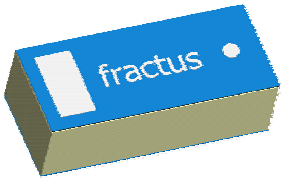
Compact Reach Xtend™
Bluetooth®, 802.11b/g WLAN
Chip Antenna



Antenna Part Number
FR05-S1-N-0-102

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1 Notes

- The antenna product described in this document is protected by at least one of the following Patents and Patent Applications owned by Fractus: **WO0154225, WO0122528, PCT/EP01/10589, PCT/EP02/07837, US60/613394, US60/627653** and **PCT/EP02/07836**.

- The configuration recommended in this document for the Compact Reach Xtend™ chip antenna can be applied to the following proprietary and ZigBee™ ready transceivers and transmitters: CC2400/2420/2430/CC2431/2500/CC2510/CC2511/CC2550/ CC2520/CCZACC06.

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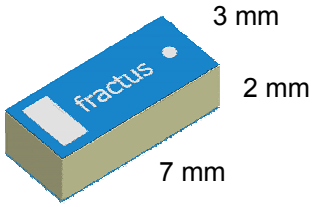
2 Antenna Description

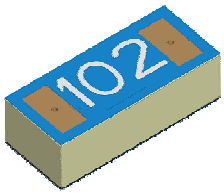
The Fractus® Compact Reach Xtend™ chip antenna is engineered specifically for devices operating at 2.4 GHz. Compact Reach Xtend™ combines small size with high performance to improve the functionality of wireless devices. Chipcon has selected the Fractus 50 Ω single-ended Compact Reach Xtend™ chip antenna to ensure high performance, minimal power consumption, and small dimensions for a USB dongle including the CC2400. Both Chipcon and Fractus have worked together to optimise integration and cost for Chipcon's reference design customers.

The Compact Reach Xtend™ chip antenna uses space-filling properties of fractal technology to minimise its size while maintaining a high radiation efficiency value. This directly impacts antenna reliability in achieving a greater communication range (distance) and in improving battery life. Compact Reach Xtend™ features an omni-directional radiation pattern optimal for highly scattered environments such as indoor environments and public spaces.

The broad bandwidth achieved by the Compact Reach Xtend™ chip antenna allows the flexibility to easily integrate the antenna in many PCB configurations independently of the plastic housing and electronic components surrounding the antenna.



Front



Back

BENEFITS

- High efficiency
- Small form factor
- Cost-effective
- Small clearance needed
- Easy-to-use

QUICK REFERENCE GUIDE*

Frequency range	2400-2500 MHz
Radiation Efficiency	> 50%
Peak Gain	> 0 dBi
VSWR	< 2:1
Polarization	Linear
Weight	0.1 g
Temperature	-40 to + 85ºC
Impedance	50Ω
Dimensions	7x3x2 mm

(*) Results measured on a USB dongle including the CC2400 (50x15mm).

Please contact your sales representative at Richardson Electronics if you require additional information on antenna integration or optimisation on your PCB.

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3 Antenna Performance

This section provides integration and mounting recommendations for the use of the Compact Reach Xtend™ Chip Antenna within the CC2400 USB dongle. Compact Reach Xtend™ has been designed to purposely minimise product integration efforts and optimise device performance.

This Application Note provide you with both the performance of the USB dongle with standard plastic housing and the PCB details necessary to implement the antenna on a client's board.

