




सत्यमेव जयते

भारत सरकार  
रेल मंत्रालयGovernment of India  
Ministry of Railways

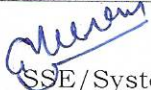


Specification  
For  
Crew Voice & Video Recording System for Electric & Diesel  
Locomotives

Specification no: RDSO/2015/EL/SPEC/0118, (Rev '1')  
Issued on 24.10.2019

Approved by	Signature
PEDSE	 24.10.19

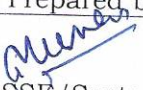


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### Status of Revision

S. N.	Date of Revision	Page No.	Revision	Reasons for Revision
1.	-	All	0	First Issue.
2.		All	1	<ol style="list-style-type: none"> <li>1. Specification revised to include the nos .of camera, their location, deletion of requirement of DVR &amp; associated sub-systems etc.</li> <li>2. Requirements of CVVRS for diesel locomotives have been included to have common specification for electric &amp; diesel locomotives.</li> </ol>

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## CHAPTER 1

### GENERAL

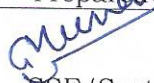


#### 1.0 SCOPE & OBJECT

- 1.0.1 This specification has been prepared in compliance to Railway Board's letter no. 2009/Elect(TRS)/441/6 Pt. dated 09.08.2019. This document lists the functional requirements of 'Crew Voice & Video Recording System' (CVVRS) for use on Electric & Diesel locomotives of Indian Railways. This document has been prepared with an aim of defining the requirements for 'Crew Voice & Video Recording System' (CVVRS) which shall ensure effective and tamperproof video and voice recording of locomotive cab and track view for post event analysis. This document is a starting point for further development of equipment specification, inspection and test schedules required for deployment of equipment on Indian Railways.
- 1.0.2 This specification covers basic technical requirements of the 'Crew Voice & Video Recording System' (CVVRS) for application on Electric & Diesel locomotives and any self-propelled vehicle treated as train.
- 1.0.3 The specification covers basic features of equipment. It is the responsibility of the manufacturer/supplier to develop circuit/detail design to meet the requirements of this specification.

#### 1.1 TERMINOLOGY

For the purpose of this specification, the following terminology shall apply:

NVR:	Network Video Recorder
FIFO:	First In First Out
RTSP:	Real Time Streaming Protocol
CMOS:	Complementary Metal Oxide Semiconductor
CCD:	Charge-Coupled Device
SSD:	Solid State Drive
CIF:	Common Intermediate format OR Common Interchange Format
WDR:	Wide Dynamic Range
FPS:	Frames per Second
CHM:	Crash Hardened Memory
ONVIF:	Open Network Video Interface Forum
GPS:	Global Positioning System
2G/3G/4G:	2 <sup>nd</sup> , 3 <sup>rd</sup> & 4 <sup>th</sup> generation of broadband cellular network technology
TCP/IP:	Transmission Control Protocol/ Internet Protocol
HTTP:	Hyper Text Transfer Protocol

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DHCP: Dynamic Host Configuration Protocol  
 RTP: Real Time Transport Protocol  
 PPPoE: Point to Point Protocol Over Ethernet

## 1.2 CONTRACTOR'S RESPONSIBILITY

The contractor's responsibility will include the following:

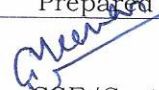


- 1.2.1 Supply of detailed instruction for installation of the equipment on the locomotives. For this purpose the supplier shall also depute his representative during installation of the first two equipments in the locomotive at each location (CLW /Shed /Workshop). Suitable mounting arrangement shall be provided by contractor.
- 1.2.2 Commissioning, testing & field trials of the prototype equipment in service. The supplier shall arrange to carry out detailed test by Vendor Approving Authority & field trial jointly with respective shed/workshop.
- 1.2.3 The supplier shall supply suitable software for evaluation of data downloaded from the system.
- 1.2.4 The design of the equipment shall be developed as per requirement given in this specification. The detailed design shall be submitted to Vendor Approving Authority for scrutiny and approval before commencement of the manufacturing. Here 'approval' means the 'approval of design features' only. The suppliers shall be fully responsible for performance of complete system.

