

ignion[™]

Your innovation.
Accelerated.

The most complete antenna for any smart meter application

APPLICATION NOTE
ONE mXTEND[™] (NN02-201)

SIMPLE AND COST-EFFICIENT SMART METER ANTENNA INTEGRATION

ALL mXTEND™ (NN02-220) and RUN mXTEND™ (NN02-224) AN for Smart Meters 698 – 960 MHz and 1710 – 2170 MHz

Ignion specializes in enabling effective mobile communications by designing and manufacturing optimized antenna products that will make your wireless devices more competitive. Our mission is to transform our clients' product development processes with innovative components that accelerate time-to-market without compromising functionality.



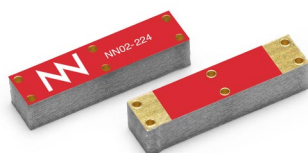
ALL mXTEND™ chip
antenna component

NN02-220

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



RUN mXTEND™
antenna booster

NN02-224

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ISO 9001: 2015 Certified



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1. PRODUCT DESCRIPTION NN02-220

The rate of smart meter implementation is projected to continue to grow as governments implement programs to encourage their deployment, helping providers get more detailed information which in turn allows them to better match utility generation with customer consumption. In this application note we illustrate how to use the ALL mXTEND™ chip antenna component (NN02-220) for operating at the 698-960MHz and 1710-2170MHz frequency ranges used in smart meters. Additionally, we have performed our tests using an Evaluation Board the size of a typical smart meter to provide the most relevant results possible for those who design smart meters.

The ALL mXTEND™ is perfect for providing cost savings in your smart meter production. It is often a lower cost component than an external antenna and being SMD pick and place it provides savings on assembly labor costs. Additionally, as this antenna is mounted internally it provides the further benefit of increased protection against environmental factors versus an external antenna. The same antenna part can be used to cover different frequency ranges, since it offers the antenna designer the flexibility of selecting the frequency regions to operate through just the customization of the matching network.



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

APPLICATIONS

- Smart meters
- Handsets
- Tablets
- Laptop PCs
- Tracking devices
- Etc.

BENEFITS

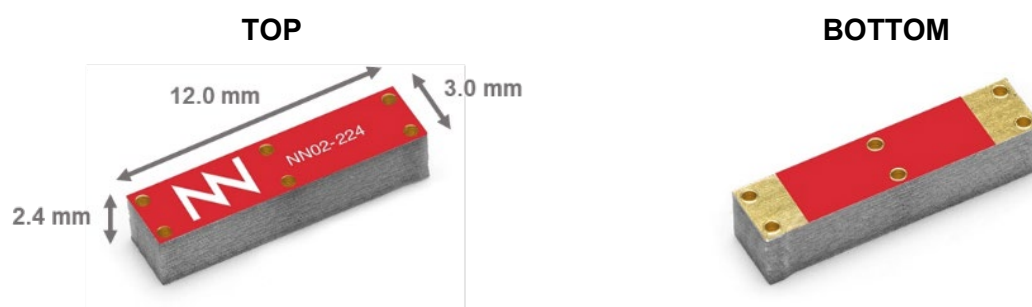
- High efficiency
- Small size
- Cost-effective
- Easy-to-use (pick and place)
- Multiband behaviour (worldwide standards)
- Off-the-Shelf Standard Product (no customization is required)

Based on Ignion proprietary Virtual Antenna™ technology, the ALL mXTEND™ belongs to a new generation of antenna products focused on replacing conventional antenna solutions with miniature, off-the-shelf components that drive fast, intelligent design. This breakthrough technology has been specifically designed to fit a diverse set of wireless applications – smart meters are just one of the many environments where this tiny antenna can be transformational.

2. PRODUCT DESCRIPTION NN02-224

The rate of smart meter implementation is projected to continue to grow as governments implement programs to encourage their deployment, helping providers get more detailed information which in turn allows them to better match utility generation with customer consumption. In this application note we illustrate how to use the RUN mXTEND™ antenna booster (NN02-224) for operating at the 824-960MHz and 1710-2170MHz frequency ranges used in smart meters. Additionally, we have performed our tests using an Evaluation Board the size of a typical smart meter to provide the most relevant results possible for those who design smart meters.

The RUN mXTEND™ is perfect for providing cost savings in your smart meter production. It is often a lower cost component than an external antenna and being SMD pick and place it provides savings on assembly labor costs. Additionally, as this antenna is mounted internally it provides the further benefit of increased protection against environmental factors versus an external antenna. The same antenna part can be used to cover different frequency ranges, since it offers the antenna designer the flexibility of selecting the frequency regions to operate through just the customization of the matching network.



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

APPLICATIONS

- Smart meters
- Smartwatches
- IoT Devices
- Modules
- Remote Sensors
- Etc.

