REPORT
On field tests
For rubble victims detection PicoR-Bio
At Russian Emergency Situation Ministry test range
(Noginsk City, Moscow region) 11.10.2012

During field tests attempts were made to find humans under rubbles, by scanning breathing and movements (limbs or body movements).

The tests took place at two locations on the test range. Each location was tested for false triggering (without a human), overall PicoR-Bio performance (with a human) using antenna modules based on printed and horn antennas. Signal processing was made on a laptop with SKI-Bio software, which allows to visualize reflected signal in real-time and record it for future analysis. Recorded radargram analysis can be processed in other programs, such as RadExplorer.

PicoR-Bio complex included:

- antenna module based on printed antennas (hereinafter - PicoR AM1 module) (pic. 1);
- antenna module based on horn antennas (hereinafter - PicoR AM2 module) (pic. 2);
- laptop with Ski-Bio software (pic. 3)

Pic. 1. PicoR AM1

Pic. 2. Module PicoR AM2

Pic. 3. Laptop with SKI-Bio software

Test site № 1

During tests on test site № 1 measurements to indicate false triggering were made and overall PicoR-Bio with PicoR AM1 and PicoR AM2 modules performance was tested .

Measurement conditions during field tests on site 1:

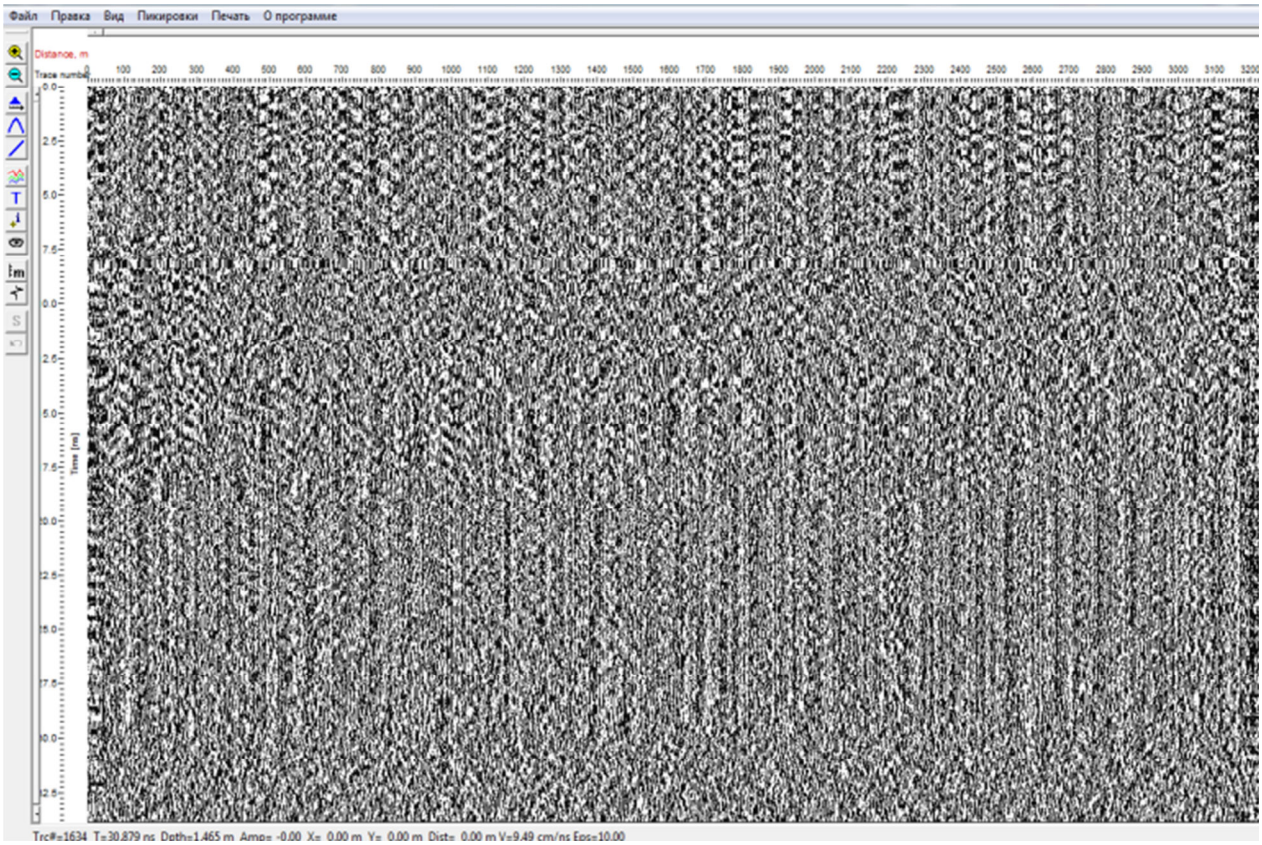
- measurements through two concrete slaps (pic.4) and through concrete slap-air- concrete slap (pic.5) were made;
- human is in sitting position;
- human movements – breathing, slight arm movements, torso turning;
- distance to antenna modules – 1,5-3 m;
- weather conditions: air T +5°C; no rain.

Pic. 4. Test site № 1
(Human detection through 2 concrete slabs)

Рис. 5. Test site № 1
(human detection through concrete slab-air-concrete slab)

First signal measurement was made through two concrete slabs to indicate false triggering using PicoR AM1, where a human was not found. No human was under this rubble, which means there was no false triggering was made.

