



Internal Wireless Device Antenna 2400-2500 MHz/4900-6000 MHz



The evolution of technology has brought the need to communicate everywhere and at all times without being confined to one space. Our internal wireless device antennas feature wide bandwidth to enhance the performance and application of portable wireless devices based on standards such as 802.11 and Bluetooth®. The antennas are specifically designed to be embedded inside devices for aesthetically-pleasing integration with high durability.

FEATURES AND BENEFITS

- Covers 2.4 to 2.5 GHz and 4.9 to 6 GHz for all WLAN applications
- Coaxial cable pigtail with various connector choices
- Omnidirectional patterns and all frequencies with increased gain in upper bands for optimal coverage
- Conformance to European RoHS Directive

Part Numbers	CAF94505, MAF95090, MAF94158		ENB2449A1-10MHL4, ENB2449A1-20UFL			
Operating Frequency (MHz)	2400-2500	5150-5350	5600-6000	2400-2500	5150-5350	5600-6000
Gain (dBi)	2	3.9	4	3.19	4.1	4.35
VSWR – Max	2:1					
Nominal Impedance (Ohms)	50					
Polarization	Vertical, Omnidirectional					
Dimensions - cm (in.)	5.08 x 1.65 (2.0 x 0.65)					
Material Substance Compliance	RoHS					
Operating Temperature – °C (°F)	-30 to +70 (-22 to +158)					
Storage Temperature – °C (°F)	-40 to +85 (-40 to +185)					

CONFIGURATION

PART NUMBER	CABLE LENGTH	CONNECTOR
CAF94505	100 mm, Ø 1.13 mm	IPEX MHF
MAF95090	175 mm, Ø 1.13 mm	IPEX MHF
MAF94158	279.4 mm, Ø 1.13 mm	IPEX MHF
ENB2449A1-10MH4L	100 mm, Ø 1.13 mm	IPEX MHF4L
ENB2449A1-20UFL	200 mm, Ø 1.13 mm	IPEX MHF

Note: Specifications are based on the 100mm cable length, standard antenna version with MHF1 / U.FL connector. Varying the cable length or type or connector will cause variations in these antenna specifications.



FLAT SURFACE ANTENNA MEASUREMENTS

Flat surface measurements were performed with the antenna in free space.

VSWR

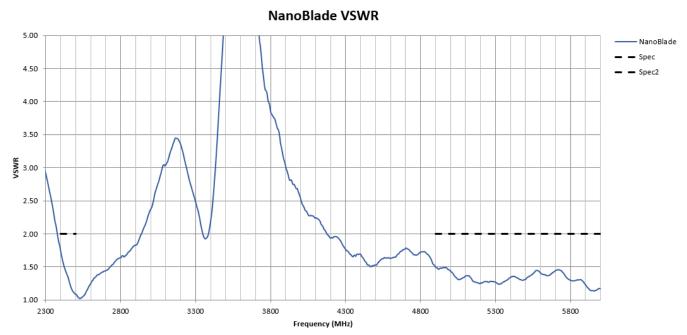


Figure 1: Antenna VSWR measured in free space

RETURN LOSS

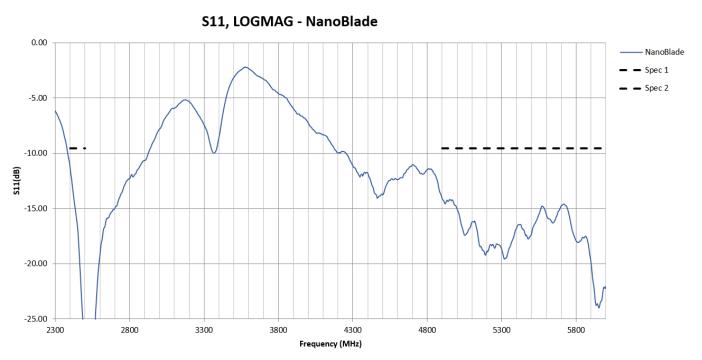


Figure 2: Antenna Return Loss measured in free space



ANTENNA CHAMBER TEST SETUP

Antenna measurements such as VSWR and S11 were measured with an Agilent E5071C vector network analyzer. Radiation patterns were measured with a Rohde & Schwarz ZNB8-4PORT vector network analyzer in a Howland Company 3100 chamber equivalent. Phase center is nine inches above the Phi positioner.

