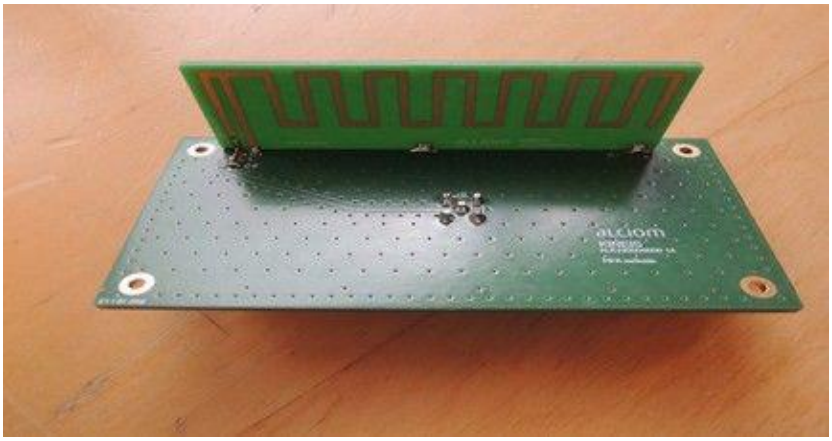
Vertical Printed Inverted F antenna

Reference design



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

1. Main features

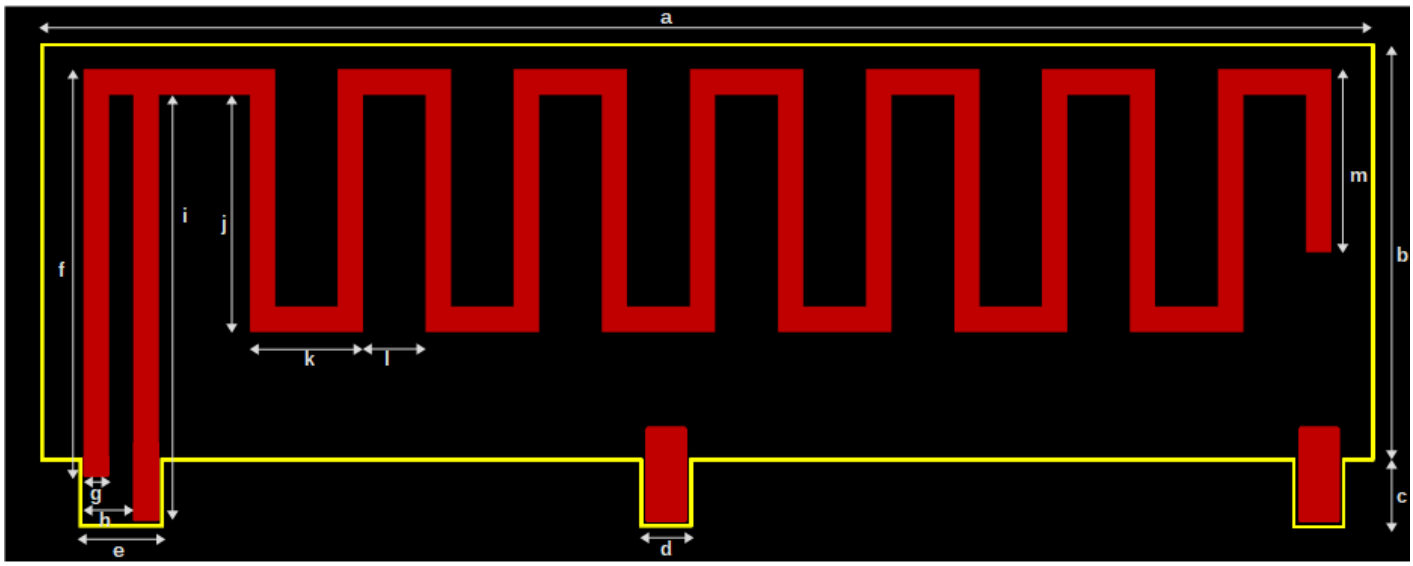
Antenna type	Printed Inverted F Antenna
Size (antenna only)	80mm x 20mm
Other caracteristics	Low cost
	Small PCB footprint
	RoHS Compliant

2. Typical performances

Frequency [MHz]	Bandwith @ return loss -10dB	Return loss min. [dB]	Max Gain [dBi]	Impedance [Ω]
401MHz (Kinéis TX band)	4,5MHz	< -15 dB	- 3 dBi	50 Ω

