

**Reasoned Document for Comments Received on Draft Specification for Item
“Telecom Integrated Power Supply System for Station as per RDSO/SPN/TC/102-2013”**

RDSO Specification				Comments Received from		RDSO’s View	Amended Clause			
Clause no							Clause no			
1.2	Some of the typical requirements of telecom equipment at the station are as under:			M/s HBL	<p>SNo.7- STM1/4 OFC Equipment 48VDC-3Amps</p> <p>SNo.8-PD MUX 48V DC 2 Amps.</p> <p>Please let us know the operating voltage range for both the above equipments</p> <p>As this is expected to be connected on 48V DC bus, and it will vary from 44 V to 57V</p>	Voltage Range of each application specified.	1.2	Some of the typical voltage requirements of telecom equipment at the station are as under:		
	7.	STM1/4 OFC Equipment	48V DC	3 Amp			7	STM1/4 OFC Equipment	-40 to -60 V DC	3 Amp
	8.	PD MUX	48V DC	2 Amp			8	PD MUX	-36 to -72V DC	2 Amp
2.1	Telecom Integrated Power Supply System shall consist of a Distribution-Switching-Control-Alarm Arrangement (DSCA) and Float Rectifier-Cum-chargers (FR-FCs) or Float Rectifier cum Boost Chargers (FR-BCs) (in N+1 configuration in hot-standby and one module in cold standby), DC-DC converter (in N+1 configuration in hot-standby) for 24V, 12V, 3-6V,			M/s Statcon	“(Optional) word to be deleted” since provision is there for SPV so MPPT cannot be optional.	It is optional as purchaser can purchase it if required (CI 11.0)	2.1	No change.		

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	48V MPPT Battery Charger (optional) , 48V battery set of adequate capacity.					
2.3	To cater for higher load requirements, same type of modules mounted in the same rack shall be capable of working in parallel load sharing arrangement.	M/s Statcon	To be written as “ To cater for higher load requirements(for modules with more than 50 watts). Same type of -----.”	Agreed.	2.3	<i>To cater for higher load requirements, (for modules with more than 50 watts) same type of modules mounted in the same rack shall be capable of working in parallel load sharing arrangement.</i>
2.6	The Telecom Power Supply will also have Solar Photovoltaic (SPV) Panels of sufficient capacity with structure so as to supplement the power requirement and reduce mains / DG Set dependency.	M/s PUNCOM	Are solar Photovoltaic Panels also part of TIPSS? Will it be bought out item?	SPV module are to be supplied in case purchaser decides to provide solar power as additional source of power supply.	2.6	<i>In case purchaser decides to provide solar power as additional source of power supply as indicated in clause 11.0, Solar Panel Modules of adequate capacity along with suitable Bracket & Bracing Plate as per IRS:S 84/92 with Latest Amendments shall be supplied alongwith TIPSS. Actual requirement of number of Solar Panels &</i>
		M/s Electric Ind.	we feel that the Panel capacity should be defined by RDSO as indenter may or may not able to tell/calculate the required panels.	Panel capacity is to be given by Purchaser based on actual site requirement & MPPT Capacity.		

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						<i>its capacity etc. shall be indicated by purchaser based on site requirement.</i>
2.7	One panel consisting of status indications and critical alarms of TIPSS is to be provided in ASM's room. The monitoring panel shall be of wall mounting type. OEM shall supply 12 core, 1.5 sq.mm signaling cable as per IRS:S 63/2007 for connecting TIPSS to Status Monitoring Panel in Station Master's room (distance to be given by Railways at the time of indenting).	M/s Statcon	Pl add this in the “ Information required by purchaser”	Agreed	2.7	Clause 11.0 has been modified accordingly
		M/s Amara Raja	Numbers of indication LED's and details are not available in the specification to calculate no.of cables (cores) required between TIPSS system and monitoring panel. 12 cores may not be required if no.of indications are less.	New Clause giving the detail of indication added.	4.2	Description as on page 23 of this document.
2.8	There shall be an automatic arrangement for disconnecting the mains within 500 ms to the rack whenever the input voltage is beyond the specified operating limits with suitable alarm indication. The TIPSS shall resume normal working automatically when the input is restored within the working limits. A self storing type static switch should be provided at the input.	M/s Statcon	Add in last after. ---- A self storing type static switch should be provided at the input “ <i>It shall be with standing 400 volts input continuously without any damage system will restore to normal when high voltage is removed.</i> ”	Agreed.	2.8	There shall be an automatic arrangement for disconnecting the mains within 500 ms to the rack whenever the input voltage is beyond the specified operating limits with suitable alarm indication. The TIPSS shall resume normal working automatically

