

ignion<sup>™</sup>

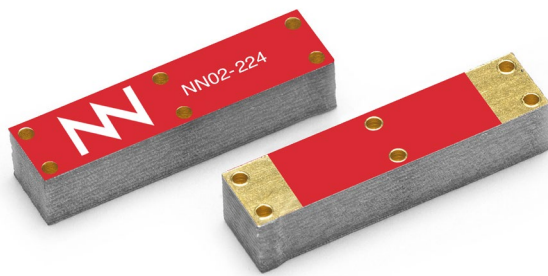
Your innovation.  
Accelerated.

# Bluetooth<sup>®</sup> and Wi-Fi<sup>®</sup> antenna booster

APPLICATION NOTE  
RUN mXTEND<sup>™</sup> (NN02-224)

## RUN mXTEND<sup>™</sup> (NN02-224) – BLUETOOTH & Wi-Fi 2400-2500 MHz

Ignion specializes in enabling effective mobile communications. Using Ignion technology, we design and manufacture optimized antennas to make your wireless devices more competitive. Our mission is to help our clients develop innovative products and accelerate their time to market through our expertise in antenna design, testing and manufacturing.



RUN mXTEND<sup>™</sup> antenna booster  
NN02-224

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Ignion is an ISO 9001:2015 certified company. All our antennas are lead-free and RoHS compliant.

ISO 9001: 2015



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# 1. PRODUCT DESCRIPTION NN02-224

The RUN mXTEND™ antenna booster has been specifically designed for providing multiband performance in wireless devices (in particular in mobile devices), enabling worldwide coverage by allowing operation in the communication standards Bluetooth, ISM, WIFI, and WLAN.



**Material:** The RUN mXTEND™ antenna booster is built on glass epoxy substrate.

## APPLICATIONS

- Handsets
- Smartphones
- Tablets
- Phablets
- Laptop PCs
- Netbooks
- Modules
- Routers
- eBook readers

## BENEFITS

- High efficiency
- Small size
- Cost-effective
- Easy-to-use (pick and place)
- Multiband behaviour (worldwide standards)
- Off-the-Shelf Standard Product (no customization is required)

The RUN mXTEND™ antenna booster belongs to a new generation of antenna solutions based on the Virtual Antenna™ technology developed by Ignion. The technology is mainly focused on replacing conventional antenna solutions by miniature and standard components.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 674491



## 2. EVALUATION BOARD BLUETOOTH

### 2.1. QUICK REFERENCE GUIDE

| Technical features     | 2.4 – 2.5 GHz             |
|------------------------|---------------------------|
| Average Efficiency     | > 75 %                    |
| Peak Gain              | 4.2 dBi                   |
| VSWR                   | < 1.5:1                   |
| Radiation Pattern      | Omnidirectional           |
| Polarization           | Linear                    |
| Weight (approx.)       | 0.19 g                    |
| Temperature            | -40 to +125 °C            |
| Impedance              | 50 Ω                      |
| Dimensions (L x W x H) | 12.0 mm x 3.0 mm x 2.4 mm |

Table 1 – Technical Features. Measures from the Evaluation Board. See Figure 1.

### 2.2. EVALUATION BOARD

This Evaluation Board EB\_NN02-224-2400 integrates a UFL cable to connect the RUN mXTEND™ antenna booster with the SMA connector. The RUN mXTEND™ provides operation in the frequency region which covers from 2.4 GHz to 2.5 GHz, through a single input/output port.

