

ANNEXE 2

**English version of the document:
Base Power System-BPS_CCTP_CNRS DR016_A03**

PARIS-NORMANDIE DELEGATION

SPECIAL TECHNICAL SPECIFICATIONS

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

PUBLIC SUPPLY CONTRACTS

SUBJECT:

**Purchase of Electronic cards called "BPS_V03-R2"
for new detection lines for the KM3NeT-ORCA project as part of
NEPTUNE funding by the Normandy region.**

Lot n°03

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 27 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
LNS	Laboratori Nazionali del Sud (Catane -Italie)
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
DU	Detection Unit
BPS	Base Power System
CMD ou CMS	Surface Mount Device ou Composant Monté en Surface
BOM	Bill Of Materials (= liste des composants)
THT	Through Hole Technology (ou Composant à Technologie traversante)

APPENDICES TO « French CCTP »

Annexe 1	Test procedure BPS_V03-R2 in french
Annexe 2	English translation of these Special Conditions of Contract
Annexe 3	English translation of Test procedure BPS_V03-R2

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 purpose of this consultation is to supply BPS_V03-R2 placed in a special container at the base of the KM3NeT experiment's detection unit (DU). It operates in air at atmospheric pressure. The card is powered at 375VDC and is responsible for supplying the low-voltage power required to operate the electronic units installed at the base of the detector and for controlling the main power supply line to the detection unit.

These technical specifications describe all of the contractor's technical obligations. These constitute a performance obligation for the contractor.

2.3 Subject matter of the contract

Purchase of 57 BPS_V03-R2 *electronic cards* for new detection lines for the KM3NeT-ORCA project as part of NEPTUNE funding by the Normandy region.

Quantity : **57 cards** (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	Buoy support structure
03	Electronic card BPS (Base Power System)
04	Penetrator VEOC in Base Module
05	Cylindrical container of the Base Module
06	Electronic card CLB (Central Logic Board)
07	TSFP optical Tranceiver
08	Hydrophone

3 Description of expected equipment

The supply must be carried out in accordance with best practice in order to be perfect in every detail.

The supply includes the following items:

- Production of PCBs with screen printing of the component list, serial number, production batch, production date, date and result of the electrical test.
- Procurement of active and passive components and accessories for the assembly of component V375C5E50BF3 and heat sink.
- Assembly and welding of electronic and mechanical components.
- Checking the printed circuit boards and the assembly of all cards, as described in point 6.
- Performing specific functionality and characterisation tests on all boards, as described in the attached document. " **Test procedure BPS_V03-R2**".

4 PCB Main construction specifications

The BPS_V03-R2 printed circuit board consists of four layers measuring 150 mm x 200 mm and is designed for mounting SMD components on the top and bottom sides and THT components on the top side. Figure 1 shows the stack-up with the measurements of the insulation thicknesses between the layers and the thickness of the copper foil. The stack-up cannot be modified; the layer thicknesses must be respected unless explicitly authorised in writing by the customer.

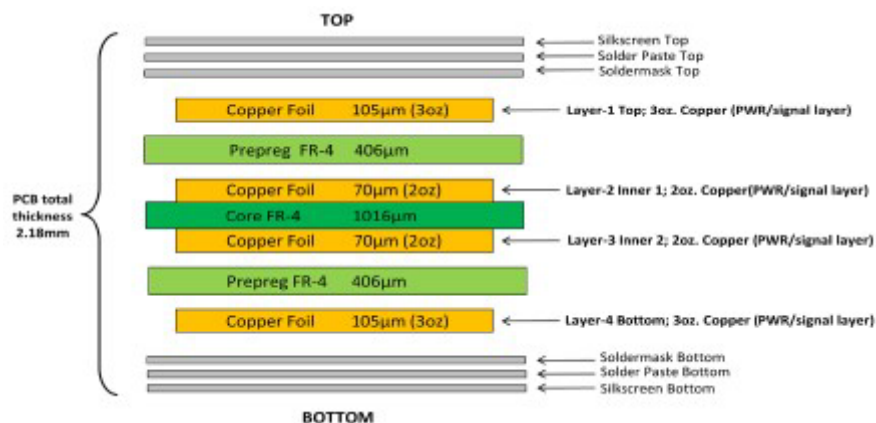


Fig. 1: PCB stacking *BPS_V03-R2*

The incremental serial number, unique for each card, must be stamped on the top side of the PCB in the appropriate screen-printed box. The number must be dry-engraved or, if printed in ink, it must be indelible to any chemical solvent.

For PCB construction specifications not expressly mentioned in these specifications, the following reference standards must be observed.

a) Base Materials for Printed Boards

IPC-4101 Specification for Base Materials for Rigid and Multilayer Printed Boards
 IPC-4103 Specification for Base Materials for High Speed/High Frequency Applications
 IPC-4562 Metal Foil for Printed Board Applications

b) Qualification for Printed Boards

IPC-6011 Generic Performance Specification for Printed Boards
 IPC-6012 Qualification and Performance Specification for Rigid Printed Boards
 IPC-6018 Qualification and Performance Specification for High Frequency (Microwave) Printed Boards
 IPC-DR-572 Drilling Guidelines for Printed Boards
 IPC-4552 Performance Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Boards
 IPC-SM-840 Qualification and performance of permanent Solder Mask
 J-STD-609 Marking and Labelling of Components, PCBs and PCBAs to Identify Lead (Pb), Lead-Free (Pb-Free) and Other Attributes

c) Acceptability for Printed Boards

IPC-A-600 Acceptability of Printed Boards (Class 2)

d) Test Methods

IPC-TM-650 Test Methods
 IPC-9252 Requirements for Electrical Testing of Unpopulated Printed Boards

e) Requirements for Soldered Electronic Assemblies

IPC-J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies
 IPC-J-STD-003 Solderability Tests for Printed Boards
 IPC-7711/21 Rework, Modification and Repair of Electronic Assemblies
 IEC-61340-5-1 Protection of electronic devices from electrostatic phenomena

f) Acceptability of Electronic Assemblies

IPC-A-610 Acceptability of Electronic Assemblies

g) Safety

UL 94 Test for flammability of plastic materials for parts in devices and appliance (V-0)
 RoHS 2011/65/EU European directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Table 1: Reference norms and standards

In the event of conflicting directives in the reference standards and these specifications, the following priorities shall apply (priority 1 being the highest):

Priority 1: Gerber files and construction documents provided to the customer

Priority 2: These specifications

Priority 3: The standards in Table 1

The specifications provided should be considered as minimum requirements.

