Part3Q&A

Q1

在传输过程中每个符号的开始频率不同和结束的频率相同 这个说法是否正确，看起来chirp都是发生了不同的频移
或者是我应该理解为每个Chirp 都是覆盖了整个频率范围（带宽）的
这块没有完全理解

> During emission, the bits are grouped together in packets of **SF** bits. Each packet is represented by a particular symbol among 2^{SF} possible forms. Between symbols, the only difference is that they all start from a specific frequency which represents the packet of bits.
>
> Figure 11 shows a theoretical example of SF2 modulation at 868,1 MHz, with a bandwidth of 125 kHz. Each symbol represents 2 bits.

Q2

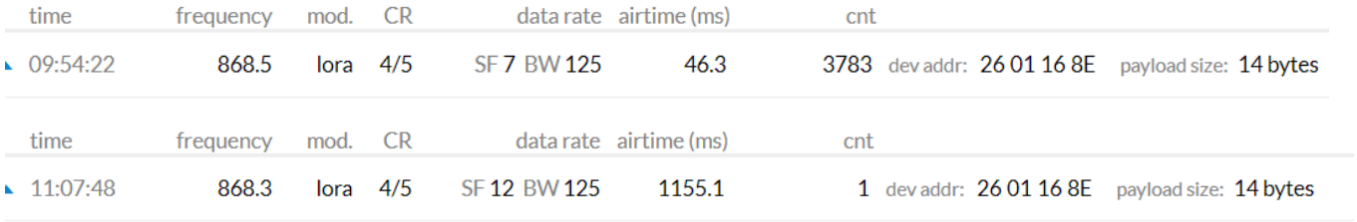
在看到SF详细描述的时候例如SF2 一个symbol一定代表2位，SF3 一个symbol一定代表三位。那么如果我使用SF3，但是我只想发送5bit的数据，他不能被3整除，这种情况怎么处理，能不能发送不完整的chirp呢

,后面的例子里也出现了类似symbol 不是整数的情况

> Exercise: Check the Time on Air value found in Figure 20 (46,3 ms)
>
> Answer: $n_{preamble} = 8$, Payload = 14, SF = 7, H = 0, DE = 0, CR = 1, so
>
> $$n_{symbol} = (8 + 4{,}25) + 8 + ceil\left(\frac{8 * 14 - 4 * 7 + 28 + 16}{4 * 7}\right)(1 + 4) = 45.25\ symbols$$

Q3

实际工程大概用SF多少，SF12的发送时间比SF7要高出很多，真的对于数据传输距离和稳定性有那么重要的意义吗，



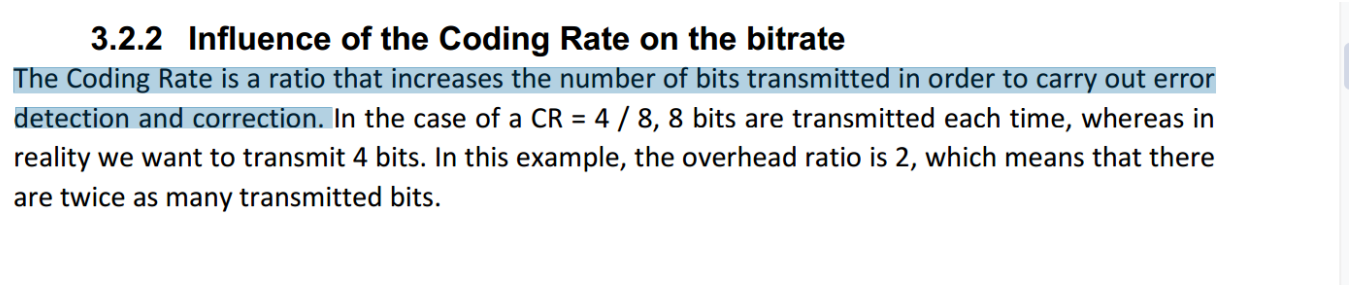
time	frequency	mod.	CR	data rate	airtime (ms)	cnt		
09:54:22	868.5	lora	4/5	SF 7 BW 125	46.3	3783	dev addr: 26 01 16 8E	payload size: 14 bytes

time	frequency	mod.	CR	data rate	airtime (ms)	cnt		
11:07:48	868.3	lora	4/5	SF 12 BW 125	1155.1	1	dev addr: 26 01 16 8E	payload size: 14 bytes

