```
+--------------------------+
|                          |
|          |     |         |
|    |    |||   |||    |   |
|  |||  ||||| |||||  |||   |
| |||||||||||||||||||||||  |
| ------------------------ |
| D I G I T A L  R U L E S |
+--------------------------+
```

Digital Signals FAQ Version: 5.3

Last Update: Aug 23, 1997
Portions Updated 2001-2004 by Worldwide Utility News

Changes made for Version 5.3
- New version of chapter 6: Decoders
- Added new info to chapter 7

Changes made for Version 5.0

- Added LESW, new 39-tone modem, HELLSCHREIBER, Mazielka, DGPS, CODAN
- Enhanced VFT section, fixed CLOVER-2000 tbl errors, updated MS5
- MIL188, COQ-82, Twinplex, RAC-ARQ, CROWD36, IRA-ARQ, PSK
- New Decoder info on Code 3 Gold, Wavecom W4100DSP and W41pc, Shareware
- New Section - ACF Summary
- New Appendix section

Changes made for Version 4.0

- New modes info, 36-50, 4+4, 1200-FSK, NATO, VFT, PSK and mystery modes
- New Reordered VHF info, added new FLEX, POCSAG, ERMES, NEC-D3 info
- New info added for Amateur modes
- Expanded Alphabet Tables
- SELCAL info added w/New Table
- References section updated

This Signals FAQ is a collaborative effort, maintained by Stan Scalsky and Mike Chace. Any questions, comments or corrections will gladly be accepted.
The authors imply no guarantee on this information and do not claim to be experts or professionals in the field of signal monitoring. All information has been gathered from public domain sources, manufacturers documents, decoder documentation, real time analysis and any radio related publication that cares to write about digital signals. We have tried to research for correctness each mode listed but it must be said that there are a lot of inaccuracies and disinformation present in the mainstream press. It is therefore a safe assumption to assume that those inaccuracies could also appear here.

Many thanks to those of you who post logs, information and answer stupid questions in the various forums that cover digital signals - you know who you are.

NOTICE: All contributors of information, tidbits, comments and corrections will be considered confidential when constructing this document.

A word of Caution: the rules about listening to signals not intended for you applies here. The contents of many signals might be considered sensitive by the party sending and the reception of such signals may be illegal in your country. The authors neither condone or encourage such acts

I would like to solicit material, to be included later, on any other analysis techniques and/or DF techniques the utilities community is currently using.

TABLE OF CONTENTS

Section 0 - Introduction

This Signals FAQ is designed to give utility listeners a sampling of the kinds of signals and sounds available on shortwave/vhf radio today along with information on the available equipment needed to understand, analyse or identify these signals. Our primary focus is to present the parameters that define the most commonly heard systems as an aid for utility monitors and not an exhaustive discussion of HF digital signalling theory. It is also our intention to give monitors a best guess clue as to who the user of an unconfirmed signal may be.

With conditions being dismal over the last few years coverage of Utility Listening, especially Digital Utilities, has been dropped from most of the main stream shortwave magazines. But in and of itself, Digital Utility listening is inherently more difficult than regular shortwave listening. The possibility of decoding the signal received adds another level of complexity. This FAQ is an attempt to let those beginners who are thinking of or wondering what digital signals can be received and decoded and maybe provide the more advanced listener with a little more information to identify those unknowns.

Here in lies the basic problem with digital utility listening - lack of information. Many systems are used by Military or Diplomatic Services and information on the specifics of a particular mode are impossible to find, even from the manufacturer. Many are considered proprietary, but that doesn't mean that a signal can not be identified! With the proper tools a given signal can be identified via the way it sounds (aurally) or how it looks (visually). Most decoders that include some kind of signal analysis can ID a signal by bit-pattern or baud rate. Many signals have a unique baud, i.e. 300 baud packet, 240 baud HC-ARQ or 164.5/218.3 ROU-FEC. Once a signal is identified there are many decoders that can print the traffic for you but keep in mind various kinds of encryption are commonly found in use with these signals. Encryption types include figure group or letter group messages and even random bit-masking or bitstream encryption, which looks like a continuous stream of random characters. You may often read the term "on-line" and "off-line" used in conjunction with various encryption schemes. Generally, off-line encryption is taken to mean groups of letters or numbers (most usually groups of five), whereas on-line schemes just appear as a continuous stream of random characters.

Keep in mind that you must be able to find a signal before you can apply the power of the decoder on the signal for identification and possible decoding. Most signals found on the airwaves today are obvious with easily distinguishable sounds, from chirping to two tone FSK to musical multitone MFSK, but as communication technology develops this will most likely change. It is safe to say that the more efficient a modulation/coding method is, the more noise like it must become. I have heard it

said in some digital groups that "Any sufficiently advanced communication is indistinguishable from noise".

And now a word about decoders...

There are many kinds of data decoders available ranging from public domain packages to professional dedicated units. Prices vary from free up to very expensive and price is dependent on how much you want to be able to decode and what tools are available for signal analysis and identification. Public domain packages, while good, can not compete with the capability provided by the more expensive dedicated data decoder unit. It is safe to say that price goes up with increased capability in this market - be prepared to spend some big money if you want to cover a lot of modes. A good rule of thumb is that a top-spec decoder will cost as much as a top-spec radio, i.e. upwards of 2,000 dollars. You'll also need to decide upon whether to buy a stand-alone decoder or one that requires a computer to run. The latter option will of course increase the cost if you don't already possess a machine, but does add flexibility to a decoder. See the Decoders reference in Section 5 for unit specifics on capability and pricing.

What should you look for in a decoder? Some useful features include:

- Signal Identification
- Accurate baud rate measurement
- Correlation Bit Analysis
- Variety in modes decoded/identified
- Ability to save captured text (disk and printer)
- Tools for analysis

You can't beat a good Signal Identification Mode, both the Wavecom units and Hoka units include this option. Also, more recently some Trialware software (RadioRAFT) is including Signal Identification. A good Signal Identification mode simplifies the task of figuring out what mode is currently tuned, but keep in mind that even the best Identification mode is not always 100% correct.
A common problem is that some keying systems share common idle characteristics (for example: SWED-ARQ, SITOR-A and TWINPLEX or SITOR-B and POL-ARQ) and active traffic is needed to correctly identify the exact mode. Also the presence of local interference, various propagation effects, or a noisy signal can make it difficult to correctly identify. Universal decoders do not include an Identification mode.

Accurate measurement of baud rate is another vital capability. Many modes can be accurately identified on baud rate alone because many rates are unique to a keying system. It also provides the opportunity to "fingerprint" a signal, system or the user. For example, the Hoka decoders can measure baudrate accurately to 3 decimal places in the presence of a quality signal but also do well on marginal signals, eventually settling down on a reasonable measurement. If your signal is full of noise you might not see 3 decimal places but at least on Hoka decoders you will have displayed those decimal places that make sense - a very nice feature.
Universal decoders have trouble with accurate baud rate measurement on the faster keying systems (for example: 192 ARQ-E) and noisy signals can be particularly confusing resulting in some very odd numbers.
I don't have any direct experience with the Wavecom line of decoders so I will not offer a comparison here. See the Baud Rate Summary Table in Section 3 for further information.

Autocorrelation Bit is a technique that samples the incoming digitized bit stream and presents the data as a graph of bit occurrences plotted against time. This will show when patterns occur within a signal, allowing you to determine the number of bits in a character frame (this is commonly referred to as the ACF), giving you another piece of information when working out an unidentified system. This kind of analysis tool reveals cycle period and shows when there are NO patterns in a signal indicating an encrypted or random bit-masked signal, allowing you to move quickly onto more productive signals. Hoka and Wavecom decoders include autocorrelation bit modules. See the ACF Summary Table in Section 4 for further information.

Mode variety is a personal preference. I would like to have a module for any mode I can receive in the spectrum! While not possible or realistic I will take as many as I can get. I find there is nothing more frustrating than being able to receive a clean signal and then not being able to identify or decode it (ignoring the problem

of encrypted signals for the moment). As of this writing it seems that Hoka offers the largest variety of modes, followed by Wavecom and finally Universal. See the manufacturers listing in Section 5 for the modes decoded by various units.

The ability to save decoded output to a file and/or the printer should be considered a very important feature of any decoder. Having some form of hard copy, on disk preferably, allows for archiving for later reference or later analysis and independent printing and editing. Hoka decoders have the ability to save decoded text to disk or output to the printer. I believe Wavecom its have a similar ability. Universal decoders support direct output to a printer and with some software can capture to disk.

If you are interested in going beyond the Identification and decoding of signals heard on the air you are going to need tools. Tools such as Spectrum Analyzers, Character Analysis and Phase modules are some of the necessary tools needed to analyze today's modern systems. This is, for obvious reasons, not for everyone. As of this writing, Hoka and Wavecom, provide extensive tool sets for analyzing signals. Universal decoders provide primitive tools sets but in all fairness, Universal decoders are not really meant for analysis but rather are best used for decoding known systems. Shareware/Trialware software is starting to include more sophisticated tools. See the listing of manufacturers in Section 5 for details.

I also like a responsive manufacturer who regularly updates their decoder in line with developments "on the air". Variations on existing systems and completely new systems are still appearing today. See the table in section 1-K for some examples.

Section 1 - Modes on Shortwave

What modes are currently on shortwave? This section attempts to present a little information about each kind of signal that can be heard within the shortwave spectrum. Signals are grouped together by the way they sound. This is an attempt to narrow the field of possible signals when trying to identify an unknown. The typical baud rate(s) of the signal is mentioned, if known, and any other synonyms or possible names are given. But ... don't make the assumption that these are ALL the modes you will ever hear. There are many signals that remain unidentified. See section 1-K for an extensive list of unknowns.

For specific details concerning modulation, framing and alphabets used by any of the following signals see Section 4.0 on System Parameters.

1-A. SINGLE TONE systems.

Single tone systems are becoming common these days with the classic Morse still in use and found in most utility bands. Newer single tone systems using Phase Shift modulation are starting to appear and are supposed to perform well in poor conditions.

CW — Morse code still used by the Amateur community and Marine operations. Speed varies depending on whether hand generated or machine generated but rates varying from 10-400 can be found. Most often found using either the standard or Cyrillic Morse character set.

LINK-11 LESW — There is a new Link-Eleven Single-tone Waveform (LESW) specification. It features an 8 phase PSK (DCPSK, Differentially Coherent PSK), scrambled, 1800Hz tone. The system is supposed to be good against poor HF conditions and problems such as multipath and fading. Throughput rates up to 4800bps occur with block inter-leaving of 0, 1.2 or 9.6 sec delay. Each packet has 192 bits (80ms) + 64 bits sync (26.67ms), each frame carries 72 bits of user info and the last frame always contains a 72 bit stop sequence. See MIL-STD-188-110A or NATO STANAG 4285. This waveform is implemented in the

General Atronic GA-122 HF modem or the Harris RF-5254B. Swedish diplo stations use a derivative of this system from Rockwell/Collins (Mediaware).

Single tone modems sound like 3kHz of noise.

HF=Datalink — An ACARS-like system used between airplanes and ground stations for passing tech info is now operational on HF. The system is an adaption of the MIL-188-110A single tone waveform modem and uses 8PSK modulation at a rate of 3600chips/s. Ground stations broadcast system management uplink packets ('squitters') every 32s on 3 or more active frequencies. This assists in finding error free channels. Adaptive rates of 150, 300, 600, 1200 and 1800 bps are supported. See Monitoring Times 6/95 Plane Talk or the Digital Review column in WUN 10/95 (V1/10) and WUN 11/95 (V1/11) for more info. Also known as HFDL or ACARS on HF. You may see this referenced as ARINC 753.

1-B. SYNCHRONOUS DATA BLOCK signals.

Signals of this type generally sound like SITOR-A - a distinctive chirping sound is their main characteristic. Short SWED-ARQ sounds and is exactly like Sitor-A. Idling TWINPLEX is the same as Sitor-A. To identify these signals by ear may be impossible depending on which mode they are currently in. A decoder that can determine signal type may need active traffic to correctly identify the mode currently tuned.

ARQ6-70 — A simplex ARQ system with a 70 bit block length using the ITA3 alphabet. A regular user is unknown but the French Diplo service has in the past. No loggings have been found for quite some time and no loggings have been reported in the previous year via WUN.

ARQ6-90/98 — 6-character-block simplex ARQ used by French and Italian Diplo services, typically 200 bd. ARQ-6/90 and ARQ-6/98 differ in their inter datablock timing.

G-TOR — Golay Transmission over Radio. A system developed by engineers at Kantronics, Inc. Users of this system include Military (Irish Air Corp, Irish Navy, Mexican Army), governmental agencies (ICRC) and the Albanian Christian Network (ACN). See WUN/Utility Round-Up 2/97 (V3.2) for more information on the ACN.

G-tor's "claimed" main advantage is speed - up to 4x faster than pactor. It also incorporates a data interleaving system that assists in minimizing the effects of atmospheric noise and has the ability to fix garbled data. G-tor tries to perform all transmissions at 300bd but drops to 200bd if difficulties are encountered and finally to 100 bd. All acknowledgments (ACK's and NAK's) are sent at 100 bd.

SWED-ARQ — Swedish Adaptive simplex ARQ used by Swedish Diplo services, typically 100 bd. Comes in the 3 packet lengths: 3, 9 and 22. Universal literature refers to this as short, medium and long. The system is able to change packet length in mid transmission, depending on conditions, giving SWED-ARQ its adaptive capability. Also known as ARQ-SWE.

TWINPLEX — 4 frequency diplex system used by organizations such as Interpol and United Nations and the government Diplo services of countries such as Australia, Denmark, Holland, Norway, Pakistan and Spain. Typically runs at 100 and rarely at 200 or 300 bd. This 2 channel system supports several different shift parameters and word,

bit, character or not-interleaved of the channel characters but is easy to identify because of its 4 peak signal. Reference Table 4-F for all the parameters. This system was developed by Thrane and Thrane of Denmark. Also known as F7B4 or TWINPLEX-SITOR.

Also see Section 1-H, BAUDOT/F7BBN, for another form of TWINPLEX.

SITOR-A The most common ARQ signal used by Amateur, Marine and some Gov. Diplo services, typically 100 bd. SITOR-A is most commonly monitored with a 170Hz shift but stations such as MOI Spain have been monitored using a 400Hz shift, Guardia Civil, Spain have also used a 400Hz wide shift, the Spanish Air Force has been using a 300Hz wide shift and the Norwegian Navy has been found using 300Hz and 850Hz shift. Also known as ARQ or TOR.

Common User	Shift (Hz)
Amateur, Marine, Gov. Diplo	170
Spanish Air Force	300
MOI Spain	400
Guardia Civil, Spain	400
Norwegian Navy	300 850

SI-ARQ Siemens Simplex ARQ used by Austrian and Indonesian Diplo services, typically 96, 144, 192 or 200 bd. Also known as ARQ-S or ARQ-1000S.

MERLIN/ALIS/ RS-ARQ Rohde & Schwarz simplex ARQ, so far found in use by German, Italian (MFA and GDF), Nairobi and Turkish Diplo services, typically 228.7bd but reports of 457.0 have been noted. Usually found with an ACF=59.

There appears to be no "real" name for the data system. Now referred to in Klingenfuss documents as ALIS but strictly speaking, ALIS is only the automatic link processor and frequency management system. It is not responsible for generating the traffic. ALIS is therefore somewhat of a misnomer. The modems generating the traffic are the GM857 and GM2000. Our suggestion is to stick with RS-ARQ as the system name.

Many of the diplo users actually control their networks with MERLIN, the name for the R&S complete data-over-radio and message handling system that can transparently deal with many types of data (fax and voice included). Consequently it has many modes. See Klingenfuss Radioteletype Code Manual 13th Ed. under "ALIS" for more information. Formerly referenced as RS-ARQ in the 12th Edition.

Reference section 1-D for the multi-tone ALIS-2 system and section 1-C for a packet-like MERLIN system.

DUP-ARQ A semi-duplex ARQ system used by the Thai and Hungarian Diplomatic service with unconfirmed use by at least one other Far Eastern Diplomatic service so this system is not unique to the Hungarians. Baud rate is typically 125 bd using ITA-2. If a DUP-ARQ system detects interference it will change frequency in 400Hz steps. If a 3kHz channel is full of interference the system will select another frequency. Also known as ARTRAC, or 125-ARTRAC.

DUP-ARQ-2 An ARQ system with the same block timing as DUP-ARQ but runs at twice the baud rate - 250 bd and uses the

ITA2 or ITA5 character set. Recent DUP-ARQ systems now auto-switch to DUP-ARQ-2 at 250bd so this system is really an enhancement to the original DUP-ARQ system. Automatic channel selection and channel hopping are still supported. Also known as ARTRAC II. First listed in Klingenfuss 14th Ed. Utility Guide. This system has been monitored sending foxes de stc.

Probable DUP-ARQ-2 signals have been noted on 13459, 13462, 14873 and 16061Hz. Look for the characteristic channel hopping.

IRA-ARQ Duplex ARQ with IRA (ITA-5), used by Czech/Slovak Diplo stations (MFA Praha, CZE), typically 171.42, 200.2, or 300.3 bd. This system uses an 11 bit character and the signal has some very wide ACF values, ACF=352 or 448 have been recorded.

A tip for monitors is to remain on frequency with the decoder set to ASCII/ITA-5 at the same speed that the ARQ is sending. Once the transfer is complete, operator chat often takes place in standard ASCII or BAUDOT.

PACTOR A system designed with a combination of packet and sitor techniques used by amateurs, MARS stations and many quasi-governmental organizations. Mutually incompatible variations are becoming common with changes made to the packet structure to support privacy requirements of the various quasi-governmental users. Commonly referred to as UN-pactor, ICRC-pactor or Swiss-pactor.

The developers of Pactor, Special Communication Systems (SCS), have licensed their hardware and software to Schuemperlin Engineering AG which has actively pursued commercial acceptance of this protocol and as many as 7 different variants have been noted so far. Code 30 defines the following variations:

	Common User	Label
Pactor 1	Amateur Non-Governmental Orgs	PACTOR
Pactor 2	ICRC	PACTOR-I
Pactor 3	UNHCR	PACTOR-U
Pactor 4	IFRC	
Pactor 5	UNO/MSF ?	
Pactor 6	included in Code 30	
Pactor 7	included in Code 30	

Don't know if Pactor 5 is the same thing to Wavecom and Hoka and who the users of Pactor 5,6 and 7 is unknown.

ICRC - Int'l Committee of the Red Cross
UNHCR- UN High Commissioner for Refugees
IFRC - Int'l Federation Red Cross and Red Crescent Societies
UNO -
MSF - Medicins sans Frontiers

Pactor I is the original implementation and is also known as FSK Pactor. Pactor II is DSP based and is as much as 8 times faster then Pactor I.

A Pactor Level II signal features 2 tones w/200Hz shift using baud rates of 100 or 200 fitting into a 500Hz channel. Pactor II is a half-duplex synchronous ARQ

system and designed to be backward compatible with the older Pactor Level I protocol. The system can handle raw 8 bit data and ASCII compression. Depending on band conditions the data throughput can be increased by changing the modulation form used. Maximum throughput is 800 bps. Pactor Level II is operational in Europe and is in the manufacturing stage in the US.

format		baud rate
DBPSK	Differential Binary PSK	200 bps
DQPSK	Differential Quad PSK	400 bps
8-DPSK	8-phase Differential PSK	600 bps
16-DPSK	16-phase Differential PSK	800 bps

1-C. PACKET-like signals or ASYNCHRONOUS DATA BLOCK signals.

While packet signals are a non-continuous signal much like SITOR-A their sound is totally different from the regular chirp, chirp sound of SITOR-A. These signals do not have the regular cadence of SITOR-A but have more of a long duration burst sound.

HC-ARQ — Haegelin-Cryptos simplex ARQ, a mode used by UN and Red Cross services but these organizations have been making a switch to PACTOR in recent years with very few loggings in 95/96. This asynchronous system uses a packet like protocol with no defined timing and supports packet/block sizes of 38, 68 and 188 ITA2 characters but always runs at 240 bd.

PACKET — A mode used to allow data communications between PCs and dumb terminals. This system is typically used by radio amateurs, and to a lesser degree, United Nations organizations. Incompatible versions also exist and are in use by quasi-governmental organizations such as ICRC, UNHCR or IFRB. Typically the AX.25 protocol incorporates a modified CRC. On HF there are a few items to note;

AX.25 — Typically 300 bd on SW. Data is arranged in packets of up to 256 bytes of 8 bit ASCII data. Each packet contains a 1 byte start flag, 3 byte address field, 1 byte control field, 0-256 bytes of data, 2 byte CRC and finally a 1 byte end flag. Packets are transmitted with no fixed timing. See the latest specification published by the American Radio Relay League (ARRL) for complete details on this system. There is also some 1200 baud PSK work done in the 10 meter ham band.

Automatic Packet Reporting System or APRS, is an application that runs "on top of" AX.25. It was invented by Bob Bruninga WA4APR that utilizes GPS data to plot a packet station's location on a map of a given region, city, state, or even country. Due to the graphics involved, units like the M8000 will not read this data; however, units like the PK232 can read it with the use of special software. Signals utilizing this mode are found in the 40 and 30 meter bands (for example) utilizing 'gateways' into 2 meters.

CLOVER — A system originally developed by Ray Petit, W7GMH, and now marketed by HAL Communications. The original modem was named CLOVER-I, the latest DSP based modem is named CLOVER-II. It sounds like a "canary" when transmitting. A signal consists of a 1s burst + a long 20s data transmission. Clovers key characteristics are bandwidth efficiency with high error-corrected data rates. Clover adapts to conditions by constantly monitoring

the received signal. Parameters which can affect quality and reliability of the transmission such as block data errors, phase dispersion, frequency offset, and signal to noise ratio are monitored. Based on this monitoring, Clover determines the best modulation scheme to use. Clover supports the following formats:

format		baud rate
BPSM	4 pulse binary phase	125 bps
QPSM	4 pulse quad phase	250 bps
8PSM	4 pulse 8 phase	375 bps
16PSM	4 pulse 16 phase	500 bps
8P2A	4 pulse 8 phase 2 amplitude	500 bps
16P4A	4 pulse 16 phase 4 amplitude	750 bps

Total band width for all modes is a narrow 500 Hz with a symbol rate of 31.25. Also known as 500Hz-CLOVER.

400Hz-CLOVER — This is regular DSP based CLOVER packed into a narrow 400 Hz bandwidth. This form of CLOVER is proprietary to GLOBE WIRELESS and was developed in cooperation with HAL Communications for use in Maritime communications. Also known as CLOVER-II or KFS-CLOVER. This form of CLOVER cannot be demodulated with standard CLOVER boards as the DSP programming, power requirements and memory capacity of the board was redone to support the new narrow bandwidth.

CLOVER-2000 — A commercial form of CLOVER developed by HAL Communications, now in beta test. Supports 4x the speed of standard CLOVER and uses a bandwidth of 2kHz. With the doubling of tones HAL has effectively doubled the rate. Symbol rate is now 62.50. The 8 tones that make up this signal are spaced 250Hz and are both phase and amplitude modulated. Maximum bit rate is 3000bps. BPSM, QPSM, 8PSM, 8P2A, and 16P4A with "auto-throttling" are supported. Data packets are long, about 4s in duration. Idle chirps are short, about .3s in duration with about .8s between chirps. Also known as "8-tone CLOVER", Q-CLOVER, or QUAD-CLOVER.

format		rate
BPSM	8 pulse binary phase	500 bps
QPSM	8 pulse quad phase	1000 bps
8PSM	8 pulse 8 phase	1500 bps
8P2A	8 pulse 8 phase 2 amplitude	2000 bps
16P4A	8 pulse 16 phase 2 amplitude	3000 bps

MERLIN/RS-ARQ/packet — A packet-like system running at 225bd with a shift of 170Hz is believed to be another MERLIN/RS-ARQ variant, its actual designation is unknown at this time.

1-D. MULTI-TONE signals/MFSK systems.

These signals are distinctive in how they sound. A rapid succession of tones, almost music-like in quality is their main feature. A sophisticated decoder and a rock steady receiver is needed to process these signals.

PICCOLO MK6/MK10 — Originally developed in 1957 in Great Britain at the Diplomatic Wireless Service or as it is known today the Communication Engineering Department of the British Foreign and Commonwealth Office (FCO). The original system was a 32 tone system and the development team was lead by J.D.Ralphs.

There is a 6 tone system (MK6) using ITA2 and a 12 tone system (also MK6) using ASCII/ITA5 but the 6 tone system is the more common. The 6 tone system is used mainly by the British Gov., Australian Gov. stations and Chilean Military. The 12 tone system is used mainly by the British Gov.

Both of the above systems normally run at 20bd but a 40bd, double speed variant, known as PICCOLO MK10 has been reported in use by British Gov. PICCOLO MK10 uses 6 tones, a special alphabet and different standby tones. Both 20bd systems can still be found on the air and the modern MK6 unit is manufactured by RACAL. The 40bd system is rarely found at this time. Reference the Klingenfuss RadioTeletype Code Manual 13th Edition for the tone pairs and PICCOLO MK6 alphabet.

For tuning purposes on a 6 tone PICCOLO MK6 signal, zero between tones 3 and 4, on a 12 tone PICCOLO signal zero between tones 6 and 7. A PICCOLO signal only has a 20Hz shift between tones so precise tuning is important and the ability to magnify a signal is a great feature. Inexact tuning will induce translation errors.

COQUELET

COQUELET Mk I is an asynchronous 13 tone ITA2 system used by French (possibly abandoned) and Belgian mil./ police. COQUELET Mk II is a synchronous 8 tone ITA2 system used by Algerian Diplo and Customs. COQUELET Mk I is also referred to as COQ13. COQUELET Mk II is also referred to as COQ8 and can use a fourth shift Arabic/Latin keyboard.

Also note that users of COQ8 seem to be using a hybrid COQ8/COQ13 system (possible COQUELET Mk III?). It is probable that this is COQ-82 or COQUELET-8 v2, a synchronous scrambled system (mentioned as being available on Wavecoms W41PC/W4100DSP) used on the Algerian Diplo links. This system is capable of recognizing either Latin or Arabic keyboards and can switch accordingly. The system has a distinctive 13.3bd preamble with a row of 'j's. This system is probably being phased out.

COQ13 translates each 5 unit ITA-2 character into a sequence of 2 tones out of total of 12. A 13th tone represents the idle condition. The system takes each character and breaks it into a 3 bit piece and a 2 bit piece. The first 3 bits of the character are sent as 1 out of 8 possible tones (1-8) and the second 2 bits are sent as 1 out of 4 possible tones (10-13). The idle tone, tone 9, is heard only during the idle or standby condition. Each tone is 75 ms in length or one character is 150 ms long giving the system a baud rate of 13.5.

COQ8 directly translates each character into a set of 2 tones from a total set of 8 tones. The idle condition used by this system is made up of tones 1 and 8 sent alternating. Each tone has a duration of 37.5 ms or 75 ms, giving an effective baud rate of 26.67 or 13.3. Baud rates of 53.3 have also been monitored.

For tuning purposes on a 13 tone Coquelet signal, zero on tone 9 during standby or between tone 8 and 10. On an 8 tone Coquelet signal zero between tones 1 and 8, these tones alternating is the idle condition. In general, a Coquelet signal only has a 30Hz shift between tones so exact tuning is important and the ability to magnify a signal is a great feature.

Reference Klingenfuss RadioTeletype Code Manual 13th Edition for this systems tone mapping and alphabet.

CROWD36 A Soviet MFSK system using 36 tones based on British Piccolo MK1. CIS Diplo service is the main user with suspected use by CIS Intel and Military services. This system is found at 40 bd with a single tone lasting 25ms. Hand keyed traffic is usually 10 bd with a single tone lasting 100ms. A spectrum analyzer will show the tones arranged in 3 distinct groups of 10+11+11 tones. Tones are spaced 40Hz apart and tones 1, 12, 24 and 36 are rarely used so you are likely to see an 80Hz gap between groups. Each of the 32 tones represents one ITA2 character code.

Also known as CIS/Russian Piccolo, URS multitone, CIS 10-11-11 MFSK or CIS-36. As of this date there are NO publicly available decoders for this system although they do exist in the professional market. Some decoders available NOW, possibly Wavecom and definitely Hoka, provide tools that can be used to demodulate the tones and from there derive a character set. One such method is covered below.

ITU documents have listed 4 different kinds of CROWD36 that vary with tone duration and baud speed. The '*' entries below are commonly heard.

		tone duration (ms)	shift between tones	tones present signal	
		v	v	v	
Russian Piccolo	1	25	40	34	* 40bd
	2	25	10	34	
	3	100	40	34	* 10bd
	4	100	10	34	

A few distinct patterns can be detected in a CROWD36 signal: selcal, idling and sending traffic. Selcal and idling are a series of 5 tones repeated in the same pattern. Traffic mode is most commonly, but not always, found as 40bd encrypted and many times operator traffic can be found in the clear at 10bd. Start-up and sign-off are usually 10bd and hand keyed.

Demodulation/Decoding

Using a Hoka Code30 V2.5 (US), select the "def general multitone" from the demodulators menu. Settings are 36 tones, 40Hz spacing and 40.1bd. This will produce output consisting of the raw tone sequences. Keep in mind that 10bd operator traffic will appear as a sequence of 4 repeated characters.

To correctly zero a CROWD36 signal is difficult. The signal is asymmetric so don't use the center of the middle tone group. Tones are only shifted by 40Hz and tuning errors as small as +-5Hz will start to induce errors.

