रेलिड&बाकारखाना,कपूरथला
RAILCOACH FACTORY, KAPURTHALA

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Sub: Issue of specification MDTS-44415 Rev.03

Please find enclosed a copy of under mentioned specification MDTS44415 Rev. 03, for information and necessary action at your end.

Description: Technical specification for Design, supply, installation, commissioning & CAMC for OBCMS & PICCU with integration of other electronic systems in IR coaches

SME/Design/Fur

CQM-I,II CPLE CWE/Fur CMM/ HSQ CMM/TKJ CWE/Shell

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S. No	Month/Year of issue	Revision/Amendment	Page No.	Reason for Amendment
1.	May/2025	00	1	First issued
2.	September/2025	01		1. Part A and Part B is added 2. Description is changed. Modified the clauses focusing on functional requirements.
3.	December/2025	02		1. Added clause 1(e) in Part B 2. Reason for amendment is changed accordingly. .
4.	May/2026	03		1. Modified point no. 1. Of deliverable expected from the OBCMS system 2. Modified point no. 2 of deliverable expected from OBCMS system. 3. Deleted point g and h of Type testing 4. Modified Clause 11(b) of warranty, service and CAMC

Forward

The specification consists of three parts: Part A, Part B & Part C.

Part A of the specification covers the requirements of the vibration based Onboard Condition Monitoring System (OBCMS) on IR coaches have been given.

Part B covers supply of integrated PICCU with PAPIS &Infotainment System, WLI, CCTV, OBCMS and integration with other Electronics system like WSP, Bio Vacuum hybrid Toilet, FSDS, FDSS, RMPU, EPPFS, Under Slung Regulated Batter Charger, Network & Electrical equipments and any other Smart equipments specified by Indian Railways on all IR coaches.

Part C covers general requirements for both Part A & B.

The condition monitoring and predictive maintenance hold the key to increase reliability and availability of rolling stock on the Indian Railways network. The system shall detect failures together with real time data from various sub systems and generate actionable alerts post analysis. Integration of other Smart systems with PICCU shall enable the transfer of data of individual subsystems to IR servers.

Such a system would finally result in improved safety, improved reliability, higher utilization, increased up-time and reduced operation cost of the railway assets by enabling predictive maintenance and reduction in failures of these assets.

Scope:

1) Under **Part A**, the specification covers the requirements for design, development, supply, commissioning, and CAMC of OBCMS on all IR Coaches. Through OBCMS, Indian Railways shall be able to monitor subsystems and create actionable alerts for the concerned authorities in case of any deviation from the norm.

2) **Part B** covers supply of integrated PICCU with PAPIS &Infotainment System, WLI, CCTV, OBCMS and integration with other Electronics system like WSP, Bio Vacuum hybrid Toilet, FSDS, FDSS, RMPU, EPPFS, Under Slung Regulated Batter Charger, Network & Electrical equipments and any other system specified by Indian Railways on IR coaches (LHB coaches). The LHB coaches shall be able to deliver the expected performance in standalone. The specification defines the Integration of various Electronics systems with PICCU for transferring the data of all sub systems on IR server through PICCU.

3) **Part C** covers general requirements for both Part A & B.

Scope of supply shall be as per the purchase order.
Complete design, supply, installation, commissioning, maintenance manuals, spares & maintenance work during warranty period & CAMC period after warranty shall be in scope of firm.

The bidder shall provide the cost breakup for the offer. The item-wise cost quoted shall be considered to account for any variation in quantity of supply.

Part A

1. Key Objectives:

Indian Railways wishes to install train mounted, 'On-board Condition Monitoring System' enabling predictive maintenance.

The OBCMS shall monitor the vibration of the system to determine the health of the rolling stock subsystems follows:

i. Health of axle bearings
ii. Health of Suspensions (both Primary & Secondary)
iii. Health of wheels
iv. Health of track

a) Improving reliability and safety by early warning of distress or impending failures in subsystems as referred in this document using the vibration & temperature signature of the wireless sensors that are strategically placed on the wheel axle box.
b) Improvement in reliability of these assets by detecting early signs of deterioration and providing ample time for planning preventive and predictive maintenance and avoiding sudden breakdowns in service.
c) Enabling scientific decision-making for maintenance of assets based on accurate deterioration trend and quantified indices of state of health of these subsystems as referred to in this document to plan condition-based maintenance rather than time-based maintenance.
d) The proposed system should be capable of being used with existing bearings without having to make any structural modifications in the bearings or any major intrusive modification in the bearing/bogie frame or electrical schematics in case of train sets.
e) Easy operation of the On-Board Condition Monitoring System by simple, automatically generated, and actionable alerts.
f) Smart coach web portal hosting, access and management.
   i. OBCMS for all IR coaches shall send the collected raw data to the Indian railways (IR) server or any server advised by IR. The supplier shall host the web portal and database of the OBCMS for the Indian Railways coaches. Furthermore, raw data collected and stored on the Indian Railway server shall be permitted to interface with the OBCMS supplier's central server (placed in India) for processing and analysis for the generation of alerts, then display on a dashboard.
   ii. The contractor shall provide format of data & depute team in Concerned Indian Railways unit for preparing server to receive data to the satisfaction of Indian railways. The team of experienced professionals shall assist Indian Railways to make server ready for the system.

iii. The contractor shall facilitate seamless data transmission between the system and Indian Railway servers for warranty period & CAMC. There must not be any data loss of any system.

iv. Firm shall comply with all presently applicable extent data protection rules issued by Government of India (CERT-In) and any rule issued thereafter.

v. The application should display the essential parameters on a dashboard. Also, Smartphone applications with authentication shall permit railway users to monitor the dashboard. The layout of the dashboard shall be designed in consultation with concerned Railway.

vi. Automatic generation analytical reports for predictive and corrective maintenance by IR.

vii. System's each & every component must meet applicable international/national standards of standardization & integration. It must be able to integrate with PICCU. It must be able to send all the data to Indian Railway servers or assigned server.

viii. System should be "future proof" to the extent that any change in communication technology and sensor electronics should not degrade its performance nor should necessitate that Indian Railways is compelled to change the purchased system to reap its intended benefits.

g) A single web portal to access the entire Data Concentrator/PICCU/IR server with standard filtering and sorting (should include Coach Wise, Rake Wise and Depot wise views). Web portals have OBCMS data analysis, alert and escalation functions for IR Coach Systems. The web portal shall internalize the acknowledgement and escalation structure. Any name, word, phrase, logo, symbol, design, image, or a combination of these elements developed in the process shall be approved by concerned Railway and shall be the intellectual property of IR.

h) Labour, material, tools, wire, cables, connectors, fasteners, brackets and any other concomitant accessories or items that might not be mentioned but essential for satisfactory functioning of the system shall be under the scope of supply of the contractor.

Note: Use of any licensed or proprietary software/application should be avoided. If unavoidable, the requisite number of licenses shall be obtained in perpetual mode to cover the warranty period & CAMC.

2. Deliverables expected from the OBCMS System:

1. The Wireless Sensor Node (WSN) shall be designed, and laboratory tested to withstand a small quantity of severe vibration levels between 200g & 500g and shall incorporate self-diagnostic capability to monitor its own health and ensure continuous operational efficiency. While vibration test levels in excess of 200g and up to 500g may be referenced and are indicative of the severity of the operating environment as part of design validation, the emphasis shall be on suitability and robustness for railway service conditions. All sensor data shall be time, date, and location- stamped. Indian Railways would appreciate the availability of proven WSN designs and tested to be compliant with EN 61373:2010, i.e. validated for harsh railway vibration environments.
2. If any part gets defective within the warranty period from the date of commissioning, the contractor shall replace the part with same make to ensure un-interrupted condition monitoring of the subsystem.
3. The design of sensors and data concentrators shall be universal (Hardware and Software) to all types of axle bearings and other subsystems of any make and shall not be specific to any type or to any specific bearing supplier.

