

ignion<sup>™</sup>

Your innovation.  
Accelerated.

# Cellular, GNSS and Bluetooth<sup>®</sup> in a single antenna

APPLICATION NOTE  
TRIO mXTEND<sup>™</sup> (NN03-310)

## ONLY one antenna for YOUR TRACKER: Mobile, GNSS & Bluetooth INTO ONE CHIP

- **Antenna Component:** TRIO mXTEND™ NN03-310
- **Dimensions:** 30.0 mm x 3.0 mm x 1.0 mm
- **Frequency regions:** 824-960 MHz, 1710-1990 MHz, 1561-1606 MHz & 2400-2500 MHz



The TRIO mXTEND™ chip antenna **enables Mobile, GNSS and Bluetooth connection simultaneously through a single antenna component**. Thanks to its modular, multiband, and multiport configuration this chip antenna works in multiple frequency regions, **making your ASSET TRACKING device simpler and more compact while reducing its time to market**.

Forget about the usual lack of space in your tracking device and the cost of that many antennas you usually need: TRIO mXTEND™ integrates **three antennas in one!** **Save time, cost and space**. TRIO mXTEND™ is presented in an **ultra slim, off the shelf component of only 1.0 mm height**, this gives the designer freedom to integrate it in about all wireless platforms.

Discover within this application note this **triple coverage** in different frequency regions including 2G, GNSS and Bluetooth: 824-960 MHz, 1710-1990 MHz, 1561-1606 MHz and 2400-2500 MHz.

Feel free to design you ideal new IoT platform, the antenna choice is only one.

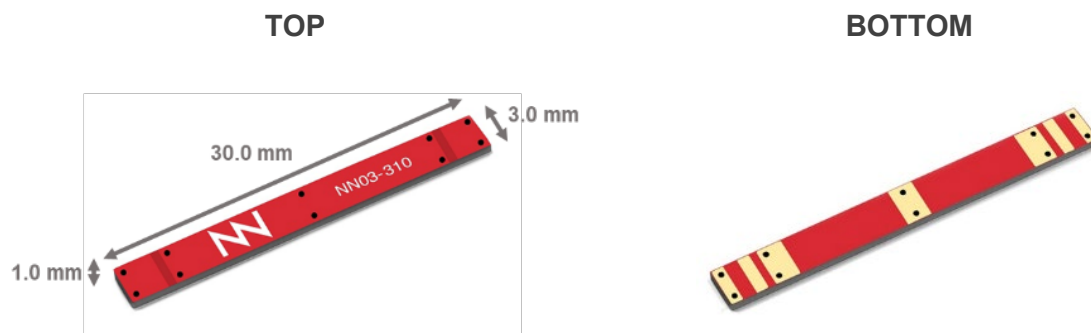
## TABLE OF CONTENTS

<b>1. PRODUCT DESCRIPTION NN03-310</b>	<b>4</b>
<b>2. EVALUATION BOARD 2G, GNSS, BLUETOOTH</b>	<b>5</b>
<b>2.1. QUICK REFERENCE GUIDE</b>	<b>5</b>
<b>2.2. EVALUATION BOARD</b>	<b>5</b>
<b>2.3. MATCHING NETWORK</b>	<b>6</b>
<b>2.4. VSWR AND TOTAL EFFICIENCY</b>	<b>9</b>
<b>2.5. TRANSMISSION COEFFICIENT</b>	<b>9</b>
<b>2.6. RECOMMENDED ANTENNA FOOTPRINT FOR NN03-310</b>	<b>10</b>
<b>2.7. RADIATION PATTERNS (824 – 960 MHz), GAIN, AND EFFICIENCY</b>	<b>11</b>
<b>2.8. RADIATION PATTERNS (1710 – 1990 MHz), GAIN, AND EFFICIENCY</b>	<b>12</b>
<b>2.9. RADIATION PATTERNS (1561 – 1606 MHz), GAIN, AND EFFICIENCY</b>	<b>13</b>
<b>2.10. RADIATION PATTERNS (2400 – 2500 MHz), GAIN, AND EFFICIENCY</b>	<b>14</b>
<b>3. PRODUCT CHANGE NOTIFICATION</b>	<b>15</b>

# 1. PRODUCT DESCRIPTION NN03-310

The TRIO mXTEND<sup>™</sup> chip antenna component has been specifically designed for providing the major level of flexibility to operate any required frequency band inside any wireless device. It can be used in its single port or multiport configuration. Several radios can be allocated inside the same antenna component when used in its multiport configuration, thus allowing its operation in a great variety of communication standards through the same single antenna piece. This modular design reduces considerably the integration complexity while saving cost, time and space. This application note is intended to illustrate its multiport configuration to operate **2G**, **GNSS** (Global Navigation Satellite Systems), and **Bluetooth** frequency bands.

TRIO mXTEND<sup>™</sup> chip antenna component not only offers the versatility of being used in a single port or multiport configuration, but also offers the flexibility to be tuned at the frequency regions of interest through just the proper adjustment of the matching network. This characteristic provides an important benefit since it allows designers to easily adapt the antenna performance to the different device requirements, constraints, or environmental conditions without the need of changing the antenna component. The results gathered herein present how the matching network should be configured for operating 2G mobile communication standards, GNSS, and Bluetooth frequencies.



**Material:** The TRIO mXTEND<sup>™</sup> chip antenna component is built on glass epoxy substrate.

## APPLICATIONS

- Asset Tracking
- Smart Meters
- Smart City & Home
- IoT Devices
- Modules & Sensors
- Routers and Gateways
- eHealth

## BENEFITS

- High efficiency
- Small size
- Multi-port: 3 radios into one antenna component
- Multiband coverage (worldwide standards)
- Off-the-Shelf Standard Product (no customization is required)
- Automated assembly (Pick and place)
- Shorter Design cycle

The TRIO mXTEND<sup>™</sup> chip antenna component belongs to a new generation of antenna solutions based on Virtual Antenna<sup>™</sup> technology owned by Ignion. This technology enables replacing conventional and custom antenna solutions by a new class of so-called antenna boosters, delivered in the form of a new range of miniature and off-the-shelf chip antenna components. These new chip antennas are by nature multiband and multipurpose, so they fit in a variety of wireless platforms to provide a wireless link at many different communication services. By using a Virtual Antenna<sup>™</sup> component the design becomes more predictable compared to a custom solution, making the whole process **faster, cheaper and easier**.

