BAR mXTEND^{TM}: A STANDARD ANTENNA SOLUTION FOR MOBILE FREQUENCY BANDS

USER MANUAL
BAR mXTEND^{TM} (NN02-232)

BAR mXTEND™: A STANDARD ANTENNA SOLUTION FOR MOBILE FREQUENCY BANDS

Ignion specializes in enabling effective mobile communications. Using Ignion technology, we design and manufacture optimized antennas to make your wireless devices more competitive. Our mission is to help our clients develop innovative products and accelerate their time to market through our expertise in antenna design, testing and manufacturing.
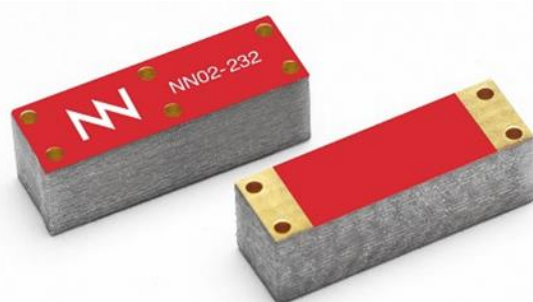
BAR mXTEND™ antenna booster

NN02-232

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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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1. ANTENNA DESCRIPTION

The BAR mXTEND™ antenna booster has been specifically designed for providing multiband performance in wireless devices (in particular in mobile devices), enabling worldwide coverage by allowing operation in the communication standards GSM850, GSM900, GSM1800/DCS, GSM1900/PCS, UMTS, LTE850, LTE900, LTE1700, LTE1800, LTE1900, LTE2000, and LTE2100.

TOP	BOTTOM

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

APPLICATIONS	BENEFITS

APPLICATIONS	BENEFITS
• Handsets	• High efficiency
• Smartphones	• Small size
• Tablets	• Cost-effective
• Phablets	• Easy-to-use (pick and place)
• Laptop PCs	• Multiband behaviour (worldwide standards)
• Netbooks	
• Modules	• Off-the-Shelf Standard Product (no customization is required)
• Routers	
• eBook readers	

The BAR mXTEND™ antenna booster belongs to a new generation of antenna solutions based on the Virtual Antenna™ technology developed by Ignion. The technology is mainly focused on replacing conventional antenna solutions by miniature and standard components.

2. QUICK REFERENCE GUIDE

Technical features	824 – 960 MHz	1710 – 2170 MHz
Average Efficiency	> 60 %	> 75 %
Peak Gain	1.3 dBi	2.1 dBi
VSWR	< 3:1	
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	0.21 g	
Temperature	-40 to +125 ⁰C	
Impedance	50 Ω	
Dimensions (L x W x H)	10.0 mm x 3.2 mm x 3.2 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. ELECTRICAL PERFORMANCE

3.1. EVALUATION BOARD (824-960 MHz and 1710-2170 MHz)

This Evaluation Board integrates a UFL cable to connect the BAR mXTEND™ antenna booster with the SMA connector. The BAR mXTEND™ provides operation in two frequency regions, from 824 MHz to 960 MHz and from 1710 MHz to 2170 MHz, through a single input/output port.

Figure 1 – EB_NN02-232-1B-2R-1P. Evaluation Board providing operation from 824 MHz to 960 MHz and from 1710 MHz to 2170MHz.

Measure	mm
A	131.0
B	120.0
C	60.0
D	7.8
E	5.0
F	11.0

Tolerance: ±0.2 mm

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

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

E: Distance between the BAR mXTEND™ antenna booster and the corner of the evaluation board
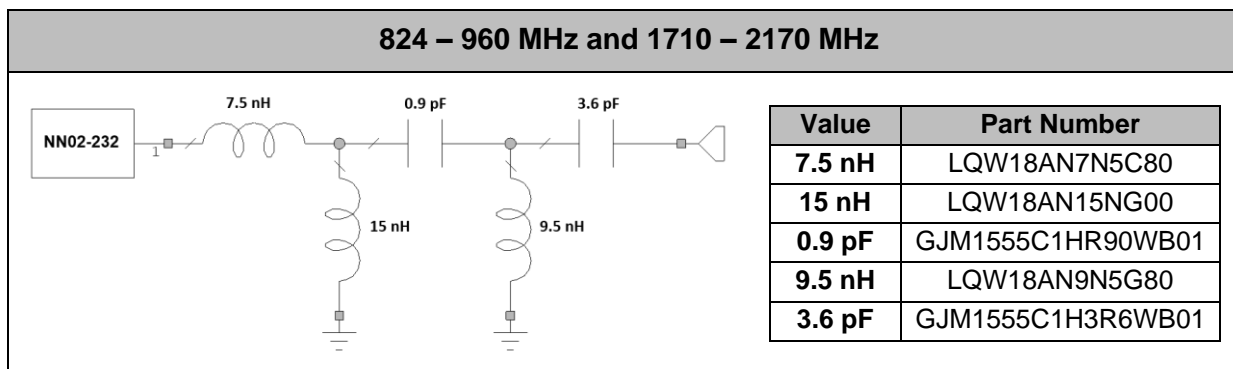**Clearance Area:** 60 mm x 11 mm (CxF)

This product is protected by at least the following patents PAT. US 8,203,492, PAT. US 8,237,615 and other domestic and international patents pending. Any update on new patents linked to this product will appear at www.ignion.io/virtual-antenna/.

