

EXPRESSION OF INTEREST (EOI)

FOR

PROVIDING DESIGN AND DEVELOPMENT SERVICES AND ToT

FOR

SOFTWARE DEFINED RADIO (SDR).

R&D, ITI Limited

Bangalore Plant

Benaluru-560016

Global Expression of Interest (EoI) for short listing of a Design Partner for Design and Development of Software Defined Radio (SDR) and Solutions.

ITI Limited, a Central Public Sector Undertaking under the Department of Telecommunications, Ministry of Communications & IT, is a Leading Telecom equipment manufacturer and Turnkey solution provider in India. The Bangalore unit of ITI Limited is ISO 9001:2015 and ISO 14001:2015 certified, and is in the process of empanelling a Design Technology Partner for Design and Development of Software Defined Radio (SDR) solutions and provide technical support for the system integration.

ITI Ltd invites responses through sealed Expression Of Interest (EoI) from reputed design and development entities, having experience in the area of Design, Development, Test, Conduct field trials, help to obtain relevant product certifications and Transfer the Technology and it's IPR for the bulk manufacturing of the product at ITI Limited.

Schedule of this EOI & Address for submitting the EoI: -

S1. No	Schedule	Date
1	EOI Issue Date	05/05/2022
2	Last Date for Pre-bid Queries to be raised by Probable Developers in writing (by email)	19/05/2022
3	Tentative date of Pre-bid meeting of Probable developers at ITI Bangalore	26/05/2022
4	Response to Pre-bid Clarifications by ITI to Probable developers	02/06/2022
5	Address at which proposal in response to EOI is to be submitted	Asst. Executive Engineer Material Management Dept. R&D, Bangalore Plant, ITI limited, Dooravaninagar Bangalore - 560 016. Phone No.: 080-28503675 E-Mail: mmr_bgp@itiltd.co.in
6	Due date for submission of EOI by Email & Hard Copy by Post	30/06/2022@4PM(IST)
7	Opening of EoI bids	01/07/2022 @ 11:00 A.M(IST)

Submission of response to this notice inviting EOI shall be deemed to have been done after careful study and examination of this document with full understanding of its Scope, Terms, and Conditions & Implications. Interested parties from Indian firms and international firms may please contact the following official to raise Pre-bid Queries and any related information pertaining to this Expression of Interest:

The Contact details: Name : C P Dwivedi

Desig. : Dy. Manager (R&D) Mobile : +91 9483009259

E-Mail : cpdwivedi_bgp@itiltd.co.in

Selection of Interested Parties: The Interested Parties fulfilling the eligibility criteria and all other terms & conditions of this EOI shall be shortlisted as per the recommendation of the EOI evaluation committee of ITI Ltd. The shortlisted Interested Parties would be required to participate in the RFP to be floated by ITI ltd. upon completion of the short listing process.

PART - 1

INTRODUCTION

ITI Limited (herein after referred to as ITI in this document), a Public Sector Undertaking under the Department of Telecommunications, Ministry of Communications & IT, is a leading Telecom equipment manufacturer and solution provider in India. The major customers of ITI are BBNL, BSNL, Indian Defence, Paramilitary forces, Railways and Central & State govt bodies of India etc.

ITI intends to participate in upcoming tenders / RFPs for the design, Manufacturing & supply of Software Defined Radio (SDR) as per requirement of customers. Considering the bulk market requirement of the product, ITI is planning to empanel Design and Development Technology Partner who can undertake the total design of Software Defined Radio (SDR) solutions including hardware, firmware and application software, supporting and mentor the R&D team of ITI Limited to enable such design and engineering on its own. This EOI is released to seek interested technology Partner, who can design and develop Software Defined Radio (SDR) solutions of various types / Form factors required by end customer etc.

Prospective design partners need to respond to this EoI by providing detailed inputs with respect to the scope of this EOI.

This Expression of Interest (EOI) aimed at short-listing the eligible bidders. The shortlisted parties will be participating in RFP to be released later (after completing the EoI Process). The Request for Proposal (RFP) will be released only to the shortlisted bidders for feasibility study, preparation of detailed project report (DPR), and undertake total design of Software Defined Radio (SDR) solution with a standard (free) warranty of 2 years from the date of completion of development, Customer certification including hardware & Software paid maintenance for period of 05 years after the completion of Standard (free) warranty of 2 years. During the above period of 5 years, the selected developer of SDR Solutions will take up any of the Upgrades and Hardware & Firmware modifications as desired by ITI.

PART-2

SCOPE OF WORK

As per Scope of work, interested parties shall undertake and complete the following activities:

- (a) Development of Hardware and Software Design for Software Defined Radio (SDR) (i.e all variants such as Handheld (HH), Manpack, Manpack HF, Truck Ground, Truck Ground HF, AFV (Armoured Fighting Vehicles), AFV HF, Airborne SDRs, Heptr Configuration-1, Heptr Configuration-2, Air Traffic Controller (ATC), Ground Data Terminal (GTD) for SDR etc) as per applicable relevant standards.
- (b) Development of the SDR products and help ITI Ltd., getting it type approved with defence accredited laboratories & certifications.
- (c) Supporting ITI in the Coordination with customer for the field integration and testing of the product in their network.

(d) Identify the Requirement of tools and Test instruments for manufacturing the product for bulk manufacturing.

- (e) Complete Transfer of Technology (ToT) without any royalty, so as to enable ITI Ltd. to manufacture the product at ITI with transfer of IPR. International Firms may indicate their willingness for full transfer (Design ToT) to ITI; however, Manufacturing ToT is must for both Indian & International developers
- (f) Technical support in getting the clients / ITI's customer approval and Product acceptance.
- (g) Mentoring /Training of resources (ITI Manpower as well as Lab setup) to create the Design and Development Infrastructure for self-supporting of the product.

PART - 3

ELIGIBILITY CRITERIA

- 1) The Interested Parties shall have a minimum annual turnover of Rs.15 Crores (average) from the EOI specified/related services during the last three financial years preceding the current FY of 2021-22.
- The Interested Parties shall have experience for minimum of 03 years in providing technological design and development services for Software Defined Radio. (Satisfactory completion certificates from customers for the projects taken-up shall be submitted).
- 3) The Interested Parties should be the Original Design Manufacturer (ODM) and not a licencee. The Company should possess the entire IPR, Source Codes, Design and Documentation of the SDR.
- 4) The Interested Parties should be unconditionally willing to assign the entire existing IPR held by it to ITI and further all the IPR developed under the present Project of SDR by the Company should be exclusively owned and held by ITI.
- 5) The Interested Parties should demonstrate at least ONE fully formed and operational SDR in either V/UHF or HF Frequency Band with entire technical specifications on one Radio Link.
- 6) The Interested Parties shall have valid ISO certificate relevant to the services being offered.

EoI should consist of following information and documents duly signed as per format given in Annexure - I.

- (a) Brief description of Bidders organization specific to the scope of EOI.
- (b) Contributions in the field Software Defined Radio (SDR) solution with verifiable references.
- (c) Development work in the SDR products/services in the defence segment
- (d) Design Lab Infrastructure with the Developer and certifications obtained by them.
- (e) Hardware and Software design capability.

- (f) Details of any patents and IPRs(Proof of Patents shall be provided with EoI)
- (g) Awards/Accolades.
- (h) Publications on the subject matter of Software Defined Radio (SDR) solutions.
- (i) Collaboration if any with leading technological institutions in India and Abroad
- (j) A write-up of having understood the purpose and scope of EOI, with proposal to undertake with the time lines from the day of Go-ahead.

PART 4

GENERAL CONDITIONS:

- 1. Interested Parties shall send their proposal in single sealed cover to the following address: Research and Development, Bangalore Plant, ITI limited, Dooravaninagar Bangalore 560 016.Phone No.: 080-28503670E-Mail: mmr_bgp@itiltd.co.in
- 2. The last date for receiving the EoI is Date: 30/06/2022, 16.00 hrs (IST).
- 3. In case the date of submission of bid is declared to be a holiday, the EoI may be s ubmitted on the next working day of ITI.
- 4. In case there are any clarifications on this notification, please contact
 - Mr. C P Dwivedi at cpdwivedi_bgp@itiltd.co.in.
- 5. <u>Late offer:</u> Any offer received after the prescribed timeline shall be rejected and shall be returned unopened to the vendor.
- 6. <u>Language of offers:</u> The offers prepared by the vendor and all the correspondence and documents relating to the offers exchanged by the vendor, shall be in Englis h language.
- 7. <u>Authorized Signatory:</u> All certificates and documents received as part of the offer shall be signed by the Authorized Representative (signing is not mandatory for technical manuals or documentation). The power or authorization, or any other document consisting of adequate proof of the ability of the signatory to bind the vendor shall be submitted if demanded by ITI.
- 8. ITI reserves the right to suspend or cancel the EOI process at any stage, to accept, or reject any, or all offers at any stage of the process and / or to modify the process, or any part thereof, at any time without assigning any reason, without any obligation or liability whatsoever.
- 9. <u>Cost of EOI:</u> The vendor shall bear all costs associated with the preparation and submission of its EOI, including cost of presentation for the purposes of clarification of the offer, if so desired by ITI. ITI in any case will not be responsible or liable for those costs, regardless of the conduct or outcome of the EOI process.
- 10. The Vendor shall be ready to give clarifications on any part of the offer to ITI Ltd.
- 11. Amendment of EOI: At any time prior to the last date for receipt of offers, ITI,

may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective vendor, modify the EOI document by an amendment. In order to provide prospective vendor reasonable time in which to take the amendment into account in preparing their offers, ITI may, at their discretion, extend the last date for the receipt of offers and/or make other changes in the requirements set out in the Invitation for EOI.

12. <u>Disclaimer</u>: ITI and/or its officers, employees disclaim all liability from any loss or damage, whether foreseeable or not, suffered by any person acting on or refraining from acting because of any information including statements, information, forecasts, estimates or projections contained in this document or conduct ancillary to it whether or not the loss or damage arises in connection with any omission, negligence, default, lack of care or mis-representation on the part of ITI and/or any of its officers, employees.

PART - 5

EOI DOCUMENTS

The Response to EOI shall be submitted online (e-tender) on website and also hard copy in a single cover (clearly marked as "EOI for Providing services for Design and Develop ment and supply of Software Defined Radio (SDR)" which shall contain one-sealed cover with the following documents:

- a) Clause-by-clause compliance to this EOI (all parts).
- b) Supporting Documents for EOI technical requirements and guide line.
- c) Proposed Design Approach along with Architecture of each type of SDR with Block Schematic stated in Technical specifications
- d) Brochures
- e) Technical writeup/paper on the development done in the field of SDR

PART-6

EVALUATION PROCESS

- 1. The ITI shall evaluate the responses of the EOI and all supporting documents & documentary evidence. ITI may seek additional documents as it deems necessary during the process of Evaluation of Offers pertaining this EoI.
- 2. The responses shall be evaluated to validate competence of the applicant according to the supporting documents specified in this document.
- 3. The decision of ITI Evaluation Committee in the evaluation of responses to the EOI shall be final. No correspondence will be entertained outside the evaluation process of the Committee.
- 4. The Evaluation Committee reserves the right to reject the proposal.
- 5. As part of clarification, discussion and presentation (if required) on technical documents to be submitted. Technical write-up /paper on what has been develop by vendors.

PART-7

Presentation with Approach & Methodology

a) The Interested Parties shall give a presentation on the proposed scope of work mentioned. The presentation will be mandatory and any Interested Parties who does not fulfill the condition will be summarily rejected.

- b) The presentation will form part of the evaluation process. The date and venue of the presentation would be intimated by ITI soon after the EoI opening date.
- c) The presentation should provide a representative solution to integrate various aspects of the project as per the scope.
- d) Presentation shall be given in English.

PART - 8

QUERIES

- 1. All queries may be sent to the ITI Limited by post, or e-mail on or before Date: 17/05/2022.
- 2. All enquiries/clarifications from the Applicants, related to this EOI, must be directed in writing exclusively to the contact person. Enquiries received after the due date shall not be entertained.
- 3. The preferred mode of delivering questions is through e-mail. The queries by the applicants shall be raised in the following format.

Sl. NO.	Page No.	Clause of The EOI	Clarification needed

- 4 The corrigendum (if any) shall be intimated to vendors by email.
- 5 In order to provide prospective applicants reasonable time for taking the corrigendum into account, ITI may, at its discretion, extend the last date for the receipt of EOI proposals which shall be notified.

Annexure - I

Documents in support of meeting the eligibility conditions

Ref: R&D/SDR/ EOI/01

(Please fill details and enclose supporting documents wherever required &applicable.)