3.1 VSWR & Radiation Efficiency

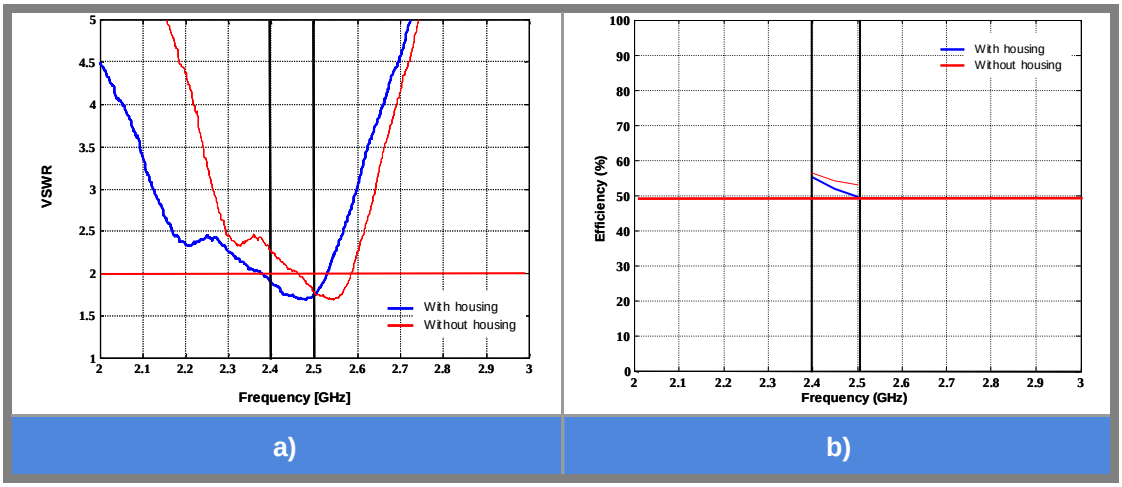


Figure 1: Electrical Performance of Compact Reach Xtend™ on TI's CC2400 USB Dongle a) VSWR and b) Radiation efficiency

Without the need of any matching network the Compact Reach Xtend™ chip antenna achieves VSWR<2 within the ISM 2.4 GHZ band on the CC2400 USB Dongle. That ensures at least 90% of the power to be delivered to the antenna and thus minimizes a) battery consumption at both sides when used in battery-operated applications (e.g. Laptops and wireless keyboard & mouse) and b) BoM cost. In addition to that, the bandwidth for which VSWR<2.5 reaches 400 MHz, which allows flexibility to adapt the antenna to different PCB and plastic housing configurations.

Based on our experience, Fractus recommends to use plastic housing of conventional ABS material to be implemented no closer than 2mm from the top part of the antenna and 2mm also from the PCB bottom side (configuration used for measurements in figure 1).

More than 50% of the power delivered to the antenna is being transmitted to the free space. This is a very high value that will increase communication reliability and prolong the battery life of e.g. a wireless keyboard and mouse.

