**LoRa Calculations**

The Time Symbol equation is:

For example, in case of SF = 8 & BW = 125KHz the Ts is:

The clock frequency of the LoRa block is 128MHz.

In case of SF = 8 & BW = 125KHz the number of clocks in one symbol is:

The 128MHz clock needs to count from 0 until 262144 to complete one symbol,

in case of SF = 8 & BW = 125KHz.

Let’s take a look at the case if SF = 8 and BW = 125KHz:

The range of the AngleAccelerator is derived from the 262144 clocks and is extended by multiplying it by 8.

That results in:

-1048576 <= AngleAccelerator <= 1048576

The number of 128MHz clocks in one cycle of 62.5KHz (Which is 125KHz/2) is 2048 clocks.

Let’s take an example where AngleAccelerator is at its highest value of 1048576:

The AngleAccelerator is divided by 32 and becomes 32768.

Then it is accumulated to wideAngleAccumulated.

wideAngleAccumulated is shifted right by 10, which results in dividing by 1024.

The result is shifted right by 2, which results in dividing by 4.

If we take the AngleAccelerator of 32768 and divide it by 1024 and then by 4, the result is:

32768/ (1024\*4) = 8

In case AngleAccelerator is 1048576, the phase will be:

8,16,24,32….

By doing this, the result of 2048 clocks (2048 clocks in one cycle of 62.5KHz) will generate a phase that changes from 0 to 16384.

By doing this, the result of 2048 (62.5KHz cycle clocks) \* 8 (gap) will give 16384.

The 16384 values vary from -8192 to +8191.

This is the Angle16BitsSigned.

The Angle16BitsSigned goes to the CORDIC sine generator and generates a sine waveform.

The CORDIC sine generator generates a full sine waveform in case the input goes between

-8192 and +8191.

In the case of Symbol 0, LoRa AngleAccelerator at the start of Symbol 0 is:

-(262144/2 \* 8) = -1048576

Then, it changes according to the following formula:

AngleAccelerator = AngleAccelerator + 8

That means that at the end of the symbol 0, it will become: +1048576

In the case of AngleAccelerator = -1048576, the phase frequency will be -62.5KHz.

In the case of AngleAccelerator = 1048576, the phase frequency will be 62.5KHz,

By changing the AngleAccelerator from -1048576 to 1048576, the phase will change from -62.5KHz to +62.5KHz.

This is an example of calculating the edge of the BW = 125KHz.

The actual sine waveform changes between -62.5KHz and +62.5KHz.