



***Government of India  
Ministry of Home Affairs  
Directorate of Coordination Police Wireless***

***Invites***

***Expression of Interest***

***For***

***Automated Testing Solutions for Central Workshop***

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## Index

<b>Table of Contents</b>		<b>Page No.</b>
<b>Part-1: General Terms</b>		
1.	<i>Notice inviting EOI</i>	3
2.	<i>Objectives and Scope of Requirement</i>	4
3.	<i>Technical Specifications of Device Under Test (DUT)</i>	4
4.	<i>Details of Test/Measuring Equipments required for automation</i>	6
5.	<i>Instruction to the Bidders</i>	6
6.	<i>Stages of EOI</i>	8
7.	<i>Firms'/Vendors' Pre-Proposal Meeting</i>	8
8.	<i>EOI Proposal Preparation Costs &amp; Related Issues</i>	8
<b>Part II: EOI SUBMISSION FORM</b>		
9.	<i>Detailed Proposal</i>	9
10.	<i>Form 1: Covering Letter on Letterhead of the Firm/Vendor</i>	10
11.	<i>Form 2: Compliance Statement</i>	11
12.	<i>Form 3: Details of the Firm/Vendor operations &amp; business.</i>	12
13.	<i>Form 4: Check List of Firm/Vendor</i>	13
14.	<i>Annexure -1</i>	14
15.	<i>Annexure -2</i>	19
16.	<i>Annexure -3</i>	39
17.	<i>Annexure -4</i>	41
18.	<i>Annexure -5</i>	44
19.	<i>Annexure -6</i>	47
20.	<i>Annexure -7</i>	49
21.	<i>Appendix-B</i>	50

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No.L-15011/1(Testing)/2020-WS  
Government of India  
Ministry of Home Affairs  
Directorate of Coordination  
Police Wireless

CGO Complex, Lodhi Road  
New Delhi-110003  
Dated: 19<sup>th</sup>, March 2021

### **Notice for inviting Expression of Interest (EOI)**

Directorate of Coordination Police Wireless is in the process of establishing the automated testing infrastructure for evaluation of Transmitter and Receiver Parameters of Analog & Digital Radio's and other communication equipment. For this purpose, this Directorate invites Expression of Interest (EOI) from Firms/Vendors for integrated solutions for the testing of all the parameters of Analog and Digital Radios of Digital Mobile Radio Tier-II & Tier-III Radios, TETRA Radios and APCO Phase-I & Phase-II Radios, Analog & Digital HF Transceivers (Static & Manpack Radios), Wireless Mesh Radio, Wide Band Receiver, Direction Finder, Batteries of Handheld Radios (Ni-Mh & Li-Ion) and SMF / VRLA Batteries.

EOI can also be downloaded from the department's website <http://www.dcpw.gov.in> and also from CPP Portal (<http://www.eprocure.gov.in>). The Firms/Vendors is expected to examine all the details in the EOI documents.

Interested firms/vendors may submit integrated solutions for Central Workshop of this Directorate duly signed by the authorized signatory only by online mode on procurement portal [www.http://eprocure.gov.in](http://www.eprocure.gov.in) along with all the annexure as mentioned in the EOI published. The Schedule of EOI is as under:

Last date and time for the download of EOI Documents	04/05/2021
Last date and time for uploading of integrated solutions by online mode	04/05/2021
Date and Opening of EOI	05/05/2021

The Expression of Interest is being issued on "No commitment basis" purely for seeking the details of potential vendors interested to participate in the advertised EOI which is likely to be issued through [www.http://eprocure.gov.in](http://www.eprocure.gov.in).

DCPW reserves the right to accept or reject any or else without assigning any reason.

*Amarjeet Singh*  
(Amarjeet Singh)  
Deputy Director, DCPW

## OBJECTIVES AND SCOPE OF REQUIREMENT

1. Directorate of Coordination Police Wireless has been acting as a nodal Agency for testing and evaluation of Communication Equipments for the use of Police Forces in the Country and also technical advisory body to the Ministry of Home Affairs.
2. Therefore, this Directorate intends to invite solicit proposals from the interested Firms/Vendors for participation in an Expression of Interest (EOI) format for automated solutions for testing and evaluation of all the technical specification mentioned against the under mentioned Communication Equipments:

**Table No.1**

SL No.	Communication Equipment's (Device Under Test) to be tested	http link of detailed QRs	Enclosed at
1	High Frequency Radios (Static & Manpack)	<a href="https://dcpw.gov.in/somepdf/TECHNICAL%20SPECIFICATION%20OF%20HF%20TRANSCEIVER.pdf">https://dcpw.gov.in/somepdf/TECHNICAL%20SPECIFICATION%20OF%20HF%20TRANSCEIVER.pdf</a>	Annexure-1
2	Very High Frequency Digital Radios of DMR Tier-II and Tier-III Radios, TETRA Radios & APCO Phase-I & Phase-II Radios (Manpack & Handheld Radios)	<a href="https://dcpw.gov.in/somepdf/Tech_specification.pdf">https://dcpw.gov.in/somepdf/Tech_specification.pdf</a>	Annexure-2
3	Ultra-High Frequency Digital Radios of DMR Tier-II and Tier-III Radios, TETRA Radios & APCO Phase-I & Phase-II Radios (Manpack & Handheld Radios)	<a href="https://dcpw.gov.in/somepdf/Tech_specification.pdf">https://dcpw.gov.in/somepdf/Tech_specification.pdf</a>	
4	Wireless Mesh Radio	<a href="https://www.mha.gov.in/sites/default/files/QRSTDWirelessRadio_070515.pdf">https://www.mha.gov.in/sites/default/files/QRSTDWirelessRadio_070515.pdf</a>	Annexure-3
5	Wide Band Receiver	<a href="https://www.mha.gov.in/sites/default/files/QRs_DigitalMonitoringReceiver_03022020_0.pdf">https://www.mha.gov.in/sites/default/files/QRs_DigitalMonitoringReceiver_03022020_0.pdf</a>	Annexure-4
6	Direction Finder	<a href="https://www.mha.gov.in/sites/default/files/DirectionFinder.pdf">https://www.mha.gov.in/sites/default/files/DirectionFinder.pdf</a>	Annexure-5
7	Batteries of Handheld Radios. (Ni-Mh & Li-Ion)	<a href="https://www.mha.gov.in/sites/default/files/QRNiMH_250214.PDF">https://www.mha.gov.in/sites/default/files/QRNiMH_250214.PDF</a>	Annexure-6
8	SMF / VRLA Batteries	<a href="https://www.mha.gov.in/sites/default/files/QRsRFI_07012019.pdf">https://www.mha.gov.in/sites/default/files/QRsRFI_07012019.pdf</a>	Annexure-7

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3. The automated testing solutions should consist of authenticated user login details, generation of authenticated test reports of all the Radios Parameters including electrical parameters except the environmental parameters of the communication equipment listed in above mentioned table.
4. The Firm/Vendor shall submit the automated System block diagram for the required Testing Solutions. The layout plan shall clearly show interconnecting cable routes between various test/measuring equipment.
5. The System Block diagram shall have step wise installation diagram and Test Procedure/alignment procedure for measurement of technical parameters of Device Under Test (DUT) as mentioned in above table.
6. The Firm/Vendor shall mention the weight & power requirements of the automated testing solutions system.
7. The Firm/Vendor shall mention the Input/output interface and cabling requirements of the automated testing solutions system.
8. The Firm/Vendor shall mention the list of components with part numbers for various modules of the automated testing solutions system.
9. The scope will also include a list of any other test/measuring equipment if required apart from the available test/measuring equipment as mentioned at Annexure-A of EOI, for automated Testing Solutions for Central Workshop of the Directorate.
10. Apart from above, the Firms/Vendors shall include all the software, hardware, peripherals, accessories, sub-components required for the functionality and completeness of the solutions, including devices, equipment, accessories, patch cords (if any), cables, software, licenses, development / testing kits, tools, etc. which may require for complete solution for the proposal.
11. This Expression of Interest is being issued purely on “**no commitment basis**” for seeking the details of potential vendors interested to participate in the advertised EOI.

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## Appendix-A

### LIST OF AVAILABLE TEST/MEASURING EQUIPMENTS WITH CENTRAL WORKSHOP OF THE DIRECTORATE

The following test/measuring equipments are available with this Directorate which are required for automation for automatic testing facility and generation of test reports:

SL No.	Name of Test/Measuring Instrument	Model Number	Manufacturer	Communication Port available
1.	Radio Communication Test Set (Analog/Digital)	Viavi-3920B	Aeroflex	RS-232/USB
2.	Real Time Signal Analyzer	RSA-51A	Tektronics	RS-232/USB
3.	Signal Generator	N-171B	Keysight	RS-232/USB
4.	Digital Storage Oscilloscope 200 MHz	MSO2202E	Gwinstex	RS-232/USB
5.	Digital Multimeter	34465A	Keysight	RS-232/USB
6.	Frequency Counter	53220A	Keysight	RS-232/USB
7.	Two Port Vector Network Analyzer	S-412E	Anritsu	RS-232/USB
8.	Battery Analyzer	C7200	Cadex	RS-232/USB
9.	Exa Signal Analyzer	N9010B-503	Keysight	RS-232/USB

### INSTRUCTIONS TO THE BIDDERS

The broad points covering detailed scope of requirements are as under:

1. The Firms/Vendor's shall read the whole EOI carefully and shall submit the appropriate solution for Integrated automated testing solutions for Central Workshop of this Directorate.

