Mr. Nicholas Brody
Manager
Spectrum Licensing Policy Section
Australian Communications and Media Authority

By email.

Dear Mr. Brody,

RASA COMMENT ON FYSO 2022-27

The Radio Amateur Society of Australia (RASA) welcomes the opportunity to provide feedback from the Amateur Radio Service on the draft Five Year Spectrum Outlook (FYSO) for 2022-27.

RASA offers the following comments.

Class licensing and the spectrum commons

The change to the Amateur Radio Service from Apparatus Licence to Class Licence is a significant one and as a result, has generated much debate and concern within the Amateur Radio community. One of RASA's roles is to listen to those concerns and bring them to the attention of the regulator.

The FYSO states "*Given that there are over 15,000 licensed amateurs in Australia, the transition to class licensing is expected to be a substantial reduction in regulatory burden*." The ACMA has yet to define publicly what aspects of Amateur Radio regulation are presently regarded as a burden and that shall no longer be supported by the ACMA under a Class Licence arrangement.

The loss of revenue from licence fees [Just over $750,000] suggests an aggressive cut in costs elsewhere to recover revenue.

The Amateur Radio community is of the view that the outcome of the *"reduction in regulatory burden"* could mean a further reduction in support and implementation when it comes to issues such as interference to Amateur activity, the implementation process for future privileges, updates and support as the Amateur Radio Service continues to evolve.

RASA's recommendation is a Service Level Agreement or similar would be appropriate to define and agree on the responsibilities and expectations of all parties under the Class Licence arrangement.

RASA also believes that the Amateur Radio Service should be represented by an Independent Sector Committee using a consensus based model. The membership to be drawn from a broad range of Amateur Radio Service representatives within the sector. This would be in keeping with other spectrum users who have self or co-regulatory arrangements which further reduce regulatory burden for the ACMA.

<u>2300–2302 MHz</u>

The Amateur Service allocation referred to as the 13 centimetre band is from 2300 to 2302 MHz and from 2400 to 2450 MHz. The 13cm band is used for Amateur Fast Scan Television, Satellites, Narrow Band Data, Linking, Earth – Moon – Earth, FM, and SSB etc.

The ACMA have yet to disclose what impact this has in practical terms to the Amateur Radio Service.

RASA believes it is in the interests of the Amateur Radio Service to have access to sufficient spectrum at differing wavelengths to allow for self-training, intercommunication and technical investigation.

According to the Australian Amateur Radio Band Plan, the potential loss of 2300 – 2302 MHz, used for Narrow Band Data, although regrettable, appears to have minimal impact.

3400–4000 MHz (remote areas)

The Amateur Service allocation referred to as the 9 centimetre band is from 3300 to 3600 MHz. The reality is that only 3300 to 3400 MHz is usable as the use of 3400 and 3575 MHz is prohibited in all major populated areas. The 9cm band is used for Amateur Fast Scan Television, Narrow Band Data, Linking, Earth – Moon – Earth, FM and SSB etc.

The ACMA have yet to state what impact this has in practical terms to the Amateur Radio Service.

RASA believes it is in the interests of the Amateur Radio Service to have access to sufficient spectrum at differing wavelengths to allow for self-training, intercommunication and technical investigation.

The potential loss of 3400 to 3600 MHz, although regrettable, will have minimal impact on the majority of the Amateur Radio Service.

Table 4: Licensing and licensing systems

Work area Proposed timelines	Project priorities	Proposed timelines
Higher power amateur operation	Finalise options following consultation	2022–23

Please refer to our previous correspondence on RASA's position - Annex A and B.

We are supportive of further investigating the licensing and technical framework and, potentially new accreditation arrangements, that could facilitate higher power limits on all licence grades.

RASA also believes that the Amateur Radio Service should be represented by an Independent Sector Committee using a consensus based model. The membership to be drawn from a broad range of Amateur Radio Service representatives within the sector. This would be in keeping with other spectrum users who have self or co-regulatory arrangements which further reduce regulatory burden for the ACMA.

Work area Proposed timelines	Project priorities	Proposed timelines
Assigned amateur beacons and repeaters	Proposed licensing options	Q3 2022: consult
	Develop guidance material for accredited persons	Q4 2022

The ACMA is aware that the assignment of repeater and beacon frequencies is not working well at all and needs to be streamlined.

RASA has had frequent complaints from clubs and individuals regarding excessive delays in receiving frequency allocations – despite the use of professional frequency assigners.

From what we are told by assigners, assignments have to be checked by the WIA. As far as we understand, this is to ensure compliance with the band plan for the band in question.

RASA's recommendation is the implementation of Radiocommunication Assignment and Licencing Instructions (RALI) – similar to those used by commercial land mobile services.

A RALI covering the 29, 52, 146, 438 and 1296 MHz bands would list the repeater and beacon channels available in each band. An assigner would use the amateur RALI data, along with the assignments listed in the Register of Radiocommunication Licences to make their assignment.

This arrangement would significantly streamline the assignment process.

Not included in the ACMA FYSO 2022-27 Draft - Access to 50 to 52 MHz by standard class licencees

Please refer to our previous correspondence on RASA's position in our FYSO 2021-26 response. - Annex A.