Sl. No.	Description	Remarks	Page No.
1.	Name of the Company		
2.	Contact Details (Name, Designation, Landline / Mobile No. , Email id, FAX No. , website etc.)		
3.	Organization Profile		
4.	Certificate of Incorporation / Registration details		
5.	Articles & Memorandum of Association with CIN No.		
6.	Area of Business for which firm is registered		
7.	Audited Annual Report / Accounts of P&L statements f or the financial years (FY 2018-19 FY 2019-20, FY 2020-21)		
8.	Annual turnover for the Financial years as per audited Accounts (FY 2018-19 FY 2019-20, FY 2020-21)		
9.	Net worth as per Audited Accounts for the Financial Ye ar (FY 2018-19 FY 2019-20, FY 2020-21)		
10.	GST Registration certificate		
11.	Copy of PAN certificate		
12.	Copy of IT returns filed during the past three years		
13.	Solvency Certificate issued by any scheduled bank during the last 6 months		
14.	Previous experience of handling similar projects/ works in the preceding four financial years (FY 2018-19, FY 2019-20, FY 2020-21, FY 2021-22)		
(a)	Details of POs (Purchase Orders) / Contracts Executed (Sample PO copies to be enclosed) in the field of SDRs		
(b)	Copy of Performance / Completion Certificates issued b y Customer, if any		
15.	Previous Experience with ITI Limited, if any		
16.	Man Power Details (Total of 100 Persons Min)		
(a)	Technical (Min of 80)		
(b)	Non-Technical		
17.	Not Black listed certificate (undertaking).		

18.	ISO or equivalent certificate	
19.	Any legal cases pending against the company? If any, details to be furnished.	

ANNEXURE-C

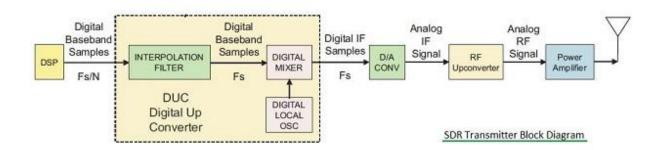
Specification for Software Defined Radio (SDR)

Project Background:

R&D ITI Ltd. intends to take up the development of Software Defined Radio (SDR). It is a special kind of advance Radio system in which, the physical layer functions are defined as software functionality i.e. a software code executes the role of a Circuit Board of the conventional radio and software-based filtering algorithms are used for frequency selection. The software generates the communication signal waveform, which is equivalent to a modulated signal, making SDR capable of communicating over a large portion of the spectrum, whilst supporting multiple protocols. The SDR is a multimode, multi-band and multi-functional radio requiring only a software upgrade for SDR operates in the HF, VHF, UHF, L-Band & S-Band frequency spectrum ranges using multiple protocols to provide secure interconnected network for communication. SDR is compatible with the legacy Military radio systems for feature enhancement. The SDR is also, a multi-channel radio, instantiated with softwaredefined waveforms capable of secure & jam-resistant, networked voice, data and video communication. It operates through a receiver, transmitter, software application and various other auxiliary systems and performs the functions of amplifiers, filters, mixers, modulators/ demodulators, and detectors. It has a broad frequency range by default and can be programmed to work at a specific frequency within the range. It can also be re-configured, thereby replacing multiple radios with a single unit and offers enhanced flexibility, cost-effectiveness, and interoperability to the user. The SDR is designed to provide communication in multi modes such as Air-to Air, Air-to-Ground and Groundto-Air configuration. The functionality and expandability is built upon an open architecture framework called the Software Communications Architecture (SCA).

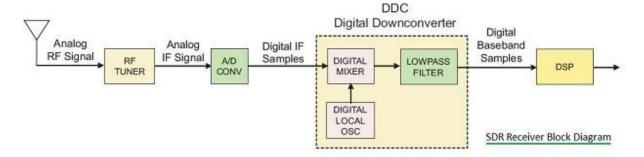
ITI looks forward to develop Handheld SDR, Manpack SDR, Manpack HF, Truck Ground SDR, Truck Ground HF,AFV (Armoured Fighting Vehicles) SDR,AFV HF,Heptr Configuration 1, Heptr Configuration 2, Air Traffic Controller (ATC) and Ground Data Terminal (GDT).

<u>Software Defined Radio (SDR) Architecture:</u> Transmitter:



SDR transmitter part consists of DSP, DUC (Digital Up Conversion), D/A converter, analog RF Up converter and power amplifier. The digital baseband part is coded in DSP which provides I/Q data as per different transmitter need. This is digitally up converted using DUC (Digital Up Conversion) with the use of digital LO (Local Oscillator) and digital mixer. The digital IF (Intermediate Frequency) samples are converted to analog IF. This analog IF is converted to analog RF using RF up converter. The RF signal is amplified before being transmitted over the air using respective antenna.

Receiver:



SDR receiver part consists of RF tuner, which converts RF signal to amplified IF signal, A/D converter converts analog IF into digital IF samples. The digital samples are passed to the DDC (Digital Down Conversion), which converts digital IF samples into digital baseband samples (Referred as I/Q data). DDC consists of digital mixer, digital Local Oscillator (LO) and low pass FIR filter. The digital baseband samples are passed to the DSP chip, where algorithms have been ported which does the functions such as demodulation, decoding & any other tasks if required.

This digital implementation based architecture is referred as SDR or Software Defined Radio. Often, FPGA is also used in place of DSP in this software defined architecture.

The baseband processing chain software on DSP/FPGA will help in correcting real time baseband and RF related impairments present in I/Q data with the use of advanced algorithms. Typically, algorithms such as DC offset correction, I/Q gain and phase imbalance correction, time, frequency and channel impairment correction are implemented in SDR receiver.

In addition to the main functions of SDR, an additional Secure module will be provisioned as a jackable / add-on card, which will be encrypting / decrypting the data using AES 256 Encryption Standard. ITI will develop a Proprietary Algorithm and port the same into the additional Secure module for getting suitable grading from SAG as per the specific grading requirements of various Customers.

The below sections will indicate the generic / provisional specifications of various form factors of SDRs. The EoI respondents are requested provide the detailed specifications as per their experience / expertise in the field of SDR.

1. Specifications:

Manpack SDR

Product Description:

- The Equipment shall be Single or Multichannel and Multi-band radio that will meet requirements of speech, data& video for ground-to-ground and groundto-air communications with software defined waveforms.
- The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication

Sl. No.	Parameter	Description	Remarks	
A	A. System Specifications			
i	Network Topology	Peer-Peer MANET		
ii	No. of Maximum Nodes	Narrow Band: 32 minimum; vendor to specify the number of Nodes Wide Band: 64 minimum; vendor to specify the number of Nodes		
iii	Transmission Protocols	UnicastMulticastBroadcast		
iv	Channel Bandwidth	25 KHz to 5 MHz (Typical); Vendor to specify the range of Bandwidth that is settable		
V	Data Rates	Narrow Band: 100 Kbps with Channel Bandwidth of < 500 KHz		

		Wide Band: 1 Mbps with Channel	
		Bandwidth of < 5 MHz;	
		Vendor to specify the max. data rates	
		supportedalong with Bandwidth	
vi	ECCM	Narrow Band: 100 Hops/sec	
VI	DCCW	minimum; Vendor to specify the	
		Hopping rate	
		Wide Band:500 Hops/sec minimum	
		(1000 Hops/sec preferred); Vendor to	
		specify the Hopping rate	
vii	Network Relay	Voice: 3 Hops minimum; Vendor to	
	Hops	specify the Network relay Hops	
		Data: 5 Hops minimum; Vendor to	
		specify the Network relay Hops	
viii	SCA (Software	Version 4.1 or latest; Vendor to	
	Communication	specify the version of SCA	
	Architecture)		
	Security	Functionality:	
ix	2	Cater for separate additional	
123		_	
		security module (to port AES	
		256 as well as to proprietary	
		algorithms SAG gradable	
		hardware module)	
		,	
		Hardware based, an	
		*	
		appropriate slot and interface	
		to be made available in the	
		SDR	
		Security support at	
		Transmission level and	
		Message level	
		 At transmission level, 	
		cryptographically	
		controlled frequency	
		hopping	
		o At message level,	
		capable of embedding	
		CPC approved user	
		specific cryptographic	
		security	
		Key Management:	
		The cryptographic algorithms and	
		keys shall be capable of being loaded	
		into the security device via a	
		handheld device/ Key Gun	
		Key Handling and Storage:	
		The SDR shall be capable of secure	
		storage of key information/data for	
		duration as specified by the user. The	
		SDR shall provide positive	
	1		l .

	T	I	1
		confirmation following each successful key loading from the key loading device and should notify in the event of key load failures. Emergency key erasure facility should also be provided	
		User Authentication: The SDR should be password protected for normal usage. Another password authentication should be provided for waveform and mission parameter programming.	
		Platform Integrity checking also shall be provided	
	Position,	GNSS and IRNSS:	
x	Navigation and Timing	The SDR should have an inbuilt GNSS receiver catering to multiple GNSS services like GLONASS and GPS. It should cater for IRNSS Services.	
		Synchronization:	
		The SDR should support	
		synchronization by both internal	
		timing source and by time signal	
		from GNSS receiver including IRNSS.	
		It is desirable to have an external	
		clock input also apart from timing	
		signal from GNSS Receiver.	
	Booting and	The SDR should bootup in less than	
xi	Switching	90 seconds; Vendor to indicate	
	g	booting time	
		It should be possible to load the	
		waveforms without power off and	
		rebooting; however, this loading of	
		waveforms will be with proper	
		authentication.	
		On powering up, the SDR should	
		offer selection of the last operated	
		waveform or any other waveform	
::	Ononotion -1	residing in the SDR.	
xii	Operational Modes	Squelch	
	MIOUES	Whisper	
		• Sulk	
-	DE Carrier 11	I.	
	. RF Specificatio	,	
i	Frequency	HF: 3 MHz to 30 MHz (Typical)	
	Range	V/UHF: 30 MHz to 512 MHz (Typical)	
		L: 1775 MHz to 1815 MHz (Typical)	
		S: 2200 MHz to 2250 MHz (Typical);	
		Vendor to specify the exact ranges for	

		each band	
Ii	Channel	25 KHz to 5 MHz (Typical); 1KHz to	
111	Bandwidth	8MHz preferable	
	Dandwidth	Actual BW supported by Manpack	
		SDR to be specified by vendor	
Iii	Channel	1 KHz	
***	Selection/		
	Frequency		
	resolution		
iv	Frequency	+/- 1 PPM or better	
	Accuracy	,	
v	RF Output	a. Transmitter Power: 0.5W to	
	Power	10W adjustable digitally / 5 to	
		50Watts	
		00 watto	
		b. Harmonics: better than 60dBc	
		c. Spurious :better than 70dBc	
		Vendor to indicate the values	
		of Tx Power, Harmonic level &	
		Spurious level	
vi	Carrier	Greater than 50 dB; Vendor to	
	Suppression	indicate the value	
vii	Sideband	Greater than 50 dB; Vendor to	
	Suppression	indicate the value	
viii	Receiver	a. Vendor to specify the actual	
	Sensitivity	receiver sensitivity separately	
		for AM, FM & other digital	
		modulation schemes along	
		with applicable BW& data	
		rates for BER of 1x10^-6	
		rates for BER of TATO	
		b. Approximate Coverage Range	
		to be specified for each	
		Modulation/ Waveform to be	
		specified	
ix	Image rejection	Greater than 60 dB;	
11/	mage rejection	Vendor to specify the value	
X	IF rejection	Greater than 80 dB;	
**	11 10,0001011	Vendor to specify the value	
xi	Adjacent	Greater than 50 dB;	
	channel	Vendor to specify the value	
	rejection		
C	. Waveforms		
	Essential	Laoppie	
i	Modern Digital	COFDM with Modulations	
	Waveforms	• QPSK	
		• 16 QAM	
		• 64 QAM	
		Any other waveform to be	

		specified by	the Vendor	
		Forward Error (
		CC or CTC	Correction	
			s: ½, ¾, 5/6	
		_	EC rates supported to	
		be specified		
C 2		be specified	by vendor	
i	Additional	• GMSK		The platform
	Waveforms	0.2.2.0		should be
		• DSSS		capable of
		• SOQPSK / C	CPM	supporting
				these additional
				waveforms
ii	Legacy	• AM		The platform
	Waveforms			should be
		• FM		capable of
		DOM		supporting
		• FSK		these legacy waveforms
		• PSK		wavelolilis
I	D. Human Machir	ne Interface		
i	Display	Front or extern	nal panel display with	
		1 1	or configuration,	
		monitoring and		
		Size & Type of Display to be specified by the Vendor		
ii	User Interface	Status LEDs	2	
		Status EED.	9	
		Keypad; deta	ails of keypad to be	
		specified by	the Vendor	
iii	Physical	PTT (Push to	Talk) Button	
	Buttons			
		Power/Volun	ne Knob	
		Display On/0	Off Button	
		• 16-position (Channel Selector	
I	E. Hardware			
E.1.	Interface Specifi	cations		
i	Interfaces	Audio	1 Analog Audio	
		Interface	channel with PTT	
		Data Interface	Ethernet	
			10/100/1000 BT &	
			1GE Opt (optional)	-
			RS232 RS485	-
			USB	1
	1	I	000	1

