Electromagnetic fields around LED light therapy panels: measurement of the Panacea ATP Pro series with a broadband EMF meter

Measurement report: electric field, magnetic field and radiofrequency fields at maximum power, assessed against the European reference levels

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Summary of results

Two Panacea ATP Pro panels were measured at maximum power (red 100%, near-infrared 100%) with a TriField TF2 broadband EMF meter, at close range in front of the LED surface and with an earthed mains connection.

Quantity	Measured	European reference level	Share of reference level
Electric field	44 to 55 V/m	5,000 V/m	approx. 1%
Magnetic field	1.0 to 1.3 mG (0.10 to 0.13 µT)	1,000 mG (100 µT)	less than 0.2%
Radiofrequency (RF)	0.054 to 0.070 mW/m²	2,000 to 10,000 mW/m²	less than 0.02%

- All values are well below the European reference levels for the general public (Recommendation 1999/519/EC, ICNIRP).
- The electric field is comparable to that of common household appliances at 30 cm; the magnetic field is at the background level of a home.
- Earthing is decisive: without guaranteed earthing the electric field was approximately twice as high (89 to 106 V/m).
- A basic consumer meter (30 Hz to 1 kHz) read 0 V/m at the same position; such "0 V/m" readings do not prove the absence of an electric field.

1. Introduction

LED panels for red and near-infrared light therapy are powered from the mains and contain a switched-mode power supply that converts the mains voltage into low-voltage direct current for the LEDs. Low-frequency alternating electric and magnetic fields exist around every mains-powered appliance; switched-mode power supplies can additionally generate components in the kilohertz range. Users of light therapy panels are positioned close to the device during a session, which raises questions about exposure to these fields.

This report describes a measurement of the electric, magnetic and radiofrequency fields directly in front of two panels from the Panacea ATP Pro series at maximum power. The results are assessed against the

European reference levels for the general public [1, 2, 3] and compared with published values for household appliances [4, 5, 6]. In addition, the influence of the earthing of the mains connection was examined and a comparison was made with a basic consumer meter, since "0 EMF" readings are regularly communicated in the market.

2. Materials and methods

2.1 Device under test

Two Panacea ATP Pro panels (red and near-infrared light, 230 V / 50 Hz, metal housing, earthed IEC mains inlet with power switch, internal power supply delivering low-voltage direct current to the LEDs). The intensity is adjustable per light type in 25%, 50%, 75% and 100%. Both panels were measured in the setting red 100%, near-infrared 100%, ALL 100%, the highest operating mode and therefore the mode in which power consumption and the generated fields are at their maximum.

2.2 Measuring instrument

Table 1. Specifications of the TriField EMF Meter model TF2 (AlphaLab Inc.) [7]

Quantity	Range	Frequency range	Accuracy	Sensor
AC magnetic field (B)	0.1 to 100 mG	40 Hz to 100 kHz	±4% at 50/60 Hz	3-axis
AC electric field (E)	1 to 1000 V/m	40 Hz to 100 kHz	±5% at 50/60 Hz	1-axis
Radiofrequency (RF)	0.001 to 19.999 mW/m²	20 MHz to 6 GHz	±20% at 1 GHz	1-axis

The instrument was used in Standard mode (flat frequency response). The display shows the current value and the peak value (PEAK) since power-on. The frequency range up to 100 kHz also covers the fields of switched-mode power supplies and LED drivers, which are not registered by basic consumer meters with a range up to approximately 1 kHz.

2.3 Measurement procedure

Both panels were measured separately, connected to an earthed wall socket. The meter was held at close range in front of the LED surface, at the height of the centre of the panel, with the sensor side facing the panel. For each quantity the meter was held still for several seconds and the displayed value was photographed (Appendix A). For each panel, two electric field measurements, two magnetic field measurements and one radiofrequency measurement were taken. The radiofrequency background level of the measurement room was recorded as a reference.

Two additional comparative measurements were made: (a) an exploratory measurement with the same instrument with the panels as a linked set, connected through a socket without guaranteed earthing, to determine the influence of earthing; (b) a measurement at the same position with a basic 3-in-1 consumer meter (KAIWEETS KEMF-1; electric field 30 Hz to 1 kHz, magnetic field 30 Hz to 1 kHz, RF 50 MHz to 3.5 GHz) [8].

2.4 Assessment framework

The reference levels for the general public in Council Recommendation 1999/519/EC of the European Union [1], based on the ICNIRP guidelines [2, 3], were used as the assessment framework (Table 2).

