

A PRESENTATION

ON

RADIO SYSTEM (TETRA)



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INTRODUCTION TO RADIO TRUNKING

Digital Radio Trunking Systems – TETRA

- **What is Radio Trunking ?**
 - ❖ Trunking stands for “sharing”.
 - ❖ Whenever resources are in short supply, they will have to be shared.
 - ❖ In Radio Communications Trunking System a fixed number radio frequencies are used and are shared by large number of remote/mobile subscribers.
 - ❖ This is commonly known as Radio Trunking System.

TETRA -INTRODUCTION

- **What is TETRA**

- ❖ TETRA stands for “Terrestrial Trunked Radio” initially it is called as “Trans European Trunked Radio”.
- ❖ TETRA –New standard from ETSI (European Telecommunication Standards Institute) for digital trunked radio system .
- ❖ Provides individual, group and direct mode communications between radios.
- ❖ Packet data and fast data transfer services .
- ❖ Fast call set-up time (300 m sec) .
- ❖ Security features & Encryption .
- ❖ TETRA provides Voice and Data Services .

- **Frequency Range:**

- ❖ 380 - 400 MHz for public safety systems,
- ❖ 410 - 430 MHz & 870-876 MHz 915-921MHz for commercial applications

- **Advantage of Digital Trunking System over Analogue Trunking System:**

- ❖ More reliable .
- ❖ Flexible .
- ❖ Low noise.

- **Disadvantages of Digital Trunking System over Analogue Trunking System:**

- ❖ Only the low coverage range as compared with Analogue Trunking System. This can be overcome by more repeaters.

JMRC RADIO INTRODUCTION

❖ Radio system shall have central control equipment at OCC for system-wide control and monitoring. The system shall comprise of following sub-systems:

- (i) Central Switching Equipment.
- (ii) Base Stations.
- (iii) Cab Equipment – the Train Radio.
- (iv) Antenna Network.
- (v) User Access Interface.
- (vi) Hand Portable Radios.

❖ Radio system shall be a digital trunked Radio system operating in the 380-400 MHz's Frequency band conforming to TETRA standards, as defined by ETSI. It shall support both voice and data communications. The bit rate shall be 7.2 kbps per time slot for data communication as a minimum. The channel access method shall be TDMA (Time-division multiple access).

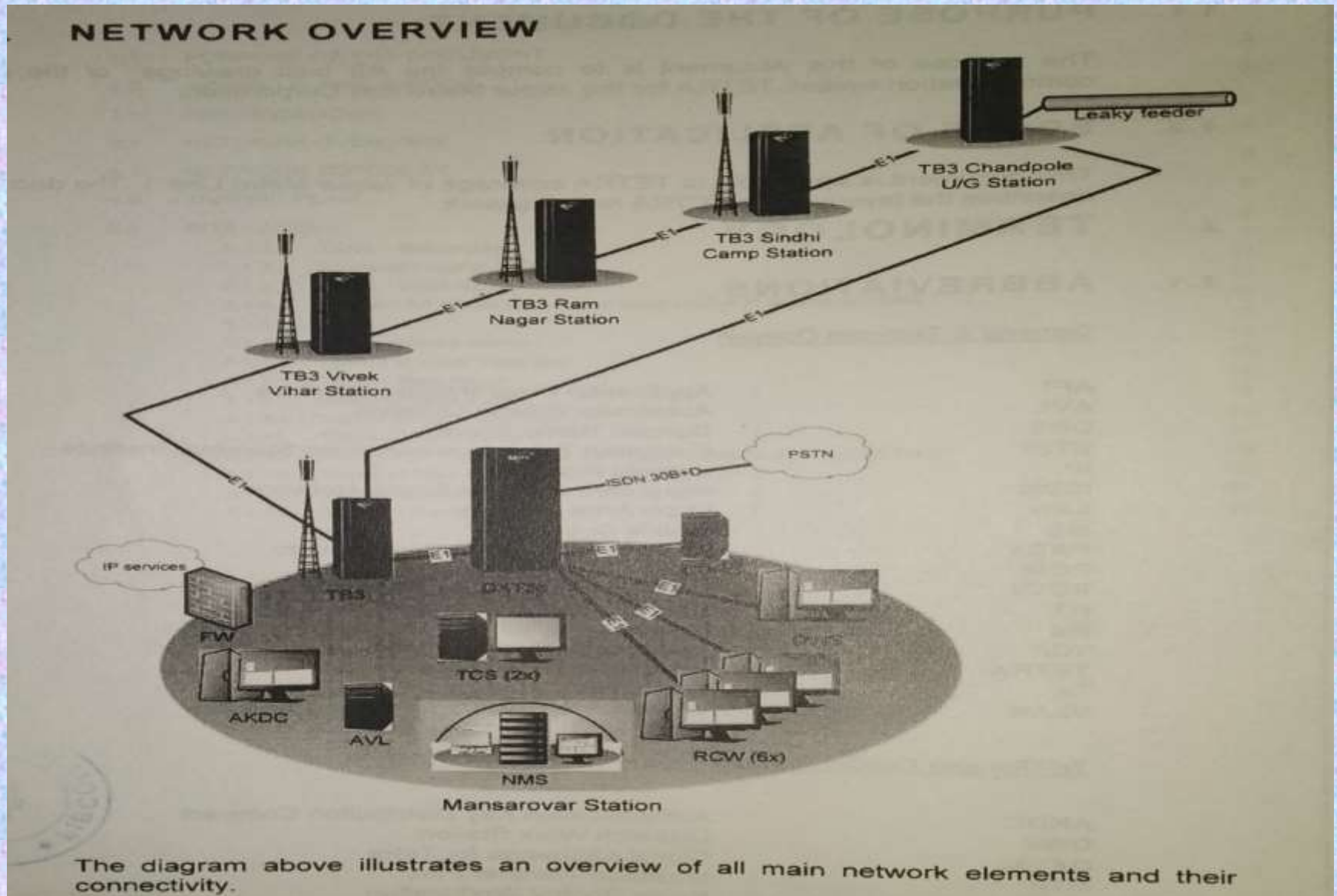
❖ The central switching equipment shall be installed in OCC and shall be designed to be highly reliable, fault-tolerant and capable of supporting non-stop call processing functions. Hot stand-by shall be provided for the central switching equipment with minimum interruption to the call processing.

