ignion

Your innovation.
Accelerated.

One IoT antenna for any UWB chip

APPLICATION NOTE
DUO mXTEND™ (NN03-320)

THE DUO mXTEND™ ANTENNA IS READY FOR ALL THE UWB CHIPS

- **Antenna Component:** DUO mXTEND™ NN03-320
- **Dimensions :** 7.0 mm x 3.0 mm x 2.0 mm
- **Frequency regions:** 3.1 GHz to 10.6 GHz

The DUO mXTEND™ antenna booster gives you the fastest UWB connectivity in a tiny and standard package of only 7.0 x 3.0 x 2.0 mm

The UWB technology and its high precision, transmission speed and reliability are being more and more popular with the upcoming bunch of IoT product development.

Within this ecosystem of new devices DUO mXTEND™ antenna booster fits perfectly the UWB requirements: **a miniature and off the shelf antenna ready to be used at the UWB frequencies and that works alone with any UWB chip**.

UWB is therefore one of the key technologies for the demanding IoT applications, and DUO mXTEND™ is the key antenna solution for all the UWB frequencies because the tiny antenna component **can cover perfectly all the extremely wide frequency spectrum** where UWB can transmit data.

Does not matter the size or form factor of your next wireless device, DUO mXTEND™ fits in about all of them because is tiny, only 7.0 x 3.0 x 2.0 mm. providing the maximum flexibility to the RF designer when he is struggling with limited space inside de platform.

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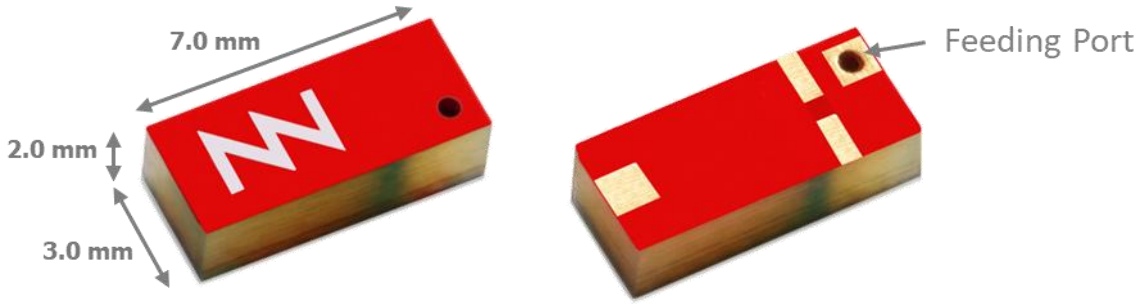
1. PRODUCT DESCRIPTION NN03-320

The DUO mXTEND™ antenna booster is a versatile antenna product specifically designed for wireless devices or modules with **small space** requirements. It offers a **high antenna efficiency** in a very reduced antenna package. Thanks to its versatility, the same antenna component can be used to operate one or multiple of the following communication services, 5G, GNSS, BT, WiFi, or UWB in a single port or multiport configuration. This application note is focused in illustrating how the DUO mXTEND™ can be used to operate all common **UWB** frequency bands in a single port configuration, namely **bands 1-14** ranging from: **3.1GHz up to 10.6GHz.**

TOP **BOTTOM**



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

APPLICATIONS

- IoT devices
- Smart city
- Smart home
- Sensors
- Tags
- Smartphones
- Wearables
- Modules

BENEFITS

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

The DUO mXTEND™ antenna booster belongs to a new generation of antenna solutions based on Virtual Antenna® 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® component the design becomes more predictable compared to a custom solution, making the whole process ***faster, cheaper and easier.***

2. EVALUATION BOARD UWB

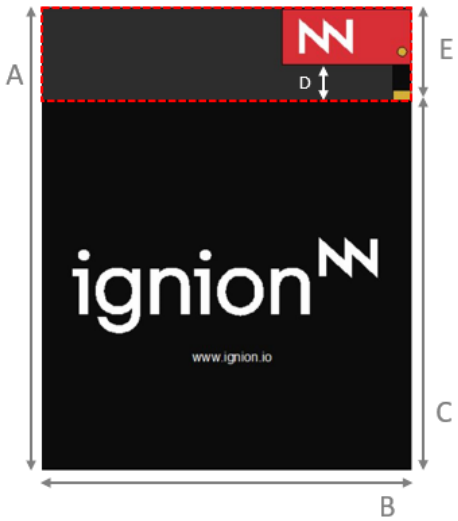
2.1. QUICK REFERENCE GUIDE

Technical features	Option 1 UWB (LFR)	Option 2 UWB (HFR)
	3.1 – 4.8 GHz	**6.0 – 10.6 GHz**
Average Efficiency	> 80%	> 80%
Peak Gain	2.3 dBi	3.6 dBi
VSWR	< 2.6:1	< 4.0:1
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	0.11 g.	
Temperature	-40 to + 125 ºC	
Impedance	50 Ω	
Dimensions (L x W x H)	7.0 mm x 3.0 mm x 2.0 mm	

