

UHF RFID System



BLUEBOX Embedded Module M950 **4 RF Ports, 1 W RF Power**

BLUEBOX
RFid System

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Safety Instructions / Warning - Read before start-up!

- The device may only be used for the intended purpose designed by the manufacturer. The operation manual should be conveniently kept available at all times for each user.
- Unauthorized changes and the use of spare parts and additional devices that have not been sold or recommended by the manufacturer may cause fire, electric shocks or injuries. Such unauthorized measures shall exclude any liability by the manufacturer.
- The liability-prescriptions of the manufacturer in the issue valid at the time of purchase are valid for the device. The manufacturer shall not be held legally responsible for inaccuracies, errors, or omissions in the manual or automatically set parameters for a device or for an incorrect application of a device.
- Repairs may be executed by the manufacturer only.
- Only qualified personnel should carry out installation, operation, and maintenance procedures.
- Use of the device and its installation must be in accordance with national legal requirements and local electrical codes.
- When working on devices the valid safety regulations must be observed.

This manual applies to the following devices:

Description:

Order Number:

Read / write 1W UHF RFID OEM device with one external antenna. Serial TTL 0-5V communication interface. EU1 (865 MHz ... 868 MHz) version.

1041U

Read / write 1W UHF RFID OEM device with one external antenna. Serial TTL 0-5V communication interface. FCC (902 MHz ... 928 MHz) version.

1041U-FCC

Read / write 1W UHF RFID OEM device with one external antenna. Serial TTL 0-5V communication interface. Brazil (902 MHz ... 928 MHz) version.

1041U-BRA

Read / write 1W UHF RFID OEM device with one external antenna. Serial RS232 communication interface. EU1 (865 MHz ... 868 MHz) version.

1051U

Read / write 1W UHF RFID OEM device with one external antenna. Serial RS232 communication interface. FCC (902 MHz ... 928 MHz) version.

1051U-FCC



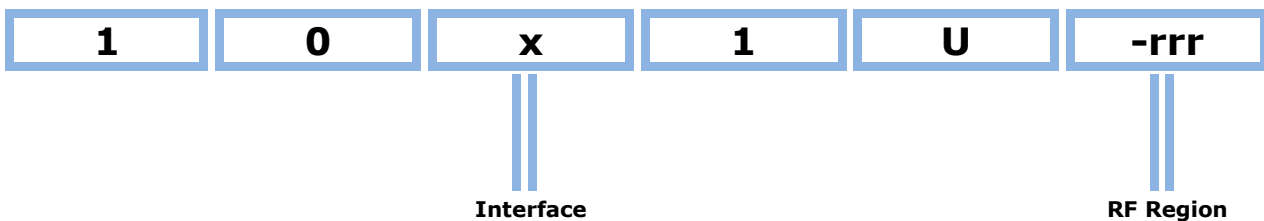
Read / write 1W UHF RFID OEM device with one external antenna. Serial RS232 communication interface. Brazil (902 MHz ... 928 MHz) version.

1051U-BRA

This manual is valid as of firmware version:

Order Number	Hardware Version	Firmware Version
1041U	2	2.61Q
1041U-FCC	2	2.61Q
1041U-BRA	2	2.61Q
1051U	2	2.61Q
1051U-FCC	2	2.61Q
1051U-BRA	2	2.61Q

Hereinafter the product identification system:



Interface:	4	=	Serial TTL 0-5V
	5	=	Serial RS232
RF Region:	Blank	=	EU1 (865 MHz ... 868 MHz)
	FCC	=	FCC (902 MHz ... 928 MHz)
	BRA	=	Brazil (902 MHz ... 928 MHz)

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1 Introduction

The **BLUEBOX OEM UHF 4CH 1W** module, hereinafter named **BLUEBOX**, is a little (dimensions 66.00 x 45.00 x 6.50 mm) read/write RFID device for industrial application and is suitable to be integrated in equipments that require 840 MHz – 960 MHz RFID technology. The **BLUEBOX** module communicates with a 'host' system (typically the equipment in which it is integrated) through a RS232 serial line (item 1541U-rrr) or a CMOS/TTL serial line ((item 1041U-rrr) and acts as a joint through a set of commands between the host system and a RFID tag present near the antenna. A 'master/slave' protocol is used for the communication between the 'host' system and the **BLUEBOX** module. Through the serial line, it is also possible to configure the functional parameters and to upgrade the firmware, the 'BLUEBOX Show' program of the SDK is foreseen to explicate these operations. Furthermore, the **BLUEBOX** module is able to handle two digital I/O. The **BLUEBOX** module is furnished without the antenna that must be arranged by the user. The connections are available on two rows of twelve solder pins (pitch 2.54 mm). The **BLUEBOX** integrates an antenna matching network and an auto-tuning procedure which allows to improve its performances with different antennas in different environments.

2 Technical Specifications

2.1 Technical Specifications 10x1U

	1041U	1051U
Power Supply	5 Vdc +/- 5%	
Power Rating¹	max 10W @RFOUT=30dBm CW typ 66mW sleep mode, no RF typ 194mW standby mode, no RF	
Sleep Mode Recovery Time¹	typ 57.8ms	
Operating Frequency	EU1: 865 MHz ... 868 MHz	
RF Transmit Power	Max 1 W (30 dBm) conducted	
RF Receive Sensitivity	Max -85dBm	
Antenna	Up to 4 external	
Antenna Connection	U.FL 50Ω	
Reading Distance²	10mt	
Supported Transponders	ISO 18000-63 ³ (EPC Class-1 Gen-2 V2)	
Communication Interface	Serial TTL 0-5V	RS232
Signalling	4 LEDs	
Digital I/O	2 'universal' channels that can be configured as input or output	

¹ Typical ratings are not guaranteed. The values listed are at room temperature (25 °C), nominal supply voltages.

² Reading distance depends on transponder type, antenna and environmental conditions.

³ ISO 18000-6C became ISO 18000-63 in 2012 due to ISO naming rules that do not allow letters in standards names.

	1041U	1051U
I/O as Input	Presents a 100 kΩ pull up resistor connected to the + of the power supply of the module; it can be used with a 'clean' switch, wired between the connection pin and the – of the power supply, or with a NPN transistor, with the collector on the connection pin and the emitter on the – of the power supply	
I/O as Output	Presents a NPN transistor with the collector on the connection pin and the emitter on the – of the power supply and a 100 kΩ pull up resistor internally wired to the + of the power supply; can be used with a load wired between the connection pin and the + of the power supply; max current 80 mA	
Dimensions	66.00 x 45.00 x 6.50 mm	
Operating Temperature	-20°C ÷ +65°C	
Storage Temperature	-40°C ÷ +85°C	
Humidity	Up to 95%, non condensing	
Connections	Solder strips, pitch 2.54 mm	

2.2 Technical Specifications 10x1U-FCC

	1041U-FCC	1051U-FCC
Power Supply	5 Vdc +/- 5%	
Power Rating⁴	max 10W @RFOUT=30dBm CW typ 66mW sleep mode, no RF typ 194mW standby mode, no RF	
Sleep Mode Recovery Time¹	typ 57.8ms	
Operating Frequency	FCC: 902 MHz ... 928MHz	
RF Transmit Power	Max 1 W (30 dBm) conducted	
RF Receive Sensitivity	Max -85dBm	
Antenna	Up to 4 external	

⁴ Typical ratings are not guaranteed. The values listed are at room temperature (25 °C), nominal supply voltages.

	1041U-FCC	1051U-FCC
Antenna Connection	U.FL 50Ω	
Reading Distance⁵	10mt	
Supported Transponders	ISO 18000-63 ⁶ (EPC Class-1 Gen-2 V2)	
Communication Interface	Serial TTL 0-5V	RS232
Signalling	4 LEDs	
Digital I/O	2 'universal' channels that can be configured as input or output	
I/O as Input	Presents a 100 kΩ pull up resistor connected to the + of the power supply of the module; it can be used with a 'clean' switch, wired between the connection pin and the - of the power supply, or with a NPN transistor, with the collector on the connection pin and the emitter on the - of the power supply	
I/O as Output	Presents a NPN transistor with the collector on the connection pin and the emitter on the - of the power supply and a 100 kΩ pull up resistor internally wired to the + of the power supply; can be used with a load wired between the connection pin and the + of the power supply; max current 80 mA	
Dimensions	66.00 x 45.00 x 6.50 mm	
Operating Temperature	-20°C ÷ +65°C	
Storage Temperature	-40°C ÷ +85°C	
Humidity	Up to 95%, non condensing	
Connections	Solder strips, pitch 2.54 mm	

2.3 Technical Specifications 10x1U-BRA

	1041U-BRA	1051U-BRA
Power Supply	5 Vdc +/- 5%	

⁵ Reading distance depends on transponder type, antenna and environmental conditions.

⁶ ISO 18000-6C became ISO 18000-63 in 2012 due to ISO naming rules that do not allow letters in standards names.

	1041U-BRA	1051U-BRA
Power Rating⁷	max 10W @RFOUT=30dBm CW typ 66mW sleep mode, no RF typ 194mW standby mode, no RF	
Sleep Mode Recovery Time¹	typ 57.8ms	
Operating Frequency	BRA: 902 MHz ... 928 MHz	
RF Transmit Power	Max 1 W (30 dBm) conducted	
RF Receive Sensitivity	Max -85dBm	
Antenna	Up to 4 external	
Antenna Connection	U.FL 50Ω	
Reading Distance⁸	10mt	
Supported Transponders	ISO 18000-63 ⁹ (EPC Class-1 Gen-2 V2)	
Communication Interface	Serial TTL 0-5V	RS232
Signalling	4 LEDs	
Digital I/O	2 'universal' channels that can be configured as input or output	
I/O as Input	Presents a 100 kΩ pull up resistor connected to the + of the power supply of the module; it can be used with a 'clean' switch, wired between the connection pin and the - of the power supply, or with a NPN transistor, with the collector on the connection pin and the emitter on the - of the power supply	
I/O as Output	Presents a NPN transistor with the collector on the connection pin and the emitter on the - of the power supply and a 100 kΩ pull up resistor internally wired to the + of the power supply; can be used with a load wired between the connection pin and the + of the power supply; max current 80 mA	
Dimensions	66.00 x 45.00 x 6.50 mm	

⁷ Typical ratings are not guaranteed. The values listed are at room temperature (25 °C), nominal supply voltages.

⁸ Reading distance depends on transponder type, antenna and environmental conditions.

⁹ ISO 18000-6C became ISO 18000-63 in 2012 due to ISO naming rules that do not allow letters in standards names.

