

Reason document for the final draft Specification no. TI/SPC/RCC/SCADA/0133 for SCADA system for 25 kV Single Phase 50Hz ac Traction Power Supply.

Clause No.	Description	Comments Received from	RDSO's remark
1.1.1	The vendor is free to develop SCADA system which communicates with relay on IEC 60870-5-103 or IEC 61850 or both in single RTU. In the master list of RDSO approved vendors, a remark will mention for status of particular vendor approved for type of communication protocol support with relay.	<p>M/s SYNERGY</p> <p>This will create confusion during bid evaluation. Also, a single SCADA system may have to communicate with Relays commissioned by different vendors.</p> <ol style="list-style-type: none"> 1. SCADA system shall support both IEC 60870-5-103 or IEC 61850 protocols. 2. In case of IEC61850, <ol style="list-style-type: none"> a. The networking of all protection relays onto a common Ethernet switch shall be in the scope of CRP vendor. Interface between RTU and protection relays shall be at this switch only. b. All RDSO-approved CRP vendors must publish a Model-implementation Conformance Statement (MICS) in line with IEC61850 recommendations as well as specifically identifying the signals required for mapping with RTU/SCADA. c. Standardized scheme for IP-addressing of relays and their IED-naming philosophy to be published. d. The RTU shall have separate Ethernet ports for connecting with the relays, which shall be of a different LAN segment from the ports used for RCC 	<p>Point-1 is accepted as it provides flexibility to interface same RTU with relay either on IEC 60870-5-103 or IEC 61850 SCADA protocol.</p> <p>Point-2 (a) Noted</p> <p>3. Point 2 (b) is noted.</p> <p>4. Point 2 (c), 2 (d), 2(e) and 2(f) is not understandable.</p>

		<p>communications.</p> <p>e. The RTU shall not merge the substation LAN with the RTU/SCADA network.</p> <p>f. RTU shall support communication with both IEC 61850 edition 1 and edition 2 relays.</p>	
		<p>M/s SYNERGY</p> <p>New clause before 1.1.4</p> <p>The SCADA system shall support data and communications security for IEC 60870-5-104 protocol as per IEC 62351-3 (Power systems management and associated information exchange - Data and communications security - Part 3: Communication network and system security - Profiles including TCP/IP). IEC 62351-3 specifies how to provide confidentiality, integrity protection, and message level authentication for SCADA and telecontrol protocols that make use of TCP/IP as a message transport layer when cyber-security is required. This requirement shall be supported for communications between RCC and RTU, and between RCC and energy management centers.</p>	Accepted as to improve data and communication security.
1.1.6	There shall be three main parts of the SCADA system – Master Station equipment, Remote Station equipment and Communication link, details of which have been covered in this specification.	<p>M/S APPSIL</p> <p>There shall be three main parts of the SCADA system – Master Station equipment, Remote Station equipment and Communication link (between RTU & RCC is in scope of purchaser-S&T supplier), details of which have been covered in this specification.</p> <p>For clarity over the scope, request RDSO to include for clarity.</p>	Accepted as to provide clarity about the scope of communication link.
1.1.9	This specification supersedes the specification No.	<p>M/S GOVIK</p> <p>- If the new specification supersedes the earlier</p>	Not accepted, This is not terms as technical

	TI/SPC/RCC/SCADA/0130(Rev.2) with A&C slip No. 1 to 3.	specification, this will pave way for the existing vendors in hiding their deficiencies weaknesses in their SCADA system supplied and commissioned till date. All the existing and new vendors will have to submit fresh documents under this draft specification and the existing vendors will hide their weaknesses and deficiencies of their past supplies under existing specification. We understand that already complaints for such deficiencies and weaknesses have been made to RDSO, Vigilance and PMO, for which enquiry is going on. We feel that the existing specification should be amended to incorporate the modifications so the history of weaknesses of earlier supplies can be correlated and tracked.	comments. Amendment of the existing SCADA specification No. TI/SPC/RCC/SCADA/0130 (Rev.2) with A&C slip No. 1 &2 is being done as per RDSO's ISO procedure.
1.2	The equipment at RCC shall be installed indoor however rooms may not be air conditioned.	M/s ASHIDA The equipment at RCC shall be installed indoor however rooms may not shall be air conditioned. M/s SYNERGY Air conditioning should be made mandatory to ensure operation of RCC hardware in regulated environment, thereby increasing the reliability and life of the equipment. The equipment at RCC shall be installed indoor and rooms will be air conditioned.	Accepted as most of the SCADA system in Indian Railways is installed in air conditioned room. Air conditioning, ensure the operation of RCC hardware in regulated environment, thereby increasing the reliability and life of RCC equipment.
1.2.1	Max. Elevation above the mean sea level -2000Mtr	M/S GOVIK As the system is tested for environmental condition and RTU is mounted in enclosure so this will not affect the SCADA system working. In our opinion this clause is not necessary.	Not accepted as ambient temperature change with altitude. This is essential to select suitable electronic components for required ambient temperature range.
1.2.1	The locations at which the SCADA system equipment (RTU)in field are to	M/S SIEMENS The locations at which the SCADA system equipment	Comments may not be accepted as, 1. Comments made on the text

	<p>function shall be subjected to heavy rains and lightning during monsoon. The extreme atmospheric condition limits for design purpose shall be as under:</p> <ul style="list-style-type: none"> - Maximum ambient temperature 55°C - Minimum ambient temperature - 20°C - Relative humidity 100 % saturation during rainy season - Max. Elevation above the mean sea level 2000 meter 	<p>(RTU)in field are to function shall be subjected to heavy rains and lightning during monsoon. The extreme atmospheric condition limits for design purpose shall be as under:</p> <ul style="list-style-type: none"> - Maximum ambient temperature 55°C - Minimum ambient temperature -20°C - Relative humidity 90-100 % saturation during rainy season - Max. Elevation above the mean sea level 2000 meter <p>Since panel is kept in-door and reaching 100% relative humidity which means dew/liquid vapor inside control room is highly unlike so our recommendation is to have the relative humidity from 90-100%.</p>	<p>which has already been strike out in the draft specification.</p> <p>2. Relative humidity 90 to 100% is not correct as it varies wider range. In the specification max. relative humidity mentioned 100 % (saturation during raining season) is correct.</p>
1.3.3	<p>The RTUs shall operate on 110 Volt dc supply provided by the Purchaser (Vdc: 110 +10% &-20%).</p>	<p>M/s ASHIDA</p> <p>The RTUs shall operate on 110 Volt dc supply provided by the Purchaser, (Vdc: 110 +10% &- 20%). The RTU shall be equipped with an 110V DC Power Pack for 10 minutes backup during DC Failure.</p> <p>This will alert the TPC just before the RTU is Power down.</p>	<p>Comments may not be accepted as there are very less probability of 110 V DC supply failure at switching station. The provision of power pack in RTU may increase the cost of RTU and periodic replacement of power pack battery. Power pack in RTU is generally not in practice.</p>
1.4.2.2	<p>The traction Power supply arrangement, sectioning diagrams & the protection scheme for the TSS are placed at Annexure 6 8 & 5 7. For further details manufacturer may refer to RDSO's specification No. TI/SPC/PSI/PROTCT/4050.</p>	<p>M/S APPSIL</p> <p>The traction Power supply arrangement, sectioning diagrams & the protection scheme for the TSS are placed at Annexure 6 8 & 5 7. For further details manufacturer may refer to RDSO's specification No. TI/SPC/PSI/PROTCT/7101 .</p> <p>CRP Specification No. TI/SPC/PSI/PROTCT/7101 to be updated</p>	<p>Comment may not be accepted as RDSO's specification No. TI/SPC/PSI/PROTCT/4050 referred in this para is correct.</p> <p>However, the annexure reference corrected as Annexure 5 & 6 in place of 6,8 & 5,7.</p>

1.4.3.2	Following relays are provided for the protection of traction substation transformers: a. Differentials relay. b. Over current relay on receiving side. c. Earth fault relay on receiving side. d. Instantaneous over-current relay on receiving side. e. Phase failure relay (to detect malfunction of feeder circuit breaker). f. Auxiliary relays for transformer faults i.e. Buchholz, excessive winding and oil temperature strip and alarm, pressure relief device trip and alarm and low oil level alarm. g. Over-current relay on 2x25 kV side as back-up to feeder protective relays.	M/s SYNERGY 1. Brief of protection scheme as per 2x25kV should also be incorporated. 2. Schematic of protection schemes at each location for 1x25kV and 2x25kV and Sub-urban sections should be incorporated.	Point-1 is accepted, brief of protection scheme for 25 KV ac traction has been incorporated in the draft SCADA specification. Point-2 is not accepted as schematic of protection scheme drawings are not available for all type of feeding arrangements. Further these drawing have no use in SCADA specification.
1.4.3.3	Panto-Flashover Relay is newly added.	SR ARB protection & LBB protection shall also be added in the list for OHE protection.	Not accepted as, This is the specification of SCADA system. All the protection function of relays need not be described in the SCADA specification. Protection functions will describe in details in the specifications of control and relay panels.
1.4.3.5	No control panel exists for the interrupters / circuit breakers at the SP and SSP and therefore the local / remote changeover switch is provided on the mechanism box of the interrupter / circuit breaker.	M/s SYNERGY 1. To be revised to incorporate as per 2x25kV also.	Comment accepted, Existing para revised as "No control panel exists for the interrupters /circuit breakers at the SP and SSP of 25 kV AC traction and therefore the local/remote changeover switch is provided on the mechanism box of the interrupter/circuit breaker. At SSP and SP of 25 kV AC traction of Mumbai Sub-urban area

			and 2x25 kV AC traction, local / remote changeover switch is generally provided on the control and relay panel”.
2.1	The Master station shall consist of latest Microsoft Windows operating system based SCADA software, running on Server grade computers in dual-redundant mode & MMI running on desktop PCs.	M/s SYNERGY 1. MMI/workstation PCs shall be workstation grade, not desktop PCs.	Comment may be accepted as workstation grade PC is superior than desktop PC in terms of speed and durability.
2.1.1	In case of OFC telecom media upto switching post & RTU, S&T shall provide 100BaseFX (Fiber Connectivity) at switching post and RCC In case of quad media (copper cable) between OFC hut and switching post, and at RCC, S&T shall provide Ethernet connectivity at switching post and RCC .	M/s ASHIDA In case of OFC telecom media upto switching post & RTU RCC, S&T shall provide 100BaseFX (Fiber Connectivity) at switching post and RCC In case of quad media (copper cable) between OFC hut and switching post, and at RCC, S&T shall provide Ethernet connectivity at switching post and RCC.	Comments may be accepted as RCC is correct word.
2.1.1	The Routers, Converters and telecom media with provision of LAN extenders or media converters (as required with copper or OFC medium respectively) shall be provided and maintained by S&T wing of railway department. In case of OFC telecom media upto switching post & RTU, S&T shall provide 100BaseFX (Fiber Connectivity) at switching post and RCC. In case of quad media (copper cable) between OFC hut and switching post, and at RCC, S&T shall provide Ethernet connectivity at switching post and RCC.	M/s SYNERGY 1. In case of copper cable, 2. a. Ethernet connectivity provided by S&T should be compatible as per 10/100BaseT/TX standard. 2. In case of fiber cable, a. 100BaseFX duplex interface suitable for single-mode fiber (9/125), 1310nm 3. Formation of communication ring should be achieved independent of connectivity with RTU. 4. System architecture for connectivity to be included	Comments may be accepted as to describe details of connectivity provided by S&T wing of railways for SCADA system. System architecture for connectivity is already described in section-4.

2.1.1S&T shall provide Ethernet connectivity at switching post and RCC.	SR Two or more Ethernet output shall be provided by S&T at RTU end.	Comment may not be accepted as single Ethernet at RTU end meets functional requirement of SCADA system.
2.1.2	Backup communication over wireless (new clause)	M/s SYNERGY SCADA Vendor will have to provide necessary hardware/software for communication with any RTU over 4G as a backup medium. A provision of dual SIM must be kept on RTU side.	Comment may not be accepted as connectivity over 4G wireless network as backup medium will impose monthly expenses per month per post. Wireless network is also not reliable and signal strength at remotely located switching post may be very low. Further, wireless network for SCADA system may be prone to cyber-attack.
2.2.1	At least 100 numbers of RTUs shall be catered by one set of SCADA and EMS server	M/s ASHIDA At least 100 50 numbers of RTUs shall be catered by one set of SCADA and EMS server Since all the Posts across Indian Railways are unmanned, dependability of huge section of up to 1000 kms comprising of 100 RTU's on a single server would create a havoc in case of Server Failures. We recommend maximum 45 to 50 RTU's in a single section or divided among 2 Sections shall be catered by one set of SCADA and EMS Servers	Comment may not be accepted as there are two servers-main and standby, if main server fails, the functionality of SCADA system taken over by hot stand by server.
		M/S SYNERGY 1. There shall be separate, dedicated, redundant communication front-ends capable of handling the communication loading of 100 RTUs. The specifications of the front-ends shall be same as per SCADA server. 2. The server-grade computers shall be rack-mountable. 3. In case single set of EMS servers has been specified for	Comments may be accepted as to describe technical requirement for interfacing of at least 100 RTUs with a single set of SCADA servers.

		complete RCC whereby multiple SCADA systems will pass on the data to this single set of EMS servers, then a standardized interface between SCADA Servers and EMS system must be specified for compatibility amongst different vendors. We propose use of DLMS for this purpose which is also currently the standard (IS 15959) being followed in the industry for exchange of metering data.	
	E1 channels and communication equipment provided by S&T wing of Railway shall be used for communication between SCADA and RTUs. One E1 channel with protection E1 channel shall be used for maximum of 15 RTUs.	M/s SYNERGY 1. As long as the provided Ethernet channel has bandwidth of Nx128kbps, a single channel can be utilized for all the N RTUs.	Not accepted as comment is not understandable.
2.2.1At least 100 numbers of RTUs shall be catered by one set of SCADA and EMS server. 2 Workstation-grade PCs in client server architecture shall be provided at RCC for every 15 RTUs to be integrated...	SR One main and one standby pair is enough for maximum 100 RTUs. But the fact is, if the server pairs get down, the entire division RCC/RTUs will be inoperable. Solution: A setup can be made as follows. Master Servers Auxiliary Servers for The division shall be operated with single pair of main and standby servers. It shall be connected with number of auxiliary servers which are equal to number of workstations (ie. TPC boards). Even though the auxiliary servers fail, master main or standby shall takeover.	Not accepted, in the event of main and standby SCADA servers fails simultaneously, there are no use of auxiliary servers. The basic aim for integrating at least 100 numbers of RTUs with single set of SCADA servers is to reduce the number of servers at RCC will also defeat
2.2.1 (a)	The second PC shall be provided with a single 42±1" signage and a second output for connecting to the projector.	M/s ASHIDA The second PC shall be provided with a single 42±1" signage and a second output for connecting to the projector display wall.	Comment may be accepted as projector has been deleted in the draft SCADA specification and display wall is proposed.
2.2.1.a (ii)	One PC will have provision for connecting four 42±1" signage display.	SR • The size of MMI monitor may be relaxed for existing	1. Point first is accepted and following is added in the existing

	By default, there is a provision of two (2) Displays; however, the number may increase if the section is large enough.....	<p>TPC room as per the space availability (Smaller size option may also be incorporated).</p> <ul style="list-style-type: none"> The SCADA graphics should support continuous zoom in/out facility with clutter/de-clutter function. When zooming in more details (static as well as dynamic data) on the graphics should become visible, and when zooming out the details should get hidden with only salient/important information visible. 	<p>para “ The existing TPC room, where the space constrains, smaller size display may be permitted with the approval of PCEE. In such case size of display shall be specifically mentioned in the tender”</p> <p>2. Second point is not accepted as the same has already been described at clause 2.2.1 (b)(iv) of the draft specification.</p>
2.2.1 A (III)	Regarding projector	<p>M/s SYNERGY</p> <p>1. It should be made clear whether projector is to be supplied or only provision for connecting a projector is required. 2. If projector is not to be supplied then is it desired that the second PC will have only one Display unit?</p>	The projector is not the feature of draft SCADA specification. Instead of projector, display wall has been proposed. The second PC will have only one display unit already mentioned. No changes are made in the existing para.
2.2.2	MD (from RTU): 15 Minutes (Window time) & Instantaneous 15 Minutes (Current Block) MD	<p>M/s SYNERGY</p> <p>1. The 15minutes shall be configurable to accommodate future changes in block intervals. Very soon this may get revised to 5 mins by CERC.</p>	Comment may be accepted as configurable time provides flexibility to accommodate future changes in block intervals.
		<p>M/S APPSIL</p> <p>- MD (through RTU): 15Minutes (Window time) & Instantaneous 15 Minutes (Current Block) MD</p> <p>Modern energy meters calculates MD and these data can be sent to SCADA through RTU. RTU need not to calculate MD again. MD throughout the system will be consisted if the data being acquired from one source i.e energy meter.</p>	Comment may not be accepted as individual energy meter is provided for each bay at TSS, to display combined MD, the addition MD in required at RTU level. Further, at some location, energy meter is provided on LV side of transformer, the compensation factor (user configurable) for transformer loss is also required to derive the HV side demand.