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)

Based on Ignion proprietary Virtual Antenna™ technology, the RUN mXTEND™ belongs to a new generation of antenna products focused on replacing conventional antenna solutions with miniature, off-the-shelf components that drive fast, intelligent design. This breakthrough technology has been specifically designed to fit a diverse set of wireless applications – smart meters are just one of the many environments where this tiny antenna can be transformational.

3. EVALUATION BOARD SMART METERING – ALL mXTEND™

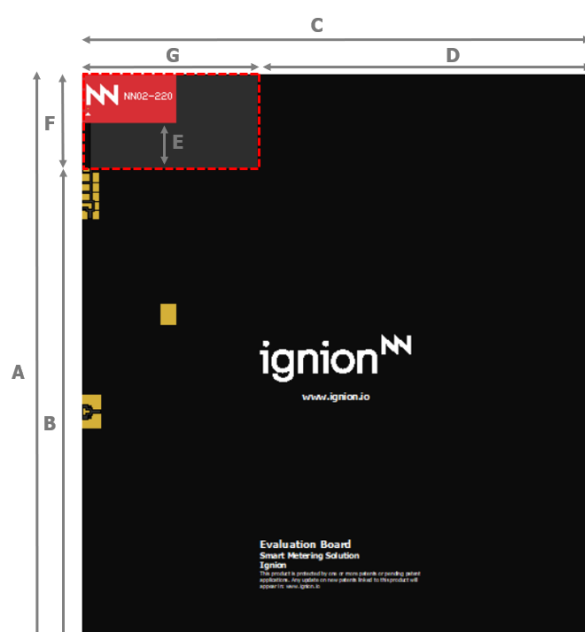
3.1. QUICK REFERENCE GUIDE

Technical features	698 – 960 MHz	1710 – 2170 MHz
Average Efficiency	> 65%	> 70%
Peak Gain	2.2 dBi	0.1 dBi
VSWR	< 3:1	
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	1.23 g	
Temperature	-40 to +125 °C	
Impedance	50 Ω	
Dimensions (L x W x H)	24.0 mm x 12.0 mm x 2.0 mm	

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

3.2. EVALUATION BOARD

This Evaluation Board EB_NN02-220-SM integrates a UFL cable to connect the ALL mXTEND™ chip antenna component with the SMA connector. The ALL mXTEND™ provides operation in the frequency region which covers from 698 to 960 MHz and from 1710 to 2170 MHz, through a single input/output port.



Measure	mm
A	145.0
B	121.0
C	130.0
D	85.0
E	12.0
F	24.0
G	45.0

Tolerance: ±0.2 mm

E: Distance between the ALL mXTEND™ chip antenna component and the ground plane.

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

Clearance Area: 24 mm x 45 mm (F x G)

Figure 1 – EB_NN02-220-SM. Evaluation Board providing operation from 698 to 960 MHz and from 1710 to 2170 MHz.

This product and/or its use are protected by Ignion patents. Other domestic and international patents pending. Additional information about patents related to this product is available at www.ignion.io/virtual-antenna/.

3.3. MATCHING NETWORK

The specs of a Ignion standard product are measured in an Evaluation Board, where an ideal case is created. However, when incorporating into real designs, nearby components such as LCD's, batteries, covers and connectors may affect the antenna performance. For this reason, placing pads compatible with 0402 and 0603 SMD components for a matching network as close as possible to the feeding point is highly recommended. Create this matching network in the ground plane area rather than the clearance area – this will provide a degree of freedom for tuning the ALL mXTEND™ chip antenna component once the design is finished, taking into account all elements of the system (batteries, displays, covers, etc.).

Please notice that different devices with different ground planes and different components nearby the ALL 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). If you need assistance to design your matching network, please contact support@ignion.io, or try our free-of-charge¹ [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 24h¹. Other information related to Ignion's range of R&D services is available at: <https://www.ignion.io/rdservices/>