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2. Firms/Vendors shall include all the software, hardware, peripherals, accessories, sub-components required for the functionality and completeness of the solutions, including devices, equipment's, accessories, patch cords (if any), cables, software, licenses, development/ testing kits, tools, etc. which may require for complete solution for the proposal.
3. This Expression of Interest is being issued purely on **"no commitment basis"** for seeking the details of potential vendors interested to participate in the advertised EOI.
4. The Firm/Vendors should provide an **"approximate estimation of cost"** (Applicable Taxes need to be mentioned separately) including an approximate breakdown of all the components that need to be structured into the costing of integrated automated testing solutions (engineering support, spares, training, documentation, product support, etc) as per Appendix-A mentioned in the EOI.
5. The Layout of proposed automated testing solutions is enclosed at Appendix-B of EOI.
6. The required important schedule & deadline for submission of Expression of Interest:

SL No.	Information	Details
1.	Expression of Interest (EOI) No. and Date	No.L-15011/1(EOI-Workshop)/2020-W/S, Dated <b>"19/03/2021"</b>
2.	Pre-Bid Conference	<b>06/04/2021</b>
3.	Last date & time for submission of written queries for clarifications	<b>13/04/2021</b>
4.	Release of response to clarifications on <a href="http://www.dcpw.gov.in">www.dcpw.gov.in</a>	<b>23/04/2021</b>
5.	Last date for submission of EOI Proposal	<b>04/05/2021</b>
6.	Address at which proposal in response to EOI is to be submitted	Deputy Director (Workshop), 7th Floor, DCPW, Block No.9, CGO Complex, Lodhi Road, New Delhi-110003.
7.	Opening of EOI Responses	<b>05/05/2021</b>

## **STAGE OF EXPRESSION OF INTEREST (EOI)**

**There will be two stages in Expression of Interest:**

### **First stage:**

1. On receipt of Expression of Interest, the assessment of EOI will be done by the Directorate. The technically capable Firms/Vendors will be called for technical discussions/presentations on a given date & time by DCPW.
2. During the technical discussions stage, this Directorate may also add those other stakeholders in the discussions who could add value to the decision making on the various technical aspects and evaluation criteria and methodology of training to be imparted.
3. Based on discussions/ presentations, one or more acceptable technical solutions may be decided upon laying down detailed technical specifications for each acceptable technical solution, quality benchmarks, warranty requirements, delivery milestones etc.

### **Second stage:**

1. Thereafter in the second stage, normal OTE/GTE bidding will be done which may not be restricted only to the shortlisted bidders of EOI. Hence, it is a 'Non-committal' EOI.

## **FIRMS/VENDORS PRE- PROPOSAL MEETING**

The Directorate will host a Firm's/Vendor's Pre-bid meeting in DCPW HQ New Delhi at 7<sup>th</sup> Floor, Conference Hall, DCPW HQrs, Lodhi Road, New Delhi. The meeting is tentatively scheduled as per the schedule on 16/02/2021 mentioned in EOI. The representatives of the interested Firms/Vendors may attend meetings at their own cost. The purpose of the conference is to provide Firms/Vendors with any clarifications regarding the EOI. It will also provide each Firms/Vendors with an opportunity to seek clarifications regarding any aspect of the EOI and the scope of work in the EOI.



## **EOI PROPOSAL PREPARATION COSTS & RELATED ISSUES**

1. The Firm/Vendor is responsible for all costs incurred in connection with participation in this process, including, but not limited to, costs incurred in preparation of proposal, participation in meeting/discussions.
2. DCPW in no case will be responsible or liable for these costs, regardless of the conduct or outcome of the EOI process.
3. This EOI does not commit DCPW to award a contract or to engage in negotiations. Further, no reimbursable cost may be incurred in anticipation of award or for preparing this EOI.

## **EOI SUBMISSION FORMS**

The applicants are expected to respond to the EOI using the forms given in this section and all documents supporting EOI criteria.

Proposal application shall comprise of following forms:

1. **Form 1:** Covering Letter on Letterhead of the Firm/Vendor
2. **Detailed Proposal** for Integrated solutions for **Automated Testing Solutions for Central Workshop** as per list of test/measuring instruments available with Workshop of the Directorate. In addition to this, the Firm shall also submit equipment layout plan, interface port details, all the software, hardware, peripherals, accessories, sub-components required for achieving the functionality and completeness of the solutions.
3. **Form 2:** Compliance Statement
4. **Form 3:** Details of the Firm/Vendor operations & business
5. **Form 4:** Check List of Firm/Vendor

**FORM 1**  
**Covering Letter on Letterhead of the Firm/Vendor**

To,

Director, DCPW  
Block No.9, CGO Complex,  
Complex, Lodi Road,  
New Delhi.

Sir,

We are hereby submitting our Expression of Interest. We fully understand and agree to comply that on verification, if any of the information provided here is found to be misleading the short-listing process or unduly favors our company in the short-listing process, we are liable to be dismissed from the EOI selection process or termination of the contract during the project.

We agree to abide by the conditions set forth in this EOI. We hereby declare that our proposal submitted in response to this EOI is made in good faith and the information contained is true and correct to the best of our knowledge and belief.

Yours Sincerely,

(Name with seal)  
(Address and Contact number)

*Anil*

**FORM 2**  
**COMPLIANCE STATEMENT**

The Compliance statement for automatic testing of under mentioned communication equipments (i.e Device Under Test) separately against each parameter of technical specification at table No.1, page No. 4 of EOI is required to be submitted by Firm/Vendor as per tabular format given below:

SL No.	Communication Equipment's (Device Under Test) to be tested	Technical Specification / Parameter	Compliance (Yes/No)	Remarks if any
1.	High Frequency Radios (Static & Manpack)			
2.	Very High Frequency Digital Radios of DMR Tier-II and Tier-III Radios, TETRA Radios & APCO Phase-I & Phase-II Radios (Manpack & Handheld Radios)			
3.	Ultra-High Frequency Digital Radios of DMR Tier-II and Tier-III Radios, TETRA Radios & APCO Phase-I & Phase-II Radios (Manpack & Handheld Radios)			
4.	Wireless Mesh Radio			
5.	Wide Band Receiver			
6.	Direction Finder			
7.	Batteries of Handheld Radios. (Ni-Mh & Li-Ion)			
8.	SMF / VRLA Batteries			

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**FORM 3**  
**DETAILS OF THE FIRM/VENDOR OPERATIONS & BUSINESS**

SL No.	Particulars	Details
1.	Name of the vendor / Company / Firm/Distributor (Company profile, in brief, to be attached)	
2.	Type (Tick the relevant category) a) Original Equipment Manufacturer (OEM): b) Government Sponsored Export Agency (Details of registration be provide) c) Authorized Vendor of Foreign Firm d) Other (Give Specific details)	
3.	Contact Details Postal Address, Fax , Email, Website, Details of contact person etc:	
4.	Local Branch / liaison office in India (if any) Name and Address	
5.	Annual Turnover for Last Three Financial Years	
6.	Details of earlier Contract with any Central/State/PSU/Private Agency.	
7.	Details of Manufacturing infrastructure available in India.	
8.	Details of Service infrastructure available in India.	
9.	Details of spare parts available in India.	
10.	Details duration of Technical Support that company can provide at user premises in India.	

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**FORM 4**  
**Check List of Firm/Vendor**

1. The bidder should ensure that all documents and papers submitted in this EOI are fully authenticated by the authorized signatory under his signature with official seal wherever applicable.
2. Every additional document submitted and every page of the EOI document shall be duly signed by the authorized signatory as a token of compliance and acceptance to all terms and conditions.
3. No overwriting/changes is allowed in submitted EOI documents.
4. The following documents form part of the EOI and should be submitted with EOI.

SL No.	Documents to be submitted	Documents to be submitted	
		Yes / No	Page no. at which document attached
1.	All pages of this EOI document, duly signed by the authorized signatory in a token of acceptance of all terms and conditions by the bidder. Any other document submitted by the bidder should also be signed by the authorized signatory		
2.	Authorization Certificate / Ownership Certificate/Partnership		
3.	Details of GST registration		
4.	Attested copy of Company Pancard		
5.	Experience details of similar project (Automation of test/measuring equipments) executed		
6.	Written statement about suitability for the job		

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**Technical Specification of 100 Watts HF Transceiver****General Specification:**

<b>General</b>	
1.Frequency Range	2.0 MHz to 29.9999 MHz with 100 Channel Spacing and 10 Hz Resolution.
2. Modes	SSB( J3E) USB, LSB, AM/AM(E),CW/MCW,AFSK
3. Preset	200 Channels or more
4. Frequency Stability	± 1 PPM or better
5. Built-in-test	Front panel testing.
6. Input Power	+ 12 V DC Nominal (10.8V to 14.4V) & 230 V AC
7. Power Consumption	≤30W in Receive & ≤ 450W in Transmit
8. EMI / EMC	MIL-STD- 461 / 462C or ETSI or CISPR 22 or IEC 61000-4 Series (TEC/EMI/TEL-001/01 FEB-09)
9.Weight	Less than 10 KG
10.Antenna Impedance	50 Ω Unbalanced
11.Protection	(i) Reverse Polarity protection ( without fuse ) (ii) Protection against high VSWR. (iii) Over Voltage and under Voltage Protection
12. Roles	Fixed/Transportable/Mobile
13. Headphone Impedance	150Ω / 300Ω / 600Ω
14.Cooling	Built in fan/ Heat sink
15.VSWR	Better than 1.5
16. Visual display	Front panel LCD display
17. Interface	RS-232 / USB
18. Programming	PC programming software and front panel Programming.
19.Communication Security	Approved encryption (SAG) may be incorporated by the user.

