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## My QTH is many km wrong in the WSPR map – how to fix it!

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### 1. Introduction

This is a question which arises quite frequently. A newcomer to WSPR constructs an Ultimate3S perfectly, configures it correctly, and operates it faultlessly. However when he looks at the WSPRnet map, he is concerned to note that the map places his station very inaccurately. Sometimes a hundred km away from his actual QTH.

Looking at the WSPRnet database query results, you can see that your location is shown as a 4-character grid-square. But many other stations are shown with 6-character grid sub-squares! Perhaps you know other people active on WSPR – and their location is much more accurate on the map – and you notice that they are shown with 6-character Locators!

What is wrong? What causes this? And how can we fix it?

### 2. The cause of the incorrect location on the map

The cause is quite straightforward. There is nothing wrong with your Ultimate3S kit! It is simply a limitation of the WSPR protocol. WSPR transmits only 50 bits of information. These are packed with a lossless compression, then encoded with forward error correction into 162 symbols of 4 frequency tones. The 50 bits of information contain only three limited items of information:

- Your callsign
- Your 4-character Maidenhead Locator
- Your power level in dBm

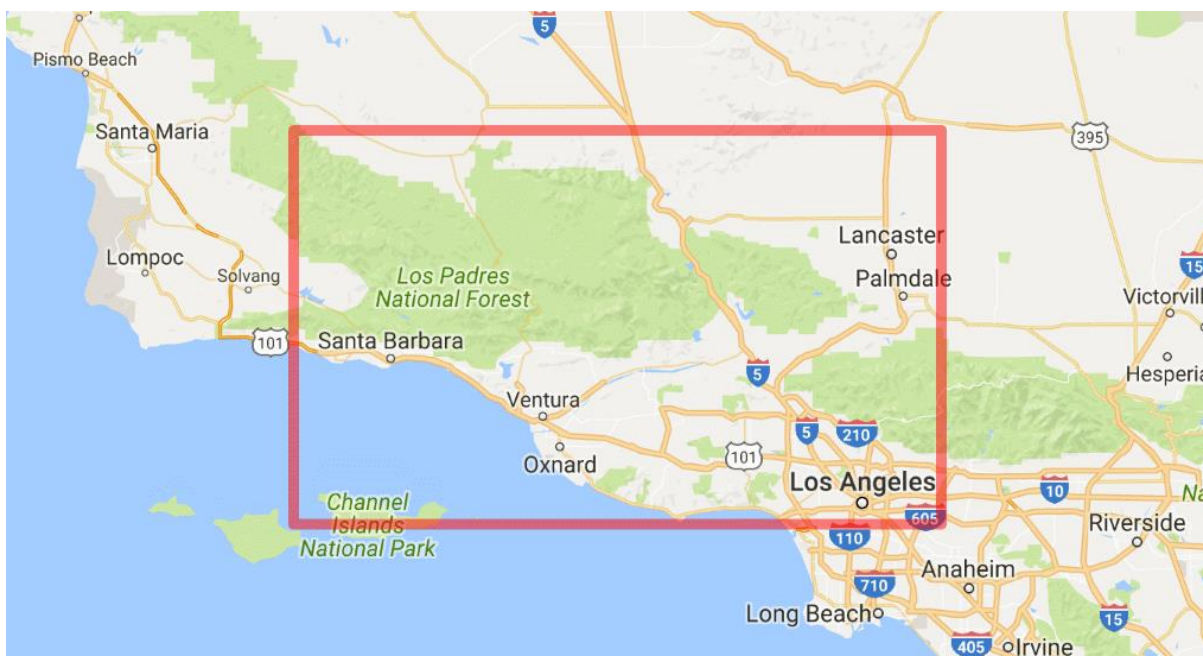
The key to this puzzle is simply the 4-character Maidenhead Locator. A 4-character locator defines a “grid square”, which measures 1 degree of latitude by 2 degrees of longitude. The area of a grid square depends on its latitude but for most of will be something like 110 x 160km (70 x 100 miles). The only information WSPRnet has about your location is this 4-character Locator and so it cannot plot your position on the map more accurately than this.

