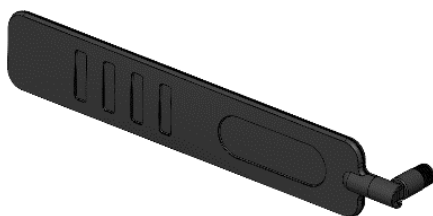


Product Datasheet AC94502-01

Multiband LTE Terminal Antenna for Smart Utility Applications

October 2023

Rev. 3.0



Revision History

Date	Rev.	Summary of Changes
October 2022	1.0	First version of Preliminary Product Datasheet
February 2023	2.0	Efficiency and VSWR values updated
October 2023	3.0	Efficiency and VSWR values updated

1 Multiband LTE Antenna

1.1 Scope and purpose

This document describes the AC94502 terminal antenna and its specifications. It is intended for customers deploying infrastructure for smart utility applications:

- Smart Utility infrastructure
- High-, medium- and low-voltage substations monitoring
- Asset management, attack protection and self-healing grids
- Power plants and industry

1.2 AC94502 features

- Terminal LTE antenna designed for indoor mounting and minimized installation time
- Excellent Multiband coverage: 450-470MHz, 630-960MHz and 1500-4000MHz
- Optimized performance at 450MHz to 470MHz
 - VSWR \leq 2.0 :1
 - Efficiency up to 85%
- Smart elbow-adapter and 90 deg hinged SMA (M) connector offer multiple degrees of freedom in antenna positioning to find optimum antenna performance.
- Performance robust against cable length variations
- Ground plane size independent
- Performance robust against mounting on conductive and non-conductive surfaces
- RoHS and REACH compliant

1.3 Antenna specifications

Table 1: AC94502-01 RF specifications

Electrical Specifications			
Frequency Range (MHz)	450 – 470	700 – 960	1700 – 4000
VSWR*	≤ 2.0:1	≤ 3.0:1	≤ 2.2:1
Efficiency* (%)	74 - 85	55 - 78	73 - 86
Peak Realized Gain (dBi)	< 2.0	< 2.9	< 4.5 (1700-2200) < 6.1 (2200-4000)
Reference Impedance (Ω)	50		
Radiation Pattern	Quasi-omnidirectional		
Polarization	Linear		
Max Input Power (W)	10		
* Measured in free space			

Table 2: AC94502-01 Physical and Environmental specifications

Mechanical Specifications	
Dimensions W x L x Th (mm)	47.6 x 274 x 8.8 Right angle 47.6 x 298 x 8.8 Straight
Weight (g)	75
Connector Type	SMA male
Material housing	ABS (housing) and PC (elbow adapter)
Recommended torque on SMA connector	0.4Nm
Max torque on SMA connector	0.5Nm
Environmental Specifications	
Operating Temperature	-40°C to +85°C
Material Compliance	RoHS
Impact Resistance	IK01

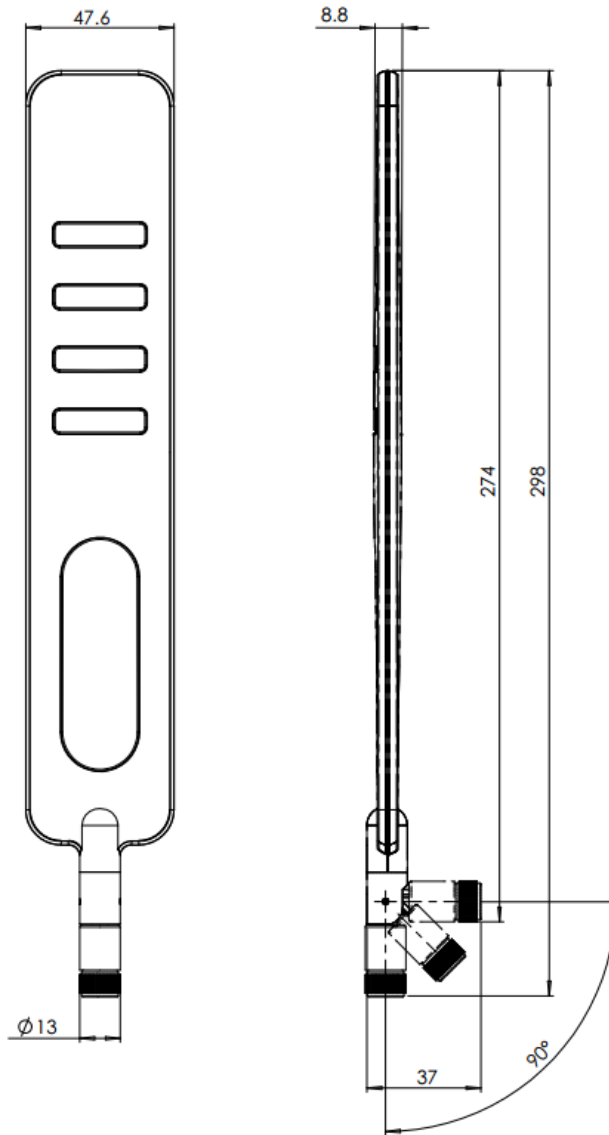


Figure 1: AC94502-01 Dimensions

Note: For all dimensions, the ISO 2768-mK standard is followed. For the outer dimensions this means a tolerance of $\pm 0.5\text{mm}$ is applicable

