

ALPW-BLEM003

Technical Data

V1.0

Revision history

Version	Date	Contributions	Changes
1.0	02/24/2013	Benjamin Deforge	First Draft

Approval

	Function	Name	Date	Visa
written by	Electronics Development Engineer	Benjamin Deforge	21/02/2013	
Reviewed by	Product Development Leader	Alexandre Gimard	xx/xx/2013	
Approved	CEO	Serge Veyres	xx/xx/2013	

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1 Regulatory Information

Officiel Product Name	ALPW-BLEM003
Hardware Revision	B
Maximum Conducted Power	+3dBm
Antenna Gain	0.9dBi
USA FCC Coordinates	Serge Veyres ALPWISE 4 Avenue Doyen Louis Weil 38000 GRENOBLE France Tel : 04.76.22.02.24 Fax : 04.76.22.15.64 Mail : Serge.veyres@alpwise.com
Canada IC Coordinates	Serge Veyres ALPWISE 4 Avenue Doyen Louis Weil 38000 GRENOBLE France Tel : 04.76.22.02.24 Fax : 04.76.22.15.64 Mail : Serge.veyres@alpwise.com
Product Identification	The labeling format is attached [6].

2 Product Description

The ALPW-BLEM003 is a *Bluetooth®* Low Energy module, fully compliant with the *Bluetooth®* 4.0 Single mode (*Bluetooth®* Smart) specification. The module embeds an energy-efficient microcontroller (ARM Cortex M-0) to run the software protocol stack. The module has external connections to an application host, via UART, I2C. The module also exports 2 ADCs, 2 GPIOs, a programming bus (two-wire SWD) and a reset pin.

The radio is controlled by a dedicated chip EM9301. It is connected via SPI to the microcontroller. A ceramic antenna is soldered on the module.

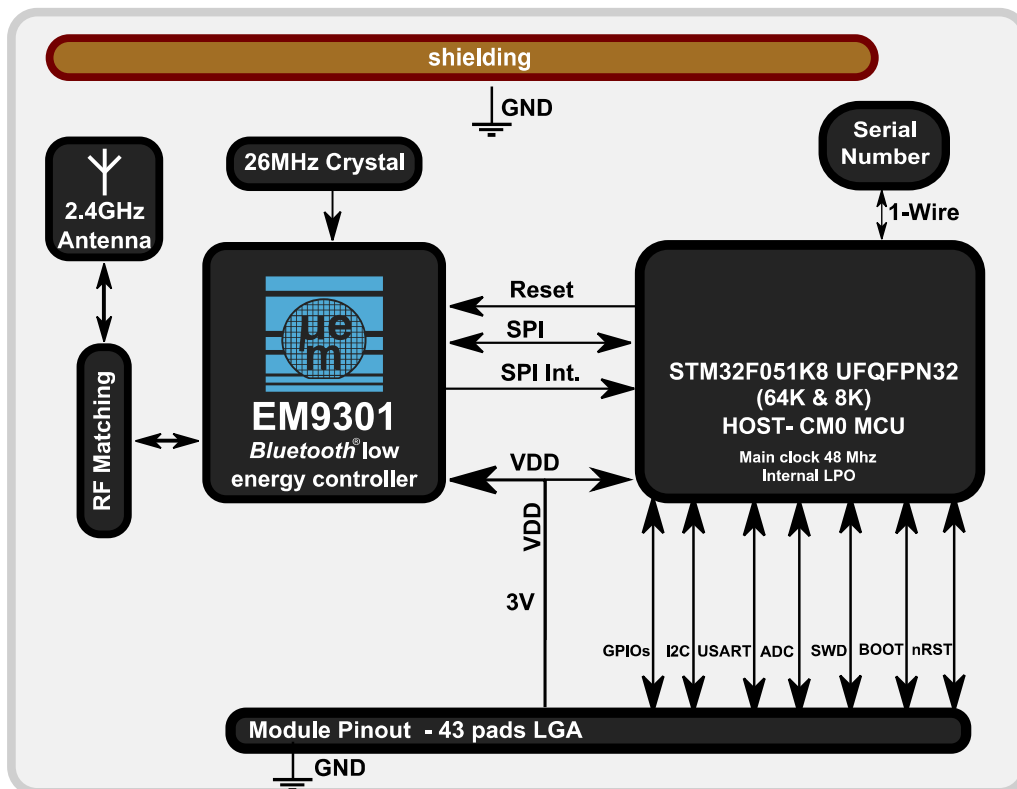
The ALPW-BLEM003 module provides a 43-pads LGA pinout, to allow reflow soldering on an application board.



