OFFICE OF THE REGISTRAR :: DIBRUGARH UNIVERSITY

DIBRUGARH :: ASSAM

PIN: 786 004

BID DOCUMENT

FOR

Designing, Development and Commissioning of Multiuser MIMO-OFDM Research and Development Test Bed

TENDER No: DU/RG/B.01.07/15/0015 Dated 09.01.2015

CUT-OUT SLIP

Designing, Development and Commissioning of Multiuser MIMO-OFDM Research and Development Test Bed

TENDER No: DU/RG/B.01.07/15/0015 Dated 09.01.2015

SUBMISSION DUE DATE & TIME : 12:30 P.M. on 23.01.2015

FROM:	**TO:**
NAME:	THE REGISTRAR
ADDRESS	DIBRUGARH UNIVERSIITY
	DIBRUGARH, ASSAM

(To be pasted on the outer envelope containing "Technical"& "Commercial" bids

OFFICE OF THE REGISTRAR :: DIBRUGARH UNIVERSITY :: DIBRUGARH

TENDER No: DU/RG/B.01.07/15/0015 **Dated 09.01.2015**

Tender Notice

Sealed Tenders are invited from reputed Manufactures / Firms for Designing, Development and Commissioning of Multiuser MIMO-OFDM Research and Development Test Bed at Dibrugarh University Institute of Engineering and Technology (DUIET).

For details please visit our website – *www.dibru.ac.in*

Availability of Bid papers	From 09.01.2015 up to 22.01. 2015 between 11:00 A.M. and 05:00 P.M.
Last date for receipt of Bid	12:30 P.M. on 23.01.2015
Time & Date of opening of Bid	02:30 P.M. on 23.01.2015
Place of opening of Bid	Office of the Registrar, D.U.
Cost of Tender Document	500/- (Non – Refundable)

The tender documents can be obtained on any working day during office hours between 11.00 AM to 5.00 PM from the office of the undersigned, by paying the cost of tender document through Bank draft in favour of **The Registrar, Dibrugarh University,** payable at Dibrugarh. The Tender Documents can be downloaded from our website *www.dibru.ac.in*

The tender should be submitted in two separate sealed envelopes *i.e.* **Part - I** (TECHNICAL BID) **Part – II (**FINANCIAL BID). The technical bid shall be opened on above mentioned date and time and the financial bid of only those bidders who qualify in technical bid shall be opened at a later date. Dibrugarh University reserves all the rights to reject any or all the tenders without assigning any reason.

Registrar
Dibrugarh University

1. INTRODUCTION

(i) Objective:

The Dibrugarh University (hereinafter to be referred to as "**Owner"**); intends to create a Multiuser-MIMO OFDM Research and Development test bed which will be used for developing and optimizing evolving wireless broadband standards, namely 4G Long Term Evolution LTE and 4G LTE (Advanced) as a part of a DeitY sponsored major Research project located at Department of Electronics and Communication Engineering, DUIET, Dibrugarh University, Dibrugarh, Assam, India.

(ii) Location of the project:

The location of the project will be at the Department of Electronics and Communication Engineering, DUIET, Dibrugarh University, Assam, as a part of a DeitY sponsored major Research project.

All interested Bidders may send in their Proposals in line with the requirements but not limited to the same, mentioning their profile, credentials, details of past work of similar nature, time required for the execution.

A. INFORMATION & INSTRUCTIONS FOR BIDDERS

1 The Document can be downloaded from **Dibrugarh University** website **www.dibru.ac.in.** The cost of Tender Document must be accompanied with Technical Bid.

2 The tender document duly completed and signed should be submitted in a sealed cover. The technical and the price bids must be packed as specified in the tender document.

3 The tender document from the bidder should be addressed to the **Registrar, Dibrugarh University.** For any kind of queries please contact Ms. **Parismita Gogoi, PI and Assistant Professor,** Department of Electronics and Communication Engineering, DUIET, **Dibrugarh University, Dibrugarh, Assam, Pin-786004, Email- parismita.ect@gmail.com, or parismita@dibru.ac.in** to be received at DUIET, **Dibrugarh University, Dibrugarh, Assam,** by the stipulated date and time.