**Transmitter Specification:**

<b>TRANSMITTER</b>	
1.RF Power	15W to 100W PEP ( Low, Medium , High ) (user programmable )
2. Spurious Emission	≤ 50 mW and 40 db or more below PEP

3. Side Band Suppression	≥ 70db or better
4.Carrier Suppression	≥ 40db or better
5.Inter modulation distortion	30db min. below PEP
6. Audio Response	Within 6db from 350Hz to 2700Hz.
1. Sidetone Level	Better than 0.1 mW into 150Ω load for 5mV of audio input at 1 KHz.
8.Modulation Sensitivity	1 to 10 mV at 1 KHz for full power under SSB mode.

**Receiver Specification:**

<b>RECEIVER</b>	
1.Receiver Sensitivity	-111dbm for 10db SINAD or better
2.Image Rejection	≥70 db or better
3.IF Rejection	≥70 db or better
4.In band Inter Modulation Distortion.	35db min. below PEP
5.Audio Response	Within ±6db from 350Hz to 2700Hz
6.Audio Output	1W across loudspeaker or more
7. Audio Frequency Harmonics Distortion.	≤ 25 db or better

**Features:**

<b>Features</b>	
1.Selective calling	Digital FSK coding ( 4/6 digit select call)
2.Scanning	5 channels per second or better
3.ALE ( 2G / 3G )	Complying MIL-STD-188-141B
4. ALE link Quality data	24 hours of up to 100 stations and 100 channels Or better.
5. ALE link Quality data resolution	Local: 5 bits SINAD, 5 bits BER Remote: 5 bits SINAD, 5 BER
6.Flash messages	Predefined messages
7. Vocoder	MELP/ACL P ( 1200 / 2400 bps )
8.Frequency Hopping	Hop Rate: 6 / 12 / 25 hops per second (User programmable) as per regulation. Hop set table:100 frequencies or better.
9. Data Modem	MIL-STD -188 -110A single tone ≥ 4800 bps Option-1 : Built-in Option-2 : External
10.GPS Interface	Inbuilt GPS with polling facility.
11.Data Communication	Provision for data communication

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12.Tele Call	The Radio set should have capability to dial and Operate data.
13.RS-232 control	The Radio set should have capability to operate at 4800 baud rate or better.
14.Tuneable receiver	Continuous tunable.
15.Radio kill/un-kill	Should have kill/un-kill function.
16. Remote Operation	Capable to operate from remote location.
17.Audio input sockets	Mic and external socket.
18. Squelch	Coded squelch.
19. Push to talk.	Suitable Microphone to be provided.

### Technical Specification of 5 to 25 Watts HF Manpack Transceiver

#### General Specification:

<b>General</b>	
1.Frequency Range	2.0 MHz to 29.9999 MHz with 100 Hz Channel Spacing and 10 Hz Resolution 10 Hz Resolution.
2. Modes	SSB ( J3E) USB, LSB, AM/AM(E),CW/MCW,AFSK
3. Preset	200 Channels or more
4. Frequency Stability	± 1 PPM or better
5. Built-in-test	Front panel testing.
6. Input Power	12 V DC Nominal (10.8 V to 14.4V )
7.Battery life Duty Cycle : 5 / 5 / 90	Option-1 : 20 hrs or more Option-2 : 40 hrs or more
8. EMI / EMC	MIL-STD- 461 / 462C or ETSI or CISPR 22 or IEC 61000-4 Series (TEC/EMI/TEL-001/01 FEB-09)
9.Weight	Less than 6 Kg with battery
10.Antenna Impedance	50 Ω unbalanced
11.Protection	(i) Reverse Polarity protection. (ii) Protection against high VSWR.
12. Roles	Man pack
13. Headphone Impedance	150Ω / 300Ω / 600Ω
14.Cooling	Convection from case.
15.VSWR	Better than 1.5
16. Visual display	Front panel LCD display
17. Interface	RS-232 / USB
18. Programming	PC programming software and front panel Programming.

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19.Communication Security	Approved encryption ( SAG) may be incorporated by user
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**Transmitter specification:**

<b>TRANSMITTER</b>	
1.RF Power	5W to 25W PEP ( Low, Medium, high) (user programmable )
2. Spurious Emission	≤40 db below PEP
3. Side Band Suppression	≥ 70db or better
4.Carrier Suppression	≥ 40db or better
5.Inter modulation distortion	30db min. below PEP
6.Audio Response	Within 6db from 350Hz to 2700Hz.
7.Sidetone Level	Better than 0.1 mW into 150Ω load for 5mV of audio input at 1 KHz.
8.Modulation Sensitivity	1 to 10 mV at 1 KHz for full power under SSB mode.

**Receiver Specification:**

<b>RECEIVER</b>	
1.Receiver Sensitivity	- 111dbm for 10db SINAD or better
2.Image Rejection	≥70 db or better
3.IF Rejection	≥70 db or better
4.In band Inter Modulation Distortion.	35db min. below PEP
5.Audio Response	Within ±6db from 350Hz to 2700Hz
6.Audio Output	1W across loudspeaker or more
7. Audio Frequency Harmonics Distortion.	≤ 25 db or better

**Features**

<b>Features</b>	
1.Selective calling	Digital FSK coding ( 4/6 digit select call)
2.Scanning	5 channels per second or better
3.ALE ( 2G / 3G )	Complying MIL-STD-188-141B
4. ALE link Quality data	24 hours of up to 100 stations and 100 channels or better.
5. ALE link Quality data resolution	Local: 5 bits SINAD, 5 bits BER Remote: 5 bits SINAD, 5 BER
6.Flash messages	Predefined messages

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7. Vocoder	MELP/ACLIP ( 1200 / 2400 bps )
8.Frequency Hopping	Hop Rate: 6 / 12 / 25 hops per second (User programmable) as per regulation. Hop set table :100 frequencies or better
9.GPS Interface	Inbuilt GPS with polling facility.
10.RS-232 control	The Radio set should have capability to operate on 4800 baud rate or more.
11.Tuneable receiver	Continuous tunable.
12.Radio kill/un-kill	Should have kill/un-kill function.
13.Audio input sockets	Mic and external socket.
14. Squelch	High Quality Syllabic Squelch
15. Push to talk.	Suitable Microphone to be provided.
16.Audio Socket	Suitable Headgear should be provided

## 2. Technical Specification of digital VHF Hand Held Radio of DMR Tier-II Technology

### General Specification:

<b>GENERAL</b>	
Frequency Range	68 to 88MHz, 136 to 174 MHz ( split or full band)
TDMA	2 – Slot
Channel Capacity	255 or more ( for display ) 16 Channels ( non-display)
Channel Spacing	12.5KHz
Operating Voltage	7.4V(rated) with Li-ion/ Ni-MH rechargeable battery of capacity 2000 mAh or higher capacity
Average battery life for 5/5/90 duty cycles	Digital:10 hrs or more Analog:8 hrs or more
Frequency Stability	±1.5 PPM or better
Antenna Impedance	50Ω
Weight	Less than 500 gms with battery
EMI/EMC	TEC GR No. TEC/EMI/TEL-001/01/FEB-09 Or ETSI EN 301 489-1 & ETSI 301 489-5

### Transmitter specification:

<b>TRANSMITTER</b>	
RF Power Output	1 to 5 Watts (programmable)
FM Modulation	11KOF3E
Digital Modulation	4FSK
Modulation Limiting	±2.5KHz
FM Hum & Noise	-40 dB or better
Adjacent Channel Power	-60 dBc or better
Audio Response	+1,-3dB
Digital Vocoder	AMBE +2
Communication Security	Approved encryption (SAG) may be incorporated by user.

## Receiver Specification:

RECEIVER	
Sensitivity ( Analog)	0.30 $\mu$ V (12dB SINAD )or better
Sensitivity ( digital)	0.30 $\mu$ V at 5% BER or better
Adjacent Chanel Selectivity	60dB or better
Inter-modulation	70dB or better
Audio Output	Minimum 500 mW
Audio Distortion	3% or better

## Feature:

### Feature wise Configuration:

#### Configuration UH1 (without display)

1. Simple press to talk.
2. Low battery alert
3. Continuous Tone Coded Squelch System (CTCSS)
4. Mixed Mode Operation ( analog and digital)

#### Configuration UH2 (with display)

1. All features of configuration UH1.
2. Any one of 2-Tone/5-Tone/ DTMF signaling.
3. Busy Channel Lockout.
4. Selective call Decode.
5. Capable to kill / un-kill.
6. Capable of VOX hand free operation.
7. PTT ID Encode.
8. Chanel Scanning with call quieting facility.
9. Emergency SOS/SIREN
10. Talk around Mode
11. Automatic Number Identification (ANI)
12. Text messages and predefined message

#### Configuration UH3 (with GPS)

1. All features of configuration of UH2.
2. Should have built-in GPS feature with following specifications:
  1. Time to First Fix (TTFF) cold start : < 2minutes
  2. Time to First Fix (TTFF) hot start : <20seconds
  3. Horizontally accuracy : <10 meters

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## Technical specification of digital VHF Mobile Radio of DMR Tier-II Technology

### General Specification:

<b>GENERAL</b>	
Frequency Range	68 to 88 MHz,136 to174 MHz ( split or full band)
TDMA	2 - Slot
Channel Capacity	255 or higher
Channel Spacing	12.5 KHz
Operating Voltage	10.8 to 15.6V DC
Frequency Stability	±1.5 PPM or better
Antenna Impedance	50Ω
Communication interface	Ethernet /USB
Weight	Less than 2Kg
Display	Alphanumeric
VSWR	Better than 1.5
Protection	Reverse polarity and High VSWR
Communication Security	Approved encryption (SAG) may be incorporated by user.
EMI/EMC	TEC GR No. TEC/EMI/TEL-001/01/FEB-09 Or ETSI EN 301 489-1 & ETSI 301 489-5

