Hellschreiber

Feldfernschreiber (field teleprinter) Machine in use during WWII – photo courtesy of Helge Fykse, LA6NCA

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What is Hellschreiber ?

- A German word that means "bright writing" - a pun on the name of its inventor, Rudolph Hell.

- Quasi-synchronous "fax-like" direct printing text transmission mode(s) that use no coding (think CW married with a dot-matrix printer)

- Family of Amateur Radio "sound-card" modes

- Classified as "Fuzzy Modes" rather than pure Digital modes - a term coined by Murray Greenman, ZL1BPU

- Often just referred to as "Hell"

Hellschreiber variants in use

- **Feld-Hell** – "Field" Hell the traditional ON/OFF keying in time domain (most popular in Amateur Radio use)

- **C/MT-Hell** – Concurrent Multi-Tone Frequency Domain Hell)

- **S/MT-Hell** – Sequential Multi-Tone Frequency Domain Hell)

- **Slow-Feld** – Intended for beacon usage (2 chars / min)

- **Duplo Hell –** Dual tone mode (two columns sent at same time)

- **PSK Hell** – Differential Phase Shift Keyed Mode (like PSK31)

- **FM Hell –** similar to PSK Hell

- **FSK Hell –** Usually 245hz shift (980hz black, 1225hz white)

**This presentation will focus on Feld-Hell.**

Hellschreiber History

- Invented in 1920's by Dr. Rudolph Hell (1901-2002).

- Patent granted in 1929 for *"Apparatus for the Electrical Transmission of Text Characters"*

- In 1934 was put into service by press agencies and news media.

- Used during WWII for press, diplomatic and military communications over land-line and radio, often in conjunction with Enigma encryption machines.

- Commercial use of Hell continued into the 1980s.

Ham Radio Hellschreiber timeline

- 1958 - First known Amateur Radio HF QSO using Hell between DL1GP and DM3KG.

- 1977 - Article by Hans, PA0CX published in *Electron* Magazine.

- 1979 – PA0CX Article re-published in English in *Ham Radio* Magazine (http://www.nonstopsystems.com/radio/hell-pa0cx-e.pdf)

- 1980 - Apple II Hell Program developed by Klaus PA0KLS

- 1997 – Hell Software for MS DOS using Hamcomm Interface developed by LA0BX

- 1998 – PSK31 mode and software created by G3PLX starting the "Windows soundcard mode" revolution in Ham Radio

- 1999 – Windows 95 *Hellschreiber* application released by Nino IZ8BLY in collaboration with Murray ZL1BPU (for Pentium-class MS-Windows machines & soundcard)

- 2006 - Feld Hell Club formed (currently close to 3000 members worldwide)

Feld Hell Transmission

A B C D E F G A Columns
7 6 5 4 3 2 1
Pixels (Rows)

Copyright (C) M. Greenman 2000
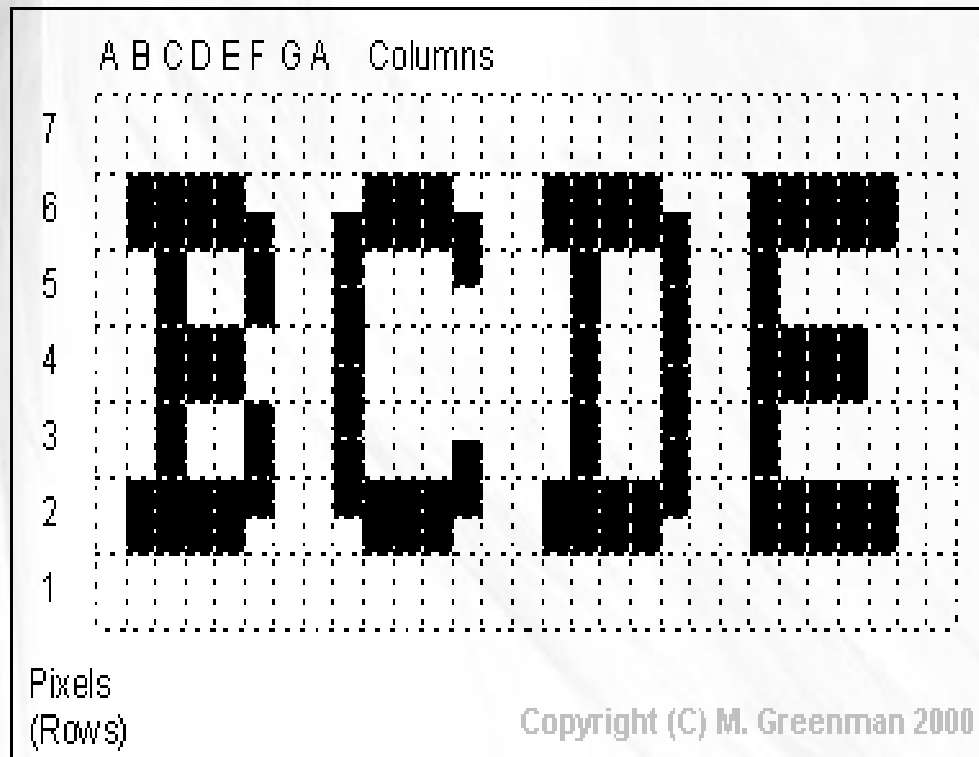
- On/Off keying at 122.5 baud yields a speed of 25 WPM

