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DUO mXTEND^{TM}: TINY CHIP ANTENNA FOR SMART TRACKING DEVICES

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- **Antenna component:** DUO mXTEND^{TM} NN03-320
- **Dimensions:** 7.0 mm x 3.0 mm x 2.0 mm
- **Frequency regions:** 1561 MHz, 1575 MHz, and 1598 MHz to 1606 MHz

This is DUO mXTEND^{TM} for GNSS: the tiny antenna booster enabling full geolocation with GNSS connectivity (GPS, GALILEO, GLONASS, BeiDou) while minimizing the real estate use on your circuit board (no clearance beyond the component's footprint).

We understand your tracking device needs to be small while you still need to provide an optimum GNSS connectivity to locate it. Therefore, DUO mXTENDTM (NN03-320) antenna booster for GNSS delivers full GNSS performance while fitting into about every tracking device owing to its tiny form factor: **only 7.0 mm x 3.0 mm x 2.0 mm**. In addition, since DUO mXTENDTM does not need any clearance on the PCB ground beyond its antenna footprint, you can use the proximity area nearby the component to arrange other elements in the PCB, reducing the size of the overall tracking device. Featuring an omnidirectional radiation pattern, your device will be tracked, no matter its attitude and orientation with respect to the satellite constellation, making of DUO mXTENDTM your ideal component for portable, handheld and wearable tracking devices.

TABLE OF CONTENTS

1. PRODUCT DESCRIPTION NN03-320

The DUO mXTEND™ antenna booster has been specifically designed for providing worldwide Global Navigation Satellite Systems (GNSS) performance 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. It presents high antenna efficiency values and its size is much smaller than traditional patch antenna solutions and its pattern is not directive, so satellite signals are tracked regardless of the relative position, attitude and orientation of the tracking device. The DUO mXTEND™ antenna booster does not require further clearance area beyond its reduced footprint, making it an ideal alternative to larger custom antennas in for small and portable tracking devices.

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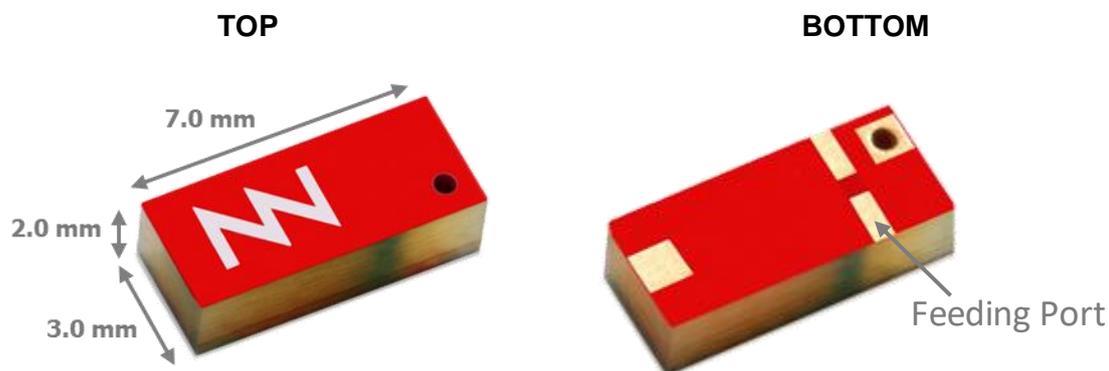
Material: The DUO mXTEND™ antenna booster is built on glass epoxy substrate.

APPLICATIONS	BENEFITS
• GPS/GALILEO/GLONASS/BeiDou modules	• High efficiency
• Smart tracking devices	• Small size
• Sport navigators	• Cost-effective
• Handsets and smartphones	• Easy-to-use (pick and place)
• Tablets	• Off-the-Shelf standard product (no customization is required)
• Digital cameras	• No clearance beyond footprint.
• Smartwatches and wearables	

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 GPS/GALILEO/GLONASS/BeiDou

2.1. QUICK REFERENCE GUIDE

Technical features	1561 MHz	1575 MHz	1598 – 1606 MHz
Average Efficiency	> 60 %	> 70 %	> 60 %
Peak Gain	1.6 dBi	1.8 dBi	1.1 dBi
VSWR	< 2.5:1		
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

