



ITER-India
(Institute For Plasma Research)

Tender Notice No.

I-ITN19001

Title	Tender No. I-ITN19001 dated 23-04-2019 for Supply of PCBs and assemblies of RF Amplifier System
Sub Title	PART-A (II): Scope of Supply, Work, Technical Specifications and other details

ITER-India, Institute for Plasma Research

Block A, Sangath Skyz, Bhat-Motera Road, Koteswar,

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Written by	Reviewed by	Approved by
ITER-India	ITER-India	ITER-India
Signature/s in sequence	Signature/s in sequence	Signature/s in sequence

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Supply of PCBs and assemblies of RF amplifier system

1.0 Brief Description:

Ion Cyclotron Heating & Current Drive (ICH & CD) group, ITER-INDIA (I-I) is conducting R & D project for development of Solid State Power Amplifier (SSPA) in frequency range 35 to 60 MHz. SSPA will be used to drive vacuum tube base high power amplifier.

Proto-type model is already developed by I-I. Based on the schematics as provided in Appendix-I, bidder has to fabricate PCBs for RF amplifier modules, power splitter, power combiner, control & monitoring cards. Bidder has to integrate these PCBs/cards with DC power supplies in a 19" rack.

Execution of this tender will be as follows:

1. Bench mark supply: Bidder has to supply 2 number PCBs of RF amplifier modules, 1 number PCB of lumped combiner, 1 number of 48 V & 1 number of 12 V DC power supply .
2. Final supply: Only after assessment of bench mark supply, I-I will give clearance to start bulk production of various PCBs/cards. These PCBs/cards include for 16 RF amplifier modules, 8 number of lumped combiners, 02 number of 8-way power splitters, low power section, control & monitoring cards, electrical distribution etc. as per scope of work. Bidder has to integrate/assemble these PCBs/cards along with 3 number of 48 V & 3 number of 12 V DC power supplies in a 19" rack.

2.0 Scope of Work:

- Bidder has to prepare a scope understanding document (SUD) based on all the inputs provided in this tender document by I-I and submit the same for review before start of fabrication/procurement.
- Bench mark supply:
 - Bidder has to prepare schematic diagram 1 and 3 (under Appendix-I) along with Bill of Material (BoM from Appendix-II) and submit the same to I-I for review & approval.
 - After getting approval for schematic diagrams from I-I, bidder has to prepare layout for corresponding schematic and submit to I-I for review & approval.
 - After getting approval for layout from I-I, bidder has to fabricate PCBs, procure the components & solder the same on the PCB.
 - Bidder has to procure DC power supplies as per specification mentioned in Appendix-IV, Table No. 11 to 12.
 - Deliver bench mark items (2 no. of RF amplifier modules, 1 no. of lumped combiner, 1 no. of 48 V & 1 no. of 12 V DC power supply) to I-I for getting approval to initiate the activity related to final supply. I-I will inform their decision within 10 working days after receipt of items at I-I site.
- Final supply:
 - Bidder has to prepare schematic diagram along with Bill of Material (BoM) for each circuits as shown in Appendix-I and Appendix-II. Bidder has to submit the schematics along with BoM to I-I for review & approval.
 - After getting approval for schematic diagrams from I-I, bidder has to prepare layout for corresponding schematic and submit to I-I for review & approval.

- After getting approval for layout from I-I, bidder has to fabricate PCBs as identified under Appendix-I.
 - After receiving approval for BOM from I-I, bidder has to procure components. Bidder has to solder components on PCBs as per approved BOM.
 - Bidder has to procure/fabricate electronics boards as per specification mentioned Appendix-III.
 - Bidder has to procure DC power supplies as per specification mentioned in Appendix-IV, Table No. 11 to 16 and integrate with different modules.
 - Bidder has to prepare fabrication drawing for water cooled heatsink and process flow diagram for water cooling distribution as per specification shown in Appendix-V and submit to I-I for review & approval and fabricate the same after receiving approval from I-I.
 - Bidder has to procure 19" rack as per Appendix-VI.
 - Bidder has to mount RF amplifier modules, 8-way splitters, 2-way lumped combiners and 2-way coaxial type combiner¹ on water cooled heatsink. Interconnection between RF modules, gate bias connection, drain bias connection etc. should be done as per specification mention in Appendix-VII.
 - Bidder has to prepare wiring diagram for 48 V & 12 V DC power supply and submit to I-I for review and approval. After receiving approval, bidder has to mount DC power supply and wiring should be done for AC / DC electrical & control connection.
 - Bidder has to prepare mounting drawing and wiring diagram for low power RF modules, driver amplifier, 2-way splitter, control & display modules, DC power supplies etc. and submit to I-I for review and approval. After getting approval mounting of components should be done in single enclosure. Interconnection between RF modules, AC connection to DC power supplies, DC connection to RF modules etc. should be done as per specifications.
 - Bidder has to prepare wiring diagram for electrical monitoring & distribution system as per diagram shown in Fig. 10 and submit to I-I for review and approval. After getting approval, bidder has to mount electrical components and wiring should be done for electrical monitoring and distribution system as per requirement.
 - Factory acceptance test should be performed in presence of I-I representative as per Appendix –VIII.
- FAT report shall be submitted to I-I for obtaining dispatch clearance
 - Site Acceptance test will be conducted as per Appendix-IX at ITER-INDIA lab, IPR. In case of failure during the test due to manufacturing defect, bidder has to modify / repair / replace of components / sub-system etc. free of charges. Bidder need to present to witness the test at their own cost. However, SAT will be performed by purchaser.
 - Submit documents/test reports as describe in Appendix-X.

Note:

Bidder has to provide their specifications, model number, make etc. for offered items in Table No. 1 to 19.

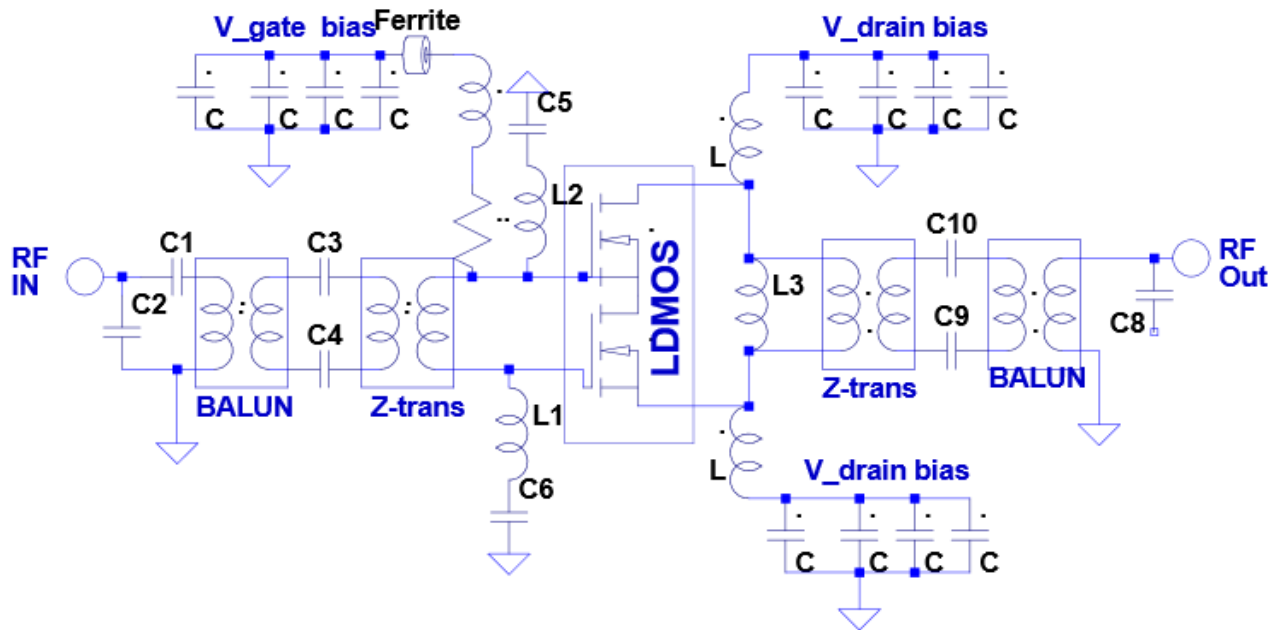
¹ 2- way coaxial type combiner shall be provided as free issue material to bidder for assembly purpose.

Appendix-I: Schematic diagram along with PCB specification:

Note: I-I will provide guidance/support for finalization of schematic & layout design. Schematic diagram along with respective PCB specifications are mentioned below.

1. RF amplifier PCB

Bidder has to prepare artwork/layout, fabricate RF amplifier PCB and solder components on PCB as per Schematic-1.



Schematic 1: RF amplifier module

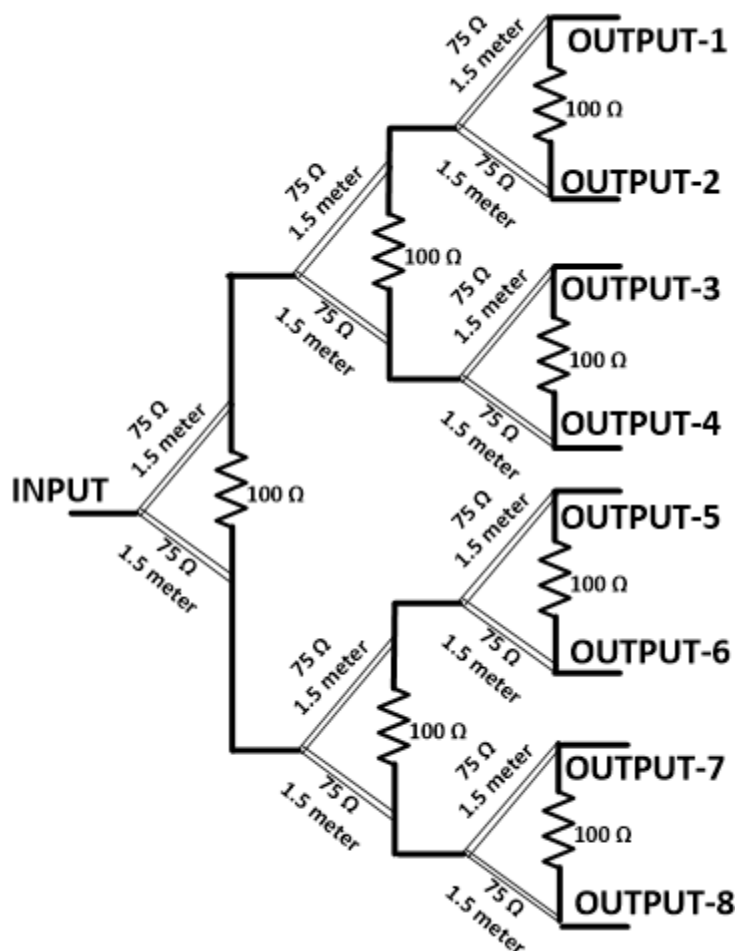
RF input, RF output, gate bias, drain bias etc. should be connected through connector or cable as required. **Bidder has to use high temperature solder material for soldering RF components.** Such 02 number of RF amplifier modules should be prepared and deliver to I-I for testing and approval. Bidder need to implement changes, if any, in the bulk production. After getting approval, bidder should fabricate 16 modules which will be mounted on 2 different water cooled heatsink using proper mounting plates. Bill of material for the items are mentioned in Appendix-II.

Table No. 1: Specification for amplifier PCB

Sr. No.	Description	Specification
1	PCB material:	FR4, double layer with 70 micron copper, lead free HAL. Thickness: 2.4 mm Tg: $\geq 170^{\circ}\text{C}$
2	PCB size	160x110 mm Max size
3	Quantity:	22 Nos

2. 8-way power splitter

Bidder has to prepare artwork/layout, fabricate 8-way power splitter PCB and solder components as per Schematic-2.



Schematic 2: 8-way power splitter.

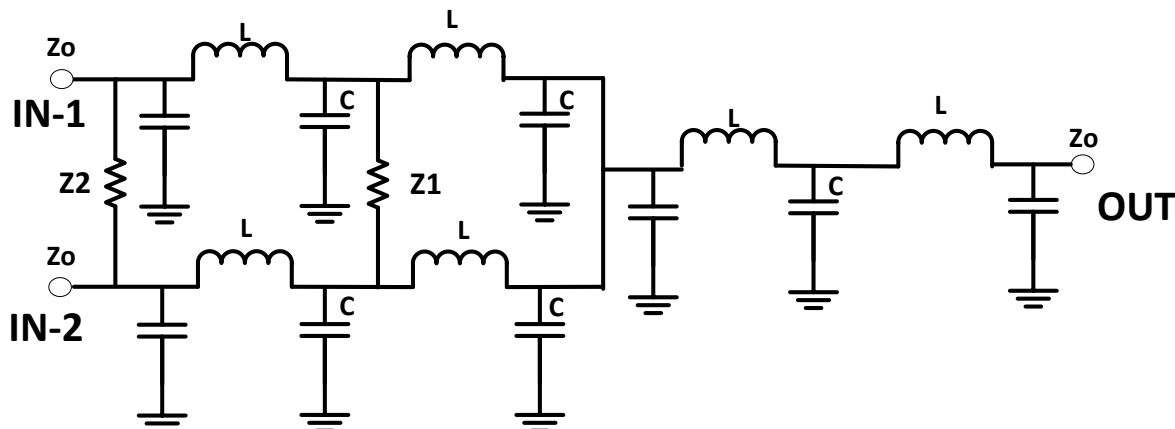
PCB need to be developed for mounting each RF resistor. Proper mounting, soldering & cable routing should be done. Such 02 number of 8-way power splitter need to be fabricated by bidder. Bill of material for the item is mention in Appendix-II.

Table No. 2: Technical specification for RF resistor PCB

Sr. No.	Description	Specification
1	PCB material:	FR4, double layer with 70 micron copper lead free HAL. Thickness: 1.6 mm Tg: $\geq 170^{\circ}\text{C}$
2	PCB size	50 x 70 mm Max size
3	Quantity:	20 Nos

3. 2-way lumped type power combiner

Bidder has to prepare artwork/layout, fabricate 2-way lumped type power combiner PCB and solder components as per Schematic-3.



Schematic-3: 2- way lumped type power combiner.

