

सौरभ गर्ग

वैज्ञानिक अधिकारी एवं
प्रभारी, आयरमॉन केन्द्रीय नियंत्रण कक्ष
विकिरण संरक्षा प्रणाली प्रभाग



भारत सरकार
Government of India

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Scientific Officer &
Officer -In-Charge, IERMON Central Station
Radiation Safety Systems Division

Ref: BARC/RSSD/IERMON/2018/445

May 30, 2018

Notice Inviting Tender (NIT) for ERM-SAT

Offers are invited for Design, development, fabrication, supply, installation and commissioning of standalone solar powered Environmental Radiation Monitor with satellite communication (ERM-SAT) for BARC as per the attached NIT document.

Response, as per the NIT document, may be sent in stages and as per the due dates mentioned therein.

Note: This fabrication shall attract concessional rate of GST at the rate of 5% as notified by Government of India. Exemption Certificate, for this effect, will be issued before delivery of the item.

Saurabh Garg
30/5/18
(Saurabh Garg)

To,
Selected Parties

Encl: As above



भाभा परमाणु अनुसंधान केंद्र, ट्राम्बे, मुंबई - ४०० ०८५, भारत

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Notice Inviting Tender (NIT)

(NIT No: BARC/RSSD/IERMON/2018/445)

**Design, development, supply, installation and
commissioning of Environmental Radiation Monitor with
Satellite communication (ERM-SAT)**



भाभा परमाणु अनुसंधान केंद्र
BHABHA ATOMIC RESEARCH CENTRE

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4. The issue of this NIT does not imply that BARC is bound to select an Applicant or to appoint the Selected Applicant, as the case may be, for the supply and services and BARC reserves the right to accept/reject any or all of proposals submitted in response to NIT document at any stage without assigning any reasons whatsoever. BARC also reserves the right to withhold or withdraw the process at any stage without intimation to all who submitted NIT Application.
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1. Organisation Overview

Bhabha Atomic Research Centre (BARC)

The Bhabha Atomic Research Centre (BARC) is India's premier nuclear research facility based in Trombay, Mumbai, Maharashtra. BARC is a multi-disciplinary research centre with extensive infrastructure for advanced research and development covering the entire spectrum of nuclear science, engineering and related areas.

BARC's core mandate is to sustain peaceful applications of nuclear energy, primarily for power generation. It manages all facets of nuclear power generation, from theoretical design of reactors, computerised modelling and simulation, risk analysis, development and testing of new reactor fuel materials, etc.

2. Objective

BARC as a part of the emergency preparedness program is involved in the design and development of standalone solar power based Environmental Radiation Monitors (ERMs) devices with GSM communication and is in the process of expanding the program to country wide network for providing real-time data from systems spread all over the country. BARC has successfully integrated, developed and installed hybrid ERM with ISRO's AWS system with Data Relay Transponder (DRT) based satellite communication system.

In this work order, BARC intend to undertake Design, development, fabrication, supply, installation and commissioning of standalone solar powered Environmental Radiation Monitor with SATellite communication (ERM-SAT). 40 ERM-SAT units are to be fabricated and commissioned as a part of this work order. It is planned to expand this ERM-SAT network to 500 units in subsequent phases as separate work orders. The ERM-SAT systems are also expected to have compatibility with other mode of communications (e.g. GSM, LAN, ZigBee etc.) and shall be rugged, compact, energy efficient and incorporate secure (encryption based) data communication. The system requirements are detailed in Annexure–I and Annexure – II.

The developed system should be able to communicate with the data receiving Earth Station installed at BARC. The specification of Earth Station is provided in Annexure-IV.

3. Deliverables

- 3.1 Supply, installation and commissioning of 40 units of Environmental Radiation Monitor with Satellite mode of Communication (ERM-SAT).
- 3.2 Sharing know-how of incorporated communication protocol / logic, so that BARC can in-house develop customized data processing applications, based on specific and strategic requirements of DAE.
- 3.3 Training of BARC man-power for basic system operation, maintenance and fault rectification, with main emphasis on components for satellite communication, prevention of unauthorized access / use.
- 3.4 Comprehensive Warranty: The supplier shall provide comprehensive warranty of 2 years for all components (including software) from the date of final acceptance of the respective installed system.
- 3.5 Upon expiry of warranty, supplier shall provide comprehensive AMC services for a period of Five years. Quote for AMC should be provided along with this NIT response. However, AMC order shall be placed separately at the end of warranty period.
- 3.6 Installation and Commissioning: The systems are required to be installed and commissioned on a concrete block of 2'x2' (or lower, as sufficient to rest and fix the base of the system) with a height of 2 feet (for on-ground installation) or 1 foot (on terrace installations).

4. NIT Requirements Process

To respond to this NIT, the vendor(s) are required to do the following:

- a) Send a Letter of Interest
- b) NIT RESPONSE SHEET in prescribed format (Appendix A)
- c) Submit a techno-commercial proposal to cover the deliverables as listed in Section 3. The Price Bid in sealed cover shall be submitted separately.
- d) Make a presentation to BARC to demonstrate competency in carrying out the work, at no cost no profit basis.
- e) Submit a compliance table to all the points/ sections of this NIT.
- f) Non-Disclosure Agreement

4.1 NIT Contact

For assistance and questions regarding this NIT, you are welcome to contact:

NIT Contact No:

022-25596985

022-25595380

sqarg@barc.gov.in, avkumar@barc.gov.in

4.2 Participation to NIT

All vendors confirming their participation should send a **Letter of Interest** enclosed in a sealed envelope and super scribed "***Letter of Interest: ERM-SAT***" and must be submitted to:

Head,

Environmental Systems and Networking Section

Radiation Safety Systems Division

Bhabha Atomic Research Centre

Trombay, Mumbai -400085

Email: avkumar@barc.gov.in

4.3 NIT Response

Responses to this NIT in prescribed format (Appendix A) must include two original hard copies. Original hard copies should be enclosed in a sealed envelope super scribed "***NIT Response: ERM-SAT***" and submitted to:

Head,

Environmental Systems and Networking Section

Radiation Safety Systems Division

Bhabha Atomic Research Centre

Trombay, Mumbai -400085

Email: avkumar@barc.gov.in

4.4 NIT Submission Guidelines & Schedule

It is necessary for vendors to submit all information as per schedule mentioned below. All responses to NIT must be on official letter heads duly signed and stamped. The NIT RESPONSE SHEET will be accepted in hard copy in prescribed format only.