		Comtral	Ethomast intenfoce 9	
		Control Interface	Ethernet interface & SNMP Protocol	
ii	Built-in-Test		SNMP Protocol PBIT) : After Power-	
11	Duin-in-Test		tomatically and may	
			cond or less; Vendor	
			naximum time taken	
		to complete the		
		-	n functions such as	
		Rx & Tx modes		
			les and options and	
		their versions.	ies and options and	
		Initiated or Mar		
		the most in-depth of the built-in tests and may take about 10 seconds;		
		_	ate the maximum time	
		fot this manual		
		Continuous BI		1
			t that runs in the	
			d has no impact on	
			or radio settings. The	
			on may be updated	
		periodically who	en the radio is	
		switched ON ar	nd in operating mode;	
		vendor to indica	ate the minimum &	
		maximum perio	odicity of status	
		updation, which	h is settable.	
	Electrical Specific			
i	Power Input	The SDR should	-	
		_	uously for a minimum	
		_	rs at 1:9 Transmit to	
			ith rechargeable and	
		_	eries and for 12 hours	
			secondary batteries.	
			should have capability	
			+/- 20% volt AC	
			adapter.	
		using provided adapter.		†
			ption: Typical Power	
		Consumption to		
		Consumption to Vendor	ption: Typical Power to be specified by the	
		Consumption to Vendor Battery Chargin	ption: Typical Power to be specified by the ng:	
		Consumption to Vendor Battery Chargin Following Bat	ption: Typical Power to be specified by the ng: ttery chargers with	
		Consumption to Vendor Battery Chargin Following Bat suitable cons	ption: Typical Power to be specified by the ng:	
		Consumption to Vendor Battery Chargin Following Bat suitable comprovided	ption: Typical Power to be specified by the ng: ttery chargers with nectors should be	
		Consumption to Vendor Battery Chargin Following Bat suitable consumprovided a. Solar chargin	ption: Typical Power to be specified by the ng: ttery chargers with nectors should be arger which is foldable	
		Consumption to Vendor Battery Chargin Following Bat suitable comprovided a. Solar chargin and man	ption: Typical Power to be specified by the specified by the stery chargers with nectors should be arger which is foldable a portable	
		Consumption to Vendor Battery Chargir Following Bat suitable comprovided a. Solar charant man b. Mains St	ption: Typical Power to be specified by the ng: ttery chargers with nectors should be arger which is foldable a portable apply charger with a	
		Consumption to Vendor Battery Chargin Following Bat suitable comprovided a. Solar chargin and man b. Mains Suitable facility to	ption: Typical Power to be specified by the specified power specified by the specified specified by the specified specified by the specified specified specified by the specified by the specified specified by the specified	
		Consumption to Vendor Battery Charging Following Battery Charging Battery Charging Battery Charging Battery Charging Battery Charging	ption: Typical Power to be specified by the specified specified specified by the specified sp	
		Consumption to Vendor Battery Charging Following Battery Charging Battery Charging Battery Charging Battery Charging Battery Charging	ption: Typical Power to be specified by the specified power specified by the specified specified by the specified specified by the specified specified specified by the specified by the specified specified by the specified	
		Consumption to Vendor Battery Charging Following Battery Charging Battery Charging Battery Charging Battery Charging Battery Charging	ption: Typical Power to be specified by the specified points and specified specified by the specified specified by the specified specified by the specified specified by the spe	
		Consumption to Vendor Battery Charging Following Battery Charging Battery Charging Battery Charging Battery Charging Following Facility to Charging Feduce the battery Charging Feduce the Charging Feduce th	ption: Typical Power to be specified by the specified points and specified specified by the specified specified by the specified specified by the specified specified by the spe	

	Physical Specifica	itions	
i	Weight	Less than 4.5 Kg including battery.	
	8 3	Weight including&excluding battery	
		to be specified by the Vendor	
ii	Physical	Less than 350 mm x 250 mm x 100	
	Dimensions	mm; Vendor to specify the physical	
	Bimensions	dimension	
iii	Connectors	The SDR should provide interface	
111	Connectors	connectors for connecting data	
		terminal and other accessories	
:	Control		
iv	Control	The SDR should have front panel	
		having control and selector knobs	
		including sulk mode, display and	
		keypad for SDR functioning and	
		programming of parameters.	
		ualification Specifications	
i	EMI/EMC	As per latest MIL STD 461	
ii	Operating	-40 deg C to +70 deg C	
	Temperature		
iii	Storage	-40 deg C to +85 deg C	
	Temperature		
iv	Ruggedisation&	All the environmental tests including	
1 4	Environmental	temperature shall be carried out in	
	conditions	accordance with the latest version of	
	Conditions	JSS 55555 & MIL Std. 810F of later	
		as applicable/ as per Customer	
TD E	Daliabilita Maint	requirements as per relevant Tables	
i	Safety	enance and Miscellaneous Reverse Polarity	
1	Salety	Reverse Polarity	
		Power and line surge spikes	
		• Fower and fine surge spikes	
		Short and Open Circuit antenna	
		<u> </u>	
		connection	
		connection	
		connection • Over voltage / under voltage	
		connection	
		connectionOver voltage / under voltage protection	
ii	Emergency	connection • Over voltage / under voltage protection Facility for emergency erasure should	
ii	Emergency Erasure	connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and	
ii		connection • Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and	
ii		connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be	
ii		connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to	
ii		connection • Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms,	
ii		connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational	
ii		connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational parameters to make SDR not	
ii		connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational	
ii iii		connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational parameters to make SDR not	
	Erasure	connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational parameters to make SDR not functional. The equipment should be capable of	
	Erasure	connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational parameters to make SDR not functional. The equipment should be capable of continuous operation for at least 72	
	Erasure	connection Over voltage / under voltage protection Facility for emergency erasure should be inbuilt to erase all the keys and algorithm. Tamper detection and response mechanism should be inbuilt in the radio set to automatically erase algorithms, secrecy keys and other operational parameters to make SDR not functional. The equipment should be capable of	

	24 hours.	
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Handheld SDR

Product Description:

- The Equipment shall be Single or Multichannel and Multi-band radio that will meet requirements of speech and data for ground-to-ground and ground-to-air communications with software defined waveforms.
- The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication.

S1. No	Parameter	Description	Remarks		
4	A. System Specifications				
i	Network Topology	Peer-Peer MANET			
ii	No of Max Nodes	Narrow Band: 32 minimum; vendor to specify the number of Nodes Wide Band: 64 minimum; vendor to specify the number of Nodes			
iii	Transmission Protocols	UnicastMulticastBroadcast			
iv	Channel Bandwidth	25 KHz to 5 MHz (Typical); Actual BW supported by Handheld SDR to be specified by vendor			
v	Data Rates	Narrow Band: 100 Kbps with Channel Bandwidth of < 500 KHz; Wide Band: 1 Mbps with Channel Bandwidth of < 5 MHz; Vendor to specify the max. data rates supported along with applicable Bandwidth			
vi	ECCM	Narrow Band: 100 Hops / Sec minimum; Vendor to specify the Hopping rate Wide Band:1000 Hops/ Sec minimum; Vendor to specify the Hopping rate			
vii	Network Relay Hops	Voice: 3 Hops minimum; Vendor to specify the Network relay Hops Data: 5 Hops minimum; Vendor to specify the Network relay Hops			
viii	SCA (Software Communication Architecture)	Version 4.1 or latest; Vendor to specify the version of SCA			
	Security	Functionality:			

ix		 Cater for separate additional security 	
		module (To port AES 256 &	
		Proprietary Algorithm which is SAG	
		gradable hardware module)	
		gradus 1 122 a. (a.	
		Hardware based, an appropriate slot	
		and interface to be made available in	
		the SDR	
		Security support at Transmission level	
		and Message level	
		o At transmission level,	
		cryptographically controlled	
		frequency hopping	
		 At message level, capable of 	
		embedding CPC approved user	
		specific cryptographic security	
		Key Management:	
		The cryptographic algorithms and keys shall	
		be capable of being loaded into the security	
		device via a handheld device/ Key Gun	
		Key Handling and Storage:	
		The SDR shall be capable of secure storage of	
		key information/data for duration as	
		specified the user. The SDR shall provide	
		positive confirmation following each	
		successful key load from the key loading	
		device and should notify in the event of key	
		load failures. Emergency key erasure facility	
		should also be provided	
		User Authentication:	
		The SDR should be password protected for	
		normal usage. Another password authentication should be provided for	
		waveform and mission parameter	
		programming.	
x	Cellular Access	3GPP 3G/4G or better	
xi	Wi-Fi	Integrated Wi-Fi and Standards Supported	
		802.11a/b/g/n/ac/ax	
	Position,	GNSS and IRNSS:	
xii	Navigation and	The SDR should have an inbuilt GNSS	
	Timing	receiver catering to multiple GNSS services	
		like GLONASS and GPS. It should cater for	
		IRNSS Services.	
		Synchronization:	
		The SDR should support synchronization by	
		both internal timing source and by time	
		signal from GNSS receiver including IRNSS	
		It is desirable to have an external clock input	
		also apart from timing signal from GNSS	
		Receiver.	

	<u></u>		
	Booting and	The SDR should bootup in less than 90	
xiii	Switching	seconds; vendor to indicate this duration	
		It should be possible to load the waveforms	
		without power off and rebooting; however,	
		this loading will be with proper password	
		Authentication	
		On powering up, the SDR should offer	
		selection of the last operated waveform or	
		any other waveform residing in the SDR.	
xiv	Operational	Squelch	
	Modes	-	
		Whisper	
		• Sulk	
]	B. RF Specificati	ons	
	•		
i	Frequency	HF: 3 MHz to 30 MHz (Typical)	
	Range	V/UHF: 30 MHz to 512 MHz (Typical)	
		L: 1775 MHz to 1815 MHz (Typical)	
		S: 2200 MHz to 2250 MHz (Typical);	
		Vendor to specify the exact ranges for each	
		band	
ii	Channel	25 KHz to 5 MHz (Typical); Actual BW	
	Bandwidth	supported by Handheld SDR to be specified	
		by vendor	
iii	Channel	1 KHz	
	Selection/		
	Frequency		
	resolution		
iv	Frequency	+/- 1 PPM or better	
	Accuracy		
v	RF Output	a. Transmitter Power: 0.5W to 10W	
	Power	adjustable digitally; Vendor to specify	
		the transmitter power output range	
		b. Harmonics: better than 60dBc	
		c. Spurious :better than 70dBc	
vi	Carrier	Greater than 50 dB	
	Suppression		
vii	Sideband	Greater than 50 dB	
	Suppression		
viii	Receiver	a. Vendor to specify the actual receiver	
	Sensitivity	sensitivity separately for AM, FM &	
		other digital modulation schemes for	
		different data rates along with	
		applicable BW for BER of 1x10^-6	
		b. Approximate Coverage Range to be	
		specified for each Modulation/	
		Waveform to be specified	
	• .•	60.10	
1X	Image rejection	> 60 dB;	

	1	1	T.
		Vendor to specify the value	
X	IF rejection	> 80 dB;	
		Vendor to specify the value	
xi	Adjacent	>50 dB;	
	channel	Vendor to specify the value	
	rejection		
(C. Waveforms		
C.1	Essential		
i	Modern Digital	COFDM with Modulations	
	Waveforms	• QPSK	
		• 16 QAM	
		• 64 QAM	
		• Any other waveform to be specified by the	
		Vendor	
		Forward Error Correction	
		CC or CTC	
		• Coding Rates: ½, ¾, 5/6	
		Any other FEC rates supported to be	
		specified by vendor	
C.2	Desirable	1 3	
i	Additional	• GMSK	The
	Waveforms		platform
		• DSSS	should be
		SOQPSK / CPM	capable of
			supporting
			these
			additional
			waveforms
Ii	Legacy	• AM	The
	Waveforms	73.6	platform
		• FM	should be
		- ECV	capable of
		• FSK	supporting these
		• PSK	legacy
		T SIK	waveforms
	⊥ D. Human Machi	ne Interface	
i	Display	4-6"colour OLED display, 480x800pixels.	
		Capacitive touch screen with Gorilla Glass	
		Usable with gloves up to 4 mm thick.	
		Resistant to false actuation from fresh or	
		salt,	
		water, snow, dirt or grease	
ii	User Interface	Status LEDs	
		Keypad; details of keypad to be specified	
		by the Vendor	
iii	Physical	PTT (Push to Talk) Button	
	Buttons		

