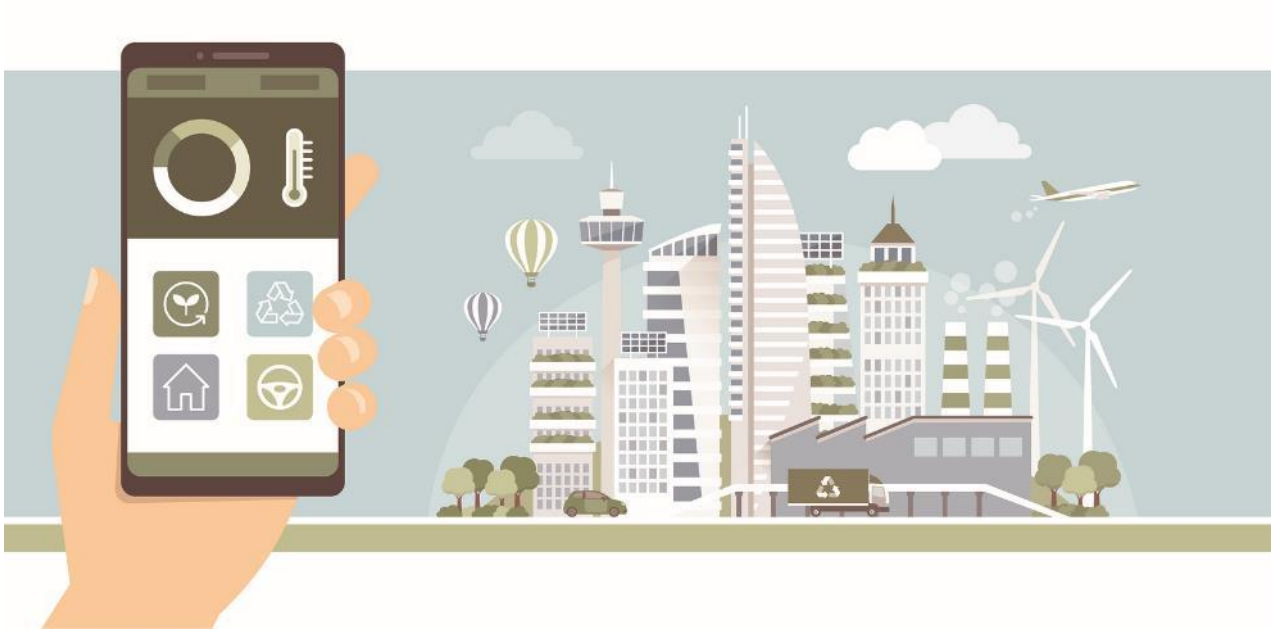
The Smart Antenna for the Smart IoT World.

- **Product**: RUN mXTEND™ NN02-224

- **Dimensions**: 12.0 mm x 3.0 mm x 2.4 mm

- **Frequency regions**: 824-960 MHz and 1710-2690 MHz



Smart cities, smart factories, smart grid, smart metering, smart tracking, smart agriculture and all possible smart things need a smart antenna. Engineers working on the development of the all the new bunch of IoT devices are looking for **the best IoT antenna**: the one covering all desired bands, with the smallest footprint and with the highest efficiency.

The antenna is an essential component of any connected wireless device that usually engineers leave as the last component to integrate because of its complexity. The reality is that ideally **the antenna should be integrated from day one** on the design and this is now possible because the antenna is not a difficult component anymore.

The RUN mXTEND™ antenna booster, and its versatility, is one of the best options to go wireless having any type of IoT platform because **one antenna component covers all IoT frequency bands**. This antenna booster is a very small chip antenna component able to be tuned to any frequency worldwide as needed. And because it is off the shelf, no customization on the antenna part will be needed so your IoT architecture becomes predictable from day one.

Easily use the RUN mXTEND™ antenna booster for any licensed or unlicensed IoT standard and obtain the antenna design for your next IoT device in the smallest package ever. **NB-IoT**, **LoRa**, **Sigfox**, **LTE-M**, **Zigbee**… doesn´t matter, RUN mXTEND™ will be your choice.

