RF WIRELESS

TRANSCEIVER FSK

## Version: 434 MHz Band / 868 MHZ Band / Code: 3-2000519 / 3-2000519A

DESCRIPTION:

The 3-2000519 and 3-2000519A modules are fully programmable multichannel PLL based FSK transceivers, with dual IF conversion and software channel selection in the 868 Mhz (p.n. 3-2000519A) and the 433 Mhz (p.n. 3-2000519) ISM bands.
The typical transmission output power is 10 mW (+10 dBm) and the sensitivity in receive mode is –108 dBm.
The dual IF conversion, together with the SAW front end filter, allows for a highly selective module, with outstanding side channel noise immunity, ideal for industrial applications and wireless RS232 and RS485 replacement.
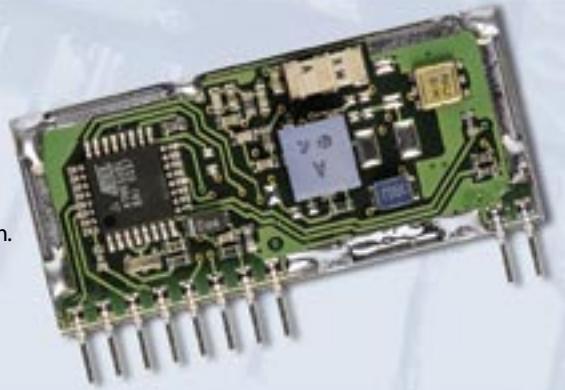
MECHANICAL DIMENSIONS:
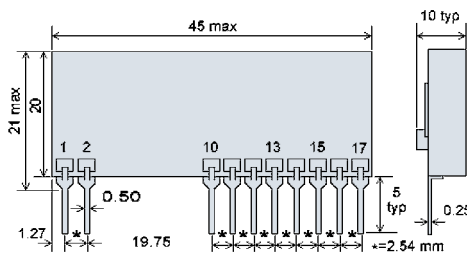
PIN DESCRIPTION:

Pin	Name	Description
1	RF IN/OUT	IRF in / out pin. During transmission, power can be up to 16 mW. To be connected to a 50 Ohm antenna.
2	GND	Ground (0 V)
10	GND	Ground (0 V)
11	+Vcc	Positive power supply
12	CTS	Clear To Send control signal (CTS)
13	+Vprog	Used only for uP In Circuit Programming. (DO NOT CONNECT)
14	RTS	Request To Send control signal (RTS)
15	TX	RS232 serial input pin
16	RX	RS232 serial output pin
17	OSC prog	Used only for uP In Circuit Proramming. (DO NOT CONNECT)

APPLICATIONS:

POS (Point Of Sale)
Bar Code Readers
Wireless Modem
Portable Terminals
Telemaintenance
Teleassistance
Remote Control

ABSOLUTE MAXIMUM RATINGS:

Module Power Supply +Vcc (pin 11)	+ 6 V
Max voltage on CTS, RTS, TX e RX (pin 12, 14, 15 e 16)	+ 6 V
Operating temperature	from -20 to +70°C
Storage temperature	from -40 to +120°C

The module is based on a state of the art AT86RF211 transceiver, and can work at any frequency between 400 Mhz an 950 Mhz. In all versions using a front end SAW filter, the bandwidth is limited to about 2 Mhz within the ETSI ISM 433 – 435 Mhz and 868 – 870 Mhz bands. The transceiver can still move within the above bands, with a 200 Hz resolution. This allows for a very precise tuning of the carrier frequency and the ability to implement 25 Khz channels if required. Switching from one frequency to another takes about 50 us for a 100 Khz variation, so that frequency hopping algorithms can be implemented, if required.

The transmitter output frequency can be set digitally by software, and is stabilised by a closed loop control. The RSSI signal can be read by the software with great accuracy, so that the output power can be matched to the strength of the received RF signal, optimising power as a function of the required range.

The dual conversion architecture, with SAW front end filter and dual IF ceramic filter guarantees a very high noise immunity and perfect compliance with I-ETS-300-220 e I-ETS-300-683.

