DISCOVERY engineering

Portable Frequency and Power Meter for Radio Signals, Radio Direction Finder for 2G-3G-4G active systems

DT-RDF

1. General Information

This User Manual applies to the portable frequency and power meter for radio signals (radio direction finder) DT-RDF and is intended to provide an overview of its operating principles and instructions for use.

The DT-RDF is a compact eight-band radio direction finder designed for high-precision localization of a subscriber device previously identified via IMSI or IMEI and operating on a known downlink ARFCN. The device enables covert operation within cellular communication bands. In addition to direction-finding functionality, it can also serve as a radio signal frequency and power meter.

The DT-RDF features the following:

- Stepwise input attenuator switching in 10 dB increments.
- Selection of input frequency band.
- Device control via Bluetooth connection.
- Battery charge/discharge monitoring.
- Integrated visual and audio indication.
- RS232 interface.

2. Warnings

Attention!

The manufacturer reserves the right to introduce minor design changes to the device that do not impair (and may improve) its operational characteristics. In such cases, this User Manual may, in some sections, not fully correspond to the version of the device you have. For complete and up-to-date information, it is recommended to refer to the latest version of the Operating Manual available on the manufacturer's website

Before powering on the device, it is necessary to carefully read this Operating Manual and strictly follow its requirements during further use. Disassembly of the device and connection of any equipment not specified in this manual are strictly prohibited. Warranty and post-warranty servicing is carried out by the manufacturer only if this Operating Manual is available, the product passport is correctly filled out, and warranty seals are intact. In cases of mechanical damage to the device, operation in chemically aggressive environments, ingress of water, dirt, or insects into the device, or violation of the operating conditions, seal integrity, and the requirements of this manual — warranty obligations become void.

3. Package Contents

Item	*Quantity*	*Note*
1. DT-RDF Device	1 pc.	-
2. LowBand Antenna	1 pc.	-
3. HighBand Antenna	1 pc.	-
4. WideBand Antenna	1 pc.	-
5. Charger	1 pc.	-
6. Headphones	1 pc.	-
7. USB-A to USB-C Cable	1 pc.	-
8. Carrying Case for DT-RDF	1 pc.	-
9. Antenna Mounting Strap	1 pc.	-

4. Technical Specifications

- Extended battery life: from 5 hours.
- Increased dynamic range:
  - 3G, LTE — 115 dB
  - LTE — 130 dB
  - 2G — 130 dB
- Receiver sensitivity:
  - 2G, LTE — not worse than – 110 dBm
  - 3G — not worse than – 93 dBm
- Supported frequency bands for GSM, UMTS, and LTE standards:
  - GSM-E: 900 – 1800 MHz
  - GSM-A: 850 – 1900 MHz
  - UMTS (3G): Bands 1 (2100), 2 (1900), 4 (1700 AWS), 5 (850), 8 (900), 10 (1700 AWS+)
  - LTE: Bands 1 (2100), 2 (1900), 3 (1800), 4 (1700), 5 (850), 7 (2600), 8 (900), 10 (1700), 12 (700), 20 (800)
- Device dimensions: 130,5 × 69 × 20 mm
- Weight: 228 г.
- LowBand antenna (250×160 mm):
  - Frequency range: 750 – 900 MHz
  - Center frequency: 825 MHz
  - Bandwidth: 150 MHz
  - VSWR: < 2
  - Gain: 5 dBi
  - Impedance: 50 Ohm
  - Polarization: linear, vertical
  - Beamwidth (HPBW): 120°
- HighBand antenna (200×110 mm):
  - Frequency range: 1700 – 2600 MHz

- Center frequency: 2150 MHz
- Bandwidth: 900 MHz
- VSWR: < 2
- Gain: 5 dBi
- Impedance: 50 Ом
- Polarization: linear, vertical
- Beamwidth (HPBW): 120°

➢ WideBand antenna (160×160 мм):

- Frequency range: 750 – 2600 MHz
- Center frequency: 1675 MHz
- Bandwidth: 1850 MHz
- VSWR: < 2
- Gain: 2 dBi
- Impedance: 50 Ом
- Polarization: linear, vertical
- Beamwidth (HPBW): 120°

Note: All of the above antenna specifications are guaranteed only when the antennas are mounted on the human body.

