

Assessment Of Temporal Uplink Emitted Power Variation For VoLTE Calls

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Exposure, VoLTE, Temporal,

1 Abstract

Voice over LTE (VoLTE) is a technology used by operators to offer voice calls over LTE technology. In this study the temporal variation of power emitted by UE during a VoLTE voice call is investigated through measurements in a human exposure point of view. The effect of Semi-Persistent-Scheduling (SPS) and voice activity detection (VAD) algorithms on emission duration is assessed and the temporal occupation rate of the uplink emitted power of UE during a VoLTE call is presented.

2 Introduction

People now use their mobile phone for a large variety of uses such as browsing, checking emails, social media, streaming etc., however, voice communication stays as one of the main mobile phone uses. Voice over IP (VoIP) applications such as Skype and WhatsApp have become very popular since they can be used on mobile phones. Since LTE systems only support packet services, the voice service will use Voice over LTE (VoLTE) other than classical circuit-switched voice technology as in GSM and UMTS. Despite the wide use of smartphones, public concerns exist about the mobile phone EMF exposure during wireless calls. Regarding voice calls, the exposure depends on various parameters such as the design of the mobile phone, the position of the mobile phone and its antenna according to the head and the emitted power of the device during a voice call. The influence of the design of the mobile phone, as well as the effect of the position on RF exposure, has been carried out in previous studies[1]. The emitted power by users equipment (UE), however, is a highly variable parameter that depends on the technology and algorithms through which voice communication is performed such as power control algorithms, voice activity detection (VAD), compression and encapsulation algorithms, conversation rate, distance from the base station etc.[2] In this study, the temporal variation of emitted power and UE during a 6 minutes VoLTE call is studied.

3 VoLTE

VoLTE is a packet switching IP based technique allowing high-quality voice calls and simultaneous data and call transfer. Since VoLTE is a native LTE application, it has the luxury to guarantee the physical resources block (PRBs) allocation to achieve an acceptable quality of service. Semi-Persistent-Scheduling (SPS) is a method used in LTE to minimize granting overhead for real-time applications such as voice calls. It takes advantage of the consistent and predictable transmission pattern of VoLTE packets (constant periods, predictable number of packets etc.) to make a persistent grant of uplink PRBs rather than scheduling the user in every cycle. A VoLTE call can be in two different states: the active state where the voice activity detection (VAD) algorithms detects the existence of voice/sound and UE sends packets in a fast frequency and the idle state during which VAD algorithms do not detect any voice/sound and the UE transmit power in a lower frequency.

4 Methods and materials

In order to characterize the power emission and emission time during a voice call, a series of measurements have been performed in an indoor urban office environment. The measurements have been performed at the 1800 MHz frequency band for LTE. A Nemo Handy handheld trace mobile solution[3] installed on a Sony Xperia XZ Premium mobile phone has been used in order to monitor and record network parameters while connected to a French commercial cellular network operator and is placed in cheek position to a SAM head full of absorbent liquid and an absorbent dummy hand. An antenna has been mounted near the trace mobile phone in order to perform relative measurements of the time variation of the emitted power and a Tektronix TDS6124C Digital Storage Oscilloscope is used to monitor and store the emitted power variation by mobile phone during a trial. The distance between the receiver antenna and the trace mobile is 2 cm. Figure 1 illustrates the measurement configuration.

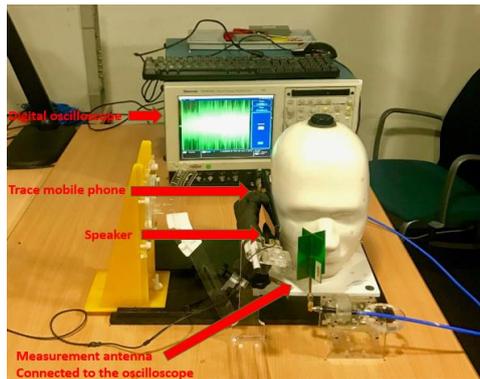


Figure 1, Measurement configuration

A 6 minutes voice speech file has been prepared which is a collection of multiple pieces of randomly chosen French audiobooks. The conversation rate of the audio file is 60%. During the measurement, the speech file has been played through a speaker, placed near the trace mobile microphone. The entire system has been caged by wave absorbents during the measurements in order to minimize the environmental noise. The sampling rate of the oscilloscope is 20kS/s.

5 Results and discussion

Measurement results performed by oscilloscope show that in active state, the UE transmits every 20 ms and in idle state every 160 ms. (figure 2). During 6 minutes of VoLTE call, UE transmits power, 4% of the time in speech mode and 0.6% of the time in silent mode.

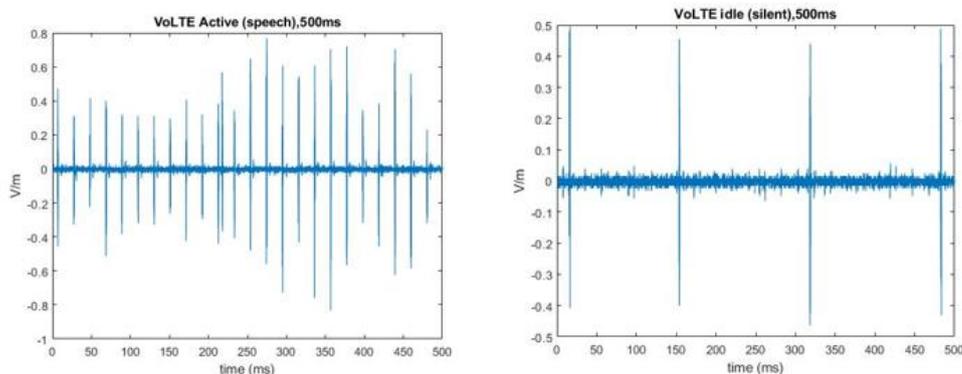


Figure 2, UE emitted power variation during 500 ms call for idle and active states

The duration of each transmission is 1ms. These results demonstrate that in case of VoLTE calls, the temporal variation of uplink emitted power is different from the temporal variation of uplink emitted power in data mode. In case of voice calls, the emission power frequency is fixed and the UE does not transmit power most of the time.

It should be noted that the frequency of power transmission in active and idle states is defined by network and can be different from one operator to another.

These results are especially interesting, in case of using trace mobile phones to assess the emitted power by UE. Since Trace mobile phones, report the emitted power in a once or twice per second, these results can help to assess the total power transmission duration and average emitted power over time correctly. The assessment of the temporal variation of uplink emitted power for other technologies and VoIP applications will be investigated in future.

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