1.4 RF Performance Measurements: VSWR in Free Space

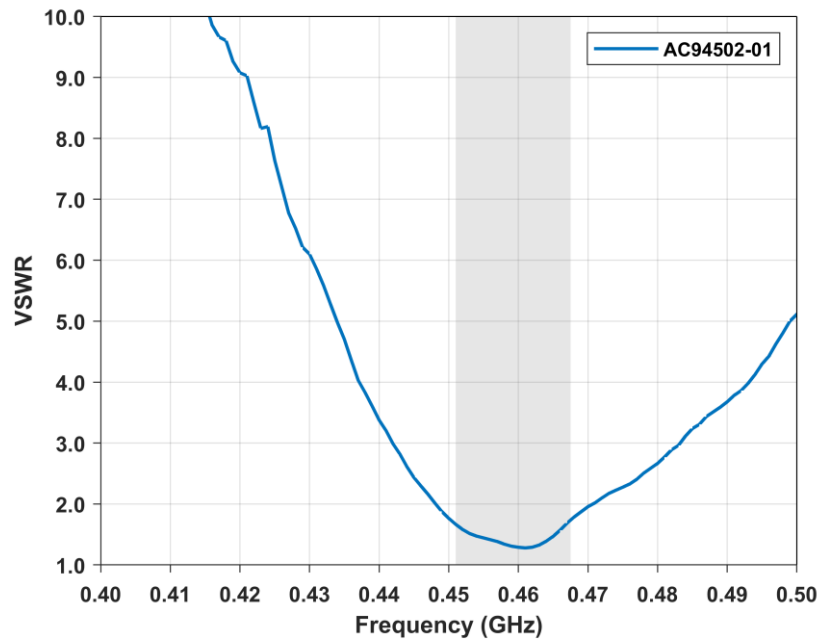


Figure 2: AC94502-01 VSWR measurements in the 400MHz – 500MHz range

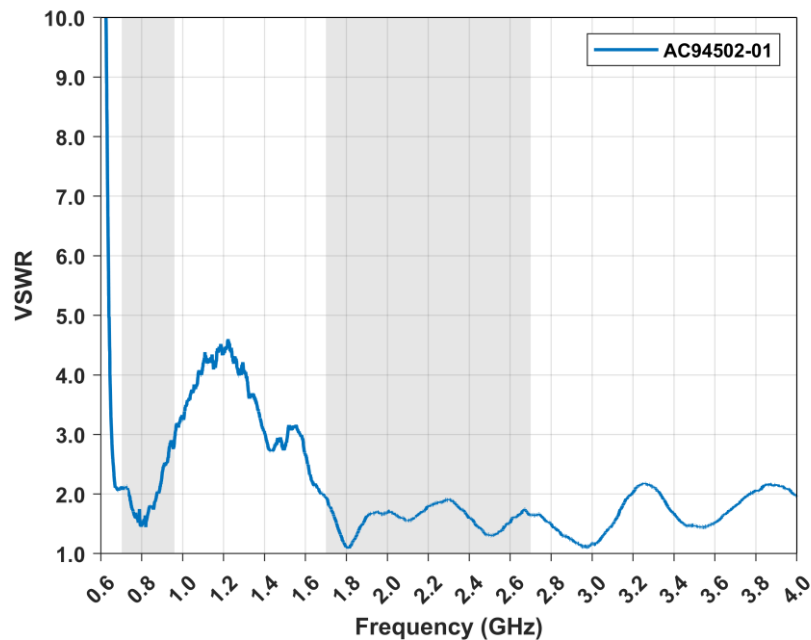


Figure 3: AC94502-01 VSWR measurements in the 600MHz – 4000MHz range

The Antenna Company International N.V. Proprietary & Confidential

1.5 RF Performance Measurements: Total Efficiency in Free Space

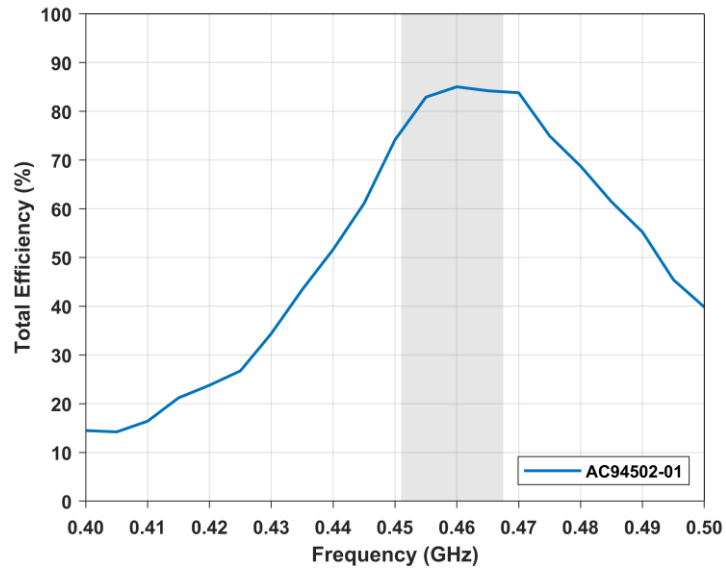


Figure 4: AC94502-01 efficiency measurements in the 400MHz – 500MHz range