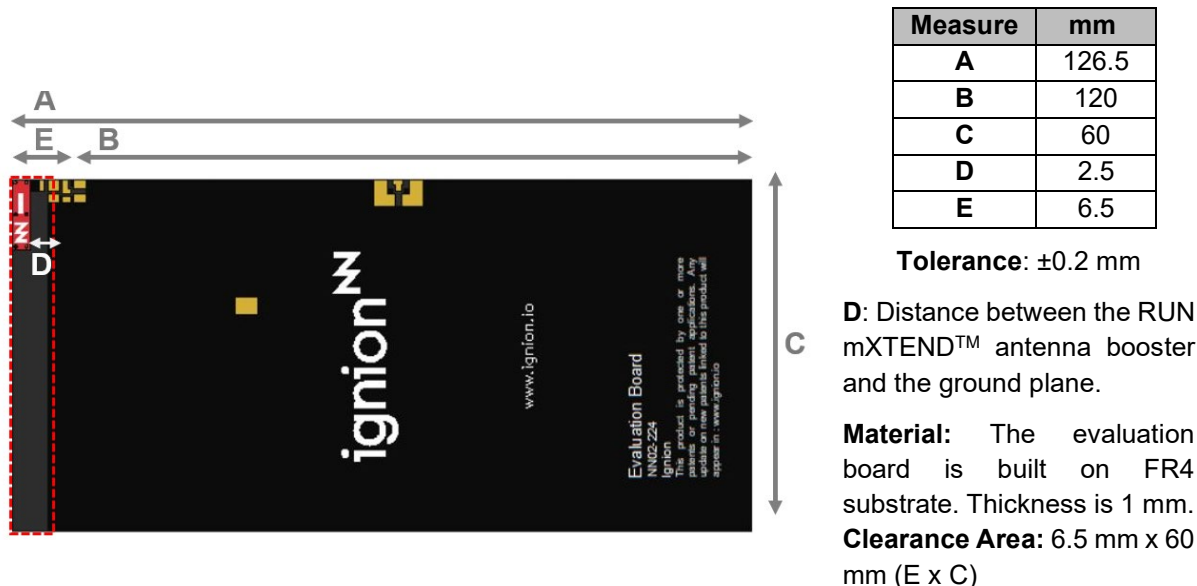


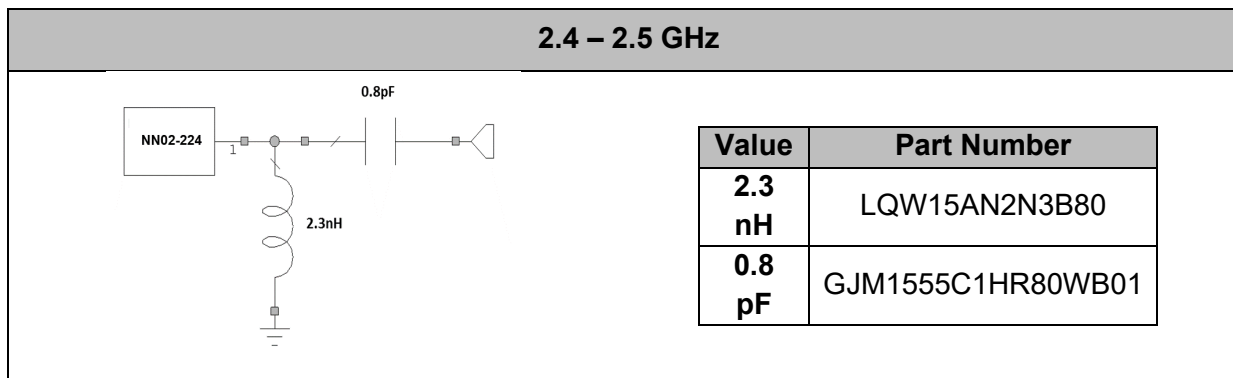
Figure 1 – EB\_NN02-224-2400. Evaluation Board providing operation from 2.4 GHz to 2.5 GHz.

This product and its use are protected by at least one or more of the following [patent](#) PAT. US 9,130,259 B2. Other domestic and international patents pending. Additional information about patents related to this product is available at [www.ignion.io/virtual-antenna/](http://www.ignion.io/virtual-antenna/).

