“FoodTester-G”
Analyzer of cesium isotopes
activity in food

Operating manual

BICT.412128.001-02 HE
Dear users,

You have chosen the device in which engineers and developers of our company had realized a completely new approach to monitor radioactive contamination of food. Now control of cesium radioisotopes in products will find its application not only in specialized laboratories but also at home without professional radiologists.

We managed to create a set of new original gamma spectrometry solutions which enabled us to use for measurements crystals of the detector smaller in size and cheaper than those of laboratory equipment. This allowed us to significantly reduce the device price in general compared to laboratory equipment.

We continue developing a new trend in radiocesium monitoring and constantly improve new mathematical solutions used in our device. We see a great opportunity for improving the quality of measurements and are going to update our software regularly. The device enables a user to independently update a software version using the Internet.

The development of the device encompasses the unique experience of monitoring contamination after the Chornobyl disaster. However, we understand that the Fukhusima accident has its unique features. That is why we expect to get information about your first-hand experience in the use of our device. Experience of the device behavior under real conditions, plus our new steps towards mathematical and metrological enhancements will be realized in later versions of software.

If you notify us of any problems occurred during the measurements, we will fix them in a new application version of the device immediately upon detection. Together we will make measurements easier and more comfortable. Our device will make you feel confident that radiocesium is under reliable control.

Best regards,
“ECOTEST” team

Version 5
Last updated: October 2013
DID YOU KNOW

Why do we monitor exactly cesium?

Human external exposure and a risk to inhale radioactive substances are attributed to the early phase of a nuclear and radiological accident. In the years following the Chornobyl nuclear accident in Ukraine, of the most long-lasting and dangerous factors of radiation impact has remained radionuclide intake with food in humans. For this reason, control of radioisotopes content in food becomes a burning issue for quite a long period of time.

Among radioisotopes, which were released after the accident into the environment, most capable of spatial distribution and transfer via biological pathways are radioactive iodine and cesium. However, radioactive iodine tends to decay rapidly so that its residence time coincides with the early phase of the accident.

In this way, radiocesium further remains a leading contributor to distribution in the environment. The natural environment may contain other types of radioisotopes released from a damaged reactor, but in practice, say, uranium is unlikely to reach those regions lacking such a mobile radioisotope as cesium. The presence of cesium clearly shows that the radioactive contamination from the reactor has reached a certain area; on the contrary, the absence of cesium in that particular area means that other contaminants from the reactor are considered unlikely.

Therefore, radiocesium is the so called marker of the distribution of the radioactive contamination. In addition, cesium is readily absorbed and can be transferred through biological chains (plants-animals-people). Keeping radiocesium content in food under control, we can address the issue of consumption of contaminated food, as well as detect pathways through which radioisotopes migrate in various ecosystems and regions.

How to measure cesium isotopes specific activity in food?

Traditional approaches are based on laboratory studies that involve a selection of individual samples from the food volume. These samples are placed in containers and for measurements are positioned towards detectors enclosed in protective facilities which are located in rooms where measurements are carried out. The advantage of these surveys is that they ensure high accuracy of a radiometric measurement of a sample. Their main drawback is that this accuracy is provided only for an individual sample but not for the whole batch. The extent to which this sample is typical of the overall volume of food is a classic problem (not taking into account heterogeneity of contamination as the sample may be randomly selected either from a point not typical of the environment or from a material too clean or too contaminated).
Moreover, carrying out an examination by sampling practices appear to be quite a time-consuming, inconvenient and sometimes even unacceptable procedure as the sample collection might cause damage to the integrity of a product (or packaging). In this way, traditional laboratory surveys play a major role in ensuring accurate official analysis (especially in situations of complex analysis of heavy contamination), but traditional methodology for investigating samples is inconvenient for practical applications on a large scale, and for this reason it is unable to address the issue of efficient, massive monitoring that could be a reliable “filter” on the way of radioactive migration.

With a need for a large-scale practical use, we have created another concept of monitoring radiocesium content in food products. We have also developed the method used to measure radiocesium contained in the food (not only in products but also in any other packages) by the way of placing the detector close to an object under testing. This approach does not always yield such a profound analysis as laboratory studies do, but it is convenient and practical.

Due to a simple measurement procedure, the “FoodTester-G” device monitors radiocesium content under almost any conditions and causes no damage to a food package. Apart from this, with no need for a sample collection the device allows you to test for cesium not only food products but also soils under cultivation, as well as any other objects or substances that may contain or transmit cesium themselves. In general, the possibility to place the detector close to different points of the tested objects provides more sufficient information, and this feature makes the concept of the “FoodTester-G” device completely different from the laboratory studies participating in a limited sample testing.

Why testing of food products using the “FoodTester-G” device is so convenient?

While testing large food volumes, instead of taking samples one places the detector close to the food. At this point, the detector is exposed to radiation coming from containers significantly larger in size than a common Marinelli sample container. Depending on a state and density of tested food, information about radiation is transferred to the attached detector from the food with the volume of ~50÷250 l. If performing the same number of measurements by placing the detector as that of taking samples by a sample method, one will get much more reliable integrated image of large volumes of food as there is a sort of direct data communication with the substantially larger volume of tested product. Apart from this, positioning the detector is more convenient and easier than selecting, crashing and placing a sample in the container.

As far as testing of small packages is concerned, a measurement made by placing a detector is not only more convenient, as it requires no burdensome sampling procedure, but also more reliable, as radiation is measured from almost all volume of packaging rather than from the collected one of 0.1 l to 1 l.
1 DESCRIPTION

1.1 Purpose of use

The “FoodTester-G” analyzer of cesium isotopes activity in food (hereinafter called the device) is intended to detect cesium radioisotopes (hereinafter called isotopes) in food products, as well as to evaluate their specific and volume activities.

The device can also be used to monitor the radiation background level in the air, radioactive contamination of soils and household items.

1.2 Technical specifications
Key specifications are presented in Table 1.1.

<table>
<thead>
<tr>
<th>Table 1.1 – Key specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
</tr>
<tr>
<td>Measurement range of cesium isotopes activity in food products (at ambient radiation background level, not more than 0.15 μSv/h) and in soils</td>
</tr>
<tr>
<td>Measurement range of gamma radiation ambient dose equivalent rate (DER)</td>
</tr>
<tr>
<td>Indication range of pulse count rate from the device’s detector</td>
</tr>
<tr>
<td>Main relative permissible error limit in gamma radiation DER measurement with 0.662 MeV energy and confidence probability of 0.95</td>
</tr>
<tr>
<td>Time of operating mode setting of the device, not more than</td>
</tr>
<tr>
<td>Time of continuous operation of the device’s detector, not more than</td>
</tr>
<tr>
<td>Operating temperature range of the device’s detector</td>
</tr>
</tbody>
</table>
Table 1.1 (continued)

<table>
<thead>
<tr>
<th>Name</th>
<th>Unit of measurement</th>
<th>Standardized value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions of the device’s detector, not more than</td>
<td>mm</td>
<td>111×36×83</td>
</tr>
<tr>
<td>Weight of the device’s detector, not more than</td>
<td>kg</td>
<td>0.325</td>
</tr>
<tr>
<td>Dimensions of the Android device, not more than**</td>
<td>mm</td>
<td>135×65×10</td>
</tr>
<tr>
<td>Weight of the Android device, not more than **</td>
<td>kg</td>
<td>0.14</td>
</tr>
<tr>
<td>Weight of the device kit in a packing box, not more than</td>
<td>kg</td>
<td>1.8</td>
</tr>
</tbody>
</table>

* One can measure an activity lower than 50 Bq/kg under condition that the tested object has optimum size (minimum ca 25 cm in all directions), or if the detector is located between the two optimum-sized packages.

