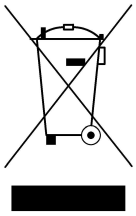
Z-AIR - UHF Radiomodem in the 868 – 870 MHz Band



In accordance with art. 13 of the Legislative Decree of 25th July 2005, no. 15 "Implementation of Directives 2002/95/EC, 2002/96/EC and 2003/108/EC, relative to reduction of the use of hazardous substances in electrical and electronic equipment, in addition to waste disposal". The crossed bin symbol shown on the equipment indicates that at the end of its working life the product must be collected separately from other waste. The user must therefore take the above equipment to the appropriate differentiated collection centres for electronic and electro technical waste, or return it to the dealer when purchasing a new appliance of equivalent type, in a ratio of one to one. Appropriate differentiated waste collection for subsequent recycling, treatment and environment-friendly disposal of the discarded equipment helps to prevent possible negative environmental and health effects and encourages recycling of the component materials of the equipment. Illegal disposal of the product by the user will be punished by application of the administrative fines provided for by the legislative decree no. 22/1997 (article 50 and following of the legislative decree no. 22/1997).





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1.0.0 General Information

The **Z-AIR** is an high quality **simplex/half duplex Radiomodem** with **integrated antenna**, operating in the **UHF 868 – 870 MHz ISM Band**.
This device is specifically designed for an **outdoor installation** and it's characterised by a **R.F. Power** of **25**, **150** or **500 mW**$_{ERP}$, automatically set by the **operating sub-band**, and a canalisation of **12.5** or **25 kHz** in according to the **ERC 70-03 Recommendation**.
This device is **Free Use** in the **whole European Union**.
At the high frequencies used in this apparatus, the losses caused by connectors and antenna wiring may significantly reduce the device operating area so, the integrated antenna, minimising these losses, improves the system efficiency.
The **RS-485 Serial Port** and the internal **switching supply unit** allow the use of a long connecting cable between the Radiomodem and its ancillaries and, to avoid any interference problems, a multicore shielded cable is used.
This cable contains all the required signals and more others such as the **RTXEnable**, operating as a remote radiomodem switch, and the outputs for external signalling Led diodes.
The radiomodem can be directly interfaced with a RS-485 equipped DTE/DCE or, using the **S107USB Converter**, with any other device equipped with an **USB Port**.
The device is completely transparent to the user and may be simply configured through a PC, using the dedicated configuring software, available for free download from our internet site www.seneca.it
The Z-AIR is enclosed in a **fiberglass tube** with **stainless steel fixing bracket and screws**, including the integrated antenna.

1.0.1 CE Conformity

The **Z-AIR** device is **compliant** to the following directives and related modifications:
EN 301 489 – 1 v 1.9.2 EMC Compatibility general directive
EN 301 489 – 3 v 1.4.1 EMC Compatibility specific for **Short Range Devices (SRD)**
EN 60950 – 1 Safety requirements plus **Attachement 11 2004**
EN 300 220 – 1 v 2.3.1 Short Range Devices specifications
EN 61000 – 4 - 4

1.1.0 Quick reference features

The **Z-AIR** is characterised by the following features:

- **Remote ON/OFF switch** via the **RTXEnable input**, driven by the **DTR** of a serial port or an equivalent external signal. This is an **active High** input, therefore the radiomodem is **active** when the **RTXEnable** is **high**.
- **Wide supply voltage range**, from **8** to **36 Vdc**, allows a long cable connection and various types of supply sources.
- **Low power consumption** in both Rx and Tx mode with **Power Saving** function to reduce the whole energy consumption. This function may be set using the **configuration software** available for free download from our website www.seneca.it.
- **Broadcasting Mode** or **Addressing management** by the configuration software or directly by the DTE..
- **Digital Repeater (Digipeater) Mode** up to **8 repeaters** to reach also very far peripherals.
- **Remote Configuration** of the units using the same operating radio channel.
- **Operating channel change by DTE.**
- **Other sophisticated features** as **ACK** with automatical **message repetition**, **NAK to DTE** at the end of the repetition cycle, **ECHO**, **Address reversal** for the answer and others.

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2.0.0 Technical Data

The **Z-AIR** is characterised by the following technical parameters:

2.0.1 Absolute Maximum Ratings

The following Table 1 indicates the maximum value that each parameter can assume and their overcoming **can damage irreversibly** the device or cause an operating condition **beyond** the **safety condition** with a considerable reduction of the reliability of the whole system.

Table 1: Z-AIR Absolute Maximum Ratings

Parameter	Description	Value
V_S	Supply Voltage (1)	**+ 36 Vdc**
I_S	Current consumption (2)	**500 mAdc**
$V_{RTXEnable}$	RTXEnable Voltage (3)	**±36 Vdc**
$I_{O-RS485}$	RS-485 Serial Port Current (4)	**± 60 mA**
$V_{RS485-GND}$	Voltage between RS-485 Serial Port and ground (4)	**-7 → + 12 Vdc**
$V_{PRS485-GND}$	Voltage peak between RS-485 Serial Port and ground (5)	Compliant to **EN 61000 – 4 - 4**
$I_{O\ Led}$	Led Driver maximum output current (6)	**10 mAdc**

NOTES:
(1) The supply voltage negative pole is **connected to Ground**.
(2) Due to the internal switching supply the maximum current consumption occurs at the **lowest supply voltage** of **8 Vdc**.
(3) The RTXEnable input **must be tied to the positive supply voltage** if this criteria is **not used**, otherwise the radiomodem is **switched OFF**.
(4) At nominal line load of **60 Ω**. The voltage/current limits are defined by the RS-485 interface chip.
(5) The peak voltage condition, at the nominal line load of 60 Ω, occurs, for example, during an electrostatic discharge. In this condition, due to the protection circuitry and the internal characteristics, the interface chip survives the event.
(6) Internally limited. Both Led outputs are protected against overvoltages by the use of a transient voltage suppressor.