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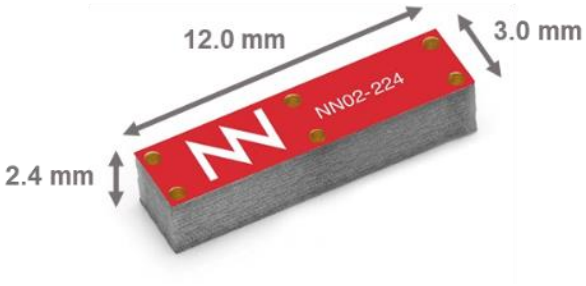
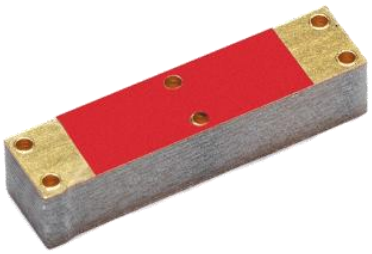
1. PRODUCT DESCRIPTION NN02-224

The RUN mXTEND™ antenna booster has been specifically designed for providing multiband performance in IoT and mobile wireless devices, enabling worldwide coverage by allowing operation in about every sub-6 GHz IoT and mobile band above 824 MHz, including for instance the communication standards GSM850, GSM900, GSM1800/DCS, GSM1900/PCS, UMTS, LTE850, LTE900, LTE1700, LTE1800, LTE1900, LTE2000, LTE2100, LTE2300, LTE2500, and LTE2600.

TOP



BOTTOM



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

APPLICATIONS

- Smart Metering
- Smart City & Smart Building
- Industrial IoT
- Remote monitoring and control
- Sensors
- Personal & Asset Tracking
- Fleet management
- RFID
- Retail
- Security Systems
- Smart Home
- Medical

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)

The RUN mXTEND™ antenna booster (NN02-224) provides multiband performance in wireless devices throughout a large range of frequencies (824-960 MHz, 1710-2690 MHz), enabling worldwide coverage and allowing operation in multiple IoT related communication standards such as NB-IoT, LTE-M, LoRa, Zigbee, SigFox, Neul, Thread, Z-Wave, Weightless, all mobile GSM/UMTS/LTE bands for 2G, 3G, 4G, 5G sub-6GHz, Bluetooth and WIFI. Based on Fractus Antennas' 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 – IoT devices are just one of the many environments where this tiny antenna can be transformational.

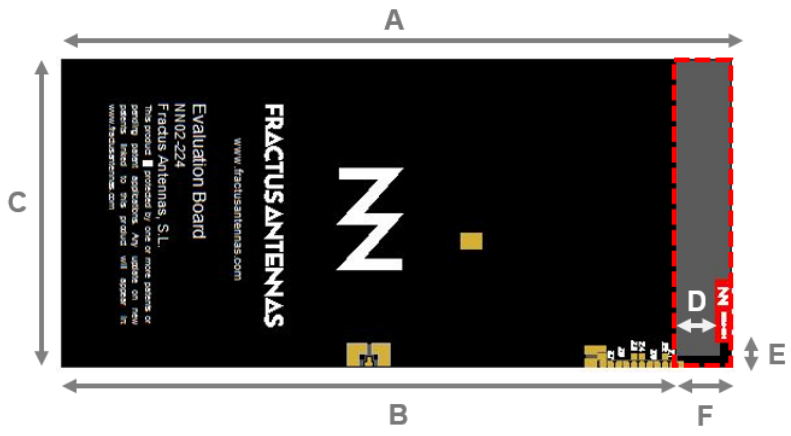
2. QUICK REFERENCE GUIDE

Technical features	824 – 960 MHz	1710 – 2690 MHz
Average Efficiency	> 65 %	> 70 %
Peak Gain	1.8 dBi	1.9 dBi
VSWR	< 3:1	
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	0.19 g	
Temperature	-40 to +125 ºC	
Impedance	50 Ω	
Dimensions (L x W x H)	12.0 mm x 3.0 mm x 2.4 mm	

Table 1 – Technical Features. Measures from the Evaluation Board. See Figure 1. Note that for obtaining comparable results, a ground plane length larger than 100 mm is recommended.

3. AN EVALUATION BOARD FOR IoT DEVICES (824-960 MHz and 1710-2690MHz)

This Evaluation Board integrates a UFL cable to connect the RUN mXTEND™ antenna booster with the SMA connector. The RUN mXTEND™ provides operation in two frequency regions, from 824 MHz to 960 MHz and from 1710 MHz to 2690 MHz, through a single input/output port.



