TO ODU A
COMM ODU A TO IDU
ODU B ALARM
COMM IDU TO ODU B
COMM ODU B TO IDU
FREQ PLAN ERROR
NO ALARMS

7.1 ODU A ALARM
S/W INCOMPATIBLE
FREQUENCY ERROR
AUTOCONFIG PA MUTE
NO ALARMS
OR
ODU DOWNLOADING
XXX%

7.2 ODU B ALARM
S/W INCOMPATIBLE
FREQUENCY ERROR
AUTOCONFIG PA MUTE
NO ALARMS
OR
ODU DOWNLOADING
XXX%

8.EXTERNAL ALARM
EXT ALARM 1
.
.
.
EXT ALARM 8
NO ALARMS

Status Branch

1. EQUIPMENT ONLINE

TX A1 ONLINE / OFF LINE
TX B1 ONLINE / OFFLINE
RCVR A ONLINE / OFFLINE
RCVR B ONLINE / OFFLINE

2. CONTROL STATUS

THIS MENU IS A REFLECTION OF THE CONTROL MENU SHOWN IN FIGURE B-5. IT ONLY DISPLAYS THE PARAMETERS WITHOUT ALLOWING FOR MODIFYING THEIR VALUES.

3. SYSTEM STATUS

RSL A XXXdBm
RSL B XXXdBm
Pout A XXXdBm / MANUA MUTED / SYSTEM MUTED
Pout B XXXdBm / MANUAL MUTED / SYSTEM MUTED

TEMP A XXX C / XXX F
TEMP B XXX C / XXX F
TX A XXXXXXXXkHz
TX B XXXXXXXXkHz
RX A XXXXXXXXkHz
RX B XXXXXXXXkHz
TX MN A XXXXXXXXkHz
TX MN B XXXXXXXXkHz
TX MX A XXXXXXXXkHz
TX MX B XXXXXXXXkHz
TX STEP XXXXkHz
RX MN A XXXXXXXXkHz
RX MN B XXXXXXXXkHz
RX MX A XXXXXXXXkHz
RX MX B XXXXXXXXkHz
RX STEP XXXXkHz
CHANNEL A OK/ DEGRADING
CHANNEL B OK/DEGRADING
RSL STATUS A OK / LOW
RSL STATUS B OK / LOW
AUTOCONF A ON HOLD /DONE
AUTOCONF B ON HOLD /DONE

4. INVENTORY

SPU
ODU A
ODU B
HPA A
HPA B
FREQ PLAN

4.1 SPU

PK VER XXXXXXXXX
ALT PK XXXXXXXXX
S/W VER XXXXXXXXX
ALT S/W XXXXXXXXX
BOOT VER XXXXXXXXX
MODEM XXXXXXXXX
ALT MDM XXXXXXXXX
ODU-DF XXXXXXXXX
ALT ODU XXXXXXXXX
FPGA XXXXXXXXX
ALT PGA XXXXXXXXX
PN XXX-XXXXXX-XX
SN XXXXXXXX
DATE XXXX-XX-XX

4.2 ODU A

S/W VER XXXX
BOOT VER XXXX
PN XXX-XXXXXX-XXX
SN XXXXXXXX
DATE XXXX-XX-XX

4.3 ODU B

S/W VER XXXX
BOOT VER XXXX
PN XXX-XXXXX

4.4 HPA A

PN XXX-XXXXXX-XXX
SN XXXXXXXX
DATE XXXX-XX-XX

4.5 HPA B

PN XXX-XXXXXX-XXX
SN XXXXXXXX
DATE XXXX-XX-XX

4.6 FREQ PLAN

PN XXX-XXXXXX-XXX
VER XXXXXXXXXXX

5. CONFIG STATUS

TO THE CONFIGURATION MENU.

6. IP ROUTING STATUS

PING
ROUTING TABLE

6.1 PING

TO: XXX.XXX.XXX.X
yyyyyyyyyyyyyyy
• CLR • • PING •

6.2 ROUTING TABLE

D: ddd.ddd.ddd.ddd/mm
R: rrr.rrr.rrr.rrr
I: i i i i i i i
P: ppppppp
• NEXT • • PREV •

Control Branch

1. IDU

FORCE TX A SET / CLR
FORCE TX B SET / CLR
FORCE RCVR A SET / CLR
FORCE RCVR B SET / CLR
TRIB LOOPBACK
MUX- DEMUX LPBK SET / CLR

1.1 TRIB LOOPBACK

TRIB LPBK 1 SET / CLR
TRIB LPBK 2 SET / CLR
.
.
.
TRIB LPBK n SET / CLR
OR
TRIB LPBK T3 SET / CLR

2. ODU

MANUAL MUTE TXA SET / CLR
MANUAL MUTE TXB SET / CLR
CW TONE A SET / CLR
CW TONE B SET / CLR

Performance Branch

1. G.826

ET XXd XXh
XX:XX
EFS
XXXXXX
ES
XXXXXX
SES
XXXXXX
UNAV
XXXXXX
BBE
XXXXXXXXX
EFSR
XX.XXXXX%
ESR
XX.XXXXX%
SESR
XX.XXXXX%
UNAVR
XX.XXXXX%
BBER
XX.XXXXX%
•RST• • •
EXIT

2. BER

ET XXd XXh
XX:XX
BER X.X E-XX
SYNC LOSS
SYNC LOSS OCCURRED
• • • •
EXIT

3. ATPC

ET XXd XXh
XX:XX
CUMUL
xxxxxxxxs
USAGE
xxx.xxxxx%
. . . .
EXIT

Configuration Branch

1. IDU
NE ADDRESS 1-999
NET_COMM
INTERNET See figure B-8
PCMCIA
DATA PORT
CONTROL PASSWORD: 0000-9999
CONFIG PASSWORD: 0000-9999
MASTER PASSWORD: 0000-9999
MODULATION: QPSK / 16QAM
CAPACITY: 2x2Mb /4x2Mb /
8x2Mb /16x2Mb
PROTECTION:UNPR / MHSB /
MHSB/SD / FD / FD/SD
TRIBUTARY
TRIBUTARY CODE: AMI / HDB3 /
B8ZS / B3ZS
T1 TRIBUTARY CODES
TRIB T3 MODE FRAMED / UNFRAMED
TRIBUTARY EQUAL
LINK ID: 00-99
FEC CORRECTION: DISABLE / ENABLE
AIS THRESHOLD: DISABLE / 1E-3
BER THRESHOLD: 1E-3 / 1E-4 / 1E-5 / 1E-6
RSL LOW SEVERITY: ALARM / STATUS
FREQ PROG MODE: NO PLAN / BY PLAN
FREQ PLAN STATUS NO PLAN / BY PLAN
LICENSE ID A XXXXXXXXXXXXXXX
LICENSE ID B XXXXXXXXXXXXXXX

1.1 NET_COMM
REMOTE: ENABLE / DISABLE
RPTR IN: ENABLE / DISABLE
RPTR OUT: ENABLE / DISABLE
LAN: ENABLE / DISABLE

1.2 PCMCIA
DUAL SERIAL PORT See figure B-9
SERVICE CHANNEL See figure B-10

1.3 DATA PORT
CHARACTER LENGTH: 5 BITS / 6 BITS
/ 7 BITS / 8 BITS
SPEED: 1200 / 2400 / 4800 /
9600 / 19200 / 38400
PARITY CHECK EVEN / ODD / NONE
CIRCUIT TYPE 1:1 / 1:N
PEER NE_ADDRESS 1-999
1.4 TRIBUTARY
TRIBUTARY 1 DISABLE / ENABLE
TRIBUTARY 2 DISABLE / ENABLE
.
.
.
TRIBUTARY n DISABLE / ENABLE

1.5 T1 TRIBUTARY CODES
TRIBUTARY T1-1 AMI / B8ZS
TRIBUTARY T1-2 AMI / B8ZS
TRIBUTARY T1-16 AMI / B8ZS
1.6 TRIBUTARY EQUAL
TRIB... 1 EQUAL 0-133' / 133-266'
/ 266-399' / 399-533' / 533-655'
TRIB... 2 EQUAL 0-133' / 133-266'
/ 266-399' / 399-533' / 533-655'
TRIB... 3 EQUAL 0-133' / 133-266'
/ 266-399' / 399-533'/ 533-655'
TRIB... n EQUAL 0-133' / 133-266'
/ 266-399' / 399-533'/ 533-655'

2. ODU A / B
TX ATTEN (dB) XX
TX FREQ SET (kHz) XXXXXXX
RX FREQ SET (kHz) XXXXXXX
ATPC RANGE (dB) xx
Atpc over rng (dB) xx
RSL SCALE WB DIR WBINV NB INV

Interfaces

1. INTERFACES *NETCOMM IP ADR/MSK* *10BT/NMS ETHERNET* *1.1 NETCOMM IP ADR/MSK* *ITEM NAME* *A: xxx.xxx.xxx.xxx/mm* *N: yyy.yyy.yyy.yyy/nn* *•CLR • / •EXIT* *1.2 10BT/NMS* *IP ADDRESS/MASK* *xxx.xxx.xxx.xxx/mm* *DHCP PEER IP ADDR xxx.xxx.xxx.xxx*	**2. STATIC ROUTES** *DEFAULT ROUTER xxx.xxx.xxx.xxx* *STATIC RTE1 DEST xxx.xxx.xxx.xxx/mm* *STATIC RTE1 ROUTER xxx.xxx.xxx.xxx* *.* *..* *STATIC RTE8 DEST xxx.xxx.xxx.xxx/mm* *STATIC RTE8 ROUTER xxx.xxx.xxx.xxx* **3. SNMP** *NOTIFIED NMS* *AUTHORIZED NMS* *RD ONLY COMMUNITY xxx.xxx.xxx.xxx* *RW COMMUNITY xxx.xxx.xxx.xxx* *WRITE PERMISSION ENABLE/ DISABLE*	**3.1 NOTIFIED NMS** *NOTIFIED NMS n xxx.xxx.xxx.xxx* *NTFD NMS n STATUS ENABLE / DISABLE* **3.2 AUTHORIZED NMS** *AUTHORIZED NMS n xxx.xxx.xxx.xxx* *NTFD NMS n STATUS ENABLE / DISABLE* **4. FTP** *FTP USER NAME xxxxxxxxxxxxxxx* *FTP PASSWORD xxxxxxxxxxxxxxx*

Dual Serial Port (PCMCIA) Display

PORT 1-A PROTOCOL: *RS-232 / COMPUTER / RTU 232 / DISABLED*
PORT 1-A SPEED: *1200 / 2400 / 4800 / 9600 / 19200 / 38400*
PORT 2-A PROTOCOL: *RS-232 / COMPUTER / RTU 232 / DISABLED*
PORT 2-B SPEED: *1200 / 2400 / 4800 / 9600 / 19200 / 38400*

Service Channel Menu

4W VF IN/OUT LEVEL -16/7dBm / 0/0 dBm
4-WIRES INTERFACE ENABLED / DISABLED
SYSTEM DESCRIPTION
xxxxxxxxxxxxxxxxxx...
xxxxxxxxxxxxxxxxx
• • • • ***EXIT***

SHUTDOWN

SHUTDOWN REASON ***SW UPGR / FW UPGR / RESET***
SHUTDOWN DELAY ***xxxxxx***

REMOTE RSL TARGET

ACT : ***-YY dBm***
NEW ***-ZZ dBm***
.CLEAR. .EXEC . EXIT

ATPC MAX USAGE (%)*

ACT : ***-YY dBm***
NEW : ***-ZZ dBm***
.CLEAR..EXEC . EXIT

Note:
XXX.XXX = actual ATPC percentage usage permitted
YYY.YYY = new ATPC percentage usage permitted
(Accepts Values form 1 to 100 , 0.0001 granularity)

Unit Exercises

1) What is the consisting of MicroStar® type II MHSB 1+1 (7 & 13 GHz) system?

---

2) What is the type of modulation that use in Microstar type II Radio system?

---

3) What is the channel bandwidth in the following tributary capacity?

2E1=……, 4E1=……, 8E1=……, 16E1=…….

---

4) What kind of management and control devices are used?

---

5) What is the difference and similar between, MicroStar® type II 7 GHz and MicroStar® type II 13 GHz systems?

---

6) What is the functions of the coaxial cable that enjoyed IDU to ODU?

---

7) Where does transmit direction protection switching take place in Hot Standby system?

---

8) Where does receive direction protection switching take place?

---

9) How does the transmit signal operate at Digital Radio systems?

---

10) How does the receive signal operate at Digital Radio systems?

UNIT 3

MicroStar® Type III

MHSB 1+1 (M/7 GHz) System

Objective:

In this Unit you will learn about digital microwave**,** MicroStar® Type III ***Monitoring Hot Standby*** MHSB 1+1 (M/7 GHz) System and to be able to operate and maintain this type of digital radio system.

Contents:

Chapter 1:Introduction

1-Performance Characteristics
2- Consists of MicroStar® type III MHSB 1+1 radio system
3- Functional Description
4- IDU Interface Terminals and Jacks
5- ODU Interface Terminals and Jacks
6- Theory of operation
   6-1- Transmit direction functions
   6-2- Receive direction functions
   6-3- Receive protection switching

Chapter 2: Operation and maintenance

(Monitoring, Controlling and Configuration)
1- By using the CIT software
2- By using a Hand-Held Terminal or a VT-100 Terminal

Unit Exercises

CHAPTER 1

MicroStar® Type III **Introduction**

- ***Performance Characteristics***
- ***Consists of MicroStar® type III MHSB 1+1 radio system***
- ***Functional Description***
- ***IDU Interface Terminals and Jacks***
- ***ODU Interface Terminals and Jacks***
- ***Theory of operation***

1. Performance Characteristics

System / Descriptions	Microstar Type 3 (7GHz)
Frequency Band (GHz)	7.110 to 7.725
Frequency Range (MHz)	7128 to 7422 F0=7275 7428 to 7722 F0=7575
Tx – Rx Spacing	161 (MHz)
Tx/Tx freq. spacing (MHz)	For capacity up to 8xE1: 28 & 16xE1: 56
Channel Bandwidth (MHz)	4xE1 = 7 & 8xE1= 14 & 16xE1=28
Modulation Type	QPSK or 16 QAM
Tx Output Power	27.5 (dBm)
Branching loss	Tx=2.2 dB & Rx :ch A=2.8 dB & ch B=13.8 dB
Tx Power Control)	20 dB in 1 dB step
Output power muting	50 dB from nominal output power
MHSB 1+1 Rec. threshold BER $10^{-}6$ (dBm)	4xE1 : ch A: -85 & ch B: -74 8xE1: ch A: -82 & ch B:-71 16xE1: ch A: -79 & ch B: -68
IF Signal	TX IF = 310 MHz & Rx IF = 70 MHz ±250 khz
Loop back	Tributary E1 Far End Loop (local and remote)
Control , Configuration & Monitoring	HHT or VT – 100 CIT software
Tributary signal	4xE1 / 8XE1 / 16 X E1 (2,048 Mb/s) with HDB3 Code & 120 ohm impedance
Residual BER	better than 10^{-12}
Max. length of coaxial cable	236 meters
Local oscillator freq. stability	≤ ± 7 ppm

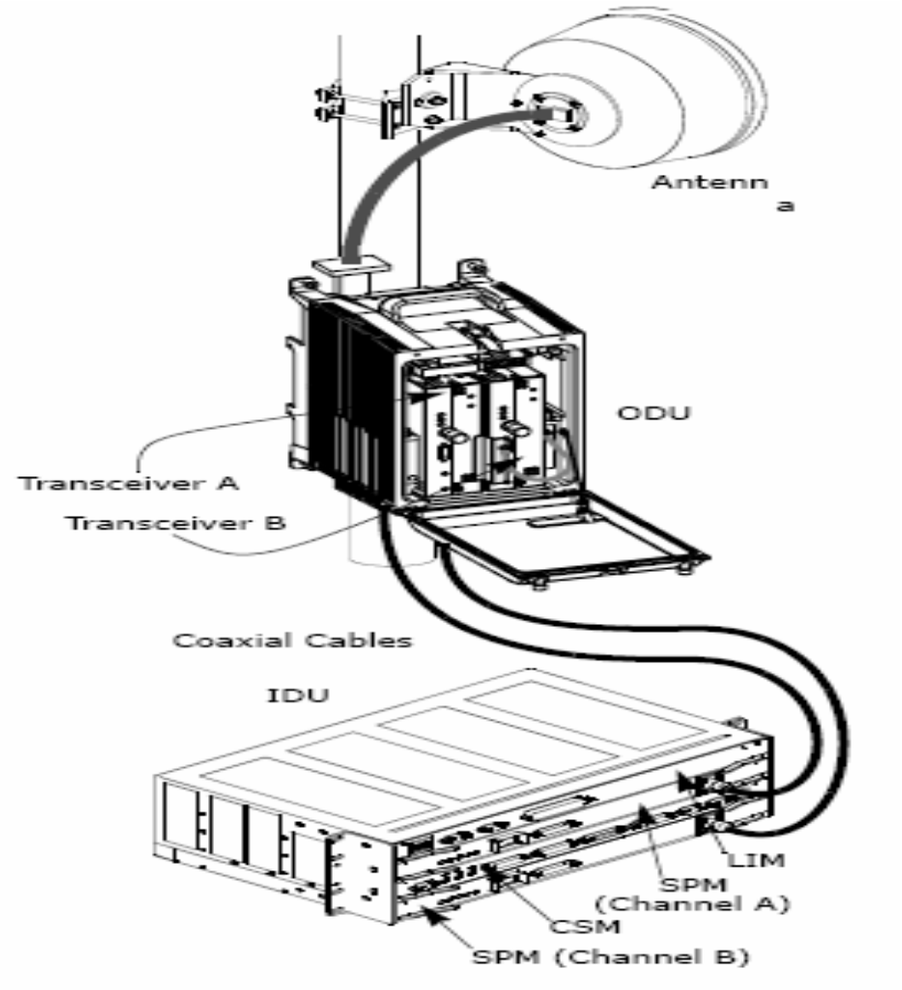
System / Descriptions	Microstar Type 3 (7GHz)
Local oscillator type	Synthesizer
Freq. step size	Freq. setting is programmable with step size 250 KHz
AGC range	-93 to – 20 dBm
Recommended RF input level (nominal)	- 45 dBm
Max. RF input level	-20 dBm no error
RSL Reference to transceiver input	-30 to -85 ± 4 dBm
Switching type	*Tx sw:* not hitless *Rx sw:* hitless or < 10 errors
Service channel 1 (data channel)	*Interface port:* RS-232 (V.28) or RS-423 (v.10) *Data bridge:* 4 way *Max. baud rate:* 19.2 k baud
Service channel 2 (VF channel) 2 wrie or 4 wrie	*Impedance:* 600 ohm blanced *input level:* -16 or 0 dBm (4 W port) *output level:* +7 or 0 dBm (4 W port) *freq. band width*: 300 Hz to 3400 Hz *VF- wire bridge:* 4-way *Signaling other sites:* 3 digit to select sites or call all sites
Consumption power	48 vdc with out optional units IDU+ODU: 146 watt
Temperature range	*IDU:* 0◦C to 50 ◦C *ODU:*33 ◦C to 55 ◦C
Warm-up time from cold start	*IDU:*5 minutes *ODU:*10 minutes

2 Consists of MicroStar® type III HSB 1+1 radio

A protected MicroStar® radio HSB 1+1 consists of:

- ***An IDU with:***
  - ❖ two SPMs (Signal Processing Module),
  - ❖ a LIM (Line Interface Module) and
  - ❖ a SCM (Controller / Service Channel Module).
- ***An ODU with:***
  - ❖ two transceivers connected by two coaxial cables to IDU side and a flexible waveguide to antenna side.

1+1 Monitored Hot Standby Configuration



2-3 Functions of IDU & ODU in HSB 1+1 radio terminal

a- IDU

The IDU performs the following functions:

- signal processing on the tributary data and control data,
- monitoring and controlling the operation of the microwave radio,
- supplying the ODU with power, a modulated IF signal, and a telemetry signal.

b- ODU

The ODU performs the following functions:

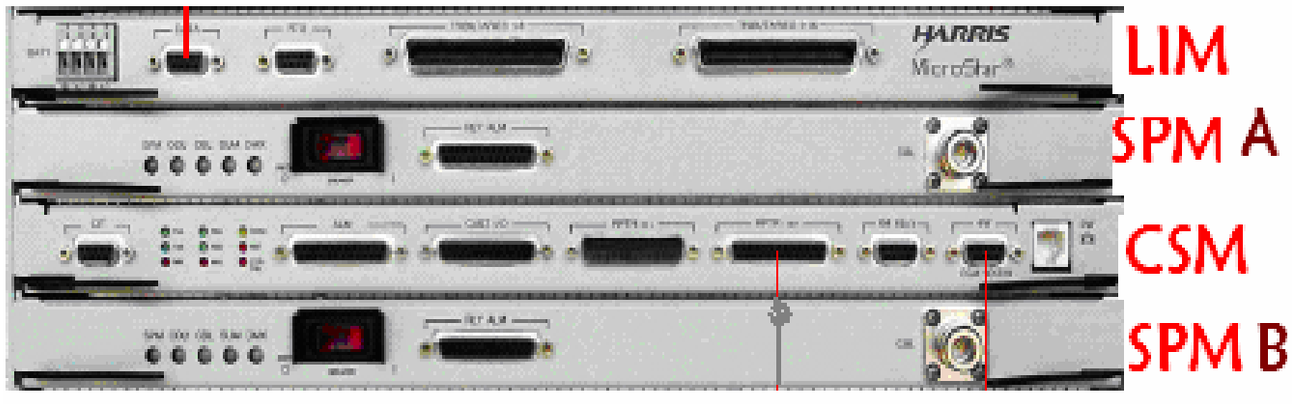
- up/down conversion, amplification, filtering and antenna coupling functions,
- supplying the IDU with an IF signal, and a telemetry signal.

Note:

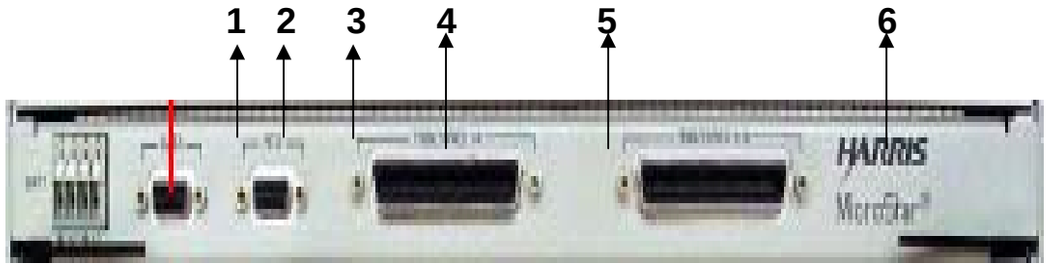
The telemetry signals are used by the controller unit in the IDU to control and monitor the operation of the ODU.

