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RF READER DESCRIPTION

DUALi

Contents

1. Signal interface

- Two communication signal interfaces : Type A and Type B
- Only one communication signal interface may be active during a communication session until deactivation by the Device or removal of the Card.

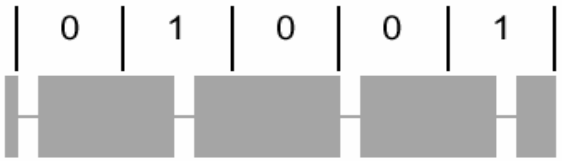
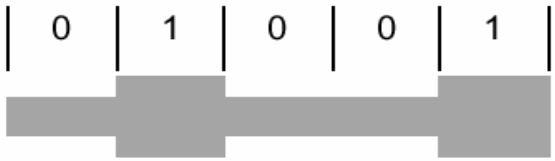
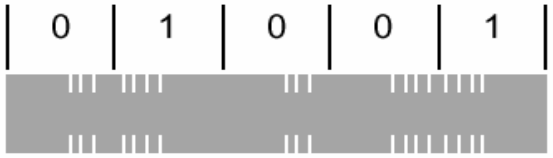
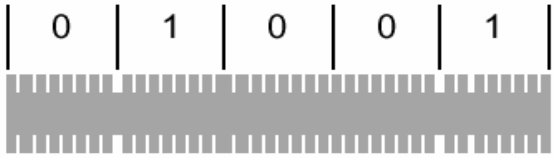
2. Initial dialogue for proximity cards

- Activation of the Card by the RF operating field of the Device.
- The Card shall wait silently for a command from the Device.
- Transmission of a command by the Device.
- Transmission of a response by the Card.

3. Power transfer

- The Device shall produce an energizing RF field which couples to the Card to transfer power and which shall be modulated for communication.
- The frequency the RF operating field shall be 13,56 MHz ±7 kHz.
- Operating field
  - The minimum unmodulated operating field shall be Hmin and has a value of 1,5 A/m rms.
  - The maximum unmodulated operating field shall be Hmax and has a value of 7,5 A/m rms.

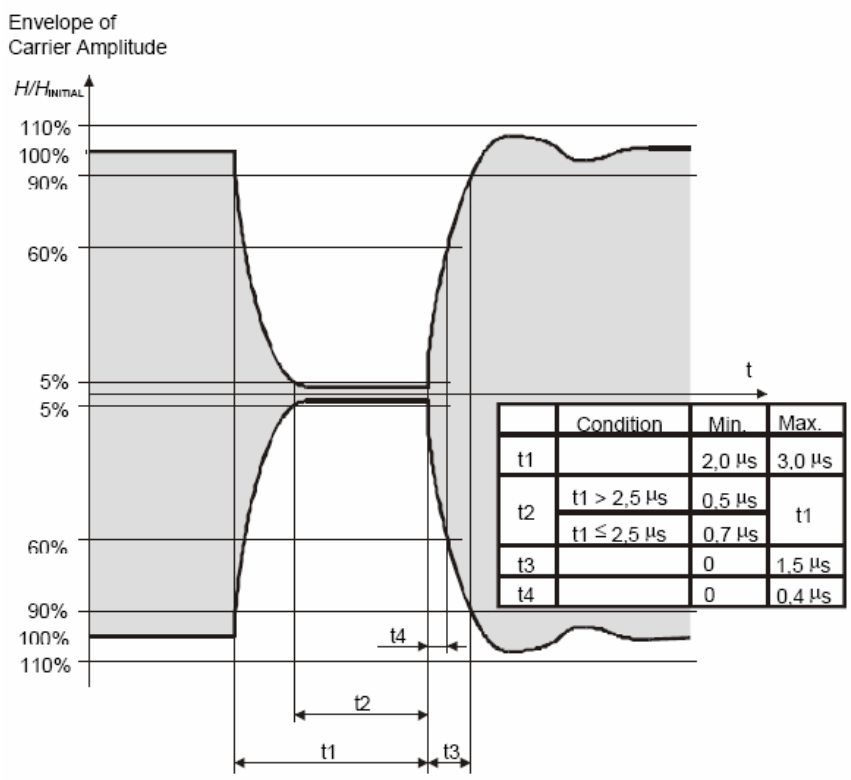
4. Modulation

	Type A	Type B
Device -> Card	ASK 100% Modified Miller, 106kbit/s 	ASK 10% NRZ-L, 106kbit/s 
Card -> Device	Load Modulation Subcarrier fc/16 OOK Manchester, 106kbit/s 	Load Modulation Subcarrier fc/16 BPSK NRZ-L*, 106kbit/s 

