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**DESIGN AND ASSEMBLY OF A CELL-PHONE
USING CATIA V5-R17**

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ABSTRACT

CATIA is a universal software used in various industries, including aerospace, construction, machinery, electronics. One of the most remarkable features of CATIA V5 is the diversity of workbenches in the mechanical design section, making the designed parts distinguishable. The design process occurs through sequential stages starting from the initial design to the actual development of the product.

The aim of this project is to design a cellular phone with its detailed components using CATIA. The facilities provided by this software help to design fancy surfaces and irregularly shaped parts, and fix the possible interferences that may occur during the assembly of these parts to avoid any future problems. Animation simulation recording will be played to show some detailed features.

Keywords: CATIA, design, cell phone, workbench, assembly.

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1 INTRODUCTION

The new generation of CAD (Computer Aided Design) softwares followed the rapid progress in industry, focusing on manufactory. Lately, highly developed and complex features were introduced to empower CAD software, allowing it to satisfy the advanced requirements dictated by the new industry. CATIA, Pro-engineer, Autodesk, and Inventor are the most commonly used softwares in this field. The main concern of this project is to use CATIA V5 to explore and optimize the different features and functions of the design. To achieve this task, transition between workbenches inside the mechanical design section was assured to attain the most feasible shape. After completing the design, the generated parts were assembled and all possible interferences were checked to prevent clashes.

Each part of the cell phone was drawn separately using CATIA, ensuring the display of all enclosed details. After assembling these parts, an animation simulation was constructed to demonstrate the main mechanical features of the designed product.

2 PART DESIGN:

In this chapter we will focus on the design of each part of the cell-phone which consists of 26 parts as follows:

PART NUMBER	DESCRIPTION OF PART	PART NUMBER	DESCRIPTION OF PART
1	Master-Part	14	Electronic Board
2	Master-Housing-FR(front)	15	Keypad
3	Master-Housing-RR(back)	16	LCD Moudle(screen)
4	Master-Flip-FR(front)	17	Hinge-Cap
5	Master-Flip-RR(back)	18	Pen-Head
6	Antenna	19	Pen-A
7	Battery 1	20	Pen-B
8	Battery 2 (battery pin)	21	Pen-C
9	Battery Cover	22	Screw
10	Battery Buckle	23	Screw-Cover
11	Battery RR(back)	24	Side-keys
12	Camera Cover	25	Sim Card
13	Master Hinge	26	Sim Card Lock

Table 2-1: List of designed parts

In my project I used the concept of reverse engineering to model a cellular phone and for this purpose I choose Motorola's phone . I dismantled the whole mobile assembly into components, which are shown above in table 2-1. From assembly point of view, I started modeling from the main block which will be referred as Master-Part in succeeding part of the report. This Master-part consists of four main sub-assemblies, and from these sub-assemblies individual components were extracted. From each component, the corresponding part of the cell phone was designed using different workbenches of CATIA software.

Following is the description design procedure for Main-part, sub-assemblies and components.

2.1 Master Part:

In this part, we didn't have any constraint so we sketched a rough outer shape which will be refined in the parts coming after.

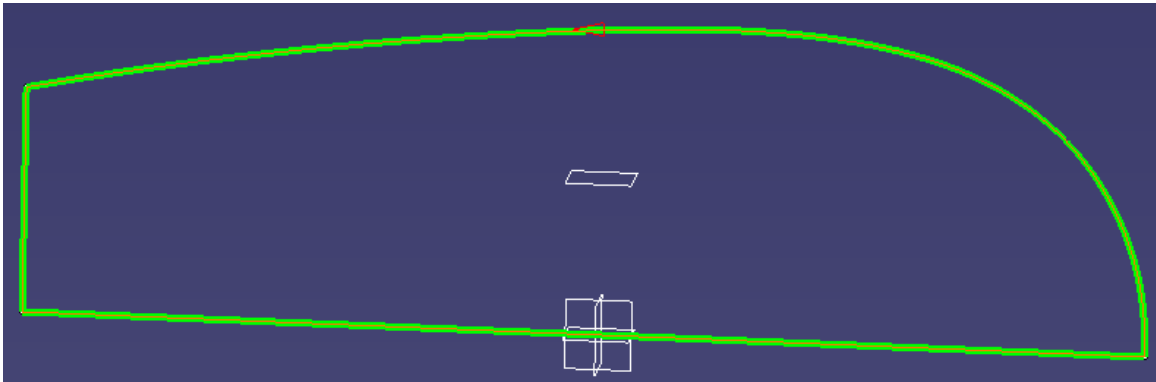


Figure 2.1.1: Sketch of the master part

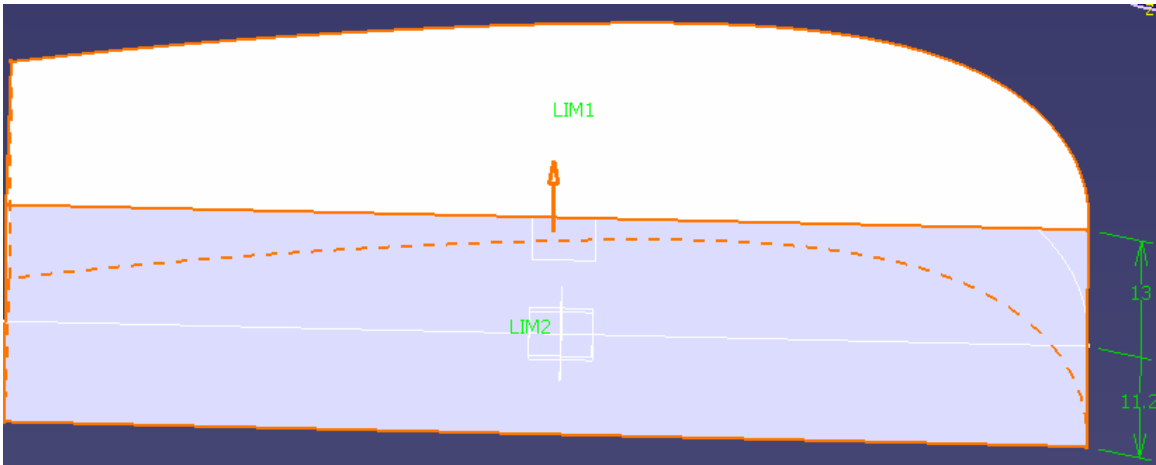


Figure 2.1.2: Pad

In the figure above we see the part being generated using pad function in Catia with two limits which will help us later.

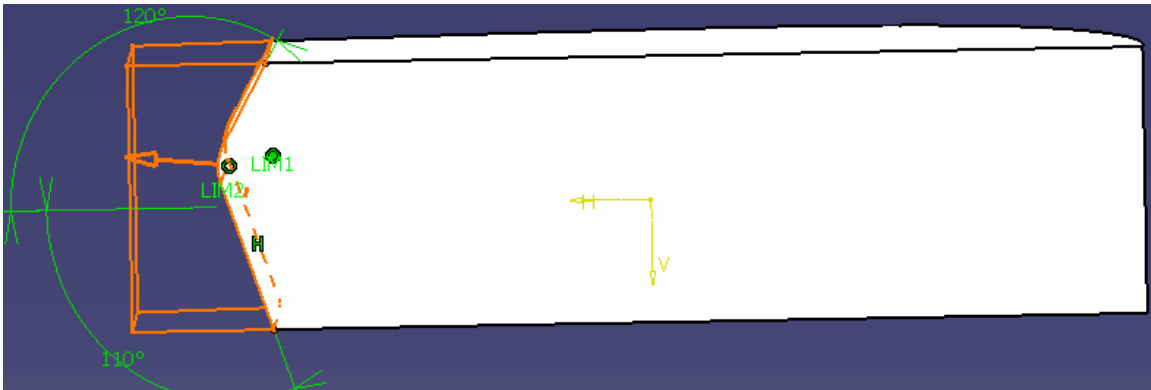


Figure 2.1.3: Pocketing a sketch

The above figure shows a sketch which reflects the base of flip-flop. We also can see that we used the pad limit to define the sketch.

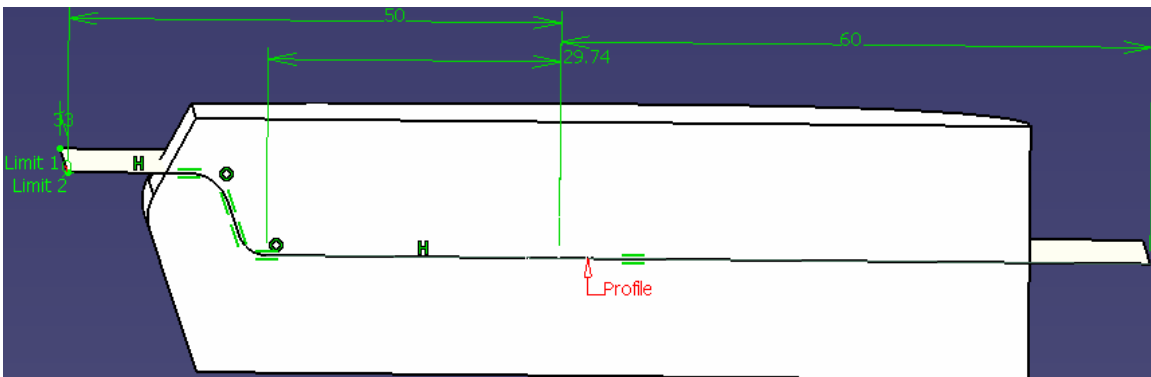


Figure 2.1.4: Cutting the master part into two parts

In the above figure a profile is drawn to split the master part. The profile then extruded to be a surface which became the cutting element.

2.2 Master-Flip-FR:

This is one of the four major parts in the cell-phone. It is the frontal appearance of the whole product. In the figure below, the upper part of master-flip-FR is represented with control points to draw two splines and then to generate a surface which will be the outer appearance of the cell-phone.

The coordinates of these control points are:

Point Number	Number in CATIA	x-axis	y-axis	z-axis
1	30	-50	0	-7
2	11	-48.28	-8.75	-7
3	12	-42.62	-17.81	-7
4	13	-36.72	-22.51	-7
5	14	-19.51	-28.02	-7
6	15	-11.41	-28.89	-7
7	16	4.17	-29.13	-7
8	17	12.51	-28.7	-7
9	18	19.32	-28.02	-7
10	19	26.89	-26.35	-7
11	20	39.21	-12.44	-7
12	21	40	0	-7

Table2-2 coordinates of control points of spline1

Point Number	Number in CATIA	x-axis	y-axis	z-axis
1	21	40	0	-7
2	45	37.23	0	-8.42
3	44	35.72	0	-8.74
4	46	33.26	0	-9.18
5	34	31.72	0	-9.47
6	47	30.35	0	-9.65
7	49	27.74	0	-9.98
8	35	22.57	0	-10.52
9	36	6.74	0	-11.5
10	29	-4.97	0	-11.62
11	22	-22	0	-11.62
12	32	-24.14	0	-11.62
13	31	-44.28	0	-9.86
14	10	-50	0	-7

Table 2-3 coordinates of control points of spline

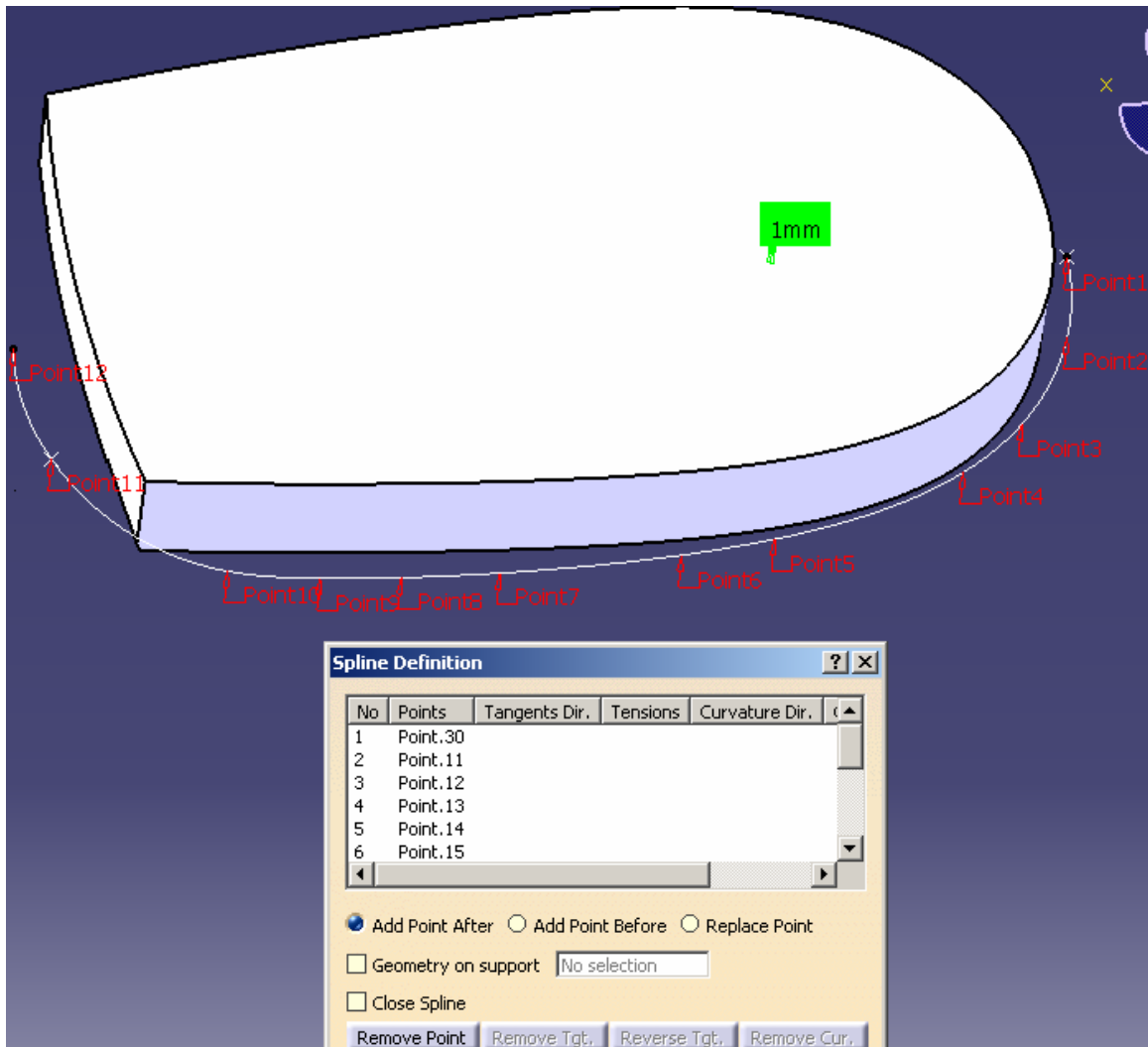


Figure 2.2.1: Shows the Master-Flip-FR with the control points of the first spline

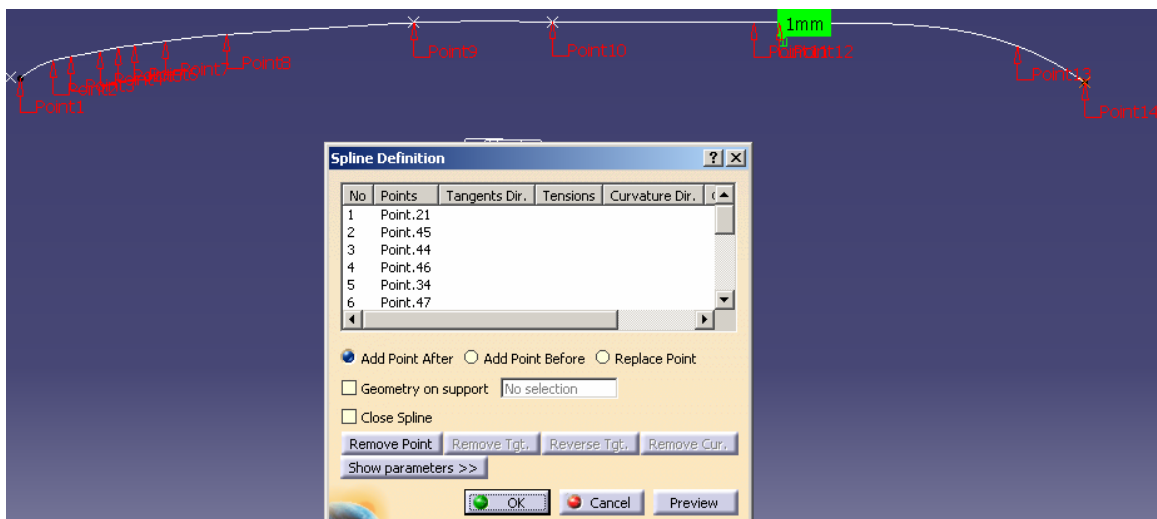


Figure 2.2.2: Shows the second spline with control points

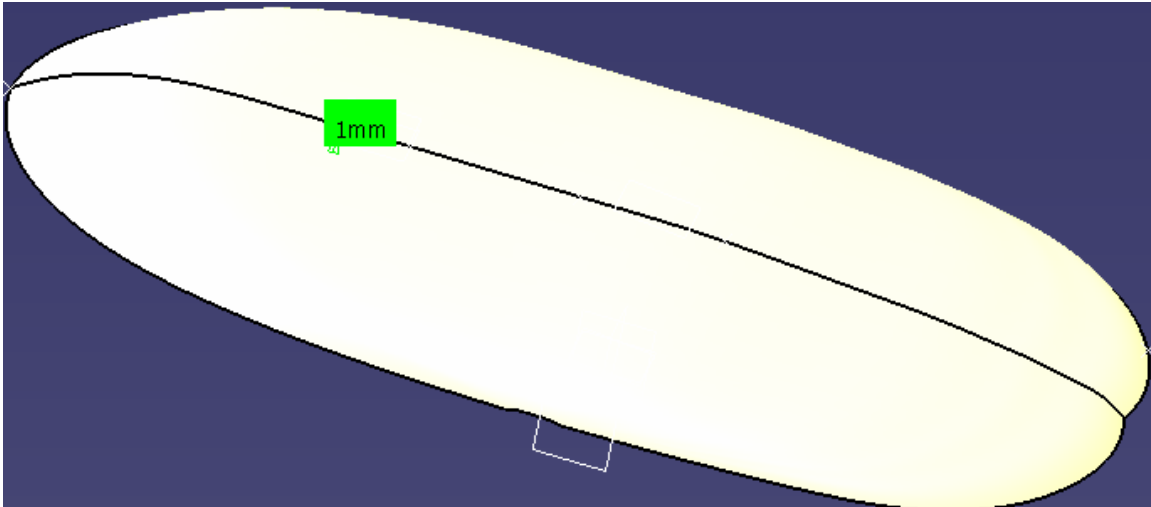


Figure 2.2.3: Surface generated between the 2 splines, then mirrored.

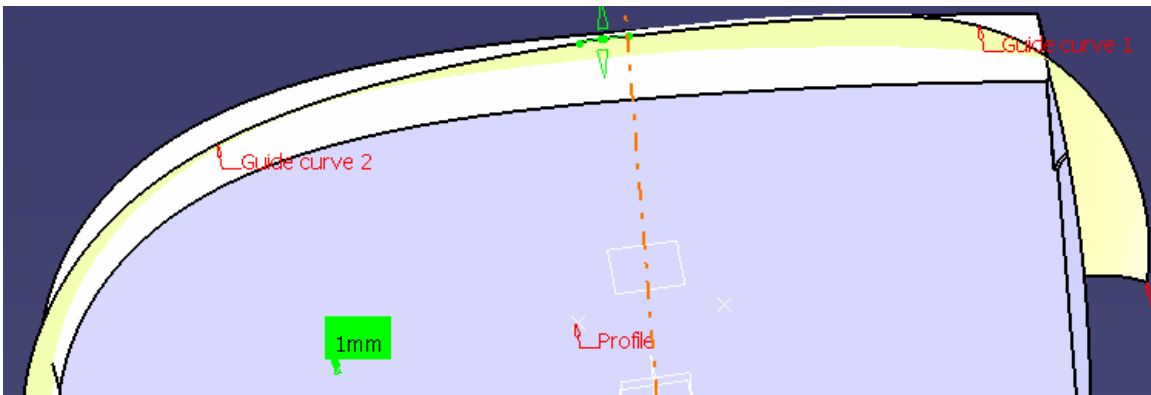


Figure 2.2.4: Cutting through the part

In the above figure, it is clearly shown how we cut the part using the surface generated by the two splines as cutting element.

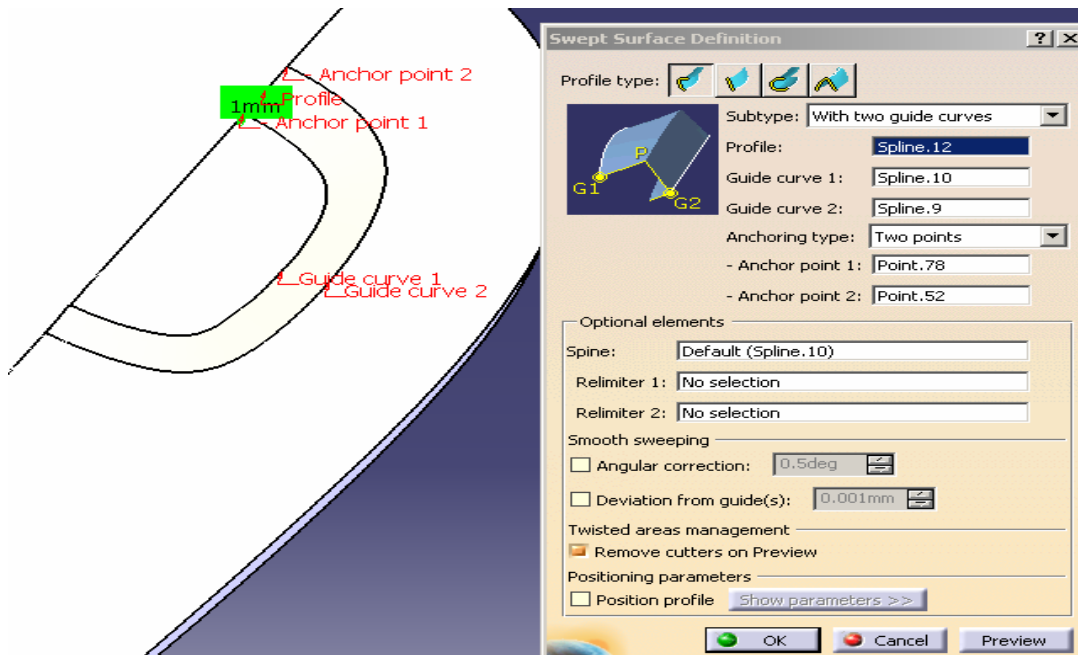


Figure 2.2.5: Generating the outer screen profile

The above figure displays how the surface was generated using sweeping function. This surface will be the contour around the outer-screen.

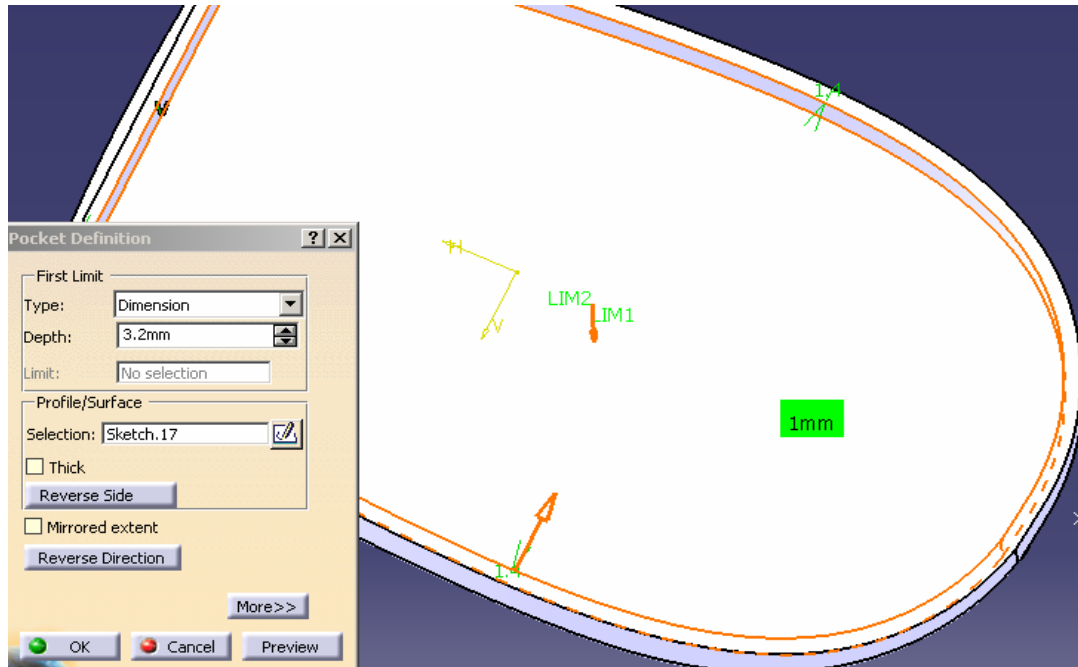


Figure 2.2.6: Generating the inside pocket

In the figure above we generated the pocket in which all the inside details will be drawn such as the thread holes and the pocketed edge.

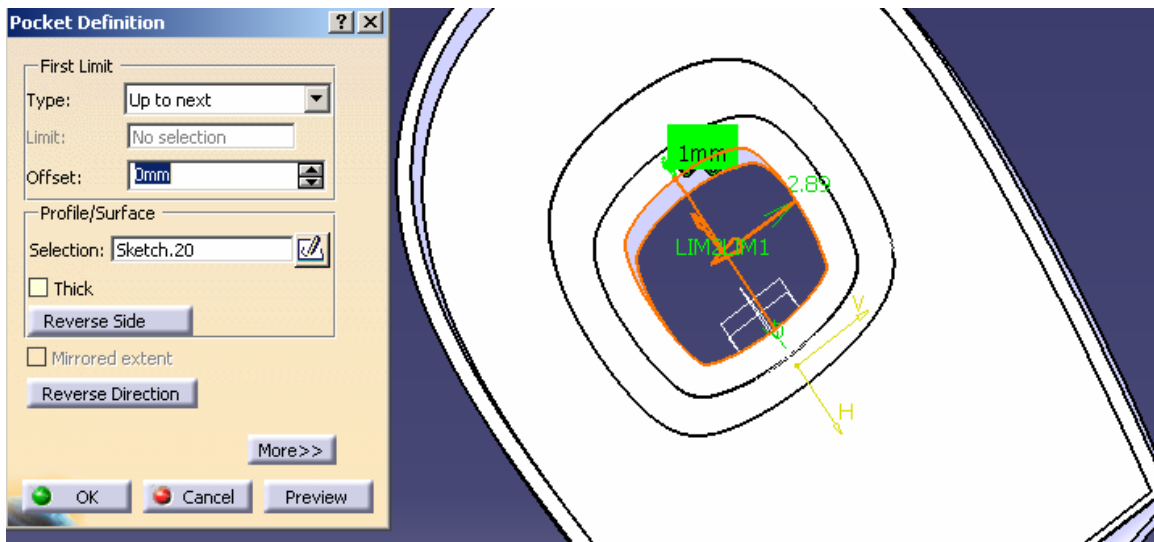


Figure 2.2.7: Pocketing a hole for the outer screen.

