CLIENT

<table>
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<tr>
<th>Company Name:</th>
<th>ABC International</th>
</tr>
</thead>
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<tr>
<td>Contact:</td>
<td>Domenic Friguglietti</td>
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DOCUMENT REVISION

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<tr>
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<td>R1</td>
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KORDIA™ CONTACTS

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<tr>
<td>Name:</td>
<td>Phil Towers</td>
<td>Dion Cunningham</td>
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</tbody>
</table>

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1 EXECUTIVE SUMMARY

Kordia was contracted by ABC International to develop an Environmental Management Plan (EMP) for the RNK Phnom Penh AM transmission site.

The aim of the EMP was to provide RNK with:

- Practical and achievable strategies within the Cambodian context for the effective social and physical environmental management of RNK’s transmission facility;
- Methods to gather baseline data facility;
- An integrated plan for comprehensive monitoring and control of impacts, including but not limited to any decisions to change the base power / radiation pattern, modifications to existing facilities and cross-border interference as a result of increases to power levels facility;
- A means to demonstrate to the Cambodian community evidence that the environmental management of the transmission site is acceptable facility; and
- Recommendations to facilitate achievement of self-regulation and integration of environmental management issues into RNK planning and operations facility.

Each aim identified above has been fully addressed in this report and are summarised below.

- The recommended strategy for the EMP has been detailed in section 4 of this report. It is recommended that the ARPANSA RPS3 standard is followed for ensuring the safety of persons exposed to radiofrequency (RF) electromagnetic fields. It is further recommended that the IEC 61000 series of international standards are followed for EMI related issues.

- Baseline data was collected during site audits in December 2008 and is detailed in section 5.2 of this report. There were a number of deficiencies relating to the RF safety compliance of the site, and recommendations for correction are detailed in section 6.1 of this report. Deficiencies identified were:
  - Occupational access restrictions;
  - General Public access restrictions;
  - RF safety signage;
  - RF safety documentation.

- Baseline environmental EME measurements were taken at locations outside the transmission site boundary fence and are detailed in section 5.3 of this report. The results of these measurements indicate that the maximum RF exposure at areas readily accessible to the general public is less then 5% of the ARPANSA RPS3 standard.

- A separate summary report has been attached as Appendix B to allow ABC/RNK to provide the environmental EME measurement results to any interested parties.

- Section 6 of this report recommends a number of corrective actions that are required, and provides guidance and a general framework for an ongoing environmental management plan to be implemented, thus ensuring the effective social and physical environmental management of RNK’s transmission facility. Ongoing support from ABC International will be required to ensure that this is implemented satisfactorily.
2 GLOSSARY

2.1 TERMS AND DEFINITIONS

**Antenna**: A device that serves as a transducer between a guided wave (e.g. coaxial cable) and a free space wave, or vice versa. It can be used to emit or receive a radio signal.

**Assessment**: The determination of compliance with the public or occupational limits of the ARPANSA RPS3 Standard (refer definition below for public and occupational limits).

**Basic Restriction**: The mandatory limiting values for human RF exposure expressed in metrics that closely match the biophysical interaction mechanisms of the known adverse health effects. Depending on the frequency of exposure, the metrics used to specify basic restrictions are: current density ($J$), specific absorption rate (SAR), incident power flux density ($S_{inc}$), and specific absorption (SA).

**Compliance**: Conformity with the relevant requirements of the ARPANSA RPS3 Standard.

**Contact current**: The rms magnitude ($I_c$) of RF current flowing through the wrist when making fingertip contact with an RF energised surface. It is expressed in units of mA.

**Current probe**: A clamp-on ‘loop’ current transformer for measuring current through the ankle or wrist.

**Decibel (dB)**: A logarithmic unit of measurement that expresses the power magnitude of an RF exposure quantity relative to a specified level. Since it expresses a ratio of two (same unit) quantities, it is a dimensionless unit.

**Electric field strength**: The rms magnitude ($E$) of the electric field vector ($E$) expressed in units of V/m.

**Electromagnetic field**: A time and space varying field associated with electric and magnetic forces on electric charges as described by Maxwell’s equations. It can be characterised at any instant by electric ($E$) and magnetic ($H$) field vectors.

**Equivalent plane wave power flux density ($S_{eq}$)**: An expression of electric or magnetic field strength in the units of power flux density (W/m²) assuming plane wave conditions.

**Evaluation**: Determination of RF exposure levels by measurement or calculation.

**General Public limits**: The basic restrictions or reference levels as defined in the ARPANSA RPS3 Standard.

**General Public exclusion zone**: An area where RF exposures have been assessed to exceed the General Public limits, but not the Occupational limits.

