

Reason Document Revision of TAN for IPMPLS (Final Draft)

S.No	Clause No. and details as per TAN	details as per Purposed TAN	Comments of Vendor	RDSO Comments	Finalised Clause
1.	Page 3 of 13 clause 5	The telecom backbone of all future works / replacement of Data networks such as PRS / UTS / FOIS / SCADA shall be with IPMPLS equipment by providing separate VPN network if required	TEAM ENGINEER This essence of this statement is requested to be reflected in the detailed specifications of LER – LSR where we are referring to category V & VI of TEC GR 48050 :2020 this need to be reflected as some of the features are very high and pertains to service provider requirements (as TEC GR is designed for service provider), a detail table is provided for your kind information (refer Annexure A- attached)	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
2.	Page No.- 03 , Para 8	Intensive training to staff on IP-MPLS technology shall be planned immediately by IRISSET and other Zonal Training Centers. IRISSET will prepare the training contents including the video clips of various modules relevant to understand various	ECR Stress should be given for practical training. i.e hand on training for initial installation and configuration of LSR & LER.	Agreed, New Clause Added.	TRAINING: 1.Onsite training shall be provided to the Railway officials as nominated by purchaser. The training shall include Network configuration of the system through use of various modules, integration of hardware with software and

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		aspects of IP-MPLS.			<p>complete operation of the system.</p> <p>2. Two Sets of training manual hard copies & soft copies containing details of technical specifications, installation and commissioning, troubleshooting & maintenance schedule etc. shall be supplied along with the equipment.</p>
3.	Page 3 of 13 clause 6	To optimize the cost and improve availability, same network infrastructure may be shared for number of services with required security features and with ring/ protection path and VPN network if required	<p>TEAM ENGINEER</p> <p>To optimize the cost and use the same infrastructure : We can use WDM modules as option same as STM 1 to migrate with ease be it new or old fibre, WDM can be considered as it has been successfully implemented, this can come under section (page No. 7 of 13) B (Interface configuration) as an option which will really get the essence of clause 6.0 in your referred TAN and provide versatility and ensure you migrate with ease – channelized STM1 module is always an issue as nearly all the circuits in Indian Railways are point to point drop and grooming of E1's into a single STM1 is not at all common feature in Indian Railways.</p> <p>Anyhow the plan is to remove STM1, it will not make</p>	Not Agreed: Incorporation of WDM technology in IPMPLS is not under consideration.	No change.

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			any difference whether we use STM1 or WDM or both to ease the migration issues in cost effective manner- It will give the user opinions for better migration planning in a cost-effective manner – where the primary objective of migration to IPMPLS network is achieved in a smart way		
4.	Page No.- 05 , Para 2	Standardize the MPLS equipment including the interfaces to be used for different categories of stations, divisional and zonal HQ locations including the IP numbering scheme. Equipment with modular and hybrid interfaces are to be procured so that interfaces with legacy TDM equipment are replaced as and when needed.	ECR Standardized of IP routing plan also be done.	Noted: This will be done separately.	No change.
5.	Page No.- 05 , Para 6	Typical schematic diagram for implementation of IP-MPLS network showing required	ECR In POC, one node of MPLS of RCIL using IG interface should be connecting and demonstrated. Hence, Fig I. may be modified. This will be the show the inter operation of MPLS equipment.	Already reflected in Fig. in Para 5.1 of POC document.	No Change

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		services at wayside station is given in fig.1 below. The scheme is for guideline and actual requirement may be decided by the user/purchaser.			
6.	Page No.- 06 , Para "NOTE"	Note: E1 interface shown in the LER is optional and Railway may use suitable converter to meet the requirement of E1 interface.	SIGNALIX Page 6 Note: E1 interface shown in the LER is optional and Railway may use suitable converter to meet the requirement of E1 interface. ---- Our suggestion is it should be clearly defined by RDSO that either E1 should be used or E1 should not be used and converter should be used by divisions to connect Mux to run the current services.	Agreed: Note is amended.	Note: E1 interface shown in the LER is optional. and Railway may use suitable converter to meet the requirement of E1 interface.
7.	Page No.- 06 , Para 7	The Data networks for PRS, SCADA etc which are still working on Statistical Mux and/or RS232 modems, will have to be migrated to full IP network and these circuits can be transferred to Ethernet interfaces right away so that their migration	ECR When PRS/UTS network shall be migrated to IPMPLS network on PAN India basis if done, what will be modalities of such transformation, any arrangement required at initial level may be communicated.	This is a policy matter and may be decided at the time of migration.	No change.

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		becomes simpler.			
8.	Page-08, para 2 (a)	a) 2x10G (optical) to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card.	CISCO a) 2x10G (optical) to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card / port in same chassis.	Requirement is Redefined.	2x10G <u>4x10G</u> (optical) <u>distributed in minimum two cards, minimum 2X10G in each card</u> to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card.
9.	Page-08, Para 2 (d)	d) 12xE1 (G.703) for working various TDM circuits of stations utilising PD Mux as well as directly (optional).	CISCO d) 8xE1 (G.703) for working various TDM circuits of stations utilising PD Mux as well as directly (optional).	Not Agreed: Required port 12 E1 optimised as per Railway Requirements	No Change.
10.	Page No.- 07 , Para 15	Since the total migration will take considerable time, the existing IP addressing planning under the control of Rly Bd will require to be modified on case to case basis as to integrate various services or	ECR It is understood that present addressing shall be as per IPv6 protocol. If not, same may be communicated	System is compatible to both.	No change.

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		<p>applications and also to operate multiple VPNs so that, during the migration exercise there are no situations like IP clash etc. This exercise shall be done by the S&T Dept. of individual Rly units in coordination with Telecom Dte of Rly Bd</p>			
11.	Page No.- 07 , Para 16	<p>An all India IP plan for the loopback IPs and interface IPs will have to be planned and followed for the migration. This IP plan must be in consonance with RCIL's MPLS network so that in future if IP level connectivity is required to be done with RCIL, it becomes smooth.</p>	<p>ECR This should be planned at Railway board level.</p>	Noted.	No change.

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12.	Page 8 of para 3	3) The LSR should be equipped with minimum 8x10G (optical) ports or as per purchaser requirements. It should be possible to upgrade the router to 16 X 10 G (Optical) by way of adding/replacing the card.	<p>CISCO</p> <p>3) The LSR should be equipped with minimum 8x10G (optical) ports or as per purchaser requirements. It should be possible to upgrade the router to 16 X 10 G (Optical) by way of adding/replacing the card. Should provide 2x100G interfaces for connectivity between two LSR</p>	2x100G Not Agreed: Optimised as per Railway Requirement.	No Change.
13.	Page 8 and 9	<p>Functional and Technical requirements of Label Edge Router (LER): The functional and technical requirement shall be as per TEC GR No. 48050:2022 for “Router for MPLS Based Transport Network” issued in March 2022 or latest with following specific requirements</p> <p>Functional and</p>	<p>NOKIA</p> <p>RDSO TAN version 2.0 [draft] is trying to adapt TEC GR 48050:2022 (a.k.a TCP-004/01/Feb-14).</p> <p>This GR is missing on critical functional requirements like C-SDN, Segment-Routing, EVPN, etc. These functional requirements of Segment Routing and EVPN were listed in RDSO TAN version 1.0</p> <p>Current TAN v1.0 has mandated IP-MPLS as the technology and functional requirements of Segment-Routing, and EVPN. These features are required to meet C-SDN approach for any large network and are also well adapted by large enterprises and service providers.</p> <p>Proposed: TEC GR 48050:2022 is not for mission critical networks like Railways, as there is no specifications for Segment-routing and EVPN in the</p>	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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		Technical requirements of Label Switch Router (LSR): The functional and technical requirement shall be as per TEC GR No. 48050:2022 for “Router for MPLS Based Transport Network” issued in March 2022 or latest with following specific requirements	GR.		
14.	Page 8 para (C)	C. Interoperability- Router Shall have IP-MPLS interoperability with routers of other multiple OEM’s	CISCO EANTC or any third party lab interoperability data should be acceptable	Interoperability testing is a necessary part of POC. In addition, any certificate may be submitted by supplier as available.	No Change.
15.	D	Functional & Technical requirements of LER	TEAM ENGINEER Enclosed a detailed working matrix for LER - Annexure A	Noted, Now final draft is aligned with Railway	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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				Requirement and TAN Version 1.0	
16.	Page 8 para (D) (1)	1. Aggregation Router of category-V with minimum chassis capacity of 60Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LER.	CISCO 1. Aggregation Router of category-V with minimum modular or Fixed chassis capacity of 60Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LER. Chassis based is optional in TEC GR	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
17.	Page 8 para (D) (2)	2. The equipment shall meet the environmental requirements as per category B2 of QM-333/Issue-1/March 2010 or latest.	CISCO 2. The equipment shall meet the environmental requirements as per category B2 of QM-333/Issue-1/March 2010 or latest or equivalent	Agreed: Provision for equivalent IS/IEC/EN is included.	Environmental Conditions: The equipment (LER & LSR) shall be designed to comply with environmental conditions as per SD-QM-333 in category B2, issued by TEC, Department of Telecommunication, Gol (or Equivalent IS/IEC/EN).
18.	Page 8 para (D) (2)	Note: Specific requirements of	CISCO Temperature should be defined, as like other GR in	Not Agreed: SD-QM-333 in	No Change.

