SPECIFICATION DOCUMENT
TOWED RECEIVER ARRAY (Type G)

CONTENTS

List of Abbreviations

LFM	Low Frequency Module
HFM	High Frequency Module
VIM	Vibration Isolation Module
AVIM	Aft Vibration Isolation Module
BOM	Bill of Materials
TRA	Towed Receiver Array
ATP	Acceptance Test Procedure
CIM	Cable Interface Module
AMD	Assembly and Manufacturing document
NPOL	Naval Physical and Oceanographic Laboratory
JSS	Joint Service Specifications
DC	Direct Current
SSD	Solid State Dive
TB	Terabyte
AWG	American Wire Gauge
RAM	Random Access Memory
RMS	Root Mean Square

1. DESCRIPTION

The Towed Receiver Array has a string of Hydrophones, which are basically underwater acoustic sensors, the function of which is to pick up sounds in the ocean. In addition to Hydrophones, the Array is equipped with Environmental sensors and Electronic Components for Signal Conditioning, Conversion and Transmission. The environmental Sensors include Heading Sensors, Depth sensors, and Roll sensors. The Towed Receiver Array Electronics is housed in a Poly Urethane Tube, which is filled with suitable Filler fluid. The Towed Receiver Array is functionally divided into different Array Modules and the Modules are inter- connected using underwater Electro-mechanical connectors. This system is intended to be fitted onboard INS Sagardhwani/Other designated naval platform.

TRA consists of twin towed receiver array modules LFM, HFM, VIM and AVIM. The following figure 1 shows the array modules.

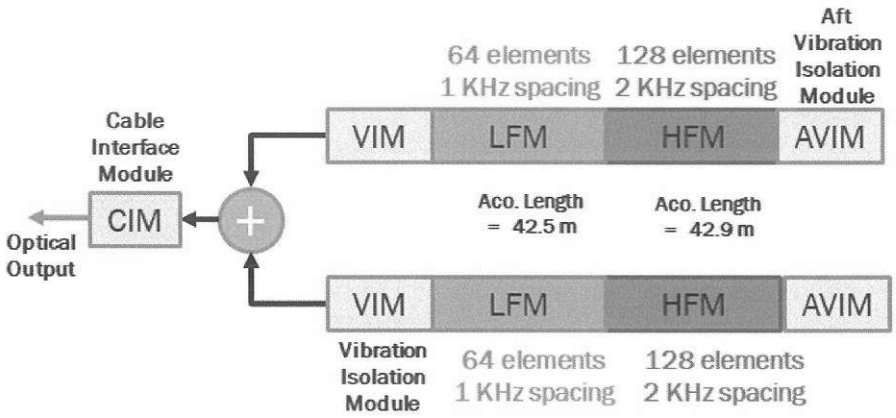

Figure 2: TRA modules

The twin array modules are connected to a cable interface module (CIM) which is unit which connects the tow cable to the array. Only the VIM, LFM, HFM, AVIM and tail rope are in the scope of the vendor.

The LFM and HFM is the module with hydrophones and associated electronics. All modules have data telemetry electronics as well as attitude measuring sensors. All sensors are interconnected through harnesses and custom wiring.

1. Detailed Assembly and Manufacturing document (AMD) will be provided at the time of placement of order.

2. Mechanical drawings for modules, housings and assembly will be provided at the time of placement of order.

3. Acceptance Test procedure for assemblies and modules will be provided at the time of placement of order.

2. SCOPE OF WORK

The work involves Development and Supply of one set of "TTLS TOWED RECEIVER ARRAY (Type G)" with all accessories, Spares as per details furnished below:-

2.1 Procurement of components, Fabrication of Sub-Systems, Assembly and Inspection/Testing of modules with End Connectors as per AMD.

2.2 Assembly of electronics and hydrophone capsules as per assembly procedure. This includes programming of FPGA/Microcontroller (Flashing of firmware) as per AMD.

2.3 Assembly, Integration and Factory Acceptance Test of the TRA Type G array shall be carried out as per AMD. These documents will be provided on finalization of contract.

