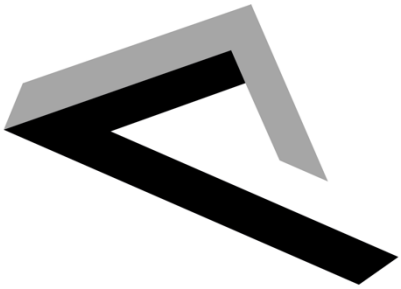

CONTINUUMBRIDGE

Range Tests of the Cascoda CA-8210

2nd January 2018

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1 Method

The CA-8210 range was tested using two Imagination Technologies' Ci40 Creator IoT development boards running IEEE802.15.4 and an OpenThread software stack. A ping test was run between the two boards using the standard script supplied with the board software. There was no means of measuring RSSI so the two boards were considered to be in range if a ping succeeded within 30 seconds of starting the test and failed if this was not the case. (It was subsequently found that the software on the Ci40 boards did not implement Thread re-transmission, so if anything this gave a slightly pessimistic coverage indication).

Tests were performed both within the 16th floor of an apartment block in London (Metro Central Heights north block) and with a fixed radio (the base station) in the same location in Metro Central Heights and a mobile radio outside. The figure below shows the location of the base station taken from the furthest point of coverage.

Figure 1. Location of Base Station Viewed from Further Point of Coverage

2 Results

2.1 Indoor Tests

These were conducted in the same locations that tests with other radios had been conducted in the past. The radios previously used were:

1. Bluegiga “long range” Bluetooth. This is a Bluetooth radio with a greater sensitivity than standard Bluetooth.
2. Texas Instruments’ Bluetooth SensorTag, generation 1.
3. Texas Instruments’ Bluetooth SensorTag, generation 1.
4. LPRS eRIC radio module based on a TI CC430F5137, operating in the 868 MHz band with a 7 dBm transmit power and a theoretical -109 dBm sensitivity.
5. WiFi. This is from a standard router supplied by an ISP. Coverage is based on whether a laptop was able to display the SSID.

The table below gives the results.

Location	Distance	Bluegiga (dBm)	SensorTag 1 (dBm)	SensorTag 2 (dBm)	TI 868 MHz	CA-8210	WiFi
Desk	0.5 m	-53	-60	-60	Pass	Pass	Pass
Far end bedroom	8 m, 2 walls	-75	-86	-80	Pass	Pass	Pass
Landing, outside door	7 m, 2 doors	-79	-90	-86	Pass	Pass	Pass
Electricity cupboard	13 m, 3 doors	-81	No signal	-90	Pass	Pass	No signal
In front of mid-corridor door	30 m, 3 doors	-84	No signal	-90	Pass	Pass	No signal
Far end of corridor	40 m, 4 doors	-90	No signal	No signal	Pass	Pass	No signal
Far end of corridor around corner	50 m, 4 doors	No signal	No signal	No signal	No signal	Pass	No signal
Behind lifts	10 m, metalwork	-93	No signal	No signal	Pass	Pass	No signal
1 Floor Below	10 m	No signal	No signal	No signal	Pass	Pass	No signal
2 Floors Below	15 m	No signal	No signal	No signal	Pass	Pass	No signal

Figure 2. Results of Indoor Tests

The satellite image below, from Google maps, shows the location of the base station and the location of the furthest point of coverage (“far end of corridor around corner”). The locations are indicated by the white dots inside black circles, highlighted with red arrows.

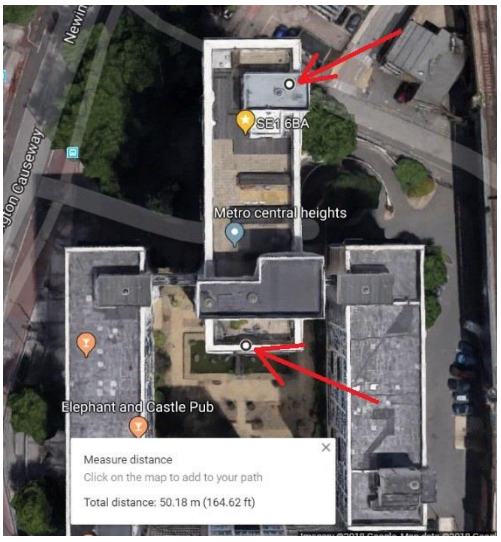

Figure 3. Satellite Image Showing Indoor Test Locations

2.2 Outdoor Tests

The base station was placed at the location shown in Figure 1. Figure 4 shows the location of the board viewed from inside the window.

