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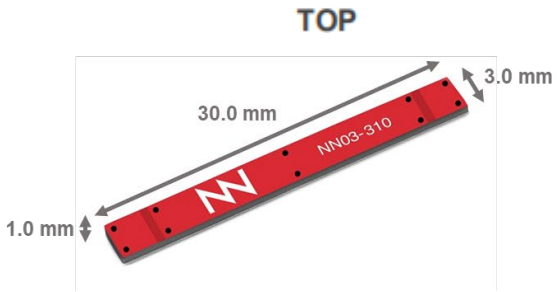
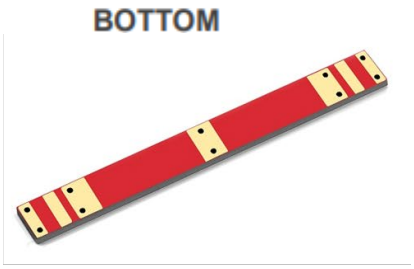
TRIO mXTEND™ (NN03-310)

DATASHEET

TRIO mXTEND™ (NN03-310)

The TRIO mXTEND™ chip antenna component is an **ultra slim,** off-the-shelf, component that measures only 1.0 mm in height, giving the designer freedom to integrate it in just about all wireless platforms. Thanks to its modular, multiband and **multiport configuration,** this chip antenna works in multiple frequency regions, including connectivity within **2G, 3G, 4G** and **5G bands**, but also for other regions of the spectrum such as **GNSS** and **Bluetooth**.





Product Benefits

- **Top performance**: Top multiband worldwide sub-6GHz cellular/IoT performance in a multi-RAT and 3 independent port antenna component.
- **Multiband & Multiport:** All cellular/ISM bands: 2G/3G/4G/5G and NB-IoT/LTE-M applications with additional GNSS, Bluetooth, Wi-Fi 6E, UWB simultaneously.
- **Versatile**: Triple radio architecture in a single, small and ultra-slim antenna package: 30mm x 1.0mm x 3.0mm.
- **Global reach:** Through multiband performance (worldwide standard compatible)
- **Reliability**: Off-the-Shelf standard product, no antenna part customization (electronic optimization)
- **Use cases**: Best for top performing compact tracking devices, IoT sensors, IoT cellular/ISM modules and mobile devices.

Operation Bands Summary

- GSM, UMTS, LTE, 5G, GNSS, Bluetooth (617 – 960MHz, 1710 – 2690MHz, 3300 – 3800MHz, 1561 – 1606 MHz and 2400 – 2500 MHz)

1. AVAILABLE SOLUTIONS SUMMARY

Class	Frequency Regions	Frequency range	More detailed info
1 Port	2	698 – 960 MHz & 1710 – 2690 MHz	CELLULAR LTE
1 Port	1	863 – 928 MHz	ISM
2 Ports	3	698 – 960 MHz, 1710 – 2690 MHz & 3400 – 3800 MHz	CELLULAR LTE + 5G
2 Ports	5	824 – 960 MHz, 1710 – 2170 MHz, 1561 MHz, 1575 MHz & 1598 – 1606 MHz	CELLULAR LTE + GNSS
3 Ports	6	824 – 960 MHz, 1710 – 1990 MHz, 1561 MHz, 1575 MHz, 1598 – 1606 MHz & 2400 – 2500MHz	MOBILE + GNSS + BLUETOOTH

