CLOVER GLOSSARY
HAL Engineering Document E2000 REV D
30 November 1992

Reference Drawings:

C1556	CLOVER-II FEC MODE TIMING	REV B	10/18/92
C1557	CLOVER-II ARQ CCB TIMING	REV A	09/13/92
C1558	CLOVER-II ARQ DATA BLOCK TIMING	REV A	09/23/92

1. SYSTEM NAMES AND PHRASES:

CLOVER: (all caps); The generic name of a class of modulation waveforms that use sequential amplitude-shaped tone pulses to send data. CLOVER waveforms have a tightly controlled frequency spectra. The data modulation may be forms or combinations of frequency, phase, or amplitude shift modulation of a tone pulse (FSM, PSM, or ASM). The number of tone pulses used and specific details of modulation, error correction, and other protocol issues are defined as specific sub-sets of CLOVER; i.e., CLOVER-I, CLOVER-II, etc. The generic word "CLOVER" may be used as a shortened description within a document if the document otherwise makes a clear distinction as to which sub-set is discussed.

CLOVER-I: (all caps); The specific sub-set of CLOVER that uses one tone frequency and has an interference bandwidth of 100 Hz. CLOVER-I is the waveform described by Ray Petit in his QEX article in July, 1990 QEX.

CLOVER-II: (all caps); The specific sub-set of CLOVER that uses four tone frequencies and has an interference bandwidth of 500 Hz. CLOVER-II is the waveform first described by Ray Petit at the ARRL Computer Networking Conference in San Jose, CA in September, 1991. CLOVER-II is also the waveform first implemented using "SUMMER CLOVER" hardware and refined for use in PCI-4000 hardware.

SUMMER CLOVER: (all caps); The specific hardware platform used from July, 1991 through November, 1991 to develop the CLOVER-II waveform; replaced 1/1/92 by PCI-4000 hardware.

PCI-4000: (all caps); The IBM-compatible plug-in card hardware that will be used as the first product that includes the CLOVER-II waveform. The PCI-4000 may also be used to support other modem waveforms. Related HAL Part Numbers:

900-04000: Complete PCI-4000/PC-CLOVER product
Includes:
930-04000: Assembled PCI-4000 circuit board
970-04000: Accessories for PCI-4000
870-04000: PCI-4000 REFERENCE MANUAL
870-04001: PC-CLOVER OPERATOR'S MANUAL
865-040yz: PC-CLOVER & Download Software, Vy.z
675-403yz: PCI-4000 Firmware ROM U3, Vy.z
675-406yz: PCI-4000 Firmware ROM U6, Vy.z

PC-CLOVER; PCC (all caps): The PC-based application software program furnished with the PCI-4000 to provide single-user control and operation of CLOVER-II operating in PCI-4000 hardware.

Host; Host Computer: In CLOVER-II as implemented in the PCI-4000, the "host computer" is the IBM-compatible computer that contains the PCI-4000 card and runs the application software. Avoid the phrase "host processor" to refer to the 68EC000 - use "Control Processor".

Control Processor: The 68EC000 microprocessor on the PCI-4000 circuit board.

Digital Signal Processor; DSP (all caps): The DSP56001 digital signal microprocessor on the PCI-4000 circuit board.

A/D (all caps): The analog-to-digital converter IC or process in the PCI-4000. Audio input to the PCI-4000 passes through the 16 bit sigma-delta A/D device.

D/A (all caps): The digital-to-analog converter IC or process in the PCI-4000. Audio output from the PCI-4000 passes through the 16-bit D/A device.

2. CLOVER-II MODES:

ARQ Mode: (ARQ = all caps); The Automatic Repeat reQuest error correction mode of CLOVER-II. ARQ is a linked mode of communications between two CLOVER-equipped stations. Data is transmitted in bursts by each transmitter/receiver station. This has also been called the "CLOVER dialog protocol" and the "point-to-point protocol".

CQ Mode: An ARQ mode in which a CLOVER-II station may initiate a generic link request call. Receiving stations display "CQ from [HISCALL]" and are offered the choice to link with the calling station.

Chat Mode: An ARQ mode which supports slow data transfer between two "keyboard operators". All data is transferred via the CCB's at a rate of 6 bytes per 2.7 seconds. When pre-buffered transmit data exceeds 255 bytes, ARQ automatically shifts into an ARQ block mode (1-way or 2-way ARQ).

