RADHAZ Consulting Pty Ltd.

NATA WORLD RECOGNISED ACCREDITATION

Accreditation Number: 15500

RF EME REPORT

In relation to a
comparison of measured and predicted levels of
environmental RF EME around a Telstra
mobile telephone base station
located at
Shepparton R/T (26725)
NSA Site No: 3630004
20 Fraser Street
Shepparton
Victoria 3630

Report No: 32723-3 (Issue A)
20th February 2013

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RF EME SURVEY

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Shepparton R/T (26725)
NSA Site No: 3630004
20 Fraser Street
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Report prepared by – Michael Bangay

Authorised NATA Signatory

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Senior Consultant

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Accredited for compliance with ISO/IEC 17025.

Contents

1. Introduction

Mr Geoff Bail, EME Compliance SME from Telstra[1] engaged RADHAZ Consulting Pty Ltd as an independent consultancy, to undertake a comparison between the measured and predicted levels of Radio Frequency Electromagnetic Energy (RF EME) at multiple locations around a mobile base station in Shepparton, Victoria. Telstra operates GSM900, WCDMA 850/2100 and LTE1800 from the site. The antennas are mounted on a lattice tower located at 20 Fraser Street.

A measurement of environmental RF EME resulting from the Telstra services at Shepparton was conducted by Johnny Lim from Radhaz Consulting on 22nd November 2012; the Radhaz Report was No. 32723-1 (Issue A) and dated 30th November 2012.

The predicted levels were determined using RF-Map2 with the RF-Map Plan File "Shepparton VIC 3630" that was down loaded from the RFNSA web site on February 6, 2013.

2. Methodology

A comparison was made between the measured and predicted Telstra LTE 1800 service RF EME levels at locations around the tower at 20 Fraser St. Shepparton that generally gave line-of-sight survey locations. During the measurements, the LTE service was artificially loaded to achieve full power from the transmitters. This enabled the measurements to be reported without any factors added to compensate for low traffic conditions.

The RF-Map2 Config Plan file was down loaded from RFNSA and which had the following details:

Document Type	RF-Map Config
Date/Time	23 Jul 2012 16:08:28
Upload Sequence No.	16
Uploaded by	Elizabeth Shilling (Ericsson)
Comment	Telstra LTE1800 As Built

The RF-MAP2 Plan file was then loaded into RF-Map2 and 11 markers were added that reflected the measurement locations. The Latitude and Longitude for these locations identified in the measurement report were taken from a Google Earth map of Shepparton. Marker heights of 1.5m were used for all except at Locations 1 (car park roof) and 3 (platform within RT tower), where 10.5m and 31.5m respectively were used to reflect the tripod mounted measurement method. The analysis was then run, resulting in a baseline of predicted RF EME levels at each of the measurement locations.

1 242 Exhibition Street, Melbourne, Victoria 3000

The file was then edited to reflect the conditions that were present when the measurements were performed. This included changing from an envelope pattern to an electrical down tilt of 3 degrees as recorded in the RFNSA Existing Configuration table for the LTE1800 service. It was noticed that the Existing Configuration data and thus RF-Map2 data for antenna port connections had not used both beams of the 2NPX210R antennae which are used to create sectors 2, 3, 4 and 6. The consequence of this was to reduce the coverage to four unbalanced sectors. As a result, the configuration was changed so the both Beam 1 and Beam 2 were used for the RF-Map prediction which reflected the actual on-site arrangement. Additionally a transmission loss of 0.8 dB was introduced to reflect the actual losses between the LTE transmitter and antenna port compared to those assumed by the standard powers used when populating the RFNSA STAD. The analysis was run again, resulting in predicted RF EME levels at each of the measurement locations for a configuration reflecting the actual site arrangement.

