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Handfree Mini Reader Module Operational Descriptions

1. Module Operation

The HANDFREE MINI READER MODULE is a single-antenna reader module. The backscatter signal is demodulated to baseband through a standard mixer stage and is filtered and amplified. The baseband signal is then sampled and processed by a microcontroller.

The entire RF section of the reader module can be completely turned OFF under software control by the microcontroller. This allows the HANDFREE MINI READER MODULE to consume very low power when in standby mode. During RFID operation, the transmit power of the HANDFREE MINI READER MODULE is 1W, so the total power consumption is 1.8A during the fraction of a second that is required to read the tags in the field. A block diagram of module is given in Fig 1.

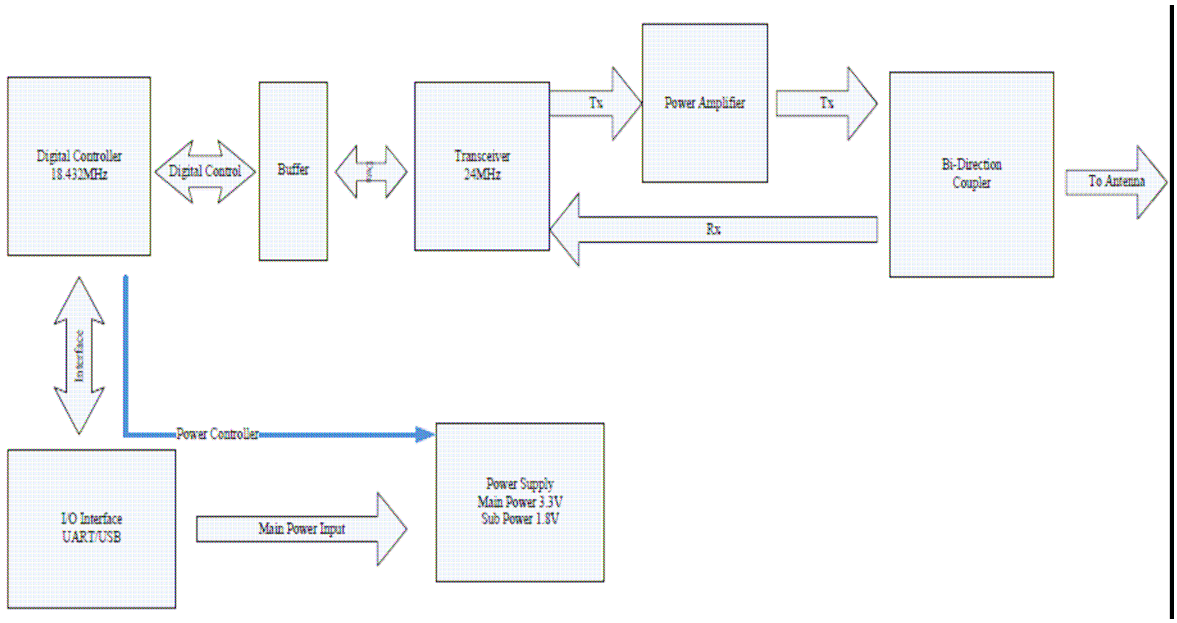

Fig 1. Handfree Mini Reader Module Block Diagram

2. Interfacing with Handfree Mini Reader Module

The Handfree Mini Reader Module is designed to interface with another circuit board (i.e. PDA as following photo) and communicate using a simple 3-wire serial interface. However, for testing purposes, it is possible to connect the

Handfree Mini Reader Module to a computer using a serial RS-232 adapter. In this case, the Handfree mini Reader module Control Panel software can be used.

Reader is mainly used to read the materials from tag to carry on the work of distinguishing of the things with PDA or the cell-phone. When PDA or the cell-phone assigns the order for Reader, reader will transmit RF wave with data out through antenna. Once tags are receiving the information, the tag will backscatter the data with 96-bit EPC C1G2 protocol to Reader through RF mechanism that is built inside. Reader receives after the data that will give PDA or the cell-phone the work of distinguishing which carries on the things.