2-4 Controls, Indicators and Jacks of IDU

IDU 1+1 Terminal

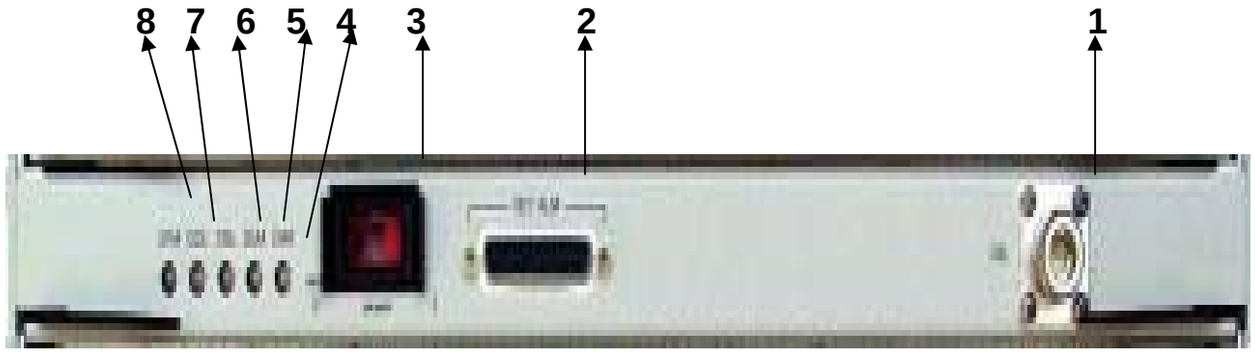


LIM (Line Interface Module) 4 / 8 / 16 E1



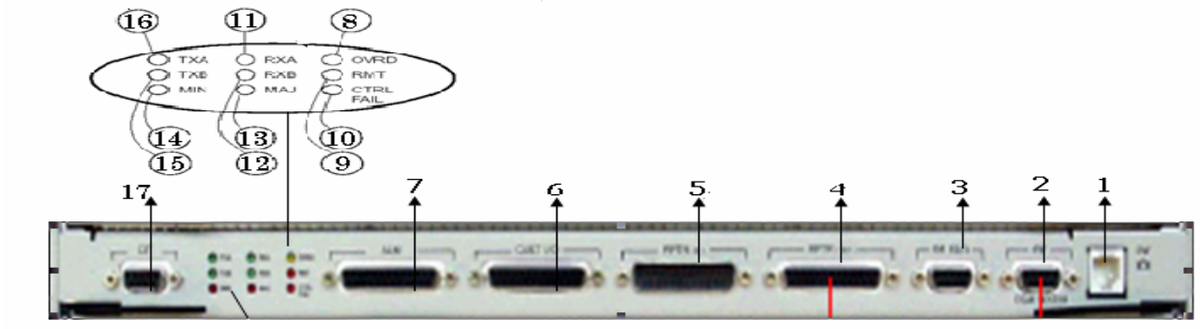
1- BATT A: for side-A.
2- BATT B: for side-B.
3- DATA: RS232/423 asynchronous utility data DCE (up to19.2 kbit/s).
4- RTU: RS232/423 data, DCE, for SNMP and FARSCAN monitoring
5- TRIBUTARIES 1-8
6- TRIBUTARIES 9-1

SPM (Signal Processing Module)



1- CBL: Connection to the ODU, carries DC power, telemetry, and composite IF signal.
2- RLY ALM: Provides customer access to SPM alarm relay contacts.
3- BREAKER: Breaker switch for the SPM***.***
4- DMX: Green LED. lit = demultiplexer is currently selected to carry traffic.
5- SUM: Two-color LED. Green = all OK, red = major alarm.
6- CBL: Two-color LED. Green = cable OK, red = cable failure.
7- ODU: Two-color LED. Green = ODU OK, red = ODU failure.
8- SPM: Two-color LED. Green = SPM OK, red = SPM failure.

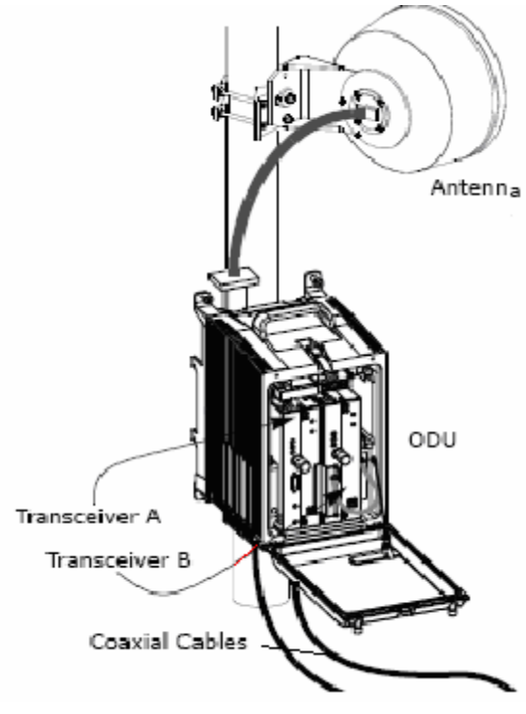
CSM (Controller / Service Channel Module)

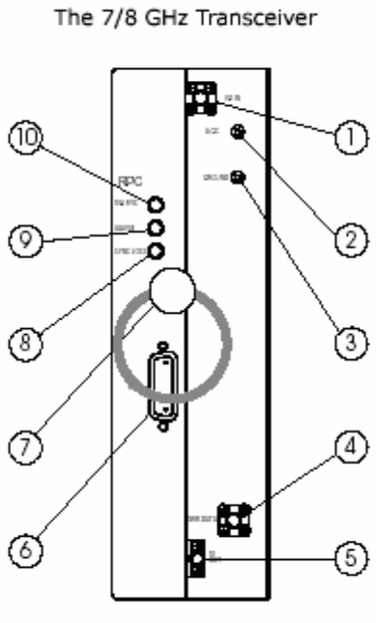


1- 2W: Connector used for customer connection for 2-wire handset.
2- 4W: Connects tor 4-wire telephone equipment.
3- 64 kbit/s: Reserved for future use.
4- RPTR(OUT):Connects network data, utility data, and voice frequency data to the RPTR (IN) port on another IDU at the same site.
5- RPTR (IN): Connects network data, utility data, and voice frequency data to RPTR (OUT) port on another IDU at the same site.
6- CUST I/O: Customer access to relays and control points.
7- ALM:DB-25 Alarm status, used for customer access to alarm relay contacts
8- OVRD: Orange LED. Indicates that a forced switch or control is active.
9- RMT: Red LED. Indicates that the coordinating radio (far end) has a major alarm.
10- CTRL FAIL: Red LED. Indicates that the controller has failed.
11- RXA: Green LED. Indicates that the receiver in channel-A is on.
12- RXB: Green LED. Indicates that the receiver in channel-B is on.
13- MAJ: Red LED. Indicates a major alarm. There is a problem affecting traffic.
14- MIN: Red LED. Indicates a minor alarm. In a protected system, traffic is being maintained by protection switching. In a non-protected system traffic is affected.
15- TXB: Green LED. Indicates that the transmitter in channel-B is selected to carry traffic.
16- TXA: Green LED. Indicates that the transmitter in channel-A is selected to carry traffic.
17- CIT: Connects to hand held terminal or CIT computer.

5. ODU Interface Terminals and Jacks

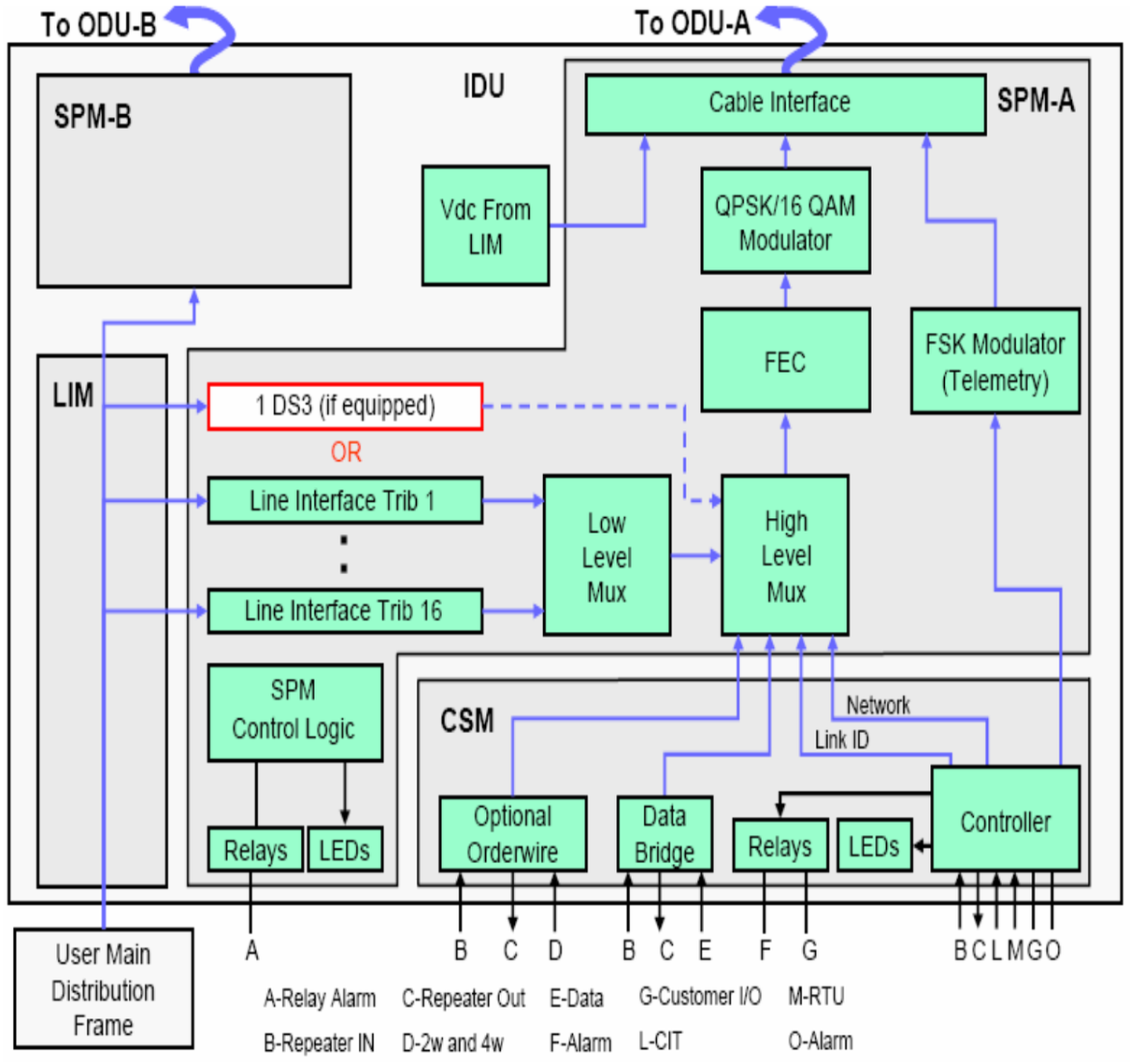
1- RX IN or RX: Female SMA, connects to the receive RF filter.
2- AGC: test point for the AGC voltage.
3- GND or GROUND:, ground to be used with AGC test point.
4- PWR / DATA or IDU / ODU: Connects, via the N-type connector on the chassis, to the IDU.
5- TX OUT or TX: Female SMA.
6- HPA: DB15 connects to the HPA (if equipped).
7- Retaining knob: used to secure the transceiver in the ODU.
8- SYNC LOSS: Red LED indicates that the IDU muldex has lost synchronization. This usually indicates that the radio signal has been lost.
9- ALARM: Red LED. Indicates that the transceiver's radio processor module (RPM) has failed or that there is a problem with the transmitter or receiver.
10- TRAFFIC: Green LED, indicates that traffic has been selected to pass through this transceiver.

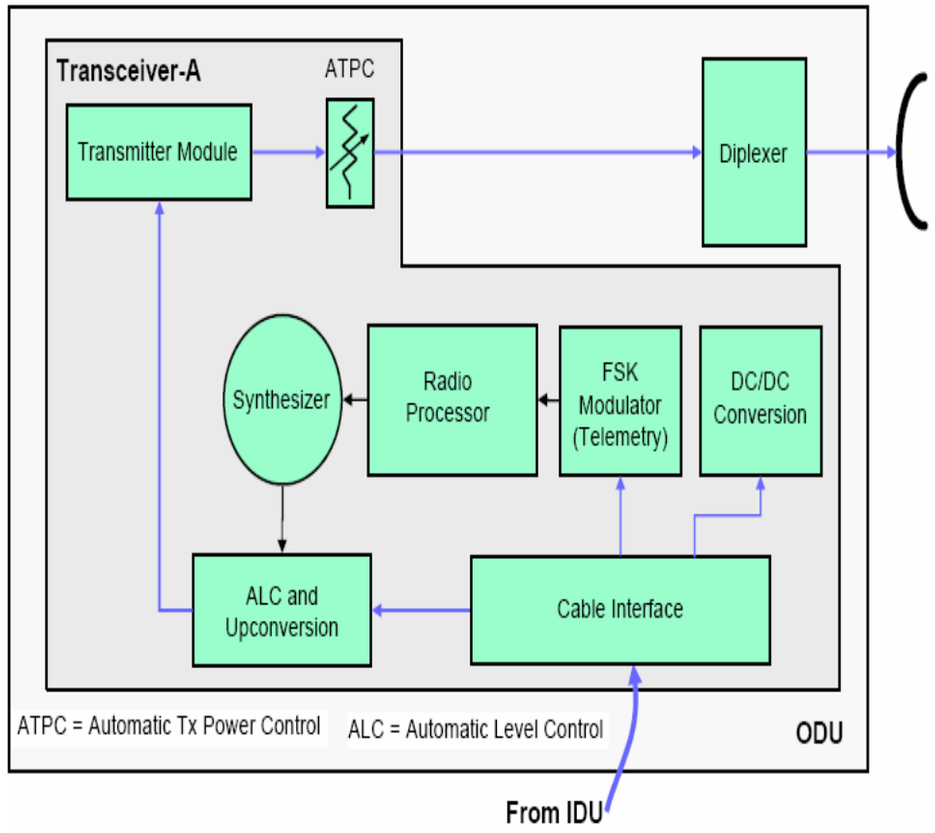




6. Theory of operation

1. Transmit Signal Block Diagram





Transmit signal description

1 Line Interface Module:

- Routes the signal to the SPU (Signal Processing Unit)

2 Line interface circuits

- convert the bipolar line coded signal into a binary return to- zero signal
- recover the clock from the incoming signal
- use the clock to regenerate the binary signal

3 low level multiplexer

- uses bit stuffing to synchronize the incoming tributaries
- combines the tributaries into a number of signals, such as:
  - One signal for 4 tributaries
  - Two signals for 8 tributaries, joined and fed directly to the high level multiplexer
  - Four signals for 16 tributaries, combined in one 34 Mbit/s signal, then fed to the high level multiplexer

4 High level multiplexer

- combines data with the network control channel, the utility data channel, and the voice frequency channel (if it is present)

5 FEC (forward error correction) circuit

- scrambles data and adds to it error correction codes
- uses 23/24 convolutional self-orthogonal code hat adds about 4% of overhead to the aggregate data rate

6 Serial-to-Parallel Converter

- converts signal into two bit-streams, the I and the Q signals for QPSK or 16QAM

7 Quadrature Mixers

- combine outputs to generate the QPSK or 16 QAM signal

8 Cable Interface

- receives the modulated signal and inserts it in the coaxial cable connecting the SPM to the corresponding transceiver in the ODU
- carries DC power for the ODU through the coaxial cable

9 Controller / Service Channel Module (CSM)

- generates a telemetry signal to configure and control the radio unit
- inserts this FSK modulated signal through the cable interface

10 Cable Interface (ODU's)

- extracts the modulated IF signal, the telemetry signal, and the DC power from the composite signal in the coaxial cable

11 ALC and Upconverter Block

- converts the modulated signal to a higher frequency in a two-stage mixer and regulates its amplify.

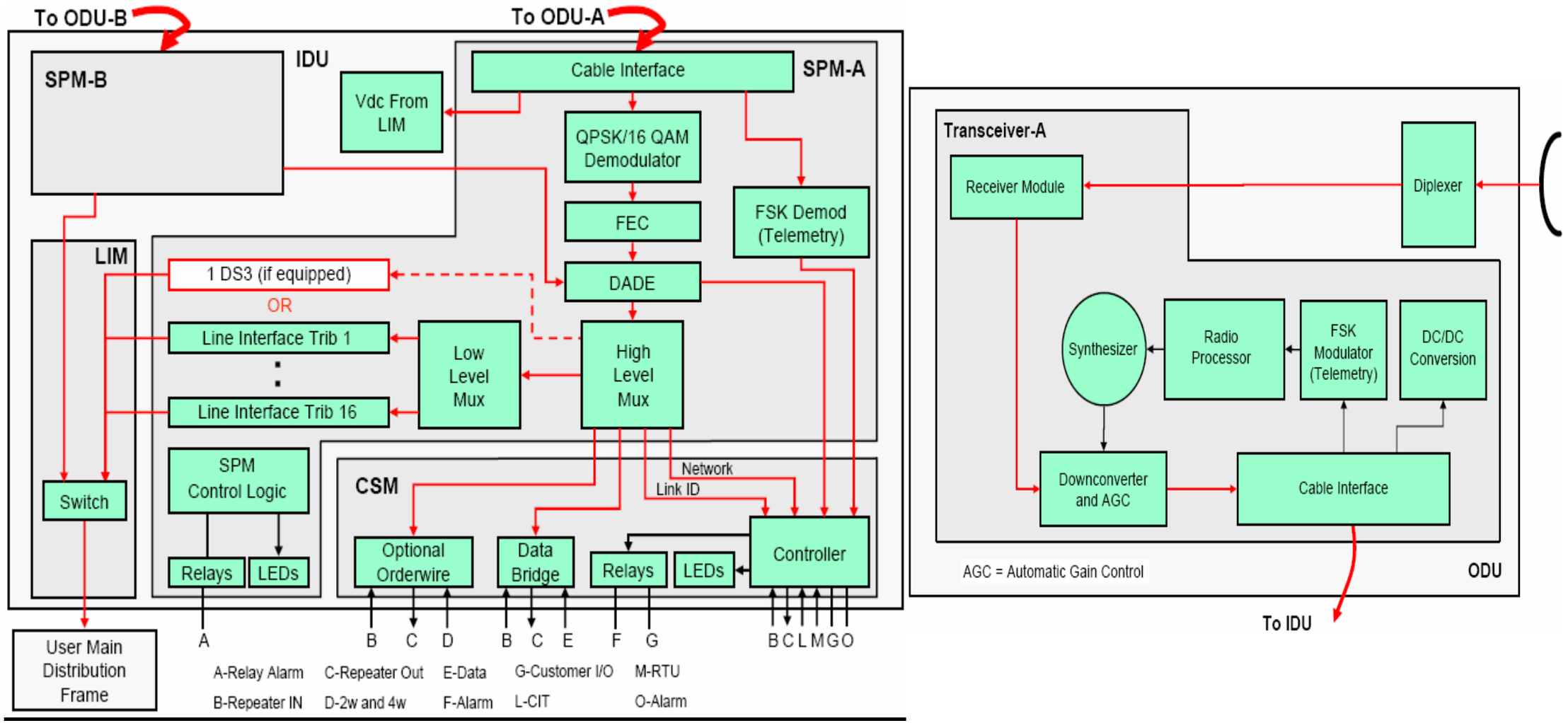
12 Transmitter Module

- raises the signal to the transmit frequency and amplifies it.

13 Diplexer

- carries the final signal through to the antenna.

2.1. Receive Signal Block Diagram



Receive signal description

1 Diplexer
- keeps the in-coming signal separate from the out-going transmit signal and removes unwanted frequencies

2 Receive Module
- amplifies the signal and down converts it to a lower frequency

3 Down-converter and AGC Block
- down-converts the signal to the 70 MHz IF frequency
- control the signal level with automatic gain control circuits

4 Cable Interface (ODU's)
- inserts the IF signal in the coaxial cable along with FSK modulated telemetry data going to the corresponding SPM

5 Cable Interface (IDU's)
- extracts the IF and telemetry signals from the composite signal in the coaxial cable

6 FSK Demodulator
- carries telemetry to the controller

7 Demodulator
- carries the IF signal and regenerates the clock and data stream,
- sends the signal to the FEC circuit in the demultiplexing section of the SPM

8 FEC (Forward Error Correction)
- uses the correction codes embedded in the signal to correct it, as necessary

9 DADE Circuits

- receive the FEC decoded signal and align 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 maintaintraffic

10 High-level Demultiplexer

- receives the FEC decoded signal and separates it from the network control, utility data, digitized voice frequency, and traffic. The traffic is now:
  - one 34 Mbit/s signal (for the 16-tributary version)
  - two 8 Mbit/s signals (for the 8-tributary version)
  - one 8 Mbit/s signal (for the 4-tributary version)

11 Low-level Demultiplexer

- receives the signals and separates the E1 (2 Mbit/s) tributaries

12 Line Interface Driver

- receives each E1 tributary and converts the binary signal from the demux into either a bipolar HDB3 format

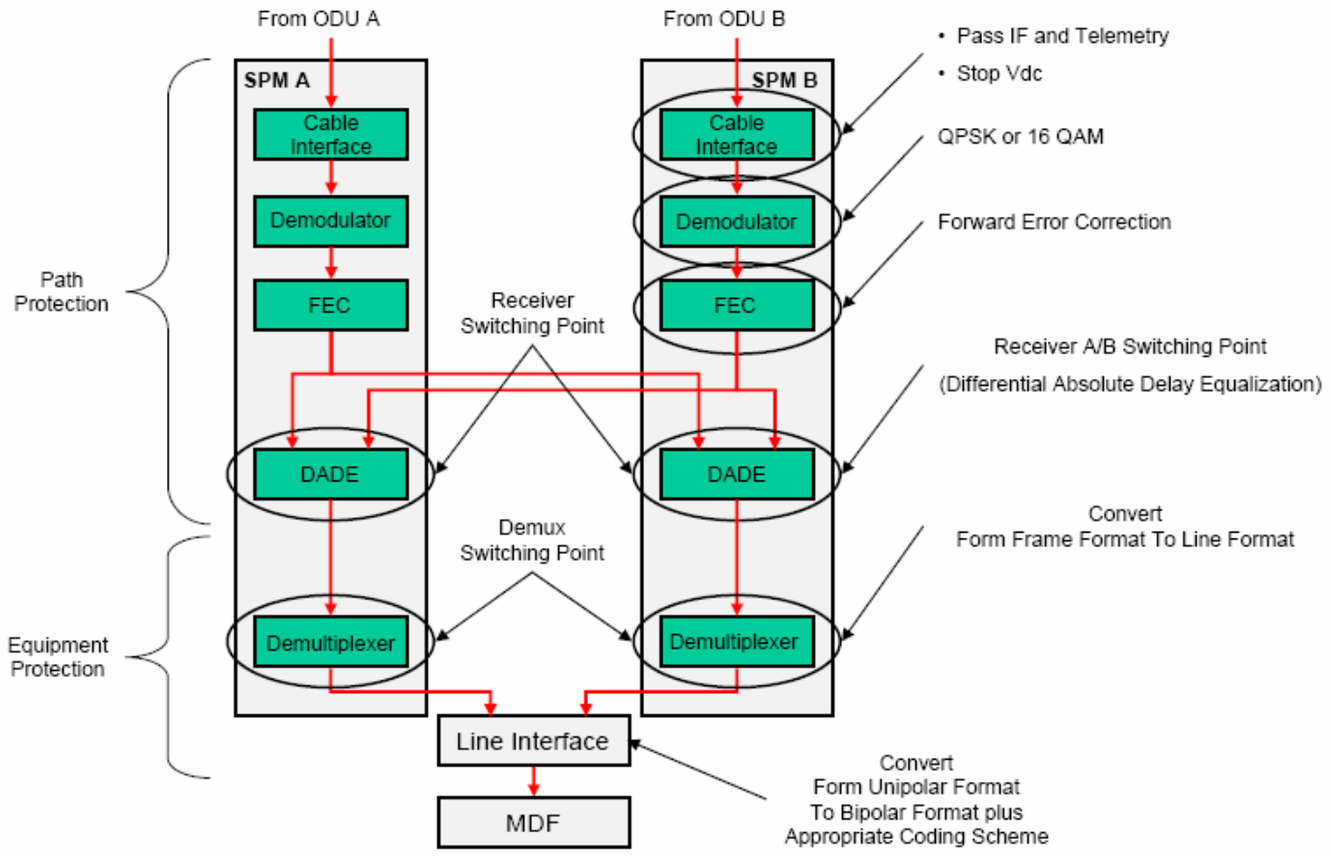
13 Line Interface Module

- contains a switch controlled by the SPU.
- selects the tributaries from one of the two (SPU or PU) in a protected radio and passes them to the output connector

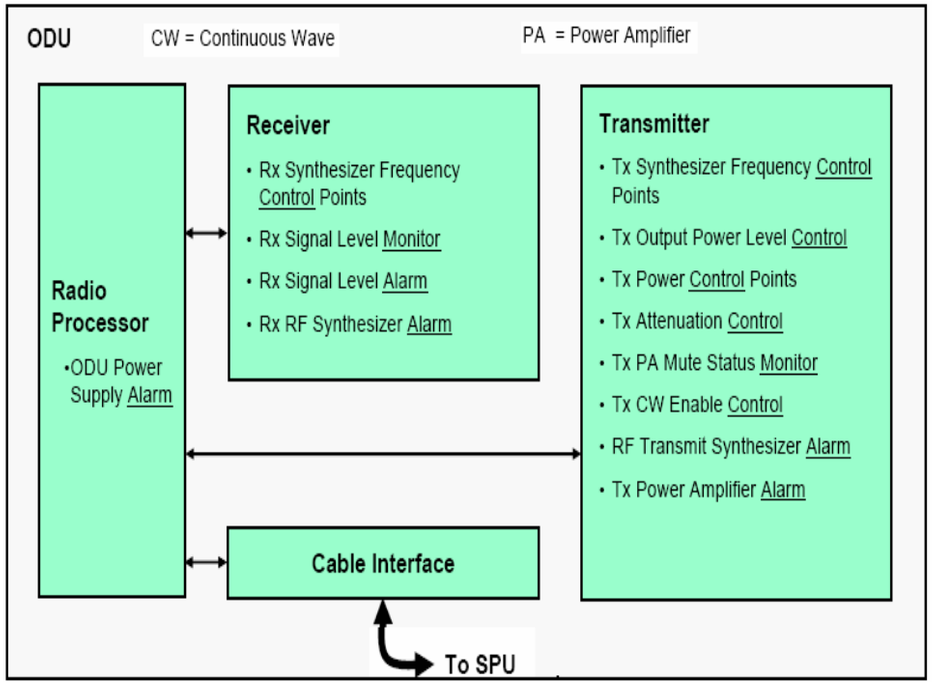
6-3- Receive protection switching

Note: Transmit direction protection switching takes place through the transmit RF switch in the ODU.