## 2. EVALUATION BOARD 2G, GNSS, BLUETOOTH

### 2.1. QUICK REFERENCE GUIDE

Technical features	Port 1 824-960 MHz	Port 1 1710-1990 MHz	Port 2 1561-1606 MHz	Port 3 2400-2500MHz
Average Efficiency	> 50%	> 60%	> 50%	> 75%
Peak Gain	0.4 dBi	1.9 dBi	0.9 dBi	2.4 dBi
VSWR	< 2.8:1	< 2.1:1	< 2.1:1	< 2.0:1
Radiation Pattern	Omnidirectional			
Polarization	Linear			
Weight (approx.)	0.25 g.			
Temperature	-40 to +125 °C			
Impedance	50 Ω			
Dimensions (L x W x H)	30.0 mm x 3.0 mm x 1.0 mm			

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

### 2.2. EVALUATION BOARD

This Evaluation Board EB\_NN03-310-2G-GNSS-BT integrates one TRIO mXTEND™ chip antenna component to provide operation from 824 to 960 MHz, 1710 to 1990 MHz at port 1, from 1561 to 1606 MHz at port 2 and 2400 to 2500 MHz at port 3.

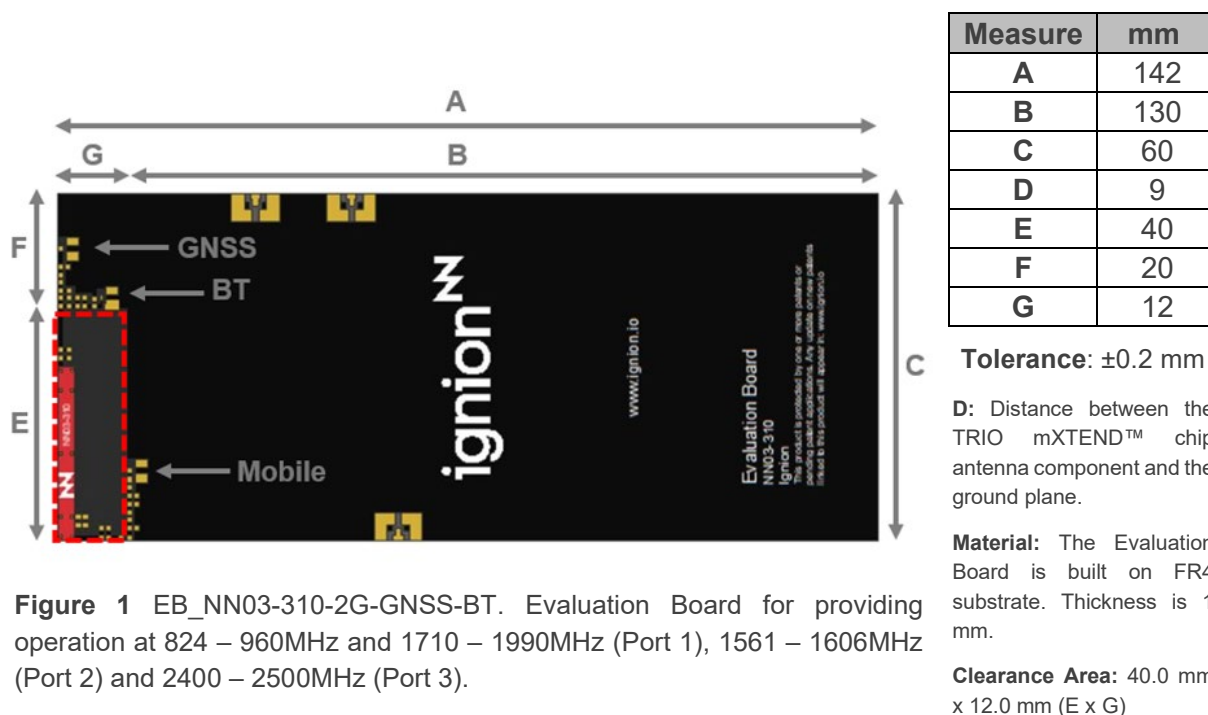


Figure 1 EB\_NN03-310-2G-GNSS-BT. Evaluation Board for providing operation at 824 – 960MHz and 1710 – 1990MHz (Port 1), 1561 – 1606MHz (Port 2) and 2400 – 2500MHz (Port 3).

This product and/or its use is protected by at least one or more of the following [patents and patent applications](#) WO 2019008171, US 16/731755, EP 18736916.0, CN 201880045357.8; and 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

TRIO mXTEND™ antenna booster needs a matching network to connect to your RF module. This section will present the proposed matching network and specs obtained in the corresponding Evaluation Board (Figure 1), which is an ideal case. Please note that different devices with different ground planes and different components nearby the TRIO mXTEND™ chip antenna component may need a different matching network. To ensure optimal results, the use of high-quality factor (Q) and tight tolerance components is highly recommended (e.g. Murata components (Figure 4, Figure 5, Figure 6)).

The antenna performance is always conditioned by its operating environment. Different devices with different printed circuit board sizes, components nearby the antenna, LCD's, batteries, covers, connectors, etc. affect the antenna performance. Accordingly, 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 of the antenna element in the ground plane area, not in the clearance area. This provides a degree of freedom to tune the TRIO mXTEND™ chip antenna component once the design is finished and taking into account all elements of the system (batteries, displays, covers, etc.).

If you need assistance to design your matching network beyond this application note, please contact [support@ignion.io](mailto:support@ignion.io), or if you are designing a **different device size** or a **different frequency band**, we can assist you in less than 24 hours. Please, try our free-of-charge<sup>1</sup> [Antenna Intelligence Cloud](https://www.ignion.io/antenna-intelligence/), which will get you a complete design report including a custom matching network for your device in 24h<sup>1</sup>. Additional information related to NN's range of R&D services is available at: <https://ignion.io/rdservices/>

