

## **Annexure –I**

(Invitation for Expression of Interest)

### **Information for Respondents**

#### **1. INTRODUCTION**

##### **1.1 About C-DAC**

Centre for Development of Advanced Computing (C-DAC) is a premier R&D organization under the Ministry of Electronics and Information Technology (MeitY), Government of India that carries out R&D in IT, Electronics and associated areas. The Thiruvananthapuram Centre of C-DAC has been working in application oriented research, design and development for various industrial and customer requirements. During these years, the Centre has acquired competency, expertise and extensive experience in the areas of Broadcast & Communications, Control & Instrumentation, Networking, Power Electronics, ASIC Design and Underwater Electronics.

Broadcast & Communications Group of C-DAC, Thiruvananthapuram has been working in technology development in the domain of wireless communication for nearly two decades and has been successful in developing radios as well as infrastructure elements that enable secure digital wireless communication solutions for the Professional Mobile Radio (PMR) segment and defense communication systems.

##### **1.2 Brief description of the product/technology/prototype to be transferred**

TETRA (Terrestrial Trunked Radio) is an open standard developed by the European Telecommunications Standards Institute (ETSI) for critical communication. It is an established and proven standard that has achieved worldwide acceptance among public safety as well as commercial user organizations. An important feature of the TETRA standard is that it has a number of open interface specifications that can be used by application developers to further enhance the capabilities. TETRA communication system is more secure and powerful when compared with other commercial wireless communication technologies. Its air interface encryption feature provides the highest level of security for voice calls and data transfer. The facility provided by TETRA standard to put proprietary encryption logic gives user total control over the data being exchanged during communication.

TETRA's market broadly comprises of user segments such as: (a) Military and Para-military forces (b) public safety organizations such as the police, fire brigade, coast guard and rescue and emergency services, (c) transportation sectors such as railways, seaports, airports and urban transport operators and (d) industrial segment - where the reliable low-data rate data communication along with the professional voice services

makes TETRA a perfect choice for doing automation in various needs and thereby increasing the business efficiency and productivity.

C-DAC's TETRA portfolio includes three major categories of indigenously developed technology components: (a) TETRA base stations (three variants viz. Xtreme, Portable and Micro), (b) TETRA radios (Handheld, Vehicle-mounted and Desktop) and (c) core network elements (including Dispatchers, Line Stations and various gateways) for interconnecting multiple TETRA Base Stations through an Internet Protocol (IP) based network for the transport of digital speech, short data, circuit mode data, status messages, mobility management and network management information. Collectively, this is referred to as the C-DAC TETRA Network (CTN). The CTN is a secure, digital, wireless, communication network that provides efficient and cost effective technology for mission critical applications working in the most demanding environments. It uses a flexible soft-switching technology with distributed database, thus eliminating the need to employ expensive MSCs (Main Switching Centre). This makes the system highly scalable and easy to install, configure and maintain. The various gateways in CTN provide user the option to connect to external networks such as PSTN, VoIP and Analog. The optional components: Authentication Centre, Voice Logger, Geographical Information System, Line Stations, Dispatchers, etc. are also included in the portfolio to enable the users to customize the network exactly as per their requirement.

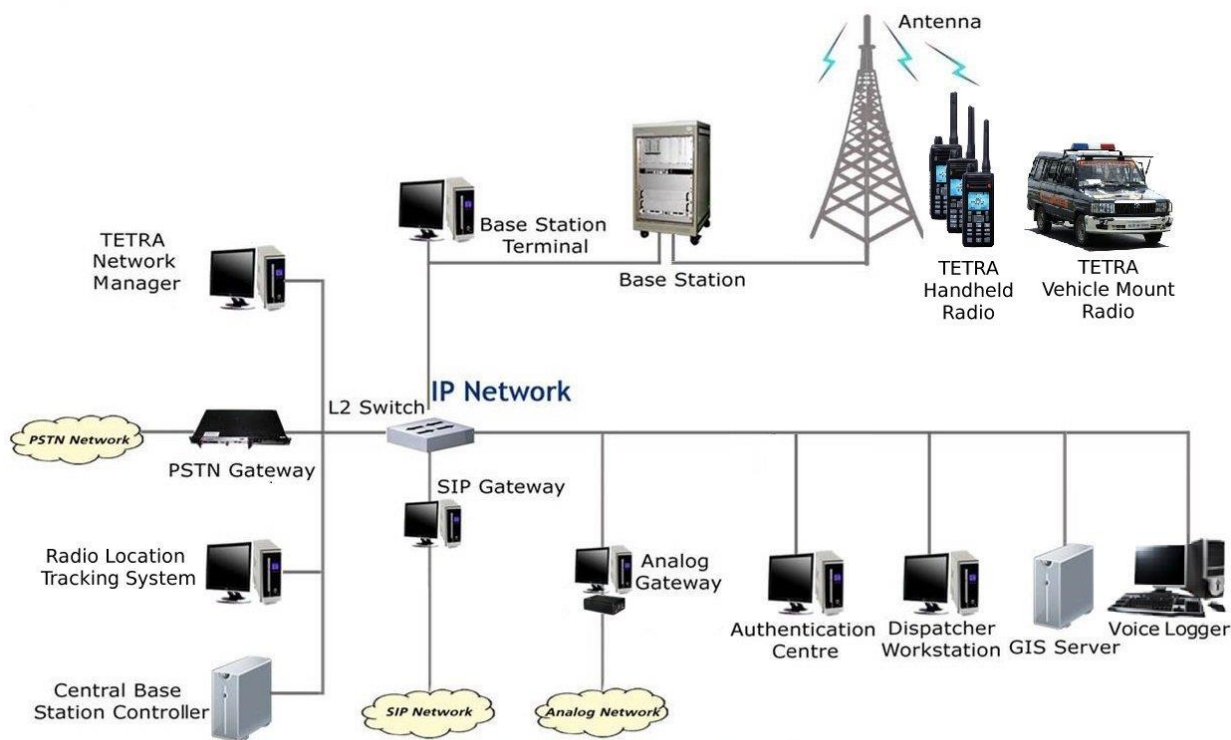


Fig: Typical C-DAC TETRA Network

The CTN supports two modes of operation: (a) the Network mode and (b) the Standalone mode.

In the Network mode, the system can have multiple Base Stations interconnected through IP network. In this mode the full set of functions, features and facilities are enabled. Network mode system is ideal for large coverage area deployment where the multiple cells interconnected through IP forms a complete network.

In Standalone mode, the system will have minimal set of components required for establishing basic TETRA communication. In this mode the system can have only one Base Station and have only limited features. The Standalone mode provides an option for establishing basic TETRA communication with a single TETRA Base Station and a minimal set of supporting components. This mode is highly suitable for isolated operations where only single cell coverage is envisaged, for example, for disaster relief operations. Table 1 lists the features common to both modes and Table 2 lists the additional features that are supported in the Network mode.