** Weight and dimensions of the Android device (a smartphone or a tablet PC) may vary with its type

1.2.1 Time of continuous operation of the Android device is specified in its user’s guide.
1.2.2 Data communications between the device’s detector and the Android device is done via Bluetooth wireless technology. Communication range is no less than 3 m.
1.2.3 The device is capable to detect $^{134}$Cs and $^{137}$Cs isotopes.
1.2.4 The device in shipping container endures:
- ambient air temperature from –25 °C to +50 °C;
- relative humidity up to (95±3) % at 35 °C temperature;
- shocks with 98 m/s$^2$ acceleration, shock pulse duration – 16 ms and shock quantity no less than 1000.

1.3 Delivery kit

- Device’s detector;
- AA rechargeable battery;
- Battery charger;
- Tablet PC, associated user’s guide and accessories (upon request);
- Operating manual of the “FoodTester-G” device;
- Screwdriver;
- Case.
1.4 Design of the “FoodTester-G” device

The “FoodTester-G” device consists of two parts: an Android device and a detector.

1.4.1 Android device
An Android device* is a smartphone or a tablet PC which runs the Android™ operating system.
*Android is a trademark of Google Inc.
If some other Android device is used instead of the one included in the delivery kit, you should make sure it meets the following technical requirements:
1. Built-in Bluetooth module;
2. Android 2.1 version or later;
3. Screen resolution: 320×480, 480×800, 540×960 or 720×1280;
4. Touch screen.
Data exchange is performed via Bluetooth wireless technology. The Android device is intended to process and display data obtained from the detector.
For detailed information about the Android device, please see its user’s guide.

1.4.2 Device’s detector
The device’s detector (hereinafter called the detector) is shown in Figure 1.1.

![Diagram of FoodTester-G device]
The detector is designed as a plastic dump-proof housing. The ingress protection rating is IP54. The housing of the detector consists of covers (1, 2), a panel (3) and a battery compartment lid (4). The “BATTERY” (5) and “COM.” (6) light-emitting diodes (LEDs), as well as the on/off button (7) of the detector are located on the panel. The compartment (8) for the rechargeable battery (9), which is closed with the lid (4) fastened with two screws (10), is located on the cover (1).

The detector is switched on by pressing the button (7). Once the detector switches on, both LEDs start blinking to indicate their operability.

The detector automatically switches off every 3 minutes provided that the Android device is not connected to it. With the button (7) still held (approximately 5 seconds) until both LEDs start blinking, you can also force the detector to switch off.

The “BATTERY” (5) LED indicates the status of the detector’s rechargeable battery. If the rechargeable battery charge level is low, the “BATTERY” LED starts blinking red.

The “COM.” (6) LED shows the status of the connection between the Android device and the detector. If a connection to the Android device is established, the LED starts blinking once per two seconds. High-frequency blinking (4 times per second) means that there is no connection with the Android device.

The detector includes: the scintillation detecting unit of gamma radiation CsI(Tl)/photodiode of 9 cm$^3$ volume, the spectrometric channel with the analogue-digital processing unit, the Bluetooth radio channel module.
2 OPERATION OF THE “FoodTester-G” DEVICE

2.1 Installing the FoodTester application on an Android device

If a tablet PC was included in the delivery kit of the device, the FoodTester application would be already installed on it. If some other Android device is used, you should download and install the application on the latter.

To do this, please use your Android device to visit the device’s page http://www.ecotest.ua/foodtester-g/ and follow the link on it. An installation file will be saved (if the Android device sends a request, choose a place to save the file).

The application begins to install afterwards. The Android device will display a corresponding message. Select “Install” in the application installation window. A window with the “Application installed” massage will be displayed over a period of time. The icon will appear in a list of the installed applications.

2.2 The FoodTester application on the Android device

Tapping the Apps ( ) button at the bottom of the Home screen of the Android device opens a new window with icons for all installed applications. If icons cannot fit on the screen in one view, you can swipe it to view more. To open the FoodTester application, touch the application’s icon in the list.

For detailed instructions for working with the Android device, refer to the user’s guide of the Android operating system.

The window of the FoodTester application is divided into two areas:
1) a symbol area;
2) a work area.

The symbol area is always at the top of the FoodTester application window and is shown in Figure 2.1.

![Figure 2.1 – Symbol area](image)
The “Antenna” (1) symbol indicates the status of the connection to the detector. The background of “Antenna” turns green if your Android device is connected to the detector. The blinking symbol in the red background means that connection to the detector is either unstable or absent. The latter may be caused by too long distance between the Android device and the detector.

The “Battery” (2) symbol shows the rechargeable battery charge level of the detector.

The number of a connected detector (3) is displayed in the middle of the symbol area.

2.3 Connecting the Android device to the detector

Figure 2.2 – Connecting the Android device to the detector
To connect the Android device to the detector, do as follows (see Fig. 2.2):
1 Press the on/off button on the detector’s housing to turn the detector on.
2 Make sure a green LED is blinking at high frequency.
3 Open the FoodTester application on the Android device.
4 Touch the “Connect” button:
   a) if the detector number appears in the initial window of the Android device (see Fig. 2.2 (4a)), this means the detector is “bound” to the Android device the connection will be established with.
   b) if the detector number does not appear in the initial window (see Fig. 2.2 (4b)), this means the detector is “unbound”. The Android device will perform search and show a list of found “FoodTester-G” detectors. In the list that appears, select a necessary one you want to connect and “bind” to the Android device.

To view the information about a “bound” detector, tap the “Menu” button on the Android device, and select the “Settings” icon. In the application settings window that opens, touch the “Detector” item in the “Measurement” category. The settings screen of the detector will appear.

After you tap the “Connect” button, the window shown in Figure 2.3 may appear.
The probable causes are:
   a) the detector is not switched on;
   b) the detector is located far from the Android device (at a distance of more than 3 m);
   c) there are problems with a Bluetooth enabled device of the Android device or the detector.
Figure 2.3 - Connection to the detector was unsuccessful

If you cannot isolate the possible source of a problem regarding a failed connection to the detector, you can use another detector that is in your possession. For connecting to that detector, switch it on and tap the “Search” button (see Fig. 2.3).
2.4 Mode of gamma radiation dose rate measurement

The detector enters this mode immediately after the Android device is connected to the detector. The FoodTester application window in the mode of gamma radiation dose rate measurement is shown in Figure 2.4.

This window shows ambient dose equivalent rate of gamma radiation (1) and counts per second from the gamma detector (shown graphically and numerically) (2). Counts per second are graphically represented in green color in the range from 0 to 100, while from 100 to 1000 – in yellow, and from 1000 to 10000 – in red.

Ambient dose equivalent rate of gamma radiation (1) and counts per second obtained from the gamma detector (2) are displayed in this window.

The mode of gamma radiation dose rate measurement makes it possible to measure dose rate of background radiation (environmental radiation), as well as perform preliminary (rough) measurements of radiological purity of the food.

**Attention:** For correct and more time-effective evaluation of cesium isotopes content in food products, dose rate of environmental background radiation should not exceed 0.15 μSv/h.
2.5 FoodTest mode (food testing)

To enter the FoodTest mode, touch the “FoodTest” button in the mode of gamma radiation dose rate measurement (see Fig. 2.4). You will see a window as shown in Figure 2.5.

**Figure 2.5 – Preparing for food testing**

Before starting food testing, please read carefully the guidelines on carrying out measurements described in section 2.5.3 “Important recommendations for food testing”. Pay attention to the required type of a food packaging or container, as well as the way of positioning the detector towards the food, etc. You can also find the guidelines in the application’s help window by touching the “How to perform food testing” button.