	1041U-BRA	1051U-BRA
Operating Temperature	-20°C ÷ +65°C	
Storage Temperature	-40°C ÷ +85°C	
Humidity	Up to 95%, non condensing	
Connections	Solder strips, pitch 2.54 mm	

2.4 Reading Performance Test

The table below shows the minimum RF channel allocation time with different inventory modes with no tags and with 1 tag in front of the antenna. The test has been made using with a 4dBi gain circular antenna with output power of 20dBm and a tag at a distance of 0.5mt from the antenna.

Inventory Mode	Time with No Tag	Time with 1 Tag
Fast Multi Tag	15ms	23ms
Fast Single Tag	15ms	18ms
Standard Multi Tag	15ms	25ms
Standard Single Tag	15ms	20ms

3 Operating Features

In 'continuous' mode the **BLUEBOX** is characterized by the coexistence of 2 'parallel' and asynchronous activities: the tag identification (inventory) and the communication with the 'host' system. The 'continuous' identification activity interacts with the communication activity through a buffer that contains the code of the last identified tags or that is empty indicating the absence of tags. Due to synchronization and filtering reasons, the buffer is handled for each identified tag by a parameter defined as 'hold time' (same as 'filter time' defined below, to be set in the range of 0 ... 99 seconds or 0 ... 99 minutes, default value 1 second) and allows to extend 'artificially' the presence of the tag after it leaves the antenna's influence area; this behavior is observable looking at the yellow led status that is 'on' indicating the presence of tags and also through the activation of the relay nr 1 (if its 'automatic' management is enabled by the flag defined in the general parameters). Through the command 'data request' it is possible to get the data contained in the buffer.

The **BLUEBOX** handles also a 100 elements FIFO queue which is combined with the 'filter time' general parameter (to be set in a range of 0 ... 99 seconds or 0 ... 99 minutes, default value 1 second) that prevents the queue saturation in case of a tag 'continuous' presence. When a tag is identified, the **BLUEBOX** verifies if it belongs to the list of read tags. If the tag do not belong to the list (it is defined as 'new'), its code will be inserted in the queue, a filter time assigned to the tag will be started and the buzzer will be activated for 0.5 seconds (if its 'automatic' management is enabled by the flag defined in the general parameters). Otherwise (the tag belong to the list of read tags), the **BLUEBOX** verifies if the relative filter time is expired. In this case (the filter time is expired), the tag is defined as 'new' and will be processed as described above, otherwise only the relative filter time will be rearmed. Through the command 'queue data request' and the relative 'ack', it is possible to get the data contained in the queue and unload it.



Buffer and FIFO queue will hold onto a maximum of 82 bytes of tag data. Once the 82 bytes of tag data limit is reached, the exceeded bytes will be discarded!

- In 'continuous' mode the **BLUEBOX** can be configured to obtain the behavior of a 'spontaneous' reader that will send a message on the serial line every time that a 'new' transponder is identified (or for every identified tag with or without a 100ms filter time according to 'spontaneous' message mode configuration). This feature is enabled (on) / disabled (off) by the solder jumper W2 or using a flag in the general configuration of the reader.

- If configured and available an host can receive the 'spontaneous' message through the serial port. The 'spontaneous' message is sent only once and no ACK/NAK reply message is implemented, see the protocol manual for details.



In case of a 'spontaneous' message send error, due to a connection or communication error, no further attempts will be made and the tag will be discarded!



BLUEBOX will hold onto a maximum of 100 tags when configured to use the 'spontaneous' message. Once the 100 tag limit is reached, the new tags will be discarded!

A subsets of the 'continuous' mode are also defined:

- 'Trigger' mode: the activation and deactivation of the 'continuous' mode is triggered with inputs. The trigger could be level sensitive or edge sensitive depending on the 'extension time' setting (to be set in a range of 0 ... 99 seconds or 0 ... 99 minutes, default value 0 seconds).

In 'continuous' mode the **BLUEBOX** can be configured in 'reading test' mode to allow the user to easily and quickly test the read range of the reader fast beeping the buzzer for every identified tag. The parameter is stored in EEPROM so its status is kept at every reader restart.

The **BLUEBOX** allows the execution of 'on request' functions. During the execution of these functions, the 'continuous' identification activity will be suspended temporarily; the involved commands are relative to device configuration and tag read/write specific activities.

If not required, the 'continuous' identification activity can be disabled through a flag defined in the general parameters. In this case, the **BLUEBOX** will only execute the 'on request' commands already defined above.

'Test' modes are also defined:

- 'RF Reading' test: in 'continuous' mode allows the user to easily and quickly test the read range of the reader with fast beeping (100ms) the buzzer (the buzzer must be connected to output 2) for every identified


tag. This 'test' mode is stored in non volatile memory and its status is kept at every reader restart and until it is disabled.

- 'RF Power' test: allows the user to easily and quickly test the minimum RF output power needed to read a tag in a fixed position. The reader sweeps from the minimum RF output power to maximum RF output power or until it finds a tag, increasing the RF power of 1 dB every 500ms with fixed Q selection algorithm and $Q=0$. It is an 'on request' function which temporarily suspends the 'continuous' mode.
- 'RF Sensitivity' test: allows the user to easily and quickly test the minimum RF input sensitivity needed to read a tag in a fixed position. The reader sweeps from the minimum RF input sensitivity to maximum RF input sensitivity or until it finds a tag, increasing the RF sensitivity of 1 dB every 500ms with fixed Q selection algorithm and $Q=0$. It is an 'on request' function which temporarily suspends the 'continuous' mode.
- Read Reflected Power: allows the user to read the reflected power of the antenna at a given frequency to check the antenna connection.
- Read RSSI: allows the user to read the signal strength received by the antenna at a given frequency to check the presence of external RF sources.

The **BLUEBOX** integrates an auto antenna tuning feature which allows the usage of the reader in many different environments and configurations. The auto antenna tuning is done at every power on and during normal operations of the reader based on RF tuning configuration parameters described in next sections.

3.1 General Parameters

Parameter	Description	Range	Default
Device Address	Device address of the reader on serial interface.	0 ... 255	255
Baud Rate	Communication baud rate on serial interface.	1200 2400 4800 9600 19200 38400 57600 115200	19200
Data Bits	Data bits on serial interface.	7 8	8

Parameter	Description	Range	Default
Stop Bits	Stop bits on serial interface.	1 2	1
Parity	Parity on serial interface.	None Even Odd	None
Filter Time	Reading and tag queue management filter time.  Note that 0 setting is internally overwritten with 1 second.	0 ... 99 seconds 0 ... 99 minutes	1 sec
I/O 1 as Output for Tag Presence	Output 1 activation on tag presence / new tag event.	Disabled Enabled	Disabled
Reading Antenna Information	To add the reading antenna information to the tag's code.	Disabled Enabled	Disabled
Transponder Type Information	To add the transponder type information in the tag's code.	Disabled Enabled	Disabled
'Spontaneous' Mode	Spontaneous mode. It is OR'ed with the solder jumper W2 setting.	Disabled Enabled	Disabled
Trigger 'Continuous' Mode with Inputs	'Continuous' mode activation management with inputs.	Disabled Enabled	Disabled
'Continuous' Mode	'Continuous' mode. If activated overrides the trigger 'continuous' mode with inputs setting.	Disabled Enabled	Enabled

The general parameters are managed through the 'Read RAM General Parameters' and 'Write ROM General Parameters' commands as described in protocol technical manuals where the parameters 1...7 fields with default values are:



1	2	3	4	5	6	7
Device Address	Serial1	Serial2	0x00	0x00	Filter Time	Functional Flags
0xFF	0x48	0x10	0x00	0x00	0x01	0x80





Where:

Parameter	Description
Device Address	Device address of the reader on serial interface in the range 0 ... 255.
Serial1	Serial interface communication settings. <ul style="list-style-type: none"> High nibble: baud rate: <ul style="list-style-type: none"> 0x0: 1200 bps; 0x1: 2400 bps; 0x2: 4800 bps; 0x3: 9600 bps; 0x4: 19200 bps; 0x5: 38400 bps; 0x6: 57600 bps; 0x7: 115200 bps. Low nibble: data bits: <ul style="list-style-type: none"> 0x7: 7 bits; 0x8: 8 bits.
Serial2	Serial interface communication settings. <ul style="list-style-type: none"> High nibble: stop bits: <ul style="list-style-type: none"> 0x1: 1 bits; 0x2: 2 bits. Low nibble: parity: <ul style="list-style-type: none"> 0x0: None; 0x1: Even; 0x2: Odd.
Filter Time	Reading management filter time (0 setting is internally overwritten with 1 second): <ul style="list-style-type: none"> Decimal 0 ... 99 for time in seconds (0 ... 99 seconds); Decimal 100 ... 199 for time in minutes (0 ... 99 minutes).
Functional Flags	Flags. Single bits are dedicated to disable (0 value) or enable (1 value) functions: <ul style="list-style-type: none"> Bit 7: Not used; Bit 6: Automatic output 1 management; Bit 5: Reading antenna information; Bit 4: Transponder type information; Bit 3: 'Spontaneous' mode; Bit 2: Not used; Bit 1: 'Continuous' mode with inputs; Bit 0: 'Continuous' mode (0=enabled, 1=disabled).