If the contractor considers it useful for improving the quality of the contract performance, it may define more restrictive criteria.

4.1 Stratification

The laminate used for the construction of the printed circuit board must be of the FR4 type with a glass transition temperature $TG \geq 130^\circ\text{C}$ and a flammability class compliant with UL 94V0 specifications. The comparative tracking index (CTI) of the laminate must be classified in category 1 ($400\text{V} < \text{CTI} < 599\text{V}$).

The laminate mark must be legible and reproduced on the top and bottom of the printed circuit board. The permitted thickness tolerance must not exceed $\pm 5\%$ of the nominal values indicated in Figure 1 and must be respected over the entire surface of the printed circuit board.

4.2 Copper

The values for copper layer thicknesses and the corresponding permissible tolerances are shown in Tables 1 and 2. The tolerance on layer thickness must be observed across the entire surface of the printed circuit board.

4.3 PCB technical specifications

Detailed specifications for the printed circuit board are contained in the construction files, which should be referred to first. Table 2 lists the main characteristics and corresponding tolerances to be observed.

Requirement	Value
Board dimensions	150mmx200mm
Number of layers	4
Panel thickness	2.18mm
Board thickness tolerance	$\pm 5\%$
Buckling and warping tolerance (measured along the maximum diagonal of the card)	$\leq 0,75\%$
Defined stack-up	SI
Thickness of outer copper layer	105 μm
Thickness of inner copper layer	70 μm
Buried holes	NO
Blind holes	NO
Controlled impedance tracks	NO
Filled and plugged vias	NO
Pressed through holes	NO
Week/year marking	Negative printing on solder reserve
Marking code and edition	Compliant with the Gerber file provided
Copper thickness in holes	$\geq 35\mu\text{m}$
Position of dimensioned holes	Within $\pm 75\mu\text{m}$ of the nominal position
Minimum residual copper ring around hole	$> 50\mu\text{m}$
Layer misalignment	$\leq 25\mu\text{m}$
Welding resistance	
- Tipo	Photography
- Thickness at the edges of the track	$\geq 4\mu\text{m}$
- Thickness at the centre of the slopes	$\geq 10\mu\text{m}$

- Centring (distance from the edge of the hole) - Centring (distance from the SMD pads) - Colour	$\geq 50\mu\text{m}$ $\geq 0\mu\text{m}$ (permitted tangency) Green
Screen-printed inscriptions on the top and bottom - Colour - Centring relative to the layout	White $200\mu\text{m}$
Mechanical holes - Tolerances for plated holes - Tolerances for non-plated holes	$-50\mu\text{m} +100\mu\text{m}$ $+100\mu\text{m} -0\mu\text{m}$
Tolerance of mechanical dimensions	Within $\pm 100\mu\text{m}$ of the nominal value

Table 2: Technical specifications required for manufacturing the PCB board BPS_V03-R2

4.4 Drilling and metallisation

The general criteria to be met for the drilling and metallisation process must comply with the IPC-DR-572 standard. Copper metallisation of through holes must be at least $35\mu\text{m}$ on average and never less than $20\mu\text{m}$. Non-functional pads must not be removed without the customer's prior authorisation. Copper thieving, if necessary to facilitate the manufacture of printed circuit boards, must be subject to prior written authorisation from the customer.

4.5 Acceptability criteria

Production yield must be **100%**, i.e. all printed circuit boards must be guaranteed to function according to the specifications set out in these specifications. The copper areas and tracks on all layers must have the thicknesses shown in Fig. 1 and comply with the tolerances indicated in Table 1.

Printed circuit boards with missing copper areas and/or thickness violations in the "copper area" are not acceptable.

The manufacture and inspection of printed circuit boards must comply with IPC-6011 and IPC-6012 Class 2 (latest revision) standards. Acceptability criteria must comply with these specifications and IPC-A-600 Class 2 (latest revision). All quality controls and tests must be carried out in accordance with IPC-TM-650 procedures. Printed circuit boards must be compatible with the lead-free assembly process. All printed circuit board production must be carried out using the same production process. Any changes to the production process, sequence of operations, equipment used or materials used must be communicated to the customer in advance and approved in writing.

4.6 Solder mask

The solder mask must be green on both sides of the printed circuit board. Compliance with IPC-SM-840 Class T is required with a minimum solder mask thickness of :

- 5 μm at the edge of the tracks
- 10 μm on electrical conductors

Gaps between the solder mask and the side walls of the tracks are not permitted, nor are bubbles and/or scratches that expose the underlying surface. The tightness of the solder mask must satisfy the adhesive tape adhesion test. (According to IPC-TM-650 2.4.28.1). All solderable areas must be free of solder mask. The solder mask must be compatible with the lead-free assembly process.

4.7 Screen printing

The screen printing must be white. The lettering must be clear and legible, not blurred, with a continuous line, and must not cover the areas to be soldered. The ink used must be permanent, non-conductive and comply with RoHS Directive 2011/65/EC.

The screen printing must be able to withstand at least 4 cycles of at least 60 seconds at a peak temperature of 270°C without deterioration.

4.8 Repairs and returns

Repairs aimed at removing short circuits or restoring broken circuits **are not permitted**.

5 Component procurement

The list of electronic and mechanical components required for assembling the BPS_V03-R2 board can be found in section 11.2 of this specification. The substitution of components specified in the bill of materials with devices having equivalent functions but different part numbers is not permitted without the customer's written authorisation. It is the contractor's responsibility to determine the quantities required based on assembly requirements and packaging type.

Note: components supplied by KM3NeT:

KM3NeT undertakes to supply the VICOR U5 Component - V375C5E50BF3 (see: BOM line 127) as well as the 4 associated VICOR components mentioned in the BOM lines 147 to 150).

