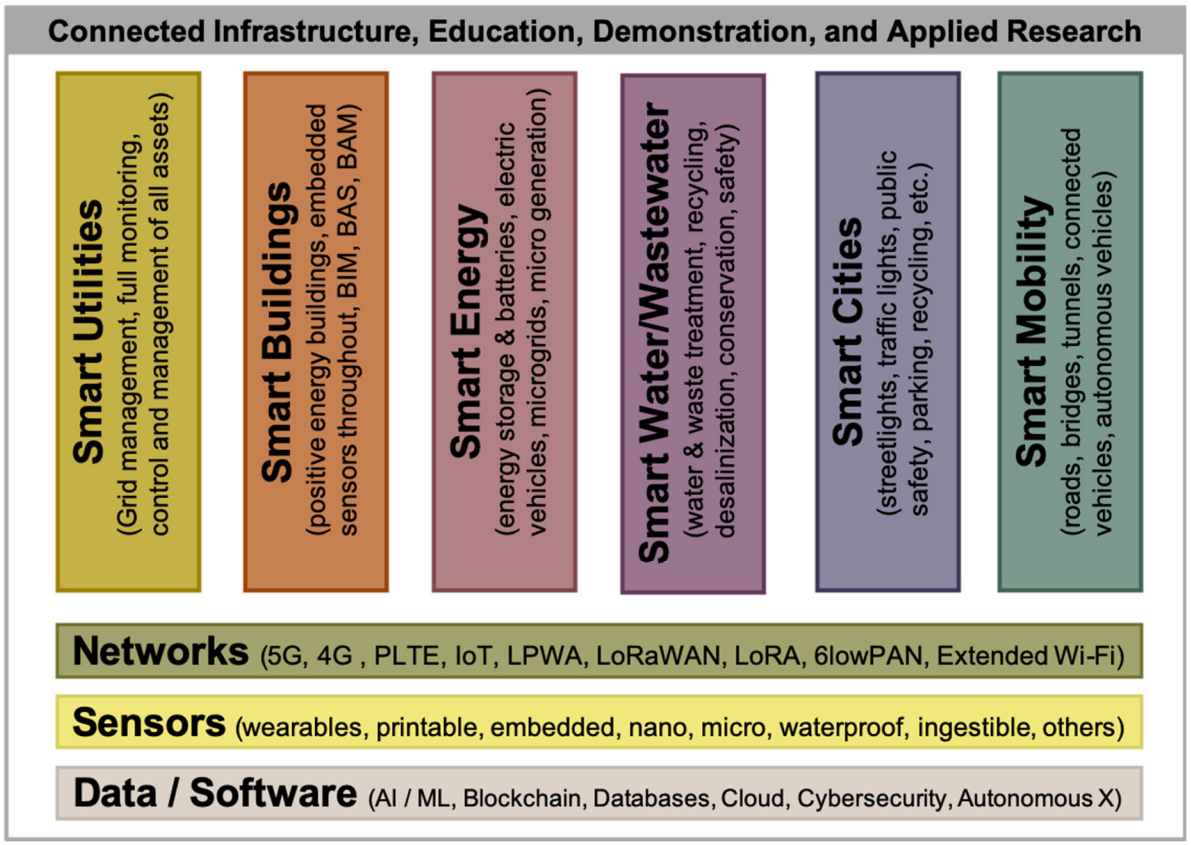
Texas State University Research Foundation
Experimental License Application – Justification

Texas State University Research Foundation (TSURF) is a non-profit research-only foundation owned by Texas State University (TXST). TXST is the 3rd largest public university in the State of Texas, with a collective population of around 40,000 students and 1,800 faculty. TXST is also the largest federally designated Hispanic & minority serving institution (HSI/MSI) in Texas, with a minority population of roughly 40%.

TSURF owns STAR Park LLC (STAR Park) and CIEDAR Consortium LLC (CIEDAR). STAR Park is a non-profit 100 acres research park location focus on working with industry via CIEDAR. CIEDAR is our non-profit multi-disciplinary research consortium working with industry responsible for all the membership management, project selection, project staffing with faculty and students, project matching and project management of all the research performed at STAR Park. CIEDAR is an acronym for Connected Infrastructure for Education, Demonstration, and Applied Research. CIEDAR is also driving the creation of nine (9) living labs within STAR Park in partnership with multiple industry companies in several sectors to accelerate digitization and digitalization of industry via our own Technology Enhanced Infrastructure vision. The 9 labs will be for the study of smart technologies applied to Utilities (water, electric, gas), Energy (fuels, storage, and cleantech), Water & Wastewater, Buildings, Infrastructure, Cities, Mobility, Sensors, BigData & Software, and Networks.



