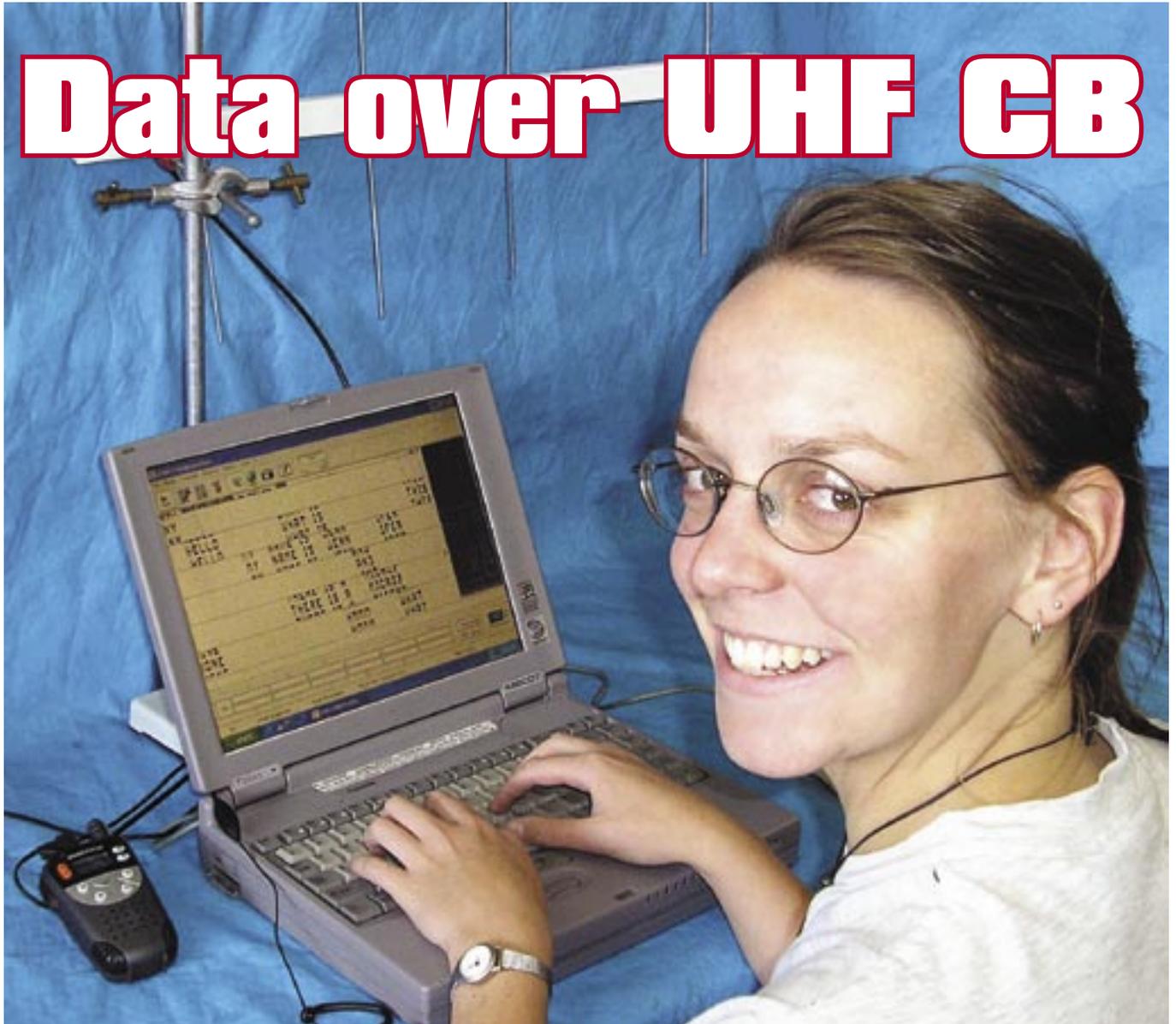


# Granddad's 1930s text messaging?

# HELLSCHREIBER

## Data over UHF CB



Young readers may be unimpressed with yesteryear's quaint technology but during the golden age of radio, beside such local 1950s staples as "Life with Dexter" and "Dad and Dave", considerable international communications came via wireless signals on the adjacent short wave bands (3-30MHz). Gasp – you mean no global roaming text messaging?