3. Results

RF-Map2 EME Plot

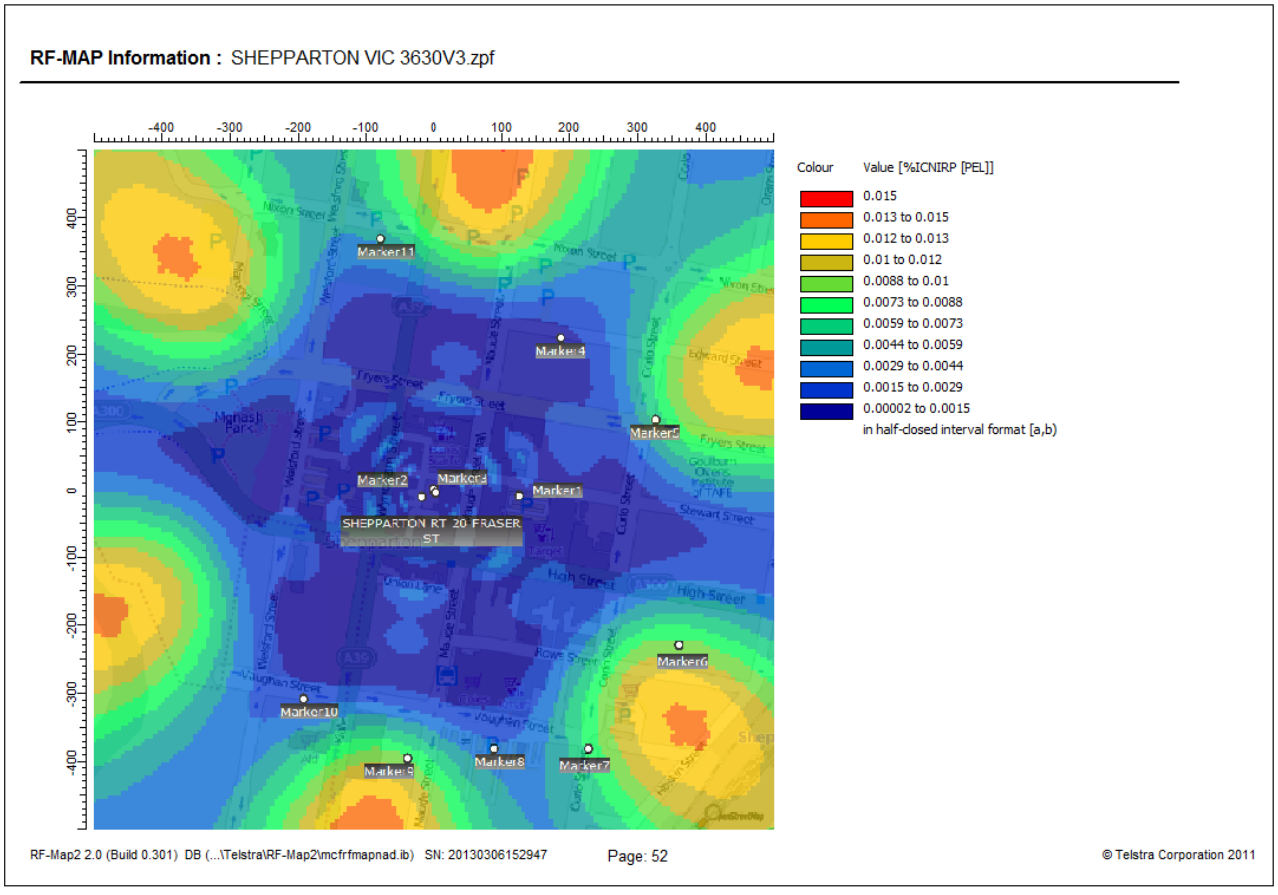
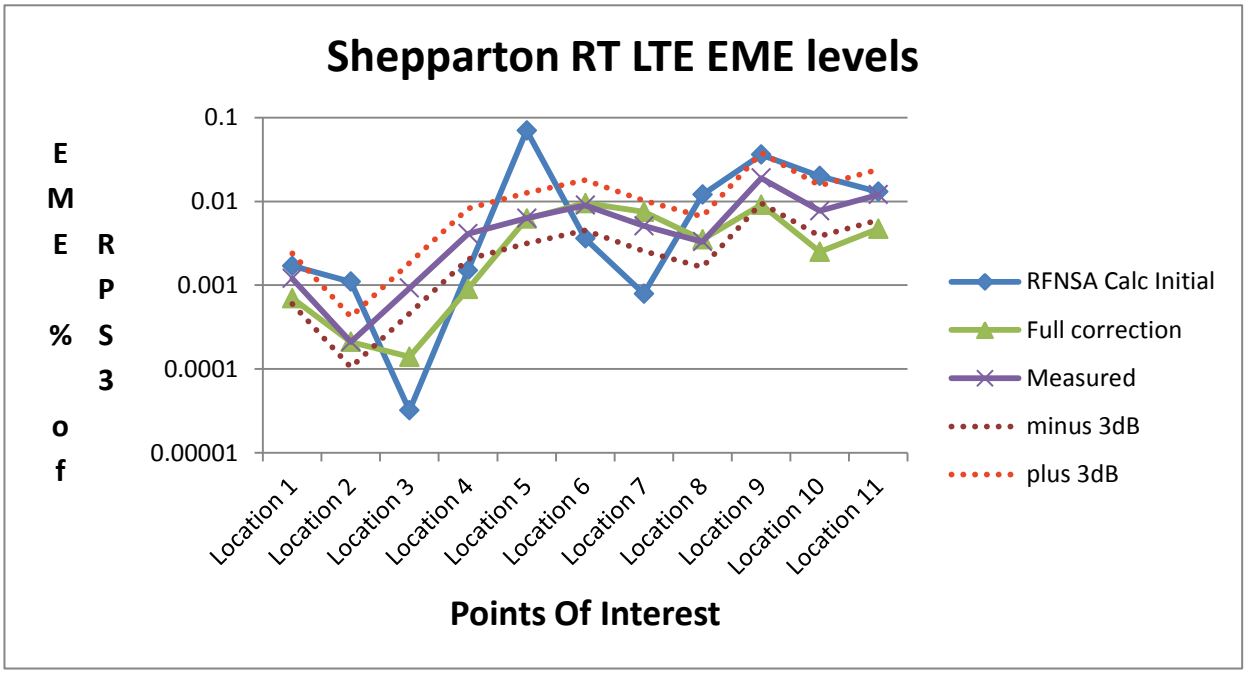