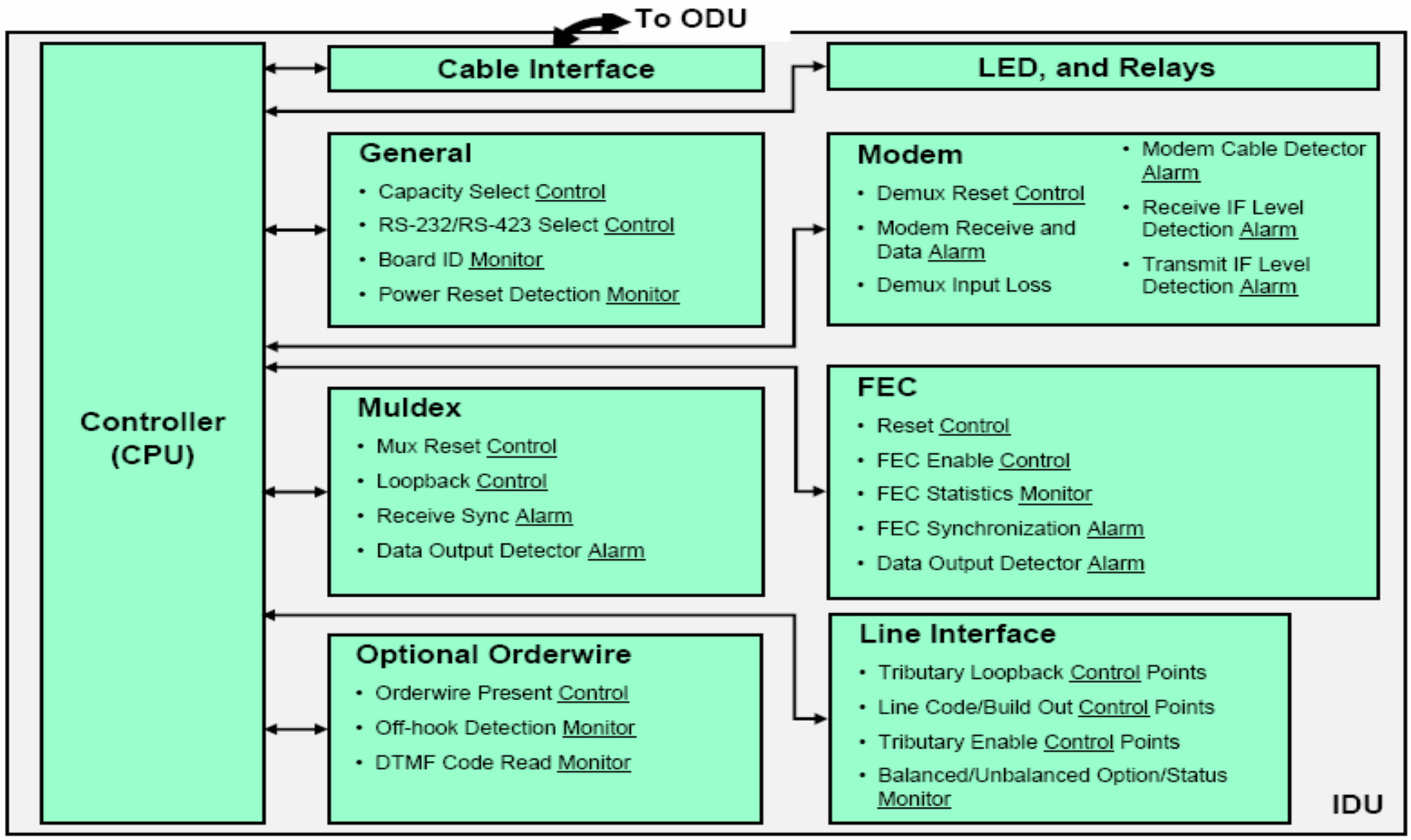
Note: Receive direction protection switching takes place in the SPU. Under the control of the radio controller, the DADE circuit will select the signal coming from either receiver A or receiver B for the demultiplexer to process.



ODU Control, Monitor and Alarm



Control, Monitor and Alarm of IDU:



CHAPTER 2

Operation and Maintenance

Monitoring, Controlling and Configuration

- ***Controller Functions***
- ***Connecting an Operator Control Device***
- ***Monitoring, Controlling and Configuration (by using CIT software)***
- ***Monitoring, Controlling and Configuration (by using a VT-100 or HHT)***

1. Controller Functions

- Monitors the status and the alarms of the Radio
- Enables the programmable system configuration of:
- Frequency setting
- RF channel ID (range 00 - 99)
- Equipment address
- Orderwire address
- Tributary enable / disable
- Line Code (HDB3, AMI, B8ZS or B3ZS)
- Line Built Out
- BER alarm threshold
- AIS insertion threshold

Controls:

- Power Attenuation (in 1 dB steps)
- Power Amp Mute
- Remote Tributary Loopback
- Provides In-service Monitoring based on G. 826
- Calculates the hop BER based on parity error
- Via the CIT port it supports the Handheld Keypad or VT-100 and allows local download of software
- Via the RTU port it connects SCAN compatible equipment and supports a PC running FarScan.
- Communicates with the ODU using a FSK telemetry signal
- Auto configures replaced units (applies to Type III equipment only)

2- Connecting an Operator Control Device

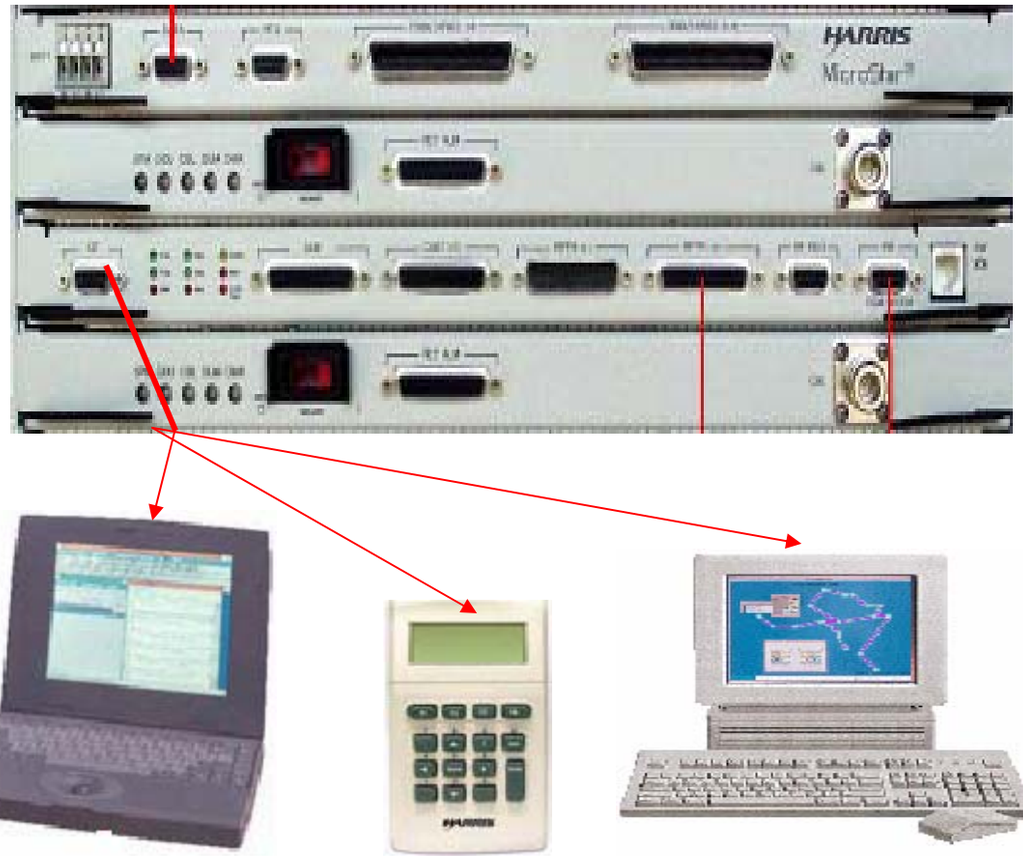
***The operator controls and monitors the MicroStar®* with either:**

1. By using a CIT software

- laptop computer running the CIT software

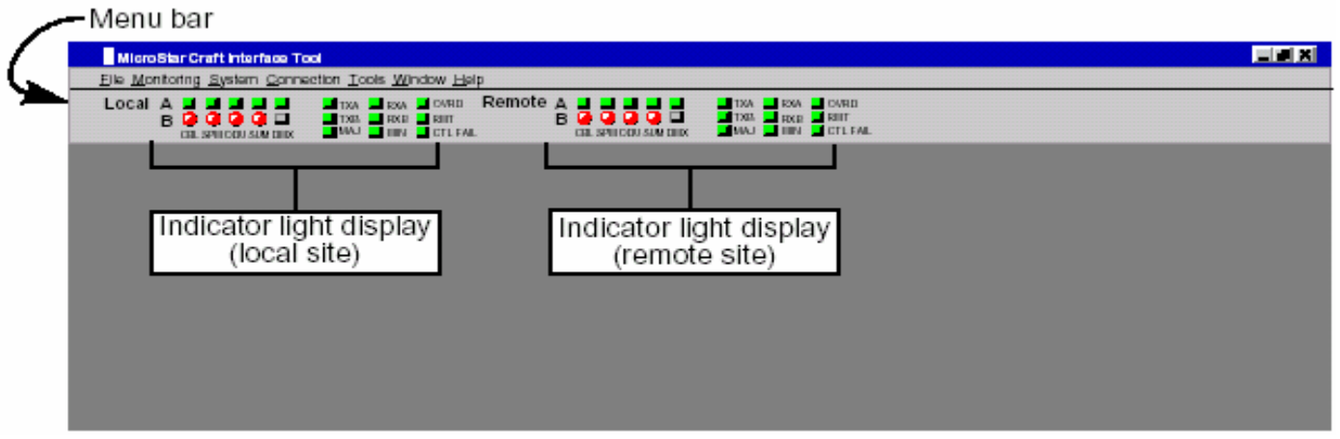
2. By using a VT-100 or HHT

- A VT-100 compatible terminal (such as our hand-held terminal) communicating with the embedded control software.
- Summary alarms are indicated by colored LEDs and are also available on relay contacts.
- All the customer connections are located on the front of the IDU.
- An optional order wire sub-module provides one digital voice frequency channel.



CI T Software **HHT** **VT-100**

. 1- By using a CIT software



Format: The Indicator Light Display:

SPM

round red Operational failure of the indoor unit equipment.

square green Indoor equipment is operating correctly.

ODU

round red Operational failure of the outdoor unit equipment

square green Outdoor equipment is operating correctly.

CBL

round red Problem with the cable connecting the IDU to the ODU.

square green Cable is working correctly.

SUM

round red An alarm (any alarm) is active. The cause of an alarm can be identified by scrolling through the Monitoring > Alarm menu with the CIT, or the hand held terminal, or VT terminal using the embedded software.

square green All of the microwave radio functions are operating correctly and no control is active.

DMXA

square green Demultiplexer A selected.

square shaded Demultiplexer A is not selected.

DMXB

square green Demultiplexer B selected.

square shaded Demultiplexer B is not selected.

TXA

square green Transmitter A is ON.

square shaded Transmitter A is not selected.

TXB

square green Transmitter B is ON.
square shaded Transmitter B is not selected.

MIN

round red System minor alarm. The cause of a minor alarm can be identified by scrolling through the Monitoring > Alarm menu with the CIT, or the hand held terminal, or VT terminal using the embedded software.
square shaded System operating normally.

RXA

square green Receiver A is ON.
square shaded Receiver A is not selected.

RXB

square green Receiver B is ON.
square shaded Receiver B is not selected.

MAJ

round red System major alarm. The cause of a major alarm can be identified by scrolling through the Monitoring > Alarm menu with the CIT, or the hand held terminal, or VT terminal using the embedded software.
square shaded System operating normally.

OVRD

diamond orange Operator controlled software override.
square shaded No operator controlled software override.

RMT

diamond red Remote terminal has a major alarm.
square shaded Remote terminal operating normally.

CTR FAIL

round red Controller failure.
square shaded Controller operating normally.

Menu Bar Description

Menu	Menu Options	Window / Menu Item Description
File	Exit	Exits the CIT interface tool.
Monitoring	Alarms	Provides all the local and remote alarms needed for radio diagnostics.
	Status	Provides the status details related to the IDU and the ODU.
	Status > IDU	Provides the information related to the IDU, such as capacity, traffic, etc.
	Status > ODU	Provides the information related to the ODU, such as frequencies, RSL, etc.
	Performance analysis	Provides information on the BER and G.826 performance analysis parameters.
	Inventory	Provides the inventory details related to the IDU and the ODU.
	Inventory >IDU	Provides the information related to the IDU's software version.
	Inventory >ODU	Provides the information related to the ODU's software version and the HPA.

System	General Configuration	Provides the general configuration details related to the IDU and the ODU.
	General Configuration > IDU	Provides information related to the IDU, such as address, RTU and threshold. It also allows the user to modify such information.
	General Configuration > ODU	Provides information related to the ODU, such as link ID and frequencies. It also allows the user to modify such information.
	Network Management	Displays SNMP configuration points on MicroStar M/H software version 3.1or higher.
	Controls	Used to show and modify controllable points The purpose of this menu is mainly for performing tests.
	Controls > IDU	Provides the IDU information related to the Force, software and external relays.
	Controls > Loopback >1 to8	Used to display and modify the loopback input to output information for the first set of 8 tributaries.
	Controls > Loopback >9 to16	Used to display and modify the loopback input to output information for the second set of 8 tributaries.
	Controls > ODU	Provides information related to the ODU parameters, such as transmit power and CW tone.
	Tributary Config. >1to8	Used to display and modify the information related to the first set of 8 tributaries.
	Tributary config. >9to16	Used to display and modify the information related to the second set of 8 tributaries.

Connection	Password Change	The user can modify the password in this menu for the MicroStar® M/H software version 3.1 or higher.
	Direct	Allows you to connect a computer running CIT to the MicroStar® radio using a communications cable.
	Via Modem	Allows you to use a telephone line for a dial-up connection by modem to connect a remote radio to the CIT application.
	Disconnect	Allows you to end the communication between a remote radio and the CIT application.
Tools	Software Upgrade	Menu used for downloading the MicroStar software from a PC to a MicroStar® M/H radio, as well as switching from the running to the alternate software.
	Software Upgrade >Download	Allows the user to initiate a software download.
	Software Upgrade >Switch Running Software	Allows the user to switch from the running to the alternate software.
	CIT password Change	Allows you to change the password for the CIT application.
	Settings > Comm Port	Allows you to assign or modify the number for the communications port
	Settings > MicroStar Modem	Allows you to change the configuration of the modem that connects to the MicroStar® M/H radio.
	Settings > CIT Modem	Allows you to change the configuration of the modem that connects to the computer running CIT.

Window	Arrange Icons Close All	This function distributes all window icons at the bottom of the main window. This function closes all open windows on the screen
Help	About CIT	Provides information about the CIT software.

a. Important: if you change the radio frequency at the remote site, traffic will be lost until you set the local site for the corresponding radio frequency.

b. Important: If you set the CW or mute controls at the remote site, you will loose traffic for 10 minutes. An automatic timer clears the commands after the 10 minutes have passed.

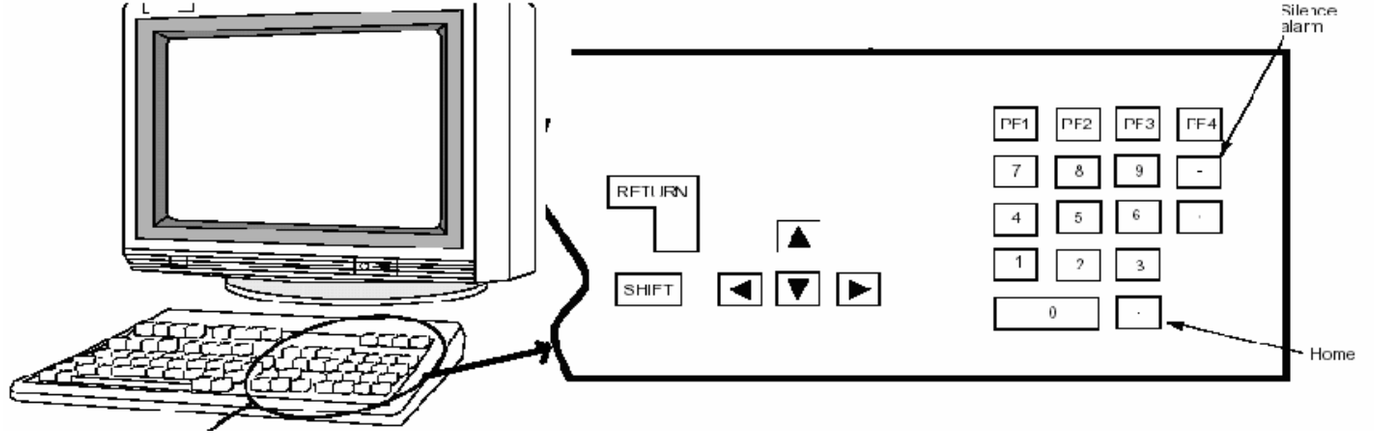
3. By using a VT-100

(Hand-Held Terminal or a VT-100 Terminal)

A- Hand-Held Terminal

Connect the hand-held terminal to the TERMINAL port on the SPU shown in, the hand-held terminal has an 11-key keypad, four function keys, and a 4-line by 20-column alphanumeric readout (display).
The numeric keys (keys 0 through 9) are used for keying in numeric values
They are also used for the following functions:
• The 2, 4, 6, and 8 numeric keys are also used as arrow keys and are used to scroll up (8 key), down (2 key), page-up (4 key), and page-down (6 key) through the menus. Page-up and page-down move the display four lines up and down respectively.
• The 5 numeric key is used as a HOME key, which closes the existing menu and returns to the MAIN menu.
The ENTER key is used to initiate the execution of a selected menu function or register a numeric value.
The function keys (F1, F2, F3, and F4) are used to execute menu functions that appear as “soft keys” on the last line in applicable menus.
Function key F1 corresponds to the first “soft key” selection, F2 to the second, F3 to the third, and F4 to the fourth. Refer to for the location of the “soft keys” in the display.

B- VT-100 Terminal



Connect the VT-100 terminal to the TERMINAL port on the SPU as shown in the craft interface tool (TERMINAL) port can be used with a standard VT-100 terminal. A VT-100 terminal is a widely used type of computer terminal manufactured by DEC (DIGITAL EQUIPMENT Corporation). Many terminals from other manufacturers can emulate the VT-100, and software is available that allows an ordinary PC to emulate a VT-100.

The VT-100 communications port must be configured as follows:

Mode: ANSI
Local écho: OFF
Control: INTERPRET
Host port: RS232C (modem port)
Port speed: 9600 baud
Data bits: 8
Stop bit: 1
Parity: OFF

The RETURN key is used to initiate the execution of a selected menu function or to register a numeric value.
The period key (.) is used as the HOME key.
The dedicated arrow keys are used to move through the menus as follows:

scroll up ↑ **Scroll down** ↓ ← **Page up** → **Page down**

The PF1, PF2, PF3, and PF4 keys serve as the four function keys that represent the “soft keys” in the display. The soft key EXIT will return the display back to the previous menu.

C- Menu Tree **Main Menu**

- ***NE ADDRESS***
- ***ALARM***
- ***STATUS***
- ***CONTROL***
- ***PERFORMANCE***
- ***CONFIGURATION***
- ***SYSTEM DESCRIPTION***

CAN'T MODIFY:

- Appears when a modify instruction cannot be carried out.

CANNOT BE APPLIED FROM A REMOTE SITE:

- Appears when a control instruction cannot be carried out from a remote site.