2.4 All environmental test as per JSS-55555 (vibration, shock and pressure test etc) on the procured PCBs, housings and assemblies

2.5 Documentation of all progress activities with traceability of components.

2.6 Documentation of Limited Qualification Tests, Inspection and Test reports

3. DELIVERABLES

1. TTLS TOWED RECEIVER ARRAY (Type G) along with SPARES
   Array consists of 2 No's of VIM Module, 2 No's of LFM Module, 2 No's of HFM Module and 2 Numbers of AVIM Module
2. Stage Inspection reports and Limited Qualification test reports.
3. Inspection report – at Factory and at NPOL.

4. DELIVERY SCHEDULE

The delivery schedule for Towed Receiver array (TRA) shall be 9 months from the date of placement of order.

5. BRIEF TECHNICAL SPECIFICATIONS

The brief specifications of the parts of TTLS TOWED RECEIVER ARRAY (Type G) are presented below.

5.1 LFM Module

LFM Module	
Module Length	43 m
Module Diameter	80 mm
End Connector	Plug at one end and Socket at other
Polyurethane Tube	43 m
Kevlar rope/tape	86 m
Fill Fluid	Prime 32 Oil, 180 Litre
Module Subassemblies	a) Hydrophone housings - Qty 64
	b) Engg Node assembly - Qty 1
	c) Power Converter assembly - Qty 2
	d) Acoustic Node Assembly - Qty 8
	e) Wiring Harnesses - Qty 8

5.2 HFM Module

HFM Module	
Module Length	43 m
Module Diameter	80 mm
End Connector	Plug at one end and Socket at other
Polyurethane Tube	43 m
Kevlar rope/tape	86 m
Fill Fluid	Prime 32 Oil, 180 Litre
Module Subassemblies	a) Hydrophone housings - Qty 128
	b) Engg Node assembly - Qty 1
	c) Power Converter assembly - Qty 4
	d) Acoustic Node Assembly - Qty 16
	e) Wiring Harnesses - Qty 16

5.3 VIM Module

VIM	
Module Length	25 m
Module Diameter	80 mm
End Connector	Plug at one end and Socket at other
Polyurethane Tube	25 m
Kevlar rope/tape	50 m
Fill Fluid	Prime 32 Oil, 80 Litre
Module Subassemblies	a) Engg Node assembly - Qty 1
	b) Power Converter assembly - Qty 1
	c) Pinger Node assembly - Qty 1
	d) Wiring Harnesses - Qty 3

5.4 AVIM Module

AVIM	
Module Length	25 m
Module Diameter	80 mm
End Connector	Plug at one end and Socket at other
Polyurethane Tube	25 m
Kevlar rope/tape	50 m
Fill Fluid	Prime 32 Oil, 80 Litre
Module Subassemblies	a) Engg Node assembly - Qty 1
	b) Power Converter assembly - Qty 1
	c) Pinger Node assembly - Qty 1
	d) Wiring Harnesses - Qty 3