**Attention:** Disregarding the guidelines on carrying out measurements described in section 2.5.3 “Important recommendations for food testing” may lead to incorrect measurement results.
Before starting your measurements, check a test place for the presence of cesium. High level of cesium in the surrounding area can reduce the accuracy of results.

The FoodTest mode consists of six steps. The first five steps specify the parameters of the food, which will be tested for the presence of cesium isotopes, and the sixth step evaluates their specific and volume activities. The device features two modes for presenting test results: a basic mode and an expert mode.

The basic mode displays the process of measurement and the results in a simplified form, while the expert mode allows observing the process of measurement in more details and receiving the information about the presence of cesium and its activity much earlier.

The expert mode provides much more information, however requires some skills in radiation measurements, especially understanding of the nature of statistical trends typical of radiation measurements.

The expert mode ensures display of specific and volume activities from the very beginning, which become more accurate in the process of measurement. But a reliable result will become available only after the shape and the width of the trend assume their typical view. It will serve an indication that sufficient data has been collected.
2.5.1 Checking a test place for cesium

Check for the presence of radiocesium in a test place before measuring products (e.g. a table on which you are testing products may be contaminated). The food should be taken away at the distance of no less than 2 m at that.

The device features two modes for presenting the check results: 1) a basic mode; 2) an expert mode.

1) The basic mode window of the application is shown in Figure 2.6.

Figure 2.6 – Checking a test place (basic mode)

The basic mode enables the user to keep track of current detection results of cesium isotopes in a place for testing. The basic mode is suitable for a novice user having no skills in radiation measurements.
2) The expert mode displays a gamma spectrum (Figure 2.7).

Figure 2.7 – Checking a test place (expert mode)

A gamma radiation spectrum allows the experienced users visually control (observe) typical display of cesium radiation in the spectrum or control potential abnormalities of background radiation.

Search for cesium isotopes in a test place is performed the same way as search for cesium isotopes in food. All peculiarities of the measurement process are absolutely identical to those described in Step 5 of the FoodTest mode (see section 2.5.2).

The test place check will stop automatically as the progress indicator reaches 100 %. The results will be used for compensation of cesium background radiation.

Automatic completion saves measurement results. You can use them for further measurements during 24 hours if these measurements are done at the same location under constant external conditions.
2.5.2 Six steps to determine specific / volume activity of the food

**STEP 1**

“Selecting a food group”

Figure 2.8 illustrates the FoodTester application window in step 1.

![FoodTester application window](image)

Figure 2.8 – STEP 1: Selecting a group to which the food belongs
Tap an icon showing a group with the food to be tested. The table below will help you determine a food group to which your food belongs.

<table>
<thead>
<tr>
<th>Group</th>
<th>Food product (food)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td>Powdered baby formula, dried milk</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td>Water, juice, tea, milk, fermented milk drink, yoghurt, cottage cheese, butter, sour cream</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td>Meat, smoked meat products, fresh fish, sushi, eggs. Canned goods</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td>Vegetables, fruits, mushrooms</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td>Grain crops, cereals, dried pasta, rusks, biscuits, sugar, salt</td>
</tr>
<tr>
<td><img src="image6.png" alt="Image" /></td>
<td>Dried vegetables, fruits, mushrooms. Dried apricots, raisins, dried nuts and fish</td>
</tr>
<tr>
<td><img src="image7.png" alt="Image" /></td>
<td>Herbs, herbal and leaf tea</td>
</tr>
<tr>
<td><img src="image8.png" alt="Image" /></td>
<td>Berries</td>
</tr>
</tbody>
</table>
“STEP 2
“Selecting a container shape”

Figure 2.9 illustrates the FoodTester application window in step 2.

Figure 2.9 - STEP 2: Selecting a container shape

Select the shape of a food container according to the following recommendations:

- “Large object” allows you to select a food container of any geometric shape provided that its dimensions are no less than ca 25 cm in each direction;
- “Parallelepiped” allows you to select a food container, which is smaller than the “large object” and is of a parallelepiped-like shape;
- “Cylinder” allows you to select a food container, which is smaller than the “large object” and is of a cylinder-like shape;
- “Containers library” allows you to select a previously created (shape and dimensions specified) food container. When the “Containers library” shape is selected, the list of food containers created by the user will appear. Choose a necessary container and touch the “Select” button. To add a new shape, edit or remove the current one, use the buttons, such as “Add”, “Edit”, and “Remove”, respectively.
STEP 3
“Selecting container dimensions” / “Selecting a detector position”

If either the “Parallelepiped” or “Cylinder” shape is selected, an additional window will appear (see Fig. 2.10) in which you should specify approximate dimensions of your food container.

Figure 2.10 – STEP 3: Selection of food container dimensions

You should place the detector close to one of the food container’s sides to which an arrow points. But if nothing hinders, you should better place it on top of the container.
If the “Large object” shape is selected, an additional window will appear (see Fig. 2.11) in which you should specify the way of positioning the detector towards the tested object – either attached to the surface (optimum alternative for measurement) or between the two “large objects” (ideally).

Figure 2.11 – STEP 3: Positioning the detector towards the tested “Large object”
Step 4 shown in Figure 2.12 illustrates the FoodTester application window in the FoodTest mode.

![FoodTester application window](image)

**Figure 2.12 - STEP 4: Starting a test**

Ensure a correct position of the detector towards the food and tap the “Start” button.

If minimum monitoring level of cesium for a chosen location and specified dimensions of the object exceeds a standardized value for a selected type of food, it is not recommended to test food products under these conditions. Find a location for testing with a lower background level or place the detector inside the large object.
**STEP 5**
“Searching for cesium isotopes in food”

**Important:** After you go to step 5, food testing begins itself. Information about the parameters specified in previous steps can be viewed via the “About measurement” menu item.

The device features two modes for presenting step 5: 1) a basic mode; 2) an expert mode.

1) The application window in the basic mode is shown in Figure 2.13.

![Figure 2.13 - STEP 5: Searching for cesium isotopes in food (basic mode).](image)

The user can observe current results of isotopes detection in food in the basic mode. The line 1 will move either to the “NOT FOUND” or “FOUND” labels during measurement depending on the presence or absence of cesium in the food, respectively. The progress indicator 2 displays accumulation of necessary
radiological information in the process of testing and in length of time fills from 0 % to 100 %. The indicator will no longer be displayed as soon as 100 % is reached. Measurement time and pulse intensity from the gamma radiation detector are displayed in the same way.

The basic mode has been developed for novice users who have no experience in radiation measurements and prevents them from hasty conclusions: it disallows calculating specific activity without all necessary information obtained.

2) The expert mode features two display options as shown in Figure 2.14.

![Figure 2.14 - STEP 5: Searching for cesium isotopes in food (expert mode)](image)

Display options in the expert mode:

1. A gamma radiation spectrum (Figure 2.14 (a)) is activated upon tapping a button. The experienced users with its help can visually control (observe) typical display of cesium radiation in the spectrum or control potential abnormalities of background radiation.
There are such tools available in this mode:

a. **spectrum scaling**, which is activated with a button (the tool expands and reduces the spectrum either horizontally or vertically);

b. **cursor**, which is activated with a button. It allows placing the cursor (a red vertical line) in the required position. The diagram represents the values of channel and energy at this cursor position;

c. **spectrum display option** – a view of the button depends on the display option selected: (input spectrum display) or (output spectrum display).