**by Stan Swan**

**Y**es – pre TV, FM, satellites, GPS (and certainly WiFi, mobile phones, internet and email) things *were* pretty tough on the electronic communications front.

However that did motivate many, myself included, to explore the technological magic then represented by radio. Numerous ham radio and electronics careers began when curious youngsters twiddled the dial on the family wireless and wondered how the sound reached them from the other side of the world.

Along with such diverse short wave **voice** stations as the Voice of America and the BBC News, a huge volume of powerful commercial, embassy, military and news service information passed as hideously sounding pulsed **data** traffic over these bands.

Tuning weak foreign stations amongst the cacophony of sounds that represented SW listening at that stage was often an frustrating but entertaining experience, compounded by atmospheric static crashes, propagation fades, heterodyne whistles, deliberate jamming interference and – oh yes – analog dials. And you thought video games were noisy! It often sounded like a cross between an orchestra tune up



**Wowowowo wowo wowo wowowow  
woow wow wow wowow woow owoo.**

and a chain-sawing woodpecker and no doubt prompted many a spouse or mum to hit the mains switch.

## Hellschreiber

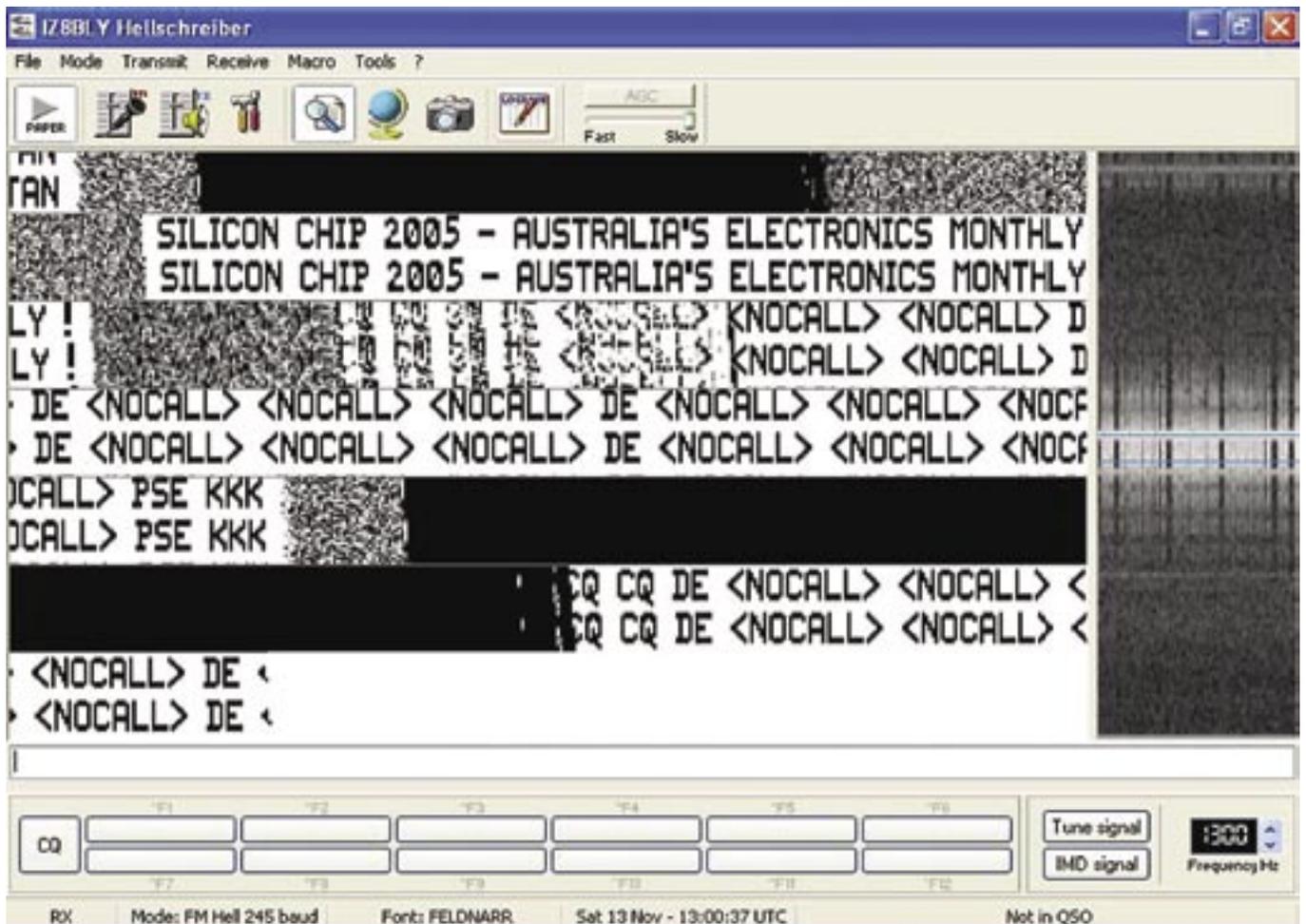
Perhaps the most enduring of these short wave **data** signals was a 1929 invention by Dr. Rudolf Hell (1901–2002!), known as **Hellschreiber** (German – Dr. Hells “bright writing”).

