



# Siretta

Enabling Industrial IoT



## SNYPER-LTE Graphyte

High performance 4G / LTE network signal analyser & data logger, available in EU and USA versions.

User Manual

Rev 1.3



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## Introduction

This user manual will cover all the aspects of the features, setup and use of the SNYPER-LTE Graphyte (EU) and SNYPER-LTE Graphyte (USA). No prior knowledge of the operating principles of the cellular mobile network is required.

This manual will explain how to conduct surveys, identify the cells available at the location of the survey and their signal strengths, and then how to use this information to successfully deploy a cellular connected device.

This document was created using SNYPER-LTE Graphyte (EU), firmware version 6.08.43 - 4.01.



# SNYPER-LTE Graphyte

## What's in the Box?

As standard, the SNYPER-LTE Graphyte comes with the following:\*

- » SNYPER-LTE Graphyte
- » Multi region power supply
- » General purpose direct connect antenna (Black)
- » 2600MHz (LTE Band 7) direct connect antenna (Light Grey)
- » liveSCAN directional antenna
- » USB Cable
- » USB car charger
- » Tripod and cradle
- » Hard carry case
- » Quick start guide

## General Description

The SNYPER-LTE Graphyte (EU) is designed to survey the cellular networks in Europe and Africa used by mobile phones and data terminals. The SNYPER-LTE Graphyte (USA) is a complementary product designed to survey the cellular networks in the USA. The term “Graphyte” used in this manual refers to both models. The Graphyte enables the operator to first determine which networks are within coverage range, and then optionally to lock to a desired cell to monitor it’s received signal strength (liveSCAN mode). Additionally, both normal and liveSCAN modes may be run continuously, logs of all measurements taken saved, and html formatted summary documents produced.

There are many different frequency bands that cellular equipment uses, and they vary region by region and country by country. In general, different regions tend to use common frequency bands, but there are always exceptions. While the SNYPER-LTE Graphyte (EU) was designed for the frequency bands typically found in Europe, in many cases these same bands can be found in other countries and regions around the world. Similarly, the SNYPER-LTE Graphyte (USA) will be able to survey many networks in other countries in North and South America and the Caribbean.

Additionally, just because a frequency band may be used in a country, that does not necessarily mean that an operator has taken out a license to do so. Please check the frequency bands supported by the Graphyte (see page 6) with the frequency bands used in the country in which the surveys are being conducted. One way to do this is to search for “List of mobile network operators by region” on Wikipedia, another is by directly contacting and asking the local network operators.

\*For replacement parts, please contact your Siretta representative or call us on +44 (0)118 976 9000



### Features

- » Reports details of all cells on all networks in coverage range
- » Coverage of 4G/LTE, 3G/UMTS (all models) and 2G/GSM cellular networks (EU model only). Bands covered vary by model.
- » SIM free operation
- » Do automatic repeated surveys at programmable intervals to see how coverage at a site varies over time, or to discover all the cells visible over a route travelled.
- » Download clear reports in .html format
- » Download .CSV files for import into Excel
- » Use the liveSCAN feature to watch the received signal strength of a cell over time. Use this to correctly align a directional antenna
- » Store at least 400 surveys
- » 240 x 320 resolution TFT display
- » Powered by internal battery, or through USB connector
- » Audible notification of events
- » Language support for English, German, French, Italian and Spanish



## SNYPER-LTE Graphyte

### User Manual

## Specifications

Table 1. Specifications of SNYPER-LTE Graphyte

	SNYPER-LTE Graphyte (EU)	SNYPER-LTE Graphyte (USA)
2G supported bands:	B3 – 1800 MHz (DCS) B8 – 900 MHz (Extended GSM)	Not supported
3G supported bands:	B1 – 2100 MHz (IMT) B8 – 900 MHz (Extended GSM)	B2 – 1900 MHz (PCS) B5 – 850 MHz (Cellular)
4G supported bands:	B1 – 2100 MHz (IMT) B3 – 1800 MHz (DCS) B7 – 2600 MHz (IMT-E) B8 – 900 MHz (Extended GSM) B20 – 800 MHz (Digital Dividend)	B2 – 1900 MHz (PCS) B4 – 1700 MHz (AWS) B5 – 850 MHz (Cellular) B12 – 700 MHz (Lower SMH) B13 – 700 MHz (Upper SMH)
Dimensions:	147mm x 76mm x 36mm	
Weight:	200g (excluding antenna)	
Operating temperature range:	-10 to +50°C*	
Storage temperature range:	-20 to +50°C*	
Operating humidity range:	45 to 85% RH non-condensing	
Antenna connector:	SMA female	
Display:	2.4" QVGA 320 x 240 TFT with LED backlight, 500 cd/m2 brightness	
Battery life:	48 hours normal use**	
Battery:	2000mAh Lithium Ion	
Voltage:	3.7V	
IP rating:	30	
USB connector:	Mini-B	
Current draw:	500 mA typical (battery on charge) 250 mA typical (battery fully charged, full survey in progress) 160 mA typical (battery fully charged, no survey in progress) 120 mA typical (battery fully charged, unit in standby with display dimmed)	

\*The battery will only charge when the temperature is between +10 to +45°C for safety and battery life reasons.

\*\*Based on 20 surveys/day at room temperature with automatic power off enabled. Operating at the extremes of the operating temperature range will degrade battery life.

## Directional Antenna Characteristics

The directional antenna supplied is a hand-held equivalent to the Siretta Oscar 20. There are two versions of this antenna that may be supplied. If the antenna is marked V2 then it is the version 2 (equivalent to the Oscar 20A), otherwise (with no marking) it is the version 1. Please refer to the appropriate characterisation table below.

