

ANNEXE 1

**English version of the document:
TSFP Optical Transceiver_CCTP_CNRS DR016_AO7**

PARIS-NORMANDIE DELEGATION

SPECIAL TECHNICAL SPECIFICATIONS

(In french : CCTP = Cahier des Clauses Techniques Particulières)

PUBLIC SUPPLY CONTRACTS

SUBJECT:

**Purchase of Tunable SFP Optical Transceiver
for new detection lines for the KM3NeT-ORCA project as part of
NEPTUNE funding by the Normandy region.**

Lot n°07

BUYER :

CNRS-Délégation Paris-Normandie
3 rue Michel Ange
75794 PARIS Cedex 16

CONTRACTUAL FORM:

Single-award framework agreement based on unit prices following a formal open tender procedure in accordance with Articles L. 2124-2, R. 2124-2 and R. 2161-2 to R. 2161-5 of the Public Procurement Code.

This is a supply contract subject to the provisions of the General Administrative Clauses for Public Supply Contracts (CCAG/FCS) issued by the decree of 31 March 2021.

This document comprises 14 pages, including the cover page.

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LIST OF ABBREVIATIONS

CCAG	Cahier des Clauses Administratives Générale = General Administrative Terms and Conditions
CCTP	Cahier des Clauses Techniques Particulières = Special Technical Specifications
CCAP	Cahier des Clauses Administratives Particulières = Special Administrative Terms and Conditions
EPST	Etablissement public à caractère scientifique et technologique = Public scientific and technological institution
FCS	Fournitures courantes ou services = Routine supplies or services
HT	Hors taxes = Excluding taxes
RC	Règlement de la consultation = Consultation rules
RGPD	Règlement général sur la protection des données personnelles = General Data Protection Regulation
PEPR	Programmes et équipements prioritaires de recherche = Priority research programmes and equipment
SCTD	Service centralisé de traitement de la dépense = Centralised expenditure processing service
CNRS	Centre national de la recherche scientifique = National Centre for Scientific Research
LPCC	Laboratoire de Physique Corpusculaire de Caen = Caen Particle Physics Laboratory
KM3NeT	Kilomètre cube Neutrino Telescope
ORCA	Oscillation Research with Cosmics in the Abyss
ARCA	Astroparticle Research with Cosmics in the Abyss
NEPTUNE	Neutrino Physics with Telescope Underwater
VEOC	Vertical Electrical-Optical Cable
BM	Base Module
DOM	Digital Optical Module
APD	Avalanche Photo Diode
BER	Taux d'erreur de bit (Bit Error Rate)
BOL	Début de vie (Beginning Of Life)
EOL	Fin de vie (End Of Life)
GbE	Gigabit Ethernet
ITU	International Telecom Union
LOS	Loss Of Signal
ODB	Open Data Base
PRBS	Séquence binaire pseudo-aléatoire (Pseudo Random Bit Sequence)
ROSA	Receiver Optical Sub-Assembly
SMSR	Side Mode Suppression Ratio
TBD	To Be Defined
TOSA	Transmitter Optical Sub-Assembly
TSFP	Tuneable Small Form factor Pluggable transceiver
UPI	Unique Product Identifier

APPENDICES TO « French CCTP »

Annexe 1	English translation of these Special Conditions of Contract
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In these Special Conditions of Contract:

- The terms "equipment", "supplies" and "materials" refer interchangeably to the materials to be supplied for each lot;
- The term "Contractor", "holder", "supplier" "successful tenderer" refers to the company that is awarded one or more lots of the contract.;
- The term "Contract" refers to the agreement concluded between the CNRS and the Holder of each lot.

1 Preamble

The provision of the services defined in this document constitutes a contract with a public institution with an obligation of means and results.

The Contractor undertakes that it is able to perform this contract in strict compliance with the obligations set out in the contract documents, in particular with regard to confidentiality, qualification and insurance clauses.

The Contractor shall be deemed, under its responsibility and regardless of any justifications provided, to have received the legal authorisations to perform and to possess the professional qualifications corresponding to the nature and importance of the service covered by this contract. The Contractor shall be solely liable for any consequences that may arise from the fact that these qualifications do not comply with regulations or are incorrect and, in particular, for the consequences of any termination that the CNRS may rightly decide to implement as a result.

In addition to the documents constituting the consultation file, the Contract Holder is required to comply with the specifications and requirements of the decrees, orders, regulations, standards and texts in force on the date of submission of its tender.