5. Operating Principle

The handheld direction finder is a compact and cost-effective radio direction-finding device designed to determine the location of a target mobile subscriber terminal that has been captured by an IMSI/IMEI catcher system operating in GSM, UMTS, or LTE standards on a known uplink ARFCN channel. The device is compatible with all types of IMSI/IMEI catchers that use GSM, UMTS, and LTE technologies.

A highly sensitive receiver module enables expansion of the search radius from 50 to 1000 meters[2]. The receiving antenna can be covertly placed under clothing or inside a small bag or briefcase along with the direction finder. The antenna is enclosed in a waterproof housing. Control of the direction finder's receiver unit is performed via an Android smartphone using a Bluetooth interface. The operator is provided with four feedback options: via a Bluetooth or wired headset, the built-in smartphone speaker, or its standard wired headset.

6. Device Components (Fig. 1):

1. SMA RF connector for antenna connection.
2. USB-C port — used for battery charging and firmware updates.
3. 3.5 mm audio jack for connecting a wired headset.
4. Bluetooth indicator.
5. ERR indicator — signals errors in device operation.
6. LOCK indicator — signals that the device has locked onto the selected frequency.
7. «ENTER/ON/OFF» button — used to power the device on/off, access the menu, and confirm selected commands.
8. «EDIT» button — used for navigating through menu items and for quick access to ARFCN channel editing mode.
9. «ATT/VOL-» button — short press decreases input attenuator level in steps; long press decreases audio volume.
10. «ATT/VOL+» button — short press increases input attenuator level in steps; long press increases audio volume.
11. OLED display — used to display current operational information.

Fig.1

7. Operating Procedure

7.1 Powering the device on and off is performed by pressing and holding the «ENTER/ON/OFF» button (see item 7 in Fig. 1) for approximately 3 seconds. After powering on, the display will briefly (for about 2 seconds) show the firmware versions of the device's internal modules (see Fig. 2).

Fig.2

The device then switches to the operating mode that was active during its last power-on session. The display shows the selected standard (UMTS, LTE, GSM-E, GSM-A), the configured ARFCN, the current gain or input attenuation level, the battery charge status, and the received signal level (see Fig. 3).

Fig.3

Note: If the display does not light up when the device is powered on, the battery must be charged before further operation.

7.2 The device menu consists of four items (see Fig. 4). Navigation through the menu items is performed by pressing the «EDIT» button.

- RAT
- Bluetooth
- Brightness
- Screen rotation

Fig.4

The active menu item is displayed in uppercase letters and enclosed between angle brackets.

- **>RAT<** – To enter this menu item, press the «ENTER/ON/OFF» button. Pressing the «EDIT» button allows you to select one of the available standards (UMTS, LTE, GSM-E, GSM-A) (see Fig. 5)

Fig.5

The desired standard is selected by pressing the «ENTER/ON/OFF» button. Next, the ARFCN channel value is configured using the «ATT/VOL-» and «ATT/VOL+» buttons. Digit-by-digit navigation is performed by pressing the «EDIT» button (see Fig. 6).

Fig.6

- **>BLUETOOTH<** – To enter this menu item, press the «ENTER/ON/OFF» button. After that, a message indicating connection to a Bluetooth device will appear on the display (see Fig. 7), and the Bluetooth indicator on the front panel will light up (see Fig. 8).

