Amateur Radio Service
RF Safety requirements are about to become part of our Licensing condition.

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As of 1st July 2002 the ACA advised that the proposed implementation date of the Standard will be delayed. The date suggested is now February 2003. Further more it is believed that the Australian Radiation Protection and Nuclear Safety Agency (ARPNSA) may become the new standard. The levels and conditions, although not the precisely the same as those of the previously proposed Australian Standards Association, are for most Amateur Stations most similar. Accordingly this paper should be read with this view in mind and await the final Legislation and conditions applicable when finally announced.

1. Background

1.1 The *Radiocommunications Act 1992* (the Act) allows the ACA to mandate a human exposure standard. Under section 162, the ACA may make standards to protect the health or safety of persons who operate, work on, use or are reasonably likely to be affected by the operation of radiocommunications transmitters or receivers.

1.2 It is proposed that as from February 2003, Amateur Services be required to comply with the public exposure limits to radiofrequency (RF) fields mandated by the Australian Communication Authority (ACA).

1.3 It should be noted that, even when Amateurs are operating in accordance with their licensed power (400 watts PEP or 120 watts Pm), it is possible that they can exceed

the proposed safe radiation limit which will be a mandatory condition and part of the Amateur License. (PEP = Peak Envelope Power. Pm = Power mean or mean Power).

1.4 All transmitter installations will be required to comply with the limits as measured in accordance with the Australian Standard AS 2772.2 - 1988. (Radiofrequency Radiation). This document may be obtained for a fee by down loading the .pdf file from www.standards.com.au. As explained above, AS2772.2 could be replaced with the ARPNSA Radiation Standard www.arpnsa.gov.au. (rps3.pdf 2,141 kB)

2. The Requirement

1.5 The proposed exposure limit for transmitter installations is a cumulative radiation level of *2 watts per square metre* averaged over a period of 6 minutes and is modified by the nature of the form factor of the mode of transmission. The requirement is based upon the effective radiation power of the transmission mode.

1.6 Licensees will be required to block public access to areas where the radiation level from installations surpass this limit.

3. Transmission Mode Form Factor

ACA define the form factor of Transmission Modes commonly used by Amateurs as follows:

Mode	Form Factor	Comment
Conversational SSB	20%	No speech processing
Conversational SSB	50%	Heavy speech processing
Voice FM	100%	
FSK, RTTY or AM	100%	
AFSK SSB	100%	
Conversational CW	40%	
Carrier	100%	As used for tune-up purposes.
Analogue TV	60%	Monochrome or PAL etc.

4. Method of Assessment

4.1 The method suggested by the ACA to determine compliance with the limits for general public human exposure has been presented in their document '*Electromagnetic radiation exposure: assessment against ACA mandated limits Amateur Radio [Edition May 2002]*. This document (amateur.pdf May 2002) may be down loaded (free of charge) from the ACA website at www.aca.gov.au.

4.2 The document provides a 9 step procedure to determine if your Station complies with the ACA standard as follows:

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STEP 1: Determine and record the antenna gain and transmitter output power that is applicable. Note that transmitter power can be specified as either peak envelope (PEP) or mean power. The determination of human exposure levels, and consequently, minimum separation distances, is based on the mean power. Accordingly, where only PEP is known, the power shall be multiplied by the conversion factor (form factor) appropriate to the mode of operation. Table 1 provides form factors for transmission modes commonly used in the amateur service. For example, an SSB transmitter has a power rating of 100W PEP and the form factor from table 1 is 0.2 (no speech processing in use). Therefore the mean power is 20W. An FM transmitter provides 25W output power and form factor is 1, therefore the mean power is 25W.
See also notes 1–3 following.
STEP 2: Consult table 2a or table 2b, as appropriate to the operating frequency band.
STEP 3: Record the minimum separation distance to be observed for each combination of operating band, antenna gain and transmitter power level.
STEP 4: If the station antenna(s) is (are) installed in such a way that the minimum separation distance(s) recorded at step 3 is (are) maintained during all operational periods (that is, the antenna(s) is (are) out of reach and people cannot inadvertently approach closer than the specified separation distance to the antenna(s)), record this fact and the compliance evaluation is completed. It would be convenient to record the details of the evaluation process in the station logbook.
STEP 5: In the event that table 2a or 2b cannot be used (for example, the antenna gain might not be known or the transmitter power level different from that in tables 2a or 2b), consult tables 3 to 12 which provide minimum separation distances for a number of antenna types representative of those used in the amateur service.
STEP 6: Having identified an appropriate antenna type in Step 5, record the minimum separation distance that is applicable to the transmitter power level in use.
STEP 7: If the station antenna(s) is (are) installed in such a way that the minimum separation distance(s) recorded at Step 6 is (are) maintained during all operational periods (that is, the antenna(s) is (are) out of reach and people cannot inadvertently approach closer than the specified separation distance to the antenna(s)), record this fact and the compliance evaluation is completed. It would be convenient to record the details of the evaluation process in the station log book.
STEP 8: In the event that the minimum separation distances recorded at Steps 3 or 6 respectively are not achieved, it will be necessary to undertake an evaluation of compliance in accordance with the procedures defined in the parent publication *Human Exposure to Radiofrequency Electromagnetic Energy Information for licensees or operators of radiocommunications transmitters: Evaluation of compliance with the ACA standard*. The procedures given in this document permit the achievement of a more precise assessment of exposure levels than is given by the “protective” assessment obtained using the pre-calculated tables.
STEP 9: As necessary, implement measures to reduce exposure levels using the methods outlined in the publication *Human Exposure to Radiofrequency Electromagnetic Energy—Information for licensees or operators of radiocommunications transmitters: Evaluation of compliance with the ACA standard.*