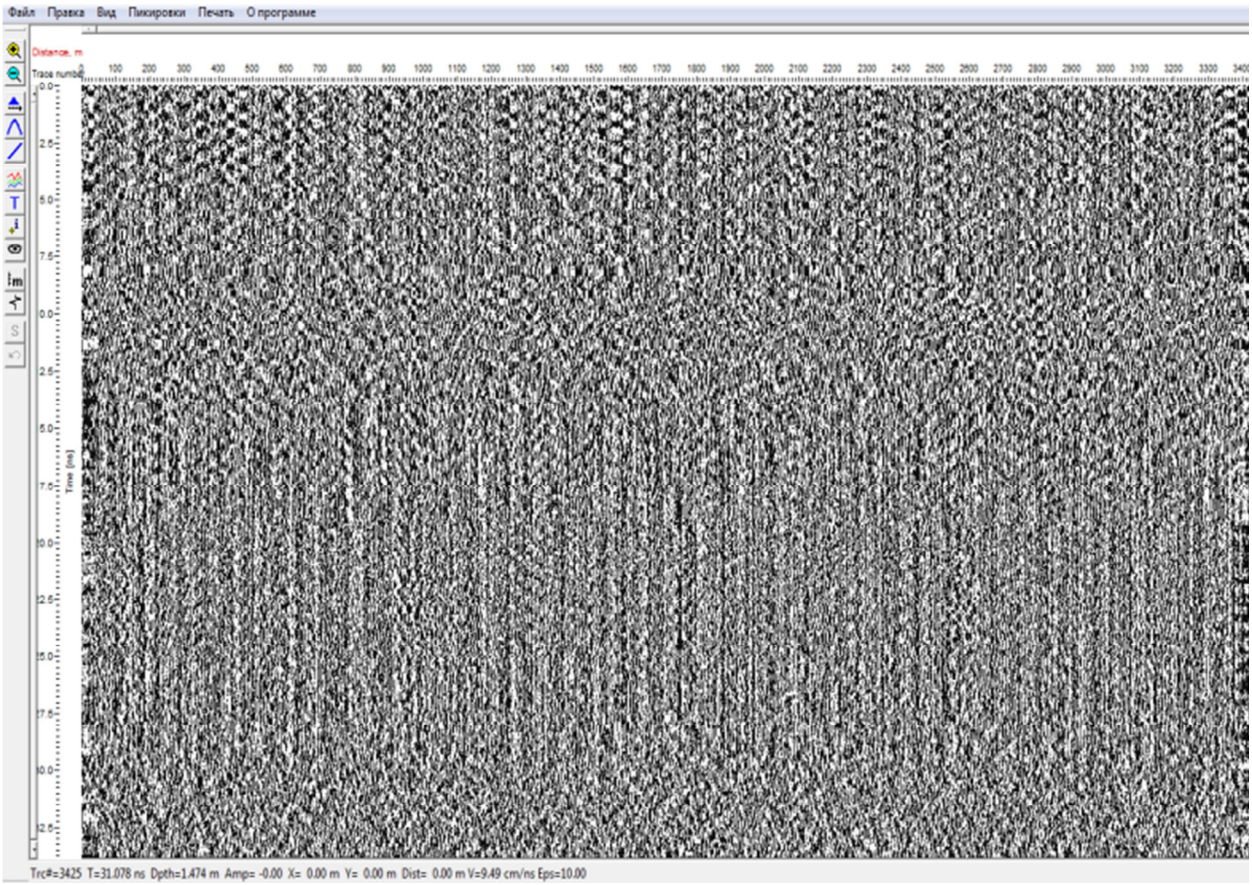
Recorded radargram is shown on pic.6.



Pic. 6. False triggering radargram through two concrete slabs using PicoR AM1 module (first signal measurement, test site № 1)

Second signal measurement was made through two concrete slabs to indicate false triggering using PicoR AM2, where a human was not found. No human was under this rubble, which means there was no false triggering was made.

