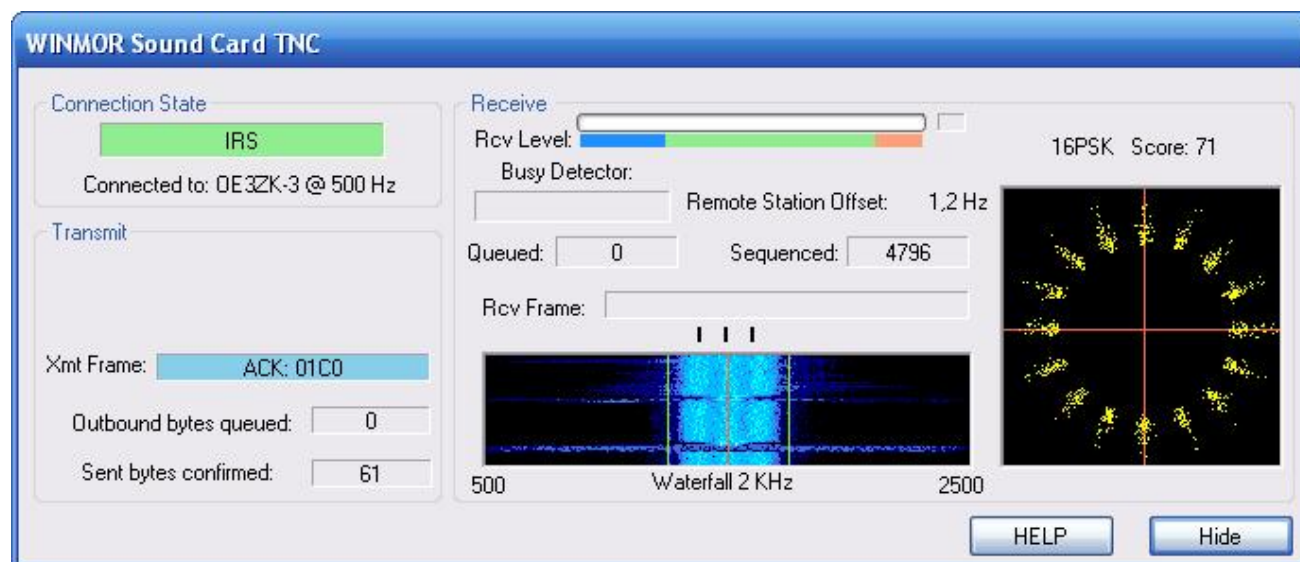


## WINMOR

### - ein Soundkarten TNC im Peer-to Peer Betatest



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## Allgemeines

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WINMOR wurde als digitales ARQ Übertragungsprotokoll [1] für die Verwendung mit dem Winlink2000 (WL2K) [2] Netzwerk konzipiert. Mit WINMOR entfällt die Notwendigkeit kostspieliger, externer, PACTOR Modem-Hardware. Allerdings wird WINMOR nie die Leistungsfähigkeit von PACTOR 3 bez. Datendurchsatz und Betriebssicherheit erreichen können. WINMOR wurde auf der ARRL/TAPR Digital Communications Conference in Chicago, September 26-28, 2008 erstmals präsentiert.

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## WINMOR...A Sound Card ARQ Mode for Winlink HF Digital Messaging

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### Abstract:

The improving computational performance of PCs and the near real-time response of PC operating systems now make it feasible to implement reasonable performance HF ARQ messaging protocols suitable for digital messaging. While Pactor (I, II, III) currently dominate and generally represent the best available performance, PC sound cards with appropriate DSP software can now begin to approach Pactor performance at lower cost than dedicated hardware HF modems. This paper covers the on-going development of an optimized sound card mode WINMOR, compatible with the popular Winlink 2000 message system<sup>1,2,3</sup>. This effort leverages a prior feasibility project by the author in the evaluation of SCAMP<sup>4</sup>, an adaptation of RDFT for digital messaging systems. The paper reviews the development effort of **WINMOR** (**WIN**link **M**essage **O**ver **R**adio) from motivation through tool development, programming, testing and deployment in the WL2K system.