Table 1

% of RPS3 - LTE services only				dB difference between corrected predicted value and the measured level
Point of interest/Survey location	Initial RF map calc using RFNSA data.	Calculated level : Corrected for feeder loss (0.8 dB), dual beams and antenna tilt (3^o)	Measured value with max LTE traffic (45 dBm Tx power)	
Location 1	0.0017	0.0007	0.0012	-2.34
Location 2	0.0011	0.00021	0.00021	0.00
Location 3	0.000032	0.00014	0.00092	-8.18
Location 4	0.0015	0.0009	0.0041	-6.59
Location 5	0.07	0.0062	0.0063	-0.07
Location 6	0.0036	0.0095	0.009	0.23
Location 7	0.00079	0.0075	0.0051	1.67
Location 8	0.012	0.0035	0.0033	0.26
Location 9	0.036	0.0091	0.019	-3.20
Location 10	0.02	0.0025	0.0077	-4.89
Location 11	0.013	0.0047	0.012	-4.07

Chart 1



4. Discussion/Conclusions

4.1. Of the eleven measurement locations there were six that had less than 3 dB difference between measured and predicted values for LTE 1800, indicating that the predicted levels were within the +/- 3 dB measurement uncertainty. Location 9 had a difference that was slightly more than 3 dB (3.2dB). The other four points ranged between -4.07 dB and -8.18 dB.
Location 3 had the highest difference between measured and predicted (-8.18 dB). Correlation was not expected for this location given it was on a platform within the RT tower, where there would have been significant reflections and shielding.
Location 4 had the next highest difference (-6.59dB) and this was probably due to multipath caused by a nearby pitched metal roof.

4.2. On average, the measured levels were greater (+2.47 dB) than the predicted levels.

4.3. The original RFNSA RF-Map2 file data produced predicted levels that were significantly different than the values that were measured because the data did not accurately reflect the on-site arrangement.

4.4. Most of the eleven points of interest were in coverage areas that were below the main beam of the antennae where the assumption that antenna gain is the product of the vertical and horizontal patterns. This is a reasonable first order approximation, but the uncertainty would increase for increasing angles of depression and off azimuth boresite. It is reasonable to expect that greater agreement between predicted and measured values would be obtained if the points of interest were in the main beam.

4.5. During the measurements or subsequently, no attempt was made to validate the actual antennae bearing, height or tilt (electrical and mechanical) was as per the RFNSA STAD. These factors add to the uncertainty of the prediction and thus the comparison.

4.6. Telstra advised that one of the two LTE1800 Remote Radio Units on the Western face of the tower (280° sector) is faulty and was disabled at the time of the measurement. It is considered this had minimal impact on the comparison since the RF EME at none of the measurement/prediction locations would result predominantly from antennas on the Western face.

4.7. Overall, the predicted and measured values were in agreement, given that there was probable multipath transmission and uncertainty associated with antennae pattern data, bearing, height and tilt.