For the wired RS232 interface of entity among PDA, cell-phone and readers, the industrial communication protocols are interchanging in order to reach the data. It is depending on the untouchable RF wave between reader and tag to reach the data to interchange with the communication protocol that is defined by EPC C1G2。

The Fig 2-1 is a data flow chart. It is including Reader, PDA and cell-phone communication code of protocol during the encoding and decoding. The code of

the communication protocol between Reader and Tag is operated with decoding. ◦

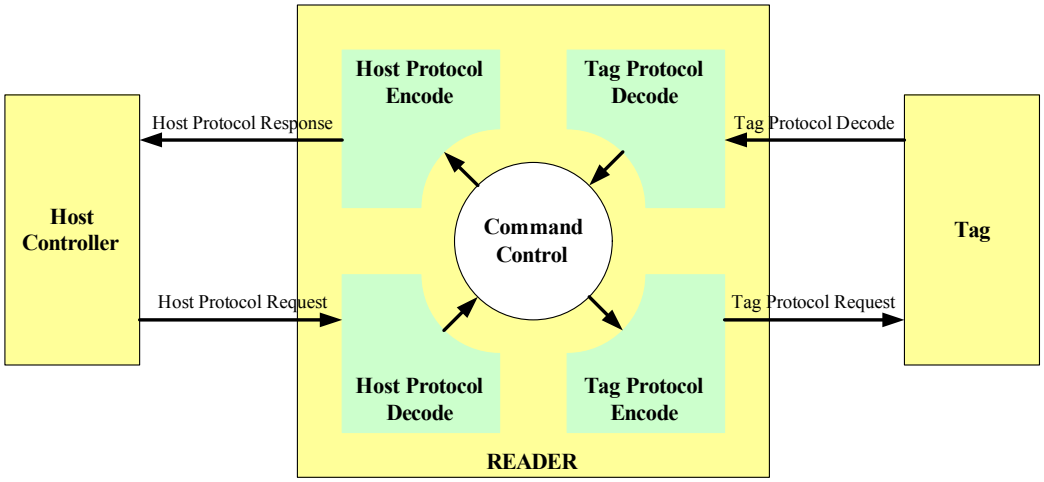

Fig 2-1. Data Flow Chart

The Fig 2-2 and Fig 2-3 show between the hardware configuration and user interface of the HANDFREE MINI READER MODULE. There are five parts of PDA or the cell-phone for system structures that are including the power, digit, radio frequency, base and FW respectively.

