

REPEATER INSTALLATION USING

THE TEST TOOL

(STEP-BY-STEP GUIDE)

Chapters

TestTool Modes

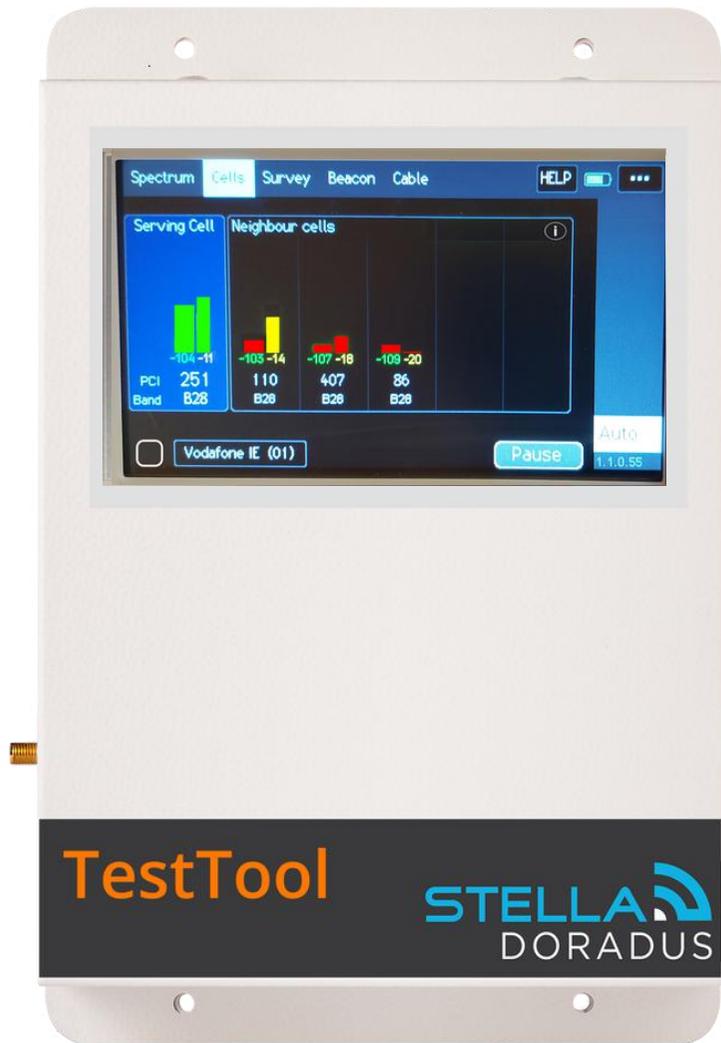
Step #1 Indoor Survey

Step #2 Outdoor Survey

Step #3 Power mode

Examples

TestTool



- Spectrum Mode
- Cells Mode
- Power Mode

Make sure you have the latest
firmware on your TestTool
V1.1.0.56

Spectrum Mode

The screenshot shows a spectrum analyzer interface with the following elements and annotations:

- Spectrum mode:** Points to the 'Spectrum' tab in the top navigation bar.
- Signal Power in dBm:** Points to the vertical axis on the left, ranging from -20 to -80 dBm.
- Menu:** Points to the three-dot menu icon in the top right corner.
- Choose a specific band:** Points to the list of bands on the right: B28 (700), B20 (800), B8 (900), B3 (1800), and B1 (2100). B20 is highlighted in green.
- If the incoming signal is too strong, increase external attenuation here:** Points to the '-' and '+' buttons at the bottom left.
- Choose Normal view or Peak Hold:** Points to the 'Normal' button at the bottom center.

The main display area shows a spectrum plot with a white signal trace. The plot is divided into three frequency bands: 'Three IE' (791 MHz to ~795 MHz), 'Eir' (~795 MHz to ~815 MHz), and 'Vodafone IE' (~815 MHz to 821 MHz). The plot area has a grid background with color-coded regions: blue for Three IE, purple for Eir, and red for Vodafone IE.

Cells Mode

Serving Cell = Dominant Tower

Quality

-5 to -13 = Good

Power

-70 to -105 = Average

PCI

Physical Cell ID

Choose operator

Menu

Auto: Let the modem choose its preferred bands

Peak Hold



RF BASICS



Serving Cell

The mobile operator instructs your phone to connect to a specific tower. This is the 'Serving Cell' tower. The Serving Cell is the strongest cell tower in the area.

When the outdoor antenna points at the serving cell, the performance of the repeater system is maximized.

Natural Signal 1

The *natural* signal inside a building is the mobile signal that exists inside a building when no repeater is installed. This signal will probably be very poor (or non existant) as this is exactly what the customers complain about.

Natural Signal 2

If the *natural* signal is weak inside the building, we can ignore it. The amplified signal from the repeater will overcome this natural signal.

If the natural signal is strong, it makes the installation a little bit more difficult. We must ensure that the outdoor Yagi points at the same tower that is producing this natural signal.

We will discuss how to do this in further slides.

