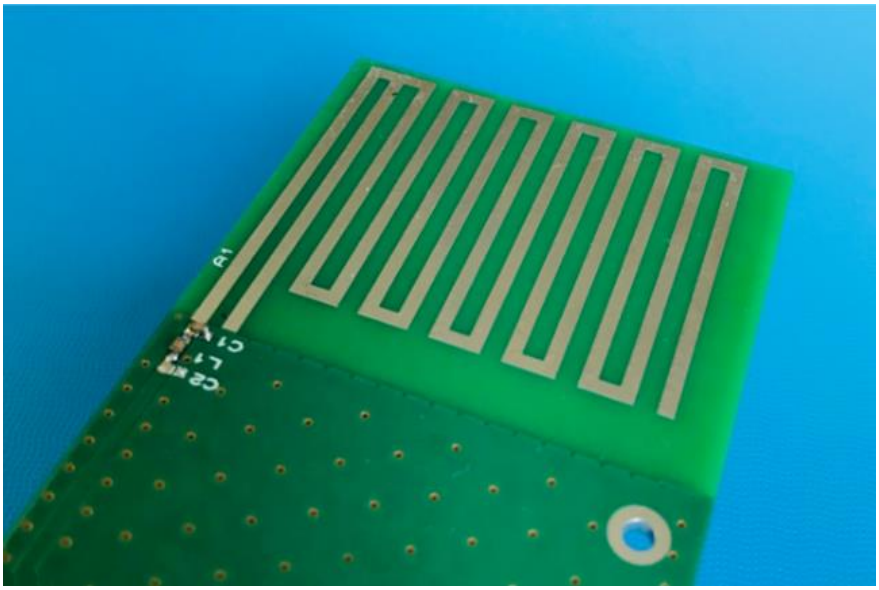
Printed Inverted F antenna

Reference design



Warning: this document presents a reference design and not a commercialized product!

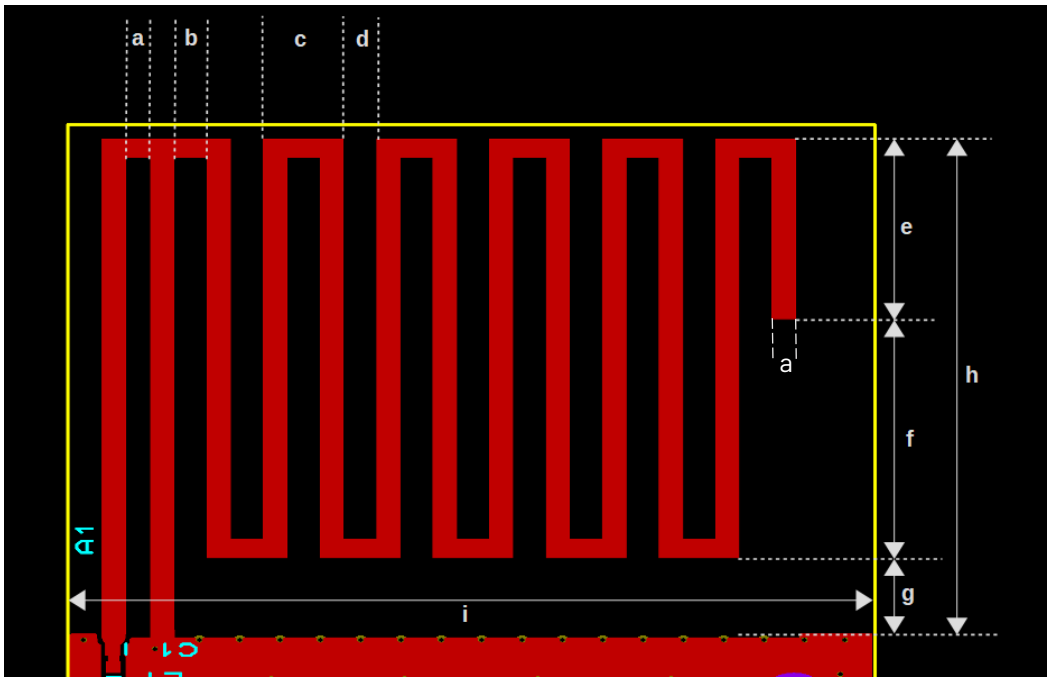
1. Main features

Antenna type	Printed Inverted F Antenna
Size (antenna only)	40mm x 50mm
Other caracteristics	Ultra low cost
	Ultra low profile
	RoHS Compliant