3.2 Radiation Pattern

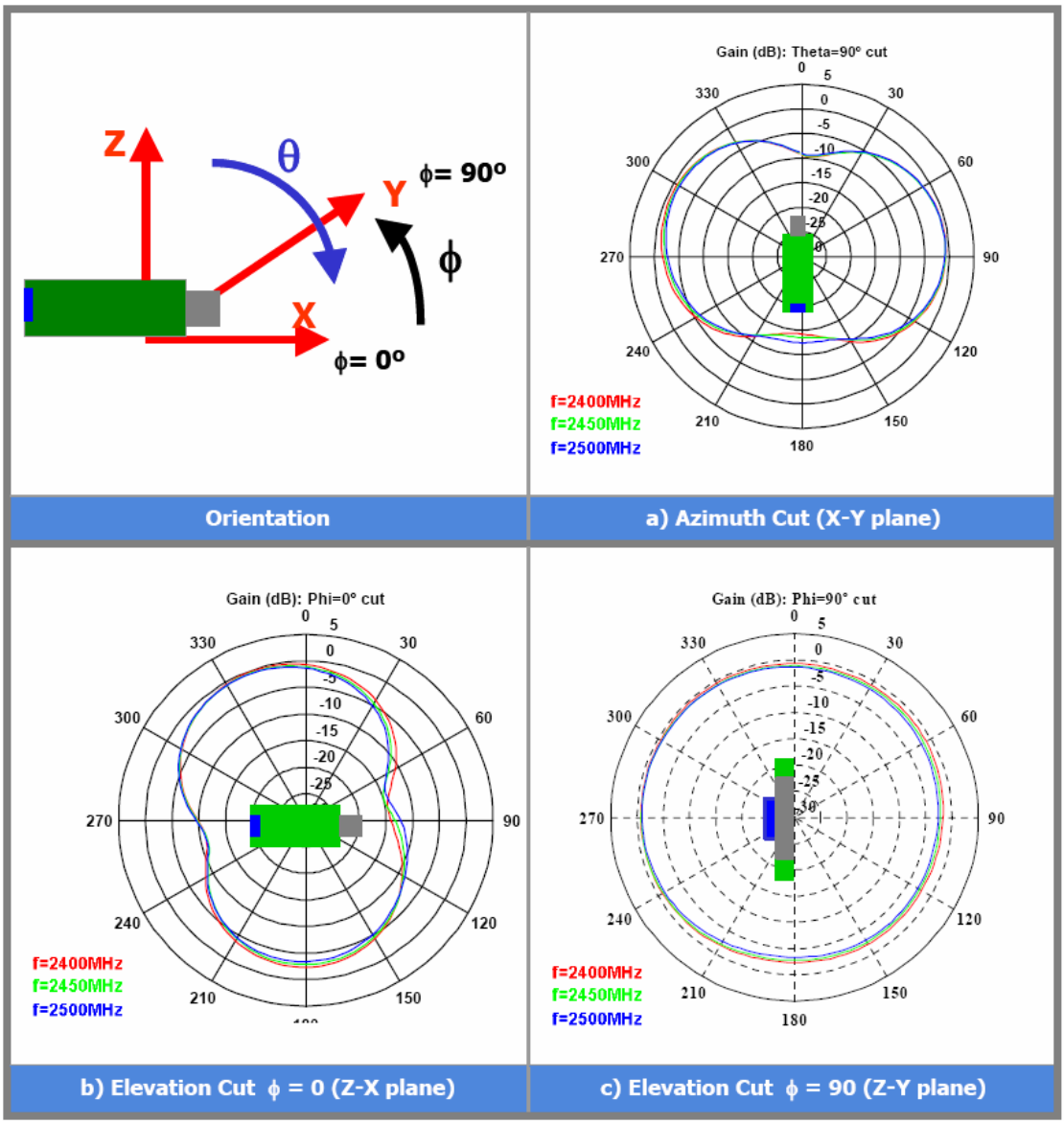
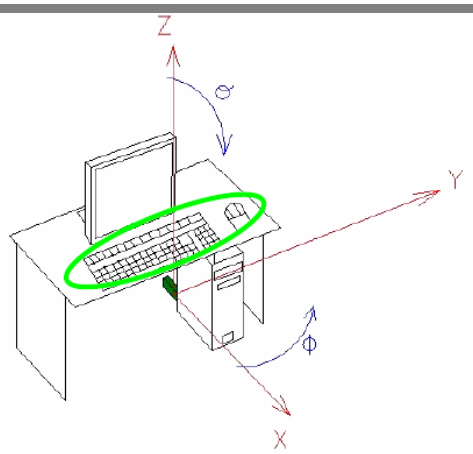