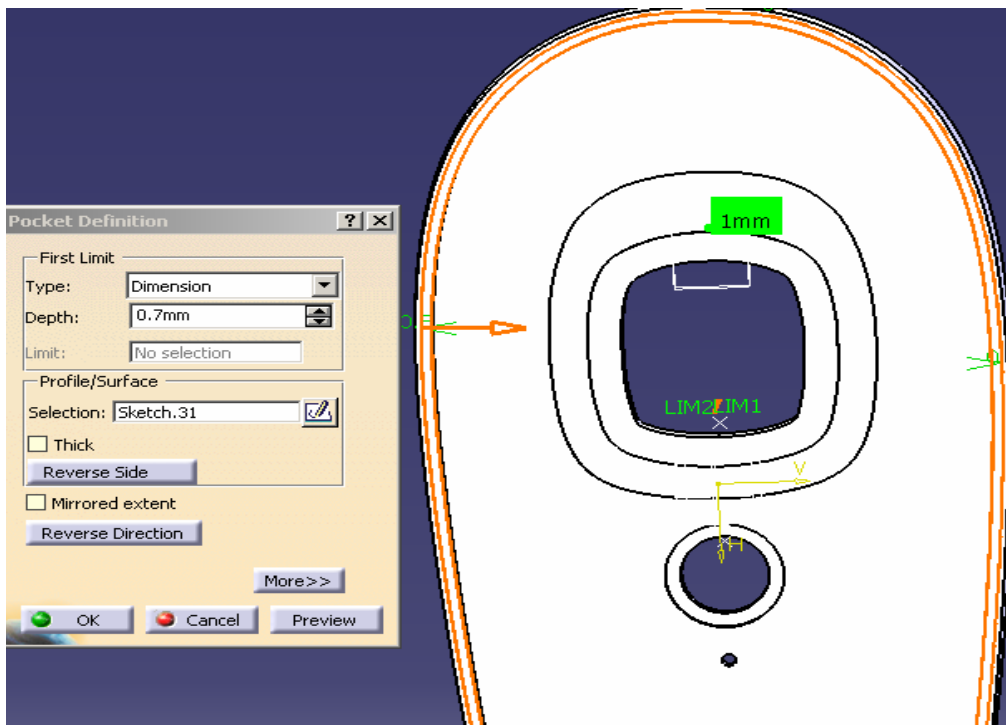


Figure 2.2.8: Pocketing the edge

In the above figure we pocketed the offset so that the other part can perfectly fit with it.

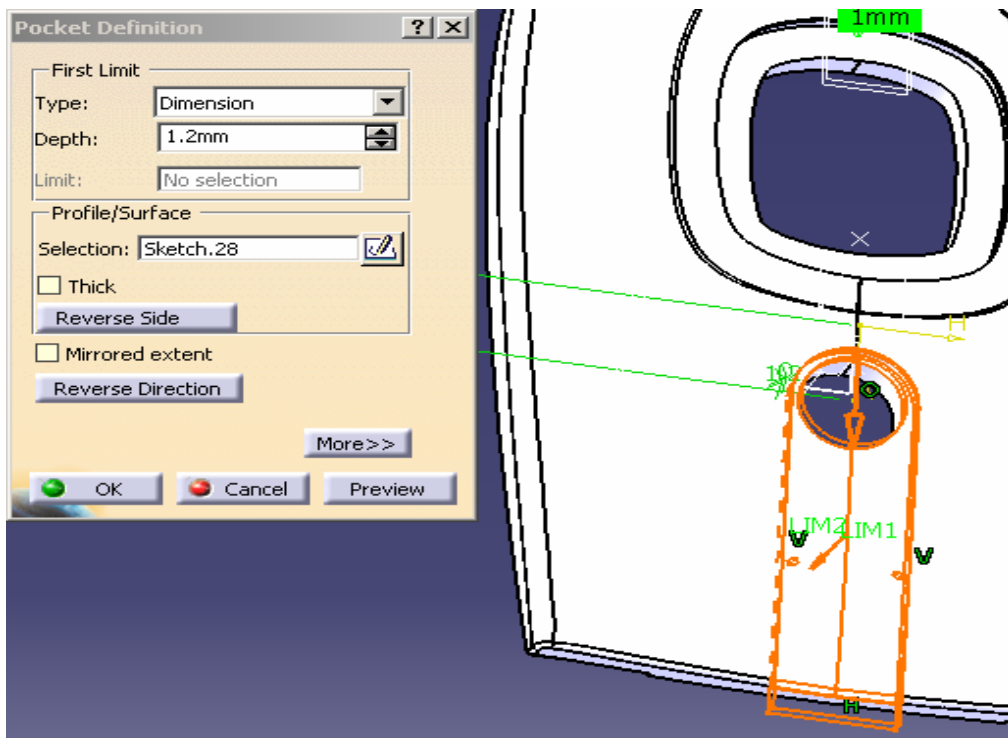


Figure 2.2.9: Pocketing the camera cover

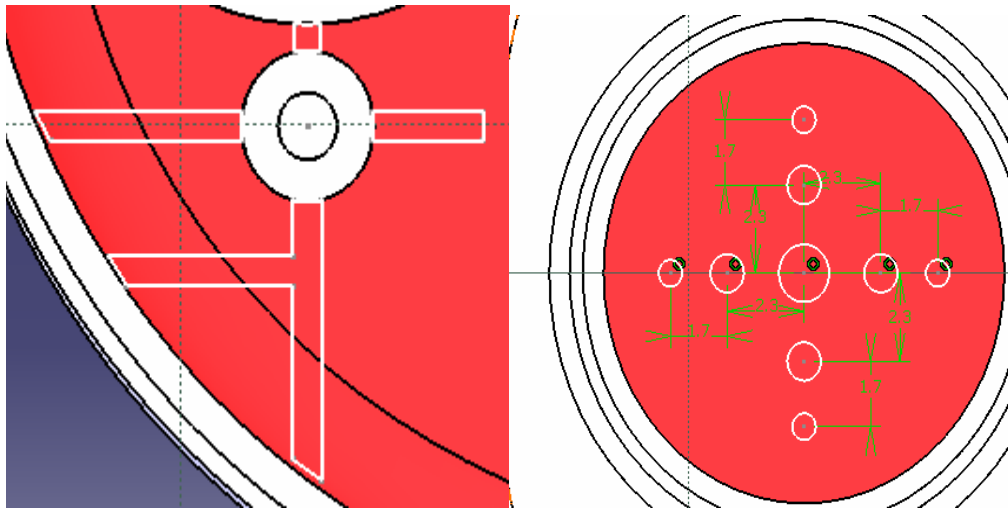


Figure 2.2.10: Different sketches showing the inner plane of the master-flip-FR

2.3 Master-Flip-RR:

This part is the second major part. It is complementary to the previous one, fitting perfectly with it; together, forming the moving part of the cell-phone.

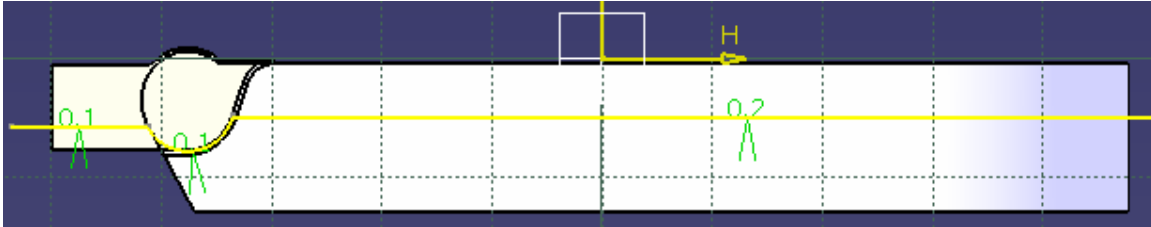


Figure 2.3.1: Splitting the master-flip

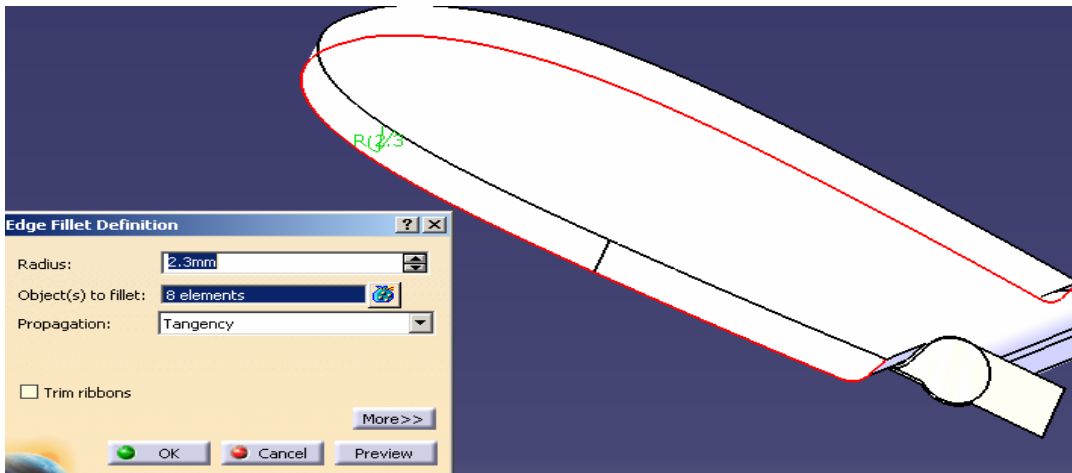


Figure 2.3.2: Edge fillet of the flip-RR

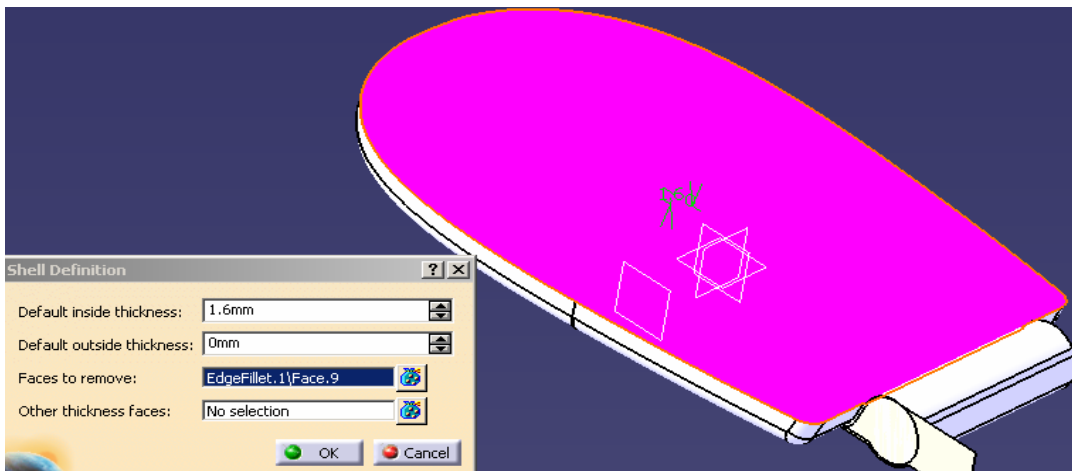


Figure 2.3.3: Displaying the shell definition of the flip-RR

The above figures depict the splitting of the master flip to obtain the flip-RR. An edge fillet of 2.3mm for all the sides were added to trim sharp edges. Then shell definition was used resulting in an inside thickness of 1.6mm.

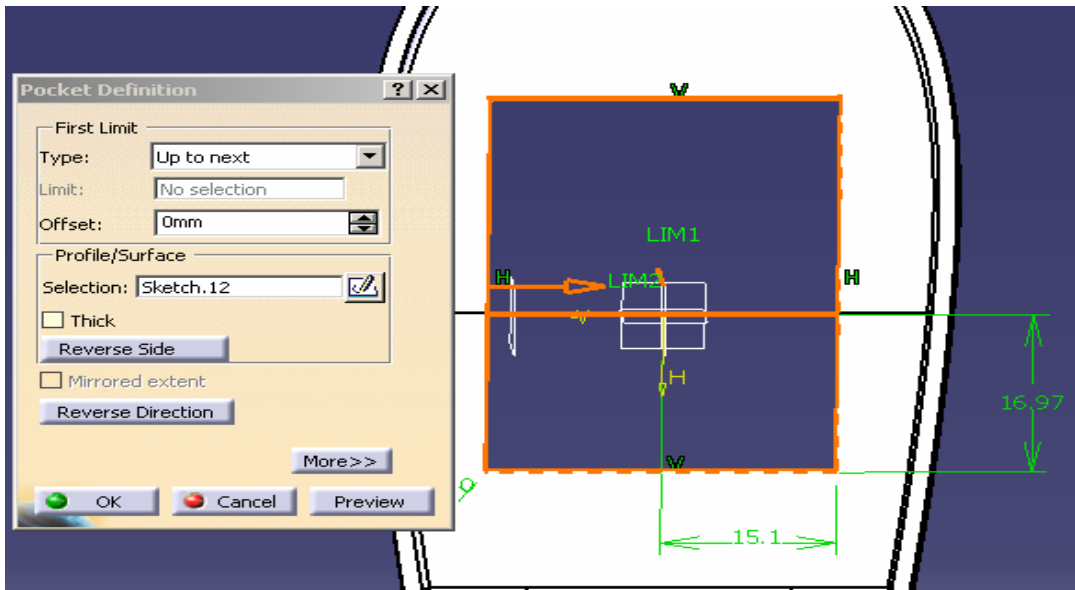


Figure 2.3.4: Pocketing the inner screen sketch

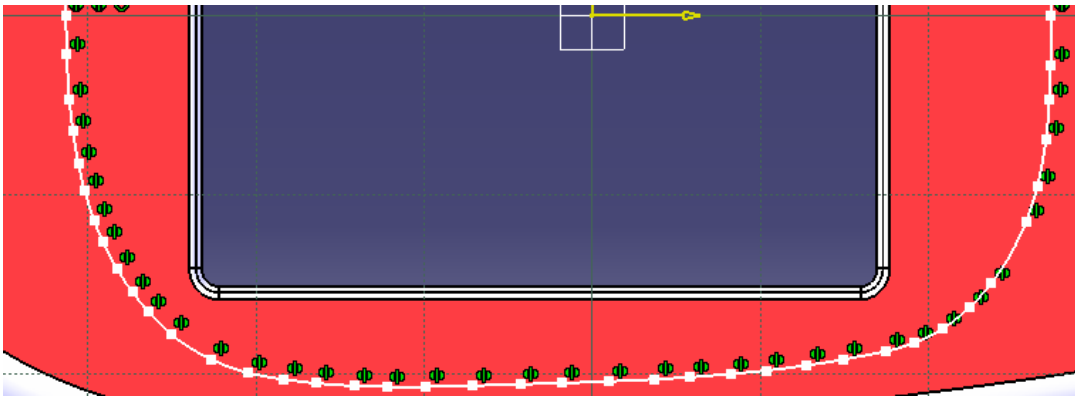


Figure 2.3.5: Drawing a spline for screen contour

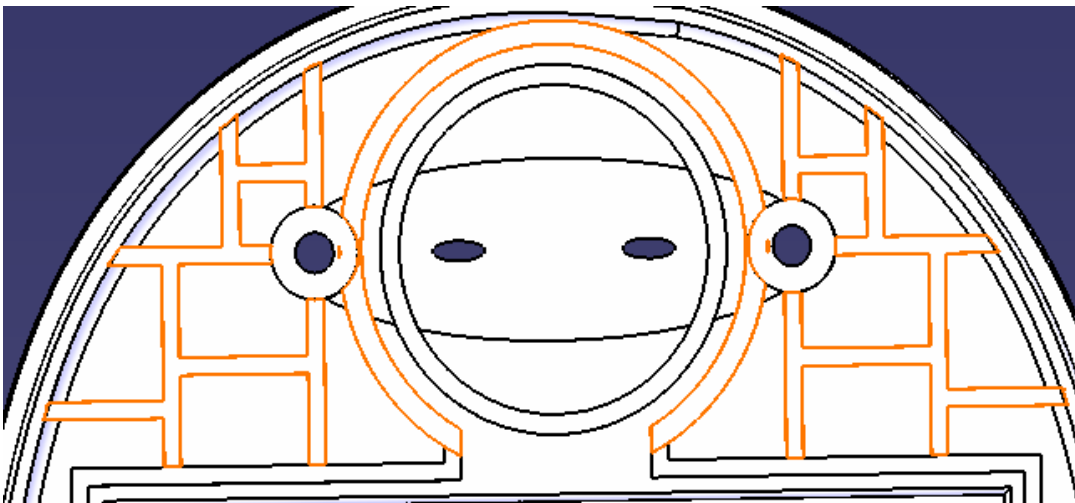


Figure 2.3.6: Drawing different sketches inside the flip-RR

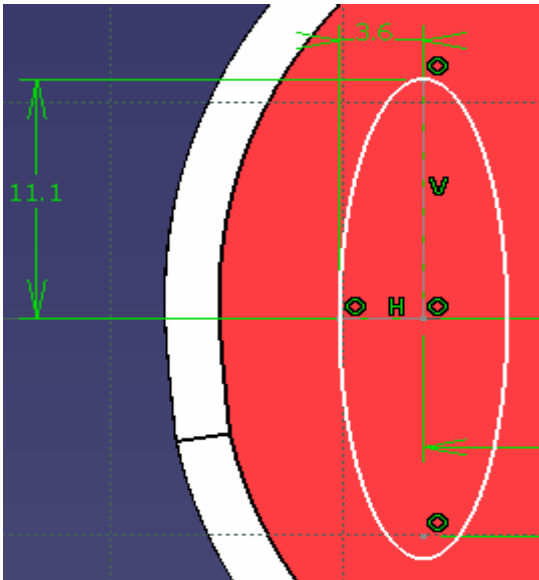


Figure 2.3.7: Drawing an ellipse for the head set.

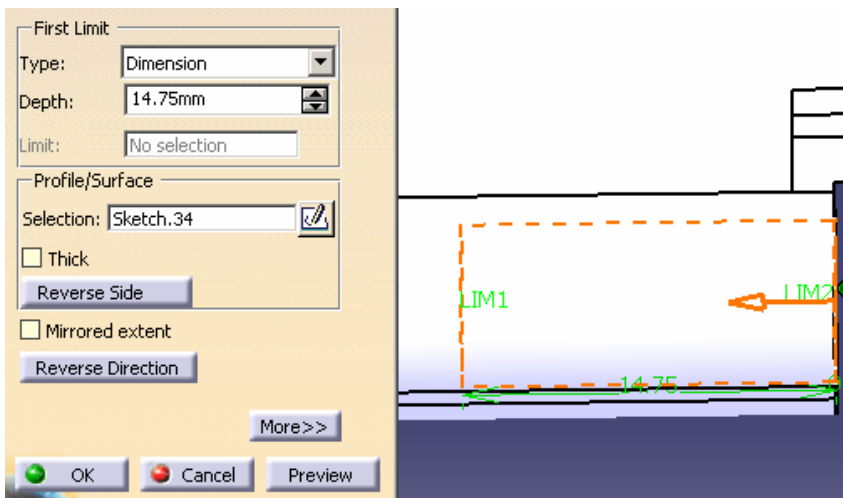


Figure 2.3.8: Pocketing a hole in which the hinge will be later inserted

In the above figures, different sketches were drawn to improve the appearance and include all the details inside the part. As a first step, the pocketing of the sketch for the inner screen was completed. Then a curve was drawn on the outer face; later, it was pocketed to create space for the screen cover. Some structures were designed to reinforce the part adjacent to the thread hole. An ellipse was sketched to design the head set. A hole in which a hinge will be inserted was pocketed. It will be later attached to the other part constituting the core of the flipflop.

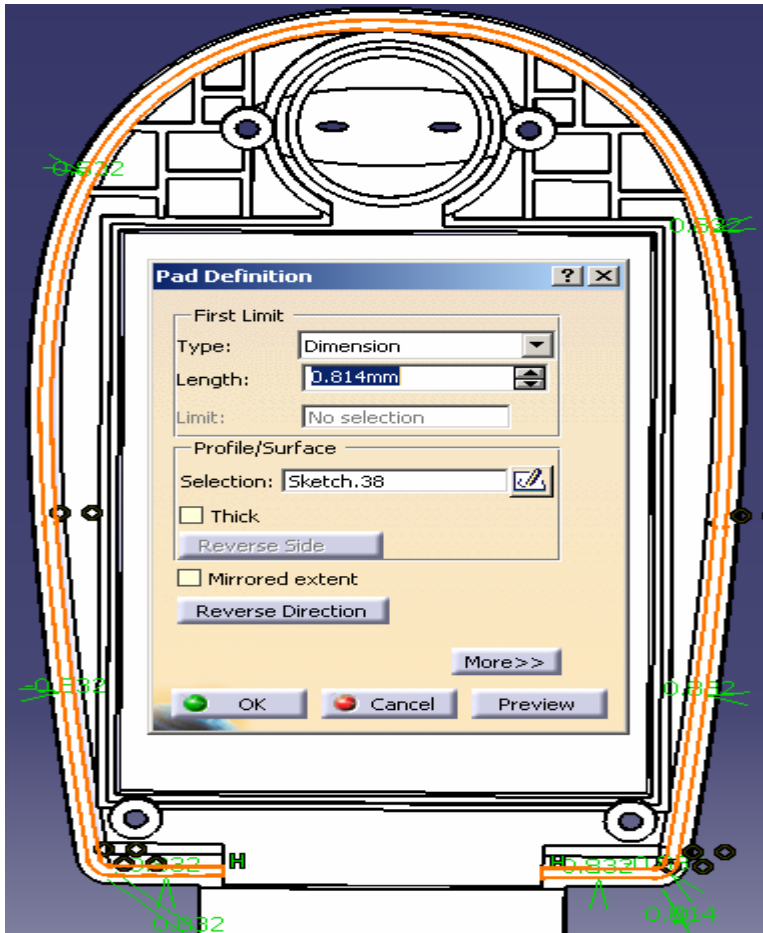


Figure 2.3.9: Padding the edge

In the above figure we padded the offset edge which will perfectly fit with the other part.

2.4 Master-housing-FR:

This part is the third major one, it is the frontal appearance of the housing part. Sketches of pads and pockets present inside it will be also used to represent other future parts to assure perfect assembly.

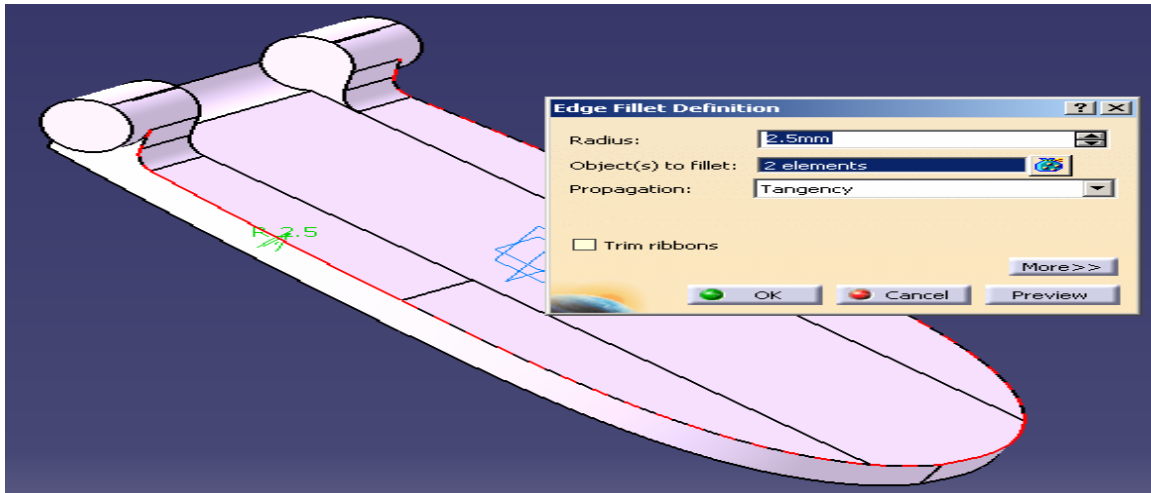


Figure 2.4.1: Master-housing-FR

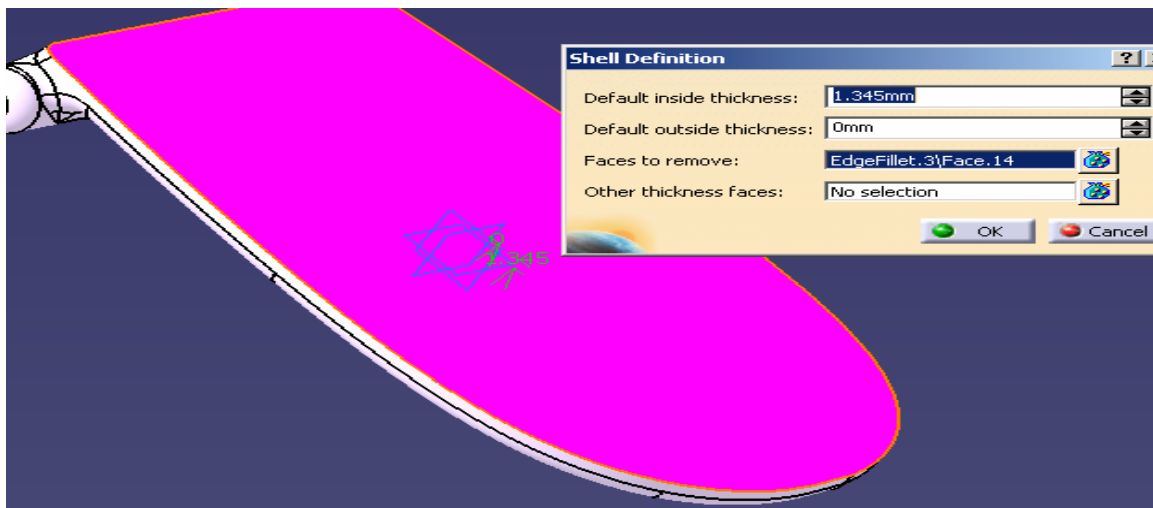


Figure 2.4.2: Shell of master-housing-FR

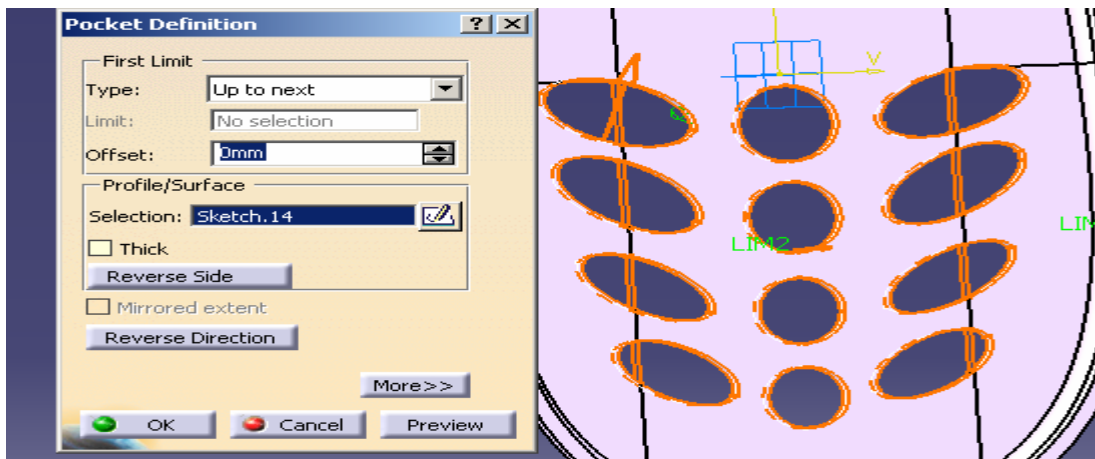


Figure 2.4.3: Pocketing holes for the keys

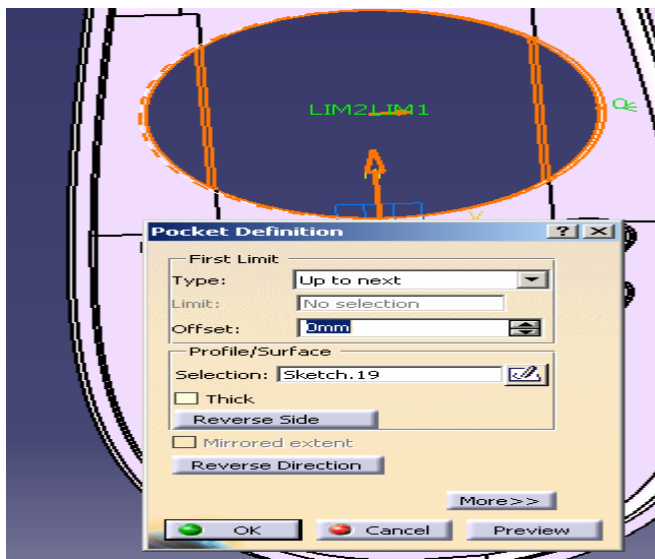


Figure 2.4.4: Pocketing holes for one key.