NIT key dates are the following :

Receiving Letter of Intent	June 15, 2018
Pre Bid Meeting	June 25, 2018 (tentative)
Deadline for receiving NIT response	July 16, 2018
Presentation to BARC to demonstrate the capability, as a proof of concept by vendors	Date will be decided based on mutual convenience (tentatively between July 20-31, 2018)

4.5 Liabilities of Agency

This NIT is only a request for information about potential products / services and **no contractual obligation on behalf of BARC** whatsoever shall arise from the NIT process. This NIT does not commit BARC to pay any cost incurred in the preparation or submission of any response to the NIT. Information received will be considered solely for the purpose of determining whether or not to conduct a competitive procurement. A determination by BARC not to compete this requirement based upon responses, or lack thereof, to this notice is solely within the discretion of BARC.

4.6 Confidentiality & NIT Ownership

Confidentiality: The contents of this NIT are deemed **confidential** and are provided to prospective bidders for proposal preparation only. This data may not be disclosed to others without the express written consent of BARC.

No party/Contractor/Bidders shall disclose any information to any Third party' concerning the matters under this NIT and the ensuing Contract/Purchase Order/Work Order/AMC Contract, if any, generally. In particular, any information identified as "Proprietary" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party. This clause shall apply to the sub-contractors, contractors, advisors, or the employees engaged by the party with equal force.

“RESTRICTED INFORMATION” CATEGORIES UNDER SECTION 18 OF: ATOMIC ENERGY ACT, 1962 AND “OFFICIAL SECRET” UNDER SECTION 5 OF OFFICIAL SECRET ACT 1923:

Any contravention of the above mention provisions by any contractor, sub-contractor, consultants, Advisors or tile employees of the contractor will invite penal consequences under the aforesaid Legislation.

PROHIBITION AGAINST USE OF BARC'S NAME WITHOUT PERMISSION FOR PUBLICITY PURPOSE

The Service Provider, Contractor or subcontractor, consultant advisor or the employees engaged by the contractor shall not use BARC's name for any publicity media like press, Radio, T.V or internet without the prior written approval of BARC.

Non- Discloser Agreement: Vendor shall execute Non-Discloser Agreement with BARC so that necessary information can be shared between both the

parties so as to clearly understand the requirement of BARC and the possible solutions that may be delivered by the vendor.

NIT Ownership: All responses to the NIT will become the property of the BARC and will not be returned.

4.7 Mode of transmission of documents

All postal communication and hard copies of documents may be transmitted through **Speed Post or Registered Post** of Indian Postal Service only. Communication transmitted through Courier service, hand delivery etc will NOT be accepted.

4.8 Disclaimer

BARC may, at its sole discretion, alter the NIT before the due date for receiving NIT response.

APPENDIX – A
NIT Response Sheet

Requirement		Response
Vendor Information		
1	Name of Person and Organisation responsible for the information contained in NIT	
2	Postal Address/Telephone/Fax/email address	
3	Experience/Expertise in: <ul style="list-style-type: none"> A. Indigenous ERM system development and deployment B. Indigenous system development and deployment with satellite based communication C. Indigenous system development and deployment with dual mode transmission (Satellite + GSM) D. Earth Station establishment, operations and maintenance E. Experience in related field (radiation monitoring/satcom) F. Ability of managing Pan-India distributed systems, AMC for ERM etc, Experience of comprehensive AMC 	Attach as required
5	In the past, has the firm as an OEM supplier, installed and commissioned countrywide network of systems/ monitoring units ? Specify the numbers, relevant details	Attach as required
6	Is the firm experienced in providing comprehensive AMC support for large number of systems/ monitoring units having similar sensors installed at Geographically separated locations in India? Specify the numbers maintained and tenure	Attach as required
7	Provide reference of earlier work carried out (similar type of high volume work). Include reference of Contracts/PO/MOUs	Attach as required
8	Highlight core competence of your company and explain how it matches with the proposed scope of work/deliverables	Attach as required
9	Describe any third party alliances, relationships and dependencies	
10	Provide details of company registration, Annual Turnover, Revenue, debts and liabilities etc	Attach as required
11	Provide information on proposed methodology of carrying out the work	
12	Details of deliverables and services offered as part of the NIT	
13	Details of documentation provided as part of the work	
Techno-Commercial		
1	Compliance matrix to the NIT	Attach as required
2	Technical Proposal clearly providing specification of deliverables	Attach as required
3	Commercial Proposal clearly highlighting the commercial terms & conditions offered. In addition to	Attach as required

	the standard conditions, the specific articles indicated at Annexure shall form a part of our Order/Contract. The supplier shall confirm all the points and send the same along with Technical & Commercial Bid.	
4	Enclose a copy of the details indicated in price quotation (WITHOUT PRICES OR BY MASKING THE PRICES) mainly to know the items/specifications for which you have indicated prices in price bid. This part should not contain prices. Provide a detailed breakup of items considered for pricing (for eg: sensor, solar panel, battery, antenna, accessories/mast, installation etc)	Attach as required
5	Methodology for comprehensive AMC. Please provide details of system reliability, number of visits, and preventive and corrective maintenance plan. List of associate office/ setup indicating geographical distribution for showing capability of carrying AMC.	Attach as required
6	Price Bid with cost breakup for each item (Separately in a sealed cover)	

Annexure-I

**Proposed Requirement
of
Environmental Radiation Monitor (ERM) with SATellite mode of
communication
(ERM-SAT)**

Requirement of Proposed ERM-SAT systems

It is proposed to install a network of Environmental Radiation Monitor (ERM) with SATellite communication (ERM-SAT).

1. Components/building-blocks of system:

- Sensor/Detector - to detect physical parameter (radiation) and convert it to electrical signal (pulse).
- EHT or High Voltage module-for conversion of low voltage supply (5V) to high voltage (500V) for operation of detector.
- Communication-Multiple communication using DRT based UHF transmitter (Satellite), GSM modem, LAN socket, with option of integration of other communication modes like OFC, Zigbee, USB etc.
- Power Source-Solar panel with battery backup.
- Electronic Circuit-For signal processing, interconnection, data storage etc.

