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TRIO mXTEND™

NN03-310

USER MANUAL

TRIO mXTEND™: The ultra slim, top performance antenna

The power of 3. TRIO mXTEND™ can combine cellular connectivity, GNSS and Bluetooth in a single chip antenna component. Leverage the possibilities of three independent radios in a powerful, slimline solution.

Thanks to its 1mm height, it can be integrated into nearly all wireless platforms. It also offers worldwide coverage and works in multiple frequency regions thanks to its modular, multiband and multiport configuration.

TRIO mXTEND™ component (NN03-310)

Most used industries.

- **Asset Tracking.**
- **Smart Metering.**
- **ISM modules.**
- **IoT sensors.**

TRIO mXTEND™ benefits.

- **Top performance**: Top multiband worldwide sub-6GHz cellular/IoT performance in a multi-RAT and 3 independent port antenna components.
- **Multiband & Multiport:** All cellular/ISM bands: 2G/3G/4G/5G and NB-IoT/LTE-M applications with additional GNSS, Bluetooth, Wi-Fi 6E, UWB simultaneously.
- **Versatile:** Triple radio architecture in a single, small, ultra-slim antenna package: 30 mm x 1.0 mm x 3.0 mm.
- **Global reach:** Through multiband performance (worldwide standard compatible).
- **Reliability:** Off-the-Shelf standard product, no antenna part customization (electronic optimization).
- **Use cases:** Best for top-performing compact tracking devices, IoT sensors, IoT cellular/ISM modules, and mobile devices.

Operation bands summary.

GSM, UMTS, LTE, LTE-M, NB-IoT, 5G, GNSS, Bluetooth, and many more within the range of 400 MHz to 8000 MHz.

CHAPTER INDEX

1 CONFIGURATION OVERVIEW

The TRIO mXTEND™ chip antenna component is a versatile antenna component that can be easily tuned to operate at any wireless frequency. Table 1 provides an overview of a few examples of configurations of the TRIO mXTEND™ chip antenna component for popular wireless frequencies, including cellular LTE, ISM, Bluetooth, GNSS, and Wi-Fi dual band.

Configuration	Frequency range	Frequency Regions
CELLULAR LTE	698 – 960 MHz & 1710 – 2690 MHz	2
CELLULAR LTE + 5G	698 – 960 MHz, 1710 – 2690 MHz & 3400 – 3800 MHz	3
CELLULAR LTE + GNSS	824 – 960 MHz, 1710 – 2170 MHz, 1561 MHz, 1575 MHz & 1598 – 1606 MHz	5
MOBILE + GNSS + BLUETOOTH	824 – 960 MHz, 1710 – 1990 MHz, 1561 MHz, 1575 MHz, 1598 – 1606 MHz & 2400 – 2500MHz	6
ISM	863 – 928 MHz	2

Table 1 - List of communication standards included in this user manual sorted by frequency range.

The following table presents the technical specifications of the TRIO mXTEND™ chip antenna component, including its radiation pattern, polarization, weight, temperature range, impedance, and dimensions. These features make the TRIO mXTEND™ a highly versatile and durable component that can be easily integrated into a wide range of wireless applications.

Technical Features	TRIO mXTEND™ (NN03-310)
Radiation Pattern	Omnidirectional
Polarization	Linear
Weight (approx.)	0.25 g
Temperature	-40 to +125 ºC
Impedance	50 Ω

Table 2 - Technical features for the TRIO mXTEND™.

PURCHASE EVALUATION BOARD THROUGH DISTRIBUTOR

Any of the evaluation boards shown in this document can be purchased through our main distributors, find them here: https://ignion.io/distributors/.