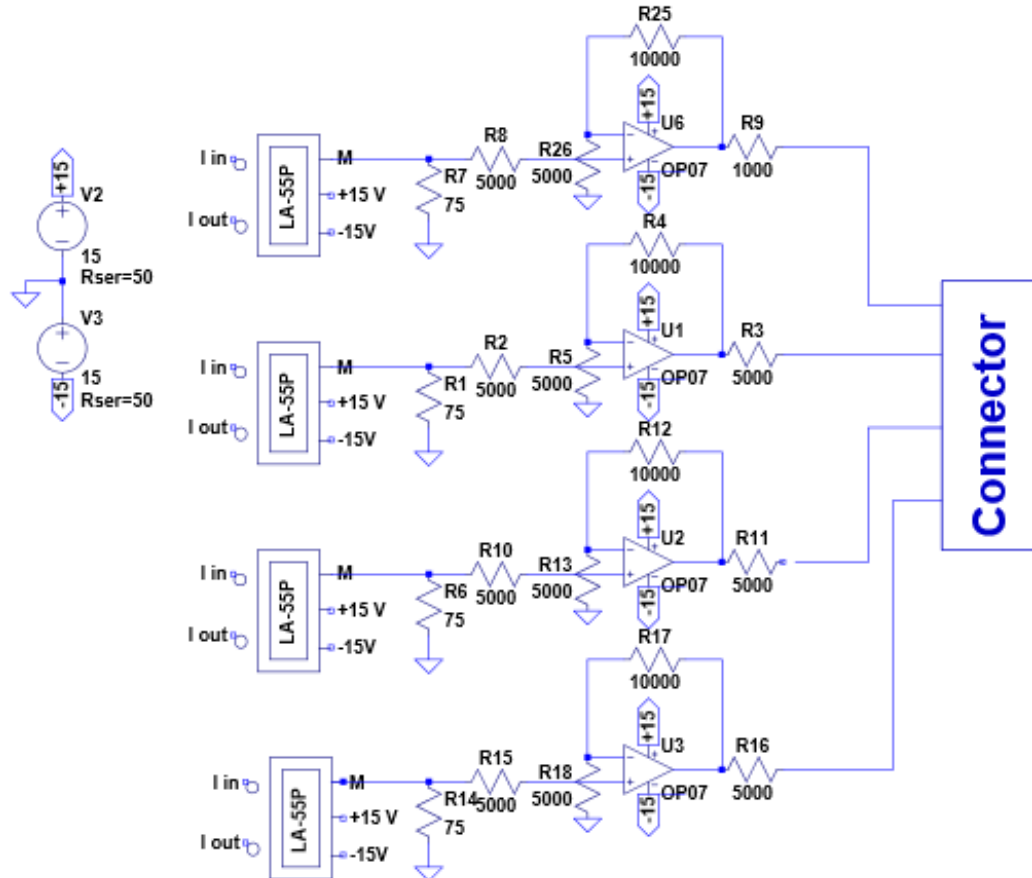
PCB specifications are shown in Table No. 3. RF components should be soldered on PCB using **high temperature solder material**. 01 number of combiner PCB should be prepared and deliver to I-I for testing and approval. Bidder need to implement changes, if any, in the bulk production. After getting approval, bidder should fabricate 08 modules which will be mounted on 2 different water cooled heatsink using proper mounting plates. Bill of material for the items are mentioned in Appendix-II

Table No. 3: Technical specification for 2-way lumped type power combiner PCB

Sr. No.	Description	Specification
1	PCB material:	RO4534, double layer with 35 micron copper Lead free HAL. Thickness: 0.8 mm
2	PCB size	80 X 100 mm Max size
3	Quantity:	12 Nos

4. Current transducer PCB

Bidder has to prepare artwork/layout, fabricate current transducer PCB and solder components as per Schematic-4.



Schematic 4: 4-channel current transducer circuit

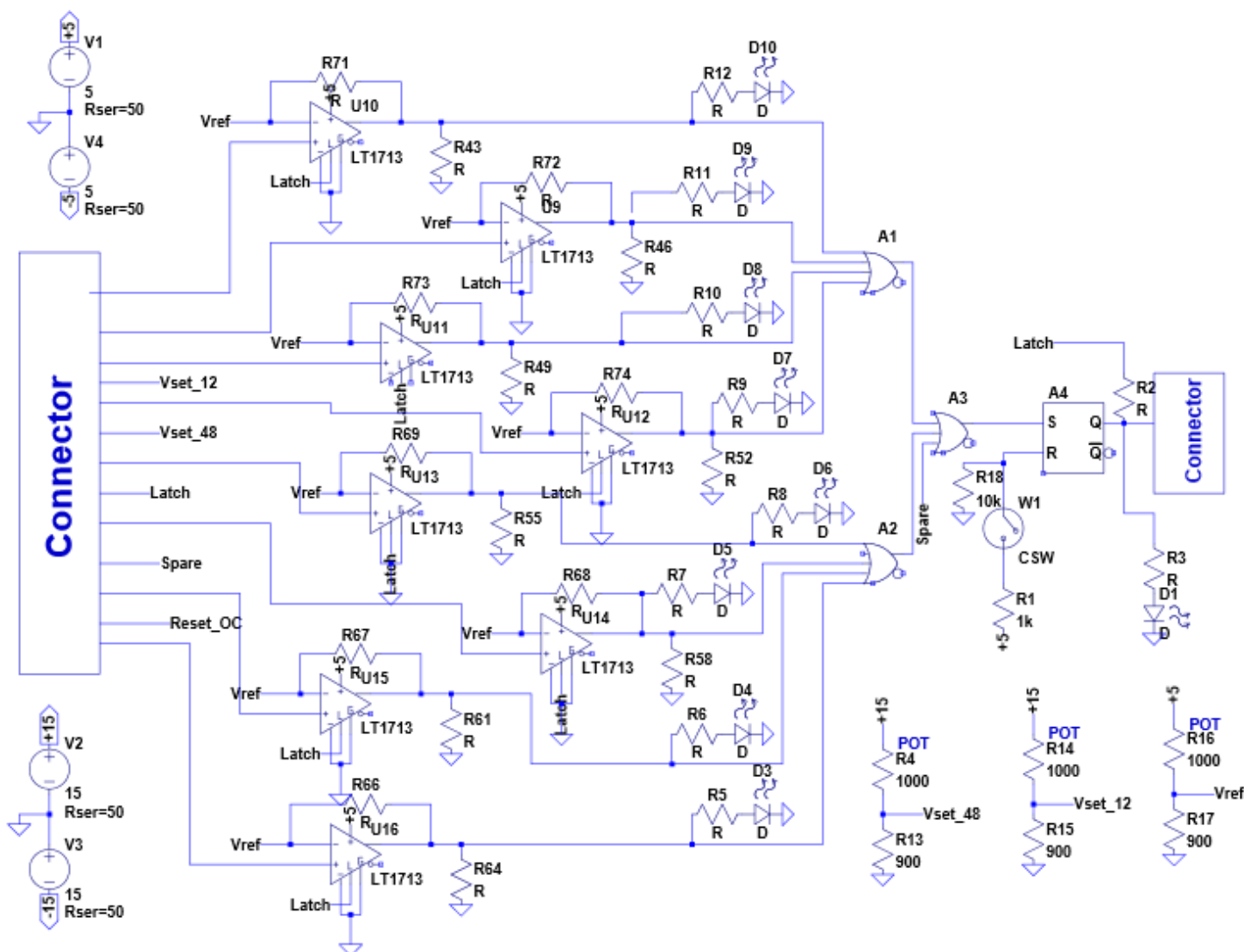
PCB manufacturing should be done as shown in Table No. 4. Components should be soldered on PCB. Such 04 Nos. of PCB should be prepared & mounted in power supply enclosure using proper mounting box. Bill of material for the item is mention in Appendix-II.

Table No. 4: Technical specification for Current Transducer PCB

Sr. No.	Description	Specification
1	PCB material:	FR4, double layer with 35 micron copper lead free HAL. Thickness: 1.6 mm Tg: $\geq 100^{\circ}\text{C}$
2	PCB size	100 X 100 mm Max size
3	Quantity:	06 Nos

5. Over current detection PCB

Bidder has to prepare artwork/layout, fabricate over current PCB and solder components as per Schematic-5.



Schematic 5: 8 channel over current detection circuit

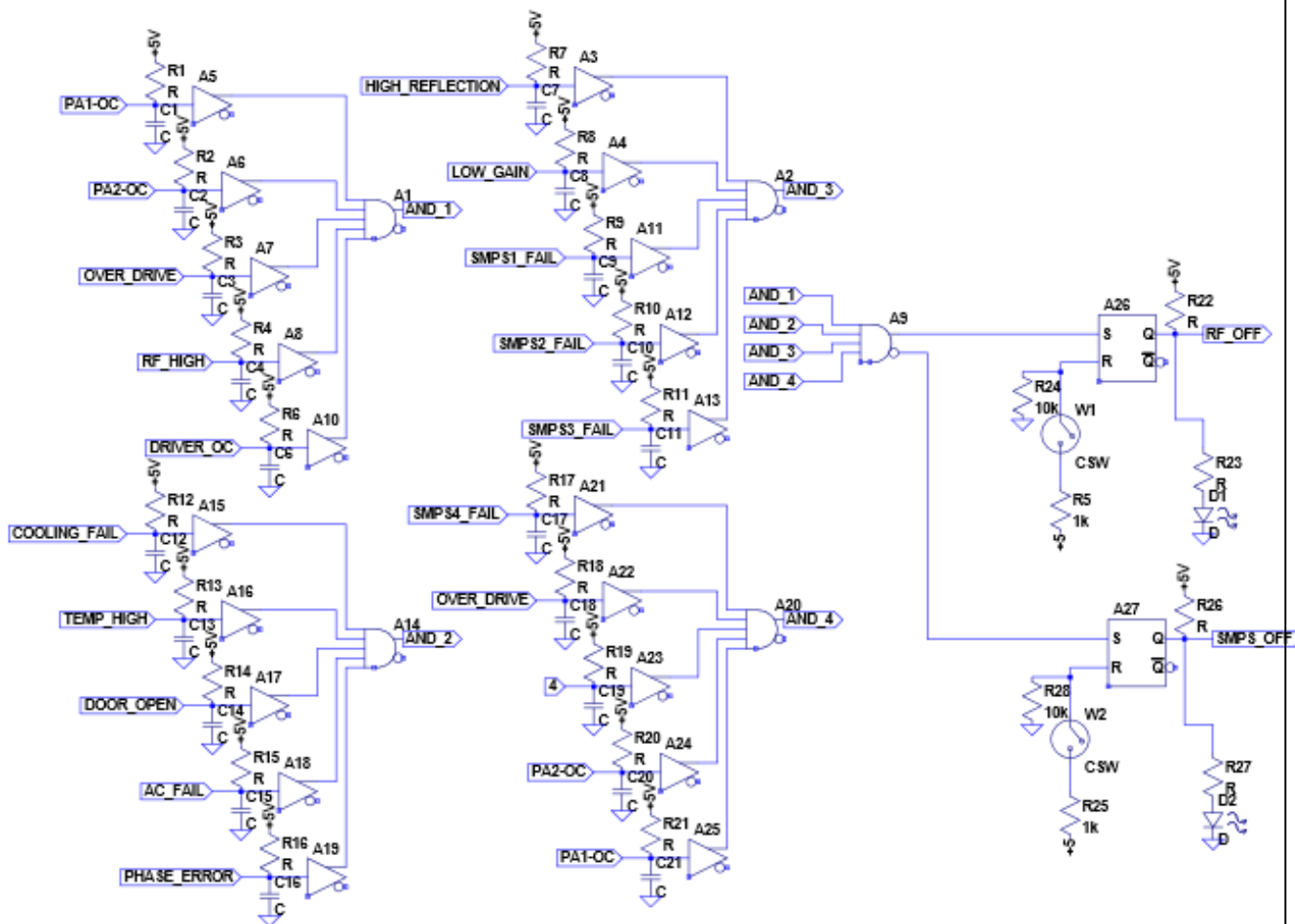
Over current detection PCB's specifications are shown in Table No. 5. Components should be soldered on PCB. Such 02 Nos. of PCB should be prepared & mounted in power supply enclosure using proper mounting box. Bill of material for the item is mention in Appendix-II.

Table No. 5: Technical specification for Over Current Detection PCB

Sr. No.	Description	Specification
1	PCB material:	FR4, double layer with 35 micron copper lead free HAL. Thickness: 1.6 mm Tg: ≥ 100 °C
2	PCB size	100 x 100 mm Max size
3	Quantity:	03 Nos

6. Interlock PCB

Bidder has to prepare artwork/layout, fabricate interlock PCB and solder components as per Schematic-6.