## 1.4 MODIFICATIONS

The supplier shall be responsible for carrying out all the modifications, which may arise due to bad design or manufacturing defect, necessary for satisfactory performance of the equipment, at his own cost during the period of warranty. The decision of Vendor Approving Authority with regard to fixing the responsibility (for bad design or manufacturing defect) shall be final and binding on the supplier. Moreover, modification, if any required on the basis of the experience gained during the field trials of prototype equipment, shall be incorporated by the supplier without any extra cost. Such modification shall be finalized in consultation with Vendor Approving Authority.

## 1.5 INSTALLATION INSTRUCTIONS:

Installation instruction shall be provided in acceptable form e.g. instruction card/manual. These instructions shall include the method of inter connection, type of cable and grade of cable, maximum resistance and whether the cable is screened. Details of any special precaution necessary shall also be stated.

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**1.6 INSTRUCTION MANUAL:**

The manufacturer/ supplier shall supply sufficient copies of instruction manual. This shall include system description and operating, maintenance, calibration and Troubleshooting manual. List of spares with part no./tech. specification shall also be included. Number of copies to be supplied shall be 10% of the number of equipment ordered, subject to a minimum of 2 copies per order.

**1.7 TRAINING OF INDIAN RAILWAYS PERSONNEL:**

The supplier shall arrange for free of cost training to Indian Railway's personnel in operation, maintenance covering Installation, Commissioning, Maintenance and troubleshooting of the system.

**1.8 DOCUMENTATION:**




The supplier should provide the following technical documents as part of their proposal.

- i. In case of already developed systems, the equipment manufacturer must provide to Vendor Approving Authority, the prototype test compliance as per EN 50155/IEC 60571 and the required details with drawings required for the purpose of evaluation of the design and its functionality. All documents shall be supplied in both hard and soft (PDF) copies.
- ii. For outsourced sub assembly such as Camera, NVR, etc. which are commercially off the shelves products and have been working in other mobile applications, the supplier shall furnish the details of credentials and certification from the OEM for its suitability in mobile application and technical support during its expected life.
- iii. In case of new or developing design, the process of design of the system clearly indicating the different stages, milestones and project duration.
- iv. Data Sheet of the equipment viz. NVR, Camera, SSD, DC-DC Converter etc.
- v. The supplier shall have Pan India Support System for maintenance and technical support for CVVRS system. The firm shall provide the necessary credentials in support of the Pan India support System.
- vi. Instruction Bulletins, data downloading manual and Troubleshooting Manual of CVVRS system.
- vii. Application software along with CVVRS System.

**1.9 REFERENCE TO VARIOUS SPECIFICATIONS:**

1.9.1 Assistance has been taken from the following standard specification in formation of this specification.

- (i) EN50155
- (ii) IS2500
- (iii) IEEE1482.1

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(iv)H.264

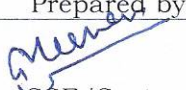


(v) G.711

(vi)IEC 60571,60529,62262,61000,1287

1.9.2 Wherever in this specification, any of the above mentioned specification is referred by number only; the latest issue of the Specification is implied.

#### 1.10 DEVIATIONS:

Any deviation from this specification with a view to improve the performance may be given due consideration provided, full particulars with justification thereof, are furnished. It may, however, be noted that due to limited availability of space in the locomotive and the necessity to ensure interchangeability with the existing measuring instruments increase in the overall mounting dimensions shall not be allowed normally.

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## CHAPTER 2

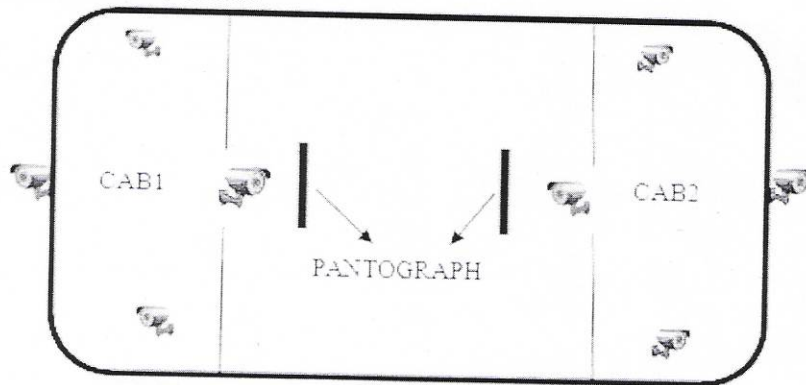
### GENERAL, FUNCTIONAL & TECHNICAL REQUIREMENTS

#### 2.0 BRIEF DESCRIPTION OF THE EQUIPMENT

The final equipment is expected to contain the following major sub components equipment. The list is indicative and the supplier shall provide further details as per their own design.