1.1. TRIO mXTEND™ FOR CELLULAR LTE

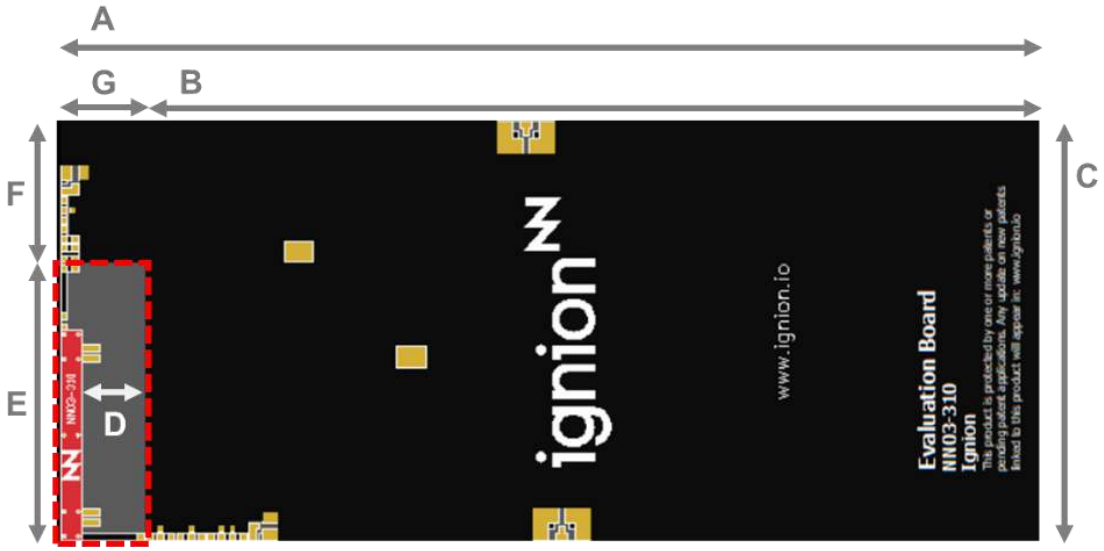
TRIO mXTEND™ is designed to cater to a wide range of wireless communication standards, including LTE CAT 1, LTE CAT-M and NB-IoT. It provides reliable operation across multiple frequency bands, ensuring a reliable path to passing cellular certification.

Technical Features	698 – 960 MHz	1710 – 2690 MHz
Average Efficiency	> 55 %	> 65 %
Peak Gain	1.1 dBi	2.4 dBi
VSWR	< 3:1	

Table 3 - Performance of TRIO mXTEND™ configured for Cellular IoT on evaluation board (142 mm x 60 mm x 1 mm).

EVALUATION BOARD FOR CELLULAR LTE

This Evaluation Board (part number: EB_NN03-310-M) integrates one TRIO mXTEND™ chip antenna component to provide operation in two frequency regions, from 698 MHz to 960 MHz and from 1710 MHz to 2690 MHz. A UFL cable connects this single input/output port to the SMA connector.



Measure	mm
A	142
B	130
C	60
D	9
E	40
F	20
G	12

Tolerance: ±0.2 mm

D: Distance between the TRIO mXTEND™ chip antenna component and the ground plane.

Material: The Evaluation Boards are built on FR4 substrate. Thickness is 1 mm.

Clearance Area: 40 mm x 12 mm (ExG).

Figure 1 – EB_NN03-310-M. Evaluation Board for providing operation in 2 frequency ranges, 698 – 960 MHz and 1710 – 2690 MHz.

1.2. TRIO mXTEND™ FOR 5G

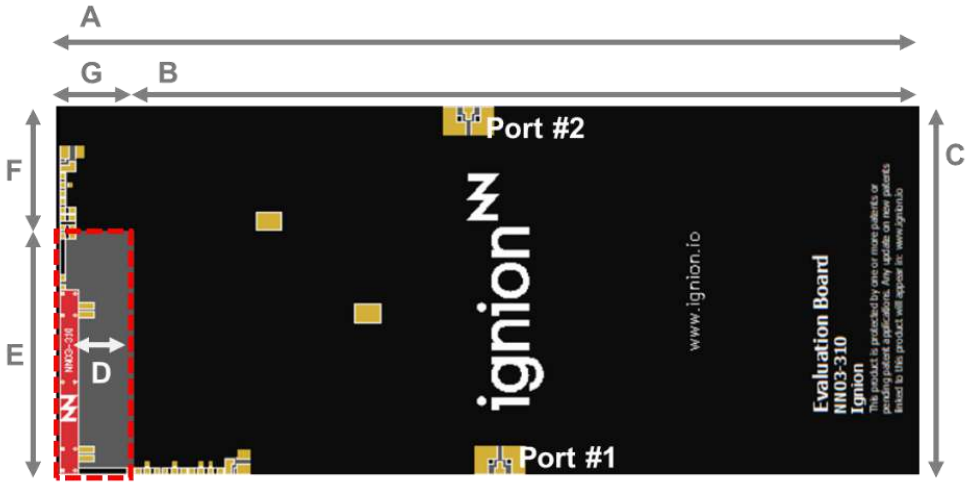
In this application, a design for **3G, 4G** and **5G** in three different frequency regions: 698-960 MHz, 1710-2690 MHz and 3400-3800 MHz will be analyzed. A two-port configuration will be utilized, and three matching networks selected, allowing us to test, obtain, and analyze the VSWR, total efficiency, transmission coefficient, radiation patterns and arrive to a recommended footprint for this solution.