		Power/Volume Knob				
		Diamless O	l			
		• Display O	l			
		• 16-positio				
	∟ E. Hardware					
	Interface Specif					
i	Interfaces	Audio	1 Analog Audio channel with	l		
		Interface	PTT	l		
		Data	Ethernet 10/100/1000 BT &	l		
		Interface	1GE Opt (optional)_	l		
			RS232	l		
			RS485	l		
			USB	l		
		Control	Ethernet interface & SNMP	l		
		Interface	Protocol			
ii	Built-in-Test	Power-ON B	IT (PBIT) : After Power-ON, it	l		
		starts autom	natically and may take about 5	l		
		second or les	ss; Vendor to specify the max	l		
		time taken to	o complete the PBIT.	l		
		It tests the n	nain functions such as Rx & Tx	l		
		modes. It als	so detects installed modules and	l		
		options and	their versions.	l		
		Initiated or Manual BIT (IBIT): It is the most				
		in-depth of the built-in tests and may take				
		about 10 seconds; vendor to specify the				
		maximum time taken for this process				
		Continuous BIT (CBIT): It is a continuous				
			test that runs in the background and has no			
		impact on radio operation or radio settings.				
		The CBIT information may be updated periodically when the radio is switched ON				
			l			
		_	and in operating mode; vendor to indicate the			
			periodicity (Min & Max that is settable)			
	Electrical Specif		11.000 1 111			
i	Power Input		ld SDR should be capable of	l		
			tinuously for a minimum period	l		
		of 8 hours at 1:9 Transmit to Receive ratio				
		with rechargeable and disposable batteries				
		and for 12 hours with secondary batteries.				
		Vendor to indicate the Battery sizing.				
		The radio also should have capability to work				
		off 230 +/- 20% volt AC using provided				
		adapter.				
		Max. Power Consumption: To be specified by				
			or Handheld SDR			
		Battery Char		ı		
		_	Battery chargers with suitable	1		
			should be provided	ı		
			charger which is foldable and	ı		
		man p	portable	1		

		b. Mains Supply charger with a facility to
		increase the charging rate in order to
		reduce the charging time of the
		batteries.
		c. Vendor the specify the time for fully
		charging the Battery
	Physical Specific	ations
i	Weight	Less than 1 Kg including battery.
		Weight including &excluding battery to be
		specified by the Vendor
ii	Physical	Less than 100 mm(w) x 200(L) mm x 60
	Dimensions	mm(D)
		Vendor to specify the physical dimension
iii	Connectors	The SDR should provide interface connectors
		for connecting data terminal and other
		accessories
iv	Control	The SDR should have front panel having
		control and selector knobs including sulk
		mode, display and keypad for SDR
		functioning and programming of parameters.
E.4	Environmental C	Qualification Specifications
i	EMI/EMC	As per latest MIL STD 461
ii	Operating	-40 deg C to +70 deg C
	Temperature	
iii	Storage	-40 deg C to +85 deg C
111	Temperature	To deg e to 100 deg e
:	-	A11 41
iv	Ruggedisation&	All the environmental tests including
	Environmental	temperature shall be carried out in
	conditions	accordance with the latest version of JSS
		55555 as applicable/ as per Customer
		requirements as per relevant Tables as well
	D-11-1-114 36-1-	asMIL Std. 810F/G
		tenance and Miscellaneous
i	Safety	Reverse Polarity
		D 14
		Power and line surge spikes
		Short and Onen Cinavit antonna
		Short and Open Circuit antenna
		connection
		Over voltage / under voltage protection
<u>;:</u>	Emponentia in ai	Equility for among an arrange of and 1.1.
ii	Emergency	Facility for emergency erasure should be
	Erasure	inbuilt to erase all the keys and algorithm.
		Tamper detection and response mechanism
		should be inbuilt in the radio set to
		automatically erase algorithms, secrecy keys
		and other operational parameters to make
	D 11 1 111	SDR not functional.
iii	Reliability	The equipment should be capable of
		continuous operation for at least 72 hours on

a single set basis without breakdown. MTBF should be at least 5000 hours and MTTR not more than 24 hours. Vendor to indicate the	
MTBF vaue	

Vehicular SDR

Product Description:

- The Equipment shall be Single or Multichannel and Multi-band vehicle mountable radio that will meet requirements of speech and data for groundto-ground and ground-to-air communications with software defined waveforms.
- The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication while mounted on vehicle.

Sl. No.	Parameter	Description	Remarks		
A	A. System Specifications				
i	Network Topology	Peer-Peer MANET			
ii	No of Max Nodes	Narrow Band: 32 minimum; vendor to specify the number of Nodes Wide Band: 64 minimum; vendor to specify the number of Nodes			
iii	Transmission Protocols	UnicastMulticastBroadcast			
iv	Channel Bandwidth	25 KHz to 10 MHz (Typical); Vendor to specify the range of Bandwidth that is settable			
v	Data Rates	Narrow Band: 100 Kbps with Channel Bandwidth of < 500 KHz Wide Band: 1 Mbps with Channel Bandwidth of < 5 MHz; Vendor to specify the max. data rates supported			
vi	ECCM	Narrow Band: 100 Hops/sec minimum; Vendor to specify the Hopping rate Wide Band:500 Hops/sec minimum			

		(1000 Hops/sec preferred); Vendor	
		to specify the Hopping rate	
vii	Network Relay	Voice: 3 Hops minimum; Vendor to	
1	Hops	specify the Network relay Hops	
		Data: 5 Hops minimum; Vendor to	
		specify the Network relay Hops	
viii	SCA (Software	Version 4.1 or latest; Vendor to	
	Communication	specify the version of SCA	
	Architecture)		
	Security	Functionality:	
ix		 Cater for separate additional 	
		security module (SAG	
		gradable hardware module)	
		Hardware based, an	
		appropriate slot and interface	
		to be made available in the	
		SDR	
		Security support at	
		Transmission level and	
		Message level	
		• At transmission level,	
		cryptographically	
		controlled frequency	
		hopping	
		o At message level,	
		capable of embedding	
		CPC approved user	
		specific cryptographic	
		security	
		Key Management:	
		The cryptographic algorithms and	
		keys shall be capable of being	
		loaded into the security device via a handheld device/ Key Gun	
		Key Handling and Storage:	
		The SDR shall be capable of secure	
		storage of key information/data for	
		duration as specified the user. The	
		SDR shall provide positive	
		confirmation following each	
		successful key load from the key	
		loading device and should notify in	
		the event of key load failures.	
		Emergency key erasure facility	
		should also be provided	
		User Authentication:	
		The SDR should be password	
		protected for normal usage. Another	

	T		
		password authentication should be	
		provided for waveform and mission	
		parameter programming.	
	Position,	GNSS and IRNSS:	
X	Navigation and	The SDR should have an inbuilt	
	Timing	GNSS receiver catering to multiple	
		GNSS services like GLONASS and	
		GPS. It should cater for IRNSS	
		Services.	
		Synchronization:	
		The SDR should support	
		synchronization by both internal	
		timing source and by time signal	
		from GNSS receiver including IRNSS	
		It is desirable to have an external	
		clock input also apart from timing	
		signal from GNSS Receiver.	
	Booting and	The SDR should bootup in less than	
xi	Switching	90 seconds. Vendor to indicate the	
		max time for Bootup.	
		It should be possible to load the	
		waveforms without power off and	
		rebooting.	
		On powering up, the SDR should	
		offer selection of the last operated	
		waveform or any other waveform	
		residing in the SDR.	
xii	Operational	Squelch	
	Modes		
		• Whisper	
		• Sulk	
В	. RF Specifications		
		1177 O 1511 (O 0 1511	
i	Frequency Range	HF: 3 MHz to 30 MHz (Typical)	
		V/UHF: 30 MHz to 512 MHz	
		(Typical)	
		L: 1775 MHz to 1815 MHz (Typical)	
		S: 2200 MHz to 2250 MHz (Typical);	
		Vendor to specify the exact range for	
	Ole a march	each band	
ii	Channel Bandwidth	25 KHz to 10 MHz (Typical); 1KHz	
	Danawiath	to 10MHz preferable	
		Actual BW supported by Vehicular	
221	Champ -1	SDR to be specified by vendor	
iii	Channel	1 KHz	
	Selection/		
	Frequency		
i	resolution	1 / 1 DDM on 5 - ++	
iv	Frequency	+/- 1 PPM or better	
<u> </u>	Accuracy	Transmitter Desert O CW (
V	RF Output	a. Transmitter Power: 0.5W to	
	Power& Spurious	50W adjustable digitally	
	Ī	1	

	T	1	1
		b. Harmonics: Better than	
		60dBc	
		c. Spurious : better than 70dBc	
		Vendor to indicate the values	
		of Tx Power, Harmonic level &	
		Spurious level	
vi	Carrier	Greater than 50 dB	
	Suppression		
vii	Sideband Suppression	Greater than 50 dB	
viii	Receiver	a. Vendor to specify the actual	
	Sensitivity	receiver sensitivity separately	
		for AM, FM & other digital	
		modulation schemes along	
		with applicable data rate &	
		BW for BER of 1x10^-6	
		b. Approximate Coverage Range	
		to be specified for each	
		Modulation/ Waveform& data	
		rate to be specified	
ix	Image rejection	Greater than 60 dB;	
		Vendor to specify the value	
x	IF rejection	Greater than 80 dB;	
		Vendor to specify the value	
xi	Adjacent channel	Greater than 50 dB;	
	rejection . Waveforms	Vendor to specify the value	
C	. wavelorms		
	Essential		<u></u>
i	Modern Digital	COFDM with Modulations	i
	Waveforms	• QPSK	
		• 16 QAM	
		• 64 QAM	
		Any other waveform to be	
		specified by the Vendor	
		Forward Error Correction	
		CC or CTC	
		• Coding Rates: ½, ¾, 5/6	
		Any other FEC rates supported	
		to be specified by vendor	
C.2 I	 Desirable		l
i	Additional	• GMSK	The platform
	Waveforms		should be
		• DSSS	capable of
		SOQPSK / CPM	supporting
		,	these
			additional
			waveforms

Ref: R&D/SDR/ EOI/01

	T *** 0			7731 1 : C
ii	Legacy Waveforms	• AM		The platform should be
		• FM		capable of supporting
		• FSK		these legacy waveforms
		• PSK		
I	D. Human Machine I	nterface		I
i	Display	Front or external	panel display with	
Ì		support for	configuration,	
		monitoring and ap	_	
		Size & Type of Dis		
••	TT T	specified by the Ve	endor	
ii	User Interface	Status LEDs		
		 Keypad; details 	s of keypad to be	
		specified by the	e Vendor	
iii	Physical Buttons	PTT (Push to Ta	lk) Button	
		Power/Volume	Knob	
		Display On/Off	Button	
		• 16-position Cha	annel Selector	
_				
	E. Hardware			
	Interface Specificat		T	T
i	Interfaces	Audio Interface	1 Analog Audio	
			channel with	
		Data Interface	PTT Ethernet	
		Data interface	10/100/1000	
			BT & 1GE Opt	
			(optional)_	
			RS232	
			RS485	
			USB	
		Control Interface	Ethernet	
			interface &	
			SNMP Protocol	
	=	Power-ON BIT (PB)	•	
ii	Built-in-Test	ON, it starts autor	ž ž	
		take about 5 secon	· ·	
			taken to complete	
		the PBIT. It tests the main for	inctions such as	
	Rx & Tx modes. It also detects installed modules and options and			
Ì		their versions.	and options and	
				i e

		the most in-depth of the built-in	
		tests and may take about 10	
		seconds; Vendor to indicate this	
		value	
		Continuous BIT (CBIT): It is a	
		continuous test that runs in the	
		background and has no impact on	
		radio operation or radio settings.	
		The CBIT information may be	
		updated periodically when the radio	
		is switched ON and in operating mode; vendor to indicate the min &	
		max periodicity	
E 2 F	 Electrical Specificat		
i	Power Input	The SDR should be capable of	
1	Tower input	working continuously for a	
		minimum period of 8 hours with DC	
		input of 24V at 1:9 Transmit to	
		Receive ratio with rechargeable and	
		disposable batteries and for 12	
		hours with 12V 75Ah secondary	
		batteries.	
		The radio also should have	
		capability to work off 230 +/- 20%	
		volt AC using provided adapter.	
		Power Consumption: Typical Power	
		Consumption to be specified by the	
		Vendor	
		Battery Charging:	
		Following Battery chargers with	
		suitable connectors should be	
		provided	
		a. Solar charger which is	
		foldable and man portable	
		b. Mains Supply charger with a	
		facility to increase the	
		charging rate in order to	
		reduce the charging time of	
		the batteries.	
		c. Time to fully charge the	
		battery to be specified by the	
		Vendor.	
	Physical Specification		
i	Weight	Less than 15 Kg including battery.	
		Weight excluding battery to be	
••	D1 1	specified by the Vendor	
ii	Physical	Less than 350 mm x 275 mm x 250	
	Dimensions	mm; Vendor to specify the physical	
:::	On the production	dimension	
iii	Connectors	The SDR should provide interface	
		connectors for connecting data	
		terminal and other accessories	

iv	Control	The SDR should have front panel			
		having control and selector knobs			
		including sulk mode, display and			
		keypad for SDR functioning and			
		programming of parameters.			
	E.4 Environmental Qualification Specifications				
i	EMI/EMC	As per latest MIL STD 461			
ii	Operating	-40 deg C to +70 deg C			
	Temperature				
iii	Storage	40 deg C to +85 deg C			
	Temperature				
iv	Ruggedisation&	All the environmental tests including			
10	Environmental	temperature shall be carried out in			
	conditions	accordance with the latest version of			
	Conditions	JSS 55555 as applicable/ as per			
		Customer requirements as per			
		relevant Tables as well as MIL Std.			
		810F/G			
E 5 E	 	ance and Miscellaneous			
i	Safety	Reverse Polarity			
1	Daicty	Reverse Folding			
		Power and line surge spikes			
		Tower and mic surge spikes			
		Short and Open Circuit antenna			
		connection			
		Connection			
		Over voltage / under voltage			
		protection			
ii	Emorgonov	Facility for amarganay argains			
11	Emergency Erasure	Facility for emergency erasure should be inbuilt to erase all the			
	Liasuit	keys and algorithm. Tamper			
		detection and response mechanism			
		should be inbuilt in the radio set to			
		automatically erase algorithms,			
		, and the second			
		secrecy keys and other operational			
		parameters to make SDR not			
:::	D-1:-1:1:4	functional.			
iii	Reliability	The equipment should be capable of			
		continuous operation for at least 72			
		hours on a single set basis without			
		breakdown. MTBF should be at least			
		5000 hours and MTTR not more			
		than 24 hours. Vendor to indicate			
		the value of MTBF			

Truck Ground SDR

Product Description:

• The Equipment shall be Single or Multichannel and Multi-band radio that will meet requirements of speech and data for ground-to-ground and ground-to-air communications with software defined waveforms.