2. Basic design features:

Developed system should be compact, stand-alone, self sufficient, solar powered with satellite and GSM communication. The system should be designed in such a way that it should occupy minimum ground space (not more than 2' x 2', without solar panel) and should be self standing, without the requirement of guy-rope or other fastening arrangements. The system's base should be made in such a way that it can be easily mounted and fixed, with nut and bolts, on a concrete platform of 2'x2' or lower size. The system should be designed in such a way that it can be easily installed and maintained by any trained layman. The system should have minimum possible projected attachments. All attachments should be placed inside (or along) the body of the system or covered, so as to make it stray animal proof.

A design, similar to existing ERM system will be preferred, with required modification in material (considering satellite antenna) and dimension.

3. Sensors Detail:

Energy compensated Geiger Muller Tube (or GM Tube) is proposed to be the main sensor/detector of the system. For extended detection range and reliability, system is proposed to have multiple and redundant sensors. It is proposed to have 2 GM Tubes, working in normal environmental condition, with detection range of 50 nGy/hr to 3 mGy/hr (for 35 KeV to 1.3 MeV energy gamma) and 1 GM tube, working in emergency condition, with detection range of 100 μ Gy/hr to 20Gy/hr (for 50 KeV to 2 MeV energy gamma). Detection range with combination of GM tubes should be 50 nGy/hr to 20 Gy/hr for 35 KeV to 2 MeV gamma radiations. Further know-how on radiation sensor and radiation monitoring systems, shall be shared with selected party for development of proposed systems, if required.

4. Data Storage capacity:

System should be able to store hourly values of all 3 detectors for minimum 10 days. These values/data should be retrievable on demand.

5. Mode of Transmission:

The system should have multiple and parallel mode of transmissions like:

- Satellite - One-way uplink at DRT (dedicated channel). No downlink at remote systems. This will be broadcasted by satellite and can be received by multiple Earth Stations (ES).
- GSM - Bidirectional communication for sending data and receiving commands as SMS. Single remote system communicating with fixed number of multiple receiving stations. Provision of two SIM slots at remote system is required.
- LAN - For wired connectivity to local user for accessing the data. One-to-one or many-to-one (multiple systems in a network, connected with one client PC).
- OFC - may be in lieu of LAN for wired connectivity at specific sites.
- USB - Optional. For local data downloading and parameter setting using laptop/tablet at the time of installation/maintenance.
- RS232 - Optional. For local parameter setting at the time of installation/maintenance.
- Zigbee - Optional. For establishment of specific intra network.

6. Transmission Policy:

All transmission to and from the system will be encrypted with BARC's proprietary algorithm.

Every 5-minute data will be generated by the sensor. This data will be checked with pre-stored alarm level. If data is higher than the alarm level, then Emergency mode will be activated. If data is lower than the alarm level, then Normal Mode will be activated. The data communication frequency will be as follows:

	Emergency Mode	Normal Mode
GSM	Every 5 minutes	As per recipient setting
Satellite	Every 5 minutes	Every hour
LAN	Every 5 minutes	Every 5 minutes
OFC	Every 5 minutes	Every 5 minutes

In Normal Mode of communication over GSM, data can be received at different intervals (5 minutes, 1 hour, 4 hours, 8 hours or 12 hours) as per requirement of respective receivers. For all the intervals of more than an hour, hourly data of all intermittent hours will be transmitted as single message. Maximum data size of a packet is 160 Characters (140 Bytes with ASCII encoding).

7. General Electronics:

System should be designed in such a way that all major components (like detector, HV module, communication modules, processing module etc.) will be in modular format and those modules should be mounted on main PCB itself. Connections to outer components (Battery, antenna etc) may be routed through standard and identifiable MIL grade connectors. Modules may be designed and encapsulated individually so as to avoid any kind of interference to other circuitry (HV module, UHF transmitter etc) and replaceable as a separate module, without the need of changing entire PCB, during onsite repair and maintenance.

Microcontroller/microprocessor may be chosen so as to suffice the data and program storage requirement along with other features like number of counters, programmable pins, RTC, flash memory etc. Existing system (ERM-GSM) uses PIC24 microcontroller.

All the components are to be chosen so as to minimize the power requirement and make the system work for longer period in absence of direct sunlight. Power consumption of existing system is 60mA with GSM in continuous listening mode and 100mA with GSM (continuous listening) and LAN.

8. Power backup capacity:

System is proposed to be installed at unattended remote locations. Hence, it is proposed to be battery operated with solar powered charging. Battery (capacity and size) should be chosen so as to suffice for minimum 8-10 days in absence of direct sunlight (rainy or cloudy weather). The battery is to be charged with the help of charging controller (modular form) with protection for both deep-discharging and overcharging.

Battery should be able to withstand open working environment. Battery is proposed to be installed in the lower part of the system to provide stability to entire system and make it self-standing.

9. Antenna:

Considering ease of installation, non-directional antennas are preferred. Preferably antenna should not be projected outside but form a part of body. Accordingly, flat, helical or Omni-directional antenna may be used. The antenna may be placed on top of the body (flat or helical antenna) or along the length of the body (helical or omni-directional antenna) covered with non-attenuating material.

10. System Housing or body:

System's housing or body should be designed to suit outdoor installation (rust free). The body should be self standing with inherent design to reject accumulation of water, dust etc. The upper part of the body, which house detector, should be of aluminum or hardened fiber so as to provide minimum attenuation to radiation and let the detector exposed to true radiation in the vicinity.

The bottom part of the body, which mainly house battery, should be strong. Overall weight of the system should be reasonable for an individual to carry along with, in train/bus etc (preferably less than 25 kg).

11. Environmental condition:

The system should sustain following environmental conditions:

- Operating Temperature : -20 to +60 °C
- Relative humidity : upto 100%.
- IP66/68 compliance
- EMI/EMC Compliance
- Sustainable upto 5 PSI pressure/shockwave
- Sustainable upto 100 kmph stormy wind condition

12. System working :

GM Tube is a gas filled detector. On interaction with incident radiation (gamma rays), the filled gas gets ionized and produces ion pair. These ion pairs give a pulse of predefined height. All such pulses will be counted for a fixed time and, based on the sensitivity of GM tube (number of counts per minute per unit of incident radiation), these counts will be converted to the radiation dose rate. This

dose rate is corrected by multiplication with suitable calibration factor. This dose rate can be stored in local memory and transmitted as per transmission mode and policy.

