User Instructions for SENRx & GENII WMI

OVERVIEW

With every Radio Communications Device, the effective range depends on many factors. The location of the receiver and transmitter is of great importance. This document outlines factors that affect signal quality in order help select suitable locations for installing Innotech devices with wireless communications.

INFLUENCING FACTORS

- **TRANSMITTER STRENGTH & INTERFERENCE**
  SENRx modules have very low power transmitters designed for short range operation. Other radio devices such as: cordless phones, video transmitters, wireless PC networks and RF telemetry devices have much stronger signals and can interfere with the *SENRx* data.

- **LINE OF SIGHT**
  Radio waves prefer to have a direct line of sight. If the transmitter is visible from the receiver, reception is usually guaranteed. Outdoors, the range can be up to 100m.

- **REFLECTION & REFRACTION**
  Radio signals have the ability to penetrate certain materials as well as to reflect and refract off others with a penalty to signal strength. Radio signals will therefore bounce their way through a building by reflecting off walls, beams, furniture, people, windows etc. Too many signal reflections and penetrations will degrade performance.

  When installing a *SENRx* module on a wall, always check both sides of the wall. There may be power cables, bookshelves, mirrors, appliances, ducts, plumbing etc. on the other side which are strong signal attenuators and reflectors.
  When installing a *SENRx* module in an office cubicle environment, locate it above the cubicle walls and avoid passage areas. The human body is an effective shield to radio signals.

  DO NOT INSTALL THE *GENII WMI* INSIDE A FULLY ENCLOSED METAL SWITCHBOARD.

- **RADIATION PATTERN**
  The field of view of the transmitter or receiver is like a huge doughnut with a vertical antenna placed at the centre. The antenna is blind to signals coming from the top or bottom, but sensitive to the sides.

  Where possible, install the *GENII WMI* at the same level or higher than the *SENRx* modules. Preferably, install the *GENII WMI* in a ceiling space centred between all the *SENRx* modules. This takes advantage of the doughnut-like field of view of the receiver and effectively doubles the range.

- **Water**
  Water is a perfect shield to 2.4GHz radio signals. High humidity (>70%) will attenuate a signal dramatically. External glass windows can be very absorbing when wet. Rain will attenuate a signal slightly.

RANGE ESTIMATION

REFLECTIONS

In a noisy environment, or when several people try talking to one simultaneously, it can be very difficult to concentrate on one voice only. Even listening to fast recurring echoes can be almost impossible. For radio receivers it is no different. Each receiver prefers to 'hear' only one call at a time, so if there are many echoes, the receiver may become confused.

For radio signals, echoes are much easier produced than for voice. All obstacles will create one or multiple echoes, especially large faces such as walls and beams.

To help identify potential problems regarding reflections, follow the steps below:

1. Establish the likely path that the radio signals will take to reach the receiver.
2. Identify the proximity and material of large obstacles.
3. Choose a matching reflection factor from Table 1 for each material type.
4. On a scale of 1 to 10, the Reflection Factor (R) indicates the likelihood of reflections produced by this material (1=none, 10=lots and strong reflections).
5. The closer the obstacle, the worse the reflection.
   · 10m will have negligible effect
   · 5m will produce some effect
   · 2m will reduce range by 50% for R>4.

ATTENUATION

As described previously, radio signals can penetrate materials. Each time a signal passes through a material its strength is reduced. The following procedure will provide an estimate of the effective signal range through materials within a building:

