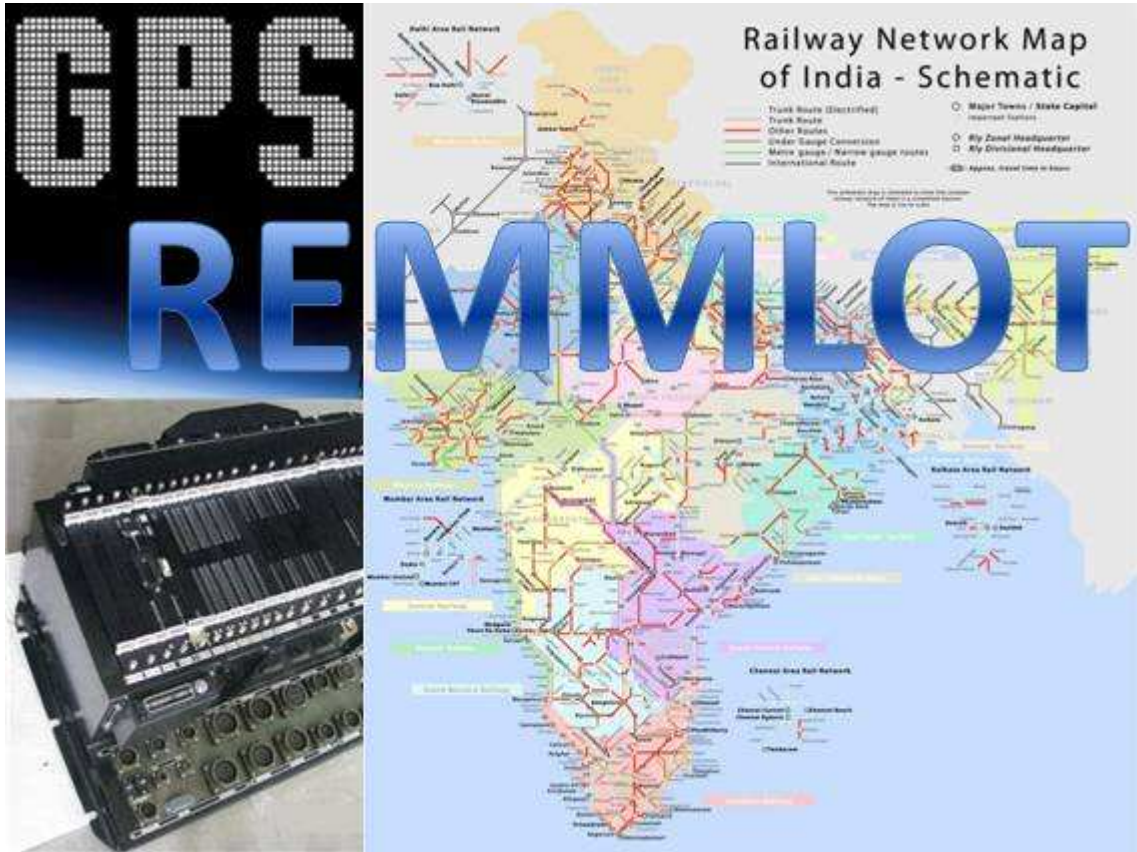


# रेमलोट: भाग-1

## REMMLOT: PART-1

### (LOCOMOTIVE REMOTE MONITORING SYSTEM)



|                      |               |               |              |
|----------------------|---------------|---------------|--------------|
| Specification Number | MP.0.04.02.04 |               |              |
| Revision             | 5             | Date of Issue | [dd/mm/yyyy] |

#### Brief Description

This is a part of a four part specification numbered 0 through to 3 describing the requirements for setting up systems for Remote Monitoring of Locomotives and Trains (REMMLOT).

## **FOREWORD**

REMMLOT Enables remote monitoring of Diesel Locomotives. It creates a complete IT enabled ecosystem which provides a platform for remotely monitoring health and operational characteristics of diesel electric locomotives.

It also enables monitoring of performance of crew and helps in identifying lapses, e.g. when he passes a signal at danger. This will enable focused counselling and training of such crew, who are prone to unsafe working.

REMMLOT also monitors condition of locomotive and makes preventive maintenance of locomotives more effective. REMMLOT monitors shutting down of locomotives when idle for a long time and generates management information to ensure this.

The complete specification for REMMLOT is split over four parts numbered from 0 to 3. Together these parts specify the requirements for setting up the complete system.