### Key Words:

Winlink 2000, WINMOR, ARQ protocols, multi-carrier PSK, Sound Card Modes, Pactor, SCAMP, HF Channel Simulators

### Motivation:

The PC, widely available DSP tools, well designed sound card/radio interfaces and improving amateur software skills have yielded a variety of sound card modes over the last several years. These modes range from simple DSP/software implementation of RTTY through complex streaming applications like Win DRM. It is one of the few remaining areas where amateurs can and do experiment. Many of the modes developed however are a replacement of existing "chat" modes or "broadcast" modes where absolute accuracy is not a requirement or data is limited to plain ASCII text. Today, however, a viable message system (with the need for compression and binary attachments) requires true "error-free" delivery of binary data. To achieve this there must be some "back channel" or *ARQ* (Automatic Retry reQuest) so the receiving station can notify the sender of lost or damaged data and request retransmission or repair. HF Pactor (I, II, III) has served us well in this regard providing good performance (net bits/sec/ Hz bandwidth) and robustness. However the proprietary nature of high performance Pactor modems (Pactor II, III) can be cost prohibitive especially in applications such as emergency communications where wide deployment coupled with low average usage make it difficult to justify the investment in high performance but costly hardware. As developers of Winlink 2000 we are continually asked to supply a lower cost of entry than Pactor for those needing to access the WL2K system on HF.

WINMOR ist keine Software, sondern ein Protokoll, es gibt jetzt zwei Programme in der Entwicklung, die dieses Protokoll verwenden:

- **RMSExpress** ein Benutzer-Client-Programm
- **RMS-HF**, ein Radio-Message-Server als Teil des WL2K Systems.