2. DETAILED AVAILABLE SOLUTIONS

2.1. LTE SOLUTION

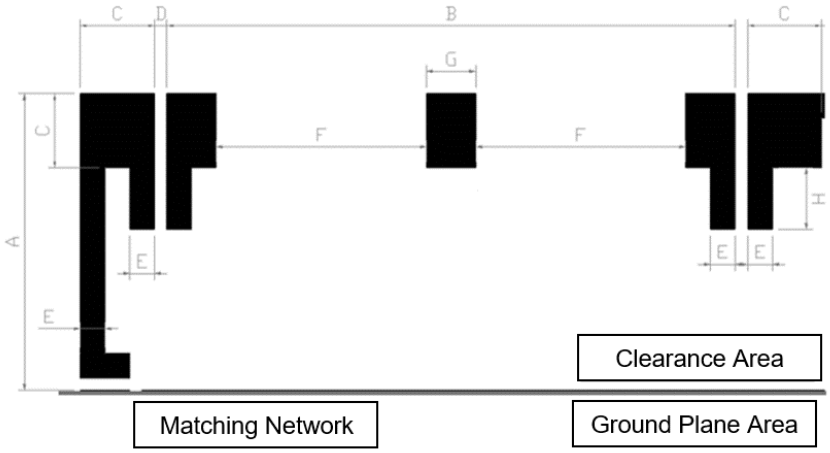
Technical features	698 – 960 MHz	1710 – 2690 MHz
Average Efficiency	> 55 %	> 65 %
Peak Gain	1.1 dBi	2.4 dBi
VSWR	< 3:1	
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	0.25 g	
Temperature	-40 to +125 ºC	
Impedance	50 Ω	
Dimensions (L x W x H)	30.0 mm x 3.0 mm x 1.0 mm	

Technical features. Measures from the evaluation board (142 mm x 60 mm x 1 mm).

2.2. ANTENNA FOOTPRINT: 1 PORT CONFIGURATION

Measure	mm
A	12.0
B	23.0
C	3.0
D	0.5
E	1.0
F	8.5
G	2.0
H	2.5

Tolerance: ±0.05mm



Footprint dimensions for the single chip antenna component in one port configuration.

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TRIO mXTEND™: UP TO THREE RADIOS IN ONE TOP PERFORMING CHIP

USER MANUAL
TRIO mXTEND™ (NN03-310)

TRIO mXTEND™

Up to three radios in one top performing chip

NN03-310

TRIO mXTEND™ | Mobile | IoT Antenna

Operating range: 698 – 8000 MHz

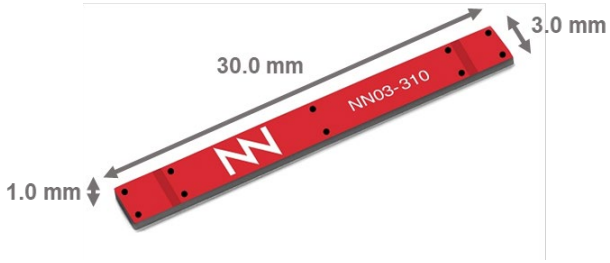
Best for: 698 – 8000 MHz

Dimensions: 30.0 mm x 3.0 mm x 1.0 mm

What is TRIO mXTEND™?

TRIO mXTEND™ is our top performing Virtual Antenna® product that covers the widest range of operating frequencies from 698 MHz up to 8.000 MHz in both cellular and unlicensed (ISM) IoT wireless devices. In addition, TRIO mXTEND™ has three independent antenna components that flexibly enables embedding three different radios of choice, such as, 4G/5G, GNSS and Bluetooth/WiFi, into a single component. The TRIO mXTEND™ has the smallest footprint in the market for its class and combined with its 1 mm slim form factor, it makes an ideal component for high-performance, small IoT tracking devices and sensors.

TOP



BOTTOM

Material: The TRIO mXTEND™ chip antenna component is built on glass epoxy substrate.

What is TRIO mXTEND™ for?

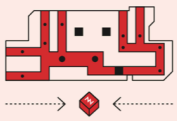
TRIO mXTEND™ is suitable for any mobile or IoT device requiring a top performance in the **Sub-GHz** frequency range. It works for global coverage cellular (**2G**, **3G**, **4G**, **5G**) as well as unlicensed IoT devices (**LoRa**, **SigFox**) and can be used in both trackers and smart meters applications. The **3-independent** input/output radio ports make the TRIO mXTEND™ an ideal compact solution for embedding **cellular/ISM, GNSS, Bluetooth** or **Wi-Fi** into a slim, compact **IoT** device and extending the operating frequency range of devices up to 8.000MHz.