3.2. MATCHING NETWORK

The specs of a Ignion standard product are measured in their Evaluation Board, which is an ideal case. In a real design, components nearby the antenna, LCD's, batteries, covers, connectors, etc. affect the antenna performance. This is the reason why 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. Do it in the ground plane area, not in the clearance area. This provides a degree of freedom to tune the BAR mXTEND™ antenna booster once the design is finished and taking into account all elements of the system (batteries, displays, covers, etc.).

Please notice that different devices with different ground planes and different components nearby the BAR mXTEND™ antenna booster may need a different matching network. To ensure optimal results, the use of high Q and tight tolerance components is highly recommended (Murata components). If you need assistance to design your matching network beyond this application note, please contact support@ignion.io, 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.ignion.io/rdservices/
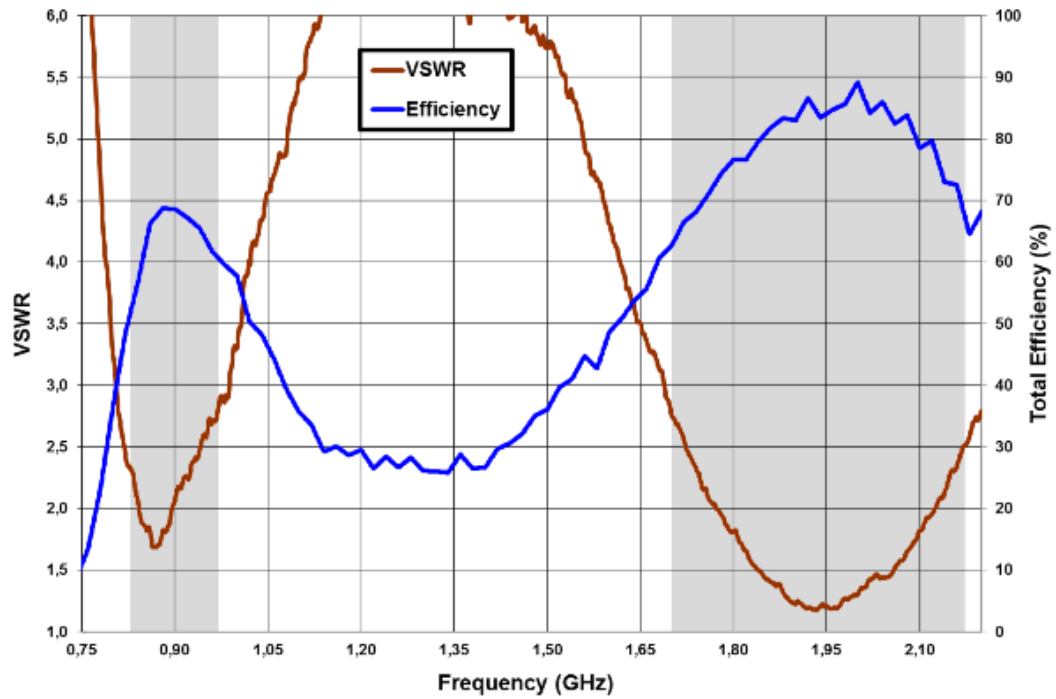
824 – 960 MHz and 1710 – 2170 MHz	

Value	Part Number
7.5 nH	LQW18AN7N5C80
15 nH	LQW18AN15NG00
0.9 pF	GJM1555C1HR90WB01
9.5 nH	LQW18AN9N5G80
3.6 pF	GJM1555C1H3R6WB01