*Table 1: Features in Standalone mode of operation*

Sl. No.	Features
1	Emergency Call
2	User Defined Short Data Services (Individual, Group & Broadcast)
3	User to user Direct Mode Operation
4	Authentication *
5	Mutual Authentication# *
6	Air Interface Encryption (Class 3)# *
7	End-to-end Encryption# *
8	Circuit Mode data#
9	Pre-emption, priority call, emergency call
10	Enhanced Coverage with Dual Diversity *
11	Simplex, Duplex and Group voice calls
12	Listener presence check
13	Group call late entry
14	Customisation of call setup parameters
15	ISDN/PSTN Gateway interface *
16	VoIP (SIP) Gateway interface *
17	Analog Gateway interface *
18	Voice Logging *
19	Radio Location Tracking *
20	Online Remote Health Monitoring
21	Dispatcher User Terminal *

Sl. No.	Features
22	Radio Location Tracking# *
Note: #Feature support in radio may vary from manufacturer to manufacturer *Optional features	

*Table 2: Additional Features in Network mode of operation*

Sl. No.	Features
1	SDS store and forward
2	Ambience Listening # *
3	Discrete Listening *
4	Dynamic Group Number Assignment (DGNA) *
5	Call Authorisation by dispatcher # *
6	Air Interface Encryption (Class 1&3)# *
7	Distributed Database
8	Distributed Soft Switching
9	Priority Overriding
10	Call barring
11	Broadcast call# *
12	Group priority scanning
13	Scalability from 1 to maximum 999 Base Stations/Dispatcher in a network
14	Built-in resilience of the IP network
15	Remote Health Monitoring (online/offline)
16	Subscriber administration
17	Call group administration
18	Event history
19	Registration Data Record, Call Data Record and Message Data Record
20	Organisational architecture of subscribers
21	Enabling/Disabling of subscriber/radio
22	Dispatcher Workstation*
23	Full IP networking

Note:

#Feature support in radio may vary from manufacturer to manufacturer

\*Optional features

### Advantages of C-DAC's TETRA Solution

- Fully indigenous technology based on the open standard.
- Cost-effective solution.
- Highly customizable.
- Supports 3-level security viz. Authentication, Air Interface Encryption and End-to-end Encryption with additional option for porting indigenous encryption algorithm.
- Maintenance and support.
- Infrastructure fully interoperable with multi-vendor radios.

### Application Areas for C-DAC's TETRA Solution

- Emergency services like disaster management centres, fire departments, ambulance etc.
- Public safety network
- Defence and Para-military services
- On-board communication system for Naval platforms
- Railway Signalling and Communication, including Metro rails
- Industrial Automation
- Coast Guard and Border Security
- Seaports and airports
- Mobile Communication System for VIP security
- Communication system for Prison Administration
- Smart City communication based on private network

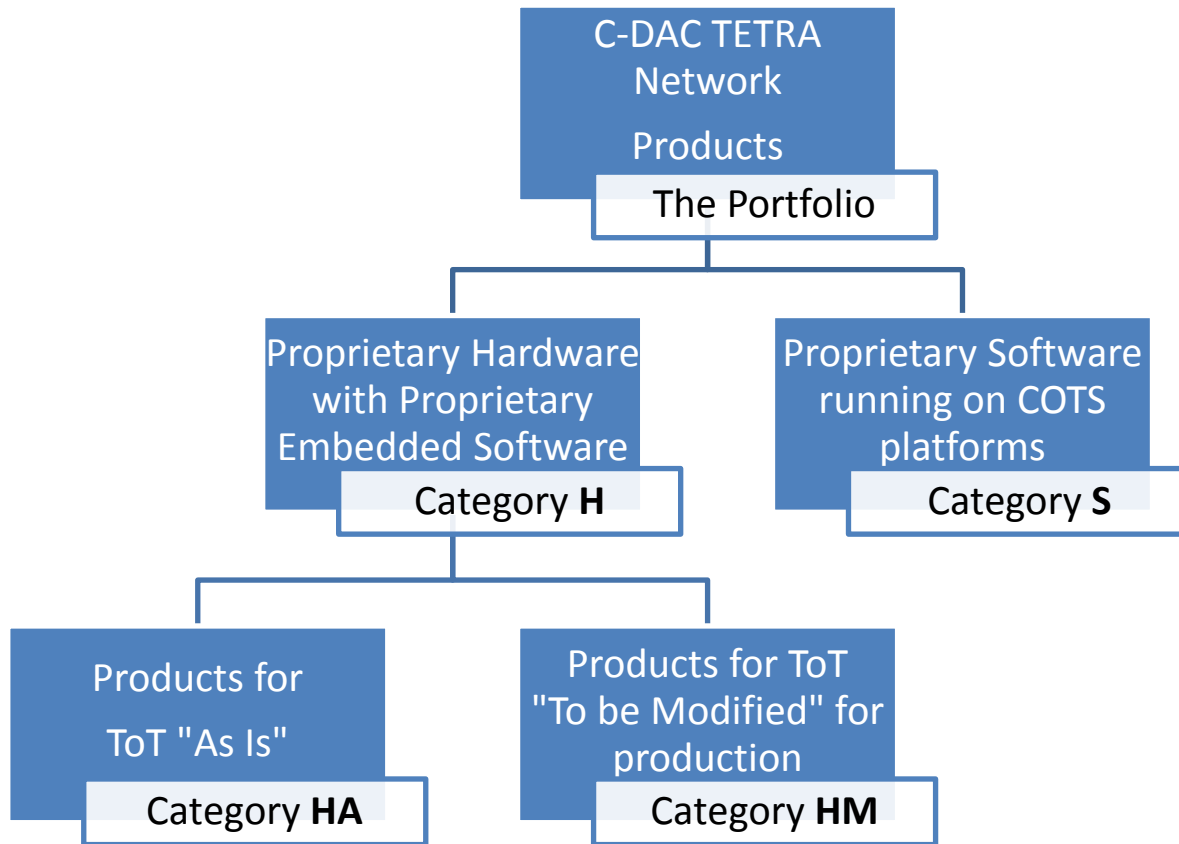
## 2. ToT/Licensing - Terms & Conditions

### 2.1 General Terms and Conditions

1. There are two types of products in C-DAC TETRA portfolio. The first category includes products consisting of proprietary software, intended for running on COTS platforms, hereafter referred to as **Category S** products. The other category included products consisting of proprietary hardware and/or proprietary embedded software, hereafter referred to as **Category H** products.
2. **Category H** products are further divided into two sub-categories. Some products are offered for ToT in “as is” form, in which case the know-how covers every aspect of the manufacturing, including packaging. These are referred to as **Category HA** products. Other products that are “to be modified” for production and deployment are also offered for ToT. For these products, the ToT partner shall take the

responsibility for product engineering, ruggedizing and packaging. These are referred to as **Category HM** products.

The categories are depicted in the Figure given below.



**Figure: C-DAC TETRA Network Product Categories**

3. The ToT and Licensing shall be non-exclusive.
4. ToT/Licensing would be done separately for each individual product.
5. Separate Terms and Conditions shall be applicable (as detailed in later part of this document) for ToT/Licensing of Category S products, Category HA products and Category HM products. ToT Agreements have to be separately signed for each of the Category H products. Such agreements are not required for Category S products. However, Licenses for Category S products would be available only to those firms who have signed ToT agreement for at least one Category H product.
6. C-DAC reserves the right to include new ToT/Licensing partners from time-to-time, through open calls for EoI and subsequent procedures. The financial terms and conditions are likely to be revised based on

the prevailing market situations from time-to-time. However, these changes shall not be binding on existing ToT/Licensing partners, except by way of explicit clauses in upcoming sections pertaining to the revision of ToT/License fees.

7. C-DAC is likely to include new products in the TETRA portfolio for ToT/Licensing from time to time. The complete ToT/Licensing process life cycle shall normally be applicable for awarding ToT/Licensing of products in the upgraded portfolio. However, existing ToT/Licensing partners are exempted from submission of EoI, though all the remaining procedures would be applicable to them as well.
8. C-DAC would not compete with ToT/Licensing partners in tenders. However, C-DAC reserves the right to use its TETRA based technologies, IPs, products and solutions, existing and those realized in future, for any purpose and in any manner for its current and future design and development activities. Further, C-DAC reserves the right to accept and undertake projects/works for delivery of products, systems, solutions and/or services based on C-DAC TETRA technology, which are awarded to C-DAC on nomination basis.
9. C-DAC reserves the right to use its TETRA based technologies, products and solutions for honouring existing contractual obligations (initiated prior to the commencement of ToT) and their natural extensions.

