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HOW TO ENSURE YOUR NATA ACCREDITED CONTRACTOR IS ABLE TO PROVIDE A NATA ENDORSED REPORT

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INTRODUCTION

Regulations setting limits for human exposure to Electromagnetic Radiation (EMR) from Radio Frequency (RF) transmitters have been progressively introduced by the Australian Communications Authority (ACA). The comprehensive regulations capture all radiocommunications installations, such as rooftop transmitters, broadcast towers and amateur radio stations as well as portable devices such as mobile phones, walkie-talkies and wireless local area networks.

As of July 1st 2004, ACA *licence holders* must comply with the EMR health exposure conditions as set out in the *Radiocommunications Licence Conditions (Apparatus Licence) Determination 2003. (the LCD 2003)*

As of 1st March 2003 *suppliers* of mobile and portable transmitting equipment must comply with the *Radio Communications (Electromagnetic Radiation - Human Exposure) Standard 2003. (the EMR Standard 2003)*

These ACA regulations mandate the EMR exposure limits and the EMR evaluation criteria of the standard published by *the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).*

Federal and State occupational health and safety (OH&S) regulations effectively impose on licensees, site owners, employers and equipment suppliers a duty of care to protect the public and workers. They must ensure that people are not exposed to EMR levels exceeding the limits prescribed by the ARPANSA standard. Mobile and portable transmitters, including consumer devices, must comply before they can be legally sold. Records that demonstrate compliance must be held and be made available for regulator audits. Failure to comply may result in loss of ACA licence, severe fines, banning of sales or recall of products. Other penalties under Federal or State OH&S regulations could also apply.

Demonstrating compliance with the ARPANSA standard is therefore of paramount importance to Radcom licensees and to suppliers of RF transmitting consumer devices. The proliferation of RF and microwave transmitters means that measurement surveys and assessments can be complex, requiring 'fit for purpose' instrumentation and highly specialised measurement and mathematical computational skills. While the regulations allow non-accredited self assessment, a NATA endorsed assessment report gives the highest confidence in the validity of the results. The NATA report is generally accepted as final by the ACA if compliance is called into question, and may be used as the basis for a due diligence defence in the event of legal action. It is therefore important to contract EMR assessors that have the ***relevant*** NATA accreditation.

NATA REQUIREMENTS FOR ACCREDITATION OF FACILITIES

A cornerstone of NATA accreditation is its use of technical experts to assess the technical competence of the personnel and the facility. NATA accredits test facilities to the requirements of ISO 17025 and inspection facilities to ISO 17020. The activities of measurement and inspection bodies are very different and so to are the NATA accreditation requirements.

It is very important to note that NATA does not accredit software because software is only considered to be a tool.

NATA EMR Measurement Facilities

EMR test facilities carry out specific physical tests and measurements and have a defined scope of measurement capability against specific EMR standards. Test facilities are thoroughly evaluated against the requirements of **ISO/Guide 17025**. NATA accreditation ensures that the facility meets internationally recognised standards for good laboratory practice, the availability of the necessary facilities and resources, adequate fit for purpose instrumentation, and rigorously assessed technical competency of the key personnel. The facility must also have an appropriate quality management system which is equivalent to ISO9002. To ensure the integrity of measurements, NATA demands full calibration traceability of measurement equipment to the national standards and the actual measurement uncertainty must be declared. NATA laboratories must also perform on-going proficiency tests in their field of accreditation and they are continually audited and re-assessed. The accreditation may be suspended or cancelled if certain deficiencies are identified.

NATA Inspection Facilities- Electromagnetic Field (EMF) Modelling

NATA Inspection accreditation is based on the internationally recognized and accepted standard *ISO/IEC 17020*. Inspection accreditation is available to independent third party facilities as well as in-house facilities. A process of peer assessment where independent technical experts assess the facility against a specific scope of activities is employed. It uses the same criteria used for test facilities except that the measurement related aspects are replaced with engineering calculations. The assessment process challenges the system for management of information, detailed review of reports, personnel's understanding of EMR, the assumptions of the ARPANSA protocol and the quality system. Validation of the engineering calculations and the prediction software are also key assessment criteria.