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

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[1] See terms and conditions for a free NN Wireless Fast-Track service in 24h at: https://www.ignion.io/fast-track-project/
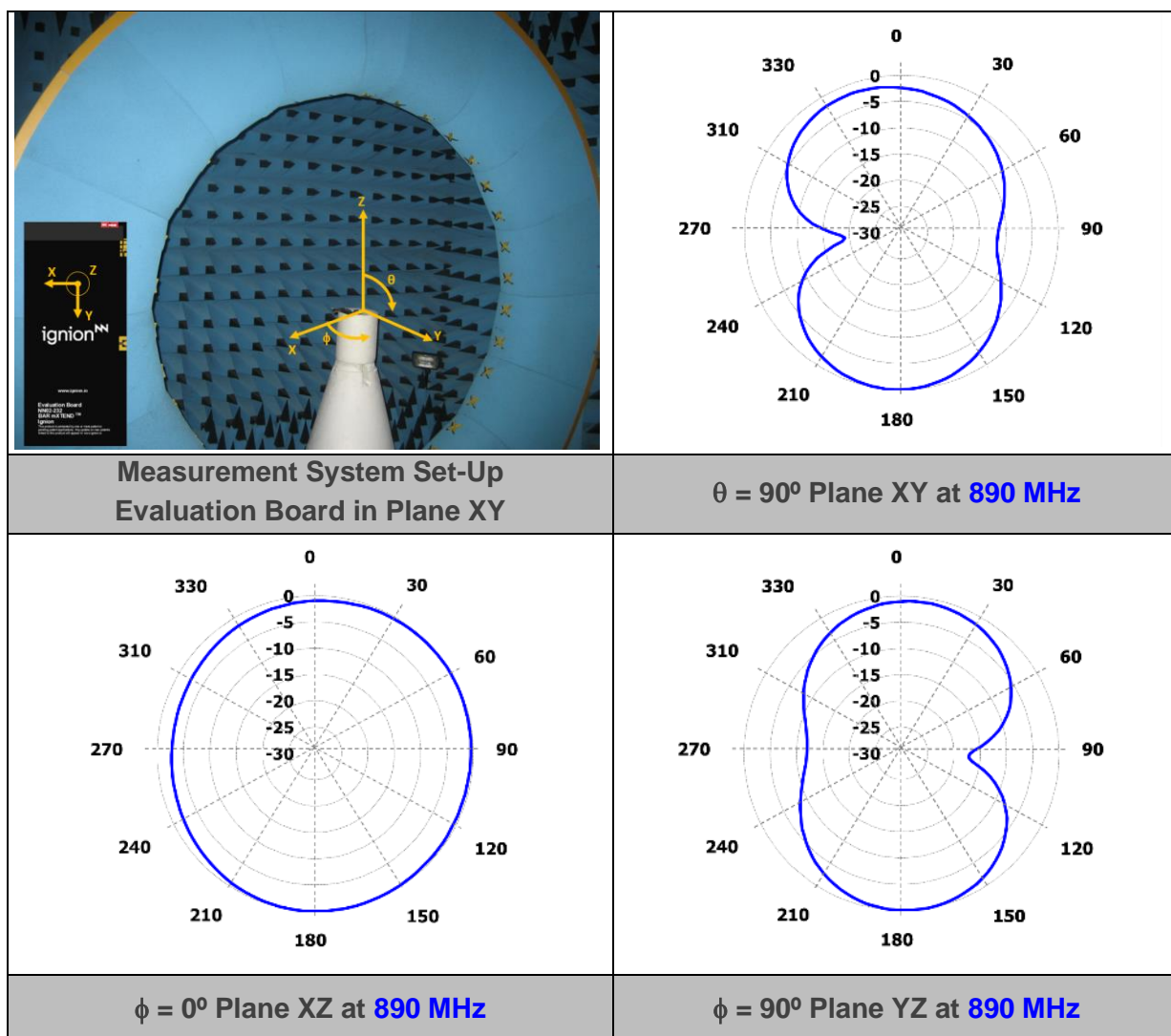
3.3. VSWR AND TOTAL EFFICIENCY

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

Figure 3 – VSWR and Total Efficiency for the 824 – 960 MHz frequency range and for the 1710 –2170 MHz frequency range (from the evaluation board (Figure 1)).

