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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.

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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.

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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.
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Introduction

Welcome to the WiNRADiO G305 scanning receiver. Your new receiver is a world-first in more than one respect. Most importantly, it is the first commercially available Software Defined Receiver (SDR) for the VHF/UHF bands, where the entire demodulator and the last intermediate frequency stage are performed by software running on a personal computer rather than using conventional hardware circuits or a dedicated Digital Signal Processor (DSP). Your PC probably has more power than even the fastest DSP had only a few years ago. Your new WiNRADiO G305 receiver is now ready to take advantage of that power.

This advanced receiver is the result of our ongoing 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, to push the radio technology forward and make it available at an affordable price.

In designing the WiNRADiO G305 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 have implemented many more features and functions than normally would be found on a typical communications receiver, we also strived to keep its operation logical, intuitive and easy to use.

The WiNRADiO G305 receiver transforms any modern personal computer into a sophisticated VHF/UHF monitoring station offering surprising power and flexibility.

We wish you many hours of enjoyment with your new G305 receiver.

WiNRADiO provides regular upgrades to our application software. Don’t forget to register as a WiNRADiO user to receive news about new products, accessories and software upgrades for your WiNRADiO G305 receiver. Use our on-line registration form on www.winradio.com/register to take advantage of this free service.
G305 Receiver Models

There are two basic models of the WiNRADiO G305 receiver:

- G305i (PCI card based “internal” model)
- G305e (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 G305i model has two connectors: the antenna connector (SMA type, 50 ohm) and 12 kHz IF (intermediate frequency) output:

![G305i Image]

The signal from the 12 kHz IF output is normally connected to the PC sound card, where it is digitized, to be then processed by the PC.

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 12 kHz IF output to the sound card input.
The external G305e model has three connectors:

![Image of G305e model with three connectors: power, IF output/control, antenna]

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 IF output/control connector combines the 12 kHz IF (intermediate frequency output), USB interface and serial interface. Normally, only the USB interface cable is supplied, and the IF signal arrives from the receiver to the PC already digitized, via the USB cable. This method is preferable, because it relies on a high-quality analog-to-digital converter inside the receiver, and guarantees optimum and consistent performance. The installation is also simpler as it does not require adjustment of the 12 kHz IF signal input level (this is already set to an optimum level inside the receiver).
It is also possible to control the receiver via the serial (RS-232) interface, which necessitates using the PC sound card for digitization of the IF signal. WiNRADiO provides a special serial interface option cable which takes care of all the appropriate connections, both to the serial port and the sound card input.

![G305e serial interface option](image)

As this interfacing method relies on the sound card to provide the digitization of the 12 kHz IF signal, it requires careful adjustment of the input signal level. The performance will depend on the sound card quality, similarly to the internal G305i model. It is a suitable method in situations where the receiver needs to be controlled by computer systems without the USB interface.

Did you know?

DRM (Digital Radio Mondiale) is a new digital broadcasting system for medium and short waves. By introducing sophisticated signal coding and compression, this system offers a dramatic improvement in broadcast quality. WiNRADiO has a DRM demodulator available for your G305 receiver. For more details please refer to [www.winradio.com/drm](http://www.winradio.com/drm).
Installation

The WiNRADiO package contains the following items:

- WiNRADiO G305i or G305e receiver
- WiNRADiO software on a CD ROM
- Start-up indoor antenna
- Audio cable (G305i model only)
- Power adapter (G305e only)
- Interface cable (G305e 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

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

Note: LCD TFT panel displays are preferable to older CRT monitor types, as modern LCD panels typically exhibit far less electromagnetic interference.
Hardware Installation

G305i model (PCI card-based)

1. Turn off the computer 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. This may be also necessary with certain types of sound cards, such as Creative Audigy 2.)*
G305e (external) model with standard USB interface

1. Connect the receiver to the USB port using the supplied cable.
2. Plug the supplied power adapter to the power outlet and connect its output to the receiver.
3. Turn the receiver on using the power switch at front of the receiver. The blue LED will blink to indicate that the receiver is powered up.

Did you know?

USB (Universal Serial Bus) is a modern interface standard designed to replace the slow RS-232 serial standard. USB version 1.0 makes it possible to transfer data at 12 megabits per second. The newer USB version 2.0 is 40 times faster. The G305e receiver is compatible with both USB interface standards.
G305e (external) model with serial (RS-232) interface

1. Connect the receiver to the serial port using the supplied adapter, which combines both the serial interface and the audio lead in one cable.

2. Connect the audio lead on the PC side to 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. This may be also necessary with certain types of sound cards, such as Creative Audigy 2.)

3. Plug the supplied power adapter to the power outlet and connect its output to the receiver.

4. Turn the receiver on using the power switch at front of the receiver. The blue LED will blink to indicate that the receiver is powered up.
G305e Interface Status Indication

The single blue LED on the front of the WiNRADiO G305e (external) receiver can display a number of different states using various specific flash patterns. Each pattern is repeated once per second.

In the following table, “black” in the pattern indicates that the LED is on in that time interval.

<table>
<thead>
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<th>No.</th>
<th>Pattern</th>
<th>Description</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Off</td>
<td>No power</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Long flash, equal gap</td>
<td>No connection to computer</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Single short flash</td>
<td>Serial connection, radio off</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Single long flash</td>
<td>Serial connection, radio on, ready</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Two short flashes</td>
<td>USB connection, radio off</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>One short flash followed by a long one</td>
<td>USB connection, radio on, ready</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Two short flashes followed by a long one</td>
<td>USB connected, but driver not installed</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Three short flashes</td>
<td>USB connected, driver installed, but application not running yet</td>
</tr>
</tbody>
</table>

For the normal Ready states as indicated by patterns 6 (for USB) or 4 (if the optional RS-232 serial interface is used), the front panel LED can be controlled by the user, under the Options top bar menu. The user has a choice for the LED to either indicate the diagnostic patterns, or be continuously on or off.

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

Your WiNRADiO G305 receiver comes with a start-up antenna consisting of a 3-meter length of coaxial lead-in cable, with an additional 3 meters of insulated wire. The thinner, insulated wire at the end is the actual antenna. The long lead-in cable is necessary for the antenna to be located as far away from the PC as possible, to reduce interference from the PC. Please note that this start-up antenna is supplied for immediate gratification only and is not intended to replace a proper VHF/UHF 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 electrical devices, and metal objects, as possible.