### Transmitter specification:

<b>TRANSMITTER</b>	
RF Power Output	5 to 25Watts (programmable)
FM Modulation	11KOF3E
Digital Modulation	4FSK
Modulation Limiting	±2.5KHz
FM Hum & Noise	-40 dB or better
Adjacent Channel Power	-60 dBc or better
Audio Response	+1,-3dB
Digital Vocoder	AMBE +2

### Receiver Specification:

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<b>RECEIVER</b>	
Sensitivity (Analog)	0.30 $\mu$ V (12dB SINAD ) or better
Sensitivity (Digital)	0.30 $\mu$ V at 5% BER or better
Adjacent Channel Selectivity	60dB or better
Inter-modulation	70dB or better
Audio Output	Minimum 3 Watts
Audio Distortion	3% or better

**Feature:**

**Feature wise Configuration:**

**Configuration UM1 (without display)**

1. 1Simple press to talk.
2. Low battery alert
3. Continuous Tone Coded Squelch System (CTCSS)

**Configuration UM2 (with display)**

1. All features of configuration UM1.
2. Any one of 2-Tone/5-Tone/ DTMF signaling.
3. Busy Channel Lockout.
4. Selective call Decode.
5. Capable to kill / un-kill.
6. PTT ID Encode.
7. Chanel Scanning with call quieting facility.
8. Emergency SOS/SIREN
9. Talk around Mode
10. Automatic Number Identification (ANI)
11. Text messages and predefined message

**Configuration UH3 (with GPS)**

1. All features of configuration of UH2.
2. Should have built-in GPS feature with following specifications:
  1. Time to First Fix (TTFF) cold start : < 2minutes
  2. Time to First Fix (TTFF) hot start : <20seconds
  3. Horizontallly accuracy : <10 meters

**Configuration UM4:Modem for Data Communication**

**Technical Specification of digital VHF Repeater of DMR Tier-II Technology**

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**General Specification:**

<b>GENERAL</b>	
Frequency Range	68 to 88 MHz, 136 to 174 MHz ( split or full band )
TDMA	2 - Slot
Operating Mode	Dual standard ( digital & analog )
Operating Selection	Fully automatic for analog & digital
Channel Capacity	16 or more
Channel Spacing	12.5 KHz
Operating Voltage	12 V DC (10.8 to 15.6 V DC) 230 V AC ±10%, 50 ±1% Hz with float charger. Automatic switchover from AC to DC during mains failure.
Frequency Stability	± 1 PPM or better
Interface	Ethernet port for IP connectivity
Antenna Impedance	50Ω
Duty Cycle	100 %
Weight	Less than 15Kg
Display	Indicator for Transmit & Receive
VSWR	Better than 1.5
Protection	Reverse polarity
EMI/EMC	TEC GR No. TEC/EMI/TEL-001/01/FEB-09 Or ETSI EN 301 489-1 & ETSI 301 489-5

**Transmitter specification:**

<b>TRANSMITTER</b>	
RF Power Output	25 to 50 Watts ( programmable )
FM Modulation	11KOF3E
Digital Modulation	4FSK
Modulation Limiting	±2.5 KHz
FM Hum & Noise	-40 dB or better
Adjacent Channel Power	-60 dB or better
Audio Response	+1, -3db
Digital Vocoder	AMBE +2

**Receiver Specification:****RECEIVER**


Sensitivity (Analog)	0.30 $\mu$ V ( 12dB SINAD ) or better
Sensitivity (Digital)	0.30 $\mu$ V at 5% BER or better
Image Rejection	65dB or better
Adjacent Chanel Selectivity	60 dB or better
Inter-modulation	70dB or better

**Technical Specification of digital UHF Hand Held Radio of DMR Tier-II Technology**

**General Specification:**

<b>GENERAL</b>	
Frequency Range	380 to 512MHz ( split or full band), 806 to 890 MHz (Full Band)
TDMA	2 - Slot
Channel Capacity	255 or more ( for display ) 16 Channels ( non-display)
Channel Spacing	12.5KHz
Operating Voltage	7.4V(rated) with Li-ion/ Ni-MH rechargeable battery of capacity 2000mAh or higher capacity
Average battery life for 5/5/90 duty cycles	Digital:10 hrs or more Analog:8hrs or more
Frequency Stability	$\pm$ 1.5PPM or better
Antenna Impedance	50 $\Omega$
Weight	Less than 500 gms with battery
EMI/EMC	TEC GR No. TEC/EMI/TEL-001/01/FEB-09  Or ETSI EN 301 489-1 & ETSI 301 489-5

**Transmitter Specification:**

<b>TRANSMITTER</b>	
RF Power Output	1 to 3 Watts (programmable)
FM Modulation	11KOF3E
Digital Modulation	4FSK
Modulation Limiting	$\pm$ 2.5KHz
FM Hum & Noise	-40 dB or better

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Adjacent Channel Power	-60 dB or better
Audio Response	+1,-3dB
Digital Vocoder	AMBE +2
Communication Security	Approved encryption (SAG) may be incorporated by user.

**Receiver Specification:**

<b>RECEIVER</b>	
Sensitivity (Analog)	0.30 $\mu$ V (12dB SINAD) or better
Sensitivity ( digital)	0.30 $\mu$ V at 5% BER or better
Adjacent Channel Selectivity	60dB or better
Inter-modulation	70dB or better
Audio Output	Minimum 500 mW
Audio Distortion	3% or better

**Feature:**

**Feature wise Configuration:**

**Configuration VH1 (without display)**

1. Simple press to talk.
2. Low battery alert
3. Continuous Tone Coded Squelch System (CTCSS)
4. Mixed Mode Operation ( analog and digital)

**Configuration VH2 (with display)**

1. All features of configuration VH1.
2. Any one of 2-Tone/5-Tone/ DTMF signaling.
3. Busy Channel Lockout.
4. Selective call Decode.
5. Capable to kill / un-kill.
6. Capable of VOX hand free operation.
7. PTT ID Encode.
8. Channel Scanning with call quieting facility.
9. Emergency SOS/SIREN
10. Talk around Mode
11. Automatic Number Identification (ANI)
12. Text messages and predefined message

**Configuration VH3 (with GPS)**

1. All features of configuration of VH2.
2. Should have built-in GPS feature with following specifications:

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- a. Time to First Fix (TTFF) cold start : < 2minutes
- b. Time to First Fix (TTFF) hot start : <20seconds
- c. Horizontally accuracy : <10 meters

**Technical Specification of digital UHF Mobile Radio of DMR Tier-II Technology**

**General Specification:**

<b>GENERAL</b>	
Frequency Range	380 to 512MHz ( split or full band), 806 to 890 MHz (Full Band)
TDMA	2 - Slot
Channel Capacity	255 or higher
Channel Spacing	12.5 KHz
Operating Voltage	10.8 to 15.6V DC
Frequency Stability	±1.5 PPM or better
Antenna Impedance	50Ω
Communication interface	Ethernet /USB
Weight	Less than 2Kg
Display	Alphanumeric
VSWR	Better than 1.5
Protection	Reverse polarity and High VSWR
Communication Security	Approved encryption (SAG) may be incorporated by user.
EMI/EMC	TEC GR No. TEC/EMI/TEL-001/01/FEB-09 Or ETSI EN 301 489-1 & ETSI 301 489-5

**Transmitter Specification:**

<b>TRANSMITTER</b>	
RF Power Output	5 to 25 Watts (programmable)
FM Modulation	11KOF3E
Digital Modulation	4FSK
Modulation Limiting	±2.5KHz
FM Hum & Noise	-40 dB or better
Adjacent Channel Power	-60 dB or better
Audio Response	+1,-3dB
Digital Vocoder	AMBE +2

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### Receiver Specification:

<b>RECEIVER</b>	
Sensitivity (Analog)	0.30 $\mu$ V (12dB SINAD ) or better
Sensitivity ( digital)	0.30 $\mu$ V at 5% BER or better
Adjacent Chanel Selectivity	60dB or better
Inter-modulation	70dB or better
Audio Output	Minimum 3 Watts
Audio Distortion	3% or better

### **Feature:**

### **Feature wise Configuration:**

#### **Configuration VM1 (without display)**

1. Simple press to talk.
2. Low battery alert
3. Continuous Tone Coded Squelch System (CTCSS)

#### **Configuration VM2 (with display)**

1. All features of configuration VM1.
2. Any one of 2-Tone/5-Tone/ DTMF signaling.
3. Busy Channel Lockout.
4. Selective call Decode.
5. Capable to kill / un-kill.
6. PTT ID Encode.
7. Chanel Scanning with call quieting facility.
8. Emergency SOS/SIREN
9. Talk around Mode
10. Automatic Number Identification (ANI)
11. Text messages and predefined message

#### **Configuration VH3 (with GPS)**

1. All features of configuration of VH2.
2. Should have built-in GPS feature with following specifications:
  - a. Time to First Fix (TTFF) cold start : < 2minutes
  - b. Time to First Fix (TTFF) hot start : <20seconds
  - c. Horizontally accuracy : <10 meters