The input spectrum includes a background constituent, while the output one is without it. Moreover, in the output spectrum channels associated with $^{34}$Cs and $^{137}$Cs are highlighted in yellow and orange, respectively.

2 A trend display (Figure 2.14 (b)) is activated with a button and features a diagram of maximum and minimum activity values with a true value within their limits. The values of specific activity in Bq/kg and volume activity in Bq/l as well as a current measurement error are represented in the diagram.

There are such tools available in this mode:

a. **scaling**, which is activated with a button (expands and reduces the trend from top to bottom);

b. **cursor**, which is activated with a button. It allows placing the cursor (a red horizontal line) at the required level of specific activity.

2.1 The upper and the lower trend lines create a band diving probable values of specific activity. A true value of specific activity is within the limits of the upper and the lower band edges. This band is wider at first and is getting narrower in the course of measurement time, since the detector accumulates more and more data and the statistic uncertainty reduces.

2.2 The band of values visualizes the development of measurement in time. A configuration of the values band gives us the basis to evaluate the process of measurement. To be more specific, we can visually determine if there is sufficient time for measurement, and what level of measurement precision has been reached at a given time. We can also see some abnormalities in the process of measurement and depending on their presence or absence judge about the reliability of measurement or decide whether to carry out additional or repeated measurements.

2.3 Ideally, the band should gradually and symmetrically move towards a conditional central line in horizontal direction (examples are shown in Figure 2.15). If the band behaves that way during measurement (we can see that band edges are more or less symmetric with respect to the horizontal center shown with a red line-cursor), it means that the current result of specific activity calculation is valid enough.
2.4 In reality, the band almost always behaves in a different way. If the band during measurement clearly deviates from a horizontal direction (moves up or down), it means that spectrum balancing processes are not steady yet (Figure 2.16 illustrates some examples of the unstable band). In order to get more reliable measurement results you should wait until the band begins moving in a stable horizontal direction (Figure 2.17 illustrates the examples of a gradual change for a stable measurement mode).
Figure 2.16 – Unstable trend band
2.5 A bandwidth is another important feature apart from its shape and direction, since it displays the error in measurement. Considering the level of accuracy you want to obtain, please wait until the band reaches an acceptable width. You can observe numeric values of maximum and minimum specific activity at the moment of measurement along with its graphic display in order to evaluate the bandwidth. Figure 2.18 shows that if the current numeric value is $112^{+47}_{-47}$ Bq/kg, the right end of the band’s lower edge is at the level of $112-47=65$ Bq/kg, while the right end of the band’s upper edge is at the level of $112+47=159$ Bq/kg.
2.6 The line-cursor can also be used to control the bandwidth. By placing the cursor at the level of the right end of the band’s upper edge, and then shifting it to the lower edge (see Figure 2.19), we can observe a numeric value, which corresponds to the level of a cursor position. In general, the line-cursor helps to control the band direction and see the level of specific activity for any point of the band.
2.7 The band is always much narrower and more stable when a “large object” is under measurement. Consequently, if nothing hinders, one should carry out the “large object” measurements. All the figures, described in the following subsections, will be improved and reached much more quickly in such a case.

2.8 If the aim of your measurement is to make sure whether the specific activity exceeds some specified level (threshold value), the trend mode appears to be the most time-effective. Right after the measurement start, place the red line-cursor at such a level of specific activity you want to control when exceeded or not yet met. Then you should follow the change of position and width of the band and wait until the entire band becomes obviously lower than the specified level. The following example (Figure 2.20) shows that the entire band of possible values of specific activity has gone below the specified threshold (threshold is a red dotted line) after about 200 seconds of measurement. You should not jump to the conclusion too quickly at the early stage of measurement, since the band may go down at the beginning and then move up the threshold. To get more reliable result you should wait for a relatively stable condition of the band when its lines change their color (color change means that the confidence level has increased: the color changes from grey to blue, and then from blue to dark blue).

![Figure 2.20 – Control of threshold exceeding with the help of the cursor](image_url)

2.9 If the line of the specified threshold remains within the band for a long period of time (entire trend band neither goes up or down the threshold), this is that very rare case when an actual activity value of the examined object is close to the specified threshold level. If you still need to know whether the activity threshold level is exceeded or not, you should continue measurement till the band becomes more or less stable regarding the threshold.
2.10 If cesium is detected in the product under testing, the lower band edge will move up the line of “zero activity” (i.e. 0 Bq/kg threshold is exceeded). Moreover, for a more confident conclusion you should wait until the gap between the edge and the zero line becomes well-defined and lasting enough, and there is no apparent tendency for a repeated dropping of the lower band edge below the zero line. One of the examples (Figure 2.21) shows that the lower band edge has crossed the zero line (red dotted line) and moves upwards after the 250 second of measurement, and there are no signs that the direction of the lower band edge will change “downwards”.

![Figure 2.21 – Cesium presence monitoring in food with the help of the cursor](image)

2.11 You should keep in mind that the right side of the band gives the most reliable information about the specific activity, since it uses all data collected at a given time. Even if the band has not reached its stable condition yet (there is a tendency to move up or down), the most correct specific activity at a given instant is depicted in the middle of the right band edge, but not as a mean value throughout the length of the band. The example illustrates a correct location of the line-cursor (red dotted line) in the middle of the right edge of the band, which is the most probable value of specific activity (Figure 2.22 (a)), and an incorrect mid-level location of the line-cursor on the whole band (Figure 2.22 (b)). A perfect band shape (as in Figure 2.15), when the middle of the right band edge coincides with the middle of the whole band length, is rather a rare occurrence.
2.12 If the band shape becomes stable, i.e. its edges are coming together towards the horizontal central line in a stable and continuous manner (ideally as in Figure 2.15), one can anticipate that this very central line will later on converge with the most accurate value of the specific activity. Thus we can predictably accept a central value of the band as a final measurement result. In such a way measurement can be rather time-effective, but its result should be treated with care and such predictions should be allowed only when measurements are not very critical.

2.13 The issue of cesium absence is a separate task. If the band surface covers the zero line, it means that cesium is probably absent. There are some aspects described below.
2.13.1 If the band center coincides with the zero line (Figure 2.23 shows that the red line-cursor is at zero position and in the center at the same time), this is the maximum probable case that there is no cesium present. The figures will show the following value of specific activity: \( 0^{+25}_{-0} \) Bq/kg.

![Figure 2.23 – Cesium absence](image)

2.13.2 If the band covers the zero line (in Figure 2.24 the red line-cursor shows the zero level, which falls within the band edges), but the band center is a bit beyond the zero line, it means either cesium is absent or there is relatively little cesium present. The figures will show the following value of specific activity: \( 15^{+27}_{-15} \) Bq/kg.

![Figure 2.24 – Probable presence of small cesium amount](image)

2.13.3 If your task is to ascertain the fact of cesium presence or absence in food as accurately as possible, you should carry on measurement as long as possible to get the final answer. In such a case the figures of subsections 2.13.1 and 2.13.2 will assume increasingly accurate and “constricted” values. It is important to realize that even if the band covers the zero line at a given time, cesium might still be present. To get more specific answer you should continue measurement. The band, in this instant, will get narrower around zero, or,
perhaps, around some relatively small real value of specific activity. But, if you still want to continue measurement in order to get more specific result, you should realize that these more specific values are almost always smaller, than the upper band edge at the moment. In other words, the value of the specified result will most probably fall within the upper and the lower edges of the already obtained band. Figure 2.25 illustrates several examples of the trend band behavior during long-term measurements.