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 WiNRADiO receiver, you should install a proper VHF/UHF antenna.

Something to consider?

WiNRADiO also manufactures many antennas and antenna accessories, suitable for your WR-G305. Whether you need an indoor or outdoor antenna, WiNRADiO probably has an antenna to suit. One of our most popular antennas, and very suitable for the G305 receiver, is our AX-71C discone antenna. For more information on this product as well as the entire WiNRADiO range of antennas and antenna accessories, see the WiNRADiO website www.winradio.com.
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 G305 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.*

Setting up the Sound Card

*This section refers to the G305i model, or the G305e model with serial interface, only. The G305e model with the standard USB interface does not require this set up and this entire section may be skipped.*

After installing the hardware and software, you will need to set-up the sound card parameters. This is done both in the WiNRADiO application and in the Windows sound card control panel – this provides the actual connection between the receiver *front-end* and the PC *back-end* of your radio system.

In computer terminology a sound card is a **wave device**. A computer may have several such wave devices installed (for example a modem with voice capabilities). That’s why you need to select the sound card as the desired wave device first. Start the WiNRADiO G305 application and click on the **Setup** button (located below the **USB** button) in the *demodulator panel*: 
The demodulator set-up window opens, as shown:

The **Wave device** drop-down list shows all the installed wave devices: *Windows default* is the Control Panel setting specified under **Start | Settings | Control Panel | Multimedia Properties | Audio**. If a sound card is specified in this Control Panel setting for both playback and recording (this is very likely, but not always necessarily so), then you can simply select *Windows Default* as the **wave device** for the demodulator. Otherwise, the specific name of the sound card should be selected.
The selected sound card must support duplex operation and the standard 44100 or 48000 samples/second sampling rates, 16 bits per sample, stereo. Most modern sound cards do satisfy all these conditions, but some cards may have a high level of distortion at 48000 samples per second; for such cases, the 44100 samples/second sampling rate is provided.

The next parameter to select is the mixer device associated with the already selected sound card, using the Mixer device drop-down list, and the Mixer line (the sound card input line). If the signal is arriving at the sound card via an external cable, the cable should be physically connected to the Line input of the sound card. If the receiver is connected internally, most probably the input would be called Aux or CD Line.

In the drop-down list of sound card inputs, each line is available either as normal, or Reversed. If the reversed line is selected, this means that the left and right channels (of the sound card stereo input) are to be reversed. Normally, you should not need to select any of these reverse inputs. However, there is a very small number of sound cards where the left and right inputs are swapped. Normally, the G305 Demodulator expects the receiver output to be connected to the right sound card input. If it is to be connected to the left input instead, the reverse input line needs to be selected from the drop-down list.

With some laptops, only the Microphone input may be available and you will need to connect the receiver to the Microphone input instead, and also select this input in the demodulator Setup panel. Certain sound cards, in particular Creative Audigy 2, have a design problem which prevents them from using the Line input in a full duplex mode. In such case, you will also need to use the Microphone input.

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 would result in overloading the sound card, and cause distortion.

The last parameter to set is the Input level. Set it to half the maximum level initially. When you then tune the receiver to your first station, you should return to this, and adjust the Input level below the point when the Clipping indicator turns red. If the signal still sounds distorted, reduce the level further down until the distortion disappears.
While adjusting the **Input level**, you will also see the noise floor of the signal spectrum shown in the main demodulator window rising proportionally.

This completes the software installation process. The G305 software then automatically configures the sound card control panel. It may be interesting to describe what it actually does and why:

Firstly, in the sound card **Playback** volume control panel, the software mutes the sound card input line the receiver is actually connected to. This is the same line as selected in the WiNRADiO G305 demodulator **Setup**, i.e. usually, this will be **Line** or **Microphone** input.

This may seem a bit unexpected: Why are we muting the input line? This is because the signal coming from the receiver is not an audio signal, but rather the intermediate frequency signal. It needs to be processed (demodulated) by the PC first, before it is output back to the sound card. That’s also why the sound card needs to be **full duplex**, to allow for such simultaneous input/output processing.

Failure to mute this line would cause a high-pitched intermediate frequency sound to be combined with the demodulated signal.

To see how the line is muted, click on the speaker icon in the task bar in the bottom, to bring up the sound card **Volume Control** panel (consult **Appendix B – Sound Card Controls** if you have difficulties locating the sound card settings):

![Volume Control Panel](image-url)
The same line will be selected in the **Recording Control** of the sound card control panel. To get there, you need to select **Options | Properties | Recording** in the top bar menu of the Volume Control panel.

The **Volume slider** of the **Recording Control** is duplicated in the demodulator **Setup** panel (where it is labeled **Input level**).

Please pay great attention to the sound card set-up, as most initial problems associated with using this type of receiver can be attributed to an incorrect sound card setting. Typical problems include:

- Not selecting the **Mixer device** or **Mixer line** correctly (which will manifest itself by the absence of any signal appearing in the spectrum scope);

- Failing to adjust the **Input level** properly, which may result either in low (or no) audio output, or, on the other hand, distortion if the signal level is too high.

*Note: Some sound cards may become overloaded and start distorting even before the **Clipping** detector in the demodulator **Setup** window is able to detect such condition. If the audio sounds distorted, try to reduce the **Input level** in the demodulator **Setup** window as the first measure.*
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 chapter *Using WiNRADiO G305 Receiver*. We hope you will return to that chapter, as the WiNRADiO G305 receiver has many fine features which it would be a shame to miss.

Start the WiNRADiO G305 receiver application (double clicking on the WiNRADiO icon). The WiNRADiO G305 receiver control panel will appear as shown below.

![WiNRADiO G305 Receiver Control Panel](image)

The WiNRADiO G305 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 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 hear the station. 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.)

Manual tuning can be done in several ways. Let’s start with the tuning knob: Place the mouse cursor to 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 in the bottom half of the tuning knob, the direction of the rotation will reverse.

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 finer: 50 Hz.

If you are still unable to tune to any stations at this point, please refer to Appendix A - Troubleshooting.

There are also several 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 chapter.