From the raw tone sequences use the table in Table 5-J to map the tone number to character.

Mazielka A SELCAL system used by the "brotherhood" stations to wake up the receiving station operator outside normally scheduled transmissions. Reported to be part of the CROWD36 system outlined above. It is composed of 6

tones out of a tone library of 13. See WUN Special Edition, V1.3, Apr '95 for a good explanation of the system and its uses.

MIL188

An 8 tone MFSK system running at 125 bps with users all over the world including Europe, Africa, Asia, Middle East and China. The only good way to distinguish users is by monitoring the follow-on voice, cw, or other modems. Tones are spaced 250Hz with tone frequencies of 750hz, 1000hz, 1250hz, 1500hz, 1750hz, 2000hz, 2250hz, and 2500hz. Symbol duration is 8ms. This system looks and sounds very much like TT2300b/TPLEX and is easy to confuse but especially look for it preceding the 2400 bps NATO PSK traffic. Also known as MFSK188, NATO MIL188 or MIL-188-141 ALE.

TT2300b/TPLEX

An 8 tone, adaptive, synchronous system manufactured by Thrane & Thrane of Denmark. The system runs at 100bd or 200bd using 8 bit ASCII with data throughput of 300 or 600bps. Primarily designed to be connected directly to a serial port of a computer, the system features auto-dial, subscriber addressing, electronic mail and can be connected to a Fax machine. The full-duplex, error-correcting (24 unit CRC) link protocol is completely transparent to any type of data coding. Used by French Diplo, UK Civil Aviation Authority (National Air Traffic System/NATS datalink, Prestwick/Reykjavik) and Algerian oil companies. This may be logged in some commercial frequency lists as TT2300-ARQ, or TRA-2300. The manufacturer's name for the protocol/coding is TPLEX.

2 distinct modes have been monitored: tfc mode and an idling sequence.

Frequencies to try: 5028.7, 5109.7, 7716.7, 7719.7.
8 tones, 200Hz spacing, ACF=8

MERLIN/ALIS-2/ RS-ARQ

This is the 240 bd 8 tone burst ARQ mode used in the Rohde & Schwarz MERLIN modem. When the system is found in the 7 tone mode it is in ISS mode, the IRS mode uses an 8 tone signal. Both will be measured as 240 bd (720 bits/sec) with tones shifted by 240Hz. Character set can be ITA2 or ASCII with 8 bit ASCII being the most common. The label ALIS-2 first appeared in the Klingenfuss 14th Ed. Utility Guide. Reference the MERLIN/ALIS note above on naming.

Turkish, German and Italian Diplo stations are the most commonly found users. The Italian Diplo stations seem to favor the 5 bit (ITA2) mode. Turkish Diplo stations have been found using the 8 bit mode for all traffic.

Monitoring tip:
Its been discovered that all 8 tone channels have ALIS (228.7bd) 2kHz below. So if you hear an ALIS procedure in progress on a frequency it's worth waiting to see if 8 tone traffic appears 2kHz higher soon after.

See section 1-B for ALIS and section 1-K for a packet-like MERLIN system.

LINK-11

A US Military/NATO 40 DPSK synchronous system using 16 tones (1 doppler tone + 14 data + 1 sync tone), the 14 data tones are 4-PSK modulated and spaced every 110 Hz (935Hz to 2585Hz w/doppler tone at 605Hz). The sync tone is 2-PSK modulated. Typical rates are 1364b/s or 2250b/s. This is a ground wave only system, so a signal

received via HF will be nearly impossible to decode because the ionosphere messes up the phase. Klingenfuss indicates a baud rate 2400. See MIL-STD-188-203-1A. Also known as TADIL-A or "alligator". Largest manufacturer of LINK-11 equipment is Rockwell-Collins. See also LINK-11 LESW in section 1-A.

MS5 — This is the Russian (Soviet) 12 tone Vocoder system with each channel QPSK modulated at 100 symbols/sec. Each tone has a shift of 200Hz and spans a frequency range of 700Hz to 2900Hz in the Lower Side Band. This system has a distinctive pilot tone (unmodulated) at 3300Hz above a kHz point with unconfirmed reports of a pilot tone at 3600Hz and has a maximum capacity of 4800 bits/s. Commonly logged in the UK.

ANNEX 10 — An ARINC HF SELCAL system with 16 tones.

HARCO-39/Harris 39-tone modem — A 4 phase PSK system implemented per MIL-STD-188-110A, appendix B. The system supports data rates of 75 to 2400bps using 39 tones spread from 675Hz to 2812.5Hz with a spacing of 56.25Hz. 1 doppler tone can be found at 393.75Hz. Block interleaving with up to 12s delay is supported. This modem has been implemented in the Harris RF-3466A and has been referred to as the Harris 39-tone modem in postings or HARCO-39 in Klingenfuss frequency lists. Check out 6712.0 (Croughton) or 11223.0, 11183.0 or 5720kHz.

A 39-tone modem sounds like noise, so as you tune across this signal an S meter will rise and fall. It sounds very much like tuning a noisy frequency.

CODAN modem — A commercial unit from Codan Pty of Australia currently used in Australia and Africa by the United Nations, aid agencies and various public authorities. The modem uses 16 tones and are QPSK modulated. The tones range from 656.25Hz to 2343.75Hz with a tone shift of 112.5Hz and runs at 2400bps. The modem is fully automatic and supports compression and selective calling. No ALE is used for link setup but a simple beacon call and audio analysis on the return signal is all thats needed. This modem is mainly used in mobile networks.

The modem has a few distinctive sounds to it. A 2 sec. "squawk" is used to realign channels. If you hear short bursts then the modem is idling.

1-E. FAX-like signals.

These signals are used for transmitting pictures, mostly marine weather maps over the airwaves and make a distinctive scratch-like sound. Press-FAX can still be found but with less frequency as Press services continue to move to satellite.

HELLSCHREIBER — FAX-like mode in that it was used to send pictures but works more like common RTTY. The Siemans systems listed below used start/stop signalling (FSK) and the Field HELL unit was semi-synchronous. The system was used by the Chinese Internal Press up until about 1993 but is now used by European amateurs on 80m and 40m.

A couple of different machines were available:

	Paper width	chars/min	chars/sec	baud rate	bandwidth	tone freq
Siemans GL72	9.5mm	367.8	6.13	300	600Hz	1000Hz
Field HELL	15mm	150	2.5	122.5	360Hz	900Hz
Siemans HELL 80	15mm	300	5.0	300	900Hz	1260Hz

FAX A picture transmission mode used by weather (meteo), some Press and less often, amateurs. Pictures are sent line by line and to correctly receive a picture you must, at most, have the drum speeds (RPM) in sync. Usual RPM values are 60, 90, 120, 240. Less important is the IOC (Incidence of Cooperation). Usual values for IOC are 288, 352, 576. For the picture to be received as it was sent both RPM and IOC should match the senders RPM and IOC. It is true that FAX use is in decline and will continue to do so in the near future. Common forms found:

Press FAX	60-240RPM	IOC 352,576
Weather FAX	60-240RPM	IOC 288,576

'Encrypted' FAX

A recent wrinkle now appearing in the declining FAX signal arena is the introduction of 'encrypted' FAX transmissions. USAF Puerto Rico and Tokyo Radio JJC have been using this FAX mode. At this time there are no decoders that are able to handle this kind of FAX transmission (although JCC will apparently sell you one).

As for the signal itself, the start, stop, and phasing signals appear to be normal but the picture data seems to use some sort of modified code. Current speculation suggests Huffman encoding or a Modified Read Code with FAX lines only including the pixels changed from the previous line.

Reference Klingenfuss Guide to Facsimile Stations for a discussion of FAX theory and examples.

1-F. SSTV - Slow Scan TV.

A picture transmission mode developed and used by the Amateur community. While these signals are FAX-like in function they do not possess the scratching quality of the FAX signal. The sound of an SSTV signal is more tonal in its composition. I do not believe that each mode can be distinguished by ear.

Currently the most popular mode found on the airwaves in North America is Scottie S1, followed less frequently by Scottie S2, Robot 36 and 72 and finally some Martin M1. Europe seems to be mostly Martin M1.

Frequencies to check: 14230 seems to be the most popular. Also check 3730, 7040, 21340 and 28680.

There are also a few newer experimental modes available from Pasokon, ProSkan, WinPixPro and Acorn. They are not widely available yet.

As the table below shows there are lots of modes to choose from with very

little in the way of a standard but the basic "standard" transfers 1 line in 8s and uses a resolution of 120x120. The sync tone used is 1200Hz, the Black tone is 1500Hz and the White tone is 2300Hz.

SSTV modes

Mode	LinexPixel Resolution	Color/RBG seq. or B/W	Time (sec)	Comments
AVT 24	128x128	Color	24	There is a 5s digital header and
90	240x320	Color	90	there is no horizontal sync
94	200x320	Color	94	
125	400	B/W	125	
188	320x400	Color	188	
Wraase SC-1 24	128x128	Color	24	-top 8 lines are grey scale
SC-1 48	256x128	Color	48	-top 16 lines are grey scale
SC-1 96	256x256	Color	96	-top 16 lines are grey scale
SC-2 30	128	R-B-G	30	
SC-2 60	256	R-B-G	60	
SC-2 120	256	R-B-G	120	
SC-2 180	256	R-B-G	180	
Scottie S1	256x320	G-B-R	110	-top 16 lines are grey scale
S2	256x320	G-B-R	71	-top 16 lines are grey scale
S3	120	G-B-R	55	-top 8 lines are grey scale
S4	120	G-B-R	36	-top 8 lines are grey scale
DX	240	G-B-R	269	-top 16 lines are grey scale
ScanMate1	512x310	Color	391	
ScanMate2	512x310	Color	261	
ScanMate DX	256x256	Color	269	
Martin M1	256x320	G-B-R	114	-top 16 lines are grey scale
M2	256x320	G-B-R	58	-top 16 lines are grey scale
M3	128x128	G-B-R	57	-top 8 lines are grey scale
M4	128x128	G-B-R	29	-top 8 lines are grey scale
HQ1				
HQ2				
Robot 12	120x128	Y-C	12	Color is sent as Luminance and
24	256x256	Y-C	24	Chrominance
36	256x256	Y-C	36	
72	256x256	Y-C	72	
8	120x128	B/W	8	Not a true B/W mode. Green element
12	120x320	B/W	12	sent as B/W image
24	240x320	B/W	24	
36	240x320	B/W	36	

SC-1 and SC-2 were developed by Volker Wraase in Kiel, Germany.
Martin was developed by Martin H. Emmerson, G3OQD/England.
Scottie was developed by E.T.J. Murpy, GM3SBC/Scotland.
Robot was developed by Robot Research.

SSTV VIS code

With the introduction of Robot 1200C, Robot Research introduced the VIS code, which is used to indicate the speed and mode at the beginning of the transmission. The VIS code, when decoded by the receiving station, will let the receiver automatically set the necessary parameters for proper reception. The VIS code is sent as part of the vertical sync pulse and is 10 bits long lasting 10*30ms. The start and stop bits are represented as a 1200Hz tone with the remaining 8 bits (including 1 even parity bit) left for encoding information. This breaks down as 1 30ms start bit at 1200Hz,

7 data bits, each 30ms, sent Lowest Significant Byte (LSB) first (logical '1' is transmitted as 1100Hz, logical '0' is transmitted as 1300Hz). 1 30ms even parity bit and 1 30ms stop bit as 1200Hz. The table is fairly extensive so for now reference the following www page(s):

http://www.wincom.net/raarssen/techinfo.txt (valid as of 1/19/96)
http://www.ultranet.com/~sstv/modes.html (valid as of 1/19/96)

1-G. SYNCHRONOUS BIT STREAM signals.

These signals are distinctive in sound in that they are continuous and possess a trilling quality. The sound of an idling signal is slightly different from a signal actively sending traffic. Many signals idle for long periods of time and send very little traffic, i.e. ARQ-E, ARQ-E3, or ARQ-M2. They can be found all over the shortwave spectrum. Other signals have a short idling phase and move directly into traffic and then terminate, i.e. POL-ARQ, SITOR-B, ROU-FEC or FEC-A.

BEE/36-50 A Russian Navy and Polish Mil./Intel Svc. synchronous bit stream commonly found in Europe but can be heard in the US, traffic is most often found running at 50bd but some 100bd signals have been found as well. The system has no apparent ACF (ACF=0) and then idles with 36 bd (ACF=2). As the traffic switches from 36bd to 50bd a preamble can be detected running with ACF=70. The system appears to be synchronous with 1 stop bit and common shifts of 85Hz, 125Hz, 250Hz and sometimes 500Hz having been recorded. In between, or at the end of messages, FSK CW has been heard using the callsign RDL. The CIS name for this system is T600.

81-81/81-29 A Russian/URS Military system with some speculation that a number of ex-Eastern Bloc countries might also make use of this system. This signal is mainly 81 bd, pseudo random, one or two characters, 12 bits, usually encrypted. Operator chatter can sometimes be found in the clear using Baudot w/Cyrillic M2 alphabet. It is mainly a 2 ch system but there is a 40.5 bd signal that is a 1 ch variant. Most commonly found baud rates are 36.5, 40.5 for the 1 ch version and 73 and 81 for the 2 ch version.

Code30 US Ver. 2.5 includes an 81-81 module but no traffic has been recorded yet. Speculation is that this older 81-81 system, as defined above, is no longer in use and that the newer 81-81 system heard NOW is more likely to be derived from the CIS-14 or CIS-27 system (81-29?).

Reports from the Logs indicate a few different users of this system. The shift pattern seems to hold for the other baud rates used by this system.

Shift	Common User
125	Navy
500	Railway Authority
200,250,500, 1000,1500	Military

ARS-GUARD A Saudi National Guard synchronous FEC system, running at 125 bd and 170Hz shift (ACF=48 or 96). Check out the following frequencies:7672.5, 7869.5, 12257.5, 12357.5, 12362.6, or 12457.5. Maybe known as SAUD-NAT.

ARQ-E A very common single channel duplex ARQ system, made by Siemens, used by French Military Forces, Italian Diplo stations and the German Gov., typically 48, 64, 72, 86,

96, 144, 192 or 288bd but the system can be adjusted with different gear variants to support user requirements. ARQ-E can also appear in VFT. Some of those baud rates and users are listed below:

Baud	Common/Suspected User
46.1	Egypt-Jordan Air coordination (VFT)
85.7	encrypt tfc, most likely Mossad or BNDVB
184.6	FF circuit used by RFFXQA Sarajevo, BIH

Also known as ARQ-1000D.

ARQ-E3 Another very common single channel duplex ARQ system used by French Military Forces, typically 48, 64, 72, 86, 96, 100, 144 or 192 bd.

ARQ-M2 A commonly found full duplex, synchronous, time division multiplex ARQ system w/2 data channels, typically using 87, 96 or 200 bd. French Military Forces are the most commonly found user and this system can idle for long periods of time with no traffic. An odd baud rate of 128.5 has been found on a number of circuits between Papeete, Tahiti and Mururoa. This system comes in 2 flavors: one is defined by the old CCIR 242 Recommendation and the other is defined by the newer CCIR 342 Recommendation. Both forms can still be found. Also known as TDM, ARQ-28, TDM-2, TDM-242, TDM-342 or 96-TDM. See Section 4 for Recommendation differences.

ARQ-M4 A rarely found full duplex, synchronous, time division multiplex ARQ w/4 data channels, typically using 87, 96, 192 or 200 bd. This system had been used by Chinese, Vietnamese and Spanish embassies. Loggings within the past year indicate use by some French Military Forces stations. This system can also idle for long periods of time with no traffic. This system also comes in 2 flavors as defined by the same recommendations as ARQ-M2. Also known as ARQ-56, TDM-4, TDM-242, TDM-342 or 192-TDM. See Section 4 for Recommendation differences

ARQ-N A single channel duplex ARQ system used by Italian Diplo services, typically using 72, 96, 144 or 192 bd. This system is related to ARQ-E but does not inverse any bits.

AUTOSPEC A FEC system once used by British coastal stations to communicate with North Sea oil rigs, typically ran with baud rates of 62.3, 68.5 or 102.7 bd. This has probably been replaced with microwave. Also known as Autospecbauer or Bauer and has been referred to as Autospec Mk1. No loggings have been recorded in the previous year. See SPREAD.

SPREAD A FEC system, used (formerly?) by Romanian diplo stations, using the Bauer code used by Autospec, with characters spread over a large time span, designed to reduce burst and fading errors. SPREAD-51 has been known to be used by Brazilian Navy and shore stations but no loggings have been noted for at least 4 years. SPREAD-11 and SPREAD-21 have not been logged recently. Typically 68.5, 102.7 or 137 bd. Also known as SPREAD -11, SPREAD-21 or SPREAD-51 depending on data spread in effect. SPREAD is Autospec Mk2. When a station sending SPREAD is idling it cannot be distinguished from AUTOSPEC. The 2 systems can only be identified when sending traffic.

CIS A general term defining a few systems used by Russian organizations, they are distinguished from each other by the bit lengths used: 11, 14 or 27 bits. CIS-11 and CIS-14 are reported to be decodeable using the Wavecom 4100DSP or the W41PC and Hoka Code 30.

* CIS-11 is a single channel duplex ARQ system used by Russian meteorological stations running at 100.05bd (according to Wavecom) or 50, 100, 150, 200 and 300 (according to Klingenfuss RadioTeletype Code Manual 13th Edition). This system uses the Cyrillic M2 alphabet in an 11bit word, 5 bits for the M2 word (bits reversed), 2 bit system state and 4 bits error correction. CIS-11 is also known as TORG-11 (system has not been used by Russians for years).

* CIS-14 is reported to be used by Russian PTT stations on links to the former republics. CIS-14 is a two channel duplex ARQ system running at 96-192bd (according to Wavecom) but the 13th Edition of the Code Manual lists a whole host of baud rates: 42.1, 47.5, 48, 50, 70.5, 72, 83.3, 84.21, 94.11, 96, 100, 144, 200 and 288 bd. This system has a 14 bit frame size with a 2 bit channel state, 2 M2 characters bit interleaved and 2 bits error detection. CIS-14 is most commonly logged running with 96bd and most traffic appears to be encrypted but at sign on you might be able to find some operator chatter and test tapes. You may find CIS-14 referenced by the name AMOR or AMOR 96 (unofficial name used by some NATO members).

* CIS-27 is currently defined as a 50 and 100bd system reported in 3 lines in the Radioteletype Code Manual, 13th Edition. 1 partial logging found in the WUN logs with no mention of this system made in Wavecom or Hoka documentation. Might best be listed in the Mystery section.

DGPS Another type of DGPS is the commonly found 100bd or 300bd MSK signal. MSK sounds like SITOR-B and is usually transmitted from beacons in the 285-325kHz region with an ACF=10. The information transmitted is real-time differential corrections in RTCM SC104 V2.1 format. There are commercial companies providing DGPS service and their data will probably be encrypted. See Utility Roundup in WUN 2/1 (Jan '96) for a good writeup on this signal and its users or section 1-J for the QPSK form of DGPS.

DUP-FEC/ DUP-FEC-2 A new system appearing with the introduction of the Wavecom W41PC (DUP-FEC-2) and the new Klingenfuss Radio Data Code book (DUP-FEC). No new signals found on the air as of yet. The system runs at 125 or 250bd and uses the ITA-2 or ITA-5 character set. This system is an enhancement of the DUP-ARQ-2 system and has many similarities.

FEC-A/FEC-100 A system used by Turkish and German Press also German, French (P6Z etc), Serbian (DFZG) and Turkish (TAD) Diplo services, typically runs with 96, 144, 192 or 288 bd and uses the ITA2-P alphabet. A fast baud rate of 384 (192x2) has been found in use by MFA Paris, F and French Emb., Rou. Siemens is the manufacturer and refers to this system as FEC-100 or FEC-100A.

GMDSS/DSC Digital Selective Calling is a variation of Sitor-B, 100 baud 170 shift, but uses a special set of 127

symbols with a 10 bit error correcting code. The system is defined in the ITU recommendation ITU-R M493-6. A DSC signal is short, about 6-7 seconds on MF/HF and contains the following: station ID, priority, station being called, frequency to use. This system is used to establish the initial contact between ships and shore stations using GMDSS.

DSC signals can be found the following frequencies: 2187.5, 4207.5, 6312.0, 8414.5, 12577.0, 16804.5 (also on VHF on Ch. 70 - 156.525 @ 1200bd). See Digital Review column in WUN newsletter Vol. 1, No.12 December, 1995 for a good writeup on GMDSS/DSC.

HNG-FEC A FEC system used by Hungarian Diplo services, typically 100.05 bd. This system uses a bit spread of 64 bits with each new character starting at intervals of 15 bits. See Klingenfuss RadioTeletype Code Manual 13th Edition for teleprinter alphabet used by this system.

IRA-ARQ An ARQ system used by the Bulgarian Diplo services, typically 75, 100, 110, 150, 180, 200, 240, 300, 600 or 800bd. Max speed seems to be 1200bd. This system uses an 11 bit character. A 10 bit variant has been noted but is rarely found. ACF is typically 55 during idle with a rhythmic cadence to the signal sound. When sending traffic the ACF disappears and the sound intensifies to a steady buzz.

A tip for monitors is to remain on frequency with the decoder set to ASCII/ITA-5 at the same speed that the ARQ is sending. Once the transfer is complete, operator chat often takes place in standard ASCII or BAUDOT.

A note of caution when measuring this system with its high baud rate. Some decoders are unable to measure high baud rates accurately or because of some in built maximum baud ceiling don't show the true baud rate. Hoka Code 3 has a maximum measurable baud rate of 480bd and will display a baud rate of 272.73 for a 600bd IRA-ARQ signal and 363.63 for an 800bd IRA-ARQ signal. The Hoka Code 30 also has the 480bd maximum but word has it that this will be removed in a later version. I have no comparison to offer concerning the Wavecom unit(s) ability to measure high baud rate systems at this time.

POL-ARQ A single channel duplex ARQ system used by Polish and Italian Diplo services, typically at 100 bd but also found less frequently at 200bd. This system uses the CCIR 476-4 alphabet with same polarity retained. Can be easily confused with Sitor-B.

RAC-ARQ/ MEROD Previously believed by the community at large to be a fabrication it has been revealed that the system actually exists. MEROD (Message Entry and Read Out Device) is the commercial name for the Racal man-ufactured equipment that uses the RAC-ARQ mode. This FEC system is documented to run at 150 and 267bd using a "wide shift FSK". This system documented heavily in the Radioteletype Code Manual 13th Edition from Klingenfuss with signal samples available on the Klingenfuss Modulation cassettes on track 38. Also if you read the Wavecom W4100 glossy from the company they list RAC-ARQ as an option but later glossies for the W4100DSP and W41PC no longer list RAC-ARQ. Also known as RACAL-ARQ.

ROU-FEC A FEC system used by Rumanian Diplo services, typically 164.48 or 218.3 bd. Signals can be encrypted, in the clear or bit-masked (have been known to use 10, 15, 24 or 31). This system has a bit spread of 128 bits with each new character starting every 16 bits. This system had been referred to as SAU-FEC in the past and renamed to RUM-FEC by Klingenfuss Publications. Wavecom still refers to the system as RUM-FEC in their documents.

SITOR-B A FEC system used by Marine Information services and the Amateur Radio community, typically 100 bd but an odd baud rate of 109.4 has also been monitored originating from Cuba. Also known as FEC or AMTOR.

SI-FEC/FEC-S A Siemens FEC system used by Austrian and Indonesian Diplo services, typically 96, 192 or 200 bd using the ITA-3 alphabet. Also known as FEC-S, FEC1000 Simplex or FEC 1000S. During idle mode this system is the same as CCIR 242 (ARQ-M2).

TORG-10/11 A Soviet 2 frequency duplex ARQ system used to transmit Meteo data using 10/11 bit blocks of ITA2 coded data plus error correction. Typically running 100 bd, 500Hz shift. TORG-11 is also known as CIS-11 and has not been used by the Russians for years.

NATO-75
NATO-100 Various NATO members have equipment which generates 75bd or (more rarely) 100bd RTTY with a variety of shifts from 85Hz to 850Hz. Within the service, these systems are usually known as RATT or CRATT (Crypto RAdio TeleType). We also have indications of the system being known as "Beaver" (US) or Link 4, although this is unconfirmed at present.

Traffic can often be recognized by twice repeated header block of 256 bits which shows an ACF of 64, and by a period of sustained reversals between "messages". The remainder of traffic is pseudo-random.

Such a system can be found permanently on 4711, 6702, and 11264kHz. We believe that this system is closely related to the Royal Navy's common "Fleet Broadcast" 75bd or 100bd system which has a message preamble of 16 RYs and VMGTCNJBH in Baudot before switching to encryption. A similar system has been reported in use by the French with a synchronization string of VYMGTCN. Reference Digital Review column in WUN V1,#1,2/95 and WUN V1,#11,11/95.

1-H. ASYNCHRONOUS BIT STREAM signals.

These signals sound like the continuous bit stream signals but with a subtle cadence difference to them. They are most often encountered sending traffic.

BAUDOT A common signal used by the Amateur community, many military and government services, typically 50, 75 or 100 bd. Inversion is possible but not frequently encountered on the data bits, giving 2^5 (32) possible arrangements. Watch for stations sending BAUDOT but using different character sets such as Arabic ATU-70, 4th Shift Arabic ATU-80 or Cyrillic, they might look like scrambled transmissions at first glance. Reference the Klingenfuss RadioTeletype Code Manual 13th Edition for some good examples and partial dictionaries. Also known as RTTY or ITA2.

ASCII A rarely found signal used by the amateur community typically 110, or 300 bd but has been tested in recent

times by VOA. Amateur station W1AW still transmits ASCII bulletins. Many times Bulgarian IRA-ARQ operator traffic can be decoded using ASCII. Also known as ITA5 or IRA.

BAUDOT/F7BBN — This is a 2 channel simplex asynchronous BAUDOT signal also referenced as TWINPLEX. Its form, according to CCIR Recommendation 346-1, is: "4 Frequency diplex systems" (Dusseldorf, 1990). Hoka Code 3 and Code 30 have a module for this labeled as: "Baudot F7BBN, 2ch ITA-2 RTTY". This is a 2 channel 4 tone diplex asynchronous signal usually consisting of 2 channels of ITA-2 baudot running at the same speed (or according to Rec. 346-1 1 channel baudot/1 channel morse code). According to the recommendation both channels are often scrambled and no loggings of this form have been found to date.

1-I. MULTI-CHANNEL/BUZZSAW like signals.

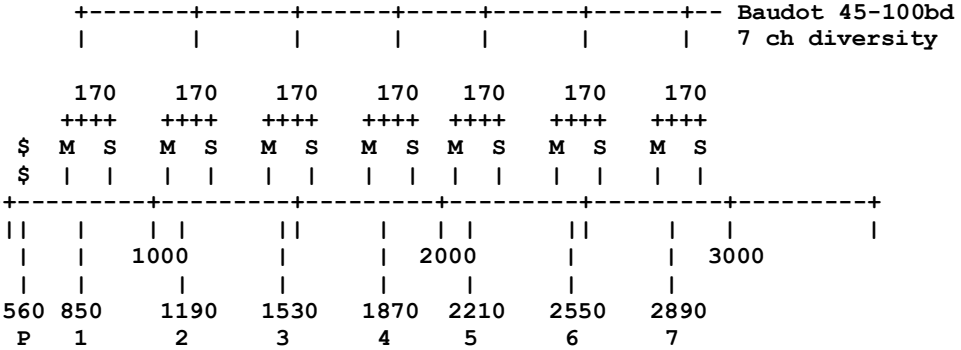
These signals are obnoxious in the way they sound. They have a very harsh buzz-like quality. Tough to decode because many signals can be transmitted together and even interleaved. Signal Diversity is often used - defined as all channels sending the same traffic but shifted in frequency and shifted in time. The receiving equipment combines the channels into a single channel if 'X' channels agree. Many times the channels are encrypted. A stand alone spectrum analyzer or one incorporated within the decoder can be a great help in identifying the signal arrangement. Hoka Code 3 and Code 30 units have a spectrum analyzer feature. Code 30 has the added ability to target an individual channel for decoding. Wavecom 4100, 4050 and Universal M8000 units also include a spectrum analyzer or spectrum display feature.

VFT or Voice Frequency Telegraphy is a general term used to define many kinds of multi-channel signals used by British Military, Canadian Military, US Military and other government institutions. Many configurations are possible. Also known as FDM or WTK (a misnomer, see MULCAST below).

Reference WUN V2#5, May '96, Digital Review for a good article on VFT.

* BR6028 — 6028 Series Diversity is a commonly found VFT system using 7 channels of 45 bd to 100 bd baudot each with 170 Hz shift used by US and Canadian Military. Channels are shifted in time, with each channel delayed by 1 second and any channel with heavy interference can be locked out causing the transmitter side to stop using the interfered with channel. This accounts for those less then 7 channel VFT's sometimes found. Also known as "BARRIE", 6028 or USA 7 channel modem.

Note: channel numbering was selected arbitrarily 1234567, some documents show channel numbering as 3614752 which are the channels in time order.



