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Your innovation.
Accelerated.

Dual-band Wi-Fi 6 (2.4 and 5 GHz) from one small-scale chip antenna

APPLICATION NOTE
DUO mXTEND™ (NN03-320)

THE MINIATURE DUO mXTEND™ FOR Wi-Fi 6 DUAL-BAND

- **Antenna component:** DUO mXTEND™ NN03-320
- **Dimensions:** 7.0 mm x 3.0 mm x 2.0 mm
- **Frequency regions:** 2400-2500 MHz and 4900-5875 MHz

Design your new Wi-Fi device with a tiny, slim and off-the-shelf chip antenna for 2.4 GHz + 5.0 GHz

Design your products today and include the latest Wi-Fi 6 standard with DUO mXTEND™. The miniature and slim DUO mXTEND™ will enable you to design, build and go to market more quickly with your devices connected to the world's most prevalent communication technology: Wi-Fi. Use DUO mXTEND™ to **streamline your innovation while meeting the cost, size and power consumption specifications of your Wi-Fi device**.

DUO mXTEND™ provides **custom performance in an off-the-shelf package**. Owing to its unique Virtual Antenna® technology, the performance of this chip antenna can be optimized using simple circuit design on any hardware platform while still providing the benefits of an off-the-shelf antenna component that needs no mechanical or supply chain customization. Need to start fast with a DUO mXTEND™ design? Get your proof-of-concept design from Oxion™ at **https://oxion.ai** in as little as 24h.

Thanks to its miniature size of only **7.0 x 3.0 x 2.0 mm**, this tiny antenna booster fits in just about any platform and because of this small size and footprint, it is ideal for wireless platforms where an **internal antenna solution is embedded** in a **NxN MIMO** architecture. Despite its tiny volume of **only 21mm^3**, DUO mXTEND™ has been designed to optimize radiation efficiency to maximize your **connectivity throughput and range** while minimizing **power consumption**.

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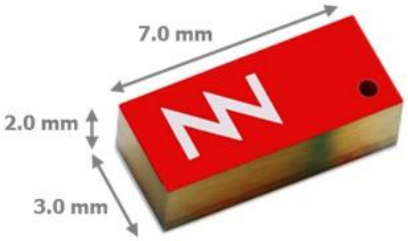
1. PRODUCT DESCRIPTION NN03-320

The DUO mXTEND™ antenna booster is a versatile antenna product specifically designed for wireless devices or modules with **small space** requirements. It offers **high antenna efficiency** in a very reduced antenna package. Thanks to its versatility, the same antenna component can be used to operate in one or multiple communication services, including Wi-Fi, 5G, GNSS, Bluetooth, or UWB in a single port or dual-port (multi-RAT) configuration. This application note is focused on illustrating how the DUO mXTEND™ can be used to operate in Wi-Fi 6 dual-band in a single port configuration, ranging from **2.4GHz up to 5.875GHz.**

TOP



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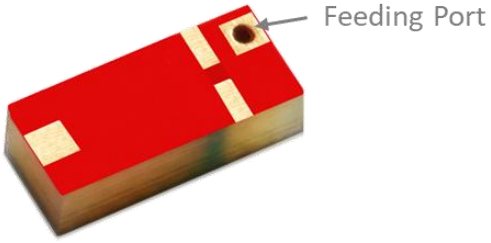


Material: The DUO mXTEND™ antenna booster is built on glass epoxy substrate.

APPLICATIONS

- Access points/mesh nodes
- Smart home
- IP cameras
- Gaming devices
- Wireless printers
- In-vehicle infotainment
- Automotive V2X
- Health monitoring devices

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 the Virtual Antenna® technology owned by Ignion. This technology replaces conventional and custom antenna solutions with a new class of antenna boosters, delivered in the form of a new range of miniature and off-the-shelf chip antenna components. These new chip antennas are multiband and multipurpose. They fit in a variety of wireless platforms to provide a wireless link for many different communication services. By using a Virtual Antenna® component, the design becomes more predictable than when using a custom solution, making the whole process ***cost effective, faster, and easier.***

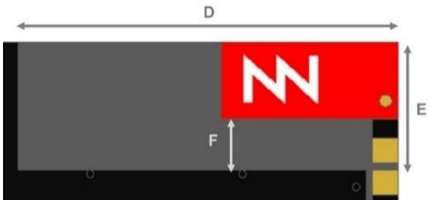
2. EVALUATION BOARD

2.1. QUICK REFERENCE GUIDE

Technical features	2.4 – 2.5 GHz	4.9 – 5.875 GHz
Average Efficiency	> 65%	> 65%
Peak Gain	4.1 dBi	3.8 dBi
VSWR	< 2.0:1	< 3.0:1
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	

2.2. EVALUATION BOARD

The Evaluation Board EB-NN03-320-C-WF integrates the DUO mXTEND™ antenna booster to provide operation in the frequency region going from 2.4 GHz to 2.5 GHz and 4.9GHz to 5.875 GHz, through a single input/output port.