Technical features	698 – 960 MHz	1710 – 2690 MHz	3400 – 3800 MHz
Average Efficiency	> 50 %	> 60 %	> 65 %
Peak Gain	1.5 dBi	2.7 dBi	3.8 dBi
VSWR	< 3:1		< 2:1

Table 4 - Performance of TRIO mXTEND™ configured for ISM on evaluation board (142 mm x 60 mm x 1 mm).

EVALUATION BOARD FOR 5G

This Evaluation Board (part number: EB_NN03-310-M-5G) integrates one TRIO mXTEND™ chip antenna component to provide operation from 698 to 960 MHz, 1710 to 2690 MHz at port #1, and 3400 to 3800 MHz at port #2. Two UFL cable connects each input/output port to SMA connectors.



Measure	mm
A	142
B	130
C	60
D	9
E	40
F	20
G	12

Tolerance: ±0.2 mm

Material: The Evaluation Boards are built on FR4 substrate. Thickness is 1 mm.

D: Distance between the TRIO mXTEND™ chip antenna component and the ground plane.

Clearance Area: 40 mm x 12 mm (ExG)

Figure 2 – EB_NN03-310-M-5G. Evaluation Board for providing operation at 698 – 960 MHz (Port #1), 1710 – 2690 MHz and 3400 – 3800 MHz (Port #2).

1.3. TRIO mXTEND™ CELLULAR LTE + GNSS

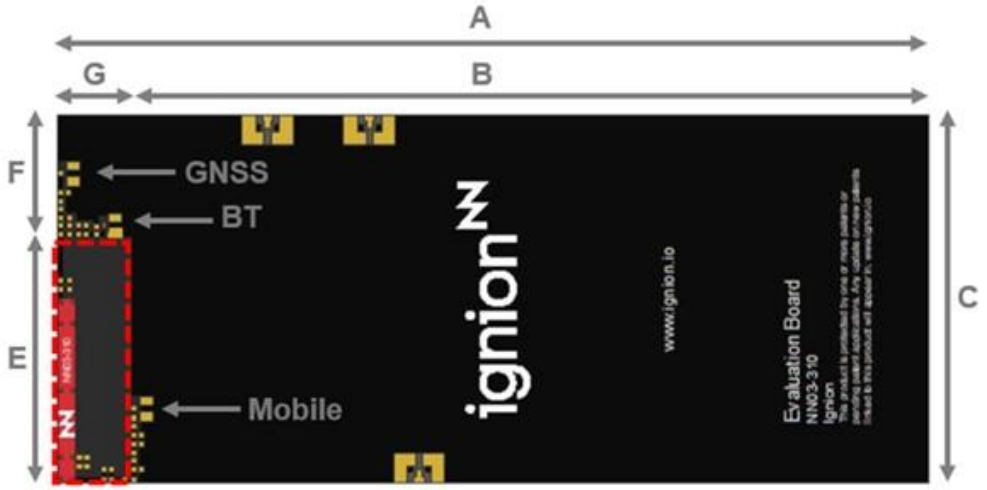
The TRIO mXTEND™ chip antenna **enables Mobile, GNSS and Bluetooth connection simultaneosly through a single antenna component**. Thanks to its modular, multiband and multiport configuration this chip antenna works in multiple frequency regions**.** In this application **triple coverage** in different frequency regions including 2G, GNSS and Bluetooth: 824-960 MHz, 1710-1990 MHz, 1561-1606 MHz and 2400-2500 MHz is obtained using the TRIO mXTEND™ in three-port configuration. An example configuration on our Evaluation Board is seen as well as different matching network configurations used and the resulting test and simulation values.