### Version 1

Table 2. Directional antenna characteristics - version 1

Band	Return Loss	VSWR
<b>Band 1 2110 to 2170 MHz</b>		
2140 MHz	-9.7 dB	1.9
<b>Band 2 1930 to 1990 MHz</b>		
1960 MHz	-16.0 dB	1.3
<b>Band 3 1805 to 1880 MHz</b>		
1842 MHz	-11.7 dB	1.6
<b>Band 4 2110 to 2155 MHz</b>		
2132 MHz	-9.6 dB	1.9
<b>Band 5 869 to 894 MHz</b>		
881 MHz	-11.0 dB	1.7
<b>Band 7 2620 to 2690 MHz</b>		
2655 MHz	-13.7 dB	1.4
<b>Band 8 925 to 960 MHz</b>		
942 MHz	-7.5 dB	2.4
<b>Band 12 729 to 746 MHz</b>		
737 MHz	-14.0 dB	1.6
<b>Band 13 746 to 756 MHz</b>		
806 MHz	-24.3 dB	1.1
<b>Band 20 791 to 821 MHz</b>		
806 MHz	-24.3 dB	1.1



#### Version 2

Table 3. Directional antenna characteristics - version 2

Band	Return Loss	VSWR
<b>Band 1 2110 to 2170 MHz</b>		
2140 MHz	-11.3 dB	1.7
<b>Band 2 1930 to 1990 MHz</b>		
1960 MHz	-18.6 dB	1.2
<b>Band 3 1805 to 1880 MHz</b>		
1842 MHz	-12.7 dB	1.6
<b>Band 4 2110 to 2155 MHz</b>		
2132 MHz	-11.2 dB	1.7
<b>Band 5 869 to 894 MHz</b>		
881 MHz	-8.3 dB	2.1
<b>Band 7 2620 to 2690 MHz</b>		
2655 MHz	-14.2 dB	1.4
<b>Band 8 925 to 960 MHz</b>		
942 MHz	-5.3 dB	3.3
<b>Band 12 729 to 746 MHz</b>		
737 MHz	-11.0 dB	1.8
<b>Band 13 746 to 756 MHz</b>		
751 MHz	-19.6 dB	1.2
<b>Band 20 791 to 821 MHz</b>		
806 MHz	-18.4 dB	1.2

## Omni-directional Antenna Characteristics

### General Purpose Antenna (Black)

This is equivalent to the Siretta Delta 27 antenna.

Table 4. Black omni-directional antenna characteristics

Band	Return Loss	VSWR
<b>Band 1 2110 to 2170 MHz</b>		
2140 MHz	-3.3 dB	5.2
<b>Band 2 1930 to 1990 MHz</b>		
1960 MHz	-13.7 dB	1.5
<b>Band 3 1805 to 1880 MHz</b>		
1842 MHz	-6.0 dB	3.0
<b>Band 4 2110 to 2155 MHz</b>		
2132 MHz	-14.0 dB	1.5
<b>Band 5 869 to 894 MHz</b>		
881 MHz	-7.0 dB	2.6
<b>Band 8 925 to 960 MHz</b>		
942 MHz	-10.0 dB	1.9
<b>Band 12 729 to 746 MHz</b>		
737 MHz	-5.0 dB	3.5
<b>Band 13 746 to 756 MHz</b>		
751 MHz	5.0 dB	3.5
<b>Band 20 791 to 821 MHz</b>		
806 MHz	-6.0 dB	3



### General Purpose Antenna (Light Grey)

This is equivalent to the Siretta Delta 24 antenna

Table 5. Light grey omni-directional antenna characteristics

Band	Return Loss	VSWR
Band 7 2620 to 2690 MHz		
2655 MHz	-10.0 dB	1.9

## Product Images

Figure 1. Front view of the SNYPER-LTE Graphyte



## SNYPER-LTE Graphyte User Manual

Figure 2. Bottom view of the SNYPER-LTE Graphyte



Figure 3. Top view of the SNYPER-LTE Graphyte



\*Although there is a SIM slot, **NO** SIM card is required to operate the SNYPER-LTE Graphyte,

## First Time Use of SNYPER-LTE Graphyte

- » Connect one of the supplied antennas to the Graphyte. It is suggested that the black antenna be used for the first survey as this is the most general-purpose antenna.
- » When first received, the battery charge state may be very low. Before using the Graphyte for the first time it is recommended that you charge the internal battery for at least 4 hours by connecting the unit to a powered USB port (either computer or the supplied mains adapter) using the supplied USB cable. If the USB port is supplying power correctly, the Graphyte will turn on and the red charge state LED in the top left of the front panel will illuminate. The Graphyte will always turn itself on when connected to a powered USB port. At other times, the Graphyte will be turned on by pressing the power button for at least half a second. The Graphyte will turn on when the power button is released.
- » On power up, welcome screen will be displayed briefly (figure 5 is shows SNYPER-LTE Graphyte (EU) welcome screen, figure 6 shows SNYPER-LTE Graphyte (USA) welcome screen) before the main menu is displayed (as shown figure 8.)

Figure 4. Power on



Figure 5. EU welcome screen



Figure 6. USA welcome screen



- » The battery voltage is monitored by internal circuitry, and if the battery charge state is exceptionally low, the Graphyte will turn itself off again. The colour of the status bar at the top of the display indicates the charge state. If it is green, the Graphyte has enough battery capacity to be operated without connecting it to a charging supply. If the charge status bar is yellow or red, please connect the Graphyte to a charging supply.
- » Set the DATE and TIME for your time zone. See [page 29](#) for more information.

## Charging and Battery Status

Approximately 4 - 6 hours are needed to fully charge your SNYPER. The device will be charged when it is plugged into a USB power source - the supplied AC adaptor or the USB host port on a PC or similar. The device's battery provides up to 48 hours use between charges, based on 20 surveys/day.

Battery charging is indicated by a '+' sign on the right of the battery status bar. To maximise the charge rate of the SNYPER-LTE Graphyte, turn it off while charging. The LED indication will still operate and will turn off when fully charged.

Figure 7. Charging and battery status



### Charging and battery status bar:

A fully charged device is indicated by a green bar extending across the top of the display.

As the device is used and the battery discharges, the battery status bar will shrink to the right of the display and change from green, to yellow, to red.

