Operational Description

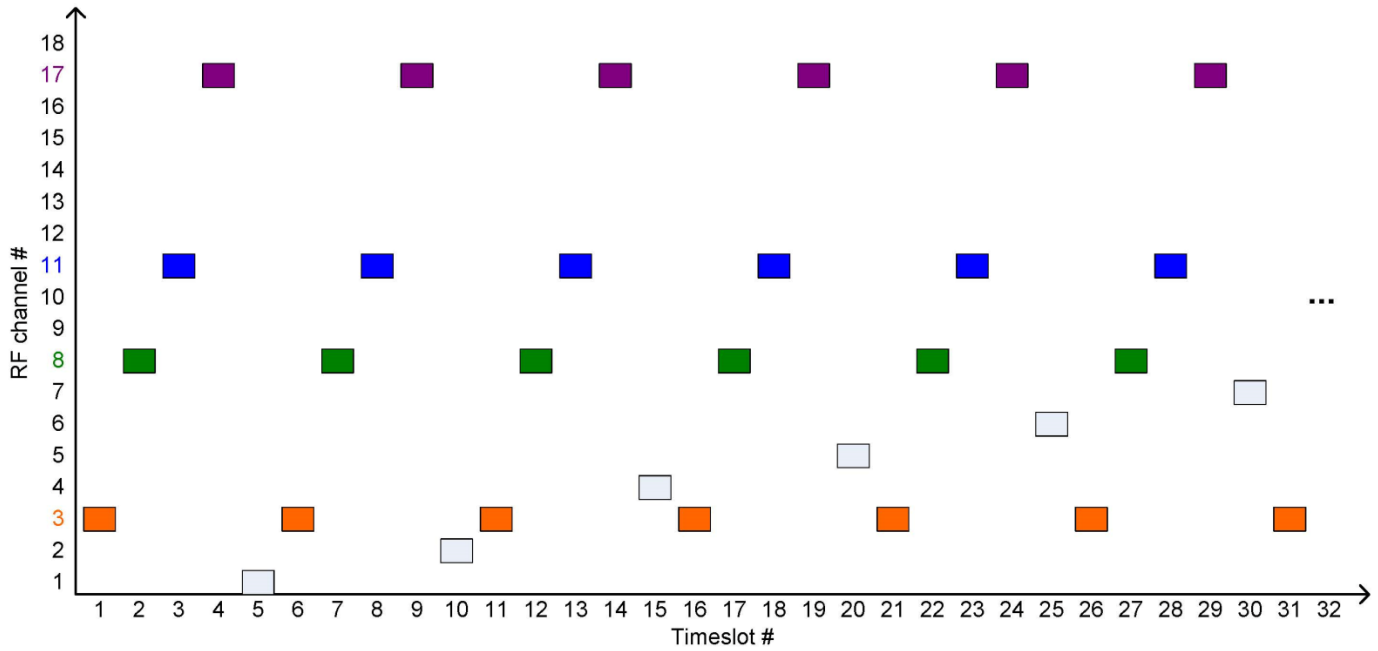
The EUT radio is a CC8520 PurePath Wireless device which includes all the circuitry required to determine and stabilize the operating frequency. It uses a 48MHz external crystal and an integrated frequency synthesizer to generate any frequency in the range of 2400-2483MHz. This frequency generation can be done with 1MHz step size. The radio uses proprietary baseband processing with shaped-8FSK modulation at a 2 MHz symbol rate using a rate-5/6 4D trellis coded modulation scheme to achieve a 5 Mbps raw data rate.

The radio uses an adaptive frequency hopping scheme. PurePath Wireless divides the 2.4 GHz band into 18 RF channels with 4 MHz bandwidth. The protocol master (receiver) controls the adaptive frequency hopping scheme for the audio network, and maintains a table with an entry for each RF channel and an associated quality-of-service (QoS) estimate for each. Each time an RF channel is used the QoS estimate is updated based on what happens during the timeslot.

The frequency hopping algorithm separates the 18 RF channels into two sets:

- A set of 4 active channels
- A set of 14 trial channels

The active channel set contains the preferred RF channels that have proven that they provide sufficiently good quality-of-service. The trial channel set contains the remaining RF channels that are only evaluated occasionally in order to be able to maintain an accurate picture of their quality-of-service. If the QoS estimate of an RF channel in the active set goes beyond a minimum threshold this channel is swapped out with the RF channel in the trial channel set that has the best QoS estimate. Other factors play in when selecting a new RF channel to the active channel set, such as trying to maintain a certain minimum distance in frequency between the different active channels.



Example of AFH hop sequence (active set in color, trial set in black/gray)

The frequency hopping algorithm, when using all 18 channels and no swaps between the active and trial channel sets occur, goes through a sequence of 70 hops over the course of which every RF channel has been used.

This 70-hop macrosequence consists of 14 repetitions of a

- 5-hop microsequence during which
    - Each of the four active RF channels are used once
    - One of the trial RF channels is used once
      (cycling through all trial channels over the course of a macrosequence)

This gives an average steady-state RF channel usage of:

- Each of the four active channels are used 20% of the time
- Each trial channel is used 1.43% of the time

The two main mechanisms that allow a PurePath Wireless system to co-exist amicably in close proximity to other 2.4 GHz radio systems (including other PurePath Wireless networks) are:

- The adaptive frequency hopping scheme described above that ensures that RF channels used by other radio systems are avoided
- Listen-before-talk mechanism that measures energy in RF channel before transmitting and avoids transmitting if the channel is already in use

These mechanisms together ensure that other radio systems are minimally impacted by a PurePath Wireless audio network in normal circumstances. However, since a low-latency audio network by its very nature transports a very time-critical data stream, both mechanisms have adaptive thresholds to ensure that the audio network is given its fair share of RF spectrum in very crowded RF environments.

Due to the proprietary nature of the communication protocol and our system's requirement for identification, the audio transmitter can only coordinate with protocol master which controls the particular network.