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DUO mXTEND[™]: MINIATURE AND HIGH EFFICIENCY BLUETOOTH ANTENNA

APPLICATION NOTE
DUO mXTEND[™] (NN03-320)

DUO mXTEND[™]: MINIATURE AND HIGH EFFICIENCY ANTENNA

- **Antenna component:** DUO mXTEND[™] NN03-320
- **Dimensions:** 7.0 mm x 3.0 mm x 2.0 mm
- **Frequency regions:** 2400 – 2500 MHz



With the DUO mXTEND[™] antenna booster you can now get a high efficiency worldwide Bluetooth connection, with a tiny chip component that doesn't need any clearance beyond its footprint.

Smart trackers, smartwatches and other tiny wearables need Bluetooth connection in the minimum possible space. This lack of space is always a restriction for the antenna in this type of devices, but now you can embed the DUO mXTEND[™] antenna booster, as it is only **7.0 mm x 3.0 mm x 2.0 mm** and even more, it **does not need any clearance** beyond its footprint, as other traditional Bluetooth antennas.

With more than a 70% average efficiency this miniature antenna allows you to reduce the size of your PCB as much as possible without losing performance, and its zero clearance beyond the antenna area leaves an extra space to embed other elements nearby.

This tiny antenna booster is ideal for tiny devices that need **Bluetooth connection in a miniature space with a high efficiency performance.**

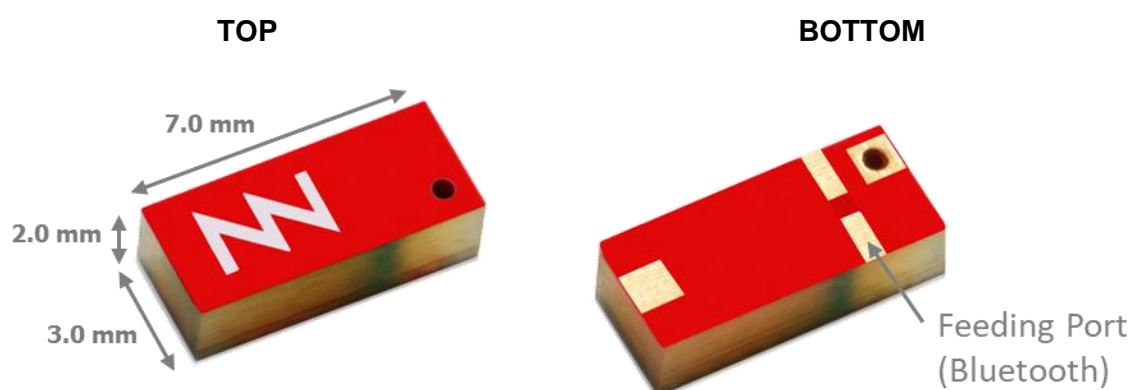
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1. PRODUCT DESCRIPTION NN03-320

The DUO mXTEND[™] antenna booster has been specifically designed for providing Bluetooth (BT) in wireless devices with small space requirements. It is a miniature antenna capable of being adapted, with a high level of flexibility, to the antenna designer needs. The DUO mXTEND[™] antenna booster does not require further clearance area beyond its reduced footprint, making it an ideal alternative to larger custom antennas for small and portable devices.

It includes two input ports, a first one for operating the BT frequency bands and a second one for operating Global Navigation Satellite Systems (GNSS). This application note illustrates its performance when just configured to operate BT. More information about the dual-port configuration can be found in its associated [User Manual](#).



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

APPLICATIONS

- Modules
- Smart tracking devices
- Sport navigators
- Handsets and smartphones
- Tablets
- Digital cameras
- Smartwatches and wearables

BENEFITS

- High efficiency
- Small size
- Cost-effective
- Easy-to-use (pick and place)
- Off-the-Shelf standard product (no customization is required)
- No clearance beyond footprint

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.