1-Way ARQ Mode: An ARQ mode in which one station sends a large volume of data. When a station's pre-buffered transmit data exceeds 255 bytes, ARQ shifts into block mode sending between 226 and 1356 data bytes in each 20 second ARQ block frame. The other station remains in "Chat Mode" to pass commands and other "order-wire" type data.

2-Way ARQ Mode: An ARQ mode in which both stations send large volumes of data. Both stations operate in block mode, sending alternate 20 second blocks of data. Transition of either station from "Chat" to "Block" mode is automatic.

Adaptive ARQ Mode: The normal ARQ mode of operation in which receive signal quality is examined and used to command the modulation to be used by the sending station. Adaptive ARQ works in both direction and each direction of the link is controlled independently. The effective data throughput of a 1-Way ARQ link varies between 8 and 70 bytes-per-second, depending upon current propagation conditions.

Manual ARQ Mode; MAN-ARQ (all caps): An experimental ARQ mode in which waveform parameters are set manually be each station. Manual ARQ waveform modes are limited to those used in AUTO-ARQ mode (BPSM through 16P4A; 60%, 75%, or 90%; 255 byte blocks). The Manual ARQ modulation may be changed while linked but the code efficiency may only be adjusted when in standby (STBY) condition. Manual ARQ code efficiency is set via the BIAS command in the Adaptive ARQ menu of the Configuration page (Robust = 60%, Normal = 75%, Fast = 90%).

FEC Mode: (FEC = all caps); The mode used by CLOVER-II for one-way "broadcast" transmission from one station to one or more receiving stations. Although both "ARQ Mode" and "FEC Mode" use forms of Forward Error Correction techniques, the term "FEC" shall be used to describe this mode rather than "Broadcast" to parallel current AMTOR/SITOR usage and to avoid the negative amateur connotation of "broadcast". FEC has also been called the "point-to-multipoint" mode of CLOVER.

Listen Mode: The mode used by CLOVER-II receiving stations to listen to CLOVER ARQ or FEC mode transmissions. Listen Mode does not require that the listening station be linked to print an ARQ mode transmission, but full ARQ error correction is not available.

Test Mode: A mode that sets the transmitter PTT line to TX and outputs a single-tone or four-tone CLOVER waveform but sends no data. Test mode is used to adjust transmitter and antenna controls and set maximum transmitter power output.

3. TRANSMISSION FORMAT:

CLOVER Control Block; CCB (all caps): Each CLOVER transmission uses a CLOVER Control Block that to synchronization and mode information. Only one CCB is sent per transmitter-ON cycle. The CCB is always sent using the waveform of 17 byte blocks and 60% error correction efficiency. In ARQ modes, the CCB is always sent using BPSM modulation; 2DPSM modulation is used in FEC mode. The CCB is followed by one or more Error Corrector Blocks (ECB) of data. The CCB has also been called the "preamble".

Data Field: The error-correction encoded data sent in each CLOVER-II transmission. The data field may contain one or more Error Correction Blocks (ECB's). When Adaptive ARQ mode is used, waveform parameters vary to match transmission conditions. Waveform parameters are fixed in Manual ARQ mode and FEC mode.

ARQ Format: ARQ modes use two transmission formats: (1) CCB Frames, and (2) Multi-block Data Frames.

ARQ CCB Frame; The CCB frame is the lowest link-level of the ARQ protocol and is used for all ARQ maintenance activities. A CCB frame lasts 2.720 seconds and both stations send CCB's using BPSM modulation, 17 byte blocks and maximum Reed-Solomon error correction (60% efficiency). The CCB frame is also used for low rate communications, passing up to 6 data bytes in each direction per frame. The CCB frame is shown in drawing C1557.

ARQ Multi-block Data Frame: Multi-block data frames are used to send large quantities of data in ARQ mode. The time length of all multi-block ARQ data frames is 19.488 seconds. ARQ data blocks are always 255 bytes long. The modulation used for the data blocks varies from BPSM to 16P4A. The error correction efficiency (ECC EFFIC) is determined by the ARQ bias chosen (60% for ROBUST, 75% for NORMAL, or 90% for FAST). Each data block includes a check sum. Blocks whose errors exceed the Reed-Solomon recovery capacity are selectively repeated. Both 1-Way and 2-Way ARQ mode use the multi-block data format. The Multi-block ARQ format is shown in drawing C1558.