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						when the input is restored within the working limits. A self storing type static switch should be provided at the input. <i>It shall be capable to with-stand 400 volts input continuously without any damage.</i>
2.9.IV	The recommended list of major components and their makes given in Annexure VI of RDSO/SPN/S/165/2012 shall be applicable for this specification also.		“Remove S from spec number”.	Agreed	2.9.IV	<i>The recommended list of major components and their makes given in Annexure VI of RDSO/SPN/165/2012 shall be applicable for this specification also.</i>
2.10	All the cables and wires used for wiring and inter connections of modules shall conform to specification No. IRS: S 76-89/IS 694 of grading 1100V. Aluminium wires shall not be used. The gauge of wiring shall be such that the current density does not exceed 3 amperes/mm square.	M/s Electric Ind.	pls clarify that the wires should conform to IRS-S-76/89 OR IS 694.....as” /” would lead to different interpretations.	Vendors may adopt best engineering practice based on requirement of various circuits to achieve specified reliability parameters.	2.10	No Change.

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Clause no					Clause no	
2.11	Transformers and inductors/ chokes used shall be vacuum impregnated and shall be of natural air-cooled type conforming IS: 6297 (Category 3 & Grade 2). Class F or higher grade insulating material as per IS:1271 and polyester enameled copper winding wire conforming to IS 13730(Pt. 3) shall be used for winding transformers and inductors/chokes. The gauge of winding wires shall be such that the current density shall not exceed 2A/sq.mm. All exposed metal parts of the transformer including laminations shall be protected against corrosion.	M/s Statcon	<p>a) Insert “—shall be vacuum impregnated or <i>using NUMEX Paper</i> and shall be natural air cooled----- including lamination shall be protected against corrosion.”</p> <p>b) The current density n ferrite transformer cannot be 2 amps. It will be force cooled.</p>	<p>Vacuum impregnation is a process by which all the moisture is first removed and insulating liquid is impregnated in the transformer. However, in order to achieve Class F or higher insulation level vendors may decide type of paper to be used.</p> <p>In view of feedback received from other vendor also the current density is being changed to 3A/sq mm</p>	2.11	Transformers and inductors/ chokes used shall be vacuum impregnated and shall be of natural air-cooled type conforming IS: 6297 (Category 3 & Grade 2). Class F or higher grade insulating material as per IS:1271 and polyester enameled copper winding wire conforming to IS 13730(Pt. 3) shall be used for winding transformers and inductors/chokes. The gauge of winding wires shall be such that the current density shall not exceed 3A/sq.mm . All exposed metal parts of the transformer including laminations shall be protected against corrosion.
		M/s Electric Ind.Since we are working on high frequency above 20KHz as prescribed by you, current density should be increased to 3A/sq mm.	Agreed.		