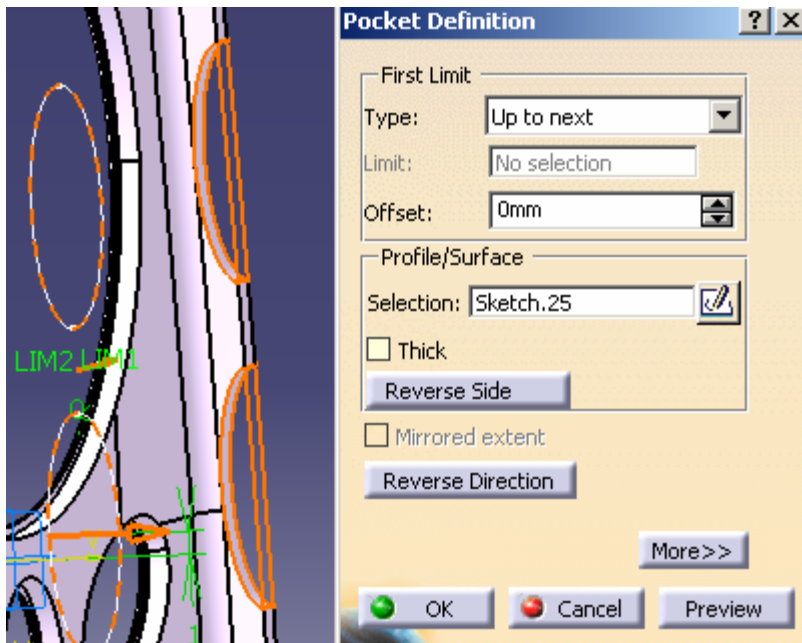


Figure 2.4.5: Pocketing for the side keys

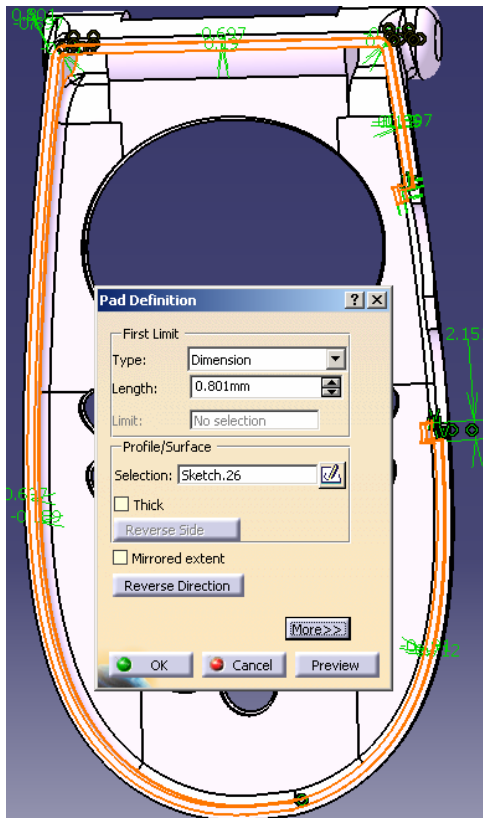


Figure 2.4.6: Padding the offset for the edges

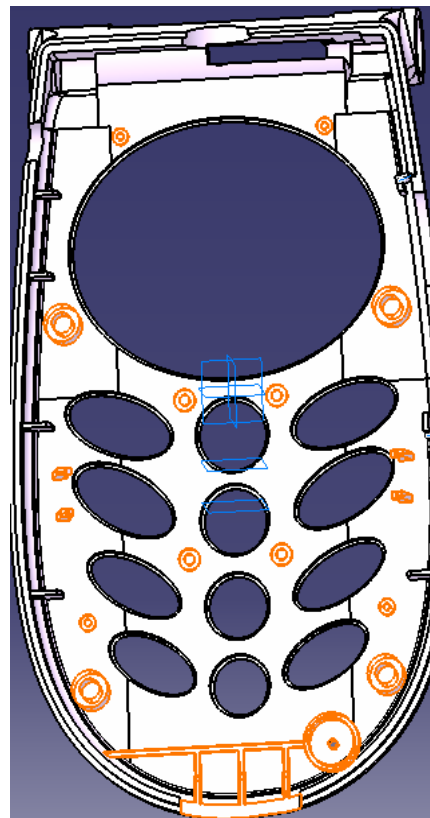


Figure 2.4.7: Padding different sketches

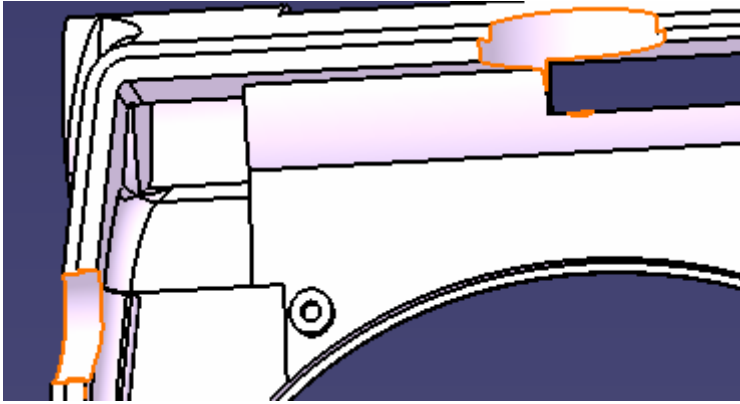


Figure 2.4.8 Pocketing holes for antenna and adapter

In the figures above, we can see the birth of master-housing-FR. Edge fillet of 2.5mm is made to assure smooth round corner. A shell function of 1.3mm inner thickness was built. Sketching holes were added as ellipses and circles for the front and side keys. In the figure 2.4.6 we offset the edge and padded the offset edge which will perfectly fit with the other part. In figure 2.4.7 we draw different sketches for various thread holes, some are designated to fit with the keypad, and others to attach housing-FR to RR. Also a microphone hub and some structures are added to fit perfectly with the board.

2.5 Master-housing-RR:

This is the fourth and the last major part of the cell-phone. It is the rear part of the housing. By designing it, the outer appearance will be completed. Sketches of pads and pockets present inside it will be also used to represent other future parts to assure perfect assembly.

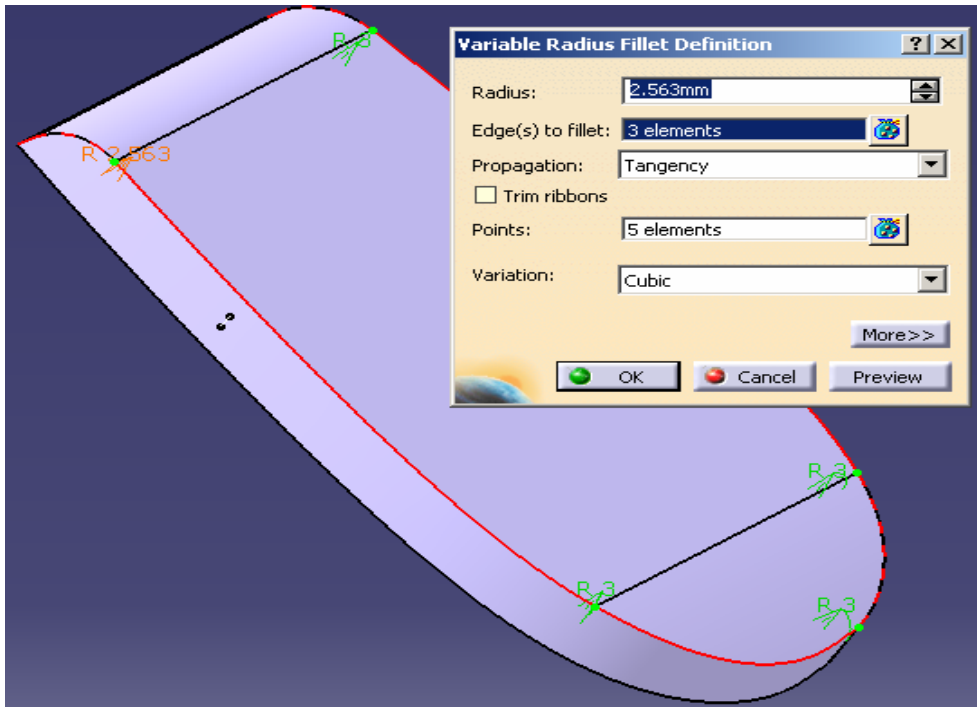


Figure 2.5.1: Fillet of the master-housing-RR

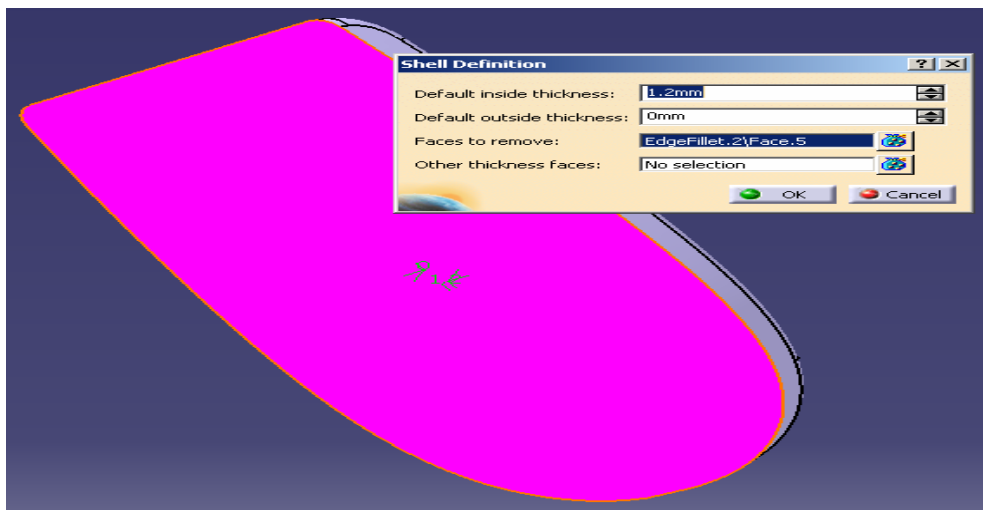


Figure 2.5.2: Shelling of the master-housing-RR

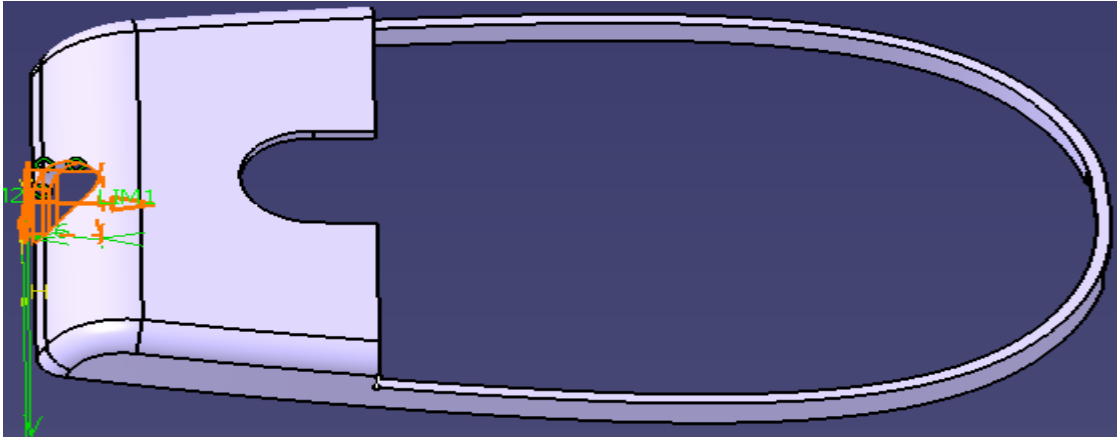


Figure 2.5.3: Pocketing sketches inside master-housing-RR

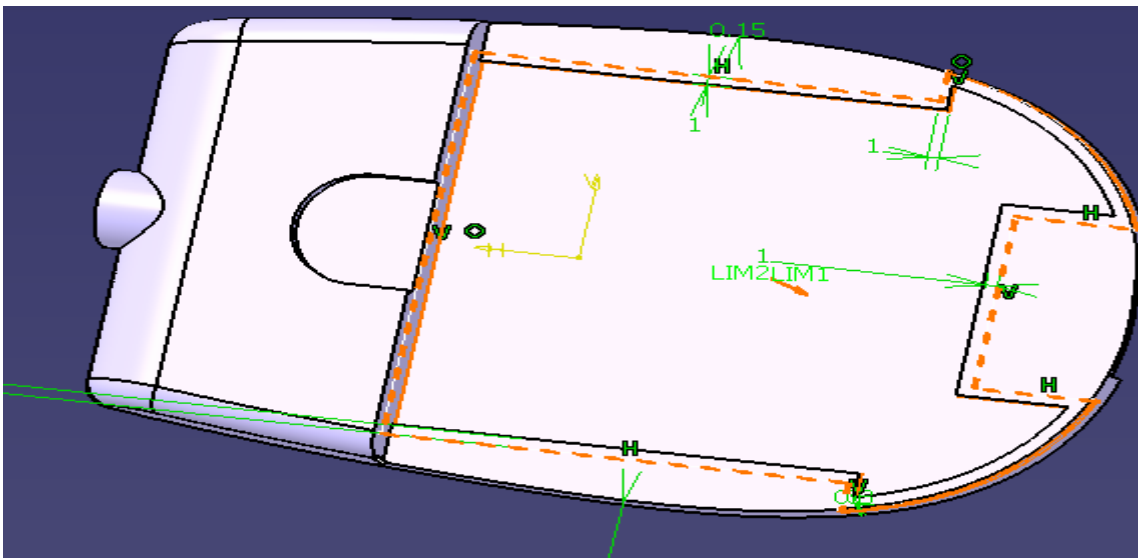


Figure 2.5.4: Padding sketches inside master-housing-RR

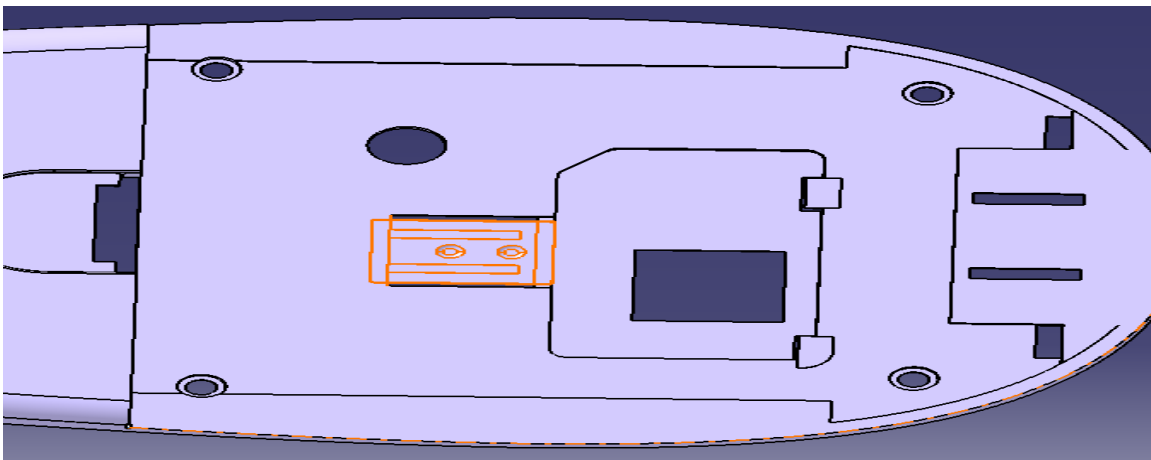


Figure 2.5.5: Master-housing-RR after many iterations

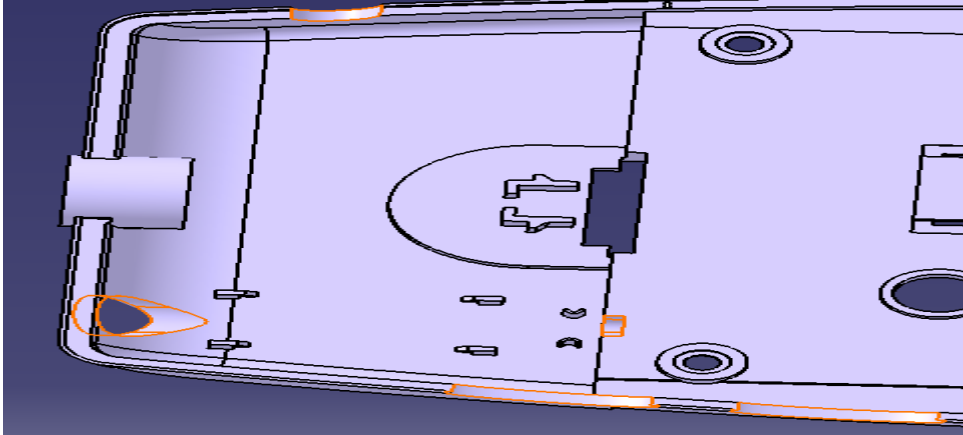


Figure 2.5.6: Pocketing different holes

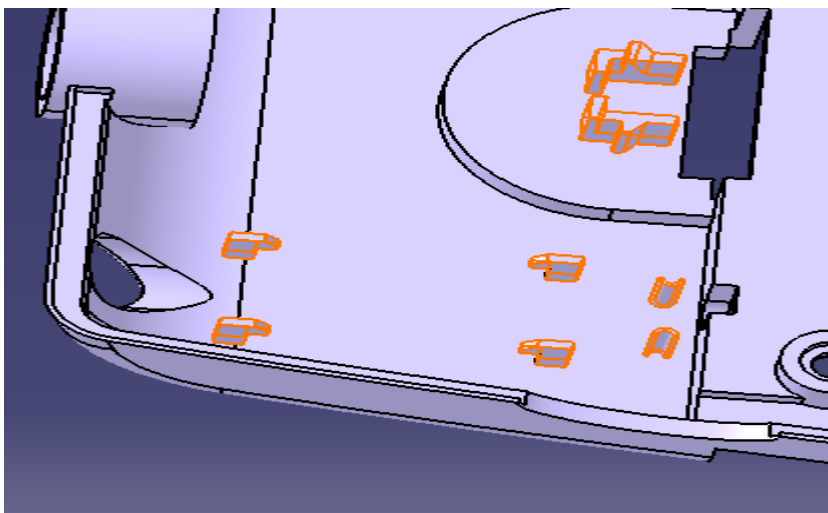


Figure 2.5.7: Padding different sketches

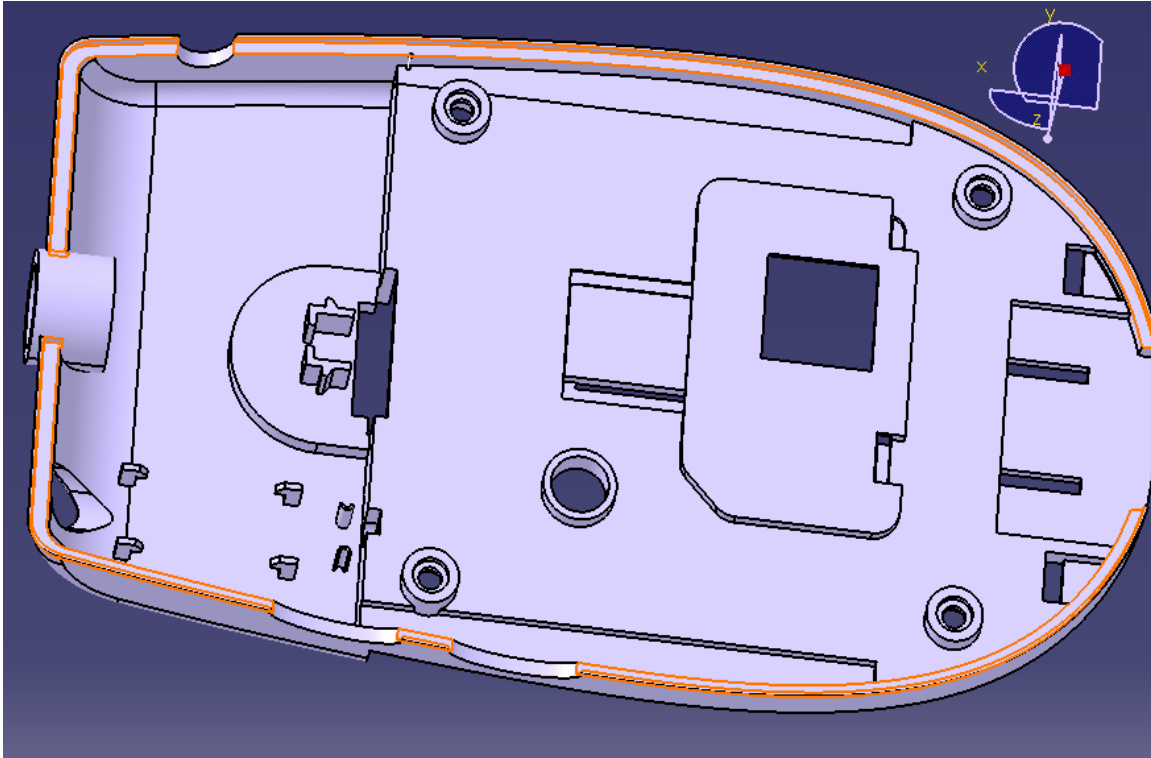


Figure 2.5.8: Offset of the edge.

The previous figures show how master-housing-RR is designed. First, as usual, a fillet for the sharp edges was made, then a shell was created. In figure 2.5.3 a sketch for the location of the battery was pocketed. In figure 2.5.4 sketches were padded to prepare the part for future assembly. Details were also added to place the sim-card, the battery pins, and the sim-card lock.

In figure 2.5.7 padding was applied to different sketches of clamps: 2 pairs of clamps facing each other will be later used to attach the pen to the body, and another pair is destined to attach the battery buckle.

In figure 2.5.8 we pocketed the offset so that the other part can perfectly fit with it

2.6 Antenna:

The figures below show the antenna used to catch network. The antenna was designed with a spherical ball, having a hole inside for chain attachment. It is made of aluminum because of its light weight.

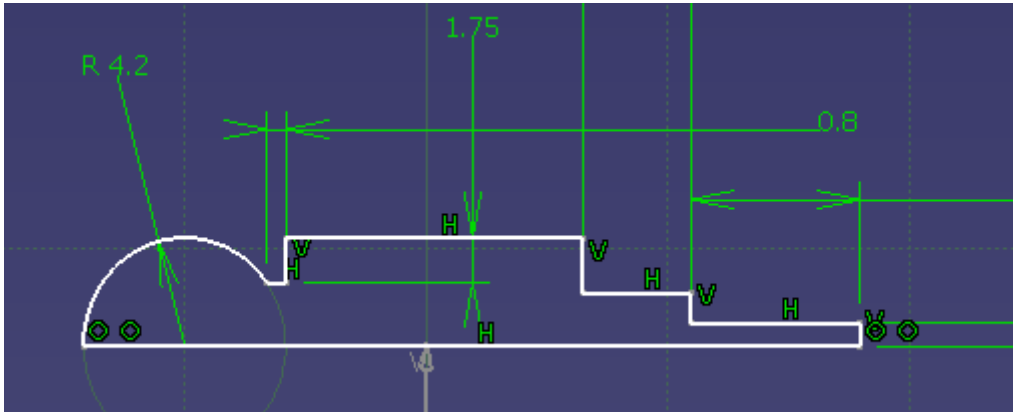


Figure 2.6.1: Sketch of the antenna

In the figure above, the cross section of the antenna is represented. The solid part will be generated by the shaft option.

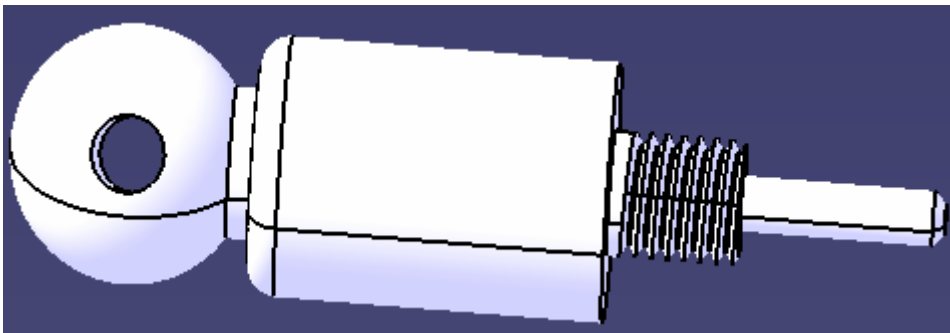


Figure 2.6.2: Antenna as a solid part

The figure above shows the antenna as a solid part with all the modifications added to the sketch .