## **2.2 ToT/Licensing for Category H products**

### **Terms and Conditions common to Category H products**

1. For each of the Category H products, the “MANUFACTURING KNOW-HOW” would be transferred to the ToT partner against a one-time payment of “MANUFACTURING LICENSE FEE”. The firmware (embedded software executable) would be distributed against payment of per unit “FIRMWARE LICENSE FEE”. However, diagnostic software would be provided as part of the hardware technology know-how to enable testing, debugging and validation of the assembled units.
2. For Category H products MANUFACTURING LICENSE FEE and FIRMWARE LICENSE FEE structure would be decided by C-DAC and would be intimated to all short listed firms.
3. Any of the short-listed firms can acquire the MANUFACTURING KNOW-HOW, for each of the Category H products, by signing respective ToT Agreements with C-DAC and paying the “MANUFACTURING LICENSE FEE, as applicable, as per the procedure given in Clause 4 below.
4. The MANUFACTURING LICENSE FEE shall be payable as follows. The first instalment of 25% (Twenty-Five percent) shall be payable at the time of signing of the ToT Agreement. The second instalment of 50% (Fifty percent) shall be payable at the time of transfer of documentation and material as outlined in Schedule I (Annexure – III) of the ToT Agreement. The third instalment of 25% (Twenty-Five percent) shall be payable at the time of transfer of documentation and material as outlined in Schedule II (Annexure – III) of the ToT Agreement.

5. The MANUFACTURING LICENSE FEE for a product may be revised for every new ToT cycle. The MANUFACTURING LICENSE FEE structure for the current ToT cycle will be published along with the Request for Proposal (RFP), to be issued after the EoI phase.
6. The terms and conditions listed herein as well as stated in the ToT Agreements together constitute the complete set of terms and conditions for ToT process. If there are any contradictions between the documents on any specific points, the ToT Agreements shall take precedence.
7. Any of the short-listed firms, after having entered into ToT Agreement for one or more of the product(s) as described in the previous clause, can acquire the required number of FIRMWARE LICENSES for the same product(s) by following the prescribed procedure, which includes payment of FIRMWARE LICENSE FEE, as applicable. The FIRMWARE LICENSE FEE structure for the current ToT cycle will be published along with the RFP.
8. The ToT partner can obtain required firmware from C-DAC and get them activated on payment of the FIRMWARE LICENSE FEE as applicable.
9. A single session training programme, with duration up to a maximum of 5 days, will be offered within ONE YEAR from the commencement of the ToT, to a group of up to ten authorized employees, of the ToT partner or their representatives, possessing the requisite qualification and experience. The training fee is included in the MANUFACTURING LICENSE FEE. However, the ToT partner shall arrange for the travel and accommodation of their personnel at their own expenses. Additional training, limited to two training sessions (each of duration up to a maximum of 5 days) per year, can be offered based on request from ToT partners on payment of separate training fees. The ToT partner shall arrange for the travel accommodation of their personnel at their own expenses. Requests for trainings outside C-DAC premises shall not generally be entertained and would be at the discretion of C-DAC. In such cases the ToT partner, at their expenses, shall arrange for the travel and accommodation of C-DAC personnel, in addition to the training fees.
10. C-DAC shall support the ToT partner for a period of TWO years from commencement of the ToT in production related activities by way of answering technical queries through e-mails or phone calls. In exceptional cases, modules or subsystems may be brought to C-DAC for inspection and trouble shooting. This would, however, be only with prior appointment and on payment basis (lab usage charges). The support period can be extended on yearly basis through separate agreements.
11. Maintenance and customer support for the products, in general, shall be the responsibility of the ToT partner. However, C-DAC shall give support to the ToT partner, by way of answering technical queries, during the specified support period defined by Clause 10 of this section.
12. Obsolescence management shall be the responsibility of C-DAC during the support period and shall be free of cost. Beyond the support period C-DAC support for obsolescence management may be extendable on yearly basis, on mutually agreed terms, throughout the product life cycle.
13. Product upgrades, involving major revision of the hardware, would be offered as part of revised portfolio, by initiating fresh ToT cycles. However, existing ToT partners possessing the know-how for a previous version of the product would be offered a discount on the MANUFACTURING LICENSE FEE



applicable for the fresh ToT cycle. FIRMWARE LICENSE FEE shall also be revised for product upgrades, which will be applicable uniformly for all ToT partners.

14. No separate ToT/Licensing cycle would be initiated for upgrades in firmware alone. However, upgrades may generally be accompanied by a revision of the FIRMWARE LICENSE FEE applicable for the particular product. The licensing partner may procure the license for the upgrade or previous version of the firmware by paying the respective license fees. Bug fixes and patches would not be considered as upgrades and would be made available free of cost.
15. If C-DAC decides to withdraw from further development and/or support of any product in this category, all source files (including those of hardware and firmware), shall be made available to the existing ToT partners for the given product at that point of time against a one-time payment. The payment structure will be published along with the RFP.

### **Terms and Conditions specific to Category HA products**

16. The ToT partner is permitted to customize the design for improving the usability/ruggedness or to impart product/brand individuality. However, any such modification shall be done only with prior written approval of C-DAC. Any such modification (a) shall not degrade the performance, reliability or usability of the system, and C-DAC shall not be responsible for any resultant degradation that may happen (b) shall not obliterate C-DAC's credits on the body of the product(s) and (c) shall not change C-DAC's right over the technology transferred.
17. C-DAC shall provide User Manual for each product. However, the ToT partner would be responsible for modifications in the User Manual necessitated by modifications as listed in Clause 17 above. The User Manual, if modified, shall be distributed only with prior written approval from C-DAC.

### **Terms and Conditions specific to Category HM products**

18. The ToT partner shall take the responsibility of ruggedizing and packaging (including EMI/EMC, environmental and any other consideration) as required. This work shall be carried out in consultation or in partnership with C-DAC. Extra effort required from C-DAC for incorporating modifications would be chargeable based on mutually agreed terms.
19. C-DAC shall provide a reference User Manual for each product. However, the ToT partner would be responsible for preparation of the User Manual for distribution, taking into account modifications during product engineering, packaging and so on. This User Manual shall be distributed only with prior written approval from C-DAC.

## **2.3 Licensing for Category S products**

1. Software products (running on COTS platforms) would be available for distribution/deployment against per node "SOFTWARE LICENSE FEE", as applicable.

2. SOFTWARE LICENSE FEE structure for each product would be decided by C-DAC and would be intimated to all short listed firms.
3. Any of the shortlisted firms, after having entered into at least one ToT Agreement (as described in the Clause II.3), can acquire the required number of licenses for any of the Category S products by following the prescribed procedure, which includes payment of SOFTWARE LICENSE FEE, as applicable.
4. The SOFTWARE LICENSE FEE structure for the current ToT cycle will be published along with the RFP. These amounts are likely to be revised every financial year thereafter. Such revisions in SOFTWARE LICENSE FEE, if any, shall be intimated to the ToT partners in writing.
5. The ToT partner can obtain required software from C-DAC and get them activated on payment of the License fee as applicable.
6. Upgrades of the software would generally be accompanied by a revision of the license fee applicable for the particular software product. No fresh Licensing cycle would be initiated for upgrades. The licensing partner may procure the license for the upgrade or for the previous versions of the software by paying the respective license fees. However, updates of the software (bug fixes, patches etc.) would be made available free of cost.
7. C-DAC shall support the Licensing partner for a period of ONE year from procurement of each license by way of answering technical queries through e-mails or phone calls. The support period can be extended on yearly basis through separate agreements and on payment basis.
8. Training programmes (on products for which partner has taken License for), limited to two training sessions (each of duration up to a maximum of 5 days) per year, can be offered based on request from licensing partners on payment of separate training fees. However, the Licensing partner shall arrange for the travel accommodation of their personnel at their own expenses. Requests for trainings outside C-DAC premises shall not generally be entertained and would be at the discretion of C-DAC. In such cases the Licensing partner shall arrange for the travel accommodation of C-DAC personnel at their expenses, in addition to the training fees.
9. Maintenance and customer support for the products, in general, shall be the responsibility of the Licensing partner. However, C-DAC shall give support to the Licensing partner, by way of answering technical queries, during the specified support period defined by Clause 8 of this section.
10. C-DAC shall provide User Manual for each product.
11. If C-DAC decides to withdraw from further development and/or support of any product in this category, all source files for software shall be made available to the existing ToT/Licensing partners for the given product at that point of time against a one-time payment of a SOURCE CODE FEE, which will be published along with the RFP.

