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In this paper, I will describe the digital mode"CCW" . Newcomers not required to copy CW as part of their test could find an initiation to CW and "old CW hands" could find interest in this mode."
This mode is available in the Multipsk "freeware" program, downloadable from the following WEB site: http: //members.aol.com/f6cte/

Introduction

The CCW ("Coherent CW") is, as the traditional CW, an On-Off Keying mode. However, the CCW Morse keying produced by the computer is exact so as to allow the synchronization and a correct estimation of the bit (carrier or absence of carrier) while the CW keying produces a signal that changes from operator to operator.

CCW is the only digital mode, designed for machines (such as in receive and transmit) which can be easily read by a human being. CW is first designed for human beings ("fuzzy" mode) which may or may not be decoded by machine according to the keying quality.

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Origin

The **CCW** was created by Ramond Petit (W6GHM) in 1975. It uses the CW character set and remains decodable by a CW ham. The initial speed of CCW is based on a dot of 100 ms long of duration. Due to the fact that all elements of the Morse language have a length based on the dot duration:

* a dash: 3 dots,
* a space between two signs of the same letter: 1 dot,
* a space between 2 letters: 3 dots,
* a space between 2 words: 7 dots,

it follows that the CCW standard speed, based on the word 'PARIS ', is equal to 12 wpm (word per minute).

Problems with the automatic decoding of the traditional Morse

For a computer, Morse is seen as a sequence of bits having either "0" or "1" for value, a bit being as long as a dot.
For example, the letter "A" (‘di dah’ followed by a 3 dots duration blank or '- --- ') will be recognized as being the sequence '10111000', if, conventionally, the value "0" is

associated to the absence of carrier and the value "1" to the presence of carrier. If all CW transmissions would be standardized on the characteristics of character keying and speed (say 20 wpm), the decoding would not be complicated.
However, in the reality, characters are keyed in a more or less regular way and the speed can be situated between 10 and 50 wpm and may vary during the QSO. So, the decoder cannot rely on a definite bit duration and must then, permanently, determines the more probable bit duration, which makes the decoding difficult. This is why, at the present time, the CW decoding by Morse specialist is better than software decoding .
Note: to equal the human decoding, it would be necessary, no doubt, to abandon the bit notion and to recognize CCW characters in the same way as characters written by hand are, I mean with neural networks leaning on a learning realized upon a set of different types of keying, speeds and signal-to-noise ratios...a big program!

CCW description

The originality of CCW compared to CW is based on an exact standard transmission as generated by the computer at a fixed speed. Hence, it is only necessary for the receiver to select the desired CW transmission in the AF spectrum, through a narrow filter then to synchronize on the received symbols (dots/dashes) flow. As soon as they are synchronized, the receiver and the transmitter will be in "Coherence", which explains the term "CCW".

This synchronization consists to:

* precisely, determine the bit length. In fact, there is always a difference in the clock frequencies of the transmitter and the receiver. For example, if the CCW QSO is done through the medium of sound cards, a difference of 1 % between both sampling frequencies is possible,
* determine the moment of the bit estimation. In fact, for each bit, it is necessary to know its beginning, the estimation being done in middle of the bit.

The initial CCW used extremely precise oscillators. Hence, it was only necessary to detect precisely the start of a dot or a dash to be sure to stay synchronized during the QSO duration. The difficulty of supplying very precise oscillators restricted, at the beginning, the use of CCW.

The advent of the personal computer changed this as it became simple to apply programs having the ability to synchronize on the signal, making extraction of the characters before displaying them.
This synchronization is generally built from a non-linearity (squaring for example) applied to the base band signal, which output is taken into account in a phase locked loop, this one generating, finally, a clock signal based on the received signal.
Note: The base band signal is obtained by demodulation of an AF signal, i.e. the suppression of the AF component (the carrier), this with a Costas loop and a matched filter. To isolate the CCW transmission, one can dispose a band-pass filter just before demodulation or apply a low-pass filter at each of the components in quadrate of the band base signal (which comes to the same).