FEC Multi-block Data Frame: Multi-block data frames are used for all FEC transmissions. As shown in drawing C1556, each FEC frame includes (1) a synchronizing sequence block, (2) a CCB (2DPSM), and (3) 3 to 9 data blocks. No-signal "gaps" separate each element of the format. Data is sent only via the data blocks and may be sent using 2DPSM through 16P4A modulation.

4. WAVEFORM: The CLOVER-II waveform includes three variable parameters: (1) Error-correction BLOCK SIZE, (2) Error-correction Efficiency (ECC EFFIC), and MODULATION format.

4.1 Error Correction:

Reed-Solomon Error Correction; RSEC (all caps): The error correction algorithm used in the CLOVER-II waveform.

Error Corrector Block; ECB (all caps): The data block defined by the Reed-Solomon Error Correction (RSEC) algorithm. Error correction is applied to data bytes within the ECB. A transmission may include one or more ECB's.

BLOCK SIZE; BLK SIZE (all caps): The total ECB size in bytes. The four BLOCK SIZE choices used in CLOVER-II are 17, 51, 85, and 255 8-bit symbols (bytes). The number of characters available for data varies with the ECC EFFIC chosen. BLOCK SIZE does not include the CCB. ARQ mode always uses 255 byte blocks; FEC uses 51, 85, and 255 byte blocks. A 17 byte block size is always used for the CCB.

Error Correction Efficiency; ECC EFFIC (all caps): A definition of the percentage of total RSEC symbols that are available for transmitting data. In CLOVER-II:

8-Bit Data Bytes per ECB

BLOCK SIZE	ECC EFFIC 60%	75%	90%	100%
17 bytes	8	10	12	14
51 bytes	28	36	42	48
85 bytes	48	60	74	82
255 bytes	150	188	226	252

Correctable Errors Per Block; CEPB (all caps): The number of character errors that may be corrected by the RSEC without requiring repeat transmissions in ARQ mode or data loss in FEC mode. In CLOVER-II:

CEPB

Correctable Data byte Errors per ECB

BLOCK SIZE	ECC EFFIC 60%	75%	90%	100%
17 bytes	1	1	0	0
51 bytes	9	5	2	0
85 bytes	16	10	3	0
255 bytes	50	31	12	0

Check-Sum: A 16-bit check-sum attached to each ARQ mode transmitter burst that triggers ARQ repeat correction when errors exceed the capacity of the RSEC.

4.2 Modulation:

Modulation Channel: One of four audio frequency channels (1, 2, 3, 4) that may be selected for CLOVER-II modulation. The available center frequencies are: 750 Hz (CH1), 1250 Hz (CH2), 1750 Hz (CH3), and 2250 Hz (CH4). Both the sending and receiving stations must coordinate which modulation channel (and radio frequency) is to be used. Channel 4 (Fc = 2250 Hz) is the default audio channel. Each channel has an interference bandwidth of 500 Hz. This has also been called the "Voice Subchannel" in some descriptions. The CLOVER-II tone channel frequencies are:

	CHAN 1	CHAN 2	CHAN 3	CHAN 4
Fc	750.0 Hz	1250.0 Hz	1750.0 Hz	2250.0 Hz
F1	562.5 Hz	1062.5 Hz	1562.5 Hz	2062.5 Hz
F2	687.5 Hz	1187.5 Hz	1687.5 Hz	2187.5 Hz
F3	812.5 Hz	1312.5 Hz	1812.5 Hz	2312.5 Hz
F4	937.5 Hz	1437.5 Hz	1937.5 Hz	2437.5 Hz

Bandwidth, Interference Bandwidth, Occupied Bandwidth: The total bandwidth required for transmission of a CLOVER waveform. This bandwidth is 500 Hz for CLOVER-II; 100 Hz for CLOVER-I. CLOVER emission bandwidth is the same for all modulation modes. The HAL definition of a CLOVER waveform bandwidth shall always be the bandwidth measured on a spectrum analyzer for the audio modulator output points that are 50 dB below the peak level. The generic and unqualified word "bandwidth" must be used carefully since it is usually interpreted as the "-3 dB" or "-6 dB" bandwidth; use "interference bandwidth" or "occupied bandwidth".