- Asset Trackers
- Smart Meters
- 5G Routers
- Mobile Reference Designs
- IoT Developer Kits
- Environmental Sensors
- Logistic Trackers
- Notebooks/Tablets
- Health sensors
- Animal Trackers
- Security sensors
- Point of Sales
- Vending Machines
- Smart City sensors

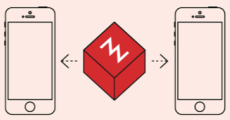
What differentiates TRIO mXTEND™ from other chip antennas?

Like every other Virtual Antenna® product, TRIO mXTEND™ is frequency neutral, meaning that its frequency response is not determined by the antenna component but designed by the electronics engineer. Virtual Antenna® technology enables packaging the desired multiband performance in the smallest ever form factors, which enables the whole mXTEND range of components becoming tiny off-the-shelf, surface-mount (SMD) electronic chips. That makes mXTEND components easy to be integrated in about any IoT device through a shorter and easier design cycle and a much more robust, reliable and costs effective manufacturing process.

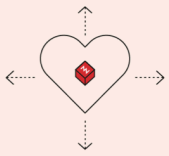
Off-the-shelf
Ready to be delivered 'as is' with no need for customization.



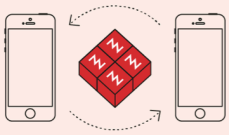
Up to 10 times smaller
A booster can be 5^3mm^3 providing the same connectivity.



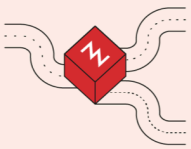
Versatility
A phone can be designed with several architectures yet still using the same component.



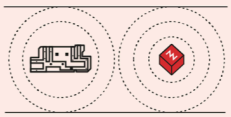
Scalability
The 'heart' ot the design can be reused across multiple device models.



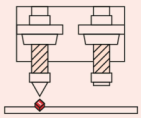
Modular
Modules or standard building blocks can be re-used in the design of multiple devices.



Multiband
A single antenna provides connectivity in 2G, 3G and 4G band.



Full performance
The same performance in a much smaller, off-the-shelf and versatile component.



Pick & place
No manual assembly is needed, only a conventional SMT machine.

In addition, TRIO mXTEND™ is the first Virtual Antenna® product featuring **Variant™** technology, which enables embedding **multiple antenna boosting elements into a single chip**. This provides a great **flexibility** in the design of a wireless IoT or mobile product, as a single antenna chip covers, through 3 independent radio ports/feeds, all radio needs for most of the IoT applications. That includes, for instance, Wide Area Network (WAM) applications (cellular but also ISM), but also GNSS, or Bluetooth/Wi-Fi/UWB, to name a few examples.

Click and select an application that fits your project:

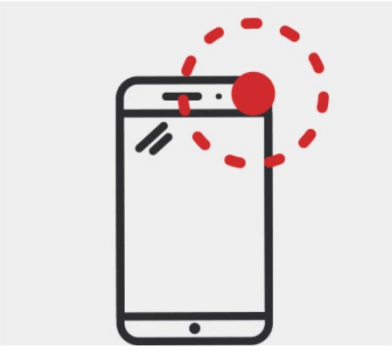
TRIO mXTEND™ FOR CELLULAR IoT *Single-Port Configuration*	NB-IoT LTE-M	(698 MHz – 2690 MHz)
TRIO mXTEND™ FOR 5G *Two-Port Configuration*	5G	(698 MHz – 3800 MHz)
TRIO mXTEND™ IoT TRACKER *Three-Port Configuration*	Wi Fi, LoRa, 5G	(824 MHz – 2500 MHz)

Click to view other useful TRIO mXTEND™ guidelines:

Chapter Index

How to embed a Virtual Antenna®

Design with Virtual Antenna® in 1-2-3



STEP 1: Place the antenna component

1. Select one corner of your PCB
2. Ensure your ground plane meets the TRIO mXTEND™ clearance area restrictions.
3. Respect a keep out space around the booster. Keep at least 5mm distance from metallic objects