It is the contractor's responsibility to ensure that components are stored and handled in accordance with the manufacturer's standards and methods that comply with ESD standards.

The traceability of purchased components (supplier, date of purchase and, where applicable, production batch) is required.

This information must be included in a report to be provided to the customer with the card documentation.

5.1 Assembly of components

SMD components are mounted on both the top and bottom sides of the BPS_V03-R2 board.

THT components are only mounted on the top side.

Component U5 V375C5E50BF3 must be assembled on the board with its own heat sink and the Micro Thermate Pad.

Component U5 is mounted in an SMD socket on the top side and requires mechanical assembly to secure it to the board..

For proper assembly and soldering, please refer to the document "Soldering Methods and Procedures for Vicor Power Modules, Design Guide & Applications Manual," which can be downloaded from the official Vicor Corporation website.

Standard procedures are required for soldering other SMD and THT components.

5.2 Documentation provided by the customer for component assembly

The client shall provide the successful tenderer with all technical documents in electronic format deemed necessary for assembly. The documents provided shall include, in particular::

- Files for creating masks for the solder paste in Extended Gerber format
- Assembly Drawings
- Complete bill of materials with part numbers for active, passive electronic components and mechanical components on the board
- Pick-and-Place file

The prints of the top and bottom layers of the component layout are presented in section 11.1.

Section 11.2 presents the nomenclature of the printed circuit board.

Tables 3 and 4 list the files available for printed circuit board production, component positioning and assembly.

Format	Extended Gerber
Output Resolution	3.4 Format
Stackup layer name	Gerber file name
Top Layer	DU_BPS_V03-R2-1.TOP
Bottom Layer	DU_BPS_V03-R2-1.BOT
Soldermask Top	DU_BPS_V03-R2-1.SMT
Inner Layer 1	DU_BPS_V03-R2-1.IN1
Inner Layer 2	DU_BPS_V03-R2-1.IN2
Soldermask Bottom	DU_BPS_V03-R2-1.SMB
Solder Paste Top	DU_BPS_V03-R2-1.SPT
Solder Paste Bottom	DU_BPS_V03-R2-1.SPB
Silkscreen Top	DU_BPS_V03-R2-1.SST
Silkscreen Bottom	DU_BPS_V03-R2-1.SSB
Assembly Top	DU_BPS_V03-R2-1.AST
Assembly Bottom	DU_BPS_V03-R2-1.ASB
Drill Drawing	DU_BPS_V03-R2-1.DRD
Thru hole Drill Drawing	thruhole.tap
Drill Tape Summary Report	DU_BPS_V03-R2-1.DTS

Table 3: List of Gerber files BPS_V03-R2

Report	File name (TEX Format)
Component List Report	COMPS.TXT
Pick and Place Report	PICKNPLC.TXT
Surface Mount Top Report	SMTOP.TXT
Surface Mount Bottom Report	SMBOT.TXT
Through Hole Top Report	THTOP.TXT
Drill List Report	DRILL.TXT

Table 4: List of files for component positioning and assembly

6 Description of validation and control tests

This section specifies the validation and control tests to which the boards must be subjected.

These tests and controls are to be considered an integral part of the production process, and the resulting data must be compiled in electronic and paper format together with the supply.

The test data must be compiled in such a way that it can be uniquely associated with the relevant board.

6.1 PCB manufacturing controls

The following checks must be carried out on the PCB:

- Presence of the required markings and labels
- Integrity of the laminate
- Centring of pads within tolerance limits
- Integrity and centring of solder resist within tolerance limits
- Definition of tracks within tolerance limits
- Copper thickness of tracks and copper areas within tolerance limits
- Absence of areas with copper deficiency within the copper areas
- Absence of detachment and/or lifting of traces or pads
- Electrical continuity check and verification of absence of short circuits on all tracks on
- 100% of PCBs manufactured.
- 2D check on 100% of PCBs manufactured for the screen-printed deposit with a detailed report to be included in the appropriate form relating to the assembled BPS_V03-R2.

6.2 Component assembly and mechanical assembly checks

The following checks must be carried out with regard to the assembly of components:

- Identification of the unit by means of a label showing the date of assembly in week, year format (in yy,ww format).
- Visual inspection to verify the complete assembly and soldering of all components and their correct positioning on 100% of the boards.
- Visual inspection to verify the correct mechanical assembly of the heat sink, the Thermate Pad and the fixing of the V375C5E50BF3 component to the PCB on 100% of the boards.
- Visual inspection and removal of any residues left on the board by the component assembly and/or soldering process on 100% of the boards.

6.3 Component procurement requirements

The supply of active and passive electronic components and mechanical parts for the BPS_V03-R2 boards must be carried out by the successful tenderer exclusively from the direct manufacturers or officially authorised distributors. The successful tenderer shall provide the client with the declaration of conformity issued by the manufacturers/distributors for all components mounted on the board.

6.4 Functionality tests

The functionality of all cards must be tested. Information regarding the test bench configuration and relevant test procedures is described in the document: **"Test Procedure BPS_V03-R2"**.

In order to improve the quality of the tests, the customer is authorised to supplement and/or simplify the tests specified in the appendix, subject to prior notification and approval by the customer.

The data resulting from the tests must be compiled electronically in such a way that it can be unambiguously linked to the card identification number.

7 Documentation

7.1 Documentation provided by the customer for PCB production

The customer shall provide the successful tenderer with all technical documents deemed necessary for the production of the printed circuit board. The printed circuit board must be manufactured in full compliance with the technical documentation. These documents form an integral part of these specifications and are provided to the successful tenderer in electronic form.

In particular, the following documents are provided:

- Extended Gerber format files for all layers of the board
- Excelon format drilling files
- Netlist

For illustrative purposes, prints of the printed circuit board layers are presented in section 11.1. The printed circuit board Gerber files are attached for evaluation purposes only. The customer will provide the official printed circuit board production documents to the successful bidder.

7.1.1 Approval and certification by the manufacturer

It is the contractor's responsibility to verify that the documentation submitted for the construction of the board is consistent and allows for the correct manufacture of the printed circuit board, assembly and soldering of components. This applies in particular to tolerances on holes, track dimensions, copper thickness, minimum distances between edges, insulation, crowns, vias, layer balancing, etc.