5. Communication signal interface Type A

[Device->Card]

- Communication from Device to Card for a bit rate of fs(Frequency of operating field)/128 shall use the modulation principle of ASK 100% of the RF operating field to create a “Pause” as shown in figure1.
- The Card shall detect the ”End of Pause” after the field exceeds 5% of $H_{INITIAL}$ and before it exceeds 60% of $H_{INITIAL}$.



	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

Figure1. Pause (fs/128)

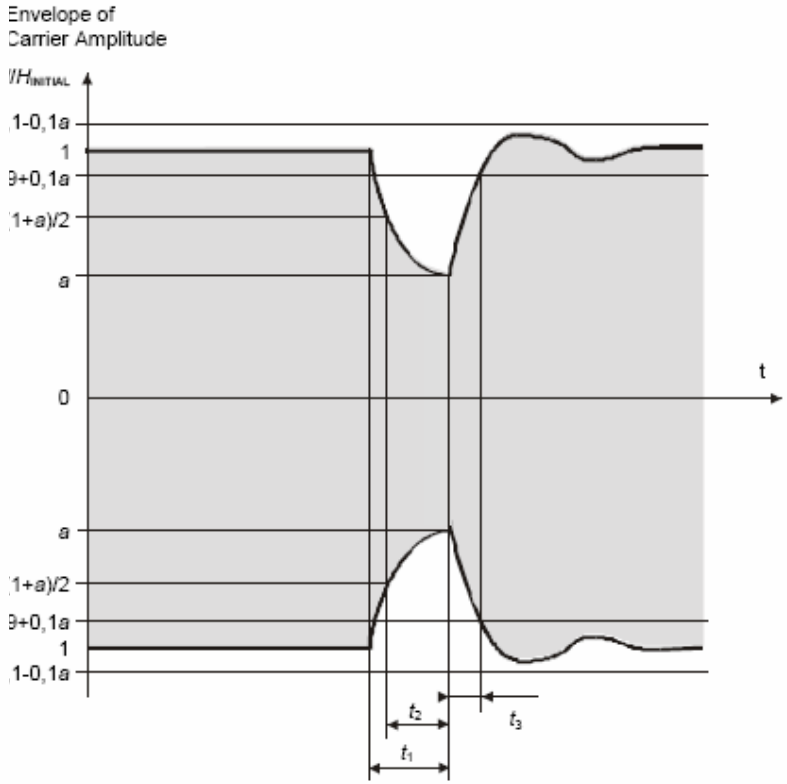
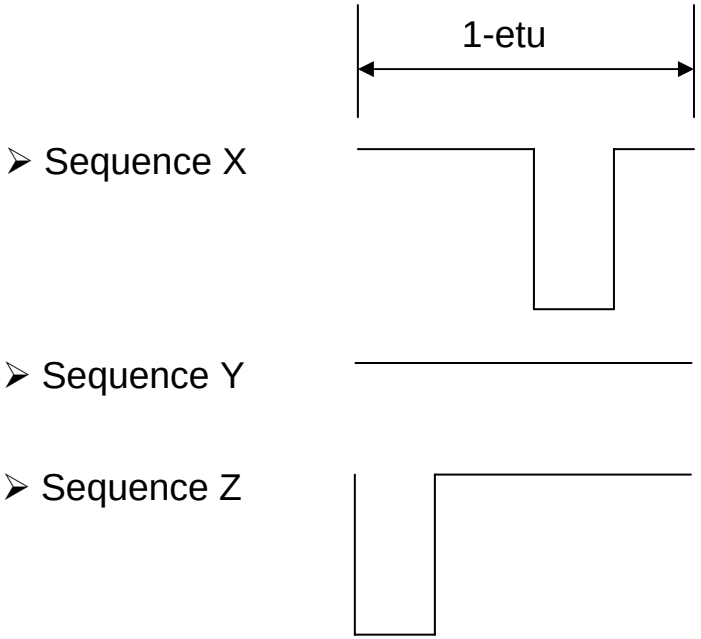
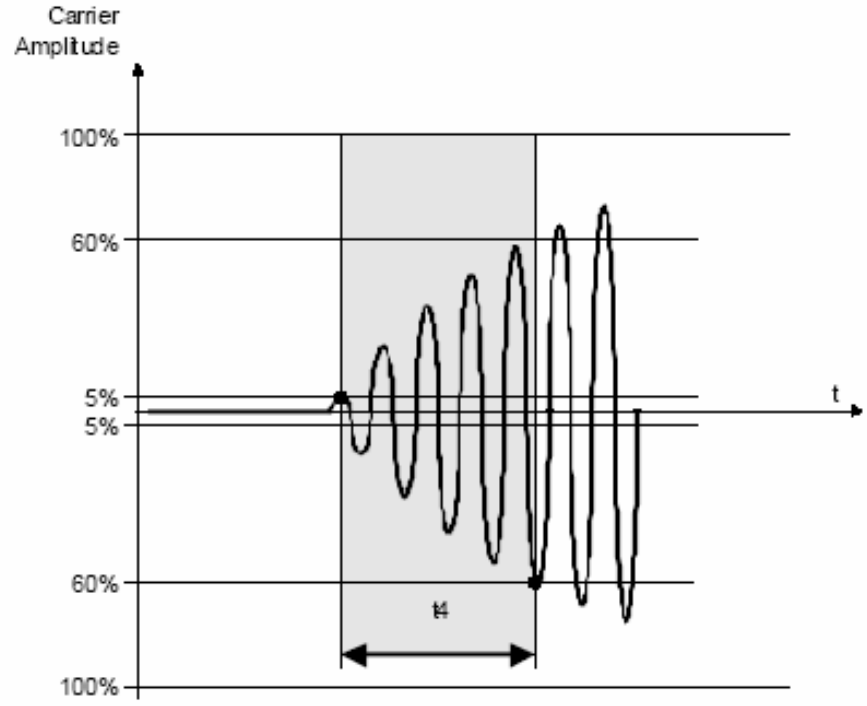