TECHNICAL CHARACTERISTICS (SEE NOTE 1):

Parameter	Min.	Tip.	Max	Unità
Transceiver Power Supply +Vcc (pin 11)	2.7	3.3	3.6	V
Vlow on CTS, RTS, TX, RX (pin 12, 14, 15, 16)	0		+Vcc·0,15	V
Vhigh on CTS, RTS, TX, RX (pin 12, 14, 15, 16)	+Vcc·0,6		+Vcc	V
Receiver Section Technical Characteristics:				
VOL on RX (pin 16) – 1 Mohm load	0.01		+Vcc·0,02	V
VOH on RX (pin 16) – 1 Mohm load		+Vcc-0.3		V
Power Consumption (RX Mode @ 3,3 V Vcc)		36		mA
Receiver Default Carrier Frequency (3-2000519)		433.100		MHz
Receiver Default Carrier Frequency (3-2000519A)		868.150		MHz
–6 dB Bandwidth		f0 ± 15		kHz
1st Channel Rejection (± 100 kHz)		32		dB
2nd Channel Rejection (± 200 kHz)		45		dB
3rd Channel Rejection (± 300 kHz)		52		dB
4th Channel Rejection (± 400 kHz)		54		dB
Receiver Sensitivity @ 2400 baud		-108		dBm
Receiver Sensitivity @ 19200 baud		-105		dBm
Baud Rate – RF Range	2400		19200	Baud
Transmitter Section Technical Characteristics:				
VIL on TX (pin 15)	0		+Vcc·0,15	V
VIH on TX (pin 15)	+Vcc·0,8		+Vcc	V
FSK Modulation (deviation from f0)		±10		kHz
Power Consumption (TX Mode @ 3,3 V, Pout = max)		65		mA
Transmitter Default Carrier Frequency (3-2000519)		433.100		MHz
Transmitter Default Carrier Frequency (3-2000519A)		868.150		MHz
Baud Rate - RF Range	2400		19200	baud
TX Output Power		+10		dBm
2nd Harmonic Level (3-2000519)			-36	dBm
2nd Harmonic Level (3-2000519A)			-30	dBm
3rd Harmonic Level			-30	dBm
4th Harmonic Level			-30	dBm
Radiated Emissions	Meet I-ETS-300-220 e I-ETS-300-683			

Note 1: All RF parameters have been measured using the built in self test, and connecting the module as per the test circuit schematic at the end of this datasheet.

INTEGRATED SOFTWARE CHARACTERISTICS (NET1)

The Multi-Point connection software (NET1) is able to establish between more modules 3-2000519/A a data link using a standard serial interface with hardware flow control. All RF related issues (packetising, Manchester coding / decoding, CRC generation and checking, hand-shaking, retransmission) are handled by NET1 so that the user can see a standard RS232 link.

NET1 stores the received bytes, and initiates automatically an RF data interchange with another module. The interchange uses a high reliability protocol, to make sure that no data will be lost even in harsh RF environments. The module in order to verify if the package was received waits for a message of ACK from the other module. Otherwise the transmission of the data packet is repeated for N times, N can be set by the user. The ACK-NACK procedure is used only when a address is specified for the modules. Another interesting function implemented in the NET1 software is the opportunity to used a 3-2000519/A module like a repeater to cover long distance, for more details see the chapter on page 18.

NET1 allows for setting of the carrier frequency, the module address, the destination address (including a 'broadcast' address) and to power the module down. A special code (byte) has been reserved for all such commands.

RS232 link using two 3-2000519 transceiver modules block diagram:
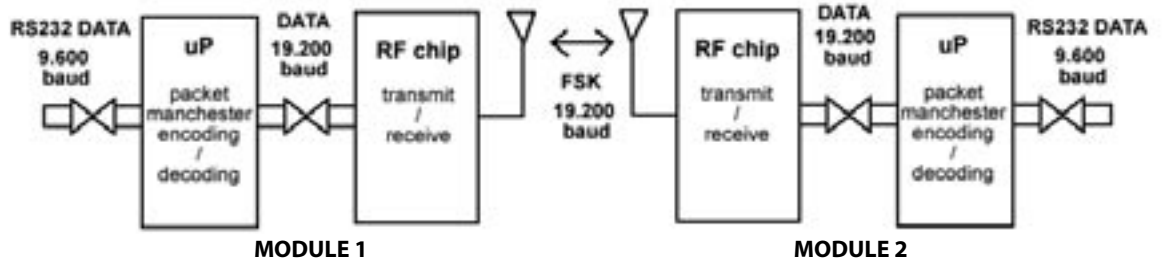
HARDWARE INTERFACE

PTP1 uses the following 3-2000519 module pins for implementing the RS232 link:

TX	: TX data to the 3-2000519 module
RX	: RX data from the 3-2000519
RTS	: Request To Send (input in the module)
CTS	: Clear To Send (output in the module)

Using the above 4 pins, the user can communicate with the module using a standard RS232 protocol. The serial link parameters are: 9600 Baud, 8 bit data, no parity e 1 stop bit..