The mobile station was taken outside and measurements made in various locations. The right-hand arrow in Figure 4 shows the location at which furthest line of sight coverage was obtained. This is illustrated in the map in Figure 5, which shows that the distance was measured as approximately 235 metres. The base station is located approximately 50 metres above the ground.

Coverage was also obtained approximately 20 metres inside the shopping centre door indicated by the left-hand arrow in Figure 4. The location of the shopping centre door is shown in the map of Figure 6 and Figure 7 is taken from the further point inside the shopping centre where coverage was obtained. It can be seen from this that there is no line-of-sight path to the base station.

Both these outdoor locations are almost the same as were obtained using the TI 868 MHz radio on a previous occasion. No Bluetooth or WiFi signals were detected outside the building at all.

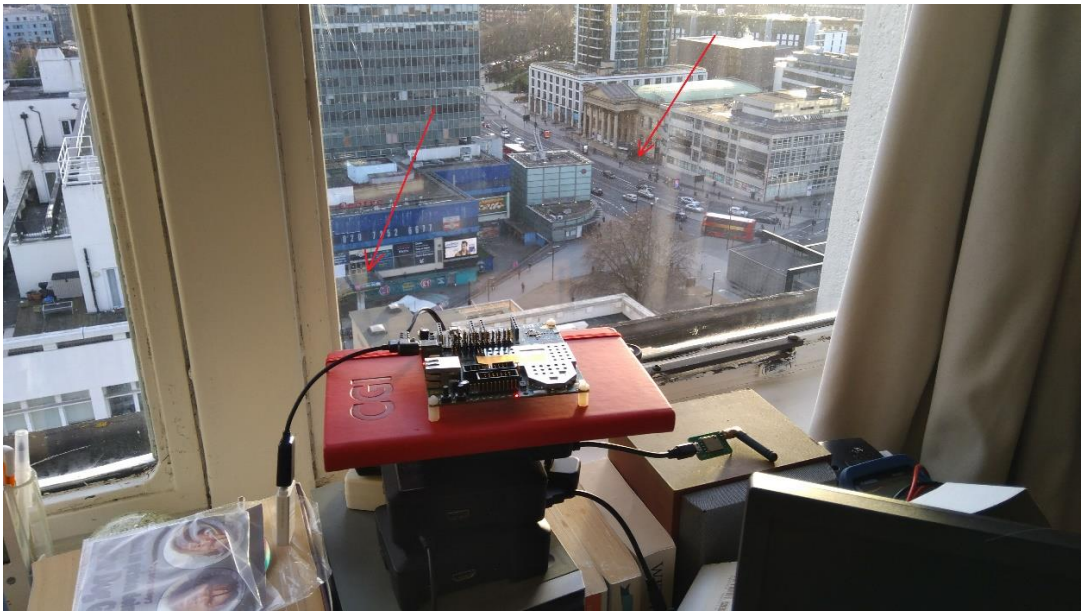

Figure 4. Base Station Location Viewed from Inside Window

Figure 5. Furthest Line of Sight Coverage

Figure 6. Shopping Centre Location

Figure 7. Shopping Centre Indoor Coverage

3 Conclusions

The CA-8210 radio on the Imagination Technologies' board gives excellent coverage. These result support previous results obtained by Cascoda (1 Km range outside). It should be remembered that the outside tests were performed with the base station board inside a window with a metal frame, which would be expected to lead to several dB path loss (see https://www.ofcom.org.uk/__data/assets/pdf_file/0016/84022/building_materials_and_propagation.pdf). In addition, coverage was obtained in the shopping centre through closed doors, which would lead to additional path loss. Indoor coverage was obtained either through reflections around bends in corridors or through penetration of multiple metallised plaster board walls or through lift shafts.

The fact that coverage is similar to that obtained with the TI chip operating at 868 MHz shows remarkable performance. The indoor tests are of particular interest, because they show a range of 45 metres through multiple doors and walls. This indicates the practicality of directly covering the whole floor of most modern office buildings from a single point in a service duct without the need to form a mesh, which is important in applications where all the devices in a network are battery-powered sensors (Thread sleepy end devices), which is ContinuumBridge's main use case.

The range of the CA-8210 was shown to be better than a the typical residential WiFi router that is was compared against. In theory, the CA-8210 should provide comparable range to WiFi. Although no technical details of this specific WiFi router are known, it does seem to have comparable coverage to other WiFi routers in the same building. This certainly indicates that the CA-8210 is likely to provide coverage that is somewhat better than typical WiFi routers.