Aside from his engineering genius, which also covered early TV and an aircraft autopilot, Dr. Hell (just his surname – nothing satanic!) was a shrewd businessman and benevolent employer, with eventually some 2000 staff in his German factories making radio gear, fax machines, scanners and commercial printing presses (Linotype/Heidelberg).

On his 100<sup>th</sup> birthday in 2001 his grateful hometown of Kiel even renamed a street “Dr-Hell-Strasse” in his honour.

Hellschreiber is a form of 1-D fax and although ancient, is still considered (along with Morse Code) one of the most effective techniques for sending text information in weak or noisy signal conditions – both wireless and landline.

However, unlike audible Morse decoding (which also



needs a trained operator), “Hell” uses the outstanding ability of our human eye and brain to recognise shapes and distorted patterns.

Instead of deciphering with your ears, Hell is decoded as an image with your eyes, via its signals traditionally printed out as characters on paper ticker tape for anyone who can read to understand.

Also, the printed copy allows later consideration of confused noisy messages - misheard Morse characters may be lost forever.

Such eye/brain data decoding has led to Hellschreiber being in fact recently titled as a human readable “fuzzy mode” – neither quite analog or totally digital.

Hellschreiber became very popular in the 1930s, at a time when teleprinters were complex and costly, since it allowed direct keyboard text transmission on machines that were cheap and reliable with few moving parts.

Its most celebrated use however came during WW2 with the German Army, when field portable electromechanical “Feld-Hell” units often were the only viable wireless communication link under battle conditions and enemy jamming.

Such a character-forming tradition ensured wide subsequent peace-time use, with commercial short wave services employing the mode for decades afterwards well into the 1980s. Even SONY once made suitable units under licence.

## Hell basics

Although it’s now fully electronic and can be enhanced with sub modes such as FM-Hell, classic Hellschreiber involves on/off keying that portrays each text character (only capitals are used) as a series of vertically delivered dot pixels in a 7x7 matrix.

In effect the outgoing keyboard characters are broken into a string of dots and then suitably reassembled at the receiver.

Two identical lines are displayed so that legibility remains with even major errors and blank spaces and gaps between characters are also considered, as are half height pixels to increase resolution.

Here’s a capital E, with tones black and silence white-

```

7
6 •••••
5 •
4 ••••
3 •
2 •••••
1
  1 2 3 4 5 6 7

```

Traditionally 150 characters were transmitted a minute, with each taking 400ms. This equates to 2½ ch/sec or about 25 “PARIS” words a minute – a comfortable typing speed for many!

With 7x7 (49) pixels a character, each pixel duration is .4/49 = 8.163ms, so the data rate is 1/8.163ms = 122.5bps.

Naturally this is very pedestrian beside even today’s



**Wowowowo wowo wowo wowowow  
woow wow wow wowow woow owoo.**

56kbps dial up modems but simplicity and robustness ensure this narrow bandwidth mode remains durable.

## Sound card software

With war surplus equipment just a memory for most old timers and as even post-war commercial equipment was scrapped in favour of modern data-comms, Hellschreiber became a technology that time *almost* passed by.

In the early 1980s however radio hams began experimenting with fully electronic implementations, although these were not for the faint hearted.

The whole wireless data field however underwent an enormous upsurge only some six years ago, as cheap PC hardware and sound cards became well established.