To this end, the following procedures must be followed:

1) In the event of implementation difficulties and/or inconsistencies and/or possible optimisations/suggestions, the contractor shall immediately inform the client. The contractor must wait for a written response from the client before continuing with the implementation.

2) No changes are permitted without the customer's written consent.

3) In the absence of any communication from the contractor, it is assumed that the documentation submitted is consistent and sufficient for the correct construction of the printed circuit board and the assembly of components.

It is the contractor's responsibility to verify that the materials required for the manufacture of PCBs comply with specifications and can be purchased without difficulty before proceeding with the manufacture of PCBs.

It is the contractor's responsibility to verify that the production processes used to manufacture the PCBs meet the requirements of these specifications and include all the necessary quality tests.

It is the contractor's responsibility to verify that the printed circuit boards produced are compatible with the component assembly phase.

7.2 Documentation to be provided by the contractor

All documents shall be drafted in French and/or English.

7.2.1 Documentation upon delivery

- A technical description
- The traceability, measurement, and testing reports mentioned in sections 5 and 6.

7.2.2 Tender documentation

- A technical description of the BPS_V03-R2 cards offered, including their specifications and dimensions
- A schedule for completion and delivery.
- A quotation detailing the cost of manufacturing, testing and transport

8 Delivery method

The production of the 57 cards, which includes the production of printed circuit boards, the supply of components, assembly and verification that the acceptability criteria defined in these specifications have been met, must take place within **3 months** of the date of receipt of the order. The successful bidder shall then complete testing of all cards within **9 months**.

Depending on the test results, the following conditions may apply

a) Positive test

If all boards have passed the test successfully, delivery is made.

b) Negative test for manufacturing defects in one or more cards attributable to a faulty printed circuit board, assembly or components.

- In the event of assembly problems that can be resolved by reworking (cold soldering, missing components or components oriented differently from the design drawing, etc.), the contractor must repair all non-functional boards within 5 working days of notification of the problem, at no additional cost to the customer.

Repaired boards must be retested.

- In the event of problems related to defective components or for any other reason requested by the customer, the contractor must repair or rework all defective cards within 10 working days of notification of the problem, at no additional cost to the customer.

Repaired cards must be retested.

- In the event of problems that cannot be resolved by replacement (problems attributable to PCB manufacturing/handling defects, serious assembly errors, etc.), new boards must be manufactured within 15 working days of notification of the problem and must undergo the prescribed tests.

For any reason for a negative test result, a written agreement between the contractor and the client on how to proceed is necessary in order to identify the causes of the problems encountered and to define the appropriate corrective measures to be taken in the production process for the execution of the next production phase. Unless otherwise specified in writing by the client, the next stage cannot take place until the repaired/reproduced cards have been tested positively and the contractor has given

written assurance that the production process has been modified appropriately to meet the acceptability criteria defined in these specifications.

9 Confidentiality clause

The supplier undertakes, on behalf of itself and its employees, associates, consultants and subcontractors, to keep all data and information relating to the project strictly confidential.

In particular, the supplier undertakes to:

- a) ensure that the data and information acquired are used exclusively for purposes related to the performance of these specifications;
- b) ensure that none of the information received is disclosed to third parties outside the contractual relationship, unless prior authorisation has been given;
- c) Under no circumstances should you give the BPS_V03-R2 form to third parties without prior written consent;
- d) Under no circumstances shall waste or leftovers be provided to third parties without written consent.

10 Shipping and delivery

Upon delivery, the successful bidder must inform the customer of the shipping method and the type of packaging and wrapping in order to assess its suitability.

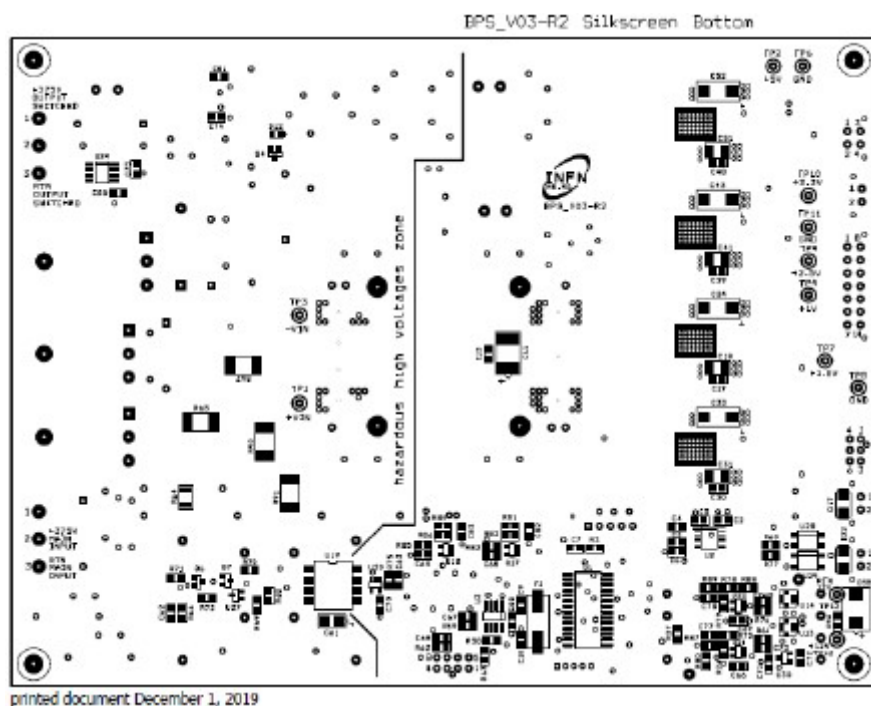
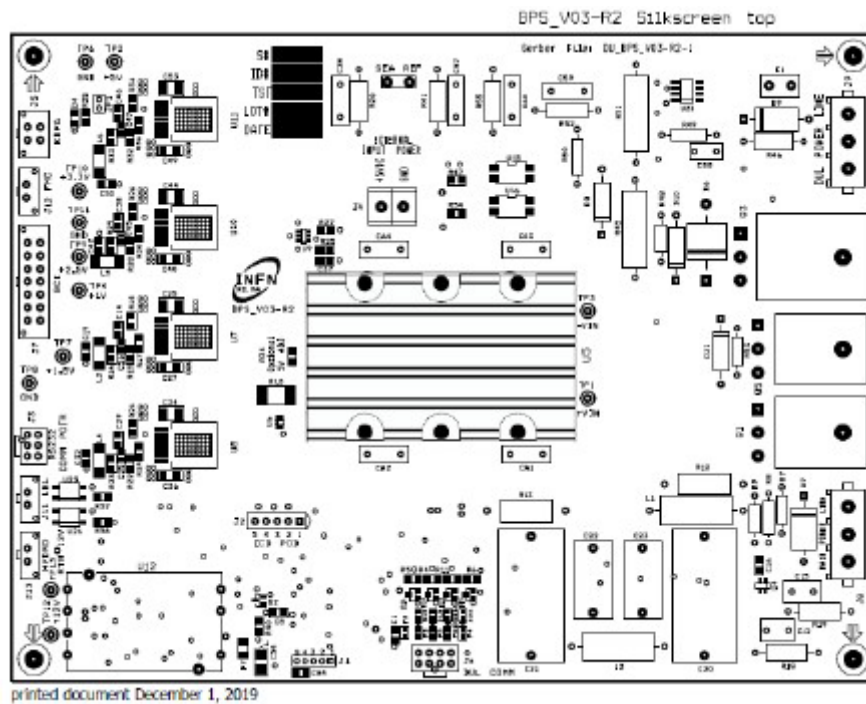
The packaging and wrapping of the cards must meet the following requirements:

- 1) Each individual card supplied must be contained in an antistatic envelope and packed in a container capable of absorbing shocks during transport.
- 2) The packaging of the production batch must be such as to ensure maximum safety during transport, shipment and storage of the material in the laboratory.

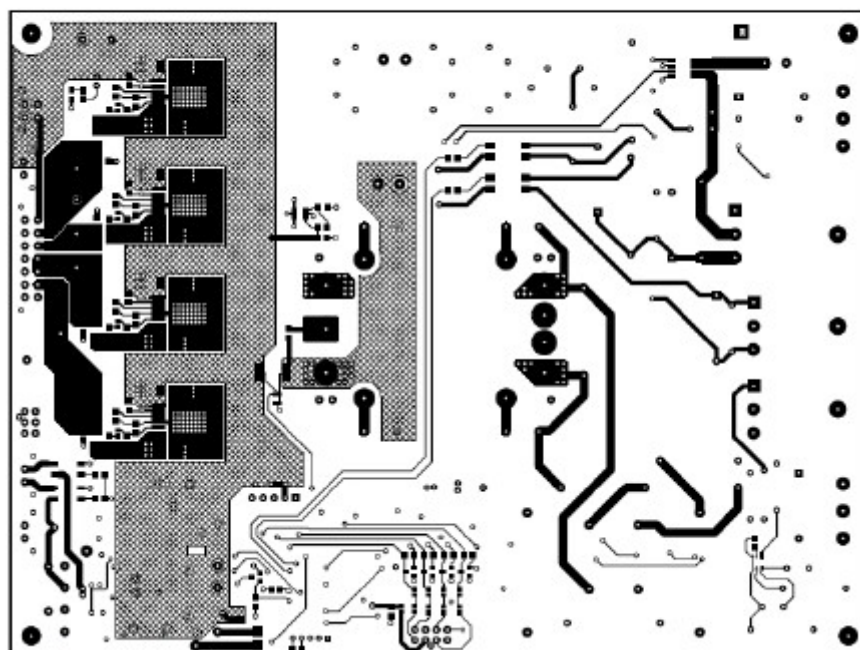
11 Documents Appendix

11.1 PCB board prints BPS_V03-R2

For illustrative purposes only, the main prints of the printed circuit board and component layout are shown below.

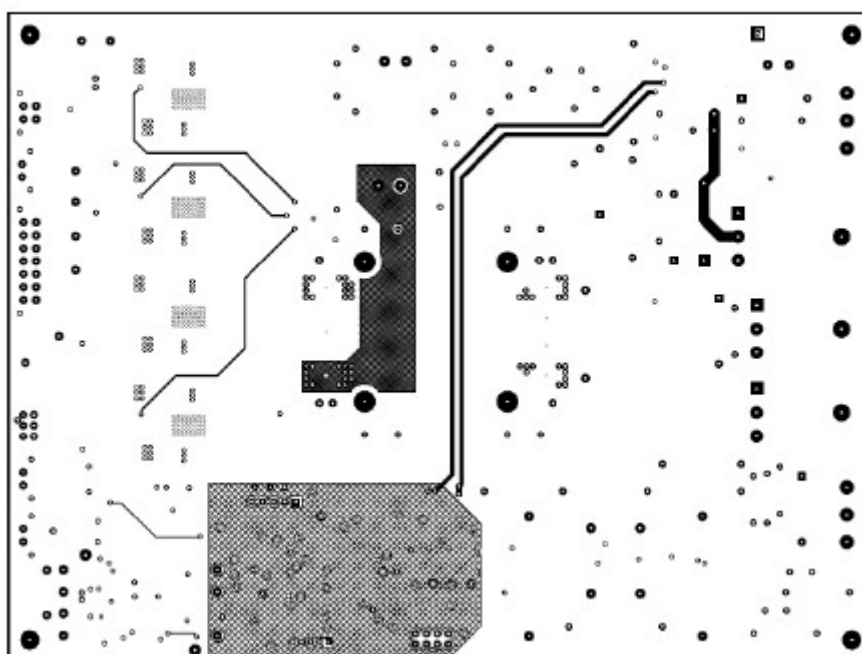


BPS_V03-R2 Layer 1 - Copper Top Side (3 ounce copper)