2. Typical performances

Frequency [MHz]	Bandwith @ return loss -10dB	Return loss min. [dB]	Max Gain [dBi]	Impedance [Ω]
401Mhz (Kinéis TX band)	6Mhz	< -15 dB	+ 0,2 dBi	50 Ω

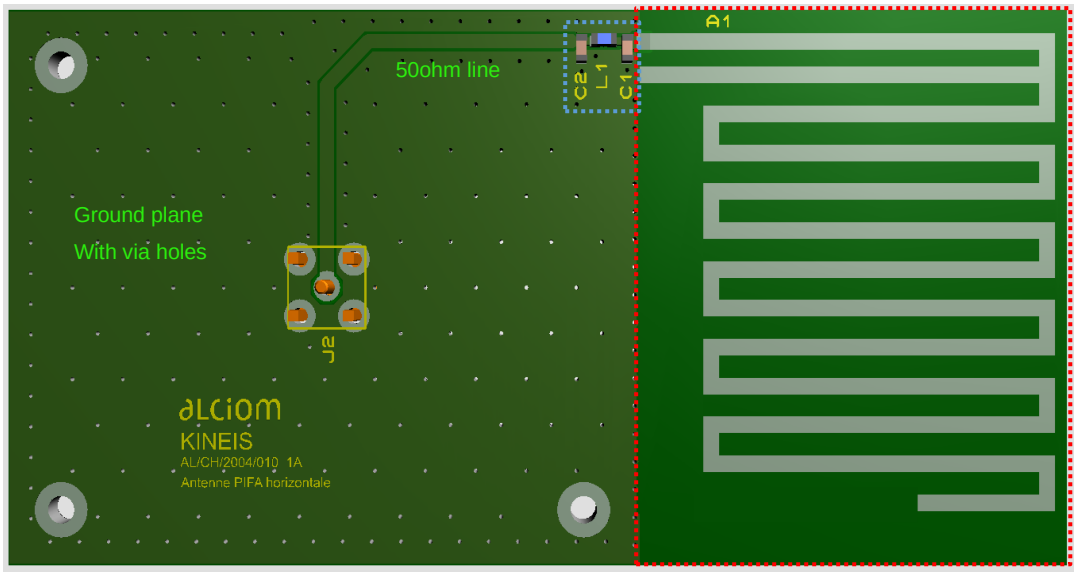
3. Layout reference design



Dimensions in mm

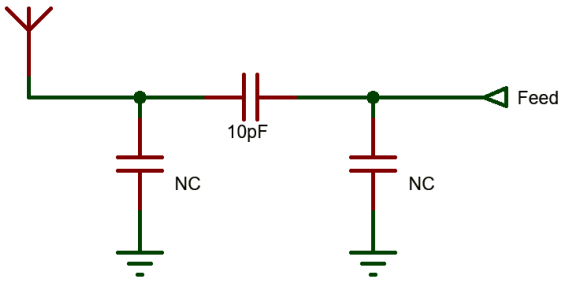
a	b	c	d	e	f	g	h	i
1.5mm	2mm	5mm	2mm	14mm	19.2mm	6mm	39.2mm	50mm

Matching components
Close to antenna



Ground Clearance Area (40 x 50 mm)
all metallization should be removed from all layers