When combined with ingenious software, the PC sound cards inbuilt digital signal processing features can offer near effortless external data encoding and decoding.

Such has been the phenomenal uptake of this approach, especially with radio hams on their short wave bands, that brand-new weak signal data modes (CLOVER, PICCOLO, PSK etc) have recently evolved, some even allowing fully digital Slow Scan TV (SSTV) images to be sent via low power HF radio transceivers around the world.

Naturally such offerings are appealing for isolated communities or seafarers and of course emergency use – ubiquitous Internet cafes and mobile (cell) phones may be early casualties in disasters such as the recent Indian Ocean tsunami and earthquakes.

## Hell’s been rediscovered!

Although perhaps best employed at lower frequencies





ow wowow woow owoo. Wo woow owoo. Wowowowo  
wowo wowo wowowow woow wow wow wowow woow .

when no other link is feasible, it's now *very* easy to experiment with Hellscreiber over licence-free UHF CB.

Enhanced modes, such as FM-Hell, offer great weak signal performance on even cheap CB sets— especially if used in conjunction with range-boosting antenna as outlined in the January 2005 SILICON CHIP.

Virtually any old Windows PC and sound card will do, since even a Win98 slow-coach laptop will readily keep up with the slow data employed. Naturally other transceivers and approved bands can be used if suitably licensed, with the old 27MHz CB band particularly tempting.

### Software – what's involved?

Shareware Hellscreiber sound card software abounds, with V4.0 of "IZ8BLY" by Italian ham Nino justifiably considered outstanding ([www.geocities.com/iz8bly/](http://www.geocities.com/iz8bly/)).

In addition to classic Feld-Hell (and even Morse), it offers many enhanced modes, with the bolder characters and impulse noise immunity of FM-Hell particularly appealing.

For extreme conditions, even meteor scatter and ultra-

ow wowow woow  
owoo. Wo woow  
owoo. Wowowowo  
wowo wowo woow  
wowow woow  
owoo. Wowowowo  
wowo wowo  
wowowow woow  
wow wow wowow  
woow owoo.



slow modes are available. Screen data can be saved as a .bmp snapshot & then printed, although if emailing images you would first convert them to a smaller .gif file. The PC screen display *can't* be taken as straight text to a spreadsheet or graph however. It's an image, remember!

Once downloaded (~1MB) and installed, you may only need to just start typing if you've two nearby sound card PCs both set to use the same mode.

Such is the robustness of this technology that with suitably adjusted mic & speaker levels, even exchanging data as **audio** signals across a small room will usually be enough to display characters on the second PC – hard walls will show up as ghosted reflections.

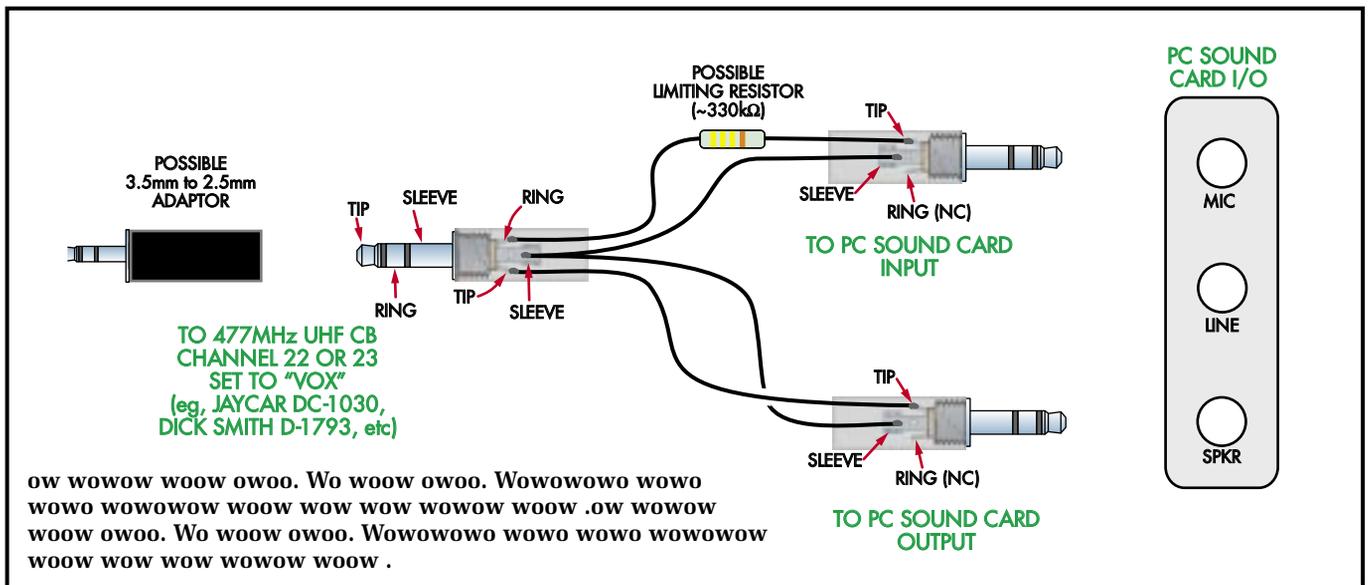
Modern switched-tone Hell implementations are quite musical incidentally, although the classic WW2 mode sounded "scratchy".