Look here for an example on placing the TRIO mXTEND™

STEP 2: Design your matching network

1. Through a combination of inductors & capacitors obtain 50 Ohms of antenna impedance to optimize the transfer of energy to your antenna
2. It is critical to fine-tune your MN throughout the entirety the design process of achieve your desired frequency response

Look here for an example of a matching network we found in an TRIO mXTEND™ application via simulation

STEP 3: Test your device

1. Perform a field test in which your antenna is placed in its final housing. Fine-tune the MN if needed.
2. Use a network analyzer to adjust mismatch
3. Test the antennas efficiency with an anechoic chamber

Look here for testing we did on our Evaluation Board, with the TRIO mXTEND™ integrated in our Anechoic Chamber

https://www.ignion.io/tutorials

Scan QR code to be taken to our videos highlighting these three easy steps

Need further help? Easy start with Antenna Intelligence Cloud

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 especially simulated for your platform **free of charge**[1], and in **24 hours**.

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

Scan QR code to be taken to our Antenna Intelligence Cloud page

TRIO mXTEND™ FOR IoT

In this application both the 698-960 MHz and 1710-2690 MHz frequency ranges are covered using the TRIO mXTEND™ in single-port configuration. Using one of our Evaluation Boards, an example of a common TRIO mXTEND™ placement is seen. Finally, two matching networks are selected, allowing us to test, obtain, and analyze the VSWR, total efficiency, gain and radiation patterns.

QUICK REFERENCE GUIDE

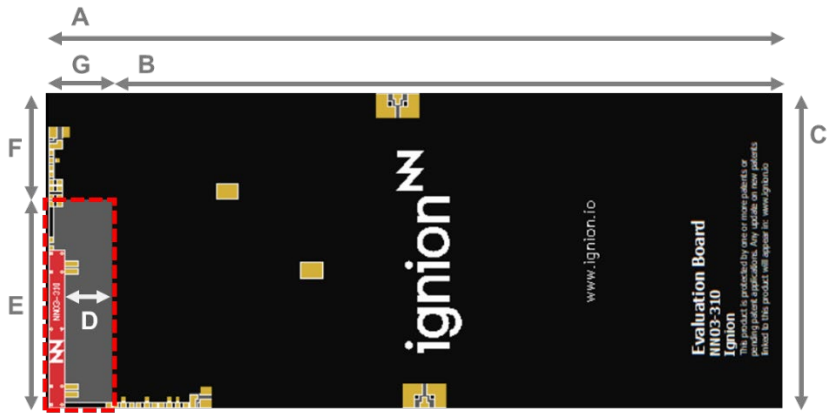
Technical features	698 – 960 MHz	1710 – 2690 MHz
Average Efficiency	> 55 %	> 65 %
Peak Gain	1.1 dBi	2.4 dBi
VSWR	< 3:1	
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	0.25 g	
Temperature	-40 to +125 ºC	
Impedance	50 Ω	
Dimensions (L x W x H)	30.0 mm x 3.0 mm x 1.0 mm	

Table 1 – Technical features. Measures from the Evaluation Board. See **Figure** 1 – EB_NN03-310-M. **Evaluation** Board for **providing operation in 2 frequency ranges, 698 – 960MHz and 1710 – 2690MHz.**. Note that for obtaining comparable results, a ground plane length larger than 100 mm is recommended.

ELECTRICAL PERFORMANCE

EVALUATION BOARD

This Evaluation Board (part number: EB_NN03-310-M) integrates one TRIO mXTEND™ chip antenna component to provide operation in two frequency regions, from 698 MHz to 960 MHz and from 1710 MHz to 2690 MHz. A UFL cable connects this single input/output port to the SMA connector.



Measure	mm
A	142
B	130
C	60
D	9
E	40
F	20
G	12

Tolerance: ±0.2 mm

D: Distance between the TRIO mXTEND™ chip antenna component and the ground plane.

Material: The Evaluation Boards are built on FR4 substrate. Thickness is 1 mm.

