e-Tender Enquiry No. CRS/SID/PUD-9016(Sat.AWS)/0322/2021-22 Dated: 23.03.2022.

SECTION III: REQUEST FOR PROPOSAL (RFP) DOCUMENT / प्रस्ताव दस्तावेज

FOR

PROCUREMENT OF DATALOGGER, UHF TRANSMITTER, YAGI ANTENNA, SENSORS AND OTHER ACCESSORIES

March, 2022

IMPLEMENTING AGENCY:

Ministry of Earth Sciences
Government of India
India Meteorological Department,
O/o the Climate Research and Services
Shivajinagar, Pune-110 005

Technical Specification

Procurement of Datalogger with satellite communication, UHF transmitter, Yagi Antenna, Sensors and other accessories under IMD Rate contract

1. INTRODUCTION

India Meteorological Department owns and operates a network of 726 AWS across the country. As part of the augmentation of the surface observation network, IMD proposes to purchase satellite-based AWS for installation in Himalayan regions and remote places.

IMD desires to enter into a rate contract for procurement of **Automatic Weather Station (AWS) with satellite communication** and its accessories. This RFP is an invitation to OEMs/Authorized representatives to participate and submit a competitive bid for the supply of **Automatic Weather Station (AWS) with only satellite communication** and its accessories. IMD may procure the **AWS with satellite communication** and its accessories as per requirement but procurement of specific no. of AWS is not guaranteed. The supply orders under the rate contract will be placed only by Head, CR&S, IMD Pune. The delivery of items will be required at Pune or any RMCs/MCs after test and acceptance as per supply order.

2. Rate Contract

2.1. IMD desires to enter into a rate contract with a successful bidder/supplier for Procurement of items mentioned in the list of deliverables (Annexure – I).

2.2. The Rate Contract shall be valid for a period of one year from the date of signing of the contract between IMD and the Successful bidder/supplier.

2.3. IMD may procure the items mentioned in Annexure – I as per requirement after entering into the rate contract. However, procurement of a specific quantity of items during the validity of the rate contract is not guaranteed.

2.4. The rate quoted by the bidder for the supply of items shall be valid for the period of the Rate Contract.

2.5. During the period of Rate Contract, India Meteorological Department may place multiple supply orders for procurement of items given in Annexure – I.

2.6. The items shall be supplied/delivered to a location(s) as mentioned in the supply order.

2.7. IMD may procure all or some of the items mentioned in the list of deliverables as per requirement through multiple supply orders during the validity period of the Rate Contract.

2.8. On the expiry of the rate contract after a period of one year, it may be renewed for a period of additional one year on the same terms and conditions, if agreed mutually.

3. SCOPE OF TENDER

3.1. The supplier shall have full responsibility to supply all AWS equipment. The list of deliverables is given in Annexure – I.

3.2. Supply, transportation and delivery of all equipment consisting of sensors, Datalogger with satellite communication, Solar panels, two FRP Enclosures (One Enclosure for SMF battery and another Enclosure for Datalogger, UHF satellite Transmitter, Solar charge control) and other related accessories/deliverables etc. at respective sites.

3.3. Provision should be made to communicate IMD AWS data stream through UHF transmitter (15 minutes interval for fifteen minutes logged data) to satellite-based receiving ERS, Pune and Delhi.

3.4. Data from the AWS site shall be transmitted through the UHF transmitter following Time Division Multiple Access (TDMA) telemetry technique and its data format via the INSAT satellite.

3.5. The Dataloggers, solar panels, sensors and Enclosures shall have two years of warranty.

4. OVERALL REQUIREMENTS

4.1. The AWS equipment along with the data communication system provides the capability for unattended operation in all weather conditions. The system shall run using Sealed Maintenance Free battery(s), rechargeable through a solar panel. The battery shall be capable to run the system for a minimum period of **15 days** on full load during total cloudy or foggy conditions. The bidders shall provide power budget calculation in the technical bid.

4.2. All equipment should be qualified for MIL GRADE or better specifications and suitable for outdoor applications.

4.3. Uplinking AWS data to the satellite compatible with INSAT-3D, INSAT-3DR DRTs. Details of satellites are provided in Annexure-III

4.4. All Datalogger and sensors quoted by the bidder should have been used in Meteorological purpose sites for <u>three years or more</u>. The performance report of Datalogger and sensors from users is to be submitted with technical bids.