Recharging is recommended once red bars are displayed on the device battery status bar.

If the device drops below allowable low battery usage the unit will switch off and charging will be required.

Table 5. Charge status indication

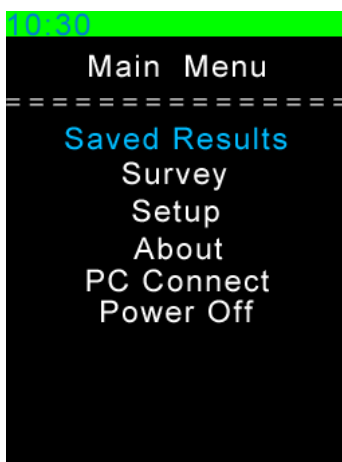
Status	LED Indication
Charging in progress	On
Charging off	Off
Temperature fault	Slow blink at 1.5/Sec
Battery fault	Fast blink at 6.1/Sec

**NOTE:** To protect the battery from damage, charging is only allowed when the temperature is between +10 and +45°C. If a temperature fault is indicated, allow the battery temperature to settle naturally to the safe charging temperature range. Do not attempt to speed this process up by deliberately heating or cooling the SNYPER-LTE Graphyte as this may cause damage. **Important:** If a battery fault is indicated, please do not continue to charge the SNYPER-LTE Graphyte. Please contact Siretta for repair instructions.

## Main Menu

Your SNYPER main menu has 6 menus (as shown below in **figure 8**), these can be selected using the UP/DOWN buttons. Once the chosen menu is highlighted, click OK. Press the BACK button to return to the main menu.

Figure 8. 'Main Menu' screen



**Saved Results:** Reviews previously saved survey.

**Survey:** Used to perform a new survey.

**Setup:** Allows personalisation of language, display, sound, reports and auto-power off.

**About:** Displays information about the device - model number, firmware versions, battery voltage and IMEI number.

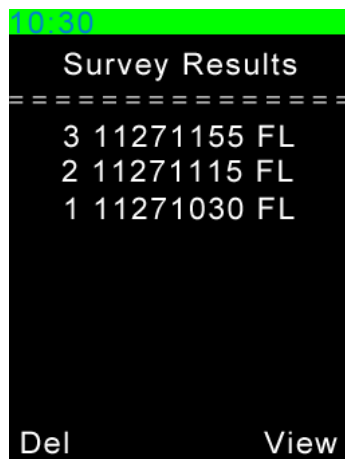
**PC Connect:** Connects device to a PC as a memory stick to allow download of reports.

**Power Off:** Powers off the device.

## Saved Results

Select 'Saved Results' from the main menu. The saved survey files are displayed and numbered in numerical order with file name and whether the survey was conducted in 2G (GSM), 3G (UMTS), 4G (LTE) or FL (Full Range) modes.

Figure 9. 'Saved Surveys' screen



### Deleting a Saved Survey

To delete a saved survey, highlight the survey you wish to delete and press the left navigation button. This will delete the survey from the SNYPER-LTE Graphyte.

**NOTE:** No warning is given prior to deleting a saved survey.

### Viewing a Saved Survey

To view a survey, highlight it and press the OK or right navigation button. You will be taken to the 'Stored Survey' menu as shown below in figure 10.

Figure 10. 'Saved Surveys' screen

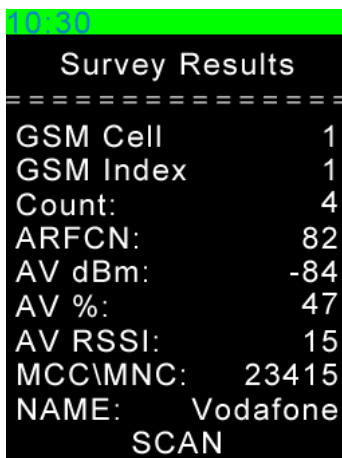




### Show Results

Highlight 'Show Results' and press OK. The SNYPER-LTE Graphyte will display all results with numbered cells from strongest to weakest. To switch between all signals found in the survey, use the LEFT/RIGHT buttons.

Figure 11. Displaying survey results



Survey Results	
GSM Cell	1
GSM Index	1
Count:	4
ARFCN:	82
AV dBm:	-84
AV %:	47
AV RSSI:	15
MCC\MNC:	23415
NAME:	Vodafone
SCAN	

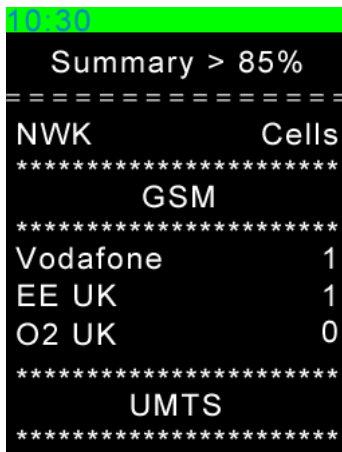
**NOTE:** You are able to perform a liveSCAN on any cell seen within the saved survey results. If performing a liveSCAN using the saved results, be aware that these results are relevant for the location where the survey was performed. If you move to a different location and try to perform a liveSCAN on previously saved results, the liveSCAN might fail as it cannot locate the cell site or channel number in the new location. This is expected behaviour and care should be taken to ensure that liveSCAN logs are only performed using recent survey results in the same vicinity.

### Show Summary

Highlight 'Show Summary' and press OK. The SNYPER-LTE Graphyte will display the number of cells by each network in frequency bands. Use the LEFT/ RIGHT buttons to switch between signal strengths received on the device.

Press the DOWN button to view the summary of results in GSM, UMTS and LTE.

Figure 12. Displaying survey results



Summary > 85%	
NWK	Cells
*****	
GSM	
*****	
Vodafone	1
EE UK	1
O2 UK	0
*****	
UMTS	
*****	

**NOTE:** Two listings may be shown for one network operator. This listing is created by the MNC and is two different MNC's both associated with the same network operator. Use the LEFT button to replace the network operator names with the MCC/MNC numbers to see this. The RIGHT button returns the view to network operator name.