Technical features	Port 1 824-960 MHz	Port 1 1710-1990 MHz	Port 2 1561-1606 MHz	Port 3 2400-2500MHz
Average Efficiency	> 50%	> 60%	> 50%	> 75%
Peak Gain	0.4 dBi	1.9 dBi	0.9 dBi	2.4 dBi
VSWR	< 2.8:1	< 2.1:1	< 2.1:1	< 2.0:1

Table 5 - Performance of TRIO mXTEND™ configured for IoT Trackers (126.5 mm x 60 mm x 1 mm).

EVALUATION BOARD FOR CELLULAR LTE + GNSS

This Evaluation Board EB_NN03-310-2G-GNSS-BT integrates one TRIO mXTEND™ chip antenna component to provide operation from 824 to 960 MHz, 1710 to 1990 MHz at port 1, from 1561 to 1606 MHz at port 2 and 2400 to 2500 MHz at port 3.



Measure	mm
A	142
B	130
C	60
D	9
E	40
F	20
G	12

Tolerance: ±0.2 mm

D: Distance between the TRIO mXTEND™ chip antenna component and the ground plane.

Material: The Evaluation Board is built on FR4 substrate. Thickness is 1 mm.

Clearance Area: 40.0 mm x 12.0 mm (E x G)

Figure 3 - EB_NN03-310-2G-GNSS-BT. Evaluation Board for providing operation at 824 – 960MHz and 1710 – 1990MHz (Port 1), 1561 – 1606MHz (Port 2) and 2400 – 2500MHz (Port 3).

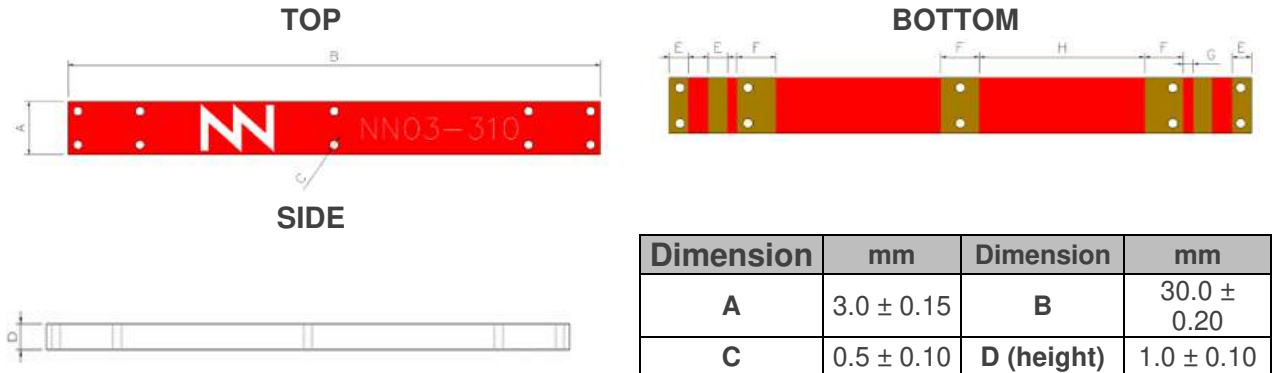
1.4. ASSESS YOUR OWN DEVICE REQUIREMENTS

If you are designing a device with a different size or operating frequency than shown above, you can assess the performance of this solution using our free-of-charge Antenna Intelligence Cloud™ tool. This tool provides a complete design report, including expected performance and tailored design guide, within 24 hours. For additional information about Ignion's range of R&D services, please visit: https://ignion.io/resources-support/technical-center/engineering-support/. If you require further assistance, please contact support@ignion.io.