2.0.2 Nominal and Operating Characteristics

The following Table 2 shows the Nominal and recommended Operating characteristics of the Z-AIR**.**

Table 2: Nominal and Operating Characteristics

General Characteristic			
Parameter	**Description**	**Value**	**Notes**
V_S	Supply Voltage	**8 – 32 Vdc**	Negative connected to ground (GND)
$I_{S-SLEEP}$	Current consumption in **Sleep mode**	**< 1 µA**	**RTXEnable** at low level, any Vs
I_{S-Rx}	Current consumption in **Rx mode**	**~ 10 mA**	@ Vs = 12 Vdc
I_{S-Tx}	Current consumption in **Tx mode**	**~ 150 mA**	@ Vs = 12 Vdc and Wo = 500 mW
$V_{O\ Led}$	Led Output Voltage	**3.4 Vdc**	No load. Internal Impedance 400 Ω.
RF Band	Operating Band (1)	**868 – 870 MHz**	With specified sub-bands
$RTX_{DataRate}$	Radio Data Speed (1)	**4.8 kbps** **9.6 kbps**	@ 12.5 kHz canalisation @ 25 kHz canalisation
$F_{Stability}$	Frequency stability	**± 1 ppm/°C**	-30 °C (-22 °F) < T < 70 °C (158 °F)
MOD	Modulation system	**9K00F1D** **18K00F1D**	@ 12.5 kHz canalisation @ 25 kHz canalisation
Antenna	Antenna type	**λ/2 integrated**	
$T_{Operating}$	Operating Temperature Range	**-30 °C → +70 °C** **-22 °F → +158 °F**	
$V_{RTXEnable}$	RTXEnable Operating Voltage (2)	**> 3 Vdc**	Active **High**. Max. voltage ±32 Vdc
$Z_{RTXEnable}$	RTXEnable Input Impedance	**~ 22 kΩ**	
Dimensions	Overall mechanical dimensions (3)	Φ 40 x L 420 mm	Including the fixing bracket
IP	Environmental protection	**IP 65**	
Directives	Reference Directives	**EN 300 220-1 v2.3.1**	
Transmitter Characteristics			
RF Power	R.F. Output Power (1)	**25 mW_{ERP}** **150 mW_{ERP}** **500 mW_{ERP}**	Depending on the selected operating sub-band in according to the **ERC 70-03 Recommendation**
ΔF	Frequency deviation (1)	**±1.8 kHz** **±3.0 kHz**	@ 12.5 kHz canalisation @ 25 kHz canalisation
W_{OStab}	Stability of the Output Power	**± 1.5 dB**	Respect to the nominal W_O

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ACP	Adjacent Channel Power	**EN 300 220-1 v2.3.1**	
$ACP_{Transient}$	Adjacent Channel Power Transient	**EN 300 220-1 v2.3.1**	
Receiver Characteristics			
Parameter	**Description**	**Value**	**Notes**
Class	Class of the Receiver	**2**	In according to **EN 300 220 – 1 v2.3.1**
LBT	Listen Before Talk (4)	**Yes**	In according to **EN 300 220 – 1 v2.3.1**
Agility	Frequency Agility (5)	**Yes**	In according to **EN 300 220 – 1 v2.3.1**
RF_{Sens}	Input Sensitivity	**< - 107 dBm**	BER < 1 x 10^{-3} @ 9,600 bps
ACR	Adjacent Channel Rejection	**EN 300 200-1 v2.3.1**	
Blocking	Blocking	**> - 36 dBm**	
Interface Characteristics			
Type	Interface type	**RS – 485**	The voltage level is **3.3 V**
Data Rate	Interface speed	**1.2 → 38.4 kbps**	
Mode	Data communication mode (6)	**Asynchronous**	Max. packet length: **11 bits**
Data Format	Allowable Data Format	**1 Start Bit** **7 or 8 Data Bits** **1 Parity Bit** **1 or 2 Stop Bits**	The packet length is fixed to **10 bits** (**Null Parity**) or to **11 bits** (**E or O Parity**). All asynchronous formats that contains 10 or 11 bits, with a start bit, may be used.
Parity	Parity management	**Yes**	Usable Parity: **Null**, **Even**, **Odd**
Operating Mode	Operating Mode	**Simplex** **Half - Duplex**	

NOTES:

(1) The configuration software allows the **sub-band** selection that automatically sets the **Rx/Tx frequencies** and the **related RF Output Power** during transmission. The **canalisation** may be set to 12.5 or 25 kHz, **independently** from the used sub-band.
All the default values for frequencies and RF Power comply to the **ERC 70-03 Recommendation**.

