WiNRADiO®

G315 VHF/UHF Receiver

User's Guide

Published by
WiNRADiO Communications
PO Box 6118, St Kilda Road, Melbourne 3004, Australia

Trademarks

WiNRADiO, G3, G315 and Radio Basic are trademarks of WiNRADiO Communications

All other brand and product names are trademarks of their respective owners.

Patents

WiNRADiO technology is protected by US Pat. No. 6,289,207 and other pending US and international patent applications.

Printed in Australia

FCC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the computer into an outlet on a circuit different from that to which the receiver is connected
- Consult an authorised dealer or an experienced radio/TV technician for help

Caution

To comply with the limits for the Class B digital device, pursuant to Part 15 of the FCC rules, the WiNRADiO receiver must be installed in computer equipment certified to comply with the Class B limits. Only peripherals certified to comply with the Class B limits may be attached to the computer containing the WiNRADiO receiver. Only original cables and power adapters must be used. Operation with non-certified cables, power adapters and peripherals may result in interference to radio and TV reception.

Modifications

Any changes or modifications to the WiNRADiO receiver could void the user's authority to operate this equipment, as well as void the manufacturer's warranty.

Limitation of Liability and Remedies

The information published in this book has been compiled from several sources. While every effort has been made to ensure its accuracy, neither the authors nor the publisher can guarantee that all information is entirely correct or up-to-date. Furthermore, neither the authors nor the publisher can take any responsibility for the use of this information or any consequences arising therefrom. WiNRADiO Communications shall have no liability for any damages due to lost profits, loss of use or anticipated benefits, or other incidental, special or punitive damages arising from the use of, or the inability to use, the WiNRADiO receiver, whether arising out of contract, negligence, tort or under any warranty, even if WiNRADiO Communications has been advised of the possibility of such damages. In no event shall WiNRADiO Communications ' liability for damages exceed the amount paid for this product. WiNRADiO Communications neither assumes nor authorises anyone to assume for it any other liabilities.

Warning

In certain countries or states it may be illegal to monitor certain frequencies. We cannot accept any responsibility for the consequences of your non-compliance with government regulations. If you are in doubt about the regulations in your country or state, please contact your nearest radio communications regulatory authority.

Table of Contents

Introduction

Welcome to the WiNRADiO G315 receiver. This advanced receiver is the result of a quest to combine many years of accumulated know-how in computer-based radio receivers with the latest advances in components and digital signal processing techniques.

In designing this receiver, we strived to provide the optimum balance of sensitivity, selectivity and dynamic range, yet maintaining low cost and implementing a number of significant features previously available only on receivers significantly more expensive, bulky and far less friendly to the user.

While we attempted to implement many more features and functions than normally would be found on a typical communications receiver, we also strived to keep the control panel streamlined, logical and easy to use.

The WiNRADiO G315 receiver transforms any modern PC desktop into a sophisticated VHF/UHF monitoring station offering surprising power and flexibility, and enjoyment of use.

We hope you will like the spectrum analyzer with a 16 Hz resolution bandwidth, continuous IF bandwidth adjustment in 1 Hz steps, graphical pass-band tuning, graphical notch filter, ultra-sensitive, selective and accurate S-meter, the convenient tuning and scanning facilities, the test and measurement functions, and many other innovative features.

The WiNRADiO G315 is not designed to be an ordinary radio receiver. It is intended to be an exemplary radio communications instrument, crafted with meticulous care and dedication to excellence.

We wish you much success and many hours of enjoyment in putting it to your good use.

*Please don't forget to register as a WiNRADiO user to receive news about new products, accessories and software upgrades for your G315 receiver. Use our on-line registration form at **www.winradio.com/register** to take advantage of this free service.*

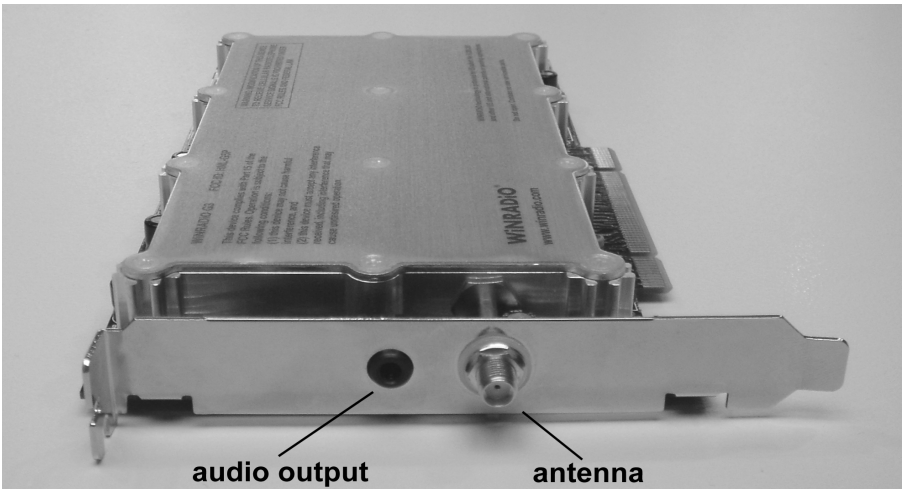
G315 Receiver Models

There are two basic models of the WiNRADiO G315 receiver:

- G315i (PCI card based "internal" model)
- G315e (USB based "external" model)

Both receivers have similar parameters and identical software user interface. This manual covers the installation and operational aspects for both types.

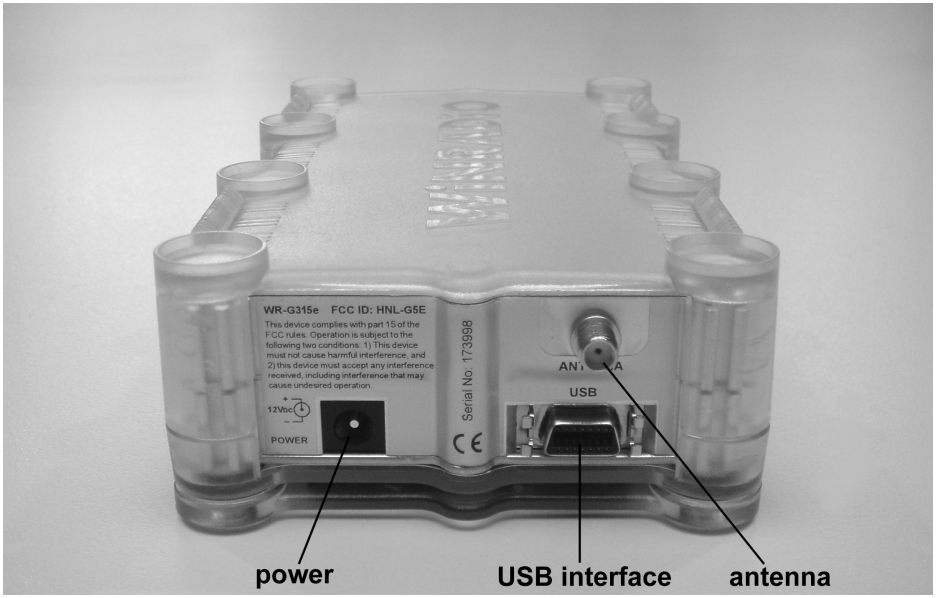
The G315i model has two connectors: the antenna connector (SMA type, 50 ohm) and an audio output:



The audio output is compatible with a PC sound card *Line input*, or can be simply connected directly to an amplified multimedia speaker, or any other suitable audio equipment. Standard 3.5mm stereo audio jack is used.

The advantage of this model is that it does not require any external power supply, and does not occupy any additional desk space. The receiver is very well shielded to prevent any interference generated by the PC from entering the receiver. The receiver comes with a suitable "*audio lead*" to connect the audio output to a sound card input.

The external G315e model has three connectors:



The *power jack* accepts 12 V DC (the power adapter must be rated for minimum 500 mA). To minimize interference, a linear-mode power adapter is recommended (as supplied by WiNRADiO).

The *antenna input* is an SMA-type connector with 50 ohm impedance.

The *USB interface* is compatible with both USB 1.0 and 2.0 standards and serves to connect the receiver to a desktop or a laptop computer.

Did you know?

The USB interface supports three data rates: A low speed rate of 1.5 Mbit/s used mostly for human interface devices (e.g. keyboards and mice), full speed rate of 12 Mbit/s which is used by most USB devices, and high speed rate of 480 Mbit/s which is only supported by the USB 2.0 standard.

Installation

The WiNRADiO G315 package contains the following items:

- WiNRADiO G315i or G315e receiver
- USB interface cable (G315e receiver only)
- WiNRADiO software on a CD ROM
- Start-up indoor antenna
- Audio cable (G315i receiver only)
- This *User's Guide*
- Warranty information

In order for the WiNRADiO receiver to function, your IBM PC compatible computer must meet the minimum system requirements specified below.

System Requirements

	Minimum	**Recommended**
CPU	500 MHz, Pentium III	1GHz or higher, Pentium IV or Athlon
RAM	64 MB	256 MB or more
Display	SVGA	SVGA (16 mil. colors)
HD free space	20 MB	40 MB
Sound card*	SoundBlaster compatible 16 bit	Creative Sound Blaster, 16 or 32 bit
OS	Windows 98/ME/2000/XP	Windows 2000/XP

** Sound card is only required with the G315e model (for playback only)*

Do you have any suggestions about how we could further improve our product, or do you wish to tell us of your experiences using this receiver in your application? Please do not hesitate to leave your comments on ***www.winradio.com/feedback****. We always love hearing from you.*

Hardware Installation

G315i model (PCI card)

1. Turn the computer off and disconnect the power cord.
2. Remove the computer case. Choose an empty PCI slot, as far as possible from the power supply and from other cards.
3. First touch the computer metalwork with your hand to drain any static charge, then carefully insert the card into the vacant slot and push down until it is firmly seated. Screw the metal bracket at the end of the card to the computer case. *(This must be done to provide proper grounding for the card)*.
4. Replace the computer case and reconnect the power cord.
5. Connect the supplied audio lead between the receiver output (a standard audio jack) and the sound card Line Input. *(If there is no Line input on your PC, as is the case with some laptops, you may use alternative inputs, such as the Microphone input.)* Or, if you prefer, you can connect the receiver directly to an amplified speaker or other suitable audio equipment.

G315e model (external model)

1. Connect the receiver to the USB port.
2. Connect the supplied power adapter to the power outlet on one side and the power lead to the receiver on the other side.
3. Turn the receiver on using the power switch at front of the receiver. The blue LED will first flash slowly, indicating that the receiver is ready.

The flashing pattern of the blue LED has diagnostic meaning and indicates various states of the receiver and its interface. It is also possible to disable the LED flashing for the normal operational state. For more details, see ***Appendix J, USB Interface Diagnostics****.)*

With the G315e model, the demodulated audio is travelling over the USB interface, so no connection to a sound card is necessary, except of course the speaker output.

Finally, connect the supplied start-up antenna to the SMA connector at the rear of the receiver. Extend the antenna so that it is as far away from the computer as possible.

Software Installation

1. If the PC is off, turn it on. Windows will find the receiver and automatically start the usual ***New hardware found*** driver installation routine. Insert the installation CD ROM into the drive, and follow on-screen instructions.

2. After installing the drivers, choose the ***Run*** command from the ***Start*** menu in Windows and type D:INSTALL (if the CD ROM is the D: drive on your PC).

3. This will run the application installer, which will guide you in the installation process.

4. After all the files have been installed to your hard disk, run the WiNRADiO G315 application.

Note: If the receiver is not detected by Windows, you can simply skip the driver installation procedure, insert the CD ROM, and run the installation program, which will also install the drivers.

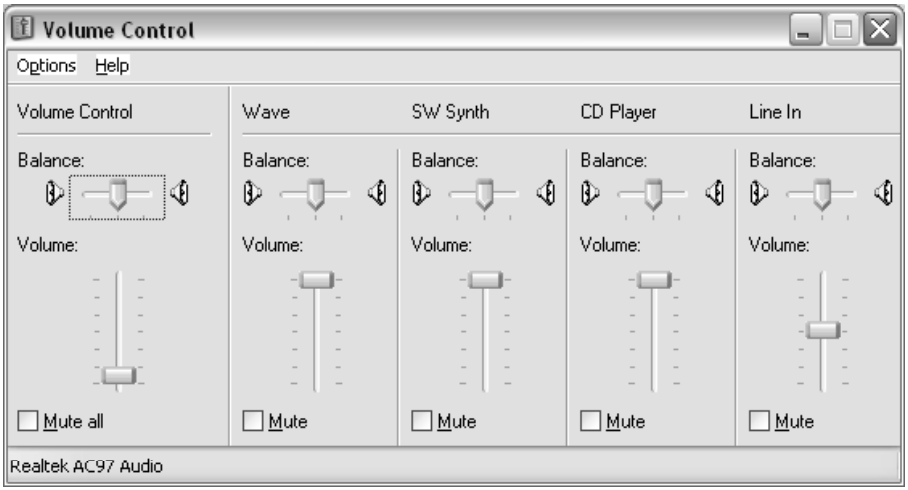
WiNRADiO also manufactures a wide range of antennas and antenna accessories suitable for many applications. The WiNRADiO AX-71C antenna (pictured) is especially suitable for the G315 receivers. Visit our web site ***www.winradio.com*** *for more information about WiNRADiO range of antennas and antenna accessories.*

Setting up the Sound Card

The G315e receiver's audio travels via the USB interface in a digitized form, to be played back by the sound card. The volume can be adjusted using the ***Wave*** volume slider (which must be unmuted) or the master ***Volume Control***.

The G315i receiver's audio output is an analog ***Line Output***. You can connect this directly to standard amplified speakers, an external amplifier of your choice, or your PC sound card. If you are using the sound card, the receiver output should be physically connected to the ***Line Input*** of the sound card.

Double click on the speaker icon in the task bar, to bring up the sound card ***Volume Control*** panel:



Make sure the *Line In* input is not muted, and the volume is set to approximately half, to get started. *(If the maximum volume as set on the receiver panel is not sufficient, you may wish to increase the sound card volume later.)*

If you are using the *Microphone* input instead of Line input, please check if there is an ***Advanced*** button under the *Microphone* volume control in the sound card control panel. If so, then click on it and uncheck the ***+20dB gain*** check box if it exists. (The extra large gain might result in overloading the sound card and cause distortion.)

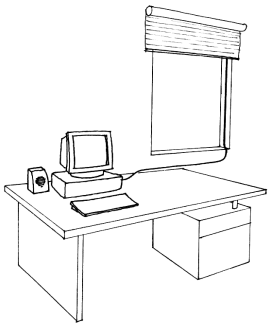
Connecting the Antenna

Unless you already have a proper antenna in place, you might like to take advantage of the supplied start-up antenna which comes with your G315 receiver.

This antenna consists of a 3-metre length of a coaxial lead-in cable, with an additional 3 metres of insulated wire. The thinner, insulated wire at the end of the coaxial cable is the actual antenna. It is necessary for the lead-in cable to be as far away from the PC as possible, to reduce potential interference from the PC.

Please note that this start-up antenna is supplied for initial tests and *immediate gratification* only. It is not intended to replace a proper antenna.

The best placement of the start-up antenna depends on your actual situation, and will often involve some experimentation. However, the basic rule is simple: Place the antenna as close to the window as you can, and keep the active part of the antenna as far away from the PC, and other electronic and electrical devices, and metal objects, as possible.



An example of start-up antenna placement

No matter how good a radio receiver is, the performance of the entire receiving system will depend on the quality of the antenna. The same applies to a WiNRADiO receiver. To make the most of your G315 receiver, you should install a proper antenna. WiNRADiO may also be able to assist with our wide range of suitable antennas – check our Web page ***www.winradio.com***.

Getting Started

There is often a degree of understandable impatience when exciting new equipment such as a new WiNRADiO receiver is acquired. The following fast-forward introduction makes it possible for you to start using your new acquisition as quickly as possible. Detailed operation is described in the subsequent chapters. We hope you will return to these chapters, as the WiNRADiO G315 receiver has many fine features which would be a shame to miss.

Start the WiNRADiO G315 receiver application (by double clicking on the WiNRADiO icon). The WiNRADiO G315 receiver control panel will appear as shown in the following picture:

WiNRADiO G315 Receiver Control Panel

The WiNRADiO G315 receiver control panel has some elements similar to conventional receivers and many additional features as well.

The quickest way to get started with this receiver is to check its operation on your local AM stations.

Using the keyboard, type in the frequency of one your local AM stations: For example, for 774 kHz, type in ***7 7 4*** , then ***k*** for kHz, then press ***Enter***. The typed-in frequency will appear on the digital frequency display. Then select the AM mode by clicking on the ***AM*** button. At this point, you should be able to see the station peak on the real-time spectrum scope, and hear the station.

Adjust the bandwidth for optimum reception using the row of numbered buttons at the bottom of the spectrum scope panel: these represent preset IF bandwidth. To adjust the IF bandwidth smoothly, use the IF bandwidth control at bottom left.

You can adjust the volume using the two buttons next to the small Volume display. *(Note also the little slider between these two buttons: you can drag it up and down to change the volume faster.)* An alternative way to adjust the volume is by using the left/right arrow keys of the PC keyboard.

Manual tuning can be done in several ways. Let's start with the tuning knob: Place the mouse cursor onto the upper half of the tuning knob, at which point you will see the cursor change to a curved double ended arrow. Hold down the right or left mouse buttons to increase or decrease the frequency, and the knob will rotate clockwise or anti-clockwise, respectively.

If you place your cursor onto the bottom half of the tuning knob, the direction of the rotation will reverse. *(You don't need to move the cursor up or down to change the rotation of the knob, simply press either the left or right mouse button.)*

The rotation increment of the tuning knob is 0.5 kHz. This can be changed easily using the *Shift*, *Ctrl* or *Alt* keys: If you press the *Shift* key while tuning, the increment will increase ten times (to 5 kHz). Pressing *Ctrl* will increase the increment a hundred times (50 kHz). On the other hand, if you use the *Alt* key, the increment becomes ten times smaller: 50 Hz.

Another way of tuning is to use the up and down arrow keys on the PC keyboard. If your mouse has a wheel, you can also use this: you might find it somewhat similar to using the tuning knob of a conventional receiver.

If you are unable to tune to any stations at this point, please refer to ***Appendix A - Troubleshooting***. There are many other ways to tune the WiNRADiO receiver other than typing the frequency or using the tuning knob. These will be explained in detail in the following chapters.

Tuning WiNRADiO G315

Manual Frequency Entry

To change frequency, simply type the new frequency into the keyboard. As soon as you press a number or decimal point, the frequency display will activate, waiting for a frequency to be typed. You can also click on the display to type in a new frequency in a highlighted field. After typing the new frequency, press ***Enter*** and the receiver will instantly retune. To abort, press ***Escape***. To enter units, such as kHz or MHz, simply press ***k*** for kHz or ***m*** for MHz after entering the digits. Any invalid keystrokes are ignored. Frequencies outside the receiver limits (9 kHz to 1800 MHz) will not be accepted and the display will revert to the previous frequency.