4. Vibrations shall be measured and transmitted under suitable speed gating and load condition to get good frequency response.
5. The system must be able to measure the health of axle bearings, Suspensions (both Primary & Secondary), wheels & Track.
6. The system shall have proven capability of detecting bearing damage at-least 3-4 months (At-least expected running 50,000 Kms) prior bearing replacement is required, allowing ample time for the bearing replacement activity to be planned in with other maintenance activities. In many cases due to maintenance defects, there is sudden failure of bearing, so it should have provision of telling early tell-tale signs as well.
7. The subsystem condition scale shall, after appropriate configuration and calibration, enable the RCF to distinguish between subsystem with none or low level of damage and those that required increased attention and finally those requiring replacement to allow continued reliable operation of the train without a line-failure of the bearing.
8. All sensor data shall be time, date and location stamped. Data location shall be typically accurate to ±10m or better. Date and Time stamp shall be taken from the Dual band GPS/GLONASS/GNSS system only. Speed shall also be measured, recorded & sent with data. Provision to fall back in case of poor satellite connectivity like dead zone, tunnel etc.
9. The allocation of wireless sensor nodes to a data concentrator and train shall be easily configured through Wireless communication between DC and WSNs by a proven method running successfully in passenger coaches on Indian Railway with dedicated frequency range using an internal antenna.
10. In the event of damage to wireless sensors a warning shall be generated to enable safe replacement at the next inspection interval.
11. The wheel condition monitoring system must be able to detect defects arising of Rolling contact fatigue like wheel shelling/wheel flats/ subsurface defects/thermal crack in wheel. It should give actionable alerts in advance before reaching the limit of wheel shelling (40 mm & 1.5 length & depth) & wheel flat (50mm).
12. Data analysis and event generation shall be the responsibility of the contractor. The screen of the dashboard should be compatible with Laptop/Desktop/Mobile/Tablet.
13. The system must be able to provide reports in different formats (CSV, PDF or similar format files which can be opened and viewed in standard PCs).
14. Alert levels should be configurable and set by the operator to enable simple, actionable responses. However, the contractor shall take the responsibility of identifying the values and setting the limits and alarm thresholds after studying the running condition of IR coaches on Main Line/Depot.
15. Users must have the provision to define the alarm thresholds and to visualize all the parameters numerically and graphically on the screen which has exceeded the alarm thresholds (defined as event).
16. The condition monitoring software algorithm should also report the state of the health of the subsystem on discreet band zone – “Green Zone” for unconditionally safe to run, “Yellow Zone”- for beginning of noticeable deterioration, “Orange Zone”- further deterioration, and “Red Zone” - for indication to pull out the asset as soon as possible since it is reaching an impending failure stage.
17. The “condition band” (Green band, Yellow band, Orange Band and Red band) as mentioned above shall, after appropriate configuration and calibration, enable the operator to distinguish between bearings/wheels and track with none or low level of rate of degradation, those that require to be kept sight of for further deterioration and finally those requiring prompt attention to allow continued reliable operation of the train without a line-failure of the asset.

18. The supplier shall be obliged to assist Indian Railways personnel in understanding the logic of the thresholds set by them to the full satisfaction of the Indian Railways personnel. The contractor shall supply an approved and reliable system which requires the least time for any fine tuning of its algorithms.
19. Vibration data shall be captured at time intervals based on speed. If required, it should be held in buffer of the data concentrator and then transmitted to a central database (IR server) for processing, analysis and alert. In the event of cellular network not being available, the data shall be held for the entire required time until cellular network coverage becomes available and then data must be transmitted at the earliest. The data holding buffer for 30 days must be designed accordingly.
20. The System shall be capable of measuring vibration data with suitable speed gating, and temperature data shall be monitored and measured continuously. The temperature and vibration data shall be sent to the Onboard Concentrator continuously. Data concentrator then will send to server recommended by Indian Railways temperature, vibration, speed, GPS/ GLONASS /GNSS data. The server will maintain log files of data. System should be able to take feedback of receipt of data. In case of any communication issue also, continuity of data should be maintained. No data should be lost.
21. The system should be capable of operating effectively with GPS/ GLONASS /GNSS, LTE/2G/3G/4G/or 5G or better cellular data network coverage with auto switching facility as per network availability. The system must be scalable to further upgrades as and when needed in future without having to replace the system. The web server applications to process and analyze the data uploaded by OBCMS and generate actionable alerts automatically through e-mails and SMSs.
22. The system must have a wireless module to use onboard concentrator cellular network for the transfer of data. The supplier shall be responsible for the required GPS/ GLONASS /GNSS, 2G/3G/4G/LTE or 5G or better data service with auto switching technology and shall be accommodated with the same in the package.
23. All data shall be captured and transmitted from system to recommend server by IR for inspection and analysis. The analysis software should be smart enough to do self-diagnosis. The recheck shall be done for the sensors detected by software to avoid false positive.
24. All the sensors should have configuration facilities so that any sensor could be installed/ replaced with any other sensor by programming its location ID, there should not be any need of re-programming of data concentrator.
25. Only standard Industry Communication protocols and encryption algorithms shall be used in the system from it to the IR Servers.
26. The sensors transmit the data wirelessly to the data concentrator, which in turn transmits the data for storage and processing in the IR Server. Additional details on the system components are presented in the following sections.
27. Data to be transmitted in intervals of 1 minute. Data to be transmitted without loss of any captured data. Firm shall ensure maximum network connectivity for seamless data transmission.

3. Hardware Requirement:

The requirement of hardware for On-board Condition Monitoring System on Indian Railways coaches is as below:

S No	Description of Requirement	Quantity per coach(minimum*)
(A)	Vibration cum temperature based Wireless Sensing Node (WSN) on each wheel axle box.	8
(B)	Data Concentrator (DC) unit.	1
(C)	Wireless communication between Wireless communication between DC and WSNs by a proven method running successfully in passenger coaches on Indian Railway	1
(D)	Secured mounting arrangement for WSN.	8
(E)	Appropriate mounting bracket and fasteners for DC.	1
(F)	MCBs (compatible with installed system ratings)	1

4. Technical Specification:

a) Wireless Sensor:

i. A single wireless sensor shall be capable of monitoring both vibration and temperature condition data when fitted to the wheel axles box.
ii. The wireless sensor shall incorporate an internal power-sustaining mechanism ensuring uninterrupted autonomous functionality throughout its service life.
iii. The allocation of wireless sensor nodes to a data concentrator and train shall be easily configured through Wireless communication between DC and WSNs by a proven method running successfully in passenger coaches on Indian Railway with dedicated frequency range using an internal antenna.
iv. The sensor shall send the regular temperature and vibration data to onboard data concentrator and then transmit it to IR server and shall not experience lag for more than 60 seconds.
v. The wireless sensor node should be deployed on the wheel axle box with suitable arrangement without disturbing the existing assembly or electrical schematics. There shall be no wired electrical output from the WSN.

vi. Wireless sensor nodes shall be common to all axle boxes. Customization may only be required for fixing bracket arrangements.
vii. Sensor housing and all other installation accessories shall be surface treated to protect it against corrosion. Sensors should be protected against any firmware.