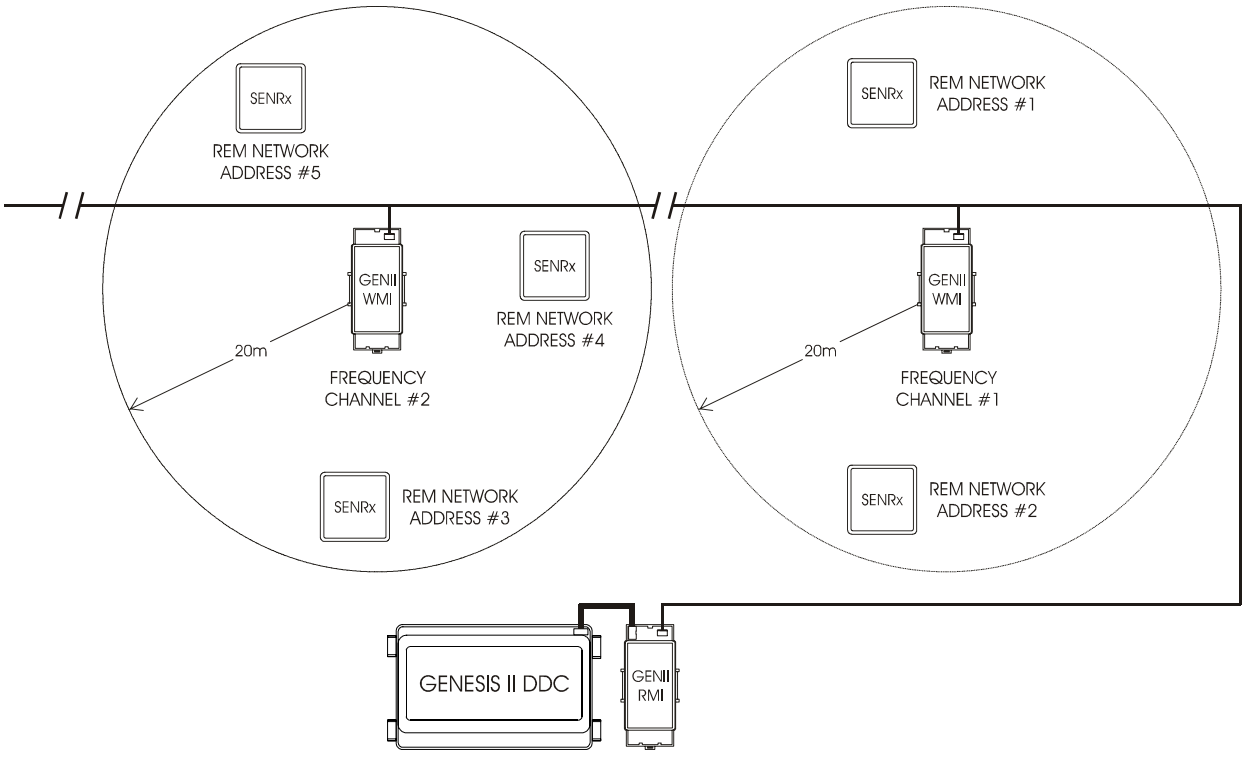
1. Establish the likely path that the radio signals will take to reach the receiver.
2. Identify the number and type of individual materials along the path.
3. Choose a matching attenuation factor from Table 1 for each material type.
4. Calculate the range per path using the following formula:

   Range [m] = 35 / (N1xA1 + N2xA2 + N3xA3 ...)
   where:
   N = Number of walls per material
   A = Attenuation Factor per material

Material	Reflection Factor [R]	Attenuation Factor [A]
Air @ 50% R. Humidity	1	1
Red Brick	3	1.67
Carpet	2	1.1
Glass	3	1.1
Fire Glass	3	1.1
Gyprok	3	1.2
Particle Board	9	1.2
Plywood	2	1.3
Concrete Bricks	9	5.3
Diamond Mesh	9	11
Tiles	8	1.3
Ceiling Tiles	4	1.1
Hollow Concrete Blocks	8	5.6
Steel	10	10

Table 1: Reflection & Attenuation Factors for Common Building Materials

NETWORK EXAMPLE WITH MULTIPLE REMOTE SENSORS & INTERFACE MODULES



GENII WMI INSTALLATION

- The Cable run between the *GENII WMI* and the GENII RMI should not exceed 500 metres. The Comms wiring requires cable especially suited for RS485. Other shielded cable is not suitable and may cause spasmodic Comms failures.

- The *GENII WMI* should be mounted within a 20m radius (depending on obstructions) of all *SENRx* modules from which it will be receiving data. The location should be dry, clean and free of excess vibration.

- **DO NOT INSTALL THE *GENII WMI* INSIDE A FULLY ENCLOSED METAL SWITCHBOARD.**

- Strictly follow the guidelines when installing the Comms wiring as outlined in the Genesis System Network Installation Instructions.

- There are four jumpers located in a row on the *GENII WMI,* labelled F0, F1, F2 & F3. These select the frequency channel to use within the 2.4-2.5GHz range. Typically, these jumpers need only be changed if multiple Wireless Module Interfaces are used or in areas with poor reception or strong interference.

  The frequency jumpers on the *GENII WMI* must exactly match the frequency jumpers on any *SENRx* modules to be communicated with.

- The "RF-RX" LED next to the antenna will turn on whenever an RF data packet is received. This can be used to detect if a *SENRx* module is within range.

***Note:**
If any jumpers on a module need to be changed, the unit must be powered down before the jumpers are altered. Anti-static precautions should be taken when changing addresses or adding or removing cabling from the terminals.

WIRING

- DO NOT connect 240V AC to any terminals.

- The cable used for RS485 Comms must be shielded single twisted pair, 120 ohms character impedance, 36 to 45pF per metre capacitance between conductors.

- The Comms cable must be organised as a bus topology. That is, starting at one end; devices are connected to it until the other end of the cable is reached. No "stubs" are allowed.

  To connect a device to the cable, a cut is made in the cable at the point where the device is to be situated along it. Then, the two new ends of the cable are wired into the device.

  The shields from the two new ends are then terminated into the terminals marked SHLD1 and SHLD2 respectively.

  Refer to the Genesis System Network Installation Instructions for more information.

SENRx INSTALLATION

- *SENRx* modules should be mounted within a 20m radius (depending on obstructions) of the *GENII WMI* Wireless Interface Module in a dry and clean location free of excess vibration.