CANNOT BE MODIFIED FROM A REMOTE SITE:

- Appears when a configuration value cannot be modified out form a remote

CHECK CONFIG ALARM HAS BEEN CLEARED BY ANOTHER USER • • • • EXIT:

- Appears if the configuration alarm has been cleared by another interface, when exiting the configuration menu after it was entered via the CHECK

CHECK CONFIGURATION:

- Appears when powering up the IDU. Reminds the operator to check the configuration of new connected units,

CONTROL ABORTED:

- Appears when a control instruction cannot be carried out.

DO YOU ACCEPT THE ACTUAL CONFIGURATION OF THE SYSTEM? • • • YES • • •NO

- Appears after the user exits the configuration menu after it was entered via the CHECK CONFIGURATION

NOT INSTALLED

- Appears when all items of a menu are unequipped.

PROGRAMING REC=XXXX

- Appears when software is being downloaded to the microwave radio. The REC field gives the number of the record currently being downloaded

ALARM BRANCH

1-IDU ALARM
CSM ALARM
SPM A ALARM
SPM B ALARM
SPM MISMATCH
NO ALARMS

1-1 CSM ALARM
EEPROM ALARM
FLASH EEPROM FAILED
NO ALARMS

1.2 SPM A ALARM
TRANSMIT ALARM
RECEIVE ALARM
EEPROM ALARM
POWER SUPPLY ALARM
ABSENT
NO ALARMS

1.3 SPM B ALARM
TRANSMIT ALARM
RECEIVE ALARM
EEPROM ALARM
POWER SUPPLY ALARM
ABSENT
NO ALARMS

2. ODU ALARM
ODU A ALARM
ODU B ALARAM
NO ALARAMS

2.1 ODU A ALARM
TRANSMIT ALARM
RECEIVE ALARM
EEPROM ALARM
SOFTWARE CORRUPTED
DOWNLOAD FAILED
POWER SUPPLY ALARM3
HPA EEPROM ALARM
HPA ALARM
RF MODULE COMM FAIL
NO ALARMS

2.2 ODU B ALARM
TRANSMIT ALARM
RECEIVE ALARM
EEPROM ALARM
SOFTWARE CORRUPTED
DOWNLOAD FAILED
POWER SUPPLY ALARM
HPA EEPROM ALARM
HPA ALARM
RF MODULE COMM FAIL
NO ALARMS

3. CABLE ALARM
CABLE A ALARM
CABLE B ALARM
NO ALARMS

4.RX TRAFFIC ALARM
BER ALARM
SYNC LOSS
SLOPE ALARM
NO ALARMS

5. TRIBUTARY ALARM
TRIBUTARY 1 ALARM1
E1 - 12
E1 - 22
E3 – 12
.
.
TRIBUTARY 16 ALARM1
NO ALARMS

5.1 TRIBUTARY n ALARM
INPUT LOSS
CODE ERROR
AIS INPUT
AIS RECEIVED
TRANSMIT OOF2
RECEIVE OOF2
NO ALARMS
NO ALARMS

6. REMOTE ALARM
REMOTE SYC LOSS
REMOTE COMM FAIL
LINK ID VIOLATION
NO ALARMS

7.SOFTWARE ALARM
ODU A ALARM
COMM IDU TO ODU A
COMM ODU A TO IDU
ODU B ALARM
COMM IDU TO ODU B
COMM ODU B TO IDU
NO ALARMS

7.1 ODU A ALARM
S/W INCOMPATIBLE
ODU DOWNLOADING
FREQUENCY ERROR
NO ALARMS

7.2 ODU B ALARM
S/W INCOMPATIBLE
ODU DOWNLOADING
FREQUENCY ERROR
NO ALARMS

8.EXTERNAL ALARM
EXT ALARM 1
.
.
EXT ALARM 8

STATUS BRANCH

1. EQUIPMENT ONLINE *ONLINE TX A1* *ONLINE TX B1* *ONLINE DEMUX A* *ONLINE DEMUX B* *ONLINE RECEIVER A* *ONLINE RECEIVER B* 2. CONTROL STATUS *THIS MENU IS A REFLECTION OF* *THE CONTROL MENU IT ONLY DISPLAYS* *THE PARAMETERS WITHOUT* *ALLOWING FOR MODIFYING* *THEIR VALUES* 3. SYSTEM *RSL A XXXdBm* *RSL B XXXdBm* *Pout A* *MANUAL MUTED /SYSTEM MUTED* *Pout B* *MANUAL MUTED / SYSTEM MUTED* *TEMP A XXX C / XXX F* *TEMP B XXX C / XXX F* *TX A XXXXXXXXkHz* *TX B XXXXXXXXkHz* *RX A XXXXXXXXkHz* *RX B XXXXXXXXkHz*	*CHANNEL A OK / DEGRADING* *CHANNEL B OK / DEGRADING* *RSL STATUS A OK / LOW* *RSL STATUS B OK / LOW* *AUTOCONF A ON HOLD / DONE* *AUTOCONF B ON HOLD / DONE* 4. INVENTORY *CSM* *SPM A* *SPM B* *ODU A* *ODU B* *HPA A* *HPA B* 4.1. CSM *S/W VER XXXXXXXXXXX* *ALT S/W XXXXXXXXXXX* *BOOT VER XXXX* *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX* 4.2. SPM A *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX*	4.3. SPM B *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX* 4.4. ODU A *S/W VER XXXX* *BOOT VER XXXX* *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX* 4.5. ODU B *S/W VER XXXX* *BOOT VER XXXX* *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX* 4.6. HPA A *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX* 4.7. HPA B *PN XXX-XXXXXX-XXX* *SN XXXXXXXX* *DATE XXXX-XX-XX* 5. CONFIG STATUS *TO THE CONFIGURATION MENU.*

CONTROL BRANCH

1.IDU	1.1 TRIB LOOPBACK	2. ODU
FORCE TX A1 SET / CLR	*TRIB LPBK 12 SET / CLR*	*TRANSMIT A ON / MUTE*
FORCE TX B1 SET / CLR		*TRANSMITE B ON / MUTE*
FORCE DEMUX A SET / CLR	*E1-13*	*CW TONE A SET / CLR*
FORCE DEMUX B SET / CLR	*E1-2*	*CW TONE B SET CLR*
FORCE RCVR A SET / CLR	*E3-1*	
FORCE RCVR B SET / CLR	.	
TRIB LOOPBACK	.	
EXT RELAY 1 SET / CLR	.	
.		
.	*TRIB LPBK 16 SET / CLR*	
EXT RELAY 4 SET / CLR		

Performance Branch

1.BER	2. G.826
BER X.X E-XX	*ET XXd XXh XX:XX*
ET XXd XXh XX:XX	*EFS XXXXXXX*
SYNC LOSS	*ES XXXXXXX*
SYNC LOSS OCCURRED	*SES XXXXXXX*
RST EXIT	*UNAV XXXXXXX*
	EFSR XX.XXXXX%
	ESR XX.XXXXX%
	SESR XX.XXXXX%
	UNAVR XX.XXXXX%
	RST
	EXIT

Configuration

1. IDU A / B *NE ADDRESS 001-999* *INTERNET* *RTU PORT RTU232 / RTU423 /* *COMPUTER / PPP /* *PPPMODEM / DISABLED* *RTU BAUD 1200 / 2400 / 4800 / 9600 /* *19200 / 38400* *DATA PORT RS-232 / RS-423* *CONTROL PASSWORD1 0000-9999* *CONFIG PASSWORD1 0000-9999* *MASTER PASSWORD1 0000-9999* *CAPACITY 4x2Mb / 8x2Mb / 16x2Mb /* *E3+2E1 / DS3* *MODULATION QPSK / 16QAM* *PROTECTION UNPR/MHSB/SD/FD / SD* *TRIBUTARY* *TRIBUTARY CODE* *TRIBUTARY MODE2* *TRIBUTARY EQUAL2* *LINK ID XX* *FEC CORRECTION DISABLE / ENABLE* *AIS THRESHOLD DISABLE / 1E-3* *BER THRESHOLD1E-3 / 1E-4 / 1E-5 / 1E-6* *S/W SW TMR 0 - 16777215* *SVC ADDRESS 000-999* *VF IN/OUT LEVEL-16 / 7dBm or 0 /*	1.1 INTERNET *MODEM* *PPP* *TCP / IP* *SNMP* *FTP* 1.1.1 MODEM *PHONE 1 XXXXXXXXXXXXXXX* *PHONE 2 XXXXXXXXXXXXXXX* 1.2TRIBUTA *TRIBUTARY 13 DISABLE /* *ENABLE* *E1 - 15 DISABLE / ENABLE* *E1 - 25 DISABLE / ENABLE* *TRIBUTARY n DISABLE / ENABLE* 1.1.2 PPP *PPP ID XXXXXXXXXXXXXXX* *PPP PSWD XXXXXXXXXXXXX* *PPP PEER ID XXXXXXXXXXXX* *PPP PEER PSWD XXXXXXXXX* *PPP IP ADRS XXX.XXX.XXX.XXX* *PPP MASK XXX.XXX.XXX.XXX* *PPP DISC TMR (MIN) 0 - 254* 1.1.3 TCP / IP *INTNET IP ADRS XXX.XXX.XXX.X* *INTNET MASK*	1.1.4 SNMP *NMS IP ADRS XXX.XXX.XXX.XXX* *ALT NMS IP ADRS XXX.XXX.XXX* 1.1.5 FTP *FTP USER NAME* *XXXXXXXXXXXXXXX* *FTP PASSWORD* *XXXXXXXXXXXXXXX* 1.3TRIBUTARY *TRIB 1 CODE2 AMI / HDB3 / B3ZS4* *E1 - 15 AMI / HDB3* *E1 - 25 AMI / HDB3* *E3 - 16 HDB3* *E3 - 25 HDB3* *.* *.* *TRIB....n CODE AMI / HDB3* 1.4TRIBUTARY CODE *TRIB... 1 MODE FRAMED /* *UNFRAMED* 1.5TRIBUTARY EQUAL *TRIB... 1 EQUAL 0-50’ / >50’* 2. ODU A / B *TX ATTEN (dB) XX* *TX FREQ SET (kHz) XXXXXXX* *RX FREQ SET (kHz) XXXXXXX*

SYSTEM DISCRIPTION

SYSTEM DESCRIPTION *xxxxxxxxxxxxxxxxxx* *...* *xxxxxxxxxxxxxxxxxx* • • • • *EXIT*	*A sample description would be as follows:* *MicroStar Protected;* *MIB files to use:* *mib-901501-006* • • • • *EXIT*

Unit Exercises

1) What is the MicroStar® type III HSB 1+1 radio consist of?

---

2) Complete the followings spacing:

a- Maximum tributary capacity…….

b- Monitoring connections devices……..

---

3) What is the type of modulation that use in Microstar type III Radio system?

---

4) What is the channel bandwidth in the following tributary capacity?

4E1=……, 8E1=……., 16E1=…….

---

5) What are the difference and similar between, MicroStar® type II 7 GHz and MicroStar® type III 7 GHz systems?

6) What is the functions of the coaxial cable that enjoyed IDU to ODU?

---

7) Where does transmit direction protection switching take place in Hot Standby system?

---

8) Where does receive direction protection switching take place?

---

9) How does the transmit signal operate at Digital Radio systems?

---

10) How does the receive signal operate at Digital Radio systems?

UNIT 4

Truepoint 5200 HSB 1+1 (7 & 13 GHz) System

Objective:

In this Unit you will learn about digital microwave {Truepoint 5200 MHSB 1+1 (7 & 13 GHz) System} and to be able to operate and maintain this type of digital radio system.

Contents:

Chapter 1: Introduction

1- Performance Characteristics
2- Consists of Truepoint 5200 HSB 1+1 system
3- IDU Interface Terminals and Jacks
4- ODU Interface Terminals and Jacks
5- Coaxial Cable Link Function
6- Functional Description of the Modules

Chapter 2: Operation and maintenance

Monitoring, Controlling and Configuration
1- By using the Web-CIT
2- By using the HH/VT-100 Terminal

Unit Exercises

CHAPTER 1
Truepoint 5200 HSB System
Introduction

- ***Performance Characteristics***
- ***Consists of Truepoint 5200 HSB 1+1 system***
- ***IDU Interface Terminals and Jacks***
- ***ODU Interface Terminals and Jacks***
- ***Coaxial Cable Link Function***
- ***Functional Description of the Modules***
- ***MMC Flash Card Location (Multi Media Card)***

Performance Characteristics

System / Descriptions	TRUEPOINT 5200 (7GHz)	TRUEPOINT 5200 (13GHz)
Frequency Band (GHz)	7.1 to 7.9	12.750 to 13.250
Frequency Range (MHz)	low Fre: 7100 to 7600 high Fre: 7250 to 7750	low fre: 12751 to 12865 high fre: 13017 to 13131
Tx – Rx Spacing (MHz)	161	266
Channel Bandwidth (MHz)	2E1 = 3.5 & 4E1 = 7 & 8E1= 14 & 16E1 =28	
Modulation Type	QPSK up to 128 QAM	
Tx Output Power (dBm)	31	26
Branching loss	Tx = 1.5 dB & Rx = 2 dB	
Tx Power Control)	30 dB in 1 dB step	
Output power muting	-70 dB from nominal output power	
Rec. Threshold BER 10 ¯6 (dBm)	ch A= -82.5 & ch B =-71.5	ch A=-80 & chB=-69
IF Signal (MHz)	TX IF = 310 & Rx IF = 70 ±200 KHz	
Loopback	- Tributary E1 Loopback NE & FE (local & remote) - MUX Loopback (local) - MODM IF Loopback (local)	
Control , Configuration & Monitoring	- VT – 100 or HHT - Web CIT	
Tributary signal	2xE1 /4xE1 / 8xE1 / 16 X E1 (2,048 Mb/s) HDB3 Code 120 ohm impedance	
Residual BER	Better than 10^{-12}	
Max. length of coaxial cable	236 meters	
Local oscillator freq. stability	≤ ± 7 ppm	
Local oscillator type	Synthe sizer	

Performance Characteristics

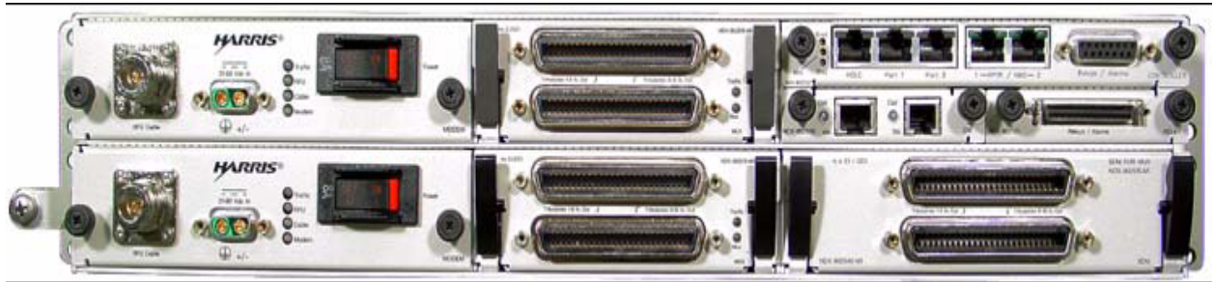
System / Descriptions	TRUEPOINT 5200 (7GHz)	TRUEPOINT 5200 (13GHz)
Freq. step size	Freq. setting is programmable with step size 250 KHz	
AGC range	-93 to – 20 dBm	
Recommended RF input level (nominal)	- 45 dBm	
Max. RF input level	-20 dBm no error -10 dBm no damage	
RSL	-30 to -85 ± 4 dBm	
Switching type	Tx sw: not hitless Rx sw: hitless or < 10 errors	
Service channel (Standard)	AUX1 (auxiliary channel 1): 19.2 kbit/s asynchronous (RS-232)	
Service channel (Optional)	AUX2 and AUX3: Orderwire or (future) Data Channel 64 kbit/s, synchronous co/contra-directional V.11 or G.703	
Consumption power 48 vdc with out optional units	SPU=22 watts & PU=10 watts & RFU=40 watts	
Temperature range	IDU= 0◦C to 50 ◦C	ODU= 33 ◦C to 55 ◦C
Warm-up time from cold start	IDU= 5 minutes	ODU= 10 minutes

2. Consists of Truepoint 5200 HSB 1+1 System

A protected Truepoint 5200 HSB 1+1 system consists of:

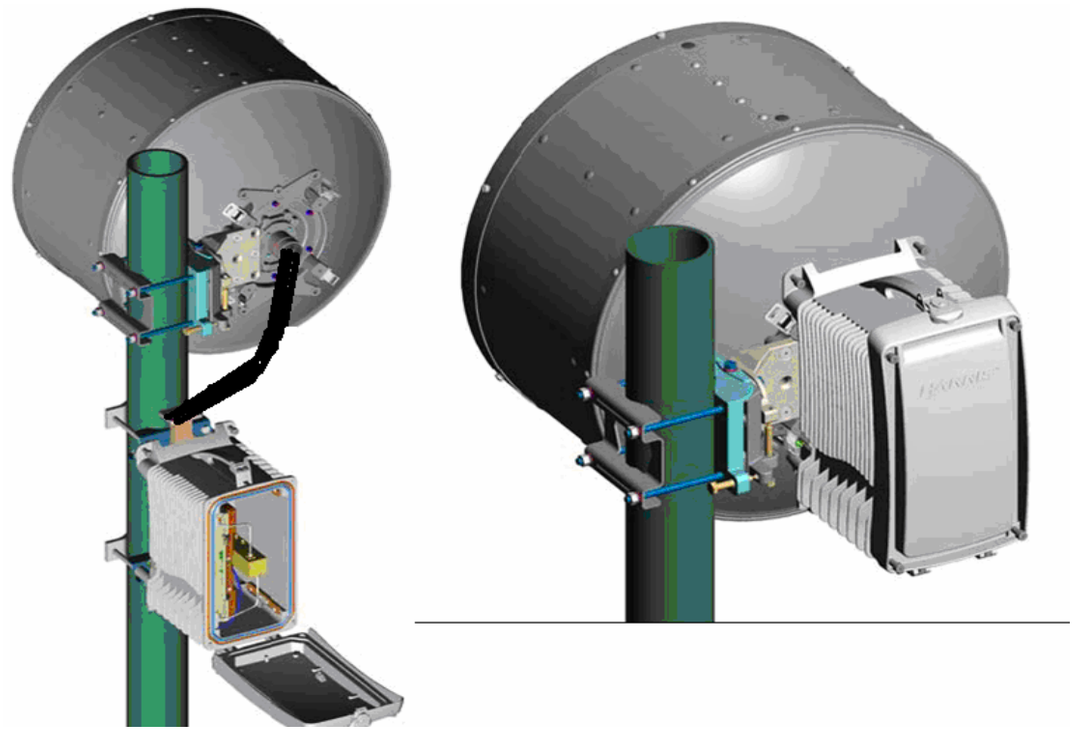
- An IDU with:

- Tow Modems for channels A & B
- Tow Multiplexer (MUX) for channels A & B
- One Signal Distribution Module (SDM)
- One Controller (controller, OW & relay alarm)

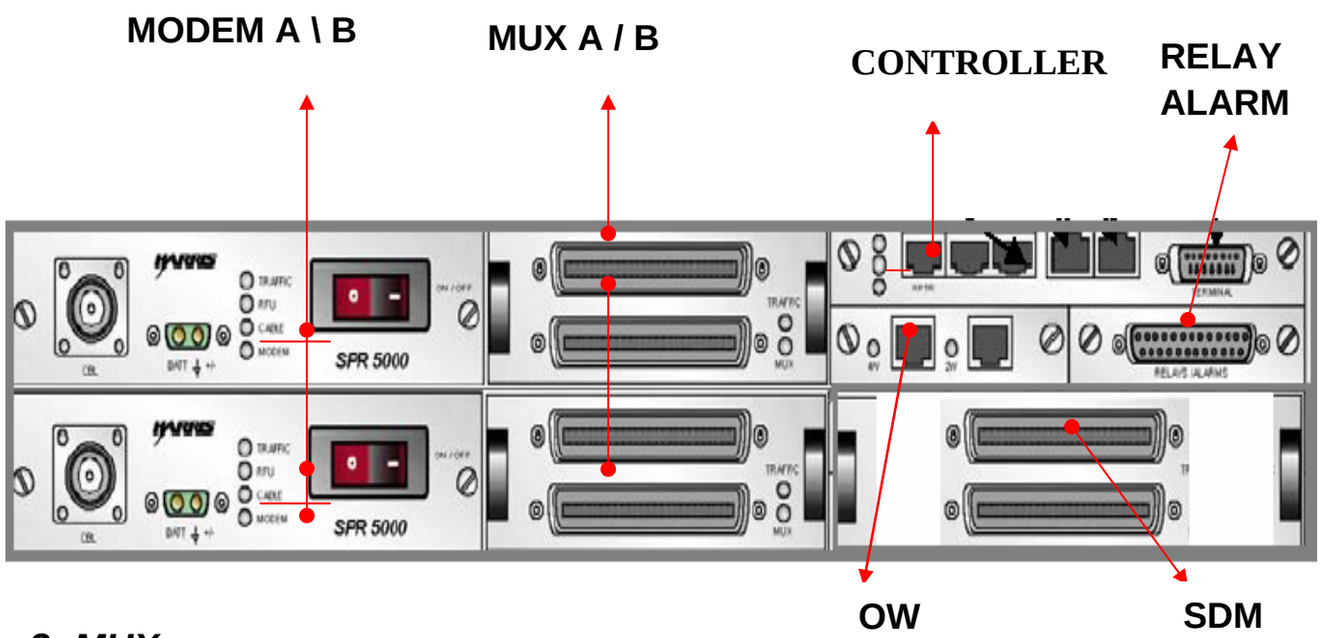


- An ODU with:

- Two transceivers connected by two coaxial cables for channel A & B to IDU side and a flexible waveguide to Antenna side.