**Limb current**: The rms magnitude ($I_L$) of RF current flowing in a wrist or ankle that has been induced by an RF exposure. It is expressed in units of mA.

**Magnetic field strength**: The rms magnitude ($H$) of the magnetic field vector ($H$) expressed in units of A/m.

**Occupational limits**: The basic restrictions or reference levels as defined in the ARPANSA RPS3 Standard.

**Occupational exclusion zone**: An area where RF exposures have been assessed to exceed the Occupational limits.
Radiofrequency (RF): A frequency of electromagnetic field oscillations that is useful for radio transmission and extends between 3 kHz and 300 GHz.

Reference levels: Practical exposure levels derived from the basic restrictions that may be used as a simpler, but more conservative, alternative approach for determining compliance with the basic restrictions. Only when the reference level is exceeded should a determination of the basic restrictions be made, since exceeding the reference level does not necessarily mean that the basic restriction has been exceeded.

RF Exposure: The subjection of a person to ambient RF and/or contact with RF energised conductors. RF exposure induces electric currents and electric fields inside a person; these are limited by the basic restrictions of the ARPANSA RPS3 Standard.

RF hazard meter: An RF survey instrument for measuring ambient electric or magnetic field strengths.

RF personal monitor: An RF monitoring device carried on a person that is designed to alert the user when ambient E or H field exposures exceed the corresponding reference levels.

RF worker: A person who:

- is aged 16 years or older, AND;
- is RF exposed as a consequence of paid or volunteer work duties, AND;
- is subject to a properly constructed RF safety program, AND;
- is trained in safe RF work practices, AND;
- has been medically assessed for fitness to work at RF exposures up to the occupational limits.

2.2 ACRONYMS AND SYMBOLS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARPANSA</td>
<td>Australian Radiation and Nuclear Safety Agency</td>
</tr>
<tr>
<td>E</td>
<td>Electric field strength (see definition)</td>
</tr>
<tr>
<td>EME</td>
<td>Electromagnetic energy in relation to effects on human health</td>
</tr>
<tr>
<td>EMF</td>
<td>Electromagnetic fields (see definition)</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic interference in relation to effects to other devices</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>EMR</td>
<td>Electromagnetic radiation in relation to effects on human health.</td>
</tr>
<tr>
<td>H</td>
<td>Magnetic field strength (see definition)</td>
</tr>
<tr>
<td>HF</td>
<td>High Frequency – 3 MHz to 30 MHz</td>
</tr>
<tr>
<td>ICNIRP</td>
<td>International Commission for Non-Ionising Radiation Protection</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IC</td>
<td>Contact current (see definition)</td>
</tr>
<tr>
<td>IL</td>
<td>Limb current (see definition)</td>
</tr>
<tr>
<td>MF</td>
<td>Medium Frequency – 300 kHz to 3 MHz</td>
</tr>
<tr>
<td>OH&amp;S</td>
<td>Occupational health and safety</td>
</tr>
<tr>
<td>RF</td>
<td>Radiofrequency (see definition)</td>
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<td>RFHCD</td>
<td>RF hazard control document</td>
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<tr>
<td>rms</td>
<td>Root mean square (see definition)</td>
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<tr>
<td>S_eq</td>
<td>Equivalent plane wave power flux density (see definition)</td>
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<td>UHF</td>
<td>Ultra High Frequency – 300 MHz to 3 GHz</td>
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<tr>
<td>VHF</td>
<td>Very High Frequency – 30 MHz to 300 MHz</td>
</tr>
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<td>WHO</td>
<td>World Health Organisation</td>
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</table>

Commercial in Confidence
3 BACKGROUND

3.1 PROJECT AIM

ABC International issued the following Request for Quotation to Kordia on 22 October 2008. This forms the basis for this report.

The Australian Broadcasting Corporation is currently managing a program of assistance with Radio National of Kampuchea that is funded by AusAID. The Cambodia Radio Development Assistance Project (CRDAP) introduced a talk-back program to enable broad based participation by remote and rural communities. The CRDAP is undergoing a transition and the level of development support is being expanded across RNK’s entire operation. Apart from focusing on content development, the successor project, to be called the Demand for Good Governance initiative (DFGG) will include the upgrade and repair of RNK transmission facilities in Phnom Penh. The successor project will receive funding from the World Bank and AusAID. The ABC will take on the role of project manager for the DFGG.