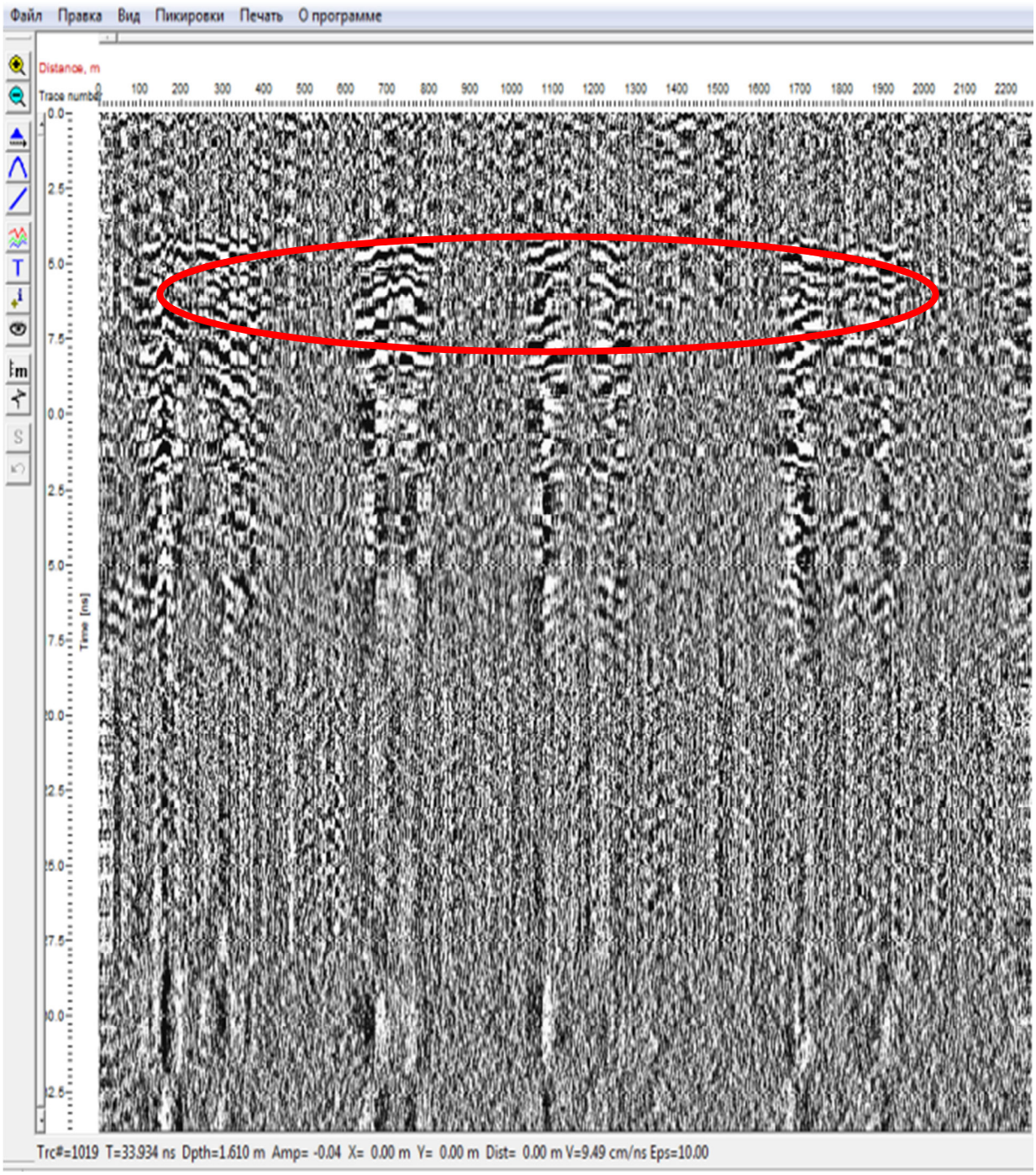
Recorded radargram is shown on pic.7.



Pic. 7. False triggering radargram through two concrete slabs using PicoR AM2 module (second signal measurement, test site № 1)

Third signal measurement was made through two concrete slabs with a human inside rubble via PicoR AM1 module. Human was found (reflected signal is marked red).

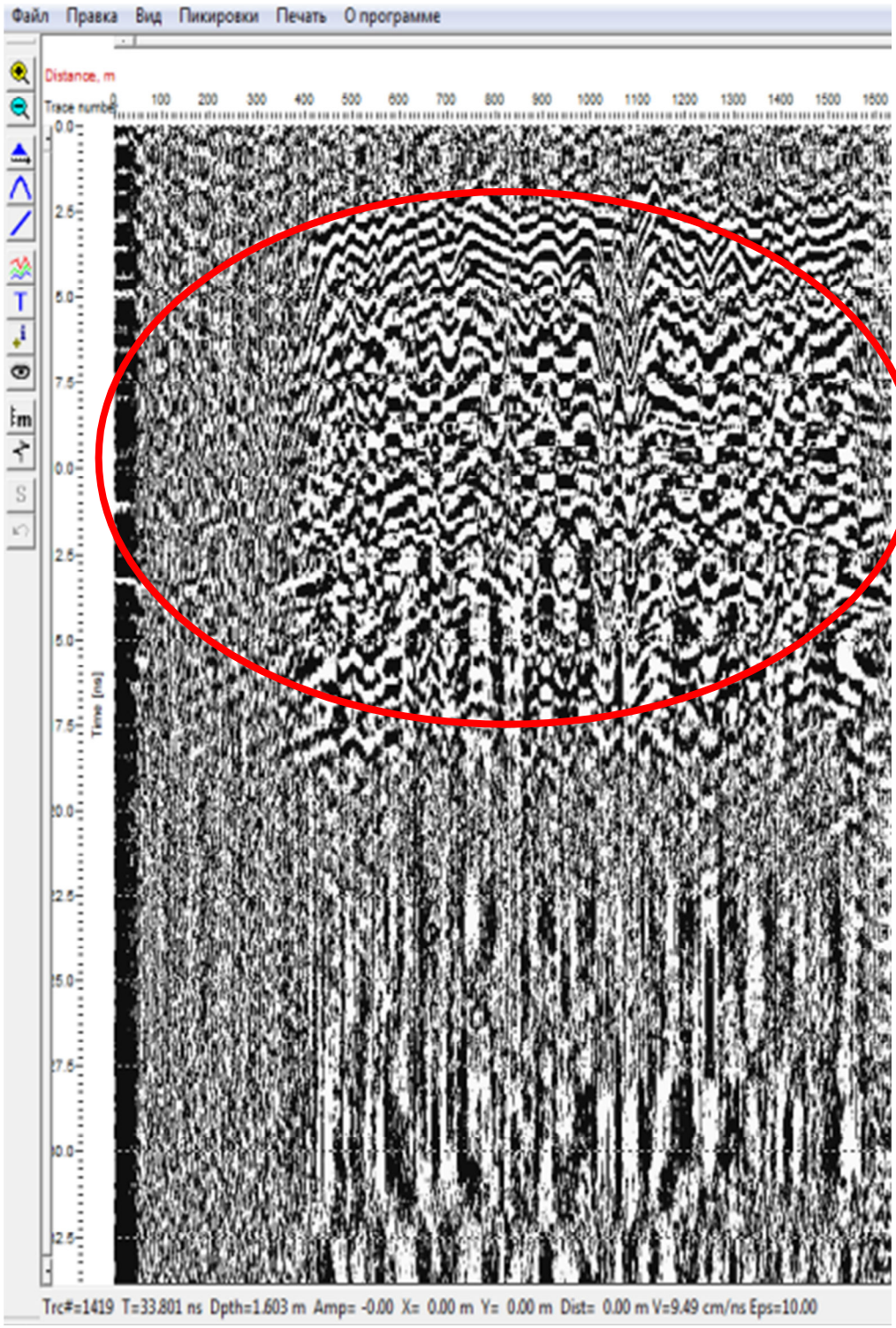
Recorded radargram is shown on pic.8.



