



Title: Downconverter of Radiometer

Global Tender Notice No.

I-I/ET-TPT/GTE/26009/26-27

Title	Tender No. I-I/ET-TPT/GTE/26009/26-27 dated 03-07-2026 for Supply of Radiometer Downconverter of frequency range 140 - 170 GHz
Sub Title	PART-A (II): Scope of Supply, work and technical specifications

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1 Introduction

Institute for Plasma Research (IPR) is a premier institute pursuing research in plasma science and technology in India. ITER-India, the Indian Domestic Agency (IN-DA), a centre of IPR, is responsible for Indian in-kind commitments to the ITER international fusion research project (<https://www.iter.org>). As a part of IN-DA deliverables, ITER-India needs to design, develop and deliver a Radiometer to ITER as an Electron Cyclotron Emission (ECE) diagnostic instrument. The ECE diagnostic is dedicated to measuring the plasma electron temperature profile with good spatial and temporal resolution.

For ITER operation, a radiometer in the frequency range 110-220 GHz is required, which will be used for the measurement of ITER core plasma electron temperature (refer Annex-A for more details, for information).

This tender is to supply a radiometer down converter of frequency range 140–170 GHz, which is to be used at ITER-India, IPR, India. Detailed technical specifications and requirements are provided in this document to enable the manufacturers/suppliers to submit their bids with complete details, complying with ITER-India requirements.

2 Scope of Supply

The scope of supply by the supplier includes the following:

Table.1.Scope of supply

Sr. no	Deliverables	Qty
1	Supply of Radiometer downconverter of frequency range 140 - 170 GHz	1
2	Power supplies compatible with power rating 230 VAC, 50 Hz and required cables & connectors	As per requirements
3	All Standard accessories required for the operation of the down convertor	As per requirements
4	(a) FAT report (b) Warranty certificate (c) Operation/Instruction manuals of the systems	1 set each in hard and soft copy



3 Scope of Work

The scope of work of Supplier includes the following:

Table.2. Scope of Work

S.No.	Scope of Work
1	Submission of proposed configuration of a Radiometer Downconverter complying with the technical specifications.
2	Submission of Factory Acceptance Test criteria for approval by ITER-India (refer to Section 6 for the acceptance test criteria).
3	Manufacturing and supply of downconverter in compliance with the technical specifications given in Table1.
4	Assembly and testing (refer #6 below) of entire system complying the technical specifications given in Table1.
5	Perform Pre-dispatch tests/Factory Acceptance Tests (FAT) given in Section 6 and submit the test reports before dispatch.
6	Delivery of items to ITER-India lab as per delivery schedule given in Section 8, with adequate packing to avoid damage during transportation.
7	Site Acceptance Tests as per Section 6

4 Technical Specifications of a Radiometer Downconverter of frequency range 140 - 170 GHz

ITER-India intends to procure a Radiometer Downconverter covering the RF frequency range of 140 GHz to 170 GHz, including an Intermediate Frequency (IF) preamplifier.

The configuration shown in Figure 1 is intended only as a representative/proposed architecture of the downconverter system. Suppliers are encouraged to submit their own technically suitable design proposals, provided the required RF frequency range is translated into an IF band of approximately 29 GHz, with a maximum IF frequency not exceeding 32 GHz. The proposed configuration, along with supporting technical details, shall be submitted as part of the bid.