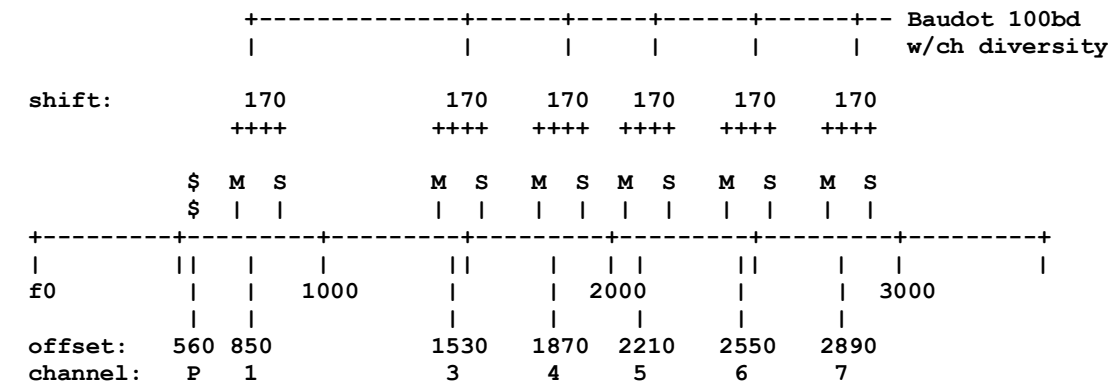
Note: the Pilot tone at 560kHz is an unmodulated tone.

Belgian Diplo (MFA Brussels, Embassy Beirut, circuits to South

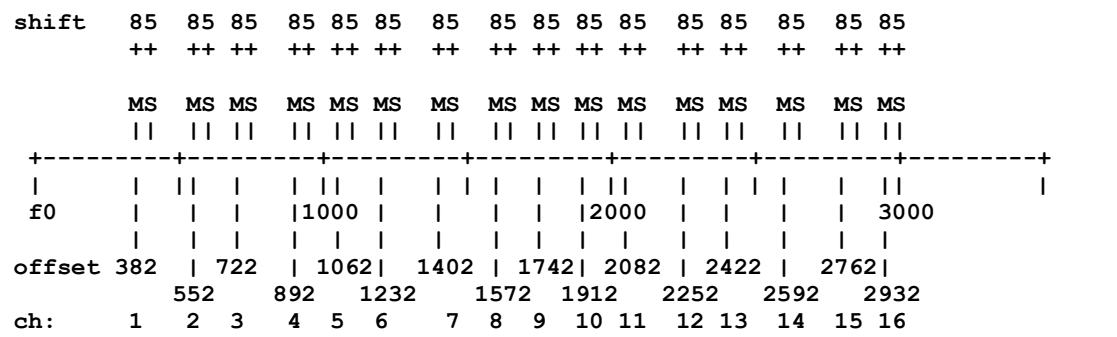
Africa, South America and southern Europe) have been noted using what seems to be a modified BR6028 system. Configuration shows:

pilot tone, ch 1, NO ch 2, Ch 3 - 7

Channel 2 never seems to be present. All channels carry 100bd/170 Baudot delayed in time by 0.5 secs. This VFT form has been noted on the following frequencies: 11107, 14476 and 14904 most early mornings (06-08UTC).



*** MULCAST/ WTK170** A system used by the US Military composed of 16 channels each with an 85 Hz shift spaced 170Hz. This system was used by the US Navy and has since disappeared from HF. Broadcasts have been monitored with 2 clear channels, Ch.14 ran 75bd weather from KAWN and Ch.16 ran 50bd APN/UPI news. This arrangement is defined by CCITT R.39-1 and is Mode B in the Universal M7000 decoder. This system is also referred to as Weston Telegraph Keying 170 (WTK170 or Marconi H5000).

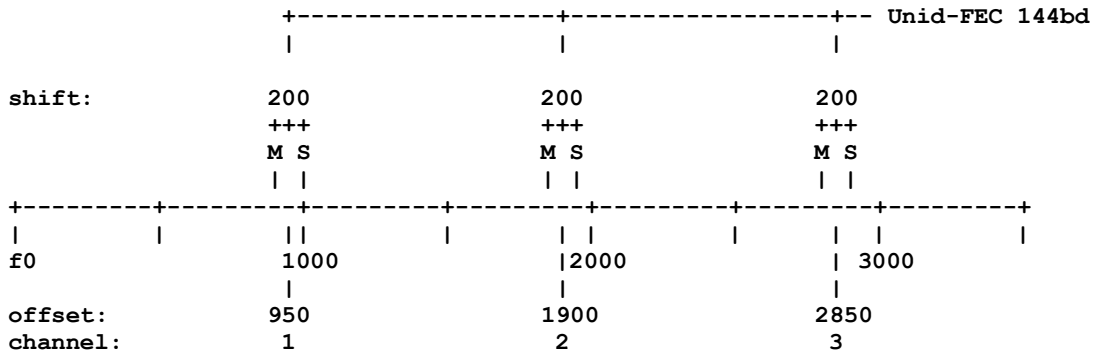


Note: The above illustrated channels are spaced 170Hz - this does not convey well in an ascii representation.

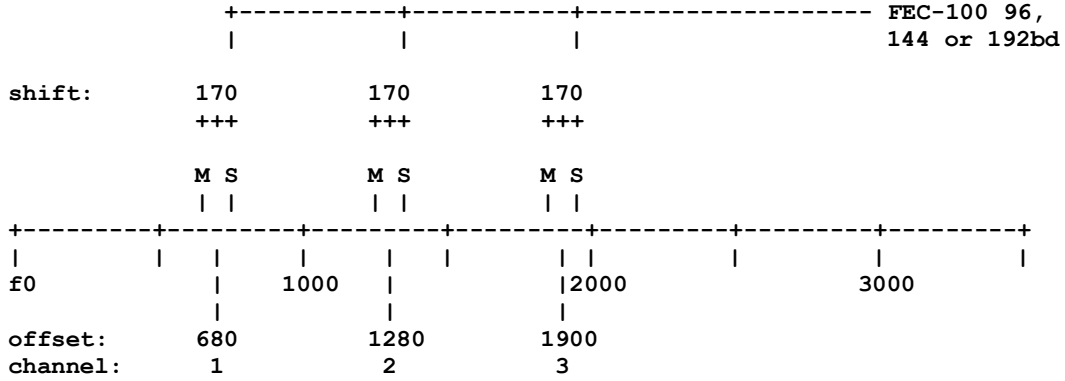
Note: There is also an 8 channel system called Weston Telegraph Keying 340 (WTK340). 8 channels shifted 340Hz with 170Hz shift on each channel.

The following VFT signals are commonly found in use by the named users so the authors have assigned names for use as a starting point in future discussions.

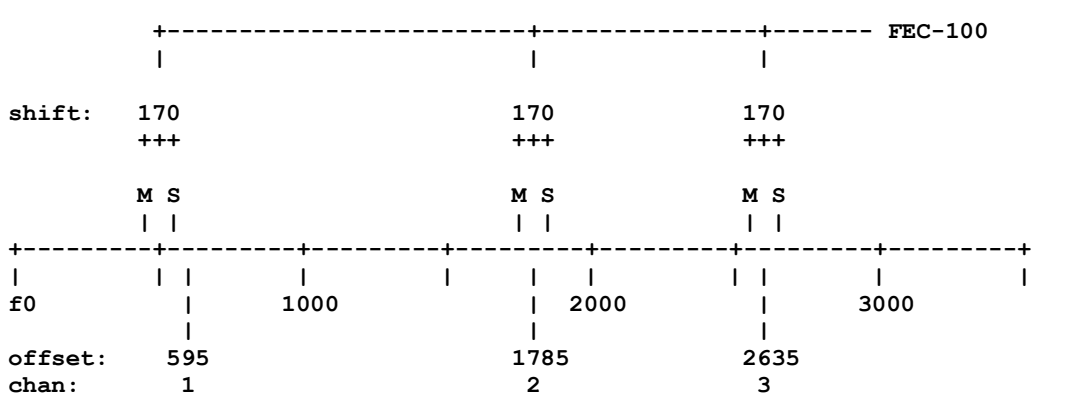
*** RUS-144 - 3 channels of 144bd/200Hz FEC system, with each channel spaced by 950Hz. The FEC system appears to be a synchronous system with no apparent ACF and is used by Russian PTTs. It has been noted on the following frequencies: 8077kHz (nighttime) and 14814kHz (daytime). It has also be noted in the past on 8063/14327.**



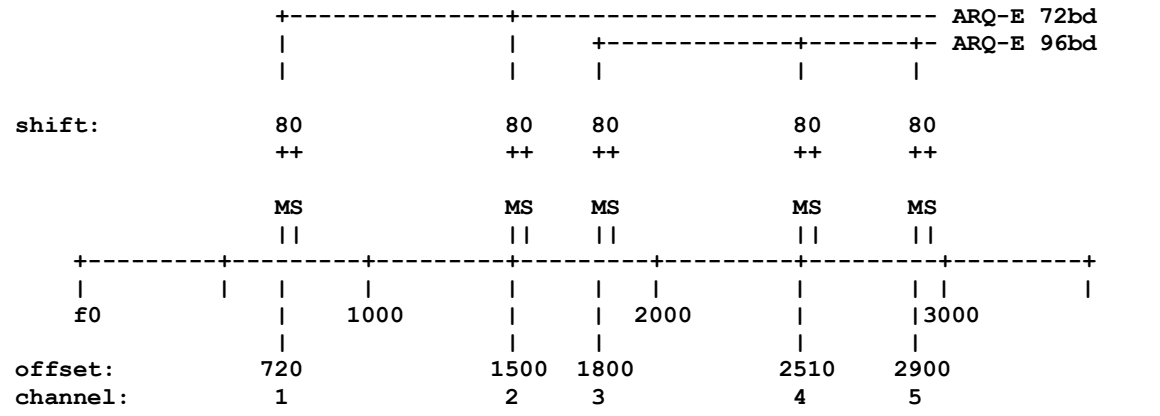
* FEC-101 - (formerly labelled "3 ch FEC-100") 3 channels of FEC-100 are known to be in use by Israeli Military, German, Indian MFA and Serbian Diplomatic services. Usual channel speeds are 3 channels of 144, 96 or 192bd with shifts between 80Hz and 170Hz. The 3ch 192bd/170 Hz arrangement with a channel spacing of 680Hz is German Air Force (shown below). Also Indian MFA, Dehli has been using a 3ch VFT with 96/170 and shifted 650Hz. This system a 3ch FDM and TDM system with each channel delayed in relation to the others and spaced apart to reduce any intermodulation.



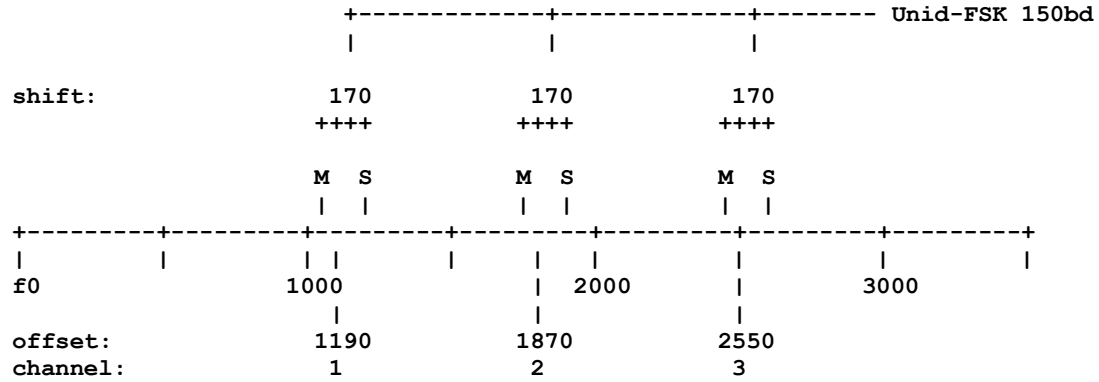
A more classic arrangement is illustrated below:



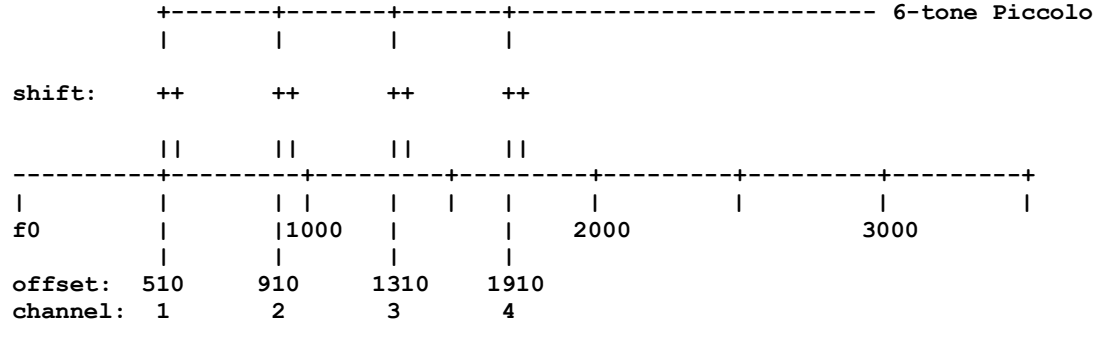
* MOI-VFT - The German Ministry of Information (MOI) and police use a multi-channel VFT comprising 72 or 96bd, 80Hz shift ARQ-E on their intercity links. Commonly heard below 5MHz in Europe. The channels for the Bonn-Stuttgart and Bonn-Hamburg links is shown below:



*** 3 ch 150 FSK - The German Navy, primarily Wilhelmshaven (DHJ59 and warships) has been noted using a configuration of 3 channels running a 150bd 170Hz shift FSK system with each channel spaced about 680 Hz to 700Hz. The 150bd FSK signals are Unid.**

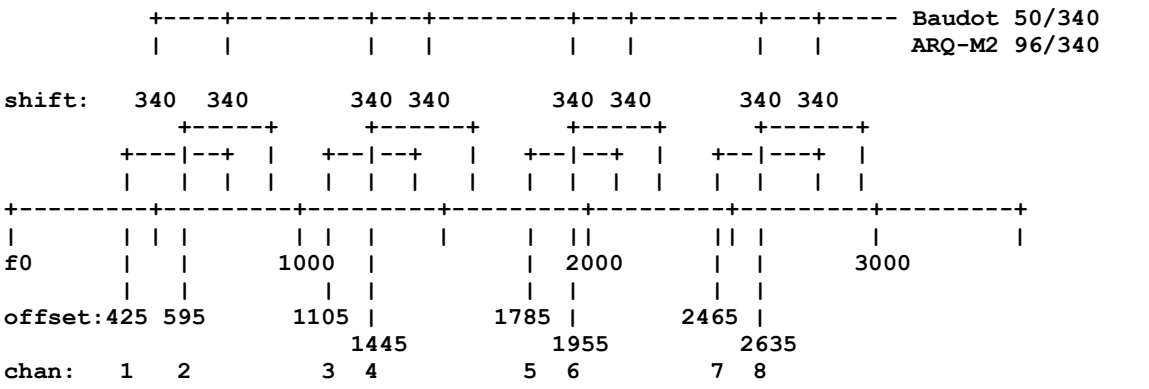


*** 3 ch Piccolo - British Military 6-tone Piccolo system with 2, 3 or 4 channels have been noted. The traffic channels are usually found sending bitstream encrypted traffic and the engineers channel idles or sends plain text operator chatter. The following channel offsets (measured from the f0 carrier point) are usually found at: +0.51kHz, +0.91kHz, +1.31kHz and +1.91kHz.**



Note: channel 1 is engineers channel

*** UK Military 8 ch VFT - A common UK (DCN) interleaved VFT. Most channels carry RYI type traffic but channel 1 carries occasional engineer exchanges. See WUN newsletter, issue 2.9 for further comments. This is also known as British HL13 (TA5).**

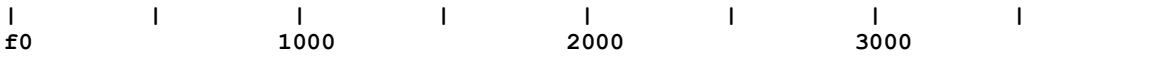


Channel 1 is engineering channel in Baudot 50/340
idles with mark tone active

Offset above shows MARK frequency: ch1: 425/765 ch5: 1785/2125
ch2: 595/935 ch6: 1955/2295
ch3: 1105/1445 ch7: 2465/2805
ch4: 1275/1615 ch8: 2635/2975

* POR-VFT A 7 ch system has been found in use by the Portuguese Army. Each channel is shifted by about 200Hz and is based on ITA2 and runs at 200bd per channel. Analysis suggests a synchronous baudot with forward error correction. The system can be decoded using the Hoka Character Analysis Duplex module with settings on ITA2, 5 bit and no-interleave. The system is used by the Portuguese SFOR units based in Bosnia. Try 11198kHz or 11202.1kHz for a sample. Listen for the LSB operator chatter between system activity.

** No channel layout yet **



1-J. Phase Shift Keying systems

Nearly all of the systems that we have outlined above use Frequency Shift Keying (FSK) of one, two or more tones. However, there are many signals to be heard on HF which are Phase modulated (Phase Shift Keying or PSK) in nature. At present, only the Hoka Code30 is capable of demodulating such signals, and as such, this area of "listening" remains a somewhat uncharted area, and none of the systems known about so far have names like the ones we use above!

However, Hoka's Code 30 provides a tool-set that allows the user to determine the characteristics of a PSK system with little more effort than an FSK-based one. This at least allows us ordinary mortals to "fingerprint" certain types of system. In a nutshell, here are the commonly encountered PSK-based systems;

2-4MHz region: Navigational aids sending Differential Global Positioning System (DGPS) information using 250bps 4-phase (or Quaternary) PSK (QPSK). Try 2834.0, 2805.0, 3226.0kHz

3-13MHz region: Soviet Mil(MOD)/FAPSI/PTT system sending 1280bps data using a 4-phase, Offset QPSK scheme. These stations are recognizable in that they are all placed on .081 offsets from a kilohertz or half kilohertz point. At least 20 channels are known to be in almost constant use. Try 9058.081, 7663.581, 5752.081, and 13369.081kHz amongst others.

Note: Recently many of these frequencies have been sprouting lower sideband twins. For example 11422.081 is paired with 11417.93,

9209.081 is paired with 9204.93. Presumably this means the system is operational and adding more capacity.

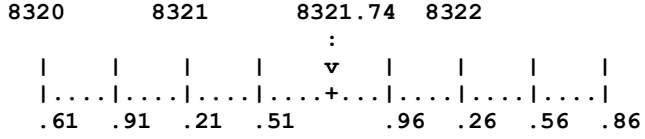
5-20MHz region: Unknown user and system sending 600bps data using 2-phase, or Binary PSK. Try 10662.8kHz. 1200bps and 2400bps signals of a similiar nature have been found in this region also.

2400-PSK	Believed to be a NATO and UK Royal Navy system, now occupying many channels and particularly active since the deployment of IFOR in former Yugoslavia. Also many 75bd RATT channels used by the Royal Navy now have the 2400-PSK system present instead. Sample of frequencies: 2535, 3370, 4578, 6410, 8158, 10480, 16164kHz
1800-PSK	A number of signals have been noted sending 1800bps QPSK data. User is unknown but suspect NATO and is much rarer than the 2400-PSK.
1600-PSK	Believed UK/US Mil system. Sample of frequencies: 4757, 5237, 10386kHz.
KRE-PSK	A North Korean BPSK system running at 1200bps. The North Korean Diplomatic services are making use of this system along with the usual Baudot.

1-K. Mystery systems

This section lists signals that have conflicting information. Some may be fabrications, some may be just unknown. These systems will be listed here rather then mix them among the confirmed and better documented systems.

new	108.8/170	An interesting FSK signal commonly logged in the UK running at 108.8bd and a shift of 170Hz. Shows an ACF of 32 during idle with a traffic ACF of 0. Very strong AM carriers have been noted nearby with Counting Station traffic after transmission indicating a US Intel source.
	1200-FSK	A 1200bps FSK system known to be used by the Italian Military or Diplo service. Always has a distinctive .7kHz offset. Has been heard on 6811.7, 9126.7, 10485.7 and 13904.7kHz amongst other channels. Italian operator chatter in USB on the carrier point can often be heard prior to messages being sent.
	4+4	This is an 8 tone MFSK signal with a unique tone arrangement. It is a Chinese Diplo system with most traffic originating from Peking. Its real name and base modulation mode (FSK/PSK) are unknown although analysis suggests that each of the 8 channels is 150bd or 75bd synchronous FSK. No estimation of total baud rate. The tones are grouped in sets of 4 spaced 300Hz apart with a 450Hz intergroup gap, 4 tones w/300Hz spacing, 450Hz gap, 4 tones w/300Hz spacing. Most 4+4 signals seem to be centered on .74. For an example try the signal centered on 8321.74:



	AIRCALL	Another system with very little factual information. This 7 tone MFSK system appears on the Klingenfuss recordings cassette on track 32. Sources indicate that this system is also generally unknown so I will list it here pending confirmation.

ARTOR — Adaptive Robust Transmission Over Radio - an adaptive, error-free mode for HF using QPSK. First mention of this system found in the 13th Edition of the Code Manual. Typical baud rates are documented to be 50, 100 or 200; automatically selected, ARQ and FEC modes are supported. This system has never been logged and probably has not been commercially released by the developer, Ascom Radiocom Ltd, Switzerland. Ascom did advertise the system (as "ARTOR, our new HF-modem") in the June 1992 issue of Signal and probably exhibited at CommunicAsia '92 in Singapore and AFCEA '92 in Washington D.C.

QAM — A system reportedly used by the Chinese, unknown usual bd rates. A sample of this signal is available on the Klingenfuss CD (CD#2/Trk9) or Cassette (Trk37). This is also the name for the modulation technique Quad Phase Shift Keying with Amplitude Modulation or Quadrature Amplitude Modulation (QAM) commonly used in high speed computer modems (9600-28800) and point-to-point microwave communications. Not known to be on HF at this time. No known loggings to date. Real?

SUI-FEC — A new UNID FEC system running at 68.5bd, 85Hz shift used by the Swiss Army. Traffic has an ACF=0 but an ACF=10 at start of messages.

This table represents most of the unknown signals that have been contributed to the WUN logs column. This is the most speculative of all the information presented in this document. This table is constructed on the assumption that similiar baud rates and ACF indicate potentially similiar systems. Still, despite its speculation, it is a good indication of the number of unidentified systems that are being used and a good pointer for further research. An unidentified system is defined as a system that could not be named by the contributing monitors decoder. All loggings are based on at least 2 or more loggings when possible. Any exceptions are noted in the comments area. The comment for an individual baud rate is a composite statement drawn from all loggings for a specific rate.

If a star appears to the right of the baud rate in the chart below it means there is a separate paragraph broken out which goes into more detail then the simple chart provides.

The following systems have been identified

800bd IRA-ARQ
363.78| 375| 25 | | 'CWB' Bulgarian Embassy, London

IRA-ARQ idling
300.01| 500| 55 | | bit stream

600bd IRA-ARQ
272.73| 450| |2.c| Possible Russian TDM system

```
   +------------------------------------ Baud (or bps, when labelled)
   |      +----------------------------- Shift (Hz)
   |      |      +---------------------- ACF or signal period
   |      |      |           +---------- First identified/WUN issue
   |      |      |           |    +------- Comments [in () is FAQ name]
   v      v      v           v    v
------+-----+--------------+---+-----------------------------------------
398.27|  703|              |2.a|
362.4 |  500| 10           |2.7|
360.5 |  780|              |2.9| acks @301/780 packet-like
301.5 |     | hdr:8        |1.a| Packet-like, w/orig. MFA Helsinki?
300.6 |  190|              |2.9| 10bit/char 1200bits/burst DGPS like.
300.12|  850| 448          |2.9|
300   |  800| 0            |pst| 57bit preamble
300   |  200| 10           |   | various orgs sending DGPS info in MSK
300   |  200| 17           |2.a| 3s bursts, packet-like
250   |  170| 22           |3.3|
250   |  150| 75/150       |3.2| fast ARQ system
250   |  170| 15/75        |2.6| ARQ w/ITA2 orig. Western Africa
      |     |              |   | probably not DUP-ARQ-2
250   |  850| 32/176       |2.7| Possible ARTRAC-II/DUP-ARQ-2 signal
250   |  170| 19/38/57/76  |2.5| FSK data bursts, w/orig. Korean Diplo?
225   *  170| hdr:8        |2.8| Packet-like (new R&S-ALIS mode?)
216.07|  114| 84           |2.b|
203.56|  400|              |3.1| 4sec idle sequence
200.3 |   85|              |2.3| Logged in the 250-350kHz range
200   |  170| 250          |pst| ARQ,simplex, 250bit frame, polarity switch
      |     |              |   | each frame (pos/neg)
200   |     | 64           |2.6| sounds like VFT, 6-peaks
200   |  400|              |2.7| sounds like ARQ6-90/98
200   |  450|              |   | sounds like ARQ-E/E3
200   | 1000| 0            |2.9| FSK
200   | 1044| 646          |3.3| Probable Russian Air Force system
186.6 |     |              |   | FEC bit-stream, very rare
178   |  240|              |pst| similiar to 80.5 but w/16bit frame
161   |  330|              |2.9| unusual 12bit frame RTTY w/ITA2 bit interleave
      |     |              |   | Most likely East European (POL) source.
      |     |              |   | see 121/330
150   |  100| 28/224       |2.6| FEC, also as 75/100 from MOSSAD, Tel Aviv
150   | 1700|              |2.7| unusually wide shift
150   *  170|              |   | VFT w/3ch 150/170 (3 ch 150 FSK)
150   |  853| 1399         |3.3| big ACF value!
144   *  200|              |   | VFT w/3ch 144/200 (RUS-144)
144   |  170| 0            |2.7|
126   |  250| 7            |2.a|
120.96|  330|              |2.9| unusual 12bit frame RTTY w/ITA2 bit interleave
      |     |              |   | Most likely East European (POL) source.
      |     |              |   | see 161/330.
115.74|  380|              |   | 23-bit frame
110   |  170| 0            |   | scrambled ASCII? common in the US, maybe NATO
109.81|  170| hdr:64 tfc:0 |   |
109.3 |  340|              |2.1| Decoded by Sitor-b. Logs from the US
108.9 *  170|0/32/64/96/200|2.4| Logs from UK, FEC/8bit char, most likely US
      |     |idl:32 tfc:0  |   | Intel source or US Mil/Air Force
107.53|  500|              |   | Most likely an encrypted CIS system
100.3 |~ 200| 38/76        |2.3| VFT w/2ch 100.3/(150-200) 1kHz ch shift ALE?
      |     |              |   | (Spanish Navy)
100   |3*400| 190          |2.7| -600/-200/+200/+600; 4-tone clover?
100bps*6*200|              |2.7| 7ch ea tone 100/200bps 4DPSK modulated
      |     |              |   |  (POR-VFT)
100   |  500| 162          |3.b| possible 12char per burst
 80.5 |~ 300|              |pst| also 81.5,122.2,161.0,163.0, 12bit frame
 75   |  850| hdr:65 tfc:0 |2.8| hdr: 64 or 65  NATO System?
 75   |  250|              |   | VMGTCNREX crypto sequence recorded with ITA2
      |     |              |   |  6-bit/interleaved. Maybe CIS-MIL
 75   |  200| 300          |3.b| Russian or UKR
 75   |  170|              |2.8| 10bit async, not ASCII, not ITA2
 75   |   70| 0            |2.8| VFT w/2ch 75/70 FSK from GYA/RN,UK
```

```
 70.1 |     |              |   | unid FSK signal
 68.5 *   85| hdr:10 tfc:0 |   | Not AUTOSPEC (SUI-FEC)
 46.1 |  240|              |3.3| Idle on reversals
 54.13|  500|              |2.b| CIS Synchronous data stream
 50   |  500| 136          |   | parallel found on other freqs. Shifts 250&500
 50   |  250| 136 or 272   |2.9| Russian?
 46.1 |  240|              |3.3| Idle on reversals
 ??   |48*??|              |2.6| 49-tone modem w/620Hz pilot on 15919.0
 ??   |var. |              |2.8| 7 chars of ITA2-P beta+7 zeros: ARQ-E like
```

o WUN issues are numbered 1-9abc for short, where 'c' is 12 or the Dec issue.
o "pst" - posted to the group list

Section 2. Modes on VHF.

There are data signals on VHF, currently dominated by pager systems. This area will continue to grow over time as more capability is added to existing systems. They are included here for reference purposes. Many of the high end professional analysis units include a few of the pager modes. But keep this in mind - according to the ECPA, monitoring of all types of paging signals is illegal and the transmissions are considered private. The ECPA, of course, only applies to the US and there may be different laws covering paging signals in effect in other countries.

But...not all modes found on VHF are dedicated to paging, there are also systems used by the Aviation industry, Public Data Networks, the amateur radio community and some European Security forces/Police.

2-A. VHF Data Signals

ACARS — Aircraft Communication and Reporting System. A packet-like 2400 bps MSK digital air to ground system for passing plane data and messages.

Check the following frequencies in AM mode for signals.

- 131.550 (US primary)
- 130.025 (US secondary)
- 129.125 (US tertiary)
- 131.475 (Air Canada proprietary channel)
- 131.725 (Europe primary)
- 131.525 (Europe secondary)
- 131.825 (Europe)
- 131.450 (Japan primary)

GMDSS/DSC — DSC on VHF is the same as DSC on MF/HF except that the system uses a 1200 bd and the packet is very short, only about 0.5 sec. Frequency used is Ch. 70 - 156.525Mhz.