Use the ***kHz*** or ***MHz*** buttons to select how you wish the frequency to be displayed.

The up/down buttons under the individual digits make it possible to quickly step up or down the frequency in the corresponding positions. *(The little slider buttons between the up/down buttons can be used for faster adjustment.)*

The ***VFO*** buttons make it possible to select from four different VFOs. A VFO is a kind of frequency memory making it possible to quickly switch between several frequencies. For example, if you tune to Frequency 1 using VFO1, and Frequency 2 using VFO2, then you can alter between Frequency 1 and Frequency 2 by simply clicking on the corresponding VFOs.

Under these buttons there is a ***Band description window*****.** This window shows the band allocation of the currently tuned frequency. While the displayed band descriptions are specific to the North American standard, they are based on international treaties and therefore are generally applicable worldwide with minor differences, which can be easily edited by the user.

The band descriptions can be overridden with a call sign or a user-defined description of a particular frequency stored in memory. This overrides the band description for a particular frequency only.

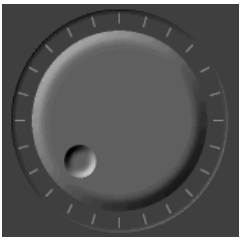
It is also possible to change the naming and frequency allocations for entire frequency bands. This can be done by editing the file called ***bands.csv*** in the WiNRADiO installation folder. (This is a standard "comma-separated-value" format file which can be edited using a spreadsheet application, such as Microsoft Excel.)

Did you know?

VFO stands for Variable Frequency Oscillator. This is a historical term dating back to the era of analog tuned radios. Before digitally tuned receivers were invented, there was no easy way to store and recall frequencies. Professional receivers had switchable oscillators where the oscillators (and their variable capacitors) themselves served as analog frequency memories. The name and the net effect remain, but the principle has changed: There is no need for multiple oscillators in modern receivers to implement this function. The frequency is simply stored in a digital memory.

Tuning Knob

The ***Tuning Knob*** makes it possible to adjust the frequency in fixed 50 Hz, 500 Hz, 5 kHz or 50 kHz steps.



To use the tuning knob, position the mouse cursor over the knob (the cursor will turn into a curved double ended arrow) and click on either the left or right mouse button. If the cursor is on the top half of the knob, the left button will decrease the frequency, and the right button will increase the frequency. If the cursor is in the lower half, the opposite will occur (and the cursor will invert its shape).

You don't need to move up or down with the cursor to change the rotation of the knob. Simply press either the right or left mouse button.

As the knob rotates, the frequency will change in 500 Hz steps. Holding the mouse button down will accelerate the tuning.

The step size can be changed to 50 Hz, 5 kHz or 50 kHz, using the ***Alt***, ***Shift*** or ***Ctrl*** keys, respectively, while clicking the tuning knob with mouse button.

Note that the Fine Tune Knob can also be conveniently rotated using a wheel of a wheel-equipped mouse, or any other standard Windows-supported pointing device.

Keyboard Tuning

The receiver frequency can also be adjusted using the keyboard cursor control keys: Using the up/down arrow keys, the frequency changes in 500 Hz steps for AM, AMS and FMN modes, 10 Hz steps for LSB, USB, DSB, ISB and CW modes and 50 kHz steps in the optional FMW mode. Using the ***Shift*** key multiplies the step by 10, the ***Ctrl*** key multiplies it by 100.

Incremental Tuning Pad

This unique tuning tool is located above the Tuning Knob. If the mouse is positioned above one of the coloured squares, the square lights up and the associated tuning increment value appears:

Clicking on the square with the left mouse button results in increasing the frequency, clicking with the right mouse button will decrease the frequency. There are several convenient tuning increments to choose from: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 5 kHz, 6.25 kHz, 8.33 kHz, 9 kHz, 10 kHz, 12.5 kHz and 25 kHz.

Tune To Peak

The ***Tune to Peak*** function can be invoked by pressing the ***TTP*** button. The receiver will tune to the signal peak (provided the peak falls inside the selected IF bandwidth – the highlighted area of the real-time frequency spectrum).

Depending on the location of the peak and type of signal, it may take several seconds for the receiver to tune in accurately, by a successive approximation process.

In the FM mode, the *Tune to Peak* function will work correctly, i.e. tune to the centre of the signal, even though the sidebands may be higher than the carrier frequency. However, it will not work in the optional wide-FM (FMW) mode.

In LSB and USB modes, the success of this facility will depend on the type of modulation signal. It may be useful for certain types of data modulation (fax), but is not usually recommended for voice modulation.

AFC (Automatic Frequency Control)

The ***Automatic Frequency Control*** function is activated by pressing the ***AFC*** button. It will keep the receiver tuned to the selected station if the transmitter frequency drifts.

While this function is active, the receiver will periodically check the received signal and correct the frequency in approximately five-second intervals.

This facility is not recommended for LSB and USB modes with voice modulation, and it is not supported for the optional wide-FM (FMW) mode.

Frequency Stepping

The ***Frequency Stepping*** facility makes it possible to specify an arbitrary frequency step size. To change the step size, click on the associated display and enter the required value (from 1 Hz to 1 MHz). You can also use the up and down buttons on the right of the display, to select from commonly used step sizes. For convenience, you can also use the small slider between the two buttons.

When the step size is selected, you can step up or down from the currently displayed frequency using the left or right arrow buttons under the step size display. The double-arrow buttons further down will cause stepping by a step size ten times larger. Stepping can also be done using the keyboard ***Pg Up*** or ***Pg Down*** keys.

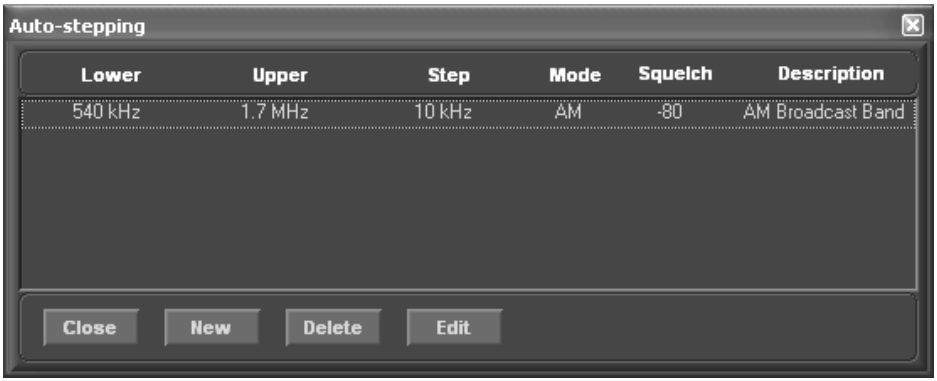
For example, if you wish to browse the AM broadcast band (approx. 530 to 1620 kHz), set the step size to 10 kHz (for North and South America) or 9 kHz (for the rest of the world), which is the channel separation for AM broadcast stations.

Tune manually to any station first, then step up or down to browse the band. To browse the shortwave broadcast stations (2.3 to 30 MHz), a step size of 5 kHz works well.

This type of fixed-size stepping is convenient if you wish to explore a frequency band where the channels are equally separated. However, you should ensure that the stepping frequencies fall on the actual channel frequencies in the band. If you know the channel separation but are unsure about the exact frequency of the first channel, tune to an active channel using manual tuning first, and only then step up or down in fixed steps.

The ***Auto*** button engages ***Auto-stepping***, which provides a significant enhancement over fixed stepping. When properly configured, auto-stepping will automatically set the step size according to the frequency you are tuned to. Auto-stepping can be also used to associate particular mode and squelch settings with specified frequency ranges.

To configure the auto-stepping ranges, go to ***Options*** **|** ***Autostepping*** in the top bar menu. The following window opens:



You can use the ***New*** button to add a new range. For each range, you need to specify the start and end of the range, step size, and optionally mode, squelch type and value, and description. You can specify as many such bands as you like.

When done, close the window.

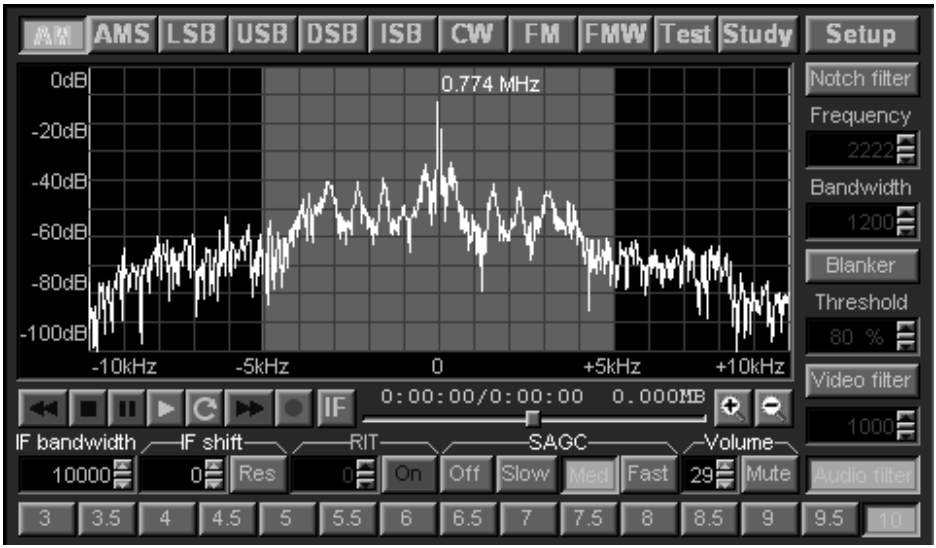
Next time when you tune to a frequency, and the *Auto* button is pressed, the step size (and optionally mode and squelch) will be set to the predefined value if the new frequency falls within a specified auto-step range.

The Demodulator

The heart of the G315 receiver is its demodulator. The demodulator is entirely software-defined, implemented using optimized filtering and quadrature demodulation techniques and executed inside the receiver's on-board DSP. All the functions related to the demodulator, i.e. demodulation mode settings, volume control, IF filter bandwidth, IF shift, RIT, software AGC, AF squelch, notch filter, noise blanker, recorder/playback and real-time spectrum display, are grouped together in an area of the front panel of the receiver which is referred to as the ***Demodulator Panel***. This panel is in fact a separate ***plug-in*** to the main receiver panel, and can be replaced by other demodulators, either developed by WiNRADiO or third parties.

Selecting Demodulation Mode

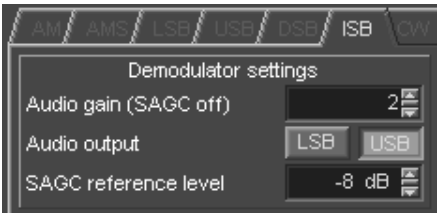
To select the demodulation mode, click the appropriate mode button in the demodulator panel:



WiNRADiO G315 Demodulator Panel

In addition to the usual and self-explanatory ***AM***, ***LSB***, ***USB***, ***CW*** and ***FM*** modes, there is also ***AMS*** (synchronous AM), ***DSB*** (dual sideband, suppressed carrier) and ***ISB*** (independent sideband). The wide-FM mode (***FMW***) is available as a factory installed option.

For ISB, the audio output can be selected between the lower and upper side bands using two selector USB and LSB buttons accessible under the ***Setup*** button:



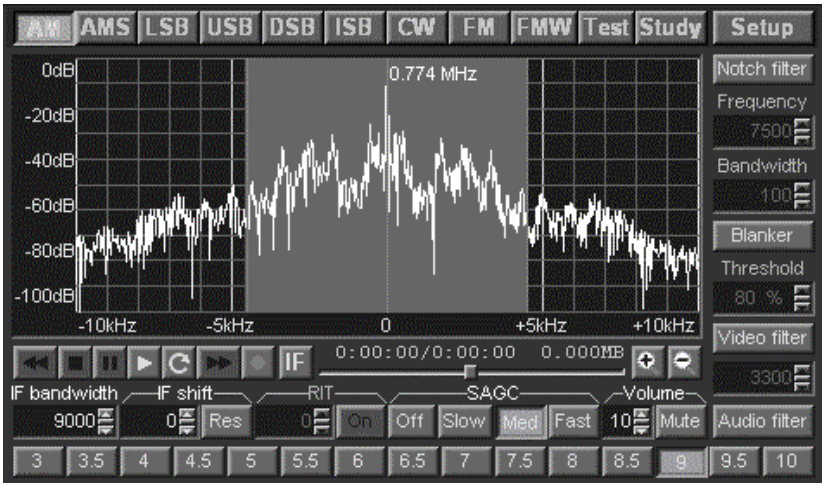
Note: Both channels of the ISB transmission can be recorded simultaneously using the recording facility of the G315 receiver. (In such case, the LSB and USB signals are recorded as left and right channels of a stereo recording.)

Real-time Spectrum Scope

The real-time spectrum display shows the actual situation within the bandwidth of the receiver. The spectrum scope shows an area of 20 kHz wide (as defined by the receiver's roofing filter). The IF (intermediate frequency) bandwidth and center frequency is software-defined and can be changed by the user to fall anywhere within the 20 kHz area. When you press the mode buttons, you will note that the central highlighted region of the spectrum changes its width. This corresponds to the IF filter bandwidth associated by default with the different modulation modes. All these default values can be overridden and finely adjusted.

The ***Video filter*** is a low-pass filter used to smooth the displayed spectrum.

When activated, the smoothness of the spectrum trace increases when the cut-off frequency decreases. The frequency can be adjusted either by direct typing in the edit box, or by clicking the up/down arrow keys, or, more conveniently, by dragging the little slider between the up/down keys.



Spectrum trace without video filter

The same signal with video filter set at 3300 Hz

The zoom in and out buttons change the displayed signal bandwidth in 2 kHz steps, while trying to keep the central red marker as close as possible to the center of the spectrum display. Using the zoom buttons, the displayed bandwidth can be changed from the default 20 kHz down to 4 kHz, making it possible to observe small details of the received spectra less than 20 Hz apart.

Setting and Adjusting IF Bandwidth

The receiver ***IF bandwidth*** can be set in several ways. The quickest way is to use the IF bandwidth presets represented by the row of buttons at the bottom of the demodulator window:

IF bandwidth presets

No.	Bandwidth
1	3000 Hz
2	3.500 kHz
3	4.000 kHz
4	4.500 kHz
5	5.000 kHz
6	5.500 kHz
7	6.000 kHz
8	6.500 kHz
9	7.000 kHz
10	7.500 kHz
11	8.000 kHz
12	8.500 kHz
13	9.000 kHz
14	9.500 kHz
15	10.000 kHz

The numbers on the buttons represent bandwidth in kHz. The preset frequencies change according to the mode selections.

All these frequencies can be changed by the user, for each mode, using a table of ***IF bandwidth presets*** accessible via the demodulator ***Setup*** button.

There are 15 presets, associated with the 15 preset buttons.

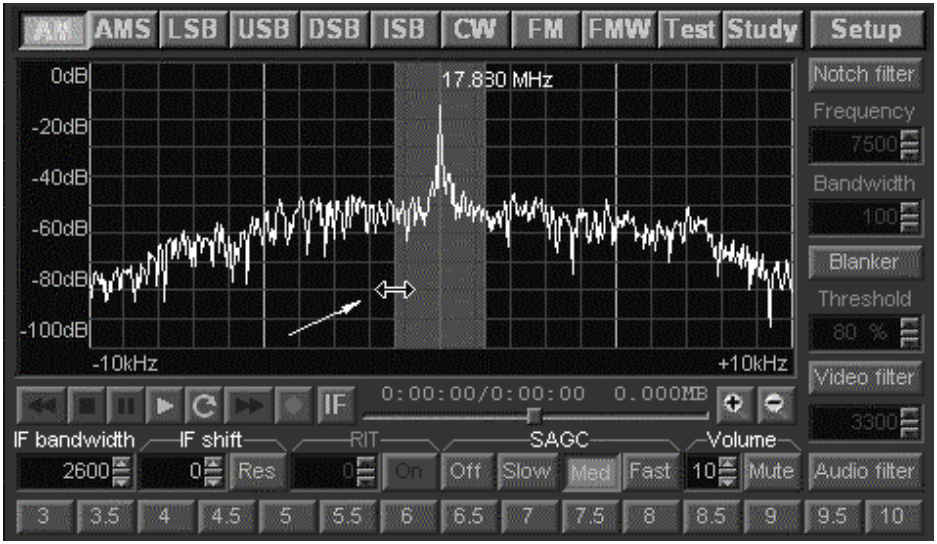
Clicking on the actual number in the ***Bandwidth*** column makes it possible to edit the IF bandwidth value associated with each button. The button label will then also change accordingly. Each modulation mode has its own set of IF bandwidth presets.

To change the IF bandwidth continuously, you can use the IF bandwidth control in the demodulator panel:

There are three ways you can use this control:

- Type the IF bandwidth directly into the edit box, in Hz (type in a number from 1 to 20000, followed by pressing ***Enter***).
- Use the small up/down cursor keys to adjust the frequency by 1 Hz steps.
- Use the small slider located between the up/down cursor keys and move it up or down. This is quite a fast and convenient method.

Another very convenient method is to adjust the IF bandwidth graphically on the real-time spectrum display, by dragging the red line bordering the shaded area representing the IF filter bandwidth:



This method makes it possible to adjust the bandwidth accurately to fit the actual bandwidth of the received signal, obtain the best signal-to-noise ratio and minimize interference from adjacent channels.

IF Shift and Passband Tuning

Dragging the centre red line of the filter passband does not result in the bandwidth change, but rather moves the entire passband. Such ***IF Shift*** makes it possible to tune the receiver to where the actual signal is, by positioning the IF filter passband precisely over the real-time signal spectrum.

To use this feature, drag the red vertical line in the middle of the highlighted filter passband anywhere over a signal peak within the displayed real-time spectrum. Alternatively, you can use the IF Shift control either by typing the IF Shift value manually, or using the up/down arrow buttons, or the small slider between the two buttons: Place the mouse cursor on it and see the cursor shape change, to indicate a 'slider' type of control. To change the IF Shift value, hold down the left mouse button to drag the slider up or down. To reset the value back to zero, press the associated ***Res*** button.

Note that for the USB and LSB modes, only one of the two filter edges can be dragged with the mouse. The other edge, which represents the imaginary "carrier" frequency of the station remains stationary. IF shift is again accomplished by dragging the centre line. The inactive filter edge is shown in a darker color.

The IF Shift facility makes it possible to quickly and visually tune to another station represented by a signal peak in the real-time spectrum. However, it is not very suitable in the AMS, USB, LSB, DSB and ISB modes if you only wish to adjust the filter passband position slightly for the station you are currently receiving (for example to avoid interference from an adjacent channel). If you do this, and are, for example, tuned to an AM station using the AMS mode, or an SSB station using the USB or LSB modes, then moving away from the exact carrier frequency will result in a whistle being heard, its pitch being directly proportional to the IF Shift displacement.