2.2.6	LAN switch should be manageable Layer-3 or higher with both OFC and copper connectivity	<p>M/s SYNERGY</p> <p>1. Since separate switches have been used for RTU network and SCADA network, therefore there is no requirement of Layer 3 switches. Since Layer 3 switches are also very highly priced, therefore all 4 switches can be layer-2 switches. Each of these switches should have 24 nos. Gigabit copper ports and 4 nos Gigabit single mode optical ports. Since switches form the backbone of communication network, therefore these switches should have dual power supply. GTP for the switch to be included in the specifications.</p>	Comment may be accepted in view of submitted justification.
2.2.6	The SCADA manufacturer shall have also to provide wireless LAN inside RCC and make necessary wiring. During failure of both LAN cables, the communication of server and workstation shall be sifted on wireless LAN automatically.	<p>M/S GOVIK</p> <p>- One can easily provide this facility but there will be major cyber security concern. Now a days more advance equipments are available to hack such type of systems. This will lead the system open ended and can create panic situation at any time. The best example for this is Mumbai electricity distribution department. On 12/10/2020 Due to cyber attack Mumbai city power was cut for whole day. Such type of attacks can affect the train movement also. As per our concerned and experience we can say that all outsiders should be kept away from SCADA system and such type of facility will not suggest to Railways.</p>	The comment on this para is no relevance as this para has already been strike out in the uploaded draft specification on RDSO website.
2.2.6	All computers would be connected on dual redundant Ethernet LAN using two numbers of minimum 24 ports Ethernet switches. The detail arrangement with two communication channels shall be as per Annexure 3. The LAN switch should be Manageble Layer-3 or higher	<p>SR</p> <ul style="list-style-type: none"> • Since 100 RTU are catered by one set of SCADA, a minimum of 14 E1 channel and 7 NMC are to be connected to IP switch. Therefore, IP switch with sufficient no. of port to be provided. • There shall be wireless LAN facility in RCC in order to meet emergencies because of network cable related failures within RCC. 	<p>Comments may not be accepted</p> <ol style="list-style-type: none"> 1. Minimum of 14 E1 channel and 7 NMC are to be connected to IP switch is not understandable. 2. Wireless LAN is not practical and reliable, hence, not accepted.

	with both OFC and copper connectivity.		
		<p>M/S APPSIL All computers would be connected on dual redundant Ethernet LAN using two numbers of minimum 24 ports Ethernet switches. The detail arrangement with two communication channels shall be as per Annexure 3. The LAN switch should be Manageble Layer-2 or higher with both OFC and copper connectivity.</p> <p>SCADA ethernet LAN does not require Layer-3 feature, hence request you to modify for economical solution based on the application.</p>	Comment may be accepted as justification for two layer switch given.
2.2.8.1	Servers Processor - Intel Core i7 Processor or latest generation processor	M/s ASHIDA Servers Processor -Intel Core i7 Processor or with latest generation processor	Comment may be accepted and revised as "Intel Core minimum i7 Processor with latest generation"
2.2.8.1	<p>Details of the desktop PC, server& accessories Processor: Intel Xeon Octa Dual Core Processor 3.0 GHz or Quad Core 2 GHz or higher upgradeable to dual processing 4 cores.</p>	<p>M/S APPSIL Details of the desktop PC, server& accessories Processor Intel Xeon Octa minimum Dual Core Processor 3.0 GHz or Quad Core 2 GHz or higher upgradeable to dual processing 4 cores. No. of cores requirement in processors is depends on efficiency of the software. Efficient softwares uses less processor cores for the best performance. Hence keeping the cores minimum will be a cost savings for purchaser</p>	Comments may be accepted and word 'minimum" is added to provide flexibility to vendors to select higher configuration processor as per their SCADA design requirement.
2.2.8.1	<p>Details of the desktop PC, server& accessories Processor: Intel Core i7 Processor or latest generation processor</p>	<p>M/S APPSIL Details of the desktop PC, server& accessories Processor: Intel Core minimum i5 Processor and 3rd generation processor</p>	Comment may not be accepted as i5 is an older generation processor.

		Processor and generation are different aspects, this is clarified	
2.2.8.1	Server: Optical Drive (DVD R/W): 16 x DVD+/-RW DVD ROM with double layer write capability.	M/s SYNERGY 1. Replace as a. Optical Drive: In built DVD-R/W-(Latest) 2. RAM should be at least 64 GB, upgradable to 128 GB considering capacity of 100 RTUs. 3. Redundant hot-swap power supplies should be specified for servers 4. Hard disk for servers shall be hot-swappable and provided in RAID 1 configuration using hardware RAID controller (RAID to be retained for better reliability) 5. Video card for workstation should be of 4GB RAM.	Comments may be accepted to specify requirement of servers for interfacing of 100 numbers of RTUs with single set of SCADA servers.
2.2.8.1	Network Interface Card - RTU network shall further be protected by employing suitable hardware firewall(s) in between..	M/s ASHIDA Network Interface Card - RTU network shall further be protected by employing suitable hardware firewall(s) in between. This is assuming E1 connection given to RCC are private network with no external Connection.	Comments may be accepted in view of submitted justification.
2.2.8.1	Details of the desktop PC, server& accessories; • Brand/Make: Any reputed make for servers and workstation grade PCs. • Monitor, keyboard & mouse: For servers, KVM rack mount console is mentioned • Operating System: Windows	SR It is desirable to mention the make of servers and workstation grade PCs as in the 130 Rev 2 specification. • HDMI switches are more preferable over VGA supporting KVM switch. • The Operating system of SCADA servers, EMS Servers, work stations may be preferred from open-source Operating System like latest LINUX, as it is more power full for control and data processing applications and it is absolutely free. For windows OS, security is a major concern and the RAM usage for antivirus is high, therefore, total system performance gets down.	Comment may not be accepted. 1. As per current RDSO,s policies, specific make is not to be mentioned in the specification. 2. The existing SCADA system operating on windows is working satisfactorily in Indian Railway. The utilisation of high RAM by antivirus depends on configuration of antivirus. 3. The comment "HDMI switches are more preferable over VGA supporting KVM switch" is not understandable.

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2.2.8.2	Number of USB ports - USB: Three, Ethernet port: Minimum 1, HDMI:1	M/s ASHIDA Number of USB ports -USB: Three, Ethernet port(USB to Ethernet): Minimum 1, HDMI:1 (If Laptop does not have Built- in Ethernet port , then USB to Eth. Converter shall be supplied.)	Comments may be accepted as USB to Ethernet convertor meets requirement of Ethernet port.
2.2.8.3	Two A4 Colour LaserJet printers	M/s ASHIDA Two A4 Colour Laser Jet printers. Printers can be from any reputed make. LasterJet will specify specific Brand.	Comments may be accepted in view of submitted justification.
2.2.8.4	Two LAN stackable switches with up-link support, with 24-Ports, 10/100/ 1000 Mbps and RJ45 interface shall be provided	M/s ASHIDA Two Four LAN stackable switches with up-link support, with 24-Ports, 10/100/1000 Mbps and RJ45 interface shall be provided	Comments may be accepted, description of switch modified according to comments given by M/s SYNERGY against para no. 2.2.6.
2.2.8.4	Switch make	M/s ASHIDA Any reputed make	Comment may be accepted and in place of particular make of switch, any reputed make is added.
2.2.8.4	LAN Stackable Switch Two LAN stackable switches with up-link support, with 24-Ports, 10/100/1000 Mbps and RJ45 interface shall be provided. Switches shall be of D-link, Cisco & Allied Telesis make or a brand as specified by the purchaser in the tender. The LAN switch should be Manageable Layer-3 or higher with both OFC and copper connectivity.	M/S APPSIL LAN Stackable Switch Two LAN stackable switches with up-link support, with 24-Ports, 10/100/1000 Mbps and RJ45 interface shall be provided. Switches shall be of D-link, Cisco & Allied Telesis make or a brand as specified by the purchaser in the tender. The LAN switch should be Manageable Layer-2 or higher with both OFC and copper connectivity. SCADA ethernet LAN does not require Layer-3 feature, hence request you to modify for economical solution based on the application	Accepted and manageable layer-2 switch is incorporated in place of layer-3 switch.
2.2.8.5	Ceiling-mount Projector	M/S APPSIL Ceiling-mount Projector Display wall	Accepted and title of the para has been revised as display wall in place

		Title change to match the specification	of ceiling mount projector.
2.3	Details of UPS: The manufacturer shall provide a reliable on-line UPS system of 2x5 KVA rating along with the batteries and associated equipment.....	SR Additional Points: • The UPS and Battery selected should have on site 24x7 service facility within the respective states. • UPS shall have real time online remote monitoring and control facility like using Simple Network Management Protocol (SNMP).	1. 24X7 service facility within the respective states may not be feasible in small states. This kind of clause in the specification may create controversy. This comment is not acceptable. 2. UPS with SNMP protocol is accepted for real time online remote monitoring and control facility.
2.3.2	The manufacturer shall purchase the UPS system from reputed suppliers like Aplab, APC, Hi Rel, Emerson network power, Dubas, Numeric & Uniline,.....	SR The reputed brand may be mentioned.	Not accepted, as per present RDSO,s policy, brand name can not be mentioned in the specification.
3.1.1	Communication over Dual Link (new clause)	M/s SYNERGY SCADA System should be able to communicate using OFC link provided by S&T wing as a primary channel and also over 4G network based backup channel. The backup channel is to be used only when the primary channel fails for a given RTU.	Comment may not be accepted as connectivity over 4G wireless network as backup medium will impose monthly expenses per month per post. Wireless network is also not reliable and signal strength at remotely located switching post may be very low. Further, wireless network for SCADA system may be prone to cyber-attack.
	The SCADA software licence should be handed over to division, the specification may be made clearer. Whenever updated the same should be advised or made available	M/s SYNERGY Replace as: The SCADA software license should be handed over to the division. Any updates/patches of the SCADA software as released by the SCADA OEM shall be made available to Railways.	Accepted

	downloadable from a webserver on line.		
	SCADA software shall be capable of working on latest version of Microsoft WINDOWS operating system.....	<p>SR</p> <ul style="list-style-type: none"> • The software should also be included with Network Management System (NMS) software, Structured Query Language (SQL) and latest version. • License key of all software which are part of SCADA system shall be provided to the purchaser and whenever updated the same should be advised or made available through download from a web server on line. 	<ol style="list-style-type: none"> 1. Provision of NMS software in traction SCADA is accepted. NMS is useful to monitor communication network devices between OFC hut and RCC, RTU cards, RCC equipments. A separate server with network management software and MMI is added in section-2 for NMS system. 2. Structured Query Language (SQL) is accepted. 3. Updates of the SCADA software will be made available to Railway by OEM. Downloading of updates of software through web server is not agreed by existing vendor. This comment is not accepted.
3.1.2.1	The software shall fully support file transfers for disturbance recording from protection relay between RTU & RCC automatically as defined by different IEC 60870-5-104 of standards. Protection relays supports IEC 60870-5-103 or IEC 61850 protocol. These standards specify own disturbance record format	<p>M/s ASHIDA</p> <p>The software shall fully support file transfers for disturbance recording from protection relay between RTU & RCC automatically as The software shall fully support file transfers for disturbance recording from protection relay between RTU & RCC automatically as defined by different IEC 60870-5-104 of standards or SFTP based file transfer. Protection relays supports IEC 60870-5-103 or IEC 61850 protocol or SFTP based file transfer. These standards specify own disturbance record format</p>	Comments may not be accepted as SFTP based file transfer is not the feature of protection relays developed by RDSO.

		Using SFTP has additional benefit of not disturbing normal communication in protocol	
3.1.8	The software may require upgradation / reconfiguration from time to time as per purchaser's modified requirements such as adding additional DI/DO/AI points in RTU or addition of complete RTU data in SCADA online without reinitializing SCADA system.	M/s ASHIDA The software may require upgradation / reconfiguration from time to time as per purchaser's modified requirements such as adding additional DI/DO/AI points in RTU or addition of complete RTU data in SCADA online without reinitializing SCADA system. Addition or deletion of RTU is a major event and hence may require re- initialize.	Comments may be accepted in view of submitted justification.
3.1.11	The SCADA servers (hardware and OS and application software) shall be hardened by way of implementing software firewalls, digitally signed software, blocking of unused ports and media drives.	M/s ASHIDA Please specify meaning of 'digitally signed software'	The words "digitally signed software" has been deleted.
3.1.14	Individual port-wise status of all Ethernet switches, routers, firewalls shall be logged in SCADA event list for link up/down events.	M/s ASHIDA Individual port-wise status of all Ethernet switches, routers, firewalls shall be logged in SCADA event list for link up/down events.	Accepted
3.1.16	SCADA vendor shall identify and deploy software patches for OS, application software during warranty and AMC, after thorough validation at their facility	M/S SYNERGY 1. Add following – a. Vendor shall be responsible for updates of anti-virus, firewalls, HIPS as installed in the servers/workstations.	Accepted
3.1.17	Remote access facilities, i.e., access from outside of the SCADA network, shall be disabled on all servers and workstations	M/s ASHIDA Remote access facilities, i.e., access from outside of the SCADA network, shall be disabled on all servers and workstations Secured remote access may be required in exceptional cases.	Not accepted as access of SCADA servers from outside of the SCADA network affects cyber security.

3.1.18	Audit Log (new clause)	<p>M/S SYNERGY</p> <p>All modifications to the SCADA database must be protected via user login. Audit trail must be available in configuration software to view the modifications carried out in the system along with date time and machine name. At least following three operations must be available in Audit Trail: 1. Insertion 2. Deletion 3. Update / Modifications</p>	Accepted, Audit log is useful for knowing history of modification made in SCADA database.
3.2.1.2	If the measurands are required at a specified periodicity the same shall be configurable. The changed analogue data shall be transmitted to server for display on HMI with time tag. However, the periodic analogue data with time tag shall be updated at interval of 2 minutes with use of high speed E1 channel.	<p>M/S APPSIL</p> <p>If the measurands are required at a specified periodicity the same shall be configurable. The changed analogue data shall be transmitted to server for display on HMI with time tag. However, the periodic analogue data with time tag shall be updated at interval of 2 minutes with use of high speed E1 Ethernet channel.</p> <p>Ethernet channels are used for SCADA communication as per Annexure-3 hence E1 Electrical 2 MBPS need to be replaced with Ethernet Channels.</p>	Not accepted as communication network of SCADA system on E1 channel connected in ring. The connectivity between RTU and OFC hut is on Ethernet.
3.2.2.2	In case of any communication failure, the last event, status, and relay parameters shall be downloaded from RTU locally, if required.	<p>M/s ASHIDA</p> <p>In case of any communication failure, the last event, status, and relay fault parameters shall be downloaded from RTU locally, if required.</p>	Accepted
3.2.3.7	All the close and open command of CB/ Interrupter/Motorised isolator issued through MMI shall be executed through DO card provided in the RTU.	<p>M/s ASHIDA</p> <p>All the close and open command of CB/ Interrupter/Motorised isolator issued through MMI shall be executed through DO card provided in the RTU on DO cards or relay via RTU.</p> <p>This will defeat the purpose of relay integration & result in duplicate hardware.</p>	Not accepted All the control operation of switchgear shall be through DO card only to enable the operation of switchgears through SCADA, at the event of relay failure or communication failure between relay and RTU.