## 2.3. MATCHING NETWORK

The specs of a Ignion standard product are measured in their evaluation board, which is an ideal case. In a real design, components nearby the antenna, LCD's, batteries, covers, connectors, etc. affect the antenna performance. This is the reason why it is highly recommended placing pads compatible with 0402 and 0603 SMD components for a matching network as close as possible to the feeding point. Do it in the ground plane area, not in the clearance area. This provides a degree of freedom to tune the RUN mXTEND™ antenna booster once the design is finished and considering all elements of the system (batteries, displays, covers, etc.).

Please notice that different devices with different ground planes and different components nearby the RUN mXTEND™ antenna booster may need a different matching network. To ensure optimal results, the use of high Q and tight tolerance components is highly recommended (Murata components). Please, if you need assistance contact [support@ignion.io](mailto:support@ignion.io) for more information related to the antenna booster matching service.



**Figure 2** – Matching Network implemented in the evaluation board (Figure 1).

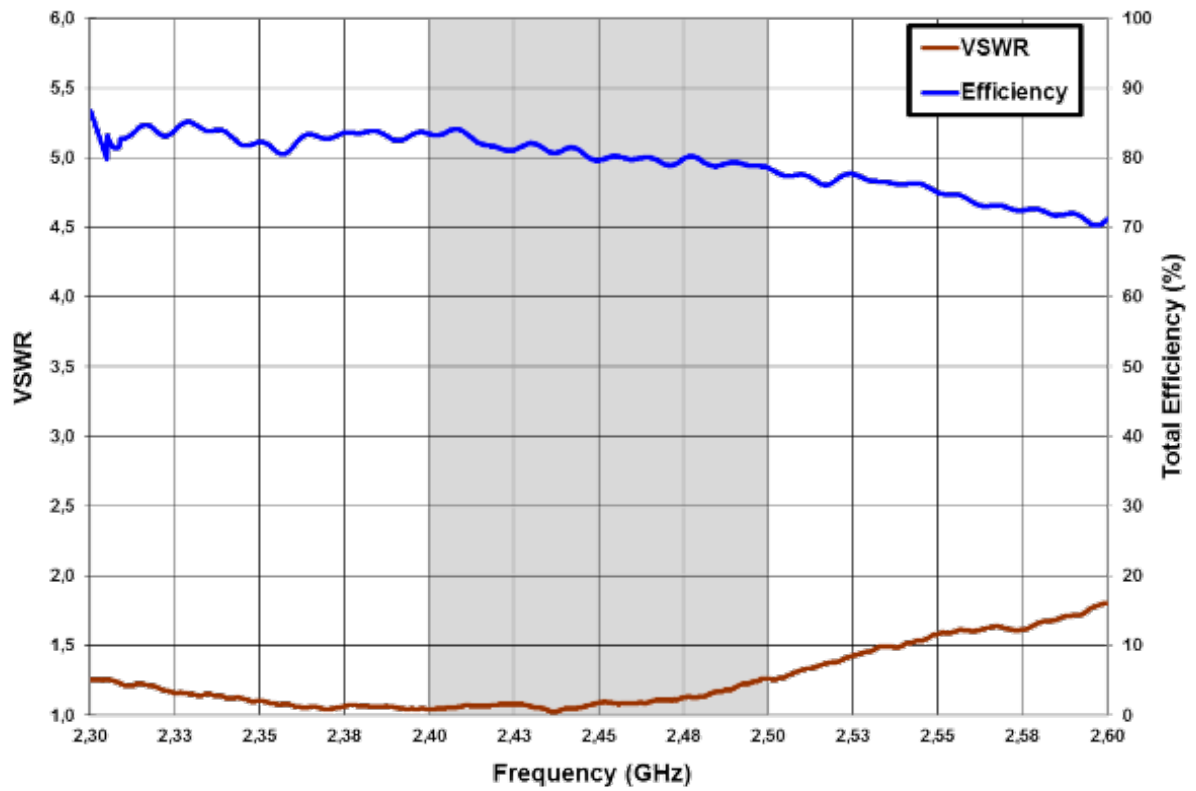
For additional information, please visit [www.ignion.io](http://www.ignion.io) or contact [info@ignion.io](mailto:info@ignion.io).