#### **Configuration VM4: Modem for Data Communication**

## Technical specification of digital UHF Repeater of DMR Tier-II Technology

### General Specification:

<b>GENERAL</b>	
Frequency Range	380 to 512 MHz ( split or full band), 806 to 890 MHz (Full Band)
TDMA	2 – Slot
Operating Mode	Dual standard ( digital & analog )
Operating Selection	Fully automatic for analog & digital
Channel Capacity	16 or more
Channel Spacing	12.5 KHz
Operating Voltage	12 V DC (10.8 to 15.6 V DC) 230 V AC $\pm 10\%$ , 50 $\pm 1\%$ Hz with float charger. Automatic switchover from AC to DC during mains failure.
Frequency Stability	$\pm 1$ PPM or better
Interface	Ethernet port for IP connectivity
Antenna Impedance	50 $\Omega$
Duty Cycle	100 %
Weight	Less than 15Kg
Display	Indicator for Transmit & Receive
VSWR	Better than 1.5
Protection	Reverse polarity
EMI/EMC	TEC GR No. TEC/EMI/TEL-001/01/FEB-09 Or ETSI EN 301 489-1 & ETSI 301 489-5/

### Transmitter specification:

<b>TRANSMITTER</b>	
RF Power Output	25 / 50 /75 Watts ( programmable )
FM Modulation	11KOF3E
Digital Modulation	4FSK
Modulation Limiting	$\pm 2.5$ KHz
FM Hum & Noise	-40 dB or better
Adjacent Channel Power	-60 dB or better
Audio Response	+1, -3db
Digital Vocoder	AMBE +2

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**Receiver Specification:**

<b>RECEIVER</b>	
Sensitivity ( Analog )	0.30 $\mu$ V ( 12dB SINAD ) or better
Sensitivity ( digital )	0.30 $\mu$ V at 5% BER or better
Image Rejection	65dB or better
Adjacent Chanel Selectivity	60 dB or better
Inter-modulation	70 dB or better

**Technical Specification of TETRA Technology Radios****DIGITAL HANDHELD RADIO:**

<b>S.I. No.</b>	<b>SPECIFICATIONS</b>	
<b>1</b>	<b>GENERAL</b>	
1.1	Frequency Range	400 MHz Band OR 800 MHz Band
1.2	Duplex Spacing	10 MHz for 400 MHz Band 45 MHz for 800 MHz Band
1.3	TDMA	4 – Slot TETRA Standard
1.4	Operation Modes	TETRA Standard
1.7	Emission	21K0D1W
1.5	Number of Channel	1000 or better
1.6	Channel Spacing	25 kHz
1.7	Number of contacts (individual / group call numbers)	1000 or better
1.8	Battery Capacity	Li-ion/Li-Poly rechargeable battery of capacity 2000 mAh or higher capacity. Bidder to specify the specific voltage
1.9	Frequency Stability	$\pm$ 1.5 PPM or better
1.10	Display	Alphanumeric
1.11	VSWR	Better than 1.5
1.12	Protection	Reverse Polarity and High VSWR
1.13	Interoperability with minimum two vendors	User/DCPW to test
<b>2</b>	<b>TRANSMITTER</b>	
2.1	RF Power Output	1 W or better
2.2	Digital Modulation	$\pi/4$ -QDPSK
2.4	FM Hum & Noise	-40 dB or better at 25 KHz

2.5	Adjacent Channel Power	-60 dB or better at 25 KHz
2.6	Audio Response	+1,-3dB
2.7	Digital Vocoder	ACELP
<b>3</b>	<b>RECEIVER</b>	
3.1	Sensitivity ( Analog)	0.30μV (12dB SINAD )or better
3.2	Sensitivity ( Digital)	0.30μV at 5% BER or better
3.3	Adjacent Channel Selectivity	60dB or better at 25 KHz
3.4	Inter-modulation	70dB or better
3.5	Audio Output	Minimum 500m W
3.6	Audio Distortion	Less than 3%
<b>4</b>	<b>GPS</b>	
4.1	Time to first fix cold Start	<2 Minutes
4.2	Time to first fix hot Start	< 20 Second
4.3	Horizontal accuracy	< 10 Meter

#### **DIGITAL MOBILE RADIO:**

<b>S.I. No.</b>	<b>SPECIFICATIONS</b>	
<b>1</b>	<b>GENERAL</b>	
1.1	Frequency Range	400 MHz Band OR 800 MHz Band
1.2	Duplex Spacing	10 MHz for 400 MHz Band 45 MHz for 800 MHz Band
1.3	TDMA	4 – Slot TETRA Standard
1.4	Operation Modes	TETRA Standard
1.7	Emission	21K0D1W
1.5	Number of Channel	1000 or better
1.6	Channel Spacing	25 kHz
1.7	Number of contacts (individual / group call numbers)	1000 or better
1.8	Operating Voltage	11.25 VDC
1.9	Frequency Stability	±1.5 PPM or better
1.1 0	Display	Alphanumeric
1.1 1	VSWR	Better than 1.5
1.1 2	Protection	Reverse Polarity and High VSWR
1.1 3	Interoperability with minimum two vendors	User/DCPW to test

<b>2</b>	<b>TRANSMITTER</b>	
2.1	RF Power Output	Minimum 25 W for all bands
2.2	Digital Modulation	$\pi/4$ QDPSK
2.3	Modulation Deviation	$\pm 2.5$ kHz at 25 kHz
2.4	FM Hum & Noise	-40 dB or better at 25 KHz
2.5	Adjacent Channel Power	-60 dBc or better at 25 KHz
2.6	Audio Response	+1,-3dB
2.7	Digital Vocoder	ACELP
<b>3</b>	<b>RECEIVER</b>	
3.1	Sensitivity ( Analog)	0.30 $\mu$ V (12dB SINAD )or better
3.2	Sensitivity ( Digital)	0.30 $\mu$ V at 5% BER or better
3.3	Adjacent Channel Selectivity	60dB or better at 12.5 KHz
3.4	Inter-modulation	70dB or better
3.5	Audio Output	Minimum 3 W
3.6	Audio Distortion	Less than 3%
<b>4</b>	<b>GPS</b>	
4.1	Time to first fix cold Start	<2 Minutes
4.2	Time to first fix hot Start	< 20 Second
4.3	Horizontal accuracy	< 10 Meter

### TECHNICAL SPECIFICATION OF APCO PHASE-I

#### Digital Handheld Radio:

SL No.	Parameter	Specification
1.	Frequency range Tx Frequency Range :  Rx Frequency Range:	For VHF :- (136-174 MHz) For UHF :- (400-470 MHz; 450-520 MHz) 700/800 MHz :- (763-870 MHz ),  For VHF :- (136-174 MHz) For UHF :- (400-470 MHz; 450-520 MHz) 700/800 MHz :- (763-776 MHz ; 851-871 MHz), (Frequency as per user requirement in the VHF and UHF bands
2.	Channels/Zones	Minimum 100 channels for 10 zone
3.	Channel spacing	12.5 & 25 KHz
4.	Frequency stability	$\pm 2$ ppm(-30°C to +60 °C)

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5.	Protocol	12.5 KHz P25 Phase 1 FDMA
6.	Type of Emission	FCC and IC compliances
7.	Type of Operation	Simplex/ Press-to-Talk (Phase-1)
8.	Maximum weight with standard Battery & Antenna	450 Grams
9.	Power source	Standard Battery pack of 2400 mAh or more.
<b>Transmitter</b>		
10.	RF Power output	VHF-5W UHF: 400 MHz-4W 800 MHz- 3W
11.	Audio Distortion	Less than 3% at 1 KHz
<b>Receiver</b>		
12.	Analog Sensitivity	0.3 $\mu$ v or Better at 12 dB SINAD
13.	Digital Sensitivity	0.3 $\mu$ v or Better at 5% BER
14.	Audio O/P	> 500mW @ 5% Distortion.
15.	Hum and noise	-33 dB @ 12.5KHz, -37dB @ 25 KHz
16.	Adjacent Channel Selectivity	-60 dB @ 12.5 KHz , -70 dB @ 25 KHz
<b>Features</b>		
17.	Support GPS	Radio should have in built GPS receiver
18.	Front Panel LCD Display	Large four line LCD with icons to display key parameters. 4 and 16 keypad options. Four programmable function keys and three way selector.
19.	Emergency Key	Programmable emergency key should be easily accessible & highly visible on the radio
20.	Scanning modes	Includes priority, dual priority , editable zone & background scan.
21.	Radio Remote Kill	To allow management of misplaced or stolen
22.	Over-the-air-rekeying (OTAR)	Should be possible without trunking system.
23.	Key field device (KFD)	For quick, reliable encryption key programming.
24.	Encryption	AES-256 or Better
25.	Vocoder	IMBE or Better

### Digital Mobile Radio:

SL No.	Parameter	Specification
1.	Frequency range Tx Frequency Range :	For VHF :- (136-174 MHz) For UHF :- (400-470 MHz; 450-520 MHz)

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	Rx Frequency Range:	700/800 MHz :- (763-870 MHz ), For VHF :- (136-174 MHz) For UHF :- (400-470 MHz; 450-520 MHz) 700/800 MHz :- (763-776 MHz ; 850-870 MHz), (Frequency as per user requirement in the VHF and UHF bands)
2.	Channels/Zones	Minimum 100 channels for 10 zone
3.	Channel spacing	12.5 & 25 KHz
4.	Frequency stability	±2 ppm(-30°C to +60 °C)
5.	Protocol	12.5 KHz P25 Phase 1 FDMA
6.	Type of Emission	FCC and IC compliances
7.	Type of Operation	Simplex/ Press-to-Talk (Phase-1)
8.	Maximum weight with standard Battery & Antenna	≤2.5 Kgs.
<b>Transmitter</b>		
9.	RF Power output	VHF-25W UHF:400 MHz-25W UHF :800 MHz- 15W
10.	Frequency Deviation:	+/- 2.5 KHz @ 12.5 KHz +/- 5 KHz @ 25 KHz
11.	FM Hum Noise	-33 dB @ 12.5 KHz -37 dB @ 25 KHz
12.	Audio Distortion	Less than 3% at 1 KHz
<b>Receiver</b>		
13.	Analog Sensitivity	0.3 μv or Better at 12 dB SINAD
14.	Digital Sensitivity	0.35 μv or Better at 5% BER
15.	Audio O/P	> 3W @ 5% Distortion in internal speaker
16.	Hum and noise	-40 dB @ 12.5KHz, -43dB @ 25 KHz
17.	Adjacent Channel Selectivity	-60 dB @ 12.5 KHz , -75 dB @ 25 KHz
<b>Features</b>		
18.	Front Panel LCD Display	Large four line LCD with icons to display key parameters. Four programmable function keys on the standard mobile head.
19.	Emergency Key	Programmable emergency key should be easily accessible & highly visible on the radio
20.	Scanning modes	Includes priority, dual priority, editable zone & background scan.
21.	Radio Remote Kill	To allow management of Radios during vehicle servicing.
22.	Key field device (KFD)	For quick, reliable encryption key programming.