The vibration based wireless sensor shall meet the following specifications:

S. No	Parameter	Specification
A	Vibration	More than 200g up to maximum of 500g
B	Temperature	-40°Cto +105°C
C	Frequency Range	1-5000Hz
D	Mounting Material Type	304 Stainless Steel or better.
E	Sampling Data Rate	At Least 2000Hz
F	Sensitivity/Accuracy	±0.05g
G	Train Speed Before Measurements Commence	Above 15 Kmph, based on Speed Signal
H	Protection Class	At least IP68 & IP69k
I	Certification	EN50121-3-2 EN 50155:2007 EN45545-2/HL3
J	Shock and vibration	EN 61373 :2010

b) Data Concentrator Communication Hub:

1. The Data Concentrator shall have at least 16 channels to incorporate all wheel axle box output for vibration and temperature analysis (Extra channels have been asked considering the future requirements).
2. The data concentrator shall be mounted on the Train Body (Either inside or under the Car frame as per IR requirement); therefore, once the bogie is dismounted from the car, it shall not require any configuration.
3. The data concentrator shall be powered by standard 110V AC/DC power supply. 110V AC/DC will be available from train side, protective MCBs and installation arrangements should be done by Contractor.
4. The data concentrator shall have GPS/GSM/ GLONASS /GNSS, Modbus TCP/IP, RS232 & RS485 for the following functions: -
   i. Data Concentrator should accept industry standard protocols like Modbus, RS485/TCP/IP. Data Concentrator should be able to configure and transmit the field data from Wireless Sensor Node.
   ii. Shock & vibration testing shall comply as per IEC-61373-2010 standard.
   iii. The entire components like GSM/GNSS/LTE router, GSM/GNSS/LTE antenna should be in one unit and well secured for a rigorous train environment.
   iv. The Data Concentrator shall have the ability to collect sensor data, tag it with date, time and location of the transmission and forward it to IR Servers.

The data concentrator shall meet the following specifications:

S. No	Parameter	Specification
A	Voltage Supply	110 V AC/DC will be available from the train side, protective MCBs and installation arrangement should be done by Contractor.
B	Communication with Wireless Sensor	Wireless communication between DC and WSNs by a proven method running successfully in passenger coaches on Indian Railway
C	Remote data transmission	2G/3G/4G/LTE or 5G or better (dependent on region) data modem-requires a data compatible SIM card with SMS enabled. Data transmission is to be directed to IR Servers. Processed data may be forwarded to customer facilities or accessed online via a Web browser.
D	Local data transmission	Local streaming serial data output, 9-way D-type connector, RS485, RS232
E	Data Storage (for periods of low/no data connection)	≥30days of data at selected rate
F	Incident report function	Continuous calculation and reporting
G	Mobile Data Network Support	2G/3G/4G/LTE or 5G or better (micro-SIM or e-SIM)
H	Communication Protocol (for communication between DC & PICCU)	Modbus RS485, RS232 TCP/IP
I	Protection Class	IP67
J	Certification	EMCEN/IEC61000-6-4EN50121-3-2 Railway Standards Compliant with EN50155:2017 and EN 50121-3

K	Indication/Status	One indication for power. One indication for communication, Signal strength.

c) Software and Algorithm:

1. The software shall be used to analyze the raw sensor data and produce simple actionable alerts for maintenance staff. The actionable alert should include the recommendation for the maintenance staff.
2. The output from the software algorithms shall be a simple numerical value & values of permissible values for Green, Yellow, Orange & Red should be mentioned to quantify the seriousness of any emerging problem depicting:
   i. Normal Health of the asset (Wheel, Axle bearing, track, Suspensions etc) being monitored.
   ii. Beginning of deterioration but does not warrant intervention.
   iii. Deterioration in the health of assets requires intervention within 3-4 months.
   iv. Deterioration in the health of assets requires immediate replacement from service at the next available service check.
   v. The output from the software algorithms shall display the current value with respect to the values mentioned above in suitable color codes for all the four conditions.
   vi. Firm shall provide all software upgrades without any additional cost in warranty & CAMC. Firm shall protect the system against any firmware.
   vii. Firm shall ensure stability of software.
   viii. All the product's licenses that bidder proposes should be perpetual licenses. The perpetual license should be in the name of the purchaser. The software licenses shall not be restricted based on location and the bidder should have the flexibility to use the software licenses for other requirements if required, provided the same does not violate the usage rights agreed with the original manufacturer.
   ix. Bidder shall use appropriate API/RTSP to push time stamped data, real time data from the OBCMS as and when needed.

d) Communications:

i. Communications between vibration-based sensor nodes and Data concentrator shall be wireless only.
ii. 2G/3G/4G/LTE or 5G or better Cellular or satellite communications shall be used to send data to and from the train.
iii. Data compression will be part of the "on train" systems so that communications can be achieved effectively with 2G/3G/4G/LTE or 5G or better cellular data communications.
iv. The communication from wireless sensors shall be free from interference by passenger communication systems such as Wi-Fi, BLE/Zigbee mesh networking and cellular radio.
v. The communication from On-board concentrator to IR server shall be encrypted and protected from any interception by outside agent.
vi. Firm to ensure maximum connectivity along Railway route by providing Single/dual SIM of stable network with maximum coverage in area. SIM payment for complete warranty & CAMC period shall be borne by the firm. Single/dual to be provided with SIM bonding to ensure maximum coverage.

vii. Data packet size must be suitable with compression algorithm & retry logic during any failure.

e) Server:

i. Information about the monitored assets on the user website shall be compatible with accessibility with common mobile devices (i-Phone, Android, Windows phone, tablets) as well as standard desktop computers running a web browser.

ii. Sensor information shall be available as simple colored status diagrams, tables of numerical values indicating alert, equipment health and diagnostic information and graphical display of historical condition information allowing comparison on all common Internet browsers, including mobile platforms.

iii. The information for monitored rail assets with sensors shall include but not be limited to:
   a) Speed.
   b) Direction.
   c) Health state (including state of the sensors and data concentrator).
   d) Condition as indicated by vibration.
   e) Necessary APIs (Application Program Interface) along with the mapping software should be developed by the supplier of the system and shall be free of cost for all future uses - including obtaining any authorization for use of Geo-mapping data and Software.

5. Miscellaneous Requirements:

i. For LHB, other axle end equipments such as pulse generator, WSP sensors, ERCU etc. are provided on axle box front covers. Hence fitment of 'OBCMS' sensors should be such that it should be suitable for fitment along with above equipments.

ii. The OBCMS equipment shall be fitted in such a way that accurate vibration data from sensors is transmitted.

iii. Equipment should be immune to Electromagnetic interference (EMI).

iv. Change of train composition and orientation of coaches might be required for train operation. The OBCMS on the IR coaches should be designed so that the network configuration should be reconfigured automatically.

v. The system should have sufficient space to store the acquired data for the period of non-availability of GSM/GNSS signal for data transfer. No data shall be lost during the period of Non availability of GSM/GNSS signal for a distance of at least 100 Kilometers.

vi. OBCMS or any other connected subsystem shall not allow any stray or unauthorized device to communicate with the IR coach system. The whole system should be designed to deny access to all unidentified or malicious or spoofing devices.

vii. The supplier must apply the policies and practices of the standard IEC62443 relating to the cyber security of the industrial installations for all the systems of its supply. The application of this standard must be evaluated by an independent accredited body, and the certificate shall be submitted to IR as a prerequisite for commissioning. Moreover, the bidder shall comply with the following requirements: -Declare the country of origin of components and products used in the system. Systems shall be designed to appropriately limit the rights for system access and

configuration through identification and authentication control. Multifactor authentication methods like combinations of password, OTP, security questions, and Digital Signature Certificate (DSC) should be used to protect critical access and control. System shall have the intrusion detection and prevention system to avert any cyber-attack. A monthly report on the cyber-integrity of the system shall be provided by the bidder during the warranty period. All essential data shall be archived regularly on offline storage media.

viii. The Vendor/Supplier shall not store, publish, or transmit any data generated by the system to any server, cloud service or external storage, solution unless explicitly authorized by Indian Railways.

ix. All connectors shall be IP65 rated or higher and shall comply with the RDSO specification no. RDSO/CG-18001(Rev.2).

x. All the required software/program/application and their installation/updating/support during warranty period & CAMC period shall be in the scope of supply of the firm.

xi. All fitment material, labor and design changes required shall be in the scope of contractor.

xii. Any additional fixtures & labor required for the fitment of the OBCMS on the coach shall be in the scope of supply of the contractor. The contractor shall take approval of concerned Indian Railway / RCF before fitment on the coach.

xiii. The supplier shall ensure that the products supplied under the system shall be within the SOD requirement (Maximum Height & Minimum clearance).

xiv. All the sensors and equipment of the coach shall be firmly mounted on the coach with anti-pilferage measures (if required) to sustain the loads under normal operating conditions.

xv. For coaches provided with a PICCU system, for example LHB coaches, data concentrators shall interface with the PICCU system over Wireless / Ethernet interface and route the OBCMS data to Railway Servers through the SIM provided in the PICCU system.

xvi. The details of Subscriber Identification Module (SIM) used in the system shall be shared with the concerned Indian Railways representative.

xvii. The login credentials to the https (renewable upto 5 years) web portal (User ID & Password) should be provided to concerned IR representative & base depots after successful completion of the training of using the portal. The portal shall have different user access levels to control and define the rights and privileges on the portal.

xviii. Demonstration of the working of OBCMS post installation and commissioning shall have to be done by the supplier.

xix. The Software User interface shall allow visualizing different measurement systems data on the same Software instance with the purpose of correlating data and improving maintenance activities.

xx. The OBCMS solution provided, wholly and individually, should be compliant with IR and UIC standards (wherever not adequately covered by IR standard).

xxi. Required testing (as per the latest versions of specified standards) and quality declarations by the firm and OEM should be provided.