(2) The **RTXEnable** input **must be tied to the positive voltage** if this criteria is **not used**, otherwise the radiomodem is **switched OFF**, and it is protected against polarity reversal.

(3) The overall dimensions **do not contains** the outgoing cable.

(4) The **threshold** is set to **–100 dBm** during the production test. This operating mode may be activated **independently** from the Agility.

(5) In this mode a **maximum** of **3 channels** may be activated. The use of a **non adjacent** pair or tern of channels is recommended to improve the performances using the Agility. This operating mode may be activated **independently** from the **LBT**.

(6) The microcontroller UART capability to manage up to 11 bits packet allows the usage of many data formats besides the most common **8**, **N**, **1**. The unique limit is the number of bits may be 10 or 11 depending on the **Parity** selection. The Serial Port formats and parameters may be set using the configuration software.

3.0.0 Circuit description

The Z-AIR Radiomodem is made up by a **motherboard**, containing the switching supply, the RS-485 Interface and all the ancillary circuits, the **dipole antenna** and, finally, the radiomodem module.

- The **Switching Supply** receives the positive input voltage, in a range from **8** to **32 Vdc**, and provides a **stabilised supply voltage** of **3.5 Vdc** to all the sections of the device.
- The **RTXEnable criteria** operates as a **solid state switch** allowing the **remote control** of the device. It's an **Active High input**, therefore the device is **switched ON** if a **positive voltage**, from **3** to **32 Vdc**, is connected to this input. If the remote control is not required, this input **must be tied** to the **positive supply input** to operate the radiomodem, otherwise the device is **switched OFF**. The radiomodem waits the configuration string for **500 milliseconds** after the turning ON, therefore the unit becomes active after this time.
- The **RS-485 Interface** operates with a **3.5 Vdc** supply and both **"A"** and **"B"** lines are protected against overvoltage conditions using a **Transient Voltage Suppressor (TVS)** device. To allow an **equipotential connection** between the device and the external DTE/DCE, it's **recommended** to connect also the **Ground wire** between the two devices. In this mode both the A and B lines of the two devices are referred to the **same common potential**.
- A **Dipole Antenna** on the printed circuit of the motherboard, directly connected to the Antenna Input/Output of the radiomodem to avoid the losses of cable and connectors.
- Two outputs for **signalling** are available and **may drive directly** the Led diode. One of these indicates the **Transmission status (ON AIR)** while the other indicates the **Power On status** of the device. Due to the internal resistor each Led diode **may be directly connected** between the output and the **ground**. These outputs can drive an **optocoupler** or an **active high input** of, for example, a microcontroller. In this case the output voltage range is from **0** to **3.4 Vdc**. with a **400 Ω** internal impedance.

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3.1.0 Cable connections, Supply and Installation Notes

In the following paragraphs are explained the device wiring, its identification and accessories and the rules for a good installation.

3.1.1 Cable connections

The following Table 3 shows the connection to the multiple wire coaxial cable.

Table 3: Wiring connections

Signal Name	Signal Type	Cable Colour
+ Vcc	Input	**Orange**
- Vcc / GND	Bidirectional	**White / Orange**
RTXEnable	Input	**White / Green**
RS-485 "A"	Bidirectional	**Brown**
RS-485 "B"	Bidirectional	**White / Brown**
RS-485 "GND"	Bidirectiona	**Green**
ON AIR Led	Output	**White**
PWR ON Led	Output	**Blue**
Cable Shield / GND	Bidirectional	**Connected into the Radiomodem (1)**

NOTES:

(1) To avoid the **"Ground Loop"** the cable shield is connected **into** the Radiomodem and **must not be connected to ground**. In this mode the shield is **equipotential** and performs the maximum shielding effect.

3.1.2 Supply Notes

The supply voltage of the Z-AIR is included in the **8 → 32 Vdc** range and the source of this voltage may be not stabilised, due to the internal switching regulator. The supply voltage input is **protected against the polarity rever-sal** but there is not an **internal fuse** because, in case of fault, its replacement would be not easy. For this reason the fuse **must be placed** in the supply source and its nominal value is of **750 mAF (Fast blowing)**. A standard **5 x 20 mm** fuse, with its **holder**, is adequate to protect the whole device.
During the transmission the current consumption reaches the higher value, therefore the length of the multicore cable **limits the minimum supply voltage** of the device. This value may be calculated by the following formula (1):

Minimum DC Supply = 0,085 x L + 8 Vdc (1) where:

L is the **cable lenght in metres** and
8 is the minimum supply voltage of the radiomodem.

For example an installation with **10 m** of cable requires the following minimum DC Supply voltage:
Minimum DC Supply voltage = 10 x 0,085 + 8 = 0,85 + 8 = 8,85 Vdc, practically **9 Vdc**.

3.1.3 Installation Notes

The device may be installed indifferently on a **wall** or on a **pole** but, in both cases, the device **must not be shielded** by the wall or the pole. To avoid this shielding effect the device **must to put out** the wall or the pole.