Please refer to the next section for an example of how to connect the module to a PC serial port.

PC SERIAL PORT CONNECTION SCHEMATIC

In order to connect a 3-2000519 module to a PC serial port, the following schematic can be used:
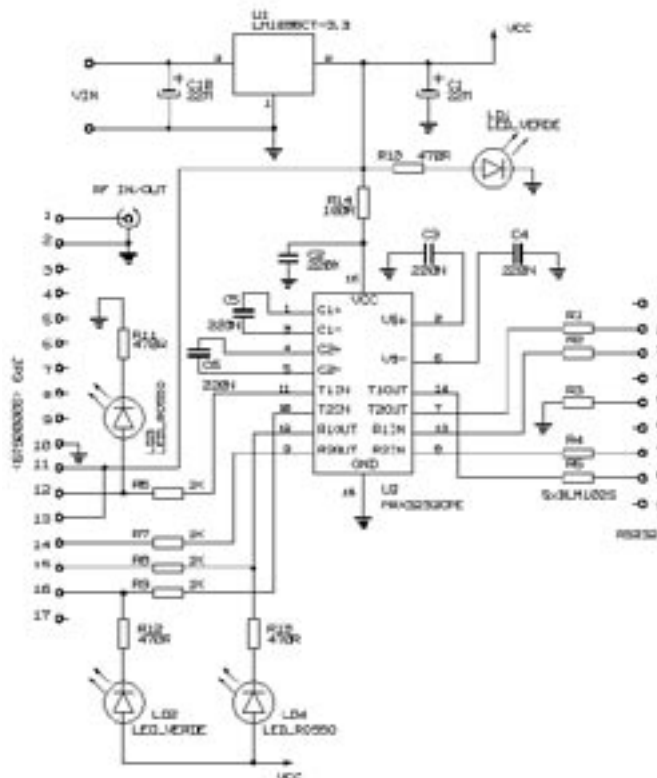
PTP1 uses a special character (byte) to put the 3-2000519 module in command mode. A byte containing the decimal code 24 (hex 18) identifies the beginning of a command sequence. To send a decimal 24 code during a data transfer, the code must be sent twice. This can only happen while transferring binary data, text files do not include the 24 character.
Term 1.3 program allows changing communication parameters.

The generic command format is the following:

0x18	Command code	# of following bytes	Parameters

Parameters are grouped into two tables; the first table shows base communication parameters while the second one shows advanced parameters which must be modified with great caution. All parameters have a factory default value which can be restored by a specific command.
Sending a configuration command, module answers always with 0xFF byte.
It's possible to read communication parameter value setting to 1 the most significant bit of the command.

The format and the description of the PTP1 supported commands are defined in the following table:

Function name	Parameters (decimal values)	Command sequence (hex values)	Default (decimal)	Note
Selection of the TX/RX channel	n : channel # (from 1 to 16) (see below for the channel frequencies)	0x18 0x01 0x01 n	n = 1	Note 2
Setting of the TX transmitted power	n : output power level (from 0 to 7) Use 0 for minimum output power (+0dBm) up to 7 for max output power (+10 dBm)	0x18 0x02 0x01 n	n = 7	Note 3
Module address Setting	n : address (from 0 to 254)	0x18 0x04 0x01 n	n = 1	
Destination address Setting	n : address (from 0 to 255) Address 255 is broadcast	0x18 0x03 0x01 n	n =255	
Read the RSSI value	Returns 1 byte with the RSSI value (0x00 minimum level, 0x11 maximum level) n : 0 chip register reading else last packet received RSSI value reading	0x18 0x05 0x01n	-	
SQUELCH setting	v : squelch value (from 0 to 63) h hysteresis value (from 0 to 7)	0x18 0x08 0x02 v h	n = 10 v = 0	Note 3
Power Down	No parameter The module wakes up again upon a high to low RTS transition	0x18 0x07 0x01 0x00	-	
Serial transmission threshold setting	n : threshold (from 1 o 16)	0x18 0x06 0x01 n	n = 1	Note 4
RF transmission threshold setting	n : threshold (from 1 to 10)	0x18 0x09 0x01 n	n = 10	Note 4
Check of the delivered packet	-	0x18 0x0B 0x01 0x01	-	Note 5
Transmission retries setting	n : max retry # (from 1 to 10)	0x18 0x0A 0x01 n	n = 3	

