

Sources of electric and magnetic fields include:

- house wiring
- electrical appliances (toasters, ovens, hair dryers, washing machines etc)
- national electricity transmission and local distribution.

What determines the strength of electric and magnetic fields?

Electric fields

Electric field strength:

- is directly related to voltage.
- reduces rapidly with distance from the source of the field.
- can be screened effectively by objects (walls, trees, ground). This means that within homes, electric fields from transmission lines are effectively blocked.
- is measured in units of volts per metre (V/m) and is normally given as kilovolts per metre (kV/m) where 1 kV/m=1000 V/m.

Magnetic fields

Magnetic field strength:

- is directly related to current.
- reduces rapidly with distance from the source of the field.
- unlike electric fields, is not screened by objects.
- is measured in terms of the magnetic flux density – tesla (T). Measurements are more frequently given in microtesla (μT), which is one millionth of a tesla.

What are some typical strengths of electric and magnetic fields?

New Zealand's National Radiation Laboratory, part of the Ministry of Health, has provided the typical field strengths shown below which are gained from their experience in measuring fields from a range of sources. These values are "typical" only in that values outside the range are possible. More detail on typical field levels around Transpower's transmission lines are also provided in this fact sheet for comparison.














Voltage is like water pressure – it drives the electric charge through a conductor such as a wire.



Current is like the flow of water in pipes, it is the actual flow of electrical charge on that conductor at any given time.

Typical range of magnetic fields

Typical range of electric fields

The public exposure guidelines (provided by ICNIRP and detailed in Fact Sheet 4) recommended by the NZ Ministry of Health are 100µT and 5kV/m for magnetic and electric field respectively.

Magnetic field (µT)	ICNIRP public exposure guideline	Electric field (kV/m)
100		5
223.0 1.3	 Electric razor	2.622 0.2
47.0 3.0	 Microwave	0.19 0.029
13.0 2.0	 Hair dryer	0.8 0.3
7.80 0.04	 Below transmission line	3.2 0.005
5.0 1.2	 Vacuum cleaner	0.10 0.07
2.2 0.5	 Electric cooker	
2.0 0.15	 Below street distribution lines	0.06 0.01
0.8 0.05	 Along central city street	
0.5 0.02	 Above electric blanket	0.6 0.058
0.3 0.03	 Clock radio	0.049 0.009
0.28 0.01	 Halogen light	0.044 0.021
0.25 0.05	 50cm from screen	
0.15 0.05	 Background in home/office	0.02 0.003

KEY	
	Upper value of range
	Lower value of range

The measurements associated with microwave ovens refer only to the low frequency electric and magnetic fields measured around microwave ovens, produced by components such as transformers and the turntable motor. They do not give any indication of possible microwave leakage.

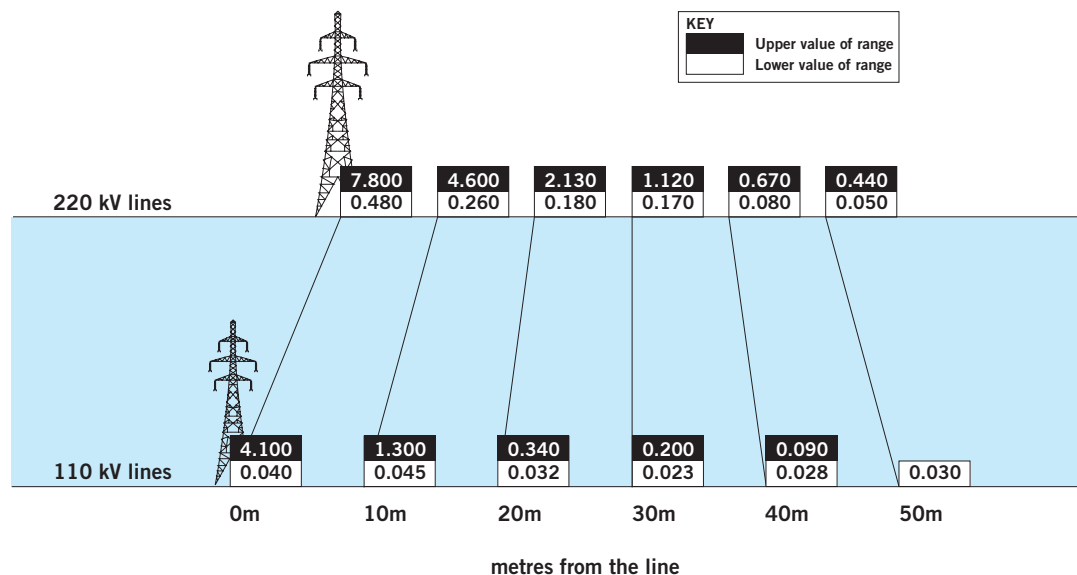
Has Transpower done any testing of electric and magnetic fields around its transmission lines?