- To remove the battery from a *SENRx* module, simply insert a flat screwdriver underneath the battery between the two clips and lever the battery out. When re-inserting, note the correct polarity as marked on the PCB.

- There are two sets of four jumpers located on the back of the *SENRx* module*. The set of jumpers closest to the battery are labeled A0, A1, A2 & A3.

  These set the network address of the *SENRx* module in the same manner as *GENII REM* products.

  Directions for setting the address are shown in the wiring diagram generated by the GEN2Config software. The jumpers located on the far right of the *SENRx* module are labeled F0, F1, F2 & F3.

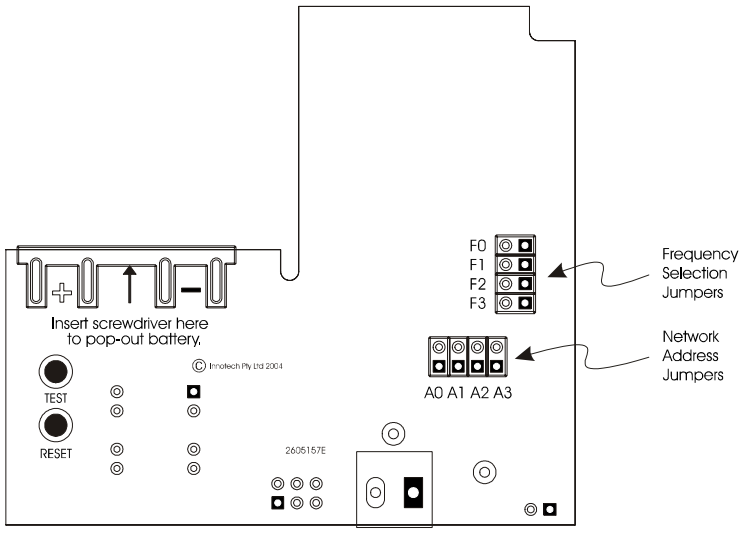
  These select the frequency channel to use within the 2.4-2.5GHz range. Typically, these jumpers need only be changed if multiple Wireless Module Interfaces are used or in areas with poor reception or strong interference. The frequency jumpers on the *SENRx* module must exactly match the frequency jumpers on the *GENII WMI* module to be communicated with.

- Also located on the back of the *SENRx* module are the "TEST" and "RESET" buttons. These can be used during installation to help select suitable locations for the modules.

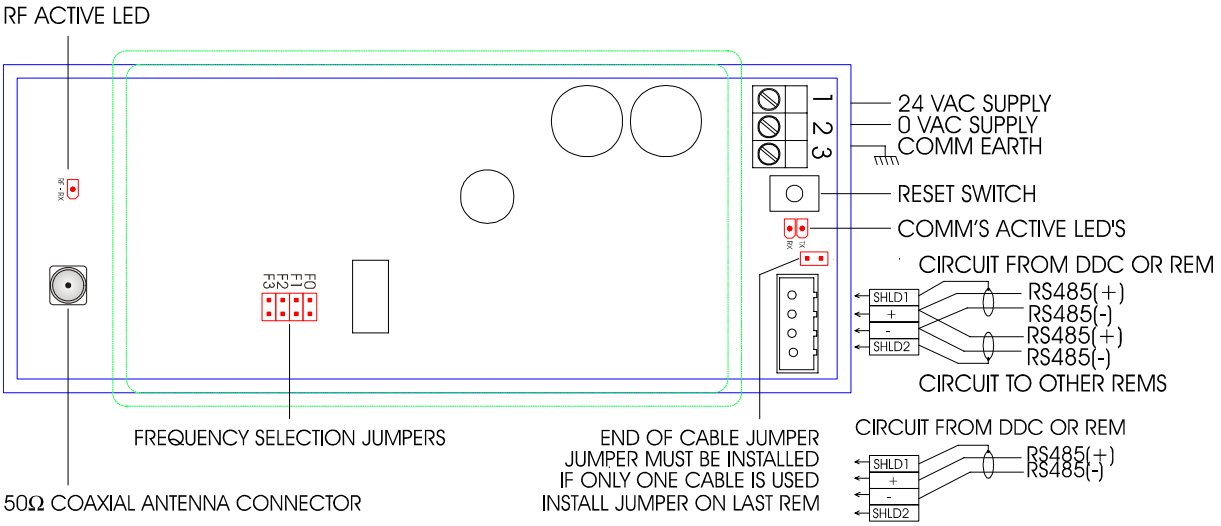
  Holding the "TEST" button and pushing "RESET" will cause the device to enter "Transmit Test Mode". In this mode, the *SENRx* module will transmit data every second for the next 3 minutes (and afterwards return to normal operation).

  The *GENII WMI* will indicate if the *SENRx* module is within range by flashing its "RF-RX" LED at 1second intervals when data is received. Intermittent or no RF-RX LED activity at the *GENII WMI* shows poor reception.

JUMPER LOCATIONS & STANDARD CONNECTIONS



SENRx Wireless Temperature Sensor



GENII WMI Wireless Module Interface

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