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

2.2. EVALUATION BOARD

The Evaluation Board EB_NN03-320-UWB integrates the DUO mXTEND™ antenna booster to provide operation in the frequency region going from 3.1 GHz to 10.6 GHz, through a single input/output port.



Measure	mm
A	25.0
B	20.0
C	20.0
D	2.0
E	5.0

Tolerance: ±0.2 mm

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

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

Clearance Area: 20.0 mm x 5.0 mm (B x E)

Figure 1 – EB_NN03-320-UWB. Evaluation Board providing operation at UWB (from 3.1 GHz to 10.6 GHz).

This product and/or its use is protected by at least one or more of the following patents and patent applications PAT. US 9,865,917 B2, WO 2019/008171, US 16/731755, EP 18736916.0,

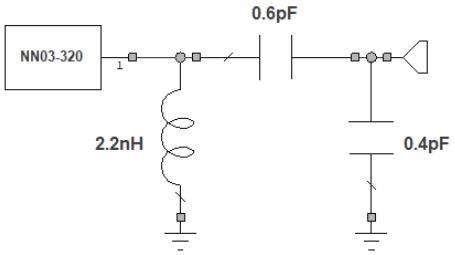
CN 201880045357.8; and other domestic and international patents pending. Additional information about patents related to this product is available at www.ignion.io/virtual-antenna

2.3. MATCHING NETWORK

DUO mXTEND™ antenna booster needs a matching network to connect to your UWB RF module. This section presents the proposed matching network and specifications obtained in the corresponding Evaluation Board (Figure 1), which is an ideal case. Thanks to its versatility the DUO mXTEND™ antenna booster can be easily tuned to cover different regions of the UWB spectrum through just the proper adjustment of the matching network. The excellent tuning capabilities of the DUO mXTEND™ makes it ideal to avoid unnecessary product redesigns each time your product specifications and operating frequencies vary. It allows you to easily adapt your design to different applications, market segments, and devices through just the proper design of the matching network by maintaining the same antenna part.

Two different options with two different matching networks are presented herein to illustrate this flexibility. The first one is used to properly tune the antenna performance to UWB channels ranging from 3.1-4.8GHz (Option 1). The second one can be used to cover channels operating from 6.0-10.6GHz (Option 2).

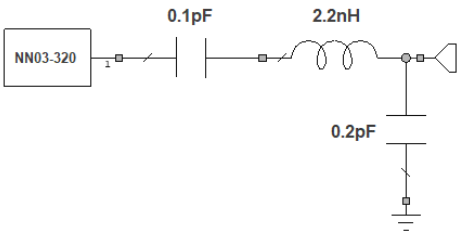
3.1 GHz – 4.8 GHz



Value	Part Number
2.2 nH	LQW15AN2N2G80
0.6 pF	GJM1555C1HR60WB01
0.4 pF	GJM1555C1HR40WB01

Figure 2 – Matching network implemented in the Evaluation Board (Figure 1) for covering the low frequency region from 3.1GHz to 4.8GHz.

6.0 GHz – 10.6 GHz



Value	Part Number
0.1 pF	GJM1555C1HR10WB01
2.2 nH	LQW15AN2N2G80
0.2 pF	GJM1555C1HR20WB01

Figure 3 – Matching network implemented in the Evaluation Board (Figure 1) for covering the high frequency region from 6.0GHz to 10.6GHz.

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. may need a different matching network. 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 DUO mXTEND™ antenna booster once the design is finished and taking into account all elements of the system (batteries, displays, covers, etc.). To ensure optimal results, the use of high-quality factor (Q) and tight tolerance components is highly recommended (e.g. Murata components (Figure 2).

If you are designing a different device size or frequency band, run your configuration through Oxion™ at https://oxion.ai, Ignion's free-of-charge[1] AI-powered antenna integration platform, and get a complete design report with a custom matching network for your device in 24h. Ignion's engineering services: https://ignion.io/design-center/engineering-support/

2.4. VSWR AND TOTAL EFFICIENCY

VSWR (Voltage Standing Wave Ratio) and total efficiency versus frequency (GHz).

