

ICT International – Wireless Site Survey Manual



June 2017



Components

The standard Survey Kit contains:

2x MCC Mini Radio Communications Device

2x 5m lightweight telescopic mast with mounting stakes

2x 5m cable

1x USB Power Bank and cable, suitable for 2 days of continuous use.

Note: The electronic components of the Survey Kit are not waterproof, and should not be used in the rain.

Setup and Surveying

Fasten the flat panel antenna to the 3rd smallest section of the telescopic mast (3rd from the top when fully extended – 5 meters), connect the RF cable to the antenna and an MCC Mini.

The USB Power Bank should be connected to one MCC Mini, and a laptop or tablet to the other MCC Mini for taking measurements.

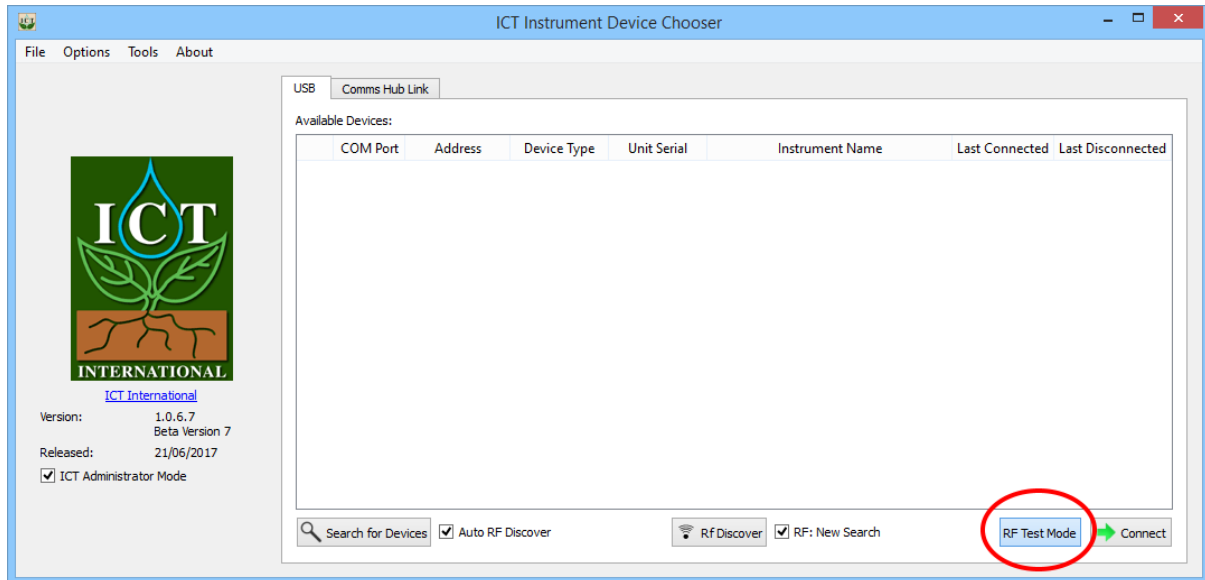
If testing without assistance, drive the installation stake in at the remote test location (ie: the one with the USB Power Bank), mount and secure the mast with the flat panel antenna pointing toward the other test location.

Take the other mast to the other test location, and install it with the flat panel antenna pointing to the remote test location. Connect the MCC Mini to the laptop/tablet, open ICT Combined Instrument Software. Scan for devices – the USB connected MCC Mini should be discovered, followed by the remote MCC Mini.



