

**REASONED DOCUMENT**  
**FOR**  
Network Monitoring System

Sub set

SPECIFICATION No. RDSO/SPN/196/2020

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**Document Control Sheet**

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New specification Clause No.	RDSO/SPN/196/2012 version 3.2- Description	Revised specification	RDSO's Remarks
----	Requirement Document of Display Screen Software Tool Requirement Document of Report Generation Software Tool	Specification Of Network Monitoring System (IRATP) Subset Of Specification No. RDSO/SPN/196/2020-NMS Version 4.0d1	This is a sub system of TCAS system. Presently only one vendor M/s Medha has developed the Network Management system and to develop more vendor for the same. This specification is merged and made as subset of TCAS specification.
1.3.6	Desktop application shall work preferably on WINDOWS Operating System (XP, Vista, Win 7, Win 8, Win 8.1 and Win 10) with 32-bit & 64 bit Platform.	The minimum configuration of PC recommended for 150 four line stations is 1.3.6.1.1.1 Windows 8 or above 1.3.6.1.1.2 CPU cores processor 1.3.6.1.1.3 12 GB, RAM1 1.3.6.1.1.4 1 static IP 1.3.6.1.1.5 <u>Minimum 2 TB hard disk for storage of log.</u>	<b>To have more conformity</b>
1.3.6	The lowest resolution for viewing displayed data on the front end screen is 1024x768. Based on Screen Resolution of current working PC, the complete GUI may not be visible to the user.	1.3.6.1.2 Internet bandwidth of 25Mbps (assuming 4 live consoles and 2 report generators working in parallel) 1.3.6.1.3 Dedicated E 1 channels connecting 5-7 Stationary TCAS in a ring. 1.3.6.1.4 Power requirement for Dual NMS server in Hot standby with 65" LED Display is 3KVA Inverter with 150AH 4 number Batteries. 1.3.6.1.5 The lowest resolution for viewing displayed data on the front end screen is 1024x768. Based on Screen Resolution of current working PC, the complete GUI may not be visible to the user. 1.3.6.1.6 The Hardware Limitations shall be specified by the OEM to the purchaser	<b>To have more conformity</b>

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1.4.3.12	Application shall have an option to send received packets by NMS to other dedicated IP Address and Port. This option shall be <b>ON/OFF</b> type. By default it Shall be <b>OFF</b> .	Application shall have an option to <u>repost all the message frames as received from the stationary TCAS units, on to another LAN port on which TMS or CTC would be connected-or dedicated IP Address and Port.</u> This option shall be ON/OFF type. By default it shall be OFF.	To have feasibility to connect TMS or other system for monitoring TCAS loco Movement
2.4.7.18	New Clause added	<b>Performance Reports</b>	Based on the field experience and to have the facility of auto generation of different performance report
2.4.7.18.1	New Clause added	<b>Generate Report</b>	
2.4.7.18.1.1	New Clause added	<u>Application shall have a generate button to generate Performance Report. On Clicking this button, Application shall take From "From month/year" to "To month/year" and also for monthly basis.</u>	
2.4.7.18.1.2	New Clause added	<u>Application shall display the trial performance report on monthly basis in the following format (XXX being month and YY is the Year):</u>	
2.4.7.18.1.3	New Clause added	<u>Application shall display the trial performance report of each make of loco in their section or all other sections on "From month/year" to "To month/year" basis in the following format (XXX being month and YY is the Year). The division name shall get appended. The cell values with greater than threshold value (99% default, configurable from 98.00000% to 99.99999%) shall be highlighted with green text and green back ground.</u>	

