Dental Device Software

Transfer the following verbal description into an EPC:

The apex locator is an electronic device used in endodontics - a dental specialty - to determine the opening at the apex of the root of a tooth, through which the nerve and blood vessels pass. The device presented has a multimedia display and operates with two buttons – a power button (ON/OFF) and VOLUME button to control the volume of the voice messages that guide the dentist during the measurement process. In addition, a demo mode presentation can be started by holding the power button for a few seconds. The device uses a Li-ion battery and the charging method is similar with this of a cell phone.

a) Upon pushing the ON/OFF button or plugging in the AC adapter, the software program starts the central processing unit and, at the same time, initializes the display driver. Once the display is active, the software program performs a check to find out if the AC adapter is plugged in. If this is the case – please follow e), if not – follow b).

b) If no adapter is plugged in, the system checks if the ON/OFF button is still pushed. If the check is negative, please follow c). For a positive check – follow d).

c) If the ON/OFF button is not pushed, the system loads an initial display. Once the initial display is started and the device is ready to measure, the software program checks if the VOLUME button has been pushed. If the check is negative, the following process is described in f), if the check is positive – follow g).

d) A positive check leads to the activation of the demo mode. Then the system displays a demo part. Once it has been displayed, the system checks if this has been the last part. If it is not the last one, the process starts over and the system displays the next demo part. A positive check means that all parts have been presented and leads to the new waiting activity described in k).

e) If the adapter is plugged in, the charging program is activated. Once the charging program is running, the system shows a "Charging" message on the display. After that, the software measures the elapsed time before continuing with further actions (time data is used). If the waiting time is less than 60 seconds, the system continues to wait. Alternative, if the waiting time exceeds 60 seconds, the system automatically switches the display off. Then it regularly checks if any button has been pushed. When this is the case, the "Charging" message has to be shown again. If no buttons have been pushed, the system proceeds with the waiting activity described in k).

f) For the case that the VOLUME button has not been pushed, the device starts with the measurement process, deciding which measurement method is most appropriate. The choice is between method #1, method #2 or none of both.

g) For the case that it has been pushed, the volume is increased by one level. Then either the volume already equals the maximum level, which demands the system to mute the device, or it is less than the maximum. Regardless of which case applies, the system always performs the VOLUME button check again.

h) If method #1 has been chosen, the software program performs it. Once the method is performed and results are displayed, the system makes again the initial decision about which method is most suitable.

i) If method #2 is suitable, the system determines whether subprogram #2.1 or #2.2 is appropriate and, after that, performs the chosen one. After a subprogram has been performed and results are displayed (additionally for #2.2, as a result, log files are saved), the software can choose again an appropriate method.

j) The third option, when no appropriate method is found, leads also to the waiting activity described in k).

k) The system now waits again and if 30 seconds have not been exceeded, the process starts all over again and the system checks again for an AC adapter. Finally, in the case that 30 or more seconds have already passed, the device automatically turns off.

```
   ON/OFF                    AC adapter
   button                    plugged in
   pushed

            (XOR)

            ( ∧ )                        Software
                                         program
   Start central      Initialize
   processing         display driver
   unit

            ( ∧ )

         Display is
         active

            (XOR)                Software
                                 program
         Check for AC
         adapter

            (XOR)

   No adapter                           Adapter          Software
   plugged in                           plugged in       program
                    Software
                    program
   Check if ON/                         Activate
   OFF button is                        charging
   still pushed                         program

            (XOR)                       Charging
                                        program
                                        running
   No         Yes        Software
                         program                (XOR)            Software
                                                                 program
         Activate                    Message    Show "Charging"
         demo mode                              message on
                                                display
         Demo mode
         activated                             Message is
                                               shown on
            (XOR)                              display

                        Software                  (XOR)            Software
                        program                                    program
   Demo part  Display first/             Time data   Measure
              next demo                              elapsed time
              part
                                                  (XOR)
         Demo part
         displayed           Software
                             program      60 or more        Less than 60
         Check if last                    seconds           seconds
         part                             elapsed           elapsed
                                                      Software
```

XOR

Yes

No

Software
program

Switch display
off

Display
switched off

Software
program

Check if any
button is
pushed

XOR

Yes

No

XOR

Software
program

Load an initial
display

∧

Initial display
loaded

Device is
ready to use

∧

XOR

Software
program

Check if volume
button is pushed

XOR

No

Yes

XOR

Software
program

Software
program

Decide which
measurement
method is
appropriate

Increase
volume +1

XOR

method is
appropriate

XOR

Method #1
chosen

Method #2
chosen

No appropriate
method found

Software
program

Perform
method #1

∧

Method
performed

Results
displayed

∧

Software
program

Check for
suitable
subprogram

XOR

#2.1 is
appropriate

#2.2 is
appropriate

Software
program

Log files

Perform
subprogram
#2.1

Perform
subprogram
#2.2

∧

∧

#2.1
subprogram
performed

Results
displayed

#2.2
subprogram
performed

Results
displayed

Log files
saved

∧

∧

XOR

XOR

Volume level
already equals
maximum

Volume level
less than
maximum

Software
program

Mute device

Device
method

XOR

XOR

Time data

Wait

Software
program

XOR

30 sec. or
more passed

30 sec. not
passed

Software
program

Turn off
device

Device turned
off