- To fasten the device to a **wall** please use the two holes in the fixing bracket with adequate screws. The holes diameter is of **6.25 mm (0.246")** so a **6 mm (0.236")** diameter screw is required. It's recommended to use a **stainless / zinc plated steel** screws to avoid corrosion.
- To fasten the device to a **pole** it's necessary to drill the pole in correspondence with the fixing bracket holes using two adequate screws. As above it's recommended to use a **stainless / zinc plated steel** screws to avoid corrosion.
  An alternative method is to lean the bracket open side to the pole and use **two**, or more, **metallic ties** to fix the bracket strictly to the pole. As for the screws also these ties must be in **stainless / zinc plated steel** to avoid corrosion.

In all cases the outgoing cable **must be fixed to avoid any traction phenomena** and the cable must form a bend to avoid the return of water in the device. The use of plastic ties or clips, in the wall fixing, it's recommended to avoid damages to the cover of the cable.

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4.0.0 Configuration and use of the Radiomodem

In the following paragraphs is shown the configuration and the use of the Z-AIR Radiomodem.
The products is released from factory with a **Default configuration** allowing the immediate use of the device in the majority of applications. To modify this configuration it's necessary to use the configuration software available, for free downloading, in our website: www.seneca.it
Because the Z-AIR utilise a **RS-485 Serial Port**, a **RS-232 to RS-485** or a **USB to RS-485 converter** is needed to configure the device, because the majority of current notebook computers uses only the USB ports.

4.0.1 Default Configuration

A new, never configured Z-AIR contains the following Default Configuration:

- Channel : **869.4125 MHz** in **Broadcasting Mode**, transparent to the user.
- R.F. Output Power : **500 mW**. The configuration software allows to modify it into **L**ow (=25 mW), **M**edium (=150 mW) and **H**igh (=500 mW).
- Radio Data Speed : **9.6 kbps** with a **25 kHz canalisation**. The configuration software allows to modify it into **12.5 kHz canalisation** with a Data Speed Radio of **4.8 kbps**.
- UART Data Speed : **9.6 kbps** with **8**, **N**, **1** format, **No flow control** and **Buffer size** of **448 Bytes**. The configuration software allows to modify both UART Speed and format but **not** the Buffer size.

This configuration allows the operation of the device in the majority of the applications simply connecting the Serial Port to the external device and the Supply. If a specific configuration is required, it's necessary to use the configuration software to modify this default configuration in according to the required performances.

4.1.0 Special Functions

The Z-AIR Radiomodems allows some interesting special functions as recommended and required by the EN 300 220 – 1 v2.3.1 directive. These functions are shown in the following paragraphs.

4.1.1 Duty Cycle Limitations

The EN 300 220 directive imposes a **Duty Cycle limit for each sub-band**. The Duty Cycle calculation utilises a **mean time of 1 hour** so, for example, a **10% Duty Cycle** implies a **maximum transmission total time** of **6 minutes for each hour** of device utilisation. This limitation **may be bypassed** using the **AFA and LBT functions**.

4.1.2 LBT, Listen Before Talk

Enabling this function the Radiomodem, before transmitting a message, checks the channel **occupation** for **5 milliseconds**. If the channel is **continuously free** for this time, it starts the transmission, otherwise, after this time, the radiomodem repeats the process until the channel is free. In this case the **waiting time** before the transmission is **5 milliseconds** plus a **random time** from **0** to **5 milliseconds,** in **0.5 milliseconds steps**. The **Input Signal Threshold** to define the channel status is set to **–100 dBm**, in according to the above directive that also imposes a **time interval of 100 milliseconds** between two transmissions if the LBT is enabled.

4.1.3 AFA, Adaptative Frequency Agility

This function is **automatically enabled** when **more than 1 channel is selected** in the configuration software that allows the selection of **2** or **3 operating channels** between the 6 available. In this operating mode the device **scans continuously** the selected channels and utilise, to transmit the message, the **less interfered channel** between the selected ones. Of course the AFA function **must be activated on the same channels** in **all the devices of the network** to operate correctly.
The use of this feature **improves** the communication reliability, **but increases** the communication time. In fact the message **preamble length**, normally of **5.83 milliseconds** @ 9.6 kbps without AFA**,** increases to **20.75** and **30.71 milliseconds** if **2** or **3** channels are selected.
Enabling **also** the **LBT** function, the channel that respect the threshold limit between the selected channels is used for the transmission and, as above indicated, the use of the two functions **bypasses** the **Duty Cycle limitations** in **all operating sub-bands**.

4.1.4 PwSav, Power Saving function

This function may be activated to **reduce the power consumption** of the whole device and may be particularly useful in battery operated systems. Normally the device is in receiving mode for the majority of the working time while the transmitting time is short and, especially in the peripherals, quite rare.
The Power Saving function operates **alternatively switching ON** and **OFF** the device, with a fixed **ON/OFF Ratio** that can be set during the configuration procedure. It's important to notice as the device, during the OFF time, is in **Sleep mode**, therefore it's completely **insensitive** to **any incoming messages** from **Serial Port** and may be waked up only by an incoming message from radio.