Although direct audio is an entertaining party or classroom trick, for proper wireless links simply turn on each UHF CB transceiver, set to a data channel and enable VOX (voice activated switching).

Suitable sound card mic/speaker and CB volume ad-



(Caption for all three pics): Wowowowo wowo wowo  
wowowow woow wow wow wowow woow owoo.  
Wowowowo wowo wowo wowowow woow wow wow  
wowow woow owoo. Wowowowo wowo wowo wowowow  
woow wow wow wowow woow owoo. Wowowowo wowo  
wowo wowowow woow wow wow wowow woow owoo.  
Wowowowo wowo wowo wowowow woow wow wow  
wowow woow owoo. Wowowowo wowo wowo wowowow  
woow wow wow wowow woow owoo. Wo woow owoo.  
Wowowowo wowo wowo wowowow woow wow wow  
wowow woow owoo. Wowowowo wowo wowo wowowow  
woow wow wow wowow woow owoo.



justing will usually be enough to trigger the transmitter, although naturally volume levels may be rather loud unless you place the CB speaker very near the PC mic.

For more elegance, it's suggested you use the headset and mic combo that is now available for most budget CB sets. These usually position nicely above the inbuilt mic and speaker of a laptop, and allow much quieter acoustic coupling – Velcro or Bluetak assist in securing PC mic to CB speaker and vice versa.

However for extended use room noises may interfere and the faint data tones may be annoying, as also may the

disabled background squelch noise if monitoring weak signals.

### Cable connection

Direct cabling of two budget CB handhelds (DSE D-1793 & Jaycar DC-1030) was investigated and although these sets differ in their I/O socket size they were found electrically similar and readily converted with 2.5-3.5mm adaptors.

To ease soldering woes on the 3.5mm stereo plug, a budget stereo headphone could be sacrificed for its shielded coaxial leads and CB plug pre-wiring. Such a cable allows a completely silent electrically-coupled connection direct to the soundcard but audio levels will almost certainly need tweaking on both your CB set and PC.

Experimentation with a Toshiba P-233 480CDT laptop showed optimum Feld-Hell connection to its soundcard mic input was via a 330kΩ series resistor. FM-Hell however, being very impulse noise immune, behaved well on both the mic and line inputs without this limiting resistor.

### Applications

Since anyone with suitable CB and PC sound card software can join in, it's feasible for a UHF Hell chat room to evolve, suiting perhaps a scout or school group.

Nino's free software is not intended for commercial use however, so using it to co-ordinate big game fishing, courier deliveries, gas field exploration and the like may be frowned on.

Perhaps the best use might be delivering weak telemetry data for an educational project – much as initially envisaged the UHF CB channels 22 and 23 would be suited for.

Data images will eventually scroll off the screen top after a few minutes unless paused however, but the IZ8BLY software includes macros that may assist.

Mmm – fancy a challenge? I wonder if a suitable Picaxe could be persuaded to generate Hell!

References and web links: For convenience these are also hot linked at [www.manuka.orcon.net.nz/hellrefs.htm](http://www.manuka.orcon.net.nz/hellrefs.htm)  
 Not much room for many more!!!!



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Issue: 203

Published: 11 August, 2005

## Hellschreiber - Revisited

Regular readers will recall Stan Swan's enthusiastic "Hellschreiber" feature back in the May 2005 issue of SILICON CHIP. It attracted a lot of interest and correspondence – not all of it 100% positive!

