

# SPLAT RF Signal Propagation, Loss And Terrain analysis tool

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I have been interested in propagation but have found very little in the way of tools for the higher bands from 50Mhz upward. I discovered SPLAT after reading an article on VHF/UHF propagation in the QRP quarterly magazine. The author suggested this propagation application is useful for generating accurate plots since the earth is not smooth. I operate QRP and in my QTH in Farningham I have poor for line of sight for radio operating on the higher bands. The SPLAT application promised to provide some useful information and has proved helpful in locating good mobile operating locations.

SPLAT stands for **S**ignal **P**ropagation, **L**oss **A**nd **T**errain and is an analysis tool written by John A. Magliacane KD2BD. This software is used for frequencies between 20 MHz and 20 GHz. This software is based on the Longley-Rice Irregular Terrain Model. SPLAT is supplied as a compiled program for Unix, Linux and Windows but can also be compiled from source code. The source is GNU General Public License version 2 and is published by the Free Software Foundation.

I am not going to explain in detail how to install this software on a PC or workstation, this is not too complex but this would take up a lot of space. This article explains some of the setup files required how I have put this software to use with a couple of example plots. You can download SPLAT from KD2DB's web page, at [www.gsl.net/kd2bd/splat.html](http://www.gsl.net/kd2bd/splat.html). SPLAT produces reports, graphs and high resolution maps that show the line of sight and Longley-Rice coverage analyses for single and multiple transmitters. Longley-Rice plots take into account the terrain of the area and the fact that the earth is not flat.

SPLAT is a command-line program, and to run it you type "splat" followed by a number of command-line options. Before running this application you will require digital elevation model (DEM) data, this is freely available from the website [http://dds.cr.usgs.gov/srtm/version2\\_1/SRTM3/](http://dds.cr.usgs.gov/srtm/version2_1/SRTM3/). The DEM data has been produced from the Space Shuttle STS-99 Radar Topography Mission and covers most of the populated parts of Earth. The DEM files are given a file name based upon the location of that square on the earth, e.g. N051E001.htg. This example DEM file contains elevation data between 51 degrees north and 52 degrees north and 1 degree east to 2 degrees east.

The DEM files need to be converted to SDF format using the srtm2sdf utility which comes with the SPLAT application download. SPLAT runs from prepared configuration files used to store various settings that are used by the application. The "QTH" files are used to store station location data and Longley-Rice parameters are stored in an ".LRP" (Longley-Rice parameters) file.

An example of a QTH file is below and contains a station name, latitude, longitude (East of 0, are negative) and height above sea level in meters, m indicates meters otherwise if no units are specified the application assumes the unit are in feet.

```
M0UAT
51.222
-0.22
30m
```

Longley-Rice parameter data files are required for SPLAT to determine RF path loss, field strength, or received signal power level in either point-to-point or area prediction mode. Longley-Rice model parameter data is read from files having the same base name as the transmitter site QTH file, but with a LRP extension.

SPLAT Longley-Rice (LRP) file example:

```
15.000 ; Earth Dielectric Constant for Average ground (Relative
permittivity)
0.005 ; Earth Conductivity (Siemens per meter)
301.000 ; Atmospheric Bending Constant (N-units)
144.000 ; Frequency in MHz (20 MHz to 20 GHz)
6 ;Radio Climate (6 = Maritime Temperate)
0 ;Polarization (0 = Horizontal, 1 = Vertical)
0.50 ; Fraction of situations (50% of locations)
0.50 ; Fraction of time (50% of the time)
30.0 ; ERP in Watts (optional)
```

It is also useful to setup a cities file that will be used to place towns or points of interest on the final map image. The exact location for towns can be found using Google maps, but make sure that any locations east of the Greenwich meridian line are stored as negative values. I found this out when I had Maidstone located at Reigate and Gravesend in West London. Example data in cities.dat file contains City/Town name, latitude and longitude. Example : Tonbridge, 51.919, -0.3 and Dartford, 51.3, -0.4

So here is an example command line as used to generate the plot below:

```
splat -t m0uat.qth -L 20 -s cities.dat -o map.ppm -metric
```

The above command will generate a Longley-Rice plot (Figure 1) for my QTH in Farningham using my cities.dat and assuming the receiving antenna height of 20 meters, and outputting to a map.ppm file. The above example LRP will be used and the area prediction map is shown below.