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The **ON Time** is internally set to **10 milliseconds**, for 25 kHz canalisation, or **13 milliseconds**, for 12.5 kHz canalisation, and **cannot be modified** while the **OFF Time** may be set by the user in the **PwSavOff field** of the configuration software. Of course **all** the devices in the communication network **must be set** with the **same PwSavOff** value for a correct operation.
The reduction of the power consumption **slows** the communication, because the **preamble length is increased by the selected PwSavOff time**.
The **Total transmission time** is the sum of the **Total preamble length** plus the **Total data time** depending on the data length, the selected canalisation and the use of AFA.
The EN 300 220-1 directive impose a **maximum Total transmission time** of **1 second** therefore the **maximum PwSavOff time that** may be set is given by the following formula (2) and (2a), respectively for 12.5 or 25 kHz canalisation. These formulas are valid for the worst operating conditions, i.e. maximum protocol length and AFA activated on 3 channels:

PwSavOff ≤ [1,000 – (42+N) x 1.667] : 10 (2) for **12.5 kHz canalisation** and

PwSavOff ≤ [1,000 – (57+N) x 0.833] : 10 (2a) for **25 kHz canalisation** in which:

42 and **57** are the **maximum number of protocol Bytes**,
N is the **message (payload) length in Bytes** and
1.667 and **0.833** is the **Byte Time** in **milliseconds**, respectively at 12.5 and 25 kHz canalisation.

The results of these formulae **are the value to insert** in the **PwSavOff field** of the configuration software.
For example a **100 bytes** message (**N=100**) originates a PwSavOff value of **:**

PwSavOff ≤ [1,000 – (42+100) x 1.667] : 10 ≤ [1,000 – 236.72] : 10 ≤ 763.28 : 10 ≤ 76.328 (76) or

PwSavOff ≤ [1,000 – (57+100) x 0.833] : 10 ≤ [1,000 – 130.78] : 10 ≤ 869.22 : 10 ≤ 86.922 (86) respectively at **12.5** or **25 kHz canalisation**. The values into brackets are the ones must be inserted into the **PwSavOff** field.
The receiving of an incoming packet from radio exits the device from the Power Saving cycle and it remains **fully active** for the **PwSava time** set in the configuration software. During this time the **answer is transmitted** with a **standard short preamble**, to speed up the communication and, after this time, the device comes back in the Power Saving cycle.
The **PwSava** timer step is **100 milliseconds** so, for example, a **PwSava = 15** means a time interval of **1.5 seconds**. This value depends on the function of the device. If the device is used as peripherals, this time must be the minimum possible to allow the DCE/DTE answer to an incoming message because, during the PwSava time, the power consumption of the unit is high. When the unit is used as **digipeater (digital repeater)**, the PwSava time is **calculated by the firmware**, independently from the value set in the field of the configuration software, therefore the PwSava value may be the same of the unit used as a peripheral.
The value **PwSava = 255** keeps the unit **always active**, including the **serial port**, but allows the management of both **short** and **long preamble messages** and may be used in all the units not require a Power Saving mode, i.e. all the units fed by the AC mains or an high capacity supply system.

5.0.0 Z-AIR Configuration.

The Z-AIR Radiomodem may be configured by the configuration software available for free download from our website: www.seneca.it
The software may be installed on a Personal Computer equipped with **Windows OS**, from **Windows '95** to **Windows 7.** Please follow the instruction and install the program in a specific directory such as, for example, **C:\ZAIR** or similar. This may be useful because the configuration files of any device may be saved into this directory. The configuration files are saved with the **.rmn extension**.
The configuration procedure is the following:

1 – Install the configuration software in your PC. The computer **must be provided** of a **USB Port** or, in alternative**,** of a **RS-232 Serial Port**. In the 1st case a **USB to RS-485 converter** is required. In the 2nd case a **RS-232 to RS-485 converter** is needed and a standard converter may be used.
2 – Connect the Z-AIR Radiomodem to the supply unit and to the PC, through the serial port converter.
3 – Open the configuration software and in the **Option Menu** choose the **COM Port**, in according to the availability of your computer, and, successively, the desired **Operating Sub-Band**. For each sub-band are specified the **Maximum R.F. Power** and the **Maximum Duty Cycle**, in according to the EN 300 220 – 1 v.2.3.1 directive.
4 – With a **switched OFF** radiomodem, push the **Turn ON button**. The button **will blink** for a **time of 5 seconds** and during this time **turn ON the radiomodem** to enter it in the **Configuration Status**.
5 – Set the radiomodem parameters to your specifications for the required use and finally push the **Write button** to store these parameters into the radiomodem. A specific configuration file **may be saved** on your PC using the **Save as** option of the **File Menu**. In this mode the complete configuration file of the device is stored into the PC and may be used to reconfigure the same or an other device. This procedure may be repeated for each radiomodem.
6 – To **exit** from the configuration procedure please push the **Turn OFF button**, and **disconnect the radiomodem from supply unit**.

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The configuration software contains **three pages**: **Basic**, **Advanced** and the **Link Test** page.

5.1.0 The BASIC Page

In this page are shown all the **basic parameters** of the device specified for each operating channels. For each values and each field, the Copy/Paste function is available, therefore the fundamental parameters of the device can be copied in each channel.