2 Presentation

The national centre for scientific research (hereinafter « CNRS » - Centre National de la Recherche Scientifique) is a public research organisation (a public scientific and technological institution, EPST, under the supervision of the Ministry of Higher Education, Research and Innovation). It produces knowledge and puts this knowledge at the service of society.

Its governance is ensured by a chief executive officer, assisted by deputy chief executives.

With over 33,000 employees, a budget of €3.5 billion and a presence throughout France, the CNRS is active in all fields of knowledge, drawing on more than 1,100 laboratories.

Present in all fields of knowledge

As France's leading multidisciplinary research organisation, the CNRS conducts research in all scientific, technological and societal fields. It covers the entire spectrum of scientific disciplines.

The CNRS is active in all major disciplines, grouped into 10 institutes, and focuses on developing collaborations between specialists from different disciplines, particularly with universities, opening up new fields of research that meet the needs of the economy and society.

Present throughout the country

17 regional delegations ensure direct, local management of laboratories and maintain links with local partners and local authorities.

2.1 General context of the project

The NEPTUNE project, funded by the Normandy Region, aims to continue the construction of underwater infrastructure to establish a KM3NeT ORCA underwater observatory for neutrino research, which will ultimately consist of around 115 detection lines and instrumentation for marine and environmental science. It is located approximately 40 km south of Toulon at a depth of 2,500 m.

2.2 Background to the purchase

The optical modules of the KM3NeT experiment transmit their data via optical fibres. To do this, the junction boxes, detection line modules and ground station must be equipped with optical transceivers with adjustable emission wavelengths, also known as TSFP optical transceivers.

These technical specifications describe all of the contractor's technical obligations. These constitute an obligation of results for the contractor.

2.3 Subject matter of the contract

Purchase of Tunable SFP Optical Transceiver for new detection lines for the KM3NeT-ORCA project as part of NEPTUNE funding by the Normandy region.

Quantity : **55 units** (Estimated quantity in relation to the budget allocation).

2.4 Allotment

This contract is a supply contract.

The contract is divided into 08 separate lots. Each lot is the subject of a separate contract.

Lots	Lot names
01	Cable vertical Opto-Electrique (VEOC)
02	Structure de support des bouées
03	Carte électronique BPS (Base Power System)
04	Pénétrateur VEOC dans le Base Module
05	Conteneur cylindrique du Base Module
06	Carte électronique CLB (Central Logic Board)
07	TSFP optical Transceiver
08	Hydrophone

3 Description of expected equipment and general and technical specifications

3.1 Description of expected equipment

3.1.1 General specifications

The TSFP transceiver will be installed on host boards with a system design life of 15 years without maintenance.

Req.1.	EOL is 15 years
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The TSFP transceivers have to meet the following general characteristics:

Req.2.	Data rate: 10 Gb/s but operated by KM3NeT at 1 Gb/s GbE
Req.3.	Range: 80 km point to point of standard single mode fiber with attenuation of 0.2dB/km and chromatic dispersion of +18 ps/(nm•km)
Req.4.	BER at EOL: better than 10 ⁻¹² measured with a PRBS of 2 ⁷ -1 at 1.25 Gb/s GbE data rate. BER should be measured setting the TOSA output power equal to the Average Output Power EOL (Req.15) and with 80km of standard single mode fiber with attenuation of 0.2dB/km and chromatic dispersion of +18 ps/(nm•km)
Req.5.	TOSA must be tuneable on 50 GHz ITU-based channel spacing in C-band and must contain a wavelength locker
Req.6.	ROSA must be a limiting APD

3.1.2 Compliance with standards

The TSFP must comply with the following standards:

Req.7.	SFF-8431 Rev 4.1 is applicable
Req.8.	SFF-8432 Rev 4.2
Req.9.	SFF-8472 Rev 10.1
Req.10.	SFF-8690
Req.11.	Telcordia GR-468
Req.12.	ROHS-6
Req.13.	Class 1 Laser Safety

3.2 Identification of minimum expected technical and functional performance

3.2.1 Functional performance specifications

The TSFP transceivers have to meet the following requirements:

	Parameter	Min	Typ	Max	Unit
	Transmitter				
Req.14.	Average Output Power BOL	-1		3	dBm
Req.15.	Average Output Power EOL	-1			dBm
Req.16.	Extinction Ratio	8.2			dB
Req.17.	Frequency stability (BOL)	$f_c - 1.5$	f_c	$f_c + 1.5$	GHz
Req.18.	Frequency stability (EOL)	$f_c - 2.5$	f_c	$f_c + 2.5$	GHz
Req.19.	Channel spacing (ITU-based grid)		50		GHz
Req.20.	TX wavelength	1528.77		1563.86	nm
Req.21.	TX frequency	191.7		196.1	THz
Req.22.	Side Mode Suppression Ratio	30			dB
	Receiver				
Req.23.	Receiver overload	-7			dBm
Req.24.	LOS assert			-27	dBm
Req.25.	LOS deassert			-25	dBm
Req.26.	Receiver damage threshold			4	dBm
	Digital diagnostics	Accuracy			
Req.27.	Transceiver temperature	± 5			°C
Req.28.	Transceiver supply voltage	$\pm 3\%$			V
Req.29.	Transmitter bias current	$\pm 10\%$			mA
Req.30.	Transmitter average optical output power	± 3			dB
Req.31.	Receiver average optical input power	± 3			dB

3.2.2 Heat management and maximum power dissipation

The heat management of the TSFP transceiver is realized via custom heatsink in thermal contact with the top side of the transceiver, for this reason the top side must be free of any label.

Req.32.	The maximum power consumption of the TSFP should be declared and it shall not exceed 2 W at EOL.
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3.2.3 Operating Conditions

The Tunable SFP transceiver must be capable to operate in the following ranges:

	Parameter	Min	Max	Unit
Req.33.	Operating case temperature	-5	+70	°C
Req.34.	Power supply voltages	3.135	3.465	V

3.3 Supplementary benefits

3.3.1 Acceptance test sheet provided by producer

The Tenderer must perform tests on the 100% of the parts delivered.

This acceptance test sheet must include the measurements of the following parameters

	Parameter reported in test sheet	Unit
Req.35.	Producer Serial Number	
Req.36.	BER at 1.25 Gb/s with a PRBS of 2^7-1 for the following conditions: - 0 km and - 80 km of standard single mode fibre with attenuation of 0.2dB/km and chromatic dispersion of +18 ps/(nm•km)	
Req.37.	Maximum Broadband SMSR: min value	dB
Req.38.	Digital Diagnostic Case Temperature Error: min and max values	°C
Req.39.	Digital Diagnostic Receiver Optical Power Error: min and max values	dB
Req.40.	Digital Diagnostic Transmitter Optical Power Error: min and max values	dB
Req.41.	Firmware Version	
Req.42.	Current consumption: max value	A
Req.43.	Power consumption: max value	W
Req.44.	Receiver LOS Assert level: max value	dBm
Req.45.	Receiver LOS Deassert level: min value	dBm
Req.46.	Receiver LOS Hysteresis: min and max values	dB
Req.47.	Maximum Sensitivity at 1.25 Gb/s with a PRBS of 2^7-1 for the following conditions: - 0 km and - 80 km of standard single mode fibre with attenuation of 0.2dB/km and chromatic dispersion of +18 ps/(nm•km)	
Req.48.	Transmitter average Power: min and max values	dBm
Req.49.	Transmitter eye crossing: min and max	%
Req.50.	Transmitter ER: min value	dB
Req.51.	Transmitter Wavelength Error: min and max values	GHz
Req.52.	Transmitter Mask Margin: min value	%

3.3.2 Labelling

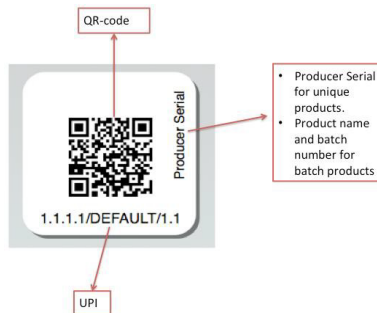
The identification of the components consists of two numbers:

- TSFP UPI; unique number distributed by KM3NeT QA
- TSFP serial number given by producer

All these number should be connected in the final product. This should be done by labelling the final product and keeping track of the underlying serial/identification numbers in records.

Req.53.	The manufactures shall keep track of all identifications: - TSFP UPI; - TSFP serial number of producer,
Req.54.	The identification numbers shall be delivered in a readable electronic file format.
Req.55.	There shall be no label on top side of TSFP
Req.56.	Each TSFP shall be marked with a unique serial number supplied by the customer (UPI). The number shall be in human readable text and in QR-code.
Req.57.	The label should fit on the cage of the TSFP.