Measure	mm
A	131
B	120
C	60
D	8.0
E	5.0
F	11

Tolerance: ±0.2 mm

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

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

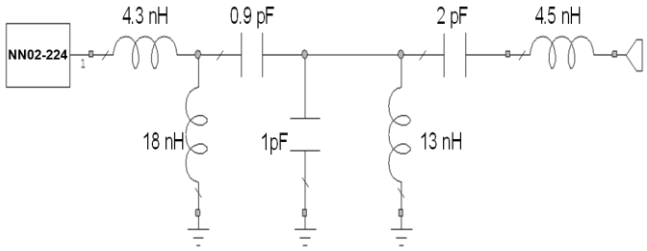
Clearance Area: 60 mm x 11 mm (F x C)

Figure 1 – EB_NN02-224-1B-2RJ-1P. Evaluation Board providing operation from 824 MHz to 960 MHz and from 1710 MHz to 2690MHz.

3.1. MATCHING NETWORK AND PERFORMANCE

The matching network and value components for this device and PCB size is provided below, together with the resulting total radiation efficiency. While the RUN mXTEND™ antenna booster remains the same for these frequency bands, the matching network topology and value of its components might be adapted to every different PCB size for an optimum performance. The specs of a Fractus Antennas standard product are measured in a reference evaluation board, to isolate the antenna performance from other system elements. 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. The matching network should be implemented in the ground plane area rather than the clearance area, this will provide a degree of freedom for tuning the RUN mXTEND™ antenna component once the design is finished, taking into account all elements of the system (batteries, displays, covers, etc.). To ensure optimal results, the use of high Q and tight tolerance components is highly recommended (Murata components).

824 – 960 MHz and 1710 – 2690 MHz



Value	Part Number
4.3 nH	LQW15AN4N3B80
18 nH	LQW18AN18NG10
0.9 pF	GJM1555C1HR90WB01
1.0 pF	GJM1555C1H1R0WB01
13 nH	LQW15AN13NG00
2.0 pF	GJM1555C1H2R0WB01
4.5 nH	LQW15AN4N5B80

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

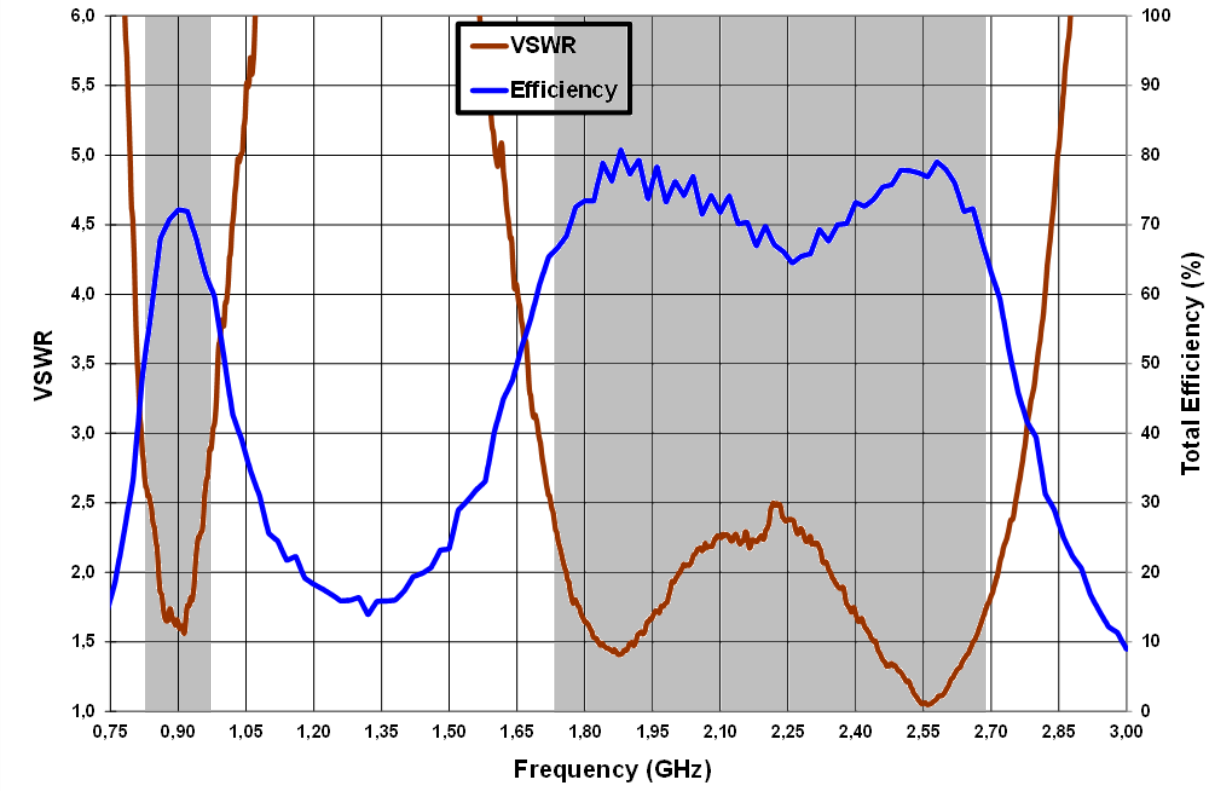


Figure 3 – VSWR and Total Efficiency for the 824 – 960 MHz frequency range and for the 1710 – 2690 MHz frequency range (from the evaluation board (Figure 1)).