EMWIN — Emergency Managers Weather Information Network is an experimental data service, formerly known as WWIN (Wireless Weather Information Network), run by the National Weather Service that utilizes a 1200 baud ASCII Bell 202 signal to transmit a hypertext system (maps and text together) that lists weather conditions. It is possible to reprogram some of the professional units (such as the M7000) to receive the text information, but special software is required to fully use both maps and the text. Areas currently supported:

Location	Watts	Frequency MHz
Washington, DC	600watts	163.35
Norman, OK	50watts	169.025
Tulsa, OK	250watts	165.0125
Oklahoma City, OK	300watts	150.525
Wichita Falls, TX	---	KTEO/90.5 FM 92kHz subcarrier

Note: the data is also transmitted from GOES 8, GOES 9, G4/Ku tr 4 and T1/Ku tr 5a.

FMS-BOS — Funkmeldesystem fur Behorden und Organisationen mit Sicherheitsaufgaben loosely translated as Radio Calling/Communications System for Authorities and Organizations with Security Concerns. Supports a baud rate of 1200 and uses BCD for all digits. This system is designed to minimize overall traffic by transmitting a series of codes in 48bits. The 48bits are divided into 6 parameters: BOS-id, Country-code, Trunk-code, vehicle-id, status, special-use.

INFOCALL — A German pager-like system used to deliver stock data and news services. Supports a baud rate of 1200bps using the ITA-5 character set.

ATIS — A VHF/UHF radio signal used on the River Rhine maritime radio. This identification signal is automatically generated at the end of speech transmission in 1200 baud FSK (mk/sp frequencies of 1300/2100Hz). The data consists of a country identifier and a call sign. This system is used in Germany, Luxombourg, France, Switzerland, Holland and Belgium.

ATIS is also the name of an aircraft communications system running at 2400bps w/ITA5.

MPT1327/1343 — A 1200bps trunking protocol first defined in 1987 by the UK Department of Trade and Industry. The system operates in VHF 136MHz to 178MHz and UHF 403MHz to 528MHz. MPT1343 is the standard that defines the behavior of radio units on the public network. The protocol supports a variety of features such as conference calling, call transfer, calling of PABX and PSTN numbers, wide area roaming, traffic jam prevention, interference prevention and automatic user location and registration. These protocols are currently handled by the Wavecom W4100dsp, W41pc and Hoka Code 30.

2-B. Special Amateur Digital/Video Modes

These modes can be found in the 6 meter (50 mhz), 2 meter (144-148 mhz), 220 mhz, 430-450 mhz ranges (70 cm.) and higher ranges. They are primarily used by Amateurs, and some of them require special hardware or software to view or use. These are capsule descriptions only; there are several good books and magazine articles published in 'QST', '73' and 'CQ' magazine which go into much more detail on these modes. Please consult them for more information.

DSC — 'Digital Selective Calling'. This is a system utilized in the amateur service that allows suitably equipped radios (such as those sold by Yaesu and Icom) to send an ASCII burst signal that allows hams to page each other by callsign over a repeater. It is somewhat similar to POCSAG.

PACKET This mode is very similar to that found on HF, except that a different tone set (typically Bell 202 tones) are utilized. These signals can be found in almost all the ham bands, including 900 mhz. There are 3 distinct protocols in use here;

AX.25 Similar to that on HF, but speeds here are typically 1200 bd FSK or 9600 bd FSK or PSK in the UHF/SHF range. Some applications using AX.25 are:

* Packet Cluster - This is a real-time networked mode that allows connected amateurs to immediatly report on DX stations and broadcast this information to whomever may be connected. One of the most common frequencies is 145.55MHz.
* APRS - somewhat similar to HF with different baud speeds being used here. The national frequency for this mode on 2 meters is 145.57MHz.
* TCP/IP - Transmission Control Protocol, Internet Protocol. This mode, which uses AX.25 as the Link Layer, is used, for example, in links between Internet and amateur BBSs. Due to the nature of the protocol and speeds used (9600 bd or better), units like the M8000 will not read this data. However, units with special software and firmware (such as that found on the PK232) can utilize this mode. Units operating in this mode are said to be in 'KISS' mode. This traffic may be found on 2 meters on 145.59MHz (and others).

ATV Amateur Television. This is a FSTV system used by hams in the 430, 900 and 1200 Mhz systems. Uses include public service and Space Shuttle relays. A special de-modulator is required to see this system in most in-stances; however, some cable TVs can also see this system on channels 60, 62 or XX.

2-C. VHF SELCAL and Analog Paging Signals.

There are a lot of commercial systems available that are being used today. Till I get a handle on all the different manufacturers and get the information collated check out the following page. It covers and presents the tones used by many commercial systems.

http://www.geocities.com/CapeCanaveral/Lab/1060/hdwsftw.html

HSC Hexadecimal Sequential Code format is an analog system introduced in 1979 that supports tone-only, numeric and voice paging. It is based on the 5/6-tone system but uses a total of 16 tones (0-9 A-F + Repeat). Selected combinations of tones can be used to activate special features built into the pager. HSC and 5/6-tone systems can work together on the same frequency.

European 5/6-tone Systems

This analog paging format uses tone sets defined by various European and United States standards organizations. This analog system uses 10 tones plus one extra tone (in most cases) as a Repeat tone. The Repeat tone is used when two tones representing the same number follow in sequence. For example: 99222 would use the tone sequence 9R2R2. Pagers using this format support up to 1 million pagers and support tone-only and voice paging.

Tones supported are listed in the following as digit/frequency in Hz. Also see Table 4-H.
CCIR1, CCIR2, CCITT, EIA, NATEL, ZVEI1/2, VDEW and EURO5 are 5 tone.
EURO is 6 tone.

+ EEA - SELCAL system conforming to Electronic Engineering Association, United Kingdom. recommendations. Tones supported 0/1981 1/1124 2/1197 3/1275 4/1358 5/1446 6/1540 7/1640 8/1747 9/1860 A/1055 B/930 C/2246.9 D/991 E/2110 F/0 with a tone duration of 40ms.

+ CCIR 1 - CCIR 1 recommendations from Comite Consultatif International De Radio. Tones supported 0/1981 1/1124 2/1197 3/1275 4/1358 5/1446 6/1540 7/1640 8/1747 9/1860 A/2400 B/930 C/2246.9 D/991 E/2110 F/0 with a tone duration of 100ms.

+ CCIR 7 - SELCAL system conforming to CCIR 7 recommendations from Comite Consultatif International De Radio. Tones supported 0/1981 1/1124 2/1197 3/1275 4/1358 5/1446 6/1540 7/1640 8/1747 9/1860 A/2400 B/930 C/2246.9 D/991 E/2110 F/0 with a tone duration of 70ms.

+ ZVEI 1 - SELCAL system conforming to ZVEI 1 recommendations from Zentralverband der Electrotechnischen Industrie, West Germany. Tones supported 0/2400 1/1060 2/1160 3/1270 4/1400 5/1530 6/1670 7/1830 8/2000 9/2200 A/2799.9 B/810 C/970 D/886 E/2599.9 F/0 with a tone duration of 70ms.

+ ZVEI 2 - SELCAL system conforming to ZVEI 2 recommendations from Zentralverband der Electrotechnischen Industrie, West Germany. Tones supported 1/2200 2/970 3/1060 4/1270 5/1400 6/1530 7/1670 8/1830 9/2000 A/2599.9 B/2799.9 C/810 D/886 E/2400 F/0 with a tone duration of 70ms. Also called DZVEI.

+ NATEL - SELCAL system conforming to Scandinavian National Telephone (NATEL) recommendations. Tones supported 0/1633 1/631 2/697 3/770 4/852 5/941 6/1040 7/1209 8/1336 9/1477 A/1633 B/600 C/1995 D/2205 E/1805 F/0 with a tone duration of 70ms.

+ EURO - SELCAL system conforming to EURO recommendations. Tones supported 0/979.8 1/903.1 2/832.5 3/767.4 4/707.4 5/652.0 6/601.0 7/554.0 8/510.7 9/470.8 A/433.9 B/400.0 C/368.7 D/1153.1 E/1062.9 F/0 with a tone duration of 100ms. Also referred to as EuroSignal. This system uses 6 tones.

+ EURO5 - SELCAL system as above but uses 5 tones.

Motorola Systems

+ EIA - SELCAL system conforming to Electronics Industries Association, United States (EIA) recommendations. Tones supported 0/600 1/741 2/882 3/1023 4/1164 5/1305 6/1446 7/1587 8/1728 9/1869 A/2151 B/2432.9 C/2010.1 D/2292 E/459 F/0 with a tone duration of 33ms.

MODAT - Tones supported 0/637.5 1/787.5 2/937.5 3/1087.5 4/1237.5 5/1387.5 6/1537.5 7/1687.5 8/1837.5 9/1987.5

REACH 11th root of 2

High Freq - 0/2400 1/2253 2/2116 3/1987 4/1865 5/1751 6/1644 7/1544 8/1450 9/1361

Low Freq - 0/1200 1/1127 2/1058 3/993 4/933 5/876 6/822 7/772 8/725 9/681

+ CCITT SELCAL system conforming to CCITT recommendations. Tones supported 0/400 1/697 2/770 3/852 4/941 5/1209 6/1335 7/1477 8/1633 9/1800 A/1900 B/2000 C/2100 D/2200 E/2300 F/0 with a tone duration of 100ms.

+ VDEW SELCAL system conforming to VDEW recommendations or German Electricity Works - Vereinigung Deutscher Elektrizitaetswerke. Tones supported 0/2280 1/370 2/450 3/550 4/675 5/825 6/1010 7/1240 8/1520 9/1860 A/2000 B/2100 C/2200 D/2300 E/2400 F/0 with a tone duration of 100ms.

+ Hoka Code 30 can decode but needs the VHF option (extra) to decode these modes.

2-D. VHF Digital Paging Signals.

POCSAG Post Office Code Standardization Advisory Group Pager system developed in 1981 and is described in CCIR Recommendation 584, Radiopaging Code 1. This system can handle up to 2 million individual addresses per carrier and can support tone only, numeric and text pagers. Operates at 512, 1200 and 2400 bps (1200 and 2400 bps are commonly referred to as Super-POCSAG. Transmits in FM Narrow using frequency bands that are country specific. POCSAG is an asynchronous protocol, it has a start up preamble signal that alerts the pager to an incoming message (wake up). Pagers are assigned to 1 of 8 groups based on address. Pagers only pay attention to the address group to which they are assigned. 2 coding formats are used for message text: BCD and 7 bit ASCII. Some documents reference POCSAG by the short-tag PAGER1.

ERMES European Radio Message System developed in 1990 by the European Telecommunications Standards Institute. Strictly a European format with no known US implementations. It supports alphanumeric, numeric and tone paging. ERMES operates at a constant speed of 6250 bps and uses 4 level FSK signalling. This protocol uses a dedicated frequency spectrum in the 169 MHz range and supports 16 adjacent channels. The pagers are designed such that each pager is assigned to a specific time slot and when the pager senses it is not in its 'home' system it begins its roaming routine by scanning all channels.

GOLAY Golay Sequential Pager Signalling System is a digital system used to transmit tone only, numeric, alphanumeric and voice pages. This is a Motorola proprietary system but now obsolete according to Motorola. It may be that GOLAY is no longer found in those VHF frequency bands that support pagers but is still believed to be on US Satellite.

Pagers are divided into groups and a preamble is sent prior to paging alerts. Only pagers within the group number sent in the preamble need to examine the data stream for their address. Supports bit rates of 300 or 600 in that a pager address is sent at 300bps and any numeric or alphanumeric information is sent at 600bps. Also known as GSC - Golay Sequential Coding.

APOC Advanced Pager Operating Code. A new mode, developed by Philips Telecom and announced in 1993, that offers higher speed and some new features while retaining backwards compatibility with POCSAG. Supports bit rates between 1200 to 6400 or about 1200 to 3200 baud using 2-PAM/FM or 4-PAM/FM modulation. Extended addressing is supported, allowing support for more then 2 million pagers. As of mid-1996, Philips has dropped APOC and instead settled a cross-licensing deal with Motorola for access to FLEX.

FLEX Paging protocol introduced by Motorola late in 1994 and will be the protocol of choice as paging company upgrade from POCSAG to FLEX in the US. FLEX supports rates of 1600, 3200 and 6400bps and can handle up to 5 billion addresses. FLEX has a 4 frequency signal arranged as evenly spaced tones with usual shifts (in Hz) of:

-4800/-1600/+1600/+4800

This signalling technique is also more susceptible to noise so a robust error correction scheme is incorp-

orated. FLEX pagers also appear to have a decreased effective paging radius when compared to POCSAG.

FLEX is a synchronous time slot protocol. The FLEX protocol does not send messages at random but instead sends all paging data destined for a particular pager during a pre-defined time slot. The pager only wakes up only when a message is expected to arrive in real time thereby saving battery life.

NEC/D3 A digital encoding format developed by NEC America that supports tone only and numeric pages at a rate of 200 bps. This format was developed for use in NEC R3-D3 pagers. This format uses 2 methods for preserving battery life. First a preamble is used to alert ALL pagers that there are incoming messages. Pagers remain idle till preamble detection. Second, pagers are grouped by address into 1 of 4 different groups. Each group is transmitted during a fixed time period and pagers only power up to look for its own address during the time its group is transmitted. Error correcting codes and even parity bits are used on each address and message.

Mark IV/V/VI A digital format that supports tone, numeric and voice paging. This system requires 2ms to send a binary 0 and 4ms to send a binary 1 making the data transmission rate between 250 to 500 bps. Mark IV could handle tone only and Mark V and Mark VI could handle up to 10 digits.

Swedish MBS An FM subcarier system developed by the Swedish Telecommunications Administration. This paging format supports tone-only, numeric and alphanumeric paging. Data is transmitted using the 57kHz subcarrier at a rate of 1187.5 bps. MBS (Mobile Search) is used in a modified form (MMBS) in the US by Cue Paging.

RBDS/RDS An FM subcarrier system developed by the Swedish Telecommunications Administration. The system transmits information to standard FM receivers using the 57kHz subcarrier with a data rate of 1187.5 bps. The signal is made up of 16 possible data groups, where each has 4 blocks of info and each block is 26 bits long. Out of the 26 bits, 16 bits are for data and 10 bits are for error correction. RBDS data groups currently supported are:

0 Basic Tuning/Switching	8 Traffic Msg Channel/TMC
1 Program Item Number	9 Emergency Warning System
2 Radio Text	10 PTY Names
3 GPS	11 Undefined
4 Clock Time & Date	12 Undefined
5 Transparent Data Chan	13 Undefined
6 In House Applications	14 Enhanced Other Networks
7 Radio Paging Services	15 Fast Tuning/Switching Info

Reference the NRSC US RBDS Standard 1/8/93: Specification of the Radio Broadcast Data System and the European Standard CENELEC EN 50 067 (4/92): Specification of the Radio Data System.

Circuit Research Labs SC-100 is an example of an RBDS processor used to inject the proper carrier in an FM signal.

RECEPTOR An FM subcarrier system developed by Seiko Telecommunications Systems, Inc. The systems uses the 64kHz

subcarrier on commercial FM broadcasts and operates with a data rate of 19kbps. The system offers a variety of services including paging, sports, weather reports, and stock quotes through the Seiko MessageWatch. The system is currently in limited use in the US with expansion planned into the top 20 US markets within the next 2 years.

2-E. VHF Two-way Paging Signals

ReFLEX	A Motorola two-way paging scheme. Currently comes in 2 forms. ReFLEX 25, which supports an outbound channel capacity of 12,800bps and inbound capacity up to 9600 bps and ReFLEX 50, which supports an outbound channel capacity of 25,600bs and inbound capacity up to 9600 bps. Both forms utilize a 50kHz channel. This scheme is designed to give the end user the ability to acknowledge a message, send replies and download data.
inFLEXon	A Motorola two-way paging protocol that allows voice and data messaging using a 50kHz Narrow Band PCS channel with a throughput of 112K bps. This system is based on the ReFLEX protocol.
NexNet	A proprietary two-way system created by Nexus Telecommunications, Ltd. of Israel uses Spread Spectrum transmission from the pager to send responses. The current system uses POCSAG to send messages to the pager. Data sent outbound from the pager is transparent to the incoming data which means that this two-way paging system can coexist on pre-existing one-way paging channels. Testing in Minneapolis, Chicago and Orlando by American Paging is expected to be completed by the end of 1996.
RAMP	Radio Mail Protocol. A two-way pager protocol built to be backwardly compatible with APOC. Currently under development by Philips Telecom.
pACT	An AT&T Wireless Services/PCSI developed open standard designed to support two-way paging and messaging services. The protocol uses an 8kbps link based on re-use of cellular channels.

* POCSAG and GOLAY can also be found on U.S. domestic C/Ku-band Satellite SCPC carriers.

Section 3. Baud Rate Summary Table

Below is a table of expected baud rates you can most likely encounter for the latest listing of modes available. An accurate baud rate is a valuable tool to identifying a particular mode and there are many modes that have unique baud rates. As of this writing the Hoka and Wavecom units seem to have the most accurate capability of all existing decoders currently on the market.

All rates are in units baud.

A few baud oddities of note:

* 128.5bd ARQ-M2 French Forces circuit(s) between Papeete, Tahiti and Mururoa.
* 184.6bd ARQ-E French Forces circuit(s) used by RFFXQA Sarajevo, BIH also it seems many former 72bd ARQ-E circuits are changing to 184.6bd ARQ-E.
* 384bd FEC-A used by MFA Paris,F and French Emb., ROU
* 109.3bd SITOR-B used by an unidentified user.
* 46.1bd ARQ-E used by Egyptian/Tunisian Air Force/Air Defense sending

in Arabic.
* 85.7bd ARQ-E used by an unidentified user sending encrypted traffic

NOTE:
For baud rates of unidentified systems reference the table in section 1-K

Synchronous Data Block Systems

50	ARTOR
96	SI-ARQ
100	SWED-ARQ TWINPLEX ARTOR SITOR-A PACTOR G-TOR ARQ6-98
125	DUP-ARQ
144	SI-ARQ
171.42	IRA-ARQ
192	SI-ARQ
200	ARQ6-70 ARQ6-90/98 TWINPLEX ARTOR SI-ARQ PACTOR G-TOR
200.20	IRA-ARQ
228.5	MERLIN/ALIS(RS-ARQ)
250	DUP-ARQ-2
300	TWINPLEX G-TOR
300.30	IRA-ARQ
457	MERLIN/ALIS(RS-ARQ)

Packet-like Systems

125	CLOVER
225	MERLIN/ALIS
240	HC-ARQ
250	CLOVER
300	PACKET
375	CLOVER
500	CLOVER
1200	ACARS/HFDL

Multi-tone/MFSK Systems

12.5	COQUELET-13
13.33	COQUELET-8
20	COQUELET-13 PICCOLO-Mk6
26.67	COQUELET-8
40	COQUELET-13 CROWD36 PICCOLO-Mk10
100	MIL188 TT2300b
240	MERLIN/ALIS-2(7 tone burst ARQ ALIS mode)
1364 b/s	LINK-11
2250 b/s	LINK-11

Synchronous Bit Stream Systems

36	BEE/36-50
36.5	81-81
40.5	81-81
42.1	CIS-14
46.1	ARQ-E
47.5	CIS-14
48	ARQ-E ARQ-E3 ARQ-N CIS-14
50	CIS-11 CIS-14 ARQ-E BEE/36-50
62.3	AUTOSPEC SPREAD-11/21/51
64	ARQ-E ARQ-E3 ARQ-N
68.5	AUTOSPEC SPREAD-11/21/51 SUI-FEC
70.5	CIS-14
72	ARQ-N ARQ-E ARQ-E3 CIS-14
73	81-81
75	IRA-ARQ

81	81-81
83.3	CIS-14
84.21	CIS-14
85.7	ARQ-E ARQ-M2-242/342 ARQ-N
86	ARQ-E ARQ-E3
87	ARQ-M2 ARQ-M4
94.11	CIS-14
96	ARQ-N ARQ-E ARQ-E3 ARQ-M2 ARQ-M4 FEC-A SI-FEC CIS-14
100	POL-ARQ SITOR-B TORG-10 IRA-ARQ CIS-11 CIS-14 ARQ-E3 BEE/36-50 ARS-GUARD SI-FEC
100.05	HNG-FEC
102.7	AUTOSPEC SPREAD-11/21/51
109.3	SITOR-B
110	IRA-ARQ
125	ARS-GUARD DUP-FEC-2
128.5	ARQ-M2-342
137	SPREAD-11/21/51
144	ARQ-N ARQ-E ARQ-E3 FEC-A CIS-14
150	IRA-ARQ CIS-11 CIS-14 RAC-ARQ
162	81-81
164.48	ROU-FEC
171	ARQ-E
171.42	IRA-ARQ
172	ARQ-M4-242/342
184.6	ARQ-E
192	ARQ-N ARQ-E ARQ-E3 ARQ-M2 FEC-A SI-FEC
200	ARQ-E3 ARQ-M2 ARQ-M4 SI-FEC IRA-ARQ CIS-11 CIS-14 POL-ARQ ARS-GUARD HNG-FEC
218.3	ROU-FEC SPREAD-11/21/51
240	IRA-ARQ
250	DUP-ARQ-II DUP-FEC-II
267	RAC-ARQ
288	FEC-A CIS-14 ARQ-E
300	IRA-ARQ CIS-11
384	FEC-A
600	IRA-ARQ

Asynchronous Bit Stream Systems

50	BAUDOT
75	BAUDOT
100	BAUDOT
110	ASCII
300	ASCII

Section 4. ACF Summary Table

Definition: ACF - AutoCorrelation Frequency, a number that is derived from the Auto Correlation BIT module in the Hoka Code 3 or Code 30. The technique and theory of Autocorrelation is not limited to Hoka equipment as Wavecoms W41PC and W4100DSP also include this analysis tool.

Result: ACF can tell you:

1. Character size -or- Frame size Character Repetition Cycle (CRC)	Needed if you wish to apply an alphabet against an unknown signal w/Simplex or Duplex Analysis modules.
2. Signal is encrypted	ACF=0 or no pattern

Theory: Autocorrelation is simply the correlation of a signal with itself or a comparison of a signal with itself as a function of time

shift. By determining the first highest peak in the graphical display of the Auto Correlation BIT module it is possible to discover the periodicity of a signal. This allow you to determine the number of bits in a character of a particular signal or the frame size of a signal. It also will reveal the randomness of a signal which instantly tells you if a signal is encrypted. Ideally, encrypted signals contain no regular patterns.

Below is a table of known signals and their ACF values. In the table, "Preamble" is defined as the non-random portion preceeding an encrypted signal. Many believe that this is used to sync the transmitter and receiver of the signal being transmitted. For signals that are mostly off-line encrypted (figure/letter group encryption) or sent clear text "data" is defined as the time which the signal is actually transmitting data or not idling. Many signals don't have a distinct idle sequence but instead transmit data then terminate. "Idle" is defined as the time the signal is sending an idle sequence. Many signals have distinct idle modes and spend many hours idling. Many times you will see a different pattern displayed by the auto correlation BIT module of a signal sending data and idling but they will have the same ACF.

System name	Preamble ACF	Data/Traffic ACF	Idle ACF	Comment
BEE/36-50	70	0	2	tfc is encrypted
81-81		0		tfc is encrypted
ARQ6-70			70	rare
ARQ6-90			90	
ARQ6-98			98	
ARQ-E		28,56	28,56	very common, mostly idle
ARQ-E3		28,56	28,56	very common, mostly idle
ARQ-M2		56	56	French Forces 4-CRC
ARQ-M2		112	112	8-CRC not common
ARQ-M4		56	56	rare
ARQ-N				
ARS-GUARD			48,96	
ASCII		7,8		async system
AUTOSPEC		40(*)		
BAUDOT		7,8,15		1 async system5 w/half-stop bit
CIS-11/TORG-11				
CIS-14				
DGPS (MSK)		10		
DUP-ARQ		88		
DUP-ARQ-2				
DUP-FEC				
FEC-A			56	
FEC-S/SI-FEC				
G-TOR				
HNG-FEC		90	90	
IRA-ARQ		11	55	
PACTOR		0		
POL-ARQ			7	
ROU-FEC		16	16	
RS-ARQ/ALIS		110(*)	59	228.7bd
RS-ARQ/ALIS2			59	240bd multitone signal
RS-ARQ/packet		0		225.2bd, tfc 0 due to encoding
SI-ARQ/ARQ-S			70	
SITOR-A			45	very common
SITOR-B			35	very common
SPREAD				
SUI-FEC	10	0		
SWED-ARQ			45	
TT2300b			8	
TWINPLEX				

(*) data from snapshots in the Klingenfuss Radioteletype Code Manual 13th Ed.

By ACF

The data listed below is ACF sorted numerically. ACF in [] is an unknown system that had a distinctive ACF. This data was taken from the Unid Signals listed in section 1-K.

ACF	System
2	BEE/36-50(idle)
7	BAUDOT(x-stop), POL-ARQ
[7]	126/250
8	BAUDOT(x-stop) ,TT2300b
10	RS-ARQ(225.2b), DGPS(MSK), IRA-ARQ
[10]	362.4/500
11	IRA-ARQ
15	BAUDOT(1.5-stop)
[15]	250/170 (West. African ARQ)
16	ROU-FEC
[17]	300/200
28	ARQ-E, ARQ-E3
[28]	150/100 (MOSSAD FEC system)
[32]	ARTRAC-II
35	SITOR-B
40	AUTOSPEC
45	SITOR-A, SWED-ARQ
48	ARS-GUARD(idle)
55	IRA-ARQ
56	ARQ-E, ARQ-E3, FEC-A, ARQ-M2, ARQ-M4
59	RS-ARQ/ALIS2(240b), RS-ARQ/ALIS(228.7)
70	ARQ-S
[75]	250/170 (West. African ARQ)
[84]	216.07/114
88	DUP-ARQ
90	ARQ6-90
96	ARQ-GUARD
98	ARQ6-98
110	RS-ARQ/ALIS
112	ARQ-M2
[162]	100/500
[176]	ARTRAC-II
[224]	150/1000 (MOSSAD FEC system)
[448]	300.12/850
[1399]	150/853

Section 5. System Parameters

This section lists the unique characteristics of each named mode: specifying character length and known alphabet for all modes. For synchronous data block systems, block length, cycle specifics and baud rate is listed. For sychronous bit stream systems, cycle information and character specifics, such as sync bits, parity bits and interleaving details are listed. Finally for the MFSK systems, tones, tone layout and tone spacing are listed.

