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Description of CODAN-3212 Data Station

CODAN-3212 is an HF transmission mode defined and developed by the same named Australian company. This mode provides a robust method of data communication over the HF path. The mode CODAN-3212 is the successor of CODAN-3012/CODAN-9001. The CODAN-3212 modem has different operation modes. The data can either be sent by a high-speed waveform to address other CODAN-3212 modems, or by using the CODAN-3212 compatibility mode at a low-speed to address other CODAN-3012 modems. A standard CODAN-3212 HF data station includes:

- a CODAN transceiver that is capable of sending data by a high-speed waveform or by the CODAN-3212 compatibility mode,
- an antenna system,
- an appropriate 12 Volt DC power supply,
- a 3212 HF data modem,
- a PC with terminal or application software that provides email, chat and FTP (file transfer protocol, standard network protocol used for the transfer of network data between a client and a server) services.

A possible setup is illustrated in Figure 1. The data station can be installed in a base station or in a vehicle. The CODAN data station can be addressed from the terminal software of a PC, either by plugging a cable between the serial COM port of the PC and the Data connector on the 3212 modem, or via an Ethernet connection between the PC and the 3212 modem. The modem interface is based on the AT industry standard, developed by the company Hayes Communications.

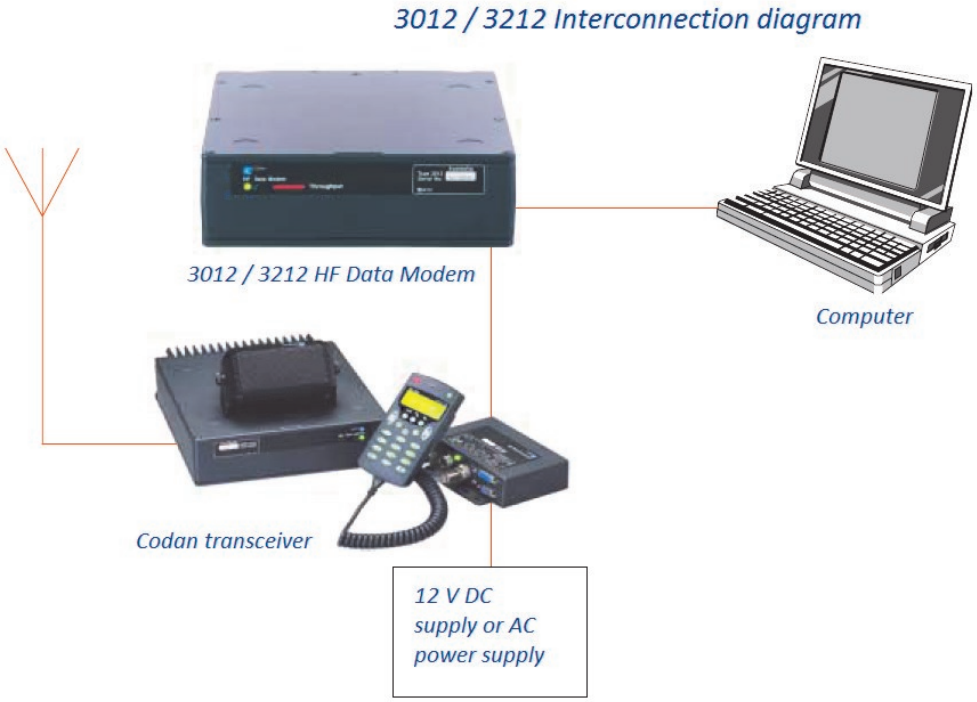

Fig. 1 CODAN data station.

CODAN HF transceivers transmit on single sidebands, either USB or LSB. This reduces the power required to send HF signals and increases the number of channels available within the HF spectrum. The transceivers are primarily used for long distance communications. Obstructions such as buildings and mountains have only little effect on the communication. The HF radio waves propagate in three ways simultaneously: *ground wave*, *direct wave* and *sky wave*. The ground wave travels near the ground for short distances up to 100 km over land and 300 km over sea. The distance covered depends on the channel frequency, transmission power and environment. The direct wave travels in a direct line from the transmitter to the receiver. Finally, the sky wave is transmitted toward the sky and is reflected by the ionosphere to a distant receiver on earth.