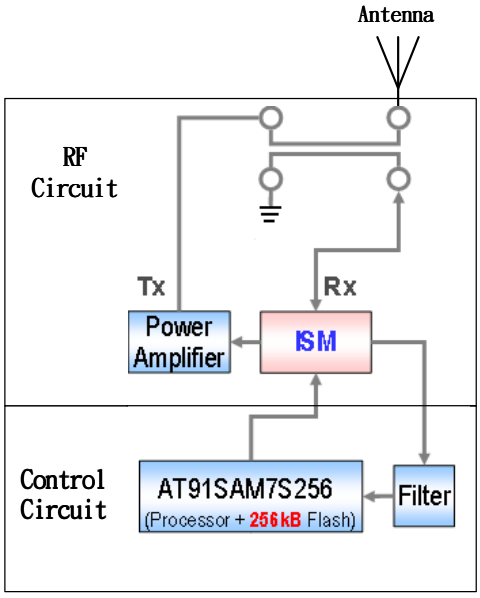

Fig 2-2. The Block Diagram of HANDFREE MINI READER MODULE

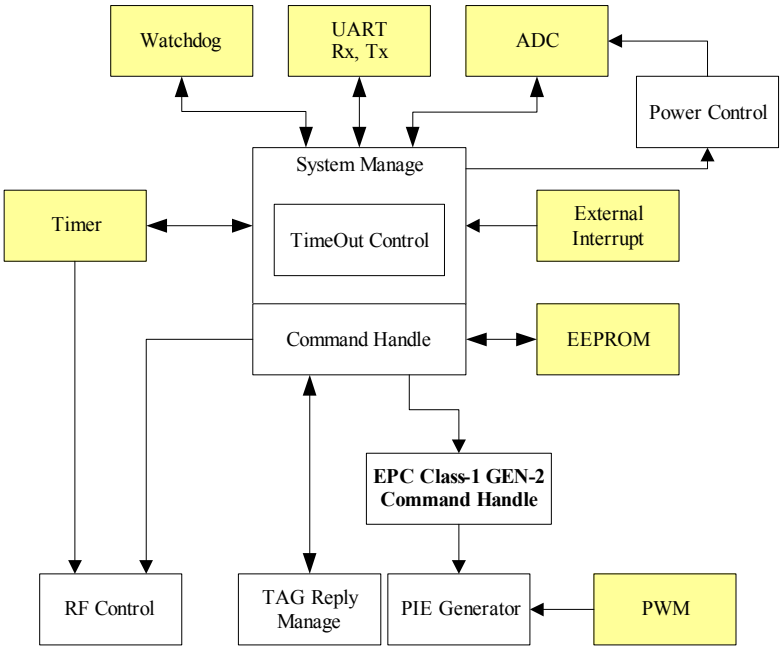

Fig 2-3. Micro-Control Unit Block Diagram

3. Frequency-hopping spread-spectrum waveform

The Handfree Mini Reader uses frequency-hopping spread spectrum (FHSS) signaling. The reader's RF envelope shall comply with Fig3-1 and Table 1. The RF envelope shall not fall below the 90% point in Figure3-1 during interval Ths. The reader shall not issue commands before the end of maximum setting-time interval in Table 1 (i.e. before Ths). The maximum time between frequency hops and the minimum RF-off time during a hop shall meet local regulatory requirements.

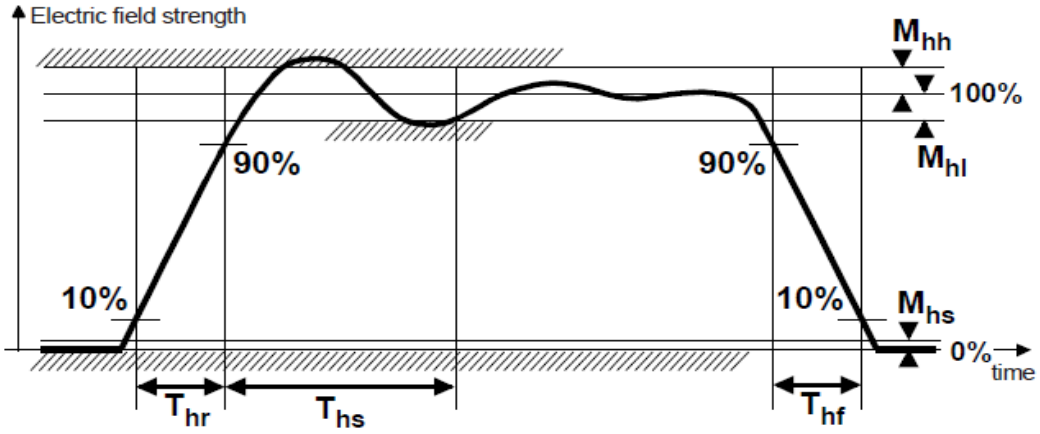

Fig 3-1

Parameter	Definition	Minimum	Typical	Maximum	Units
T_{hr}	Rise time			500	µs
T_{hs}	Settling time			1500	µs
T_{hf}	Fall time			500	µs
M_{hs}	Signal level during hop			1	% full scale
M_{hl}	Undershoot			5	% full scale
M_{hh}	Overshoot			5	% full scale

Table1

Commanded Tag backscatter format	Channel width	Channel center frequencies f_c	Guardbands
Subcarrier	500 kHz	Channel 1: 902.75 MHz Channel 2: 903.25 MHz • • Channel 50: 927.25 MHz	Lower bandedge: 902 MHz – 902.5 MHz Upper bandedge: 927.5 MHz – 928 MHz
FM0	In accordance with local regulations		

Table 2

4. Frequency Channel configuration Table

This table3 contains the power up default configuration for US FCC. This is a Pseudo Random, 50 channels table with frequencies from 902 to 928 MHz on 500KHz centers with appropriate guard bands.