STEP 1

Indoor test

Understand the natural signal

Indoor Test

Go to the room in the building where the customer requires signal the most. (Example: The bosses office)

Connect the omni antenna to the TestTool.

You will use Spectrum mode and Cells mode to understand the natural signal in this location.

Indoor Test

Case A - Weak or no signal inside building.

In highly insulated buildings you may see little to no signal on any band. This makes the installation easier. Simply go to the roof, find the direction of the strongest tower, and point the antenna there.

Skip to STEP 2 - Outdoor test.

Indoor Test

Case B - Strong natural signal inside building.

However, in other buildings, that are not so well insulated, expect to see some signal, especially at the lower 2 bands (B28,B20). The rule here is that you must find the location of these towers up on the roof and point the Yagi antenna towards them.

This way, the repeater system is not *competing* against this strong natural signal, but instead, complimenting it.

Example 1



In the example above, we can see several cells (1 serving cells and 5 neighbours). Cells with power less than -105dBm can be ignored as they are too weak and will probably not be able to compete with the repeater.

However we must take note of the serving cell which has a power of -102dBm.

Go to **Cells Mode**.

Make sure AUTO is selected.

In Auto mode, the TestTool will automatically choose the best cell from ANY band. It may take up to 20 seconds for it to rest on a particular serving cell.

Take note of the PCI and Band of the Serving Cell.

Example:

PCI =14

Band = B20

Note: Operators allways try to push users onto the highest available band. In the example above, the highest available band is B20(800MHz).

Example 2



Serving Cell:

PCI = 323

Band = B3

In the example above, 323 (B3) is strong enough to become the serving cell. Notice there are also 2 neighbours (263 and 495). These 3 cells are of similar power, and all on B3. We can choose from any of these cells on the roof. This allows us some more freedom on the roof in choosing a direction.

Whatever band the serving cell is, you can be assured that all bands lower than this band will also be available. Example: if the serving cell is B3, then B28, B20 and B8 will also exist and will probably be very strong too.

STEP 2

Outdoor test

Locate the dominant cell tower outside.

Roof Signal Test

Now that the indoor survey is complete, and the serving cell is known for each operator, the direction of these towers must be determined *outside* the building.

Go to the roof with the TestTool and connect a directional antenna, ie a Yagi

Roof Signal Test



Rotate the Yagi antenna slowly through 360 degrees, and note the different Cells that become the Serving cell.

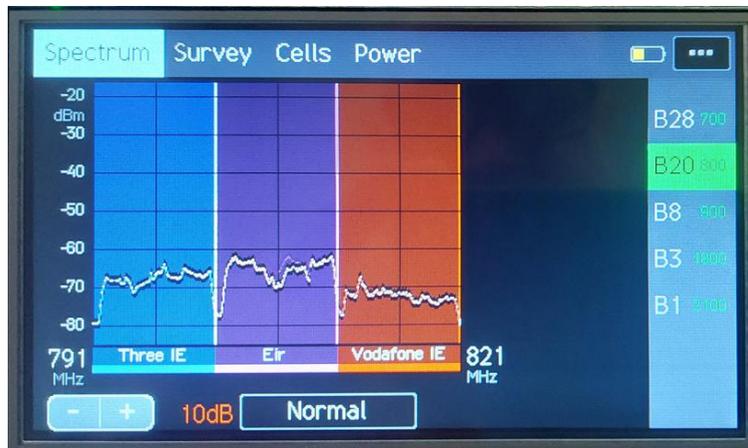
Note when Cell 14 appears in the dominant position.

Fine tune it until the Power and Quality for cell 14 is at a maximum. The antenna is now in an optimal direction for this operator.

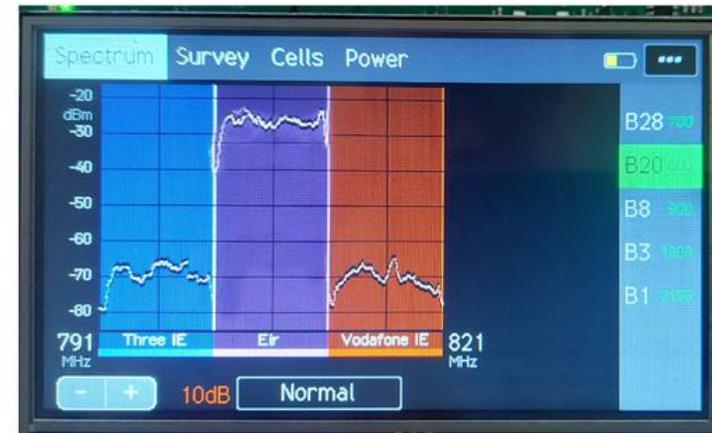
Roof Signal Test

Do this test for all required operators. If the operators are all on the same tower it is easy. However, in practice you will probably find that the serving cell of one or maybe two operators is in another direction. You will have to make a judicious choice in this case where to point the antenna. Always make sure the signal is "balanced" for all required operators. Use Spectrum mode to ensure all operators are "balanced"

Balance the Operators



Above: as there is only a 10dB difference between the operators, this can be considered "balanced."