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		temperature may be defined by the purchaser, if any.	RDSO. Kindly add 65 DegreeC should be maximum temperature	category B2 suffices the requirements of IR.	
19.	Page 8 para (D) (1)	Aggregation Router of category-V with minimum chassis capacity of 60Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LER	<p>NOKIA: As per current TAN v1.0 LER is 30Gbps [FD], which meets the traffic capacity handling of Railway applications.</p> <p>The railway requirement is various type of interfaces, like E1, STM-1, STM-4, and 1/10G Ethernet. 10Gbps per slot capacity is over kill for 32xE1, or 4xSTM-1 interface card. As per current TAN v1.0 also there is no minimum slot capacity asked</p> <p>Proposed: Aggregation Router should be of minimum chassis capacity of 30Gbps (Full Duplex) for LER</p>	Not Agreed: Redefined as per Railway Requirement.	Router shall support non-blocking throughput of 60 Gbps half duplex / 30 Gbps full duplex or higher.
20.	Page 8 and 9	Aggregation Router of category-VI with minimum chassis capacity of 200Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LSR	<p>NOKIA: Since LSR will be terminating multiple 10G interfaces from way-side. Junction to Junction connectivity shall require 100G interface considering future growth and also help in saving critical fiber pairs.</p> <p>Proposed: Request change the clause: Aggregation Router of minimum chassis capacity of 200Gbps (Full Duplex) and minimum slot capacity 120Gbps (Full Duplex) shall be used for LSR</p> <p>B) Interface Configuration: The LSR should be</p>	Not Agreed: Redefined as per Railway Requirement.	<p>1. The LSR should be equipped with minimum 8x10G (optical) ports distributed in minimum, two cards minimum 4X10G in each card, or as per purchaser requirements. It should be possible to upgrade the router to 16 X 10 G (Optical) by way of</p>

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		B) Interface Configuration: The LSR should be equipped with minimum 8x10G (optical) ports or as per purchaser requirements. It should be possible to upgrade the router to 16 X 10 G (Optical) by way of adding/replacing the card.	equipped with minimum 2x100G + 8x10G (optical) ports or as per purchaser requirements. It should be possible to upgrade the router to 16 X 10 G (Optical) by way of adding/replacing the card.		adding/replacing the card. 2. Router shall support non-blocking throughput capacity of 160-200 Gbps half duplex/80 Gbps full duplex or higher.
21.	E	Functional and Technical requirements of Label switch Router LSR	TEAM ENGINEER Enclosed a detailed working matrix for LSR - Annexure A	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
22.	Page 4 Para A	A. TENTATIVE IMPLEMENTATION SCHEME AND MIGRATION PLAN	Tejas In the current scenario, each Railway station has SDH equipment catering to E1s. SDH Network is running on fiber pair. IMPLS Network will be running on another fiber pair. In order to free the fiber used for SDH Network, it is required to support 32*E1s Card in every LER Router. In case E1 modules are made optional, it will never be possible for Railways to build	Not Agreed: Required port 12 E1 optimised as per Railway Requirements .	No Change.

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		Note: E1 interface shown in the LER is optional and Railway may use suitable converter to meet the requirement of E1 interface.	a Universal Backbone Packet Network. We recommend to modify the clause as “E1 interface shown in the LER is mandatory and should be offered to railways either through 32*E1 module on system or equipping 32*E1 Smart SFPs. For the purpose of equipping 32*E1 Smart SFPs, the OEM should offer LER Router with additional 32*1GE(SFP) ports. E1s will be carried over IP/MPLS network using Circuit Emulation (CEM) protocols.		
23.	Page 7 Para B	B. Interfaces Configuration 2) LER shall provide the following minimum interfaces or as per purchaser requirement: d) 12xE1 (G.703) for working various TDM circuits of stations utilising PD Mux as well as directly (optional). e) 2xSTM1 (channelized, optical) ports (optional).	Tejas As per Railway’s application use-case, E1 is mandatorily required to be supported on the router while STM-1 can be optional as per the railway’s application use case. Request for amendment of the clause as “ 2) LER shall provide the following minimum interfaces or as per purchaser requirement: d) 32xE1 (G.703) for working various TDM circuits of stations utilising PD Mux as well as directly (mandatory). e) 2xSTM1 (channelized, optical) ports (optional).”	Not Agreed: Required port 12 E1 optimised as per Railway Requirements	No Change.
24.	Page No.- 08 , Para 1	Aggregation Router of category-V with	ECR Aggregation router should have fixed capacity of 60	Agreed:	Router shall support non-blocking

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		minimum chassis capacity of 60Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LER.	Gbps and slot capacity should be removed.		throughput of 60 Gbps half duplex / 30 Gbps full duplex or higher.
25.	Page 8 Para 2	Interface configuration b) 4 x 1GbE (copper) to connect to various network at stations c) 4 x 1GbE (optical) to connect to various network at stations optically	TEAM ENGINEER Both modules are very critical for your network growth and to need to have option of upgradable to 8 x 1 GbE (copper) and similarly 8 X 1Gbe optical, the E1 circuits will migrate to Ethernet as migration progress hence it is essential that the IPMPLS device can have a greater number of Ethernet interfaces by way of replacing or addition f) Once again we emphasis to consider WDM as option which will help in migration and this is successfully being used at sites– this can change the speed of migration and ease of it in a cost-effective manner E1's interface to be integrated in the device (as a module) as it will be part of the IPMPLS device and configuration trouble shooting will be of ease as each station will have a few E1's without fail and give the user the comfort of its availability	Redefined as per Railway Requirement.	LER shall provide the following minimum interfaces or as per purchaser requirement: a) 2x10G 4x10G (optical) <u>distributed in minimum two cards,</u> minimum 2X10G in each card to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card. b) 4x1GbE (copper) to connect various networks at stations <u>(Optional).</u>

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					<p>c) 4x1GbE—8x1GbE (optical) <u>distributed in minimum two cards, minimum 4X1GbE in each card</u> to connect various networks at stations optically.</p> <p>d) <u>12xE1 (G.703)</u> for working various TDM circuits of stations utilising PD Mux as well as directly (optional).</p> <p>e) <u>2xSTM1</u> (channelized, optical) ports (optional).</p>
26.	Page 8, 9	<p>D. Functional and Technical requirements of Label Edge Router (LER):</p> <p>E. Functional and Technical requirements of Label Switch Router (LSR):</p> <p>3.11 DHCP</p>	<p>TEJAS</p> <p>The requirement of DHCP varies on case to case basis depending on the end application. In railways, The IP assignment via DHCP is significant only to local LAN based applications. For the same, DHCP server can be used instead of router.</p> <p>Hence, we request to remove “DHCP” from the list of mandatory items.</p>	<p>Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0</p>	<p>Final draft is changed accordingly based on RDSO TAN Ver. 1.0.</p>