3.2.5.1	Smart Objects (new clause)	<p>M/s SYNERGY</p> <p>SCADA system configuration editor should support “Smart Objects” to configure objects like CB, BM, Transformers etc. A Smart Object completely defines the object it refers to. For example, a CB represented by Smart Object will allow user to configure its status, L/R, command, current measurement, associated protections signals etc. all at one place. Instead of defining all the statuses and command signals as general I/O, Smart Objects links them together in a meaningful form. By placing a smart object on a graphic, user must be able to choose what all properties are to be displayed. This enforces “Object Oriented” engineering of the system and avoids configuration errors.</p> <p>User must be able to create and modify Smart Objects at will and as per requirement. User should also be able to specify which properties of a Smart Object are mandatory and which are optional. Mandatory properties will enforce that all relevant properties are specified for each object thereby reducing errors.</p> <p>Creating a Smart Object in the configuration should automatically create its required I/O as specified in the property of the object.</p>	<p>Not accepted,</p> <p>Existing para 3.2.5 –SCADA software configuration is sufficient to describe the requirement of SCADA software configuration.</p> <p>Addition of new para as suggested by M/s SYNERGY may restrict the vendor base.</p>
3.2.5.2	Electrical Network Configuration (new clause)	<p>M/S SYNERGY</p> <p>User should be able to define complete Traction Power Supply Network in the SCADA system by means of various equipment such as CB, BM, transformers, isolators etc. The system should be able to trace the power supply network in real-time and should be able to colour various sections of the network based on the power availability. Mismatch in Catenary Indication</p>	<p>Comments may be accepted in view of submitted justification.</p>

		<p>acquired from field and calculated by Network Flow Analyzer should be brought to notice of TPC via alarm / event. Sections which are currently not charged, should be displayed in white color (configurable) while charged sections must be displayed in red (configurable).</p> <p>System should provide a dedicated Network Topology Editor in which complete section can be configured and various properties of equipment can be specified.</p>	
3.2.3.6	The software shall be capable of issuing single commands to open or close the multiple switching devices.	<p>M/S SYNERGY</p> <p>1. Replace “single” with “group”.</p>	Accepted as the group command is correct word.
3.2.6	<p>Time Synchronisation:</p> <p>The software should have the facility to synchronize the Host computer clock through GPS. Master station servers shall be time – synchronized from the GPS receiver directly while all MMI shall be time-synchronized by the Main Server over Ethernet LAN. This time synchronization shall be based on absolute time (containing year, month, day, hours, minutes, seconds, milliseconds) sent by GPS clock on a serial communication channel. It may be noted that the GPS receiver can also have LAN port for communication, which will avoid using serial ports in RCC computers.</p> <p>The clock of the RTUs shall be synchronized with servers as per IEC</p>	<p>M/S SIEMENS</p> <p>Time Synchronisation:The software should have the facility to synchronize the Host computer clock through GPS/NTP. Master station servers shall be time – synchronized from the GPS receiver directly while all MMI shall be time-synchronized by the Main Server over Ethernet LAN. This time synchronization shall be based on absolute time (containing year, month, day, hours, minutes, seconds, milliseconds) sent by GPS clock/NTP Clock on a serial communication channel. It may be noted that the GPS receiver can also have LAN port for communication, which will avoid using serial ports in RCC computers.</p> <p>The clock of the RTUs shall be synchronized with servers as per IEC 60870-5-104 protocol.</p> <p>GPS master clock is more expensive than NTP master clock due to cost of material, mainly antenna, and GPS receiver.</p>	Not accepted as GPS clock is more reliable and accurate as compared to NTP.

	60870-5-104 protocol.		
3.2.7.1	RTU Diagnostics:	SR Facility for pinging the IP of RTU CPU shall be provided in the MMI display. Whenever an RTU gets inoperable, working TPC can click the button and ping the RTU CPU and assure whether communication is correct or not.	Accepted, this feature provides facility to check communication of particular RTU working or not.
3.2.7.2	RCC Diagnosticsf) Status of all IP based communication equipments from RCC to RTU	M/S APPSIL RCC Diagnosticsf) Status of all IP based communication equipments from RCC to RTU within RCC Complete network monitoring and management will part of S&T contractor scope. However within RCC will be in SCADA contractor scope.	Not accepted, NMS has been included in the SCADA specification for monitoring of complete network devices between RCC and RTU.
3.2.7.2 (F)	Status of all IP based communication equipments from RCC to RTU	M/S SYNERGY 1. Replace this with: Status of all IP based communication equipment from RCC to RTU over SNMP (V2c/V3) protocol.	Accepted as it facilitates real time online monitoring of network devices.
3.2.9.1	The system should provide three security levels for access for different functions: a) Traction power controller (TPC): - To view and Control. b) RCC Engineer – To edit configuration information and to add TPCs. c) System Engineer- To add new RCC Engineers.	M/S SIEMENS The system should provide "at least" three security levels for access for different functions: a) Traction power controller (TPC): - To view and Control. b) RCC Engineer – To edit configuration information and to add TPCs. c) System Engineer- To add new RCC Engineers. GPS master clock is more expensive than NTP master clock due to cost of material, mainly antenna, and GPS receiver.D7	1. The word 'at least' is acceptable. 2. The para "GPS master clock is more expensive than NTP master clock due to cost of material, mainly antenna, and GPS receiverD 7" not relevant to clause no. 3.2.9.1. This comment is not accepted.
		M/S APPSIL It shall be possible to restrict activation of the process	Not accepted as existing para is appropriate.

		<p>pictures of each object (sections, bays, apparatus...) within a certain user authorisation group. Each user shall then be given access rights to each group of objects, e.g.:</p> <ul style="list-style-type: none"> a) Display only b) Normal operation (e.g. open/close of switchgear) c) Restricted operation (e.g. by-passed interlocking) d) System administrator <p>For maintenance and engineering purposes of the HMI / server, the following authorisation levels shall be available:</p> <ul style="list-style-type: none"> a) Traction power controller (TPC): To view and control (No engineering allowed) b) RCC Engineer – To edit configuration information and to add TPCs (Engineering / configuration allowed) c) System Engineer- To add new RCC Engineers (Entire system management allowed) <p>The access rights shall be defined by passwords assigned during the log-in procedure. Only the system administrator shall be able to add/remove users and change access rights. Further each operation must be logged in to the event/alarm list along with the user name.</p> <p>For better and enhanced access level control, request RDSO to include the same in the specification</p>	
3.2.9.6	Automatic Backup (new clause)	<p>M/S SYNERGY SCADA system will provide facility of “Automatic Backup” of complete SCADA software along with historical and configuration data to a “Network Attached Storage”</p>	<p>Accepted as the automatic backup of complete SCADA software is secure and there are no chance to miss the SCADA software backup. Human</p>

		(NAS). Last two backups should be available at all times and older backups should be deleted automatically. A dedicated NAS should be supplied at RCC with the following specifications: • Dual 10/100 Ethernet Ports • 4TB SAS / SATA drives configured in RAID 1 It should be possible to restore SCADA system to the last point of backup available on NAS.	intervention is also not required to take the backup timely.
3.2.14.4	Alarm Processing and displays: For CB tripping's, in addition to events/alarm list, a separate popup window shall be opened on the operator screen in a dedicated area in overall mimic window with details of relays, reactance, resistance & current values etc. whichever applicable. It should be closed on acknowledge by TPC.	SR Additional points: • In case of any communication failure, relay tripping parameters stored in RTU shall be immediately sent to RCC once the communication gets restored. • System generated SMS facility for CB tripping to the concerned TPC, OHE/PSI supervisors also shall be included.	Not accepted, 1. First point has already described in para 5.3.1 of the draft SCADA specification. 2. Railway RCC is manned, SMS generation for CB tripping is no use and also require additional equipment at RCC and monthly expanses of network used for SMS facility.
3.2.14.4	For CB tripping's, in addition to events/alarm list, a separate popup window shall be opened on the operator screen in a dedicated area in overall mimic window with details of relays, reactance, resistance & current values etc. whichever applicable. It should be closed on acknowledge by TPC.	M/S APPSIL For CB tripping's, in addition to events/alarm list, a separate popup window shall be opened on the operator screen in a dedicated area in overall mimic window with details of relays, reactance, resistance & current values etc, only if it is available from the field relay through RTU. whichever applicable. It should be closed on acknowledge by TPC. Alternatively a special marking in event list to show special symbol marking to identify the important trips like CB tripping shall be posible. An alternate solution proposed, request you to include the same	Accepted, the existing para modified as "for CB tripping's, in addition to events/alarm list, a separate popup window shall be opened on the operator screen in a dedicated area in overall mimic window with details of relays, reactance, resistance & current values or V, I, Phase angles or distance or Z and its angle, only if it is available from the field relay through RTU. It should be closed on acknowledge by TPC."

3.2.15.1	SMS Alerts (new clause)	<p>M/S SYNERGY</p> <p>SCADA system should have inherent facility to send critical alerts over SMS to configured users. System should provide facility to select any alarm / event to be sent to a single or group of persons. System should be able to send SMS via modem or via web. Any hardware required to meet the functionality is part of the SCADA supply and should be considered by the supplier.</p> <p>Please note that third party software to send SMS and mails are not acceptable and are not allowed.</p>	<p>Not accepted as Railway RCC are manned, SMS generation for CB tripping is no use and also require additional equipment at RCC and monthly expenses of network used for SMS facility.</p>
	Disturbance Record Server (new clause)	<p>M/S SYNERGY</p> <p>A separate server shall be provided at RCC, to collate the acquired disturbance records, and organize the same based on location, equipment, Date-time. The disturbance records acquired by SCADA from the relays via the RTUs should automatically get saved in this server at a designated location. The data shall be available for a minimum of 1 year duration. The server shall have a welldefined directory structure, identifying the hierarchy such as section, location, equipment, relay type. A web-based GUI shall be available from the server, which can be accessed from any workstation on the SCADA LAN. The GUI shall display the fault records in the same hierarchy as above, and shall be sortable based on time, substation, equipment, relay type. It shall be possible to download or view the fault record waveforms from the GUI itself. It shall be possible to –</p> <ul style="list-style-type: none"> • Automatically identify and classify faults based on tripping type (OCR, DPR, etc.). • Automatically identify transient faults based on auto-recloser operation status. 	<p>Not accepted as provision of separate server for disturbance record resulted increase overall cost of SCADA system.</p>

		<ul style="list-style-type: none"> • Calculate min/max RMS values, and peak values of voltage and current. • Generate reports such as equipment-wise summary of faults occurred during a given user selectable time-period. <p>The specifications of the server shall be same as SCADA server.</p>	
3.2.16	Power Block	<p>M/S APPSIL Power Block</p> <p>Alternatively following is also acceptable. For each remotely controllable switching device, standard device control blocking feature will be used for any equipment or group of equipment for operation blocking.</p> <p>Alternate solution: For each remotely controllable switching device, standard device control blocking feature will be used for any equipment or group of equipment for operation blocking. This is available as a standard feature in most of the SCADA package</p>	Not accepted as existing para is appropriate.
3.2.17	Under-voltage tripping of SP Bridging interrupters: Under extended feed conditions....	<p>SR</p> <p>Additional Points: There should be a manual option from SCADA to bypass the condition in the event of PT physical failure @ SP with specific permission to CTPC/SSE/RC.</p>	Accepted as it provides flexibility to TPC to bypass under voltage tripping of SP Bridging interrupter at the event of physical PT failure.
3.2.18	Automatic Fault Localisation of OHE (AFLN)	<p>M/S APPSIL</p> <p>Automatic Fault Localisation of OHE (AFLN)</p> <p>We request RDSO to clearly specify AFL actual functionality in detailed in this clause along with application and suitable examples in order to confirm our comment on this section.</p>	Existing para is appropriate, functional requirement of AFLN has already described in this clause.
3.2.20	Disturbance Records:	SR	Not accepted as latest disturbance

		Additional point: • In case of any communication failure, the last event, status, and relay parameters shall be downloaded from RTU locally by PSI supervisor with the guidance from TPC for failure analysis. • COMTRADE viewer shall be of reputed make suggested by relay OEM.	stored in the relay can also be downloaded from the relay directly.
3.2.22	Message pad: One page shall be provided for the operator....	SR Additional points: there shall be a facility to put "REMARKS "notes on MIMIC to any Equipment, Parameters, and interconnections.	Accepted
	Message pad: One page shall be provided for the operator to record/add important messages. They can also be edited and removed by the operator. The messages will be retained by the system even if the MMI is shutdown. When it is brought up again, the last entered message shall be viewable by the operator.	M/S APPSIL Message pad: One page shall be provided for the operator to record/add important messages. They can also be edited and removed by the operator. The messages will be retained by the system even if the MMI is shutdown. When it is brought up again, the last entered message shall be viewable by the operator. The messages entered in Hot system shall be automatically replicated to Standby system when SCADA failover takesplace. For improvement in the feature	Accepted
3.2.23	Web Reports (new clause)	M/S SYNERGY It should be possible to view all SCADA reports over web, via web server either on a web browser running on a client PC or over mobile phone. There should not be any requirement to install any software except for a web browser.	Not accepted as SCADA reports over web is no use.
3.2.23	Data logging and Reports generation iii. Duration during the month when the voltage went above or below 27 or 17 KV at the TSS and SP respectively.	M/S APPSIL Data logging and Reports generation iii. Duration during the month when the voltage went above or below 27 or 17 KV at the TSS and SP respectively.	Not accepted as this is essentially required to know duration of the voltage above or below from preset value.

	<p>iv. Duration during the month when the current is exceeding full load capacity of the transformer.</p> <p>v. Energy data interpretation, MD violation.</p>	<p>iv. Duration during the month when the current is exceeding full load capacity of the transformer.</p> <p>v. Energy data interpretation, MD violation.</p> <p>Not part standard SCADA reportings, can not be provided. Request you to remove</p>	
3.2.23	<p>Data logging and Reports generation</p> <p>vi. Report in standard format as per Annexure-11.</p>	<p>M/S APPSIL</p> <p>Data logging and Reports generation</p> <p>vi. Report in standard format as per Annexure-11 (part of EMS reporting)</p> <p>Complete reporting will be part of EMS only</p>	<p>Not accepted as reports generation in standard format is the part of SCADA system.</p>
3.2.24	<p>Voltage profile at TSS, SSP, SP& ATP: Recording of Voltage Profile at TSS, SSP,SP& ATP shall be done and stored in the RTU. Minimum duration for monitoring shall be 48 hours. The voltage parameter shall be recorded when voltage is below 19 kV and above 28 kV. Voltage between 19 kV and 28 kV shall be considered as normal and hence no recording requires. It shall be possible to display these values in form of Graph and Tabular report as and when required. Filtering of voltage profile data shall be done by date and time. It shall be possible to read from Voltage-Time graph the time and duration of low/high voltage along with values.</p>	<p>M/S APPSIL</p> <p>Voltage profile at TSS, SSP, SP& ATP: Recording of Voltage Profile at TSS, SSP,SP& ATP shall be done and stored in the SCADA or EMS. Minimum duration for monitoring shall be 48 hours. The voltage parameter shall be recorded when voltage is below 19 kV and above 28 kV. Voltage between 19 kV and 28 kV shall be considered as normal and hence no recording requires. It shall be possible to display these values in form of Graph and Tabular report as and when required. Filtering of voltage profile data shall be done by date and time. It shall be possible to read from Voltage-Time graph the time and duration of low/high voltage along with values.</p> <p>Complete system data will be stored in SCADA or EMS only, request RDSO to correct the same</p>	<p>Accepted</p>

3.2.25	Help functions: On-line help and tutoring guide should be provided for all major functions in the MMI using the HELP option. The help sections will guide the operator for any specific help for carrying out certain tasks.	M/S APPSIL Help functions: On-line help and tutoring guide should be provided for all major functions in the MMI using the HELP option. The help sections will guide the operator for any specific help for carrying out certain tasks. Alternatively help in the form of pdf is also acceptable. An alternate solution proposed	Not accepted, Help function should be integral part of SCADA system.
3.2.26.6	Playback (new clause)	M/S SYNERGY The software should provide facility to TPC operator to "Playback" historical data on the MMI graphics itself. TPC should be able to pick a time range by specifying start and end date and time and software should display the values of all elements present in the graphics from the selected time frame. The TPC should be able to "Play" the data whereby the data should move forward in time at a selected speed, automatically. TPC should also have to pause, resume, fast forward and rewind. On exiting the mode, the picture should be refreshed with current real-time data.	Not accepted as justification and use of playback feature is not mentioned.
3.2.27	Failover of dual hot-standby systems	SR Auxiliary servers which are equal to number of workstations may be provided.	Not accepted, In the event of main and standby SCADA servers fails simultaneously, there are no use of auxiliary servers.
3.3.4	Geographical representation (new clause)	M/S SYNERGY SCADA system should be capable of displaying the complete section on to the locations' geographical map. The geographical map shall be arranged by SCADA vendor and should be available offline. The map should	Not accepted as justification and use of geographical map is not mentioned.