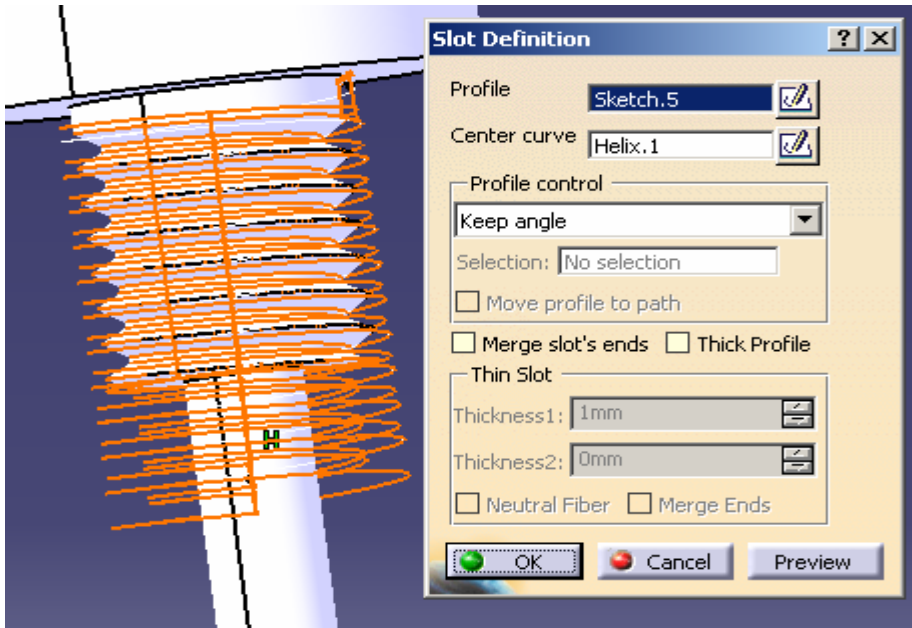


Figure 2.6.3: Threaded part of antenna

This figure shows the threaded lower part done by using a helix and a small trapezoidal sketch (sketch5).

2.7 Battery 1:

It is one of the easiest parts to design. It consists mainly of drawing a rectangle based on standard dimensions, then padding it.

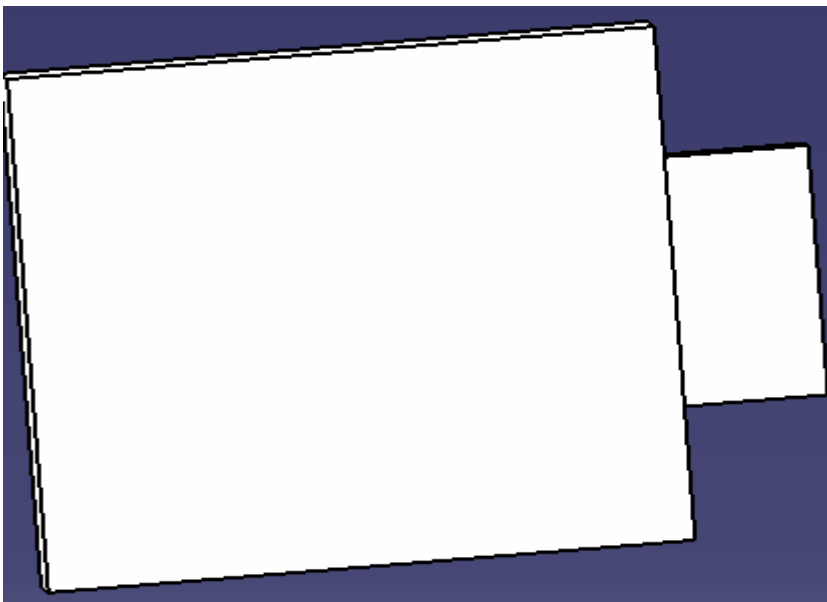


Figure 2.7.1 Side view of the battery

2.8 Battery 2 (battery pin):

The design shows two identical pins for the positive and the negative poles. The figure below represents the sketch of the battery pin which will be extruded using pad function.

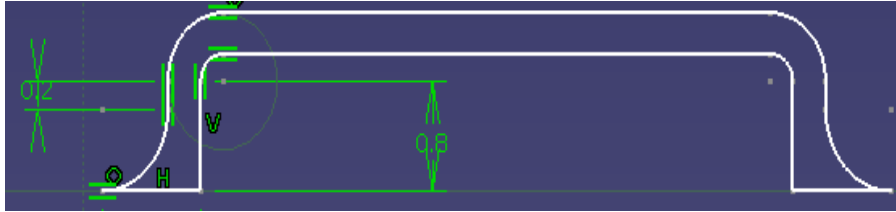


Figure 2.8.1: sketch of the battery pin

2.9 Battery Cover:

This is also an outer part which will be attached to the master-housing-RR. Profile and guiding curves were extracted from the master-housing-RR. A surface was generated using them.

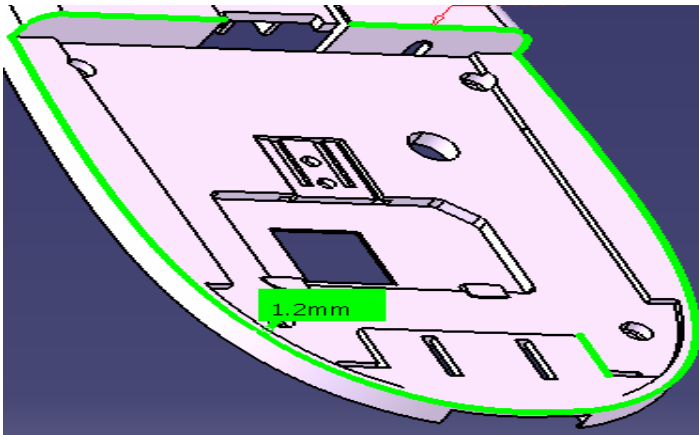


Figure 2.9.1: Extracted curves to generate the battery cover

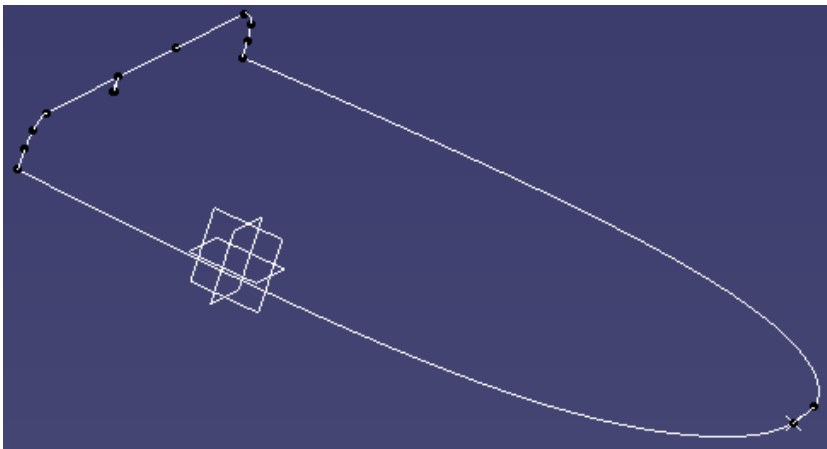


Figure 2.9.2: Curves attached to each other

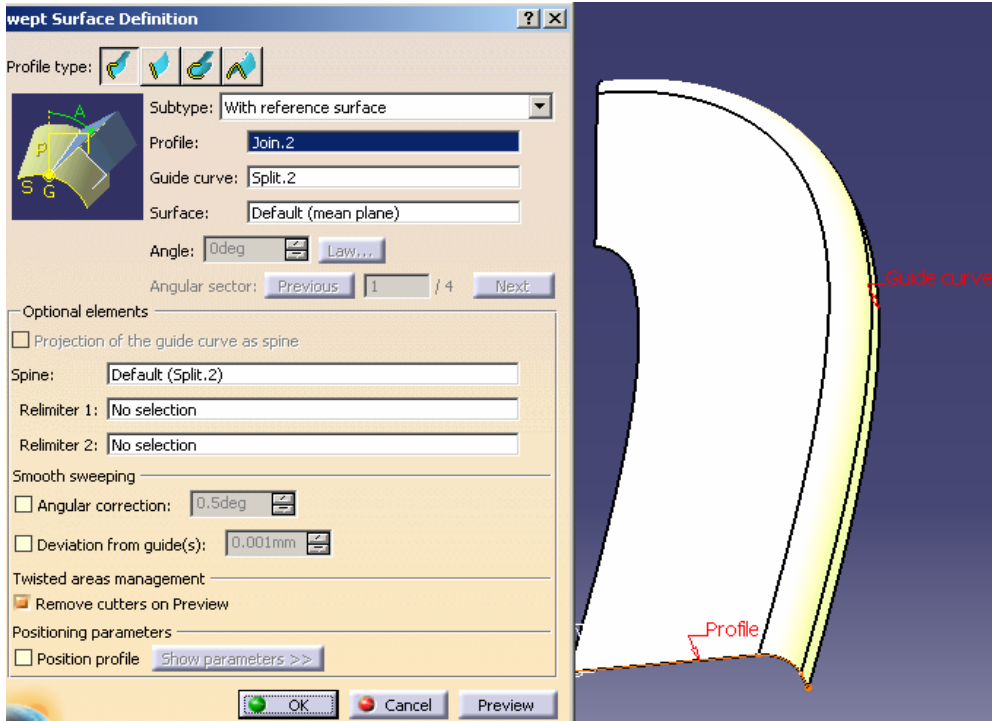


Figure 2.9.3: Generating a surface using extracted curves

The above figure clearly displays how we have generated each side of surface separately; otherwise a cusp would have resulted. To fill the space between the two surfaces we generated a surface using the fill function.

2.10 Battery Buckle:

This part is used to attach the battery cover to the master-housing-RR.

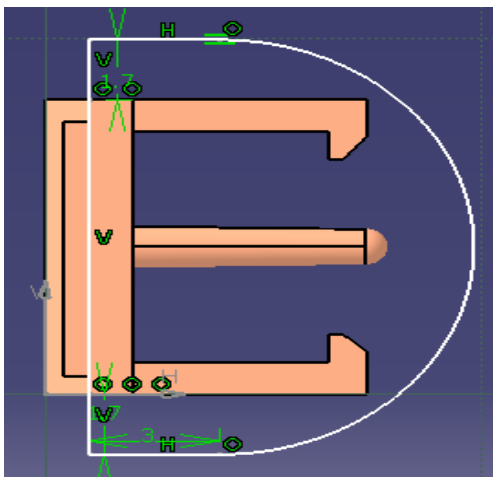


Figure 2.10.1: Sketch of the upper-part

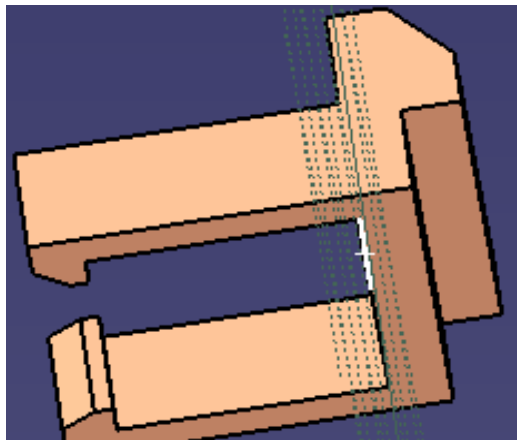


Figure 2.10.2: Showing the lower part

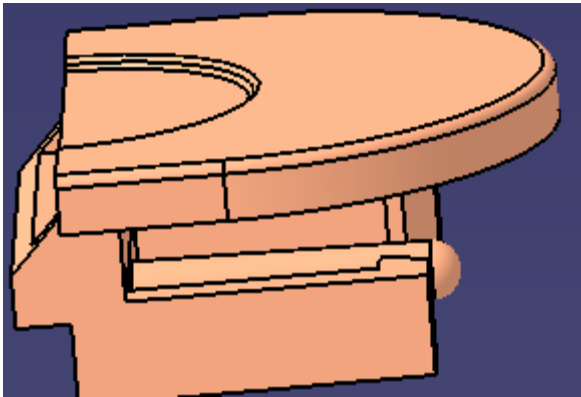


Figure 2.10.3: Showing the whole model

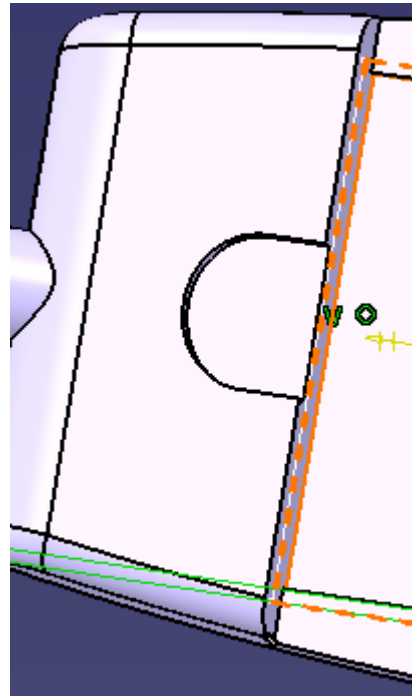


Figure 2.10.4: Battery buckle place

In this part, padding and pocketing were used to make iterations.

In figure 2.10.4 we see where the battery buckle will fit on the master-housing-RR.

2.11 Battery RR:

This part together with the battery cover will make a sandwich around the battery itself. It is extracted from the master-housing-RR.

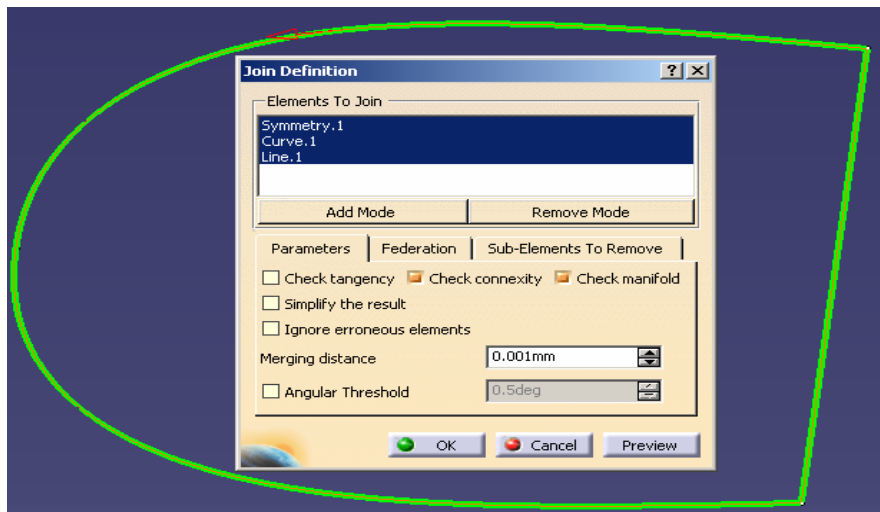


Figure 2.11.1: Showing extracted curves

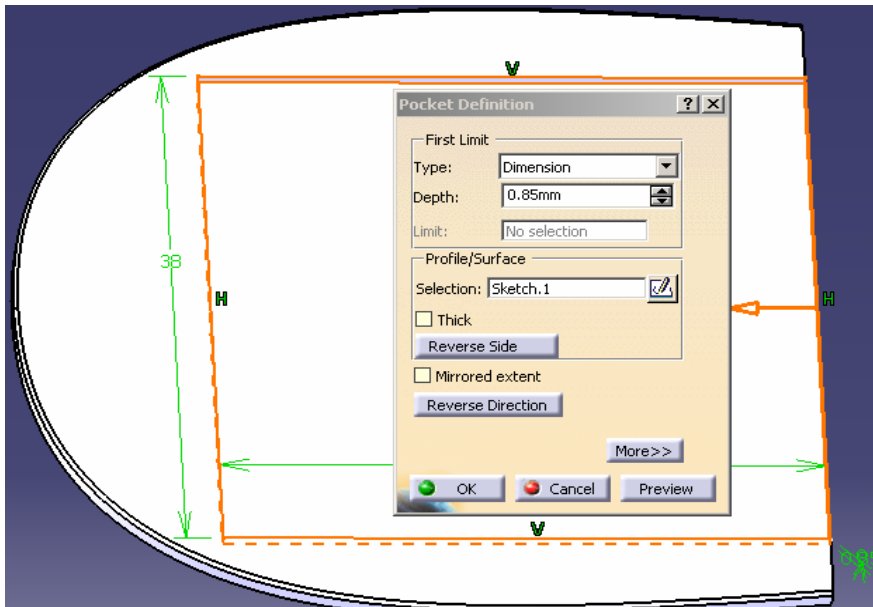


Figure 2.11.2: Pocketing a sketch

In the above figure, the dimension of the pocketed sketch is almost equal to that of the battery.

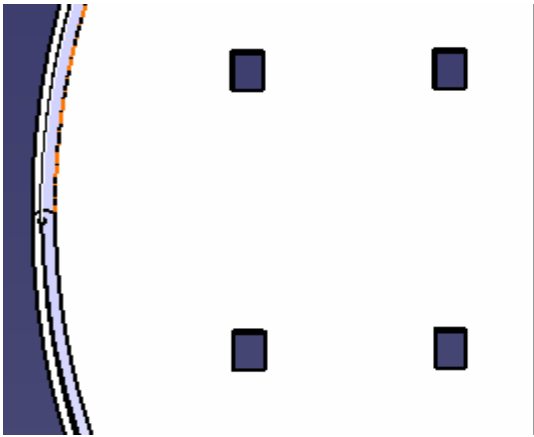


Figure 2.11.3: Holes for the battery pins to fit in

2.12 Camera Cover :

This part is the cover for the camera lens. It will be attached to the master-flip-FR.

The sketch below is extracted from the master-flip-FR.



Figure 2.12.1: Sketch of the Camera cover

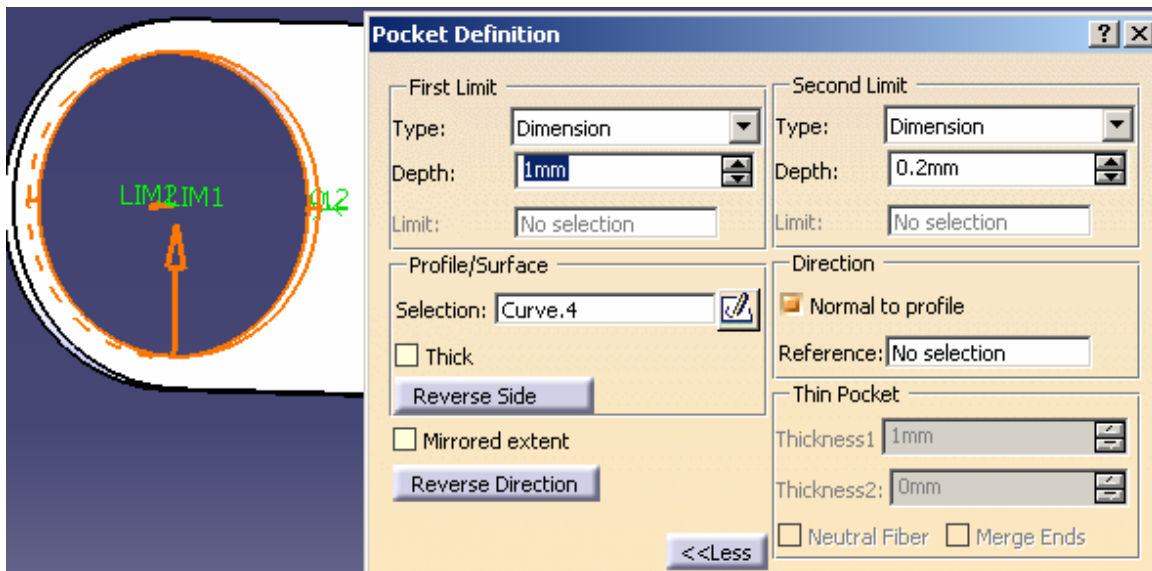


Figure2.12.2: Padding a hole for the lens

2.13 Master hinge:

This part will connect the master-flip to the master-housing. The squared end of the master hinge will fit in the master-housing, while the rest will fit in the master-flip. This part should be rotatable, but in our design, it is just for demonstration.

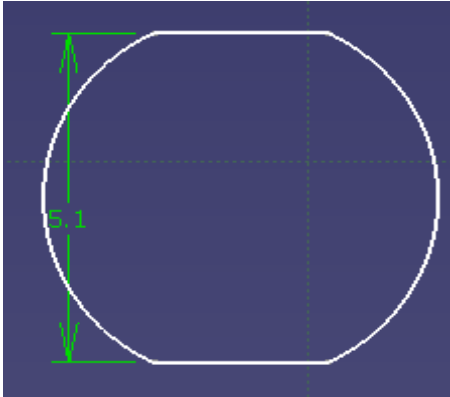


Figure 2.13.1 Sketch of the middle body

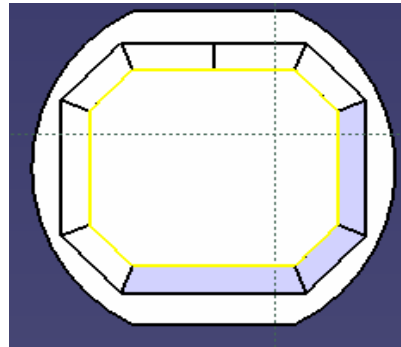


Figure 2.13.2 Sketch of one end

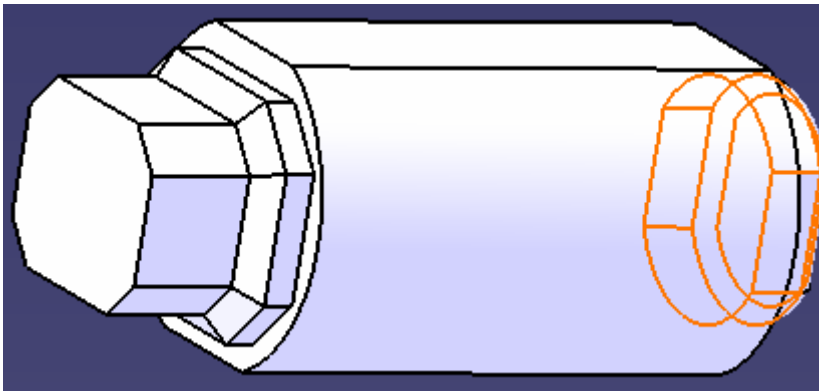


Figure 2.13.3 Master hinge

2.14 Electronic-board:

The electronic board is the core of the cell-phone, while the other parts are designed only for appearance. In our design we have included the basic electronic parts.

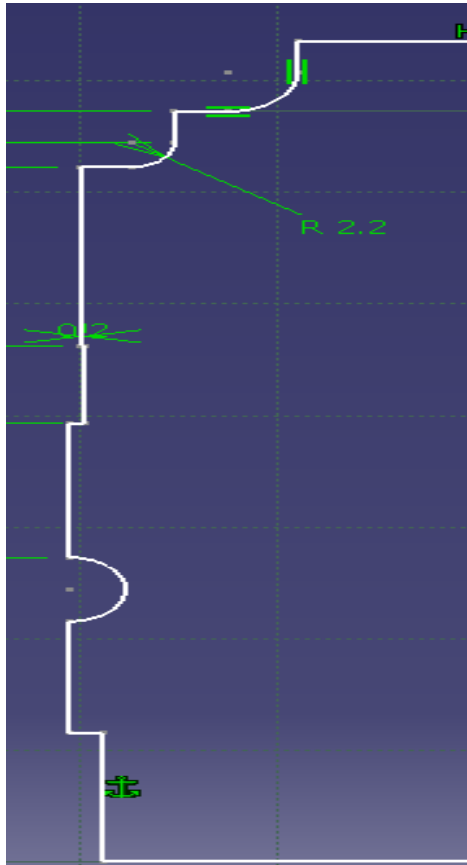


Figure 2.14.1: Sketch of the electronic-board

The above sketch is made in harmony with the master-housing-FR and master-housing-RR. It will fit between them. The semi-circles and different orientations were designed to facilitate the fittings.

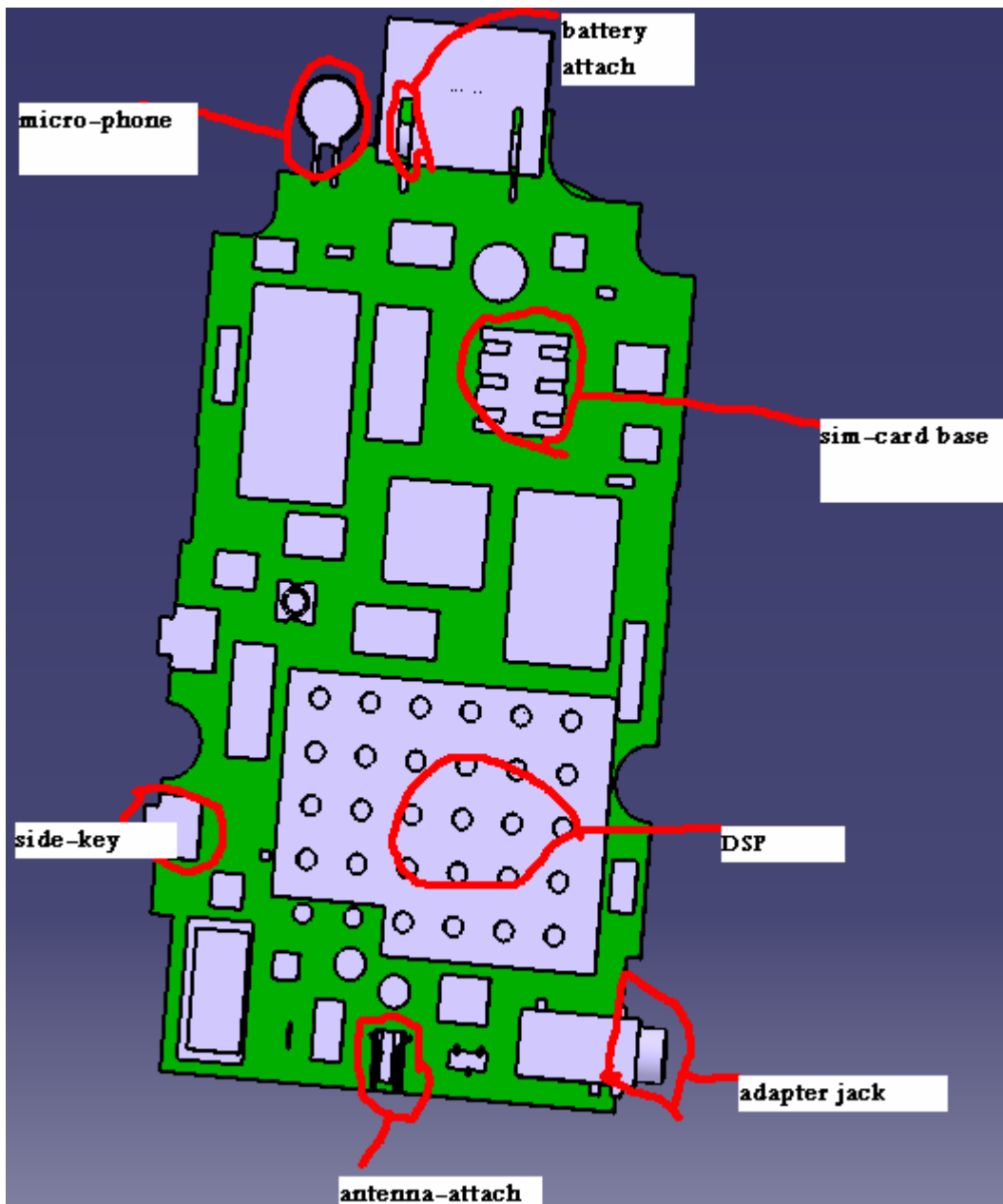


Figure 2.14.2 Labeling electronic board

The figure above displays the labels of some parts: microphone, battery attach, sim-card base, DSP(Digital Signal Processor),adapter jack, and side-key. Also, other parts were left unlabeled, like the micro-processor , the memory, the capacitors and the diodes.

