Compliance monitoring of Spark cellsites: annual summary 2020-21

EMF Services
Professional EMF measurement and advisory services

Report 2021/86

This report was prepared for:
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About EMF Services and the author of this report

EMF Services is a division of Monitoring and Advisory Services NZ Ltd (MAASNZ), and provides professional measurement and advisory services related to possible health effects of electromagnetic fields (EMFs), such as the extremely low frequency (ELF) electric and magnetic fields found around any wiring, appliances or infrastructure carrying mains electricity, and the radiofrequency (RF) fields produced by radio transmitters and some industrial equipment.

Martin Gledhill has an MA degree in Natural Sciences (Physics) and an MSc in Medical Physics. He is a member of the Australasian Radiation Protection Society and of the Bioelectromagnetics Society. Before forming MAASNZ he was head of the non-ionising radiation section at the National Radiation Laboratory of the New Zealand Ministry of Health. In this position he provided advice to central and local government, the public and industry on the health effects of EMFs, and carried out measurement and assessment services in this area. This work included providing policy advice to the Ministries of Health and the Environment, preparation of public information material, presenting expert evidence at local authority and Environment Court hearings, and assessing exposures to EMFs by both measurements and calculations.

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1 Introduction

Spark New Zealand Ltd has commissioned EMF Services to carry out compliance monitoring of exposures to radiofrequency (RF) fields around their cellsites. This report presents the results of measurements at 48 sites carried out between July 2020 and the end of May 2021. The purpose of the tests is to measure exposures to radiofrequency (RF) fields near Spark cellsites to determine the maximum exposure at the time the measurements were made, and the maximum possible exposure should all the equipment at the Spark site (and any other transmitters nearby) operate at full power. Exposures are compared against the appropriate limits in New Zealand Standard 2772.1:1999 *Radiofrequency Fields Part 1: - Maximum exposure levels 3 kHz - 300 GHz,* as required by the Resource Management (National Environmental Standards for Telecommunications Facilities) Regulations 2016 ("the NES").

Sites selected for testing fall into one of four categories:

- They have been of particular interest to the public, or because of their location, might be so in the future;
- Calculations of exposure have significant uncertainty;
- It is difficult to determine the areas near a site with reasonable public access;
- Theoretical assessment of compliance is difficult due to the proximity of other transmitters (eg co-siting with another operator).

Some sites are pre-selected by Spark, while others which fall into one or more of the above categories are selected by EMF Services. Spark are not informed when the testing will take place.

2 Overview of measurement methodology

A full description of the measurement equipment, methodology, post-processing of the data and uncertainty analysis for the monitoring is presented in EMF Services Report 2020/98 *Compliance testing of Spark cellsites: methodology. Revision 6*. The measurement equipment used for these surveys was calibrated in December 2018 and October 2020.

In summary, a preliminary survey of the area around a site is made using a broadband measurement probe. This meter measures the overall exposure from all transmitters that might contribute to the total but is not able to distinguish the individual contributions from each transmitter. Because the exposure limit in NZS 2772.1:1999 depends on the transmitter frequency, and cellsites transmit at several frequencies, it is not possible to use the readings from the broadband measurements to determine precisely the exposure as a percentage of the public limit in the Standard. Nor is it possible to use the measurements to determine what the exposure would be if all transmitters at a nearby cellsite were operating at full power. On the other hand, the broadband measurements provide a ready means to find how exposures vary around a site, and find the locations where exposures tend to be highest.

Once the locations where exposures are highest have been determined using the broadband meter, a narrowband meter is used to take further measurements. The narrowband meter is able to determine the contribution to exposure in different frequency bands, and measure components of cellphone base station transmitters from which the maximum possible exposure from that transmitter can be determined. Narrowband measurements are used to:

- Determine the contributions from different transmitters to the overall total;
- Evaluate the exposure at the time of measurement as a percentage of the public limit in NZS 2772.1:1999;
- Determine what the maximum possible exposure would be if all the Spark equipment, and any other transmitters nearby, were operating at full power.

The measurement method used tends to result in the exposure at the time of measurement, and the maximum possible exposure, being overestimated. It is also worth noting that, in practice, there is very little likelihood of all transmitters at a cellsite operating simultaneously at full power.

3 Summary of results

3.1 Results for 2020-21

Figure 1 presents a histogram of the maximum exposure from all sources (ie from the Spark site of interest and any other transmitters nearby) measured during the survey with the narrowband meter, at the 48 sites surveyed in the 2020-21 period. 11 of the sites were either shared with, or close to, sites belonging to one or two other mobile phone network operators. Exposures are expressed as a percentage of the public limit in NZS 2772.1:1999, and the graph shows the percentage of sites falling into each exposure category.