- ❖ Switching controller shall also provide interfaces to control the gateways to other types of networks such as LAN, PSTN and EPABX etc.
- ❖ Radio base stations shall be installed at selected locations to relay communications between all the Radios in the Radio system.
- ❖ Control module shall also initiate the local trunking mode automatically upon detection of the loss of communication link between central equipment and local equipment or in the event of detection of failure of fault tolerant central equipment.
- ❖ Radio system at Chandpole underground station of the EW corridor shall have a Leaky Coaxial Cable (LCX) along each track in the tunnels for communication with train-borne mobile Radio and hand-portables.
- ❖ Radio system in the elevated station of EW section shall have tower mounted antennae for wide area coverage and LCX within the stations, where necessary.
- ❖ User access interface shall facilitate ease of operation. Interface with controllers at OCC /DCC shall be menu driven and make use of feature rich GUI (like RCW).

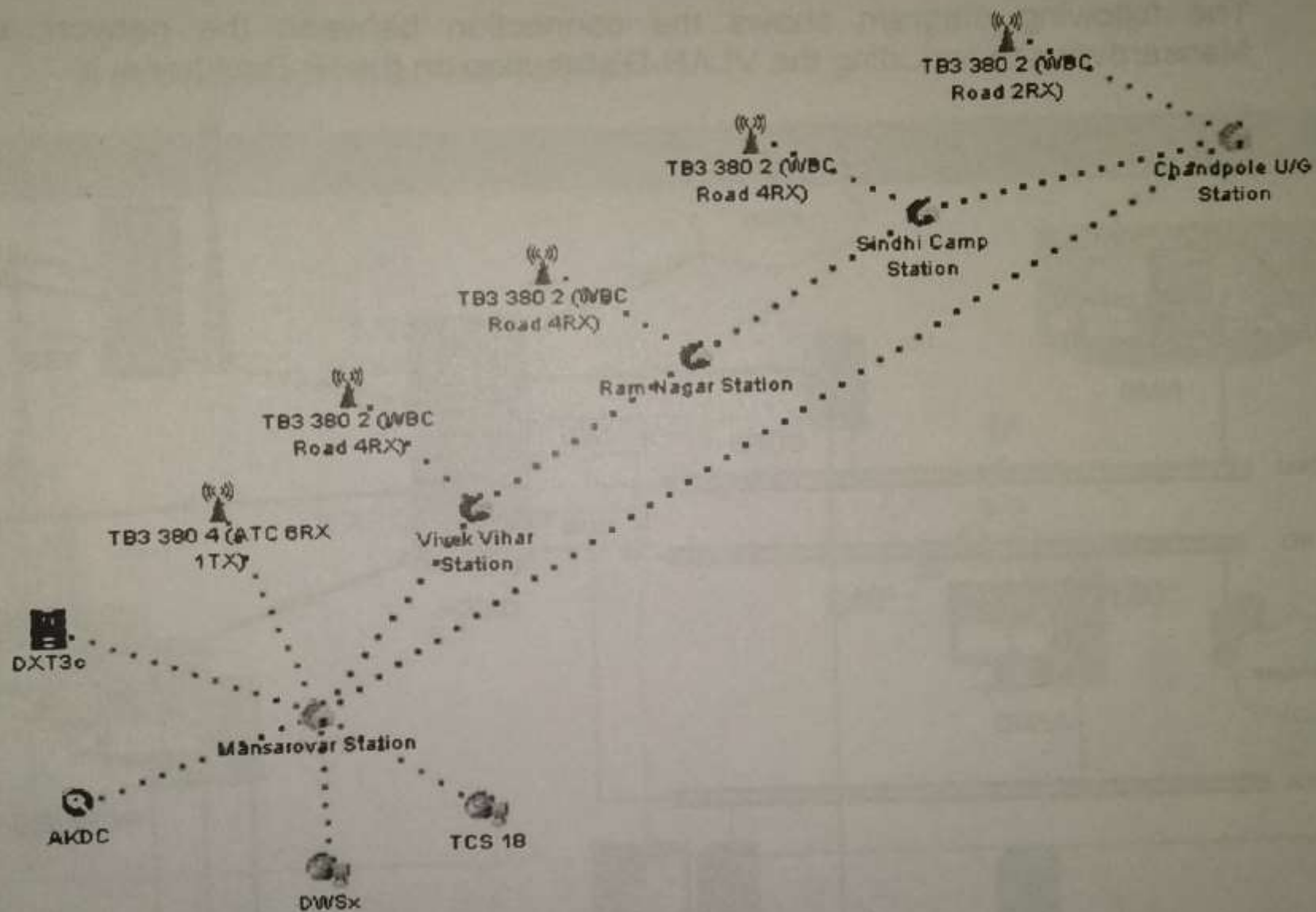
❖ The Radio system shall support both the cab mounted train Radio and hand portable Radio for system operations, maintenance and security functions throughout the JMRC operating area including depot.

