



## Nokia Wrist Attached Sensor Platform

### Wrist Unit Assembly Instructions

Tom Ahola 2009-02-23  
Copyright © 2009 Nokia Corporation

#### Contents

1.	Bluetooth antenna and keypad .....	3
2.	Battery holder .....	4
3.	Charger connector.....	5
4.	Top cover assembly .....	5
5.	Attaching the display .....	11
6.	Attaching the electronics to the top cover .....	13
7.	Attaching vibra, charger wire and power switch.....	15
8.	Closing the covers.....	18
9.	Flashing and testing .....	19
10.	Troubleshooting .....	21

## Introduction

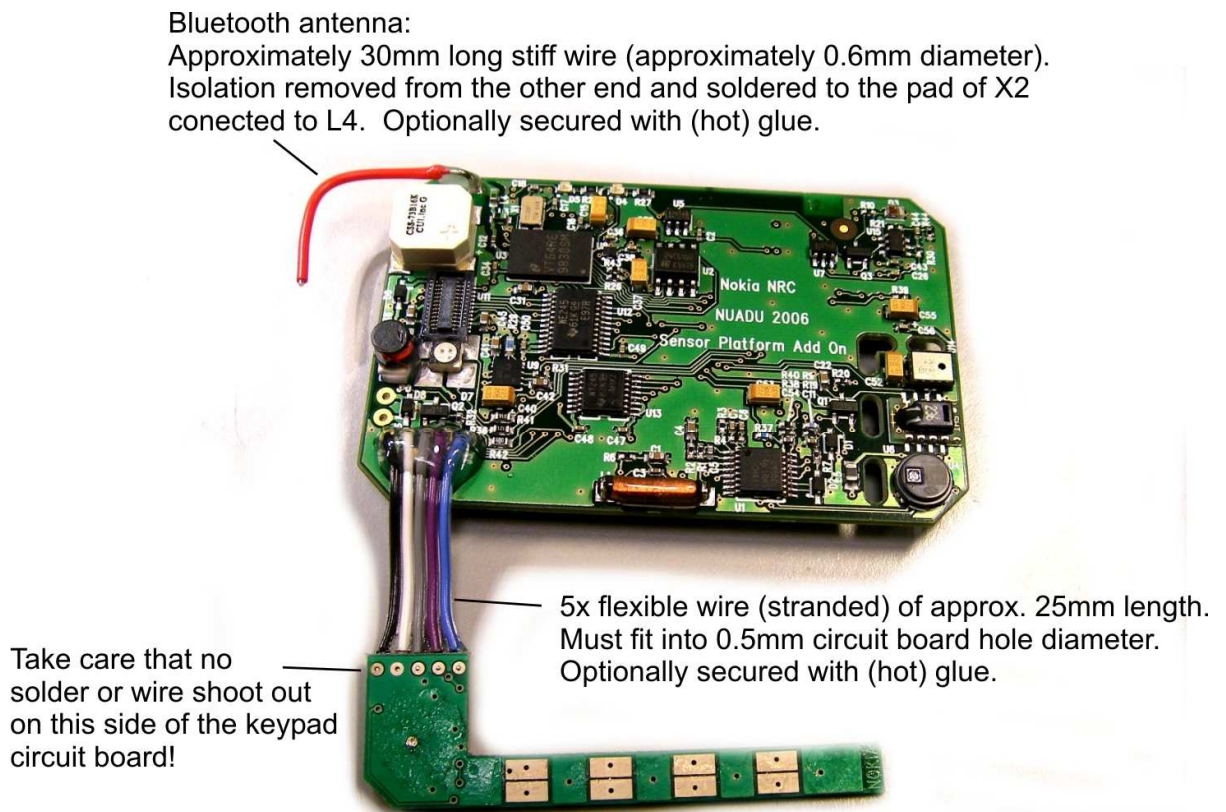
This document describes the construction of the wearable wrist unit (WU) sport version (2009) of the Nokia Wrist Attached Sensor Platform (NWSP). Figure 1 shows the complete assembled unit. There are several improvements compared to the previous version of the wrist unit. Now there is a socket for flash programmer accessible without opening the device. Also, there is a socket for standard Nokia charger so no charger dock is needed anymore. Power switch is now accessible with fingers. Bigger grids have resulted in louder audio. Lastly the mechanics manufacturing is much cheaper.



Figure 1 NWSP Development Platform Wrist Unit Assembled and Operating

## 1. BLUETOOTH ANTENNA AND KEYPAD

Start by attaching the Bluetooth antenna and touch keypad to the add-on board as shown in Figure 2. The wires for the keypad can be a piece of ribbon cable or separate wires. For the wrist unit the length of the cable/wires can be 20-25mm. Too long wires will be difficult to fit into the casing. The keypad circuit board will be glued to the cover so there must not be anything (glue, solder, wires) shooting out to the flat side of the board. The wires don't have to be inserted into the holes but can be soldered to the surface only. The wires should be connected so that each one of the five pads on the keypad board are connected to each one of the pads on the add-on board in order with the orientation of boards shown in the figure. Glueing of the wires is optional but recommended to make the connections more robust.



**Figure 2 Attaching the Bluetooth antenna and touch keypad to the add-on board.**

## 2. BATTERY HOLDER

Screw the battery holder to the SP circuit board with three screws as shown in Figure 3. Note that if using the original PDP battery holder there must be a small slot made for the power switch. A knife, dremel or file can be used to do this.

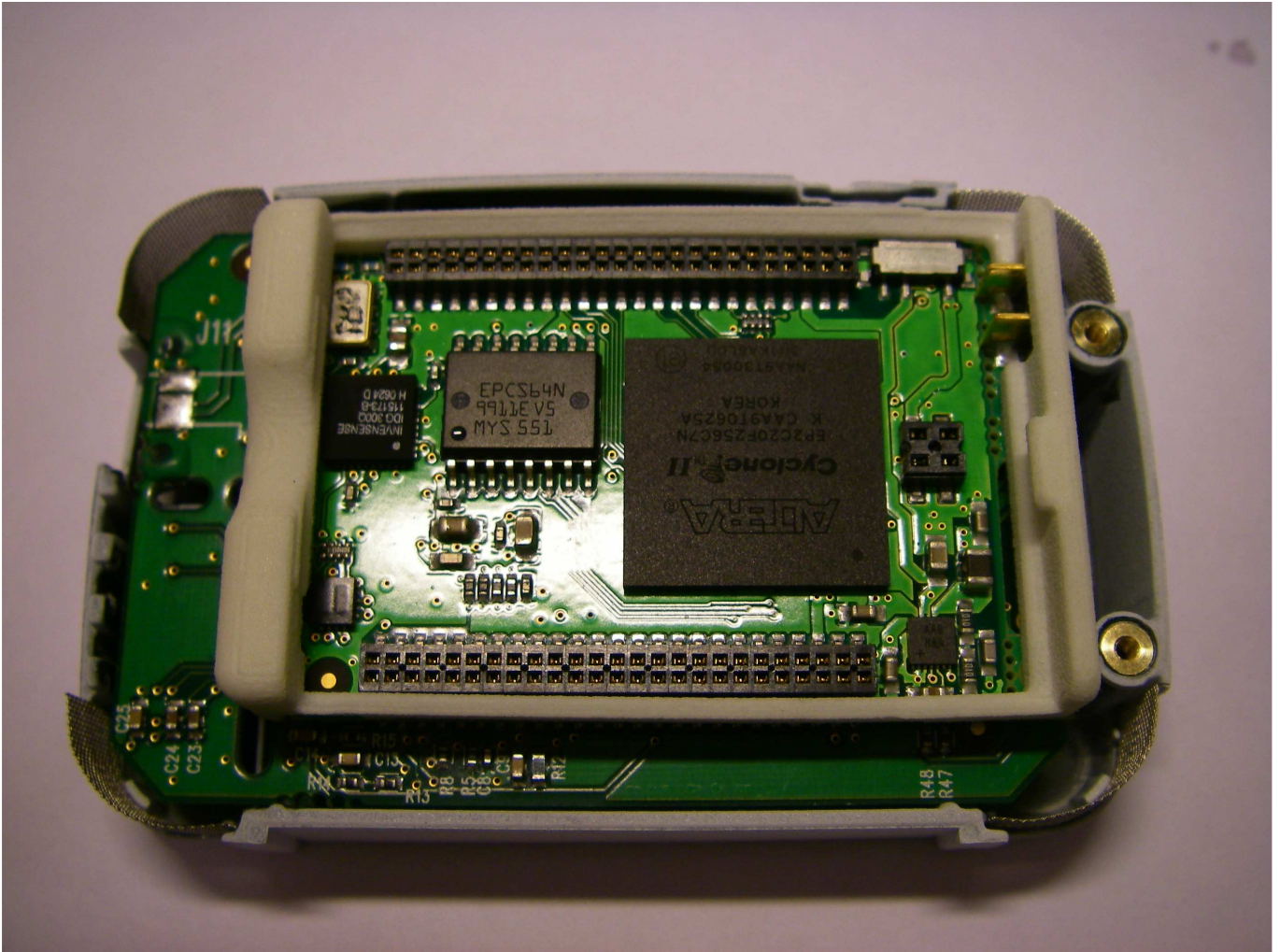


Figure 3 Battery holder is screwed to the SP board with three screws.