Additionally, a handset and a speaker for acoustic monitoring, can be connected to the transceiver. The handset has buttons for

- toggling mute on or off,
- starting a call,
- switching scanning on or off, or if the user was in a call, ends the call and turns switching on,
- manually tuning the antenna,
- adjusting the receiver frequency to compensate for any frequency difference between the receiver and the transmitter,
- selecting the mode (either USB or LSB),
- selecting the channel frequency for the communication.

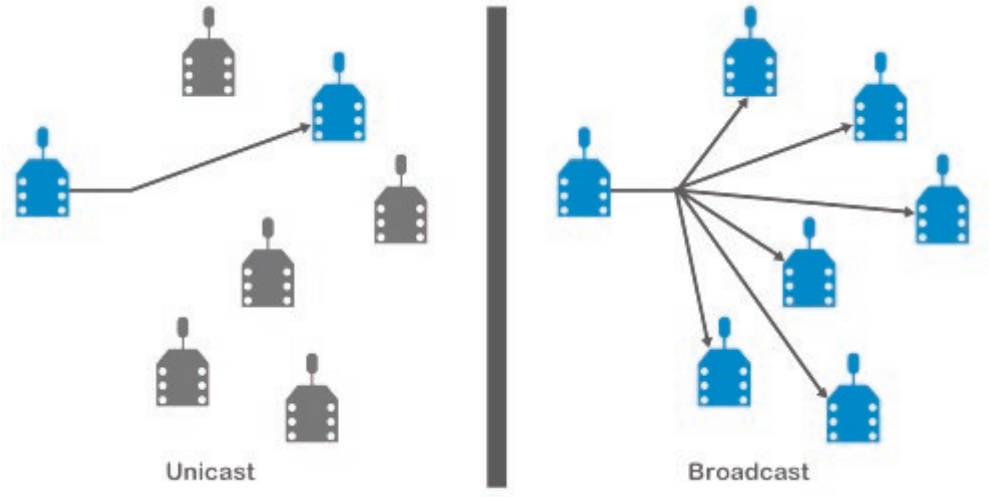

Fig. 2 Peer-to-peer (unicast) vs. broadcast communication.

The data is passed from the terminal software of the PC to the 3212 modem. It is processed by the 3212 modem and then send to the CODAN transceiver for transfer via HF to the transceivers in the communication system. At the receiving node, the data is transferred from the transceiver to the 3212 modem, where it is decoded, and then sent to the terminal software of the PC. In order to send data between multiple modems, the corresponding transceivers need to be set to the same channel. A front panel LED indicator shows presence of power, modem link status and throughput of the transmitted or received data.

Prior to sending data between two modems, a proprietary ALE (automatic link establishment) will provide automatic channel selection. CODAN modems operate under full-duplex mode, so they act as RS232 (serial communication transmission of data) link between two stations once a link is established. The data between two or more CODAN-3212 modems can either be sent by a peer-to-peer communication (Selective Repeat ARQ protocol) or by a broadcast communication (Non-ARQ protocol). The Selective Repeat ARQ (Selective Automatic Repeat Request) is a protocol for error detection and error correction in a data transmission and is a specific instance of the ARQ protocol. In a Selective Repeat ARQ transmission, the transmitting node needs an explicit confirmation that the data was received at the receiving node. When the receiver detects an error in a received frame, it automatically requests the transmitter to resend the frame, whereas in other forms of the ARQ protocol, every frame from that point must be sent again. This process repeats until the packet is error free or the error continues beyond a predefined number of transmissions and thus the communication breaks down on poor conditions. In a Non-ARQ transmission, the transmitting node sends packets to the receiving node, without explicit confirmation that the data was received at the receiving node. In a peer-to-peer communication, only two modems are involved (sender and receiver), whereas in a broadcast communication all modems within a certain address range can be addressed. The setup of a peer-to-peer and a broadcast communication is illustrated in Figure 2. Error-free transmission is guaranteed for peer-to-peer communications, but not for broadcast communications in difficult transmission conditions without the possibility of repetition (ARQ). Additionally, in a peer-to-peer communication the data can be sent using a compression, which is not possible in the broadcast mode because of the unreliable communication conditions. A lossless compression format is used for compressing CODAN-3212 data stream with arbitrarily length.