Pic. 8. Radargram signal through two concrete slabs with a human inside rubble using PicoR AM1 (third signal measurement, test site № 1)

Fourth signal measurement was made through two concrete slabs with a human inside rubble via Picor AM2 module. Human was found (reflected signal is marked red).

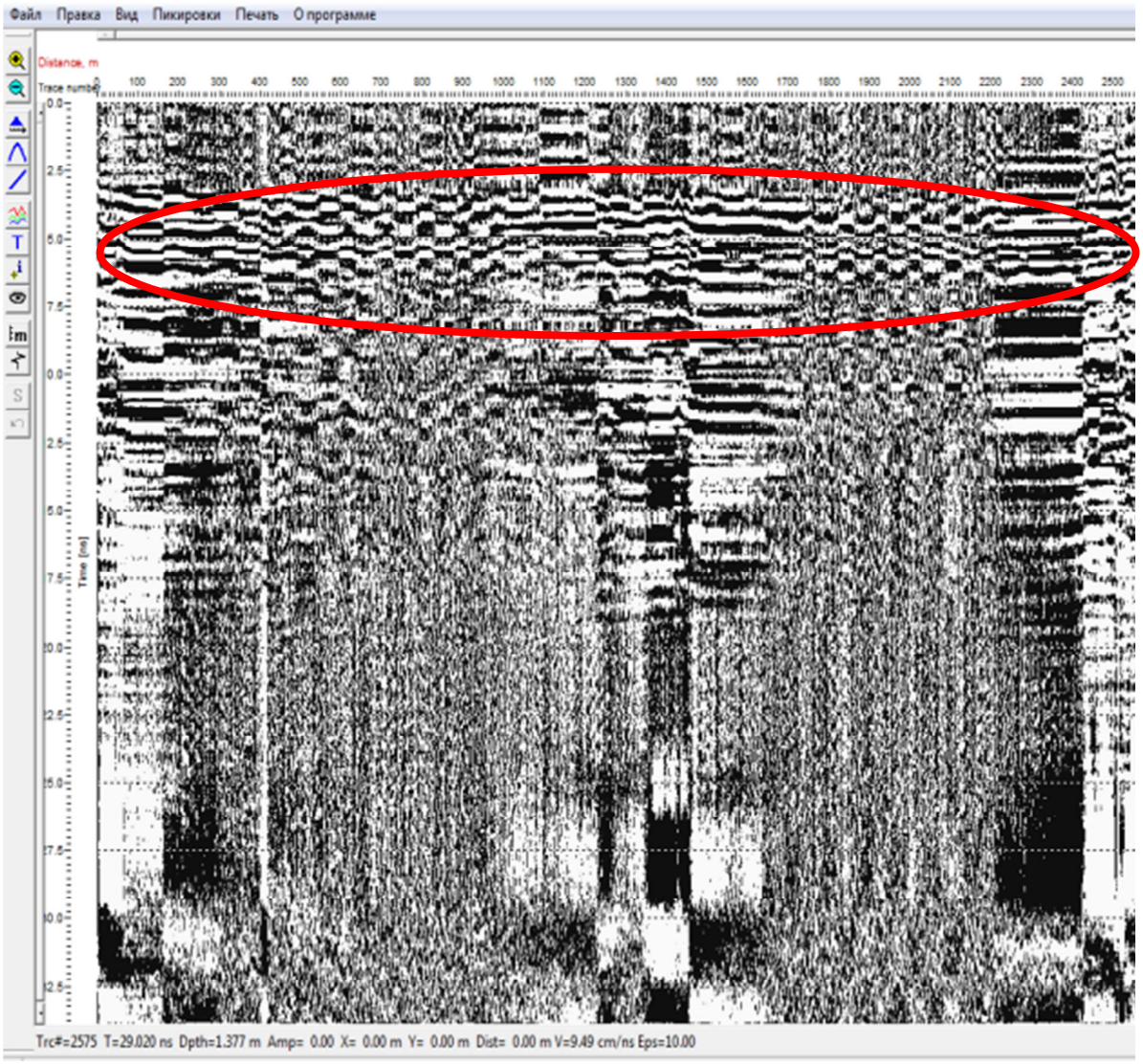
Recorded radargram is shown on pic. 9.



Pic. 9. Radargram signal through two concrete slabs with a human inside rubble using PicoR AM2 (fourth signal measurement, test site № 1)

Fifth signal measurement was made through a concrete slab – air – concrete slab with a human inside rubble via PicoR AM1 module. Human was found (reflected signal is marked red).

