PHILIPS
WDCT System Enhanced Hopper

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1 SCOPE

The document gives an overview about the Philips WDCT System with Enhanced Hopper. It describes the TDMA structure and the basics of the hopping algorithm used. It refers to the FCC regulations and explains how the FCC regulations are met.

2 WDCT SYSTEM IMPLEMENTATION

2.1 Basics

- 8 Bearer slots per frame at 0.576MBits per sec
- Bearers on fixed slot but frequency agile (hopping)
- ID dependent hopper 95 frequencies
- Synchronization randomly selects frequency and tries all slots

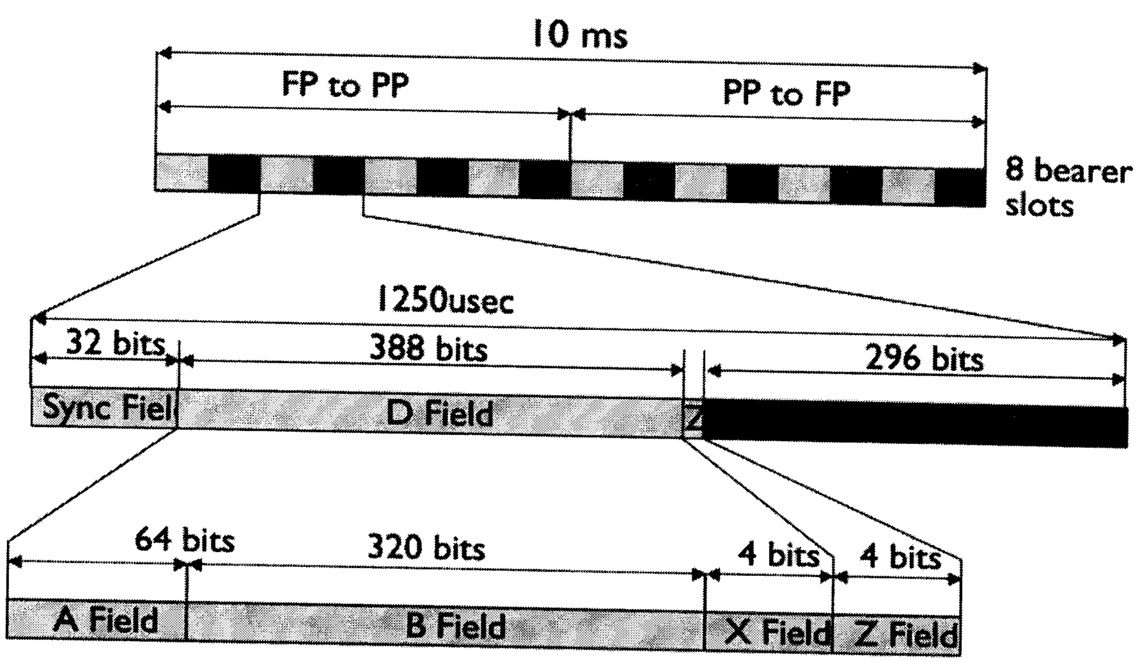

Fig.1 WDCT Frame structure

2.2 WDCT Frame Structure

A regular TDMA is used. The frame structure is repeated every 10ms, corresponding to 5760-bit duration.

- The basic slot structure is extracted from DECT P32 slot.
- Those fields in the slot structure are similar to the DECT specification.

3 HOP SEQUENCES

3.1 General description

Each system, comprising a BS and its associated HSs, is given the specific value of an identity value during manufacture, this value is specific to one system only. This value is used by the algorithm to generate hopping sequences that are used by this specific system. There is a 95 element sequence generated.

The 95 element sequence is used for all dummy bearers transmitted by the BS and for setting up all traffic bearers.

The hopping sequences are generated in such a way that the elements are random in both distance from each other and in the direction from each other.

When a BS transmits it uses one entry from the sequence in each frame in a cyclic manner so that once the end of the sequence is reached, the first element is taken again and so on. This means that over time each entry in the sequence will be used equally.

Each slot in the same frame is separated from the previous slot by one entry in the sequence.

Because the BS and the HSs in a system have the same identity value they generate identical sequences, so that once a HS has made a reception from the BS on any element in the sequence it can follow the same sequence and maintain synchronisation.

Because each system only knows the identity of its own hopping sequence identity and not any other system values it cannot predict other hopping sequences and so it does not have the ability to be coordinated with other FHSS systems.

3.2 Hop sequences

To generate the hop sequence a 'Frequency Picking' approach is used. Hop frequencies are picked one at a time from those available and appended to the partially formed sequence. The way in which hop frequencies are picked and appended is dependent on the given ID. The proprietary algorithm used guarantees that:

- All 95 frequencies are always used in 1 hop sequence
- A minimum hop distance is guaranteed
- A good random spread over all channels is guaranteed

Example of the hopping sequences:
95 element sequence: (70, 57, 37, 30, 24, 7, 65, 42, 34, 81, 91, 21, 5, 38, 85, 54, 68, 20, 6, 92, 50, 32, 14, 58, 40, 2, 79, 67, 15, 41, 73, 55, 93, 47, 29, 80, 11, 89, 71, 19, 59, 77, 9, 53, 90, 0, 83, 36, 62, 18, 43, 27, 72, 66, 8, 44, 22, 74, 88, 63, 48, 26, 75, 82, 3, 39, 28, 45, 86, 60, 16, 25, 76, 51, 31, 13, 94, 78, 46, 64, 23, 4, 12, 84, 52, 61, 35, 1, 17, 69, 56, 10, 49, 87, 33)

4 FCC REGULATIONS

1. section 15.247(a):

describe how the EUT meets the definition of a frequency hopping spread spectrum system, found in Section 2.1, based on the technical description.

- pseudo random frequency hopping sequence: describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, in order to demonstrate that the sequence meets the requirement specified in the definition of a frequency hopping spread spectrum system.

  - see 3.2 Hop sequences

- Equal hopping frequency use: describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g., that each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event).

  - The hop sequence does not contain any hop channel more than once. This ensures that the chosen 95 frequencies are used evenly as required

- System receiver input bandwidth: describe how the associated receiver(s) complies with the requirement that its input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.

  - A band pass filter is implemented on the RF side with pass band of the ISM band. The filter is fixed implemented in the transceiver IC (uaa3548) used

- System receiver hopping capability: describe how the associated receiver(s) has the ability to shift frequencies synchronization with the transmitted signals.

  - A fixed frequency hopper dependent on the individual base ID is used. The sequence is not changed. The receiver knows the sequence and can follow it (see 3.2 Hop sequences)

2. Section 15.247(g):

describe how the EUT complies with the requirement that it be designed to be capable of operating as a true frequency hopping system.

  - The hopper is using all 95 frequency channels defined for 2.4G ISM. The hopper is using all 95frequency channels only once. The mean time of channel occupation of 30/95 = 0.315 is guaranteed by those means.

3. Section 15.247(h):

describe how the EUT complies with the requirement that it do not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

  - The pseudo random sequence is generated ID based. So every set has an own seuquence.This is guaranteed by simulation done within Philips.