

**SPECIFICATIONS**  
**for**  
*Components for upgrading the LLRF System*

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## 1 INTRODUCTION

The Specifications document is an integral part of the award documentation, representing all the requirements based on which each tenderer shall write the Technical Proposal.

The Specifications document contains technical specifications. They define, as applicable and without limiting to the following, characteristics regarding the qualitative, technical and performance levels, operational safety, sizes, packing, labeling.

The competent institutions from where Contractors can obtain information on the mandatory regulations regarding work protection, fire prevention and suppression and environmental protection, which must be observed while fulfilling the Contract are:

- The Ministry of Labor, Family, Youth and Social Solidarity;
- The Territorial Labor Inspectorate of Ilfov;
- The Inspectorate for Emergency Situations of Bucharest - Ilfov;
- The Ministry of the Environment, Waters and Forests;
- The National Environment and Protected Areas Agency;
- The Ilfov County Environmental Directorate.

Under this award procedure, the **“HORIA HULUBEI” NATIONAL INSTITUTE FOR RESEARCH AND DEVELOPMENT IN PHYSICS AND NUCLEAR ENGINEERING (IFIN-HH)** will act as Contracting Authority, namely Purchaser under the Contract.

For the purpose of this section of the award documentation, any activity described in a certain chapter of the Specifications and not explicitly specified in other chapter, will have to be interpreted as being mentioned in all chapters where the Supplier deems that such information should have been mentioned to ensure the fulfillment of the Contract subject matter.

The English version of the Specifications shall prevail when writing the tender.

## 2 CONTEXT FOR MAKING THIS PROCUREMENT

### 2.1 Information about the Contracting Authority

“Horia Hulubei” National Institute for Research and Development in Physics and Nuclear Engineering (IFIN-HH) conducts scientific research and technological development in physics and nuclear engineering. IFIN-HH specializes in developing knowledge in physics, particularly subatomic physics, and increasing the impact of the nuclear field in the society, through advanced research and the most professional services. IFIN-HH’s mission is to generate, hoard and disseminate knowledge in its field of activity and to participate actively in transferring to society the knowledge and technologies generated. The principal activities of IFIN-HH are to conduct fundamental, indicative and applied research, technological development activities, services of strategic interest and to devise draft regulations of public national interest regarding the assurance of the fundamental requirements imposed for physics and nuclear engineering.

The Extreme Light Infrastructure - Nuclear Physics (ELI-NP) Project is underway at IFIN-HH and will become a European Center of excellence for high-level research in ultra-high intensity lasers, laser-matter interaction and secondary radiation sources offering unparalleled possibilities worldwide. At the ELI-NP facility the laser intensities will go beyond that of current state-of-the-art lasers by an entire order of magnitude. Due to its unique characteristics, this multidisciplinary facility will provide new opportunities to study the fundamental processes observed during light-matter interaction. ELI-NP will create a research & development platform promoting the development of applications for the benefit of society where applied research will play an important role.

The ELI-NP facility is located in Magurele, Ilfov county, Romania. It hosts a High-Power Laser System equipped with two 10 PW beams and will host a Gamma Beam System able to produce gamma beams with much higher parameters compared to the beams produced by the present state-of-the-art machines worldwide.

## **2.2 Information about the context that determined this procurement**

For a smooth running of the scientific activities under the ELI-NP project, the GBS (Gamma Beam System) system must satisfy the technical requirements contained in the TDR. This requires related equipment to generate and process the signals. Reaching the parameters stated in the GBS Linac Upgrade TDR requires the connection of equipment that will make up a system for processing and synchronizing the RF (radiofrequency) signal, i.e. the *LLRF (low level radiofrequency) System*.

## **2.3 Information on the benefits anticipated by the Contracting Authority**

The products described herein are intended to contribute to achieving the ELI-NP's mission of being the most important European research and development infrastructure, facilitating experiments with extremely high intensity electromagnetic fields, through the implementation of the first 10 PW laser system worldwide.

The programmatic needs of the future experiments, established by the scientific community (the final user of the ELI-NP facility) in the ELI-NP Whitebook, and by the International Scientific Advisory Board (ISAB), in their annual reports on ELI-NP progress, have led to the implementation of several experimental areas in this facility. The scientific community is awaiting ELI-NP to be a state-of-the-art laser infrastructure, where users will be able to perform topmost research experiments. This requirement involves a very predictable working time (with minimum downtime) to conduct painstaking experiments planned years in advance. It is therefore imperative to implement strategies to minimize the risk of operational incapacity in the case of this facility.

## **3 DESCRIPTION OF THE REQUESTED PRODUCTS**

This Specification are intended for purchasing the components that will upgrade the existing LLRF system of the GBS Linac to allow its operation with the upgraded GBS Linac, which involves the reconfiguration of the existing accelerator modules, the installation of the new RF electron source and the expansion of the existing Linac to integrate a new accelerator module. The upgraded LLRF system will allow the synchronization of the existing master reference oscillator with the RF devices integrated in the LLRF system, which will distribute RF signals to the new RF electron source, to the reconfigured accelerator modules and to the new accelerator module. The RF signals will be transferred and controlled by the upgraded LLRF system to the components of the LINAC that require high-performance RF signals, namely the RF cavities, the injector laser and the klystrons.

### **3.1 Description of the current situation at the Contracting Authority's level**

ELI-NP is currently undergoing the implementation and construction of the gamma beam system. This stage involves the integration of the components, materials and devices generating electromagnetic waves for the linear accelerator as an essential part of the gamma beam system.

### **3.2 Overall objective to which this procurement will contribute**

The ultimate objective is to build a fully functional gamma beam system in accordance with the Technical Design Reports (TDRs) established by the international scientific community upon the proposal of the financing project.

### 3.3 Specific objective to which this procurement will contribute

The LLRF components are essential for delivering the electron beam, at the parameters stated in the GBS TDR.