Tone Pulse: The shaped-amplitude pulse at a defined audio center frequency used by CLOVER waveforms to send data. The tone pulse itself may be modulated by changing the phase or amplitude between one tone pulse and its next occurrence.

Dolph-Chebychev; D-C (all caps): The amplitude-shaping function applied to each CLOVER-II tone pulse to produce a compact and bandwidth efficient frequency spectra.

Tone Pulse Sequence; TPS (all caps): A repetitive sequence of tone pulses, each at different center frequencies. The CLOVER-II waveform uses four tone pulses, spaced in frequency by 125 Hz and each center frequency at an odd multiple of 62.5 Hz. The sequence repeats in ascending frequency order from the lowest to highest frequency (i.e., 2062.5 - 2187.5 - 2312.5 - 2437.5 - 2062.5 - etc. for modulation channel #4, centered at 2250 Hz. Data is sent by changing the phase or amplitude of each tone pulse between its sequential transmissions.

Phase Shift Modulation; PSM (all caps): Modulation of a CLOVER tone pulse by changing its phase between sequential transmissions of that tone pulse. CLOVER-II uses 4 forms of PSM: Binary Phase Shift Modulation (BPSM), Quad Phase Shift Modulation (QPSM), 8-level Phase Shift Modulation (8PSM), and 16-level Phase Shift Modulation (16PSM). The term "Phase Shift Keying" (PSK) is not used to avoid confusion between wide-bandwidth PSK modulation of a continuous carrier and CLOVER's phase modulation between tone pulses.

Amplitude Shift Modulation; ASM (all caps): Modulation of a CLOVER tone pulse by changing its amplitude between sequential transmissions of that tone pulse. CLOVER-II uses two forms of ASM: 2-level Amplitude Shift Modulation (2ASM), and four-level Amplitude Shift Modulation (4ASM). The term "Amplitude Shift Keying" (ASK) is not used to avoid confusion with wide-bandwidth ASK modulation of a continuous carrier and CLOVER's amplitude modulation between tone pulses.

Frequency Shift Modulation; FSM (all caps): Data modulation by alternate ON/OFF transmission of tone pairs in the CLOVER-II 4-tone sequence. CLOVER-II supports two forms of FSM: 2-bit FSM (2FSM) in which one bit is sent via tones 1 and 3 and the other bit by tones 2 and 4, and Diversity FSM (DFSM) in which the same data bit sent using tone pairs 1 and 3 and pairs 2 and 4 to provide frequency diversity. The term "Frequency Shift Keying" (FSK) is not used to avoid confusion with wide-bandwidth FSK modulation of a continuous carrier and CLOVER's ON/OFF selection of tone pulses within the sequence.

Modulation Format: CLOVER-II may use up to 11 different modulation formats. Current implementation uses 8 of these formats (CW ID and 2DPSM through 16P4A). The formats are:

1	4 channel pulse ON/OFF keying	(CW ID; not data)
2	Diversity pulse-frequency-position	(DFSM;31.25 bps)
3	Quad-diversity binary PSM	(4DPSM; 31.25 bps)
4	2-channel pulse-frequency-position	(FSM; 62.5 bps)
5	Dual-diversity binary PSM	(2DPSM; 62.5 bps)
6	4-channel parallel binary PSM	(BPSM; 125 bps)
7	4 channel parallel quadrature PSM	(QPSM; 250 bps)
8	4-channel parallel 8-ary PSM	(8PSM; 375 bps)
9	4-channel 8PSM plus 2 level ASM	(8P2ASM; 500 bps)
A	4-channel parallel 16-ary PSM	(16PSM; 500 bps)
B	4-channel 16PSM plus 4 level ASM	(16P4ASM; 750 bps)

CCIR Emission: The CCIR emission designator for CLOVER-II modulation is:

500H J2 DEN or 500H J2 BEN

Crest Factor: The peak-to-average ratio of the transmitted signal. For CLOVER-II modulation:

Crest Factor <= 2:1 (voltage)
<= 6 dB (power)

5. ARQ MODE PARAMETERS:

Connect; Connection: The formal linking of two CLOVER ARQ-mode stations by exchange of call-signs and synchronizing data.