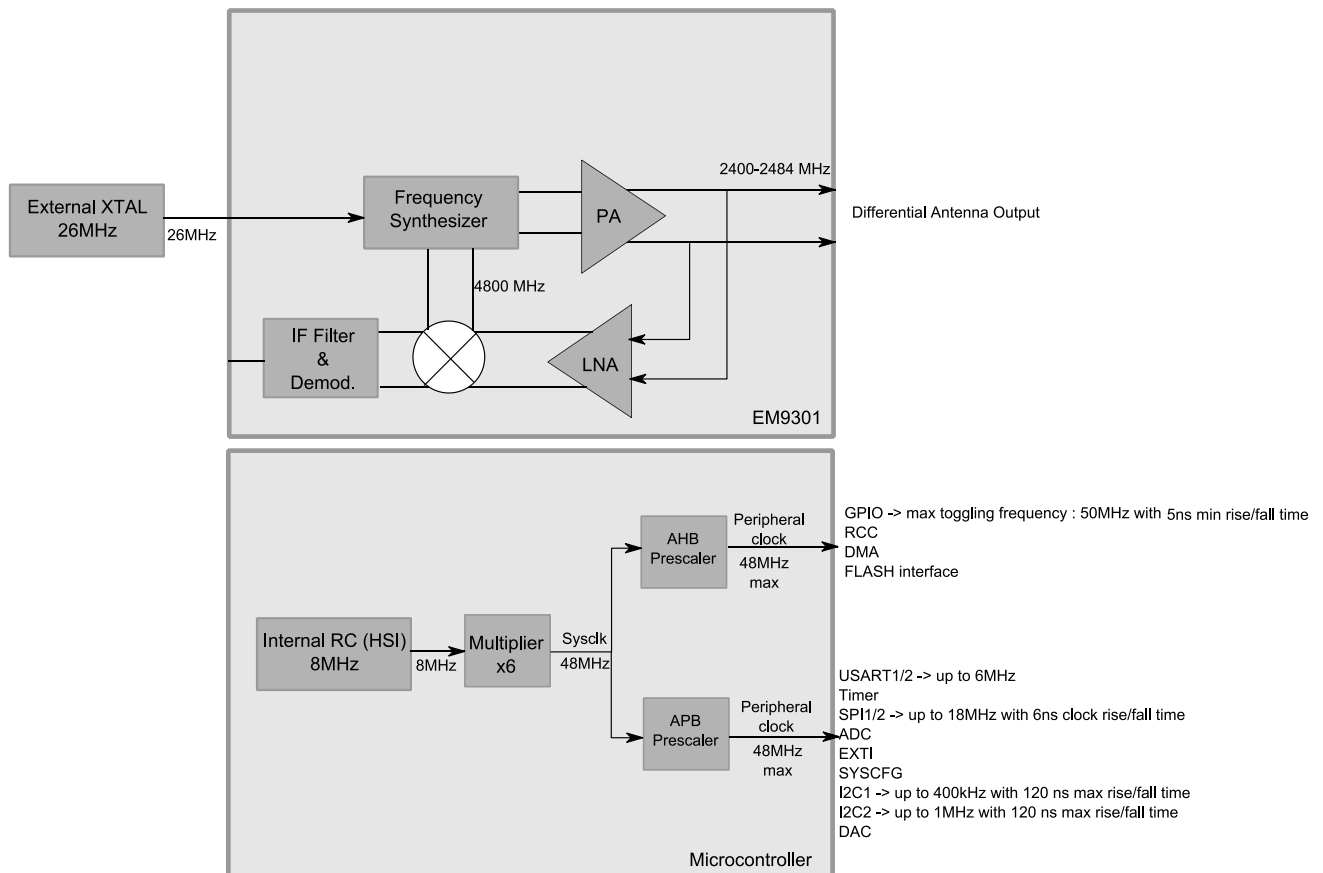
2.1 Commercial Description

The commercial product description is attached [6].