---

**Did you know?**

Hertz, as a unit of frequency, used to be called “cycles per second” (cps), along with related multiples kilocycles (kc) and megacycles (Mc) – now kilohertz and megahertz. It is named after the German physicist Heinrich Rudolf Hertz, who made important scientific contributions to electromagnetism.
Using WiNRADiO G305

Tuning to a Frequency

To change frequency, simply type the new frequency into the keyboard. As soon as you press a digit 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. After typing the new frequency, press \textit{Enter} and the receiver will instantly retune. To abort, press \textit{Esc}.

To enter units, such as kHz or MHz, simply press \textit{H} for Hz, \textit{K} for kHz or \textit{M} for MHz after entering the digits. Any invalid keystrokes are ignored. Frequencies outside the receiver limit (9 kHz to 1800 MHz) will not be accepted and the display will revert to the previous frequency.

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

Under these buttons there is a \textit{band description window}. This shows the band allocation of the currently tuned frequency. These band descriptions are based on those applicable to North America. However, these allocations are based on international treaties and therefore are generally applicable worldwide.

Note that the default band allocation can be overridden with a call sign or a user-defined description of a frequency stored in memory. The default band description is also user modifiable: it resides in the file \textit{bands.csv} in the WiNRADiO installation folder. This file can be edited using a spreadsheet application, such as Microsoft Excel.
Fine Tuning

The **Fine Tune Knob** makes it possible to finely adjust the frequency in 0.5 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).

Using the keyboard only, the frequency can be similarly adjusted using the **Up/Down** cursor keys.

To speed up tuning, the step size can be increased ten or one hundred times by holding the **Shift** or **Ctrl** keys respectively, while clicking the tuning knob with the mouse button or using the **Up/Down** keyboard keys. This is a very convenient feature if you wish to tune quickly across a frequency range: hold the mouse button and accelerate the movement by pressing the **Shift** or **Ctrl** keys. On the other hand, pressing the **Alt** key will reduce the tuning step ten times.

A similar function is performed by the **Tune Step Multiplier** buttons:

![Tune Step Multiplier buttons](image)

Normally, the **x1** button is down by default. When **x0.1** or **x10** are pressed, the rotation of the tuning wheel will result in ten times smaller or larger increment, respectively. If the **S** button is pressed, the increment will be then equal to the step size, as set and indicated by the **Step** control.

While the **Fine Tune Knob** has the same step in all modulation modes, for the **Up/Down** keyboard keys the default step changes to 10 Hz in CW, DSB, ISB, LSB and USB modes. This is convenient for fine tuning in these modes.

*Note that the Fine Tune knob can also be conveniently rotated using a wheel-equipped mouse, or any other standard Windows supported pointing device. Taking advantage of this facility, it is possible to emulate the “feel” of a conventionally tuned receiver.*
Fast Tuning Pad

If you place the cursor over any of the yellow squares of the Fast Tuning Pad, you will see a frequency increment value displayed above the highlighted square. This can vary from 1 Hz to 50 kHz, in convenient steps. By combining horizontal movement of the mouse with alternating left and right mouse buttons, you can quickly tune to any frequency, and step through the band with the appropriate step size.

Setting the Modulation Mode

To select the modulation mode, click on the appropriate Mode button in the Demodulator panel:

The real-time spectrum display shows the output of the receiver (i.e. the intermediate frequency signal) as it is applied to the PC sound card. 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 (intermediate frequency) filter bandwidth associated with the different modulation modes.
For example, standard AM mode has 6 kHz bandwidth, while narrow AM (AMN) uses 4 kHz bandwidth. The CW mode uses a narrow bandwidth of 500 Hz. You will see the trace color change from white to yellow where the spectrum falls within the filter bandwidth. This indicates that you are only receiving the yellow part of the displayed spectrum and the surrounding frequencies are rejected.

If you mistune the receiver somewhat, you will see the spectrum shifting. This assists you to tune the receiver right to the center of the transmitter frequency, and to select the correct AM mode to avoid interference from adjacent signals.

The optional FMW (wide FM, broadcast FM) mode is a special case amongst the modulation modes. Please refer to Appendix F – Wide-band FM Option. If this option is not installed, the FMW button is disabled.

If you also purchased the optional Professional Demodulator, you can select this demodulator from the Demodulators top bar menu. The basic functions such as volume control, audio muting and mode selection are identical to the standard demodulator.

For details of the many additional functions such as continuous IF bandwidth adjustment and other special features of the Professional Demodulator, please refer to Appendix E - Professional Demodulator Option.
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 or down buttons next to the volume display.

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

Finally, another convenient way of changing the volume is by using the **Left** and **Right Cursor** keys on the keyboard.

Mute Control

Next to the **Volume** control is the **Mute** button, which allows you 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.

Audio Filter

Pressing the **AF Filter** button activates the **Audio Frequency Filter**. This is a band-pass filter which emphasizes voice frequencies within the 300 Hz to 3000 Hz range. This filter can be used to make conversation on the bands more intelligible and to filter out unwanted squelch signalling tones (CTCSS).
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.

The AGC (Automatic Gain Control) 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 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 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, if the sensitivity appears to be very low, check the AGC setting first.

Did you know?

Your G305 receiver employs two AGC loops: The first one is the hardware AGC, which acts upon the analog incoming signal. The second AGC loop is performed entirely in software, acting upon the digitized signal and supplementing the action of the hardware AGC.
IF Gain

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. On the other hand, if the gain is too low, it will make the receiver appear “deaf”.

Manual IF Gain setting is useful when hunting for very weak signals buried in noise.

![Manual IF Gain Control]

Software AGC

The Software AGC facility is available in the demodulator panel, and provides a supplementary function to the main AGC. (The main AGC employs a hardware circuit, while the Software AGC relies entirely on software.)

![Software AGC]

Software AGC is useful for compensating audio volume changes when the antenna signals are so weak that the main (hardware) AGC is not yet activated, or when the main AGC is disabled and the manual IF gain is used.
AFC

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.*

RF Gain

The RF Gain (i.e. radio frequency front-end gain of the receiver) can be adjusted using two controls, the **Attenuator** and **Preamplifier**. Normally, the **Attenuator** should be off, and the **Preamplifier** should be on, for maximum receiver sensitivity.