### 3. Details of Products / Technology to be Transferred

Following are the details of C-DAC's TETRA products:

#### I. Xtreme TETRA Base Station [Category – HA]

Xtreme TETRA Base Station (XTBS) is a high capacity, scalable base station which can be configured with up to 8 carriers. The base station is capable of transmitting up to 40W per carrier. It features diversity reception and thereby enhances the area of coverage. It can be powered from AC mains as well as from 48V DC. Its modular design provides flexibility and cost saving without compromising the performance. The base station is available in two different models which supports up to maximum four carriers and eight carriers respectively.

#### Features

- High Power, high capacity
- Enhanced coverage with Dual Diversity
- Digital Receiver with enhanced sensitivity
- Fast call setup
- All types of calls including Simplex, Duplex, Group, Broadcast and Circuit Mode Data
- Late Entry, Priority Group Scanning
- Call pre-emption, priority calls, emergency calls
- Individual/Group messaging services like SDS-TL, SDS Type1/Type2/Type3 and Pre-defined/User-defined status messages.
- Supplementary services like Late Entry, Call Authorized by Dispatcher, Ambience Listening, Discreet Listening and Dynamic Grouping (DGNA).
- Mutual Authentication / Encryption – Class 3 with fall back option to Class 1
- Option for porting proprietary encryption algorithms
- End-to-end Encryption call support
- Fast and easy configuration and installation
- Scalability from 1 to 999 Base Stations in a network
- Support for both standalone and network mode operation
- Full IP networking – Interface to any IP network with Star, Ring or Meshed configuration over Optical Fiber, Microwave, LAN, Satellite etc.
- Distributed database with flexible soft switching
- Intelligent fallback modes
- Built-in resilience for IP connectivity
- Remote Monitoring – Efficient performance/health monitoring from remote station

#### Specifications

Standard	TETRA V+D Air Interface ETS 300 392 – 2
Frequency Band	380 to 390 MHz / 410 to 420 MHz (Reception)
	390 to 400 MHz / 420 to 430 MHz (Transmission)

Duplex Spacing	10 MHz
Carrier Separation	25 KHz
Channel Data Rate	36 kbps
Speech Code Rate	4.8 kbps
Modulation	Pi/4 DQPSK
Access Method	TDMA with 4 time-slots
User Data Rate	7.2 kbps per timeslot
Protected Data Rate	2.4 kbps and 4.8 kbps
Tx. Power	Power Class 1 (Configurable up to 40 W per carrier)
Carrier Support	Configurable from 1 to 8 carriers
Receiver Sensitivity	-115 dBm
Trunking	Message Trunking
Power Supply	48V DC, 85 - 264 V AC, 50/60 Hz
Power Consumption	2.6 KW (4 carriers)
Dimension in mm (WxDxH)	550x800x1400 (4 carriers)
Weight (without combiner rack)	~ 130 Kg (4 carriers)
Operating Temperature	-20 to 55 °C

## II. Portable TETRA Base Station [Category – HA]

Portable TETRA Base Station (PTBS) is the portable version of TETRA Base Station. As it can be mounted on a vehicle and can be operated from a battery, PTBS is very much suitable for quick deployment at an emergency/disaster site. It accommodates all the features of XTBS except that it supports lesser number of carriers and can radiate up to a maximum power of only 15 W when run in single carrier mode. The most important feature of PTBS is that it incorporates the state of the art Multi-Carrier Power Amplifier (MCPA) technology.

### Features

- Can be placed inside a vehicle
- Quick deployment
- Digital Receiver with enhanced sensitivity
- Fast call setup
- All types of calls including Simplex, Duplex, Group, Broadcast and Circuit Mode Data
- Late Entry, Priority Group Scanning
- Call pre-emption, priority calls, emergency calls
- Individual/Group messaging services like SDS-TL, SDS Type1/Type2/Type3 and Pre-defined/User-defined status messages.
- Supplementary services like Late Entry, Call Authorized by Dispatcher, Ambience Listening, Discreet Listening and Dynamic Grouping (DGNA).
- Mutual Authentication / Encryption – Class 3 with fall back option to Class 1

- End-to-end Encryption call support
- Fast and easy configuration and installation
- Support for both standalone and network mode operation
- Full IP networking – Interface to any IP network with Star, Ring or Meshed configuration over Optical Fiber, Microwave, LAN, Satellite etc.
- Distributed database with flexible soft switching
- Intelligent fallback modes
- Built-in resilience for IP connectivity
- Remote Monitoring – Efficient performance/health monitoring from remote station

### Specifications

Standard	Tetra V+D Air Interface ETS 300 392 – 2
Frequency Band	380 to 390 MHz / 410 to 420 MHz (Reception)
	390 to 400 MHz / 420 to 430 MHz (Transmission)
Duplex Spacing	10 MHz
Carrier Separation	25 KHz
Channel Data Rate	36 kb/s
Speech Code Rate	4.8 kb/s
Modulation	Pi/4 DQPSK
Access Method	TDMA with 4 time-slots
User Data Rate	7.2 kb/s per timeslot
Protected Data Rate	2.4 Kbps and 4.8 Kbps
Tx. Power	Power Class 3 (Configurable up to 15 W – in single carrier operation)
Carrier Support	Up to 4 (adjacent) carriers, with reduced power
Receiver Sensitivity	-115 dBm
Trunking	Message Trunking
Power Supply	85 - 264 V AC, 50/60 Hz available with external power converter. For vehicle mount operation - 24V DC.
Power Consumption	280 W
Dimension in mm (WxDxH)	475x400x180
Weight(Approx.)	20 Kg
Operating Temperature	-20 to 55°C

### III. Micro TETRA Base Station [Category – HA]

The Micro TETRA Base Station (MTBS) is the smallest among the three variants of C-DAC TETRA Base Stations. Like Portable TETRA Base Station MTBS also uses the Multi-Carrier Power Amplifier (MCPA) technology and has a maximum transmission power capability of 6.3 W when run in single carrier mode. This

base station is designed for both indoor and outdoor deployment. The base station can also be mounted on a vehicle and can be used for mission critical operations.