- Cameras:

**For Electric Locomotives:** IP based Digital cameras (2 Nos. inside each cab and 2 nos. outside cameras at each end. One of the outside cameras will face the track & other one will be installed on roof facing towards pantograph (Total 08 cameras). The tentative location of cameras are as under.



**For Diesel Locomotives:** IP based Digital Cameras (2 nos. Inside Camera in each cab and 1 Outside Camera on either end i.e. IP Cameras of 4 nos. for single cab and 6 Nos. for dual cab).

- Network Video recorder with processing system and data storage capable of receiving standard RTSP stream from connected IP cameras. 8 channel NVR shall be provided in each cab of electric Locomotive and Diesel Locomotive.
- DC-DC Converter to feed the system from loco control voltage, if required.
- Required cables and interfacing equipment
- Hardware for mounting and cabling

#### 2.1 GENERAL REQUIREMENTS

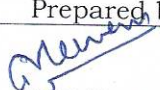
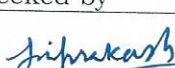
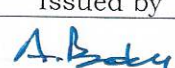
The equipment is expected to meet the following general requirements:

- 2.1.1 CVVRS shall be combination of IP based digital cameras with built in microphones, Network Video Recorder (NVR) along with data storage memory suitable for mobile vehicle operations. The integration of camera & microphones with mobile Network Video Recorder installed in cab shall be based on standard interface. Inbuilt Microphone should be of adequate rating and having high signal to noise Ratio for proper Voice quality.

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- 2.1.2 The indication of health of recording shall be displayed in NVR.
- 2.1.3 The Control Voltage available to Electric locomotive is 110 V DC (70V to 136V) from battery and 72V DC (50V to 90V) from accumulator battery and/or an auxiliary generator in case of Diesel locomotives. The input voltage to the system may be according to OEM's design. However, to make compatible the system with Electric & Diesel locomotive power supply, firm has to provide individual DC-DC Converter of suitable capacity. The DC power from locomotive can be tapped for input to DC-DC Converter through MCB of adequate rating. The DC-DC converter integral to NVR is also acceptable. Voltage fluctuations lying between 0.6 to 1.4 times of Nominal voltage and not exceeding 0.1 second shall not cause any deviation in functioning of CVVRS. Voltage fluctuations lying between 1.25 to 1.4 times of Nominal voltage and not exceeding 1 second shall not cause damage to the unit. The unit may not be fully functional during these fluctuations. Cables for power Supply should be Electron beam irradiated cables.
- 2.1.4 System shall use video signals from various types of CCD (Charge-coupled device)/CMOS or better colour cameras installed at different locations and audio signals from microphones to process them and record all the cameras. The OEMs may study the noise level inside the locomotives & shall design the noise suppression facility accordingly.
- 2.1.5 System should ensure that once recorded, the video cannot be tempered /altered/deleted; ensuring the audit trail is intact for evidential purposes.
- 2.1.6 System shall provide minimum last 72 hours data on FIFO basis of all the camera recordings @ 15 FPS or more, at 4 CIF or better quality (extended capacity of cameras i.e. present capacity + 25%) with simultaneous storage of audio signal.
- 2.1.7 The digital video and audio signal received through individual channel in SSD of Network Video Recorder. The CVVRS should support dual stream.
- 2.1.8 The recording resolution and frame rate for each camera shall be user programmable.
- 2.1.9 All the cameras & control equipment shall be suitable for operation from -20<sup>0</sup> C to 70<sup>0</sup> C ambient and relative humidity up to RH up to 90% non-condensing.
- 2.1.10 The expected life of the equipment shall be 12 years or more.
- 2.1.11 Sampling shall be done as per IS 2500 wherever not specified but required. Sampling shall be done as per the requirements wherever specified in this document. If the specific contract includes specific clause for sampling, the same shall be applicable.