CODAN-CHIRP — Automatic Link Establishment

Prior to sending data between the CODAN modems, a proprietary ALE is used for link establishment consisting an 80 Baud (symbols/sec) Chirp signal. ALE refers to HF Automatic Link Establishment (ALE). Today most of the ALE systems operate according to the US federal standard (FED-STD-1045) or the higher specification Military standard (MIL-STD-188-141B). ALE is a mechanism allowing an HF radio to automatically determine the best channel to establish a link. CODAN ALE offers convenient features such as text messaging, GPS position send or request, and broadcast calling. The data station originating a data call transmits a Chirp sequence with signalling information. This information causes a RING signal at the receiving node. If the receiving node accepts the call, an exchange of more signalling information follows. The signalling information contains the source and destination address, as well as the parameters of each modem, such as the serial number, the tuning and the transmission mode: secure, secure interactive and unsecure (compressed or uncompressed). In a peer-to-peer communication, the sender and the receiver exchange information about their parameters, whereas in a broadcast communication only the sender sends information about his parameters. Once all the signalling information has been sent, the link is established and the data transfer between the modems begins.

CODAN-3012 and CODAN-3212 Compatibility Mode

The CODAN-3012 HF data modem provides a fast, reliable and cost-effective text and data communication possibility for organisations operating in areas with unreliable telecommunications infrastructure. CODAN-3212 compatibility mode is used to communicate with other CODAN-3012 modems. The CODAN-3012 waveform transports data using a selective repeat ARQ protocol. The modulation and coding systems incorporate design features to eliminate the effects of multi-path delay, selective fading, frequency offset error, frequency burst, dynamic range limitations and protocol cross-linking in the HF transmission. Prior to sending data between the modems, a proprietary ALE is used for link establishment consisting with an 80 Baud (symbols/sec) chirp signal. The CODAN-3012 waveform is modulated onto 16 tones, with a spacing of 112.5 Hz between the channels and a bandwidth of 1800 Hz. The modem supports a user data rate of 2400 bit/sec and the modulation type is differential quaternary phase-shift keying (DQPSK). It further permits data transfer rates up to 6000 bit/sec (compressed) and up to 1475 bit/sec (uncompressed). The CODAN-3012 mode supports several modes for transmission, where the packet structure of each mode is different. The different transmission modes are: secure, secure interactive and unsecure (compressed or uncompressed).

CODAN-3212 High-Speed Mode

CODAN-3212 HF data modem provides a reliable, cost-effective and *high speed* mobile data communication in remote areas with poor telecommunications infrastructures. CODAN-3212 is based on the latest modem technology with an error free data rate up to 7200 bit/sec uncompressed, typically four times faster than comparable modems on the market. Prior to sending data between the modems, a proprietary ALE is used for link establishment consisting with an 80 Baud (symbols/sec) chirp signal. The CODAN-3212 waveform is derived from Military Standard (MIL-STD) waveforms, which are based on STANAG 4539 and modified to provide optimal performance over the commercial 2.4 kHz HF channels. The CODAN-3212 waveform transports data using the STANAG-5066 protocol. The modulation is serial (single-tone) 8-PSK and QAM. The modem supports the following user data rates in bit/sec: 75, 150, 300, 600, 1200, 2400, 3600, 4800, 6000 and 7200.

CODAN-CHIRP, CODAN-3012 and CODAN-3212 Implementation by Wavecom

The modes CODAN-CHIRP, CODAN-3012 and CODAN-3212 are implemented in the Wavecom decoders (HF Modes → PSK & OFDM). All of the decoders demodulate and decode the CODAN signals, use frequency tracking and correction methods, verify the CRC checksum, decompress and decode the user data. The CODAN decoders automatically correct small frequency deviations from the exact center frequency of the signal. For CODAN-CHIRP, the decoder automatically identifies the polarity (NOR or INV), the source and destination address, as well as information about the serial number, the tuning and the transmission mode (secure, secure interactive or unsecure, compressed or uncompressed) (Fig. 3). For CODAN-3012, the decoder automatically identifies the polarity (NOR or INV), transmission mode (secure, secure interactive or unsecure) and the scrambling start value for secure and secure interactive transmissions. The decoder also indicates if the preamble has been found and afterwards starts decoding the data (Fig. 4). For CODAN-3212, the decoder identifies the user data rate and the interleaver, and afterwards starts decoding the data. The results can be displayed in HEX, Binary or ASCII format. Additionally, the decoded output for CODAN-3212 can be displayed according to the STANAG-5066 protocol and the quality of the decoded CODAN-3212 signal can be visualized in the phase plane (Fig. 5).

