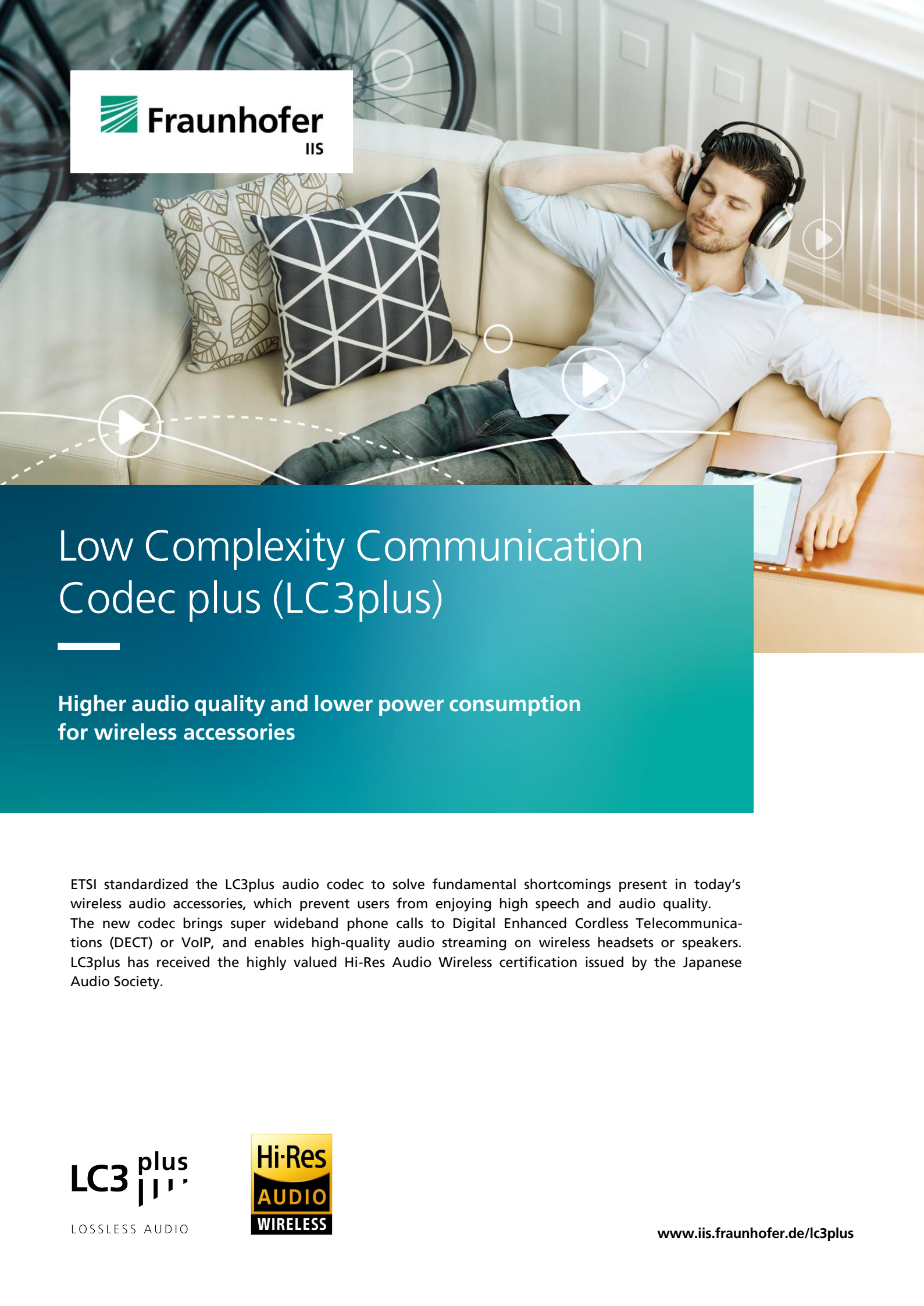




Low Complexity Communication Codec plus (LC3plus)

**Higher audio quality and lower power consumption
for wireless accessories**

ETSI standardized the LC3plus audio codec to solve fundamental shortcomings present in today's wireless audio accessories, which prevent users from enjoying high speech and audio quality. The new codec brings super wideband phone calls to Digital Enhanced Cordless Telecommunications (DECT) or VoIP, and enables high-quality audio streaming on wireless headsets or speakers. LC3plus has received the highly valued Hi-Res Audio Wireless certification issued by the Japanese Audio Society.