Above: Here, the Eir operator (purple) is much more than 10dB stronger than the other 2. This is considered unbalanced. This means there is a nearby Eir tower. You will need to shield the outdoor Yagi from this strong tower.

STEP 3

Record Outdoor Signal



Record Outdoor Signal

The Yagi should be connected to the TestTool and pointed at the Serving Cell on the roof.

On the TestTool, go to Power Mode.

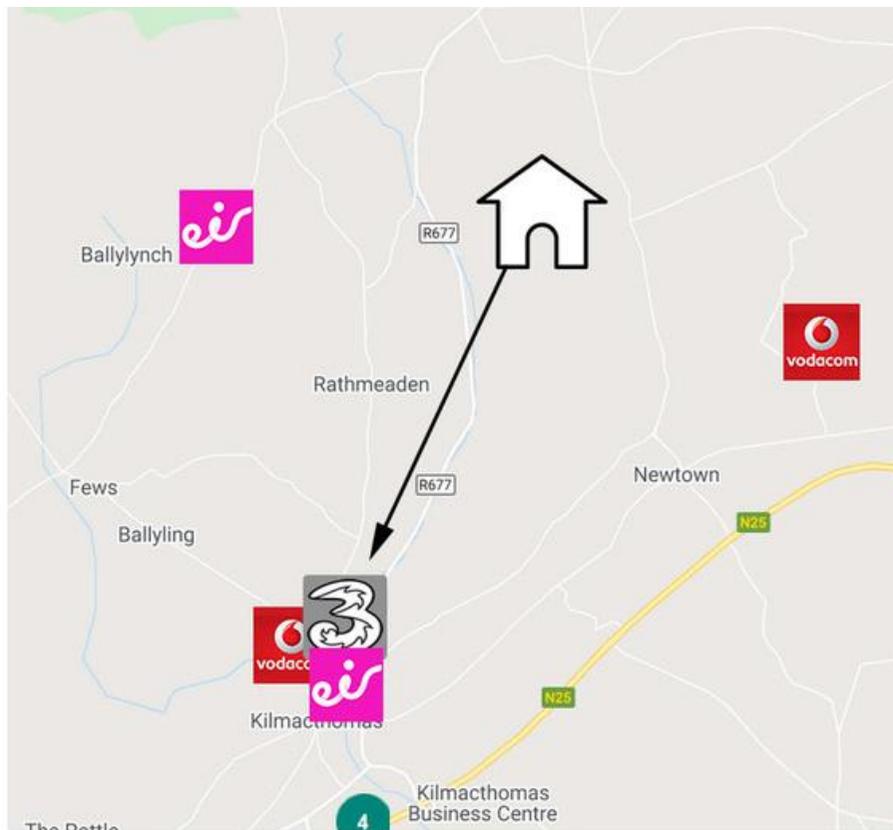
Click "Measure"

Wait 60 seconds, and then record the 6 values in your notebook. These values can be used later on in the StellaPlanner to help you design the installation more accurately.

EXAMPLES



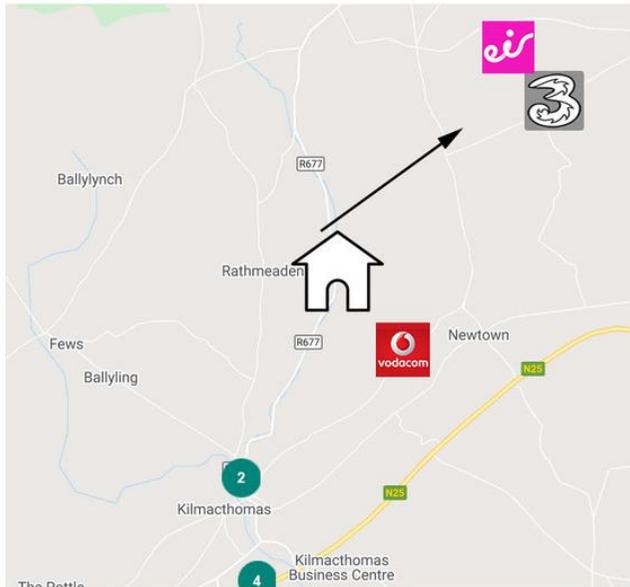
Operators Sharing Tower



When the dominant tower has 2 or 3 operators on it, no decision is necessary.

Simply point the antenna at this tower to successfully optimize all 3 operators (Image: Eir, Vodafone and Three).

Operators Who Don't Share Towers



Occasionally, there might be 2 operators on one tower (Eir and Three), and a third operator on a different tower (Vodafone).

Assuming all three operators are required, the outdoor antenna will have to be positioned such as to “balance” the signal for all 3 operators. This precise direction can be determined with the TestTool in **Spectrum mode**.

Links

France: www.cartoradio.fr

Spain: www.antenasmoviles.es

Italy: <https://lteitaly.it>

Ireland: <https://siteviewer.comreg.ie/>

THANK YOU!



STELLA 
DORADUS