### Features

- Micro form factor
- IP65 rated
- Suitable for indoor and outdoor deployment
- Digital Receiver with enhanced sensitivity
- Fast call setup
- All types of calls including Simplex, Duplex, Group, Broadcast and Circuit Mode Data
- Late Entry, Priority Group Scanning
- Call pre-emption, priority calls, emergency calls
- Individual/Group messaging services like SDS-TL, SDS Type1/Type2/Type3 and Pre-defined/User-defined status messages.
- Supplementary services like Late Entry, Call Authorized by Dispatcher, Ambience Listening, Discreet Listening and Dynamic Grouping (DGNA).
- Mutual Authentication / Encryption – Class 3 with fall back option to Class 1
- End-to-end Encryption call support
- Fast and easy configuration and installation
- Support for both standalone and network mode operation
- Full IP networking – Interface to any IP network with Star, Ring or Meshed configuration over Optical Fiber, Microwave, LAN, Satellite etc.
- Distributed database with flexible soft switching
- Intelligent fallback modes
- Built-in resilience for IP connectivity
- Remote Monitoring – Efficient performance/health monitoring from remote station

### Specifications

Standard	Tetra V+D Air Interface ETS 300 392 – 2
Frequency Band	380 to 390 MHz / 410 to 420 MHz (Reception)
	390 to 400 MHz / 420 to 430 MHz (Transmission)
Duplex Spacing	10 MHz
Carrier Separation	25 KHz
Channel Data Rate	36 kb/s
Speech Code Rate	4.8 kb/s
Modulation	Pi/4 DQPSK
Access Method	TDMA with 4 time-slots
User Data Rate	7.2 kb/s per timeslot
Protected Data Rate	2.4 Kbps and 4.8 Kbps
Tx. Power	Power Class 5(Configurable up to 6.3 W)
Carrier Support	Up to 4 (adjacent) carriers, with reduced power
Receiver Sensitivity	-115 dBm

Trunking	Message Trunking
Power Supply	48V DC, 85 - 264 V AC, 50/60 Hz available with external power converter. For vehicle mount operation - 24V DC.
Power Consumption	200 W
Dimension in mm (WxDxH)	425x280x135
Weight (Approx.)	12 Kg
Operating Temperature	-20 to 55°C

#### IV. ISDN/PSTN Gateway [Category – HA]

The ISDN-PSTN Gateway (IPGT) facilitates voice communication between the TETRA network subscribers and external network (ISDN, PSTN, PABX, GSM etc.) subscribers. The gateway performs the signalling conversion, protocol conversion and transcoding necessary for interconnecting the analog PSTN and digital ISDN networks with TETRA network. The Gateway can be interfaced with the PSTN exchange through E1 Interface as well as FXO interface. Gateway also provides FXS interfaces to connect to a PABX or a telephone. IPGT can be configured for up to 4 E1 lines giving a total of 120 voice channels. It also supports 8 FXO lines and 8 FXS lines. The gateway, being IP enabled, can be connected at any point in the network. The gateway allows direct dialling from TETRA subscriber to PSTN/GSM/PABX subscriber and two-stage dialling the other way.

##### Features

- Configurable up to 120 simultaneous calls between TETRA network & PSTN network
- 4 Standard E1 ISDN PRI interface
- 8 Telephone interface (FXS)
- 8 PSTN interface (FXO)
- 19", 2U form factor, rack mountable
- Conforms to ETSI standard
- CAD and Discreet Listening enabled
- IP enabled
- Can be connected at any point in the network
- Can have multiple IPGTs in the TETRA network
- Support for both standalone and network mode operation

##### Specifications

Interface	E1 ISDN PRI Q931 Protocol, FXO (PSTN Exchange)
	FXS interface (PABX/ Telephone)
	Ethernet 10/100 Mbps (Network)
Power Supply	230V AC

Power Consumption	110 W
Form Factor	2U
Weight (Approx.)	5 Kg
Operating Temperature	-0 to 50°C

## V. TETRA Handheld Radio [Category – HM]

C-DAC TETRA Handheld Radio (THR) is a high performance digital mobile radio designed as per the ETSI standard for professional mobile radio users. The radio design is based on high performance cutting edge devices meeting the specifications of TETRA. The design is “to be modified” in terms of packaging and ruggedizing, with due attention to EMI/EMC and environmental considerations.

### Features

#### Basic Services

- Registration - New ITSI location update, Roaming location update, BS initiated location update, Call restoration roaming location update
- Voice Call - Duplex Call, Half-duplex Call, Group Call, Broadcast Call
- Circuit Mode Data Communication - Unprotected (7.2 kbps), Medium protected (4.8 kbps), Protected (2.4 kbps)
- Messaging - Individual SDS, Group SDS, Broadcast SDS, Pre-defined Status messages
- Authentication - MS Initiated, Mutual Authentication
- Encryption - Air Interface Encryption, End-to-end Encryption
- Security Class - Class 1, Class 3, Class 1&3
- Direct Mode Operation (DMO)
- GPS Support

#### Supplementary Services

- Call Identification
- Talking Party Identification
- Call Authorized by Dispatcher
- Priority Call
- Late Entry
- Pre-emptive Priority Call
- Barring of Outgoing Calls
- Barring of Incoming Calls



- Discreet Listening
- Ambience Listening
- Dynamic Group Number Assignment

## Specifications

Radio Mode	TETRA TMO or DMO
Frequency range	410 - 430 MHz / 380 - 400 MHz
Power class	4 (1 Watt)
Rx Static Sensitivity	-112 dBm (min)
Rx Dynamic Sensitivity	-103 dBm (min)
Audio power	1 W
External audio in/out	3.5 mm audio jack
Microphone	Built-in electret type
Data communication	Single slot data call with data rates 2.4 kbps, 4.8 kbps and 7.2 kbps
Data interface	USB 2.0 (Virtual UART)
Human interface	Through keypad and display
Battery	3.7 V, Lithium Ion 6 Ah
Power save mode	User configurable auto sleep
Battery voltage indication	Graphical display of remaining charge
Signal level indication	-110 dBm to -48 dBm with an accuracy of +/- 4 dBm
Antenna	Detachable whip antenna
Display type	TFT LCD colour display, 240 x 320 with 8-bit resolution
Display viewing area	37 mm x 49 mm
Dimension (HxWxD)	136 mm x 54 mm x 42 mm
Weight (approx.)	350 grams (radio only) and 500 grams (with battery)
Battery charging	5 V DC @ 2A
Battery life	12 hours with 5/5/90 standard duty cycle
Talk time	more than 4 hours
Battery life time	1000 recharge cycles with capacity reduce to 60%
Operating temperature	-30 to 60 °C (targeted after final packaging)
GPS	5-10 m accuracy
Display/Language	Alphanumeric, English
Contacts list	200
Inbox size	50
Talk groups	100
Talk group scan list	100

Software upgradation	Yes
Security	Both Air Interface and End-to-End encryption

## VI. TETRA Vehicle Mount/Desktop Radio [Category – HM]

C-DAC TETRA Vehicle Mount / Desktop Radio (TVMR/TDR) is a high performance digital mobile radio designed as per the ETSI standard with a maximum transmission power capability of 10W. The radio can be fitted inside a vehicle for mobile application or can be mounted on a table for stationary operations. The design is “to be modified” in terms of packaging and ruggedizing, with due attention to EMI/EMC and environmental considerations.