4.5. The Datalogger, UHF satellite transmitter and Solar Charge controller must be housed in FRP Enclosure

4.6. UHF Transmitter must have certification from IMD for functional operation through INSAT satellites. The OEM certificate of the UHF Transmitter should be enclosed.

4.7. The antenna should be portable with LHCP and RHCP modes of polarization (switchable in the field) compatible with INSAT-3D and INSAT-3DR DRTs.

4.8. Test points to be provided on the system for monitoring the clock, stream of data bits and facility to view the above on the front panel display.

4.9. Facility to give manual commands to transmit data for testing purposes.

4.10. A separate FRP enclosure (IP 66) shall be provided to house SMF.

4.11. All sensors should be interfaced with Datalogger as per IMD requirements. At all AWS sites, wind sensors should be installed at a height of 10 m.

4.12. The datalogger shall have sufficient memory to store data for 1 year and stored data shall be retrievable via serial port/ USB port/Ethernet port to a PC/laptop and a USB pen drive or any other compact and commercially available solid-state memory device in standard CSV file format without the requirement of specific software to retrieve the data.

4.13. The system shall have the facility to issue a command for forced/manual transmission of data in the datalogger.

4.14. The system shall have time synchronization (timekeeping) via GPS.

4.15. ONLINE Training of IMD officials for installation and maintenance of AWS to Nodal officers designated by IMD.

4.16. The supplier shall supply hardbound copies of operation and maintenance manuals and soft copies in USB Drive as per supply order.

4.17. Thes supplier shall ensure support from OEM for Datalogger and AWS sensors at least for 8 years after the test and acceptance.

4.18. IMD's Test certificate for the UHF transmitter shall be submitted with a tender document.

4.19. If the Technical Evaluation Committee desires that bidders shall provide presentation and demonstration of the complete AWS system including sensors, Datalogger, Communication equipment (UHF transmitter) etc. offered in response

to this tender the bidder shall have to make presentation and demonstration to the TEC at No cost and No commitment basis as a part of Technical Evaluation at IMD office or ONLINE, the supplier shall make such arrangement. Failure to demonstrate and/or Non-compliance of any component during the demonstration will be considered non-compliance.

5. SPECIFICATIONS OF SENSORS

a) For all sensors offered, valid certification from NIST traceable (National Institute for Standards and Technology, USA) /IMD is to be submitted.
b) User certificate for the performance of sensors is to be submitted with the technical bids.
c) All sensors should be used for Meteorological purposes and their performances at AWS sites for the last three years and details may be submitted in the technical bids.
d) Cables used for sensors to connect the Datalogger should be Teflon insulated multi-strand and silver coated.
e) All sensors quoted in the technical bids will be tested in the IMD calibration Lab, Pune.
f) **For sensors, valid Certification from a reputed International/ Indian institute is to be submitted**.

5.1	**Temperature and Relative Humidity Sensor with Radiation Shield**		
5.1.1	**Air Temperature**		
	a. Sensor type		Pt 100 RTD
	b. Measurement Range		-40 °C to +60 °C
	c. Accuracy (with radiation shield)		± 0.35 °C or better for -40°C to +10 °C ± 0.35 °C or better for +10°C to +60 °C
	d. Resolution		0.1 °C
	e. Output		Analog
5.1.2	**Relative Humidity**		
	a) Measurement Range		0% to 100%
	b) Accuracy (including non-linearity, hysteresis and repeatability)		± 3% RH or better with membrane filter
	c) Output		Analog
	d) Resolution		1% or better
	e) Sensor type		Capacitive / solid state
5.1.3	**Radiation Shield its accessories for the installation on the Mast.**		
	a) Type		Thermoplastic
	b) Louvered		Minimum 9
	c) Ventilation		Natural
	d) Mounting Accessories		Aluminium Mounting bracket and Stainless-steel U Bolt clamp
5.2	**Ultrasonic Wind Sensor and its accessories for the installation on 10 m Mast**		
5.2.1	**Wind Speed**		
	a) Range (Operation)	:	0 to 60m/s or better
	b) Sustainability	:	Up to 60 m/sec
	c) Accuracy	:	± 0.5 m/s or better
	d) Resolution	:	0.1 m/s
	e) Threshold	:	0.5 m/s
	f) Response time	:	1 sec or better