The system should also be able to receive commands from Central Station (CS), in the form of SMS and respond accordingly. System should send daily health status to CS and ES along with any health related alarm (like low battery etc). Detailed working principle and technical detail of existing ERM-GSM system can be found in Annexure-II.

Annexure – II

Details of Existing BARC developed ERM-GSM System

Existing ERM-GSM System developed by BARC

1. Design Criteria:

The ERM-GSM System is designed with the following criteria:

- **Zero Down Time:** The system must be working reliably at any point of time. Adequate redundancy is provided in measurement and data communication. All components are of MIL grade, wherever possible.
- **Low Maintenance:** The requirement of visiting to the site for preventive maintenance and/or calibration check should not be more than once in a year.
- **Easy Maintenance:** It must be easy for a trained layman to carry out the maintenance.
- **Outdoor Installation:** The system is designed for outdoor installation for measurement of natural background radiation as well as enhanced radiation levels due to accidental release of radioactivity into the atmosphere.
- **Energy Harvesting:** The system is powered by battery with solar power charging.
- **Ease of Communication:** GSM is selected as the means for data communication in view of availability and low cost. The system in addition, should have a LAN socket modem for wired communication for local display and redundancy.
- **Operating Environment:** The system will operate at ambient air temperature between -20°C and $+60^{\circ}\text{C}$ and ambient

2. Technical Specifications of Existing ERM-GSM:

2.1. Environmental and Fallout Dose Measurements

Detected radiation:	Gamma radiation
Detectors:	Energy compensated GM tubes
Energy response:	35 keV to 2 MeV

Low Dose Detector (High Sensitivity)

(VacuTec 70031E or LND 7807 or Equivalent Specification)

(Two detectors are used for low dose measurement for redundancy and to prevent false alarm.)

Sensitivity (Cs^{137})	14 counts/s / $\mu\text{Gy/h}$
Measurement range for Low Dose	50 nGy/h to 3 mGy/h
Length of active volume of detector	235 mm
Plateau voltage range	400 to 600 V
Recommended supply voltage	450V
Plateau slope	< 0.1%/V
Dead time	160 μs

High Dose Detector (Low Sensitivity)

(VacuTec 70018E or LND 71412 or Equivalent Specification)

Sensitivity (Cs ¹³⁷)	0.02 counts/s / μGy/h
Measurement range for Low Dose	100 μGy/h to 20 Gy/h
Length of active volume of detector	5 mm
Plateau voltage range	520 to 620 V
Recommended supply voltage	550V
Plateau slope	< 30%/100V
Dead time	20 μs

Measurement range (combined)

50 nGy/h to 20 Gy/h

Accuracy (Cs ¹³⁷)	± 15%
Calibration	Programmable Lookup Table

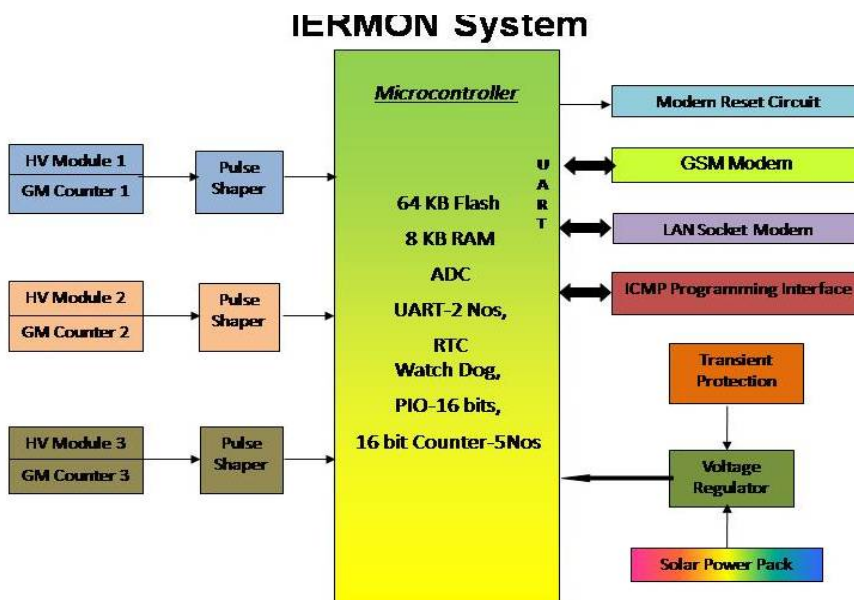
2.2 Environmental

Operating temperature	-20 ⁰ C to +60 ⁰ C
Relative humidity	up to 100%
System enclosure	IP68 compliance for detectors & Electronics Housing IP66 for battery housing with support for solar panel
EMI/EMC	IEC applicable standards

2.3. Power Supply

Solar panel, 20Wp, 9V
 Sealed Maintenance Free Battery, 6V/24AH (2 x 12 AH)
 Charge Control Relay Module for protection of battery from over charging and deep discharge

2.4. System Description



The Following types of radiation detectors are used in the system:

- High sensitivity GM counters (GM Counter 1 and GM Counter 2 in the diagram)
- Low sensitivity GM counter (GM Counter 3 in the diagram)

The high voltage required for GM1 and GM2 is 450V and for GM3 is 550V. Separate HV module is recommended for GM1 and GM2 though both the tubes can be operated from a single supply. Using separate HV module enhances redundancy but it leads to increased power consumption. Selection of HV module is critical for this reason.

Wavecom Q2686 based GSM modem is being used.

The LAN Socket Modem shown in the block diagram is for having LAN based communication, fibre based communication etc. This port is also used by service engineer for interfacing with Note Book PC at the time of system maintenance/calibration.

The Solar Power Pack consists of solar panel, charge control relay and SMF (Sealed Maintenance Free) battery. The present system is designed to operate using 20Wp solar panel with 6V/24Ah (2 x 12Ah) battery.

Transient Suppression Devices are used to protect the system from electrical transients that may enter the system through the cable from solar panel.