Purchase this or other evaluation boards through our main distributors by visiting the following link: https://ignion.io/distributors/.

2 MECHANICAL SPECIFICATIONS

2.1 DIMENSIONS, TOLERANCES, AND RoHS



Dimension	mm	Dimension	mm
A	3.0 ± 0.15	**B**	30.0 ± 0.20
C	0.5 ± 0.10	**D (height)**	1.0 ± 0.10
E	1.0 ± 0.05	**F**	2.0 ± 0.05
G	0.5 ± 0.05	**H**	8.5 ± 0.05

Figure 4 – TRIO mXTEND™ chip antenna component dimensions and tolerances.

The TRIO mXTEND™ chip antenna component NN03-310 is compliant with the restriction of the use of hazardous substances (**RoHS**). For more information, please contact support@ignion.io.

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

2.2 SPECIFICATIONS FOR THE INK

The next figure shows the range of the colors in the TRIO mXTEND™ antennacomponent:

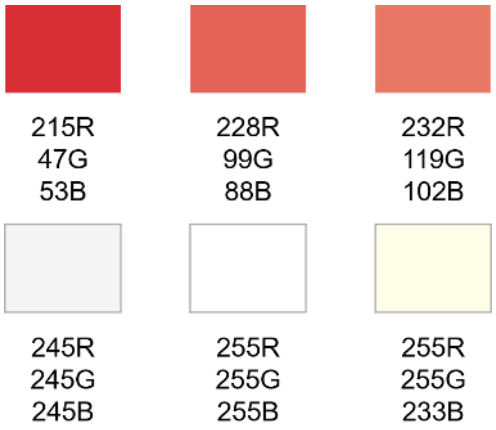


Figure 5 – Acceptable color range.

3 ASSEMBLY AND MANUFACTURING

Figure 9 shows the back and front views of the TRIO mXTEND™ chip antenna component (NN03-310). Due to the product configuration, the feeding pad can be the pad 1 and 7.

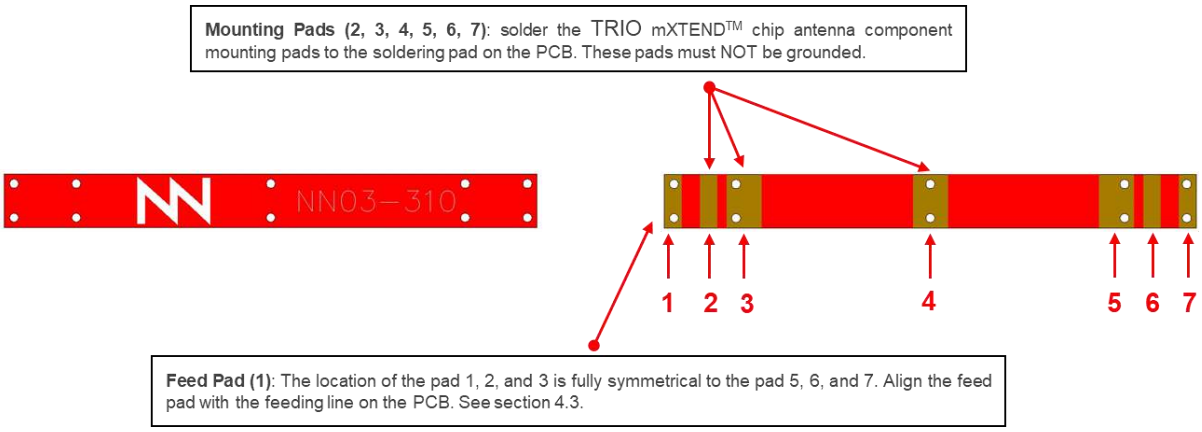


Figure 6 – Pads of the TRIO mXTEND™ chip antenna component (NN03-310).