	g) Output	:	Digital
5.2.2	**Wind Direction**		
	a) Range	:	0 to 359 Degrees
	b) Accuracy	:	±5 degrees or better
	c) Resolution	:	1 deg. or better
	d) Response time	:	1 sec or better
	e) Output	:	Digital
5.2.3	**Accessories**		
	a) Mounting accessories	:	1m GI Pipe and fitting accessories of sensors on Pipe at 10 m height.
	b) Cable	:	10 meters cable- 4 core Teflon shielded cable.
5.3	**Tipping Bucket Rain Gauge sensor or with better technology with electrical heater and its accessories for the installation at AWS site (**Rainfall monitoring in the Himalayan region and also Measurement of the water equivalent of the snow in the funnel)		
	a) Sensor type	:	Tipping Bucket with Electrical Heater
	b) Heating element with the power supply cable	:	Low power requirement and power supply for the heating element may be 12 V DC Battery supply.
	c) Collector Area	:	Specified Collector Area should be between 200 cm^2 to 325 cm^2
	d) Height above funnel	:	Height above the funnel should be sufficient to accumulate rain during heavy rainfall/snow.
	e) Switch	:	Rugged Magnetic Proximity
	f) Resolution	:	0.5 mm per tip or better
	g) Accuracy	:	±2% to ±4% or better, for rain rate up to 25 mm/hr to 100 mm/hr ±5% or better, for rain rate>100 mm/hr
	h) Material of Outer Body/housing (Base/Collector)	:	Rust Proof Housing.
	i) Levelling	:	Suitable levelling adjustment screws and circular spirit level must be provided on the base of TBRG for levelling the Tipping bucket Mechanism.
	j) Debris protection filter	:	A suitable (Wire mesh) debris protection filter should be provided inside the collector.
	k) Accessories for installation of sensors at AWS site and cable	:	1 m height GI Pipe and its 0.04-meter diameter, square (1 m X 1m X 0.02 m) shape antirust plate (for TBRG sensors and 10 meters Teflon 2 core shielded cable.
5.4	**Pressure sensor and its accessories**		
	a) Range	:	600 to 1100 hPa
	b) Accuracy	:	± 0.2hPa or better for complete range (600 to 1100 hPa)
	c) Resolution	:	0.1 or better
	d) Output	:	Digital
	e) **Accessories**	:	1 meter 4 core Teflon shielded cable
5.5	**Snow gauge sensors and its accessories**		
	a) Range (snow depth)	:	0 to 10 m
	b) Accuracy	:	± 5 mm
	c) Resolution	:	0.1 mm
	d) Output	:	Digital

	e) **Accessories**	:	Sensors installation pole and other accessories for the installation at filed and 4 core Teflon shielded cable
5.6	**Tipping Bucket Rain Gauge sensor and its accessories**		
	a) Sensor type	:	Tipping Bucket
	b) Collector Area	:	Specified Collector Area should be between 200 cm^2 to 325 cm^2
	c) Height above funnel	:	Height above the funnel should be sufficient to accumulate rain during heavy rainfall.
	d) Switch	:	Rugged Magnetic Proximity
	e) Resolution	:	0.5 mm per tip or better
	f) Accuracy	:	±2% to ±4% or better, for rain rate up to 25 mm/hr to 100 mm/hr ±5% or better, for rain rate>100 mm/hr
	g) Material of Outer Body/housing (Base/Collector)	:	Rust Proof Housing.
	h) Levelling	:	Suitable levelling adjustment screws and circular spirit level must be provided on the base of TBRG for levelling the Tipping bucket Mechanism.
	i) Debris protection filter	:	A suitable (Wire mesh) debris protection filter should be provided inside the collector.
	j) Accessories for installation of TBRG sensors at AWS site and cable	:	1 m height GI Pipe and its 0.04-meter diameter, square (1 m X 1m X 0.02 m) shape antirust plate (for TBRG sensors and 10 meters Teflon 2 core shielded cable.

6. POWER SUPPLY

6.1. The complete AWS station shall have the capability for unattended operation at remote places using Sealed Maintenance Free (SMF) battery, Electrical charger, Solar charge controller and rechargeable through a Solar panel.

a) **Battery**: 65 AH, 12 V SMF batteries
b) **The switch with fuse is required for the power supply to the Datalogger.**
c) **Solar Charge controller**: It should the charge supplied SMF battery with supplied Solar panel and also Over-load protection, Short circuit protection, Protection from lightning strike and Under-voltage protection.
d) **Solar Panel**: 75 W rated capacity.

