Invitation of Expression of Interest (EOI) for acquiring Open Standard Digital Trunking Radio System for Chandigarh Police

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Chandigarh Police invites EOI from implementation agencies for acquiring Open standard Digital Trunking Radio System for Chandigarh Police.

Introduction to the project

Chandigarh Police intends to install ITU recommended Open Standard based Digital Trunking Radio System on a turnkey basis. Therefore interested companies/agencies are invited to study the present wireless communication infrastructure and Geographical area of Chandigarh and accordingly furnish estimated cost of the project as per the requirement mentioned at **Annexure 'A'**. Present infrastructure of Chandigarh Police wireless Communication is conventional Analog System based for the entire Chandigarh UT.

Documents to be provided by company/firm as part of submission

The company/firm would be required to submit the proof of concept/solution with the following points as part of their submission:-

- Company/firm Experience in "Similar" Projects – Learning on issues, challenges, solution proposed, recommendations
- To clarify users understanding of the system
- **Participation in EOI is purely for suggestion purpose not a base for the selection of any participated company/firm.**

PRE-QUALIFICATION CRITERIA

Following will be the minimum pre-qualification criteria. Each eligible company/firm should possess all of the following pre-qualification criteria. Responses not meeting the minimum pre-qualification criteria will be rejected and will not be evaluated.

Sr. No.	Pre Qualification Criteria	Supporting Compliance Document
1.	The applicant shall be a firm/company/partnership firm	Copy of certificate of incorporation/Partnership Deed, MOA

	registered as per Indian law and who have their registered offices in India.	must be enclosed, and the key person must be associated from the beginning of the firm.
2.	The applicant has to submit ITR of last two financial years.	Financials need to be certified by CA with registered number and stamp of the firm.
3.	The firm should not be black listed by any Central Govt./ State Govt./ PSU/ Govt bodies.	Self attested copy to be enclosed.
4.	Company should have PAN/TAN No/GST registration certificate	Copy of certificate to be enclosed
5.	The company must have completed projects of similar nature in last 5 years	Certificates/Endorsements from the concerned institutes.

Instructions to the Companies/Firms: -

1. Company/firm are advised to study all the instructions/ forms/ terms / requirements and other information as per **Annexure 'A'** carefully. Submission of the EOI shall be deemed to have been done after careful study and examination of the EOI documents with full understanding of its implications.
2. The responses to this EOI should be full and complete in all respects.
3. The company/firm is responsible for all costs incurred in connection with participation in this process.
4. Chandigarh Police will hold a discussion meeting with the prospective company/firm on 24-08-22 at Chandigarh Police Headquarters, Additional Deluxe Building, Sector 9 D, Chandigarh. Further, as per requirement, the company/firm may make a presentation on the proposal to the department.
5. At any time prior to the last date of receipt of EOI, Chandigarh Police may, for any reason, whether at its own initiatives or in response to a clarification requested by a prospective company/firm, modify the EOI document by a corrigendum.
6. Chandigarh Police may terminate the EOI process at any time and without assigning any reason. Chandigarh Police makes no commitments, expression or implied that this process will result in a business transaction with anyone.
7. The interested firms are required to submit soft copies of their EOI documents and supported documents as per Expression of Interest (EOI) electronically at e-mail pcr-chd@nic.in, pdspcomn-chd@nic.in upto 20/8/22 Any proposal received by the Chandigarh Police after the above deadline shall be rejected.
8. No further correspondence on the subject will be entertained.

Note: - All the suggestions are not chargeable.

Disclaimer: *This EOI is not an offer by the Department or a tender document but it is an invitation to receive suggestions from interested parties. The purpose of this EOI document is to apply best ideas/suggestions/information that may be useful to Chandigarh Police in formulating the proposals of Digital wireless communication system.*

MEMBER

Signature_____
DSP/Comn.

MEMBER

Signature_____
DSP/PWLC

MEMBER

Signature_____
SO/Accounts

MEMBER

Signature_____
AC (F & A)

MEMBER

Signature_____
DC (F & A)
Nomine of finance depdt. for purchase proposal of Chandigarh Police

MEMBER

Signature_____
Technical/Member
Department of E&ECE, PEC

MEMBER

Signature_____
SSP/HQRs

MEMBER

Signature_____
DIGP/UT

CHAIRMAN

Signature_____
IGP/UT

Annexure –A

Schedule of Requirement

OPEN STANDARD DIGITAL TRUNKING RADIO SYSTEM

Typical system configuration to meet technical specification and requirements is indicated below. The bidder may propose better system configurations if any, for full functioning, successful and trouble free installation, commissioning, operation and maintenance of the system supported by all necessary hardware, licensed software and documents along with the technical bid.

A. System Equipments:

Sr. No.	Requirement	Qty.
1.	Main Control Room Equipments (Master Site): a. Digital Open Standard Radio Trunking System Control and Switching Equipment (TSCSE) IP Based with complete hot standby. b. Network Management System comprising of Network Management Server (NMS) and Network management Terminals (NMT) with two clients c. AES 256 encrypted Dispatch Consoles collocated at Central Police Control Room d. AES 256 encrypted Dispatch Consoles collocated at New PHQ for Safe City e. 90 Channels IP based Digital Voice Logger System f. Hardware and Software for AVLS/APLS Server and Client g. 50" or better LED Monitor of reputed make for AVLS/APLS h. Telephone interconnect Gateway with E1 over QSIG/SIP over IP based i. Unified Threat management (UTM) for connecting CPCR with Mirror site.	01 Lot 01 Lot 18 05 01 01 Lot 02 01 01 Lot
2.	Repeater/ Base Station Equipments: Sufficient number of Repeater Stations in **400 MHz** with required configurations Redundant Repeater Site Controller, Masts/ Towers of required height, Antenna System, Transmitter Combiner, Receiver Multicoupler, Tower Top Amplifier, Couplers, Cables, Surge, Interfaces and lightning protection system, accessories etc.	Bidder to specify
3.	Antenna Masts/ Towers as per specifications	Bidder to specify
4.	Redundant 7/13/15 GHz Microwave links to connect all repeater stations to master site with necessary tower and accessories.	Bidder to specify
5.	Full Alphanumeric keypad Static Radio with GPS, AES 256 encryption and accessories as per Technical Specifications.	175
6.	Full Alphanumeric keypad Mobile Radio with GPS, AES 256 encryption and accessories as per Technical Specifications.	275

7.	Full Alphanumeric keypad Portable Radio with GPS, AES 256 encryption, belt clip, Li-ion or better battery, Single unit battery charger and accessories as per Technical Specifications. a. 06 Way or better Position rapid Multi Unit chargers b. Spare Li-ion 2100 mAh or better batteries c. Light weight Speaker Microphone, earphone with clip, complete hand free kit for each Hand Held Radio d. Suitable carrying case e. Headset for portables f. Vehicular Charger for portable radios	1800 50 3600 1800 1800 1000 1500
8.	Digital Vehicular Repeater System (For Coverage Enhancement) with all accessories.	02
9.	Programming kits: a. Repeater / Base Station Equipments b. Static Radios c. Mobile Radios d. Portable Radios e. Inter Site Link Test Equipments f. Portable programming laptop for repeaters and Master switch	 03 03 03 05 02 05
10.	Latest AES with minimum 256 bits encryption infrastructure and Key Management System: a. Hardware and software for OTAR with two clients b. Hardware and Software for OTAP with two clients c. Key loader with interface cables	 01 lot 01 lot 02
11.	Commensurate capacity 1+1 redundant online UPS's for all offered equipments with phase changeover switch for UPS and direct mains with maintenance free battery bank for 8 hours backup for: a. For all Repeater sites b. Central Police Control Room.	 Bidder to specify 01 Lot
12.	Test Equipments/ Tools: a. Radio Communication Test Set for Trunked radio system. b. Through Line Power meter c. Any other item required for field testing	 01 05 01 lot
13.	Temperature Maintenance System: a. Sufficient numbers of Environment Control System at all Repeater sites with automatic change over every 6 hours. b. Sufficient numbers of Environment Control System at switching centre with automatic change over every 6 hours.	 Bidder to specify 01 Lot
14.	Miscellaneous: a. Earthing equipment b. Transient protection equipment	 01 lot 01 lot
15.	Manuals of System components, TSCSE, repeater radios, static/mobile radios, portable radios, Digital Voice Logger, antenna system, inter site link equipments etc.: a. Operating Manuals b. Service / maintenance Manuals c. Programming Manuals	 20 05 05

16.	Any other hardware/software/system equipment required to meet the technical specifications and requirements of the tender	Bidder to specify

16) **Services:**

Sl. No.	Requirement	Qty.
1.	Project Management, Installation, Commissioning, Programming, Acceptance testing	01 lot
2.	Master and Repeater site preparation alongwith cable tray inside the room, power cabling, earthing, surge protectors and any other necessary civil/electrical component required for infrastructure etc.	01 lot
3.	Three years on site comprehensive warranty for all equipment's (except batteries)	01 lot
4.	Seven years CAMC after warranty period of 03 years	01 lot
5.	Training: a. Repair/ Maintenance Training at the manufacturer premises b. Repair/ Maintenance Training at the premises of Purchaser c. User Operational Training at the user's location	 01 lot 01 lot 01 lot
6.	Civil/Electrical work at each Repeater Sites based on the network design and assessment of the bidder	01 lot
7.	Charges of Repeater sites Rental charges (for sites other than Chandigarh Police establishments), Electricity charges and technical manpower charges.	01 Lot

Note:

1. The bidder shall also submit the **scanned copy of** Bill of Material as per requirement clearly giving the country manufacture, nomenclature, make, model no. & quantities of all the items to be supplied for Open standard Digital Radio Trunking System.
2. The Project shall be completed on turnkey basis and any other item/ hardware/ software/ service required for successful completion of the project shall be provided by the finally selected bidder within the quoted prices.
3. The successful bidder shall not use any existing equipment/infrastructure and new equipment would have to be used for DTRS.