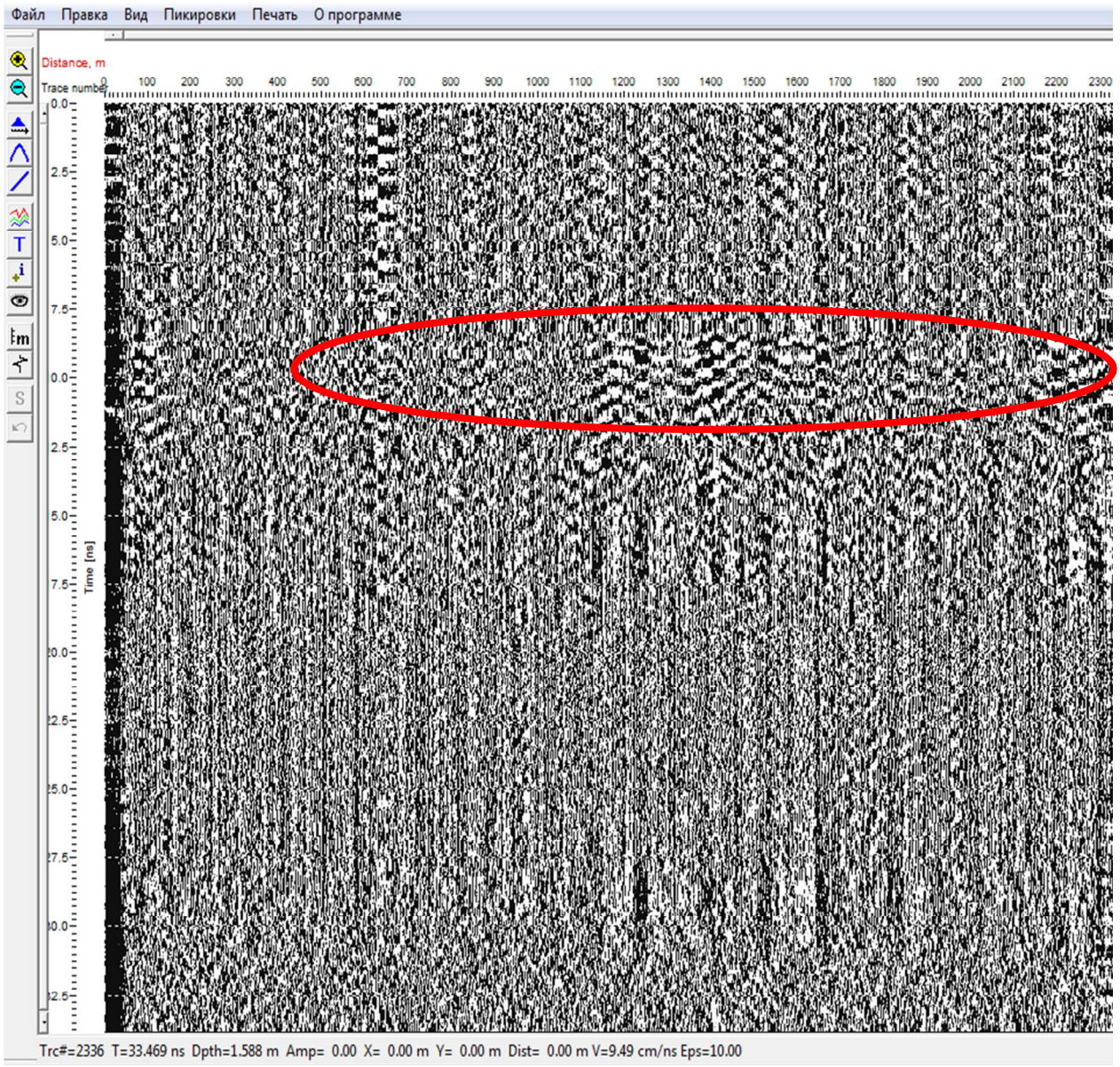
Recorded radargram is shown on pic. 10.



Pic. 10. Radargram signal through concrete slab – air – concrete slab with a human inside rubble using PicoR AM1 (fifth signal measurement, test site № 1)

Sixth signal measurement was made through a concrete slab – air – concrete slab with a human inside rubble via PicoR AM2 module. Human was found (reflected signal is marked red).

Recorded radargram is shown on pic. 11.



Pic. 11. Radargram signal through concrete slab – air – concrete slab with a human inside rubble using PicoR AM2 (sixth signal measurement, test site № 1)

The following conclusions were made based on signal measurement from test site:

- PicoR AM1 and PicoR AM2 contained in PicoR-Bio were tested for false triggering. No false triggering was identified;

- PicoR-Bio signal was measured using:

a) PicoR AM1 module. Human identification through two concrete slabs; concrete slab – air – concrete slab. Human was found in both signal measurement cases.

b) PicoR AM2 module. Human identification through two concrete slabs; concrete slab – air – concrete slab. Human was found in both signal measurement cases.

