ISO14443 调制及编码说明

1. 调制解调及编码标准

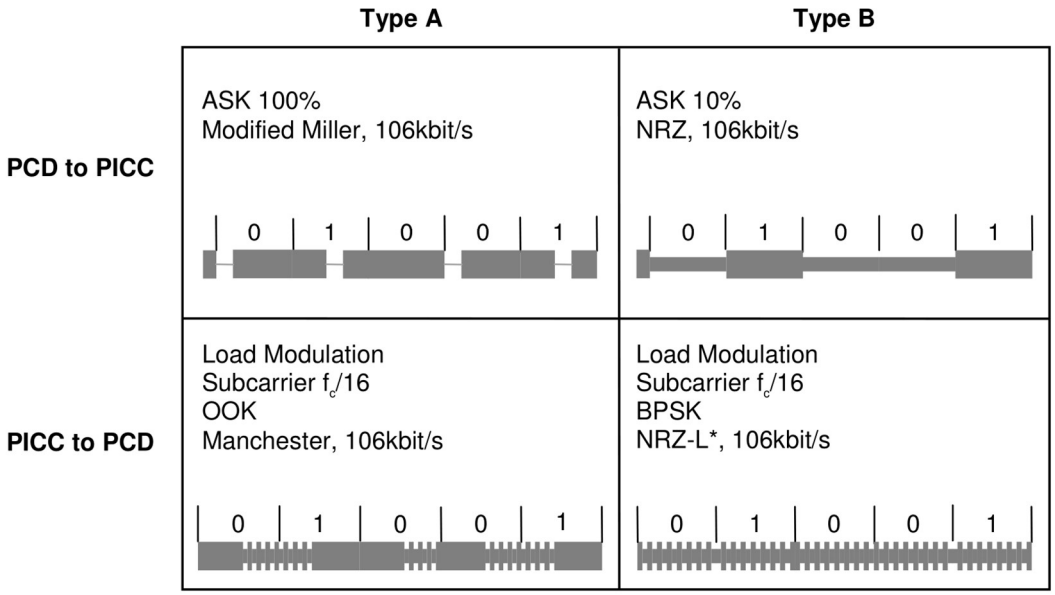


Figure 1 — Example communication signals for Type A and Type B interfaces

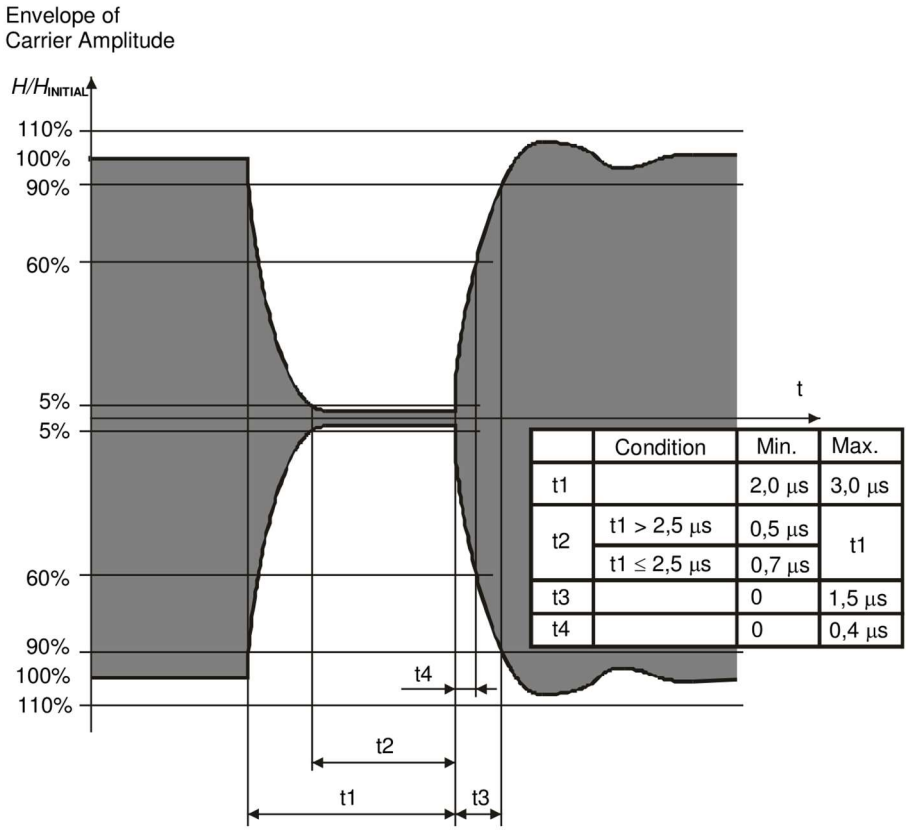
2. 14443A

黄色为天线信号峰值检波波形，紫色为解调后的数字信号

紫色信号逻辑分析抓取图形

a) PCD to PICC

1) 标准



	Condition	Min.	Max.
t1		2,0 µs	3,0 µs
t2	t1 > 2,5 µs	0,5 µs	t1
	t1 ≤ 2,5 µs	0,7 µs	
t3		0	1,5 µs
t4		0	0,4 µs

Figure 2 — Pause

8.1.3 Bit representation and coding

The following sequences are defined:

— sequence X: after a time of half the bit duration a "Pause" shall occur.

— sequence Y: for the full bit duration no modulation shall occur.

— sequence Z: at the beginning of the bit duration a “Pause” shall occur.

The above sequences shall be used to code the following information:

— logic “1”: sequence X.

— logic “0”: sequence Y with the following two exceptions:

i) If there are two or more contiguous “0”s, sequence Z shall be used from the second “0” on.

ii) If the first bit after a “start of frame” is “0”, sequence Z shall be used to represent this and any “0”s which follow directly thereafter.

— start of communication: sequence Z.

— end of communication: logic “0" followed by sequence Y.

— no information: at least two sequences Y.

2) 逻辑分析仪抓取的数字信号

依据 1)，可得出 PCD 发送的是 7bit 数据 0x52(WUPA)

b) PICC to PCD

1) 标准

8.2.5 Bit representation and coding

The following sequences are defined :

— sequence D: the carrier shall be modulated with the subcarrier for the first half (50%) of the bit duration.

— sequence E: the carrier shall be modulated with the subcarrier for the second half (50%) of the bit duration.

— sequence F: the carrier is not modulated with the subcarrier for one bit duration.

Bit coding shall be Manchester with the following definitions:

— logic “1”: sequence D

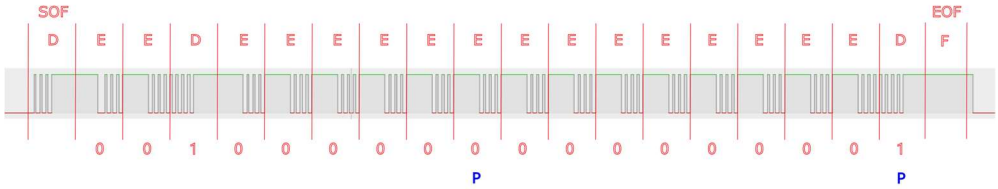
— logic “0”: sequence E

— start of communication: sequence D

— end of communication: sequence F

— no information: no subcarrier

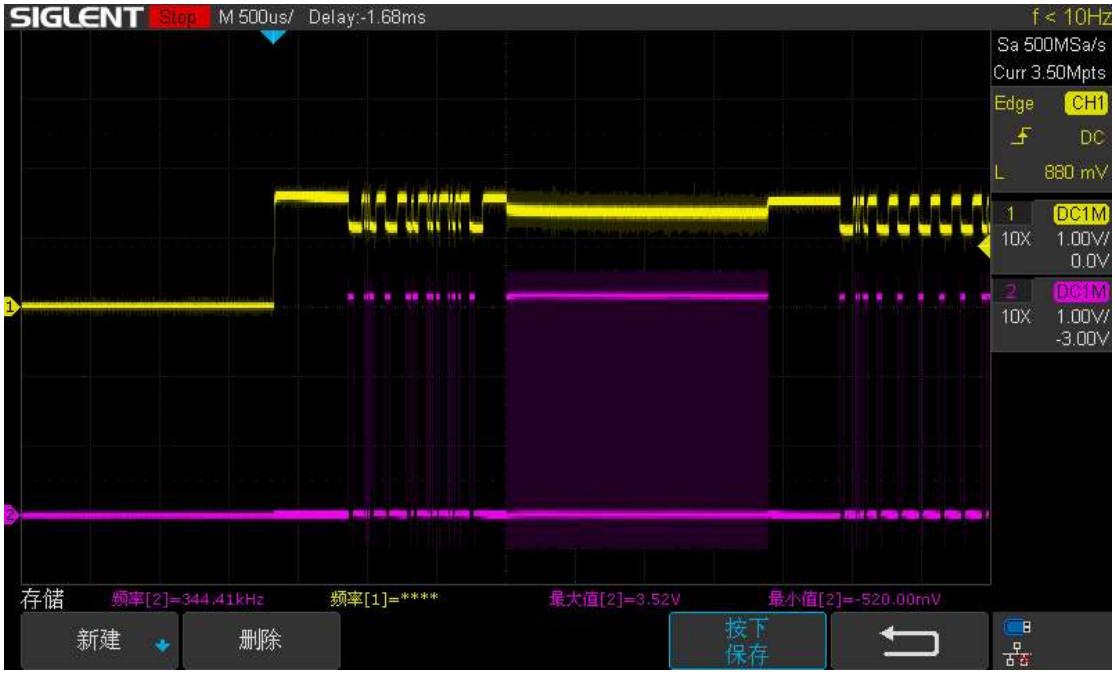
2) 逻辑分析仪抓取的数字信号



依据 1)，每 8bits 一个校验位(Odd Parity bit)，可得出 PICC 发送的数据是 0x04 0x00

3. 14443B

黄色为天线信号峰值检波波形，紫色为解调后的数字信号



a) PCD to PICC

1) 标准

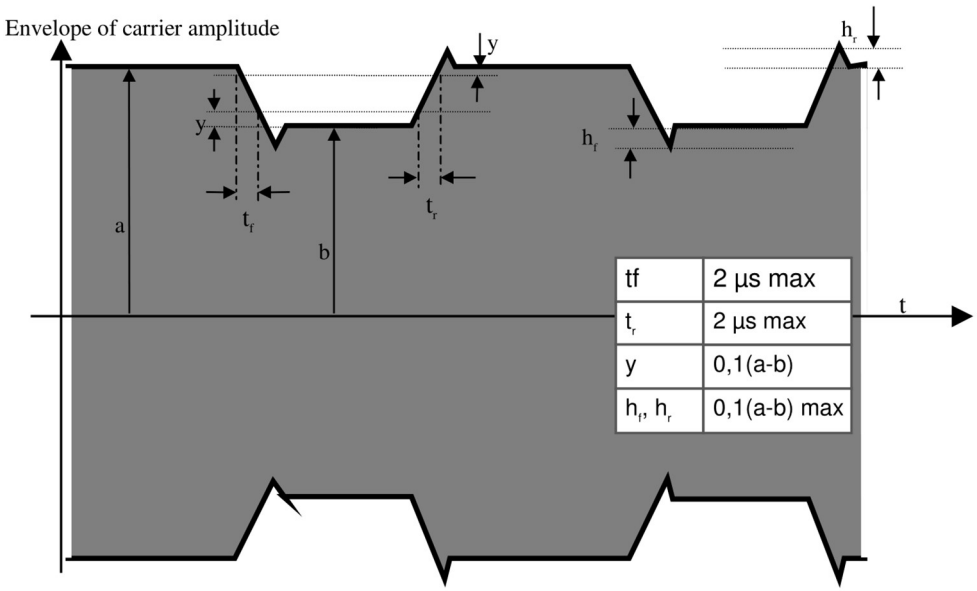


Figure 4 — Type B modulation waveform

9.1.3 Bit representation and coding

Bit coding format shall be NRZ-L with logic levels defined as follows:

— logic “1”: carrier high field amplitude (no modulation applied).

— logic “0”: carrier low field amplitude.

2) 示波器中测量黄色凹陷部分宽度与发送数据对照

b) PICC to PCD

1) 标准

9.2.5 Bit representation and coding

Bit coding shall be NRZ-L where a change of logic level shall be denoted by a phase shift (180°) of the subcarrier.

The initial logic level for NRZ-L at the start of a PICC frame shall be established by the following sequence:

— After any command from the PCD a guard time TR0 shall apply in which the PICC shall not generate a subcarrier. TR0 shall be greater than 64/*f*s.

— The PICC shall then generate a subcarrier with no phase transition for a synchronization time TR1. This establishes a subcarrier phase reference Ø0. TR1 shall be greater than 80/*f*s.

— This initial phase state Ø0 of the subcarrier shall be defined as logic “1” so that the first phase transition represents a change from logic “1” to logic “0”.

— Subsequently the logic level is defined according to the subcarrier phase reference:

Ø0: represents logic "1"

Ø0 + 180°: represents logic "0".

2) 逻辑分析仪抓取的数字信号

i. 0→1

ii. 1→0

iii. 副载波频率