		represent the actual geographical territory onto which the Catenary status of complete network (up and down line) should be displayed. In the event of catenary failure, the catenary of the respective sub-section should start flashing on the map itself and operator should be able to jump to the section's SLD.	
3.4	Training Simulator (new clause)	M/S SYNERGY Training Simulator should be part of the standard SCADA system. A separate server machine (similar to SCADA server) should be provided along with its operator workstation to carry out operator training.	Not accepted as training simulator require separate server and work station resulted increase the cost of SCADA system and additional space is also required in RCC.
4.2	STM-1/MPSL	M/S SYNERGY 1. Replace MPSL with MPLS	Accepted as MPLS correct short name of multiprotocol level switching
4.2	Purchaser S&T wing of Railway shall provide redundant high speed communication medium between RCC & Station Hut through STM-1/MPSL equipment connected in a ring. The purchaser shall provide all technical details of the communication media offered for SCADA. The communication link up to RTU shall be provided by the purchaser S&T wing of Railway which shall not be redundant one.	M/S APPSIL Purchaser S&T wing of Railway shall provide redundant high speed communication medium between RCC & Station Hut through STM-1-4/MPLS-TP equipment connected in a ring. The purchaser shall provide all technical details of the communication media offered for SCADA. The communication link up to RTU shall be provided by the purchaser S&T wing of Railway which shall not be redundant one. All Mission Critical Communication runs in line with CIGRE recommendation using MPLS-TP Technology. Hence this is revised to STM-1-4 or MPLS-TP Equipment.	Not accepted as communication equipment within the scope of S&T department.
4.3	S&T wing shall provide redundant communication mediumstation by providing spare	M/S SYNERGY 1. The sentence is incomplete.	Accepted, the sentence " OFC hut to switching station by providing spare" corrected with " OFC hut to switching station by providing spare channel"

4.4	The communication setup for implementing high speed communication is achieved through use of Router with an inbuilt 2-port E1 interface card, LAN extender/Media converter etc. In this arrangement one E1 which shall be provided between stations to station. For network redundancy, additional E1 is utilized to form an OFC ring from station to station.	M/s ASHIDA The communication setup for implementing high speed communication is achieved through use of Router with an inbuilt 2 port E1 interface card, LAN extender/Media converter etc. In this arrangement one E1 which shall be provided between stations to station. For network redundancy, additional E1 is utilized to form an OFC ring from station to station. This is part to be provided by S&T. Need to clarify that this is not under scope of SCADA manufacturer	This has already been specified in para 4.1 of the draft specification that "S&T wing of Railway shall provide, maintain and replace communication media and all telecom equipments installed for extending data communication by providing end to end telecom connectivity (from RCC to Remote Terminal Unit (RTU) at switching post for SCADA system. There is no need to change this para.
4.5	Figure: Telecom scheme for high speed SCADA based on TCP/IP communication	M/s ASHIDA Figure to be changed. (Image Attached)	Accepted as changes are required in telecom scheme to describe telecom equipment for quad as well as OFC medium.
	240Vac at RCC and 110V at switching post	M/S SYNERGY 1. Replace 110V with 110VDC	Accepted as 110 V DC is correct word.
	Telecom scheme: E1 channels	SR Bandwidth requirement for communication shall be upgraded from 2MB (2 E1 channels x 2 MB) to 8MB (2 E2 channels x 8MB). Once the TSS locations become unmanned, 24x7 surveillance from RCC will be required. To achieve this without any delay in communication, sufficient bandwidth will be required (4MB).	Not accepted as surveillance system has not a feature of present SCADA system.
4.6	Note: For clause no. 4.1, 4.2, 4.4 & 4.5, the redundant communication medium between RCC & station Hut through STM-1 equipment connected in a ring is not mandatory for the section where OFC work is in progress or branch line / spur link. The requirement of	M/S SYNERGY 1. As per the communication arrangement described in this chapter, the presence / absence of a ring is not known to SCADA/RTU equipment. From SCADA point-of-view, only one communication channel exists, which may or may not have alternate paths on the backbone network. Therefore, switching of paths is to be	The changes desired in the specification is not clear.

	redundant communication for such section shall be decided between PCEE & PCSTE jointly. Whenever, redundant communication available in such section, the SCADA system shall be switched over to redundant communication immediately.	performed by the equipment provided by S&T.	
4.6	The Railways/purchaser S&T wing of Railway shall have to ensure the availability of E1 channel, telecom networking equipment and medium of communication.....	SR 2 E1 channel per 15 RTU required (Since more than 18 post not driven by 1 E1 channel).	Not accepted as comment is not understandable.
4.6 (b)	CISCO 1921 series router/CTC converter	M/S SYNERGY These makes / models need not be mentioned since this equipment would be provided by S&T. CISCO 1921 especially is not a good example either. Forced cooling arrangement need not be mentioned.	Accepted
4.8	4G network as backup communication (new clause)	M/S SYNERGY Vendor must provide a backup communication channel over 4G network. This shall consist of: 1. A broadband connection on RCC side 2. M2M gateway in the RCC 3. Dual SIM 4G modem with each RTU 4. Any other component required for effectively communicating between RCC and RTUs over 4G network.	Comment may not be accepted as connectivity over 4G wireless network as backup medium will impose monthly expenses per month per post. Wireless network is also not reliable and signal strength at remotely located switching post may be very low. Further, wireless network for SCADA system may be prone to cyber-attack.
5.1.1	The RTU Hardware shall include redundant CPU modules, it's associated digital input/output modules, alarm input modules, analogue input	M/S SYNERGY Add following also – The redundant CPU shall have capability of synchronizing their states in order to maintain the most recent copy of the process state such	Not accepted as existing para is appropriate.

	modules, watchdog, transducers, memory, interposing contactors, redundant power supply units and surge arresters and other items necessary for its proper functioning. In case of failure of CPU/PSU the redundant module will take care without interrupting the functionality of	as, I/O states, SoE in both CPUs. In the event of a switchover of CPUs, the newly promoted active CPU should have the most recent state, as was before the switchover. The synchronization between the CPUs shall be achieved using dual-ported memories allowing one CPU to read/write from/to the memory of other CPU, without intervention of the other CPU.	
5.1.1	The RTU Hardware shall include redundant CPU modules, it's associated digital input/output modules, alarm input modules, analogue input modules.....	SR The RTU CPU should be 5redundant in all respect.In the event of CPU hardware failure,changeover not happening since the port is live. Redundancy software should either check both port and Hardware or there should be a provision at RCC to view every port of RTU CPU and should be able to enable or Disable the CPU port.	Not accepted as failure of CPU hardware will result port dead and changeover take place in the RTU.
5.2.3	Modular type of construction shall be adopted to facilitate unit replacement of devices wherever required and must be scalable to cater TSS/SSP/SP with up to 4 lines.	M/s ASHIDA Modular type of construction shall be adopted to facilitate unit replacement of devices wherever required and must be scalable to cater TSS/SSP/SP with up to 4 lines & 2 Transformers.	Not accepted as number of transformer requirement varies according to power supply feeding arrangement and traction load requirement.
		M/S SYNERGY 1. The RTUs provided for each location TSS/SP/SSP/ATP shall be sized such that the I/O capacity of 4 lines can be accommodated by way of installing I/O modules/racks only. Suitable space inside the RTU enclosure shall be made to allow installation of such modules/racks.	Not accepted as existing para is generalized and appropriate. The vendors are free to implement as per their design.
5.2.4	- all electronic modules shall be mounted vertically and fixed on the main frame of the cabinets. The RTU housing internal design shall be according to isolation needs and space	M/S GOVIK Now a days advance electronics modules can have smaller size also. So, there should not be limitation of 19 inch rack. Instead of this specification should call for expandable RTU with minimum size of rack, which will	Accepted as to provide flexibility to vendors for using suitable size of rack as per their design. The existing words "generally only standard 19 inch" replaced with "minimum possible

	restrictions therefore generally only standard 19 inch racks with integrated terminals shall be used for reducing the wiring. RTU shall be compact expendable and scalable. Suitable check points/ diagnostic indications shall be provided on the cards for monitoring its healthiness.	reduce the size of cubicle of TSS, SSP and SP.	size racks”
5.2.6	Proper protection by providing MCB’s (of ABB, Siemens, Schneider make only)to different supply circuits shall be ensured inside the RTU.	M/s ASHIDA Proper protection by providing MCB’s (of ABB, Siemens, Legrand, Schneider make only)to different supply circuits shall be ensured inside the RTU.	Accepted, in place of ABB, Siemens, Schneider make only, the word any reputed make is mentioned in the specification. IEC 60898-2 added in the para .
5.3.1	Moreover minimum of 400 events shall be stored in the RTU memory sequentially, in case of communication failure, for reporting to the master station.	M/s ASHIDA Moreover minimum of 400 events shall be stored in the SP/SSP RTU memory sequentially, in case of communication failure, for reporting to the master station.	Based on the comments of other SCADA manufacturer and requirement, storage capacity of RTU increased to 10000 for TSS/SP/SSP RTU.
5.3.1	The RTU shall be designed for handling telecommands, telesignals and telemetered parameters as per the details given in this specification. All the changes (one or more) in the status of the circuit breakers / interrupters /motor-operated isolators and alarms that may occur between consecutive polling shall be stored by the RTU until they are reported to the master stations along with their time of occurrence. Moreover, a minimum of 400 events shall be stored in the RTU	M/S SYNERGY The RTU shall be designed for handling telecommands, telesignals and telemetered parameters as per the details given in this specification. All the changes (one or more) in the status of the circuit breakers / interrupters /motor-operated isolators and alarms that may occur between consecutive polling shall be stored by the RTU until they are reported to the master stations along with their time of occurrence. Moreover, a minimum of 10000 events shall be stored in the RTU memory sequentially, in case of communication failure, for reporting to the master station. The events should also be stored in non-volatile memory so that these can be transferred to RCC even if	<ol style="list-style-type: none"> 1. In place of 1000 events for TSS and 400 events for SP/SSP RTU, the minimum of 10000events stored in RTU memory is accepted to avoid loss of events during communication failure. 2. Viewing of commands received by RTU using the diagnostic software is not much useful. This suggestion is not accepted.

	<p>memory sequentially, in case of communication failure, for reporting to the master station. For TSS, minimum 1000 events should be stored. The events should also be stored in non-volatile memory so that these can be transferred to RCC even if the RTU is power cycled or communication restores after failure.</p>	<p>the RTU is power cycled or communication restores after failure.</p> <p>The RTU shall also support viewing of commands received by the RTU using the diagnostic software. The RTU shall display the time of receipt of command, command value, and whether it was accepted or rejected by the RTU.</p>	
		<p>M/S APPSIL</p> <p>The RTU shall be designed for handling telecommands, telesignals and telemetered parameters as per the details given in this specification. All the changes (one or more) in the status of the circuit breakers / interrupters /motor-operated isolators and alarms that may occur between consecutive polling shall be stored by the RTU until they are reported to the master stations along with their time of occurrence. Moreover a minimum of 400 events shall be stored in the RTU memory sequentially, in case of communication failure, for reporting to the master station. For TSS, minimum 10000 events should be stored. The events should also be stored in non-volatile memory so that these can be transferred to RCC even if the RTU is power cycled or communication restores after failure.</p> <p>As per the specificaiton clause 3.2.2.2, "In case of any communication failure, the last event, status, and relay parameters shall be downloaded from RTU locally", having more storage capability in RTU will be helpful for analysis purpose</p>	<p>Accepted, minimum 10000 events storage in RTU memory incorporated for TSS/SP/SSP RTU.</p>

5.3.1	<p>The RTU shall be designed for handling telecommands, telesignals and telemetered parameters as per the details given in this specification. All the changes (one or more) in the status of the circuit breakers / interrupters /motor-operated isolators and alarms that may occur between consecutive polling shall be stored by the RTU until they are reported to the master stations along with their time of occurrence. Moreover a minimum of 400 events shall be stored in the RTU memory sequentially, in case of communication failure, for reporting to the master station. For TSS, minimum 1000 events should be stored. The events should also be stored in non-volatile memory so that these can be transferred to RCC even if the RTU is power cycled or communication restores after failure.</p>	<p>M/S SIEMENS</p> <p>The RTU shall be designed for handling telecommands, telesignals and telemetered parameters as per the details given in this specification. All the changes (one or more) in the status of the circuit breakers / interrupters /motor-operated isolators and alarms that may occur between consecutive polling shall be stored by the RTU until they are reported to the master stations along with their time of occurrence. Moreover a minimum of 400 events shall be stored in the RTU memory sequentially, in case of communication failure, for reporting to the master station. For TSS, minimum 1000 events should be stored. The events should also be stored in non-volatile memory so that these can be made available to RCC even if the RTU is power cycled or communication restores after failure.</p> <p>to avoid auto data transfer after every restart, events can be pulled manually from web browser so that flooding of data from multiple RTUs can be avoided at RCC</p>	<p>Not accepted as manual pulling of events is not practical and there are chances of events loss.</p>
5.3.2	<p>RTU shall use IEC 60870-5-104 protocol for communication with RCC. The RTU shall be configurable to report analogue & status changes by exception to RCC. However, RTU shall also support periodic reporting of analogue data and periodicity shall be configurable from 1</p>	<p>M/S SYNERGY</p> <p>Add the following also – The RTU shall support communication with at least 4 master stations simultaneously using IEC 60870-5-104 protocol using separate logical databases for each master station. At boundary post locations, it shall be possible to use a single RTU to report to both RCCs.</p>	<p>Accepted as justification given by the firm. A new para-5.3.12 is added in the final draft specification.</p>

	sec to 15 minutes. The dead-band for reporting Analogue value by exception shall be settable from 1% to 10% of the maximum measuring range. In addition, analogue values shall also be reported to Master station by exception on violation of a defined threshold limit. The threshold values are to be configured in the RTU so that any sudden variation.		
	4G Network Based backup channel (New Clause)	M/S SYNERGY RTU should be provided by a dual SIM modem for implementing a backup communication channel. GPRS based communication should be used only when the OFC channel provided by S&T wing fails. Switchover from S&T channel to 4G on failure of OFC channel, and switchover back to OFC channel on restoration of OFC channel shall be automatic.	Comment may not be accepted as connectivity over 4G wireless network as backup medium will impose monthly expenses per month per post. Wireless network is also not reliable and signal strength at remotely located switching post may be very low. Further, wireless network for SCADA system may be prone to cyber-attack.
5.3.3	in analogue value, like crossing a limit, or a significant change in the value is reported spontaneously to SCADA	M/S SYNERGY 1. To be merged with previous clause.	Accepted
	SNTP Server Support (new clause)	M/S SYNERGY Add the following – The RTU shall support SNTP server feature in order to synchronize the clock of the IEC61850 relays. The SNTP server shall report time of the RTU's internal clock, which in turn is being synchronized by RCC SCADA over IEC 60870-5-104 protocol.	Accepted as this feature is essential if communication between relay and RTU on IEC 61850 protocol.
5.3.4	RTU shall support Maximum Demand (Apparent power) calculation based on	M/S SYNERGY RTU shall support Maximum Demand (Apparent power)	Accepted as instantaneous MD is useful to know the instantaneous

	5 to 60 minutes (configurable) window periods based on inputs received from energy / power transducers. The value of MD shall be reported to RCC after each window period.	calculation based on 5 to 60 minutes (configurable) window periods based on inputs received from energy/power transducers. The instantaneous and window values shall both be available from the RTU. The instantaneous value shall be reported as per cyclicity of analog value reporting. The value of MD shall be reported to RCC after each window period along with timestamp.	demand of TSS.
		<p>M/S APPSIL RTU shall acquire Maximum Demand (Apparent power) value from energy meter based on 5 to 60 minutes (configurable) window periods based on inputs received from energy/power transducers. The value of MD shall be reported to RCC after each window period.</p> <p>Modern energy meters calculates MD and these data can be sent to SCADA through RTU. RTU need not to calculate MD again. MD throughout the system will be consisted if the data being acquired from one source i.e energy meter.</p>	Not accepted as IR TSS provided with separate energy meter for transformers way. To know combined MD of a TSS, the summing of MD recorded by individual energy meter is required at RTU level.
5.3.5	The CPU will restore without any manual intervention after restoration of power failure or communication failure or internal fault	<p>M/S SYNERGY The CPU will restore without any manual intervention after restoration of power failure or communication failure or internal fault. All restarts shall be reported to RCC over the IEC60870-5-104 protocol.</p>	Accepted as it provides information regarding switchover of RTU CPU.
	New clause after 5.3.6	<p>M/S SYNERGY The RTU shall also have IEC 60870-5-101/104 protocol support for interfacing with automatic fault locator equipment that may be installed in 2x25kV network. The RTU shall acquire the fault data such as location, health status of AFL equipment over this interface, and update the same at RCC SCADA.</p>	Accepted as the feature shall be available in SCADA AFL interface if AFL provided in future. A new para-5.3.14 is added in the final draft specification.