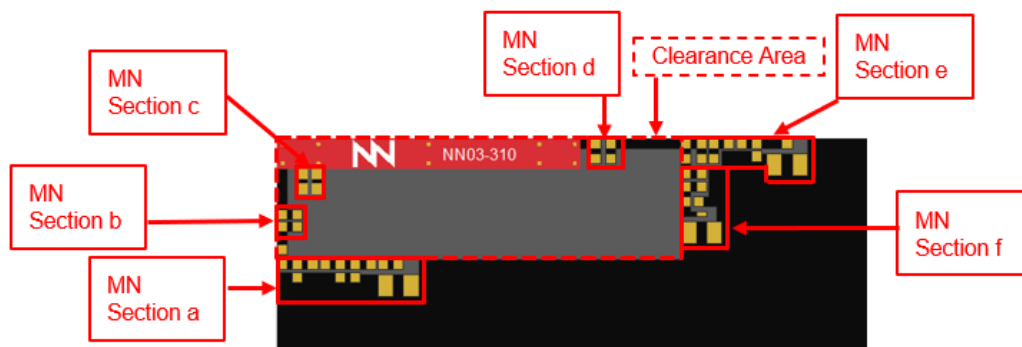


Figure 2 –TRIO mXTEND™ matching network layout

<sup>1</sup> See terms and conditions for a free Antenna Intelligence Cloud service in 24h at: <https://www.ignion.io/antenna-intelligence/>

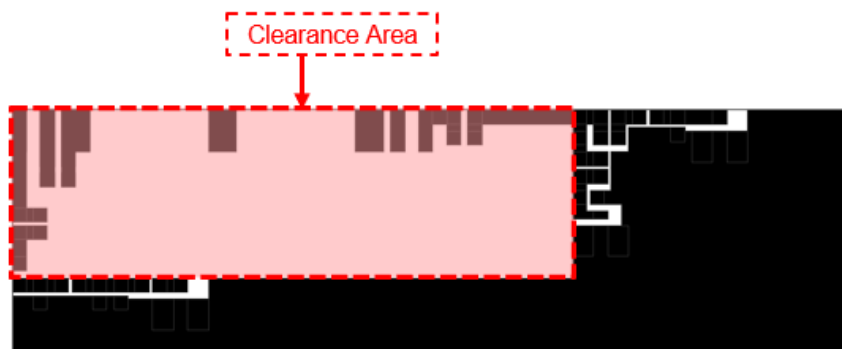
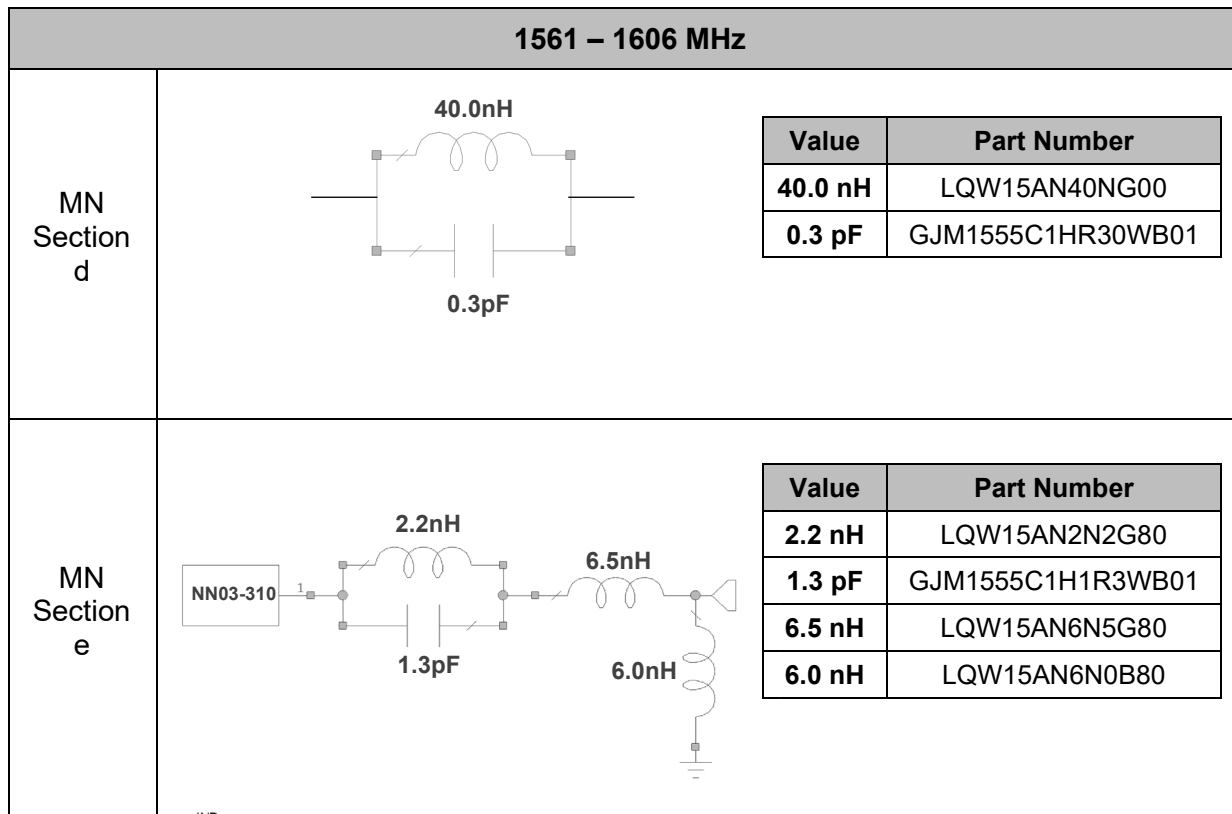


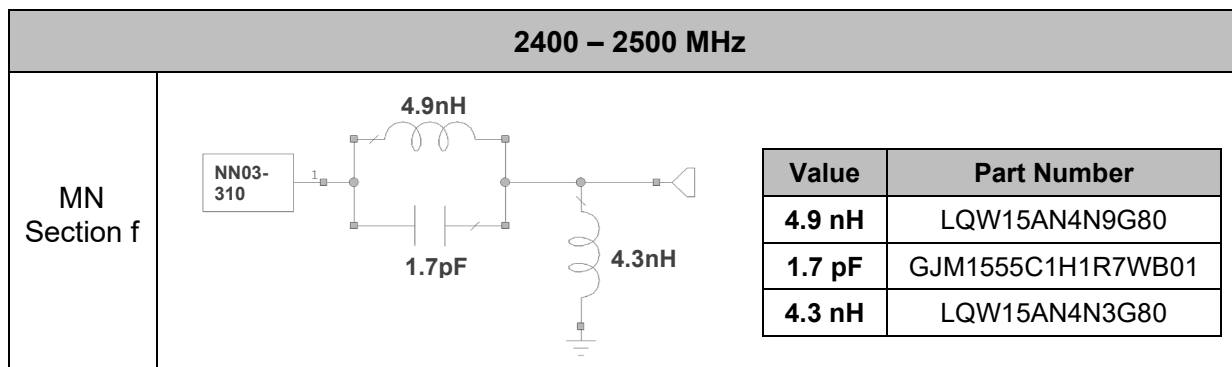
Figure 3 – TRIO mXTEND™ chip antenna component footprint