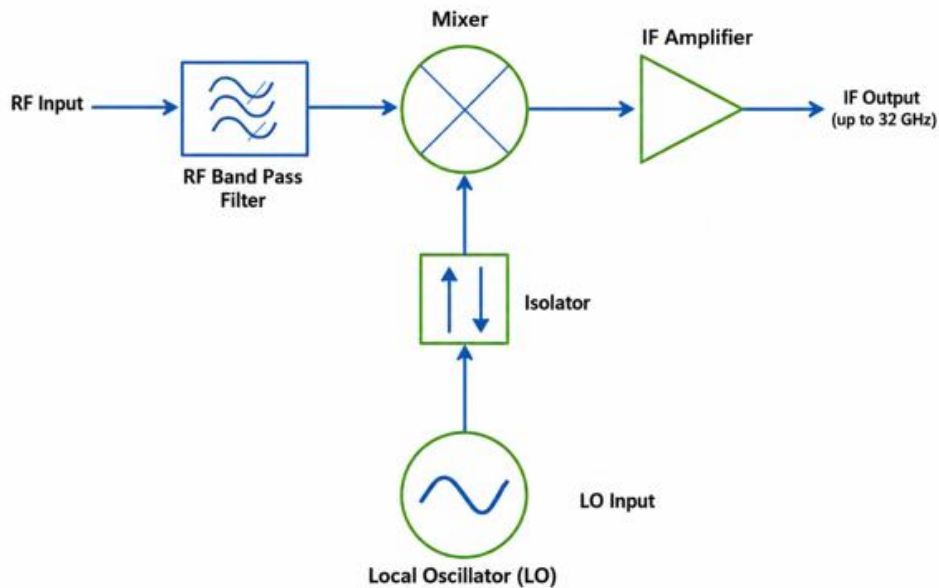


Figure 1: A Schematic representation of Radiometer downconverter of frequency range 140 - 170 GHz

4.1. Brief Functional Description

In a typical radiometer downconverter system:

1. The incoming RF signal is first mixed with a signal generated by a Local Oscillator (LO). The mixer performs frequency translation of the RF spectrum to a significantly lower Intermediate Frequency (IF) range.
2. The down-conversion stage shall provide:
 - Good conversion efficiency/gain
 - Stable and reliable operation over the specified frequency range
3. The Local Oscillator shall exhibit:
 - High frequency stability
 - Low phase noise characteristics suitable for radiometric applications
4. The converted IF signal shall subsequently be amplified using a:
 - Low-noise Broadband IF amplifier/preamplifier

The required technical specifications are given in below:

Part-A(II) Scope of Supply, work and technical specifications

Table 3 : Technical specifications of a Radiometer downconverter (140-170 GHz)

Sr. No.	Parameter	ITER-India Specification	Unit	Remarks
1.	RF input Frequency range	140 - 170	GHz	
2.	Pass band frequency range of the band pass filter	140 – 170	GHz	
3	Input RF connection waveguide Port	D-band waveguide interface compatible with the specified RF frequency range		
4	Insertion loss of the band pass filter	≤ 2	dB	
5	Rejection Frequency (Lower Side) of the band pass filter	128 and lower	GHz	
6	Rejection Frequency (Higher Side)	182 and above	GHz	
7	Rejection loss	≥ 40	dB	
8	Allowed Maximum RF input power	≥ 0	dBm	
9	Required Local oscillator (LO) to bias the mixer	The frequency of the LO should cover input RF frequency range and give IF band of 29 GHz and maximum IF frequency range of 32 GHz.		The LO frequency stability shall be better than ± 5 ppm, and the long-term drift of the LO output power shall be less than 3% during continuous operation.
10	IF frequency Band	29	GHz	
11	Maximum IF frequency	32	GHz	
12	Intermediate frequency (IF) range	Suitable to achieve specifications in Sr.9 and 10		

13	Conversion loss of the down convertor mixer	≤ 15	dB	
14.	RF Input 1 dB compression point (P1dB) of the mixer	≥ -20	dBm	
15.	Frequency band for IF preamplifier	29	GHz	
16.	Frequency range for IF preamplifier	As per IF frequency range, maximum 32 GHz		
17.	Gain of the Preamplifier for IF frequency	≥ 12	dB	
18.	Noise figure of the Preamplifier for IF frequency	≤ 4	dB	
19	Type of IF Output connector	SMA		
20	Supply AC voltage	Single-phase 230 V $\pm 10\%$, 50 Hz AC. All required power cables, RF/IF connectors, interconnecting cables, and accessories shall be included in the supply.		