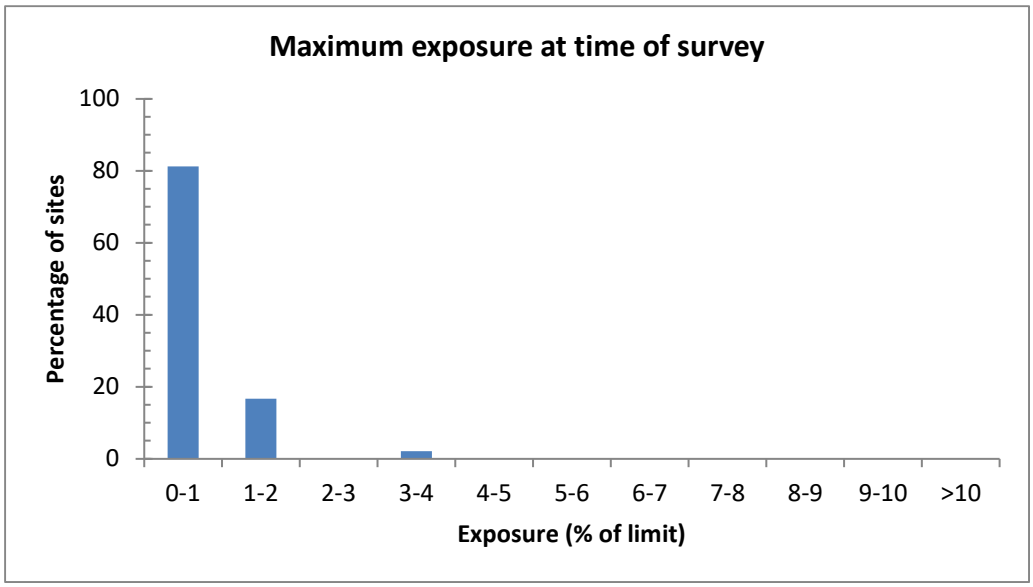

Fig 1. Histogram of maximum exposures found at the time of measurement at the 48 sites surveyed in 2020-21.

This graph shows that, for example, at 81% of the sites tested (39 out of 48), exposures at the time the measurements were made were less than 1% of the public limit. The highest exposure measured at the time of the survey was equivalent to 3.9% of the public limit.

Figure 2 shows the theoretical maximum possible cumulative exposure[1] at the 48 sites, if all the Spark transmitters, and transmitters belonging to other cellular network operators nearby, were to transmit simultaneously at full power.

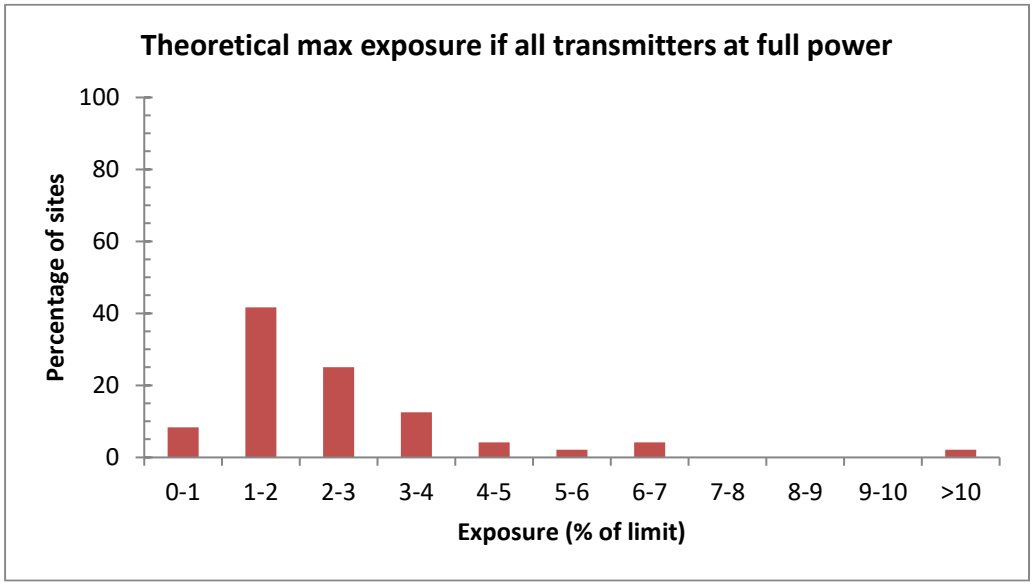

Fig 2. Histogram of theoretical maximum possible exposures at the 48 sites surveyed in 2020-21, if they and all other sites nearby were to transmit at full power.

This graph shows that at 8.3% of the sites tested, the theoretical maximum possible cumulative exposure would be less than 1% of the public limit, and at a further 42% of sites the theoretical maximum possible exposure would be between 1% and 2% of the limit. The highest theoretical maximum possible exposure was 11% of the public limit.