❖ All Radio communications shall be continuously recorded in a digital voice recorder.

NETWORK OVERVIEW

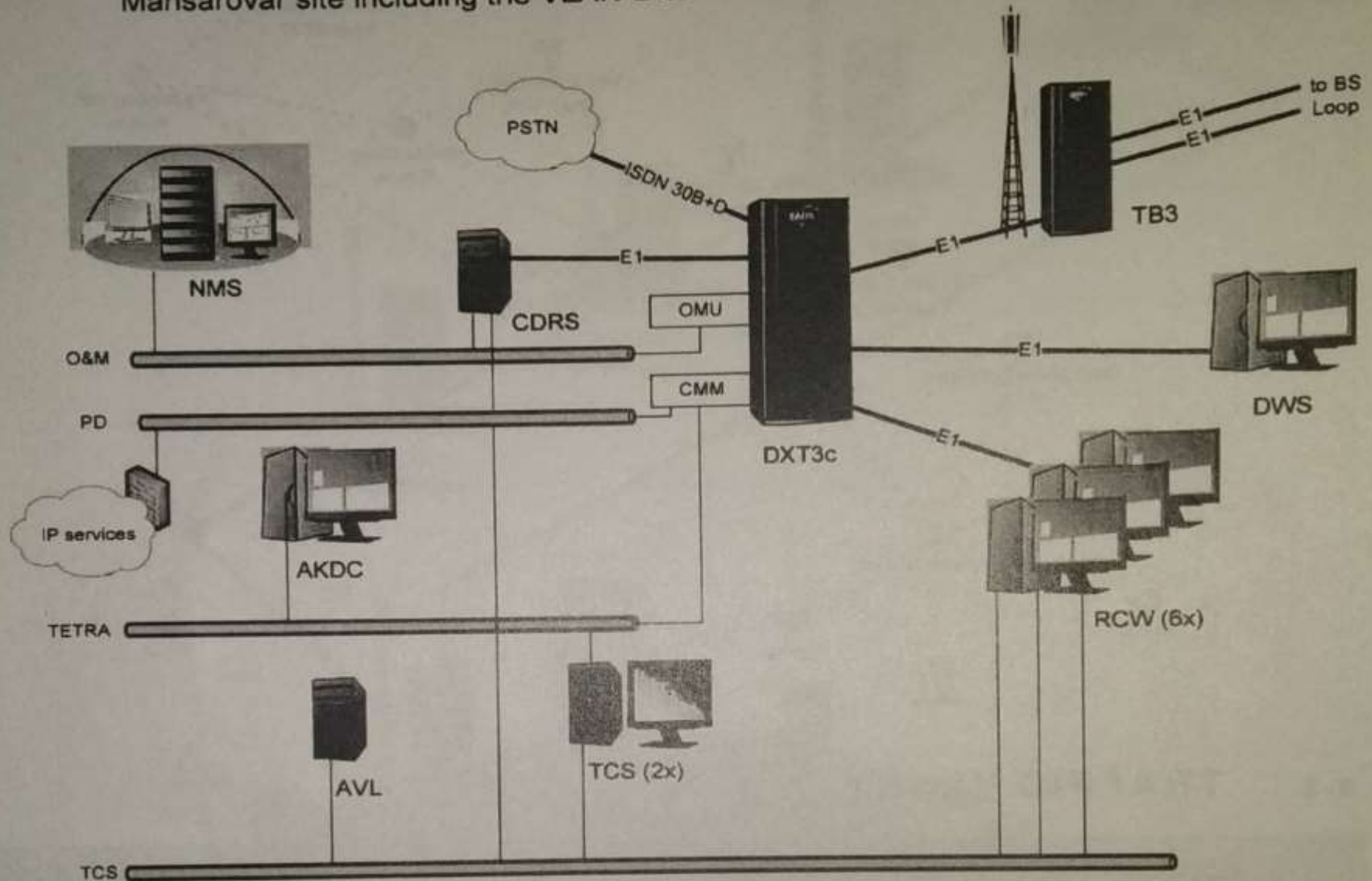


NETWORK TOPOLOGY



5.1. SITE LAYOUT

The following diagram shows the connection between the network elements at Mansarovar site including the VLAN-Distribution on the IP-Backbone.