Table 2: Measured Telstra Base Station RF EME Contribution – Services Breakdown

Measurement Location[1]	Measured RF EME Levels Contributed by Telstra Mobile Base Station % of the RPS3 General Public Exposure Limit[2]						
	Telstra WCDMA850	Telstra GSM900	Telstra WCDMA2100	Telstra LTE1800 (with Traffic Loading)	Telstra LTE1800 (No Traffic Loading)	**Telstra Total** (with LTE1800 Traffic Loading)	**Telstra Total** (No LTE1800 Traffic Loading)
1 – Rooftop Car Park	0.0061	0.00084	0.00006	0.0012	0.00024	0.0082	0.0072
2 – North of Tower at Ground Level	0.00079	0.000026	0.00015	0.00021	Not Measured	0.0012	Not Measured
3 – Observation Platform	0.0018	0.00017	0.00022	0.00092	Not Measured	0.0031	Not Measured
4 – Edwards Fryers Car Park	0.015	0.00022	0.00022	0.0041	0.00078	0.02	0.016
5 – Corner Fryers St and Corio St	0.03	0.00017	0.00027	0.0063	0.00091	0.036	0.031
6 – Rowe Street Car park between Corio St and North St	0.033	0.00081	0.00032	0.009	0.0013	0.044	0.036
7 – Corner Vaughan St and Corio St	0.0089	0.00018	0.00069	0.0051	0.002	0.015	0.012
8 – Vaughan Street Car park between Maude St and Corio St	0.019	0.00011	0.00046	0.0033	0.00073	0.023	0.021
9 – Corner of Vaughan St and Maude St	0.02	0.00011	0.00024	0.019	0.0041	0.039	0.024
10 – Vaughan St Car Park between Welshford St and Wyndham St	0.0044	0.00026	0.00028	0.0077	0.0017	0.013	0.0066
11 – Queens Garden	0.0096	0.000088	0.00029	0.012	0.0021	0.022	0.012

Note:

1. Refer to Appendix A and B for measurement location details.
2. Percentages based on the measured power density at each location with respect to the ARPANSA General Public exposure limits. A value of 100% indicates the RPS3 General Public Limit.
3. The measured levels were rounded to 2 significant figures.

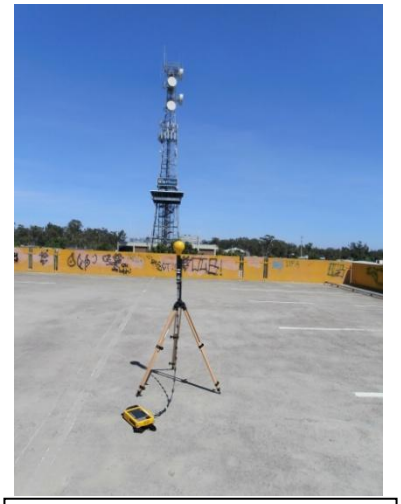
5. Glossary and Abbreviations

Radio Frequency Electromagnetic Energy (RF EME)	RF EME is a measure of the radiofrequency energy at a particular location generated by transmitting sources such as antennas.
ARPANSA RPS3 General Public Limit	Existing Australian Radiation Protection Standard limits or reference levels for continuous exposure of the general public to radio frequency transmissions.
Power Density	The rate of or the amount of electromagnetic energy flowing through a given area.
ACMA	Australian Communications and Media Authority
Cumulative RF EME	The weighted sum of all RF EME that occurs in the bandwidth of the measuring instruments, it is expressed as a percentage of the relevant RPS3 limit.
GSM	Global System for Mobile Communications. A second generation mobile telephony technology.
WCDMA	Wideband Code Division Multiple Access. A third generation mobile telephony technology.
LTE	Long Term Evolution. A fourth generation mobile telephony technology.
RFNSA	Radio Frequency National Site Archive – An online register of radio sites
Broadcast	Public transmission services such as radio and TV.
STAD	Site Transmitter and Antenna Data tabulated on the RFNSA for both Existing and Proposed systems at the site.

5 Appendices

Appendix A – Measurement Point Locations

Appendix B – Measurement Location Photographs



Location 1

Location 2

Location 3

Location 4

Location 5

Location 6

Location 7

Location 8

Location 9

Location 10

Location 11

Appendix C – Measurement and Prediction Details

- The measured value includes the instrument noise. The actual RF EME level will be lower than the reported values.

- The SRM3000 meter measures the electric field strength and then converts the levels to the equivalent power density.

- The amplitude of mobile services signals varies with the traffic level and nature of the mobile phone call. The cumulative EME levels presented in this report do not have any factors added to accommodate for worst case exposure situations. While these signals were recorded as they existed at the time of the survey (11:00am – 5:30pm), Telstra network traffic data confirmed that the usage at the time of measurement represents a typical busy day.

- By adhering to documented processes and implementing proven field techniques the estimated uncertainty budget can be minimized. Measurement expanded uncertainty has been calculated in accordance with the requirements of ISO/IEC 17025.

- The expanded measurement uncertainty for the SRM-3000 monitor/probe was calculated as, $U = \pm 3$dB, with a coverage factor $k = 2$, and a level of confidence of 95%.

- All Narda SRM-3000 measurements were recorded as a percentage of the general public limit of the ARPANSA RPS3 Standard.

- RADHAZ Consulting permanently stores all measurement equipment calibration details, site maps, recorded measurement scans and prediction data.