2. EVALUATION BOARD Bluetooth

2.1. QUICK REFERENCE GUIDE

Technical features	2400 MHz – 2500 MHz
Average Efficiency	> 70 %
Peak Gain	1.8 dBi
VSWR	< 2.5:1
Radiation Pattern	Omnidirectional
Polarization	Linear
Weight (approx.)	0.11 g.
Temperature	-40 to +125 °C
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

This Evaluation Board EB_NN03-320-m-BT integrates a UFL cable to connect the DUO mXTEND™ antenna booster with the SMA connector. The DUO mXTEND™ provides operation in one frequency region from 2400 MHz to 2500 MHz (Bluetooth), through a single input/output port (Figure 1).

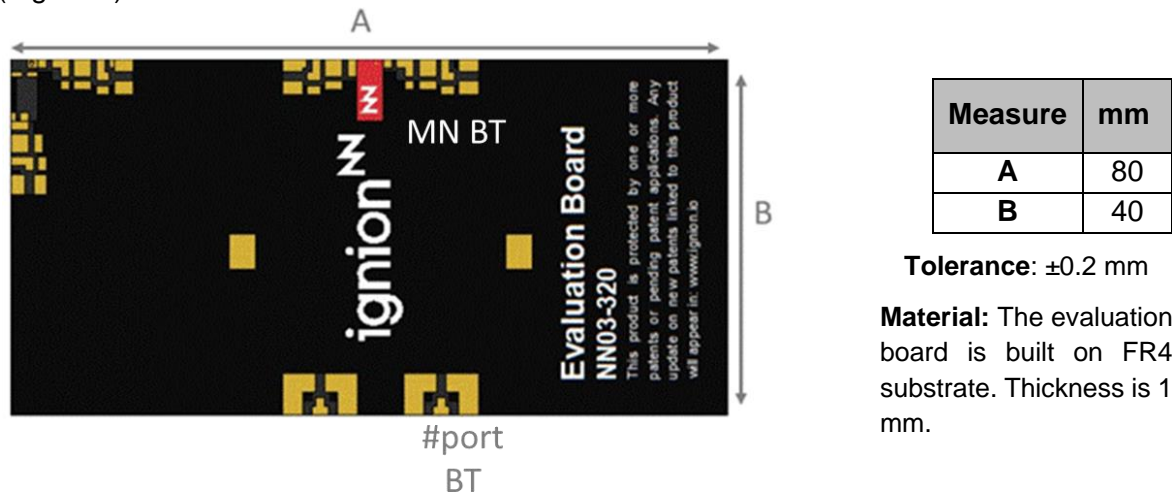


Figure 1 – EB_NN03-320-m-BT. Evaluation Board providing operation at Bluetooth (from 2400 MHz to 2500 MHz). Notice that the clearance area is equal to the DUO mXTEND™ footprint.

This product and/or its use is protected by at least one or more patents and patent applications. Please check related patent information at: [ignion patents](http://ignion.com/patents).

2.3. MATCHING NETWORK

DUO mXTEND™ needs a matching network to connect to your Bluetooth receiver. This section describes a suitable matching network (Figure 2) for DUO mXTEND™ and the resulting product specs when measured in the reference evaluation board (EB_NN03-320-m-BT) (Figure 1). Please note that different tracking devices with different form factors, RF ground planes and nearby components may need a different matching network.