3. IDU Interface Terminals and Jacks



2- MUX

TRAFFIC: Green The module is on-line
Off No traffic passing
MUX: Green The MUX is operating properly
Red The MUX is faulty

3- Controller

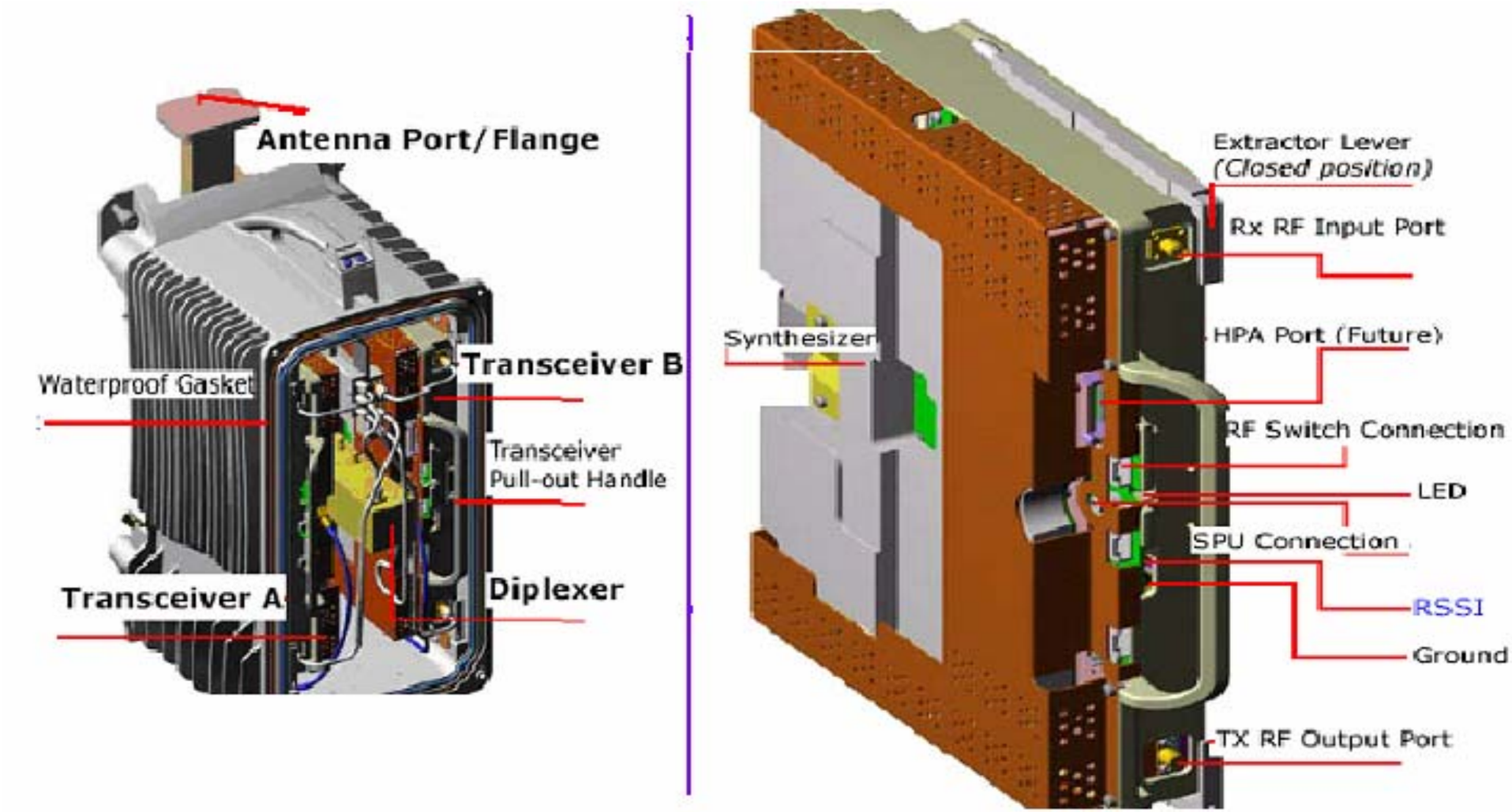
R MT: Off The remote site is operating properly
Yellow Problem with the remote site
MIN:- Off The system is operating properly
Yellow Manually forced or minor alarms
MAJ: Green The System is operating properly
Red There is a problem that has inttraffi

1- تا 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
Red: The cable connecting has failed.
MODEM:
Green: The modem is operating properly
Red: The modem is faulty

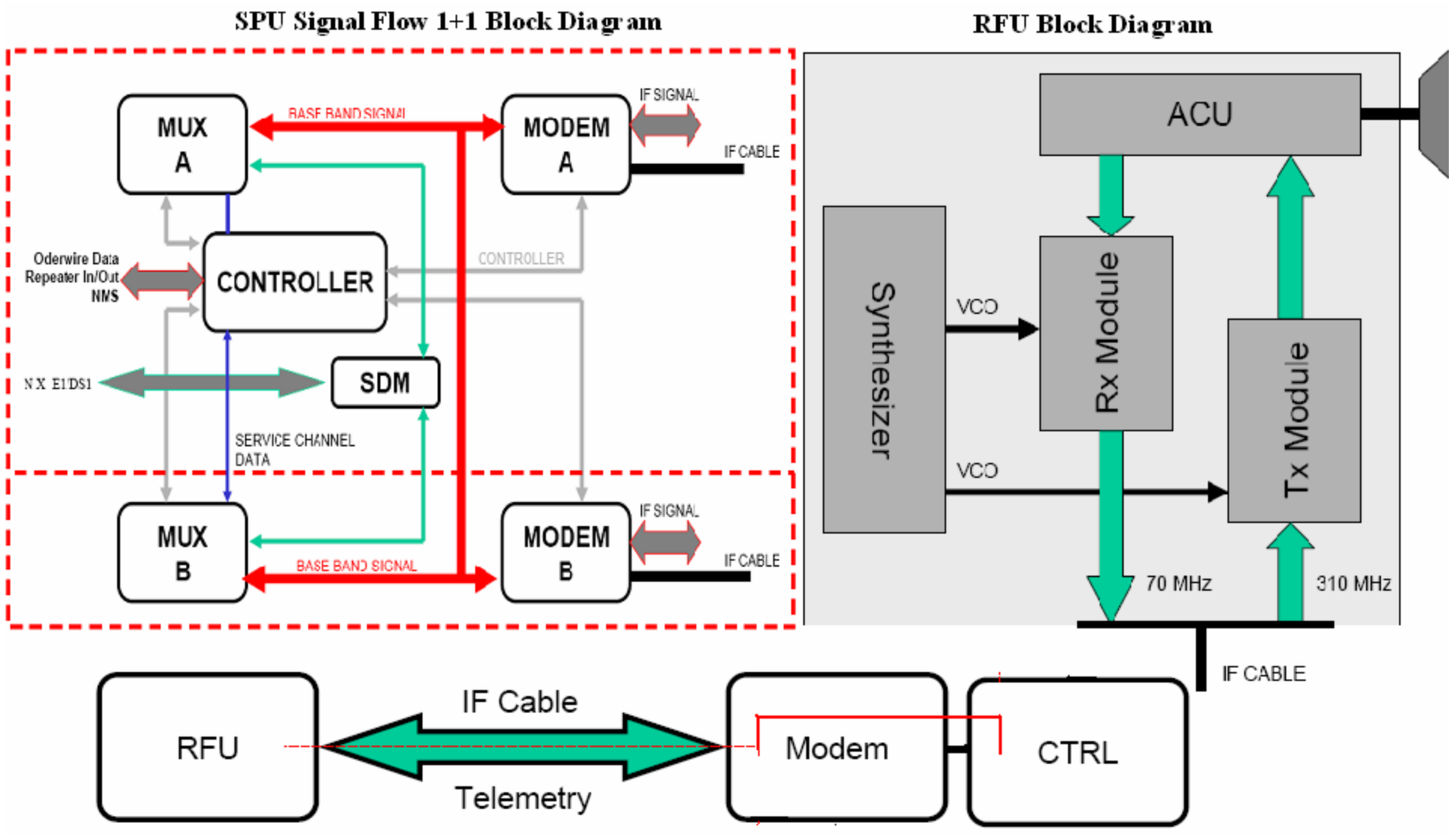
4. ODU Interface Terminals and Jacks

ODU (Transceiver)



5. Theory of Operation

General Block Diagram:



Transmit Signal Processes

1. SPU MUX (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.

2. Multiplexer (PDH)

- Uses bit stuffing to synchronize the incoming tributaries
- Multiplexes the tributaries together with the service channel data coming from the controller to an aggregate data rate
- Provides service channel clock to the controller.

3. SPU modem FEC (Forward Error Correction) 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 the aggregate data rate.(Generates the clock for multiplexer in PDH case).

4. Modulator

- Maps the FEC encoded signal corresponding to the specified modulation which is programmable to be 4/16/32/64/128/256 QAM.
- Generates modulated IF signal with specified modulation type.

5. 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 SPU

6. SPU Controller

- Generates a telemetry signal to configure and control the radio unit
- Feeds the service channel packet data to multiplexer This packet data is multiplexed together with the main tributary signals and other data such as wayside channel in 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. RFU transceiver 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. Upconverter block

- Converts the modulated signal to a higher frequency in a two-stage mixer and regulates its amplitude

9. Transmitter module

- Up-converts the signal to the transmit frequency and amplifies it

10. RFU Diplexer

- Carries the final signal through to the antenna

Receive Signal Processes

1. RFU Diplexer

- Keeps the in-coming signal separate from the out-going transmit signal and removes unwanted frequencies.

2. RFU transceiver 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 automatic gain control (AGC) circuits.3Cable interface (RFU's)
- Inserts the IF signal in the coaxial cable along with the modulated telemetry data going to the corresponding SPU.

4. SPU modem Cable interface (SPU's)

- Extracts the receive IF and telemetry signals from the composite signal in the coaxial cable

5. Demodulator

- Has an IF AGC circuit to compensate the SPU/RFU cable loss
- Has an IF filter to eliminate the adjacent interference signals.
- Contains a slope equalizer to compensate 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 Carrier from the IF signal and regenerates the clock and data streams.
- Sends the signal to the FEC circuit.

6. FEC (Forward Error Correction)

- Uses the correction codes embedded in the signal to correct it, as necessary.

7. 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. SPU MUX 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 service channel packet data and sends it to the Controller.

9. SPU Controller

- Receives service channel packet data and clock from DEMUX.
- Recovers the respective data and sends it to the respective data ports or circuits for further processing

6. IF Coaxial Cable Link Function

The IF cable link from the IDU to the ODU is used by both traffic and control signals:

1. From the IDU to the ODU it carries:

- The modulated transmit IF signal.
- Telemetry signal (for control).
- DC power.

2. From the ODU to the IDU it carries:

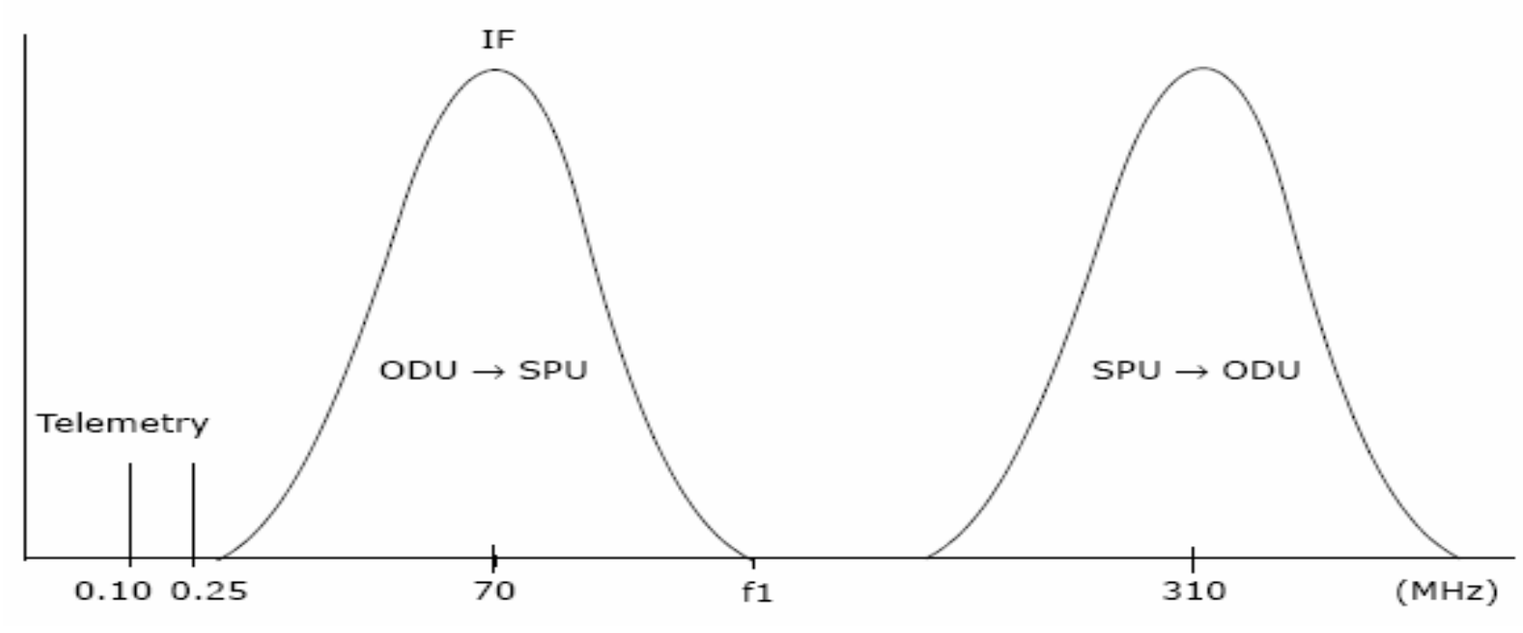
- The receiver IF signal.
- Telemetry signal (for alarms and control response).

Note:

From the ODU to the IDU it carries receive IF signal, and telemetry signal..

Figure below shows how these different signals occupy different frequency slots on the cable interfaces in the IDU, and ODU use filters to separate the different signals as they insert and extract them from the composite signal on the cable.

Frequency Distribution on Coaxial Cable



7. Functional Description of the Modules

The Modem

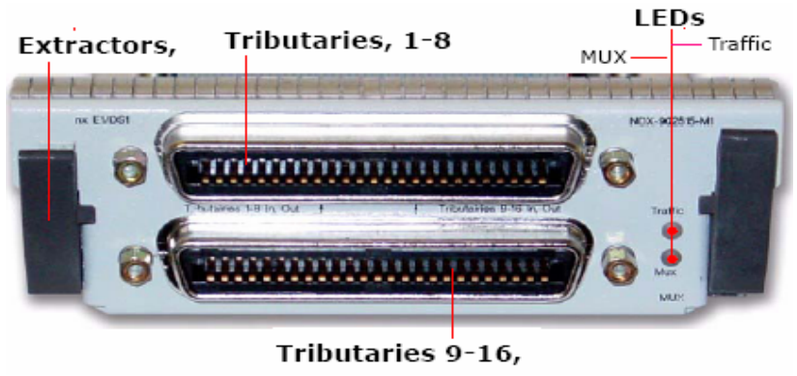
LEDs	Color	Meaning
TRAFFIC	*Green*	The module is on-line (see Note below
	Off	No traffic passing
RFU	*Green*	The RFU is operating properly
	Red	The RFU has failed
CABLE	*Green*	The cable connecting the IDU to the RFU is working properly
	Red	The cable connecting the SPU to the RFU has failed
MODEM	*Green*	The modem is operating properly
	Red	The modem has failed

Features and Functions:-

- Narrow Bandwidth: 2.5 to 3o MHz
- Wide Bandwidth: 2.5 to 56 MHz
- Modulation & Demodulation programmable to QPSK & 16 up to 256 QAM
- Power supply (21 to 60 Vdc), providing DC voltage to the SPU and PU
- FEC encoder and decoder
- DADE, enabling errorless receiver switching
- Connects to the transceiver through a single standard coaxial cable
- Transmit IF and receive IF are 310 and 70 MHz, respectively
- Four LEDs provide status/alarms,

The Multiplexer (MUX)

LEDs	Color	Meaning
TRAFFIC	*Green*	The module is on-line
	Off	No traffic passing
MUX	*Green*	The MUX is operating properly
	Red	The MUX is faulty

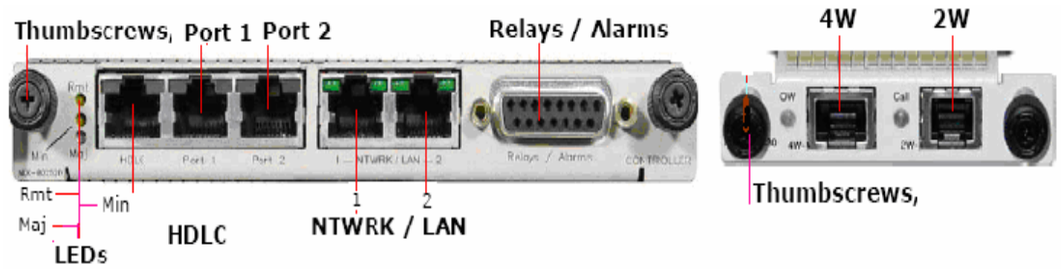


Features and Functions:

- Provides different interfaces to accommodate the PDH applications.
- Protection of the MUX in a 1+1 shelf is optional.

The Controller & Orderwire

LEDs	Color	Meaning
RMT	*Off*	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	There is a problem that has interrupted Traffic



Features and Functions:

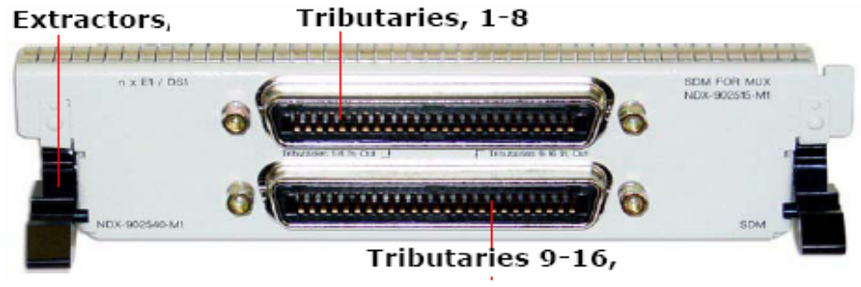
- Monitors all the terminal's modules by indicating alarms through each module's LEDs.
- Provides associated relay contacts
- Displays the status of the radio upon request through the HHT, the Web-CIT, the Element Manager
- Allows radio configuration and control via the same tools.
- All configurations parameters are stored on a removable 32 MB MMC for easy retrieval when replacing a Controller.

Auxiliary Channels:

- Consist of the network communication (Net Comm.) data.
- Net Comm. protocol encapsulates the SCAN (FarScan™), Order wire, data channel, NMS and some additional services for transporting this information in the radio's overhead.
- Dynamically allocated payload to each service that is in use, replacing services that are not in use.
- 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.
- Customer accessible services: a 2 x 64 kbit/s payload (through 2 bays located underneath the Controller), and a 19.2 kbit/s data channel (RS-232), as part of the basic offering.
- These bays can accommodate the optional modules given in the following table.

Optional modules	Functions
Order wire	Voice capability to the Truepoint™ microwave network
Co-directional or Contra directional V.11 64 kbit/s data	Point-to-point 64 kbit/s data channel within a hop of Co-directional or Contra- TRuepoint™ 5000 radios (Future)
directional G.703 64 kbit/s data	
Relays and Alarms	In addition to the basic 4 relays and 2 alarm inputs on the Controller, the module provides either 12 relays and 12 alarm inputs or 6 relays and 30 alarm inputs
10/100 BASE-T Over 64 kbit/s (Future)	Additional dedicated 10BASE-T point to point channel for the customer's own use (NMS or inter-sites LAN connectivity)
Dial-in modem (Future)	Accessibility to the system network through a telephone line without additional equipment (Single telephone cable line to be connected to the public telephone outlet)

Signal Distribution Module, (SDM)

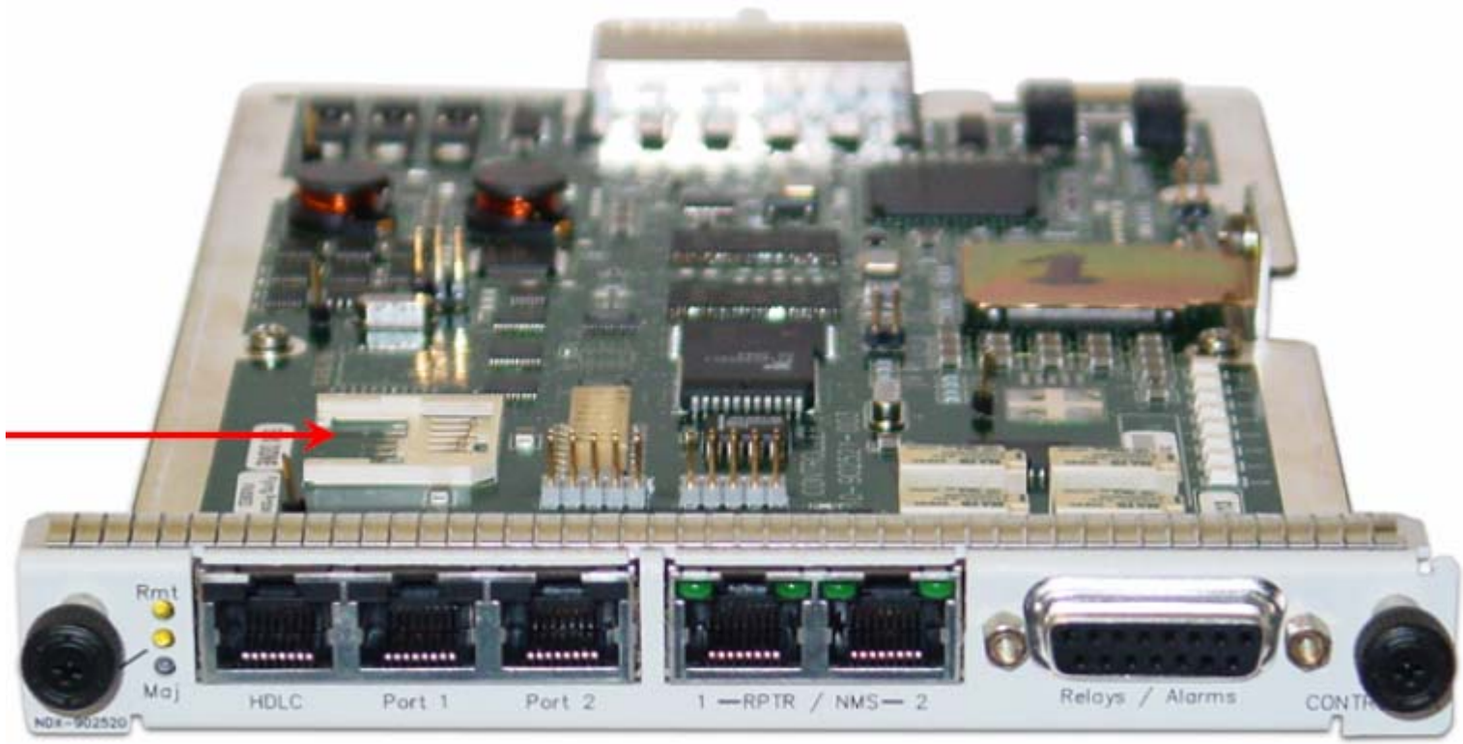


Features and Functions:-

- Provides a customer's access point for their tributary signals (for multiplexer- protected systems only, except for STM-1/OC-3 interface).
- 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.
- With the presence of the SDM and tributaries connected to the SDM, One of the MUXes can be replaced without affecting traffic.