2.2 Block Diagram



2.3 Clock tree



2.4 Schematics

The schematics are attached [6].

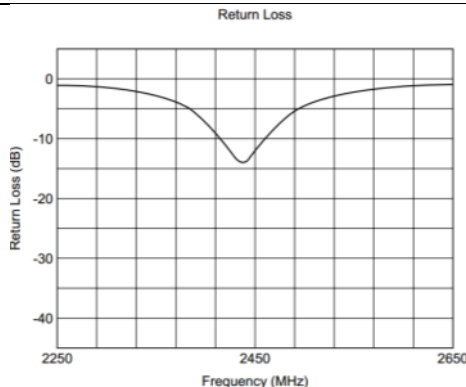
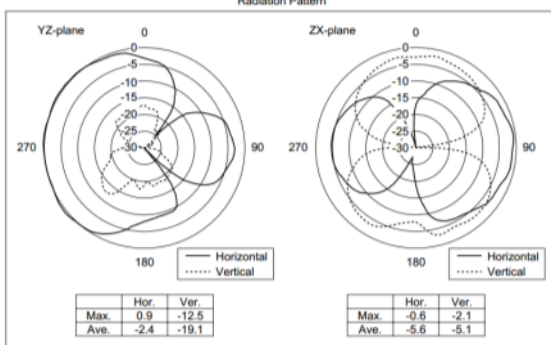
2.5 Bill of Material

The Bill of Material is attached [6].

3 Technical Data

3.1 Antenna

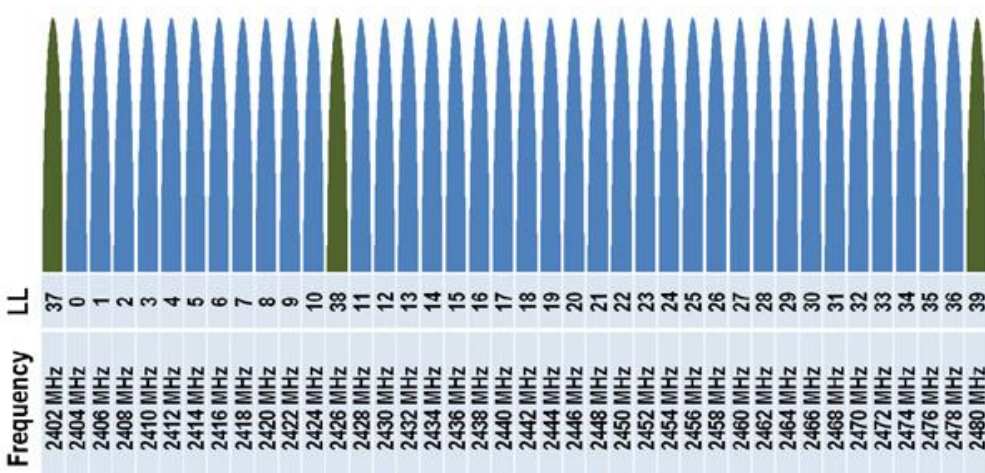
The ceramic antenna is permanently soldered on the pcb.