824 – 960 MHz and 1710 – 1990 MHz															
MN Section a															
	<table border="1"> <thead> <tr> <th>Value</th> <th>Part Number</th> </tr> </thead> <tbody> <tr> <td>12.0 nH</td> <td>LQW18AN12NG80</td> </tr> <tr> <td>1.0 pF</td> <td>GJM1555C1H1R0WB01</td> </tr> <tr> <td>6.0 nH</td> <td>LQW18AN6N0G80</td> </tr> <tr> <td>2.4 pF</td> <td>GJM1555C1H2R4WB01</td> </tr> <tr> <td>5.6 nH</td> <td>LQW18AN5N6G80</td> </tr> <tr> <td>3.6pF</td> <td>GJM1555C1H3R6WB01</td> </tr> </tbody> </table>	Value	Part Number	12.0 nH	LQW18AN12NG80	1.0 pF	GJM1555C1H1R0WB01	6.0 nH	LQW18AN6N0G80	2.4 pF	GJM1555C1H2R4WB01	5.6 nH	LQW18AN5N6G80	3.6pF	GJM1555C1H3R6WB01
	Value	Part Number													
	12.0 nH	LQW18AN12NG80													
	1.0 pF	GJM1555C1H1R0WB01													
	6.0 nH	LQW18AN6N0G80													
	2.4 pF	GJM1555C1H2R4WB01													
5.6 nH	LQW18AN5N6G80														
3.6pF	GJM1555C1H3R6WB01														
MN Section b															
	<table border="1"> <thead> <tr> <th>Value</th> <th>Part Number</th> </tr> </thead> <tbody> <tr> <td>2.2 nH</td> <td>LQW15AN2N2G80</td> </tr> <tr> <td>1.1 pF</td> <td>GJM1555C1H1R1WB01</td> </tr> </tbody> </table>	Value	Part Number	2.2 nH	LQW15AN2N2G80	1.1 pF	GJM1555C1H1R1WB01								
	Value	Part Number													
2.2 nH	LQW15AN2N2G80														
1.1 pF	GJM1555C1H1R1WB01														
MN Section c															
	<table border="1"> <thead> <tr> <th>Value</th> <th>Part Number</th> </tr> </thead> <tbody> <tr> <td>13.0 nH</td> <td>LQW18AN13NG80</td> </tr> <tr> <td>0.1 pF</td> <td>GJM1555C1HR10WB01</td> </tr> </tbody> </table>	Value	Part Number	13.0 nH	LQW18AN13NG80	0.1 pF	GJM1555C1HR10WB01								
	Value	Part Number													
13.0 nH	LQW18AN13NG80														
0.1 pF	GJM1555C1HR10WB01														

Figure 4 – Matching Network implemented in the Evaluation Board port 1 (Figure 1)