TETRA SYSTEM PARAMETERS

TETRA system configuration parameters are given in the next charts. Non-c parameters may use default values:

Item	Parameter
Network Name	JAIPUR METRO LINE1
Mobile Country Code (MCC)	0404
Mobile Network Code (MNC)	00007 used in FAT
Frequency band	380-400 MHz
Inter-canal step	25 kHz
Duplex spacing	10 MHz
Offset	+12.5 kHz
Total number of channel	10
N° first channel (*)	frequency awaited
N° last channel (*)	frequency awaited
Keep requested simplex/duplex mode (32)	Yes

Parameters:

Tx/Rx Frequency (in MHz)

390.025/380.025

390.05/380.05

390.075/380.075

390.1/380.1

390.125/380.125

CENTRAL SWITCHING UNIT (DXT3C)



MSOR DEPOT TETRA BASE UNIT



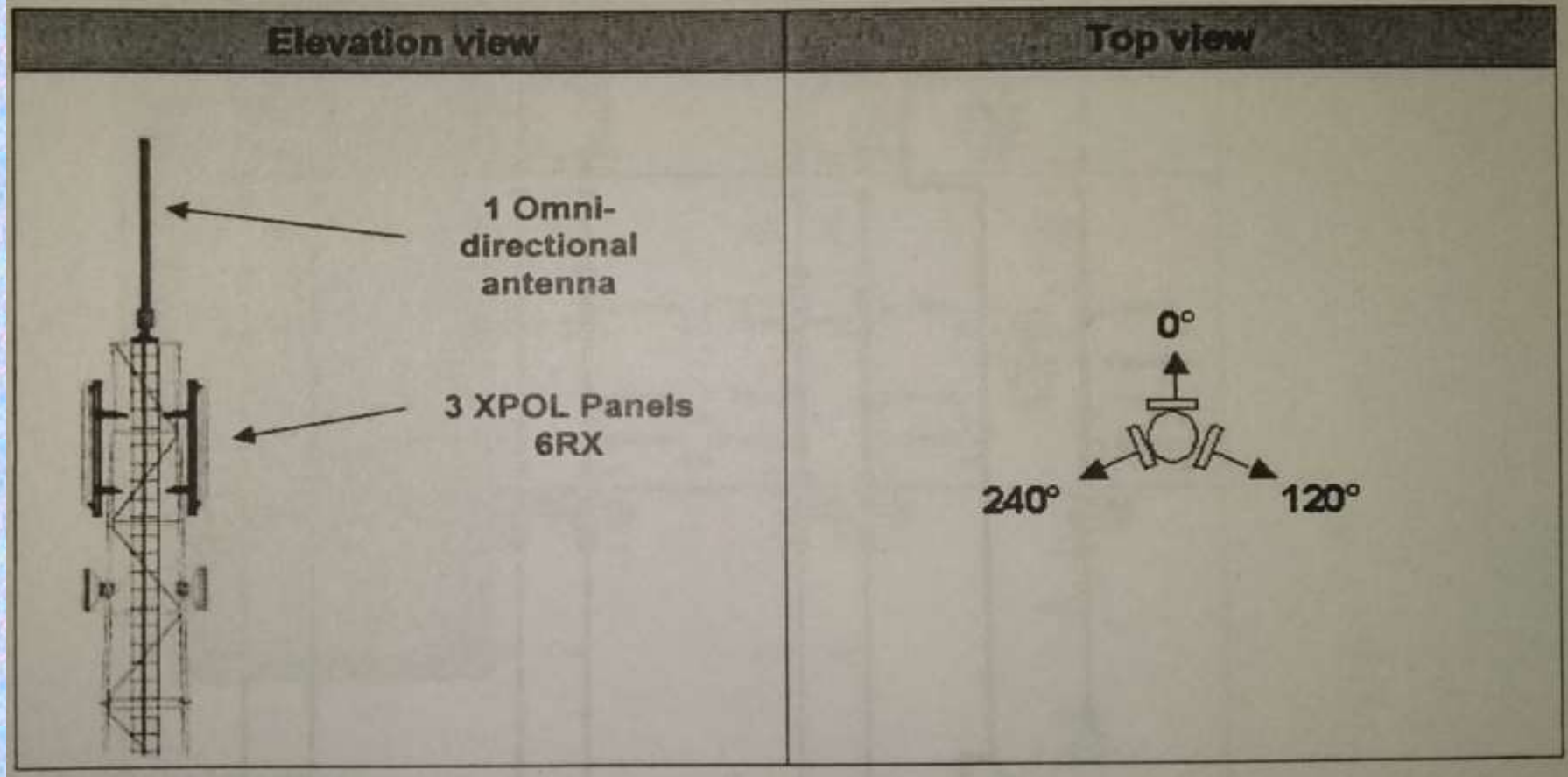
MAINLINE TETRA BASE UNIT