8. MMC Flash Card Location (Multi Media Card)

- One software supports all hardware options.
- Software resides on the removable MMC Flash card
- System configuration is stored in the MMC card
- Includes firmware for SPU modules and RFU
- Field upgradeable



Loopback

The following loopback tests can be performed locally or remotely through the Keypad or Web-CIT:

Modem IF loopback (only locally)

- MDM IF LPBK

MUX loopback tests

- MUX LPBK
- RMT MUX LPBK

Tributary Input or Radio loopback tests

- LCL TRIB input LPBK
- RMT TRIB input LPBK
- LCL TRIB radio LPBK
- RMT TRIB radio LPBK

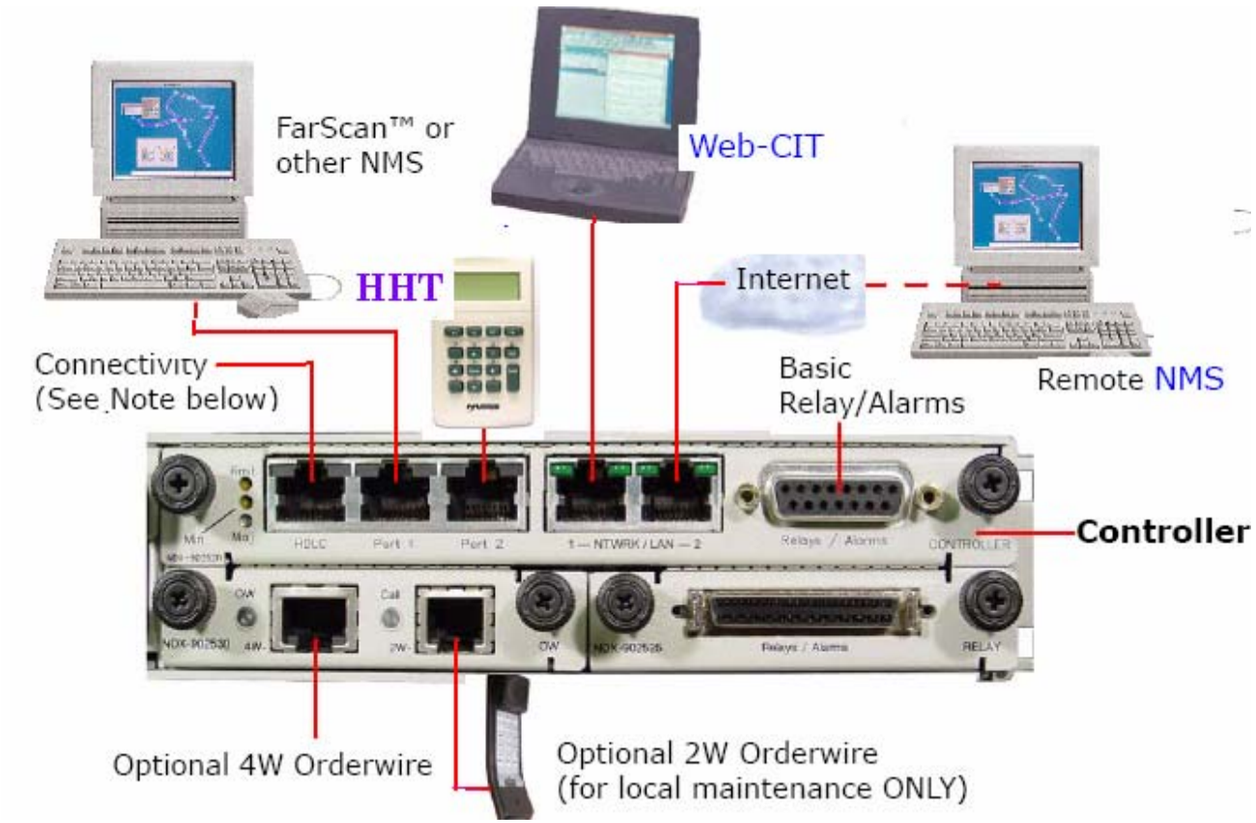
CHAPTER 2

Monitoring, Controlling and Configuration

Truepoint™ 5000

- ***Connecting Remote and Local Communications Equipment***
- ***Monitoring, Controlling and Configuration (by using Web-CIT)***
- ***Monitoring, Controlling and Configuration (by using VT-100 or HHT)***

1. Connecting Remote and Local Communications Equipment



- **Interconnectivity details between Truepoint™ and other MCD products.**

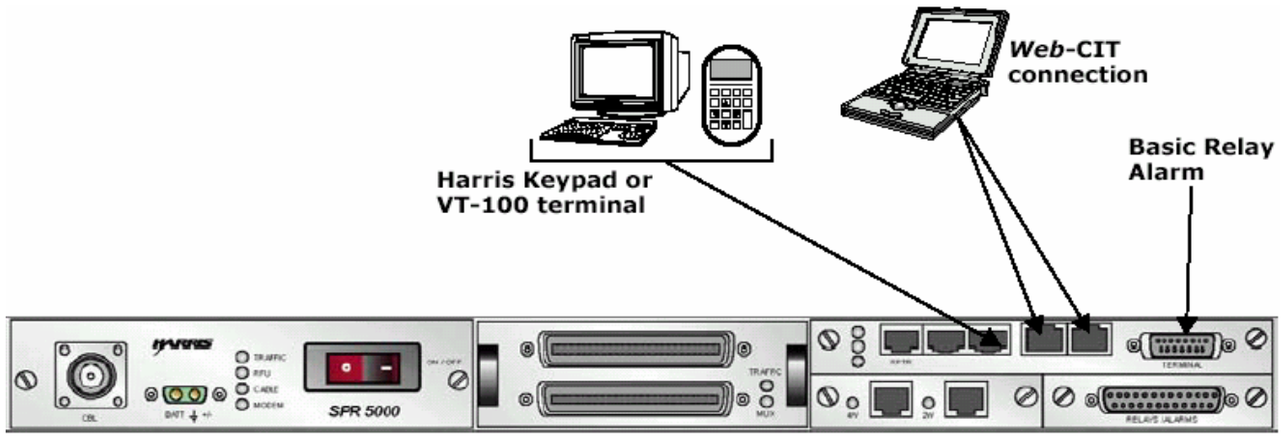
2. Monitoring, Controlling and Configuration

The operator controls and monitors the **Truepoint™** 5ooo with either:

1. By using a Web-CIT

2. By using a VT-100 Terminal

- a VT-100 compatible terminal (such as Hand-Held Terminal) communicating with the embedded control software.



2.1. By using a Web-CIT

Connecting to the Radio: Truepoint Web-CIT
There are two ways to connect to the radio with the Truepoint Web-CIT.

Option 1

1. Connect a PC to a 10/100 Base-T port on the IDU. You will need a standard Ethernet cable.

2. Go to your internet browser and type in the IP address that corresponds to the NE address; ***the default NE address of a new radio is 999 so the IP address will be 10.9.99.1.***

3. You will be prompted to enter your user name and password. If this is the first time you are connecting to the system, ***the default user name is admin and the default password is 12345.*** If you have both a local and a remote site, you will need to login to both sites.

4. Once you have entered your user name and password, will appear.
Note that the local radio is on the left side of the main frame and the remote radio is on the right side.
If the local and the remote system do not have the same software version, the remote site will display a notification message. The functionality of the local window in the CIT will not be affected. If this occurs, open a separate CIT session to access the remote site.

5. Go to CONFIGURATION > SYSTEM and enter a new NE address.
Make sure you click the APPLY button. Once you have done this, you will need to reboot the Controller.

6. The defaults for the TRuepoint Ethernet interface are ENABLED, and AUTO mode. Auto mode automatically generates the Ethernet IP address and subnet mask for each radio based on the NE address. In order to make sure that you will connect correctly, you should go to Start > Settings > Network and Dial-up Connections on your PC. Then click on Local Area Connection and then the Properties tab.
Select Internet Protocol (TCP/IP) and then the Properties tab. Make sure that “Obtain an IP address automatically” is selected.

If at a later date you change the ETHERNET MODE to Manual, you should follow these same steps except make sure that “Use the following IP address” is selected.

7. Once this is done and the system has rebooted, go to your internet browser and type in the IP address that corresponds to the number you entered as the NE address.
Examples: NE Address is 232, IP address is 10.2.32.1
NE Address is 1, IP address is 10.0.1.1
NE Address is 20, IP address is 10.0.20.1
NE address is 800, IP address is 10.8.00.1

Option 2

1. Using the Harris Keypad or another VT-100 compatible terminal, enter the NE ADDRESS in the CONFIGURATION > NETWORK MANAGEMENT menu.
The NE ADDRESS must be a number from 001 to 999.

2. Connect a PC to a 10/100 Base-T port on the IDU. You will need a standard Ethernet cable.

3. The defaults for the TRuepoint Ethernet interface are ENABLED, and AUTO mode. Auto mode automatically generates the Ethernet IP address and subnet mask for each radio based on the NE address. In order to make sure that you will connect correctly, you should go to Start > Settings > network and Dial-up Connections on your PC. Then click on Local Area Connection and then the Properties tab. Select Internet Protocol (TCP/IP) and then the Properties tab. Make sure that “Obtain an IP address automatically” is selected.
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Examples: NE Address is 232, IP address is 10.2.32.1

NE Address is 1, IP address is 10.0.1.1
NE Address is 20, IP address is 10.0.20.1
NE address is 800, IP address is 10.8.0.1

5. You will be prompted to enter your user name and password. If this is the first time you are connecting to the system***, the default user name is admin and the default password is 12345.*** If you have both a local and a remote site, you will need to login to both sites.
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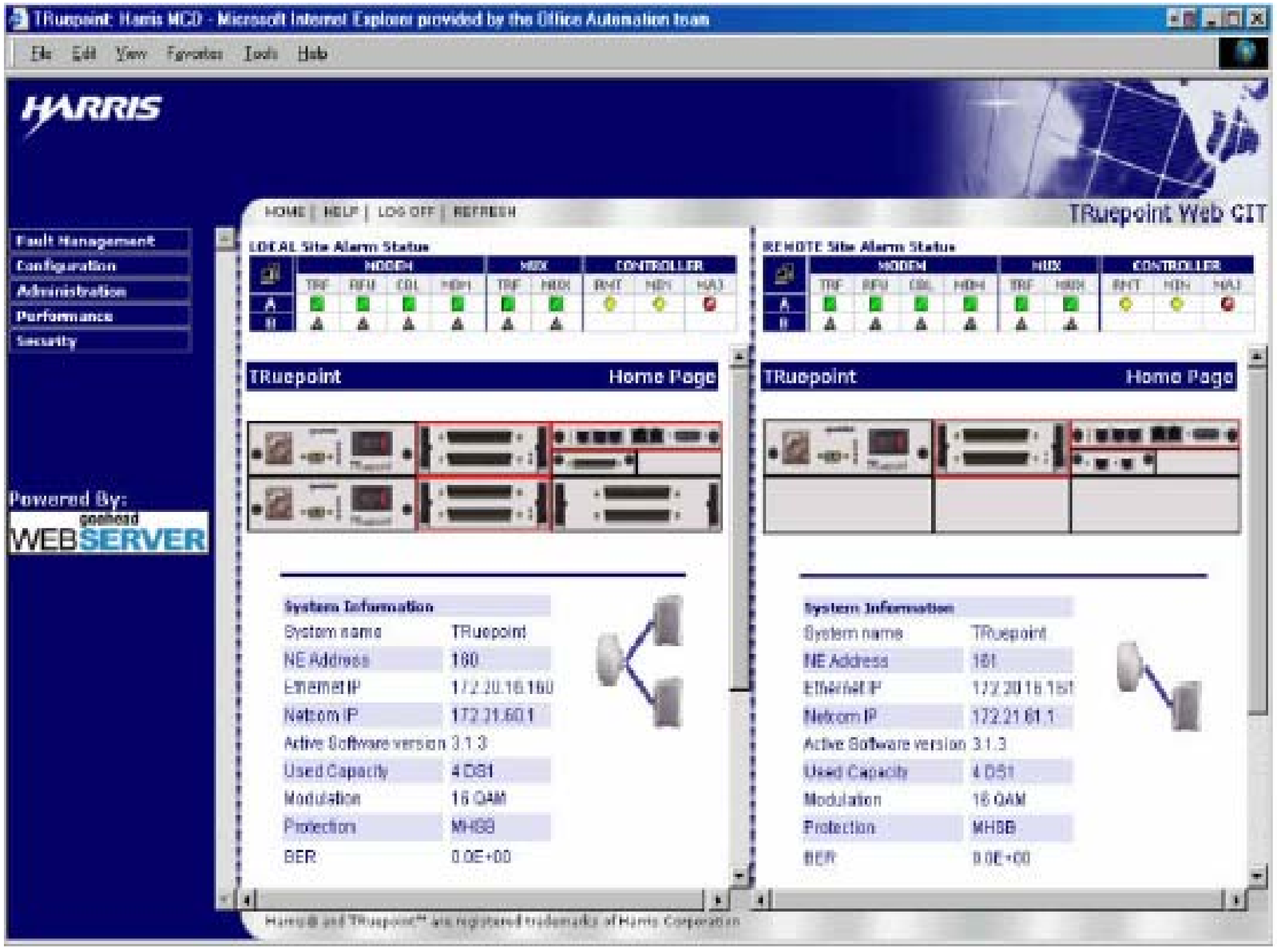
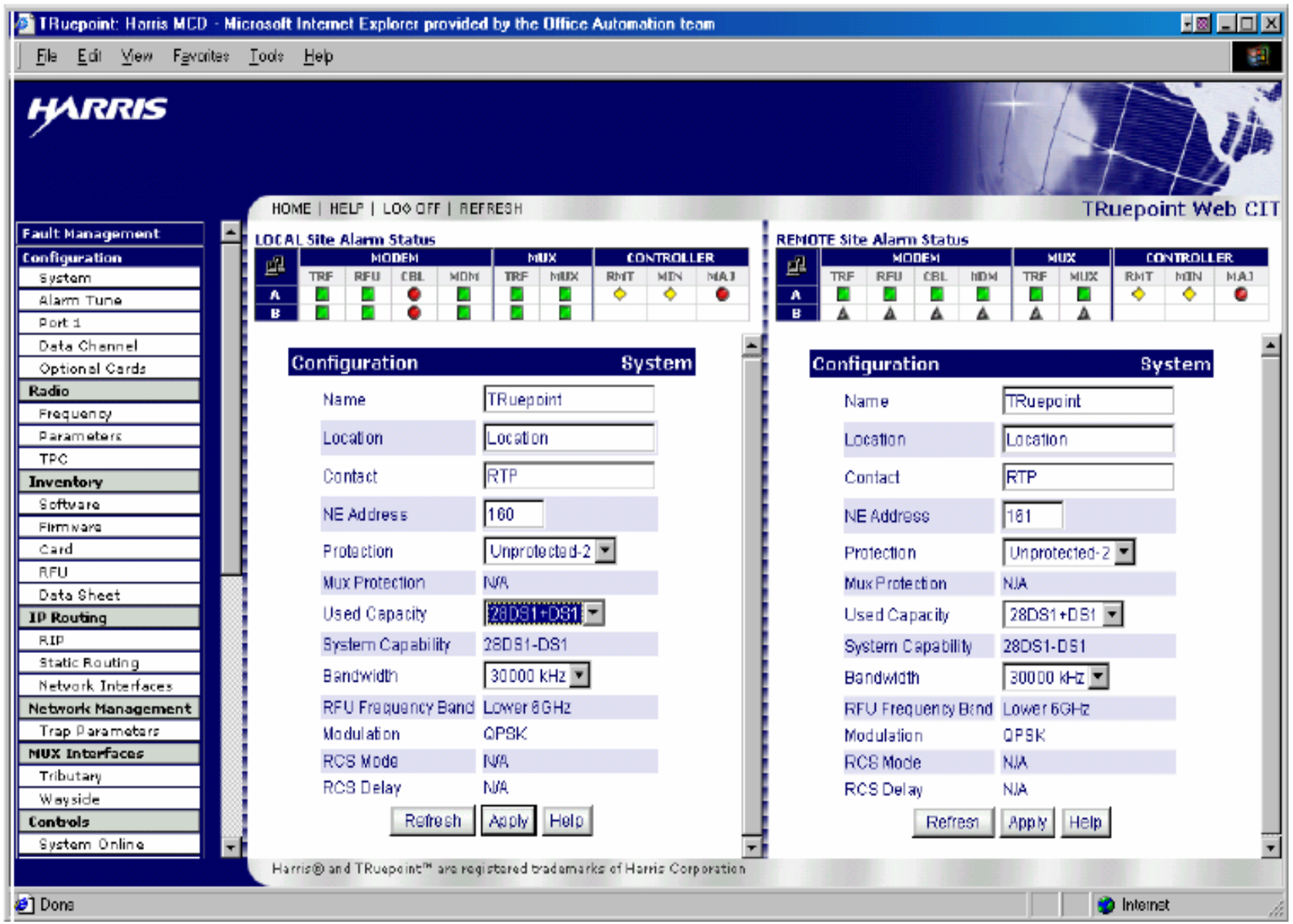
6. Once you have entered your user name and password, will appear. Note that the local radio is on the left side of the main frame and the remote radio is on the right side.

Truepoint CIT main page



System Configuration Menu



Configuring and Operating the Radio: Truepoint Web-CIT

Expanding Menus

Once the Web-CIT is connected the operator simply uses the navigator bar on the far left hand side to move from menu to menu. To expand a menu, click on the appropriate menu item in the black bar and the rest of that menu will appear as shown in Figure In this example, the Configuration menu has been expanded, while the Fault Management, Administration, Performance, and Security menus have not.

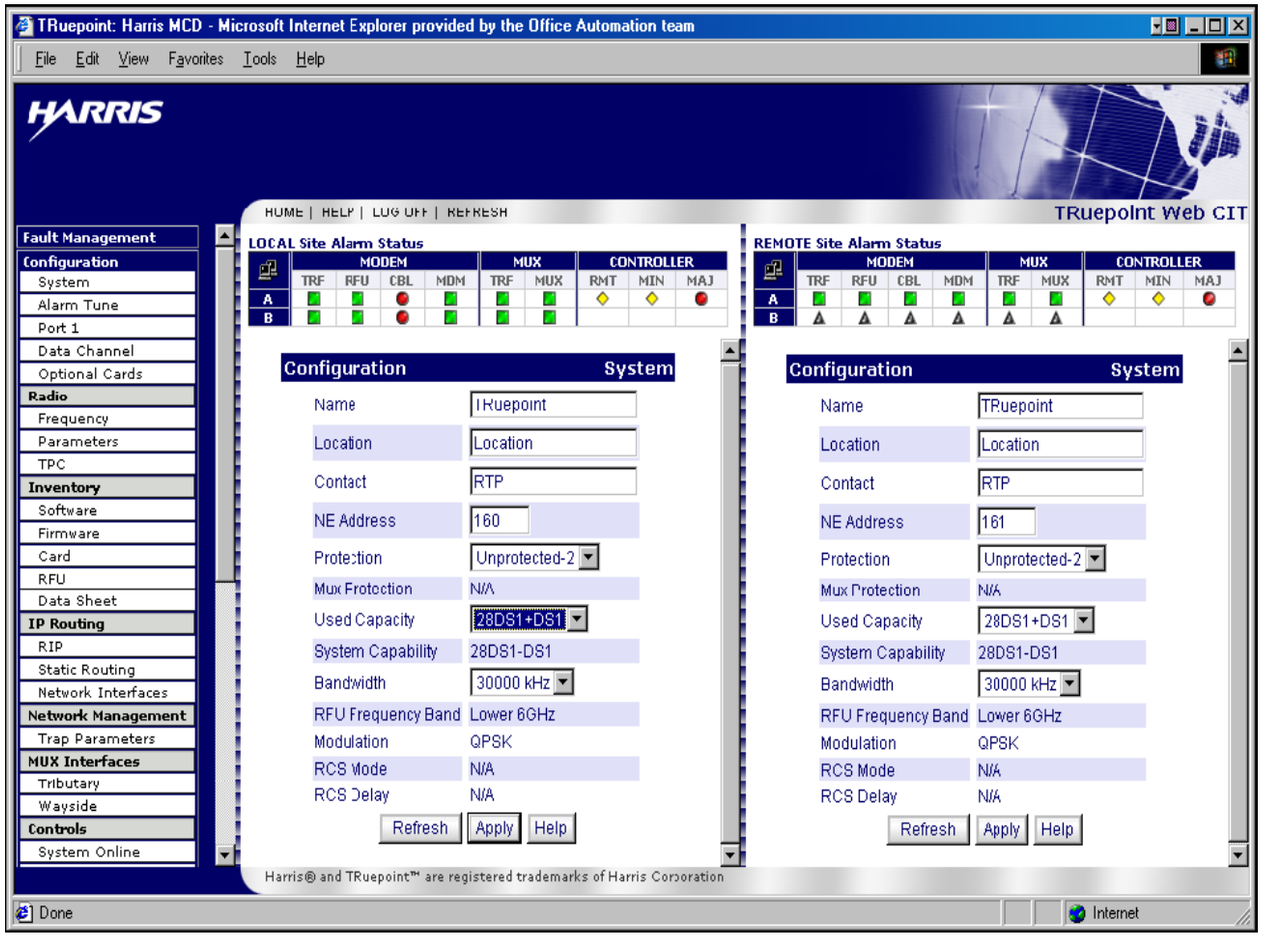
Selecting menu options

Once you have expanded a menu, you can move from screen to screen simply by clicking on the appropriate option. Figure shows the screen that appears when you click on CONFIGURATION > SYSTEM.

System Configuration Menu

Many of the menus provide a number of optional operations. For example the CONFIGURATION > SYSTEM screen provides multiple drop down menus as seen in Figure.

If you make a change, you must click the APPLY button at the bottom of each frame for that change to take effect.



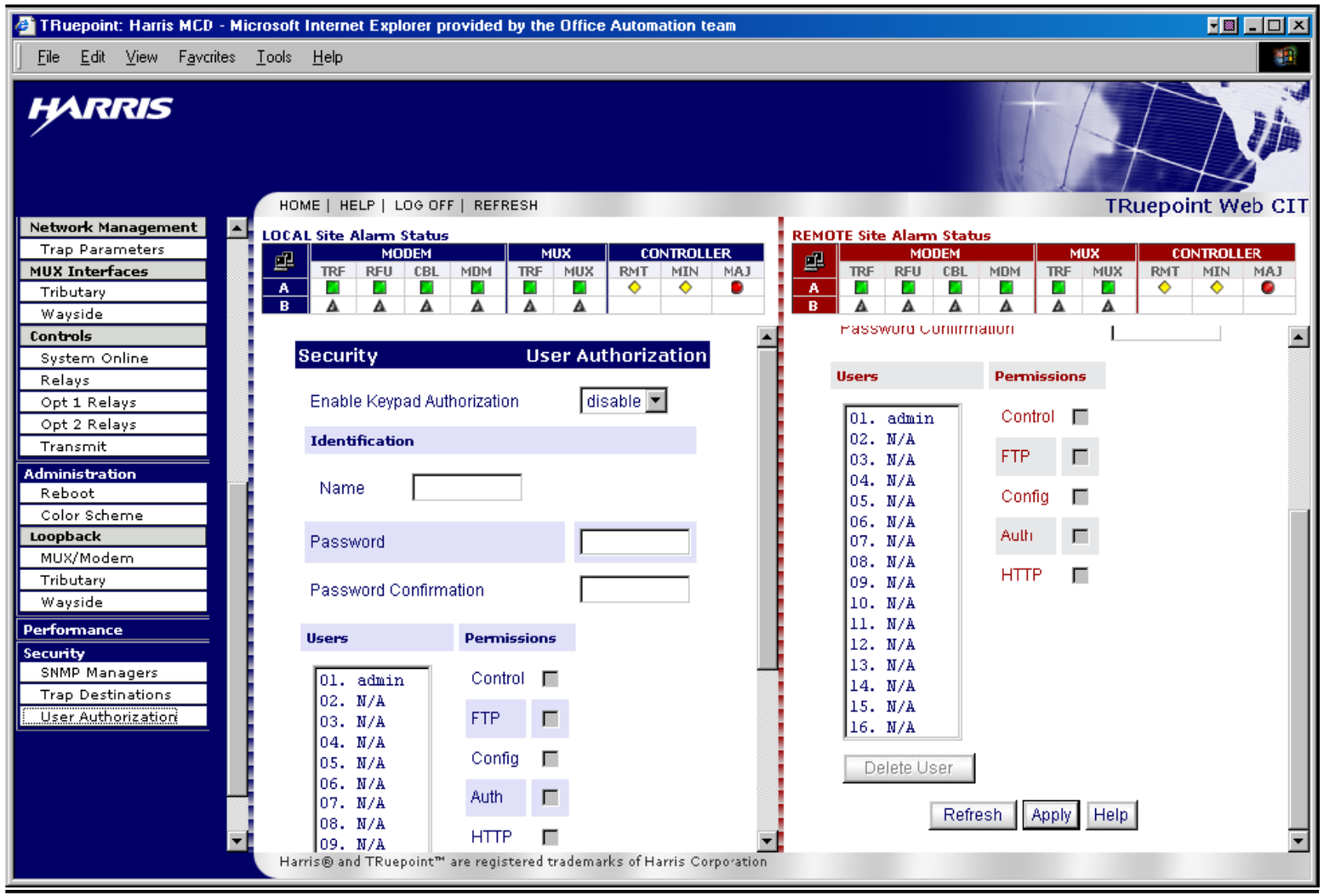
User Authorization

Go to SECURITY > USER AUTHORIZATION.
As noted before, the default user is **admin** and the default password is **12345**.This screen allows you to change your default user name and password as well as set up additional users.
To change the default (or 01 user) name, click on the 01 user line so it is highlighted, enter the new name and password in the appropriate boxes, and click APPLY.
To add a new user, click on the next available open user slot. Once you have done that, enter the user NAME and PASSWORD and then confirm the PASSWORD. All of the access options will default as checked. If an available user has not been selected the boxes will be grayed out. To change a user's access privileges, simply uncheck the box next to the option that you do not want that user account to access. Click APPLY to add that user.