![Graphs illustrating trend band behavior during long-term measurements.](image-url)

a) three results of a long-term measurement of a “large sample” with $\approx 5 \text{ Bq/kg specific activity}$
b) three results of a long-term measurement of a “large sample” with ≈0 Bq/kg specific activity

Figure 2.25 – Examples of the trend band behavior during long-term measurements

2.13.4 The above-mentioned features of the band development pattern during measurement can serve the basis for control of the presence or absence of cesium radiation within background radiation irrespective of the task to monitor either food or surface contamination.
There are three ways to complete the search for cesium radioisotopes in food:

1. Automatic completion upon achieving measurement progress equal to 100%;
2. Forced completion after you tap the “Stop” button (the option of activity evaluation will become available, provided that you have currently gathered sufficient information and the progress equals to more than 50%);
3. Search interruption upon achieving maximum test time, which is 6 hours (the “Continue search button” will be disabled).

**Important:** It is recommended to wait for automatic completion when measurement progress becomes equal to 100%. In the case of forced completion, you should consider that the specific activity determination becomes more accurate in the process of testing. You will get more reliable results only if you continue measurement.

In section 2.5.4 “Approximate measurement time at various background values” you can review approximate values of measurement time for testing food products depending on their cesium isotopes contamination and environmental background level.

After completing the search for isotopes, the window of the basic mode will look as shown in Figure 2.26 (a) if cesium isotopes in a tested food product are absent or as in Figure 2.26 (b) if cesium radioisotopes are present.
Figure 2.26 – STEP 5: Search for cesium isotopes in food is completed

In case of forced completion of measurement with less than 50% of progress, the activity evaluation option will be disabled (Figure 2.26 (a)). In case of measurement completion with the progress more than 50% but less than 100%, approximate value of activity is available. For more accurate value, please continue the search until its auto-completion with 100% of measurement progress. (Figure 2.26 (b)). If you need to get as accurate result as possible, continue testing even after achieving 100% of measurement progress. Touch the “Continue search” button to continue the search. Maximum testing time makes 6 hours. Then the search is automatically stopped and no further testing is possible (the “Continue search” button is disabled).

If you need to correct spectrometric tract parameters of the device, you will see a message, saying “Calibration required”. For more details about energy calibration, see section 4.

To evaluate specific and volume activities of cesium radioisotopes, touch the “Activity evaluation” button. To exit the FoodTest mode and return to the mode of gamma radiation dose rate measurement, touch the “Exit FoodTest” button.

While exiting the FoodTest mode, the application warns you that measured data will be lost. If the progress indicator has achieved 100 %, you can save a measurement report that includes parameters of food and results received. Moreover, measurement description that you can enter will be also saved. The example of a report is presented in Appendix 1 (a). For more information about reports, see section 2.7.
The final window of the FoodTester application with the values of specific and volume activities of cesium isotopes is shown in Figure 2.27.

(a) 

(b)
Figure 2.27 – STEP 6: Evaluation of activity

This window shows the results of calculated specific and volume activities for cesium isotopes in a food product under testing in the events of forced (Figure 2.27 (a)) and automatic (Figure 2.27 (b)) measurement completion.

If calculated activity exceeds the minimum detectable activity of the device (50 Bq/kg) as well as the minimum monitoring level of cesium for the chosen location and specified dimensions, the results will appear as in Figure 2.27 (b). If the calculated activity is less than at least one of the values, the results will appear as in Figure 2.27 (a). To view the results in case of cesium absence, see Figure 2.27 (c).

The “Continue search” button allows further detection of isotopes in food.

To view the standardized values of cesium isotopes specific activity, touch the “Standardized values” button. Specify sanitary standards for cesium isotopes specific activity in food in your country. Some standards can be found in section “Safety standards for cesium isotopes specific activity in food” of this operating manual.

To return to the mode of gamma radiation dose rate measurement, touch the “Exit FoodTest” button.
2.5.3 Important recommendations for food testing

Attention: Failure to adhere to the following recommendations may lead to incorrect measurement results.

Before starting the measurement of the food products it is strongly recommended to find a place with a low background level – not more than 0.15 µSv/h. Higher radiation background may distort measurement results. To measure background, use FoodTester in the mode of gamma radiation dose rate measurement.

The test place should be also checked for the presence of cesium (e.g. a table on which you are testing food might be contaminated). The tested products should be taken away at the distance of no less than 2 m at that.

2.5.3.1 Preparing a food product for testing

1 The food packaging (container) may be made of any kind of material. In the case of a metal container, its thickness should not exceed 1 mm.

2 Do not mix food products of different types for testing (since different food types cannot be equally contaminated). For instance, do not mix mushrooms with fish. The product should be of homogeneous consistency.

Figure 2.28 – Uniformity of product types
2.5.3.2 Food shape and dimensions

1. Larger food product size deliver greater precision and shorter period of time to get measurement results. You should have a food container with dimensions of no less than 25 cm in each direction.

![25 cm container](image)

Figure 2.29 – Recommended container dimensions

Ideally, the detector should be placed in a position between packages or sacks of food with dimensions of more than ca 25 cm in any direction from the detector.

The detector can be attached to the surface of the food product with the same dimensions as described above (optimum alternative) if there is no possibility to put it between the packages.

![Ideal and optimum alternatives](image)

Figure 2.30 – Ideal and optimum alternatives of food product dimensions

Even if there is no possibility to use for testing a food container with ideal dimensions, the recommended dimensions of the food container should be no less than 10 cm in any direction.

2. If the container is smaller in size, put several containers of the same type together to get the overall dimensions of no less than ≈25 cm in any direction (otherwise, dimensions has to be less than 14x14x11 cm).
3 The relatively small-sized containers (up to ca 25 cm) are required to have a parallelepiped-like or cylinder-like shape. If the dimensions of the object exceed ca 25 cm in all directions, the shape of the container is of no importance.

**Attention:** Testing of food products with the dimensions of less than 14x14x11 cm should be considered as indicative, i.e. they give approximate evaluation of cesium specific activity.
2.5.3.3 Positioning the detector towards a food product

1. Place the detector close to the widest side of the food container.

Figure 2.32 – Attaching the detector to the widest side of the container

2. Place the detector with its reference point (side labeled with the “+” symbol) close to the food. The reference point is inscribed on the detector’s housing under the case.

Figure 2.33 – Placing a food product close to the detector’s reference point
3 Place the detector on the surface of the container so that there is no significant air layer between the detector and the food product.

![Figure 2.34 – No air layer](image)

4 Place the detector above the surface of the food container in the case there is some air layer at the package top and the food container is large-sized and heavyweight. In such a way, firstly, you can avoid too much pressure on the detector’s housing; secondly, reduce the influence of a possibly contaminated surface on which a tested product is located.