As part of the preparation for the DFGG initiative, the ABC commissioned Kordia Solutions to conduct an Electro Magnetic Radiation survey and study into possible engineering solutions to extend the coverage of the Radio National of Kampuchea’s AM transmission facility in Phnom Penh (see attachment 1 & 2). As a result of this work and requirements to satisfy donor funding requirements, there is a need to commission an Environment Management Plan (EMP) for RNK’s Phnom Penh transmission site.

The aim of the EMP will be to equip RNK with:

- Practical and achievable strategies within the Cambodian context for the effective social and physical environmental management of RNK’s transmission facility;
- Methods to gather baseline data facility;
- An integrated plan for comprehensive monitoring and control of impacts, including but not limited to any decisions to change the base power / radiation pattern, modifications to existing facilities and cross-border interference as a result of increases to power levels facility;
- A means to demonstrate to the Cambodian community evidence that the environmental management of the transmission site is acceptable facility; and
- Recommendations to facilitate achievement of self-regulation and integration of environmental management issues into RNK planning and operations facility.

Recommendations from the recent transmission survey work has resulted RNK in agreeing to improve safety at the Phnom Penh transmission site, which should also be taken into account in the preparation of the EMP (see attachment 3).

List of relevant Attachments:
Attachment 1 - EMR Survey – Kordia Solutions
Attachment 2 – AM Expansion Report – Kordia Solutions
Attachment 3 – Letter from Tan Yan, Director General Radio National of Kampuchea
Attachment 4 – Transmitter Survey ARFC
Attachment 5 – ABC General Terms and Conditions
3.2 PROJECT SCOPE

Kordia’s understanding of “Environmental” in the context of this plan and project primarily relates to the main RNK transmission facility in Phnom Penh, in regard to;

- Radio Frequency Electro Magnetic Emission (RF EME) related issues in relation to impact on human health, and
- Electro Magnetic Inference (EMI) to other electronic devices.

Kordia will travel to Cambodia to conduct a site audit. Specific tasks will include;

- Gather information for the final report in regard to social and physical environmental issues for the transmission facility
- Gather further baseline data on occupational and non occupational RF Safety, EMI and other relevant stakeholder concerns
- Set up environmental EMR measuring reference points outside the Phnom Penh fence line. Note – this can be measured at certain intervals or after transmission changes to measure the impact of EMR levels in General Public areas
- Discuss with stakeholders the coverage improvement plan

Kordia will then develop a plan that incorporates findings from the site audit and investigations from above that provides a plan and road map that;

- Provides best practice, simple guidelines and procedures for site environmental RF Safety management, that take into consideration Cambodian or local site issues that can lead to self regulation
- Recommends further training, if required (on top of EME training already being provided by Kordia)
- Can monitor and control impacts, e.g. change the base power, radiation pattern or other modifications to existing facilities

3.3 APPLICABLE REFERENCE DOCUMENTS

3.3.1 RF EME STANDARDS IN RELATION TO IMPACT ON HUMAN HEALTH

This section entails a review of the key neutral international commissions and organisations providing advice on appropriate measures for ensuring the safety of persons exposed to radiofrequency (RF) electromagnetic fields.

The World Health Organisation summarises all known EME standards that are used by various countries. Based on the WHO website Cambodia does not currently have a published EME standard, and does not align itself to any international guidelines. For further detail, refer to http://www.who.int/docstore/peh-emf/EMFStandards/who-0102/Worldmap5.htm

The most important reference sources for this Environmental Management Plan (EMP) are the international guidelines or standards issued by the International Commission for Non-Ionising Radiation Protection (ICNIRP) and by the standards arm of the Institute for Electrical and Electronic Engineers (IEEE), as these are the common source documents for national RF safety agencies around the world due to their respected international standing. The views of various health agencies that have been prominent in this area, including the World Health Organisation (WHO) have also been considered.

Most country specific standards, with regards to exposure limits, are derived from the ICNIRP Guidelines or the IEEE standards. The ICNIRP 1998 guidelines [1] are the most widely referenced guideline used by countries when developing their standards. Country specific standards incorporate the exposure limits recommended by the above organisations, but also tend to include specific detail regarding personnel protection, reporting, etc. These specific
details vary from country to country, and hence there are very few, if any, standards that are adopted by more than one country.

The Australian Radiation and Nuclear Safety Agency (ARPANSA) is the Australian Government’s expert authority on RF Safety matters and has published a Radiation Protection Standard (RPS) on human exposure to RF fields [2]. The ARPANSA RPS3 standard is based on the recommendations of the 1998 ICNIRP Guidelines.