TECHNICAL SPECIFICATIONS AND REQUIREMENTS OF
OPEN STANDARD DIGITAL TRUNKING RADIO SYSTEM
FOR CHANDIGARH POLICE

The **Scope of Work** shall include design, supply, delivery at site, unloading, any other services associated with the delivery of equipment and materials, installation, commissioning, integration, software optimization, providing warranty/ post warranty services for the entire latest Open Standard Digital Trunking Radio System and any other related accessories/services for the complete setting up of the proposed system and all type of radios (Static/Mobile/Hand Held) as per the Schedule of Requirements and Technical Specifications. The successful bidder shall assume full responsibility of the complete System for its entire life cycle (10 years). The related licenses for import of System and wireless sets shall be the responsibility of the bidder from all government organizations. However Chandigarh Police will provide support for completing all relevant formalities for obtaining licenses.

S.No.	Description
1	SYSTEM OVERVIEW:
1.1	Introduction : Chandigarh Police intends to install **Open standard Digital Trunking Radio System, in 400 MHz Frequency Band**, fully ready for Wide Area Multiple site Operations for all over Chandigarh coverage. a. System infrastructure and control room site equipments should be IP based. b. Flexibility: The system must have flexibility for future up gradation as the system is expected to serve the communication requirement of Chandigarh Police for at least next 10 years.
1.2	Dispatch Center Sites: Dispatch Site at CPCR, Chandigarh Mirror Site
1.3	i) **Multi Channel Operation**: The system should be equipped to support multi channel operation for meeting current traffic requirements and should be expandable by 100% in future. The bidder should specify the number of sites required and adequate number of channels required at each site to meet the required grade of service from the proposed system. ii) The number of frequency spots required for meeting 4000 radios operation as per traffic norms should be projected as per **Appendix – 1** from day-one with DQ-4 quality. The number of repeaters should also be factored from day-one. **Tentative Procurement Plan of radios: -** **a) At initial Implementation – 2250 nos. Radios (Current requirement)** **(b) Radios -1750 nos. to be added over a period of next 5 years** iii) The System should provide report of traffic as per **Appendix-1** on full load. In case any area is not provided require traffic norms with free from congestion at DQ-4 quality, the bidder shall be responsible to install additional infrastructure in quoted cost by the bidder at no cost to the user.
1.4	Modular Expansion : The system must have the capability of modular expansion in channels by adding extra repeaters only (upto the maximum capacity) at each site.

1.5	Efficient Channel Utilization: The system shall not unnecessarily tie up multiple channels at multiple sites, for all call types, for the same user. The system must be efficient in order to minimize the number of channels used in any given conversational scenario. The bidder shall describe how the channel can be efficiently allocated.
1.6	System Reliability: Purchaser is very concerned about the reliability of such an expensive system. This Open Standard Digital Trunking Radio (400 MHz) System will be used all over Chandigarh. The Bidder must substantiate technically that their proposed system is very reliable or has adequate reliability mechanisms included in its architecture / design portfolio. No degradation in the system trunking features is permissible in case of failure of a controller. All field replaceable units must be hot swappable.
1.7	Roaming: Subscriber radio should be capable of accessing any and all sites within the system for ease of roaming.
1.8	Number of Talkgroups :
	a. A Talkgroup is defined as group of members having the same functions or role and where there is a need to communicate to each other. The system should support at least 250 Talkgroups, with the capability to expand. The bidder should specify the maximum number of talkgroups the proposed system can support.
	b. It should be possible to give different priority to different talk groups system.
	c. Any subscriber radio can be programmed to be a member of any talkgroup either at initial implementation or at any time in the future. Bidders should describe how this process would take place and what would be the restrictions when a subscriber radio is added in a talkgroup.
	d. All subscriber radios should be capable of being assigned with talkgroups address designators. All subscriber radios operating with the same talkgroup must receive both sides of every conversation addressed to or from the talkgroup.
1.9	Number of Unique Individual Radio ID :
	a. The signaling language will permit the system to assign not less than 4500 unique individual radio IDs (Identification), with the capability to expand to 10000. The bidder should specify the maximum number of unique individual radio IDs the proposed system can support.
	b. All radios must have the capability of being a member of any or all talkgroups. Regardless of the talkgroup affiliation, the radio ID for subscriber radio should not change. Each subscriber radio must have its unique individual radio ID, independent of talkgroup and/or telephones interconnect capability.
1.10	Up gradation / Updation: The system and subscriber radio features and facilities should preferably be software upgradable. (check for free upgrade clause).
1.11	The equipments / items of the proposed system should meet all EMI/EMC standards wherever applicable.

1.12	Interoperability: The entire system shall be IP based such that future expansion of sites is possible. Other Manufacturer's Radio terminals of Open standard Digital Radio Trunking System should operate on the system with standard trunking features. Bidder shall submit test report/certificate from Association of the proposed technology/ILAC/NABL accredited Government Lab for the proposed subscriber radios and repeater in compliance to interoperability requirement. The bidder shall demonstrate the interoperability with sample sets of minimum 02 other vendors.
1.13	The proposed trunked radio system shall comply with the ITU recommended Digital Radio Trunking Standards, at the time of the proposal submission.
1.14	Frequency Planning:
	a. The bidder shall perform radio frequency planning ensuring efficient use of the available frequency pairs. The frequency plan including calculations shall be submitted to Chandigarh Police for review, as part of the Design stage.
	b. The successful bidder shall perform radio frequency planning for microwave link in ring topology as per NFAP ensuring efficient use of spectrum. The frequency plan including calculations shall be submitted to Chandigarh Police for review, as part of the Design stage.
	c. The successful bidder shall enclose detailed calculations as part of the Design stage, to establish that there will be no interference/ illegal carrier from other radio communication links operating in this area in the same band of frequencies.
	d. The use of radio frequency spectrum in India is regulated by the Wireless Planning and Coordination (WPC) Wing of the Ministry of Communications, Government of India. Frequency clearance for the use of specific frequencies is to be obtained. Based on the frequency plan proposed by the successful bidder, approval from WPC shall be obtained. The bidder, if so required by the WPC, shall incorporate specific changes in the frequency plan, after mutual discussions.
	e. Bidder shall specify number of frequency pair required for signal coverage and inter-site connectivity through secure microwave spectrum for complete Chandigarh.
2	SYSTEM FEATURES :
2.1	Signaling Channel Concept :
	a. This Open Standard Digital Radio Trunking System should operate using the dedicated signaling control channel protocol concepts with high speed data of 7.2 Kbps or better.
	b. Sufficient redundancy with auto switch over should be provided for control channel at each site. Bidder should explain the signaling scheme in detail.
2.2	Priority Levels:
	a. The proposed system should allow a dispatch console operator to preempt or over-ride a particular subscriber radio into a selective call, group call to pass important conversation.
	b. A minimum of 4 levels of priority should be incorporated in the system to ensure timely processing of calls, including group call, individual calls as

	well as telephone calls. The levels of priority are classified as follows.
	c. Emergency Priority – This should be highest level of priority upon activation of the emergency button, the next available voice channel should be immediately assigned regardless of system loading.
	d. Operation Priority – This should be minimum 3 levels of priorities, to be assigned according to the requirements of the users.
2.3	Automatic Retry: In an adverse signaling condition, when a subscriber radio's request for voice channel, is not properly received by the system on the first try, the subscriber radio should automatically send the request again, until the request is acknowledged or the maximum allowed number of retries is reached. The bidder should specify the maximum number of retries for the system.
2.4	Out of Contact Indication:
	a. Whenever a subscriber radio leaves the coverage of the signaling channel, and attempts to access the system (via PTT), an audible alert should be sounded. These alerts should have distinct tones other than any other audible tones generated by the subscriber radio. This will enable the end user to determine that the radio unit is out of contact with the system.
	b. Dispatch console should be alerted by visual or audio indication if called radio is out of range/ contact.
	c. In addition to audible alert, a visual indication of this condition is preferred to be displayed on the operator console / System management terminal.
2.5	Queuing of Request for Voice channel: If the system becomes fully loaded (all available RF voice channels are assigned) the second and lower precedence level requests for a voice channel will be placed in a queue. The queue will cause the system to assign voice channels (as they become available). According to the priority levels bidders should specify the length of queue.
2.6	System Busy Tone : When the system is fully loaded and the subscriber radio requests for a voice channel by pressing the PTT, a distinct system busy tone should sound on the radio, as long as the PTT button is pressed/any other tone to differentiate from access tone shall be accepted.
2.7	Busy queuing call-back:
	a. The system should provide a call-back feature when any subscriber radio is placed into a system busy queue.
	b. The system will cause the subscriber radio to emit an audible alert, specific for call back, and the subscriber radio should access the assigned channel.
2.8	Continuous talk-group Affiliation Notification: The system should broadcast continuous updates of the channel assignments of talkgroups to all subscriber radios enabling the late entrant radios to automatically join conversation in progress.
2.9	Message / transmission type of Talkgroup : The different user groups supported on this system will have different call characteristics, and hence may be supported more efficiently by being message trunked (a certain post transmission access time exists) or by being transmission trunked (the post transmission access time is zero). It should be possible to select message trunked or transmission trunked via the system manager terminal. The repeater hang time should be programmable. The bidder should specify this operation.