![Figure 2.35 – Placing the detector above the food container](image)

5 Use a plastic bag and change it from time to time to prevent the detector from being polluted.
### 2.5.4 Approximate measurement time at various radiation background values*

<table>
<thead>
<tr>
<th>Background, μSv/h</th>
<th>Cesium isotopes specific activity in food</th>
<th>Cesium isotopes specific activity in food</th>
<th>Cesium isotopes specific activity in food</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;50 Bq/kg**</td>
<td>50 Bq/kg</td>
<td>100 Bq/kg</td>
</tr>
<tr>
<td></td>
<td>Measurement time, s</td>
<td>Error, %</td>
<td>Measurement time, s</td>
</tr>
<tr>
<td>0.02</td>
<td>7000 30</td>
<td>550 30</td>
<td>250 30</td>
</tr>
<tr>
<td></td>
<td>4000 40</td>
<td>300 40</td>
<td>150 40</td>
</tr>
<tr>
<td>0.05</td>
<td>13900 30</td>
<td>900 30</td>
<td>300 30</td>
</tr>
<tr>
<td></td>
<td>7900 40</td>
<td>500 40</td>
<td>200 40</td>
</tr>
<tr>
<td>0.07</td>
<td>18300 30</td>
<td>1100 30</td>
<td>400 30</td>
</tr>
<tr>
<td></td>
<td>10300 40</td>
<td>650 40</td>
<td>200 40</td>
</tr>
<tr>
<td>0.10</td>
<td>24900 30</td>
<td>1400 30</td>
<td>500 30</td>
</tr>
<tr>
<td></td>
<td>14000 40</td>
<td>800 40</td>
<td>300 40</td>
</tr>
<tr>
<td>0.15</td>
<td>35500 30</td>
<td>1900 30</td>
<td>600 30</td>
</tr>
<tr>
<td></td>
<td>20000 40</td>
<td>1100 40</td>
<td>400 40</td>
</tr>
</tbody>
</table>

* Values are given for the case where the detector is attached to the large object.

** For activities less than 50 Bq/kg, the device is not able to define an accurate value of cesium isotopes activity in food.

**Important:** The lower is cesium isotopes activity in food, the more time is needed for getting results of food testing.

**Important:** The lower is a radiation background level, the lower cesium isotopes activity in food can be detected using the “FoodTester-G” device.

**Important:** You should always try to take as many food products as needed to form a “large object” in size (two “large objects” located at both sides of the detector are even better). Thus measurement is the most time-effective and accurate.
2.6 The SoilTest mode (soil testing)

Tap the “SoilTest” button in the mode of gamma radiation dose rate measurement to enter the SoilTest mode (see Figure 2.4). You will see the window as shown in Figure 2.36.

![Figure 2.36 – Selecting a soil test type](image)

Before starting soil testing, please read carefully the guidelines on carrying out measurements described in section 2.6.3 “Important recommendations for soil testing”. Pay attention to the way of selecting the type of measurement, as well as positioning the detector above the soil surface, etc. Guidelines are also available in the help window of the application, which appears when you tap the “How to perform soil testing” button.

**Attention:** Disregarding the guidelines on carrying out measurements described in section 2.6.3 “Important recommendations for soil testing” may lead to incorrect measurement results.
SoilTest consists of two modes: “Specific / Volume activities” and “Surface activity”.

Before defining specific / volume activities, check the test place for the presence of cesium. High level of cesium in the surrounding area can reduce the accuracy of results.

There are six steps to calculate specific / volume activity in the SoilTest mode (examination of a soil sample). The first five steps specify the parameters of soil, which will be tested for the presence of cesium isotopes, while the sixth step evaluates their specific and volume activities.

Calculation of surface activity in the SoilTest mode comprises five steps. The first four steps specify the parameters of soil, which will be tested for the presence of cesium isotopes, and the fifth step evaluates their surface activity.

The device features two options for presenting test results: a basic mode and an expert mode.

The basic mode displays the process of measurement and the results in a simplified form, while the expert mode allows observing the process of measurement in more details and receiving the information about the presence of cesium and its activity much earlier.

The expert mode provides much more information, however requires some skills in radiation measurements, especially understanding of the nature of statistical trends typical of radiation measurements.

The expert mode ensures display of activity from the very beginning, which becomes more accurate in the process of measurement. But a reliable result will become available only after the shape and the width of the trend assume their typical view. It will serve an indication that sufficient data has been collected.
The SoilTest mode allows testing the following soil types:

<table>
<thead>
<tr>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertile soil</td>
</tr>
<tr>
<td>Lawn</td>
</tr>
<tr>
<td>Marsh soils</td>
</tr>
<tr>
<td>Sand</td>
</tr>
<tr>
<td>Crushed stone</td>
</tr>
<tr>
<td>Asphalt, concrete (surface activity only)</td>
</tr>
</tbody>
</table>
2.6.1 Six steps to measure soil specific and volume activities

**Attention:** Before starting the measurement of soil, it is strongly recommended to check its test place for cesium content (e.g. a table on which you are testing food products might be contaminated). The food should be taken away at the distance of no less than 2 m at that.

Steps order in this mode:
1. Selecting a soil type.
2. Selecting a container shape.
4. Starting a test.
5. Searching for cesium isotopes in soil.
6. Activity evaluation.

After you have collected a soil sample to be tested and placed it into a package (of optimum size, if possible), steps 2-6 describing measurement of specific and volume activities of soils are absolutely the same as steps 2-6 that deal with measurement of food specific and volume activities. These steps are described in section 2.5.2.
2.6.2 Five steps to measure soil surface activity

**STEP 1**

“Selecting a soil type”

Step 1 shown in Figure 2.37 illustrates the FoodTester application window.

Figure 2.37 - STEP 1: Selecting a soil type for testing

Tap an icon showing a type of soil to be tested.
**STEP 2**

“Selecting height”

Step 2 shown in Figure 2.38 illustrates the FoodTester application window.

Figure 2.38 - STEP 2: Selecting height

Select a height above a surface where the detector will be located during testing. The higher the detector, the bigger the tested surface area is. Select 10 cm height for local testing (surface radius up to 1-3 m), select 100 cm height for large areas (surface radius up to 20-50 m).

**Important:** Please read the guidelines outlined in section 2.6.3 to make a right choice of measurement height.
Step 3 shown in Figure 2.39 illustrates the FoodTester application window in the SoilTest mode.

Place the detector at the height selected during the previous step and tap the “Start” button. Do not change the detector position until the end of the test.

Figure 2.39- STEP 3: Starting a test
Search for cesium isotopes on surface is performed the same way as search for cesium isotopes in food. All peculiarities of the measurement process monitoring and interpretation of measurement results in the basic and expert modes are absolutely identical to those described in Step 5 of the FoodTest mode (see section 2.5.2)
The final window of the FoodTester application with the values of cesium isotopes surface activity is shown in Figure 2.40.

**Figure 2.40 – STEP 5: Surface activity evaluation**

This window shows the results of calculated surface activity for cesium isotopes in soil in the events of forced (Figure 2.40 (a)) and automatic (Figure 2.40 (b)) measurement completion.

Specify sanitary standards for cesium isotopes surface activity in your country.

The “Continue search” button allows further detection of cesium isotopes.

To return to the mode of gamma radiation dose rate measurement, touch the “Exit SoilTest” button.

While exiting the SoilTest mode, the application warns you that measured data will be lost. If progress indicator has achieved 100 %, you can save a measurement report that includes parameters of food and received results. Moreover, measurement description that you can enter will be also saved. The example of a report is presented in Appendix 1 (b). For more information about reports, see section 2.7.
2.6.3 Important recommendations for soil testing

Attention: Failure to adhere to the following recommendations may lead to incorrect measurement results.

2.6.3.1 Placing the detector above the soil surface

1. Measurement of soil surface activity can yield an accurate result averaged for quite a large area (within a radius of tens of meters), if a surface of the area under monitoring is flat (without obvious hills or holes). The slope of the targeted area is not as important as its flatness.

2. The radius of data collection depends on the condition of the area under monitoring. Thus, if the area has a smooth flat surface (for instance, concrete area), radiological data can be collected from rather remote area zones. However, if the area is flat in general, but its surface is rough (for example, it is a gravel road or it is covered with small plants or lawn grass), the radius of data collection becomes smaller.

3. If the detector is placed at a height of 100 cm above the soil surface, averaged measurement of soil surface contamination within the radius of up to 20-50 m is performed.

4. If the detector is placed at a height of 10 cm above the soil surface, local measurement of soil surface contamination within the radius of up to 1-3 m is made.