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Clause no					Clause no	
2.12	<p>Fuses & Connectors All plug- in connectors shall be non-interchangeable. Connectors as per IEC 947 shall be provided. Fuse holder identification shall include details of fuse rating and type. All power fuses shall confirm to specification IS 13703 / IS 9224.</p>	M/s Electric Ind.	...pls specify that these connectors are for PCB level Or Module level.	This clause is applicable for various type of connectors used in the equipment.	2.12	No Change.
2.16.3	<p>OEM shall supply copper cable of suitable dia as per IS: 694 and grade 1100V for connecting TIPSS to Battery bank (distance to be given by Railways at the time of indenting) as given below –</p> <p>a) For 200AH battery – 16 Sq.mm</p> <p>b) For 300AH battery – 25 sq.mm</p>	M/s Electric Ind.	<i>...Maxm distance between battery and TIPSS should be prescribed by RDSO as it would save money to railways and by keeping the length short we can have a highly reliable system.</i>	The information regarding Distance between IPS rack & battery (in meters) is to be provided by the Purchaser. Clause 11.0 has been modified, accordingly.	2.16.3	Clause 11.0 modified
3.1.1	The FRBC/FRFC Modules shall be provided with natural/forced cooling. The capacity of FRBC/FRFC module	M/s Prcesion	Capacity of per FRBC module may be 20Ax 3=60A instead of 25 Ax 3. Because as per battery	The rating of FRBC module has been kept 25 Amp in	3.1.1	No change.

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	will be 25 Amp .		charging rate calculation of 300 AH Battery at C/10 rate is 30 amp. So it is suggested to use three modules of 20 Amp each.	order to have uniformity with respect to SMPS Based Telecom Power Supply System on Indian Railways.		
3.1.3	All the modules shall be housed in 19” rack. Cable entries will be from the top of the rack. In the rack Control panel, FRBC /FRFC Module , DC-DC Converter should be placed from top to bottom respectively. It shall be also possible to place all the DC-DC Converters in a separate wall mountable rack of suitable/9U size which may be installed in the ASM Room situated at a maximum distance of 200 Mtr. 48 V supply with class-C SPD Protection (as per Cl. 3.2.12.3 Of this specification) will be extended to this unit in case this unit is kept in ASM Room. Two core signaling cable of 16 mm ² as per IRS:63-07 with latest amendment is	M/s Electric Ind.it should be added in the information to be provided by the purchaser as per Cl 11.0	The information regarding Distance between IPS rack & ASM Room (in meters) is to be provided by the Purchaser. Clause 11.0 has been modified, accordingly.	3.1.3	Clause 11.0 modified

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	to be supplied by manufacturer and railway/purchaser has to specify the distance of the ASM Room from TIPSS.					
3.1.3 VIII	Facility shall be provided at the top of the rack to connect external AC power and lightning arrestors (if provided inside the rack). Where cables pass through metal panels, suitable rubber grommets shall be provided to protect cable from damage.	M/s Amara Raja	Facility shall be provided at the top of the rack to connect external AC power from lightning arrestor's box .	Clause is self-explanatory and does not require any change.	3.1.3 VIII	No change.
3.2.2	<p>DC output Characteristics</p> <p>(I) Auto Float Mode</p> <p>a) The Float voltage of each rectifier module shall be continuously adjustable & pre- settable at any value in the range of 48V to 56V. The prescribed float voltage setting is 54V for VRLA battery.</p> <p>b) The DC output voltage shall be maintained within $\pm 1\%$ of the</p>	M/s PUNCOM	What is the change of mode criterion from float to charge mode and from charge to float mode?	Criteria defined.	3.2.2	<p>DC output Characteristics</p> <p>(I) Auto Float Mode</p> <p>a) The Float voltage of each rectifier module shall be continuously adjustable & pre- settable at any value in the range of 48V to 56V. The prescribed float voltage setting is 54V for VRLA battery.</p>

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	<p>half load preset voltage in the range 25% load to full load when measured at the output terminals over the full specified input range.</p> <p>(II) Auto Charge Mode: In Auto Charge Mode FR-FC shall supply battery & equipment current till terminal voltage reaches set value, which is normally 2.3V/Cell (55.2V) & shall change over to constant voltage mode it shall remain in this mode till a changeover to float mode signal is received.</p>					<p>b) The DC output voltage shall be maintained within $\pm 1\%$ of the half load preset voltage in the range 25% load to full load when measured at the output terminals over the full specified input range.</p> <p>(II) Auto Charge Mode: In Auto Charge Mode FR-FC shall supply battery & equipment current till terminal voltage reaches set value, which is normally 2.3V/Cell (55.2V) & shall change over to Auto Float mode after a defined delay of 0, 1, 2, 4 hours adjustable, to be set as per battery manufacturer's specification. If battery voltage falls upto 48 V it will change to Auto Charge mode.</p>

