









# (Frequently Asked Questions)

What parameters can bettair<sup>®</sup> nodes measure? How the sensors are integrated? How often should the sensor cartridges be changed? Which measurement techniques and ranges are used? How sensors are calibrated? What is the maintenance cost of the nodes? How is the data displayed? How much does it cost to subscribe to data management and visualization software? How to connect a node to send data? What happens if there is a failure in the mobile antenna network? How is it supplied with power and what is its consumption? What are the advantages of the cloud technology used by bettair<sup>®</sup>? Can the nodes be integrated into a customer's own information system? Can the location be easily changed? How to fasten the node? What accessories are available? What certifications do bettair® nodes have? Is it approved according to air quality standards?



# What parameters can bettair<sup>®</sup> nodes measure?

- They are currently available with NO<sub>2</sub>, NO, O<sub>3</sub>, CO, SO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, VOC and CO<sub>2</sub> sensors. You can choose which of these sensors the instrument is purchased with.
- In addition, whatever the choice of sensors mentioned above, all nodes include sensors for PM<sub>10</sub>, PM<sub>2.5</sub>, PM<sub>1</sub>, noise, pressure, temperature, humidity, and communications module.

#### How the sensors are integrated?

• Sensors are integrated in a cartridge that is easily interchangeable by the user. This allows them to be replaced by a new cartridge at the end of their useful life, thus renewing all of them in a single action.



# How often should the sensor cartridges be changed?

The bettair® system is currently designed for a sensor life of 24 months, ensuring that data quality is maintained, although in certain circumstances of particularly hostile conditions it is recommended that the sensors are replaced after 18 months.



Gases							
Parameter	Technique	Range	Resolution	Precision			
NO <sub>2</sub>	Electroch. cells	0 -20 ppm	0.1 ppb	± 3 ppb			
<b>O</b> 3	Electroch. cells	0 - 20 ppm	0.1 ppb	± 5 ppb			
NO	Electroch. cells	0 – 20 ppm	0.1 ppb	± 4 ppb			
CO	Electroch. cells	0 - 500 ppm	0.1 ppb	± 30 ppb			
<b>SO</b> <sub>2</sub>	Electroch. cells	0 - 50 ppm	0.1 ppb	± 15 ppb			
CO2	NIDR	400 - 10000 ppm	1 ppm	± 30 ppm			
H₂S	Electroch. cells	0 - 50 ppm	0.1 ppb	± 10 ppb			
NH <sub>3</sub>	Electroch. cells	0 – 100 ppm	0.3 ppm	± 1 ppm			
VOC	Electroch. cells	0 – 100 ppm	1 ppb	± 10 ppb			
VOC	Metal oxide semic.	0 - 500 IAQ units	1 IAQ units	3 IAQ units			

# Which measurement techniques and ranges are used?

Paarticles					
Parameter	Technique	Range	Resolution	Precision	
PM1 (μg/m³)	OPC	0 – 1000 / 2000	1	± 2	
PM <sub>2,5</sub> (μg/m³)	OPC	0 – 1000 / 2000	1	± 2	
$PM_{10}$ (µg/m <sup>3</sup> )	OPC	0 - 1000	1	± 2	

Auxiliary parameters						
Parameter	Range	Resolution	Precision			
Temperature (°C)	-40 - 85	0.01	± 0.4			
Humidity (0/ HD)	0 - 85	0 - 85 85 - 100 0.1	± 0.5%			
nullially (%nk)	85 - 100		± 1.5%			
Pressure (hPa)	300 - 1500	0.18 Pa	± 0.6			
Noise (db)	35 - 120	0.1	± 1			

# How sensors are calibrated?

Prior to delivery to customer, a sensor calibration process is performed at the factory.

This calibration, together with the exclusive data processing software developed by bettair®, allows to maintain a maximum and stable correlation of the final data during the whole life of the sensors.

This same factory calibration process is performed on each cartridge supplied. Thus, a node on which a new cartridge is installed has the same reliability of the pollutant data as a new node.

# What is the maintenance cost of the nodes?

None. Factory calibration is included in the purchase price of the nodes and cartridges and, due to the design of the specific data processing based on machine-learning technology, no additional action is required.

# How is the data displayed?

Through any internet browser, without the need to install any software, on PC, mobile or tablet.



With the purchase of a bettair® node, access to a specific portal with different functionalities for viewing and downloading reports is provided by means of a username and password.

Each user can view the real-time data of all the nodes he/she has purchased, which will be displayed geo-positioned on a map, due to the integrated GPS. By default, the GPS location of the device is updated every midnight, unless another frequency is specifically requested.

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		Law 151-200 Uniteality 201-300 Very Uniteality	No data
•	$\sim$	301-500 Hazardous	

For every customer, is also available a **public data website**, where they can offer a simplified version just to share with the general public basic information of location and real time & historic data of nodes. You can find an example at:

#### https://public.bettair.city/baena

# How much does it cost to subscribe to data management and visualization software?

None. It is included free of charge for all users who purchase a node.

In addition, when a new cartridge is purchased to replace a depleted one, this subscription is automatically renewed.

#### How to connect a node to send data?

There are different ways to connect a node. Although connection via network cable is available, the most common way is via 3G/4G mobile connectivity (integrated as standard).

To achieve mobile connectivity, a SIM card with activated data transmission must be inserted in the node.



For the supply of nodes in the EU and associated countries, neither the SIM card nor the data connection service has any cost for the user, nor does the user have to make any arrangements to activate it, as it is factory configured.