The Amateur Service allocation referred to as the 6 metre band is from 50 to 54 MHz.

The restrictions on standard class licencees access to the lower end of the 6M band came from the days of analogue television with VHF Channel 0 audio on 51.75 MHz. With the adoption of digital television the restriction is now redundant and Standard Class licencees should be granted access to 50-52 MHz. The sector is united on this issue.

RASA requests that the ACMA include the return of 50 to 52 MHz to standard class licencees for inclusion in the year ahead.

Finally, RASA would like to thank the ACMA for the opportunity to respond to FYSO 2022-27 and look forward to our continuing cooperation.

Yours sincerely,

P.M. Anslow
RASA President
28 April 2022

Enc.
Annex A - Comments on FYSO 2021-26 - May 2021

Annex B - Review of Radio Frequency Electromagnetic Energy Hazards for Amateur Radio - Dr Andrew Smith, VK6AS - May 2019

Annex A

Mr. Nicholas Brody
Manager
Spectrum Licensing Policy Section
Australian Communications and Media Authority

By email.

Dear Mr. Brody,

COMMENTS ON FYSO

I write with reference to the recent FYSO 2021-26. RASA offers the following comments.

Increased output power

As detailed in previous submissions and in our response to the recent consultation on licencing options, RASA's view is that there is no health or occupational health reason preventing power limits for Advanced class Radio Amateurs to be increased.

Moreover, there is no real-world evidence that an increase in power will increase complaints of RFI.

The full analysis from 2019 is enclosed.

Accordingly, it is requested that the maximum PEP for Advanced licences be increased from 400W to 1 kW as a part of the new licencing arrangements.

Access to 50-52 MHz by standard class licencees

Again, as discussed in our submission to the licencing options paper, Standard Class licencees should be granted access to 50-52 MHz. The sector is united on this issue.

As with the high power issue, we request that this change be implemented with the revised licencing arrangements

HF spectrum demand

We note that the WIA has made an ambit claim for extra amateur bands in the 3-12 MHz range in their FYSO response.

Amateurs already have access to the entire 7 and 10 MHz bands, and expansion of the 3.5 MHz band is precluded by the large amount of land mobile allocations between 3.7 and 4 MHz.

We discussed this issue in depth in a recent piece on our website at:

https://vkradioamateurs.org/can-we-justify-more-bands/

5 MHz band

After some consideration, RASA wishes to note our objection to the ACMA decision not to grant amateurs access to the 5351.5–5366.5 kHz band.

Our view is that the needs of all spectrum users were not properly considered in the decision.

Defence's claim that granting amateurs secondary status in a 15 kHz wide band (already used by land mobile services) would adversely impact operations is simply not justifiable technically or operationally. This is especially the case when considering the vast size of the Australian continent and the very low EIRP for amateurs mandated by the ITU.

210 other countries (including NZ) have allowed amateur access to the 5 MHz band, and most of these countries have much higher population densities than Australia.

Indeed, the three countries with the world's largest defence forces, China (2.1M), India (1.4M) and the United States of America (1.1M), all allow amateur access to the 5 MHz band….and yet, the Australian Defence Force, with a strength of 60,000, operating in a sparsely populated continent, blocks access….

We suggest that ACMA should have considered other spectrum access methodologies, such as a trial of fixed channel operation, before making a decision that, in our view, was not properly informed by technical facts.

We are considering formally requesting a review of the decision.

Yours sincerely

G.C. Dunstan
President
25 May 2021

Encl.

Annex B

Review of Radio Frequency Electromagnetic Energy Hazards for Amateur Radio

Andrew Smith, VK6AS RASA

Oral and Maxillofacial Surgeon

1) Introduction

- At the request of the spectrum branch of the ACMA following a meeting with the Radio Amateur Society of Australia (RASA), it was agreed that RASA would investigate the issue of power limits for Radio Amateurs and report back to the Authority.
- It maybe that recent changes in standards by ARPANSA are not fully reflected in regulations for Amateur Radio Hobbyists and in their Assessments.
- Radio frequency Electromagnetic Energy (RFE) is a potential hazard to humans and animals if exposure limits are exceeded.

2) Background

(Sources ARRL, RSGB and FCC)

Electromagnetic radiation consists of waves of electric and magnetic energy moving together (that is, radiating) through space at the speed of light. Taken together, all forms of electromagnetic energy are referred to as the electromagnetic spectrum. Radio waves and microwaves emitted by transmitting antennas are one form of electromagnetic energy. Often the term electromagnetic field or radiofrequency (RF) field may be used to indicate the presence of electromagnetic or RF energy.

An RF field has both an electric and a magnetic component (electric field and magnetic field), and it is often convenient to express the intensity of the RF environment at a given location in terms of units specific for each component. For example, the unit "volts per meter" (V/m) is used to measure the strength of the electric field and the unit "amperes per meter" (A/m) is used to express the strength of the magnetic field.