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2.1.12 Each unit of system i.e. NVR, Camera, SSD, , DC-DC Converter (If required) shall contain a number plate indicating

- Serial number
- Date of manufacturing
- Name of manufacturer
- Model number.

The major sub-assemblies going into each unit should also be numbered and recorded with the supplier for future reference.

2.1.13 The equipment shall be appropriately painted for operational use, 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 life time of the equipment.

The offered system and all major components and parts shall have proper identification and traceability to facilitate failure analysis and life cycle data.

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

2.1.14 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.

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

2.1.16 The equipment manufacturer shall submit an undertaking to support the equipment during its declared lifetime. This undertaking shall be provided during type testing and design approval and also while entering into purchase contracts.

## 2.2 FUNCTIONAL REQUIREMENTS

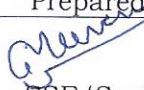


The equipment shall address the following functional requirements.

2.2.1 All Cameras shall be Day/Night cameras.

2.2.2 Housing of cameras shall be of IP 66 or better rating for Inside camera and IP 67 or better for outside camera.

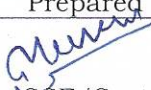


2.2.3 The recording shall support audio trail feature.

2.2.4 All camera recordings shall have Camera ID & location/ area of recording as well as date/ time stamp. Camera ID, Location/ Area of recording & date/ time shall be programmable by the system administrator with User ID & Password. The system shall be provided with internal battery to keep the clock (Date & Time) working. Date/Time stamp of recorded video and System shall be updated with GPS clock.

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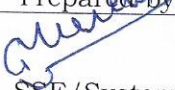




- 2.2.5 The recorder shall be Network Video Recorder for mobile applications compatible with ONVIF based IP digital cameras & NVR ONVIF standard.
- 2.2.6 Facility of camera recording in real-time mode 24 or lower FPS as well as in any desired combination must be available in the system.
- 2.2.7 The recorder shall be fully user-configurable allowing every camera input to be set individually.
- 2.2.8 NVR (recorder) shall be able to provide power to all cameras. There shall no need for external power supply source for each camera.
- 2.2.9 Facility of Camera recording in CIF, 2CIF, 4CIF, D1, 2 Mega Pixel as well as in any combination i.e. any camera can be recorded in any quality.
- 2.2.10 The offered system shall have facility to export the desired portion of clipping (from a desired date/ time to another desired date/ time) on external drive. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc. Supplier specified software is also acceptable in addition to standard software. The full application software package shall be provided by the supplier for downloading and viewing the recordings. Trial version or limited user type application software is not acceptable.
- 2.2.11 Acknowledgeable Audio visual alarm feature is required to indicate the failure of recording of any of the audio and video channel in each cab. The logging of data for failure of channel or any other abnormality in the system should be stored in the NVR.
- 2.2.12 System shall have hardware available for 2G/3G/4G (auto connect) and GPS connectivity for remote monitoring. Railway may ask for enabling the feature of remote monitoring. SIM card for each NVR for wireless data transmission and required server space shall be optional item for remote video management system. The server shall be located in India and comply minimum TIA-942 Tier III standard. Govt. of India Policy on the server shall be applicable. The optional item shall be provided by the CVVRS supplier at an additional cost, if specifically asked for the same in the tender. The CVVRS system should have the feature of Video management System similar to the system being used in other commercial applications for security surveillance such as remote viewing the video, remote health monitoring of CVVRS system, real time alert of system faults through email, SMS, etc.
- 2.2.13 The system should facilitate for interfacing with Crash Hardened Memory (CHM) complying IEEE 1482.1 to store data simultaneously as future requirement and scalable feature. The preferred communication interface with CHM should be on Ethernet. The firm may submit the undertaking for supporting the interfacing with crash hardened memory, if provided by Railways. The firm shall be bound to integrate the system with these requirements at later stage whenever asked. The CHM shall be provided by Railway or can be procured from the CVVRS vendor.