Antenna Reference	Murata LDA212G4410K-283																																																						
Center Frequency	2460MHz with +- 31MHz tolerance																																																						
Nominal Bandwith	84MHz @VSWR 4																																																						
Nominal Impedance	50 ohms																																																						
Typical Return Loss	<div><p>Return Loss</p></div>																																																						
Gain	<table><tr><th colspan="7">BT/WLAN2.4G</th></tr><tr><th colspan="2" rowspan="2">Linear Polarization</th><th colspan="2">YZ-plane</th><th colspan="2">ZX-plane</th><th rowspan="2">Efficiency (dB)</th></tr><tr><th>Hor. (dBi)</th><th>Ver. (dBi)</th><th>Hor. (dBi)</th><th>Ver. (dBi)</th></tr><tr><td rowspan="2">2400 MHz</td><td>Max.</td><td>-0.2</td><td>-14.8</td><td>-1.4</td><td>-3.3</td><td rowspan="2">-3.1</td></tr><tr><td>Ave.</td><td>-3.3</td><td>-20.4</td><td>-6.4</td><td>-6.4</td></tr><tr><td rowspan="2">2442 MHz</td><td>Max.</td><td>0.9</td><td>-12.5</td><td>-0.6</td><td>-2.1</td><td rowspan="2">-2.2</td></tr><tr><td>Ave.</td><td>-2.4</td><td>-19.1</td><td>-5.6</td><td>-5.1</td></tr><tr><td rowspan="2">2484 MHz</td><td>Max.</td><td>-0.4</td><td>-13.2</td><td>-1.9</td><td>-3.1</td><td rowspan="2">-3.2</td></tr><tr><td>Ave.</td><td>-3.4</td><td>-19.3</td><td>-6.8</td><td>-5.8</td></tr></table> <p>Max gain = 0.9dBi</p>	BT/WLAN2.4G							Linear Polarization		YZ-plane		ZX-plane		Efficiency (dB)	Hor. (dBi)	Ver. (dBi)	Hor. (dBi)	Ver. (dBi)	2400 MHz	Max.	-0.2	-14.8	-1.4	-3.3	-3.1	Ave.	-3.3	-20.4	-6.4	-6.4	2442 MHz	Max.	0.9	-12.5	-0.6	-2.1	-2.2	Ave.	-2.4	-19.1	-5.6	-5.1	2484 MHz	Max.	-0.4	-13.2	-1.9	-3.1	-3.2	Ave.	-3.4	-19.3	-6.8	-5.8
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Radiation Pattern	<div><p>Radiation Pattern</p></div>																																																						

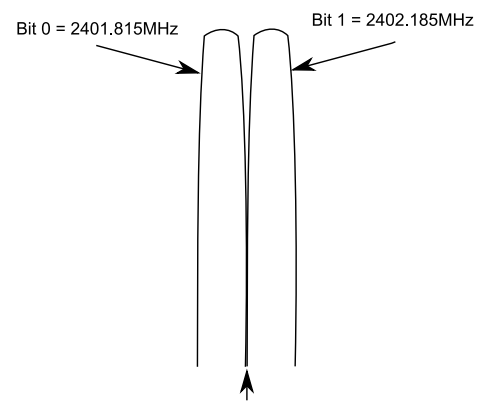
Data from Murata

Data from Murata

3.2 Spectrum Usage

Band	2.4GHz ISM band 2400MHz -> 2483.5MHz
Channels	40 Channels 2MHz wide 37 data channels, 3 advertisement channels 
Frequency Tolerance	Frequency tolerance for the whole packet : +- 150kHz max 26MHz crystal tolerance : 30ppm Frequency Drift during packet : 50kHz max Maximum drift rate : 400Hz / μ s
Transmit Power	BLE spec : -20dBm to +10dBm EM9301 : -20dBm, -16dBm, -12dBm, -9dBm, -6dBm, -3dBm, 0dBm, +3dBm Power accuracy : +- 3dB
Declared Transmit Power	+3dBm

3.3 Data Type

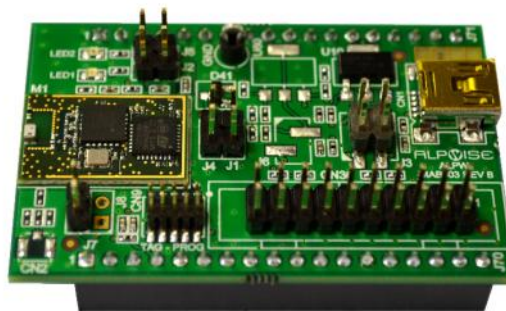
Modulation	Gaussian Frequency Shift Keying (GFSK) Modulation index : ~ 0.5 (0.45 to 0.5) 
Data Rate	1Mbps 1 bit per symbol
Hopping	Adaptive frequency hopping

3.4 Receiver

Sensitivity	Bluetooth spec : -70dBm min @ 0.1% BER EM9301 : -80dBm typical, from EM9301 specs
	The EM9301 internally uses a 4.8GHz carrier frequency for the demodulation process.

4 Test Software

The ALPW-BLEM003 is soldered on the ALPW-EASY-Kit board.