Table 2. Reference levels for the general public [1]

Quantity	Frequency	Reference level
Electric field strength	50 Hz	5,000 V/m
Magnetic flux density	50 Hz	100 µT (1,000 mG)
Power density (RF)	400 MHz to 300 GHz	2 to 10 W/m² (2,000 to 10,000 mW/m²)

3. Results

Table 3. Measurement results per panel, setting 100% / 100% / ALL 100%, earthed mains connection, close range in front of the LED surface

No.	Panel	Quantity	Value	Peak	Evidence
1	ATP Pro, panel A	Electric field	44 V/m	65 V/m	Photo A2
2	ATP Pro, panel A	Electric field	55 V/m	58 V/m	Photo A4
3	ATP Pro, panel A	Magnetic field	1.3 mG (0.13 µT)	1.3 mG	Photo A3
4	ATP Pro, panel A	Magnetic field	1.0 mG (0.10 µT)	1.0 mG	Photo A5
5	ATP Pro, panel A	Radiofrequency	0.054 mW/m²	0.256 mW/m²	Photo A1
6	ATP Pro, panel B	Electric field	45 V/m	49 V/m	Photo B2
7	ATP Pro, panel B	Electric field	52 V/m	55 V/m	Photo B4
8	ATP Pro, panel B	Magnetic field	1.2 mG (0.12 µT)	1.9 mG	Photo B3
9	ATP Pro, panel B	Magnetic field	1.3 mG (0.13 µT)	1.3 mG	Photo B5
10	ATP Pro, panel B	Radiofrequency	0.070 mW/m²	0.329 mW/m²	Photo B1

Table 4. Summary and assessment against the reference levels (both panels)

Quantity	Measured range	Reference level	Share of reference level
Electric field	44 to 55 V/m (peak 65 V/m)	5,000 V/m	0.9% to 1.1% (peak 1.3%)
Magnetic field	1.0 to 1.3 mG (peak 1.9 mG)	1,000 mG	0.10% to 0.13% (peak 0.19%)
Radiofrequency	0.054 to 0.070 mW/m² (peak 0.329 mW/m²)	2,000 mW/m² (lowest value)	less than 0.02%

3.1 Influence of earthing

In the exploratory measurement with the panels as a linked set, connected through a socket without guaranteed earthing, the electric field was 89 to 106 V/m (peak 115 V/m), the magnetic field 0.9 to 1.2 mG and the radiofrequency field 0.090 mW/m². After connection to an earthed wall socket the electric field fell to 44 to 55 V/m; the magnetic and radiofrequency fields did not change.

3.2 Comparison with a consumer meter

The consumer meter (KEMF-1) indicated an electric field of 0 V/m at the same position, against 44 to 106 V/m on the TF2. The magnetic readings of both instruments agreed (0.6 to 1.3 mG). The RF readings of both instruments were of the same order of magnitude and fluctuated independently of the position relative to the panel.

4. Discussion

4.1 Assessment

All measured values are well below the European reference levels for the general public: the electric field at approximately 1%, the magnetic field at well below 0.2% and the radiofrequency field at less than 0.02% of the reference level. This applies to the most unfavourable conditions: maximum power and a measurement position at close range in front of the panel. At the usual session distance the values are lower, since electric and magnetic fields from a local source decrease strongly with distance [5].

4.2 Electric field in perspective

Table 5 lists the electric field strengths of household appliances at 30 cm as published by the WHO, based on data from the German Federal Office for Radiation Protection [4]. The electric field directly in front of the panel (44 to 55 V/m) is comparable to that of a vacuum cleaner or television at 30 cm and lower than that of a refrigerator, iron or hair dryer at 30 cm. The measurement distance at the panel is shorter than the 30 cm in the comparison table, so the comparison is conservative. Power-frequency electric fields barely penetrate the body: the body behaves as a conductor and the internal electric field is many orders of magnitude smaller than the external field [2]. This is why the reference level for the electric field is relatively high.