3.3.2 ELECTROMAGNETIC INTERFERENCE (EMI) STANDARDS

Electromagnetic Immunity can be defined as the ability of electronic equipment to be immune from unwanted electromagnetic signals (interference).

There are a number of international EMI standards available. The most commonly adopted standards are those published by the International Electrotechnical Commission (IEC). The applicable generic EMI standards as published by the IEC are:


These standards call for residential, commercial and light industrial electrical equipment to have a 3 V/m immunity requirement and industrial equipment to have a higher 10 V/m immunity requirement.
4  STRATEGY FOR ENVIRONMENTAL MANAGEMENT AT RNK

This section of the report discusses all of the key topics that must be considered when formulating an Environmental Management Plan (EMP).

For each topic, a specific approach has been recommended and a principal source document has been identified in order for baseline EME/EMI measurements and/or safety requirements to be aligned with.

The two main topics that this environmental management plan refers to are:

- Radio Frequency Electromagnetic Emission (RF EME) related issues in relation to impact on human health;
- Electromagnetic Inference (EMI) to other electronic devices.

The opinions presented in this report have been considered from a viewpoint that is aligned with the following guiding principles for a suitable Environmental Management Plan (EMP):

- Safety;
- Financial Cost of compliance;
- Ease of implementation; and
- Harmonising with International practices.

4.1  STRATEGY FOR RF EME RELATED ISSUES

As indicated on the WHO website, the great majority of developing nations have no specific RF Safety Regulations, and this applies to Cambodia. The recommended approach in order to manage RF Safety related issues in relation to impact on human health is to adopt the ARPANSA RPS3 standard.

Baseline audits and EME measurements have been completed, and ongoing issues and tasks that will need to be addressed have been identified and are detailed later in this document.

4.2  STRATEGY FOR EMI

The recommended approach in order to manage EMI issues is to adopt the international IEC Standards:

- IEC 61000-6-1 “Generic Standards – Immunity for residential, commercial and light-industrial environments”;
- IEC 61000-6-2 “Generic Standards – Immunity for industrial environments”.

Baseline EMI measurements have been completed, and ongoing issues and tasks that will need to be addressed have been identified and are detailed later in this document.
5 BASELINE DATA

5.1 GENERAL
Baseline data was collected primarily using the following methods:

- A site audit of the RF safety compliance against the ARPANSA RPS3 Standard was completed by Kordia in December 2008, using industry based knowledge and a standard checklist.
- Baseline Environmental measurements were performed outside the site boundary to ensure public safety and provide baseline EME and EMI readings.

5.2 SITE AUDIT FINDINGS

5.2.1 BACKGROUND
Section 5 of ARPANSA RPS3 details the required protection measures that should be undertaken, and this forms an integral part of this EMP. It should be noted that some sections of the ARPANSA RPS3 standard are not applicable to the Cambodian environment, and these sections have not been evaluated as part of this EMP.

The Phnom Penh transmission site was audited against Section 5 of the ARPANSA RPS3 standard. Section 5 details the required protection measures that should be undertaken for Occupational and General Public.

5. Protection—occupational and general public exposure

This section prescribes processes so as to ensure that:

(a) no occupationally exposed person, aware user or person in a controlled area, is exposed to RF fields that exceed the occupational exposure limits; and

(b) no member of the general public is exposed to RF fields in excess of the general public limits.

Figure 1 – Extract of Section 5 from ARPANSA RPS3

5.2.2 EME HAZARD IDENTIFICATION
A RF Hazard Control Document (RFHCD) [5] was completed for this site in May 2008 by Kordia. The EME measurements were taken with the RNK service operating at 80 kW and 160 kW transmitter power levels, and scaled up for 200 kW and 500 kW operation. The RFHCD also identified that there were EME signage and access restriction issues around the site, but no elevated EME levels were found outside the boundary fence line. There were a number of deficiencies identified with the site, all of which are addressed in this document.

The Kordia RFHCD was independently evaluated by a third party commissioned by the World Bank. This evaluation concluded that the findings of the Kordia RFHCD could be accepted.

The RFHCD will remain current unless the configuration changes to one that is not listed in the RFHCD, e.g. altering the antenna pattern to become directional. If a new survey is required, then it is recommended that an ISO17025 accredited company should be used.
5.2.3 ACCESS RESTRICTIONS AND SIGNAGE

OCCUPATIONAL ACCESS RESTRICTIONS
There is no access restriction around the transmission mast to prevent access into areas above the occupational reference level. A non-metallic fence complete with locked gate should be installed to restrict access to this area. The area contained should be sufficient to enclose the levels above the occupational limits that were identified in the Kordia RFHCD, giving due consideration to likely future transmitter power levels and/or antenna pattern changes.