MSOR DEPOT ANNTENA LAYOUT

1.1. TBS1 – MANSAROVAR

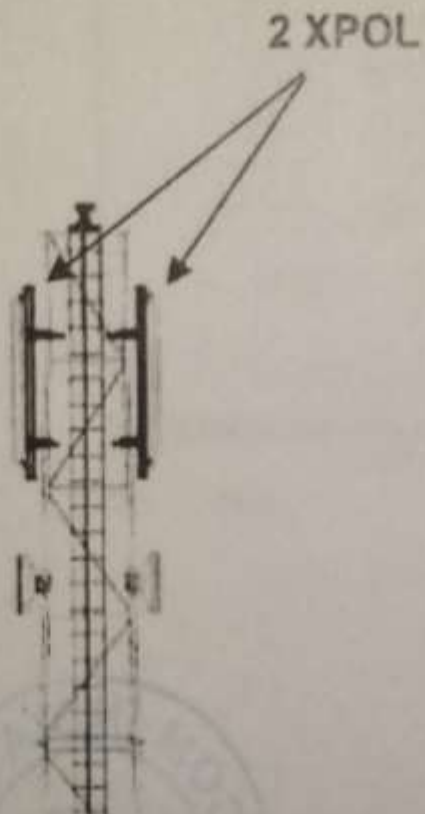
1.1.1. *Antenna layout on tower*



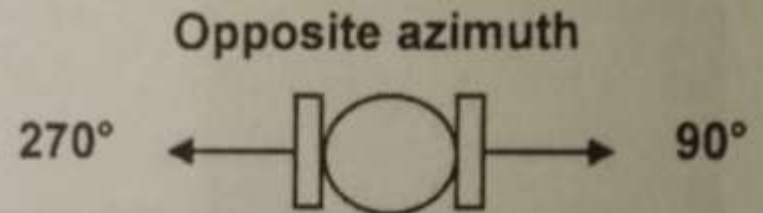
VKVR, RMNR & SICP ANNTENA LAYOUT

8.1. Antenna layout on tower

Elevation view



Top view



TETRA CALL TYPES

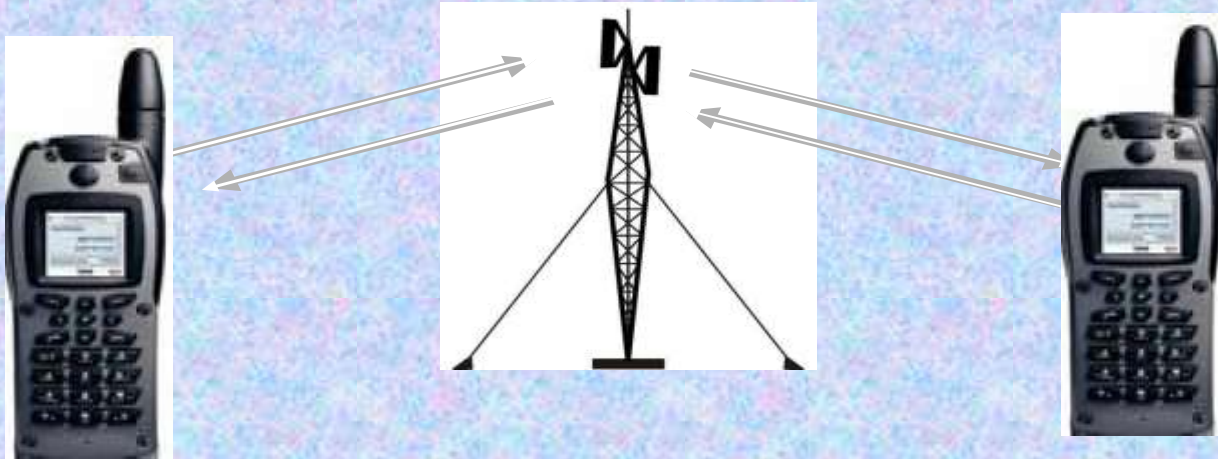
TETRA call types

- ❖ Private call (individual call) .
- ❖ Phone call (PSTN or PABX call).
- ❖ Group call .
- ❖ Emergency call .
- ❖ Broadcast call .
- ❖ Telephone Interconnect Call.
- ❖ Station PA Call

TETRA CALL TYPES

Simplex calls

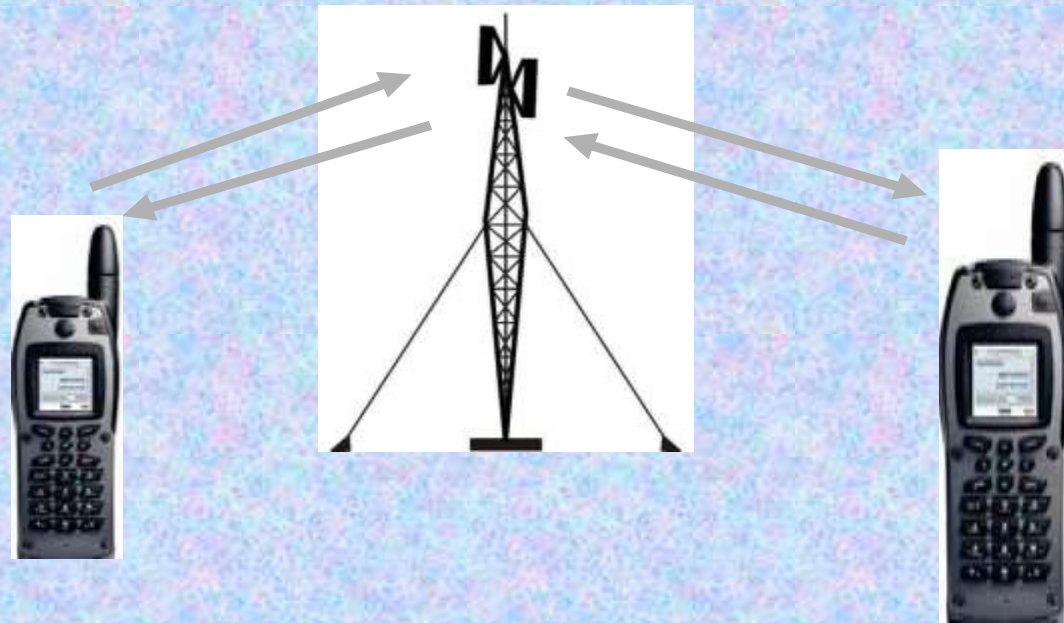
- ❖ Radio is either transmitting or receiving .
- ❖ Requires operation of PTT switch (Push To Talk) .
- ❖ Group calls are always simplex