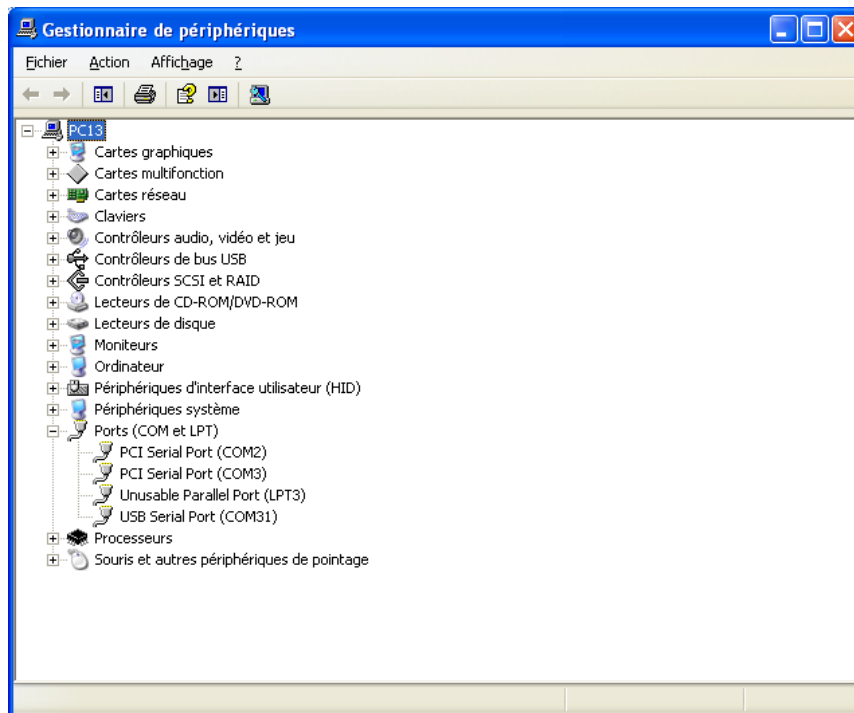
4.1 Transmitter test

4.1.1 Starting the transmitter test Application

The module can be put under transmitter test mode. This allows sending commands directly to the Bluetooth Low Energy radio.

Connect the UART/USB FTDI cable the PC. Get the port COM number allocated to "USB Serial Port" in the device manager.

When powered, the red and green LEDs light up. The red LED will go off when the BLE radio is ready to accept commands.

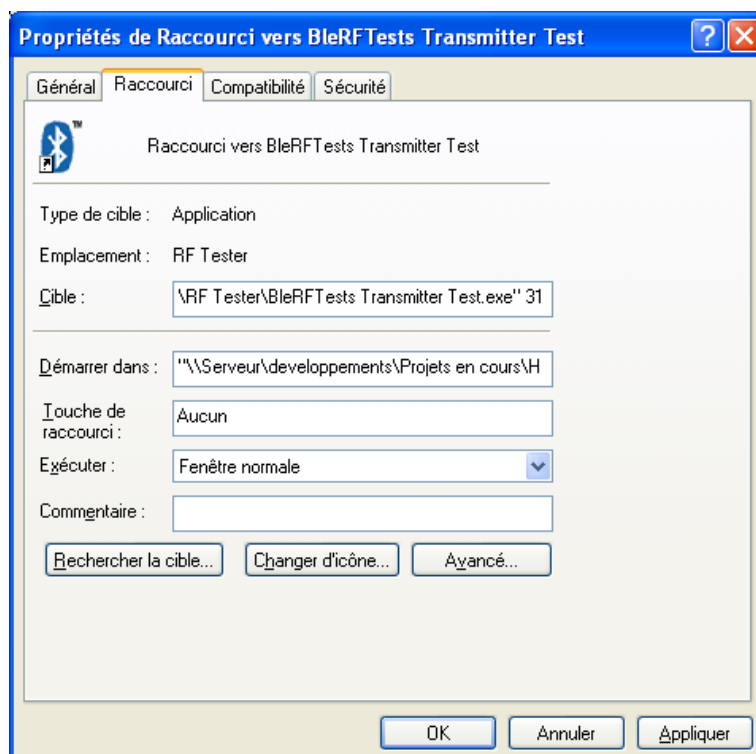


The port Com number must be passed in argument when launching "BLERFTests Transmitter Test".