2.10	Individual Subscriber Radio Disable:
	a. The system must allow the system manager terminal to disable over the air any subscriber radio(s) currently operational on the system. The system manager terminal must indicate when it succeeds in disabling the subscribe radio. A disabled subscriber radio must not be able to transmit/receive nor otherwise join into any voice conversation on the system.
	b. If for any reason the trunked system is shutdown or disabled, any disabled subscriber radios must remain disabled.
	c. A disabled subscriber radio can only be re-enabled by the system manager terminal. Once this is accomplished, an indication will be sent to the system manager terminal.
	d. To preserve system throughput, the operation of enabling and disabling radios be done through the control channel.
	e. Bidder should describe the above process in detail.
2.11	Multiple Voice Channel:
	a. RF Voice Channels should be assigned as needed and no user should be dependent on any given voice channel for communications, the failure of any one RF voice channel will not be apparent to the user.
	b. In the event of a RF voice channel failure, the controller should not assign that particular repeater and will simply continue assigning the remaining voice channels.
2.12	Transmitter Low Power Shutdown:
	a. In addition to the receiver interference condition, the site controller should detect a loss or decrease in repeater transmitter output power. If the output power of the transmitter falls below a certain threshold level, the site controller should not assign that channel.
	b. This threshold should be set such that a channel will automatically be taken out of service when its output power drops to a level where communications become degraded.
2.13	Site Trunking: It is imperative that the failure of a site link will result in that site going into site trunking mode and work independently from the rest of the sites in the system. Site trunking mode should still provide limited trunking features just like any single site trunking system. Bidder to specify the features that will be available in single site operation.
2.14	System Fallback Mode: Central control / multisite control system shall have minimum two level of fall back mode.
2.15	System should support Over the air programming (OTAP) and Over the air rekeying (OTAR) for subscriber radios.
2.16	Encryption: AES encryption and key management system should be latest with minimum 256 bits. Contractor shall deploy Key Management Centre and ensure that Over The Air key management is deployed for updating keys in radio units in a secure manner. Bidders must include key management tools that support OTAR delivery of crypto keys either via direct connection to the network or via a wireless connection. Key Management Centre at CPCR and Mirror site shall be provided with license to support terminals from other manufacturers. It shall be possible to Stun/Kill the compromised terminals. OEM certification to be provided.
2.17	Digital voice and Encrypted Digital Voice transmission: The proposed system

	should be capable of supporting Digital voice and data. The proposed system should also support Encrypted Digital voice call with the following features.
	a. Radios equipped with secure capability can have the option to communicate in either the encrypted or clear mode.
	b. End-to-end encrypted radio communication between two or more radios must be ensured without compromising on voice quality. This means that for a call involving two or more repeater sites, the voice signal remains in encrypted forms both over the air as well as through the link (microwave or optic fiber or wire line) connecting the sites.
	c. Monitoring of all call, both non-encrypted and encrypted from a dispatch console.
	d. Transmitting to the subscriber radio from a dispatch console in either non-encrypted or encrypted mode.
	e. AES 256 Bit type-3 certified encryptor module must be built-in into the radios.
3	SITE ASSIGNMENT:
3.1	Received Signal Strength Measurement: Roaming subscriber radios operating in the system should be equipped with the capability to monitor signal strengths of the adjacent repeater sites. This allows the subscriber radios to automatically select the site with the best signal, instead of re-affiliating with the next available site when the audio quality at the current site becomes unacceptable. Rest of subscriber radios should be able to operate only in the pre-specified site.
3.2	System Database Updating:
	a. When a radio user enters a site and changes the talkgroup selector on his radio or switches on the radio, the radio should automatically transmits its unique ID and its talkgroup affiliation to the system controller. Upon the receipt of such a information from the subscriber radio, the system controller should determine the site affiliation of the radios, and update its database with all these new information pertaining to the radio. The whole process should be automatic.
	b. To allow the system controller to maintain an accurate, up-to-date database on the location of each subscriber radio, the system must also be able to determine if a radio is out of range, switched off or re-affiliated with another site. Thus, calls should not be assigned to users who are not active on the system.
3.3	Dynamic Site Assignment:
	a. Where members of a talkgroup are not present at a site, that site should not be activated for a conversation involving the said talkgroup. This should ensure that valuable channel resources are not tide-up unnecessarily, and is a critical requirement in this wide area system.
	b. The System Controller should be programmable via the system manager terminal with information which will designate subscriber radio as either wide area users or single site users. Programming by individual radio for site assignment is unacceptable in this system because of the multiple numbers of sites and the expected large number of users.
3.4	System Handover: As a subscriber radio moves out of a site into another site in the wide area system the radio should automatically affiliate on to the new site. The call in progress must follow the user to the new site. The process must minimize the potential audio loss for soft handover. The Bidder should explain

	how a system handover process works on his system.
3.5	Subscriber should get traffic channel allotted within 300 msec. for single site operation and for multisite operation. The system should be capable of providing channel allocation within 300 msec. for 99% of all subscriber requests. For 1% subscriber requests the channel allocation shall be with-in 01 second. Bidder to specify channel allocation time.
4	CALL TYPES:
4.1	**Selective Call:** The trunked system should permit any properly equipped subscriber radios to selectively call another radio, regardless of their talkgroup affiliations or locations within the wide area system. Without involving other subscriber radio users in the system, this should provide privacy to the parties involved in the private conversation. The two radios communicating in the selective call mode should be capable of displaying the other radio ID on the radio display. The system should support simultaneous selective call for at least 0.3% of total number of subscribers at any instant of time irrespective of subscriber location.
4.2	**Group Call:** The system should allow subscriber radios to be grouped into talkgroups/sub-groups. Under normal operation, group members will communicate with the dispatch console operator as well as with other members in the same talkgroup. The subscriber radio user should be able to talk to other talkgroups that are preprogrammed on the radio by manual selection on the radio. The proposed subscriber radios should receive and display the ID of the transmitting radio. The system should support simultaneous group call for at least 10 Talk Groups from Day one plus another 20 Talk Groups in ratio of procurement plan of radios suggested at any instant of time irrespective of subscriber location
4.3	**Collective Call:**
	a. It should be possible to group any combination of talkgroup into a higher level group for purposes of multi talkgroup/collective calling.
	b. Collective calls can be configured to interrupt group calls or wait until all group traffic has ceased before being processed.
	c. Subscriber radios should respond to a collective call without requiring the subscriber radio users to change the talkgroup affiliation. Each collective call should require only one RF voice channel to conserve frequency resources.
4.4	Emergency Call: The proposed system should immediately allocate a voice channel on priority to the authorized radio subscriber even when all the channels are busy, by pressing a single button on the subscribers' radio. The emergency channel assigned will remain with the radio subscriber for a preset period of time.
4.5	Telephone Interconnect Call:
	a. The bidder should describe the operation of telephone communication in detail and limitations if any.
	b. Telephone communication IP PABX (SIP over IP)/ E1 over QSIG in case of Mobile /Static/ Hand-held radio to Landline and vice-versa must be supported by the system.
5	COVERAGE AND FIELD TEST:
	a. The proposed system must provide radio coverage throughout the Jurisdiction of Chandigarh for Hand Held radios as well as mobile radios with sufficient sites to meet traffic requirements as attached at **Appendix-1.**

b. The proposed system must provide penetration in building above ground level throughout Chandigarh.
c. The Bidder to ensure proper ensure proper signal level inside vital buildings/locations (List can be provided on bidder's request) by installing suitable in-building solutions.
d. The prospective bidders to submit portable inbound/ outbound RF coverage calculations and coverage plots of Chandigarh considering suitable number of repeater sites with minimum -85dbm signal strength on road and -95dbm inside the building(single wall coverage 30% of the room should be exposed to outside space) to confirm that the required RF coverage stated above can be achieved.
e. The RF coverage should provide a minimum Delivered Audio Quality (DAQ) – 4 or above audio signal for both outbound (talkout) and inbound (talkback) communications with 95% reliability from a location (to be tested at different time periods). Primary requirement is to achieve DAQ-4 or above but in case of difference of opinions then signal strength -85dbm on road and -95dbm inside the building will be considered for RF coverage. The DAQ shall be defined as follows:

DAQ	Definition
1	Unusable speech present but not understandable.
2	Speech understandable with considerable effort. Requires frequent repetition due to noise or distortion.
3	Speech understandable with slight effort. Requires occasional repetition due to noise or distortion.
3.5	Speech understandable without repetition. Some noise or distortion present.
4	Speech easily understandable. Little noise or distortion.
4.5	Speech easily understandable. Rare noise or distortion.
5	Perfect. No distortion or noise discernible.

f. The audio quality shall be tested by the joint team of bidder and Chandigarh Police at different places in Chandigarh city. DAQ-4 or above audio signal for both outbound and inbound should be ensured by the I bidder.
g. The signal/audio quality to be tested inside the building (25%), outside on the fringe area of the coverage (50%), vital locations (25%) etc.
h. Field test shall be carried out after completion of each site installation in order to estimate coverage and DAQ levels in different locations.
i. After full completion of all sites installations for checking of handing over, interference, compatibility with existing network and other features.
j. After completion of microwave networking in order to estimate the required data throughput of 2 Mbps from each base station to the control Centre irrespective of the number of hops in between, automatic change over in case of cutoff of a link.
k. The signal strength in various locations in Chandigarh city shall be measured while testing audio quality. The equipment for measuring the signal strength shall be provided by the bidder for testing.
l. The test equipment to be calibrated by government approved lab.

6	MAIN SYSTEM EQUIPMENTS:
	Introduction: The backbone system should consist of one main control site and suitable number of repeater sites to provide reliable, secure digital voice and data communication among the main police control room, districts/ unit control rooms, static/ mobiles and portable radios throughout Chandigarh. The repeater sites should be linked to the main control site through appropriate microwave link and should also have a provision to interface with I.P based WAN/LAN of Chandigarh Police as stand-by to the microwave link.
6.1	Main Control Room Equipments (Master Site): Open Standard Digital Radio Trunking System Control and Switching Equipment (TSCSE) IP Based:
	a. The TSCSE will be installed at main control room site. It will perform automatic multisite signaling and control functions for wide area call. It must support minimum 3000 subscriber radios and scalable to 5000 subscriber radios and minimum 25 talk groups without any additional cost of hardware and software. The TSCSE should support encrypted and clear digital voice calls, data call etc. There should be provision for dispatch console connectivity, voice logger, telephone interconnect, text messaging, packet data service, Over the Air Programming (OTAP), Over the Air Re-keying (OTAR), Network/ System manager terminal, Encryption Key Loader, intersite link data etc.
	b. There shall be two clients for OTAR and OTAP facility, one at CPCR, PHQ and other at Mirror site.
	c. The TSCSE should have control over the RF channel assignment of the system. It should identify an available RF channel at each site before directing the concern subscriber radio or group of radios to the available voice channel.
	d. Open Standard Digital Radio Trunking System Control and Switching Equipment (TSCSE) IP Based with hot standby controller either centralized or distributed with complete set-up as standby system to avoid single point of failure.
	e. Any failure in the main TSCSE will be detected and all functions should be taken over by hot stand-by TSCSE automatically without losing any information or data.
6.1.1	Features of TSCSE :
	a. IP based centralized or distributed Redundant Switching / Routing Equipment b. Operational voltage: 230 V AC/ - 48V DC c. Management terminal PC with 21" LED monitor or better d. Expandability- Modular e. Lightening protection in power source as well as communication path f. Licensed copy of all system and application software's g. Sufficient communication ports for Switching / Routing Equipment for inter site link configuration h. Bidder should specify capacity of Switch support for: i. Maximum number of Repeater / Base sites. ii. Maximum number for RF / Communication channels iii. Maximum number of Radio terminals iv. Maximum number for Dispatch Consoles v. Maximum number for PABX / PSTN connections vi. Maximum Talk Group vii. Maximum Logical radio ID

	i. Capability to support Data applications. j. Status SDS, Text Messaging facility min. 100 character
6.2	Network Management System: The Network Management System should consist of latest server PC with minimum 21" LED monitor and all necessary software's. It should perform administrative work, configuration management, accounting management, performance management, security management and fault management of the system. The System manager terminals should have the capability to access the function and features of the Open Standard Digital Trunking System. There shall be two Network management terminals one at PHQ and other at Mirror Site.
6.2.1	General
	a. Administration and maintenance activities remotely on the sub-systems.
	b. System support for number of NMTs.
	c. The NMT should provide map of the equipments such as switch controllers, radio base stations, switches and servers / workstations in radio system with status and alarm indication.
	d. The NMT should provide user-friendly GUI to the NMS administrator and operators with pull-down menu, function keys, online help screens, windows, color pictures and statistical graphs for easy operation and interpretation of information.
	e. The NMT/NMS shall provide report module in GUI form for full traffic utilization per site of the network.
	f. The NMT/NMS shall provide customized reports of total sites, system performance and system logs.
	g. Provision for monthly system backup and restoration facility from backup.
	h. The network management system shall be compatible with all proposed system equipment.
6.2.2	Fault Management: The fault management feature should have the capability to monitor and display the status and status history of system components and when needed perform diagnostics. In case of link failure, the alarms shall synchronize automatically after a link restoration assuring that system managers always have complete and accurate history of events.
6.2.3	Configuration Management
	a. Subscriber Management for i. Radios ii. Talk group / Multi-Group iii. Status / Message Management
	b. Infrastructure Management i. Switch Controller Management ii. Radio Base Station Management
	c. System Software Management
6.2.4	Accounting Management: The accounting management feature should have the capability of tracking the activity of radio users on the system and allow the customer to produce reports about the air-traffic on the system.
6.2.5	Performance Management: The performance management feature should have the capability to monitor, control and optimize the utilization of system resources.
6.2.6	Security Management
	a. System should support multiple number of network management user accounts.

	b. Access rights to the various network management applications.
	c. Multiple levels of access rights to users for performing tasks with these applications.
	d. The security management feature should have the capability of allowing the establishment of authorized log-on names and passwords to the NMS.
6.2.7	Maintenance of NMS
	a. Necessary licensed OS, Application and Recovery software to maintain NMS server and terminals.
	b. Database backup facility.
6.3	Dispatch Consoles: The central police control room should be equipped with dispatch console equipments capable of having communication with the subscriber radios under their respective jurisdictions and control/coordinate their activities. The dispatch console control electronics should comprise of distributed independent multi processors. Each console should be capable of independent operation. The console equipment should be provided with all necessary control to access the Digital Radio trunking system. The audio routing and interconnection in the console should be based on digital voice switching technology providing virtually no cross talk, even in multiple patching conditions and high immunity to radio frequency fields. It should be equipped with the following minimum features:
	a. Licensed copy of all system and application software.
	b. Dispatch console should be able to control the following: i. Individual calls (Digital & Encrypted AES 256 bits) ii. Group calls (Digital & Encrypted AES 256 bits) iii. Data services iv. Patched-group calls v. Status, SDS and Text messaging minimum 100 characters. vi. Group membership management
	c. Radio enable/disable facility through dispatch console/NMT /SMT/NMS/SMS.
	d. The Dispatch console with latest professional Computer (PC) with 19" LED Monitor or better.
	e. The Dispatch console with Graphical User Interface (GUI) and follows Windows/Linux design standards such as: pull-down menus, drag and drop capability, visual icons, on-line help, graphical toolbar and re-sizing capabilities.
	f. The GUI should be mouse driven.
	g. Group/Individual calls should initiate by selecting a talk-group/individual from the graphical display.
	h. The Dispatch console should show call history.
	i. Dispatch console should control the Dynamic talk group.
	j. A Goose neck micro phone as an input device for voice communication.
	k. A foot switches for PTT activation using the foot.
	l. A reputed make headset with all dispatcher consoles and external speakers.
6.4	Digital Voice Logger System (DVLS) IP based: - The system shall provide audio recording of all channels. This system must be able to reconstruct the total scenario of radio communication and Data between the wireless dispatcher and the PCR van related to an incident. System must provide scenario replay in a simple way to reduce such time dramatically. Replay of the scenario should be