Schematic 6: Interlock circuit-hardwire

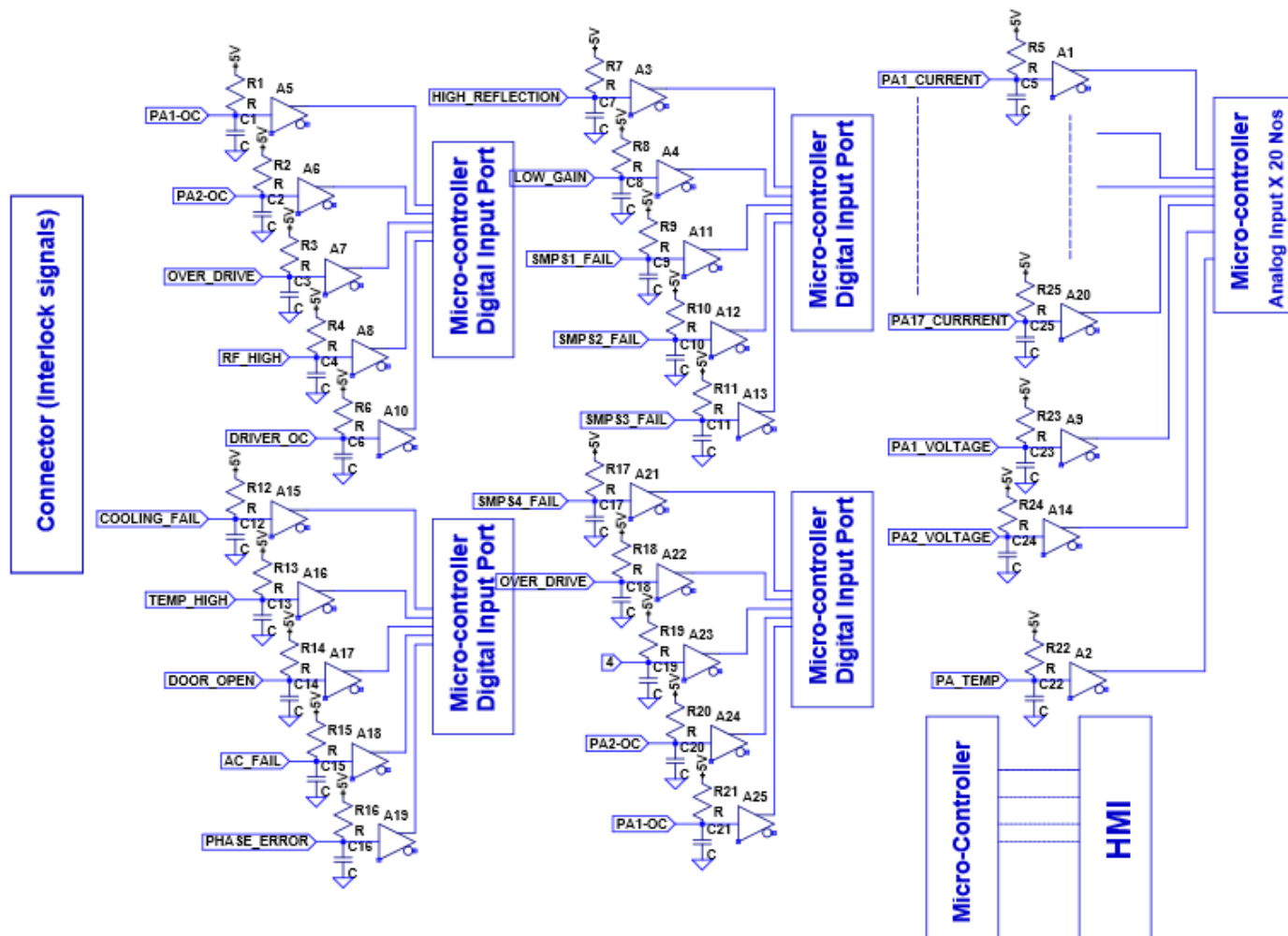
PCB manufacturing should be done as per specification shown in Table No. 6. Components should be soldered on PCB. PCB should be mounted in low power enclosure using proper mounting plates. Bill of material for the item is mention in Appendix-II.

Table No. 6: Technical specification for Interlock PCB

Sr. No.	Description	Specification
1	PCB material:	FR4, double layer with 35 micron copper lead free HAL. Thickness: 1.6 mm Tg: $\geq 100^{\circ}\text{C}$.
2	PCB size	120 x 100 mm Max size
3	Quantity:	03 Nos

7. Micro-controller based interlock PCB

Bidder has to prepare artwork/layout, fabricate micro-controller based interlock PCB and solder components as per Schematic-7.



Schematic 7: Interlock circuit-Microcontroller

PCB specifications are shown in Table No. 7. PCB should be mounted in low power enclosure using proper mounting plates. Bill of material for the item is mention in Appendix-II.


Table No. 7: Technical specification for Micro-controller based interlock PCB

Sr. No.	Description	Specification
1	PCB material:	FR4, double layer with 35 micron copper lead free HAL. Thickness: 1.6 mm Tg: $\geq 100^{\circ}\text{C}$
2	PCB size	120x 100 mm Max size
3	Quantity:	03 Nos

Appendix-II: Procurement of components

Bidder has to procure components as per part number given in Table No. 8

Table No. 8: List of component

Sr. No.	ITER-INDIA specifications	Part Number	Total Quantity	Remarks
BoM for RF amplifier module (2+16 Nos)				
1.	RF Power Field Effect Transistors, Frequency : 10 to 100 MHz Power Level: Better than 1700 W CW Drain voltage: 65 V DC Power Gain: 27 ± 1.5 dB Efficiency: Better than 65 % Case Style: <div style="text-align: center;">  <p>NI-1230H-4S</p> </div>	MRFX1K80H NXP	25 Nos	
2.	Ferrite core: Ferrite toroidal Material: 68 Frequency Response: High Q up to 100 MHz Inner Diameter: 7.9 mm Outer Diameter: 12.7 mm Height: 6.35 mm Tolerance: ± 1 mm	FT-50A-68 Amidon	120 Nos	
3.	Ferrite core: Ferrite toroidal Material: 68 Frequency Response: High Q up to 100 MHz Inner Diameter: 35.5mm Outer Diameter: 61 mm Height: 12.7 mm Tolerance: ± 1 mm	FT-240-68 Amidon	64 Nos	
4.	Ferrite toroidal Material: 43 Frequency Response: Suppresses 25 MHz to 300 MHz Inner Diameter: 35.5mm Outer Diameter: 61 mm	FB-43-24001 Amidon	25 Nos	

	Height: 12.7 mm Tolerance: ± 1 mm			
5.	RF cable: Impedance: 10.7 ohm Insulator: Teflon Voltage rating: 600 V Temperature rating: -65C to +200 C	TC-12 communication concept Inc.	15 meter	
6.	RF cable Power handling: ~200 W/CW at 100 MHZ Attenuation: 1 dB/100 feet Impedance: 50 Ω Dielectric: PTFE	RG 178	30 meter	
7.	RF cable Power handling: ~2000 W/CW at 100 MHZ Attenuation: 1 dB/100 feet Impedance: 50 Ω Dielectric: PTFE	RG 400	30 meter	
8.	Electrolyte capacitor Capacitance: 470uF, 100V Type- SMD, Radial	MAL225099913 E3 VISHAY	80 Nos	
9.	RF ceramic capacitor: 470 pF Capacitance Tolerance (\pm): 20 % Working Volt DC WVDC: 200 VDC Insulation resistance: >0.1 G Ω	ATC100B471M W200XT	40 Nos	
10.	RF ceramic capacitor: 10 pF Capacitance Tolerance (\pm): 10 % Working Volt DC WVDC: 1000 VDC Insulation resistance: >1 G Ω	ATC100C100K W2500X	24 Nos	
11.	RF ceramic capacitor: 22 pF Capacitance Tolerance (\pm): 10 % Working Volt DC WVDC: 1000 VDC Insulation resistance: >1 G Ω	ATC100C220K W2500X	24 Nos	
12.	Ferrite bead: Impedance: 150 \pm 25 Ω at 100 MHz DCR: 0.5 Ω Max Current: 200 mA	2518061517Y0 Fair-Rite	25 Nos	
13.	RF ceramic capacitor: Capacitance: 1000 pF Capacitance Tolerance (\pm): 20 % Working Volt DC WVDC: 1000 VDC Insulation resistance: >1 G Ω	ATC100C102M W1000X	80 Nos	
14.	RF ceramic capacitor: Capacitance: 2.2 uF Capacitance Tolerance (\pm): 10 % Working Volt DC WVDC: 100 VDC Insulation resistance: 100 M Ω	HMK432B7225 KM-T Taiyo Yuden	40 Nos	
BoM for splitters (02 Nos) & combiners (1+8 Nos)				

15.	RF cable with HN-male connector-right angle (both end): Power: 5 kW/CW at 100 MHz Insertion loss: 0.2 dB Return loss: 30 dB Length: 1.5 meter Cable type: RG393 or equivalent		6 Nos	
16.	RF cable with LC-male connector-right angle (both end): Power: 10 kW/CW at 100 MHz Insertion loss: 0.2 dB Return loss: 30 dB Length: 1.5 meter Cable type: HPL-600 Times microwave system or equivalent		5 Nos	
17.	Power Resistor Resistance range: $200 \pm 5 \% \Omega$ Power: 400 W Frequency range: 10 to 100 MHz Mounting: Flange type	IPP-RB215-200	15 Nos	
18.	Power Resistor Resistance range: $75 \pm 5 \% \Omega$, Power: 50 W Frequency range: 10 to 100 MHz Mounting: Flange type	IPP-RB203-75	15 Nos	
19.	Power Resistor Resistance range: $100 \pm 5 \% \Omega$ Power: 20 W Frequency range: 10 to 100 MHz Mounting: Flange type	IPP-RB201-100	20 Nos	
20.	High power high voltage resistor: Resistance range: $100 \pm 5 \% \Omega$ Power rating: 800 W Maximum voltage: 4 kV	IPP-RB216-100	10 Nos	
21.	High power high voltage resistor: Resistance range: $100 \pm 5 \% \Omega$ Power rating: 800 W Maximum voltage: 4 kV	LPS0800H1000J B VISHAY	06 Nos	
22.	Power resistor Resistance range: $100 \pm 1 \% \Omega$ Power rating: 2 W	PCAN1206E100 0BST5 VISHAY	20 Nos	
23.	RF Termination, 50 Ω : Power: 150 W Frequency range: 10 to 300 MHz Max VSWR: 1.2:1 Mounting: Flange type		25 Nos	
24.	RF coaxial cable: Impedance: $75 \pm 3 \Omega$ Velocity of propagation: 69.5 % Conductor DCR: 800.5 Ohm / km	HUBER+SUHN ER make Coaxial	200 foot	

	Power Handling: 300 W/CW at 100 MHz	Cable: RG_179		
25.	RF ceramic capacitor: Capacitance: 51 pF Capacitance Tolerance (\pm): 5 % Working Volt DC WVDC: 1500 VDC Insulation resistance: >1 G Ω	ATC 100E510JW3600 X	24 Nos	
26.	RF ceramic capacitor: Capacitance: 47 pF Capacitance Tolerance (\pm): 5 % Working Volt DC WVDC: 1500 VDC Insulation resistance: >1 G Ω	ATC 100C470JT2500 X	24 Nos	
27.	RF ceramic capacitor: Capacitance: 91 pF Capacitance Tolerance (\pm): 5 % Working Volt DC WVDC: 1500 VDC Insulation resistance: >1 G Ω	ATC 100C910JT2500 X	24 Nos	
28.	RF ceramic capacitor: Capacitance: 120 pF Capacitance Tolerance (\pm): 5 % Working Volt DC WVDC: 1500 VDC Insulation resistance: >1 G Ω	ATC 100C121JT2500 X	24 Nos	
29.	RF ceramic capacitor: Capacitance: 160 pF Capacitance Tolerance (\pm): 5 % Working Volt DC WVDC: 1500 VDC Insulation resistance: >1 G Ω	ATC 100C161JMS250 0X	24 Nos	
30.	Air core RF Inductor: 135 nH Tolerance (\pm): 5% Current rating: 5 Amps RMS Operating frequency: 10 to 80 MHz		12 Nos	
31.	Air core RF Inductor: 115 nH Tolerance (\pm): 5% Current rating: 5 Amps RMS Operating frequency: 10 to 80 MHz		12 Nos	
32.	Air core RF Inductor: 190 nH Tolerance (\pm): 5% Current rating: 5 Amps RMS Operating frequency: 10 to 80 MHz		24 Nos	
33.	Air core RF Inductor: 160 nH Tolerance (\pm): 5% Current rating: 5 Amps RMS Operating frequency: 10 to 80 MHz		24 Nos	
34.	Air core RF Inductor: 300 nH Tolerance (\pm): 5% DC Current rating: 25 Amps		40 Nos	
35.	RF Inductor Designer kit (SMD type) Inductance value: 50 to 700 nH	Coilcraft Designer's Kit	1 Set	

	Turn: ½ turn RMS current: 5 A Tolerance: +/- 5%	C438-2		
36.	RF Inductor Designer kit (Horizontal mount) Inductance value: 20 to 700 nH Turn: ½ turn Tolerance: +/- 5%	Coilcraft Designer's Kit M304	1 Set	
37.	RF Inductor Designer kit (vertical mount) Inductance value: 50 to 700 nH Turn: ½ turn RMS current: 5 A Tolerance: +/- 5%	Coilcraft Designer's Kit M302	1 Set	
38.	PCB mountable N(f) connector: Frequency: DC-100 MHz Impedance: 50Ω Insertion loss: <0.20 dB		20 Nos	
39.	PCB mountable straight SMA(f) connector: Frequency: DC-100 MHz Impedance: 50Ω Insertion loss: <0.20 dB		30 Nos	
40.	PCB mountable right angle SMA(f) connector: Frequency: DC-100 MHz Impedance: 50Ω Insertion loss: <0.20 dB		30 Nos	
41.	HN(male)-N(f) adapter: Frequency: DC-100 MHz Impedance: 50Ω Insertion loss: <0.20 dB Power:1.5 kW/CW		03 Nos	
42.	LC(male)-N(f) adapter: Frequency: DC-100 MHz Impedance: 50Ω Insertion loss: <0.20 dB Power:1.5 kW/CW		05 Nos	
43.	Axial Fan: Size: 80 X 80 X25 mm Operating Voltage: 230 V Type: Bearing Air Flow: > 20 CFM		10 Nos	
44.	Axial Fan: Size: 120 X 120 X 38 mm Operating Voltage: 230 V Type: Bearing Air Flow: > 90 CFM		10 Nos	
45.	Axial Fan:		5 Nos	

	Size: 172 X 150 X 51 mm Operating Voltage: 230 V Type: Bearing Air Flow: > 180 CFM			
BoM for control & interlock PCBs				
46.	Current transducer Primary Nominal Current: 50 A RMS Secondary Nominal Current: 25 mA RMS Conversion ratio: 1:1000 Linearity error: <0.5% Supply Voltage : -15 V to +15 V	LA-55P LEM make	20 Nos	
47.	Current Transducer Primary Nominal Current: 25 A RMS Secondary Nominal Current: 25 mA RMS Conversion ratio: 1: 1000 Linearity error: <0.5% Supply Voltage : -15 V to +15 V	LA25-P LEM make	02 Nos	
48.	Operation Amplifier Input range: 0 to ± 14 V Unity gain bandwidth: 200 kHz CMRR: 100 dB Package: SMD/SMT	OP07C	30 Nos	
49.	Comparator Input range: 0 to +5 V Response time: Better than 10 ns CMRR: 50 dB Package: SMD/SMT	LT1713CMS8	25 Nos	
50.	SR flip-flop Input range: 0 to +5 V Propagation delay: Better than 300 ns Package: SMD/SMT	CD4044BD	05 Nos	
51.	AND gate Dual 4 input AND gate Input range: 0 to +5 V Propagation delay: Better than 300 ns Package: SMD/SMT	CD4082BNSR	10 Nos	
52.	OR gate Dual 4 input OR gate Input range: 0 to +5 V Propagation delay: Better than 300 ns Package: SMD/SMT	CD4072BM	10 Nos	
53.	Buffer Hex buffer/converter Input range: 0 to +5 V Propagation delay: Better than 300 ns Package: SMD/SMT	CD4050B	10 Nos	