Table 5. Electric field strength of household appliances at 30 cm [4], compared with the measured value of the panels

Source	Electric field	Distance
Stereo receiver	180 V/m	30 cm
Iron	120 V/m	30 cm
Refrigerator	120 V/m	30 cm
Mixer	100 V/m	30 cm
Toaster	80 V/m	30 cm
Hair dryer	80 V/m	30 cm
Colour TV	60 V/m	30 cm
Coffee machine	60 V/m	30 cm
Panacea ATP Pro, 100%, earthed (this report)	**44 to 55 V/m**	close range in front of the panel
Vacuum cleaner	50 V/m	30 cm
Electric oven	8 V/m	30 cm
Light bulb	5 V/m	30 cm
Reference level, general public [1]	5,000 V/m	

4.3 Magnetic field in perspective

Alternating magnetic fields are not shielded by the body and are therefore the most relevant quantity in exposure assessment. The measured 1.0 to 1.3 mG (0.10 to 0.13 µT) directly in front of the panel is at the level of the background field in homes (0.01 to 0.2 µT) [5] and well below the values of, for example, a hair dryer (0.01 to 7 µT), microwave oven (4 to 8 µT) or vacuum cleaner (2 to 20 µT) at 30 cm [6].

4.4 Radiofrequency field

The RF values (0.054 to 0.070 mW/m², peaks up to 0.33 mW/m²) correspond to the background level of Wi-Fi and mobile telephony in the measurement room and show no relation to the position relative to the panel. A source that itself emits RF produces a stable, clearly elevated value close to the source that decreases with distance. The RF values are therefore attributed to the environment and not to the panels.

4.5 Influence of earthing

The alternating electric field around an appliance with a metal housing is largely determined by the potential of the housing. With a good connection to earth the housing is at earth potential and shields the interior; without earthing the housing capacitively takes on part of the mains voltage and itself acts as a source. The halving of the electric field after connection to an earthed socket (section 3.1) is consistent with this. For users it follows that the panel should be connected to an earthed socket, without unearthed extension cords or power strips.

4.6 Readings of "0 V/m"

Every appliance connected to 230 V contains a mains cable, a switch and a power supply in which the mains voltage is present. Around these there is always an alternating electric field that is measurable close to the appliance with a sensitive broadband instrument. A reported value of exactly 0 V/m close to such an appliance generally indicates a measurement at a greater distance, a measurement of the magnetic field only, or an instrument that does not register the frequency range of the power supply. The comparison in section 3.2 illustrates the latter: the consumer meter read 0 V/m where the broadband instrument registered 44 to 106 V/m. Readings of "0 EMF" are therefore not interpretable without a statement of the instrument, frequency range and measurement distance.

5. Conclusion

At maximum power (red 100%, near-infrared 100%, ALL 100%) and with an earthed mains connection, the following values were established at close range in front of the Panacea ATP Pro panels: electric field 44 to 55 V/m, magnetic field 1.0 to 1.3 mG (0.10 to 0.13 µT), radiofrequency field 0.054 to 0.070 mW/m².

All values are well below the European reference levels for the general public: the electric field at approximately 1%, the magnetic field at well below 0.2% and the radiofrequency field at less than 0.02% of the reference level. The electric field is comparable to that of common household appliances at 30 cm; the magnetic field is at the background level of a home. The radiofrequency field originates from the environment and not from the panels. Earthing of the mains connection halves the electric field and is therefore the most important factor within the user's own control.

6. Recommendations for use

- Connect the panel to an earthed wall socket; do not use unearthed extension cords or power strips.
- Keep the usual session distance; the fields decrease rapidly with distance.
- Do not route the mains cable over or along the seating position.

7. Limitations

- This report concerns a measurement with a professional handheld instrument (TriField TF2, factory calibration), not a laboratory test according to a standardised procedure such as EN 62233. The results are representative of the order of magnitude of the fields.
- The values apply to the measurement position at close range in front of the panel. At the usual session distance the values are lower.
- The electric field was measured single-axis and also depends on the surroundings and the quality of the earthing; values may differ per installation.
- The results apply to the measured units in the described operating condition.

8. References

1. Council of the European Union. Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz). Official Journal L 199, 30 July 1999.
2. ICNIRP. Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). Health Physics 2010; 99(6): 818-836.
3. ICNIRP. Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz). Health Physics 2020; 118(5): 483-524.
4. World Health Organization. What are electromagnetic fields? Typical electric field strengths measured near household appliances (at a distance of 30 cm). Data: Federal Office for Radiation Protection, Germany, 1999.
5. EMFs.info (National Grid, UK). Electric and magnetic fields from household wiring and appliances.
6. Federal Office for Radiation Protection (BfS), Germany. Household appliances and electrical installations: magnetic flux density of household appliances at 3 cm, 30 cm and 1 m.
7. AlphaLab Inc. TriField EMF Meter Model TF2: specifications and owner's manual.
8. KAIWEETS. KEMF-1 EMF Meter: product specifications.