To make it possible to move the filter passband only, but still remain tuned to the same frequency, there is also an associated ***Passband Tuning*** mode: This is invoked by dragging the graphical centre of the filter passband with the right mouse button instead of the left one. This makes it possible to finely adjust the filter position in the AMS, LSB, USB, DSB, ISB or CW modes, without the whistle effect. Note that in this mode (indicated by "***PBT***" displayed in the filter passband) it is not possible to move the filter passband to another station - simply revert to the normal IF shift mode using the left mouse button or the ***IF Shift*** control, or press the ***Res*** button, if you need to move to another station peak.

To summarize, there are two ways to shift the real-time spectrum:

1. ***IF Shift*** (without BFO change) which makes it possible to tune the receiver to another frequency by dragging the entire filter passband over a peak of a visible signal. Use the left mouse button for this.

2. ***Passband Tuning*** (with tandem BFO change), making it possible to adjust the filter position in SSB and CW modes without detuning the received station. This is done using the right mouse button.

Note: IF shift and Passband tuning are available in all modes except the optional wide-FM mode.

Volume Control

The ***Volume control*** is also located in the ***Demodulator panel***. The volume can range from 0 (no sound) to 31 (full volume). To enter a value directly, click on the display and type in the new volume level. The volume can be also increased or decreased by clicking on the up/down buttons next to the volume display.

Another convenient way of changing the volume is by using the small *slider* button between the up/down buttons. Place the mouse cursor on it and see the cursor shape change, to indicate a 'slider' type of control. To change the volume, hold down the left mouse button to drag the slider up or down.

Finally, another convenient way of changing the volume is using the ***left and right cursor keys*** on the keyboard.

Mute Control

Next to the Volume control is the ***Mute*** button, which makes it possible to switch off the audio output quickly. It is faster to use than setting the volume to zero, with the added benefit of not changing the set volume level. To use the mute control, simply click on this button. Click again to release.

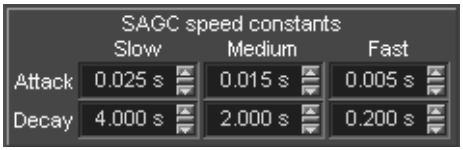
Software AGC

In addition to the usual hardware *AGC* (Automatic Gain Control), the G315 receiver also has ***Software AGC***.

This facility is used to compensate for audio volume changes when the antenna signals are so weak that the hardware AGC is not yet activated, or when the hardware AGC is disabled and manual IF gain setting is used instead.

Think of the Software AGC as an "Automatic Volume Control", which acts on the demodulated audio signal, while the hardware AGC acts on the undemodulated intermediate frequency signal.

The software AGC has four settings: ***Off***, ***Slow***, ***Medium*** and ***Fast***. These make it possible to disable the AGC, or to select the speed with which the AGC reacts. Typically, the AGC would be in the Medium position.

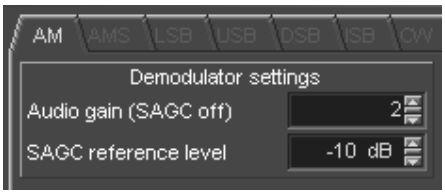


The timing of slow, medium or fast speed settings is user-definable under the ***Setup*** button:

The attack time (the speed with which the SAGC reacts to a rising signal level) as well as the decay time (the speed with which the SAGC reacts to a lowering signal level) can be adjusted separately.

For most practical applications, the medium setting with its default speed settings is recommended. Slow setting would be used especially with Morse code (CW mode), while fast setting might be appropriate for very noisy signals (where noise bursts might temporarily desensitize the receiver if slow decaying SAGC was employed).

When enabled, SAGC tries to maintain the audio output at a constant level, the ***AGC reference level***. This level is user adjustable under the ***Setup*** button, separately for each demodulation mode:



The higher the *AGC reference level*, the louder the maximum audio volume (which can be then reduced by the volume control). However, with a high level and strong signal levels there will be a distortion. Decreasing the AGC reference level will result in lower audio levels.

The ***Audio gain*** setting is applicable only when SAGC is turned off, making it possible to set a fixed gain level (i.e. the maximum volume) for each demodulation mode separately.

Note:

1. SAGC is available only in AM, CW and SSB modes. (The FM demodulator audio output is not dependent on the input signal level.)

2. If the receiver volume appears too low (and yet the volume control is all the way up), make sure that SAGC is enabled.

3. If the sound is distorted despite the volume being turned down, make sure that SAGC reference level is not set too high.

4. If the sound is too weak when SAGC is disabled (and yet the volume control is all the way up), use the Audio gain setting to increase the level.

Notch Filter

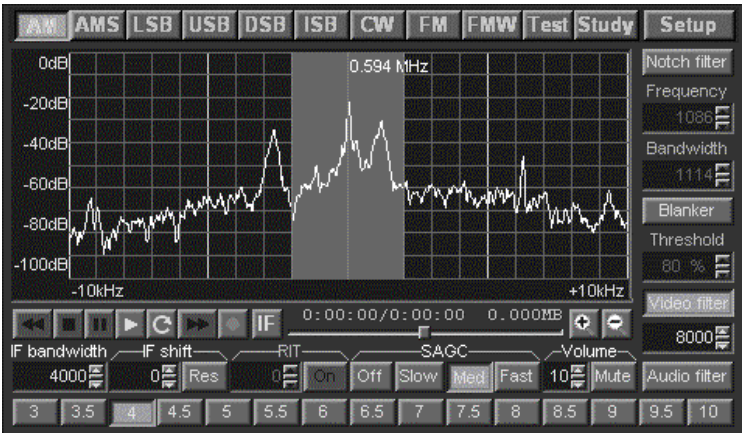
The notch filter is a band-stop filter which can be used to minimize the effects of interference falling inside or near a received station's spectrum. The filter is activated by pressing the Notch Filter button. The centre frequency and the bandwidth can be adjusted using the correspondingly named controls:

For both controls, the same usage rules apply as with the IF bandwidth setting, i.e. the values can be changed by direct manual entry, or finely adjusted by using the up/down cursor keys, or by dragging the slider between them.

Another way of changing the Notch Filter parameters is by dragging the stopband of the filter (a blue shaded area) with the mouse.

The stopband width can be adjusted by dragging the edges, while the centre frequency can be changed by dragging the centre line, which makes it possible to conveniently position the filter stopband over the interfering signal.

The following picture shows a signal with a strong interference in the passband (the large peak right of center).



In the resulting audio, typically there would be a strong buzzing sound. After engaging the notch filter and adjusting its center and bandwidth (by dragging the blue area center and edges) to fall exactly over the interference, the situation will look like this:

This results in significantly reduced interference and a much more pleasing sound.

Audio Filter

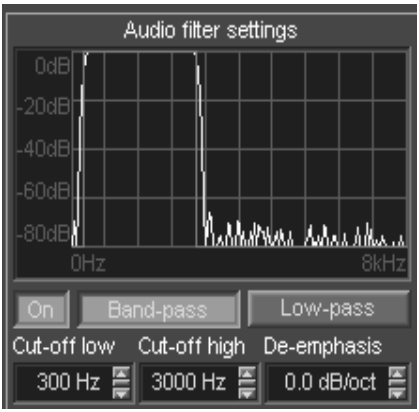
The ***Audio filter*** makes it possible to apply filtering to the demodulated audio.

This is useful in particular for noisy signals, where intelligibility is improved by emphasizing particular frequencies (usually speech frequencies 300-3000 Hz).

In the FM mode the audio filter is usually necessary to provide ***de-emphasis*** of high frequencies. It is also useful to remove low-frequency audible tones of CTCSS squelch signalling.

The ***Audio filter*** is activated using a button at bottom right of the demodulator panel:

There two types of filters: band-pass and low-pass, and their parameters can be adjusted under the ***Setup*** button:



The ***Audio filter settings*** make it possible to adjust audio filtering parameters separately for each demodulation mode. The ***On*** button either enables or disables filtering, and is tied to the ***Audio filter*** button in the demodulator front panel.

The ***Band-pass*** and ***Low-pass*** buttons make it possible to select the desired type of filter. The filter cut-off frequencies can be either entered numerically, or the filter edges can be dragged with the mouse. For the band-pass filter, the entire passband may be shifted left or right by dragging the top horizontal red line.

With a band-pass filter, suitable low and high cut off values for good intelligibility of voice communications are 300 and 3000 Hz, respectively.

De-emphasis is usually necessary for FM demodulation only. The typical value is -6dB/octave. Some operators also sometimes use de-emphasis in AM mode, to make the audio less tiring with prolonged listening.

Noise Blanker

The ***Noise Blanker*** is effective for random high-level noise spikes, such as atmospherics.

The Noise Blanker is activated by pressing the ***Blanker*** button. If the instantaneous IF signal level exceeds the specified ***Threshold*** level, those IF samples are replaced with older ones. The threshold level is set as a relative value, a percentage of the maximum possible sample level.

Receiver Incremental Tuning (RIT)

In some other receivers, this is also referred to as the ***Clarifier***. This function is used exclusively for SSB (USB or LSB) modes. It is not available, nor necessary, for other modulation modes.

In effect this is a ***VFO for IF shift****;* a short-term memory for IF shift.

If two communicating SSB stations are not exactly on the same frequency, listening to them may need an adjustment for one of the frequencies, otherwise one of the stations might sound distorted. To spare you from having to quickly tune to the new frequency while listening to the dialogue, the RIT function makes it possible to conveniently adjust the frequency increment by simply engaging or disengaging the ***RIT*** button.

To set up RIT, firstly tune the receiver precisely to one of the stations, until you have perfect sound. Then press the RIT button and adjust the RIT frequency increment (it is shown in Hz) to hear the second station clearly. You can either type the increment value in the edit box (which is a slow way), or use the up/down arrow keys, or the small slider located between the arrow keys, which is the fastest way.

Then simply turn RIT on and off, depending on which station is currently on air.

Recording and Playback

The G315 receiver's demodulator has integrated recording and playback functions. This facility makes it possible to record and playback the demodulated audio in standard *".wav"* files, as well as the modulated signal at the IF level (***IF recording***).

The IF recording feature can be very useful in situations where the received signal is of some significance and needs to be analyzed. A weak or interference-obscured signal can be thus "re-received" with different bandwidths, notch filter and noise blanker settings, to arrive at the best possible demodulated audio.

Recording starts when the ***Recording*** button (red dot) is engaged, and stops when the ***Stop*** button (green square) is pressed. The ***Pause*** button (two green vertical lines) is also available.

Playback is done by pressing the ***Play*** button (green arrow), and the ***Fast Backward*** and ***Fast Forward*** buttons complement the recording controls.

When the ***IF*** button is engaged, the recorder will record on the IF level instead of audio. The recorded files will have the extension "*.if.wav*".

The round arrow button, when engaged, causes an infinite looping when playing either audio or the IF signal: When the recorded signal reaches the end, the playback will restart immediately again from the beginning. This is particularly useful when you are playing back an IF signal and experimenting with different settings of filters for the best possible audio quality.

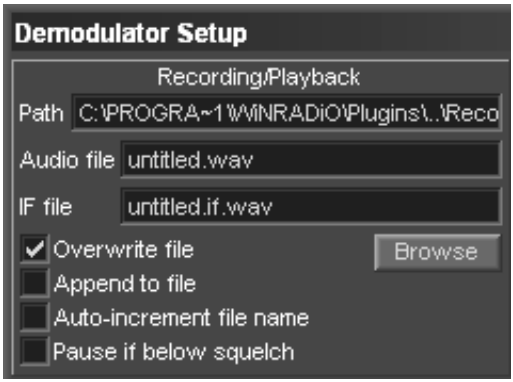
The recorder uses the following fixed "***.wav***" file formats:

1. For audio recording (except in ISB mode): 16 kHz sampling rate, 16-bit mono

2. For audio recording in the ISB mode: 16 kHz sampling rate, 16-bit stereo

3. For IF recording: 64 kHz sampling rate, 16-bit, mono

The recording/playback set-up is done using a dedicated section in the Demodulator settings (under the ***Setup*** button):



The recorded file path can be set up using the ***Path*** edit box. The default file names for recording/playback can be set up using the ***Audio file*** and ***IF file*** edit boxes, for Audio files and IF files, separately. The directory ***Browse*** button can be used to advantage, instead of typing the path and file names.

The audio and IF file names are related; the only difference is the "*.if*" used before the "*.wav*" extension for the IF files.

For recording, there are three possible options to choose from:

Overwrite file - the file, if it exists, is completely overwritten with new samples.

Append to file - the new samples are appended to the file, if it already exists.

Auto-increment file name - each time the record button is pressed, a number just before the ".wav" extension, and ".if" for IF files, is incremented; if there is no initial number, 1 is automatically used first.

Normally, the recording does not depend on the squelch. However, if the option ***Pause if below squelch*** is activated, the recording will pause accordingly.

The path and the file names for audio and IF recording can be both manually edited or configured using a dedicated dialog box shown by clicking on the ***Browse*** button. The audio and IF file names are correlated, the only difference being the "*.if*" used before the *".wav*" extension.

The file names can contain "wildcards" which make it possible to include date, time, frequency, etc., inside the name of the file. The following wildcards are supported:

#D - system date (in YYYYMMDD format)

#T - system time (in HHMMSS format)

#F - frequency in MHz (6 decimals)

#M - mode -("AM","AMS","DSB","USB","LSB","ISB","CW","FM","FMW")

#N - serial number of the receiver

For example, the following is an acceptable file name, where the date, time and frequency will be included:

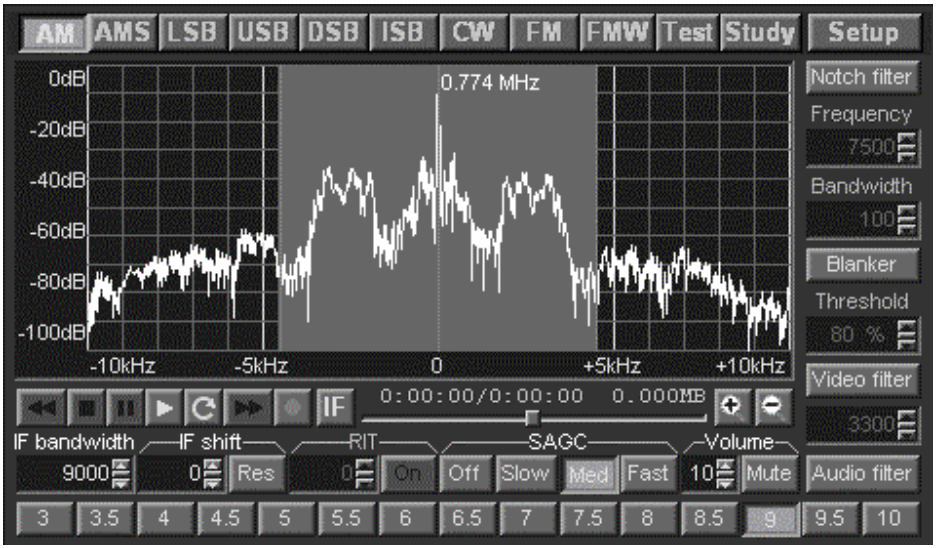
```
myfile #d #t #f.wav
```

Recoding is also possible while the receiver is scanning and searching for stations. To take advantage of this feature, enable ***Pause if below squelch***, set up a file name which includes the #F frequency wildcard, and start scanning. Depending on the scanning parameters, the receiver will then record the intercepted station audio or IF samples to "wav" files.

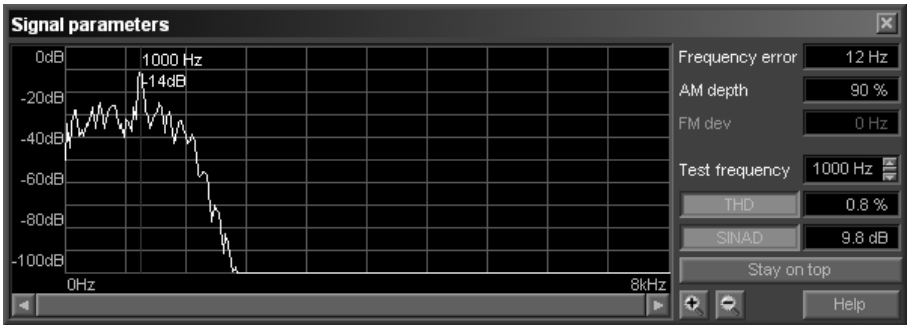
For example, if ***Pause if signal appears*** is enabled, and the ***Pause delay*** is set to 10 seconds, then samples of 10 seconds each will be recorded – see the ***Scanner Configuration*** chapter for more information.

Test and Measurement

The ***Test and Measurement*** function of the G315 receiver is invoked by pressing the ***Test*** button:



This causes an instrumentation window to open which contains several facilities to assist with analysis and measurement of the received signal:



The real-time ***Audio Spectrum Analyzer*** on the left of the window makes it possible to observe properties of the demodulated signal with a 5 Hz resolution.

The red marker can be dragged with the mouse and the associated frequency and level observed at the top of the marker. To zoom the spectrum graph in and out, use the zoom buttons on the left of the ***Help*** button.

The ***Frequency error*** display indicates the frequency error of the received signal (presuming the receiver is tuned to the correct frequency).

The ***AM depth*** display measures depth of amplitude modulated signals.

The ***FM deviation*** display shows frequency deviation of frequency modulated signals.

The ***THD*** and ***SINAD*** buttons enable the measurement of ***Total Harmonic Distortion*** and ***SINAD*** (signal-plus-noise-plus-distortion to noise-plus-distortion ratio), respectively. The test frequency for these two functions (which should be equal to the modulating audio frequency applied to the RF test signal connected to the antenna) can be adjusted using the Test frequency edit box.

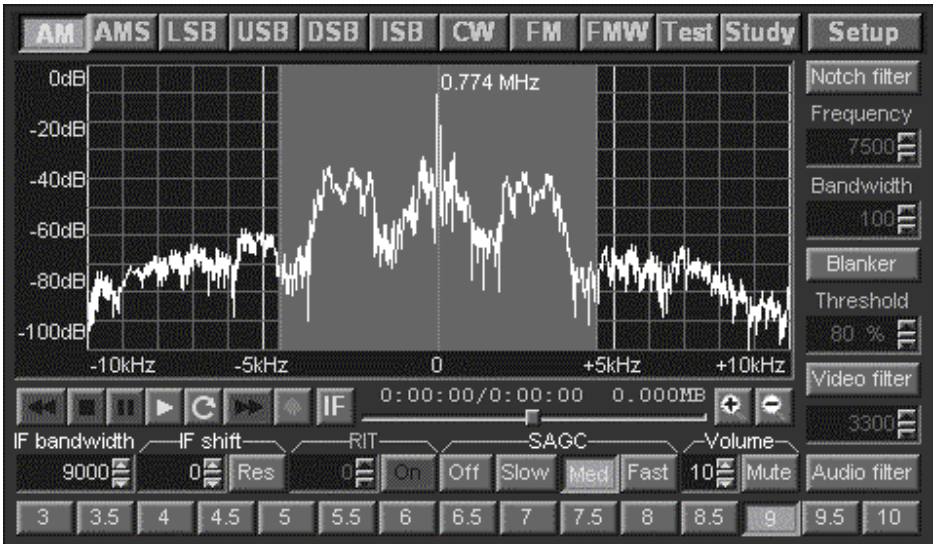
The ***Stay on Top*** button can be used whenever it is convenient for the test and measurement window to remain on top of all other windows.