A “grid subsquare” is defined by 6 characters and will have an area of something like 5 x 6km (3 x 4 miles) approximately. That would define your position much more accurately than the 4-character “grid square”. But the WSPR protocol transmitted by your Ultimate3S does not send the 6-character Locator, because it would not be possible to fit this additional information into the 50 bits of a WSPR message.

As an example, let us say you live in Beverly Hills, California, US. Your locator in the commonly used 6-character format is DM04TB. You have entered this into your Ultimate3S (or connected the QRP

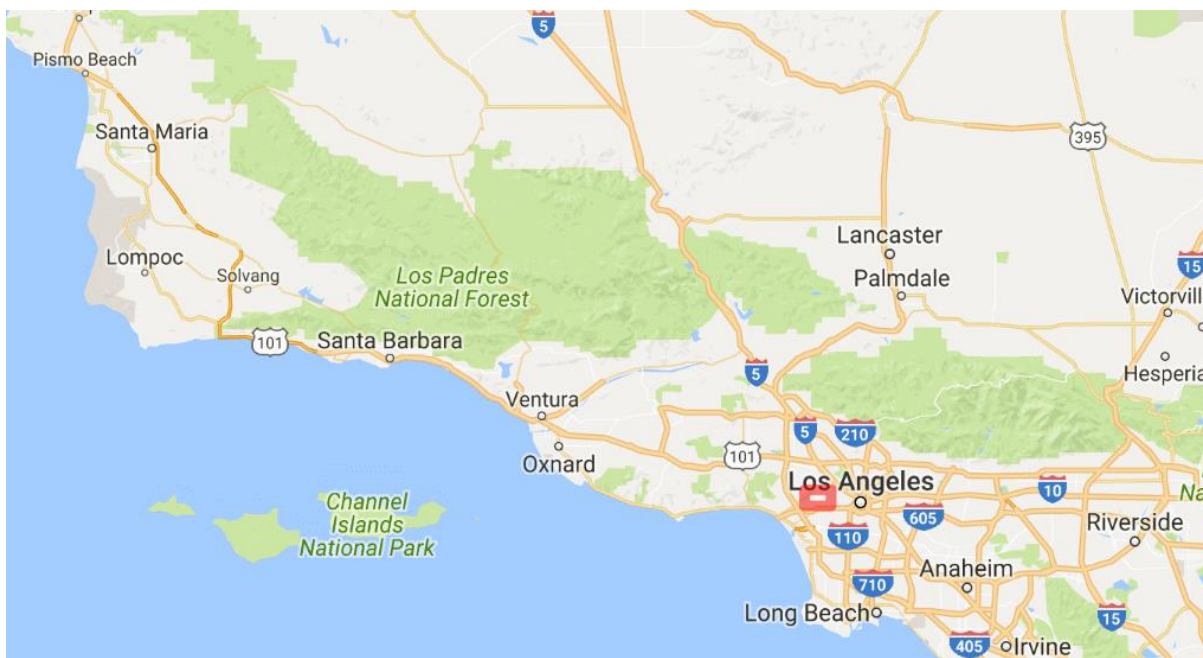
Labs QLG1 GPS receiver kit, in which case the Locator will be calculated using the latitude and longitude from the GPS).

First, look at this map showing the extent of the grid-square DM04.



This is all that WSPR knows of your location. So it is not surprising that your station plotted on the map may be a long way from Beverley Hills.

Now look at the same map, but with the red rectangle indicating the sub-square DM04TB.



That's a lot better! Much closer to your actual location! Of course, if you zoom in a lot, you won't necessarily be in the right street. But it's close enough!

### 3. Getting your 6-character Locator into WSPRnet

How do all those people get their 6-character Locator into the WSPRnet database, if the WSPR protocol is sending only the 4-character Locator? The answer is a quirk (if I may call it that) of the way WSPRnet behaves.

