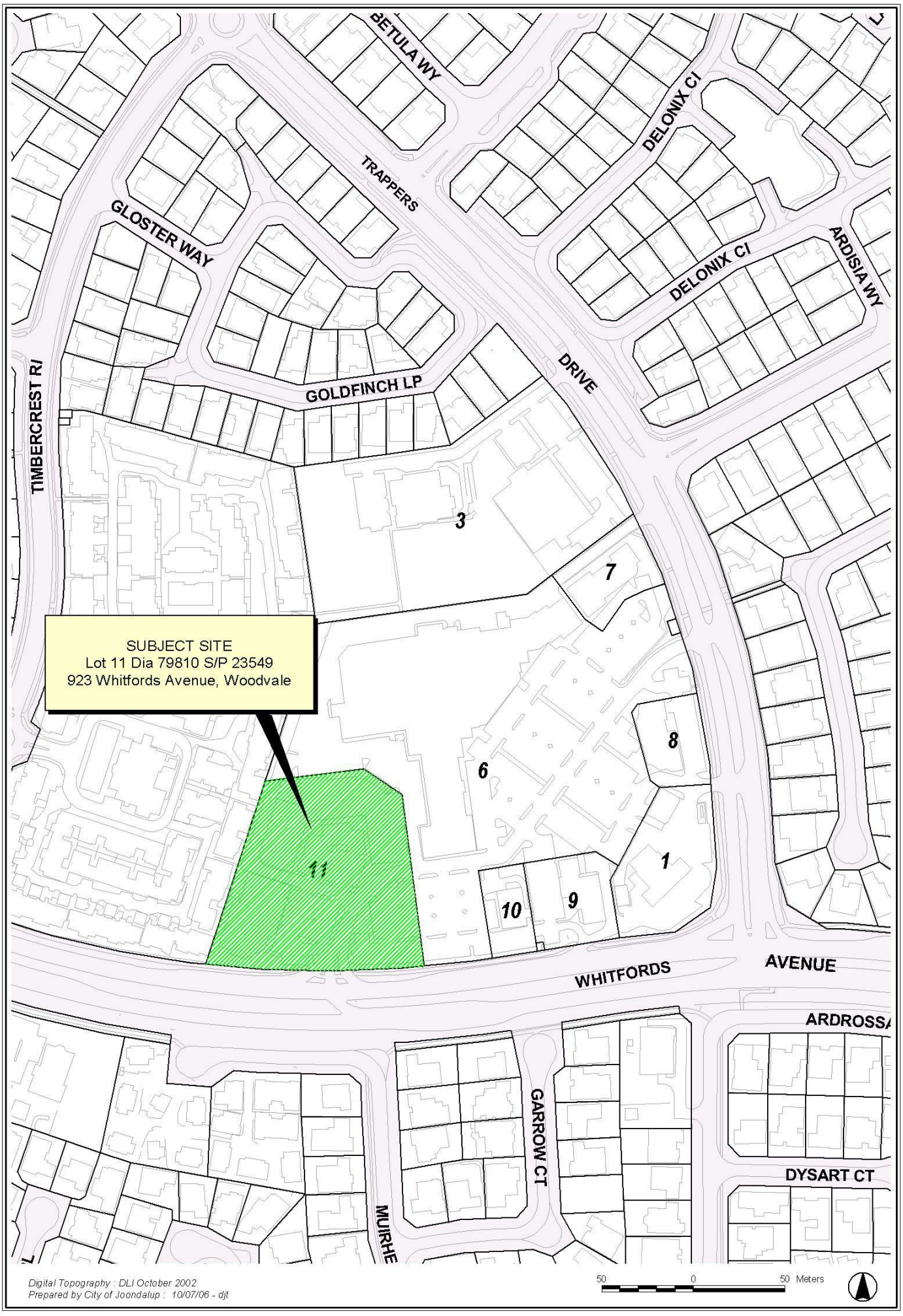
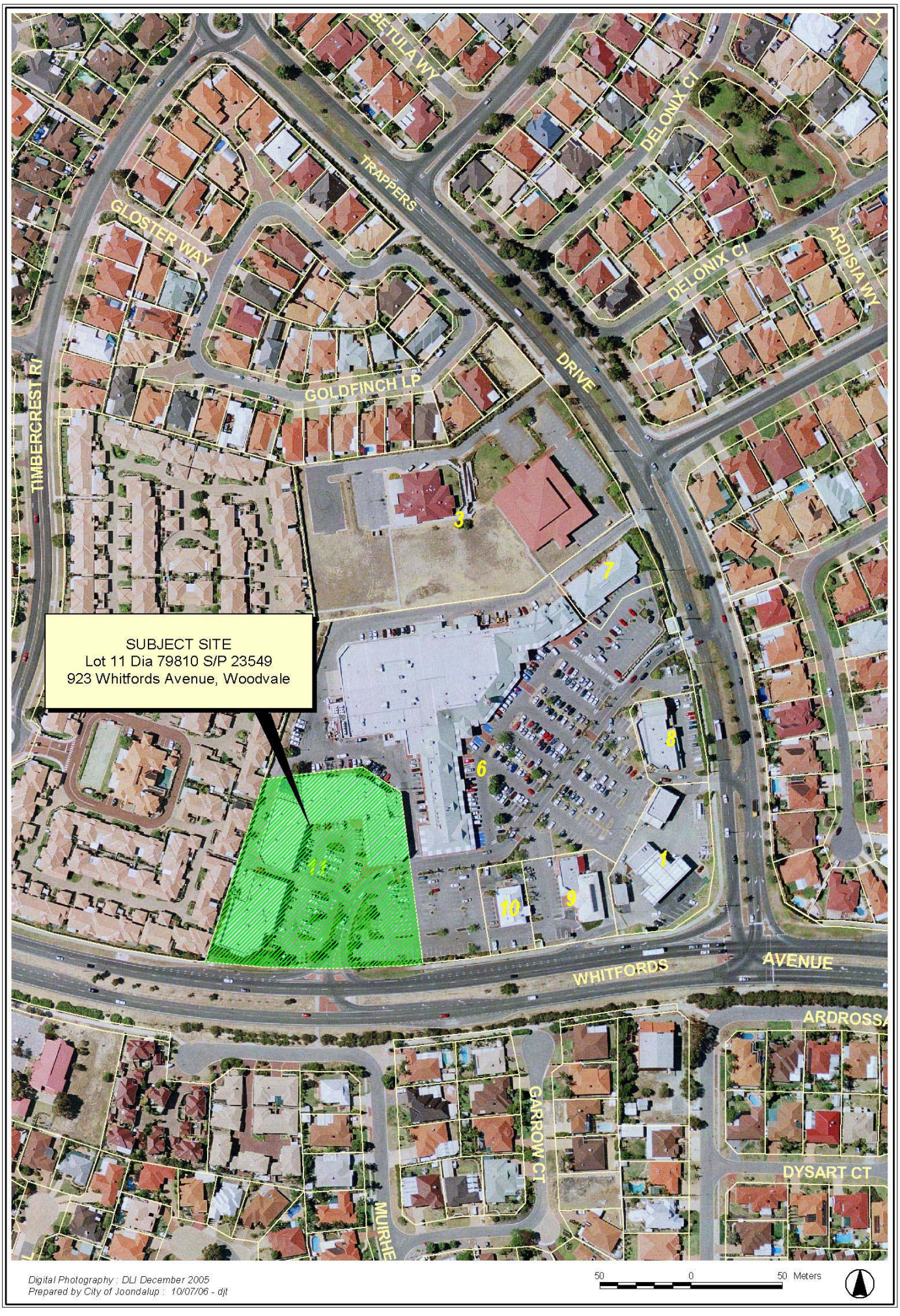