Did you know?

Using the SINAD measurement facility and a calibrated signal generator, you can measure the receiver sensitivity very easily. For example, to measure AM sensitivity, connect the signal generator to the antenna input and turn on AM modulation (the modulation depth is usually set to 30%, although some manufacturers prefer to quote sensitivity figures at higher modulation depths, for example 60 or 80%). Set the Test frequency equal to the modulating frequency (typically 400 Hz or 1 kHz). Adjust the IF bandwidth for the maximum SINAD. Then gradually keep reducing the generator output level to the point when SINAD drops to 10 dB. The receiver sensitivity is then equal to the generator level at this point. Measuring AM sensitivity using SINAD rather than the conventionally used S+N/N is quite appropriate as SINAD also includes distortion, which is as much an impediment to intelligible reception as noise, and therefore provides a more practical result. Even though in theory using SINAD should result in the sensitivity figures being somewhat worse than if S+N/N is used, in practice, with a good receiver such as the WR-G315, there is not a noticeable difference.

Demodulator Structure

The internal structure of the G315 demodulator can be accessed and explored using the ***Study*** button:



The ***Study*** button reveals the internal structure of the currently selected demodulator, and offers additional measurement facilities.

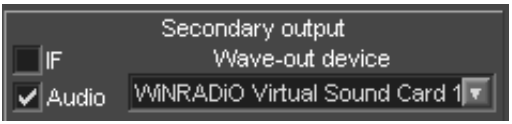
This function is intended for users wishing to acquaint themselves more deeply with ***Software Defined Radio*** principles. It is described in greater detail in ***Appendix E – Inside G315 Demodulator***.

Did you know?

The award-winning WiNRADiO G303i receiver was the world's first software-defined commercially available receiver and the first PC-based receiver to earn five-star rating from the WRTH publication.

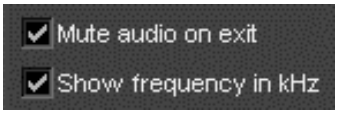
Other Demodulator Settings

The ***Secondary output*** can be applied to IF or audio signal. It is intended for third-party applications that require access to the digitized IF or audio samples for further signal decoding. The IF samples are passed at 48 kHz sampling rate, two channels. Audio samples are passed at 16 kHz, one channel.



The *Secondary output* can be used to advantage by the optional ***WiNRADiO Virtual Sound Card*** software (see ***www.winradio.com/vsc***), which makes it possible to pass the digitized signals from the receiver directly to a third-party application without any intervening re-digitization process and therefore without introducing any additional distortion to the received signal. Alternatively, it is also possible to use this feature to provide an output to a secondary (real) sound card.

The last remaining demodulator settings are ***Mute audio on exit*** and ***Show frequency in kHz,*** located at the bottom left of the demodulator ***Setup*** panel***.***



As all critical demodulation functions are performed inside the on-board DSP, the receiver can continue playing audio even when the application is closed, as long as power is supplied to the board. Check the ***Mute audio on exit*** checkbox if you wish for the audio to be muted when the application is closed. This facility is available only on the internal (G315i) model; with the G315e model, the audio cannot continue once the application is closed.

Show frequency in kHz applies to the frequency displayed next to the marker in the demodulator real-time spectrum display. If this is unchecked, the frequency will be displayed in MHz. This is independent from the main frequency display, which is governed by the ***kHz*** and ***MHz*** buttons located next to the main display.

Receiver Gain Control

There are three hardware controls related to the receiver gain: ***AGC***, ***Manual IF Gain*** and ***Attenuator***.

AGC

The receiver must process a considerable variation of signals, ranging from very weak to very strong. This requires the sensitivity of the receiver to vary according to the incoming signal strength. This can be done automatically using ***AGC*** (Automatic Gain Control) or manually, using manual ***IF Gain*** control.

The incoming signal can vary in intensity, with changing propagation conditions, and also depending on the modulation type and content. For example, with CW signals (where information is transmitted by keying the transmitter on and off), the signal strength will vary substantially during the transmission. The demodulated signal will then sound better with a slow AGC (as the receiver will not have time to increase the gain during the "off" intervals, and increase the background noise and causing a raspy sound).

On the other hand, use fast AGC when listening to especially weak signals buried in static and noise. Otherwise, each new burst of noise would desensitize the receiver for a long time and you could miss long periods of useful transmissions. If unsure, use the medium speed AGC setting.

It is easy to forget that AGC has been disabled. If the signal sounds distorted, or, on the other hand, sensitivity appears to be very low, check the AGC setting first.

IF Gain Control

The AGC can be turned off using the AGC ***Off*** button. The receiver gain must then be adjusted manually. This is done using the ***IF Gain*** control.

Note that by setting an excessive gain, the receiver will overload and the demodulated signal will be distorted, which can be very easily observed in the real-time spectrum scope. On the other hand, if the gain is too low, it will make the receiver appear "deaf".

Manual *IF Gain* setting is very useful when hunting for very weak signals buried in noise. The *IF Gain* control is only enabled when the AGC is switched off.

The gain can be adjusted in three ways: by typing the value directly in the edit box, by using the up and down buttons, or by dragging up or down the centre slider button.

RF Gain Control

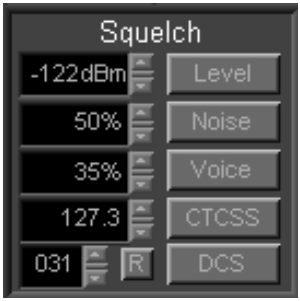
The ***Attenuator***, when enabled, makes it possible to reduce the receiver sensitivity by 18 dB. The ***Preamplifier***, when disabled, reduces front-end gain by further 12 dB.

By attenuating the input signal and/or reducing the front-end preamplifier gain, the sensitivity of the receiver is reduced to avoid overloading by strong signals (e.g. from local broadcast stations).

If you are experiencing overload problems, try to disable the ***Preamplifier*** first.

If sensitivity appears poor, please make sure that the attenuator is disabled and the preamplifier is enabled.

Squelch Control



The ***Squelch control*** can be used to automatically mute the receiver when no signal is being received. The squelch serves two purposes: Firstly, without a signal, all you will usually hear is noise, so squelch is provided to cut out the noise until a useful signal is received, making the receiver more comfortable to use. Secondly, when the receiver is scanning, the objective is to stop the scan when a useful signal is found - what a "useful signal" actually means is defined by the squelch setting.

The G315 receiver has five different types of squelch, to maximize operator convenience and to make scanning more efficient and faster:

Level squelch refers to the received signal strength, as it is indicated by the *S-meter.* If the signal strength is higher than the specified threshold, the squelch will open and the receiver will be unmuted.

Noise squelch determines the level of noise in the received demodulated audio *below* which the squelch will open and unmute the receiver. This is particularly useful for the FM mode, where there is a considerable level of noise in the absence of a useful signal. The current *Noise* value is shown in the demodulator spectrum display if this type of squelch is enabled.

Voice squelch determines the contents of voice frequencies in the spectrum of the demodulated audio. If higher than the preset threshold, the squelch will open. The voice frequencies content of the currently received signal is shown in the demodulator spectrum display.

CTCSS *(Continuous Tone Coded Squelch System)* defines a particular *CTCSS* code which, when received, will open the squelch. The currently received *CTCSS* code is shown in the demodulator spectrum display.

DCS *(Digital Control Squelch, also known as Continuous Digital Controlled Squelch System or CDCSS)* specifies a particular *DCS* code which will open the squelch. The ***R*** button serves to indicate a *reverse* code, to comply with systems which transmit the *DCS* code in reverse.

The *Level* squelch can operate simultaneously with any of other types of squelch. If the *Level* squelch is selected together with any other then ***both*** selected conditions must be satisfied at the same time for the squelch to open ("***and***" condition).

The *Noise*, *Voice*, *CTCSS* and *DCS* squelch modes are mutually exclusive – only one can be active at a time.

If the AGC is off, the *Level* squelch is disabled (because this also disables the S-meter), but all other squelch types still remain active and can be used with the manual *IF gain* setting.

To adjust the *Level* squelch control, first tune to an unoccupied frequency that produces only noise. Increase the squelch until the receiver is muted. You will see the red-colored segment of the S-meter growing until it gets higher than the current S-meter value. At that moment the receiver will be muted and the word "***squelched***" will be displayed on the S-meter. Add a few dB extra (to allow a margin for background noise fluctuation on the band). Now when you tune to an occupied frequency, if its signal strength is higher than the squelch level, the receiver will be unmuted.

To adjust the *Noise* squelch control, first tune to an unoccupied frequency that produces only noise. Note the *Noise* value indicated inside the demodulator spectrum display. Then tune to an occupied frequency where there is a useful signal, and note the *Noise* value again. Then set the *Noise* threshold somewhere between these extreme values. Note that the *Noise* squelch is particularly effective in the FM mode. The *Noise* values depend on the *IF Bandwidth* setting, which is useful to mention especially if you are using the *Professional Demodulator*, where the *IF Bandwidth* can be adjusted.

The adjustment of the Voice squelch is similar: Tune to an unoccupied channel first, then an active voice channel, note the corresponding Voice spectrum values, and set the Voice threshold between the two extremes.

It is easy to forget that squelch is active. If the receiver doesn't seem to be operational (no sound from the speaker), check the squelch and mute settings first.

To disable the squelch action, simply disengage all squelch buttons (Level, Noise, Voice, CTCSS and DCS).

Memory

The WiNRADiO G315 receiver has the ability to store up to ten thousand frequencies in one memory file. It makes it possible to load and save different memory files for a huge amount of total storage, limited only by the size of the PCs hard disk.

Storing a Frequency into Memory

With each frequency, you can store several attributes: mode, call sign, user comment, group assignment, squelch and a hotkey.

To store a frequency into memory, the receiver must first be tuned to that frequency (and the appropriate mode must be selected if you also wish to store the mode). Next click on the ***S*** button in the Memory Control Panel as shown above.

A ***Store frequency*** dialog box will pop up, making it possible to assign a memory number to the current frequency.

*Note: The default memory file is called **G3memory.15m** and resides in the same path as the WiNRADiO receiver application, i.e. usually in the **C:/Program files/WiNRADiO/G315/** folder.*

Did you know?

*There are a number of WiNRADiO utilities and plug-ins dedicated to processing and manipulation of memory files. In addition to storing frequencies in memory files, you can also have databases, which are suitable for a larger number of frequencies. For more details of available applications related to memories and databases, please refer to **www.winradio.com/software**.*

At the top of the window there is the current memory file name into which you are storing. You can have as many different memory files as you wish. Note the file extension is always "*.15m*".

The next line shows the allocated memory number. You can change this to another memory number if you wish (including one which is already allocated). Up to 10,000 frequencies can be stored in each memory file.

Then follow the current frequency, IF shift and bandwidth parameters. You can alter these if you wish.

The third item contains the group assignment buttons. You can assign the frequency to one or more of 16 different groups, whose meaning you define yourself.

When you are searching or scanning for a particular type of frequencies (for example “Airforce”), the group assignment will allow you to confine the searching and scanning to that particular type.

Note that a particular frequency may be associated with more than one group at the same time.

There are also several additional items that can be optionally stored with each frequency:

- Most stations have a name or call sign. You can store up to 11 characters in the ***Call sign*** field.
- For quick tuning to your favorite stations, you can assign ***Hotkeys*** (function keys F2 to F12) to up to eleven different frequencies. If you then press a hotkey, the associated frequency will be instantly recalled. Hotkeys which are already assigned will be shown in this dialog box as 'used', however you can overwrite the previous assignment with a new one if you wish.
- User ***Comments*** can also be stored with a frequency. The size of the comments is limited to 31 characters.
- The ***Mode*** and ***Squelch*** values can also be stored, which will then be set automatically when the frequency is recalled.
- Finally, a ***Memory Scan Lock-out*** can be set for each memory, which means that the memory will not be included in a memory scan. In the memory Recall window, such memories will be shown with a small 'x' preceding the memory number.

Finally, when everything has been set, click on ***OK*** or press ***Enter*****,** to save the new frequency.

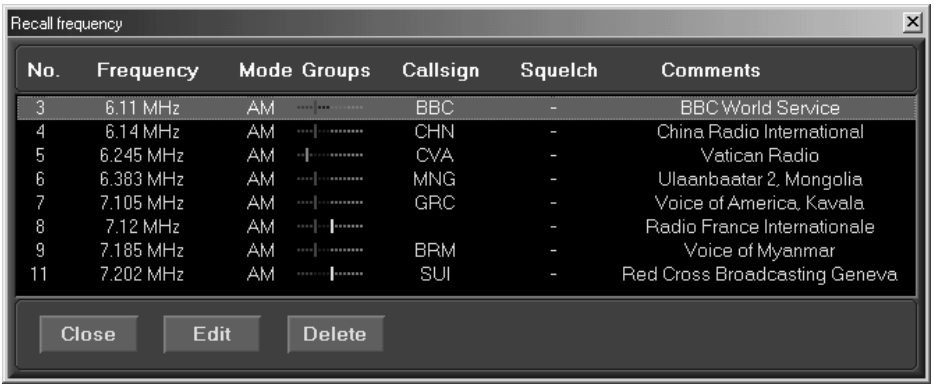
Recalling a Frequency from Memory

There are several ways to recall a frequency from memory:

- Using the ***Recall frequency (R)*** button
- Typing a number into the memory number display
- Using a hotkey
- Memory stepping

If you click on the ***R*** button, a dialog box will pop up showing a list of all memory frequencies.

To select a frequency, click on an item in the list, and the frequency will be tuned. Then close the window. Alternatively, use the ***up*** or ***down cursor keys*** to choose the frequency and press ***Enter***.



The assigned memory groups are shown as color bars for a quick visual overview of which frequencies are associated with which groups (see the corresponding colors in the Store frequency window). When you position the mouse cursor over a highlighted memory, the actual group numbers will be displayed in a floating 'hint' box.

Editing Memory

To change the settings for a particular frequency, open the ***Recall frequency*** dialog box as described in the previous section. Select the item you want to edit and click on ***Edit*** (alternatively, double-click on the item). A dialog box will pop up showing the current settings. All the settings, except the memory number, can be edited. After the entry has been edited, click on ***OK.***

Deleting a Frequency

To remove a frequency, open the ***Recall frequency*** dialog box. Select the frequency you wish to delete, and click on ***Delete***. You will be asked to confirm that you want to delete this frequency from memory. To delete all frequencies, select ***Clear*** from the ***Memory file*** sub-menu in the ***File*** menu. You will be asked to confirm that you want to clear all the frequencies in the memory.

Saving a Memory File

Each memory file, containing up to ten thousand frequencies, is stored separately, allowing different memory files to be loaded and saved. To save the current memory file, simply select ***Save*** from the ***Memory file*** sub-menu in the ***File*** menu. If you wish to save it with a different name, select ***Save as*** instead, and a dialog box will pop up allowing you to specify the file name.

When you exit the WiNRADiO G315 application, all memory changes are automatically saved; there is no need to use the Save command before exit.

Opening a Memory File

When the WiNRADiO receiver application starts up, the most recently used memory file will be opened automatically.

To open a different memory file, select ***Open*** from the ***Memory file*** sub-menu in the ***File*** menu. A dialog box will pop up allowing you to choose a memory file to load.

Memory Stepping

Memory stepping makes it possible to step through frequencies stored in the current memory file.

To step through memory frequencies use the left or right arrow buttons located under the memory ***S*** and ***R*** buttons. The double-arrow buttons located further down make it possible to advance ten frequencies up or down (or to the start or end of the memory list if it is less than ten frequencies away).

Memory stepping will only work if there are frequencies stored in memory. If no frequencies have been stored, nothing will happen if you try to step through the memory.

Scanning

The WiNRADiO G315 application contains a comprehensive set of scan functions to enable the user to search for stations which are currently on the air. There are three basic types of scanning: ***Immediate Scanning*** (*Searching*), ***Range Scanning*** and ***Memory Scanning***. The scanning method is selected using the appropriate button in the ***Scanning Control Panel***:

Immediate Scanning (Searching)

This is the simplest scanning method. Click on the ***Search*** button to select this scanning mode, then use the [**>>**] or [**<<**] buttons to scan either forward or backward from the currently tuned frequency. To stop scanning, press the ***Stop*** button (marked with a green square). To pause, press the ***Pause*** button (marked with two vertical bars).

A signal is considered 'found' when it satisfies the squelch conditions.

For example, if *Level* squelch is selected, then the signal level must be higher than the specified threshold for the squelch to open. Correct setting of the squelch threshold is therefore essential for scanning: If you set the squelch level too low, the scanning will stop even if there is no signal. On the other hand, if the squelch level is set too high, then a useful signal may be missed because it will fall short of the threshold level. With a bit of trial and error, you will need to adjust the optimum setting for the squelch level (usually a few dB above the background noise floor).

With *Noise* and *Voice* squelch, set the threshold between the indicated values for background noise (no signal) and active signal. For *CTCSS* and *DCS* squelch, set the frequency or code of the required station.

Scanner Configuration

When a signal strength level is higher than the squelch level, this indicates that a signal has been found. You can configure the software to specify what action you want to be taken at this point. To access this configuration facility, go to ***Options*** **|** ***Scanning*** in the top bar menu.

There are two basic actions the software can do when a signal is found: ***Pause*** scanning or ***Stop*** scanning. If ***Pause*** is selected, then you need to further specify the conditions under which the scanning will ***Resume***. The conditions to resume can be one of the following:

- When the signal disappears *(i.e. the scanning resumes immediately when the signal disappears)*;
- After 'Delay time' *(i.e. no matter if the signal disappears during the user-defined Delay Time interval or not, the software will always wait for the entire Delay Time interval, and only then resume scanning*);
- When a signal disappears during 'Delay time' *(i.e. the scanning will not resume if the signal returns within an interval shorter than, or equal to, Delay Time);*
- When no signal during 'Delay time' *(i.e. the scanning will resume if there is a no-signal gap equal to, or longer than, Delay time).*

The ***Delay time*** interval can be set from 1 to 100 seconds.