Programs using the serial port as interface between the transceiver and the computer have been created. They are:
* COHERENT written by Bill de Carle (VE2IQ),
* PCW written by Ernst Schroder (DJ7HS).

The initial synchronization with the correspondent is done sending a sequence of dots, by simply clicking on the key $.
.
MULTIPSK is a Windows program using the soundcard to receive and transmit CCW

Several modifications (Patrick F6CTE / Ludwig DK5KE) have been made compared to the original CCW, this to give to the operator the same type of use as for another digital mode (BPSK31, for example).

These modifications are the following:
1) multiple speed has been added (24 and 48 wpm) of the initial speed (12 wpm), the 24 wpm speed being the most adapted to a chat between two Hams,
2) a specific idling character has been added (.....), so as to keep the synchronization in case of characters absence,
3) "CCW" is transmitted, at the transmission start, with a space and an idling character (.....),
4) so as not to lose the synchronization, one prevents the user to type more than one space between two words.

Please note that the program can follow a maximum CCW signal 15 to 25 Hz/min drift (according to the CCW speed and the signal-to-noise ratio),

Results and use conditions

The minimum signal-to-noise ratio for which CCW is decoded with very few errors is a function of the speed and the type of transmitted characters.
For the standard speed of 12 wpm, the average minimum signal-to-noise ratio is about -12 dB. It is equal to -8 dB at 24 wpm and to -5 dB at 48 wpm, which is correct but not very good compared to the BPSK31 mode, for example. Upon performance, It is much more comparable to RTTY 45 bauds.

The decoding is only reliable if there is not too much QRM/QRN and not too rapid fading, because the program does not distinguish level variations due to environment, from level variations due to keying.
Conversely, CCW is not sensitive to ionospheric Doppler as are all BPSK modes.

CCW use

CCW is done in USB.

It is suggested to choose for CCW, the following frequencies: 1844, 3561, 7031, 10107, 14061, 21061, 24907, 28061 KHz USB (QRP frequencies + 1 KHz).

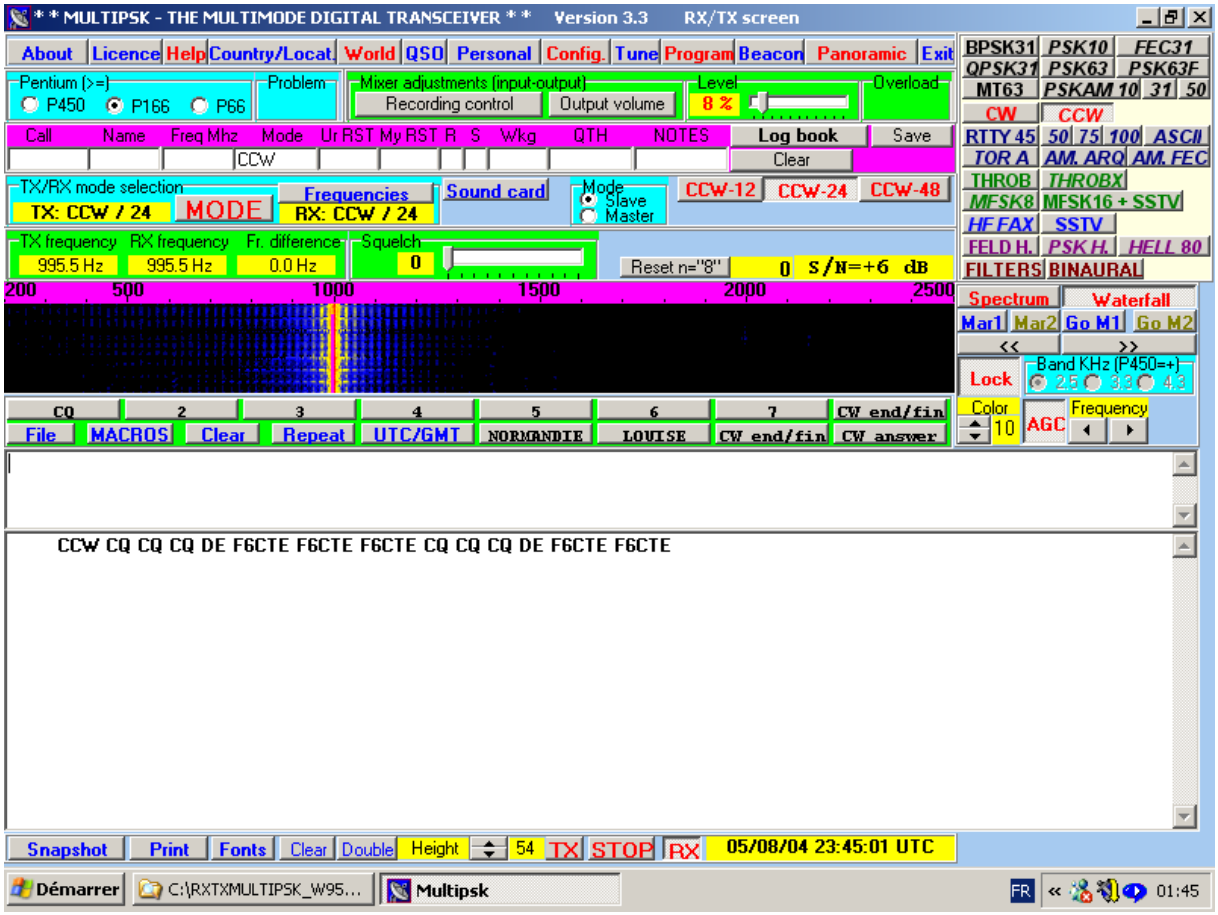
When starting transmission, it is transmitted "CCW", a space and an idling character (.....), which allows to distinguish this call from CW calls.