Part – B

Scope:

This part of specification covers the technical requirements for design, development, supply, installation, commissioning, warranty and CAMC of PICCU with integration of other electronic systems in LHB coaches.

a. Following integrated electronic systems shall be in scope of firm for supply, installation, commissioning, warranty and CAMC: -

i. PAPIS &Infotainment System
ii. WLI
iii. CCTV
iv. OBCMS

b. Following Electronic systems shall be integrated by the firm with the system supplied by them. Supply of these equipments listed below shall be in the scope of Railways: -

i. WSP
ii. Bio-Vacuum hybrid Toilet for IR passenger coaches
iii. FSDS& FDSS system
iv. RMPU
v. Electro-Pneumatic pressurized flushing system.
vi. ETBU
vii. Under slung Regulated Battery Charger
viii. Network & Electrical equipment
ix. Or any other system specified by Indian railways.

c. Firm shall be completely responsible for successful installation, commissioning, integration and performance of other electronic systems with PICCU during warranty & CAMC for the work done for integration.

i. Applications on the PICCU shall communicate and Integrated data from all systems from PAPIS, WLI, CCTV, OBCMS, WSP, Bio Vacuum hybrid Toilet system, FSDS, FDSS, RMPU, EPPFS, ETBU or any other system specified by Indian railways for IR passenger coaches. All Collected data from all systems shall be uploaded and stored on PICCU and then transfer data in securely and encrypted from to IR server recommended by Indian Railways.
ii. Data from IR server shall be taken for analysis by application. The Application shall process and analyze the stored data of all sub systems and generate actionable alerts automatically through emails and SMSs.
iii. There shall be single web portal to access all the data monitored by system with standard filtering and sorting (should include Coach-wise, Rake-wise, and Depot wise views).

Web portals shall have data analysis, alert and escalation functions for the monitored systems.

iv. There shall also be Captive portal login on Wi-Fi hotspot for passengers to access prerecorded infotainment content

v. PICCU shall have self-diagnosis function to detect any error related to transfer data from individual electronic systems & report on web portal.

vi. The offer shall include a recommended list of spare parts required for day-to-day maintenance of the smart coach equipment. At least 10% of the spares of all critical hardware shall be maintained at the user depot by the supplier. Any replacement request under the warranty shall be covered through- this account and shall be later recouped by the supplier.

vii. Use of any licensed or proprietary software/application should be avoided as far as possible. If unavoidable, the requisite number of licenses shall be obtained and renewed to cover the warranty period.

viii. Bidder should also provide API to get the systems health check data, system tampering information as needed for integration with PICCU.

1. Functional And Design Requirements:

a) Passenger Information and Coach Computing Unit (PICCU) [Guiding/Governing/Functional Specification: RDSO/CG-18001 (Latest version)]

PICCU shall be an integrated, scalable, upgradable industrial computer complying with IEC60571-I or EN50155. It shall act as the storing and uploading the data from all electronic systems. It shall comprise components and systems to deliver requisite functionality. PICCU shall be fitted onboard on the coach. SBC (Switch Board Cabinet) has the electrical supply available at 750 V AC, 415 V AC, and 110 V AC/ DC. Indian Railways shall approve the power rating for the system (all electrical components and subsystems) in the scope of this specification. PICCU shall have all inbuilt voltage converter and inverter to meet the power requirements, PICCU shall meet the following minimum requirements: -

i. Industrial grade 64-bit multi-core processor (minimum quad-core, 1.8 GHz base clock, with ≥4 MB cache) from reputed make (Intel, ARM, or equivalent), designed for extended temperature operation and long-term availability (≥10 years lifecycle). The processor shall be capable of handling concurrent tasks including data acquisition (Modbus/CAN), video streaming (CCTV), passenger information services, and secure communication to IR servers without performance degradation.

ii. The PICCU shall have an open communication platform like Multiple RS-485/RS-232 (for FSDS, WSP etc), CAN Bus (used in some railway control systems), Ethernet (GbE, often dual redundant) for CCTV/IP cameras, USB 3.0 for external storage or USB sensors, Digital I/O (GPIO) for alarms, relays, Modbus RTU (via RS-485/RS-232) and Modbus TCP (via Ethernet) for transfer of data from onboard systems. PICCU integration with the other controller should not be restricted.

iii. Latest GNU Linux Linux-based Industrial OS (Preferred)

iv. 16–32 GB ECC RAM.

v. At least 500 GB Industrial SSD/NVMe on board memory for OS and applications.

vi. Removable and swappable SSD/NVMe media for infotainment content storage of 1TB.
vii. Removable and swappable SSD/NVMe media for CCTV content in cyclic manner of 4 TB or more capacity.
viii. Removable SD card/Micro SD card of 64 GB storage for emergency storage of data in case of SSD failure. SD card/Micro SD shall be accessible through Service port.
ix. Built in 7-inch touch screen having minimum 7-inch, 1024 × 600, capacitive touch, 16:9, brightness ~350 nits.
x. Cellular network module for wireless communication (shall handle all the data communication requirements) with dual SIM card port, SMA connectors, and roof-mounted IP67 rated GSM-GNSS/GPS/ GLONASS combo antenna (anti-theft design). The SIM. card slots shall be accessible for replacement of SIM cards.
xi. 50 channels NMEA-OI 83 compatible GPS/GNSS/ GLONASS receiver with L1+L5 and NAVIC support to meet guidelines to use NAVIK in Indian infrastructure project with positional accuracy within 5-meter radius under open sky, 95% of the time. It shall use the GSM/GNSS/GPS / GLONASS combo antenna.
xii. Compact design for LED Power on indication in front side of PICCU.
xiii. Reset push button on backside of PICCU to factory reset and reboot.
xiv. IP65 rated fan-less design of PICCU enclosure within 3U rack mounting to ensure fitment (1 U equals 1.75-inches: 3 x 1.75" = 5.25-inches).
xv. Inbuilt LTE/2G/4G/5G or better and GPS/GNSS/GSM/ GLONASS module to connect with the internet.
xvi. PICCU to be tagged with an alphanumeric identifier (MCP-PICCU-XXXXXXXX); where XXXXXXXX shall be the coach number, this identifier shall be configurable and protected with authentication. [Refer 14. I of RDSO/CG-18001 (Rev 2) for details].
xvii. Compliance with temperature and humidity requirements as per EN50155 standard
xviii. Inbuilt power supply unit for 110V AC/DC required capacity MCB at input terminal for connection of wires, short circuit fuse etc.
xix. Electromagnetic interference (EMI) filter assembly (with inbuilt stabilizers) to suppress any unwanted spikes and surges from power lines or other systems.
xx. Shielded and earthed against electromagnetic/static induction in the operating conditions.
xxi. All the specifications and design related information for comprising systems must be documented and provided in soft and hard copies. The documentation will- include operating, maintenance and troubleshooting manuals.