4. Typical tuning and matching circuit

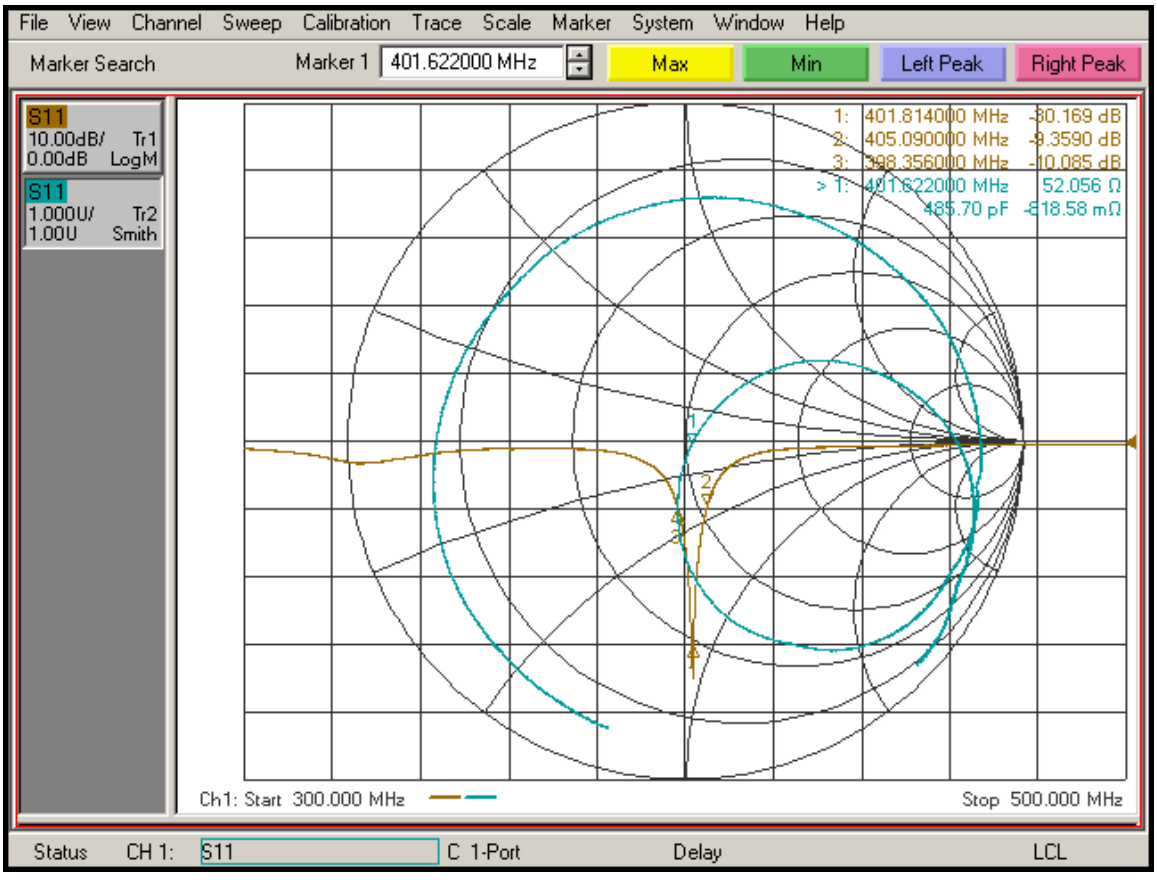


Use of High-Frequency/High-Q Capacitors and inductors is recommended for matching network.

Nota : Calculation and implementation of a specific tuning network is recommended in order to compensate influence of the environment close to the antenna on the application circuit (packaging, circuit formfactor, large component). See general integration guidelines.

5. Typical Return Loss S11

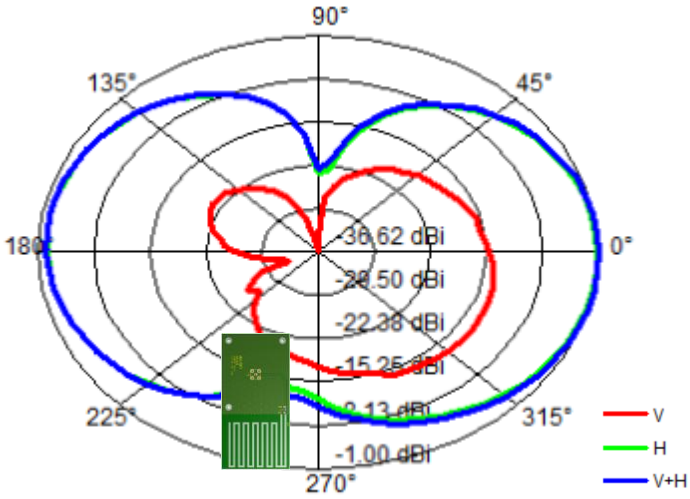
Measured on the 100mm x 50mm test board with tuning and matching circuit