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I Background

TSURF, through CIEDAR, is involved in the study of all technologies with application to the lifecycle monitoring, control, and management of infrastructure assets. This includes the:

- Validation of existing technologies
- Evaluation of emerging technologies
- Development of new technologies

CIEDAR enables the multidisciplinary study, testing and development of technologies with application to infrastructure. Project teams may include faculty and students from civil engineering, electrical engineering, industrial engineering, manufacturing engineering, mechanical engineering, physics, chemistry, geography, mathematics, computer science, design, business, communications, phycology, sociology, biology, and others.

The Smart Networks Lab is a foundational pillar of the CIEDAR Consortium. The Smart Networks Lab on technologies, platforms, and full-stack applications of modern networks (wired and wireless). Topics of interest include the evolution of mobile telephony modern modulation and information transfer (e.g. OFDM/A, MU/MIMO, DSSS/CSS), as well as network architectures, use-cases, and devices which leverage licensed and unlicensed access network plus backhaul and the broad area of Internet-of-Things technologies (IoT) and applications within a in-building environment.

Evaluation, validation, and optimization of the following technologies/products in a single configuration for optimal performance, fleet configuration of hundreds/thousands of nodes to test multiple use cases. All tests require a core network, access points, and connected edge sensors.

Key network technologies at the 900 MHz broadband Part 27 frequencies

- Private LTE
- NB-IOT, CAT-M1, LTE

II Request for Conventional Experimental Radio License

A Purpose of Test

TSURF requests an experimental radio license to test LTE equipment and evaluate application use-cases on 900 MHz spectrum. The purpose of the testing is research into network architecture, network-resident nodes, and end-station technologies which support novel applications of small-scale licensed wireless deployments for in-building use in heavy volume (i.e. 30,000 to 100,00 sensors per building.

All experiments will be at low power and confined within the buildings, therefore TSU requests notification only of others using the spectrum. In all applications, we anticipate the use of LTE-certified Band Class 8 equipment to avoid interference with systems operating on spectrum adjacent to the proposed 900 MHz broadband allocation.

All testing will comply with Rule Section 5.84 and will not cause interference to either co-channel or adjacent channel licensees authorized pursuant to the current 900 MHz band plan. It will be conducted on MTA channels held by PDV Spectrum Holdings, LLC and interleaved B/ILT channels that are licensed to others or have never been applied for and remain vacant in the test area. The testing will also be a "proof of concept" opportunity, whereby TSURF can validate the benefits of wireless broadband connectivity for several novel application scenarios. The testing will confirm that LTE data speeds and capacity can support the important fixed field-area functions and applications that are currently conducted on narrowband systems or on legacy copper-based circuits that may be de-constructed.

B Technical Parameters of Test

This project leverages the expertise of researchers at TXST via TSURF and CIEDAR as well as commercial partners in leveraging private broadband network solutions to implement a communications network that is relevant to market verticals and pertinent top-level application scenarios ranging from healthcare, transportation, public safety, education and agriculture to critical enablers including energy services, utility modernization, industrial control, environmental/biological monitoring, and cyber-security.

This experimental license is the first step (Phase 1) toward a future collaboration involving TSURF, industry partners, and entities including the National Science Foundation (NSF), the 5G technology accelerator US-IGNITE, the Department of Energy (DoE), the Department of Defense (DoD), the Texas Commission on Environmental Quality (TCEQ), and various other state/federal funding sources.

In particular, multiple current TSURF projects are focused on the development and practical implementation of management and control systems which require bidirectional, real-time machine-to-machine communication (M2M) and backhaul capability to centralized facilities for data analysis. Certain specific applications include monitoring of in-building energy services facilities with focus on distributed voltage optimization, control of dynamically placed network access facilities with aggregated backhaul capability for real-time management and communication during active-shooter events, realistic training of first-responders using Augmented Reality (AR) headsets for large-scale environmental or pandemic response, and in-situ monitoring of endangered species. Communication pathways for many of these scenarios are often unavailable due to dynamic placement requirements, or impossible to completely implement and test in a lab-based setting.

The expected outcomes of this engagement include objectively-measured and verified metrics of communication system parameters which dominate the performance of the various application scenarios, as well as validated approaches to mitigating negative performance issues which may be

customized to individual application requirements. These application scenarios have not previously been tested or evaluated using a private broadband network leveraging LTE technology.

Based on the understandings and lab results generated in the development, testing, and validation of these applications, scholarly papers describing the application results will be published, and a report summarizing success metrics and use-case performance outcomes via a private LTE network will be prepared.

TSURF requests the experimental license for 24 months.