

ALL mXTEND™ application note for Sharkfin automotive devices

- **Antenna Component:** ALL mXTEND™ NN02-220
- **Dimensions:** 24.0 mm x 12.0 mm x 2.0 mm
- **Frequency regions:** 698-960 MHz and 1710-2690 MHz



A Sharkfin mobile antenna car is, among others, one of the many applications of the new **ALL mXTEND™** chip antenna component. These type of automotive antenna elements, fully harmonized in terms of design with the car body, optimize mobile coverage while enabling a seamless operation to the car driver.

The new Fractus Antennas Sharkfin reference design explains how to deliver **full mobile performance, including LTE700**, in just a **small 40x40 package**. The result is a minimal visual impact of the Sharkfin element while providing

flexibility on the final form and design factor. The small size and full mobile worldwide performance of this Sharkfin solution is enabled by the features of the ALL mXTEND™ chip antenna product. Owing to the unique properties of this Virtual Antenna™ technology, the miniature and off-the-shelf **ALL mXTEND™** chip antenna component covers the entire mobile spectrum from **698 MHz** up to **2690 MHz**.

The ALL mXTEND™ chip antenna component and other Fractus Antennas products based on its proprietary Virtual Antenna™ technology are protected by one or more of the following [Fractus Antennas patents](#).

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



TABLE OF CONTENTS

1.	PRODUCT DESCRIPTION NN02-220.....	3
2.	QUICK REFERENCE GUIDE	4
3.	EVALUATION BOARD (698-960 MHz and 1710-2690MHz).....	4
3.1.	MATCHING NETWORK.....	6
3.2.	VSWR AND TOTAL EFFICIENCY	7
3.3.	RADIATION PATTERNS (698-960 MHz), GAIN AND EFFICIENCY	8
3.4.	RADIATION PATTERNS (1710-2690 MHz), GAIN AND EFFICIENCY	9

1. PRODUCT DESCRIPTION NN02-220

The ALL mXTEND™ chip antenna component has been specifically designed for providing multiband performance in wireless devices enabling worldwide coverage. Among other applications, it is used for designing Sharkfin devices able to operate in full mobile communication standards as for example LTE700, GSM850, GSM900, GSM1800/DCS, GSM1900/PCS, UMTS, LTE850, LTE900, LTE1700, LTE1800, LTE1900, LTE2000, LTE2100, LTE2300, LTE2500, and LTE2600.



SHARKFIN



Material: The ALL mXTEND™ chip antenna component is built on glass epoxy substrate (left). Sharkfin product (right).

APPLICATIONS

- Vehicle Communication
- V2V, V2X
- Sharkfin antenna

BENEFITS

- High efficiency
- High gain
- Small size
- Full mobile worldwide standards including LTE700
- Cost-effective
- Easy-to-use (pick and place)
- Off-the-Shelf Standard Product (no customization is required)

The ALL mXTEND™ chip antenna component belongs to a new generation of antenna solutions based on the Virtual Antenna™ technology developed by Fractus Antennas. The technology is mainly focused on replacing conventional antenna solutions by miniature and standard components. Referring to Sharkfin solutions, Fractus Antennas has developed a Sharkfin reference design that features reduced dimensions while delivering high efficiency performances.

