RTL Site Survey Kit

Version 1.1

Warning: This manual contains important safety and operating information.
Please read, understand and follow the instructions in the manual.

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1. Site Survey – Radio Frequency Overview

1a. Radio frequencies and propagation;

HWM / Radio-Tech Transmitters and receivers are available in the following radio frequencies;

153MHz
169MHz
434MHz
869MHz

Currently, we can provide Site Survey Kits for 153MHz and 169MHz only

1b. UHF / VHF Overview

Radio Frequencies between 300 and 3000 MHz are classified as UHF (Ultra High Frequency)
Radio Frequencies between 30 and 300 MHz are classified as VHF (Very High Frequency)

In very general terms;

Higher Frequencies (UHF) = Less interference, shorter range, smaller antenna, more expensive

Lower frequencies (VHF) = More interference, longer range, larger antenna, less expensive

Each of these frequencies has slightly different characteristics which can affect the performance of the devices and can make them more or less suited to specific environments. There are both advantages and disadvantages to UHF and VHF.

1c. UHF vs VHF Devices

The primary advantage of UHF is that there is less chance of interference from other sources as there is more radio spectrum available at these frequencies.
UHF radio waves propagate mainly by line of sight; they are blocked by hills and large buildings although the transmission through building walls is high enough for indoor reception.

VHF propagation characteristics are ideal for longer-distance communication, with a range generally farther than line of sight from the transmitter.
While VHF is blocked by large land features such as hills and mountains, it is less affected by buildings and other less substantial objects than UHF frequencies.

So, which is better for your installation environment?

UHF will deal better with going through internal walls or other obstacles than VHF, so if your installation is generally made up of transmitters and a hub inside a building, UHF may be the better choice.

VHF will transmit further for the same amount of power compared to UHF.

UHF will not penetrate walls or other obstacles as well as VHF, so if your installation consists of transmitters placed further away from each other in more open spaces, VHF may be the better choice.

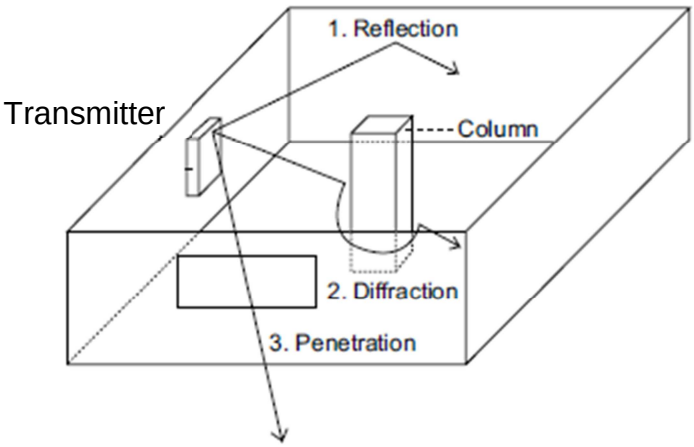
1d. Understanding Radio Waves

Choosing the best sites for the Transmitters and Hubs requires careful planning and testing of the area.
The best location may not always be the most convenient for installation.

Characteristics of Radio Waves
The transmission of radio waves and the Transmitter/Hub coverage area depend on the structure and materials of the installation environment.

Office equipment, such as computers and fax machines, can interfere with radio waves.
Such equipment may create noise or interfere with the performance of the Transmitters/Hubs.

The illustration below shows the special transmitting characteristics of radio waves.
1. Radio waves are reflected by objects made of materials such as metal.
2. Radio waves are diffracted by objects such as metallic columns.
3. Radio waves penetrate objects made of materials such as glass.



1e. Relationships between Radio Waves and Building Structure and Materials

• Coverage area is affected more by the building materials and their thickness than the number of obstacles.
• Radio waves tend to be reflected or diffracted by conductive objects and rarely penetrate them.
• Radio waves tend to penetrate insulated objects and are rarely reflected by them.
• Radio waves penetrate thin objects more than thick objects.
• The table below shows the transmission tendency of radio waves when they reach various objects.

