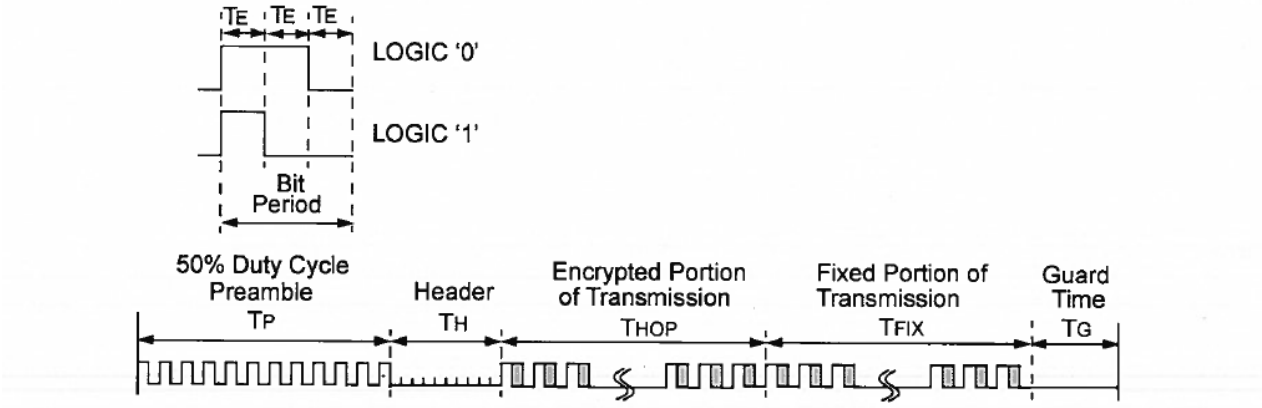
Duty Cycle Calculations

Notes:
• TSSRF115011U is a new SKU. We are applying to add it under FCC ID: CFS8DL5824, IC: 573F-5824.
• 5834-4 is an old SKU which is already certified under FCC ID: CFS8DL5824, IC: 573F-5824. With this application, we want to add encrypted mode transmission under its FCC grant and IC certificate.

Non-Encrypted Mode:
Timing and calculations for the TSSRF115011U in non-encrypted mode are identical to those for the 5834-4 as currently certified under FCC ID: CFS8DL5824, IC: 573F-5824. These calculations were presented for the initial submittal of the 5834-4 device under FCC ID: CFS8DL5824, IC: 573F-5824.

Encrypted Mode:
The transmissions for SKUs TSSRF115011U and the 5834-4 in encrypted mode are identical. Therefore timing and calculations in encrypted mode are the same for both devices. These are given below:

Definitions:
• An inactive data cycle is an 'empty' time period with the same duration as an active data cycle. In an inactive data cycle, there is no data transmitted.
• In an active data cycle, data is transmitted as shown here:



Where:
T_E = 0.102 mS. This is the size of one 'Time Element'.
50% Duty Cycle Preamble = $23T_E$ Total Length with 12 high and 11 low levels.
Encrypted Portion of Transmission = 32 bits = $32*(3*T_E)$.
Fixed Portion of Transmission = 34 bits = $34*(3*T_E)$.
Header = $10T_E$
Guard Time = $15T_E$

A single transmission in the encrypted format is five data cycles in duration. It consists of:
(1) one active data cycle
followed by

(2) four consecutive inactive data cycles.

Calculation of duty cycle uses worst case data content in the transmission in order to maximize duty cycle on-time. This consists of 32 zeros for the encrypted portion and 30 zeros plus 4 ones in the fixed portion of the transmission (4 ones are always transmitted in the fixed portion).
Duty cycle is calculated by dividing the message transmission 'on' time by the total transmission time.

'Total time' & 'on' time for the active data cycle is calculated as follows:

- *Preamble*: Total time = $23*T_E$. 'On' time is 12 high levels = $12*T_E$ (fixed)
- *Header*: Total time = $10*T_E$. 'On' time is 0 high levels (fixed)
- *Encrypted Portion*: Total time = $96*T_E$ encrypted data (32 bits). 'On' time is all logic zeroes or (2/3*32) $*3T_E$ per bit = $64*T_E$
- *Fixed Portion*: Total time = $102*T_E$ fixed data (34 bits$*3T_E$ per bit). Note: 4 bits are always set. 'On' time consists of 4 logic ones and (34-4) logic zeroes. It is thus (1/3*4$*3T_E$ per bit + 2/3*(34-4)$*3T_E$ per bit) = $64*T_E$
- *Guard Time*: Total time = $15*T_E$. Note: 'on' time is 0 high levels (fixed)

Total data cycle time = (23 + 10 + 96 + 102 + 15)*0.102 = 25.1 mS
Total On Time in an active data cycle = (12 + 0 + 64 + 64 +0)*0.102 = 14.28 mS. This is the same as the total on time in a transmission (1 transmission = 1 active data cycle + 4 inactive data cycles).
Total Transmit Time = 5 * data cycle time = 5 *25.1mS = 125.5mS (note since the average power calculations specifies a 100mS maximum period, total transmit time of 125.5mS must be replaced by 100mS).

Therefore the duty cycle for the peak to average power conversion is:

Duty Cycle = [14.28 mS / (100) mS] = 14.28%