4. Bidders needing any further clarifications or queries may contact the above **Assistant Professor,** Department of Electronics and Communication Engineering, DUIET, **Dibrugarh University**. However, the tender of the Bidders should be received as mentioned in point 2 & 3 above in appropriate manner well within the stipulated due date.

Important Note:

1. DIBRUGARH UNIVERSITY has the sole discretion to qualify or accept the tender and reject the proposal without assigning any reason whatsoever.

1. DEFINITIONS:

In this document the following words and expressions have the meaning hereby assigned to them.

i. DU means Dibrugarh University.

ii. Bidder means an organization that works on embedded systems design & development and preferably has an in-house R&D unit engaged in research, design, and development. The **Bidder** is expected to execute the project as per the specifications laid down by the Owner. The **Bidder** will submit the bid to the Owner.

iii. Project means (i) the commissioning of a Multiuser MIMO- OFDM Research and Development test bed with deliverables as described subsequently in this document.

iv. Owner shall mean **DU**.

v. Commissioning of the Plant shall mean successful operation of the test bed according to the requirements listed under **section 2.**

vi. Awardee means the bidder who is awarded the tender.

vii. R & D means Research and Development which is a process intended to create new and improved technology that can provide an advantage.

2. GENERAL:

i. Interested bidders may please refer to attached **Section-1** "Who Can Apply", of this document and ensure their applicability accordingly.

ii. All information called for as mentioned in **Section–1** should be furnished as required in tabulated form.

iii. The bidder ***s***hall mention company/ entity`s Name, Registration number of Incorporation with Registrar of companies, postal address with zip code, phone numbers, name of the contact person, contact Email id in the technical bid document.

iv. Even though a Bidder may satisfy all the tender requirements, he would be liable to disqualification if he has:

a. Made misleading or false representation or deliberately suppressed the information in the forms, statements and enclosures

b. Record of poor performance such as abandoning work, not properly executing / completing the contract, or financial failures/weakness etc.

v. The tender document duly completed and signed should be submitted in a sealed cover superscribing: "**MULTIUSER MIMO TESTBED TENDER BID*"***. The tender should be addressed the Registrar**,** Dibrugarh University, Dibrugarh, Assam, Pin- 786004 to be received at by **12:30 P.M. on 23.01.2015.**

vi. The complete bid shall be signed and stamped by the Bidder on each page.

vii. Bids must be submitted by the time and date mentioned in the Letter Inviting Tender at the address stated therein.

viii. A committee approved by **Registrar, Dibrugarh University** shall assess the applications from the bidders.

ix. Both the (i) technical, un-priced bid, and (ii) priced bid are to be in Hard Copies in separately secured & sealed covers and placed together inside one master cover. In addition, the technical, un-priced bid should also be provided in .pdf format on a Compact Disc along with the hard copies.

x. Parties needing any further clarifications or queries may contact the above PI from DU***. However, the tender documents of the parties should be received in sealed envelope by the stipulated due date as mentioned above.***

3. FINAL DECISION MAKING AUTHORITY

Owner reserves the right to accept or reject any application and reject all applications at any time, without assigning any reason or incurring any liability to the applicants.

The Bidder is expected to carry out the assignment with due diligence and in accordance with standard practices and ethics of the profession.

All costs during the bid preparation stage related to site visit, for example board, stay, transport and any other incidental costs shall be borne by the Bidder. Advance intimation is to be given to help for accommodation at DU on chargeable basis.

The Award Criteria of the Bidder, Eligibility criteria are described in Section-1 of this document.

The Owner (DU) has the right to award or cancel the award without assigning any reasons to the Participating Bidders.

4. PROJECT DESCRIPTIONS

A description of the project is given in section-2 of this document.

5. SCOPE OF WORK

1. *To design a scalable communication setup to work in 'real time'.*
2. To implement 2 x 2 and 4x 4 MU MIMO-OFDM communication system.
3. To test various 'channel estimation' and 'pre-coding' algorithms using the setup.
4. To implement a 3GPP-LTE communication scheme.