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3.2.7 (III)	III. The FR-FC modules shall be fully protected against short-circuits. It shall be ensured that short circuit IV. does not lead to any fire hazard.	M/s Amara Raja	Club point III & IV. May be typing error	Agreed.	3.2.7 (III)	<i>The FR-FC modules shall be fully protected against short-circuits. It shall be ensured that short circuit does not lead to any fire hazard.</i>
3.2.14	Radio Frequency Interference Suppression: The module shall be designed to minimize the level of electromagnetic interference (EMI), both conducted and radiated, detected in its vicinity and generated by Switch Mode Power conversion Equipment operating within the rack. The radiated & conducted noise shall be within the limits specified in International specification no. IEC CISPR 22 'A'. The firm shall submit certificate to this effect from accredited national/international test house at the time of type test. Limits and test	M/s Statcon	Kindly include “ <i>Firms using same module whose EMI EMC has been done within last 3 year will be exempted from this. A certificate copy of old test will be submitted</i> ”	The type testing is to be done at predefined interval and EMI EMC test is to be conducted during the type test on the picked up sample. Hence suggestion is not agreed to.	3.2.14	No Change.

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	methods are given in Annexure-I.					
3.2.17 (b)	It shall also be programmable as a Boost Charger (BC) under manual control after isolating it from the float bus.	M/s PUNCOM	For LMLA batteries, boost charging concept as in clause 3.1.17(b) is not as per diagram given on page 22. Reason: Clause 3.1.17(b) is as per Scheme 1 of RDSO/SPN/TL/23/99 and diagram on page 22 is as per scheme 2 of RDSO/SPN/TL/23/99	Separate diagram for boost charging mode is being included in the draft specification.		Page 24 & 25 of this document.
		M/s Amara Raja	Float Rectifier-Float-Charger-Boost Charger (FR-BC): In addition to requirement of FR-FC Modules, the FR-BC Modules shall meet the following additional requirement. a) The FR-BC module shall be programmable to work as FR-FC	This provision is Already covered in Cl. 3.2.17 (a).	3.2.17 (b)	No change.

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			or FR-BC. When programmed as FR-FC, it shall be capable of working as FR-FC with other FR-FCs and shall comply with all the requirements of FR-FC.			
4.0	<p>REQUIREMENT OF DISTRIBUTION-SWITCHING-CONTROL AND ALARM ARRANGEMENT (DSCA)General:</p> <p>Depending on the system requirements system shall be provided with a Distribution-Switching-control-alarm Arrangement (DSCA) for the Ultimate Expandable Capacity.</p>	M/s PUNCOM	What is the ultimate capacity of FR-BC/FC-BC rack?	It is 2+1 i.e. 50+25 amps.	4.0	<p>REQUIREMENT OF DISTRIBUTION-SWITCHING-CONTROL AND ALARM ARRANGEMENT (DSCA)General:</p> <p>Depending on the system requirements system shall be provided with a Distribution- Switching-</p>