### Export Results

Selecting 'Export Results' will cause the SNYPER-LTE Graphyte to create and export two files, XSURVRES.CSV and XSURVRES.HTM. These are equivalent to a single cycle survey .CSV and .HTM file based on the data collected during the survey.

This function allows a survey to be 'recovered' if the survey files have been deleted from the file system while the SNYPER-LTE Graphyte was connected to a PC using PC Connect (see page 34).

If the survey was a multi-cycle survey, the full log of all surveys is not recreated. The .CSV and .HTM files created by the export will lose information regarding the number of times a cell was seen, only the averaged data remains in the files.



## Survey Menu

The SNYPER-LTE Graphyte has 3 operational modes for performing surveys.

- » **Single Survey:** A single, complete survey of the cellular environment as seen by the SNYPER-LTE Graphyte. The survey result is available as a .csv file, with a .htm summary file.
- » **Multiple Cycle Survey:** In Multiple Cycle Survey, the user can conduct a survey over many cycles (user defined up to 500). These surveys can either run consecutively with each other, or after a user selectable time interval of up to 24 hours. The Graphyte will show the average of all the surveys carried out. Like Single Scan survey, .HTM and .CSV files will be created. In Multiple Cycle Survey there will be two .CSV files created. One with the averaged summary data, and one containing all the data from all the surveys that were conducted.

Multiple cycle survey is a significant feature of the SNYPER-LTE Graphyte. Received signal strength of cellular networks is not a constant. They vary in even short spaces of time. Therefore, carrying out a multiple cycle survey in an area gives a much better view of best signal strength for a specific network. It is recommended that users carry out a 5-cycle survey as a minimum to get a good view of signal strength available in any given location.

**NOTE:** The Graphyte can only record a maximum of 255 cells (combined total of 2G, 3G and 4G). This will never be a problem when the Graphyte is not moving. If, however, the Graphyte is doing a multi-cycle log on a moving vehicle, then the maximum of 255 could be a limitation dependant on vehicle speed and number of measurement cycles. Please also remember that a survey is not instant – the Graphyte will be retuning its radios to listen to all the different frequencies that it supports (many hundreds!) as it conducts a survey, and this is the reason why a survey will take several minutes to complete. So a survey where the Graphyte is moving does not represent a survey of all frequencies at a single point on the ground, but survey along the movement path between when the individual survey started and when it completed.

- » **liveSCAN:** This is a continuous survey where the SNYPER-LTE Graphyte is locked onto a user specified channel frequency. The SNYPER-LTE Graphyte graphically shows the received signal strength of that channel on a continuously updated rolling display until cancelled. In conjunction with the supplied directional antenna, this allows the user to move the antenna around until the direction with the greatest signal strength is found. In conjunction with an omni-directional antenna, this allows the user to move around a site to identify the location of the best signal strength of the channel locked onto. A .csv file of each survey taken during the liveSCAN is kept for the user to analyse if required.



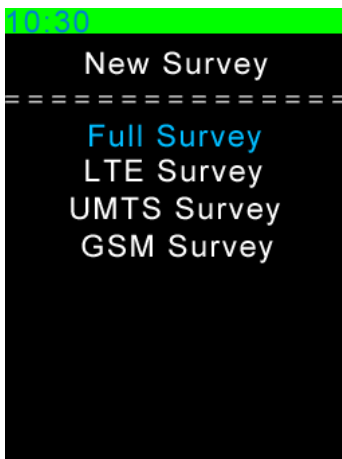
## Performing a Single Survey

To perform a single survey on your SNYPER-LTE Graphyte, follow the steps below:

**Step 1.** Select 'Survey' from the main menu and press OK.

**Step 2.** Use the UP/DOWN buttons to select what survey you would like to perform and press OK.

Figure 13. Selecting survey to perform



**Full Survey:** Performs a survey for the LTE, UMTS and GSM networks.

**LTE Survey:** Performs a survey for the LTE network only.

**UMTS Survey:** Performs a survey for the UMTS network only.

**GSM Survey:** Performs a survey for the GSM network only.

**NOTE** - Only SNYPER-LTE Graphyte (EU) can survey the GSM network.

**Step 3.** Cycle option should be set at <1>. Press OK to perform a single survey. When the survey is complete, a list of saved results as shown in figure 15 will be displayed.

Figure 14. Selecting survey to perform

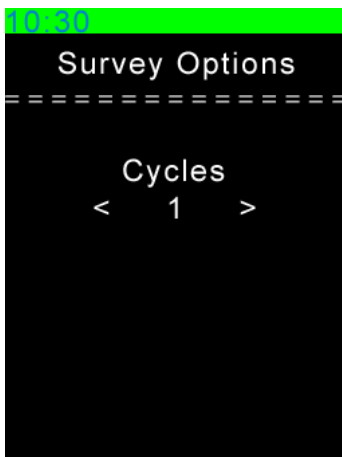


Figure 15. Survey complete



The file format is saved as:  
Month:Day:Hour:Minute

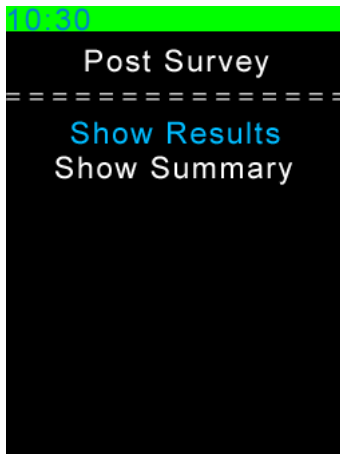
**[no extension]:** The directory name created into which the survey files will be written.

**.csv:** Comma separated value files.

**.htm:** HTML web browser file.

Step 4. Press OK to be taken to the post survey menu as show below in figure 16.