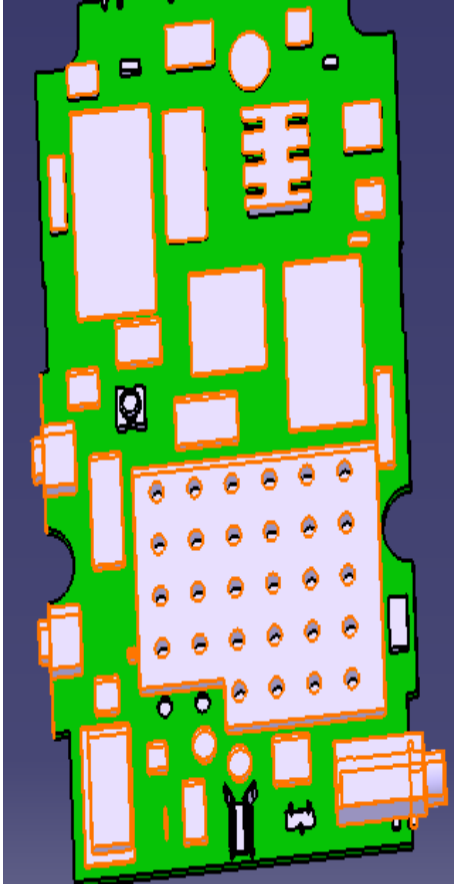


Figure 2.14.3 Different sketches

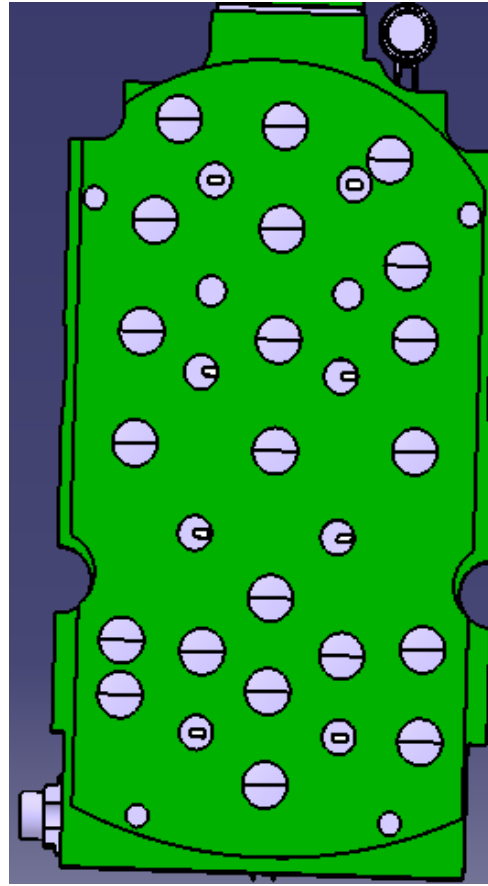


Figure 2.14.4 frontal view with bottoms

In the above two figures we see the different sketches using various pads and pockets. Everything is perfectly fitted into position. Also in the frontal view we see the bottom which will be attached to the keypad. No materials were applied to this part because each portion is made of specific material.

2.15 Keypad:

This part is made of soft rubber. Most of the sketches are copied from master-housing-FR. As a result, the new padded sketches will fit perfectly in the holes of the master-housing-FR.

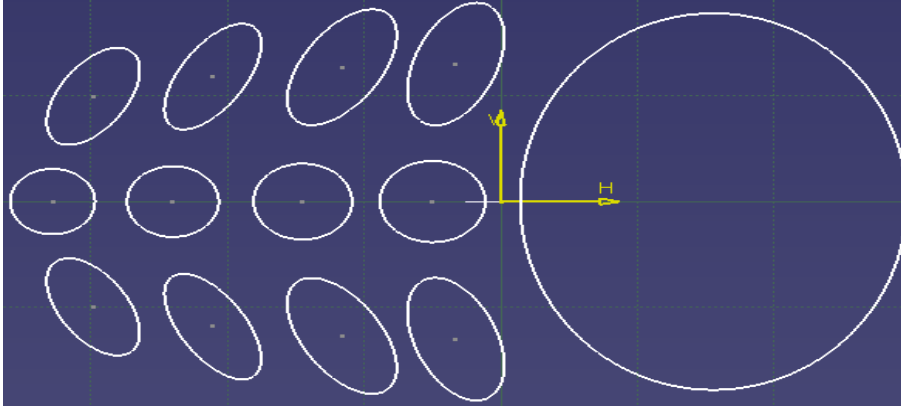


Figure 2.15.1: Sketches of the keys

In the figure above, the sketches were copied from master-housing-FR. They will be padded to create the keys.

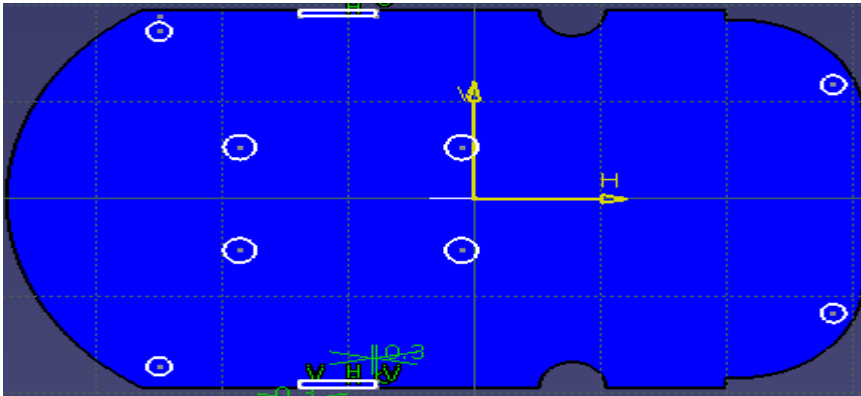


Figure 2.15.2: Sketches which will be pocketed

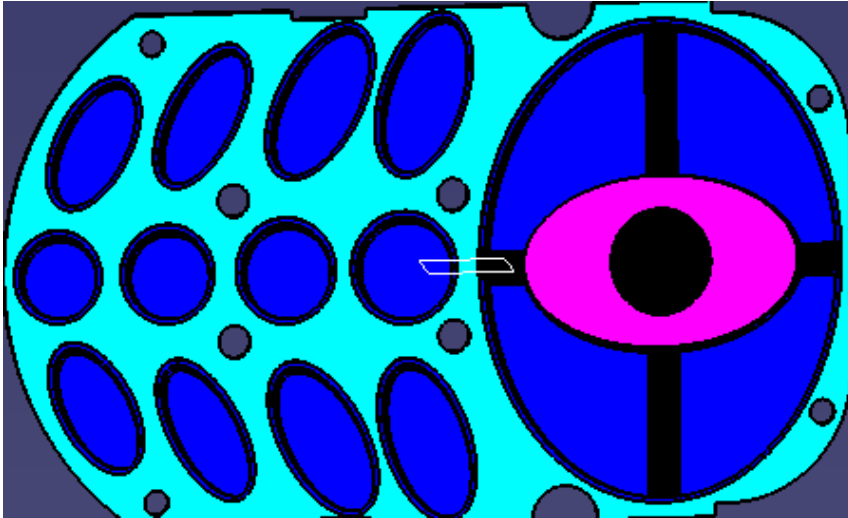


Figure 2.15.3: Front view of the keypad

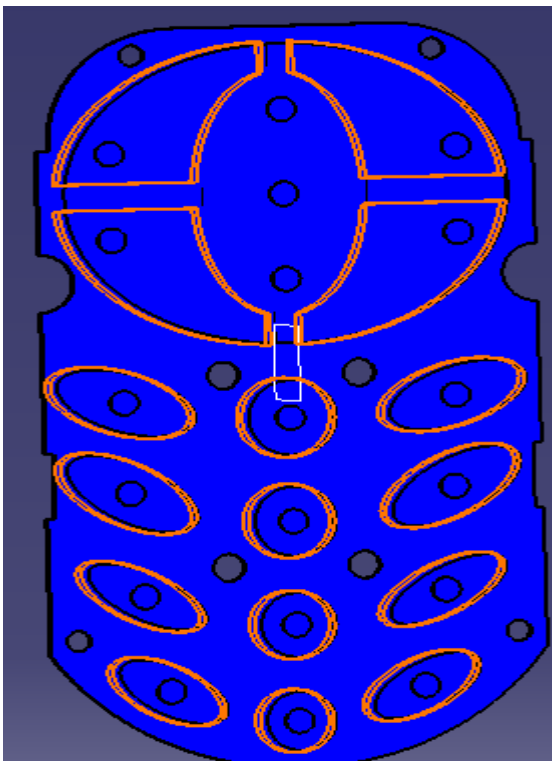


Figure 2.15.4: Rear view of the keypad

In the above figures we can see how sketches are drawn to be pocketed to assure the perfect contact with the master housing-FR. In the second figure we see the front view of the keypad. Different colors were used to represent the bottoms in the large pad. In figure 2.15.4 Small circular pads were drawn on each bottom to insure perfect contact with the board.

2.16 LCD Mouldle(screen):

This part has two screens, the bigger one is the main screen, it will be attached to master-flip-RR. The smaller one will be placed on the outermost side, where the camera is located underneath.

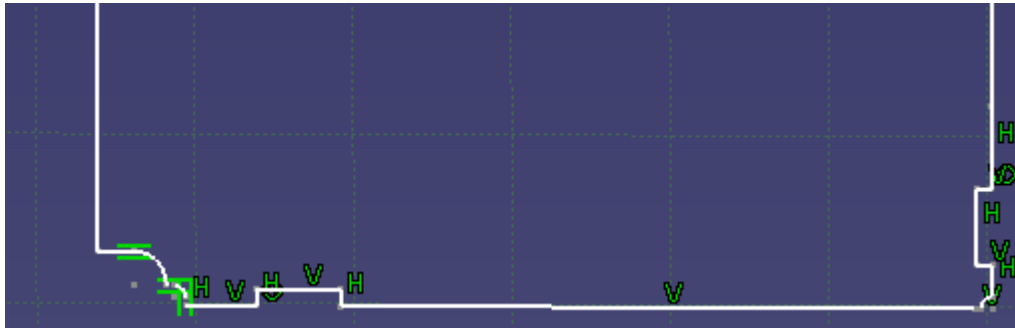


Figure 2.16.1: Sketch of the board of the LCD screen

In the above figure we see the sketch with all the curves to fit into position when assembled

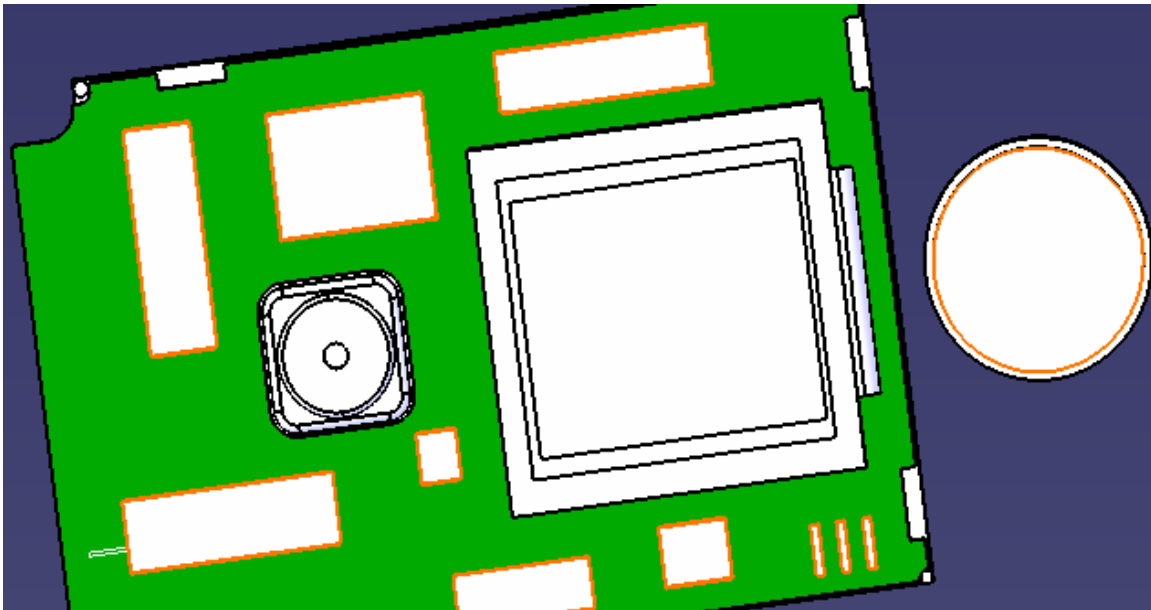


Figure 2.16.2: Sketching different electronic parts on the board

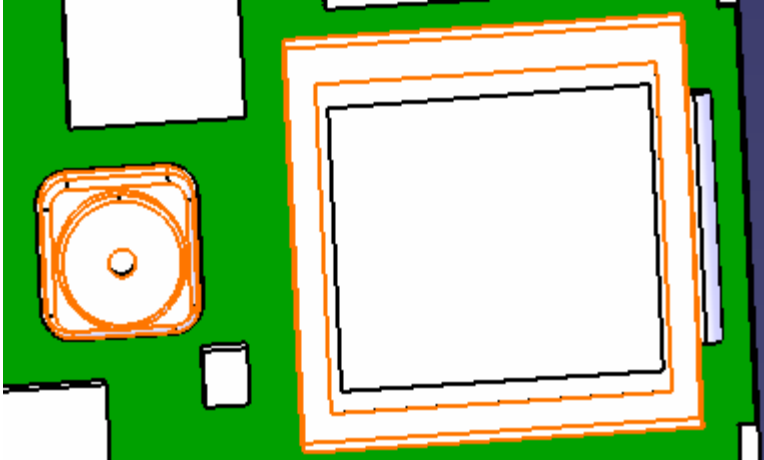


Figure 2.16.3: Sketching the small screen and the camera

The small screen is 19x16mm. The camera is presented as a circular pad with the pin hole representing the lens that will be covered by the lens cover to assure protection.

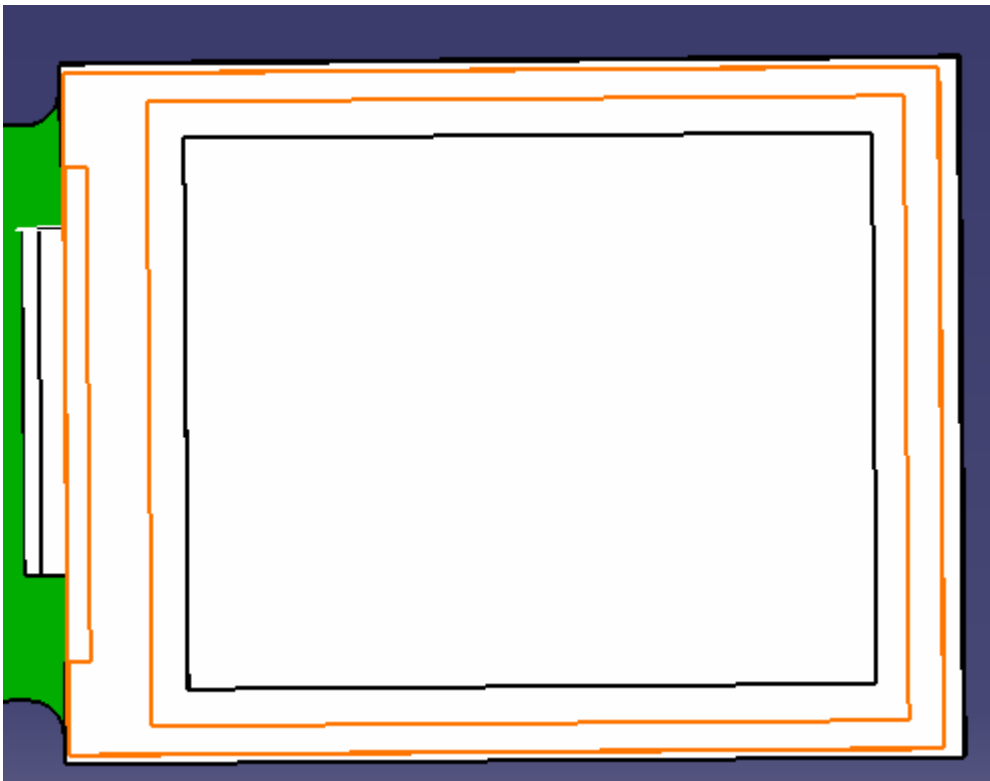


Figure 2.16.4: Sketching the inner screen

Here we can see the size of the inner screen which is 38x52 mm but the actual screen displayed is the most inner one which is 30x40mm.

2.17 Hinge Cap:

This part is used as a top cover of the master-housing-FR for aesthetical reasons. It is made of aluminum, because of its light weight. Its appearance harmonizes with that of the antenna.

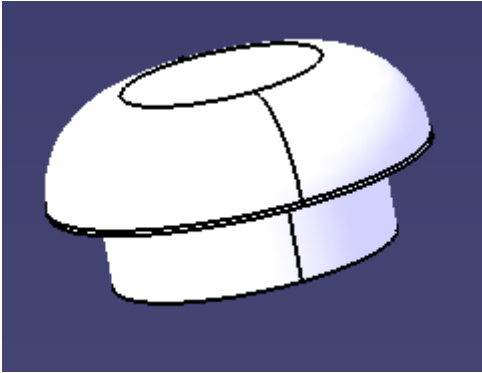


Figure 2.17.1: Hinge Cap

One hinge cap is found on each side of the master-housing-FR. Each was made up of two circles with different diameters.

2.18 Pen-head:

This part is made of plastic it has the shape a pen head but of course it doesn't have ink inside.

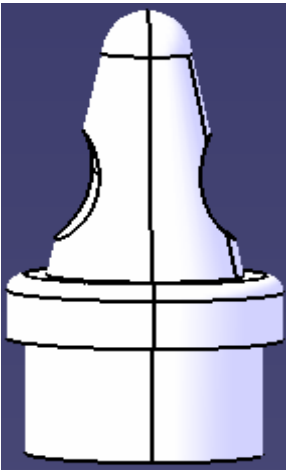


Figure 2.18.1: Pen-head

In the figure we see different sketches drawn to make the shape similar to a real pen. Also the hole on each side to make it fit into position.

2.19 Pen A :



Figure 2.19.1: Pen A

2.20 Pen B :



Figure 2.20.1: Pen B

2.21 Pen C :



Figure 2.21.1 Pen C

The above three parts Pen A, Pen B, Pen C, are cylindrical pads which will fit together to form the arm of the pen.

2.22 Screw:

The screw is used to attach different parts together such as master housing-FR and RR together. It also has a diameter and length to aligned with the diameter and length of the hole.

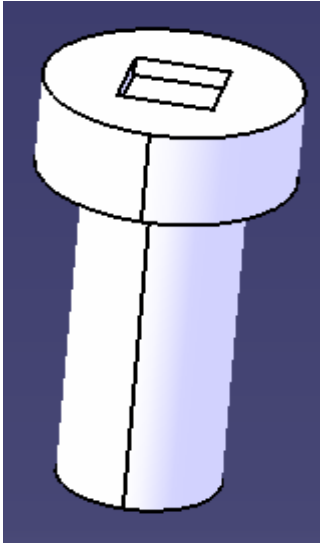


Figure 2.22.1: Screw

2.23 Screw Cover:

It's a rubber cap on top of the screw in the master-flip-FR and RR

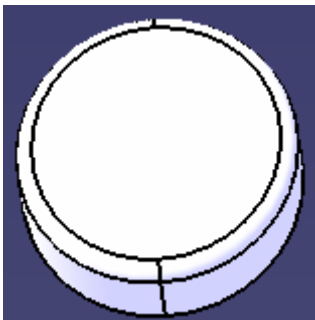


Figure 2.23.1: Screw Cover

2.24 Side keys:

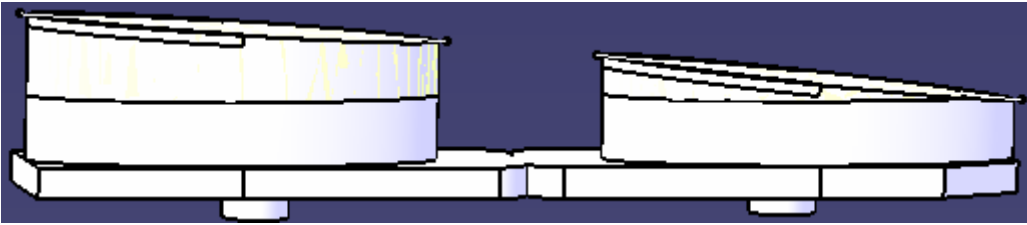


Figure 2.24.1: side view of the side keys



Figure 2.24.2: top view of the side keys

In the figures above we can see the side keys with different views. The figure 2.24.1 shows us different height and the cutting angle so the bottoms will have the same orientation as the out side body.

2.25 Sim Card:

That's usually not included in the cell-phone. But we draw it for simulation purposes.

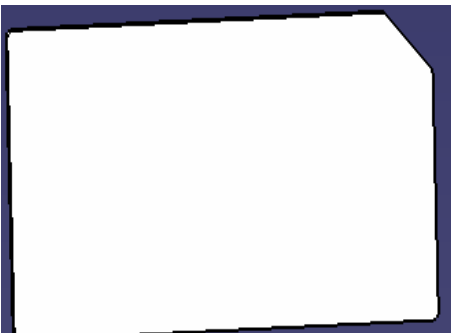


Figure 2.25.1: Sim-card

2.26 Sim Card Lock:

It is used to lock the sim-card in its place on the base connected to the electronic board. As we see the figure below its like a smiley face where the mouth is for grabbing with our finger, where the eyes will be the guides in the slots. Also the nose will be the fixing element into position. It was drawn using the sketch below and then making some pads and pockets.



Figure 2.26.1: sim-card lock sketch

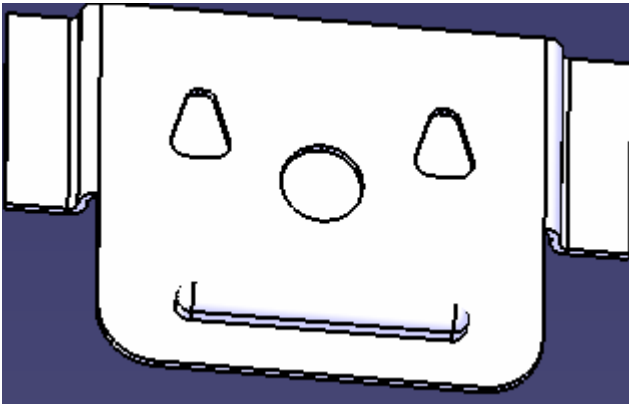



Figure 2.26.2: sim-card lock


3 ASSEMBLY DESIGN


In this chapter we are going to discuss assembly design of different parts together. In our project we assembled four different products. In each product there are certain steps to be conducted to assure perfect assembly. At the end we will have a final assembly which is the product of the four products. The main reason we do the assembly on two steps is that we will have a sub-product before having the final product. So any interference or clash will be solved in the sub-product before introducing it to the final product.

Here is a brief definition of the of the assembly symbols used:

Fix Component 

Coincidence icon: 

Contact icon: 

Offset icon: 

3.1 Product1 :

Is composed of twelve parts assembled together these parts are:

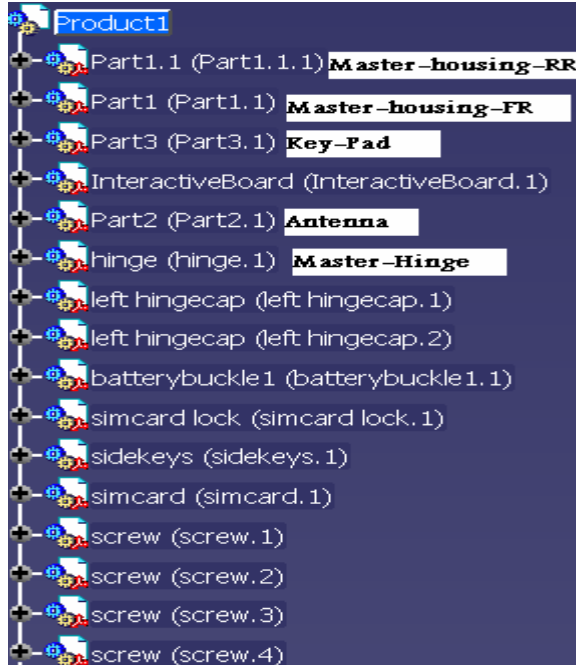

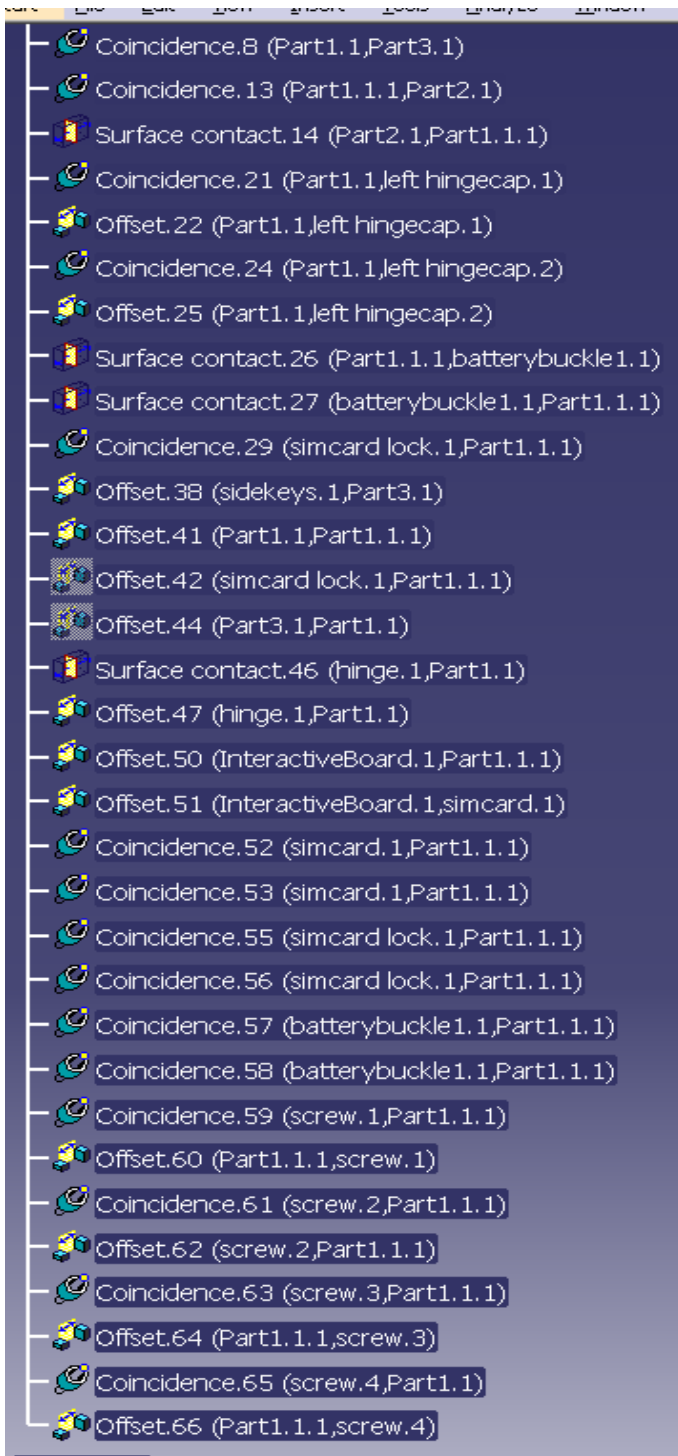


Figure 3.1.1: product1 parts list

In the above figure we see different parts. To assemble these parts together there are some constraints to follow in the assembly workbench. We had the Master-housing-RR as the

base so we fixed it with  Fix.3 (Part1.1)



To the left are the constraints used in the assembly they are about 32 constraints to assure perfect assembly. We used different kinds of assembly functions. We cant talk about each precisely because it will be a time consuming.