RF waves can be characterized by a wavelength and a frequency. The wavelength is the distance covered by one complete cycle of the electromagnetic wave, while the frequency is the number of electromagnetic waves passing a given point in one second. The frequency of an RF signal is usually expressed in terms of a unit called the hertz (Hz). One Hz equals one cycle per second. One megahertz (MHz) equals one million cycles per second. Different forms of electromagnetic energy are categorized by their wavelengths and frequencies. The RF part of the electromagnetic spectrum is generally defined as that part of the spectrum where electromagnetic waves have frequencies in the range of about 3 kilohertz (3 kHz) to 300 gigahertz (300 GHz). Probably the most important use for RF energy is in providing telecommunications services. Radio and television broadcasting, cellular telephones, radio communications for police and fire departments, amateur radio, microwave point-to-point links, and satellite communications are just a few of the many telecommunications applications. Microwave ovens are a good example of a noncommunication use of RF energy. Other important noncommunication uses of RF energy are radar and for industrial heating and sealing. Radar is a valuable tool used in many applications from traffic enforcement to air traffic control and military applications. Industrial heaters and sealers generate RF radiation that rapidly heats the material being processed in the same way that a microwave oven cooks food. These devices have many uses in industry, including molding plastic materials, gluing wood products, sealing items such as shoes and pocketbooks, and processing food products.

The quantity used to measure how much RF energy is actually absorbed in a body is called the specific absorption rate (SAR). It is usually expressed in units of watts per kilogram (W/kg) or milliwatts per gram (mW/g). In the case of whole-body exposure, a standing human adult can absorb RF energy at a maximum rate when the frequency of the RF radiation is in the range of about 80 and 100 MHz, meaning that the whole-body SAR is at a maximum under these conditions (resonance). Because of this resonance phenomenon, RF safety standards are generally most restrictive for these frequencies. Biological effects that result from heating of tissue by RF energy are often referred to as "thermal" effects. It has been known for many years that exposure to very high levels of RF radiation can be harmful due to the ability of RF energy to rapidly heat biological tissue. This is the principle by which microwave ovens cook food. Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because of the relative lack of available blood flow to dissipate the excessive heat load. At relatively low levels of exposure to RF radiation, that is, levels lower than those that would produce significant heating, the evidence for harmful biological effects is ambiguous and unproven. Such effects have sometimes been referred to as "nonthermal" effects. It is generally agreed that further research is needed to determine the effects and their possible relevance, if any, to human health.

In general, however, studies have shown that environmental levels of RF energy routinely encountered by the general public are typically far below levels necessary to produce significant heating and increased body temperature. However, there may be situations, particularly workplace environments near high-powered RF sources, where recommended limits for safe exposure of human beings to RF energy could be exceeded. In such cases, restrictive measures or actions may be necessary to ensure the safe use of RF energy.

Some studies have also examined the possibility of a link between RF and microwave exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. In fact, other studies have failed to find evidence for a causal link to cancer or any related condition. Further research is underway in several laboratories to help resolve this question.

In 1996, the World Health Organization (WHO) established a program called the International EMF Project that is designed to review the scientific literature concerning biological effects of electromagnetic fields, identify gaps in knowledge about such effects, recommend research needs, and work towards international resolution of health concerns over the use of RF technology. The WHO maintains a website that provides extensive information on this project and about RF biological effects and research.

Various organizations and countries have developed exposure standards for RF energy. These standards recommend safe levels of exposure for both the general public and for workers. In the United States, the Federal Communications Commission (FCC) has adopted and used recognized safety guidelines for evaluating RF environmental exposure since 1985. Federal health and safety agencies-such as the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA)-have also been involved in monitoring and investigating issues related to RF exposure.

The FCC guidelines for human exposure to RF fields were derived from the recommendations of two expert organizations, the National Council on Radiation Protection and Measurements (NCRP) and the Institute of Electrical and Electronics Engineers (IEEE). Expert scientists and engineers developed both the NCRP exposure criteria and the IEEE standard after extensive reviews of the scientific literature related to RF biological effects. The exposure guidelines are based on thresholds for known adverse effects, and they incorporate appropriate margins of safety. Many countries in Europe and elsewhere use exposure guidelines developed by the International Commission on Nonionizing Radiation Protection (ICNIRP). The ICNIRP safety limits are generally similar to those of the NCRP and IEEE, with a few exceptions.

The NCRP, IEEE, and ICNIRP exposure guidelines state the threshold level at which harmful biological effects may occur, and the values for maximum permissible exposure (MPE) recommended for electric and magnetic field strength and power density in both documents are based on this threshold level. The threshold level is a SAR value for the whole body of 4 watts per kilogram (4 W/kg). The most restrictive limits on whole-body exposure are in the frequency range of 30-300 MHz where the RF energy is absorbed most efficiently when the whole body is exposed. For devices that only expose part of the body, such as mobile phones, different exposure limits are specified.

Major RF transmitting facilities under the jurisdiction of the FCC-such as radio and television broadcast stations, satellite-earth stations, experimental radio stations, and certain cellular, PCS, and paging facilities-are required to undergo routine evaluation for RF compliance whenever an application is submitted to the FCC for construction or modification of a transmitting facility or renewal of a license. Failure to comply with the FCC's RF exposure guidelines could lead to the preparation of a formal Environmental Assessment, possible Environmental Impact Statement, and eventual rejection of an application.