Clearance Area: 40 mm x 12 mm (ExG)

Figure 1 – EB_NN03-310-M. Evaluation Board for providing operation in 2 frequency ranges, 698 – 960MHz and 1710 – 2690MHz.

This product and its use are protected by at least one or more of the following patents and patent applications PAT. US 62/529032; and other domestic and international patents pending. Additional information about patents related to this product is available at www.ignion.io/virtual-antenna/.

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 TRIO mXTEND™ chip antenna component once the design is finished and considering all elements of the system (batteries, displays, covers, etc.).

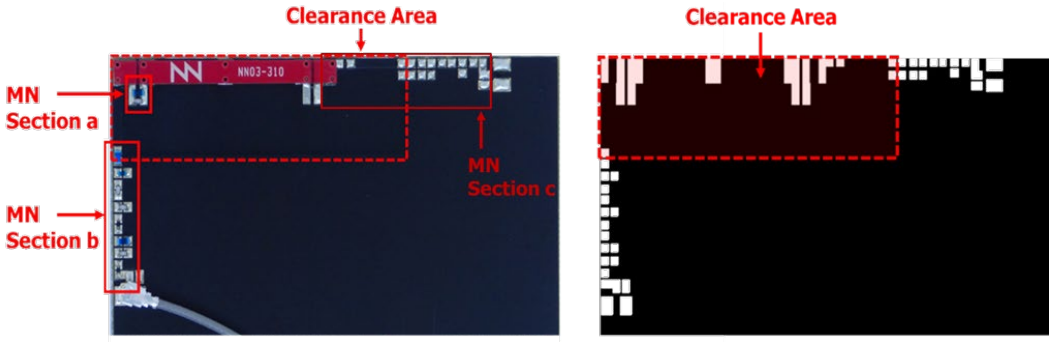
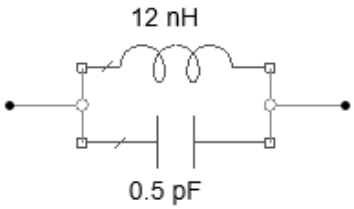


Figure 2 – Matching network distribution

Please notice 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 Q and tight tolerance components is highly recommended (Murata components).

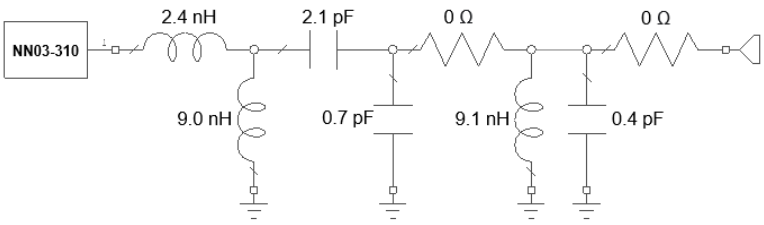
698 MHz – 960 MHz and 1710 MHz – 2690 MHz

MN Section a



Value	Part Number
12 nH	LQW18AN12NG10
0.5 pF	GJM1555C1HR50WB01

MN Section b



Value	Part Number
2.4 nH	LQW18AN2N4C80
9.0 nH	LQW15AN9N0G80
2.1 pF	GJM1555C1H2R1WB01
0.7 pF	GJM1555C1HR70WB01
9.1 nH	LQW18AN9N1G80
0.4 pF	GJM1555C1HR40WB01

Figure 3 – Matching network implemented in the Evaluation Board 1 port (**Figure** 1).

This matching network applies to this Evaluation Board. Other configurations would require a matching network adjustment. If you need assistance to design your matching network beyond this application note, please contact 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[1] Antenna Intelligence Cloud, which will get you a complete design report including a custom matching network for your device in 24h[1]. Additional information related to Ignion's range of R&D services is available at: https://ignion.io/rdservices/