- A text character is represented by 5 X 5 pixels in 7 X 7 dot matrix that is raster-scanned

- Pixel Transmit order A1, A2 .. A7, B1, B2 etc.

- Black pixels transmitted as tone-on, white as tone-off

- Keyed sine-wave audio signal drives mic input of SSB Transmitter

- Hell-specific fonts are used for maximum readability

Feld Hell Reception

- Data, as received, is painted on the display for visual interpretation by the human eye (no FEC, no decoding of characters)

- Quasi-synchronous reception – no auto synchronization of transmit and receive clocks. Both clock run at approximately the same speed. Synchronization is done by visual adjustment of clock speed at receiver, if required.

- Small errors in timing are compensated for by displaying each received image twice (timing errors result in image slant).

WW2 Siemens Hellschreiber (photo courtesy of Frank, N4SPP)

Sights and Sounds of Feld Hell

40m Contest QSO with W8H at Dayton Hamvention 2009 in severe QSB
(Note the very slight upward slant on his print)

W8LEW at W8H Dayton Hamvention 2009 *(photo courtesy of Tery, KD8GNC)*

Why operate Feld Hell ?

- Simplicity ! – It's Human readable. Think of it as "Visual CW". The human brain excels at optical pattern recognition.

- At 25 wpm is a good conversational mode for slow typists – promotes more real-time chats and fewer "canned QSOs"

- Relatively narrow bandwidth (~300 Hz) adapts well to use of narrow CW IF filter on receiver.

- Easy to use – tuning is not critical, is tolerant of frequency drift (works well with older HF rigs) unlike many modes.

- Robust – similar to CW in ability to copy through noise; tolerant of Polar Flutter / Doppler effects, unlike PSK modes.