GENERAL PUBLIC ACCESS RESTRICTIONS
There is an existing perimeter fence around the transmission site, however the site gates are not always closed, and members of the general public can freely enter the site. This is further compounded by fact that a number of families are living on the site. Further measures are required in order to protect members of the general public.

SIGNAGE REQUIREMENTS
There was no RF safety signage present on the site. Areas where the potential exists for RF exposures to exceed public exposure limits should be clearly marked with appropriate signs. General Public and occupational exclusion zones have been identified, so signage should be installed at the site. Signage requirements, and examples of signage, are detailed in Appendix A.

RF SAFETY DOCUMENTATION
The Kordia RFHCD, completed in June 2008, forms an administrative control that should be kept on site for any person to refer to. This document was not located on site.

The above deficiencies will be addressed in subsequent sections of this document.

5.3 EME/EMI ENVIRONMENTAL MEASUREMENTS

5.3.1 METHODOLOGY
Environmental EME reference locations were set up around the perimeter fence of the site. The site locations were chosen to enable easy identification of the measurement location, and be in areas easily accessible by anyone, i.e. not within buildings where access may be restricted.  

On the day of the measurements the RNK service was confirmed as operating at 80kW on 918 kHz. The measurements were taken using broadband EME measuring equipment that was calibrated over the entire frequency range of transmissions from the site. Both E-field and H-field results were recorded, but it should be noted that the H-field results were below the sensitivity of the H-field probe.

The primary reason for setting up these measurement locations was to record a base line of the EME levels that are present outside the transmission site boundary. This will allow for the levels to be easily remeasured if any transmission parameters change, or if any questions are raised regarding the EME levels that are outside the site boundary fence. The results have been summarised into a separate document, attached as Appendix B to this report. This document has been compiled to enable ABC/RNK to publish these results to the community to show that the transmission site is operating well within recognised exposure limits.

There is no requirement to retest the EMR levels on a regular basis. The only reason to retest the levels would be if any transmission site parameters change, e.g. transmitter power level, frequency, antenna configuration, etc.

Any retesting that is required should only be carried out by ISO17025 accredited companies with appropriate experience and knowledge in EME measurements.
5.3.2 EME MEASUREMENT LOCATIONS

Figure 2: Map indicating measurement locations in the vicinity of the RNK transmission site

Note: There is recent high density building development around the Western and Northern boundaries of the site that is not shown on this satellite image.
### 5.3.3 EME MEASUREMENT RESULTS

#### Measured Environmental EME levels

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<th>GPS Ref:</th>
<th>Az</th>
<th>d</th>
<th>hgt</th>
<th>E field</th>
<th>H field</th>
<th>% of GP limit</th>
<th>% of GP limit</th>
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<tr>
<td>11º 32.001 N</td>
<td>104º 53.190 E</td>
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<td>104º 53.230 E</td>
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<td>15</td>
<td>3.11</td>
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#### Frequency (MHz) Reference level GP limit

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<th>Reference level</th>
<th>GP limit</th>
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<td>E-field – Time Averaged</td>
<td>86.8 V/m</td>
</tr>
<tr>
<td></td>
<td>H-field – Time Averaged</td>
<td>0.794 A/m</td>
</tr>
</tbody>
</table>
6 EMP PLAN

6.1 OUTSTANDING ISSUES AND CORRECTIVE ACTION REQUIRED

6.1.1 OCCUPATIONAL ACCESS RESTRICTIONS

There is no access restriction around the transmission mast to prevent access into areas above the occupational reference level. A non-metallic fence complete with locked gate should be installed to restrict access to this area. The area contained should be sufficient to enclose the levels above the occupational limits that were identified in the Kordia RFHCD, giving due consideration to likely future transmitter power levels and possible antenna pattern changes.

**ACTION POINT:** A fence of 5m from the mast and active components would be required for 200kW omni-directional operation. Initial electronic modelling of the proposed directional mast option (refer to the Kordia AM coverage expansion study [6]) indicates that a fence of 7m from the mast and active components will be required. Further fencing will be required around the reflector ground attachment, and this can only be quantified once the director is installed.

6.1.2 GENERAL PUBLIC ACCESS RESTRICTIONS

There is an existing perimeter fence around the transmission site, however the site gates are not always closed, and members of the general public can freely enter the site. This is further compounded by fact that a number of families are living on the site. Further measures are required in order to protect members of the general public.

