



RFL 9506

SSB Powerline Carrier System



Fig. 1 RFL 9506 Analog Powerline Carrier System

SYSTEM FEATURES

The RFL 9506 Single Sideband Powerline Carrier System is a highly flexible and compact PLC terminal where the most important parameters such as HF transmission frequencies, input and output levels as well as modulation percentages are fully programmable from a standard PC or from a dedicated console. Thanks to its modularity, the configuration and features of the equipment can be easily adapted, at any time, to the particular requirement of the communication network.

Supervision as well as programming can be carried out from a distance, by means of an external data channel, at a maximum speed of 9600 bit/s, or by means of the internal 50 bd pilot and signalling channel.

Four models of the RFL 9506 terminals are available, their output power, measured at the coaxial-connector output, being 5 W, 20 W, 40 W and 80 W (PEP) respectively. This power can be increased, depending on the channel frequency, up to a value between 150% and 280% for a period of no more than 500 ms in order to transmit a teleprotection signal (overboosting).

Depending on the number and type of channels, type D for data and type T for speech-plus transmission, five versions are available for each output power rating. The conversion from the simplest to the most complete version of the same wattage is achieved by the simple addition of the relevant modules, no replacement of common cards being required.



BASEBAND AND PILOT CHANNEL

The baseband stretches from 300 Hz and 3850 Hz. Using D type channels, the whole base band can be used for high-speed data transmission, for multiple telegraph-channel transmission or for teleprotection. A maximum of twenty nine (29) 50Bd/120 Hz, fourteen (14) 100Bd/240 Hz or seven (7) 200 Bd/480 Hz VFT channels can be allocated in this band. It can also be used for three 600 Bd channels, spaced 960 Hz, or two 1200 Bd channels.

Both speech and data can be transmitted simultaneously in T type channels, the lower frequency of the speech band being 300 Hz and the higher one presettable between 2000 Hz and 3400 Hz. The maximum baud rate achievable in the superimposed (speech-plus) band is 1200 Bd when the speech band is limited to 2000 Hz. In addition, a built in point-to-point orderwire function is included with these modules.

The pilot channel is situated at the virtual frequency of 150 Hz, making all the bands between 300 Hz and 3850 Hz available for user information. It is used to carry out the following functions:

- Automatic Gain Control (AGC) independent for each channel
- Telephone signalling
- Signal-to-noise (s/n) ratio measurement
- Link synchronization based on a Master-Slave scheme
- Bidirectional low-speed data transmission in order to:
 - a) transfer the internal supervision data and programming commands from one terminal of the link to the other
 - b) establish a remote loop for testing purposes

PROGRAMMING

RF channel allocation is completely field programmable. This is achieved by means of three modulations and demodulations, two of which are carried at fixed frequencies and the third at a digitally generated frequency which is variable in 1 Hz steps. The baseband can then be set, from the keyboard, at any point in the PLC frequency range with 1 Hz resolution. This allows the equipment not only to fit any allocation scheme but also to solve some special interference problems by adequately moving the transmission frequency band. The only manual adjustment required concerns the center frequency and the bandwidth of the receive and transmit line filters.

It is also possible to preset, from the keyboard, speech-filter cutoff frequencies, AF input and output levels,

modulation percentages, transmit and receive pilot-tone levels and the S/N ratio alarm threshold, as well as to define, for each AF output, the S/N ratio at which the output becomes blocked. As no manual adjustment is required for these parameters, presettings can also be carried out from a remote control center through a data modem of up to 9600 bit/s or through the pilot channel.

SUPERVISION SYSTEM

The supervision system stores, in both link terminals and in chronological order, the alarms produced by each of these terminals. Both local and remote alarms are displayed on the front of each terminal.

It is also possible to consult, from each link end, the preset parameters in a terminal as well as data concerning the present state of the equipment, covering things such as the chronological list of alarms and events, the AGC operating point and the estimated value of the noise spectral density, which allows the S/N ratio for different bandwidths to be calculated in the programming terminal. Data transmissions made through the pilot channel take place only when there is no call transmission; they are interrupted as soon as a call appears and are resumed once the pulse transmission has finished.

OPTIONS

Up to six optional modules can be plugged into the type-D single-channel terminal. These modules carry out the following functions:

- Programmable asynchronous modem. Based on digital signal processing, this FSK modem can be preset for different bandwidths and center frequencies and for transmission rates ranging from 50 bit/s to 1200 bit/s.
- Input/Output combiner module which can be connected as a 4-way /4-wire bridge or used for four (4) auxiliary inputs and outputs.
- DSP Teleprotection modules for one function (one module) or three functions (2 modules).
- Transit Filter modules allow the selection and amplification of data channels from the superimposed band to be passed on the another communication link. A phase equalizer is included to compensate for group-delay distortion
- Equalizer. Compensation for amplitude and or group delay distortion is provided for either 1 or 2 channels.



TECHNOLOGY

The RFL 9506 Power-Line Carrier equipment and optional modules use microprocessor-based technology, digital signal processing and high performance filtering by means of active components and switched-capacitor devices. Thanks to the use of the most advanced elements in the synthesis process of the modulation signals, channel-frequency presetting can be carried out in 1 Hz steps.