- ***When creating users, make sure that "Auth" is unchecked if you do not want the user to have access to the User Authorization screen. Otherwise, a user could change their permissions.***

To delete a user, click on the user you want to delete so that the user is highlighted and then click the DELETE button. Clearing out the text in the NAME and PASSWORD boxes will not delete a user.
HHT: CONFIGURATION > USER AUTHORIZATION.

Color Scheme

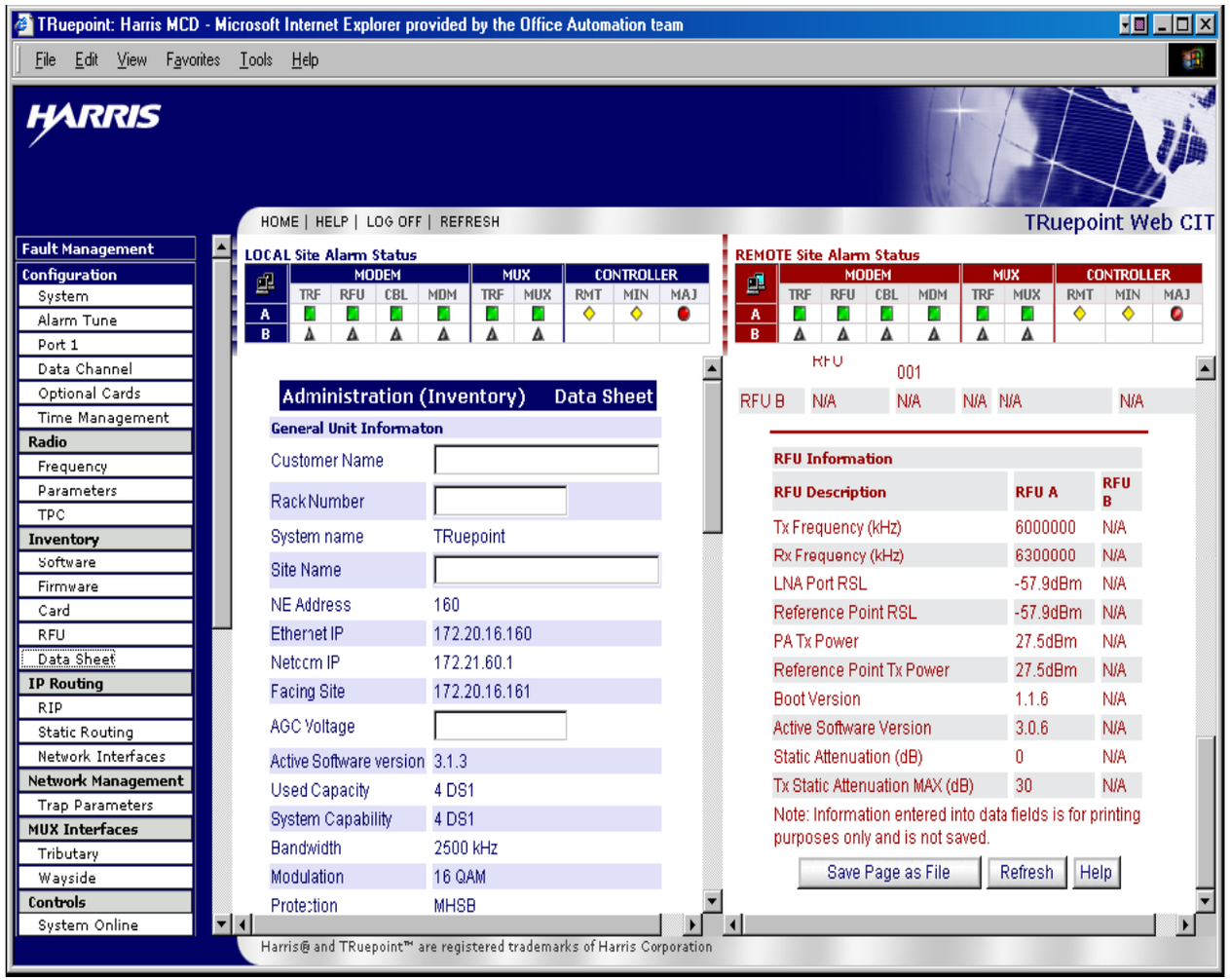


-

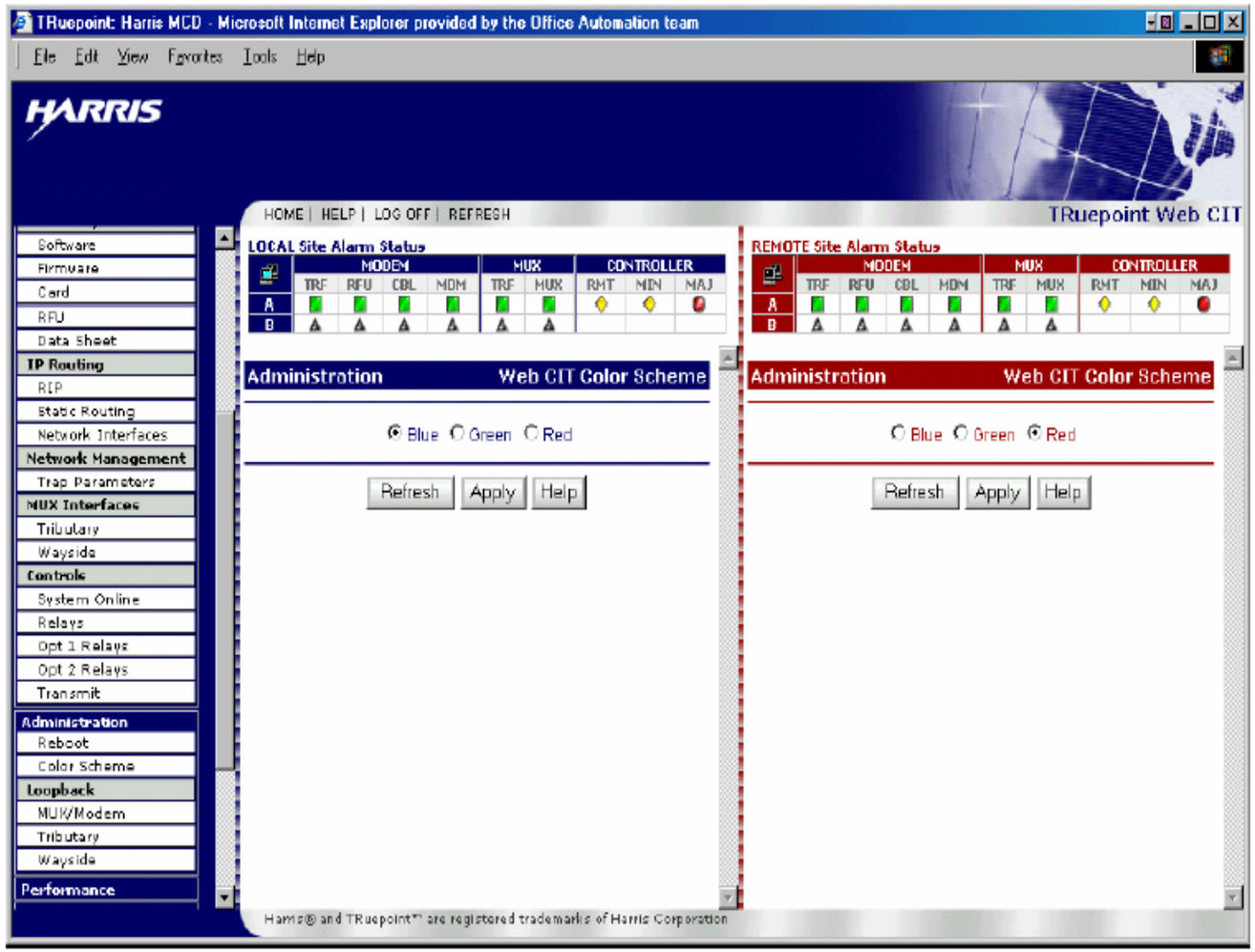
DATA SHEET

Go to CONFIGURATION > INVENTORY > DATA SHEET.
The Data Sheet page displays inventory information about the radio, as seen in Figure. If you want to print this information, select the “Save Page as File” button as seen on the right hand side of Figure. The information will be saved as a Comma Separated Value file which can then be imported into applications such as Microsoft Excel.
There are four data fields that you can fill out as seen on the left hand side of Figure for printing purposes only. These fields are Customer Name, Rack Number, Site Name, and AGC voltage.

There is no equivalent to the Data Sheet in the HHT. However, the STATUS branch contains most of the same information.



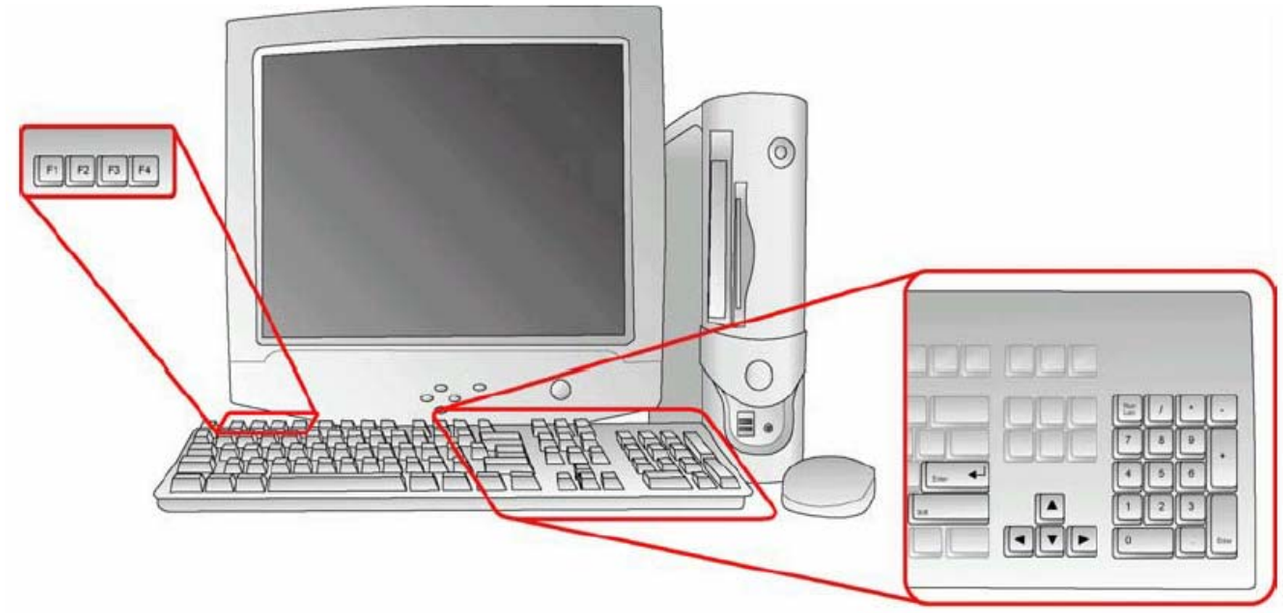
T Color Scheme



2.2. By using a VT-100/ Hand-Held Terminal

- a VT-100 compatible terminal (such as Hand-Held Terminal) communicating with the embedded control software.

VT-100 Terminal or PC



Hand-Held Terminal

2.2.1. VT-100 Terminal or PC

Connect the VT-100 terminal or PC to Port 2 on the IDU. You will need an RJ-45 to RS-232 cable or a RJ-45 cable with a RS-232 adapter.
Port 1 or Port 2 can be used with a standard VT-100 terminal or a PC with software that emulates a VT-100; Port 2 is pre-configured at 9600 baud.
All Windows PCs have HyperTerminal which will allow you to emulate a VT-100 terminal. To use HyperTerminal, go to Programs > Accessories > Communication > HyperTerminal from the Windows Start menu.

The VT-100 or PC communications port must be configured as follows:
The layout of a typical PC keyboard. You will need to use the numeric keys for entering numeric values and the arrow keys to scroll up and down.
The RETURN key is used to initiate the execution of a selected menu function or to register a numeric value.

Mode	**ANSI**
Local echo	**OFF**
Control	**INTERPRET**
Host port	**RS232C**
Port speed	**9600 baud**
Data bits	**8**
Stop bit	**1**
Parity	**NONE**

The period key (.) is used as the HOME key.
The F1, F2, F3, and F4 keys serve as the four function keys that represent the “soft keys” in the display. The soft key EXIT will return the display back to the Previous menu.
The dedicated arrow keys are used to move through the menus as follows:

~ scroll up ↑ Scroll down ↓ ← Page up → Page down

. The PF1, PF2, PF3, and PF4 keys serve as the four function keys that represent the “soft keys” in the display. The soft key EXIT will return the display back to the previous menu.

2.2.2. Hand-Held Terminal

Connect the hand-held terminal to the TERMINAL port on the SPU shown in, the hand-held terminal has an 11-key keypad, four function keys, and a 4-line by 20-column alphanumeric readout (display).
The numeric keys (keys 0 through 9) are used for keying in numeric values

They are also used for the following functions:
• The 2, 4, 6, and 8 numeric keys are also used as arrow keys and are used to scroll up (8 key), down (2 key), page-up (4 key), and page-down (6 key) through the menus. Page-up and page-down move the display four lines up and down respectively.
• The 5 numeric key is used as a HOME key, which closes the existing menu and returns to the MAIN menu.
The ENTER key is used to initiate the execution of a selected menu function or register a numeric value.
The function keys (F1, F2, F3, and F4) are used to execute menu functions that appear as “soft keys” on the last line in applicable menus.
Function key F1 corresponds to the first “soft key” selection, F2 to the second, F3 to the third, and F4 to the fourth. Refer to for the location of the “soft keys” in the display.

2.2.3. Menu Tree

Main Menu

- *NE ADDRESS LCL* — *NE address selection screen*
- *ALARM*
- *STATUS*
- *PERFORMANCE*
- *CONTROL*
- *CONFIGURATION*
- *SYSTEM DESCRIPTION*

Some Alternate Displays

The displays below are not on the menu tree, but appear under certain circumstances, replacing the current display from the menu tree.

ABSENT	Appears when items in a particular menu are not installed.
S/W CORRUPTED	Appears if the software in the RFU is corrupted.
FORGOT PASSWORD?	Appears in the menu when a user has logged in as a guest.

ALARM BRANCH

1-system
NO ETHERNET ADDRESS
DHCP CLIENT FAILED
REBOOT
LOAD CORRUPTED
CABLE A/B
MUX CARD MISMATCH
SDM MISMATCH
RFU MISMATCH
MDM A/B SPI COMMUNICATION
MUX A/B SPI COMMUNICATION
OPT 1/2 SPI COMMUNICATION
RFU A/B COMMUNICATION
MMC FILE SYSTEM
CONFIG FILE
ATPC TX A/B HIGH POWER
TPC TIME LIMIT
TPC A/B TIME LIMIT
BER
BER A/B
NO RF NEIGHBOR
BANDWIDTH UNKNOWN
CNTLR REPLACE ME
RF LINK SVC FAIL

2-PATH
RSL A/B LOW
SIGNAL A/B DEGRADED
ALIGNMENT
REMOTE SYNC LOSS
DEMUX A/B SYNC LOSS
DEMUX A/B WAYSIDE SYNC LOSS
MUX RMT LOF

3-CONTROL ACTIVE
TX A/B LOCK
LOCK RX RFU DECODER A/B
LOCK RX DADE DEMUX A/B
MODEM IF LOOPBACK
MUX HIGH LEVEL LOOPBACK
If you have TRIB DS1/E1
If you have OC3/STS3
If you have TRIB DS3
If you have WAYSIDE
RFU A/B MUTED
TX A/B CW TONE

3-1 TRIB SD1/E1
TRIB DS3 X LOCAL INPUT LOOPBACK
TRIB DS3 X LOCAL RADIO LOOPBACK
TRIB DS3 X REMOTE RADIO LOOPBACK
TRIB DS3 X REMOTE RADIO LOOPBACK REQUEST

4-EXTERNAL ALARMS
CONTROLLER EXTERNAL INPUT 1
CONTROLLER EXTERNAL INPUT 2
OPTIONAL 1 EXTERNAL INPUT
OPTIONAL 2 EXTERNAL INPUT

5-CARD ABSENT
MUX A/B ABSENT
MDM A/B ABSENT
RFU A/B ABSENT
OPT 1/2 ABSENT
SDM ABSENT

6-MODEM A/B
MDM A/B UNKNOWN
MDM A/B FIRMWARE NOT UPGRADED
MDM A/B FPGA DOWNLOAD
MDM A/B FPGA SETTING
MDM A/B REPLACE ME
MDM A/B SYNTHESIZER
MDM A/B WRONG OPTION

7- MUX A/B
MUX A/B UNKNOWN
MUX A/B FIRMWARE NOT UPGRADED
MUX A/B FPGA DOWNLOAD
MUX A/B FPGA SETTING
If you have OC3/STS3
If you have TRIB DS1/E1
If you have TRIB DS3
If you have WAYSIDE
MUX A/B TX CLOCK INPUT LOSS
MUX A/B REPLACE ME

8-RFU A/B
RFU A/B FAILED
RFU A/B SOFTWARE NOT UPGRADED
RFU A/B SOFTWARE DOWNLOAD
RFU A/B SETTING
RFU A/B RX EQUIPMENT
RFU A/B TX EQUIPMENT
RFU A/B EEPROM
RFU A/B SYNTHESIZER
RFU A/B PA LOW
RFU A/B PA OUTPUT OUT OF RANGE
RFU A/B REPLACE ME
RFU A/B TX SILENT FAILURE
RFU A/B CALIBRATION TABLE MISMATCH
RFU A/B MUTE FOR TELEMETRY

9-OPT 1/2
OPT 1/2 UNKNOWN
OPT 1/2 FIRMWARE NOT UPGRADED
OPT 1/2 FPGA DOWNLOAD
OPT 1/2 FPGA SETTING
OPT 1/2 NOT SUPPORTED IN SIMPLEX
OPT 1/2 REPLACE ME
OPT 1/2 10BT COMM

10-SDM
SDM UNKNOWN
If you have TRIB DS1/E1

If you have TRIB DS3

If you have WAYSIDE

10-1 TRIB DS1/E1
TX INPUT LOS
TX INPUT AIS
TX INPUT DEGRADED
RDI IN ALM

STATUES BRANCH

1-ON LINE EQUIPMENT
MUX A/B TX ONLINE
MDM A/B TX ONLINE
RFU A/B TX ONLINE
MUX A/B RX ONLINE
MDM A/B RX ONLINE
RFU A/B RX ONLINE
MUX A/B SEL BY ADM SELECTED

2-SYSTEM
CAPABILITY XXXXXXXX
USED CAPACITY XXXXXXXX
CHANNEL BW XXX MHz
MODULATION XXXXXXXX
RFU BAND XXX GHz
PROTECTION XXXXXXXX
MUX PROTECTION XXXXXXXX
DUPLEX MODE XXXXXXXX
OPT 1
OPT 2

3-RADIO
PA TX A PWR XXX dBm
REF TX A PWR XXX dBm
PA TX B PWR XXX dBm
REF TX B PWR XXX dBm
LNA RSL A XXX dBm
REF RSL A XXX dBm
LNA RSL B XXX dBm
REF RSL B XXX dBm
RSL A STATUS OK/LOW
RSL B STATUS OK/LOW
TX A XXX kHz
TX B XXX kHz
RX A XXX kHz
RX B XXX kHz
RFU A TEMP XXX C
RFU A MAX TEMP XXX C
RPC A TEMP XXX C
RFU B TEMP XXX C
RFU B MAX TEMP XXX C
RPC B TEMP XXX C
TPC POWER MODE
MANUAL/ATPC/DTPC
ELAPSE TIME DD:HH:MM:SS
TPC EXCEED XXX %

4-NETWORK MANAGEMENT
NE ADDRESS XXX
NETCOM IP INTFC
NETCOM IP DISABLED
ETHERNET IP INTFC
ETHER IP DISABLED
DEFAUL ROUTER XXX.XXX.XXX.X

4-1-NETCOM IP INTFC
NETCOM IP STATUS
IP ADDR MODE
INTERFACE
ADR
MSK

4-2- ETHERNET IP INTFC
ETHER IP STATUS
IP ADDR MODE
INTERFACE
ADR
MSK

5-TIME MANAGEMENT
LCL DATE YYYY-MM-DD
LCL TIME HH:MM:SS
TIME OFFSET XX:XX
GMT DATE YYYY-MM-DD
GMT TIME HH:MM:SS
SNYC MODE XXX
SERV. MODE XXX

6-RELAYS
CNTRL RELAY 1 ENG/DEN
CNTRL RELAY 2 ENG/DEN
CNTRL RELAY 3 ENG/DEN
CNTRL RELAY 4 ENG/DEN
OPT1 RELAY 0..11 ENG/DEN
OPT2 RELAY 0..11 ENG/DEN

7-INVENTORY
CONTROLLER
MUX A
MUX B
MODEM A
MODEM B
OPT CARD 1
OPT CARD 2
SDM
RFU A
RFU B
H/W KEY FAILED/NONE/4TRIBs/
8TRIBs/12TRIBs/16TRIBs
SONET INTERFACE
UNKNOWN/ELECTRICAL
/OPTICAL SINGLE/OPTICAL MULTI
F/W VER XXXX
SETTING VER XXXX
PN XXX-XXXXXX-XXX
SN XXXXXXXX
REVISION XX
DATE XX-XX-XXXX