Turning the **Attenuator** on reduces the receiver sensitivity by 18 dB (i.e. 6 times), while switching the **Preamplifier** off results in a further reduction by approx 12 dB.

**Attenuator and Preamplifier**

Why would you ever need to reduce the sensitivity? Because unusually strong signals from local stations may occasionally cause overloading. Such overloading can make the reception worse, and even cause stations to appear on frequencies, where none exist (**ghost** stations). See **Appendix C - Dealing with Interference** for more information on this phenomenon.

If a received signal is too strong, causing overloading, distortion or the appearance of ghost stations, you should reduce its level by pressing the **Attenuator** button and/or disabling the **Preamp**.
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 G305 receiver has five different types of squelch, to maximize operator convenience and to make scanning more efficient and faster:

![Squelch Control Interface]

**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.

To disable the squelch action, simply disengage all squelch buttons (Level, Noise, Voice, CTCSS and DCS).
**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 – in such cases, both conditions must be satisfied for the squelch to open. However, 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.

**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/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/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), 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 also be 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 Lower and Upper ends of the range, Step size, and optionally Mode, Squelch and Description. You can specify as many such bands as you like. When done, close the window.

Next time 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.

**Frequency Memory**

The WiNRADiO G305 receiver has the ability to store up to ten thousand frequencies in one memory file. It also allows you to load and save different memory files for a huge amount of total storage, limited only by the size of your hard disk.
The memories can be accessed via the Memory Control Panel. The currently selected memory is shown in the memory number display, from where it can be also selected.

It is possible to browse through memories one by one using the [<>] buttons. The [<<] and [>>] buttons provide a fast advancement, skipping by ten memories in the indicated direction.

Storing a Frequency into Memory

With each frequency, you can store several attributes: mode, callsign, 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, allowing you to assign a memory number to the current frequency.

Did you know?

WiNRADiO also offer complete frequency database software suitable for your receiver, for example the WaveBase. For this, and other software accessories, please refer to WiNRADiO website www.winradio.com.
Storing Frequency to Memory

At the top of the dialog box is the name of the currently selected memory file, followed by the frequency you are storing. The next line shows the next available memory number. You can change this to another memory number if you wish (including one which is already allocated). 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 frequency may be associated with more than one group at the same time.
There are also other additional items that can be optionally stored with each frequency:

- Most stations have a name or callsign. You can store up to 11 characters in the **Callsign** field.

- For quick tuning to your favorite stations, you can assign **Hotkeys** (function keys F2 to F12) for 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 the **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 Memory Recall
- Typing a number into the memory number display
- Using a hotkey
- Memory stepping

To recall a frequency, 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**.
Recall Frequency from Memory

You can click on the column descriptions to sort the memories by the column.

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, including 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 one 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. G305 receiver memory files have an extension ".05m".

*When you exit the WiNRADiO G305 application, all memory changes are automatically saved; there is no need to use the Save command before exit.*

Opening a Memory File

When WiNRADiO 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/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.

Memory Import / Export

Under **File** | **Memory File** | **Import from CSV** or **Export to CSV**, the memories can be imported from, or exported to, a CSV (comma separated values) file. The CSV file can be loaded to spreadsheet software and edited. If you are manually editing an exported CSV file for re-import, make sure that the item sequence is preserved, including the "reserved items" (which should be left blank).
Importing third-party frequency data is also possible, however the imported file must be first edited in a spreadsheet, for the imported parameters to be exactly in the specified order, including the reserved items:


We recommend exporting an existing memory file and examining the format of the exported CSV file before attempting to import third-party data.

Did you know?

Each memory file you create can contain up to 10,000 frequencies. You can have as many memory files as you wish. Each frequency consumes approximately 100 bytes of hard disk space. Assuming that on a typical PC you would have about 20 gigabytes spare on a hard disk, this means that you probably have room for about 200 million frequencies!
Scanning

The WiNRADiO G305 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:

![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 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.

Scan Settings

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:

1. When the signal disappears (i.e. the scanning resumes immediately when the signal disappears);

2. After a certain user-defined **Delay time** (i.e. no matter if the signal disappears during this Delay Time or not, the software will always wait for the Delay Time interval, then resume);

3. When the signal disappears during **Delay time** (i.e. the scanning will resume after Delay time, or earlier if the signal disappears);

4. When there is no signal during the **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 **Scan rate** controls the speed at which scanning occurs, by specifying the maximum number of scanning steps per second. Note that the actual maximum achievable scanning speed may be limited by the CPU speed of your computer, as well as available memory and any background tasks that the computer is currently performing.

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 later: it serves to restrict *Memory 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 G305 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.

*Note that scanning speed can be affected by your CPU power and available memory. CPU-intensive background processes can also slow down scanning. Squelch modes that require more intensive signal processing compared to plain Level-based squelch (such as Voice, Noise, CTCSS and DCS squelch modes) may also exhibit different scanning speeds, depending on the CPU power and the characteristics of the received signal.*
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.

![Scan ranges dialog box](image)

### Setting up Scan Ranges

Note the check box at the start of every specified range. This allows you to selectively enable and disable ranges to be scanned, without having to delete and re-enter them.

To define a new range, use the **New** button. This will open a dialog box, where you will be asked to specify lower and upper limit frequencies of the range, the modulation mode, squelch settings, and, optionally, a description. You can enter as many such ranges as you like:

![New range dialog box](image)

### Adding a New Range

![Adding a New Range](image)
When the range definition is done, close this window, then close the scanner settings. Then activate the **Range** button in the **Scanning** control panel:

![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.

An additional 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 the **Auto Store** checkbox in the Scan ranges set-up window, and specify the memory 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 for scanning when the signal is found (for example, pause when signal found, 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.*
Memory Scanning
The last scanning method is Memory Scanning. Here the receiver will step through memory frequencies, starting from 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, its value will be used to compare with the current signal level. If there is no value stored, the current squelch value will be assumed.

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.

S-meter

The WiNRADiO G305 receiver Signal Strength Meter (S-meter) makes it possible to measure signal strength in either S-units, dBm or µV (microvolts). The units are selected by correspondingly marked buttons on the right side of the display. In the microvolt mode, the p-p button is also enabled, making it possible to select peak-to-peak values rather than the default RMS (Root Mean Square) values.