**ACTION POINT:** It is recommended that:
- All security personnel are to be informed of the requirement to restrict access as far as practical. This shall include keeping the gates closed as often as possible.
- All visitors, residents and staff attending site should be made familiar with the EME hazards on site, and be made aware of the locations of restricted areas.

6.1.3 SIGNAGE REQUIREMENTS

There was no RF safety signage present on the site. Areas where the potential exists for RF exposures to exceed public exposure limits should be clearly marked with appropriate **notice** signs. General Public and occupational exclusion zone have been identified on site, so additional **caution** and **warning** signage should be installed at the site. Signage requirements, and examples of signage, are detailed in Appendix A.

**ACTION POINT:** It is recommended that:
- **Warning** signs are required on the guy wires, and on the outside of the proposed mast enclosure fence and gate.
- **Caution** signs are required at the general public boundaries identified in the Kordia RFHCD. Due consideration needs to be given to likely future transmitter power levels. For a maximum transmitter power level of 200kW, signs at a radius of 22m from the mast and 1.2m from the guy wires are required. It is recommended to mount the signs on 1.2m posts, at 10m intervals around the mast, and four signs around each guy wire.
- **Notice** signs are required at all access points to the transmission site.

6.1.4 RF SAFETY DOCUMENTATION

The Kordia RFHCD, completed in June 2008, forms an administrative control that should be kept on site for any person to refer to.
**ACTION POINT:** It is recommended that the RFHCD document is translated into Khmer, and then both English and Khmer versions be placed on site in a location that is accessible for all staff and visitors.

### 6.2 ONGOING MANAGEMENT PLAN

The following items form the basis of the ongoing Environmental Management Plan.

#### 6.2.1 OCCUPATIONAL PROTECTION

Section 5.1 of ARPANSA RPS3 standard addresses managing risk for occupational exposure. The significant hazard on the Phnom Penh site is the AM transmission mast. The Kordia RFHCD identified that occupational exposure levels were exceeded around the mast, and on contact with the guy wires. Methods for controlling these hazards are described where applicable in the following sections.

The following sub-sections of the ARPANSA RPS3 document are relevant, and are investigated in more detail.

**ARPANSA Section 5.1.2 – Risk Management Process**

This section looks at identification, assessment, and control of hazards on the site. Kordia staff audited the Phnom Penh transmission site in December 2008, and conducted this risk assessment.

**ARPANSA Section 5.1.3 – Control Prioritization**

This section details how to manage hazards where there is potential for exposure above the Occupational limits. Kordia identified a number of hazards that need to be addressed, and these are documented in the order of the control priority sequence on RPS3.

- a) **Elimination** – It is not practical to eliminate the hazard. To eliminate the hazard would require the service to be turned off, which would prevent the RNK program being transmitted.
- b) **Substitution** – This would require substituting the hazard for a less hazardous item of plant. Again, this is not practical to achieve.
- c) **Engineering Controls** – This includes redesign of equipment or work processes and/or isolation of the hazard. It has been identified that there were no barriers around the main mast to prevent personnel accessing areas that are above the occupational exposure limits. It is highly recommended that a non-metallic fence, locked gate and suitable signage be installed around the mast to restrict access to this area. The distance from the mast should be sufficient to contain the levels above the occupational limits that were identified in the Kordia RFHCD, with consideration given to a potential antenna pattern change. This is already addressed in further detail in Section 6.1.1.
- d) **Administrative Controls** – This includes the use of signage, down-powering or outages, etc. The Kordia RFHCD documents RF safety procedures for the site. This is already addressed in further detail in Section 6.1.3.
- e) **Personal Protective Equipment (PPE)** – There is not suitable PPE available for use on AM transmission sites.
ARPANSA Section 5.1.4 – Training and supervision

All relevant RNK Personnel have recently undergone EME awareness and EME measurement training courses in November 2008. This training included interpretation of the RFHCD that was published for the site. The staff that successfully completed the courses are now appropriately trained.

ARPANSA Section 5.1.7 – Assessment of Reference Levels

Kordia completed a measurement assessment of the site in May 2008. A RFHCD was written and published. The RFHCD is currently being translated into Khmer. Both the English and Khmer RFHCD documents should be placed on site and be made available for anyone to refer to.

