

## Technical Specifications (In-Cash Procurement)

# Design and integration of high and low power microwave systems\_ Technical specifications

The work involves technical expertise in the design of the integration solutions required to physically support the microwave diagnostics and their integration within ITER infrastructures, like port plugs and buildings, and in designing of mm-wave layouts for several microwave systems, such as CTS, reflectometry and interferometry. Several mm-wave systems are scheduled to be operational for the first plasma campaign.

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## 1 Purpose

This document describes technical needs for the design and the integration of high and low power microwave systems in ports and buildings.

## 2 Scope

The work aligns with the ITER project, currently under construction in France. This device will study the potential of controlled nuclear fusion to provide energy for mankind. In order to study the behaviour of this device, a set of monitoring systems (referred to as Diagnostics) is required; these systems will provide the information required to understand the performance of the device. The work involves the integration and engineering justification microwave systems, such as Collective Thomson Scattering, as well as mm-wave assessment, mm-wave components design and mechanical engineering of microwave diagnostics, especially those required for the first plasma, and port integration activities themselves.

## 3 Definitions

CM	Configuration Model
CTS	Collective Thomson Scattering
DA	Domestic Agency
DFW	Diagnostic First Wall
DSM	Diagnostic Shield Module
DM	Detailed Model
ECE	Electron Cyclotron Emission
EM	Electromagnetic
FDR	Final Design Review
IDM	ITER Document Management
ISS	Interspace Support Structure
IO	ITER Organization
IO-TRO	ITER Organization Technical Responsible Officer
PBS	Plant Breakdown Structure
PCSS	Port Cell Support Structure
PDR	Preliminary Design Review
PP	Port Plug
RH	Remote Handling
SIR	System Integration Review
VV	Vacuum Vessel

For a complete list of ITER abbreviations see: [ITER Abbreviations \(ITER\\_D\\_2MU6W5\)](#).

## 4 References

Links inserted in text (where applicable).

## 5 Estimated Duration

The duration shall be for 12 months from the starting date of the contract. Services are to be provided predominantly at the IO work site. Travel to the DA or other sites may be required to carry out the work.

## 6 Work Description

The work involves technical expertise in the design of the integration solutions required to physically support the microwave diagnostics and their integration within ITER infrastructures, like port plugs and buildings, and in designing of mm-wave layouts for several microwave systems, such as CTS, reflectometry and interferometry. Several mm-wave systems are scheduled to be operational for the first plasma campaign. The work to be done is to provide technical expertise to work with the IO-TRO. It involves many areas of activity that have to be documented:

- Meeting preparatory notes, including agenda and draft attendee selection;
- Record of progress against schedule;
- Mm-wave assessment of microwave components inside port plugs, in-VV or in the buildings (transmission lines, mitre bends, mirrors, penetrations etc);
- Mechanical assessment of supports for transmission lines and other mm-wave components across the tokamak;
- Assessment and analysis of electrical and cooling needs for mm-wave sources (eg gyrotrons for CTS);
- Integration of systems inside ports and in the buildings;
- Input documents, presentations, meeting notes related to meetings related with the development of the work;
- Input documents, presentations, meeting notes related to at workshops and conferences.

Travel to the DA or other sites (including conferences) may be required to carry out the work.

## 7 Responsibilities

### 7.1 Contractor's Responsibilities

In order to successfully perform the tasks in these Technical Specifications, the Contractor shall:

- Strictly implement the IO procedures, instructions and use templates;
- Provide experienced and trained resources to perform the tasks;
- Contractor's personnel shall possess the qualifications, professional competence and experience to carry out services in accordance with IO rules and procedures;
- Contractor's personnel shall be bound by the rules and regulations governing the IO ethics, safety and security IO rules.

### 7.2 IO's Responsibilities

The IO shall:

- Nominate the Responsible Officer to manage the Contract;

- Organise a monthly meeting(s) on work performed;
- Provide offices at IO premises.

## 8 List of Deliverables and due dates

The main deliverables are provided as follows:

D #	Description	Due Dates
D01	Review the current mm-wave design of the CTS system located in the first plasma EP#12. Summarize findings in the report.	T0 + 1 month
D02	Provide assessment of CTS ex-vessel transmission line in terms of compliance with confinement, fire zoning and vacuum requirements. Make sure that corresponding interfaces are enabled. Come up with realistic and feasible installation sequence for CTS ex-vessel transmission lines and sources. Prepare a report in the IDM.	T0 + 3 months
D03	Review the input mm-wave and mechanical design of CTS in-port plug components and in-port cell port interspace components and agree the models for EqP#12 port integration PDR. Prepare a report in the IDM.	T0 + 6 months
D04	Review the outcome of the first plasma port integration EP#12 design review with respect to the CTS system and assess impact of changes on the system. Propose engineering solutions to improve designs and document in the IDM.	T0 + 9 months
D05	Update a mechanical design for CTS system and infrastructures in Equatorial Port #12. Document the design changes and prepare inputs for System Load Specification production for FDR level design.	T0 + 10 months
D06	Assess integration of microwave systems (in-vessel, in-port plugs and ex-vessel) aimed for the first plasma operations in terms of mm-wave performance and structural integrity. Propose solutions for components to withstand loads without affecting their functional performance. Prepare a report in the IDM.	T0 + 12 months