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 and “squelched” will be displayed.
The squelch value is always indicated in dBm units (even if the signal strength is displayed in S-units or microvolts).

Note that when the AGC is off (and manual IF gain control is activated), the S-meter is disabled. This is because the S-meter relies on the AGC for its proper function.

**Power Switch**

The *On/Off 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 receiver application, the power status at exit will be remembered.

**Date and Time Displays**

The clock display, located under the *Fast Tuning Pad*, indicates the current time and date.

The *UTC* clock shows *Universal Coordinated Time*, formerly called *GMT* (Greenwich Mean Time), which is the standard time used around the world. This is provided because most shortwave stations announce their broadcast times in UTC. Both displays derive their 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 Scope

In addition to the narrow-band **real-time** spectrum scope, which is located inside the demodulator panel, the G305 receiver also has a wide-band spectrum scope which operates by fast tuning the receiver across the user-specified frequency range, or “sweeping”. Click on the yellow triangle button on the left of the **Power switch** and the **Spectrum Scope** display will slide out at the bottom:

![Spectrum Scope](image)

To set up spectrum sweeping, enter the **Start** and **End** frequencies, to specify the start and end of the sweeping range, respectively. Next specify the frequency **Step**.

Bear in mind that the resolution bandwidth of the swept spectrum is approximately 1 kHz. If you select step sizes larger than this value, you may be missing some parts of the spectra. This is actually not always such a bad thing: If you know the channel separation on the band, it is advantageous to set the step size equal to this channel separation (for example, on VHF/UHF bands it is often 12.5 or 25 kHz). Stepping with larger step size speeds up the spectrum sweeping.

![Spectrum Sweep](image)

The sweeping is controlled using a set of buttons similar to a tape recorder: The **Start** button (with a triangle) starts sweeping. The **Stop** button (with a square), stops sweeping, while the **Pause** button pauses it. The button with a red round arrow selects continuous sweeping, 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.
The **Min**, **Man** 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 examining long-term 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.*

There are also two **Zoom in/out** buttons performing their self-explanatory functions, and a **Clear** button, which clears the graph and the min/max values.

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.

If you press the **Hits** button, the spectrum display changes to a **Hit Counter**. The **Hit Counter** 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.

The **Hit Counter** works in a similar way to a spectrum analyzer, where the horizontal axis represents the frequency span. However, instead of displaying signal strength on the vertical axis, 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 that fits the window. The other bars will have proportionally smaller heights. The **Min**, **Max** and **Diff** buttons are disabled in the **Hit Counter** mode.
The squelch condition that needs to be satisfied for a "hit" can be any valid combination of the five types of squelch available in the main panel.

For example, it can be Level only, or CTCSS, or Level+CTCSS, etc.

Note also that if there was a hit on a particular frequency during a particular scan, the respective bar will turn red for the rest of the scan, while other bars will remain yellow. This is designed to provide an indication of current activity in the band.

To hide the **Spectrum Scope**, use the yellow triangle button next to the power switch again.

*Note: When selecting the spectrum scope parameters, it is recommended that the step size is made equal to the channel spacing on the band. For example, on many VHF/UHF bands, the spacing is 12.5 or 25 kHz. Making the step size the same as the channel spacing, and the start frequency equal to that of the first channel in the band, will ensure that each step will fall on the center of a channel. This will maximize the spectrum sweeping speed and ensure the best graphical representation of the actual situation on the band.*

---

*Did you know?*

*Radio frequency spectrum is a valuable commodity, just like real estate. Frequency bands are allocated and licensed to prevent interference and misuse. In the US, frequencies between 9 kHz and 275 GHz have been allocated for use by terrestrial or space radiocommunications by the Federal Communications Commission. Frequencies outside of these limits are currently not regulated (at the time of writing this book).*
Appendix A - Troubleshooting

Problem (G305i or G305e with serial interface option only): My PC does have a Line input, but there is no Line input shown in the mixer line list in the demodulator set-up window.

Solution: The mixer line list is provided by Windows. It shows all available mixer channels which are capable of full duplex operation. It appears that the Line input of your sound card is not capable of full duplex operation. This is the case with certain sound cards, most notably with Creative Audigy 2. You will need to use the Microphone input instead. See also the related problem below.

Problem: I have connected the receiver to the Microphone input, but the sound is severely distorted.

Solution: You need to disable the microphone preamplifier – this is located in the sound card control panel (note the button Advanced under the microphone volume control). Sometimes this checkbox or button is marked +20 dB booster. See also the problem below for another possible cause of this problem.

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 down – typically, the Med setting is used).

G305i or G305e with serial interface option only: Check the Input gain in the demodulator Setup panel: it should be set just below the clipping level (sometimes a bit lower if the sound card starts distorting before the clipping is detected). If both settings are correct, try to reduce the sampling rate from 48000 samples/second to 44100 (also in the demodulator Setup). (Using 48000 samples/second should provide better performance if good quality sound cards are used, but some sound cards are not able to provide good quality sampling at this sampling rate.)
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: Engage the SAGC button in the demodulator front panel (typically, the Med setting is used).

G305i or G305e with serial interface option only: Also check the Input gain in the demodulator Setup panel: it should be set as high as possible, just below the clipping level.

Problem (G305i or G305e with serial interface option only):
The WiNRADiO application installed OK, but there is no sound coming from the speaker.

Solution: Check if you see any noise appearing in the demodulator spectrum scope (under the AM, AMS, etc., mode selection buttons). If there is a flat line or only very little noise visible, check the following:

- The receiver output is connected 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 Microphone or Aux but the software settings need to be changed accordingly.)

- The sound card has been set up correctly. Especially make sure that the Recording Line input has been enabled (you will find this panel under Options | Recording in your sound card volume control panel – click on the speaker icon in the bottom bar to get to the volume control panel first):
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.

- The receiver demodulator has not been set up properly. Make sure that the sound card type and the audio input are properly selected (this panel is accessible under the Setup button in the demodulator panel):

  ![G305 Demodulator Setup](image1)

- The sound card has the left and right inputs reversed. Normally, the G305 Demodulator expects the receiver to be connected to the Right input. Using the reverse input makes the demodulator use the Left input instead. (This is a very rare problem, so use this only when all other possible remedies have been explored.)