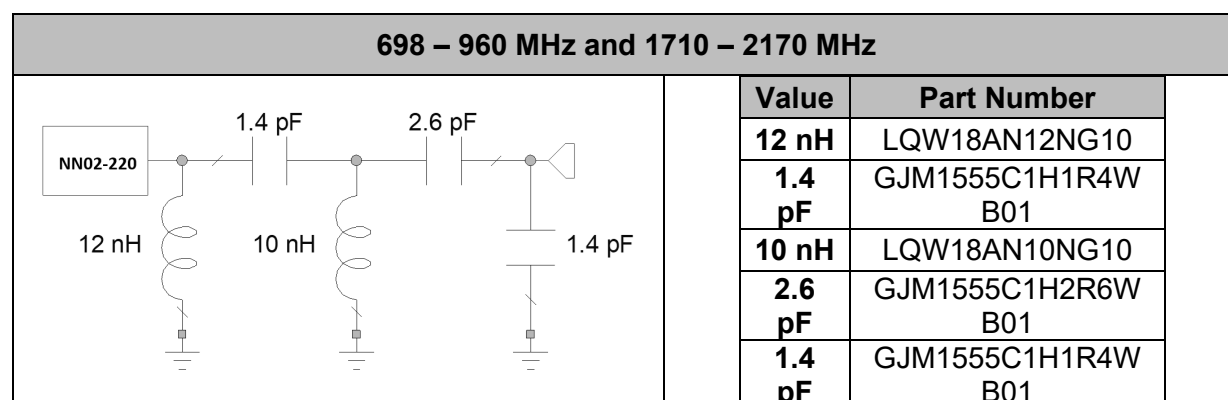


Figure 2 – Matching Network implemented in the Evaluation Board (Figure 1).

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