This Evaluation Board EB_NN03-320-m-GNSS integrates a UFL cable to connect the DUO mXTEND^{TM} antenna booster with the SMA connector. The DUO mXTEND^{TM} provides operation in three frequency regions, 1561MHz (BeiDou E1 band), 1575 MHz (GPS L1 band and GALILEO E1) and from 1598 MHz to 1606 MHz (GLONASS L1 band), through a single input/output port.
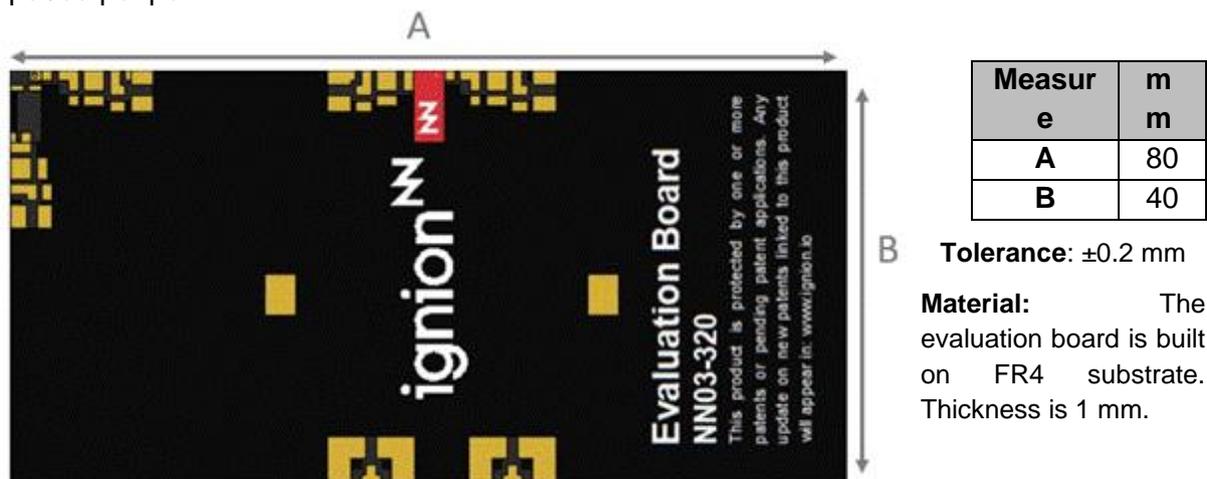

Measure	mm
A	80
B	40

Tolerance: ±0.2 mm

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

Figure 1 – EB_NN03-320-m-GNSS. Evaluation Board providing operation at BeiDou E1 band (1561 MHz), GPS L1 band and GALILEO E1 band (1575 MHz), and GLONASS L1 band (from 1598 MHz to 1606 MHz). Notice that the clearance area is equal to the DUO mXTEND^{TM} 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.

2.3. MATCHING NETWORK

DUO mXTEND™ needs a matching network to connect to your GNSS receiver. This section describes in Figure 2 a suitable matching network for DUO mXTEND™ and the resulting product specs when measured in the reference evaluation board (EB_NN03-320-m-GNSS) described in the previous section. 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 24h[1]. Other related to NN's range of R&D services is available at: https://www.ignion.io/rdservices/

1561 MHz, 1575 MHz and 1598 – 1606 MHz

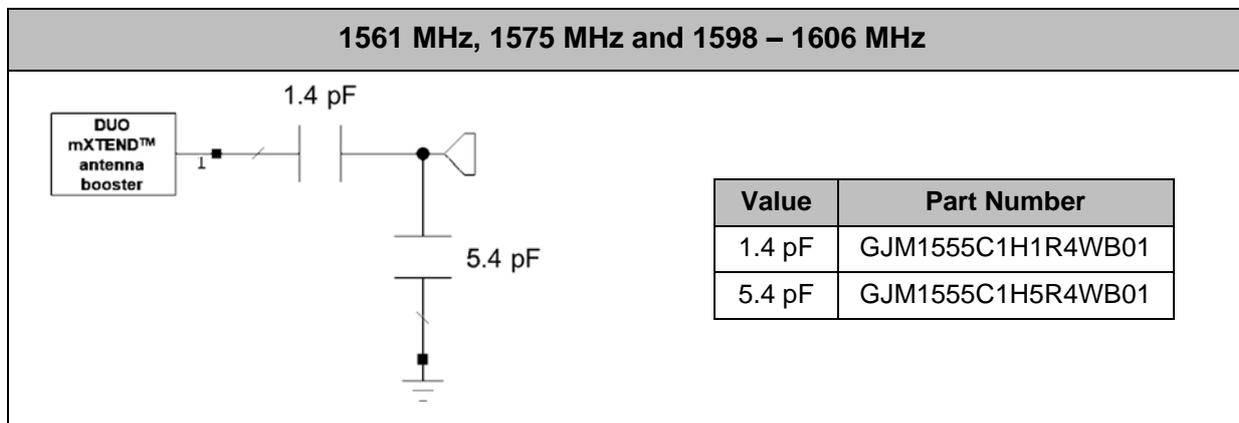| Value	Part Number
1.4 pF	GJM1555C1H1R4WB01
5.4 pF	GJM1555C1H5R4WB01