The scanning speed is determined by the scanning step size. The scanner tunes the receiver in increments of 10 kHz and uses 10 kHz wide “chunks” of the IF spectrum to search for a signal. If the step size is 10 kHz, the typical scanning speed will be up to approximately 50 channels per second. If the step size is 5 kHz, then the scanner only needs to retune the receiver once per every two steps, which results in a nearly double the effective scanning speed. For 1 kHz steps, the effective scanning speed will be up to approximately 500 channels per second.

Note that the maximum scanning speed may be limited by the actually available CPU resources of your computer.

When a signal is found and scanning pauses, waiting for the pre-set Delay time to expire, the countdown timer will appear inside the [<<] or [>>] buttons. If no Delay time was set and scanning is pausing until the signal disappears, then the [<<] or [>>] button will flash.

Groups

The ***Groups*** setting is useful for ***Memory Scanning***, which will be described in detail later: it serves to restrict scanning to particular memory groups only.

Exclusions

Sometimes it is desirable to exclude certain frequencies from scanning. This means that such specified frequencies should be ignored, even if the signal level on these frequencies is higher than the squelch.

The WiNRADiO G315 receiver application makes it possible for multiple frequency ranges to be excluded. This is done using the ***Exclusions*** button. When you press this button, you will open an ***Exclusions editor*** window, allowing you to enter a range of frequencies to be excluded.

For these exclusions to become active, check the ***Enable excluding while scanning*** checkbox in this window.

Frequency Range Scanning

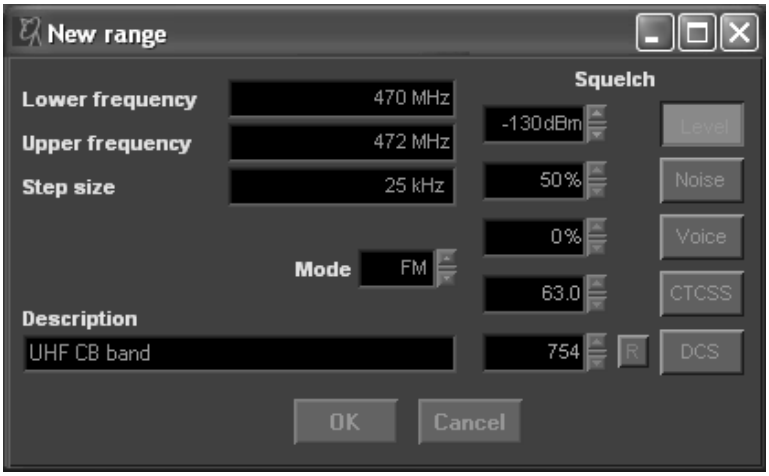
To be able to use Frequency Range Scanning, you need to set up the desired scanning ranges first. This is done using the ***Ranges*** button in the ***Options | Scanning*** top-bar menu.

Note the check box at the start of a range. This is useful in situations where you may have several ranges defined, and you wish to enable only one or several from the list, without the need to redefine the whole range list each time you want to make change in one range only. Use the checkbox to select the particular range(s) you wish to include in range scanning.

A very useful feature of frequency range scanning is that all found frequencies can be automatically stored in memory, even if the receiver is left unattended. To do this, enable ***Auto Store*** and specify the memory number range to which the frequencies should be written. You can also specify a special Group Number to be assigned to such frequencies.

When using the Auto Store option, you should also set the appropriate conditions in ***Scan Settings*** to take effect when the signal is found. For example, ***Pause when signal appears***, and ***Resume*** after the minimum delay time will provide the fastest scanning and writing into memory). *Note that if more signals are found than there are allocated memories, the excess frequencies will not be stored.*

To create a new range, click the ***New*** button. This will open a dialog box, where you can specify lower and upper limit frequencies of the range, the step size, modulation mode, squelch type and value, and, optionally, a description. You can enter as many such ranges as you like.



When the range definition is done, close this window, then close the scanner settings. Then activate the ***Range*** button in the ***Scanning*** control panel:

When you press the ***Scan Forward*** button [**>>**], the scanner will commence scanning from the start frequency of the first range. When the last frequency of the first range is reached, it will then continue onto the next range, etc. When it reaches the end of the last range, it will go back to the start of the first range and continue looping infinitely until a signal is found, or until manually stopped or paused. If you use the ***Scan Backward*** [**<<**] button, the process will be exactly reversed (i.e. starting from the top frequency of the last range and working its way downwards).

You can stop or pause this activity using the ***Stop*** or ***Pause*** buttons. If you use the *Pause* button, then restarting scanning using *Scan Forward* or *Scan Backward* buttons will resume the action from the paused frequency. If you stop scanning with the *Stop* button, then using the *Scan Forward* or *Scan Backward* buttons will recommence scanning from the initial (or the last) frequency again.

If no ranges are specified in the Ranges list, then activating scanning in the Range mode will result in no action.

Memory Scanning

The last scanning method is ***Memory Scanning***. Here the receiver will step through memory frequencies, starting with the first one to the last one, and repeating the loop until a signal is found or until manually stopped.

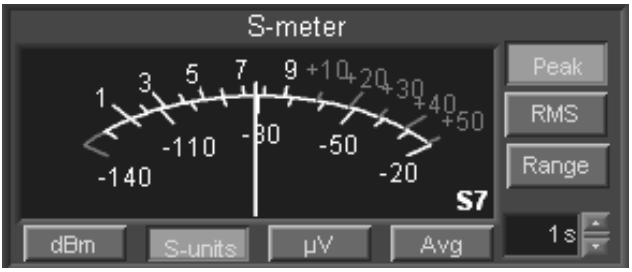
If a squelch value is stored with a memory, this value will then be used to compare with the current signal level. If there is no value stored, the current squelch value will be used as the scanning threshold.

It is possible to restrict scanned frequencies to particular memory groups only. These groups can be selected from the ***Options | Scanning | Groups*** window, accessible from the top bar menu. Groups can be enabled/disabled using the check box ***Enable group restriction*** in the same window.

Note: The speed of memory scanning is faster for frequencies which are close to each other. For example, if the next frequency is closer than 10 kHz to the previous one, and the specified bandwidth also falls within this 10 kHz distance, then the receiver will not need to tune its hardware to the new frequency. Instead, it will tune to the new frequency by software processing of the received spectrum. This will result in tuning to the new frequency much faster. Also, the smaller the tuning step, the faster it takes for the receiver to settle on the new frequency. The software always automatically sorts the frequencies internally before scanning, in order to speed up the scanning process as much as possible.

S-meter

The WiNRADiO G315 receiver is equipped with a very sensitive and selective ***Signal Strength Meter*** (*S-meter*) which makes it possible to measure peak or RMS signal level dBm, µV or S-units, within the IF filter passband. The measurement units are selected by appropriately marked buttons at the bottom of the display.

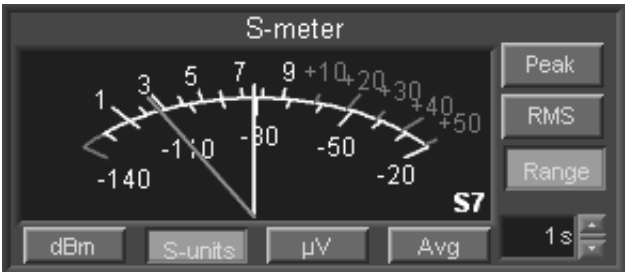


The *S-meter* also shows the currently selected value of the squelch (the red section at the bottom side of the scale). When the signal strength falls under the squelch level (i.e. the needle falls in the red region and turns red also), the receiver audio will be muted.

The squelch value is always indicated in dBm (even if the signal strength is displayed in S-units or microvolts).

The ***Peak*** and ***RMS*** buttons select between peak and RMS values (calibrated for sine wave modulation).

The *S-meter* is very selective, and acts only upon signals within the actually selected IF bandwidth (shaded area in the real-time spectrum display). The ***Range*** button splits the *S-meter* "needle" into two, and makes it possible to observe the dynamic range of the input signal (i.e. the minimum and the maximum values within the signal bandwidth):



The ***Avg*** button, when activated, shows the *S-meter* level value as a floating average within the preset time interval (settable from 1 to 99 seconds). This is used to smooth the *S-meter* movements. Any change which may affect the *S-meter* value (such as tuning the receiver to a new frequency or changing the attenuator setting), resets the averaging interval, so that the *S-meter* may react immediately to such change.

Note: The S-meter relies on the AGC for its proper operation. Therefore, if the AGC is switched off and manual IF gain is used instead, the S-meter is also disabled.

Did you know?

There are no exact definitions for S-units, merely recommendations. Historically, the S-units referred to subjectively perceived signal strength as follows:

S1… faint signals, barely perceptible
S2… very weak signals
S3… weak signals
S4… fair signals
S5… fairly good signals
S6… good signals
S7 …moderately strong signals
S8 …strong signals
S9… extremely strong signals

Nowadays, most manufacturers, including WiNRADiO, usually implement the ARRL recommendation where the S-units are spaced 6 dB apart and S9 corresponds to 50 µV at a 50 ohm antenna input, or -73 dBm (on HF bands).

Power Switch

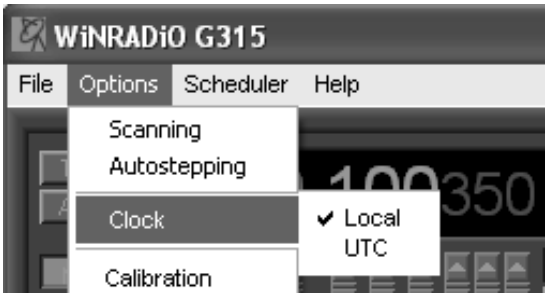
The ***Power switch***, located at the bottom-right corner of the application window, controls the receiver power. When it is off, the receiver circuitry will be powered down and no sound will be heard through the speaker or headphones.

When you exit and restart the WiNRADiO application, the power on/off status at exit will be remembered.

Date and Time Display

The clock display at the top right corner of the application window indicates the current time and date.

The display can show either UTC time or local time. To switch between the two modes, you can either click directly on the ***(UTC)*** or ***(Local)*** indicators, which will toggle between the two modes. Alternatively, you can select the clock mode under ***Options*** in the top bar menu:

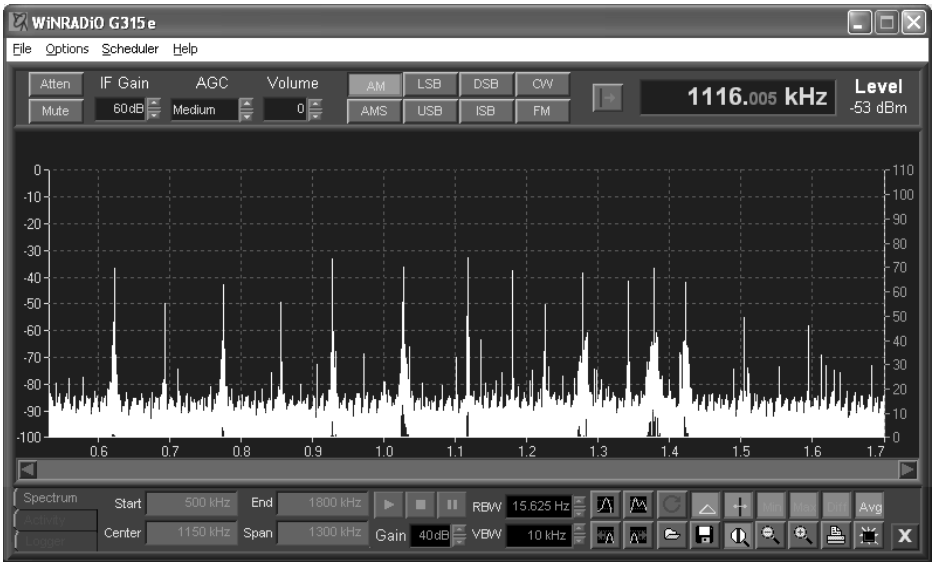


Both clock modes derive their time and date information from the PC clock. The time difference is determined by Windows ***Time Zone*** setting (***Start | Settings | Control Panel | Date/Time Properties | Time Zone tab***).

Spectrum Sweep Functions

The ***Spectrum Sweep Functions*** exist in two forms, selectable by clicking one of the yellow triangle buttons on the left of the On/Off switch:

If the upward pointing arrow button is pressed, the large sized ***full-screen*** spectrum sweep display will slide out upwards, entirely obscuring the receiver main control panel:

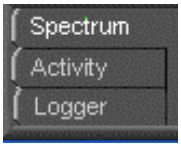


If the downward pointing button is activated, the display will slide downwards, and will remain attached to the bottom of the receiver control panel, without obscuring it:

This smaller version of the spectrum sweep functions can be resized to a convenient size by dragging the bottom edge up or down.

The bottom parts of both spectrum sweep windows are exactly the same. The full-screen version also contains a basic set of the receiver controls at the top, so that the user does not need to go back to the receiver panel to change mode, volume, attenuator, etc.

Unlike the spectrum scope inside the demodulator panel, which is real-time and narrow band, the spectrum sweep functions are wide-band and the graph is created by fast tuning the receiver across the specified frequency range in smaller “chunks” of IF spectra, which are joined together.



There are three spectrum sweeping facilities: ***Spectrum Analyzer***, ***Activity Monitor*** and ***Logger***. These are selectable using tabs at bottom left of the sweep window. The ***Spectrum Analyzer*** function is similar to a conventional spectrum analyser. The ***Activity Monitor*** function makes it possible to monitor activity on a given frequency band, including channel occupancy measurements. The ***Logger*** function can perform long term signal strength logs on individual selected channels.

Spectrum Analyzer

To set up spectrum sweeping, enter the ***Start*** and ***End*** frequencies to specify the start and end of the sweeping range, respectively. Alternatively, you may enter the ***Center*** and ***Span*** frequencies.

Next select the ***RBW*** (*Resolution Bandwidth*), which determines how detailed the spectrum will be (the lower the RBW, the finer the detail). The finest RBW is 15.625 Hz. The RBW has a proportional effect on the spectrum sweeping speed, i.e. the greater the RBW, the faster speed, but at the expense of detail.

The ***VBW*** (*Video Bandwidth*) is a low-pass filter which is applied to the resulting "video" trace of the signal and makes it possible to smooth the trace. The lower the VBW, the smoother the trace. This setting has the same effect as the Video Filter in the demodulator panel.

The spectrum analyzer, when activated, disables the AGC. This is in order to have a uniform gain for the entire scanning range – if the gain was changing due to the AGC action, the spectrum trace would be distorted (stronger signals would appear weaker, and weaker signals would appear stronger). The ***Gain*** control (adjustable from 0 to 99 dB) is used to set the IF gain for the spectrum analyzer.

Note that if the gain is set too high, the receiver may overload in the presence of strong signals and the trace will be distorted around these signals. On the other hand, if the gain is too low, some weak signal peaks may be missed.

The sweeping is controlled using a set of buttons similar to an audio recorder: The ***Start*** button (with a triangle) starts sweeping. The ***Stop*** button (with a square) stops sweeping, while the ***Pause*** button (with two vertical lines) pauses it.

The button with a red round arrow selects ***continuous sweeping mode***, which means that the sweep will continue from the start frequency when the end frequency is reached, and continue in this loop until manually stopped. If this button is disengaged, the spectrum analyzer will be in a *single shot* sweeping mode:

When the mouse cursor is positioned over the spectrum graph, a red cursor will appear. Clicking anywhere on the spectrum graph tunes the receiver to the corresponding frequency. You can also drag the mouse horizontally across the spectrum and continuously tune the receiver.

The frequency corresponding to the cursor position, as well as the corresponding signal level will be shown above the spectrum graph. In addition to the frequency and level, minimum, maximum and their difference values are also shown. These are values obtained throughout the entire time that the spectrum analyzer is sweeping. Note that if the spectrum analyzer is in the single-shot mode, the min and max values will be equal upon the termination of the sweep.

Right-clicking on the spectrum graph will cause a stationary blue vertical line, the “marker” to appear over the graph. The marker can be either dragged using the mouse, or repositioned by simply right-clicking on a new location. The marker can be made invisible by disengaging the ***Show Marker*** button:

The Show marker button gets activated automatically upon right-clicking on the spectrum graph.

When the marker is activated, marker frequency and the associated trace values will be displayed under the cursor values. If the marker delta mode is activated using the ***Marker Delta Mode*** button, these values will become differential with respect to values associated with the current position of the cursor.

The ***Min***, ***Max*** and ***Diff*** buttons enable the display of minimum, maximum and differential values when continuous sweeping is selected. (A scale for the differential trace will be displayed on the right-hand side whenever the ***Diff*** button is pressed.)

The differential trace is very useful when investigating activity on a given band. The receiver can be left unattended in the continuous sweeping mode, and any activity on the band will be clearly visible on the differential trace.

Note that it is also possible to save a spectrum graph and then load it later to perform a new sweep to show differences from the old graph, to see what has changed on the band in the meantime.

The G315 *Spectrum Analyzer* also contains special function buttons to locate peaks in the displayed frequency spectrum:

The ***Find Maximum Peak*** button (top left of the four) locates the maximum peak of the entire spectrum and positions the marker over the peak. The ***Find Next Peak*** (top right) find the next tallest peak. The two buttons below, ***Find Peak Left*** and ***Find Peak Right***, locate the next tallest peaks in the respective direction.

The ***Averaging*** button enables ***trace averaging***. With trace averaging enabled, the displayed trace is not the actual currently swept trace, but rather an average of the currently swept trace and the previous trace:

There are also three zoom-related buttons:

The first button centers the zooming action around the marker (if the marker position has been set) - if this button is disabled then zooming will be done with respect to the center of the screen. The next two buttons perform the actual zooming in and out functions.

Spectrum sweeps can be opened and saved using file manipulation buttons:

To hide the spectrum sweep window, use the yellow X button at bottom right:

The larger of the two versions of the spectrum sweep window also contains basic controls of the receiver, which are self-explanatory:

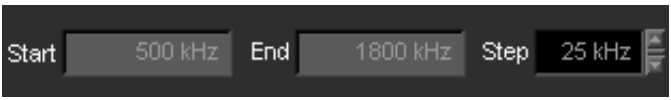
The only additional feature is the ***Tune to marker*** button. This is a momentary button which tunes the receiver to the current marker frequency, if the marker is enabled:

These controls are the same for all three spectrum sweeping functions.

Activity Monitor

Unlike the ***Spectrum Analyzer*** which sweeps a continuous spectrum in a frequency range, the ***Activity Monitor*** operates on discreet channel frequencies.

To set up the sweep, you only need to define three parameters:



The ***Start*** frequency should be the frequency of the first channel in the band. The ***Step*** size should then be equal to the channel spacing.

There are three types of displays available in the Activity Monitor: ***Level***, ***Hit Count*** and ***Time on Air***. These are selectable using three corresponding buttons.