TETRA CALL TYPES

Duplex calls

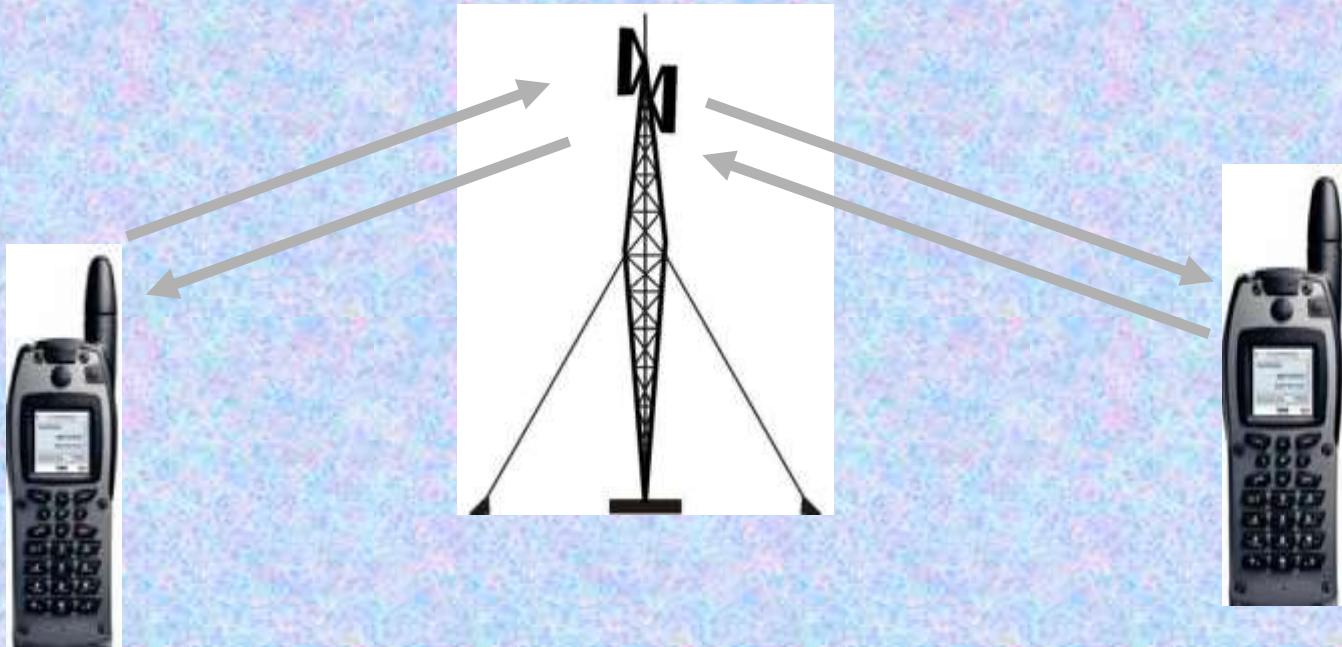
- ❖ Radio is transmitting and receiving (like GSM phone call).
- ❖ Does not require holding PTT to continue transmission .



TETRA CALL TYPES

Private call

- Private call (individual call)
 - ❖ A call between two parties within the TETRA network .
 - ❖ Simplex or duplex.



TETRA CALL TYPES

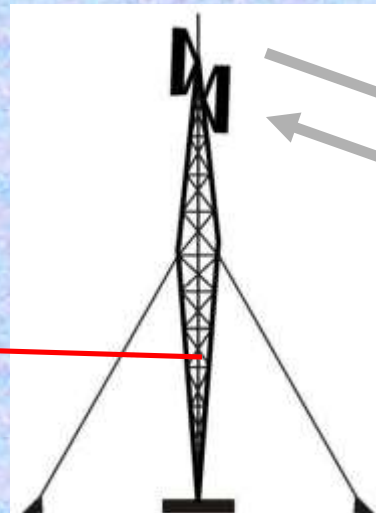
Phone call

Phone call (PSTN or PABX call)

A call between a TETRA user and a fixed or mobile phone.