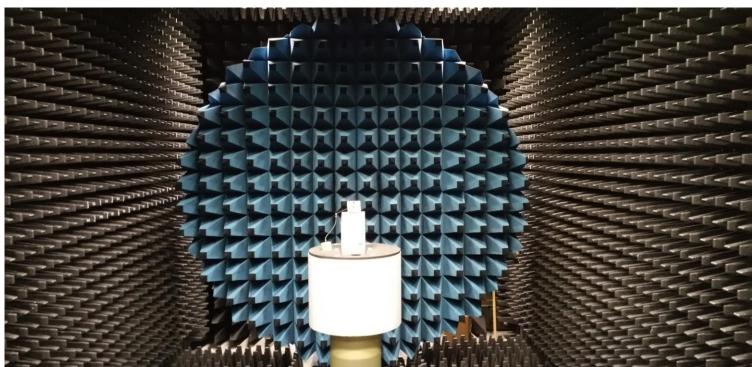


Figure 3: Howland Company 3100 Antenna chamber

ANTENNA RADIATION PERFORMANCE

Nanoblade centered in free space

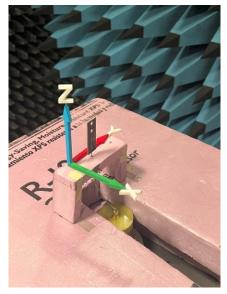
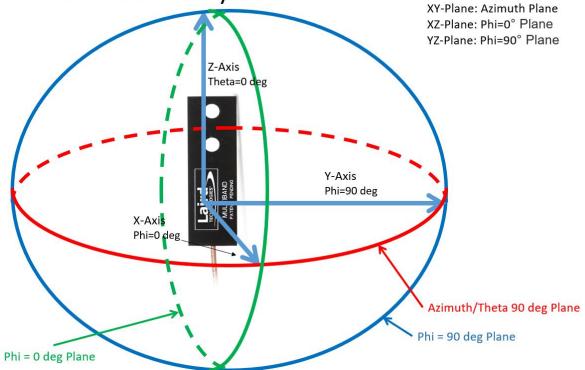


Figure 4: Flat surface setup



3D Measurement Coordinate System

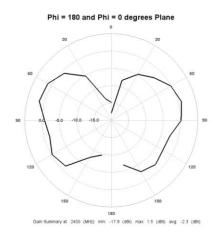


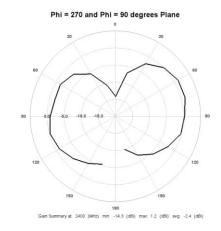


RADIATION PATTERNS - 2D Plots

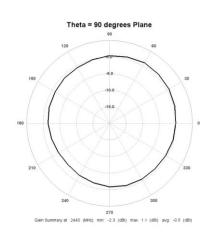
Theta = 90 degrees Plane 50 120 60 -10.0 -16.0 300 210 240 270 Gain Summary at 2400 (Mrtz) min. -1.8 (dB) max. 1.1 (dB) avg. -0.2 (dB)