### 3. CHARGER CONNECTOR

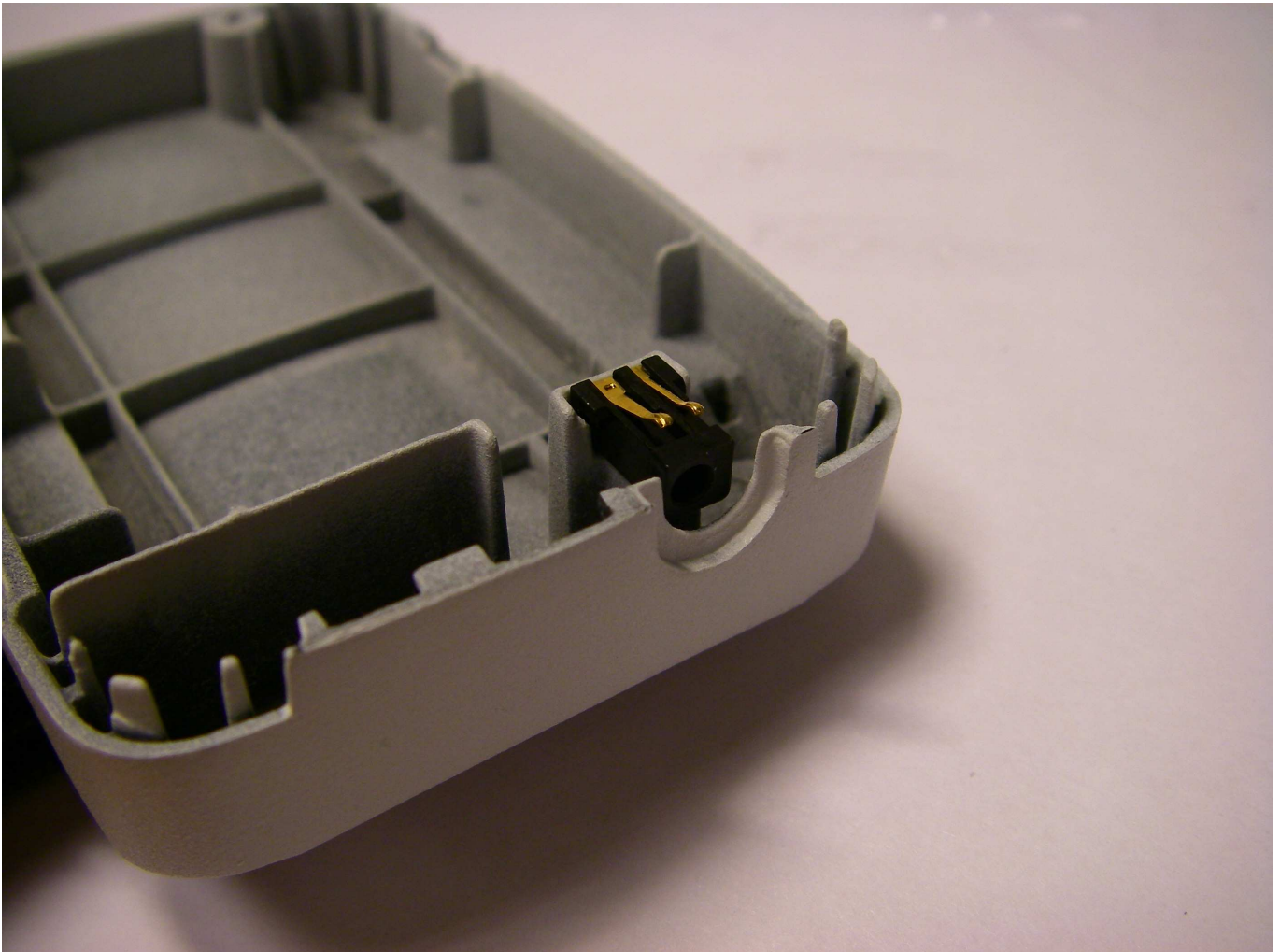
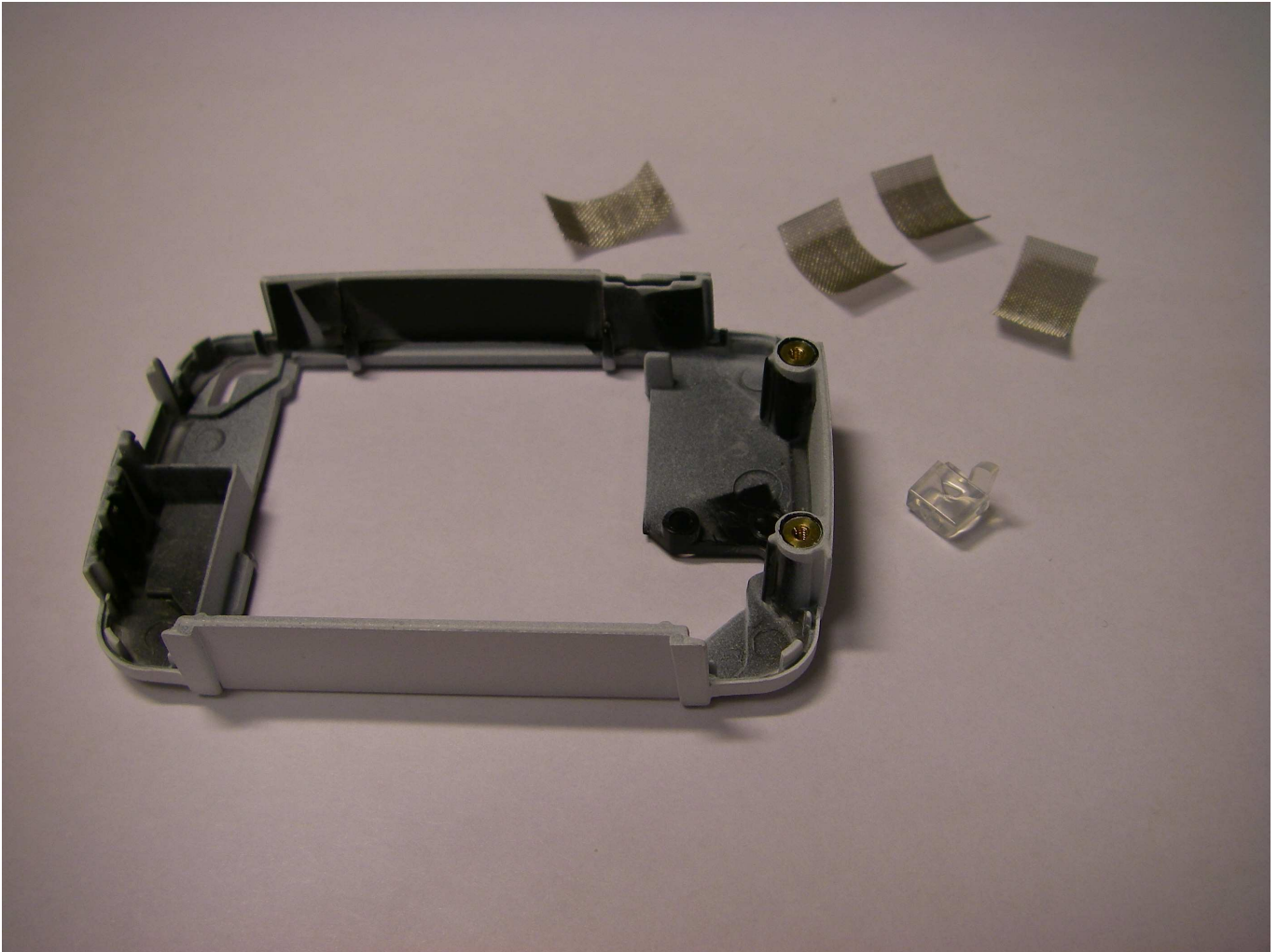


Figure 4 Glue the charger connector in place as shown in the picture. Take care to press it all the way down against the supports beneath.

### 4. TOP COVER ASSEMBLY



**Figure 5** For the top cover four steel grids and two transparent light guides are needed. Slightly bend the grids before assembly.