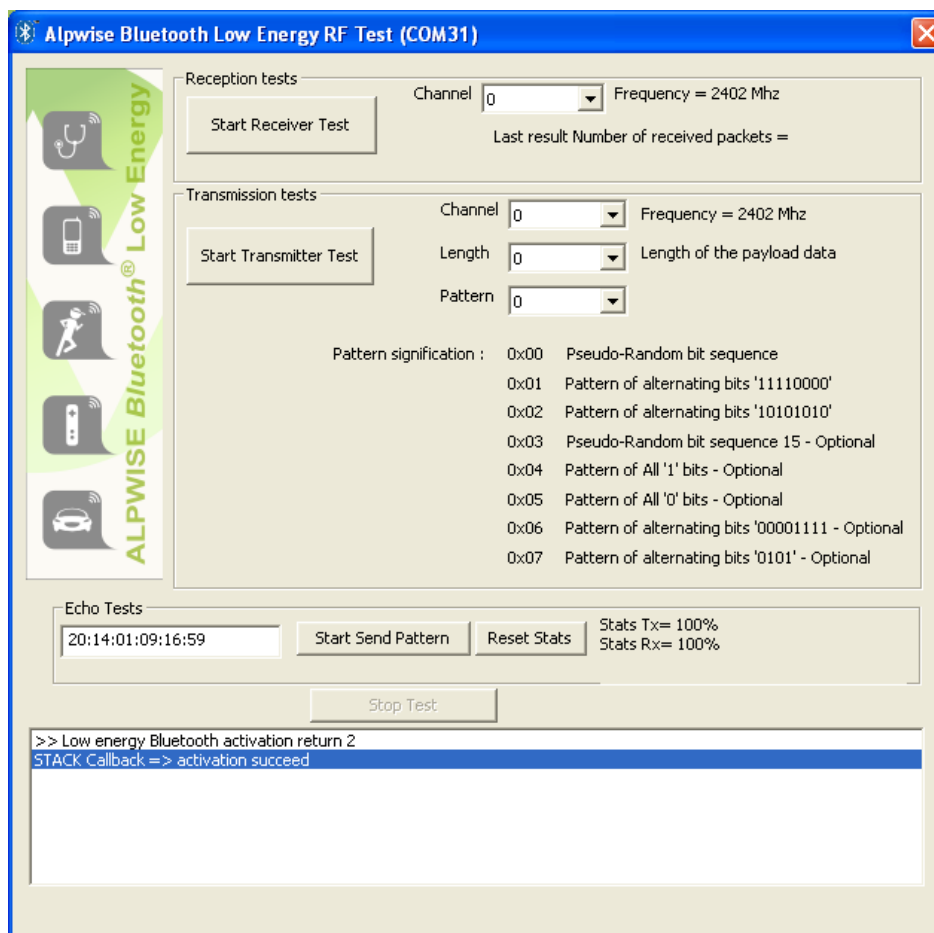


BLERFTests Transmitter Test

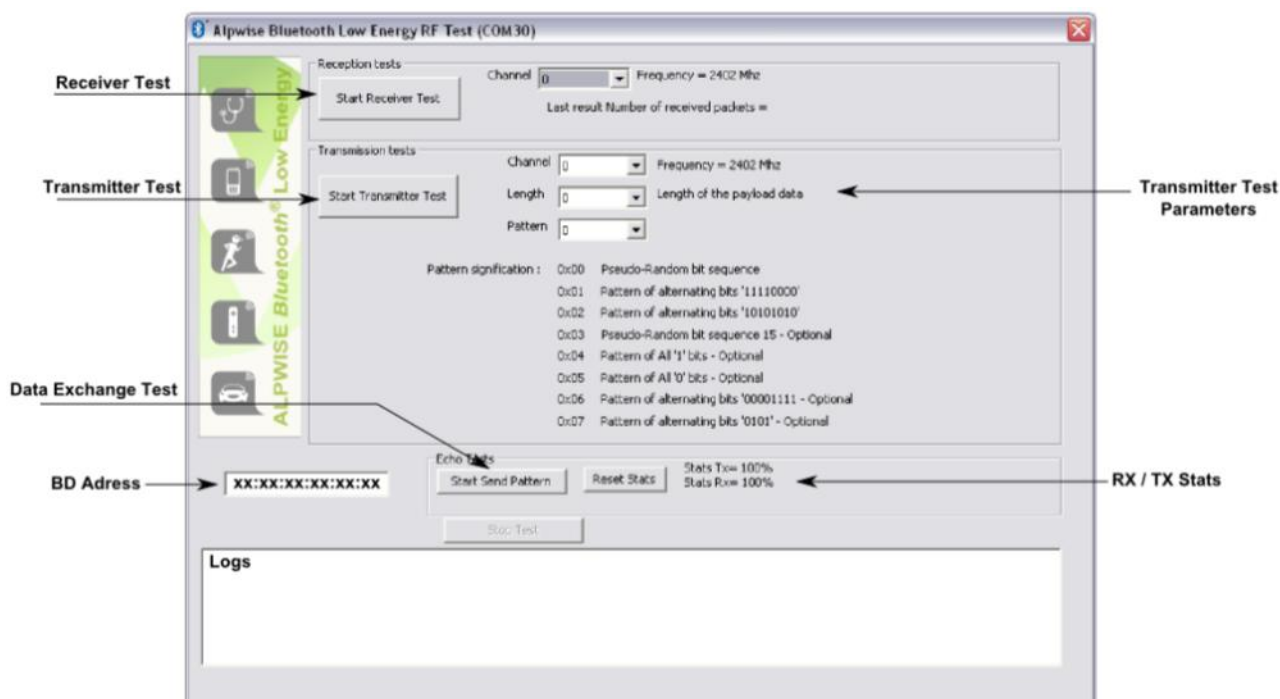
Create a shortcut, go to Properties -> Raccourci and add the port COM number.



Double click the shortcut.



4.1.2 Window description



The "RFTester – Transmitter test" allows accessing to the transmitter and receiver test functions. The parameters are the following:

- Channel Identifier : from 0 to 39

Frequency (MHz)	Channel Number	Type	Frequency (MHz)	Channel Number	Type
2402	0	Data	2442	20	Data
2404	1	Data	2444	21	Data
2406	2	Data	2446	22	Data
2408	3	Data	2448	23	Data
2410	4	Data	2450	24	Data
2412	5	Data	2452	25	Data
2414	6	Data	2454	26	Data
2416	7	Data	2456	27	Data
2418	8	Data	2458	28	Data
2420	9	Data	2460	29	Data
2422	10	Data	2462	30	Data
2424	11	Data	2464	31	Data
2426	12	Data	2466	32	Data
2428	13	Data	2468	33	Data
2430	14	Data	2470	34	Data
2432	15	Data	2472	35	Data
2434	16	Data	2474	36	Data
2436	17	Data	2476	37	Adv
2438	18	Data	2478	38	Adv
2440	19	Data	2480	39	Adv

Channel Type

Three channels are reserved to the advertisement process, used by the BLE device to signal its presence, emitting burst at a programmable interval (from 20ms to 10.28sec).