3.2 Configuration Parameters

3.2.1 Input and Output

Parameter	Description	Range	Default
Input 1 Mode	<p>Input 1 activation / deactivation mode of the 'continuous' mode in 'trigger' mode.</p> <ul style="list-style-type: none"> 0: Disabled 1: ON -> Activate all antennas; OFF -> Deactivate all antennas 2: OFF -> Activate all antennas; ON -> Deactivate all antennas 3: ON -> Activate antenna 1; OFF -> Deactivate antenna 1 4: OFF -> Activate antenna 1; ON -> Deactivate antenna 1 5: ON -> Activate antenna 2; OFF -> Deactivate antenna 2 6: OFF -> Activate antenna 2; ON -> Deactivate antenna 2 <p> Note that this parameter become effective only after a reboot of the reader.</p>	0 1 2 3 4 5 6	1
Input 2 Mode	<p>Input 2 activation / deactivation mode of the 'continuous' mode in 'trigger' mode.</p> <ul style="list-style-type: none"> 0: Disabled 1: ON -> Activate all antennas; OFF -> Deactivate all antennas 2: OFF -> Activate all antennas; ON -> Deactivate all antennas 3: ON -> Activate antenna 1; OFF -> Deactivate antenna 1 4: OFF -> Activate antenna 1; ON -> Deactivate antenna 1 5: ON -> Activate antenna 2; OFF -> Deactivate antenna 2 6: OFF -> Activate antenna 2; ON -> Deactivate antenna 2 <p> Note that this parameter become effective only after a reboot of the reader.</p>	0 1 2 3 4 5 6	0
Extension Time	<p>'Continuous' mode activation/deactivation management with inputs extension time.</p> <ul style="list-style-type: none"> In 'trigger' mode, if =0 the trigger is level sensitive, otherwise it is edge sensitive and this time defines the 'continuous' mode activation time extension. 	0 ... 99 seconds 0 ... 99 minutes	0

Parameter	Description	Range	Default
	 Note that this parameter become effective only after a reboot of the reader.		
Debounce Time	<p>The inputs debounce time.</p>  Note that 0 setting is internally overwritten with 50ms.  Note that this parameter become effective only after a reboot of the reader.	0.00 ... 0.99 seconds 0.0 ... 9.9 seconds	0
Output 1 Time	<p>The output 1 activation time with output 1 activation on tag presence / new tag event enabled. If =0 the output 1 is continuously activated with the tag presence, otherwise is activated with a new tag event for a time defined by this parameter.</p>  Note that this parameter become effective only after a reboot of the reader.	0 ... 99 seconds 0 ... 99 minutes	0

The input 1 and 2 modes allowed values are

Input 1 Mode	Input 2 Mode
ON -> Activate all the antennas; OFF -> Deactivate all the antennas	Disabled
OFF -> Activate all the antennas; ON -> Deactivate all the antennas	Disabled
Disabled	ON -> Activate all the antennas; OFF -> Deactivate all the antennas
Disabled	OFF -> Activate all the antennas; ON -> Deactivate all the antennas
Disabled	ON -> Activate antenna 1; OFF -> Deactivate antenna 1
Disabled	OFF -> Activate antenna 1; ON -> Deactivate antenna 1
Disabled	ON -> Activate antenna 2; OFF -> Deactivate antenna 2
Disabled	OFF -> Activate antenna 2; ON -> Deactivate antenna 2
ON -> Activate antenna 1; OFF -> Deactivate antenna 1	Disabled
ON -> Activate antenna 1; OFF -> Deactivate antenna 1	ON -> Activate antenna 2; OFF -> Deactivate antenna 2

Input 1 Mode	Input 2 Mode
ON -> Activate antenna 1; OFF -> Deactivate antenna 1	OFF -> Activate antenna 2; ON -> Deactivate antenna 2
OFF -> Activate antenna 1; ON -> Deactivate antenna 1	Disabled
OFF -> Activate antenna 1; ON -> Deactivate antenna 1	ON -> Activate antenna 2; OFF -> Deactivate antenna 2
OFF -> Activate antenna 1; ON -> Deactivate antenna 1	OFF -> Activate antenna 2; ON -> Deactivate antenna 2
ON -> Activate antenna 2; OFF -> Deactivate antenna 2	Disabled
ON -> Activate antenna 2; OFF -> Deactivate antenna 2	ON -> Activate antenna 1; OFF -> Deactivate antenna 1
ON -> Activate antenna 2; OFF -> Deactivate antenna 2	OFF -> Activate antenna 1; ON -> Deactivate antenna 1
OFF -> Activate antenna 2; ON -> Deactivate antenna 2	Disabled
OFF -> Activate antenna 2; ON -> Deactivate antenna 2	ON -> Activate antenna 1; OFF -> Deactivate antenna 1
OFF -> Activate antenna 2; ON -> Deactivate antenna 2	OFF -> Activate antenna 1; ON -> Deactivate antenna 1

The input and output parameters are stored in configuration page nr. 0x05 and are managed through the 'Read Configuration Parameters' and 'Write Configuration Parameters' commands as described in protocol technical manuals where the parameters 1...7 fields with default values are:


1	2	3	4	5	6	7
Input1 Mode	Input2 Mode	Extension Time	0x00	Debounce Time	Output 1 Time	0x00
0x01	0x00	0x00	0x00	0x00	0x00	0x00



Where:

Parameter	Description
Input1 Mode	Input 1 activation / deactivation mode of the 'continuous' mode in 'trigger' mode: <ul style="list-style-type: none"> 0x00: Disabled 0x01: ON -> Activate all antennas; OFF -> Deactivate all antennas 0x02: OFF -> Activate all antennas; ON -> Deactivate all antennas 0x03: ON -> Activate antenna 1; OFF -> Deactivate antenna 1

Parameter	Description
	<ul style="list-style-type: none"> 0x04: OFF -> Activate antenna 1; ON -> Deactivate antenna 1 0x05: ON -> Activate antenna 2; OFF -> Deactivate antenna 2 0x06: OFF -> Activate antenna 2; ON -> Deactivate antenna 2
Input2 Mode	Input 2 activation / deactivation mode of the 'continuous' mode in 'trigger' mode: <ul style="list-style-type: none"> 0x00: Disabled 0x01: ON -> Activate all antennas; OFF -> Deactivate all antennas 0x02: OFF -> Activate all antennas; ON -> Deactivate all antennas 0x03: ON -> Activate antenna 1; OFF -> Deactivate antenna 1 0x04: OFF -> Activate antenna 1; ON -> Deactivate antenna 1 0x05: ON -> Activate antenna 2; OFF -> Deactivate antenna 2 0x06: OFF -> Activate antenna 2; ON -> Deactivate antenna 2
Extension Time	'Continuous' mode activation/deactivation management with inputs extension time. <ul style="list-style-type: none"> In 'trigger' mode, if =0 the trigger is level sensitive, otherwise it is edge sensitive and this time defines the 'continuous' mode activation time extension. And the values allowed are: <ul style="list-style-type: none"> Decimal 0 ... 99 for time in seconds (0 ... 99 seconds); Decimal 100 ... 199 for time in minutes (0 ... 99 minutes).
Debounce Time	The inputs anti-bounce time. 0 setting is internally overwritten with 50ms. <ul style="list-style-type: none"> Decimal 0 ... 99 for time in mseconds (0 ... 990 mseconds) Decimal 100 ... 199 for time in seconds (0.0 ... 9.9 seconds)
Output 1 Time	Output 1 activation time with output 1 activation on tag presence / new tag event enabled. If =0 the output 1 is continuously activated with the tag presence, otherwise is activated with a new tag event for a time defined by this parameter. <ul style="list-style-type: none"> Decimal 0 ... 99 for time in seconds (0 ... 99 seconds); Decimal 100 ... 199 for time in minutes (0 ... 99 minutes).

3.2.2 'Spontaneous' Message

Parameter	Description	Range	Default
Message Trigger	The 'spontaneous' message trigger event: <ul style="list-style-type: none"> 0: One 'spontaneous' message for every 'new tag'; 1: One 'spontaneous' message for every identified tag (slow mode with a filter time of 100ms). 2: One 'spontaneous' message for every identified tag (fast mode with no filter time).  Note that this parameter become effective only after a reboot of the reader.	0 1 2	0

Parameter	Description	Range	Default
Message on Serial Interface	'Spontaneous' message on serial interface.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Enabled
Format	The 'spontaneous' message format. <ul style="list-style-type: none"> 0: Message is sent with BlueBox protocol rules; 1: Message is sent, without any control character, in dual char string form; 2: Message is sent like in option 1 but at the end CR will be appended; 3: Message is sent like in option 1 but at the end CR+LF will be appended. 4: Message is sent, without any control character, in ASCII form. Non printable chars (0x20..0x7E) are replaced with '\.' (0x2E). 5: Message is sent like in option 4 but at the end CR will be appended. 6: Message is sent like in option 4 but at the end CR+LF will be appended. 7: Message is sent like in option 1 with an STX char at the begin of the message. 8: Message is sent like in option 2 with an STX char at the begin of the message. 9: Message is sent like in option 3 with an STX char at the begin of the message. 10: Message is sent like in option 4 with an STX char at the begin of the message. 11: Message is sent like in option 5 with an STX char at the begin of the message. 12: Message is sent like in option 6 with an STX char at the begin of the message.  Note that this parameter become effective only after a reboot of the reader.	0 1 2 3 4 5 6 7 8 9 10 11 12	0
Encoding	The 'spontaneous' message encoding.	None Decimal	None

The 'spontaneous' message format and encoding allowed values are

Format	Encoding
0	None
1	None
2	None
3	None

Format	Encoding
4	None, Decimal
5	None, Decimal
6	None, Decimal
7	None
8	None
9	None
10	None, Decimal
11	None, Decimal
12	None, Decimal

The 'spontaneous' message parameters are stored in configuration page nr. 0x09 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals where the parameters 1...7 fields with default values are:

1	2	3	4	5	6	7
Message Trigger	Interface	Format	Encoding	0x00	0x00	0x00
0x00	0x00	0x00	0x00	0x00	0x00	0x00



Where:








Parameter	Description
Message Trigger	<p>The 'spontaneous' message trigger event:</p> <ul style="list-style-type: none"> 0x00: One 'spontaneous' message for every 'new tag'; 0x01: One 'spontaneous' message for every identified tag (slow mode with a filter time of 100ms). 0x02: One 'spontaneous' message for every identified tag (fast mode with no filter time).
Interface	<p>The interface where to send the 'spontaneous' message activation/deactivation. Single bits are dedicated to enable (0 value) or disable (1 value) an interface:</p> <ul style="list-style-type: none"> Bit 7: Not used; Bit 6: Not used; Bit 5: Not used; Bit 4: Not used; Bit 3: Not used; Bit 2: Not used;




Parameter	Description
	<ul style="list-style-type: none"> Bit 1: Not used; Bit 0: Serial interface.
Format	<p>The 'spontaneous' message format:</p> <ul style="list-style-type: none"> 0x00: Message is sent with BlueBox protocol rules; 0x01: Message is sent, without any control character, in dual char string form; 0x02: Message is sent like in option 1 but at the end CR will be appended; 0x03: Message is sent like in option 1 but at the end CR+LF will be appended. 0x04: Message is sent, without any control character, in ASCII form. Non printable chars (0x20..0x7E) are replaced with '.' (0x2E). 0x05: Message is sent like in option 4 but at the end CR will be appended. 0x06: Message is sent like in option 4 but at the end CR+LF will be appended. 0x07: Message is sent like in option 1 with an STX char at the begin of the message. 0x08: Message is sent like in option 2 with an STX char at the begin of the message. 0x09: Message is sent like in option 3 with an STX char at the begin of the message. 0x0A: Message is sent like in option 4 with an STX char at the begin of the message. 0x0B: Message is sent like in option 5 with an STX char at the begin of the message. 0x0C: Message is sent like in option 6 with an STX char at the begin of the message.
Encoding	<p>The 'spontaneous' message encoding:</p> <ul style="list-style-type: none"> 0x00: None; 0x01: Decimal.