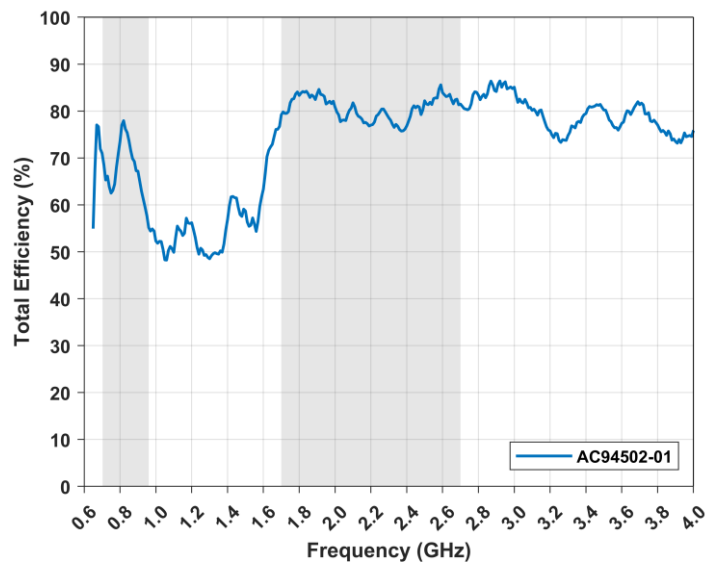


Figure 5: AC94502-01 efficiency measurements in the 650MHz – 4000MHz range

1.6 RF Performance Measurements: VSWR on a Cabinet

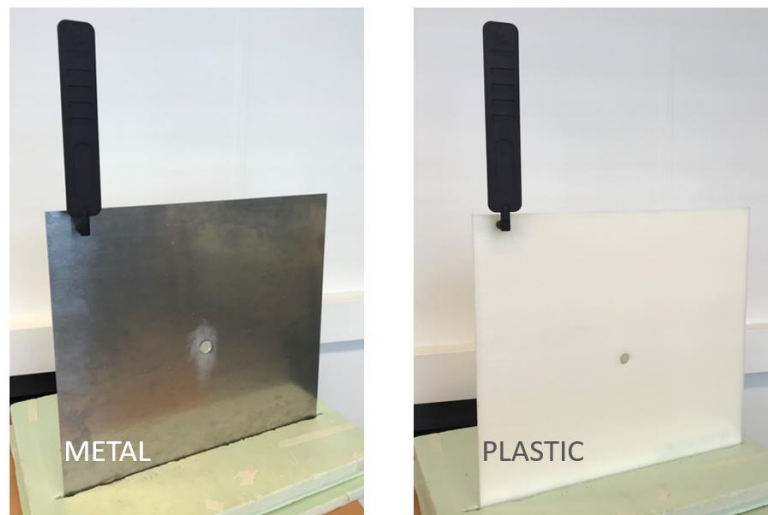


Figure 6: AC94502 testing conditions on a metal plate (left) and a plastic sheet (right)

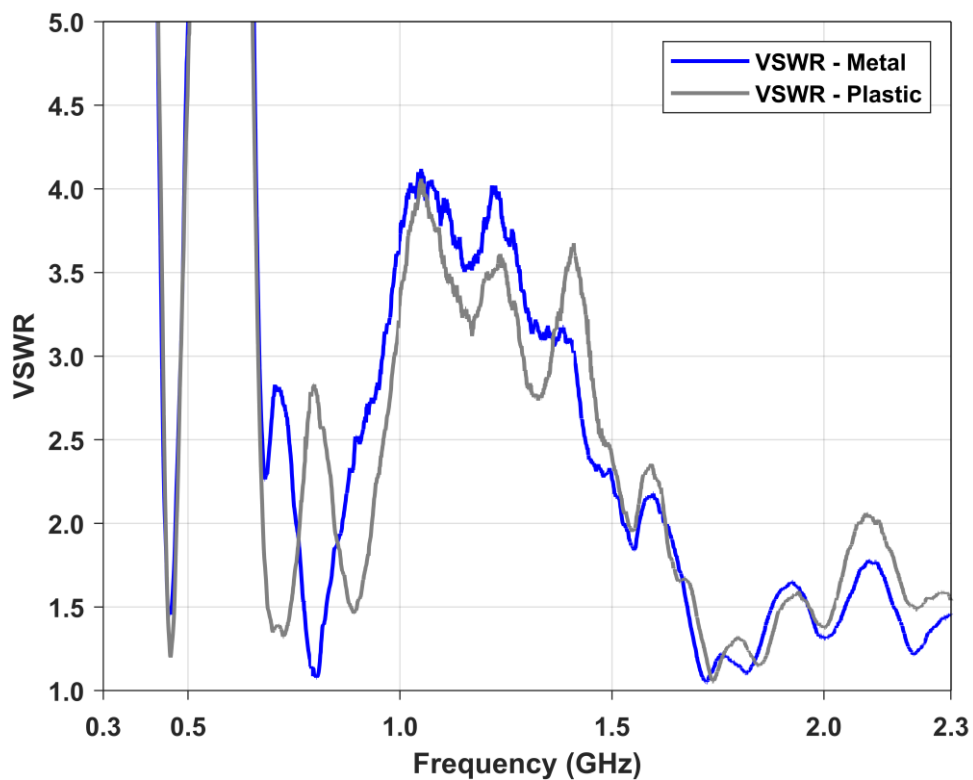


Figure 7: VSWR measurements of the AC94502-01 antenna when mounted on a metal plate (blue line) and on a plastic sheet (grey line)