Give format we expect the label to be:



Or



UPI is 3.4.3.2.3.1/TSFP/1.xxx (=PBS/variant/version.serial number). Second layout of label could be the most appropriate to fit cage. The xxx value to be given by Nikhef to supplier.

3.3.2 Packaging for transport and storage

Req.58.	The TSFP shall be delivered in a box protecting the unit against abuse during transport.
Req.59.	The supplier shall describe the packaging for the transportation of the TSFP
Req.60.	The packaging shall protect the TSFP against mechanical shocks during the transportation
Req.61.	The packaging shall protect the TSFP against ESD
Req.62.	Each box should be accompanied by a printed sheet with the technical characteristics of the TSFP in the box
Req.63.	The format of the electronic file containing the characteristics of each TSFP and the association between the supplier serial number and the KM3NeT UPI will be agreed after the tender completion.
Req.64.	Shock indicators shall be present on the transport box
Req.65.	The contractor shall have full responsibility for the transport including insurance; the delivery must be delivered free of charge at the customer address, and all shipping costs including any customs duties and operations shall be charged to the company.

4 Delivery times / Terms and conditions of delivery and performance of services

Delivery is at the expense of the holder.

The equipment will be packaged to ensure safe transport.

Delivery will be made in a single phase.

The delivery time must be stated in the tender by the contractor, provided that it does not exceed the maximum time limit.

4.1 Maximum delivery time for all products

Maximum time limit : 04 months

4.2 Delivery terms and premises layout

Deliveries are made on working days from Monday to Friday between 9am and 12pm and between 2pm and 5pm.

Packaging and delivery shall be borne by the contractor.

The contractor is responsible for packaging, packing, loading and stowage operations.

The risks associated with transport to the place of delivery are borne by the contractor.

The exact date of delivery of the services will be agreed upon between the laboratory and the contractor

The services delivered by the contractor or their representative must be accompanied by a delivery note drawn up in duplicate, specifying:

- ✧ The date of dispatch,
- ✧ Tender references,
- ✧ Identification of the contractor,
- ✧ Identification of delivered supplies.

Damage caused by deliveries and installations:

The holder remains liable for any damage of any kind caused by their agents or the carrier to equipment: buildings, land, plantations, installations, etc.....

The CNRS reserves the right to carry out itself or have carried out, on behalf of the holder, the repair of any damage caused.

4.3 CNRS Technical Correspondents

Jérôme PERRONNEL

Laboratoire de Physique Corpusculaire de Caen - LPCC

6 Boulevard Maréchal Juin

14050 Caen cedex

France

4.4 KM3NeT Technical Correspondents

Jan-Willem Schmelling

Nikhef

Science Park 105

1098 XG Amsterdam

The Netherlands

4.5 Delivery locations / Access

Delivery must be made to the following address:

ECS - Laboratorio CAPACITY
Attn : Guido Schioppa
Viale Carlo III di Borbone 153
81020 San Nicola la Strada (CE) Italie

Delivery hours: Monday to Thursday, 10:00 a.m. to 2:00 p.m. (Friday: closed)

➤ Outside the times indicated, it will not be possible to load or unload.

5 Documentation to be provided by the Holder

Documents must be written in French and/or English.

5.1 Documentation upon delivery

Req.66.	Each delivery shall contain a printed sheet with serial number(s) and the technical characteristics of the TSFP(s)
Req.67.	The format of the electronic file containing the characteristics of each TSFP and the association between the supplier serial number and the KM3NeT UPI will be agreed after the tender completion.

5.2 Tender documentation (to be attached to the technical tender)

Tender documents for the TSFP are packed in a separate zip file. The documents are :

Req.68.	Calculated Reliability: FIT as predicted per Telcordia SR-332. The reliability should be calculated in a temperature range between 10 and 60 °C at 15 years.
Req.69.	Field Reliability as ratio between the Total number of failed units returned to the manufacturer from the field and Total number of units that have been produced.
Req.70.	Telcordia GR-468 Qualification report

6 Verification operations

Upon delivery, the CNRS carries out the following checks and tests :

- Visual inspection
- Documentation control

6.1 Terms and conditions for final acceptance of services

Final acceptance shall be declared within a maximum of two weeks after delivery, following the checks described in § 6 and the provision of the documentation listed in § 5.1.