# 169MHz performance test

## Long range propagation test on the 169 MHz band

"CONNECTING INNOVATION FOR INTELLIGENT WIRELESS"

**Ste**
Engineering Department
2014

# 169MHz long distance test

## The test system

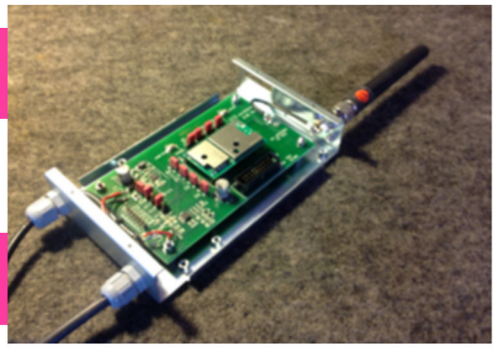


**FIGURE 1**

The Radiomodem is mounted on the EVB8A3 Evaluation Board and inside a metal box so as to be shielded against EMI noise coming from the USB cable or from the PC and, most importantly, to provide a suitable ground reference to the antenna.

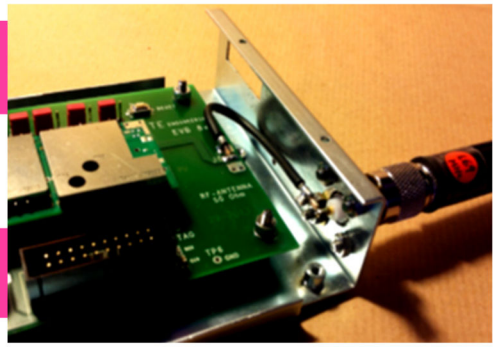
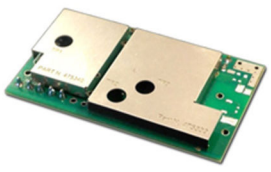


**FIGURE 2**

Detail of the installation of the Evaluation Board inside the metal box and the connection of the RF to the antenna TNC connector through a 50 ohm coaxial cable (RG174).

**FIGURE 3**

The Central station BK82N3HP Radiomodem is placed on a balcony of the headquarters of STE (Bistolfi street n.49). The Radiomodem is programmed in the "Echo" mode and powered by a 12V battery. Note that the system is mounted so as to hold the quarter wave antenna in a vertical position so as to be omnidirectional to all the remote locations of the test .



RADIOMODEM
BK8
TRANSCEIVER

## The BK8 Radio-Modem

The BK8 Radio-modem is part of a family of compact NBFM wireless data transceiver modules to be employed on the License free ISM Bands (169MHz – 434MHz – 868MHz - 915MHz). The family comprises modules with external Antenna and with integrated Antenna.A 32 bit Arm Cortex-M0 LPC1114 microcontroller is employed to implement also the most advanced communication protocol with the best performance/consumption ratio for battery operated systems.The BK82N3HP is the external antenna version optimised for quarter wave shortened Helical Antennas.Depending on the Antenna performance and obstacles this version offer the maximum long range operation (up to several kilometers).