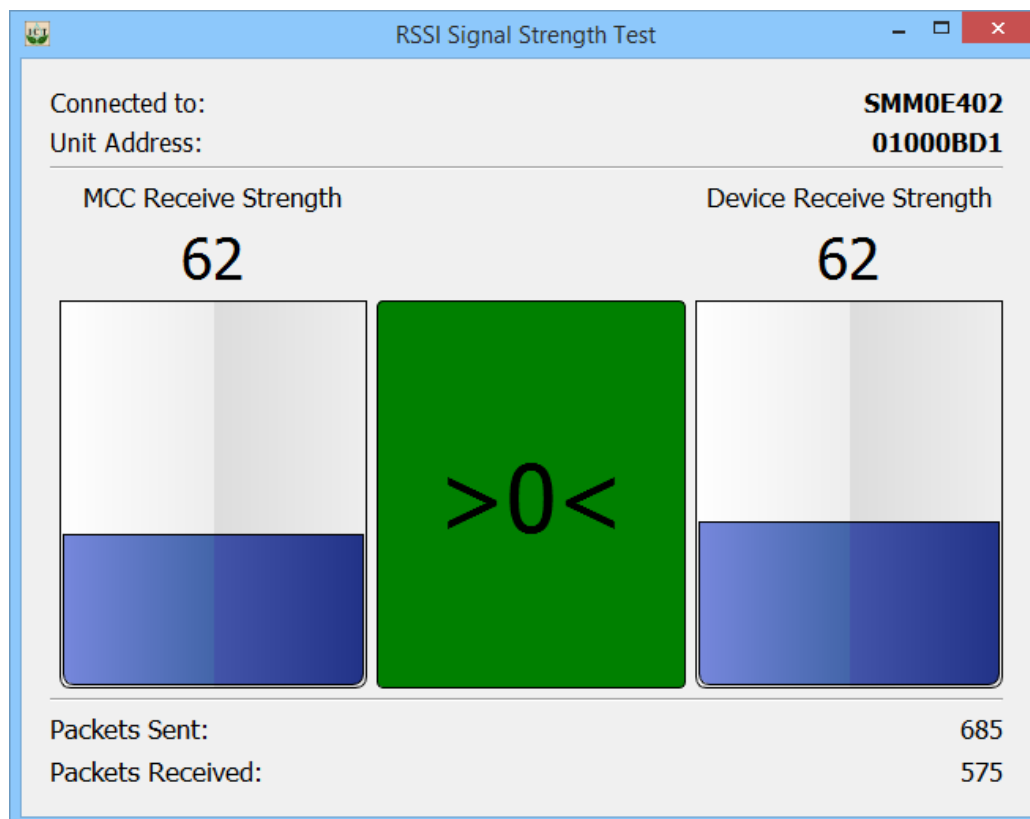
Surveying

Select RF Test Mode and connect to the other MCC Mini.



After a short delay, the RSSI Signal Strength Test window will be displayed. Once the Receive Strength numbers have stabilised, record the MCC Receive Strength, the difference, and the Device Receive Strength.

The difference should be no more than 10, and the strength should be less than 80 (a smaller number indicates a stronger signal).





As an example, 560 meters with line of sight impeded totally by trees, signal strength was 60, >1, 61. (5m mast, 14dB flat panel antenna)

Appendices

Theoretical Calculations:

Depending on the distance between transmitter and receiver and the frequency being transmitted, the transmission path can be considered to be equivalent to that of free space, (ie unaffected by the physical environment), if all obstacles, including the surface of the earth, are outside a cigar shaped envelope with the minimum radius at the midpoint being the First Fresnel Radius. If this radius is impeded by the smooth shape of the earth, (eg a gentle hill), such that the line between the antennas was tangent to the crest of the hill, the signal path attenuation caused by the hill could be as much as 60dB. If the obstruction was a relatively discrete object such as a line of trees or a wall, the attenuation could be as little as about 15dB.

The table below shows the radio signal attenuation in free space for a range of distances. This is equivalent to the results for an ideal unimpeded communications path on site.

Distance (m)	Frequency (GHz)	First Fresnel Zone Radius (m)	Free Space Attenuation (dB)
100	2.4	1.8m	80
200	2.4	2.5m	86
300	2.4	3.1m	89.5
400	2.4	3.5m	92
500	2.4	4m	94
600	2.4	4.3m	95.6
700	2.4	4.7m	96.9
800	2.4	5m	98
900	2.4	5.3m	99.1
1000	2.4	5.6m	100
2000	2.4	7.9m	106
3000	2.4	9.7m	109.5
4000	2.4	11.2m	112
5000	2.4	12.5m	114

$$Si = Pt + Gt - Ct + Sr + Gr - Cr - Lfs - PI$$

Si = Signal level margin above the noise floor at the receiver (dB)

Pt = Transmitter power (dBm) (= 20dBm approx.)

Gt = Transmitter antenna gain (dB) (=14dB for Survey Kit Antenna)

Ct = Transmitter antenna coax cable loss (dB) (= 0.66dB approx. for 3m cable)

Sr = Receiver sensitivity (dBm) (= -85dBm approx. Note that 85 is added rather than subtracted)

Gr = Receiver antenna gain (Gr) (=14dB for Survey Kit Antenna)

Cr = Receiver antenna coax cable loss (dB) (= 0.66dB approx. for 3m cable)

Lfs = Free space signal attenuation. (dB) (= 100dB for 1000m for example)

PI = Path losses due to site conditions. (dB) (Between 0dB and 60dB depending on hills and obstructions in communication path)

For a good radio link, the result should be greater than 20dB.

Note: The standard Survey Kit uses light-weight 14dB antennae. Standard flat panel antennae supplied by ICT International are 19dB.