1.7 RF performance Measurements: Total Efficiency on a Cabinet

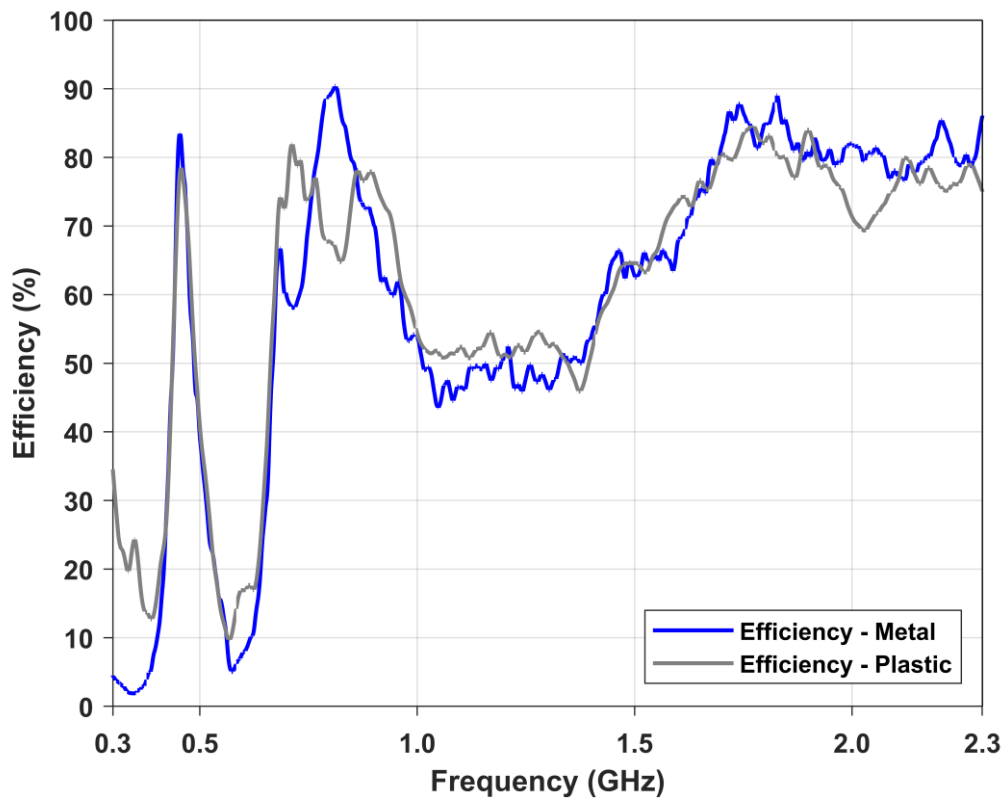


Figure 8: Efficiency measurements of the AC94502-01 antenna when mounted on a metal plate (blue line) and on a plastic sheet (grey line)

1.8 Radiation pattern

The tables below shows the typical measured radiation patterns of the AC94502-01 antenna in free space. The patterns are evaluated along the XZ, YZ and XY planes as illustrated in below figure.

Pictures of the test-setup are depicted below.



Figure 9: X, Y and Z coordinates indicating the radiation pattern evaluation planes