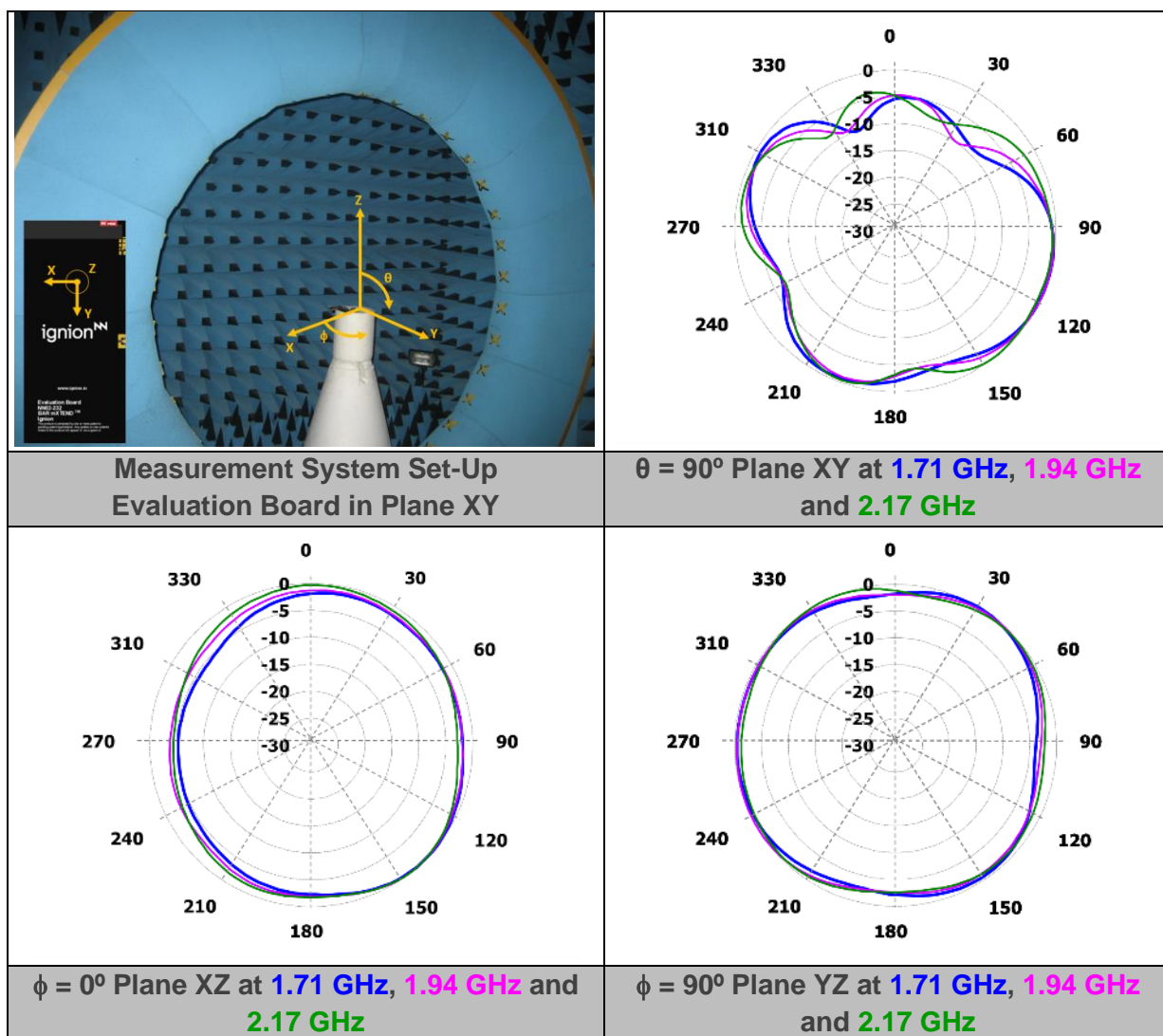## 3.4. RADIATION PATTERNS (824-960 MHz), GAIN AND EFFICIENCY

Measurement System Set-Up Evaluation Board in Plane XY	**θ = 90⁰ Plane XY at 890 MHz**
ϕ = 0⁰ Plane XZ at 890 MHz	**ϕ = 90⁰ Plane YZ at 890 MHz**

Gain	**Peak Gain**	1.3 dBi
	Average Gain across the band	0.9 dBi
	Gain Range across the band (min, max)	-0.5 **<–>** 1.3 dBi
Efficiency	**Peak Efficiency**	68.7 %
	Average Efficiency across the band	64.4 %
	Efficiency Range across the band (min, max)	50.3 – 68.7 %

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.

3.5. RADIATION PATTERNS (1710-2170 MHz), GAIN AND EFFICIENCY

Measurement System Set-Up Evaluation Board in Plane XY	**θ = 90º Plane XY at 1.71 GHz, 1.94 GHz and 2.17 GHz**
φ = 0º Plane XZ at 1.71 GHz, 1.94 GHz and 2.17 GHz	**φ = 90º Plane YZ at 1.71 GHz, 1.94 GHz and 2.17 GHz**

Gain	**Peak Gain**	2.1 dBi
	Average Gain across the band	1.6 dBi
	Gain Range across the band (min, max)	0.9 <–> 2.1 dBi
Efficiency	**Peak Efficiency**	89.1 %
	Average Efficiency across the band	79.5 %
	Efficiency Range across the band (min, max)	64.7 – 89.1 %

Table 3 – Antenna Gain and Total Efficiency from the evaluation board (Figure 1) within the 1710 – 2170 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

3.6. CAPABILITES AND MEASUREMENT SYSTEMS

Ignion specializes in designing and manufacturing optimized antennas for wireless applications and providing our clients with RF expertise. We offer turn-key antenna products and antenna integration support to minimize your time requirement and maximize your return on investment during your product development efforts. We also provide our clients with the opportunity to leverage our in-house testing and measurement facilities to obtain accurate results quickly and efficiently.
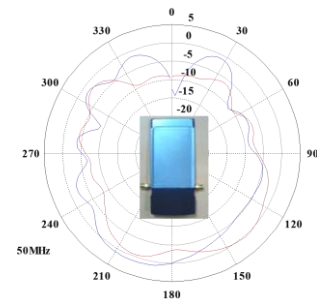