6.2. The Supplier must attach a detailed **POWER BUDGET CALCULATION** taking care of solar panel and battery efficiency and sufficient safety factor of the system supported with documentary proof in the technical bid for power consumption of the AWS station so that AWS should run for 15 days during a cloudy day or without charging the battery. The detailed power consumption of each component of the AWS system must be mentioned in the technical brochures to support the statement.

7. SPECIFICATIONS OF DATALOGGER AND UHF TRANSMITTER

7.1. DATA LOGGER

I. General
Datalogger quoted in response to a tender enquiry should have been used for last two years for Meteorological purpose and should be well proven during severe weather conditions. Its performance certificate from users is to be submitted for the last two years.

No.	Features	Requirements
i)	Power	Shall Operate with 12V Power from Solar panel / Battery. Data Logger should supply controlled Power to all sensors.
ii)	Sampling	Every one second Wind, Temperature, Humidity, Pressure and every one-minute Rain Fall
iii)	Ports	Sensors: No of Ports to sample data from above sensors and redundant ports in case of failure of current ports. All Ports used to sample data should be configurable to any globally available digital wind, temperature, pressure sensor and Rainfall available. Facility to connect new sensors to redundant ports (if required). Cables from sensors are directly connected to Ports of Data Logger without any Signal conditioner in between. Every port shall have the facility to apply slope and Offset for all above sensors to maintain WMO accuracy. All ports shall be protected from surges due to lightning activities.
iv)	Quality Checks	The datalogger shall apply quality checks such as gross error check and time consistency check for sensors be following WMO No.8 "Guide to Meteorological Instruments and Methods of Observation" Part-III Chapter 1 and Part-II Chapter 1, Seventh Edition, 2008.
v)	Keypad	Internal keypad and internal backlit LCD/LED display with display the command, data characters. Facility to Input station parameters such as Station ID (Alphanumeric), Station name (Alphanumeric), Transmission time and uplink frequency.
vi)	Processing & Data storage	Process & Stores data one string in every minute containing one min vector average of Wind direction, speed, Temperature, Humidity, Pressure, Mean sea level pressure, Rainfall, Max Temp, Min Temp, 24hrs Rainfall, Battery Voltage, Health status etc. The internal memory of Data Logger shall be sufficient to store 1 year of 1 min average and one min interval. Stored data should be transferred to a commercially available pen drive through a front panel key. It shall compute & store Daily minimum Temperature at 03UTC, Daily maximum at 12UTC and 24 Hr accumulated Rainfall at 03 UTC.
vii)	RTC	RTC clock should have an internal battery for retention of time in absence of an External Power supply. Stability Long-term is 1 ppm/year or better.
ix)	Software	Interface Software in datalogger shall be upgradable by transferring upgraded software to Datalogger through USB Pen drive.
x)	Transmission mode	ISRO - Time Division Multiple Access (TDMA)

7.2. UHF Transmitter

1	Carrier Frequency Band	:	402.0 MHz - 403.0 MHz (Carrier frequency 402.74 MHz)
2	Carrier Settability	:	In steps of 100 Hz from 402.0 MHz to 403.0 MHz
3	Modulator	:	PCM/BPSK
4	Data bit rate	:	4.8 KBPS (User selectable)
5	Data coding	:	NRZ(L)
6	Frequency stability:		
	a) Long term	:	Transmit frequency inaccuracy including ageing of oscillator should not exceed ± 400 Hz per year. The oscillator/synthesizer should have provision to adjust for the long-term drift
	b) for temperature	:	± 1 ppm or better (-40 to +55°C)
7	Signal Bandwidth	:	6.0 kHz maximum or better
8	Output Power	:	3-10 W (settable)
9	Power Stability	:	±1 dB
10	Spurious	:	-60 dB or better
11	Harmonics	:	-40 dB or better
12	Environmental Operating Temperature	:	-40°C to +55°C
13	Environmental Relative Humidity	:	0 to 100% RH
14	Operating power	:	Switched 12V D.C controlled by the data logger.
15	Telemetry technique	:	Time Division Multiple Access (TDMA) with details given in Annexure-II.