6. Deliverables:

Please see section-2 of this document.

7. Schedules:

The Bidder will commission the design within **3 months** after the contract is formally awarded. However, a shorter dead line for the commissioning of the project would be desirable.

8. ELIGIBILITY AND AWARD CRITERIA

The criteria for awarding the work to create a Multiuser MIMO- OFDM R&D test bed ***at the DUIET campus of Dibrugarh University have*** been mentioned in **Section-1** of this document. Thus, parties are requested to essentially cover in their proposals following assessment parameters:

i. Description of the background and organization of your firm/entity and each associate for this assignment.

ii. Past experience of providing similar test platform and/or MIMO- OFDM system to be stated chronologically with name of the Client with location address and the details of Client contact person (designation, e-mail, phone/mobile number), and as built Photographs.

iii. Since, the subject project is very technical in nature, due weightage shall be given for high technical capability.

iv. The financial bid will consist only of the total (lump sum) cost of designing and commissioning the project. Only the total cost will be considered for evaluation of financial bid. In case of arithmetic or any other error, the lower cost will be considered.

v. Manpower, travel and other expenses related to the selected bidder's participation in R&D on the test bed will be borne by the bidder. The Owner may, on a payment basis provide lodging and boarding to the bidder's personnel.

9. PAYMENTS

i. An advance payment *(50% maximum)* will be made to the Awardee for completion of the First phase of specified component of the work.

ii. Remaining Fifty Percent (50%) of contracted amount will be released on successful commissioning of the test bed. The advance amount of the 50% shall be adjusted at this stage.

iii. All payments by **OWNER** to **BIDDER** shall be preferably made by wire transfer to an account. (Mandate Form will be provided to the successful bidder at due course of time)

PART-I: TECHNICAL BID

This part shall contain technical and un-priced proposal in separately sealed envelopes clearly super-scribing on the top of the envelope “TECHNICAL BID”, Name of Work, Tender No., Due Date, Name and Address of the bidder shall also be written outside the envelope.

PART – II: FINANCIAL BID

This part i.e. FINANCIAL BID shall be submitted in a separate sealed envelope duly signed and stamped on each page clearly superscribing on top of the envelope "FINANCIAL BID- DO NOT OPEN" as detailed herein below. Name of Work, Tender No., Due Date, Name and Address of the bidder shall also be written outside the envelope. Correction fluid is not allowed to be used. In case there is any correction, the Bidder shall cut the same neatly and put his signature and stamp with date near the place of each correction. The financial bid will consist only of the total (lump sum) price of designing and commissioning the project and any other information/ document which has been specifically asked to be furnished along with the price part. Only the total cost will be considered for evaluation. In case of arithmetic or any other error, the lower cost will be considered. The bid shall be signed by the person legally authorized to enter into commitment on behalf of the Bidder.

(i) COST OF BIDDING

The bidder shall bear all direct and indirect costs associated with the preparation or delivery/ submission of their Bid, participating in discussions etc. including costs and expenses related with visits to the site(s) and Owner's offices. The Owner will in no case be responsible or liable for reimbursement of those cost and expenses regardless of the outcome of the bidding process.

All questions and clarifications related to Bidding documents shall be addressed in writing (by Email only) to:

Parismita Gogoi, PI and Assistant Professor, Department of Electronics and Communication Engineering, DUIET, Dibrugarh University, Dibrugarh, Assam, Pin- 786004,

Email- parismita.ect@gmail.com, or parismita@dibru.ac.in to be received at DUIET, Dibrugarh University, Dibrugarh, Assam

(ii) DISCUSSIONS AND NEGOTIATIONS

Owner shall be free to engage in discussions or negotiations with any or all Bidders concerning the terms of their respective bids at all time prior to execution by both parties.

(iii) UNSUCCESSFUL BID

In the event that a Bidder is unsuccessful with its bid, Owner shall notify the Bidder accordingly. The Owner shall retain all the documents of the Bids.