The pulses from the GM counters are converted to TTL pulses using Pulse Shaper circuits. The TTL pulses from the Pulse Shaper are fed to the inputs of the counters of the micro controller. The micro controller is programmed to read the counter values at every five minutes without disturbing the counter. The extrapolated hourly dose is computed from the counts and checked with the preset trigger level for verifying any abnormal increase of radiation. If at least two out of the three detectors agree on exceeding alarm level, an 'event flag' is set and the processor transmits the dose level every five minutes until the dose level falls below the trigger level. Normal counting time is one hour, synchronized with the Real Time Clock. At the end of the counting period (signalled by the 'end-of-hour' interrupt from RTCC), the counts are converted to dose rate using appropriate conversion factor derived from the calibration lookup table. Necessary correction will be applied if the counting time is less than one hour, as normally the case when the system is started or restarted. The hourly dose is stored in memory.

3. Photo of existing system :



External View



Internal View

Annexure – III

Details of Satellite Communication System

Specifications of Satellite Communication System

1. Transmitter & Antenna

The system transmitter should be an internal component of system. It should have necessary hardware and software to receive data from internal memory of the system and transmit in TDMA mode. The transmitter should have the capability to handle data transmission to the DRTs located on any of the INSAT series of satellites. The selection of frequency and mode of transmission shall be through software settings only. No hardware changes for switching from one satellite DRT to another are desirable.

1.1 Transmitter features

Carrier Frequency Band	:	402.0 MHz - 403.0 MHz
Carrier Settability	:	In steps of 100 Hz from 402.0 MHz to 403.0 MHz
Modulator	:	PCM/BPSK
Data bit rate	:	4.8 KBPS (User selectable)
Data coding	:	NRZ(L)

Frequency stability

a) Long term	:	Transmit frequency inaccuracy including aging of oscillator should not exceed 400 Hz per year. Oscillator/synthesizer should have provision to adjust for the long term drift.
b) for temperature	:	1 ppm or better (-40 to +55 °C)
Signal Bandwidth	:	6.0 KHz maximum or better
Output Power	:	3-10 W (settable)
Power Stability	:	1 dB
Spurious	:	-60 dB or better
Harmonics	:	-40 dB or better
Environmental Operating Temperature	:	-40°C to +55°C
Environmental Relative Humidity	:	0 to 100% RH for outdoor equipment
Operating power	:	Switched 12V D.C controlled by data logger.

1.2 Antenna features

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

1.2.2 The vendor shall provide non directional antenna suitable for transmission to any one of INSAT satellites based DRTs (located anywhere in the geostationary arc from 45°E to 115°E longitude), without need of explicit pointing arrangement. Proper lightning and surge protection shall be provided, if required, to protect all the equipment connected to the antenna from atmospheric hazards.

- 1.2.3 Antenna to be designed with an optimum size and shape, so that it can be encapsulated within the body of the system. Systems should be able to operate in harsh and saline conditions and adaptable to tropical conditions.
- 1.2.4 The following technical features shall be supplied by the vendor (or best suited, as per latest technology, as per compatibility of the entire system requirement)

Polarization	:	LHCP and RHCP (Switchable in field)
Gain	:	Minimum 11 dBi or better
Center frequency	:	402.0 MHz to 403.0 MHz
3dB Beam width	:	40°
VSWR	:	1.2 : 1
Impedance	:	50 ohms
Operating wind speed	:	250 kmph
Wind Survival	:	300 kmph
Material	:	Rust-proof and oxidation-proof for use in coastal and saline areas
Connector type	:	To be specified by bidder
Operating temperature	:	-40°C to +55°C
Relative Humidity	:	0 to 100% RH
Weight	:	Light weight
Size and shape	:	As per system body
Operating rain rate	:	100 mm/hr

2. Transmission Policy:

All transmission to and from system will be encrypted with BARC’s proprietary algorithm.

Every 5 minutes data will be generated by the sensor. This data will be checked with pre-stored alarm level. If data is higher than the alarm level, then Emergency mode will be activated. If data is lower than the alarm level, then Normal Mode will be activated. The data communication frequency will be as follows:

	Emergency Mode	Normal Mode
GSM	Every 5 minutes	As per recipient setting
Satellite	Every 5 minutes	Every hour
LAN	Every 5 minutes	Every 5 minutes
OFC	Every 5 minutes	Every 5 minutes

The vendor shall propose solution using IRNSS/NavIC towards time keeping with accuracy of milliseconds, for correcting the local clock of the system every day.

Annexure – IV

Details of Existing Earth Station

Specifications Of Existing Earth Station at BARC, Mumbai

1. General features

The earth station (**RF section from antenna to demodulator**) is capable of receiving downlink transmissions in the entire 300 MHz band (4500 – 4800 MHz) from any of the DRTs on board INSAT series of satellites (LHCP/RHCP polarizations).

2. Details of earth station antenna

The following features are available:

Reflector size	:	3.8 metres
Reflector type	:	Solid fibre glass material
Mount Design	:	Polar mount
Feed Mount	:	Prime focus feed
Feed type	:	Linear
Input frequency (for feed)	:	4.5 to 4.8 GHz
G/T	:	31.7 dB / K
Operating frequency	:	4500- 4800 MHz
Gain	:	>=43 dB
Polarization	:	LHCP / RHCP selectable
Elevation Adjustment Range	:	0-90 (Coarse & fine adjustment)
Azimuth Adjustment Range	:	0-360 (Coarse & fine adjustment)

Annexure – V

**Conditions of Annual Maintenance Contract
(To be awarded separately at the end of warranty period)**

Terms and Condition (T&C) of the Maintenance Contract

1. Period of the Contract:

- 1.1. This contract shall remain in force for a period of Five (05) years from the completion of warranty period of installed system/systems.
- 1.2. BARC reserves the right to terminate this contract by giving a notice of one month, without any financial obligation on the part of BARC. In the event of cancellation of the contract for a reason or the other the payment for services carried out will be paid on pro-rata basis.