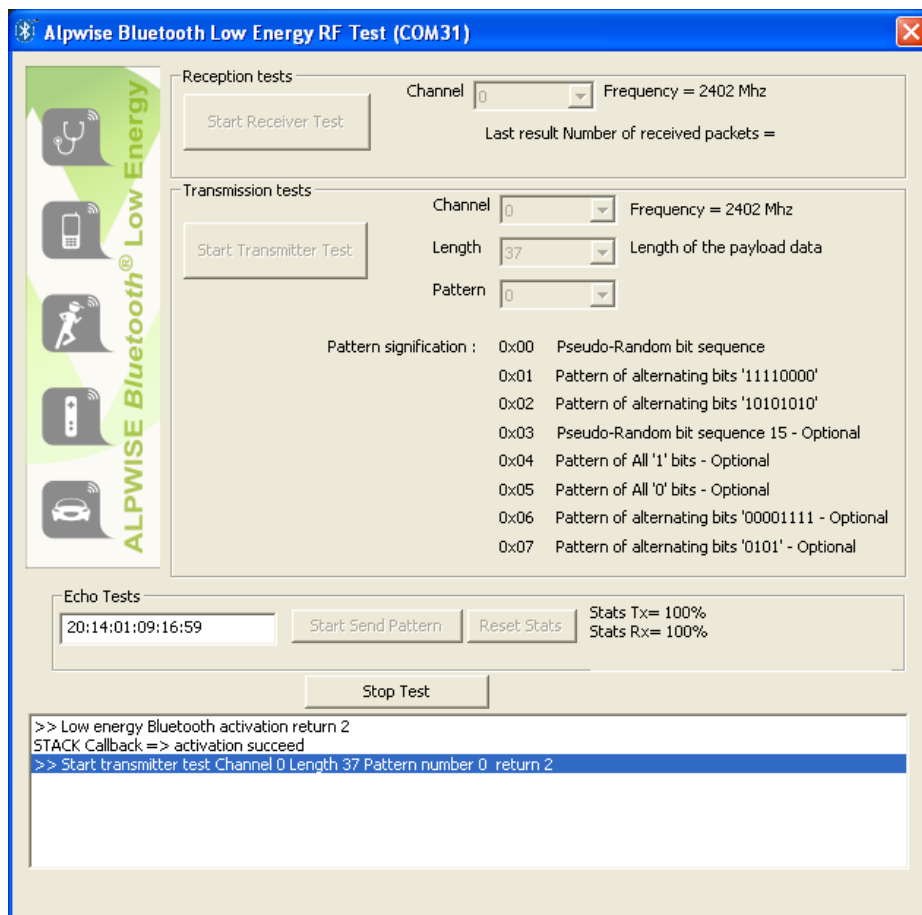
- Length

Data packet length, from 0 to 37 bytes.

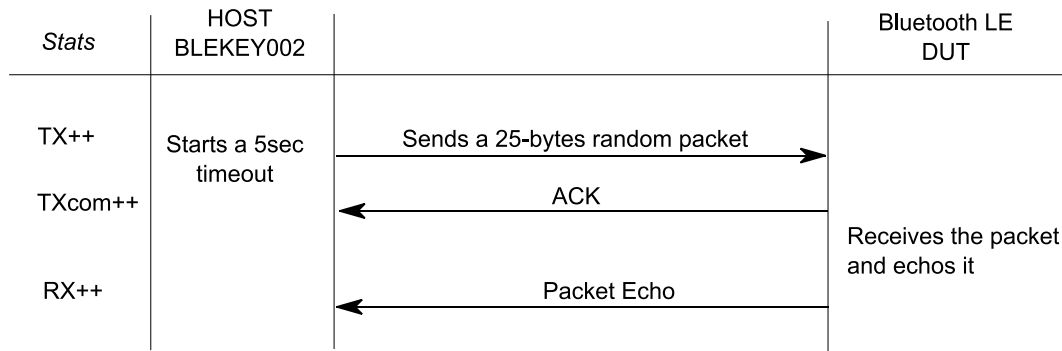
- Data Type

Several options :

Argument	Description	Commentaire
0	Pseudo-random bit sequence (PRBS9)	Transmitter power test
1	Pattern of alternating bits : « 11110000... »	Frequency drift test
2	Pattern of alternating bits : « 10101010.... »	Initial transmission frequency test
3	PRBS15	optionnel
4	Pattern of all '1' bits	optionnel
5	Pattern of all '0' bits	optionnel
6	Pattern of alternating bits « 00001111... »	optionnel
7	Pattern of alternating bits "0101..."	optionnel



The device acknowledges the start of the test.



5 Embedded Firmware

The DUT has two operating mode

- HCI Mode for the transmitter test mode
- Data Exchange for the application mode

6 External Documents

- [1] [ALPW-BLEM003-Product Identification](#) Labeling and serial numbering of the product
- [2] [ALPW-BLEM003-REVB Schematics](#) Schematics
- [4] [ALPW-BLEM003 Commercial-brief](#) Commercial Briefs product description
- [5] [ALPW-BLEM003 REV B BOM FCC](#) Bill of Material

7 Contact information

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