  ![G305 Demodulator Setup](image2)

- Make sure the squelch is not activated (none of the Squelch buttons are down).
Problem: I can tune the receiver and see the signal peaks in the spectrum scope, but I can’t hear any sound at all.

Solution: Check that your speaker or headphone is connected to the speaker output of the sound card. Set the volume to medium (say 15), disengage all squelch buttons. Make sure the Mute button in the demodulator panel is released, too, and the speaker output of the sound card is unmuted in the sound card control panel.

Problem (G305i or G305e with serial interface option only): I can hear the audio, but it is not a pleasant sound. There is an interfering high pitch tone.

Solution: You need to mute the Line input in the sound card control panel - see the panel on the next page. (What you are probably listening to is the intermediate frequency signal mixed with the demodulated audio signal.)
Problem: I can hear the audio and tune the receiver, but the audio drops-out occasionally, and the display is very sluggish, sometimes it even freezes.

Solution: Close all other simultaneously running programs to reduce the burden on the CPU. If the CPU usage shows consistently more than 80%, this may indicate insufficient CPU resources for the G305 application. (Check the CPU usage under the Setup button in the demodulator window. The CPU resource meter is at bottom left.)

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. 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 the antenna is picking up too much ambient noise. Try to improve the antenna, or move it further away from the PC. (Additional noise-defeating measures may be in order; 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 some other household appliance. Your PC (especially the monitor) could be also the culprit. Unless you can suppress the interference at the source (which is not always possible), 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.)
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.

WiNRADiO G305 receivers require a full duplex sound card, meaning that the card must be able to simultaneously process signals in two directions (i.e. record and playback) at the same time. The majority of modern Sound Blaster compatible cards are indeed like that. However, some cards may not be full duplex, and some may not be full duplex with respect to the Line channel, therefore the Microphone channel has to be used instead.

The Recording section of a sound card is used to input and digitize the IF (Intermediate Frequency) signal arriving from the receiver (only the Right channel is used, of the Left and Right stereo channels). The Playback section is then used to output the demodulated audio signal to the speaker(s).

For the WiNRADiO G305 application, there is a need to independently control both sound card sections: The Recording section volume needs to be adjusted to provide the correct IF signal level for the demodulation process; the Playback section control is needed to be able to control the speaker volume.

Typically, you would access the Playback volume control panel by clicking a speaker icon in the Windows task bar. From this panel, you can get to the Recording control panel by selecting Options | Properties | Recording in the top bar menu.

If the speaker icon is missing, an alternative way of accessing the Recording/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/disable the speaker icon, and how to get to the recording/playback controls from within the Windows control panel. The methods vary depending on the version of Windows you are using.
<table>
<thead>
<tr>
<th>Windows</th>
<th>Enable “speaker” icon</th>
<th>Recording/playback volume controls</th>
</tr>
</thead>
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<tr>
<td>98</td>
<td>Control Panel</td>
<td>Multimedia Audio-tab</td>
</tr>
<tr>
<td></td>
<td><strong>Checkbox</strong>: “Show volume control on the taskbar”</td>
<td>**Control Panel</td>
</tr>
<tr>
<td></td>
<td><strong>Sound Playback</strong>: Click on button</td>
<td><strong>Sound Recording</strong>: Click on button</td>
</tr>
<tr>
<td>ME</td>
<td>Control Panel</td>
<td>Sounds and Multimedia Sounds-tab</td>
</tr>
<tr>
<td></td>
<td><strong>Checkbox</strong>: “Show volume control on the taskbar”</td>
<td>**Control Panel</td>
</tr>
<tr>
<td></td>
<td><strong>Sound Playback → Volume</strong> button</td>
<td><strong>Sound Recording → Volume</strong> button</td>
</tr>
<tr>
<td>2000</td>
<td>Control Panel</td>
<td>Sounds and Multimedia Sounds-tab</td>
</tr>
<tr>
<td></td>
<td><strong>Checkbox</strong>: “Show volume control on the taskbar”</td>
<td>**Control Panel</td>
</tr>
<tr>
<td></td>
<td><strong>Sound Playback → Volume</strong> button</td>
<td><strong>Sound Recording → Volume</strong> button</td>
</tr>
<tr>
<td>XP</td>
<td>Control Panel</td>
<td>Sounds and Audio Devices Sounds-tab</td>
</tr>
<tr>
<td></td>
<td><strong>Checkbox</strong>: “Place volume icon in the taskbar”</td>
<td>**Control Panel</td>
</tr>
<tr>
<td></td>
<td><strong>Sound Playback → Volume</strong> button</td>
<td><strong>Sound Recording → Volume</strong> button</td>
</tr>
</tbody>
</table>

**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.
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, welders, 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 G305 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. 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 on the Attenuator in the receiver control panel. You may also try shortening the antenna.

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 book, since the large majority of WiNRADiO users should not experience this problem (after all, not too many of us live next door to a radio station). However, broadcast frequency filters and tunable preselectors are standard items and can be obtained from good radio equipment suppliers.

Can we help?

WiNRADiO produces a range of antennas and radio accessories, including antenna splitters, amplifiers and interference filters, suitable for your G305 receiver. Please visit our website www.winradio.com for more information on our products.
Appendix D - Inside WR-G305

Technically minded users may like to explore the WiNRADiO G305 Receiver and experiment with some of the innovative concepts of *Software Defined Radio*.

The WiNRADiO G305 Receiver is the world's first commercially available *Software Defined Radio* for the VHF/UHF bands, where the demodulator function is fully performed in software running on a standard PC. The potential for experimentation is therefore substantial. This receiver and its software have been indeed designed to promote and encourage such experimentation.

The WiNRADiO G305 receiver represents only one half of the entire radio. The other half is your PC. 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 a 4-pole crystal filter with an IF bandwidth of 15 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 12 kHz.
Both DDS circuits derive their reference frequency from a 20 MHz reference oscillator.

The 12 kHz IF output is then fed to the right channel of the Line input of the PC sound card. You can hear what it sounds like if you use the sound card mixer panel to listen directly to this input (rather than using the G305 Demodulator software).