3.2.3 RF and EPC C1G2 (Class-1 Generation-2)

Hereinafter the configurable RF parameters of the **BLUEBOX**.





Parameter	Description	Range	Default
RF Geographical Region	RF geographical region.  Note that ETSI, FCC and Brazil readers cannot be altered and only operate per the regulatory laws in the EU, USA/Canada and Brazil.	EU1: ETSI FCC: FCC BRA: Brazil	EU1: ETSI FCC: FCC BRA: Brazil
RF Geographical Region	RF geographical region.  Note that ETSI, FCC and Brazil readers cannot be altered and only operate per the regulatory laws in USA/Canada, the European Union and Brazil.	0 ... 30 dBm	20 dBm
RF Transmit Power	RF conducted transmit power in dBm.	-49 ... -85 dBm	-76 dBm



Parameter	Description	Range	Default
	 Refer to country specific regulations for limitations. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.		
RF Channel	RF channel.  Note that 0 value stands for default settings of the selected region.  Refer to country specific regulations for channel allocation within the band. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.	EU1: 0 ... 10 FCC: 0 ... 50 BRA: 0 ... 50	0
Antenna 1 Activation	Activation of antenna 1.	Disabled Enabled	Enabled
Antenna 2 Activation	Activation of antenna 2.	Disabled Enabled	Disabled
Antenna 3 Activation	Activation of antenna 3.	Disabled Enabled	Disabled
Antenna 4 Activation	Activation of antenna 4.	Disabled Enabled	Disabled
RF Channel Allocation Time	The maximum period of consecutive transmission on the same RF channel.  Note that 0 value stands for default settings of the selected region.  Refer to country specific regulations for limitations. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.	0.00 ... 0.99 seconds 0 ... 99 seconds	0
RF Channel Pause Time	The minimum time between two consecutive transmissions in the same RF channel.  Note that 0 value stands for default settings of the selected region.  Refer to country specific regulations for limitations. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.	0.00 ... 0.99 seconds 0 ... 99 seconds	0

Parameter	Description	Range	Default
RF Chip Standby Mode	Activation / deactivation of the standby mode of the RF chip during RF off conditions to reduce power consumption and temperature increase.	Disabled Enabled	Enabled
RSSI Information	The detection tag's signal RSSI I and Q measured values information.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Disabled
Max RSSI Information	The detected tag's signal max RSSI I and Q measured values information.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Disabled
Tag Read Count Information	The tag read count information.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Disabled

Hereinafter the configurable EPC C1G2 (Class-1 Generation-2) parameters of the **BLUEBOX**.

Parameter	Description	Range	Default
Inventory Mode	How the reader does an inventory in 'continuous' mode.	Fast Multi Tag Fast Single Tag Standard Multi Tag Standard Single Tag	Standard Multi Tag
R->T Link Frequency	R->T Link Frequency as defined in EPC Class 1 Generation 2 protocol.	40 kHz 160 kHz 256 kHz 320 kHz 640 kHz	160 kHz
R->T Bit Coding	R->T Bit coding as defined in EPC Class 1 Generation 2 protocol.	FM0 Miller 2 Miller 4 Miller 8	Miller 2
Q Selection Algorithm	The Q selection algorithm used for setting the slot-counter parameter as defined in EPC Class 1 Generation 2 protocol.	Dynamic Fixed	Dynamic
Q Value	The Q value used in fixed Q selection algorithm or the starting Q value used in dynamic Q selection algorithm as defined in EPC Class 1 Generation 2 protocol.	0 ... 15	3

Parameter	Description	Range	Default
Q Initial	The minimum allowed Q value in dynamic Q algorithm mode.	0 ... 15	0
Q Final	The maximum allowed Q value in dynamic Q algorithm mode.	0 ... 15	4
Q Adjust Rounds	The maximum Q adjust rounds in dynamic Q algorithm mode.	0 ... 5	3
Inventory Cycles	The inventory cycles in inventory command.	0 ... 5	3
Search Mode	How the reader singulates (select) tags in 'continuous' mode.	Dual Target Single Target	Dual Target
Session	The session used as defined in EPC Class 1 Generation 2 protocol.	S0 S1 S2 S3	S0
Target	The target used as defined in EPC Class 1 Generation 2 protocol.	A B	A
EPC size	The size of the recognized EPC in bytes. 0 means all EPC sizes,	0 ... 62	0
ReadAfterDetect Activation	Activation of the ReadAfterDetect mode in 'continuous' mode.  Note that this parameter become effective only after a reboot of the reader.	None TID Custom	None
ReadAfterDetect Password	The password to be used to access to tag's memory in ReadAfterDetect mode (Inventory Mode = Standard Single/Multi Tag with Custom Info). Use a '0' password if the access password is not requested.  Note that this parameter become effective only after a reboot of the reader.	0x00 0x00 0x00 0x00 ... 0xFF 0xFF 0xFF 0xFF	0x00 0x00 0x00 0x00
ReadAfterDetect Bank	The tag's memory bank to access in ReadAfterDetect mode (Inventory Mode = Standard Single/Multi Tag with Custom Info).  Note that this parameter become effective only after a reboot of the reader.	Reserved EPC TID User	Reserved
ReadAfterDetect Address	The tag's memory start address to access in the specified memory bank in ReadAfterDetect mode (Inventory Mode = Standard Single/Multi Tag with Custom Info).  Note that this parameter become effective only after a reboot of the reader.	0x00 0x00 0x00 0x00 ... 0xFF 0xFF 0xFF 0xFF	0x00 0x00 0x00 0x00
ReadAfterDetect Length	The number of tag's memory blocks (2-bytes length) to access in the specified memory bank in	0 ... 255	0

Parameter	Description	Range	Default
	ReadAfterDetect mode (Inventory Mode = Standard Single/Multi Tag with Custom Info). In case of Reserved or User bank selected 0 means no tag's memory block access, in case of TID bank selected 0 means auto-length (class identifier, manufacturer identifier, serial number).  Note that this parameter become effective only after a reboot of the reader.		
ReadAfterDetect Info Flags	The tag's info (PC, EPC, CRC) to include in the tag's ID in ReadAfterDetect mode (Inventory Mode = Standard Single/Multi Tag with Custom Info).  Note that this parameter become effective only after a reboot of the reader.	PC, EPC, CRC	PC, EPC, CRC
Use AFI	To enable/disable the AFI (Application Family Identifier) management.	Disabled Enabled	Disabled
AFI	The AFI (Application Family Identifier) value.	0 ... 255	0

The RF and EPC C1G2 (Class-1 Generation-2) parameters are stored in configuration pages nr. 0x01, 0x02, 0x04 and 0x82 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals.

The parameters 1...7 fields with default values are of page 0x01 are:

1	2	3	4	5	6	7
RF Receive Sensitivity	Functional Flags	0x00	0x00	0x00	0x00	0x00
0x4C	0x00	0x00	0x00	0x00	0x00	0x00

Where:

Parameter	Description
RF Receive Sensitivity	Absolute value of the RF input sensitivity.
Functional Flags	Flags. Single bits are dedicated to disable (0 value) or enable (1 value) functions: <ul style="list-style-type: none"> • Bit 7: Not used; • Bit 6: Not used • Bit 5: Not used; • Bit 4: Not used;

Parameter	Description
	<ul style="list-style-type: none"> • Bit 3: Max RSSI information; • Bit 2: Tag read count information; • Bit 1: RSSI information; • Bit 0: To disable the RF chip standby mode (0=enabled, 1=disabled).

The parameters 1...7 fields with default values of page 0x02 are:

1	2	3	4	5	6	7
RF Geograph. Region	RF Transmit Power	RF Channel	Antennas Activation	EPC C1G2	RF Maximum Allocation Time	RF Minimum Pause Time
0x02	0x14	0x00	0x01	0x30	0x00	0x00

Where:

Parameter	Description
RF Region	RF geographical region: <ul style="list-style-type: none"> • 0x01: North America (FCC compliant); • 0x02: Europe (ETSI compliant); • 0x03: Brazil (FCC subset compliant).
RF Transmit Power	RF conducted transmit power.
RF Channel	RF channel. Channel 0 stands for default settings of the selected region.
Antennas Activation	A byte whose bits are dedicated to disable (0 value) or enable (1 value) the antennas to use: <ul style="list-style-type: none"> • Bit 7: Not used. • Bit 6: Not used. • Bit 5: Not used. • Bit 4: Not used. • Bit 3: Antenna 4. • Bit 2: Antenna 3. • Bit 1: Antenna 2. • Bit 0: Antenna 1.
EPC C1G2	A byte whose bits are dedicated to manage Q value and session/target parameters: <ul style="list-style-type: none"> • Bit 7 ... bit 4: Q value in fixed Q selection algorithm or starting Q value in dynamic Q selection algorithm, as defined EPC Class 1 Generation 2 protocol (0x0=0 ... 0xF=15); • Bit 3 ... bit 2: Session as defined in EPC Class 1 Generation 2 protocol (00b=S0, 01b=S1, 10b=S2, 11b=S3); • Bit 1: Q selection algorithm (0=dynamic, 1=fixed);




Parameter	Description
	<ul style="list-style-type: none"> Bit 0: Target as defined in EPC Class 1 Generation 2 protocol (0=A, 1=B).
RF Maximum Allocation Time	<p>The maximum period of consecutive transmission on the same RF channel. 0 stands for default settings of the selected region. The allowed values are:</p> <ul style="list-style-type: none"> Decimal 0 ... 99 for time in mseconds (0 ... 990 mseconds); Decimal 100 ... 199 for time in seconds (0 ... 99 seconds).
RF Minimum Pause Time	<p>The minimum time between two consecutive transmission in the same RF channel. 0 stands for default settings of the selected region. The allowed values are:</p> <ul style="list-style-type: none"> Decimal 0 ... 99 for time in mseconds (0 ... 990 mseconds); Decimal 100 ... 199 for time in seconds (0 ... 99 seconds).