#### **a) Receiving WSPR**

When you receive WSPR transmissions and decode them using one of the available programs such as “WSPR”, one of the configuration parameters in the software is your Maidenhead Locator. When you configure your 6-character Maidenhead Locator here, it is sent to WSPRnet when your decoded WSPR spots are uploaded to the WSPRnet server. WSPRnet then associates that 6-character Locator with your callsign. For the rest of eternity, every time a 4-character Locator is received and uploaded for your callsign, if those 4 characters match the ones WSPRnet has for your callsign, then WSPRnet automatically adds the 5<sup>th</sup> and 6<sup>th</sup> characters to define the complete 6-character grid subsquare.

The other stations that are reported in the database with 6-character locators are simply people who have received WSPR (and uploaded spots) as well as transmitted WSPR.

Therefore the first way to remedy the situation is to just receive some WSPR, having configured your WSPR decoding program with your 6-character Locator, and upload the spots.

#### **b) WSPR’s “Extended” mode**

WSPR also has an “extended” mode. In this mode, WSPR sends a secondary 2-minute WSPR transmission containing additional information. You are able to transmit your 6-character Maidenhead Locator, or a compound callsign with pre- or suffixes.

The extended mode uses a 15-bit hash table to encode your callsign and associate the two messages together. The receiving station must receive both pieces of the message. The 15 bits can represent a maximum of 32,768 combinations and there is not a one-to-one mapping between callsigns and hash codes. Multiple stations could have the same hash code. Therefore there is a possibility of collision.

The Ultimate3S kit is capable of sending the extended mode WSPR. But I do not recommend using it, unless you have a particular reason for doing so – for example, if you wish to use WSPR to track a mobile station to more accuracy, or if you need to use a callsign pre- or suffix.

#### **c) The 3<sup>rd</sup> method – getting your 6-character Locator into WSPRnet without receiving!**

Finally, here is a trick which you can use to force WSPRnet to store your 6-character Locator, without sending the questionable extended mode, and without doing any WSPR reception. To do this, you manually upload a dummy spot file.

When someone receives WSPR, in the computer’s WSPR program directory there is a file called “ALL\_WSPR.txt” which contains a list of spots. All you need to do is create a dummy file in the correct format, and manually upload it. WSPRnet will then record the 6-character Locator and associate it to your callsign.



The file format contents are in the following format:

161116 0846 9 -23 -0.4 14.097158 GOUPL IO90 23 0 1 0

Note the callsign “GOUPL” and the 4-character Locator “IO90”. “23” is the transmitter power in dBm (200mW in this example). The first field is the date in YYYYMMDD format, followed by time.

I do not know if it is necessary for this file to contain any spots. The method which I have used which works, is to edit the file to contain a single line. Set the date field to today’s date, and the time to something reasonable and recent. Enter your correct callsign, and your correct 4-character Locator.

The reason for entering a spot with of your own callsign is that when you upload this file, WSPRnet will recognise that you have uploaded a spot of yourself and it will just ignore this row. No entry will be made in the database. But magically, your 6-character Locator will be stored!

A template for this file can be downloaded from this QRP Labs URL: [http://qrp-labs.com/images/appnotes/AN002\\_WSPR.txt](http://qrp-labs.com/images/appnotes/AN002_WSPR.txt)

Now visit the following page at WSPRnet using your browser: <http://wsprrnet.org/olddb> - this is the “old” WSPR database interface. The page looks like this:

The area of the page at the top right is where you can manually upload your dummy WSPR spots file. Fill in the callsign entry box, and the “Your grid” box with your 6-character Locator. Be sure to use the whole 6-character Locator! Click the “Choose File” button on the next line and select the dummy file which you have edited (see above description). Click the checkbox “Show verbose parser output” just in case there are any errors and this helps to describe them better. Then finally click the “Upload spots” button.



This is all it takes to get your 6-character Maidenhead Locator into WSPRnet and have the map properly locate you to reasonable accuracy. Any new WSPR spots from your Ultimate3S transmitter will now show in the query list with your 6-character Locator.

## 4. Document revision history

1.1	05-Dec-2016	Changed "Beverly Hills, CA, US" to "Beverly Hills, California, US"
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