2. Scope of work:

- 2.1. This contract shall be onsite, comprehensive, preventive as well as breakdown maintenance for Environmental Radiation Monitors with Satellite communication (ERM-SAT)
- 2.2. Under this contract ERM-SAT installed at various places though out the country will be covered.
- 2.3. This contract/agreement will also cover all labor charges for the entire period of the contract.
- 2.4. Preventive maintenance shall be carried out at least **once in a year for ERM-SAT**, during the contract period.
- 2.5. System should be attended and corrected for any faults & failures, whenever a complaint is registered. Service engineer attending the system should make sure that after attending the system, same is working fine and satisfactorily in as sense.
- 2.6. Complaint may be registered by call, mail or any other mode of communication. Service Provider shall communicate the details (phone numbers, email and address) for registering the complaints. Service Provider shall also furnish communication matrix of officers to be informed/communicated if problem is not satisfactory resolved.
- 2.7. During each service visit, service engineer shall perform following action/test on the respective system:
 - 2.7.1. Present location and direction of the system shall be checked with originally installed details. Any variation may be reported to local authority, seeking their reason/justification of shifting. Same shall be recorded and informed to BARC.
 - 2.7.2. Any physical damage to the system may properly be recorded (preferably with photographs) and same should be informed, in writing, to local authorities, along with BARC. Appropriate corrective measures may be taken as suggested by BARC.
 - 2.7.3. Entire system should be wiped clean from accumulated dust and other dirt. Solar panel may be cleaned, preferably with mild soap solution.

(Avoid using sharp object/tools for cleaning. This may damage the solar panel surface)

- 2.7.4. Solar panel direction may be checked and corrected to get maximum sun-light. Solar panel facing south will be most preferred condition, subjected to clear front.
 - 2.7.5. All nut-bolts and screws should be tested for corrosion. Same should be replaced if corroded or damaged. Water repellent and corrosion protective grease may be applied on nut-bolts and screws for future protection.
 - 2.7.6. Solar panel mounting clamp/fixture may be checked for corrosion and/or any other damage. Necessary appropriate action (replacement of clamp, painting etc) may be taken.
 - 2.7.7. Antenna/Junction box should be checked for water/sediment accumulation. Same may accordingly be cleaned. Antenna and other connectors shall be checked for corrosion/damage. Same may be properly fixed/tightened.
 - 2.7.8. System's surrounding may be checked for any grown-up vegetation/construction etc which may affect the systems functioning. Appropriate action may be taken for clearing the vegetation or relocation of the system, as found suitable.
 - 2.7.9. Battery voltage (with and without load), solar panel voltage (with and without load) may be checked. Terminals of charge controller, battery and solar panel may be checked and tightened properly. In case of improper voltage reading, battery/solar panel may be replaced.
 - 2.7.10. Sealing gaskets should be checked for any wear and tear. Same may accordingly be replaced.
- 2.8. Battery should be replaced at least once in three years. As this contract will be valid for the period of 5 years after warranty, hence battery should be replaced at least twice during the period of this contract. This shall be in addition to battery replacement due after any battery fault.
- 2.9. Always a new, tested and completely charged battery shall be used for replacing an old battery. Battery removed from any existing system or new battery older than 18 months shall not be used as replacement. If spare battery is transported in discharged condition, same may be adequately charged using external battery charger before connecting to the system.
- 2.10. For any PCB related complaint (improper data, communication issue, etc), it is advisable to replace the entire PCB with a new tested PCB. This new PCB shall be locally checked (by connecting to LAN) and configured for original System parameters. After PCB replacement, same should be informed to BARC for necessary setting and online testing. Service engineer should leave the site only after receiving confirmation from BARC.
- 2.11. After attending every service/complaint call, service engineer shall:

- 2.11.1. Contact BARC and inform the problem and action taken.
 - 2.11.2. Confirm the communication and correctness of data as received at BARC.
 - 2.11.3. Observe the general wear and tear of the system and assess the remaining life of the system. This will require taking corrosion, damage, condition of electronics etc into consideration. This will help in planning for future replacement of the system.
 - 2.11.4. Inform the local authority about servicing and action taken. Local authority shall also be briefed and discussed for any further action to be taken. A performa may be designed for this intimation and acknowledgement, which may be duly filled for record.
- 2.12. After every Service visit (handing one or more system), service engineer shall furnish the Detailed Service Report (DSR) to BARC.
- 2.13. Service Provider, on monthly basis, shall combine all DSRs sent by various service engineers and furnish Monthly Service Report (MSR) for all services carried out in that month by 5th of following month to BARC. This MSR will be checked and confirmed by BARC, based on individually received DSRs and current status of the attended systems. Format and guideline of DSR and MSR may be mutually decided by Service Provider and BARC.
- 2.14. Service engineers shall carry all necessary tools, equipments and appropriate quantity of tested and working spares with him, while attending any service/complaint call. :
- Working and Tested PCB of the system
 - Spare SIM card
 - Charged Battery
 - Solar Panel mounting clamp.
 - Set of nut-bolts and screws
 - Antenna and other communication related components
 - Charge Controller
 - Mil grade connectors
 - Battery Charger
 - Battery tester
 - Multimeter
- * This list is only a suggestive and not conclusive
- 2.15. Service Provider shall keep all the systems in up-to-date condition with required fault mitigation exercises. The final objective of this maintenance contract should be to attain system availability not less than 99% This availability factor may be mutually decided before entering into the contract.
- 2.16. The maintenance services will be comprehensive and will include cost of labor, faulty parts/complete equipment replacement with new parts/equipment, including plastic parts etc. In case of replacement, the Service provider has to supply latest approved version of equipment/parts and replaced part/equipment will be automatically covered under the AMC.

- 2.17. It is possible that during the contract period, Systems could be added or removed from the scope of AMC. This will be done on pro-rata basis.
- 2.18. Immediate resolution of problem and keeping IERMON network uptime up to 99 % (on monthly basis) is a key factor. Service Provider has to keep adequate spares and standby systems at its various zonal/regional offices, so as to minimize the transportation time from office/factory/store to the site and bringing the system up at the earliest.
- 2.19. A network uptime figure of less than **95%** (on monthly basis) may be considered as sufficient ground to consider services as unsatisfactory and BARC may, at its sole discretion, levy penalty or terminate the contract, in which case the pro rata payment, for the period of AMC services rendered by Service Provider, will be made after recovery of necessary penalty. Further, unsatisfactory service would also lead to encashment of PBG, if any.