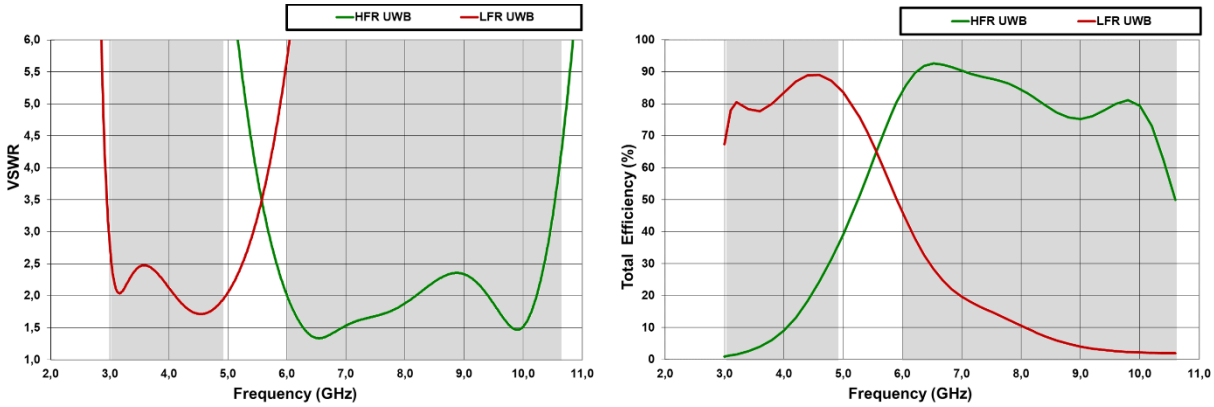
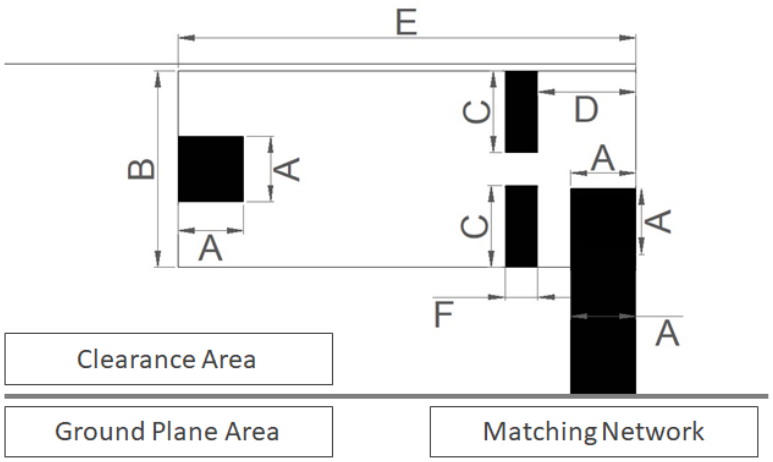


Figure 4 – VSWR and total efficiency for the UWB LFR (3.1GHz – 4.8GHz) and for the UWB HFR (6.0GHz – 10.6GHz) from the Evaluation Board (Figure 1 with the matching networks gathered in Figure 2 (LFR UWB) and Figure 3 (HFR UWB), respectively. Simulated results obtained with CST.

1 See terms and conditions for the free-of-charge Oxion™ service at: https://oxion.ai

2.5. RECOMMENDED ANTENNA FOOTPRINT FOR NN03-320

The DUO mXTEND™ antenna booster (NN03-320) can be placed close to a corner or the PCB or close to the center of the longitudinal PCB edge. See below the recommended footprint dimensions when it is placed close to a corner of the PCB with the feeding line aligned with the longest side of the board according to the Evaluation Board (Figure 1).