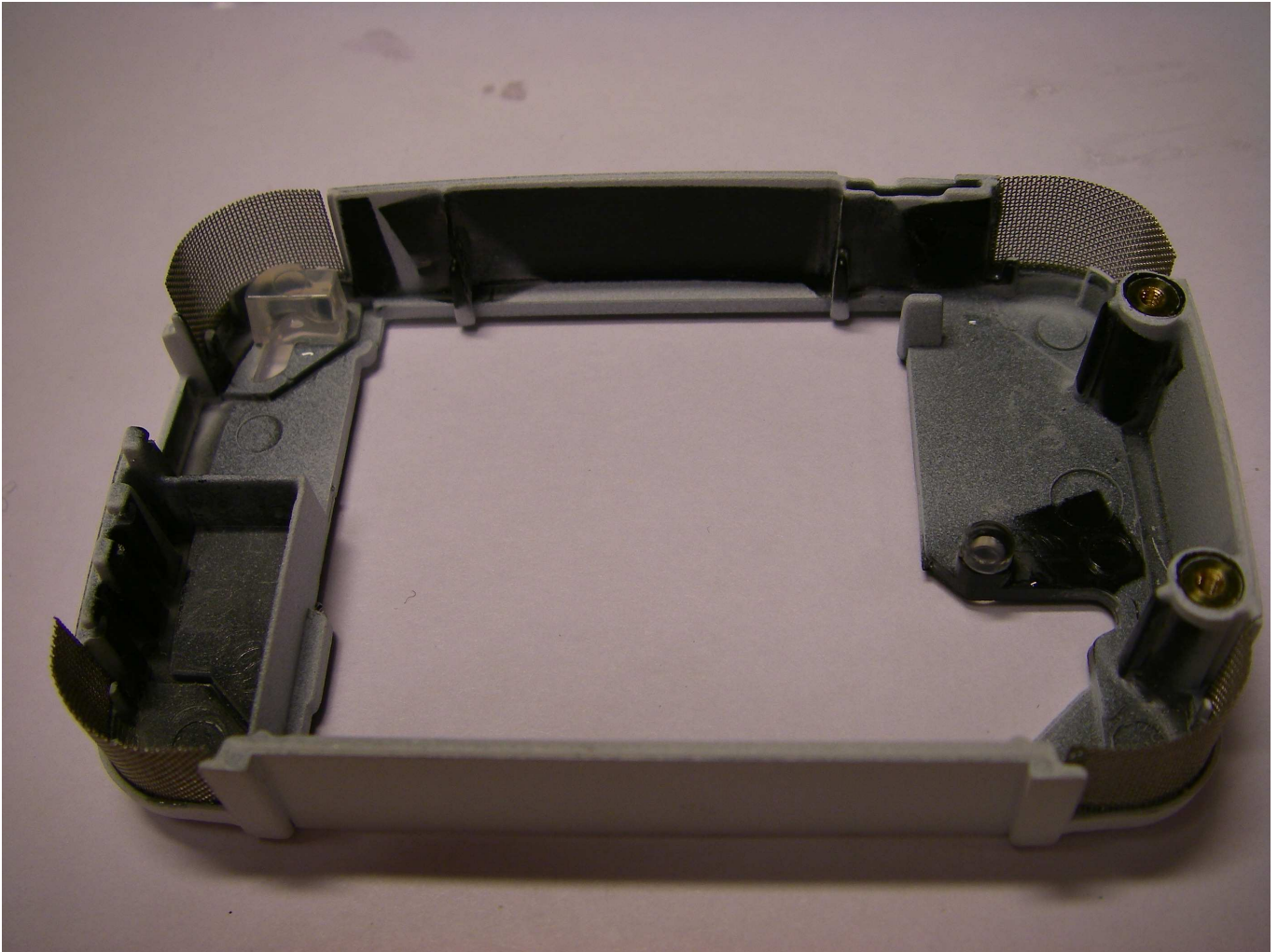
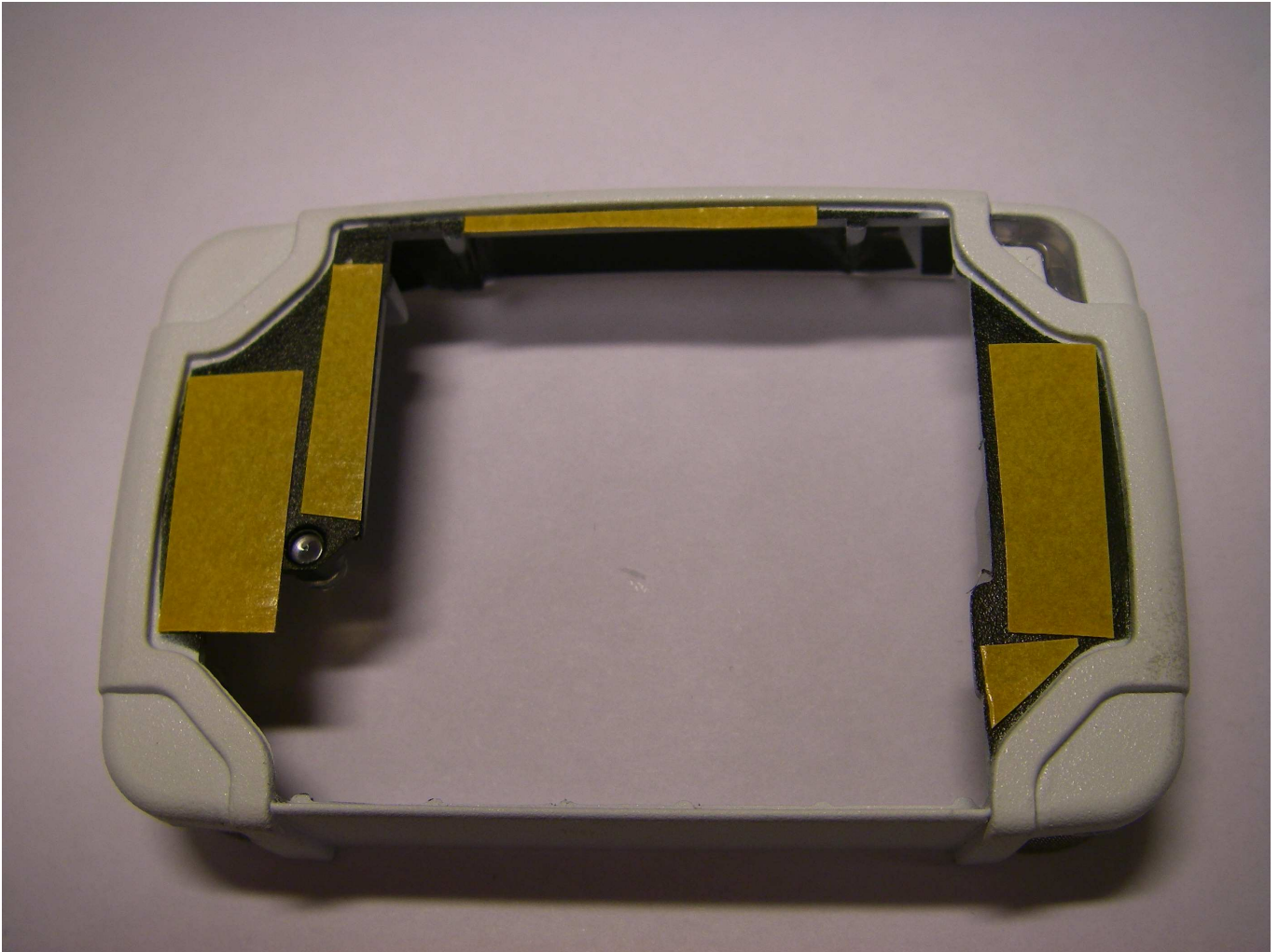


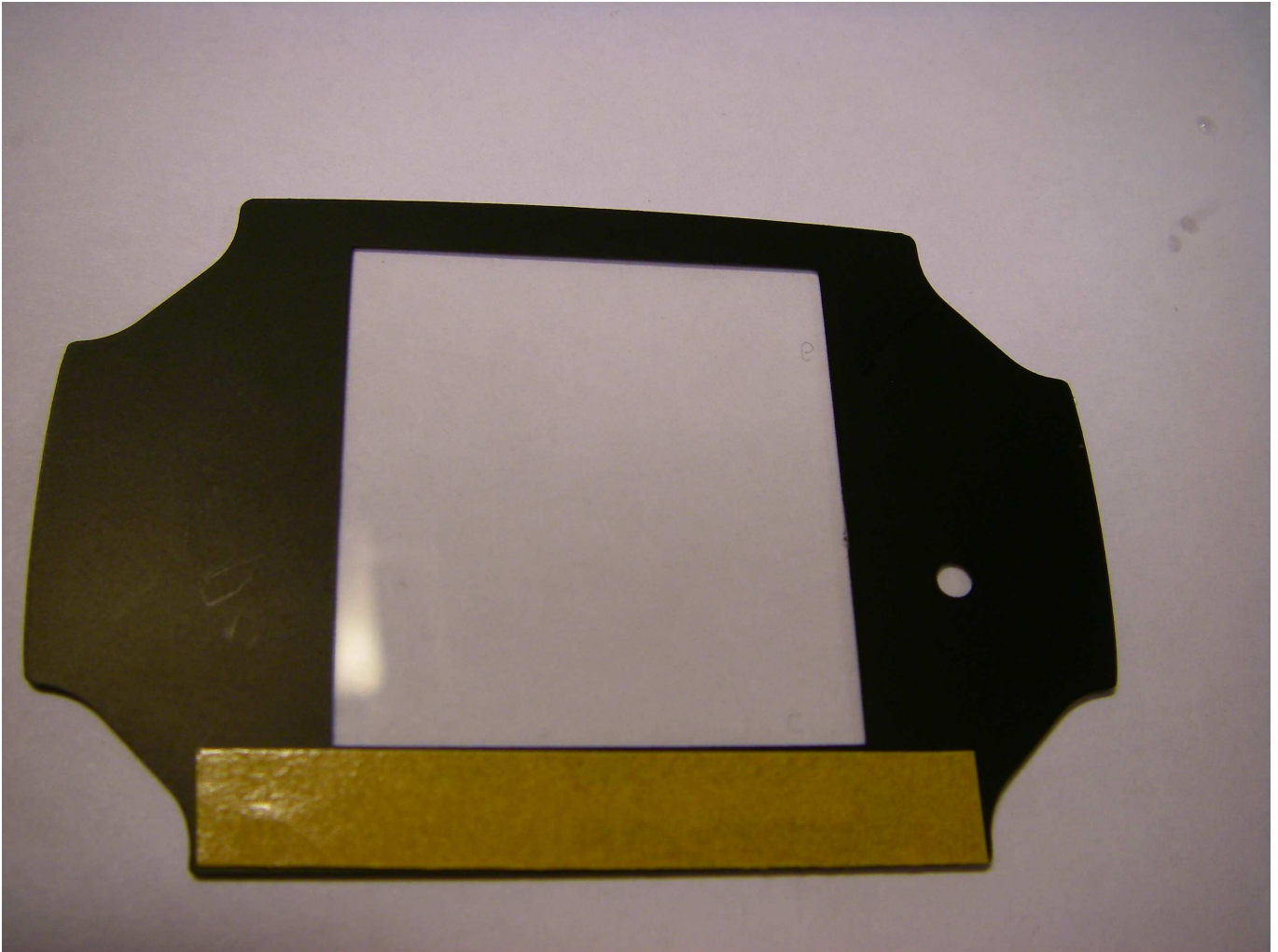
Figure 6 First glue the light guides in place, then glue the steel grids.