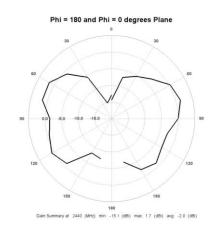
2D Plots at 2400 MHz

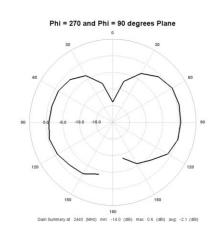




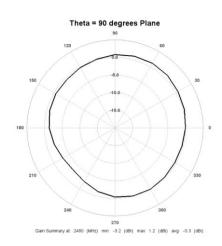
2D Plots at 2440 MHz

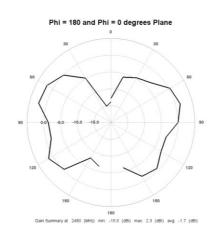


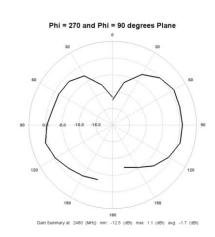




2D Plots at 2480 MHz



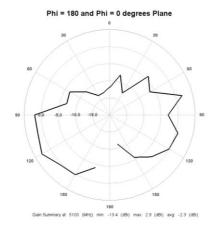


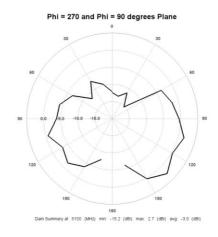




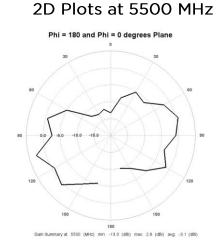
2D Plots at 5100 MHz

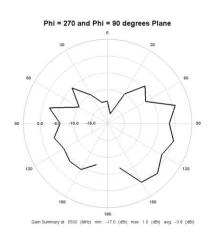
Theta = 90 degrees Plane
90
120
0,0
180
180
240
270
Gain Summary at 5100 (MHz) mm. 44 (gB) max 2.4 (gB) avg 0.1 (gB)



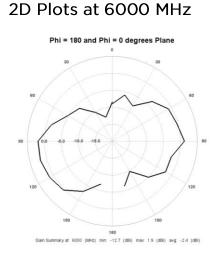


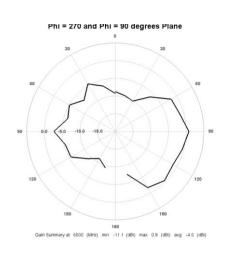
Theta = 90 degrees Plane 90 120 0,0 45,0 180 30 210 210 270 Gan Summary 4t. 5500 (Meta) mm - .59 (38) max 1.7 (38) avg -0.8 (88)





Theta = 90 degrees Plane 90 120 4.0 150 150 210 240 270 Gain Summary at 6000 (MP42) mm. -4.7 (dBi) max 2.1 (dBi) avg 0.3 (dBi)







RADIATION PATTERNS - 3D Plots

3D Plots at 2400 MHz

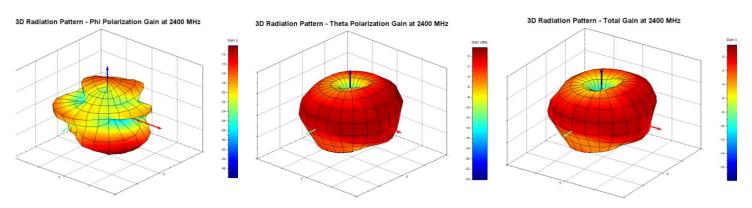


Figure 5: Phi polarization, Theta polarization and, and total gain plots - 2400 MHz

3D Plots at 2440 MHz

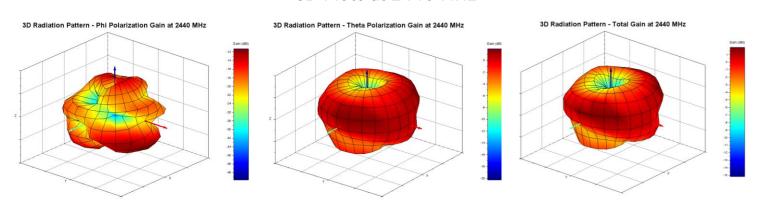


Figure 6: Phi polarization, Theta polarization and, and total gain plots - 2440 MHz