NOTES:
1. The tables provide data for power levels and antenna gains that are representative of

those typically used by stations in the amateur service. It is possible to extrapolate or interpolate the data to derive minimum separation distances for other power levels or antenna gain figures. Note that separation distance is proportional to the *square root* of the ratio of the power levels or gains expressed numerically[2]. For example, if operation is on 100 W, multiply the separation distance for 50 W by the square root of two, 1.414. However, it may be easier to simply adopt the separation distance for the nearest higher power level or antenna gain case.

2. The tables are based on transmitter output power and do not include an allowance for feed-line attenuation or other losses. In cases where the feed-line loss is accurately known for each operating band, the power level used for evaluation purposes can be reduced by the feed-line loss. For example, if transmitter output power is 50 W and feed-line loss is 3 dB, the power level used for evaluation should be 25 W.

3. In principle it is also permissible to reduce the power level used for evaluation purposes by the ratio of transmission to reception time in each 6-minute averaging period. Because of the highly variable nature of amateur operations, including the possibility of an extended transmission period, this factor has not been used in the calculation of separation distances. However, should the duty cycle of transmission be known and *always* maintained, multiply the separation distance by the *square root* of the duty cycle. For example, if the station always operates two minutes transmit, two minutes receive, two minutes transmit the worst case duty cycle in six minutes is two thirds. The separation distance would be multiplied by 0.82, the square root of two thirds.

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5. Safe Distances from HF Transmitting Antennae.

The following table provides estimated distances from transmitting antennas necessary to meet [ACA-EMR] power density limits for general public exposure.

Table 2a

Frequency MHz/Band	Antenna Gain (dBi)	Power 10 watts	Power 25 watts	Power 50 watts	Power 120 watts
2(160m)	0	0.28	0.45	0.63	0.99
2(160m)	3	0.41	0.65	0.92	1.42
4(80m)	0	0.41	0.65	0.92	1.42
4(80m)	3	0.57	0.90	1.27	1.97
7(40m)	0	0.54	0.85	1.20	1.86
7(40m)	3	0.76	1.20	1.70	2.63
7(40m)	6	1.04	1.65	2.33	3.62
10(30m)	0	0.63	1.00	1.41	2.19
10(30m)	3	0.89	1.40	1.98	3.07
10(30m)	6	1.27	2.00	2.83	4.38
14(20m)	0	0.63	1.00	1.41	2.19
14(20m)	3	0.89	1.40	1.98	3.07
14(20m)	6	1.27	2.00	2.83	4.38
14(20m)	9	1.77	2.80	3.96	6.13
18(17m)	0	0.63	1.00	1.41	2.19

18(17m)	3	0.89	1.40	1.98	3.07
18(17m)	6	1.27	2.00	2.83	4.38
18(17m)	9	1.77	2.80	3.96	6.13
21(15m)	0	0.63	1.00	1.41	2.19
21(15m)	3	0.89	1.40	1.98	3.07
21(15m)	6	1.27	2.00	2.83	4.38
21(15m)	9	1.77	2.80	3.96	6.13
25(12m)	0	0.63	1.00	1.41	2.19
25(12m)	3	0.89	1.40	1.98	3.07
25(12m)	6	1.27	2.00	2.83	4.38
25(12m)	9	1.77	2.80	3.96	6.13
30(10m)	0	0.63	1.00	1.41	2.19
30(10m)	3	0.89	1.40	1.98	3.07
30(10m)	6	1.27	2.00	2.83	4.38
30(10m)	9	1.77	2.80	3.96	6.13

Note 1. These separation distances apply only in the direction of the main beam/lobe of the antenna. The figures for 0 dBi gain can be applied outside the main lobe, which can be taken as being +/- 45 degrees off bore sight/antenna boom axis for the purpose of compliance.
Note 2. The figures as given by ACA are based on zero transmission loss and conversationa1 carrier mode of transmission. (100% Form Factor)

6. Safe Distances from VHF/UHF Transmitting Antennae.

The following table provides estimated distances from transmitting antennas necessary to meet [ACA-EMR] power density limits for general public exposure.