# 169MHz long distance test

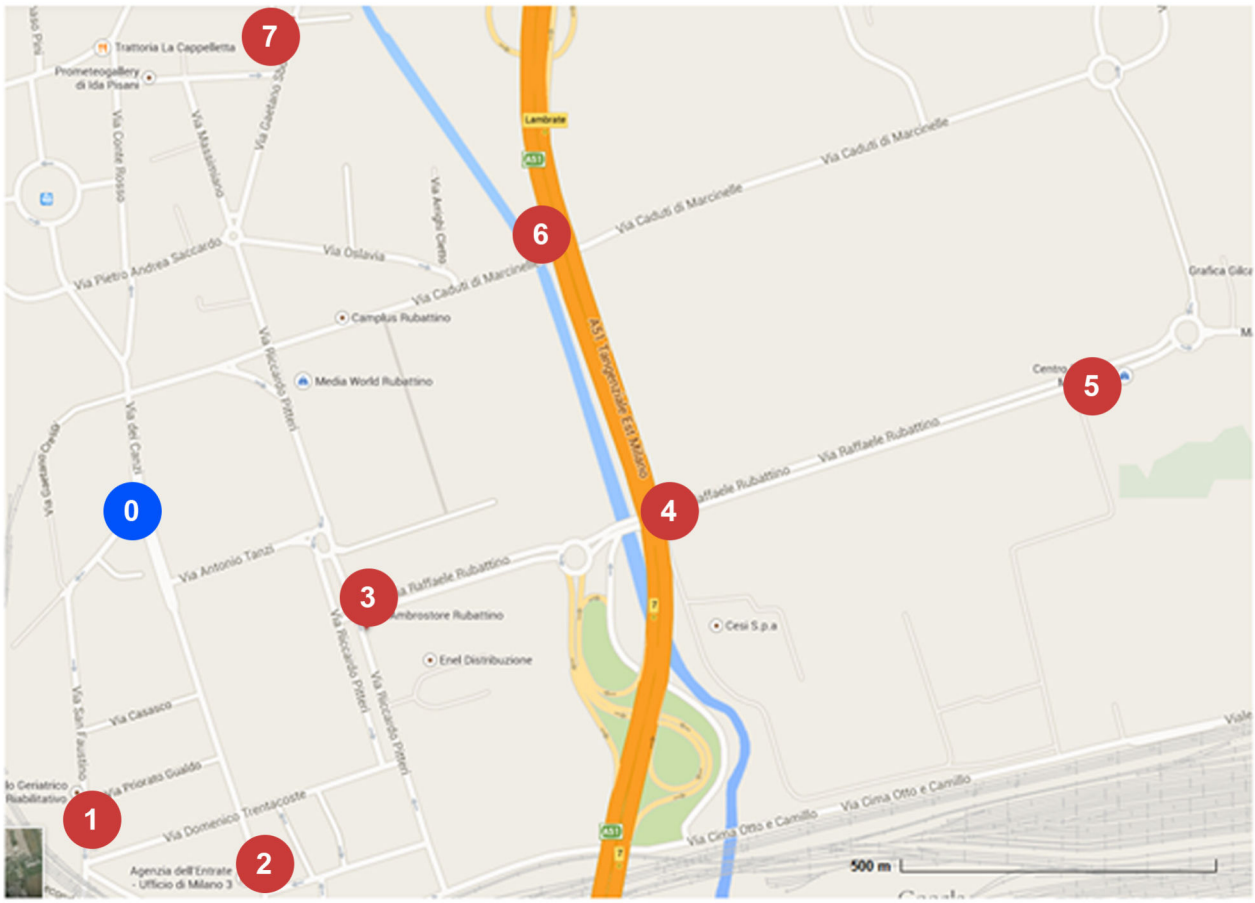
## Radiomodem BK82N3HP

**Long range propagation test on the 169 MHz VHF band**

Tests made are a meaningful proof of the range of communication between two radio modules BK82N3HP within an urban environment.The Central-Station, (tuned on "Echo" mode), was installed at the first floor of STE building (Milano - Via Bistolfi 49); the Remote Station ( linked to a PC through the USB port ) was placed in different locations to evaluate both field strength and background noise (please refer to the attached map showing the tests area). Trasmission power had been set at 500mW but above all antennas had been carefully tuned to get better results.Antenna is a normal ¼ -Shortened. This type of antenna needs an efficient ground plane in order to properly operate.Henceforth the system had been put into a metal box which is acting as the efficient "ground" as well as l a shield against possible EMI noise coming from either the PC or from the USB wire.The measurements show how the noise is particularly low although the tests had been taken in a highly industrialised area.

While taking the tests we could monitor the impact of wave propagation abnormalities (reflections, diffractions) which shown signal variances even higher than +/-10dB when moving antennas location in a range of 30/50 cm. This is a key info when you have to set-up distance and positioning of antennas within a data transmission network .Using an "Antenna diversity" system onto the Central Station could be one possible solution to the above problem.Otherwise, it could be useful to program the transmission on two different channels (Frequency Diversity).