Figure 7 Detail of steel grid and light guide.



**Figure 8** Attach thin double sided tape to the top cover as shown in the figure.



**Figure 9** Also place thin double sided tape to the bottom of the window on the painted side. This tape will hold the capacitive touchpad. It is important that there is no air bubbles or gaps between the circuit board and the window.



**Figure 10** Attach the window to the top cover. Press firmly so the double sided tape will stick properly.

## **5. ATTACHING THE DISPLAY**

Between the LCD display and the circuit board there need to be four flexible supports. These supports should be approximately 4mm high. In this prototype four layers of 1mm thick double sided foam tape has been used as shown in Figure 11. Do not attach the SP board yet although it is visible in the picture! The locations of these supports are shown in Figure 12 (ignore everything else in this picture, as it is showing the development unit.). Leave the non-sticky protection foil on the topmost piece of tape so the LCD does not stick to the supports but can slide over them to get into position.

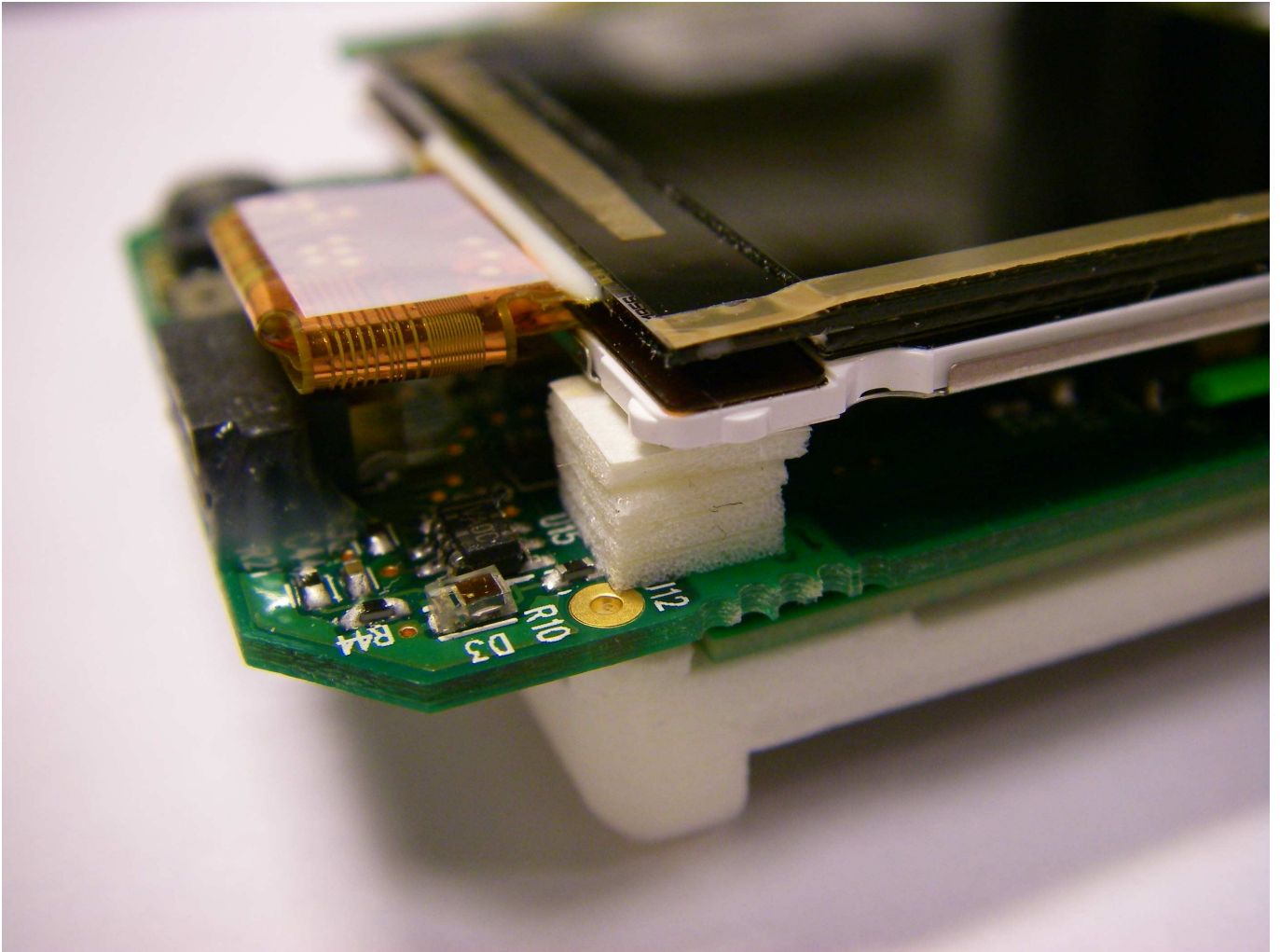
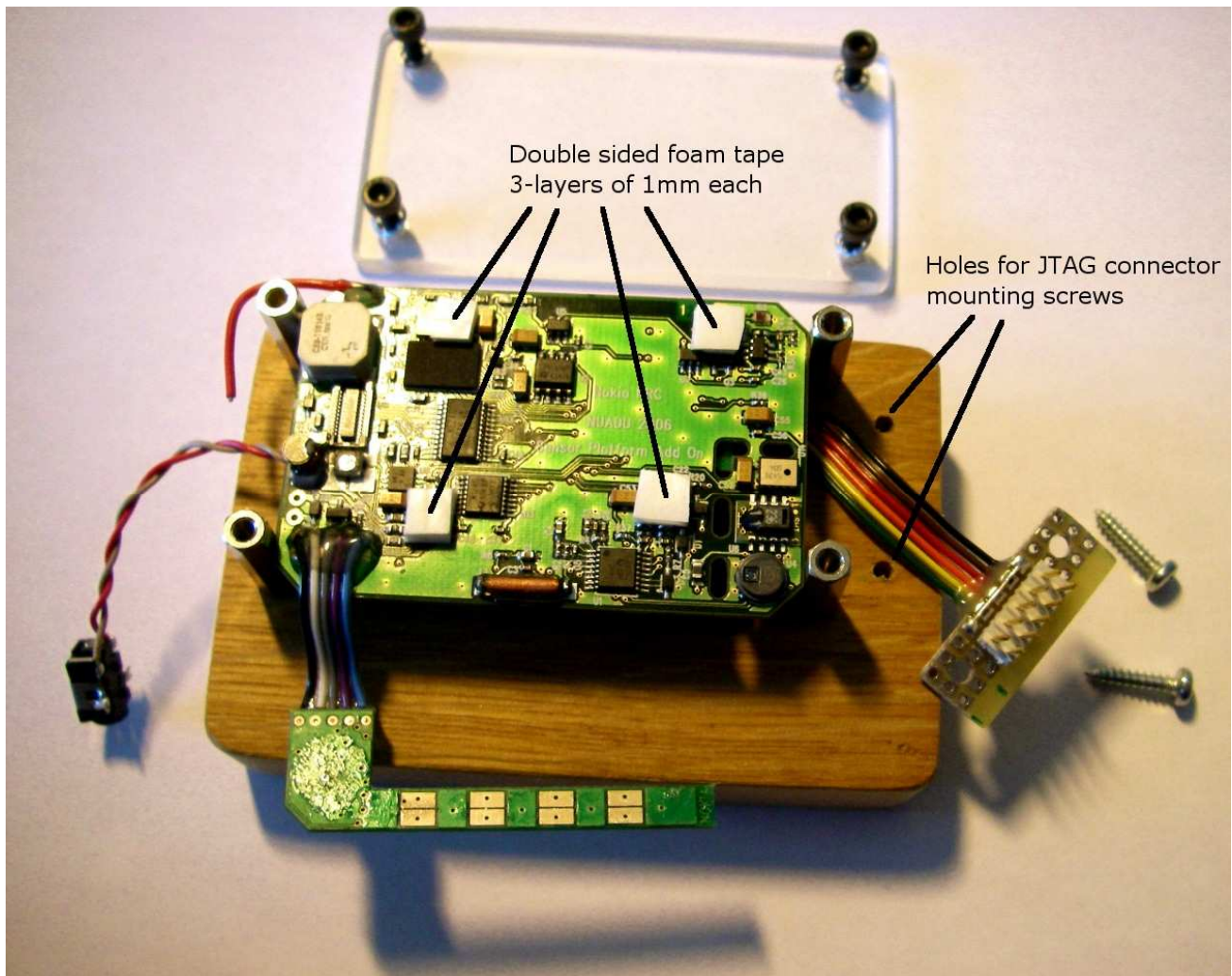