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

1. Apply a solder paste on the pads of the PCB. Place the TRIO mXTEND™ chip antenna component on the board.
2. Perform a reflow process according to the temperature profile detailed in Table 6, Figure 8.
3. After soldering the TRIO mXTEND™ chip antenna component 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:

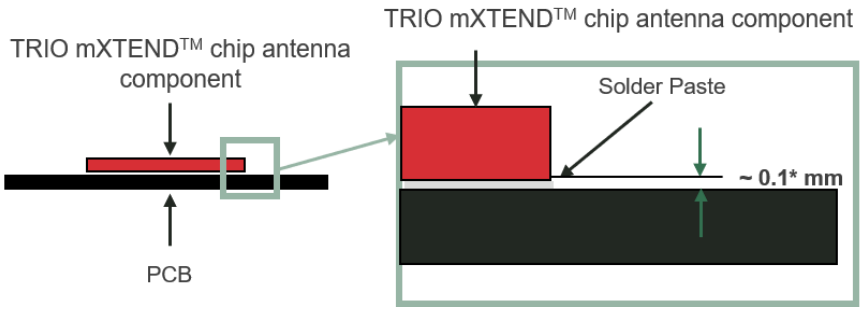


Figure 7 – Soldering Details.

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 TRIO mXTEND™ chip antenna component NN03-310 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 6 - Recommended soldering temperatures.

Next graphic shows temperature profile (grey zone) for the TRIO mXTEND™ chip antenna component assembly process reflows ovens.

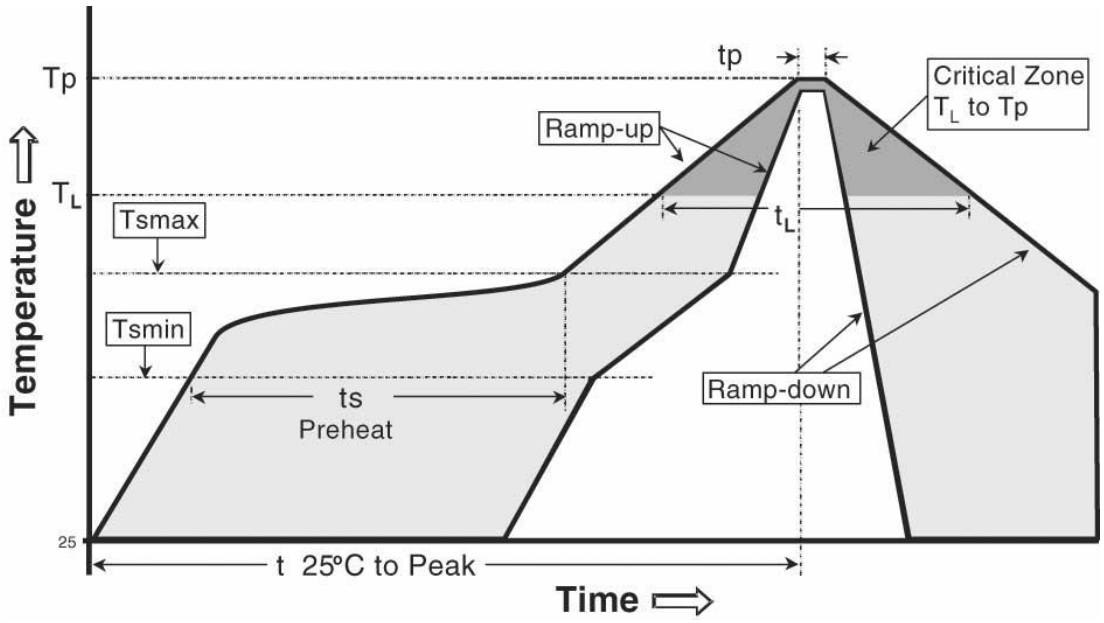
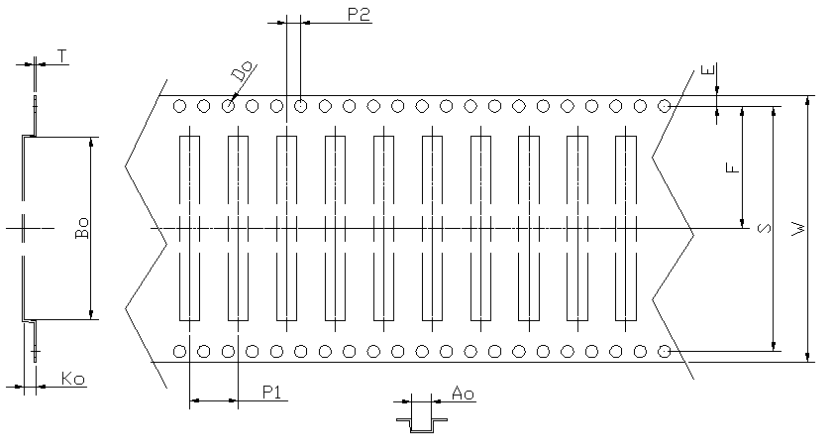