Independence Criteria

Inspection facilities are accredited by NATA as Type A, B or C. Type A facilities are independent third party facilities whereas Type B and C are "in-house" facilities that may have a conflict of interest with your business. The independence status can be checked on the conditions of accreditation to ensure that the NATA facility does not have a conflict of interest when performing your assessment.

NATA SCOPES AND EMR ASSESSMENTS

EMR compliance is established if the ***basic restrictions*** for exposure to EMR are satisfied in accordance with the ARPANSA standard. The ***basic restrictions*** are given as limits for the maximum specific absorption rate (***SAR***) of RF energy per unit mass of human tissue (***Watts/kg***) for whole body and partial body exposure. SAR measurements are inherently complex and difficult to perform, so the SAR limits are also given in terms ***Reference Levels*** which are practical to measure. They are expressed in the more user friendly terms of ***power density*** or ***field strength***. Compliance is achieved when the ARPANSA reference levels are not exceeded. Reference Level measurements are directly measured, usually with conventional EMR meters that are calibrated to read ***electric field*** (***E-Field***) in units of Volt/metre (***V/m***) and ***magnetic field*** (***H-Field***) in units of Amps/metre (***A/m***) or *power density* (***Pd***) in units of Watts/square metre (***W/m²***). (For some cases, ***limb currents*** or ***contact currents*** must be measured but these will not be discussed here.)

The subject of EMR compliance is therefore very diverse and a variety of approaches can be taken. The four most common ways to assess for compliance with the ARPANSA standard will be discussed.

1. Establish that the device meets the non-evaluation criteria (power versus distance threshold) per Schedule 5 of the ARPANSA standard.
2. Specific Absorption Rate (SAR) measurements.
3. Reference Level measurements incorporating one or more of the following;
    a. E-field
    b. H-field
    c. Power Density
    d. Limb/contact currents
4. Modelling/predictions involving manual or software engineering calculations.

Determine applicable EMR limits from ARPANSA Standard.

Firstly, you must determine the specific assessment criteria required by the ARPANSA standard. The cumulative exposure from all nearby transmitters on the site must be assessed against the ARPANSA limits. Determine the frequency of each transmitter on your site, including all those belonging to third parties. If the site is exposed to radar or similar transmissions, then a specialist assessment is required.

Check that the accreditation scope of the NATA facility includes all transmit frequencies at your site and those in nearby sites.

This is important because some NATA facilities have instruments or software that can assess over a wide frequency range, however, the actual NATA scope may be limited to telecoms mobile phone carrier frequencies. If the assessed site has low frequency transmitting antennas, or transmit frequencies outside the NATA scope of your proposed contractor, then that contractor must not issue a NATA endorsed report for the cumulative EMR at that site. If the site has EMR from radar transmitters (eg. Airport/ship environment) then the NATA facility must be accredited for *"radar and similar pulsed sources".*

Reference Level Measurements

Determine the applicable Reference Level limit. i.e. Power density, (***Pd***) electric (***E***) or magnetic (***H***) field strength.

E-Field and H-Field Measurement

The ARPANSA reference levels below 10 MHz are given as ***E-field*** and ***H-field***. For frequencies above 10 MHz, ***E, H*** and ***Pd*** reference levels are given. If the assessment includes transmitters below 10 MHz, then clearly, the NATA scope must include both *E* and *H fields* at the appropriate frequencies. For example, a NATA facility must not perform a NATA assessment of a site that has AM or HF band broadcast antennas unless the NATA scope includes both E and H field measurements at the relevant frequencies. The scope of some NATA facilities is limited to broadband *E–field*, sometimes over a narrow frequency range. When selecting a facility, ensure that the scope of the NATA facility is adequate and that you will receive a NATA endorsed report.

