



TV WHITE SPACE

HIGH-SPEED INTERNET OVER LONG-DISTANCES FROM JUST ONE ACCESS POINT!

+ WHAT IS LETI'S TV WHITE SPACE DEMONSTRATION?

Leti's demonstration shows a wireless-network solution based on TV White Space technology that provides broad coverage indoors and outdoors: up to 64 km range in open spaces.

This demonstration is the first one implementing the IEEE 1900.7 standard for a wide-area, wireless network.

+ WHAT IS TV WHITE SPACE?

TV White Spaces (TVWS) are portions of the spectrum made available for unlicensed use at locations where the spectrum is not being used by licensed services, such as television broadcasting.

- The technology is authorized in the U.S., the UK, Japan, Singapore, Canada and Brazil. Trials have been conducted in these countries, as well as India, South Africa, Ghana, Botswana, Namibia, Tanzania and Kenya.
 - The new IEEE 1900.7 standard allows exploitation of TVWS, making Internet traffic possible without interfering with TV reception quality.
 - Leti has been an active contributor to the IEEE 1900.7 standard, which will be published in 2016.
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- This technological innovation extends the local network coverage (house, garden, campus, Internet access, local radio broadcast) and lowers the level of emitted power.
 - Deploying this technology is simple and inexpensive thanks to the low number of access points needed to cover a large geographical area compared to WiFi.
 - TVWS technology operates in unlicensed bands.
 - TVWS is a standardized solution, compliant with regulation.

+ APPLICATIONS

Primary applications for this invention include:

- Rural broadband access, in particular in sparsely populated communities where DSL is not widely deployed (>10 km range with rooftop antennas) ①
- Ubiquitous access to communication networks in developing countries
- University campuses / industrial hot spots (typically a 1 km range in urban areas) ②
- Public or advertisement information broadcasting
- Small-scale corporate or extended home networks (indoor / outdoor) ③

① Rural broadband access



Many people living in rural areas do not have access to high-bandwidth services. TVWS technology could close the digital divide thanks to a low CAPEX infrastructure.

② University campuses, industrial hot spots



In places like university campuses, a lightweight infrastructure of outdoor TVWS access points can cover buildings and outdoor areas, providing low-cost broadband Internet access.

③ Small-scale corporate or extended home networks (indoor/outdoor)



Thanks to the wall-penetrating capability of UHF signals, the TVWS local access point located in the building provides indoor and outdoor coverage.

+ HOW DOES IT WORK?

Using a transceiver designed by Leti, the innovation is an advanced non-orthogonal waveform filter bank multicarrier (FBMC) technology also designed by Leti. It enables flexible usage of the spectrum and excellent adjacent-channel interference control. The CES demonstration is the first worldwide implementation of this new modulation used in the IEEE 1900.7 standard. The demonstration also shows how FBMC technology outperforms classic broadband multicarrier technology (OFDM).

KEY FIGURES:

- Channelization minimum / maximum: 2 MHz / 40 MHz
- Able to select any configuration of 2 MHz on / off channels in a 40 MHz window
- FCC regulatory constraint: Adjacent Channel Leakage Ratio (ACLR) >55 dBc
- Implementation footprint only 30% larger than OFDM counterpart

FBMC compared to OFDM:

Propagation condition	FBMC 36dBm	CP-OFDM 27dBm
Urban*	0.93 km	0.53 km
Suburban*	1.56 km	0.89 km
Free Space Loss	63.72 km	22.61 km

*Okamura-Hata model

In channels adjacent to incumbent users such as TV broadcasters, FBMC TV White Space coverage can double the reach of classic OFDM systems. For instance, IEEE 1900.7 can deliver 20 Mbps at 1,400 m in suburban environments (considering 4 W TX power and BER=10⁻³ at the receiver).

INTERESTED IN THIS TECHNOLOGY?

IEEE 1900.7 is the first wireless standard based on FBMC modulation, which has been identified as a candidate for future 5G cellular technologies. Leti has proven skills and deep background in efficient hardware implementation of advanced modulation modems, such as FBMC. For example, Leti is studying multiple-antenna processing (MIMO) to increase data rates.

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