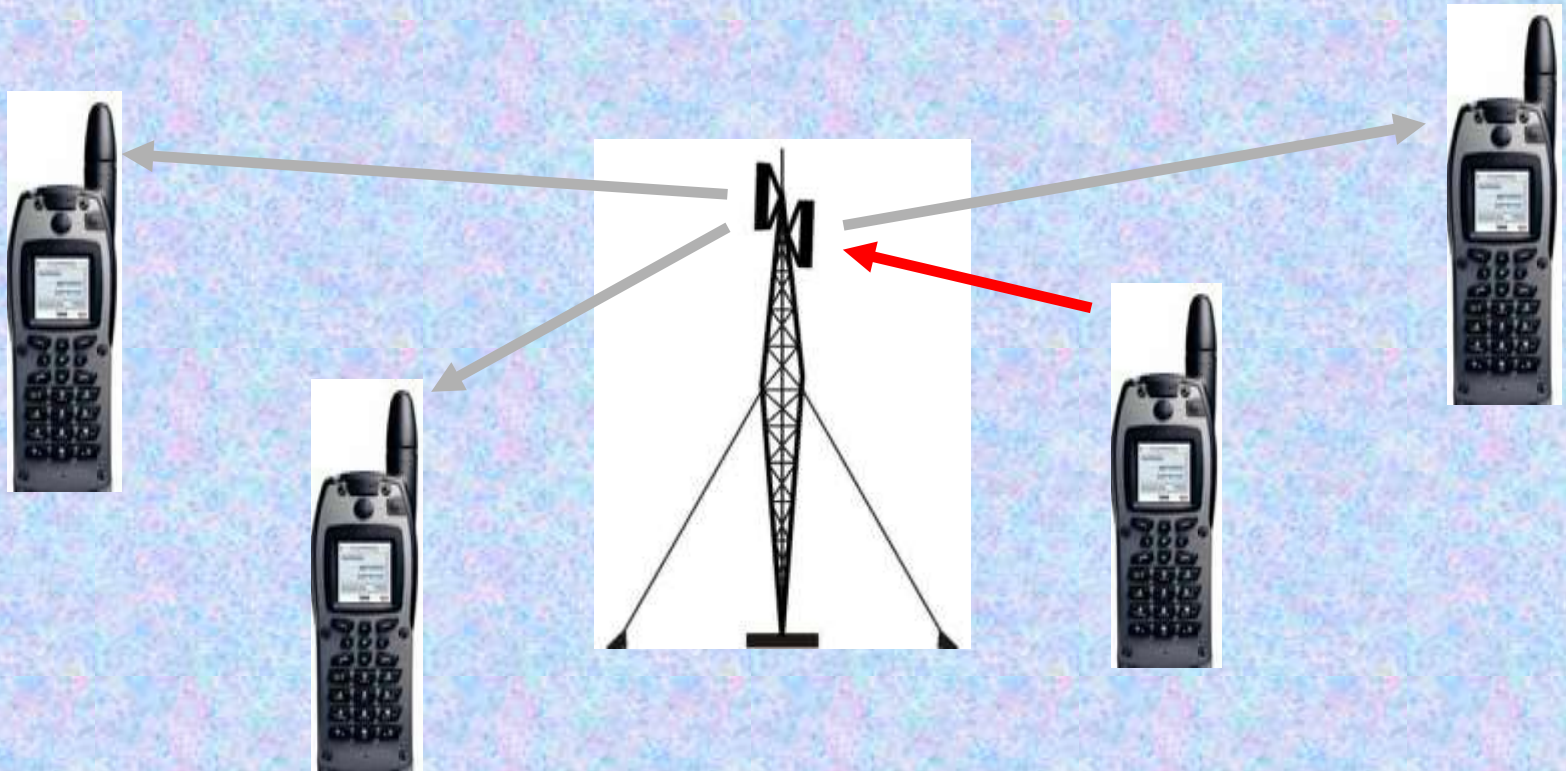
Call is set up via the TETRA network's PSTN Gateway.

Call is normally duplex.



TETRA CALL TYPES-Group call

- Group call
 - ❖ A call between more than two parties.
 - ❖ Call is always simplex, direct set-up.
 - ❖ Only possible if one or more groups have been attached.



RADIO SYSTEM INTERFACE

The Radio system shall interface with following sub-systems of JMRC:

- (i) Interface with FOTS:** The base stations of Radio system shall interface with the FOTS to convey audio and data signals between base stations and central equipment.
- (ii) Interface with Telephone System:** The Radio system shall interface with the telephone system to permit selected hand portable Radios to initiate Radio to Telephone calls and vice-versa without the intervention of OCC.
- (iii) Interface with the Public Address System:** The Radio system shall provide an interface to allow selected hand portables Radio access to the pre-defined PAS zone combinations at each station as selected by the Radio user via the alpha-numeric keypad.
- (iv) Interface with Signaling and Train Control System:** The Radio system shall interface with signaling equipment:
 - 1. To enable it to report the Alarm and status of the Train borne Signalling Equipment to the OCC.
 - 2. (For dynamic registration of Train Identification Number (TID) using the information provided by the ATS System.