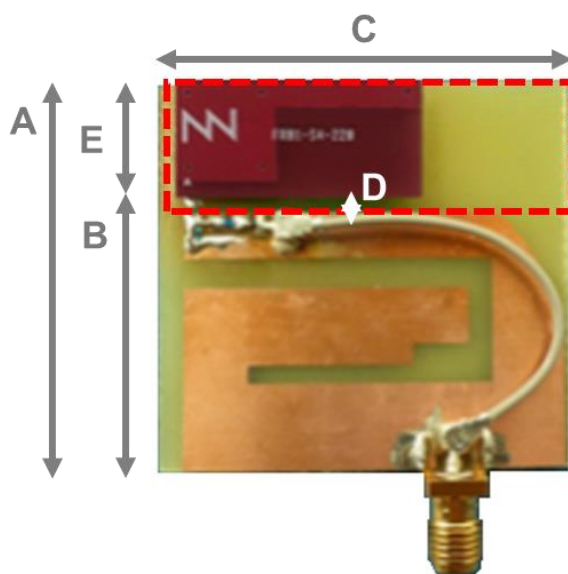
2. QUICK REFERENCE GUIDE

Technical features	698 – 960 MHz	1710 – 2690 MHz
Average Efficiency	> 35 %	> 60 %
Peak Gain	1.8 dBi	7.1 dBi
VSWR	< 4.5:1	
Radiation Pattern	Omnidirectional	
Polarization	Linear	
Weight (approx.)	1.23 g	
Temperature	-40 to +125 °C	
Impedance	50 Ω	
Dimensions (L x W x H)	24.0 mm x 12.0 mm x 2.0 mm	

Table 1 – Technical Features. Measures from the Evaluation Board. See Figure 1. Note that the evaluation board is mounted at the center of a metallic ground plane of 600mm x 600mm.

3. EVALUATION BOARD (698-960 MHz and 1710-2690MHz)

This Evaluation Board integrates a UFL cable to connect the ALL mXTEND™ chip antenna component with the SMA connector. The ALL mXTEND™ provides operation in two frequency regions, from 698 MHz to 960 MHz and from 1710 MHz to 2690 MHz, through a single input/output port.



Measure	mm
A	40.0
B	27.0
C	40.0
D	1.0
E	13.0

Tolerance: ±0.2 mm

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

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

Clearance Area: 13mm x 40mm (ExC)

Figure 1 – NN02-220-SF1. Evaluation Board providing operation from 698MHz to 960MHz and from 1710MHz to 2690MHz.

This product and its use is protected by at least one or more of the following patents and patent applications <http://www.fractusantennas.com/patents>. Additional information about patents related to this product is available at www.fractusantennas.com/virtual-antenna/.

3.1. MATCHING NETWORK

The specs of a Fractus Antennas standard product are measured in their evaluation board, which is an ideal case. In a real design, components nearby the antenna, such as 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 ALL mXTEND™ chip antenna component once the design is finished and considering all elements of the system (connectors, covers, etc.).

Please notice that different devices with different ground planes and different components nearby the ALL mXTEND™ chip antenna component 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@fractusantennas.com, or try our free-of-charge¹ **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.fractusantennas.com/rdservices/>

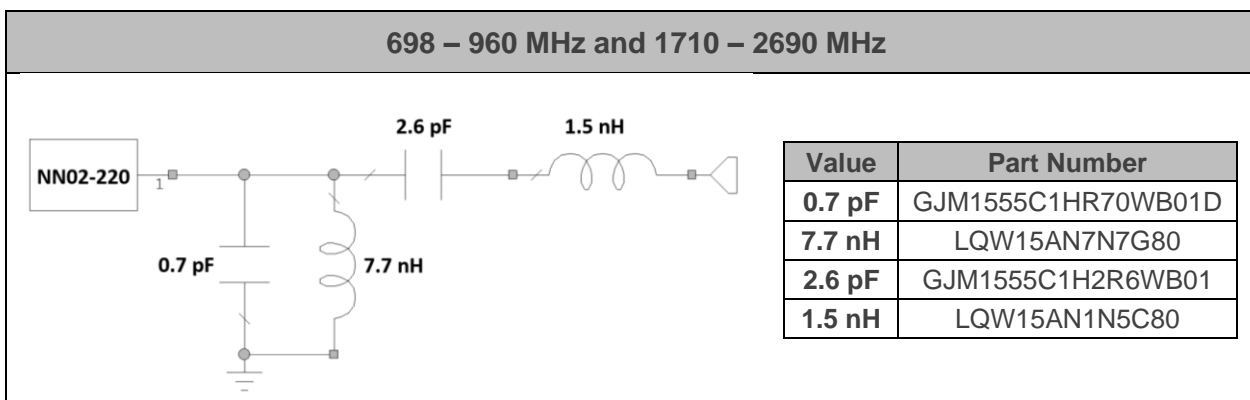


Figure 2 – Matching Network implemented in the evaluation board (Figure 1).

