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SiXTEMP Message Timing and Duty Cycle Calculation

OVERVIEW

The SiXTEMP and its Access Point (AP) use an 802.15.4-compliant message protocol which is similar to Zigbee on the physical level. In the RF6 device system, there will be one AP which will serve as the coordinator between all the sensor devices in the system. The AP generates a 5ms beacon every 245.76ms. The spacing between beacons is called a ‘’superframe’. A diagram of the superframe is provided on the following page. Within a superframe, the SiXTEMP and AP have specific windows in which they are allowed to transmit. For both, outside of these windows, the transmitter is off. The SiXTEMP is a sensor device. Within a given superframe a sensor device such as the SiXTEMP can only generate one of two response types: MAC or 6LowPAN. The MAC response is triggered by the beacon. In this case, each sensor has a reserved time slot in which it can transmit its response. MAC responses contain alarm, status, or supervision information. If a sensor device detects a collision (ie it does not receive an ACK from the AP), the response will be retransmitted in a second time slot in the superframe called the transmit retry window. If this is not successful, the sensor will attempt a third retry in the 5mS transmit retry window of the next superframe. Only one sensor can send a 6LowPAN response within a given superframe.

The SiXTEMP utilizes O-QPSK with DFSS modulation in the 2.4GHz band, with a 250kbps data rate.

PROTOCOL AND DATA RATE

TIMING DIAGRAM

A timing diagram is presented on the following page.

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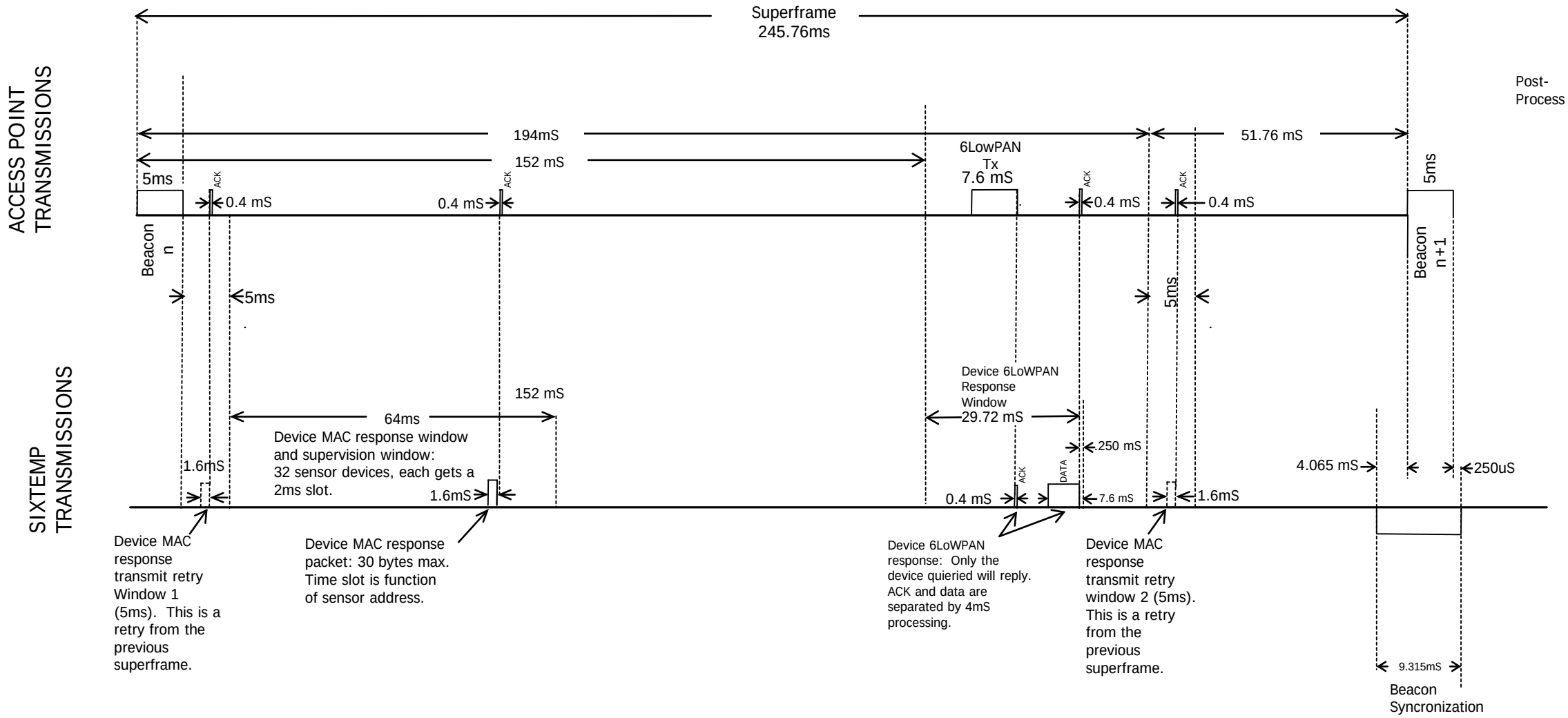
TIMING DIAGRAM

The Access Point (coordinator) generates beacon every 245.76ms (superframe). As shown in the figure, the duration of the beacon is 5ms.



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WORST CASE TRANSMIT TIME WITHIN A 100mS WINDOW

This section is included in support of radiated emissions calculations.

In the worst case, these four RF6 transmissions may occur within a 100ms window:

Alarm Packet: 30 Bytes @ 250 kbps = (30 * 8) * (1 / [250*10^3]) = **960 uS**
Retransmission Packet: 30 Bytes @ 250 kbps = (30 * 8) * (1 / [250*10^3]) = **960 uS**
6LowPan Packet: 128 Bytes @ 250 kbps = (128 * 8) * (1 / [250*10^3]) = **4096 uS**

The Total Tranmit Time is:
Alarm Packet (960uS) + Retransmission Packet (960uS) + 6LowPan Packet (4096uS)
= 960 uS + 960 uS + 960 uS + 4096 uS = **6.976 mS**

Duty cycle for purposes of calculating average radiated emissions is thus 6.976ms/100ms = 6.976%.