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	<p>The unit shall comprise of the following:</p> <p>a)Termination for the batteries</p> <p>b)Termination for the load</p> <p>c)Interconnecting arrangement for power equipment</p> <p>d)Battery Switching Arrangement (connection to/Isolation from system)</p> <p>e)Termination for AC input to the rack</p> <p>f) Termination for AC and DC to FR-FC modules</p> <p>g)Circuit Breakers/Fuses etc.</p> <p>Two numbers of potential free contacts for connecting to network monitoring system for monitoring DC output fail, DC output over voltage, DC output under voltage and mains fail shall be provided.</p>	M/s Amara Raja	<p>Add these points also along with a to g</p> <p>f) Termination for Solar power</p> <p>g)Termination for DG power</p>	Agreed.	4.0	<p>control-alarm Arrangement (DSCA) for the Ultimate Expandable Capacity.</p> <p>The unit shall comprise of the following:</p> <p>a) Termination for the batteries</p> <p>b) Termination for the load</p> <p>c) Interconnecting arrangement for power equipment</p> <p>d) Battery Switching Arrangement (connection to/Isolation from system)</p> <p>e)Termination for AC input to the rack</p> <p>f) Termination for AC and DC to FR-FC modules</p> <p>g) Breakers/Fuses etc.</p> <p>h) Termination for Solar</p>

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Clause no					Clause no	
						<p><i>power</i></p> <p><i>i) Termination for DG power</i></p> <p>Two numbers of potential free contacts for connecting to network monitoring system for monitoring DC output fail, DC output over voltage, DC output under voltage and mains fail shall be provided.</p>
4.1(b)	<p>Battery health Monitoring in Auto Mode:</p> <p>The system shall change over to Auto charge mode to charge the battery at higher voltage of 55.2V till the battery is fully recouped.</p>	M/s PUNCOM	What is the change of mode criterion from float to charge mode and from charge to float mode?	Criteria defined in Cl.3.2.2	3.2.2	As Above.

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4.1(c)	It should also be possible to monitor individual cell (for 24 Cells of 2 V each) of battery bank and status of all cells shall be made available in a graphical form / Table and strength of week cell can be detected and alarm should be generated which can be displayed in a Alpha-Numeric display provided in DSCA.	M/s Precision Electronics	Monitoring of each battery may be asked in place of each cell.	Monitoring of each cell is required.	4.1(c)	No Change
5.0	REQUIREMENTS OF DC-DC CONVERTER	M/s PUNCOM	Required Output range of 12V and 24V DC to DC converters is not mentioned.	±1% already specified in Cl 5.1	5.0	No Change.
5.1	The DC/DC converter covered under this specification shall work satisfactorily meeting all the prescribed parameters as long as the DC input voltage is within 44V to 58V (66V in case of FRBC). The output regulation shall be ±1% of set value from 10% load to full load for the entire input range. Typical voltage ratings are 24V, 12V, and 3-6V DC and typical current ratings are	M/s PUNCOM	As per this clause, Max. Input Voltage to the DC to DC converters in case of Boost charging is 66V. It should be 58V only as dropper diodes are used in boost charging mode. Reason: Since Dropper diodes are used so the voltage would not go	The input voltage range of DC-DC Converter shall be from 44 V to 66V.	5.1	No Change.

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	1 Amp and 5 Amp depending upon load requirement.		beyond 58V.			
5.2	Each converter shall be provided with a proper plug in arrangement for DC input & output. A toggle switch shall be provided for switching ON/OFF the unit.	M/s Statcon	Remove word “Toggle”.	Agreed.	5.2	<i>Each converter shall be provided with a proper plug in arrangement for DC input & output. A switch shall be provided for switching ON/OFF the unit.</i>
5.14	The converter shall have self-resetting type protection from over load/ short circuit of DC output. The converters shall be adequately protected against surges/ lightning at the input.	M/s Statcon	To Add: <i>If such test on same product is done within last 3 year then old certificate can be submitted</i>	The type testing is to be done at predefined interval and such test is to be conducted during the type test on the picked up sample. Hence suggestion is not agreed to.	5.14	No Change.
5.17	Parallel Operation: DC-DC Converter operating in parallel with one or more modules of similar type, make and rating, other output conditions remaining within specified limits. The current sharing	M/s Statcon	Add – “DC –DC converter (<i>more than 50 Watts</i>) of operating in parallel---- ”.	Agreed	5.17	Parallel Operation: DC-DC Converter (<i>more than 50 Watts</i>) operating in parallel with one or more modules of similar type, make and rating,