5.3.6	RTU firmware shall be capable of being reconfigured (under password control) locally from the laptop/portable programming device and from the Central Master Station by using RTU Maintenance Software. SCADA manufacturer shall furnish authentic copies of RTU firmware in CD/DVD to the purchaser. Document regarding File formats shall be submitted along with design/ drawings of SCADA to RDSO for approval.	<p>M/S APPSIL</p> <p>RTU firmware shall be capable of being reconfigured (under password control) locally from the laptop/portable programming device and from the Central Master Station by using RTU Maintenance Software. SCADA manufacturer shall furnish authentic copies of RTU firmware in CD/DVD to the purchaser. Document regarding File formats shall be submitted along with design/ drawings of SCADA to RDSO for approval.</p> <p>Firmware can not be reconfigured, we believe it's a typo error, request you to update the same. RTU Parameterrization and configuration can be carried out from RCC / Remote.</p>	Accepted as justification given by the firm
5.3.7	The RTU shall have self-monitoring / diagnostic for fault conditions. This shall provide various details such as, defective cards I/O cards, host lines, device status, command supervision etc. The RTU should generally support the test procedures as per standard protocol IEC 60870-5-104. SCADA vendor shall submit the details of specific diagnostic function to RDSO at the time of design document and drawing approval.	<p>M/S SYNERGY</p> <p>Add the following also – The RTU shall support a web server interface, using which the diagnostics of the RTU can be checked and logs downloaded. The web server shall support common browsers such as Chrome, Firefox, Edge, and shall not require installation of any other software for its functioning. The RTU shall also support SNMP protocol to allow monitoring of the RTU modules and other diagnostic information from a Network Management System.</p>	<ol style="list-style-type: none"> 1. RTU with web server interface is not accepted as web server interface for RTU is not required. 2. The RTU with SNMP protocol is accepted to monitor real time online status of RTU modules.
5.3.8	-Min 1 nos. RS-232 Console Port, 6 2nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS,	<p>M/s ASHIDA</p> <p>-Min 1 nos. RS-232 Console Port, 6-2nos 4 Nos. RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-</p>	1. In place of 6 numbers RS-485 port, proposed 4 numbers RS-485 port is not accepted as this para has been deleted to make same RTU

	<p>Multi- Function Meters/Energy meter on MODBUS protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol. Or Min 1 nos. RS-232 Console Port, 2 4 nos RS-485 ports for communication with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and 2 numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol. Or Min 1 nos. RS-232 Console Port, 4 2nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi- Function Meters/Energy meter on MODBUS protocol and and 2 numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol. -The RTU shall support data transfer from protection relays as per IEC 60870-5-103 & NIFPS, multifunction meter/energy meter etc. as per</p>	<p>Function Meters/Energy meter on MODBUS protocol. Minimum 2 nos. of Ethernet ports and OR 2 nos. optical port (selectable as per requirement) for communicating with the RCC as per IEC 60870-5-104 protocol. Or Min 1 nos. RS-232 Console Port, 2 4 nos RS-485 ports for communication with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and 2 numbers of Redundant Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and OR 2 nos. optical ports (selectable as per requirement) for communicating with the RCC as per IEC 60870-5-104 protocol. Or Min 1 nos. RS-232 Console Port, 4 2nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and and 2 numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and OR 2 nos. optical ports (selectable as per requirement) for communicating with the RCC as per IEC 60870-5-104 protocol. -The RTU shall support data transfer from protection relays as per IEC 60870-5-103 & NIFPS, multifunction meter/energy meter etc. as per MODBUS protocol using RS-485 ports or IEC 61850 and other standards</p>	<p>must be supported IEC 60870-5-103, IEC 61850, MODBUS protocol for communication with IEDs.</p> <p>2. In place of 2 numbers Ethernet port and 2 numbers optical ports, 2 numbers Ethernet port or 2 numbers optical ports (selectable as per requirement) is not accepted as communication media for some post is on copper and some post is on OFC.</p> <p>3. The word “redundant” port for communication with numerical relays on IEC 61850 protocol is accepted.</p>
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	MODBUS protocol using RS-485 ports or IEC 61850 and other standards		
	Analog input card - AI card to be used for PT & CT inputs.	M/s ASHIDA Analog input card - AI card to be used for PT & CT inputs . RTCC inputs i.e. OTI, WTI And Transformer Tap Position (for online tap changer).	<ol style="list-style-type: none"> 1. The deletion of CT & PT inputs is not accepted as few location where the communicable relay is not available, measurand parameter need to be transfer through AI card to RCC. 2. The addition of RTCC input and transformer tap position is accepted.
5.3.8	RTU shall be capable of locally implementing miscellaneous traction power control and protection needs e.g. a. Interlock release-request facility for circuit breakers/ interrupters control at boundary post. b. Tripping of CB/BM on under voltage at SP after a set time delay.	M/S SYNERGY Clause number repeated. To be corrected.	Accepted
5.3.8	Interchangeability - All switching station CPUs shall be interchangeable with changing the address to use the CPU at other RTU in case of failure and non availability of spare CPU to restore the important RTU (like TSS and SP).	M/S GOVIK All types of hardware cards in RTU are to be same for interchangeability in TSS /SSP /SP, but depending upon type of RTU, configuration file may change. This file is required to be download before making the RTU online. Complete interchangeability including software is possible if all types of panel (TSS/ SSP/ SP) having are same configuration. Apart from the above, we also want to draw your attention on STR clause No. 1.2 of STR No. TI/STR/0028 Rev.1, which calls for experience of execution of three complete SCADA systems for reputed organizations to become eligible for getting RDSO	<p>Not accepted,</p> <ol style="list-style-type: none"> 1. Existing para is appropriate. 2. Eligibility criteria for registration of new vendors for SCADA system is not the part of SCADA specification.

		<p>approval for SCADA. This clause is hindering entry of any new player in Railway and as a result till now, there are only two players, monopolizing the whole business. While studying the past data and governing specifications, we found some interesting facts which are narrated below :-</p> <ol style="list-style-type: none">1. Till Year 2006 RDSO was governing SCADA system as per Specification TI/RCC/SCADA/0986. In this specification, there was not any requirement of SCADA System experience for getting RDSO approval. The existing players, namely M/s Ashida, Mumbai and M/s Synergy, Faridabad got their names approved as per this specification in the year 2004.2. In 2006, RDSO changed Specification to TI/RCC/SCADA/0990 and there was hardly any difference in the two specifications namely TI/RCC/SCADA/0986 and 0990. At the same time STR No. TI/STR/0028 was introduced, and this STR was having clause no. 1.2 “ SCADA vendor should have commissioned at least three complete SCADA systems for reputed organization, like Indian Railway. SEBs, NTPC, ONGC, and other reputed Private and PSU Organization in last three financial years.” This clause of STR was introduced after approval of the existing two vendors by RDSO and did not allow any other vendor to get even eligible to get any SCADA business from Railways as late as till 2020 (since last 16 years).3. Indian Railways is depending only on these two vendors despite serious technical and quality issues of their supplies (even highlighted to Vigilance and PMO). Now through various resources Indian Railways has shown their deep interest to develop vendor in SCADA through floating Expression of Interest and advertisements in National News Papers.	
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5.3.8	RTU Architecture- Technical Details:	<p>SR Additional points: • Every TSS shall have a console facility (preferably laptops) to control their respective feeding zones by connecting the console in the RTU. This facility will be useful in case of emergency and there is communication issue from RCC. After getting permission from Sr.DEE/TRD, respective TPC can guide the PSI supervisor to control the section using the console. • RTU architecture should be “modular type” which has a</p>	<ol style="list-style-type: none"> 1. First point is not accepted as TSS is also equipped with control and relay panel. Any operation of field equipment during emergency can be done from control and relay panel. 2. Second point is not accepted as Modular type construction is already mentioned in para 5.2.3 of

		separate CPU module, and can have other modules like modem, DI cards, DO cards, AI cards, Catenary indication cards added, normally by plugging into a common "backplane" (a bit like a PC motherboard and plug in peripheral cards). All modules such as DI/DO/AI shall be communicated with CPU over I2C like fast communication protocols and each individual channel of each modules must be scanned at a minimum rate of every 1ms by CPU.	the specification.
5.3.8	RTU ARCHITECTURE- TECHNICAL DETAILS: Reset Switch Available	M/S SIEMENS Resetting can also be done externally through MCB/PB It is not recommended to have reset switch on RTU to avoid human error which can lead to accidently resetting of RTU.	Not accepted as justification given for providing MCB/PB externally is not correct. Human errors are possible whether reset switch provided on RTU or externally. The provision of reset switch on RTU is more practical.
5.3.8	RTU ARCHITECTURE- TECHNICAL DETAILS: Communication Ports -Min 1 nos. RS-232 Console Port, 2nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with Multi-Function Meters/Energy meter on MODBUS protocol. Min 2 nos. of Ethernet ports for communicating with the RCC as per IEC 60870-5-104 protocol.	M/S SIEMENS Min 2 nos. Serial Ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with Multi-Function Meters/Energy meter on MODBUS protocol. Min 2 nos. of Ethernet ports for communicating with the RCC as per IEC 60870-5-104 protocol. Any additional requirement of ports can be provided by add on communication module. Depending upon available protocols, ports can be used and can also accommodate the future requirement too by additional communication module and without change in RTU.	Not accepted as multiplexing of CPU RTU port may results slow rate of data transfer between communicable field IED s and RTU.
5.3.8	RTU ARCHITECTURE- TECHNICAL DETAILS: Analog input card : AI card to	M/S SIEMENS Accuracy should be 0.2% (or better) with Transducer and	Not accepted as accuracy of AI card should not be related on CT/PT

	be used for PT & CT inputs - Accuracy 0.1% (or better) of full scale.	0.6% (or better) without external transducer for CT & PT. Accuracy of AI card will be in line with CT/PT accuracy class and proposed accuracy is well suitable for protection CT/PT class, where as for metering RTU will get the data from meters.	accuracy.
5.3.8	RTU ARCHITECTURE- TECHNICAL DETAILS RAM 128MB (Min) or as per design requirement Non-Volatile Memory 128 MB or as per design requirement	M/S APPSIL RTU ARCHITECTURE- TECHNICAL DETAILS RAM 128MB (Min) or as per design requirement higher than 128MB Non-Volatile Memory 2 GB or as per design requirement higher than 2 GB To ensure the minimum requirements are met by all the bidders, request you to update the same	Accepted as per justification given by the firm
5.3.8	Communication Ports (including redundancy requirement) -Min 1 nos. RS-232 Console Port, 6 nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol. Or Min 1 nos. RS-232 Console Port, 2-4 nos RS-485 ports for communication with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and 2	M/S APPSIL Communication Ports (including redundancy requirement) -Min 1 nos. RS-232 / USB Console Port, 6 nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol. Minimum 4 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol. Or Min 1 nos. RS-232 / USB Console Port, 2-4 nos RS-485 ports for communication with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and 2 numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for	1. In place of Min. 1 number RS-232 console Port, the minimum 1 number RS-232/USB Console port is accepted as per justification given by the firm. 2. Deletion of 2 numbers optical port is not accepted as communication equipment provided at OFC hut. S&T department provides Ethernet or optical interface for RTU.

	<p>numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol.</p> <p>Or</p> <p>Min 1 nos. RS-232 Console Port, 4 nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and and 2 numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol.</p>	<p>communicating with the RCC as per IEC 60870-5-104 protocol.</p> <p>Or</p> <p>Min 1 nos. RS-232 / USB Console Port, 4 nos RS-485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-Function Meters/Energy meter on MODBUS protocol and and 2 numbers Ethernet port for communication with numerical relays on IEC 61850 protocol. Minimum 2 nos. of Ethernet ports and 2 nos. optical port for communicating with the RCC as per IEC 60870-5-104 protocol.</p> <p>- All the modern RTUs supports for USB or any ethernet interface for console port locally, request to include the same.</p> <p>- Since the RTUs will be interfaced to RCC via communication equipment, no FO ports are not required in RTU. FO ports are generally used for long distance communication, here the RTUs and communication equipment will be mounted in same control room.</p> <p>Request your acceptance for the changes</p>	
5.3.8	Operating System, firmware Real-time (RTOS) or embedded Linux	<p>M/S APPSIL</p> <p>Operating System, firmware Real-time (RTOS) or embedded Linux or others meeting RTU functional requirements</p> <p>Request your acceptance alternate OS in RTU</p>	Accepted
5.3.8	Protection Voltage surge protection per channel	<p>M/S APPSIL</p> <p>Protection Voltage surge protection per channel (inbuilt / external)</p>	Accepted as per justification given by the firm.

		To have flexibility with compact design, request you to include the options in specificaiton	
5.3.8	Digital Input Card LEDs ON/OFF and LEDs per channel & power	M/S APPSIL Digital Input Card LEDs ON/OFF and LEDs per channel & power / healthiness of the module Power LED is available in Power Supply Module for monitoirng overall power supply to RTU. Hence power monitoing LED is not required for each DI card. However it is mandatory to have healthiness monitoing LED in each DI card, request you to include the same.	Accepted as per justification given by the firm
5.3.8	Digital Output Card- LEDs ON/OFF LEDs per channel & Power or suitable diagnostic tools shall be implemented in SCADA software and RTU to check the healthiness of each channel whenever required.	M/S APPSIL Digital Output Card- LEDs ON/OFF LEDs per channel & Power or suitable diagnostic tools shall be implemented in SCADA software and RTU software tool to check the healthiness of each channel whenever required Shall be part of RTU diagnostic tool	Accepted as per justification given by the firm
5.3.8	Pulse Durations: 100-2500ms, latched outputs	M/APPSIL Pulse Durations: 100-2500ms, latched outputs Pulse Duration 10 ms will not provide reliable data as per actual funtional requirement hence we request RDSO to consider pulse duration from 100ms to 2500ms to ensure reliable data capature.	Already implemented in the earlier draft uploaded on RDSO website.
5.3.8	Analog input card AI card to be used for PT & CT inputs.	M/S APPSIL Analog input card AI card to be used for PT & CT inputs (with suitable transducer).	Accepted as per justification given by the firm.

		As per the specification clause 5.5.2, Transducer to be included for CT/VT interface, request you to include the same.	
5.3.8	Analog input card LEDs ON/OFF LEDs per channel & Power	M/S APPSIL Analog input card LEDs ON/OFF LEDs per channel & Power / healthiness of the module Power LED is available in PSM for monitoirng overall power supply to RTU. Hence power monitoing LED is not required for each AI card. However it is mandatory to have healthiness monitoing LED in each AI card, request you to include the same.	Accepted as per justification given by the firm.
5.5.8	Cyber Security · RTU shall communicate with whitelisted SCADA servers only. Requests from unauthorized locations shall be rejected and logged by the RTU. · All connections requested received by the RTU shall be logged in the RTU audit log, including connection acceptance and rejection. · Configuration changes made to RTU shall be logged in the RTU audit log. · Access to RTU via its configuration software shall be protected using username/password combination. Facility to have multiple users with different access rights shall be possible.	M/S APPSIL Cyber Security - RTU shall communicate with whitelisted SCADA servers only. Requests from unauthorized locations shall be rejected and logged by the RTU. - All connections requested received by the RTU shall be logged in the RTU audit log, including connection acceptance and rejection. - Configuration changes made to RTU shall be logged in the RTU audit log. - Access to RTU via its configuration software shall be protected using username/password combination. Facility to have multiple users with different access rights shall be possible. - Access to RTU via its configuration software shall be reported on SCADA as an event. - It shall be possible to enforce configuration software	Not accepted as changes required in the para is not mentioned.