Figure2.Pause (fs/64,fs/32,fs/16)

- Bit representation and coding(Modified Miller Code)



- Logic “1” : Sequence X
- Logic “0” : Sequence Y



Definition of "End of Pause“(fs/128)

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

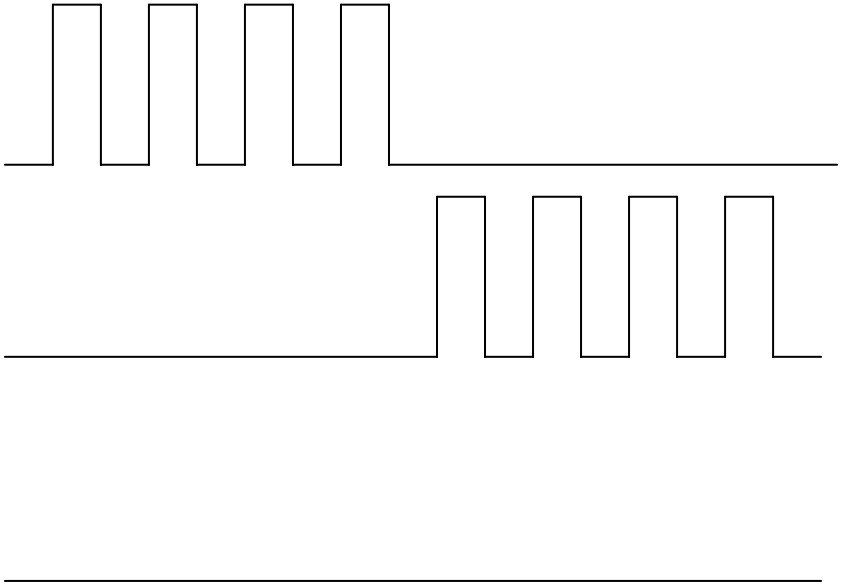
[Card->Device]