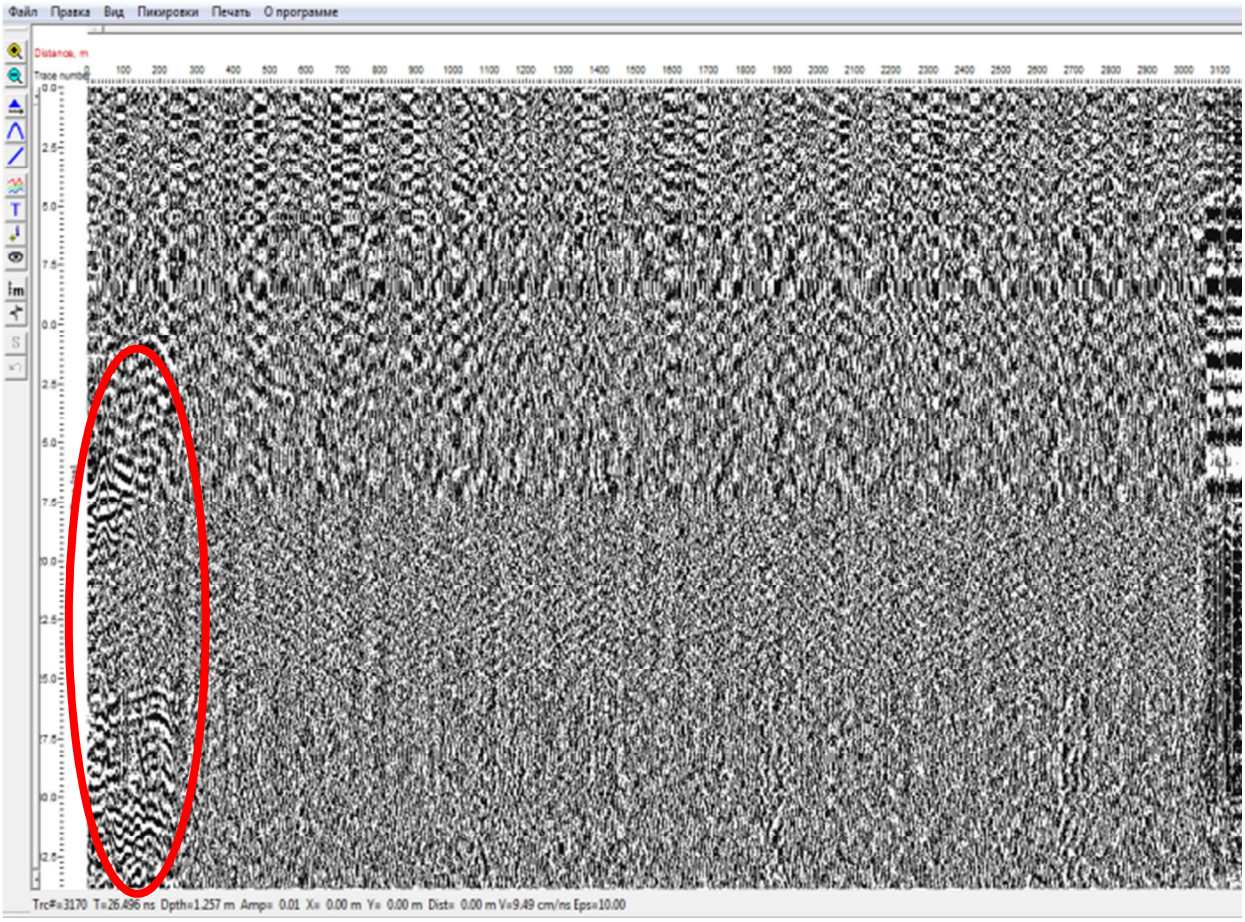
Test site № 2

Signal measurement conditions on test site № 2:
- signal measurement through soil and concrete slab was made (pic. 12);
- human is in sitting position;
- human movements – breathing, arm slight moving, torso turning;
- distance to antenna modules – 1,5-2 m;
- weather conditions: air T= +5°C; drizzle .

Pic. 12. Test site № 2

Seventh signal measurement was made through soil – concrete slab to indicate false triggering using PicoR AM1, where a human was not found. Device operator movement was indicated (marked red). No human was under this rubble, which means there was no false triggering was made.