Broadcast Antennas Radio and television broadcast stations transmit their signals via RF electromagnetic waves. Broadcast stations transmit at various RF frequencies, depending on the channel, ranging from about 550 kHz for AM radio up to about 800 MHz for some UHF television stations. Frequencies for FM radio and VHF television lie in between these two extremes. Operating powers can be as little as a few hundred watts for some radio stations or up to millions of watts for certain television stations. Some of these signals can be a significant source of RF energy in the local environment, and the FCC requires that broadcast stations submit evidence of compliance with FCC RF guidelines. The amount of RF energy to which the public or workers might be exposed as a result of broadcast antennas depends on several factors, including the type of station, design characteristics of the antenna being used, power transmitted to the antenna, height of the antenna and distance from the antenna. Since energy at some frequencies is absorbed by the human body more readily than energy at other frequencies, the frequency of the transmitted signal as well as its intensity is important.

Public access to broadcasting antennas is normally restricted so individuals cannot be exposed to high-level fields that might exist near antennas. Measurements made by the FCC, EPA, and others have shown that ambient RF radiation levels in inhabited areas near broadcasting facilities are typically well below the exposure levels recommended by current standards and guidelines. Antenna maintenance workers are occasionally required to climb antenna structures for such purposes as painting, repairs, or beacon replacement. Both the EPA and OSHA have reported that in these cases it is possible for a worker to be exposed to high levels of RF energy if work is performed on an active tower or in areas immediately surrounding a radiating antenna. Therefore, precautions must be taken to ensure that maintenance personnel are not exposed to unsafe RF fields.

Portable Radio Systems "Land-mobile" communications include a variety of communications systems that require the use of portable and mobile RF transmitting sources. These systems operate in narrow frequency bands between about 30 and 1,000 MHz Radio systems used by the police and fire departments, radio paging services, and business radio are a few examples of these communications systems. There are essentially three types of RF transmitters associated with land-mobile systems: base-station transmitters, vehicle-mounted transmitters, and handheld transmitters. The antennas used for these various transmitters are adapted for their specific purpose. For example, a base-station antenna must radiate its signal to a relatively large area, and, therefore, its transmitter generally has to use higher power levels than a vehicle-mounted or handheld radio transmitter. Although these base-station antennas usually operate with higher power levels than other types of land-mobile antennas, they are normally inaccessible to the public since they must be mounted at significant heights above ground to provide for adequate signal coverage. Also, many of these antennas transmit only intermittently. For these reasons, such base-station antennas have generally not been of concern with regard to possible hazardous exposure of the public to RF radiation. Studies at rooftop locations have indicated that high-powered paging antennas may increase the potential for exposure to workers or others with access to such sites, for example, maintenance personnel. Transmitting power levels for vehicle-mounted land-mobile antennas are generally less than those used by base-station antennas but higher than those used for handheld units.

Handheld portable radios such as walkie-talkies are low-powered devices used to transmit and receive messages over relatively short distances. Because of the low power levels used, the intermittence of these transmissions, and the fact that these radios are held away from the head, they should not expose users to RF energy in excess of safe limits. Therefore, the FCC does not require routine documentation of compliance with safety limits for push-to-talk two-way radios.

Microwave Antennas Point-to-point microwave antennas transmit and receive microwave signals across relatively short distances (from a few tenths of a mile to 30 miles or more). These antennas are usually rectangular or circular in shape and are normally found mounted on a supporting tower, on rooftops, on sides of buildings, or on similar structures that provide clear and unobstructed line-of-sight paths between both ends of a transmission path or link. These antennas have a variety of uses, such as transmitting voice and data messages and serving as links between broadcast or cable TV studios and transmitting antennas. The RF signals from these antennas travel in a directed beam from a transmitting antenna to a receiving antenna, and dispersion of microwave energy outside of the relatively narrow beam is minimal or insignificant. In addition, these antennas transmit using very low power levels, usually on the order of a few watts or less. Measurements have shown that ground-level power densities due to microwave directional antennas are normally a thousand times or more below recommended safety limits. Moreover, as an added margin of safety, microwave tower sites are normally inaccessible to the general public. Significant exposures from these antennas could only occur in the unlikely event that an individual was to stand directly in front of and very close to an antenna for a period of time.

Satellite Systems Ground-based antennas used for satellite-earth communications typically are parabolic "dish" antennas, some as large as 10 to 30 meters in diameter, that are used to transmit (uplinks) or receive (downlinks) microwave signals to or from satellites in orbit around the earth. The satellites receive the signals beamed up to them and, in turn, retransmit the signals back down to an earthbound receiving station. These signals allow delivery of a variety of communications services, including long-distance telephone service. Some satellite-earth station antennas are used only to receive RF signals (that is, just like a rooftop television antenna used at a residence) and, since they do not transmit, RF exposure is not an issue. Because of the longer distances involved, power levels used to transmit these signals are relatively large when compared, for example, to those used by the microwave point-to-point antennas discussed above. However, as with microwave antennas, the beams used for transmitting earth-to-satellite signals are concentrated and highly directional, similar to the beam from a flashlight. In addition, public access would normally be restricted at station sites where exposure levels could approach or exceed safe limits.