3. Deputation of Qualified Man-power:

- 3.1. Service Provider shall recruit qualified and experienced man-power, as service engineers, on his own payroll. These service engineers shall be suitably trained to attend the faults and repair the systems covered in this contract. All payments to these service engineers related to their wages, allowances, social security, medical, bonus and any other obligations shall be made by Service provider only. BARC will not responsible for making payment of any kind to these man-powers.
- 3.2. Service Provider shall make necessary arrangement for providing spares/tools to these service engineers, including arranging technical expertise/guidance to these service engineers, if required.
- 3.3. Service Provider will finally be responsible for assigning particular engineer/s for 'On-Priority' attending of the reported call/complaints under this contract.
- 3.4. All cost of travelling, lodging and boarding, etc of these service engineers on duty under this contract or otherwise shall be borne by Service provider only.
- 3.5. Many of the installation sites of the systems are in the restricted areas. Service Provider should provide the Identity Card and police verification certificate (PVC) to all service engineers/personnel involved for work under this contract. In case the service engineer is not an employee of Service Provider but an expert or local labor, he/she must be accompanied by Service Provider's representative. All such representatives should have Service Provider Identity card and clear police verification, at their own arrangement.

4. Spares and Tools:

- 4.1. Service Provider shall be required to keep sufficient quantity of spare systems/PCBs/assemblies/sub-assemblies at various Zonal Offices. The list

and quantity of spare at each zonal office can be mutually worked out by Service Provider and BARC. Service engineers shall replace faulty PCB/component from this spare and send the faulty part/system for necessary repair.

- 4.2. On receiving such faulty parts/systems, Service Provider shall supply equal or more quantity of working, tested and latest replacement of same part/system, so as to keep spare stock at each zonal office full.
- 4.3. Further, necessary tool kits for carrying out the necessary jobs/ work/ maintenance will be maintained and positioned by the Service Provider.
- 4.4. All cost of transportation/courier of these faulty or healthy parts/ spares shall be borne by Service Provider only. BARC will not be liable to pay for any such transportation/courier under this contract.

5. Guaranteed Repair time:

- 5.1. Service Provider shall ensure to attend the service/complaint call preferably on the same day itself, if system is situated within 50 km from its zonal/regional office where service engineers are deputed, and within 2 working day in all other cases from registering the complaint.
- 5.2. The fault should be rectified and system should be properly working within 4 working days after reporting the complaint.
- 5.3. In case service engineer/s visits a site, outside the city of his/her deputation, for attending more than one system, sufficient spares shall be carried to the site. If despite carrying sufficient quantity of spares, system could not be rectified within 4 working days due to shortage of spares only, a conditional extension of 2 days may be given by BARC so that necessary spares can be brought (in person or by courier from Service Provider HQ/ZO) and system can be repaired in 6 working days. This extension will be strictly conditional and will cover only genuine cases where sufficient spares carried but all were consumed for repair of other systems or fault is detected to a component which is not commonly carried as spares, like solar panel etc. This should not be treated as an excuse for not carrying sufficient and proper spare to site. Decision of granting or denying this extension will rest with BARC only.

6. Penalty:

- 6.1. In case of the stipulated repairs time not being adhered to, the following penalty shall be imposed.
- 6.2. The penalty will be charged for each faulty system for the value equivalent to certain percentage of single system CMC charge for entire contract. This percentage will be based on time taken for repair of the system from registering the complaint:

Beyond 4 working days and up to 7 working days- 5%
Beyond 7 working days and up to 15 days - 10%
Beyond 15 days and up to 1 month - 15%

- 6.3. If the system is not repaired and/or replaced even after 1 month, penalty of 15% of the system CMC charges for the entire contract period (applicable for that system) shall be charged per month.
- 6.4. On the last day of the contract period or on termination of the contract, all the systems shall be in perfect working condition failing which the full cost of repairs, if any incurred, will be recovered from the security deposit/last bill.

7. Billing and Payment:

- 7.1. Payment for this contract shall be in ten (10) instalments as half yearly Arrear. It means that after six months, Service Provider shall submit the invoice for the proportionate amount (not more than 1/10th of the total cost plus applicable taxes). Hence first instalment shall be payable only after 6 months from the initiation of the contract and last instalment will be payable after completion of the contract period.
- 7.2. Service Provider may raise invoice in triplicate indicating the service contract number, date, period (Month/Quarter) for which payment is claimed, for arranging the payment.

8. Confidentiality Clause:

- 8.1. No party/Contractor/Bidders shall disclose any information to any Third party' concerning the matters under this contract generally. In particular, any information identified as " Proprietary" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party. This clause shall apply to the sub-contractors, contractors, advisors, or the employees engaged by the party with equal force

“RESTRICTED INFORMATION” CATEGORIES UNDER SECTION 18 OF: ATOMIC ENERGY ACT, 1962 AND “OFFICIAL SECRET” UNDER SECTION 5 OF OFFICIAL SECRET ACT 1923:

Any contravention of the above mention provisions by any contractor, sub-contractor, consultants, Advisors or tile employees of the contractor will invite penal consequences under the aforesaid Legislation.

8.2. PROHIBITION AGAINST USE OF BARC’S NAME WITHOUT PERMISSION FOR PUBLICITY PURPOSE

The Service Provider, Contractor or subcontractor, consultant advisor or the employees engaged by the contractor shall not use BARC’s name for any publicity media like press, Radio, T.V or internet without the prior written approval of BARC

9. Performance Bank Guarantee and Security Deposit:

- 9.1. Service Provider shall have to submit Performance Bank Guarantee of the value of 10% of the contract amount within 15 days from the issue of letter of Intent as Bank Guarantee drawn in favour of Accounts Officer, BARC, Mumbai. The invocation period of Performance Bank Guarantee should

remain valid for a period of 60 days beyond the date of completion of all the contractual obligations of the service provider/supplier.

- 9.2. Apart from this, Security Deposit will be recovered at the rate of 5% of the bill amount till it becomes 5% of tendered amount of work. Security Deposit will be returned at the end of contract period or at the time of termination of contract without any interest but after deducting penalties, if any, imposed on him.
10. Service Provider will maintain "History Card" and documentation for each system under this Contract.
11. Service Provider will not sub-contract or permit any personnel other than the Service Provider employees to perform any work, service or other activities required by BARC without the prior written consent of the BARC.