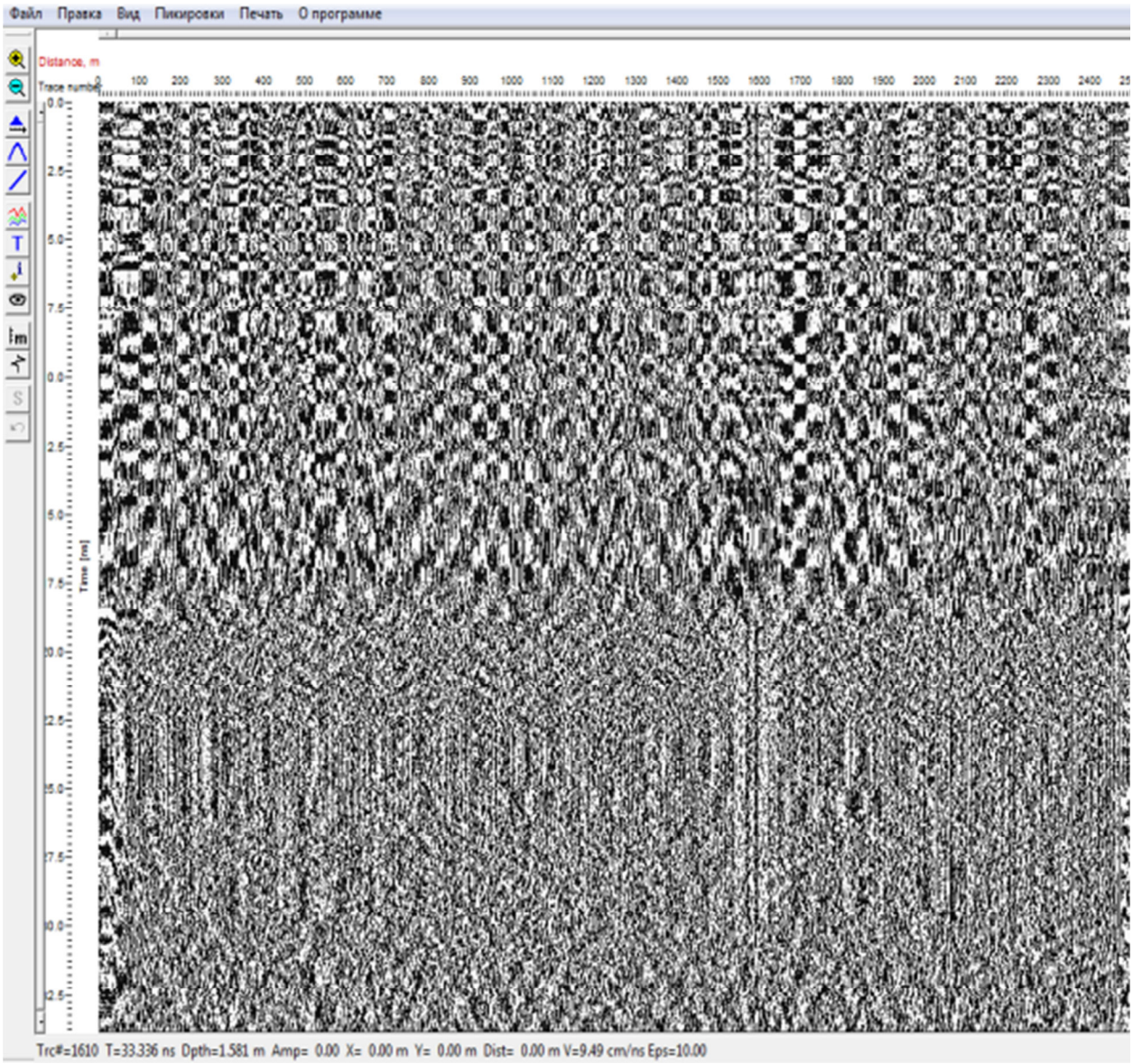
Recorded radargram is shown on pic. 13.



Pic. 13. False triggering radargram using PicoR AM1 module
(seventh signal measurement, test site № 2)

Eighth signal measurement was made through soil – concrete slab to indicate false triggering using PicoR AM2, where a human was not found. No human was under this rubble, which means there was no false triggering was made.

Recorded radargram is shown on pic. 14.



Pic. 14. False triggering radargram using PicoR AM2 module (eighth signal measurement, test site № 2)

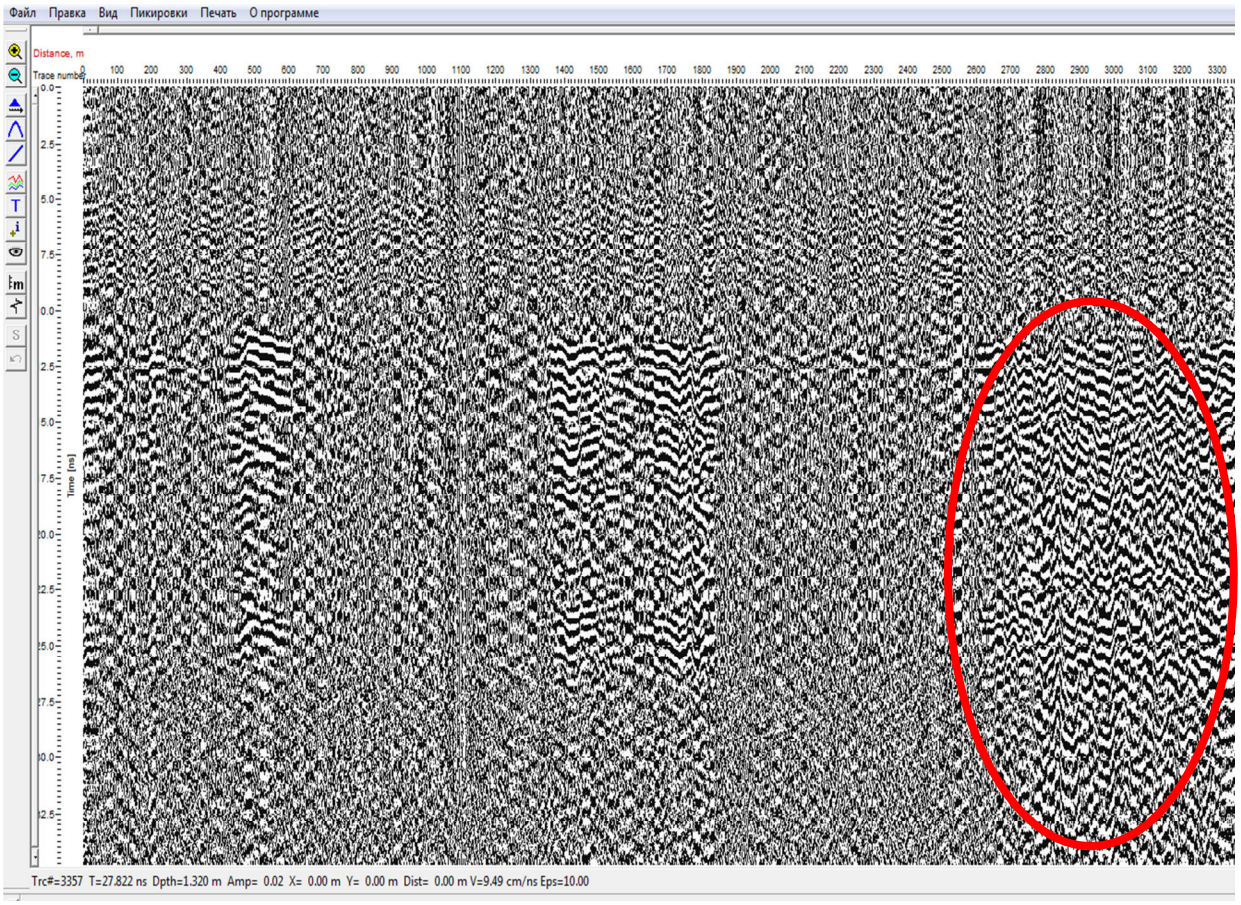
Ninth signal measurement was made through soil – concrete slab to test PicoR AM1 overall performance, on condition when a human is under rubble. Human was found (reflected signal is marked red).