The user must not answer a CCW transmission by a CW signal (automatic CW included), because in CW there is no idling transmission, which may cause the program to lose the synchronization.

The user must be sure to hear a CCW transmission before answering in CCW because it is useless, in CW, to send idling characters.

At the present, the CCW activity being very weak, the QSO will be done preferably on sked.

As a conclusion, CCW can be either an experimentation field (and our hobby is also an experimental activity) or a first step to CW.


** MULTIPSK - THE MULTIMODE DIGITAL TRANSCEIVER ** Version 3.3 RX/TX screen
About Licence Help Country/Locat World QSO Personal Config. Tune Program Beacon Panoramic Exit
Pentium (>=) P450 P166 P66
Problem
Mixer adjustments (input-output) Recording control Output volume
Level 8 %
Overload
Call Name Freq Mhz Mode Ur RST My RST R S Wkg QTH NOTES
CCW
Log book Save Clear
TX/RX mode selection TX: CCW / 24 MODE Frequencies RX: CCW / 24
Sound card
Mode Slave Master
CCW-12 CCW-24 CCW-48
TX frequency 995.5 Hz
RX frequency 995.5 Hz
Fr. difference 0.0 Hz
Squelch 0
Reset n="8"
0 S/N=+6 dB
200 500 1000 1500 2000 2500
CQ 2 3 4 5 6 7 CW end/fin
File MACROS Clear Repeat UTC/GMT NORMANDIE LOUISE CW end/fin CW answer
BPSK31 PSK10 FEC31
QPSK31 PSK63 PSK63F
MT63 PSKAM 10 31 50
CW CCW
RTTY 45 50 75 100 ASCII
TOR A AM. ARQ AM. FEC
THROB THROBX
MFSK8 MFSK16 + SSTV
HF FAX SSTV
FELD H. PSK H. HELL 80
FILTERS BINAURAL
Spectrum Waterfall
Mar1 Mar2 Go M1 Go M2
<< >>
Lock
Band KHz (P450=+) 2.8 3.3 4.3
Color 10
AGC
Frequency
CCW CQ CQ CQ DE F6CTE F6CTE F6CTE CQ CQ CQ DE F6CTE F6CTE
Snapshot Print Fonts Clear Double Height 54 TX STOP RX 05/08/04 23:45:01 UTC
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