The parameters 1...7 fields with default values of page 0x04 are:

1	2	3	4	5	6	7
Inventory Mode	R->T Link Frequency	R->T Bit Coding	0x00	EPC Size	Use AFI	AFI
0x02	0x02	0x01	0x00	0x00	0x00	0x00

Where:

Parameter	Description
Inventory Mode	<p>A byte whose bits are dedicated to manage the inventory mode, the search mode and the ReadAfterDetect info activation parameters:</p> <ul style="list-style-type: none"> Bit 7: Not used. Bit 6: Search mode (how the reader singulates tags in 'continuous' mode): <ul style="list-style-type: none"> 0b: Dual Target (the reader singulates tags in both A and B states). 1b: Single Target (the reader singulates only tags that are in A state). Bit 5: Activation of the ReadAfterDetect with custom info as defined in ReadAfterDetect Password, Bank, Address, Length and EPC Info parameters (0b=OFF, 1b=ON). Bit 4: Activation of the ReadAfterDetect with auto TID info (0b=OFF, 1b=ON). Bit 3 ... bit 0: Inventory mode (how the reader does an inventory in 'continuous' mode): <ul style="list-style-type: none"> 0x0: Fast Multi Tag: Inventory mode that does not take the tag to the Opened but to the Acknowledged state. This inventory mode is not as secure as the standard mode, but it is faster. 0x1: Fast Single Tag: The same inventory mode like the Fast Multi Tag, but with the slot count of 1. This has the effect that no anticollision procedure is performed. 0x2: Standard Multi Tag: Inventory mode like defined in the EPC C1G2 standard. 0x4: Standard Single Tag: The same inventory mode like the Standard Multi Tag, but with the slot count of 1. This has the effect that no anticollision procedure is performed.

Parameter	Description																				
	<div><div></div><div>Note that allowed values are:</div><table><thead><tr><th>Inventory Mode</th><th>ReadAfterDetect with Custom Info</th><th>ReadAfterDetect with Auto TID</th><th>Search Mode</th></tr></thead><tbody><tr><td>Fast Multi Tag, Fast Single Tag</td><td>Disabled</td><td>Disabled</td><td>Dual Target, Single Target</td></tr><tr><td>Standard Multi Tag, Standard Single Tag</td><td>Disabled</td><td>Disabled</td><td>Dual Target, Single Target</td></tr><tr><td>Standard Multi Tag, Standard Single Tag</td><td>Disabled</td><td>Enabled</td><td>Dual Target, Single Target</td></tr><tr><td>Standard Multi Tag, Standard Single Tag</td><td>Enabled</td><td>Disabled</td><td>Dual Target, Single Target</td></tr></tbody></table></div>	Inventory Mode	ReadAfterDetect with Custom Info	ReadAfterDetect with Auto TID	Search Mode	Fast Multi Tag, Fast Single Tag	Disabled	Disabled	Dual Target, Single Target	Standard Multi Tag, Standard Single Tag	Disabled	Disabled	Dual Target, Single Target	Standard Multi Tag, Standard Single Tag	Disabled	Enabled	Dual Target, Single Target	Standard Multi Tag, Standard Single Tag	Enabled	Disabled	Dual Target, Single Target
Inventory Mode	ReadAfterDetect with Custom Info	ReadAfterDetect with Auto TID	Search Mode																		
Fast Multi Tag, Fast Single Tag	Disabled	Disabled	Dual Target, Single Target																		
Standard Multi Tag, Standard Single Tag	Disabled	Disabled	Dual Target, Single Target																		
Standard Multi Tag, Standard Single Tag	Disabled	Enabled	Dual Target, Single Target																		
Standard Multi Tag, Standard Single Tag	Enabled	Disabled	Dual Target, Single Target																		
R->T Link Frequency	<div>R->T link frequency:<ul style="list-style-type: none">0x00: 40 kHz;0x02: 160 kHz;0x04: 256 kHz;0x05: 320 kHz;0x06: 640 kHz.</div>																				
R->T Bit Coding	<div><div>R->T bit coding:<ul style="list-style-type: none">0x00: FM0;0x01: Miller 2;0x02: Milller 4;0x03: Miller 8.</div><div><div></div><div>Note that allowed values are:</div><table><thead><tr><th>R->T Link Frequency</th><th>R->T Bit Coding</th></tr></thead><tbody><tr><td>40 kHz</td><td>FM0, Miller 2, Miller 4, Miller 8</td></tr><tr><td>160 kHz</td><td>FM0, Miller 2, Miller 4, Miller 8</td></tr><tr><td>256 kHz</td><td>Miller 4, Miller 8</td></tr><tr><td>320 kHz</td><td>Miller 4, Miller 8</td></tr><tr><td>640 kHz</td><td>Miller 4, Miller 8</td></tr></tbody></table></div><div><div></div><div>DRM (Dense Reader Mode):</div><table><thead><tr><th>R->T Link Frequency</th><th>R->T Bit Coding</th></tr></thead><tbody><tr><td>256 kHz</td><td>Miller 4, Miller 8</td></tr><tr><td>320 kHz</td><td>Miller 4, Miller 8</td></tr></tbody></table></div></div>	R->T Link Frequency	R->T Bit Coding	40 kHz	FM0, Miller 2, Miller 4, Miller 8	160 kHz	FM0, Miller 2, Miller 4, Miller 8	256 kHz	Miller 4, Miller 8	320 kHz	Miller 4, Miller 8	640 kHz	Miller 4, Miller 8	R->T Link Frequency	R->T Bit Coding	256 kHz	Miller 4, Miller 8	320 kHz	Miller 4, Miller 8		
R->T Link Frequency	R->T Bit Coding																				
40 kHz	FM0, Miller 2, Miller 4, Miller 8																				
160 kHz	FM0, Miller 2, Miller 4, Miller 8																				
256 kHz	Miller 4, Miller 8																				
320 kHz	Miller 4, Miller 8																				
640 kHz	Miller 4, Miller 8																				
R->T Link Frequency	R->T Bit Coding																				
256 kHz	Miller 4, Miller 8																				
320 kHz	Miller 4, Miller 8																				
EPC Size	The size of the recognized EPC in bytes. 0 means all EPC sizes.																				
Use AFI	<div>To enable/disable the AFI (Application Family Identifier) management:<ul style="list-style-type: none">0x00: Disabled;0x01: Enabled.</div>																				

Parameter	Description
AFI	The AFI (Application Family Identifier) value.

The parameters 1...14 fields with default values of page 0x82 are:

1	2	3	4	5	6	7
ReadAfterDetect Password0	ReadAfterDetect Password1	ReadAfterDetect Password2	ReadAfterDetect Password3	ReadAfterDetect Bank	ReadAfterDetect Address0	ReadAfterDetect Address1
0x00	0x00	0x00	0x00	0x00	0x00	0x00

8	9	10	11	12	13	14
ReadAfterDetect Address2	ReadAfterDetect Address3	ReadAfterDetect Length	ReadAfterDetect Info Flags	Q	Q Adjust Rounds	Inventory Cycles
0x00	0x00	0x00	0x03	0x05	0x03	0x03




Where:

Parameter	Description
ReadAfterDetect Password0 ReadAfterDetect Password3	The password to be used to access to tag's memory in ReadAfterDetect mode. Use a '0' password if the access password is not requested.
ReadAfterDetect Bank	The tag's memory bank to access in ReadAfterDetect mode: <ul style="list-style-type: none"> 0x00: Reserved; 0x01: EPC; 0x02: TID; 0x03: User.
ReadAfterDetect Address0 ... ReadAfterDetect Address3	The tag's memory start address to access in the specified memory bank in ReadAfterDetect mode.
ReadAfterDetect Length	The number of tag's memory blocks (2-bytes length) to access in the specified memory bank in ReadAfterDetect mode. In case of Reserved or User bank selected, 0 means no tag's memory block access; in case of TID bank selected, 0 means auto-length (class identifier, manufacturer identifier, serial number).

Parameter	Description
ReadAfterDetect Info Flags	<p>The tag's info (PC, EPC, CRC) to include in the tag's ID in ReadAfterDetect mode. A byte whose bits are dedicated to disable (0 value) or enable (1 value) functions:</p> <ul style="list-style-type: none"> • Bit 7: Not used; • Bit 6: Not used; • Bit 5: Not used; • Bit 4: Not used; • Bit 3: Not used; • Bit 2: CRC field; • Bit 1: EPC field; • Bit 0: PC field.
Q	<p>Minimum and maximum Q value to be used in dynamic Q selection algorithm:</p> <ul style="list-style-type: none"> • High nibble: minimum Q value (0x0 ... 0xF); • Low nibble: maximum Q value (0x0 ... 0xF).
Q Adjust Rounds	Maximum Q adjust rounds in dynamic Q selection algorithm.
Inventory Cycles	The inventory cycles in inventory command.

3.2.4 Dynamic Power Management

This section provides details on the configurable dynamic power management parameters of the **BLUEBOX**.

Parameter		Range	Default
Mode	<p>How the reader manages the power in 'continuous' mode.</p>  Note that this parameter become effective only after a reboot of the reader.	Off Up Up/down	Off
Power Step	<p>The power step in dynamic power management mode activated.</p>  Note that this parameter become effective only after a reboot of the reader.	1 ... 5 dB 10 ... 500 mW	1 dB
Time Step	<p>The time step in dynamic power management mode activated.</p>  Note that this parameter become effective only after a reboot of the reader.	0.1 ... 9.9 seconds	1.0 sec

The dynamic power management parameters are stored in configuration page nr. 0x07 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as

described in protocol technical manuals where the parameters 1...7 fields with default values are:

1	2	3	4	5	6	7
Mode	Power Step	Time Step	0x00	0x00	0x00	0x00
0x00	0x01	0x0A	0x00	0x00	0x00	0x00

Where:

Parameter	Description
Mode	Dynamic power management activation / deactivation in 'continuous' mode: <ul style="list-style-type: none"> 0x00: Off; 0x01: Up, only increase power by power step every time step; 0x02: Up / Down, increase power and then decrease it by power step every time step.
Power Step	Power step: <ul style="list-style-type: none"> 0x01 ... 0x05 for power step in dB (1 ... 5 dB); 0x81 ... 0xB2 for power step in mW x 10 (10 ... 500 mW).
Time Step	Time step: <ul style="list-style-type: none"> Decimal 1 ... 99 for time in ms x 100 (0.1 ... 9.9 seconds).

3.2.5 RF Tuning

Hereinafter the configurable runtime RF tuning parameters of the **BLUEBOX**.

Parametro	Descrizione	Range	Default
Max Tune Steps	The maximum runtime RF antenna tune steps. 0 to disable the runtime RF antenna tuning.	0 ... 250	15
Max Tune Frequency Hops	The maximum RF frequency hops on the same RF frequency before RF antenna tuning.	0 ... 250	15
Min Tune Frequency Hops	The minimum RF frequency hops on different RF frequency after RF antenna tuning.	0 ... 250	15
Tune Hysteresis Index	The runtime RF antenna tune hysteresis index of measured reflected power.	10% ... 50%	30%

The Tuning parameters are stored in configuration page nr. 0x0D and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write

RAM/ROM Configuration Parameters' commands as described in protocol technical manuals where the parameters 1...7 fields with default values are:

1	2	3	4	5	6	7
Max Tune Steps	Max Tune Frequency Hops	Min Tune Frequency Hops	Tune Hysteresis Index	0x00	0x00	0x00
0x64	0x0F	0x0F	0x1E	0x00	0x00	0x00

Where:

Parameter	Description
Max Tune Steps	The maximum runtime RF antenna tune steps. 0 to disable the runtime RF antenna tuning.
Max Tune Frequency Hops	The maximum RF frequency hops on the same RF frequency before RF antenna tuning.
Min Tune Frequency Hops	The minimum RF frequency hops on different RF frequency after RF antenna tuning.
Tune Hysteresis Index	The runtime RF antenna tune hysteresis index of measured reflected power.