### 3.4 Requested products and ancillary operations needed to be performed

While performing the Contract, the Supplier's activity will be guided by the following principles:

- i. The Supplier acts in the interest of the Contracting Authority throughout the duration of the supply of the products, under the conditions and within the limits described in the documentation of this award procedure.
- ii. The Supplier acts with a view to achieving the objectives of the Contract with regard to optimizing the use of resources necessary to fulfilling the Contract objectives.

#### 3.4.1 Requested products

##### Overall description:

The upgraded LLRF system will allow the synchronization of the existing master reference oscillator with the RF devices which will distribute the RF signals to the new RF electron source, to the reconfigured accelerating modules and to the new accelerating module. The components will be integrated in the existing LLRF system in order to update it to meet all the specifications of the upgraded GBS Linac. The following table specifies the deliverables:

Nr. Crt.	Quantity	Unit of Measurement	Product	Place of delivery	Requested delivery deadline	Minimum technical specifications OR functional requirements	Minimum warranty duration/validity term
1.	2.	3.	4.	5.	6.	7.	8.
1	5	pc.	<i>LLRF Module (Low Level Radio Frequency) Unit (1)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	minimum 12 months from the date of signing the qualitative receipt report by the Purchase with the result "Accepted"
2	1	pc.	<i>LLRF Module Low Level Radio Frequency Unit (2)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	minimum 12 months from the date of signing the qualitative receipt report by the Purchase with the result "Accepted"
3	5	pc.	<i>Frequency Module</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	minimum 12 months from the date of signing the qualitative receipt report by the Purchase

							with the result "Accepted"
4	1	pc.	<i>Analog to digital converter module (ADC Module)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	minimum 12 months from the date of signing the qualitative receipt report by the Purchaser with the result "Accepted"
5	1	pc.	<i>Software packet (perpetual licence)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	N/A
6	600	m	<i>Coaxial RF cables with connectors (1)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	N/A
7	20	m	<i>Coaxial RF cables with connectors (2)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	N/A
8	600	m	<i>Coaxial RF cables with connectors (3)</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	N/A
9	1	pc.	<i>Rack</i>	30 Reactorului Street, Măgurele, IFIN-HH, ELI-NP Building	Maximum 3 months from the date of signing of the contract by both parties but no later than 30.11.2026	According to Annex 1	minimum 12 months from the date of signing the qualitative receipt report by the Purchaser with the result "Accepted"

NOTE 1: In accordance with the provisions of art. 156 (2) – (3) of Act No. 98/2016, the technical specifications stating a certain manufacturer, origin or procedure characterizing the products or services provided by a certain economic operator and which refer to specific trademarks, patents, types, origin or manufacturing shall be interpreted and applied as accompanied by the wording "or equivalent".

NOTE 2: Any reference in the present tender documentation (including the specifications), which refers to technical specifications and, as a priority, to national standards transposing European standards, European technical assessments, common technical specifications, international standards, other technical reference systems established by the European standardization bodies or, in the absence of any of these, to national standards, national technical agreements or national technical specifications relating to the design, calculation and execution of the works and the use of the products, shall be read and interpreted as being accompanied by the mention "or equivalent".

**Annex 1 contains the information and description of the LLRF components and accessories, including technical specifications and requirements.**

### 3.4.2 Warranty

The warranty period granted by the Supplier for the products is specified in the table under Chapter 3.4.1 and shall commence from the date of signing by the Purchaser of the Qualitative Acceptance Report with the result "Accepted". The Supplier will have to guarantee to the Contracting Authority that the products delivered are new, unused and are not "demo", reconditioned products or ones that have been previously rejected by another Purchaser.

The warranty period of the products will be extended with the period of time during which the products/components subject to repairs/replacements have not been available, a period equal to the duration between the date of the written request made by the Contracting Authority and the date when the products/components are reinstalled or recommissioned by the Supplier.

The warranty will have to cover all costs resulting from the remediation of defects in the warranty period, including, but not limited to:

- i. Packaging, including the supply of protective shipping material (cardboard, boxes, crates, etc.);
- ii. Transport through an authorized shipper, including international shipping (if applicable);
- iii. Defects diagnosis, including personnel costs;
- iv. Repairing of all defective components or provision of new components;
- v. Replacement of all defective components with new ones;
- vi. Assembly of components in their initial condition;
- vii. Testing of the components to ensure proper operation.
- viii. Recommissioning of the components.

### **3.4.3 Delivery, packing, labeling, transport and insurance during transport**

The delivery term for the products requested in the table under Chapter 3.4.1 shall be no later than 3 months from the date of signing of the contract by both parties, but no later than 30.11.2026. A product is considered delivered when all the activities under the contract have been completed, the product operates at the agreed parameters and is accepted by the Contracting Authority.

All components will be delivered quantitatively and qualitatively at the place indicated by the Contracting Authority. These components, described in chapter 3.4.1, will be accompanied by all subassemblies/component parts necessary for commissioning and maintaining them.

The Supplier will pack and label the products supplied so as to prevent any damage or deterioration during their transport to the established destination.

If applicable, the packaging must be designed to withstand, without limitation, accidental handling, exposure to extreme temperatures, salt and precipitations during transport and storage in open places. When establishing the size and weight of the packaging the Supplier will take into account, where applicable, the distance to the final destination of the supplied products and the possible absence of handling facilities in transit points.

Transport and all associated costs are in the Supplier's exclusive charge. The products will be insured against loss or damage which occurs during transport and caused by any external factor.

The delivery destination is the headquarters of IFIN-HH: 30 Reactorului St., postcode 077125, Măgurele, Ilfov county, ELI-NP experimental building.

The Supplier shall be responsible for the delivery of the product and the performance of the ancillary operations within the agreed term and shall be deemed to have taken into account all difficulties that may be encountered in this regard and shall not invoke any reason for delay or additional costs.

### **3.4.4 Ancillary operations**

#### **3.4.4.1 Testing of the products**

The Supplier shall perform all the needed configurations/settings so that the from positions 1-4 in cap. 3.4.1 operate within optimal parameters, according to Annex 1 of the present Specifications.