Figure 3.1.2: showing different constraints

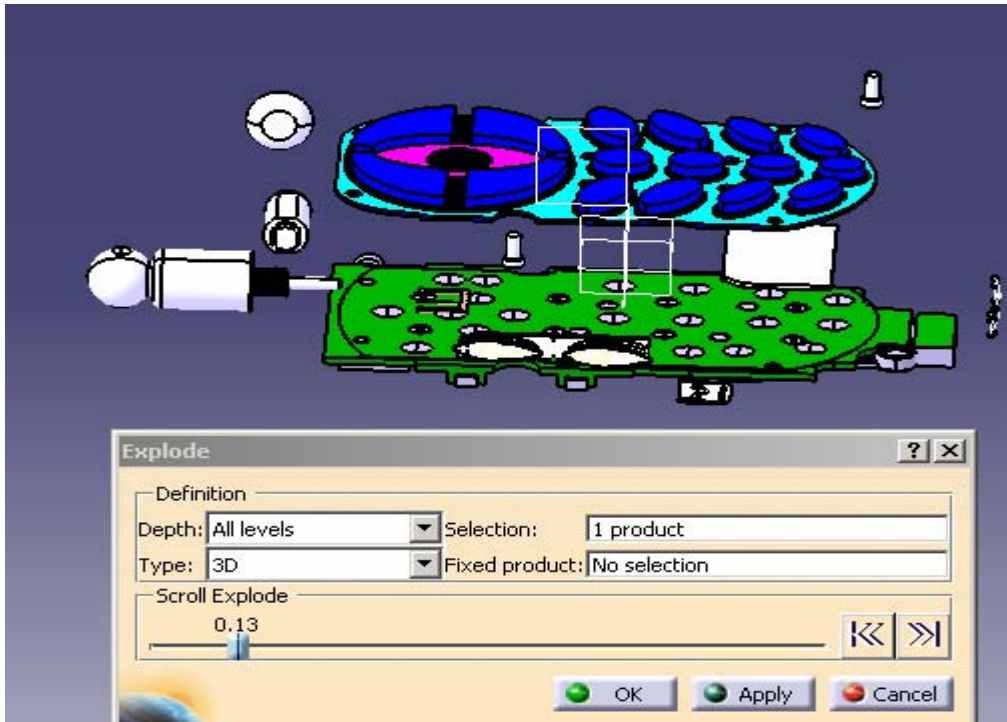


Figure 3.1.3: Showing different parts with the explode

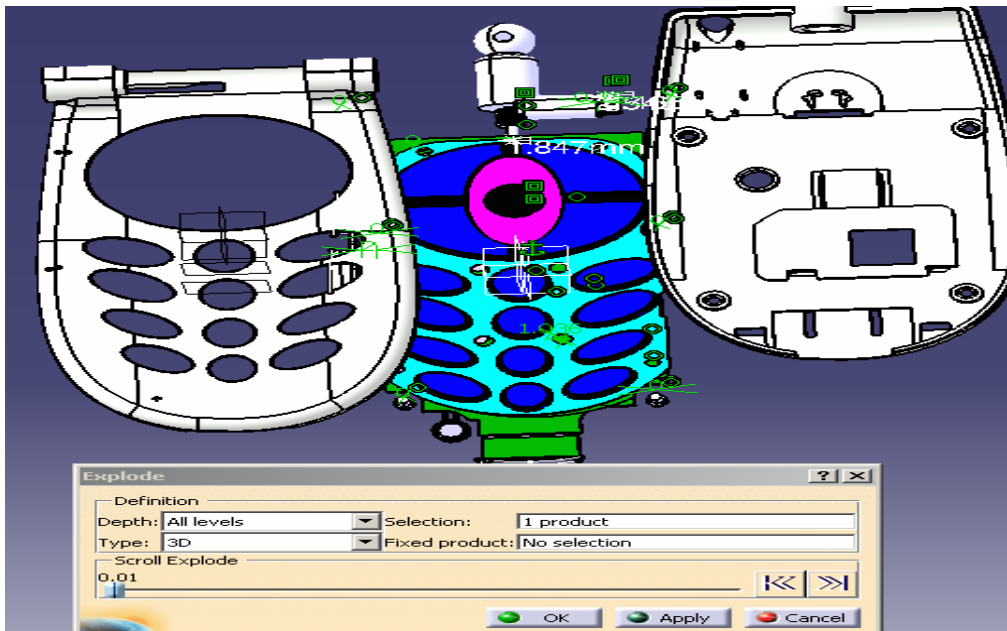


Figure 3.1.4: Showing all the parts with the explode

The above figures are showing different angles of view and different levels of the explode option. The first one is showing us the key-pad, antenna, electronic board, master-hinge, and simcard. While in the second one the previous mentioned parts are shown next to master-housing-FR and RR.

3.2 Product 2:

Is composed of five parts as shown in the figure below as the screw cover is repeated twice. Assembled together using four constraints. The first constraint is the fix. Here we fixed master-flip-FR and we assembled the other parts on it using the offset constraint.

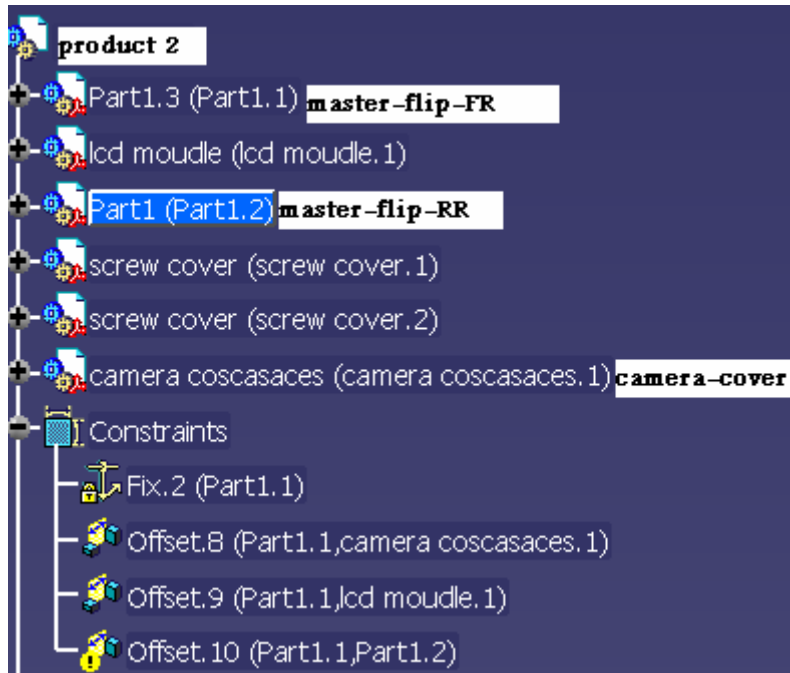


Figure 3.2.1 showing product list and constraints

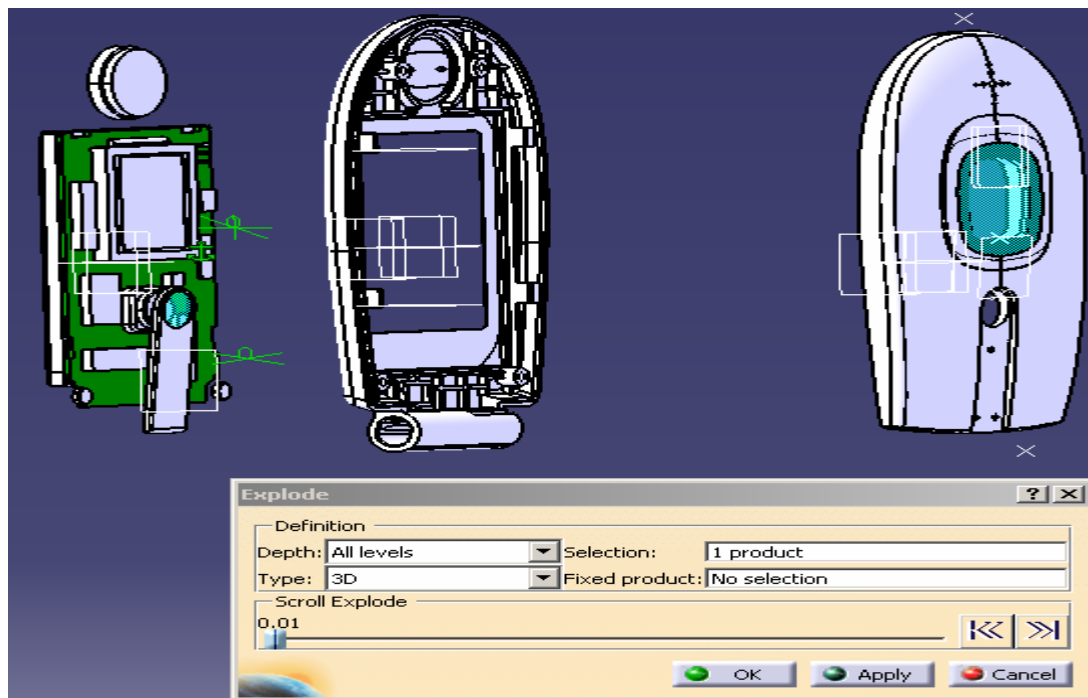


Figure 3.2.2: showing parts with explode

3.3 Product3 :

Its composed of 4 parts as shown in the figure below, the battery pin is repeated twice.

Assembled together using seven constraints.

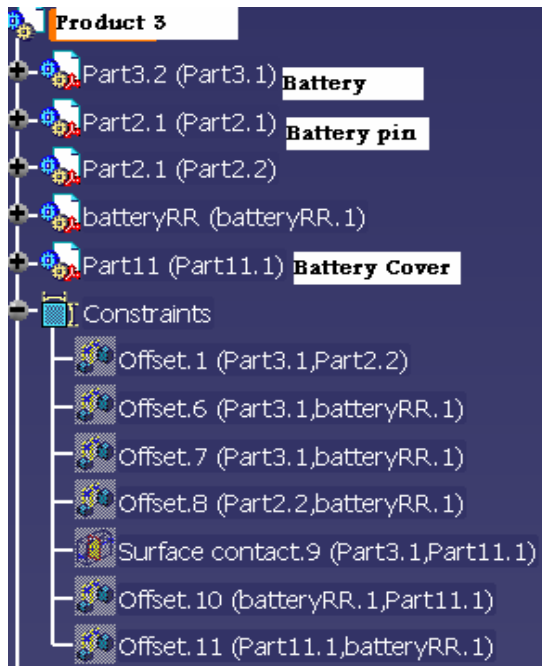


Figure 3.3.1 showing product list and constraints

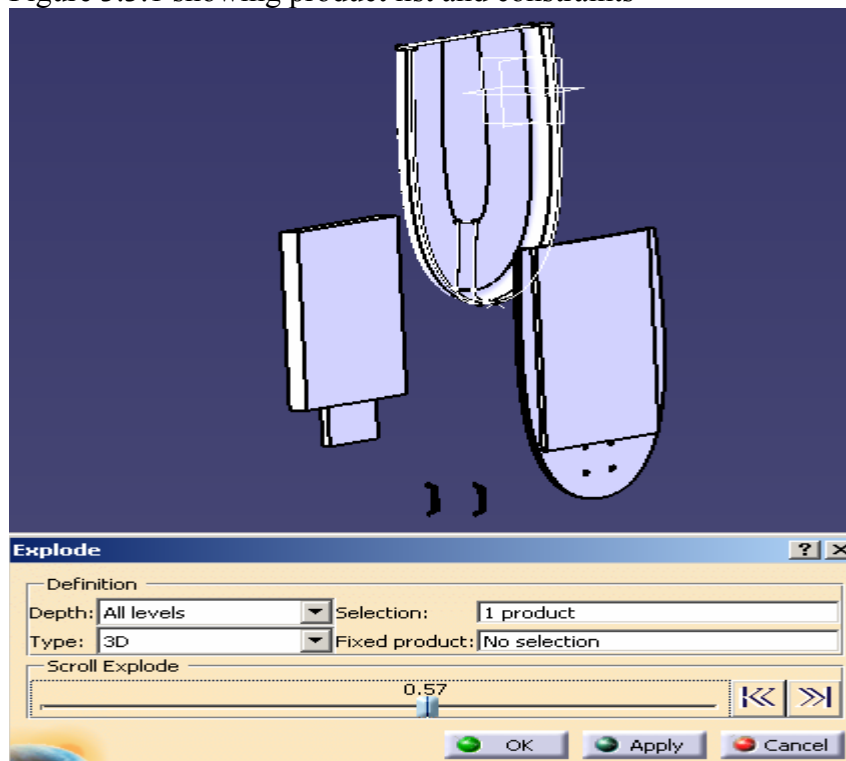


Figure 3.3.2: showing parts with explode

3.4 Product4:

Composed of 6 parts shown in figure below . Assembled together using seven constraints

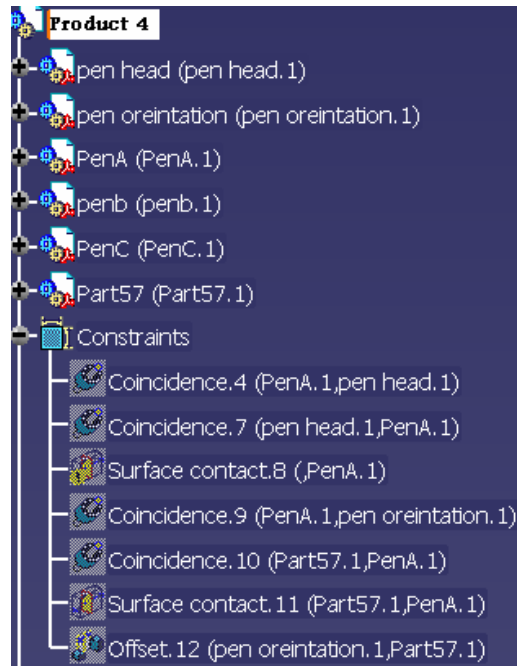


Figure 3.4.1 showing product list and constraints

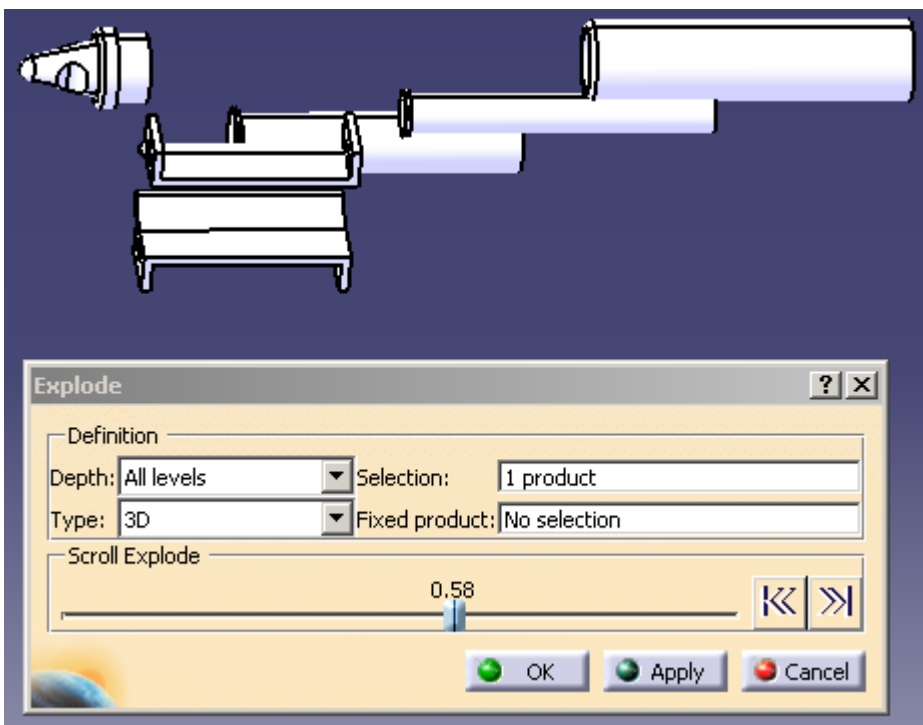


Figure 3.4.2: showing parts with explode

3.5 Final assembly:

Composed of the 4 products mentioned above, this assembly will show all the parts designed previously together. In this assembly we fixed product1 which include the master-housing-FR and RR. Then we attached product2 which include master-flip-FR and RR using coincidence constraint. after that we attached product3 which include the battery components to product1 using offset constraint. We also attached product 4 which include the pen to product1 using offset constraint.



Figure 3.5.1: showing product list with constraints

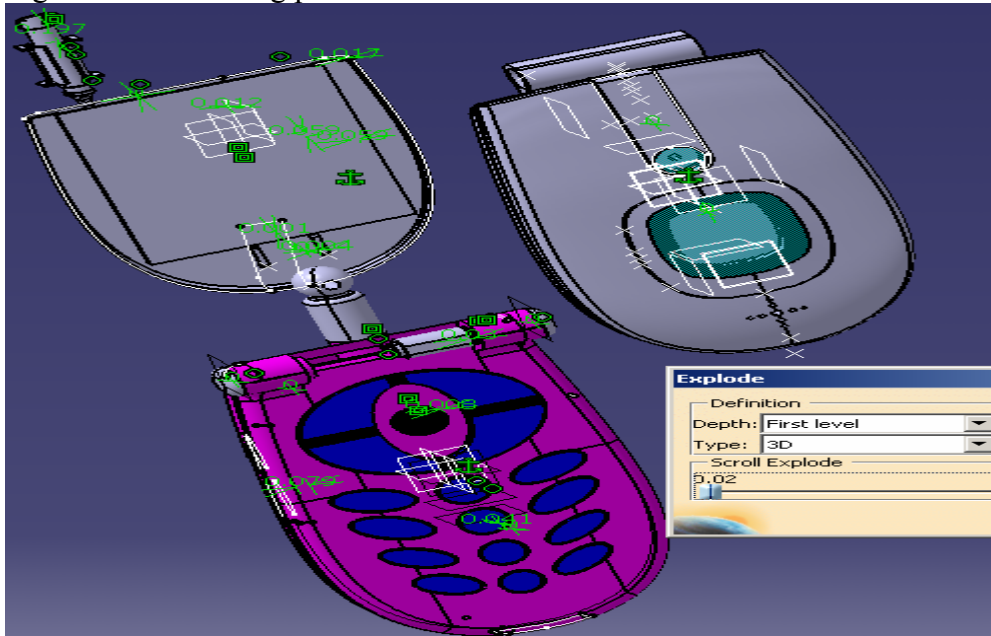


Figure 3.5.2: showing parts with explode

3.6 Clash analysis:

After assembling each product, a clash analysis has to be done to assure there is no interference. In case of interference the check clash table will show you which parts are interfering with each other to fix them.

So we run a check clash for product 1 as shown in figure 3.6.1 and there was 8 clashes which means the product have interference in eight different places. and the major one was the interference between master housing-FR and RR. In different iterations we managed to get rid of these interferences as a result we had 0 clashes as shown in figure 3.6.2. The same procedure was followed with product 2 which had 4 clashes and as a result we can see figure 3.6.3. As for product 3 we had 3 clashes as shown in figure 3.6.4 and were solved as shown in figure 3.6.5.

