NXP NCF29A1 - Introduction to ASK and FSK signal modulation of key chip

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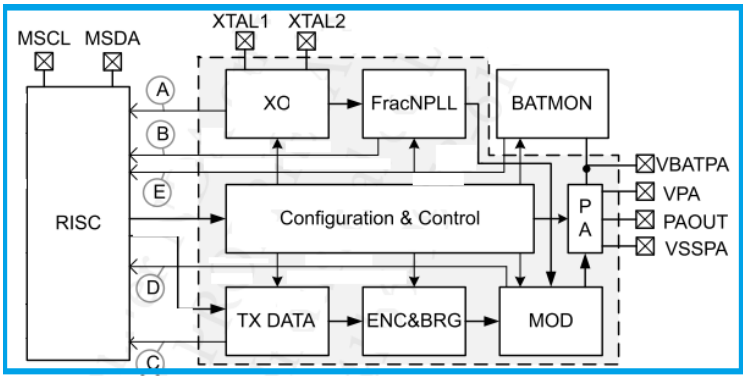
1. Introduction to NCF29A1 UHF Transmitter

UHF transmitter on chip The NCF29A1 integrates a multi-channel . It requires no external components except for the reference crystal oscillator and loop antenna matching circuit. It can operate in the frequency band of 310-447MHz and can also support the 868MHz and 915MHz bands upon request. The device has a unified reference frequency (27.6 MHz) for all bands.

The NCF29A1 UHF transmitter is controlled by a RISC controller and supports FSK, ASK, OOK modulated carriers with data rates up to 25kbit/s (Manchester encoding). The programmable power amplifier adjusts the antenna pin voltage to minimize carrier temperature variations and battery voltage variations.

The transmitter includes baseband and RF signal processing, and finally amplifies the modulated RF signal through the power amplifier PA.



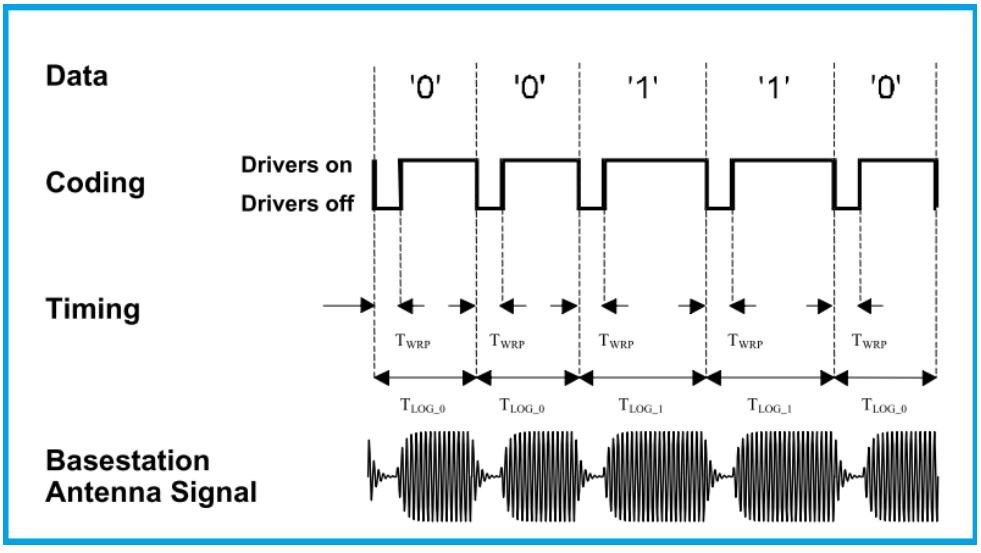
2. UHF signal modulation method

1. ASK modulation

ASK (Amplitude Shift Keying) Amplitude keying, the possible states of the digital modulation signal correspond to the binary information symbol or its corresponding baseband signal state, and the modulated signal is called a binary digital modulation signal. Keying with binary information symbols is also called binary amplitude keying, which is represented by 2ASK, that is, OOK (On-Off Keying) binary on-off keying. This modulation method has inferior noise resistance performance to other modulation methods.

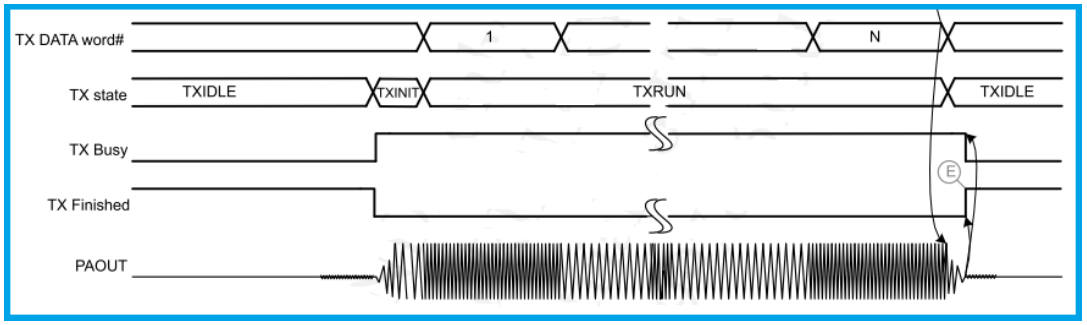
When the debugged baseband signal is 1, the carrier is transmitted;

When the debugged baseband signal is 0, no carrier is transmitted;



2. FSK modulation

FSK (Fequency Shift Keying) frequency shift keying uses two oscillation sources with different frequencies to represent signals 1 and 0. The 1 and 0 of the digital signal are used to control the alternating output of two independent oscillation sources. This modulation method has good anti-noise and anti-attenuation performance.



