EMF COMPLIANCE REPORT FOR SMARTCO

RELAY AND ACCESS POINT DESIGNS

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EMF COMPLIANCE REPORT FOR SMARTCO RELAY AND ACCESS POINT DESIGNS

1. SUMMARY

SmartCo plan to install a number of Relays and Access Points in a variety of locations. This report provides a generic guideline to ensure that the current limit for EMF in the vicinity of transmitter antennas is not exceeded. The report ensures that the guidelines cover the worst case conditions and in many cases will have a significant safety factor.

The analysis cannot take into account the effect off any nearby transmitters which may add to the cumulative EMF.

The report recommends that the general public are prevented from having access to any area within 1 metre of the antennas.

2. BACKGROUND

SmartCo plan to install a number of Relays and Access Point stations as part of their implementation of smart power meters. These stations collect data from surrounding meters and transmit them back to a network node. Two different generic transmitter configurations are planned depending on the role of the specific station

This paper provides an evaluation of the ElectroMagnetic Field strength (EMF), measured as a power flux density, due to these radio transmitters. The analysis uses the current New Zealand Standard NZS2772 to derive a zone around the antennas where the general public should not have access.

3. ABBREVIATIONS

Symbol	Unit	Unit of
dBi	Decibels relative to an isotropic antenna	Antenna gain
EMF	Electromagnetic field	Power flux density
m	Metres	Length
MHz	Megahertz	Frequency
W	Watts	Power
$\mu W/cm^2$	Microwatt per centimetre squared	Field strength

4. CONFIGURATIONS

This report considers two different generic designs. A **Relay** receives signals from the smart meters and transmits the information on to either another Relay site or to an Access Point. An **Access Point** receives the signal from the Relay and retransmits this to a cellsite in one of the cellular bands. The key parameters for each design are:

Design type	Frequency MHz	Transmitter output Watts	Antenna type	Antenna Gain dBi
Relay	915-921	1	J-Pole	3
Access Point	915-921	1	J-Pole	3
	Either 900-915	0.25	MobileMark RMM	3
	Or 1920-1935	0.25	MobileMark RMM	3

When the antennae are mounted with their axis vertical the radiation pattern is omni-directional in the horizontal plane. In the vertical plane the antennas each have a null in the vertical direction. However to account for the antennas being mounted in various configurations a worst case was assumed that the antenna gain was 3 dBi in all directions.

The transmitters only operate when they receive a signal. This analysis assumes the worst case when the transmitters operate continuously for at least six minutes as specified in the NZS2772 (see Section 5 below).

5. STANDARDS

The latest New Zealand Standard for Radiofrequency Fields Exposure is NZS 2772.1:(1999) In table 6 of this specification the maximum power flux density limits in areas of public access are specified as:

Frequency	Max Power Flux Density
10 – 400 MHz	200 $\mu W/cm^2$
400 – 2000 MHz	f/2 $\mu W/cm^2$ (f = frequency in MHz)
2000 – 300,000 MHz	1000 $\mu W/cm^2$

Exposure to these fields should not be exceeded over any 6 minute period.

This limit is based on the exposure guidelines published in 1998 by the International Commission on Non-ionising Radiation Protection (ICNIRP).

The facility must also comply with Regulation 4 of the Resource Management (National Environmental Standards for Telecommunications Facilities) Regulations 2008 (see Appendix A). This requires specific measurement of the field strength if the general public could have access to areas where this is calculated to be greater than 25% of the standard.

The safety areas derived in this report are based on 25% of those specified in NZS2772.

6. METHOD OF ANALYSIS

For each operating frequency the maximum field strength permitted by NZS2772 was derived. The radiated power was then calculated in all directions and from this the distance from the antenna where the maximum field strength was 25% of that permitted. From these results the worst case minimum safe distance from each antenna was recorded.

As noted in section 4 each of the antennas have a vertical radiation pattern which means the radiated power varies with elevation. This generic analysis has taken the worst case direction to ensure the standard is not exceeded irrespective of the orientation of the antennas.

The analysis assumed that the electromagnetic fields of interest were not in the “near field” of the antennas because in this area the minimum safe distance would be less than those calculated. The distance of the near field from each antenna is noted in the results.