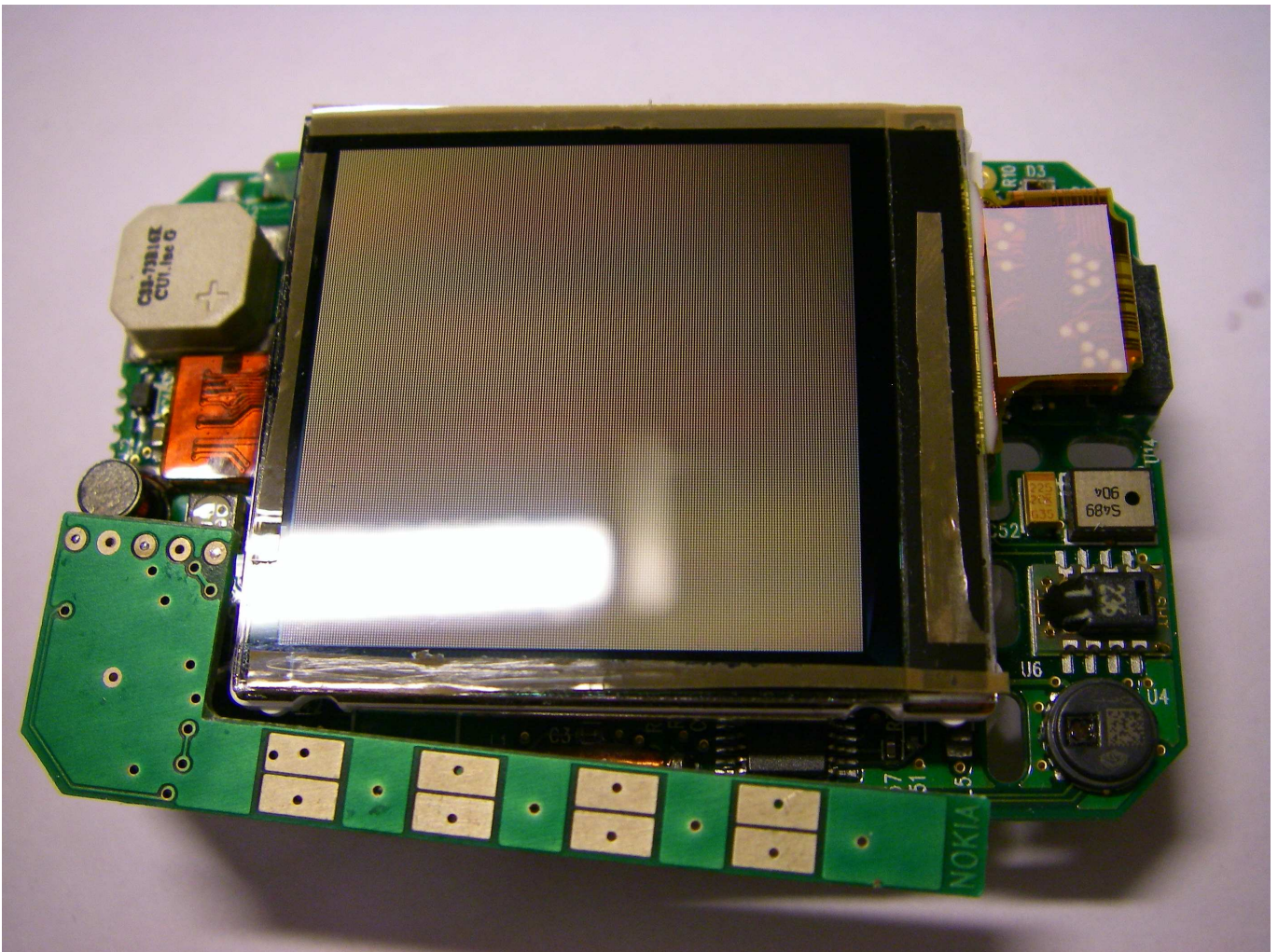
Figure 11 Four layers of 1mm thick double sided foam tape beneath the LCD display.



**Figure 12 Double sided foam tape supports for LCD display added to the electronics assembly. (Ignore everything else in this picture, as it is showing the development unit.)**

.Connect the display as shown in Figure 13. (Actually it would be better to connect it to the board later to avoid damage.) It is important to add tape strips to the edges of the display because if the LCD glass is touching the plastic window there will be disturbing optical interference effects in some cases. Preferably use transparent tape (office tape) and make sure the very edges of the display glass only (about 1mm) are taped so the tape won't be visible through the window opening. Replace the protection foil on top of the LCD to avoid fingerprints on the glass if connected to the board at this point.

## **6. ATTACHING THE ELECTRONICS TO THE TOP COVER**



**Figure 13** Put the LCD display on top of the supports and snap the display connector to the socket. Then add thin stripes of tape to the edges of the display.

The next step is difficult. The display, capacitive keypad and add-on circuit board assembly will be fitted to the top cover as shown in Figure 14. **Do not attach** the SP board (with the battery holder) yet although shown in the figure! Start by putting the capacitive keypad into the place at the very bottom of the window. Don't leave any space between the circuit board and the bottom side wall of the cover, otherwise the LCD will not fit above it. Have the window against the table (careful not to scratch window) and press the circuit board hard down to make it stick well to the double sided tape. There must not be any air bubbles or gaps between the circuit board and window.

Next remove the protection foil from the LCD or the LCD could be snapped into the connector at this point if not done already. Then bend the LCD and add-on circuit board into the top cover and carefully aligning the display to the guides pressing it down as far as it goes against the window leaving only a very thin air gap defined by the (office) tape at the edges of the display. Also press down the circuit board as far as it goes. In the process check that the Bluetooth antenna wire does not get into the way.