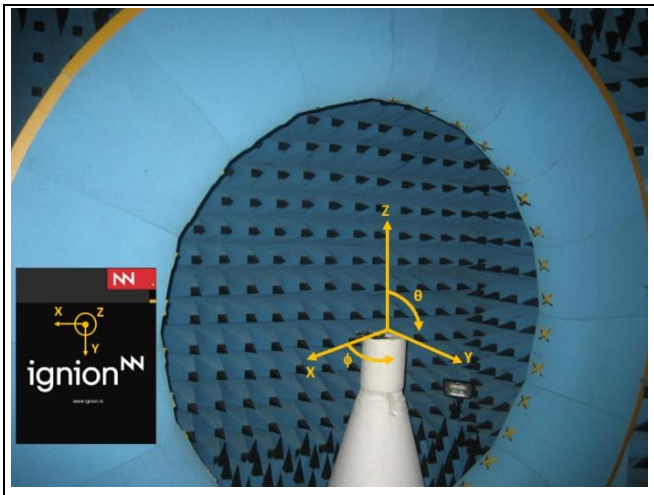
Measure	mm
A	1.0
B	3.0
C	1.25
D	1.5
E	7.0
F	0.5

Tolerance: ±0.05mm

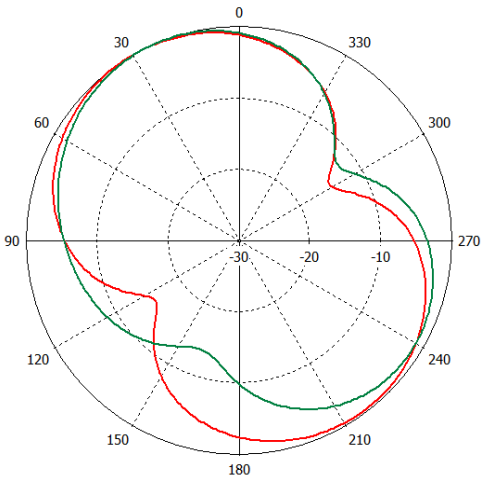
Figure 5 – Footprint dimensions for the NN03-320 in the corner for UWB.

For additional support in the integration process, please contact support@ignion.io.

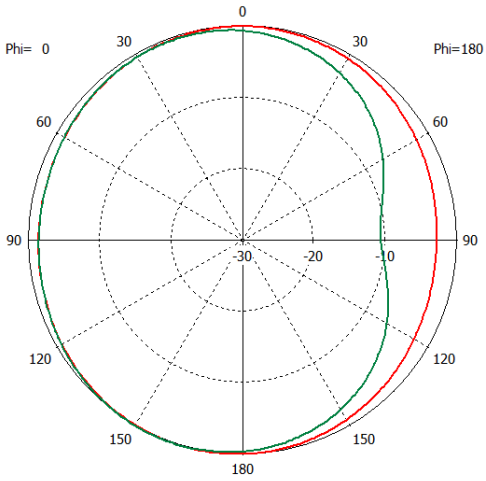
2.6. RADIATION PATTERNS UWB (3.1 to 4.8 GHz), GAIN, AND EFFICIENCY



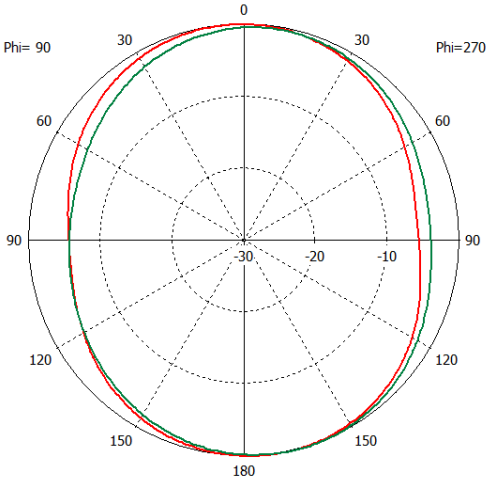
Measurement System Set-Up Evaluation Board in Plane XY