Fig.7

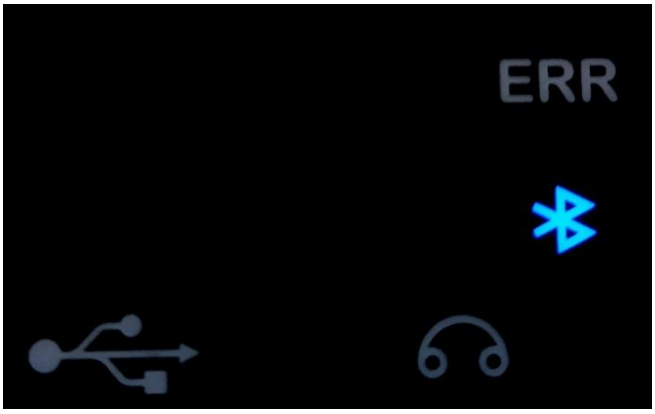

Fig.8

Note: In Bluetooth mode, the brightness level of the device's display and keypad backlight is automatically set to «night mode».

- **>BRIGHTNESS<** – To enter this menu item, press the «ENTER/ON/OFF» button. Within this menu, you can set the desired brightness level for the device's display and keypad backlight. There are four brightness levels available for selection (see Fig. 9).

Fig.9

➢ **>SCREEN ROTATION<** – This menu item is activated by pressing the «ENTER/ON/OFF» button. When activated, the display image is rotated by 180° (see Fig. 10).

Fig.10

7.3 Attenuation adjustment is performed using the «ATT/VOL-» and «ATT/VOL+» buttons (short press).

7.4 To adjust the volume level, press and hold the «ATT/VOL-» or «ATT/VOL+» button.

7.5 Position the direction finder and receiving antenna in any suitable orientation that ensures maximum possible sensitivity. The highest antenna sensitivity is achieved when it is pointed toward the expected direction of the signal source.

7.6 By gradually rotating the device left and right, determine the direction that yields the maximum signal level on the receiver's indicator or, alternatively, the highest audible volume in the headphones.

7.7 At the moment the maximum signal level is reached, the direction in which the direction finder is pointed corresponds to the direction of the signal source (see Fig. 11).