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- 2.2.14 System shall have facility of additional camera installation beyond the originally planned capacity. The recorder shall have minimum 2 digital Input/outputs for system interfacing.
- 2.2.15 The recorder shall have a Universal Serial Bus (USB) interface on the front panel for service and maintenance.
- 2.2.16 The recorder shall have an Ethernet port via an M12 connector
- 2.2.17 The recorder shall be supplied in a compact black aluminum enclosure of maximum size of 3U sub Rack (Maximum 19" width & 12" depth).
- 2.2.18 Industrial grade Vibration and Shock Proof Solid State Drive (SSD) shall be used for data storage and can be un-mountable from NVR as pluggable device for offline downloading the Data. There shall be sufficient memory to store minimum last 72 hours data on FIFO (First in First Out) basis.
- 2.2.19 Mounting of NVR shall be as such that it shall be housed in a sealed, tamper resistant housing (preferably with Lock and Key arrangement) along with relevant hardware/fasteners such as tri-wing type screws required for installation to deter theft of SSD, NVR as well as any sub-unit of CVVRS system with common hand tools. Lock for tamper resistant housing of NVR, storage device as well as any sub unit of CVVRS System shall be of reputed make. Mounting arrangement shall be made to isolate vibration to avoid transmission of shock and vibration to the equipment to the extent possible. Camera shall be provided with suitable anti pilferage arrangement.
- 2.2.20 The recorder shall have recording modes viz. continuous, manual, or programmed modes on date, time and camera-wise. All modes shall be disabled and enabled using scheduled configuration. It shall also be possible to search and replay the recorded images on date, time and camera-wise. Different recording speeds (FPS) and resolution for each recording mode for each camera shall be possible.
- 2.2.21 Audio recording should be synchronized with respective camera.
- 2.2.22 The application software should allow retrieval of data or any date / time interval chosen through search functionality of the application software. The system should also allow for backup of specific data on any external device in a format which can be replayed through Personal Computer (PC) with standard PC based software (license free).
- 2.2.23 The software should Support flexible 1/ 2/ 4 Windows Split screen display mode or scroll mode on the PC monitor or on preview monitor as per site requirement.
- 2.2.24 The software should have digital zoom facility to view particular patch.
- 2.2.25 Adequate provisions should be made in the design for suppression of internal transients,

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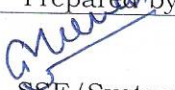


spikes and to withstand external transients, spikes and surges as per limits laid down in IEC-60571.

## 2.3 TECHNICAL REQUIREMENTS

The proposed system shall meet the following technical requirements:

Image Sensor	1/3"CCD/CMOS or better
Resolution	HD 2 Mega Pixel for Outside and Inside View.
System Compatibility	ONVIF
Protocols	TCP/IP, HTTP, DHCP, RTP, RTSP, PPPoE
Ethernet	10/100 Base-T
Lens	Focal length-3.6mm or better for both the cameras (Fixed lense)
Night Vision	The system shall be able to record at a distance of 30m outside. The system shall be able to record at a distance of 5m inside cab.
Signal to Noise Ratio	WDR of Minimum 100 dB for IP camera.
IP Rating	Dust protection with dehumidifying membrane, IP-67 to IEC 60529 for outdoor camera and IP 66 to IEC 60529 for Inside camera and vandal proof (Impact rating IK-10 to IEC 62262)
Operating Temperature	-20 °C to 70 °C Ambient
Synchronization	Internal
Back light compensation	Automatic
Automatic white balance	Yes
Video output signal	M-12 or Aviation plug, Rugged RJ-45/M-12
Power source camera	Less than 15 Watt
Inbuilt SD card compatibility	Yes
Standard compliance	Rolling Stock: EN 50155:2007/IEC 60571 or latest compliance (shock, vibration, temperature, EMC)