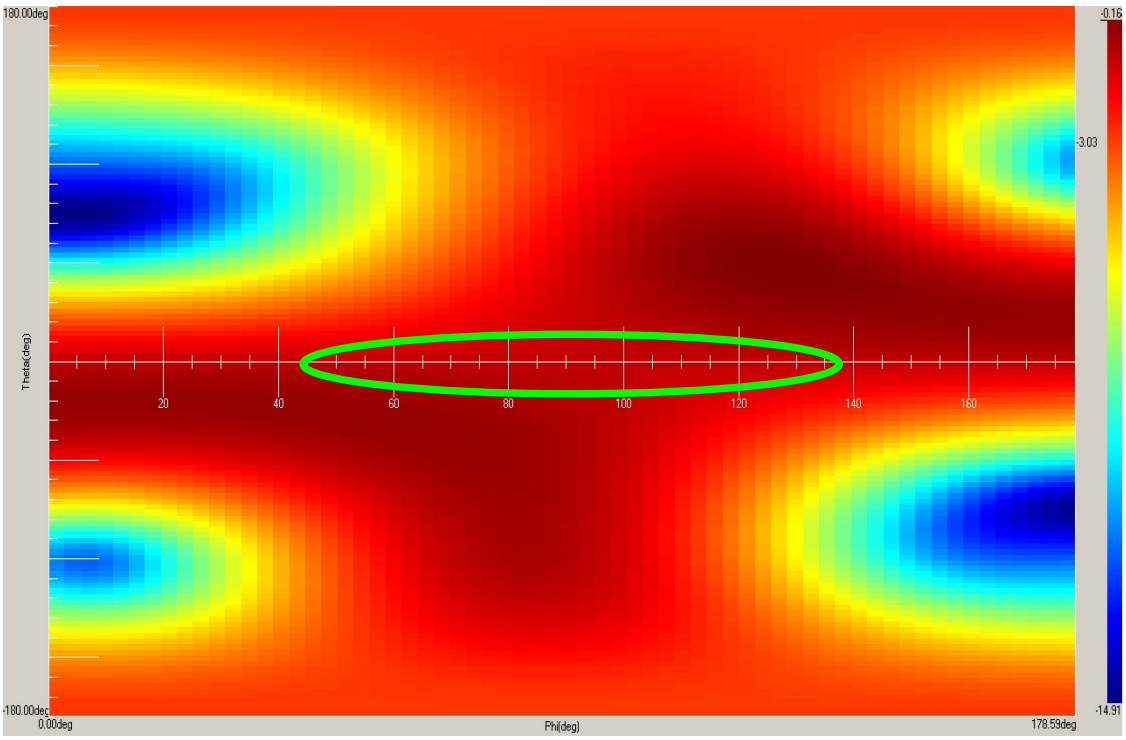
Figure 2: Radiation Pattern for Azimuth (a) and Elevation Cuts (b and c)

3.3 Gain



In conventional configurations, a USB device will typically be connected to a PC standing on the right side of user's feet (below table). In such case, both a wireless keyboard and mouse will be located at Theta=0º and Phi ranging from –45º to +45º.

The Compact Reach Xtend™ chip antenna used in the CC2400 USB Dongle achieves very high gain values (green circle on left side picture) [0dBi, -0,5 dBi], which will increase link reliability and maximise data transfer success.

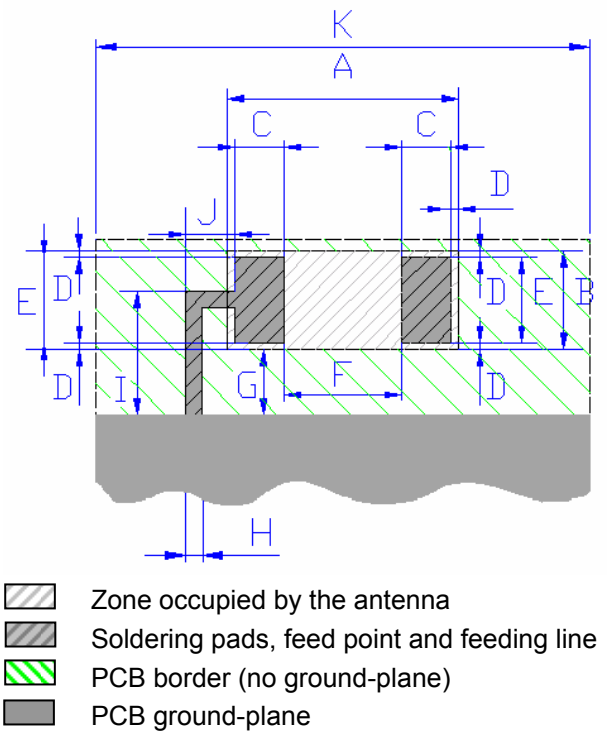


Phi (ϕ)

Figure 3: Gain [dBi] Projected in 2D Plot from a 3D Measurement

4 Mechanical Characteristics

4.1 PCB Footprint Details



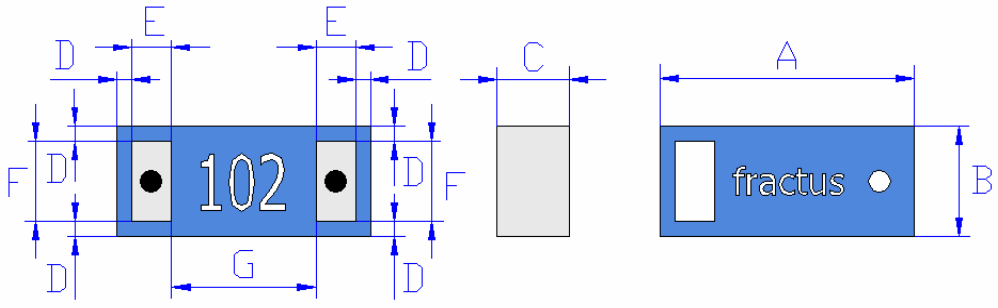
All dimensions listed in millimetres.