Figure 8 – Temperature profile.

4 PACKAGING

The TRIO mXTEND™ chip antenna component NN03-310 is delivered in tape and reel packaging.



Measure	mm		
Ao	3.3	±	0.1
Bo	30.3	±	0.1
Ko	2	±	0.1
W	44	±	0.3
D0	1.5	±	0.05
P1	8	±	0.1
P0	4	±	0.1
P2	2	±	0.1
E	1.75	±	0.1
F	20.2	±	0.1
S	40.4	±	0.3
T	0.3	±	0.05

Figure 9 - Tape dimensions and tolerances.

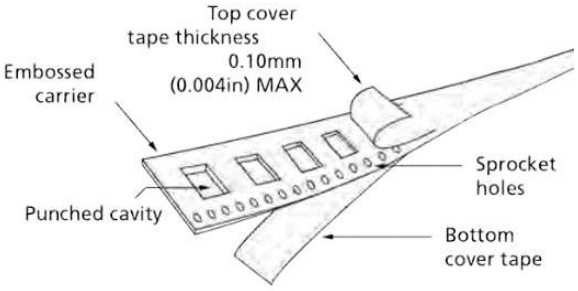
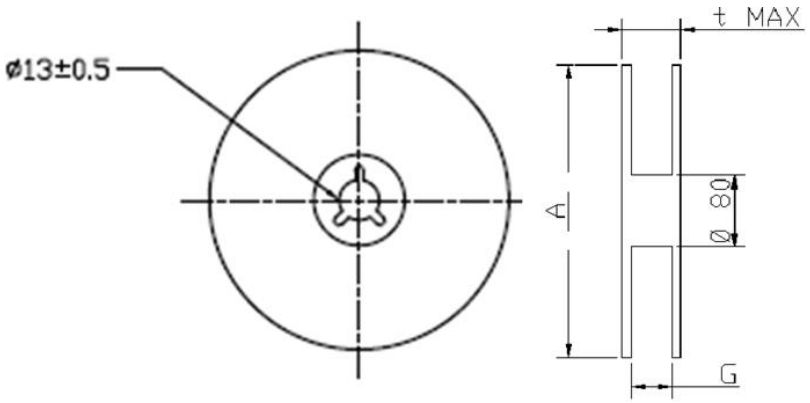


Figure 10 - Image of the tape.



Measure	mm		
A	330	±	2.0
G	44.4	±	0.13
t MAX	48.4	±	0.13

Reel Capacity: 3000 pcs

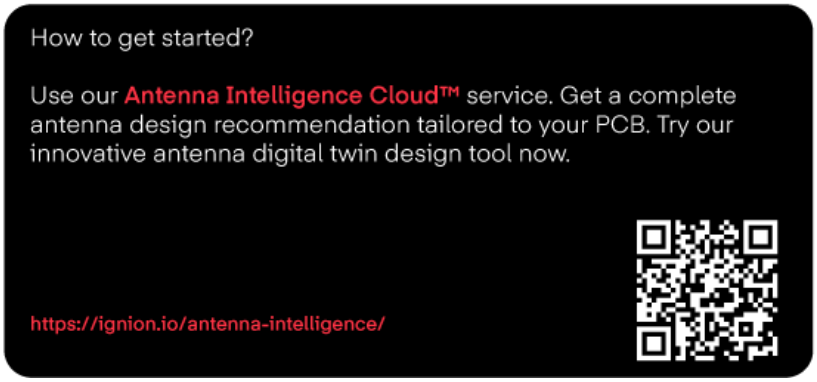
Figure 11 – Reel Dimensions and Capacity.