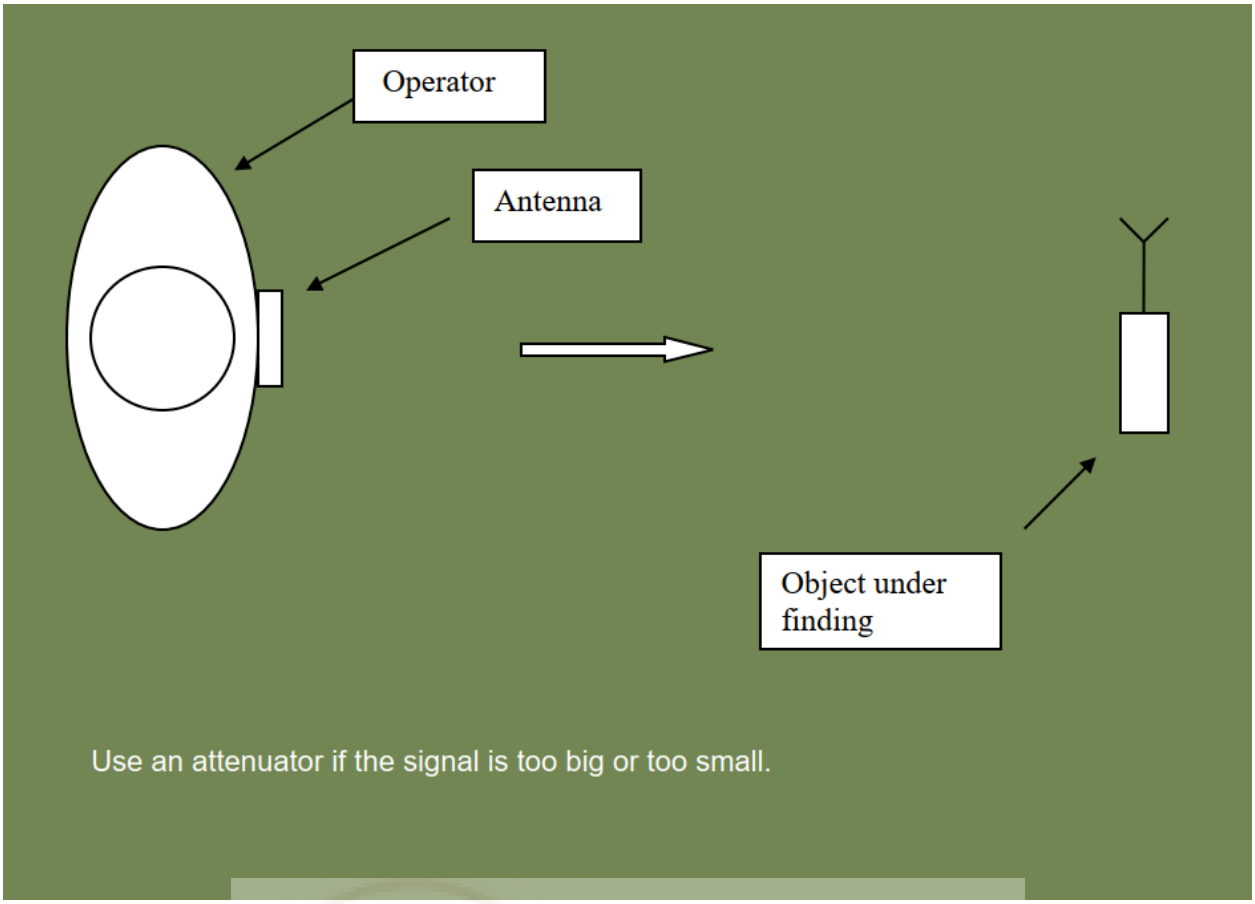

Fig.11

8. Application interface elements (see Fig. 12):

1. Connection button/indicator.
2. Battery charge level indicator.
3. Button to access Bluetooth settings.
4. Display of GPS coordinates and positioning accuracy.
5. Maximum recorded signal level indicator.
6. Current signal level indicator.
7. Sound mode switch/indicator. Available modes: OFF — sound off, TONE — continuous tone, BEEP — intermittent signal.
8. Button to clear the directional diagram.
9. Network type switch button (RAT — Radio Access Technology).
10. Map/Compass mode toggle.
11. Attenuation decrease button.
12. Attenuation increase button.

13. ARFCN input field (Absolute Radio Frequency Channel Number).

Fig.12

9. Operating Procedure (Smartphone + Device)

9.1 Further control is carried out via the smartphone. Install the Locator.apk file on a mobile device (smartphone or tablet) running Android 6.0 or later. After successful installation, the Locator application icon will appear on the screen (see Fig. 13).

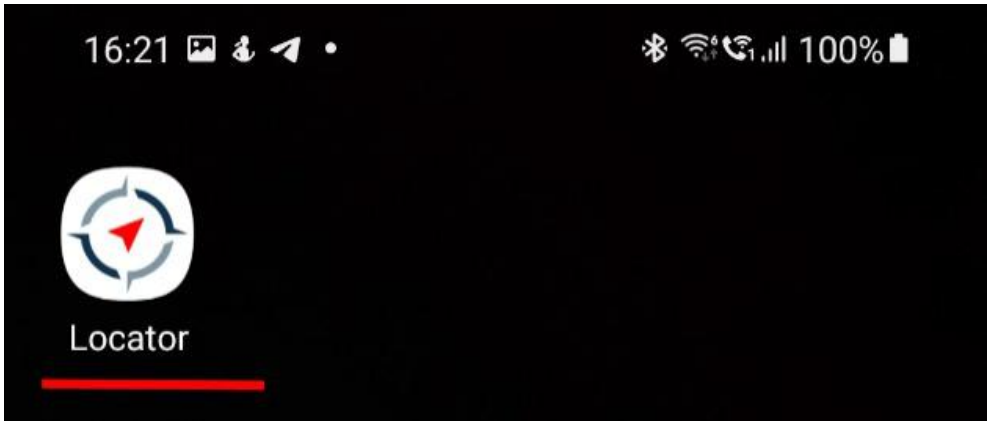

Fig.13

9.2 Enable Bluetooth on your smartphone or tablet. On the direction finder device, enter the menu by pressing the «ENTER/ON/OFF» button. Use the «EDIT» button to select the «BLUETOOTH» menu item. Confirm your selection by pressing «ENTER/ON/OFF». In the Locator application, tap the button with the red circle to establish a connection with the GSM/UMTS/LTE receiver (see Fig. 14).