The Supplier will remain responsible for protecting the delivered products until their final acceptance by the Contracting Authority, taking all suitable measures to prevent hitting, scratching and other types of damage.

The conformity of the delivered products with the technical specifications will be verified through the **Factory Acceptance Test (FAT)** as follows:

- *LLRF Module Unit (1)*
- *LLRF Module Unit (2)*
- *Frequency module*
- *ADC module*

The testing of the LLRF components at the Supplier's headquarters will consist in checking each individual product. The factory acceptance means the qualitative checking process by testing all parameters defined in Annex1, the confirmation by the Purchaser of the fact that the test results prove compliance with the requirements of the Specifications and with the obligations assumed through the submitted tender shall be confirmed by the signing of the Factory Acceptance Test (FAT) certificate marked "ACCEPTED".

The Supplier will specify the FAT results in detail, in a report.

The Supplier will issue a Factory Acceptance Test (FAT) Report and will send it to the Contracting Authority, for acceptance, according to Chapter 5.1, before starting the delivery of the components at the headquarters of the Contracting Authority.

The analysis of the results of the tests included in the Factory Acceptance Test Report will be performed by the Contracting Authority not later than 5 (five) working days from the date of receiving the Factory Acceptance Test Report, according to the provisions of the Specifications. Should the Contracting Authority deem necessary, throughout the period of analysis of the test results, to repeat or supplement the tests conducted, it will give notice to the Supplier in this respect, in which case the period for accepting the Factory Acceptance Test Report will be extended accordingly.

After the Contracting Authority signs the Acceptance Certificate marked "ACCEPTED", the Supplier shall take into custody, free of charge, the products subject to delivery at the premises of the Contracting Authority and shall assume all risks related thereto, as described in the Custody Agreement. The products under custody will be inventoried and identified as distinct items to allow for their traceability (including those recorded in the inventory certificate or the acceptance certificate), each of the products being distinctly marked as "IFIN-HH/ELI-NP property". Throughout the custody period, all risks of any nature relating to the products held in custody by the Supplier, including the risk of loss or damage, as well as all costs arising from custody, including insurance, security, and similar expenses, shall be borne by the Supplier. Any modification of the custody conditions shall be made by signing a new custody agreement or an addendum to the existing one.

Upon termination of the custody, after delivery of the products to the headquarters of IFIN-HH, the parties shall conclude a certificate of custody termination and handover-takeover report of the products; this certificate must contain the location where the handover-takeover takes place, the products subject to handover-takeover, their identification elements and their state on the date of signing the certificate.

Throughout the factory acceptance test (FAT) process, the Supplier will give the Contracting Authority the possibility to attend, with minimum 2 (two) persons, in the whole factory test acceptance procedure intended for the components. To this end, the Supplier will give notice to the Purchaser, 10 (ten) days in advance, about starting to test the parameters of the components according to the Specifications. The Contracting Authority will notify within 3 (three) days from the date of the notification for starting the testing, the designated persons for participation.

#### **3.4.4.2 Staff training**

The Supplier is responsible for the training of the personnel assigned by the Contracting Authority. The purpose of the training is to transfer the knowledge necessary both for operation and for the

maintenance of the components at the positions 1-4 of cap. 3.4.1. The number of persons to be trained shall be a minimum of 2 (two), and the training shall be conducted on the day following the completion of the FAT.

The Supplier will have to ensure that the Contracting Authority's personnel acquire the understanding of how components work, namely:

- i. understanding all their functionalities;
- ii. their operation;
- iii. information about the routine maintenance that will have to be performed by the user;
- iv. troubleshooting and identifying the problems occurring during operation.

The Supplier will have to propose any additional activity that might be necessary to make sure that the Contracting Authority's personnel are fully trained to ensure the proper use of the components. During the training session the Supplier will provide support materials which will include at least operating manuals and maintenance manuals, which will remain in the Contracting Authority's possession. All support materials will be in Romanian and/or English. The training session will be held in Romanian and/or English.

#### **3.4.4.3 Technical support**

Throughout the warranty period, the Supplier will provide technical support for the products at positions 1-4 of cap 3.4.1. The Supplier will ensure a contact point dedicated to the Purchaser's authorized personnel where one can report any operation problem for which technical support is requested in managing an incident, to make sure that any reported situation is promptly handled.

The Supplier will respond in 2 (two) working days to any incident reported by the Purchaser.

### **3.5 Duties and responsibilities of the parties**

#### **3.5.1 Duties and responsibilities of the Supplier:**

- a) Setting up the performance bond in the amount and by the deadline specified in the Contract.
- b) Fulfilling the Contract while complying with the delivery deadlines
- c) Supplying the products and providing the auxiliary operations and warranty in accordance with the requirements of the Specifications, at the standards and with the performances set out in the Technical Proposal;
- d) Providing all resources necessary to perform the Contract;
- e) Fulfilling the obligations to supply the product specified herein (equipment delivery and provision of ancillary operations while complying with the best practices in the field, the applicable legal and contractual provisions (including by its personnel, employed or contracted by it, its management, its subordinates and employees in the territory), so as to ensure the delivery of the products as required in the Contract;
- f) Carrying out all due diligence necessary to fulfill its obligations within the deadline undertaken in the Contract;
- g) The Supplier shall be responsible for the delivery of the product and the performance of the ancillary operations within the agreed term and shall be deemed to have taken into account all difficulties that may be encountered in this regard and shall not invoke any reason for delay or additional costs.;
- h) Allocating specialized personnel for the relationship with the Person in charge of the Contract nominated by the Contracting Authority;
- i) Making available all information and documents regarding the Contract upon the control missions conducted by the Managing Authority/Intermediate Body or by other structures with

competences in controlling and recovering debits related to European Union funds and/or national public funds related thereto, as applicable.