54.	Inverter Hex inverter Input range: 0 to +5 V Propagation delay: Better than 300 ns Package: SMD/SMT	CD4049UB	10 Nos	
55.	Analog Multiplexer Single-Ended 8-Channel Analog signal range: 0 to 10 V OFF isolation: better than 40 dB	MPC508A	05 Nos	
56.	Ceramic Capacitor Capacitance:0.1 μ F Tolerance: 10 % Operating Voltage: 50 V Insulation: 100M Ω or better Termination Style: SMD/SMT	12065F104K4T2 A AVX	100 Nos	
57.	Ceramic Capacitor Capacitance:0.01 μ F Tolerance: 10 % Operating Voltage: 50 V Insulation: 100M Ω or better Termination Style: SMD/SMT	12065F103K4T2 A AVX	50 Nos	
58.	Electrolytic Capacitor Capacitance: 10 μ F Tolerance: 20 % Operating Voltage: 100 V Leakage current: 20 μ A or better Termination Style: SMD/SMT	MAL214699901 E3 VISHAY	50 Nos	
59.	Tantalum Capacitor Capacitance: 4.7 μ F Tolerance: 20 % Operating Voltage: 50 V ESR: 250 m Ω or better Insulation: 100M Ω or better Termination Style: SMD/SMT	TCJY475M050R 0250 AVX	50 Nos	
60.	Resistor Resistance: 100 Ω Tolerance: 1% Power: 400 mW Voltage Rating: Better than 120 V Termination Style: SMD/SMT	RCS0805100RF KEA VISHAY	100 Nos	
61.	Resistor Resistance: 1 k Ω Tolerance: 1% Power: 400 mW Voltage Rating: Better than 120 V Termination Style: SMD/SMT	RCS08051K00F KEA VISHAY	100 Nos	
62.	Resistor Resistance: 5.1 k Ω Tolerance: 1%	RCS08055K10F KEA VISHAY	100 Nos	

	Power: 400 mW Voltage Rating: Better than 120 V Termination Style: SMD/SMT			
63.	Resistor Resistance: 200 k Ω Tolerance: 1% Power: 400 mW Voltage Rating: Better than 120 V Termination Style: SMD/SMT	RCS0805200KF KEA VISHAY	100 Nos	
64.	Trimming Potentiometer Resistance: 10 k Ω Power: 200 mW Voltage Rating: Better than 100 V Termination Style: SMD/SMT	3269P-1-103LF Bourns	10 Nos	
65.	LED Red color Forward Current: 20 mA Termination Style: SMD/SMT		25 Nos	
66.	LED Green color Forward Current: 20 mA Termination Style: SMD/SMT		25 Nos	
67.	Switch Type: Pushbutton SPST Current: 1 Amps		2 Nos	
68.	D-Sub High Density Connector set for enclosure mounting: Pin: 25 Gender: Male-Female pair Mounting Angle: Straight Termination Style: Through Hole	Allied, Wurth elektronik or Phoenix contact make	6 Set	
69.	Ferrite for D-type connector Material: 43 Length: 1.43 mm Width: 0.3 mm Height: 0.27 mm Impedance at 100 MHz: 82 Ohm Hole: 25	DC-43-25B Amidon	20 Nos	
70.	Ferrite round cable bead Material: 43 Inner Diameter: 6.3 mm Outer Diameter: 14.3 mm Height: 10.2 mm Impedance at 100 MHz: 89 Ohm	FB-43-5622 Amidon	50 Nos	
71.	Zener Diode Zener Voltage: 3 V Zener Voltage tolerance: 2%, Power dissipation: > 400mW, Package: SOD-123	MMSZ5225C VISHAY	10 Nos	
72.	Zener Diode Zener Voltage: 3.3 V Zener Voltage tolerance: 2%,	MMSZ5226C VISHAY	50 Nos	

	Power dissipation: > 400mW, Package: SOD-123			
73.	Zener Diode Zener Voltage: 3.6 V Zener Voltage tolerance: 2%, Power dissipation: > 400mW, Package: SOD-123	MMSZ5227C VISHAY	10 Nos	
74.	Zener Diode Zener Voltage: 3.9 V Zener Voltage tolerance: 2%, Power dissipation: > 400mW, Package: SOD-123	MMSZ5228C VISHAY	10 Nos	
75.	Zener Diode Zener Voltage: 4.7 V Zener Voltage tolerance: 2%, Power dissipation: > 400mW, Package: SOD-123	MMSZ5230C VISHAY	50 Nos	
BoM for electrical distribution system				
76.	Molded case circuit breaker: Current rating: 100 A Max rated operational voltage: 600 V, 4 Pole Max Short circuit Current: 25kA Switching capacity: According to IEC 60947 Arrangement of electrical connectors: Front terminal- lug type Protection class IP:IP40 Accessory: Shunt trip coil/230 V	3VA1010- 3ED42-0AA0 SIEMENS	1 Nos.	
77.	DPDT Relay: Contact rating: - 250 V/4A for resistive load - Max allowed Voltage: 250V AC /40 V DC Coil Specification: - Nominal voltage: 24 VDC Switching frequency: 5 cycles/min Surge strength: 1.2 kV between coil & contact Contact material: Ag alloy Mounting accessories: DIN type	RE224DMF Goodsky make RE series	05 Nos	
78.	AC protector: AC voltage: 3 phase/4 wire-415 V Protection against: Phase sequence, phase unbalance, under voltage, over voltage etc. Reset mode: Auto reset Mounting: DIN type	ALV D2 Minilec	01 Nos	
79.	MCB 2 Pole:	5SL62107RC	01 Nos	

	Voltage: 230-415 V Current rating: 5 A or more Package: Plastic	SIEMENS		
80.	Fuse for control circuit Rating: 3 A, 230V Type: Glass Inbuilt with DIN terminal block		02 Nos	
Connectors for power supply interfacing				
81.	Panel mount feed-through Connector-Right angle type Load current: 40 Amps Nominal Voltage: 300 V Pin: 16, solder type	Allied, Wurth elektronik or Phoenic contact	06 Nos	
82.	Panel mount feed-through Connector- Right angle type Load current: 100 Amps Nominal Voltage: 800 V Pin: 4, solder type	Allied, Wurth elektronik or Phoenic contact	05 Nos	
83.	Line filter: Rated voltage: 230 V/50 Hz Rated Current: 10 Amps	810911010 Wurth elektronik	01 Nos	

Note: In case of unavailability of components, bidder has to provide equivalent parts, after getting approval from I-I.

Appendix-III: Electronics board procurement

Bidder has to procure RF and display boards as per specifications shown in Table No. 9 and 10.

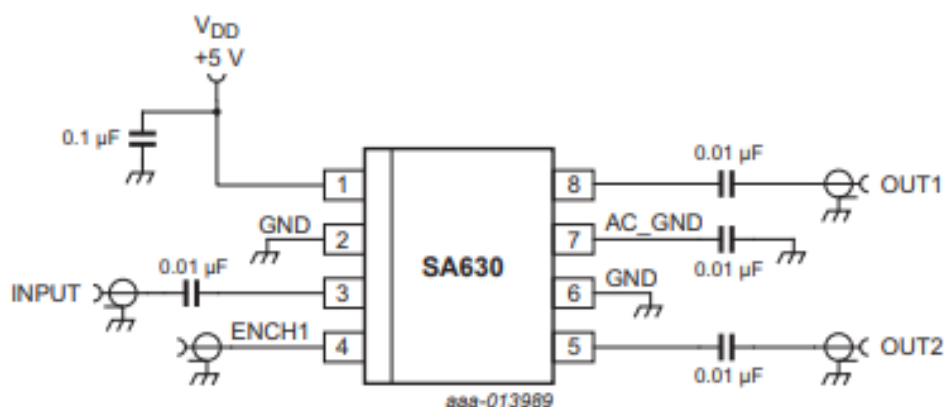
1. RF board

Bidder has to procure or fabricate RF boards like RF switch, variable gain amplifier, low power amplifier, driver amplifier, dual directional coupler and power detector. Technical specifications of each module is mentioned in respective table with schematic diagram. Bidder may refer datasheet of preferred make for detail information of board.

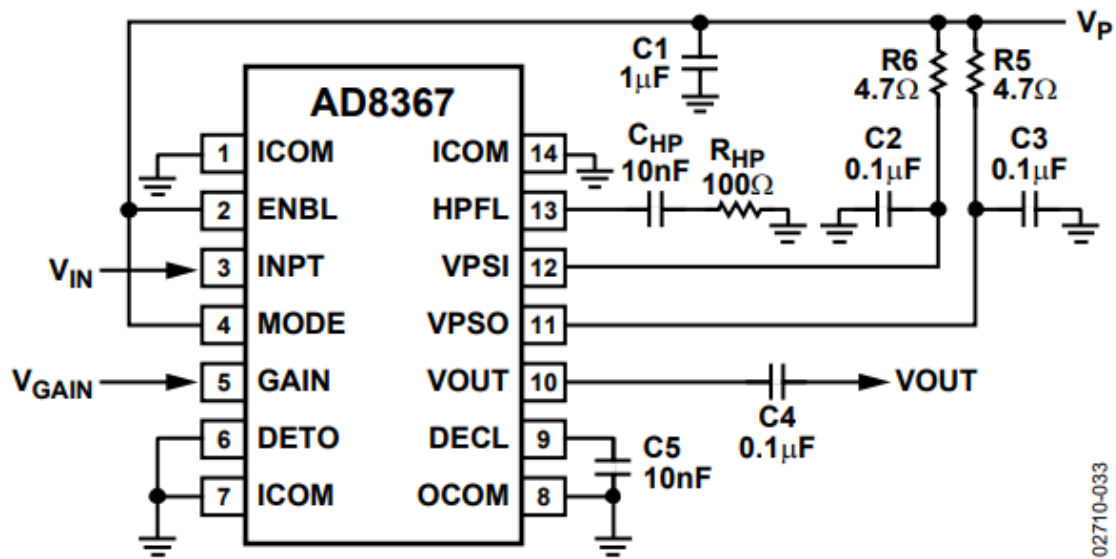
Table No. 9: Technical specification for low power RF boards

Sr. No.	ITER-INDIA Specifications	Remarks
1	RF Switch <ul style="list-style-type: none"> Frequency: 30 to 100 MHz Input power : +15 dBm Isolation: Better than 50 dB Switching response: Less than 100 ns. Control Signal: TTL type Model No & make: SA630 /NXP Reference circuit: as per schematic 8 Quantity: 04	
2	Variable Gain Amplifier: <ul style="list-style-type: none"> Frequency: 30 to 100 MHz Input power: +5 dBm Variable gain Range:40 dB Control Signal: 0-1 V DC Model No & Make: AD8367 / Analog Devices Reference circuit: as per schematic 9 Quantity: 02	
3	Low Power Amplifier <ul style="list-style-type: none"> Frequency: 30 to 100 MHz Max Output Power: +30 dBm Gain: 10 \pm1 dB VSWR: Better than 1.3:1 Bias voltage: 12 VDC Model No & Make: HELA-10+ / Minicircuit Reference circuit: as per schematic 10 Quantity: 02	
4	Driver Amplifier <ul style="list-style-type: none"> Model No & Make: MRF6VP2600 / NXP Cooling: Force air cooled heatsink Reference circuit: as per schematic 11 Quantity: 01	Bidder has to fabricate PCB for the driver amplifier as per the schematic 11 only, with part no MRF6VP2600.

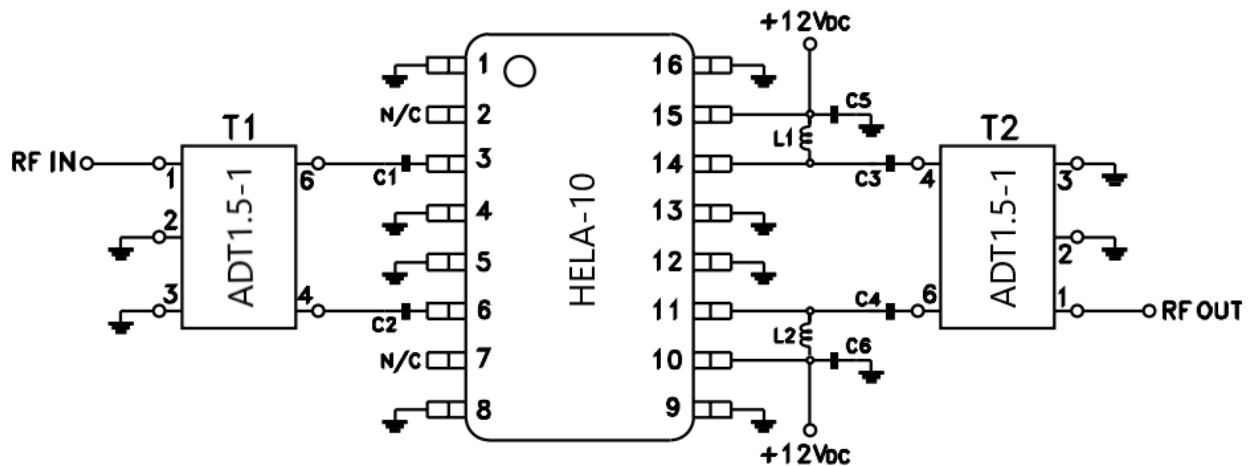
5	Dual Directional Coupler <ul style="list-style-type: none"> Frequency: 30 to 100 MHz Power handling: 300 W/CW Coupling: 50 \pm1 dB Directivity: 20 dB Input-output return loss: 30 dB Model No & Make: DDCH-50-521+ / Minicircuit Connectors: SMA-female Quantity: 01	
6	Power Detector <ul style="list-style-type: none"> Frequency: 30 to 100 MHz Input power range: -30 to 0 dBm Output: DC voltage as well as digital output Dynamic range: 30 dB Linearity: \pm1 dB Model No & Make: LTC 5587 / Linear Technology Reference circuit: as per schematic 12. Quantity: 06	



