

Mississippi State University

Notice of Proposed Sole Source Purchase

256-029

Mississippi State University anticipates purchasing the item(s) listed below as a sole source purchase for a Federal research award. Anyone objecting to this purchase shall follow the procedures outlined below.

1. Commodity or commodities to be purchased (make, model, description):

One year of technical support and software upgrades for i) AMARI NW 2000 SE and ii) AMARI UE Simbox 064, which are two systems that we procured in the past and have in our laboratory, listed below

i) AMARI NW 2000 SE (FIX)

License ID: 7f-0a-2f-57-27-3c-2b-44

ii) AMARI UE Simbox 064 (FIX)

Includes:

1 AMARI UE 064 license

1 i9 based PC

4 AMARI PCIe SDR 2x2 cards

2. Explanation of the need to be fulfilled by this item(s), how is it unique from all other options, and why it is the only one that can meet the specific needs of the department:

This is a unique fully-software defined implementation of a 5G communications system—5G network (AMARI NW 2000 SE) and 5G user equipment (AMARI UE Simbox 064), emulating up to 64 users—that is commercially available. The software is tested with the company's hardware (standard computer and custom software radios) and commercial 5G cell phones and will enable testing 5G in the lab and outdoors, in different radio environments and circumstances of interest to the research community and the sponsor.

Without official technical support and software upgrades, we face risks of system downtime, security vulnerabilities, and incompatibility with new protocols, which could severely impact our R&D capabilities.

The service/product in question provides hardware and software support that is proprietary to Amarisoft, the manufacturer and developer of the AMARI NW and UE series. No 3rd party sells or is authorized to sell these products, as only Amarisoft has

access to the source code, firmware, and internal documentation required for the necessary services.

This is the only product that can meet the specific needs of the department. This need is having a standard-compliant 5G system for testing in the laboratory and outdoors to advance research towards better 5G technology and systems. 4G long-term evolution (LTE) solutions are available from different research groups and companies, but those do not meet the current and future needs of our department. 5G technology and systems are more sophisticated than 4G systems. They are more flexible and will be used in new mission-critical contexts, such as autonomous driving, public safety, drone-based networking, and precision agriculture.

In order to ensure 5G will meet its goals for supporting many industrial verticals and mission critical services of critical importance to the US government, the 5G protocols and network components need to be scientifically analyzed, vulnerabilities identified, and solutions developed. Therefore, the department needs to have the equipment that implements the latest 5G protocols to facilitate obtaining cutting edge research results that can be experimentally evaluated and demonstrated on production-like systems in a controlled research environment. There have been multiple papers that claim 5G security vulnerabilities and others propose innovative solutions to make 5G more secure. Most researchers use simulations and only few have the capability and the knowledge to demonstrate 5G research on a real 5G system. The ECE department of MSU is actively involved in 5G security research and believes that it is a strategic research direction. New findings about 5G will capture worldwide attention and will likely influence the evolution of communications in the US and worldwide. Moreover, the Amarisoft system will be a hands-on educational tool for our students and faculty and will be used to develop a workforce that is prepared to tackle the communications challenges of US industry and US government agencies. It will also support other government sponsored projects in the department, including the \$24M Aerial Experimentation and Research Platform for Advanced Wireless (AERPAW) project that MSU is co-leading and heavily involved in

(https://nsf.gov/awardsearch/showAward?AWD_ID=1939334), as well as the NSF Convergence Accelerator project

(https://www.nsf.gov/awardsearch/showAward?AWD_ID=2515378) for the Track G Program on Securing Operation Through 5G Networks. The Amarisoft product provides a stable 5G system for experimentation with drones and a baseline system for the development and testing of Beyond 5G and 6G technology and system for better radio frequency spectrum coexistence

(https://www.nsf.gov/awardsearch/showAward?AWD_ID=2332661), among others.

Having an advanced 5G laboratory at MSU enabling practical research experiments, reproducible experiments, and education in advanced wireless communications and

networking will also attract new sponsors and sponsored research programs across multiple disciplines.

3. Name of company/individual selling the item and why that source is the only possible source that can provide the required item(s):

Amarisoft, <https://www.amarisoft.com/>, is the sole source of AMARI Callbox Pro and UE Simbox 064, which are a fully software-defined 5G base station and 5G user equipment emulation system that Amarisoft designed, maintains, and distributes. It is extremely difficult to implement 5G protocols and systems in software, because of the complex signal processing algorithms and procedures to process up to Billion samples per second in real time, for instance to enable untethered virtual reality or vehicle control. The company Amarisoft hires the world's best software developers and engineers who have been able to implement a stable 5G system that is standard compliant for enabling wireless research that is directly relevant to the emerging commercial and mission critical 5G networks.

4. Estimated cost of item(s) and an explanation why the amount to be expended is considered reasonable:

The cost with educational discount is \$11,845. This covers support service and software upgrades to the latest 5G systems. A new 5G Release is frozen every six months and Amarisoft implements the new features which then allow cutting edge research.

The two systems implement a standard-compliant 5G base station with integrated core network and a 64 UE emulator. It implements the sophisticated 5G radio and networking protocols fully in software, which needs an optimized implementation, for running an enhanced broadband wireless communications system on a standard computer. It will support various research projects on testing and improving 5G in different ways. This software-defined system is unique, portable, and allows experimentation in the lab and outdoors.

5. Explanation of the efforts taken by the department to determine this is the only source and the efforts used to obtain the best possible price:

PI Marojevic is an expert in the field of advanced wireless communications and his research contributed to software radios and the development of 4G and 5G networks. Since his research projects use and advance modern wireless systems, he is well aware of the existing options to support 5G wireless research. We have searched for alternative solutions and vendors and did not find any fully software-defined and Third Generation Partnership Project (3GPP) standard-compliant 5G base station available on the market. A software-defined system allows easy portability and upgradability which is essential for our project and continuing research at MSU.

The awarded project is to build a Next-Generation Wireless Network Testbed, based on the latest 5G protocol and the Open Radio Access Network (O-RAN) architecture.

Amarisoft is a software company that develops and maintains the 5G network in software and designs the supporting hardware which is part of the requested equipment. They offered a custom quote for MSU with an additional discount.

Other software companies, to the best of our knowledge, have not implemented a fully standard compliant end-to-end 5G system yet for enabling over-the-air testing, as opposed to simulators, or do not sell it.

Any person or entity that objects and proposes that the commodity listed is not sole source and can be provided by another person or entity shall submit a written notice to:

Jennifer Mayfield

Director of Procurement & Contracts

jmayfield@procurement.msstate.edu

Subject Line must read “Sole Source Objection”

The notice shall contain a detailed explanation of why the commodity is not a sole source procurement. Appropriate documentation shall also be submitted if applicable.

If after a review of the submitted notice and documents, MSU determines that the commodity in the proposed sole source request can be provided by another person or entity, then MSU will withdraw the sole source request publication from the procurement portal website and submit the procurement of the commodity to an advertised competitive bid or selection process.

If MSU determines after review that there is only one (1) source for the required commodity, then MSU will appeal to the Public Procurement Review Board. MSU will have the burden of proving that the commodity is only provided by one (1) source.