Table 2b

Frequency (MHz/Band)	Antenna Gain (dBi)	Power 10 watt	Power 25 watt	Power 50 watt	Power 120 watt	Power 400W PEP
50 (6m)	0	0.63	1.00	1.40	2.19	1.78
50 (6m)	3	0.89	1.40	2.00	3.07	2.52
50 (6m)	6	1.27	2.00	2.80	4.38	3.56
50 (6m)	9	1.77	2.80	4.00	6.13	5.03
50 (6m)	12	2.50	3.95	5.60	8.65	7.10
50 (6m)	15	3.54	5.60	7.90	12.27	10.03
144(2m)	0	0.63	1.00	1.4	2.19	1.78
144(2m)	3	0.89	1.40	2.0	3.07	2.52
144(2m)	6	1.27	2.00	2.8	4.38	3.56
144(2m)	9	1.77	2.80	4.0	6.13	5.03
144(2m)	12	2.50	3.95	5.6	8.65	7.10
144(2m)	15	3.54	5.60	7.9	12.27	10.03
144(2m)	20	6.29	9.95	14.1	21.80	17.84
144(2m)	24	9.99	15.8	22.35	34.62	28.28
450(70cm)	0	0.63	1.00	1.4	2.19	1.78
450(70cm)	3	0.89	1.40	2.0	3.07	2.52
450(70cm)	6	1.27	2.00	2.8	4.38	3.56
450(70cm)	9	1.77	2.80	4.0	6.13	5.03

450(70cm)	12	2.50	3.95	5.6	8.65	7.10
450(70cm)	15	3.54	5.60	7.9	12.27	10.03
450(70cm)	20	6.29	9.95	14.1	21.80	17.84
1240(23cm)	0	0.63	1.00	1.4	2.19	1.78
1240(23cm)	3	0.89	1.40	2.0	3.07	2.52
1240(23cm)	6	1.27	2.00	2.8	4.38	3.56
1240(23cm)	9	1.77	2.80	4.0	6.13	5.03
1240(23cm)	12	2.50	3.95	5.6	8.65	7.10
1240(23cm)	15	3.54	5.60	7.9	12.27	10.03
1240(23cm)	20	6.29	9.95	14.1	21.80	17.84

Note 1. ACA state that these separation distances apply only in the direction of the main beam/lobe of the antenna. The figures for 0 dBi gain can be applied outside the main lobe, which can be taken as being +/- 45 degrees off bore sight / antenna boom axis for the purpose of compliance.
Note 2. The figures as given by ACA are based on zero transmission loss and conversationa1 carrier mode of transmission. (Pm 100%)
Note 3. The writer has added a 400 watt SSB PEP column based on zero transmission loss conversational non processed SSB Mode. This clearly demonstrates that the separation distance is less than that of carrier mode transmission as a result of the duty cycle. (non speech processing 20% Form Factor)

7. Obtaining a High Power Permit

7.1 Previously held permit.

7.1.1 Since 1984 I have held a high power permit for both 144 and 432 MHz. As a consequence of the change in our licensing requirements (introduction of Radiation Safety limits) it was necessary for me to reapply.

7.1.1 There was a period when, under the new licensing condition applicable to the Amateur Service, that Legislation prevented varying these conditions. It was only after considerable negotiation by the Wireless Institute of Australia (WIA) and with the understanding of the ACA that changes were implemented and allowed for alterations within the Act.

7.2 Necessary Requirement s

7.2.1 In order to demonstrate that my Station would comply with the Australian Standard it was necessary to re submit a comprehensive document that addressed:

(a) the reason for my application
(b) justification for the use of higher than normally licensed power.
(c) a detailed assessment of the site radiation and exclusion zone distances and proof of how these could not be breached.
(d) obtain National Accredited Testing Authority (NATA) validation of the site radiation exclusion zone figures.
(e) address all safety aspects required to meet the Australian Standard.
(f) provide a detailed description of the equipment, testing methods and test equipment necessary to maintain the ability to meet (c) above.
(g) Inspection of the site to confirm

- technical details were in accordance with the application
- Ability to accurately measure power levels.
- safety exclusion zones would be maintained.

7.2 The high power amendment to the licence was granted under the following conditions

- To be issued for a period of 12 months that may be extended on a yearly basis upon written submission stating the original parameters have not changed (power, Aerial Gain and losses, safety exclusion zone)
- conditional that interference is not caused to all other Broadcast and Radio communication Services
- to be used for celestial communications only.