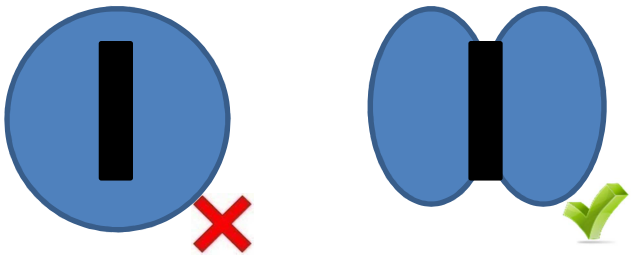
Object	Material	Transmission Tendency
Wall	Concrete	The thicker they are, the less radio waves will penetrate them.
	Ferroconcrete	Radio waves can penetrate them, but the more iron there is, the more radio wave are reflected
Window	Glass	Radio waves usually penetrate them.
	Glass re-enforced with wire mesh	Radio waves usually penetrate them but tend to be reflected
	Glass covered with metallic film	Radio waves are weakened considerably when they penetrate a window.
Floor	Ferroconcrete	The thicker they are, the less radio waves will penetrate them.
Partition	Steel	Radio waves are reflected and rarely penetrate them
	Plywood, Glass	Radio waves usually penetrate them.
Column	Ferroconcrete	Radio waves can penetrate them, but the more iron there is, the more radio wave are reflected
	Metal	Radio waves tend to be reflected or diffracted
Cabinet	Steel	Radio waves tend to be reflected or diffracted and rarely penetrate them.
	Wood	Radio waves can penetrate them but they are weakened.

1f. Radio Transmission Patterns

Just because a Transmitter and Receiver are close together does not mean that the receiver will be able to pick-up the transmitted signal reliably.

This is due to the way (or shape) that Transmitters operate and the strength of the transmitted signal;
It is not usually possible to achieve an equal ‘sphere’ of transmission strength; usually there are stronger/weaker areas.

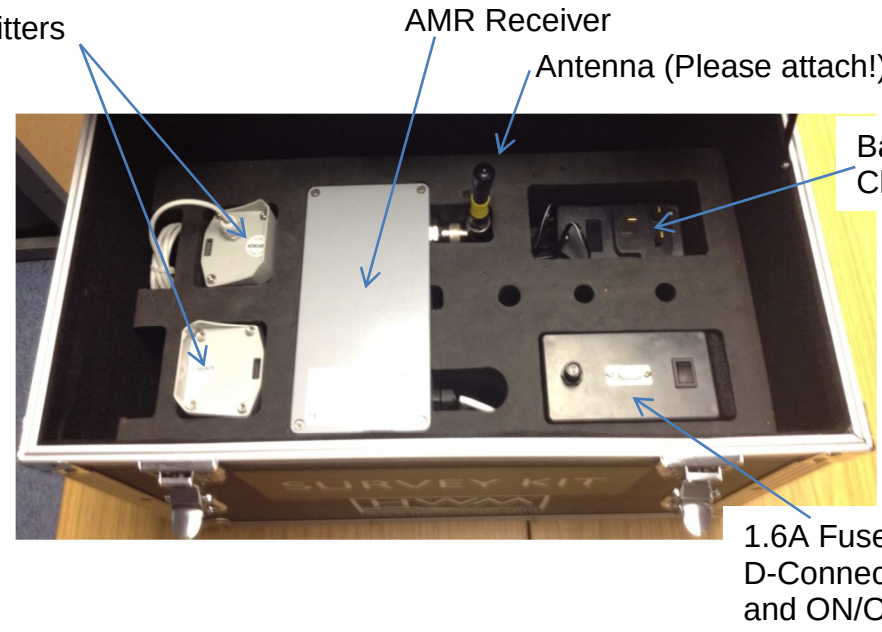
Example:



Also, if the Transmitter and Receiver are too close together, the Transmitted signal can saturate the Receiver and result in very poor/no reception.