7.3. Yagi Antenna

7.3.1. Antenna features

(a) The bidder shall ensure compatibility of the antenna in the entire system and also ensure the achievement of objectives given in the telemetry link calculations to be provided by the bidder.

(b) The antenna shall have a proper mounting and pointing arrangement suitable for transmission to any one of INSAT satellites-based DRTs (located anywhere in the geostationary arc from 45°E to 115°E longitude). The bidder shall also provide suitable templates and fixtures/tools for reorienting the antenna towards any satellite by the field personnel as and when required.

(c) Proper lightning and surge protection shall be provided to protect all the equipment connected to the antenna from atmospheric hazards.

(d) Antenna to be designed with an optimum size so that it could be easily transported to remote and inaccessible places. Mounting of antenna should take care of Azimuth and Elevation changes. Systems have to operate in harsh and saline conditions and be adaptable to tropical conditions.

(e) The following technical features shall be supplied by the bidder in addition to the technical information being provided by him as part of the bid.

(i)	Polarization	:	LHCP and RHCP (Switchable in the field)
(ii)	Gain	:	Minimum 11 dBi or better

(iii)	Center frequency	:	402.0 MHz to 403.0 MHz
(iv)	3dB Beam width	:	40º
(v)	VSWR	:	1.2: 1
(vi)	Impedance	:	50 ohms
(vii)	Axial Ratio	:	To be specified by the bidder
(viii)	Operating wind speed	:	250 kmph
(ix)	Wind Survival	:	300 kmph
(x)	Material	:	Rust-proof and oxidation-proof for use in coastal and saline areas
(xi)	Connector type	:	To be specified by the bidder
(xii)	Mounting	:	Should have engraved elevation angle marking
(xiii)	Operating temperature	:	-40°C to +55°C
(xiv)	Operating Relative Humidity	:	0 to 100% RH
(xv)	Weight	:	Lightweight
(xvi)	Size	:	Small, portable
(xvii)	Operating rain rate	:	100 mm/hr and waterproof

8. WEATHERPROOF FRP ENCLOSURE FOR AWS

8.1. Two separate enclosures are required for AWS.

8.2. Weatherproof Enclosure of AWS should be FRP Enclosure (IP 66) and for outdoor use to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water.

8.3. One enclosure FRP Enclosure (IP 66) is suitable to keep Datalogger, solar charge Controller, Pressure sensors, switch with the suitable fuse for power supply to the Data logger and UHF Transmitter.

8.4. Another separate FRP Enclosure (IP 66) for 12 V, 65AH SMF batteries.

8.5. Silicone gasket is used for both Enclosures for harsh environments and extreme temperatures.

8.6. FRP Enclosure (IP 66) enclosures should be designed for outdoor applications that require corrosion protection against chemicals and water. From humble to harsh environments, it safeguards vital electrical and electronic components with enclosures, climate control and accessories to help keep operations up and running smoothly.

8.7. Enclosure with hinged door and locking facility.

8.8. Data Pockets provide convenient storage for wiring diagrams, operation manuals and other documentation inside an enclosure.

9. COMPLIANCE STATEMENT

The tenderer shall submit a detailed item-wise compliance/ non-compliance statement referring para-wise/sub-para wise to the requirements given in the document, for quick evaluation of tender and for any future reference. The compliance statement shall be supported by original brochure(s) of the equipment or sub component from the manufacturer. In case the original brochure is silent on any part of tender specification, it shall be supported by an undertaking by the manufacturer along with user certificate* for that particular equipment/ sub-component, if claimed complied. The technical

specifications and other requirements contained in this document are essentially required by the indenter. However, reasons for non-compliance, if any, for certain limited paras, or even sub-paras of the document may also be given by the tenderer. **Silence or inadequate information on any part of the technical specification, any conditional compliance or failure / omission to provide any such details will be treated as non-compliance.** All non-compliance of specifications, even of small nature, should be clearly brought out.

Sample format for Compliance (C)/ Non- Compliance (NC) statement:

Clause/Para/ Sub-para no.	**Item description as per IMD specification**	**Compliance (C)/ Non- Compliance (NC)**	**Remarks (if any)/ Supporting Documents (wherever required)**
Section-I			
...			
Section-II			
...			
Section-III			
1	Introduction	Understood	
2	Scope of tender	C	
2.1		C	

10. WARRANTY FOR AWS

(i) The successful bidder shall provide a warranty **for TWO YEARS** of the entire system including datalogger and sensors. The firm has to enter into the agreement as per terms and conditions laid down by IMD during two years Warranty.