## Protokollbeschreibung

## Durchsatzraten

### Tabelle erzielbarer Daten-Durchsatzraten

| WINMOR Mode Rate Worksheet (200, 500, 1000, 2000Hz B |            |           |       |          |            |                 |              |              |              | Revised: 9/17/2009 |                    | Rick Muething, KN6KB |           |                |                     |                               |                              |                                |
|------------------------------------------------------|------------|-----------|-------|----------|------------|-----------------|--------------|--------------|--------------|--------------------|--------------------|----------------------|-----------|----------------|---------------------|-------------------------------|------------------------------|--------------------------------|
| Mode Description                                     | Info b/Sym | Sampl Sym | Baud  | # of car | ~BW (Hz)   | Raw bps/H (Sym) | Leader (Sym) | OH/Car (Sym) | PL/Car (sym) | RS-FEC/Car (sym)   | Frame Length (sym) | Frame Length (sec)   | ACK (sec) | Rx+Tx +O (sec) | Tot Cycle Len (sec) | Net max Throughput (bits/sec) | Net max Throughput (byt/min) | Net max Throughput (wrds/min)? |
| 15 Car 16PSK Prag TCM + RS                           | 3          | 128       | 62,50 | 15       | 2000       | 1,41            | 27           | 16           | 256          | 56                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 1637,3                        | 12280                        | 4093                           |
| 15 Car 8PSK Prag TCM + RS                            | 2          | 128       | 62,50 | 15       | 2000       | 0,94            | 27           | 24           | 256          | 48                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 1091,5                        | 8186                         | 2729                           |
| 15 Car 4PSK Prag TCM + RS                            | 1          | 128       | 62,50 | 15       | 2000       | 0,47            | 27           | 48           | 192          | 80                 | 347                | 5,552                | 1,056     | 0,3            | 6,908               | 416,9                         | 3127                         | 1042                           |
| 15 Car 4FSK +RS                                      | 2          | 256       | 31,25 | 15       | 2000       | 0,47            | 13           | 24           | 64           | 64                 | 165                | 5,280                | 1,056     | 0,3            | 6,636               | 289,3                         | 2170                         | 723                            |
| 7 Car 16PSK Prag TCM + RS                            | 3          | 128       | 62,50 | 7        | 1000       | 1,31            | 27           | 16           | 256          | 56                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 764,1                         | 5731                         | 1910                           |
| 7 Car 8PSK Prag TCM + RS                             | 2          | 128       | 62,50 | 7        | 1000       | 0,88            | 27           | 24           | 256          | 48                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 509,4                         | 3820                         | 1273                           |
| 7 Car 4PSK Prag TCM + RS                             | 1          | 128       | 62,50 | 7        | 1000       | 0,44            | 27           | 48           | 192          | 80                 | 347                | 5,552                | 1,056     | 0,3            | 6,908               | 194,6                         | 1459                         | 486                            |
| 7 Car 4FSK +RS                                       | 2          | 256       | 31,25 | 7        | 1000       | 0,44            | 13           | 24           | 64           | 64                 | 165                | 5,280                | 1,056     | 0,3            | 6,636               | 135,0                         | 1013                         | 338                            |
| 3 Car 16PSK Prag TCM + RS                            | 3          | 128       | 62,50 | 3        | 500        | 1,13            | 27           | 16           | 256          | 56                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 327,5                         | 2456                         | 819                            |
| 3 Car 8PSK Prag TCM + RS                             | 2          | 128       | 62,50 | 3        | 500        | 0,75            | 27           | 24           | 256          | 48                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 218,3                         | 1637                         | 546                            |
| 3 Car 4PSK Prag TCM + RS                             | 1          | 128       | 62,50 | 3        | 500        | 0,38            | 27           | 48           | 192          | 80                 | 347                | 5,552                | 1,056     | 0,3            | 6,908               | 83,4                          | 625                          | 208                            |
| 3 Car 4FSK +RS                                       | 2          | 256       | 31,25 | 3        | 500        | 0,38            | 13           | 24           | 64           | 64                 | 165                | 5,280                | 1,056     | 0,3            | 6,636               | 57,9                          | 434                          | 145                            |
| 1 Car 16PSK Prag TCM + RS                            | 3          | 128       | 62,50 | 1        | 200        | 0,94            | 27           | 16           | 256          | 56                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 109,2                         | 819                          | 273                            |
| 1 Car 8PSK Prag TCM + RS                             | 2          | 128       | 62,50 | 1        | 200        | 0,63            | 27           | 24           | 256          | 48                 | 355                | 5,680                | 1,056     | 0,3            | 7,036               | 72,8                          | 546                          | 182                            |
| 1 Car 4PSK Prag TCM + RS                             | 1          | 128       | 62,50 | 1        | 200        | 0,31            | 27           | 48           | 192          | 80                 | 347                | 5,552                | 1,056     | 0,3            | 6,908               | 27,8                          | 208                          | 69                             |
| 1 Car 4FSK +RS                                       | 2          | 256       | 31,25 | 1        | 200        | 0,31            | 13           | 24           | 64           | 64                 | 165                | 5,280                | 1,056     | 0,3            | 6,636               | 19,3                          | 145                          | 48                             |
| 1 Car Connect Request (V4PSK)+RS                     | 1          | 128       | 62,50 | 1        | 200        | 0,31            | 27           | 0            | 104          | 32                 | 163                | 2,608                |           |                |                     |                               |                              |                                |
| 1 Car Coded Control 4FSK + RS                        | 2          | 256       | 31,25 | 1        | 200        | 0,31            | 13           | 0            | 8            | 8                  | 29                 | 0,928                |           |                |                     |                               |                              |                                |
| 1 Car ACK 4FSK +RS                                   | 2          | 256       | 31,25 | 1        | 200        | 0,31            | 13           | 0            | 12           | 8                  | 33                 | 1,056                |           |                |                     |                               |                              |                                |
| Leader extension (symbols 0-16)                      | 0          |           |       |          | See Note 2 |                 |              |              |              |                    |                    |                      |           |                |                     |                               |                              |                                |
| Calculated Leader extension (ms)                     | 0          |           |       |          |            |                 |              |              |              |                    |                    |                      |           |                |                     |                               |                              |                                |