Site Survey Kit Contents

NB: Depending on the kit type, the contents may vary slightly from the example below.



The Battery Charger has two LEDs, the RED LED indicates that the battery is being charged, the GREEN LED indicates the battery is fully charged.

Included with the kit is also a CD containing the necessary s/w and manual.

If you laptop does not have the necessary drivers for the USB/Serial converter, they can be downloaded from
http://www.ftdichip.com/Drivers/VCP.htm

Site-Survey Procedure

Installation Steps.

Have information on the age and construction of the buildings. For example:

- Site Address and floor plan of site.
- Old Victorian buildings have very thick walls
- Some hospital buildings are lead lined (X-Ray departments and rooms with X-Ray scanners)
- Buildings with a high metal percentage in its construction
- Any internal lined rooms (e.g cleanrooms)
- Lift Shafts (and lift motors)
- Other Radio Transmitters

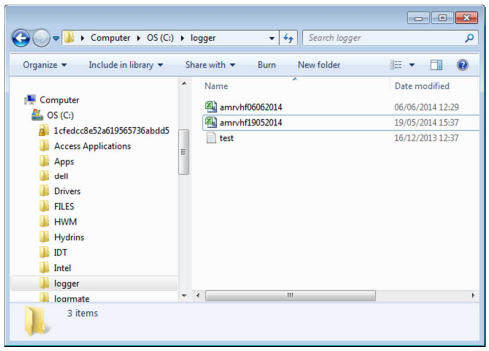
Other considerations:

- Location of computer rooms
- Ethernet points and Firewalls (Wi5 Ethernet versions only)
- Ease of accessibility to the equipment – e.g at height or in a locked room
- Power points
- Protection of the equipment – e.g on a corridor wall, will trollies etc damage the equipment when passing
- Floor level of where the hub is installed – basements can cause issues with connectivity
- Any transformers or welding equipment nearby – strong effect on the radio waves
- Locations of transmitters at different levels – e.g in a meter pit and in a tower block
- How many hubs are required

1. Based on the probable location of the transmitters, select a suitable location for the Wi5. If this is not carried out correctly, then transmission of data to the GSM/GPRS network will be unreliable. If there is poor GSM/GPRS coverage, consider using an Ethernet Wi5 if possible.
    a. Chose an area with good GPRS coverage for your chosen GSM Network provider.
    b. Use a GPRS Signal Meter (or Wi5 Command line and STATUS command) to check the GPRS Signal Level is >14 +CSQ. (20 ~ 30 +CSQ recommended). Check the reading several times to ensure a constant result is achieved.
    c. Place the Wi5 high up to improve GPRS reception (Consider external Antenna if GPRS signal level is low.)
    d. A suitable Power supply is nearby.

NB: Using a mobile phone to check signal strength **does no**t adequately check the strength or quality of the GPRS data connection. The Wi5 uses the GPRS service to transmit its data, it is the strength of this service which must be checked. Use a GSM Scanner if in any doubt.

2. Using the site-survey kit, setup the Receiver and your Laptop in the same location as the Wi5 hub and place the transmitter as close to their final position as possible. Check reception at the Wi5 site.
    a. Check several pulses of data to ensure reliability
    b. Consider the use of Repeaters if the reception at the Wi5 is unreliable.
    c. Use a radio scanner set to the chosen frequency, check the area for any interference from other sources.
3. Create a folder in the C: drive of your Laptop called ‘logger’ and put a file in it (example, the text file ‘test’ in the screen shot below)



Install and open the software ***amr_rtcom_v22*** **(or later)**

Once you have the program running, you need to set the communications port from the options in the top left of the program.