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. VSWR AND TOTAL EFFICIENCY

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

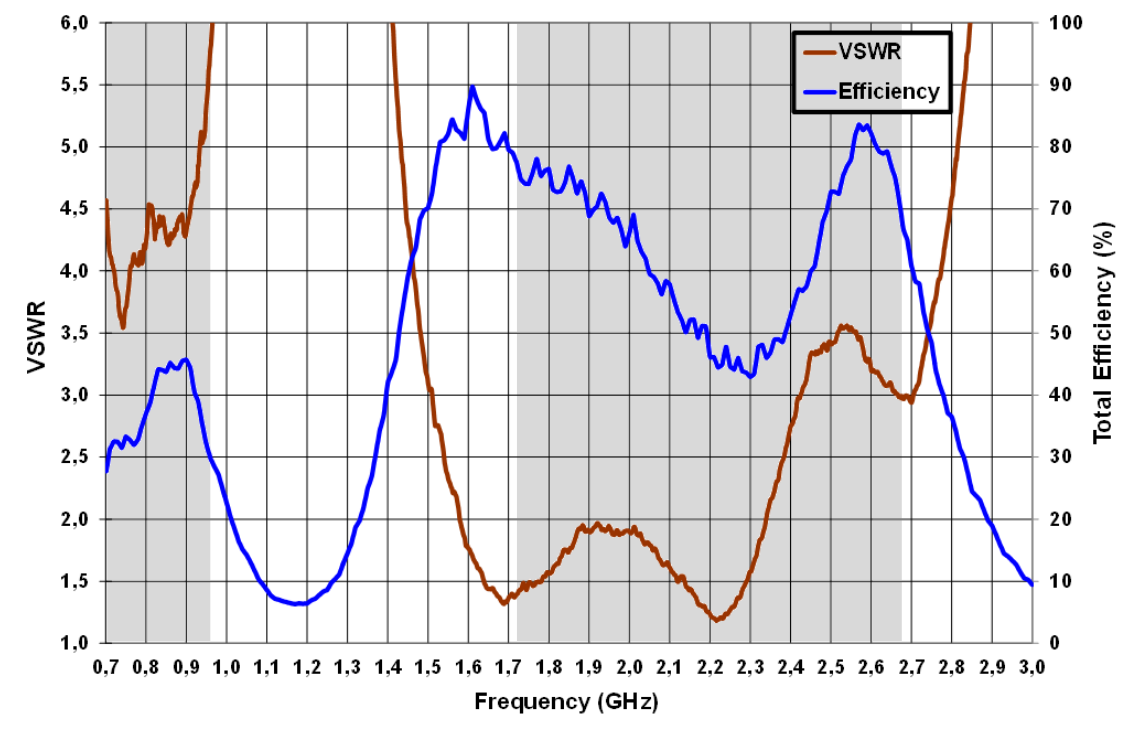
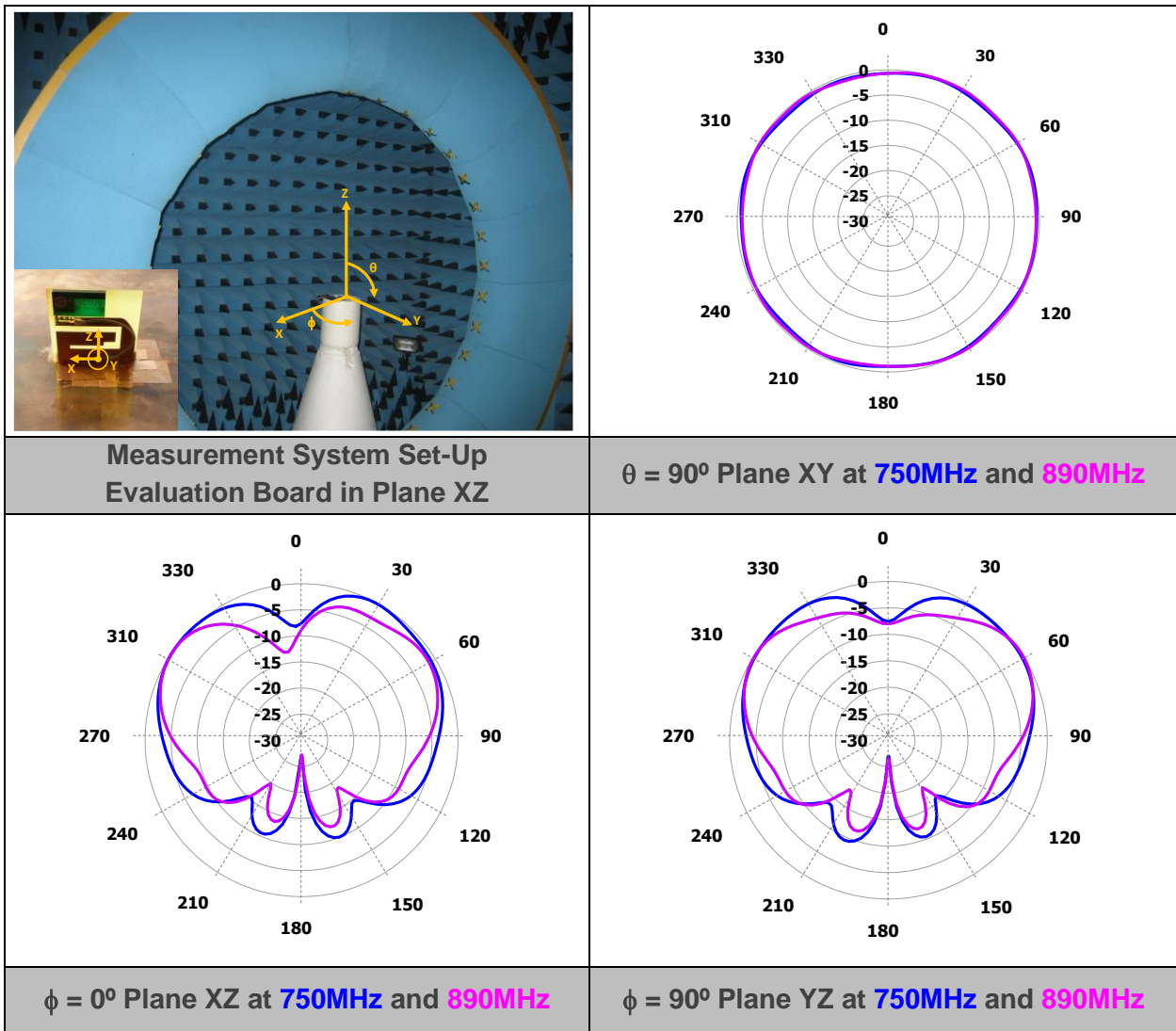