	<ul style="list-style-type: none"> · Access to RTU via its configuration software shall be reported on SCADA as an event. · It shall be possible to enforce configuration software access, only after appropriate access from SCADA software. · RTU shall prevent execution of unauthorized third-party applications. 	<p>access, only after appropriate access from SCADA software.</p> <p>- RTU shall prevent execution of unauthorized third-party applications.</p> <p>We request you to modify this clause considering relevant IEC standard and NERC recommendation.</p>	
5.3.9	Automatic opening of Paralleling BMs on CB Tripping (new clause)	<p>M/S SYNERGY</p> <p>When a CB trips, fault current travels through multiple paths since paralleling BMs are usually kept closed. This causes inaccurate data of fault current in Protection Relay. On tripping of Feeder CB, TSS RTUs should be able to give command to other RTUs to open their paralleling BMs fed through the tripped FCB within a short time span of less than a second so that on next operation of Auto-recloser (after 1 second), fault current shall travel through a singular path and give accurate data to the protection relay regarding fault current/location of fault.</p>	Not accepted as auto reclosing time is 0.5 second. Opening of paralleling BMs through SCADA may not achieve before the autoreclosing of FCB. There is also a probability of communication failure of some post.
5.3.8	CPU - Communication Ports	<p>M/S SYNERGY</p> <p>To avoid issues during drafting of tender/supply of items, it is recommended to fix the port requirements in the specification itself. This will also allow easy adaptation of the RTU in case CRP is changed, without having to change the RTU modules. Following is the recommended specification –</p> <ul style="list-style-type: none"> • 4 nos RS232/RS485 ports for communication with Numerical Protection Relays on IEC 60870-5-103 protocol & with NIFPS, Multi-Function Meters/ABT meter on MODBUS and DLMS protocol • 2 numbers Ethernet port for communication with 	Accepted, the option of IEC 60870-5-103 or IEC 61850 protocol has been deleted. Same RTU must be supported IEC 60870-5-103, IEC 61850, MODBUS protocol for communication with IEDs to enables same RTU interfaced with IEC 60870-5-103, IEC 61850, MODBUS protocol compliant IEDs.

		numerical relays on IEC 61850 protocol. • 2 nos. of Copper Ethernet port for communicating with the RCC as per IEC 60870-5-104 protocol. • The above ports shall be provided such that all ports can be used simultaneously using independent communication parameters (baud rate etc.) and communication protocols. • All ports shall be isolated and surge-protected as per IEC 61850-3 standard. • A layer-2 managed Ethernet switch shall be provided with minimum 4 Nos. copper ports and 2 Nos. optical ports. Optical port shall be compatible to 100BaseFX (single-mode fiber) specification. • Ethernet switch shall be compliant to IEC61850-3. • Ethernet switch shall be mountable within RTU rack/on DIN RAIL/on 19" rack.	
5.3.8	CPU - Interchangeability	M/S SYNERGY This clause shall be made applicable to all RTU modules, i.e., CPU, Power Supply, DI, DO, AI, and any other module required for functioning of the RTU.	Accepted as it provides more flexibility to user. A new para-5.3.15 is added in the final draft specification.
5.3.8	Analog Input - AI card to be used for PT & CT inputs.	M/S SYNERGY CT input is not applicable, as the same is achieved through multi-function transducer / energy meter.	Not accepted as AI card can also be used for current measurands.
5.3.8	Analog Input – A/D Converter	M/S SYNERGY The analog input shall support measuring of PT voltages up to 110% of nominal value without loss in accuracy. A 16-bit A/D converter should be used.	Accepted
New Clause before 5.3.9	The RTU address shall be configurable. The RTU address should not be lost in case of power swings or surges. It shall be possible for the purchaser to reconfigure the address for the remote station. (The manufacturer shall train	M/S SYNERGY All I/O modules of the RTU shall be hot-swappable, to allow ease of maintenance, troubleshooting, and reduce the need for shutting down the entire RTU during such activities.	Accepted as this feature facilitates card replacement without shutting down the RTU.

	the purchaser in the setting, configuring of the RTU's.)		
New clause before 5.3.10	Time accuracy of RTU time stamp shall be 1ms. A separate test to certify this would be specified.	M/S SYNERGY It shall be possible to configure and record selected set of analog parameters at a resolution of 1 second. This function once enabled shall function continuously, and provide automatic retrieval at RCC of the recorded data. The data transfer can take place in buffered fashion, such that normal functions are not affected.	Accepted
5.4.2	The failure of PSU may lead to total shut down of the RTU hence the design and selection of components for PSU shall be such as to achieve zero failure under extreme service conditions. In no case the required output voltage level of PSU should drop below designed value while taking on load. Overloading by any module due to its internal failure should not cause the total failure of PSU.	M/S SYNERGY Add the following – It shall be possible to isolate/switch-off one unit of the redundant PSU set without removing any connections. This shall enable testing/troubleshooting of faulty unit within a PSU set. Power Supply Unit should be hot-swappable so that replacement of any one unit does not cause shutdown of the RTU. Power supply failure indication from each of the redundant power supply units should be reported to RCC.	Accepted as this feature enable to change any one power supply without shutdown complete RTU.
5.5.2	The independent Transducers/Multi-Function Transducers (MFT) required for acquiring Analog inputs from CT/PT shall also be supplied by the manufacturer	M/s ASHIDA The independent Transducers/Multi-Function Transducers (MFT/MFM) required for acquiring Analog inputs from CT/PT shall also be supplied by the manufacturer	Accepted as multifunction meter can also be used.
5.5.6	ii. In signalling line surge protection device of class D type shall be provided as per IEC61643-11 & VDE 0675 Pt 6.	M/S SYNERGY Since the communication equipment is being provided by S&T wing, therefore first line of protection in signal line against surge should be provided by S&T wing. The relevant standards now applicable for the same are IEC61643-21 instead of IEC61643-11. VDE 0675 Pt 6 is	Not accepted as surge protection shall be provided in RTU also. IEC 61643-11 has been replaced by IEC 61643-21.. The german standard VDE 0675 Pt 6 has been removed from the specification as per

		just a German version of IEC61643-11 and therefore can be removed. (Secondary protection against surges is provided in the CPU and already specified in type tests as well)	justification given by the firm. Protection against surge is not defined under type tests, type test only specify test parameters.
5.5.6 (ii)	In signaling line surge protection device of class D type shall be provided as per IEC 61643-11 IEC 61643-21 & VDE 0675 Pt 6.	SR In signaling line, surge protection device of class D IPM (Integrated protection module) type shall be provided as per IEC 61643-11 IEC 61643-21 & VDE 0675 Pt 6.	Not accepted as basic requirement is to provide surge protection. Implementation technique of surge protection is the view of particular manufacturer.
5.5.7	The RTUs should be capable of integrating anemometer & telesignaling from anemometer should be available on workstations (MMI)".	M/s ASHIDA The RTUs should be capable of integrating anemometer on MODBUS RTU rs485 OR 4- 20mA interface & telesignaling from anemometer should be available on workstations (MMI).	Accepted
		M/S SYNERGY Amend as follows – The RTUs should be capable of integrating anemometer (4-20mA output)/MODBUS connection & telesignaling from anemometer should be available on workstations (MMI). Anemometer shall be installed and wired to the RTU by the Purchaser. The requirement for this interface shall be clearly mentioned in the tender by the Purchaser.	Accepted to clarify anemometer under whom scope and type of interface required with anemometer for interfacing with RTU.
5.5.9	SCADA software shall monitor the telecom equipment and accordingly compute the telecom channel daily availability figures, as well as availability figures of each equipment such as RTU, Switch, Router, Firewall wherever applicable	M/s ASHIDA SCADA software shall monitor the telecom equipment and accordingly compute the telecom channel daily availability figures, as well as availability figures of each equipment such as RTU, Switch, Router, Firewall wherever applicable As major telecom equipment's are under S&T scope, monitoring in SCADA may not be feasible.	Accepted as telecom equipments are under S&T scope.
5.5.9	• RTU shall calculate the transformer	M/S SYNERGY	Accepted being the additional

	<p>on-load operating hours and report the same to SCADA. Alarm generation on exceeding a preset limit shall be possible to inform the TPC on need for maintenance or transfer of load to standby transformer. • CB operation counter shall be maintained by the RTU, and reported to SCADA. Alarm generation on exceeding a preset limit shall be possible to inform the TPC on need for maintenance. • SCADA software shall monitor the telecom equipment and accordingly compute the telecom channel daily availability figures, as well as availability figures of each equipment such as RTU, Switch, Router, Firewall wherever applicable.</p>	<p>Add the following – RTU shall support pass-through feature to allow on-demand access to the relays connected to it directly from RCC. This facility shall be enabled/disabled through a SCADA command, which shall be allowed to be issued by administrative user only</p>	<p>feature which permits direct access of relays from RCC.</p>
6.1.1	<p>The SCADA equipment shall be designed for the following typical capacity of telecommands, telesignals and telemetered parameters for a TSS, SSP, SP and ATP of double line section. The figures given below may vary depending on the layout of TSS, SP, SSP& ATP in a particular section, which could have single, three or more tracks, the details of which will be given by the purchaser in the tender document. The RTU shall be wired and ready for use as per the input/output list specified in the project or specified below. The RTU</p>	<p>M/S SYNERGY The minimum I/O capacity of 2x25kV RTUs to be rechecked. As per our experience, there is need for more I/O. Further, it is recommended that other signals which are typically not monitored be also included, so that remote monitoring in unmanned conditions can be performed fully.</p>	<p>Rechecked and DI from relay for 2x25 kv TSS increased to 800 instead of 500.</p>

	panel shall be complete with relays, contactors, transducers etc. for the quantities as indicated in a contract. Alarms/status to be monitored in SCADA, marking each alarm as being applicable to 25kV or 2x25kV or Sub-urban as per DI/DO/AI requirements		
6.1.1	Telecommands (DO)*- From Relays/MFT (32)	M/S APPSIL Telecommands (DO)*- From Relays/MFT (32) All the command interface will be done through RTU hardwired only, hence DO is applicable for relays / MFT. Kindly remove the same	Not accepted as DO is also required for relay reset and also for future use.
6.1.1.1	There shall be provision of spare AI, DI and DO cards/modules in RTU. 10% spares may be kept at RCC apart from (instead of) providing spare AI/DI/DO cards in the RTU since it is practically not possible to ensure healthiness of so many cards over a long period.	M/S SYNERGY To ensure interchangeability across RTU types, all RTUs should have the same type of modules. Hence, the channel count / module should remain same across TSS/SP/SSP/ATP. Otherwise, clause 6.1.3 will be defeated. Let wired spares be part of I/O count mentioned in clause 6.1.1 so as to remove any confusion. Also, clause 6.1.2 can then be removed	Not accepted as existing para is appropriate.
6.1.3	The basic design of TSS, SSP, SP& ATP RTUs shall be identical for the purpose of interchangeability and standardisation. Actual DI/DO/AI shall be provided & configured as per requirements.	M/S APPSIL The basic design of TSS, SSP, SP& ATP RTUs shall be identical for the purpose of interchangeability and standardisation of CPU. Actual DI/DO/AI shall be provided & configured as per requirements. Only CPU shall be interchangeable with any RTU, Complete RTU with panel interchangeability is not	It has already mentioned, RTU shall be interchangeable and actual DI/DO/AI shall be provided and configured as per requirement.

		required as the no. of DI/DO/AI varies based on the actual requirement. Kindly confirm if our understanding is correct.	
6.4	Some of the tele signals (alarms / status inputs) have been discussed below for vendor's clarity.	SR Additional point: Tele signal (Alarm) for monitoring healthiness of AT at SSP/SP/TSS on MIMIC can be provided.	The tele signalling for failure of 240V AC supply is already mentioned at para 6.4.2 of draft specification.
6.4.4	Failure of individual fuse of above PTs shall be monitored by the RTU. If associated relay has not the facility of PT Fuse fail output then "PT fuse fail" indication shall be generated through rectifier and novolt relays	M/S SYNERGY Normally, this signal is to be captured through protection relay. If the same is not available in relay, then hardwired signal is being recommended. Necessary auxiliary contacts suitably wired up and terminated on the control and relay or terminal board at traction post shall be provided by the Purchaser.	Not accepted as existing para is appropriate.
6.4.10	Necessary hardwiring between RTD interface device and RTU shall be in the scope of SCADA manufacturer. The SCADA should be able to communicate with the RTD interface device through RS 485 over IEC 60870-5-103 provided on the transformer for above mentioned parameters.	M/S SYNERGY It is more common to find RTD transducers with Modbus output on RS485. Hence, replace IEC 60870-5-103 with Modbus RTU protocol.	Accepted, MODBUS protocol has also included in the para.
6.4.11	Telesignalling of fire protection, NIFPS and power quality compensating equipment	M/s ASHIDA Telesignalling of fire protection, NIFPS and power quality compensating equipment. (Modbus register address for NIFPS shall be furnished by purchaser)	Accepted as register address is required for point address mapping in SCADA. The existing para may be corrected as "RTU shall be capable for interfacing NIFPS, Anemometer, battery charger, power quality compensating equipment etc. through RS 485 over IEC 60870-5-103 or MODBUS protocol / IEC 61850 protocol through Ethernet port
		M/S SYNERGY The interface with these equipment shall be on Modbus RTU / IEC60870-5-103 protocol on RS485 bus.	

			for tele signalling of different alarm/parameters to RCC. Modbus register address/IEC 60870-5-103 point address mapping of these equipment shall be furnish by purchaser.”
7.1.1	For any manufacturer developing first SCADA system as per this specification, RDSO shall conduct all the tests stipulated in clause Nos.7.2.1 to 7.2.3.	M/S SYNERGY In case a vendor already has type test reports not older than 3 years for the approved RTU design, then the vendor should be exempt from conducting type tests again.	Not accepted as any changes in RTU design needs type test again to confirm design parameters.
7.2.5.5	RDSO shall also witness the erection & commissioning tests for first system developed as per this specification	M/s ASHIDA RDSO shall also witness the erection & commissioning tests for first system developed as per this specification This point should be removed, as RDSO would be monitoring detailed prototype testing.	Accepted
7.2	Environment and EMI test on RTU: Test No-A8 : AC Ripple in dc supply as per 60870-2-1 Table 8. $\leq 5\%$ of nominal DC Voltage	M/S SIEMENS Testing done as per the IEC61000-4-17 whereas the product standard followed is IEC61850-3 ED.2 Table : 10% of Un Offered Sicam A8 sereis RTUs are being supplied and commissioned for substation automation across all voltage levels and in all countires. These RTUs are developed and tested complying to all required IEC standards.	Accepted as this is the correct IEC reference.
7.2	Environment and EMI test on RTU: Test No-B9 : Power Frequency Voltage with stand Test as per IEC 60870-2-1. 2kVrms for 1 minute	M/S SIEMENS The Power frequency voltage withstand test is identical to the High Voltage withstand test / Dielectric Insulation Test. The insulation test is conducted as per IEC61010-1.	Not accepted as this is not terms as comment.

		Offered Sicam A8 sereis RTUs are being supplied and commissioned for substation automation across all voltage levels and in all countires. These RTUs are developed and tested complying to all required IEC standards.	
7.2	Environment and EMI test on RTU:Test No-C15 : Vibration test with severity of weight centered endurance by sweep frequency 10 Hz-150 Hz, displacement of 0.15 mm acceleration of 2 g and of duration of 2 Hours in each axis. (Total 6 Hours).	<p>M/S SIEMENS</p> <p>Testing done as per the IEC 60068-2-6 with following results</p> <p>Type of Vibration : Sine Sweep</p> <p>Axis : X , Y , Z-axes</p> <p>Frequency range: 10 - 150 Hz</p> <p>Displacement: >0,075mm (0,2 g between 10 – 26 Hz)</p> <p>Displacement: 0,075mm (26 – 60 Hz)</p> <p>Acceleration: 1,09 g (60 – 150 Hz)</p> <p>Sweep rate: 1 Oct. /Min.</p> <p>Duration: 10 Cycles</p> <p>Test in 3 axes</p> <p>Offered Sicam A8 sereis RTUs are being supplied and commissioned for substation automation across all voltage levels and in all countires. These RTUs are developed and tested complying to all required IEC standards.</p>	Not accepted as this is not terms as comment.
7.2 (a)	Vendor shall also submit the necessary test certificates issued from reputed testing agencies for IEC 60870-5- 104, IEC 61850, IEC 60870-5- 103 & MODBUS as applicable	<p>M/s ASHIDA</p> <p>Vendor shall also submit the necessary test certificates issued from reputed testing agencies for IEC 60870-5-104, IEC 61850, IEC 60870-5-103 & MODBUS as applicable Testing of IEC 60870-5-104, IEC 61850, IEC 60870-5-103 & MODBUS as applicable would be witnessed by RDSO.</p> <p>There is no Indian lab which tests all these protocols.</p>	Comment may be accepted as per justification given by the firm.

