Technical overview LoRaWAN network

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HELLO!

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Technical overview CSS as a modulation for Long Range Communication

SF	125 (kHz)			SNR (dBm)	Range (Km)
	Bit rate (kb/s)	Sensitivity (dBm)	ToA (ms)		
7	5.4	-124	56	-7.5	2
8					
9					
10					
11					
12	0.29	-137	1483	-20	15

- Code rate: 4/5
- Payload: 14 byte

$$bit\ rate(s) = \frac{BW}{2^{sf}} \times sf \times CR$$

$$bit\ rate(s) = \frac{125}{2^{7}} \times 7 \times \frac{4}{5} = 5.468\ kb/s$$

$$bit\ rate(s) = \frac{125}{2^{12}} \times 12 \times \frac{4}{5} = 0.2929\ kb/s$$

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Code rate: 4/5

Payload: 14 byte

$$T_{on\_the\_air} = T_{payload} + T_{preamble} \qquad T_{preamble} = (4.25 + 8) \times \frac{2^{SF}}{BW} \qquad T_{payload} = N_{payload} \times \frac{2^{SF}}{BW}$$

$$N_{payload} = 8 + max\left[Ceil\left(\frac{8PL - 4SF + 28 + 16 - 20IH}{4(SF - 2DE)}\right) \times (CR + 4), 0\right]$$

$SF = 7 \quad BW = 125\ kHz \quad Payload = 14\ byte$

$$N_{payload} = 8 + max\left[Ceil\left(\frac{8 \times 14 - 4 \times 7 + 28 + 16}{4(7 - 2)}\right) \times (1 + 4), 0\right] = 35 + 8 = 43$$

$$T_{payload} = 43 \times \frac{2^7}{125} = 44.032\ ms$$

$$T_{preamble} = (4.25 + 8) \times \frac{2^7}{125} = 12.544\ ms$$

$$T_{on\_the\_air} = T_{payload} + T_{preamble} = 44.032 + 12.544 = 56ms$$

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9					
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Code rate: 4/5

Payload: 14 byte

$$SNR(SF) = \frac{SNR_0}{2^{SF}}$$

$$SNR_0 = \frac{E_{bit}}{NF} = 31\ mW\ (SNR_0\ equals\ 15\ dBm\ for\ the\ SX1272\ transceiver)$$

$$SNR(12) = \frac{31}{2^{12}} = 0.007mW = -21dBm$$

$$SNR(7) = \frac{31}{2^{7}} = 0.24218\ mW = -6.2dBm$$

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SF	125 (kHz)			SNR (dBm)	Range (Km)
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7	5.4	-124	56	-7.5	2
8					
9					
10					
11					
12	0.29	-137	1483	-20	15

Code rate: 4/5

Payload: 14 byte

$$Receiving\ sensitivity = -174 + 6 + 10 \log\ BW + SNR$$

$$Receiving\ sensitivity\ (12) = -174 + 6 + 51 - 21 = -138$$

$$Receiving\ sensitivity\ (7) = -174 + 6 + 51 - 6.1 = -123.1$$

Technical overview CSS as a modulation for Long Range Communication

SF	125 (kHz)			250 (kHz)			500 (kHz)			SNR (dBm)	Range (Km)
	Bit rate (kb/s)	Sensitivity (dBm)	ToA (ms)	Bit rate (kb/s)	Sensitivity (dBm)	ToA (ms)	Bit rate (kb/s)	Sensitivity (dBm)	ToA (ms)		
7	5.4	-124	56	110	-122	20	219	-116	10	-7.5	2
8											4
9											6
10											8
11											10
12	0.29	-137	1483	0.5	-135	495	0.98	-129	247	-20	15

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THANKS!

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