Letter	Meas.
A	7.00
B	3.00
C	1.50
D	0.20
E	2.60
F	3.60
G	2.00
H	0.50
I	3.75
J	1.50
K	15.00

Figure 4: Footprint Details on the CC2400 USB Dongle

Fractus can support customisation of this PCB footprint for your specific device needs and optimise the antenna performance within your specific device.

4.2 Dimensions and Tolerances



Back Side **Front Side**

A	7.000 ± 0.200	E	1.100 ± 0.015
B	3.000 ± 0.200	F	2.200 ± 0.015
C	2.000 ± 0.200	G	4.000 ± 0.015
D	0.400 ± 0.015		

All dimensions are in millimetres (mm)

The white rectangle located on the front side of the antenna provides you with a visual cue to mount the antenna. It is located physically above the feed point of the antenna and has been included to reduce probability of manufacturing error.

Figure 5: Antenna Dimensions and Tolerances

4.3 Assembly Process

Figure 6 shows a backside view of the Compact Reach Xtend™ chip antenna and the location of the feeding point and the mounting pad:

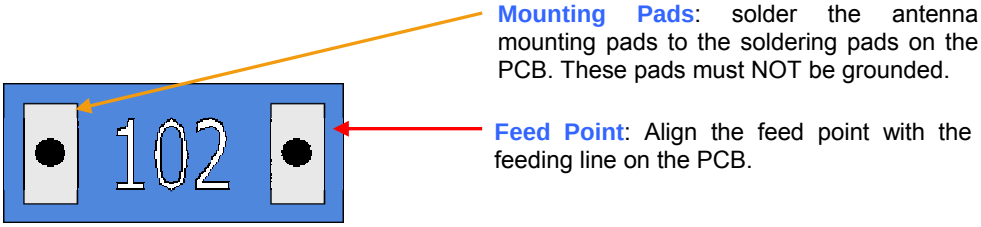


Figure 6: Back Side View of the Compact Reach Xtend™ Chip Antenna

Being a surface mount device (SMD), the basic assembly process flow for this antenna is as follows:

1. Apply a solder paste on the mounting pads of the PCB. Place the antenna on the board.
2. Perform a baking process. In the case that a simultaneous reflow for double-sided surface mounting or flow soldering is required, use a temporary adhesive to affix the antenna to the PCB before soldering.
3. After soldering (*) the antenna to the circuit board, perform a cleaning process to remove any residual flux. Fractus recommends conducting a visual inspection after the cleaning process to verify that all reflux has been removed.

The drawing below shows the soldering details obtained after a correct assembly process:

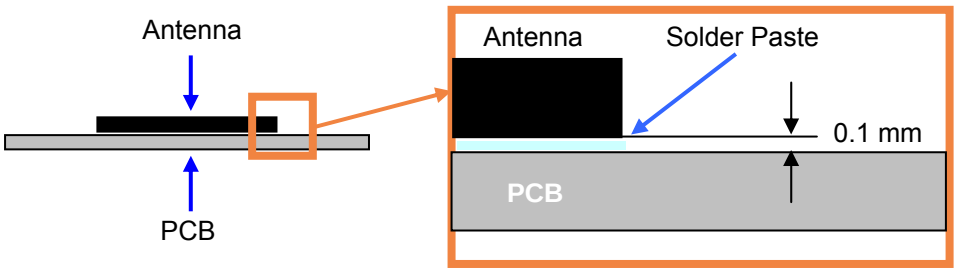


Figure 7: Soldering Details

The recommended solder reflow temperatures given below follows the IPC/JEDEC J-STD-020C standard:

	Stage	Temperature Range (C°)	Time Appliance Recommended (sec)	Maximum Time Appliance (min)
1	Initial pre-heating	25 - 150	90	4
2	Soak	150 - 180	60 – 90	2
3	Reflow	180 - 235	30 - 60	2
4	Cooling down	180 - 25	N/A	N/A

(*) Notice that Compact Reach Xtend™ can be soldered following a Pb-free (RoHS) compliant process.