BETULA WY
TRAPPERS
DELONIX CI
GLOSTER WAY
DELONIX CI
ARDISIA WY
TIMBERCREST RI
GOLDFINCH LP
DRIVE
3
7
SUBJECT SITE
Lot 11 Dia 79810 S/P 23549
923 Whitfords Avenue, Woodvale
8
6
11
1
10
9
WHITFORDS
AVENUE
ARDROSSA
GARROW CT
DYSART CT
MUIRHE
Digital Topography : DLI October 2002
Prepared by City of Joondalup : 10/07/06 - djt
50 0 50 Meters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AVENUE
ARDROSSA
GARROW CT
DYSART CT
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Digital Photography : DLI December 2005
Prepared by City of Joondalup : 10/07/06 - djt
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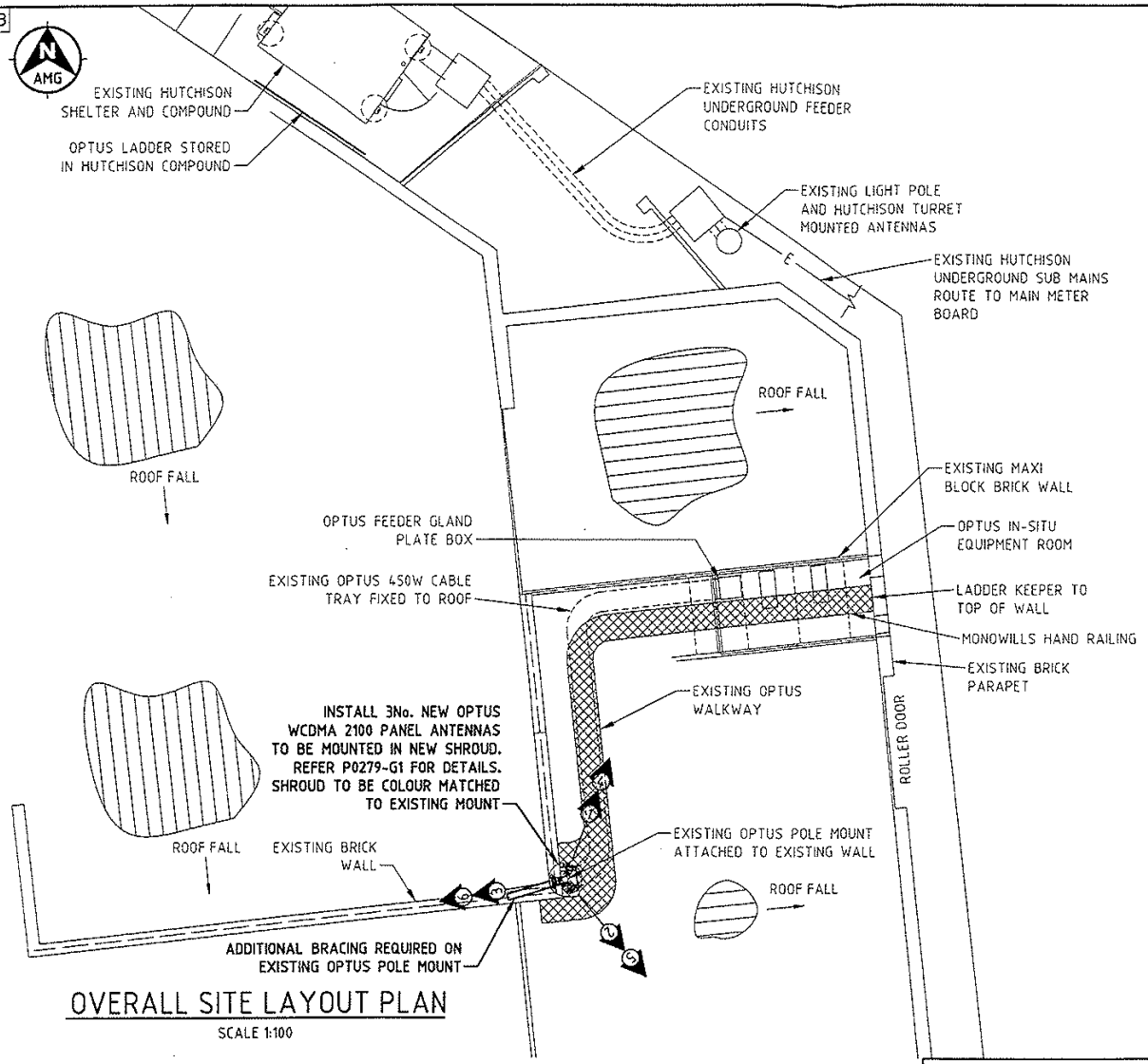
A3



OVERALL SITE LAYOUT PLAN

SCALE 1:100

ANTENNA CONFIGURATION

GSM900	SECTOR 1	SECTOR 2	SECTOR 3
SYMBOL	①	②	③
AZIMUTH	20°	140°	260°
ANTENNA TYPE	CJPX308DR	CJPX308DR	CJPX308DR
ANTENNA MHPAs	-	-	-
NO. OF ANTENNAS	1 OFF	1 OFF	1 OFF
ANTENNA HEIGHT	11m	11m	11m
FEEDER TYPE	2 x VXL5-50	2 x VXL5-50	2 x VXL5-50
FEEDER LENGTH	18m APPROX	18m APPROX	18m APPROX
STATUS	**EXISTING**	**EXISTING**	**EXISTING**
WCDMA2100	SECTOR 1	SECTOR 2	SECTOR 3
SYMBOL	④	⑤	⑥
AZIMUTH	20°	140°	260°
ANTENNA TYPE	KATHREIN 742215	KATHREIN 742215	KATHREIN 742215
ANTENNA MHPAs	1x2 PORT MHPA	1x2 PORT MHPA	1x2 PORT MHPA
NO. OF ANTENNAS	1 OFF	1 OFF	1 OFF
ANTENNA HEIGHT	13.3m	13.3m	13.3m
FEEDER TYPE	2 x AVA5-50 (7/8")	2 x AVA5-50 (7/8")	2 x AVA5-50 (7/8")
FEEDER LENGTH	25m APPROX	25m APPROX	25m APPROX
STATUS	**NEW**	**NEW**	**NEW**

NOTES:

1. MHPA TO BE FITTED BELOW PROPOSED WCDMA 2100 PANEL ANTENNA.
2. NEW FEEDER CABLES TO PENETRATE EXISTING GLAND PLATE IN EQUIPMENT ROOM ROOF AND RUN IN EXISTING CABLE TRAY TO BASE OF POLE MOUNT. FEEDER CABLES STRAPPED TO EXISTING MOUNTING POLES.
3. ALL WCDMA ANTENNAS TO BE INSTALLED WITH MECHANICAL TILT KITS (MTK), MAST HEAD AMPLIFIERS (MHA) & REMOTE CONTROL UNITS (RCU). FINAL POSITION TO BE CONFIRMED ON SITE BY RIGGING/INSTALLATION CONTRACTOR.
4. ALL WCDMA ANTENNA TAILS BETWEEN ANTENNA & MHA MUST NOT EXCEED 1.5m IN LENGTH. PRIOR WRITTEN NOTIFICATION TO & APPROVAL FROM NOKIA MANAGEMENT IS REQUIRED IN ALL CASES WHERE IT IS PROPOSED TO EXCEED 1.5m.

Rev	Date	Revision Details	Co.	By	Ver.	App.
A	15.02.06	PRELIMINARY	CW	PM	-	

Connell Wagner
Connell Wagner Pty Ltd ABN 54 005 139 873
118 Military Road (PO Box 538) Neutral Bay
New South Wales 2089 Australia
Telephone: +61 2 9465 5599
Facsimile: +61 2 9465 5598
Email: cwsyd@conwag.com