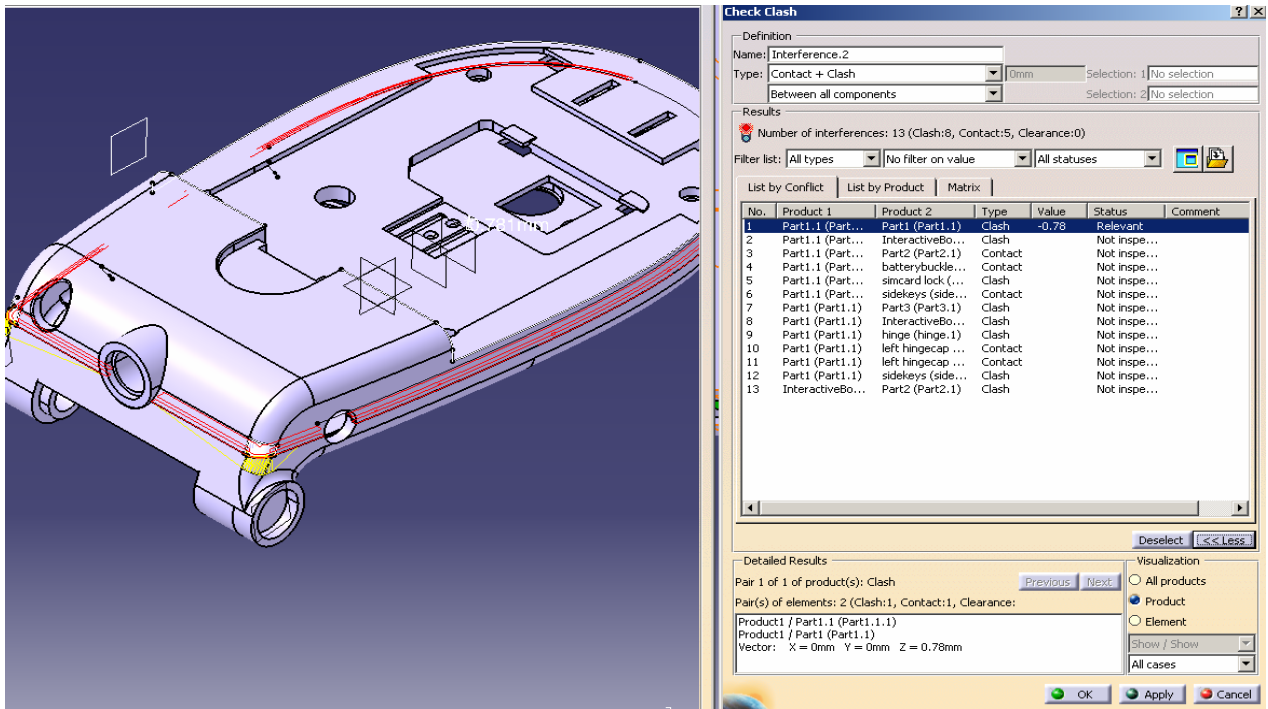


Figure 3.6.1: Showing clashes in product1

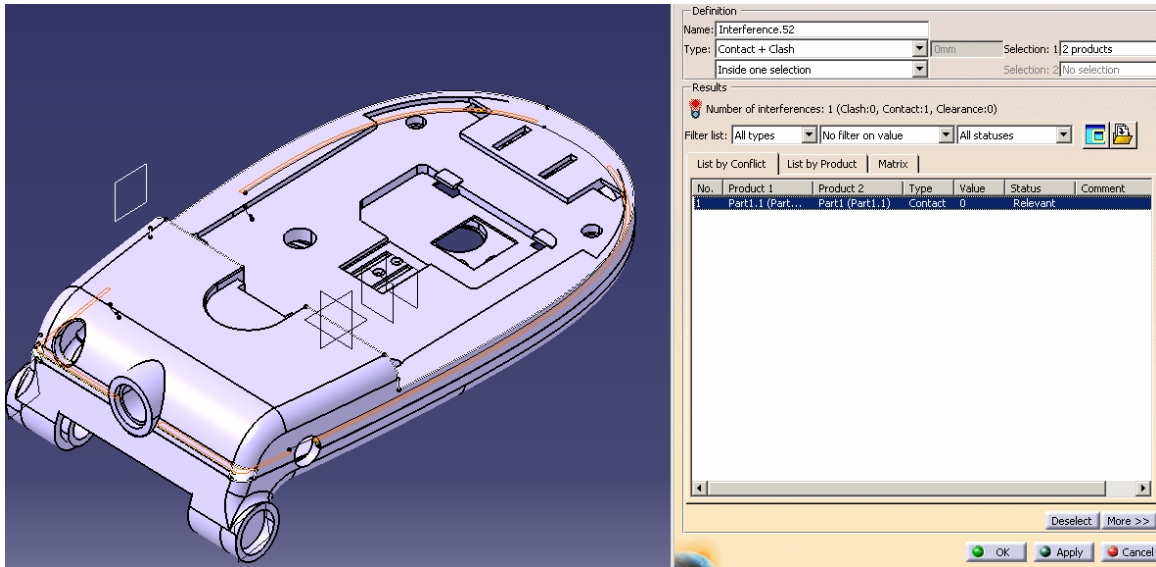


Figure 3.6.2: showing product 1 without clashes

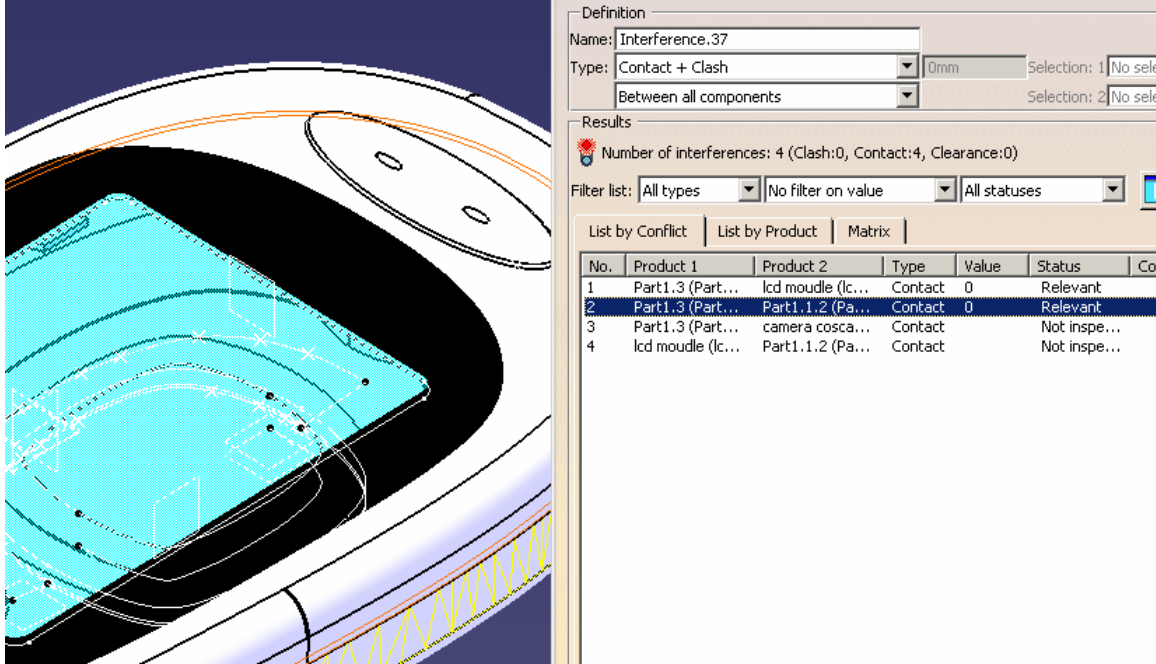


Figure 3.6.3: Showing product 2 without clashes

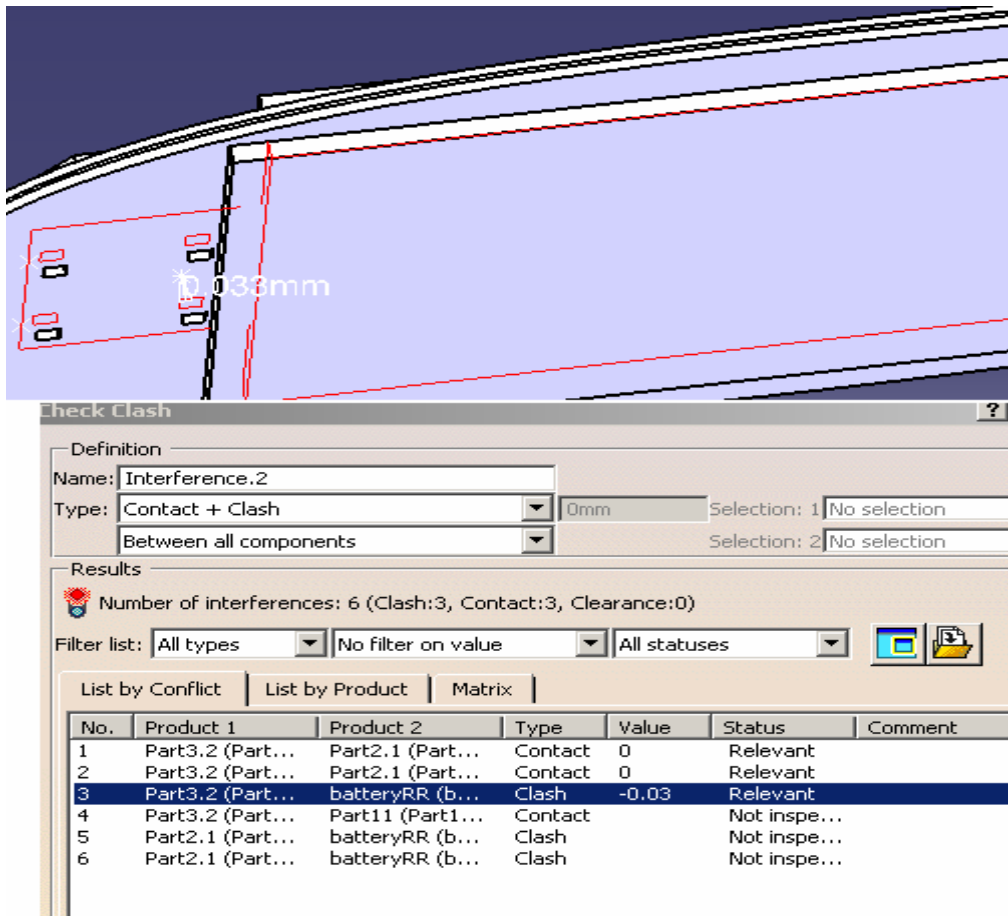


Figure 3.6.4 Showing product3 with clashes

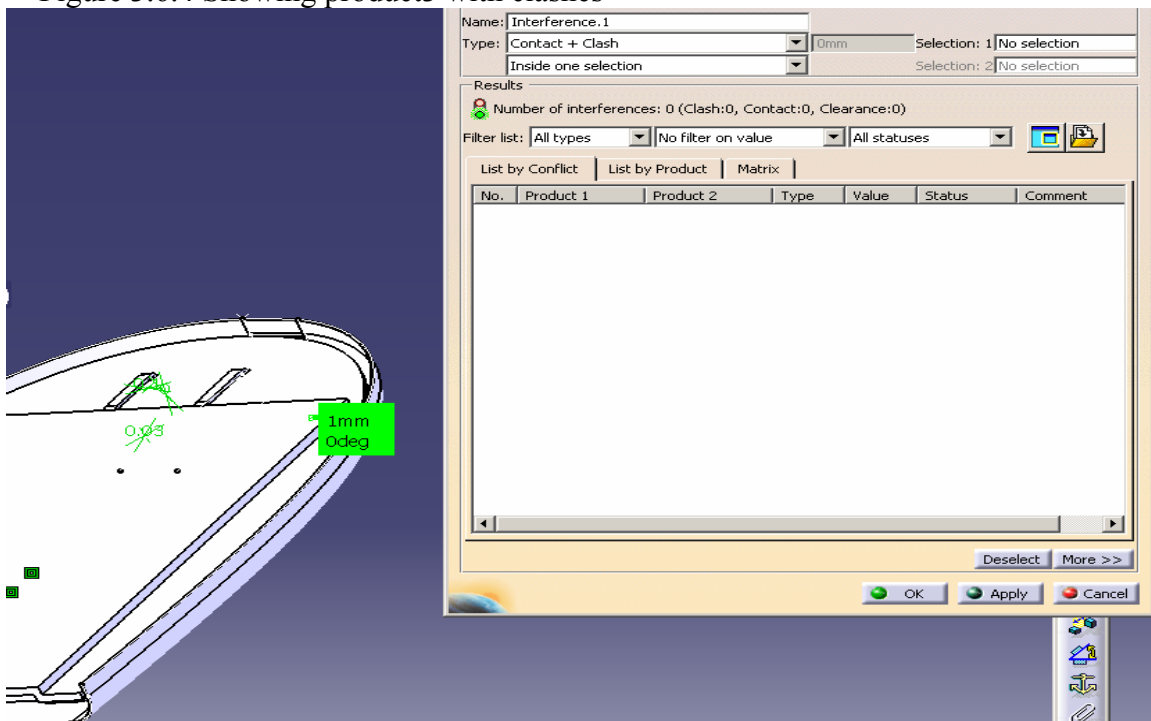




Figure 3.6.5: showing product3 without clashes

4 Mechanism-Design:

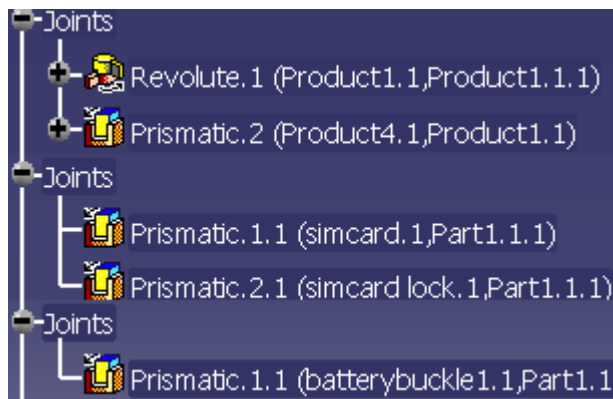
In this chapter we are going to discuss mechanisms added to this product, for this purpose we are going to use Digital mock up workbench. Which enables us to create mechanisms between parts in side the product and simulate them.

Brief definition of mechanisms used:

 **Revolute.**: rotation of one part around the other after specifying axis of rotation.

 **Prismatic.**: translation of one part with respect to the other after specifying direction.

In our project we used revolute function once and prismatic four times. For revolute it was between product 1 which include (master housing) and product2 which include (master flip). While prismatic was used inside product 1 it self to show how to insert the sim-card and how to lock it and also how to lock the battery to the body using the battery buckle.



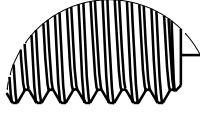
5 CONCLUSION

While carrying out this project, we managed to discover and use the varied functions applied to the different workbenches, such as part design and wire frame surface design. Many challenges were faced and surmounted; however, the main one was encountered when in the assembly workbench, trying to ensure that no interferences exist between its parts. Such task was successfully accomplished, thanks to the clash analysis which facilitated the check over.

The DMU Kinematics was also explored to create a movie simulation of some mechanical features of the product. In conclusion, all operations were conducted effectively leading to the birth of the cell phone.

References:

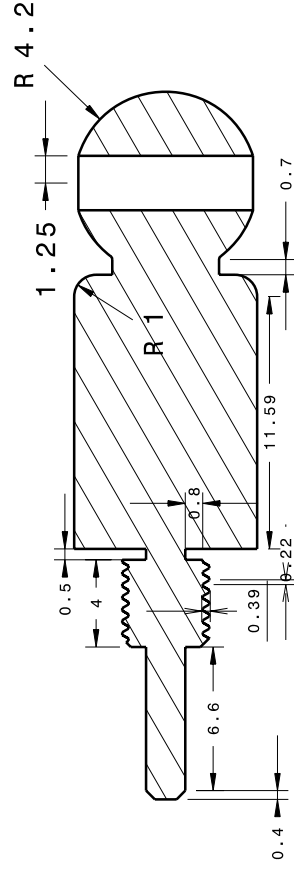
- ▶ CatiaV5 R17 online help file
- ▶ <http://www.sdcpublishations.com/pdfsamples/1-58503-261-1-4.pdf>
- ▶ CatiaV5 workbook Release 15
- ▶ <http://electronics.howstuffworks.com/inside-cell-phone.htm>



Detail B
Scale: 6:1



Front view
Scale: 3:1

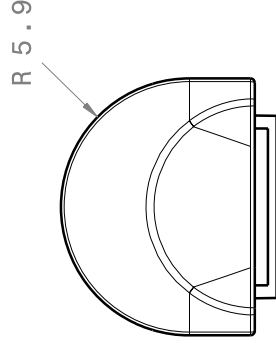
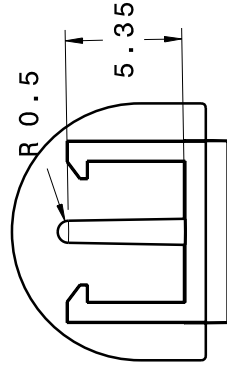
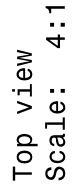
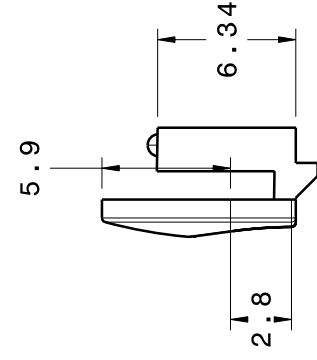
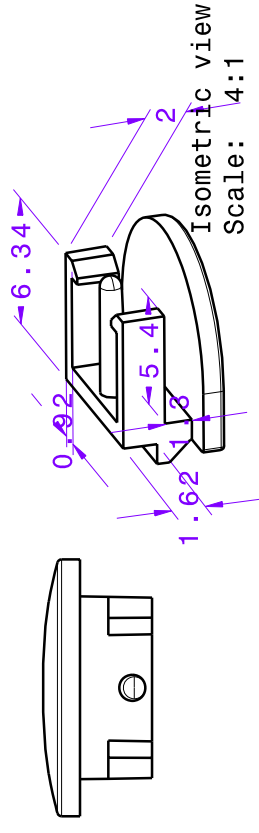



Bottom view
Scale: 3:1

~~Scale: 4:1~~

W

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DESIGNED BY: amersankari		BATTERY_BUCKLE		I
DATE: 10/4/2007				H
CHECKED BY: XXX				G
DATE: XXX				F
SIZE B		Concordia University		E
SCALE 1:1	WEIGHT (kg) 0.00	DRAWING NUMBER BATTERY BUCKLE	SHEET 1 / 1	D
				C
				B
				A

A

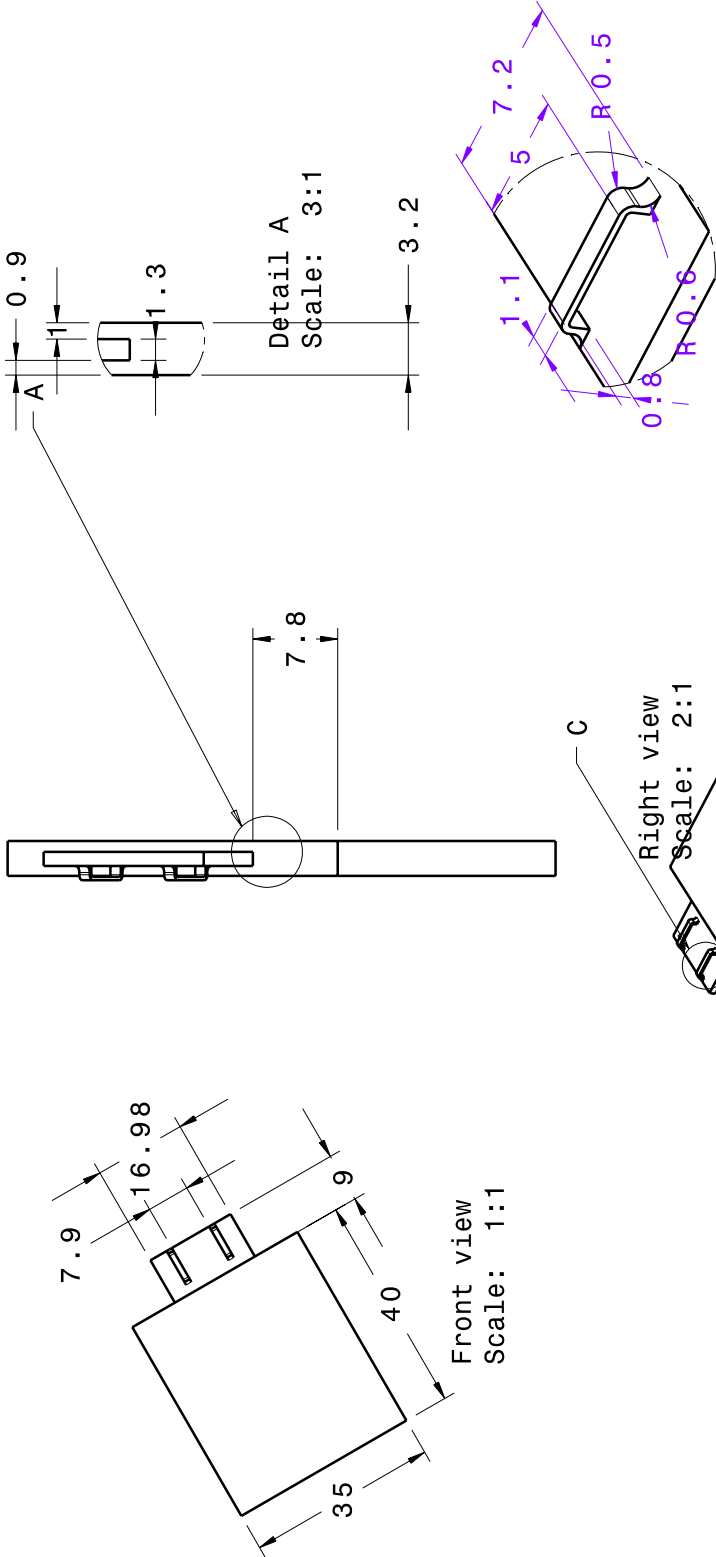
m

o

a

w


u



Bottom view
Scale: 1:1

Isometric view
Scale: 1:1

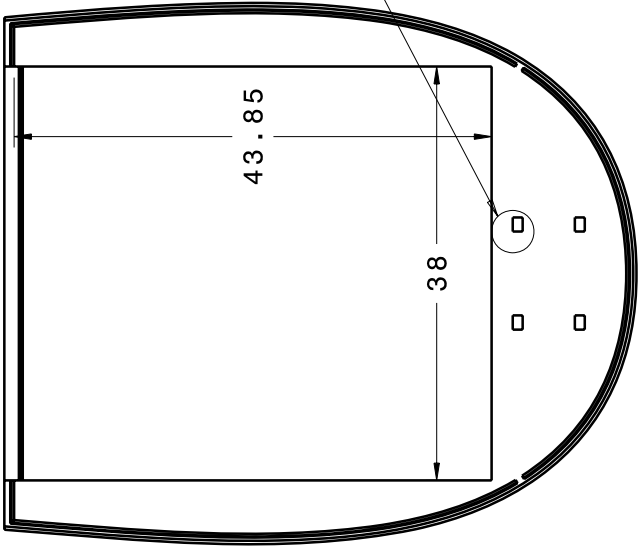
Detail C
Scale: 5:1

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CHECKED BY:	XXX			G	—	
DATE:	XXX			F	—	
SIZE		B		E	—	
SCALE		1:1		D	—	
WEIGHT (kg)		0.00	DRAWING NUMBER		C	—
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			SHEET 1/1		A	—
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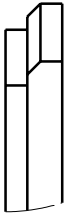
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A

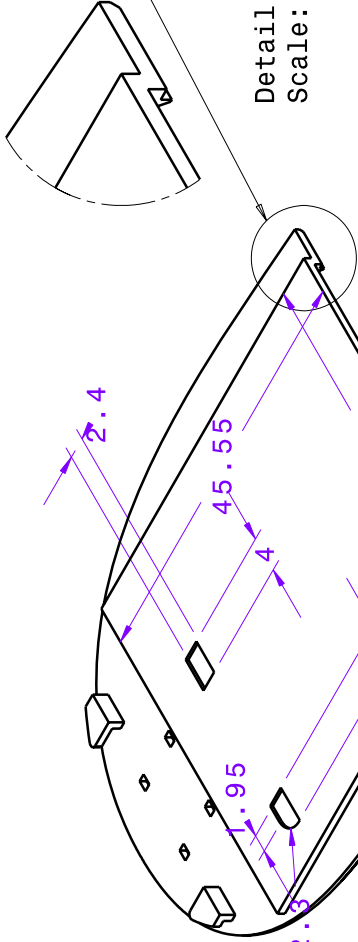
Top view
Scale: 2:1



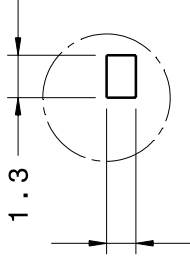
Detail A
Scale: 8:1



Detail B
Scale: 5:1

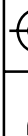


Isometric view
Scale: 2:1



Detail C

Scale: 6:1

DESIGNED BY: amersankar1		Scale: 6:1	Battery rr		I	—
DATE: 10/16/2007			Concordia University	H	—	
CHECKED BY: XXX				G	—	
DATE: XXX				F	—	
SIZE B		E		—		
SCALE 1:1	WEIGHT (kg) XXX	DRAWING NUMBER XXX	SHEET 1/1	D	—	
				C	—	
				B	—	
				A	—	
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Left view
Scale: 2:1

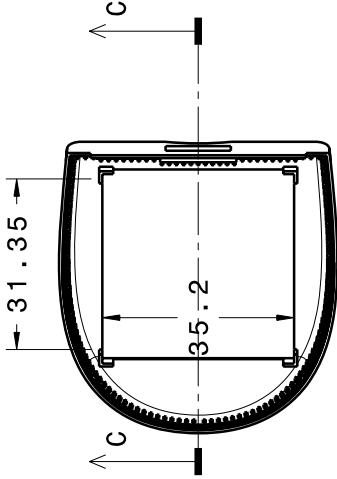
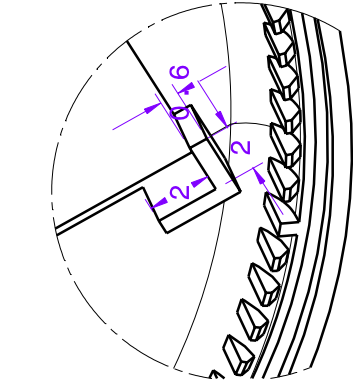


Rear view
Scale: 2:1

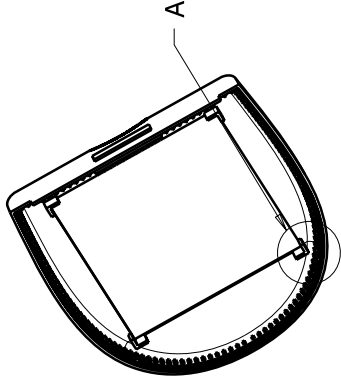
C

A

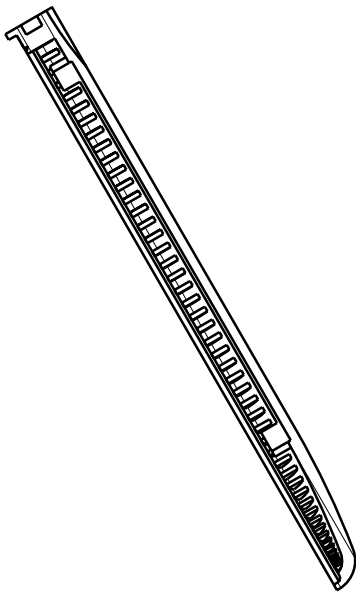
W U A C M A



Top view
Scale: 1:1

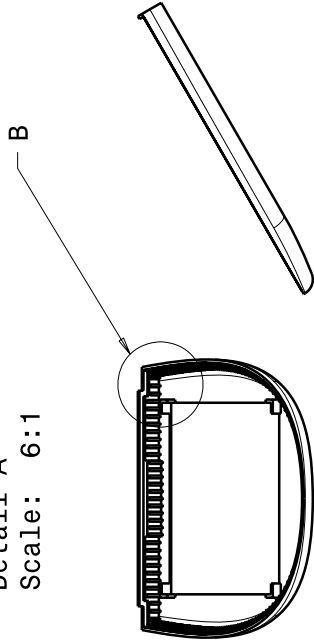


Isometric view
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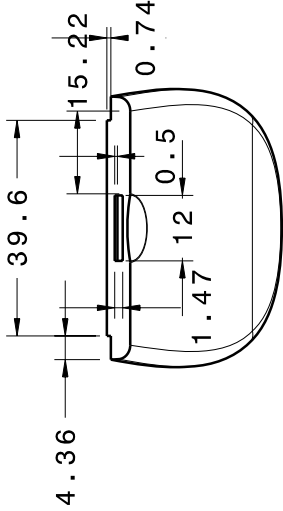


Section view C-C
Scale: 2:1

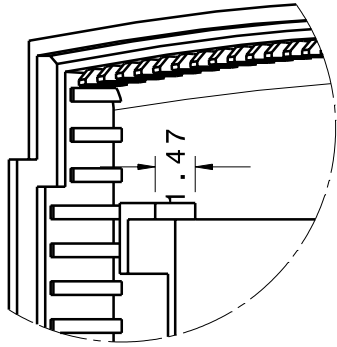
Detail A
Scale: 6:1



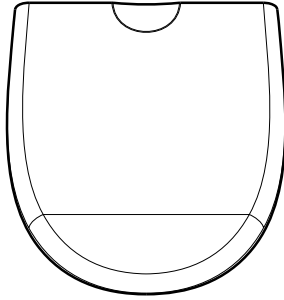
Left view
Scale: 1:1



Front view
Scale: 1:1



Detail B
Scale: 5:1

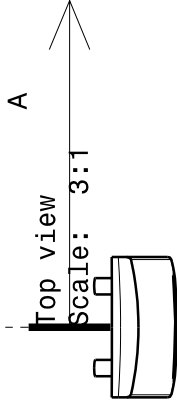
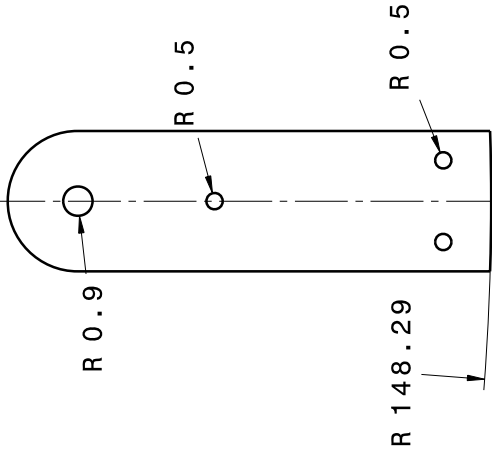
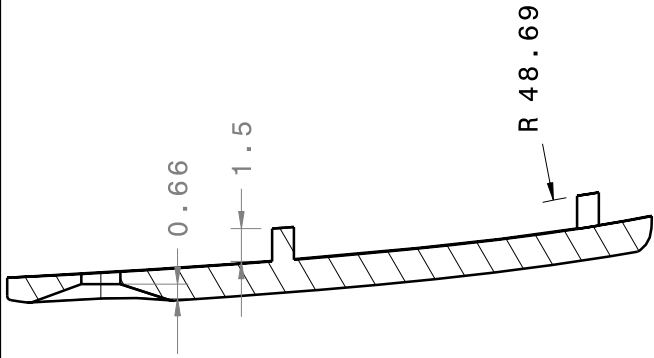


Bottom view
Scale: 1:1

Right view
Scale: 1:1

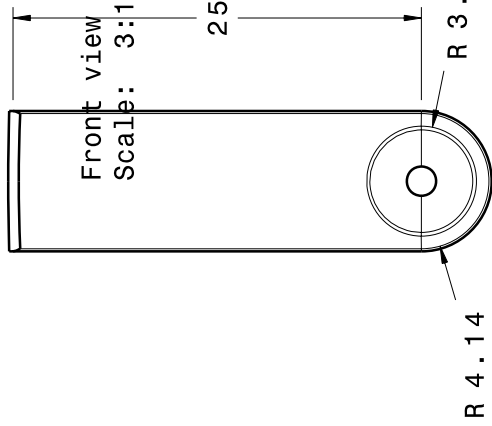
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CHECKED BY: XXX				G	—
DATE: XXX				F	—
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SCALE 1:1				D	—
WEIGHT (kg) 0.00				C	—
DRAWING NUMBER		BATTERY		B	—
SHEET				A	—
1/1		This drawing is our property; it can't be reproduced or communicated without our written agreement.			