## **DISCLAIMER**

This specification is based on the studies and trials conducted by RDSO. Although every care is taken in specifying details adequately and unambiguously, RDSO shall not liable for any kind of damages / losses incurred by any and all due to errors or omissions in this document. When using the information described herein, the user is ultimately responsible for their own actions, as well as the actions of subordinates and assistants, and the consequences arising therefrom.

This document may mention numerous commercial and proprietary trade names, registered trademarks and the like (not necessarily marked as such), patents, production and manufacturing procedures, registered designs, and designations. RDSO wishes to point out very clearly that the present legal situation in respect of these names or designations or trademarks must be carefully examined before making any commercial use of the same.

Names of industrially produced apparatus and equipment may be included to a necessarily restricted extent only and any exclusion of products not mentioned in this document does not imply that any such exclusion has been based on quality criteria or any other qualifying consideration.

## **COPYRIGHT**

RDSO has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission of RDSO. Enquires relating to the copyright should be addressed to Executive Director (Administration), RDSO.

## **ADDRESS FOR COMMUNICATION**

Government of India - Ministry of Railways,  
Research Designs & Standards Organization  
Manak Nagar  
Lucknow  
Uttar Pradesh  
India  
Pin: 226 011  
Fax: +91 (522) 2458500  
Phone: +91 (522) 2451200 (PBX)  
+91 (522) 2450115 (DID)  
Website: [www.rdsso.indianrailways.gov.in](http://www.rdsso.indianrailways.gov.in)

## LIST OF AMENDMENTS

Kindly see part 0 of the specification.

DRAFT

## CONTENTS

|      |   |    |
|------|---|----|
| 0    | Introduction .....  | 4  |
| 1    | Objectives and Scope of the specification.....                              | 4  |
| 2    | Terminology / Abbreviations.....  | 4  |
| 3    | Definitions.....  | 4  |
| 4    | Brief description of the system/equipment/components.....                   | 4  |
| 5    | General requirements.....   | 4  |
| 5.1  | Manufacturers qualification.....  | 4  |
| 5.2  | Equipment Requirements.....   | 4  |
| 5.3  | Training.....   | 5  |
| 6    | Functional requirements.....  | 5  |
| 6.1  | GPS Location.....   | 5  |
| 6.2  | Communication link for data transfer.....                                   | 5  |
| 6.3  | Relay of logged data.....   | 5  |
| 6.4  | Power supply.....   | 6  |
| 6.5  | Entry of loco pilot details.....  | 6  |
| 6.6  | SOS Signal.....   | 6  |
| 6.7  | GPS Clock Synchronization.....  | 7  |
| 6.8  | Storing of loco details.....  | 7  |
| 7    | Technical requirements.....   | 7  |
| 7.1  | Equipment.....  | 7  |
| 7.2  | GPS system.....   | 7  |
| 8    | Applicable Drawings.....  | 8  |
| 9    | Safety requirements.....  | 8  |
| 10   | Environmental/Climatic requirements.....                                    | 8  |
| 11   | Details of standards followed and validation.....                           | 8  |
| 12   | Maintenance and diagnostic aid.....   | 8  |
| 13   | Documents to be supplied by equipment supplier.....                         | 8  |
| 14   | Accessories.....  | 8  |
| 14.1 | Tools.....  | 8  |
| 14.2 | Spares.....   | 8  |
| 15   | Training.....   | 8  |
| 16   | Tests & Verification:.....  | 8  |
| 16.1 | Standards for testing.....  | 8  |
| 16.2 | Sampling plan.....  | 8  |
| 17   | Types of tests.....   | 8  |
| 17.1 | Type Tests.....   | 9  |
| 17.2 | Field trials.....   | 9  |
| 17.3 | Acceptance test.....  | 9  |
| 17.4 | Routine test.....   | 9  |
| 17.5 | Makers test certificate for outsourced item.....                            | 10 |
| 18   | Painting, labeling and marking.....   | 10 |
| 19   | Packaging and delivery.....   | 10 |
| 20   | Guarantee / Warrantee.....  | 10 |
| 21   | Intellectual Property Rights.....   | 10 |
| 21.1 | Undertaking by equipment manufacturer.....                                  | 10 |
| 21.2 | Declaration of confidentiality of submitted documents by manufacturers..... | 10 |
| 22   | Information to be supplied by supplier.....                                 | 10 |
| 23   | Information to be supplied by purchaser.....                                | 11 |

## LIST OF FIGURES

No table of figures entries found.