3.2 Results for 2014-21

Figures 3 and 4 present the same data for all 328 sites measured since 2014.

[1] This is referred to as a "theoretical maximum" because in practice there is no chance that this would happen.

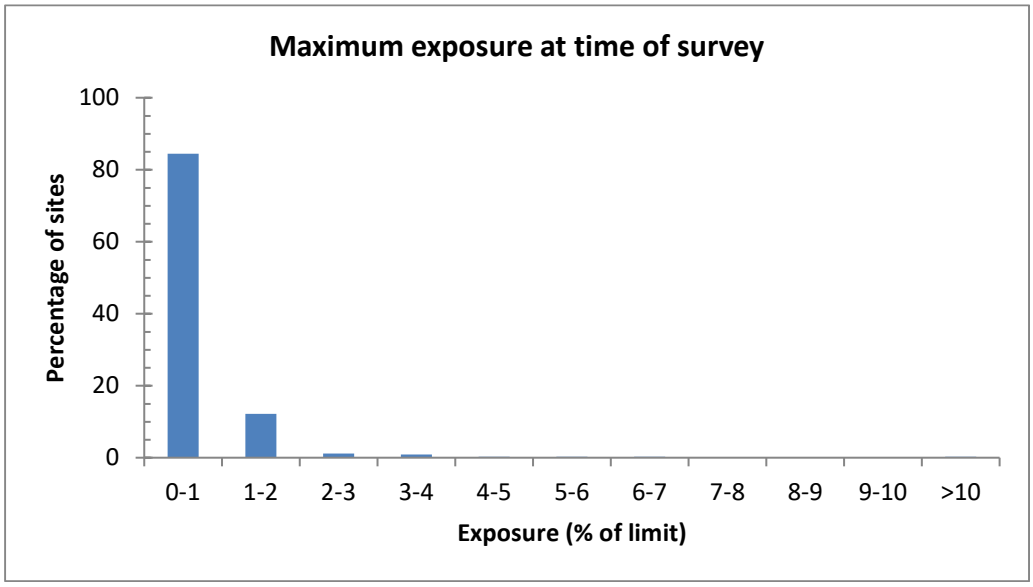

Fig 3. Histogram of maximum exposures found at the time of measurement for all 328 sites surveyed since 2014.

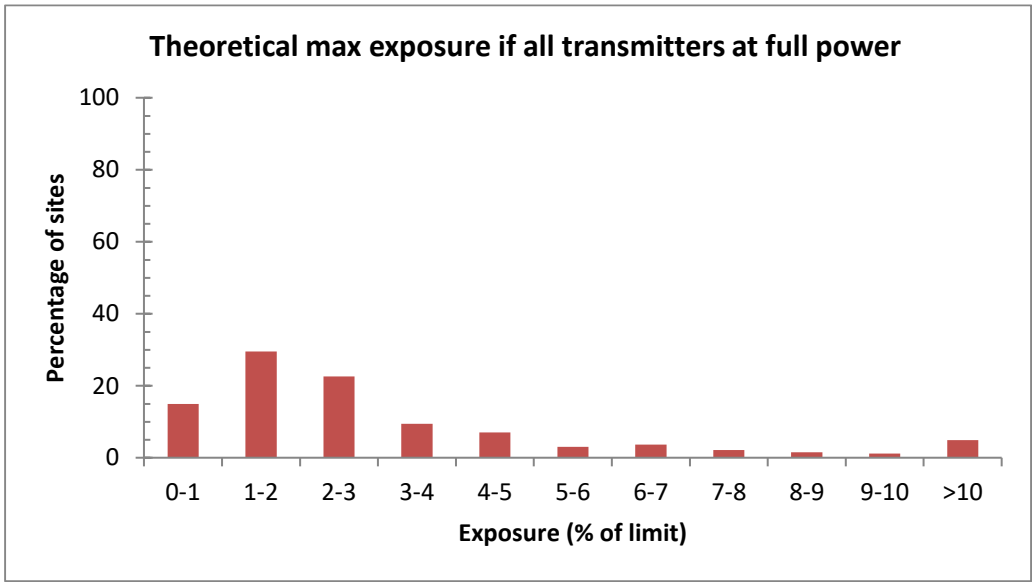

Fig 4. Histogram of theoretical maximum possible exposures for all 328 sites surveyed since 2014, if they and all other sites nearby were to transmit at full power.

4 Results table

A summary of results for the individual sites surveyed in 2020-21 is presented in the table below. A number in brackets after the site name indicates the total number of times this site has been checked.