Agilent E5071B

VSWR
&
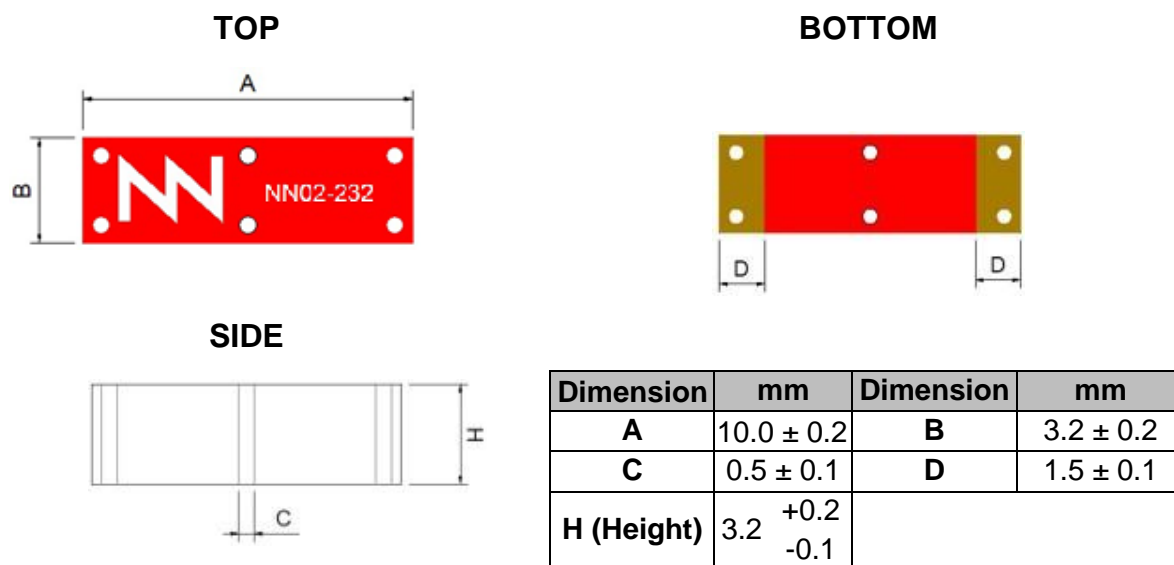S Parameters
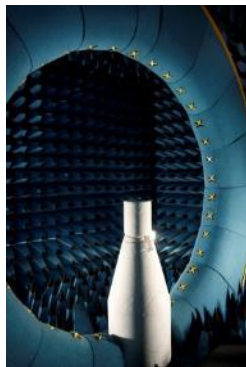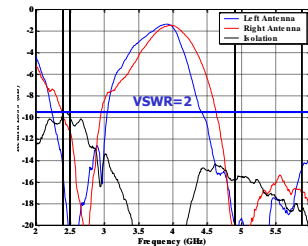
SATIMO STARGATE 32

Radiation
Pattern
&
Efficiency

Anechoic chambers and full equipped in-house lab

4. MECHANICAL CHARACTERISTICS

4.1. DIMENSIONS AND TOLERANCES

TOP   **BOTTOM**

SIDE

Dimension	mm	Dimension	mm
A	10.0 ± 0.2	**B**	3.2 ± 0.2
C	0.5 ± 0.1	**D**	1.5 ± 0.1
H (Height)	3.2 +0.2 -0.1		

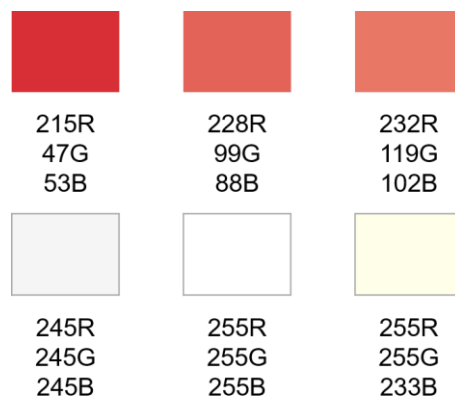**Figure 4 –** BAR mXTEND™ antenna booster dimensions and tolerances.

The 2 pads are fully symmetrical to mount it on the PCB. See Figure 6.

The BAR mXTEND™ antenna booster NN02-232 is compliant with the restriction of the use of hazardous substances (**RoHS**).

The RoHS certificate can be downloaded from www.ignion.io.

4.2. COLOUR RANGE FOR THE INK

Next figure shows the range of the colours in the BAR mXTEND™ antenna booster:

215R
47G
53B

228R
99G
88B

232R
119G
102B

245R
245G
245B

255R
255G
255B

255R
255G
233B

Acceptable color range

4.3. ANTENNA FOOTPRINT

Assuming that the BAR mXTEND™ antenna booster NN02-232 is placed in the clearance area of the PCB, see below the recommended footprint dimensions.