Recorded radargram is shown on pic. 15.

Pic. 15. Radargram signal with a human under rubble using PicoR AM1 (ninth signal measurement, test site № 2)

Tenth signal measurement was made through soil – concrete slab to test PicoR AM2 overall performance, on condition when a human is under rubble. Human was found (reflected signal is marked red).

Recorded radargram is shown on pic. 16.



Pic. 16. Radargram signal with a human under rubble using PicoR AM2 (tenth signal measurement, test site № 2)

The following conclusions were made based on signal measurement from test site:

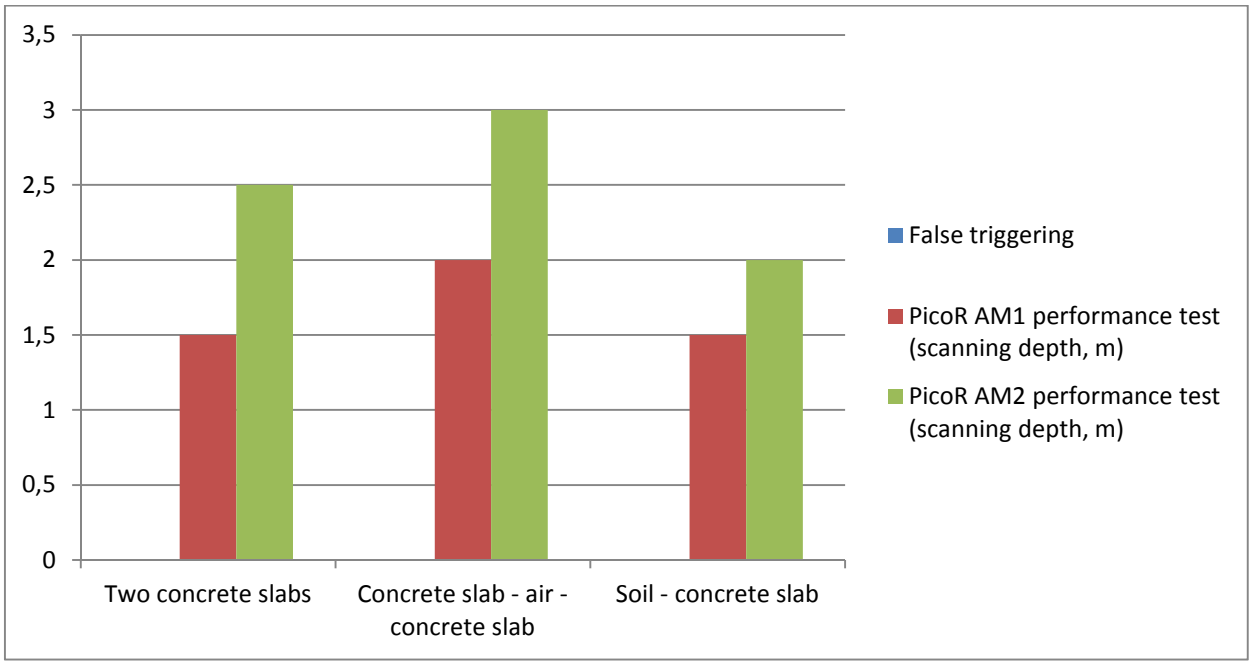
- PicoR AM1 and PicoR AM2 contained in PicoR-Bio were tested for false triggering. No false triggering was identified;

- PicoR-Bio signal was measured using:

a) PicoR AM1 module. Human identification through soil - concrete slab. Human was found.

b) PicoR AM2 module. Human identification through soil - concrete slab, Human was found.

The chart below displays test results on two test sites (pic 17).



Pic. 17. Test results for two test sites

During PicoR-Bio device for people identification under rubbles field tests at Russian Emergency Situation Ministry test range the following conclusions were made:

1. No false triggering were identified at both test sites using printed antenna module PicoR AM1 and horn antenna module PicoR AM2.

2. Human was identified on test site 1 by breathing, slight arm movements, torso turning:

- under two concrete slabs at 1,5m depth using PicoR AM 1;
- under two concrete slabs at 2,5m depth using PicoR AM 2;
- under concrete slab-air-concrete slab at 2m depth using PicoR AM1;
- under concrete slab-air-concrete slab at 3m depth using PicoR AM2;

3. Human was identified on test site 2 by breathing, slight arm movements, torso turning:

- under soil-concrete slab at 1,5m depth using PicoR AM1;
- under soil-concrete slab at 2m depth using PicoR AM2.

Thereby, human identification depth using PicoR AM2 is 1,5-2 times higher, than PicoR AM1.

4. In one of the measurements signal reflection form device operator was identified. To exclude false alarms operator should be at least 2-3 meters away from device and should not move.