## LIST OF TABLES

Table 1: Locomotive Parameters and Reports

6

Table 2: Locomotive Pilot Details

6

Table 3: Types of Tests

9

## LIST OF REFERENCED DOCUMENTS

Kindly see part 0 of the specification.

DRAFT

## 0 Introduction

This document is a part of set of documents specifying equipment and services for the deployment of Remote Monitoring of Locomotives and Trains (REMMLOT). Kindly see the list of referenced documents for locating other documents of the set.

## 1 Objectives and Scope of the specification

This document describes the requirements of locomotive remote monitoring system consisting of on-board equipment i.e. Locomotive Remote Monitoring System (LRMS) required for the implementation of REMMLOT.

## 2 Terminology / Abbreviations

Kindly refer common list in part 0 of the specification.

## 3 Definitions

Kindly refer common list in part 0 of the specification.

## 4 Brief description of the system/equipment/components

The locomotive remote monitoring system on-board equipment (OBE) consists of hardware components and associated modification and integration of software for making the equipment functional and interfaced to the locomotive computer. The following shall be considered as part of this equipment:

- Interface card for locomotive MBCS providing full functionality required for REMMLOT.
- Antennae suitable for mounting on the locomotive inclusive of mounts and shrouds / covers protecting the antennae from environmental and physical damage.
- Connectors / cables and wiring accessories required for making the equipment functional.
- Software for enabling all equipment features on the locomotive computer.
- Service support required for fitment, integration, software modification for making the features fully operational.
- GPRS/EDGE/CDMA system for transfer data. This provision shall include connectivity (including subscription cost) for the specified warrantee period.
- Training for operations and maintenance of the equipment.
- A utility for download and convert the data logfile of the MBCS to NI TDMS format. This utility shall have features to upload the converted file to the LTMS server. This feature is required incase of failure of system to upload data.

## 5 General requirements

### 5.1 Manufacturers qualification

Manufacturer of the equipment shall be an RDSO approved supplier of the MBCS for diesel-electric locomotives.

Incase of third party supply, the LRMS manufacturer shall have a formal MoU with the MBCS manufacturer and approval to supply LRMS modules must be provided by the concerned MBCS manufacturer.

### 5.2 Equipment Requirements

The equipment specified in this document is expected to meet the following general requirements.

- i) The equipment shall be designed for installation on diesel electric locomotives equipped with MBCS. The equipment manufacturer shall get the equipment design approved by RDSO before fitment on locomotives.
- ii) The computer interface cards of the equipment shall be interfaced with the locomotive computer, preferably be an integral part of the system and shall plug into the system bus.

- iii) The antennae for GPS and GPRS/EDGE/CDMA systems shall be fitted on the locomotive exterior and shall be located for best possible reception / transmission. These antennae shall not violate the MMD of Indian Railways.
- iv) The equipment, cabling and connectors shall be designed to handle the harsh environmental conditions of the locomotive.
- v) The equipment shall be capable of working in all types of electrified as well as non electrified territories.

### 5.3 Training

The equipment manufacturers shall arrange, training this shall be a part of the equipment supply. Personnel of Indian Railways shall be nominated to attend. The to and fro fare and living expenses shall be borne by Indian Railways.

## 6 Functional requirements

The LRMS shall provide the following functions:

### 6.1 GPS Location

The system shall reliably acquire the GPS coordinates and time data of the vehicle both at standstill and on run.

### 6.2 Communication link for data transfer

The system shall provide GPRS/EDGE/CDMA based communication capability transfer of data from the locomotive to the data server both at standstill and on the run. The GPRS / EDGE module shall be such that it shall be easily upgradable as required to keep up with the changes in technology of the mobile telephony systems in the country.

#### 6.2.1 Performance requirement of communications link

The communication system shall be capable of transmitting all acquired data at rates better than once in 10 minutes. The equipment (including the communications provider) shall achieve this requirement better than 95% of the times in a month.

The equipment provider shall suitably select the modem and service accordingly.

#### 6.2.2 Antennae for GPS/GPRS/EDGE/CDMA

The antennae shall be mounted on the exterior of the locomotive. The design of the mounting and location shall be selected in such a manner that the locomotive with the mounted antennae does not infringe the Indian Railway Maximum Moving Dimensions.