**Figure 5** – Matching Network implemented in the Evaluation Board port 2 (Figure 1)

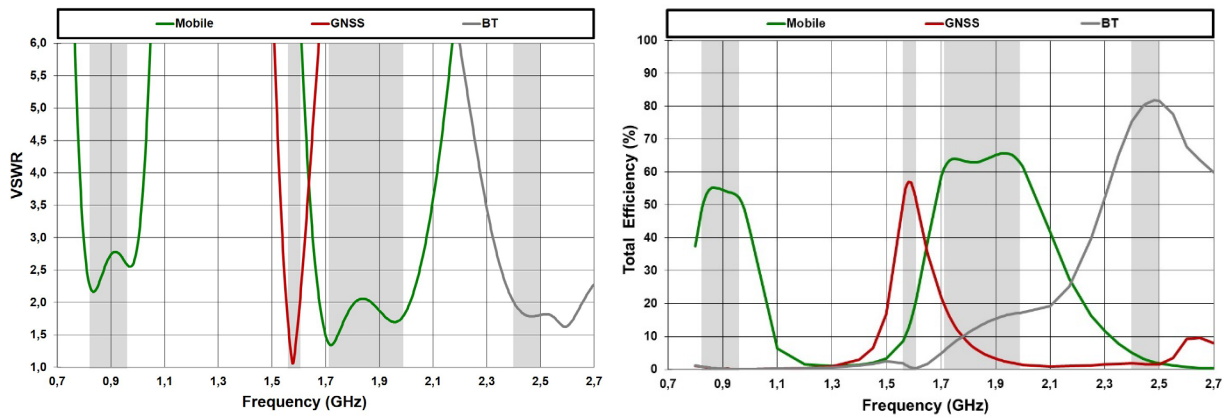


**Figure 6** – Matching Network implemented in the Evaluation Board port 3 (Figure 1)



## 2.4 VSWR AND TOTAL EFFICIENCY

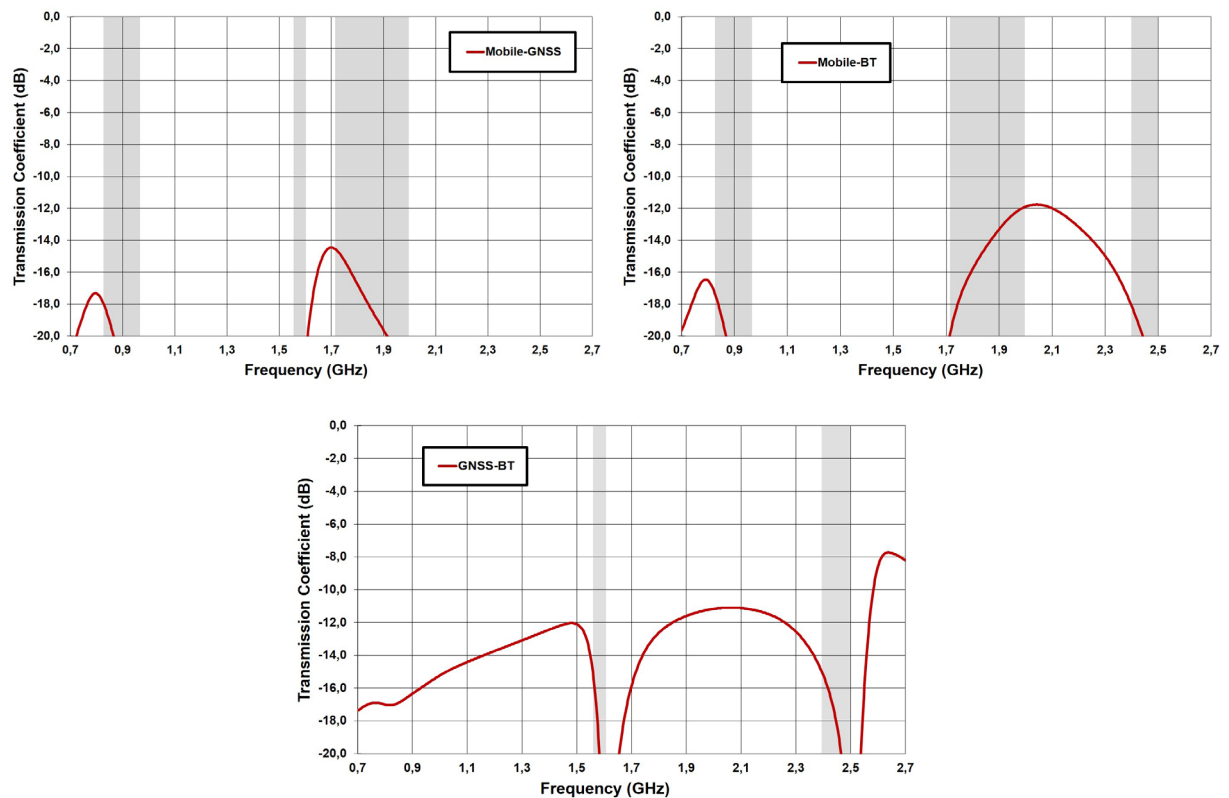
VSWR (Voltage Standing Wave Ratio) and Total Efficiency versus Frequency (GHz).



**Figure 7** – VSWR and Total Efficiency for the different bands covered by the Evaluation Board from Figure 1. Simulated results obtained with CST.

## 2.5 TRANSMISSION COEFFICIENT

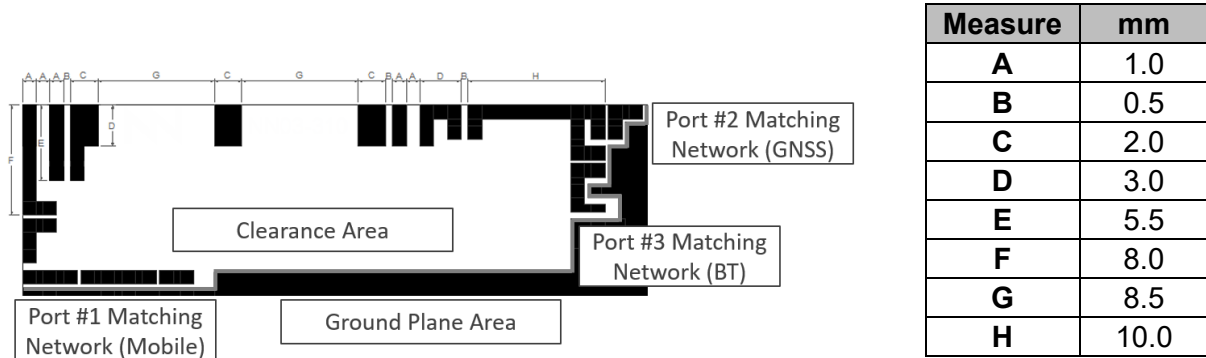
The transmission coefficient between the three ports is gathered herein.



**Figure 8** –Transmission coefficients between the ports of the Evaluation Board from Figure 1

## 2.6 RECOMMENDED ANTENNA FOOTPRINT FOR NN03-310

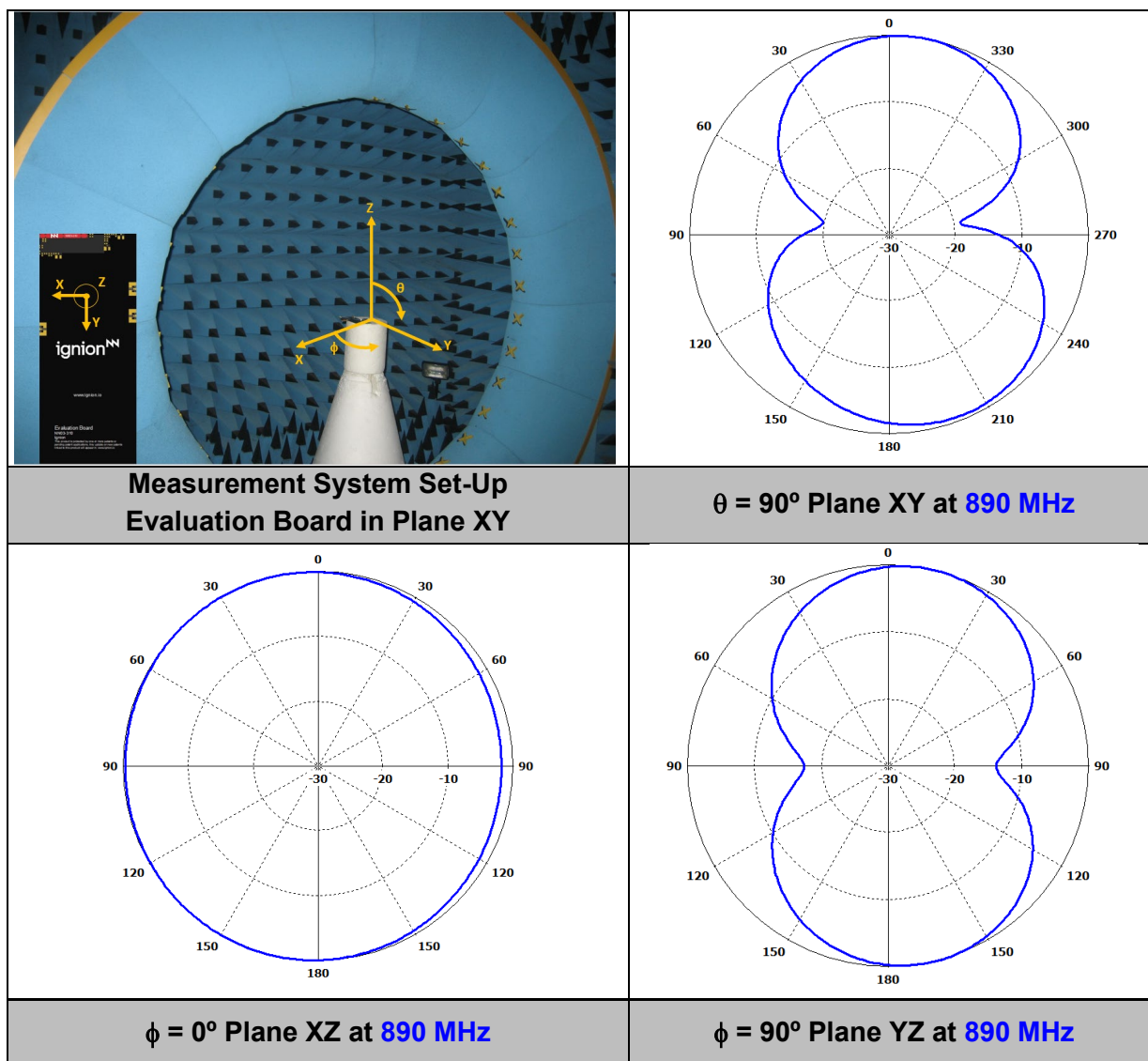
The TRIO mXTEND™ chip antenna component (NN03-310) must be placed in the clearance area of the PCB, see below the recommended footprint dimensions, to provide operation from 824 to 960 MHz, 1710 to 1990 MHz at port 1, from 1561 to 1606 MHz at port 2 and from 2400 to 2500 MHz at port 3.