	possible based on radio I.D. / talk group I.D., Alias, etc as well as date / Time criteria. The system should have the capability to store and retrieve the selected audio calls to an archived media such as DVD/Pen drive etc. Primary storage media should have the capability to store the audio calls for at least 1 year. User must have an account name and password and the administrator must define who has the access to what in the system. User may log in to the recorder and may only have access to his own calls. It should be capable of recording 25 channels simultaneously. The proposed DVLS should be integrated with ERSS-112 DVLS so as to provide complete scenario replay. The API details shall be provided for integration.
6.5	Automatic Vehicle/Person Location System (AVLS/APLS):
	a. An automatic Vehicle/Person Location System (AVLS/APLS) working on the Network Radios, for monitoring and management of designated radios on 50" LED monitor, shall be provided.
	b. The AVLS/APLS Server and Client shall be a standalone application subsystem and comprise of hardware, software and network to be located at the Master Site CPCR. This application shall be supported on a separate Dispatcher for AVL/APL, with the Fault Management Controller. The Dispatcher shall show a map of the city. Mobiles & Handhelds which have the GPS feature enabled and are out in the open for the GPS to be activated, shall be tracked on the Dispatcher screen. The Dispatcher screen shall show the coordinates of the location of a user along with the User ID and shall track its movement as it moves. For, providing this feature, a separate AVL/APL Server shall be provided and interfaced to the Radio system. The Server shall have features such as message queues and prioritization so as to avoid network congestion that might be caused by sending automated message for the AVL/APL application, when a large number of user congregate within the area of a single base station.
	c. The person in control shall be able to know the location of vehicles and Personnel (carrying Radio Units with GPS) automatically over a one minute update. The bidder should specify accordingly.
	d. The Radio Units having built-in GPS should support the following: i. GPS activity indicator ii. Current position information iii. Position information sending on request or on triggers (eg: time, distance, Status message) iv. Position sending during emergency calls
	e. The radio shall automatically update its GPS location when one of the following events happens: i. When polled ii. After moving a pre-defined distance iii. After a pre-defined time has lapsed iv. When an emergency call is made v. Bidder shall demonstrate GPS accuracy of ± 10 meters or better
	f. Digital Map: The Base Map shall be provided by Chandigarh Police; however the bidders will be responsible for integration and display of all GPS enabled resources on the Map.
6.6	Unified Threat Management (UTM) for connecting CPCR and Mirror site.
	UTM should be NGFW Type with Rack unit form factor, IPV6 ready from

	A	day 1, Hot Swappable dual power supply, having redundant fan.
	B	Features: Layer 3 – Layer 4, NAT, VPN, Application Visibility and Control (AVC), Next Generation Intrusion Prevention System (IPS)
	c	Protocols: TCP, UDP, HTTP/TCP, TCP/UDP
	d	Packet Size (KB): 64
	e	Throughput with all features enabled Under Test Condition) (Mbps): 9000 or better
	f	Concurrent Session/Concurrent Connection: 8M
	g	New session/Connection per second: 450K
	h	Type of Interface Supported Multiselect:: 10G SFP+
	i	Number of GE Copper interface: 8
	j	Number of 10G SFP+ interface: 2
	k	Number of GE Small Form-Factor Pluggable (SFP) interface: 8
	l	Number of col /WAN Ports: 8
	m	Number of Ipsec VPN Peers supported (Site to Site): 2000
	n	Number of Ipsec VPN Peers supported (Client to Site): 50000
	o	Number of SSL VPN Peers supported (Client to Site): 10000
	p	SSD Storage: Minimum 400 GB
	q	Type of Processor: x86, ASIC
	r	Details of the Firewall Policies for the Firewall provided with the License: Web Security Essentials / URL Filtering,IPS License,Application Visibility License,APT (Advance Persistant Threat) License (Anti Malware Protection , C& C attacks, Geo IP Protection, Zero Day Threat Protection),Gateway Anti virus,Gateway Anti spam
	s	NGIPS Signature supported: 10000
	t	Security Intelligence: IP Domain
7	Repeater Stations: a. The bidder shall estimate and propose number of sites along with numbers of Base radios at each site for complete coverage of subscriber radio operating in Chandigarh to meet traffic requirements as shown in figure attached at **Appendix-1**. The dynamic surge of traffic shall be 15% on central site and 10% at fringe area in addition to normal traffic. b. The prospective bidders may carry out the survey of entire Chandigarh and propose suitable locations and height of masts/towers for installation of the antenna for all over Chandigarh coverage. The repeater site locations may be selected on mutual agreement between Chandigarh Police and bidder to achieve the desired RF coverage. Master site will be provided by Chandigarh Police. The bidder shall select Repeater sites from the list of suggested sites mentioned at **Appendix-2** or any other sites selected mutually.	
7.1	Repeater Site Controller: Site controller should provide the necessary control and signaling functions to interact with the main system controller in dynamic allocation of channels to the requesting subscriber radios. The site controller should differentiate between local and roaming users and allocate the channels accordingly. The site controller should support all types of calls. Site controller should have redundancy and redundant site controller should automatically take over if working controller gets failed. All database updating should take place in working and redundant site controller.	

7.2	Repeater System: The repeater should be of Open Standard Digital Radio Trunking (400 MHz) and capable of handling digital radios in the network.
	a. The repeater sites should be linked to the control and switching equipment installed at the main control site through appropriate microwave link and provision should be made for standby link through I.P based WAN/LAN of Chandigarh Police.
	b. The repeater station should be designed for continuous unattended 24 hours of operation. Loss of one RF channel must not affect the operation of the other channels.
	c. Every repeater module/ base radio must have an independent power supply such that PSU failure shall not affect more than one repeater.
	d. The repeater station should be capable of monitoring the integrity of its equipments. Automatic alarm reporting to the system manager, operator console and diagnostic aids for detecting and isolating problems should be provided.
	e. The controller should shut down the respective repeater channel when it detects a carrier on a channel that has not been assigned to members of the system. The controller will not assign that repeater channel until the unwanted carrier is moved. As soon as the unwanted carrier disappears the system controller should automatically put back the repeater channel in operation.
	f. The repeater should be housed in the free standing in-door cabinets. Every repeater cabinet should come with a surge protection. Diagnostic indicator / meter should be provided at site for maintenance and repair work.
	g. Repeater hang time: The bidder should describe in detail the use of repeater hang time in operation of their proposed system. The description should focus on how the proposed system will maximize the efficient use of the trunking channels and what flexibility the user has in changing hang time.
	h. In case of failure of site controller other repeater/site controller should take over as site controller.
	i. Whenever new control channel is assigned as a control channel, field radios should acquire that as control channel automatically. Repeater should meet or exceed the following specifications.
7.2.1	General:
	a. AC Supply Voltage: 220 V AC, 50 Hz ±10%
	b. DC Supply Voltage: Bidder to mention the operating DC voltage
	c. Temperature Range: -10^{0}C to + 60^0 C
	d. Channel Spacing: 12.5/25 KHz
7.2.2	Transmitter:
	a. Frequency: 400-470 MHz
	b. Modulation: Bidder to specify.
	c. RF Power Output: Bidder to specify and programmable
	d. Duty Cycle: 100%, 24 x 7 basis
	e. RF Output Impedance: 50 ohms
	f. Frequency Stability: ± 0.5 PPM or better at – 10^{0}C to +60^0 C
	g. Adjacent Channel Power: -60dBc or better
	h. Audio Distortion: < 3% at 1 KHz, at 3 KHz deviation (clear mode)
7.2.3	Receiver:
	a. Frequency Range: 400-470 MHz
	b. Frequency Stability: ± 1 PPM from-30^{0}C to +55^{0}C

	c. Channel Spacing: 12.5/25 KHz
	d. Sensitivity: - 115 dBm or better at 5% BER Static
	e. Frequency Generation: Synthesized
	f. Modulation: Bidder to specify.
	g. Adjacent Channel Selectivity: 65 dB or better
	h. Inter Modulation: 70 dB or better
	i. Spurious and Image: better than 70 dB
	j. RF input impedance: 50 ohms
	k. Audio Distortion: <3% at 1 KHz
7.3	Repeater Stations Tower/Mast:
	a. Required number of tower/mast of suitable height and weight for installation of antenna system at all repeater sites will be the responsibility of bidder. b. The height of the towers should be selected in such a way that it provides RF coverage all over Chandigarh for smooth communication. c. The prospective bidders shall mention the height of the towers/ masts considered while designing the network for all over Chandigarh coverage. d. All towers, nuts & bolts etc shall comply with the requirements of Indian Standard (IS). In case of any conflict between the two standards, the Indian Standards shall prevail. e. The towers shall be self-supporting galvanised steel structure. f. Type of tower: Appropriate height monopole/three/four legged light weight Tower (Antenna mount Platform, cable Tray, Safety climbing Ladder, etc) Hot Dip Galvanized roof top tower with tower load as per tender requirement. IS: 8500 – Structure micro alloyed (ordinary and high strength quality), IS: 2062 – Structured steel (fusion welding quality). g. Ladder and platform: From bottom to top of the tower with guard with resting platform at 15m and working platform at 30m etc. h. Lightning Arrester: Advanced protection system (Early Steamer Emission). i. Tower Earth: All legs of the tower shall be separately earthed with 70 Sq mm multistrand copper wire. Earthing shall be provided with suitable earth enhancing compound. j. The towers shall be equipped with Aviation Warning Lights in conformity with the relevant requirements of ICAO. All proposed tower facilities shall be marked and lighted as per Indian Aviation Administration rules and requirements. k. Foundation and structural design diagram: The bidder should inspect the building/sites and design the foundation taking into consideration of the building parameters and propose the tower. l. Structural design & foundation design details for towers to be submitted. m. During construction of the Tower foundation, the Contractor shall be responsible for the safety of the site and the structures nearby. The earthing design shall be as per IS 3043 or better standard for radio Towers. n. A means of preventing unauthorized access onto the ladder shall be provided. o. The Tower/ Mast should be able to withstand at least upto 160 km/hour wind speed of the concerned Seismic Zone as currently defined by the Indian Meteorological Department (whichever is higher) while supporting the maximum number of antennae plus four additional antennae required of the same type/size, located at full height. p. The tower loading must take into account the wind load, seismic conditions (Zone IV), antenna loads, all tower accessories and at least 100% safety margin against structural failure for the actual anticipated configuration.