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23.	Encryption	AES-256 or Better
24.	Vocoder	IMBE or Better

**Technical Specification of APCO PHASE-II Technology Radios**

**DIGITAL HANDHELD RADIO:**

<b>S.I. No.</b>	<b>SPECIFICATIONS</b>	
<b>1</b>	<b>GENERAL</b>	
1.1	Frequency Range	400 MHz Band OR 800 MHz Band
1.2	Duplex Spacing	10 MHz for 400 MHz Band 45 MHz for 800 MHz Band
1.3	TDMA	2 – Slot
1.4	Operation Modes	APCO P25 Phase II
1.5	Emission	9K80D7W.
1.6	Number of Channel	1000 or better
1.7	Channel Spacing	12.5 kHz
1.8	Number of contacts (individual / group call numbers)	1000 or better
1.9	Battery Capacity	Li-ion/Li-Poly rechargeable battery of capacity 2000 mAh or higher capacity. Bidder to specify the specific voltage
1.10	Frequency Stability	±1.5 PPM or better
1.11	Display	Alphanumeric
1.12	VSWR	Better than 1.5
1.13	Protection	Reverse Polarity and High VSWR
1.14	Interoperability with minimum two vendors	User/DCPW to test
<b>2</b>	<b>TRANSMITTER</b>	
2.1	RF Power Output	4W for 400 MHz Band (programmable) 3W for 800 MHz Band (programmable)
2.2	Digital Modulation	Inbound : HCPM (TDMA) Outbound : HDQPSK (TDMA)
2.3	FM Hum & Noise	-40 dB or better at 12.5 KHz
2.4	Adjacent Channel Power	-60 dBc or better at 12.5 KHz
2.5	Audio Response	+1,-3dB
2.6	Digital Vocoder	AMBE +2 (Dual Rate)
<b>3</b>	<b>RECEIVER</b>	
3.1	Sensitivity ( Analog)	0.30µV (12dB SINAD )or better

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3.2	Sensitivity ( digital)	0.30 $\mu$ V at 5% BER or better
3.3	Adjacent Chanel Selectivity	60dB or better at 12.5 KHz
3.4	Inter-modulation	70dB or better
3.5	Audio Output	Minimum 500m W
3.6	Audio Distortion	Less than 3%
<b>4</b>	<b>GPS</b>	
4.1	Time to first fix cold Start	<2 Minutes
4.2	Time to first fix hot Start	< 20 Second
4.3	Horizontal accuracy	< 10 Meter

**DIGITAL MOBILE RADIO:**

S.I. No.	SPECIFICATIONS	
<b>1</b>	<b>GENERAL</b>	
1.1	Frequency Range	400 MHz Band OR 800 MHz Band
1.2	Duplex Spacing	10 MHz for 400 MHz Band 45 MHz for 800 MHz Band
1.3	TDMA	2 - Slot
1.4	Operation Modes	APCO P25 Phase II
1.7	Emission	9K80D7W
1.5	Number of Channel	1000 or better
1.6	Channel Spacing	12.5 kHz
1.7	Number of contacts (individual / group call numbers)	1000 or better
1.8	Operating Voltage	11.25 VDC
1.9	Frequency Stability	$\pm$ 1.5 PPM or better
1.10	Display	Alphanumeric
1.11	VSWR	Better than 1.5
1.12	Protection	Reverse Polarity and High VSWR
1.13	Interoperability with minimum two vendors	User/DCPW to test.
<b>2</b>	<b>TRANSMITTER</b>	
2.1	RF Power Output	Minimum 25 W for all bands
2.2	Digital Modulation	Inbound : HCPM (TDMA) Outbound : HDQPSK (TDMA)
2.3	FM Hum & Noise	-40 dB or better at 12.5 KHz
2.4	Adjacent Channel Power	-60 dB or better at 12.5 KHz
2.5	Audio Response	+1,-3dB
2.6	Digital Vocoder	AMBE +2 (Dual Rate)
<b>3</b>	<b>RECEIVER</b>	
	Sensitivity ( Analog)	0.30 $\mu$ V (12dB SINAD )or better
3.2	Sensitivity ( Digital)	0.30 $\mu$ V at 5% BER or better

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3.3	Adjacent Channel Selectivity	60dB or better at 12.5 KHz
3.4	Inter-modulation	70dB or better
3.5	Audio Output	Minimum 3 W
3.6	Audio Distortion	Less than 3%
<b>4</b>	<b>GPS</b>	
4.1	Time to first fix cold Start	<2 Minutes
4.2	Time to first fix hot Start	< 20 Second
4.3	Horizontal accuracy	< 10 Meter

**Technical Specification of DMR Technology, Tier-III**

**DIGITAL HANDHELD RADIO:**

<b>S.I. No.</b>	<b>SPECIFICATIONS</b>	
<b>1</b>	<b>GENERAL</b>	
1.1	Frequency Range	400 MHz Band OR 800 MHz Band
1.2	Duplex Spacing	10 MHz for 400 MHz Band 45 MHz for 800 MHz Band
1.3	TDMA	2 – Slot
1.4	Operation Modes	DMR Tier III
1.7	Emission	11K0F3E, 7K60FXE , 7K60FXD ,7K60FXW
1.5	Number of Channel	1000 or better
1.6	Channel Spacing	12.5 kHz
1.7	Number of contacts (individual / group call numbers)	1000 or better
1.8	Battery Capacity	Li-ion/Li-Poly rechargeable battery of capacity 2000 mAh or higher capacity. Bidder to specify the specific voltage
1.9	Frequency Stability	±1.5 PPM or better
1.10	Display	Alphanumeric
1.11	VSWR	Better than 1.5
1.12	Protection	Reverse Polarity and High VSWR
1.13	Interoperability with minimum two vendors	User/DCPW to test.
<b>2</b>	<b>TRANSMITTER</b>	
2.1	RF Power Output	4W for 400 MHz (programmable) 3W for 800 MHz Band (programmable)
2.2	Digital Modulation	4FSK DMR TIER-III
2.3	Modulation Deviation	±2.5 kHz at 12.5 kHz
2.4	FM Hum & Noise	-40 dB or better at 12.5 KHz
2.5	Adjacent Channel Power	-60 dBc or better at 12.5 KHz
2.6	Audio Response	+1,-3dB
2.7	Digital Vocoder	AMBE +2

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<b>3</b>	<b>RECEIVER</b>	
3.1	Sensitivity ( Analog)	0.30 $\mu$ V (12dB SINAD )or better
3.2	Sensitivity ( digital)	0.30 $\mu$ V at 5% BER or better
3.3	Adjacent Channel Selectivity	60dB or better at 12.5 KHz
3.4	Inter-modulation	70dB or better
3.5	Audio Output	Minimum 500m W
3.6	Audio Distortion	Less than 3 %
<b>4</b>	<b>GPS</b>	
4.1	Time to first fix cold Start	<2 Minutes
4.2	Time to first fix hot Start	< 20 Second
4.3	Horizontal accuracy	< 10 Meter

**DIGITAL MOBILE RADIO:**

<b>S.I. No.</b>	<b>SPECIFICATIONS</b>	
<b>1</b>	<b>GENERAL</b>	
1.1	Frequency Range	400 MHz Band OR 800 MHz Band
1.2	Duplex Spacing	10 MHz for 400 MHz Band 45 MHz for 800 MHz Band
1.3	TDMA	2 – Slot
1.4	Operation Modes	DMR Tier III
1.7	Emission	11K0F3E, 7K60FXE , 7K60FXD ,7K60FXW
1.5	Number of Channel	1000 or better
1.6	Channel Spacing	12.5 kHz
1.7	Number of contacts (individual / group call numbers)	1000 or better
1.8	Operating Voltage	11.25 VDC
1.9	Frequency Stability	$\pm$ 1.5 PPM or better
1.10	Display	Alphanumeric
1.11	VSWR	Better than 1.5
1.12	Protection	Reverse Polarity and High VSWR
1.13	Interoperability with minimum two vendors	User/DCPW to test
<b>2</b>	<b>TRANSMITTER</b>	
2.1	RF Power Output	Minimum 25 W for all bands
2.2	Digital Modulation	4FSK DMR TIER-III
2.3	Modulation Deviation	$\pm$ 2.5 kHz at 12.5 kHz
2.4	FM Hum & Noise	-40 dB or better at 12.5 KHz
2.5	Adjacent Channel Power	-60 dB or better at 12.5 KHz
2.6	Audio Response	+1,-3dB