The AGC is performed in the first IF stage, based on the level of the last IF output (at 12 kHz IF). As the IF bandwidth of the first IF stage is 15 kHz, the AGC action is delayed until the dynamic range of the first IF stage is fully utilized – this is in order not to cause desensitization of the receiver in the presence of neighboring strong signals, falling within the 15 kHz IF bandwidth. The resulting variation in audio output is then compensated for in software, using Audio AGC in the software demodulator.

The final IF bandwidth is then adjusted entirely in software. If the Professional Demodulator is used, this bandwidth is continuously variable from 100 Hz to 15 kHz.

**Did you know?**

The G305 receiver's hardware front-end is a dual conversion superheterodyne – the rest of the signal processing, including further down-conversion, is done entirely in software domain. The superheterodyne was patented in 1918 by American inventor Edwin Howard Armstrong, an author of many radio related inventions, including the regenerative circuit and frequency modulation.
Appendix E - Professional Demodulator Option

The WiNRADiO G305 receiver has provision for additional demodulators, in place of the supplied standard one. Installed demodulators can be selected via the Demodulators top bar menu. Check the WiNRADiO Web site www.winradio.com periodically, for available demodulators.

The optional Professional Demodulator takes the concept of software-defined shortwave receiver a step further. The main differences between the Standard and the Professional demodulator are as follows:

- Additional demodulation modes (DSB and ISB)
- Continuously variable IF bandwidth (from 100 Hz to 15 kHz)
- User-adjustable IF filter coefficients and other parameters
- User-adjustable software AGC
- User-adjustable audio filter
- User-definable IF bandwidth presets
- Interactive demodulator structure with two spectrum scopes and a vector voltmeter
- Additional instrumentation (SINAD and THD meter)
- Secondary audio or IF output
The front panel of the Professional Demodulator looks similar to the standard one. Note in particular the added DSB and ISB modes, the continuous IF filter bandwidth control, enhanced Software AGC (the time constants are user definable in the Setup window), and a row of IF bandwidth preset buttons at the bottom. The numbers on top of the IF bandwidth preset buttons indicate the associated bandwidth (in kHz). These presets, too, are entirely user-definable.

To change the IF bandwidth, you can type the desired value (in Hz) directly in the IF bandwidth edit box, or use the associated up/down buttons.

*Do not overlook the small but very significant slider located between the bandwidth up/down arrow buttons: It allows you to change the IF bandwidth within a large range, by moving the slider cursor up and down, with a very impressive effect:*

![IF bandwidth slider](image)

In the real-time spectrum scope, the currently selected IF bandwidth is indicated using a different background color. The portion of the real-time signal spectrum falling within the IF bandwidth is shown in yellow.

**Adjusting Demodulator Parameters**

Each demodulation mode has its own associated set-up panel, accessible under the Setup button (located under the CW mode button). By selecting the mode either using the front panel or the tabs at top-right of the demodulator set-up window, you can see and adjust the filter settings applicable to the selected modes.

The meaning of each filter is best understood looking at the demodulator structure (under the View demodulator structure button). The cut-off frequencies and lengths of these filters can be adjusted and optimized by the user, either by direct typing in the parameter or using the sliders.

Each filter length (i.e. the number of its taps), can be an odd number between 3 and 511. The more taps, the better the filter characteristics, and the better the performance of the receiver, but the computing task for the CPU is harder.
Therefore, while increasing the filter lengths, always watch the CPU usage (shown at bottom left of the demodulator Setup window) in order not to starve the operating system of CPU resources (80% is a good upper limit). Starving the system of CPU resources manifests itself by the computer becoming sluggish or possibly "freezing" entirely.

The first parameter, Post-mixer filter length parameter refers to the post-mixer low-pass filter, whose cut-off frequency is automatically related to the currently selected IF bandwidth. For AM, AMN, AMS, CW, DSB, ISB, FM6 and FMN modes, the post-mixer filters bandwidth is half of the IF bandwidth, while for LSB and USB both bandwidths are equal to the IF bandwidth. The factory default length is 63. Reducing this value will decrease the receiver selectivity and make the receiver more prone to interference from nearby strong signals. However, for slower computers it may be necessary to compromise on this figure if the demodulator appears too slow (to the point of the panel "freezing" or drop-outs of audio) because of insufficient CPU resources. If your CPU speed allows it, then we would recommend to set this value to its maximum limit (511).
If you have a preference for particular IF bandwidths, you can associate them with any of the ten preset buttons (located at the bottom of the demodulator front panel) by double clicking the Bandwidth column of the IF bandwidth presets table, and then typing in the numerical bandwidth value in Hz. The buttons are numbered (1 to 10) from left to right. The factory default values can be restored at any time, by pressing the *Restore default settings* button. Each modulation mode has a separate set of IF bandwidth presets.

The audio filter’s length is adjustable under the *Audio filter length* parameter. Note how this parameter influences the actual filter passband (represented by the blue graph under *Audio filter settings*), compared to the ideal passband (represented by red lines). The *Audio filter settings* make it possible to adjust audio filtering separately for each demodulation mode. The *On* button either enables or disables filtering, and is tied to the *AF 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 filter 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 use with FM modulation only. The typical value is -6dB/octave.

Finally, all demodulated audio output is scaled up by an *Audio gain* factor. The scaled audio signal level is further adjusted with the *Volume control* in the demodulator main panel. However, when the *Software AGC* is active, the fixed *Audio gain* setting is ignored, and the software will automatically adjust the audio level according to the *SAGC reference level* setting.

*If you are experiencing audio distortion when using the Software AGC, this is probably because the SAGC reference level is set too high.*
The attack and decay times for the three possible Software AGC speeds (slow, medium and fast) can be also configured, under SAGC Speed Constants on the left of the demodulator settings window:

![Demodulator Settings Window](image)

**Demodulator Structure**

The G305 Professional Demodulator implements the general quadrature representation of all narrow-band 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 and Q. Users familiar with Software Defined Radio digital signal processing concepts, will find the G305 Professional Demodulator to be a useful tool for experimentation and study, where the effects of various filter settings can be easily observed and optimized.

The entire demodulation process can be observed in the demodulator structure window, accessible from within the demodulator settings (press the Setup button under the CW mode button), then the large View Demodulator Structure button). Each mode has its own associated structure. By selecting the mode either using the front panel or the tabs at top-right of the set-up window, you can observe the different structures applicable to the selected modes. Each mode also has its own set of filter settings available for experimentation.