• The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication

SN	Parameter	Description	Remarks		
A.	A. System Specifications				
i	Network Topology	Peer-Peer MANET			
ii	No of Max Nodes	Narrow Band: 32 minimum; vendor to specify the number of Nodes Wide Band: 64 minimum; vendor to specify the number of Nodes			
iii	Transmission Protocols	UnicastMulticastBroadcast			
iv	Channel Bandwidth	25 KHz to 10 MHz (Typical); Vendor to specify the range of Bandwidth that is settable			
v	Data Rates	Narrow Band: 100 Kbps with Channel Bandwidth of < 500 KHz Wide Band: 1 Mbps with Channel Bandwidth of < 5 MHz; Vendor to specify the max. data rates supported			
vi	ECCM	Narrow Band: 100 Hops/sec minimum; Vendor to specify the Hopping rate Wide Band:500 Hops/sec minimum (1000 Hops/sec preferred); Vendor to specify the Hopping rate			
vii	Network Relay Hops	Voice: 3 Hops minimum; Vendor to specify the Network relay Hops Data: 5 Hops minimum; Vendor to specify the Network relay Hops			
viii	SCA (Software Communication Architecture)	Version 4.1 or latest; Vendor to specify the version of SCA			

	1		
ix	Security	 Cater for separate additional security module (SAG gradable hardware module) Hardware based, an appropriate slot and interface to be made available in the SDR Security support at Transmission level and Message level At transmission level, cryptographically controlled frequency hopping At message level, capable of embedding CPC approved user specific cryptographic 	
		security	
		Key Management: The cryptographic algorithms and keys shall be capable of being loaded into the security device via a handheld device/ Key Gun	
		Key Handling and Storage: The SDR shall be capable of secure storage of key information/data for duration as specified the user. The SDR shall provide positive confirmation following each successful key load from the key loading device and should notify in the event of key load failures. Emergency key erasure facility should also be provided	
	Position,	User Authentication: The SDR should be password protected for normal usage. Another password authentication should be provided for waveform and mission parameter programming; GNSS and IRNSS:	

	AT	/// ODD 1 111 1 11 11	
X	Navigation and	The SDR should have an inbuilt	
	Timing	GNSS receiver catering to multiple	
		GNSS services like GLONASS and	
		GPS. It should cater for IRNSS	
		Services.	
		Synchronization:	
		The SDR should support	
		synchronization by both internal	
		timing source and by time signal	
		from GNSS receiver including	
		IRNSS	
		It is desirable to have an external	
		clock input also apart from timing	
		signal from GNSS Receiver.	
	Booting and	The SDR should bootup in less	
xi	Switching	than 90 seconds; Vendor to	
		indicate the Booting time	
		It should be possible to load the	
		waveforms without power off and	
		rebooting.	
		On powering up, the SDR should	
		offer selection of the last operated	
		waveform or any other waveform	
		residing in the SDR.	
xii	Operational	Squelch	
	Modes	_	
		 Whisper 	
		_	
		• Sulk	
В.	RF Specification	• Sulk	
	-	• Sulk	
B.	Frequency	Sulk ns HF: 3 MHz to 30 MHz (Typical)	
	-	• Sulk ns HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz	
	Frequency	• Sulk ns HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical)	
	Frequency	• Sulk MF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz	
	Frequency	• Sulk MF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical)	
	Frequency	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz	
	Frequency	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical);	
	Frequency	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges	
i	Frequency Range	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band	
	Frequency Range	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz	
i	Frequency Range	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable	
i	Frequency Range	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck	
i	Frequency Range	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by	
i	Frequency Range Channel Bandwidth	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor	
i	Frequency Range Channel Bandwidth Channel	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by	
i	Frequency Range Channel Bandwidth Channel Selection/	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor	
i	Frequency Range Channel Bandwidth Channel Selection/ Frequency	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor	
i ii iii	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor 1 KHz	
i	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution Frequency	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor	
i ii iiv	Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor 1 KHz +/- 1 PPM or better	
i ii iii	Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy RF Output	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor 1 KHz +/- 1 PPM or better a. Transmitter Power: 0.5W to	
i ii iiv	Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy	• Sulk HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact ranges for each band 25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by Truck Ground SDR to be specified by vendor 1 KHz +/- 1 PPM or better	

		4. COM-44.	
		to 50Watts	
		b. Harmonics: Better than	
		60dBc	
		c. Spurious :Better than	
		70dBc	
		roube	
		Vendor to indicate the	
		values of Tx Power,	
		Harmonic level & Spurious	
		level	
vi	Carrier	Greater than 50 dB	
	Suppression		
vii	Sideband	Greater than 50 dB	
viii	Suppression	Nondanta angaitatha a atau 1	
V111	Receiver	a. Vendor to specify the actual	
	Sensitivity	receiver sensitivity	
		separately for AM, FM &	
		other digital modulation	
		schemes and data rate	
		along with applicable BW	
		for BER of 1x10^-6	
		b. Approximate Coverage	
		Range to be specified for	
		each Modulation/	
		Waveform to be specified	
		•	
ix	Image rejection	Greater than 60 dB;	
		Vendor to specify the value	
X	IF rejection	Greater than 80 dB;	
		Vendor to specify the value	
xi	Adjacent	Greater than 50 dB;	
	channel	Vendor to specify the value	
C	rejection Waveforms		
C.	Wavelullis		
C.1 E	Ssential		
i	Modern Digital	COFDM with Modulations	
	Waveforms	• QPSK	
		• 16 QAM	
		• 64 QAM	
		Any other waveform to be	
		specified by the Vendor	
		Forward Error Correction	
		CC or CTC	
		• Coding Rates: ½, ¾, 5/6	
		Any other FEC rates supported	
		to be specified by vendor	

C.2 I	Desirable			
i	Additional Waveforms	GMSKDSSSSOQPSK / C	PM	The platform should be capable of supporting these additional waveforms
ii	Legacy Waveforms	AM (SSB & DFM (Narrow DFSKPSK	OSB) Band & Wideband	The platform should be capable of supporting these legacy waveforms
D.	. Human Machin	e Interface		
i	Display		pisplay to be	
ii	User Interface	Status LEDs	ils of keypad to be	
iii	Physical Buttons	 PTT (Push to ' Power/Volum Display On/C 16-position C 	e Knob	
E.	Hardware			
E.1.	Interface Specific	cations		
i	Interfaces	Audio Interface Data Interface	1 Analog Audio channel with PTT Ethernet 10/100/1000 BT & 1GE Opt (optional)_ RS232 RS485 USB	
		Control Interface	Ethernet interface & SNMP Protocol	

		Power-ON BIT (PBIT) : After Power-		
ii	Built-in-Test	ON, it starts automatically and		
	20	may take about 5 second or less;		
		Vendor to specify the time taken		
		to complete the PBIT.		
		It tests the main functions such		
		as Rx & Tx modes. It also detects		
		installed modules and options and		
		their versions.		
		Initiated or Manual BIT (IBIT): It		
		is the most in-depth of the built-in		
		tests and may take about 10		
		seconds; Vendor to specify max		
		time for Manual BIT		
		Continuous BIT (CBIT): It is a		
		continuous test that runs in the		
		background and has no impact on		
		radio operation or radio settings.		
		The CBIT information may be		
		updated PERIODICALLY when the		
		radio is switched ON and in		
		operating mode; vendor to indicate		
		the main & max time settable		
E.2 E	lectrical Specific	ations		
i	Power Input	The SDR should be capable of		
	_	working continuously for a		
		minimum period of 8 hours with		
		24 V battery at 1:9 Transmit to		
		Receive ratio with rechargeable		
		and disposable batteries; vendor		
		to indicate the Battery capacity		
		The radio also should have		
		capability to work off 230 +/- 20%		
		volt AC using provided adapter.		
		Power Consumption: Typical		
		Power Consumption to be		
		specified by the Vendor		
		Battery Charging:		
		Following Battery chargers with		
		suitable connectors should be		
		provided		
		a. Solar charger which is		
		foldable and man portable		
		b. Mains Supply charger with		
		a facility to increase the		
		charging rate in order to		
		reduce the charging time of		
		the batteries.		
		c. Time to fully charge the		
		battery to be specified by		
		the Vendor.		
E 3 D	hysical Specifica			
ம்.3 F	E.3 Physical Specifications			

			<u></u>
i	Weight	Less than 15 Kg including battery.	
		Weight excluding battery to be	
		specified by the Vendor	
ii	Physical	Less than 350 mm x 250 mm x	
	Dimensions	200 mm; Vendor to specify the	
		physical dimension	
iii	Connectors	The SDR should provide interface	
		connectors for connecting data	
		terminal and other accessories	
iv	Control	The SDR should have front panel	
		having control and selector knobs	
		including sulk mode, display and	
		keypad for SDR functioning and	
		programming of parameters.	
E.4	Environmental O	ialification Specifications	
i	EMI/EMC	As per latest MIL STD 461 G	
ii	Operating	-40 deg C to +70 deg C	
	Temperature		
iii	Storage	40 deg C to +85 deg C	1
111	Temperature	To deg e to 103 deg e	
iv	Ruggedisation&	All the environmental tests	
	Environmental	including temperature shall be	
	conditions	carried out in accordance with the	
		latest version of JSS 55555 as	
		applicable/ as per Customer	
		requirements as per relevant	
		Tables as well as MIL Std. 810F/G	
E.5	Reliability, Maint	enance and Miscellaneous	
i	Safety	Reverse Polarity	
		Power and line surge spikes	
		Short and Open Circuit	
		antenna connection	
		Over voltage / under voltage	
		protection	
		protection	
ii	Emergency	Facility for emergency erasure	
	Erasure	should be inbuilt to erase all the	
		keys and algorithm. Tamper	
		detection and response	
		mechanism should be inbuilt in	
		the radio set to automatically	
		erase algorithms, secrecy keys and	
		other operational parameters to	
		make SDR not functional.	
iii	Doliobility		
1111	Reliability	The equipment should be capable	
		of continuous operation for at	
		least 72 hours on a single set basis without breakdown. MTBF	
Ī		should be at least 5000 hours and	

Ref: R&D/SDR/ EOI/01 Date: 04-05-2022

MTTR not more than 24 hours;	
Vendor to indicate the MTBF	
Value	

Airborne SDR

Product Description:

- The Equipment shall be Single or Multichannel and Multi-band radio that will meet requirements of speech, Video and data for ground-to-ground and ground-to-air communications with software defined waveforms.
- The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication

SN	Parameter	Description	Remarks
A	. System Specifi	cations	
i	Network	Peer-Peer MANET	
1	Topology	T CCI-I CCI IVIANIZI	
ii	No of Max	Narrow Band: 32 minimum;	
	Nodes	vendor to specify the number of	
		Nodes	
		Wide Band: 64 minimum; vendor	
		to specify the number of Nodes	
iii	Transmission	• Unicast	
	Protocols		
		Multicast	
		Broadcast	
iv	Channel	25 KHz to 10 MHz (Typical);	
IV	Bandwidth	Vendor to specify the range of	
	Dandwidth	Bandwidth that is settable	
v	Data Rates	Narrow Band: 100 Kbps with	
	Bata Rates	Channel Bandwidth of < 500 KHz	
		Wide Band: 1 Mbps with Channel	
		Bandwidth of < 5 MHz;	
		Vendor to specify the max. data	
		rates supported	
vi	ECCM	Narrow Band: 100 Hops/sec	
		minimum; Vendor to specify the	
		Hopping rate	
		Wide Band:500 Hops/sec	
		minimum (1000 Hops/sec	
		preferred); Vendor to specify the	
		Hopping rate	
vii	Network Relay	Voice: 3 Hops minimum; Vendor	
	Hops	to specify the Network relay Hops	