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2.7	Digital Vocoder	AMBE +2
<b>3</b>	<b>RECEIVER</b>	
3.1	Sensitivity ( Analog)	0.30 $\mu$ V (12dB SINAD )or better
3.2	Sensitivity ( digital)	0.30 $\mu$ V at 5% BER or better
3.3	Adjacent Chanel Selectivity	60dB or better at 12.5 KHz
3.4	Inter-modulation	70dB or better
3.5	Audio Output	Minimum 3 W
3.6	Audio Distortion	Less than 3 %
<b>4</b>	<b>GPS</b>	
4.1	Time to first fix cold Start	<2 Minutes
4.2	Time to first fix hot Start	< 20 Second
4.3	Horizontal accuracy	< 10 Meter

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## TECHNICAL SPECIFICATIONS OF WIRELESS MESH RADIO

SL No.	Parameter	Specifications
a)	Frequency range	UHF band
b)	No of Channel	24 channels or more (Programmable/selectable)
c)	Frequency Stability	± 1.0 PPM or better
d)	Protocol	Standard Digital Technology
e)	Type of Emission	Modulation technique complying to open standard protocol approved by ETSI/FCC.
f)	Type of Operation	IP Mesh Radio
g)	Type of Antenna	Helical / wrap dipole antenna
h)	Weight	Less than 1600 grams excluding bty.
i)	Power Source	Ni-Mh or Li-ion rechargeable battery with belt clips to meet the operating time of 10 Hours (voice and data) or more.
<b>Transmitter</b>		
a)	R F Power output	Min 1 Watt
b)	Audio distortion	Less than 3% @ 1 Khz
<b>Receiver</b>		
a)	Audio Output	500 mW or higher
<b>Environmental Specification</b>		
a)	Operating Temperature	-20°C to +55°C or better
b)	Storage Temperature	-20°C to +60°C to better
c)	Humidity	90% at 50°C (as per MIL810E)
d)	Environmental standard	MIL 810 F
e)	Waterproof Protection	IP 54, IP55 or better
<b>GPS</b> The radios should have GPS to function with an accuracy of less than 15 meter and should be able to transmit back the coordinates to be displayed on Ground Control Station, Ruggedized PDA/Wrist computer along with supplied adequate Geo software.		
<b>Mesh Radio Features</b>		
a)	Text Messages	Should be capable of storing and sending at least 100 predefined messages with minimum 250 characters
b)	Emergency Button	Should be provided or programmable on the keypad
c)	Mode of calls	Should be configurable to make selective call
d)	Simultaneous Voice/Data session	Should be available
e)	Remote Radio Killing /Stun /Revive facility	Should be available

f)	Networking	IPv4 based inter-networking with other media like satellite terminal/ long range radio systems.
g)	Mesh network	Multi-hop self- healing and self-forming mesh networking.
h)	Secrecy	Should provide inherent protection against casual eavesdropping with any commercial grade secrecy.
i)	Data rate	Minimum 1Mbps or better
j)	Communication Range per hop	1000 mtrs or more for line of sight and 500 mtr or more for non-line of sight.
k)	Min number of hops	3 or more
l)	VOX	Should have a VOX module
m)	Interface Ports	USB or with a suitable plug in connector for USB interface.

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**TECHNICAL SPECIFICATION OF WIDE BAND RECEIVER/ MONITORING RECEIVER**

<b>Parameter</b>	<b>Specifications</b>
a. Role	Static/Mobile/Man pack version
b. Frequency Range	100 KHz to 1300 MHz
c. No of memory channel	Minimum 2000 memory channel
d. Memory bank	40 or more
e. Search bank	40 or more
f. Tuning steps/ Frequency resolution	Minimum step size 10 Hz
g. Receive Mode	Intercept both digital and analog modes:- a) Digital Mode-DMR(4FSK), DPMR, NXDN, P25 (APCO25 PH-1 & 2), TETRA, b) Analog Mode-AM, USB, LSB, CW, NFM etc.
h. Antenna Impedance	50 Ohm
i. Selectivity	Better than 60 dB (25KHz) , better than 50 dB (12.5) KHz
j. Sensitivity	530 KHz -17.99999 MHz: 0.75 $\mu$ V (12dB) SINAD, 18 MHz- 1300 MHz 0.35 $\mu$ V (12dB SINAD)
k. VFO (Variable Freq. Oscillator)	Minimum 3 Nos. (0.5-1300MHz)
l. Frequency stability	< $\pm$ 2.5 ppm
m. AF Power output	1 W (Approx.)
n. Weight & Dimensions	Less than 2 kg and 200 mm (W) x 65mm(H) x 250 mm (D)
<b>2. Power Supply : Should operate with AC and DC Power supply</b>	
a. AC 230 V $\pm$ 10 %	
b. 12V DC $\pm$ 10 %	
<b>3 Environmental Parameters</b>	
Operating Temperature	-10°C to +55°C
<b>4. Antenna with accessories. Provide suitable antenna for interception (As per user requirement)</b>	
Man pack Role	i) VHF Tape Antenna ii) UHF Tape Antenna iii) Flexible Whip VHF & UHF Antenna iv) Battery capacity- 7 Ah & 12V v) DC cable, Carry bag, Battery Charger , Head Gear (Single side).
Mobile Role	i) 0/3 dB VHF antenna with 3 mtrs. Cable bracket mount. ii) 0/3 dB UHF antenna with 3 mtrs. Cable bracket mount.

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	iii) Flexible Whip VHF & UHF Ant. With DC cable.
Static Role	i) 0/3/6 dB VHF GP Antenna ii) 0/3/6 dB UHF GP Antenna iii) HF Broadband Dipole Ant with 30 mtrs RG 213 iv) Discone Wideband Antenna v) HF,VHF & UHF Antenna vi) ½ inch low loss RF Cable 30 mtrs (Loss – 0.03 dB/mtrs) DC Cable , Power supply unit.
a. Connector jack for external speaker/headphone	Should be available
b. Technical/operation Manual	Should be provided by firm
c. Telescopic Mast (Optional as per user requirement )	20 feet Telescopic mast with supporting rope (3 sections), base plate , fixing pictle
d. External speaker (Optional as per user requirement)	Yes
<b>5. Receiver Features</b>	
a. Display	Alphanumeric LCD/LED display
b. Priority scanning	Should be available
c. Auto store of frequency	Should be available
d. AFC (Automatic Freq. Control)	AFC (Automatic Freq. Control) function for spot on tuning
e. Squelch	NSQ, LSQ
f. Squelch & Volume control knob	Should be available
g. Pass frequency mode	Should be available
h. Multiple IF bandwidth	3/6/15/30/100/200 KHz
i. Audio recording (Built-in)	> 200 Hrs
j. Built in playback facility	Should be available
k. Data clone lead	To interface with computer
l. Data backup & Restore data facility via SD/SDHC card	Backup & Restore data (Memory channel/search bank/configuration) facility should be available
m. Real time clock	should be available

n. Auto sleep, Alarm, Record Timer	should be available
<b>6. Optional System</b>	Life time online firmware update support for newly added features
	Receiver should have facility to operate by window based PC
	Audio Analyzer Software

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**TECHNICAL SPECIFICATION OF DIRECTION FINDER****DF Processor**

S/No	Nomenclature	Technical Parameters
1.	Frequency Range	20 MHz to 3000 MHz
2.	DF accuracy (Multi Path Propagation)	Better than 02 degree, RMS over entire Frequency range
3.	Bearing resolution	Better than or equal to 0.1 degree
4.	Display Parameters	(a) Modulation (b) Bandwidth (c) Signal Strength in dbm (d) Bearing and location fix (e) Bearing quality (f) Time of DF (g) Should have facility for working in darkness by lighting by the display
5.	Detection modes	AM,FM,SSB, CW, PSK, FSK, Frequency Hopping and Burst Signal
6.	Operating Modes	(a) Automatic (b) Manual
7.	FH DF Capability	Minimum 350 hops per second
8.	DF Receiver Channels	Minimum three channel DF Processor
9.	Minimum required signal duration for DF	Less than or equal to 1 m second
10.	Response time of LF system	Display of location fix within 2 seconds of initiating LF command. The entire procedure of requesting the bearings location calculation and plotting the same on the map must complete within 2 seconds.
11.	Receiver sensitivity	State-of-art, better than 2 micro volts per meter in entire frequency range for 10 db SNR and 6 KHZ Band width.
12.	Frequency history	Store history of minimum 1000 Frequency including time of DF, LF and Modulation and bearing quality.
13.	Calibration	Should cater for auto calibration as well as site error calibration
14.	Computer	Rugged laptop. GIS Software should facilitate display of maps digitized in DVD/DGN/DEM(in DTED) formats.
15.	External PC Port	All DF stations should provide a port for extending the control station database to a remotely connected PC.

### **DF ANTENNA SYSTEM**

16.	DF Antenna	a) Coverage of Azimuth 360 degree Elevation 60 degree
		b) Light weight , robust, telescopic type easy to raise (pneumatic/electromechanical/hand crankable) masts.
		c) Mast and antenna should be able to withstand high wind velocities of upto 150 Km/h.
		d) Height of the antenna mast should not be more than 10 meters from ground.
		e) Mast should be mounted on top of vehicle and should permit erection on ground upto 50 meters away from vehicle.
		f) All antenna accessories should be capable of being carried in suitable modification. To be made on the top/side of the vehicle.
17.	GPS Receiver	Should be available with each station of the system. Facility for manual entry of one's own location should also exist in the system.
18.	GPS Integration	Each station of the system should have an additional port for integration of GPS results

### **SEARCH AND INTERCEPTION RECEIVER**

19.	Frequency Band	20 Mhz-3000 MHz
20.	Memory scan	1500 Channel per second
21.	Scan rate search	Minimum 10 GHz/second
22.	Protected Frequency	Minimum 200
23.	Pre-settable scanning frequency Band	a) <u>Edge Scan</u> :- Facility to scan between specified lower and upper limits covering entire frequency band. b) Should be able to cover entire frequency band for scanning. c) Should be able to select a sub band for scanning. d) Should be able to protect frequencies and sub band from scanning.
24.	Antenna	Omani directional and directional with 6 db gain. The antenna should be software selectable from the scanning post.