- The Card shall be capable of communication to the Device via an inductive coupling area where the carrier frequency is loaded to generate a subcarrier with frequency fs.
- Subcarrier :fs/16 (~847 kHz). (Consequently, during initialization and anticollision, one bit duration is equivalent to 8 periods of the subcarrier.)
- The subcarrier is modulated using OOK.
- 106kbps Bit representation and coding : Manchester Code
- 212kbps/424kbps/847kbps Bit representation and coding : BPSK-NRZ
- Bit coding shall be Manchester with the following definitions :

. Sequence D

. Sequence E

. Sequence F



.Logic “1” : Sequence D

.Logic “0” : Sequence E

. start of communication

: Sequence D

. end of communication

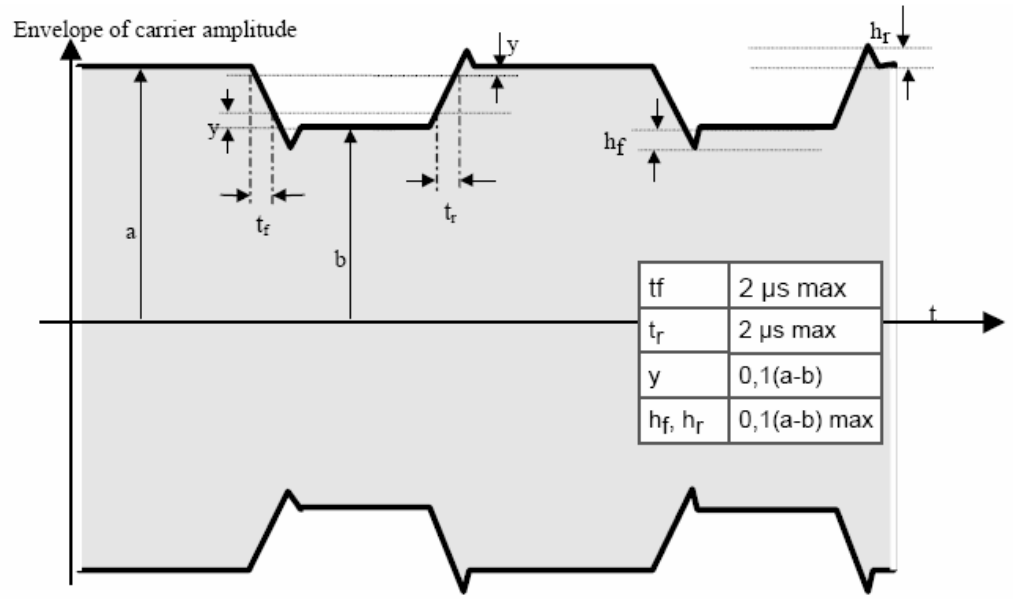
: Sequence F

.No data : No subcarrier

6. Communication signal interface Type B

[Device->Card]

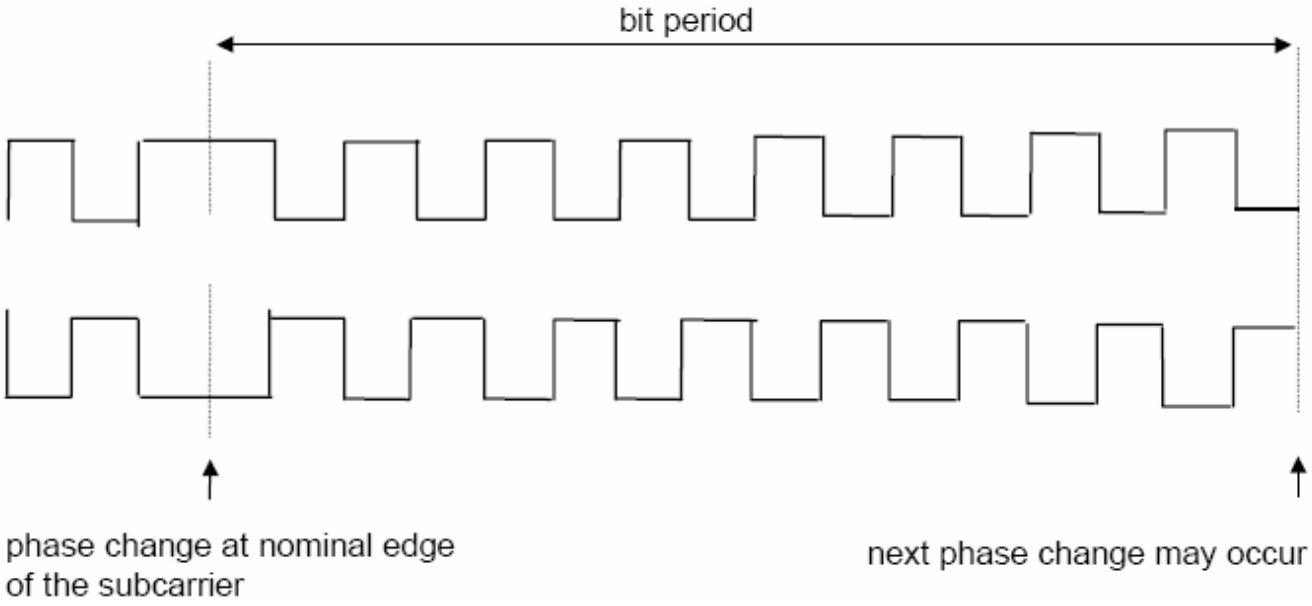
- Modulation : ASK-10%, Modulation index : 8% ~ 14%