5 Other requirements:

- All Standard accessories required for the operation of the Radiometer down convertor shall be part of the scope of supply and to be specified in the bid.
- Power supplies compatible with power rating 230 VAC, 50 Hz and required cables & connectors.
- Lab Environment temperature: +18 to +30 °C, max relative humidity ~85%
- Operation manual, data sheets, technical manuals (in English language).

6 Acceptance test criterion (FAT & SAT)

The final acceptance of the integrated systems will be given after the following two tests:

1. Pre-dispatch test (FAT) at factory site by the supplier
2. Site acceptance test (SAT) at ITER-India lab

Part 1: Pre-dispatch tests/Factory Acceptance Tests (FAT)

The list of proposed tests are given below. If any modifications are necessary in the tests/procedures, the vendor can suggest the same to ITER-India. The test criteria can be mutually agreed upon between both parties within 1 month of placing the purchase order. The test report will be evaluated by ITER-India and if found satisfactory, ITER-India will send the dispatch clearance to ship the material.

List of proposed Tests:

- (1) Achievable noise figure of the downconverter at any single RF frequency.
- (2) Insertion loss vs frequency of the band pass filter of frequency range 140 to 170 GHz. Or data sheet
- (3) The conversion gain of the combined system i.e. mixer and pre-amplifier.

However, the test criteria can be mutually agreed between both the parties within one month of placing the purchase order.

Part 2: Acceptance tests at ITER-India laboratory/Site Acceptance Tests (SAT)

The final acceptance of the Radiometer downconverter will be given after successful site acceptance tests at the ITER-India lab. The functionality of the downconverter is tested by measuring a few IF frequency(s), using the spectrum analyzer. SAT is conducted in presence of supplier either physically or remotely.

ANNEX-A

ITER ECE RADIOMETER (110 - 220 GHz)

The ITER ECE low-frequency radiometer is one of the two radiometers which will be used for the measurement of ITER-core plasma electron temperature. For ITER operation at high toroidal field ($B_{0r} \sim 5.3$ T), the 1st harmonic ECE frequencies extend from 110 - 220 GHz. This low-frequency radiometer will provide measurement of plasma electron temperature profile by measuring 1st harmonic frequency range 110 - 220 GHz for the full Bt operation.

Wide frequency range of the Radiometer extending over more than one microwave band need separate receivers for each band in order to ensure good performance. A set of four receivers is used, with IF bandwidth of 22 to 29 GHz. A frequency splitter unit is used for splitting the ECE radiation frequency band into four receiver bandwidths efficiently.

The low-frequency radiometer shall consist of the following sub-systems as shown in Figure 2:

1. Receiver 1: 110 - 138 GHz bandwidth with sixteen channels of 1 GHz bandwidth
2. Receiver 2: 140 - 168 GHz bandwidth with fourteen channels of 2 GHz bandwidth
3. Receiver 3: 172 - 197 GHz bandwidth with fifteen channels of 2 GHz bandwidth
4. Receiver 4: 198 - 220 GHz bandwidth with thirteen channels 2 GHz bandwidth

A Frequency splitter unit which will split the ECE radiation 110 - 220 GHz into above four receiver bands as mentioned above.

In addition to these, there is a need of 16 tunable channels for real time measurement. The tunable channels have an electrically tunable filter (YIG filter). These filters have 3 dB bandwidths in the range 150 to 250 MHz, and tunable center frequencies. Provision should be made to connect each of these channels to any of the IF sections via fully remotely controlled hardware.