NOKIA
Downer ENGINEERING
A DIVISION OF DOWNER EDI LIMITED

Client: 'yes' OPTUS

JV SITE ID: JP9156

Project: MOBILE NETWORK AUSTRALIA
SITE No:- P0279
KINGSLEY
923 WHITFORD AVE, WOODVALE

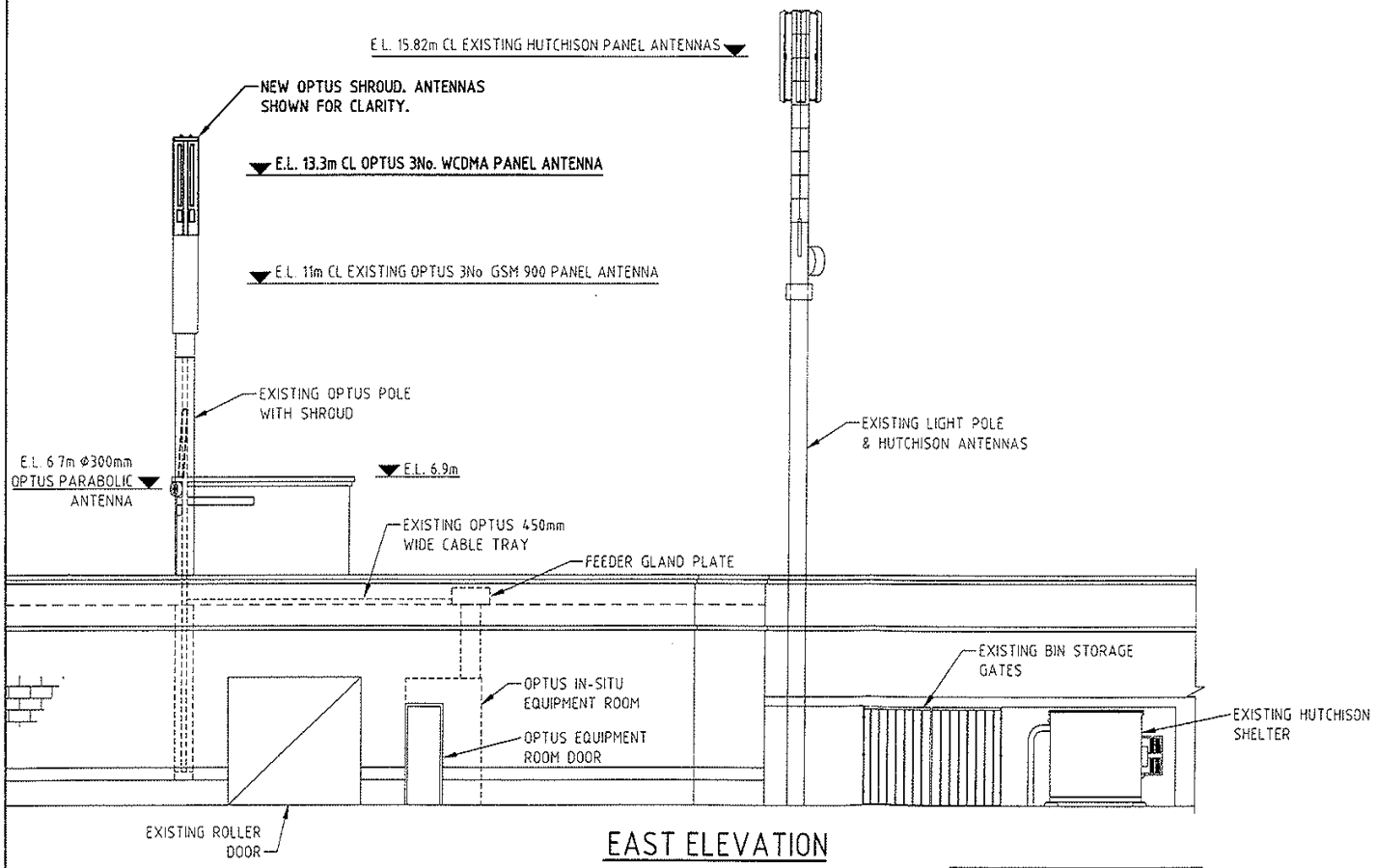
Drawing Title: SITE LAYOUT PLAN

PRELIMINARY

Designed	Drawn	Date
PM	DJC	03.02.06
Verified		Scale
		1:100
Approved		Project No.
		P016.00
Drawing No.		Revision
P0279-G2		A

20 10 0 10 20 30 40 50mm

A3



EAST ELEVATION

SCALE 1:100

JV SITE ID: JP9156

PRELIMINARY

Rev	Date	Revision Details	CW Co.	PM By	– Var.	App.
A	15.02.06	PRELIMINARY				

Connell Wagner

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NOKIA

Downer ENGINEERING
A DIVISION OF DOWNER EDI LIMITED

Client: 'yes' OPTUS

Project: MOBILE NETWORK AUSTRALIA
SITE No:- P0279
KINGSLEY
923 WHITFORD AVE, WOODVALE

Drawing Title: SITE ELEVATION

Designed	Drawn	Date
PM	DJC	03.02.06

Verified: Scale 1:100

Approved: Project No. P016.00

Drawing No. P0279-G4 Revision A

20 10 0 10 20 30 40 50mm

City of Joondalup

POLICY 7-11 – TELECOMMUNICATIONS FACILITIES

STATUS: **City Policy** - *A policy that is developed for administrative and operational imperatives and has an internal focus.*

City policies are referred to Council for review and endorsement.

RESPONSIBLE DIRECTORATE: Planning and Community Development

OBJECTIVE:

STATEMENT:

1 The City recognises that it is bound by the Federal legislation relating to telecommunication facilities and that it has no jurisdiction over the location or installation of "low impact" facilities as defined under the *Telecommunications (Low-Impact Facilities) Determination Act 1997*.

2 The City, as a general rule, does not support the installation or location of telecommunication facilities, particularly in the vicinity of schools, childcare establishments, hospitals and general residential areas.

3 The City recognises the right of land owners/applicants to make applications for planning approval for telecommunication facilities deemed to be other than low impact under the *Telecommunications Act,* and acknowledges its obligation to make a recommendation to the WAPC or determine the application in its own right.

4 Having received a Development Application for a telecommunication facility, the City will advertise the proposal for a 30-day period and consult with the local community surrounding the proposed site. Owners and occupiers of property within a radius of 500m will be advised in writing, at the cost of the applicant, and afforded an opportunity to make comment to the Council prior to the matter being considered at a Council meeting.

5 In making a recommendation to the WAPC or determining the application the Council will have regard to;

(a) the comments and concerns of the local community,
(b) the merits of the particular proposal
(c) compliance with the industry code of practice,
(d) compliance with matters required to be considered under the District Planning Scheme, and
(e) the general concerns of the Council regarding the potential effects of telecommunication facilities referred to in point 2 above.

City of Joondalup

Amendments:	C172-12/02. CJ206-10/05
Related Documentation:	
Issued:	October 2005

A

Summary of Estimated RF EME Levels around the Mobile Phone Base Station at, 923 Whitford Ave, Woodvale WA, 6026

Introduction:

Date 18/09/06

This report summarises the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels at ground level emitted from the existing antennas at the Mobile Phone Base Station at 923 Whitford Ave, Woodvale WA,6026. Maximum EME levels estimated are at distances of 5.0, 50.0, 100.0, 200.0, 300.0, 400.0, 500.0 m from the base station. The procedures for making the estimates have been developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA)[1]. These are documented in the ARPANSA Technical Report; "Radiated EME Exposure Levels - Prediction Methodologies" which is available at www.arpansa.gov.au

EME Health Standard

ARPANSA, an agency of the Commonwealth Department of Health has established a Radiation Protection Standard[2] specifying limits for continuous exposure of the general public to RF transmissions at frequencies used by mobile phone base stations. Further information can be gained from the ARPANSA web site.

The Australian Communications and Media Authority (ACMA)[3] mandates exposure limits for continuous exposure of the general public to RF EME from mobile phone base stations. Further information can be found at the ACMA website www.acma.gov.au/ACMAINTER:STANDARD:pc=PC_2798

Existing Site Radio Systems

Optus GSM900	3GIS/CDMA2100		

Table of Predicted EME Levels – Existing

Distance from the antennas at 923 Whitfords Ave, bearing 23.96 ° (m)	Maximum Cumulative EME Level - All Carriers (% of ACMA mandated exposure limits[4])
5	0.0067
50	0.13
100	0.34
200	0.13
300	0.057
400	0.031
500	0.02
Maximum EME level 93.023 m, 23.96° from the antennas at 923 Whitfords Ave	0.34

Note: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimising transmitter power to only serve established phone calls[5].

Summary – Existing Radio Systems

RF EME levels have been estimated from the existing antennas installed at 923 Whitford Ave, Woodvale WA,6026. The maximum cumulative EME level at 1.5 m above ground level is estimated to be 0.34 % of the ACMA mandated exposure limits.

Proposed Site Radio Systems

Optus Vodafone JV/CDMA2100			

Table of Predicted EME Levels – Existing & Proposed

Distance from the antennas at 923 Whitfords Ave, bearing 23.11 ° (m)	Maximum Cumulative EME Level - All Carriers (% of ACMA mandated exposure limits[4])
5	0.0073
50	0.14
100	0.34
200	0.14
300	0.066
400	0.036
500	0.023
Maximum EME level 96.27 m, 23.11° from the antennas at 923 Whitfords Ave	0.34

Note: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing and proposed antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimising transmitter power to only serve established phone calls[5]

Summary – Existing & Proposed Radio Systems

RF EME levels have been estimated from the existing and proposed antennas installed at 923 Whitford Ave, Woodvale WA, 6026. The maximum cumulative EME level at 1.5 m above ground level is estimated to be 0.34 % of the ACMA mandated exposure limits.

Reference Notes:

1. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a Federal Government agency incorporated under the Health portfolio. ARPANSA is charged with responsibility for protecting the health and safety of people, and the environment, from the harmful effects of radiation (ionizing and non-ionizing).

2. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2002, 'Radiation Protection Standard: Maximum Exposure Levels to Radiofrequency Fields — 3 kHz to 300 GHz', Radiation Protection Series Publication No. 3, ARPANSA, Yallambie Australia.
[Printed version: ISBN 0-642-79400-6 ISSN 1445-9760]
[Web version: ISBN 0-642-79402-2 ISSN 1445-9760]

3. The Australian Communications and Media Authority (ACMA) regulates telecommunications and radiocommunications, including licensing, compliance with codes and standards, spectrum management and consumer safeguards. It also represents Australia's communications interests internationally.