(ii) The terms and conditions during Warranty Period are given in detail as **Annexure-IV.**

11. DELIVERY SCHEDULE

Delivery of all equipment and accessories shall be done at respective MC/RMCs/IMD offices as per supply order within **60 days** from the date of placement of supply order through a single consignment. The list of deliverables is given as **Annexure-I.**

12. TRAINING

The successful bidder shall provide comprehensive training in installation, integration, calibration, operation, maintenance, troubleshooting and replacement of defective modules of proposed Datalogger, UHF Transmitter, sensors, Datalogger programming and system-related topics **to IMD officers for a minimum period of Two Working Days ONLINE.** Training syllabus, material and documentation in the English language shall be provided along with time table well before the commencement of training for evaluation by IMD. A soft copy of finalized training material should be provided to all the trainees.

Annexure –I

LIST OF DELIVERABLES

S. No.	Item	Make & model Country of origin	Qty. Nos.
1	2	3	4
1.	Temperature Humidity Sensor with Radiation Shield with 5m Teflon cable with suitable MIL grade Amphenol connectors and mounting accessories (Calibration certificate of all sensors with validity certificate is required)		As per supply order
2.	Wind sensors with mounting accessories and 10 m Teflon cable with suitable MIL grade Amphenol connectors (Calibration certificate of all sensors with validity certificate is required)		As per supply order
3.	Rain Gauge Sensor (TBRG) **with electrical heater** with mounting accessories and with 5m Teflon cable with suitable MIL grade Amphenol connectors (Calibration certificate of all sensors with validity certificate is required)		As per supply order
4.	Rain Gauge Sensor (TBRG) with mounting accessories and with 5m Teflon cable with suitable MIL grade Amphenol connectors (Calibration certificate of all sensors with validity certificate is required)		As per supply order
5.	Pressure sensors with 1m Teflon cable (Calibration certificate of all sensors with validity certificate is required)		As per supply order
6.	Snow depth sensors with mounting accessories and with 5m Teflon cable with suitable MIL grade Amphenol connectors (Calibration certificate of all sensors with validity certificate is required)		As per supply order
7.	Datalogger with mounting accessories and USB pen drive (16 GB or more) for data retrieval		As per supply order
8.	UHF transmitter with Yagi Antenna with mounting accessories on 10 m mast		As per supply order
9.	FRP Enclosures for keeping electronics items- Datalogger, Pressure sensors, solar charge controller, ON/ OFF power supply switch with suitable fuses.		As per supply order
10.	FRP enclosure for housing 12 V, 65 AH SMF batteries		As per supply order
11.	12 V, 65 AH SMF BATTERY		As per supply order
12.	75 W Monocrystalline Solar Panel with mounting accessories on the 10 m Fixed mast		As per supply order
13.	Solar charge controllers for charging 65AH, 12 V SMF BATTERY using 75 W solar panel.		As per supply order
14.	12 V, 100AH SMF BATTERY with FRP Enclosures for Electrical Heater		As per supply order
15.	150 W Monocrystalline Solar Panel with mounting accessories on the mast for using an electrical heater		As per supply order
16.	Solar charge controllers with 15 A current rating for charging 100AH,12 V SMF BATTERY using 150 W solar panel		As per supply order
17.	Hard and soft copy of operation and maintenance manuals.		As per supply order
18.	ONLINE Training of IMD officials for 2 working days.		One item
19.	Transportation charge of one complete AWS system from successful Bidder office to any IMD office (given in Annexure-V) as per supply order		As per supply order
20.	Transportation charge of one item (sensors/data logger/solar panel/battery/enclosure) from successful Bidder office to IMD office (given in Annexure-V) as per supply order		As per supply order