First of all, a brief recap for those who might have missed it. Stan talked about the "rediscovery" of this WWII-vintage communication system, actually used to great effect by the German army with their portable "Feld-Hell" electromechanical units.

In some ways, Hellschreiber may be thought of as a forerunner to modern-day facsimile machines, since it writes an image to paper. However, it was/is limited to transmission and reception of letters/numbers.

Stan talked about the free Hellschreiber software available on the 'net and then went on to describe how it could be used on the "data only" channels 22 and 23 of the Australian UHF CB radio system, along with a suitable computer and sound card.

Whoops!

What Stan didn't realize at the time was that the "data only" channels are restricted to absolutely miniscule amounts of data – three seconds maximum in each hour. This is much less than Hellschreiber requires.

We only twigged to this ourselves when several readers (presumably users of the data-only channels!) wrote in to tell us of the transgression.

It's not mentioned at all on the Australian Communications Authority (ACA) website Class Licencing page [http://internet.aca.gov.au/ACAINTER.65650:STANDARD:pc=PC\\_1265](http://internet.aca.gov.au/ACAINTER.65650:STANDARD:pc=PC_1265) In fact, you have to go right back to the ACA's "Radio Communication (Citizen Band Radio Stations) Class Licence 2002" page [http://internet.aca.gov.au/acainterwr/aca\\_home/legislation/radcomm/class\\_licences/cbrs.rtf](http://internet.aca.gov.au/acainterwr/aca_home/legislation/radcomm/class_licences/cbrs.rtf), then wend your way right through to Schedule 1 (CB station operational requirements) and finally work your way down to Section 6(g), before you find the specific reference to Channels 22 and 23 having a time limit.

Phew! No wonder people don't know about it!

Moreover, those regulations, reproduced below (with the relevant clause in italics), don't even mention the limitation to "telemetry and telecommand" – something Hellschreiber definitely is not. (Telemetry and Tele-command are digital signals, transmitted from one UHF CB to another, designed to either do something or read something – such as open or close an electronic gate lock or measure the water level in a dam on the opposite side of the property).

To find those limitations, you need to go back to the Class Licencing Page mentioned above and . . . oh yes, there it is – Telemetry and Telecommand.

Therefore, we must warn UHF CB users that, despite their being no licence requirements for their operation, there are most certainly regulations which have to be obeyed and the authorities could take a very dim view of people tying up the data channels with such things as Hellschreiber or even SSTV. (Stan had also been toying with the idea of using UHF 22/23 for SSTV but following our advice has shelved that idea, too!)

There was one other small oversight in the Hellschreiber article. Stan supplied a photograph of a Hellschreiber transceiver (published on page 42 of that issue), which he had obtained from an obscure site on the 'net (good old Google!) and could not determine who, if anyone, claimed to own the copyright.

However, it seems that the photo in question may have itself been copied from the website of another NZ ham, Murray Greenman, ZL1BPU, who was not happy that he was not acknowledged as the rightful owner.

To be honest, had we known about an original version of this contentious photo <http://www.qsl.net/zl1bpu/FUZZY/History/fh44.jpg> we would have asked for permission to use it instead because it is of significantly better quality than the one Stan gave us and we actually printed!

In any case, we apologise to Murray Greenman for the apparent inadvertent use of his photograph.

Item	Channel	Carrier Frequency(Megahertz)	Restriction
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6	22	476.950	A transmitter employed in a CB station:
			(a) must operate with a transmitter power not exceeding 5 watts; and
			(b) must not exceed an EIRP of 8.3 watts; and
			(c) must operate with an occupied bandwidth not exceeding 16 kHz; and
			(d) must not exceed a carrier frequency error of $\pm 3$ kHz; and
			(e) must not exceed an adjacent channel power of -22 dBm; and
			(f) must not exceed a conducted spurious emission of -30 dBm; and
	23	476.975	(g) must operate on a duty cycle of not more than 3 seconds in any period of 60 minutes; and
			(h) must be fitted with a device that shuts the transmitter down after 3 minutes of continuous operation.
			A receiver employed in a CB station must operate with a conducted spurious emission not exceeding -57 dBm.
			Note: The use of single frequency store and forward repeaters is permitted.

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