3D Plots at 2480 MHz

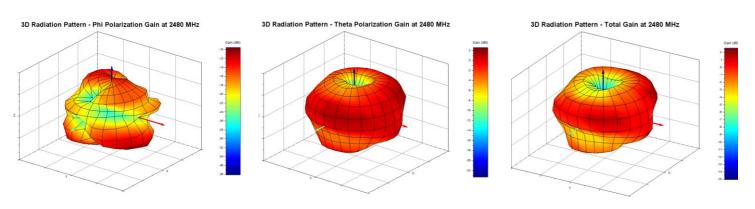


Figure 7: Phi polarization, Theta polarization and, and total gain plots – 2480 MHz

3D Plots at 5100 MHz

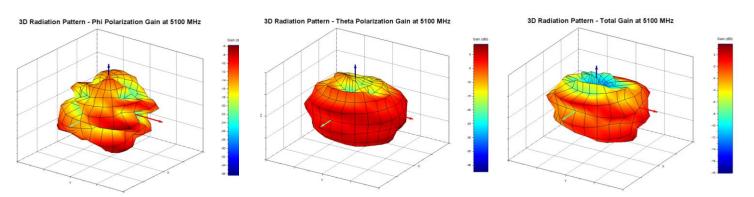


Figure 8: Phi polarization, Theta polarization and, and total gain plots – 5100 MHz

3D Plots at 5500 MHz

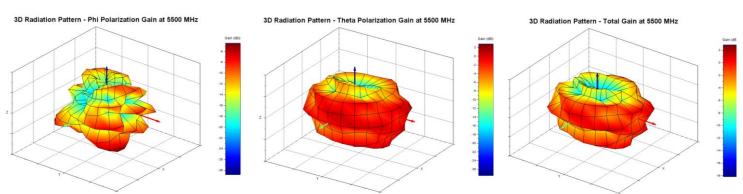


Figure 9: Phi polarization, Theta polarization and, and total gain plots - 5500 MHz

3D Plots at 6000 MHz

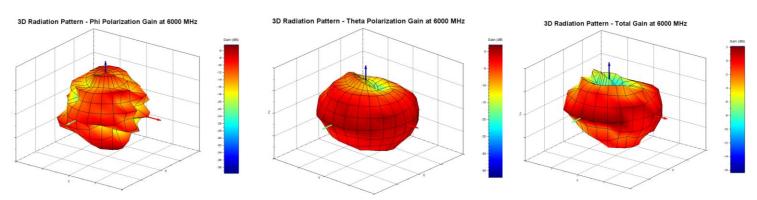


Figure 10: Phi polarization, Theta polarization and, and total gain plots - 6000 MHz

EFFICIENCY

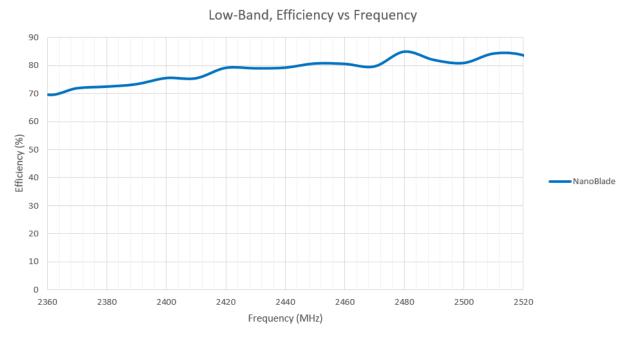


Figure 11: Low-Band antenna efficiency measured in free space with a nominal value of -1.1dB across the operating frequency

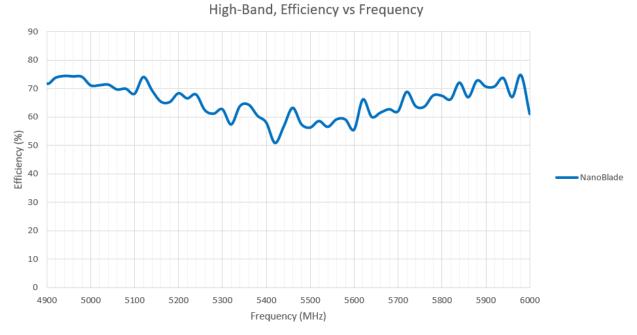


Figure 12: High-Band antenna efficiency measured in free space with a nominal value of -1.91dB across the operating frequency