**Tolerance:** ±0.2mm

**Figure 9** – Footprint dimensions for the NN03-310 chip antenna component.

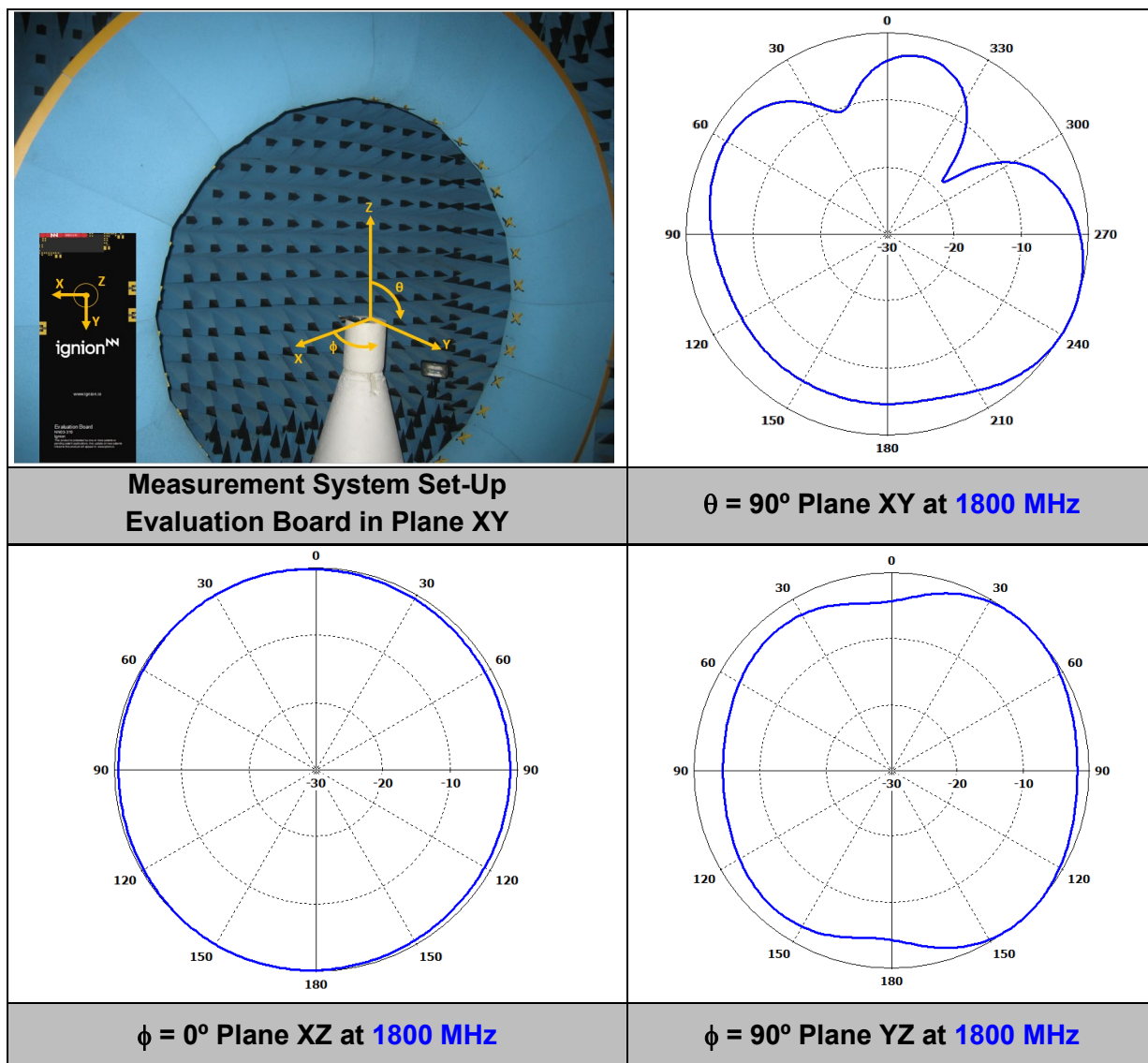
## 2.7 RADIATION PATTERNS (824 – 960 MHz), GAIN, AND EFFICIENCY



<b>Gain</b>	<b>Peak Gain</b>	0.4 dBi
	<b>Average Gain across the band</b>	0.08 dBi
	<b>Gain Range across the band (min, max)</b>	-0.6 $\leftrightarrow$ 0.4 dBi
<b>Efficiency</b>	<b>Peak Efficiency</b>	55.3 %
	<b>Average Efficiency across the band</b>	53.7 %
	<b>Efficiency Range across the band (min, max)</b>	49.2 – 55.3 %

**Table 2** – Antenna Gain and Total Efficiency from the Evaluation Board port 1 (Figure 1) within the 824MHz – 960MHz frequency range. Simulated results obtained with CST.