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Appendix A. Photographic record of the measurements

Unedited photographs of the display during the measurement. The red light in the photographs is the light of the panel itself. The peak value (PEAK) since power-on is shown at the top of the display.



Photo A1. Panel A, RF: 0.054 mW/m² (peak 0.256).

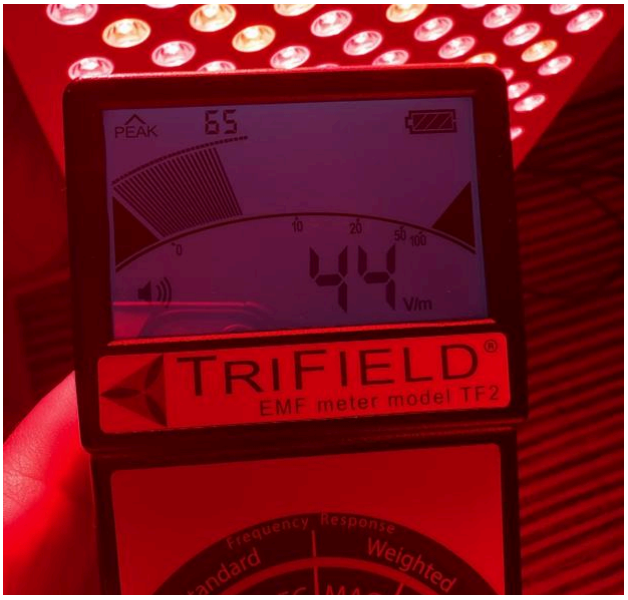


Photo A2. Panel A, electric field: 44 V/m (peak 65).

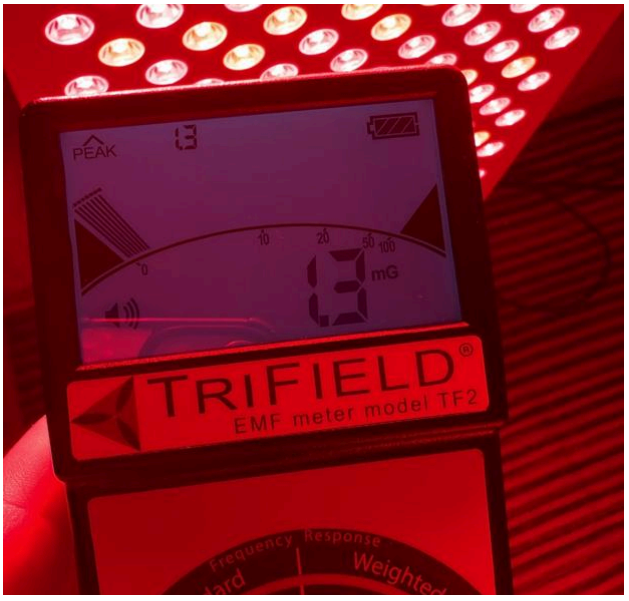


Photo A3. Panel A, magnetic field: 1.3 mG (peak 1.3).

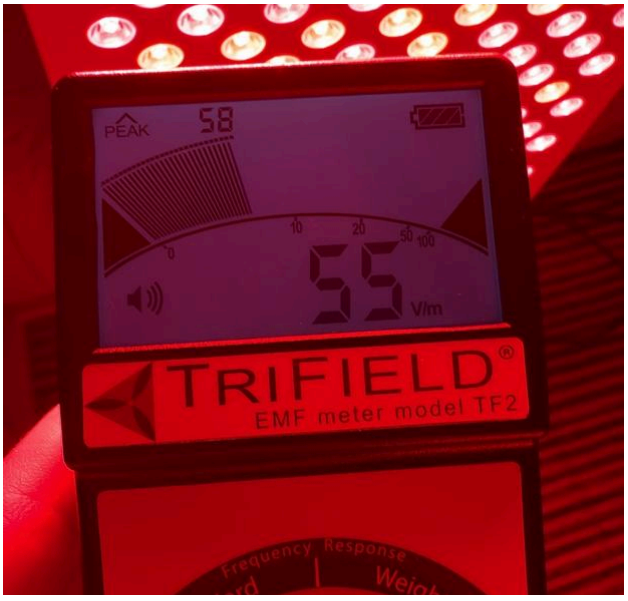


Photo A4. Panel A, electric field: 55 V/m (peak 58).