If you need assistance to design your matching network beyond this application note, please contact support@ignion.io, or try our free-of-charge **NN Wireless Fast-Track** design service, you will get your chip antenna design including a custom matching network for your device in 24h¹. Other related to NN's range of R&D services is available at: <https://www.ignion.io/rdservices/>

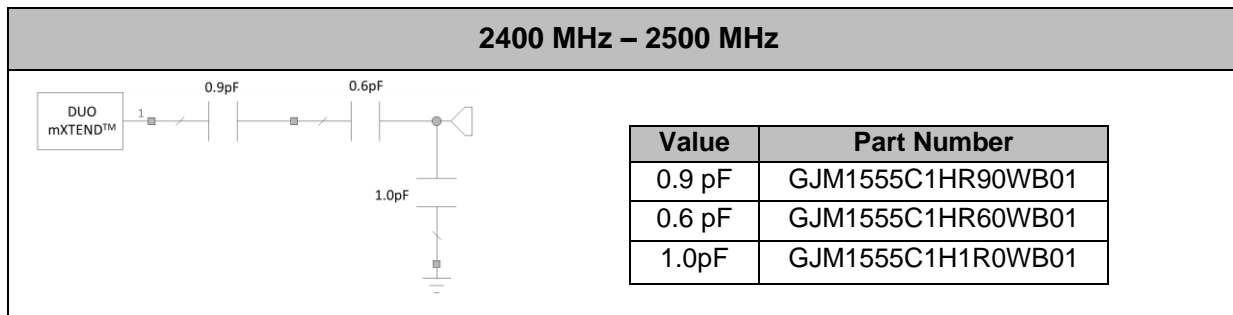


Figure 2 – Matching Network implemented in the evaluation board (Figure 1).

To ensure optimal results, the use of high-quality factor (Q) and tight tolerance components is highly recommended (e.g. Murata components with part numbers as in Figure 2). The antenna performance is always conditioned by its operating environment so that 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. Do it in the ground plane area, not in the clearance area. By tuning the matching network in your final design with your final surrounding components (batteries, displays, covers, etc.) you will be able to optimize the antenna performance without changing the antenna part.

¹ See terms and conditions for a free NN Wireless Fast-Track service at: <https://www.ignion.io/fast-track-project/>