Format and description of advanced commando supported by NET1 software are reported in the next table:

Function name	Parameters (decimal values)	Command sequence (hex values)	Default (decimal)	Note
Respond time setting for ACK packet	n : from 10 to 200 10 is equal to 2ms 50 is equal to 12.6ms	To write: 0x18 0x10 0x01 n To read: 0x18 0x90 0x01 0x01	n = 10	
Preamble length setting	n : from 9 to 200 10 is equal to 2.08ms 20 is equal to 4.16ms	To write: 0x18 0x11 0x01 n To read: 0x18 0x91 0x01 0x01	n = 20	
Timeout setting to receive the ACK packet	n : from 1 to 200 the total time is equal to 2ms*n	To write: 0x18 0x12 0x01 n To read: 0x18 0x92 0x01 0x01	n = 50	
Timeout setting to clear the buffer for serial data reception	n : from 1 to 200 the total time is equal to 2ms*n	To write: 0x18 0x14 0x01 n To read: 0x18 0x94 0x01 0x01	n = 50	
Timeout setting to clear the buffer for serial data transmission	n : from 1 to 200 the total time is equal to 2ms*n	To write: 0x18 0x15 0x01 n To read: 0x18 0x95 0x01 0x01	n = 50	
Command byte setting	n : new command byte (from 0 to 255)	To write: 0x18 0x16 0x01 n To read: 0x18 0x96 0x01 0x01	n = 24	
Serial baud rate setting	n : 0 is equal to 1200 baud 1 is equal to 2400 baud 2 is equal to 4800 baud 3 is equal to 9600 baud 4 is equal to 19200 baud 5 is equal to 38400 baud 6 is equal to 57600 baud 7 is equal to 115200 baud	To write: 0x18 0x13 0x01 n To read: 0x18 0x93 0x01 0x01	n = 3	

Nota1: TX / RX CHANNEL SELECTION

3-200519 : 433-434.7 MHz Band

Channel N°	Centre Frequency		Channel N°	Centre Frequency
1	433.100 MHz		9	433.900 MHz
2	433.200 MHz		10	434.000 MHz
3	433.300 MHz		11	434.100 MHz
4	433.400 MHz		12	434.200 MHz
5	433.500 MHz		13	434.300 MHz
6	433.600 MHz		14	434.400 MHz
7	433.700 MHz		15	434.500 MHz
8	433.800 MHz		16	434.600 MHz

3-200519A : 868-870 MHz Band

Channel N°	Centre Frequency		Channel N°	Centre Frequency
1	868.150 MHz		5	869.500 MHz
2	868.250 MHz		6	869.675 MHz
3	868.350 MHz		7	869.800 MHz
4	868.450 MHz		8	869.900 MHz

Using various channels for communication it is possible to realise adjacent systems without interference. This is possible thanks the high receiver selectivity and a proper space distribution of the modules. Here below are same examples how to place the modules working on different channels to minimise the interference between them. The distances are calculate using the theoretical e.m. attenuation in free space.
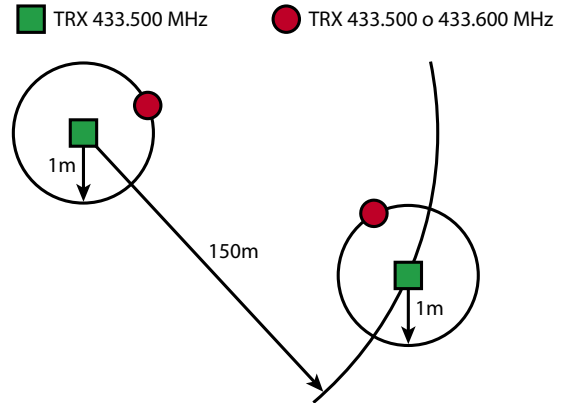
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Adjacent frequency example (+-100kHz):