Tests had been taken as shown in the below map:




Hereafter find the tests result for each post, showing parameters recorded from both Central and Remote station.

# 169MHz long distance test

**RSSI:** Received Signal Strength Indicator.
**Noise:** On channel Noise level.
**VBAT:** BK8xx supply voltage measure.

0. Design department STE - Via Bistolfi 49. About 15 meters distance in a straight line between Master and Slave across two walls.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:04:54 | -54 | -105 | 3.35 | -56 | -123 | 3.35 |
| 27/02/2014 | 14:07:26 | | | | | | |
| 27/02/2014 | 14:07:27 | -53 | -103 | 3.35 | -56 | -124 | 3.30 |
| 27/02/2014 | 14:07:33 | | | | | | |
| 27/02/2014 | 14:07:34 | -53 | -103 | 3.35 | -56 | -125 | 3.35 |
| 27/02/2014 | 14:07:41 | | | | | | |
| 27/02/2014 | 14:07:42 | -53 | -100 | 3.35 | -56 | -122 | 3.30 |
| 27/02/2014 | 14:07:49 | | | | | | |
| 27/02/2014 | 14:07:49 | -55 | -98 | 3.35 | -58 | -122 | 3.35 |

**0 test**

1. Via S.Faustino 36. 500 meters distance in a straight line between master and slave.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:17:52 | -82 | -104 | 3.35 | -84 | -122 | 3.30 |
| 27/02/2014 | 14:17:58 | | | | | | |
| 27/02/2014 | 14:17:59 | -78 | -107 | 3.35 | -81 | -121 | 3.35 |
| 27/02/2014 | 14:18:06 | | | | | | |
| 27/02/2014 | 14:18:07 | -85 | -111 | 3.35 | -87 | -125 | 3.35 |
| 27/02/2014 | 14:18:15 | | | | | | |
| 27/02/2014 | 14:18:16 | -80 | -106 | 3.35 | -81 | -124 | 3.35 |
| 27/02/2014 | 14:18:23 | | | | | | |
| 27/02/2014 | 14:18:24 | -83 | -107 | 3.35 | -87 | -121 | 3.35 |

**1 test**

2. Via Bistolfi 8. 500 meters distance in a straight line between Master and Slave - just few obstacles obstructing signal.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:24:46 | -79 | -104 | 3.35 | -82 | -119 | 3.30 |
| 27/02/2014 | 14:24:53 | | | | | | |
| 27/02/2014 | 14:24:54 | -78 | -106 | 3.35 | -80 | -118 | 3.35 |
| 27/02/2014 | 14:25:00 | | | | | | |
| 27/02/2014 | 14:25:01 | -80 | -106 | 3.30 | -82 | -124 | 3.30 |
| 27/02/2014 | 14:25:07 | | | | | | |
| 27/02/2014 | 14:25:08 | -84 | -106 | 3.35 | -86 | -121 | 3.30 |
| 27/02/2014 | 14:25:15 | | | | | | |
| 27/02/2014 | 14:25:16 | -79 | -105 | 3.35 | -78 | -120 | 3.35 |

**2 test**

3. Via Pitteri corner with Via Rubattino. 360 meters distance in a straight line between Master and Slave.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:30:49 | | | | | | |
| 27/02/2014 | 14:30:50 | -91 | -103 | 3.30 | -92 | -124 | 3.30 |
| 27/02/2014 | 14:30:56 | | | | | | |
| 27/02/2014 | 14:31:01 | | | | | | |
| 27/02/2014 | 14:31:02 | -88 | -111 | 3.35 | -90 | -125 | 3.35 |
| 27/02/2014 | 14:31:08 | | | | | | |
| 27/02/2014 | 14:31:09 | -83 | -103 | 3.35 | -88 | -119 | 3.35 |
| 27/02/2014 | 14:31:15 | | | | | | |
| 27/02/2014 | 14:31:16 | -92 | -111 | 3.35 | -89 | -118 | 3.35 |
| 27/02/2014 | 14:31:22 | | | | | | |
| 27/02/2014 | 14:31:23 | -86 | -103 | 3.35 | -87 | -120 | 3.35 |