The antennae shall be suitably protected for damage due to environmental elements and physical damage

### 6.3 Relay of logged data

The system shall be able to access all locomotive parameters as captured by the MBCS and shall relay these and the GPS coordinates and RTC time to a central server at specified intervals. These parameters shall be defined for each locomotive type and microprocessor control combination.

#### 6.3.1 Data to be relayed from the locomotive

The data to be transferred from the locomotive to the remote server shall be a subset of the captured data. The exact data to be transferred and its frequency shall be decided jointly by the MBCS vendor and RDSO.

The presently defined list of parameters and reports based on the same are listed in the table below. The MBCS manufacturer shall define these parameters jointly with RDSO, wherever these are not defined, following the pattern provided in the documents listed in the table below:

| S. No. | Locomotive and Control Type | Parameters List | Report for Display of Data | Remarks |
|--------|-----------------------------|-----------------|----------------------------|---------|
|--------|-----------------------------|-----------------|----------------------------|---------|

|   |  |  |   |
|---|--|--|---|
| 1 | ALCO with MEP660 of Medha Servo Drives | Modification sheet No.MP.MOD.EC.05.27.10 (Rev. 00) Date 26.03.2010 | Motive Power Report MP.MISC.253 dt 31/03/2010 |
|---|--|--|---|

**Table 1: Locomotive Parameters and Reports**

### 6.3.2 Data format for relaying data

The data from the locomotives shall be relayed using the NI-TDMS file format. The exact structure, channel names and information headers shall be detailed separately for each combination of loco class and control type jointly by RDSO and the MBCS manufacturer.

### 6.3.3 Transfer of logged data by other than wireless means

A software utility shall be provided to download and convert and save the logged data of the MBCS to NI-TDMS format file. These files shall be created such that each file contains the logged data for one day (also see requirement of start and end times for logged data in TDMS files).

### 6.3.4 Naming of TDMS files

TDMS files shall be named as per the following template: NNNNN-YYYYMMDD.tdms (NNNNN is the locomotive number and YYYYMMDD is the date in year (4-digit), month (2-digit) and date (2-digit) format. It shall be possible to submit these files to the LTMS server for safekeeping, analysis and archival.

### 6.3.5 Start and end times for logged data in TDMS files

The TDMS file name for a given date shall contain data logged for the 24 hours. The new file shall be created at 00:00 HRS and all 24 hours data shall be logged to this file. In case the locomotive happens to be in motion at this appointed time; the data shall be logged to the TDMS file currently being used instead of opening a new file. The new file shall be opened when the locomotive comes to a halt.

## 6.4 Power supply

The GPS and GPRS/EDGE/CDMA sub-systems shall normally be powered from the locomotive computer chassis but shall have backup power source directly from the locomotive battery capable of supporting the system when power has been removed from MBCS.

The system shall have failover features which allow the GPS and GPRS/EDGE/CDMA sub-systems to be switched to the loco battery.. This power source selection shall be fully automated and shall require no human intervention.

## 6.5 Entry of loco pilot details

LRMS shall provide a feature for the loco pilots to enter their details into the system. This detail shall be saved as a part of the datalog file. The following details shall be entered by the loco pilots through the MBCS or the DIALS display.

| S. No. | Data Label                            | Remarks   |
|--------|---------------------------------------|-----------|
| 1.     | Loco pilot name                       | Mandatory |
| 2.     | Loco pilot cellphone number           | Mandatory |
| 3.     | Assistant loco pilot name             | Mandatory |
| 4.     | Assistant loco pilot cellphone number | Mandatory |
| 5.     | HQ Station                            | Mandatory |
| 6.     | Division                              | Mandatory |
| 7.     | Railway                               | Mandatory |
| 8.     | Train details (train number / name)   | Mandatory |
| 9.     | Train load                            | Mandatory |

**Table 2: Locomotive Pilot Details**

## 6.6 SOS Signal

A system of loco pilot SOS signal shall be provided to permit the pilot to call for help by pressing a single button. This shall have the feature of informing the loco pilot whether a message could be sent or not. After acknowledging the SOS requirement LRMS shall display the toll free number for technical support that can be called manually for assistance.



When the SOS button is pressed, a snapshot of all I/O and state of the locomotive control system shall be captured and transmitted to the LTMS server.