If you need assistance to design your matching network, please contact [support@ignion.io](mailto:support@ignion.io), or try our free-of-charge<sup>1</sup> [Antenna Intelligence Cloud](https://www.ignion.io/antenna-intelligence/) design service, which will get you a chip antenna design including a custom matching network for your device in 24h<sup>1</sup>. Other information related to Ignion's range of R&D services is available at: <https://www.ignion.io/rdservices/>

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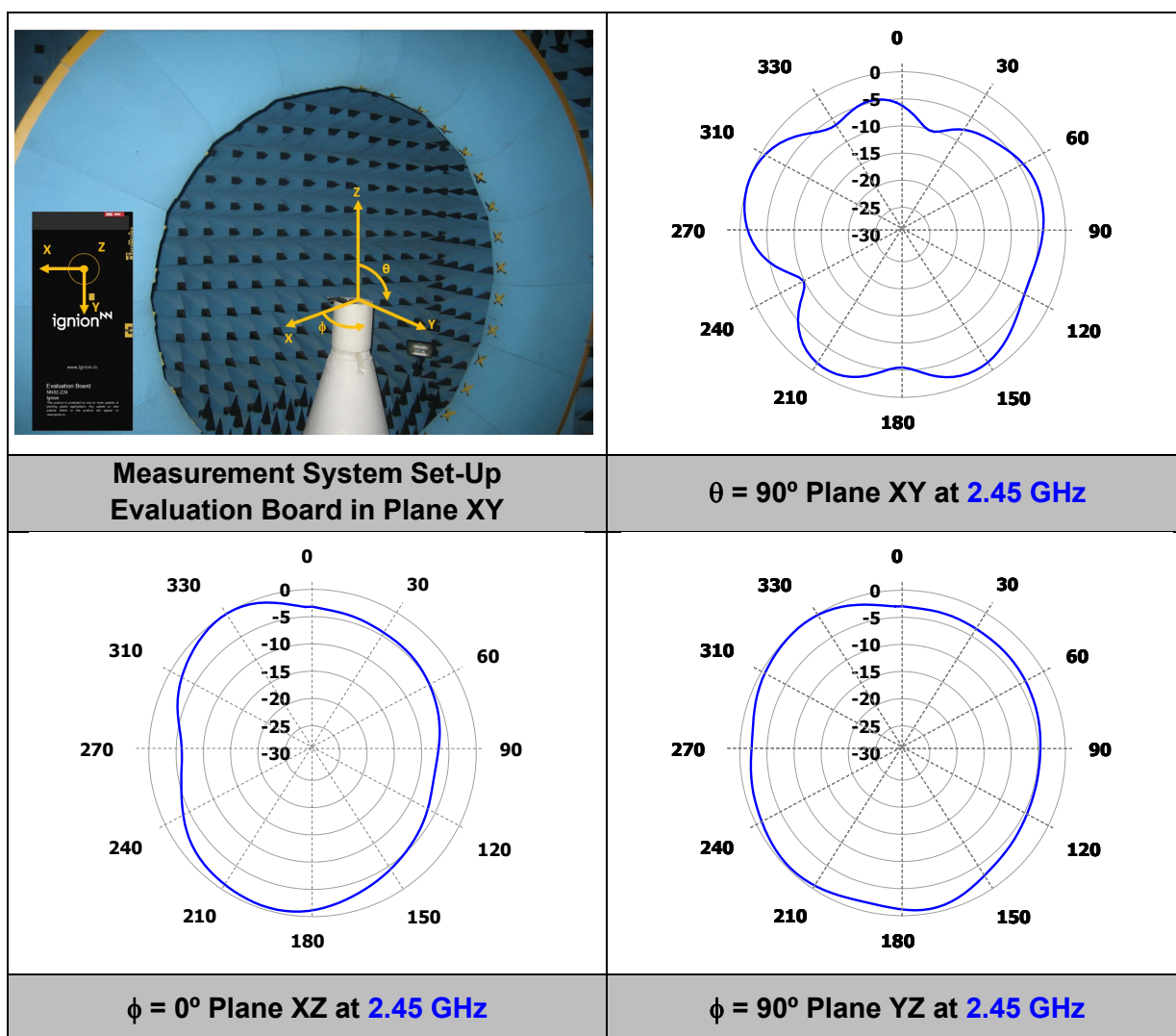
## 2.4. VSWR AND TOTAL EFFICIENCY