- Bit representation and coding(NRZ)
  - Logic “1” : Carrier high field amplitude(no modulation applied).
  - Logic “0” : Carrier low field amplitude.

[Card->Device]

- The Card shall be capable of communication to the Device via an inductive coupling area where the carrier frequency is loaded to generate a subcarrier with frequency fs.
- Subcarrier : fs/16 (~847 kHz).
- Subcarrier modulation
  - The subcarrier shall be BPSK modulated
  - Phase shifts shall only occur at nominal positions of rising or falling edges of the subcarrier.



7. Waveform

- Card->Device

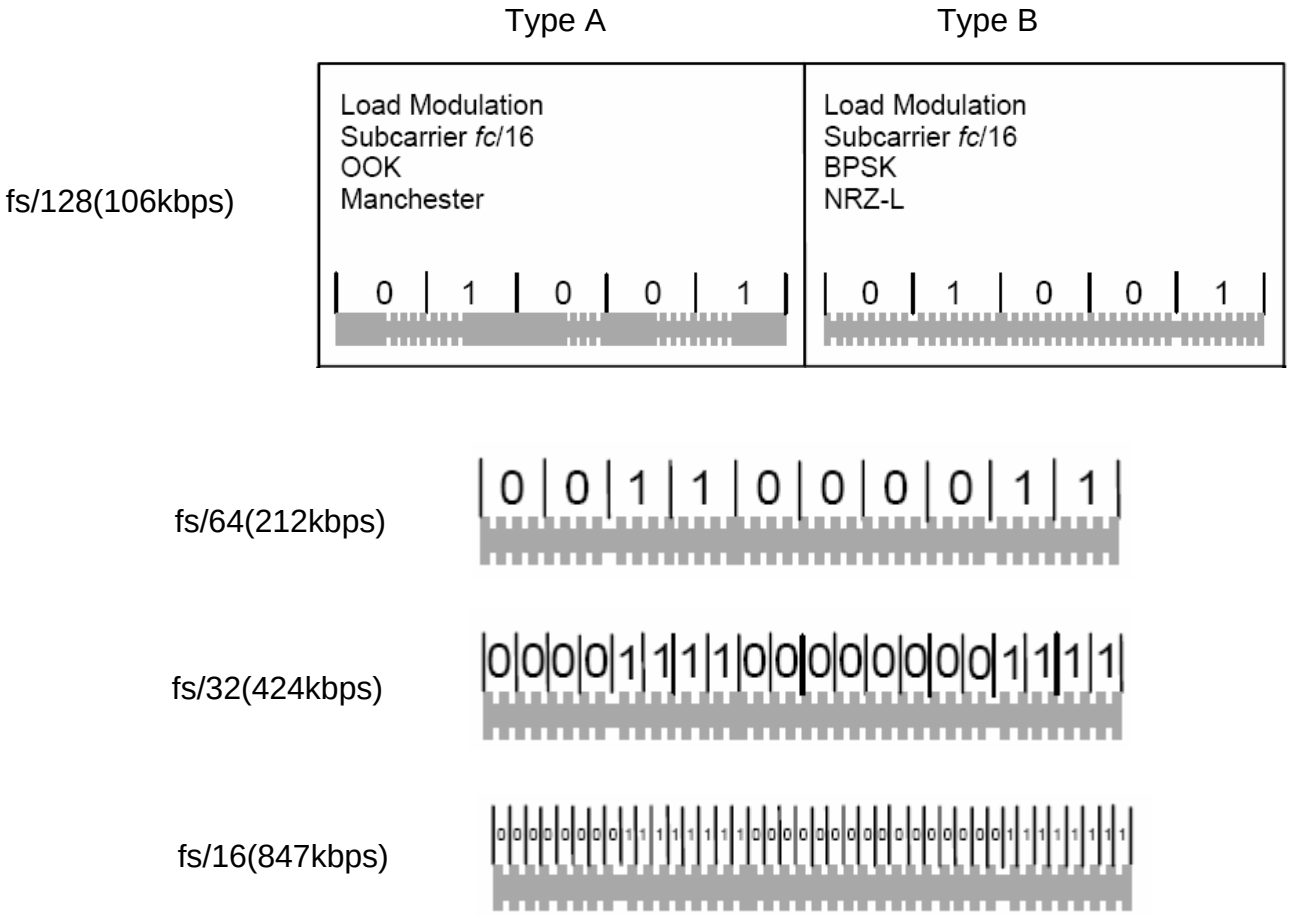
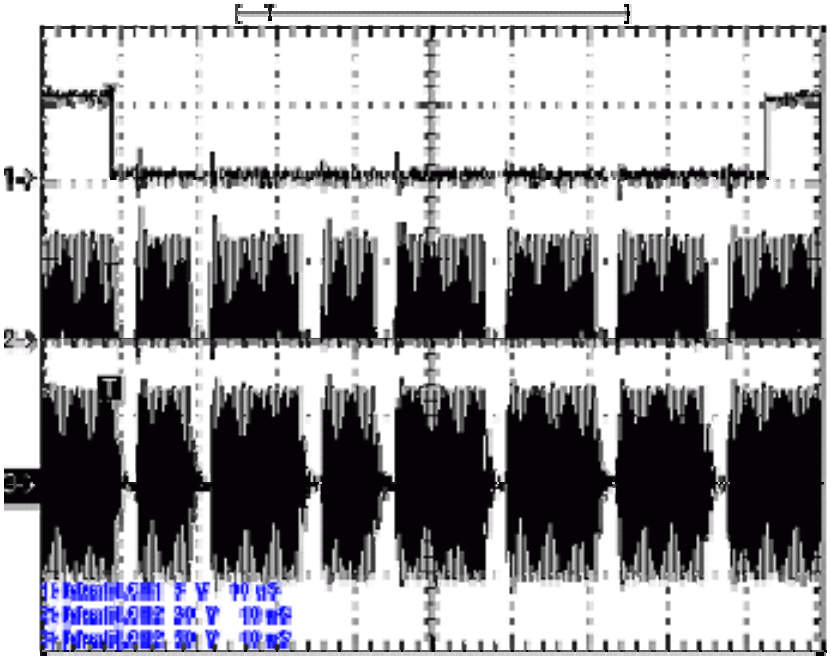
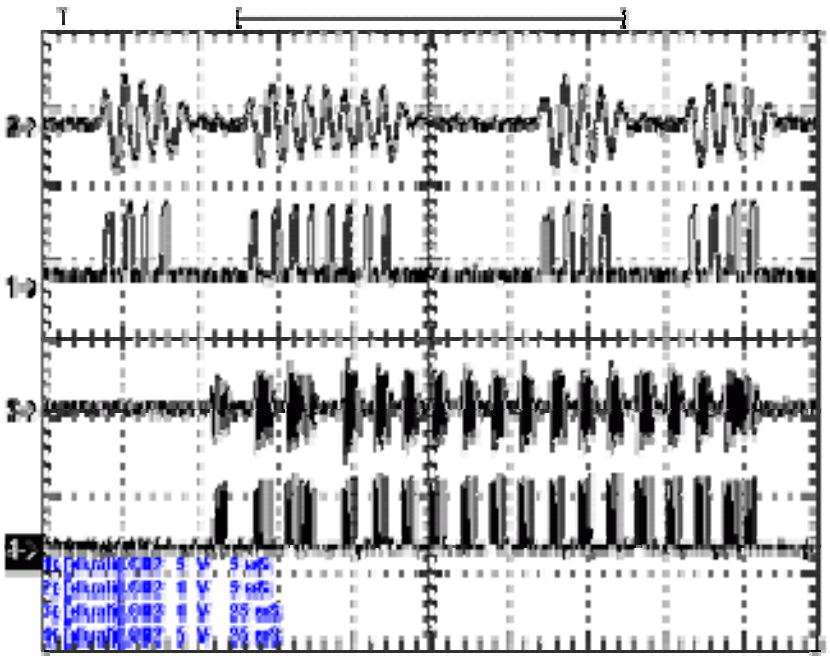