4.4 Packaging

The Compact Reach Xtend™ chip antenna is available in tape and reel packaging.

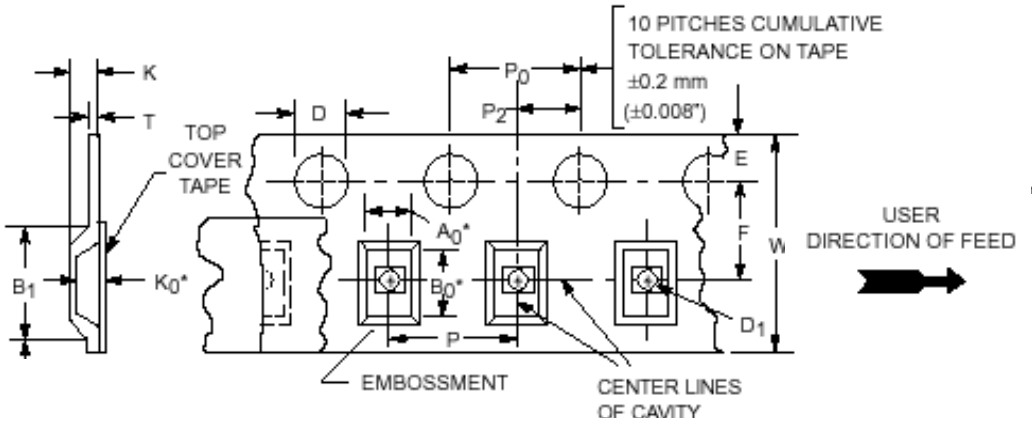
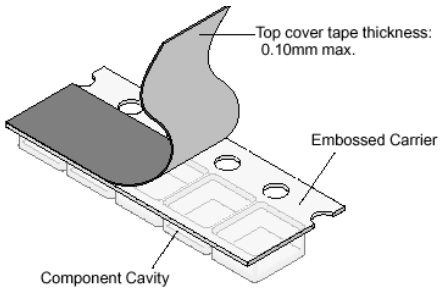
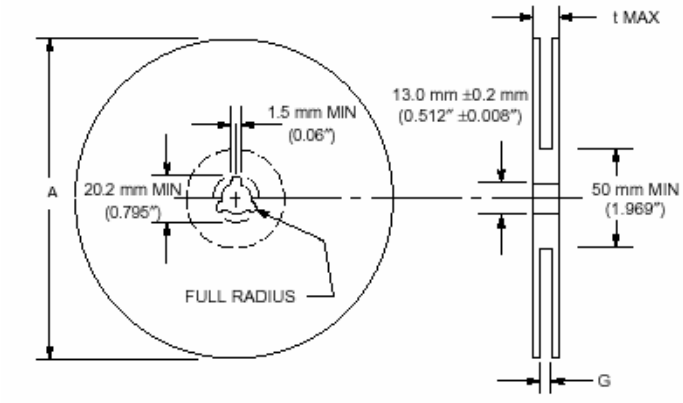


Figure 8: Tape Dimensions

TAPE SIZE	12	Wmax	16.3
A0	3.5	E	1.7
B0	7.4	F	7.5
K0	2.0	K	2.4 max
B1	8.2 max	P	8.0
D	1.5	P0	4.0
D1	1.5 min	P2	2.0

All dimensions are in millimetres (mm)





A max	330
G	16.4
t max	22.4

All dimensions are in millimetres (mm)

Reel Capacity: 2500 antennas.

Figure 9: Reel Dimensions and Capacity

5 General Information

5.1 Document History

Revision	Date	Description/Changes
SWRA092B	2008-02-27	Added reference to CCZACC06 and CC2520
SWRA092A	2007-04-25	Cosmetic changes. Added Important Notice
SWRA092		Initial release

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