VSWR (Voltage Standing Wave Ratio) and Total Efficiency versus Frequency (GHz).



**Figure 3** – VSWR and Total Efficiency for the 2.4 – 2.5 GHz frequency range (from the evaluation board (Figure 1)).

## 2.5. RADIATION PATTERNS (2.4-2.5 GHz), GAIN AND EFFICIENCY



|                   |  |                               |
|-------------------|--|-------------------------------|
| <b>Gain</b>       | <b>Peak Gain</b>                                   | 4.2 dBi                       |
|                   | <b>Average Gain across the band</b>                | 3.9 dBi                       |
|                   | <b>Gain Range across the band (min, max)</b>       | 3.6 $\leftrightarrow$ 4.2 dBi |
| <b>Efficiency</b> | <b>Peak Efficiency</b>                             | 86.0 %                        |
|                   | <b>Average Efficiency across the band</b>          | 80.4 %                        |
|                   | <b>Efficiency Range across the band (min, max)</b> | 75.7 – 86.0 %                 |

**Table 2** – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 2.4 – 2.5 GHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.



### 3. EVALUATION BOARD CR80 BLUETOOTH

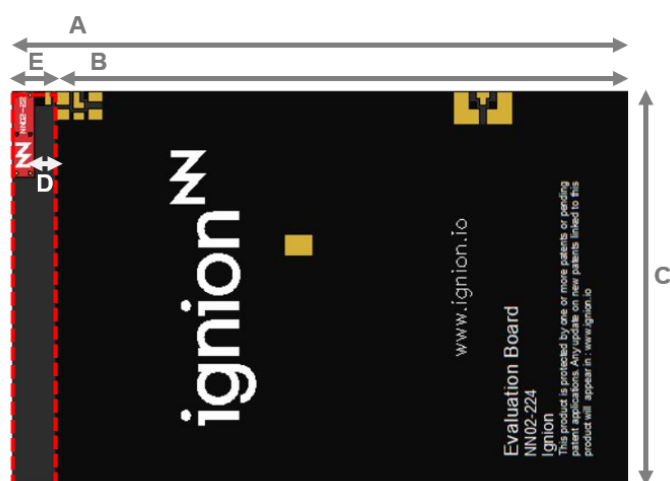
#### 3.1. QUICK REFERENCE GUIDE

| Technical features        | 2.4 – 2.5 GHz             |
|---------------------------|---------------------------|
| Average Efficiency        | > 70 %                    |
| Peak Gain                 | 3.0 dBi                   |
| VSWR                      | < 1.5:1                   |
| Radiation Pattern         | Omnidirectional           |
| Polarization              | Linear                    |
| Weight (9pprox..)         | 0.19 g                    |
| Temperature               | -40 to +125 °C            |
| Impedance                 | 50 Ω                      |
| Dimensions<br>(L x W x H) | 12.0 mm x 3.0 mm x 2.4 mm |

Table 3 – Technical Features. Measures from the Evaluation Board. See Figure 4.