■ TRX 433.500 MHz   ● TRX 433.500 o 433.600 MHz

3m

150m

3m
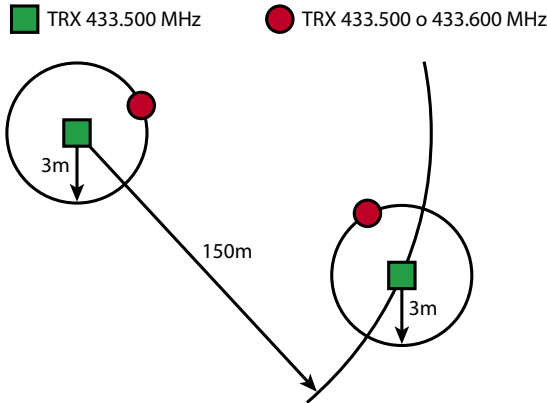
Far frequency example (+-300 kHz)

■ TRX 433.500 MHz   ● TRX 433.500 o 433.600 MHz

1m

150m

1m

Note 2: Is possible to change the module address and the destination path of the RF packets. The default address is the broadcast address, in this way to modules are able to communicate without setting a specific address. Note that in broadcast mode there is no control about the delivery of the packets, no ACK packet is send.
To define the destination of a RF packet to a specific module you must set the path to reach it; if the path has length = 1 this mean that the RF packet is sent directly to the specific module; for example two modules with address 1 and 2, to send a RF packet from module 1 to module 2 you have to set the path on module 1 in this way: 0x18 0x03 0x01 0x02. On the other hand for the communication from module 2 to module one the right path to set is: 0x18 0x03 0x01 0x01.

Often happens that one module can't reach an other one due to long distance between them or to an obstacle interposed between, in this case is possible use one module like "repeater". In this situation the path of the RF packet have to contain the addresses of the modules (or the broadcast address) and of the repeaters.
For example may say we have 4 modules with addresses 1, 2, 3 and 4. We would like to send a data packet from the module 1 to the module 3 passing obligatorily trough the module 2. The path to set is 0x18 0x03 0x02 0x02 0xFF.

The path can contain not more than two repeaters.
In this way a Wireless Net can be created, the Net will work properly only in the case there are no collision between contemporaneous transmission.

Note 3: The notes refer to specific registers within the AT86RF211 transceiver. The complete datasheet can be downloaded from:
 http://www.atmel.com/atmel/products/prod533.htm
More specifically, the output power setting sets the TXLVL field of the CTRL1 register(see below) while the SQUEL-CH settings set fields TRSSI e HRSSI of CTRL1

Description of RSSI measurement with hysteresis mechanism: If the RSSI measure is higher than the RSSI level, DATAMSG is validated (high RSSI level = TRSSI - HRSSI). If the RSSI measure is lower than the low RSSI level, DATAMSG is inhibited (low RSSI level = TRSSI - HRSSI). Between these two levels, DATAMSG validation depends on the previous measurement.
Exemple: TRSSI=32   HRSSI=4   High RSSI level=36   Low RSSI level= 28

MRSSI	27	32	35	36	35	32	29	28	27	25
RSSI level	NOK	NOK	NOK	OK	OK	OK	OK	OK	NOK	NOK
DATAMSG				valid	valid	valid	valid	valid		

Note 4: The serial transmission threshold is used to initiate a serial transmission as soon as n bytes have been received from the RF receiver. Min value 1, default value 1, max value 16.
The RF transmission threshold is used to initiate an RF transmission as soon as n bytes have been received from the RS232 interface. Min value 1, default value 10, max value 10.
As for the max number of (eventual) retransmissions, min value 1, default value 3, max value 10.
PTP1 includes a timeout, so both the serial transmission and the RF transmission are initiated (and the corresponding buffers flushed) if the relevant link has been inactive for a certain time (after the arrival of the last byte).
The two above parameters refer to what is called the 'packet length'. It is recommended to avoid using too short a packet, because the efficiency of the protocol will decrease.