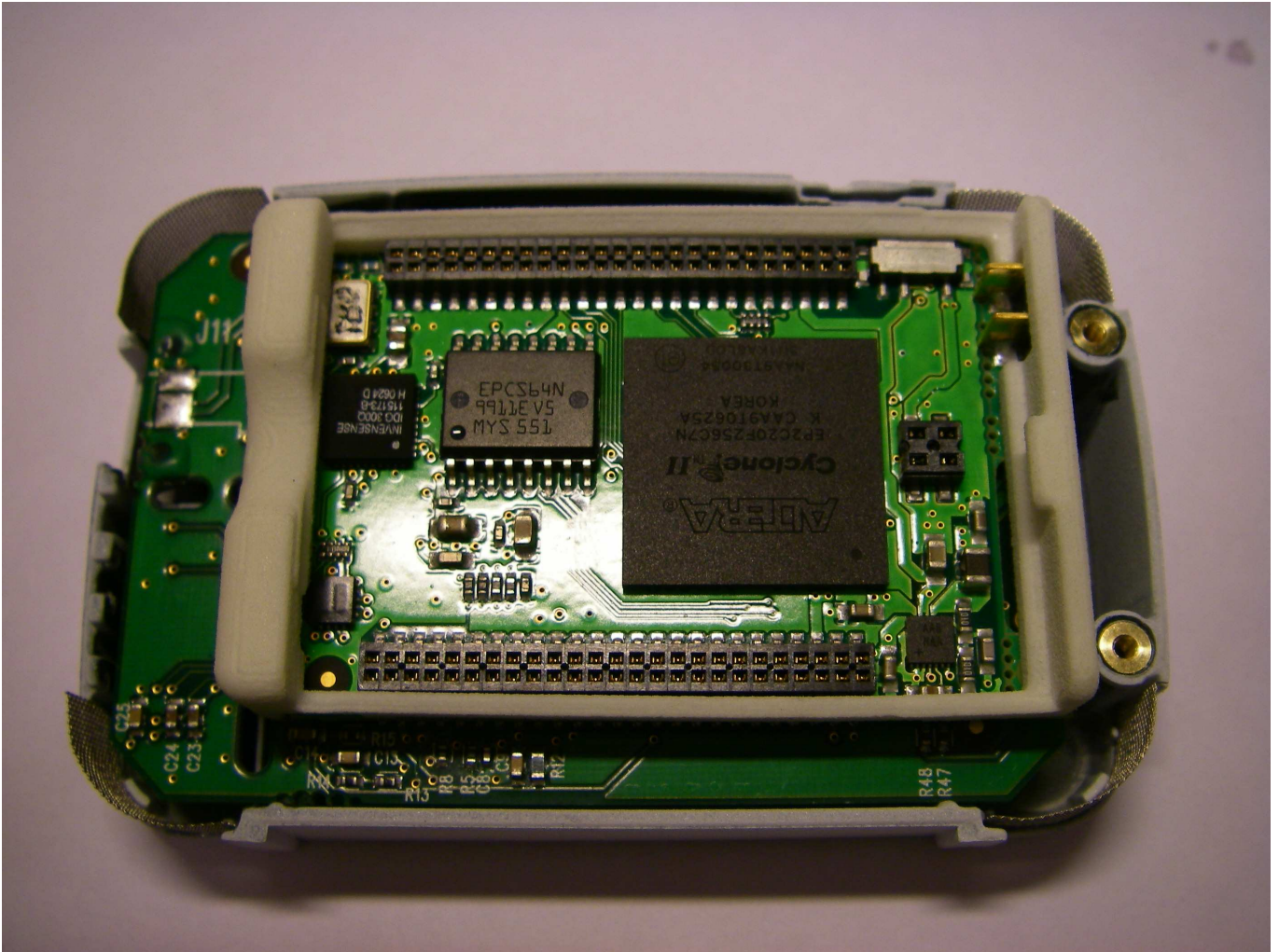
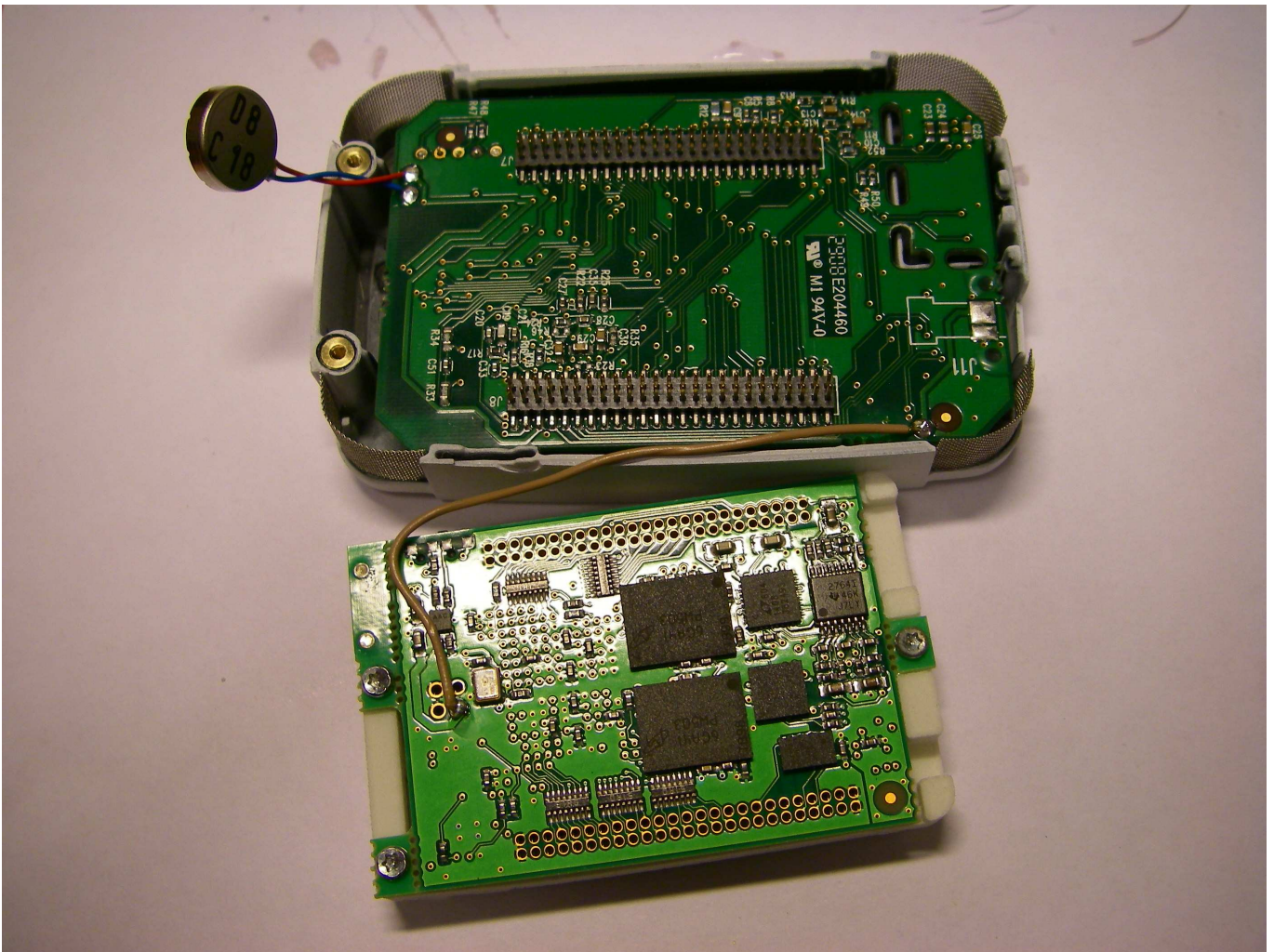


Figure 14 Electronics inserted into the top cover.

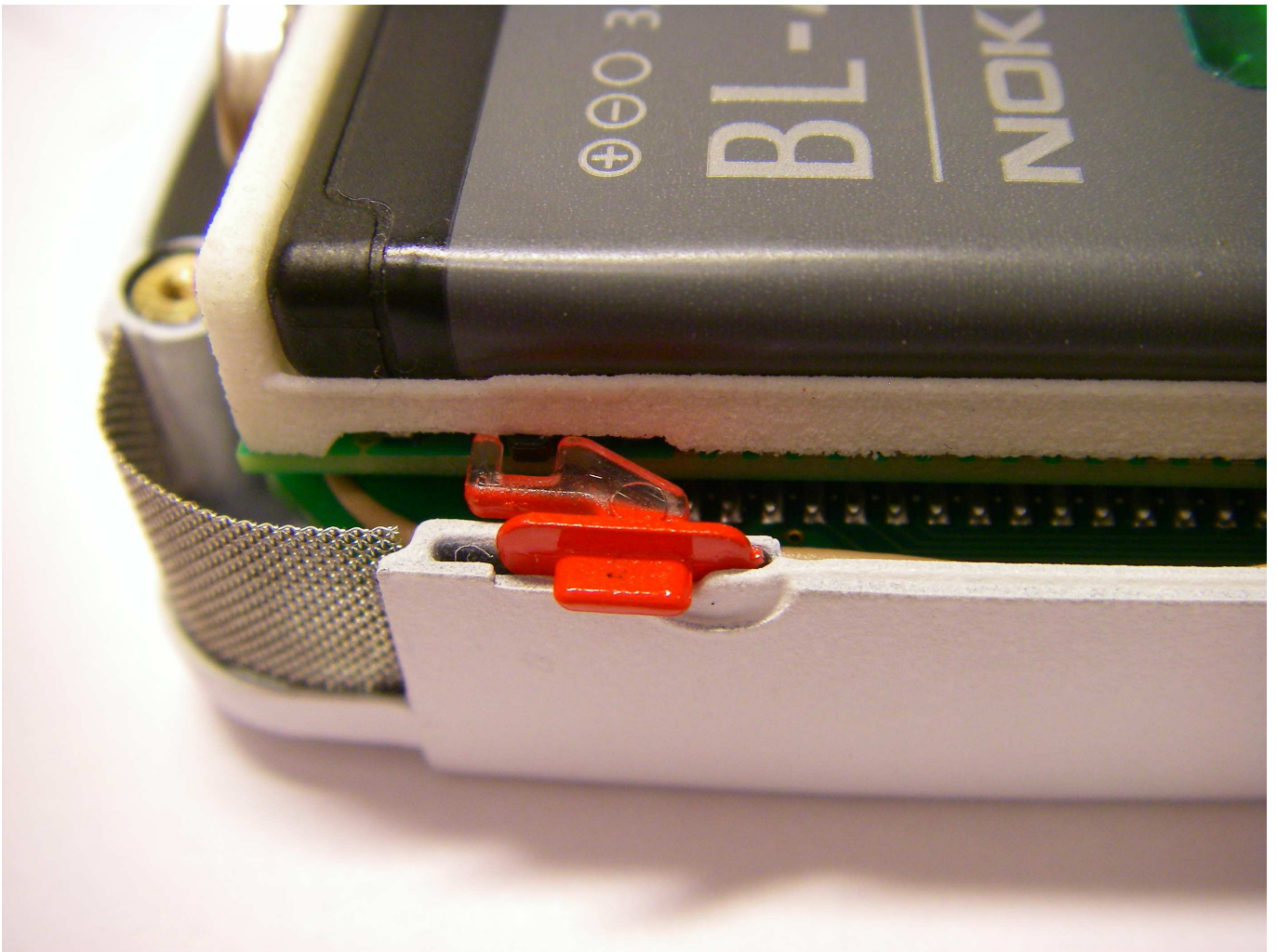
## 7. ATTACHING VIBRA, CHARGER WIRE AND POWER SWITCH

Next solder the vibra and charger wire as shown in Figure 15.