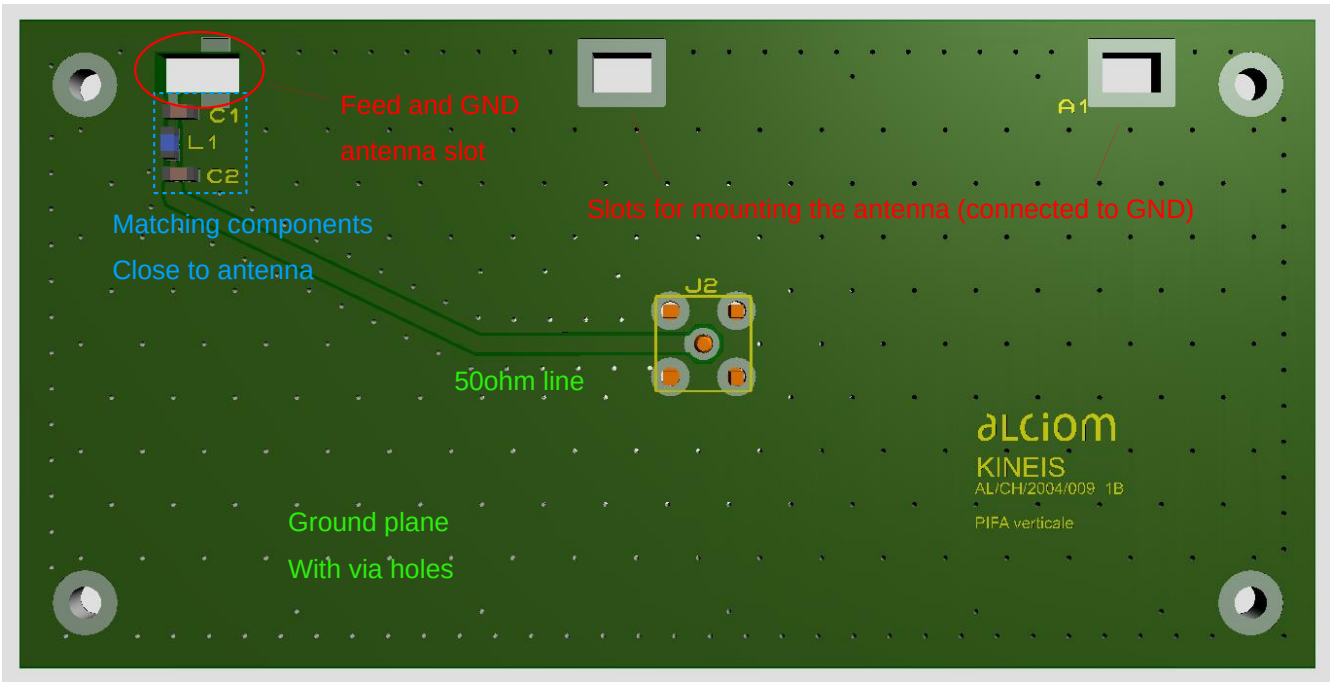
Performances measured on Kineis test board. Size 100x50 mm

3. Layout reference design

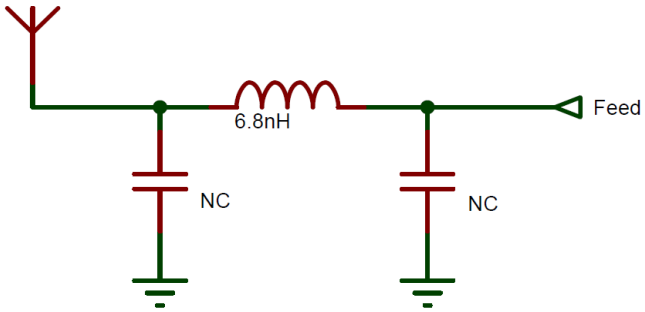


Dimensions in mm

a	b	c	d	e	f	g	h	i	j	k	l	m
80mm	25mm	4mm	3mm	5mm	24.5mm	1.5mm	3mm	25.5mm	14.2mm	6.8mm	3.8mm	13.5mm