NORM Connection; NORM (all caps): The short time duration calling mode used to establish a preliminary link between two CLOVER-II ARQ mode stations. A NORM connect provides early call-sign recognition for control of frequency scanning stations. A formal CLOVER connect sequence ("ROBUST") follows after a NORM-connection is made. The NORM connection mode will connect when conditions approximate the throughput of AMTOR (5-6 characters-per-second). This is the normal mode to use when linking two ARQ stations. This has also been called the "FAST" and "Ping" connection mode.

ROBUST Connection; ROBUST (all caps): A connection mode that may be used when transmission conditions are very poor. ROBUST will connect using BPSM modes at very low throughput.

NORM Retry: The number of connection retries that will be made when the NORM connection mode is used.

ROBUST Retry: The number of connection retries that will be made when the ROBUST connection mode is used.

FAIL Retry: The number of connection retries that will be made when the link fails. If restored, the connection will be the same type as made originally (NORM or ROBUST).

Disconnect; END (all caps): The procedure and signal that disconnects two CLOVER-II stations in ARQ mode and ends the link. END is also used in FEC mode to signal the completion of that transmission.

Normal Disconnect: The standard disconnect procedure used in ARQ mode that ends the transmission after all previously loaded transmit data has been sent and acknowledged in ARQ mode.

Immediate Disconnect: A disconnect signal that does not wait for an acknowledgment from the other station. The immediate disconnect is used to terminate an FEC transmission.

Immediate Stop Transmit; Panic Kill; KILL (all caps): The transmitter is immediately inhibited without completing pending data or sending a disconnect signal. A KILL does not "cleanly" end an ARQ link.

Call Sign: The identifying text string (8 characters maximum) used to identify and selectively link to each station in ARQ mode.

MYCALL; MY (all caps): The call sign of the local station.

HISCALL; HIS (all caps): The call sign of the station being called.

SCAN-CONTROL (all caps): The output signal that may be used to indicate that an ARQ connection has been made; often used to control frequency-scan circuits; also called SEL-CAL output. The SCAN-CONTROL signal may be set to CONT (continuous) or PULSE. In CONT mode, the signal is pulled to ground when the ARQ connection is established and remains in this state until disconnection. In PULSE mode, the signal is pulsed to ground at link-up for 0.4 seconds and then remains open until disconnect at which time it is again pulsed to ground.

ARQ Frame, ARQ Time Frame: In CLOVER ARQ mode, the time between the start of a transmitter pulse and the start of the next transmitter pulse from that same station. This definition parallels that used for a "frame" of other ARQ-type emissions - such as SITOR and AMTOR. The CLOVER-II ARQ time frame is either 2.784 seconds (CCB-only, "Chat Mode") or 19.488 seconds long (1-Way or 2-Way block modes).

Transmit Burst; TB (all caps): In CLOVER-II ARQ mode, a single transmitter pulse. A TB includes a preamble and one or more error corrector blocks (ECB) of data. The "TB length" is the time length of the entire transmitter-ON period, including the CCB and ECB data field.

Adaptive ARQ: In CLOVER-II ARQ mode, the process by which the receiving station measures signal quality parameters of the received signal and adjusts the format of the transmitting signal to maximize data throughput. The signal quality of the received signal sets the modulation mode transmitted by the other ARQ station (BPSM through 16P4A). CLOVER-II adaptive control is dynamic and automatic. Adaptive control is available only in ARQ mode and not in FEC mode.

AUTO-ARQ Mode; AUTO-ARQ (all caps): Same as "Adaptive Control".

AUTO BIAS; ARQ BIAS; (all caps): The control strategy used in AUTO-ARQ mode to change waveform parameters. Three options are available: (1) FAST, (2) NORM, and (3) ROBUST. FAST BIAS causes CLOVER-II to shift waveform modes quickly and uses the lowest amount of Reed-Solomon error correction (ECC EFFIC = 90%). FAST is most useful when transmission conditions are stable or change slowly. Using ROBUST bias, CLOVER-II changes waveform parameters slowly and the maximum error correction is used (ECC EFFIC = 60%). ROBUST is most useful when transmission conditions are unstable and/or quickly changing. NORM BIAS is the compromise setting between FAST and ROBUST and uses 75% Reed-Solomon error correction efficiency.

The BIAS option of the Adaptive ARQ menu on the Configuration page of PC-CLOVER sets the bias and therefore code efficiency for both AUTO-ARQ and Manual-ARQ modes.

