5G (ENCQOR) Technology Development Challenge- Device Coexistence in the 6GHz Band

Challenge Launch Date	August 16, 2019
Challenge Deadline	September 13, 2019
Challenge Statement	With increased traffic demand on cellular networks additional spectrum is needed. Ericsson is interested in exploring the potential of utilizing the 6GHz licensed exempt spectrum with LTE and 5G technology. Ericson is interested in analyzing the two most popular methods for coexistence of radio devices in licensed exempt spectrum: energy detection and preamble signal detection.
Project Partner	• Ericsson Canada Inc.
Timeline	• 2 years
Available funding	• $150 000 • Maximum $136 364 for project costs • Maximum $13 636 for Institutional Overhead (10% of project costs)
Applicant Type	• Ontario based College or University
Location	• Work would be completed at the Applicant Institution with some travel to Ottawa to work with the Ericsson team at their facility in Kanata.
Project Details	• Because of the ever-growing traffic demand in cellular networks additional radio spectrum for mobile communication is needed. With the amount licensed radio spectrum being limited, 3GPP started investigating the use of license-exempt spectrum with LTE and 5G technology. • Termed 6 GHz band, several countries are studying if the 5.925 GHz to 7.125 GHz band could be made available for license-exempt use. Whereas, use of the 2.4 GHz and 5 GHz license-exempt spectrum has been dominated by IEEE 802.11 Wireless LAN (Wi-Fi), the new 6 GHz spectrum is a greenfield band that many dissimilar technologies will occupy as soon as the band becomes accessible. • When operating in license-exempt spectrum, radio devices need to employ coexistence mechanisms that help to efficiently share the

	spectrum among their own and dissimilar technologies to reduce the interference that may cause a radio communication signal to fail. • One such mechanism is Listen-Before-Talk (LBT) that senses the radio channel for other transmissions. If found, a device defers from occupying the radio channel since multiple, simultaneous transmissions cause interference. • To avoid such interference, it has been proposed that devices could defer from transmitting if the energy that exceeds a certain threshold is detected in the radio channel. (energy detection method for coexistence) • A different mechanism, the preamble detection method for coexistence, is used in IEEE 802.11. IEEE 802.11 devices which search for the IEEE 802.11 'preamble signal'. When an IEEE 802.11 device detects an IEEE 802.11 preamble signal the device behaves more carefully and act less aggressively. However, the IEEE 802.11 preamble signal can be easily missed as this method of coexistence has not been improved upon in the 20 years since it was developed. • Various entities have claimed that coexistence between dissimilar technologies would be improved if all technologies operating in the 6 GHz band were forced to implement the IEEE 802.11 preamble signal. However, this idea has been disputed because of limits to the preamble's robustness and detectability. Since today's networks are much more dense and employ many more devices than when this method was developed at the end of the last century, Ericsson is interested in working with an academic partner to determine if the preamble signal method of coexistence meets modern needs. •
Project Goals/ Outcomes	The successful academic team is expected to: Analyze if the IEEE 802.11 preamble helps to improve coexistence in a modern context. Develop a flexible solution that will generate the IEEE 802.11 preamble under various conditions. E.g., the presence of background noise or previously unused settings • Analyze the behavior of 10-15 commercially available IEEE 802.11 devices and assess their sensitivity to the preamble. • Assess how often devices trigger a deferral based on the preamble resp. on exceeding the energy detection threshold. • Analyze if the efficiency of IEEE 802.11 networks improves if the preamble is omitted resp. if energy detection is performed at thresholds different from today's settings. Through statistical evaluation and big data analysis, correlations shall be revealed. • The project will also analyze preamble vs energy detection behaviour of commercial IEEE 802.11 nodes for;

	○ Rate-dependent compliance of the selected units to IEEE 802.11 standards and regulatory compliance guidelines ○ Investigate concurrent behaviour of multiple devices regarding fair sharing of the spectrum ○ Investigate commercial IEEE 802.11 nodes under structured interference • The project will results in a set of recommendations for for future deployments and the settings selection.
Applicant Capabilities	• Team should have prior experience working with wireless technologies, specifically 802.11 and 3GPP • In addition, the team should have expertise in the following areas; ○ Excellent programming skills ○ FPGA programming experience ○ Experience working with software defined radios ○ Developing applications on software defined radios ○ Working with 3GPP and 802.11 equipment ○ Excellent understanding of statistical analysis and big data techniques ○ Excellent Test automation expertise ○ Expertise working with various lab equipment including but not limited to spectrum analyzers, SDR platforms, VNA, etc. ○ Good hardware development expertise ○ Good experience working with linux and windows • The team should have access to high quality calibrated lab equipment; Software defined radio platforms, spectrum analyzers, protocol analyzers, power meters, VNA, high end PCs, anechoic chambers, programmable RF generators, automation equipment, etc.
Additional Information	• NA

Launched in 2018, the ENCQOR 5G Academic Technology Development Program partners Ontario based Researchers with ENCQOR 5G Anchor Firms on 5G technology development projects. Areas of research interest are defined by Challenge Statements submitted to OCE by the ENCQOR 5G Anchor Firms and posted to the OCE website on a rolling basis.

If you are interested in developing an expression of interest, please visit the program guidelines for information on next steps.

For any questions about new Challenge Statements or the ENCQOR 5G SME Technology Development Program please contact Sarah Fairlie at sarah.fairlie@oce-ontario.org'