



**General Part Bidirectional Transceiver Tender Nikhef
(KM3NeT_Bidirectional_Transceiver_2020_00), Version 1
Paul de Jong, Antonio d'Amico, Jan-Willem Schmelling, Ronald
Bruijn, Frank Kayzel**

Date: 01/03/2020

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KM3NeT_Bidirectional_Transceiver_2020_001

**Paul de Jong, Antonio d'Amico, Jan-Willem Schmelling, Ronald Bruijn, Frank
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Nikhef

Abstract

This describes the qualification and selection procedure for the Bidirectional Transceiver tender.

Recipients

TenderNed

Document Status

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1 Documentation

1.1 Abbreviations

Abbreviation	Description
APD	Avalanche Photo Diode
BER	Bit Error Rate
BOL	Beginning Of Life
DOM	Digital Optical Module
EOL	End Of Life
GbE	Gigabit Ethernet
IT	Italy
ITU	International Telecom Union
KM3NeT	Cubic Kilometre Neutrino Telescope
LOS	Loss Of Signal
ODB	Open Data Base
PRBS	Pseudo Random Bit Sequence
ROSA	Receiver Optical Sub-Assembly
TBD	To Be Defined
TOSA	Transmitter Optical Sub-Assembly
UPI	Unique Product Identifier

1.2 Reference Documents

Abbreviation	Title	Reference
RD1	Bidirectional Transceivers Technical Specification	KM3NeT_Bidirectional_2020_001_Technical Specification_def

2 Introduction- Objective of tender

KM3NeT is an international Collaboration aiming to exploit the Mediterranean Sea for (I) observation of neutrinos emitted by cosmic sources and (II) a measurement of the neutrino oscillation patterns. The two corresponding detectors, ARCA and ORCA (Astroparticle and Oscillation Research with Cosmics in the Abyss), will be installed at two different sites: at 3500 m depth, ~80 km offshore Capo Passero, at the southernmost tip of Sicily, Italy for ARCA and at 2500 m depth, ~40 km offshore Toulon, France for ORCA. In both sites the detector will also support long-term, real-time measurements for earth and sea sciences.



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The heart of the experiment consists of the so-called optical modules, each containing 31 photomultipliers (PMTs), whose purpose is the detection of Cerenkov light generated by the products of the interaction of the neutrino with the water nuclei.

This tender asks for the production of Bidirectional Transceivers necessary for phase 2 of the neutrino telescope.

3 Tender: General Conditions

The document RD1 is binding for the specifications of the Bidirectional Transceivers Type A and Type B.

Each Bidirectional Transceiver shall be tested by the company and the results shall be provided in an excel sheet whose format will be provided by Nikhef, RD1 req.66.

The General Government Purchase Conditions 2018 are applicable i.e. ARIV_2018 conditions as published here: https://www.nwo-i.nl/wp-content/uploads/2019/11/ARIV_2018-mei2018_0-2.pdf.

4 Time schedule and documents

The Bidirectional Transceivers delivery shall be following the time schedule of Table 1.

	<i>Description of delivery</i>	<i>Date</i>
	Order of 580 type A	50 per month starting Feb 2021
	Order of 957 type B	100 per month starting Feb 2021

Table 1 Delivery Schedule Bidirectional Transceivers type A and type B.

Nikhef furthermore requests the offer to be valid to exercise an option on an additional order of **340 of type A and 561 of type B**. The option should be valid until 12 months after signature of the delivery contract.

The delivery shall be accompanied with a CoC.

The terms and conditions that will determine the issuing of the Progress Status attestation are described in the procurement documents, with particular reference to RD1, for the procedures for carrying out acceptance tests.

The Company accepts the measurement rules contained in the RD1 document.



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For each delivery Nikhef will carry out checks on a sample of 5 Bidirectional Transceivers of each type.

If one or more Bidirectional Transceivers per sample will have characteristics that do not comply with the specifications, the company will not be able to issue the invoice and the entire stock will be returned to the sender for replacement. Failure to accept does not imply an extension of delivery times.

Payments will then be made using the methods and terms described in the Contractual Conditions set out on the basis of the tender.