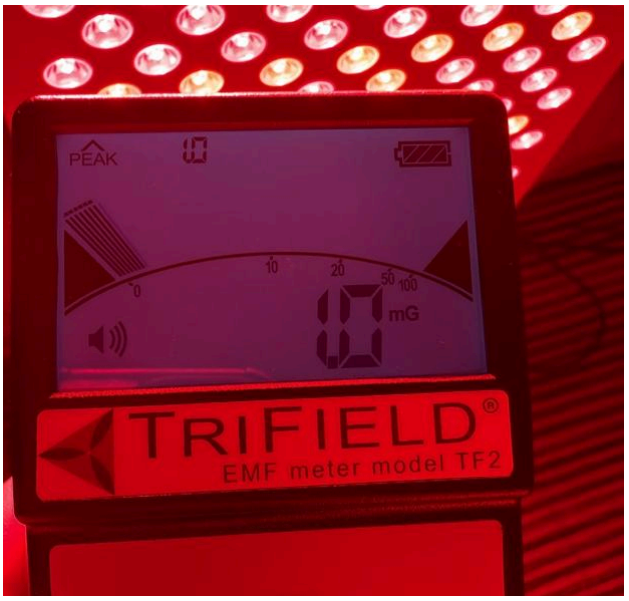


Photo A5. Panel A, magnetic field: 1.0 mG (peak 1.0).



Photo B1. Panel B, RF: 0.070 mW/m² (peak 0.329).

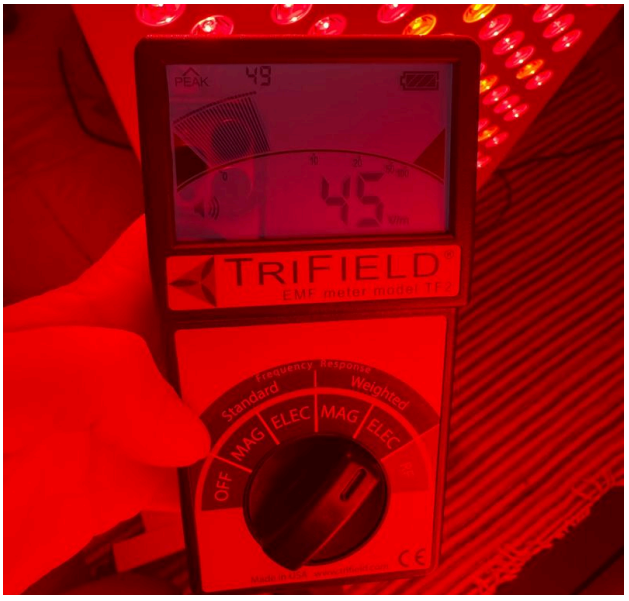


Photo B2. Panel B, electric field: 45 V/m (peak 49).



Photo B3. Panel B, magnetic field: 1.2 mG (peak 1.9).

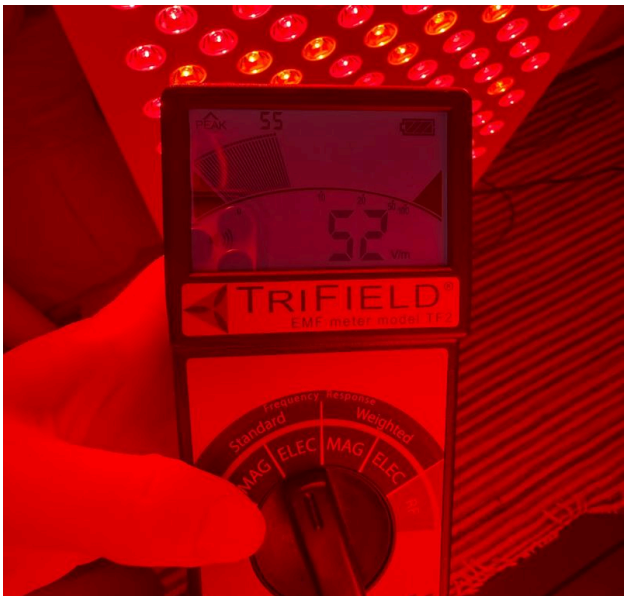


Photo B4. Panel B, electric field: 52 V/m (peak 55).



Photo B5. Panel B, magnetic field: 1.3 mG (peak 1.3).