Radar Systems Radar systems detect the presence, direction, or range of aircraft, ships, or other moving objects. This is achieved by sending pulses of high-frequency electromagnetic fields (EMF). Radar systems usually operate at radiofrequencies between 300 megahertz (MHz) and 15 gigahertz (GHz). Invented some 60 years ago, radar systems have been widely used for navigation, aviation, national defense, and weather forecasting. People who live or routinely work around radar have expressed concerns about long-term adverse effects of these systems on health, including cancer, reproductive malfunction, cataracts, and adverse effects for children. It is important to distinguish between perceived and real dangers that radar poses and to understand the rationale behind existing international standards and protective measures used today. The power that radar systems emit varies from a few milliwatts (police traffic-control radar) to many kilowatts (large space tracking radars). However, a number of factors significantly reduce human exposure to RF generated by radar systems, often by a factor of at least 100:

- Radar systems send electromagnetic waves in pulses and not continuously. This makes the average power emitted much lower than the peak pulse power.
- Radars are directional and the RF energy they generate is contained in beams that are very narrow and resemble the beam of a spotlight. RF levels away from the main beam fall off rapidly. In most cases, these levels are thousands of times lower than in the main beam.

- Many radars have antennas which are continuously rotating or varying their elevation by a nodding motion, thus constantly changing the direction of the beam.
- Areas where dangerous human exposure may occur are normally inaccessible to unauthorized personnel.

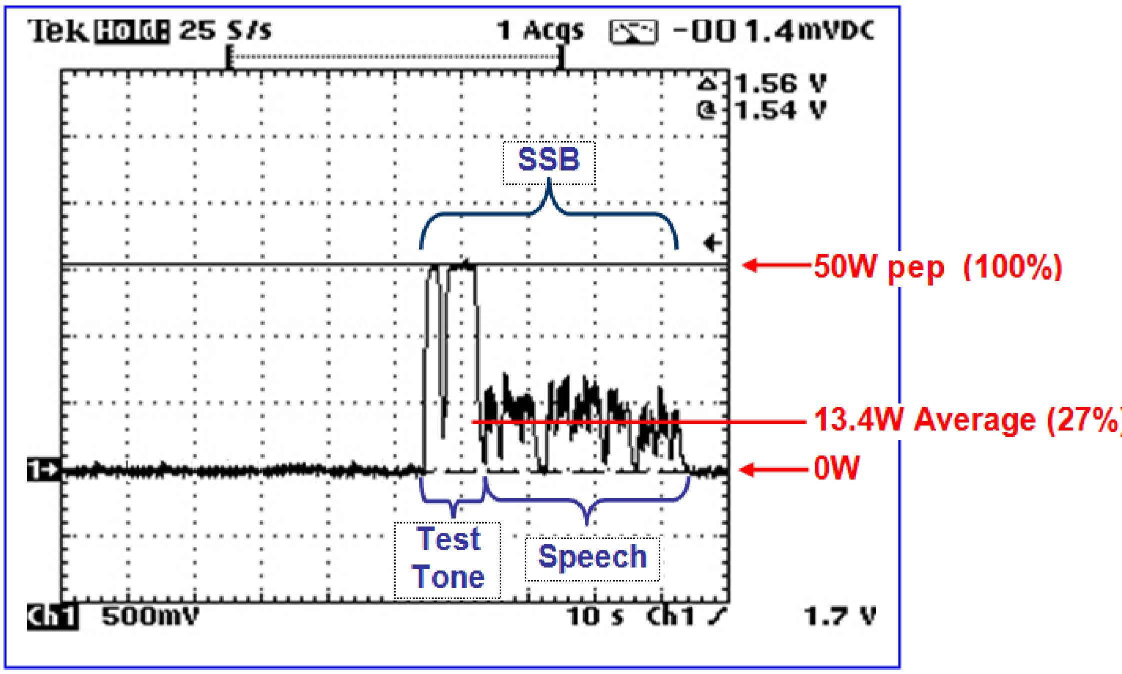
3) The Effects Of Transmission Method Upon RF Exposure

Unlike commercial broadcast transmissions where the mean transmission power typically approaches the maximum permissible power under their license, Amateur Radio operators frequemtly elect to use transmission modes where the mean power is significantly lower than the authorized PEP levels. This is important factor to incorporate when calculating total RF exposure to humans, independent of antenna height and radiation angle assessment.

The ARPANZA methodology for assessment of RF power to humans examines mean field intensity taken over a six-minute period. As such, this model should be applied to transmissions by Amateur Radio operators when assessing actual transmission modes being used on HF frequencies.

The approved convention for establishing PEP transmitter power (pX) using Single Sideband (SSB) emissions, is by subjecting the transmitter to a fully modulated pair of non-harmonically related audio tones (two-tone calibration method). The resulting output is then measured with a suitably calibrated PEP power meter.
When that same transmitter is then subjected to normal speech patterns via microphone, the resulting RF emissions are significantly lower than the two-tone benchmark tests.

In the following example a transmitter was calibrated to emit a measured 50 watts PEP into a test load using the conventional two-tone test standard. The audio source was then shifted to a conventional voice-modulated transmission, typical of operation by Amateur Radio operatives. The mean power over the prescribed six minute period fell to 27% of the two-tone assessed power level benchmark.