7.4	Repeater Antenna System:
	a. Repeater site will require high gain (bidder to specify) Omni/ directional antenna, for transmit, and receive alongwith minimum 03 diversity in case of directional amplifier. One each spare antenna of Tx and Rx shall be provided by the Bidder at each site in addition to operational antenna. b. The antenna systems should be connected via continuous 1x5/8" LDF (or better) cable for Tx/ Rx with proper connectors and grounding kit to the combiner / receiver multicoupler. Cable installation should be as per standard telecom procedure with minimum signal loss. All antenna systems should be installed with proper lightening protection. Site must have adequate grounding system; reputed make lightening / surge protection devices should be used in the antenna/ power supply systems. c. The antenna and tower should be able to withstand minimum 150 km/hour wind speed. d. The bidder should specify power handling capacity of antenna. e. The bidder should provide specification sheets of the antennas, receiver, multi-couplers, transmitter combiners, and any other equipment necessary to assure a complete system. f. Gain of antenna should be selected in such a way that it provides RF coverage all over Chandigarh for smooth communication. g. The outdoor antenna shall be robust construction utilizing corrosion resistant material. The feeder cable connections shall be weatherproof and fully sealed. h. RF Power Monitoring shall be provided for Tx Antennas. i. Transmitter Combiner: i. The design of the transmitter combiner should be such that it caters to redundancy and maintenance. ii. Combiner should be of auto tune type field tunable. iii. The transmitter combiner should be expandable and should meet the following minimum specifications: A. Channel Separations: 250 KHz or better B. Isolation Tx- Tx: 60 dB or better C. Insertion Loss (5 Channel): 3.6 dB or less D. Operating Temperature: -10 to 60^0C j. Receiver Multicoupler: i. The receiver multicoupler should be expandable type with all unused ports terminated with 50 ohms. ii. The multicoupler to reject out of band RF signals. k. Tower top receiver pre-amplifier of minimum 20 dB gain should be supplied at each repeater site to improve radio coverage.
7.5	Redundant 7/13/15GHz Microwave link to Control Inter Site Link (1+1 Microwave) in frequency band available at the time of application:
	a. All the repeater sites should be connected to TSCSE through Microwave Link. Repeater and control/switching equipment linked by suitable capacity Microwave link in ring topology along with required hardware (e.g. mux/ demux) and having hardware redundancy i.e. 1+1 hot standby configuration. In case of Microwave link failure the system should work in I.P based WAN/LAN of Chandigarh Police.
	b. Frequency Band: 07/13/15 GHz
	c. Power Output: Bidder to specify
	d. Antenna Gain: Bidder to specify
	e. 230 V AC operations.
	f. Interfacing ports: IP / E-1.

	g. Link management terminal with license software
8	GENERAL RADIO FEATURES:
	a. The activation of the transmit control (PTT) should initiate a request for a channel via the signaling channel. The request should include the talkgroup to which the radio set is designated. In the event that the request is not acknowledged by the control channel the unit should automatically attempt re-access until the access is accomplished; or if no RF voice channel is available an indication of busy should be presented at the subscriber radio and automatically retry call (Call prompt) when RF voice channel is available.
	b. The subscriber radios should be multi channel (minimum 100) synthesized type of radio having Dynamic Regrouping Talk groups capability.
	c. The subscriber radios should be able to perform the following tasks: i. Process call request in response to activation of the PTT switch. ii. Encode and transmit inbound service request to system. iii. Automatic switching of RF channel. iv. Generate alarm alert tones.
	d. The subscriber radios should include base stations, mobile/static radios and portable (handheld radios). The radios should include full keypad type. It should support but not limited to following features: i. To initiate a conversation with any subscriber radios operating in the same or multiple site system, on a one to one basis (selective call), regardless of the current group affiliation and locations of both parties. To selectively alert any subscriber radio operating in the same multisite system, regardless of the current talkgroup affiliations and location of both parties. ii. To initiate telephone interconnect call to any landline parties by keying in the land line telephone number via the radio keypad. iii. To initiate short data text messaging for any subscriber radio. iv. Radio should support Digital and AES 256 encrypted voice call. v. Radio should support IP Packets.
	e. All subscriber radios should come with alpha numeric display. Following information should be initiated on the display depending on the radio's mode of operation: i. Min. 12 characters should be displayed regarding called/caller radio ID/ alias. ii. The talkgroup ID/alias during a talkgroup call. iii. Call type with continuous caller ID. iv. Battery level indicator, Tx/ Rx indicator v. Received Signal Strength Indicator (RSSI) vi. Out of contact indicator vii. The numbers of the landline subscriber during a telephone interconnect call by the radio user.
	f. All subscriber radios should be capable of being software programmed (PC Programmable) via radio programming software.
	g. Over the air programming (OTAP) facility should be available to programme the radio remotely.
	h. Radio should support Over the Air Re-keying (OTAR) for encryption management.
	i. Offered radios should be of open standard to operate in other manufacturers Digital Open Standard System with GPS and AES 256 encryption facility.

	j. The user/mobile terminals employed in the network shall be of a type/model certified from Association of the proposed technology/ILAC/NABL accredited Government Lab with respect to ITU standards.
	k. All the specifications will be tested with the help of test equipments provided by the vendor however in case field/lab test of any specification is not possible then OEM certification should be provided to verify the same.
8.1	Open Standard Digital Static Radio:
	All Static Radios should have:
	a. Minimum 6dB gain Static Antenna with installation clamp, surge and lightning protectors, 30 meters standard low loss RF LDF cables, patch cables and standard connectors etc. for static locations.
	b. Full alphanumeric keypad
	c. LCD/TFT/LED display
	d. Microphone with keypad
	e. Night mode for low intensity display
	f. Suitable SMPS Power Supply cum battery charger
	g. 03 Watt or better with internal and external speaker.
	h. 4 meters or above Battery cable with fuse and reverse polarity protection
	i. Static operation mounting brackets, screws, clamps & installation kit
	j. Digital voice and data Operation
	k. Supply Voltage: 12 V DC Nominal
	l. Temperature Range: -10^0C to 60^0 C
	m. Ruggedness: Water & Dust IP-54/IP-56 or better and Vibration resistant MIL standard 810 C,D,E,F&G.
	n. Head phone for hands free operation
	o. Protection for reverse polarity
8.1.1	Transmitter:
	a. Frequency: 400 MHz (400 –470 MHz)
	b. RF Power Output: Bidder to specify and programmable
	c. Channel Spacing: 12.5/25 KHz
	d. Frequency Stability: ± 1.5 PPM or better at -10^0C to 60^0 C
	e. Output Impedance: 50 Ohms
	f. Audio Distortion: < 3% at 1 KHz, at 3 KHz deviation (clear mode)
	g. Modulation: Bidder to specify.
	h. VSWR: Better than 1.5
8.1.2	Receiver:
	a. Frequency: 400 MHz. (400- 470 MHz)
	b. Sensitivity: -112 dBm at 5% BER or better
	c. Frequency Stability: ± 1.5 PPM or better at -10^0C to 60^0C
	d. Channel spacing: 12.5/25 KHz
	e. Adjacent Channel Rejection Selectivity: 60 dB or better
	f. Spurious and Image: better than 70 dB
	g. Audio output: 3 Watt or better
	h. Audio Distortion: Less than 3% at 1 KHz in mode
8.1.3	Other features:
	a. Direct mode operation
	b. Group scanning with priority selection
	c. Status Messaging
	d. Late entry

	e. Remote enable/disable facility
	f. Display with backlight: Alphanumeric
	g. Text Message using keypad (Minimum 100 character)
	h. Terminal to terminal file transfer operation @9.2 kbps data rate or better
	i. Roaming Feature within RF coverage area of the sites.
	j. Auto retry
	k. Port for headset attachment and USB cable alongwith Port for data communication and radio programming.
	l. Audio Visual Alerts (Bidder should Specify)
8.2	Digital Open Standard Mobile Radio:
	All Mobile Radios should have
	a. Minimum 3dB gain mobile RF Antenna and GPS Antenna with installation clamp, 5 meters or above standard RF co-axial cable with standard connectors for PCR vans/ other police vehicles.
	b. Full alphanumeric keypad
	c. Microphone
	d. 03 Watt or better with internal and external speaker.
	e. 4 meters or above Battery cable with fuse and reverse polarity protection
	f. Digital voice and data Operation
	g. Vehicle operation mounting brackets & installation kit.
	h. Supply Voltage: 12 V DC Nominal
	i. Temperature Range: -10^0C to 60^0 C
	j. Ruggedness: Water & Dust IP56 or better and Vibration resistant MIL standard 810 C,D,E,F&G
	k. Protection for reverse polarity and final PA Stage impedance mismatch
8.2.1	Transmitter
	a. Frequency: 400 MHz (400 – 470 MHz)
	b. RF Power Output: Bidder to specify and programmable
	c. Channel Spacing: 12.5/25 KHz
	d. Frequency Stability: ± 1.5 PPM or better at -10^0C to 60^0 C
	e. Modulation: Bidder to specify
	f. VSWR: Better than 1.5
	g. Output Impedance: 50 Ohms
	h. Audio Distortion: < 3% at 1 KHz, at 3 KHz deviation (clear mode)
8.2.2	Receiver:
	a. Frequency: 400 MHz. (400- 470 MHz)
	b. Sensitivity: -112 dBm at 5% BER or better
	c. Frequency Stability: ± 1.5 PPM or better at -10^0C to 60^0C
	d. Channel spacing: 12.5/25 KHz
	e. Adjacent Channel Rejection Selectivity : 60 dB or better
	f. Spurious and Image: better than 70 dB
	g. Audio output: 3 Watt or better
	h. Audio Distortion: Less than 3% at 1 KHz in mode
8.2.3	Other features:
	a. Direct mode operation
	b. Group Call (Digital & Encrypted)
	c. Group scanning with priority selection
	d. Status Messaging
	e. Late entry

