Application Hint 42

QwikRadio™- Calculating the C_{TH} Capacitor

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The following application hint refers to the MICRF002, MICRF007, MICRF011 and MICRF022 QwikRadio™ Receivers. The calculations apply to data-patterns with 50/50 and 33/66 duty cycles.

The C_{TH} capacitor value is dependent on several factors. It is important to calculate the right capacitor value for each specific application. A wrong C_{TH} capacitor value will deteriorate the maximum range in the RF link. The example below shows how to calculate it and a table is provided for other frequencies.

Example No. 1: 1.2kbps, 50% Manchester

When a 50% duty cycle data pattern with a preamble is used, (see Figure 1) use the following formula to calculate C_{TH},

$$C_{TH} = \frac{\left(\frac{5}{DATARATE}\right)}{\left(\frac{578200}{REFOSC}\right)} \quad \text{(Equation 1)}$$

Fixed Mode, SEL0 = 1, SEL1 = 0

Carrier Frequency: 433.92 MHz.

Reference Oscillator: 6.7458 MHz, up conversion

Plugging in the values at Equation 1, we have

$$C_{TH} = \frac{\left(\frac{5}{1200}\right)}{\left(\frac{578200}{6.7258}\right)}$$

C_{TH}= 48.6nF

The closest commercial value is 47nF. Notice that the C_{TH} value is dependent mainly on the baud rate (data pattern) and the reference oscillator frequency. See Table 1 and 2 for other baud rates and frequencies.

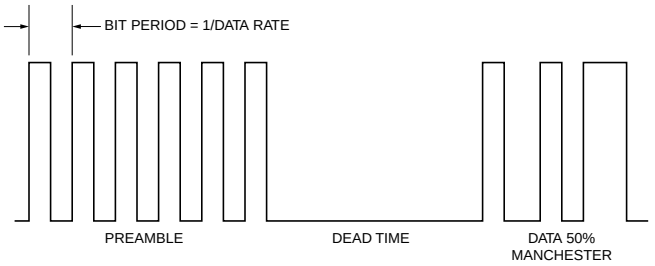

Figure 1. Data Pattern, 50% Manchester

Table 1. Freq. 315 MHz, 50% Duty Cycle, Manchester encoding, no squelch, REFOSC=4.897MHz, pulse with preamble, fixed mode.

Baud Rate bps	C_{TH}	C_{AGC}	SEL0	SEL1
1200	39nF	2.2µF	1	0
2400	18nF	1µF	0	1
4800	8.2nF	0.47µF	1	1
9600	4.7nF	0.22µF	1	1

Table 1.

Table 2. Freq. 433.92 MHz, 50% Duty Cycle, Manchester encoding, no squelch, REFOSC=6.7458MHz, pulse with preamble, fixed mode.

Baud Rate bps	C_{TH}	C_{AGC}	SEL0	SEL1
1200	47nF	2.2µF	1	0
2400	27nF	1µF	0	1
4800	12nF	0.47µF	1	1
9600	5.6nF	0.22µF	1	1

Table 2.

Note 1: The AGC capacitor values are suggested values and will depend on how much dead time there is between preamble and data and how fast the receiver needs to be in stead state.

Note 2: For 33/66 coding scheme, use the same equation 1 to calculate C_{TH}.

Note 3: Application note 22 has further information about the C_{TH} pin.

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