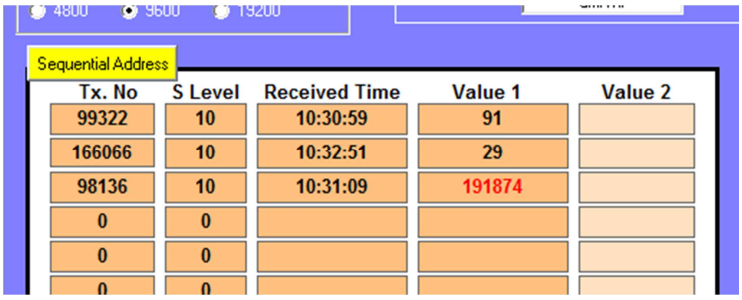
Below this box is the baud rate. Set it to 9600

Set the ‘Receiver Type’ to VHF

In the top centre, is a box for setting the file locations and frequency of data capture. The 'enable logging' tick box needs to be ticked. The file path and file name should be automatically set to *C:\logger* and *amr.* This will allow all data files captured to be stored on the C:\ where you created the 'logger' file previously. Select the tick box for 'Log every message received'.

4. Connect the stubby antenna to the Receiver by screwing together. The use of a whip antenna is an option at this point.
5. Connect your laptop to the survey kit using the Serial to USB converter.
6. Open the software and ensure the settings are correct, and switch on the survey kit.

7. At this point, it is a good idea to test the survey kit is functioning correctly. Activate the reed switch within the pulse transmitters, by slowly waving the magnet in a sideways motion just above where the cable enters the pulse transmitter. If it is quiet, you should hear the faint click of the reed switch.
8. In the software program, you should notice the transmitter number appear in the column labelled 'Tx No'. Next to that should be the signal strength (on a scale of 1-10, with 10 being the best signal), and the received time of the pulse. You should aim to get all transmitter Signal Levels '4' or above for reliable data transmission/reception.



9. Leaving the laptop where it is, take the Transmitter, magnet and RF scanner and go to each location where a transmitter is to be installed. Hold the magnet on the transmitter (on the same part as mentioned earlier). You should hear a 'Chirp' on the RF scanner every time the transmitter sends a pulse. Count 10 of these pulses and record the time.

10. Repeat at every location as required, and return to the laptop.

11. You will be able to view the data collected by selecting the file from C:/logger. This will be in an Excel file. You can check the results by cross referencing the time noted, against the time in the spread-sheet.

It is easier if there are 2 people helping with the survey. 1 person can stay with the laptop, whilst the other goes around to the survey points, at the same time keeping in contact via phone or other means.
If the transmitter location is unsuitable, consider the following:

- Use of repeaters
- Moving the transmitters
- Moving the hub
- Use of whip antenna (Internal or External)

PREVIOUSLY INSTALLED TRANSMITTERS

If transmitters have already been installed, and you wish to check that they are being detected, setup the equipment as described above, and wait for at least 20 minutes (dependant on transmitter pulse time – default is 15 minutes) for the transmitters to appear on the display.

Troubleshooting;

1. Cannot see an active Com port in the AMR Receiver screen.
    a. Ensure the USB/Serial adaptor Drivers are correctly installed.
    b. Check the port number of the USB/Serial converter is shown in DeviceManager. Re-number the port to a port number < 8 if necessary. Restart the PC

2. Cannot see any log data.
    a. Ensure the logging option is checked, and the box for the logging interval is also checked.
    b. Check that the folder C:\logger exists and that you have placed a file in that folder.

3. Cannot receive data from the transmitters.
    a. Swipe the transmitter with a magnet to force it to chirp.
    b. Check the battery is charged and the Survey Kit is turned on
    c. Check the fuse is present and intact
    d. Type the serial number of the transmitter in the TX. No field of the s/w.
    e. Within the AMR Receiver case, the 4 DIP switches should all be set to ‘OFF’, the GREEN and AMBER LEDs should be on, the RED LED should flash when a chirp is received. The ‘MODE’ jumper should be set to “RS232”

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