Fig.14

If the connection is successful, the circle will change color from red to green (see Fig. 15).

Fig.15

9.3 Select the required cellular network standard using the «Network» button (network type selection) (see Fig. 16).

Fig.16

9.4 Enter the ARFCN value in the «ARFCN» field and press «OK» to confirm (see Fig. 17).

Fig.17

9.5 The setup is now complete. Use the signal level diagram to determine the direction by locating the maximum signal value — additionally, the estimated direction is marked with an orange oval (see Fig. 18).

Fig.18

10. Operating Procedure with Web Server

Preparation:

Start the web server using the following command:

```
./server target_power_level
```

where *target_power_level* is the target signal power in milliwatts (mW). If it is necessary for the server to continue running after the current session ends, perform the following steps:

- Press Ctrl + Z to suspend the current process and move it to the background.
- Enter the command: `dh`
- Then execute the command: `disown`

Operation:

Switch to the map display mode using the corresponding button (see Fig. 19).

Fig.19

After that, the application interface will appear as shown in (Fig. 20):

Fig.20

1. Agent with lost connection or critically low signal level. In this case, the last «normal» signal value is displayed, and the indicator border changes to red.
2. «Operator circles» — graphical indicators whose diameter is inversely proportional to the received signal strength (the higher the signal level, the smaller the circle).
3. Target point — displayed only if the target's location can be calculated. Indicates the approximate position of the object.

Search Procedure

1. Proceed in the direction of the operator with the smallest circle diameter — this corresponds to the highest signal level. Periodically perform a 360° rotation to check for peak signal levels.
2. When the target point appears on the screen, verify its validity: if it is located at a significant distance from all operators, perform an additional 360° rotation. If you are confident in the accuracy of the displayed point — proceed toward it.

11. Supported Receive Channels (RX) by Standard:

LTE	*UMTS*	*GSM-E*	*GSM-A*
0-599	10562-10838	0-124	128-251
600-1199	9662-9938	975-1023	512-810
1950-2399	412-687	512-885	
2400-2649	1537-1738		
1200-1949	1887-2087		
2750-3449	2937-3088		
3450-3799	3112-3388		
4150-4749	3412-3687		
5010-5179	4357-4458		
6150-6449	1007-1087		

12. Manufacturer (Supplier) Warranty

The manufacturer guarantees the operability of the device, provided that the user complies with the operating, transportation, and storage conditions specified in this User Manual. The warranty period for the device is 12 months from the date of sale. The date of sale must be confirmed by a corresponding entry (stamp) in this User Manual. If the device fails during the warranty period and the user has complied with the specified operating conditions, the supplier is obliged to eliminate the failure free of charge and take measures to prevent such defects in future production batches. In the event of a defect during the warranty period, the user must send the DT-RDF portable frequency and power meter (direction finder) to the manufacturer along with a cover letter stating the reason for the claim, and attach this User Manual.

590 Kingston Road, London, SW20 8DN, UK

Warranty Certificate No_____

Device: DT-RDF; Serial Number_____

Date of Manufacture_____

Date of Sale_____

Customer_____

Date of Receipt for Repair_____

Reported Malfunction_____

Date of Repair Completion_____

Cause of Malfunction_____

Repair Performed By: _____ _____ _____

Last Name Signature Date

Date of Shipment_____

590 Kingston Road, London, SW20 8DN, UK

Warranty Certificate No_____

Device: DT-RDF; Serial Number_____

Date of Manufacture_____

Date of Sale_____

Customer_____

Date of Receipt for Repair_____

Reported Malfunction_____

Date of Repair Completion_____

Cause of Malfunction_____

Repair Performed By: _____ _____ _____

Last Name Signature Date

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