Measure	mm
A	1.7
B	6.8
C	3.2
D	2.0

Tolerance: ±0.1 mm
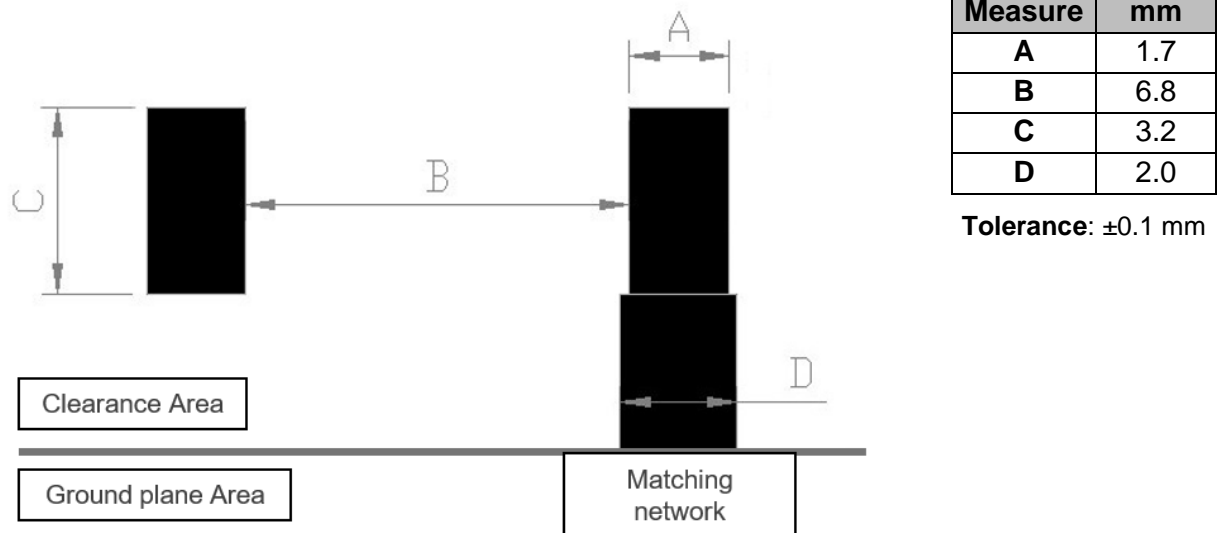
Figure 5 – Footprint dimensions for the single booster.

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

5. ASSEMBLY PROCESS

Figure 6 shows the back and front view of the BAR mXTEND™ antenna booster NN02-232. Due to the symmetry in the product configuration, the feeding pad can be any of the 2 pads.
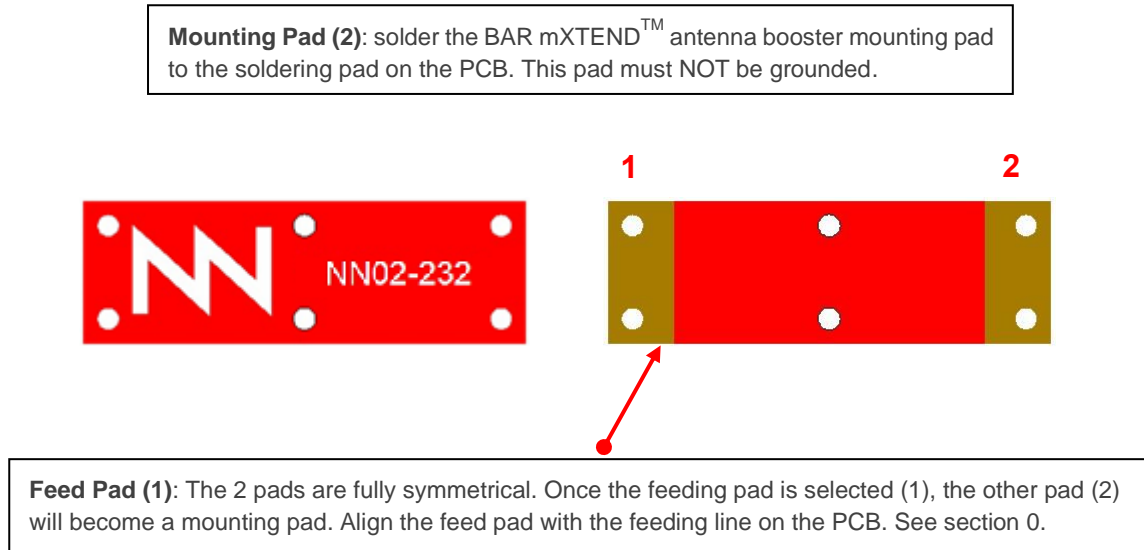
> **Mounting Pad (2)**: solder the BAR mXTEND™ antenna booster mounting pad to the soldering pad on the PCB. This pad must NOT be grounded.

> **Feed Pad (1)**: The 2 pads are fully symmetrical. Once the feeding pad is selected (1), the other pad (2) will become a mounting pad. Align the feed pad with the feeding line on the PCB. See section 0.

Figure 6 – Pads of the BAR mXTEND™ antenna booster NN02-232

As a surface mount device (SMD), the BAR mXTEND™ antenna booster is compatible with industry standard soldering processes. The basic assembly procedure for the BAR mXTEND™ antenna booster is as follows:

1. Apply a solder paste on the pads of the PCB. Place the BAR mXTEND™ antenna booster on the board.
2. Perform a reflow process according to the temperature profile detailed in Table 4, Figure 8.
3. After soldering the BAR mXTEND™ antenna booster to the circuit board, perform a cleaning process to remove any residual flux. Ignion recommends conducting a visual inspection after the cleaning process to verify that all reflux has been removed.