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27.	Page 8	<p>In addition to feature mapped as required (Y) in clause No. 10.5 of TEC GR 48050:2022, the following Optional and Not Required (O and N) features given shall be mandatory requirements of the Category-V Aggregation Router (LER).</p> <p>MPLS L3 –VPN, VPLS, Autonomous System, MPLS-TP, SyncE Support, Synchronisation Reference, DHCP, Access Control List, Software Management, Security, Correlation, Forensic, External Storage, SLA Management, Provisioning</p>	<p>NOKIA: RDSO TAN version 2.0 [draft] is mandating MPLS-TP feature sets for Cat.V and VI [LER, LSR]. Which otherwise as per TEC GR are Optional.</p> <p>Current TAN v1.0 has mandated IP-MPLS as the technology and there is no single reference to MPLS-TP in TAN v1.0.</p> <p>There is no possible driver for Railways/RDSO to mandate MPLS-TP and IPMPLS co-existence. The current transport network of Railways is SDH which is aimed to be replaced by a single technology (either MPLS-TP or IPMPLS). IPMPLS in all aspects supersedes MPLS-TP, and MPLS-TP is already seeing its sunset with no development at standards body since 2018.</p> <p>RDSO TAN version 2.0 [draft] is mandating few additional functional features for LER and LSR [Software Management, Security, Correlation, Forensic, External Storage, SLA Management, Provisioning Management, EMS Network Requirements] which are falling under eMS/NMS Requirements as per the TEC GR</p> <p>Proposed: Please remove MPLS-TP and its references from the TAN v2.0</p> <p>Please remove Software Management, Security, Correlation, Forensic, External Storage, SLA</p>	<p>Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0</p>	<p>Final draft is changed accordingly based on RDSO TAN Ver. 1.0.</p>
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		Management, EMS Network Requirements.	Management, Provisioning Management, EMS Network Requirements from LER		
28.	Page 8 Para 3.2	D. Functional and Technical requirements of Label Edge Router (LER) 3.2 VPLS	NIVETTI EVPN VPLS is becoming an obsolete standard and has scalability issues, we recommend VPLS to be replaced with EVPN which is the latest standards and overcomes all shortcomings of VPLS.	Not Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
29.	Page 8 Para 3.3	Autonomous System	SIGNALIX Autonomous System, what we understand here is the concept of Routing protocol, such as BGP100, which is in the unified AS.	Noted,	-
30.	Page 9 Para 3.4	MPLS-TP	NIVETTI MPLS-TP is a transport technology and should not be part of IP/MPLS router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
31.	Page 9 Para 3.4	MPLS-TP	CISCO MPLS-TP is an obsolete technology and No development on this technology since last few years. Kindly delete this requirement. Whether RDSO want to keep an obsolete technology? IP/MPLS and MPLS-TP are not same technology and can not run together. Please delete this.	Agreed, Now final draft is aligned with Railway Requirement and TAN	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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				Version 1.0	
32.	Page 9 Para 3.4	MPLS –TP:	SIGNALLX: MPLS TP is connection oriented and involves manual creation of LSP between two nodes. On the other hand, MPLS+ LDP/RSVP/ISIS/OSPF can be used for auto creation of tunnels. As manual intervention is required in MPLS TP so there won't be more option for path protection as compared to MPLS IP network. At the most in MPLS TP the configuration support 1:1 but in case of MPLS IP it is possible to create a circuit 1:n fashion. MPLS TP is a replacement of SDH, so it is developed by incorporating some limited features of MPLS with OAM which can easily replace SDH network. On the other hand, MPLS IP have comprehensive MPLS features. ---- Need to be Deleted.	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
33.	Page No.- 08 , Para 3.4	MPLS-TP	ECR It should be as per latest technology/Protocol	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
34.	Page 9 Para 3.8	Software Management:	SIGNALLX: We understand that it is the upgrade and patching of the device software which enables client to upgrade a software version, add new features, and fix software bugs.	Noted,	-
35.	Page 9 Para	Security:	CISCO	Agreed,	Final draft is changed

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	3.10		These are not functionality of router, These are NMS clause, Please delete from router	Now final draft is aligned with Railway Requirement and TAN Version 1.0	accordingly based on RDSO TAN Ver. 1.0.
36.	3.10	Security:	SIGNALIX: We understand that equipment should support ACL, packet filtering firewall, SSH, tftp, GRE, IPsec and other basic security features.	Noted,	-
37.	Page 8 para 3.11	Correlation	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
38.	Page 9 para 3.10	Correlation:	SIGNALIX: We understand that router should be capable of mirroring, and then should cooperate with tools to analyze packet capturing messages. As per the TEC GR guideline a log management solution will be required apart from eMS/NMS tool. For this extra server & storage is required and additional software is required. This will impact the overall commercial of the project. Instead of asking for Correlation & Forensic as per TEC GR guideline, we request you to add these requirement directly in NMS specification.	Noted.	-

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			It should state " The NMS tool should support inbuilt Root cause analysis (RCA) algorithms"		
39.	Page 9 para 3.12	Forensic:	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
40.	Page 9 para 3.12	Forensic:	SIGNALIX We understand that router should be capable of mirroring, and then should cooperate with tools to analyze packet capturing messages. As per the TEC GR guideline a log management solution will be required apart from eMS/NMS tool. For this extra server & storage is required and additional software is required. This will impact the overall commercial of the project. Instead of asking for Correlation & Forensic as per TEC GR guideline, we request you to add these requirement directly in NMS specification. It should state " The NMS tool should support inbuilt Root cause analysis (RCA) algorithms"	Noted.	-
41.	Page No.- 09 , Para 3.12	Forensic	ECR Should be deliberated in TCSC meeting	Noted.	-
42.	Page No.- 09 , Para 3.13	External Storage	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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				Requirement and TAN Version 1.0	
43.	3.13	External Storage:	SIGNALIX We need further elaboration about the requirement / application of Indian Railways IP MPLS router.	Noted.	-
44.	Page No.- 08 , Para 3.12	External Storage	ECR Expandability option should be available for future integration of the external storage.	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
45.	Page 9 Para 3.14	SLA Management	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
46.	Page 9 Para 3.15	Provisioning management:	SIGNALIX: We understand that a Unified Network Management System is required by Indian Railway so that from that terminal, Monitoring / Provisioning management of routers at different stations in Division can be configured and controlled.	Noted.	-

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47.	Page 9 Para 3.15	Provisioning Management	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
48.	Page 9 Para 3.16	EMS Network Requirements	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
49.	Page 9 Para 3.16	EMS Network Requirements	SIGNALIX We understand that router should support SNMP and Netconf.	Noted.	-
50.	Page 9 Para 4.2	Router shall support 10K IPv4 & 5K IPv6 routes	NIVETTI Router shall support minimum 64K IPv4 and 64 K IPv6 Router, should be there similar to LSR. 10K/5K IPv4/IPv6 routes are less in a router. Minimum of 64K IPv4 and 64K IPv6 routes should be there similar to LSR	Not Agreed, It suffices the Railway Requirements	No Change.
51.	Page 9 Para 4.5	Minimum 64 MPLS VPLS	NIVETTI Minimum 64 EVPN To be replace with EVPN	Not Agree: VPLS is also required for Layer 2	No Change.