6.2.2 GENERAL PUBLIC PROTECTION

Section 5.7 of ARPANSA RPS3 details the measures required for the protection of members of the general public who may be exposed to RF fields due to their proximity to antennas or other RF sources. Kordia identified a number of issues that need to be addressed, and these are documented in the order of the ARPANSA standard.

a) Determination of boundaries – RPS3 requires that the determination of boundaries where general public exposure limit levels have been exceeded. This was undertaken and documented in the Kordia RFHCD. Although the existing 200kW transmitter is only operating at 80kW, boundaries were determined for 80kW, 160kW 200kW and 500kW omni-directional antenna operation. Environmental EME measurements have also been taken outside the site during this site audit. This has been conducted to document typical EME levels outside the site, and could be used to provide information regarding emissions from the site to the local community if required. Full details are in Section 5.3.

b) Restriction of public access – RPS3 requires that public access is restricted to those areas where general public exposure limits are exceeded. This is done with the perimeter fence around the transmission site. There are issues with the site gates not being closed, and members of the general public entering the site easily. This is further compounded by fact that a number of families of security guards, etc are living on the site. It is recommended that:
   - All security personnel are made aware of the requirement to restrict access as much as practical. This shall include keeping the gates closed as much as possible.
   - All non operational personnel be made familiar with the EME hazards on site, and be made aware where there are restricted areas.

c) Signage – Signage complying with AS 1319 [7] is required. AS1319 details the style of the signage, not what signs are required. Kordia’s interpretation of the specific signage required on site, and examples of signage are attached as Appendix A.

d) Minimising unnecessary RF exposure – If all the previous sections are satisfied, then this section has been sufficiently addressed.
6.2.3 ROUTINE CHECKS
A routine maintenance program should be established to provide routine checks of transmitter base power, site access restrictions and signage.

Although there is no requirement to recheck the EME environmental readings at routine periods, it would be required if the transmission parameters change, i.e. increase in transmitted power above 80 kW, change in antenna pattern, etc.

6.2.4 EMI CONSIDERATIONS
Electromagnetic Immunity can be defined as the ability of electronic equipment to be immune from unwanted electromagnetic signals (interference).

The presence of RF fields can cause electrical equipment to perform with steady, momentary, or intermittent disruption. This is becoming of increasing concern as more electrical devices move to microprocessor designs.

The appropriate standards to reference are the international IEC standard IEC 61000-6-1 "Generic Standards – Immunity for residential, commercial and light-industrial environments", and IEC 61000-6-2 "Generic Standards – Immunity for industrial environments". These standards call for residential, commercial and light industrial electrical equipment to have a 3 V/m immunity requirement and industrial equipment to have a higher 10 V/m immunity requirement.

As the intended use of the development is for residential or commercial, the IEC Immunity standard recommends an immunity of 3 V/m.

There are a few locations outside the boundary fence that are subjected to EME levels above 3 V/m. This may result in some nuisance EMI problems in poor quality electronic goods in the immediate vicinity of the perimeter fence.

6.3 COMMUNITY CONSULTATION
It is recommended that RNK investigate methods of publishing results of the environmental EME measurements. A recommended measurement summary is attached in Appendix B. This could be posted on a website, provided through public consultation, letter drop in the neighbourhood, or even discussed on-air. This could be a good public relations exercise to show that RNK is a responsible broadcaster.
7 REFERENCES

The following references have been used in this report:

1. ICNIRP 1998, 'Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)', *Health Physics*, vol. 74, no. 4, pp. 494-522. This document is available at: [www.icnirp.org/documents/emfgdl.pdf](http://www.icnirp.org/documents/emfgdl.pdf)

2. ARPANSA RP3 “Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3 kHz to 300 GHz (2002)”. This document is available at [www.arpansa.gov.au](http://www.arpansa.gov.au)

3. IEC 61000-6-1 “Electromagnetic compatibility (EMC) - Part 6-1 : Generic Standards – Immunity for residential, commercial and light-industrial environments”

4. IEC 61000-6-2 “Electromagnetic compatibility (EMC) - Part 6-2 : Generic Standards – Immunity for industrial environments”


6. Kordia coverage expansion study report, “Cambodia AM coverage expansion study-R1” dated June 2008

7. AS1319, “Safety signs for the occupational environment”
APPENDIX A – RECOMMENDED RF SAFETY SIGNAGE

TYPE AND NATURE OF RF SAFETY SIGNS

RF safety signs indicate the nature and degree of RF hazard associated with a given fixed RF source or compliance site. The nature of the RF hazard is indicated by a symbol, and the degree of the hazard is indicated by the sign colour and bearing words.

RF safety signs should employ multiple languages where appropriate.