4. Typical tuning and matching circuit

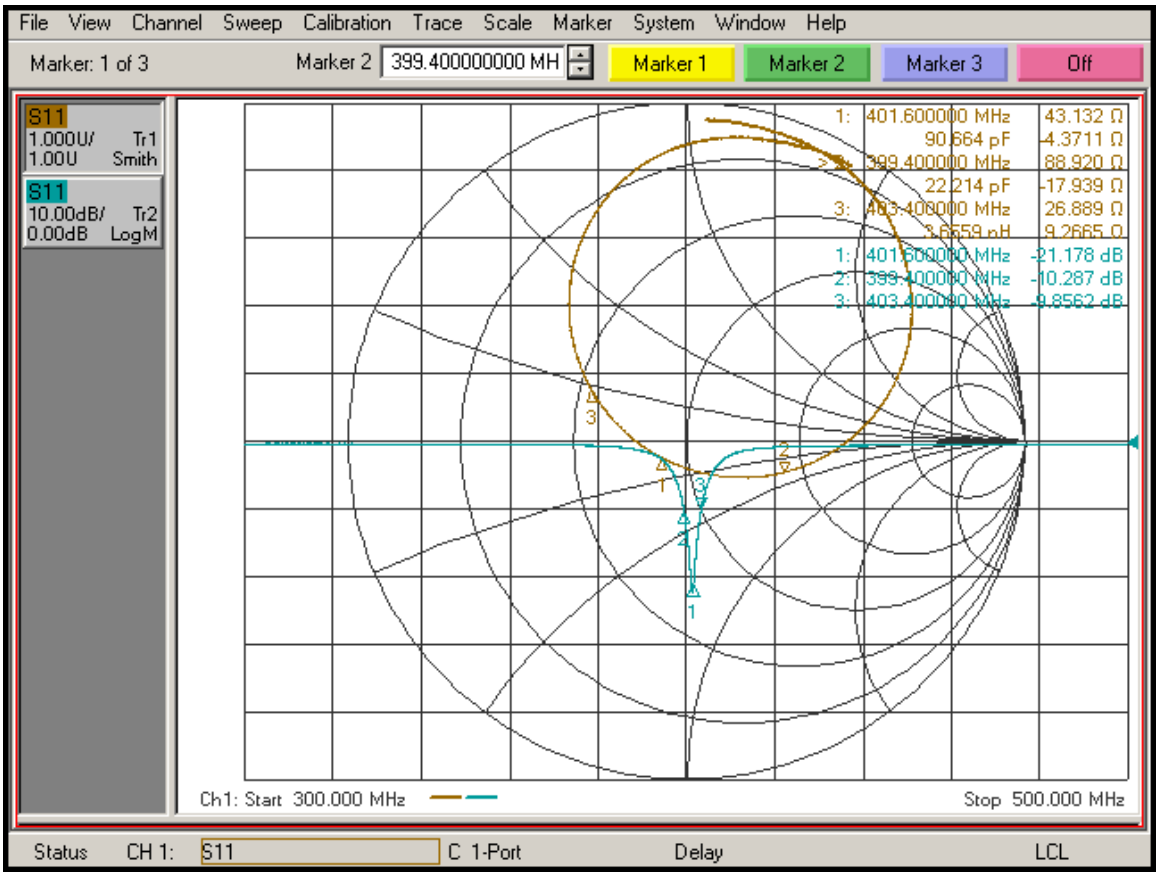


Use High-Frequency/High-Q Capacitors and inductors are recommended for matching network.

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.

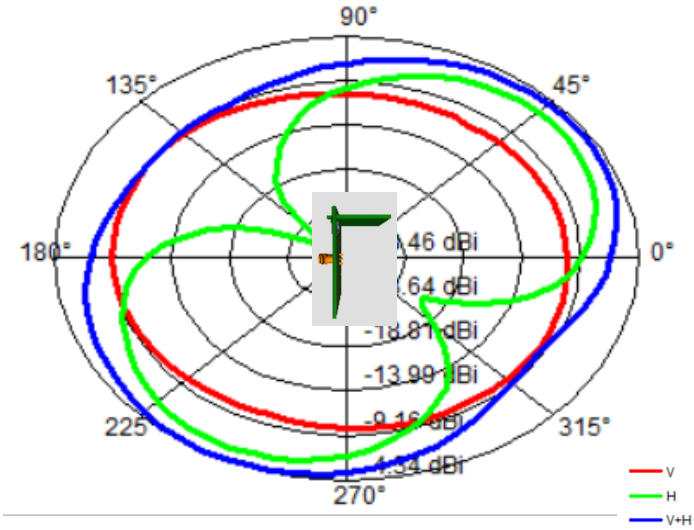
5. Typical Return Loss S11

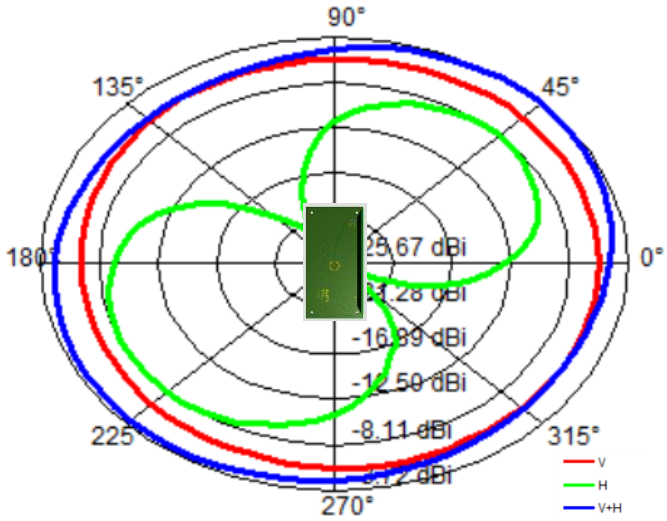
Measured on the 100x50mm test board with tuning and matching circuit