Besides undertaking predictive modelling and monitoring around its assets for operational and design purposes, Transpower, from time to time, receives calls from members of the public who wish to know if the field levels from nearby transmission lines are safe.

In many cases, Transpower pays for the measurements of field levels in and around dwellings on behalf of the residents. The measurements are undertaken by the National Radiation Laboratory (as described in Fact Sheet 1) and a report provided that outlines the measurements taken and their relevance.

Results of measurements around more than 75 residences undertaken between January 2006 and March 2009 are summarised in the graphs below and overleaf. The graphs represent measurements around each residence where access beneath the line was available. The access was either on the property or in publicly accessible areas close to the home, such as the roadside.

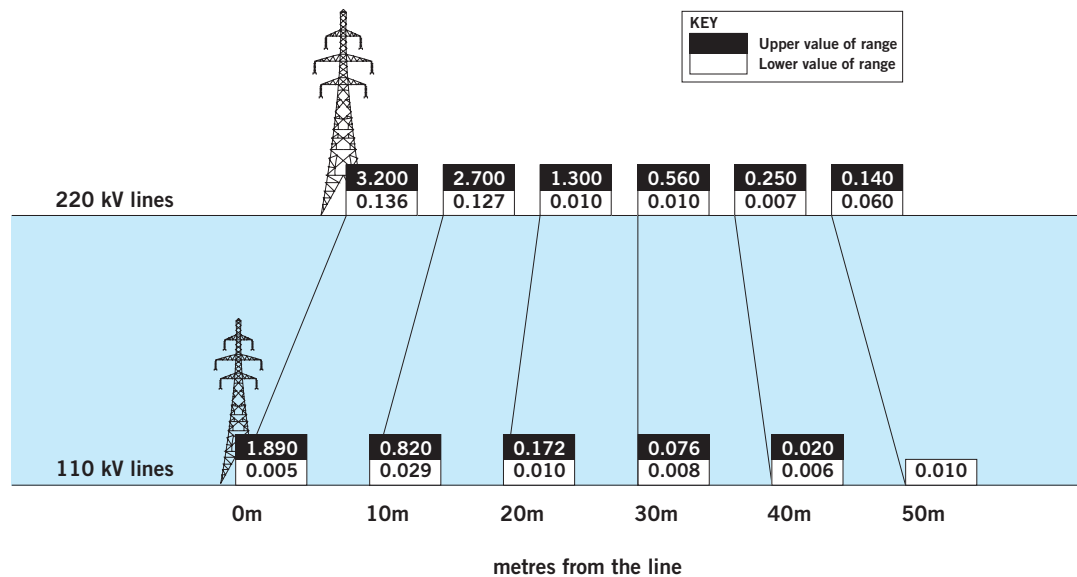
Range of magnetic field levels measured around NZ Transmission lines (μT).



Magnetic field levels reflect the flow of electrical current on a line at the time of measurement. As previously identified, changes in the electrical load (i.e. current) on the transmission line, will be reflected in changes in the magnetic field strengths.

Even beneath Transpower's transmission lines, the strength of measured magnetic fields is well below the Ministry of Health public exposure guideline of $100 \mu\text{T}$ and reduces rapidly with distance.

Range of electric field levels measured
around NZ transmission lines (kV/m)



Electric field strength relates to a lines voltage and is lowest beneath the lines of lower voltage. The measured field strengths are below the Ministry of Health public exposure guideline of 5kV/m, even beneath the line. Field strengths reduce rapidly with distance away from the line.

The maximum magnetic field measured in the period was less than 10% of the ICNIRP public exposure guideline. The maximum electric field measured in the period was less than 65% of the Ministry of Health public exposure guideline.

This is one of five fact sheets produced by Transpower to provide the public with information about electric and magnetic fields. This fact sheet provides information on typical electric and magnetic field levels found in the environment including around transmission facilities. Other fact sheets that are available and provide more detailed information cover:

- **Fact Sheet 1 on electric and magnetic fields and Transpower**
- **Fact Sheet 2 on the nature of electric and magnetic fields**
- **Fact Sheet 4 on guidance on safe levels of electric and magnetic fields**
- **Fact Sheet 5 on electric and magnetic fields and the question of health effects.**

If you have further questions concerning EMF please call Transpower on 0508 526 369 or contact us through our website www.transpower.co.nz.