Figure 21: Time on Air for one byte transmitted in SF7 and SF12

Q4

CR coding rate CR值多出来的编码是什么，原始bit比如是4 bits CR是4/5发送会发5bits 多出来的bit是什么东西， 意思是原始bit指的是payload，其他数据帧里的帧头尾以及CRC的东西是多出来的部分吗?

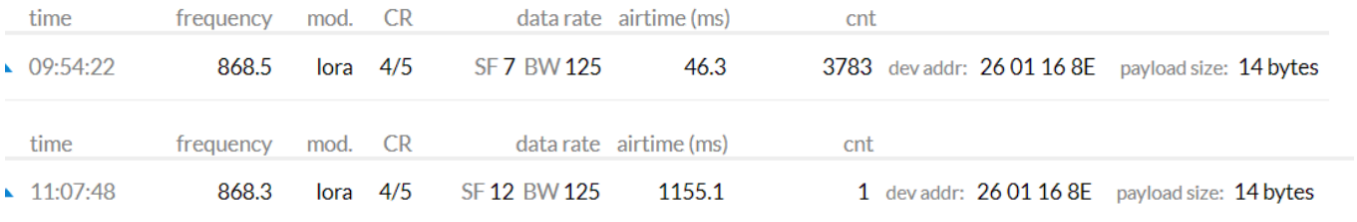


3.2.2 Influence of the Coding Rate on the bitrate

The Coding Rate is a ratio that increases the number of bits transmitted in order to carry out error detection and correction. In the case of a CR = 4 / 8, 8 bits are transmitted each time, whereas in reality we want to transmit 4 bits. In this example, the overhead ratio is 2, which means that there are twice as many transmitted bits.

说的不是很明白

Q5



time	frequency	mod.	CR	data rate	airtime (ms)	cnt		
09:54:22	868.5	lora	4/5	SF 7 BW 125	46.3	3783	dev addr: 26 01 16 8E	payload size: 14 bytes

time	frequency	mod.	CR	data rate	airtime (ms)	cnt		
11:07:48	868.3	lora	4/5	SF 12 BW 125	1155.1	1	dev addr: 26 01 16 8E	payload size: 14 bytes

Figure 21: Time on Air for one byte transmitted in SF7 and SF12

这个表里的cnt是什么意义

Q6

3.3 Simulation of a LoRa transmission

3.3.1 Time on Air calculation

The Time on Air depends on the number of symbols sent in a LoRa frame and the time of one symbol.

$Time\ on\ Air = n_{symbol} . T_{symbol}$ where

- n_{symbol} is the number of symbols present in the LoRa frame.
- $T_{symbol} = \frac{2^{SF}}{Bandwidth}$ is the time of one symbol.

n_{symbol} depends on many LoRa parameters and can be summarised using the following formula:

$$n_{symbol} = (n_{preamble} + 4{,}25) + 8 + max\left(ceil\left(\frac{8.Payload - 4.SF + 28 + 16 - 20.H}{4(SF - 2.DE)}\right)(CR + 4),0\right)$$

Where:

- Payload is the LoRa PHY payload
- SF is the Spreading Factor
- H=0 when the Header is enabled and H=1 otherwise
- DE=1 when the low data rate optimization is enabled, 0 otherwise
- CR is the Coding Rate from 1 to 4

这个公式里的一些常数项好像没有讲到怎么推导，是否需要关注，还是说这个公式如果需要使用直接用就行

DE H这两个参数之前没有讲解过，low data rate optimization是什么概念