**Note:** International certification by Certification body UL, CE, FCC etc. is desirable to ensure quality product.

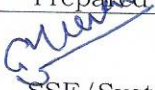


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### CHAPTER 3

#### INSPECTION

- 3.1 The whole of the material or fittings used in the construction of the equipment shall be subjected to inspection by the Inspecting authority and shall be to his entire satisfaction.
- 3.2 The inspecting authority shall have the power to:-
- Adopt any reasonable means he may consider necessary to satisfy himself that all the materials or fittings specified are actually used throughout the construction.
  - Visit at any reasonable time and without previous notice, either contractor's works or his sub-contractor's works to inspect the manufacturing and the quality of the work at any stage.
  - To reject any materials or fittings that does not conform to the relevant standard specifications or have not been manufactured in accordance with the approved practices. The rejected materials or fittings shall be marked in a distinguishable manner and shall be disposed on in such manner as the inspecting officer may direct to avoid its inadvertent use in the product order as per this specification.
- 3.3 The manufacturer shall offer all the testing facilities free of charge to inspecting authority. Testing of equipment and fittings shall, as far as possible be carried out at the works of the manufacturer. Testing of bought out components may also be carried out at sub-contractor's premises, if so required. The contractor shall provide free of charge, such materials or fittings as may be required for testing whether at his own or his subcontractor's premises. The test for which facilities are not available may be carried out at RDSO or any other approved laboratory for which the testing charges shall be payable by the supplier.
- 3.4 All the equipment and the fittings required for test shall be selected by the inspecting officer and the tests shall be carried out in his presence.
- 3.5 No material shall be packed or dispatched until it has been passed by the inspecting officer but the contractor's responsibility for its efficiency in every way, shall remain the same as if the work had been manufactured and tested by himself.
- 3.6 Should any part require alteration or any defect appear during the test or trial the contractor shall without any extra charges make such alteration or rectify the defects to the satisfaction of the inspecting authority?
- 3.7 Copies of Maker's test certificate, guarantee for the performance of the equipment shall be supplied in duplicated along with the delivery of each unit.

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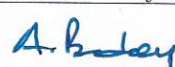


## CHAPTER 4

### CLIMATIC AND ENVIRONMENTAL CONDITION

The climatic and environmental conditions prevailing are as following:

➤ Atmospheric temperature	Maximum temperature of metallic surface under the Sun: 75 degree Celsius and in shade: 70 degree Celsius Minimum temperature: - 20 degree Celsius (Also snow fall in certain areas during winter season)
➤ Humidity	100% saturation during rainy season
➤ Reference site conditions	i) Ambient temperature: -20 °C to 70°C ii) Humidity: 100% iii) Altitude: 1776 m above mean sea level
➤ Rain fall	Very heavy in certain areas.
➤ Atmospheric conditions	Extremely dusty and desert terrain in certain areas. The dust concentration in air may reach a high value of 1.6 mg/m <sup>3</sup> . In many iron ore and coal mine areas, the dust concentration is very high affecting the filter and air ventilation system.
➤ Coastal area	Humid and salt laden atmosphere with maximum pH value of 8.5, Sulphate of 7 mg per liter, maximum concentration of chlorine 6 mg per liters and maximum conductivity of 130 micro Siemens /cm.
➤ Wind speed	High wind speed in certain areas, with wind pressure reaching 150 kg/m <sup>2</sup> .
➤ Electromagnetic pollution	High degree of electromagnetic pollution is anticipated in locomotive machine room/HT & LT compartment, where the equipment shall be mounted. Necessary precaution shall be taken in this regard. The system shall be interference free from the communication system between the Guard-Driver-Control and Public address system. The system should be tested as per IEC 61000 for Electro Magnetic Compatibility.
➤ Vibration	The system shall be designed to withstand the vibrations and shock encountered in service satisfactorily as specified in IEC 1287 and 60571 publications for the electronic equipments used on Rail Vehicle and relevant IECs as applicable to other equipment.

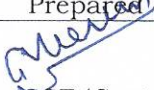


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## CHAPTER 5

### TESTS

#### TESTS, VERIFICATION & VALIDATION

- 5.1 The Type & Routine tests shall be carried out in accordance to IEC 60571/EN 50155(latest edition).
- 5.2 Verification of test certificates and reports submitted.
- 5.3 Verification of compatibility for fitment on locomotive.
- 5.4 Fitment and trials on Electric loco & Diesel loco.
- 5.5 Prototype test of first set of CVVRS each for Electric loco & Diesel loco shall be carried out by vendor approving authority.
- 5.6 Extended field trials for performance evaluation. Performance shall be closely monitored and evaluated by Vendor approving authority.

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 SSE/System	 SSE/System	 JDSE/System

**CHAPTER 6****ORDERING INFORMATION**

Purchaser shall provide following information for purchase enquiry/order:-

RDSO specification no.:

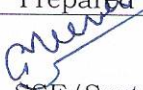


Copies of evaluation software (if applicable):

Nos. of camera:

Nos. of NVR:

No. of DC-DC converter(if any):

SSD:

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 SSE/System	 SSE/System	 JDSE/System