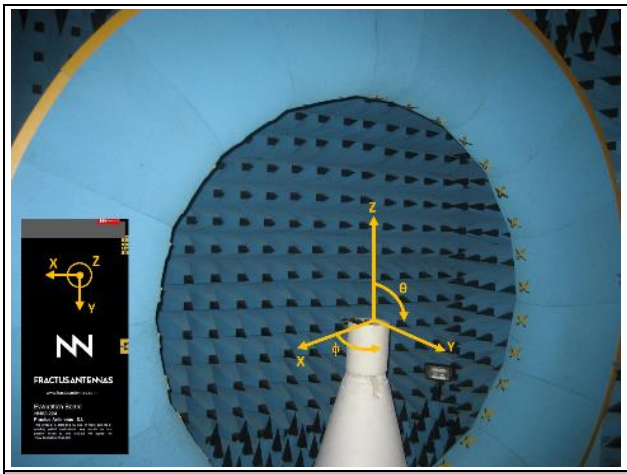
Please notice that different devices with different ground planes and different components nearby the RUN mXTEND™ antenna component may require a fine tuning of the matching network.

For additional information, please visit www.fractusantennas.com or contact info@fractusantennas.com.

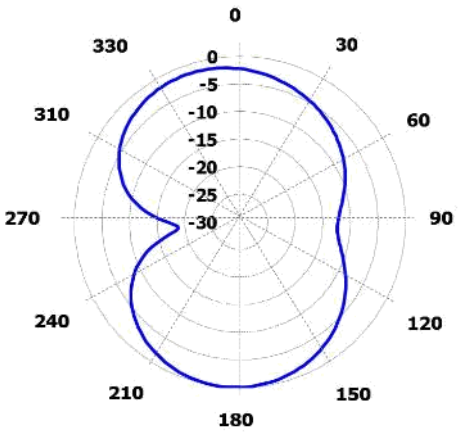
If you need assistance to design your matching network, please contact support@fractusantennas.com, or try our free-of-charge[1] **NN Wireless Fast-Track** design service, you will get your chip antenna design including a custom matching network for your device in 24h[1]. Other related to NN's range of R&D services is available at: https://www.fractusantennas.com/rdservices/

[1] See terms and conditions for a free NN Wireless Fast-Track service in 24h at: https://www.fractusantennas.com/fast-track-project/

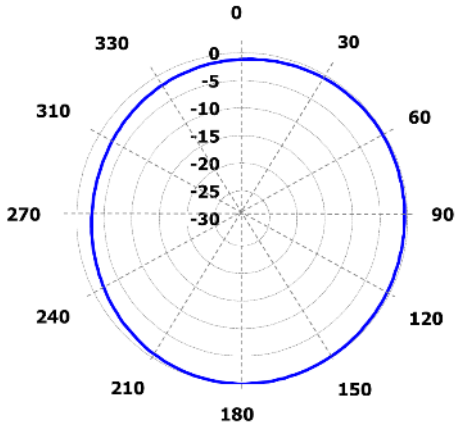
3.2. RADIATION PATTERNS (824-960 MHz), GAIN AND EFFICIENCY



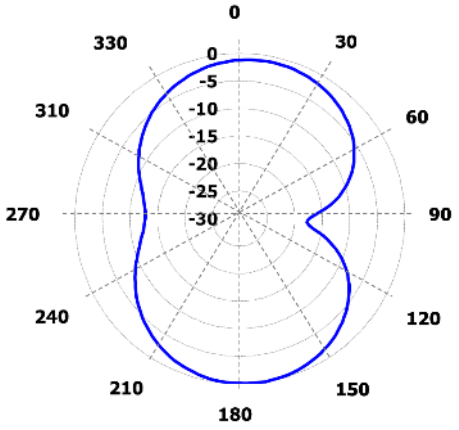
Measurement System Set-Up
Evaluation Board in Plane XY