Figure. Card -> Device Waveform

- TYPE A CARD WAVEFORM

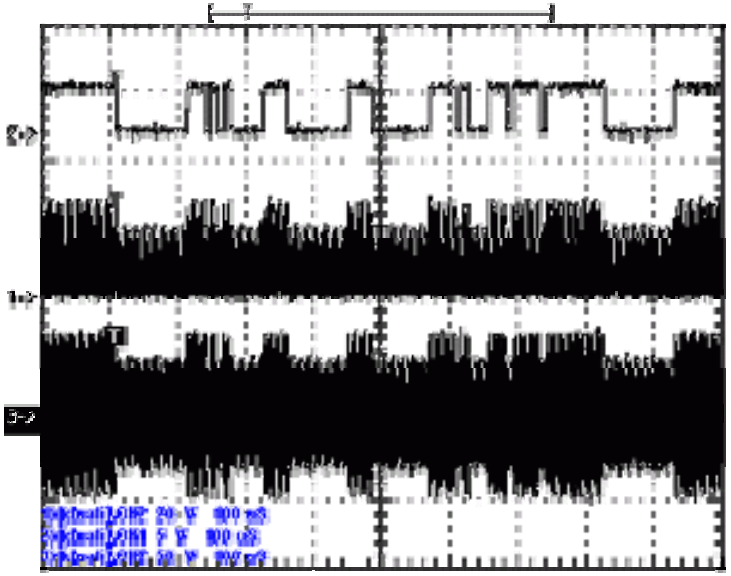


TYPE A TRANSMISSION WAVEFORM



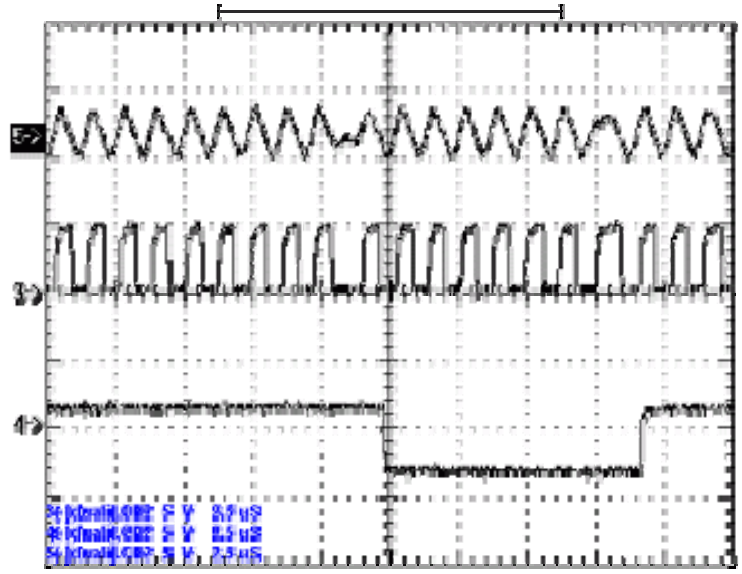
TYPE A RECEPTION WAVEFORM

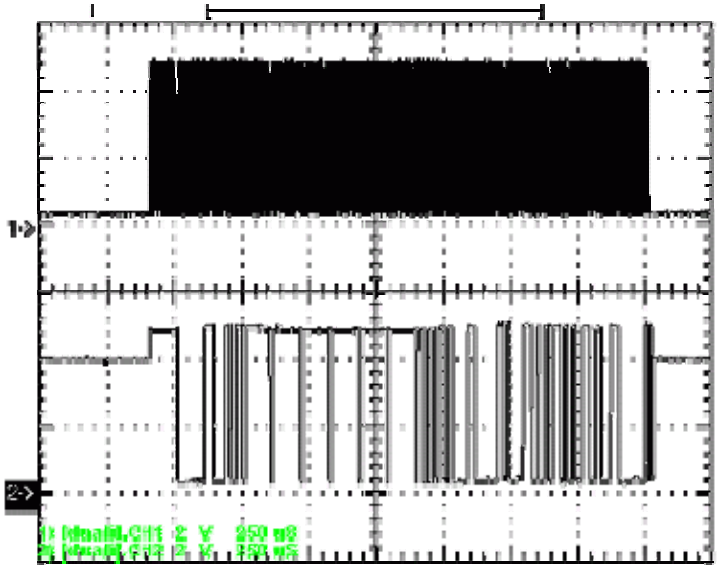
- TYPE B CARD WAVEFORM



TYPE B TRANSMISSION WAVEFORM

TYPE B RECEPTION WAVEFORM



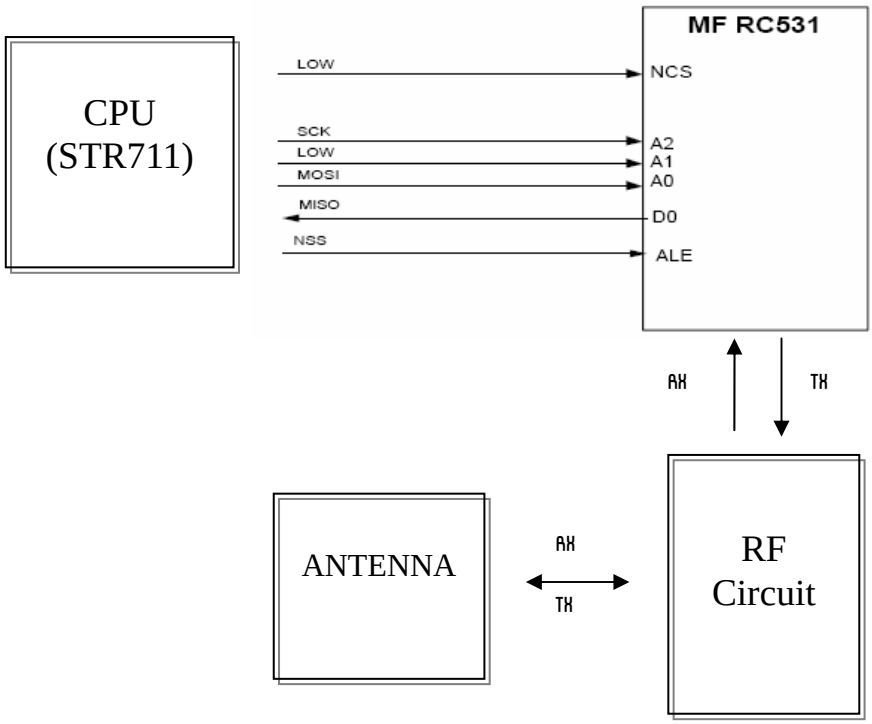


Description of Antenna and Circuit

< LOOP ANTENNA>

A loop antenna is very directional. The pickup pattern is shaped like a figure circle. The loop will allow signals on opposite sides to be received, while off the sides of the loop the signal will decrease or be nulled out. The nulling feature will allow you to remove a local station on a frequency and pick up another on the same frequency by removing the local signal. A loop don't an amplifier.

2. CIRCUIT



- DE-PCA20 use MF RC531's serial peripheral interface(SPI). The SPI clock SCK has to be generated by the CPU. Data communication from the CPU to the slave uses the line MOSI. Line MISO is used to send data back from the MF RC531 to the CPU.

- The MF RC531 employs an integrated quadrature-demodulation circuit giving the possibility to detect an ISO 14443 compliant subcarrier signal applied to pin RX. The ISO 14443-A sub-carrier signal is defined as a manchester coded ASK-modulate signal. The ISO 14443-B sub-carrier signal is defined as an NRZ-L coded BPSK modulated ISO 14443-B sub-carrier signal.

The quadrature-demodulator uses two different clocks, Q-and I-clock, with a phase shift of 90° between them. Both resulting sub-carrier signals are amplified, filtered and forwarded to a correlation circuitry. The correlation results are evaluated, digitised and passed to the digital circuitry.