(iv) CONTACTING THE OWNER

No bidder, their representatives or agents shall contact the OWNER on any matter relating to this Bid from the time of submission of Bids, unless requested so in writing. Any effort by a Bidder to influence the OWNER in the Owner's decisions in respect of Bid evaluation will result in the rejection of that Bidder's Bid.

11. PERFORMANCE SCHEDULE

The **OWNER** expects the successful BIDDER to perform and complete the activities of the project covered in the scope of work defined in the letter to be carried out within 3 (three) months from Bidder's acceptance of the award of work which shall be the date of email / fax / letter of acceptance whichever is issued earlier.

(i) Meeting

After award of work to the Bidder**,** a meeting will be held between the **Owner** and the **Bidder for:**

a) Clarification & Interactions between **BIDDER** and Owner on the quantum of work, deliverables etc. of the proposed Study,

b) Identify any additional information required from the Owner or the bidder**.**

12 ASSOCIATION OF OWNER'S PERSONNEL

The Awardee shall ensure that **OWNER** is kept fully informed at all stages of the work under this agreement.

13. NOTICES

Any notice or communication required hereunder shall be made by registered or certified air mail, addressed to the proper address mentioned below:

BIDDER: (To be furnished by the **BIDDER)**

OWNER : **Dibrugarh University, Dibrugarh, Assam, Pin- 786004,**

All correspondence, Invoices, Notices and claims sent by BIDDER to OWNER shall be addressed for the attention of **Parismita Gogoi.**

BIDDER will indicate the name, address and contact details of the person to whom OWNER has to address the correspondence.

14. OWNER'S RIGHTS

(i) The Owner reserves the right to accept a bid other than the lowest and to accept or reject any bid in whole or part, or to reject all bids with or without assigning in reasons.

15. **EVALUATION OF TECHNICAL BID**

All valid bidders are required to submit bids in two parts i.e. **PART-I: TECHNICAL BID** and **PART-II: FINANCIAL BID**. The technical part of the bid will be evaluated by the owner for its completeness and accuracy.

16. EVALUATION OF PRICE BID

(i) The price bids of only those bidders shall be considered for opening and evaluation whose bid is determined to be technically and commercially acceptable to the owner.

(ii) Evaluation of price bid shall be taken up to determine the competitive prices of the techno-commercially acceptable bids and include the following:

a. The quoted prices shall be checked to determine the arithmetical correctness of the same.

b. The Owner reserves their right to negotiate the quoted price.

Section-1

Bidder`s Eligibility Criteria

Organizations that design and manufacture wireless communication system testbeds/ prototypes, preferably MIMO- OFDM and have in-house R&D unit. The R&D unit must be engaged in research, design, and development of the technologies. The Bidder should have a proven track record of (i) providing test beds as specified in the project **or/and** (ii) manufacturing and supplying wireless communication system prototypes.

ASSESSMENT METHOD

A committee comprising of duly nominated officers from DU and approved by Registrar, DU shall assess the responses from the bidders.

Since, the subject project is very technical in nature, due weightage shall be given for high technical capability.

DETAILS OF ALL WORKS OF SIMILAR NATURE COMPLETED DURING THE LAST TWO FINANCIAL YEARS ending 31st March 2015

Assignment name:	Approx. value of the contract (in Indian Rupees):
Country:	Duration of assignment (months):
Location within country:	
Name of Client:	Address:
Start date according to contract (month/year):	Actual start date (month/year):
Stipulated completion date (month/year):	Actual completion date (month/year)
Narrative description of Project:	

NOTE:

1. FOR STIPULATED DATE OF COMPLETION, SUBMIT COPY OF WORK ORDER

2. FOR ACTUAL DATE OF COMPLETION, SUBMIT COPY OF COMPLETION CERTIFICATE.

Signature of Applicant (s)