### **3.5.2 Duties and responsibilities of the Contracting Authority:**

- a) Providing the Supplier with all information necessary to perform the Contract;
- b) Nominating the person in charge of Contract performance, involved in the relationship with the Supplier;
- c) Rigorously analyzing the situations notified by the Supplier, which may prevent the Contract from being performed in a timely and effective manner and, in justified cases, applying the contractual clauses regarding the extension of the term/modification of the Contract;
- d) Appointing the deliverables acceptance committee;
- e) Making the payment within the time limit specified in Section 6 of the Specifications.

## **4 DOCUMENTATION THAT MUST BE PROVIDED TO THE CONTRACTING AUTHORITY IN CONNECTION WITH THE PRODUCT**

The documents to be transmitted by the Supplier to the Contracting Authority at the time of delivery are:

- 1) Declaration of Conformity/Certificate of Conformity for the components, with the specifications contained in the Specifications document;
- 2) Warranty Certificate for all components;
- 3) User, maintenance and service manuals/sheets, including brief theory of operation, disassembling instructions, technical specification, including the technical parameters and block diagrams, list of spare parts and charts, for the components, including all its subassemblies, in Romanian and/or English, firmware (and upgrade procedure);
- 4) Factory Acceptance Test Report, with the results of the measurements performed (FAT);
- 5) List of all components delivered;
- 6) Delivery/Dispatch Note;
- 7) Detailed cabling and interconnection diagrams;
- 8) A wiring diagram with the interconnection of the sub-assemblies for the rack.

## **5. ACCEPTANCE OF THE COMPONENTS**

### **5.1 Factory Acceptance Test (FAT) for positions 1-4 from chapter 3.4.1.**

Factory Acceptance means the process of qualitative verification by testing the measurable parameters defined in Annex 1, the confirmation by the Purchaser that the test results demonstrate the compliance of the measured parameters with the requirements of the Specifications and with the obligations assumed through the submitted tender, such confirmation being made by signing the Factory Acceptance Certificate (FAT).

The Supplier will specify the FAT results in detail, in a report.

The analysis of the results of the tests contained in the Factory Acceptance Test Report will be performed by the Contracting Authority not later than 5 (five) working days from the day of receiving the Factory Acceptance Test Report, according to the provisions of the Specifications and undertaken by the Supplier in the Technical Proposal. After checking and determining the conformity of the factory tests with the provisions of the Specifications and with the parameters undertaken by the Supplier in the Technical Proposal, the Purchaser signs the factory acceptance test certificate marked as "ACCEPTED" for the tested parameters. Should the Contracting Authority deem necessary, throughout the period of analysis of the test results, to rerun or supplement the tests conducted, it will give notice to the Supplier in this respect, in which case the period for accepting the Factory Testing

Test Report will be extended accordingly. The FAT shall be carried out at the Supplier's premises, and, during the same trip, the training session organized on the day following the completion of the FAT shall also take place.

After the signing by the Contracting Authority of the Acceptance Certificate marked "ACCEPTED", the Supplier shall take into custody, free of charge, the products subject to delivery at the premises of the Contracting Authority and shall assume all risks related thereto, as described in the Custody Agreement. The products subject to custody shall be inventoried and identified by distinct elements that will enable their traceability (including those recorded in the inventory report and/or the acceptance certificate), each of the products being distinctly marked "IFIN-HH/ELI-NP property". Throughout the custody period, all risks, of any nature, on the products in the Supplier's custody, including the risk of loss or damage, as well as all expenses incurred by custody, including insurance costs, security, etc. are the responsibility of the Supplier. Any modification of the custody conditions shall be made by signing a new custody act or an additional act to the existing one.

## **5.2 Acceptance of Training Services**

The qualitative acceptance of the training services shall be carried out at the time the services are provided, based on the report submitted by the Supplier, with one of the following results:

- a) Accepted
- b) Rejected.

## **5.3 Final Acceptance for Items 1–4 under Chapter 3.4.1**

The final acceptance of the components listed under items 1–4 in Chapter 3.4.1 shall be carried out within a maximum of 5 (five) working days from their delivery to the premises of the Contracting Authority, in accordance with Chapters 3.4.1 and 3.4.3 of these Specification.

The final acceptance of the components shall be performed following the quantitative and qualitative acceptance, respectively after:

- the signing of the Factory Acceptance Certificate (FAT) and the delivery of all components to the premises of the Contracting Authority.

The Qualitative Acceptance Report shall include one of the following results:

- a) Accepted
- b) Rejected.

## **5.4 Reception of products from positions 5-9 from chapter 3.4.1.**

Reception of products from positions 5-9 of chapter 3.4.1. will be done both quantitatively and qualitatively, no later than 5 (five) working days from their delivery to the Purchaser's headquarters, as follows:

a) Quantitative reception will be carried out after delivery of the products in the requested quantity to the location indicated by the Contracting Authority, based on a Quantitative Reception Report, which will include at least the delivery date, the place of delivery and the persons who participated in the quantitative reception.

b) Qualitative reception will be carried out after verification of compliance with the requirements of the Specifications and after verification of the fulfillment of the performances assumed by the tenderer through the technical proposal.

The Qualitative Reception Report will include one of the following results:

- a) Accepted

b) Rejected

## **6 PAYMENT METHODS AND CONDITIONS**

### **Payment method:**

#### **Advance payment**

- 30% advance payment of the total contract value in maximum 30 days from the date of setting up the performance bond and the date of receiving the fiscal invoice issued by the Supplier, based on an instrument securing the return of the advance payment valid throughout the performance of the contract. The advance payment will be recovered through 30% deductions from the value of further payments. If the advance payment is not totally reimbursed at the end of the contract or before the termination of the contract, or for various circumstances/reasons, the unpaid difference will immediately become due and payable by the Supplier to the Contracting Authority.

#### **Intermediate payments**

- intermediate payments of not more than 90% of the contract value, in maximum 30 days from receiving the invoice issued by the Supplier for the equipment mentioned in point 3.4.4.1 for which FAT is requested, accompanied by the factory acceptance test (FAT) certificate, signed without objections by the Purchaser;

#### **Final payment**

- final payment of not more than 10% of the contract value, in maximum 30 days from receiving the invoice issued by the Supplier, accompanied by the qualitative acceptance certificate signed by the Purchaser, with the mention "ACCEPTED" and the documents mentioned in chapter 4.