7.2 (a)	Communication Protocol Testing	M/S SYNERGY Test certificates of DNV GL (Formerly KEMA) should be provided for IEC 60870- 5-104 (RTU & SCADA Software), IEC 61850 (RTU) protocols.	Not accepted as test report from any reputed agency is acceptable.		
	Communication Protocol testing: All the important services as...	SR Maximum time required by server to complete scanning of 100 RTUs (or when Maximum possible number of RTUs connected to server) may be mentioned.	Not acceptable		
7.2 (b)1	Environment and EMI test on RTU	M/S SYNERGY Please refer to Annexure-A of this document for revised table which mentions test methods, and correct test parameters also. Linking cold test to altitude alone is not recommended. It should be related with ambient temperature conditions in the geographical area where SCADA system is to be installed. We recommend the following: For regions such as Shimla and Srinagar, minimum temperature of -10 Deg C may be considered and therefore an RTU which is type tested for dry heat of 70 Deg C, Cold Test of -10 Deg C may be uniformly considered for all regions	Not accepted as minimum temperature at high altitude may fall below -10 Deg. C.		
7.2 b	b) RTU functionality Test: Environment and EMI test on RTU 1. The following tests shall be conducted on the RTU sub assemblies (cards/modules). A. EMI/EMC IMMUNITY TESTS FOR RTU	M/S APPSIL b) RTU functionality Test: Environment and EMI test on RTU 1. The following tests shall be conducted on the RTU sub assemblies (cards/modules). A. EMI/EMC IMMUNITY TESTS FOR RTU Request RDSO to specify the requirement which are acceptable universally and complied by majority of the vendors.	Not accepted as RTU located in close proximity of MV and HV open air and GIS or vacuum switchgear, cables with direct connection to HV equipment to meet level-4 as per IEC 60870-2-1.		
	2. Electrical Fast Transient Burst Test as per IEC 60870-2-1	ON	Level 3 4	4 2 - 12 kV	A

		<table border="1"> <tr> <td>2.</td> <td>Electrical Fast Transient Burst Test as per IEC 60870-2-1</td> <td>ON</td> <td>Level 3</td> <td>2 kV</td> <td>-</td> <td>1 kV</td> <td>A</td> </tr> </table>	2.	Electrical Fast Transient Burst Test as per IEC 60870-2-1	ON	Level 3	2 kV	-	1 kV	A	
2.	Electrical Fast Transient Burst Test as per IEC 60870-2-1	ON	Level 3	2 kV	-	1 kV	A				
7.2	<p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>9. For voltage dips and interruption as per IEC61000-4-29</p>	<p>M/S APPSIL</p> <p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>9. For voltage dips and interruption as per IEC61000-4-29</p> <p>Request RDSO to specify the requirement which are acceptable universally and complied by majority of the vendors.</p> <p>Since these are new requirement, HAPG shall revert on the same</p>	<p>Accepted and requirement specified in the specification.</p>								
7.2	<p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>10. Conducted Emission tests as per CISPR22 Class A on power lines, communication ports</p>	<p>M/S APPSIL</p> <p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>10. Conducted Emission tests as per CISPR22 Class A on power lines, communication ports</p> <p>Request RDSO to specify the requirement which are acceptable universally and complied by all of the vendors.</p> <p>Since these are new requirement, HAPG shall revert on the same</p>	<p>This clause has been deleted as this test is not essential.</p>								
7.2	<p>b) RTU functionality Test:</p>	<p>M/S APPSIL</p>	<p>This clause has deleted as this test is</p>								

	<p>Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>11. Radiated emission tests as per CISPR22 Class A</p>	<p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>11. Radiated emission tests as per CISPR22 Class A</p> <p>Request RDSO to specify the requirement which are acceptable universally and complied by all of the vendors.</p> <p>Since these are new requirement, HAPG shall revert on the same</p>	not essential.
7.2	<p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>C ENVIRONMENTAL TEST FOR RTU</p> <p>15. Dry heat as per IEC 60068-2-2: Continuous operation at 70 DegC for for 96 Hours.</p>	<p>M/S APPSIL</p> <p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p> <p>15. Dry heat as per IEC 60068-2-2: Continuous operation at 55 DegC for for 16 Hours.</p> <p>Request RDSO to specify the requirement which are acceptable universally and complied by all the vendors. We believe 96 hours is a typo error and all these equipments are mounted a shaded location and 55 Deg C will meet the operational requirement. Request you to accept the same.</p>	Not accepted, existing description is correct.
7.2	<p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>C ENVIRONMENTAL TEST FOR RTU</p>	<p>M/S APPSIL</p> <p>b) RTU functionality Test: Environment and EMI test on RTU</p> <p>1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).</p> <p>A. EMI/EMC IMMUNITY TESTS FOR RTU</p>	Not accepted, existing description is correct.

	16. at 40 DegC and 95 % RH in operational condition for 12 Hours	16. at 40 DegC and 95 % RH in operational condition for 16 Hours Request RDSO to specify the requirement which are acceptable universally and complied by all of the vendors.	
7.2	b) RTU functionality Test: Environment and EMI test on RTU 1. The following tests shall be conducted on the RTU sub assemblies (cards/modules). C ENVIRONMENTAL TEST FOR RTU 17. *Cold test as per IEC 60068-2-1; 0 DegC -20 DegC -10DegC operational condition for 16 Hours.	M/S APPSIL b) RTU functionality Test: Environment and EMI test on RTU 1. The following tests shall be conducted on the RTU sub assemblies (cards/modules). C ENVIRONMENTAL TEST FOR RTU 17. *Cold test as per IEC 60068-2-1; 0 DegC -20 DegC - 10DegC -40DegC operational condition for 16 Hours. Request RDSO to specify the requirement which are acceptable universally and complied by all of the vendors.	Not accepted, existing description is correct.
7.2	b) RTU functionality Test: Environment and EMI test on RTU 1. The following tests shall be conducted on the RTU sub assemblies (cards/modules). C ENVIRONMENTAL TEST FOR RTU 18. * Damp heat test Cyclic as per IEC 60068-2-30; At high temperature at 50Degc and low temperature at 0DegC -10DegC; Dwell time in high or low temperature for 3 Hours. Transition of 1Degc per minute, and for 5 such cycles in operational condition.	M/S APPSIL b) RTU functionality Test: Environment and EMI test on RTU 1. The following tests shall be conducted on the RTU sub assemblies (cards/modules). C ENVIRONMENTAL TEST FOR RTU 18. * Damp heat test Cyclic as per IEC 60068-2-30; At high temperature at +55DegC and low temperature at 0DegC +20DegC , Dwell time in high or low temperature for 3 Hours. Transition of 1Degc per minute, and for 5 such cycles in operational condition. Request RDSO to specify the requirement which are acceptable universally and complied by all of the vendors.	Accepted as IEC 60068-2-30 specify lower and higher temp. 25 and 55 deg. C respectively.

8.3.1	In order to give proper maintenance support, AMC for a period of Seven years (excluding warranty period of three years) shall be part of the contract.	M/S SYNERGY We strongly recommend 4 years AMC.	Not accepted as no justification given for 4 years AMC.
8.3.1.1	2.Low maintenance lead acid Batteries	M/s ASHIDA 2. Low maintenance lead acid VRLA Batteries	Accepted as VRLA batteries are specified for RCC in the specification.
8.3.1.2	In addition to above 10% of the total holding of the different types of cards/modules of RTU (e.g. DI, DO, CPU, AI, PSU, Routers, LAN extenders etc.) shall be handed over to the purchaser after 7 years or completion of the AMC period for using as spares for remaining life of the SCADA system. Purchaser shall define the detailed scope of AMC.	M/S SYNERGY It should be made clear whether the 10% spares mentioned in 6.1.1.1. can be used by vendor during warranty/AMC and whether it is the same 10% spares to be handed over to Railway after completion of warranty. There has been confusion in the past as to when (at what stage) the spares are to be supplied. This may please also be clarified.	Existing clause is appropriate, 10 % spare of total holding of the different type cards shall be handed over to purchaser after completion AMC period.
8.3.1.3	The SCADA manufacturer shall include these aspects while quoting prices for 04 years AMC	M/s ASHIDA The SCADA manufacturer shall include these aspects while quoting prices for 04 07 years AMC	Accepted as AMC period of SCADA specified 07 years in the specification.
8.2	LAN Tester	M/s ASHIDA Quantity not mentioned	Accepted and Quantity has been specified in the specification.
8.2	Tools and Plants/Testing Instruments for System Maintenance: LAN Tester	SR LAN Tester shall be of reputed make(like Fluke etc). Additional T&P required. 1) LAN Power/Band width tester, 2) Earth tester 3) portable vacuum Cleaner 4)RJ 45 crimping tool 5) Pin type crimping tool.	Additional T&P is not accepted as railway can procure these T&P separately as per their requirement.
8.3.1	Annual Maintenance Contract:	M/S APPSIL Annual Maintenance Contract: We request you to elaborate further in detail AMC requirements as this being long term contract may involve further involvement of upgradation of server OS	Not accepted as detail scope of AMC can not be elaborated in the specification. Purchaser shall define detailed scope of the AMC.

		along with application software. OS support from Microsoft will also have life cycle hence long term AMC clause need to be re-discussed and to be re-drafted as per actual functional requirements.	
8.3.1.1	Battery	SR It is to be mentioned as VRLA (Valve Regulated Lead Acid) battery instead of Low Maintenance Lead Acid battery.	Accepted
9.4	Minimum Requirements of Smart Energy Meter (MODBUS): • Accuracy Class – 0.2S • 1 no. RS485 port to communicate with RTU • Voltage • Current • MW • MVAR • MVA • PF • Frequency • Energy Import Energy Export • Maximum Demand	M/s ASHIDA Minimum Requirements of Smart Energy Meter (MODBUS): • Accuracy Class – 0.2S • 1 no. RS485 port to communicate with RTU • Voltage • Current • MW • MVAR • MVA • PF • Frequency • Energy Import Energy Export • Maximum Demand Only one energy counter is sufficient for Railway application. MD value as reported by meter is different from the one expected by Railways, hence it is to be calculated in RTU	Not accepted as energy import, energy export, maximum demand are the feature of smart energy meter. These parameters is required to be transfer to RCC.
9.8	Real-time acquisition & viewing of the following parameters.... Energy Meter installed on HV/LV side of the TSS.....	SR Additional Points: Based on user configurable, start time for each TSS and interval (15 minutes/30 minutes), the block wise demand shall be calculated in RTU. The same shall be plotted real-time in a graphical form and to be shown in tabular form.	Accepted
9.9	11. Apart from above, any other report / statistics required by the railways	M/s ASHIDA 11. Apart from above, any other report / statistics required by the railways Reports are already standardised by RDSO	Not accepted as any additional report may be required in future shall be generated from SCADA.
9.9	9.9 The EMS software shall be provide the following– 14. Incorporation of power purchase	M/S APPSIL 9.9 The EMS software shall be provide the following– 14. Incorporation of power purchase agreements for	Not accepted as SCADA and EMS servers are not the separate requirement. Vendor evaluation

	<p>agreements for scheduling of demand as per available declared capacities of generators.</p> <p>15. Optimal scheduling of power</p> <p>16. Import/Export of approved schedules as per LDC.</p> <p>19. DSM charges estimation</p>	<p>scheduling of demand as per available declared capacities of generators.</p> <p>15. Optimal scheduling of power</p> <p>16. Import/Export of approved schedules as per LDC.</p> <p>19. DSM charges estimation</p> <p>SCADA server and EMS servers are two separate requirements hence we request RDSO to keep this separate requirement for vendor evaluation. We propose for face to face meeting for discussion on RDSO Technical Specification actual functional requirement to suggest improvement in enclosed clause.</p>	<p>shall be done for complete SCADA system.</p>
9.9	Dashboards	<p>M/S SYNERGY</p> <p>The EMS software should provide facility to create different dashboards to view various energy parameters. The dashboard editor should allow displaying values either in numeric form, tabular, pie-chart, trend, bar chart etc. as per the requirement. Flexibility should be provided to display all or selected EMS parameters acquired by the system. Calculations on displayed parameters should also be possible through the dashboard editor.</p>	<p>Accepted as it provides better visualization of different energy parameter on EMS work station.</p>
9.9 (21)	Facility to exchange data with EMS of other divisions or zonal centers.	<p>M/s ASHIDA</p> <p>Facility to exchange view data of with EMS of from other divisions or zonal centres.</p> <p>Scope needs to be clear. It is recommended to give view-only access from divisional or zonal centres</p>	<p>Accepted</p>
9.11	All values are to be logged at 30 second interval	<p>M/s ASHIDA</p> <p>All values are to be logged at 30 second interval</p> <p>Conflicts with Integration period is already mentioned as 15 min configurable</p>	<p>Accepted as per justification of the firm</p>
Anx.4	Point address mapping: Panto flashover	SR	<p>Already added in annexure-4</p>

	relay	Point address mapping following also shall be added 1. LBB protection 2. ARB protection	
Additional points:		<p>SR</p> <ul style="list-style-type: none"> • Layout plan for TPC boards and Server Rooms, Battery rooms and UPS rooms shall be provided in the specification. • DTMF equipment which is available with TPC is of old concept with 4 wire communication. It can be replaced with IP based DTMF phones 	<p>Not accepted,</p> <ol style="list-style-type: none"> 1. Layout plan can not be included in the specification as RCC room is not of a standard size. Zonal railway can be decided RCC layout as per space available for RCC. 2. DTMF equipment is within the scope of S&T department. This is not the part of SCADA specification.
	New Clauses	<p>M/S SIEMENS RTU Shall support the parameter storage and shall be provided on a flash memory card.</p> <p>By this means it shall be possible to replace components without parameter and/or firmware loading via PC's.</p>	<p>Not accepted as para 5.3 of the SCADA specification described functional requirement of RTU. The existing description of RTU functional requirement is appropriate.</p>
		<p>M/S SIEMENS RTU shall have Integrated crypto chip and IPSec encryption to fulfill the high cyber security requirements as per BDEW White paper standards, IEEE 1686 and https protocol that ensures secure transmission of sensitive data. To prevent from any cyber attack.</p>	<p>Not accepted as requirement of cyber security is already explained at para 5.5.8 of the SCADA specification.</p>
		<p>M/S SIEMENS The IED under the RTU could be directly accessed from the Engineering PC in the Control Center in a different network. Normally the IEDs are integrated into the system through</p>	<p>Accepted.</p>

		<p>the RTUs, This means, there is no direct connection between the Control Center and the IEDs.</p> <p>Therefore, it is not possible for the customer to get direct access to the IEDs from an engineering station in the control center.</p>	
		<p>M/S SIEMENS</p> <p>RTU shall support RBAC (role based access control) according to IEC 62351-8, BDEW-Whitepaper and IEEE 1686.</p> <p>To prevent from any cyber attack.</p>	<p>Cyber security is already explained at para 5.5.8 of the SCADA specification. IEC 62351 added in the para 5.5.8.</p>
		<p>M/S SIEMENS</p> <p>RTU shall have Password protected access so to ensure that only authorized persons can access the system.</p> <p>To prevent from any unathorised access.</p>	<p>Refer 5.5.8 of the SCADA specification, password protection is already specified.</p>
		<p>M/S SIEMENS</p> <p>RTU shall have integrated firewall for separation of TCP/IP networks, firmware signature for protection against firmware manipulation, security logbook supported by non-volatile storage of system events and RBAC in accordance with IEC 62351-8 which ensures that users may exercise only the rights that correspond to their assigned role</p> <p>Hardware-based firewall by which the connection with the SCADA via IEC104 can be completelly separated from the rest of the network.</p>	<p>Not accepted.</p>
		<p>M/S SIEMENS</p> <p>The RTU shall utilize different media for local and remote communication. The consequent use of IEC standards must guarantee consistent addressing from acquisition to output</p> <p>To avoid the dependency on media type.</p>	<p>Not accepted</p>

		<p>M/S SIEMENS The RTU must present an open, expandable and future-proof system, by taking into account latest standards, such as e.g. Flash card technology, integrated PLC functionality; modular system concept, etc.</p> <p>It shall be possible to replace components without parameter and/or firmware loading via PC's. By modular concept, easy to replace the faulty components only. PLC logic can also be adopted wherever needed.</p>	Refer para 5.2 of the specification where physical construction of RTU is specified.
		<p>M/S SIEMENS RTU Feature:- a) IEC 61850 Ed.1/Ed.2 Client & Server incl. GOOSE b) Mindconnect (IOT) & AMQP/MQTT (IOT) Future proof solution, data can be monitored on Cloud from Remote Control Center in future without change in any RTU hardware.</p>	Not accepted
		<p>M/S SIEMENS RTU shall also support periodic reporting of analog data and periodicity shall be configurable from 2 sec to 1 hour.</p>	Refer para 5.3.2 of SCADA specification where periodic reporting of analog data has already specified.
		<p>M/S SIEMENS RTU Shall support Time Sync support via communication protocol, IRIG-B or SNTP, IEC 1588 (PTP)</p>	Not accepted as time sync of RTU is already specified in the specification.
		<p>M/S SIEMENS The RTU shall have an internal clock with the stability of ± 3.5 ppm (-40°C to +70°C), ± 2 ppm (0°C to 40°C) or better</p>	Refer para 5.3.8 of SCADA specification where internal clock is specified.
		<p>M/S SIEMENS Remote monitoring via the integrated web-server to monitor all IO modules using a standard web browser</p>	Not accepted
		<p>M/S SIEMENS</p>	Refer para 5.4 of SCADA