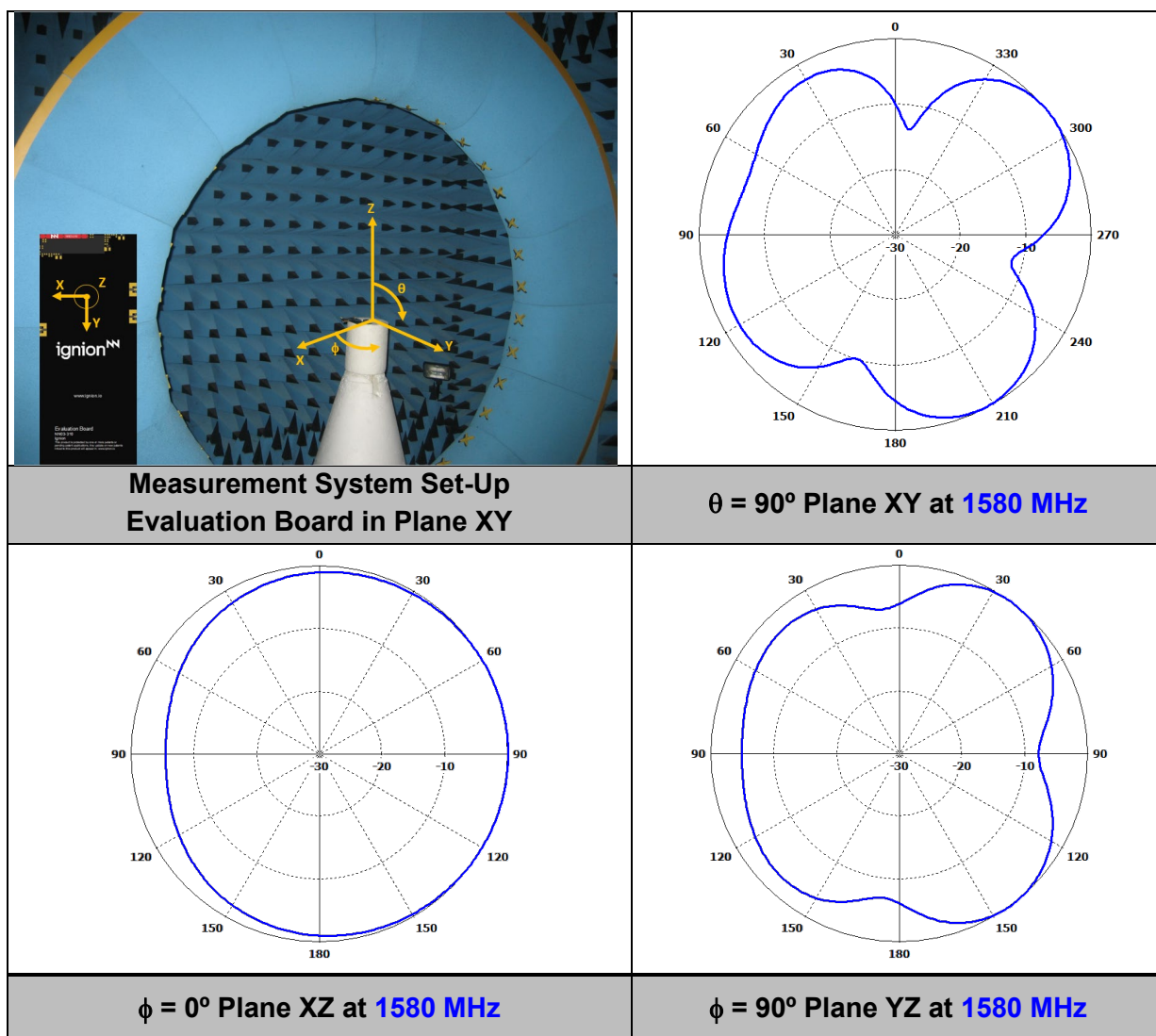
## 2.8 RADIATION PATTERNS (1710 – 1990 MHz), GAIN, AND EFFICIENCY



Gain	Peak Gain	1.9 dBi
	Average Gain across the band	1.5 dBi
	Gain Range across the band (min, max)	1.2 $\leftrightarrow$ 1.9 dBi
Efficiency	Peak Efficiency	65.7 %
	Average Efficiency across the band	63.9 %
	Efficiency Range across the band (min, max)	61.0 – 65.7 %

**Table 3** – Antenna Gain and Total Efficiency from the Evaluation Board port 1 (Figure 1) within the 1710MHz – 1990MHz frequency range. Simulated results obtained with CST.