Figure 16. Selecting a post survey option

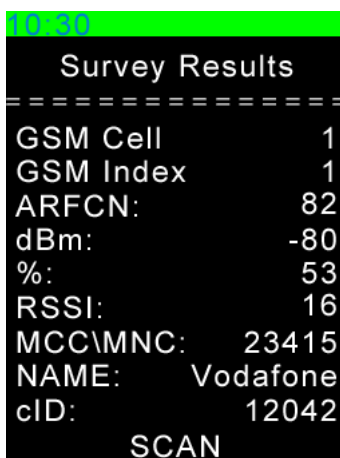


### Show Results

Highlight 'Show Results' and press OK. The SNYPER-LTE Graphyte will display all results with numbered cells from strongest to weakest. To switch between all signals found in the survey, use the LEFT/RIGHT buttons.

**NOTE** - The SNYPER-LTE Graphyte (USA) does not survey the GSM band. As a result, there is no GSM survey option and it is not included as part of a full survey.

Figure 17. Displaying survey results



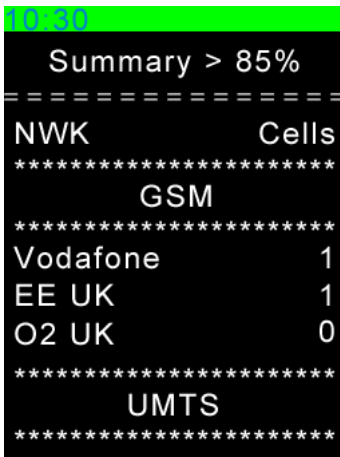


### Show Summary

Highlight 'Show Summary' and press OK. The SNYPER-LTE will display the number of cells by each network in frequency bands. Use the LEFT/ RIGHT buttons to switch between signal strengths received on the device.

Press the DOWN button to view the summary of results in GSM, UMTS and LTE.

Figure 18. Displaying survey results



The screenshot shows a handheld device screen with a green status bar at the top displaying '10:30'. Below the status bar, the text 'Summary > 85%' is displayed. The screen is divided into sections for different network types: GSM and UMTS. Each section lists network operators and the number of cells they have. The GSM section lists Vodafone (1 cell), EE UK (1 cell), and O2 UK (0 cells). The UMTS section is currently empty.

NWK	Cells
***** GSM *****	
Vodafone	1
EE UK	1
O2 UK	0
***** UMTS *****	

**NOTE:** Two listings may be shown for one network operator. This listing is created by the MNC and is two different MNC's both associated with the same network operator.

### Save Results

With default settings, it is not necessary to save the results as this is automatically done at the completion of the survey. However, if you have selected the user option to turn off automatic saving of results, you will need to highlight 'Save Results' and press OK to save results to the SNYPER-LTE Graphyte.

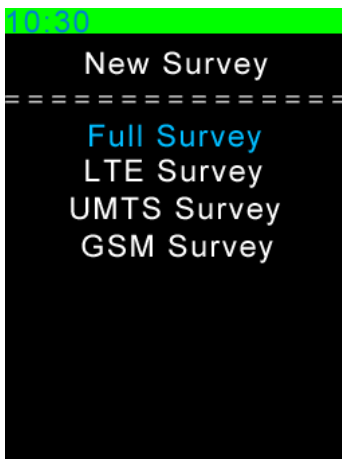
## Performing a Multiple Cycle Survey

To perform a multiple survey on your SNYPER-LTE Graphyte, follow the steps below:

**Step 1.** Select 'Survey' from the main menu and press OK.

**Step 2.** Use the UP/DOWN buttons to select what survey you would like to perform and press OK.

Figure 19. Selecting survey to perform



**Full Survey:** Performs a survey for the LTE, UMTS and GSM networks.

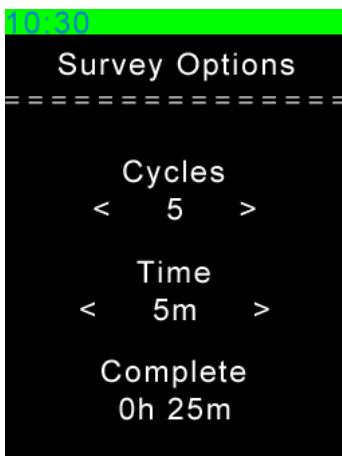
**LTE Survey:** Performs a survey for the LTE network only.

**UMTS Survey:** Performs a survey for the UMTS network only.

**GSM Survey:** Performs a survey for the GSM network only.

**Step 3.** Use the RIGHT button to select number of survey cycles and time of each cycle. Press OK to begin survey. You will be prompted to enter your charging cable for extended survey.

Figure 20. Selecting multiple survey options



**Cycles:** You can increase the number of cycles using the RIGHT button, increasing in increments of 5. You can perform a maximum of 500 cycles.

**Time:** Use the RIGHT button to increase the time interval in minutes between each survey. If you select zero (0) for the time interval, this will perform back to back surveys.

A Multiple Cycle Survey can be interrupted by pressing the back key for at least half a second. Depending where in the logging flow the SNYPER-LTE Graphyte is, it might take up to 30 seconds for the survey to be interrupted.

When the survey is complete, a list of saved results as shown in **figure 21** will be displayed.

Figure 21. Survey complete



The file format is saved as:  
Month:Day:Hour:Minute

**[no extension]:** The directory name created into which the survey files will be written.

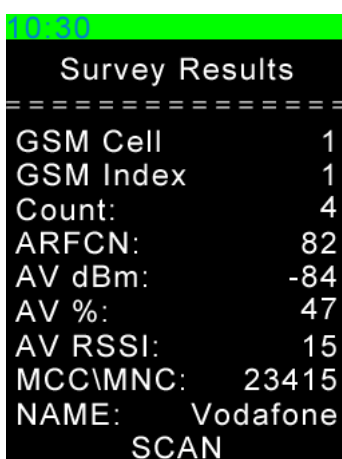
**.csv:** Comma separated value files.

**.htm:** HTML web browser file.

### Show Results

Highlight 'Show Results' and press OK. The SNYPER-LTE Graphyte will display all results with numbered cells from strongest to weakest. To switch between all signals found in the survey, use the LEFT/RIGHT buttons.