## 6.7 GPS Clock Synchronization

The GPS clock data shall be shared with other locomotive systems for synchronization / correction of RTC. This sharing shall be done using NMEA 2000 (high level communication format only) over Ethernet (IEEE 802.3 10baseT 100base Tx M12 D-Coding).

## 6.8 Storing of loco details

LRMS shall also be capable of storing locomotive details on board a non-volatile memory. It shall be possible to update this data via maintenance interface with the MBCS or also directly via the GPRS/EDGE link via the server. In both cases the system shall ensure that data is updated both on the locomotive LRMS and the server based LTMS. These details shall be maintained in an XML format and shall include the following:

- i) Loco number
- ii) Homing shed
- iii) Details of major sub assemblies
- iv) Schedule done and date
- v) Schedule due and date
- vi) Contact numbers of the shed

## 7 Technical requirements

The LRMS shall comply with the following technical requirements:

### 7.1 Equipment

- i) All cards and plug-in devices of LRMS interfacing with the vehicle computer shall comply with all requirements of the respective MBCS.
- ii) The criteria for testing of the LRMS that interfaces with the MBCS shall be identical to that of the MBCS components.

### 7.2 GPS system

The GPS sub system shall meet or exceed the following requirements:

- i) L1 Frequency C/A Code with 12 (or higher) independent Tracking Module (Channels).
- ii) Tracking Sensitivity shall be better than -150 dBm.
- iii) Autonomous Positional Accuracy shall be better than 10 metres
- iv) Suitable to work upto 250 kmph speed
- v) 1Hz Update Time
- vi) Reacquisition time < 250 milli seconds
- vii) Cold Start better than 45 seconds
- viii) Warm Start shall be better than 38 seconds.
- ix) Hot start better that 5 seconds
- x) Antenna Short Circuit Protection
- xi) Built-in Antenna supervisory circuit for determination of active antenna open or short state
- xii) Built-in non volatile RTC with battery backup option
- xiii) The GPS data shall be made available for other applications / equipment on board the locomotive. This data shall be provided as per the NMEA 2000 (high level communication format only) over Ethernet (IEEE 802.3 10baseT 100base Tx M12 D-Coding).

## 8 Applicable Drawings

There are no drawings forming a part of this specification.

## 9 Safety requirements

The equipment shall meet all statutory and regulatory criteria required for safety of users.

All requirement as specified in the specifications of the respective MBCS equipment shall be complied by the LRMS.

## 10 Environmental/Climatic requirements

All requirement as specified in the specifications of the respective MBCS equipment shall be complied by the LRMS.

The antennae and its accessories including cables and connectors shall be tested for compliance to AAR-S-5702.

## 11 Details of standards followed and validation

As specified in the specifications of the respective MBCS equipment.

## 12 Maintenance and diagnostic aid

As specified in the specifications of the respective MBCS equipment.

## 13 Documents to be supplied by equipment supplier

The equipment provider shall provide all documents as specified in the specifications of the respective MBCS equipment.

A copy of the detailed bill of materials for the REMMLOT system shall be provided.

## 14 Accessories

### 14.1 Tools

The supplier shall provide all tools required for maintenance by the end user. The list of tools shall be jointly approved by RDSO and the equipment provider before supply.

### 14.2 Spares

The supplier shall provide all spares required for maintenance by the end user. The list of spares shall be jointly approved by RDSO and the equipment provider before supply.

## 15 Training

The equipment manufacturer shall provide training to maintainers operators and other users of the system where required for operations, maintenance and proper use of the system.

## 16 Tests & Verification:

The equipment shall be tested for functional capability, ability to withstand environmental conditions and for reliable performance under field conditions.

### 16.1 Standards for testing

The equipment interfacing with the MBCS shall be tested in accordance to the requirements of the MBCS.

### 16.2 Sampling plan.

Unless otherwise specified, the sampling plan shall be in accordance with IS2500.

## 17 Types of tests

The equipment shall be tested as per the following scheme.

| S. No. | Category of Test       | Remarks   |
|--------|------------------------|---|
| 1      | Type tests (Prototype) | These tests shall be done on a sampled lot of prototypes. Sampling shall be done as per guidelines contained in IS2500. Such tests are required only on initial approval, change of design and change of manufacturing processes. These tests shall be done as pre-requisite for design approval. |
| 2      | Field trials           | These trials shall be conducted for establishing equipment reliability under field conditions. A minimum sample size shall be installed to work under field conditions and performance monitored for a specified time.  |
| 3      | Acceptance tests       | These tests shall be done on all or sample of lot. Sampling shall be done as per IS2500. These may require simulated inputs for testing the operations under extreme conditions of inputs.  |
| 4      | Routine tests          | Tests are required to verify the functional working of the system. These may require simulated inputs for testing the operations under extreme conditions of inputs.  |

**Table 3: Types of Tests**

### 17.1 Type Tests

The equipment cards interfacing to the MBCS shall be tested as per the requirements of the MBCS equipment.