The drawing below shows the soldering details obtained after a correct assembly process:
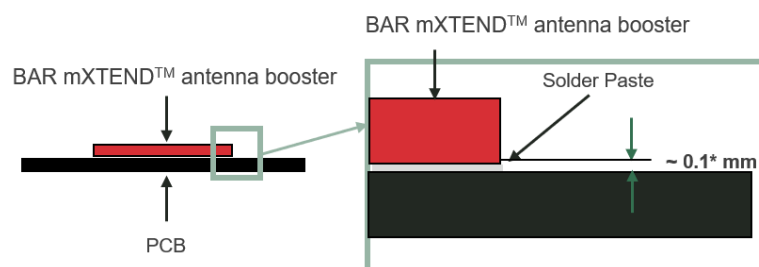

Figure 7 – Soldering Details.

NOTE(*): Solder paste thickness after the assembly process will depend on the thickness of the soldering stencil mask. A stencil thickness equal or larger than **127 microns (5 mils)** is required.

The BAR mXTEND™ antenna booster NN02-232 can be assembled following the Pb-free assembly process. According to the Standard **IPC/JEDEC J-STD-020C**, the temperature profile suggested is as follows:

Phase	Profile features	Pb-Free Assembly (SnAgCu)
RAMP-UP	Avg. Ramp-up Rate (Tsmax to Tp)	3 ºC / second (max.)
PREHEAT	- Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (tsmin to tsmax)	150 ºC 200 ºC 60-180 seconds
REFLOW	- Temperature (TL) - Total Time above TL (tL)	217 ºC 60-150 seconds
PEAK	- Temperature (Tp) - Time (tp)	260 ºC 20-40 seconds
RAMP-DOWN	Rate	6 ºC/second max
Time from 25 ºC to Peak Temperature		8 minutes max

Table 4 – Recommended soldering temperatures.

Next graphic shows temperature profile (grey zone) for the BAR mXTEND™ antenna booster assembly process reflow ovens.
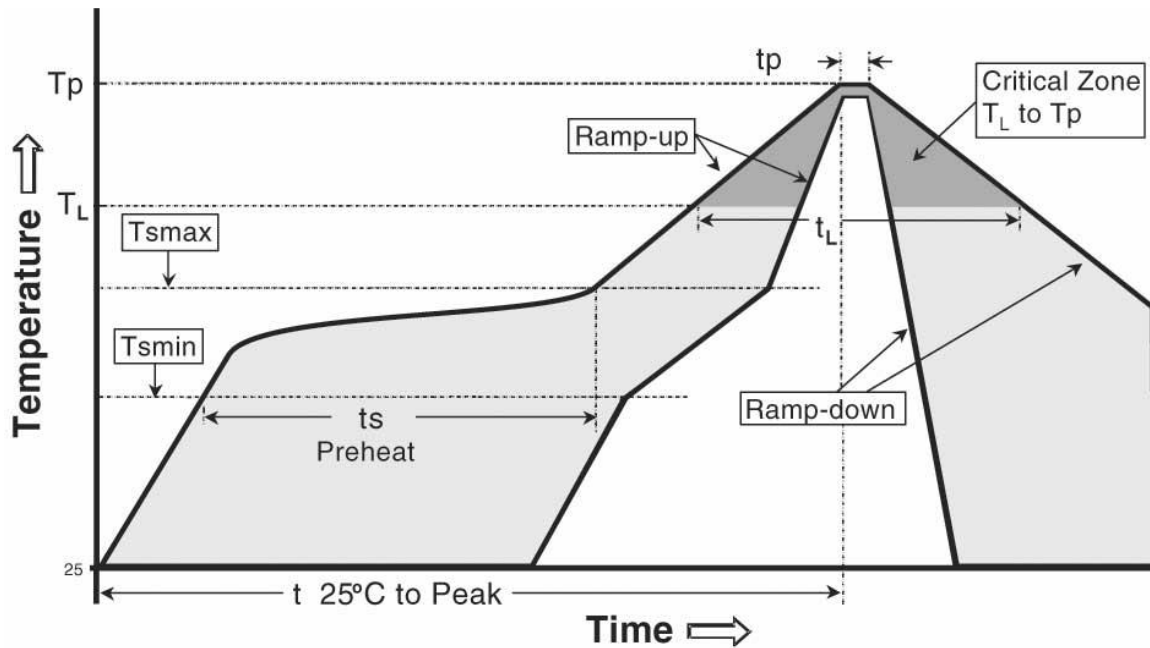
Figure 8 – Temperature profile.