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FLOW CHART SERIAL DATA SENDING THRESHOLD
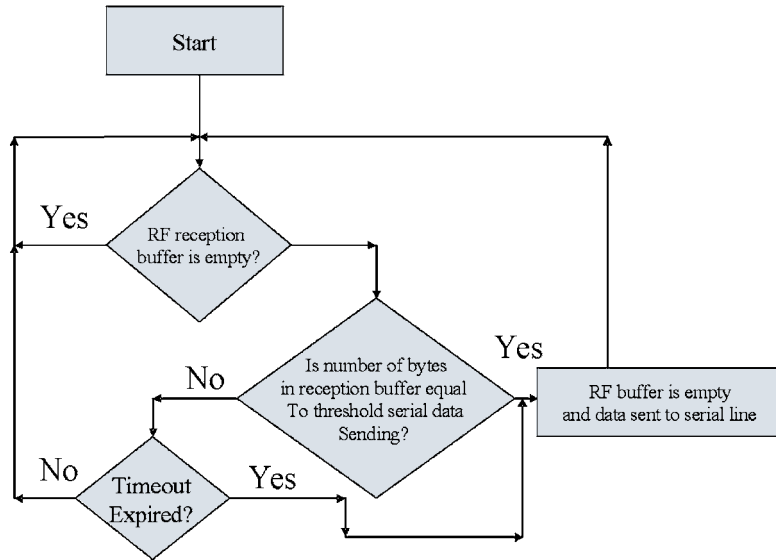
RTS/CTS FLOW CHART DURING SERIAL TRANSMISSION/RECEPTION
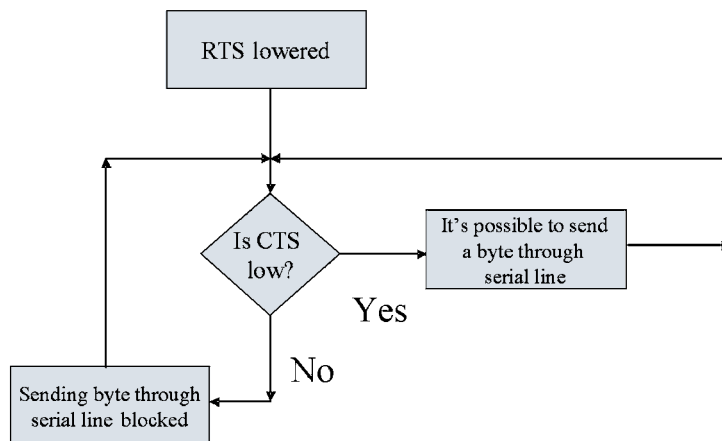
N.B.: during RF packets transmission, module raises CTS line to show that input serial buffer cannot receive further data. If CTS signal is raised during a byte sending, the byte is not lost but after that is necessary to stop data sending until CTS line is lowered again.

Note 5: It is possible to check if the last packet transmitted was successfully delivered to the destination unit, this can be done with the command after that the module will respond with a byte with the following meaning:
0x01 if the packet was not delivered
(in this case the maximum number of retransmission was reached and non ACK message was received from the destination module)
0x00 if the packet was delivered

Note 6: It is possible to interrogate the module about the actual RSSI value and the RSSI value measured during the reception of a packet; in this last case the software memorises the RSSI value of the last packet receive correctly by the RF interface.

Note 7: It is possible to return to the default configuration of the parameters (set by the manufacture and reported in the table under the column "Default"). This could be useful when a module don't work properly due to a wrong configuration of the parameters.

Note 8: The module has a free memory area in the EEPROM that can be access by the customer.
The free memory is from 0x30 to 0x1FF.

Note 9: It is possible to set the module in power down mode, the RTS pin in this mode has to be set to high. To exit from power down the pin RTS has to be set to low.

To test the data interchange between two 3-2000519 modules, the following procedure can be used. Both modules must be connected to the COM1 port of two different PC (PC1 e PC2).
Both PC must run a Windows 9x/ME/NT/2000/XP operating system, be equipped with a standard serial port (COMx) and the ZOC terminal emulation program has to be installed (can be downloaded from www.emtec.com/zoc/).

It is possible to use two types of communication:

• A broadcast communication, where a 3-2000519/A transmits a text file and all other 3-2000519/A modules, eventually presents within RF communication range, receive at the same time the text file sent.
• A point-to-point communication where a 3-2000519/A module transmits a text file to another specific module. In this case, delivery packet control mechanisms are active.

Before starting to send text file it's necessary to configure 3-2000519/A modules (suppose, for example, to have two modules connected to PC1 and to PC2). Configuration is made by Term 1.3 program and it's necessary to do only before the beginning of transmissions. Configuration is stored after power off modules too. Configuration needs to be changed only when changing communication type.