ANTENNA GAIN

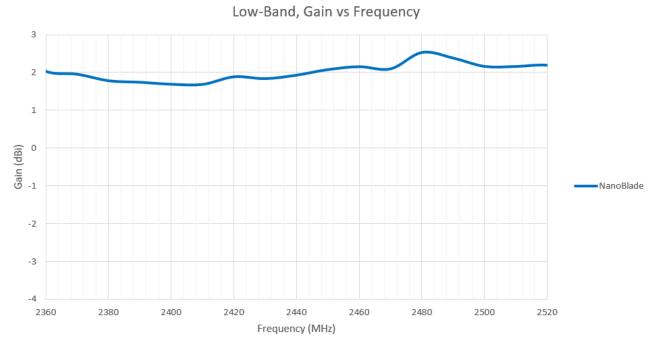


Figure 13: Low-Band Total Gain vs. Frequency, measured in free space

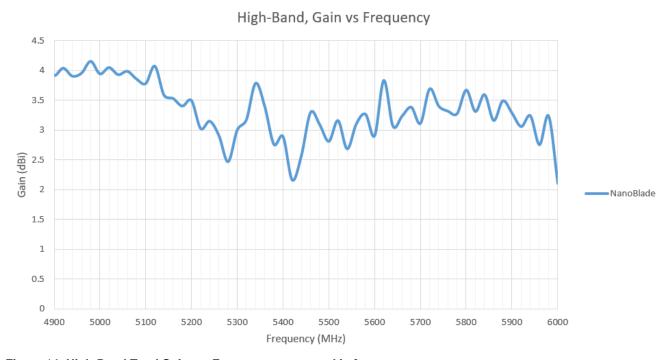
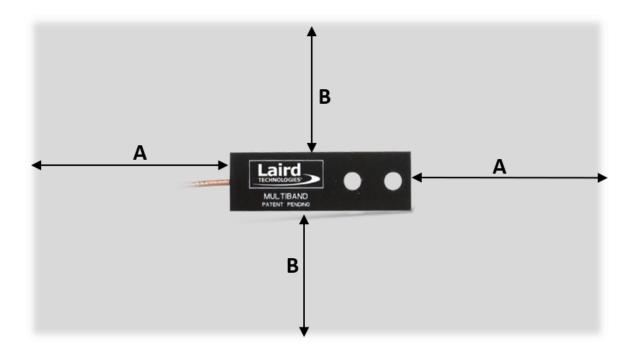
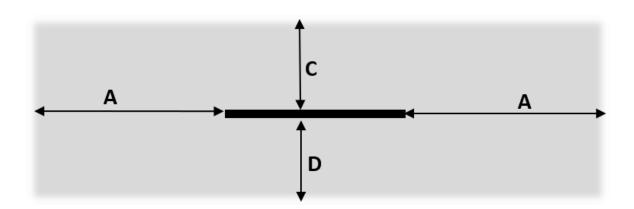


Figure 14: High-Band Total Gain vs. Frequency, measured in free space



RECOMMENDED ANTENNA CONDUCTIVE MATERIAL KEEP OUT REGION





Keep Out Region Distance (mm)				
Α	В	С	D	
5	5	10	10	

Notes:

- Antenna can be mounted on polycarbonate with a nominal thickness of 2.25mm (1.5mm 3mm), or with plastic screws
- Diagram is not to scale





ADDITIONAL INFORMATION

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Internal Wireless Device Antenna

REVISION HISTORY

1.0 10 Mar 2022 Initial Release Various 2.0 25 Oct 2023 Lindated Antenna Patterns Placement & Keep Out Adam Engelbrecht	Version	Date	Notes	Approver
2.0 25 Oct 2023 Undated Antenna Patterns Placement & Keen Out Adam Engelbrecht	1.0	10 Mar 2022	Initial Release	Various
Region	2.0	25 Oct 2023	Updated Antenna Patterns, Placement & Keep Out Region	Adam Engelbrecht

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