	f. Remote enable/disable facility
	g. Display with backlight – Alphanumeric
	h. Text Message using keypad (Minimum 100 character)
	i. Terminal to terminal file transfer operation @9.2 kbps data rate or better
	j. Call history
	k. Roaming Feature within RF coverage area of the sites.
	l. Auto retry
	m. Port for headset attachment and USB cable alongwith Port for data communication and radio programming.
	n. Audio Visual Alerts (Bidder should Specify)
8.3	Digital Open Standard Portable Radio
	All Hand Held Portable Radios should have
	a. Suitable Helical Antenna
	b. LCD or TFT or LED display
	c. Full alphanumeric keypad
	d. Three Li-ion minimum 2000 mAh or better batteries
	e. LED light notification
	f. Rapid single unit battery chargers for 230 Volt AC operations.
	g. Carrying Case / Belt Clip
	h. Temperature Range : -10^0C to 60^0 C
	i. Ruggedness – Water, Dust and Vibration resistant MIL standard 810 C,D,E,F,G
	j. Ingress Protection IP 67/68 (Battery and Radio)
8.3.1	Transmitter:
	a. Frequency: 400 MHz (400 – 470 MHz)
	b. RF Power Output: Bidder to specify and programmable
	c. Channel Spacing : 12.5/25 KHz
	d. Frequency Stability: ± 1.5 PPM or better at -10^0C to 60^0 C
	e. Output Impedance:50 Ohms
	f. Modulation : Bidder to specify
	g. Audio Distortion: < 3% at 1 KHz, at 3 KHz deviation (clear mode)
8.3.2	Receiver:
	a. Frequency: 400 MHz (400 – 470 MHz)
	b. Sensitivity: -112 dBm at 5% BER or better
	c. Frequency Stability: ± 1.5 PPM or better at -10^0C to 60^0 C
	d. Channel spacing: 12.5/25 KHz
	e. Adjacent Channel Rejection Selectivity : 60 dB or better
	f. Spurious and Image: better than 70 dB
	g. Audio output: 500 milliwatt or better
	h. Audio Distortion: Less than 3% at 1KHz
8.3.3	Other features:
	a. Direct mode operation
	b. Group scanning with priority selection
	c. Status Messaging
	d. Late entry
	e. Remote enable/disable facility
	f. Display with backlight – Alphanumeric.

	g. Text Message using keypad (Minimum 100 character)
	h. Terminal to terminal file transfer operation @ 9.2 kbps data rate or better
	i. Call history
	j. Roaming Feature within RF coverage area of the sites.
	k. Auto retry
	l. Man Down
	m. Port for hands free kit, headset attachment and USB cable alongwith Port for data communication and radio programming..
	n. Audio Visual Alerts (Bidder should Specify)
9	**Digital vehicular repeater system (for coverage enhancement:**
9.1	General
	a. Frequency Band: 400 MHz
	b. Channel spacing: 12.5/25 KHz
	c. Half Duplex operation
	d. In-Band configurations
	e. Power supply: Bidder to quote
	f. Number of channels: Minimum 100
	g. Operating temperature: -10°C to +60°C
	h. Antenna impedance: 50 Ohm
	i. Duty cycle: Continuous
9.1.1	TRANSMITTER:
	a. Power Output: 10 W or better
	b. Max Spurious Output: -20dBm
	c. Frequency Stability: +/- 1.5ppm
	d. Audio Distortion: <2%
9.1.2	RECEIVER:
	a. Receiver Sensitivity: -115 dBm or better
	b. Frequency Stability: +/- 1.5 dBm
	c. Selectivity: 12.5 / 25 kHz 60 dB / 75 dB
	d. Intermodulation: 70 dB
	e. Audio Output (Repeater Detect Audio): 600 mV RMS nominal, flat response
	f. Audio Distortion: <2% or better
9.1.3	POWER SUPPLY: (AC & DC Operated) & Power Backup
	a. Backup: 15 hours or above
	b. Power supply: Suitable charger and sealed maintenance free battery for the requirement
9.1.4	ANTENNA
	a. Type: Multiple dipole antennas capable to adjust the dipoles
	b. Gain: 9dB Gain or better
	c. Antenna Impedance: 50 Ohm
	d. V.S.W.R.: Less than 1.5
	e. Accessories: Suitable accessories for fixing etc.
9.1.5	CABLE

	Cable type: RF Low loss Cable – 100 Mtrs in one length & suitable Connectors both ends at less than 5dB loss or better for 100 Mtrs at 400 MHz band and 50 ohm impedance and suitable short cable.
10	RADIO PROGRAMMING KIT:
	a. The bidder should include in his proposal all necessary radio programming and Encryption Key Loading kits needed for the operation of the Digital Open Standard Trunked radio system including radio programming licensed software, interfacing hardware, laptop computer programmer and required radio terminal cables for: i. Base Stations, ii. Static/ Mobiles iii. Portables iv. Inter site Link Equipment b. Any other kit required
11	KEY MANAGEMENT HARDWARE AND SOFTWARE:
	a. Over the Air Rekeying (OTAR) hardware and software for Encryption with two clients. b. Over the Air Programming (OTAP) hardware and software with two clients: Bidder should explain in detail how OTAP/OTAR will interface with offered system and working of OTAP/OTAR. c. Key loader with interface cables for loading the encryption keys manually.
12	POWER SUPPLY:
	Commensurate capacity N+N redundant online UPS's with phase changeover switch for UPS and direct mains, of reputed make with maintenance free battery bank for minimum 4 hours backup for all the repeater sites and central police control room. The proposed UPSs should be very robust and reliable to provide uninterrupted power supply round the clock having following minimum features: a. Input Voltage Range: 160 VAC to 280 VAC b. Input Frequency Range: 47 Hz to 53 Hz c. Output Voltage: 230 VAC d. Output waveform: Pure Sine Wave e. Voltage regulation: ± 1% f. Efficiency: > 90 % g. Power factor: 0.8 or better h. Control Panel Display : Yes i. Alarm audible & visible (in case of failure): Yes j. Online monitoring: Yes k. Design modular: Yes
13	TEMPERATURE MAINTENANCE SYSTEM:
	Temperature Maintenance System of reputed/ standardized make with all accessories, and having at least five star ratings for all repeater stations and Central Control Switch site. a. Sufficient Weather Control System should be provided at each base station with automatic change over every 6 hours. b. Sufficient Weather Control System should be provided at switching centre with automatic change over every 6 hours. c. Weather Control System should be unmanned, so machine should be rugged, reliable, maintenance free and designed for long life.

	d. The proposed temperature maintenance system should be able to provide sufficient cooling to the system round the clock at all locations as per system design parameters.
14	TEST EQUIPMENTS /TOOLS:
	License shall supply all tools, test instruments and other accessories to the testing party of Licensor and /or TEC for conducting tests, if it so desires, prior to commissioning of the service or at any time during the currency of the License. In the interest of security, suitable monitoring equipment as may be prescribed by the licensor for each type of system used will be provided by the Licensee at his own cost for monitoring, as and when required. The bidder should include in his bid essential test and measuring instruments & tools for proper upkeep, calibration and maintenance of the system & radios as mentioned below: a. Suitable Radio Communication Test Set having all technical features of Base Station, mobile, static, handheld sets and accessories etc. for offered Trunked radio system with auto test and auto alignment facility. b. Through Line Power meter etc. c. Any other item essential for field testing.
15	MISCELLENOUS:
15.1	Critical Spares:
	The bidder shall maintain sufficient spares and enclose a list of the same for complete system including TMCSE, Repeaters, digital voice logger, inter site link equipments, dispatcher consoles, Radios etc. to ensure required availability of the network during the warranty period and CAMC period.
15.2	Earthing Policy:
	a. Main earth shall be provided at UPS Room. Main Earth shall be terminated by the bidder at a copper strip. b. The Clean Earthing arrangements for Telecom Equipment's must be protected using a mesh of copper "earth" strips of appropriate cross-sectional dimensions, forming a local Clean Earth Bus. c. An earthing system (Main earth and clean earth) shall be designed to assure personnel safety and protection of installations against damage. It shall also serve as a common voltage reference and to contribute to the mitigation of disturbances. d. The earthing system shall generally meet the requirements of IEEE 1100, NFPA 780, IEC 1024. e. The earth resistance at any point on the Clean Earth shall be below 0.5 ohm, and that for the Main Earth shall not exceed 2.0 ohm at any location and under any soil and/or climatic condition. f. All metal work and metallic items (including chassis) shall be earthed to the Main Earth to ensure the safety of personnel. g. The earthing connection shall be inspected periodically at intervals frequent enough to ensure that the earth connection meets all the requirements.
15.3	Transient Protection:
	a. Despite the provision of earthing as specified above, failure of communication equipment do occur on account of finite earth resistance during occurrence of high voltage transients. b. An effective transient protection system must protect the communication