Following communication interfaces shall be inbuilt in the PICCU:

a. Cellular network module shall support 2G (GSM/GNSS, GPRS, and EDGE), 3G (UMTS, CDMA2000. and HSPA) and 4G /5G or higher (LTE) with auto switching facility as per the network availability.
b. Standard protocols like HTTPs, SFTP, TCP/IP, VOW, and others shall be available on PICCU.
c. Type A USB ports (minimum two) at front and back each (to support data transfer, system backup, and restore) with M12 connectors; required number of electrically isolated RS 485 and RS232 with M12/Military Grade connectors.
d. Industrial Ethernet port for train wide network.
e. One VGA and one HDMI ports.
f. Managed network switch (EN50155 certified) with internal 16 POE ports.

g. GSM/GSNN network subscription to facilitate required data transmission between PICCU and IR server at 4G/5G/LTE or better, for warranty & AMC period shall be in scope of firm.

b) On Board Condition Monitoring System (OBCMS)

a. As stated earlier in Part A of Specification, the OBCMS shall monitor the health and safety of key components by enabling predictive maintenance and reduction in sudden failures of the assets.
b. For hardware & functional requirements, the system shall be as per Part A of specs.
c. However, firms may optimize upon hardware requirements across all sub systems with prior approval of Indian railways.

c) Closed-circuit television (CCTV) or Video Surveillance[Governing Specification: RDSO SPN TC 106 2025 V 3.1]

i. The coaches shall be equipped with a video surveillance system to record events during journeys. These recordings might prove helpful in investigating any mishap or tragic event.
ii. All requirements of CCTV system provided in RDSO specification RDSO SPN TC 106 2025 V 3.1 (Latest revision) shall meet by the firm.
iii. Hardware shall also be as per RDSO specification RDSO SPN TC 106 2025 V 3.1(Latest revision).
iv. However, firm may optimize upon hardware requirement across all sub systems with prior approval of Indian railways.

d) Water Level Indicator [Governing Spec: IS/RDSO-CG/0002:2025 with Corrigendum 1].

i. The module shall indicate the status of water level in the water tanks.
ii. Hardware shall also be as per RDSO specification IS/RDSO-CG/0002:2025 with Corrigendum 1.
iii. However, firm may optimize upon hardware requirement across all sub systems with prior approval of Indian railways.

e) PICCU shall be interfaced with Switch Board cabinet with RS485/Ethernet connection at single point interfaced for accessing the data from electrical systems. Following consolidated data shall be communicated to PICCU with standardized MODBUS/TCP-IP protocol.

1 HVAC/RMPU status:

a. Temperature (Set Temperature supply Air, Return Air & Fresh Air)
b. Humidity
c. Compressor ON/OFF Status
d. Heater ON/OFF Status
e. LP/HP Real Time reading Including Trip Status
f. Over Heat Protection
g. All types of RMPU Controller Data related to Faults.

2 **Under Slung Regulated Batter Charger Status:**

a. Battery Voltage

b. Battery Current
c. RBC OK/EBC On
d. Battery Health Status
e. DC insulation Failure Positive/negative
f. Output Overvoltage, Overcurrent & Short circuit
h. Over Temperature
i. Input single Phasing, Over Voltage & Under Voltage

3 **Network Status:**
a. Selected Network Net-1/Net-2
b. Current/Voltage/Power Consumption at Coach Level

4 **Other Electrical Parameters:**
a. Over Voltage/Under Voltage/Phase Sequence/Single Phasing status in 750V & 415V Circuit.
b. Insulation Failure in 415V & 110V AC circuit
c. Water Pump ON/OFF Status

f) System Integration with PICCU:

PICCU shall be integrated with electronic systems to store and upload the data on IR servers for monitoring and analyzing purposes. Application programming interfaces (APIs) may be required to be developed by the OEM or obtained from OEMs to communicate with the following modules. The supplier Shall provide: the application(s) on the PICCU and https web to access information- from connected peripherals. The following systems that shall be integrated with PICCU are: -

i. PAPIS
ii. WLI
iii. CCTV
iv. OBCMS
v. WSP
vi. Bio Vacuum hybrid Toilet for IR passenger coaches
vii. FSDS& FDSS system
viii. RMPU
ix. Electro-Pneumatic pressurized flushing system
x. ETBU
xi. Under slung Regulated Battery Charger
xii. Network & Electrical equipment

In addition to the above-mentioned systems, PICCU may be connected with any other systems specified by Railways.

Connection of integration of PICCU with Electronic systems will be in scope of supplier under this specification.

g) Web and Mobile Phone Applications:

i. Mobile phone applications (both Android and iOS platform) shall be designed and hosted on the respective application stores for the use by passengers. The apps shall authenticate passengers and give access to the infotainment content using PNR only; Complete PNR list

for the journey shall be fetched at the start of journey with periodic updates at the stations where charting is done.

ii. Mobile phone applications (both Android and iOS platform) shall be designed and hosted on the respective application stores for the railway users, all coach monitored systems and related information, and alerts shall be pushed through the apps. Railway users shall be authenticated using login credentials and crucial access shall be authenticated by OTP.

iii. Single https web profile to access all the data stored by PICCU with standard filtering and sorting (should include Coach Wise, Rake Wise, and Depot wise views). Web portals have data analysis, alert, and escalation functions for Coach Systems (including OBCMS). The web portal shall internalize the acknowledgement and escalation structure.

iv. Any name, word, phrase, logo, symbol, design, image, or a combination of these elements developed in the process shall be approved by Indian Railways and shall be the intellectual property of Indian Railways.

v. Development shall be made in consultation with RCF. The contractor shall provide format of data & depute team in Concerned Indian Railways unit for preparing server to receive data to the satisfaction of Indian railways. The team of 3-4 experienced professionals shall work with Indian Railways for make server ready for the system.

vi. Team deputed by contractor shall develop application, web portal, App or any other system required for complete functioning of the system.

h) Smart coach web portal hosting, access, and management:

a. A https web interface shall be developed by firm as per Railways requirement for monitoring, viewing on PC/Mobile apps train rake wise, depot wise, zone wise of all coaches by all concerned users at stations, depot, zone etc and automatic alert messaging to the concerned train supervisor of next upcoming station.

b. The supplier shall host the web portal and database of the integrated system on IR server or any server recommended by Indian railways.

c. Web based application and database service to automatically synchronize all data from IR server of the smart coach fleet. The. application should display the essential parameters on a dashboard. Also, smart phone applications with authentication shall permit railway users to monitor the dashboard. The layout of the dashboard shall be designed with Indian Railways consultation.

d. Automatic regular upload/download of all operating data of IR server and connected equipment from coaches.

e. Automatic generation analytical reports for predictive and corrective maintenance by IR.

i) Software:

The software shall receive raw data from sensors and produce simple actionable alerts for maintenance staff. The actionable alert should include the recommendation for the maintenance staff.

All the product's licenses that bidder proposes should be perpetual licenses. The perpetual license shall be in the name of the purchaser. The software licenses shall not be restricted based on location and the bidder should have the flexibility to use the software licenses for other requirements if required, provided the same does not violate the usage rights agreed with the original manufacturer.