5.1.1 System Code

This parameter identifies the communication network and, of course, **it must be the same in all the devices of the network**. The default value is **1** but may be useful to change it because a neighbouring network, if uses the same radiomodem model, may interfere with ours. The use of a different System Code prevents the receiving of the messages from the interfering network.

5.1.2 Rx and Tx Frequencies

Both the Rx and Tx frequencies are indicated in **kHz**. For example **869.412.50 is equivalent to 869,412.50 kHz** or to **869.4125 MHz**. **All the devices in the network must use the same frequencies/channels**, otherwise **no communication is possible**. If **no one channel is selected**, the radiomodem is **automatically set to use the Channel 1**. To select an operating channel, **check off the box** on the right side of the Channel. Checking off **two or three** boxes, the **Adaptative Frequency Agility (AFA) function** is **automatically enabled** (please refer to § 4.1.3). The default values, for both 12.5 and 25 kHz canalisation may be changed by the user. Of course, any changes in the operating channel/frequency of one device must be copied into **all other devices of the network** to ensure the communication**.**

5.1.3 RTC upd (Real Time Clock Update)

This parameter controls the sending of a **Real Time Clock** data in the transmitted packet. This option is **available only for specifically designed Software** and **is not implemented** in standard devices.

5.1.4 LBT (Listen Before Talk)

If selected, checking the related box, the device "listen the channel" before transmitting and transmits only if the average signal on the operating channel is **less than –100 dBm**. Please refer to paragraph 4.1.2 for more details.

5.1.5 Broad. (Broadcasting)

In this operating mode **all the devices release the incoming message to their communication port**. This is the **Default Operating Mode**, as explained in the paragraph 4.0.1. To obtain this behaviour both the **Its Addres** and the **Target addres are not considered**. The **Its Address**, that identifies each radiomodem, **must be different for each radiomodem** to allow the use of the **advanced features and utilities**, such as the **Link Test**.
A network in **Broadcasting Mode** can use **one and only one unit as Digipeater**, if the devices use the configuration parameters. A **Broadcasting Mode message** can be sent in a no broadcasting mode network, using a particular addressing method as explained in the related paragraphs**.**

5.1.6 Power (R.F. Output Power)

For each selected operating sub-band the output power is **automatically set** to the correct value imposed by the EN 300 220 – 1 v 2.3.1 directive. **Only** in the **869.400** to **869.650 MHz band**, in which is permitted a **500 mW$_{ERP}$** output power, is available the choice of the output power between **three values**: **L = 25 mW**, **M = 150 mW** and **H = 500 mW**.

5.1.7 Flow Control

The use of the **RS-485 Serial port** inhibits the **Flow Control**, therefore the related box is **inactive** (grey colour).

5.1.8 Time DTX

This value defines the **delay time** between the **end of an incoming message** from the **Serial Port** and its **transmission**. It's used to avoid a partial packet transmission, if a **dead time** is present between the **incoming bytes**. The default values of **10 milliseconds it's generally adequate** to avoid this phenomena but may be increased until it ceases.

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5.1.9 Baud Rate DTE / Parity

Selects the Serial Port **data speed** in a range from **1,200** to **38,400 bps**. It **must be equal to the DTE/DCE baud rate** to assure the correct communication. The default values is **9,600 bps**. The **Parity** box permits the choice of the value of the **Parity Bit**, if used. The permissible values are **N = None**, **E = Even** or **O = Odd**. The default value is **N = None**.

5.1.10 Dig. In Repet. Time

This function is **not available** on the Z-AIR Radiomodem, therefore the related box is **inactive** (grey colour).

5.2.0 The ADVANCED Page

In this page are shown all the **Advanced Parameters** of the device, specified for each operating channel. As in the Basic page, a Copy/Paste function is available for each parameter and field, therefore the parameters can be easily copied into all channels**.**

5.2.1 Its Address

This parameter **identifies** the device. The allowable value varies from **1** to **255**. Each device in the network **must be identified** with a **different Its Address** to allow all the implemented functions. The value **Its Addr = 1** is generally assigned to the **Master Unit** of the network. When a network utilises the **Power Saving procedure**, this value identifies a **Master unit followed by an always active digipeater chain**, therefore the message is sent with a **standard short preamble**, if it is **directed to a Digipeater**, while is sent with **long preamble**, determined by the **PwSavOff time**, if it is **directed to a peripherals**.
In the Master units using a **Power Saving Mode Digipeater chain**, the Its Addr value **must be > 1** such as 2 or 3 etc. etc.
To allow the management of messages with different preambles length, both the **Master** and **all the always active Digipeater units must be set with PwSava = 255,** while the digipeaters in **Power Saing Mode will have** a different PwSava value. The use of an always active Master and Digipeater chain reduces significantly the propagation time of the message in a Power Saving network, allowing an higher communication speed**.**
Of course, both the **Master** and **all the Digipeaters** must be fed directly by the AC main or by a supply source without any capacity limitation, because the devices are **always active** with their standard current consumption.

5.2.2 Target

It's the **address** of the message addressee. The allowable value varies from **1** to **255**. In all configuration modes this value **must be set** but if a **Broadcasting Mode** or a **Addressing from DTE Mode** is selected this value is **not considered**. It's recommended to set this value **different** from **Its Addr**ess. Normally the **Target** address of the **peripherals** is the **Its Addr**ess of the unit use as **Master**, while the **Target** address of the Master is one of the **Its Addr**ess of the **peripherals**.