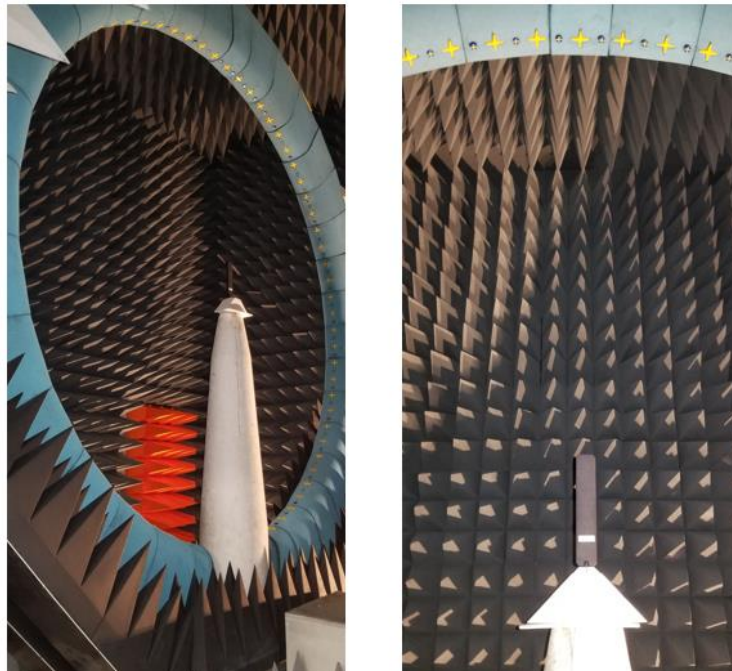
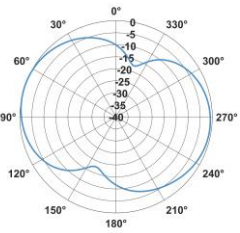
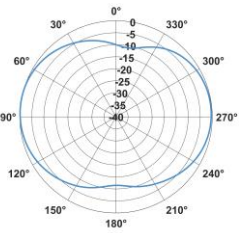
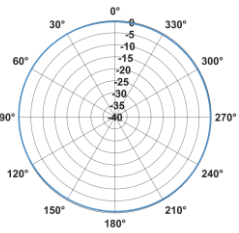
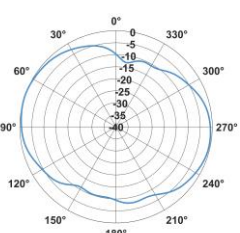
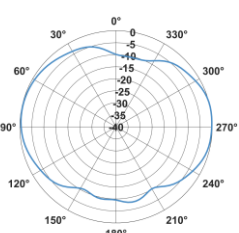
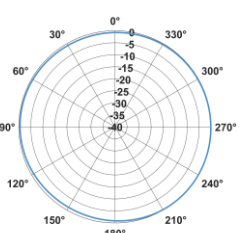
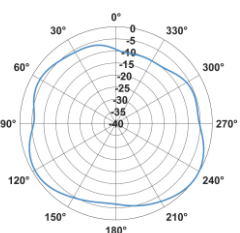
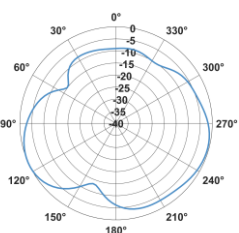
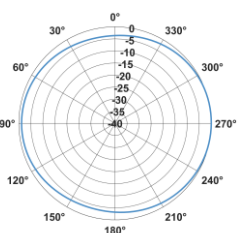
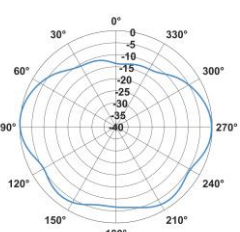
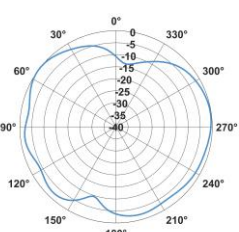
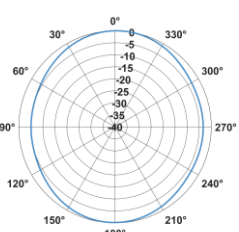
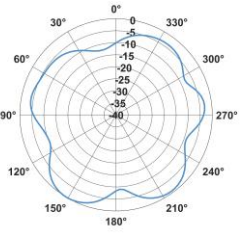
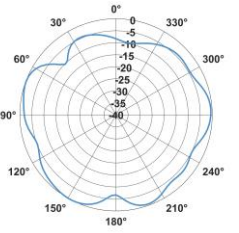
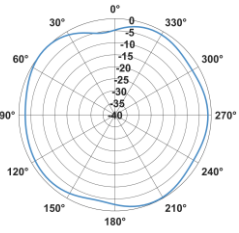
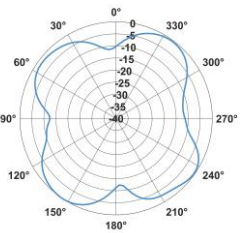
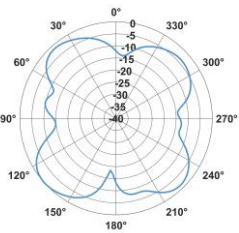
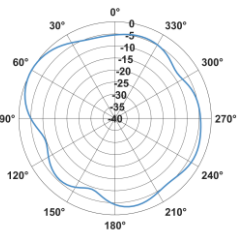
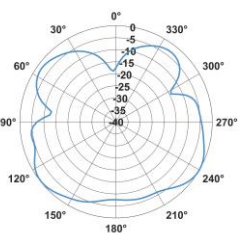
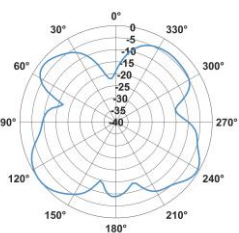
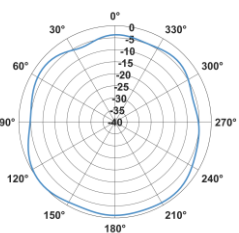
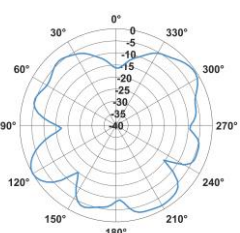
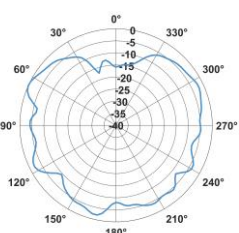
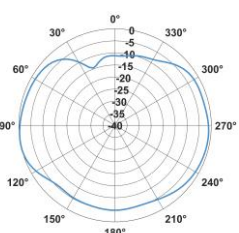