Power Density Measurement Above 10 MHz

EMR professionals will often refer to ***near field*** or ***far field*** measurements. The *ACA LCD 2003* defines *far field* as follows:

***"far field**, of an antenna, means the region at distances from the antenna greater than the larger of:*

(a) $2D^2/\lambda$ *; and*
(b) 0.5λ *;*

where:

λ *is the wavelength of the RF field.*
D *is the maximum lineal dimension of the antenna."*

The *far field* breakpoint is dependent on the wavelength (or frequency) and the mechanical parameters associated with each antenna. Typical *far field* distances for various antennas are shown on the table below. EMR meters measure the *E-field* or *H-field* component of the electromagnetic wave. If the survey point is in the *far field*, the free space impedance (**Zo**) is known to be constant at *377 ohms* hence the survey meter may be calibrated to indicate power (flux) density by using the relationship $Pd = E^2 \div Zo$ or $Pd = H^2 \times Zo$.

When a transmitter operates at greater than 10 MHz, and the survey point is in the *far field* then only one of the reference levels (*E-field*, *H-field* or *Power density*) needs to be measured or calculated to show compliance. When the survey point is in the *near field* and power density needs to be assessed, both *E* and *H fields* must be measured to show compliance. *Near field* measurements are therefore more complex and require two different EMR probes. The assessment methodology and the calibration of the *E-field* and *H-field* EMR meter must cover the entire frequency range of all transmitters at this site, and the **NATA scope** must include both *E-field* and *H-field* measurements.

When the NATA scope does not include ***near field*** measurements, a very conservative estimation of the ***Power Density*** is derived based on the ***E-field*** as measured in the ***near field*** of an antenna. This method results in a greatly overstated ***Power Density*** and results in unacceptably large exclusion zones. While this may not be a problem for the top of a tower, it can have a major impact on some sites such as rooftops, by creating un-necessary or impractical restrictions on worker access to the site.

(please turn to next page for chart)

Examples of Far Field Distances for Various Antennas

Transmitter	Frequency (MHz)	Antenna Size (metres)	Far Field Distance (metres)	
			$2D^2/\lambda$	0.5λ
AM broadcast station	0.774	100	51.6	190
27 MHz Whip	27	1.5	0.5	5.5
FM Broadcast Array	108	4	12	1.4
UHF 480 MHz Co-linear	480	1.2	4.6	0.31
GSM 900 Antenna	900	2.5	38	0.17
GSM 1800 Antenna	1800	2.5	75	0.08
3G Antenna	2100	2.5	88	0.07
2.4GHz WLAN	2400	0.03	0.014	0.06
5.8GHz WLAN	5800	0.03	0.035	0.03
Airport Radar	3000	3	180	0.05
Small Microwave Dish	30000	0.6	72	0.005
Satellite Uplink Dish	12000	5	2000	0.013

The larger of the two numbers in each of the *Far Field Distance* columns in the table above is the closest distance to the antenna where compliance can be based on the measurement of *E-field* alone. For closer distances, both *E* and *H-Field* must be measured, otherwise, the power density will be overstated. Using an EMR contractor whose scope does not include both *E* and *H near field* measurements, may result in unnecessary and onerous hazard restrictions for access to your site.

SAR Measurements

When the transmitting antenna is close proximity to the human body, the survey points are in the *extreme near field* and it is not possible to measure the reference levels because of the complex interaction between the RF source and the body. SAR measurements are used to determine the actual SAR (rate of absorption of RF energy by the body) caused by the transmitter. The ARPANSA standard specifies SAR limits and criteria for cases when SAR measurements must be performed. Generally, when a device operates within 20cm of any part of the human body, compliance can only be determined by means of SAR measurements. SAR compliance measurements involve sophisticated test equipment and complex procedures, and are usually performed on hand held or body worn devices, or apparatus/antennas operated in close proximity to people.