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	shall be within $\pm 10\%$ of the average current per converter module and within individual capacity of each converter module in the system when loaded between 50 to 100% of its rated capacity for all other working conditions.					other output conditions remaining within specified limits. The current sharing shall be within $\pm 10\%$ of the average current per converter module and within individual capacity of each converter module in the system when loaded between 50 to 100% of its rated capacity for all other working conditions.
6.0 (a)	It should be using MPPT Algorithm. Giving algorithm efficiency of 98% or higher. Efficiency at rated output voltage and full load should not be less than 93%. Even at less than full load, efficiency should not drop to less than 90% at 30% full load.	M/s Statcon	“-----Efficiency of 98% or Higher <i>For rating more than 1 KW efficiency at Rated output voltage &-----</i> ”	It is envisaged that rating of system will be more than 1 KW.	6.0 (a)	No change.

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7.0	<p>Source Prioritization: If all power sources are available first priority will be given to solar energy. Power supply to DCDC converters, telecom loads and Battery will be supplied through solar modules. While solar energy is sufficient enough to support the load all other sources will be disconnected.</p> <p>Second priority is to Grid supply.</p> <p>Third priority is given to battery. When grid supply is not available, the main controller checks the healthiness of battery. If battery is at charged condition and state of charge is greater than 70%, battery power will be used to support DCDC converters, and telecom loads. If battery is also discharged and no other source is available, it will give an indication as well as potential free contact should be provided which may be utilized for starting the DG.</p>	M/s Electric Ind.Source Prioritization.....Pls clarify the provision (where it is to be located) of this AMF panel which would define this prioritization....Pls clarify the master panel of MPPT Charger Location as per Cl. 3.2.16.	This may be decided based on best engineering practice. However this clause is being modified to clear the requirements.	7.0	<p>Source Prioritization: If all power sources are available and option of Solar Power has been used first priority will be given to solar energy.i.e.. Power supply to DCDC converters, telecom loads and Battery will be supplied through solar modules and if it is not upto the requirement the available current from Solar will be used and balance requirement will be taken from AC Power Supply. While solar energy is sufficient enough to support the load all other sources will be disconnected.</p> <p>Second priority is AC 220V 50 Hz Power supply.</p> <p>Third priority is given to battery. When grid supply</p>
		M/s Precision Electronics	It is interpreted from the system diagram that battery bank is continuously connected with DC bus bar and battery bank remains under charge in presence of mains input. Hence in absence of AC mains, load will be only on battery bank. Please confirm.	Yes load will be on Battery Bank.		

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						is not available, the main controller checks the health of battery. If battery is in charged condition and state of charge is greater than 70%, battery power will be used to support DCDC converters, and telecom loads. If battery is also discharged and no other source is available, it will give an indication as well as potential free contact should be provided which may be utilized for starting the DG.
9.4.1	Visual inspection shall be carried out on one of the TIPSS unit of each type. The functional test shall be carried on each TIPSS. The modules shall be tested for insulation resistance, high voltage test, temperature rise test, performance and protection tests as per the	M/s Electric Ind.	<i>...Pls make the Performance as N/2 OR make it in such a way that some percentage of modules should be tested on full load and some on half load. As it becomes very tedious to test all modules at No Load, 25% , 50% and 100% Load.</i>	Not agreed	9.4.1	No Change.

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Clause no					Clause no	
	sampling plan given below:					
10.7.1.I	The climatic tests shall be carried out by setting the system in boost charge mode of operation. During the period of exposure in each test, the system shall be connected to supply mains of nominal input voltage and shall deliver the rated output voltage of 2.3V/ Cell or 2.4V/cell for VRLA/LM batteries respectively to a resistive load.	M/s PUNCOM	The climate test should be carried out by setting the system in charge mode of operation and not on boost charge mode. Further it should deliver the rated output voltage of 2.3V/cell for both VRLA/LMLA batteries. Reason: Because in boost charge the operation is not at the rated capacity but at some lower capacity.	Not Agreed.	10.7.1. II	No Change.
11.0	Information to be given by Purchaser: 1.Type of Battery:LMLA/VRLA and AH capacity. 2.Type of Stand in case LMLA is utilized: Wooden/FRP. 3.Solar (MPTT Charger)(optional) required /Not required.			In view of feedback received under clause No. the ‘ Information to be given by Purchaser ’ is being modified.	11.0	Information to be given by Purchaser: 1.Type of Battery:LMLA/VRLA and AH capacity. 2.Type of Stand in case LMLA is utilized:

**Reasoned Document for Comments Received on Draft Specification for Item
“Telecom Integrated Power Supply System for Station as per RDSO/SPN/TC/102-2013”**

RDSO Specification		Comments Received from		RDSO's View	Amended Clause	
Clause no					Clause no	
	4.No. of DC-DC Converter, voltage and rating. (1 Amp/5 Amp)					Wooden/FRP. 3.Solar (MPTT Charger)(optional) required /Not required. 4.No. of DC-DC Converter, voltage and rating. (1 Amp/5 Amp) 5. Distance of ASM Room from location of TIPSS. (In meters) 6. Distance of Battery Bank from TIPSS. (In meters)
New Cl		M/s Amara Raja	<p>Details of LED indications required in Status Monitoring panel may be included in Specification to have better clarity.</p> <p>We recommend these indications.</p> <ol style="list-style-type: none"> 1. FRFC/FRBC's Fault 2. DCDC Converters Fault 3. Solar Modules Fault(optional) 	Agreed.	4.2	New clause introduced Description as on Page 22 of this document.

**Reasoned Document for Comments Received on Draft Specification for Item
“Telecom Integrated Power Supply System for Station as per RDSO/SPN/TC/102-2013”**

RDSO Specification		Comments Received from		RDSO's View	Amended Clause	
Clause no					Clause no	
			4. Start Generator 5. Stop Generator			
New Suggestion		M/s Electric Ind.	<i>Referring all above points we strongly recommend to issue different drawings as in Signal....</i> <i>One for VRLA Battery</i> <i>For LMLA Battery</i> <i>For MPPT Charger specifying the capacity of SPV Panels</i> <i>For DC DC converters reqd in ASM Room.</i>	Agreed. Drawing for VRLA & LMLA given.		Page no. 24 & 25 of this document.

**Reasoned Document for Comments Received on Draft Specification for Item
“Telecom Integrated Power Supply System for Station as per RDSO/SPN/TC/102-2013”**

4.2 Requirement of ASM Panel:

Status monitoring panel shall be installed in the room of ASM on duty. The panel shall have following LED indications and alarms with resetting switch:

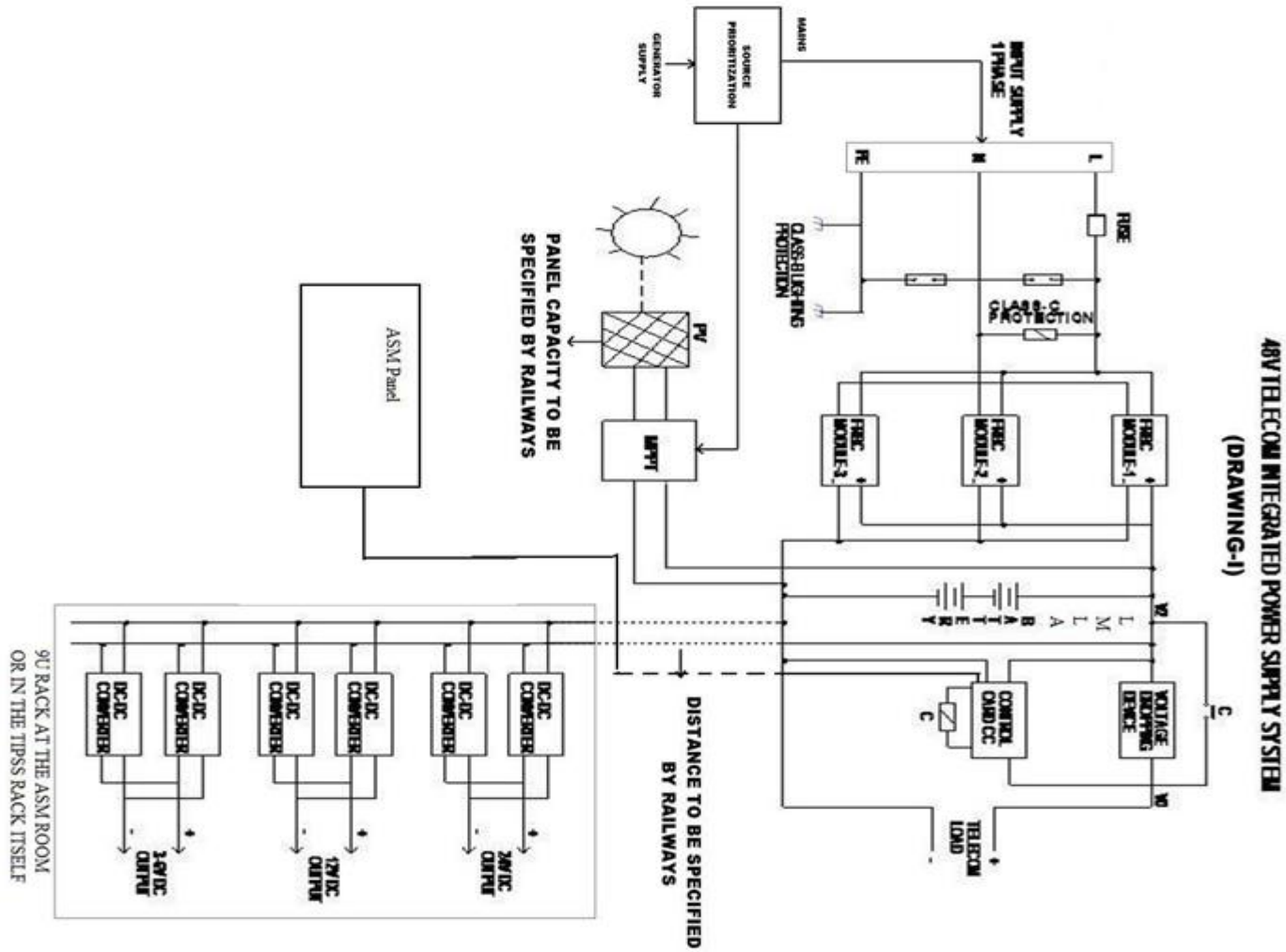
	Instruction	Condition	LED Ind.	Remark
A	Run Gen set	50% DOD	RED	Audio / visual alarm. Alarm can be acknowledged for audio cut off.
B	Emergency start generator	60% DOD	RED	-do-
C	System shut down	70% DOD	RED	All DC-DC converters to work. Audio alarm will continue till Generator is started.
D	Call S & T staff	Equipment fault	RED	Failure of any module or in case battery gets disconnected from circuit will give the alarm in panel. Alarm can be acknowledged for audio cut-off.
E	Stop Gen Set	FRBC change over to float mode	GREEN	Audio /Visual alarm

Audio alarm in case of A, B & C shall be of one type of tone and there shall be different tone for the case of D & E cases.

4.2.1

In A, B & C conditions, the visual LED indication will remain lit until fault is cleared or the DG set is started and battery is charged upto 110V i.e. 2V/cell as the case may be until reset push button is pressed. In case of D condition, if fault is not cleared, the LED will continue to glow, even if reset push button is pressed.

**Reasoned Document for Comments Received on Draft Specification for Item
“Telecom Integrated Power Supply System for Station as per RDSO/SPN/TC/102-2013”**



**Reasoned Document for Comments Received on Draft Specification for Item
“Telecom Integrated Power Supply System for Station as per RDSO/SPN/TC/102-2013”**