The Supplier will issue invoices as mentioned above. The invoices will specify the contract number, the issuing date and the due date of those invoices.

## **7 LEGAL FRAMEWORK GOVERNING THE RELATIONSHIP BETWEEN THE CONTRACTING AUTHORITY AND THE SUPPLIER**

The tenderer that has become Supplier is bound to comply, while performing the Contract, with the obligations applicable in the environmental, social and work fields set forth by EU law, domestic law, collective agreements, or by the provisions of the international law in the environmental, social and work fields listed in Annex X to Directive 2014/24:

- i. ILO Convention 87 on Freedom of Association and the Protection of the Right to Organise;
- ii. ILO Convention 98 on the Right to Organise and Collective Bargaining;
- iii. ILO Convention 29 on Forced Labour;
- iv. ILO Convention 105 on the Abolition of Forced Labour;
- v. ILO Convention 138 on Minimum Age;
- vi. ILO Convention 111 on Discrimination (Employment and Occupation);
- vii. ILO Convention 100 on Equal Remuneration;
- viii. ILO Convention 182 on Worst Forms of Child Labour;
- ix. Vienna Convention for the protection of the Ozone Layer and Montreal Protocol on substances that deplete the Ozone Layer;
- x. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;
- xi. Stockholm Convention on Persistent Organic Pollutants (POP);
- xii. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (UNEP/FAO) (The PIC Convention, 10 September 1998), and its 3 regional Protocols.

**8 MANAGEMENT OF THE CONTRACT AND OF THE REPORTING ACTIVITY UNDER THE CONTRACT**

Risks and measures for managing the risks associated with the Supplier, without limitation:

<b>Risks</b>	<b>Management measures</b>
Failing to meet times of completion due to the Supplier's fault	Sanctions for culpable non-fulfillment or faulty fulfillment of the obligations undertaken by Contract
Failing to comply with the delivery deadline for reasons beyond the Supplier's will	Changing the supply date by Addendum, based on corresponding supporting documents
Failing to set up the Performance Bond	Contract rescission
Setting up the Performance Bond with delay	Extending the deadline for setting up the Performance Bond, upon the Supplier's justified request without exceeding 15 days from the date of signing this Contract)
The ancillary products and services are not be accompanied on delivery by the specific documents provided for in the Contract or in the documents of the Annex to the Contract	Acceptance of the products and of the ancillary services will only be made after fulfillment of contractual obligations concerning the supply of documents that must accompany the products
Difficulties in managing the Supplier's relationship with its subcontractors (if applicable)	The Contractor takes over part(s) of the Contract related to the subcontracting activity or replaces the subcontractor with a new subcontractor under the conditions stipulated in the Contract
Failing to fulfill the provisions on the firm commitment for support (if applicable)	The Contracting Authority's right to compensation and/or claim damages
Failing to fulfill the legal provisions regarding the conflict of interests	Terminating the Contract de jure and enforcing contractual sanctions
Supplying and providing non-conforming products and services or changing contractual specifications under the level of standards required in the Award Documentation/Tender	Conducting the acceptance of the products and of the ancillary services by ensuring a thorough checking of the conformity of the technical specifications of the products delivered and of the services provided with respect to the requirements of the Specifications and the submitted Tender, part of the Contract
Inconsistencies between the Technical Proposal and the specifications contained in the Specifications document	Specifying in the Contract the priority of the specifications contained in the documentation over the Technical Proposal, except when the technical parameters contained in the Technical Proposal are higher than those requested, in which case the provisions of the Technical Proposal will prevail

Risks and measures for managing the risks associated with the Contracting Authority, without limitation:

<b>Risks</b>	<b>Management measures</b>
Delays in making payment	Sanctions for culpable non-fulfillment or faulty fulfillment of the obligations undertaken by Contract

Inadequate monitoring of the contract, respectively of the contract deadlines	Nomination by the Purchaser of a person in charge of Contract monitoring
The need arises to modify certain Contract items	Providing for contractual clauses that limit the modification of the Contract in strict compliance with the provisions of art. 221 of Act No. 98/2016