Annexure-II

TIME DIVISION MULTIPLE ACCESS (TDMA) TECHNIQUE

1. Each TDMA type transmitter shall have a unique GPS synchronized time of transmission. The burst data format is shown in Fig (1). However, CRC is added to the data frame and half-rate convolution coded. It is then appended with CR & BTR preamble and UW and transmitted in TDMA mode. Burst duration is 186 milliseconds.
2. TDMA technique is an open-loop system with timing derived from GPS receiver which is part of AWS. TDMA frame duration is one hour. The one hour frame is divided into two and each AWS is assigned a 1-second time slot in the first half-hour slot and the repeat transmission is done after 30 minutes, which falls in the second half-hour slot.
3. The one-second frame is worked out taking into account the following details:
   a) 20-millisecond differential propagation delay over the coverage area.
   b) RTC clock accuracy is around 1 millisecond per day - GPS receiver updates RTC once every twenty-four hours to conserve the battery power of AWS.
   c) GPS receiver accuracy of less than 1 microsecond
   d) Guard time is required in the present burst receiver at Hub station.
4. **Features of ISRO TDMA transmission**

   Features of the ISRO TDMA transmission scheme are provided for general guidance.

   (i) The total number of AWS that could be accommodated in a single carrier is 1800.
   (ii) By including CRC in the data frame, data validity could be ensured.
   (iii) By preserving BCH coding of SID, data quality could be checked and valid data retrieved even for the bad CRC.
   (iv) By preserving the present SID (Station Identification Code) structure of IMD, SID for all users of DRT could be standardized. The SID consists of 21bits (9 bits for user type, 2 bits for priority, and 10 bits for Platform ID)
   (v) With Forward error correction convolution coding, better data quality is ensured.
   (vi) With one repeat transmission, the reliability of data reception is improved.

1	CRC CODE GENERATION	Polynomial; CRC-CCITT-16 $X^{16}+X^{12}+X^{5}+1$
2	DATA SCRAMBLING	Polynomial: $1+X^{-1}+X^{-15}$ Initial State: 6959 (Hex)
3	CONVOLUTION ENCODING	Convolution Coding ½ Rate, Constraint Length K=7 Polynomial: G1=133(Octal), G2=171(Octal)
4	HEADER DETAILS	CR: 192 Symbols (all '0's) BTR: 64 Symbols (all '1's) UW: 64 Symbols (07EA CDDA 4E2F 28C2 (Hex)) Note: UW transmitted with LSB first of every byte, starting from 07EA. (See Fig.1)

5	RF DATA ENCODING	Differential coding (NRZ-L) is done for the entire burst (Preamble and the convolution coded bits) before RF modulation.

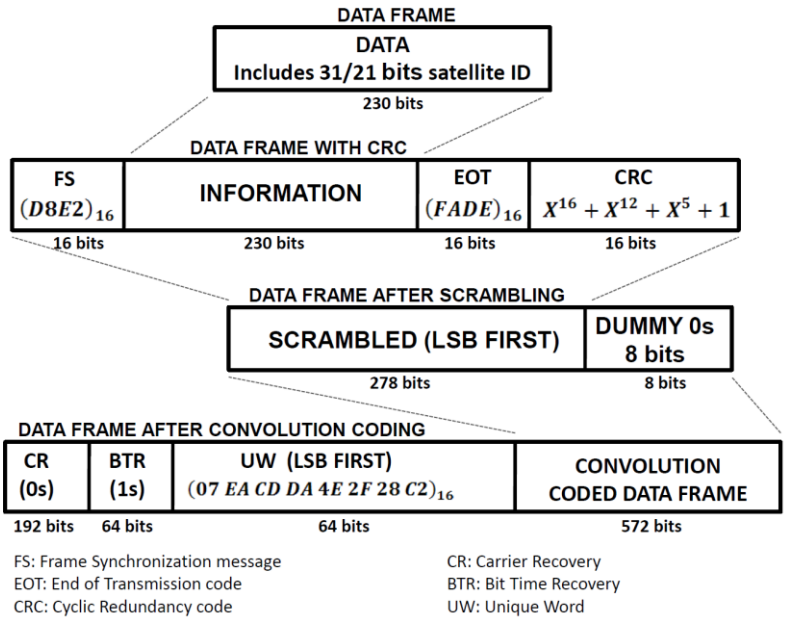

Fig. 1: Burst Transmission Format for TDMA Technique (4800 Symbols/sec.)

Fig.1 may be referred to. CRC is calculated for 262 bits which include FS and EOT. It is then scrambled. 1byte, all '0's is added with the scrambled bits, after which the entire bits are convolution coded. Preamble (CR, BTR and UW) is appended with the convolution coded bits. The resulting bits are then differential coded and transmitted. The system should have the flexibility to accommodate more carrier channels by suitable changes in the TDMA transmission scheme. More details will be provided at the time of the design review meeting which will be held with the successful bidder. However, it should be ensured by the bidder that the system configuration is flexible and accommodate more than 30 sensors without any additional cost.