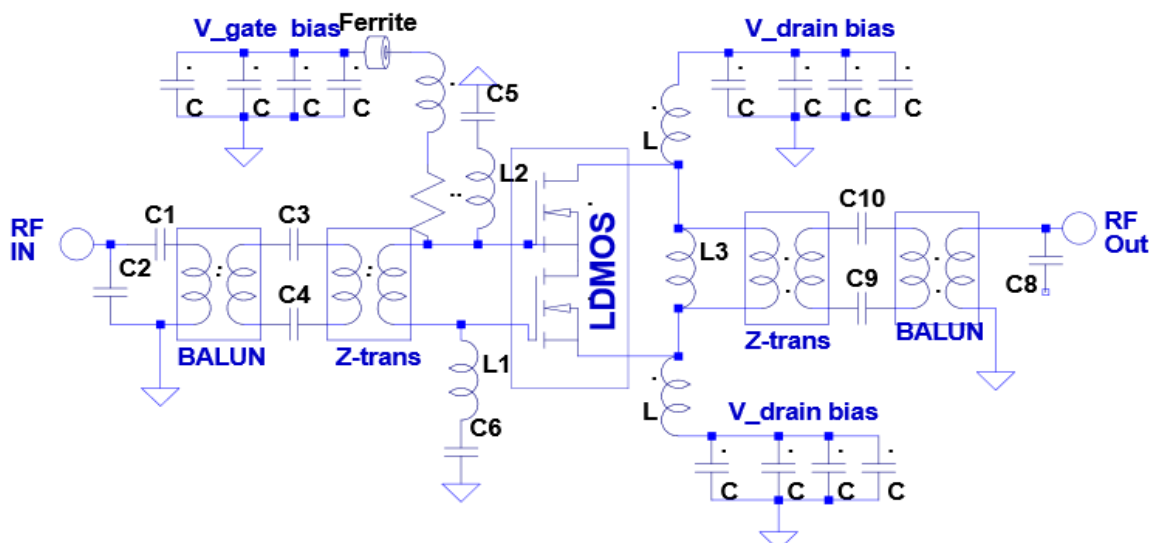
Schematic 8: Reference circuit for RF switch



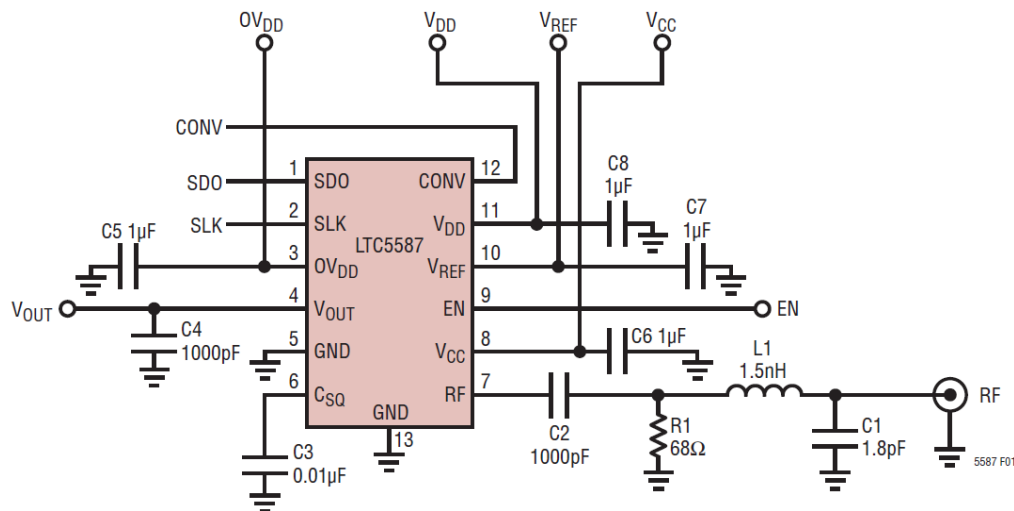
Schematic 9: Reference circuit for variable gain amplifier



Schematic 10: Reference circuit for low power amplifier



Schematic 11: Reference circuit for driver amplifier (MRF6VP2600)



Schematic 12: Reference circuit for Power Detector

2. Display and micro-controller module

Bidder has to procure touch screen display with driver card as mentioned in technical specification in Table No. 10 under Sr. No. 1. Touch screen & driver card should be mounted in single box to prevent physical damage. Necessary accessories should be arranged & wiring should be done for interfacing of micro-controller card to driver card and driver card to display.

Only procurement, mounting and wiring of hardware with peripheral is under scope of bidder. Software programming is under scope of ITER-INDIA.

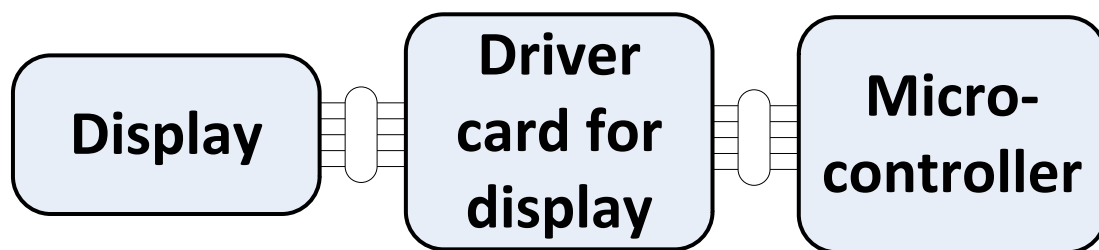


Table No. 10: Technical specification for Components for display module

Sr. No.	ITER-INDIA Specifications
1	<p>Touch screen display with driver card:</p> <ul style="list-style-type: none"> • Display size: 7" Touchscreen • Display type: Capacitive touch • Screen Resolution: 800 x 480 pixels • Accessories: Adapter board, DSI ribbon cables & required hardware for mounting • Enclosure for display & adapter board: High Impact Polystyrene (HIPS) enclosure with mounting hardware • Preferred make: Raspberry Pi

	<ul style="list-style-type: none">Quantity: 01
2	<p>Microcontroller board for ATmega2560:</p> <ul style="list-style-type: none">Operating voltage: 5VDIO pins: 40 or moreAnalog pin: 8 or moreFlash Memory:256 KBSRAM: 8 KBEEPROM: 4 KBPreferred make: Arduino Mega 2560 R3Quantity: 01

Appendix-IV: Procurement of DC power supply

Bidder has to procure DC power supply as specification mentioned in Table No. 11 to 16. Bidder have to arrange necessary mounting hardware, cable & connectors for mount and electrical connection of these DC power supplies. Power supplies should be mount in 19” enclosures. Bidder has to deliver 1 number of 48 V (Table No. 11) and 1 number of 12 V (Table No. 12) power supply with bench mark supply. Remaining quantity should be shipped with final delivery.

Table No. 11: Specifications for 48 V/ 200 A DC Power Supply

Sr. No.	ITER-INDIA specification
1.	DC Voltage range : 48 to 55 V DC
2.	DC Current range: 0 to 200 Amps
3.	Rated DC Power: 10 kW
4.	Line regulation: Better than $\pm 1\%$ Load regulation: Better than $\pm 1\%$
5.	Ripple & Noise: Better than 300 mVp-p
6.	Efficiency at full load: Better than 85 %
7.	Remote On/Off control: Electrical signal or Dry contact
8.	Parallel operation: Normal
9.	Protection required against faults: <ul style="list-style-type: none"> - Over Load - Over voltage - Over temperature
10.	Function required: <ul style="list-style-type: none"> - Remote sense - Current sharing (up to 20 kW) - Alarm signal for AC fail, DC ok, fan fail
11.	Indication required for: <ul style="list-style-type: none"> - Output voltage OK - Protection activated
12.	EMI/EMC compatibility (declaration or certificated products for following standard): <ul style="list-style-type: none"> - EN55032/EN55011 or equivalent for conducted & radiated emission - EN61000-3-2 or equivalent for Harmonic current - EN61000-3-3 or equivalent for voltage flicker - EN61000 or equivalent for EMC Immunity like ESD, radiated, surge, conducted etc.
13.	Safety Standard: UL60950-1, TUV EN 60950-1 or equivalent
14.	MTBF value: 40,000 hours (Telcordia SR-332)
15.	Input to output isolation: Better than 1.5 kV AC
16.	Isolation Resistance: 100 M Ω at 500 V DC
17.	Mounting: 19” rack mountable with max height of 2U
18.	Weight: < 25 Kg



19.	AC input: 230 V single phase Or 415 V three phase +/- 10 %, 50 Hz
20.	Cooling: Forced air cooling
21.	Operating temperature: 10 to 50 °C
22.	Make: Mean well, TDK Lambda, Magna Power Electronics
23.	Quantity : 4 Nos

Table No. 12: Specifications for 12 V/ 200 A DC Power Supply

Sr. No.	ITER-INDIA specification
1.	DC Voltage: 12 V DC
2.	DC Current range: 0 to 200 Amps
3.	Rated DC Power: 2.4 kW
4.	Line regulation: Better than $\pm 1\%$ Load regulation: Better than $\pm 1\%$
5.	Ripple & noise : Better than 200 mVp-p
6.	Efficiency at full load: Better than 85 %
7.	Remote On/Off control: Electrical signal or Dry contact
8.	Parallel operation: Normal
9.	Protection required against faults: <ul style="list-style-type: none">- Over Load- Over voltage- Over temperature
10.	Function required: <ul style="list-style-type: none">- Remote sense- Current sharing (up to 8 kW)- Alarm signal for SMPS Ok
11.	EMI/EMC compatibility (declaration or certificated products for following standard): <ul style="list-style-type: none">- EN55032/EN55011 or equivalent for conducted & radiated emission- EN61000-3-2 or equivalent for Harmonic current- EN61000-3-3 or equivalent for voltage flicker- EN61000 or equivalent for EMC Immunity like ESD, radiated, surge, conducted etc.
12.	Safety Standard: UL60950-1, TUV EN 60950-1 or equivalent
13.	MTBF value: 40,000 hours (Telcordia SR-332)
14.	Input to output Isolation: Better than 1.5 kV AC
15.	Isolation Resistance: 100 M Ω at 500 V DC
16.	Dimension: Max 300x200x80 mm (LxWxH)
17.	Weight: < 5 Kg
18.	AC input: 230 V single phase Or 415 V three phase +/- 10 %, 50 Hz
19.	Operating temperature: 10 to 50 °C

20.	Make: Mean well, TDK Lambda, Magna Power Electronics
21.	Quantity : 4 Nos

Table No. 13: Specifications for 48 V/ 20 A DC Power Supply

Sr. No.	ITER-INDIA specification
1.	DC Voltage: 48 V DC
2.	DC Current range: 0 to 20 Amps
3.	Rated DC Power: 1 kW
4.	Line regulation: Better than $\pm 1\%$ Load regulation: Better than $\pm 1\%$
5.	Ripple & noise: Better than 300 mVp-p
6.	Efficiency at full load: Better than 85 %
7.	Remote On/Off control: Electrical signal or Dry contact
8.	Parallel operation: Normal
9.	Protection required against faults: <ul style="list-style-type: none"> - Over Load - Over voltage - Over temperature
10.	Function required: <ul style="list-style-type: none"> - Remote sense - Current sharing (up to 2 kW) - Alarm signal for SMPS Ok
11.	EMI/EMC compatibility (declaration or certificated products for following standard): <ul style="list-style-type: none"> - EN55032/EN55011 or equivalent for conducted & radiated emission - EN61000-3-2 or equivalent for Harmonic current - EN61000-3-3 or equivalent for voltage flicker - EN61000 or equivalent for EMC Immunity like ESD, radiated, surge, conducted etc.
12.	Safety Standard: IEC60601-1 or equivalent
13.	MTBF value: 40,000 hours (Telcordia SR-332)
14.	Input to output Isolation: Better than 1.5 kV AC
15.	Isolation Resistance: 100 M Ω at 500 V DC
16.	Dimension: Max 300x120x80 mm (LxWxH)
17.	Weight: < 2 Kg
18.	AC input: 230 V single phase Or 415 V three phase +/- 10 %, 50 Hz
19.	Operating temperature: 10 to 50 °C



20.	Make: Mean well, TDK Lambda, Magna Power Electronics
21.	Quantity : 01 Nos

Table No. 14: Specifications for 12 V/1 A DC Power Supply

Sr. No.	ITER-INDIA Specification
1.	DC Voltage: 12 V DC
2.	DC Current range: 0 - 1 Amps
3.	Rated DC Power: 12 W
4.	Line regulation: Better than $\pm 1\%$ Load regulation: Better than $\pm 1\%$
5.	Ripple & noise: Better than 200 mVp-p
6.	Efficiency at full load: Better than 70 %
7.	Protection required against faults: <ul style="list-style-type: none">- Over Load- Over voltage- Over temperature
8.	EMI/EMC compatibility (declaration or certificated products for following standard): <ul style="list-style-type: none">- EN55032/EN55011 or equivalent- EN61000-3-2 or equivalent- EN61000-3-3 or equivalent
9.	Safety Standard: TUV EN60950-1 or equivalent
10.	MTBF value: 40,000 hours
11.	Input to output Isolation: Better than 1.5 kV AC
12.	Isolation Resistance: 100 M Ω at 500 V DC
13.	Dimension: Max 70 x 60 x 30 mm (LxWxH)
14.	Weight: < 0.3 Kg
15.	AC input: 230 V single phase +/- 10 %, 50 Hz
16.	Operating temperature: 10 to 50 °C
17.	Make: Mean well, TDK Lambda, Magna Power Electronics
18.	Quantity : 02 Nos

Table No. 15: Specifications for Triple Output Power Supply +5V, +15V,-15V DC

Sr. No.	ITER-INDIA specification
1.	Output-1: +5V, 3 Amps Output-2: +15V, 1 Amps Output-3: -15V, 0.5 Amps
2.	Line regulation: Better than $\pm 1.5\%$ Load regulation: Better than $\pm 3\%$
3.	Ripple & noise : Better than 200 mVp-p
4.	Efficiency at full load: Better than 75 %
5.	Protection required against faults: - Over Load - Over voltage
6.	EMI/EMC compatibility (declaration or certificated products for following standard): - EN55032 or equivalent - EN61000-3-2 or equivalent - EN61000-3-3 or equivalent - EN61000-6-2 or equivalent
7.	Safety Standard: TUV EN60950-1 or equivalent
8.	MTBF value: 40,000 hours
9.	Input to output Isolation: Better than 1.5 kV AC
10.	Isolation Resistance: 100 M Ω at 500 V DC
11.	Dimension: Max 120x120x40 mm (LxWxH)
12.	Weight: < 0.5 Kg
13.	AC input: 230 V single phase Or 415 V three phase +/- 10 %, 50 Hz
14.	Operating temperature: 10 to 50 °C
15.	Make: Mean well, TDK Lambda, Magna Power Electronics
16.	Quantity : 01 Nos