In the ***Level*** mode, the absolute signal strength values are shown, in ***dBm*** units:

The ***Hit Counter*** mode makes it possible to plot a histogram of "*hits*" for frequency channels within the specified frequency range. A "*hit*" is an instance when the signal satisfies the squelch conditions for the given frequency. This makes it possible to observe and monitor traffic on particular channels over a period of time, and provide an indication of activity on a band. Instead of displaying signal strength on the vertical axis like the ***Spectrum Analyzer***, the ***Hit Counter*** shows the number of hits.

The hits are represented by bars of different heights. The height of each bar is relative to the number of hits. The bar corresponding to the frequency with the highest number of hits will always remain of the maximum height (100%) that fits the window. The other bars will have proportionally smaller heights. The marker, ***Min***, ***Max*** and ***Diff*** buttons are all disabled in the ***Hit Counter*** mode.

The ***Time on Air*** mode is similar to the ***Hit Counter***, however, the bar heights represent percentages of time during which the channels were on air (relative to the total scan time).

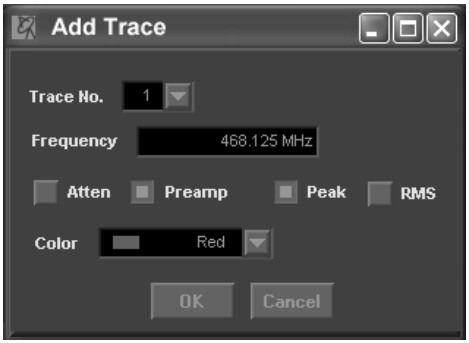
The difference between ***Hit Counter*** and ***Time on Air*** displays can be best understood if you consider a situation where there was only a single hit in the scanned band: Using the ***Hit Counter***, there will be always one bar displayed, and will remain of the same (maximum) height, no matter how long you leave the program running. With ***Time on Air***, the height of the bar will decrease progressively with each new scan.

If there is an active signal on a particular frequency, the respective bar will turn red for the rest of the scan. This is designed to give you a visual idea of current activity in the band.

Signal Strength Logger

The ***Logger*** makes it possible to record signal strength on several discrete frequencies over a period of time. Up to 50 separate frequencies can be monitored and you can also specify the sampling interval.

To set up logging for a particular frequency, press the ***Add*** button and the following window appears:



Atten and ***Preamp*** buttons specify the required state of the ***Attenuator*** or ***Preamplifier*** for each trace. ***Peak*** and ***RMS*** refer to the S-meter measurement mode as they exist in the main panel. Each trace can have a different color, to be distinguishable on the screen.

Similarly to the ***Spectrum Analyzer*** and ***Activity Monitor,*** the Logger is started, paused and stopped using three recorder-like buttons:

The log files can be also opened and saved using the same file open and save buttons:

The log files are saved in the ***CSV*** (comma separated values) format. For example, if the interval is set to 1 minute, and there are three traces, 101.9 MHz (red), 468.125 MHz (green) and 808.000 MHz (yellow), the "***.csv***" file will contain lines similar to this:

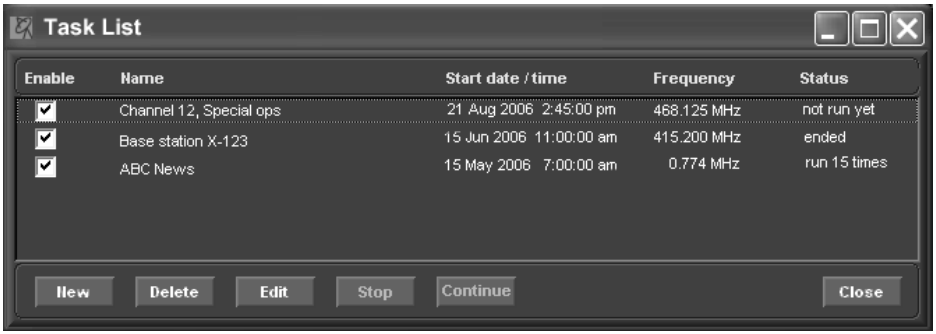
```
"Interval 00:01:00"
"Atten Off","Preamp On","Peak"
"101.9","468.125","808"
"red","green","yellow"
"-99.9","-120.0","-75.1"
"-99.8","-120.2","-75.2"
"-100.1","-120.1","-74.9"
"-99.9","-80.1","-74.9"
"-99.8","-80.2","-75.1"
"-99.8","-80.2","-75.1"
```
(etc.)

The first line specifies the measurement interval in ***hh:mm:ss*** format (in our example it is 1 minute). The second line saves the attenuator, preamplifier and S-meter mode status (***Peak*** or ***RMS***). The third line specifies the frequencies in MHz, and the fourth line defines the colors for each trace.

The subsequent lines then show the signal strength values for each of the specified frequencies respectively, in dBm units. Each line corresponds to a single measurement taken in the specified interval.

Scheduler

The ***Scheduler*** is invoked from the top bar menu. When invoked you will see a ***Task List*** window which looks similar to this:



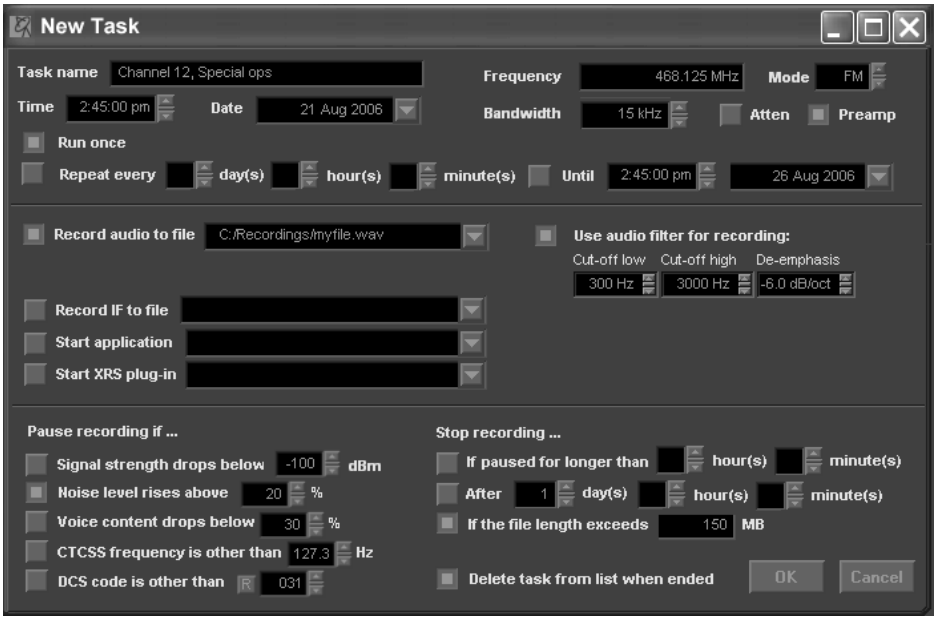
This is a brief summary of tasks, either pending or already executed. Each line represents a single task. At the start of each line there is a checkbox which makes it possible to disable or enable a task which has not run yet, or which runs repetitively.

The rest of the line text shows some basic parameters of each task, such as the starting date and time, the frequency and the status.

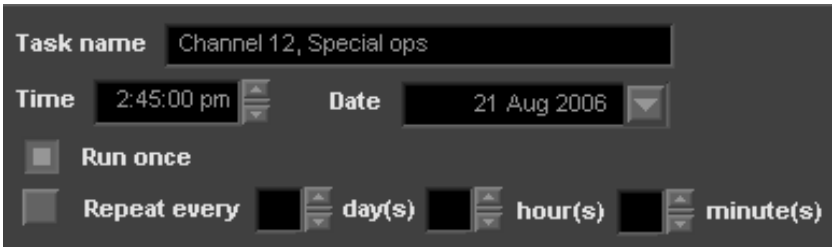
The status information can be one of the following:

- ***Not run yet*** - The task has not been yet executed because it has been either disabled or the specified starting time or date has not arrived yet.
- ***Ended*** – The task has been already executed.
- ***Run N times*** – This is a repetitive task which has already run N number of times and is awaiting its next due time.
- ***Running*** – The task is currently running.
- ***Stopped*** – The task was stopped by the user prematurely.

To create a new task, click on the ***New*** button. You will get the following window:



Firstly choose a task name, then enter the commencement time and date. (Pressing on the drop-down button next to the ***Date*** edit box reveals a handy calendar.)



A task can be either run once, or repeated many times. You can select the repetition interval in days, hours and minutes.

For a repetitive task you also can (optionally) define a final time and date which will terminate the task:

If you don't enable the ***Until*** time or date, then the task will repeat forever.

Then you need to specify the receiver parameters for the task, first of all the frequency and demodulation mode:

Bandwidth is the ***IF bandwidth***, equivalent to that in the main panel. ***Atten*** and ***Preamp*** also correspond to the main panel settings of the ***Attenuator*** and ***Preamplifier***.

In the next part of the task definition you need to specify what you actually wish the task to do. You have four options:

1. Record audio to a "***.wav***" file

2. Record IF (intermediate frequency) to a "***.if.wav***" file

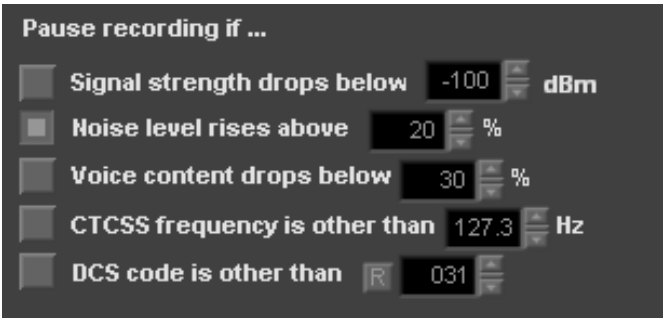
3. Start a separate application (this can be any independent third-party application)

4. Start an ***XRS plug-in*** (this can be any of the installed plug-ins which show in the ***Plugins*** top bar menu).

Only one option can be active at a time. Each option invites you to enter a file name, relevant to the type of task selected.

With the audio recording task, you can also enable and specify the parameters of a ***band-pass audio filter***. It is advisable to use this audio filter, especially for narrow-band FM signal where de-emphasis (typically -6dB/oct) is usually necessary, and where low-frequency signalling often introduces disturbing low frequency components to the audio. Low and high cut-off frequencies of 300 and 3000 Hz, respectively, usually provide best results for voice recordings.

If you chose any of the two recording tasks, you can also specify situations where the recording should pause – in order to save disk space and also to cut out long pauses when playing back.



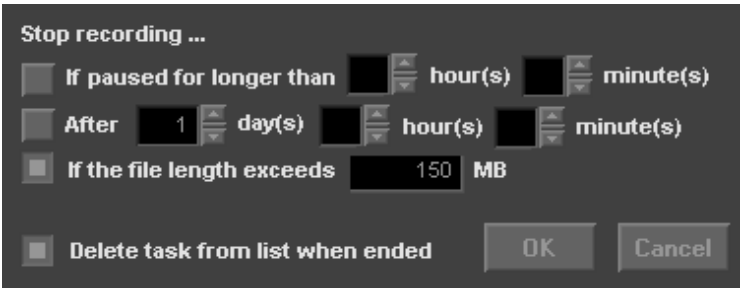
The five pause conditions replicate the main panel ***Squelch*** settings and should be adjusted similarly. The signal strength setting can be used in conjunction with any of the remaining four (i.e. the recording will stop if the signal either drops below the specified level, ***or*** satisfies the other specified condition).

For IF recording, only the signal strength condition is enabled, because no modulation content processing is performed on the recorded IF signal.

Finally, to terminate a recording task, you have the following options to stop the recording:

1. If it has paused for a longer than specified time.
2. After a specified time elapses.
3. If the file length exceeds a predefined value (in Megabytes).

You can choose any or all of these options at the same time.



When the task is ended, you have the option of having it automatically deleted from the list (which is a default setting), or keep it in the list as an inactive task. The latter option might be convenient if you wish to keep track or previous tasks or if you would like to re-instate a task by editing it.

Finally, in the ***Task List***, you can delete a task entirely (by highlighting a task by clicking at it, then pressing the ***Delete*** button), or editing an existing task using the ***Edit*** button. Any task can be edited, whether it has run or not, or is currently running. However, to be able to edit a currently running task, you need to stop it first, using the ***Stop*** button. If a task is stopped, it will remain in the task list until either continued or deleted manually.

The ***Stop*** and ***Continue*** buttons are normally greyed out and become active only for running or stopped tasks, where applicable.

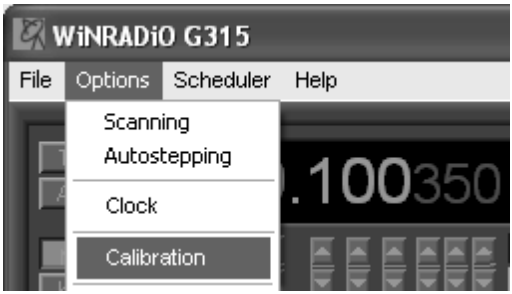
It may not be always possible to continue a stopped task if its timing conditions can no longer be met (for example, if the actual time is now past the specified recording end time) – in such case the ***Continue*** button will remain greyed out.

Note: For repetitive recording tasks, you can use file name wildcards to advantage, as described in the ***Recording and Playback*** *chapter. For example, a file name* `myfile-#d-#t-#f.wav` *will contain the date, time and frequency and for each task repetition a new file will be created (rather than overwriting the previously created file again and again).*

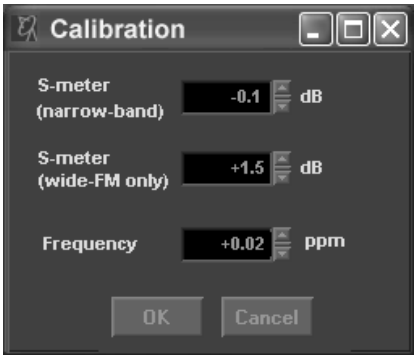
Calibration

The receiver already comes fully calibrated from the factory. However, it is possible for the user to calibrate the receiver and improve its accuracy further, to be on par with precision test instruments.

The *S-meter* as well as the tuned frequency can be calibrated by introducing a fixed offset to the displayed values. This is useful for correcting errors caused by large temperature changes or long-term component aging. Access to this facility is provided via the ***Options*** top bar menu:



Upon selecting the Calibration function, the following window appears:



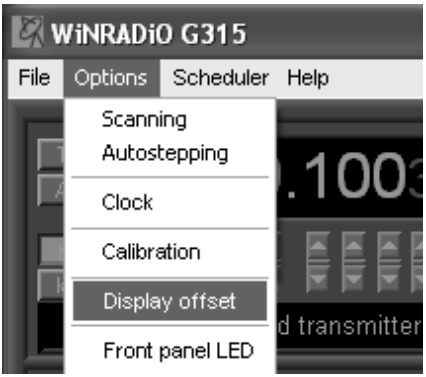
The *S-meter* value can be adjusted up and down in multiples of 0.1 dB. Separate controls are available for the narrow band modes (AM, AMS, USB, LSB, ISB, DSB, CW and FM) and the optional wide-FM (FMW) mode.

The tuned frequency can be adjusted up and down in multiples of 0.01ppm (parts per million). At 1 MHz, this represents 0.01 Hz steps.

*See also **Appendix H** and **Appendix I**, for other methods of calibration available for this receiver.*

Display offset

This feature makes it possible to introduce a large fixed offset to the displayed frequency. It is particularly useful if a *down-converter* is being used with the receiver (for example the WiNRADiO ***WR-DNC-3500*** downconverter which makes it possible to receive signals up to 3.5 GHz on the WR-G315 receiver). This facility is selectable under the ***Options*** menu:

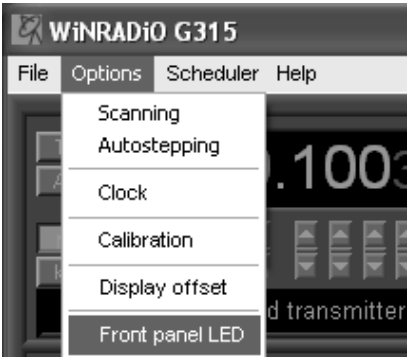


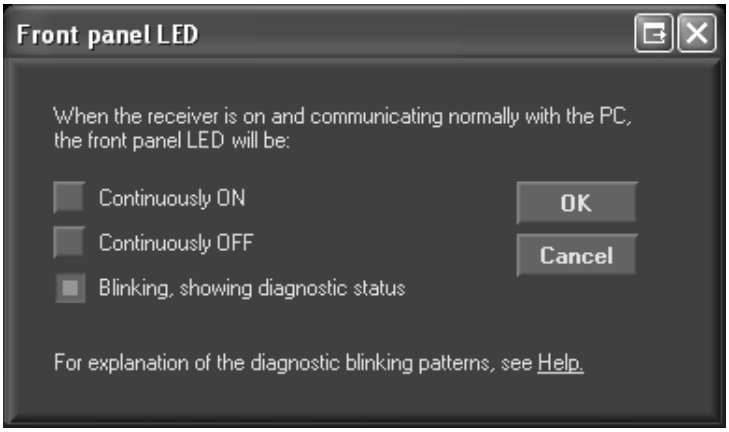
Enter the required offset value (in MHz) in the edit box. The correct value for the *WR-DNC-3500* unit is -1700 MHz (i.e. 3500 MHz at the antenna will translate to 1800 MHz at the input of the receiver).

Front Panel LED

The front panel blue LED flashes with various different patterns which are useful especially for installing the receiver and debugging possible interfacing problems (see ***Appendix J***). The behavior of the LED in its normal "*receiver ready*" state can be controlled by the user, making it possible to keep the LED continuously on or off, for the user's convenience.

This feature is available under the ***Options*** top bar menu:



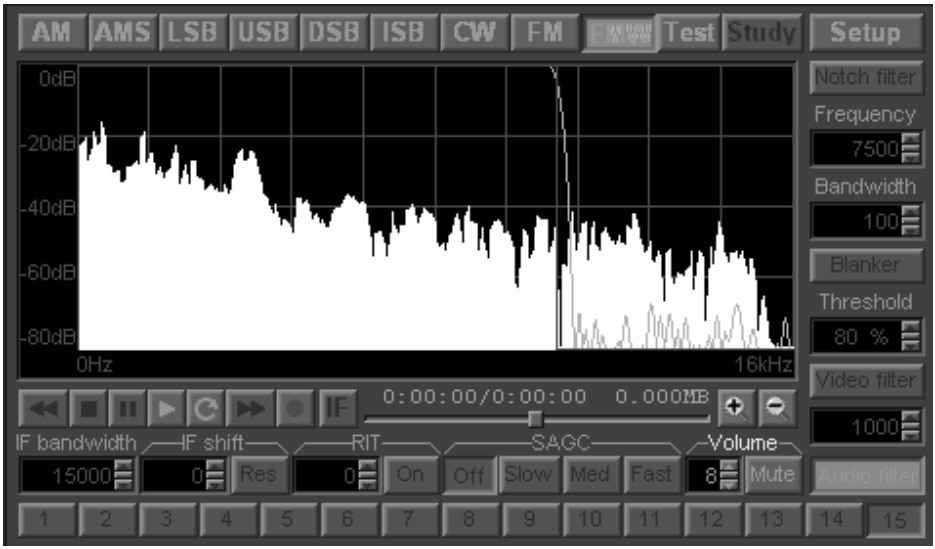


Wide FM Option

With the standard G315 receiver, the ***FMW*** mode button is disabled and the wide FM demodulation mode is not available. This is because wide FM demodulation is not possible to be provided as part of the G315 *software-defined radio* system, within the constraints imposed by the processing power of the G315 DSP and a standard personal computer.