**3 test**

# 169MHz long distance test

4. Via Rubattino on the corner with Cesi Spa entrance 800 meters distance in a straight line between Master and Slave - just few obstacles obstructing signal

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:35:24 | -75 | -109 | 3.35 | -78 | -120 | 3.35 |
| 27/02/2014 | 14:35:30 | | | | | | |
| 27/02/2014 | 14:35:31 | -74 | -111 | 3.35 | -75 | -122 | 3.35 |
| 27/02/2014 | 14:35:37 | | | | | | |
| 27/02/2014 | 14:35:38 | -81 | -112 | 3.35 | -81 | -125 | 3.35 |
| 27/02/2014 | 14:35:46 | | | | | | |
| 27/02/2014 | 14:35:47 | -70 | -108 | 3.35 | -73 | -119 | 3.35 |
| 27/02/2014 | 14:35:54 | | | | | | |
| 27/02/2014 | 14:35:55 | -72 | -112 | 3.35 | -72 | -124 | 3.35 |

**4 test**

5. Via Rubattino nearby the Porsche center 1540 meters distance in a straight line between Master and Slave - just few obstacles obstructing.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:40:06 | | | | | | |
| 27/02/2014 | 14:40:10 | | | | | | |
| 27/02/2014 | 14:40:11 | -93 | -105 | 3.35 | -96 | -122 | 3.35 |
| 27/02/2014 | 14:40:17 | | | | | | |
| 27/02/2014 | 14:40:18 | -95 | -104 | 3.35 | -94 | -121 | 3.30 |
| 27/02/2014 | 14:40:26 | | | | | | |
| 27/02/2014 | 14:40:27 | -102 | -112 | 3.35 | -102 | -121 | 3.35 |
| 27/02/2014 | 14:40:34 | | | | | | |
| 27/02/2014 | 14:40:38 | | | | | | |
| 27/02/2014 | 14:40:39 | -99 | -110 | 3.35 | -103 | -123 | 3.35 |
| 27/02/2014 | 14:40:44 | | | | | | |
| 27/02/2014 | 14:40:45 | -94 | -110 | 3.30 | -98 | -123 | 3.30 |
| 27/02/2014 | 14:40:49 | | | | | | |

**5 test**

6. Via Caduti di Marcinelle close to Tangenziale flyover.
750 meters distance in a straight line between Master and Slave.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:46:04 | -86 | -106 | 3.30 | -91 | -123 | 3.35 |
| 27/02/2014 | 14:46:11 | | | | | | |
| 27/02/2014 | 14:46:12 | -88 | -111 | 3.35 | -90 | -125 | 3.35 |
| 27/02/2014 | 14:46:19 | | | | | | |
| 27/02/2014 | 14:46:20 | -84 | -107 | 3.35 | -87 | -121 | 3.30 |
| 27/02/2014 | 14:46:28 | | | | | | |
| 27/02/2014 | 14:46:29 | -82 | -107 | 3.30 | -84 | -121 | 3.35 |
| 27/02/2014 | 14:46:35 | | | | | | |
| 27/02/2014 | 14:46:36 | -80 | -109 | 3.30 | -82 | -119 | 3.35 |

**6 test**

7. Via Sbodio 24. 800 meters distance in a straight line between Master and Slave.

| DateTime | | Remote_RSSI | Remote_NOISE | Remote_VBAT | Central_RSSI | Central_NOISE | Central_VBAT |
|---|---|---|---|---|---|---|---|
| | | dBm | dBm | V | dBm | dBm | V |
| 27/02/2014 | 14:51:09 | | | | | | |
| 27/02/2014 | 14:51:14 | | | | | | |
| 27/02/2014 | 14:51:15 | -99 | -112 | 3.35 | -98 | -123 | 3.35 |
| 27/02/2014 | 14:51:21 | | | | | | |
| 27/02/2014 | 14:51:22 | -94 | -105 | 3.35 | -94 | -124 | 3.30 |
| 27/02/2014 | 14:51:28 | | | | | | |
| 27/02/2014 | 14:51:29 | -92 | -103 | 3.30 | -96 | -124 | 3.35 |
| 27/02/2014 | 14:51:36 | | | | | | |
| 27/02/2014 | 14:51:37 | -94 | -104 | 3.35 | -101 | -125 | 3.35 |
| 27/02/2014 | 14:51:45 | | | | | | |
| 27/02/2014 | 14:51:46 | -91 | -110 | 3.35 | -92 | -119 | 3.35 |