3.4. VSWR AND TOTAL EFFICIENCY

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

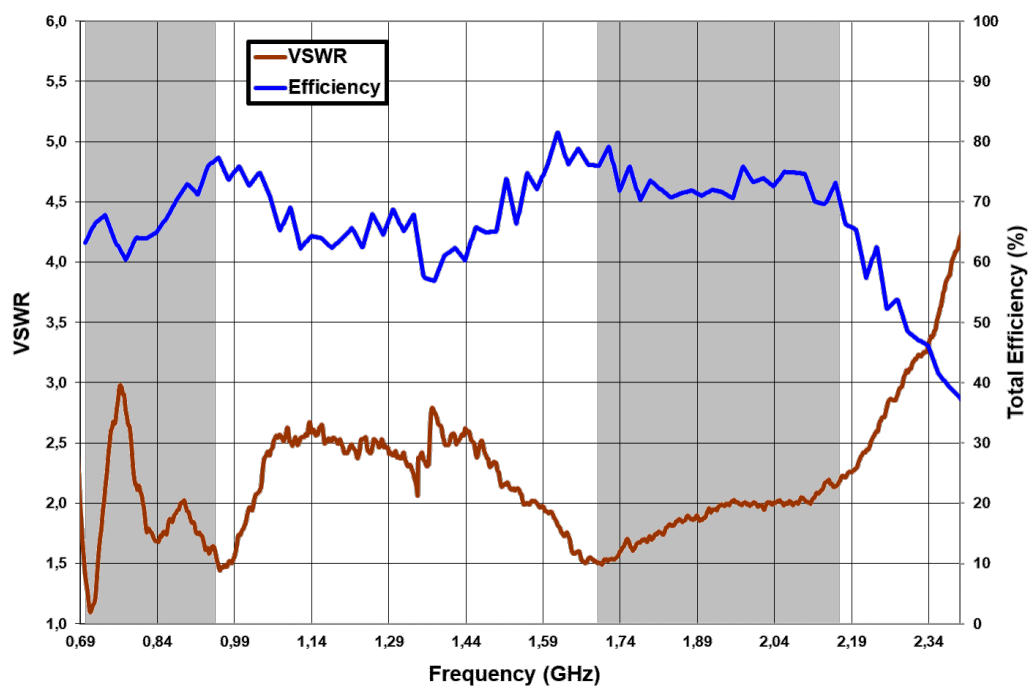
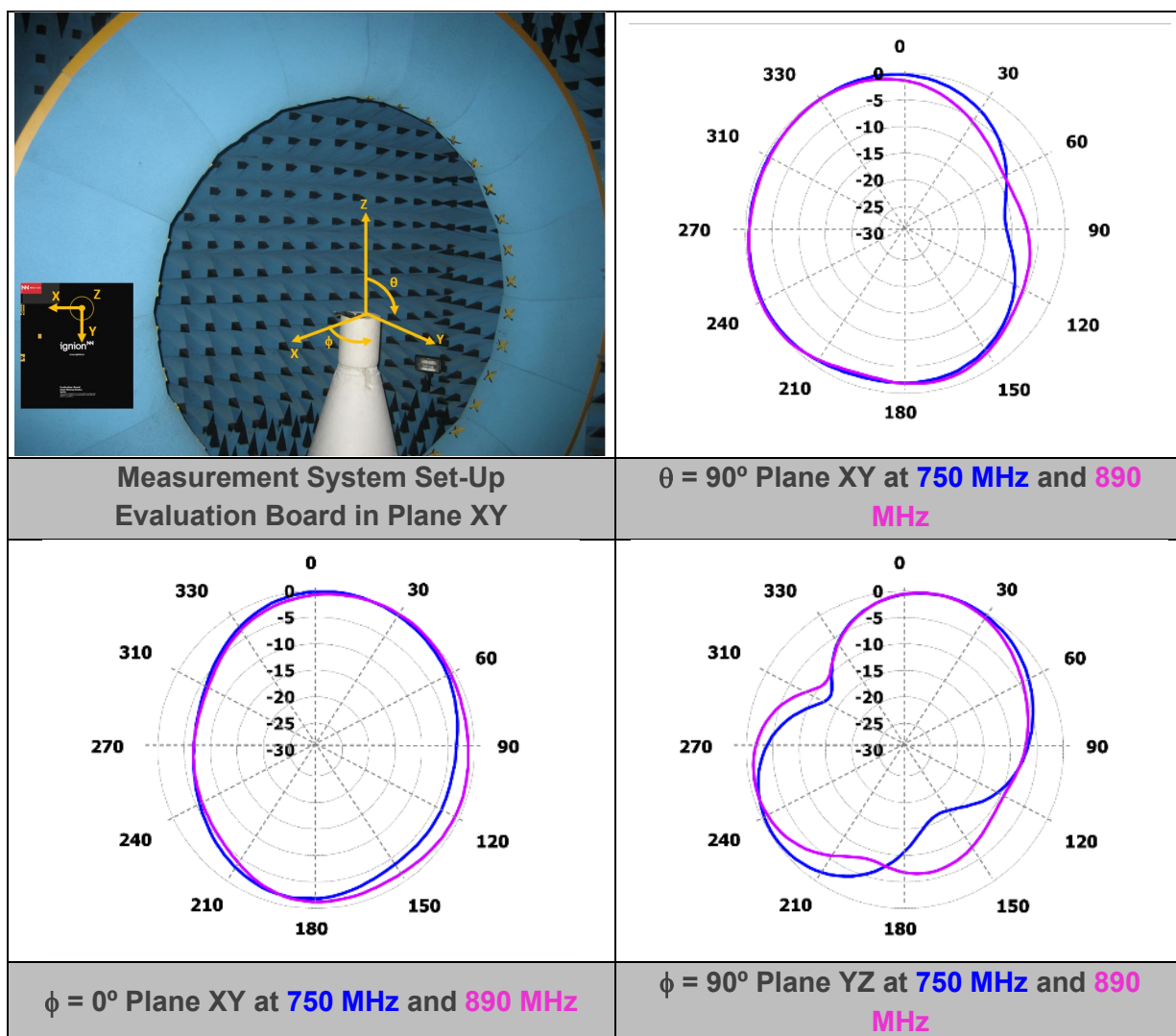