Town/city, name of site	Date measured	Type of site*	Max exposure at time of survey (% of public limit)	Max possible exposure (% of public limit)	Comments
Auckland, Avondale West	17/09/20	Monopole, residential	0.67	1.50	
Auckland, Bleakhouse Road	11/02/21	Lamppost, residential	0.99	3.90	
Auckland, Bridge Street	16/09/20	Lamppost, residential	0.70	2.10	2degrees nearby
Auckland, Bucklands Beach Road	11/02/21	Lamppost, residential	0.96	3.30	Vodafone nearby
Auckland, Comins Crescent	14/04/21	Lamppost, residential	0.85	3.60	
Auckland, Devonport	13/04/21	Monopole, residential	0.28	2.80	
Auckland, Dominion Road	17/09/20	Lamppost, residential	0.77	1.90	Vodafone nearby
Auckland, Glengarry Bend	17/09/20	Lamppost, residential	1.90	3.20	
Auckland, Green Lane West	13/04/21	Lamppost, commercial	0.50	2.30	
Auckland, Heron Park South	28/01/21	Lamppost, residential	0.90	4.70	
Auckland, Highbury	22/10/20	Rooftop, commercial	3.90	11.00	2degrees nearby
Auckland, Manuka Road	5/08/20	Lamppost, residential	0.14	1.00	
Auckland, Merton Road	12/04/21	Lamppost, residential	1.00	6.30	Vodafone and 2degrees nearby
Auckland, Mokoia Road	14/07/20	Lamppost, residential	0.25	2.00	
Auckland, Pupuke Road	5/08/20	Lamppost, residential	0.58	2.30	
Auckland, Roberts Road Shops	28/01/21	Lamppost, residential	0.31	0.78	
Auckland, Rua Road	17/09/20	Lamppost, residential	0.52	3.10	
Auckland, San Bernadino Drive	27/01/21	Lamppost, residential	1.40	6.60	
Auckland, St Johns Road	12/04/21	Lamppost, residential	0.45	1.80	
Auckland, Station Road	16/09/20	Lamppost, residential	0.76	2.10	
Auckland, Sunnyhaven Avenue	13/04/21	Monopole, residential	1.60	5.50	
Auckland, Sunset Road	13/04/21	Lamppost, residential	0.34	1.20	
Auckland, Swanson Road	27/01/21	Lamppost, residential	0.81	3.60	Vodafone and 2degrees nearby
Auckland, Upper Hillsborough	17/09/20	Lamppost, residential	1.40	2.80	

Town/city, name of site	Date measured	Type of site*	Max exposure at time of survey (% of public limit)	Max possible exposure (% of public limit)	Comments
Auckland, Wairau Road	22/10/20	Lamppost, residential	0.39	1.30	2degrees nearby
Otago, Alexandra Town North	21/08/20	Monopole, reserve	0.39	1.60	
Pukekohe, Pukekohe West	10/12/20	Lamppost, residential	0.81	2.10	
Tauranga, Gate Pa	10/12/20	Lamppost, residential	1.10	2.80	
Rotorua, Springfield Shops	9/12/20	Monopole, residential	0.74	2.00	
New Plymouth, Waitara North	9/02/21	Lamppost, residential	0.57	1.60	
Taranaki, Hawera West	9/02/21	Lamppost, residential	0.56	1.50	
Wellington, Broadmeadows	23/04/21	Monopole, residential	0.33	1.70	
Nelson, Arapiki	24/05/21	Lamppost, residential	0.15	1.10	
Nelson, Nelson East	26/05/21	Rooftop, commercial	0.32	2.90	2degrees nearby
Blenheim, Blenheim South	25/05/21	Monopole, residential	0.20	0.63	
Blenheim, Renwick	26/05/21	Monopole, commercial	0.27	1.80	2degrees nearby
Blenheim, Springlands	25/05/21	Monopole, commercial	0.74	1.70	
Christchurch, Hargood Ferry	5/05/21	Monopole, residential	0.37	1.30	
Christchurch, Hyde Park	2/12/20	Lamppost, residential	0.33	1.50	
Christchurch, Oaklands	3/05/21	Monopole, residential	1.10	2.20	2degrees nearby
Christchurch, Rolleston West	5/05/21	Lamppost, residential	0.23	1.00	
Christchurch, St Martins	2/12/20	Monopole, residential	0.64	2.00	2degrees nearby
Queenstown, Fernhill	6/11/20	Lamppost, residential	0.69	2.50	
Dunedin, Carlton Hill	19/11/20	Lamppost, residential	1.30	2.90	
Dunedin, Dunedin Oval	19/11/20	Monopole, commercial	1.10	4.80	
Gore, Gore North	16/11/20	Monopole, residential	0.41	1.30	
Gore, Gore South	16/11/20	Monopole, commercial	0.25	1.20	
Gore, Gore Town	16/11/20	Rooftop, commercial	0.56	1.60	

*Type of site shows where the antennas are mounted, and the predominant nature of the surrounding area.