5 EASY DESIGN JOURNEY WITH VIRTUAL ANTENNA® TECHNOLOGY

This is the simple step by step design journey when designing with Virtual Antenna® technology. You can either do it yourself or you can leverage Ignion's comprehensive support. Our team of experts is available throughout every step, from feasibility to certification and can help ensure you get the antenna right.

Figure 12 – Virtual Antenna® design journey for a successful IoT solution.

Step 1 - Feasibility: The Antenna Intelligence Cloud™ provides feasibility results on a bare PCB in terms of reflection coefficient, total efficiency, and design recommendations such as antenna placement and clearance area.



Step 2 - Build design file: Build the design files (Gerber files) with optimal antenna integration based on Ignion templates and design recommendations received from the Antenna Intelligence Cloud™.

Step 3 - EM simulation: Validation of the design files with an Electro-Magnetic (EM) simulation of the full device considering every component, ensuring project requirements are met. Further allowing evaluation of design changes and their impact to the antenna performance.

Step 4 - Final Gerber design file sanity check: Check done by Ignion free of charge, ensuring that the antenna, matching network layout and other design recommendations on the final Gerber file follows the design guidelines before manufacturing.

Step 5 - Produce prototype and test: Verify performance results are aligned with expectations, easily fine-tune matching network if needed.

Step 6 - Certification pre-test: Perform OTA tests to ensure the device is meeting certification requirements.

PRODUCT CHANGE NOTIFICATION

PCN Number: NN19100013

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-S4-210	NN03-310

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-S4-210 FRACTUS to NN03-310 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: March 2020
Samples	X	Available from: April 2020

Ignion Contact:

Supply Chain
Name: Albert Vidal
Email: albert.vidal@ignion.io

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

ISO 9001: 2015 Certified

6 ANNEX: LIST OF BANDS

6.1 Cellular IoT bands covered

Bands	Uplink (MHz)	Downlink (MHz)	Region
1	1920 – 1980	2110 – 2170	GLOBAL
2	1850 – 1910	1930 – 1990	NA
3	1710 – 1785	1805 – 1880	GLOBAL
4	1710 – 1755	2110 – 2155	NA
5	824 – 849	869 – 894	NA
6	830 – 840	875 – 885	APAC
7	2500 - 2570	2620 - 2690	GLOBAL
8	880 - 915	925 - 960	GLOBAL
9	1749.9 - 1784.9	1844.9 - 1879.9	APAC
10	1710 – 1770	2110 – 2170	APAC
12	699 - 716	729 – 746	GLOBAL
13	777 – 787	746 - 7756	GLOBAL
14	788 - 798	758 – 768	GLOBAL
15	1900 – 1920	2600 – 2620	-
17	704 - 716	734 - 746	GLOBAL
18	815 – 830	860 – 875	JAPAN
19	830 – 845	875 – 890	JAPAN
20	832 – 862	791 – 821	EMEA
23	2000 – 2020	2180 – 2200	NA
25	1850 – 1915	1930 – 1995	NA
26	814 – 849	859 – 894	NA
27	807 – 824	852 – 869	NA
31	452.5 – 457.5	462.5 – 467.5	-
34	2010 – 2025	2010 – 2025	EMEA
37	1910 – 1930	1910 – 1930	NA
39	1880 – 1920	1880 – 1920	CHINA
65	1920 – 2010	2110 – 2200	GLOBAL
66	1710 – 1780	2110 – 2200	NA
70	1695 – 1710	1995 – 2020	NA
71	663 – 698	617 – 652	-
72	451 – 456	461 – 466	-

6.2 GNSS bands covered

Bands	Frequency (MHz)	System
B1	1561.098 - 1591.7875	BeiDou
L1	1575.42	GPS
L1	1598.0625 - 1605.375	GLONASS
E1	1575.42 - 1602	Galileo

6.3 Bluetooth/Wi-Fi bands covered.

Comm. Standard	Frequency (MHz)	# band
Bluetooth/Wi-Fi	2400 - 2500	single band

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