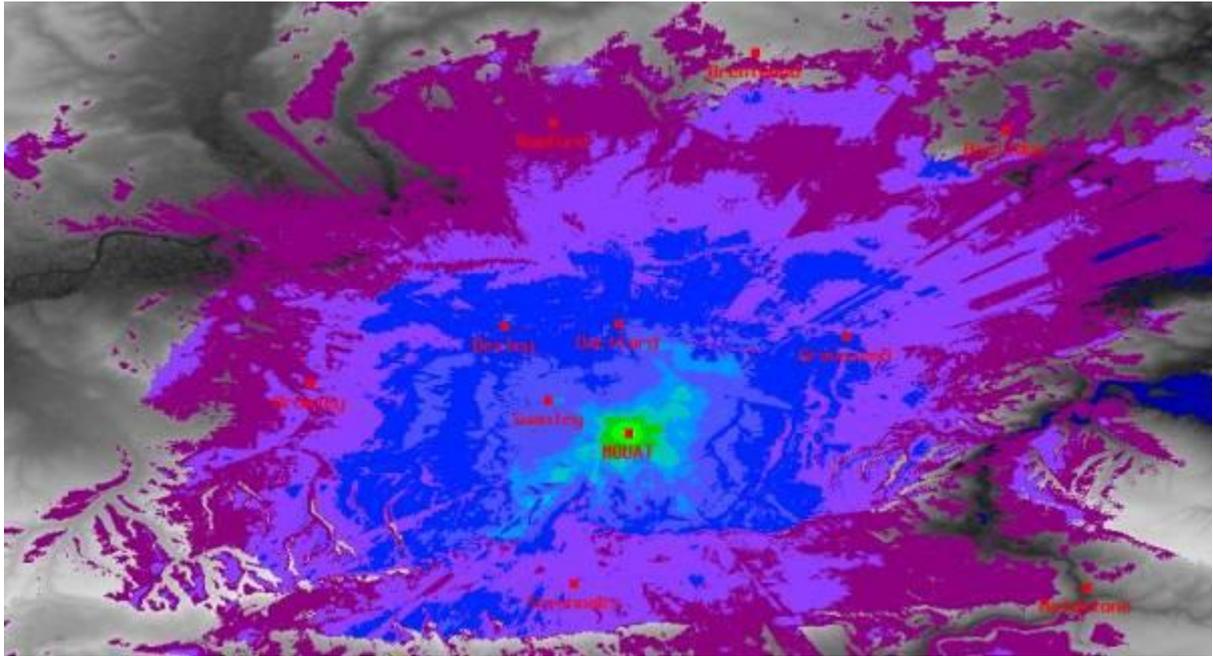


Figure 1. Longley-Rice Coverage for location M0UAT Farningham, KENT JO01CJ

The output map is in a format called portable pixmap format (PPM), Linux graphic viewers will display this format and many can convert it to Portable Network Graphics (PNG) for display on websites. In the above SPLAT plot it shows signal strength in dBµV/m, as I have specified in the LRP file my effective radiated power (ERP) in watts. If effective radiated power (ERP) is not specified the plot will show path loss. The lighter or brighter colours indicate greater values to the darker ones, rather like the rainfall on weather maps.

As you can see from the map my QTH has poor coverage in most directions except towards the North and North West. So to locate a much improved site for mobile operation I have tried the Longley-Rice plot for the Wrotham Hill site and the map below shows the coverage is much improved. Command line use for this plot

**splat -t wrotham.qth -L 10 -metric -db 28 -s cities.dat -o wrotham.ppm**