AUTOPOWER (all caps): A feature of AUTO-ARQ mode in which the transmitter power of HIS station is adjusted based on SNR of the received signal at MY station. AUTOPOWER may be set ON or OFF.

6. PERFORMANCE PARAMETERS:

Base Rate: The raw bits-per-second (BPS) data rate within the CLOVER-II data field. The base rate is determined only by the modulation waveform chosen and does not include the effects of error correction overhead or ARQ frame overhead.

Throughput; Data Throughput: In CLOVER-II applications that send alphanumeric text or other data formatted in 8-bit bytes, the throughput is a measure of the quantity of 8-bit data characters or bytes that are passed per unit time by CLOVER transmissions in one direction (units = bytes-per-second (byps)). In ARQ mode, the throughput is the number of data bytes transmitted during a transmitter burst (TB) divided by the ARQ Frame Length in seconds. In FEC mode, the throughput is the number of data bytes transmitted per second during one FEC transmission.

Channel Throughput: A measure of the two-way performance in ARQ mode. The channel throughput is the total of bytes transmitted in both directions divided by the ARQ frame length in seconds (units = bytes-per-second (byps). Throughput, Data Throughput, and Channel Throughput are the same in FEC mode.

S/N (all caps): The dB ratio of signal power to noise power in a given noise bandwidth.

Radio S/N: "Radio S/N" is measured at the receiver audio output with noise bandwidth set by the receiver filters; used to measure and compare CLOVER performance to other data modes.

CLOVER S/N; SNR (all caps): CLOVER S/N (SNR) is measured after data detection and processing over a very narrow bandwidth; used for adaptive control. For the same signal:

CLOVER S/N >> Radio S/N.

Frequency Offset; FRQ (all caps): A parameter output from the PCI-4000 that indicates the tuning error on the received signal.

Phase Dispersion; PHS (all caps): A log parameter output from the PCI-4000 that indicates the amount of phase dispersion ("jitter") on the received signal.

MY TX; MTX (all caps): A parameter output by CLOVER-II from the PCI-4000 that indicates the percentage output power from MY transmitter when AUTOPOWER is used.

HIS TX; HTX (all caps): A parameter output by CLOVER-II from the PCI-4000 that indicates the percentage output power from HIS transmitter when AUTOPOWER is used.

Channel Spectra Data: Parameters output by CLOVER-II from the PCI-4000 that indicate received signal spectra. The NARROW option outputs data in 62.5 Hz increments at eight frequencies within the selected audio channel (#1 through #4). The WIDE option outputs 20 sets of data in 125 Hz increments from 500 Hz to 3000 Hz. The amplitude output of each frequency increment is in 0.5 dB steps.

CLOVER GLOSSARY
HAL Engineering Document E2000 REV A
10 April 1992

REVISION A CHANGES

Please replace the following pages of E2000 REV - with new REV A pages:

Page	Change
0	Revision Level (DWG # E2000 REV A)
1	Revision Level
6	Description of Robust—onnection

Changes to each page are indicated by left margin vertical bars.

Discussion:

In current CLOVER-II software, the "ROBUST" ARQ connection mode uses only frequency shift modulation (FSM) waveforms (#2 & #4 in table of Page 6). While the data rate of these waveforms is slow (31.25 or 62.5 bps), FSM can be used under highly dispersive ionosphere conditions that would not support use of phase or amplitude shift modulation (PSM/ASM) waveforms. FSM modes do not impose stringent frequency or phase stability requirements.

At present (4/10/92), the ARQ connection mode and waveforms available are linked. A NORM-connection may use PSM and ASM modes (#3, and #5 through B); a ROBUST-connection may use FSM waveforms (# 2 and #4). It is planned that this linkage will be removed and that AUTO-ARQ will transition freely between FSM and PSM/ASM waveforms as conditions require; once linked, the full set of waveforms can be used in either connection mode.

However, it is also planned to continue to provide two connection modes - NORM and ROBUST. These modes would then set only the minimum signal quality required to establish an ARQ link. It is suggested that applications that use frequency scanning may prefer to use NORM mode and not connect at a given frequency if conditions are very poor or marginal; it is better frequency management to shift to a different frequency on which the data throughput will be higher. ROBUST connection mode can be used if multiple frequency access is not available and data transfer is required even under poor conditions and at slow rates.