Table No. 16: Specifications for 24V/2.5 A DC Power Supply

Sr. No.	ITER-INDIA specification
1.	DC Voltage: 24 V, DC Current: 2.5 A
2.	Line regulation: Better than $\pm 1\%$ Load regulation: Better than $\pm 1\%$
3.	Ripple & noise : Better than 200 mVp-p
4.	Efficiency at full load: Better than 85 %
5.	Protection required against faults: - Over Load

	- Over voltage
6.	EMI/EMC compatibility (declaration or certificated products for following standard): <ul style="list-style-type: none"> - EN55032 or equivalent - EN61000-3-2 or equivalent - EN61000-3-3 or equivalent - EN61000-4-2 or equivalent - EN61000-4-5 or equivalent - EN61000-4-8 or equivalent
7.	Safety Standard: TUV EN60950-1 or equivalent
8.	MTBF value: 40,000 hours
9.	Input to output Isolation: Better than 1.5 kV AC
10.	Isolation Resistance: 100 MΩ at 500 V DC
11.	Dimension: Max 60x100x60 mm (WxHxD)
12.	Weight: < 0.5 Kg
13.	Mounting: DIN rail mount
14.	AC input: 230 V single phase Or 415 V three phase +/- 10 %, 50 Hz
15.	Operating temperature: 10 to 50 °C
16.	Make: Mean well, TDK Lambda, Magna Power Electronics
17.	Quantity : 01 Nos

Appendix-V: Fabrication of water cooled heatsink & cooling distribution system

Bidder has to fabricate/procure water cooled heatsink as per reference Fig. 1. Mechanical dimension are for reference only, and it may vary depending upon size of PCBs. Bidder has to prepare final mechanical 2D drawing & take approval from I-I before start of fabrication/procurement. Cooling connection should be made leak proof for operation at 5.0 bar pressure. Bidder has to make drilling/ tapping for mounting of multiple components on both side of water cooled heatsink.

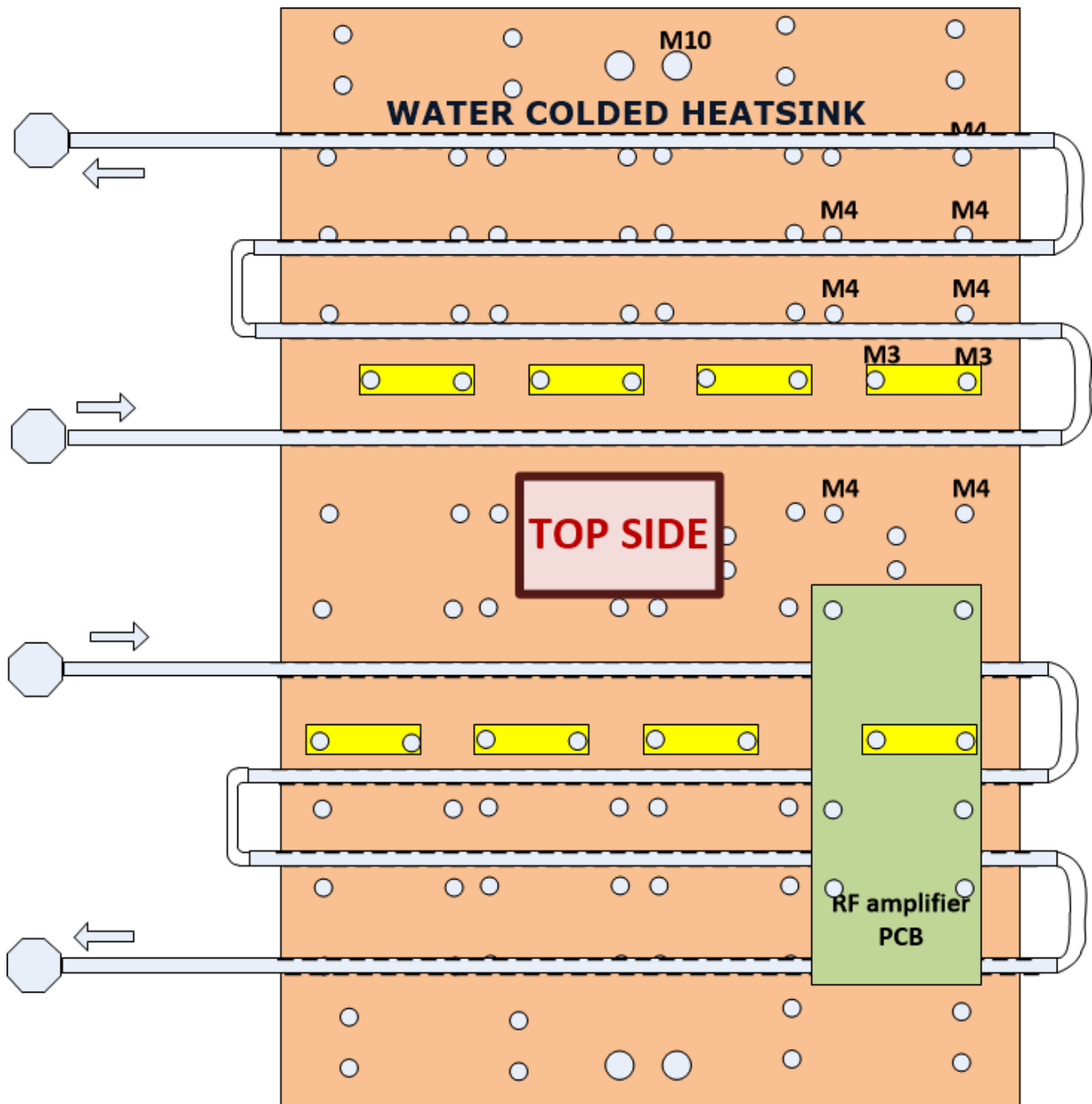


Figure 1: Water Cooled Heatsink.

Table No. 17: Specification for water cooled heatsink for high power application.

Sr. No.	ITER-INDIA Specifications
1.	Heatsink material: Aluminum
2.	Cooling tube material: Copper Thickness: 1.2 mm Diameter: 6.4 mm
3.	Dimension of heatsink: Length: ~450 mm Width: ~430 mm Thickness: 15 to 16 mm
4.	Tube Connector: ¾" NPT male Material: SS 304
5.	Quantity: 02 Nos

Bidder has to fabricate and assemble cooling distribution system as per Fig. 2. Necessary components, flexible & solid cooling pipe, support for copper tube, required accessories etc. should be procured as per specification mentioned in Table No. 18. **Brass parts are not allowed in cooling circuit.**

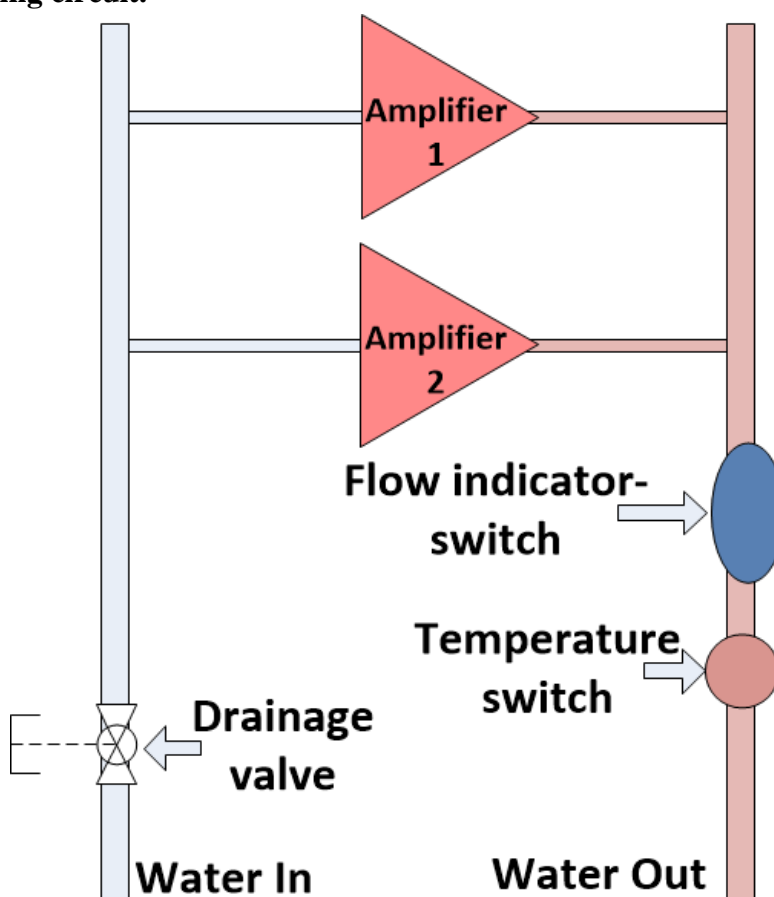


Figure 2: PFD diagram for water cooling


Table No. 18: Technical specification cooling components

Sr. No.	ITER-INDIA Specifications
1.	Flow switch: Flow switch range: 40-80 LPM Contact type: NO-NC Connection: 1" NPT type Voltage requirement: 24 V DC or 230 V AC Quantity: 01 Nos
2.	Water temperature switch: Temperature range: 40-50 °C Contact type: NO-NC Connection: 1" NPT type Voltage requirement: 24 V DC or 230 V AC Quantity: 01 Nos
3.	Flexible hose pipe: Connector: ¾" NPT female on both side Connector material: SS 304 Hose material: Nylon Operating water pressure: 10 Bar Length: 1 meter Quantity: 6 Nos
4.	SS Pipes & elbows: 1" NB & ¾" NB, SCH40 ERW SS304 pipe Quantity: as per requirement

Appendix-VI: Procurement of 19” rack

All components/sub-system should be mounted in single 19” rack as shown in Fig. 4. Bidder has to procure 19” rack as per specification mention in Table No. 19.

Table No. 19: Specification of 19” instrument rack.

Sr. No.	ITER-INDIA Specification
1.	Size of Rack-800Wx800Dx1800H mm (01 Nos)
2.	Door – Solid-Hinged Type with lock, limit switch mounting, Bulb holder and cables (02 Nos)
3.	Material – Aluminum/Steel
4.	Conductive coating on inner surface
5.	L-Shaped 19” angle and its required mounting
6.	<p>19” enclosure rack mountable kit-enclosure for:</p> <ol style="list-style-type: none"> 1. Low power section-6U height, 500mm depth, 20 kg (01 Nos) 2. Electrical section-6U height, 500mm depth, 20 kg (01 Nos) 3. Power supply 6U height, 600mm depth, 100kg (02 Nos) 4. Amplifier section 5U height, 500mm depth, 100kg (02 Nos) 5. Final stage combiner section 6U height, 500mm depth, 100kg (01 Nos) <p>Total quantity: 07 Nos</p> 
7.	Castor wheels 2 No with break and 2 No. without break with all the required mounting
8.	Lifting bolts (04 Nos)
9.	19” Extension Board with 16 A MCB (01 Nos)
10.	Cable Manager, 1U,19” Mounting (04 Nos)
11.	<p>Compliance:</p> <ul style="list-style-type: none"> - Mechanical: IEC 297 or equivalent - IP : Up to IP 41 or equivalent - EMI/EMC: MIL STD 461 or equivalent - Shock and vibration : MIL STD 167 or equivalent
12.	Make: Rittal, APW President, Glaum Enclosures or Schroff

Appendix- VII: Assembly & mounting of amplifier system

Basic block diagram of overall system is shown in Fig. 3. Block diagram contains 16 amplifier pallets, power splitter & combiner, DC power supplies, low power section (LPS) with driver amplifier, control & display etc. Tentative mounting scheme for all system/sub-system in 19" rack is shown in Fig. 4. Bidder has to mount each system/sub-system in 19" compatible enclosure. Detail specification of 19" rack & enclosure is describe in Appendix-VI. Necessary mounting hardware, cable tray, shielding & insulating sleeves should be used as per instruction recommended by I-I.