4. ACMA mandated exposure limits as in force at the issue date of this report. Further information refer to the ACMA web site http://www.acma.gov.au/ACMAINTER:STANDARD:pc=PC_2052

5. The EME predictions in this report assume a worst-case scenario being:
- base station transmitters operating at maximum power (no automatic power reduction)
- simultaneous telephone calls on all channels
- an unobstructed line of sight view to the antennas.
In practice a worst-case scenario is rarely the case. There are often trees and buildings in the immediate vicinity, and cellular networks automatically adjust transmit power to suit the actual telephone traffic. For these reasons, care should be taken when comparing prediction reports & actual measurements, as the predicted levels will often be considerably higher.

Issued by: GHD, Data reference file – 923 Whitford Ave, Woodvale WA, 6026 - 20060918112025

Connell Wagner

26 October 2006

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256 Adelaide Terrace
Perth WA 6000

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Facsimile: +61 8 9223 1605
Email: cwper@conwag.com
www.conwag.com

Chief Executive Officer
City of Joondalup
P.O. Box 21
JOONDALUP WA 6919

Dear Sir

State Administrative Tribunal WA: Matter No. DR327 of 2006
Connell Wagner Pty Ltd v City of Joondalup

I refer to the Directions Hearing of 18 October 2006 in relation to SAT Matter No. DR327 of 2006 at which the City requested further specific information from Connell Wagner in relation to the Telecommunications Facility: Woodvale Park Commercial Centre, Lot 20, 923 Whitfords Avenue, Woodvale WA 6026.

We have prepared the attached response in accordance with the details requested in the City's facsimile of 24 October 06.

Should you require any further information, please do not hesitate to contact me on 9223 1601.

Yours sincerely

Jeff Barham
Principal
Water & Environment

CC: State Administrative Tribunal
GPO Box U1991
PERTH WA 6845

Outcomes of State Administrative Tribunal Directions Hearing – 18 October 2006

It was agreed that the following additional information be provided to Council:

1. What testing and reporting is required under the MERCS system and how often is this undertaken?

2. With the "high levels of reporting" already undertaken, why can't the City (Council) be provided with copies of these reports?

3. Evidence (from previous testing of other facilities) to demonstrate that levels of EME do not increase during the life of a facility unless additional equipment is added.

Additional information due by 27 October 2006

SAT Dates: Directions Hearing – 24 November 2006, 2:00pm

Council Dates: Committee Briefing (Deputation) – 14 November 2006
Ordinary Council Meeting – 21 November 2006

Response:

1. The Mobile Carriers Forum (MCF) is working actively to address public concerns about mobile phone towers and implement its EME regulatory compliance strategy. The strategy is called the Mobile EME Regulatory Compliance Strategy (MERCS).

This strategy is coordinating inter-carrier exchange of information to facilitate compliance with cumulative exposure requirements under the relevant standards and regulations. MERCS is a compliance strategy developed by the Mobile Carriers to meet the regulatory requirements of:

- Australian Communications and Media Authority (ACMA);
- Radiocommunications Licence Conditions; and,
- OH&S Legislation.

Mobile carriers must comply with standards on exposure to electromagnetic energy (EME) set by the ACMA. This requirement is given effect through the following:

- Radio Communications Act 1992
- Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard 2003.
- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Radiation Protection Standard - 7 May 2002

The MERCS Process enables the management of cumulative site EME in line with the requirements of ARPANSA Radiation Protection Standard (RPS) No. 3 (Compliant with International ICNIRP Standard) OH&S regulations which require compliance with the ARPANSA EME Standard for:

- Cumulative EME Assessment;
- EME exclusion zones; and,
- Site Access control & Safe Work Procedures.

The ARPANSA Radiation Protection Standard limits Maximum Exposure Levels to Radiofrequency Fields 3kHz to 300GHz and includes requirements for protection of the general public, management of risk in occupational exposure and additional information on measurement and assessment compliance.

Assessment of EME from all services at shared sites is undertaken by NATA Accredited Site RF Assessors. This is an assessment of Cumulative EME impact and is undertaken whenever the site is upgraded or additional equipment is proposed.

The MERCS Process involves a set of Key Components for management of EME compliance, as follows:

- National Site Archive for all Sites (RFNSA)
- National Antenna Data Base – providing base system data for assessments
- NATA Pre qualified Independent RF Assessors
- Standard EME Site Safety Documents
- Standard Site Signage and a proportioned cost recovery structure

Worlds Best Practise processes are applied in the cumulative assessments of EME for:

- Standardisation of processes and site management
- Wider application to the radio industry in general
- Cumulative assessment to ensure total site compliance
- Desktop assessments leveraging 10 years of development & operation
- Management of operational risks through concise hazard management

MERCS has been implemented and developed since 2000 as a tested strategy with automated systems & processes. The MCF Implementation strategy is to retrospectively apply to all carrier sites by 2008 with assessments to include other Radio Licensees at shared sites. Where a new site is built, or a site is upgraded, MERCS applies immediately.

NATA Accredited Site RF Assessors are EME specialists and are contracted by Carriers, Radio Licensees or Site Operators requiring the following tasks and outputs:

- Liaison between owner & carrier
- Site data collation & validation
- Site Audits
- Update & load data and reports onto the Radio Frequency National Site Archive (RFNSA)
- EME / EMI design assessment report (recommendations to carriers)
- Environmental EME Assessment
- Radio Comms Site Management Book (RCSMB) Production
- Site Compliance Certificate (NATA Accredited)

In conclusion:

- Detailed assessment and documentation of sites takes place under MERCS to facilitate compliance with cumulative EME exposure requirements under the relevant standards and regulations.
- This is undertaken by NATA Accredited Site RF Assessors to international best practice standards.
- The assessment and documentation procedures occur when a site is upgraded or when additional equipment is added. Where a site is not assessed in this way before 2008, the procedures will apply retrospectively.
- All reporting and documentation from MERCS is readily available from the Radio Frequency National Site Archive (RFNSA). We recommend that the City refer to the RFNSA for the most up to date information. Further information about this database is provided in the response to question 2.

2. Optus and all Carriers take their responsibilities for providing information and managing EME issues very seriously and as a result have created the Mobile Carriers Forum, Radio Frequency National Site Archive (RFNSA).

This site is an internet archive of mobile telephone base stations and radio communication facilities in Australia. The RFNSA was launched in April 2003 in conjunction with the new ACIF Code - Deployment of Radio Communications Infrastructure.

The RFNSA provides a listing of all new mobile telephone base station facilities built or upgraded since April 2003. Over time the RFNSA will provide a listing of all mobile telephone base stations in Australia.

You can enter the web site at the following address and search for the subject site:
http://www.rfnsa.com.au/nsa/index.cgi

Under the tabs at the top you will find site details and the site names and codes for all carriers using the site. Under the 'Reports' tab is located the latest information regarding identified frequencies in use, and the most up-to-date RFEME report (sometimes referred to as the Environmental Report) for the site.

A greater level of information is available to the landlord on all sites where carriers are present and if you require access to any sites where Council is the landowner, please do not hesitate to contact the carrier with details and they will make access available to you.