Bidder shall use appropriate API/RTSP to push time stamped data, real time data from the OBCMS and other integrated systems when needed. Bidder should also provide API to get the system health check data, system tampering information as needed for integration with PICCU.

j) Miscellaneous Requirements:

1. PICCU or any other connected subsystem shall not allow any stray or unauthorized device to communicate with the coach system. Whole system shall be designed to deny access to all unidentified or malicious or spoofing devices.
2. Any update for software, configuration settings, infotainment content, and even encryption keys for IR Coaches shall be able to update over the air (OTA) through cellular network and via USB on IR server.
3. All connectors shall be IP65 rated or higher and shall comply with the RDSO specification no. RDSO/CG-18001 (Rev 2).
4. All the required software/program/application and their installation/updation/support during warranty period and subsequent AMC shall be in the scope of supply of. the firm.
5. PICCU shall queue the local data in cache memory whenever the cellular connectivity is not available and uploaded to the IR server promptly when system finds the network available.
6. As multiple electronic system equipments need to be integrated with PICCU, compatibility issues may arise due to different underlying OS/programs. The applications shall be developed with a view to having compatibility with various makes of all interconnected systems. Any additional hardware or software to facilitate the same shall be in the scope of the supplier.
7. All fitment material, labour, and design changes required shall be in the scope of bidder.
8. Any additional fixtures & labour required for the fitment and integration of electronic systems with PICCU in the coach shall be in the scope of supply of the firm. The bidder shall take approval of Indian Railways before fitment in the coach.
9. Application programming interfaces (API) might be required for the integration of data from various sensors and equipment. The responsibility to develop API. or procure from the OEMs shall reside with the bidder.
10. In case of any conflict with RDSO specifications, the RDSO specification shall supersede.
11. All the sensors and equipments of the electronic systems shall be firmly mounted on the coach with ant pilferage measures (if required) to sustain the loads under normal operating conditions.
12. The details of the Subscriber Identification Module (SIM) used in the system shall be shared with Indian railways.
13. The login credentials to the https web portal (User ID & Password) should be provided to Indian Railways & base depots after successful completion of the training of using the portal. The portal shall have different user access levels to control and define the rights and privileges on the portal.
14. Demonstration of working of all coach equipments on the portal post installation and commissioning shall be done by the supplier.
15. The provided solution, wholly and individually, should be compliant to IR and UIC standards(wherever not adequately covered by IR standard).
16. Required testing (as per. the latest versions of specified standards) and quality declarations by the firm and OEM should be provided.
17. Stickers of all items of all sub systems shall be in the scope of bidder. The bidder shall require approved design/ drawing of the stickers by Indian Railways.

18. Decalcomania (decal) sticker of Coach shall comply to RDSO specification RDSO/2010/CG 08. The design/ drawing shall be approved by Indian Railways.
19. Legal Cyber Security Requirements to be complied with according to CERT-In & IR-CERT guidelines.
20. The supplier must apply the policies and practices of the standard IEC 62443 relating to the cyber security of the industrial installations for all the systems of its supply. The application of this standard shall have to be evaluated by an independent accredited body, and the certificate shall be submitted to Indian Railways as a prerequisite for the commissioning. Moreover, the bidder shall comply with following requirements: -
    a. Declare the country of origin of components and products used in the system.
    b. The PICCU and its integration with other smart systems shall be designed to appropriately limit the rights for system access and configuration through identification and authentication control. Multifactor authentication methods like combinations of password, OTP, security questions, and Digital- Signature Certificate (DSC) shall be used to protect critical access and control.
    c. Complete systems shall have the intrusion detection and prevention system, to avert any cyber-attack. A monthly report on cyber integrity of the system shall be provided by the bidder during the warranty period. All essential data shall be archived regularly on offline storage media.
21. Detailed wiring diagrams, connection diagrams and drawings of sensor/equipments fitting on the coach drawings. This shall include a booklet containing the principle of working/algorithm for each of the sensors.
22. Bill of material with detailed leaflet, documentation in soft and hard for each coach.
23. Operating, Maintenance and Troubleshooting manuals in hard and soft copies for each coach shall be provided by the bidder.
24. All Requirements of Indian Railways stated in Part A of the specification, shall be applicable in Part B also.
25. Complete system design shall be done in consultation with Indian Railways.
26. Firm shall ensure that there is no data loss due to network issues. Firm shall provide dual sim/single sim dual band for ensuring complete coverage. The system should support either Single or Dual SIM Dual band based on the availability of a stable network connection.
27. Data shall be sent every minute. System shall have adequate memory to store data so that if there is network loss, then data gets saved on system & sent when network is received again.
28. Testing of communication of PICCU (which is integrated with mentioned electronic systems) and its integration with other systems specified by IR shall be done at the time of prototype approval.
29. The system enclosure should be made of durable and tamper-resistant materials, with reinforced corners and edges. The enclosures should also provide features like locking mechanisms to deter theft and tampering. The enclosure should comply with dust and water protection (IP 67). The enclosure should also be free from sharp edges. The enclosure should be such that it is able to dissipate heat generated by equipment and should be aesthetic. The dimension of enclosure shall be within 500(L)x300(B)x200(H) mm approximately to house the equipment in such a way that maintenance can be done without any difficulty.

Part C

1. General Requirements:

a) Cable and Connectors:

The power cables and connectors shall meet the following specifications:

S. No	Parameter	Specification
a)	Rated Voltage and Current	As per the requirement of the contractor, shall be approved by RCF.
b)	Connection Method	Push-in connection (Industrial Grade)
c)	Connector Performance Standards	Shock and Vibration Compliance with EN50155:2001 Fire and Smoke EN45545-2 Temperature Range-20°/+85°C Degree of Protection IP67
d)	Cable Performance Standards	Fire retardant - EN60332-3-25 Flame retardant - BS6853 EN50305 Hazard level HL3:EN45545-2
e)	Conformity	Connector: Shock and Vibration EN50155:2001 Connector/Cable: Fire Protection EN45545-2 Cable: Fire retardant EN60332-3-25 Cable: Hazard level HL3:EN45545-2

i. All cables (Power and communication cable) must be protected by fire retardant shrinkable sleeve throughout its routing.
ii. All cables are to be routed through suitable railway grade conduits/ grommet / glands & to be properly clamped.
iii. Long lasting and as per railway standards proper wire numbering with suitable heat shrinkable sleeves to be done for all power and communication cables
iv. E-beam cables as per RDSO specification shall be used for supplying cables. Sufficient circuit protection shall be provided.
v. Any stray voltage/leakage currents shall not affect the working of the system i.e. suitable protection shall be provided for the same.
vi. Positive and Negative cables shall be segregated. Any cables passing though under frame shall be provided with cable sealing/ cable jacketing system.
vii. PTFE cables conforming to specifications on JSS 51038 shall be used for internal wiring of data communication cables and shall not infringe with any metal parts.

viii. The control cable size shall be of minimum 1.5 sq. mm for single core cable and 1.0 sq.mm for multi-core cable.

ix. Terminal on of all power, control and data cables including the connectors with suitable crimping lugs/wire end ferrules/contact pins shall be in the scope of supplier.

x. Adequate earthing shall be made with suitable crimping lugs and SS fasteners wherever required.

2. Environmental Conditions:

Description	Limiting values
Maximum Ambient Operating Temperature	55-60°C The temperature of the outside train body when exposed directly to the sun for long period of time during peak summer, may be assumed to rise to 70°C approx.
Minimum temperature	-10°C
Humidity	100% saturation during the rainy season.
Rainfall	Rain during Summer season generally occurs from June to September. However, occasionally rain also takes place during the winter season. Average annual rainfall of Chennai is approximately 850mm and maximum rainfall in any 24hr period is up to 250mm.
The atmosphere during the hot season	Extremely dusty, including bird feathers.
Maximum wind speed	150Kmph
SO_2 level in atmosphere	80-120mg/m° Thus contractor shall provide conformal coating on PCB boards to mitigate high SO_2 content in atmosphere as specified in contract.
Suspended particulate matter in the atmosphere	360-540mg/m3
Shock & Vibrations	The sub-systems and their mounting arrangements shall be designed to withstand satisfactorily the vibration & shocks encountered in service.
Hazard level	HL3:EN45545-2

3. Coach Operating Conditions for On-Board Equipments :

A. Car-body dynamics: Equipment shall withstand satisfactorily the vibrations and shocks normally encountered in service as indicated below:

(i). Maximum vertical acceleration 1.0g
(ii). Maximum longitudinal acceleration 3.0g
(iii). Maximum transverse acceleration 2.0g

The vibrations are of sine wave form, and the frequency vibration is between 1Hz to 50Hz. The amplitude 'a' expressed in millimeters is given as a function of f, by equations

$a = 25/f$ for values of f from 1 Hz to 10Hz.