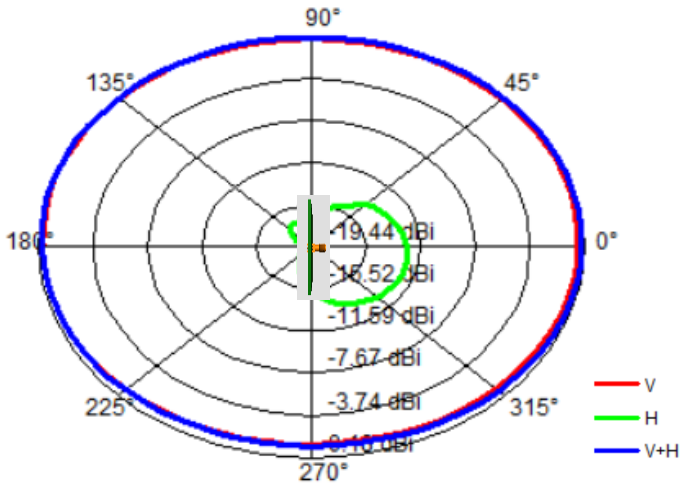
6. Typical Free space Radiation Patterns

Measured on the 100x50mm test board with tuning and matching circuit

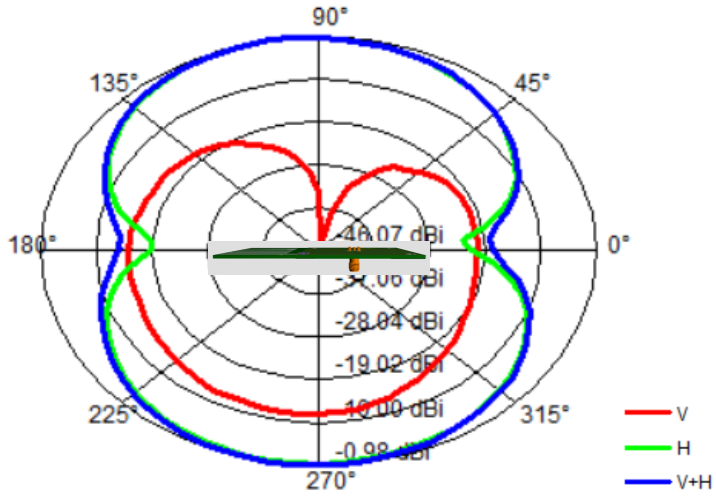
XY-PLANE

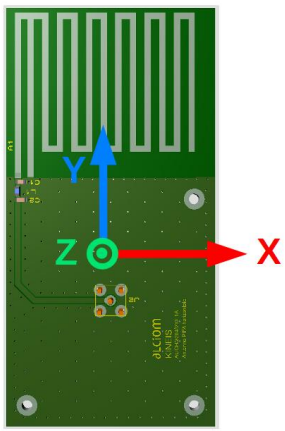


XZ-PLANE



YZ-PLANE





7. General integration guidlines

a. Ground plane dimensions

Dimensions of the ground plane have an impact on the performance of the antenna. It is recommended to use a ground plane whose dimensions are similar to or larger than the dimensions indicated in this document. Use of a smaller area will result in reduced antenna performance.

b. Matching Network

Place 0402 or 0603 SMD footprint for the matching network (Pi network/3 componants), as close as possible to the antenna feed point. Place this matching network in the ground plane area, not in the clearance area. This network will make possible to tune antenna impedance once the design is finished and all the elements of the system (batteries, displays, covers, etc.) are in place.

c. Clearance area and volume

Keep an area free from electronic components, traces (exept antenna trace) and ground plane in all PCB layers of the active part of the antenna (see Layout reference design)

Small components (SMD resistors, capacitors, inductors and integrated circuits) can be placed on the whole surface of the ground plane (on both sides of the circuit)

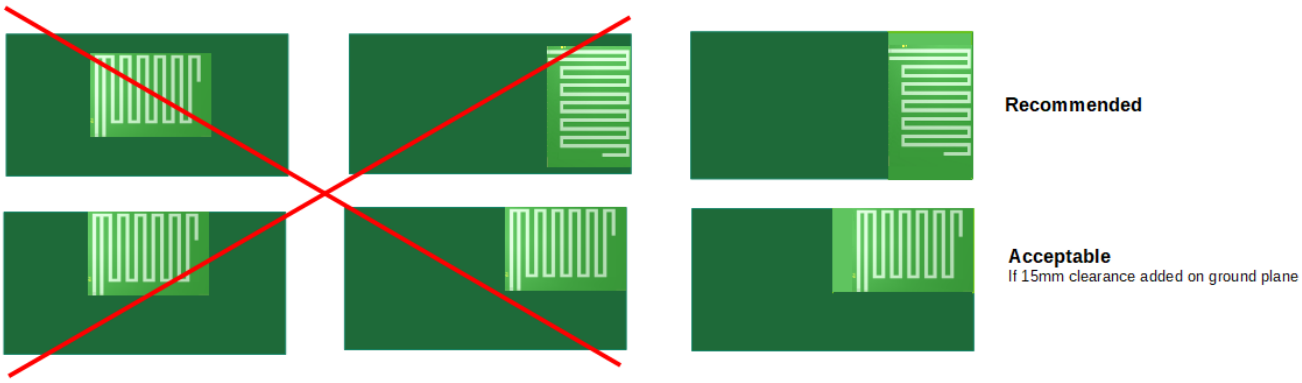
Maximize the volumetric clearance distance between the antenna and the closest mechanic part.