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52.	NEW	Additional Scale Value mapped from GR	<p>CISCO Kindly accept scale value changes as below table from GR and RDSO TAN</p> <table border="1"> <thead> <tr> <th></th> <th>LER</th> <th>LSR</th> </tr> </thead> <tbody> <tr> <td>Gbps</td> <td>60</td> <td>460</td> </tr> <tr> <td>Minimum No. of VRF</td> <td>100</td> <td>500</td> </tr> <tr> <td>Minimum No of Routes per VRF</td> <td>10K</td> <td>64K</td> </tr> <tr> <td>Ipv4 Routes to be supported</td> <td>10K</td> <td>64K</td> </tr> <tr> <td>Ipv6 Routes to be supported</td> <td>5K</td> <td>64K</td> </tr> <tr> <td>MAC Address Support</td> <td>16K</td> <td>128K</td> </tr> <tr> <td>Static Routing</td> <td>NA</td> <td>NA</td> </tr> <tr> <td>SVL / LSP Entries</td> <td>4K</td> <td>32K</td> </tr> <tr> <td>OSPF</td> <td>4K</td> <td>24K</td> </tr> <tr> <td>IS-IS</td> <td>4K</td> <td>24K</td> </tr> <tr> <td>TE Tunnels</td> <td>100</td> <td>500</td> </tr> <tr> <td>Pseudowire (VLL) services</td> <td>1K</td> <td>8K</td> </tr> <tr> <td>Multicast routes</td> <td>1K</td> <td>4K</td> </tr> <tr> <td>Multicast groups</td> <td>100</td> <td>250</td> </tr> <tr> <td>BGP Peers</td> <td>64</td> <td>250</td> </tr> <tr> <td>QoS Traffic Policers</td> <td>4K</td> <td>24K</td> </tr> <tr> <td>ACL Entries</td> <td>1K</td> <td>2K</td> </tr> <tr> <td>Power Supply redundancy</td> <td>Yes</td> <td>Yes</td> </tr> <tr> <td>Control and Switch Fabric Cards Re</td> <td>NO</td> <td>Yes</td> </tr> <tr> <td>Interfaces distributed in different d</td> <td>NO</td> <td>Yes</td> </tr> <tr> <td>ingress buffering at line-rate</td> <td>20 ms</td> <td>80 ms</td> </tr> <tr> <td>egress buffering at line-rate</td> <td>20 ms</td> <td>80 ms</td> </tr> <tr> <td>EVC level queues per system</td> <td>500</td> <td>2K</td> </tr> <tr> <td>Traffic buffering and shaping per s</td> <td>12 MB</td> <td>2GB</td> </tr> </tbody> </table>		LER	LSR	Gbps	60	460	Minimum No. of VRF	100	500	Minimum No of Routes per VRF	10K	64K	Ipv4 Routes to be supported	10K	64K	Ipv6 Routes to be supported	5K	64K	MAC Address Support	16K	128K	Static Routing	NA	NA	SVL / LSP Entries	4K	32K	OSPF	4K	24K	IS-IS	4K	24K	TE Tunnels	100	500	Pseudowire (VLL) services	1K	8K	Multicast routes	1K	4K	Multicast groups	100	250	BGP Peers	64	250	QoS Traffic Policers	4K	24K	ACL Entries	1K	2K	Power Supply redundancy	Yes	Yes	Control and Switch Fabric Cards Re	NO	Yes	Interfaces distributed in different d	NO	Yes	ingress buffering at line-rate	20 ms	80 ms	egress buffering at line-rate	20 ms	80 ms	EVC level queues per system	500	2K	Traffic buffering and shaping per s	12 MB	2GB	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
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		<p>feature mapped as required (Y) in clause No. 10.5 of TEC GR 48050:2022, the following Optional and Not Required (O and N) features given shall be mandatory requirements of the Category-V Aggregation Router (LSR).</p> <p>MPLS L3 –VPN, VPLS, Autonomous System, MPLS-TP, SyncE Support, DHCP, Access Control List, Software Management, Security, Correlation, Forensic, External Storage, SLA Management, Provisioning Management, EMS Network</p>	<p>RDSO TAN version 2.0 [draft] is mandating MPLS-TP feature sets for Cat.V and VI [LER, LSR]. Which otherwise as per TEC GR are Optional.</p> <p>Current TAN v1.0 has mandated IP-MPLS as the technology and there is no single reference to MPLS-TP in TAN v1.0.</p> <p>There is no possible driver for Railways/RDSO to mandate MPLS-TP and IPMPLS co-existence. The current transport network of Railways is SDH which is aimed to be replaced by a single technology (either MPLS-TP or IPMPLS). IPMPLS in all aspects supersedes MPLS-TP, and MPLS-TP is already seeing its sunset with no development at standards body since 2018.</p> <p>RDSO TAN version 2.0 [draft] is mandating few additional functional features for LER and LSR [Software Management, Security, Correlation, Forensic, External Storage, SLA Management, Provisioning Management, EMS Network Requirements] which are falling under eMS/NMS Requirements as per the TEC GR</p> <p>Proposed: Please remove MPLS-TP and its references from the TAN v2.0</p> <p>Please remove Software Management, Security, Correlation, Forensic, External Storage, SLA Management, Provisioning Management, EMS</p>	<p>Now final draft is aligned with Railway Requirement and TAN Version 1.0</p>	<p>accordingly based on RDSO TAN Ver. 1.0.</p>
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		Requirements	Network Requirements from LER.		
54.	Page 10 Para 3.1	E. Functional and Technical requirements of Label Switch Router (LSR): 3,1 MPLS L3-VPN	NIVETTI Both LDP and RSVP-TE to be included. LDP provides scalability and RSVP-TE will provide traffic engineering capabilities	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
55.		D. Functional and Technical requirements of Label Edge Router (LER): E. Functional and Technical requirements of Label Switch Router (LSR): 3.11 Correlation	TEJAS: The railways network will be built using Routers from multiple OEMs with Railtel network routers also as part of the network, correlation is applicable to NMS functionality rather than EMS. The NMS is integrated with multiple OEM EMS Systems to make sense of a large number of events collected from the network. The EMS role is only to send the events/alarms/logs etc. to NMS. Hence, we request to remove "Correlation" from the list of mandatory items.	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
56.		D. Functional and Technical requirements of Label Edge Router (LER): E. Functional and	Tejas The requirement of external storage server depends on the scale of the network (for e.g. qty of routers to be managed.). Hence external storage is not mandatory for every division or location at railways. Rather the decision to have external storage should be left to the tendering authority.	Agreed, Now final draft is aligned with Railway Requirement and TAN	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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		Technical requirements of Label Switch Router (LSR): 3.13 External Storage	Hence, we request you to remove “External storage” from the list of mandatory items.	Version 1.0	
57.		D. Functional and Technical requirements of Label Edge Router (LER): E. Functional and Technical requirements of Label Switch Router (LSR): 3.14 SLA Management	Tejas SLA management clauses as defined in GR is applicable to service provider networks, that provide service to their enterprise customers. While railways don’t lease service to other entities or enterprise. Since the SLA involves the measurement of performance counters collected from multiple OEM devices of the Network, it is implemented at higher layers i.e. at NMS (instead of EMS). The EMS role is to send the events, alarms, service related counters etc. of a particular OEM router to NMS system. Hence, we request to remove “SLA management” from the list of mandatory items.	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
58.	Page No.- 10 , Para 3.4	MPLS-TP	ECR MPLS-TP not required as IPMPLS itself is latest to MPLS-TP	Agreed, Now final draft is aligned with Railway Requirement and TAN	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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				Version 1.0	
59.	Page No.- 10 , Para 3.4	MPLS-TP	NIVETTI MPLS-TP is a transport technology and should not be part of IP/MPLS router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
60.	Page No.- 10 , Para 3.4	MPLS-TP	CISCO MPLS-TP is an obsolete technology and No development on this technology since last few years. Kindly delete this requirement. Whether RDSO want to keep an obsolete technology? IP/MPLS and MPLS-TP are not same technology and can not run together. Please delete this.	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
61.	Page No.- 10 , Para 3.10	Correlation	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
62.	Page No.- 10 , Para 3.11	Forensic	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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				Requirement and TAN Version 1.0	
63.	Page No.- 10 , Para 3.11	Forensic	ECR Forensic may have no as such utility	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
64.	Page No.-10 , Para 3.12	External Storage	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
65.	Page No.-10 , Para 3.12	External Storage	ECR storage in LER storage have no such utility	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
66.	Page No.-10 , Para 3.13	SLA Management	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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				aligned with Railway Requirement and TAN Version 1.0	
67.	Page No.-10 , Para 3.14	Provisioning Management	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
68.	Page No.-10 , Para 3.15	EMS Network Requirements.	CISCO These are not functionality of router, These are NMS clause, Please delete from router	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
69.	Page No.-10 , Para 3.15	EMS Network Requirements.	NIVETTI MPLS Router/LER should support RESTful APIs to enable EMS/NMS and device monitoring in addition to SNMP support. It is very important for Label Switch Router (LSR) to support API for configuring the device. To proactively manage, monitor and control overall network health, availability and performance by collecting network	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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			information on various parameters such as temperature, power, packet loss, throughput, response time, utilization, error rates, downtime/uptime and also configuring the system cannot be effectively done using SNMP. SNMP is very slow, insecure and a huge overhead to both the device and NMS. XML based REST APIs should be supported by MPLS Routers/LSR.		
70.	NEW	Additional Clause for LSR	CISCO Additional Clause for Segment Routing features from clause 3.18.7.1 to 3.18.7.5 in TEC/GR/IT/TCP-006/01/AUG-16 MPLS SDN GR. (Segment Routing, SR-TE, ISIS and OSPF Extensions for Segment Routing, Topology independent LFA, BGP-LS and PCEP are the major functionality in Segment routing should be supported in MPLS Router)	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
71.	NEW	Additional Clause for LSR	CISCO 3.10.12 Route Reflector is Not applicable for V & VI. We would recommend Route Reflector functionality should be there in LSR	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
72.	Page No.-10 , Para 4.1	Router shall support non-blocking throughput capacity of 200 Gbps full duplex or higher.	CISCO Router shall support non-blocking throughput capacity of 460 Gbps full duplex or higher.	Not Agreed: LSR of 200Gbps suffices the Railway Requirements	No Change.