θ = 90º Plane XY at 3.1 GHz and 4.8 GHz



ϕ = 0º Plane XZ at 3.1 GHz and 4.8 GHz

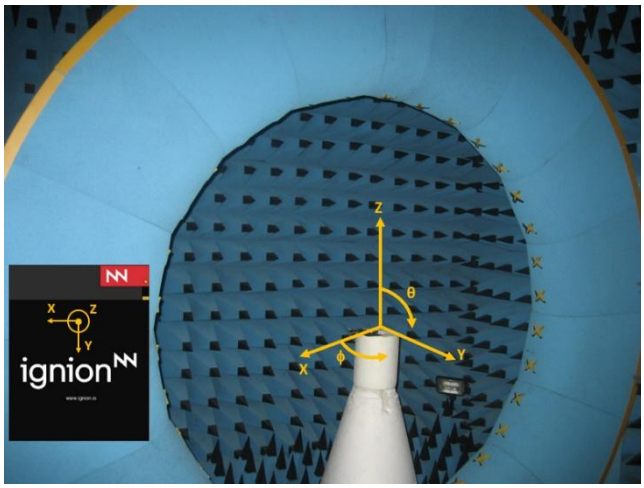


ϕ = 90º Plane YZ at 3.1 GHz and 4.8 GHz

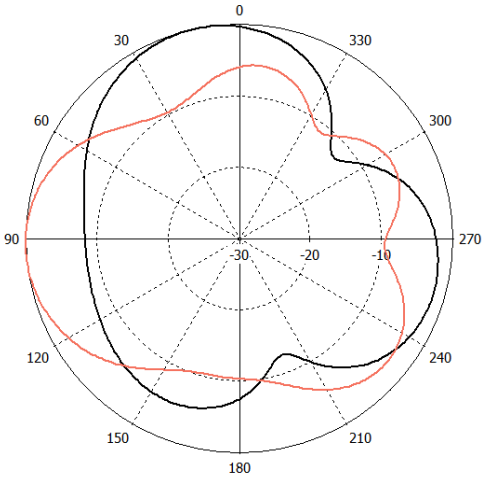
LFR UWB 3.1-4.8GHz	**Gain**	**Peak Gain**	2.3 dBi
		Average Gain across the band	1.7 dBi
		Gain Range across the band (min, max)	1.1 **<–>** 2.3 dBi
	Efficiency	**Peak Efficiency**	89.0 %
		Average Efficiency across the band	83.0 %
		Efficiency Range across the band (min, max)	77.7 – 89.0 %

Table 2 – Antenna gain and total efficiency from the Evaluation Board (Figure 1) for 3.1GHz **–** 4.8GHz with the matching network of Figure 2. Simulated results obtained with CST.

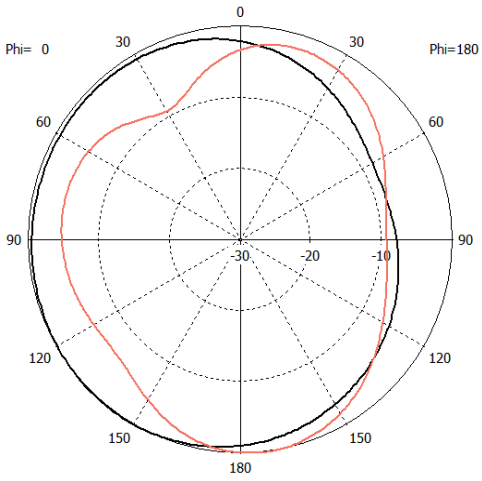
2.7. RADIATION PATTERNS UWB (6.0 to 10.6 GHz), GAIN, AND EFFICIENCY



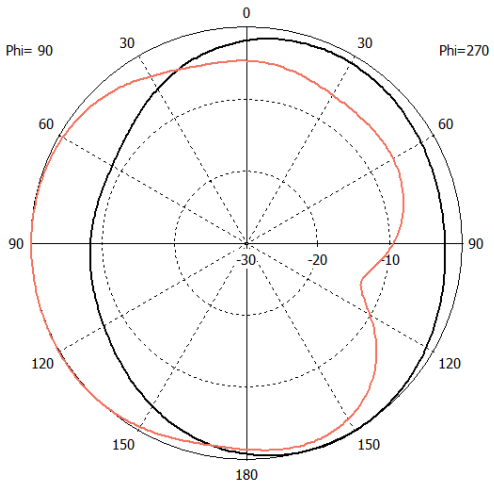
Measurement System Set-Up Evaluation Board in Plane XY



θ = 90º Plane XY at 6.0 GHz and 10.6 GHz



ϕ = 0º Plane XZ at 6.0 GHz and 10.6 GHz



ϕ = 90º Plane YZ at 6.0 GHz and 10.6 GHz

HFR UWB 6.0-10.6GHz	**Gain**	**Peak Gain**	3.6 dBi
		Average Gain across the band	3.0 dBi
		Gain Range across the band (min, max)	1.5 **<–>** 3.6 dBi
	Efficiency	**Peak Efficiency**	92.6 %
		Average Efficiency across the band	82.2 %
		Efficiency Range across the band (min, max)	50.0 – 92.6 %

Table 3 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) for 6.0GHz – 10.6GHz band considering the matching network in Figure 3. Simulated results obtained with CST.

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

Use Oxion™, Ignion's AI-powered antenna integration platform, and get your ready-to-test antenna design for your platform free of charge[1] and in 24 hours.

https://oxion.ai

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

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