VSWR AND TOTAL EFFICIENCY

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

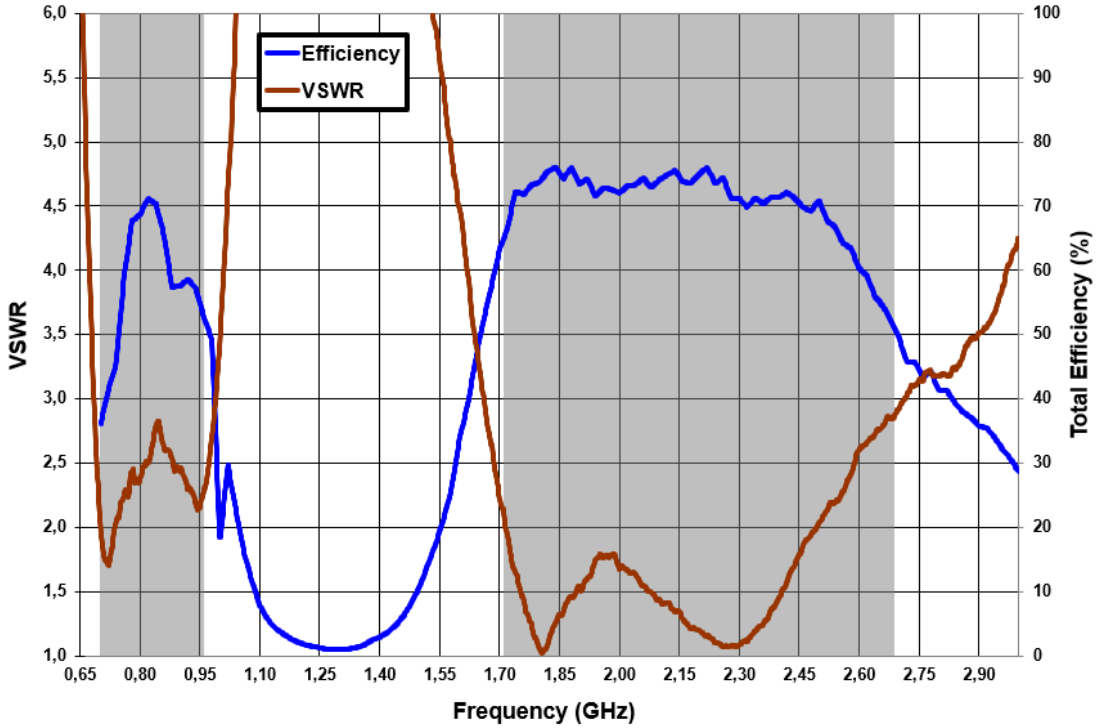
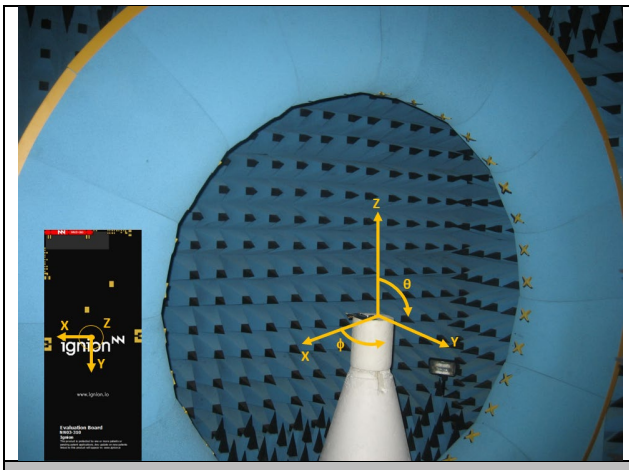


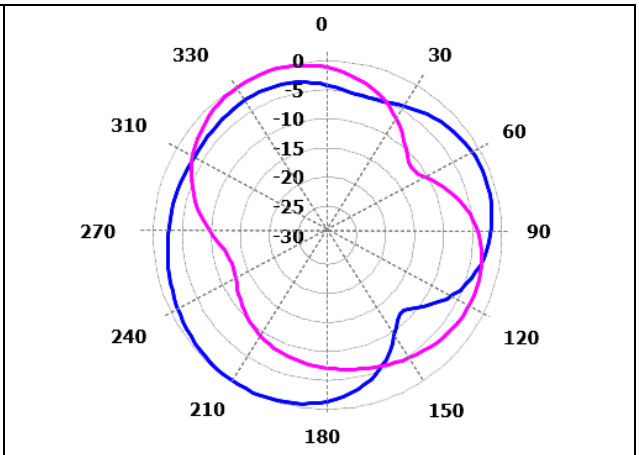
Figure 4 – VSWR and Total Efficiency for the 698 – 960 MHz frequency range and for the 1710 – 2690 MHz frequency range (from the Evaluation Board) (**Figure** 1).