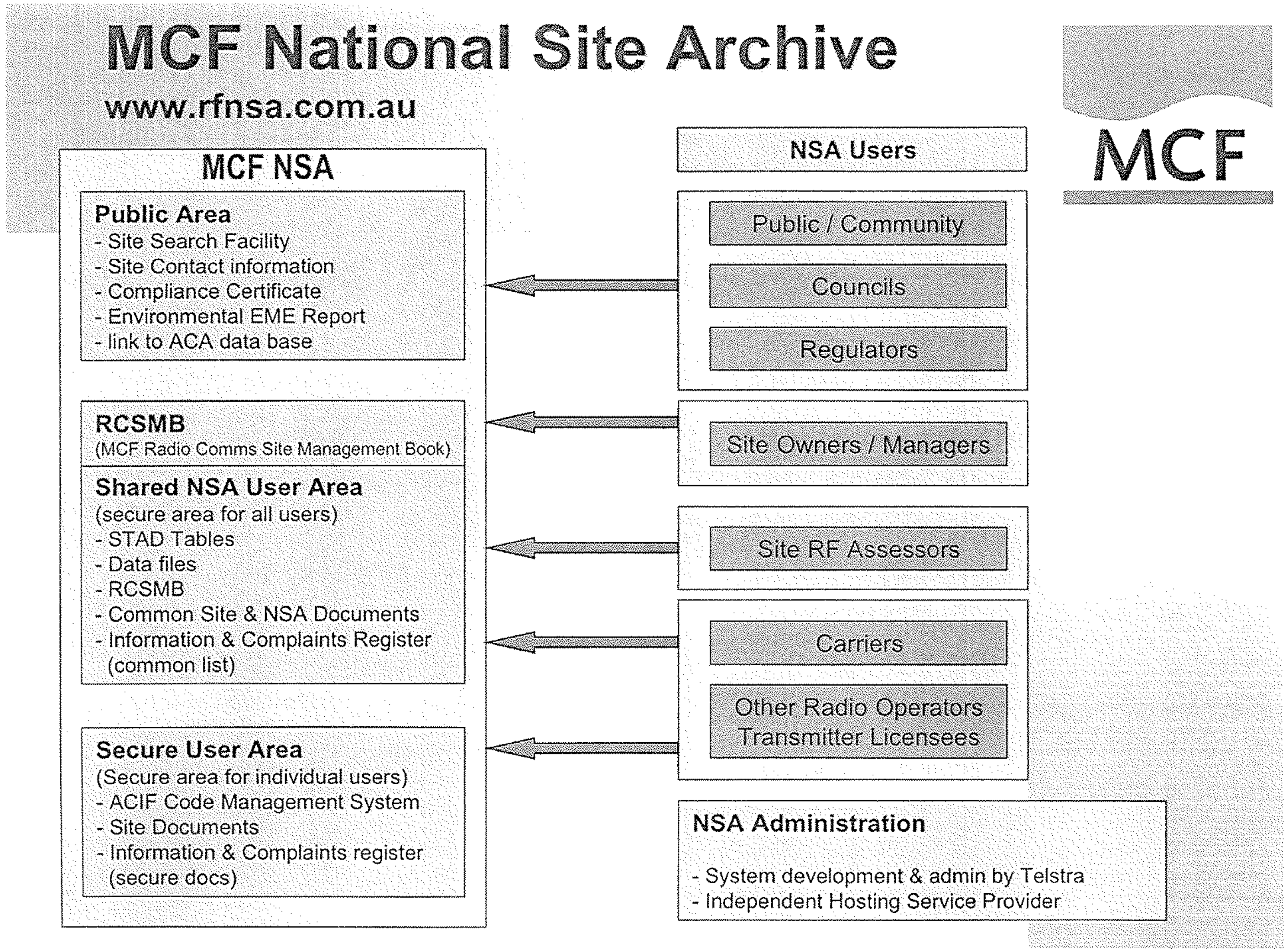
Please note that by agreement between all Carriers on the site this information and documentation is continuously updated and must include all existing and proposed equipment on the site.

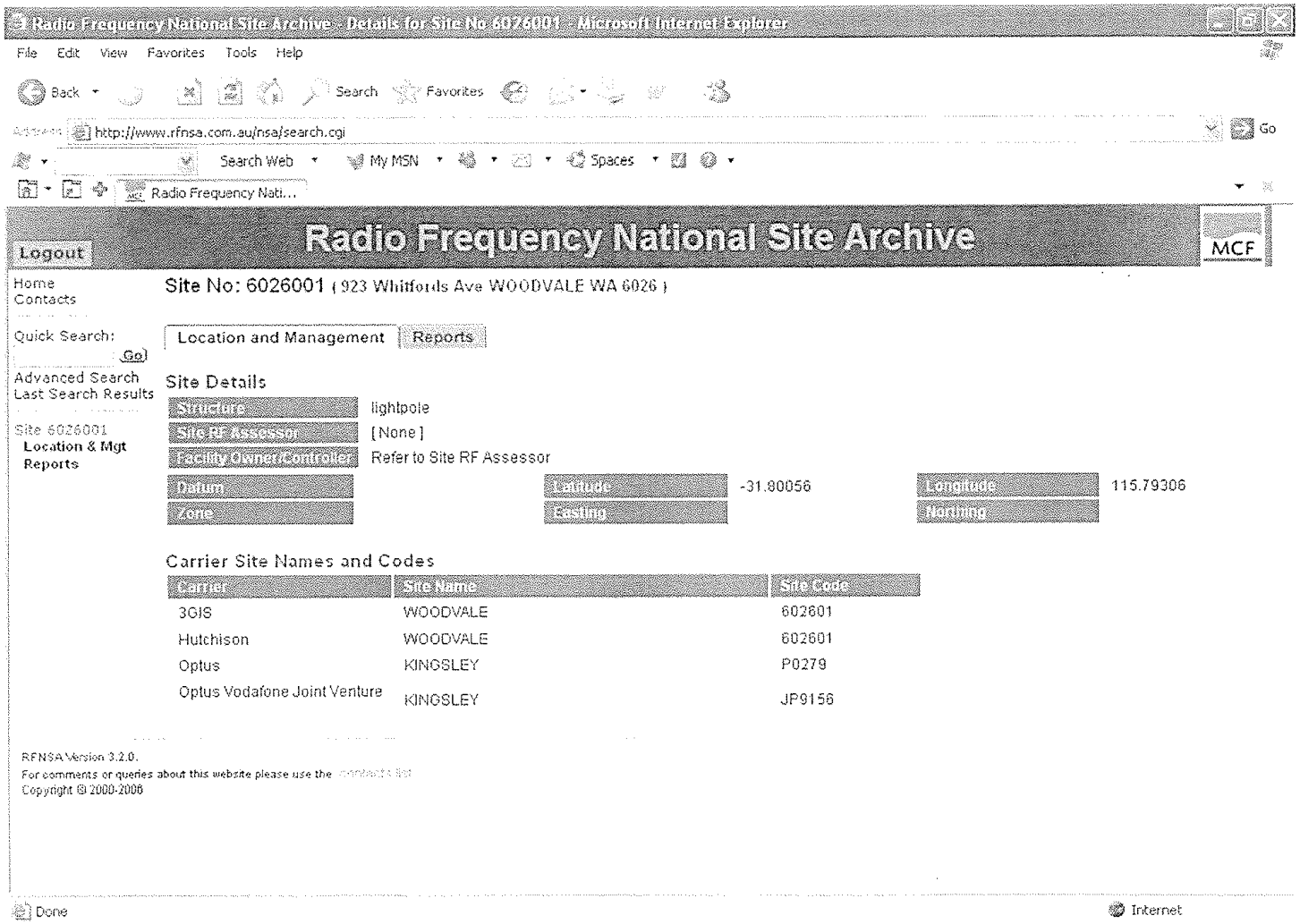
You will note that due to the continual upgrading programmes being carried out by all Carriers, equipment and EME documentation is updated on the NSA and confirmed on a regular basis. When equipment changes on a site do occur (unless undertaken via Maintenance procedures under very strict guidelines), the carrier is obliged to either apply for development approval from the City Council, or if the proposed infrastructure is 'Low Impact', it must undertake the necessary notification and consultation required under the *ACIF Industry Code – Deployment of Mobile Phone Network Infrastructure.* This procedure specifically includes notification and consultation with Council. Hence any significant changes to the facility must be notified to Council at which point the City will be provided with amended EME reports. We recommend that the City refer to the RFNSA for the most up to date information.

The diagrams on the following pages represent the availability of access to various users of the RFNSA. We have also provided a snapshot of the subject site on the RFNSA and some example details of the type of information uploaded to the NSA site. The City has access to the Public Area of the site details including the:

- Site Search Facility
- Site Contact information
- Compliance Certificate
- Environmental EME Report
- Link to ACMA data base

In conclusion, the City of Joondalup has ready access to the Radio Frequency National Site Archive which provides current relevant information on the subject site. The City is also notified, or approached for development approval, if the site infrastructure is to be changed or added to. Further information is available via the carriers on request.


MCF National Site Archive
www.rfnsa.com.au
MCF
MCF NSA
Public Area
- Site Search Facility
- Site Contact information
- Compliance Certificate
- Environmental EME Report
- link to ACA data base
RCSMB
(MCF Radio Comms Site Management Book)
Shared NSA User Area
(secure area for all users)
- STAD Tables
- Data files
- RCSMB
- Common Site & NSA Documents
- Information & Complaints Register (common list)
Secure User Area
(Secure area for individual users)
- ACIF Code Management System
- Site Documents
- Information & Complaints register (secure docs)
NSA Users
Public / Community
Councils
Regulators
Site Owners / Managers
Site RF Assessors
Carriers
Other Radio Operators Transmitter Licensees
NSA Administration
- System development & admin by Telstra
- Independent Hosting Service Provider