The antennae and its accessories including cables and connectors shall be tested for compliance to AAR-S-5702.

### 17.2 Field trials

The LRMS equipment shall be subjected to field trials as a part of initial acceptance. These trials shall be conducted after successful completion of all functional tests for all features.

Performance shall be closely monitored and evaluated by RDSO for 10 locos for minimum six months. The following parameters shall be evaluated:

- i) Reliability under actual operating conditions
- ii) Advantages for locomotive operation and maintenance
- iii) Maintainability of the system

### 17.3 Acceptance test

Acceptance tests shall constitute the following:

- i) Verification of records of type tests
- ii) Verification of field testing reports.
- iii) Visual check of the system for:
  - a. General workmanship.
  - b. Quality of soldering and component mounting.
  - c. Legend printing.
  - d. Green masking.
  - e. Indications and displays.
  - f. Mounting and clamping of connectors.
  - g. Proper housing of cards.
- iv) Functional test of all features of the equipment if required by simulated inputs.

### 17.4 Routine test

The routine test shall consist of visual check and functional test as specified under acceptance test.

## 17.5 Makers test certificate for outsourced item

All items that are outsourced by the equipment manufacturer shall be indicated so. The type and extent of control that has been exercised shall be provided with proper documentation.

The manufacturers (of the outsourced sub-assembly) test certificates shall be provided.

## 18 Painting, labeling and marking

The equipment shall be appropriately painted for aesthetics and protection. The parts, connector ports, mounting points etc shall be clearly marked in a manner that these are easily readable and remain legible over the lifetime of the equipment.

ID plate Name of Component, Make, Sl. No, Date of Manufacture, Ratings shall be provided on all assemblies/subassemblies.

## 19 Packaging and delivery

The equipment consists of sensitive and fragile electronic systems. These should be packed with precautions required to prevent damage in transit.

All requirements of IRS conditions for packaging and delivery shall be applicable.

## 20 Guarantee / Warrantee

The equipment manufacturer shall provide warranty guarantee for performance as per the IRS conditions.

The subscription and the functioning of the GPRS / EDGE connectivity shall be ensured by the manufacturer for the duration of the warrantee and also during the period of extended warrantee.

## 21 Intellectual Property Rights

### 21.1 Undertaking by equipment manufacturer

All the specifications issued by RDSO shall include a requirement of undertaking to be signed by Vendors on "INFRINGEMENT OF PATENT RIGHTS". The undertaking can be as under

Indian Railways shall not be responsible for infringement of patent rights arising due to similarity in design, manufacturing process, use of similar components in the design & development of this item and any other factor not mentioned herein which may cause such a dispute. The entire responsibility to settle any such disputes/matters lies with the manufacturer/ supplier.

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 violations. Data, specifications and other IP as generated out of interaction with railways shall not be unilaterally used without the consent of RDSO and right of Railways / RDSO on such IP is acceptable to them.

### 21.2 Declaration of confidentiality of submitted documents by manufacturers

While submitting a new proposal/design, manufacturer must classify their documents confidentiality declaration, such as

This document and its contents are the property of M/s XYZ(Name of the vendor) or its subsidiaries. This document contains confidential proprietary information. The reproduction, distribution, utilization or the communication of this document or any part thereof, without express authorization is strictly prohibited. Offenders will be held liable for the payment of damages. Indian Railways/RDSO is granted right to use, copy and distribute this document for the use of inspection, operation, maintenance and repair etc.

## 22 Information to be supplied by supplier

The equipment manufacturer must provide to RDSO, the complete details of algorithms, design and drawings required for the purpose of evaluation of the design and its functionality.

All documents as required by the specification of MBCS.

Operations and maintenance manuals, spare parts catalog shall be supplied to all users as required in both hard and soft (PDF) copies.

### **23 Information to be supplied by purchaser**

Required design details and layouts of locomotives on which LRMS is required to be fitted.

DRAFT