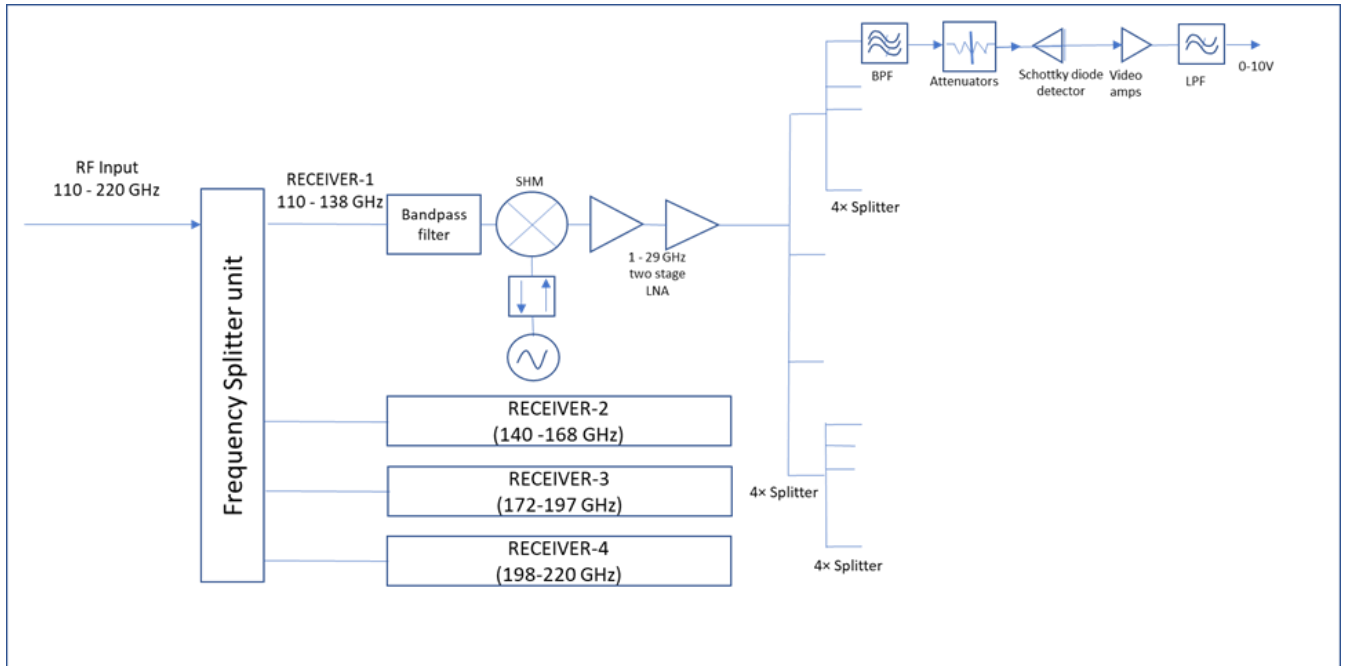


Figure 2 : Schematic representation of low -frequency Radiometer (110-220 GHz)

Annexure-B: Technical Compliance Sheet

Sr. No.	Description	Offered Specifications	Bidder's compliance (Yes/No)		
a	Scope of Supply and Scope of work as per Section-2 and 3 respectively				
b	Table 3: Technical specifications of a Radiometer downconverter (140-170 GHz)				
Sr. No.	Parameter	ITER-India Specification	Unit		
1.	RF input Frequency range	140 - 170	GHz		
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3	Input RF connection waveguide Port	D-band waveguide interface compatible with the specified RF frequency range			
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10	IF frequency Band	29	GHz		
11	Maximum IF frequency	32	GHz		
12	Intermediate frequency (IF) range	Suitable to achieve specifications in Sr.9 and 10			
13	Conversion loss of the down convertor mixer	≤ 15	dB		
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15.	Frequency band for IF preamplifier	29	GHz		



16.	Frequency range for IF preamplifier	As per IF frequency range, maximum 32 GHz			
17.	Gain of the Preamplifier for IF frequency	≥ 12	dB		
18.	Noise figure of the Preamplifier for IF frequency	≤ 4	dB		
19	Type of IF Output connector	SMA			
20	Supply AC voltage	Single-phase 230 V $\pm 10\%$, 50 Hz AC. All required power cables, RF/IF connectors, interconnecting cables, and accessories shall be included in the supply.			
c	Document evidence to compliance to Essential Eligibility Criteria provided				
d	Other requirements as per Section-5				
e	Acceptance test criterion (FAT&SAT) as per Section-6				
f	Annex-A				



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Bidder Signature		
Name of the signatory & Title	Name	Title
Bidder's Official seal		
Place & Date	Place	DD-MM-YYYY