The effects of transmission mode upon RF exposure levels on HF

Where impact of RF exposure to humans on HF frequencies is being assessed, the method of modulation significantly affects the result when compared with standard emission benchmark testing.

An additional offset factor applies to Amateur radio transmissions, as in practical terms they tend to be of a very low duty cycle. While actively engaged in conversation, most transmissions would not exceed 1-2 minutes of duration before the remote station is invited to speak for a similar period. This effect further reinforces the established low-impact of higher power HF emission by Amateur radio operations around the world.

4) Are RF Emissions from Amateur Stations Harmful?

There are hundreds of thousands of amateur radio operators ("hams") worldwide. Amateur radio operators in the United States are licensed by the FCC. The Amateur Radio Service provides its members with the opportunity to communicate with persons all over the world and to provide valuable public service functions, such as making communications services available during disasters and emergencies. Like all FCC licensees, amateur radio operators are required to comply with the FCC's guidelines for safe human exposure to RF fields. Under the FCC's rules, amateur operators can transmit with power levels of up to 1500 watts. However, most operators use considerably less power than this maximum. Studies by the FCC and others have shown that most amateur radio transmitters would not normally expose persons to RF levels in excess of safety limits. This is primarily due to the relatively low operating powers used by most amateurs, the intermittent transmission characteristics typically used and the relative inaccessibility of most amateur antennas. As long as appropriate distances are maintained from amateur antennas, exposure of nearby persons should be well below safety limits.

To help ensure compliance of amateur radio facilities with RF exposure guidelines, both the FCC and American Radio Relay League (ARRL) have issued publications to assist operators in evaluating compliance for their stations.

(Source ARPANSA)

Australian exposure limits

For mobile telecommunications frequencies, the relevant standard enforced in Australia is the Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields – 3kHz to 300GHz (also called RPS3 or simply the ARPANSA Standard). At the frequencies considered in this study, the exposure limits it specifies are equivalent to those of the 1998 Guidelines published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

These limits have been determined on the basis of established health effects and include safety margins. They are designed to protect all members of the public including those sometimes thought to be particularly vulnerable (the elderly, the infirm, pregnant women and children).

The most restrictive of the appropriate limits from the ARPANSA Standard is the reference level for time averaged general public exposure. These reference levels are used for all comparisons in this study.

At the time of this survey there were four frequency bands used for transmissions from mobile phone base stations in Australia. Although the allowable limits vary within three of the frequency bands, for simplicity a single value will be used. The chosen values of the limit are more restrictive (slightly lower) than those allowed by the ARPANSA Standard.

Band Name	Frequency [MHz]	Services	Limit [mW/m^2]
850 MHz	870 - 890	WCDMA (UMTS)	4250
900 MHz	935 - 960	GSM & WCDMA	4500
1800 MHz	1805 - 1880	GSM & LTE	9000
2100 MHz	2110 - 2170	UMTS (WCDMA)	10000

Reference level for time averaged general public exposure to RF fields.

What is a broadcast tower?

Broadcast towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure, including microwave dishes. These antennas emit radiofrequency (RF) electromagnetic energy (EME). This fact sheet provides information about concern of adverse health effects arising from exposure to RF EME from broadcast towers.

Are broadcast towers regulated in Australia?

The RF EME emissions from broadcast towers and other communications installations are regulated by the Australian Communications and Media Authority (ACMA). The ACMA's regulatory arrangements require broadcast towers to comply with the exposure limits in the ARPANSA RF Standard. The ARPANSA Standard is designed to protect people of all ages and health status against all known adverse health effects from exposure to RF EME. The ARPANSA Standard is based on scientific research that shows the levels at which harmful effects occur and it sets limits, based on international guidelines, well below these harmful levels.

How much RF EME are people exposed to from broadcast towers?

Broadcast towers supporting FM radio and TV antennas are placed on the highest point in an area, so the transmitted signal has a clear path to receiving antennas. The transmitted signal is projected away from the tower almost horizontally so that as much area as possible is covered. This minimizes the signal strength at ground level near the tower. The higher-level RF EME therefore occurs at a height not accessible to the general public.

Typical EME exposure levels at ground level in areas surrounding FM radio and TV broadcast towers are well below the limit for public exposure in the ARPANSA RF Standard. However, this may not be the case for AM radio sites where the tower itself acts as an antenna. Therefore, access to the base of AM radio towers is restricted, to prevent the general public entering areas where the limits of the Standard may be exceeded.

Do broadcast towers cause any health effects?

Health authorities around the world, including ARPANSA and the World Health Organization, have examined the scientific evidence regarding possible health effects from broadcast towers. Current research indicates that there are no established health effects from the low RF EME exposure encountered by the public from broadcast towers.

Conclusion

No adverse health effects are expected from living near broadcast towers.

ARPANSA will continue to review the research into potential health effects of RF EME emissions from broadcast towers and other sources in order to provide accurate and up-to-date advice.

How am I exposed to radiofrequency radiation?