5.5 WORK DESCRIPTION

1 Procurement of all components as per the Bill of materials provided by NPOL. No alternate components are acceptable.

2 Testing of all procured components as per ATP in AMD.

3 Fabrication of Mechanical Components from recommended vendors as per BOM and NPOL drawings

4 Hydrophone procurement as per NPOL BOM

5 Assembly of PCBs in housings as per NPOL Specifications

6 Assembly of sensors in housings as per NPOL Drawings

7 Qualification tests of PCBs and assemblies as per Specifications

8 Testing of harness and connectors as per NPOL Specifications

9 System wiring as per NPOL wirelist

10 Load testing as per NPOL Specifications

11 Connectorisation of modules and tube insertion as per NPOL assembly document

12 Filling of oil into tube as per NPOL assembly document

13 Sealing of flexible tube as per NPOL assembly document

14 Testing at 6 stages of assembly as per NPOL ATP as per test setup specified

15 Module level testing and integration as per NPOL ATP

16 Integrated testing as per NPOL ATP

17 Documentation and preparation of Test Reports at all stages as per ATP

18 Documentation of all qualification tests

19 Factory Acceptance Tests as per NPOL Specifications

20 Delivery at NPOL

5.6 Bill of Materials

#	Nomenclature	Qty	AU	Make/OEM	Part No.
1	Pre-Amplifier PCB with Micro-D Connector	460	No's	Zcrossing, Vytilla	ZC_TLA000023
2	8-Channel GbE Node	57	No's	Digital Core, Kakkanad	701-1-50412
3	DC-DC converter	19	No's	CubeTech, Gurgaon	CTS1835A
4	Harness-1KHz	18	No's	Nicomatic, Bengaluru	NINC00166
5	Harness-2KHz	39	No's	Nicomatic, Bengaluru	NINC00257
6	Harness-VIM	14	No's	Nicomatic, Bengaluru	NINC00258
7	3-Port Bridging Switch	15	No's	N.P.O.L	
8	AHRS daughterboard	10	No's	N.P.O.L	
9	Pinger daughterboard	5	No's	Keltron Controls Aroor	803840002
10	Harness Mating connector Male	9	No's	Nicomatic, Bengaluru	HD222I6Q16D51ZF1000
11	Harness Mating connector Female	9	No's	Nicomatic, Bengaluru	HD221I6Q16D53ZF1000
12	GbE EM Connector	10	No's	VMX-Hi, Kochi	
13	Hydrophone	460	No's	Keltron, Kuttipuram	
14	Depth Sensor	8	No's	Amphenol	NPI15H352AH
15	Accelerometer	10	No's	Silicon Designs	2422-025
16	Pinger hydrophone (Type E)	4	No's	Keltron, Kuttipuram	
17	Pinger Projector (3P)	4	No's	Keltron, Kuttipuram	
18	EM Connector blanking piece	4	No's	VMX-Hi, Kochi	
19	Node PCB housing	60	No's	N.P.O.L	
20	Hydrophone Housing	480	No's	N.P.O.L	
21	DC-DC Convertor Housing	18	No's	N.P.O.L	
22	AHRS Unit Housing	16	No's	N.P.O.L	
23	Heading sensor housing	8	No's	N.P.O.L	
24	Depth Sensor Housing	8	No's	N.P.O.L	
25	Accelerometer Housing	10	No's	N.P.O.L	
26	Vibration De-couplers	20	No's	N.P.O.L	
27	Spacers	600	No's	N.P.O.L	
28	Kevlar Tape	2000	m	Viraj Syntex OR Kusumgar Corporates, Gujarat	
29	PU Hose	1000	m	Polyhose, Chennai	
30	Crimp rings	46	No's	N.P.O.L	
31	Isopar L Oil	600	L	Generic	
32	Tail Rope	100	m	Generic	
33	Wire, 20 AWG, Multi-strand, Silver plated, 600V rms, PTFE insulated, (2 Colors - Red & Black), -65°C to +260°C	500 (each color)	m	Generic	
34	Wire, 16 AWG, Multi-strand, Silver plated, 600V rms, PTFE insulated, (2 Colors - Red & Black), -65°C to +260°C	300 (each color)	m	Generic	

35	CAT5E, Bandwidth 100MHz, 100 ohm, braided/oil shield, Silver plated copper stranded, 26AWG	100	m		
36	Shielded Twisted Pair, 28AWG, Multi Stranded Silver Plated, PTFE insulated, 600 V rms, -65°C to +260°C	100	m		
	Test Equipment				
37	Tester and UI with GbE Port, 16GB RAM, 1TB SSD	2	No's	Generic	
38	Insonification unit	2	No's	Keltron Controls Aroor	
39	300V DC Supply	2	No's	TDK Lambda	
40	Voltmeter	2	No's	Fluke	
41	Mechanical Test jig & Fixture (including blanks, O rings, Ti Screws etc.) for load testing, pressure testing & functional load testing	1	No's	N.P.O.L	
42	Twin Array Test Connector	1	No's	VMX-Hi, Kochi	663007335
43	Cable Analyzer (measurement of IL, crosstalk, propagation delay, skew to CAT5E specifications)	1	No's	Fluke DTX-1800 or equivalent	

5.7 Sub-assemblies

The following assemblies are required to make one set of the array

Sl. No.	Nomenclature	Qty	Used in
1	Hydrophone subassembly	384	LFM, HFM
2	Depth Sensor Sub-assembly	8	LFM, HFM,VIMs
3	GbE Node Sub-assembly	48	LFM, HFM
4	AHRS Sub-assembly	8	LFM, HFM,VIMs
5	Pinger Sub-assembly	4	VIM
6	DC-DC Sub-assembly	16	LFM, HFM,VIMs

The rest of the spares will have to be made into sub-assemblies and delivered along with the system.