5.2.3 Digip. (Digipeater Address)

It's the **address** of the unit used as **Digital Repeater (Digipeater)**. The allowable value varies from **1** to **255**. The value **Digip. = 0** shows that is **not used a Digipeater**. In a **Broadcasting Mode** network the digipeater unit **first repeats the message** and, **successively, releases it** to its serial port while in an **Addressing from DTE** network, the digipeaters **only repeat the message without releasing it** to the serial port. In this networks, using the address from DTE, the value in the Digip. field is **not used** and the correct addressing **must be done** by the DTE.

5.2.4 ACK (Acknowledge)

This option allows the target unit to send an **Acknowledge answer**, when it receives correctly a message. The source unit repeats the message **until the receiving of an ACK** or the **expiry of the repetitions Number** set in the **Repetition field**. It's important to notice as this function **slows the communication**, due to the presence of the ACK message, specially if it is not immediately received. In the majority of applications an ACK control is made by the application, therefore it's not necessary to enable this feature.

5.2.5. Repetition

Indicates the number of **repetitions** of the message if an ACK is **not received**. The allowable values varies from **1 to 255** and this field is **inactive if the ACK is unselected**.

5.2.6 NAK to DTE

If the **ACK function is enabled,** at the **expiry of the repetitions** the device send a **NAK character (ASCII 21 =§)** to the DTE, to signalling the communication failure. This function is available **only if is enabled the ACK**.

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5.2.7 Addr to DTE

If enabled, the radiomodem sends to the DTE the **Address byte of the message source unit**. The position of the byte is **before the payload**, i.e. is the **1st byte of the incoming message** and it is **contiguous to the payload**.

5.2.8 Rx Addr for Tx (Received Addresses for Transmission)

This feature allows the radiomodem to **store**, temporarily, in its memory the **addresses of the last received message** and to **use them, reversed, for the answer**. This feature simplifies significantly the answer management in the peripherals.

5.2.9 Echo

This feature is **not available in Broadcasting Mode**. In other operating modes may be useful to **test the Radio link**, because the message sent to the target unit is **returned** to the sending unit to verify the communication. In the target unit the message **is not released** to its serial port, therefore this function verifies **only the Radio link** and **not the serial port integrity**.

5.2.10 Addr from DTE (Addressing from DTE)

This function is available **only** if **Rx Addr for Tx is not enabled**. If this function is enabled, the **DTE must create the Addressing string** that is sent as **Head of the sending message (payload)**. This string **must be contiguous to the payload without any dead time** between the two ones. The addressing string is composed by the following bytes in the **exact sequence of sending**:

1st – The **System Code byte** that **must be the one** of the network.
2nd – A **Flag Byte** in which the 1st bit (LSB) is the **Broadcasting**, the 2nd is the **Echo**, the 3rd is the **ACK** and the 4th is the **Diagnostic Request** while **all t**he other **4 bits** are set to **0**. Please refer to the online help of the configuration software for more details on the Diagnostic Mode.
3rd – A **Number of Addresses Byte**, showing the total number of following addresses, including the digipeaters and the target addresses.
4th (to **11th**) – The **Digipeaters Addresses Bytes**, from a minimum of **0** (no digipeater used) to a maximum of **8** digipeater units, positioned under the **correct sequence of routing**.
4th (to **12th**) – The **Target Address Byte**, showing the address of the target unit of the message.

As appears clearly from the above list, the **string length** may vary as function of the **network complexity**, from a **minimum of 4 bytes** to a **maximum of 12 bytes** depending on the number of the required digipeaters. In this string the **last byte is always** the **address** of the **target unit** and these additional bytes **don't modify the maximum message (payload) length of 448 bytes**.

5.2.11 PwsavOff (Power Saving OFF Time)

Set the **turn OFF time** of the receiver in the Power Saving Cycle. The time step is of **10 milliseconds** and the allowable values vary from **1** to **240**, equivalent to 10 milliseconds to 2.40 seconds. The value **PwsavOff = 0** keeps the unit **always active**. This time is used to define the **preamble length** therefore **all the units in the network must be set with the same PwsavOff time**. The **turn ON time** of the unit is internally set to **10** or **13 milliseconds** respectively for a **25** or **12.5 kHz canalisation**. Please remember as the EN 300 220 v.2.3.1 directive imposes a **maximum transmission time ≤1 second**. Please refer to § 4.1.4 for more details.

5.2.12 PwSava

It defines the **delay time**, after a receiving message, to **come back in the Power Saving Cycle**. The **PwSava time step** is of **100 milliseconds** and the admissible values vary from **1 to 254** corresponding to a **100 milliseconds** to **25.4 seconds**. The value **PwSava = 0** means an **always active** unit while the value **PwSava = 255** allows the unit to manage incoming messages with **variable length preambles**. In fact, during the receiving of an incoming message from the radio, the unit **exits** from the Power Saving cycle and remains active, in this time interval, to allow the answer to the incoming message. Normally this value may be kept quite low to reduce the power consumption because, in this time interval, the unit shows its standard power consumption. Generally, because the answer from the connected DTE/DCE is practically immediate, a value of **5 (500 milliseconds)** or **10 (1 second)** is adequate. In the units used as **Digipeaters**, the Pwsava time is **internally calculated by the firmware**, therefore is not necessary to calculate it and, also for these units, may be set the **same time** used for the peripherals.