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73.	NEW	Additional Scale Value mapped from GR	<p>CISCO Kindly accept scale value changes as below table from GR and RDSO TAN</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #00aaff; color: white;"> <th></th> <th>LER</th> <th>LSR</th> </tr> </thead> <tbody> <tr><td>Gbps</td><td>60</td><td>460</td></tr> <tr><td>Minimum No. of VRF</td><td>100</td><td>500</td></tr> <tr><td>Minimum No of Routes per VRF</td><td>10K</td><td>64K</td></tr> <tr><td>Ipv4 Routes to be supported</td><td>10K</td><td>64K</td></tr> <tr><td>Ipv6 Routes to be supported</td><td>5K</td><td>64K</td></tr> <tr><td>MAC Address Support</td><td>16K</td><td>128K</td></tr> <tr><td>Static Routing</td><td>NA</td><td>NA</td></tr> <tr><td>SVL / LSP Entries</td><td>4K</td><td>32K</td></tr> <tr><td>OSPF</td><td>4K</td><td>24K</td></tr> <tr><td>IS-IS</td><td>4K</td><td>24K</td></tr> <tr><td>TE Tunnels</td><td>100</td><td>500</td></tr> <tr><td>Pseudowire (VLL) services</td><td>1K</td><td>8K</td></tr> <tr><td>Multicast routes</td><td>1K</td><td>4K</td></tr> <tr><td>Multicast groups</td><td>100</td><td>250</td></tr> <tr><td>BGP Peers</td><td>64</td><td>250</td></tr> <tr><td>QoS Traffic Policers</td><td>4K</td><td>24K</td></tr> <tr><td>ACL Entries</td><td>1K</td><td>2K</td></tr> <tr><td>Power Supply redundancy</td><td>Yes</td><td>Yes</td></tr> <tr><td>Control and Switch Fabric Cards Re</td><td>NO</td><td>Yes</td></tr> <tr><td>Interfaces distributed in different d</td><td>NO</td><td>Yes</td></tr> <tr><td>ingress buffering at line-rate</td><td>20 ms</td><td>80 ms</td></tr> <tr><td>egress buffering at line-rate</td><td>20 ms</td><td>80 ms</td></tr> <tr><td>EVC level queues per system</td><td>500</td><td>2K</td></tr> <tr><td>Traffic buffering and shaping per s</td><td>12 MB</td><td>2GB</td></tr> </tbody> </table>		LER	LSR	Gbps	60	460	Minimum No. of VRF	100	500	Minimum No of Routes per VRF	10K	64K	Ipv4 Routes to be supported	10K	64K	Ipv6 Routes to be supported	5K	64K	MAC Address Support	16K	128K	Static Routing	NA	NA	SVL / LSP Entries	4K	32K	OSPF	4K	24K	IS-IS	4K	24K	TE Tunnels	100	500	Pseudowire (VLL) services	1K	8K	Multicast routes	1K	4K	Multicast groups	100	250	BGP Peers	64	250	QoS Traffic Policers	4K	24K	ACL Entries	1K	2K	Power Supply redundancy	Yes	Yes	Control and Switch Fabric Cards Re	NO	Yes	Interfaces distributed in different d	NO	Yes	ingress buffering at line-rate	20 ms	80 ms	egress buffering at line-rate	20 ms	80 ms	EVC level queues per system	500	2K	Traffic buffering and shaping per s	12 MB	2GB	<p>Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0</p>	<p>Final draft is changed accordingly based on RDSO TAN Ver. 1.0.</p>
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		Technical requirements of eMS/ Network monitoring and provisioning system at divisional and Zonal HQ	Enclosed a detailed working matrix for LER - Annexure A – • NMS in STT/TAN/IP MPLS/2020 Ver 1.0 focuses on your network requirements unlike in GR 48050:2020 for category V & VI it is designed for service providers as this category V & VI come under Aggregation certain features are optimal and not mandatory so it will be prudent to retain STT/TAN/IP MPLS/2020 Ver 1.0 NMS which focuses on your needs in an explicit manner	Now final draft is aligned with Railway Requirement and TAN Version 1.0	accordingly based on RDSO TAN Ver. 1.0.
75.	Page No-11 para F(ii)	Provisioning and management requires visibility and control. Management Information Bases (MIBs) are significant to provide standardized visibility into the network. MIBs are available for all protocols and applications developed by the IETF and are used to manage the network. Service provisioning will be done quicker	ECR MIBs of equipment having SNMPv1, SNMPv2 and SMPNv3 should be supporting	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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		whether the service provision required one location or multiple locations. This will minimize the chance for errors, provide corrective actions and assist in detecting, troubleshooting, and resolving failures during the provisioning itself			
76.	page No -11 para F(iii)	Network monitoring and provisioning system Hardware and Software will be deployed at Divisional HQ locations. Zonal HQ, Section HQ will get Workstations to Manage the network of their own area through workstation terminal from the same NMS	ECR A single NMS software for IP MPLS system may be developed by RDSO and this will be used PAN India and the vendor equipment's should support this software.	Noted: This will be done separately.	No change.
77.	Page10 Para	MPLS-VPLS	NIVETTI	Not Agreed.	No Change.

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	4.5		MPLS-EVPN Request change to EVPN as indicated earlier		
78.	Page10 Para 4.2	E. Functional and Technical requirements of Label Switch Router (LSR): 4.2 Router shall support 64k IPv4 and 64k IPv6 routes Multicast routes 1k	TEJAS IPv4 is 32 Bit addressing scheme while IPv6 is 128 Bit addressing scheme. Hence IPv6 Routes Header is 4 times bigger than IPv4, which leads to 4X Memory Usage. Hence the IPv6 Routes requirement should be amended to 16K. Moreover, as per TEC GR 48050:2022, Category-V and VI, IPv6 Routing capacity is 25% of the IPv4 Routing Capacity. Hence, we request to change the clause as below: Router shall support 64k IPv4 and 16k IPv6 routes & Multicast routes 1k	Agreed	Router shall support 64k IPv4 & 64k <u>16k</u> IPv6 routes Multicast routes 1K
79.	D. Functional and Technical requirements of Label Edge Router (LER):	3. In addition to feature mapped as required (Y) in clause No. 10.5 of TEC GR 48050:2022, the following Optional and Not Required (O and N) features given shall be mandatory requirements of the Category-V Aggregation Router (LER).	TEJAS Most of the features mentioned under DoS Attacks in GR are implemented in Firewall and not in the scope of access and aggregation routers. We request you to exempt the GR clause no. 8.1.8 applicability in RDSO TAN.	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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80.	G. Functional and Technical requirements of eMS/Network monitoring and provisioning system at division and zonal HQ:	The functional and technical requirement shall be as per TEC GR No. 48050:2022 for “Router for MPLS Based Transport Network” issued in March 2022 or latest with following specific requirements, in addition to as defined in TEC GR No 48050:2022.	<p>TEJAS The existing STT/TAN/IP-MPLS/2020 Ver 1.0 is exhaustive and comprehensive document covering the railway requirements of EMS/NMS.</p> <p>We request you to keep the existing TAN clauses of EMS/NMS and remove the applicability of TEC GR No. 48050:2022.</p>	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
81.	Page 13 Para I.	I. Certification/Testing:	<p>SIGNALLX: 2) Vendor shall have TEC certification of the product as per TEC GR 48050:2022 for “Router for MPLS Based Transport Network” issued in March-2022 or latest alongwith the parameter defined in this document. --- Needs to be deleted as it is a Generic Specification for different Users including but not less than Telecom / Power Transmission / Gas distribution Companies and Defence sector etc working in the field having vast network and have different requirements/application. Further TEC mandatory certification as required is already mentioned at Point 1.</p>	Agreed	<p>MTCTE Certification:</p> <p>Vendor shall have MTCTE certification for the product as per relevant TEC ER at the time of opening of tender.</p>
82.	Page 13 Para I.	<u>Certification / Testing</u>	<p>TEAM ENGINEER Lot of investment – time has been done for</p>	Agreed	Environmental Conditions has been