### Features

#### Basic Services

- Registration - New ITSI location update, Roaming location update, BS initiated location update, Call restoration roaming location update
- Voice Call - Duplex Call, Half-duplex Call, Group Call, Broadcast Call
- Circuit Mode Data Communication - Unprotected (7.2 kbps), Medium protected (4.8 kbps), Protected (2.4 kbps)
- Messaging - Individual SDS, Group SDS, Broadcast SDS, Pre-defined Status messages
- Authentication - MS Initiated, Mutual Authentication
- Encryption - Air Interface Encryption, End-to-end Encryption
- Security Class - Class 1, Class 3, Class 1&3
- Direct Mode Operation (DMO)
- GPS Support

#### Supplementary Services

- Call Identification
- Talking Party Identification
- Call Authorized by Dispatcher
- Priority Call
- Late Entry
- Pre-emptive Priority Call
- Barring of Outgoing Calls
- Barring of Incoming Calls
- Discreet Listening

- Ambience Listening
- Dynamic Group Number Assignment

### Specifications

Radio Mode	TETRA TMO or DMO
Frequency range	410 - 430 MHz / 380 - 400 MHz
Power class	2 (10 Watt)
Rx Static Sensitivity	-112 dBm (min)
Rx Dynamic Sensitivity	-103 dBm (min)
External audio in/out	Fist Mic / 3.5 mm audio jack
Audio power	2W (external speaker), 1.5W (fist mic speaker)
Microphone	Built-in electret type (Fist Mic), Condenser type (through 3.5 mm audio jack)
Data communication	Single slot data call with data rates 2.4 kbps, 4.8 kbps and 7.2 kbps
Data interface	USB 2.0 (Virtual UART)
Human interface	Through keypad and display
Power Source	12 V DC for vehicle mount, 230 V AC Adapter for desktop
Signal level indication	-110 dBm to -48 dBm with an accuracy of +/- 4 dBm
Antenna	Magnetic Mount
Display type	TFT LCD colour display, 240 x 320 with 8-bit resolution
Display viewing area	49 x 37 mm
Dimension (HxWxD)	60 mm x 190 mm x 142 mm
Weight (approx.)	2 kg
Operating temperature	-30 to 60 °C (targeted after final packaging)
GPS	5-10 m accuracy
Display/Language	Alphanumeric, English
Contacts list	200
Inbox size	50
Talk groups	100
Talk group scan list	100
Software upgradation	Yes
Security	Both Air Interface and End-to-End encryption

### VII. TETRA Key Loader [Category – HM]

TETRA Key Loader (TKL) is a hardware device used for distributing Authentication/Encryption keys generated at Authentication Centre to all C-DAC TETRA radios in the network. The Key Loader interfaces with both C-DAC TETRA radio and Authentication Centre. It has user friendly HMI which helps operator to perform key distribution efficiently. The design is “to be modified” in terms of packaging and ruggedizing, with due attention to EMI/EMC and environmental considerations.

## Features

- HMI provides simple and efficient key distribution facility.
- Store/transfer keys for both End-to-end and Air Interface Encryption.
- Multi-level security for the operator prevents unauthorized access to the device.
- Dead Battery operation.
- Reliable data backup and retrieval.

## Specifications

Data interface protocol	USB 2.0
Data interface connector	USB Type A
Human interface	Through keypad and display
Display type	TFT LCD colour display, 240 x 320 with 8-bit resolution.
Battery	3.7 V, Lithium Ion 6 Ah
Power save mode	User configurable auto sleep
Battery voltage indication	Graphical display of remaining charge
Dimension (HxWxD)	135 mm x 54 mm x 42 mm
Weight	400 grams (with battery)

## VIII. Radio Charging Station [Category – HA]

Radio Charging Station (RCS) is a proprietary hardware device used for charging multiple C-DAC TETRA handheld devices and batteries simultaneously. It provides six independent ports that allow fast charging of either handheld devices or batteries.

### Features

- Universal input voltage (85 - 264VAC)
- Desktop design with standard charging ports and cables
- Type-C ports and cables are reversible; no longer need to flip the connector.
- LED indication for active ports
- LED indication for charging status

### Specifications

AC input	85 - 264V, 2A@230VAC
Charging Ports connector	USB Type C
Charging port specification	5V DC at 2A (Max)
Number of ports	6
LED Indications	Port Active, Charging Status, System ON

Dimension (HxWxD)	47 mm x331 mm x220mm
Weight	2.3 Kg

## IX. TETRA Line Station [Category – HA]

C-DAC TETRA Line Station (TLS) is a wired device that does similar functionalities as that of a TETRA radio. The device is having Ethernet interface and can be connected anywhere in the C-DAC TETRA Network. The device operates from conventional AC/DC power supply. It supports both standalone and network mode of operation.

### Features

#### Basic Services

- Voice Call - Duplex Call, Half-duplex Call, Group Call, Broadcast Call
- Messaging - Individual SDS, Group SDS, Broadcast SDS, Pre-defined Status messages
- Emergency call and messaging
- Encryption - End-to-end Encryption
- Support for both standalone and network mode operation

#### Supplementary Services

- Call Identification
- Talking Party Identification
- Priority Call
- Late Entry
- Pre-emptive Priority Call
- Barring of Outgoing Calls
- Barring of Incoming Calls
- Discreet Listening

### Specifications

Audio power	2 W
Audio Input	In-built and external mic
Audio Output	In-built and external speaker
Human interface	Through keypad and display
Power Source	12 V DC adapter and PoE
Display type	TFT LCD colour display, 240 x 320 with 8-bit resolution
Display viewing area	37 mm x 49 mm
Dimension (HxWxD)	136 mm x 80 mm x 50 mm (approx.)
Weight (approx.)	500 grams

Operating temperature	0 to 60 °C
Display/Language	Alphanumeric, English
Contacts list	200
Inbox size	50
Talk groups	100
Talk group scan list	100
Software upgradation	Yes
Security	End-to-End encryption

## X. Data Acquisition Unit [Category – HA]

The Data Acquisition Unit is an accessory hardware device which can be connected to the TETRA Mobile Station through a USB interface and can be used for acquiring data from multiple sources simultaneously. The DAU is having up to eight data acquisition ports through which it can acquire data from four or eight sources simultaneously. The data acquisition ports are full duplex RS-232 interface with standard DB-9 connector. The DAU can be configured for required baud rate, ports in use and other standard serial communication protocol parameters. Separate LED indicators are provided for showing each channel status. DAU operates on a 12 V DC.

### Features

- Operates on standard 12 VDC.
- Up to 8 independent channels.
- Each channel can be configured separately.
- Separate LED indicators for each channel
- USB 2.0 interface for radio connection

### Specifications

Power input	12 V DC
Radio connectivity	USB Type A Receptacle
Data acquisition	DB9 connector, RS-232
Number of ports	Up to 8
Aggregate throughput	Up to 7.2 Kbps
Dimension (HxWxD)	50 mm x 400 mm x 150 mm
Weight	1 Kg

## XI. Base Station Terminal [Category – S] (Free of cost with XTBS/PTBS/MTBS in Network Mode)

Base Station Terminal (BST) is the graphical user interface for C-DAC TETRA Base Station when run in network mode. The software, which runs on a desktop PC, monitors the functioning of the base station from a remote location. It has a user-friendly, interactive graphical interface that helps the base station operator to monitor the call proceedings, subscriber registrations, channel status, health of different modules within the base station etc. It is also used to configure the different hardware modules within the base station. It has two mode of operation viz. Normal User and Administrative User.

### Features

- Does the configuration of TETRA base station
- Real-time display of all radio registrations and calls happening in the base station
- History of all registrations, calls and messages happened in the base station
- Search facility on the history of registrations, calls and messages
- Monitors and displays health parameters of various hardware modules of base station
- Live graphical display of signal strength of all channels in base station
- Facility to test various modules of the base station
- Reporting of errors and emergency messages
- Two types of operator modes viz. Normal User and Administrative User

### System Requirements

Computer Type	Desktop PC / Laptop
Operating System	Microsoft Windows 7 or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB or above
Hard Disk	500 GB or above
Network	Ethernet 10/100 Mbps

### XII. Standalone System Manager [Category – S](Free of cost with any product in Standalone Mode)

Standalone System Manager (SSM) is the integrated graphical user interface for C-DAC TETRA Base Station, ISDN-PSTN Gateway, VoIP Gateway and Voice Logger when run in standalone mode. It allows user to configure all the above elements and also shows their running status in real-time. It also configures Dispatcher User Terminals in Standalone mode. It also shows live subscriber registrations, calls, channel status and health status of different modules of standalone components.