Figure 22. Displaying survey results



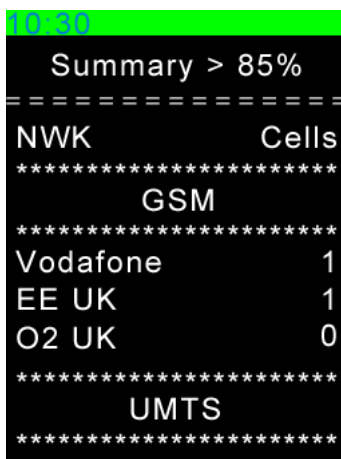


### Show Summary

Highlight 'Show Summary' and press OK. The SNYPER-LTE will display the number of cells by each network in frequency bands. Use the LEFT/ RIGHT buttons to switch between signal strengths received on the device.

Press the DOWN button to view the summary of results in GSM, UMTS and LTE.

Figure 23. Displaying survey results



**NOTE:** Two listings may be shown for one network operator. This listing is created by the MNC, and is two different MNC's both associated with the same network operator.

### Save Results

With default settings, it is not necessary to save the results as this is automatically done at the completion of the survey. However, if you have selected the user option to turn off automatic saving of results, you will need to highlight 'Save Results' and press OK to save results to the SNYPER-LTE Graphyte.



### Performing a liveSCAN

liveSCAN works by locking the SNYPER-LTE Graphyte to a selected base station channel and the cell it is operating on. Once the SNYPER-LTE Graphyte locks to a channel, a continuous update of the received signal strength of that cell will be reported on the SNYPER-LTE Graphyte.

liveSCAN can be used in two modes:

- » **Directional liveSCAN:** When conducting liveSCAN with a directional antenna, moving the antenna horizontally will show the direction with the highest signal strength. A .csv file of each survey taken during the liveSCAN is stored for analysis if required. A directional antenna covering all frequencies is supplied with the SNYPER-LTE Graphyte to perform this task
- » **Omni-directional:** When conducting liveSCAN with an omni-directional antenna, moving the SNYPER-LTE Graphyte to different areas in a building will show “hotspots” with the highest signal strength.

Users are encouraged to use their own antennas when performing a survey or liveSCAN on the SNYPER-LTE Graphyte.

Using the antenna which is intended to be used in the proposed installation will give the best indication of how the antenna will perform. Placing the antenna in potential mounting locations and orientations will allow the operator to make an informed choice about what the best antenna placement is for that installation.



## SNYPER-LTE Graphyte User Manual

To perform a liveSCAN on your SNYPER-LTE Graphyte, follow the steps below:

**Step 1.** Conduct a survey of any type using an omni-directional antenna.

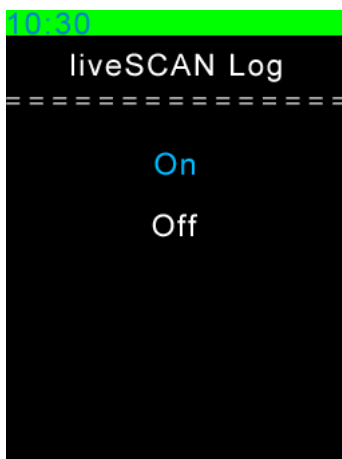
**Step 2.** When the survey is complete view the results acquired. Use the LEFT/RIGHT buttons to find the survey results you wish to liveSCAN.

**Step 3.** Remove the connected omnidirectional antenna and connect a directional antenna, or the intended antenna for your installation (recommended).

**Step 4.** Press OK to initiate liveSCAN.

**Step 5.** You will be given the option of logging the liveSCAN results. Select 'On' or 'Off' using the UP/DOWN buttons. Press OK to begin liveSCAN.

Figure 24. liveSCAN logging

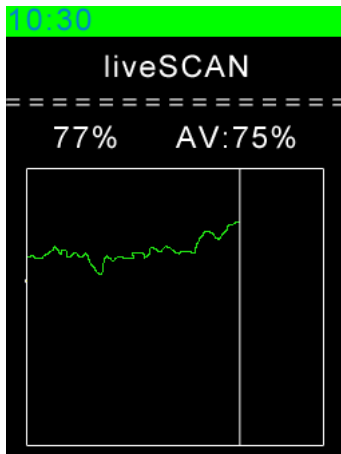


**On:** Performs a liveSCAN and logs all captured results. Results will be available to download in .csv format by following the PC Connect steps on **page 34**.

The first liveSCAN survey log file is named LL000000.csv, the second LL000001.csv, etc. There is **NO** .htm file stored for liveSCAN logging.

**Off:** Performs a liveSCAN without logging results.

Figure 25. liveSCAN in progress



The default liveSCAN view shows the active signal strength as a %, and the average of all readings taken (again as a %).

The vertical white line scrolls from left to right across the screen and indicates the current measurement position. The green line shows the actual and historical liveSCAN measurement data.

Use the UP/DOWN buttons to switch between display modes:

- » Average reading
- » Number of readings
- » Elapsed time
- » Network operator

The active signal strength reading is shown at all times.

**IMPORTANT:** Starting a liveSCAN from saved results will result in unpredictable behaviour, as the initial survey may have been performed under different circumstances.

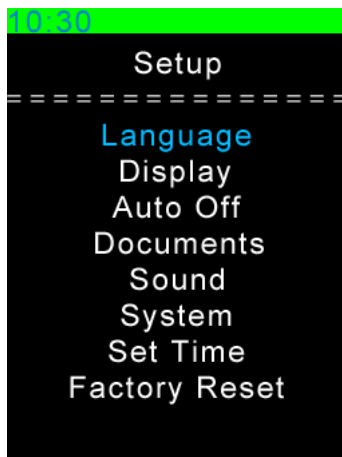
**Siretta recommends to conducting a survey first and then running liveSCAN from that survey.**

Press the BACK button to abort liveSCAN – the SNYPER-LTE Graphyte will return to the Survey Results screen. A further liveSCAN can be conducted by selecting different cells from the survey results.