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		<p>1) Vendor shall have mandatory MTCTE certification for the product</p> <p>2) Vendor shall have TEC certificate of the product as per TEC GR 48050:2022 for Router for MPLS based Transport Network issued in March 2022 or latest along with the parameter defined in this document</p>	<p>certification for your STT/TAN/IP MPLS/2020 Ver 1.0 and in addition we have been tested by RDSO further testing will add enormous cost, time this requirement to be OR Between 1 and 2 for vendors who have already supplied and RDSO tested the product, adding barriers will only add cost to the product with so many duplications of testing.</p> <p>We would like to highlight that in your STT/TAN/ IP-MPLS/2020 Version 1.0 under category certification: from 6.1 to 6.7 has been completed which cannot be just forgotten or dismissed and new testing standards introduced</p> <p><u>Details of certification already completed:</u></p> <ul style="list-style-type: none"> • Should comply with NEBS level 3 specification / Equivalent TEC QM333 or latest specifications • Safety IEC / EN 60825-1 or IEC / EN 60825-2 • Storage EN300 019-2-1 class 1.2 / GR -63- CORE and GR 1089- CORE / Equivalent TEC QM333 or latest specifications • Transport EN300 019-2-2 class 2.3 / GR -63-CORE and GR1089- CORE / Equivalent TEC QM 333 or latest specifications • IN service EN300 019-2-3 class 3.2 / GR – 63 -CORE and GR-1089-CORE • Relative humidity 5 to 85% (non-condensing) 	<p>reviewed.</p> <p>MTCTE Certification:</p> <p>Vendor shall have MTCTE certification for the product as per relevant TEC ER at the time of opening of tender.</p>
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			<ul style="list-style-type: none"> • Operating temperature -15 deg C to 60 deg C 		
83.	Page 13 Para I.	<p>Functional and Technical requirements of eMS/Network monitoring and provisioning system at division and zonal HQ</p> <p>I (2) TEC Certification</p>	<p>NIVETTI TEC testing should be done against the Service and functional requirement defined by railways in the subsequent sections</p> <p>TEC-GR has generic requirements and long list of functionalities which Railways may not need. TEC testing should be done against the Service and functional requirement defined by railways in the subsequent sections</p>	Agreed	<p>MTCTE Certification:</p> <p>Vendor shall have MTCTE certification for the product as per relevant TEC ER at the time of opening of tender.</p>
84.	8	<p>Version 1.0 STT/TAN/IP-MPLS/2020 Version 1.0</p> <p>Safety IEC / EN 60825-1 or IEC / EN 60825-2</p>	<p>TEAM ENGINEER This pertains to laser diode of SFP, equipment safety standards are different they are IS 13252 (1992) (this can also be verified from GR 48050:2020 clause 7.0) – this can be modified in the earlier STT/TAN/IP MPLS/2020 Ver 1.0</p>	Agreed	<p>Safety: As per IS 13252-1 or IEC: 60950-1 or IEC 62368-1.</p>
85.	NEW		<p>ECR The codel life of IP MPLS equipment's (LER & LSR) should be defined.</p>	Noted: This will be done separately.	No change.
86.	NEW	General	<p>Everest The NMS OEM should be registered in India for atleast 5 years or more. They have successfully deployed NMS tool for 10000+ devices in any of 3 Govt./PSU/BFSI sector. PO copies and customer sign</p>	Not Agreed This is the part of Unified Network	No Change.

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			off copies to be provided.	Management System. This will be done separately.	
87.	NEW	Helpdesk	<p>Everest The system should have an integrated ITILv3/v4 certified ITSM tool from the same OEM. The tool should be ITIL certified for Incident Management, Problem Management, Change Management, Request Fulfilment, Knowledge Management, Asset management & Service Level Management. ITIL Certificate to be provided for the same. ITIL certificate to be produced for mentioned process.The integration should be bi-directional in nature. The integrated ITSM module should have its own Android & IOS app</p>	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
88.	NEW	General	<p>Everest The solution should be a unified system which can monitor networks, servers, apps and any IT or Non-IT Communicable device (ex.: Core router, switches, servers,RF device, VSAT etc.). The tool should be vendor agnostic.</p>	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
89.	NEW	Reporting	<p>Everest The system should be capable to retrieve and show fault, performance , inventory and SLA data in a single dynamic view with option to export the views into PDF, Word, Excel, HTML etc. formats depending</p>	Not Agreed This is the part of Unified Network	No Change.

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			on the need. System should have capability to add any additional information about the nodes via custom fields.	Management System. This will be done separately.	
90.	NEW	General	Everest System should have multi level Node Tags for device grouping and resource/interface tagging for element grouping. Apart from Node Tags additionally system should have options to do device grouping based on default fields and customer fields	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
91.	NEW	General	Everest The tool should have Integrated Web based feature to build Network Diagram, No separate client window to configure network Diagram. The builder should be similar to MS Visio with all pre-loaded shapes and icons.	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
92.	NEW	Performance	Everest The proposed monitoring solution should be able to monitor network traffic by capturing flow data from network devices, including Cisco Netflow v5 or v9, Juniper J-Flow, IPFIX, sFlow, NetStream data and also sampled Netflow data. Solution must be able to store ALL flows without any rollups or loss for retention period - for security and audit purposes. The tool	Not Agreed This is the part of Unified Network Management System. This will be done	No Change.

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			should support traffic analysis via packet capture also.	separately.	
93.	NEW	General	Everest IPAM solution should be from same OEM and should have complete IP discovery , IP management with historical tracking. IPAM should have IP Grouping, Sub grouping and role and privileged based access. Support both IPv4 and V6 along with IP Classes and VLSM based	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
94.	NEW	Configuration Management	Everest The configuration changes to be done on target network devices must follow an approval-based system wherein changes can be performed only after required approvals are passed. Tool must have in-built approval mechanism along with option to integrate with Change Management module of other ITSM tools for the approval process.	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
95.	NEW	Configuration Management	Everest Tool must provide option to perform standard compliance checks across all target CLI-based network devices. The tool should allow customer to configure the rules for compliance checks.	Not Agreed This is the part of Unified Network Management System. This will be done separately.	No Change.
96.	NEW	Configuration	Everest	Not Agreed	No Change.

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		Management	Tool must provide an option for taking remote access via Telnet / SSH to target CLI-based Network Devices with an option to record all sessions to capture all commands being executed on the remote devices. The tool must allow session relay wherein a higher-privileged user can view the ongoing CLI session of a lower-privileged user in real-time from the tool GUI. The sessions should be saved for historical analysis with flexible filter options like searching for sessions in which a particular command has been executed.	This is the part of Unified Network Management System. This will be done separately.	
97.	NEW		ECR The functional requirements of Segment Routing and Segment routing traffic were listed in RDSO TAN version 1.0. For the Automization of services & in future in term of inter operability with RCIL , Provision of segment routing & segment routing traffic engineering should be included.	Agreed, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
98.	NEW		SIGNALLX LSR and LER must support Redundant DC power Redundant fans.	Agreed: Redundant DC Power already given in LER and LSR. Fan Tray shall be Field Replaceable Unit (FRU)	No Change
99.	NEW		SIGNALLX LSR and LER should be designed with front to back air flow, satisfying highly efficient heat dissipation	Clause already given: LSR and LER	No Change.

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			requirements.	should be temperature hardened as it is normally placed at field locations without any air conditioning arrangement.	
100.	NEW		SIGNALIX We further suggest that Hardware / Interface requirement should be finalized by RDSO, i.e. E1, STM, 1G, 10G 100G etc. As keeping things open to division units will create confusion and may lead controversy in future. Say for e.g. few division mention DWDM/STM1 in tender whereas railways applications simply says STM1 to be connect with LER.	Port Details already given as per Railway Requirement in TAN.	No Change.
101.	NEW		SIGNALIX We also request you to add "Helpdesk management" as per the TEC GR guideline.	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
102.	Document No. STT/TAN/IP-	Document No. STT/TAN/IP-MPLS /2020 Version 1.0	TEAM ENGINEER 1) This is a well-done document only LER (1.5 & 5.1) and LSR (1.6 & 5.1) clause need to be changed for	Noted, Now final draft is	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.

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	<p>MPLS /2020 Version 1.0</p>		<p>higher specifications of backplane speed and interfaces required</p> <p>2) SAA feature can be made optional as it is a propriety feature</p> <p>3) External alarms need to be clearly defined or deleted</p> <p>4) NGMVPN general terminology to be used like MVPN as each OEM has their nomenclature to execute it</p> <p>5) This document (STT/TAN/IP-MPLS /2020 version 1.0) can be fine-tuned as many OEM's have been working on it from the past few years</p> <p>6) Complete overhauls of the document might not be required as it will create developing new product and again getting it tested which will be time consuming, investment when it is not at all required</p> <p>7) Safety IEC / EN 60825-1 or IEC / EN 60825-2: This pertains to SFP laser diode and not the equipment, foe equipment we can refer to IS13252(1992) – this reference can be taken from GR 48050:2020 clause 7.0-page no. 111 of it</p> <p>8) In OAM features we can mention that monitoring L2 Y.1731 can be used and L3 Y.1564 giving more clarity to the user as they are also learning currently, this are standard monitoring tools for networks</p> <p>9) Out of Band port can be described in more detail that it is an SNMP / Console port as it is creating ambiguity in field - this are trivial issues but have very high nuisance value for no fruitful reason to the application needs</p>	<p>aligned with Railway Requirement and TAN Version 1.0</p>	
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103.	POC Page 5 Para 2.3	3.0 POC FRS_03 2.3 (LER & 3.3 (LSR) The Router shall have external alarm options	NIVETTI Would LEDs be qualified as external alarm, please clarify	Agreed: Clause is reframed.	<u>The router should have suitable onboard visual indication for various functionalities/failures.</u> he router should have external Alarm Option.
104.	POC Page 5 Para 2.3	3.0 POC FRS_03 2.3 (LER & 3.3 (LSR) The Router shall have external alarm options	TEAM ENGINEER 1 The purpose of this need to be defined like LED indictors which indicate alarm and status of the devices as it is creating lot of confusion during POC most of them are considering it as potential free contacts 2 Being a new age IPMPLS device where the NMS shows various minor & major alarms – removal of modules, power off, fan try removed along with major alarms like breakage of path etc., being reflected for each device in the central NMS the need of external alarm is NIL 3. However if required we also have RDSO RDPMS- Remote Diagnostic Predictive Maintenance system which is already being implemented across India Railways network for monitoring your assets so in it we can incorporate MPLS device in indoor telecom equipment it will be more apt and they can monitor the power etc., as required for other features NMS is available be it major or minor alarms	Agreed: Clause is reframed.	<u>The router should have suitable onboard visual indication for various functionalities/failures.</u> he router should have external Alarm Option.
105.	POC Page 5 Para 2.1	Power Supply I/P Specification	CISCO Demonstrate the equipment has redundant DC	Agreed	Demonstrate the equipment has