## 9 Acceptance Criteria

The deliverables will be posted in the Contractor's dedicated folder in IDM, and the acceptance by the IO will be recorded by their approval by the designated IO TRO. These criteria shall be

the basis of acceptance by IO following the successful completion of the services. These will be in the form of reports as indicated in section 8, Table of deliverables.

## 10 Specific requirements and conditions

- Experience in mechanical and mm-wave analysis;
- Experience in 3D and 2D drawings interpretation;
- Experience of all techniques in deliverables list;
- Schematics definition;
- Design organization;
- Technical document generation;
- System requirements management;
- Technical risk analysis.

## 11 Work Monitoring / Meeting Schedule

Work is monitored through reports (see List of Deliverables section).

## 12 Delivery time breakdown

See Section 8 “List Deliverables section and due dates”.

## 13 Quality Assurance (QA) requirements

The organisation conducting these activities should have an ITER approved QA Program or an ISO 9001 accredited quality system.

The general requirements are detailed in [ITER Procurement Quality Requirements \(ITER\\_D\\_22MFG4\)](#).

Prior to commencement of the task, a Quality Plan must be submitted for IO approval giving evidence of the above and describing the organisation for this task; the skill of workers involved in the study; any anticipated sub-contractors; and giving details of who will be the independent checker of the activities (see [Procurement Requirements for Producing a Quality Plan \(ITER\\_D\\_22MFMW\)](#)).

Documentation developed as the result of this task shall be retained by the performer of the task or the DA organization for a minimum of 5 years and then may be discarded at the direction of the IO. The use of computer software to perform a safety basis task activity such as analysis and/or modelling, etc. shall be reviewed and approved by the IO prior to its use, in accordance with [Quality Assurance for ITER Safety Codes \(ITER\\_D\\_258LKL\)](#).

## 14 CAD Design Requirements (if applicable)

For the contracts where CAD design tasks are involved, the following shall apply:

The Supplier shall provide a Design Plan to be approved by the IO. Such plan shall identify all design activities and design deliverables to be provided by the Contractor as part of the contract.

The Supplier shall ensure that all designs, CAD data and drawings delivered to IO comply with the Procedure for the Usage of the ITER CAD Manual ([2F6FTX](#)), and with the Procedure for the Management of CAD Work & CAD Data (Models and Drawings [2DWU2M](#)).

The reference scheme is for the Supplier to work in a fully synchronous manner on the ITER CAD platform (see detailed information about synchronous collaboration in the ITER [GNJX6A](#) - Specification for CAD data production in ITER Contracts.). This implies the usage

of the CAD software versions as indicated in CAD Manual 07 - CAD Fact Sheet ([249WUL](#)) and the connection to one of the ITER project CAD data-bases. Any deviation against this requirement shall be defined in a Design Collaboration Implementation Form (DCIF) prepared and approved by DO and included in the call-for-tender package. Any cost or labour resulting from a deviation or non-conformance of the Supplier with regards to the CAD collaboration requirement shall be incurred by the Supplier.

## 15 Safety requirements

ITER is a Nuclear Facility identified in France by the number-INB-174 (“Installation Nucléaire de Base”).

For Protection Important Components and in particular Safety Important Class components (SIC), the French Nuclear Regulation must be observed, in application of the Article 14 of the ITER Agreement.

In such case the Suppliers and Subcontractors must be informed that:

- The Order 7th February 2012 applies to all the components important for the protection (PIC) and the activities important for the protection (PIA).
- The compliance with the INB-order must be demonstrated in the chain of external contractors.
- In application of article II.2.5.4 of the Order 7th February 2012, contracted activities for supervision purposes are also subject to a supervision done by the Nuclear Operator.

For the Protection Important Components, structures and systems of the nuclear facility, and Protection Important Activities the contractor shall ensure that a specific management system is implemented for his own activities and for the activities done by any Supplier and Subcontractor following the requirements of the Order 7th February 2012 ([PRELIMINARY ANALYSIS OF THE IMPACT OF THE INB ORDER - 7TH FEBRUARY 2012 \(AW6JSB v1.0\)](#)).