### Features

- Does the configuration of TETRA Base Station, ISDN-PSTN Gateway, VoIP Gateway and Voice Logger in standalone mode
- Configures Dispatcher User Terminals in Standalone mode
- Real-time display of all subscriber registrations and calls

- Monitors and displays health parameters of various hardware modules
- Reporting of errors and emergency messages

### System Requirements

Computer Type	Desktop PC / Laptop
Operating System	Microsoft Windows 7 or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB or above
Hard Disk	500 GB or above
Network	Ethernet 10/100 Mbps

### XIII. Central Base Station Controller [Category – S]

The Central Base Station Controller (CBSC) acts as the network management server of C-DAC TETRA Network. It holds the entire database of the network and does the administration and maintenance of all components as well as subscribers in the network. However the network is not at all dependent on the CBSC for its functioning. In the event of an unlikely failure of CBSC, the TETRA network will continue to work using the distributed database available with different Base Stations and Gateways. TETRA Network Manager (TNM) software is the front-end Graphical User Interface for CBSC. It provides user the facility to efficiently manage, monitor and maintain each component/subscriber in the network. It also provides the user multiple search facility for easy retrieval of historical data. Using this application, the administrator can log in to the network directly from the CBSC server or from a remote PC where TNM is installed. CBSC is not required when CTN is configured in standalone mode.

#### Features

##### Configuration Management

- Configures Base Stations, Gateways, Dispatchers etc. from remote location
- Central Database Repository
- Database Management
- Report Generation
- Offline and Online monitoring of network events
- Exporting/importing of database

##### Subscriber Management

- Addition and Deletion of Subscribers
- Hierarchical distribution of subscribers
- Supports a maximum of 16 organizations, each with a maximum of 1024 departments



- Inter-organizational and intra-organizational privileges
- Modification of user attributes/profiles
- Call Group management
- Enabling/Disabling of TETRA radios
- Provide, modify or withdraw services
- Offline and online monitoring of subscriber activities
- Registration Data Record, Call Data Record and Message Data Record
- Multiple search facility on historical data
- Backup and retrieval of history data

## System Requirements

### Central Base Station Controller (CBSC)

Computer Type	Server
Operating System	Microsoft Windows 2016 or above
CPU	Intel/AMD Quad-core Processor, 2 GHz or above
Memory	8 GB
Hard Disk	500 GB or above
Network	Ethernet 10/100 Mbps

### TETRA Network Manager (TNM)

Computer Type	Desktop PC*
Operating System	Microsoft Windows 7 professional or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500 GB or above
Network	Ethernet 10/100 Mbps

\* Separate computer is required only if TNM is run from a machine other than CBSC

## XIV. Dispatcher Workstation [Category – S]

TETRA Dispatcher Workstation (DWS) is a software application that provides Dispatcher users the facility to manage, supervise and control the TETRA radio subscribers of an organization. In addition to the subscriber management capability, it also possesses all the communication features that of a normal TETRA radio. Being the only element in the TETRA network, capable of executing certain unique supplementary services like Dynamic Group Number Assignment (DGNA), Ambience Listening, Discreet Listening and Call Authorized by

Dispatcher (CAD), Dispatcher is one of the most powerful components in the network. It could be the nodal point at the time of emergency and could act as the first contact point during emergency situations.

A Dispatcher has three levels of users, viz. Normal User, Administrative User and Super User. A TETRA network can have multiple Dispatchers at different locations as per the requirement.

### Features

- Simplex Call, Duplex Call, Group Call, Broadcast Call, Priority Call, Emergency Call
- Individual calls to other external networks like PSTN/PABX, VoIP etc.
- Group calling facility to legacy analog networks through Analog Gateway
- Individual and Group messaging
- Live subscriber registration monitoring, call monitoring and message monitoring
- Live voice interception (Discreet Listening) of all calls in TETRA network
- Ambience Listening
- Dynamic grouping and ungrouping of subscribers
- Call Authorized by Dispatcher (CAD)
- Calling Party and Cell identification
- Talking Party and Cell identification
- Live location tracking of each TETRA subscriber
- TETRA subscriber management
- Call group management
- TETRA subscriber kill/stun facility
- Multi-level dispatcher users
- Automated distress call support
- User friendly GUI for easy operation
- Can have multiple dispatchers in TETRA network
- Support for both standalone and network mode operation

### System Requirements

Computer Type	Desktop PC
Operating System	Microsoft Windows 7 professional or above
CPU	Intel/AMD Dual-core Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500 GB or above
Audio	Headset or external speaker and mic
Network	Ethernet 10/100 Mbps

## XV. Dispatcher User Terminal [Category – S]

TETRA Dispatcher User Terminal (DUT) is also a GUI based application software which does all the functionalities similar to TETRA Line Station but runs on a desktop PC or laptop. It possesses all the communication features that of a normal TETRA radio. A TETRA network can have multiple Dispatcher User Terminals at different locations as per the requirement.

### Features

- Simplex Call, Duplex Call, Group Call, Broadcast Call, Priority Call, Emergency Call
- Individual calls to other external networks like PSTN/PABX, VoIP etc.
- Group calling facility to legacy analog networks through Analog Gateway
- Individual and Group messaging
- Calling Party identification
- Talking Party identification
- Live geographical location tracking of each TETRA subscriber
- User friendly GUI for easy operation
- Can have multiple Dispatcher User Terminals in TETRA network
- Support for both standalone and network mode operation

### System Requirements

Computer Type	Desktop PC / Laptop
Operating System	Microsoft Windows 7 professional or above
CPU	Intel/AMD Dual-core Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500 GB or above
Audio	Headset or external speaker and mic
Network	Ethernet 10/100 Mbps

## XVI. SIP Gateway [Category – S]

The SIP Gateway (SIPGT) is a Voice over IP gateway based on SIP protocol which interfaces the SIP telephone network with TETRA network. It does the conversion of TETRA protocol data to SIP and vice versa.

### Features

- Supports SIP version 2.0 and TETRA ETS 300 392 -2
- IP enabled
- Can be connected at any point in the network
- Provides communication between TETRA and VoIP phones using SIP Protocol

- Does the conversion of speech data from G711/G729 to ACELP and vice versa.
- Authentication support
- Handles simultaneous calls
- CAD and Discreet Listening enabled
- Support for both standalone and network mode operation

### System Requirements

Computer Type	Server/Industrial PC
Operating System	CentOS 7.4 or above
CPU	Intel/AMD Dual-core Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500 GB or above
Network	Ethernet 10/100 Mbps

## XVII. Analog Gateway [Category – S]

Analog Gateway (AGT) facilitates communication between radios in conventional Analog network and TETRA radios in C-DAC TETRA Network. It performs the signaling conversion and transcoding necessary for interconnecting the analog network with TETRA network. The Analog Gateway software runs on a computer, which is connected to an Analog radio through C-DAC Analog Radio Interface Unit. The application monitors carrier sense input and controls PTT output of Analog radio.

### Features

- Group calls initiated from TETRA network are propagated to Analog network by controlling PTT signal to Analog radio
- Call activity on analog network is detected through Carrier Sense signal from Analog radio and establishes group call in TETRA network.
- Being IP enabled, can be connected at any point in the network.
- Support for both standalone and network mode operation

### System Requirements

Computer Type	Server/Industrial PC
Operating System	Microsoft Windows 2016/Windows 7 professional or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500 GB or above
Audio	Line in and Line out
USB	USB 2.0 or above

Network	Ethernet 10/100 Mbps
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### XVIII. Voice Logger [Category – S]

TETRA Voice Logger (VL) is a multi-channel voice-logging tool that allows user to automatically record all calls routed from analog, digital and VoIP lines in the TETRA Network. It has a graphical user interface (GUI) through which the administrator can configure the required parameters. Features of the GUI include advanced search features, backup/restore features, voice format conversion and multimedia operations.