Synchronous Data Block Systems - Table 5-A

	character size (bits)	alphabet in use	block size (chars)	repetition cycle (bits)	total rep. cycle time(mS)	cycle breakdown as (ISS/IRS/rest)	most commonly found baud	comments
ARQ6-70	7	ITA3	6	70	350	42/7/21	200	6ch*35ms=210ms 140ms ps rare
ARQ6-90	7	CCIR476	6	90	450	42/7/41	200	6ch*35ms=210ms 240ms ps
ARQ6-98	7	CCIR476	6	98	490	42/7/49	200	6ch*35ms=210ms 280ms ps
SWED-ARQ/ ARQ-SWED	7	CCIR476	3	45	450	21/7/17	100	3ch*7bit=210ms 210ms ps
			9	90	900	63/7/20	100	9ch*7bit=630ms 270ms ps
			22	180	1540	154/7/19	100	22ch*7bit=1540ms 260ms
TWINPLEX	7	CCIR476	2*3	45	450	21/7/17	100	See Table 4-F
SITOR-A	7	CCIR476	3	45	450	21/7/17	100	3ch*70ms=210ms 240ms ps
SI-ARQ/ ARQ-S/ ARQ1000S	7	ITA3	3	42	437.5	21/7/14	96	every odd cycle has
			4	56	583.3	28/7/21	96	all bits inverted
			5	70	729.2	35/7/28	96	RC of 5 and 6 are
			6	84	875.0	42/7/35	96	most commonly found
			7	98	1020.8	49/7/42	96	
DUP-ARQ/ ARTRAC	5	ITA2+7p	5	88	704	32/32/12	125	7p added to ea. blk of 5 char. each xm burst is 32bits. 5ch @ 5bits + 7p=256ms xm 96ms ps
DUP-ARQ-2/ ARTRAC 2	5	ITA5 or ITA2		176	704		250	1frame = 2blks DUP-ARQ = 2blks of 32bits 1blk is 5bit cksum + 3x8bit chars + 00
MERLIN/ ALIS/RSARQ	5	ITA2	48	111	485.4		228.7	1 blk = 2id + 30data+ 16crc. 1ack blk = 16bits
PACTOR	8	ITA5	96	125	1250	96/12/17	100	*IRS is 12bits and
			192	250	1250	192/24*/32	200	ALWAYS sent @100bd
G-TOR	8	ITA5	21		240	192/16/32	100	
			45		240		200	
			69		240		300	

Asynchronous Data Block System - Table 5-B

	char size (bits)	alphabet in use	block size (chars)	block size (bits)	block tx time (mS)	block breakdown (chars)	most commonly found baud	comments
HC-ARQ	5	ITA2	38	174	725	4 char sync, 5*30 chars, 4 char CRC	240	All packets sent with no timing restraints. Data packet can be sent at
	5	ITA2	68	324	1350	4 char sync, 5*60 chars, 4 char CRC	240	any time after a rx'ed ACK from other station. Is therefore "Asynch".
	5	ITA2	188	924	3850	4 char sync, 5*180 chars 4 char CRC	240	Packet length usually data chars + 8 chars overhead (4 header+4CRC)
PACKET/ AX25	8	ITA5	8-264	64-2112	21-704	1 start flag, 3 address, 1 control 0-256 data chrs 2 CRC bytes and end flag	300	Overhead is fixed at 8 bytes. Data block = 0 to 256 bytes

Asynchronous Bit Stream Systems - Table 5-C

	char size	using alphabet	characteristics
BAUDOT	5 bit	ITA2	1 start,5 data, 1, 1.5, or 2 stop (exact stop bit length can vary) 1 char = 7, 7.5, 8 bits
ASCII	x bit	ITA5	1start,5,6,7 data bits(x), 1 stop + 1p (optional) 1 char = 8,9 or 10bits/p bit = none,even or odd
BAUDOT/ F7BBN	5 bit	ITA2	2 ch, same speed ea. ch, 4 frequency, async

Synchronous Bit Stream Systems - Table 5-D

	char size (bit)	using alphabet	repetition cycle	characteristics
ARQ-N	7	ITA2P	4/8	No inverted char every 4 of 8 char
ARQ-E/ ARQ1000D	7	ITA2P	4/8	every 4th/8th char inverted which marks it as the 1st char of that block of 4 of 8 chars
ARQ-E3	7	ITA3	4/8	see ARQ-E
ARQ-M2-242	7	ITA3	4/5/8	a-ch erect, b-ch invert, char interleaved
342	7	ITA3	4/8	a-ch erect, b-ch invert, char interleaved
ARQ-M4-242	7	ITA3	4/5/8	a/c-ch char interleaved a/b c/d bit interleave a-ch erect b/c/d invert
342	7	ITA3	4/8	a-ch erect, b-ch invert a/b chars interleaved c-ch invert d-ch erect a/b c/d bit interleave

AUTOSPEC	10	ITA2 + 5p		1 char = 10 bits, 5bits of ITA2, 5 parity bits
SPREAD	10	ITA2 + 5p		1 char = 10 bits w/ea. char interleaved over 11,21 or 51 bits
81-81	12	CYR M2		1 frame = 12 bits. 2-ch (bauds 73,81) 1 frame = 6 bits. 1-ch (bauds 36.5,40.5)
CIS-11	5	CYR M2		1 frame = 11bits. 5 M2 char + 2state + 4p M2 char: in reverse order. 2state bits define system state and alphabet.
CIS-14	5	CYR M2		1 frame = 14bits. 2-ch bit interleave frame:a1B1a2B2a3B3a4B4a5B5a6B6p1p2(2*6bits+2p) a-ch:a2-6 b-ch:B2-6 a1B1=state (IDLE/TFC) p1p2=error correction 1 frame = 28bits. CIS-14 variant
DUP-FEC-2 DUP-FEC	5	ITA2 or ITA5		1 frame = 32bits. 5bit CRC used.
FEC-A/ FEC100A	7	ITA2P		data bits+p bits interleaved. Parity created by shift register. 2 known lengths: 71 and 127
HNG-FEC	15	15 bit		1st 5bits ITA-2 with bits 1 and 5 inverted + 10bits error correction. interleave of 64bits, each new char starts 15bits after preceding char
POL-ARQ	7	CCIR476	4/5/6	Similar to ARQ-N but using CCCIR476 alphabet
ROU-FEC/ RUM-FEC	16	16 bit		interleave of 128bits, new char starts 16bits from preceding char. Bit masking used (10,15,31)
SI-FEC/ FEC-S/ FEC1000S	7	ITA3		each char inverted and repeated 15 chars later, or 1050ms, similar to ARQ-M2-242
SITOR-B/ NAVTEX	7	CCIR476		char interleaved, each char simply repeated after 350ms (5 chars/35 bits later)
TORG-10/11	11	ITA2		1 frame = 11 bits: 5 data+2sync+4p. See CIS-11

Multi-tone/MFSK/PSK Systems - Table 5-E

	modulation	# of tones	tone shift/arrangement	tone shift/spacing (Hz)	bps(FSK) / symbol/sec(PSK)	comments
PICCOLO MK6	MFSK	6	5*20Hz tone3-8	20	20	1 char -> 2 tones, ea 50ms so 1 char = 100ms. 7.5 unit ITA2 gives 75 baud throughput
		12	11*20Hz tone0-11	20	20	ITA5 version.
PICCOLO MK10	MFSK	6	5*40Hz	40	40	special alphabet in use 1 char -> 2 tones, ea 25ms
COQUELET 8	MFSK	8	7*26.7Hz tone1-8	26.7	26.7	1 char = 2 consecutive tones ea 37.5ms. 1 char is 75ms
COQUELET 13	MFSK	13	8*30Hz tone1-8 + 4*30Hz tone9-12	30	13.3	1 char = 2 consecutive tones ea. 75ms. 1 char is 150ms
CROWD36	MFSK	36	35*40Hz tone1-36	40	40 10	3 groups of 10+11+11 tones tones 1,12,24,36 rarely used

						1 of 32 tones=1 of 32 ITA2 chars 1 tone = 100ms@10bps 1 tone = 25ms@40bps
MIL188	MFSK	8	7*250Hz	250		1 sym = 8ms
TT2300b/ TPLEX	MFSK	8	7*200Hz	200	100/ 200	100bd gives 300bps throughput 200bd gives 600bps throughput 1 tone is 5ms@100bd 10ms@200bd
LINK-11	QPSK	15	14*110Hz tone 1@935Hz	110		1 doppler tone @605Hz offset 1 sync tone @2915Hz offset
LESW/LINK11 Single Tone Waveform	8PSK	1	0*1800Hz	0		data rates up to 4800bps 1 packet=192bits+64bits sync 256bits=80ms +26.67ms
MERLIN/ ALIS-2	MFSK	8	7*240Hz tone1-8	240	240	240sym/s or 720b/s
MS5 Russian Vocoder	QPSK	12	11*200Hztone1-11 tone 1@700Hz	200	100	1 pilot tone @3300Hz (rare: 3600Hz)
CLOVER	PSK	4	3*125Hz	125	31.25	Supp: BPSM/125bps QPSM/250bps 8PSM/375bps 16PSM/500bps 8P2A/500bps 16P4A/750bps Total bandwidth 500Hz
CLOVER-2000	PSK	8	7*250Hz	250	62.50	Supp: BPSM/500bps QPSM/1000bps 8PSM/1500bps 8P2A/2000bps 16P4A/3000bps Total bandwidth 2kHz
HF=Datalink	8PSK	1	0*1440Hz	0		Adaptive rates of 150,300,600, 1200,1800 supported.
4+4	MFSK	8	3*300Hz tone1-4 1*450Hz Gap 3*300Hz tone5-8			1 channel is 150bps BPSK
39-tone modem	PSK	39	38*56.25Hz	56.25	2400	tones 675Hz to 2812.5Hz 1 doppler tone @393.75Hz
CODAN modem	QPSK	16	15*112.5Hz	112.5	2400	tones 656.25Hz to 2343.75Hz

TWINPLEX Parameters - Table 5-F

- o CCIR476 alphabet, 1 char = 7bits
- o 2 channels of 3 characters, 1 block = 6 chars
- o Characters may be "erect" or "inversed" or "erect and inversed"
- o 1 cycle = 450ms, 210ms tx 240ms rx
- o Interleave is station selectable
- o Channel decode is station selectable
- o Frequency shift is station selectable

Interleave (lower case: ch1 UPPER CASE: ch2)	
WORD -	abc ABC def DEF ghi GHI jkl
BIT -	a1 A1 b2 B2 c3 C3 d4 D4 e5 E5 f6 F6
CHAR -	a A b B c C d D e E f F
NONE -	abc def ghi jkl [normal SITOR sends interleave NONE]

Frequency Offset				Shift	User
f1	f2	f3	f4		
-400	-200	+200	+400	200/400/200	*

Channel Decode Method		ch.1	ch.2
*	F7B-1	BBYY	BYBY
	F7B-2	BBYY	BYYB
	F7B-3	BYBY	BBYY
*	F7B-4	BYBY	BYYB
	F7B-5	BYYB	BBYY
	F7B-6	BYYB	BYBY

B defined as:0/spc/start

```
-200 -85  +85  +200 |115/170/115|*Spain/Pakistan|| Y defined as:1/mrk/stop
-255 -85  +85  +255 |170/170/170| Dutch         ||
-150 -50  +50  +150 |100/100/100|               ||
-300 -100 +100 +300 |200/200/200|               ||
-200 -85  +85  +600 |115/170/515| Pakistan      || * commonly found
                    | 65/170/ 65|               ||
--------------------+-----------+---------------++-------------------------
Usual defaults: 100bd, 115/170/115, Erect ch A, Invert ch B, word interleave
-------------------------------------------------------------------------
```

Notes on Alphabets - Table 5-G

- ITA2 is also referenced as Murray code.
- ITA3 is also called Moore code and each character is defined by the 35 possible combinations of 3 ones and 4 zeros (3:4). 32 are the commonly defined character set and the remaining 3 are for error control and idle.
- ITA5 can be referred to as IRA.
- ITA5 is the ASCII alphabet and consists of 128 characters, controls, specials, numbers, lower case letters and upper case letters. This alphabet uses up to 7 bits and sometimes includes a 8th bit for parity.
- ITA2P is also referenced as ARQ1a by some manufacturers.
- ITA2P is 5 bit ITA2 converted to 7. A character is composed of 1 sync bit + 5 bit ITA2 char + parity. Sync bit is always 1 (except for idle and RQ), parity is odd.
- BAUER is a 10 bit alphabet, used by AUTOSPEC and SPREAD and is composed of a 5 bit ITA2 char + 5 bits parity. The parity arrangement is selectable and is often encountered with 5 bit ITA2 + 5 bit ITA2 repeated. In the even parity scenario the second 5 bits are inverted.

- 16 bit alphabet 0 is a 16 bit alphabet, used only by ROU-FEC
  16 bit alphabet 1 is a 16 bit alphabet mod 10, used only by ROU-FEC
  THESE ALPHABETS ARE LISTED IN Wavecom 4100 literature - no further details.

  The ROU-FEC alphabet is arranged with a single character length of 16 bits and each 32 bit pattern equals one ITA2 character. Note that the actual ITA2 character bit pattern does not appear in the ROU-FEC character bit pattern. This is because the alphabet is designed to obtain a maximum Hamming distance.

- FEC-A uses convolutional error correction with shift register lengths of 72 or 128 bits. Every 2nd bit is used for convolutional error correction making each codeword 14 bits.

- With the introduction of the W4100DSP and W41pc, Wavecom has introduced some new alphabets:
  - TASS Cyrillic
  - Bulgarian ASCII
  - Alphabet no. 403 used by Coquelet-8
  - Alphabets no. 401 and 402 used by Coquelet-13
  - Alphabets 80S and 82S used by Coquelet-82

- These alphabets are based on ITA2, a 5 bit alphabet.
  - Cyrillic M2
  - Cyrillic M19
  - Hebrew
  - Arabic ATU-70 ("Baghdad 70")
  - 4th shift Arabic ATU-80 ("Baghdad 80")
  - 3rd shift Greek
  - 3rd shift Korean
  - 3rd shift Amharic
  - 3rd shift Thai
  - transparent

- 3rd shift Japanese is a 6 element code with start and stop signals used in Japan for their national TELEX network.

Code Tables

B defined as:0/spc/start
Y defined as:1/mrk/stop

No.	Letter	ITA2 Figure	Telex Fig.	Mil. Fig.	ITA2	ITA2P ARQ1A	ITA3	SITOR CCIR476
1	A	-	-	-	YYBBB	BYYBBBY	BBYYBYB	BBBYYYB
2	B	?	?	?	YBBYY	BYBBYYB	BBYYBBY	YBYYBBB
3	C	:	:	:	BYYYB	BBYYYBB	YBBYYBB	BYBBBYY
4	D	$(1)	wru	$	YBBYB	BYBBYBY	BBYYYBB	BBYYBYB
5	E	3	3	3	YBBBB	BYBBBBB	BYYYBBB	YBBYBYB
6	F	%(2)	$	!	YBYYB	BYBYYBB	BBYBBYY	BBYBBYY
7	G	&(2)	&	&	BYBYY	BBYBYYB	YYBBBBY	BYBYBBY
8	H	#(2)	#	stop	BBYBY	BBBYBYY	YBYBBYB	BYYBYBB
9	I	8	8	8	BYYBB	BBYYBBY	YYYBBBB	BYBBYYB
10	J	@(3)	bell	'	YYBYB	BYYBYBB	BYBBBYY	BBBYBYY
11	K	(	(	(	YYYYB	BYYYYBY	BBBYBYY	YBBBBYY
12	L	)	)	)	BYBBY	BBYBBYY	YYBBBYB	BYBYYBB
13	M	.	.	.	BBYYY	BBBYYYB	YBYBBBY	BYYBBBY
14	N	,	,	,	BBYYB	BBBYYBY	YBYBYBB	BYYBBYB
15	O	9	9	9	BBBYY	BBBBYYY	YBBBYYB	BYYYBBB
16	P	0	0	0	BYYBY	BBYYBYB	YBBYBYB	BYBBYBY
17	Q	1	1	1	YYYBY	BYYYBYY	BBBYYBY	YBBBYBY
18	R	4	4	4	BYBYB	BBYBYBY	YYBBYBB	BYBYBYB
19	S	'(3)	'	bell	YBYBB	BYBYBBY	BYBYBYB	BBYBYYB
20	T	5	5	5	BBBBY	BBBBBYB	YBBBYBY	YYBYBBB
21	U	7	7	7	YYYBB	BYYYBBB	BYYBBYB	YBBBYYB
22	V	=	;	;	BYYYY	BBYYYYY	YBBYBBY	YYBBBBY
23	W	2	2	2	YYBBY	BYYBBYB	BYBBYBY	BBBYYBY
24	X	/	/	/	YBYYY	BYBYYYY	BBYBYYB	YBYBBBY
25	Y	6	6	6	YBYBY	BYBYBYB	BBYBYBY	BBYBYBY
26	Z	+(4)	"	"	YBBBY	BYBBBYY	BYYBBBY	BBYYYBB
27	cr	cr	cr	cr	BBBYB	BBBBYBB	YBBBBYY	YYYBBBB
28	lf	lf	lf	lf	BYBBB	BBYBBBB	YBYYBBB	YYBBYBB
29	ls	ls	ls	ls	YYYYY	BYYYYYB	BBBYYYB	YBYBBYB
30	fs	fs	fs	fs	YYBYY	BYYBYYY	BYBBYYB	YBBYBBY
31	sp	sp	sp	sp	BBYBB	BBBYBBB	YYBYBBB	YYBBBYB
32	idle(5)				BBBBB	BBBBBBY	BBBBYYY	YBYBYBB
	RQ					YYYBBBB	BYYBYBB	YBBYYBB
	idle/beta					YBBYBBY	BYBYBBY	BBYYBBY
	idle/alpha					YBBBYYB	BYBYYBB	BBBBYYY
	CS1							BYBYYBB
	CS2							YBYBYBB
	CS3							BYYBBYB
	CS4							BYBYBBY
	CS5							BYYBYBB

(1) "Who are you?" or British Pound symbol
(2) each country can assign
(3) can be switched
(4) sometimes " instead of +
(5) idle or 3rd shift

ITA-5/ASCII/IRA

hex digit 1st-->	0	1	2	3	4	5	6	7
7	B	B	B	B	Y	Y	Y	Y
6	B	B	Y	Y	B	B	Y	Y
5	B	Y	B	Y	B	Y	B	Y
4 3 2 1								
0 B B B B	NUL	DLE	SPC	0	@	P	`	p
1 B B B Y	SOH	DC1	!	1	A	Q	a	q
2 B B Y B	STX	DC2	"	2	B	R	b	r
3 B B Y Y	ETX	DC3	#	3	C	S	c	s
4 B Y B B	EOT	DC4	$	4	D	T	d	t
5 B Y B Y	ENQ	NAK	%	5	E	U	e	u
6 B Y Y B	ACK	SYN	&	6	F	V	f	v
7 B Y Y Y	BEL	ETB	'	7	G	W	g	w
8 Y B B B	BS	CAN	(	8	H	X	h	x
9 Y B B Y	HT	EM	)	9	I	Y	i	y
A Y B Y B	LF	SUB	*	:	J	Z	j	z
B Y B Y Y	VT	ESC	+	;	K	[	k	{
C Y Y B B	FF	FS	,	<	L	\	l	|
D Y Y B Y	CR	GS	-	=	M	]	m	}
E Y Y Y B	SO	RS	.	>	N	^	n	~
F Y Y Y Y	SI	US	/	?	O	_	o	DEL

B defined as:0/mrk/stop
Y defined as:1/mrk/stop

bit ordering: 7654321

Special Notes:
YYBBBBB 60 - back tic (`)
BYBBYYY 27 - single quote (')
BYBYYBB 2C - comma (,)
BYBYYBY 2D - minus/dash (-)
YBYYYYY 5F - underline (_)
YYYYYYB 7E - tilde (~)

ACK - acknowledge
BEL - bell
BS - backspace
CAN - cancel
CR - carriage return
DC1 - device control 1
DC2 - device control 2
DC3 - device control 3
DC4 - device control 4
DEL - delete
DLE - data link escape
ENQ - enquiry or WRU
EM - end of medium
EOT - end of transmission
ESC - escape
ETB - end of block
ETX - end of text
FF - form feed
FS - file separator
GS - group separator
HT - horizontal tab
LF - line feed
NAK - negative acknowledge
NUL - null
RS - record separator
SI - shift in
SO - shift out
SOH - start of header
SPC - space
STX - start of text
SUB - substitute
SYN - synchronous idle
US - unit separator
VT - vertical tab

References: Wavecom Elektronik AG, Wavcom W4100 product literature
Wavecom Elektronik AG, W41PC User Manual and correspondance
HOKA Electronics, Code 3 v5.00 decoder manual and correspondance
HOKA Electronics, Code 30 v2.00 decoder manual and correspondance
Klingenfuss Radioteletype Code Manual, 13th Edition

Crowd-36 Tones and Alphabet - Table 5-H

tone	Freq(Hz)	Ch/Fg	tone	Freq(Hz)	Ch/Fg	tone	Freq(Hz)	Ch/Fg
1	-640	unperf	13	-160	G	25	320	D
2	-600	Q	14	-120	T	26	360	I
3	-560	X	15	-80	F	27	400	H
4	-520	W	16	-40	fs	28	440	ls
5	-480	V	17	0	M	29	480	S
6	-440	E	18	40	Y	30	520	O
7	-400	K	19	80	C	31	560	N
8	-360	space	20	120	cr	32	600	-
9	-320	B	21	160	Z	33	640	A
10	-280	R	22	200	U	34	680	P
11	-240	J	23	240	L	35	720	
12	-200	ctl	24	280	****	36	760	

ctl - control purposes
fs - figure shift
ls - letter shift
**** - ref tone on 10bd op chat

Notes: * This is a preliminary table!
* The output of the alphabet in use may vary at customer request.
* Watch for tone 24 to stay up before 10bd operator chatter.

5/6 Tone Paging Parameter Tables - Table 5-I

European 5/6 tone systems - frequencies in Hz
---

* is Repeat tone
= is Group tone

CCIR-1/2, CCITT, EIA, NATEL, ZVEI1/2, VDEW and EURO5 are 5 tone, EURO is 6 tone

tone	EEA	CCIR-1	CCIR-7	ZVEI ZVEI-1	DZVEI ZVEI-2	DDZVEI	NATEL	EURO
0	1981	1981	1981	2400	2200	2400	1633	979.8
1	1124	1124	1124	1060	970	1060	631	903.1
2	1197	1197	1197	1160	1060	1160	697	832.5
3	1275	1275	1275	1270	1160	1270	770	767.4
4	1358	1358	1358	1400	1270	1400	852	707.4
5	1446	1446	1446	1530	1400	1530	941	652
6	1540	1540	1540	1670	1530	1670	1040	601
7	1640	1640	1640	1830	1670	1830	1209	554
8	1747	1747	1747	2000	1830	2000	1336	510.7
9	1860	1860	1860	2200	2000	2200	1477	470.8
10/A	=1055	=2400	=2400	=2799.9	2599.9	= 885	1633	433.9
11/B	930	930	930	810	2799.9		600	400
12/C	2246.9	2246.9	2246.9	970	810		=1995	368.7
13/D	991	991	991	886	886		2205	1153.1
14/E	*2110	*2110	*2110	*2599.9	*2400	* 970	*1805	*1062.9
15/F	2400	0	0	0	0		0	0
	40ms	100ms	70ms	70ms	70ms	70ms	70ms	100ms

Tone Duration

tone	EIA	MODAT	CCITT	VDEW	Reach 11th root of 2 Hi Freq	Reach 11th root of 2 Lo Freq
0	600	637.5	400	2280	2400	1200
1	741	787.5	697	370	2253	1127
2	882	937.5	770	450	2116	1058
3	1023	1087.5	852	550	1987	993
4	1164	1237.5	941	675	1865	933
5	1305	1387.5	1209	825	1751	876
6	1446	1537.5	1335	1010	1644	822
7	1587	1687.5	1477	1240	1544	722
8	1728	1837.5	1633	1520	1450	725
9	1869	1987.5	1800	1860	1361	681
10/A	2151		1900	2000		
11/B	2432.9		2000	2100		
12/C	=2010.1		2100	2200		
13/D	2292		2200	2300		
14/E	* 459	* 487.5	2300	2400		
15/F	0		0	0		
	33ms	40ms	100ms	100ms	40ms	40ms
				Tone Duration		

EEA - Electronic Engineering Association, UK
CCIR - Comite Consultatif International de Radio
ZVEI - Zentralverband der Electrotechnischen Industrie, West Germany
DZVEI - Depressed ZVEI
DDZVEI - Double Depressed ZVEI
NATEL - Scandinavian National Telephone
Euro - 6 tone Hi power AM paging in ECPT countries.
EIA - Electronics Industries Association, US - Motorola Metropage
MODAT - Motorola 7 tone ANI Status System
REACH - 2 to 5 tone selective call, ANI

Section 6. What decoders are available.

This section will list most known units with information collected from a variety of open sources. They range from the professional high end units, through the hobbiest units, down to the public domain units. This grouping is purely the opinion of the compiler and is not meant to disparage any manufacturer.

A professional unit is a unit that covers many modes, includes sophisticated analysis tools, and probably costs a lot of money. These units represent the cutting edge in decoder technology. At this time we group Hoka, Wavecom and Universal as professional units. The hobbiest units are those units that include the most common modes, some tools for analysis and are a little more affordable. Public domain units are self-explanatory but non the less valuable as a stepping stone to a more sophisticated unit if you find the area of signals analysis intriguing.

An attempt is made to completely list the complete capabilities and features of the professional units based on the latest literature from the manufacturers. This is done because they provide the most for the money.

In the hobby units, an attempt is made to provide hilites for each unit. Keep in mind that it is impossible to own or test all the units mentioned here - nor would you want to. Many units provide the same capability and similiar tools and the decision to buy one unit over another will probably come down to cost. Another question to consider is whether or not "hobbiest" units can really be considered serious units for monitoring? If you have the desire to ferret out and identify digital signals then these units will have a high frustration factor because they don't include the wide selection of modes currently on the air or the necessary tools to analyse a signal. If some military, marine, or amateur monitoring is what you are looking for then these units can be a cost effective selection.

FAX and SSTV units are not covered in this document. Instead check out one of the best FAX/SSTV references on the net:

http://www.hffax.de/

This page is maintained by Marius Rensen and covers FAX technology, FAX transmission schedules and decoders. This page also includes SSTV related programs. See the SSTV information in Section 1-F of this document for other net resources.

Specifically this section covers the following data decoders:

	Professional/Semi Pro Units	Manufacturer/Distributor
	Code 3, Code 3 Gold	Hoka
new	Code 3 Gold Professional	Hoka
new	Code 30A, Code 300A	Hoka
new	Code 300-32	Hoka
	W4010	Wavecom
	W4050DSP	Wavecom
	W4100DSP	Wavecom
new	W51PC, W51LAN	Wavecom
new	W41PC Mark II, W41USB	Wavecom
	W40PC	Wavecom
new	SCS PTC IIex	SCS Special Communications Systems
new	SCS PTC IIpro	SCS Special Communications Systems
	M8000v7.5	Universal
new	Timewave DSP-599zx	Timewave

	Decoder/Receiver Control Software	Manufacturer
new	Hamscope	
new	MixW	
new	Radiocom 5.1	Computer International Inc.
new	Winradio Universal FSK Decoder	Winradio
new	Winradio Digital Suite	Winradio
new	Mscan Meteo Pro	Combi Tech International

The following listing shows the units for which no current information has been found. They may show up on the used market, and references are included where available.

Amateur Radio/Hobby Units

Unit/Software	Company	
AEA PK232 series	Advanced Electronics Applications	Company folded in 1996; now sold under the Timewave label
AEA DSP232	Advanced Electronics Applications	discontinued
AEA DSP2232	Advanced Electronics Applications	discontinued
AEA PK900	Advanced Electronics Applications	discontinued, but upgrade program mentioned on Timewave web site
ERA Microreader	ERA	out of business
Franklin Converter	Logic Limited	out of production?
Kantronics KAM+	Kantronics	superceded by KAM98
KAM98	Kantronics	superceded by KAM XL
Mode Master	Lowe	out of production?
MCL 1100	Momentum Communications	out of business
Personal Code Explorer	Microcraft Corporation	out of production?

The following units were, at one time, all sold by Universal Radio.
Please see this URL for further information:
http://www.universal-radio.com/catalog/decoders/rttymods.pdf

M-200F
M400
M600
M600A
M900
M1000
M1200
M6000

These are units currently in production:

	Unit	Manufacturer/Distributor
	BMK-MULTY v3.43	G4BMK
	P38 (internal DSP)	HAL
	DXP38 (external DSP)	HAL
	DSP4100 (internal)	HAL
	PCI4100 (external)	HAL
new	KAM-XL	Kantronics
new	MFJ1213	MFJ
	MFJ1214PC	MFJ
new	MFJ1224	MFJ
new	MFJ1225	MFJ
new	MFJ1276	MFJ
	MFJ1278B data controller	MFJ
	PC HF Facsimile V 8.0	Software Systems Consulting
new	Tigertronics BP-2M	Tigertronics
new	Timewave PK232DSP/PSK31	Timewave
new	M8000	Universal

	Self Contained Units	Manufacturer/Distributor
new	M450	Universal
new	AOR TDF-370	Universal
	MFJ-462B MultiReader	MFJ
new	AOR ARD-2	Universal (recently marked as 'discontinued')

Public Domain/Shareware

Hamcomm
RadioRaft
new XPERTA
new JVComm32
new Terman 93
new Meteoware
new Intercom
new MMTTY
new TrueTTY
new SeaTTY
new MultiPSK
new Skysweeper
new Multimode

Selected Soundcard Interfaces

Rigblaster/Nomic
Tigertronics Signalink
Windows SSTV VOX Controller
Rascal/Rascal Isolated
MFJ-1275/1275M
MFJ-1279/1279M/1279T
Donner's Digital Interfaces

Terminal Node Controller/Demodulator Support Programs

DOS Programs

Copycat Pro 2.1
NCPlus
NCPtc2
NCTerm
XPCom
XPDual
XPKam
XPPci
XPPtc

Windows Programs

Airmail 2000
Alpha
DSP-Rtty
DSRTTY-Win
Easyterm
KAGold
M7KTerm
Multicomm
NCW95pk
NCWinptc
Pakterm
PKGold
PKTerm
RCKrtty
Winptc2
XPWare

Linux Programs

KTPC2

DSP Audio Programs

Analyzer 2000
Audacity
Chromasound
Diamond Cut Five/Live
DSPFilter
Echofilter
GNASP1
Hamalyzer
Spectra Plus
Spectran
Spectrogram
SR5

Other programs can be found here:
http://www.csun.edu/~vfeen0br/johnpage/rttysoft.html
http://www2.ari.net/ajr/rtty/ (requires purchase of disks)
http://home.wanadoo.nl/nl9222/software.htm
http://www.tigertronics.com/bay_soft.htm
http://www.tigertronics.com/sl_soft.htm

Many new decoding packages have become available that accept audio into a soundcard. Unfortunatly, due to the many-and sometimes conflicting-standards for 'Soundblaster' compatible cards, some software will work, while others will not. Still, the list of soundcard-compatible software continues to grow. A very good listing of these packages can be found here:

http://www.muenster.de/~welp/sb.htm

Section 6-D includes information on some of the more popular soundcard interfaces. Persons interested in whether the interface will work with the software they select should check these websites or write to the individual involved to see if it will work before purchasing.