$a = 250/f^2$ for values of f exceeding 10Hz and up to 50 Hz.

In the direction corresponding to the longitudinal movement of the vehicle, the equipment is subjected for min. 2Hz to 50 Hz Vibrations of such a value that the maximum acceleration is equal to 3.0g. Maximum value for vibration level of the equipment shall be tested as per IEC 61373.

B. Coach-body displacement encountered under dynamic conditions:

(i). Vertically- ±100 mm
(ii). Laterally - ± 80 mm
(iii). Longitudinally- ±10 mm
(iv). Bogie rotation about centre pivot- ±4°
(v). Maximum Speed of train - 180 KMPH

4. Design Requirements:

i. Preparation of Drawings & Plans clearly showing complete System infrastructure for Railway approval and their modifications as per Railway requirements shall be in the scope of contractor.
ii. The sensor data mapping program should be stored in the non-volatile memory of system unit to facilitate conversion from raw data to output. Software should be able to compensate the atmospheric pressure variation of different geographic location of pan India rail network.
iii. Systems shall have appropriate low power modes and watchdog timer to ensure that the sensor keeps running continuously and system restarts automatically in case of a software fault.
iv. The system should send data only once per cycle (i.e. minimum for 1 minute) and there should not be any repetition of data. In case of no network data shall not be queued for sending to IR server, however real time data shall be sent to IR server as soon as network restores.
v. The data communication between the transmitter and the receiver shall be on HTTPS protocol with token-based security wherein token is required to be sent to IR server in form of the header for each communication. All the data will be shared in Json format or MQTT protocol or any protocol as defined and accepted by Railways.
vi. Communication protocol for transmitting and receiving between PICCU and IR server. Details of communication protocol shall be shared by Indian railways provider during design stage-I installation & commissioning.

(a) All data generated by the system shall be the exclusive property of Indian Railways. it shall retain full rights to use, manage, and distribute this data at its discretion.

(b) The Vendor/Supplier shall not store, publish, or transmit any data generated by the system from IR server to cloud service or any external storage, solution unless explicitly authorized by Indian Railways.

vii. Power consumption of the complete system Per/Hour/Day shall be worked out and clearly defined.

5. Connectivity & Data Security:

System shall have hardware available for establishing connectivity over the 2G/3G/4G/5G/GSM/GNSS network with auto switching facility as per the network avalaibility & M2M based Single or Dual SIM connectivity with APN based VPN established for the system for wireless data transmission. The system shall also support bandwidth aggregation (bonding) over the two SIMs of 5G/GSM/GNSS. The scope of the bidder for providing SIM-based connectivity is elaborated in the below points:

i. The selected bidder shall provide Single/dual from two different service providers. The SIM cards should be enabled with adequate data packs to meet the monthly consumption of the data transfer and alerts from the system to and from the IR server with sufficient built-in buffer for seamless data transfer.

ii. The bidder is responsible for configuring single/dual for each of the systems which should be enabled to connect to the 5G network by default.

iii. SIMs should have auto switching to mobile data connectivity technologies as per network availability in the absence of 5G networks.

iv. Each of the SIM cards must be configured to enable access to a dedicated Access Point Name (APN) through a Static routable Private IP address.

v. The bidder shall integrate the SIM cards into the system, ensuring proper communication between the devices and the private APN and establish secure connections between the smart system & PICCU in the IR cloud.

vi. The bidder should configure the authentication method (i.e., username and password and other credentials) required to access the dedicated APN.

vii. The bidder should provide the IR server to resolve domain names within the private network.

viii. The bidder should implement necessary security measures, and encryption, to ensure the privacy and integrity of data during internet access.

ix. The bidder is responsible for maintaining a log of all the internet sessions namely source/destination IP, bytes sent/received, session start/end, timestamps, peak bandwidth used, etc. This type of information should be retained for a minimum period of 30 days for all the system.

x. System shall have capability to automatically transfer all required data to IR server as per the user requirements and when the system latches on to the Wi-Fi network available at the Railway Track/ Stations/EMU Shed/Stabling Line/Washing Line/Coaching Depot.

xi. The bidder must ensure high availability and reliability of mobile connectivity, minimizing downtime and disruptions to internet access as the system is required to operate on a 24x7 basis.

xii. The bidder should adhere to industry best practices and compliance standards related to mobile network security, connectivity, and data privacy.

xiii. The bidder is required to furnish detailed documentation outlining the configuration parameters of the APN and any specific settings that shall be enabled on the system to ensure adequate uninterrupted connectivity.

xiv. The training and documentation should include guidelines for troubleshooting and resolving connectivity issues related to both the private network and internet access.

xv. Data stored in OBCMS should be encrypted and should be accessible remotely by authorized Railway user only.

xvi. The system should have additional space for edge processing and future extension to cater for Analytics related enhancement.

xvii. Updates and upgrades of all software/firmware including OS, bug-fixes and patches for the entire solution: The OEM shall provide necessary support remotely or on-site as per requirements as asked by Railways. However, successful bidders will be responsible for making these services available to Railways from respective OEM.

xviii. Bidder will install System Software (Firmware, OS, RDBMS, App Server etc.) in the IR Systems, with all service /ports in closed /deny-all mode and then opening the ports & services as per need.

xix. Bidder will ensure that all default users /accounts are in closed /disabled state after the installation.

xx. **Health Monitoring:**

System shall support their over-the-air remote health monitoring & management as well as software up-gradation over 5G mobile data service (M2M SIMs with private APN) using central Device Monitoring & Configuration Management System. System shall also send to central system information about their software/application/DB version, IP & Mobile Service Provider info of mobile data SIMs, CPU/Memory/Disk usage, processor & OS information, details/status of running processes etc over 5G.

6. Testing & Approval:

The supplier / vendor shall submit the design details of the complete system with other integration systems complying with the technical, design requirements of this specification including layout drawings, coach interfaces requirements, integration requirements, operation and maintenance manual, including the requirement of spares and consumables for the approval by Vendor approving authority. Quality assurance plan covering all stages of manufacturing, quality control and testing at various stages of the sub assemblies and final system shall be submitted for approval by vendor approving authority.

Prototype approval:

a) Prototype approval from the concerned IR representative shall be obtained before bulk supply by the supplier based on the fitment and commissioning in each type of rolling stock at concerned Railway. Any change or deviation in drawing, material supplied, or any other approved delivery shall need re-approval from the IR representative concerned.

b) Prototype approval shall be done as per approved QAP of the firm on test bench at firm's premises for verification of the technical, design requirements and testing of the system

followed by actual fitment on a coach and successful functional tests as per this specification.

c) Following parameters and system functionality will be checked during prototype approval:

Dimensional check & Visual Inspection:

a) Dimensional check as per design / interface drawing.
b) Working of system controls & indications.
c) Functional check of the complete system including web interface.
d) Demonstration / calibration of level sensors.
e) Any other tests considered necessary.

7. Type testing:

a. Type testing of the system shall be done from any Govt. Lab or NABL accredited testing lab and test report shall be submitted to the vendor approving authority.
b. Type testing shall be done for all tests (Mandatory & optional) as specified in clause 13.3.1 of EN50155 specification (latest revision). In addition to above impact resistance test shall also be carried out as per IS: 17050:2023.
c. All applicable test certificates, data sheets or any pertaining document shall be provided by the firm.
d. The supplier / vendor shall submit the design details of the Complete system complying with the technical design requirements of this specification including layout drawings, coach interfaces requirements, integration requirement, operation and maintenance manual, including the requirement of spares and consumables for the approval by Vendor approving authority. Quality assurance plan covering all stages of manufacturing, quality control and testing at various stages of the sub-assemblies and final system shall be submitted for approval by vendor approving authority.
e. Firm shall show architecture of system till component level & provide proven performance credential.
f. Validation of product to be carried out with simulated faults on track, wheel & bearing with vibration signature & alerts. Scheme shall be approved by Indian Railways.
g. Type tests of sensors shall be witnessed by Design representative of RCF.