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2.4.7.18.1.4	New Clause added	<u>Application shall display the inter-operability trial performance report on “From month/year” to “To month/year” basis in the following format (XXX being month and YY is the Year). The division name shall get appended. The cell values with greater than threshold value (99% default, configurable from 98.000000% to 99.999999%) shall be highlighted with green text and green back ground.</u>	<b>Based on the field experience and to have the facility of auto generation of different performance report</b>
2.4.7.18.1.5	New Clause added	<u>Application shall display the number of trips report on “From month/year” to “To month/year” basis in the following format (XXX being month and YY is the Year). The division name shall get appended.</u>	
2.4.7.18.1.6	New Clause added	<u>Application shall display the number of kilometres of IRATP runs report on “From month/year” to “To month/year” basis in the following format (XXX being month and YY is the Year). The division name shall get appended.</u>	
2.4.7.18.1.7	New Clause added	<u>Application shall display the number of hours of IRATP runs report on “From month/year” to “To month/year” basis in the above format (XXX being month and YY is the Year). The division name shall get appended.</u>	
2.4.7.18.1.8	New Clause added	<u>Application shall display the Performance of IRATP report on “From month/year” to “To month/year” basis in the following format (XXX being month and YY is the Year). The division name shall get appended. Similarly, this performance of IRATP report on monthly basis also shall be made available.</u>	

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<b>Section 3</b>	<b>New Chapter is added as “Requirement Document OF Artificial Intelligence In Network Monitoring System For TCAS (for future use) [version 1.2]”</b>		It is being added with the plan of future development to upgrade the system with New technology.
3.1	New Clause added	Scope	
3.1.1	New Clause added	<u>Understand the data flow in the Network Monitoring System of TCAS.</u>	
3.1.2	New Clause added	<u>Prepare a detailed Functional Requirement Specifications for introducing Artificial Intelligence.</u>	
3.1.3	New Clause added	<u>Model the data using suitable Machine Learning Method.</u>	
3.1.4	New Clause added	<u>Achieving 90%, 98%, 99.9%, 99.99% correct predictions in six months, twelve months, eighteen months and twenty four months period respectively.</u>	
3.1.5	New Clause added	<u>The predictions shall include the hardware module going faulty, software errors, Loco Pilot wise handling, formation/station/make wise performance and braking parameters etc.</u>	
3.1.6	New Clause added	<u>Development of User Friendly Reports.</u>	
3.1.7	New Clause added	<u>Development of common protocols for ease of use of the development across various makes of NMS.</u>	
3.2.1	New Clause added	<u><b>Error Alert Generation</b> : Acquiring the data from the sensors on a timely basis and automatically generating alert when encountering any sort of dissimilarity or abnormal behaviour of any component of the system. It will broadly consist of following two modules:</u>	
3.2.2	New Clause added	<u><b>Equipment Health Tracking:</b> Provided the radio health data of hardware components of the system, the proposed system will analyse the incoming inputs within a user specified time window (For ex. Every 2 hours/6 hours/1 day) and predict any upcoming potential equipment failures</u>	

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3.2.3	New Clause added	<u>Real Time Exception Analysis: the task of this module will be to foreseen the upcoming potential exceptions before they actually occur, and provide day wise/week wise logs for better accountability.</u>	
3.2.4	New Clause added	<u>Real Time Intelligent Reporting: Harnessing the information used in the general report generation along with some powerful artificial intelligence algorithms to carry out real time analysis of the incoming data and generating summaries on a daily/monthly basis.</u>	
3.2.5	New Clause added	<u>Faulty Parameter Analysis : involves generating alerts as soon as a parameter is reported faulty (i.e. in real time) and prediction of fault in advance.</u>	It is being added with the plan of future development to upgrade the system with New technology.
3.2.6	New Clause added	<u>Anomaly Detection : this system will be capable of finding the events that does not conform to the certain expectations of normal behaviour of the system and reporting it to the concerned personnel in real time so as to avoid occurrences undesirable outcomes</u>	It is being added with the plan of future development to upgrade the system with New technology.
3.2.7	New Clause added	<u>Braking Pattern Prediction: through this module we will be imparting intelligence to the system in terms of efficient breaking algorithms using a more data driven approach. The task will be to optimize the number of brake commands sent to the Brake System of a locomotive via LOCO TCAS thus reducing unwanted delays. Data driven efficient braking algorithm will be developed</u>	It is being added with the plan of future development to upgrade the system with New technology.
3.2.8	New Clause added	<u>Dash boarding: this module will provide a real time summary of all the information a user needs to know at a particular time in form of a dashboard entailing a variety of Real time graphs.</u>	It is being added with the plan of future development to upgrade the system with New technology.