Figure 3 – VSWR and Total Efficiency for the 698 - 960 MHz and 1710 - 2170 MHz frequency range (from the Evaluation Board (Figure 1)).

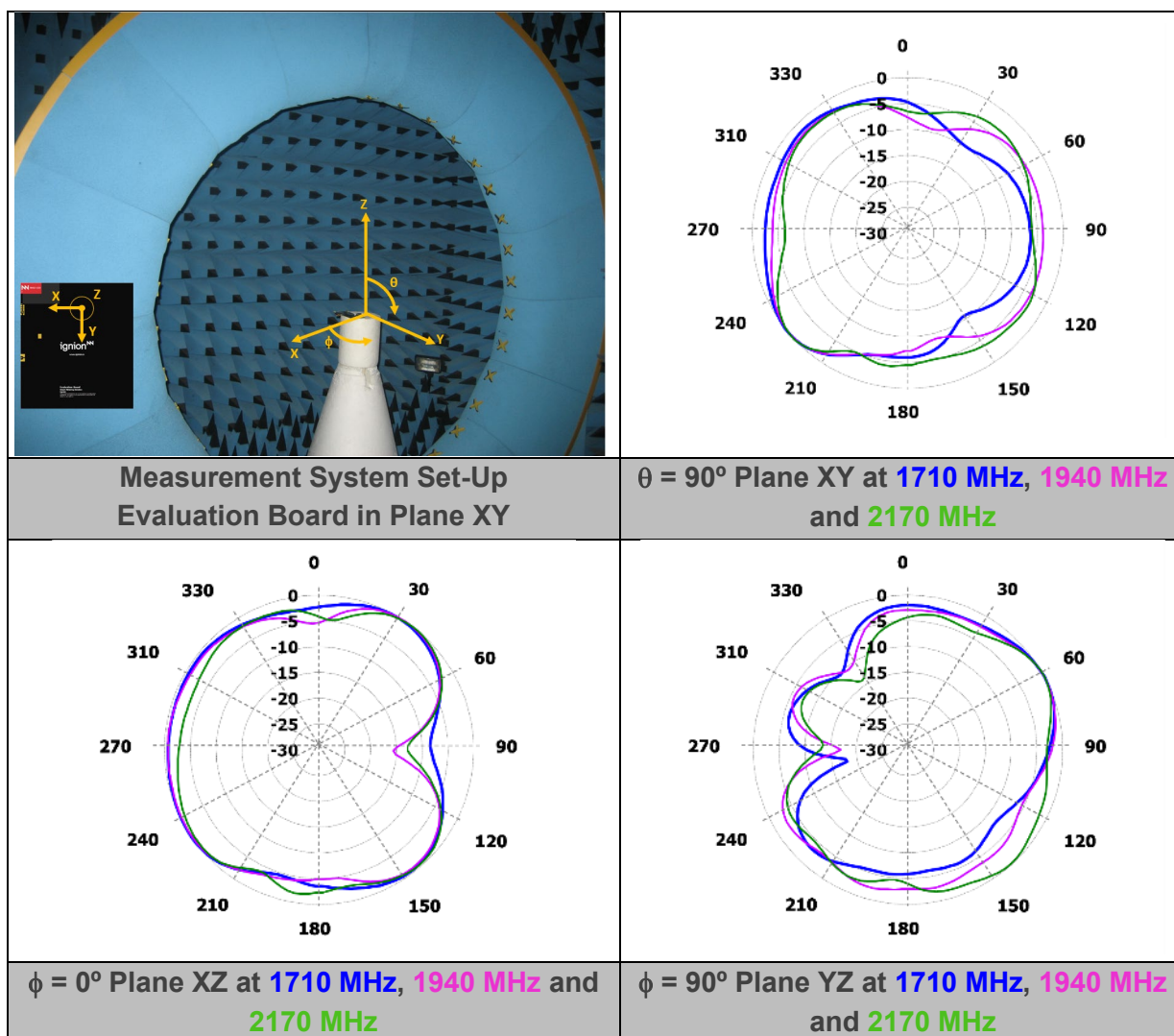
3.5. RADIATION PATTERNS (698 – 960 MHz), GAIN AND EFFICIENCY



Gain	Peak Gain	2.7 dBi
	Average Gain across the band	2.15 dBi
	Gain Range across the band (min, max)	0.9 \leftrightarrow 2.7 dBi
Efficiency	Peak Efficiency	77.4 %
	Average Efficiency across the band	67.7 %
	Efficiency Range across the band (min, max)	60.5 – 77.4 %

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

3.6. RADIATION PATTERNS (1710 – 2170 MHz), GAIN AND EFFICIENCY



Gain	Peak Gain	2.9 dBi
	Average Gain across the band	0.1 dBi
	Gain Range across the band (min, max)	-3.7 \leftrightarrow 2.9 dBi
Efficiency	Peak Efficiency	79.2 %
	Average Efficiency across the band	72.8 %
	Efficiency Range across the band (min, max)	68.2 – 79.2 %

Table 3 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 1710 – 2170 MHz frequency range. Measurements made in the Satimo STARGATE 32 anechoic chamber.

4. EVALUATION BOARD SMART METERING – RUN mXTEND™

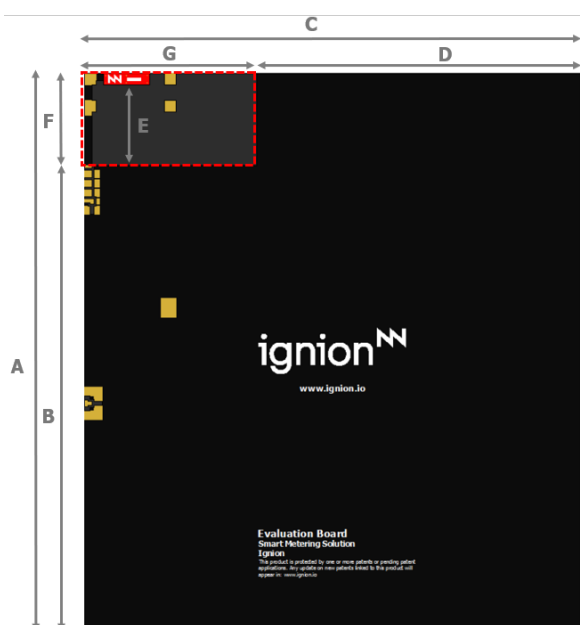
4.1. QUICK REFERENCE GUIDE

Technical features	824 – 960 MHz	1710 – 2170 MHz
Average Efficiency	> 70%	> 65%
Peak Gain	-5.7 dBi	-0.7 dBi
VSWR	< 3:1	
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 4 – Technical Features. Measurements from the Evaluation Board. See Figure 4.

4.2. EVALUATION BOARD

This Evaluation Board EB_NN02-224-SM 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 824 to 960 MHz and from 1710 to 2170 MHz, through a single input/output port.



Measure	mm
A	145.0
B	121.0
C	130.0
D	85.0
E	21.0
F	24.0
G	45.0

Tolerance: ±0.2 mm

E: 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: 24 mm x 45 mm (F x G)

Figure 4 – EB_NN02-224-SM. Evaluation Board providing operation from 824 to 960 MHz and from 1710 to 2170 MHz.