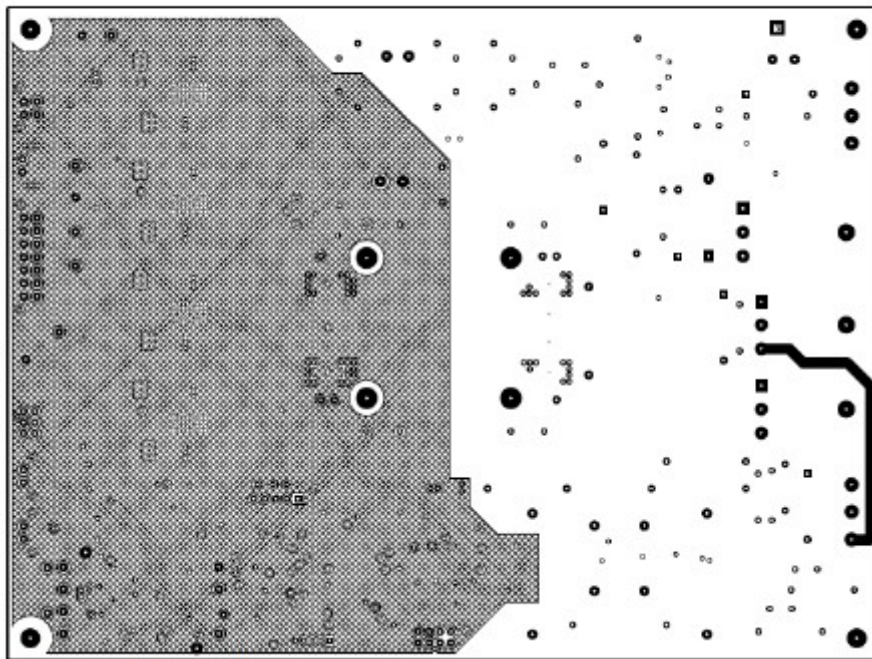
printed document December 1, 2019

BPS_V03-R2 Layer 2 - Copper Inner 1 (2 ounce copper)



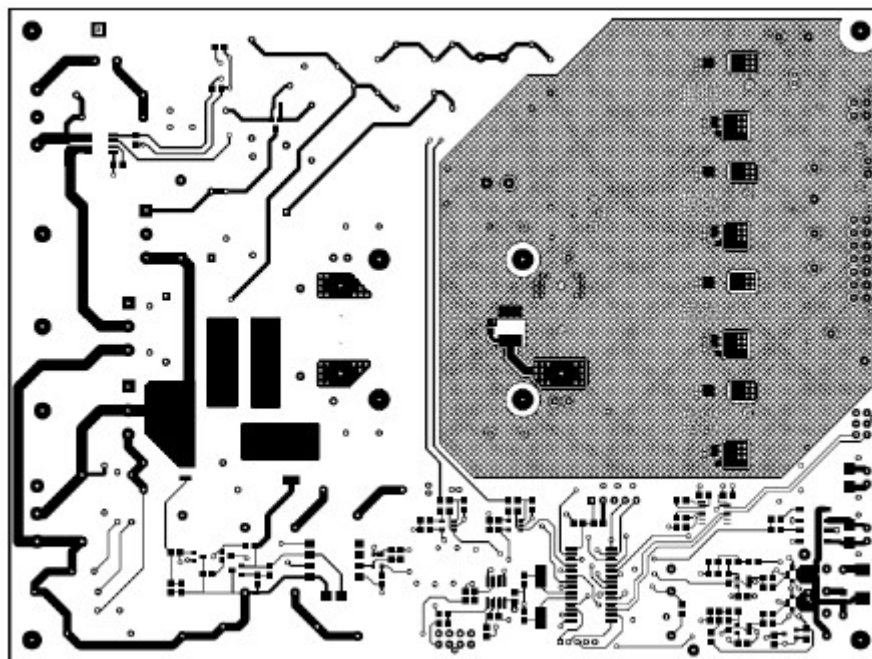
printed document December 1, 2019

BPS_V03-R2 Layer 3 - Copper Inner 2 (2 once copper)

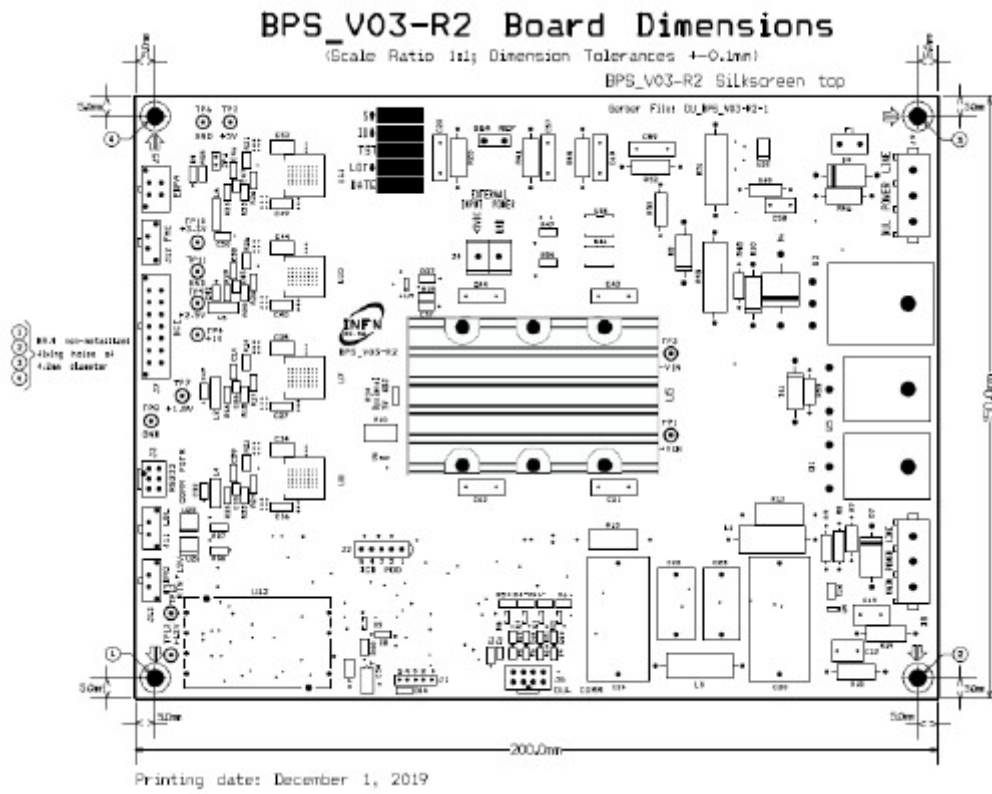


printed document December 1, 2019

BPS_V03-R2 Layer 4 - Copper Bottom Side (3 once copper)



printed document December 1, 2019



11.2 Liste des composants de la carte BPS_V03-R2

Below is a list of components marked with the "reference" number on the printed circuit board, along with the corresponding "part number" and manufacturer. The quantity shown in the list refers to the individual board. The list includes accessories for mounting the V375C5E50BF3 component.