Most RF fields found in the environment are due to commercial radio and TV broadcasting, and from telecommunications facilities (such as mobile phone base stations). RF exposure from telecommunications facilities is generally less than from radio or TV broadcasting. RF sources in the home include microwave ovens, mobile telephones, cordless telephones, wireless computer networks, smart meters, burglar alarms, and remote controls. Overall, the RF field background level from household appliances is low, and of the order of a few tens of $\mu W/m^2$. Relatively high levels of exposure to RF fields can occur to workers in the broadcasting, transport and communications industries when they work in close proximity to RF transmitting antennas and radar systems. Some industrial processes that use RF fields to heat materials can also produce high exposure to workers.

Exposure to RF reduces very rapidly with distance so although we may be exposed to RF from various sources (such as smart meters, mobile base stations and other wireless communication transmitters), it is close proximity to a particular source (e.g. when using a mobile phone) that will typically dominate the exposure. Measurement surveys have shown that exposure to RF radiation in the environment from various sources is very low and typically much lower than the allowable limit for safety in the Australian RF Standard.

What are the health effects of radiofrequency radiation exposure?

Exposure to sufficiently high levels of RF EMR can heat biological tissue and potentially cause tissue damage. The amount of environmental RF EMR routinely encountered by the general public is too low to produce significant heating or increased body temperature. At low levels of exposure to RF EMR (ie field intensities lower than those that would produce measurable heating) the evidence for production of harmful biological effects is ambiguous and unproven. Although there have been studies reporting a range of biological effects at low levels, there has been no indication that such effects might constitute a human health hazard. Some epidemiological studies have shown an association between heavy mobile and cordless phone use and brain cancer (most pronounced for glioma). Limitations of the methodology prevent conclusions of causality being drawn from these observations. The possibility of adverse health effects from the use of mobile phones is described in the ARPANSA fact sheet Mobile Telephones and Health.

How can I protect myself from RF exposure?

In 2002 ARPANSA published the standard: Radiation Protection Standard - Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz. The ARPANSA RF Standard sets limits for human exposure to RF EMR in the frequency range 3 kHz to 300 GHz. The Standard also includes requirements for protection of the general public and the management of risk in occupational exposure, together with additional information on measurement and assessment of compliance.

In March 2014 an independent Expert Panel reviewed the scientific literature published since the ARPANSA RF Exposure Standard was prepared. The Expert Panel found that the exposure limits in the RF Standard continue to provide a high degree of protection against the known health effects of RF electromagnetic fields

5) **Health risks with increased power**

- A review of world literature has identified that radio amateurs have no higher incidence of medical conditions or causes of death from RFE than the general public. (Radio-Frequency and ELF Electromagnetic Energies A Handbook for Health Professionals, Hitchcock RT and Robertson RM. Revised 1994, John Wiley and Sons.)
- A review of the literature failed to ascertain any reports of damage to humans and/or animals from any amateur transmissions at power levels up to 2kW PEP. Data is scarce on issues related to microwave frequencies but yet again there are no reports of illnesses or diseases. (Ibid.)
- There is no empirical evidence that supports the ACMA position that an increase of PEP from 400W to 1kW would have any deleterious effect on radio amateurs, members of the public or animals, as long as the emissions comply with ARPNSA standards. Even at 1kW the levels of emission provided are very low when compared with broadcast antennas. There is no validity in terms of health,

well-being and OHS that supports the ACMA argument for a 400W PEP limit in the Amateur HF and VHF/UHF bands.

- Power limit levels and risks for microwave transmissions are less well identified and will require individual monitoring and licencing.

6) **Interference risks with increased power**

- It is a *sine qua non* that with increased power, the higher and closer the source then the risk of Radio Frequency Interference (RFI) may increase
- There are multiple sources of RFI apart from Amateur Radio Transmissions.
- Change from analogue to Digital TV transmissions has reduced the risk of amateurs interfering with TV broadcasting and a literature review suggests that the number of complaints over this have dropped worldwide although other factors including a lack of follow up on reports of interference through personnel shortages may have had an effect
- There has been an increase in interference complaints as a result of non-compliant appliances causing RFI. These are not caused by amateur equipment.
- There is no evidence that there has been any increase in RFI complaints in countries (NZ and Canada) (Sources FCC, NZART and Radio Commission of Canada) that have increased their permitted PEP over the last decade or so.
- Australia has a unique situation but in view of the evidence it would seem logical that a trial be undertaken allowing amateurs to use 1kW PEP on HF and VHF/UHF amateur bands with a well-structured reporting system for RFI complaints and investigations of these performed by the ACMA in association with Amateurs.

7) Conclusion

- There is no health or occupational health reason preventing power limits for Radio Amateurs in the HF/VHF/UHF bands to be increased.
- There is little or no evidence that suggests that an increase in power will increase complaints of RFI.
- In view of Australia’s unique situation, it would be sound practice for an increased power level to be monitored in detail.

8) Proposal

The ACMA should increase the maximum PEP from 400W to 1kW for the amateur HF/VHF/UHF bands and conduct monitoring for any increase in RFI that this may possibly cause.

Andrew Smith

Perth

May 2019

Appendix 1

ARPANSA Standards, References and Information

Radiation Protection Series No. 3

Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz (2002)

This standard specifies limits of human exposure to radiofrequency fields in the range 3kHz to 300GHz to prevent adverse effects. It specifies basic restrictions for occupational exposure, general public exposure, and equipment and usage parameters.