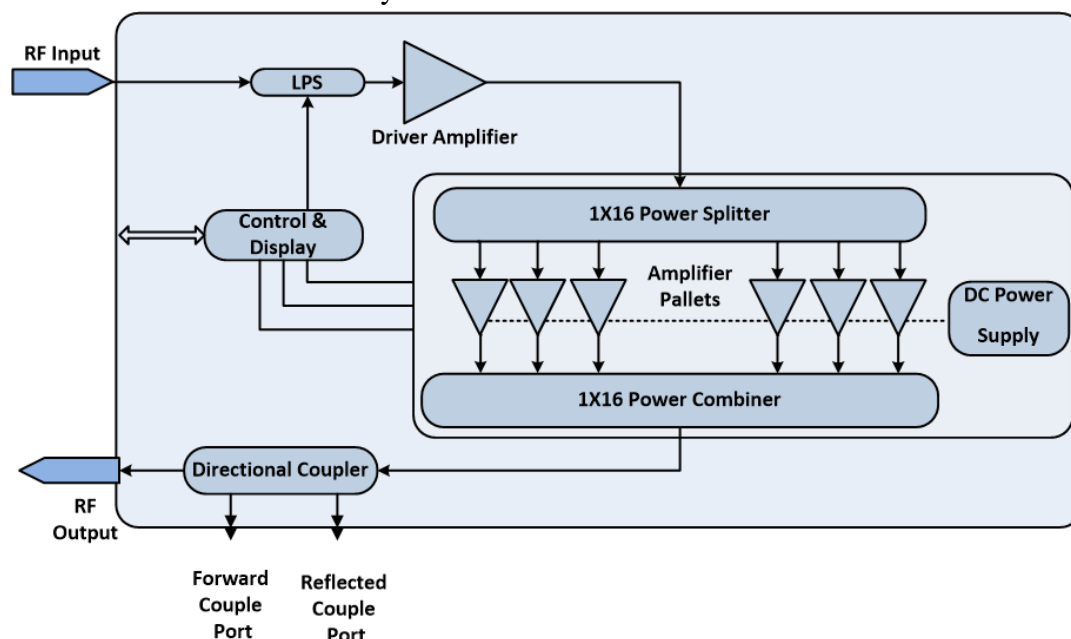


Figure 3: Block diagram for overall system

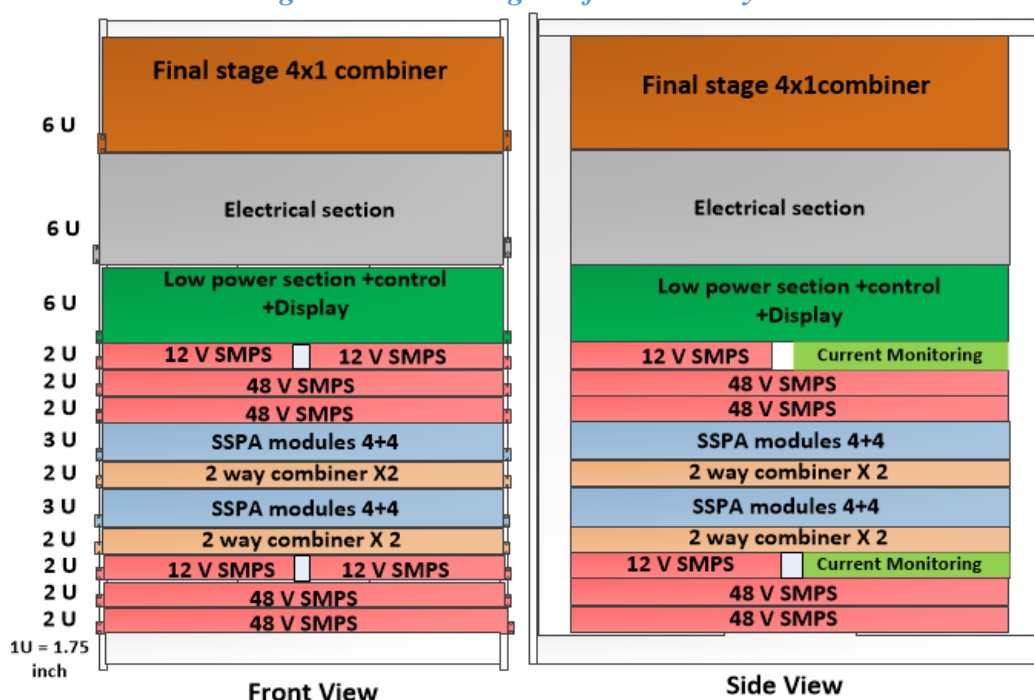


Figure 4: Mounting in 19" rack

1. Mounting of RF amplifier modules on water cooled heatsink

Bidder has to mount RF amplifier module (08), 8-way power splitters (01), 2-way power combiner (04) and 2-way coaxial type power combiner (02) on both side of water cooled heatsink & put whole assembly in single enclosure.

Bidder has to mount RF amplifier PCB (Table No. 01) on copper plate (150 x100 x 8 mm LWH) as per Fig. 5. Tapping/insert should be done as required to mount PCB, LDMOS, connectors etc. RF components. Such 18 number of set to be prepared, in which 02 modules will be submit for testing & approval and 16 modules should be mounted on 2 different water cooled heatsink.



Figure-5: Mounting of RF amplifier PCB on copper plate

PCB mounted copper plate (pallet) should be mounted on water cooled heatsink using proper mounting hardware and heat conducting grease. 08 number of pallets will be mounted on each water cooled heatsink. Such two set means 16 number of pallets to be prepared. Fig. 6 show layout of 8 pallets on water cooled heatsink.

Bidder has to mount 01 no of 8-way power splitter & 04 no of 2-way lumped combiner on each water cooled heatsink as shown in Fig. 6. Such two set should be assembled.

Electrical wiring, RF wiring, connector soldering/mounting etc. should be done as required.

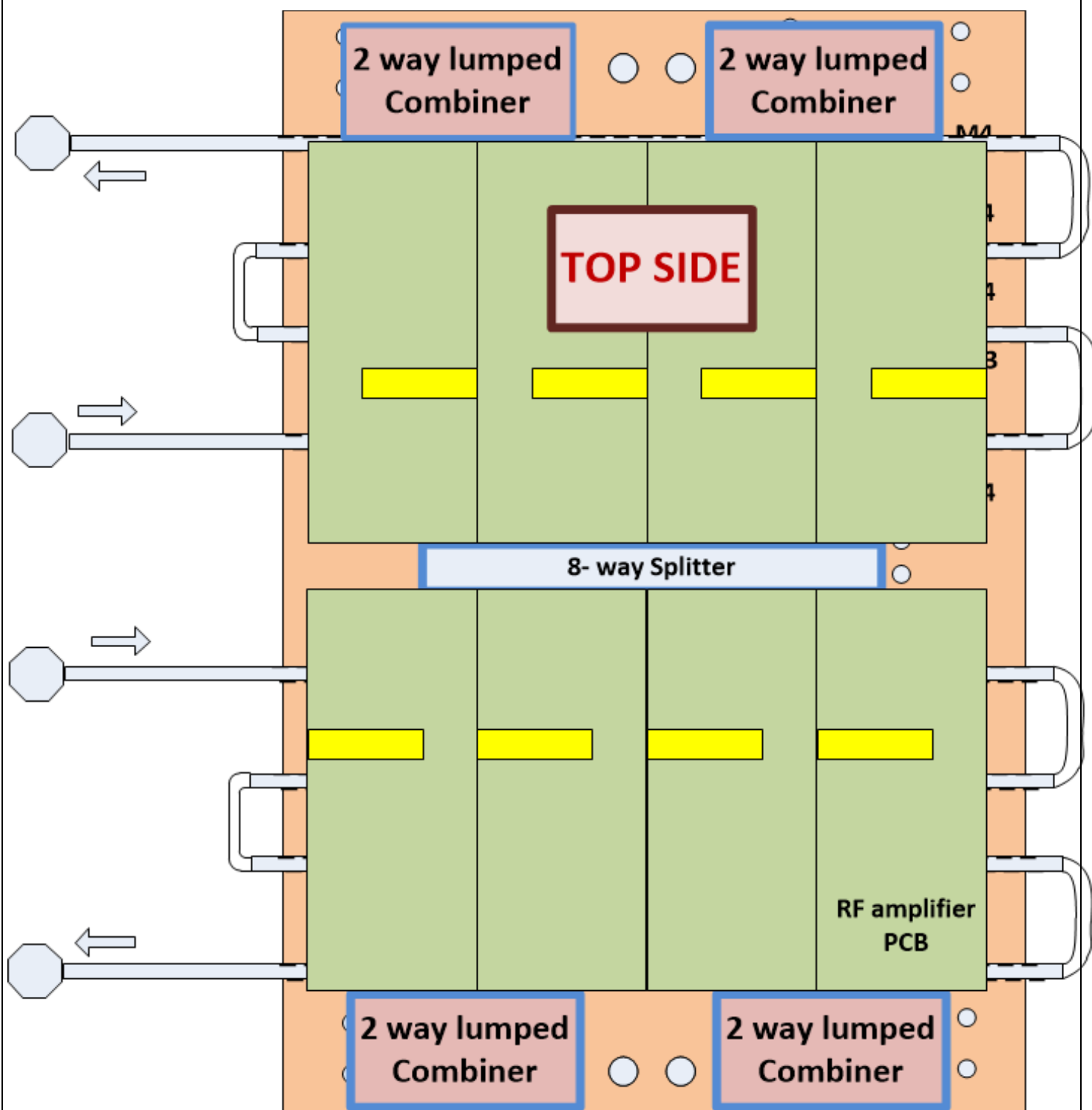


Figure 6: Mounting of 8 pallets on water cooled heatsink

Bidder has to mount 2-way coaxial type combiner on water cooled heatsink as shown in Fig. 7.

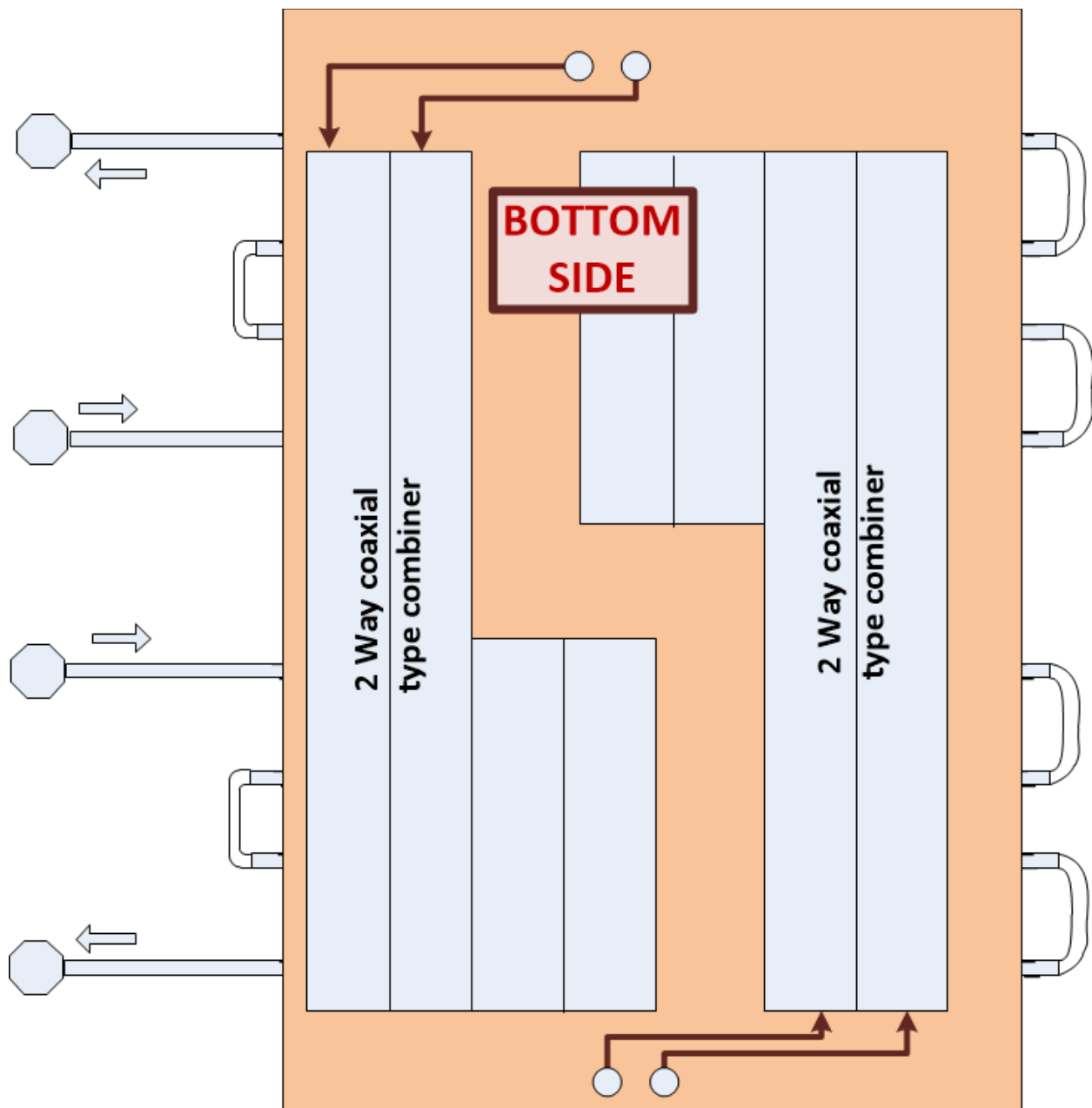


Figure 7: Mounting of 2-way coaxial type power combiner on water cooled heatsink

Bidder has to mount 2-way coaxial type power combiner (FIM) on water cooled heatsink as shown in Fig. 7. RF power resistor should be mounted with thermal conducting grease. RF connector & RF cable mounting/ routing should be done by bidder.

Water cooled heatsink with RF amplifier PCB, 8-way splitters, 2-way lumped type power combiner & 2-way coaxial type combiner should be mounted in single enclosure compatible for 19" rack. Bidder has to use support for water cooling connection coming out from enclosure. Bidder has to fabricate enclosure with perforated sheet & assemble axial fans for air circulation.

4-way coaxial type final stage combiner² should be mounted in 19" rack with proper mechanical support. Water cooling should be provided for power resistor, if required.

² 4-way final stage combiner will be provided as a free issue material by I-I for assembly purpose.

2. Assembly & integration of 48 V & 12 V DC power supply

Bidder has to procure DC power supplies as per specification mentioned in Table No. 11 and 12. Bidder has to ensure mounting compatibility of power supplies with 19" rack. Necessary electrical connection for AC input voltage from electrical distribution to power supply input, DC output voltage from power supply to RF amplifier modules, control signals from control board to power supply etc. should be done as per requirement specified for power supply datasheet. Bidder has to assemble axial fan for air circulation in power supply enclosure. Bidder has to use connectors for all electrical connection mentioned above.