3.3 Device Status

The information about the current status of the **BLUEBOX** shall be read with the 'Read Device Status' command as described in protocol technical manuals where the status bytes 1 and 2 have the following meaning.

Status Byte	Description
Status Byte 1	Byte whose bits have the following meaning: <ul style="list-style-type: none"> • Bit 7: Not used • Bit 6: Not used; • Bit 5: RF status (0=off, 1=on) • Bit 4: 'Continuous' mode (1=enabled) • Bit 3: Not used • Bit 2: Not used • Bit 1: Output 2 status (1=activated) • Bit 0: Output 1 status (1=activated)
Status Byte 2	Byte whose bits have the following meaning:

Status Byte	Description
	<ul style="list-style-type: none"> • Bit 7: Solder jumper W4 (1=closed) • Bit 6: Solder jumper W3 (1=closed) • Bit 5: Solder jumper W2 (1=closed) • Bit 4: Solder jumper W1 (1=closed) • Bit 3: Not used • Bit 2: Not used • Bit 1: Input 2 status (1=activated) • Bit 0: Input 1 status (1=activated)

4 Installation

4.1 General Instructions

- Install the device using the solder strips.
- Keep the device away from direct sunlight, high humidity, extreme temperatures, and sources of electromagnetic interference. Any combination of these conditions might degrade performance or shorten the life of the device.
- Connect the device as defined in electrical connections section.
- Power the device as defined in electrical connections section. The boot sequence begins in either case when power is supplied to the device. This sequence typically completes within 5 seconds. After the boot sequence finishes, the device accepts commands, not before. The LED on the device alerts you to the status as defined in status indications section.

4.2 Avoiding Interference

The device usually operates without any interference caused by radio communication if it is

- use as intended;
- correctly installed.



The operation free of radio disturbance cannot be guaranteed for each application.

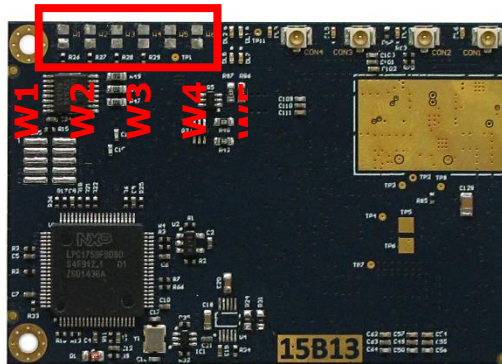
If the device causes radio disturbance in an application, the following instructions will help:

- Realign the antenna.
- Change the position of the antenna.
- Increase the distance between the device and the antenna.

- Change the power supply of the device.
- Contact the support of the manufacturer.

5 Hardware Settings

This section provides details on the hardware settings of the **BLUEBOX**.



Solder Jumper

W1	Closed: sets default communication parameters 255, 19200, 8, n, 1.
W2	Closed: enables 'spontaneous'.
W3	Not used. Do not close!!!
W4	Not used. Do not close!!!
W5	Not used. Do not close!!!
W6	Closed: hardware reset.

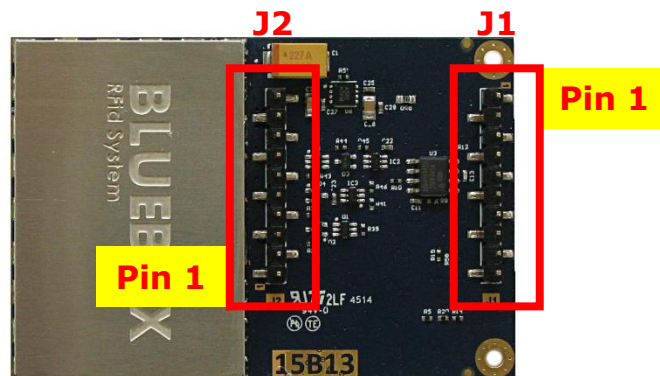
6 Connections

Observe the following instructions before electrical installation.

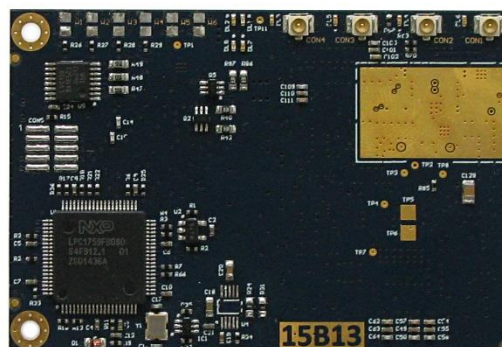


- The device must be connected by a skilled qualified person.
- Electric supply with a low noise LDO voltage regulator to avoid reader performance reduction due to noise interferences.

Connect the **BLUEBOX** using the solder strips as defined in the image and tables below.



Antenna #4 #3 #2 #1



Connections on J1:

Pin	No	Description	
		1041U	1051U
n.c.	1	Not connected	Not connected
n.c.	2	Not connected	Not connected
+ Vin	3	DC power supply 5 V +/- 5%	DC power supply 5 V +/- 5%
- Vin (GND)	4	DC power supply GND	DC power supply GND
n.c.	5	Not connected	Not connected
n.c.	6	Not connected	Not connected
n.c.	7	Not connected	Not connected
n.c.	8	Not connected	Not connected
n.c.	9	Not connected	Not connected
n.c.	10	Not connected	Not connected

Connections on J2:

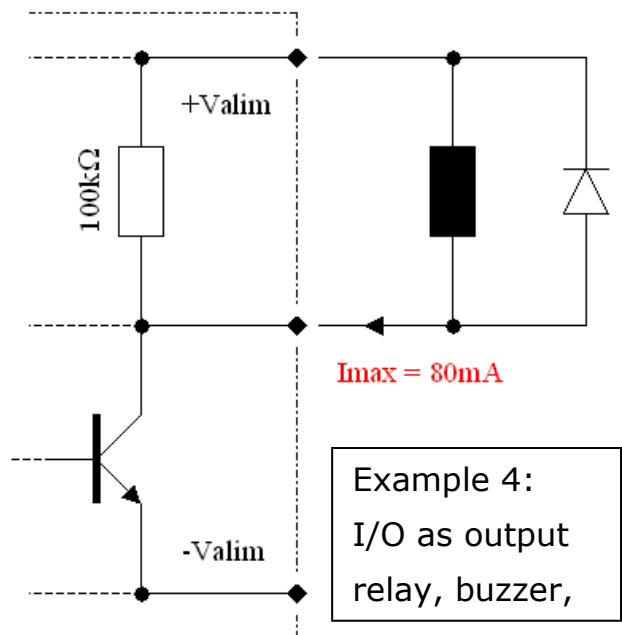
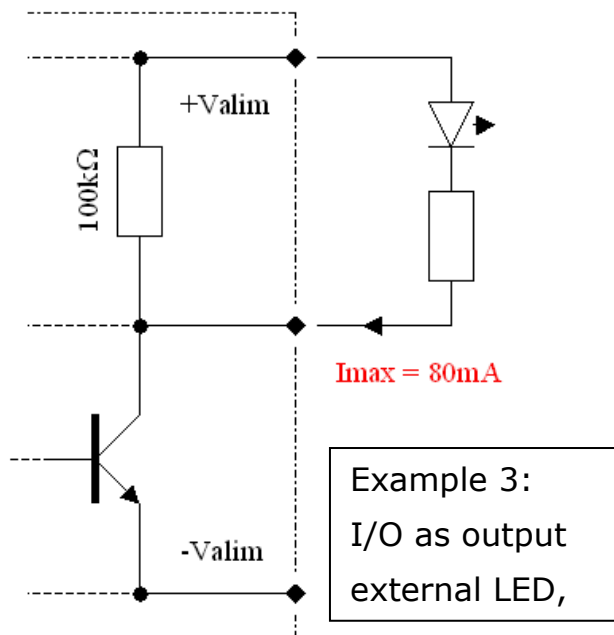
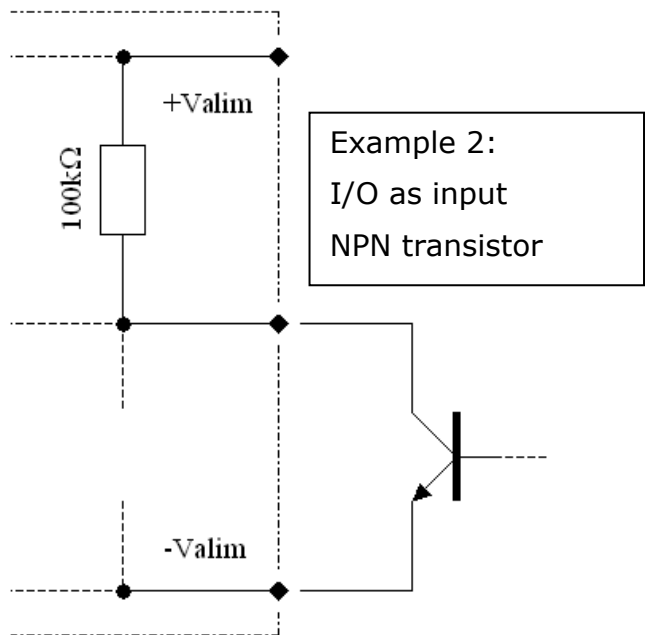
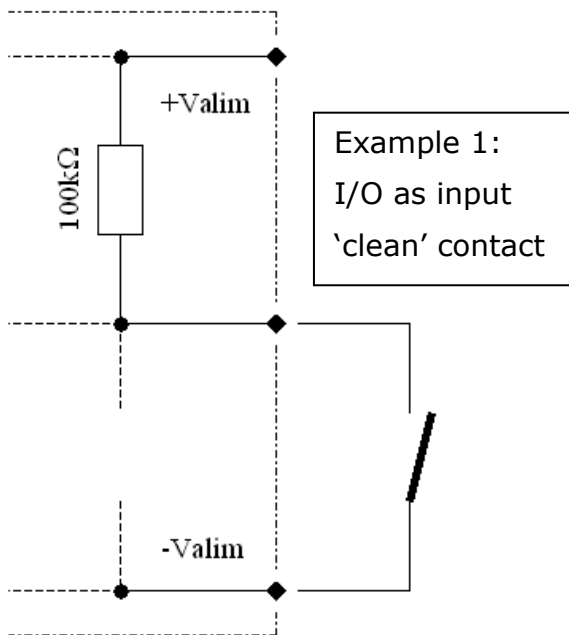
Pin	No	Description	
		1041U	1051U
RX	1	TTL serial line (from host)	RS232 serial line (from host)
TX	2	TTL serial line (to host)	RS232 serial line (to host)
TEST	3	Do not connect!!!	Do not connect!!!
I/O 1	4	'Universal' digital Input / Output	'Universal' digital Input / Output
n.c.	5	Not connected	Not connected
I/O 2	6	'Universal' digital Input / Output	'Universal' digital Input / Output
LED 2	7	'Red' external led	'Red' external led
LED 1	8	'Green' external led	'Green' external led
- Vin (GND)	9	DC power supply return (GND)	DC power supply return (GND)
+ Vin	10	DC supply DC 5 V +/- 5%	DC supply DC 5 V +/- 5%



External LEDs wiring: anodes respectively on pin 7 and pin 8, cathodes on pin 9 (GND); when activated, the LED is +5V powered through a limiting 330 Ω resistor mounted on the module.