Measure	mm
A	80
B	40
C	75
D	15
E	5
F	2

Tolerance: ±0.2 mm

F: 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: 15 mm x 5.0 mm (DxE)

Figure 1 - Evaluation board dimensions.

Please note that the DUO mXTEND™ is a versatile antenna solution that can cover additional frequency ranges to those covered in this document. If your device will operate in any other band, please contact to support@ignion.io for assistance.

2.3. VSWR AND EFFICIENCY

This section explains the antenna performance in terms of VSWR (Voltage Standing Wave Ratio) and Total Efficiency results versus frequency (GHz) for the Wi-Fi dual-band frequency bands.

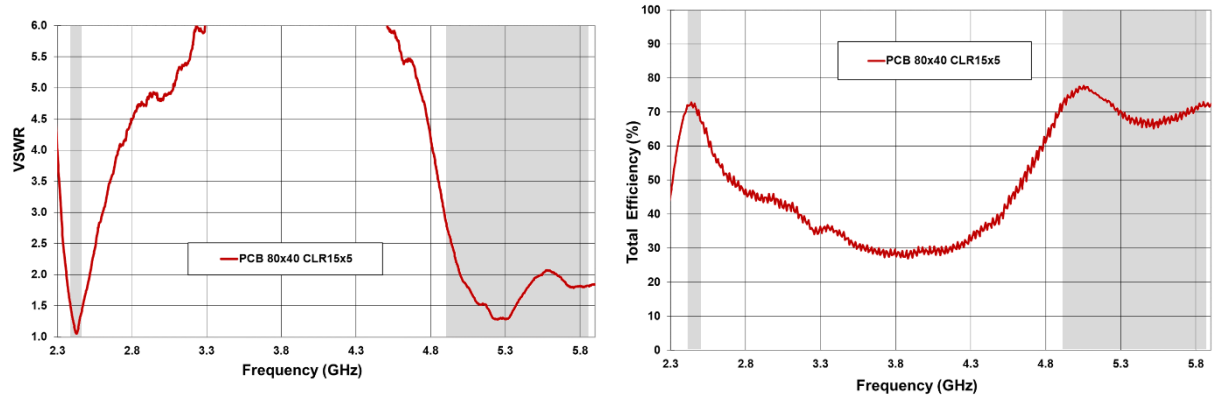


Figure 2 – VSWR and Total Efficiency for the 2.4 – 2.5 GHz frequency range and for the 4.9 – 5.875 GHz frequency range (Figure 1).

	2.4 – 2.5GHz					4.9 – 5.875GHz				
DUO mXTEND™	**$\eta_{a\ 2400MHz}$**	**$\eta_{a\ 2500MHz}$**	**Min**	**Max**	**Av. η_a**	**$\eta_{a\ 4900MHz}$**	**$\eta_{a\ 5875MHz}$**	**Min**	**Max**	**Av. η_a**
On the corner	70.0	67.3	67.3	72.8	71.1	71.4	72.2	65.2	77.8	70.9

Table 1 - Antenna efficiency considering a PCB of 80mm x 40mm for 2.4 – 2.5GHz and 4.9 – 5.875GHz frequency ranges (**Figure** 1).

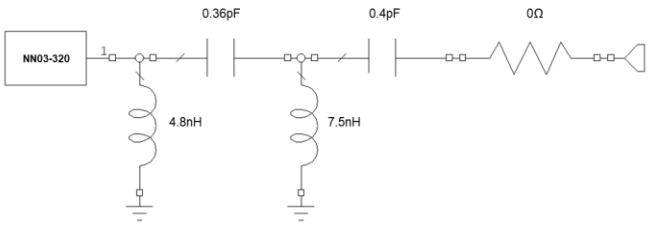
DUO mXTEND™ operates at the required Wi-Fi dual-band frequency spectrum with high efficiency values.