7. CALCULATED MINIMUM SAFE DISTANCE

The following table shows the minimum safe distance to ensure the EMF does not exceed 25% of the limit specified in NZS2772

Design type	Frequency MHz	Max EMF permitted $\mu W/cm^2$	Max radiated power Watts	Min Safe Distance from Antenna m	Distance of "near field" m
Relay	915-921	450	2	0.4	0.14
Access Point	915-921	450	2	0.4	0.14
	900-915	450	0.5	0.2	0.14
	1920-1935	1000	0.5	0.15	0.08

8. INTERPRETATION AND COMMENT

The results show that the major factor in determining the minimum safe distance is the 915 – 921 MHz transmitter since its radiated power is significantly higher than the other transmitters.

The minimum safe distance from the 915 – 921 MHz antenna is 0.4 m. This is well outside the "near field" which extends 0.14 m from the antenna so the calculations are valid.

The maximum cumulative total radiated power of the Access Point when 2 transmitters are operating at the same time is 2.5 W which results in a minimum safe distance of about 0.42 m.

The calculations assume the worst case when the transmitters are operating continuously for at least 6 minutes and the field is in the direction of maximum antenna gain.

The types of calculations used to derive these safe distances do not precisely model the nature of radio propagation. They do not account for reflections and refraction which occur to varying degrees in any radio system. To account for this a margin of safety factor of approximately 100% is added to the calculated result with final recommendation for a safe distance of 1 m.

These calculations do not take into account the cumulative effect of any nearby transmitters. It is recommended that this is considered on a site by site basis if there is a transmitter within 10 m of a Relay or Access Point.

9. RECOMMENDATIONS

To ensure the EMF from a SmartCo Relay or Access Point does not exceed 25% of the NZS 2772 it is recommended that the general public do not have access to areas within 1.0 m of the antennae.

It is recommended that the cumulative effect of any nearby transmitters is considered on a site by site basis if there is a transmitter within 10 m of a Relay or Access Point.

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APPENDIX A

Regulation 4 of the Resource Management (National Environmental Standards for Telecommunications Facilities) Regulations 2008

Telecommunication facilities generating radiofrequency fields: activity status

- (1)This regulation applies to the planning and operation of a telecommunication facility that generates radiofrequency fields.

  (2)A telecommunication facility is a permitted activity as far as radiofrequency fields are concerned if the network operator that plans and operates the facility complies with—
  - (a)the conditions in subclauses (3) and (4); and
  - (b)the condition in subclause (5), if it applies.

  (3)The first condition is that the network operator plans and operates the telecommunication facility in accordance with *NZS 2772: Part 1:1999 Radiofrequency Fields Part 1 – Maximum Exposure Levels – 3 kHz to 300 GHz*.

  (4)The second condition is that the network operator ensures that the relevant local authority receives, before the telecommunication facility becomes operational, the following:
  - (a)written or electronic notice of where the facility is or where it is proposed to be; and
  - (b)a report that—
    - (i)is prepared in accordance with *NZS 6609.2: 1990 Radiofrequency Radiation: Part 2: Principles and Methods of Measurement 300 kHz to 100 GHz*; and
    - (ii)takes account of exposures arising from other telecommunication facilities in the vicinity of the facility; and
    - (iii)predicts whether the radiofrequency field levels at places in the vicinity of the facility that are reasonably accessible to the general public will comply with *NZS 2772: Part 1:1999 Radiofrequency Fields Part 1 – Maximum Exposure Levels – 3 kHz to 300 GHz*.

  (5)The third condition applies if the prediction referred to in subclause (4)(b)(iii) is that the radiofrequency field levels will reach or exceed 25% of the maximum level authorised by *NZS 2772: Part 1:1999 Radiofrequency Fields Part 1 – Maximum Exposure Levels – 3 kHz to 300 GHz* for exposure of the general public. The network operator must ensure that the relevant local authority receives, within 3 months of the telecommunication facility becoming operational, a report that—
  - (a)is prepared in accordance with *NZS 6609.2: 1990 Radiofrequency Radiation: Part 2: Principles and Methods of Measurement 300 kHz to 100 GHz*; and
  - (b)provides evidence that the actual radiofrequency field levels at places in the vicinity of the facility that are reasonably accessible to the general public comply with *NZS 2772: Part 1:1999 Radiofrequency Fields Part 1 – Maximum Exposure Levels – 3 kHz to 300 GHz*.

  (6)A telecommunication facility that is not a permitted activity under this regulation is a non-complying activity as far as radiofrequency fields are concerned.