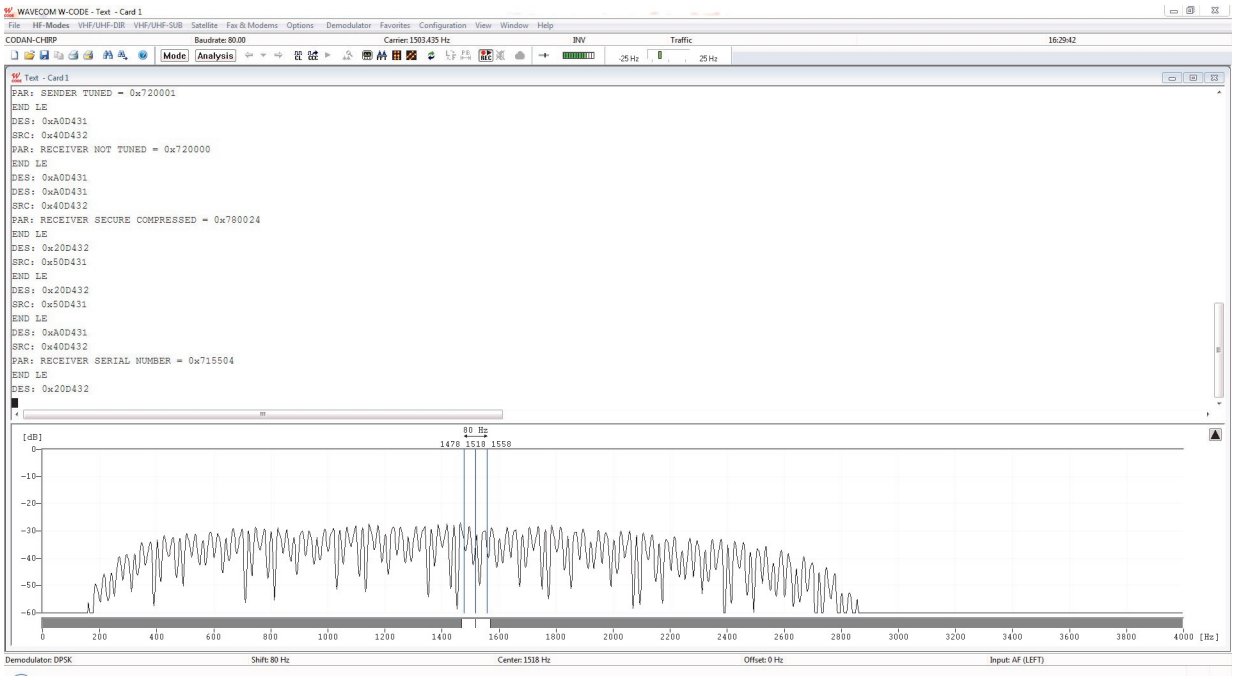

Fig. 3 CODAN-CHIRP decoding output.

Fig. 4 CODAN-3012 decoding output.