The size of the sign shall be such that it is clearly distinguishable under the appropriate conditions. Reflective materials should be used where possible.

NOTICE SIGN

The purpose of the Notice sign is to make people aware that an RF compliance zone exists beyond that specific point. The sign colours and wording should correspond to that in the figure below (not to scale).

A Notice sign should be posted at all access control points to the compliance site indicating that the area beyond that point is under RF management and to alert persons to the potential for exposures exceeding the public limit.
CAUTION SIGN

The purpose of the Caution sign is to warn people that beyond that specific point or within the demarcated area, RF exposure levels may exceed the public limits. The sign colours and wording should correspond to that in the figure below (not to scale).

If a public exclusion zone exists at a publicly accessible area (i.e. rooftop, AM Radio site), a Caution sign should be posted at the compliance boundary, or edge of the General public exclusion zone, to alert personnel to the possibility of exposures exceeding the public limit.

![Caution Sign Image]

BEYOND THIS POINT RF LEVELS EXCEED THE LIMITS FOR THE PUBLIC

NO MEMBER OF THE PUBLIC SHOULD ENTER THIS AREA WITHOUT APPROPRIATE APPROVAL
The purpose of the Warning sign is to warn people that, beyond that specific point or within the demarcated area, RF exposure levels will exceed the occupational limits. The sign colours and wording should correspond to that in the figure below (not to scale).

If an occupational exclusion zone exists at an accessible area (i.e. rooftop, AM Radio site, support structure), a Warning sign should be posted at the compliance boundary, Occupational Exclusion zone boundary, or access point to alert personnel to the possibility of exposures exceeding the occupational limit.
APPENDIX B – ENVIRONMENTAL EME SUMMARY SHEET

This Appendix provides a summary of the environmental EME readings that were taken. This is designed to be able to be provided to the community, or anyone that expresses concerns over the EME emissions from the sites.
An Environmental Survey of Radiofrequency fields around the RNK AM transmission site.

Background
An environmental survey of radiofrequency (RF) fields was conducted around the RNK AM transmission site located in Phnom Penh in December 2008. Eleven (11) publicly accessible locations were identified, and the RF exposure level from the RNK transmission site was measured and recorded at each location.

The survey was conducted by Kordia under contract to ABC International/RNK. The survey methodology is in accordance with Kordia’s internationally recognised ISO17025 quality accredited RF measurement program.

Results

<table>
<thead>
<tr>
<th>Location (refer to figure 1 for actual locations)</th>
<th>Maximum RF level (% ARPANSA limit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement location 1 (Front entrance gate to site)</td>
<td>0.51</td>
</tr>
<tr>
<td>Measurement location 2 (Road junction, west of site)</td>
<td>0.15</td>
</tr>
<tr>
<td>Measurement location 3 (North of site)</td>
<td>0.12</td>
</tr>
<tr>
<td>Measurement location 4 (North of site)</td>
<td>0.39</td>
</tr>
<tr>
<td>Measurement location 5 (North of site)</td>
<td>0.19</td>
</tr>
<tr>
<td>Measurement location 6 (North of site)</td>
<td>0.10</td>
</tr>
<tr>
<td>Measurement location 7 (West boundary of site)</td>
<td>4.84</td>
</tr>
<tr>
<td>Measurement location 8 (South West corner of site)</td>
<td>2.23</td>
</tr>
<tr>
<td>Measurement location 9 (South of site)</td>
<td>1.18</td>
</tr>
<tr>
<td>Measurement location 10 (South of site)</td>
<td>0.47</td>
</tr>
<tr>
<td>Measurement location 11 (South of site)</td>
<td>0.13</td>
</tr>
</tbody>
</table>

The RF measurements shown above have been averaged over a six minute period to account for variations in modulation of the AM transmission service. The service was operating at 80kW, with peak modulation levels of 105%

These results indicate that the maximum public RF exposures from the RNK transmission site surveyed in this audit are many times below the safe limits determined by the Australian Radiation and Nuclear Safety Agency (ARPANSA). ARPANSA is Australia’s national expert government authority for RF safety (see www.arpansa.gov.au). The safe limits set by ARPANSA are based on recommendations of the ICNIRP 1998 guidelines.

More information about RF Electromagnetic Fields can be obtained from the World Health Organisation (WHO) website at: www.who.int/peh-emf/en/

Dion Cunningham
RF Specialist

Brett Moule
RF Consultant
Figure 1: Map indicating measurement locations in the vicinity of the RNK AM site.

Note: There is recent high density building development around the Western and Northern boundaries of the site that is not shown on this satellite image.