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4.3. MATCHING NETWORK

The specs of a Ignion standard product are measured in an Evaluation Board, where an ideal case is created. However, when incorporating into real designs, nearby components such as LCD's, batteries, covers and connectors may affect the antenna performance. For this reason, placing pads compatible with 0402 and 0603 SMD components for a matching network as close as possible to the feeding point is highly recommended. Create this matching network in the ground plane area rather than the clearance area – this will provide a degree of freedom for tuning the RUN mXTEND™ antenna booster once the design is finished, taking into account all elements of the system (batteries, displays, covers, etc.).

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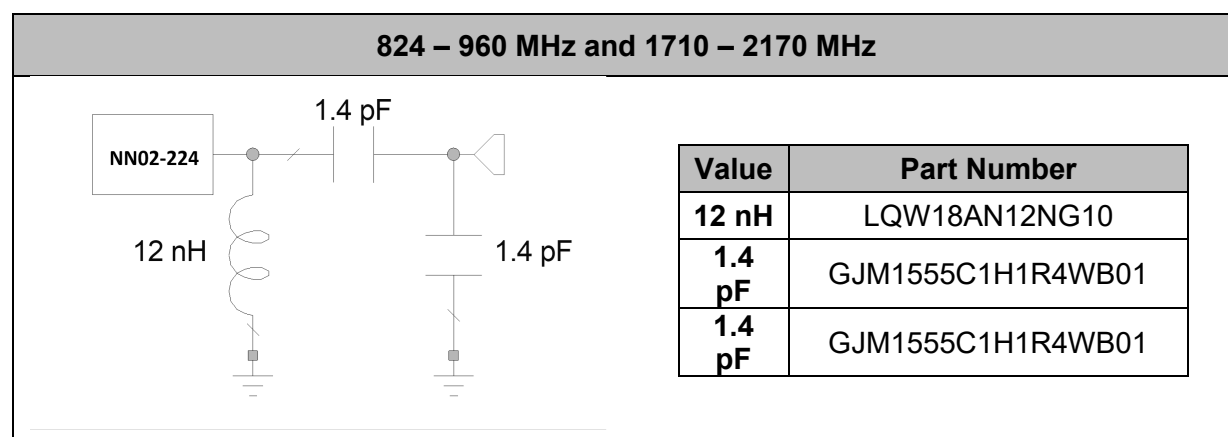


Figure 5 – Matching Network implemented in the evaluation board (Figure 4).

² See terms and conditions for a free Antenna Intelligence Cloud service in 24h at: <https://www.ignion.io/antenna-intelligence/>