	T		
		Data: 5 Hops minimum; Vendor to	
	0.04 (0.0	specify the Network relay Hops	
viii	SCA (Software	Version 4.1 or latest; Vendor to	
	Communication	specify the version of SCA	
	Architecture)		
_	Security	Functionality:	
ix		 Cater for separate 	
		additional security module	
		(SAG gradable hardware	
		module)	
		,	
		 Hardware based, an 	
		appropriate slot and	
		interface to be made	
		available in the SDR	
		Security support at	
		Transmission level and	
		Message level	
		o At transmission	
		level,	
		cryptographically	
		controlled frequency	
		hopping	
		o At message level,	
		capable of	
		embedding CPC	
		approved user	
		specific	
		<u> </u>	
		cryptographic	
		security	
		Key Management:	
		The cryptographic algorithms and	
		keys shall be capable of being	
		loaded into the security device via	
		a handheld device/ Key Gun	
		Key Handling and Storage: The SDR shall be capable of	
		secure storage of key	
		information/data for duration as	
		specified the user. The SDR shall	
		provide positive confirmation	
		following each successful key load	
		from the key loading device and	
		should notify in the event of key	
		load failures. Emergency key	
		erasure facility should also be	
		provided	
		User Authentication:	
		The SDR should be password	

		protected for normal usage.	
		Another password authentication	
		should be provided for waveform	
		and mission parameter	
		programming.	
	Docition	GNSS and IRNSS:	
	Position,		
X	Navigation and	The SDR should have an inbuilt	
	Timing	GNSS receiver catering to multiple	
		GNSS services like GLONASS and	
		GPS. It should cater for IRNSS	
		Services.	
		Synchronization:	
		The SDR should support	
		synchronization by both internal	
		timing source and by time signal	
		from GNSS receiver including	
		IRNSS	
		It is desirable to have an external	
		clock input also apart from timing	
		signal from GNSS Receiver.	
	Booting and	The SDR should bootup in less	
xi	Switching	than 90 seconds; Vendor to	
		indicate the max booting time	
		It should be possible to load the	
		waveforms without power off and	
		rebooting.	
		On powering up, the SDR should	
		offer selection of the last operated	
		waveform or any other waveform	
		ı	
•••	0	residing in the SDR.	
xii	Operational	• Squelch	
	Modes		
		• Whisper	
		• Sulk	
E	3. RF Specification	ns	
i	Frequency	HF: 3 MHz to 30 MHz (Typical)	
	Range	V/UHF: 30 MHz to 512 MHz	
		(Typical)	
		L: 1775 MHz to 1815 MHz	
		(Typical)	
		S: 2200 MHz to 2250 MHz	
		(Typical);	
		Vendor to specify the exact range	
		for each band	
ii	Channel	25 KHz to 10 MHz (Typical); 1KHz	
111	Bandwidth	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	
	Danuwlum	to 10MHz preferable	
		Actual BW supported by Airborne	
T	01 1	SDR to be specified by vendor	
Iii	Channel	1 KHz	
	Selection/		

	Frequency	
	Frequency resolution	
iv	Frequency	+/- 1 PPM or better
IV	Accuracy	1/- 111 W Of Better
v	RF Output	a. Transmitter Power: 0.5W to
	Power	10W adjustable digitally / 5
		to 50Watts
		to oowatts
		b. Harmonics: 60dBc
		c. Spurious : 70dBc
vi	Carrier	Greater than 50 dB
	Suppression	
vii	Sideband	Greater than 50 dB
	Suppression	
viii	Receiver	a. Vendor to specify the actual
	Sensitivity	receiver sensitivity
		separately for AM, FM &
		other digital modulation
		schemes along with data
		tae& applicable BW for BER
		of 1x10^-6
		b. Approximate Coverage
		Range to be specified for
		each Modulation/
		Waveform to be specified
ix	Image rejection	Greater than 60 dB;
		Vendor to specify the value
X	IF rejection	Greater than 80 dB;
xi	Adiacont	Vendor to specify the value Greater than 50 dB;
XI	Adjacent channel	Vendor to specify the value
	rejection	vendor to speeny the value
C	. Waveforms	
	Essential	
i	Modern Digital	COFDM with Modulations
	Waveforms	• QPSK
		• 16 QAM
		• 64 QAM
		Any other waveform to be
		specified by the Vendor
		Forward Error Correction
		CC or CTC
		• Coding Rates: ½, ¾, 5/6
		Any other FEC rates supported
		to be specified by vendor
C.2 1	 Desirable	
		

i	Additional	• GMSK		The platform
	Waveforms			should be
		• DSSS		capable of
		SOQPSK / C	PM	supporting
				these additional
				waveforms
ii	Legacy	• AM		The platform
11	Waveforms	Alvi		should be
	, avererane	• FM		capable of
				supporting
		• FSK		these legacy
				waveforms
		• PSK		
	TT M1-:	- I		
D.	. Human Machin	e interiace		
i	Display		nal panel display	
			for configuration,	
		monitoring and		
		Size & Type of D		
ii	User Interface	specified by theStatus LEDs	vendor	
11	Osci interiace	Status LEDS		
		Keypad; deta	ils of keypad to be	
		specified by t	U -	
iii	Physical	PTT (Push to '		
	Buttons	,	,	
		Power/Volum	e Knob	
		• Display On/C	off Button	
		• 16-position C	hannel Selector	
		o To position e		
E.	. Hardware			
E.1.	Interface Specifi	cations		
i	Interfaces	Audio Interface	1 Analog Audio	
			channel with PTT	
		Data Interface	Ethernet	
			10/100/1000 BT	
			& 1GE Opt	
			(optional)_	
			RS232	
			RS485 USB	
		Control	Ethernet	
		Interface	interface &	
		IIICIICC	SNMP Protocol	
		Power-ON BIT (F	PBIT) : After Power-	
ii	Built-in-Test	ON, it starts aut	•	
			5 second or less;	
		Vendor to specif	y the time taken	

	1	
		to complete the PBIT.
		It tests the main functions such
		as Rx & Tx modes. It also detects
		installed modules and options and
		their versions.
		Initiated or Manual BIT (IBIT): It
		is the most in-depth of the built-in
		tests and may take about 10
		seconds; vendor to indicate Max
		Manual BIT duration
		Continuous BIT (CBIT): It is a
		continuous test that runs in the
		background and has no impact on
		radio operation or radio settings.
		The CBIT information may be
		updated every second when the
		radio is switched ON and in
		operating mode
	Electrical Specific	
i	Power Input	The SDR should be capable of
		working continuously for a
		minimum period of 8 hours with
		DC supply of 24 V at 1:9 Transmit
		to Receive ratio with rechargeable
		and disposable batteries; Vendor
		to indicate the Battery capacity
		The radio also should have
		capability to work off 230 +/- 20%
		volts AC using provided adapter.
		Power Consumption: Typical
		Power Consumption to be
		specified by the Vendor
		Battery Charging:
		Following Battery chargers with
		suitable connectors should be
		provided
		a. Solar charger which is
		foldable and man portable
		b. Mains Supply charger with
		a facility to increase the
		charging rate in order to
		reduce the charging time of
		the batteries.
		c. Time to fully charge the
		battery to be specified by
		the Vendor.
	Physical Specifica	
i	Weight	Less than 5 Kg including battery.
		Weight excluding battery to be
	D1	specified by the Vendor
ii	Physical	Less than 350 mm x 250 mm x
	Dimensions	250 mm; Vendor to specify the

		physical dimension	
iii	Connectors	The SDR should provide interface	
		connectors for connecting data	
		terminal and other accessories	
iv	Control	The SDR should have front panel	
		having control and selector knobs	
		including sulk mode, display and	
		keypad for SDR functioning and	
		programming of parameters.	
E.4 I	Environmental Qu	alification Specifications	
i	EMI/EMC	As per latest MIL STD	
ii	Operating	-40 deg C to +70 deg C	
	Temperature	3	
iii	Storage	-40 deg C to +85 deg C	
111	Temperature	To deg e to 100 deg e	
:	-	A11 +12 0 0000000000000000000000000000000	
iv	Ruggedisation&	All the environmental tests	
	Environmental	including temperature shall be	
	conditions	carried out in accordance with the	
		latest version of JSS 55555 as	
		applicable/ as per Customer	
		requirements as per relevant	
D E I	 	Tables&MIL Std. 810F/G	
i	T .		
1	Safety	Reverse Polarity	
		Power and line surge spikes	
		Short and Open Circuit	
		antenna connection	
		antenna connection	
		Over voltage / under voltage	
		protection	
ii	Emergency	Facility for emergency erasure	
	Erasure	should be inbuilt to erase all the	
		keys and algorithm. Tamper	
		detection and response	
		mechanism should be inbuilt in	
		the radio set to automatically	
		erase algorithms, secrecy keys and	
		other operational parameters to	
		make SDR not functional.	
iii	Reliability	The equipment should be capable	
		of continuous operation for at	
		least 72 hours on a single set	
		basis without breakdown. MTBF	
		should be at least 5000 hours and	
		MTTR not more than 24 hours;	
		MTBF to be specified by the	
	Î.	Vendor	

Ref: R&D/SDR/ EOI/01 Date: 04-05-2022

Air Traffic Control (ATC) SDR

Product Description:

• The Equipment shall be Single or Multichannel and Multi-band radio that will meet requirements of speech, Video and data for ground-to-ground and ground-to-air communications with software defined waveforms.

• The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication

SN	Parameter	Description	Remarks
A.	System Specific	eations	
•	NT / 1	D D MANDO	
i	Network Topology	Peer-Peer MANET	
ii	No of Max Nodes	Narrow Band: 32 minimum; vendor to specify the number of Nodes Wide Band: 64 minimum; vendor to specify the number of Nodes	
iii	Transmission Protocols	UnicastMulticastBroadcast	
iv	Channel Bandwidth	25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable; Vendor to specify the range of Bandwidth that is settable	
v	Data Rates	Narrow Band: 100 Kbps with Channel Bandwidth of < 500 KHz Wide Band: 1 Mbps with Channel Bandwidth of < 5 MHz; Vendor to specify the max. data rates supported	
vi	ECCM	Narrow Band: 100 Hops/sec minimum; Vendor to specify the Hopping rate Wide Band:500 Hops/sec minimum (1000 Hops/sec preferred); Vendor to specify the Hopping rate	
vii	Network Relay Hops	Voice: 3 Hops minimum; Vendor to specify the Network relay Hops Data: 5 Hops minimum; Vendor to specify the Network relay Hops	
viii	SCA (Software Communication Architecture)	Version 4.1 or latest; Vendor to specify the version of SCA	
	Security	Functionality:	

Ref: R&D/SDR/ EOI/01

ix		 Cater for separate additional security module (SAG gradable hardware module) Hardware based, an appropriate slot and interface to be made available in the SDR Security support at Transmission level and Message level At transmission level, cryptographically controlled frequency hopping At message level, capable of embedding CPC approved user specific cryptographic 	
		embedding CPC	
		_	
		security	
		Key Management:	
		The cryptographic algorithms and	
		keys shall be capable of being	
		loaded into the security device via a handheld device/ Key Gun	
		Key Handling and Storage:	
		The SDR shall be capable of	
		secure storage of key information/data for duration as	
		specified the user. The SDR shall	
		provide positive confirmation following each successful key load	
		from the key loading device and	
		should notify in the event of key load failures. Emergency key	
		erasure facility should also be	
		provided	
		User Authentication:	
		The SDR should be password protected for normal usage.	
		protected for normal usage. Another password authentication	
		should be provided for waveform	
		and mission parameter	
	Position,	programming. GNSS and IRNSS:	
	ı		

			•
X	Navigation and Timing	The SDR should have an inbuilt GNSS receiver catering to multiple GNSS services like GLONASS and GPS. It should cater for IRNSS Services.	
		Synchronization: The SDR should support synchronization by both internal timing source and by time signal from GNSS receiver including IRNSS It is desirable to have an external clock input also apart from timing	
xi	Booting and Switching	signal from GNSS Receiver. The SDR should bootup in less than 90 seconds; Vendor to indicate Max booting time It should be possible to load the	
		waveforms without power off and rebooting. On powering up, the SDR should	
		offer selection of the last operated waveform or any other waveform residing in the SDR.	
xii	Operational Modes	SquelchWhisper	
		• Sulk	
B.	RF Specification	ns	
i	Frequency Range	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band	
ii	Channel Bandwidth	25 KHz to 5 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by ATC SDR to be specified by vendor	
iii	Channel Selection/ Frequency resolution	1 KHz	
iv	Frequency Accuracy	+/- 1 PPM or better	
v	RF Output Power	a. Transmitter Power: 0.5W to	

		ETTT 1: . 1.1 1: . 11 / E	I
		5W adjustable digitally / 5	
		to 50Watts	
		1. Hannanian Dattan than	
		b. Harmonics: Better than	
		60dBc	
		c. Spurious :Better than	
		70dBc	
vi	Carrier	Greater than 50 dB; Vendor to	
	Suppression	specify the value	
vii	Sideband	Greater than 50 dB; Vendor to	
	Suppression	specify the value	
viii	Receiver	a. Vendor to specify the actual	
	Sensitivity	receiver sensitivity	
		separately for AM, FM &	
		other digital modulation	
		schemes for varios data	
		rates along with applicable	
		BW for BER of 1x10^-6	
		b. Approximate Coverage	
		Range to be specified for	
		each Modulation/	
		Waveform to be specified	
ix	Image rejection	> 60 dB;	
		Vendor to specify the value	
x	IF rejection	> 80 dB;	
		Vendor to specify the value	
xi	Adjacent	>50 dB;	
	channel	Vendor to specify the value	
	rejection		
C.	Waveforms		
C.1 E	Ssential		
i	Modern Digital	COFDM with Modulations	
	Waveforms	• QPSK	
		• 16 QAM	
		• 64 QAM	
		Any other waveform to be	
		specified by the Vendor	
		Forward Error Correction	
		CC or CTC	
		• Coding Rates: ½, ¾, 5/6	
		Any other FEC rates supported	
		to be specified by vendor	
	Desirable 1	911911	m1 1 . C
ii	Additional	• GMSK	The platform
1	Waveforms	• DSSS	should be capable of
1			