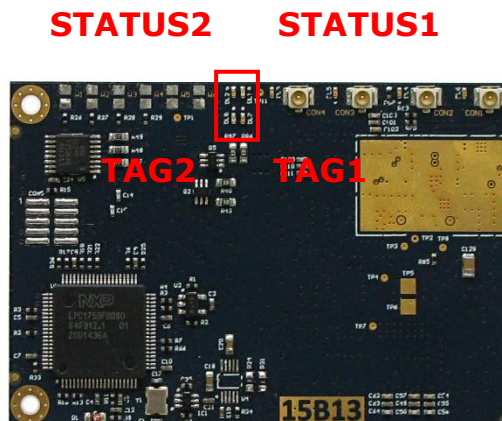
7 Wiring Examples

This section provides details on the I/O wiring of the **BLUEBOX**.







8 Status Indications















This section provides details on the status indications of the **BLUEBOX**.





The **BLUEBOX** uses eight LEDs. The following tables provides the indicator states and flash rates.

LED State	Description
On	The indicator is constantly on
Off	The indicator is constantly off
Blinking	The indicator turns on and off with a frequency of 2 Hz: on for 250 ms, followed by off for 250 ms
Slow Blink	The indicator turns on and off with a frequency of 1 Hz: on for 500 ms, followed by off for 500 ms
Fast Blink	The indicator turns on for 50ms and then off.

LED	Color	State	Meaning
SYSTEM1	 (yellow)	Blinking	<ul style="list-style-type: none"> Antenna active, no tag detected in 'continuous' mode.
	 (yellow)	Slow Blink	<ul style="list-style-type: none"> Antenna not active in 'continuous' mode.
	 (yellow)	On	<ul style="list-style-type: none"> Antenna active, tag detected in 'continuous mode. System initialization.
	 (off)	Off	<ul style="list-style-type: none"> Power supply for the device is missing.

LED	Color	State	Meaning
			<ul style="list-style-type: none"> Hardware defect. System upgrade.
SYSTEM2	 (red)	On	<ul style="list-style-type: none"> System error. System initialization. System upgrade.
	 (off)	Off	<ul style="list-style-type: none"> Power supply for the device is missing. Hardware defect.
TAG1	 (green)	Fast Blink	<ul style="list-style-type: none"> Tag detected in 'continuous' mode
	 (green)	On	<ul style="list-style-type: none"> System initialization
	 (off)	Off	<ul style="list-style-type: none"> No tag detected in 'continuous' mode. Power supply for the device is missing. Hardware defect. System upgrade.
TAG2	 (red)	Fast Blink	<ul style="list-style-type: none"> Tag collision or error detected in 'continuous' mode
	 (red)	On	<ul style="list-style-type: none"> System initialization
	 (off)	Off	<ul style="list-style-type: none"> No tag collision or error detected in 'continuous' mode. Power supply for the device is missing. Hardware defect. System upgrade.
ANT1	 (green)	On	<ul style="list-style-type: none"> Antenna 1 selected.
	 (off)	Off	<ul style="list-style-type: none"> Antenna 1 not selected.
ANT2	 (green)	On	<ul style="list-style-type: none"> Antenna 2 selected.
	 (off)	Off	<ul style="list-style-type: none"> Antenna 2 not selected.
ANT3	 (green)	On	<ul style="list-style-type: none"> Antenna 3 selected.
	 (off)	Off	<ul style="list-style-type: none"> Antenna 3 not selected.

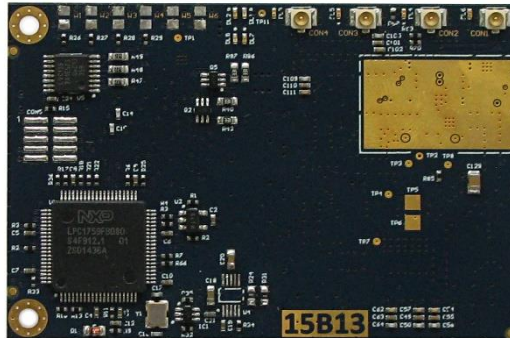
LED	Color	State	Meaning
ANT4	 (green)	On	<ul style="list-style-type: none"> Antenna 4 selected.
	 (off)	Off	<ul style="list-style-type: none"> Antenna 4 not selected.

It is possible to connect external LEDs (see connections) in place of the internal SYSTEM LEDs (external LED 1 <-> yellow internal LED; external LED 2 <-> red internal LED); in this case the corresponding internal LEDs are automatically formatted.

9 Antenna

The **BLUEBOX** is equipped with four connectors for up to four external antennas that are available in various models.

antenna #4 #3 #2 #1



The read range of an RFID system always depends on various factors like antenna size, transponder size, transponder IC type, orientation between transponder and reader antenna, position of the transponder versus the reader antenna, noise environment, metallic environment, etc. Therefore all data about read ranges can only be typical values measured under laboratory conditions. In real live applications the read range may differ from the data mentioned in the datasheet.

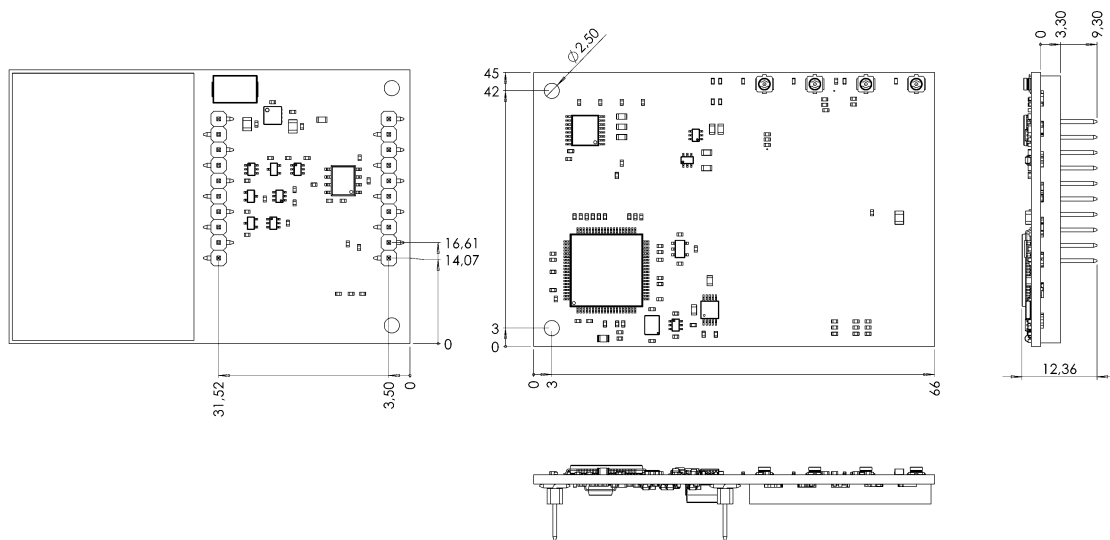
10 Maintenance, Repair and Disposal

If used correctly, no maintenance and repair measures are necessary

- The device must only be repaired by the manufacturer.
- After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.
- Keep the device free from soiling.

11 Mechanical Drawings

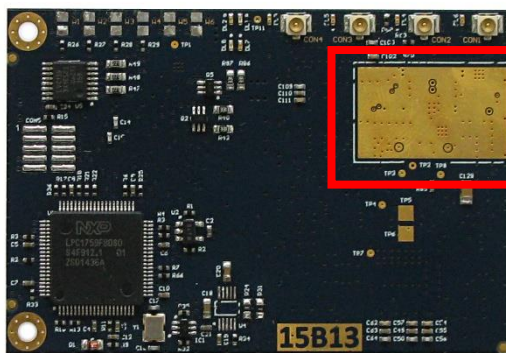
This section provides details on the mechanical drawings of the **BLUEBOX**.



Dimensions in mm.

12 Heat Dissipation

It necessary to place an heatsink on the board area with no solder (see the image below) to allow the heat dissipation of the RF part. As an alternative, place a thermal pad between the board area with no solder (see the image below) and a metal surface, for example the metal surface of the enclosure.



Heatsink area
(20.00 x 12.00 mm)

13 Document Revision History

Date	Revision	Description
22/09/14	1.00	First release.
26/11/14	1.01	Replaced the reader bottom picture in section 6. Replaced the mechanical drawing in section 10.
26/02/15	1.02	Changed the firmware version reference in the first page. Added the 'reading test' mode description in section 3 and relative command (section 4.11). Added the Program EPC of Type C Tags command description in section 4.20.
13/04/15	1.03	Changed the firmware version reference in the first page. Added the 57600bps and 115200bps baud rates support (section 3.1, 4.2 and 4.8). Added the 'spontaneous' message parameters (section 3, 3.3, 4.4, 4.10 and 4.27).
02/07/15	1.04	Changed the firmware version reference in the first page. Added the RF sensitivity parameter in technical specification table (section 2), in RF parameters section (section 3.2) and RF parameters commands management (sections 4.4 and 4.12). Moved Q value and Session in EPC C1G2 (Class-1 Generation-2) parameters section (section 3.3). Added the dynamic power parameters section (section 3.5) and commands (sections 4.7 and 4.15).
08/10/15	1.05	Changed the firmware version reference in the first page Replaced the table of the ordering codes and moved it in the preface section. Added the ReadAfterDetect configuration parameters description in section 3.3 and EPC C1G2 #2 configuration page management commands (section 4.6 and 4.15).
26/10/15	1.06	Fixed ASCII table context in section 4.
03/06/16	1.07	Changed the firmware version reference in the first page Corrected the storage temperature range in section 2. Added the description of 'trigger' mode in section 3. Added the output 1 activation time description in sections 3.1 and 3.4. Added the debounce time description in section 3.4.