#### 3.2. EVALUATION BOARD

This Evaluation Board EB\_NN02-224-CR80-2400 integrates a UFL cable to connect the RUN mXTEND™ antenna booster with the SMA connector. The RUN mXTEND™ provides operation in the frequency region which covers from 2.4 GHz to 2.5 GHz, through a single input/output port.



| Measure | mm   |
|---------|------|
| A       | 86   |
| B       | 79.5 |
| C       | 54   |
| D       | 2.5  |
| E       | 6.5  |

Tolerance: ±0.2 mm

**D:** Distance between the RUN mXTEND™ antenna booster and the ground plane.

**Material:** The evaluation board is built on FR4 substrate. Thickness is 1 mm.

**Clearance Area:** 6.5 mm x 54 mm (E x C)

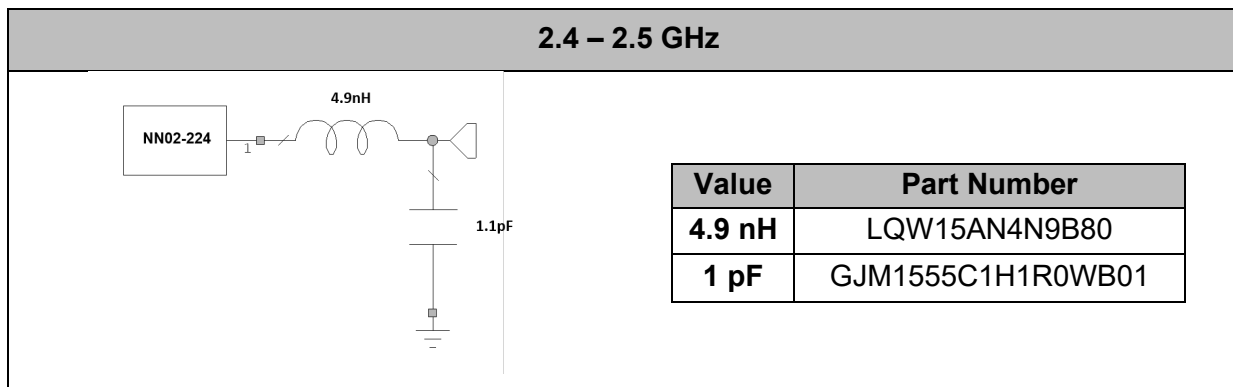
Figure 4 – EB\_NN02-224-CR80-2400 in CR80 standard format. Evaluation Board providing operation from 2.4 GHz to 2.5 GHz.

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**Figure 5** – Matching Network implemented in the evaluation board (Figure 4).