Download the Standard

Radiation Protection Series 3 - Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz - *updated 31 May 2016*

The digital edition of the standard includes:

- Errata - Radiation Protection Series 3 *issued May 2003*
- Revision of Schedule 5 *issued May 2016*

Printed Copies

Printed copies of RPS No. 3 are available for purchase directly from ARPANSA (AUD$22.00 per copy, incl. GST and postage).

Download an ORDER FORM.

Revision of Schedule 5 of RPS3

ARPANSA has revised Schedule 5 of RPS3 by extending the scope to include equipment operating up to 6 GHz. The revision is intended to reduce compliance costs for suppliers of low-powered mobile or portable transmitting equipment. The revision does not affect the requirements of this equipment in meeting the human exposure limits.

Prior to the revision exemptions in Schedule 5 applied to mobile or portable devices emitting RF fields at frequencies between 100 kHz and 2500 MHz. An increasing number of low-powered transmitting devices operate outside this range, for example Wi-Fi operating at 5,000 MHz. Because these devices were outside the scope of Schedule 5, suppliers were required to demonstrate compliance by conducting an individual assessment (by direct measurement or calculation). By increasing the scope of Schedule 5, more low-powered devices will be exempt from the direct testing provisions, thereby reducing compliance costs and regulatory burden.

In developing the amendment to Schedule 5, ARPANSA consulted the joint Standards Australia/Standards New Zealand TE-007 Committee, which developed the Australian and New Zealand RF standard (AS/NZS 2772.2:2011). This Committee includes members from various stakeholders, including members of the telecommunications industry.

ARPANSA’s preliminary assessment of the revision concluded that there will be no regulatory impact on business or individuals. The Office of Best Practice Regulation agreed, therefore a regulatory impact statement was not required.

The proposed amendments to Schedule 5 are provided in the comparison table below:

Schedule 5 - Table of Amendments:

- RPS 3 - Proposed amendment to Schedule 5
- RPS 3 - Proposed amendment to Schedule 5

RPS3 Supporting Documents

- An explanatory Question & Answer Guide to the ARPANSA Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields - 3kHz to 300Ghz (PDF 411 kb) (**Note:** this document contains hypertext navigation links and is best viewed in the Adobe Acrobat Reader. A text only version without links is also available for printing Text version - An explanatory Question & Answer Guide to the ARPANSA Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields - 3kHz to 300Ghz (PDF 245 kb)
- *A brief outline of the human auditory perception associated with exposure to high power short pulse radiofrequency electromagnetic fields and in particular, with the appropriate formulation and specification of human exposure limits. Finally, a proposed revised formulation of relevant restrictions is presented as a solution to the problem. The proposed formulation introduces a new limiting quantity and alters the way in which localised pulse or modulated RF exposure to the head would be evaluated*: Human auditory perception resulting from exposure to high power pulsed or modulated microwave radiation — specification of appropriate safety limits (PDF 111kb)
- *Paper describing the management of overexposures to electromagnetic fields, specifically the flowchart on page 192 shows the steps in the management of the patient*. (PAPER: Hocking B and Gobbo F. Medical aspects of overexposures to electromagnetic fields (PDF 401 kb). J Health Saf. Environ. 2011, 27(3): 185-195) *First published by CCH Australia in the 2011 Journal of OHS*
- *Exposure limits for far field exposure to microwave radiation vary depending on the frequency of radiation. At frequencies below 10 GHz relatively large "hot spots"*

are formed and the heat load on the whole body is generally the major constraining factor. A measurement averaging time of around six minutes is quite adequate. At higher frequencies, absorption of RF energy is restricted to relatively small volumes of tissue near to the surface of the body. In such circumstances, heating can be quite rapid and progressively shorter measurement averaging times are required. This document discusses the effect of frequency on measurement averaging times: Measurement averaging considerations on appropriate specification of exposure limits for radiofrequency electromagnetic fields (PDF 278kb)

- Abstracts on research into bio-effects of RF at low levels of exposure (PDF 161 kb)
- Neurological case studies (PDF 22 kb)
- Research into bio-effects at low levels of exposure (PDF 109 kb)
- Case reports: Neurological effects of RFR in humans (PDF 19 kb)

Relevant links

- Durney, C.H., Massoudi, H. & Iskander, M.F. 1986, Radiofrequency Radiation Dosimetry Handbook, 4th edn, United States Air Force Research Laboratory Technical Report USAFSAM-TR-85-73, Brooks Air Force Base, Texas USA.
- The RF Radiation Safety Handbook (Ronald Kitchen, Pub. Butterworth-Hienemann Ltd. 1993) provides a practical description when performing RF surveys for a variety of applications. The same book also describes the various commercial instruments and personal RF dosimeters.
- Stewart W. 2000, ‘Mobile phones and health’, Independent expert group on mobile phones, NRPB, Didcot, UK.
- WHO 2000, ‘Electromagnetic fields and public health cautionary policies’, March 2000.

- Communications Alliance Ltd, 2011, Industry Code C564: Mobile Phone Base Station Deployment