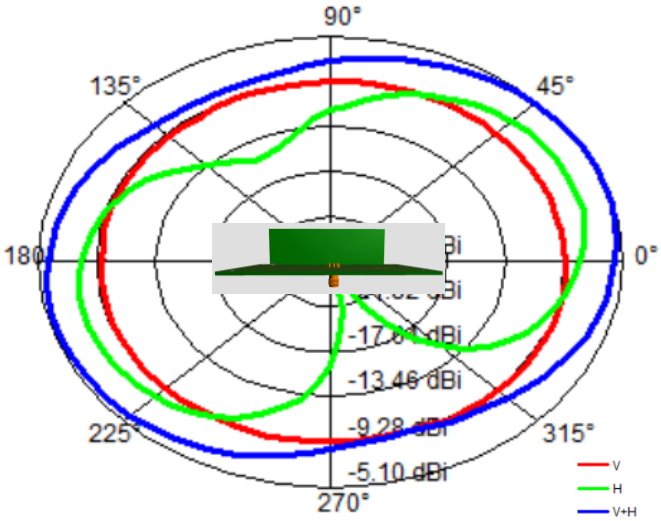


6. Typical Free space Radiation Patterns

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







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 components), 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

Small components (SMD resistors, capacitors, inductors and integrated circuits) can be placed close to the antenna.

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
- no plastic part within 10mm of the active part of the antenna

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. Transmission line

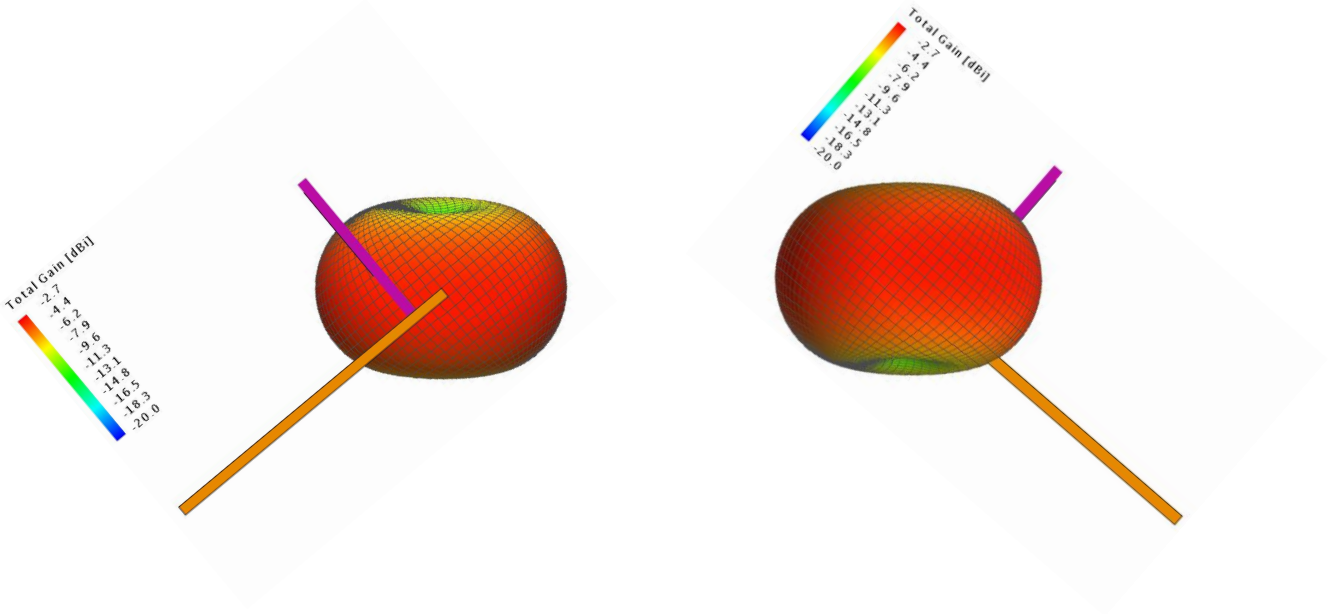
Design transmission line with a characteristic impedance of 50 ohm. Locate your RF chip as close as possible to the matching network in order to reduce the losses introduced by the transmission line.

e. 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 as shown below to guarantee the best reception by the satellites (simulated 3D radiation pattern):



Note: depending on the deployment constraints of the device, orientating the base PCB horizontally and the antenna PCB vertically could also be acceptable but would result in a loss of performances for the satellites passing on one side of the horizon.

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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