		GOODGIZ / O	DM.	arran antin a
		SOQPSK / C	PM	supporting these
				additional
				waveforms
iii	Legacy	• AM		The platform
111	Waveforms	Alvi		should be
	Waveloring	• FM		capable of
		1 1/1		supporting
		• FSK		these legacy
				waveforms
		• PSK		
1	 D. Human Machir	 ne Interface		
-	.			
i	Display	Front or exter	nal panel display	
			for configuration,	
		monitoring and		
		Size & Type of D		
		specified by the	Vendor	
ii	User Interface	Status LEDs		
		77 1 1 1	'1 C1 1 1	
		0.2	ils of keypad to be	
		specified by	the Vendor	
iii	Physical	• PTT (Push to	Talk) Button	
	Buttons			
		Power/Volum	e Knob	
		Diamless On 10	VCC Doubbarra	
		Display On/C	ni Bullon	
		• 16-position C	hannel Selector	
		To position o		
]	E. Hardware			
E 1	. Interface Specifi	laatiama		
i	Interface specific	Audio Interface	1 Analog Audio	
1	Interfaces	radio interiace	channel with PTT	
		Data Interface	Ethernet	
		Bata interface	10/100/1000 BT	
			& 1GE Opt	
			(optional)_	
			RS232	
			RS485	
			USB	
		Control	Ethernet	
		Interface	interface &	
			SNMP Protocol	
ii	Built-in-Test	Power-ON BIT (F	PBIT) : After Power-	
		ON, it starts aut	•	
		may take about	5 second or less;	
		_	y the time taken	
		to complete the		
		It tests the main		
l		as Rx & Tx modes. It also detects		

installed modules and options and their versions. Initiated or Manual BIT (IBIT): It is the most in-depth of the built-in tests and may take about 10 seconds; Vendor to indicate max IBIT duration Continuous BIT (CBIT): It is a continuous test that runs in the background and has no impact on radio operation or radio settings. The CBIT information may be updated periodically when the radio is switched ON and in operating mode; Vendor to indicate the min & max periodicity that is settable E.2 Electrical Specifications i Power Input The SDR should be capable of working continuously for a minimum period of 8 hours with DC supply of 24V at 1:9 Transmit to Receive ratio with rechargeable and disposable batteries; Vendor to indicate the Battery capacity for Secondary batteries The radio also should have capability to work off 230 +/- 20% volts AC using provided adapter. Power Consumption: Typical Power Consumption to be specified by the Vendor Battery Charging: Following Battery chargers with suitable connectors should be provided a. Solar charger which is foldable and man portable b. Mains Supply charger with a facility to increase the charging rate in order to reduce the charging time of the batteries. c. Time to fully charge the battery to be specified by the Vendor. E.3 Physical Specifications i Weight Less than 5 Kg including battery.				
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the Vendor. E.3 Physical Specifications i Weight Less than 5 Kg including battery.				
E.3 Physical Specifications i Weight Less than 5 Kg including battery.			= -	
i Weight Less than 5 Kg including battery.			the Vendor.	
		hysical Specifica	tions	,
TT7.1.1.411	i	Weight		
Weight excluding battery to be			Weight excluding battery to be	
specified by the Vendor			specified by the Vendor	
ii Physical Less than 350 mm x 250 mm x	ii	_		
Dimensions 250 mm; Vendor to specify the		Dimensions	250 mm; Vendor to specify the	

	T		
•••		physical dimension	
iii	Connectors	The SDR should provide interface	
		connectors for connecting data	
		terminal and other accessories	
iv	Control	The SDR should have front panel	
		having control and selector knobs	
		including sulk mode, display and	
		keypad for SDR functioning and	
		programming of parameters.	
E.4 I	 Environmental Or	ualification Specifications	
i	EMI/EMC	As per latest MIL STD 461G	
ii	Operating	-40 deg C to +70 deg C	
11	Temperature	-40 deg e to 170 deg e	
iii	-	40 dag C to 195 dag C	
111	Storage	-40 deg C to +85 deg C	
	Temperature	A11 (1	
iv	Ruggedisation&	All the environmental tests	
	Environmental	including temperature shall be	
	conditions	carried out in accordance with the	
		latest version of JSS 55555 as	
		applicable/ as per Customer	
		requirements as per relevant	
		Tables& MIL Std. 810G	
E.5 I	Reliability, Mainto	enance and Miscellaneous	
i	Safety	Reverse Polarity	
		Į ,	
		Power and line surge spikes	
		Short and Open Circuit	
		antenna connection	
		antenna connection	
		0	
		Over voltage / under voltage	
		protection	
ii	Emergency	Facility for emergency erasure	
	Erasure	should be inbuilt to erase all the	
		keys and algorithm. Tamper	
		detection and response	
		mechanism should be inbuilt in	
		the radio set to automatically	
		erase algorithms, secrecy keys and	
		other operational parameters to	
		make SDR not functional.	
iii	Reliability	The equipment should be capable	
111	Remarking		
		of continuous operation for at	
		least 72 hours on a single set	
		basis without breakdown. MTBF	
		should be at least 5000 hours and	
		MTTR not more than 24 hours;	
		Vendor to indicate the MTBF	

Ground Data Terminal (GDT) SDR

Product Description:

• The Equipment shall be Single or Multichannel and Multi-band radio that will meet requirements of speech and data for ground-to-ground and ground-to-air communications with software defined waveforms.

Date: 04-05-2022

• The equipment shall support the creation of Mobile Adhoc Networks (MANET) to provide secure and jam resistant voice, data and video communication

SN	Parameter	Description	Remarks			
	System Specific					
i	Network	Peer-Peer MANET				
	Topology					
ii	No of Max	Narrow Band: 32 minimum;				
	Nodes	vendor to specify the number of				
		Nodes				
		Wide Band: 64 minimum; vendor				
		to specify the number of Nodes				
iii	Transmission	• Unicast				
	Protocols	D. 6 - 14 4				
		Multicast				
		Broadcast				
		Broadcast				
iv	Channel	25 KHz to 10 MHz (Typical);				
	Bandwidth	Vendor to specify the range of				
		Bandwidth that is settable				
v	Data Rates	Narrow Band: 100 Kbps with				
		Channel Bandwidth of < 500 KHz				
		Wide Band: 1 Mbps with Channel				
		Bandwidth of < 5 MHz;				
		Vendor to specify the max. data				
	DOOM	rates supported				
vi	ECCM	Narrow Band: 100 Hops/sec				
		minimum; Vendor to specify the				
		Hopping rate Wide Band:500 Hops/sec				
		minimum (1000 Hops/sec				
		preferred); Vendor to specify the				
		Hopping rate				
vii	Network Relay	Voice: 3 Hops minimum; Vendor				
	Hops	to specify the Network relay Hops				
	_	Data: 5 Hops minimum; Vendor to				
		specify the Network relay Hops				
viii	SCA (Software	Version 4.1 or latest; Vendor to				
	Communication	specify the version of SCA				
	Architecture)					
	Security	Functionality:				
1X		Cater for separate				
		additional security module				

Ref: R&D/SDR/ EOI/01

		(SAG gradable hardware	
		module)	
		TT1 1 1	
		Hardware based, an	
		appropriate slot and	
		interface to be made	
		available in the SDR	
		 Security support at 	
		Transmission level and	
		Message level	
		 At transmission 	
		level,	
		cryptographically	
		controlled frequency	
		hopping	
		o At message level,	
		capable of	
		embedding CPC	
		approved user	
		specific	
		cryptographic	
		security	
		Key Management:	
		The cryptographic algorithms and	
		keys shall be capable of being	
		loaded into the security device via	
		a handheld device/ Key Gun	
		Key Handling and Storage:	
		The SDR shall be capable of	
		secure storage of key information/data for duration as	
		specified the user. The SDR shall	
		provide positive confirmation	
		following each successful key load	
		from the key loading device and	
		should notify in the event of key	
		load failures. Emergency key	
		erasure facility should also be	
		provided	
		User Authentication:	
		The SDR should be password	
		protected for normal usage.	
		Another password authentication	
		should be provided for waveform	
		and mission parameter	
	Dogition	programming.	
v	Position, Navigation and	GNSS and IRNSS: The SDR should have an inbuilt	
X	Timing	GNSS receiver catering to multiple	
<u> </u>	111111112	arroo receiver catering to multiple	

		GNSS services like GLONASS and	
		GPS. It should cater for IRNSS	
		Services.	
		Synchronization:	
		The SDR should support	
		synchronization by both internal	
		timing source and by time signal	
		from GNSS receiver including	
		IRNSS	
		It is desirable to have an external	
		clock input also apart from timing	
	Daylin a a 1	signal from GNSS Receiver.	
:	Booting and	The SDR should bootup in less	
Xi	Switching	than 90 seconds; Vendor to indicate the max booting time	
		It should be possible to load the	
		waveforms without power off and	
		rebooting.	
		On powering up, the SDR should	
		offer selection of the last operated	
		waveform or any other waveform	
		residing in the SDR.	
xii	Operational Modes	• Squelch	
		• Whisper	
		_	
		• Sulk	
В.	RF Specification		
	<u>-</u>	ns	
B.	Frequency	ns HF: 3 MHz to 30 MHz (Typical)	
	<u>-</u>	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz	
	Frequency	ns HF: 3 MHz to 30 MHz (Typical)	
	Frequency	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical)	
	Frequency	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz	
	Frequency	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical);	
	Frequency	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range	
i	Frequency Range	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band	
	Frequency Range	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz	
i	Frequency Range	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable	
i	Frequency Range	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR	
i	Frequency Range	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable	
i	Frequency Range Channel Bandwidth	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor	
i	Frequency Range Channel Bandwidth Channel	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor	
i	Frequency Range Channel Bandwidth Channel Selection/	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor	
i	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution Frequency	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor	
i ii iii	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor 1 KHz +/- 1 PPM or better	
i ii iii	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy RF Output	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor 1 KHz +/- 1 PPM or better a. Transmitter Power: 0.5W to	
i ii iii	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor 1 KHz +/- 1 PPM or better a. Transmitter Power: 0.5W to 10W adjustable digitally / 5	
i ii iii	Frequency Range Channel Bandwidth Channel Selection/ Frequency resolution Frequency Accuracy RF Output	HF: 3 MHz to 30 MHz (Typical) V/UHF: 30 MHz to 512 MHz (Typical) L: 1775 MHz to 1815 MHz (Typical) S: 2200 MHz to 2250 MHz (Typical); Vendor to specify the exact range for each band 25 KHz to 10 MHz (Typical); 1KHz to 8MHz preferable Actual BW supported by GDT SDR to be specified by vendor 1 KHz +/- 1 PPM or better a. Transmitter Power: 0.5W to	

		1. II	
		b. Harmonics: 60dBc	
		c. Spurious : 70dBc	
		Vendor to indicate the	
		values of Tx Power,	
		Harmonic level & Spurious	
:	Carrier	level Greater than 50 dB; Vendor to	
vi		,	
vii	Suppression Sideband	specify the value Greater than 50 dB; Vendor to	
VII	Suppression	specify the value	
viii	Receiver	a. Vendor to specify the actual	
VIII	Sensitivity	receiver sensitivity	
	Scholivity		
		separately for AM, FM &	
		other digital modulation	
		schemes along data	
		ratesalong with applicable	
		BW for BER of 1x10^-6	
		b. Approximate Coverage	
		Range to be specified for	
		each Modulation/	
		Waveform to be specified	
		-	
ix	Image rejection	Greater than 60 dB;	
		Vendor to specify the value	
X	IF rejection	Greater than 80 dB;	
		Vendor to specify the value	
xi	Adjacent	Greater than 50 dB;	
	channel	Vendor to specify the value	
~	rejection		
C.	Waveforms		
C.1 E	ssential		
i	Modern Digital	COFDM with Modulations	
	Waveforms	• QPSK	
		• 16 QAM	
		• 64 QAM	
		Any other waveform to be	
		1	
		specified by the Vendor	
		Forward Error Correction CC or CTC	
		• Coding Rates: ½, ¾, 5/6	
		Any other FEC rates supported	
		to be specified by vendor	
	esirable		T
i	Additional	• GMSK	The platform
	Waveforms	P.000	should be
		• DSSS	capable of
			supporting

		• SOODSK / C	DM	these
		SOQPSK / C	PIVI	additional
				waveforms
ii	Legacy	• AM		The platform
	Waveforms			should be
		• FM		capable of
		DOLL		supporting
		• FSK		these legacy waveforms
		• PSK		wavelorins
D.	Human Machine	e Interface		
i	Display		nal panel display	
			for configuration,	
		monitoring and		
		Size & Type of D	1 0	
ii	User Interface	specified by theStatus LEDs	VCHUUI	
11	Joer Interface	- Status LEDS		
		Keypad; deta	ils of keypad to be	
		specified by t		
iii	Physical	PTT (Push to '	Talk) Button	
	Buttons	,	•	
		• Power/Volum	e Knob	
		Dismlars On IC	off Darthon	
		• Display On/C	II BulloII	
		• 16-position C	hannel Selector	
_		_		
E.	Hardware			
E.1. I	nterface Specific	ations		
i	Interfaces	Audio Interface	O	
			channel with PTT	
		Data Interface	Ethernet	
			10/100/1000 BT	
			& 1GE Opt (optional)_	
			RS232	
			RS485	
			USB	
		Control	Ethernet	
		Interface	interface &	
			SNMP Protocol	
ii	Built-in-Test	,	PBIT) : After Power-	
		ON, it starts aut	· ·	
]		may take about 5 second or less;		
		•		
		Vendor to specif	y the time taken	
		•	y the time taken PBIT.	
		Vendor to specif to complete the It tests the main	y the time taken PBIT.	