## Setup Menu

By selecting 'Setup' from the main menu, the following setup changes can be made (as shown below in **figure 26**). To select a sub menu use the UP/DOWN button until relevant menu is highlighted, then use the LEFT/RIGHT buttons to amend preference. Setup options are automatically saved.

Figure 26. 'Setup' screen



**Language:** Language selection of your SNYPER product.

There are 5 language settings; ENG (English), DEU (German), FRA (French), ITA (Italian), SPA (Spanish). *Default = ENG*

**Display:** Determines the brightness, body text and highlighted text colour.

**Brightness:** 6 settings for display brightness. 0 (low) - 5 (high).

**Body Text:** 10 colour settings for body text.

**Highlighted Text:** 10 colour settings for highlighted text.

*Default: Brightness = 5, B-Text = White, H-Text = Blue*

**Auto off:** Is a method of power saving for the SNYPER-LTE Graphyte. It controls the automatic powering down of the unit if it has not been used for a period and dimming of the display to reduce power. This can be useful where the Graphyte has been left to do a survey without a charging supply to maintain the battery.

This may be set to on or off. When set to off, the Graphyte will only power off when the user turns the power off from the keypad (or the battery runs flat). When set to off, the delay setting has no effect.

When set to on, the Graphyte will automatically turn itself off after a period of inactivity set by the delay setting. Surveying or pressing a button is counted as activity and resets the delay timer. The Graphyte will never turn itself off while conducting a survey, only after the survey completes and the subsequent delay timer expires. Note that when conducting a long survey, it is still recommended that the Graphyte be connected to a power source to prevent the battery from completely discharging during the survey.

**Delay:** This is the delay in minutes. Valid settings are 1, 2, 3, 4, 5, 6, 7, 8 or 9. The delay counter is reset while a survey is in progress or by a button press.



## SNYPER-LTE Graphyte User Manual

**Auto Dim:** This is the delay in minutes for the display to dim to a point where it is barely readable. Pressing any button on the keypad resets the timer, and if the display has dimmed will restore the displays brightness setting.

*Default: Auto Off = On, Delay = 2, Auto Dim = 2*

**Documents:** Following every survey, the user can save the survey files on the SNYPER-LTE Graphyte.

**HTML:** Save files in HTML format, this can be set to ON or OFF.

**CSV:** Other file formats such as .XML files can be created by first opening the .CSV file in Microsoft Excel and then saving/exporting into the desired format.

**Auto Save:** Valid settings are ON and OFF. ON is the factory default setting. This controls if files are automatically saved or not after a survey is conducted. If auto save is turned OFF, there will be a menu option displayed after every survey to allow that surveys results to be saved.

*Default: HTML = On, CSV = On, Auto Save = On*



## SNYPER-LTE Graphyte User Manual

**Sound:** SNYPER-LTE Graphyte and keypad sound.

**Sound:** Notification sound, this can be set to ON or OFF.

**Keypad:** Keypad sound, this can be set to ON or OFF.

Default: Sound = On, Keypad = On

**System:** The System function is used to operate the Graphyte in various modes, giving the user more information on the surveys.

**Mode:** The SNYPER-LTE Graphyte can report results in Standard, Advanced or Engineer mode. See 'Mode' section below.

**ITU Region:** This setting is required in engineering mode to ensure DL and UL frequencies are correctly calculated. This has three settings, EMEA (1) = Europe, Africa, the Middle East west of the Persian Gulf including Iraq, the former Soviet Union and Mongolia, AMER (2) = Americas, Greenland and some of the eastern Pacific Islands and APAC (3) = Asia, east of and including Iran, and most of Oceania.

**Debug Log:** This may be set to On or Off. Siretta Support may ask you to enable this, otherwise leave the setting off. If enabled, a debug file is started. The file is named DBGLOG.TXT and is found in the root of the Graphyte file system. The file is named as a .txt file so that it can be easily sent via email, but is actually a proprietary file format that can be interpreted by Siretta support. During Graphyte use, debug data is written to this file. The next time that the Graphyte is connected to the PC, the DBGLOG.TXT file should be saved to the PC as when PC Connect is exited, the log created is erased and restarted to prevent the file from growing to an excessive size.

Default: Mode = Standard, ITU Region = EMEA (1) SNYPER-LTE Graphyte (EU) / AMER (2) SNYPER-LTE Graphyte (USA), Debug Log = Off

Set Time: Date and time can be set using the UP/DOWN buttons.

Date: YYYY\MM\DD

Time: HH\MM\SS

Factory Reset: Resets the SNYPER-LTE Graphyte to factory settings.

**NOTE:** Performing factory reset will delete all saved files from the SNYPER-LTE Graphyte's internal memory.

Factory reset does not reset the date and time, nor does it revert the firmware in the unit to the factory supplied version if it has been updated by the user. These are the only aspects of the Graphyte unaffected by a factory reset.

## Mode

This has three settings, Standard, Advanced and Engineer. The factory default is standard. These modes determine what cell parameters are shown in the surveys. Additional parameters are shown on the results screen of the SNYPER-LTE Graphyte and in the HTM and CSV files.

**Standard Mode** - This is the default shown throughout the manual.

**Advanced Mode** - This additionally shows BSIC for GSM (2G) surveys; SCR, RSCP and ECIO for UMTS (3G) surveys; and PhyCellID, RSRP, RSRQ and BW for LTE (4G) surveys.

**Engineer** - In addition to the extra information shown in advanced mode, this shows the DL and UL frequencies in MHz (calculated from the ARFCN) for all surveys.

**Debug Log** - This can be set to On or Off. Factory default is off.

Siretta Support may ask you to enable this, **otherwise leave the setting off**. If for support reasons, Siretta ask for this to be enabled, a debug file will be created when the next survey is conducted. The file is named DBGLOG.TXT and is found in the root of the SNYPER-LTE Graphyte file system. The file is named as a .txt file so that it can be easily sent via email, but it is actually a proprietary file format that can be interpreted by Siretta support.