BPS_V03-R2 Control & Monitoring Revised: Friday, November 29, 2019

Revision: 01

INFN Roma

Bill Of Materials December 1,2019 23:21:46

Item	Q.ty	Ref.	Component P/N	Manufacturer
1	4	CA1,CA2,CA3,CA4	S472M39Z5UN63L6R	Vishay
2	27	C1,C2,C3,C4,C5,C6,C7,C8,C13,C19,C32,C37,C42,C50,C56,C62,C63,C64,C65,C66,C69,C70,C71,C74,C75,C84,C85	C0805F104K5RACAUTO	Kemet
3	2	C9,C10	08052U180GAT2A	AVX
4	1	C11	T59EE477M016C0025	Vishay
5	1	C12	RDED72W474K5B1H03B	Murata
6	4	C14,C29,C38,C46	C0805C473J3GACTU	Kemet
7	1	C15	CK45-B3AD222KYNNNA	TDK
8	1	C16	C0805C224K1RACTU	TDK
9	4	C17,C30,C39,C48	0805ZD475KAT2A	AVX
10	4	C18,C31,C41,C51	C1210C107M9PACTU	Kemet
11	2	C20,C21	BFC233920225	Vishay
12	2	C22,C23	BFC233840334	Vishay
13	3	C24,C43,C52	T510X227K016ATE025	Kemet
14	4	C25,C34,C44,C53	C1210C226K4PACTU	Kemet
15	1	C26	C1608C0G1H101J080AA	TDK
16	4	C27,C36,C40,C49	12066D226KAT2A	AVX
17	1	C28	DEBB33F102KA3B	Murata
18	1	C33	T510X227K016ATE025	Kemet
19	2	C35,C45	C1608C0G1H221J080AA	TDK
20	1	C47	C1608C0G1H181J080AA	TDK
21	1	C54	TPSB106K016R0500	AVX
22	1	C55	TR3W107K025C0100	Vishay
23	2	C57,C60	DEBB33F102KA3B	Murata
24	1	C58	DEBB33D151KC1B	Murata
25	1	C59	DEBB33F102KA3B	Murata
26	1	C61	TPSB476K010R0250	AVX
27	4	C67,C68,C77,C78	08055C474KAZ2A	AVX
28	1	C72	C0805X106K8RACAUTO	Kemet
29	4	C73,C76,C82,C83	C0805C101F5GACTU	Kemet
30	2	C80,C81	C0805C102F1GACTU	Kemet
31	1	D4	APTD2012LSURCK	Kingbright
32	1	D6	P600M-E3	Vishay
33	2	D7,D9	1.5KE440A	Littelfuse
34	1	D8	1N5388BG	ON Semiconductor
35	2	D10,D11	1N5347BG	ON Semiconductor
36	1	D12	CD0603-B0240R	Bourns Inc.
37	4	D13,D14,D15,D16	BAT54S-E3-08	Vishay
38	2	D17,D22	SMAJ15A	Littelfuse
Item	Q.ty	Ref.	Component P/N	Manufacturer

39	4	D18,D19,D20,D21	CDBU70	Comchip Technology
40	1	F1	BK/PCB-4-R	Busmann / Eaton
41	5	F2,F3,F4,F5,F6	0438.250WRA	Liittelfuse
42	1	F7	0440003.WRA	Liittelfuse
43	1	JP1	M22-2015005	Harwin
44	1	J1	M22-2015005	Harwin
45	1	J2	1-826629-0	TE Connectivity / AMP
46	1	J3	105310-1206	Molex
47	1	J4	PM 5.08/2/90 3.5	Weidmuller
48	1	J5	43045-0413	Molex
49	1	J6	105310-1208	Molex
50	1	J7	43045-1413	Molex
51	2	J8,J9	350789-1	TE Connectivity
52	3	J11,J12,J13	43650-0215	Molex
53	2	L1,L3	B82145A1474J000	Epcos
54	4	L2,L4,L5,L6	FBMJ4516HS720NT	Taiyo Yuden
55	1	Q1	SiHG73N60E-GE3	Vishay/Siliconix
56	1	Q2	BSS123LT1G	ON Semiconductor
Item	Q.ty	Ref.	Component P/N	Manufacturer
57	1	Q3	IXTK32P60P	IXYS Corporation
58	1	Q4	FMMT459TA	Diodes Zetex
59	1	Q5	SiHG73N60E-GE3	Vishay Siliconix
60	1	Q6	MMBT3906-7-F	Diodes Incorporated
61	1	Q7	MMBT3904-7-F	Diodes Incorporated
62	1	R3	CR0805-FX-2202ELF	Bourns
63	4	R4,R5,R6,R11	CRCW080547K0FKEA	Vishay
64	1	R7	HHV-25JT-52-10M	Yageo
65	1	R8	MF1/4LCT52R100J	KOA Speer
66	1	R9	YR1B12K4CC	TE Connectivity
67	1	R10	CRF2512-FZ-R006ELF	Bourns
68	2	R12,R13	ROX2SJ33R	Tyco Electronics
69	7	R14,R21,R25,R26,R27, R31,R37	CRCW080510K0FKEA	Vishay
70	4	R15,R22,R28,R32	CRCW080575K0FKEA	Vishay
71	3	R16,R23,R29	CRCW08051K00FKEA	Vishay
72	1	R17	ERA6AEB304V	Panasonic
73	1	R18	HVR3700008203FR500	Vishay
74	1	R19	HVR3700004124FR500	Vishay
75	2	R20,R41	HVR3700001005JR500	Vishay
76	1	R24	CRCW080559K0FKEA	Vishay
77	1	R30	PFC-W0805LF-03-3482-B	TT Electronics
78	1	R33	CRCW08051K10FKEA	Vishay
79	1	R34	PTN0805E1563BST1	Vishay
80	1	R35	CRCW08051K50FKEA	Vishay
81	1	R36	CRCW080523K7FKEA	Vishay
82	1	R40	CRCW080547K0FKEA	Vishay
83	1	R45	PR03000204703JAC00	Vishay
84	1	R46	CCF601M00FKE36	Vishay
85	2	R47,R54	RC0805FR-071KP	Yageo
86	1	R48	CFR25J68K	TE Connectivity
87	1	R49	HVR2500001004FR500	Vishay
88	1	R50	HVR2500008203FR500	Vishay
89	1	R51	PR03000201003JAC00	Vishay
90	1	R52	CMF60200K00FHEK	Vishay
Item	Q.ty	Ref.	Component P/N	Manufacturer