Please add this page to the end of E2000 REV A.

CLOVER GLOSSARY
HAL Engineering Document E2000 REV B
20 May 1992

REVISION B CHANGES

The following pages completely replace document E2000 REV A. Please discard REV A and use the enclosed REV B for all work.

Changes between REV A and REV B are indicated by left margin vertical bars.

Discussion:

1. The differences between the CLOVER Control Block (CCB) and Error Corrector Block (ECB) and the relationship between ECB and BLOCK size are clarified.

2. The PCI-4000 and PC-CLOVER will support 4 rather than 5 audio channels as indicated in some sections of REV B. This change recognizes the bandwidth and bandpass limitations of currently available HF radio transmitters and receivers.

3. The difference between NORM and ROBUST Connections (see page 6) is only in the quality of signal required at the time that an ARQ connection is made. A NORM connection favors a link that will support data throughput at or above typical AMTOR performance (5-6 characters-per-second). This is the favored connection mode if other frequencies may be used, as when contacting a frequency-scanning station. When the ROBUST mode is used, an ARQ connection will be made even under poor conditions when the auto-adaptive data throughput will be very slow. A ROBUST connection may be used when a link must be made regardless of conditions and more favorable frequencies are not available. Regardless of which connection mode is used, once linked, the auto-adaptive ARQ control will adjust waveform parameters over the full range of CLOVER-II capabilities.

NOTE: This is a change in philosophy from that described in REV A revision notes.

4. Various typographical errors are corrected.

Please add this page to the end of E2000 REV B.

CLOVER GLOSSARY
HAL Engineering Document E2000 REV C
31 October 1992

REVISION C CHANGES

The following pages completely replace document E2000 REV B. Please discard REV B and use REV C for all work. Changes between REV B and REV C are indicated by left margin vertical bars.

Discussion:

1. Three drawings are added to this document. C1556, C1557, and C1558 show the FEC and ARQ time formats used by CLOVER-II.

2. PC-CLOVER and PCI-4000 download software will be supplied on the same distribution diskette. Separate HAL part numbers for two diskettes are no longer required.

3. Descriptions of CQ Mode, Chat Mode, 1-Way ARQ, and 2-Way ARQ are added to section 2 (pp 2 & 3).

4. Descriptions of the ARQ CCB, ARQ Multi-block, and FEC formats are added to section 3 (p. 4).

5. Errors in the Error Correction Efficiency and the Correctable Data Byte Errors per PCB tables on Page 5 have been corrected.

6. The four CLOVER-II modulation channels and tone frequencies of each are presented in a new table on page 6.

7. The factory default modulation channel for CLOVER-II is changed from CHAN 3 @ Fc = 1750 Hz (REV B and earlier) to CHAN 4 @ Fc = 2250 Hz. This makes the CLOVER-II audio pass band compatible with that required for "high-tone" AMTOR, HF Packet, and RTTY (2125/2295 or 2110/2310 Hz).

8. New definitions for the CLOVER-II CCIR Emission designator and modulation Crest Factor are included on page 8.

9. ARQ frame times are corrected on page 9.

10. Adaptive ARQ and AUTO BIAS descriptions (p. 10) are revised

11. Throughput is now defined in units of bytes-per-second (byps). Units of characters-per-second (cps) are reserved for use when data compression coding is added (pp 10 & 11).

12. Various typographical errors are corrected.

Please add this page to the end of E2000 REV C.

CLOVER GLOSSARY
HAL Engineering Document E2000 REV D
30 November 1992

REVISION D CHANGES

The following pages completely replace documents E2000 REV B and E2000 REV C. Please discard previous versions and use REV D for all work. REV C was changed before distribution beyond HAL staff. Therefore all changes made by REV C and REV D are shown by left margin vertical bars (all changes since REV B).

Discussion:

1. Chat mode continues until buffered transmit data exceeds 255 bytes, not 32 bytes as reported in REV C (p. 2).

2. The modulation mode of Manual ARQ may be changed while linked. Code efficiency may be changed only when not linked. Code efficiency is via the BIAS option on the Configuration Page 1 of PC-CLOVER. This bias affects both AUTO- and Manual-ARQ operation. Block is always fixed at 255 bytes for all ARQ modes (pp. 3, 10).

3. Various typographical errors are corrected.

Please add this page to the end of E2000 REV D.