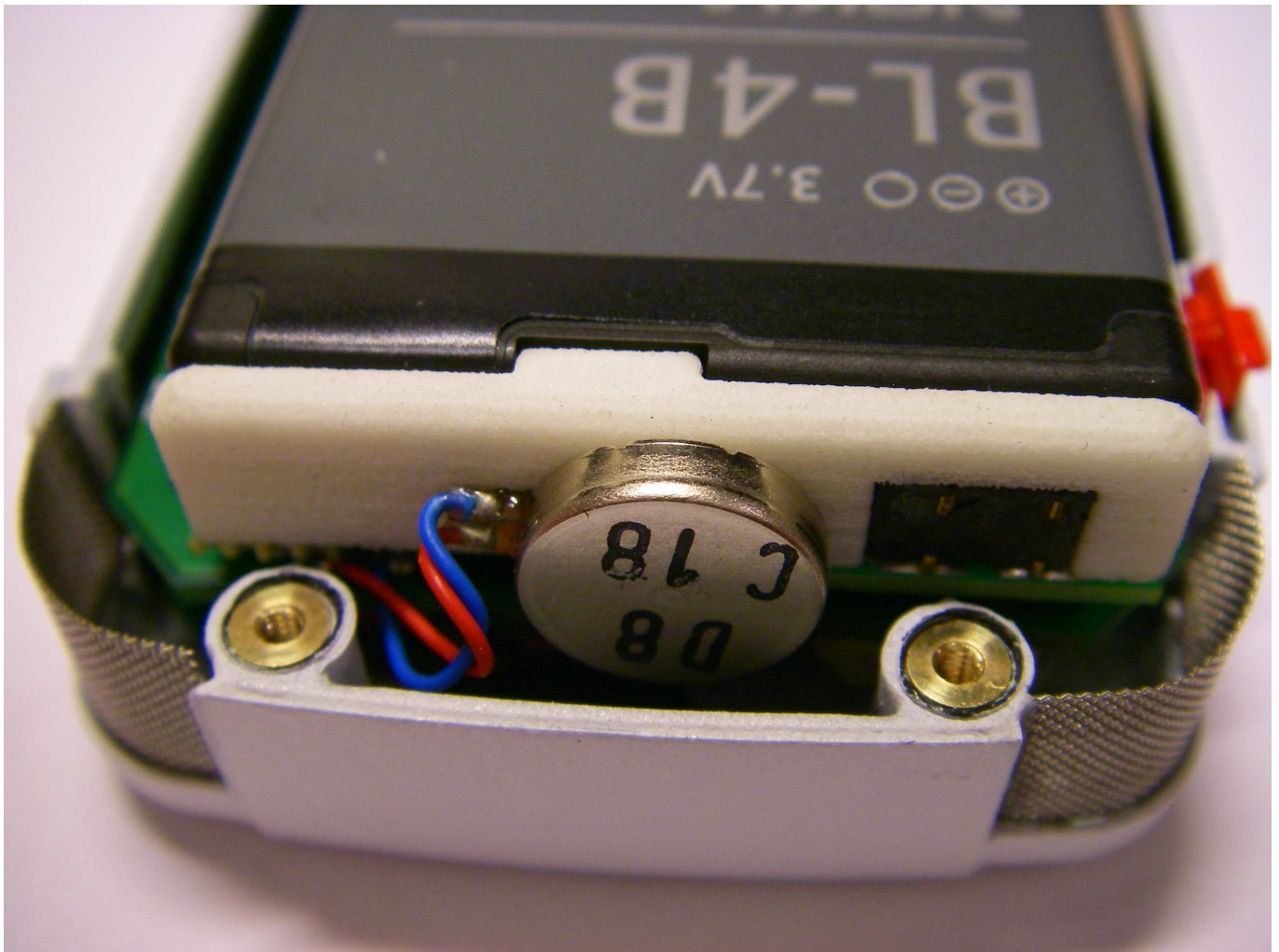


**Figure 15 Solder vibra and charging wire.**

Next add the power switch as shown in Figure 16. Check and remove any protruding plastic from the part so it will slide properly from end to end in the slot. Then make sure the power switch is in off position – this is to the right position in the figure. Then add the battery to the holder.



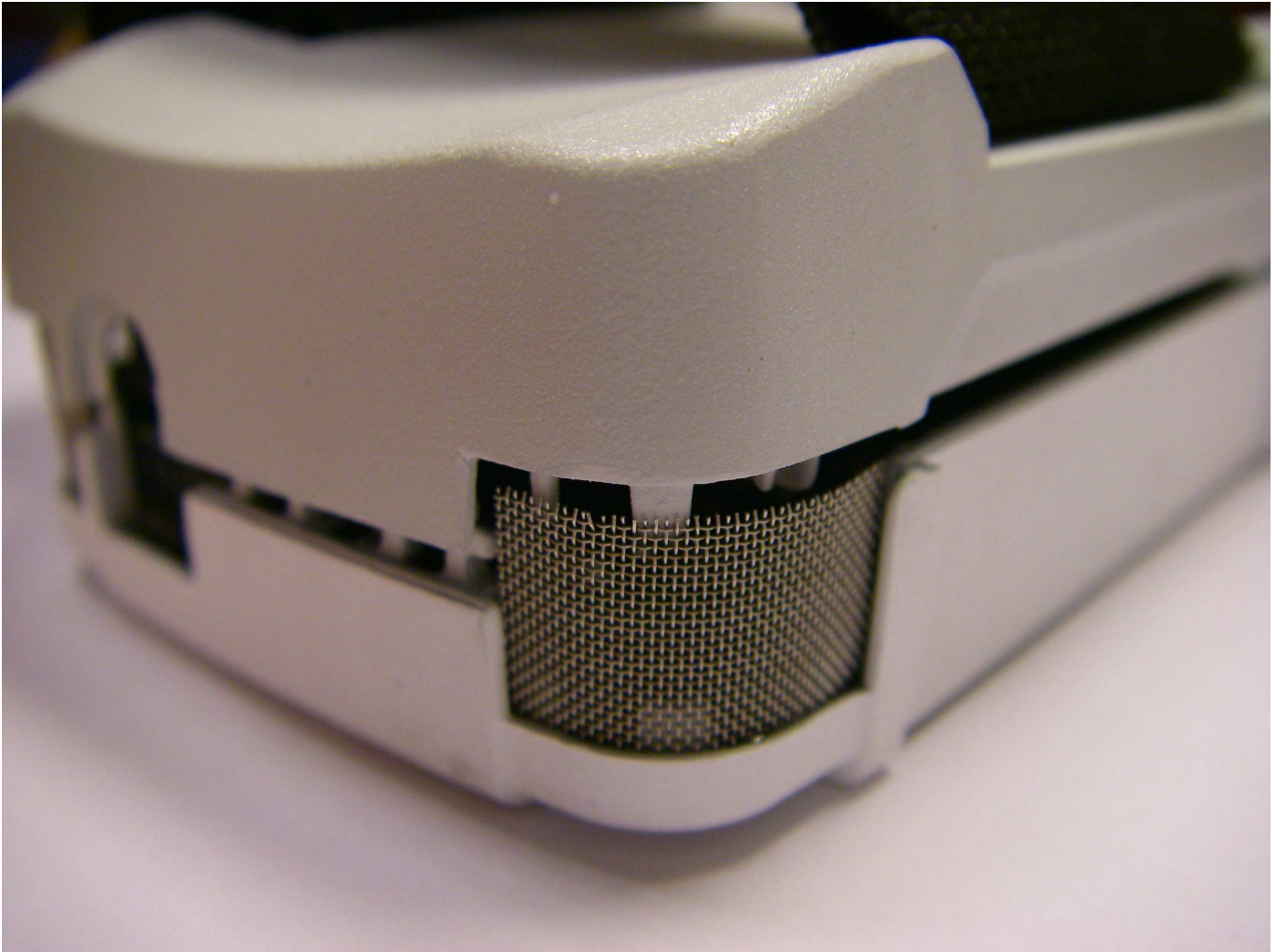
**Figure 16** Add the power switch. Check and remove any protruding plastic from the part so it will slide properly.



**Figure 17** Stick the vibra to the end of the battery holder with the double sided tape provided by the vibra.

## **8. CLOSING THE COVERS**

Figure 18 shows the final step to attach the covers together. . Be careful not to damage the steel grids – align each corner while putting them together. By pressing the side of top cover where the hooks are (near the charging connector) the covers can be attached without much bending. This pressing technique is the only way to safely open the device without damaging it. Finally use screws to fasten the covers.