BROADCAST COMMUNICATION

1. Power two 3-2000519 modules.
2. Open Term1.3 on PC1.
3. Set up setting as follows:

Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	selected

4. Click Init Port button.
5. Write in the white box, under Buffer write, the following string: 18040101. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 1.
6. Click Write To Port button.
7. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 01 FF from serial port.
8. Write in the white box, under Buffer write, the following string: 180301FF. String is made by 4 bytes written in hexadecimal code. The parameter to set is the destination module's address, which has been set to 0xFF, that is the broadcast address.
9. Click Write To Port button.
10. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18830101 and you should get 01 FF FF from serial port.
11. Open Term1.3 on PC2.

12. Set up setting as follows:

Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	selected

13. Click Init Port button

14. Write in the white box, under Buffer write, the following string: 18040102. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 2.

15. Click Write To Port button.

16. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 02 FF from serial port.
Write in the white box, under Buffer write, the following string: 180301FF. String is made by 4 bytes written in hexadecimal code. The parameter to set is the destination module's address, which has been set to 0xFF, that is the broadcast address.

17. Click Write To Port button.

18. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18830101 and you should get 01 FF FF from serial port.

19. Close Term1.3 both on PC1 and on PC2 clicking Exit button.

POINT TO POINT COMMUNICATION

1. Power two 3-2000519 modules.

2. Open Term1.3 on PC1.

3. Set up setting as follows:

Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	selected

4. Click Init Port button.

5. Write in the white box, under Buffer write, the following string: 18040101. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 1.

6. Click Write To Port button.

7. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 01 FF from serial port.

8. Write in the white box, under Buffer write, the following string: 18030102. String is made by 4 bytes written in hexadecimal code. The parameter to set is the destination module's address, which has been set to 0x02, that is the address of the other module.

9. Click Write To Port button.

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10. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18830101 and you should get 01 02 FF from serial port.
11. Open Term1.3 on PC2.
12. Set up setting as follows:

|	
Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	selected

13. Click Init Port button.
14. Write in the white box, under Buffer write, the following string: 18040102. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 2.
15. Click Write To Port button.
16. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 02 FF from serial port.
17. Write in the white box, under Buffer write, the following string: 18030101. String is made by 4 bytes written in hexadecimal code. The parameter to set is the destination module's address, which has been set to 0x01, that is the address of the other module.
18. Click Write To Port button.
19. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string; 18830101 and you should get 01 01 FF from serial port.
20. Close Term1.3 both on PC1 and on PC2 clicking Exit button.

After chosen communication type, text file transfer can be done in the following mode:
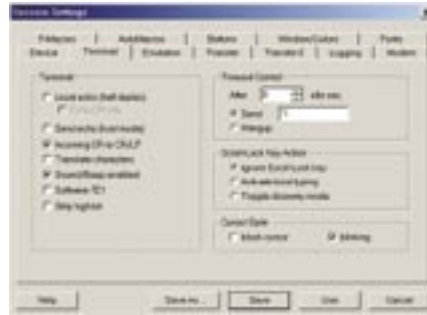
1. Power both 3-2000519 modules (a 433.92 Mhz _ wave antenna must be connected)
2. Open Zoc on PC1
3. Click with the left mouse button on the highlighted icon in the next figure:

4. Hit the Device bookmark, and set the parameters as in the next figure:
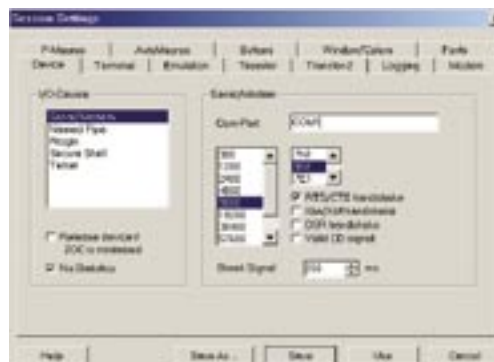
5. Hit the Terminal bookmark and set the parameters as in the next figure:
6. Click Use button.

7. Open Zoc on PC2 an follow the same steps done on PC1.
8. From the Transfer menu on PC1 select Send Textfile.
9. Select a text file.
10. Verify that the text file appears on the Zoc screen on PC2.

It's possible to modify serial port character sending speed in ZOC program options. This is to obtain higher transfer speed. To change speed is enough to:

1. Press combination buttons ALT+S or repeat point 3.
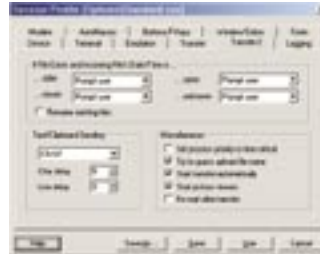
2. Choose section Transfer-2;
3. Reduce Char delay value (left bottom of the window): for example, change it from 10 to 5.
4. Press Use Button.