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

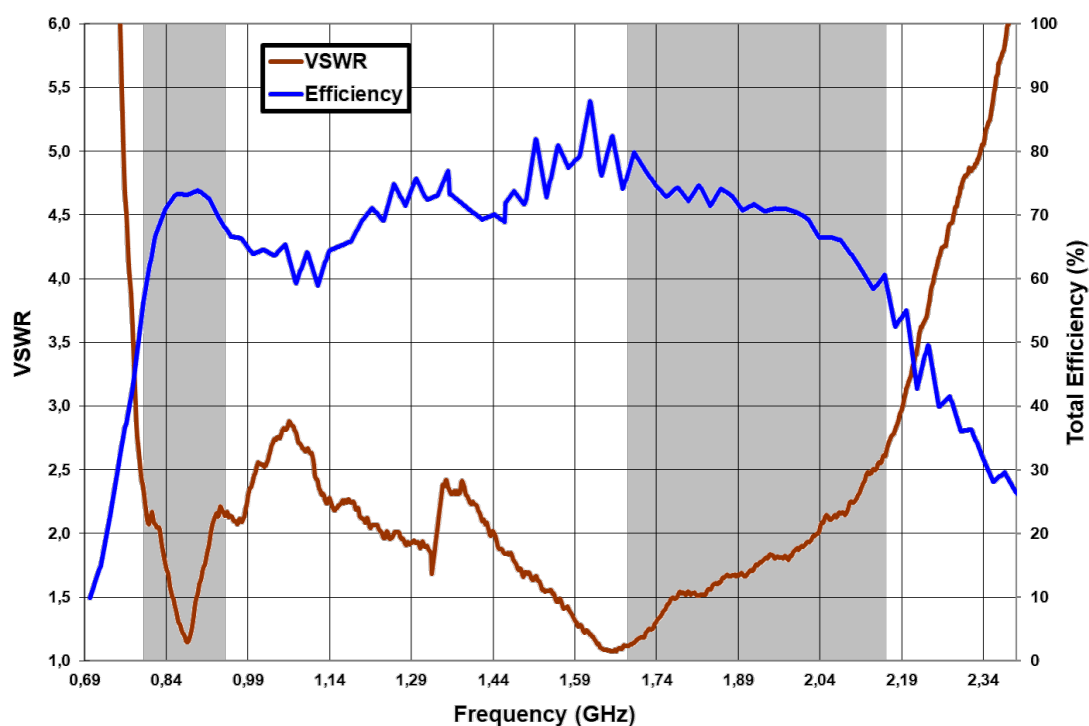
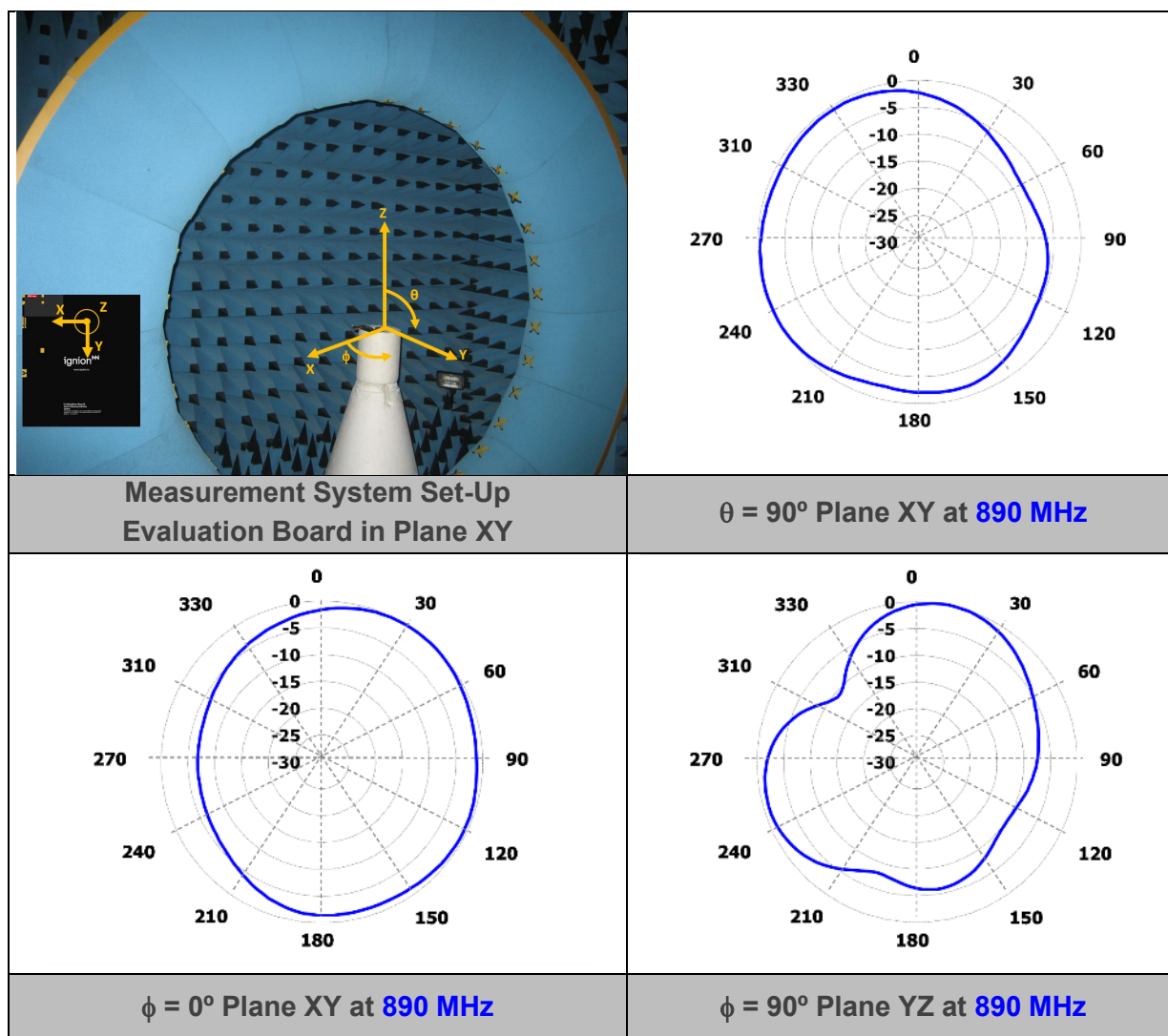


Figure 6 – VSWR and Total Efficiency for the 824 - 960 MHz and 1710 - 2170 MHz frequency range (from the Evaluation Board (Figure 4)).