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

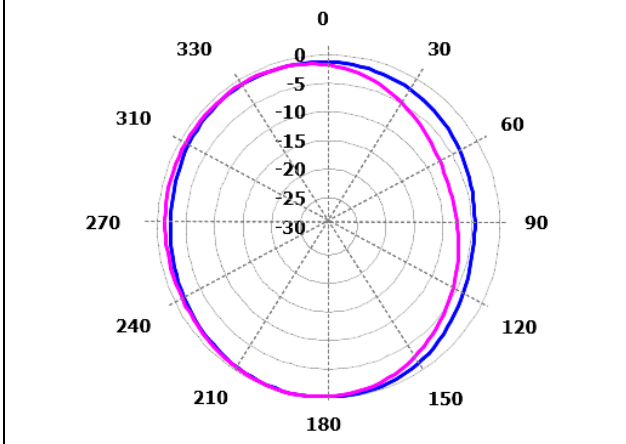
RADIATION PATTERNS (698-960 MHz), GAIN AND EFFICIENCY



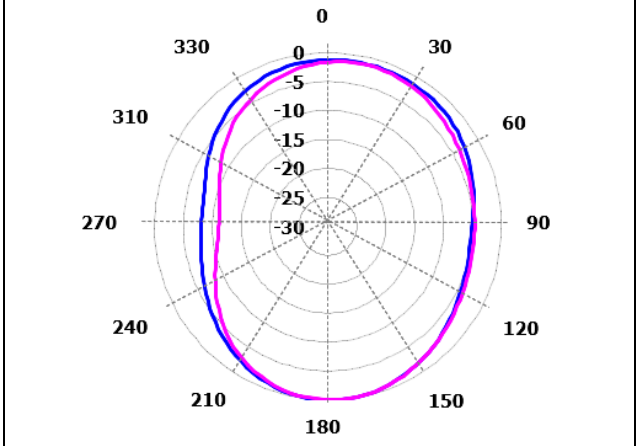
Measurement System Set-Up
Evaluation Board in Plane XY