GENERAL CHARACTERISTICS

Operation mode

Modulation

Single side-band with suppressed carrier and triple frequency conversion

Synchronization

By master-slave scheme, or plesiochronous (no synchronization)

Basic Bandwidth

4 kHz per channel

Pilot Tone

Functions

Automatic Gain Control (independent for each channel)
Telephone signaling
Signal-to-noise ratio measurement
Link synchronization (selectable)
Data transmission for the maintenance service (internal data)

Central Frequency

150 Hz (virtual frequency)

Modulation

By frequency-shift keying of ± 30 Hz

Maximum rate

50 baud

Generation of internal frequencies

From a single 15.36 MHz crystal-quartz oscillator:

Frequency stability within specified temperature and voltage ranges

Better than 6×10^{-8}

Ageing

Better than 6×10^{-8}

Automatic Gain Control (AGC)

Dynamic Range

≥ 55 dB with 10% pilot modulation

Efficiency

± 20 dB input level variations provoke variations of less than ± 0.2 dB at the output

Alarms

Power-supply failure
Amplifier failure
Excessive receive level
Loss of synchronism
Frequency-synthesizer failure
Pilot loss of channel 1
Pilot loss of channel 2
Low S/N ratio of channel 1
Low S/N ratio of channel 2
Card out

The alarms are sent to the appropriate link end and displayed and made available through an RS-232C interface in both local and remote terminals. In addition, each of these alarms can be assigned to one or more of four output relays — three with one voltage-free changeover contact and one with two.

Alarm relays

Contact rating 250V/2A

Programming and supervision system interface

RS-232C. Transmission rate: 300, 600, 1200, 2400, 4800 and 9600 bytes

HIGH FREQUENCY CHARACTERISTICS

Frequency range

From 40 kHz to 500 kHz

Nominal carrier frequency

Presettable in 1 Hz steps

Transmission and reception bands

Erect or inverted, adjacent or separated

Nominal impedance

Selectable between 50, 75, 125 and 140 Ω . Other values on request.

Return loss

≥ 11 dB



Transmitter

Spurious emission

In accordance with IEC 495 cls. 5.2.4 and figure 7 and A 2.

Receiver

Sensitivity

Minimum pilot level for AGC threshold: -30 dBm

Selectivity

Over 68 dB at 300 Hz and over 100 dB at 4 kHz outside the band; in accordance with IEC 495 cls. 5.3.1.5.

Frequency spacing for parallel operation on the same line

Not less than the nominal line-filter bandwidth

Parallel connection losses

In accordance with IEC 495, figure 5

AUDIO-FREQUENCY CHARACTERISTICS

Available band

From 300 Hz to 3850 Hz

Whole-band inputs/outputs

Nominal impedance

600 Ω , balanced

Return loss

≥ 20 dB

Nominal level

Programmable between -20 dBm and +6 dBm

Input limiter

In accordance with IEC 495 cls. 5.3.1.9

Output blocking

For pilot loss and/or low S/N ratio with an independent threshold value.

Teleprotection

Any input can be used for teleprotection signal transmission

Boosting control

By means of an optocoupler. Input voltage between 30 V and 190 V

E and M signaling

Call transmission

By means of an optocoupler. Input voltage between 30 V and 190 V.

Call reception

By means of a relay with a contact rating of 1A/250V

Call impulse distortion

$\leq 10\%$

SPEECH MODULE

4W input/output

Nominal impedance

600 Ω , balanced

Return loss

≥ 20 dB

Nominal level

Programmable between -20 dBm and + 8 dBm

2W telephone termination

Subscriber-side and exchange-side by means of plug-in modules

I/O nominal level

Programmable between -20 dBm and +8 dBm

2W/4W switching

By means of an optocoupler. Input voltage between 30 V and 190 V.

Speech-filter cut-off frequency

Programmable between 2000 Hz and 3400 Hz in 5 Hz steps..

Superimposed (speech-plus) band

Between 1.06 times the speech-filter cut-off frequency and 3850 Hz

Dynamic compressor/expander

In accordance with CCITT recommendation G.162

Operation

By external command. Included or excluded in rest conditions.

External command

By means of an optocoupler. Input voltage between 30V and 190V.



OPERATING CONDITIONS

Temperature and humidity

From -5 C to + 45 C and relative humidity no greater than 95%, in accordance with IEC 721-3-3 class 3K5 (climatogram 3K5)

Maximum consumption

5W Version: 100 W
20W Version: 160 W
40W Version: 210 W
80W Version: 360 W

Voltage withstanding and electromagnetic compatibility

In accordance with IEC 495 table 2

Storage conditions

In accordance with IEC 721-3-1 class IK5

MECHANICAL CHARACTERISTICS

Dimensions

5W Version 19 x 10.5 x 13.38" (482 x 267 x 340 mm)
20/40W Version 19 x 15.75 x 13.38" (482 x 400 x 340 mm)
80W Version 19 x 21 x 13.38" (482 x 533 x 340 mm)

Weight

5W Version 31 lbs. (14 kg)
20/40W Version 46 lbs. (21 kg)
80W Version 62 lbs. (28 kg)

COMPUTER REQUIREMENTS

Compatible personal computer (PC) AT or Superior
MS-DOS 3.0 or higher
VGA monochrome or color

Specifications subject to change without notice.



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