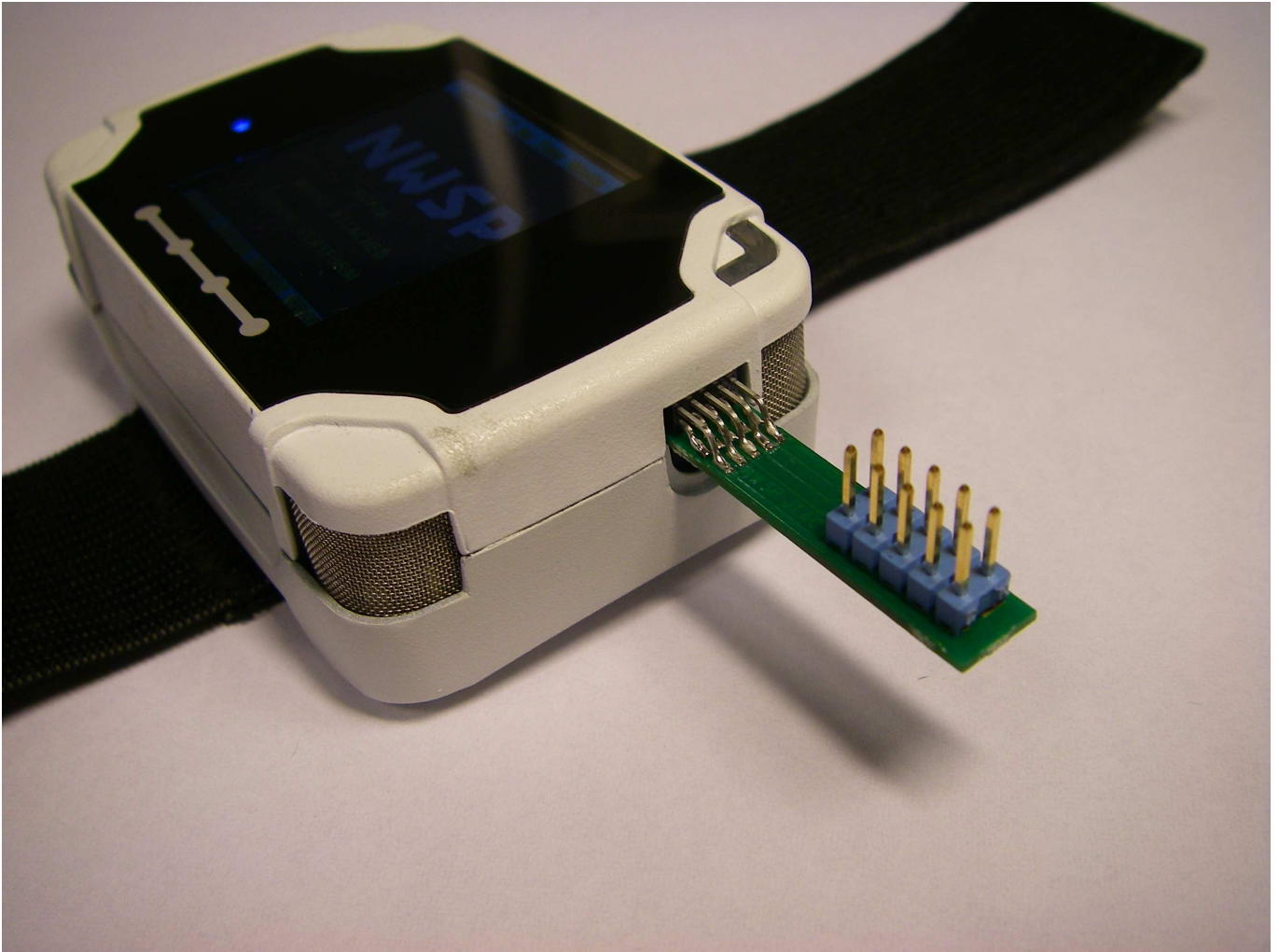


**Figure 18** Finally press the covers together. Be careful not to damage the steel grids – align each corner while putting them together. By pressing the side of top cover where the hooks are (near the charging connector) the covers can be attached without much bending.

## 9. FLASHING AND TESTING

Before flashing charge the battery for at least 15 minutes. To flash the device attach the flash adapter as shown in Figure 19. Then connect Altera or Terasic USB Blaster as shown in figure Figure 10. Take care not to connect the headers the wrong way or the device or USB blaster could be damaged. Turn on the NWSP just before flashing with Altera's flashing program. Don't keep power on for a long time if there is no program flashed to the device or the device might become damaged.

To test the device run sufficient demo application and test functionality of various sensors: Compass, Inclinometer, Gyro, Barometer, Temperature and Humidity. Check that display and LED is functional, vibra rotates at powerup and buzzer emits sounds on keypad presses. Bluetooth communication could also be tested using the NWSP PC software. Microphone and light detector could also be tested but there are no demo application using those in the open source version of the software.



**Figure 19** Inserting the flash adapter.

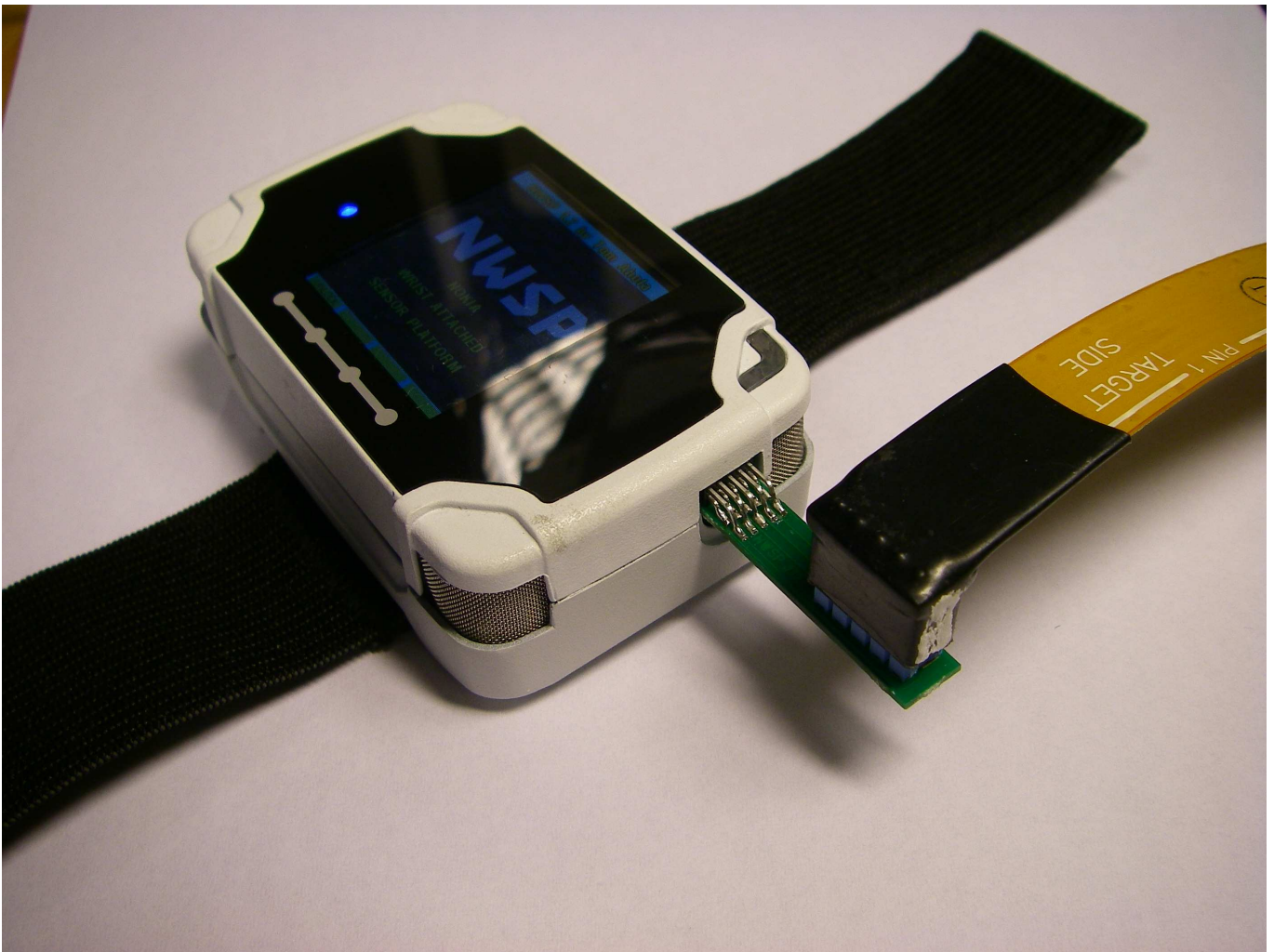


Figure 20 Attaching USB Blaster to the flash adapter.

## 10. TROUBLESHOOTING

- ✓ The device does not boot (nothing happens when turning the device on)
  - Check that SP and add-on circuit board are properly pressed together
  - Try to reflash the device
  - Is the battery charged?
  - Is the plastic power switch properly in place?
- ✓ There is partial functionality of display/buzzer (only either one works or there are errors in the display)
  - Check that SP and add-on circuit board are properly pressed together – there is easily contact problems if there is not enough force pressing the whole package together – the foam tape supports for the display acts as a spring creating pressure. Add some more tape or cardboard below the battery if more pressure is needed.
- ✓ If some of the buttons in the capacitive keypad does not work
  - Try to shut down and restart the device (this recalibrates the sensor)
  - There might be an airgap or bubble between the window and circuit board – try to press them better together