	equipments from transients of the following specifications as a minimum: MIL-STD-704A or equivalent.
16.	ENGINEERING SERVICES:
	a. The finally selected Bidder shall design, supply, install, test and commission the proposed Digital Trunk Radio System.
	b. The Bidder shall furnish complete technical details with all calculations for link engineering, planning and dimensioning of the system/network, concerned relevant literature, drawings, and installation materials regarding the applicable system.
	c. The successful bidder will be responsible for system performance to fulfill all technical requirements including a guarantee of radio network coverage and capacity, installation and programming of base station and static sites and IP based Communication Dispatch centre equipment, microwave backbone, optimization of the radio infrastructure, training of system users and maintenance personnel, and achieving satisfactory system performance.
	d. Acceptance tests of system components, software and equipment provided pursuant to this specification must be passed to the satisfaction of Chandigarh Police.
	e. Three years on site comprehensive warranty for all equipments (except portable batteries which should have minimum 18 months standard warranty and SMF batteries should have minimum 24 months standard warranty) should be provided. The warranty period will begin from the date of acceptance of entire system by Chandigarh Police. During warranty period, the system components restoration time in case of failure should be less than 2 hours however the entire system should never fail.
16.1	Installation work Plan:
	a. The successful bidder should submit a preliminary installation work plan, installation test and procedures and installation schedule chart.
	b. The bidder should provide all technical details supported by technical documents, brochures etc. for system, system component, radios, other required peripherals and accessories.
	c. The bidder should then work together with Chandigarh Police to finalize the work plan 15 days prior to commencement of installation.
16.2	Site preparation:
	a. *Chandigarh Police shall provide space at master site. Repeater sites locations may be selected by the bidder from the list of suggested sites given at* ***Appendix-2 or any other sites suggested by the bidder in mutual discussion with Chandigarh Police officials****. Further, in case of Chandigarh Police buildings, the bidder shall be responsible for preparation of sites for civil work and environment control at their own cost. However, Bidder has the liberty to install Repeater site on other Civil buildings other than Chandigarh Police buildings to have the desired level of signal strength as per requirement of Chandigarh Police. The, rental charges, electrical charges, maintenance charges and any other charges shall be borne by the successful bidder for the entire period of contract. These costs will be included by the Purchaser in the project cost while deciding the lowest bidder.*

	b. *It shall be the responsibility of finally selected bidder to install all other infrastructure/equipments necessary for the smooth functioning of master site and repeater site.*
	c. *The bidder should submit all equipment/ Master site/ repeater site preparation plan including Antenna installation drawings, Tower & foundation drawings, RF cabling & electrical loading drawings, routing along with earthling plan involved for total requirements of the installation.*
	In case the contract is extended mutually beyond 10 years on Annual Maintenance Contract basis, the contractor shall provide complete maintenance of all the equipments including UPSs and its batteries, Temperature maintenance systems etc. supplied under the contract. The rates of AMC beyond 10 years will be decided mutually i.e. between Contractor and Purchaser (after approval of competent authority). ***Further, the, rental cost of sites & other charges in respect of other than Chandigarh Police establishments will be paid by the Purchaser. The supplier shall provide the copy of rental agreement including incremental clauses of rent so that Chandigarh Police could sign separate agreement with the site owner.***
	d. Bidder shall specify Load per site in KWH and number of manpower required to maintain complete sites.
	e. The bandwidth of lease line connectivity other than Chandigarh Police sites listed at Appendix-2 may also be mentioned as second level of redundancy to the sites.
	f. The cost of civil/electrical work at each Repeater Site based on the network design and assessment shall be borne by the successful bidder. The civil infrastructure including self supporting masts or antenna system should be able to support wind speed of 150 KM/Hour.
	g. The ownership of other civil sites shall rest with Chandigarh Police and bidder shall ensure free access to the site and in no case like delay in payment of rent or delay in any maintenance payments shall prohibit Chandigarh Police from access of the site. The responsibility shall rest with the bidder.
	h. The cost of maintenance and manpower to attend the site for day-to-day maintenance shall also be quoted by the bidder and cumulative cost of 10 years shall be included in the project cost.
16.3	System Acceptance Test:
	a. On completion of the installation, the bidder should conduct a system acceptance test. The bidder should propose a detailed system acceptance test plan, which should be jointly reviewed and finalized by Chandigarh Police and the successful bidder.
	b. The bidder should provide the test equipment required during the system acceptance test period with model number and quantity of these equipments. The bidder should repair or replace at no additional cost to Chandigarh Police, should any of the proposed equipment is found faulty during the system acceptance test period.
	c. The bidder to provide the detailed testing methodology to be adopted alongwith the test booklet procedure.

16.4	All that is required but not mentioned in this document for successful and trouble free installation, commissioning, operation and maintenance of the system, the bidder should incorporate in his bid being a turnkey project. The bidder is at liberty to indicate additional features and capabilities of the offered system.
17.	Training: The Bidder should provide training programmes for the purchaser's Engineers, Technicians and system users.
	Part I :- In first part Chandigarh Police will depute its twenty (10) engineers / Technicians for training at the works of the manufacturers factory premises for the period of Four (04) Weeks. In case of works out side India, all the expenses including fare, lodging and boarding should be borne by the supplier. The bidder should quote it separately. The Team of Chandigarh Police Officers should also be part of system acceptance at factory level.
	Part II:- In second part the supplier should provide Four (04) Weeks training to the 20 engineers/Technician of Chandigarh Police at the premises of Purchaser at no extra cost. Both training part should cover the following aspects: a. Description of all functional assemblies of the system, including controls, indicators and monitoring system. b. Line up procedures for the system and adjustment of operating parameters and other Operation and maintenance procedures. c. Practical replacement procedures/practices for major assemblies including RF units. To the experienced technicians of police in the complete trouble shooting and maintenance of the equipment, both at the board replacement and preferably at the board repair level.
	Part III :- User Operational Training: a. This training programme will be conducted at the user's location and will be structured so as to train up to 15 of the purchaser's supervisory and training personnel who will in turn train individual operators. b. The engineers and technicians should be taught the functionality of each equipment in the system and to identify common hardware/software failures.

Appendix-2

Preferable Sites of Chandigarh Police for installation of Repeater

Sr. No	Site	Sector
1	Police Headquarter	Sector-9
2	Police station – 3	Sector-3
3	Police Post- Lake	Sector-6
4	Police station – 11	Sector-11
5	Police post- 24	Sector-24
6	Police Post- PGI	Sector-12
7	Police station – 17	Sector-17
8	Home Guard Headquarters	Sector-17
9	Police Post- Neelam	Sector-17
10	Police post ISBT 17	Sector-17
11	Police Post – 22	Sector-22
12	Police station – Sarangpur	Sector-14 West
13	Police station – 19	Sector-19
14	Police station – 26	Sector-26
15	Police post- Bapudham	Sector-26
16	Police station – Ind Area	Ind. Area phase-1
17	Police Post- Daria	Ind. Area phase-1
18	Police station – Mani Majra	Sector- 13
19	Police station – IT Park	IT Park
20	Police station – Mauli Jagran	Mauli Jagran
21	Police station – 31	Sector-31
22	Police station – 34	Sector-34

23	Police Post- Burail	Sector-45
24	Police station – 49	Sector-49
25	Police station – 36	Sector-36
26	Police Post- 61	Sector-61
27	Police Post ISBT-43	Sector-43
28	Police station – 39	Sector-39
29	Police Post- Palsora	Sector-55
30	Police station – Maloya	Maloya
31	IRBn Complex	Sarangpur

Radio Density (%age) - Zone Wise

Appendix - I

Services required:-

1. Selective Call/Messaging/Data
2. Group Call/Messaging/Data

System should support

Minimum concurrent:-

1. Voice Call - 10 and
2. Selective Call = .3% of the total subscriber radio irrespective of location.

Note:- Voice call should have priority over data and messaging

Central Division	PS - 11	23%
	PS - 3	
	PS - 17	
	PS - Sarangpur	
East Division	PS - 26	19%
	PS - 19	
	PS Ind. Area	
North-East Division	PS - MM	18%
	PS - IT Park	
	PS - Mauli Jagran	
South-West Division	PS - Maloya	21%
	PS - 39	
	PS - 36	
South Division	PS - 34	19%
	PS - 31	
	PS - 49