Radio Frequency National Site Archive - Details for Site No 6026001 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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http://www.rfnsa.com.au/rnsa/search.cgi
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Contacts
Quick Search:
Go
Advanced Search
Last Search Results
Site 6026001
Location & Mgt
Reports
Site No: 6026001 (923 Whitfords Ave WOODVALE WA 6026)
Location and Management
Reports
Site Details
Site/fibre
lightpole
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Facility Owner/Controller
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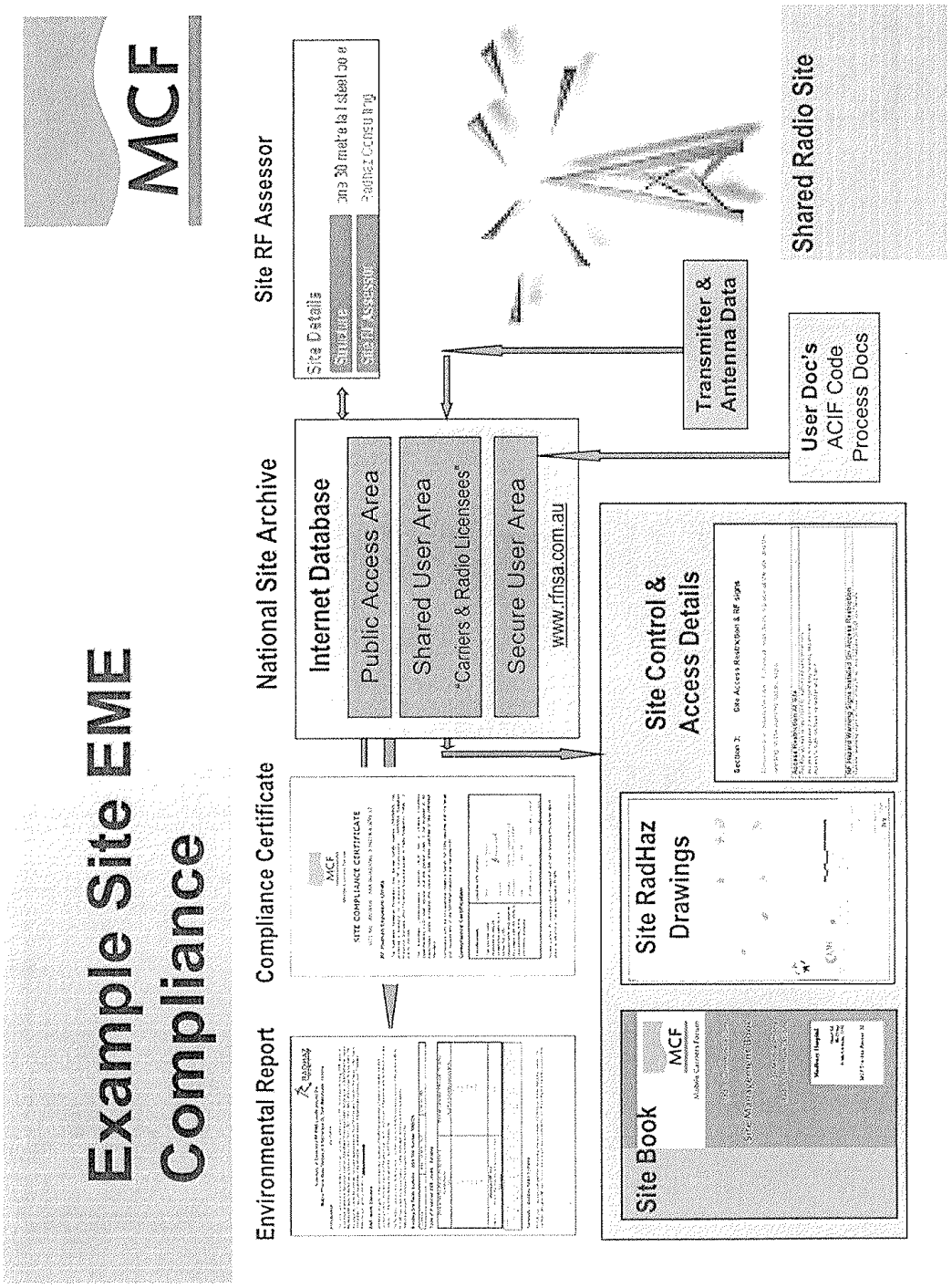
MCF
Example Site EME Compliance
Environmental Report
Compliance Certificate
National Site Archive
Site RF Assessor
Internet Database
Public Access Area
Shared User Area
"Carriers & Radio Licensees"
Secure User Area
www.rfnsa.com.au
Site Details
Site Control & Access Details
Site RadHaz Drawings
Site Book
Transmitter & Antenna Data
User Doc's
ACIF Code
Process Docs
Shared Radio Site

3. We provided in our submission of 19 October 2006 a report which summarises the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels emitted from the antennas (existing and proposed) at the Mobile Phone Base Station. This report is prepared in accordance with the requirements of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) which is an agency of the Commonwealth Department of Health. The Agency has established a Radiation Protection Standard specifying limits for continuous exposure of the general public to RF transmissions at frequencies used by mobile phone base stations.

It was found that for the site at the Woodvale Park Commercial Centre the EME percentage level was calculated to be 0.34%. This is well within acceptable limits, being 294 times below the standard maximum exposure levels. We have again provided this report for your reference (refer Attachment A).

We have stated that without physical changes to the infrastructure, the maximum cumulative radiofrequency RFEME levels emitted from the antennas (existing and proposed) at the Mobile Phone Base Station, being 0.34% of the acceptable limit, will not change. This is because the calculation of this level assumes a worst case scenario being:

- base station transmitters operating at maximum power
- simultaneous telephone calls on all channels
- an unobstructed line of sight view to the antennas

The RFEME levels emitted from the Mobile Phone Base Station will vary between 0% and 0.34% of the acceptable limit depending on the usage of the transmitters by customers and the distance of the user from the Mobile Phone Base Station. The level at various distances from the Mobile Phone Base Station will also decrease due to environmental factors such as obstructions and topography.

Unless a transmitting antenna is swapped for an antenna of a different power rating, or new equipment is added to the site, this maximum level cannot physically be exceeded. If these changes do occur, the carrier is obliged to either apply for development approval from the City Council, or if the proposed infrastructure is 'Low Impact', it must undertake the necessary notification and consultation required under the *ACIF Industry Code – Deployment of Mobile Phone Network Infrastructure*. This procedure specifically includes notification and consultation with Council. Hence any significant changes to the facility must be notified to Council at which point the City will be provided with amended EME reports.

It has been conclusively found that actual measured RFEME levels are well below the predicted maximum cumulative levels due to the factors described above.

Post-installation testing of the existing mobile phone base station at the subject site was undertaken at the request of neighbouring residents. It should be noted that the actual measured EME levels were all more than 3000 times below the standard maximum exposure levels. The measured level within the creche area for Ultimate Bodies (inside the Woodvale Park Commercial Centre) was greater than 100,000 times below the standard. This report, dated May 2005, has previously been provided to Council.

Previous detailed measurement surveys conducted by ARPANSA of 60 mobile phone base sites found conclusively that the estimated levels on the RFEME reports can be over 10 to 1000 times greater than what is physically measured. A summary of this report is attached for your reference (refer Attachment B).

An independent audit of base stations being undertaken by ARPANSA to ensure compliance with Australian Government exposure regulations and to ensure greater transparency in carrier performance. The aim of the program is to audit EME exposures from one telecommunications facility per month for 12 months over 2006/07 - a rolling audit. Depending on community interest, a maximum of 15 sites could be audited.

The overall objective of the program is to demonstrate, via an independent Government assessment, that base stations of particular concern to some sectors of the community, do in fact operate within the safety exposure standards set by the Federal Government.

The audit program will be administered by ARPANSA. As such, in-kind resources will be provided by ARPANSA. The ACMA have also agreed to provide in-kind support as part of their regional site inspection program. Funding commenced in July 2006.

The measured EME emissions should be compared with the ARPANSA (ICNIRP) Standard. Results will be qualified as a % of the Standard, such as those represented in the RFEME report provided to Council for the subject site (i.e. 0.34%). Where relevant, reporting of the findings will also highlight the worst case scenario predictions made in the Environmental Report, as a comparison.

The community will also benefit from receiving the results within context, as such a comparison will be made with the levels from broadcast TV and radio – general environmental surveys of all RF in the area will provide an important environmental context. Each site will also be measured from various locations of interest in the vicinity. The assessor will also consider taking some measurements indoors as well as outdoors, in places of interest around a site eg. a school classroom.

Carriers will be asked for frequency data for the purposes of accuracy; however the time of the audit will be unknown to the carrier in order to ensure spontaneity and transparency.

The sites to be audited will ultimately be selected by the community – as sites of local interest and concern. Depending on resources available, several locations around a site should be measured. Under the proviso that they met the Audit's criteria, site surveys triggered or initiated by the community, as part of a carrier's deployment program, will also be considered for inclusion in the Audit Program. For example, Carrier X may be requested to undertake an EME survey of a site using a NATA accredited lab – these results should be provided to ARPANSA to include in the Audit Program's results on line. Therefore, Should Council request a post-installation EME survey of the subject site, it may be included in the ARPANSA Audit Program.

Results will be reported on the ARPANSA website once the measurements have been finalised, site by site. Members of the general community will be encouraged to access the data. The ARPANSA website, an excellent source of information on previous EME Surveys and with further details of the proposed Audit Program, can be accessed at http://www.arpansa.gov.au

In conclusion:

- Without physical changes to the infrastructure, the maximum cumulative radiofrequency RFEME levels emitted from the antennas (existing and proposed) at the Mobile Phone Base Station will not change. This is because the calculation of this level assumes a worst case scenario which cannot physically be exceeded by the infrastructure on the site.