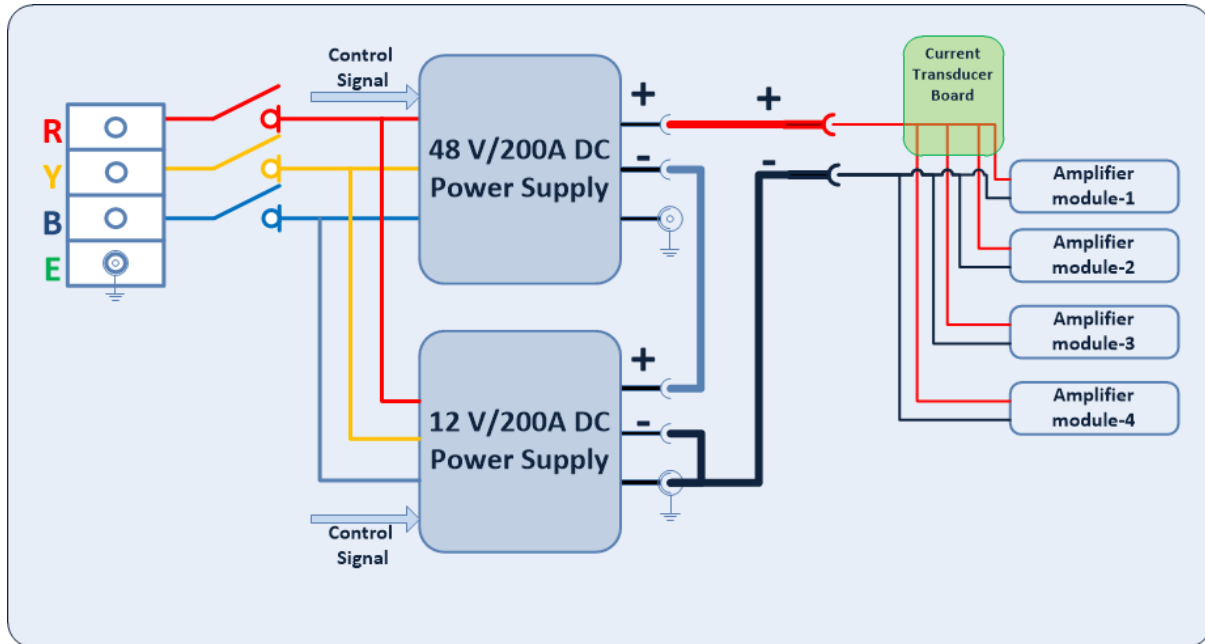


Figure 8: Wiring of DC power supply

3. Assembly & integration of low power system, control cards & driver amplifier.

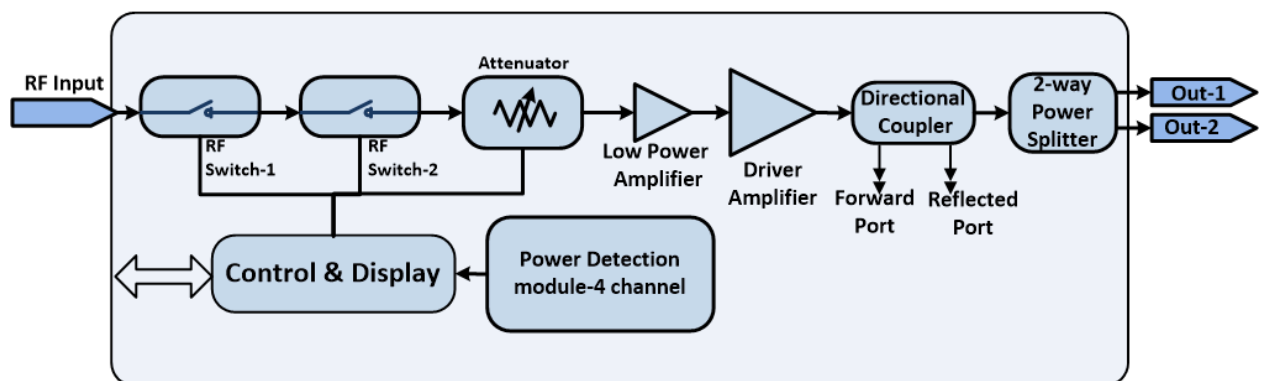


Figure 9: Block diagram of low power section & control modules

Bidder has to procure/fabricate low power RF modules, driver amplifier, splitter, control & display modules, DC power supplies (Table No. 13 to 16) and mount in single enclosure. Fig. 9 shows connection & mounting sequence for the same. RF input/output, AC-DC connection, control & display connection etc. should be done as required. Line filters should be placed in the AC input line. Air cooled heatsink for driver & low power amplifier should be procured

& assembly should be done. Bidder has to fabricate enclosure with perforated sheet & assemble axial fans for air circulation.

4. Assembly & integration of electrical monitoring & distribution system

Bidder has to procure electrical components, cable & other accessories as per technical specification mentioned in Table No. 8 and mount/assemble all items in single enclosure as required. Necessary connectors, terminal blocks, mounting hardware, cable etc. should be used and proper electrical standard should be maintained for assembly & wiring of electrical monitoring & distribution system. Electrical wiring diagram is shown in Fig. 10. Indication light (230V-10mm size) should be mount on front side of enclosure for following indication:

- R-Y-B Indication
- Electrical fault (Orange) for UV, OV & phase fault
- ON/OFF (RED/GREEN)
- Interlock indicators (RED) for water cooling fault, over temperature fault and door interlock

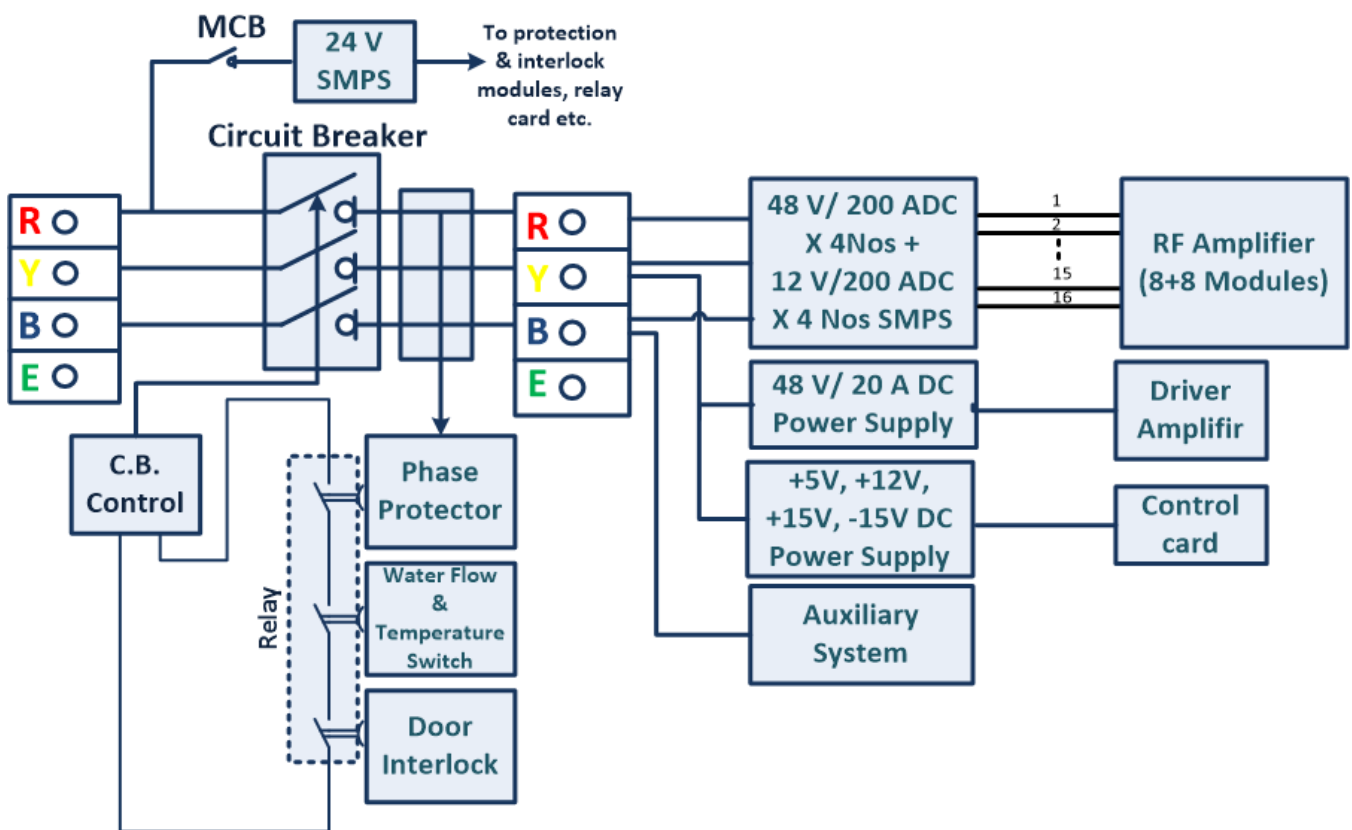


Figure 10: Electrical Monitoring & Distribution

Appendix-VIII: Factory acceptance test format
Table No. 20: Factory acceptance test format

Sr. No.	ITER-INDIA Specifications	Condition of factory acceptance test
1.	Fabrication and mounting of RF amplifier and control cards as per Appendix-I.	Visual, mechanical dimensions checking & continuity test using DMM <ul style="list-style-type: none"> - RF amplifier module - Current transducer card - Over current detection card - Interlock Card - Micro controller based interlock card
2.	Procurement of components as per Appendix-II.	- Visual & continuity test for applicable components.
3.	Fabrication and mounting of low power RF modules as per Appendix-III.	Visual & continuity test using DMM for: <ul style="list-style-type: none"> - RF Switch - Variable gain amplifier - Low power amplifier - Driver amplifier - Dual direction coupler - Power detector - Display module & micro controller
4.	Procurement & integration of DC power supply & accessories as per Appendix-IV.	Visual & functional test for: <ul style="list-style-type: none"> - 48 V/200 A DC power supply - 12 V/200 A DC power supply - 48 V/20 A DC power supply - 12 V/1 A DC power supply - +5/+15/-15 V DC power supply - 24 V/2.5 A DC power supply
5.	Fabrication of water cooled heatsink with cooling monitoring & distribution system as per Appendix-V.	<ul style="list-style-type: none"> - Checking of mechanical dimensions of water cooled heatsink - Leak test for water cooled heatsink & distribution system at 7.5 bar pressure - Function test of water flow switch & temperature switch
6.	Procurement of 19" rack as per Appendix-VI.	- Checking of mechanical dimensions
7.	Integration of Electrical Distribution along with monitoring & control as per Appendix-VII	<ul style="list-style-type: none"> - Visual & continuity test for all connection - Function test of MCCB, DPDT relay, AC protection system etc.

Appendix-IX: Site acceptance test format
Table No. 21: Site acceptance test format

Sr. No.	ITER-INDIA Specifications	Condition of site acceptance test
1.	RF and control cards as per Appendix-I.	Visual, mechanical dimensions checking & continuity test using DMM <ul style="list-style-type: none"> - RF amplifier module - Current transducer card - Over current detection card - Interlock Card - Micro controller based interlock card
2.	Low power RF modules as per Appendix-III.	Visual & function test for: <ul style="list-style-type: none"> - RF Switch - Variable gain amplifier - Low power amplifier - Driver amplifier - Dual direction coupler - Power detector - Display module & micro controller
3.	DC power supply & accessories as per Appendix-IV.	Visual & functional test for: <ul style="list-style-type: none"> - 48 V/200 A DC power supply - 12 V/200 A DC power supply - 48 V/20 A DC power supply - 12 V/1 A DC power supply - +5/+15/-15 V DC power supply - 24 V/2.5 A DC power supply
4.	Water cooled heatsink with cooling monitoring & distribution system as per Appendix-V.	<ul style="list-style-type: none"> - Checking of mechanical dimensions of water cooled heatsink - Leak test for water cooled heatsink & cooling distribution system at 7.5 bar pressure - Function test of water flow switch & temperature switch
5.	19" rack as per Appendix-VI.	<ul style="list-style-type: none"> - Checking of mechanical dimensions
6.	Integration of Electrical Distribution along with monitoring & control as per Appendix-VII	<ul style="list-style-type: none"> - Visual & continuity test for all connection - Function test of MCCB, DPDT relay, AC protection system etc.

Appendix-X: Deliverable documents
Table No. 22: List of documents (soft copy and hard copy)

Sr. No	Deliverables	Quantity
1.	Final Bill of material (BOM), Final schematic diagrams, PCB files and gerber files of all types of cards, mechanical drawing and General Assembly (GA) drawing of all PCB assembly	1 set
2.	Final fabrication drawing for all mechanical parts like, 2-way power combiner, 4-way final stage combiner, RF amplifier modules, mounting plates & enclosures used, water heatsink, cooling circuit etc.	1 set
3.	Wiring diagram for electrical monitoring & distribution system	1 set
4.	Datasheet, operating manual, certificate & test report of all procured items	1 set

Appendix-XI: Compliance matrix format

Bidder has to provide Compliance matrix with their comment with the bid.

Table No. 23: Compliance matrix

Sr. No.	ITER-INDIA's Specifications / requirement	Comply Yes/No	Comments
1.	Scope of work:	Understanding & delivery of scope understanding document before start of fabrication/procurement as per section-1.	
2.	Scope of work: Bench mark supply	Fabrication & supply 2 number of RF amplifier modules, 1 number of lumped combiner, 1 number of 48 V & 1 number of 12 V DC power supply as per scope of work as per section-1.	
3.	Scope of work: Final supply	Fabrication & supply 16 RF amplifier modules, 08 number of lumped combiner, 03 number of 48 V, 01 number of 12 V DC power supply, 02 number of 8-way power splitter, 04 number of 2-way coaxial combiner, 01 number of 4-way final stage of combiner, low power section, control & monitoring, electrical distribution etc. as per scope of work as per section-1.	
4.	PCB fabrication	Preparation of artwork/layout, fabrication of PCB and solder components on PCB as per Schematic-1 to 7, Appendix-I.	
5.	Procurement of Components	Procurement of components as per specification mentioned in Table No. 8, Appendix-II	
6.	Procurement of electronics	Procurement of electronics boards as per specification mentioned in	

	boards	Table No. 9, Appendix-III		
7.	DC power supplies	Procurement, wiring & mounting of DC power supplies as per Table No. 11 to 16, Appendix-IV.		
8.	water cooled heatsink & cooling distribution system	Fabrication of water cooled heatsink & cooling distribution system as per Appendix-V.		
9.	19" instrument rack	Procurement of 19" instrumentation rack as per specifications mentioned in Table No.19, Appendix-VI.		
11.	Assembly & mounting in 19" rack	<ol style="list-style-type: none"> 1. Mounting of amplifier modules, power splitters & power combiner on both side of water cooled heatsink as per Fig. No 6 & 7. 2. Assembly & integration of 48 V & 12 V DC power supply as per Fig. No. 8. 3. Assembly & integration of low power system, control cards & driver amplifier as per Fig. No. 9. 4. Assembly & integration of electrical monitoring & distribution system as per Fig. No. 10. 		
12.	Factory acceptance test	Performer Factory acceptance test as per Appendix-IX.		
13.	Site acceptance test	Witness of site acceptance test as per Appendix-X.		
14.	Documents	Supply of document as per Table No. 22, Appendix-XI		
15.	Project schedule	Project schedule & payment milestone as per Tender document Part-A(III)		