However, wide-band FM demodulation capability is available as a factory-installed option. This is in fact a self-contained "*hardware-defined*" receiver and is available for both G315i and G315e models.

If the *Wide FM Option* is installed, the ***FMW*** button becomes active. The demodulator spectrum display shows real-time spectrum of the demodulated audio (rather than the IF spectrum as in the narrow-band modes). A user-adjustable audio filter is shown superimposed over the audio spectrum (you can drag the filter passbands graphically with a mouse to observe the effect of the variable filtering).



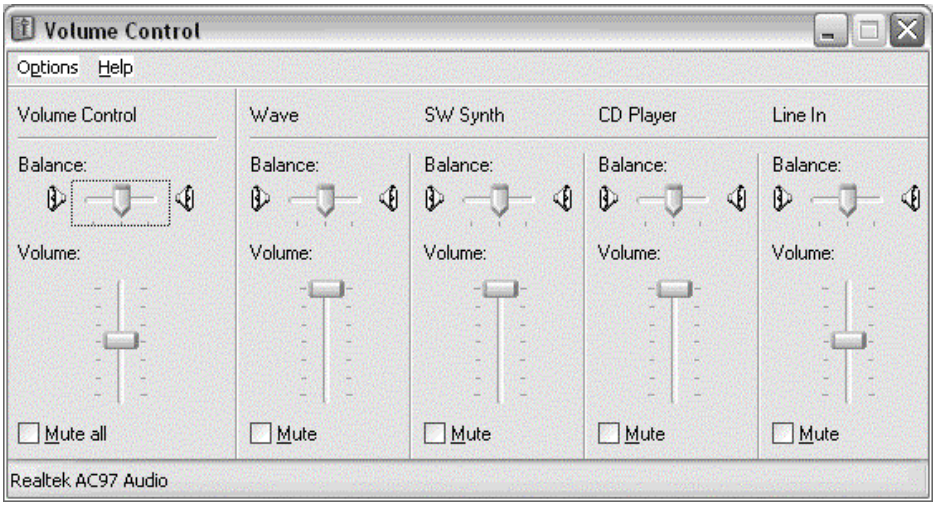
The IF bandwidth of the FWM mode is fixed to 230 kHz and is not adjustable. While it is not possible to perform IF recording in this mode, it is of course possible to make audio recordings.

Appendix A – Troubleshooting

Problem: The WiNRADiO application installed OK, but there is no sound coming from the speaker.

Solution: Check if you see any noise appearing in the spectrum scope in the demodulator panel (under the AM, AMS, etc., mode selection buttons). When you tune to a station, you should be able to see a peak on the real-time spectrum scope. If you can't see any peak, please make sure your antenna is properly connected. If you can see a peak but there is no sound coming from the speaker, please check the following:

- The ***Mute*** button in the demodulator panel is disengaged and the volume is set to a medium level (say 15).
- ***SAGC*** is set to medium.
- The squelch is disabled (i.e. all ***Squelch*** buttons are disengaged).
- The ***Attenuator*** is off, ***Preamp*** is on, and ***AGC*** is set to medium.
- With G315e receiver, the sound is coming via the Windows ***Wave*** device. Make sure that this is unmuted in the sound card control panel and the sound card volume is set accordingly.
- With G315i receiver, the receiver audio output is connected either to an amplified speaker (a standard PC multimedia speaker with stereo input cable), or to the sound card ***Line input*** using the supplied cable. (If your PC sound card does not have a *Line input*, you can use alternative inputs such as ***Aux*** or ***Microphone***.)
- If the G315i receiver is connected directly to amplified speakers, make sure they are turned on, and the volume is set to approximately one half. If you are using the sound card for the audio output, check that the input to which the receiver is connected to is not muted in the sound card control panel and its mixer volume is also set to approximately one half, as well as the overall *Volume Control*:



*Note: If you have difficulties accessing the sound card control panels (for example if there is no speaker icon), refer to **Appendix B – Sound Card Controls**.*

Problem: I can hear the audio and tune the receiver, but the sound is distorted.

Solution: *Check if the **AGC** is switched on (i.e. either the **Slow**, **Med** or **Fast** buttons are pressed – usually the medium setting should be used). Also set **SAGC** to **Med**. In the demodulator **Setup**, adjust the SAGC reference level down.*

Problem: The sound is OK in AM mode, but FM mode sounds unpleasant or distorted.

Solution: Ensure that the ***Audio filter*** in on, and set to ***Bandpass*** in the demodulator **Setup**, with de-emphasis set to -6dB/oct. Also try to reduce ***Audio gain*** under ***Demodulator settings***.

Problem: I can hear the audio and tune the receiver, but the volume is too low, even if I adjust the volume control to maximum.

Solution: Presuming the volume is set to the maximum level (31) in the demodulator panel, you can adjust the volume also in the sound card control panel, or on the amplified speakers you are using. Also, if ***SAGC*** function is turned off, turn it on by clicking the ***Med*** button:

You can increase the volume when SAGC is on by adjusting the ***AGC reference level*** under ***Setup*** (excessive level will cause distortion). If you prefer to keep SAGC off, you can increase the volume under ***Setup***, by adjusting the ***Audio gain*** level.

Problem: I can hear the audio and tune the receiver, but the spectrum scope display is very sluggish, sometimes it even freezes.

Solution: Close all other simultaneously running programs to reduce the burden on the CPU. This may indicate insufficient CPU resources in your PC. Perhaps you have too many programs running in the background?

Problem: I can hear the audio and tune the receiver, but the audio is very noisy. The background noise level displayed on the spectrum scope appears very high.

Solution: Make sure the ***Attenuator*** is switched off and the ***Preamp*** is on. Check that your antenna is properly connected, the connector is not loose and that the antenna cable is not damaged. Does the noise floor drop significantly if you disconnect the antenna? If so, then perhaps the antenna is picking up too much ambient noise. Try to improve the antenna, or move it further away from the PC. (*For additional noise-defeating measures see also **Appendix C – Dealing With Interference**.)*

Problem: Reception is obscured with a buzzing interference.

Solution: Check for the sources of interference in your surroundings: it could be fluorescent lights, a lamp dimmer, or other household appliances. Your PC (especially the monitor) could be the culprit. Unless you are able to suppress the interference at the source, the only solution is to install a better antenna, preferably an outdoor one. Computer networks are especially noisy and if your PC is connected to one, you will almost certainly need an outdoor antenna. If the interference level varies periodically with peaks about 30-100 kHz apart, the most likely culprit is the monitor or the video card. Switch the monitor off - if the interference disappears then the cause is the monitor. Modern LCD monitors generate much lower levels of interference than CRT ones. (*See also* ***Appendix C – Dealing With Interference***.)

Problem: I managed to drag the spectrum scope window down to the point where the bottom is now obscured, so that I can't drag it back (and the top is as high at the top of the screen as I could go).

Solution: Windows allows you to resize any window up to the height of the desktop. This problem can happen after resizing almost any resizable windows.

You can resize or move the taskbar (just like any other window) to reveal the bottom of G315 panel. Make sure that ***Lock the Taskbar*** is not checked in the pop-up menu (right-click on an empty space on the taskbar). If the taskbar is locked, you can't resize or move it. If you prefer to move the taskbar to the left side of the desktop, just hold the mouse on the empty space and drag it.

Another way to solve this problem is to close the G315 application and manually edit the ***WRG315.ini*** file in the Windows directory. For example, you will see values similar to these:

```
[Scope-03E27014]
Visible=1
Height=300
```

"03E27014" is the serial number of the receiver. Your 'Height' value is probably greater, and you should change it to a reasonable value (about 200).

Did you know?

The G315 receiver can be also controlled remotely and the audio streamed in real-time to another computer on a network (including the Internet). The software for this is called the ***Client/Server Option****. Refer to WiNRADiO website at* ***www.winradio.com/software*** *where you will also find other software options available for this receiver.*

Appendix B- Sound Card Controls

Sound card control panels and their settings can be somewhat confusing. They are also rather inconsistent from one version of Windows to another.

The G315e receiver requires that the sound card ***Wave*** input is unmuted. The volume can be then adjusted using the Wave slider and the master ***Volume Control***.

The G315i receiver does not require a sound card as the output is already a converted analog ***Line Output***. You can connect this directly to standard amplified multimedia speakers or an external amplifier of your choice. You can also connect it to a sound card.

If you wish to connect your G315i receiver to a sound card, you can simply use the supplied audio cable and connect it to the Line input (alternatively to ***Microphone*** input, if the ***Line*** input is not available). The output volume is controlled by the ***Playback*** volume control of the sound card.

Typically, you would access the Playback volume control panel by clicking the speaker icon in the Windows Task Bar.

If the speaker icon is missing, an alternate way to accessing the Playback controls is via the Windows Control Panel. Here you can also enable or disable the speaker icon.

The table on the following page shows how to enable or disable the speaker icon, and how to get to the playback controls from within the Windows control panel. The methods vary depending on the version of Windows you are using.

Did you know?

The ubiquitous PC sound card was invented in Singapore by Sim Wong Hoo, engineer and entrepreneur, who founded the Creative Technology company in 1981. His first product, an Apple computer clone, did not take off. However, his second product, the PC sound card, hit its target well: More than 120 million sound cards have been shipped by Creative Technology, mostly under the Sound Blaster brand.

Windows	Enable "speaker" icon	Recording/playback volume controls
98	*Control Panel* | *Multimedia* *Audio-tab* **Checkbox**: "Show volume control on the taskbar"	*Control Panel* | *Multimedia* *Audio-tab* **Sound Playback**: Click on  button
ME	*Control Panel* | *Sounds and Multimedia* *Sounds-tab* **Checkbox**: "Show volume control on the taskbar"	*Control Panel* | *Sounds and Multimedia* *Audio-tab* **Sound Playback** → **Volume** button
2000	*Control Panel* | *Sounds and Multimedia* *Sounds-tab* **Checkbox**: "Show volume control on the taskbar"	*Control Panel* | *Sounds and Multimedia* *Audio-tab* **Sound Playback** → **Volume** button
XP	*Control Panel* | *Sounds and Multimedia* | *Sounds-tab* **Checkbox**: "Place volume icon in the taskbar"	*Control Panel* | *Sounds and Multimedia* *Audio-tab* **Sound Playback** → **Volume** button

Appendix C – Dealing with Interference

Electromagnetic Interference (EMI) is what prevents us from receiving a clear signal, even when the receiver should be sensitive enough to receive it. There are many types of interference you can experience with radio receivers, emanating from both natural and man-made sources.

Natural interference is produced by atmospheric phenomena such as storms and sun activity.

Not so surprisingly, man-made interference is often worse. Sources include electric motors, power lines, passing cars, electrical welding equipment, fluorescent lights, fax machines, computer networks, etc. Receiving antennas should always be as far away from sources of electromagnetic interference as possible.

One significant source of man-made electromagnetic interference is the personal computer - and the video monitor in particular. Since the WiNRADiO G315 receiver requires a personal computer to operate, this creates a potential paradox. The WiNRADiO receiver itself is designed to be substantially immune to PC interference. However, any receiver needs to be connected to an antenna, and antennas can't discriminate between useful signals and interference. The interference from your PC can either radiate directly to the antenna, or it can be conducted to it along the outer conductor of the lead-in cable. Even in professional radio receiving stations, a lot of care and effort is always needed, if this type of self-interference is to be avoided.

Some computers are worse than others in terms of generated electromagnetic interference. The worst culprits are usually video monitors, which radiate radio frequencies at multiples of horizontal deflection frequencies. These frequencies range from about 30 to 100 kHz, and you can sometimes hear their harmonics right across the entire shortwave band. If you find strong signals sounding somewhat like a tractor engine, spaced between approximately 30 and 100 kHz apart (on modern hi-resolution monitors, the typical frequency is around 94 kHz), your monitor is most likely the cause.

To check this, tune to one of the interfering signals, then switch off the monitor and see if the signal disappears. If the interference still exists you could continue using the WiNRADiO receiver, and live with the fact that some useful frequencies will be obscured by your monitor's interference, or you can replace your monitor with a 'quieter' one (modern LCD displays are far quieter than old CRT monitors), or you can try to relocate your antenna further away from your computer.

A good remedy to try is to wind five to ten turns of the antenna lead-in cable through a large ferrite core (the doughnut shaped *toroid* type), near the PC end of the cable. This suppresses ***common-mode interference***, which is a typical but curable problem with PC-controlled receivers.

Another type of interference which you may encounter is ***intermodulation interference***. This is usually caused by strong local stations, whose frequencies combine to create 'ghost' signals on frequencies which are arithmetic combinations of the stations' frequencies. These 'ghost' signals can sometimes coincide with useful frequencies, rendering them partially or completely unusable. They will usually disappear when you switch off the ***Preamplifier*** or switch on the ***Attenuator*** in the receiver control panel.

If you live very close to a strong local transmitter, these measures may be insufficient. In such case, you should be able to eliminate intermodulation by fitting a special filter to your antenna, to reduce the level of the signals causing the interference. The design and application of such filters falls beyond the scope of this user's guide. However, broadcast frequency filters and tunable ***preselectors*** are standard items and can be obtained from good radio equipment suppliers.

Did you know?

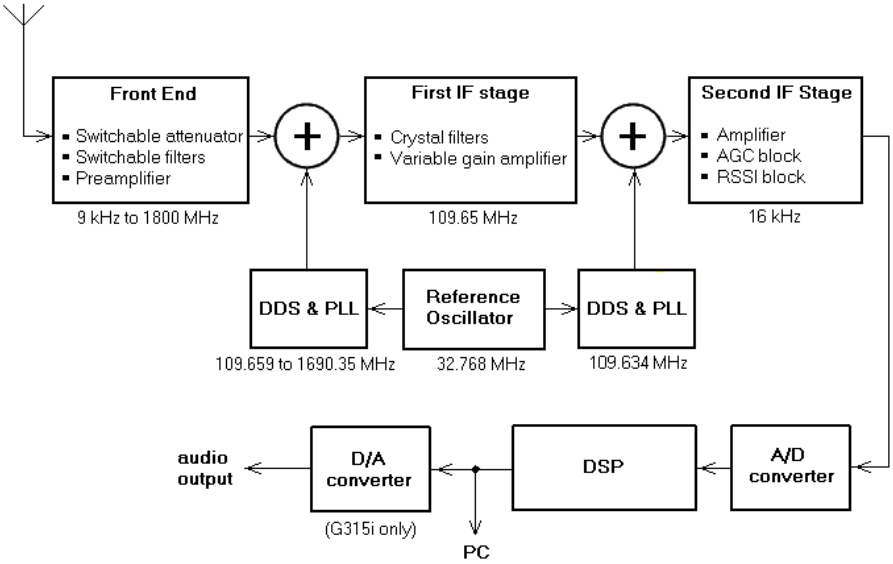
WiNRADiO also offers antenna and antenna accessories such as broadcast interference filters suitable for the G315 receiver. Please refer to WiNRADiO website at ***www.winradio.com/antennas*** *where you will also find antenna solutions available for this receiver.*

Appendix D – Inside WR-G315 Hardware

Technically minded users may like to explore the WiNRADiO G315 Receiver and experiment with some of the innovative concepts of this ***Software Defined Radio***.

The WiNRADiO G315 Receiver is one of the first commercially available Software Defined Radios, where the Demodulator function is fully performed in software.

The receiver hardware contains the following functional blocks:



The incoming signal from the antenna (in the 9 kHz to 1800 MHz range, is filtered and amplified, then fed into a mixer. Here it is mixed with the first LO (local oscillator), which is performed by a DDS (Direct Digital Synthesizer), with a PLL (Phase Locked Loop). The resulting 109.65 MHz intermediate frequency is filtered using two 4-pole 109.65 MHz crystal filters with an IF bandwidth of 20 kHz, and then amplified.

The second mixer again uses a DDS with a PLL to mix the 109.65 MHz signal down to the last intermediate frequency, which is 16 kHz (the last IF frequencies may be selected within a range of 12 to 22 kHz, to suit various special applications).

The receiver's internal reference frequency for both DDS circuits is 16.384 MHz, which is derived from a precise 32.768 MHz oscillator.

The 16 kHz centered output of the second IF stage is fed to a 16-bit A/D converter sampling at 64 kHz. This digitized signal is processed by a DSP which performs digital filtering (responsible for the variable IF bandwidth) and demodulation. Additional digital signal processing (for example FFT functions related to the real-time spectrum scope and selective S-meter) is performed on the host PC.

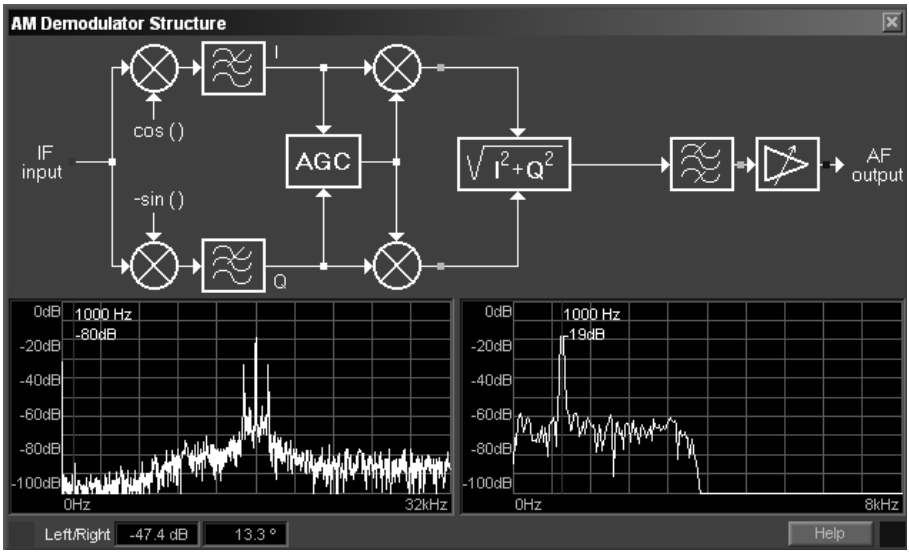
The AGC is performed in the first IF stage, based on the level of the last IF output. The AGC action is delayed until the dynamic range of the first IF stage is fully utilized – this is in order to prevent desensitization of the receiver in the presence of neighbouring strong signals, falling within the 20 kHz IF bandwidth. The resulting variation in audio output is then compensated in software, using the ***Software AGC*** facility of the demodulator.