- Hard to overdrive on Tx, not prone to IMD issues like PSK31

- Works quite well at low power levels; low duty cycle like CW

Comparison of Sensitivity vs. Speed for Soundcard Modes
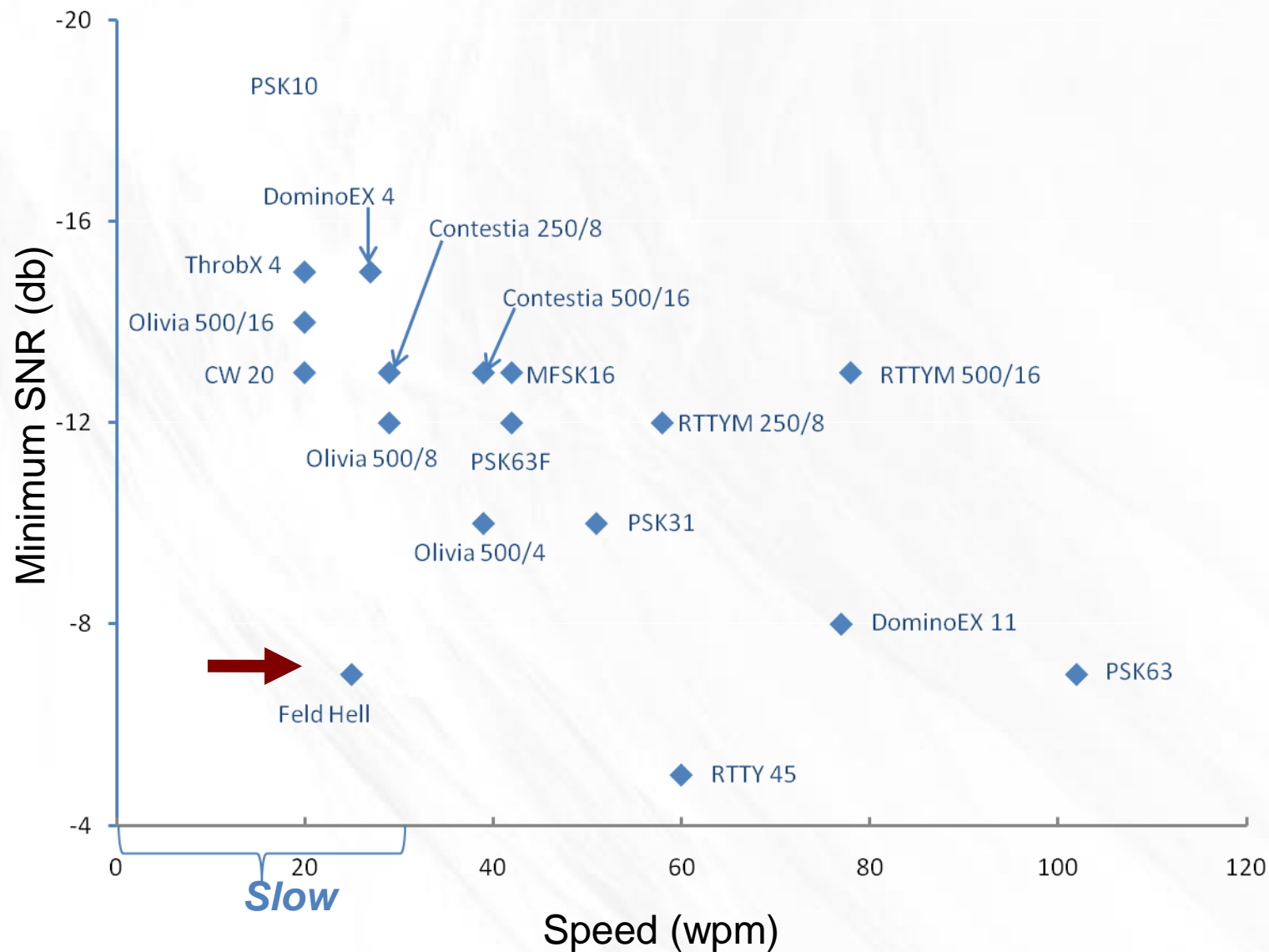
Graph courtesy of Wes, WZ7I

Multi-path Performance of Souncard Modes - (table courtesy of Wes, WZ7I)

Percentage Copy For Various Digital Modes During HF Path Simulations

Mode	Speed (WPM)	Minimum Sensitivity	High Latitude Moderate Path delay (3 ms) Freq Spread 10 Hz		High Latitude Disturbed Path delay (7 ms) Freq Spread 30 Hz		Mid Latitude Disturbed Path delay (2 ms) Freq Spread 1 Hz		Low Latitude Disturbed Path delay (6 ms) Freq Spread 10 Hz		Mid Latitude NVIS Worst Case Path Delay (20 ms) Freq Spread 1 Hz
		Sensitivity	-8 db SNR	+10 db SNR	-3 db SNR	+10 db SNR	-8 db SNR	+10 db SNR	-8 db SNR	+10 db SNR	+10 db SNR
PSK63	102	-7	0	0	0	0	50	ND	0	0	10
DominoEX 11	77	-8	0	0	0	0	80	100	0	0	85
RTTY 45	60	-5	0	90	40	50	20	90	0	70	80
PSK31	51	-10	0	0	0	0	70	ND	0	0	0
PSK63F	42	-12	100	100	0	0	90	100	10	90	50
MFSK16 320/16	42	-13	100	100	75	ND	100	100	100	100	100
Contestia500/16	39	-13	100	100	100	100	100	100	100	100	95
Olivia 500/4	39	-10	90	90	95	100	90	100	90	100	95
Olivia 500/8	29	-12	100	100	100	100	90	100	100	100	100
DominoEX 4	27	-8	0	0	0	0	90	90	0	0	95
Feld Hell	25	-7	90	90	readable	90	90	100	poor	90	80
Olivia 500/16	20	-14	100	100	100	100	100	100	100	100	100
CW 20 wpm	20	-13	100	100	100	100	90	100	90	100	100
ThrobX-4	20	-15	70	70	0	ND	90	100	70	0	60
PSK10	18	-18	0	0	0	0	20	0	0	0	0

Data from Tony Bombardiere, K2MO using PathSim from Moe Wheatley, AE4JY

Getting started with Feld Hell

- Similar hardware requirements to other sound-card modes (i.e. if you are already using PSK31 you may have everything you need)

- SSB transceiver

- Computer with sound-card (MS Windows, Linux or Mac OS X)

- Soundcard interface and cabling - providing interconnection, isolation and PTT capability

- Software (mostly free)

Typical Soundcard modes setup

Basic station hookup diagram.