Date	Revision	Description
		Changes in general and I/O parameters configuration commands (sections 4.2, 4.7, 4.11 and 4.16).
29/06/16	1.08	<p>Added the operating features and description of the configurable parameters (section 3).</p> <p>Added the test modes description in section 3.</p> <p>Deleted the communication protocol section.</p> <p>Deleted the supported transponders appendix.</p>
24/11/16	1.09	<p>Updated the reader's firmware versions object of this manual.</p> <p>Added the RF chip standby mode in RF parameters in section 3.1.3.</p>
06/12/16	1.10	<p>Updated the reader's firmware versions object of this manual.</p> <p>Added the ReadAfterDetect with custom info activation in EPC C1G2 parameters in section 3.1.3.</p> <p>Added the ReadAfterDetect with auto TID info activation in EPC C1G2 parameters in section 3.1.3.</p> <p>Added the search mode in EPC C1G2 parameters in section 3.1.3.</p> <p>Update the inventory mode range in EPC C1G2 parameters in section 3.1.3.</p>
12/07/17	1.11	<p>Updated the reader's firmware versions object of this manual.</p> <p>Fixed the technical protocol manuals.</p> <p>Added a warning to changed configuration parameters that become effective only after a device.</p> <p>Added the 640 kHz link frequency support.</p> <p>Added a table with allowed and DRM (Dense Reader Mode) link frequency and bit coding settings.</p> <p>Added a warning with the maximum supported ID length in bytes.</p> <p>Added the device status section.</p> <p>Added the antennas description section.</p>
08/06/18	1.12	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Added warnings in 'spontaneous' message management in operating features.</p>

Date	Revision	Description
		<p>Added the RF sensitivity test, read reflected power and read RSSI test modes description in operating features section.</p> <p>Added the RF antenna tuning configuration parameters description.</p>
01/08/18	1.13	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Minor changes in operating features.</p> <p>Minor changes in general and configuration parameters.</p> <p>Added the RSSI info activation flag in RF configuration.</p>
09/10/18	1.14	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Minor changes in general and configuration parameters.</p> <p>Added the AFI management in EPC C1G2 configuration.</p> <p>Minor changes in status indications.</p>
16/10/18	1.15	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Added configuration for the "spontaneous" message format.</p>
22/10/18	1.16	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Added the tag read count info activation flag in RF configuration.</p> <p>Corrections in operating features and configuration parameters.</p>
30/10/18	1.17	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Changed description in "spontaneous" message format field in spontaneous message configuration.</p> <p>Added ASCII mode setup for the "spontaneous" message format field in spontaneous message configuration.</p>
14/12/18	1.18	<p>Updated the reader's firmware versions object of this manual in preface section.</p> <p>Updated the power ratings info in technical specifications section.</p> <p>Added the sleep mode recovery time in technical specifications section.</p>
11/01/19	1.19	<p>Updated the company name/logo and BLUEBOX logo.</p>

Date	Revision	Description
		<p>Updated the reader's firmware versions object of this manual.</p> <p>Added the max RSSI info activation flag in RF configuration.</p>
01/02/19	1.20	<p>Updated the reader's firmware versions object of this manual.</p> <p>Added the Brazil RF region support in RF configuration and in regions of operation appendix.</p> <p>Minor changes and corrections in the configuration parameters.</p> <p>Moved the plans of frequencies from RF configuration parameters section to regions of operations appendix.</p> <p>Moved the power requirements from antennas section to regions of operations appendix.</p>
05/02/19	1.21	<p>Corrected the RF antenna selection in RF configuration parameters.</p> <p>Move the tag data bytes limit warning from RF configuration parameters to operating features section.</p> <p>Added a warning about the RSSI information, max RSSI information and tag read count information usage in RF configuration parameters.</p>
15/02/19	1.22	<p>Corrected the continuous mode triggered by inputs flag position in flags field in general parameters.</p>
17/05/19	1.23	<p>Updated the reader's firmware versions object of this manual.</p> <p>Added the spontaneous message for every identified tag slow/fast mode selection in spontaneous message configuration parameters.</p> <p>Minor changes and corrections in the configuration parameters.</p>
02/09/19	1.24	<p>Updated the reader's firmware versions object of this manual.</p> <p>Changes and document fixes in all sections.</p>
04/05/20	1.25	<p>Updated the reader's description object of this manual.</p> <p>Updated the reader's firmware versions object of this manual.</p> <p>Added the FCC and Brazil reader's models.</p> <p>Added the product identification system.</p>

Date	Revision	Description
		<p>Replaced ISO 18000-6C with ISO 18000-63. ISO 18000-6C became ISO 18000-63 in 2012 due to ISO naming rules that do not allow letters in standards names.</p> <p>Added the STX + dual char string format setup selection (STX + dual char string, STX + dual char string + CR, STX + dual char string + CRLF) in spontaneous message configuration parameters.</p> <p>Added the STX + ASCII string format setup selection (STX + ASCII string, STX + ASCII string + CR, STX + ASCII string + CRLF) in spontaneous message configuration parameters.</p> <p>Added the message encoding selection (None, Decimal) in spontaneous message configuration parameters.</p> <p>Added the installation section.</p> <p>Added safety informations in electrical connections section.</p> <p>Added the maintenance, repair and disposal section.</p> <p>Format and document fixes in all sections.</p>

A. Regions of Operation

The **BLUEBOX** reader has been designed to work in various regions with differing frequency requirements. This document covers operation in North America, Brazil and Europe.

A.1. Operation in Europe

For European operation, the **BLUEBOX** reader supports the frequency plan listed in the table below and is compliant with the ratified ETSI EN 302-208 specification V.3.1.0. This specification states that no listen-before-talk is performed, the maximum continuous transmit time on a channel is four seconds, and the reader enforces the 100 ms off time before reusing the same channel. In some applications (i.e. conveyor systems) it may be necessary for interrogators to transmit while tags are not present. To accommodate such requirements, the device shall include within interrogators a means to minimize the overall length of transmission commensurate with the application. This may include the provision of trigger mechanisms within interrogators to initiate transmissions.

RF Channel	Frequency [MHz]
4	865.7
7	866.3
10	866.9
14	867.5



According to ETSI EN 302208-1 only channels 4, 7, 10 and 13 (internal numerated as 1, 4, 7 and 10) could be used at high power! Other RF channels are present only for test purposes and should not be used in normal operation!

European regulations describe radiating power limits in relation to dipole antenna and ERP (Efficient Radiating Power) is used as a measure. The maximum RF output power is defined by the antenna gain, the half power beam width and the cable attenuation on the reader - antenna connection. For antennas with a half power beam width of up to 70° a power of $P_{ERP,max} = 2W$ ERP is allowed. For other half power beam widths a reduced power of $P_{ERP,max} = 0.5W$ ERP. The maximum **BLUEBOX** RF output power is defined as:

$$P_{C,max} = P_{ERP,max} - G_{IC} + 5.15 + C_L$$

Where:

$P_{C,max}$	Maximum RF output power in dBm
$P_{ERP,max}$	Maximum ERP power of the antenna in dBm
G_{IC}	Circular antenna gain in dBic
C_L	Cable loss in dB

A.1 Operation in North America

The FCC specifies frequency hopping across the North American spectrum allocated to UHF RFID (902–928 MHz, with hopping occurring between 902.75–927.25 MHz in 500 KHz steps). This specification states that no listen-before-talk is performed, the maximum continuous transmit time on a channel is 0.4 seconds.

RF Channel	Frequency [MHz]
1	902.75
2	903.25
3	903.75
...	...
49	926.75
50	927.25



Other RF channels and single channel selection are present only for test purposes and should not be used in normal operation!

FCC regulations describe the radiating power limits in relation to isotropic antenna and EIRP (Efficient Isotropic Radiating Power) is used as a measure. The maximum RF output power is defined by the antenna gain, the half power beam width and the cable attenuation on the reader - antenna connection. A power of $P_{EIRP,max} = 36\text{dBm}$ EIRP subject to a maximum conducted power of allowance of 30dBm at the antenna connector is allowed. The maximum **BLUEBOX** RF output power is defined as:

$$P_{C,max} = P_{EIRP,max} - G_{IC} - 2.15 + 5.15 + C_L$$

Where:

$P_{C,max}$	Maximum RF output power in dBm
$P_{ERP,max}$	Maximum ERP power of the antenna in dBm
G_{IC}	Circular antenna gain in dBic
C_L	Cable loss in dB

A.2. Operation in Brazil

The **BLUEBOX** operates over a subset of the FCC North American spectrum (902–928 MHz, with specific frequency and channel usage dictated by regulations of each country. Frequency hopping spread spectrum (FHSS) is used. No listen-before-talk is performed, the maximum continuous transmit time on a channel is 0.4 seconds.

RF Channel	Frequency [MHz]
1	902.75
2	903.25
3	903.75
4	904.25
5	904.75
6	905.25
7	905.75
8	906.25
9	906.75
10	907.25
26	915.25
27	915.75
28	916.25

RF Channel	Frequency [MHz]
29	916.75
30	917.25
31	917.75
32	918.25
33	918.75
34	919.25
35	919.75
36	920.25
37	920.75
38	921.25
39	921.75
40	922.25
41	922.75
42	923.25
43	923.75
44	924.25
45	924.75
46	925.25
47	925.75
48	926.25
49	926.75
50	927.25



Other RF channels and single channel selection are present only for test purposes and should not be used in normal operation!

Brazil regulations describe the radiating power limits in relation to isotropic antenna and EIRP (Efficient Isotropic Radiating Power) is used as a measure. The maximum RF output power is defined by the antenna gain, the half power beam width and the cable attenuation on the reader - antenna connection. A power of $P_{\text{EIRP,max}} = 36\text{dBm}$ EIRP subject to a maximum conducted power of allowance of 30dBm at the antenna connector is allowed. The maximum **BLUEBOX** RF output power is defined as:

$$P_{\text{C,max}} = P_{\text{EIRP,max}} - G_{\text{IC}} - 2.15 + 5.15 + C_{\text{L}}$$

Where:

$P_{\text{C,max}}$	Maximum RF output power in dBm
$P_{\text{ERP,max}}$	Maximum ERP power of the antenna in dBm
G_{IC}	Circular antenna gain in dBic
C_{L}	Cable loss in dB