Channel	Frequency	HST_RFTC_FRQCH_CFG	HST_RFTC_FRQCH_DESC_PLLDIVMULT	HST_RFTC_FRQCH_DESC_PLLDACCTL
0	915.75	0x00000001	0x00180E4F	0x14020200
1	915.25	0x00000001	0x00180E4D	0x14020200
2	903.25	0x00000001	0x00180E1D	0x14020200
3	926.75	0x00000001	0x00180E7B	0x14020200
4	926.25	0x00000001	0x00180E79	0x14020200
5	904.25	0x00000001	0x00180E21	0x14020200
6	927.25	0x00000001	0x00180E7D	0x14020200
7	920.25	0x00000001	0x00180E61	0x14020200
8	919.25	0x00000001	0x00180E5D	0x14020200
9	909.25	0x00000001	0x00180E35	0x14020200
10	918.75	0x00000001	0x00180E5B	0x14020200
11	917.75	0x00000001	0x00180E57	0x14020200
12	905.25	0x00000001	0x00180E25	0x14020200
13	904.75	0x00000001	0x00180E23	0x14020200
14	925.25	0x00000001	0x00180E75	0x14020200
15	921.75	0x00000001	0x00180E67	0x14020200
16	914.75	0x00000001	0x00180E4B	0x14020200
17	906.75	0x00000001	0x00180E2B	0x14020200
18	913.75	0x00000001	0x00180E47	0x14020200
19	922.25	0x00000001	0x00180E69	0x14020200
20	911.25	0x00000001	0x00180E3D	0x14020200
21	911.75	0x00000001	0x00180E3F	0x14020200
22	903.75	0x00000001	0x00180E1F	0x14020200
23	908.75	0x00000001	0x00180E33	0x14020200
24	905.75	0x00000001	0x00180E27	0x14020200
25	912.25	0x00000001	0x00180E41	0x14020200
26	906.25	0x00000001	0x00180E29	0x14020200
27	917.25	0x00000001	0x00180E55	0x14020200
28	914.25	0x00000001	0x00180E49	0x14020200
29	907.25	0x00000001	0x00180E2D	0x14020200
30	918.25	0x00000001	0x00180E59	0x14020200
31	916.25	0x00000001	0x00180E51	0x14020200
32	910.25	0x00000001	0x00180E39	0x14020200

33	910.75	0x00000001	0x00180E3B	0x14020200
34	907.75	0x00000001	0x00180E2F	0x14020200
35	924.75	0x00000001	0x00180E73	0x14020200
36	909.75	0x00000001	0x00180E37	0x14020200
37	919.75	0x00000001	0x00180E5F	0x14020200
38	916.75	0x00000001	0x00180E53	0x14020200
39	913.25	0x00000001	0x00180E45	0x14020200
40	923.75	0x00000001	0x00180E6F	0x14020200
41	908.25	0x00000001	0x00180E31	0x14020200
42	925.75	0x00000001	0x00180E77	0x14020200
43	912.75	0x00000001	0x00180E43	0x14020200
44	924.25	0x00000001	0x00180E71	0x14020200
45	921.25	0x00000001	0x00180E65	0x14020200
46	920.75	0x00000001	0x00180E63	0x14020200
47	922.75	0x00000001	0x00180E6B	0x14020200
48	902.75	0x00000001	0x00180E1B	0x14020200
49	923.25	0x00000001	0x00180E6D	0x14020200

Table 3

Is the hopping sequence pseudorandom, based on the technical description?

Yes.

Is each channel used equally on average, based on the technical description?

Yes

Does the associated system receiver have a compliant input bandwidth, based on the measured 20 dB emission bandwidth?

Yes

Does the associated system receiver have the ability to hop in synchronization with the transmitter, based on the technical description?

Yes

15.247(g) Does the design of the frequency hopping system allow it to comply with all pertinent requirements when presented with a lengthy data stream?

Yes

15.247(h) Does the frequency hopping system comply with the non-coordination requirement?

Yes