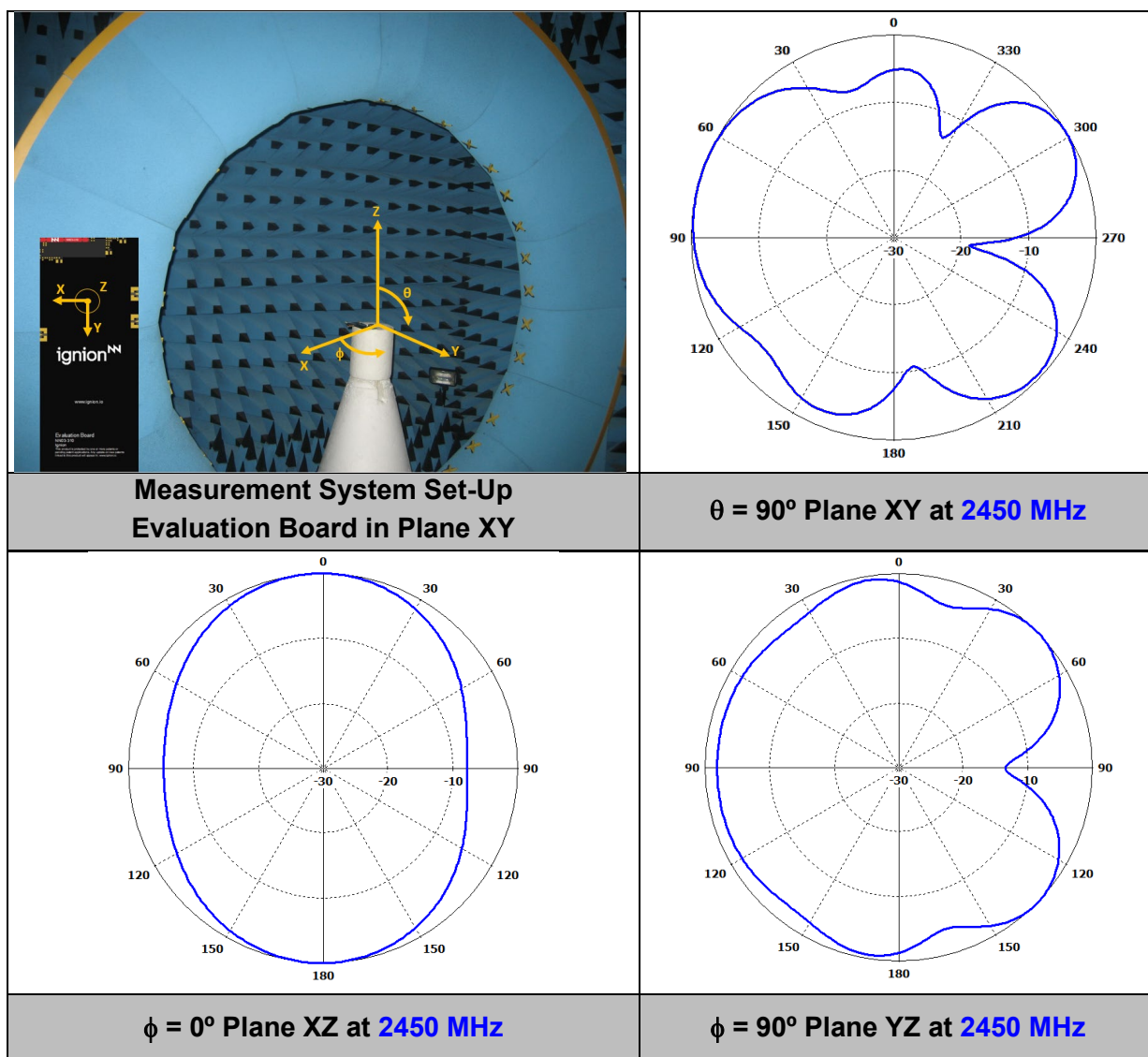
## 2.9 RADIATION PATTERNS (1561 – 1606 MHz), GAIN, AND EFFICIENCY



Gain	Peak Gain	0.9 dBi
	Average Gain across the band	0.7 dBi
	Gain Range across the band (min, max)	0.3 $\leftrightarrow$ 0.9 dBi
Efficiency	Peak Efficiency	57.0 %
	Average Efficiency across the band	54.6 %
	Efficiency Range across the band (min, max)	50.8 – 57.0 %

**Table 4** – Antenna Gain and Total Efficiency from the Evaluation Board port 2 (Figure 1) within the 1561MHz – 1606MHz frequency range. Simulated results obtained with CST.

## 2.10 RADIATION PATTERNS (2400 – 2500 MHz), GAIN, AND EFFICIENCY



<b>Gain</b>	<b>Peak Gain</b>	2.4 dBi
	<b>Average Gain across the band</b>	2.3 dBi
	<b>Gain Range across the band (min, max)</b>	2.1 $\leftrightarrow$ 2.4 dBi
<b>Efficiency</b>	<b>Peak Efficiency</b>	81.8 %
	<b>Average Efficiency across the band</b>	79.9 %
	<b>Efficiency Range across the band (min, max)</b>	75.3 – 81.8 %

**Table 5** – Antenna Gain and Total Efficiency from the Evaluation Board port 3 (Figure 1) within the 2400MHz – 2500MHz frequency range. Simulated results obtained with CST.

### 3. PRODUCT CHANGE NOTIFICATION

This document is property of Ignion,  
Not to disclose or copy without prior written consent

PCN Number: NN19100013

Notification Date: October 07<sup>th</sup>, 2019

**Part Number identification:**

Part Number changes, it will be applied in all the document of the company (User Manual, Data Sheet, ...)

Previous Part Number
FR01-S4-210

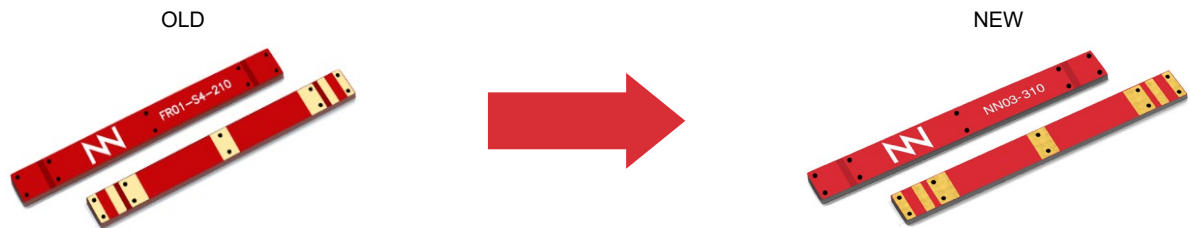
New Part Number
NN03-310

**Reason for change:**

<input type="checkbox"/> Specs (electrical/mechanical)	<input type="checkbox"/> Manufacturing location
<input type="checkbox"/> User Manual/Data Sheet	<input type="checkbox"/> Quality/Reliability
<input type="checkbox"/> Material/Composition	<input type="checkbox"/> Logistics
<input type="checkbox"/> Processing/Manufacturing	<input checked="" type="checkbox"/> Other: Part Number

**Change description**

1.- Part Number: From FR01-S4-210 FRACTUS to NN03-310 Ignion in the User Manual



**Comments:**

- 1.- Electrical and Mechanical specs remain the same
- 2.- Footprint in the PCB to solder the chip antenna remains the same

**Identification method**

1.- The part number on the antenna is different

User Manual	<input checked="" type="checkbox"/>	Available from: January 2020
Samples	<input checked="" type="checkbox"/>	Available from: January 2020

Ignion Contact:

Sales		Supply Chain	
Name:	Josep Portabella	Name:	Albert Vidal
Email:	<a href="mailto:josep.portabella@ignion.io">josep.portabella@ignion.io</a>	Email:	<a href="mailto:albert.vidal@ignion.io">albert.vidal@ignion.io</a>

**Do you need more help with your antenna for your device?**

Use our **Antenna Intelligence Cloud service** and get your ready-to-test antenna design specially thought for your platform **free of charge<sup>1</sup>** and in **24 hours**.

<https://www.ignion.io/antenna-intelligence/>

The TRIO mXTEND<sup>™</sup> chip antenna component and other Ignion products based on its proprietary Virtual Antenna<sup>™</sup> technology are protected by one or more of the following [Ignion patents](#).

All information contained within this document is property of Ignion and is subject to change without prior notice. Information is provided “as is” and without warranties. It is prohibited to copy or reproduce this information without prior approval.

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

ISO 9001: 2015 Certified





ignion<sup>™</sup>

Your innovation.  
Accelerated.

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