8. Inspection:

a. The inspection will be carried out generally as per firm's approved drawings, firms approved QAP as and any other specification given in specification.
b. The inspection of material will be carried out at contractor's premises by authorized representatives of nominated Inspecting agency as per manufacturers drawing, physical & chemical properties, various critical dimensions as per approved Quality Assurance Program (QAP) as by vendor developing authority.
c. Contractor shall provide free of charge labour, material, tools, gauge and appliance etc. required by the inspecting authority for inspection at manufacturing location.

9. Spares:

a. The minimum design life of complete OBCMS system is 15 years. The supplier/OEM shall ensure the availability of all spares of the system for a period of at least 15 years. This shall be irrespective of the fact whether the supplier/OEM or his sub supplier/OEM have stopped manufacturing the system/equipment's to the design supplied to IR.

b. The offer shall include a recommended list of spare parts required for day-to-day maintenance of the coach equipment. At least 10% of the spares of all critical hardware shall be maintained at the Railway concerned by the supplier. Any replacement request under the warranty shall be covered through this account and shall be later recouped by the supplier.

c. Spares & consumables required shall be all inclusive part of warranty. Strict provisions of imposing penalty on vendors for unreasonable downtime and repeated failures of the components/sub-assemblies shall be ensured by purchaser.

10. Penalty Clause:

Penalty will be imposed on the firm for delay in attending the Breakdown Calls. Problems or failures reported would be advised to the Contractor's Representative at the designated locations through any official communication channel. The Contractor's representative shall attend such failures within the stipulated time starting from the time of intimation, failing which penalty as described hereunder shall be applied on the Contractor. Any delay by the Contractor's representative in completing the above activities shall affect the real time data analysis of the System & may cause damages. Therefore, the Railway shall recover from the Contractor as agreed damages.

Penalty Rate: For this purpose, downtime shall be calculated as percentage of total downtime hours for the month. In case the contractor fails to maintain a penalty shall be levied as table furnished below:

Down Time Penalty:

1.5% or less - Nil
> 1.5% to 3% - 02% of the total monthly proportionate bill
> 3% to 5% - 05% of the total monthly proportionate bill
> 5% to 10% - 10% of the total monthly proportionate bill
> 10% - 20% of the total monthly proportionate bill

The Bidder shall perform Root Cause Analysis of all failures - a detailed technical analysis report on the root cause and steps taken for avoiding such recurrence of such failure from bidder shall be submitted within 05 working days from the date of failure.

11. Warranty, Services and CAMC:

a. Installation, commissioning, services to provide alerts and proper functioning under warranty period is the responsibility of the bidder.

b. Any software or application updation or upgradation essential for designed performance, security and integrity of system shall be the responsibility of the bidder during the warranty period. The contractor shall be responsible for any On-site replacement /repair / breakdown /

debugging of any equipment /program supplied under the scope for a period CAMC & warranty period from the date of commissioning of system. but it recognised that long term continual exposure to shock loadings in excess of 200g fall outside of the EN61373:2010 design parameters of the WSN

c. The time period of warranty shall be three years from the date of commissioning of coach in Zonal Railways or four years from the date of supply of the system to Indian Railways whichever is earlier. During warranty period no payment shall be made. Firm shall carry out all preventive maintenance during it.
d. Further there shall be 3 years of compulsory CAMC (Comprehensive Annual Maintenance Contract) and Subscription of services to provide alerts.
e. Annual payment for CAMC service (including taxes) of each system shall be fixed **5%** percentage of per unit supply rate of the system (including taxes) for CAMC period. The payment may be made on quarterly basis by concerned Zonal Railways.
f. Bidder shall provide a complete maintenance schedule for the item.
g. During Warranty & CAMC, firm shall do all software upgrades without any additional cost. Firm shall protect system against any virus, firmware etc.
h. PBG of 5 % shall be kept as performance guarantee. It shall be released after successful completion of warranty period and successful signing of CAMC agreement with Zonal Railways.

12. Documentation & Training:

a. Following the acceptance of the prototype, the contractor shall provide technical manuals as given below about the system in English. The information should be both printed and in electronic format and shall be provided to IR.

1. Operating and maintenance instructions.
2. Periodic Maintenance Schedule (Daily / Trip/ Monthly) in line with maintenance schedule of LHB IR coaches.
3. Schematic diagrams of Installation & commissioning and their instruction.
4. Schedule of operating principles.

b. The contractor shall provide theoretical and practical training for the staff of workshops and zonal railways.

13. Infringement of Patent Rights:

The Supplier/Vendor is required to give undertaking on "INFRINGEMENT OF PATENT RIGHTS". The undertaking shall be as under:

i. “Indian Railway shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design and development of this item and any other factor not mentioned herein which may cause such dispute. The entire responsibility to settle any such disputes/matter lies with the Supplier/Vendor”.
ii. “Details/Design/Documents given by them are not infringing any IPR and they are responsible in absolute and full measure instead of Railways for any such violation. Data, specification

and other IP as generated out of interaction with Railways shall not be unilaterally used without the consent of RDSO and rights of Railway/RDSO on such IP as acceptable to them".

14. Particular Requirements:

a. Complete system requires higher reliability of various components especially the critical components and reliable internet connectivity during the entire journey for real time monitoring of various data and syncing data with railway network (IR server of Indian Railways). There must not be any data loss due to network issues. Firm to ensure maximum connectivity along Railway route by providing dual/single sims of stable network with maximum coverage in area.

b. The firm should have in-house testing facilities to test the performance of all critical components of the complete system.

c. The firm should have well-established design facilities with qualified & competent design personnel and well-established manufacturing facilities required for real-time On-Board condition-based Monitoring systems.

d. The firm should possess ISO: 9001 certificates issued by NABCB accredited certification body / International Accreditation forum (IAF) under multilateral Recognition arrangement (MLA) for its works address covering the items under manufacture, supply and installation etc. The firm should have established a quality control system and organization to ensure quality of the product.

e. Suppliers / vendors should have design capability in the field of electronic instrumentation and IoT based networked devices for customized application.

15. Documentation: -

Documentation to supplement the understanding, planning, execution, maintenance and troubleshooting of IR coach systems. The following shall be provided by the bidder at the time of submission of the tender.

a. Detailed Gantt Chart to integrate with concerned Railway production stages with clear timelines.

b. Detailed wiring diagrams, connection diagrams and sensor/equipment fitting on the coach drawings. This shall include a booklet containing the principle of working for each of the sensors.

c. Bill of material with detailed leaflet, documentation in soft and hard for each coach.

At least 4 hard copies and soft copies for each Operating, Maintenance and Troubleshooting manuals coach shall be provided by the bidder.

16. Specifications of Smart equipment of coaches: -

S No	Smart systems	Specification
i.	PAPIS	RDSO/CG-18001 (Rev.2 or latest)
ii.	WLI	IS/RDSO-CG/0002:2025 with Corrigendum 1 or latest
iii.	CCTV	RDSO SPN TC 106 2025 V 3.1 or latest
iv.	OBCMS	Part A of Specification no. MDTS44415 Rev.02 or latest
v.	WSP	RDSO/2011/CG-04 Rev.3 or latest
vi.	Bio Vacuum hybrid Toilet for IR passenger coaches	RDSO/2017/CG-06 Rev.3 or latest
vii.	FSDS	RDSO/2008/CG-04 Rev.6, Amendment.1 or latest
viii.	FDSS system	IS/RDSO/CG/S/22001, Amendment.1 or latest
ix.	RMPU(Microcontroller)	RDSO/PE/SPEC/AC/0139-2009 Rev.1 or latest 2
x.	Electro-Pneumatic pressurized flushing system	MMDTS-19027 (Rev.03 or latest)
xi.	ETBU	RDSO_PE_SPEC_EMU_019L (REV-0) or latest

Firm shall design its system in conformance to above specification.