Note: Such a mixed arrangement, where the critical analog-to-digital sampling and processing are done by the on-board DSP while the rest is performed by the PC (rather than all processing being done on the PC), has the advantage of providing consistently high performance by eliminating performance variations caused by poor quality or incorrectly set up PC sound cards. A higher quality analog-to-digital converter used in the G315 receiver makes also a higher sampling rate possible than is available on a standard PC sound card, which results in a further improved performance. With the time-critical demodulation code running on the DSP, this also makes it possible for a single PC to support several receivers running simultaneously without burdening the CPU resources.

Appendix E – Inside WR-G315 Demodulator

The internal structure of the G315 demodulator is easily accessible by pressing the ***Study*** button in the demodulator panel.

The G315 Demodulator relies on a general quadrature representation of the incoming modulated signals. Such signals can always be considered as the sum of two amplitude-modulated carriers having a 90 degree offset, usually referred to as ***I & Q***.

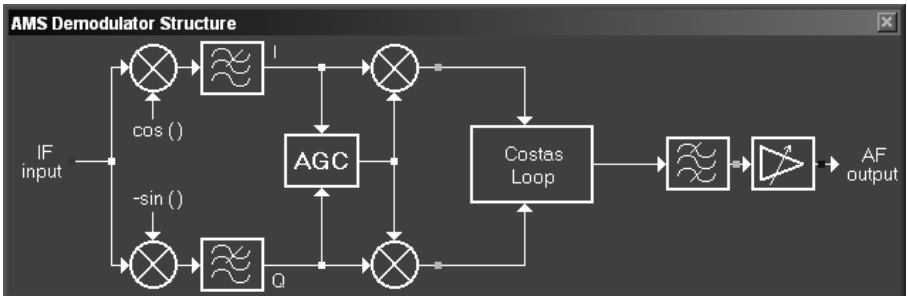


AM Demodulator Structure

The demodulator structure windows include two spectrum analyzers making it possible to view signal spectra in real-time. Each analyzer can be associated with any of the ***test points*** shown as green dots in the diagram. To connect the left spectrum analyzer to a particular test point, left-click on the green test point. Its color will change to red. Right-clicking on a dot will connect it to the right analyzer, and the color will change to blue. If both displays are connected to the same test point, the point color will turn magenta.

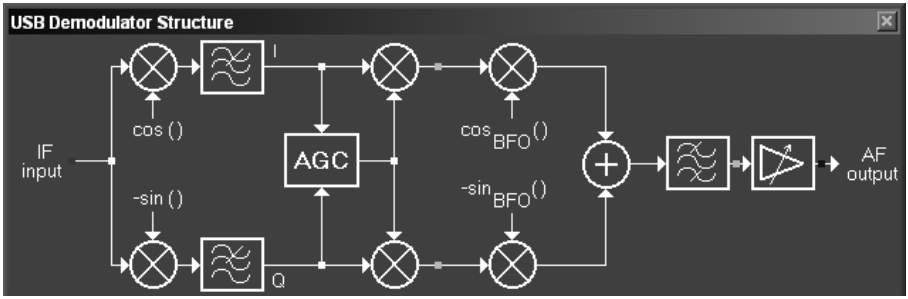
Within the displayed spectra, a red color frequency cursor can be manually dragged, using the left mouse button, over a particular spectral component. The two ***Vector Voltmeter*** displays labelled Left/Right indicate the relative amplitude and phase difference between the two spectral components at the cursor frequency.

For synchronous demodulation of amplitude modulated signals (the *AMS* mode) without carrier or with a fluctuating one, the G315 demodulator uses a PLL carrier recovery technique based on the ***Costas loop***:



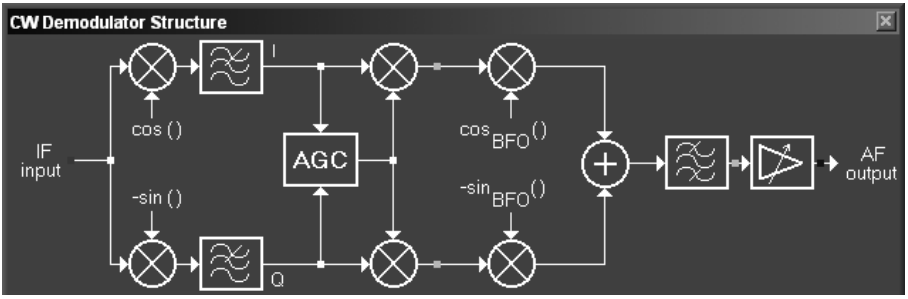
Synchronous AM Demodulator Structure

The LSB and USB demodulators have basically the same topology. ISB can be thought of as a combination of LSB and USB, where each of the sound card channels is used for one of the independent side bands.



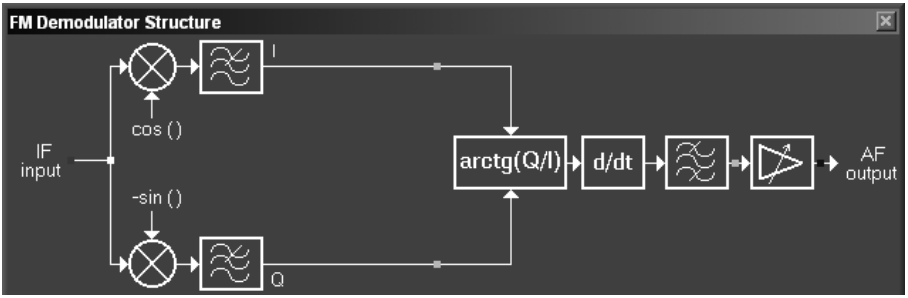
USB Demodulator Structure

The CW received signals are first down-converted to zero Hz, and then, after additional channel filtering, up-converted to a convenient audio frequency. This frequency (a ***digital BFO***) is user-adjustable, by changing the value of the ***CW tone frequency*** parameter in the demodulator setup.



CW Demodulator Structure

Finally, the frequency demodulator performs a time derivative function on arctangent of Q over I, to arrive at amplitude-independent frequency demodulation of the input signal:



Appendix F – Developer Support

WiNRADiO has always extensively supported third-party software development efforts with all our receivers, and the WiNRADiO G315 receiver is no exception. We provide technical details for developers to be able to develop the following:

- Third-party applications controlling the WiNRADiO G315 receiver. *(We do this by providing API information making it possible to access the receiver hardware from third party software. See also **http://www.winradio.com/home/developer.htm**.)*
- Plug-ins to provide enhanced functionality. (*For this, we have developed a special interfacing standard called **XRS**, Extensible Radio Specification. All our receivers conform to this standard, and many plug-ins are already available for various applications; see **http://xrs.winradio.com***.)
- New types of demodulators. *(The G315 demodulators in fact represent a special type of XRS plug-in. Detailed information is also available at **http://xrs.winradio.com**.)*
- Support under alternative operating systems. *(See for example **http://www.linradio.com**.)*
- Support under ***Radio Basic*****,** an easy to use specialized programming language for radio receivers. *(See **http://www.rbasic.com**.)*

*Have you registered yet? WiNRADiO provides regular upgrades to our application software. Use our on-line registration form on w**ww.winradio.com/register** to take advantage of this free service.*

Appendix G – Hardware Options

Numerous factory-fitted hardware options are available for the G315 receiver. Please note that some of these options are for OEM applications only and may not be available in your location. Please check with your dealer regarding availability.

External Reference Oscillator Option (G315/XR)

The “XR” option, available only for the G315i model, adds an external SMA connector to the receiver board, which can be used to connect an external reference oscillator for the highest possible frequency accuracy. This external oscillator can be any frequency from 8 to 20 MHz. The input is AC-coupled, has 150 ohm impedance, and expects the external reference signal to be a sine or square wave, in the range of 100 mV to 5 V peak-to-peak.

To select the external reference frequency, the following command-line software switch is used:

```
/c
```

This switch disables the internal reference oscillator and defines the frequency of an external reference oscillator. The external reference frequency can be in the range of 8 and 20 MHz. For example, if the external frequency is 16.7890124 MHz, this would require the following command-line switch:

```
/c16.7890124
```

To apply the command-line switch, you can either type the name of the application in the Windows Run Program edit box, followed by the desired command-line switch. Alternatively, you can right-click on the G315i receiver desktop icon, select ***Properties***, and add the command-line switch to the ***Target.***

For example, for external reference 10 MHz, the command-line switch would be as follows:

```
"C:\Program Files\WiNRADiO\G315\WRG315.exe" /c10
```

You can also copy the desktop icon, creating one with the command-line switch, and one without, and renaming the icons to reflect the associated functional differences.

Note: The entire file path name of the Target is enclosed in double quotes, but not the command-line switch (otherwise it would be considered to be part of the executable file name).

Reference Oscillator Output Option (G315/RO)

The "RO" option, available only for the G315i model, can be used to output the internal reference frequency. This is useful for situations when the receiver's internal oscillator is to be used as a reference for other equipment. If an external reference is used, this can be provided to other receivers in a daisy-chain arrangement.

If the receiver relies on its internal reference oscillator, this option will provide 16.384 MHz reference output. If an external oscillator is used, then the external oscillator frequency will be provided at this output.

The output is a DC-coupled sine wave at CMOS compatible output levels (approx. 0.6 to 4V), impedance 150 ohm.

Intermediate Frequency 109.65 MHz Output Option (G315/IF0)

The "IF0" option, available only for the G315i model, provides a wide-band output at the 109.65 MHz first intermediate frequency. This is useful for a real-time spectrum display, wider than the 20 kHz wide spectrum display provided in the G315 receiver.

Intermediate Frequency 10.7 MHz Output Option (G315/IF1)

Similar to the previous option, the "IF1" option provides a wide-band IF output. The difference is that this option involves an additional down-converter which converts the 109.65 MHz IF down to 10.7 MHz. This option is available only for G315i receiver.

Intermediate Frequency 16 kHz Output Option (G315/IF2)

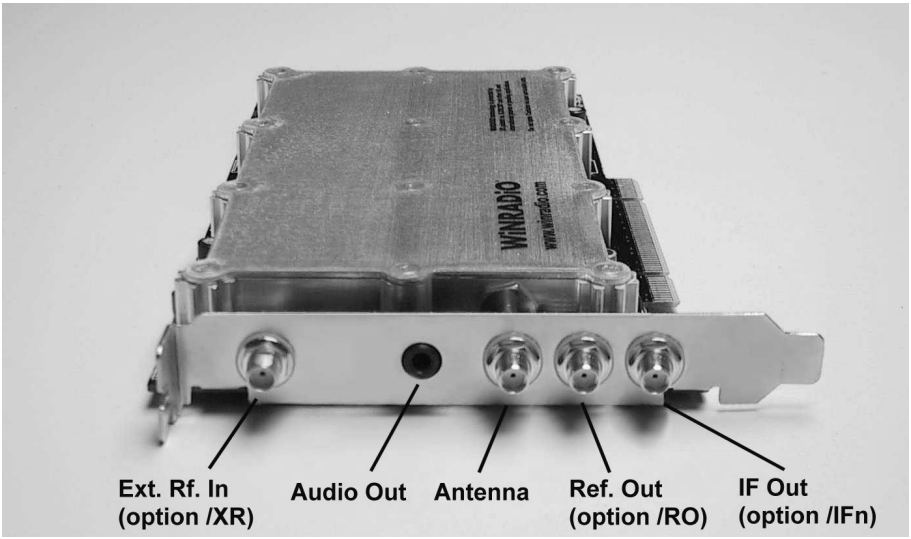
The “IF2” option provides a narrow-band IF output at 16 kHz, its bandwidth limited by the receiver's 20 kHz roofing filter. This option is available only for the G315i receiver. This is a useful option for low-cost experiments with *Software-Defined Radio*, because the frequency is low enough for the signal to be digitized by a standard PC sound card.

Wide-band FM Option (G315/WFM)

The “*WFM Option*” makes it possible to receive wide-band modulated signals (“broadcast FM”) on the G315 receivers. On the standard G315 receiver, the wide-band FM capability is not included, because it is not possible to provide this within the constraints of the 20 kHz instantaneous bandwidth of the digitized IF signal and the DSP software processing power.

The WFM option is in fact a self-contained “hardware-defined” receiver. The user can receive wide FM broadcasts, but cannot see the entire 230 kHz bandwidth spectrum in real time. Instead, the demodulator spectrum panel shows real-time spectrum of the demodulated audio. It is also not possible to perform IF recording, but it is of course possible to make audio recording. This option is available for both G315i and G315e receiver models.

Note: To order a receiver with a mix of the above options, simply add all the option codes to the receiver model number: For example, for a G315i receiver with external reference oscillator and 10.7 MHz IF output, the model number will be G315i/XR/IF1. All options can be mixed together except the IF options where only one can be selected, i.e. IF0, IF1 and IF2 cannot be selected at the same time.



G315i receiver with options fitted

Note: Numerous software options for this receiver are also available; please refer to the WiNRADiO Web site or contact us at ***www.winradio.com/enquiry*** *for details.*

Did you know?

The idea of processing radio frequency signals by converting them to an intermediate frequency first (i.e. the superheterodyne principle) is attributed to the American inventor and radio pioneer Edwin H. Armstrong. Armstrong also invented several other important founding concepts of modern radio, such as frequency modulation.

Appendix H – Frequency Calibration

The G315 receiver series features an excellent frequency accuracy and stability for a receiver of its class. It is however possible to improve this accuracy yet further, by individual calibration. One method of frequency calibration was described in the ***Calibration*** chapter. This method corrected the tuned frequency by multiplying the displayed value by an adjustable factor.

Another method of frequency calibration is accomplished by inserting a reference frequency parameter in the ***WRG315.ini*** file which resides in the Windows directory. The reference frequency parameter consists of two lines of the following format:

```
[ClockCalibration]
receiver_serial_number=reference_frequency
```

The receiver serial number can be obtained for example from the ***About*** box in the G315 application. The reference frequency is the actual frequency of the internal reference oscillator in Hz. This is normally 16.384 MHz, i.e. 16384000 Hz.

Each receiver is factory calibrated, so a fundamental correction to the nominal 16.384 MHz reference frequency already exists and is stored in the receiver's internal memory. This correction can be overridden by the new parameter in the ***WRG315.ini*** file. To determine the true offset from a perfect tuning, firstly use 16384000 (i.e. the nominal reference frequency in Hz) as the ***reference_frequency*** parameter. Say your receiver serial number is 02L27011:

```
[ClockCalibration]
02L27011=16384000
```

Save the ***WRG315.ini*** file with this value, then start the G315 application. The frequency error will be now much worse because the new parameter overrides the original factory calibration. Then tune the receiver to a known frequency standard. A high-accuracy signal generator can be used, or one of the WWV Time and Frequency Standard stations. Observe the peak with the spectrum scope and listen to the beat frequency in the CW mode with a minimum IF bandwidth. Then note down the frequency difference. (For example, -152 Hz at 10 MHz).

Then scale the frequency difference to 16.384 MHz. For example, if the frequency difference is -152 Hz at 10 MHz, it will be -249 Hz at the 16.384 MHz reference frequency.

To arrive at the corrected reference frequency, subtract the frequency difference from 16384000. In our example, 16384000-(-249)=16384249. The entire reference frequency parameter in the ***WRG315.ini*** file will be then as follows:

```
[ClockCalibration]
02L27011=16384249
```

Save the ***WRG315.ini*** file, then restart the G315 application and observe the difference.

To return to the original factory frequency calibration, simply delete the inserted two lines in the ***WRG315.ini*** file. You can also delete the entire file (which will however result in losing all current receiver settings and return to factory defaults for all of them).

Did you know?

The WWV Time and Frequency Standard station which broadcasts on 2.5, 5, 10, 15 and 20 MHz, has a long history that dates back to the very beginning of radio broadcasting. The call letters WWV were assigned to the US National Institute of Standards and Technology (then called the National Bureau of Standards) in October 1919. By December 1922, it was decided that the station's purpose would be the transmission of standard frequency signals. The accuracy of the transmitted frequency was quoted as being better than 0.3 per cent. Nowadays the station frequency is controlled within one part in 10^{13}, which represents frequency accuracy thirty billion times better.

Appendix I – S-meter Calibration

The G315 receiver series features a uniquely accurate and powerful S-meter. However, it is possible to improve this accuracy yet further, by individual calibration. One simple method of frequency calibration was described in the ***Calibration*** chapter. This method makes it possible to offset the displayed S-meter values by a user-adjustable constant. While this method will work in most circumstances, a more powerful method exists which makes it possible to calibrate the S-meter in many points for as many frequencies as required. This is done using a special ***S-meter Calibrator*** application, which can be downloaded from the following WiNRADiO Web page:

www.winradio.com/home/calibrator.htm

The *S-meter Calibrator* alters the factory-supplied default data in the receiver calibration file ***WRG315.cal*** which resides in the receiver application folder (i.e. typically ***C:/Program files/WiNRADiO/G315***).

The *S-meter Calibrator* requires the use of a precisely calibrated synthesized signal generator to generate calibration levels in the frequency range of interest. It possible to create calibration tables for as many frequency points as required, and interpolate between these tables to arrive at absolute calibration values for any arbitrary frequency the receiver is tuned to.

The *S-meter Calibrator* includes special commands to create, edit and manipulate calibration tables, interpolate between individual calibration points within a particular table as well as between entire tables, view calibration graphs for individual frequencies, and other useful facilities.

The *S-meter Calibrator* is provided as an *"as is"* complimentary tool for WiNRADiO receiver users. The calibration procedures should not be attempted by persons without a deeper understanding of the underlying concepts, as WiNRADiO can only provide a limited technical support for this application, and can accept no responsibility for any difficulties arising from its use.

To restore the original factory calibration, simply delete the ***WRG315.cal*** file and reinstall the G315 application.

Appendix J – USB Interface Diagnostics

The flashing pattern of the blue LED on the external G315e model has a diagnostics meaning. Normally, when the receiver is powered up and the application running, the blue LED should flash in a dih-dah pattern (i.e. a short flash followed by a long one).

A complete list of the flashing patterns and their meaning is as follows:

No.	Pattern	Description	Mode
1		Off	No power
2		Long flash, equal gap	No connection to computer
3		Two short flashes	USB connected, radio off
4		One short flash followed by a long one	USB connected, radio on, ***receiver ready***
5		Two short flashes followed by a long one	USB connected, driver not installed
6		Three short flashes	USB connected, driver installed, application not running

For the normal ***Receiver ready*** state as indicated by pattern 4 (one short flash followed by a long one), the front panel LED can be controlled by the user, under the ***Options*** | ***Front panel LED*** top bar menu. The user has a choice for the LED to either indicate the diagnostic patterns, or be continuously on or off (while the application is running).

This is useful in situations when a blinking LED might appear disturbing and a steady state is preferable when the receiver is running.