Annexure – VI

General Terms & Conditions

Instructions For Two Part Tenders

1. We invite your offer duly signed, consisting in two parts/envelopes marked as follows:-
 - a. Part – I - Technical & Commercial (other than price)
 - b. Part- II - Price
- 1.1. PART – I – Technical & Commercial Bid in Hard copy only (**This part should not contain prices**)
 - 1.1.1 Technical: The detailed technical specification of offer should be covered in this part. Please enclose a compliance statement as per NIT for all the qualifying criteria (point by point). Also enclose a copy of the details indicated in price quotation (WITHOUT PRICES OR BY MASKING THE PRICES) mainly to know the items/specifications for which you have indicated prices in price bid. This part should not contain prices.
 - 1.1.2 Commercial Terms: This part should cover commercial terms & conditions offered by you. In addition to the standard conditions, the specific articles indicated at Annexure shall form a part of our Order/Contract. The supplier shall confirm all the points and send the same along with Technical & Commercial Bid.
 - 1.1.3 This part i.e. Part – I Technical & Commercial should not contain any price details and be kept in a sealed cover duly superscribed as **“Part I – Technical & Commercial Quotation against NIT No.----- dated ----- for providing due on -----”**. The cover should indicate “SENDERS” address
- 1.2 PART II – Price Bid In Hard Copy Only
 - 1.2.1 This part shall indicate Price.
 - 1.2.2 The price for the items should be indicated in this part. All the items/specifications mentioned in the Technical Part should be reflected here and prices indicated against each. Whenever options are quoted, the same should also be indicated with quantity and unit rate separately. The prices are to be mentioned both in figures and in words. In case there is any difference between figures and word quote, the figure quote shall have precedence on the word quote. The price bid shall be submitted as per NIT and shall provide Compliance Statement for all the points. This part should also be kept in a sealed cover superscribed as **“Part II – Price Quotation against NIT No.----- dated-----for providing due on -----”**.
- 2 The two sealed covers prepared as above should be kept in another envelope, sealed and superscribed as **“Quotation against NIT No.----- dated-----for providing due on -----”** Containing 2 separate covers Part-I, Part – II and addressed to:

Head,
Environmental Systems and Networking Section
Radiation Safety Systems Division

Bhabha Atomic Research Centre
Trombay, Mumbai -400085

- 3 Your offer should reach us on or before the due date and time. **Late offers received after the due date and time will not be considered.**
- 4 Vendors may note that BARC also reserves the right of not considering an offer, if there are any deviations in the commercial and/or general terms and conditions offered against the requirements as per this NIT, even if the offer is technically suitable.
- 5 Consortium bidding is not allowed for this NIT. BARC shall assign the overall responsibility of implementation on a single vendor (prime vendor) for the entire works. Any dependency on any sub-contractors shall be managed by the prime vendor and should not have any bearing whatsoever on BARC and the performance of the final contract. However, the prime vendor must specify the source/partner against the proposed systems and the services which includes information like work/business profile of such a supplier, experience in executing/supplying similar type of system/subsystem for which the subcontract is being awarded, etc.
- 6 **In production and pre-despatch inspection:**
 - 6.1 BARC reserves the right to test and inspect the product during any stage of production, with or without advance intimation to the vendor.
 - 6.2 BARC engineers shall be allowed, during normal working hours of normal working days of the vendor's production/fabrication facility, to inspect the quality of the product.
 - 6.3 Based on assessment of BARC engineers, vendor may be asked to modify and correct their practice/approach, for better product quality.
 - 6.4 Vendor should allow BARC engineers to enter into production/fabrication facility and access the production line and assess the quality of unfinished/semi-finished/finished product.
 - 6.5 After completion of production, pre-despatch inspection shall be carried out by BARC engineers at vendor's facility. Material shall be delivered only after successful pre-despatch inspection.
- 7 **Delivery/ Payment Terms:**
 - 7.1 The Price shall be quoted for destination. Price should include either all India delivery or separate state wise delivery charges.
 - 7.2 Price shall be quoted, including the cost of Installation and commissioning (I&C). This I&C cost shall be mentioned separately, either on all India basis or on state-wise basis.
 - 7.3 Taxes and duties, wherever applicable and payable shall be indicated separately.

7.4 GST will be applicable at a concessional rate of 5% for R&D institutions (certificate will be provided by BARC).

7.5 Payment Terms:

7.5.1 BARC discourages advance payment. However, in justifiable cases 30% advance payment against Bank Guarantee of equivalent amount can be made. Bank guarantee should be valid for 24 months or the delivery period plus 90 days, whichever is later.

7.5.2 30% after successful delivery and balance 40% on successful installation and commissioning of item at identified location/ site, and on receipt of certification from focal point and on submission of Performance Bank Guarantee of 10% of Total Order Value. In case, installation and commissioning is not required by BARC, balance payment can be released after delivery.

7.6 Performance Guarantee: Vendor shall provide Performance Bank Guarantee for 10% of the value of Order/Contract from a Scheduled Bank, valid till the end of warranty period plus 3 months with a claim period of three months.

NOTE: All Bank Guarantees shall be as per our format, issued by a Scheduled Bank on Rs.100/- Non-judicial Stamp Paper

7.7 Liquidated Damages: Timely execution of the project is the essence of this contract and shall be strictly adhered to failing which Liquidated Damages will be levied. Vendor is liable to pay liquidated damages at 0.5% per week of delay or part thereof subject to a maximum of 30% on pro-rata basis

8 Others:

8.1 Transit Insurance: Vendor shall insure the items at his own cost.

8.2 Validity of the Offer: 360 days from date of submission of proposal.

8.3 BARC shall have the rights to Purchase the items in Whole lot or Part, as the case may be.

9 Pre-Bid Meeting

In order to provide a better understanding of the requirement, it is proposed to have a pre-bid meeting with the prospective vendors, as per the tender notice, at BARC, Mumbai. Vendors who are desirous to attend the meeting may provide details of the representatives attending the meeting well in time. During this meeting, vendors may also see and understand the existing ERM-GSM system and Earth Station of BARC.

10 Delivery Schedule

The desired delivery schedule is less than 24 months from the placement of the purchase order. Bidder shall provide the firm delivery schedule being proposed along with milestones (like supply of system, installation, testing & acceptance etc), in the technical bid.

The delivery schedule will be an important criterion in selecting the vendor (s).

11 Cost break-up in the Price bid

11.1 In order to have flexibility of choosing the required configuration, the bidders shall submit the price bid with the break-up.

11.2 Bidder shall submit a comprehensive list of deliverables with price masked for any/all proposed configurations factoring the line-items, in its technical bid.