Low Energy, Low Latency, High Quality

LC3plus features operation modes ranging from medium bit rates for optimal voice transmission to high bit rates for high-resolution music streaming services. At the same time, the codec operates at low latency, low computational complexity, and low memory footprint. By reducing the required bit rate by roughly 50 percent compared to legacy codecs for wireless platforms and accessories, LC3plus paves the way for low-energy services that prolong battery life and facilitate the creation of smaller products. Ultra-low-delay modes down to 1.25 ms suit applications such as gaming, while LC3plus Lossless mode enables to seamlessly switch between lossless and High-Resolution depending on the available bandwidth.

High-resolution & Lossless Streaming

With its dedicated high-resolution and lossless audio mode, LC3plus provides an audiophile level transmission link of up to 24 bit and 192 kHz audio data. Depending on content and bitrate, LC3plus Lossless dynamically delivers the best possible quality per frame – either fully lossless or high-resolution – automatically making the most of the available bitrate.

Switching between the two happens seamlessly and is inaudible to the listener. It achieves best-in-class Signal-to-Noise (SNR) ratio and Total Harmonic Distortion and Noise (THD+N) values. Thus, LC3plus is the ideal codec to bring high-transparency audio streaming to high-quality and high-resolution wireless devices such as headsets or loudspeakers. LC3plus High-Resolution is certified for the Hi-Res Audio Wireless logo of the Japan Audio Society (JAS). The Lossless mode of LC3plus also fulfills the requirements of this certification.

Advanced Transmissions Robustness

A powerful concealment for packet losses and bit-errors is crucial in wireless transmission environments like Bluetooth and DECT. LC3plus includes an Advanced Packet Loss Concealment (APLC) algorithm, which significantly improves audio quality in error-prone conditions. APLC can conceal packet losses for speech, music, and even high-resolution content.

The LC3plus channel coding was specifically designed for DECT channel characteristics and facilitates the transmission of LC3plus payloads over heavily distorted DECT channels.

Both features enable wireless connections without interruption, even if the wireless receiver is far away from the sending device. In addition to APLC, the codec ensures high robustness with a special low-bitrate fallback mode: LC3plus provides an excellent performance at 64 kbps, while the sweet spot to achieve the best SNR and THD+N is between 125 and 250 kbps.

Open Standard

LC3plus has been standardized by ETSI as TS 103 634, making it the first and only open standard to provide the quality of high-resolution music streaming services also over wireless accessories. This in turn allows manufacturers to remain independent from proprietary, vendor-specific technologies. The technology is included in the 2019 DECT standard and brings super-wideband speech quality to DECT. The ETSI TC Speech and Multimedia Transmission Quality recommends LC3plus for global deployment in DECT and VoIP applications (TS 103 624).

Availability

LC3plus software is available from ETSI and Fraunhofer, which provides implementations for dedicated platforms like ARM or HiFi. For the licensing of the Fraunhofer LC3plus software copyright and Fraunhofer patents please contact lc3-licensing@iis.fraunhofer.de.

High Resolution Audio streaming over the Bluetooth A2DP profile is supported by LC3plus. Fraunhofer offers a specification for use of LC3plus High-Resolution as a vendor-specific codec via Bluetooth A2DP. Please scan the code to access the technical paper for more information. Upon request, Fraunhofer also provides Android patches to enable the usage of LC3plus High-Resolution via Bluetooth A2DP.



Contact

Fraunhofer Institute for Integrated Circuits IIS

Management of the institute	Mandy Garcia
Prof. Bernhard Grill (executive)	Phone +49 9131 776-6178
Prof. Giovanni Del Galdo	lc3-licensing@iis.fraunhofer.de
Prof. Albert Heuberger	www.iis.fraunhofer.de/lc3
Prof. Alexander Martin	www.iis.fraunhofer.de

Am Wolfsmantel 33
91058 Erlangen, Germany
Phone +49 9131 776-0
info@iis.fraunhofer.de