### **INTRA SYSTEM COMMUNICATION**

25	Intra system communication (between DF stations in	a) Tactical VHF/UHF FM radio.
		b) Transmitting power minimum 20 W
		c) For voice and data communication between post of

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	a cluster)	DF Station. d) Should incorporate FH technologies for ECCM for communication between DF Stations. Intercommunication system should use only directional antennas. e) Small in size and lightweight. f) Minimum range 20 Km with suitable antenna system mounted on the vehicle.
26	Intra system communication (between DF stations and hand held terminal)	a) Tactical VHF/UHF FM radio b) Transmitter Power i) LVDS end Minimum 20 W. ii) Handheld 5W. c) For voice and data communication between LVDS and Hand Held terminals. d) Should incorporate digital secure communication technique/ commercial encryption of 32 bit or higher. e) Small in size and lightweight f) Minimum range 10 Km, with suitable antenna system

#### **POWER SUPPLY**

27	Power supply	a) System should be self contained for stabilized power requirement by providing rechargeable batteries and light weight noiseless generators. b) Should also be capable of operating from single phase 220 V AC with built in facility to charge the battery. A stabilizer should cater for this purpose. c) The battery pack should be capable of providing uninterrupted power supply for SIX Hours without charging. d) Circuit breakers should be catered in the system unit vehicle and in the power supply vehicle. e) Earthing protection should be catered in the system unit vehicle and in the power supply vehicle f) Noise level of the generator sets should be better than 86 dBA.
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**TECHNICAL SPECIFICATION OF NI-MH BATTERY FOR HANDHELD RADIO SET**

S/ NO.	SPECIFICATION	PARAMETERS
1	Application	Use with VHF/UHF Handheld Radio Set (Type & Model of Radio Set for which battery is required will be decided by user organization during procurement)
2	<b>Electrical</b>	
	a) Type of Battery Chemistry	Ni-MH (Nickel Metal Hydride)
	b) Rated Capacity	2000/2200/2300/2500 mAH or higher capacity @ C5 rating (Capacity of battery will be decided by user organization during procurement)
	c) Nominal Voltage	7.2 Volts
3	<b>Mechanical</b>	
	a) The battery casing should make a high strength polycarbonate /ABS blend.	
	b) The Battery casing should be bonded by ultrasonic welding.	
	c) The Cell should be inter connected by spot-welded through necessary circuit	
	d) The Battery to be made of premium grade cells to achieve- consistent capacity & longer lasting performance	
	e) The Battery should communicate with the Radio/chargers easily with minimal force insertion or in the same manner as the OEM supplied battery.	
	f) The battery should be equipped with spring loaded belt clip or belt clip (optional where as applicable)	
4	<b>Protection :-</b> Battery should be equipped with a protection circuit to protect from :- Over Temperature, Short Circuit & Reverse Polarity etc.	
5	<b>Description :-</b> i) The sleeve of cells used should preferably indicate the following :- Part Number/Month & Year of Manufacturer /Voltage of cell /Capacity of Cell/Country of Cell. ii) The label of the battery should be self destructive type and specified the following:- Battery voltage /Capacity/Chemistry of Cell/ Suitable Model of Set/Serial number of/Part of battery /Month & Year of Manufacturer & trade mark " Logo" of the firm to be embossed /heat stamped. iii) Clear instruction shall be given " To charge the battery on suitable charges".	
6	The battery should pass the following Environmental Tests mentioned as under as per IS: 9000 or any equivalent standard followed by Capacity Test @ C/5 rate. 1.Equipment shall be suitable for operation in the following environmental conditions. a. Operating Temp. Range : -10°C to +55°C b. Storage Temp. Range : -40°C to +70°C c. Relative Humidity : 95% Max at +40°C non- condensing	

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2. Tests to be conducted & Conditions of tests as per IS:9000

a) Dry Heat : Part III/SEC.5/1977 55°C ±2 °C, RH < 50 % , Duration 16 hours.

b) Damp Heat (Cyclic) Test: Part V/SEC.2/variant 1/1981 40°C (+/-)2°C, RH 95%  
Two cycles of 24 (12+12) hours each.

c) Cold Test : Part II/SEC . 4/1977 (-) 10° +/- 3°C, Duration 16 hours.

d) Drop Test (in packed : Part VII/SEC.3/1979 Six drops one on each condition face  
Height of fall 1000mm in case of hand held items and 500 mm in case of other items.

e) Vibration Test : Part VIII/1981 12 hours, 4 hours along with each axis , at 15- 150  
Hz and with amplitude of 0.15 mm/2g.

f) Storage Test : Part III/SEC.5/1977 & -40°C for 5 hours. Part II/SEC.4/1977 then  
raises the temperature to 70°C for 16 hours.

g) Bump Test: Part VII/SEC.2/1979 4000 bumps at peak acceleration of 400m/s sq.

3. Environmental test Report with equivalent or superior conditions would be  
acceptable.

4. The Functional tests and permissible degradation shall be as under.

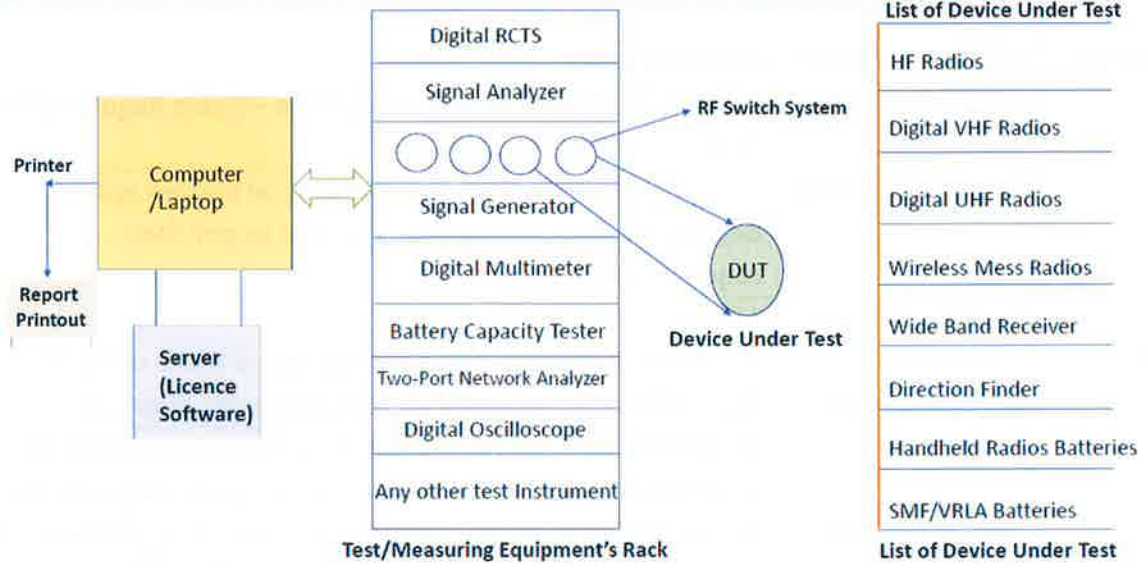
No degradation in battery capacity when measured at C/5 rate .



**TECHNICAL SPECIFICATION OF SEALED MAINTENANCE FREE /VRLA BATTERY**

SL No.	SPECIFICATION	PARAMETERS
1	Type of Battery Chemistry	SMF VRLA (Sealed Maintenance Free – Valve Regulated lead Acid)
2.	Nominal Capacity	7 to 200 AH @ C/20 rating (Capacity of battery will be decided by user during procurement as per their requirement)
3.	Nominal Voltage	12V
4.	Container / Cover Material	The battery container and casing should make of PC/PC + ABS/ ABS blend of newly developed better material
5.	Weight	As per JISC 8702 of IEC 60896-21/22 latest or similar to weight of branded manufacturer battery of rated capacity
6.	Dimension and Marking	As per JISC 8702 or IEC 60896-21/22 latest or similar to the size of branded manufacturer batteries of rated capacity.
7.	Terminal type	As per JISC or IEC 60896-21/22 or any standard.
8.	<p>The quoted battery should full fill the following specifications as per the JISC (Japanese Industrial Standards Committee) 8702/1998 or IEC 60896-21/22 latest or any equivalent standard.</p> <ul style="list-style-type: none"> <li>(i) General Requirements.</li> <li>(ii) Capacity Tests</li> <li>(iii) High rate discharge test</li> <li>(iv) Endurance in cycle</li> <li>(v) Charge retention</li> <li>(vi) Endurance in trickle application</li> <li>(vii) Gas recombination</li> <li>(viii) Resistance to vibration</li> <li>(ix) Resistance to shocks</li> <li>(x) Max. Permissible current.</li> </ul>	
9	<p>At least the following items shall be adequately designated on the battery:-</p> <ul style="list-style-type: none"> <li>(i) Type designation</li> <li>(ii) Nominal voltage</li> <li>(iii) Rated Capacity</li> <li>(iv) Month &amp; Year of Manufacturer</li> <li>(v) Supplier name and /or trade mark</li> <li>(vi) The battery shall carry a marking of polarity of both terminals by plus symbol (+) and minus symbol (-) on the lid adjacent to the terminals.</li> <li>(vii) Additional data such as recommended charging voltage, charging current, capacity at other discharge rates, battery mass and other instructions shall be supplied with the battery.</li> </ul>	

**Block Diagram of Proposed Automated Testing Solutions for Central Workshop**



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