Figure 3 – VSWR and Total Efficiency for the 698 – 960 MHz frequency range and for the 1710 – 2690 MHz frequency range (from the evaluation board (Figure 1)).

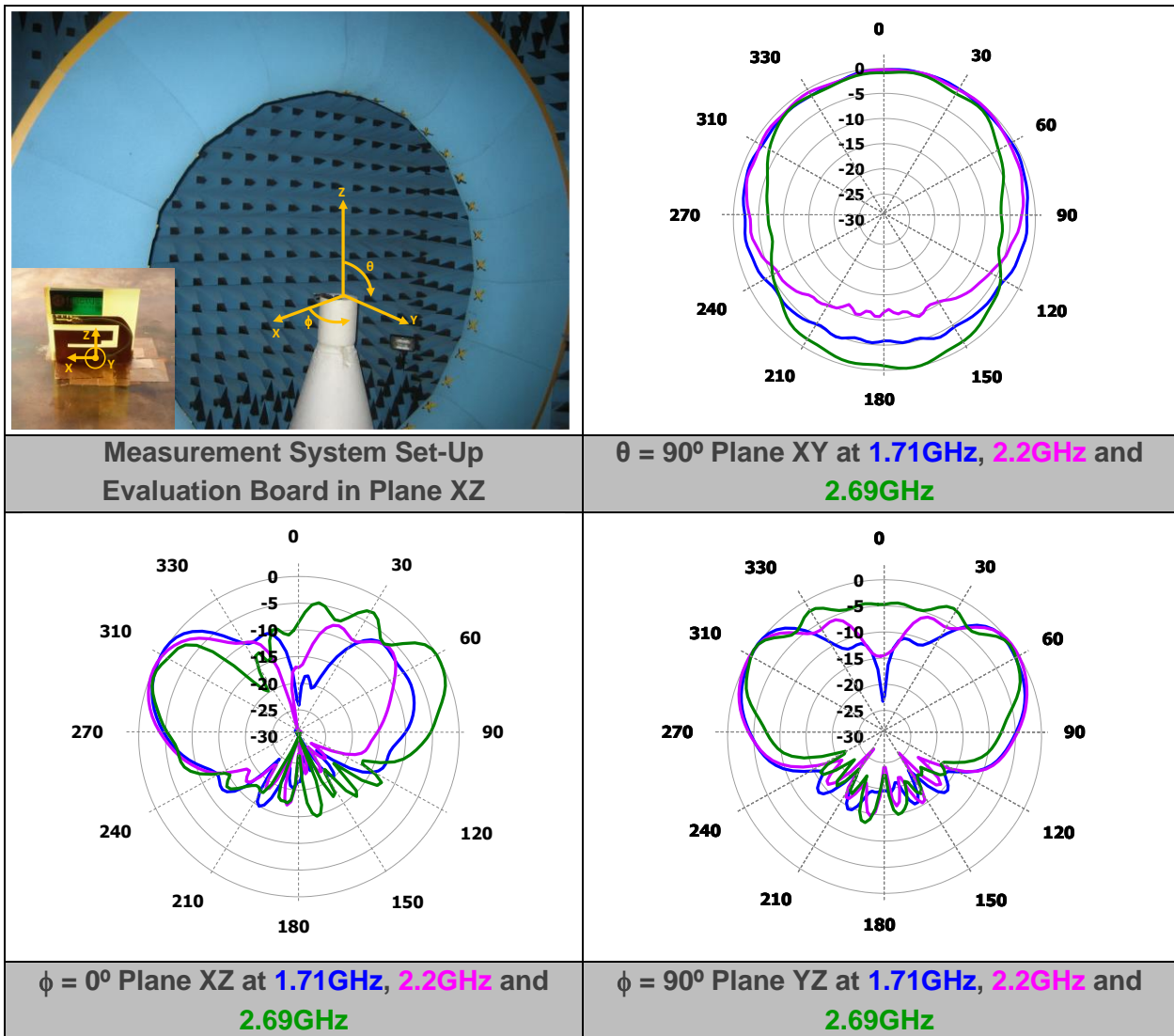
3.3. RADIATION PATTERNS (698-960 MHz), GAIN AND EFFICIENCY



Gain	Peak Gain	1.8 dBi
	Average Gain across the band	1.2 dBi
	Gain Range across the band (min, max)	0.1 <-> 1.8 dBi
Efficiency	Peak Efficiency	45.7 %
	Average Efficiency across the band	37.9 %
	Efficiency Range across the band (min, max)	27.7 – 45.7 %

Table 2 – Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 698 – 960 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

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



Gain	Peak Gain	7.1 dBi
	Average Gain across the band	6.0 dBi
	Gain Range across the band (min, max)	4.6 <-> 7.1 dBi
Efficiency	Peak Efficiency	83.6 %
	Average Efficiency across the band	63.7 %
	Efficiency Range across the band (min, max)	42.9 – 83.6 %

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.

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