Note: This diagram is a basic sound card station hookup and does not show a keying connection for CW and/or FSK. That connection is user supplied and requires an 1/8" mini jack to connect the key out of the RIGblaster to the radio's straight key input and/or FSK keying terminals.

PTT, KEYING & SWITCHING: Supplied DB9M to DB9F serial cable connected between the RIGblaster's serial jack and computer's com port. (not needed for VOX)

TRANSMIT AUDIO: Supplied 3.5 mm, 1/8" stereo phone plug patch cord from computer's line* output to RIGblaster's audio in.

RECEIVE AUDIO: Supplied 3.5mm, 1/8" stereo phone plug patch cord from radio's speaker or line out to computer's line* input.

COMPUTER SPEAKER RE-CONNECT: Cable from computer speaker re-connects to RIGblaster's audio output

MICROPHONE: Mic. cable supplied with RIGblaster. Connection goes to front of RIGblaster for RJ45 modular radios.

* For laptop computers use the computer's mic. input in place of the line input and use the headphone output in place of the line output.

Feld Hell software

- IZ8BLY *Hellschreiber* - Hell modes only on MS Windows. Will run on anything from WIN95 and up. Good choice for older Celeron or Pentium class computers. (freeware)

- Fldigi – Multimode, runs on Linux, Windows and Mac OS X (freeware)

- Digital Master 780 (DM780) – Multimode, part of the Ham Radio Deluxe suite of programs (freeware). MS Windows Only.

- MultiPsk – Multimode, MS Windows (freeware)

- MixW – Multimode, MS Windows (requires payment to license)

- others

Some operating tips

- Most Hell applications support "panoramic" tuning (i.e point and click on a signal on the waterfall) so tuning is as simple as PSK31.

- Unlike PSK31 and RTTY, Hell doesn't send a constant "diddle" during TX.

- If you are using a soundcard interface that triggers the radio PTT via VOX you need to enable a VOX delay to avoid constant interface T/R switching ("chattering") between transmitted characters.

- Adjust TX audio level as you would for PSK31 (little to no ALC indication on the rig during TX).