2.6.3.2 Recommendations for choosing the type of measurement

1. When choosing the type of measurement, check out the size of a tested area. If the area is limited in size (for example, one of its directions does not exceed 3 m or buildings are located within a few meters), local measurement performed by positioning the detector at the height of 10 cm is recommended.

2. Regardless of the overall size of the area, if it features local holes (with a radius extending from tens of centimeters to several meters) that are potentially susceptible to contamination, local measurement is recommended.

3. Averaged measurements performed by positioning the detector at the height of 100 cm cannot be applied if a large area is under testing and you know that it is locally contaminated, as well as if lateral dimensions of a contaminated plume are known in advance (or visually obvious). Local measurements of obviously contaminated plumes are recommended.

4. If there are noticeable holes or bulges in the area, but the surface is relatively flat within the radius of 10-30 m, make averaged measurement of surface activity in that area (at the height of 100 cm), and measure surface activity of certain holes as if measuring local contamination (at the height of 10 cm).
5. If the area under testing is big and flat enough, and varied covers are
typical of its different regions (for example, patches of bare ground and grass), it
is recommended to make local measurements in certain places with a
homogeneous surface.

2.6.3.3 Additional recommendations for measurements

1. Use simple supporting stands made of light materials (for example, the
10 cm thick sheet of foamed plastic can be put under the device for local
measurement) to hold the device at a necessary height during measurement time.
Keep the stand free from contaminants.

2. Local measurements are preferable to make averaged measurements
more precise.

3. Even if the area is ideally flat and smooth it is recommended to make a
series of measurements at different points (averaged measurements in each 5-
10 m, while local ones – 1-3 m).

4. If contamination is known to penetrate the soil at the depth of up to 5 cm
and deeper, monitor a contaminated area in the mode of specific activity
measurement by placing the device on the soil or by collecting samples.

5. Before you start measuring, make sure there are no relatively high
objects (buildings or trees) contaminated with cesium in the vicinity (at a distance
of one meter to tens of meters), since the detector may sense radiation emitted by
such objects and yield incorrect measurement results of soil contamination.
2.7 Measurement results

Reports are stored in the ua.ecotest.foodtester folder in the downloads directory of the Android device.

Tap the “Menu” button on the Android device and select the “Settings” icon. In the application settings window that opens, touch the “Manage reports” item in the “Reports” category. The screen opens (Figure 2.41), showing a list of saved measurement reports.

![Figure 2.41 – Measurement reports](image)

The name of a report includes a date and start time of measurement. You can view the report by choosing its name in the list. For selected reports, such commands like “Share” (for example, send via Bluetooth or email) and “Remove” are available.
2.8 Demo mode

The application provides a demo mode that allows you to learn about functional capabilities even if you do not have the detector.

Open the FoodTester application. Do not connect the Android device to the detector (do not touch the “Connect” button). Tap the “Menu” button on the Android device and select the “Settings” icon. In the application settings window that opens, touch the “Start demo mode” item in the “Demo” category.

**Important:** Data shown in the demo mode are emulated by the application, i.e. they are not real values from the device’s detector. A red “FoodTester Demo” label in the symbol area, where the number of the connected FoodTester-G detector is normally displayed, will serve as an indication to you.

After you start the demo mode, an application screen opens in the mode of gamma radiation dose rate measurement. The values of DER and counts per second will gradually increase within a whole measurement range of the device. After maximum values are achieved, minimum values will be displayed again. The graphical view of counts per second will change from green to red colors.

Moreover, you can find the information on how the application works in the FoodTest and SoilTest modes.

When choosing a food group, shape and packaging in the FoodTest mode, and setting soil parameters in the SoilTest mode, enter any values you want. After the search for cesium isotopes starts, testing data will appear. You can see the measurement progress both in basic and expert modes. When the progress indicator reaches 100 %, testing will end automatically. You can continue a search until maximum measurement time is reached.

**Attention:** Measurement time in the demo mode is displayed conditionally. The test that lasts 6 hours under real conditions will take just a few minutes.
3 FoodTester APPLICATION UPDATE

To update the FoodTester application on your Android device, do the following:

1 Set up an Internet connection (for example, with a built-in Wi-Fi connection in your Android device);

2 Make sure installation of applications downloaded from sources other than Market is allowed. Touch the “Applications” item in the Settings screen of the Android device and select the “Unknown sources” check box;

3 Open the FoodTester application. Do not connect the Android device to the detector (do not tap the “Connect” button). Tap the “Menu” button and select the “Settings” icon. In the application settings window that opens, touch the “Application update” item in the “Update” category;

4 After notification about installation, which is described above, you will be informed that application updates are available. If the update is not required, the message, saying “You have the latest version of the FoodTester application installed”, will appear. Whenever the application update is available the following message “New version of the FoodTester application is available. Do you wish to download and install it now?” is displayed. Tapping the “Ok” button will show “Downloading update…”. The download time depends on your Internet connection. After that, the application begins to install. The Android device will notify you that an application you are installing will replace another one. Accept this notification. Select “Install” on the application settings screen. The “Application installed” message will be displayed over a period of time.
4 ENERGY CALIBRATION

The energy calibration is done with the aim to correct spectrometric tract parameters which tend to be changed during a device operation. It is recommended that the device be exposed to energy calibration at intervals of not less than one per three months. After testing is completed, in the application window you can see the tip saying that calibration is needed (Figure 2.26(b)).

The energy calibration is based on the measurement of naturally occurring isotope $^{40}K$, which in most cases exists in the environment, with a subsequent automatic recalculation of coefficients of the “FoodTester-G” device. To perform a time-effective calibration procedure, it is recommended to use potassium-containing substances. For example, purchase the so called potassium chloride fertilizer of 1 kg weight, which is available in hardware stores, garden centers or nurseries specializing in fertilizers.

The FoodTester application makes use of calibration coefficient files that comply with you detector. Select the “Calibration files” item in the “Calibration” category of the application settings window. In the window that opens, you will find your detector in the “Files were downloaded for detectors” category. If it is not enlisted, please download calibration files to your Android device. For this purpose, “bind” your detector to the Android device (see section 2.3), set up an Internet connection (for example, with a built-in Wi-Fi connection in your Android device), then tap the “Menu” button on the Android device and select the “Settings” icon. Tap the “Calibration files” item in the “Calibration” category of the application settings window. In the window that opens, select the “Download” item in the “Advanced” category. As soon as you receive a message with the instructions described above, the application starts downloading calibration files. Upon that your detector will be displayed in the list of detectors with the downloaded calibration files.

**Attention:** If a new detector will be “bound” to the Android device, the procedure of calibration files downloading should be repeated.

To perform calibration, enter the mode of gamma radiation dose rate measurement, touch the “Menu” button on the Android device, and select the “Settings” icon. In the application settings window that opens, tap the “Energy calibration” item in the “Calibration” category. Figure 4.1 illustrates the window that will appear.
Important: Please read these instructions carefully before starting calibration. Disregarding the listed below recommendations might cause incorrect operation of “FoodTester-G”.

Recommendations on how to prepare for the energy calibration:

1. Keep the detector within the temperature range from +17 °C to +25 °C for at least 1.5 hours;

2. Make sure that the batteries of your detector and Android device are charged enough to operate for at least 2 hours;

3. Place your detector and Android device in a location with the stable ambient air temperature ranging from +17 °C to +25 °C;

4. Place the detector near potassium-containing substances (e.g. potassium chloride fertilizer) to perform a reliable and time-effective calibration;
5 Touch the “Start calibration” button (see Fig. 4.1), and do not change the position of the detector and Android device until a message of calibration completion appears.