**7 test**

# 169MHz - AMR

## The 169MHz ISM Band

The use of the 169,4 to 169,8 MHz radio spectrum band for ERMES in the Community has decreased dramatically or even ceased altogether, with the result that this radi spectrum band is not being efficiently utilised by ERMES and could therefore be better used to fulfil other Community policy needs.25. As mandated, the CEPT has produced a new frequency plan and channel arrangement allowing six types of preferred applications to share the radio spectrum band from 169,4 up to 169,8125 MHz, in order to meet several Community policy needs. Recently ECC Decision addresses the frequency band of 169 MHz band for use in additional applications: the subject matter of this Decision is the harmonisation of the conditions for the availability and efficient use of the 169,4-169,8125 MHz for the purposes of applications such as "Airing aids", "Social alarms", "Meter readings", "Tracing and asset tracking", "Paging" and "Private mobile radio services".

AMR automatic meter READING

CUBY

## Cuby: a new gateway concept

Cuby is a new STE proprietary multi-technology concept.
With just few easy steps CUBY is able to create an effective sensors network at high energetic efficiency. A wide range of different sensors can be mounted within the same system: low consumption MicroSp, 169Mhz Systems, Wireless M-Bus,Zig-Bee sensors as well as Bluetooth.
Thanks to wi-fi connection Cuby becomes a hub of the internet network.
Cuby it's a new way of thinking wireless.Thanks to Cuby we can today focus on the application itself better than thinking how to technically achieve it.
Cuby is able to autonomously all the data exchange process among devices.
Thinking about new solutions and applications both B2C and B2B will be just a piece of cake. The system is supplied along with a web-server software which enables final user to manage all linked devices. You can also constantly check-up sensors status as well as manage alrams and events.
Cuby is an outstanding starting point to kick off your idea!

## The Sp.Net: network evolution

Sp.net is the new multi-technology sensors network produced by STE. Thanks to sp.net you will be able to create your own wireless infrastructure with just few easy steps while saving your money. Sp.net can include different solutions such as low-consumption MicroSp systems, ZigBee sensors, Bluetooth and WiFi which can be managed just by one fully integrated Gateway perfectly equipped to handle everything at its best. With sp.net you will be able to control any kind of sensor within any environment. A wide range of applications which go from small home sensors to bigger urban systems as well as more sophisticated use such as checking wheel pressure through a sensor placed into the tyre which sends data directly to your smartphone. Any object, no matter whether big or small, can be part of your sp.net network.

sp.net
wireless sensors

## Micro.Sp Alliance

Micro.Sp: the enabling technology for a Greener and more Sustainable world.
The Micro.Sp Alliance develops and promotes a breakthrough in Energy Efficient Wireless Sensors (EEWS): based on the extremely advanced Micro.Sp technology, the new standard aims to contribute to enable the market of "Internet of Things" (IOT) and smartphone based applications as well as to monitor and control objects in the network.
Micro.Sp alliance delivers a new method of creating wireless sensors by using standard components normally available on the market, thus supporting the widespread of cost effective solutions for a large spectrum of applications.
The alliance's vision is to offer the highest grade of integration along with the most advanced solution for a cost effective approach to the business, contributing to reduce installation, operational costs and to reduce the environmental impact.
We believe in a greener and smarter world and our mission is to offer a new technology for everyone and everything.

# Company contacts

**STE srl**
R&D center of wireless and telemetry solutions

**Address**
Via Bistolfi Leonardo, 49
20134 Milan
Italy

**Office line** +39 02 26411765
**Fax line** +39 02 2640118
**Email** info@stecom.com

**"CONNECTING INNOVATION FOR INTELLIGENT WIRELESS"**