Notes: 1) The 4FSK mode was modified for lower user data and higher RS FEC and now runs slower than the 4PSK mode.  
2) Leader extension up to 16 symbols (256 ms) may be used for slow switchover Transceivers or VOX operated PTT  
3) The above modes yield the following speed ranges depending on session bandwidth:  
note these selections may change based on testing!  
2000 Hz BW Sessions: 15x16PSK, 15x8PSK, 15x4PSK, 15x4FSK, 7x4FSK ~ 12:1 speed range  
1000 Hz BW Sessions: 7x16PSK, 7x8PSK, 7x4PSK, 7x4FSK, 3x4FSK ~ 13:1 speed range  
500 Hz BW Sessions: 3x16PSK, 3x8PSK, 3x4PSK, 3x4FSK, 1x4FSK ~ 18:1 speed range  
200 Hz BW Sessions: 1x16PSK, 1x8PSK, 1x4PSK, 1x4FSK ~ 6:1 speed range  
4) Session BW is set by Server (answering) station using one of 4 coded idle frames (200, 500, 1000, or 2000 Hz)  
5) All PSK modes use pragmatic Trellis Code Modulation (one redundancy bit/symbol) and use the standard R=1/2, K=7 (NASA Voyager) Viterbi Encoder/Decoder based on Phil Karns Code.  
6) Rx + Tx + O refers to the receive to transmit, transmit to receive and software overhead delays and is typical for modern hardware. The protocol actually measures the latency due to RX-TX switchover, sound card and CPU processing latency.  
7) Word per minute calculation based on average word of 5 char + space and a 50% compression ratio (typical using B2 compression on mid to large messages). Short messages will be less.

## Software

## Betatest- und Sked-Frequenzen

Der WINMOR Betatest findet gegenwärtig im "Peer-to-Peer" Verfahren statt. Die Anbindung an WL2K über RMS-HF wird erst später möglich sein.

14.112 MHz Dial USB ist die Hauptfrequenz in Europa.

Skeds können hier [\[3\]](#) vereinbart werden.

### MHeard Log von OE3ZK auf 14.112 MHz

2009.10.08 18:36:56 K2MO

2009.10.08 18:29:01 C56DL

2009.10.08 17:30:01 PD4U

2009.10.06 19:28:10 KB3CS

2009.10.06 18:54:15 N2UBP

2009.10.06 18:53:37 9Y4LT

2009.10.06 18:22:02 K4PPK

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2009.10.06 18:22:02 K4PPK  
2009.10.06 16:23:40 EA5GF  
2009.10.05 19:50:52 OE1KBC  
2009.10.05 18:07:47 K4DMU  
2009.10.05 17:58:52 KD4NUE  
2009.10.05 16:31:11 KR4XN  
2009.10.05 16:19:57 NY3J  
2009.10.05 15:28:28 KB0E  
2009.10.05 15:25:33 OH7JJT  
2009.10.05 14:26:48 OE3ZK-3  
2009.10.04 17:51:26 PA0LSK  
2009.10.04 17:34:09 IZ3LEF  
2009.10.04 17:30:37 EA2AFR  
2009.10.04 14:02:38 K4JCC  
2009.10.04 13:05:12 LA3RIA  
2009.10.03 18:30:42 9Z4BM  
2009.10.03 15:49:00 VE2AEY  
2009.10.03 15:26:10 VA3LKI  
2009.10.03 14:22:46 W5SEG  
2009.10.03 13:50:44 ON5VW  
2009.10.03 13:37:45 N1CPE  
2009.10.03 12:58:28 LA5VNA  
2009.10.03 12:02:13 I3FUE  
2009.10.03 09:41:43 S57MK  
2009.10.01 18:12:13 LZ1CWK  
2009.10.01 17:38:25 LZ1OE  
2009.10.01 09:02:31 LZ1ZM  
2009.09.29 11:22:49 SM6ESQ