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.

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[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).
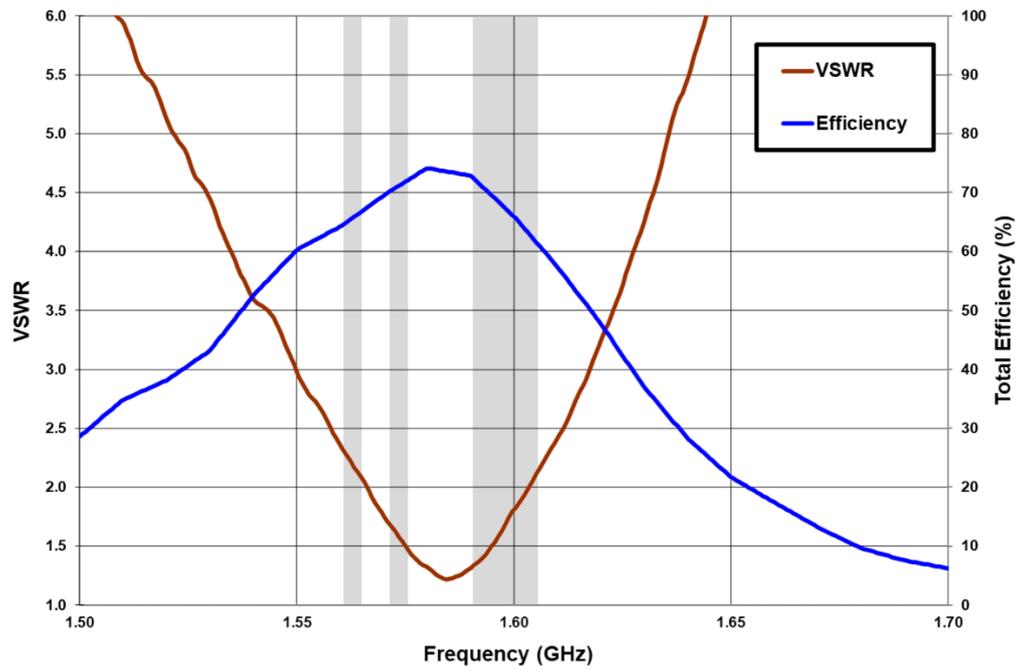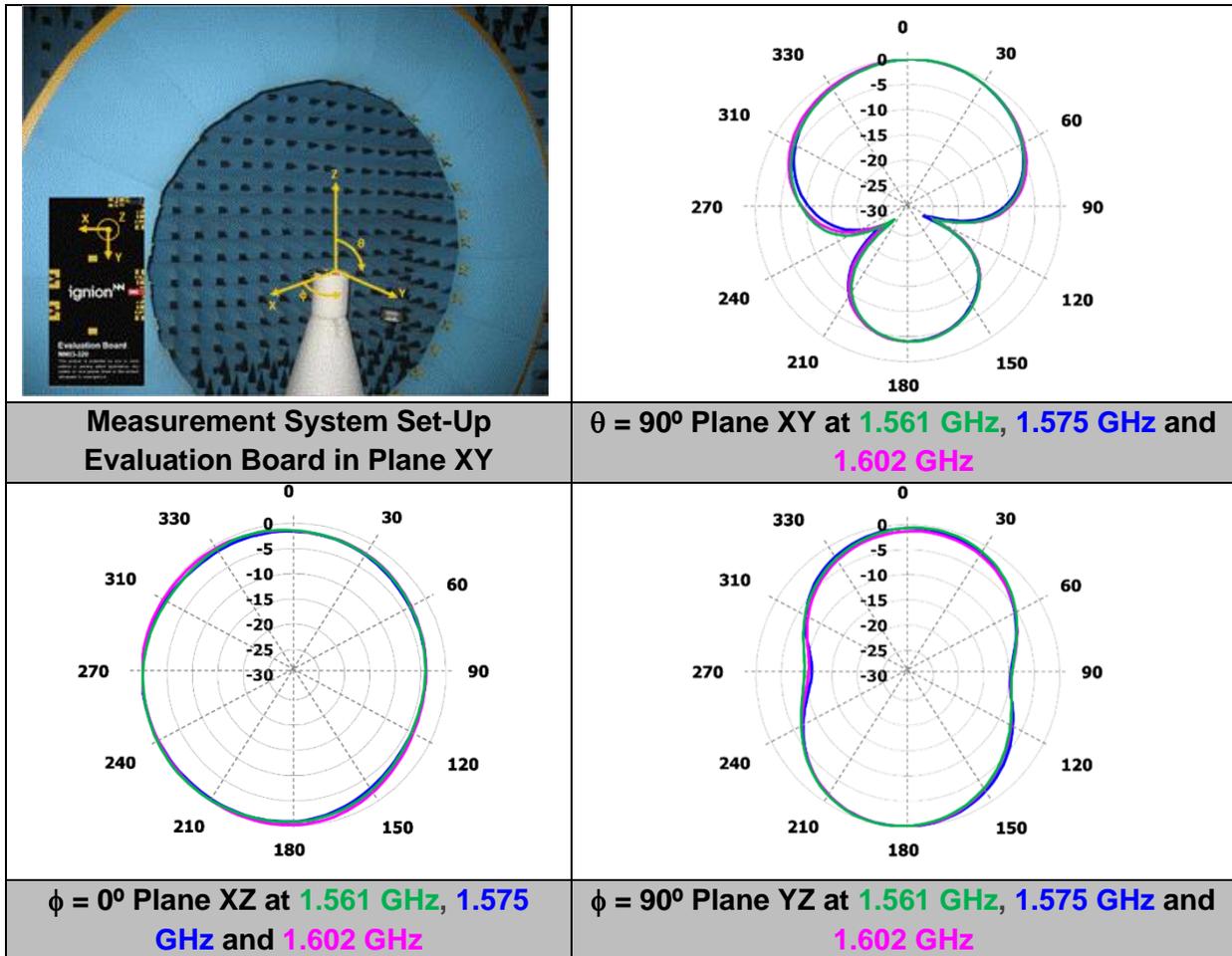

