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PRESS RELEASE

5TONIC Labs and Telefónica Successfully Test Cohere Technologies' 5G turboConnect™ Fixed Wireless Access

Cohere Technologies demonstrates near six-fold improvement in spectral efficiency in live trials that confirm the suitability of OTFS to support 5G fixed wireless access

SANTA CLARA, Calif. and MADRID — March 26, 2018 – 5TONIC Labs, Telefónica, and Cohere Technologies today announced that the companies have cooperated in successful trials to test Cohere Technologies' new 5G turboConnect™ Fixed Wireless Access (FWA) solution.

The solution uses Cohere's patented OTFS modulation to deliver broadband access to urban, suburban, and rural environments. Based on the results of these tests, Cohere's spectral efficiency was proven to be nearly six times better than other solutions, providing unprecedented coverage and capacity at a fraction of the cost of fiber or alternative technologies.

The tests, conducted over three days at 5TONIC Labs and Telefónica headquarters, were designed to demonstrate high spectral efficiency via joint equalization and linear scaling. In the tests, Cohere achieved aggregated throughput of 300 Mbps in 10 MHz, with a measured spectral efficiency of 57 b/s/Hz across 14 layers in a 90 degree sector, clearly demonstrating the industry-leading capabilities of Cohere's 5G turboConnect access platform and its ability to deliver impressive performance under real world conditions.

Summary of Test Results from Telefonica Campus Trial (14 layers)		
Aggregated throughput	300 Mbps in 10 MHz	TDD - Duty Cycle 50/50
Traffic Usable Spectral efficiency	57 b/s/Hz	in a 90 degree sector

**Complete test results available in Appendix 1.*

The tests also showed 5G turboConnect enables capacity to scale linearly with antenna layers and channel bandwidth, making it applicable to a variety of fixed and mobile broadband use cases.

“The objectives of the tests were to show the spectral efficiency based on measured throughput, and evaluate coverage, the role of interference, peak data rates, linear scaling with MIMO order, real time processing, and the ability to scale. These are key performance indicators required for a successful deployment of Fixed Wireless Access service,” said Arturo Azcorra, vice-chairman, 5TONIC. “We are very happy with the results obtained, that clearly improve on those obtained with other technological solutions. We look forward to continue cooperating with Cohere in the testing of its OTFS solutions, both for FWA applications as well as for other use cases, such as ultra-reliable communications and connections with high-speed vehicles.”



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Introduced at Mobile World Congress 2018 in February, Cohere's 5G turboConnect leverages standard architecture and components to implement a state of the art software-based cloud RAN solution. This reduces total cost of ownership and enables the operator to quickly deploy services. The new Massive MU-MIMO Antenna technology produces 10X capacity of LTE per cell, with 100% coverage and 100% spectrum re-use. It is interference resilient and provides uniform SLA across cell. An entirely new multi-dimensional modulation, OTFS overcomes the inherent issues of wireless transmission far more effectively than the current modulations (e.g., OFDM, and CDMA) to dramatically increase bandwidth and coverage.

The tests conducted by 5TONIC were designed to assess the suitability of OTFS based radio equipment for supporting fixed wireless access, a potential 5G use case that Telefónica and other operators are actively exploring. 5TONIC administered tests over three days where several links with different lengths and propagation conditions were established at two different locations: the 5TONIC lab, and Telefónica headquarters at Distrito Telefónica.

"The true star of these tests is OTFS, proving once again the technology delivers a guaranteed high capacity link under any conditions," said Shlomo Rakib, Chief Executive Officer at Cohere Technologies. "Working with Telefónica and our 5TONIC partners, we were again able to demonstrate in a real-world scenario how OTFS is an ideal candidate for 5G and beyond, achieving spectral efficiency nearly six times better than any other competing solutions. With this milestone, Cohere continues its successful track record of demonstrations and trials, completed in cooperation with a broad range of operators around the world."

ABOUT 5TONIC

5TONIC was initiated by Telefónica and IMDEA Networks Institute with a clear vision to create an open research and innovation ecosystem laboratory in which industry and academia come together to boost technology and business innovative ventures. The laboratory promotes joint project development, joint entrepreneurial ventures, discussion fora, events and conference sites, all in an international environment of the highest impact. 5TONIC serves to show the capabilities and interoperation of pre-commercial 5G equipment, services and applications, by leading global companies in the 5G arena.

ABOUT TELEFÓNICA

Telefónica is one of the leading telecommunications companies in the world in terms of on stock market valuations and number of clients. Supported by state of the art fixed, mobile and broadband networks, together with an innovative offer of digital services, the company is transforming itself into a "Digital Telco", positioning the company very favorably when it comes to satisfying client needs and capture growth in new revenue and market opportunities. Present in 21 countries and with a total client base of 329 million accesses, Telefónica has a strong presence in Spain, Europe and Latin America which are the main areas in which the company concentrates its strategic development and growth.



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ABOUT COHERE TECHNOLOGIES

Cohere Technologies is solving the most pressing challenges in wireless communications with its groundbreaking Orthogonal Time Frequency and Space (OTFS) technology. This new patented 2D modulation scheme will revolutionize the industry as it prepares to deliver on the promise of 5G with 100 percent coverage, 10x spectral efficiency and a 50 percent cost savings over existing solutions. Carriers around the world are testing OTFS and 5G turboConnect for fixed wireless access and 5G applications. Founded in 2009, Cohere Technologies is headquartered in Santa Clara, California. The Company completed A, B and C financing rounds and is led by a seasoned team of telecom and wireless industry veterans. Cohere Technologies is a 5TONIC member since 2016. For more information visit www.Cohere-Technologies.com.

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Appendix 1:

Complete Test Results: Trial at Telefónica Campus					
<ul style="list-style-type: none"> - Deployed Cohere Technologies' 5G turboConnect FWA uplink system at Telefonica HQ campus - Demonstrated spectral efficiency across eight 2x2 MIMO beams - Mix of LoS and nLos links within 300m, many reflections and long delay spread - Test focus on Uplink spectrum efficiency 					
Operational Specs					
BW: 10 MHz Channel	TDD Schedule: 50/50	DFE enabled	Sector of 90 degrees	QAM 64 to 256	Duty cycle 50/50
12 Layers performance					
Aggregated throughput	261 Mbps		in a 90 degree sector		
Traffic usable Spectral efficiency	52 b/s/Hz		in a 90 degree sector		
Raw spectral efficiency	$(4 * 7 + 8 * 8) = 92$ b/s/Hz		in a 90 degree sector		
14 Layers performance					
Aggregated throughput	285 Mbps		in a 90 degree sector		
Traffic usable Spectral efficiency	57 b/s/Hz		in a 90 degree sector		
Raw spectral efficiency	$(4 * 6 + 6 * 7 + 4 * 8) = 98$ b/s/Hz		in a 90 degree sector		