91	1	R53	CFR25J22K	TE Connectivity
92	1	R55	HVR3700001005JR500	Vishay
93	4	R56,R57,R60,R77	RC0805FR-071KP	Yageo
94	2	R58,R63	ERA-6AEB243V	Panasonic
95	2	R59,R62	ERA-6AEB154V	Panasonic
96	2	R61,R76	ERA-6AEB103V	Panasonic
97	1	R64	TNPV12101M50BEEN	Vishay
98	4	R65,R67,R90,R91	352251KFT	TE Connectivity
99	1	R66	TNPW08052K20BEEA	Vishay
100	1	R68	ERJ-PB6B9102V	Panasonic
101	1	R69	ERJ-PB6B5602V	Panasonic
102	3	R70,R82,R85	ERA-6AEB333V	Panasonic
103	1	R71	ERA6AEB683V	Panasonic
104	1	R72	CRT0805-BY-10R0ELF	Bourns
105	2	R73,R78	ERA-6AEB1622V	Panasonic
106	2	R74,R79	ERA-6AEB6982V	Panasonic
107	1	R75	CPF0805B523KE1	TE Connectivity
108	2	R80,R88	ERA-6AEB222V	Panasonic
109	2	R81,R84	ERA-6AEB223V	Panasonic
110	2	R83,R86	ERA-6AEB563V	Panasonic
111	2	R87,R89	CPF-A-0805B180RE1	TE Connectivity
112	1	TP1	5116	Keystone Electronics
113	1	TP2	TEST-1(R)	Multicomp
114	1	TP3	5116	Keystone Electronics
115	1	TP4	TEST-1(R)	Multicomp
116	1	TP5	1-0726388-2	TE Connectivity / AMP
117	3	TP6,TP8,TP11	TEST-1(BK)	Multicomp
118	1	TP7	TEST-1(R)	Multicomp
119	1	TP9	TEST-1(R)	Multicomp
120	1	TP10	TEST-1(R)	Multicomp
121	1	TP12	TEST-1(Y)	Multicomp
122	1	TP13	TEST-1(BU)	Multicomp
123	1	U1	PIC18F26K22-I/SO	Microchip
124	1	U2	MAX3232IPW	Texas Instruments
125	1	U3	LMP7702MA/NOPB	Texas Instruments
126	1	U4	LTC4366CTS8-2#TRMPBF	Linear Technology
127	1	U5	V375C5E50BF3	Vicor
128	1	U6	INA214AIDCKT	Texas Instruments
129	1	U7	LMZ10505TZE-ADJ/NOPB	Texas Instruments
130	3	U8,U10,U11	LMZ10503TZE-ADJ/NOPB	Texas Instruments
131	1	U9	LM3880MF-1AB	Texas Instruments
132	1	U12	CC10-0512SF-E	TDK-Lambda
133	2	U13,U14	ACS70331EESATR-2P5U3	Allegro MicroSystems
134	1	U15	AQY214EHA	Panasonic Electric Works
135	1	U16	AQY216EHA	Panasonic Electric Works
136	5	U17,U18,U20,U21,U22	LMP7701MF/NOPB	Texas Instruments
137	1	U19	HCNR201-300E	Broadcom / Avago
138	2	U23,U24	ACS724LLCTR-10AU-T	Allegro Microsystems
139	4	U25,U26,U28,U29	AQY212G2S	Panasonic
140	1	U27	TLV431BIDBZTG4	Texas Instruments
141	1	U30	MCP1703AT-3302E/CB	Microchip
142	1	Y1	AS-3.6864-18-SMD	Railtron

Note: components crossed out and highlighted in yellow are provided by KM3NeT.

Mounting Accessories of U5			
Item	Qty.	Part Number	Manufacturer
147	1	30183	Vicor
148	1	20265	Vicor
149	1	Kit-20176	Vicor
150	1	Set-16025	Vicor
Mounting Accessories of Q3, Q5, Q1			
Item	Qty.	RS Components Part Number	Manufacturer
151	3	190-462	RS Pro
152	3	524-281	RS Pro
153	6	525-739	RS Pro

Note: components crossed out and highlighted in yellow are provided by KM3NeT.

12 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.

The delivery time will be determined by the holder, provided that it does not exceed the maximum time limit.

Delivery may be made in several batches, which must be specified in the offer.

12.1 Maximum delivery time for all products

Maximum time limit : 10 months

12.2 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.

12.3 CNRS Technical Correspondents

Jérôme PERRONNEL
Laboratoire de Physique Corpusculaire de Caen - LPCC
6 Boulevard Maréchal Juin
F-14050 Caen cedex
France

12.4 KM3NeT Technical Correspondents

Carlo Alessandro NICOLAU
INFN-RM
Piazzale Aldo Moro 2,
Roma 00185
Italy

12.5 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:
From Monday to Thursday, from 10:00 to 14:00

Outside the indicated times it will not be possible to proceed with load or unload

13 Verification operations

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

- Visual inspection
- Documentation control

13.1 Terms and conditions for final acceptance of services

Final acceptance shall be declared within a maximum of two weeks after delivery, following verification checks and the provision of the documentation listed in this document..