θ = 90º Plane XY at 750 MHz and 890 MHz



ϕ = 0º Plane XZ at 750 MHz and 890 MHz

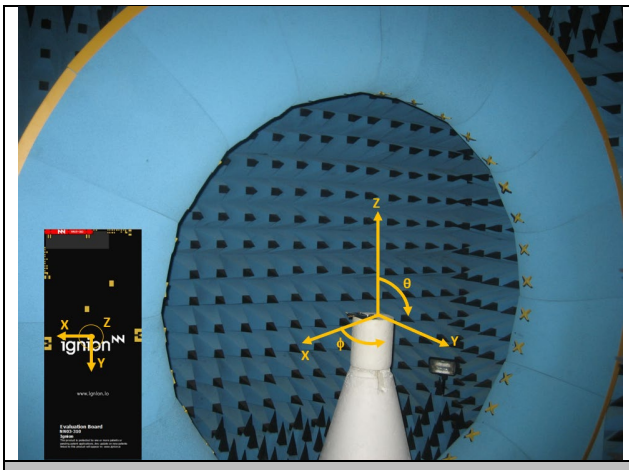


ϕ = 90º Plane YZ at 750 MHz and 890 MHz

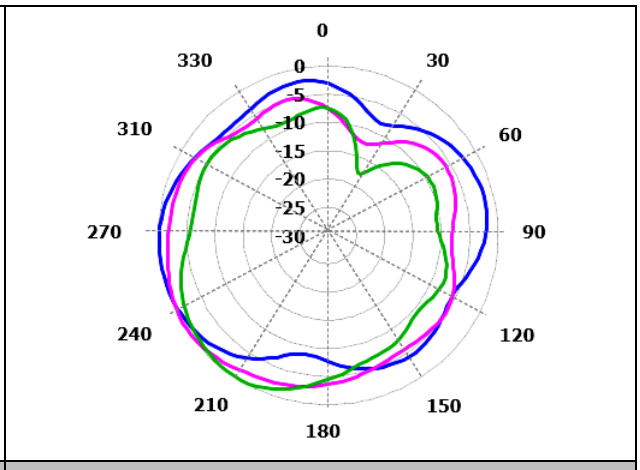
Gain	**Peak Gain**	1.1 dBi
	Average Gain across the band	0.5 dBi
	Gain Range across the band (min, max)	-0.7 **<–>** 1.1 dBi
Efficiency	**Peak Efficiency**	71.1 %
	Average Efficiency across the band	58.8 %
	Efficiency Range across the band (min, max)	36.1 – 52.5 %

Table 2 – Antenna Gain and Total Efficiency from the Evaluation Board (**Figure 1**) within the 698 – 960 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

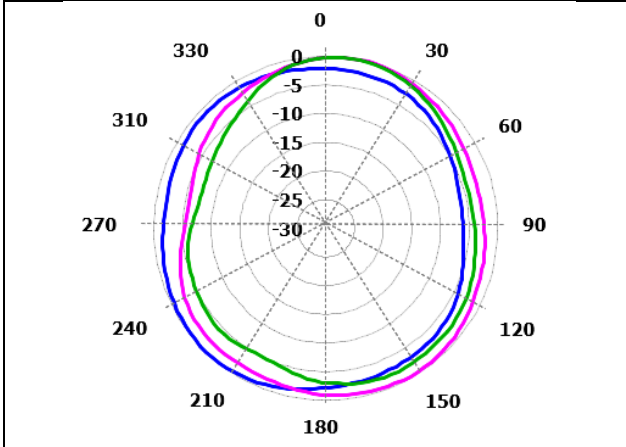
RADIATION PATTERNS (1710-2690 MHz), GAIN AND EFFICIENCY



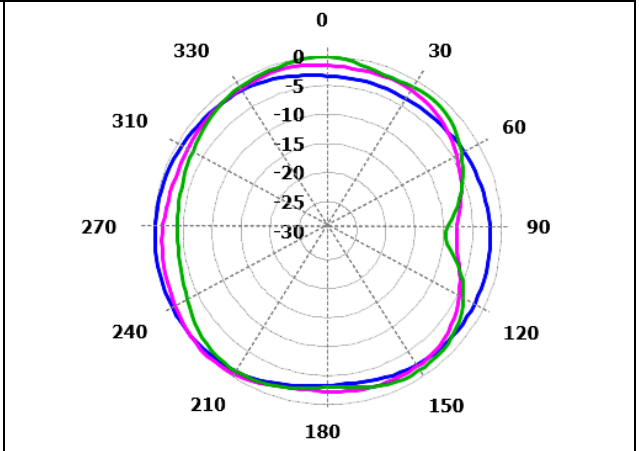
Measurement System Set-Up Evaluation Board in Plane XY



θ = 90º Plane XY at 1.71 GHz, 2.2 GHz and 2.69 GHz



ϕ = 0º Plane XZ at 1.71 GHz, 2.2 GHz and 2.69 GHz



ϕ = 90º Plane YZ at 1.71 GHz, 2.2 GHz and 2.69 GHz

Gain	**Peak Gain**	2.4 dBi
	Average Gain across the band	1.8 dBi
	Gain Range across the band (min, max)	0.3 **<–>** 2.4 dBi
Efficiency	**Peak Efficiency**	76.0 %
	Average Efficiency across the band	70.4 %
	Efficiency Range across the band (min, max)	64.7 – 50.8 %

Table 3 – Antenna Gain and Total Efficiency for the Evaluation Board (**Figure 1**) within the 1710 – 2690 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

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