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		Router shall have redundant DC power supply - 48VDC nominal. EXPECTED O/P Demonstrate the equipment has redundant DC power supply - 48VDC nominal and can work in hot standby mode.	power supply -48VDC nominal and can work in case of failure of one Power source.		redundant DC power supply -48VDC nominal and can work in case of failure of one Power source.
106.	POC Page 5 Para 2.2	Port Configuration INPUT Specification a) 2x10G (optical) to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card. Expected O/P a) 2x10G (optical) to connect to the adjacent stations. It should be possible to upgrade the	CISCO a) 2x10G (optical) to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card / port in same chassis.	Partially Agreed: Clause is Reframed.	<u>4x10G</u> (optical) ports <u>distributed in minimum two cards, minimum 2X10G in each card</u> , to connect to the adjacent stations..

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		router to 4 X 10 G (Optical) by way of adding/replacing the card.			
107.	POC Page 5 Para 2.4	Hot Swappable INPUT Specification Controller cards, interface card should be hot - swappable and field replaceable unit (FRU) Expected O/P Demonstrate the hot - swappable and field replaceable unit (FRU) feature for Controller cards, interface card.	CISCO Please delete this clause, as LER can be fixed modular.	Not Agreed,	No Change.
108.	POC Page 6 Para 3.5	Control Plane Redundancy	SIGNALIX It should be clarified that Only control Card redundancy is required. Interface is will be provided in single card only and card will be hot swappable and field Replaceable units.	Clarified.	1. Control plane should be redundant and should be able to take full load even with failure of one controller card. 2. Controller cards, interface card should be hot - swappable and field replaceable unit (FRU).

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109.	POC Page 6 Para 2.5	Out Of band Management	<p>SIGNALIX We understand that a management Port should be made available which can be configured and connected on client to manage the device. This is required to be clarified because during POC we were told that OOBM port should be such programmed that in case of failure of the device a lay man can install new system on site.</p>	Clarified	<p>The Router shall have provision for remote out-of-band management capability</p>
110.	POC Page 7 Para 4.1	<p>Non-blocking throughput I/P Spec Router shall support non-blocking throughput of 60 Gbps full duplex for LER and or higher & 200Gbps switching speed Full duplex for LSR or as specified by the user</p>	<p>CISCO Kindly allow: OEM Declaration of scale values are acceptable for following clauses</p> <p>1. Aggregation Router of category-VI with minimum chassis capacity of 460Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LSR. This is as per port capacity (16x10G+2x100G + 30% future expansion)</p>	<p>Partially agreed. Provision of Test Certificate is added.</p>	<p>1. Support of non-blocking throughput of 60 Gbps full duplex for LER shall be demonstrated. (Alternatively, Certificate from accredited Lab of Internationally/ National reputed shall be acceptable). Support of non-blocking throughput of 200 Gbps switching speed Full duplex for LSR shall be demonstrated. (Alternatively, Certificate from accredited Lab of Internationally/ National reputed shall</p>

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					be acceptable).
111.	POC Page 7 Para 4.1	4.0 POC Per_04 (4.1) Non-Blocking throughput	TEAM ENGINEER This cannot be tested in the field and alternative method as to be provided for verification by means of any NABL accredited LAB report or confirmation from OEM	Agreed	1. Support of non-blocking throughput of 60 Gbps full duplex for LER shall be demonstrated. (Alternatively, Certificate from accredited Lab of internationally/ National repute shall be acceptable). 2. Support of non-blocking throughput of 200 Gbps switching speed Full duplex for LSR shall be demonstrated. (Alternatively, Certificate from accredited Lab of Internationally /National repute shall be acceptable).
112.	Annexure-I, POC Guidelines	FRS_02: Functional and Technical Requirements of LER test cases	TEJAS Clause 2.4 of TAN2.0 refers to a chassis-based router with minimum one controller card, one interface card of 10G, one interface card of 1G, one interface card of E1s, one interface card of STM-1 to cater to LER	Agreed Clause is reframed	<u>LER shall provide the following minimum interfaces or as per purchaser requirement:</u> (i) <u>4x10G</u> (optical)

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		<p>2.4 Controller cards, interface card should be hot-swappable and field replaceable unit (FRU)</p> <p>Functional and Technical requirements of Label Edge Router (LER): The functional and technical requirement shall be as per TEC GR No. 48050:2022 for “Router for MPLS Based Transport Network” issued in March 2022 or latest with following specific requirements.</p> <p>1. Aggregation Router of category-V with minimum chassis capacity of</p>	<p>interfaces as required by railways.</p> <p>Clause 3.6.1 of TEC GR, Category-V mentions “the interfaces are required to be distributed in different cards”.</p> <p>We understand that the interfaces of the same type can be offered on a single card.</p>		<p>ports <u>distributed in minimum two cards, minimum 2X10G in each card</u>, to connect to the adjacent stations.</p> <p>(ii) 4x1GbE (copper) ports to connect various networks at stations (Optional).</p> <p>(iii) <u>8x1GbE</u> (optical) ports <u>distributed in minimum two cards, minimum 4X1GbE in each card</u>, to connect various networks at stations optically.</p> <p>(iv) 12xE1 (G.703) for working various TDM circuits of stations utilising PD Mux as well as directly (optional).</p> <p>(v) 2xSTM1 (channelized, optical) ports (optional). All the optical interfaces shall be equipped with suitable optics to work on two single mode fibres upto 40km</p>
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		60Gbps (Full Duplex) and minimum slot capacity 10Gbps (Full Duplex) as per Clause No. 3.1 of TEC GR 48050:2022 shall be used for LER.			
113.	Annexure-I, POC Guidelines	<p>FRS_02: Functional and Technical Requirements of LER test cases</p> <p>2.2 Port Configuration LER shall provide the following minimum interfaces or as per purchaser requirement: a) 2x10G (optical) to connect to the adjacent stations. It should be possible to upgrade the router to 4 X 10 G (Optical) by way of adding/replacing the card. b) 4x1GbE (copper)</p>	<p>TEJAS TEC GR clause 4.2.9.2 (a, b) and clause 4.2.11.1 (a, b & d) are applicable for railways as the interface requirements are E1 (G.703) & STM1 (channelized, optical) ports.</p> <p>We request you to mention above clauses of GR in TAN for E1 and STM-1 interfaces for avoiding any ambiguity.</p>	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Accordingly final draft is reviewed and changed

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		<p>to connect various networks at stations.</p> <p>c) 4x1GbE (optical) to connect various networks at stations optically.</p> <p>d) 12xE1 (G.703) for working various TDM circuits of stations utilizing PD Mux as well as directly (optional).</p> <p>e) 2xSTM1 (channelized, optical) ports (optional).</p>			
114.	POC Page 7 Para 4.2	<p>Per_04: Performance LER/LSR test cases</p> <p>4.2 – No of Routes – LER support for 10K IPv4 & 5K Pv6 routes to be demonstrated.</p> <p>2. LSR support for 64K IPV4 & IPV6 Routes to be demonstrated</p>	<p>NIVETTI Both LER and LSR should have same route scalability of 64K else LSR routes cannot be fully transferred to peer LERs</p>	<p>Not Agree. Routs given in TAN Suffices the Railway Requirements</p>	<p>No Change.</p>

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115.	POC Page 7 Para 4.5	4.5 VPLS – LER is configurable Minimum 64 MPLS VPLS shall be demonstrated. 2. LSR is configurable minimum 500 MPLS VPLS shall be demonstrated.	NIVETTI VPLS to be changed to EVPN as proposed earlier	Not Agreed: VPLS is also required for Layer 2 services.	No Change.
116.	NEW	J. Security requirements of Label Switch Router (LSR): We would recommend inclusion of Security Requirements also considering the criticality of this Network and the need for Secure MPLS Routers/LSR.	NIVETTI It is Mandated that the router is of indigenous origin where <ol style="list-style-type: none"> 1. The intellectual Property Right (IPR) resides in India for Hardware Design. 2. The Copyright is in India for software design & Development and Network operating system copyright is owned by Indian Company. 3. Company is willing to provide the entire design and IP for review and security audit to and Govt of India organization, if asked for or should have a already audited certificate from any Govt of India agency. 4. Company should give a declaration letter by CEO for the above points. 	Noted, Now final draft is aligned with Railway Requirement and TAN Version 1.0	Final draft is changed accordingly based on RDSO TAN Ver. 1.0.
117.	LER & LSR	The router shall	RDSO Review:	Clause is	The router shall support