**Did you know?**

*All the software-implemented digital filters used in the G305 receiver are of the linear phase FIR (Finite Impulse Response) type, with maximum 511 taps, providing a filter shape far superior to conventional analog hardware filters.*
The demodulator structure windows include two spectrum analyzers, making it possible to view signal spectra in real-time. Each analyzer can be "connected" to 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 labeled Left/Right indicate the relative amplitude and phase difference between the two spectral components at the cursor frequency.

There are two additional tools provided in this window: THD (total harmonic distortion) and SINAD (signal-plus-noise-plus-distortion to noise-plus-distortion) meters. They can be used to test the overall receiver performance as well as provide indication of the sound card quality.
To use these facilities, a pure tone-modulated signal must be applied to the receiver antenna input, and the frequency of the modulating tone must be equal to the **Test freq** setting.

When either of the **THD** or **SINAD** buttons is activated, the right-hand spectrum display will be automatically connected to the end of the demodulator chain (i.e. right-clicking on any other test points will not work until both the **THD** and **SINAD** buttons are released).

When you change the modulation mode, the displayed structure of the demodulator will change accordingly, allowing you to exploring it. For example, for the **AMS** mode (*synchronous AM demodulation*), the G305 Professional Demodulator uses a digital carrier recovery technique based on the so-called **Costas loop**:

\[
\begin{align*}
\text{IF input} & \quad \cos (\cdot) \quad \text{Costas Loop} \quad \text{AMS} \\
\quad \text{cos } (\cdot) & \quad \text{sin } (\cdot) \quad \text{Q}
\end{align*}
\]

**Synchronous AM Demodulator Structure**

---

**Did you know?**

**Synchronous AM demodulation mode is particularly useful when listening to an amplitude modulated signal without a carrier or with a fluctuating one, for example when receiving a fading long-distance shortwave station. When listening to an AM station where one of the sidebands are damaged due to adjacent interference, it is possible to use either the LSB or USB mode to improve reception.**
Secondary Output

The **Secondary output** can be activated either for IF or audio signals. It is intended for third-party applications that require access either to the IF samples for demodulating transmissions not handled by the default demodulator, or for applications that use the demodulated audio 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.

This feature can be utilized by the optional WiNRADiO **Virtual Sound Card** software (see [www.winradio.com/vsc](http://www.winradio.com/vsc) for more information), 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.

**If the WiNRADIO Virtual Sound Card is not used, leave these two checkboxes unchecked.**

---

**Did you know?**

If you intend to use external third-party decoding or signal processing programs, the WiNRADiO Virtual Sound Card offers major advantages:

- **By eliminating sampling rate differences between the WiNRADiO receiver and the PC sound card, signal discontinuities due to buffer over/under runs are eliminated.**

- **Signal degradation introduced due to double conversion (digital-to-analog and then again analog-to-digital) is eliminated. Sound card interconnecting cables are also gone.**

- **CPU usage is decreased due to saved operating system resources which normally would have to be allocated when sharing the same sound card between two or more applications, affecting the demodulation process on slower computers.**
Appendix F - Wide-band FM Option

The “WFM” option makes it possible to receive wide-band modulated signals (“broadcast FM”) on the G305 receivers. On the standard G305 receiver, the wide-band FM capability is not included, because it is not possible to provide this as part of fully software-defined receiver, within the constraints of the 15 kHz instantaneous bandwidth of the digitized IF signal and the processing power of an ordinary PC.

The WFM option is in fact a self-contained conventional “hardware-defined” “receiver within a receiver”. The user can receive wide FM broadcasts, but cannot see the entire 230 kHz bandwidth in real time or adjust the IF bandwidth. Instead, the real-time spectrum panel shows demodulated audio spectrum. This option is available for both G305i and G305e receiver models.

The Software AGC (SAGC) function is disabled (because the WFM option is entirely hardware), but the Audio Filter, Volume and Mute functions work normally. When used with the Professional Demodulator Option, the Audio Filter becomes user-adjustable. Its cut-off frequencies can be continuously adjusted by dragging the filter overlay conveniently displayed inside the spectrum display.
Appendix G - Developer Support

WiNRADiO has always extensively supported third-party software development efforts with all our receivers, and the WiNRADiO G305 receiver is no exception. We provide technical details for developers to be able to develop the following:

1. Third-party applications controlling the WiNRADiO G305 receiver. We do this by providing API information making it possible to access the receiver hardware from third party software. (See http://www.winradio.com/home/developer.htm).

2. 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).


Have you registered yet? WiNRADiO provides regular upgrades to our application software. Use our on-line registration form on www.winradio.com/register to take advantage of this free service.
Appendix H - Frequency Calibration

The G305 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.

The receiver calibration is accomplished by inserting a reference frequency parameter in the wrg305.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 from the About box in the G305 application. The reference frequency is the actual frequency of the internal reference oscillator in Hz. This is nominally 20 MHz, i.e. 20000000 Hz.

Each receiver is factory calibrated, so a correction to the nominal 20 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 wg305.ini file. To determine the true offset from a perfect tuning, firstly use 20000000 (i.e. the nominal reference frequency in Hz) as the new reference_frequency parameter. Say your receiver serial number is 02L27011:

```
[ClockCalibration]
02L27011=20000000
```

Open the existing wrg305.ini file, add the above two lines, then save the file and start the G305 application. The frequency error will now be much worse because this 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. Typically, this will be a negative number (for example, -652 Hz at 10 MHz).
Then scale the frequency difference to 20 MHz. For example, if the frequency difference is -652 Hz at 10 MHz, it will be -1304 Hz at the 20 MHz reference frequency.

Then subtract the frequency difference from 20000000. In our example, the resulting reference_frequency will be 20000000-(-1304)=20001304. The entire reference frequency parameter in the wrg305.ini file will be then as follows:

```
[ClockCalibration]
02L27011=20001304
```

Save the wrg305.ini file, then restart the G305 application and observe the difference.

To return to the original factory frequency calibration, simply delete the inserted two lines in the wrg305.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).

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**Did you know?**

The WWV Time and Frequency Standard stations which broadcast on 2.5, 5, 10, 15 and 20 MHz, have 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.