Figure 10: Test chamber pictures for antenna radiation properties measurements

Table 3: Radiation Patterns of AC94502-01

Frequencies (MHz)	$\varphi = 0^\circ$ [X,Z]	$\varphi = 90^\circ$ [Y,Z]	$\vartheta = 90^\circ$ [X,Y]
450 MHz			
470 MHz			
700 MHz			
900 MHz			

Frequencies (MHz)	$\varphi = 0^\circ$ [X,Z]	$\varphi = 90^\circ$ [Y,Z]	$\vartheta = 90^\circ$ [X,Y]
1700 MHz			
2000 MHz			
2400 MHz			
3600 MHz			

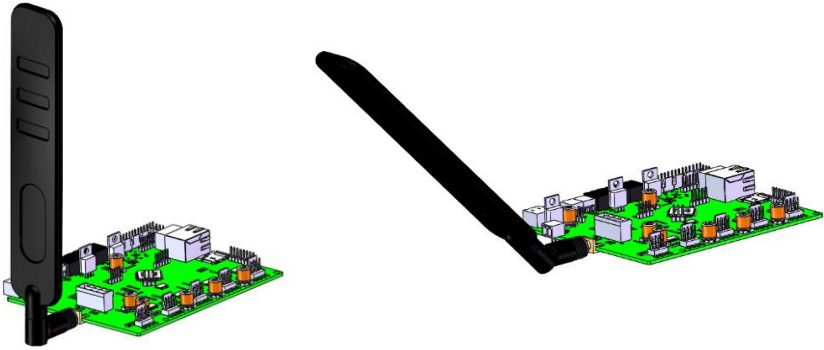
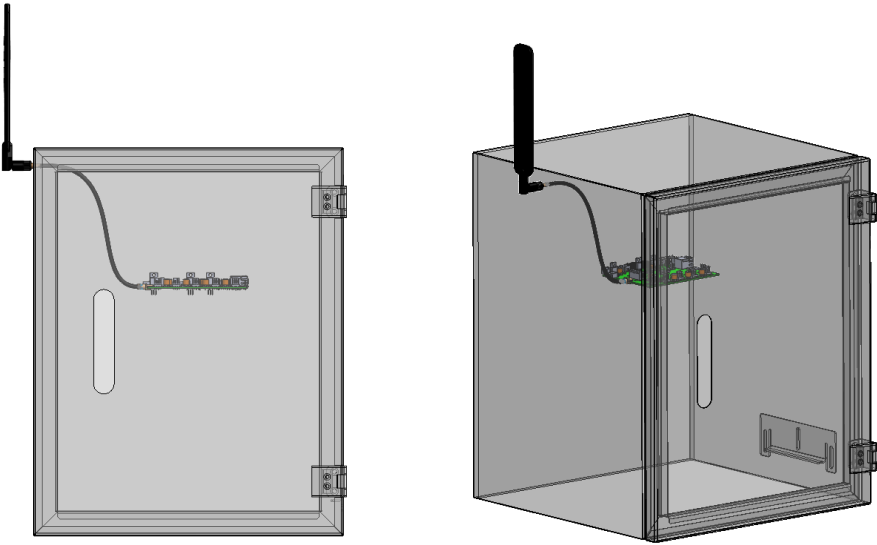
The Antenna Company International N.V. Proprietary & Confidential

2 Product Handling

2.1 Assembly Recommendations

The AC94502-01 is designed to support indoor installation conditions. The antenna can be mounted on a router/CPE or a cabinet as illustrated in below table. The cabinet walls can be metallic or non-conductive.

Table 4: Assembly recommendations of the AC94502-01 antenna

Direct PCB Mount

Cabinet Mount


2.2 Mounting Options

The 90 deg hinged SMA (M) connector and corresponding elbow adapter of the AC94502-01 have been designed to support multiple degrees of freedom as illustrated in below figures.

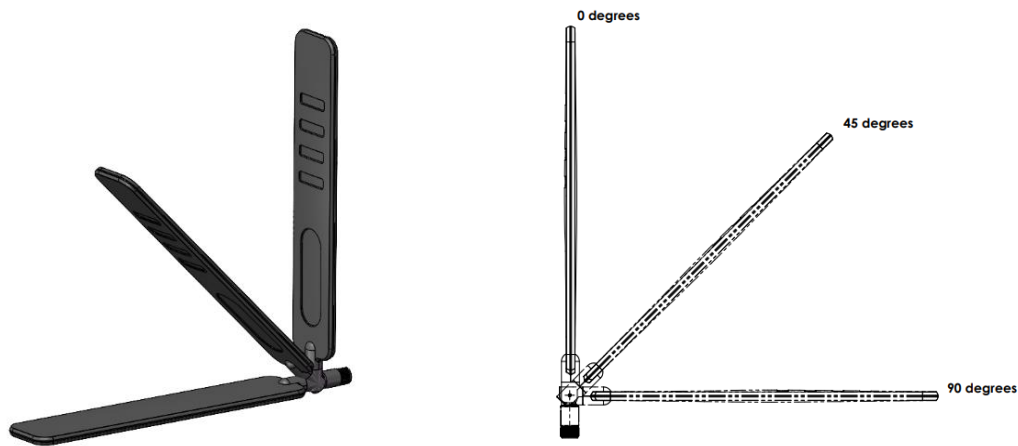


Figure 11: Illustrations of the three stands (0deg, 45deg and 90deg) supported by the elbow adapter.