		41 sin nsi s ns	
		their versions.	
		Initiated or Manual BIT (IBIT): It	
		is the most in-depth of the built-in	
		tests and may take about 10	
		seconds; Vendor to indicate the	
		max time for IBIT	
		Continuous BIT (CBIT): It is a	
		continuous test that runs in the	
		background and has no impact on	
		radio operation or radio settings.	
		The CBIT information may be	
		updated every second when the	
		radio is switched ON and in	
		operating mode	
E.2 E	Electrical Specific	ations	
i	Power Input	The SDR should be capable of	
	_	working continuously for a	
		minimum period of 8 hours with	
		DC supply of 24 V at 1:9 Transmit	
		to Receive ratio with rechargeable	
		and disposable batteries; Vendor	
		to indicate the Battery capacity	
		The radio also should have	
		capability to work off 230 +/- 20%	
		volt AC using provided adapter.	
		Power Consumption: Typical	
		Power Consumption to be	
		specified by the Vendor	
		Battery Charging:	
		Following Battery chargers with	
		suitable connectors should be	
		provided	
		-	
		a. Solar charger which is	
		foldable and man portable	
		b. Mains Supply charger with	
		a facility to increase the	
		charging rate in order to	
		reduce the charging time of	
		the batteries.	
		c. Time to fully charge the	
		battery to be specified by	
		the Vendor.	
E.3 P	hysical Specifica	tions	
i	Weight	Less than 5 Kg including battery.	
	- 3	Weight excluding battery to be	
		specified by the Vendor	
ii	Physical	Less than 350 mm x 250 mm x	
	Dimensions	250 mm; Vendor to specify the	
		physical dimension	
iii	Connectors	The SDR should provide interface	
111	Connectors	connectors for connecting data	
		terminal and other accessories	
	l .	terminal and other accessories	

		m	
iv	Control	The SDR should have front panel	
		having control and selector knobs	
		including sulk mode, display and	
		keypad for SDR functioning and	
		programming of parameters.	
	_	nalification Specifications	
i	EMI/EMC	As per latest MIL STD 461	
ii	Operating	-40 deg C to +70 deg C	
	Temperature		
iii	Storage	- 40 deg C to +85 deg C	
	Temperature		
iv	Ruggedisation&	All the environmental tests	
	Environmental	including temperature shall be	
	conditions	carried out in accordance with the	
		latest version of JSS 55555 as	
		applicable/ as per Customer	
		requirements as per relevant	
		Tablesand MIL Std. 810F/G	
E.5 1	Reliability, Mainte	enance and Miscellaneous	
i	Safety	Reverse Polarity	
		Power and line surge spikes	
		Short and Open Circuit	
		antenna connection	
		Over voltage / under voltage	
		protection	
		•	
ii	Emergency	Facility for emergency erasure	
	Erasure	should be inbuilt to erase all the	
		keys and algorithm. Tamper	
		detection and response	
		mechanism should be inbuilt in	
		the radio set to automatically	
		erase algorithms, secrecy keys and	
		other operational parameters to	
		make SDR not functional.	
iii	Reliability	The equipment should be capable	
		of continuous operation for at	
		least 72 hours on a single set	
		basis without breakdown. MTBF	
		should be at least 5000 hours and	
		MTTR not more than 24 hours;	
		Vendor to indicate the MTBF	
		Value	
		Value	

Ref: R&D/SDR/ EOI/01 Date: 04-05-2022

A. Finalization of detailed requirements

Vendor shall finalize the detailed requirements for hardware (electrical & mechanical), software and test procedures in consultation with ITI and submit the same to ITI, after the placing of order.

ANNEXURE-A: DELIVERABLES FOR MOBILE HANDSET INTERFACE UNITS at RFP Stage

Sl. No.	Item	Qty
Section A.	Functional units	
1	Supply of functional Software Defined Radio (SDR)unit meeting all the functional and performance requirements as per the Technical Specification. SDR one Set is as follows: a. Handheld SDR - 1 No. b. Manpack SDR - 1No. c. Manpack HF - 1 No d. Truck Ground SDR - 1 No. e. Truck Ground HF - 1 No f. AFV (Armoured Fighting Vehicles) SDR - 1No. g. AFV HF - 1No. h. Heptr Configuration 1 - 1 No. i. Heptr Configuration 2 - 1 No. j. Air Traffic Controller (ATC) - 1 No. k. Ground Data Terminal (GDT) - 1 No. Note: Complete knock down kits of Software Defined Radio (SDR)unit are to be supplied in addition to supply of 6 sets of Software Defined Radio (SDR)unit).	6 Sets
Section B.	Software & Accessories	

1	Source code of all FPGA, Software and Microcontrollers for functionalfor Software Defined Radio (SDR)unit meeting all the functional and performance requirements as per the Technical Specification; Foreign Vendors shall agree for PROVIDING ALL DOCUMENTATION for Manufacturing ToT for productionising of SDRs at ITI; Willingness to transfer the IPR may be commented for Foreign Vendors.	1 Set (for each of 11 form factors)
2	Test results of all 10 Software Defined Radio (SDR)unit (hard and soft copy).	1 Set (for each of 11 form factors)
3	List of test & Measuring instruments for Software Defined Radio (SDR)unit (hard and soft copy).	1 Set
4	User manual with precautions & procedures to put into service and operate the module to full capacity for Software Defined Radio (SDR)units (hard & soft copy).	1 Set (for each of 11 form factors)
5	Detailed process & procedure to port add-on software at ITI end for Software Defined Radio (SDR) unit (hard and soft copy).	1 Set (for each of 11 form factors)
6	Hands on training for operation, maintenance and trouble shooting at ITI premises for Software Defined Radio (SDR)unit and associated units.	11 weeks
Section C.	Complete Knock Down (CKD) Kits	
1	Kit of complete parts for Software Defined Radio (SDR)unit including PCBs, components, mechanical parts, and fixing items.	6 Sets. (1 for each of 11 form factors)
2	Detailed BoMs for Software Defined Radio (SDR)unit covering Electrical/Electronics/Mechanical parts and fixing items including front panel with sensor to erase (hard & soft copy in A3 or A4 format suitable to view/edit in AUTOCAD).	1 Set (for each of 11 form factors)
3	Sources of supply for Software Defined Radio (SDR)unit for the items covered in the BoMs with multiple sources (min 4) for each item (hard & soft copy).	1 Set (for each of 11 form factors)
4	Detailed assembly drawings for Software Defined Radio (SDR)unit (hard & soft copy in A3 or A4 format suitable to view/edit in AUTOCAD).	1 Set (for each of 11 form factors)
5	Technical document for the methods involved in manufacturing & assembly process for Software Defined Radio (SDR)unit (hard & soft copy).	1 Set (for each of 11 form factors)
		1400015,

		factors)
7	Gerber files for all types of PCBs (RS274X format) for all layers, legend markings, solder masks, etc. of Software Defined Radio (SDR)unit (soft copy).	1 Set (for each of 11 form factors)
8	Details of PCB complexity like number of layers, minimum track width, pad to pad/track distance, minimum drill diameter, etc for all types of Software Defined Radio (SDR)unit (hard & soft copy).	1 Set (for each of 11 form factors)
9	Gerber file for stencil and file for X-Y co-ordinates/orientation, for complete SMT assembly of components of all PCBs of Software Defined Radio (SDR)unit (soft copy).	1 Set (for each of 11 form factors)
10	Individual PCB layer graphical data of all PCBs of Software Defined Radio (SDR)unit in AUTOCAD format (soft copy).	1 Set (for each of 11 form factors)
11	Drill data details of all PCBs of Type-A & Type-B, in the medium and format (EXELLON) compatible with CNC machines in the market (soft copy).	1 Set (for each of 11 form factors)
12	Bare board testing data for inspection of all PCBs of Software Defined Radio (SDR)unit (soft copy).	1 Set (for each of 11 form factors)
13	Software built into all the programmable devices of all modules of Software Defined Radio (SDR)unit as bit file / MCS file (soft copy).	1 Set (for each of 11 form factors)
14	Programmer unit with associated driver software suitable for latest OS to program software controlled parts of modules of Type-A & Type-B.	1 Set (for each of 11 form factors)
15	Source code for the software built into the programmable devices of all the modules of Software Defined Radio (SDR)unit (soft copy).	1 Set (for each of 11 form factors)
16	List of development tools for the design & development of firmware of all modules of Type-A & Type-B.	1 Set (for each of 11 form factors)
17	Right to amend the design of all modules to suite the future requirements of customer.	1 Set (for each of 11 form factors)
18	Functional block diagram of all modules of Software Defined Radio (SDR)unit (hard & soft copy)	1 Set (for each of 11 form

		6 4
19	Functional description of all modules of Software Defined Radio (SDR)unit (hard & soft copy).	factors) 1 Set (for each of 11 form factors)
20	Circuit schematic/Layout of all PCBs and also the schematic of inter module connectivity within Software Defined Radio (SDR)unit (hard and soft copy).	1 Set (for each of 11 form factors)
21	Technical document for the detailed testing procedure at all module /unit levels of Software Defined Radio (SDR)unit (hard & soft copy)	1 Set (for each of 11 form factors)
22	Vendor to provide ATP document for Software Defined Radio (SDR)unit (hard & soft copy)	1 Set (for each of 11 form factors)
23	Hands on training for assembly, testing and trouble shooting, porting of software of all modules of Software Defined Radio (SDR)unit to Technicians / Engineers at ITI premises.	4 weeks
24	List of proprietary test/measuring instruments including special functions / packages for functional verification of Software Defined Radio (SDR)unit (hard & soft copy).	1 Set (for each of 11 form factors)
25	Proprietary test accessories & test jigs including software.	1 Set (for each of 11 form factors)
26	Vendor to conduct EMI/EMC/Environment tests to meet specified requirements at unit level and submit the test results and test certificates for successful completion for Software Defined Radio (SDR)unit (hard copy)	1 Set (for each of 11 form factors)

Ref: R&D/SDR/ EOI/01 Date: 04-05-2022

ANNEXURE-B: TERMS & CONDITIONS FOR SOFTWARE DEFINED RADIO (SDR)

2. NDA: Vendor shall give NonDiscloser Agreement (NDA) for the quoted product along with Technical offer.

- 3. **Confidentiality:** Vendor should not disclose/display on their website, Brochures, showcase the quoted product in any kind of exhibitions or in any other form to third party.
- 4. **Design Reuse:** Vendor should not sell same product or product architecture consist of 80 percent of used component on quoted product.
- 5. **PCB Design:** Vendor shall design PCB with available package at ITI CAD group premises for the quoted product.
- 6. **Progress Report:** Periodic presentation on progress of intermediate hardware and software architecture to be provided.
- 7. **ToT:** Vendor shall give the full transfer of technology (ToT) for the quoted product, for in-house production. All deliverables shall be re-usable, re-modifiable and recompilable.
- 8. **Royalty-free:** Vendor shall not have any proprietary components with specific firmware and the ToT is totally royalty/license free.
- 9. **Warranty:** Standard warranty shall be for 2 year (free of charge) from the date of completion of ToT for the Hardware / Firmware and ToT. During warranty period, vendor shall also support to resolve all the issues observed during the fabrication of PCBs and assembly/testing of units at ITI premises and field integration and network issues including Software & Hardware issues.
- 10.**ATP:** Acceptance tests shall be conducted along with ITI officials at ITI premises in ITI's Testbed as per mutually agreed ATP. Vendor shall carryout modification of all units (hardware/software) including documents to incorporate any changes observed during testing at any stage.
- 11.**Technical support:** Technical support shall be extended to resolve the Network integration problems in 2 year warranty period (free of cost) and on chargeable basis beyond warranty period for a period of 5 years which includes Software upgrades & Hardware modifications. Vendor shall visit the ITI premises & end-user sites to resolve the issues observed during testing/warranty period.

12. Schedule: a.

- i. Total period of development & qualification testing shall be approximately 36 Months from the PO date.
- ii. Interested parties may indicate the timeframe for development & Qualification testing for each of the 11 types of SDRs.