- If the site infrastructure was to be changed or added to, resulting in a change to the EME levels emitted, the carrier is obliged to either apply for development approval from the City Council, or if the proposed infrastructure is 'Low Impact', it must undertake the necessary notification and consultation required under the *ACIF Industry Code – Deployment of Mobile Phone Network Infrastructure*. This procedure specifically includes notification and consultation with Council.

- It has been conclusively proven by previous detailed measurement surveys conducted by ARPANSA that the estimated levels on the Environmental RFEME reports can be over 10 to 1000 times greater than what is physically measured at operating mobile phone base stations. ARPANSA continues to undertake Base Station Site Audits to demonstrate, via an independent Government assessment, that base stations of particular concern to some sectors of the community, do in fact operate within the safety exposure standards set by the Federal Government.

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

Conference paper

Are measurements of RF EMR necessary around Mobile Phone Base Stations

by Michael Bangay and Stuart Henderson

Abstract

This paper reports the findings from an audit of 60 mobile phone base stations around Australia. Predictions of exposure levels based on antenna power, orientation and gain were performed prior to an extensive measurement program allowing a comparison to be made between measurements and predictions. The methodologies for the measurements and predictions are presented. On average, the measurements showed that the exposure levels at the location of the highest predicted level were 0.021% of the Australian (ICNIRP) limits. By comparison, the predicted levels for the same locations were generally more than 15 times higher than the measured level. Overall, the correlation between measurement and prediction was quite poor although the measured level was always less than the predicted level. The predictions suggest that predicted levels should not be considered to be a surrogate for measurements when exposure levels around base stations are being considered for epidemiological studies. Predictions of RF EMR are only useful for determining worst case exposure levels for compliance requirements.

Introduction

The rapid deployment of mobile telecommunications infrastructure in Australia and the world has prompted public concern over possible health effects from exposure to radiofrequency electromagnetic energy (RF EME) emanating from mobile telephone base station antennas. It is an Australian government requirement that companies wanting to operate and erect base station antennas provide a worst case estimate of the RF EME public exposure to local government authorities before consent for the development can occur. Although the prediction of RF EME is generally regarded as reasonable approach to determine worst case exposure it was thought that a measurement audit of a number of sites was necessary to both verify the predictions and assess the actual exposure levels. In July 2003, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) commissioned a series of RF EME measurements in the vicinity of sixty mobile telephone base stations in five Australian cities in order to determine the exposures of the general public. The sixty sites were generally around base stations located in an urban environment consisting mainly of single storey buildings. The base station antennae were either on towers or multistorey buildings and included co-located base stations. The audit process allowed an up-to-date calculation of the predicted worst case levels as a precursor to the measurement. The prediction allowed the levels of highest exposure to be identified and provided the measurement locations for the audit. As the predictions and the measurements provided data for the exposure levels at the same location a comparison between the measured and predicted was made possible.

Where access permitted, measurements were conducted along the radial from the tower where the predicted maximum was found from modelling. Three nominal points along the radial were chosen, these were: 50m, 200 m and 500m from the tower. In a few cases the desired bearing was not accessible and the measurements were taken along the direction of another sector. Further measurements were made at (or as near as practicable to) the location of the predicted maximum field level, hereafter referred to as the Max location. This position varied over the range of 14m to 480m from the tower, but was generally between 50m and 200m from the tower.

EME Measurements

Measurements of radiated low level RF EME below the measurement threshold of broadband hazard probes are usually performed by using calibrated antennas and a RF spectrum analyser. The electric field strength (dB V / m) can be calculated using the following equation:

$$dB\mu V/m = dB\mu V + AF + CL \quad (1)$$

where $dB\mu V/m$ is field strength in the unit of decibel microvolt per metre,
$dB\mu V$ is the spectrum analyzer reading in decibel microvolt,
CL is cable loss in decibel and AF is the antenna factor.

Field strength measurements over the frequency band 10 kHz to 2.2 GHz may be performed by the use of a range of antennae. For frequencies up to 30 MHz a loop antenna may be used to measure the magnetic field strength. A bi-conical antenna can used to measure electric fields over the range 20 MHz to 220 MHz, while a log-periodic antenna can be used to cover the band 200 MHz to 1.2 GHz. Hybrid antennas have recently become available that cover even wider frequency ranges. Adjustable dipoles are also used to measure electric fields over the range of frequencies used by mobile phone networks. As antennas measure either the electric or magnetic field, a calculation of the equivalent power density needs to be performed. The following formula enables the calculation of equivalent power density (Pd) to be made and assumes a field impedance of 377 ohm:

$$P_d = \frac{E^2}{377} \text{ or } P_d = H^2 \bullet 377 \quad (2)$$

where E is electric field strength in volt per metre and
H is magnetic field strength in amp per metre.

Measurements performed for this study of base stations emissions were made using a dipole antenna (Anritsu model MP651B with extended calibration to cover all required frequencies) and a spectrum analyser (Agilent model E4407B). Electric field levels were recorded with the dipole antenna in three orientations: vertical (X), horizontal perpendicular (Y) and horizontal aligned (Z) to the direction of the base station antenna at a height of 1.5m above the ground. The power density at each location was determined by combining these X, Y and Z polarisation measurements.

Spatial variations of RF EME levels caused by multipath signals make it difficult to accurately quantify the exposure level at any particular survey location. An attempt to quantify the vertical spatial variability was made by making multiple measurements at five positions (the corners and centre) within a one square metre area in a vertical plane perpendicular to the direction of the base station antenna at the Max location. The power density was calculated from X, Y and Z polarisation electric field measurements taken at each of the five points. The standard deviation of the five measurement positions was large, typically around 60% of their mean value. In order to obtain a worst case exposure, the maximum of these five measured values was used in subsequent analysis.

At each site, the X, Y and Z orientation equivalent power densities derived from the field measurements were combined to give the power density for each control (GSM) or pilot channel (CDMA, 3G) frequency present. Once these values were obtained for each site, the cumulative mean for all transmitted signals for each of the sixty sites was determined and plotted in Figure 1. The values in the figure are frequency weighted for the ICNIRP limits and are expressed as fraction of the Australian (ICNIRP) limits.

It should be noted that this survey provides a glimpse of the situation at a particular moment in time. Mobile telecommunications networks are not rigid infrastructure, but rather dynamic systems which evolve and adapt to requirements. Transmitters operate according to demand with transmitted power (apart from control and pilot channels) varying according to adaptive power control. The difficulties this presents for obtaining accurate indication of exposure were largely circumvented by measuring the control or pilot channels and then multiplying by a traffic factor. Measurements previously performed by ARPANSA indicate that the average (24 hr) exposure increase due to raised transmitting power levels resulting from more telephone traffic rarely exceeds 30% above the minimum power levels. Figure 1 includes the traffic factor of 1.3.

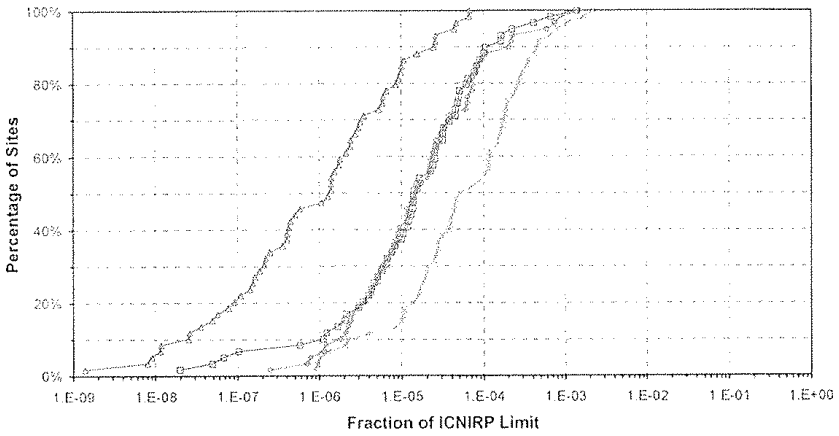

Figure 1 Cumulative frequency distribution showing the percentage of sites as a fraction of the Australian (ICNIRP) limit for the nominal distances from the tower of ○ 50m, □ 200m, △ 500m and × Max.