2.4. MATCHING NETWORK

The DUO mXTEND™ antenna booster requires a matching network to connect to your Wi-Fi transceiver. This section describes the recommended matching network topology and values (Figure 3) for the Wi-Fi dual-band solution shown in the Evaluation Board (Figure 1).

Thanks to its versatility, the DUO mXTEND™ antenna booster can easily be tuned to cover the Wi-Fi spectrum through simply adjusting the matching network. The excellent tuning possibilities of the DUO mXTEND™ make it ideal for avoiding 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 maintaining the same antenna part and just adjusting the design of the matching network.

2.4 GHz – 2.5 GHz & 4.9 GHz – 5.875 GHz



Value	Part Number
4.8 nH	LQW15AN4N8G80
0.36 pF	GJM1555C1HR36WB01
7.5 nH	LQW18AN7N5C80
0.4 pF	GJM1555C1HR40WB01
0Ω	-

Figure 3 – Matching network implemented in the Evaluation Board (Figure 1) for covering Wi-Fi dual-band

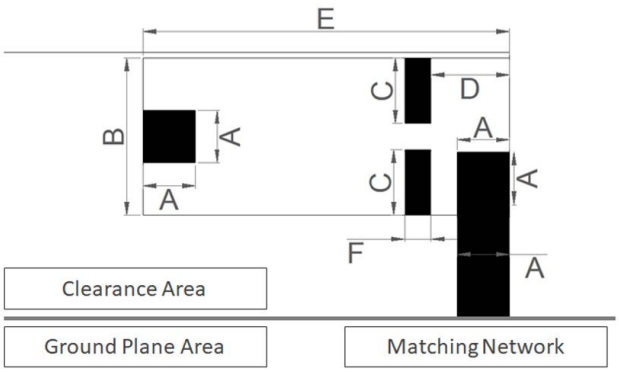
The antenna performance is always conditioned by its operating environment. Different devices with different printed circuit board sizes, components near the antenna, displays, batteries, covers, connectors, etc. may need different matching networks. Accordingly, it is highly recommendable to place pads 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, and not in the clearance area. This provides a degree of freedom to tune the DUO mXTEND™ antenna booster once the design is finished and takes 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 also highly recommended (e.g. Murata components (Figure 3)).

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/

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

3. RECOMMENDED ANTENNA FOOTPRINT FOR NN03-320

The DUO mXTEND™ antenna booster (NN03-320) must be placed as close as possible to the corner of the PCB with the feeding line aligned with the longest side of the board to get the best performance. See below the recommended footprint dimensions (Figure 4).

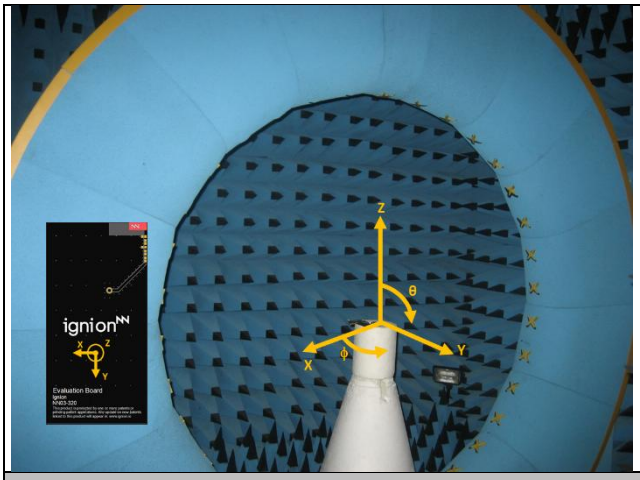


Measure	mm
A	1.0
B	3.0
C	1.25
D	1.5
E	7.0
F	0.5

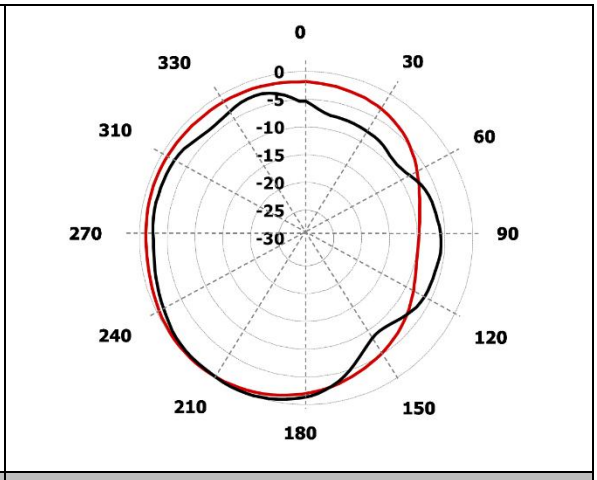
Tolerance: ±0.05mm

Figure 4 - Footprint dimensions for the DUO mXTEND™ (NN03-320) antenna booster placed on the corner.