Section-2

MU MIMO –OFDM TESTBED REFERENCE DESIGN

Introduction

Multiuser MIMO or massive MIMO (MU-MIMO) is currently a new emerging research area, where single user MIMO concept is improved greatly for communicating with several users at the same time from the base station. MU-MIMO has been recently incorporated into evolving wireless broadband standards, namely 4G Long Term Evolution LTE and 4G LTE (Advanced). Among the two, the most modern 4G LTE (Advanced) standard allows the use of a modest number of 8 antenna terminals at the transmitter (TX) side. That way, MU-MIMO enables the development of future broadband networks to a much greater scale by reaping all the benefits of conventional state-of-the-art MIMO. Although substantial research has been done on the theoretical front, recent focus is on making multi user MIMO (MU-MIMO) practically realizable. The performance analysis of MU-MIMO over a faded environment is one of the more practical concepts from the designing point of view of a wireless network. It offers an enormous scope for further research in the coming years.

To thoroughly assess real world implementation and performance aspects as well as limitations of MU-MIMO communication, a prototype system is of paramount importance. It is an important aspect to assess wireless communications systems in real-world scenarios through hardware built-up. Among the different strategies suitable for undertaking such assessment, the testbed approach constitutes a simple and flexible solution. Hardware platforms and testbed is an essential tool to evaluate, in realistic scenarios, the performance of wireless communications systems.

Scope of the work:

1. *To design a scalable communication setup to work in "real time ".*

In a long run everything may get changed, but we should be able to adhere to the setup for implementing a communication system which is in trend. So we want the setup to be scalable both in terms of software and hardware. By real time we mean that the platform should be fast enough to support all the highly computational tasks with no noticeable latency.

2. *To implement 2 x 2 and 4x 4 MU MIMO-OFDM communication system.*

We will start with implementation of a "2 by 2" MU MIMO-OFDM setup. The setup should be easily tunable to a "2 by 1" or "1 by 2" system according to the requirement. There should also be provision of upgrading the system to accommodate more transmit and receive antennas for further development. Again, most importantly, there should be some provision for synchronization of the transmitters and receivers. The above is to be repeated with 4 x 4 cases as well. Also Number of active user must range between 4-10 for MU MIMO propagation.

3. *To test various "channel estimation" and "beam forming" algorithms using the setup.*

For now, we will be working on performance evaluation of different channel estimation and precoding algorithms, which can be the existing algorithms like ZF, LMS, MMSE, ML etc. or the custom designed ones.

4. *To implement a 3GPP-LTE communication scheme.*

The platform should support a minimum bandwidth of 20 MHz to be compliant with 3GPP-LTE standard and also support a minimum input i/q sapling rate of 100 Mbps. Configuring the soft-computational framework of the MU-MIMO for 3GPP standard also should be possible.

Technical requirements/ Deliverables are:

1. *Selectable working band from a large bandwidth.*

   This requirement arises from the fact that we may try with different frequency bands. For example we should be able to switch between 2.45 GHz ISM band and 5.8 GHz ISM band. Also we should be able to transmit and receive in the GSM band.

2. *On board high performance computing programmable hardware.*

   On board computation is always a better option for real time implementation. Our custom designed algorithms will be heavy in computation and hence the requirement must be fulfilled. Again, programming the hardware should not be a bottleneck if we are ready with our algorithm.

3. *Transmit power of the transmitter should be good enough to be able to work in a large area with added mobility.*

   To check the performance of the system in mobile environment, where the receiver may go mobile, we need good transmit power.

4. *There should be provision for synchronization of the sample clocks and sample time so that the device is capable of MU MIMO communication in true sense.*

   Synchronization is always an issue in communication. In MIMO this will be more significant, specially because of the spatial separation between the transmitters and receivers.

Miscellaneous Clauses:

1. As most of our earlier work is done in MATLAB, so support for integration with MATLAB or SIMULINK environment will be desirable.

2. There should be a good deal of customizable hardware in the setup.

3. Technical support throughout the entire project is sought. It will help us to catch up with the real work in short time. Manufacturer support at the beginning of the development phase is sought.

4. Support for various programming environment is sought. Scientific tool like LABVIEW should be supported.

5. The selected bidder is expected to provide warranty and operations and maintenance support as well as training to project staffs and faculty of DU at their laboratories.

Registrar
Dibrugarh University