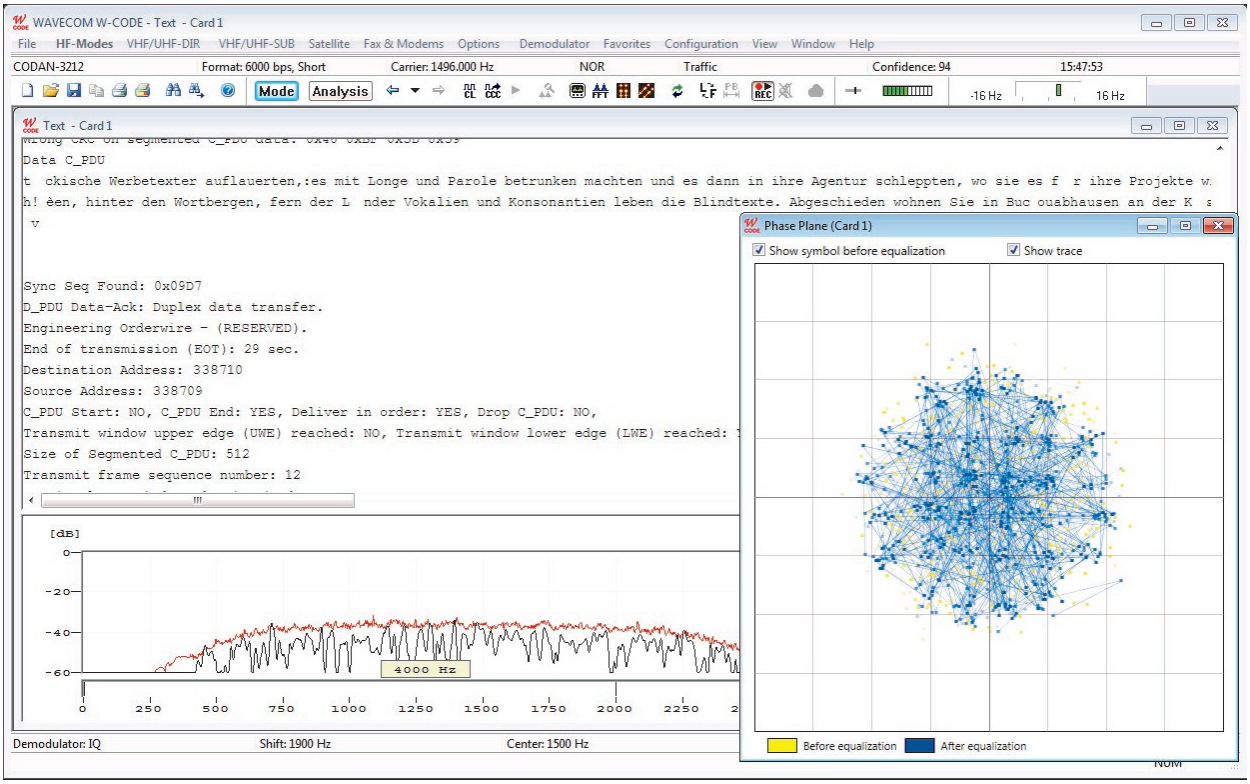

Fig. 5 CODAN-3012 decoding output with phase plane.

Reference

[1] Internet https://www.digi.com/resources/documentation/Digidocs/9000145613/concepts/c_point_to_multipoint.htm
[2] Wikipedia https://en.wikipedia.org/wiki/Selective_Repeat_ARQ
[3] CODAN-3012 Data Modem Fact Sheet
[4] CODAN-3212 Data Modem Fact Sheet
[5] NGT Transceiver SRx, Getting Started Guide
[6] HF Data Modem 3212 User Guide
[7] Internet https://www.codanradio.com

Since more than thirty years Wavecom Elektronik AG has developed, manufactured and distributed high quality devices and software for the decoding and retrieval of information from wireless data communication in all frequency bands. The nature of the data communication may be arbitrary, but commonly contains text, images and voice. The company is internationally established within this industry and maintains a longstanding, world-wide network of distributors and business partners.

Product Information

Products	http://www.wavecom.ch/product-summary.php
Datasheets	http://www.wavecom.ch/brochures.php
Specifications	http://www.wavecom.ch/product-specifications.php
Documentation	http://www.wavecom.ch/manuals.php
Online help	http://www.wavecom.ch/content/ext/DecoderOnlineHelp/default.htm http://www.wavecom.ch/content/ext/MonitoringSystemOnlineHelp/default.htm
Software warranty	One year free releases and bug fixes, update by DVD
Hardware warranty	Two years hardware warranty
Prices	http://www.wavecom.ch/contact-us.php

System Requirements

	Minimum	*Recommended*
CPU	Core i5 or Core i7 2.8 GHz	Core i7-6700 3.4 GHz
Memory	4 - 8 GB RAM	16 - 32 GB RAM
OS	Windows 7	Windows 10 32-bit or 64-bit

Distributors and Regional Contacts

You will find a list of distributors and regional contacts at http://www.wavecom.ch/distributors.php

WAVECOM ELEKTRONIK AG
8090 Zurich, Switzerland
E-Mail: sales@wavecom.ch
Internet: www.wavecom.ch