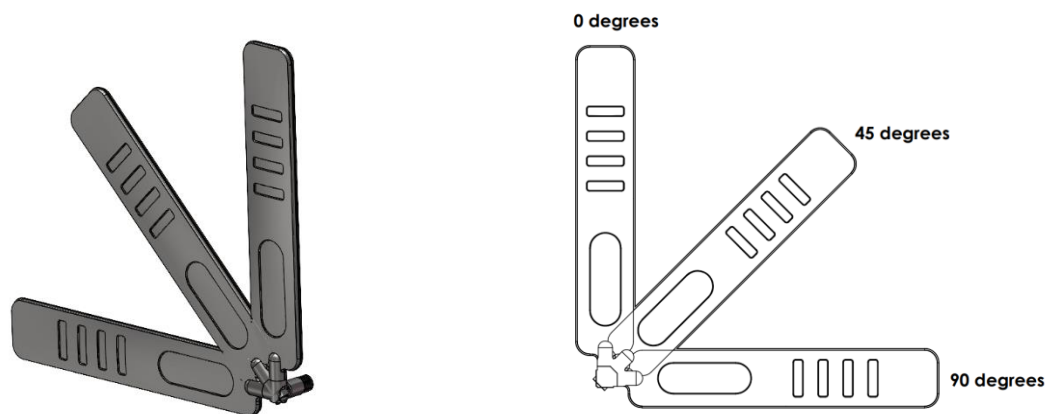
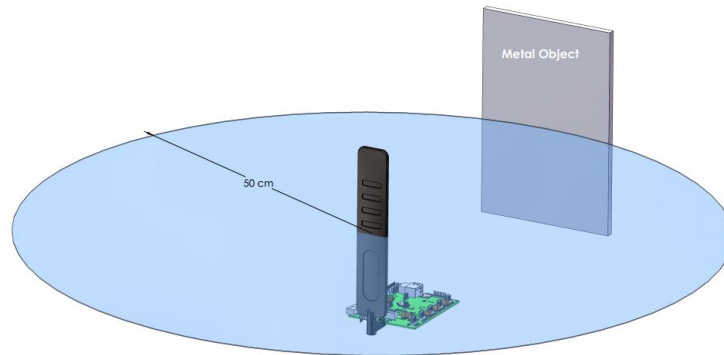


Figure 12: Illustrations of three out of the multiple mounting angles supported by the SMA connector. Any other angle can be defined by the user when tightening the SMA connector.

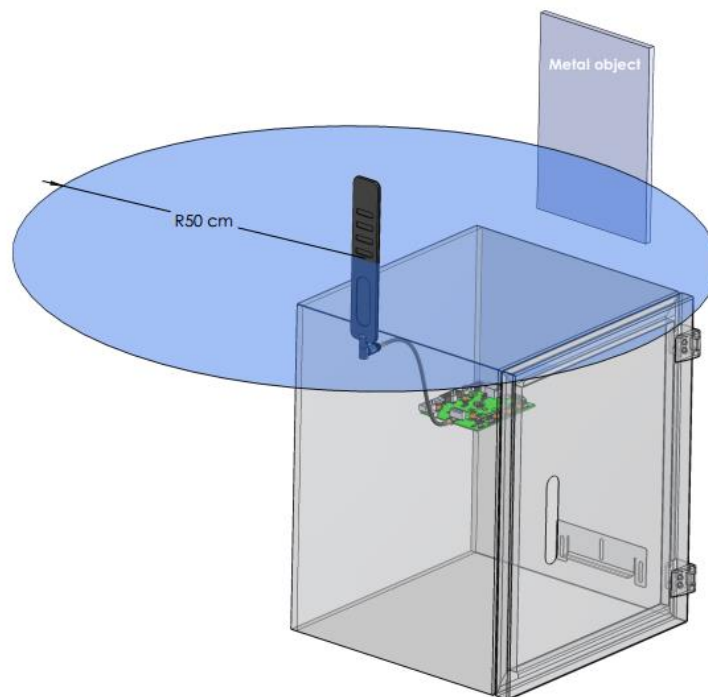
2.3 Mounting Guidelines

It is recommended to keep the near-field region surrounding the antenna free of metal objects.

The metal-free area is illustrated in the figure below by the light-blue shaded circles with a 50cm radius for both direct PCB mount and cabinet mount configuration.



PCB Mount Configuration



Cabinet Mount Configuration

Figure 13: Illustration of the recommended clearances around the AC94502-01 when mounted on a PCB (Top) or a Cabinet (Bottom)

3 Product Marking & Ordering Information

3.1 Product Marking

The housing of the AC94502-01 will have no markings.