In recent years, 2 modes - ALE and HF ACARS (also referred to as PC-HFDL) have become more readily decodable thanks to work by Charles Brain of Great Britian. ALE is often used by the military and some diplomatic stations. For more information on ALE, see:

http://www.chbrain.dircon.co.uk/pcale.html

Charles has also written software that will copy a relativly new mode known as HFDL. This is actually a series of protocols used by the military and aviation industries. Charles' version copies the protocol used by the airlines to report aircraft positions, statuses and other information to ground stations. You can download both the freeware and commercial versions of this software (called PC-HFDL) here:

http://www.chbrain.dircon.co.uk/pchfdl.html

6-A. PROFESSIONAL/SEMI PRO UNITS

6-A.1 HOKA Decoders

Decoder:	Code 3 NOTE: Supported, but no longer in development, per their web page
URL:	http://www.hoka.net/old_product/code3/code3uk.htm
Level:	Comprehensive, sophisticated decoder for Experts
Synopsis:	The Hoka Code 3 comes in two parts: an interface box which connects to a free serial port of an IBM compatible PC, and the software itself, on a 1.44Mb 3.5 inch PC diskette. The hardware interface box now contains a software controlled filter which improves decoding performance over the previous version (v4). Bandpass filter is automatically controlled in center frequency and bandwidth for optimum setting depending on the decoding module, baud speed and shift setting. The decoder is implemented entirely in software which makes it extremely powerful together with a wealth of analysis tools, most of which are also included as standard. This is probably the most powerful decoder for its price. The user has practically complete control over all important parameters for each mode decoded. Exotic data systems are available as optional software modules, at extra cost. Comprehensive on-screen diagnostics and system information are shown for each mode decoded. Each module is chosen from a simple menu system with one-key commands to set or change system parameters. There is even an optional module (Auto Classification) which will measure the system's baud speed and shift parameters, analyse the bit pattern and jump into the correct decoding module for the received data system! Full Synoptic decoding of meteo AAXX and BBXX codes is also available as an option.
Modes Decoded:	ARQ6-70 ARQ6-90 & 98 ARQ-E ARQ-N

ARQ-E3
ARQ-M2-242/2 ch CCIR242
ARQ-M4-242/4 ch CCIR242 (Part of ARQ-M2-242 module)
ARQ-M2-342/2 ch CCIR342-2
ARQ-S/SI-ARQ
ASCII (ITA-5/IRA)
AUTOSPEC
Baudot RTTY with Auto speed determination
COQUELET Mk I (13 tone) (Option "Specials")
COQUELET Mk II (8 tone) (Option "Specials")
CW with Auto speed determination (uses "Farnsworth" method)
DUP-ARQ ARTRAC Mark 1 and 2
FAX 60, 90, 120, 240 LPM: 288, 352, 576 IOC B/W & 16 shade
FEC-A (with Error correction enabled)
FEC-100, FEC-101 (Option "Specials")
GMDSS/DSC (Option "Specials")
HC-ARQ (Option "Specials")
HELLSCHREIBER
HNG-FEC (Option "Specials")
AX.25 Packet 300 Baud
PACTOR, including ICRC and UNHCR variants
PICCOLO Mark VI (Option "Specials")
POL-ARQ
ROU-FEC/RUM-FEC (Option "Specials")
SI-FEC/FEC-S
SITOR-A
SITOR-B
SPREAD 11, 21, 51 (built into AUTOSPEC module)
SWED-ARQ/ARQ-SWED
SYNOP 'AAXX' and 'BBXX' decoding (Option "SYNOP")
TORG-10 & 11 (Option "Specials")
TWINPLEX

Analysis Tools: Frequency Spectrum
Frequency Scope
Auto Classification

Extras Required: IBM Compatible PC (80286 or better)
Mono or Colour Monitor
1 free serial port (for LF3 Interface connection)

Supplier: (US) Computer Aided Technologies, PO Box 18292,
Shreveport, LA 71138, USA Tel: 318 636 1234
email: scancat@scancat.com
http://www.scancat.com

(NL) Hoka Electronics, Flessingsterrein 13,
NL-9665, BZ Oude Pekela, Netherlands Tel: +31 5978 12327
email: info@hoka.com

Decoder: Code 3 Gold
NOTE: Supported, but no longer in development, per their web page

URL: http://www.hoka.net/old_product/code3gold/code3golduk.htm

Level: Intermediate

Synopsis: The Code 3 Gold is the latest incarnation of the capable Code 3 decoder software. Arriving in a newly repackaged interface, now fitting into a dongle stlye standard RF shielded serial connector. This interface needs no external power supply, with all power coming directly from the PC serial port. Both 9 pin and 25 pin serial connectors are supported. For Windows 3.1 users, the software will run in a DOS Window. This package is aimed at those who wish to decode the systems found on the HF and VHF airwaves but if you want to get into the underlying details you will find

that only the basic analysis tools are included.

Modes Decoded: Basic Code3 Gold handles many VHF systems and the more common HF systems. This includes Packet (300+1200), Baudot, Ascii, Hellschreiber, Sitor ARQ/FEC, Pactor1 thru 5, Fax (FM and AM Meteosat) and SSTV (Martin 1 only).

The "full version" includes: Annex10, Hell, Morse, ARQ-S, ARQ-SWE, ARQ-E, ARQ-M2/4 (CCIR242/CCIR342), ARQ-N, ARQ-6, ARQ-E3, POL-ARQ, Twinplex, Artrac, F7BBN Baudot Twinplex,GTOR, FEC-A, FEC-S, Autospec, Spread, HC-ARQ, TORG10/11, ROU-FEC, HNG-FEC, Coq8/13, Piccolo Mk6, GMDSS/DSC and SYNOP (AAXX/ BBXX with 10,000 stations)

Analysis Tools: Audio Spectrum Analyzer
Auto Classification
Ad Storage Scope
ASCII save to disk

Alphabets: International
US Military
Nat.Scandinavian
Greek3 shift
M19 Cyrillic and Latin
M2 Cyrillic and Latin
Amateur upper/lower cases

Extras Required: PC 486 or better HIGHLY recommended.
VGA supported (SVGA supported with Tseng ET4000)
Runs in a DOS box under Win9x (Pentium 100 or better).

Supplier: (US) Computer Aided Technologies, PO Box 18292, Shreveport, LA 71138, USA Tel: 318 636 1234
email: scancat@scancat.com
http://www.scancat.com

(NL) Hoka Electronics, Flessingsterrein 13, NL-9665, BZ Oude Pekela, Netherlands Tel: +31 5978 12327
email: info@hoka.com

Decoder: Code 3 Gold Professional
NOTE: Supported, but no longer in development, per their web page

URL: http://www.hoka.net/old_product/code3goldpro/code3goldprouk.htm

Level: Intermediate

Synopsis: This version is very similar to Code 3 Gold, but adds new analysis tools. It also includes new auto tune and classify modules

Modes Decoded: ASCII ITA5, 45 - 2400 Baud
Baudot ITA2
Morse CW
Sitor Auto A/B Sitor with auto-detect. A / B Mode
ARQ CCIR 625 A
FEC CCIR 625 B
Pactor 1-7
Packet Radio AX 25 HF 300/1200 Baud
Hellscreiber
HFDL aka HF ACARS
Facsimile AM/FM
SSTV Martin 1 mode Slow Scan TeleVision
PICCOLO MK VI MFSK 6 tones ITA2
PICCOLO MK VI MFSK 12 tones ITA5
COQUELET 8 MFSK 8 tones ITA2
COQUELET 13 MFSK 13 tones ITA5

CROWD 36 / CIS 36 MFSK 36 tones
PSK 31
Annex 10 Aereo Selcall HF
AUTOSPEC FEC 68.5 e 137 Baud Bauer alphabet
SPREAD 11 21 51
ARQ 6 70 CCIR 476 alphabet ITA3
ARQ 6 90/98 CCIR 476 Variant CCIR 476
ARQ E
ARQ N
ARQ E3 CCIR 519
ARQ S ARQ 1000 S
ARQ SWE with 3/9/22 crc
ARQ POL
DUP ARQ
HC ARQ
RAC-ARQ/Merod
RS-ARQ / ALIS 228.5 Baud
RS-ARQ II / Merlin / ALIS II 240 Baud
CIS 14 / AMOR
8181
TOR G10-11 / CIS 11
GTOR
GMDSS DSC
Baudot F7B 2ch ITA2 F7b
TWINPLEX ARQ F7b1 - F7b6
EC A FEC 100
FEC S FEC 1000 S
HNG FEC
ROU FEC
TDM ARQ 342 1/2/4 ch
TDM ARQ 242 1/2/4 ch
DCF 77
Dirty Sitor A
FEC 100 RAW
FEC 100 Interleave
WX decoder meteo SYNOP AAXX and BBXX from
Baudot, ARQ-E3, TORG 10-11 / CIS11

Analysis Tools:

Shift Speed Measurement
Power Spectrum 0 a 4 kHz, with ZOOM 1 +- 1000 Hz e
ZOOM 2 +- 500 Hz
Waterfall Display 0 - 4 kHz, with ZOOM
AD Spectrum with ZOOM 1 and ZOOM 2
Oscilloscope
Oscilloscope XY
AD Scope
Oscilloscope AFP Amplitude, Frequency, Phase
Phase Plane
Correlation MOD
Correlatin Bit
Speed Measurement Mark / Space
Speed Measurement Preset
Speed Bit Analysis
Bit Analysis
Characters Analysis Duplex
Characters Analysis Simplex
Auto-Classification
Demodulator
Bit Buffer (DOS only)

Alphabets:

International ITA 2
US MIL
National Scandinavian
GREEK 3 Shift
Hebrew
M19 Cyrillic
M19 Latin
M2 3 Shift Cyrillic

M2 3 Shift Latin
Arabic 70
Arabic 70 Latin
Arabic 80
Arabic 80 Latin
Amateur Upper/Lower

Extras Required: PC 486 or better HIGHLY recommended.
VGA supported (SVGA supported with Tseng ET4000)
Runs in a DOS box under Win9x (Pentium 100 or better).

Supplier: (US) Computer Aided Technologies, PO Box 18292,
Shreveport, LA 71138, USA Tel: 318 636 1234
email: scancat@scancat.com
http://www.scancat.com

(NL) Hoka Electronics, Flessingsterrein 13,
NL-9665, BZ Oude Pekela, Netherlands Tel: +31 5978 12327
email: info@hoka.com

Decoder: Code 30A

URL: http://www.hoka.net/old_product/code30/code30uk.htm
NOTE: Supported, but no longer in development, per their web page

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: This is the new version of Code 30 with a different PC card. It is now DSP driven, with matched filters for PCs

Modes Decoded: ARINC ANNEX10 Selcal (aircraft selcals)
ARQ6-70
ARQ6-90 & 98
ARQ-E
ARQ-N (built info ARQ-E module)/ARQ1000D
ARQ-E3
ARQ-M2-242/2 ch CCIR242
ARQ-M4-242/4 ch CCIR242 (Part of ARQ-M2-242 module)
ARQ-M2-342/2 ch CCIR342-2
ARQ-M4-342/4 ch CCIR342-2 (Part of ARQ-M2-242 module)
ARQ-S/SI-ARQ
ASCII (ITA-5/IRA)
AUTOSPEC (also all SPREADs)
Baudot RTTY with Auto speed determination
Baudot F7BBN RTTY with Auto speed determination
COQUELET Mk I (13 tone)
COQUELET Mk II (8 tone)
COQUELET-8 FEC
CW with Auto speed determination (uses "Farnsworth" method)
DUP-ARQ ARTRAC
FAX 60, 90, 120, 240 LPM: 288, 352, 576 IOC B/W and
256 shade at 1024x768. Also Meteosat AM demod.
FEC-A (with Error correction enabled)
FEC-A RAW (no Error correction)
GMDSS/DSC
HC-ARQ
HELLSCHREIBER
HNG-FEC
AX.25 Packet 300 and 1200 Baud
PACTOR, including ICRC and UNHCR variants
PICCOLO Mark VI
POL-ARQ
ROU-FEC/RUM-FEC
SI-FEC/FEC-S
SITOR-A
SITOR-A RAW

SITOR-B
SPREAD 11, 21, 51 (built into AUTOSPEC module)
SWED-ARQ/ARQ-SWED
TIME (DCF77) - set PC date/time to DCF77 time.
TORG-10 & 11
TWINPLEX
HFDL (otherwise known as HF ACARS)
MS5/Fire
Crowd36
RAC-ARQ/MEROD
MIL-188-141A ALE
8181
AMOR96
FEC100A/101
GTOR
Num13
PSK31
RS-ARQ 228,240
SKYFAX
SYNOP
SSTV Martin 1

Demodulators: OOK, BFSK, MFSK, 2DPSK, FEK (4,6,8,13 Tones),
4DPSK

Analysis Tools: Signal Spectrum "Analyser" with high precision Baud Rate
and Shift measurement
Audio Oscilloscope with zoom function
Waterfall
Auto Correlation Bit/Mod functions
Speed Bit
Phase display

Alphabets (ITA2 variants):
Standard International
US Military
M19 Cyrillic (Optional)
M19 Latinized (Optional)
M2 3rd Shift Cyrillic (Optional)
M2 3rd Shift Latinized (Optional)
Hebrew (Optional)
Arabic ATU-70 (Optional)
Arabic ATU-70 Latinized (Optional)
Arabic ATU-80 4th shift (Optional)
Arabic ATU-80 4th shift Latinized (Optional)
Farsi (Optional)

Extras Required: IBM Compatible PC (486 clone running 25 mhz or better)
AT style half size slot
Mono or Colour Monitor

Supplier: (NL) Hoka Electronics, Flessingsterrein 13,
NL-9665, BZ Oude Pekela, Netherlands Tel: +31 5978 12327
email: info@hoka.com

Decoder: Code 300A
NOTE: Supported, but no longer in development, per their web
page

URL: http://www.hoka.net/old_product/code300/code300uk.htm

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: This module is unique in that it is fully remote-
controllable, allowing for up to 16 seperate
monitoring stations at the same time. The software
can be configured easily as a 'master', 'slave'
or 'standalone'. It is mounted in a special unit which

can be fitted in a 19 inch rack and runs under a true 32 bit DSP processing system. Multitasking under Win9x is available.

Modes Decoded: All modes available under Code30A

Demodulators: Same as Code 30A

Analysis Tools: Same as Code 30A plus:
AFP Scope
Straddle
Eye Diagram
LMS
Audio Record

Alphabets: Same as Code 30A above, except that alphabets marked optional are standard here. Included are National Scandinavian, Greek and Amateur upper/lower case.

Extras Required: Video Monitor, Keyboard, Power supply (Euro standard), RS232 for up to 16 stations which can be controlled at once, audio patches for each unit

Supplier: (NL) Hoka Electronics, Flessingsterrein 13, NL-9665, BZ Oude Pekela, Netherlands Tel: +31 5978 12327 email: info@hoka.com

---

Decoder: Code 300-32

URL: http://www.hoka.net/code300-32/code300-32.htm

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: This module runs in a true 32 bit environment, with full multitasking. Instead of using a dedicated dongle, it uses the sound card for input. The software is DSP driven. Multi channel recording (even as a standard .wav file) is available. Up to 256 decoders are supported, networked by TCP/IP. Control via Internet or an Intranet is supported.

Modes Decoded: All modes available under Code30A except Amor96, Fec101, Dup-ARQ
Additional Modes:
ARQ 625
FEC 625
BEE36-50
CIS11
FEC 100 (Dirty/Interleave/Raw modes)
IRQ-ARQ
Mil188-110 (39 tone/Serial)
Pactor 2
R37
RS-ARQ1,2 (5/7/8 bit)
STANAG 4285, 4529
8129
405 391

Demodulators: DSP driven, internal to the PC

Analysis Tools: AD FFT
AD Oscilloscope
Auto Classifications
Bitstream output
EYE Pattern
Hard Disk Recording
Graphical Squelch
Oscilloscope digital
Oscilloscope AFP

Oscilloscope XY
Phase Plane
Phase Scope
Phase Spectrum
Shift Speed Measurement
Waterfall
Waterfall + sonogram

Extras Required: PC running Win 98, 2000, NT4 or XP

Supplier: (NL) Hoka Electronics, Flessingsterrein 13,
NL-9665, BZ Oude Pekela, Netherlands Tel: +31 5978 12327
email: info@hoka.com

6-A.2 Wavecom Decoders

Decoder: WaveCom W4010
NOTE: No longer in production

URL: http://www.wavecom.ch

Level: Comprehensive, intermediate level decoder

Synopsis: The first comprehensive decoder for the amateur as well as professional user. Now being phased out in favour of the more up-to-date W4050 but still widely available on the second hand market. Again, a self-contained unit requiring a composite monitor for the control, and incoming text displays. Like its W4100 bigger brother, this decoder again sports just about every mode that is in regular use on HF plus a good array of analysis tools.
Software and modes decoded are held in a number of EPROMs contained in the machine, making for simple update.

Modes Decoded: Baudot RTTY Auto speed determination
CW Auto speed determination
SITOR-A
SITOR-B
ASCII (ITA-5/IRA)
SI-ARQ
FEC-A
SI-FEC
AUTOSPEC
SWED-ARQ
ARQ-E
ARQ-E3
POL-ARQ
ARQ-M2
ARQ-M4
AX.25 Packet 300 and 1200 Baud
FAX 60, 90, 120, 240 LPM: 288, 352, 576 IOC

Analysis Tools: Speed/Baudrate Determination
IAS Baudrate determination
Shift Measurement
System Alphabet and Bit analysis
Unshift On Space (UOS)
Multiple Scroll Inhibit

Extras Required: Composite Video Monitor

Supplier: WaveCom Nachrichtentechnik AG, Badenerstrasse 122,
CH-8434, Kaiserstuhl, Switzerland. Tel: 1858 0200

Decoder: WaveCom W4050DSP
NOTE: No longer in production

URL:	**http://www.wavecom.ch**
Level:	**Comprehensive, VERY sophisticated decoder for Experts**
Synopsis:	**Full use is be made of Digital Signal Processing technology allowing for the decoding of traditional and more complex systems like DPSK, QPSK, etc. Has a very powerful suite of analysis tools and modes that can be decoded. HP and Epson Printer drivers are available. Many VHF modes are also supported.**
Modes Decoded: (HF)	**ALE** **ARQ-E** **ARQ-E3** **ARQ-M2-242 and 342** **ARQ-M4-242 and 342** **ARQ-N** **ARQ-6-90** **ARQ-6-98** **ASCII** **AUTOSPEC** **Baudot RTTY** **BULG ASCII** **CIS-11** **CIS-14** **CIS-36** **COQUELET 8** **COQUELET 16** **COQUELET 30** **CW** **DGPS** **DUP-ARQ** **DUP-ARQ2** **DUP-FEC2** **FEC-A** **FELDHELL** **G-TOR** **GMDSS/DSC** **HC-ARQ** **HNG-FEC** **PACKET 300/600/1200** **PACTOR 1-6** **PICCOLO MK.6** **PICCOLO MK.12** **POL-ARQ** **PRESS-FAX** **PSK31** **RUM-FEC** **SI-ARQ** **SI-AUTO** **SI-FEC** **SITOR-ARQ** **SITOR-AUTO** **SITOR-FEC** **SPREAD 11,21,31** **SSTV MODES: Martin 1-4** **Scottie 1-4** **SC 1/16/32** **Robot 8/12/24/36** **Wraase SC1 24,48,96** **Wraase SC2 30,60,120,180** **SWED-ARQ** **TWINPLEX** **WEATHER FAX**
Alphabets:	**ITA-1 Latin 5 bit**

ITA-2 Latin 5 bit
ITA-2 Latin 5 bit transparent
ITA-2 Cyrillic
ITA-2 Danish/Norwegian
ITA-2 Swedish
Baghdad70 Arabic
Baghdad80 Arabic
Cyrillic, Third Shift and TASS
Greek, Third Shift
US ASCII
German ASCII
Danish/Norwegian ASCII
Swedish ASCII
Bulgarian ASCII
SITOR 7 bit
ARQ1A
Bauer
HNG-FEC
RUM-FEC
Latin and Cyrillic Morse

Analysis Tools: Real Time FFT with adjustable cursors
FFT bandwidths of 24khz, 4khz, 1khz, 500 hz
FFT averaging 1-64
4 FFT windows available
Real Time Waterfall, Sonogram and Oscilloscope

The following analysis are available with full
graphical display and cursors:
HF/VHF/UHF baudrate
HF/VHF/UHF shift

DPSK/BPSK/QPSK bitrate measurement
DPSK/BPSK/QPSK phase plane display
Baudrate and shift resolution
Autocorrelation bit length and x-y zoom
Bit Analysis
Raw FSK analysis
HF MSK analysis
VHF/UHF selcall analysis
F7B analysis

Hardware/Firmware Differences
with the W4100DSP: uses a 13.5 vDC 1.3 amp supply
has no DSP receiver interface
21.4 MHz IF input an option
Firmware updates available via download

Extras Required: VGA or Multisync 640X480 resolution

Supplier: WaveCom Nachrichtentechnik AG, Badenerstrasse 122,
CH-8434, Kaiserstuhl, Switzerland. Tel: 1858 0200

Decoder: WaveCom W4100DSP
NOTE: No longer in production

URL: http://www.wavecom.ch

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: VERY similar to the W4050DSP as detailed above, with
some minor hardware and firmware differences.
HP and Epson Printer drivers are available.

Modes Decoded: All modes detailed for the W4050DSP but includes
PCM30/E1

Alphabets: Same as the W4050DSP

Analysis Tools: Identical to the W4050DSP mentioned above

Hardware/Firmware Differences with the W4050DSP: uses a 220 V Euro plug (110 VAC option)
RACAL SSI DSP receiver interface
21.4 MHz IF input available standard
Software updates by floppy

Extras Required: VGA or Multisync Monitor 640X480 resolution

Supplier: WaveCom Nachrichtentechnik AG, Badenerstrasse 122, CH-8434, Kaiserstuhl, Switzerland. Tel: 1858 0200

Decoder: WaveCom W51pc, W51Lan

URL: http://www.wavecom.ch/HTML/w51pc.htm
W51Lan URL: http://www.wavecom.ch/HTML/w51LAN.htm

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: The W51PC is a next generation board of the W41PC class. The board contains more on-board memory and requires a 32 bit PCI bus. This makes the board faster and more flexible than the W41PC. A 21.4 Mhz IF output is standard, not optional as it is with the other boards in this class. The W51Lan can be used in LAN applications, mobile or portable. It is enclosed in a shielded metallic box and will interface with Windows XP or third party software such as Shoc RSM (c). It has the same capabilities as W51PC, except that it has its own operating system, complete with hard drive and running on Windows XP

Modes Decoded: All modes listed for W4050 except Coquelet 16, 30, Spread 31
additional modes:
CCIR-1, 7
CIS-36
Coquelet 13, 80
FM-Hell
MFSK-8, 16
Mil 188-110A
Mil 188-110B
Pactor (Globe Wireless version)
Clover (Globe Wireless version)
Pactor 7,8
Pactor II 1-8
Pactor2 Fec 1-8
PSK125F, PSK63F
Spread 51
SSTV SC-1 8s and Automatic
STANAG 4285, 4415, 4529, 4539, 5066

Alphabets: All characters sets included in W4050
Additional character sets;
ITA5-French
ITA2-Hebrew 5 bit
Greek Morse
Arabic Morse
Hebrew Morse
Wavecom Unicode format

Analysis Tools: Same as those found on W40PC, but all FFT functions limited to a max bandwidth of 192 khz. In addition a code analysis function is available.

Extras Required: (W51PC) Pentium 200 Mhz Windows machine, min 800x600 resolution (W51Lan) System contains Pentium 800 Mhz Windows

XP machine, 256 MB RAM, 20 GB Drive, triple 10/100 Ethernet, 1 Serial, 2 USB, SVGA video, adaptor for 9-32 VDC, 100-230 VAC. A Windows XP or similar PC is required, or third party software such as Shoc RSM (c)

Supplier: WaveCom Nachrichtentechnik AG, Hammerstrasse 8, CH-8180, Buelach, Switzerland. Tel: +41 1 872 70 60

Klingenfuss Publication, Hagenloher Str. 14
D-72070 Tuebingen, Germany. Tel: +49 7071 62830
info: http://www.klingenfuss.org
email: klingenfuss@compuserve.com

Decoder: WaveCom W41pc Mark II
W41USB

URL: http://www.wavecom.ch/w41pc.htm
W41USB URL: http://www.wavecom.ch/HTML/w41usb.htm

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: The W41pc is a DSP based plug-in card for the IBM PC and uses the windows front-end to drive the board under Win95 or NT 95. Simultaneous operation of up to 8 cards is supported allowing for the monitoring of up to 8 different transmissions on the same PC. Decoding of over 50 modes spanning the HF, VHF, UHF and SHF is supported. Remote control is supported thru a combination of software from SHOC (Radio Manager) and Klingenfuss (frequency database). The W41PC has the added capability of supporting the development of unique decode modes. The W41PC source code (available to official organizations or other authorized users) allows complete control over all parameters. NOTE: Various Windows and PC printer drivers are available. W41USB is for notebooks with USB port.

Modes Decoded: All modes available in the W4050 except Coquelet 16,30, Packet 600, Spread 31
Additional Modes:
Mil 188-141A
Coquelet 13, 80
Pactor II
Spread 51

Alphabets: All character sets included in W4050, except;
ITA-2 Danish, Norwegian, Swedish
Ascii in German, Danish, Norwegian, Swedish, Bulgarian
Additional character sets;
ITA3 7 bit
ITA5 7 bit Ascii
Hebrew 5 bit
Transparent 5 bit
Greek Morse
Arabic Morse
Hebrew Morse

Anaylsis Tools: All of the tools found on W40PC, with these additions;
FFT Sonogram, Spectrum combined
Selcall Analysis

Extras Required: Pentium 200 Mhz Windows machine, min 800x600 resolution
Requires a 16 bit ISA slot.

Supplier: WaveCom Nachrichtentechnik AG, Hammerstrasse 8, CH-8180, Buelach, Switzerland. Tel: +41 1 872 70 60

Klingenfuss Publication, Hagenloher Str. 14
D-72070 Tuebingen, Germany. Tel: +49 7071 62830

info: http://www.klingenfuss.org
email: klingenfuss@compuserve.com

Decoder: WaveCom W40pc

URL: http://www.wavecom.ch/w40pc.htm

Level: Comprehensive, VERY sophisticated decoder for Experts

Synopsis: The W40pc is a DSP based plug-in card for the IBM PC and uses the windows front-end to drive the board under Win95 or NT 95. Simultaneous operation of up to 8 cards is supported allowing for the monitoring of up to 8 different transmissions on the same PC. Decoding of over 50 modes spanning the HF, VHF, UHF and SHF is supported. Remote control is supported thru a combination of software from SHOC (Radio Manager) and Klingenfuss (frequency database). The W41PC has the added capability of supporting the development of unique decode modes. The W41PC source code (available to official organizations or other authorized users) allows complete control over all parameters.

Modes Decoded: All modes that the W4050 except Packet 600, Spread 31, Coquelet 16, 30
Additional Modes:
Packet 9600
Pactor II
HFDL (HF-Acars)

Alphabets: Same character set as W41PC

Analysis Tools: FFT real time spectrum, waterfall, sonagram
Real Time oscilliscope
FSK Shift and baudrate measurement
PSK Symbol rate and phase plane
MFSK analysis
HF code analysis
High precision baudrate
Autocorrelation
Bit length analysis
Bit correlation

Extras Required: Pentium 200 Mhz Windows machine, min 800x600 resolution
Requires a 16 bit ISA slot

Supplier: WaveCom Nachrichtentechnik AG, Hammerstrasse 8,
CH-8180, Buelach, Switzerland. Tel: +41 1 872 70 60

Klingenfuss Publication, Hagenloher Str. 14
D-72070 Tuebingen, Germany. Tel: +49 7071 62830
info: http://www.klingenfuss.org
email: klingenfuss@compuserve.com

6-A.3 SCS Decoders

Decoder: SCS PTC-IIex
SCS PTC-IIPro

URL: http://www.scs-ptc.com/news.html

Description: Professional/DSP modem for PACTOR II and other modes.
The de facto standard for Airmail and other Pactor-based mailboxes. Modems will support packet radio up to 19200 baud with no additional hardware. Optional PACTOR III support.
The Pro version adds a GPS interface for NMEA data, integrated RS232/TTL interface, and a TCXO for added stability at higher baud rates.

Synopsis: The newest version of the PTC decoder, it can handle the newest versions of PACTOR and is backward compatible with older PACTOR versions. 1 HF port and 2 VHF/UHF packet ports are available. Transceiver control for Icom, Kenwood, SGC, R&S and Yaesu and others are available thru a seperate port. This unit utilizes a true 32 bit system using a Motorola RISC unit. Firmware updates are available free and can be downloaded from the website.

Modes Decoded: See http://www.scs-ptc.com/software.html for information

Analysis Tools: LED Indicators for Idle, connection type, compression and packet status with PTT shown on front panel, along with a series of tuning LEDs.

Extras Required: Compatible transceiver, such as those from Icom, Kenwood, Yaesu, SGC and others. See the website for more information.

Supplier: SCS Special Communications Systems
Roentgenstrasse 36
D-63454 Hanau
Germany
Phone: +49 6181 23368

6-A.4 Universal Decoders

Decoder: Universal M8000 (version 7.5)

URL: http://www.universal-radio.com/catalog/decoders/0087.html

Level: Professional-grade, sophisticated decoder for Experts

Synopsis: Stand-alone decoder much used by professional and semi-professional monitoring agencies around the world. Decodes just about anything that you'll hear on VHF or HF, but not quite in the same league as the Hoka PC-based systems or the Wavecom family. Can be fully controlled by a computer or terminal. Ten memories can be used to store favourite operating settings. Housed in a standard 19 inch rack mount cabinet.