**Endorsed by**  
**GSD Leader, ELI-NP,**  
**Catalin Matei**

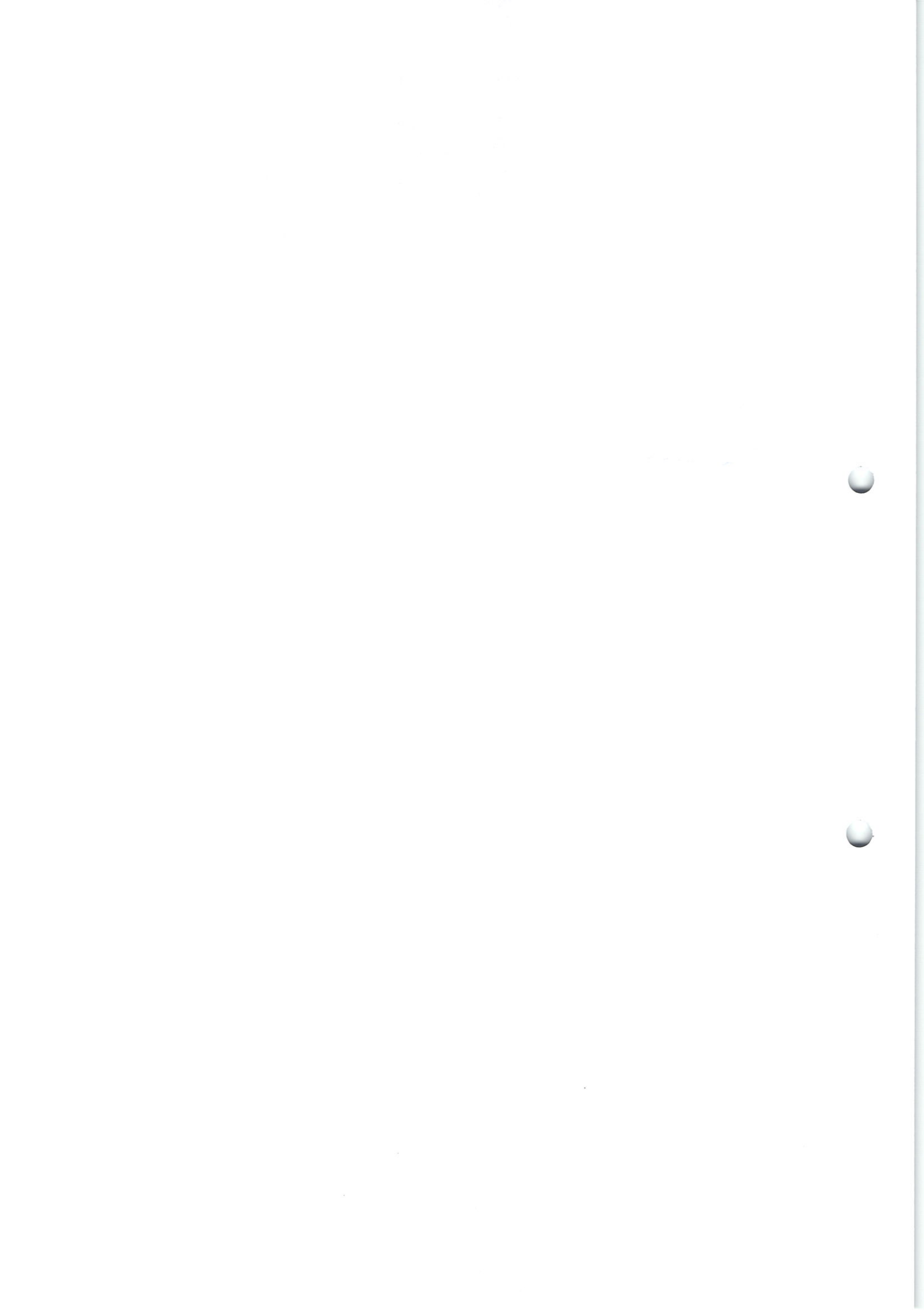


**Persons in charge of the Contract,**  
**Emilia CIRSTEA**



**Piotr TRACZ**



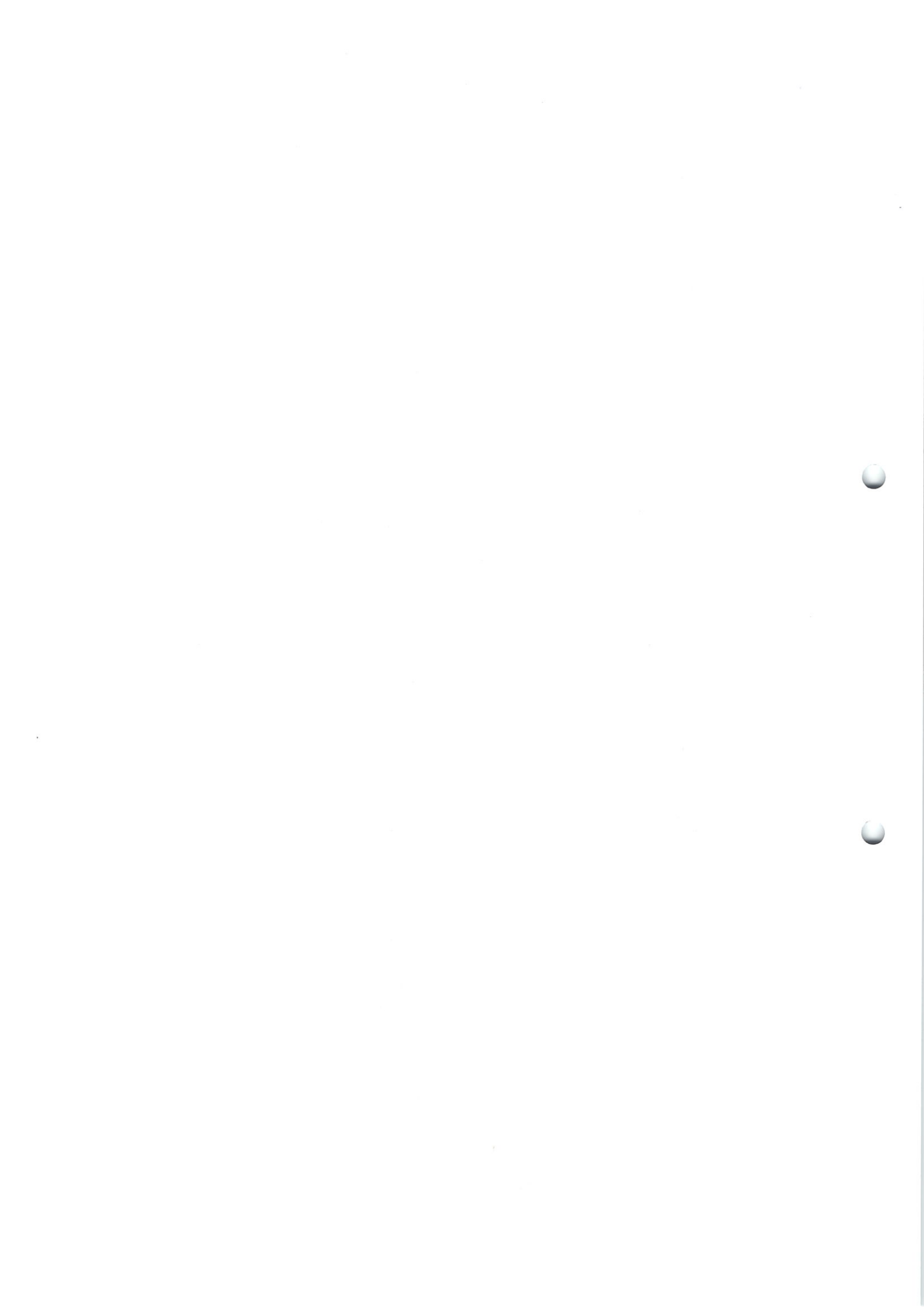


Annex 1

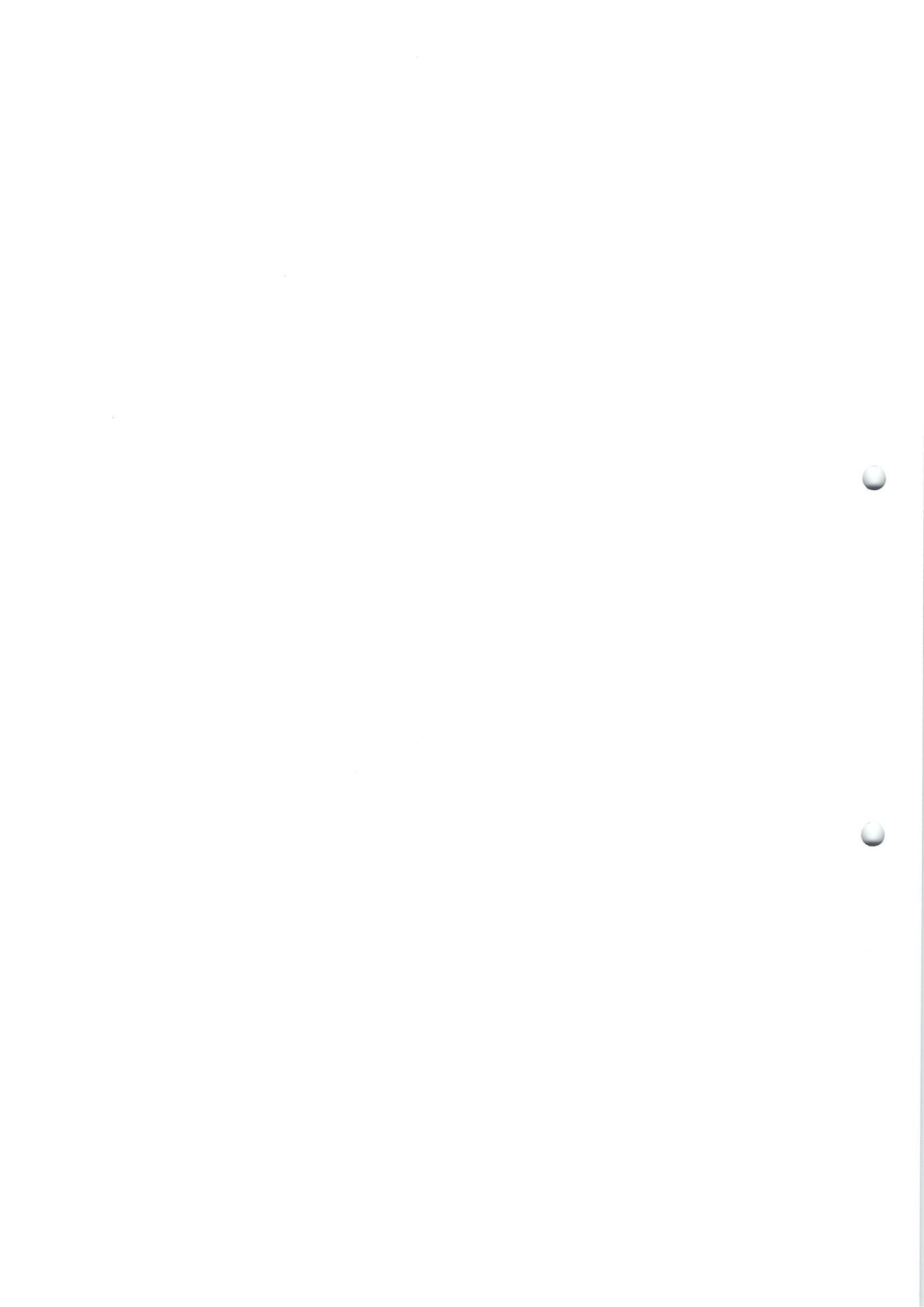
1. Deliverable Description and Specifications

	Component	Definition	Qty.	Technical Specification
1	LLRF Module (Low Level Radio Frequency Unit (1)) (for LINAC)	Used to generate RF drive signals for klystron amplifier, and to process digitally output signals from diagnostic devices in Linac accelerating modules	5 pcs	<ul style="list-style-type: none"> <li>• Operation frequency: 2856 MHz</li> <li>• Amplitude resolution: equal to or less than 0.01% RMS</li> <li>• Phase resolution: equal to or less than 0.01° RMS</li> <li>• Temperature stable operation: <math>\leq 95</math> fs at ambient temp. <math>24^{\circ}\text{C} \pm 2^{\circ}\text{C}</math></li> <li>• Capability for shaping of output pulsed signals</li> <li>• Integrated with an experimental physics and industrial control system (EPICS<sup>1</sup>) input/output controller (IOC) – EPICS<sup>1</sup> IOC</li> <li>• Size: 19" width, rack mountable.</li> <li>• Rack mounting accessories</li> <li>• Compatibility with the parameters required for integration with the ELI-NP LLRF system and the timing system described below will be demonstrated during FAT:               <ul style="list-style-type: none"> <li>-power of RF input signals: +20 dBm (max) (2856 MHz);</li> <li>-connector type for RF input signals: SMA-female</li> <li>-power of MO input signal: +15 dBm (max) (2856 MHz)</li> <li>-connector type for MO input signal: SMA-female</li> <li>-voltage level of trigger signal: 3.3 V (LVTTTL)</li> <li>-connector type for trigger signal: coaxial LEMO (00.250)</li> <li>-voltage level of interlock input and output signal: +24 V</li> </ul> </li> <li>• Number of RF inputs and outputs:               <ul style="list-style-type: none"> <li>- 0 RF inputs</li> <li>- 1 RF output per Unit (to drive a klystron)</li> </ul> </li> </ul>
2	LLRF Module (Low Level Radio Frequency Unit (2)) (for LINAC)	Used to generate rf drive signals for klystron amplifier, and to process digitally output signals from diagnostic devices located in Linac accelerating modules	1 pc	<ul style="list-style-type: none"> <li>• Operation frequency: 2856 MHz</li> <li>• Amplitude resolution: equal to or less than 0.01% RMS</li> <li>• Phase resolution: equal to or less than 0.01° RMS</li> <li>• Temperature stable operation: <math>\leq 95</math> fs at ambient temp. <math>24^{\circ}\text{C} \pm 2^{\circ}\text{C}</math></li> <li>• Capability for shaping of output pulsed signal</li> <li>• Integrated with an experimental physics and industrial control system (EPICS<sup>1</sup>) input/output controller (IOC) – EPICS<sup>1</sup> IOC</li> <li>• Size: 19" width, rack mountable.</li> <li>• Rack mounting accessories</li> <li>• Compatibility with the parameters required for integration with the ELI-NP LLRF system and the timing system described below will be demonstrated during FAT:</li> </ul>