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3.2.9	New Clause added	<u>The primary focus of the proposed system is to optimize the durations of Alert generation, Fault Prediction and Anomaly Detection and bring about automation in order to derive a real time decision support system capable of providing intelligent insights in a more user friendly format with least human intervention and within a minimal time offset.</u>	
4.0	<b>New Chapter is added as “Criteria for Network Monitoring System Software approval</b>		<b>New Chapter added: To confirm the criteria for the approval of software based on the experience in development Project</b>
4.1	New Clause added	<b>Safety Requirements:</b> The Template and Database Files which are used in the Application are not supposed to open whenever the Application is running, because the files may corrupt.#	<b>New Chapter added: To confirm the criteria for the approval of software based on the experience in development Project</b>
4.2	New Clause added	<b>Human Factor Requirements:</b> Provision shall be given for the user to browse the NMS Binary data file and generate the reports and graphs for analysis. User can also save the reports.	
4.3	New Clause added	<b>Implementation Requirements:</b> <u>NMS Software shall follow Coding Standards and guidelines as per EN-50128 and shall meet SIL0 requirement.</u>	
4.4	New Clause added	<b>Exception Handling Requirements:</b> Exception handling shall done throughout the application, where ever required, exception message shall be displayed and recorded.	
4.5	New Clause added	<b>System Qualification Requirements:</b>	

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4.5.1	New Clause added	<b>Acceptance Criteria:</b> After releasing the NMS Software, the Version No. and CRC shall be frozen and verifiable.	New Chapter added: To confirm the criteria for the approval of software based on the experience in development Project
4.5.2	New Clause added	<b>Test Audits, Reports, and Reviews</b> 4.5.2.1 <u>Internal Review Reports by V&amp;V for meeting SILO requirement as per EN-50128</u> 4.5.2.2 <u>Internal Functional Test Reports in RDSO approved functional test format.</u>	
4.5.3	New Clause added	<b>Type of Delivery / End-user deliverable:</b> The end-user deliverable shall be provided in the form of Software Setup. The SW shall be formally released by Verification & Validation.	
4.6	New Clause added	<b>Criteria for Approval</b>	New Chapter added: To confirm the criteria for the approval of software based on the experience in development Project
4.6.1	New Clause added	<b>Test to be carried out before installation</b>	
	New Clause added	4.6.1.1 <u>The functional tests shall be carried out to demonstrate in the actual field conditions in simulated environment that the complete NMS system operates correctly in accordance with the Specifications.</u> 4.6.1.2 <u>Factory acceptance test for the NMS data base for station and loco shall be carried out to ensure that the application data is configured correctly.</u> <b>4.6.1.3</b> <u>The NMS system developed by the firm shall be interoperable with existing TCAS vendors. The NMS shall be tested in RDSO lab for communication with Stationary TCAS of existing vendors.</u>	

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4.6.2	New Clause added	<p><b><u>Test to be carried out after installation and before permitting field trial</u></b></p> <p>4.6.2.1 <u>The tests shall sequence through all required operations and that the local field configuration of data base is correct.</u></p>	
4.6.3	New Clause added	<p><b><u>Field trial Performance Assessment</u></b></p> <p>4.6.3.1 <u>Firm shall demonstrate operational availability of NMS software in a TCAS territory over a period of 30 days for minimum logging of 20 stationary TCAS station. During this period, the operational availability shall be 98.50 % or better on weekly basis without any issue.</u></p> <p><u>Availability % = (Total up time/Total Time) x 100</u></p> <p>4.6.3.2 <u>During field trial period, the NMS shall not hang and the PC in which NMS is installed shall not be rebooted. Firm shall submit the evidence for the same.</u></p>	<p><b>New Chapter added: To confirm the criteria for the approval of software based on the experience in development Project</b></p>

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