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	Cl.No. 1.6 & 1.7 Respectively	support following Timing ports– TOD in, TOD out, SYNC/BITS interface/similar timing protocol required for LTE network.	NTP included as it is generic requirement.	reviewed.	following Timing ports– TOD in, TOD out, NTP , SYNC/BITS interface/similar timing protocol required for LTE network.
118.	LER & LSR Cl.No. 2.5 & 2.5 Respectively	Router shall support multi-chassis LAG for aggregation of links across two chassis.	RDSO Review: There is no standard mechanism for doing MC-LAG and it is not interoperate. Functionality is achieved with Aggregation of Link as stated in clause No. 2.4.	Clause is deleted	Clause is deleted.
119.	LER & LSR Cl.No. 2.6 & 2.6 Respectively	Router shall support performance monitoring for Layer-2 and layer-3 services (Y.1731/Y.1564, TWAMP, SAA or equivalent).	RDSO Review: As discussed with Railtel Performance Monitoring shall be done with Y.1731 and TWAMP. Hence Y.1564 and SAA or equivalent may be deleted to avoid any issue regarding interoperability.	Clause is reviewed.	Router shall support performance monitoring for Layer-2 and layer-3 services (Y.1731/ Y.1564 , TWAMP, SAA or equivalent).
120.	LER & LSR Cl.No. 2.7 & 2.7 Respectively	Router shall support IPV4 and IPV6, IGMP, MLD, and PIM-SM & SSM, ECMP, NGMVPN .	RDSO Review: NGMVPN is not required for Railway application.	Clause is reviewed.	Router shall support IPV4 and IPV6, IGMP, MLD, and PIM-SM & SSM, ECMP, NGMVPN .
121.	LER & LSR Cl.No. 2.9 & 2.9	BGP Prefix independent control (EDGE and Core).	RDSO Review: It is required for very high end Routers.	Clause is deleted	BGP Prefix independent control (EDGE and Core).

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	Respectively				
122.	LER Cl.No. 3.3	Router shall support 3 level HQOS on all kind of Ethernet interface with minimum 8K hardware queues.	RDSO Review: LER hardware queues reviewed and reduce to 6K In line with LSR .	Clause is reviewed.	Router shall support 3 level HQOS on all kind of Ethernet interface with minimum 8K 6K hardware queues.
123.	New	-	RDSO Review: EMI/EMC Test is included as per Railway Requirements.	Clause is Added	EMI/EMC Test.

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Annexure A

SL No.	Description	IPMPLS TAN Version 1.0		TEC GR 48050 2020		IPMPLS TAN Version 2.0-d0		Comments / Suggestions / Request
		LER	LSR	Category V	Category VI	LER Required (V)	LSR Required (VI)	
V	Features							
1	Minimum Chassis Capacity(*) [Full duplex]	30G	80G	40G	200G	40G	200G	<ul style="list-style-type: none"> • LER back plane capacity to be increased as LER is part of main ring as Indian railways is a linear network and not hierarchical so the difference between LER & LSR cannot be very high - LER makes the maximum number as it is provided at each station • LER features can be near similar to LSR except for more higher bandwidth connectivity needs for creating rings in LSR • The back plane capability to be good for LER as it will form the back bone of the network , in addition to have multiple tributary slots for expansion which is very essential
2	Packet Processing Capacity							
3	Minimum Packet Processing and forwarding rate for a packet size of 64 bytes.(In pps)	-	-	59mpps	297mpps	59mpps	297mpps	The above mentioned also is applicable to this clause - this is as per GR category can be increased as needed
4	Minimum No. of VRF	-	-	NO info in GR	NO info in GR	100	100	For category V & VI there is no information in GR and it can be as per earlier TAN
5	Minimum No of Routes per VRF	-	-	NO info in GR	NO info in GR	256	256	For category V & VI there is no information in GR and it can be as per earlier TAN
3	Ipv4 Routes	10K	64K	20K	100K	10K	64K	<ul style="list-style-type: none"> • Due diligence has been done for the number of routes etc., required for Indian Railways in version 1.0 and similarly reflected in TAN version 2.0 • GR is for service provider where we will have
	Ipv6 Routes	5K	64K	5K	25K	5K	64K	
	MPLS Layer3 VPN's	100	500	NO info in GR	NO info in GR	100	500	
	MPLS Layer2 PW's	500	500	NO info in GR	NO info in GR	500	500	
	MPLS VPLS	64	500	NO info in GR	NO info in GR	64	500	

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Annexure A

SL No.	Description	IPMPLS TAN Version 1.0		TEC GR 48050 2020		IPMPLS TAN Version 2.0-d0		Comments / Suggestions / Request
		LER	LSR	Category V	Category VI	LER Required (V)	LSR Required (VI)	
V	Features							
	BFD Sessions	64	64	NO info in GR	NO info in GR	64	64	multiple customer unlike for captive network of Indian railways
6	Routing Scalability figures							<ul style="list-style-type: none"> • The same above yard stick to be applied for this features & unnecessary high numbers will load the device components cost , time etc., • GR features for this category are very high they are based on the for service provider • In similar fashion like earlier version 1.0 is requested for this features
	MAC Address Support	N	N	24K	80K	32K	32K	
	LSP Entries	N	N	16K	32K	1K	1K	
	Static routing	N	N	10K	10K	1K	1K	
	RIP	N	N	15K	25K	16K	16K	
	OSPF	N	N	15K	25K	16K	16K	
	IS-IS	N	N	15K	25K	16K	16K	
7	VPLS / Multicast Scalability Figures							<ul style="list-style-type: none"> • The same above yard stick to be applied for this features also unnecessary high numbers will load the device components and cost of it • GR features for this category are very high they are based for service provider
	VPLS instances	N	N	1K	2K	1K	1K	
	TE TUNNELS	N	N	1K	2K	1K	1K	
	Pseudowire (VLL) services	N	N	8K	32K	1K	1K	
	Multicast routes	N	N	1K	1K	256	256	
	Multicast groups	N	N	1K	2K	1K	1k	
	BGP Peers	N	N	64	64	32	32	
	QoS Scalability figures							
	QoS Traffic Policers	N	N	16K	32K	128	128	• The same above yard stick to be applied for

Reason Document Revision of TAN for IPMPLS (Final Draft)

Annexure A

SL No.	Description	IPMPLS TAN Version 1.0		TEC GR 48050 2020		IPMPLS TAN Version 2.0-d0		Comments / Suggestions / Request
		LER	LSR	Category V	Category VI	LER Required (V)	LSR Required (VI)	
V	Features							
8	ACL Entries	N	N	16K	32K	1.5K	1.5K	<p>this features also unnecessary high numbers will load(higher cost) the device components</p> <ul style="list-style-type: none"> *GR features for this category are very high they are based on the for service provider *Features like Black Hole filtering to be incorporated to stop unwanted traffic from an IP which will be useful *In similar fashion like earlier version 1.0 is requested * GR is saying NO for category V & VI (Access Control) but the number of entries is being provided - this need to be verified
I	Module level Redundancy							
1	Power Supply redundancy	Y	Y	O	Y	Y	Y	Dual power supply for LER & LSR would be ideal as both are critical and would be ideal to have to two power supplies

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V	Features							
2	Control and Switch Fabric Cards Redundancy	N	Y	Optional	Y	Optional	Y	<ul style="list-style-type: none"> • For Both(LER & LSR) - control card redundancy would be beneficial so that you do not need any additional equipment as standby, this will be cost-effective ,additional equipment might require major change in power supply arrangements - space & resources which are vital like optical fibre etc., Redundant switch fabric is not requested • Control card redundancy will be necessary for both LER & LSR increasing the reliability ,resilience of the network as the network become pure IPMPLS in a short time and such feature will add value and comfort and also ensure network better uptime to which is very essential
3	Interfaces distributed in different cards	Y	Y	Y	Y	Y	Y	<ul style="list-style-type: none"> • LER also to be ensured that it support more tributary cards as each station is a valuable MPLS POP where services are being derived and not pizza box device •This features(more tributary cards) might look trivial but will add immense value to the network as the network grows and creating versatility • The hardware features are more essential than software as it can be upgraded at a latter stage but not hardware once procured