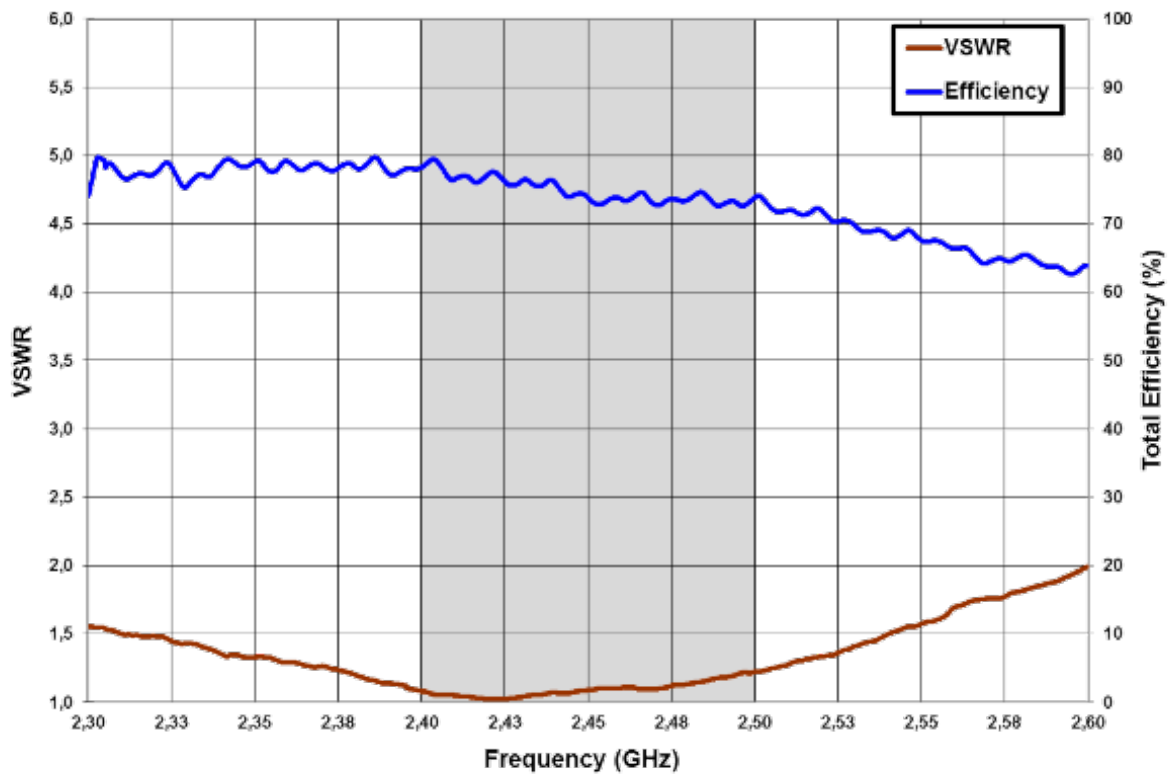
For additional information, please visit [www.ignion.io](http://www.ignion.io) or contact [info@ignion.io](mailto:info@ignion.io).

If you need assistance to design your matching network, please contact [support@ignion.io](mailto:support@ignion.io), or try our free-of-charge<sup>1</sup> [Antenna Intelligence Cloud](#) design service, which will get you a chip antenna design including a custom matching network for your device in 24h<sup>2</sup>. Other information related to Ignion’s range of R&D services is available at: <https://www.ignion.io/rdservices/>