Figure 3 – VSWR and Total Efficiency for BeiDou E1 band (1561 MHz), GPS L1 band and GALILEO E1 band (1575 MHz), and GLONASS L1 band (1598 – 1606 MHz) (from the evaluation board (Figure 1)).

2.5. RADIATION PATTERNS (1561-1606 MHz), GAIN, AND EFFICIENCY

Measurement System Set-Up Evaluation Board in Plane XY	**θ = 90º Plane XY at 1.561 GHz, 1.575 GHz and 1.602 GHz**
φ = 0º Plane XZ at 1.561 GHz, 1.575 GHz and 1.602 GHz	**φ = 90º Plane YZ at 1.561 GHz, 1.575 GHz and 1.602 GHz**

BeiDou	**Gain**		1.6 dBi
	Efficiency		64.9 %
GPS/GALILEO	**Gain**		1.8 dBi
	Efficiency		72.1 %
GLONASS	**Gain**	**Peak Gain**	1.6 dBi
		Average Gain across the band	1.1 dBi
		Gain Range across the band (min, max)	0.7 <–> 1.6 dBi
	Efficiency	**Peak Efficiency**	66.2 %
		Average Efficiency across the band	63.4 %
		Efficiency Range across the band (min, max)	60.4 – 66.2 %

Table 2 – Antenna Gain and Total Efficiency from the evaluation board (Figure 1) for BeiDou E1 (1561 MHz), GPS L1 band and GALILEO E1 band (1575 MHz), and GLONASS L1 (1598 – 1606 MHz) bands. Measures made in the Satimo STARGATE 32 anechoic chamber.

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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

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