Phonak Insight

roger

Roger Technology

Roger – digital adaptive wireless at 2.4 GHz

Roger – digital adaptive wireless at 2.4 GHz Roger is a technology standard developed by Phonak, which features adaptive, wireless transmission and runs on the 2.4 GHz band. Roger audio signals are digitized and packaged into very short (160 µs) digital bursts of codes (packets) and broadcast several times, each time using different channels between 2.4000 and 2.4835 GHz. Frequency-hopping between channels, in combination with these repeated broadcasts, avoids interference issues. The latency in Roger is just 12.8 ms. Roger systems are also tap-proof, ensuring the privacy of a user's signal is not compromized, even by accident.

The frequency-hopping which Roger employs is adaptive, meaning only free channels are used. Roger transmitters regularly sense all the 40 channels, informing the system of which channels are steadily occupied (by other nearby systems operating at 2.4 GHz, such as WiFi networks) and which channels are free. The transmitter then automatically 'hops' around the occupied channels (see Figure 1). This means that even if there is a lot of traffic at 2.4 GHz, the interruption or loss of a Roger connection is highly unlikely.

In comparison, Bluetooth wireless technology only repeats its packet broadcasts at the demand of the receiver, or employs repetition if using the SCO protocol. If acknowledgement of a packet's reception does not arrive at the Bluetooth transmitter, the packet is broadcast again. As a result, Bluetooth receivers are almost continuously transmitting back to the transmitter, which significantly increases a receiver's power consumption.

With Bluetooth, the maximum number of receivers is limited to three. Therefore, even two listeners with binaural ear-level Bluetooth receivers cannot listen to the same Bluetooth stream, let alone larger groups. In the Bluetooth headset protocol the latency is acceptable (10 to 15 ms), however, the audio bandwidth is often limited (up to 4 kHz), unless the 'wideband audio' feature of the hands-free profile version 1.6 is used, which can go up to 7 kHz. In the Bluetooth audio streaming protocol, A2DP, the bandwidth increases to 20 kHz, but the latency of well over 100 ms prevents this from being suitable for live face-to-face communication. Only with special Bluetooth chips on both ends can this delay be reduced, to around 40 ms.

Roger offers a full audio frequency bandwidth – from 200 Hz to 7,300 Hz. The system's internal signal-to-noise ratio is around 55 dB, making background noise very quiet. With Roger, it is not only possible to transmit an audio signal, but also to transmit and receive control data – when setting up and/or maintaining a MultiTalker Network for example.

Electromagnetic waves at 2.4 GHz have a wavelength of about 12.5 cm/5". This enables the design of new, small wireless transmitters containing short built-in antennas. At 800 MHz the wavelength is 37.5 cm/15" and at 200 MHz (in the traditional FM frequency range) the wavelength is 1.5 m/4.9 ft, which requires the external microphone cable to also act as the radio's antenna.

As 2.4 GHz is a freely accessible band worldwide (a so-called ISM band: Industry, Science and Medical), no license is necessary to use it. This gives Roger users the freedom to use their systems anywhere in the world. Servicing Roger systems while traveling is also simplified, as this standard is the same in each country.

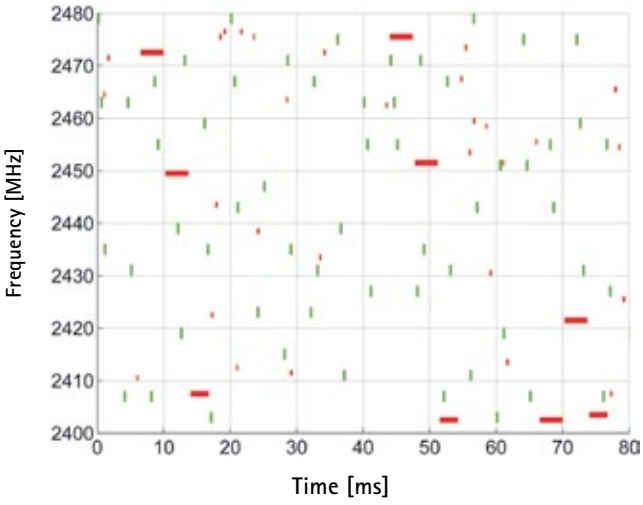

Figure 1
Time and frequency diversity of Roger codes (packets). On the vertical axis the frequency within the 2.4 GHz band is shown, while the horizontal axis shows time. By hopping frequencies and repeatedly broadcasting audio packages, collisions causing mutual interference are minimized.

The Roger chip

Phonak has developed the proprietary Roger microchip for dedicated use with miniaturized ear-level receivers (see Figure 2). This chip contains 6.8 million transistors, while a Pentium Pro processor by comparison contains 5.5 million. On the chip, analog and digital blocks are situated next to RAM, ROM, EEPROM and Flash memory blocks.

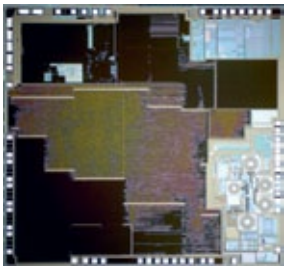

Figure 2
The Roger microchip.