

Optimum Bitcoding and Baudrate for a Future Wireless Meter Readout Standard

I) Wireless Bitcoding

1.) Requirements

- a) DC-free data required for FM and AM
- b) Phase/Frequency-recovery for receive clock
- c) Bitsecurity?
- d) Minimize maximum 0/1-sequence length
- e) Fast regulation of data slicer
- f) Sync-Bits definition at end of data header
- g) Capture-Support
- h) Optimize HF bandwidth
- i) Simple Coding/Decoding
- j) Fast detection of idle header

2.) Current ideas

- a) Manchester/Biphase-Code 01/10
- b) Good Phase-und Clock-Recovery
- c) Fast Data-Slicer: Max 2 Clock times 00/11
- d) Idle Header if (3-4)*identical bits
- e) Capture-Support (3-4)*Identical alternating
- f) Required bandwidth: Poor
- g) Simple coding/decoding
- h) Fast recognition of Idle-Header
- i) Used in various systems/ ATEM/ RF-EIB

3.) New Proposal: Coding of 4Bit-Groups

- a) Goal: Higher code/bandwidth efficiency
- b) 4 data bits coded as 6 Chips (instead of 8 as manchester)
- c) Use only those 20 with $3^0/3^1$: DC-free
- d) Dont use: 000111, 010101 und their Complement
- e) Reasons: Max 0/1-length, bandwidth
- f) Max. 4 Zeroes and max. 4 Ones in series
- g) Acceptable for dataslicer (Manchester: 3-4)
- h) Use 00001111/11110000 for header/Capture
- i) Simple Decodierung: optimized Codetable
- j) Decodeable via HW or SW: Table or sequential
- k) Special Sync-sequence as header
- l) 33% more efficient (Bandwidth/data rate/uP-speed)
- m) Channel occupancy, collision rate, current requirement

II) Chiprate 32768 Hz

- 1.) Now 38400 kHz=19200Baud @Biphase-coding
- 2.) Advantages of high speed
 - a) Short channel occupancy: High channel utilization
 - b) Low battery discharge transmit
 - c) Fast header recognition= small average receiver current
 - d) Short telegrams: Collision, disturbances minimized
- 3.) Disadvantages of high speed
 - a) High bandwidth
 - b) Reduced sensitivity
 - c) Requires processor power
- 4.) Advantage of 38400Hz
 - a) Standard
 - b) Available if UART
 - c) UART-Access Receiver
- 5.) Disadvantages of 38400 Hz
 - a) No low cost quartz
 - b) No low power quartz
 - c) Not deducable from 32768 watch-crystal
 - d) Difficult for battery powered meters
 - e) Requires 2 quartz processors or MSP430-3xx
- 6.) New proposal 32768 Hz
 - a) Directly available from watch crystal
 - b) Simple low cost meters (especially transmit only)
 - c) High flexibility processor types
 - d) Custom-IC transmitters possible
 - e) 32kHz-Processors with RC-type fast clock
 - e) MSP 430-1xx directly usable
 - f) TEMIC and others usable
 - e) Custom-IC-solutions possible for alarm and similar syst.
 - f) Due to bitcoding: PC-UART not directly usable
 - g) Funk=Synchron, UART-Asynchron: Start/Stop/Synchron?
 - h) PC-receiver requires additional logik/ Speed conversion
 - i) 15% less bandwidth: More RF-frequency tolerance
 - j) 15% less required processor speed, Simpler software
 - k) 15% more transmission speed, channel capacity
 - m) 15% less battery charge
 - n) Goal: Proposal for future standard