2.4. VSWR AND TOTAL EFFICIENCY

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

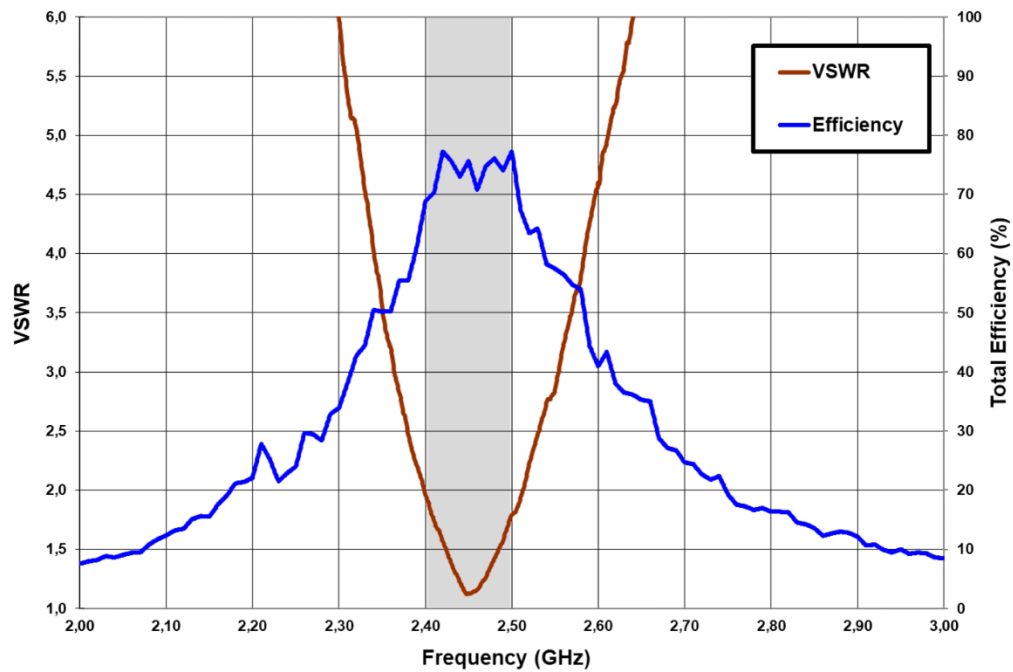
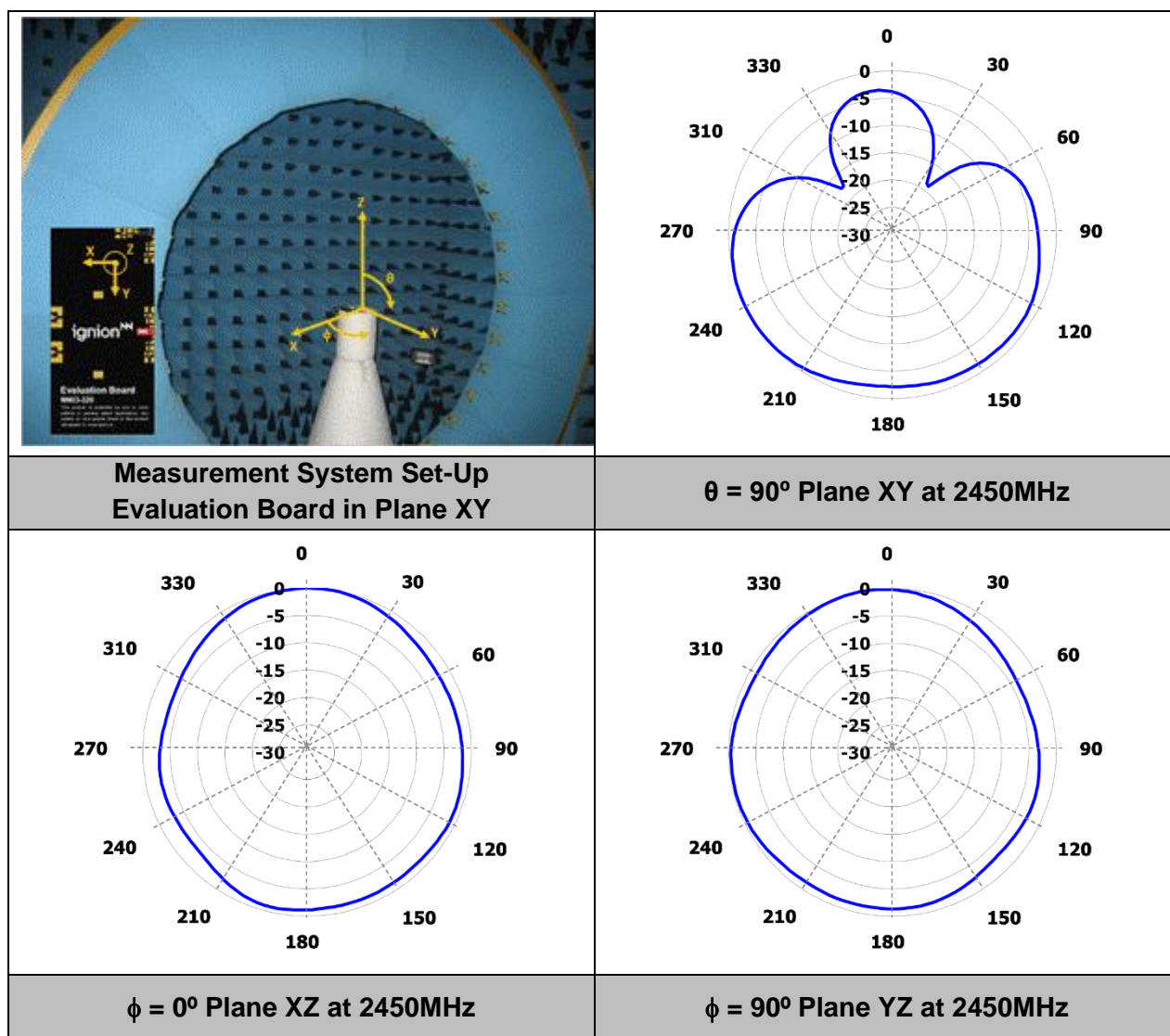


Figure 3 – VSWR and Total Efficiency Bluetooth band (2400 MHz – 2500 MHz) (from the evaluation board (Figure 1)).