Modes Decoded: Baudot RTTY 20 to 250 Baud, auto speed determination
CW (auto speed determination)
SITOR-A
SITOR-B
ASCII (ITA-5/IRA) 75, 110, 150, 300, 600, 1200 Baud
VFT (FDM) 8, 12, 16, or 24 channels
Piccolo 6 tone
ARQ-M2 86, 96, 100 Baud
ARQ-M4 172, 192, 200 Baud
ARQ-E 48, 64, 72, 86, 96, 144, 192 Baud
ARQ-E3 48, 64, 72, 86, 96, 100, 192, 200 Baud
ARQ-S 4, 5, 6, 7 character blocks
ARQ-6-90 200 Baud
SWED-ARQ 3, 9, 22 character blocks
FEC-A 96, 144, 192 Baud
FEC-S 96, 100, 144, 192, 200 Baud
FAX 60, 90, 120, 240 LPM: 288 or 576 IOC
AX.25 Packet 300, 1200 baud
PACTOR 100, 200 Baud
PACKET (w/pass-all packets)
POL-ARQ
GMDSS

Analysis Tools: Third shift Cyrillic alphabet can be printed on-screen. Literal mode printing of data

received, databit mode, auto baudrate, tuning and shift determination. Start printer when upto 3 matching selcalls are received. On-screen tuning scope. Screen print and screen saver. Multi-channel ARQ surveillance function. Signal spectrum display. User settable signal filters. Multiple scroll inhibit and Unshift on Space. Built-in self test functions. Display has on-screen tuning bars and real-time clock.

Extras Required: VGA colour monitor (640x860 resolution or better)
Graphics compatible parallel printer (for FAX)

Options: 19 inch rack mounting kit, service manual

Supplier: (US) Universal Radio, 6830 Americana Parkway, Reynoldsburg, Ohio, OH 43068, USA Tel: 614 866 4267

(UK) Martin Lynch, 140-142 Northfield Avenue, Ealing, London, W13 9SB, United Kingdom
Tel: +44 181 566 1120

6-A.5 Timewave units

Decoder/DSP unit: DSP-599zx

URL: http://www.timewave.com/amprods.html

Description: A highly flexible DSP noise and data filter with many configuarble features. One option is with the use of their DSP-RTTY software, it can decode several digital modes.

Synopsis (features): Hyper-speed DSP Processor with 80 KB Ram
Field upgradeable design keeps you up to date
LCD display for Visible MemoryTM and Calibrated FiltersTM
Wideband filter for AM and FM (VHF & UHF)
Continuous filter tuning up to 5,000 Hz using optical encoders Voice, Lowpass, Highpass, from 200 Hz - 5,000 Hz
CW and Data filters 10 Hz to 600 Hz wide
Audio Test Instrument Generator, Millivoltmeter, & Tone Decoder
Manual notch Heterodyne Eliminator
Provides noise reduction
Bandpass filters Bandwidths range from 10 Hz to 600 Hz, and center frequencies from 200 Hz to 2150 Hz.
Can function as a DSP front end to popular TNCs such as KAM, PK-232, MFJ-1278
Functions as a dedicated TU for a PC with the appropriate software

Modes Decoded: RTTY Shifts: 170, 200, 425, 850 Hz
Data Rates: 45, 50, 57, 75 Baud
Has data filters for:
AMTOR
PACTOR
SSTV
PSK31
PACKET
G-TOR
CW

Extras Required: DSP-RTTY software
requires: 486 PC or better, Microsoft Windows 95®, Windows 98®, or NT 4.0, 5MB free hard disk space, and 8 MB RAM (16MB recommended), and a Timewave DSP-599zx or DSP-59Y Signal Processor.

6-A.6 Decoder/Receiver Control Software

In this section, software that combines control over 1 or more receiver models *and* digital decoding capabilities will be discussed

---

Decoder:	Radiocom
URL:	http://www.computer-int.com/rc.htm
Level:	Mid Level Software
Synopsis:	This package is unique in that it includes control modules for some 80 receivers and transceivers. It includes some sophisticated tools for analysis as well as DSP capability.
Modes Decoded:	RTTY SITOR including NAVTEX support Synop CW PSK31 FAX (AM/FM for satellite FAX supported) SSTV (5.2-all modes) (4.0- Color, Scottie 1, Martin 1, SC2 180, Robot 72) DCF77 (4.0)
Analysis Tools:	Audio Analyzer Dual Scopes Frequency Analyzer Time and Spectrum Scopes Audio recorder Programmable Filters and Equalizers including FFT functions
Extras Required:	Pentium/Celeron at 200 MHz or better 64 MB Ram Duplex sound card with line in Com port (for receiver/transceiver ctl) Windows 95/98/NT4.0 SP3, ME, XP Graphics card at 1024x768 16 bit minimum
Supplier:	Computer International 207 South US Rte 27 St.Johns, Michigan 48879-1903 Tel/FAX: 517-224-1791 1-877-977-6918 Email: computer-int@mintcity.com

---

Decoder:	Hamscope
URL:	http://www.qsl.net/hamscope
Level:	Mid Level Software
Synopsis:	Decoding software which uses numerous external engines for interfaces. It also has receiver controls for Icom, TenTec, Kenwood and Yaesu transceivers. Can interface with several popular logging programs. A DDE server comes standard for building other connections to the program.
Modes Decoded:	PSK31 RTTY ASCII Packet MFSK16 CW

Analysis Tools: Spectrum Display

Extras Required: Requires the MMTTY and AGWPE engines for Rtty and Packet operations, respectivly. Runs on Pentium 133 Mhz or better, 16 bit SVGA card required for spectrum display. Operating systems include Win9x, NT, 2000, XP and ME

Decoder: MixW

URL: http://mixw.net

Level: Mid Level Software

Synopsis: A powerful decoding package with multiple tuning options, macro control of numerous transceivers/receivers, macro language and a flexible logging option. The waterfall and other display options can also be used on SSB.

Modes Decoded:
Baudot RTTY
Ascii
BPSK31/QPSK31
PSK63 (via a macro command)
Throb
Hellschreiber
Pactor I (receive only)
Packet (see note below)
FAX
SSTV (Martin 1/2,Scottie 1/2/DX,Robot 36/72,MP115,TTT, BW 8/12/24/36/43)
MT63
FSK31
AMTOR A/B
MFSK

Analysis Tools: Waterfall, oscilliscope, audio spectrum analysis

Extras Required: Due to licensing requirements, use of Q15X25 requires a seperate dll which can be downloaded from the MixW web site.
Minimum system; 486/100 Pentium, 166 recommended
16 MB RAM
3.5 MB space
runs on Win9x, ME, MT4, 2000, XP

Decoder: Winradio Universal FSK Decoder

URL: http://www.winradio.com/home/fskdecoder.htm

Level: Sophisticated digital software

Synopsis: While this software doesn't decode all of the modes that the Hoka series does, it does introduce modes not commonly found on Windows-based software. In addition, the page mentions that other modes can be added by modifying various decoding parameters, suggesting that the architecture of this software can be configured by the user, which is highly unusual in any software sold today.

Modes Decoded:
ARQ1000D
ARQ-E
ARQ-N
ARQ-6
ARQ6-70
ARQ6-90
ARQ6-98
ARQ-E3
Baudot

ASCII
Packet
POL-ARQ
SITOR-A
SITOR-B
NAVTEX
Raw Bits
SI-ARQ
SWED-ARQ

Analysis Tools: Spectrum Analyzer
Eye Pattern Scope
Bit and baud estimations done in the Time Estimations module via histogram
Character Translation tables with independent histogram

Extras Required: IBM PC compatible computer
(200 MHz or higher, or MMX CPU any speed)
Windows 95/98/2000 or NT4
32 MB of RAM, 3 MB of free disk space
SoundBlaster compatible sound card
or a DSP-based WiNRADiO receiver
WiNRADiO receiver

Supplier: WiNRADiO Communications
222 St. Kilda Road
St. Kilda 3182
Australia

Tel: +61 3 9525 5300
Fax: +61 3 9525 3560

Info: info@winradio.com
Sales: sales@winradio.com
Support: support@winradio.com

A list of dealers for various parts of the world can be found at the following URL;
http://www.winradio.com/home/contacts.htm

Decoder: Winradio Digital Suite

URL: http://www.winradio.com/home/ds.htm
NOTE: also see http://www.winradio.com/home/ads.htm as most of the same functionality appears to exist.

Level: Mid Level Software

Synopsis: This is the first of two software packages developed for use with the Winradio family. Its modest requirements plus a built-in spectrum analyzer and oscilloscope should make tuning in Packet and other signals a breeze. A couple of VHF modes are also supported

Modes Decoded: HF Fax
Packet Radio (HF and VHF)
Digital Tone Multi-Frequency Signalling (DTMF)
Continuous Tone Coded Squelch System (CTCSS)

Analysis Tools: Signal Classifier
Note: identifies voice, noise, data or silent channel
Audio Oscilloscope and Spectrum Analyzer
Squelch-controlled Audio Recorder and Playback

Extras Required: IBM PC compatible (100 MHz Pentium or higher)
Windows 95/98/2000 or NT4

8 MB of RAM, 3 MB of free disk space
16 bit Soundblaster compatible soundcard
Winradio unit

Supplier: WiNRADiO Communications
222 St. Kilda Road
St. Kilda 3182
Australia

Tel: +61 3 9525 5300
Fax: +61 3 9525 3560

Info: info@winradio.com
Sales: sales@winradio.com
Support: support@winradio.com

A list of dealers for various parts of the world can be found at the following URL;
http://www.winradio.com/home/contacts.htm

Decoder: Mscan Meteo Pro

URL: http://www.mscan.com/

Level: Mid-level Software

Synopsis: A program that is geared toward the maritime and sailing industry. It's unique in that in can use either a Soundcard input or a dedicated modem (PTC-II series supported) as input.Images stored in .rtf format.
As of May 2002, new version of Mscan includes receiver control for Icom, JRC, HF-150, Quadrad and Ten Tec RX-320

Modes Decoded: Baudot RTTY
Navtex
Weather FAX

Analysis Tools: None

Extras Required: Pentium Computer with soundcard (?)

Supplier: CombiTech International
P.O. Box 8041
NL-4330EA Middelburg
The Netherlands
Tel: +31 118 601665
Fax: +31 118 601104
E-Mail: combitech@mscan.com

A list of worldwide distributors can be found at:
http://www.mscan.com/mscan/agents.html

Decoder: RXPlus

URL: http://www.cam.org/~noelbou/RxPlus

Level: Mid-level Software

Synopsis: This program was originally created to control the RX320, but now is adding Drake and Icom receivers, with more to come. It also has an DSP audio filter and other features.

Modes Decoded: Baudot RTTY
FAX

SSTV
PSK31

Analysis Tools: Waterfall display

Extras Required: none

Supplier: available through website and RXPlus Yahoo group

==========

6-A.7 Skysweeper

URL: http://www.skysweep.com

Description: This package decodes several modes, and at the same time, in the standard edition, has a built in set of DSP tools. This package is unique in that you can purchase it in various levels (indicated in parenthesis in the Modes section), all of which can build onto one another.

Modes Decoded: (Lite) CW RTTY PSK31 PSK63 PSK125 MFSK16 2MFSK16 4MFSK16 Skyboost, Recorder Timer SSTV HELLSCHREIBER

(Standard Plus) Same as above plus QPSK31, SSTV, Hellschreiber (transmit) Additional Receive Modes:AX25 Packet (3.02 version) DGPS, GMDSS/DSC (HF and VHF), HFDL, HF FAX, ALE, PACTOR 1, SELCAL, SITOR A/B, SHIP, SYNOP, Satellite FAX, PSK105 Hell, PSK245 Hell, Feld Hell MFSK36/CROWD36, DTMF, PICCOLO 6/12 COQUELET8/13 Stanag 4285, Stanag 5066

SSTV Modes: Martin 1/2, Scottie 1/2, Scottie DX

(Professional) All of the above, plus configurable generic decoders FSK MFSK MPSK MSK PAM PSK QPSK Stanag 4285, Stanag 5066

DSP and Analysis Tools: (Lite, Standard Plus): FIR, NOISEMIN, NOTCH, MIXER, SHIFT, PITCH, Signal Recorder, Hum removal Autocorrelation High Resolution FFT 3FFT Spectrum and Waterfall (Professional): Modulation speed, Signal phase and bit domain analysis, Online/Offline Bit Analyzer, PSK Speed Analyzer

Recommended System requirements:
Win9x, Win2000, WinME, Win NT and WinXP
600 Mhz (recommended 1 Ghz) processor
64 MB RAM (recommended 128 MB)
30MB disk space
duplex sound card

Contact Information: Registrations: info2@skysweep.com
FAX: 358 9 8514639
Customer Service: info2@skysweep.com
Technical Support: tech@skysweep.com
Feedback: feedback@skysweep.com
Dealers: UK Pervisell
8 Temple End, High Wycombe, Bucks HP13 5DR
Tel. +44 1494 443033 Fax: +44 1494 448236
Email: sales@pervisell.com
Internet: www.pervisell.com

USA Computer Aided Technologies
P.O. Box 18285 1112 Francais Dr. Shreveport, LA 71118 USA
Phone (USA - Toll free) (888)-722-6228 (24 hours)
Phone (OUTSIDE USA) 318)-687-4444 (24 hours)
FAX (318)-686-0449 (24 hours)

Questions or Technical Assistance:
318-687-2555 (9am to 3pm Central Time)

Email: scancat@scancat.com

6-B AMATEUR RADIO/HOBBY UNITS

6-B.1 OUT OF PRODUCTION/DISCONTINUED MODELS

This chart will attempt to summarize those models that have been discontinued, are out of production or the original company no longer exists. The addresses listed are the last ones known; they may or may not be valid any longer.

UNIT NAME	M	L	SYNOPSIS	MODES
AEA DSP 232, DSP 2232	1		Dedicated TNCs which at one time could be used for both terrestrial and satellite work. 2 different modems were available along with TDM decoding- a first for an amateur TNCs. The 232 had 1 port, the 2232 had 2 ports which could be used for gateway operations	Baudot,Ascii,Navtex, TDM, PACTOR, AMTOR modes A/B/Listen, HF and VHF Packet, CW
AEA PK900	1		A dual-port TNC with all the modes used for the original PK232 plus a G3RUH compatible modem on port 2 for satellite packet operation	Baudot RTTY,Ascii,CW, Pactor,Packet,HFFAX, Amtor/Sitor,Navtex, ARQ-M2 (TDM)
ERA Microreader Mk2 version 4.2	3	E	A self-contained decoder w/16 char LCD display of incoming text,decodes all basic HF modes and includes a Morse tutor. Serial port allows text to PC. 12V DC power supply needed. LED tuning bar graph supported.	Baudot RTTY:45.45 50,75,100bd, SITOR-A/B, CW
Franklin Converter [10/95mt]	4		PC based software and external converter can receive, store and process FAX. Supports common amateur modes. Audio spectrum analyzer and tuning scope supported.	SSTV 15 modes RTTY,CW,ASCII, NAVTEX,AMTOR
KAM+ Multi-Mode Controller	6		Stand-alone unit supports all amateur modes and is the ONLY unit that support GTOR. Dual port operation supported. Programmable Mark/Space supported.	AMTOR,RTTY,ASCII, GTOR,PACTOR,CW, HF&VHF PACKET, NAVTEX,WEFAX support available
KAM98 Multimode Controller	6		Updated version of the KAM+. Continues support for GTOR, and adds EMWIN and GPS support. Now has 2 A/D ports and 2 Control line inputs.	Same as KAM+ except: WEFAX now standard, adds EMWIN, GPS and remote control, telemetry and HF email.
Lowe Mode Master	7	E	Easy to use software-based decoder from the makers of the popular HF-series receivers. The system decodes the basic HF systems and also provides a map facility for driving the system. IBM PC needed.	Baudot RTTY, CW, SITOR-A, SITOR-B, FAX
Momentum Communications MCL 1100 "Easy Reader"	8	E	A self-contained decoder,requires a composite monitor for display. On-screen tuning graph is displayed w/ status line. Auto or manual tuning of signal supported. Optional serial port supported. 12V DC power supply	Baudot RTTY:45.45 50,75,100,110,200 300bd, ASCII:45.45 50,75,100,110,200 300bd. SITOR-A/B, CW

			needed.	
Personal Code Explorer [4/93 MT]	B		Hardware card supports the common modes with good FAX performance. Needs a CPU w/greater then 8MHz speed, 512K memory, 1 serial port. Includes tuning scope and will store FAX but not RTTY output.	CW, RTTY, FAX, SITOR-A/B, PACKET ASCII, Navtex

6-B.2 CURRENT MODELS

UNIT NAME	M	L	SYNOPSIS	MODES
BMK-MULTY v3.43	2		Versatile unit supports the amateur modes. Audio signal analyzer (opt) and logging are supported. Supports transmit on all modes. Supports a variety of interfaces: ST5/6,AEA-CP1 BARTG MULTYTERM,G3LIV PC internal modem,G3IQI modem. Low cost options (20.00) and upgrades (5-10.00)	RTTY,CW,AMTOR, PACTOR (opt), FAX and SSTV (opt)
HAL P38 DXP38	5		The only game in town for affordable Clover processing. This plug-in DSP card works on 386/486 based DOS computers. It offers programmable tones for AMTOR, PACTOR and RTTY and supports all CLOVER modulation formats. Note: DXP38 is external DSP unit, identical specs	CLOVER P-Mode,AMTOR, BAUDOT,ASCII
HAL DSP4100 PCI4100	5		DSP Driven modems for digital ops Provides CLOVER mode along with AMTOR, P-Mode and Baudot support. DSP4100= This is an external modem requiring 10-18vdc and is flash upgradable PCI4100= Unit is a plug-in PC card. Requires a full length slot, 286 or better. Flash upgradable	CLOVER P-Mode,AMTOR, BAUDOT,ASCII
KAM-XL Multimode Controller	6		This version is believed to replace the KAM98. It will include dual mailboxes, and is GPS compatible. Remote control, sysop access, Host and KISS modes supported. Dual ports (one may be devoted to HF operations) are supplied.	Packet 300/1200 baud GTor PACTOR 1 PSK31 RTTY NAVTEX/AMTEX ASCII WXFAX AMTOR ARQ CW
MFJ1213 PC interface	9		Computer interface that allows user to copy RTTY and FAX. Hamcomm and JVFax supplied. Autosave and ATC	supports Hamcomm and JVFAX style software
MFJ1214PC	9		Tuning indicator for RTTY, CW speed tracking, WeFAX can show 16 grey levels or full color. FAX requires 512k RAM and can zoom. VGA is supported.Auto Signal Analyzer	RTTY,CW,ASCII, WeFAX and color FAX
MFJ1224/1225	9		A basic interface for Commodore or IBM compatibles for digital xsmn.	RTTY,ASCII,CW

		8 pole filter for 170hz RTTY and CW. Built in tuning indicator (Note: MFJ1225 is identical in functions but is receive-only)	
MFJ1276	9	20 LED bargraph for tuning. 32K email memory is available. Note: MFJ1276T is identical but has an additional 2400 baud modem.	Packet (HF/VHF), PACTOR
MFJ1278B	9	Fax/SSTV supports 16 grey levels and color. SSTV supports Robot color 36/72, Robot B/W 8/12/24/36, Scotty color 1/2, Martin color 1/2 and AVT 90/94. VIS tones are supported. Signals analysis supported on RTTY, ASCII,PACKET,SITOR-A/B. 20 LED tuning indicator included. Options: MFJ1278/DSP - DSP installed MFJ1278BT - 2400bd packet mode built in	RTTY,PACKET,FAX, PACTOR,SITOR-A/B, SSTV (color),ASCII, CW,GPS compatible
PC HF Facsimile v8.0	A	This software combines their older HF Fax and PC/SWL programs. Now runs under Windows. Supports tuning and digital scopes, auto-signal ID, tunable filters and variable shifts, unattended capture and printing.	CW Baudot Ascii SITOR A/B Navtex,WX FAX
Tigertronics BP-2M	C	A serial converter that can feed many different HF/VHF decode pgms like Hamcomm. A DOS program (suppl-ied) is used to set the converter to 'modes' which can process the audio to a serial DB25 input	Depends on program used
Timewave PK232DSP /PSK31	D	A new version of the AEA PK232 with updated DSP filters and firmware changes which allow for automatic switching of filters dependent on mode. Changes are user installable by changing EEPROMS and some simple soldering. The PSK31 version includes a soundcard interface for this popular mode	RTTY,ASCII,CW, PACTOR,300/1200 baud Packet,FAX, AMTOR/SITOR,NAVTEX Mailbox ops, ARQ-M2 (TDM) PSK31 (PK232/PSK31 version only)

Suppliers:

(1) AEA went out of business in 1996; some of its older digital products are supported by Timewave (item D)

(2) written by G4BMK, distributed by BARTG software sales

(3) ERA, 26 Clarendon Court, Winwick Quay, Warrington, WA2 8QP, United Kingdom Tel: +44 1925 573118
[NOTE: Thought to be out of business]

(4) Logic Limited, 113 Cascade St., Morganton, NC 28655
Tel: orders (800) 439-8898 tech line (704) 437-1833
[NOTE: Thought to be out of business]

(5) HAL Communications Corp, P.O. Box 365, Urbana, IL 61801-0365 Tel: (217) 367-7373
email: halcomm@halcomm.com
http://www.halcomm.com/

(6) Kantronics

1202 East 23rd Street
Lawrence KS. 66046
Phone: (785)842-7745 FAX: (785)842-2031
email: sales@kantronics.com
http://www.kantronics.com/uhfvhfhf.htm

(7) Lowe Electronics, Chesterfield Road, Matlock,
Derbyshire, DE4 5LE, United Kingdom. Tel: +44 1629 580800
Inquiries: info@lowe.co.uk
http://www.lowe-electronics.com/

(8) Momentum Communications, 6-7 Clarkson Place, Dudley
Road, Lye, West Midlands, DY9 8EL, United Kingdom Tel: +44 1384 896879
[NOTE: Thought to be out of business]

(9) MFJ, Box 494, Miss. State, MS 39762
Tel: orders (800) 647-1800 tech line (800) 647-TECH(8324)
Email: mfjcustserv@mfjenterprises.com
Products: http://www.mfjenterprises.com/index.php

(A) Software Systems Consulting, 615 S. El Camino Real
San Clemente, CA 92672 Tel: (714) 498-5784
Email: dpekin@ssccorp.com
http://www.ssccorp.com/

(B) Microcraft Corporation, Box 513M, Thiensville, WI 53092
Tel: (414) 241-8144
[NOTE: Thought to be out of business]

(C) Tigertronics, 400 Daily Lane, Grants Pass Oregon 97527
phone: (541)474-6700
http://www.tigertronics.com/home.htm

(D) Timewave Technology Inc.
58 Plato Blvd. E.
St. Paul, MN 55107 U.S.A.
Voice 651-222-4858
Fax 651-222-4861
E-mail: sales@timewave.com
Technical: techsupport@timewave.com
http://www.timewave.com/amprods.html
The PK900 is listed in Timewave's web site as being discontinued;
However, there was an update program in place for the 900, 232 and
2232 units. The status of this update program is not known.

==========

6-B.3 Self Contained Units

In this section, those units that have LCD or similar readouts built into the unit themselves will be discussed. Some may have outputs so they can be read on a larger screen.

Decoder: Universal M450 version 1.5

URL: http://www.universal-radio.com/catalog/decoders/0450.html

Description: Entry level decoder for Beginners

Synopsis: An easy-to-use decoder with most of the common modes found on both VHF, UHF and HF. Self-contained unit with a two line LCD display providing for 40 characters of text, there is also an 8000 character scrollable buffer which holds incoming text for review later.
The M450 includes a serial port for connection to PC so a separate interface for text capture is not necessary. A control program for the serial interface is included.

Modes Decoded: Baudot RTTY 45, 50, 57, 75, 100 Baud
Baudot RTTY 60, 66, 75, 100, 132 WPM
SITOR-A
SITOR-B
ASCII (ITA-5/IRA) 75, 110, 150 Baud
FEC-A 96, 144 Baud
FAX 120 LPM, 576 IOC
SWED-ARQ
DTMF 16 digits
CTCSS (PL) 41 standard tones
DCS (DPL) 104 standard codes

Analysis Tools: LED Indicators for Mark, Space, Input and Data

Extras Required: Graphics compatible parallel printer (for FAX)

Supplier: (US) Universal Radio, 6830 Americana Parkway,
Reynoldsburg, Ohio, OH 43068, USA Tel: 614 866 4267

(UK) Martin Lynch, 140-142 Northfield Avenue,
Ealing, London, W13 9SB, United Kingdom
Tel: +44 181 566 1120

Decoder: AOR TDF-370

URL: http://www.universal-radio.com/catalog/decoders/2711.html

Level: Casual use with PSK31 interface makes it useful
for hams as well as those wanting an introduction
to some common modes.

Synopsis: A brand new DSP driven unit- can be used in a
standalone configuration or fed thru a computer
(RTTY only). Uses 4 different filters for voice,
and 3 for CW modes.

Modes Decoded: PSK31
CW
RTTY (45, 50 and 75 baud-170,425,850 hz shift)
SSTV: Robot 36
Robot 72
Scottie 1,2
AVT90, 94

Analysis Tools: None

Extras Required: SSTV requires a separate terminal program to display
output

Options: None

Supplier: (US) Universal Radio, 6830 Americana Parkway,
Reynoldsburg, Ohio, OH 43068, USA Tel: 614 866 4267

Decoder: MFJ-462B MultiReader

URL: http://www.mfjenterprises.com/products.php?prodid=MFJ-462B

Description: Entry level decoder for Beginners

Synopsis: Read data from 2 line LCD readout with contrast
adjustment. 8k memory buffer standard

Modes Decoded: RTTY
CW
FEC (AMTOR-FEC, also known as Sitor-B)
ASCII

Analysis Tools: Tuning Indicator, CW Speed Tracking

Extras Required: Epson compatible printer required for printing
12 VDC or use 110 VAC with MFJ-1312B AC adapter

Supplier: MFJ, Box 494, Miss. State, MS 39762
Tel: orders (800) 647-1800 tech line (800) 647-TECH(8324)
Email: mfjcustserv@mfjenterprises.com
Products: http://www.mfjenterprises.com/index.php

Decoder: AOR ARD-2

URL: http://www.universal-radio.com/catalog/decoders/3763.html

Level: Beginner

Synopsis: A small handheld unit that allows the user to view ACARS or NAVTEX data on a small LCD screen. It's unique in that it supports NAVTEX data in both English and Japanese. It can send data to a PC via a DB9 Port

Modes Decoded: ACARS, NAVTEX

Analysis Tools: None

Extras Required: 12 VDC or 4 AA batteries
DB9 RS232 cable required for data transfer to PC

Options: none

Supplier: Universal Radio
6830 Americana Parkway
Reynoldsburg Oh. 43068
Sales: (800)431-3939
Info: (614)866-4627
FAX: (614)866-2339
Email: dx@universal-radio.com
NOTE: Recently marked as discontinued on Universal's website

6-C. PUBLIC DOMAIN/SHAREWARE SOFTWARE

UNIT NAME	M	L	SYNOPSIS	MODES
Hamcomm (Version 3)	1	I	This PC-based decoder is trialware. The interface, which connects to the PC serial port, can be built at little cost. Despite being low-cost the decoder is a fine piece of soft-ware w/features found in decoders costing over $100. PC, monitor and 1 serial port needed. 30 days free. registration: US$30	Baudot RTTY:45-200bd, CW 5-40wpm, SITOR-A/B, ASCII PACTOR (registered only) Signal Osciloscope Spectrum Analyser Bit Len. Analyser Tuning Aid + Meteo SYNOP,SHIP and WX decoder.
RadioRaft 3.21	2	I	A DOS based program that supports automatic decoding,speeds from 10 to 6400bps,bit display for analysis (DIGIT). This allows setting word size,parity,sync/async,bin/hex and character code options. Can be fed by a comparator or dedicated modem 386/486/Pentium,VGA,com port,650K disk,550K mem,runs in DOS. LITE	BAUDOT,ASCII,SITOR A/B,ARQ-E,ARQ-M2/4 PACKET,ARQ-E3, ROU-FEC,FEC-A, SI-ARQ,SWED-ARQ, ARQ6-90/98,CIS-11, SPREAD11/21/51,CW, AUTOSPEC,SI-FEC, ARQ-N,HNG-FEC,Oscar 11 UOSAT,ACARS, GMDSS/DSC,PACTOR I, DUP-ARQ,POCSAG,

			version freely available, USD28 for registered version.	DGPS,1382,POL-ARQ
XPERTA	3		A program that evidently can decode the polytones used by station XPH (thought to be Russian in origin)	XPH
JVComm32	4		Version 1.22 includes new ability to decode Synop messages, NAVTEX and RTTY, as well as Meteo FAX and many different types of SSTV. Can use either Soundcard input or a serial interface Registration is 60 Euros	Baudot RTTY FAX Navtex, SSTV, Synop decode
Terman 93	5		DOS based program that requires a RS232 level comparitor for a signal conversion. Can run on a 286, but 386 or better recommended.	Baudot RTTY AMTOR PACTOR (ARQ, FEC and listen)
Meteoware	6		A unique program that takes SYNOP codes and translates them into several languages, including English Dutch, German or French	A program that would capture SYNOP text onto a text file is required.
Intercom	7		This program decodes Feldhell, a relatively new ham mode. It can accept input from either a soundcard or a XR2206 processor	CW,Baudot RTTY, ASCII,BPSK31,FEC, ARQ,FELDHELL
MMTTY	8		A RTTY decoding program; although it's limited to one mode, it can be used as a plug in to several other packages	Baudot RTTY, also has DSP and notch functions
TrueTTY	9		This package includes several tuning aids, keyboard shortcuts. It's soundcard compatible and can integ- rate with other DXSoft products	Baudot RTTY,ASCII, PSK31,SITOR-B/NAVTEX, MULTIFSK16,PACKET, DTMF,SELFEC
SeaTTY	9		A package oriented toward mariners with FAX and NAVTEX capabilities.	Baudot RTTY, HF FAX, NAVTEX
MultiPSK	A		This package decodes several newer ham modes, as well as having some DSP/filtering options as well as macro controls. Unique among these packages is auto detection of BPSK modes.	BPSK31,QPSK31,PSK63, PSKAM,PSK63F, PSKFEC31,CW,CCW, Throb4,ThrobX,Baudot RTTY,AMTOR A/B, NAVTEX,FELDHELL, PSK HELL,FAX,SSTV
Multimode	B		The only multimode system that is supported on a MAC. Supports several HF/VHF modes	CW,RTTY,SSTV,FAX,ALE, NAVTEX ACARS,PACKET, PSK31,SITOR A/B, HELLSCHREIBER,DTMF, EIA,CCIR,CTCSS, SELCAL,LORAN-C

Suppliers:

(1) W. F. Schroeder, Augsburger Weg 63, D-33102 Paderborn, Germany
Also on many BBSes and Internet Archives.
Unofficial page: http://www.pervisell.com/ham/hc1.htm

(2) Francois Guillett, F6FLT
http://perso.wanadoo.fr/radioraft or
http://radioraft.free.fr/

email: F6FLT@TheOffice.net

Fully registered versions can be bought from:

PERVISELL Ltd , 8 Temple End, High Wycombe, Bucks, HP13
5DR, GREAT BRITAIN - Tel +01494 443033 Fax +01494
448236
http://www.pervisell.com
NOTE: See this site for other models of comparators:
http://www.pervisell.com/ham/index.html#Demodulators

Dieter DIPPEL, DF4RD, Muggenhofer Str. 193, D-90429
Nьrnberg, GERMANY - Tel/fax 0911 3 18 79 48
contact: DF4RD@qsl.net

(3) Available from the following site (note: all in Spanish):
http://anas.worldonline.es/tarabicu/xperta.htm

(4) Eberhart Backeshoff
Obschwarzback 40A
40822 Mettman
Germany
URL: http://www.JVComm.de/
Email: E.Backeshoff@jvcomm.de

(5) Available for download from:
http://www.baycom.org/~tom/ham/ham.html

(6) Available for download from:
http://www.geocities.com/meteoware/

(7) More information: http://home.uwnet.nl/~pa3byz/rttymade.htm

(8) More information: http://mmhamsoft.ham-radio.ch/mmtty/index.html

(9) TrueTTY product page: http://www.dxsoft.com/en/products/truetty/
SeaTTY product page: http://www.dxsoft.com/en/products/seatty/
Registration is sent via EMetrix, Regsoft and Regnow
NOTE: Virtual drivers and hardware emulators can be found at the bottom
of the TrueTTY home page. These emulators may be required for Win2000
and XP systems

(A) Home page: http://members.aol.com/f6cte/multipsk_e.htm

(B) Home page: http://www.blackcatsystems.com/software/multimode.html

---

6-D. SELECTED SOUNDCARD INTERFACES

Where 'software available' appears, the manufacturer either
supplies a CD Rom (sometimes for an additional fee) or has
links to compatible software.

