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Session Title: **RF Radiation Safety** by Doug McArthur (VK3UM)

Through out the World many Government Organizations have indicated that they are proposing to implement, or are in the process of implementing mandatory standards of radiation limits pertaining to the Radio Amateur Service. In Australia such standards are scheduled for introduction in February 2003.

Because of the nature of EME (Earth-Moon-Earth) communications, radiated power levels can be high and may, under certain situations, pose a radiation hazard.

This paper provides a method where the accurate prediction of the likely radiation levels can be achieved by the use of software. In the author's opinion, most available software appears not to address the near field radiation characteristics of circular aperture antennae. This aspect may be significant in an EME Station being able to meet radiation limits that may be set by Authorities. This software allows the user to vary all relevant parameters and quickly obtain the necessary Radiation Data pertaining to your EME Station. It will be demonstrated to the audience, from data supplied by conference participants, any such likely hazards or exclusion zones that may be required for safe operation.

The software features include the ability to

- vary the Radiation Limit (not all Administrations propose the same limit).
- select the frequency of operation (50 MHz to 49 GHz).
- choose the transmitter output power and associated feed losses.
- select the transmission mode duty factor and averaging period characteristics.
- Circular aperture calculations for Parabolic reflectors (vary the size and efficiency).
- Rectangular aperture calculations for single and multiple yagi arrays. (vary the single yagi gain and multiple stacking configurations).
- Chose either metric or imperial measurements.

The On Axis Exclusion Zone will be displayed in text (RF.exe) and graphical format (RFGraph.exe) showing both near and far field radiation levels.

In addition the *System Performance Calculator* will simultaneously display both S/N Moon Echo, Sun Y and Sky Temperature to Ground Y factors. Additional variables not given prominence by similar calculators have also been included. These include the ability to vary the following .

- 10.7cm Solar flux.
- Dish mesh characteristics.
- spill over and feed through values.
- Integrated cascaded Amplifier gain / Noise Figures to derive overall System Noise.

as well as the other common variables of frequency, sky temperature, LNA, receiver noise figure, band width and system loss factors. The calculator will provide most accurate data and thus allow the user to define their operational capabilities.

References

Most Administrations around the World are addressing Electro Magnetic Radiation (EMR) issues. This complex, and at times emotional subject, of what is safe or not, has in many countries still to be finalised.

As responsible Amateur Radio Operators, pursuing a highly technical aspect of our hobby in the form of EME, it behoves us to understand the effects of EMR, and respect our obligations to our family and neighbours by preventing any RF radiation exposure above that which is recognised as safe.

A search of the www will reveal a seemingly un-ending volume of material on the subject. Many Country Administrations have direct references to the subject matter. It is there for suggested that you visit your own Administration web site to obtain the relevant information pertaining directly to your own operation.

I have chosen, as further reference material, (a) one of the World's most respected and recognised Reference Body (ICNIRP), (b) an Administration's Standard (ARPNSA) and (c) an Administration's proposed Application of EMR Standards within the Amateur Radio Service (Australian Communication Authority).

- The International Commission on Non-Ionising Radiation Projections. Since the beginnings of INIRC and ICNIRP over 20 years ago, its members have devoted their scientific efforts to providing independent authoritative advice on non-ionising radiation and health. Today this work is carried out, not only by the main Commission, but through the expertise of the members of its four scientific Standing Committees on Epidemiology, Biology, Physics and Engineering and Optical Radiation. More recently ICNIRP has added an ever larger range of specific skills and expertise to its membership through the appointment of Consulting Members. Thus ICNIRP aspires to providing the most authoritative independent expert advice on matters relating to non-ionising radiation and health and to consult widely in formulating and promulgating such advice. ICNIRP is registered under German law as a non-profit making body. Its Secretariat is based in Munich. Many EMR Standards are tied directly to the ICNIRP findings and recommendations. www.icnirp.de
- The Australian Radiation Protection and Nuclear Safety Agency. (ARPNSA) Radiation Protection Standard. Maximum Exposure Levels to Radiofrequency Fields – 3kHz to 300 GHz. www.arpnsa.gov.au. (rps3.pdf 2,141 kB) This document contains an extensive collection of References, Case Histories and Bibliography about the subject as well as the rationale pertaining to the Standard.
- The Australian Communication Authority. Document amateur.pdf May 2002 details the organizations application of EMR to the Amateur Radio Service. www.aca.gov.au.