θ = 90º Plane XY at **890 MHz**



ϕ = 0º Plane XZ at **890 MHz**

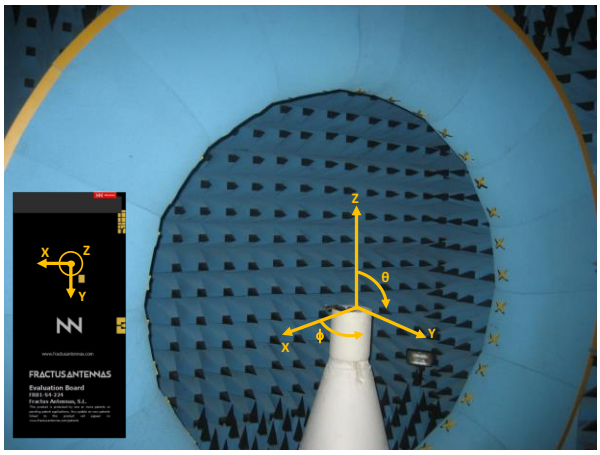


ϕ = 90º Plane YZ at **890 MHz**

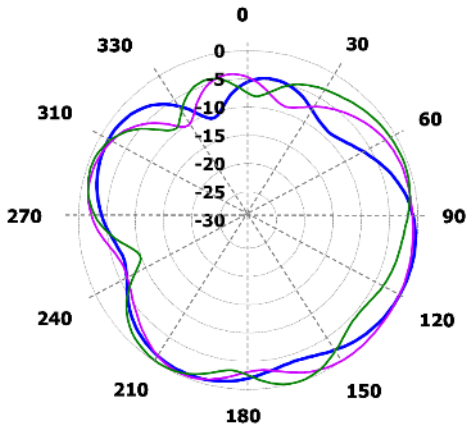
Gain	**Peak Gain**	1.8 dBi
	Average Gain across the band	1.1 dBi
	Gain Range across the band (min, max)	-0.2 <–> 1.8 dBi
Efficiency	**Peak Efficiency**	72.1 %
	Average Efficiency across the band	66.6 %
	Efficiency Range across the band (min, max)	49.8 – 72.1 %

Table 2 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 824 – 960 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

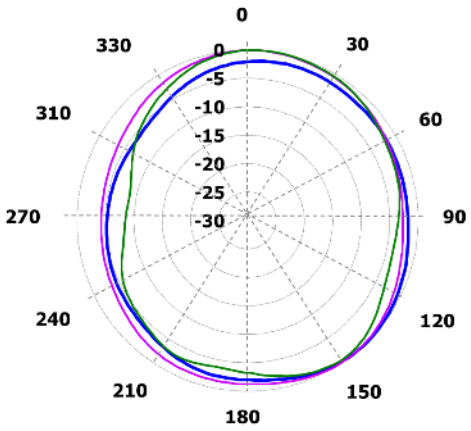
3.3. RADIATION PATTERNS (1710-2690 MHz), GAIN AND EFFICIENCY



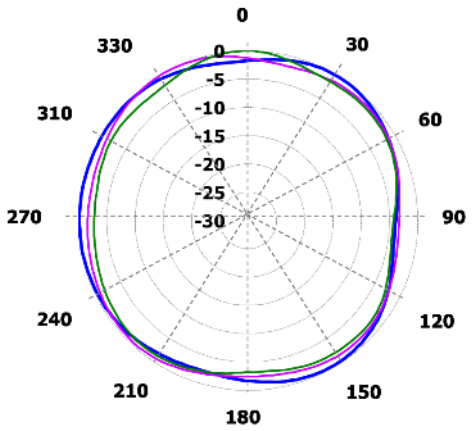
Measurement System Set-Up Evaluation Board in Plane XY



θ = 90º Plane XY at 1.71GHz, 2.2GHz and 2.69GHz



ϕ = 0º Plane XZ at 1.71GHz, 2.2GHz and 2.69GHz



ϕ = 90º Plane YZ at 1.71GHz, 2.2GHz and 2.69GHz

Gain	Peak Gain	1.9 dBi
	Average Gain across the band	1.3 dBi
	Gain Range across the band (min, max)	0.5 <–> 1.9 dBi
Efficiency	Peak Efficiency	80.7 %
	Average Efficiency across the band	72.7 %
	Efficiency Range across the band (min, max)	62.6 – 80.7 %

Table 3 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 1710 – 2690 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

This product and its use is protected by at least one or more of the following patents and patent applications US 8,203,492; US 8,237,615; PCT/EP2013/064692; WO2014/012842; US 62/028,494; US 62/072,671; and other domestic and international patents pending. Additional information about patents related to this product is available at www.fractusantennas.com/virtual-antenna

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

ISO 9001: 2015 Certified

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