Recommandations :

- no metal part within 20mm of the active part of the antenna (antenna trace)
- no plastic part within 10mm of the active part of the antenna (antenna trace)

Nota : Calculation and implementation of a specific tuning network is recommended in order to compensate influence of the environment close to the antenna on the application circuit (plastic enclosure, circuit formfactor, large component)..

d. Antenna Location



e. Transmission line

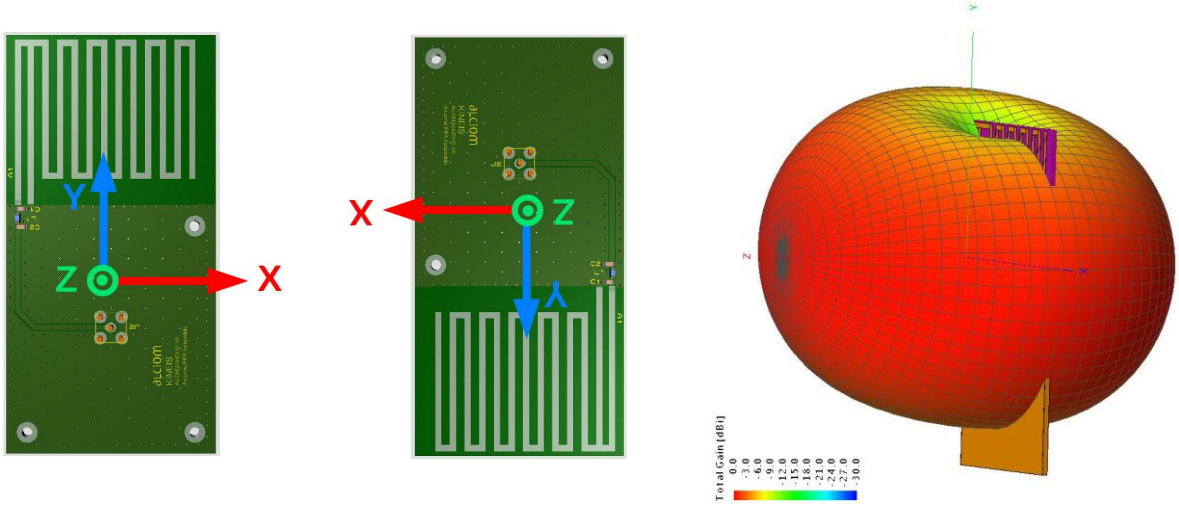
Design transmission line with a characteristic impedance of 50 ohm according to PCB stackup. Locate your RF chip as close as possible to the matching network in order to reduce the losses introduced by the transmission line.

f. Device orientation

In order to perform the most efficient transmissions, a Kinéis device requires an omnidirectional antenna for the following reasons:

- Elevation: the satellites are mostly visible at elevations below 60° with regards to the horizon
- Distance: a satellite is further at the horizon (up to 2400km) and closer at zenith (down to 600km), so an omnidirectional antenna allows to compensate for the distance differences

Considering the radiation pattern, this antenna should thus be oriented vertically along the Y axis to guarantee the best reception by the satellites, as shown below:



8. Additional information

a. Contact and support

Technical support and commercial contacts are available from Kinéis at the following link: https://www.kineis.com/contact/

b. Custom integration

This reference design was developed for Kinéis by Alciom (www.alciom.com)

When integrating this antenna into your device, you may contact Alciom for a potential redesign or customization (ground plane dimensions, matching network, influence of battery and casing…) or for any consulting services by email at contact@alciom.com.

c. Legal notices

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All values written in this document are measured at operating temperature of 20°C and may differ when using a different equipment or setup. Kinéis reserves the right to make changes, corrections, enhancements, modifications, and improvements to this document at any time without notice.