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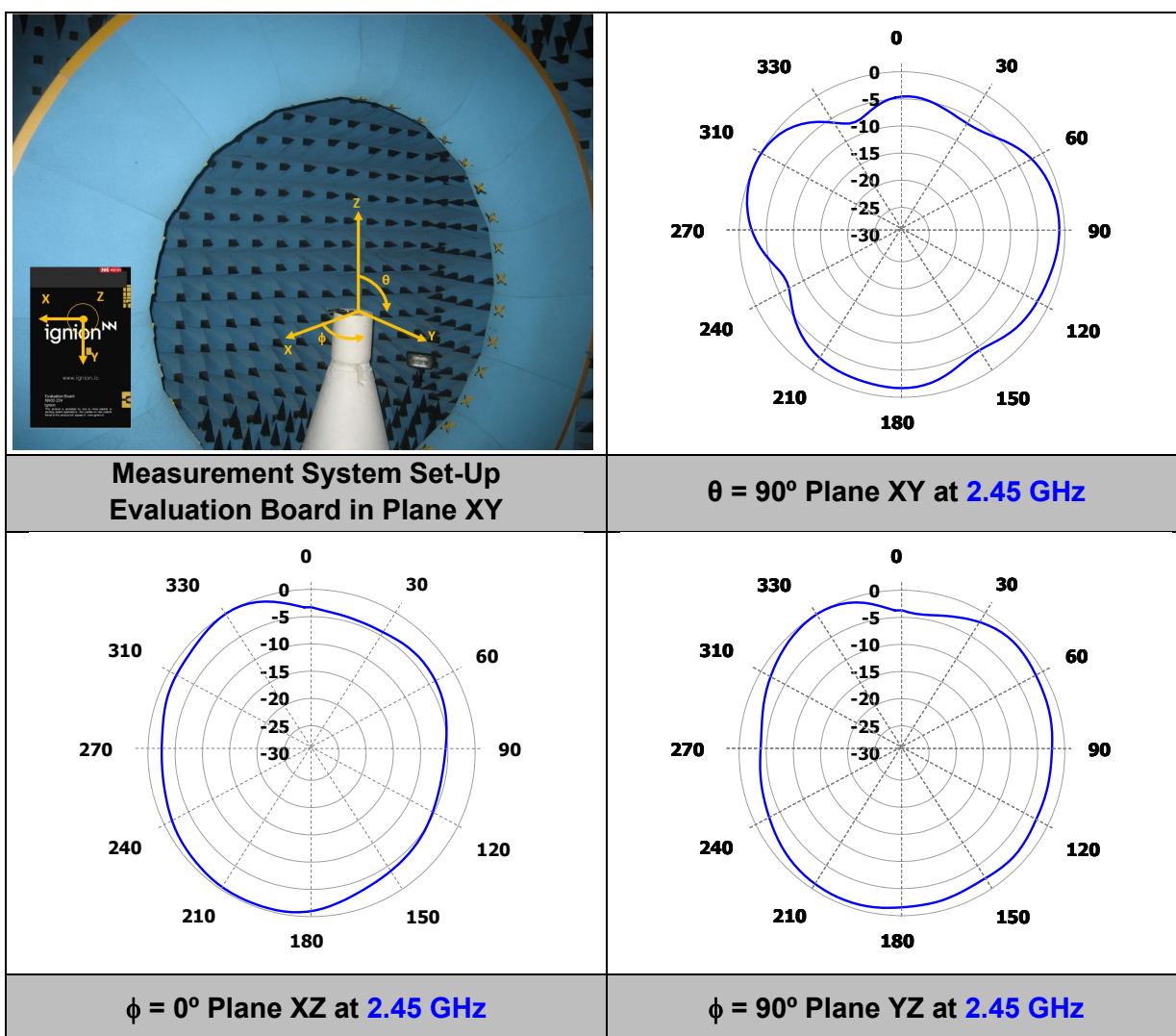
### 3.4. VSWR AND TOTAL EFFICIENCY

VSWR (Voltage Standing Wave Ratio) and Total Efficiency versus Frequency (GHz).



**Figure 6** – VSWR and Total Efficiency for the 2.4 – 2.5 GHz frequency range (from the evaluation board (Figure 4)).

### 3.5. RADIATION PATTERNS (2.4-2.5 GHz), GAIN AND EFFICIENCY



|            |   |               |
|------------|---|---------------|
| Gain       | Peak Gain                                   | 3.0 dBi       |
|            | Average Gain across the band                | 2.7 dBi       |
|            | Gain Range across the band (min, max)       | 2.5 ↔ 3.0 dBi |
| Efficiency | Peak Efficiency                             | 79.6 %        |
|            | Average Efficiency across the band          | 74.8 %        |
|            | Efficiency Range across the band (min, max) | 71.6 – 79.6 % |

**Table 4** – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 4) within the 2.4 – 2.5 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

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Contact:  
[support@ignion.io](mailto:support@ignion.io)  
+34 935 660 710

#### Barcelona

Av. Alcalde Barnils, 64-68 Modul C, 3a pl.  
Sant Cugat del Vallés  
08174 Barcelona  
Spain

#### Shanghai

Shanghai Bund Centre  
18/F Bund Centre, 222 Yan'an Road East,  
Huangpu District  
Shanghai, 200002  
China

#### New Delhi

New Delhi, Red Fort Capital Parsvnath Towers  
Bhai Veer Singh Marg, Gole Market,  
New Delhi, 110001  
India

#### Tampa

8875 Hidden River Parkway  
Suite 300  
Tampa, FL 33637  
USA