Fldigi running on a Linux Netbook
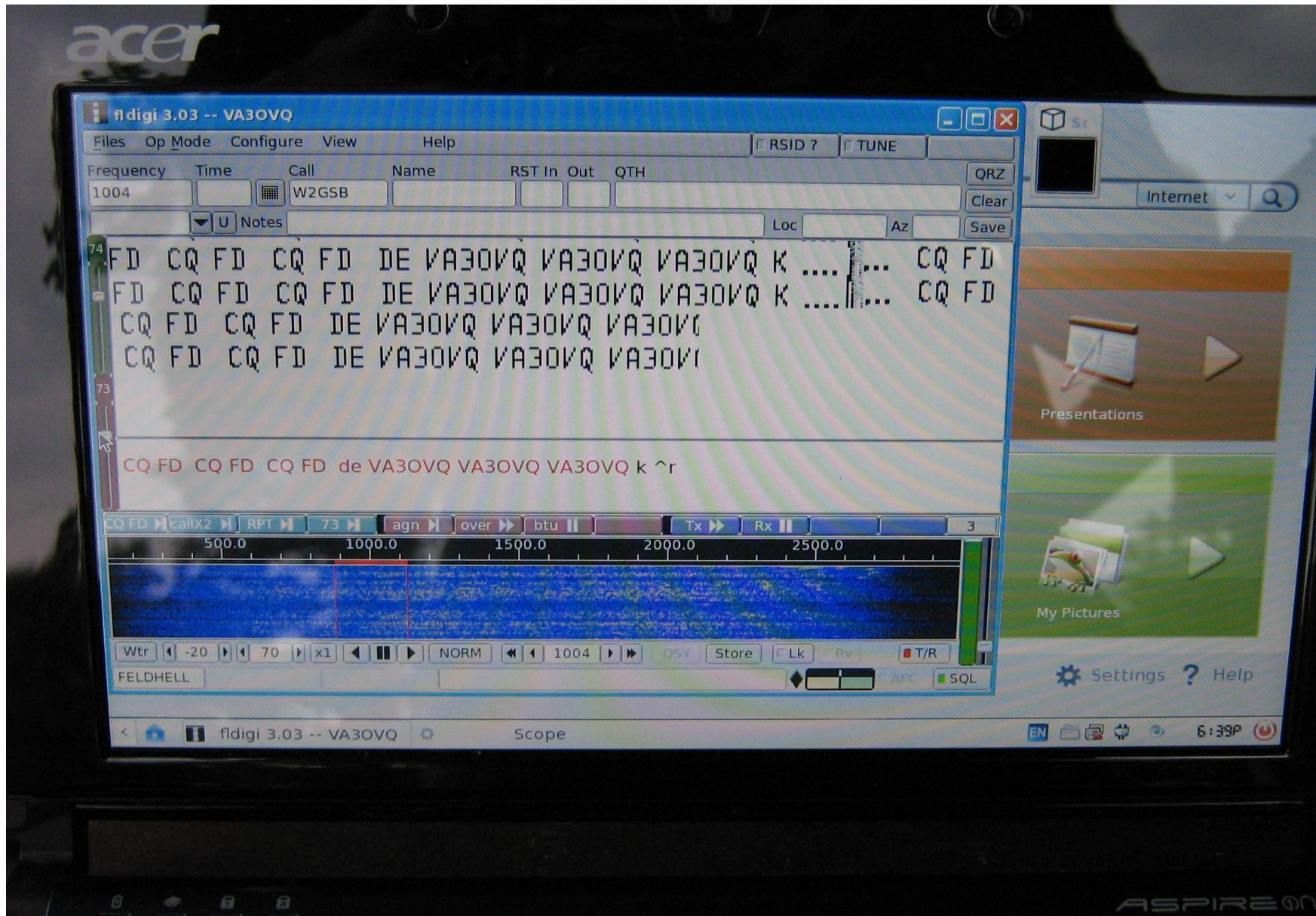
Hell Operating Frequencies

160M - 1.804 Mhz

80M - 3.574 to 3.584 Mhz

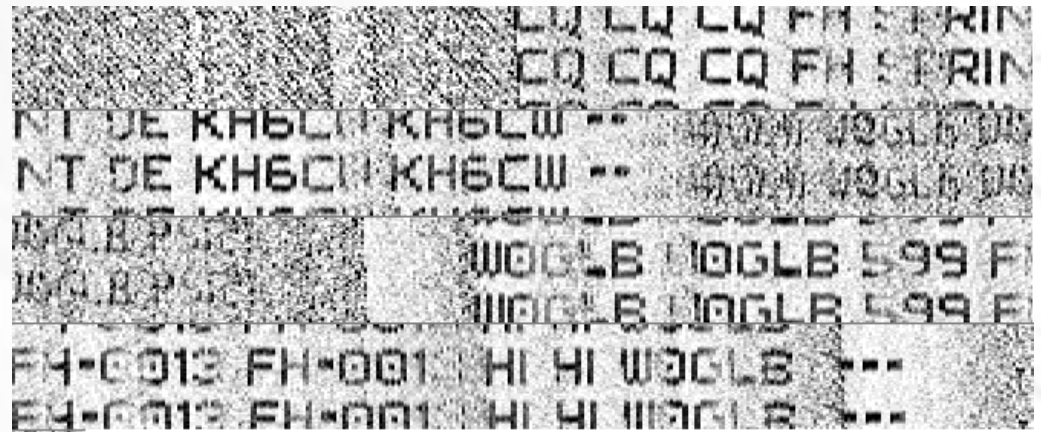40M - 7.077 to 7.084 Mhz

30M - 10.137 Mhz

20M - 14.063 Mhz

17M - 18.104 Mhz

15M - 21.074 Mhz

12M - 24.924 Mhz

10M - 28.074 Mhz

Feld Hell Club

- Started in 2007 to promote worldwide usage of Hellschreiber modes by Amateurs

- 3000+ members worldwide

- Free Membership

- Sponsors Awards, Nets and Monthly Contests & Sprints and Special Events.

- Online presence via Web page, Twitter, Spotting page and Yahoo Discussion Group

- http://sites.google.com/site/feldhellclub/

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See you in Hell !