6. PACKAGING

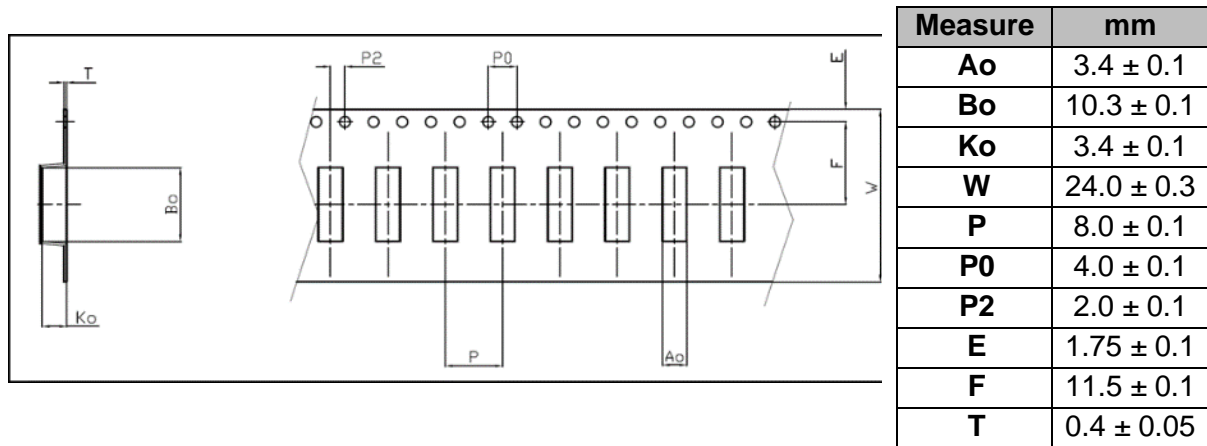The BAR mXTEND™ antenna booster NN02-232 is delivered in tape and reel packaging.

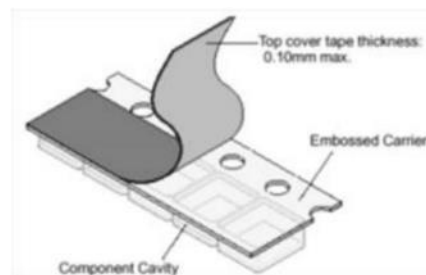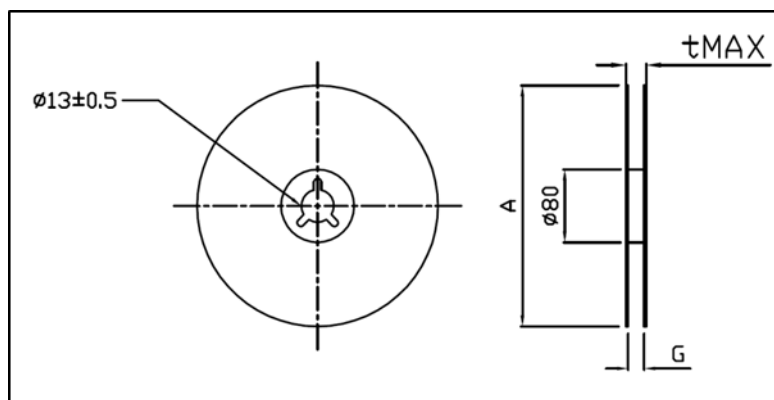| Measure	mm
Ao	3.4 ± 0.1
Bo	10.3 ± 0.1
Ko	3.4 ± 0.1
W	24.0 ± 0.3
P	8.0 ± 0.1
P0	4.0 ± 0.1
P2	2.0 ± 0.1
E	1.75 ± 0.1
F	11.5 ± 0.1
T	0.4 ± 0.05

Figure 9 – Tape dimensions and Tolerances.

Figure 10 – Image of the tape.

Measure	mm
A	330 ± 1.0
G	25.5 ± 0.2
tMAX	29.5 ± 0.2

Reel Capacity: 2000 pcs

Figure 11 – Reel Dimensions and Capacity.

7. PRODUCT CHANGE NOTIFICATION

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PCN Number: NN19100010

Notification Date: October 07th, 2019

Part Number identification:

Part Number changes, it will be applied in all the document of the company (User Manual, Data Sheet, …)
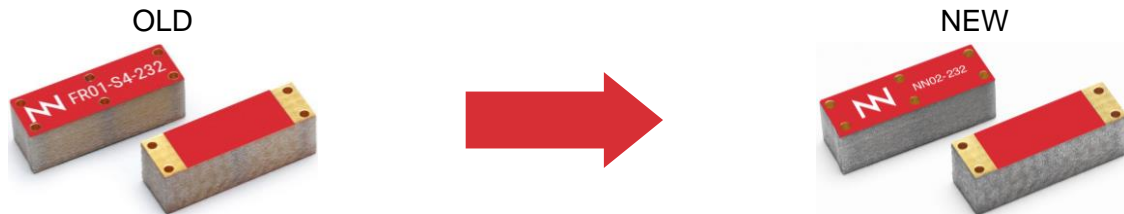
Previous Part Number	New Part Number
FR01-S4-232	NN02-232

Reason for change:

☐	Specs (electrical/mechanical)	☐	Manufacturing location
☐	User Manual/Data Sheet	☐	Quality/Reliability
☐	Material/Composition	☐	Logistics
☐	Processing/Manufacturing	X	Other: Part Number

Change description

1.- Part Number: From FR01-S4-232 FRACTUS to NN02-232 Ignion in the User Manual

OLD   NEW

Comments:

1.- Electrical and Mechanical specs remain the same
2.- Footprint in the PCB to solder the chip antenna remains the same

Identification method

1.- The part number on the antenna is different

User Manual	X	Available from: May 2020
Samples	X	Available from: May 2020

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Last Update: January 2021

ignion

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Accelerated.**

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