Predictions

The properties of each base station (such as number of antennas, their type, height, tilt, orientation and transmitter power) were obtained from the Mobile Carriers' Forum National Site Archive database on the Internet.i (The Mobile Carriers' Forum is an industry body comprised of the four carriers operating in Australia.) Typical transmitter power was 47 dBm with antenna gains of about 17 dBi having 120 degree beam width. Using site specific information along with the horizontal and vertical antenna gain characteristics, computer models of the predicted RF EME levels in the vicinity of the mobile phone towers were produced using the Telstra RF Map software packageii. RF Map performs a calculation of far field power density on the basis of the inverse square relationship that exists between power density and distance from the radiating antenna. While an accurate description of the Effective Isotropic Radiated Power (EIRP) radiated toward any point of interest around the antenna is essential for the prediction to be accurate, no transmission losses were taken into account between the transmitter and antenna. EIRP is the product of the linear isotropic gain and antenna power. The following equation forms the basis for RF Map's far field calculation of RF EME:

$$P_d = \frac{GA_p}{4\pi d^2} \qquad (3)$$

where P_d is power density watts per metre squared
G is far field linear gain
A_p is antenna power in watts and
d is separation distance (metre) from the antenna to the point of interest.

Telstra RF Map software with its street mapping facility was used in order to determine the practical location for measurements along the axis where the predicted maximum was found. The software allows exposure levels to be determined for any bearing, height and distance from the antenna. This capability allowed an exposure prediction to be made for the same location where the measurement was made. While RF Map can build the EME vertical profile at any point around the base station this feature was not used for this study as there were no data available to accurately describe the topography. Consequently, the tower was assumed to stand in a horizontal plane for which the field levels were calculated. In addition, reflections from and attenuation by buildings and other objects in the environment were not included in the model calculations. In all cases the measured values were less than the predicted values (on average by a factor of 0.07). A histogram of the ratio of measured to predicted values at each nominal distance from the tower is shown in Figure 2. An example of an EME plot for a base station is shown below in Figure 3.

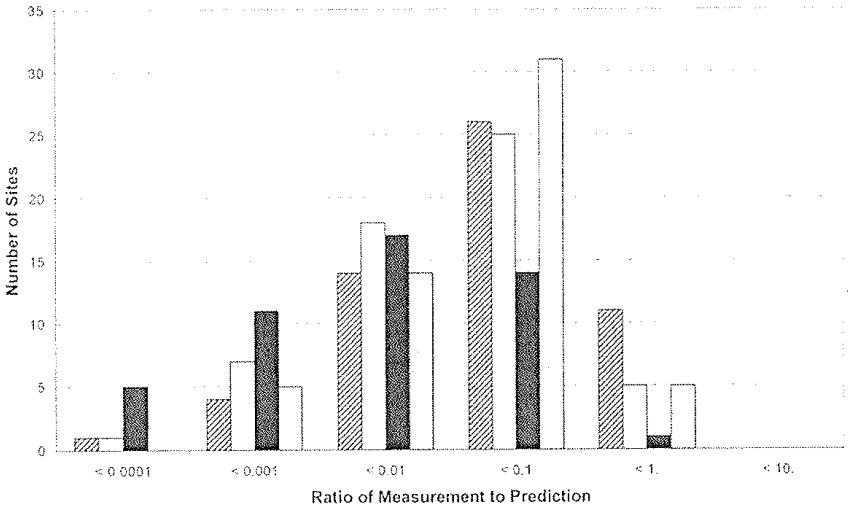

Figure 2 Histogram showing the number of measurement sites where the ratio of the measured to predicted power densities was less than the abscissa value at nominal distances of ▨ 50m, □ 200m, ■ 500m and ☐ Max.

RF-MAP Information : Bulleen 3105001 Voda.tpf

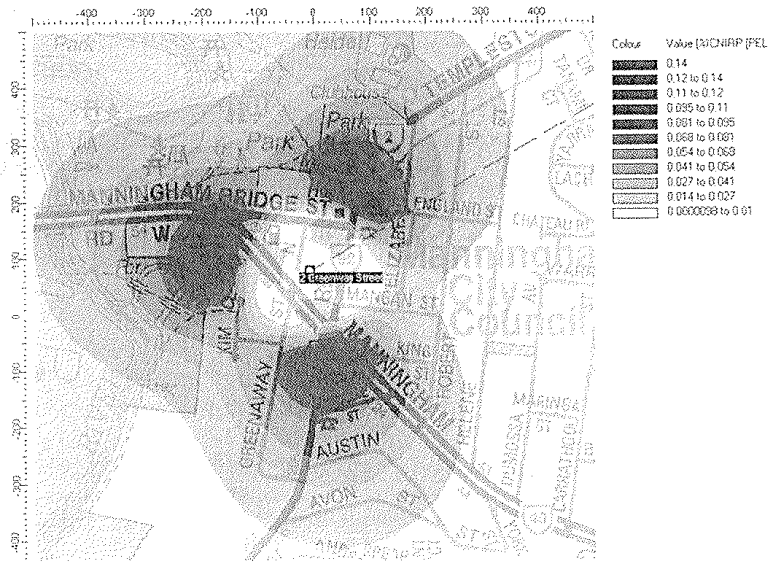

Figure 3 Example EME plot for a base station using RF-Map software.

Discussion

This study showed that predicted levels have a poor correlation to measured levels; the Pearson correlation coefficient was 0.3. This is considered to be a consequence of both path loss resulting from loss of line-of-sight transmission and destructive interference resulting from multipath transmission. The spread of predictions indicate that calculated levels of RF EME do not provide an accurate prediction of exposure. While it is reasonable to conclude that calculated level will always be less than the actual exposure it is only possible to say that most predictions will be between 10 to 1000 times greater than the actual exposure and will have significant variations over measuring volumes as small as 1 to 2 cubic metres.

The overall level of RF EME exposure for people living in the urban environment involves the simultaneous exposure to a large number of radio sources. This study also took the opportunity to measure the other significant radio signals that contribute to public exposure. The sources included broadcast AM radio, TV (VHF, UHF) and FM radio. The measurements which were performed at distances ranging from 50 m to 500 m from the base stations are shown in Figure 4 and can be assumed to be generally representative of what exists in the area. These results show that the level of RF EME weighted for frequency coming from public broadcast services is similar to that from a nearby base station measured on the maximum exposure radial at a distance of 500 m from the base station. While the level of EME from the base station may increase by as much as an order of magnitude or more as the measuring distance is decreased from 500m on the maximum EME radial, it is reasonable to assume that off this axis the signal will decrease to some extent. The contribution to the overall RF EME from other sources may be an important consideration for any epidemiology study and will likely present as a confounder.

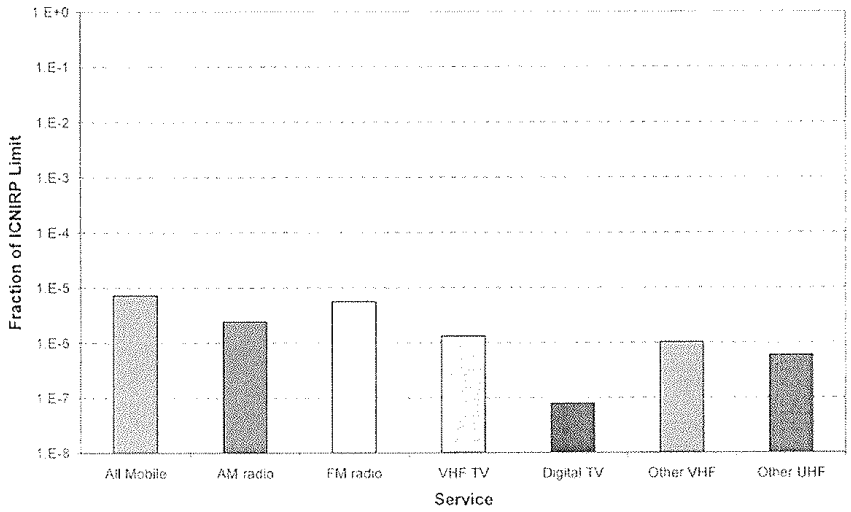

Figure 4 Measured power levels from all mobile services at 500m from the tower and all other services (radio, television, paging, etc.) at the ambient location. All measurements are presented as fractions of the relevant Australian (ICNIRP) limit.

Summary

Only under ideal circumstances can measurements and predictions of RF EME produce similar levels of exposure. However, the real living environment does not generally provide the conditions that give an uninterrupted line-of-sight transmission path devoid of reflecting, re-radiating and absorbing objects. The following conclusions have been derived from the study:

The wide distribution of predictions compared with measured levels indicates that in most situations estimates are of no value when real exposure estimates are needed.
Estimates for safety compliance that are based on worst case EIRP levels and no loss of signal as a consequence of absorption, reflection or multipath effects should be seen as the theoretical maximum and will provide over estimates that mainly range from 10 to more than 10,000 times greater than what would be otherwise measured.
If the level of personal exposure from a base station is needed to be accurately known a personal dosimeter would need to be employed.

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[i]. Mobile Carriers' Forum National Site Archive database website http://radbase.trl.telstra.com.au/ncia/index.cgi

[ii]. Telstra RF Map Software reference

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