6. TERMS AND CONDITIONS

1. Vendor should submit a production plan and quality assurance (QAP) plan along with the quote (technical bid).
2. Detailed drawings, wiring diagram, assembly instructions and ATP will be provided as part of an assembly and manufacturing document (AMD) from NPOL on placement of contract. Any design detail other than that required for system development will not be provided. However, the vendor will be given required information on the Scope of work and the facility to be established for executing the Job on request prior to the tender opening date.
3. The assembly and testing will be carried out by the vendor under the supervision of NPOL officers. Only permanent employees of the firm are allowed to carry out this work.
4. All the necessary test and assembly equipments should be brought by the vendor for wiring, soldering and testing. Work bench and floor space will be provided for carrying out the work.
5. No deviation is permitted in the assembly procedures laid out by NPOL. No alternative design submitted by Vendor is acceptable or permitted.
6. Failure of development of system at any stage of manufacture will be the responsibility of Vendor. No part payment will be provided by NPOL for partly completed work.

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7. No NPOL manpower will be provided to facilitate the manufacture, assembly and testing of wet end system.
8. NPOL or its nominated agency will carry out the final Inspection of the finished product at NPOL as per ATP. The vendor shall arrange the documents relevant for the Factory Acceptance Tests [FATs] of wet end system. Necessary assistance and test facilities to conduct testing shall be provided by the vendor.
9. Any clarification can be done prior to submission of bid. Clarification should be requested to Director NPOL, clearly referring the tender enquiry number. The vendor should clearly mention the contact number and contact person at his end for NPOL to get back to the specific query.
10. Non availability of bought out item will not be cited as a reason for failure in delivery of the system. Vendor has to ensure availability of all necessary material required for the assembly before submission of bid.
11. All the components to be procured as mentioned in the Bill of materials from the specified vendors (Section 5.6) and unused items shall be provided to NPOL in assembled & tested form at the time of delivery of Towed Receiver Array.
12. Vendor has to enclose a Signed Specification Compliance Sheet which is attached. Vendor has to accept all specification mentioned in the Specification compliance sheet. Specification compliance sheet to be attached in technical bid.
13. The vendor's technical competence, managerial capabilities and financial status will be assessed by a team of Officers of NPOL to ascertain the Company's capability to complete the given work within the specified time period.
14. The design of Towed receiver arrays is the sole property of NPOL. The contractor shall not disclose any information regarding the wet end system without written permission of NPOL. A relevant clause will be included in the contract.
15. All equipment necessary for development and testing will be the responsibility of the Vendor. The following testing equipment has to be arranged by the Vendor for carrying the testing work. (All measurement equipments should be calibrated and this should be traceable).
    - Cable Analyser to check the health of the gigabit links in the wiring
    - Computer/ Laptop with 1G Ethernet port loaded with Lab -view software
    - Function (Arbitrary Waveform) generator(10 MHz)
    - 100 MHz Digital storage oscilloscope.
    - High Voltage (300V/2 kW) DC power supply, with UPS back up
    - Regulated DC power supply 0 – 30V, 5A
    - 1000 V Megger
    - RMS Multimeter
    - Soldering Station and SMD Rework Station
16. The array assembly and testing will be carried out in NPOL premises. Components and sub-assemblies may be done at vendor's own premises.
17. ESS and ET facility should be available at vendor's factory.
18. Vendor shall deploy 4 Engineers (2 Electronics, 2 Mechanical) at NPOL during the array assembly phase. Vendor shall deploy 3 technicians for electronics activity and 2 technicians for mechanical activity at NPOL during the array assembly phase.
19. Vendor should cater for 10% variation in BOM (by value) while estimating the cost.