If it's desiderable to maximize text file sending performance, it's possible to increase the RF transmission threshold. In fact, RF packets which are sent contain many data and so communication stage is optimized.

REPEATER COMMUNICATION EXAMPLE

Using 3 modules 3-2000519 connected to 3 PCs it's possibile to implement a communication between two modules passing through the third one.

1. Power 3-2000519 modules.
2. Open Term1.3 on PC1.
3. Set up setting as follows:

Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	selected

4. Click Init Port button.

5. Write in the white box, under Buffer write, the following string: 18040101. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 1.
6. Click Write To Port button.
7. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 01 FF from serial port.
8. Write in the white box, under Buffer write, the following string: 1803020203. String is made by 5 bytes written in hexadecimal code. The parameter to set is the route of destination module, which orders to arrive to module with address 3 through module with address 2.
9. Click Write To Port Button.
10. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string; 18830101 and you should get 02 02 03 FF from serial port.
11. Open Term1.3 on PC2.
12. Set up setting as follows:

|	
Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	not selected

13. Click Init Port button.
14. Write in the white box, under Buffer write, the following string: 18040102. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 2.
15. Click Write To Port button.
16. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 02 FF from serial port.
17. Open Term1.3 on PC3.
18. Set up setting as follows:

Port No :	COM1
Baudrate :	9600
Parity :	None
Data bits :	8
Stop Bit :	1
Flow Control :	None
Append line feed :	not selected
Do not append carriage return :	not selected
Send as ASCII character :	not selected
Send Memory Buffer :	selected
Continuous Send :	not selected
Log buffer to file buffer.log :	not selected
View terminal input in hexadecimal:	selected
Send Hex:	selected

19. Click Init Port button.
20. Write in the white box, under Buffer write, the following string: 18040103. String is made by 4 bytes written in hexadecimal code. The parameter to set is the module's address, which has been set to 3.
21. Click Write To Port button.
22. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18840101 and you should get 03 FF from serial port.
23. Write in the white box, under Buffer write, the following string: 1803020201. String is made by 5 bytes written in hexadecimal code. The parameter to set is the route of destination module, which orders to arrive to module with address 1 through module with address 2.
24. Click Write To Port button.
25. Verify the reception of the byte 0xFF; to verify if the parameter has been set correctly send the string: 18830101 and you should get 02 02 01 FF from serial port.
26. Close Term1.3 on PC1, PC2 and PC3 clicking Exit button.

At this point open ZOC on PC1, PC2 and PC3 and send a text file from PC1, which will arrive to PC3.
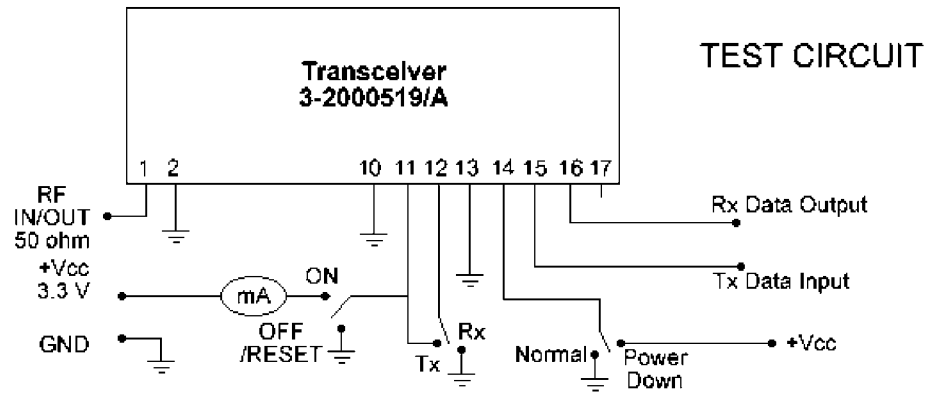
The module enters a test mode every time a transition from high to low of the 'test mode' pin (pin 13) is seen. Other pins are reassigned as per the above figure. During test mode, the module 'copies' whatever there is on the RF to the RX data output, or whatever there is on the TX data input on the RF, depending on the state of the RX / TX pin. This 'transparent' mode can be used for implementing protocols other than RS232 as well as for testing the link.

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