The NATA scope must include SAR measurements for appropriate frequency range and the appropriate SAR measurement standard. Current regulations do not allow the use of EMF modelling to prove compliance with the SAR limits. More information on SAR measurements can be found at www.emctech.com.au

Use of NATA Logo

NATA has strict rules for the use of the NATA logo in advertising and in endorsing reports however, it is a case of "buyer beware" before engaging a NATA contractor. The NATA logo may only be used on documents and reports where the use of the NATA logo is consistent with the actual scope of accreditation and it is not misleading in any way.

Choosing a NATA Contractor

The assessment of a communications site will vary considerably and a variety of approaches can be taken. The risk is minimized and the highest confidence is achieved when a NATA accredited assessment is performed. Choosing a NATA rated service provider, can be fraught with risks because NATA laboratories are not all the same. Many NATA assessment facilities have very recent or partial accreditation which may not be specific to the EMR task in hand or may not cover the complete scope of the work requirement.

NATA publishes a list of NATA accredited EMR assessment facilities however they have widely varying scopes and choosing one with the appropriate scope that meets specific assessment requirements, is not an easy task. Unless the scope of the NATA listed facility specifically includes the actual measurements or predictions required by your project, then the NATA rules prohibit that facility from issuing a NATA endorsed report. The NATA logo or reference to NATA must not be used on an assessment report involving measurements or predictions that are not within the actual scope of the NATA facility. Similarly software generated reports can only use the NATA Logo where the results and inputs are appropriate.

Therefore, organisations without specific technical knowledge, will need to exercise caution in selecting a NATA contractor or purchasing software products designed to generate so-called 'NATA reports'. By asking the NATA facility some pertinent questions, the appropriate response should be solicited and hopefully, a NATA endorsed report should result.

QUESTIONS TO ASK THE EMR FACILITY

1. **Are you a NATA accredited facility for EMR measurements?**
2. **Are you a NATA accredited Inspection Facility for EMR predictions?**
3. **What is the Scope of the NATA accreditation(s)**
4. **Does the scope of accreditation cover the complete standard? ie. SAR, Reference Levels (E, H and Power Density)**
5. **Does your accreditation scope cover my specific task ?**
6. **Are there limitations on your deliverables ?**
7. **Will I receive an unconditional NATA endorsed report?**
8. **Is the testing subcontracted to another facility?**
9. **Will the report you deliver meet ACA and OH&S due diligence requirements?**
10. **In relation to communications sites, does your report cover the ARPANSA Standard requirements or do you only provide an ARPANSA EME ENVIRONMENTAL report?**

CONCLUSION

The use of non-NATA accredited assessments may expose you to unnecessary risks. A NATA endorsed report supplied by an appropriately accredited contractor is the lowest risk approach to EMR compliance and will reduce your liability as long as the contractor is accredited for the whole of the specific task and is an independent third party.

Independence of the assessment is assured by choosing a NATA measurement facility that is accredited as a public testing service or by choosing a Type A Inspection Facility that is accredited for EMR predictions.

Choosing a NATA facility that has a wide scope of accreditations for both Measurement and Prediction (modelling) assessments will ensure that the most appropriate and cost effective compliance assessment is performed. In the event of a dispute, safe access boundaries determined by direct measurements will always take precedence over those based on predicted levels.

When the compliance of a site is called into question or in the event of a dispute, NATA reports are accepted by the ACA and other regulatory bodies as final.

An initial NATA report can also avoid duplicate costs where there are safety or interference issues with a communications site.

Details of the NATA accreditation of EMC Technologies are set out on www.emctech.com.au and on the NATA website **www.nata.asn.au**
This article is intended as a general guide only. For more details see the NATA website **www.nata.asn.au** or call the Alliance on 02 6242 0209.

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