		RTU shall support redundant power supply and PRP,HSR,RSTP network functionality	specification where redundant power supply is already specified.
		M/S SIEMENS RTU Shall support Different protocols on same interface shall be possible in RTU	Not accepted
		M/S SIEMENS RTU Shall support High EMC (electromagnetic compatibility) upto 5kV (IEC 60255)	Not accepted.
		M/S SIEMENS RTU Shall support Extended temperature range (-40°C to +70°C)	Not accepted.
		M/S SIEMENS RTU Data storage: The configuration of the RTU (firmware and parameters) shall stored centrally on an exchangeable, non-volatile storage card. Battery backup is not allowed.	Not accepted

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Environment and EMI test on RTU (mentioned in the draft specification)

1. The following tests shall be conducted on the RTU sub assemblies (cards/modules).

TEST No	DESCRIPTION OF THE TEST	EUT Status	Test Level	Power supply points		I/O Points	Passing Criteria
				CM	DM		
A.	EMI/EMC IMMUNITY TESTS FOR RTU			CM	DM	CM	
1.	Surge immunity test as per IEC 60870-2-1	ON	Level 3 4	4 ± 2 kV	±12 kV	4 ± 2 kV	A
2.	Electrical Fast Transient Burst Test as per IEC 60870-2-1	ON	Level 3 4	4 ± 2 kV	-	±12 kV	A
3.	Damped Oscillatory WAVE Test as per IEC 60870-2-1	ON	Level 3	2.5 kV	1 kV	2.5 kV	A
4.	Electrostatic Discharge test as per IEC 60870-2-1	ON	Level 3	+/- 6 kV in contact discharge mode or +/- 8 kV in air discharge mode			A
5.	Radiated Electromagnetic Field Test as per IEC 60870-2-1	ON	Level 3	10 V/m electric field strength			A
6.	Power Frequency Magnetic Field Test as per IEC 60870-2-1	ON	Level 3	30 A/m of magnetic field strength (continuous duration sine wave)			A
7.	Conducted Disturbance induced by Radio Frequency field as per IEC 61000-4-6:1996	ON	Level 3	10V, 150 KHz to 80 MHz			A
8.	AC Ripple in dc supply as per 60870-2-1 Table 8	ON	VR3	≤ 5% of nominal DC Voltage			0
9.	For voltage dips and interruption as per IEC61000-4-29	ON					0
10	Conducted Emission tests as per CISPR22 Class A on power lines, communication ports						
11.	Radiated emission tests as per CISPR22 Class A						
B.	INSULATION TEST FOR RTU						
12.	Power Frequency Voltage with stand Test as per IEC 60870-2-1	OFF		2kVrms for 1 minute			No break down or flashover

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13.	1.2/50 μ s Impulse voltage withstand test as per IEC 60870-2-1	OFF		2 kVp	No break down or flashover
14.	Insulation Resistance test	OFF		Measure Insulation resistance using 500 V DC Megger before & after Power frequency & Impulse voltage withstand tests.	As per manufacturer standard
C	ENVIRONMENTAL TEST FOR RTU				
15.	Dry heat as per IEC 60068-2-2	ON		Continuous operation at 70 ⁰ for for 96 Hours.	0
16.	Damp heat test as per IEC 60068-2-78-3 or latest	ON		at 40 ⁰ C and 95 % RH in operational condition for 12 Hours	0
17.	*Cold test as per IEC 60068-2-1	ON		0 ⁰ C -20 ⁰ C -10 ⁰ C operational condition for 16 Hours.	0
18.	* Damp heat test Cyclic as per IEC 60068-2-30	ON		At high temperature at 50 ⁰ c and low temperature at 0 ⁰ C -10 ⁰ C; Dwell time in high or low temperature for 3 Hours. Transition of 1 ⁰ c per minute, and for 5 such cycles in operational condition.	0

* The vendor who got order for high altitude, these test shall be carried out at -25⁰C.

Note:-

EUT-Equipment Under Test

CM- Common Mode; DM- Differential Mode

~~I/O points do not include communication ports~~

I/O points includes DI, DO, AI, communication ports

Passing Criteria:

0 – no failure; normal performance within the specified limit

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- A- Minor failure: Temporary degradation or loss of function or performance which is self-recoverable, however issuance of control output command is not allowed.

The vibration test specified as under shall be conducted on the complete assembled RTU.

19.	Vibration test with severity of weight centered endurance by sweep frequency 10 Hz-150 Hz, displacement of 0.15 mm acceleration of 2 g and of duration of 2 Hours in each axis. (Total 6 Hours).
20.	Enclosure Protection test IP 51 as per IEC:529

M/s SYNERGY Comments type test**2. Annexure A: RTU type test requirement**

TEST No.	DESCRIPTION OF THE TEST	EUT Status	Test Level	Power supply points		I/O Points	Passing Criteria	RDSO's remark
A.	EMI/EMC IMMUNITY TESTS FOR RTU			CM	DM		CM	
1	Surge immunity test as per IEC 60870-2-1 (Test Method: IEC 61000-4-5)	ON	Level 4	4 kV	2 kV	2kV	A	Accepted
2	Electrical Fast Transient Burst Test as per IEC 60870-2-1 (Test Method: IEC 61000-4-4)	ON	Level 4	4kv	-	2kv	A	No change
3	Damped Oscillatory WAVE Test as per IEC 60870-2-1 (Test Method: IEC 61000-4-18)	ON	Level 3	2.5 kV	1 kV	2.5 kV	A	No change
4	Electrostatic Discharge test as per IEC 60870-2-1 (Test Method: IEC 61000-4-2)	ON	Level 4	+/-8 kV in contact discharge mode or +/- 15 kV in air discharge mode			A	RTU installed in uncontrolled areas should meet level level-4 as per IEC 60870-2-1.
5	Radiated Electromagnetic Field Test as per IEC 60870-2-1 (Test Method: IEC 61000-4-3)	ON	Level 3	10 V/m electric field strength			A	No change
6	Power Frequency Magnetic Field Test as per IEC 60870-2-1 (Test Method: IEC 61000-4-8)	ON	Level 5	100 A/m of magnetic field strength (continuous duration)			A	RTU, located in close proximity of

				sine wave)		MV and HV open air and GIS or vacuum switchgear or other electrical installations should meet level-4 as per IEC 60870-2-1.
7	Conducted Disturbance induced by Radio Frequency field as per IEC 61000-4-6:1996	ON	Level 3	10V, 150 KHz to 80 MHz	A	No change
8	AC Ripple in dc supply as per 60870-2-1 Table 8 (Test Method: IEC 61000-4-17)	ON	VR3	$\leq 5\%$ of nominal DC Voltage	0	Corrected as 10 % of nominal DC Voltage as per IEC 61850-3
9	For voltage dips and interruption as per IEC61000-4-29	ON		30% of Un for 0.1s, 60% of Un for 0.1s, 100% of Un for 50ms	A	Accepted as per IEC 61850-3
10	Conducted Emission tests as per CISPR22 Class A on power lines, communication ports					This test has been deleted
11	Radiated emission tests as per CISPR22 Class A					This test has been deleted
B	INSULATION TEST FOR RTU					
12	Power Frequency Voltage with stand Test as per IEC 60870-2-1 (Test Method: IEC 60255-27)	OFF		2kVrms for 1 minute	No break down or flashover	No change
13	1.2/50 μ s Impulse voltage withstand test as per IEC 60870-2-1 (Test Method: IEC 60255-27)	OFF		5KV for power ports, 1KV for signal ports	No break down or flashover	Accepted as per IEC 60255-27
14	Insulation Resistance test (Test Method: IEC 60255-27)	OFF		Measure Insulation resistance using 500 V	> 100MO	Accepted as per IEC 60255-

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A	EMI/EMC IMMUNITY TESTS FOR RTU			CM	DM	CM			
1.	Surge immunity test as per IEC 60870-2-1	ON	Level 4	4 kV	2 kV	4 kV	A	I/O points specially on analogue input the req is com=2.0kVp/norm=1.0kVp according to IEC 60870-2-1 For CT/VT we are meeting 4Kv/2Kv	Accepted
2.	Electrical Fast Transient Burst Test as per IEC 60870-2-1	ON	Level 4	4 kV	-	2 kV	A	Complied	
3.	Damped Oscillatory WAVE Test as per IEC 60870-2-1	ON	Level 3	2.5 kV	1 kV	2.5 kV	A	Complied	
4.	Electrostatic Discharge test as per IEC 60870-2-1	ON	Level 3			+/- 6 kV in contact discharge mode or +/- 8 kV in air discharge mode	A	Complied	
5.	Radiated Electromagnetic Field Test as per IEC 60870-2-1	ON	Level 3			10 V/m electric field strength	A	Complied	
6.	Power Frequency Magnetic Field Test as per IEC 60870-2-1	ON	Level 3			30 A/m of magnetic field strength (continuous duration sine wave)	A	Complied	
7.	Conducted Disturbance induced by Radio Frequency field as per IEC 61000-4-6:1996	ON	Level 3			10V, 150 KHz to 80 MHz	A	Complied	
8.	AC Ripple in dc supply as per 60870-2-1 Table 8	ON	VR3			≤ 5% of nominal DC Voltage	0	Complied	
9.	For voltage dips and interruption as per IEC61000-4-29	ON					0	Complied Levels to be defined in the specification.	Level defined
10.	Conducted Emission tests as per CISPR22							Complied	Test deleted

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	Class A on power lines, communication ports							CISPR 22:2008 Withdrawn and is replaced with CISPR 32	
11.	Radiated emission tests as per							Complied Standards to be referred. CISPR 22:2008 Withdrawn and is replaced with CISPR 32	Test deleted
B	INSULATION TEST FOR RTU								
12.	Power Frequency Voltage with stand Test as per IEC 60870-2-1	OFF	2kVrms for 1 minute				No break down or flashover	Complied Comm- 1.6 Kv for 60 sec I/O & PS- 3 Kv for 60 Sec Need to specify the Class from IEC 60870-2-1 VW1- 0.5kV VW2- 1kV VW3- 2.5kV Classes VW1 and VW2 are preferred for equipment operating at d.c. voltages below 60 V. Classes VW2 and VW3 are valid for supply voltages up to 250 V.	VW3 has been specified
13.	1.2/50 μ s Impulse voltage withstand test as per IEC 60870-2-1	OFF	2 kVp				No break down or flashover	Complied Need to specify the Class from IEC 60870-2-1 VW1- 1 kV VW2- 2 kV VW3- 5 kV	VW3 has been specified

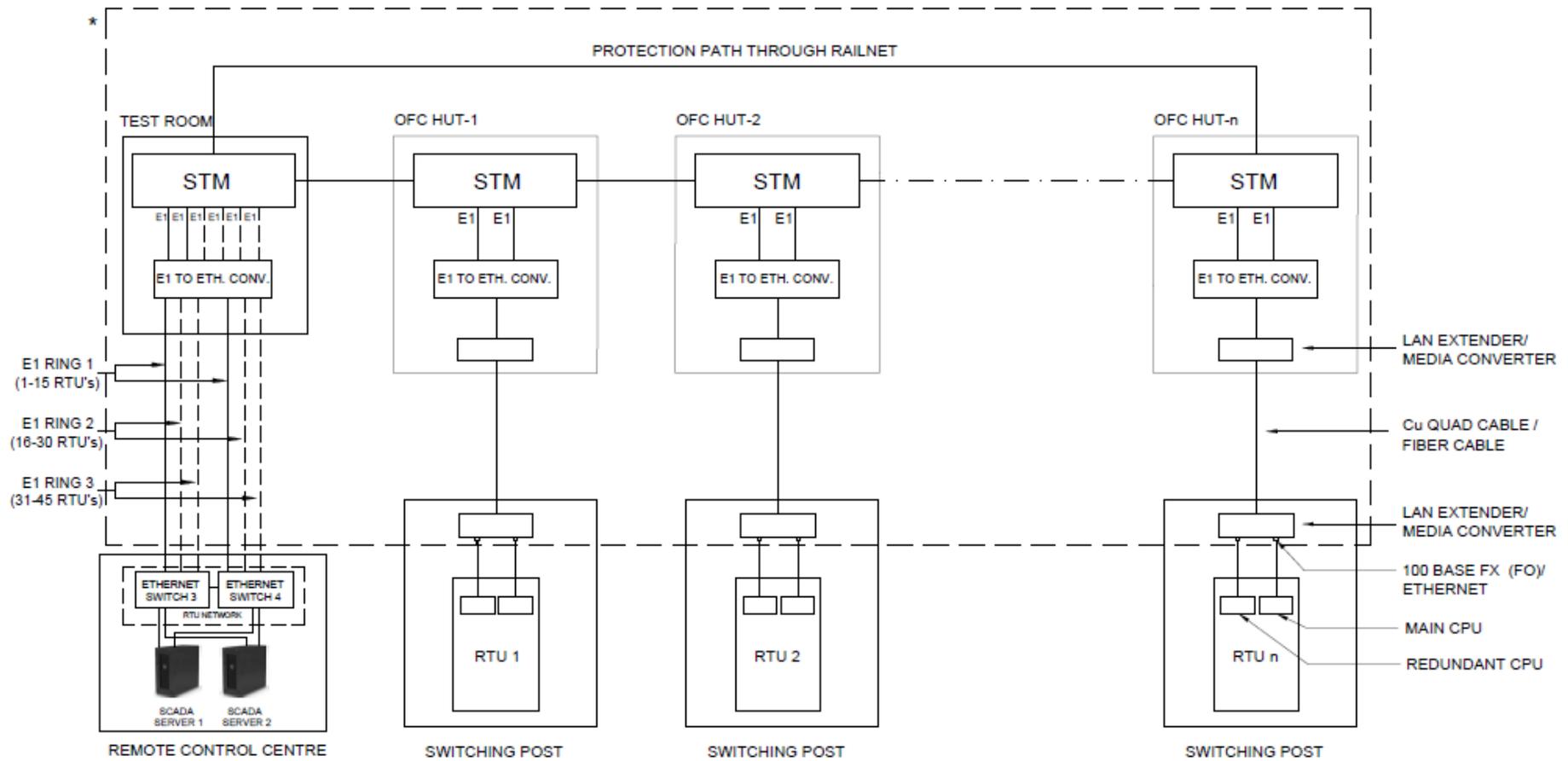
								Classes VW1 and VW2 are preferred for equipment operating at d.c. voltages below 60 V. Classes VW2 and VW3 are valid for supply voltages up to 250 V.		
14.	Insulation Resistance	Insulation test	OFF	Measure Insulation resistance using 500 V DC Megger before & after Power frequency & Impulse voltage withstand tests.		Measure Insulation resistance using 500 V DC Megger before & after Power frequency & Impulse voltage withstand tests.	As per manufacturer standard	Complied		
C	ENVIRONMENTAL TEST FOR RTU									
15	Dry heat as per IEC 60068-2-2		ON	Continuous operation at 70 Deg for for 96 Hours.				0	Complied	
16	Damp heat test as per IEC 60068-2-78 3 or latest		ON	at 40 Deg and 95 % RH in operational condition for 12 Hours				0	Complied	
17	*Cold test as per IEC 60068-2-1		ON	0 Deg -20 Deg C -10Deg C operational condition for 16 Hours.				0	Complied	
18	* Damp heat test Cyclic as per IEC 60068-2-30		ON	At high temperature				0	Complied 25/55°C/144 h 95% rh	Accepted

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			at 50°C and low temperature at 0°C - 10°C; Dwell time in high or low temperature for 3 Hours. Transition of 1°C per minute, and for 5 such cycles in operational condition.					12 + 12 hour cycle—6 cycles The test levels mentioned here need to be revisited, as it is referring to “Change in temp test”	
19	<i>Vibration test</i>		with severity of weight centered endurance by sweep frequency 10 Hz-150 Hz, displacement of 0.15 mm acceleration of 2 g and of duration of 2 Hours in each axis. (Total 6 Hours).					Complied According to IEC 60068-2-6 Test Standard to be referred	Accepted
20	Enclosure Protection test					IP 51 as per IEC: 529		Complied Front side: IP 40 Other sides of housing: IP 20 (incl. terminals)-IP 51 with panel enclosure can claim	Not accepted

* The vendor who got order for high altitude, these test shall be carried out at -25°C. I/O points includes DI, DO, AI, communication ports

Telecom scheme by ASHIDA



Note : 1. * The Routers, Converters and telecom media with provision of LAN extenders or media converters shall be provided and maintained by S&T wing of railway. However the IP's for the same shall be defined by the manufacturers at the time of erection/commissioning.

Figure: Telecom scheme for high speed SCADA based on TCP/IP communication