2.5. RADIATION PATTERNS (2400 - 2500 MHz), GAIN, AND EFFICIENCY



Gain	Peak Gain	1.8 dBi
	Average Gain across the band	1.5 dBi
	Gain Range across the band (min, max)	1.1 dBi \leftrightarrow 1.8 dBi
Efficiency	Peak Efficiency	77.3 %
	Average Efficiency across the band	74.1 %
	Efficiency Range across the band (min, max)	68.8 – 77.3 %

Table 2 – Antenna Gain and Total Efficiency from the evaluation board (Figure 1) for Bluetooth (2400 MHz – 2500 MHz) band. Measure made in the Satimo STARGATE 32 anechoic chamber.

2.6. ANTENNA FOOTPRINT

See below the recommended footprint dimensions for the DUO mXTEND™ antenna booster NN03-320.

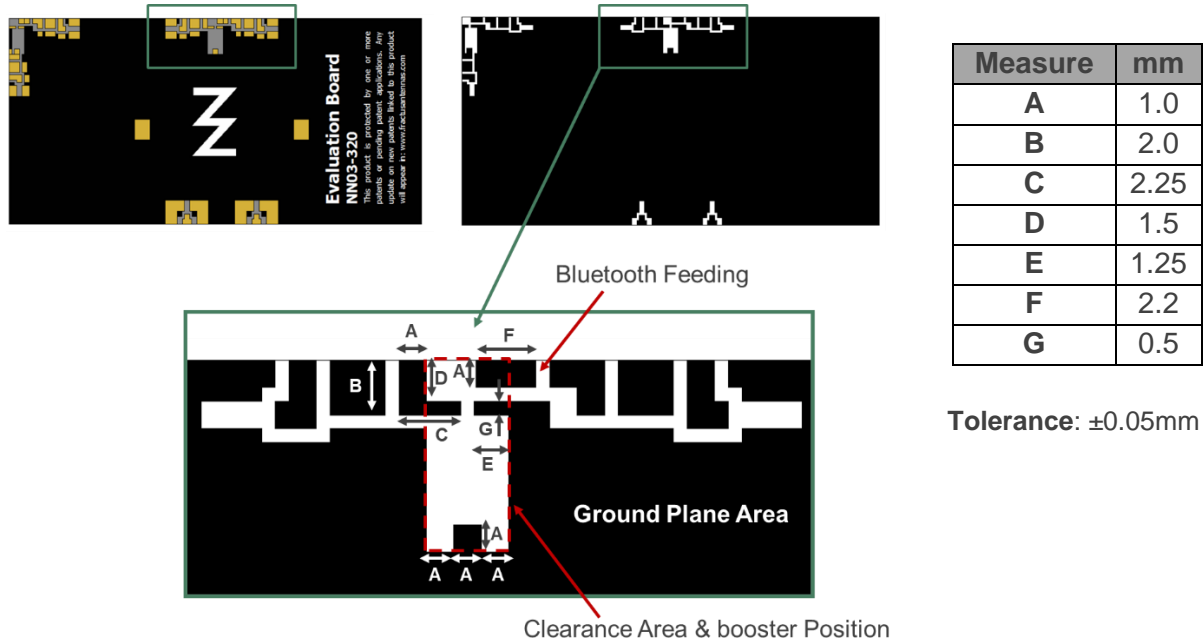


Figure 4 – Footprint dimensions for the DUO mXTEND™ (NN03-320) antenna booster.

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

Ignion products and solutions are protected by [Ignion patents](#).

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

ISO 9001: 2015 Certified



This project has received funding from CDTI
under grant agreement IDI-20190285