A. Rigblaster and Nomic [software available]
West Mountain Radio
18 Sheehan Avenue
Norwalk, CT 06854
Phone 203.853.8080
Fax 203.299.0232
URL: http://www.westmountainradio.com/

B. Tigertronics Signalink SL-1+ Sound Card Interface
[software available]
P.O. Box 5210 Grants Pass, Oregon 97527
Phone: 1-800-8BAYPAC (822-9722) FAX: (541)474-6703
URL: http://www.tigertronics.com/sl+main.htm

C. Windows SSTV VOX controller (useful for other modes, too)
Peter Lockwood G8SLB, 36 Davington Road, Dagenham, Essex, RM8 2LR
Email: G8SLB@QSL.net

URL: http://www.angelfire.com/ok/g8slb/g8slbpg2.html#vox

D. The 'Rascal' and the 'Rascal Isolated' interfaces
[software available]
BUX CommCo
115 Luenburg Drive
Evington, VA 24550
FAX: (804) 525-7818
URL: http://www.buxcomm.com

E. MFJ-1273
http://www.mfjenterprises.com/products.php?prodid=MFJ-1273B
MFJ-1275
http://www.mfjenterprises.com/products.php?prodid=MFJ-1275
MFJ-1279
http://www.mfjenterprises.com/products.php?prodid=MFJ-1279
MFJ-1275M (Modular plug)
http://www.mfjenterprises.com/products.php?prodid=MFJ-1275M
MFJ-1279M (8 pin Modular Plug)
http://www.mfjenterprises.com/products.php?prodid=MFJ-1279M
MFJ-1279T (4 pin Modular Plug)
http://www.mfjenterprises.com/products.php?prodid=MFJ-1279T
NOTE; As of October 2002, the website lists the 1279 as also available for 220VAC Both the 1273 and 1279 models include CD ROM of software.
MFJ, Box 494, Miss. State, MS 39762
Tel: orders (800) 647-1800 tech line (800) 647-TECH(8324)
Email: mfjcustserv@mfjenterprises.com

F. Donner's Digital Interfaces
P.O. Box 158
Hamersville, Oh. 45130
Phone: 937-379-2517
FAX: 801-340-4805
URL: http://home.att.net/~n8st/

6-E. TERMINAL NODE CONTROL/DEMODULATOR SUPPORT PROGRAMS

6-E.1 DOS Programs

These programs run in native DOS; some will run in Windows in a DOS box. Please see the supplied URL for specific information. All programs assume at least 640k of memory, 1 serial port as as a standard, and if any extra accessories are required, they will be mentioned.

Software: Copycat Pro 2.1
URL: http://www.scancat.com/copypro.html
TNCs: Universal M-7000, M-8000, AEA/Timewave PK-232, MFJ-1278
Extras: RS-232 converter required for M-7000 and M-8000; sold as CAT-7000 and CAT-8000 respectivly. Mouse supported.

Software: NCPlus
URL: http://web.inter.nl.net/hcc/PA0NC/
TNCs: SCS PTC plus

Software: NCPtc2
URL: http://web.inter.nl.net/hcc/PA0NC/
TNCs: SCS PTCII

Software: NCTerm
URL: http://web.inter.nl.net/hcc/PA0NC/
TNCs: AEA/Timewave PK-232/PK-900

Software: XPCom
URL: http://www.glaswerks.com/xpware/dos_programs.htm
TNCs: AEA/Timewave PK-232, MFJ-1278, AEA/Timewave PK-88

Software: XPDual
URL: http://www.glaswerks.com/xpware/dos_programs.htm
TNCs: AEA/Timewave PK-900, DSP-2232

Software: XPKam
URL: http://www.glaswerks.com/xpware/dos_programs.htm
TNCs: KPC-9612 and several Kantronics packet modems

Software: XPPci
URL: http://www.glaswerks.com/xpware/dos_programs.htm
TNCs: HAL P38, PCI-4000M, DSP-4000

Software: XPptc
URL: http://www.glaswerks.com/xpware/dos_programs.htm
TNCs: Paccomm PTC, SCS PTC, SCS PTC Plus

6-E.2 Windows Programs

These programs assume Win 9x as a minimum OS; many will support 2000, XP, ME, ect. Please see the supplied URL for information.

Software: Airmail 2000 (Pactor over HF email)
URL: http://www.airmail2000.com/
TNCs: SCS PTC-II and IIe
KAM +, KAM98
AEA/Timewave PK-232. PK-900, DSP-1232, DSP-2232
MFJ-1276, 1278B
Hal DXP-38

Software: Alpha
URL: http://www.dh7rg.de/Sites/Alpha/goEng.htm
TNCs: SCS PTC+, PTC-II, PTC-IIE and PTC-IIPro

Software: DSP-RTTY
URL: http://www.timewave.com/dsprttyds.htm
TNCs: Timewave DSP-599zx, DSP-59Y (Baudot Rtty only)

Software: DSRTTY-Win
URL: http://www.halcomm.com/DSRTTY-Win.htm
TNCs: HAL modems such as ST-8000 or ST-8000A

Software: Easyterm
URL: http://www.mvhenley.com/eztpage.html
TNCs: AEA, HAL, Kantronics TNCs
SCS PTC-II

Software: KAGold series
URL: http://www.interflex.com/private/frame.htm
TNCs: KaGOLD for the Kantronics KAM/KPC-1/KPC-2/KPC-3
and KPC-4
KaGOLD/PT w/PACTOR and GTOR
support (for ALL Kantronics TNCs)

Software: M7KTerm
URL: http://www.trifid-nebula.de/m7000/m7000.htm
TNCs: Universal M-7000

Software: Multicomm Host
URL: http://www.cssincorp.com/multicommhost/
TNCs: MFJ-1276 with 1.2.9x firmware
MFJ-1278 with 1.1.X firmware with BLP
TAPR TNC-2 TNCS (packet only)

Software: NCW95PK
URL: http://web.inter.nl.net/hcc/PA0NC/
TNCs: AEA/Timewave PK-232/PK-900

Software: NCWinPTC
URL: http://web.inter.nl.net/hcc/PA0NC/

TNCs: SCS-PTC series

Software: Pakterm for Windows
URL: http://www.cssincorp.com/pacterm/
TNCs: KAM 98
KAM XL
Several Kantronics Packet-only modems
DSP-1232 (Satellite Telemetry only)
DSP-2232 (Satellite Telemetry only)

Software: PKGold series
URL: http://www.interflex.com/private/frame.htm
TNCs: PkGOLD for AEA PK-88/PK-232
PkGOLD/PT as above but with PACTOR support
PkGOLD/900 for the PK-900 (Dual Port, with Pactor support)
dspGOLD for the DSP-1232/DSP-2232 (Dual Port, with
Pactor support)

Software: PKTerm for Windows
URL: http://www.cssincorp.com/pkterm/
TNCs: HK-232 (firmware after Dec.1993),+ MBX model
PK-232 (same as above),+ MBX and DSP models
DSP-232 (firmware after Dec.1998)
PK-290
DSP-1232
DSP-2232
PK-900
Several AEA/Timewave packet-only TNCs

Software: RCKRtty
URL: http://www.rckrtty.de/html/product_info_english.htm
TNCs: RTTY and PSK31 with Soundcard
SCS-PTC-IIpro, SCS-PTC-II, SCS-PTC-IIe, SCS-PTCplus
AEA-PK232, AEA PK-232MBX, AEA-PK900
MFJ1278, MFJ1278B
DSPCOM
KAM, KAMPlus
HAL-DXP38, HAL-DSP4100

Software: XPWare for Windows
URL: http://www.glaswerks.com/xpware/xpware_for_windows.htm
TNCs: AEA PK232, PK900, DSP232, DSP2232 (host mode)
Other AEA/Timewave and Kantronics Packet modems
SCS PTC, PTC+ and PTC-II Controllers
Hal P38, PCI4000M and DSP-4100

6-E.3 Linux Programs

Software: KTPC2
URL: http://kptc.sourceforge.net/
TNCs: SCS PTC-II, PTC-IIE, IIPro

Software: Various utilities, see the page as stated
URL: http://neurosis.hungry.com/~ben/software/index.html
TNCs: M-7000, some Hoka units

6-F. DSP AUDIO PROGRAMS

With the development and popularity of soundcard decoding programs, another kind of program came into existance - those that allow you to view an audio waveform and manipulate its characteristics. In some cases, one can define filters and analyze the signal utilizing an audio spectrum analyzer. This capability can be used to enhance your understanding of how a digital signal is constructed, and may give you clues as to the signal's type. This takes some study, but many digital DXers find tools such as these to be an invaluable aid.

Software: Analyzer 2000
URL: http://www.brownbear.de

Software: Audacity
URL: http://audacity.sourceforge.net/

Software: Chromasound
URL: http://www.barberdsp.com/csnd/csnd.htm

Software: Diamond Cut Five/Live
URL: http://www.enhancedaudio.com

Software: DSPfilter
URL: http://mmhamsoft.ham-radio.ch/dsp/index.htm

Software: Echofilter
URL: http://www.computecsa.co.za/echofilter

Software: GNASP1
URL: http://www.boatanchors.de/software/gnasp1.html

Software: Hamalyzer
URL: http://www.hamalyzer.com

Software: Spectra Plus
URL: http://www.soundtechnology.com

Software: Spectran
URL: http://www.qsl.net/padan/spectran.html

Software: Spectrogram
URL: http://www.visualizationsoftware.com/gram/gramdl.html

Software: SR5
URL: http://www.ar5.ndo.co.uk/

Section 7. Reference Materials

The following are a series of references related specifically to Utility Monitoring. They cover logs, technical information on signals and signal sources. You can never have enough references when it comes to Digital Utilities.

7-A. Selected Vendors and Sites

PC-Frequency:
e-mail: support@frequencymanager.de
http://www.frequencymanager.de/

Klingenfuss Publications:
e-mail: klingenfuss@compuserve.com
http://www.klingenfuss.org

SHOC: e-mail: support@shoc.ch
http://www.shoc.ch/

Monitoring Times:
e-mail: mteditor@grove.net
http://www.monitoringtimes.com

HFFAX: e-mail: hffax@compuserve.com (Marius Rensen)
http://www.hffax.de

7-B. Magazines and Books

International Telecommunication Union
The ITU publishes lots of information, all avaiable at cost, on all aspects of radio and its management. One of the best and most

applicable documents the ITU makes available is:

Spectrum Monitoring Handbook 1995 (ISBN: 92-61-05761-6)

International Telecommunication Union
Sales and Marketing Service
Place des Nations
CH - 1211 Geneva 20
Switzerland
Internet: sales@itu.ch

Monitoring Times - An all round, covers all aspects of the shortwave hobby type of magazine. No regular RTTY column since Jack Albert stopped writing but covers some digital issues in their Federal File, Utility World or Digital Digest columns. This magazine is published by Grove Enterprises.

Monitoring Times
P.O. Box 98
300 S. Highway 64 West
Brasstown, NC 28902-0098
704-837-9200
All rates quoted in US Dollars as of 2002/05 issue
Electronic subscription: 19.95 for 1 year
38.90 for 2 years
57.85 for 3 years

	6 months	1 year	2 years	3 years
US Rate	14.00	25.95	49.95	73.95
US 1st class	29.50	56.95	111.95	166.95
Canada Surface	21.00	38.50	73.95	109.95
Foreign	30.00	57.50	112.95	168.50

RTTY Listener - This newsletter "was" available free of charge to owners of Universal decoder boxes (M1000, M1200, M7000 and M8000). Bound reprints are available from Universal. Last issue was published Dec '94 with a followup issue published in Apr '97. The reprints are good references if you own any of the Universal line of decoders.

Universal Radio
6830 Americana Pkwy.
Reynoldsburg, OH 43068
614-866-4267

Klingenfuss - Well known publisher of frequency reference guides. Their publications can be found at many radio/Ham equipment suppliers. The references tend to be Eurocentric but are non the less valuable and extensive.

The Radio Data Code Manual (combined Radioteletype Code Manual and Air and Meteo Code Manual) is especially valuable for those that want some of the bit-level information about the various protocols found on the shortwave spectrum. A unique reference book for the digital monitor.

Klingenfuss Publications
Hagenloher Str. 14
D-72070 Tuebingen
Germany

From the Jan'97 catalog:

1997 Guide to Utility Stations [15th edition]	DEM 80
1996/1997 Guide to Worldwide WeatherFax Services	DEM 60
Radio Data Code Manual [15th edition]	DEM 70

Siebel Verlag - A good solid reference, published every 2 years with good coverage of digital modes. While the text is written in German the frequency log are all easy to read. Check out WUN V2.3 March '96 for a complete review.

Spezial-Frequenzliste
9kHz - 30MHz
Ausgabe 1996/1997
By Rainer Brannolte/Wolf Siebel
ISBN: 3-922221-80-7
Price: 34.80 DM

Siebel Verlag
Auf dem Steinbuechel 6
D-53340 Meckenheim
Tel: ++49-2225-3032
Fax: ++49-2225-3378

7-C. Frequency Databases

Klingenfuss

1997 Super Frequency List [3rd edition] DEM 60

Klingenfuss Publications
Hagenloher Str. 14
D-72070 Tuebingen
Germany

Frequency Manager for Shortwave Listener

Ingenieurburo fur Satellitentechnik

23000 up-to-date frequencies and 10000 callsigns for aero, coast, fixed, embassy, fax, volmet and military. More than 150 pages, descriptions, tables, all HF-systems as a technical handbook integrated in a special help system. Tables on NATO routing indicators, routing indicators for AFTN, callsigns, arabic translations, HF-systems, table of system parameters with users, recognizing PSK and formats of common telegramms

PC-Frequenz US 60
Broadcast module (optional) US 20
Quarterly update US 20

NSK
Ingenieurburo fur Satellitentechnik
Muhlenweg 11
24217 Stakendorf
Germany
Tel: 01149 4344 6758
Fax: 01149 4344 5154

SHOC RadioData

SHOC has a Utility database that covers many services such as DIPLO stations, Air, Maritime, Military, Police, Government, Disaster relief, United Nations, Defense, ICRC/Read Cross, Press Agencies, Telecom, FAX, Meteo and Time Signals. The database is maintained by professionals in the monitoring business and is continuously updated. The database includes info such as: frequency, station, callsign, mode, baudrate, shift, latitude and longitude of the transmitter. See their homepage for a complete list of supported database fields and information on the other databases and products they offer.

RadioData Utility Database 300.00 SFr.

Mail/FAX to:

R.Haenggi
Weiherhof 10
CH-8604 Volketswil
Switzerland
Tel: +41-1-997 15 55 FAX: +41-1-997 15 56

7-D. Tape and CD Reference Materials

Klingenfuss - A unique way to test your decoder is to use one of the following audio reference materials. These sources allow you to hear and decode what the various modes sound like.

Compact Cassette Recording of Modulation Types [6th edition] DEM 60
Compact Disc Recording of Modulation Types [1st edition] DEM 100

Klingenfuss Publications
Hagenloher Str. 14, D-72070 Tuebingen, Germany

Siebel Verlag - A demonstration cassette is also available from the makers of the Spezial-Frequenzliste. The cassette includes a selection of commonly found signals: Baudot - various bauds and shifts, Sitor-A/B, ARQ-E, ARQ-E3, ARQ-M2, FEC-A, POL-ARQ, ROU-FEC, ARQ-SWE, TWINPLEX, PICCOLO-6, FAX and CW. Available from the address above. Price: 19.80 DM

7-E. Mailing Lists (Reflectors)

code3list: a mailing list dedicated to Hoka Code 3 and Code 3 Gold decoder. Not manufacturer sponsored. Topics include use, hints, tips, problems, etc.

Subscription Policy: OPEN
contact point: sscalsk@mail.ameritel.net (Stan Scalsky)

code30users: a mailing list dedicated to the Hoka Code 30 decoder. Not manufacturer sponsored. Topics included use, tips, problems and issues related to analysis.

Subscription Policy: CLOSED
contact point: sscalsk@mail.ameritel.net (Stan Scalsky)

Digitalradio: http://groups.yahoo.com/group/digitalradio/
This is a meeting place to discuss amateur radio digital applications such as RTTY, CW, PSK31, PSK63F, PSK10, MFSK16, THROB, ALE, PACTOR, HELL, SSTV and more. There are several reflectors dedicated to these separate modes but this egroup focuses on all digital modes.

DXSoft: http://groups.yahoo.com/group/dxsoft/
For discussing DXsoft products such as TrueTTY and SeaTTY

JVComm: http://www.jvcomm.de/forum/index.html
For discussing the JVComm32 software

Mixw: http://groups.yahoo.com/group/mixw/

MMTTY: http://groups.yahoo.com/group/MMTTY/

AEA/Timewave PK232:
http://groups.yahoo.com/group/PK232/

Rigblaster: http://groups.yahoo.com/group/rigblaster/

RXPlus: http://groups.yahoo.com/group/RxPlus/

Skysweeper: http://groups.yahoo.com/group/skysweeper/

Worldwide Utility News: http://www.wunclub.com
A worldwide electronic club dealing exclusively with Utility Signals on HF. Newsletter is sent on a monthly basis electronically. Topics covered include International Civil Aero, Logs, Digital Signals, Nautical, Military, Numbers and Longwave.

Section 8. Appendix

8-A. Appendix A - Abbreviations

The use of abbreviations is becoming quite common and sometimes confusing in todays radio related literature. There has been an explosion of new DSP related technology in recent years being applied to all aspects of telecommunications. Below is a modest attempt to define some of the more frequent abbreviations as found in the radio monitoring literature. Trying to explain the theory behind many of these abbreviations would fill several sizeable textbooks so I will not attempt in depth explanations. A list of abbreviates can be lengthy so I have attempted to limit the list to those directly related to topics of modulation and analysis. Additions welcome.

Abbreviations designating Modulations

AFSK	Audio Frequency Shift Keying
APSK	Amplitude Phase Shift Keying
ASK	Amplitude Shift Keying
BPSK	Binary Phase Shift Keying
CPFSK	Continuous Phase FSK
DPSK	Differential Phase Shift Keying
FEK	Frequency Exchange Keying
FFSK	Fast Frequency Shift Keying (also called MSK)
FSK	Frequency Shift Keying
GFSK	Wavecom term
MFSK	Multi Frequency Shift Keying
MSK	Minimum Shift Keying
OOK	On/Off Keying
OQPSK	Offset Quad Phase Shift Keying
PCM	Pulse Code Modulation
PSK	Phase Shift Keying
QAM	Quad Phase Shift Keying with Amplitude Modulation
	Quadrature Amplitude Modulation
QPSK	Quad Phase Shift Keying
2DPSK BPSK	2-phase Differential Phase Shift Keying
4DPSK QPSK	4-phase Differential Phase Shift Keying
BPSM	Binary Phase Shift Modulation
QPSM	Quadrature Phase Shift Modulation
8PSM	8-level PSM
8P2A	8PSM + 2-level ASM
16P4A	16PSM + 4-level ASM
8PSK	8-phase states 0/45/90/135/180/225/270/315, each phase change
16PSK	16-phase states or 22.5 degrees per phase, each phase change
8P2A	ASK with 8PSK
16P4A	ASK with 16PSK

Abbreviations generally related to Radio and Analysis

ACF	Auto Correlation Function
ARQ	Automatic Request for Repeat
DFT	Discrete Fourier Transform
DSB	Double Side Band
FDM	Frequency Domain Multiplex
FEC	Forward Error Correction
FFT	Fast Fourier Transform
ISB	Independent Side Band
LSB	Lower Side Band
SSB	Single Side Band
TDM	Time Domain Multiplex
USB	Upper Side Band
VFT	Voice Frequency Telegraphy

8-B. Appendix B - Emmission Classification

Quite frequently emmission designators appear in logs from various sources including WUN logs. Not everyone, especially if you are not into amateur

radio, is familiar with the meaning of the more commonly used classes such as F1B, F7B or B9W.

Article 4, Section II, of the Radio Regulations, Geneva, 1986 defines the following symbols for the purpose of classifing emissions. The classification system is used by official monitoring stations in coordinating monitoring efforts. The correct classification of received emissions is also used to resolve and develop interference techniques and for station identification.

For the complete description of an emission, the bandwidth (in 4 characters) is added in front of the classification. See the examples section.

```
      +----------------------- type of modulation on the carrier
      | +--------------------- nature of signal on main carrier
      | | +------------------- type of information
      | | | +----------------- detail of signals
      | | | | +--------------- kind of multiplexing
      | | | | | +------------- Group of system
      | | | | | | +----------- System in Group
      | | | | | | |

 aaaa X X X Y Y Z Z
                                        123 - required
      1 2 3 4 5 6 7                     45  - optional
      +---+ +-+ +-+                     67  - supplement
```

```
a) No modulation          ----------> N  unmodulated
b) Amplitude modulation   ----------> A  DSB, double sideband
c) Angle modulation       --------+   H  SSB, single sideband full carrier
d) (b)+(c) combo or seq   ------+ |   R  SSB, single sideband variable carrier
e) Pulse                  ----+ | |   J  SSB, single sideband suppressed carrier
f) None of the above      --+ | | |   B  ISB independant sideband
g) Everything else          + | | | |   C  vestigial sideband
                            | | | | |
                            | | | | +-> F  FM, frequency modulation
+-------------+             | | | |     G  Phase modulation
| 1st symbol |              | | | |
+-------------+             | | | +---> D  combo
                            | | |
                            | | +-----> P  unmodulated sequence of pulses
                            | |         K  amplitude modulation
                            | |         L  width or duration is modulated
                            | |         M  position or phase is modulated
                            | |         Q  angle modulated during pulse
                            | |         V  pulse - other
                            | |
                            | +-------> W  emission - other
                            |
                            +---------> X
```

```
                      0   No modulating signal
                      1   single channel/digital info/no modulating sub-carrier
+-------------+       2   single channel/digital info/modulating sub-carrier
| 2nd symbol |        3   single channel analog info
+-------------+       7   2 or more channels digital info
                      8   2 or more channels analog info
                      9   composite system
                      X   other

                      N   No information
                      A   Telegraphy - aural reception
                      B   Telegraphy - automatic reception
+-------------+       C   Fax
| 3rd symbol |        D   Data or telemetry
+-------------+       E   Telephone
                      F   Television
                      W   Combo of above
                      X   None of the above
```

Appendix 6, part A of the Radio Regulation, Geneva, 1986 allows for two other classifications. If neither symbol is available then a - should appear in their place.

4th symbol		
	A	binary - elements of differing numbers/duration
	B	binary - elements with same number and duration, no error correction
	C	binary - elements with same number and duration, error correction
	D	4-ary - each condition equals 1 signal element
	E	multi - each condition equals 1 signal element
	F	multi - each condition or combo equals 1 character
	G	sound of broadcasting quality - monophonic
	H	sound of broadcasting quality - stero or quadrophonic
	J	sound of commercial quality
	K	sound of commercial quality w/frequency inversion or band-splitting
	L	sound of commercial quality w/separate FM signals to control demod level
	M	monochrome
	N	color
	W	combo of above
	X	none of the above

5th symbol		
	N	none
	C	code-division multiplexing
	F	frequency-division multiplexing
	T	time-division multiplexing
	W	combined frequency-division and time-division multiplexing
	X	other

Supplementary information is not required but is usually helpful for a complete identification. The following table lists the currently known supplements as defined by the ITU. The table uses further qualifiers as listed below:

In the case of multitone systems further qualification will be found showing duration of each tone, tone shift and number of tones. For example:

```
    TT2300b: 010/200/008 - 10ms tone duration
                         - 200Hz shift between tones
                         - 8 tones present in the signal
```

For multichannel systems a similiar arrangement is used but will show shift in channel, channel spacing, number of channels. For example:

```
    BR6028: 170/340/007 - 170Hz channel shift
                        - 340Hz channel spacing
                        - 7 channels in the signal
```

Supplements

6th symbol - Group of system

A	Morse
C	Asynchronous
E	ARQ
F	ARQ burst type
H	TWINPLEX
J	Unknown
K	FEC
M	Multitone
N	Radionavigation and location

7th symbol - actual system in group

A- Morse

C- Asynchronous
CB telex Baudot
CC telex Russian
CD telex Arabic
CK telex ASCII

E- ARQ pulse train
EA ARQ-1000 duplex
EB ARQ-E3
EC 342 TOR 1 kan
ED 342 TOR 2 kan
EE 342 TOR 4 kan
EF 242 TOR 2 kan
EK ARQ-N
EL POL-ARQ
EM TORG 10-11

F- ARQ (burst)
FA Simplex/SITOR
FB
FC ARQ 1000 Simplex
FD SWED-ARQ
FE ARQ6-70
FF ARQ6-90
FG ARQ6-98
FH UN-ARQ
FI HC-ARQ
FK RS-ARQ
FL ARTRAC
FN PACKET
FX P 162

H- TWINPLEX
HA SITOR F7B-?
HB F7B-1
HC F7B-2
HD F7B-3
HE F7B-4
HF F7B-5
HG F7B-6
HH with ASCII
HK with Baudot
HL F7 Baudot/Morse
HM F7 scr.pt/Morse

J- Unknown
JA ARTRAC

K- Forward Error Correction
KA FEC-100
KB SITOR-B
KC FEC1000 Simplex
KD Autospec
KE ROU-FEC
KF HNG-FEC

M- Multitone
MA Piccolo MK6 w/ITA2
MB Piccolo MK6 w/ITA5
MC Piccolo MK1/330
MF Rus. Piccolo 1 025/040/034
MG Rus. Piccolo 2 025/010/034
MH Rus. Piccolo 3 100/040/034
MI Rus. Piccolo 4 100/010/034
ML Coquelet MK1
MM Coquelet MK1
MP TT2300b

Examples

N0N	Unmodulated carrier
A1A	CW telegraphy, standard Morse alphabet, no sub-carrier
A2A	CW telegraphy, standard Morse alphabet, with sub-carrier
A3E	DSB, used by broadcasting stations
B7B	VFT on LSB, VFT on USB
B8E	ISB, often used by broadcasting stations (feeders)
B9W	voice on LSB, VFT on USB
F1A	Telegraphy, Cyrillic Morse alphabet
F1B, F7B	RTTY
F1C, F2C, F3C	FAX, FM
J2C, J3C	FAX, AM
J3E	SSB, telephony, suppressed carrier
R3C	FAX

CLOVER	500HJ2DEN
SITOR-A	F1BCN FA
BAUDOT	F1BBN CB
TWINPLEX F7B-2	F7BDX HB 175/200/175