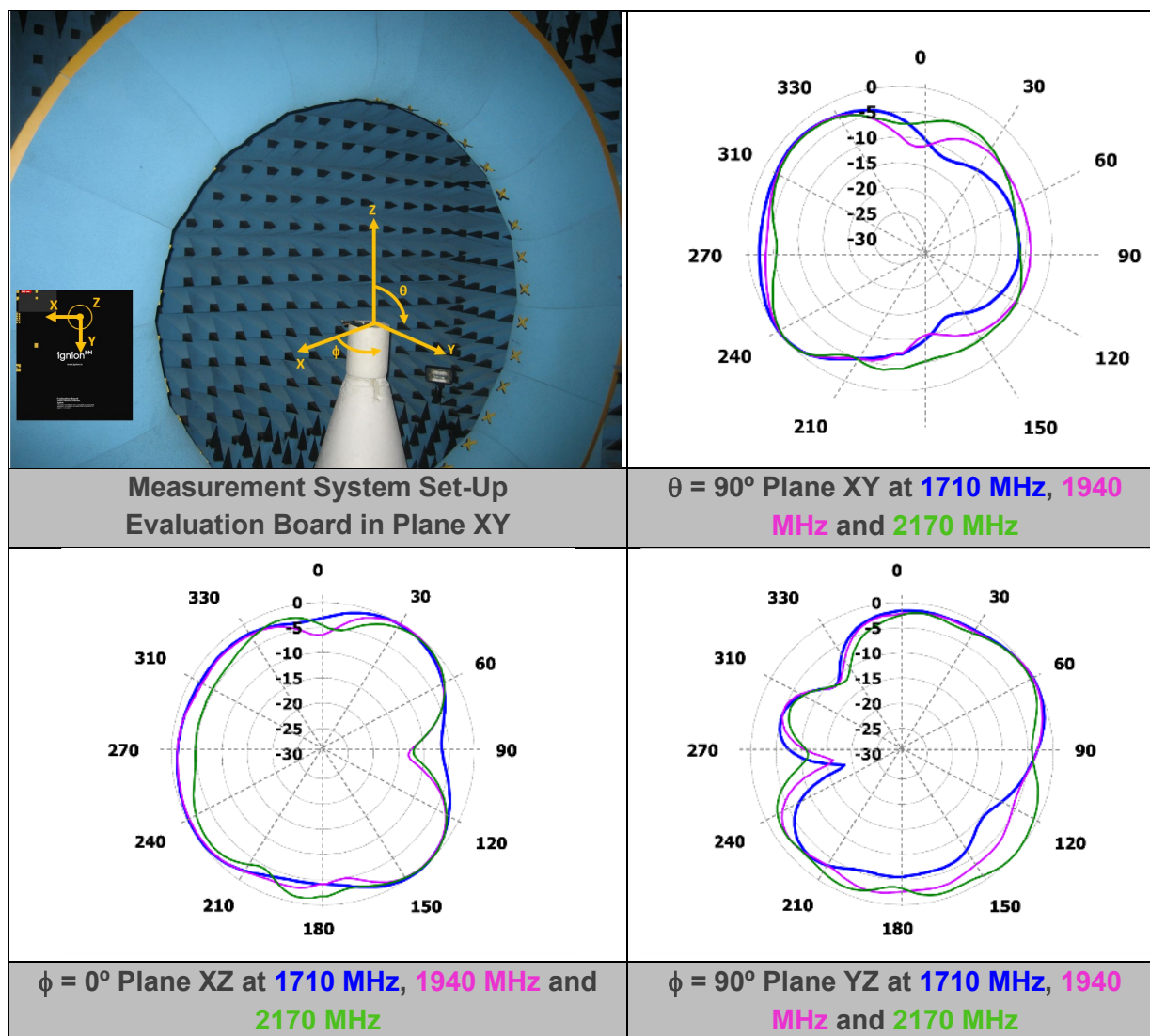
4.5. RADIATION PATTERNS (824 – 960 MHz), GAIN AND EFFICIENCY



Gain	Peak Gain	2.8 dBi
	Average Gain across the band	-5.7 dBi
	Gain Range across the band (min, max)	-7.0 <--> 2.8 dBi
Efficiency	Peak Efficiency	73.8 %
	Average Efficiency across the band	71.5 %
	Efficiency Range across the band (min, max)	66.6 – 73.9 %

Table 5 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 824 – 960 MHz frequency range. Measurements made in the Satimo STARGATE 32 anechoic chamber.

4.6. RADIATION PATTERNS (1710 – 2170 MHz), GAIN AND EFFICIENCY



Gain	Peak Gain	3.0 dBi
	Average Gain across the band	-0.7 dBi
	Gain Range across the band (min, max)	-4.5 <--> 3.0 dBi
Efficiency	Peak Efficiency	78.5 %
	Average Efficiency across the band	69.5 %
	Efficiency Range across the band (min, max)	54.7 – 78.5 %

Table 6 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 1710 – 2170 MHz frequency range. Measurements made in the Satimo STARGATE 32 anechoic chamber.



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