#### Features

- Access Control/Data Security
- Blind Recording
- Multi-Channel Support
- Advanced Search
- Multimedia features
- Backup & Restore
- Remote Access
- Support for both standalone and network mode operation

#### System Requirements

Computer Type	Server
Operating System	CentOS 7.4 or above
CPU	Intel/AMD Dual-core Processor, 2 GHz or above
Memory	4 GB
Hard Disk	1TB or above
Audio	Speaker, Headset
Network	Ethernet 10/100 Mbps

### XIX. Voice Logger Remote Client [Category – S]

Voice Logger Remote Client (VLRC) is an authorized client software that can access the Voice Logger database remotely and do multimedia operations, voice format conversion, stored voice data playback etc. As the communication between Voice Logger server and remote client is through IP it can be connected anywhere in the network.

#### Features

- Access Control/Data Security
- Advanced Search

- Multimedia features
- Backup & Restore

### System Requirements

Computer Type	Desktop PC
Operating System	Microsoft Windows 7 professional or above (Windows version), CentOS 7.4 or above(Linux version)
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500GB or above
Audio	Speaker, Headset
Network	Ethernet 10/100 Mbps

### XX. Geographical Information System [Category – S]

Geographical Information System (GIS) is a server application that stores the geographical map information of locations where the TETRA radios are deployed. This server provides necessary information to Dispatcher Workstations and Dispatcher User Terminals to perform real-time location monitoring of all TETRA subscribers in the network.

#### Features

- Multi-layer
- Digital vector map
- Higher zoom levels
- Advanced search facility
- AJAX enabled
- Support for both standalone and network mode operation

### System Requirements

Computer Type	Server
Operating System	CentOS7.4 or above
CPU	Intel/AMD Quad-core Processor, 2 GHz or above
Memory	8 GB
Hard Disk	1 TB or above
Network	Ethernet 10/100 Mbps

### XXI. Authentication Centre [Category – S]

The main function of the Authentication Centre (AC) is to ensure secure communication within the TETRA network. It generates and stores the keys of all subscribers in the network. It does the authentication of all subscribers in the network during registration. It also enables base station to carry out air interface encryption when the base station run in encrypted mode. It has a Key Loading Device interface through which C-DAC TETRA Key Loader can be connected and keys can be downloaded for distribution to radio terminals. It also supports import and export of subscriber keys as per TETRA SFPG Recommendation 01.

### Features

- Being IP enabled, can be connected at any point in the TETRA network
- Support for both standalone and network mode operation
- Supports Class 3 Security with Authentication
- Used to ensure that terminal is genuine and allowed in the network.
- Supports Mutual Authentication, which ensures that in addition to verifying the terminal, the network can be trusted.
- Authentication requires both network and terminals have proof of secret key
- Import/export of subscriber keys (radios of other vendors) as per TETRA SFPG Recommendation 01.

### System Requirements

Computer Type	Server/Industrial PC
Operating System	Microsoft Windows 2016/Windows 7 professional or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500 GB or above
USB	USB 2.0 or above
Network	Ethernet 10/100 Mbps

## XXII. Data Terminal [Category – S]

Data Terminal (DT) is a software application that is used for transferring data from one C-DAC TETRA radio to another. It has a very friendly graphical user interface that provides user the facility to transfer data reliably and easy. It runs on a desktop/laptop having Windows 7 / Windows 10 operating system and it interfaces with the radio through the radio programming cable. The user can make/receive voice calls as well as do live chat in addition to the data transfer facility.

### Features

- Reliable data transfer between C-DAC TETRA radios.
- Supports unprotected, semi protected and fully protected data transfer

- Can make/receive voice calls
- Live chatting facility even during data transfer

#### System Requirements

Computer Type	Desktop PC / Laptop
Operating System	Microsoft Windows 7 professional or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500GB or above

#### XXIII. Radio Programming Software [Category – S](Free of cost with Handheld/Vehicle Mount/Desktop Radio)

Radio Programming Software (RPS) is used for programming both handheld and vehicle mount / desktop TETRA radio. Using this software, radio user data as well as radio firmware can be programmed.

#### Features

- Radio firmware programming
- User data configuration
- Contact list, Call groups import/export

#### System Requirements

Computer Type	Desktop PC / Laptop
Operating System	Microsoft Windows 7 professional or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500GB or above

#### XXIV. TETRA Radio Encryption Algorithm Programmer [Category – S]

TETRA Radio Encryption Algorithm Programmer (TREAP) is an application software used for programming both Air Interface and End-to-end Encryption algorithm on C-DAC TETRA radios. The software allows radios to be programmed with both standard as well as proprietary encryption algorithms.

#### Features

- Radio encryption algorithm programming
- Supports both standard and proprietary algorithms

#### System Requirements



Computer Type	Desktop PC / Laptop
Operating System	Microsoft Windows 7 professional or above
CPU	Intel/AMD Processor, 2 GHz or above
Memory	4 GB
Hard Disk	500GB or above

#### XXV. Data Dispatching Server [Category – S]

The Data Dispatching Server (DDS) is an application software running on a server machine which collects data sourced from various data acquisition units connected in C-DAC TETRA Network. The data received from each source is aggregated and send to a central Data Analyser (an entity external to CTN) as a User Datagram Packet (UDP) over IP network.

##### Features

- Receives data from multiple sources in CTN.
- Aggregates the data and dispatches to a central server.
- Interim storage of received data during connectivity error and automatic update to server on connection re-establishment.

##### System Requirements

Computer Type	Server
Operating System	CentOS 7.4 or above
CPU	Intel/AMD Quad-core Processor, 2 GHz or above
Memory	8 GB
Hard Disk	1 TB or above
Network	Ethernet 10/100 Mbps

#### 4. List of Products for ToT/Licensing

Sl. No.	Product	Category	ToT	Licensing
1	Xtreme TETRA Base Station	HA	Yes	Yes
2	Portable TETRA Base Station	HA	Yes	Yes
3	Micro Tetra Base Station	HA	Yes	Yes
4	ISDN/PSTN Gateway	HA	Yes	Yes
5	Radio Charging Station	HA	Yes	No
6	TETRA Line Station	HA	Yes	Yes
7	Data Acquisition Unit	HA	Yes	Yes
8	TETRA Handheld Radio	HM	Yes	Yes
9	TETRA Vehicle Mount/Desktop Radio	HM	Yes	Yes
10	TETRA Key Loader	HM	Yes	Yes
11	Central Base Station Controller	S	No	Yes
12	Dispatcher Workstation	S	No	Yes
13	Dispatcher User Terminal	S	No	Yes
14	SIP Gateway	S	No	Yes
15	Analog Gateway	S	No	Yes
16	Voice Logger	S	No	Yes
17	Voice Logger Remote Client	S	No	Yes
18	Geographical Information System	S	No	Yes
19	Authentication Centre	S	No	Yes
20	Data Terminal	S	No	Yes
21	TETRA Radio Encryption Algorithm Programmer	S	No	Yes
22	Data Dispatching Server	S	No	Yes
23	Base Station Terminal*	S	No	No
24	Standalone System Manager**	S	No	No
25	Radio Programming Software***	S	No	No
*	Free of cost with XTBS/PTBS/MTBS in Network Mode			
**	Free of cost with XTBS/PTBS/MTBS in Standalone Mode			
***	Free of cost with Handheld/Vehicle Mount/Desktop Radio			