7. Vendor Qualification Criteria

a. The vendor should have prior successful experience in developing & supplying towed arrays or towed array sonars in the past seven years ending 31st December 2023 to DRDO/Defence PSU/PSU/Indian Navy. Supply order copies of executed orders shall be attached as proof.
Order value should not be less than Rs 2 crores (including GST & other charges).

b. The vendor's Average Annual financial turnover during the last 3 years, ending 31st March 2024, should be at least 400 Lakh.

c. The bids of Industry Partner who attend the pre-bid meeting will only be considered for evaluation after tender opening.

8. Pre-Bid Meeting

The date of pre bid meeting is at 11:00hrs on ~~3-Oct-2024~~ at NPOL, Kochi. The desirous Industry Partners to attend the pre-bid meeting need to intimate the same before 2 working days of the meeting date. The bids of Industry Partner who attend the pre-bid meeting will only be considered for evaluation after tender opening. Detailed specification, Schematic Drawings and Acceptance Test Plan will be shared with the desirous Industry Partners qualified for attending the pre-bid meeting. Contact person: Mr. Nirmal Mohan, Sc F, contact no. 0484-2571242, 9447767416, email-nirmal.npol@gov.in will be the contact person for conducting the pre-bid meeting. Industrial Partner shall complete all prerequisites for participation in the meeting latest by 2 days before the scheduled time of the meeting.

9. Payment Terms

a) 20% of the project value on placement of supply orders on suppliers/OEMs of major inward items (Specification, Section 5.6, Table - BOM Sl. No's 1 to 17 is the major inward items)
b) 30% of the project value after vendor submits proof of receipt of major inward items (Specification, Section 5.6 Table - BOM, Sl. No's 1 to 17 is the major inward items) at vendor premises
c) Remaining 50% on delivery of the system

10. PRICE BID FORMAT

Sl. No	Description of item/items/Service	Quantity (A/u)	Unit cost (₹)	Total cost (₹)
1.	Towed receiver array (Type G) as per specification	1 Set		
			Total cost (Basic without GST)	
			GST @ __%	
			Total cost including GST	
Note	Lowest Bidder (L1 bidder) - The financial bids of the qualified bidders would be compared and the lowest quoted vendor would be arrived on the basis of total cost (FOR NPOL, Kochi) of the deliverables and services including statutory levies, taxes and duties on final product which are to be paid extra as per actual.			

NIRMAL MOHAN, SCF

APPENDIX A

SPECIFICATION COMPLIANCE SHEET

Sl. No.	Specification	C/NC	Remarks
1	Procurement of all components as per the Bill of materials provided by NPOL. No alternate components are acceptable.		
2	Testing of all procured components as per ATP		
3	Fabrication of Mechanical Components from recommended vendors as per BOM and NPOL drawings		
4	Hydrophone procurement as per NPOL BOM		
5	Assembly of PCBs in housings as per NPOL Specifications		
6	Assembly of sensors in housings as per NPOL Drawings		
7	Qualification tests of Sensors, PCBs and assemblies as per Specifications		
8	Testing of harness and its connectors as per NPOL Specifications		
9	Testing of EM Connectors and its harness termination connector as per NPOL Specifications		
10	System wiring as per NPOL wirelist		
11	Load testing as per NPOL Specifications		
12	Connectorisation of modules and tube insertion as per NPOL assembly document		
13	Filling of oil into tube as per NPOL assembly document		
14	Sealing of flexible tube as per NPOL assembly document		
15	Testing at 6 stages of assembly as per test setup specified in NPOL ATP. The stages are 1)Inward testing 2)Assembly testing 3)Post-ESS testing 4)Module assembly (pre oil filling) 5) Module assembly (post oil filling) 6) Integrated testing		
16	Module level testing and integration as per NPOL ATP		
17	Integrated testing as per NPOL ATP		
18	Documentation and preparation of Test Reports at all stages as per ATP		
19	Documentation of all qualification tests		
20	Factory Acceptance Tests as per NPOL Specifications		
21	Delivery at NPOL		