



WaveMAX Features

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Date: May 2008

Issue: 1.0

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1. Introduction

This document identifies and describes the key features that exist within the Wavesight range of WaveMAX radio bridges. Many are unique to Wavesight and some are adaptations from the 802.11 MAC (Media Access Controller) to enable high bandwidth and long range to be both established and maintained.

Additions have been built alongside the 802.11 MAC to enable such features as Multicast acceleration for video use.

Security is considerably enhanced by the incorporation of super-packets.

The descriptions defined here enable the reader to implement those features and to tune the deployed system to maximum effectiveness in accordance with its defined use.

2. Turbo Mode

This mode allows for the combining of two adjacent channels for greater bandwidth capacity. The raw signalling rate is therefore doubled to a maximum of 108Mbps. The channel size is doubled from 20MHz to 40MHz.

Channels used are 5.760 and 5.800 under the guidance of Ofcom rules in the UK. The Wavesight range of radios, however, allows for Turbo mode in all 5GHz bands (A, B and C) but, B and C must be avoided in the UK.

Turbo mode is not available in the 2.4GHz band.

Tight legislation controls exist in some territories so reference must be made for local rules.

3. XR Mode

This mode still provides forward error correction for efficient transmission, but we trade off bandwidth for range. The physics of RF correlates bandwidth and range and the process is to get the required balance. The further the link required the lower the available bandwidth. We have built an algorithm which maintains the highest possible bandwidth. This is sometimes referred to as long (extra) range mode.

The facility has to be specifically configured in the base unit, but is automatically switched on in the satellite. Sometimes a satellite will be observed as switching into this mode if its received signal is poor. It is therefore an automatic trade off to maintain the best possible link.

4. Super AG Mode

This mode brings into play three key features of the operation of WaveMax.

4.1 Compression

Before we encapsulate data into our Fast Frames, we compress the data using the LZ77 coding technique. This provides enhanced on air security.

LZ77 algorithms achieve compression by replacing portions of the data with references to matching data that has already passed through both compression encoder and decoder. A match is encoded by a pair of numbers called a length-distance pair, which is equivalent to

the statement "each of the next length characters is equal to the character exactly distance characters behind it in the uncompressed stream." (The "distance" is sometimes called the "offset" instead.)

4.2 Fast Frames

This restructures the content of every frame by extending away from 802.3 frame constraints and variable characteristics. Inter-packet gaps are removed giving a longer (super-packet) which in turn provides for increased bandwidth performance and greater security. The frame size is therefore changed from a variable length to a fixed length of 4750 Bytes. Individual packet headers are also removed, where the individual packet information is binary encoded and re-structured into a super-packet header. The whole process is reversed at the receiving end.

4.3 Bursting

This co-exists with Fast Frames providing contiguous Frames, maintaining high data rates across the link. Here, we set a master frame header which not only holds the details of individual frames, but allows for contiguous frame transmissions without individual (Fast Frame) headers. The total number of Burst Frames is 8.

5. DFS (Dynamic Frequency Selection)

The basis of this requirement is to search for, and adjust accordingly, if any reserved channels are being used in the locality of the WaveMAX installation. In the UK and other territories, there is the possibility of locating a WaveMAX link in close proximity to a reserved radar channel. WaveMAX must recognise this RF signature and move (automatically) to the next available channel.

By identifying the signature, rather than look for a high 'noise' level, WaveMAX retains high efficiency thereby avoiding hysteresis where the state could continually change. The effect of such state change would seriously affect the bandwidth capability.

Each channel search could take a maximum of 60 seconds. As there are 5 channels, a delay of 5 minutes after unit switch on before a link is confirmed could occur if the DFS signature is found. Once the new channel is locked, the scan will not be repeated unless the system is powered down and restarted.

Currently, DFS is a legislative requirement for the European Union.

6. TPC (Transmission Power Control)

A system of altering the power levels for different countries and varying regulations.

Upon configuration set-up, you will be asked for the country code of operation and the antenna gain being used. This feature will be available in future releases of the WaveMAX firmware. Currently, this is a manual set up via RF Analyser.

7. Encryption

The various schemes available in the WaveMAX range of radios are as follows;

- 128bit and 40bit (encrypted WEP)
- TKIP

- AES
- WPA
- IEEE 802.1x (Radius)

8. Hidden Node

There is a setting in satellites to enable them to be aware that they will not all be able to detect other satellites in the network. This can occur when there are long distances between satellites and the Base unit, or where there are obstacles that block satellite to satellite paths. Although satellites can only communicate with each other via a Base unit, they must however, be able to detect the RF radiated from other satellites in a network so they do not attempt a transmission when another satellite is transmitting. With the use of CSMA/CA, (Carrier Sense Media Access / Collision Avoidance), it is vital that all units build up entries in the various data queues and send when the next slot appears. We have to allow for each satellite to get its command from the base rather than independently transmit.

9. Multicast Streaming

This facility increases the bit rate for any packet that is being transmitted to any group of receivers (Multicast).

We change the multicast data ceiling in the 802.11 MAC. The standard 802.11 multicast rate is 6Mbps. As 802.11 will automatically work at a minimum data level (protocol handling), we need this facility to ensure that essential data such as fast video is serviced. There is no frame acknowledge, so the transmission is once only however, if data is blocked for any reason, there is no re-transmit.

As the system designer may wish to tune a system and allow for different data ceiling levels, we have built into a Multicast accelerator, 4 modes of maximum data bandwidth which are 9, 12 18 and (super boost) 21Mbps. These data rates relate to a raw RF signalling rate of 54Mbps. If the WaveMAX is operated in Turbo mode, these data rates are doubled.

10. Retry

Retry levels are available where difficult (harsh RF environments) occur. The higher the number of retries the lower the data bandwidth will result. Only use or alter this parameter where guaranteed delivery rather than high maintained bandwidth is required.