<sup>1</sup> EPICS(Experimental Physics and Industrial Control System) is a set of applications and software modules that are distributed through a free "open source" licence used for the development of complex control systems (based on hundred of computers that are interconnected). See <https://epics-controls.org/>



				<ul style="list-style-type: none"> <li>-power of RF input signals: +20 dBm (max) (2856 MHz);</li> <li>-connector type for RF input signals: SMA-female</li> <li>-power of MO input signal: +15 dBm (max) (2856 MHz)</li> <li>-connector type for MO input signal: SMA-female</li> <li>-connector for voltage level of trigger signal: 3.3 V (LVTTTL),</li> <li>-connector type for trigger signal: coaxial LEMO (00.250)</li> <li>-voltage level of interlock input and output signal: +24 V</li> <li>• Number of RF inputs and outputs: <ul style="list-style-type: none"> <li>- 10 RF inputs</li> <li>- 1 RF output (to drive a klystron)</li> </ul> </li> </ul>
3	Frequency Module	Used to generate CW reference RF signals	5 pcs	<ul style="list-style-type: none"> <li>• Number of outputs: at least 4</li> <li>• Input signal frequency: 2856 MHz</li> <li>• Output signal frequency: 64.9 MHz (= 2856 MHz ÷ 44)</li> <li>• Bandwidth: ±5 MHz</li> <li>• Output power: +16 dBm ±1 dB</li> <li>• Integrated phase noise (RMS): &lt;60 fs (10 Hz – 10 MHz)</li> <li>• Harmonics and spurious components: &lt; -50 dBc</li> <li>• Input connector type: SMP</li> <li>• Output connectors type: SMA-F (50 ohm)</li> <li>• Capability for integration in ELI-NP 'RMO distribution amplifier' (will be demonstrated during FAT)</li> </ul>
4	Analog to digital converter module (ADC Module)	Digital processor to process digitally output signals from RF reference distribution system	1 pc	<ul style="list-style-type: none"> <li>• Number of inputs: at least 4</li> <li>• Operation frequency: 64.9 MHz (= 2856 MHz ÷ 44)</li> <li>• Phase resolution: 0.01° RMS</li> <li>• Capability for integration in ELI-NP LLRF ('Low Level Radio Frequency Unit')</li> <li>• Capability to measure phase between input signals</li> <li>• Capability to control ELI-NP 'RMO distribution amplifier' output signal phase.</li> </ul>
5	Software Package (perpetual licence)	Software for upgrading ELI-NP trigger signal generator for operation with new frequency of reference signal	1 pc	<p>SW package for the ELI-NP trigger signal generator has the following functionalities:</p> <ul style="list-style-type: none"> <li>• Upgrade from operating frequency of 71.4 MHz to 64.909 MHz</li> <li>• Possibility to disable OR-ing output triggers</li> </ul> <p>The Contracting Authority must be able to download, install and use, without additional cost, functional or generic updates for the major version/generation of the suite/application offered, for a minimum period of 12 months from the date of completion of reception.</p>



6	RF Coaxial Cables with Connectors	Used for transfer radio frequency signals between components	600 m	<ul style="list-style-type: none"> <li>• RF Coaxial Cable (1)</li> </ul> <p>Low phase drift vs. temperature: maximum 20 fs/K/m  Low insertion loss: &lt; 27 dB/100m @ 3 GHz  Impedance: 50 Ohm  Shielding Effectiveness: &gt; 90 dB  Flexible: bend radius &lt; 30 mm  Operation frequency: from DC up to more than 3 GHz  40x compatible RF connector (impedance 50 Ω)</p>
			20 m	<ul style="list-style-type: none"> <li>• RF Coaxial Cable (2)</li> </ul> <p>Impedance: 50 Ohm  Insertion loss: maximum 70 dB/100m @ 3 GHz  Shielding effectiveness: &gt; 90 dB  Flexible: bend radius &lt; 15 mm  Operation frequency: from DC up to more than 3 GHz  40x RF connectors compatible with the coaxial cable (impedance 50 Ω)</p>
			600 m	<ul style="list-style-type: none"> <li>• RF Coaxial Cable (3)</li> </ul> <p>Shielding effectiveness: &gt; 90 dB  Flexible: bend radius &lt; 10 mm  30x RF connectors compatible with the coaxial cable (impedance 50 Ω)</p>
7	Rack	Used to hold RF devices	1 pc	<ul style="list-style-type: none"> <li>• dimensions: width 80 cm ±10cm cm, height 220 cm, depth 100cm</li> <li>• glass front and metal rear doors</li> <li>• input for cables: on top</li> <li>• mains socket integrated</li> <li>• cooling fans on top</li> </ul> <p>The contractor will select the patch panels and feedthroughs with connectors or adapter that must be compatible with dimensions of rack, number of cables pieces, and type of cable connectors.</p>