W A C M A



Top view
Scale: 3:1


Section view A-A
Scale: 4:1



Front view
Scale: 3:1

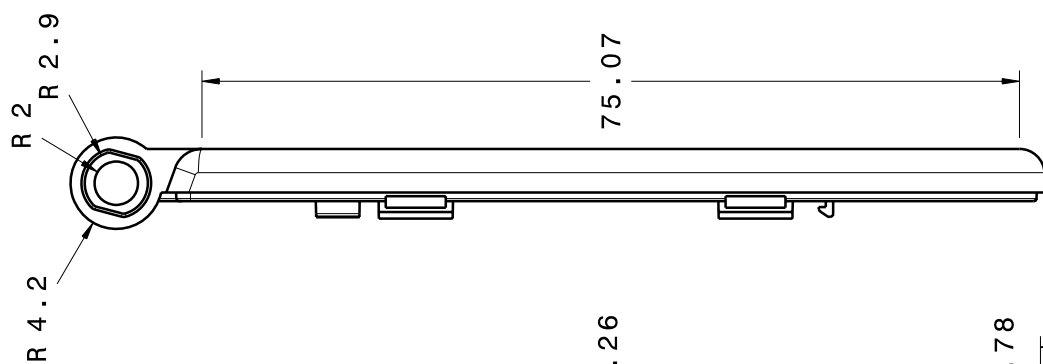
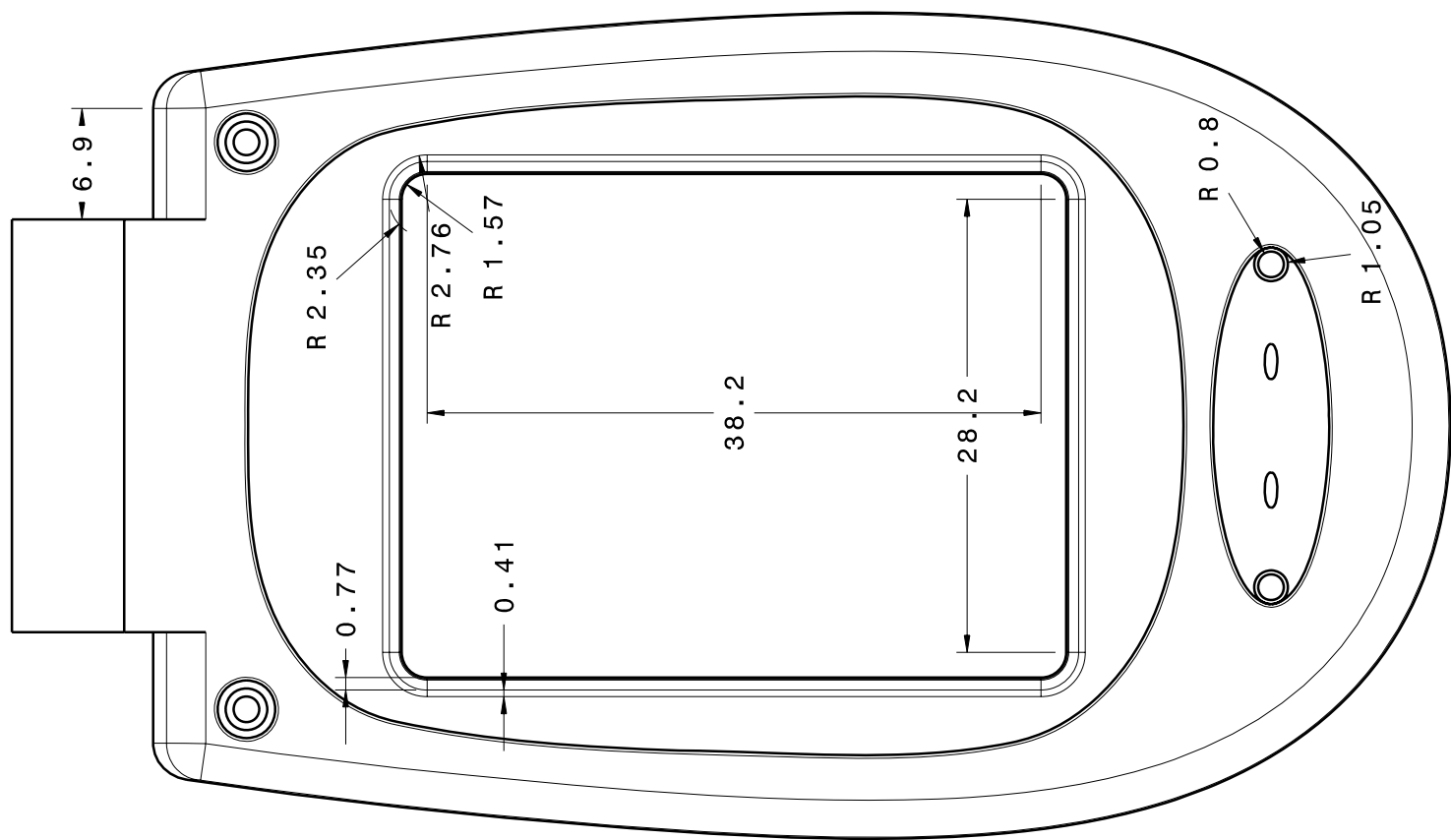


Isometric view
Scale: 3:1

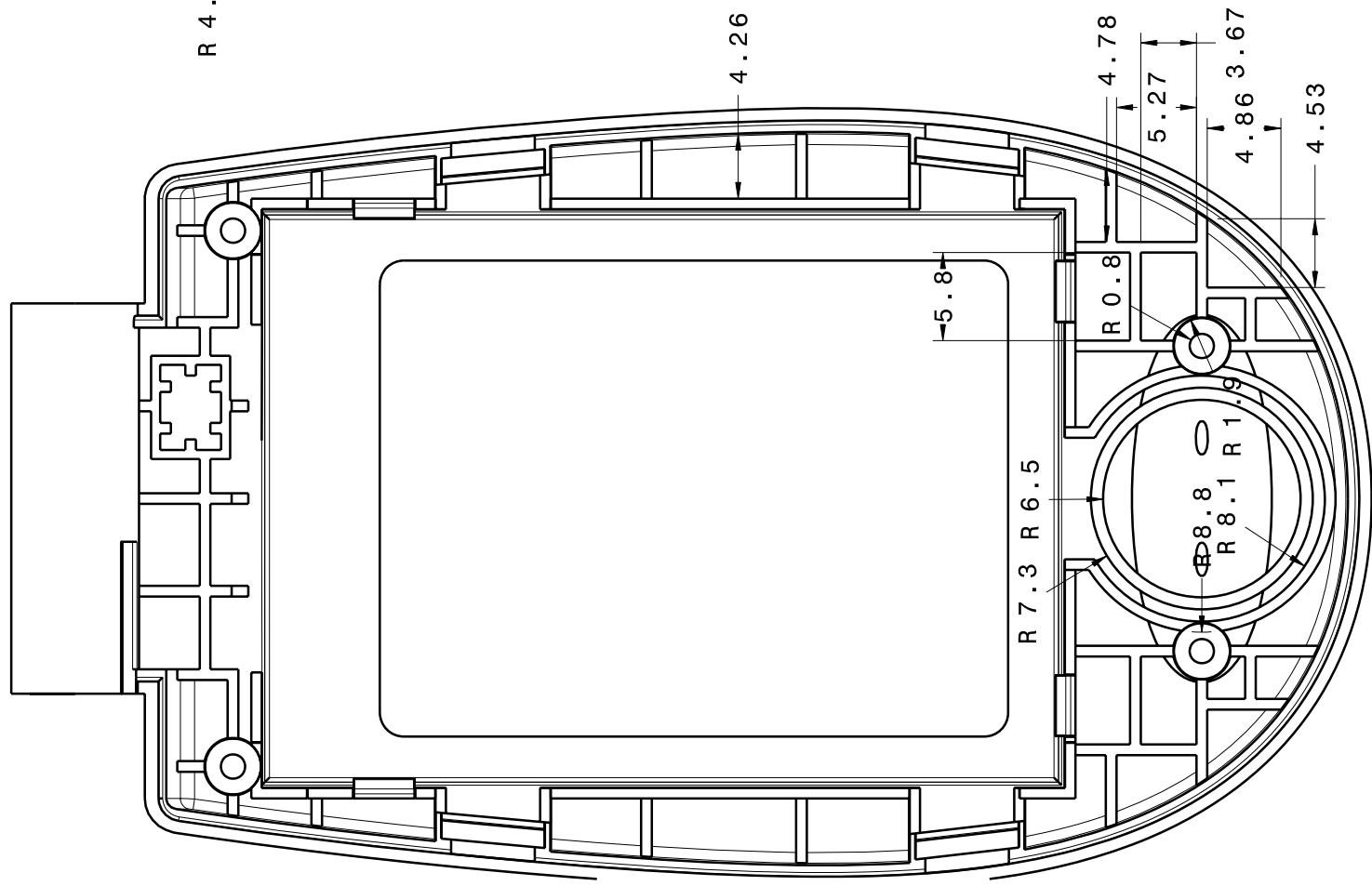
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DATE: 10/5/2007						H	—		
CHECKED BY: XXX						G	—		
DATE: XXX						F	—		
SIZE B				Concordia University				E	—
								D	—
SCALE 1:1		WEIGHT (kg) 0.00		DRAWING NUMBER CAMERA COS		SHEET 1/1	C	—	
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						A	—		

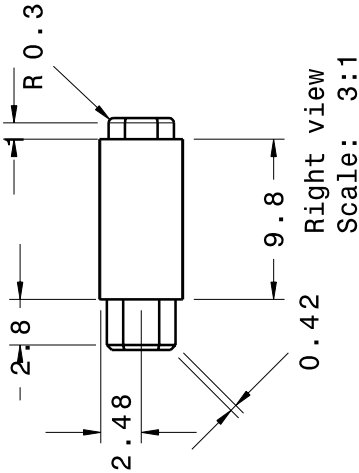
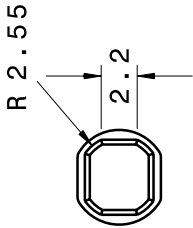
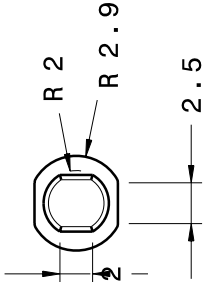
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
A



Right view
Scale: 2:1





DESIGNED BY: amersankari		HINGE 1		I	—
DATE: 10/5/2007				H	—
CHECKED BY: XXX				G	—
DATE: XXX				F	—
SIZE		Concordia University		E	—
B				D	—
SCALE	WEIGHT (kg)			C	—
1:1	0.00			B	—
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W

W

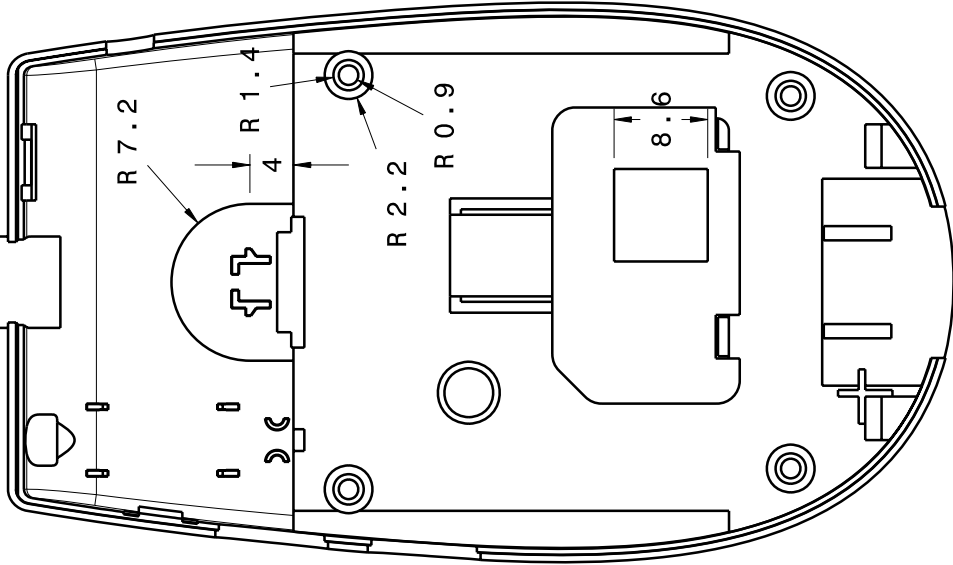
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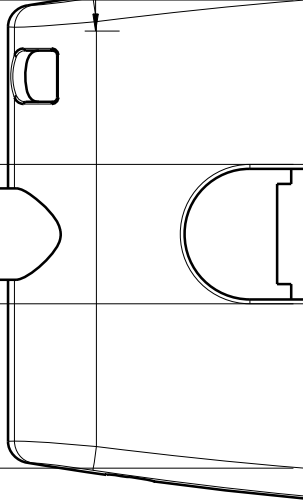
Q

Q

8.4



15.33
15.1



Detail A
Scale: 3:1

A

34.94

R 2.25

Rear view
Scale: 2:1

DESIGNED BY:
amersankari

DATE: 10/7/2007

CHECKED BY:

XXX

DATE:

XXX

SIZE

B



WEIGHT (kg)

1:1 0.00

DRAWING NUMBER

HOUSING RR

SHEET

1/1

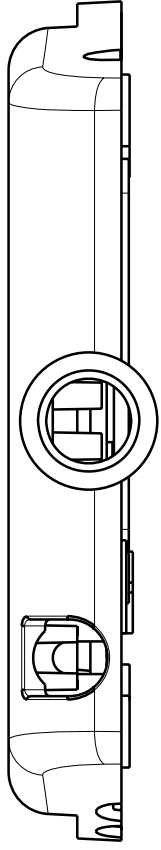
HOUSING_RR1

Concordia University

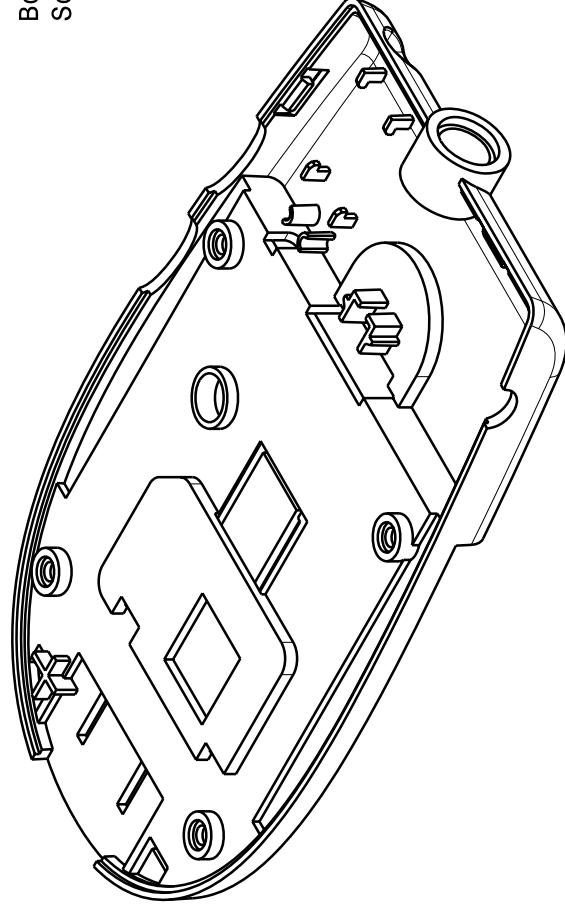
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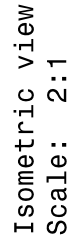
A




Top view
Scale: 3:1



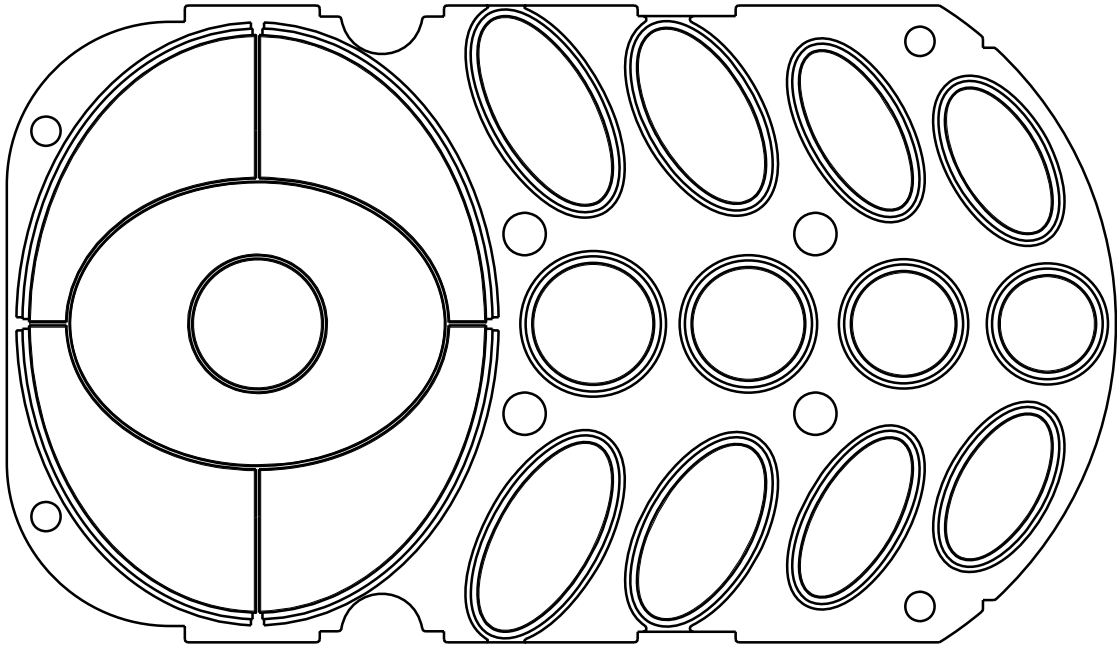
Left view
Scale: 2:1



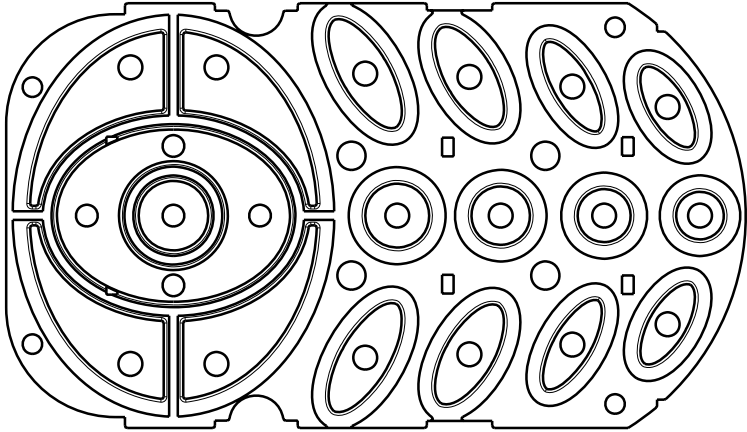
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DATE: 10/8/2007				H
CHECKED BY: XXX				G
DATE: XXX				F
SIZE B		Concordia University		E
SCALE 1:1	WEIGHT (kg) XXX	DRAWING NUMBER XXX	SHEET 1/1	D
				C
				B
				A

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
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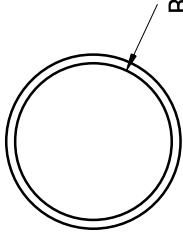
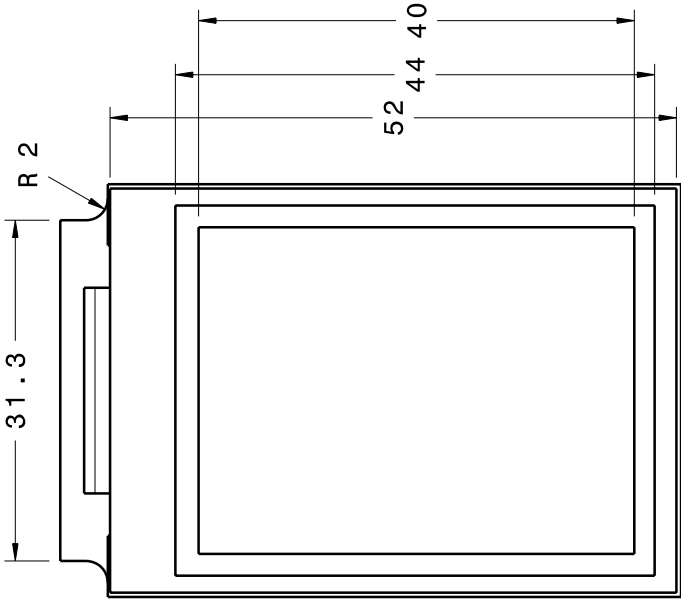
Front view
Scale: 3:1



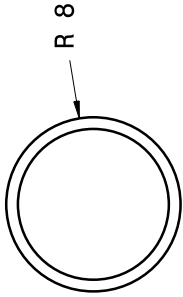
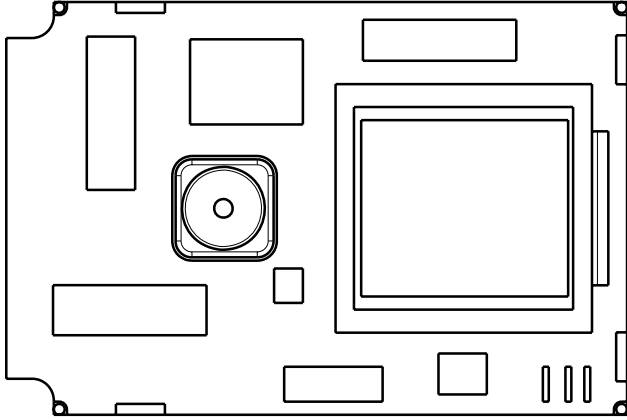
Rear view
Scale: 2:1

DESIGNED BY: amersankari		KEYPAD		I	—	
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CHECKED BY:	XXX			G	—	
DATE:	XXX			F	—	
SIZE		B		E	—	
		Concordia University			D	—
SCALE	1:1	WEIGHT (kg)	0.00	C	—	
		DRAWING NUMBER		B	—	
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		1/1				
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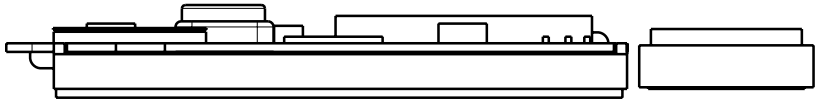
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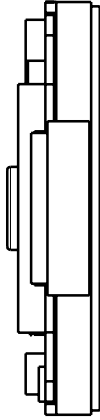
Rear view
Scale: 2:1




Front view
Scale: 2:1



Left view
Scale: 2:1



Bottom view
Scale: 2:1

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CHECKED BY:	XXX			G	-
DATE:	XXX			F	-
SIZE	B			E	-
SCALE	1:1			D	-
WEIGHT (kg)	0.00	Concordia University		C	-
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SHEET	1/1	This drawing is our property; it can't be reproduced or communicated without our written agreement.		A	-

F A C A C F A

A

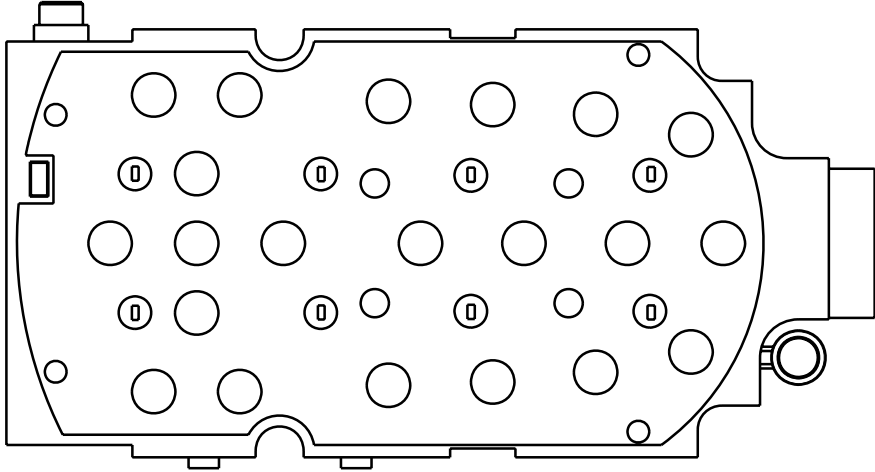
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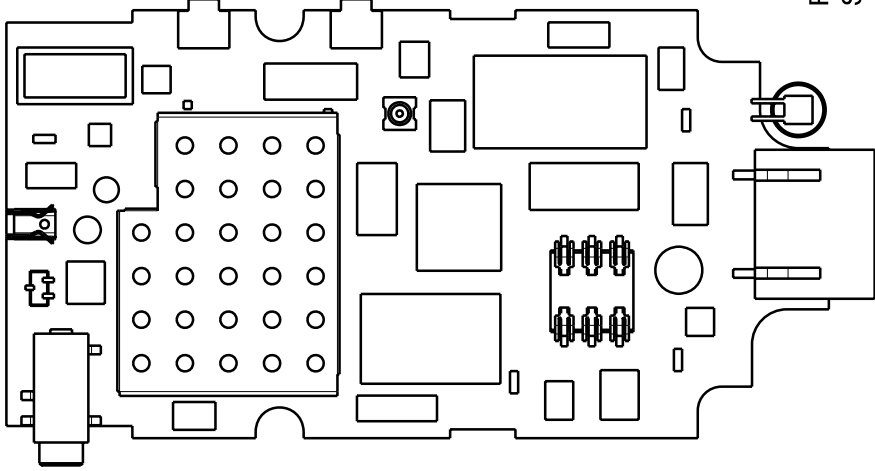
d

f


F



Front view
Scale: 2:1

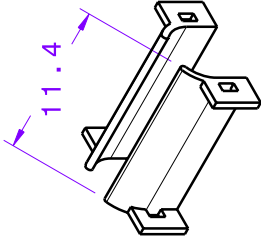


Rear view
Scale: 2:1

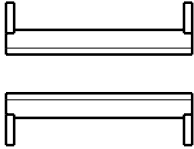
DESIGNED BY: amersankar.i		PCBA		I	—
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DATE:	XXX			F	—
SIZE		B	Concordia University	E	—
				D	—
SCALE	1:1	WEIGHT (kg) 0.00		C	—
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		SHEET		A	—
1/1		PCBA			
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A

F



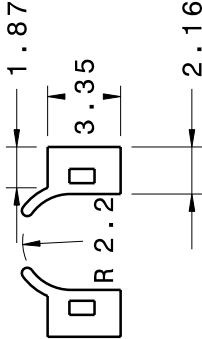
Isometric view
Scale: 3:1




Front view
Scale: 3:1



Left view
Scale: 3:1



Bottom view
Scale: 4:1

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DATE:	10/8/2007			H	—	
CHECKED BY:	XXX			G	—	
DATE:	XXX			F	—	
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SCALE	1:1	WEIGHT (kg)			D	—
DRAWING NUMBER		PEN_ORIENTATION		C	—	
SHEET				B	—	
1:1		1/1		A	—	
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