3.2 Packaging

The AC94502-01 will be packed in dedicated trays or bubble bags and delivered in a carton box containing 100 samples as illustrated in the figure below. Larger quantities (i.e., ≥ 100 pcs) will therefore be shipped in multiple orders of 100 samples.

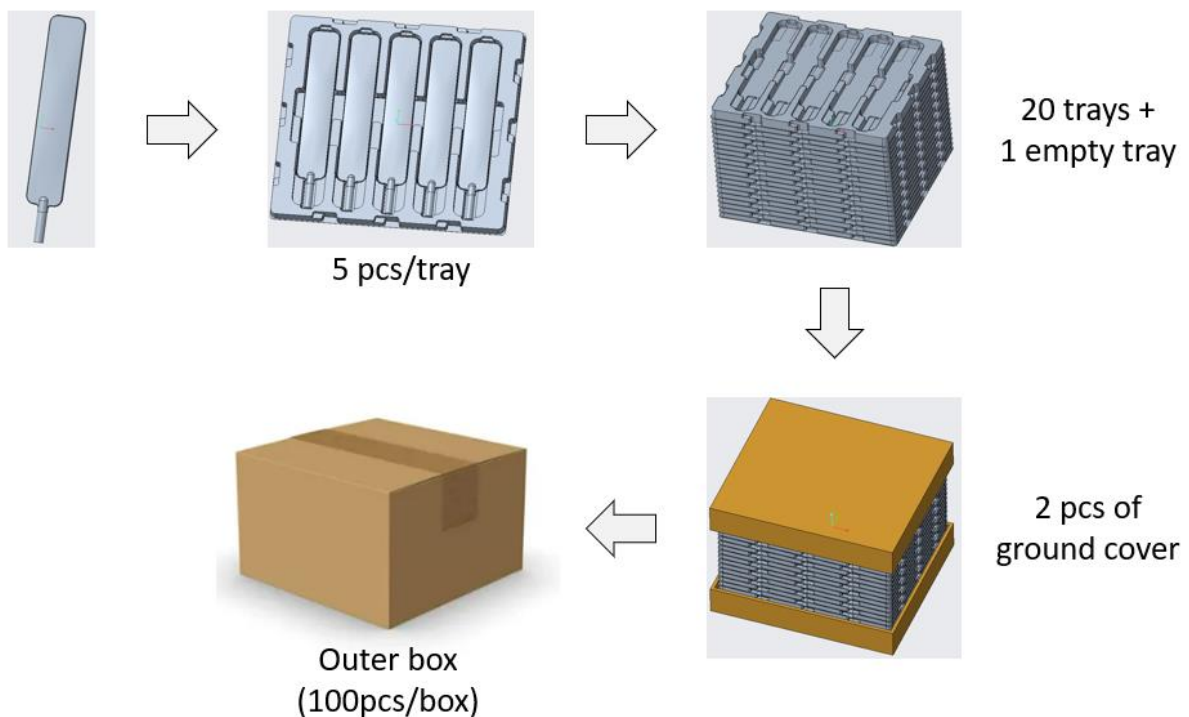


Figure 14: Packaging dimensions of the AC94502-01

3.3 Ordering Information

Orders should be placed at orders@antennacompany.com.

For purchase orders please state: Part number, description, quantity and price.

Table 5: AC94502-01 ordering information

Part Number	Description	MOQ [pcs]
AC94502-01	Multi-band indoor LTE antenna for Smart Utility Applications	Multiple of 100

3.4 Environmental Compliances

The AC94502-01 product complies with all international norms as listed in below table.

Table 6: AC94502-01 environmental compliance overview

Region	Regulation	Reference	Compliant
US	US EPA Toxic Substances Control Act amended December 2020 Declaration	TSCA Section 6(h)	✓
US	California Proposition 65 Safe Drinking Water & Toxic Enforcement Act of 1986 Declaration		✓
EU	RoHS 3	EU 2015/863	✓
EU	EU REACH	EU 1907/2006	✓
WW	Responsible Minerals Initiatives		✓
EU	Persistent Organic Pollutants	(EU) 2019/1021	✓
EU	Packaging Directive	94/62/EC	✓
EU	PFOA Free	2006/122/ECOF	✓
US	UL Mark	UL 94-HB	✓
WW	Salt spray	MIL-STD 810F/ASTM B117	✓

The information furnished by Antenna Company and its agents is believed to be accurate and reliable. Responsibility for the use and application of Antenna Company materials rests with the end user since Antenna Company and its agents cannot be aware of all potential uses. Antenna Company makes no warranties as to the fitness, merchantability, or suitability of Antenna Company materials or products for any specific or general uses. Antenna Company shall not be liable for incidental or consequential damages of any kind. All Antenna Company products are sold pursuant to the Antenna Company terms and conditions of sale in effect from time to time, a copy of which will be furnished upon request. All Antenna Company's products are sold pursuant to the Antenna Company's domestic terms and conditions of sale in effect from time to time, a copy of which will be furnished upon request.

Antenna Company is a registered trademark of The Antenna Company International N.V. Other product and brand names used in this document may be trademarks or registered trademarks of their respective owners.

© 2023 Antenna Company. All rights reserved.