**Important:** If during calibration the “Could not calibrate the detector. Potassium was not found” message appears, try to change the position of the detector (for example, place it as close to the wall of a measurement room as possible) and repeat calibration.

**Important:** If during calibration procedure the “Parameter is out of range” message appears, please restore coefficients by pressing the “Restore coefficients” button. Repeat calibration following the recommendations on how to prepare for the energy calibration. If the message appears again, contact a manufacturer.

Before the calibration starts it is recommended that once per year factory coefficients be restored by tapping the “Restore coefficients” button (see Fig. 4.1).

Approximate time required to perform a calibration is 30 minutes with the use of the potassium chloride fertilizer of 1 kg weight, and no less than 2 hours without using potassium-containing substances.
5 TROUBLESHOOTING AND MESSAGES

The “Detector damaged” message appears. There is a problem with the “FoodTester-G” detector. Switch the detector off, and then turn it on. If the message appears again, contact the service center or the manufacturer.

The “Calibration files are damaged or not found. You can download them in the application settings window” message appears.

Touch the “Menu” button on the Android device and tap the “Settings” icon. In the application settings window that opens, select the “Calibration files” item in the “Calibration” category.

The presence of your detector in the list of detectors with downloaded calibration files means that these files are damaged. Select the check box labeled “Clear current” under “Advanced”.

Download the calibration files as described in section 4 “Energy calibration”.

If you receive the message again after the calibration files download, contact the service center or the manufacturer.

The “Could not calibrate detector. Potassium was not found” message appears during the energy calibration.

Try to change the detector position (for example, place the detector as close to a wall of the measurement room as possible or use the potassium chloride fertilizer of 1 kg weight) and repeat a calibration.

The “Parameter out of range” message appears during the calibration relative to energy.

Touch the “Restore coefficients” button in the energy calibration window to restore coefficients. Repeat the calibration following the given recommendations on preparing for a calibration (see section “Energy calibration”). If the message occurs again, contact a manufacturer.

You may see the following messages “Update files could not be saved. Update aborted” during application update, “Calibration files could not be saved. Download aborted” while downloading the calibration files.

Check the settings of the Android operating system for free space available on the Android device to save files.
6 SAFETY STANDARDS FOR CESIUM ISOTOPES SPECIFIC ACTIVITY IN FOOD

**Attention:** Applicable safety standards for cesium isotopes specific activity in food in your country may be different from those included in this section.

Food safety standards for cesium isotopes specific activity in Japan (dated April 2012)

<table>
<thead>
<tr>
<th>Food products</th>
<th>Standardized value, Bq/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking water</td>
<td>10</td>
</tr>
<tr>
<td>Milk, Milk products</td>
<td>50</td>
</tr>
<tr>
<td>Baby nutrition</td>
<td>50</td>
</tr>
<tr>
<td>Vegetables, grains, meat, eggs, fish, etc.</td>
<td>100</td>
</tr>
</tbody>
</table>

Food safety standards for cesium isotopes specific activity in Ukraine in accordance with the order of the Ukrainian Ministry of Health Care No 255 as of 19.08.1997

<table>
<thead>
<tr>
<th>Name</th>
<th>Bq/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread, bread products</td>
<td>20</td>
</tr>
<tr>
<td>Potatoes</td>
<td>60</td>
</tr>
<tr>
<td>Vegetables (leaf and root vegetables, cooking herbs)</td>
<td>40</td>
</tr>
<tr>
<td>Fruits</td>
<td>70</td>
</tr>
<tr>
<td>Meat and meat products</td>
<td>200</td>
</tr>
<tr>
<td>Fish and fish products</td>
<td>150</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>100</td>
</tr>
<tr>
<td>Egg</td>
<td>6</td>
</tr>
<tr>
<td>Water</td>
<td>2</td>
</tr>
<tr>
<td>Condensed and concentrated milk</td>
<td>300</td>
</tr>
<tr>
<td>Dried milk</td>
<td>500</td>
</tr>
<tr>
<td>Wild berries and mushrooms</td>
<td>500</td>
</tr>
<tr>
<td>Dried wild berries and mushrooms</td>
<td>2500</td>
</tr>
<tr>
<td>Medicinal plants</td>
<td>600</td>
</tr>
<tr>
<td>Other products</td>
<td>600</td>
</tr>
<tr>
<td>Special baby nutrition</td>
<td>40</td>
</tr>
</tbody>
</table>
7 MANUFACTURER INFORMATION

Private enterprise “Scientific and production private enterprise “Sparing-Vist Center”
(PE “SPPE “Sparing-Vist Center”)

33 Volodymyr Velyky Str.,
Lviv, 79026,
Ukraine

Tel.: +380 32 242 15 15 (multichannel)
+380 32 242 21 15 (multichannel)
Fax: +380 32 242 20 15

E-mail: sales@ecotest.ua
website: www.ecotest.ua
8 CERTIFICATE OF ACCEPTANCE

The “FoodTester-G” analyzer of cesium isotopes activity in food of BICT.412128.001-02 type with ___________ serial number meets ТУ У 33.2-22362867-030:2012 technical specifications, and is calibrated and accepted for use.

Date of manufacture ______________________

QCD Representative: _________________

Stamp here (signature)

9 PACKING CERTIFICATE

The “FoodTester-G” analyzer of cesium isotopes activity in food of BICT.412128.001-02 type with ___________ serial number packed by the private enterprise “SPPE “Sparing-Vist Center” in accordance with the requirements, specified in ТУ У 33.2-22362867-030:2012.

Date of packing _________________

Stamp here

Packed by _________________

(signature)

Packed product accepted by: _________________

(signature)
10 WARRANTY

10.1 The warranty period of the devices shall terminate and be of no further effect in 18 months after the date of commissioning, or after the end of the storage period.

10.2 The warranty period of storage of the device is six months after its manufacture date.

10.3 Free of charge repair or replacement during the warranty period of use is performed by the producer enterprise provided that:

10.3.1 The customer observed the guidelines on its use, shipping and storage.

10.3.2 The customer encloses a warranty certificate filled out accurately and clearly.

10.3.3 The customer encloses the failed device.

10.4 If the defect (according to the claim) is eliminated, the warranty period is prolonged for the time when the device was not used because of the detected defects.

10.5 The batteries failure is not a reason for claim, after their warranty period is expired.

10.6 Warranty is void in case of:

10.6.1 Any mechanical or thermal damage;

10.6.2 Any liquid remains;

10.6.3 Foreign objects found inside the detector;

10.6.4 The warranty stamps are violated, the housing opened, repairs or any internal changes made;

10.6.5 The serial number of the device deleted or changed.

10.6.6 The use of any accessories not provided by the manufacturer.
APPENDIX 1
EXAMPLES OF MEASUREMENT REPORTS

a)
FoodTester measurement report

FoodTester-G #1200067
Date / time: 05.03.13 15:19
Sample #1

Parameters
Test type FoodTest
Food group Grain, corn
Container shape Large object
Detector position Attached to the surface

Results
Measurement time 1245 c
Progress 100 %
Min. cesium monitoring level 60 Bq/kg
Specific activity $80_{-22}^{+22}$ Bq/kg
Volume activity $112_{-31}^{+31}$ Bq/l

b)
FoodTester measurement report

FoodTester-G #1200067
Date /time: 05.03.13 16:59
Sample #2

Parameters
Test type SoilTest
Soil type Fertile soil
Detector height 10 cm

Results
Measurement time 2000 s
Progress 100 %
Surface activity $1690_{-943}^{+943}$ Bq/m²