Annexure-III

INSAT DRT SPECIFICATIONS

For data transfer from field AWS unit to AWS Data Receiving Earth Station at Pune, the Data Relay Transponder (DRT) on the different INSAT series of satellites shall be used and the specifications given below shall be treated as standard to be adhered to by the offered telemetry system.

S. N.	**SATELLITE**	**INSAT 3DR 74^0 E**	**INSAT-3D 82^0E**
1	RECEIVEFREQ. BAND	4500- 4510 MHz	4500- 4510 MHz
2	TRANSMIT FREQ.	402.65 - 402.85Mhz	402.65 - 402.85Mhz
3	RECEIVE G/T	-19db/deg.K	-19db/deg.K
4	MAX.EIRP	24dBW peak	24dBW peak
5	C-BAND EIRP for RECEIVE FLUX DENSITY	2.0dBW for – 146 dBW/m^2	2.0dBW for – 146 dBW/m^2
6	REC.POLARISATION	LHCP	LHCP
7	TRANSMIT POLARISATION	LINEAR	LINEAR
8	FREQ.TRANSLATION ERROR	±40KHz over life & ±6Khz over 1 month	±40KHz over life & ±6Khz over 1 month

Annexure - IV

TERMS AND CONDITIONS DURING WARRANTY FOR INSTRUMENTS OF AUTOMATIC WEATHER STATION

1. The successful bidder shall provide a Warranty for Two Years to all equipment of AWS. The warranty period shall start from the date of test and acceptance of the system.
2. IMD will appoint a nodal officer at MC/RMC/CRS for test and acceptance of the system. During two years warranty period, the successful bidder should repair or replace if any instruments became defective.
3. A penalty of Rs. 500/- per item will be imposed in case of failure to do the maintenance and other related works mentioned above. This penalty will be deducted from their Performance Security deposit.
4. The successful bidder has to collect the defective items from MC/RMC/CRS and after repair, it should return them to the concerned office.
5. Reports of maintenance of defective items of AWS equipment shall be submitted to the respective Nodal officer immediately. **The** successful bidder **shall also provide the details, reasons and remedial actions for defects to Nodal officers of AWS site and MCs/RMCs /CRS, Pune.**
6. If the successful bidder does not rectify the fault for more than 15 days then IMD reserves the right to get the system rectified from any outside agency. The charges incurred shall be deducted from the performance security of the firm.
7. It is the responsibility of the bidder to repair the defective items during two years warranty periods.

Annexure - V

Delivery of AWS or any items of AWS to any IMD offices

S. NO.	RMCs and MCs	LOCATION
1	RMC Chennai	Chennai
2	RMC Delhi	Delhi
3	RMC Guwahati	Guwahati
4	RMC Kolkata	Kolkata
5	RMC Mumbai	Mumbai
6	RMC Nagpur	Nagpur
7	MC Ahmedabad	Ahmedabad
8	MC Agartala	Agartala
9	MC Amaravati	Amaravati (Andhra Pradesh)
10	MC Bengaluru	Bengaluru
11	MC Bhopal	Bhopal
12	MC Bhubaneswar	Bhubaneswar
13	MC Chandigarh	Chandigarh
14	MC Dehradun	Dehradun
15	MC Gangtok	Gangtok
16	MC Goa	Panji (Goa)
17	MC Hyderabad	Hyderabad
18	MC Jaipur	Jaipur
19	MC Leh	Leh
20	MC Lucknow	Lucknow
21	MC Patna	Patna
22	MC Ranchi	Ranchi
23	MC Raipur	Raipur
24	MC Shillong	Shillong
25	MC Shimla	Shimla
26	MC Srinagar	Srinagar
27	MC Thiruvananthapuram	Thiruvananthapuram
28	MO Jammu	Jammu
29	DWR Bhuj	Bhuj (Gujarat)
30	CWC Visakhapatinam	Visakhapatinam
31	MO Port Blair	Port Blair
32	MO Minicoy	Minicoy
32	DWR Bhuj	Bhuj (Gujarat)
33	MO Jammu	Jammu