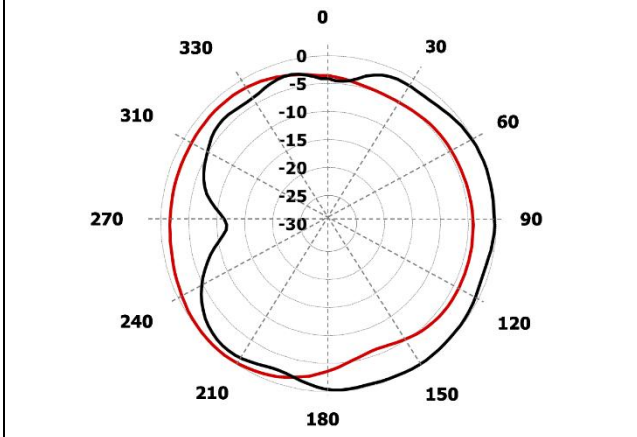
3.1. RADIATION PATTERNS, GAIN AND EFFICIENCY



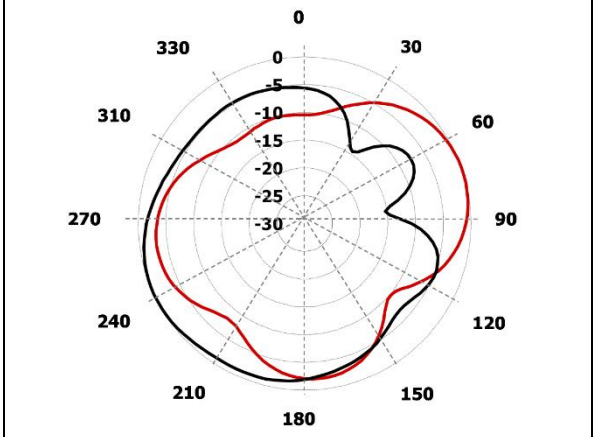
Measurement System Set-Up Evaluation Board in Plane XY



θ = 90º Plane XY at **2.45 GHz** and **5.4 GHz**



ϕ = 0º Plane XZ **2.45 GHz** and **5.4 GHz**



ϕ = 90º Plane YZ at **2.45 GHz** and **5.4 GHz**

		2.4 – 2.5 GHz	4.9 – 5.875 GHz
Gain	Peak Gain	4.1 dBi	3.8 dBi
	Average Gain across the band	1.2 dBi	2.9 dBi
	Gain Range across the band (min, max)	3.0 <–> 4.1 dBi	1.0 <–> 3.8 dBi
Efficiency	Peak Efficiency	72.8 %	77.8 %
	Average Efficiency across the band	71.1 %	70.9 %
	Efficiency Range across the band (min, max)	67.3 – 72.8 %	65.2 – 77.8 %

Table 2 - Antenna Gain and Efficiency within the 2.4 – 2.5 GHz band and the 4.9 – 5.875 GHz band. Measurements made on the evaluation board and in the Satimo STARGATE 32 anechoic chamber.

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

The DUO mXTEND™ antenna booster and other Ignion products are based upon proprietary Virtual Antenna® technology that is protected by one or more of the following https://ignion.io/files/Patent-list-NN.pdf

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

ISO 9001: 2015 Certified

ignion

Your innovation.
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Contact:
support@ignion.io
+34 935 660 710

Barcelona

Carrer Jesús Serra Santamans, 2
Building 2, 3rd Floor, 08174
Sant Cugat del Vallès, Barcelona,
Spain
+34 935 660 710

Shenzhen

Keyan Road 9, Nanshan District
BAK Science and Technology Building,
Room 1301E, Shenzhen, GD 518057
China
+86 138 2653 8470

Tampa

8875 Hidden River Parkway, Suite 300,
Tampa, FL 33637,
USA
+1 407-902-9278
+1 888 726 8366