For the rest of the countries, a SIM card with worldwide coverage can be supplied, but the cost of this should be passed on, being much more advisable for the user or local distributor to install a card with a data contract for that country<sup>1</sup>.

Optionally, it is possible to connect the nodes via Ethernet, or even to a LoRaWAN network.

# What happens if there is a failure in the mobile antenna network?

Although it is not easy for this situation to arise nowadays, the node can have a large internal memory, which allows the storage of about 7 days of data, which will be sent to the central server when the device recovers the connection.

# How is it supplied with power and what is its consumption?

The node is supplied as standard with a power cable for connection to the mains. With an integrated universal transformer, it can be powered at 110-220 V and 50-60 Hz. A DC version of the node is also available in the 18-75 V range.

Average power consumption is < 1 W, with peaks of 12 W when the internal battery is charging.

This internal battery allows it to continue to operate for 3-4 days in case of power failure.

It also has (optional) a solar panel specially designed for the node, which makes the node autonomous in the absence of connection to electrical network.

PoE power supply is also available.

# What are the advantages of the cloud technology used by bettair<sup>®</sup>?

The current processing system, whose development was initiated in 2012 by researchers at the Polytechnic University of Catalonia, is based on the knowledge of the behavior of the sensors throughout their useful life in changing environmental conditions.

So, the principles on which this technology is based are twofold: high-level quality control of the components used, and machine-learning based data processing that allows the intelligent system to model the sensors performance, throughout their useful life and considering the conditions of the environment, in order to guarantee the data reliability.

<sup>&</sup>lt;sup>1</sup> Bettair has a list of "supported operators". If not on this list, nodes will simply require a firmware update to support the new operator.



In addition, with this centralized processing using complex algorithms, developed through years of research and field testing, the user will immediately benefit from any future improvements to the system.

On the other hand, the configuration of both the autonomous sending of data from the sensor and the web access platform frees the user from any type of investment or software installation on their own computer systems.

# Can the nodes be integrated into a customer's own information system?

Yes. bettair<sup>®</sup> provides the API for the user to integrate the final data obtained after data processing into the user's own system as he/she sees fit. This information can be found in a section of the platform, and also in this link: https://docs.bettair.city/api/

bettair® technology is based on the intelligent processing of the raw data sent by the nodes, using complex algorithms specially designed for this purpose. This is why the data that would be transferred to the user's system via the API comes from the bettair® servers, not directly from the nodes.

We also offer, upon request, the service of integrating the data into the user's tools, if the user does not have technical resources to do it.

# Can the location be easily changed?

The bettair® MK2.5 node dimensions are 210 x 178 x 114 mm (8.27 x 7.01 x 4.49 in), and weighs approximately 1.5 kg (3.31 lb) with cartridge. In addition, it only needs to be connected to a nearby source of electricity (mains or solar panel supplied as an option), which makes the ease of relocation optimal.



# How to fasten the node?

The node has an anchorage on its back that allows, by use of simple commercial clamps, its attachment to poles or lampposts (the most common way).

In any case, a small accessory for wall mounting can also be supplied.



There is also an accessory consisting of a magnetic holder to be fixed on the roof of a vehicle, for example, and thus make the change of measurement location more immediate.

# What accessories are available?

The following accessories are currently available:

- Solar power panel
- Mechanical wind speed & direction sensor
- Sonic wind speed & direction sensor
- Complete weather station, adding precipitation, wind speed and direction, and solar radiation.
- Wall mounting bracket
- Magnetic bracket

# What certifications do bettair® nodes have?

- EMC compliance: Directive 2014/30/EU
- Emissions: EN55032 Class BA -> "Class A"
- Immunity: EN55024 Class BA -> "Class A"
- LVD compliance: Directive 2014/35/EU
- Electrical Safety: EN62368-1
- RED compliance: Directive 2014/53/EU
- FCC compliance: FCC Part 15 Subpart B, IEC 661672-1:2013

# Is it approved according to air quality standards?

Obviously, this type of analyzers do not have the same approvals as the standard analyzers that are installed in the "official" air quality stations, the philosophy is to be complementary to them.

The cost of a complete equivalent station, with all the analyzers measuring the same as these nodes, could be more than 200 k $\in$ .

Currently, no air quality standard approvals are in place for this type of equipment. CEN Working Group 42 (CEN/TC 264 WG42) has recently published a standard (UNE CEN/TS 17660-1:2021) to define the methodology for testing and classifying "low cost" pollutant gas sensors into three groups according to their accuracy. bettair® engineers have acted as consultants in the development of these standards, and it is likely that these nodes will be the first to obtain these approvals. There is also a guide developed by the US EPA which, along the same lines, provides criteria for evaluating these devices.

The bettair® device is in the process of obtaining certification is the UK Environment Agency's Monitoring Certification Scheme for equipment (MCERTS) for particulate measurement, expected finished by the end of 2023.

During the last few years, bettair® nodes have participated in many intercomparisons carried out by independent entities, obtaining the best results in the market. Some of



them have been carried out by the Cambridge University (UK) and by the certification services Swiss multinational company SGS, following the US EPA recommendations for this type of tests on field.

To corroborate all this, bettair® also participated in the AIRLAB Microsensors Challenge 2023, considered the most exhaustive test in existence. These tests have been carried out by comparing the devices for months with reference equipment in France and Thailand simultaneously, and bettair® nodes have been proclaimed **the most accurate device in the world**.