3. Signal Formation

The NCF29A1 modulation mode is configured by the ASK bit, ASKRMP and FSKRMP registers for software ASK and software FSK modulation.

1、ASK

In the case of ASK, the amplitude of the RF signal slopes between two levels defined by AMH and AML; a binary signal '0' from the encoder is converted to an ASK amplitude of AMH level and '1' to AML level.

Soft-ASK sets a linear amplitude gradient between two amplitudes in AML and AMH assigned to the binary modulation signal. The difference between the two signal amplitudes represents the ASK modulation index (ASK modulation depth). The ramp time between the amplitude values is controlled by the ARMPEXP and ARMPMANT bits in the AKSRMP register.

2、FSK

In the case of FSK, the signal frequency is tilted between fTX±fDEV, with a binary signal '0' being represented by a positive frequency deviation.

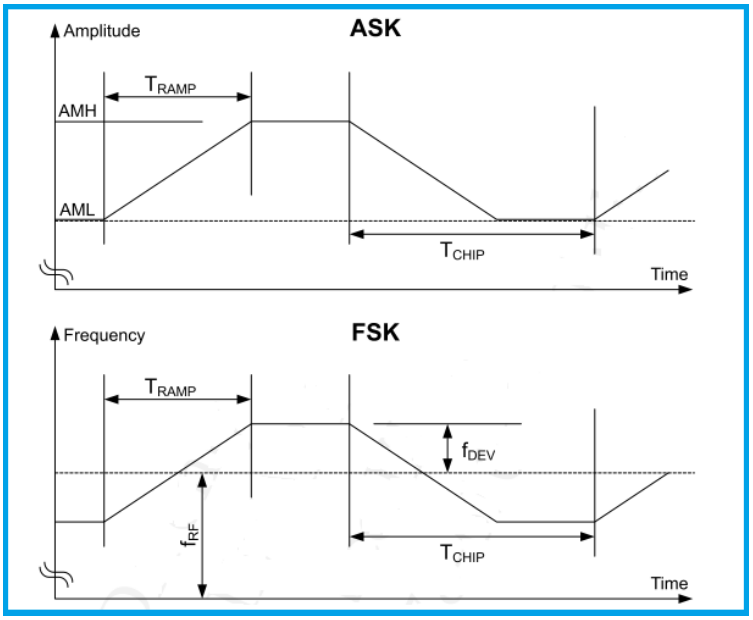
Soft-FSK is based on a linear frequency gradient between two equidistant signal frequency values of the RF carrier. The positive and negative offsets of the carrier frequency representing binary modulation are defined as the frequency offset fDEV. The ramp time of Soft-FSK should be configured to achieve the lowest spectral noise in the receiving baseband.

3. Signal slope

For both modulation methods, the ratio between the ramp time of the linear signal TRAMP and the transmission signal time TCHIP is defined as the signal slope.

To avoid a decrease in the sensitivity of the receiving end, the slope of the linear curve at the zero crossing point should not be higher than the slope of the sine curve, that is, slope = 2/Π = 63.7%.

Slope = TRAMP / CHIP

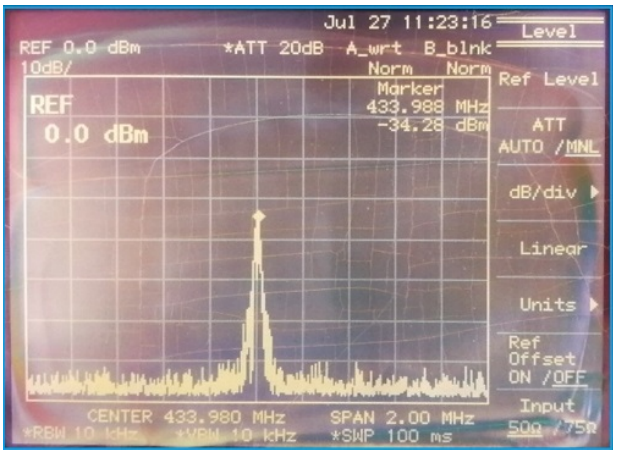


4. Modulation Signal Example

Example measurement using NCF29A1 transmitting a typical RKE RF protocol setup

Configuration 1:

- Center frequency 433.92 MHz
- Manchester coded ASK modulation
- Baud rate 10 kbit/s



Configuration 2:

- Center frequency 433.92 MHz
- Manchester coded FSK modulation
- Frequency deviation +/- 42 kHz
- Baud rate 10 kbit/s