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5.3.0 The Link Test Page

The Link Test is an utility to control the efficiency of the **Radio Link**. It can show both the communication error or the RSSI value of the received R.F. signal in both local and remote units. This program may be useful when a communication failure occurs to determinate if the problem is in the Radio Link, such as an interfering signal, or if the problem is in the remote DTE/DCE.
The program requires an **univocal identification of each unit,** i.e. a **different Its Addr**ess for each unit of the network.
Starting with a turned OFF device, the correct sequence is the following:

1 – Push the **Turn ON** button in the Configuration software. It starts to blink in green colour for 5 seconds
2 – During this time interval (5 seconds), **turn ON the device supply** to **enter in configuration mode**
3 – Press the **Read** button to verify the entry in configuration mode
4 – Open the Link Test page
5 – Press the **OK** button to read and save the existing configuration and going to the Step 2 page
6 – **Turn OFF the device supply**
7 – Turn ON the device supply to enter in **normal operating mode**
8 – Enter the required data to execute the test (target and digipeaters addresses)
9 – Execute the packet quality test or the remote diagnostic test as desired.
10 – Stops the test and **turn OFF** the radiomodem
11 – Push the **Exit/Restore button** and within **5 seconds turn ON** the radiomodem to enter in configuration mode
12 – Wait for the complete restoring of the operating configuration
13 – **Switch OFF** the radiomodem

5.4.0 Channel change by DTE

The choice between the available channels may be done directly from DTE during the use of radiomodem, avoiding to put it into configuration mode. This function is **active only if the Addr from DTE option is active**, may be used **also in Broadcasting Mode**, but **cannot be implemented if the AFA is active**. To obtain the channel change, a **specific frame must be sent from DTE to the device**. This frame contains **3 bytes** in the following sequences:

0x00 – 0x10 – 0x"New Channel Number", for a normal **Addr from DTE network**, or
0x00 – 0x11 – 0x"New Channel Number"h, for a **Broadcasting Mode network**.

In both cases the **New Channel Number** may varies from **0x01** to **0x06** because **6** are the maximum available channels, **3** if is selected the 25 kHz canalisation.
After a channel change, please wait at least **2 milliseconds before starting the normal operation**, to permit the complete parameter change

5.4.1 Use of the Diagnostic out of the Configuration program

The Z-AIR radiomodem allows the Diagnostic Mode without entering in the Configuration program. To allow this feature the radiomodem **must be configured** in a **Addressing from DTE Mode** and a particular hexadecimal string **must be sent** to the Radiomodem.
The required string, in according to the Address from DTE Mode, please refer to paragraph 5.2.10, is composed as follows:

1 – The System Code Byte, equal to the System Code of the network
2 – A **Flag Byte** of value **0x08** which enable the **Diagnostic Flag** and, consequently, the **Diagnostic answer** from the remote unit
3 – A **quantity of Addresses Byte** that shows the total number of addresses in the route
4 – The **Digipeaters addresses bytes,** listed in the exact sequence of routing, with a maximum of 8 digipeater units
5 – The **Target Address Byte** and
6 – **A "message" byte**, to emulate the Link Test protocol. This byte can assume any binary value from **0x01** to **0xFF**.
In this mode the remote unit sees a message identical to a "Link Test Mode" and answers with its diagnostic parameters such as Battery Voltage and RSSI.
The diagnostic answer from the remote unit contains both the **Battery Voltage and the RSSI** which the local unit adds the **Local RSSI**, as explained in the Link Test procedure. To obtain the effective values of the RSSI and Battery Voltage measurement it's necessary to apply the following formulas (3) and (4):

RSSI (dBm) = (RSSI value : 2) – 130 (3)
V_{BATT} (V) = (V_{BATT} value) : 21,1 (4)

It's important to remember as all the measured value are in **binary/hexadecimal code**, therefore these values **must be converted** into **decimal code** before apply them in the related formula.
For example the measured RSSI values of **0x70**, equal to **decimal 112**, determines an effective RSSI of:

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RSSI (dBm) = (112 :2) – 130 = 56 – 130 = -74 dBm

and, in the same way, the measured value of $\mathbf{V_{BATT}}$ = **0x47**, equal to **decimal 71**, determines a Battery Voltage of:

$\mathbf{V_{BATT\ (V)}}$ **= (71) : 21,1 = 3,365 Vdc**.

The value of the Battery Voltage shows the supply voltage of the transceiver integrated circuit, therefore it remains constant, if the supply source is stabilised, otherwise it may vary, if the supply voltage is derived from a battery.

All stated specifications are subjected to change without notice or obligation.

SENECA s.r.l.
Via Austria, 26 – 35127 PADOVA – ITALY
Tel. +39 049 8705 359 (408)
Fax +39 049 8706 287

www.seneca.it - info@seneca.it

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