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Q-MAC ELECTRONICS

HF TRANSCEIVERS & ANTENNA SYSTEMS

HF POWER VS RANGE

HF HELP FILES

Q-MAC Electronics Pty Ltd

HF HELP FILES

HF POWER vs RANGE

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1 Introduction

1.1 The effect of power output on range.

There is much misunderstanding on the topic of power output and range achieved by HF communication systems.

Two different propagation modes exist for HF communication. These are Skywave and Groundwave.

1.1.1 GROUNDWAVE

Field strength on groundwave varies with range and soil type.

At close range over dry ground a 12dB increase in power is required to double the range. At longer range a 20dB increase in power is required to double the range.

Limit range on groundwave can be as little as 10km over sand or as much as 100km over seawater.

A change of output power from 50watt to 130watt is only 4dB and consequently has only a very small effect on achievable range – typically 2%. There is often more than 4dB difference between the efficiencies of different manufacturers vehicle antenna tuners so that a 50watt radio can outperform a 130watt radio if the antenna tuner is more efficient.

1.1.2 SKYWAVE

Many users of HF links use Skywave in the 100-500km range. This is considered as NVIS, Near Vertically Incident Skywave, where the signal bounces directly back from the ionosphere. A horizontally polarized antenna is used which has high angle radiation. The received signal is essentially constant over a radius of 500km. The signal to noise ratio is good if the correct frequency is chosen and a 4dB difference in signal level is not detectable. The correct frequency is one a little beneath the CRITICAL frequency which can be found by studying ionosondes available at www.ips.oz.au The critical frequency rises to about 9MHz at noon during a sunspot maximum and is as low as 5MHz at noon during a sunspot minimum. Vertical whip antennas on vehicles are not well suited for this mode of operation and are often bent back to increase the horizontal radiation.

For longer distance communication of 1000km and beyond power becomes a more significant issue. However 4dB change will not help significantly. At least 10dB increase in power is necessary to make a worthwhile difference. This would mean increasing from 50watt to 500watt. In fixed station use the utilization of a beam antenna should be considered for higher frequency long distance working.

1.2 Noise

Most HF systems are limited by external noise level if operation is on frequencies below 10MHz. Atmospheric oise due to thunderstorm activity varies by up to 50dB between summer and winter. It is highest in summer and lowest in winter. Man-made power line and other noise can also vary by 50dB, being very severe in urban environments where overhead power lines and computers are present.

Relative to a 50dB variation, 4dB change is vanishingly small and so in circumstances where a 50watt signal won't get through, a 130watt signal won't get through either.

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2 Other Information

2.1 Author

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Rod Macduff is Managing Director of Q-MAC Electronics which is a specialist supplier of HF Communications to the Humanitarian, Aid & Relief and Military organisations. Rod Macduff worked with Racal BCC for 10 years on the Jaguar V tactical hopping radio and travelled extensively consulting with armies on their secure communication issues. The Q-MAC HF-90 hopping radio is in service in 75 nations and has been adopted by Humanitarian, Aid & Relief, Army, Police and Intelligence organisations.

2.2 About Q-MAC Electronics

Q-MAC Electronics is specialist designer and manufacturer of HF Transceivers. The flagship product the HF-90 is the world's smallest high performance HF SSB Transceiver. The HF-90 and Q-MAC Electronics have been awarded many accolades and is currently used by thousands of users in over 80 countries worldwide. The HF-90 is one of the most versatile HF transceivers available and is suited to military, paramilitary and humanitarian aid and relief applications.

Q-MAC offers the HF-90 in a variety of configurations suited to manpack, vehicle and base station applications. A full complement of accessories is also offered for use with the HF-90; including antennas, field battery charging accessories, carry packs/cases and more. All Q-MAC products are backed by the company's strong commitment to after sales service, support and certified ISO9001 quality standards.

2.3 Contact Details

For Further Information Contact;

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