Types of Radio System

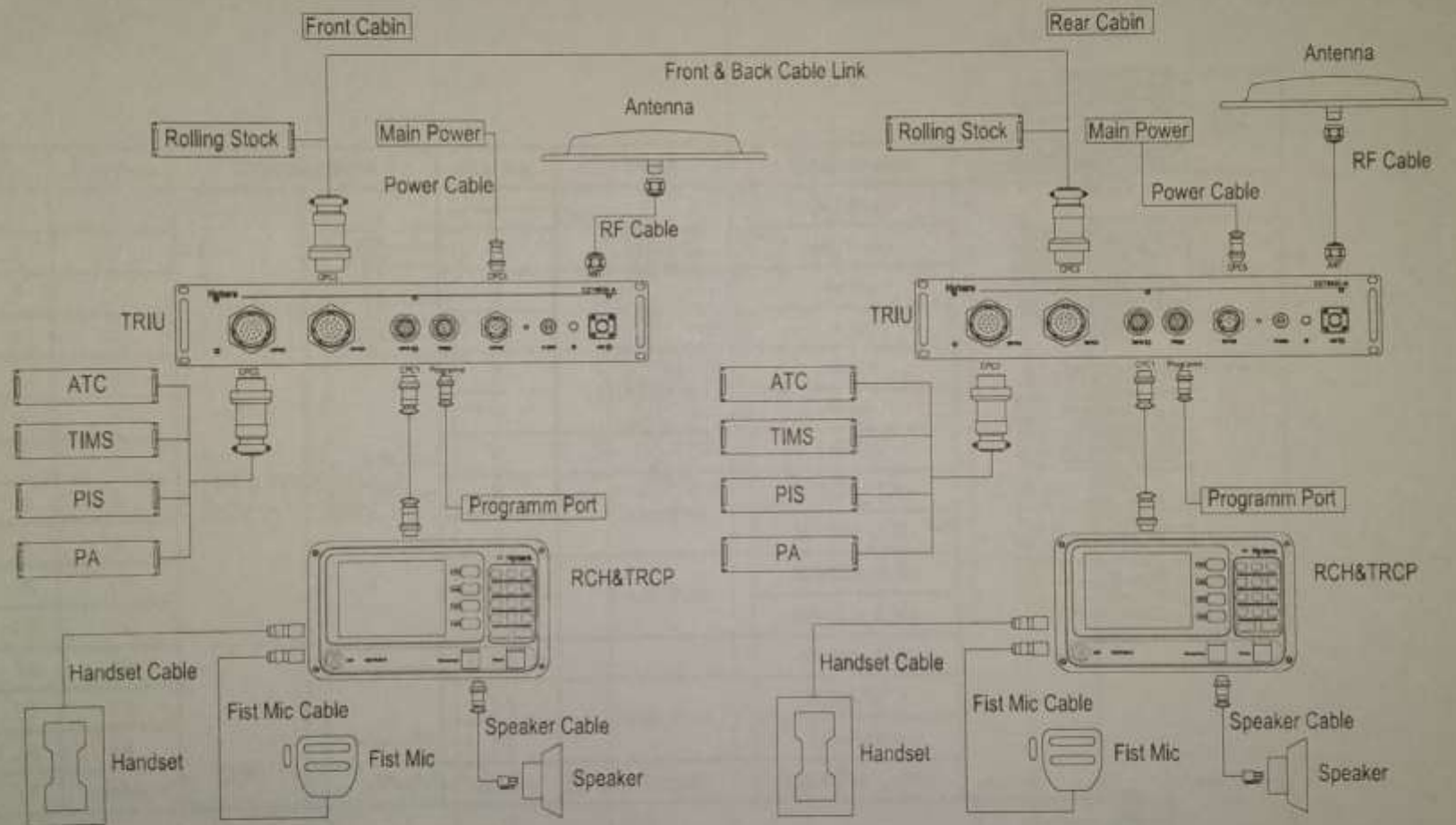
- **TCS Server**
- **Train Borne Radio,**
- **RCW (Radio Control Workstation) Server and Client**
- **RCP/RAU**
- **CDRS (Centralized Digital Record System) Server and Client**
- **AVLS Server and Client**
- **AKDC Client**
- **NMS Server and Client**

USER ACCESS

Following types of MMI / access units shall be used on the Radio system:

- (i) Radio Control Workstation (RCW):** RCW shall have full dispatcher facilities for controllers through the use of feature rich GUI.
- (ii) Radio Access Unit (RAU):** The RAU shall provide all individual and group call set up and receipt through the use of a multi-function feature phone facility connected directly to the Radio control system. The RAU shall connect to the Radio system independently from the RCW and shall, thus, provide a back-up in the event of failure of the RCW.
- (iii) Radio Control Panel (RCP):** The RCP shall be located at station control rooms and other designated locations and provide full fixed and mobile Radio functions including individual and multi-group calls
- (iv) Train Radio Control Panel (TRCP):** The TRCP shall be integrated into the train cab and shall provide train drivers with all call functions via the Radio control head.
- (v) Hand Portables.**

RADIO CABLING LAYOUT





Omni Antenna Installations



Panel Antenna Installations



Feeder Cable Installations



Leaky Cable Installations

Radio Maintenance Schedule

Daily:-

- Checking alarm LOGS on full vision MMI at OCC.
- Train Radio Status and call check through RCW.
- Checking status of Aviation lights installed on Radio Tower
- Train Radio call recording.

Weekly:-

- Cleaning and Checking of all connection of train Radio equipments & also the tightness of bolts or train radio unit to chassis.
- Cleaning and Testing of RCP/RAU

Monthly:-

- Cleaning & checking of all connections of EBTS Units.
- Cleaning & checking of connectors of RCW Client Server & testing functionalities.
- Physical Checking of Leaky Cables & Connectors.

Quarterly:-

- Physical checking of Towers of aviation warning light, RF antenna, RF cables & power cables.
- External Cleaning of Train radio Units
- Backup of all nodes.

Half Yearly:-

- Cleaning of all equipments and functional testing.
- Internal Cleaning of unit and power supply.

Yearly:-

- Power Measurement.

THANKS