5 Delivery of the supply

The Bidirectional Transceivers shall be delivered DDP to:

Nikhef Attn. A. d'Amico Science Park 103 1098 XG Amsterdam The Netherlands
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6 Selection Criteria for the tender

For the participation in this call for tender it is requested that the participating Companies have economic and technical capabilities.

Economic capabilities:

The Company shall have had in the last two years a minimum annual turnover of € 500,000 in the sector of activity subject to the contract, to guarantee the production capacity and the economic soundness of the company.

Technical capabilities:

The company must have produced in the last three years, on average at least 2,000 Bidirectional Transceivers per year.



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7 Tender procedure and selection criteria for the most economical and high-quality Bidirectional transceivers

The award criteria are identified in the following table.

Criteria			Perc. %	Sub %	Permitted maximal deviation from requirement
A	Price		40		
B	Quality		20		
		B1	Calculated Reliability	5	Not Constrained
		B2	Average Output Power EOL	5	-10%
		B3	BER EOL	5	0%
		B4	Maximum Power consumption EOL	5	+10%
C	Quality of transport and packaging		5		
D	Technical quality of the		35		
		D1	Average Output Power BOL	10	-10%
		D2	Frequency Stability BOL	10	0%
		D3	BER BOL	10	0%
		D4	Power consumption BOL	5	+1-%
Total			100		

Table 2 Table with selection criteria

The Companies will be invited to formulate a technical and economic offer according to the criteria set out below.

Based on the documentation supplied for criteria B the commission attributes an OK (1) or NOK (0) to the criteria. The criteria will then be multiplied with the percentage mentioned in Table 2.

The Companies shall provide 1 sample per transceiver (1 of type A and 1 of type B) to Nikhef to allow the measurements to be performed for criteria D1, D2, D3 and D4.

The samples shall be available at Nikhef within 1 week after the tender deadline. The samples will be returned to the company after the evaluation phase will be completed.



Based on the results of the measurements on the samples, the Commission attributes a OK (1) or NOK (0) score for the reference criteria. The approved criteria shall contribute with the percentage mentioned in Table 2 to the total score.

If the values reported and measured deviate more than the number mentioned in the last column of Table 2 from the required value the competitor will be excluded.

7.1 A criterion – Price

The economic offer is realized on the basis of the price formula.

The coefficient of the performance V is assigned according to the following formula.

$$V = 0.9 + 0.1 \cdot (O - O_{\text{average}}) / (O_{\text{low}} - O_{\text{average}})$$

Where:

O	offer competitor,
O_{low}	lowest offer,
O_{average}	mathematical average of all offers

7.2 B criterion – Quality of Bidirectional Transceivers

The quality evaluation of the Bidirectional Transceivers will be based on:

- B.1 Criteria: Req.68 Calculated reliability (FIT)
- B.2 Criteria: Req.21 Average Output Power EOL
- B.3 Criteria: Req.9 BER at EOL*
- B.4 Criteria: Req.35 Maximum supply current

If the requirement is met the criteria will get an OK (1) and multiplied by the weighting factor in Table 2

7.3 C criterion - Quality of transport and packaging

The company shall present a descriptive report of the transport and packaging procedures in the technical offer. The score will be attributed on the basis of the description report of the packaging that the company will have to present during the offer phase.

Evaluation elements will be:

- the strength of the box against the mechanical shocks of the Bidirectional Transceiver during transport;
- ease of handling of the box;

If the requirement is met the criteria will get a OK (1) and multiplied by the weighting factor in Table 2.



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7.4 D criterion -Technical quality of the Bidirectional Transceivers

The technical evaluation of the bidirectional transceivers will be based on the measurements performed on the samples provided by each Company during the offer phase.

The measured variables, according to the procedure described in the Technical Specifications RD1, are:

D.1 Criteria: Req.20 Average Output Power BOL

D.2 Criteria: BER BOL better than Req. 9 BER EOL*

D.3 Criteria: Supply current BOL better than Req.35 Maximum supply current EOL

*Fiber type: standard single mode fiber with attenuation of 0.2dB/km and chromatic dispersion of +18 ps/(nm•km).

If the requirement is met the criteria will get a OK (1) and multiplied by the weighting factor in Table 2.

8 References to Regulations

The supplier must comply with the RoHS Directive.