7-1-CONTROLLER
S/W VER XXXX
ALT S/W VER XXXX
BOOT VER XXXX
PN XXX-XXXXXX-XXX
SN XXXXXXXX
REVISION XX
DATE XX-XX-XXXX

7-2-MUX A,B
TYPE MUX STM1,OC3 / MUX nxE1 /
MUX nxDS1 / MUX 3DS3+3WS /
MUX 100BT/DS3 E3+WS

STATUS BARANCH CONTINUED

1- INVERNTOTY

CONTROLLER
MUX A
MUX B
MODEM A
MODEM B
OPT CARD 1
OPT CARD 2
SDM
RFU A
RFU B

1-1.MODEM A,B

TYPE MODEM/MODEM WB/ MODEM(ALPHA)/ MODEM NB
F/W VER XXXX
SETTING VER XXXX
PN XXX-XXXXXX-XXX
SN XXXXXXXX
REVISION XX
DATE XX-XX-XXXX

1-2.OPT CARD 1,2

TYPE ORDERWIRE/AlarmRelay12R12A/ AlarmRelay 6R30A
F/W VER XXXX
SETTING VER XXXX
PN XXX-XXXXXX-XXX
SN XXXXXXXX
REVISION XX
DATE XX-XX-XXXX

1-3. SDM

TYPE STM1, /nxE1Balanced/ nxE1Unbalanced/Balanced

1-4. RFU A,B

TYPE
TX A MIN XXXXXXX kHz
TX A MAX XXXXXXX kHz
RX A MIN XXXXXXX kHz
RX A MAX XXXXXXX kHz
ATTEN A MAX XXX dB
S/W VER XXXX
SETTING VER XXXX
BOOT VER XXXX
RPC CAL VER XXXX
TX CAL VER XXXX
RX CAL VER XXXX
HPA CAL VER XXXX
PN XXX-XXXXXX-XXX
SN XXXXXXXX
TXPN XXX-XXXXXX-XXX
TXSN XXXXXXXX
RXPN XXX-XXXXXX-XXX
RXSN XXXXXXXX
RPCPN XXX-XXXXXX-XXX
RPCSN XXXXXXXX
MFG DATE XX-XX-XXXX
CLEI XXXXXXXX

2-S/W DETAIL

2-1. CONTROLLER

S/W VER XXXX
ALT S/W VER XXXX
BOOT VER XXXX

2-2. MUX A,B

F/W VER XXXX
SETTING VER XXXX
PRI F/W VER XXXX
PRI SETTING XXXX
ALT F/W VER XXXX
ALT SETTING XXXX

2-3.MODEM A,B

F/W VER XXXX
SETTING VER XXXX
PRI F/W VER XXXX
PRI SETTING XXXX
ALT F/W VER XXXX
ALT SETTING XXXX

2-4.OPT CARD 1,2

F/W VER XXXX
SETTING VER XXXX
PRI F/W VER XXXX
PRI SETTING XXXX
ALT F/W VER XXXX
ALT SETTING XXXX

2-5. RFU A,B

S/W VER XXXX
PRI S/W VER XXXX
PRI SETTING XXXX
ALT S/W VER XXXX
ALT SETTING XXXX

PERFORMANCE BRANCH

1-SYS BER	
MEASUREMENT	RUN/STOP
BER	XXXXXXX
TIME	XXd XXh XX:XX
2- ERR SEC	
RESET STATISTICS	EXEC
ET	XXd XXh XX:XX
UNAV	XXd XXh XX:XX
AV	XXd XXh XX:XX
EFS	XXXXXXXX
ES	XXXXXXXX
SES	XXXXXXXX
BBE	XXXXXXXX
SEP	XXXXXXXX
EFSR	XXX%
ESR	XXX%
SESR	XXX%
UNAVR	XXX%
BBER	XXX%
SEPI	XXX%

3- LATCH EDD SEC	
ET	XXd XXh XX:XX
UNAV	XXd XXh XX:XX
AV	XXd XXh XX:XX
EFS	XXXXXXXX
ES	XXXXXXXX
SES	XXXXXXXX
BBE	XXXXXXXX
SEP	XXXXXXXX
EFSR	XXX%
ESR	XXX%
SESR	XXX%
UNAVR	XXX%
BBER	XXX%
SEPI	XXX%

CONTROL BRANCH

1-LOCK
LOCK TX OUT A/B SET/CLR
LOCK RA/DECDR A/B SET/CLR
LOCK RXD/DMUX A/B SET/CLR

2-SWITCH
TX SWITCH SIDE A/SIDE B
RX/DECDR SIDE A/SIDE B
DMUX/DMD SIDE A/SIDE B
TX OUT
RX/DECDR
RXD/DMUX

3-LOOPBACK
HIGH LVL LPBK
RMT RADIO LPBK
LOCAL LPBK
WS LPBK

3-1.HIGH LVL LPBK
MDM IF LPBK SET/CLR
MUX LPBK SET/CLR
If you have a 2+0 system:
MDM A/B IF LPBK SET/CLR

MUX A/B LPBK SET/CLR

3-2.RMT RADIO LPBK
FOR E1/DS1:
TRIB X RMT LPBK SET/CLR
If you have a 2+0 system:
TRIB Ax/Bx RMT LPBK SET/CLR
or For OC3/STS3:
MUX RMT LPBK SET/CLR
If you have a 2+0 system:
MUX Ax/Bx RMT LPBK SET/CLR
or FOR DS3:
TRIB 1 (2,3) RMT LPBK SET/CLR
If you have a 2+0 system:
TRIB A1/B1 RMT LPBK SET/CLR

3-3.LOCAL LPBK
For E1/DS1:
TRIB X LOC LPBK SET/CLR
INPUT/RADIO

If you have a 2+0 system:
TRIB Ax/Bx LOC LPBK SET/CLR
INPUT/RADIO

or For OC3/STS3:
MUX LOC LPBK SET/CLR
INPUT/RADIO

If you have a 2+0 system:
MUX Ax/Bx LOC LPBK SET/CLR
INPUT/RADIO

or FOR DS3:
TRIB 1 (2,3) LOC LPBK SET/CLR
INPUT/RADIO

If you have a 2+0 system:
TRIB A1/B1 LOC LPBK SET/CLR
INPUT/RADIO

3-4.WS LPBK
WS1 (2,3) LOC LPBK SET/CLR
INPUT/RADIO
If you have a 2+0 system:
WS A1/B1 LOC LPBK SET/CLR
INPUT/RADIO

WS1 (2,3) RMT LPBK SET/CLR
If you have a 2+0 system:
WS A1/B1 RMT LPBK SET/CLR

4-TRANSMIT
TX-A MUTE ON/OFF
TX-B MUTE ON/OFF
CW TONE A ON/OFF
CW TONE B ON/OFF
RESET TPC STAT

5-RELAYS
CNTRL RELAY 1 SET/CLR
...
CNTRL RELAY N SET/CLR
OPT 1 RELAY 0 SET/CLR
...
OPT 1 RELAY 11 SET/CLR
OPT 2 RELAY 0 SET/CLR
...
OPT 2 RELAY 11 SET/CLR

6-RFU DOWNLOAD
UPGRADE RFU A
UPGRADE RFU B
RFU A DWLD XXX%
RFU B DWLD XXX%

7-SELECT S/W
PRI LOAD XXX
ALT LOAD XXX
RUN ALT SOFTWARE EXEC
RUN ALT SYSTEM EXEC
UPDATE HW EXEC

CONFIGURATION BRANCH

1-SYSTEM
SPU
RFU
OUTPUT POWER

1-1. SPU
USED CAPACITY1 See footnote.
PROTECTION
UNPROT/2 UNPROT/MHSB/FD/SD/FD+SD
MUX PROTECTION UNPROT/PROTECTED
DUPLEX MODE SIMPLEX T/SIMPLEX R/DUPLEX
CHANNEL BW XXX MHz
OPT CARD 1 ENABLE/DISABLE
OPT CARD 2 ENABLE/DISABLE
SHOW PATH ALARMS SHOW/HIDE
RCS MODE SIMPLE/SMART/DISABLE
RCS DELAY 0/2/4/6/8/10/12/14/16/18/20
RX DFM THRESH 1/X
RSL LOW SEVERITY ALARM/STATUS
DANGR CTRL TIMEOUT

1-2. RFU
TX A FREQ XXXXXXXX
RX A FREQ XXXXXXXX
TX A ACU EXTRA LOSS XXXXXXXX
RX A ACU EXTRA LOSS XXXXXXXX
TX B FREQ XXXXXXXX
RX B FREQ XXXXXXXX
TX B ACU EXTRA LOSS XXXXXXXX
RX B ACU EXTRA LOSS XXXXXXXX
RSSI OUT PROPORT/INVERTED

1-3.OUTPUT POWER
TPC MODE MANUAL/ATPC/DTPC
TX A/B STAT ATTEN 0-40dB INCREMENTS OF .5
ATPC REM RSL THR 0-25 dB
ATPC BOOST STEP 0-15 dB
TX A COORD ATTEN 0-25 dB
TX B COORD ATTEN 0-25 dB
MAX EXCEED % 0-100%
NOMINAL REM RSL -70 to -20 dBm

2-NETWORK MANAGEMENT
NE ADDRESS 001...999
IP ROUTING
SNMP
PING
NETCOM OVER ENET ENABLE/DISABLE
NETCOM OVER HDLC ENABLE/DISABLE

2-1 IP ROUTING
NE ADDRESS 001...999
IP ROUTING
SNMP
PING
NETCOM OVER ENET ENABLE/DISABLE
NETCOM OVER HDLC ENABLE/DISABLE

NETCOM INTERFACE ENABLE/DISABLE
NCOM IP ADDR MODE AUTO/MANUAL
NCOM MANUAL IP ADDR XXX.XXX.XXX.XXX
NCOM MANUAL IP MASK XXX.XXX.XXX.XXX
ETHERNET INTERFACE ENABLE/DISABLE
ENET IP ADDR MODE MANUAL/DHCP/AUTO
ENET MANUAL IP ADDR XXX.XXX.XXX.XXX
ENET MANUAL IP MASK XXX.XXX.XXX.XXX
ENET DHCP SERVER ENABLE/DISABLE
IP FORWARDING ENABLED/DISABLED
DEFAULT ROUTER XXX.XXX.XXX.XXX
STATIC ROUTES
DYNAMIC ROUTING

2.1.1 STATIC ROUTES
ROUTE 1 ENABLE/DISABLE
...
ROUTE 10 ENABLE/DISABLE

2.1.1.1 ROUTE N
IP ROUTE N ADDRESS XXX.XXX.XXX.XXX
IP ROUTE N MASK XXX.XXX.XXX.XXX
NEXT IP ROUTER N XXX.XXX.XXX.XXX

2.1.2 DYNAMIC ROUTING
RIP MODE DISABLE/VER1/VER2/VER1&2
RIP OVER NETCOM ENABLE/DISABLE
RIP OVER ETHERNET ENABLE/DISABLE

CONFIGURATIN BRANCH CONTINUED

1-NETWORK MANAGEMENT
NE ADDRESS 001...999
IP ROUTING
SNMP
PING
NETCOM OVER ENET ENABLE/DISABLE
NETCOM OVER HDLC ENABLE/DISABLE

1.1 SNMP
SNMP MANAGERS
COMMUNITY STRINGS
TRAP DESTINATION
TRAP PARAMETERS
TRAP CUSTOMIZATION2

1.1.1SNMPMANAGERS
MANAGER 1 ENABLE/DISABLE
MANAGER 2 ENABLE/DISABLE...
MANAGER 10 ENABLE/DISABLE

1.1.2 COMMUNITY STRINGS
GET COMMUNITY
SET COMMUNITY

1.1.3 TRAP DESTINATION
DEST 1 ENABLE/DISABLE
DEST 2 ENABLE/DISABLE
...
DEST 10 ENABLE/DISABLE

1.1.4 TRAP PARAMETERS
TRAP COMMUNITY
TRAP ENABLE CUSTOM/DISABLE

1.2 PING
PING IP ADDRESS
PING START

2-TIME MANAGEMENT
SET LOCAL DATE YYYY-MM-DD
SET LOCAL TIME HH:MM:SS
RESET SECONDS
SET TIME OFFSET XX:XX
TIME SYNC MODE FREE CLK/SWTP/NETCOM
TIME SERVER MODE DISABLE/SNTP/NETCOM
SNTP+NET

3-RELAYS
CNTRL RELAY 1 INPUT INPUT-N...
CNTRL RELAY 4 INPUT INPUT-N
OPT 1 RELAY 0 INP INPUT-N...
OPT 1 RELAY 11 INP INPUT-N
OPT 2 RELAY 0 INP INPUT-N...
OPT 2 RELAY 11 INP INPUT-N

4- EXTERNAL ALARMS
CNTRL EXT ALM 1
CNTRL EXT ALM 2
OPT 1 EXT ALM 0...
OPT 1 EXT ALM 29
OPT 2 EXT ALM 0
...
OPT 2 EXT ALM 29

CONFIGURATION BRANCH CONTINUED

1-TRIBUTARIES
If you have NxDS1, 28DS1, or 28DS1+WS
If you have NxE1, E3, E3+E1, OC3, STM1, or STS3
If you have DS3
If you have 21E1

If you have a 100BT option

1.1 ENABLE
1.2 CODE
1.3 EQUALIZER
1.4 FRAMING

1.1 ENABLE
TRIBUTARY x ENABLE/DISABLE
If you have a 2+0 system:
TRIBUTARY Ax/Bx ENABLE/DISABLE

1.2 CODE
TRIB x CODE AMI/B8ZS
If you have a 2+0 system:
TRIB Ax/Bx CODE AMI/B8ZS

1.3 EQUALIZER
TRIB x EQUALIZER 0'-133'/133'-266'/
266'-399'/399'-533'/533'-655
If you have a 2+0 system:
TRIB Ax/Bx EQUALIZER 0'-133'/133'-266'/
266'-399'/399'-533'/533'-655'

1.4 FRAMING
If you have 28DS1 or 28DS1+WS:
TRIB 1 FRAMED M1-3 asynch/C-bit parity
If you also have 2+0:
TRIB A/B FRAMED M1-3 asynch/C-bit parity

2-ENABLE
TRIBUTARY x ENABLE/DISABLE
If you have a 2+0 system:
TRIBUTARY Ax/Bx ENABLE/DISABLE

3.1 ENABLE
3.2 EQUALIZER
3.3 FRAMING

3.1 ENABLE
TRIBUTARY 1 ENABLE/DISABLE
If you have 3DS3 +WS:
TRIBUTARY 2/3 ENABLE/DISABLE
If you have a 2+0 system:
TRIBUTARY A1/B1 ENABLE/DISABLE

3.2 EQUALIZER
TRIB 1 EQUALIZER 0'-225'/226'-450'
If you have 3DS3 +WS:
TRIB 2/3 EQUALIZER 0'-225'/226'-450'
If you have a 2+0 system:
TRIB A1/B1 EQUALIZER 0'-225'/226'-450'

3.3 FRAMING
TRIB 1 FRAMED M1-3 asynch/C-bit parity
If you have 2+0:
TRIB A/B FRAMED M1-3 asynch/C-bit parity

4-1 ENABLE

4-2 CLOCK SOURCE

4-1 ENABLE
TRIBUTARY x ENABLE/DISABLE
If you have a 2+0 system:
TRIBUTARY Ax/Bx ENABLE/DISABLE

4-2 CLOCK SOURCE
MUX CLOCK SOURCE
AUTOMATIC/INTERNAL/EXTERNAL
If you have a 2+0 system:
MUX A/B CLOCK SOURCE
AUTOMATIC/INTERNAL/EXTERNAL

5.1 PORT SEGREGATION
5.2 RATE LIMIT

5.1 PORT SEGREGATION
MUX PORT SEG. ENABLE/DISABLE
If you have a 2+0 system:
MUX A/B PORT SEG. ENABLE/DISABLE

5.2 RATE LIMIT
MUX PORT 1 NO LIMIT/128KBPS/256KBPS
512KBPS/1MBPS/2MBPS/4MBPS/8MBPS
MUX PORT 2 See Port 1.
If you have a 2+0 system:
MUX A/B PORT 1 See Port 1.
MUX A/B PORT 2 See Port 1.

CONFIGURATION BRANCH CONTINUE

1-WAYSIDE
MODE
ENABLE
CODE
EQUALIZER
TERMINATION

1.1MODE
OC3 ONLY
WAYSIDE 1 MODE DISABLE/DS1/E1
If you have a 2+0 system:
WAYSIDE A1/B1 MODE DISABLE/DS1/E1

1.2 ENABLE
3DS3+3WS, 21E1, 28DS1+WS,
100BT+E1,100BT+DS1, DS3+DS1, E3+E1
WAYSIDE 1 ENABLE/DISABLE
If you have a 2+0 system:
WAYSIDE A1/B1 ENABLE/DISABLE
If you have 3DS3 +WS:
WAYSIDE 2/3 ENABLE/DISABLE

1.3 CODE
OC3 (DS1), 3DS3+3WS, 28DS1+WS,
100BT+DS1, DS3+DS1
WS 1 CODE AMI/B8ZS
If you have a 2+0 system:
WS A1/B1 CODE AMI/B8ZS
If you have 3DS3 +WS:
WS 2/3 CODE AMI/B8ZS

1.4 EQUALIZER
OC3 (DS1), 3DS3+3WS, 28DS1+WS,
100BT+DS1, DS3+DS1
WS 1 DS1 EQUALIZER 0'-133'/133'-266'266'-399'/399'-533'/533'-655'
If you have a 2+0 system:
WS A1/B1 DS1 EQUALIZER See above.
If you have 3DS3 +WS:
WS 2/3 EQUALIZER See above.

1.5 TERMINATION
OC3 (E1)
WS 1 TERMINATION
UNBALANCED 75ohms/BALANCED 120ohms
If you have a 2+0 system:
WS A1/B1 TERMINATION See above.

2-ORDERWIRE
OW OVER RF ON/OFF
OW OVER LAN UP ON/OFF
OW OVER LAN DOWN ON/OFF
OW OVER HDLC ON/OFF
4W ACTIVE CARD 1 ON/OFF
GAIN LVL CARD 1 "0/0dBm"/"-16/7dBm"
4W ACTIVE CARD 2 ON/OFF
GAIN LVL CARD 2 "0/0dBm"/"-16/7dBm"

3-DATA CHANNEL
DATA CHANNEL MODE BROADCAST/PT TO PT
PT TO PT DESTIN 1 001...999/0:NONE
PT TO PT DESTIN 2 001...999/0:NONE

4-COMM PORT SETTINGS
PORT 1 APP PPP/SCAN/DATA
PORT 1 PARITY NONE/ODD/EVEN
PORT 1 CHAR LEN 5/6/7/8
PORT 1 SPEED 1200/2400/4800/9600
19200/38400/57600/1152004

5-USER AUTHORIZATION
USER XXXXXXXX
PASS XXXXXXXX
CONTROL ACCESS YES/NO
CONFIG ACCESS YES/NO
FTP ACCESS YES/NO
HTTP ACCESS YES/NO
AUTH ACCESS YES/NO
APPLY CHANGES

1- What is the consisting of Truepoint 5200 HSB 1+1 (7 & 13 GHz) system?

2- What is the type of modulation that use in Truepoint 5200 Radio system?

3- What is the channel bandwidth in the following tributary capacity? 2E1=……, 4E1=……, 8E1=……., 16E1=…….

4- What kind of management and control devices are used in Truepoint 5200 HSB ?

- ---

5- What are the difference and similar between, Truepoint 5200 7 GHz and Truepoint 5200 13 GHz systems?

6- What is the function of the coaxial cable link between IDU & ODU?

7- Where does transmit direction protection switching take place in Hot Standby system?

8- Where does receive direction protection switching take place?

9- How does the transmit signal operate at Digital Radio systems?

10- How does the receive signal operate at Digital Radio systems?

Symbol	Meaning	Symbol	Meaning
AIS	Alarm Indication Signal.	**MHSB**	Monitored Hot Standby
AMI	Alternate Mark Inversion.	**MMC**	Multi Media Card
ASIC	Application Specific Integrated Circuit.	**MSUU**	Microwave Software Upgrade Utility
ATDE	Adaptive Time Domain Equalization.	**NMS**	Network Management System
ACU	Antenna Coupling Unit	**PABX**	Private Automatic Branch Exchange.
ADM	Add/Drop Multiplexer	**PDH**	Plesiosynchronous Digital Hierarchy
ATPC	Automatic Transmit Power Control	**PLL**	Phase-Locked Loop.
BER	Bit Error Rate.	**PPP**	Point-to-Point Protocol
B8ZS	Bipolar 8 Zero Substitution	**PU**	Protection Unit.
CPU	Central processing unit.	**QAM**	Quadrature Amplitude Modulation
CW	Continuous Wave.	**QPSK**	Quadrature Phase Shift Keying
DADE	Differential Absolute Delay Equalization.	**RCS**	Reverse Channel Switching
DHCP	Dynamic Host Configuration Protocol	**RFU**	Radio Frequency Unit
DTPC	Dynamic Transmit Power Control	**RIP**	Routing Information Protocol
DOS	Disk Operating System.	**RMS**	Rack Mounting Space
EEPROM	Electrically Erasable Programmable Read Only Memory	**RPC**	Radio Processing Card
		RSL	Received Signal Level
FD	Frequency Diversity	**RSSI**	Received Signal Strength Indicator
FEC	Forward Error Correction	**RTU**	Remote Terminal Unit.
FSK	Frequency Shift Keying.	**SD**	Space Diversity
FTP	File Transfer Protocol	**SDH**	Synchronous Digital Hierarchy
HDB3	High Density Bipolar order 3	**SDLC**	Synchronous Data Link Control
HDLC	High-level Data Link Control	**SDM**	Signal Distribution Module
HHT	Handheld terminal	**SNMP**	Simple Network Management Protocol
IF	Intermediate Frequency	**TCP/IP**	Transmission Control Protocol/Internet Protocol
IP	Internet Protocol	**UDP**	User Datagram Protocol
LAN	Local-area Network	**WAN**	Wide-area Network
LIM	Line Interface Module	**Web-CIT**	Web-Craft Interface Tool

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UNIT 2: MicroStar® Type ll MHSB 1+1 (7 & 13 GHz) System

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1- Performance Characteristics
2- Consists of MicroStar® type ll HSB 1+1 radio
3- Functional Description
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5- ODU Interface Terminals and Jacks
6- Theory of operation

Chapter 2: Operation and maintenance

1- Monitoring, Controlling and Configuration
By using a Hand-Held Terminal or a VT-100 Terminal

Unit Exercises

UNIT 3: MicroStar® Type lll MHSB 1+1 (M/7 GHz) System

Chapter 1:Introduction

1- Performance Characteristics
2- Consists of MicroStar® type lll MHSB 1+1 radio system
3- Functional Description
4- IDU Interface Terminals and Jacks
5- ODU Interface Terminals and Jacks
6- Theory of operation

Chapter 2: Operation and maintenance

(Monitoring, Controlling and Configuration)

1- By using the CIT software
2- By using a Hand-Held Terminal or a VT-100 Terminal

Unit Exercises

UNIT 4: Truepoint 5200 HSB 1+1 (7 & 13 GHz) System

Chapter 1: Introduction

1- Performance Characteristics
2- Consists of Truepoint 5200 HSB 1+1 system
3- IDU Interface Terminals and Jacks
4- ODU Interface Terminals and Jacks
5- Coaxial Cable Link Function
6- Functional Description of the Modules

Chapter 2: Operation and maintenance

Monitoring, Controlling and Configuration

1- By using the Web-CIT
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Unit Exercises

Glossary