See **table 6** below for breakdown of information provided in each mode.

For full description of survey parameters, see SNYPER Survey Terminology:  
<https://www.siretta.com/snyper-survey-terminology>

Table 6. Breakdown of information provided

	Standard (S)	Advanced (A)	Engineer (E)
Index - Base station number assigned by your SNYPER-LTE Graphyte	✓	✓	✓
Network - Name of the network provider	✓	✓	✓
MCC - Mobile Country Code being received	✓	✓	✓
MNC - Mobile Network Code being received	✓	✓	✓
dBm - Signal strength being received. Signal strength ranges from -115dBm to -25dBm (UMTS); -100 to -25dBm (LTE), the larger the number the higher the signal strength.)	✓	✓	✓



## SNYPER-LTE Graphyte User Manual

Table 6 (continued). Breakdown of information provided

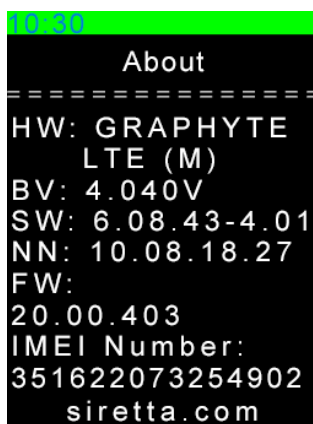
<b>RSSI</b> - Received Signal Strength Indicator (Values range from 0 - 31 (GSM); 0 - 91 (UMTS); 0- 76 (LTE), the higher the number the higher the signal strength.)	✓	✓	✓
<b>Signal</b> - Percentage signal received (Values range from 0% - 100%, the higher the number the higher the signal strength.)	✓	✓	✓
<b>Band</b> - Frequency band being received	✓	✓	✓
<b>ARFCN</b> - Absolute Radio Frequency Channel Number being received (GSM)	✓	✓	✓
<b>UARFCN</b> - UTRA Absolute Radio Frequency Channel Number being received (UMTS)	✓	✓	✓
<b>EARFCN</b> - E-UTRA Absolute Radio Frequency Channel Number being received (LTE)	✓	✓	✓
<b>Cell ID</b> - Unique ID of the network cell being received (if available)		✓	✓
<b>SCR</b> - Scrambling Code (UMTS)		✓	✓
<b>LAC</b> - Location Area Code		✓	✓
<b>BSIC</b> - Base Station Identity Code (GSM)		✓	✓
<b>RSCP</b> - Received Signal Code Power (UMTS)		✓	✓
<b>ECIO</b> - Ratio of Energy Chip / Interference in dB (UMTS)		✓	✓
<b>RSRQ</b> - Reference Signals Received Quality (LTE)		✓	✓
<b>RSRP</b> - Reference Signals Received Power		✓	✓
<b>BW</b> - Downlink Bandwidth in MHz		✓	✓
<b>DL</b> - Signal Download Frequency			✓
<b>UL</b> - Signal Upload Frequency			✓



## About Menu

By selecting 'About' from the main menu, information about your SNYPER-LTE Graphyte will be displayed (as shown below in **figure 27**).

Figure 27. 'About' screen



**HW:** SNYPER-LTE Graphyte model hardware version.

**BV:** Battery voltage.

**SW:** Current application and loader software versions running on your SNYPER-LTE Graphyte.

**NN:** The current list of global network names stored on your SNYPER product as of the displayed date (dd.mm.yy).

**FW:** SNYPER-LTE Graphyte firmware version

**IMEI Number:** The unique IMEI number of your SNYPER-LTE Graphyte.

## PC Connect

The PC Connect feature allows you to download all stored surveys from your SNYPER onto your PC.

The data is downloaded to your PC in CSV and HTML format. The downloaded data will include GSMUMTS\LTE survey results.

To download data from your SNYPER-LTE Graphyte follow the steps below:

**Step 1.** Connect supplied USB cable to your SNYPER-LTE Graphyte and PC.

**Step 2.** Select 'PC Connect' from the main menu, and use the RIGHT button to enable PC Connect.

Windows Explorer will open automatically with a drive named 'GRAPHYTE'. If Windows explorer does not open automatically, open it by pressing and holding the Windows key and 'e'. A new drive called 'GRAPHYTE' will be visible, containing one directory with the same name as the files saved.

Figure 28. Prepare for data download

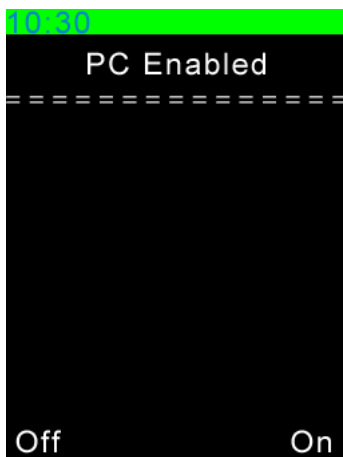
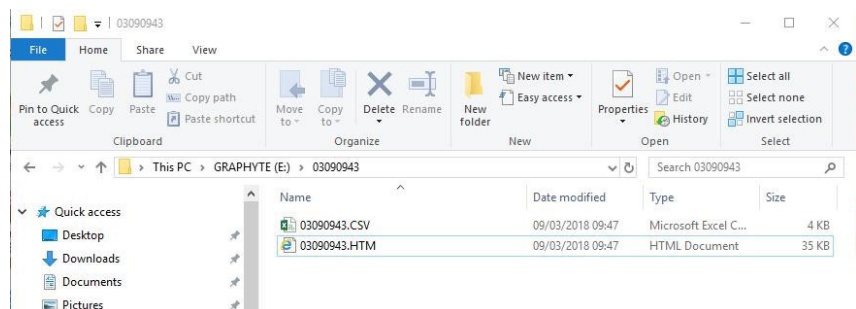


Figure 29. Downloading your SNYPER product data to PC

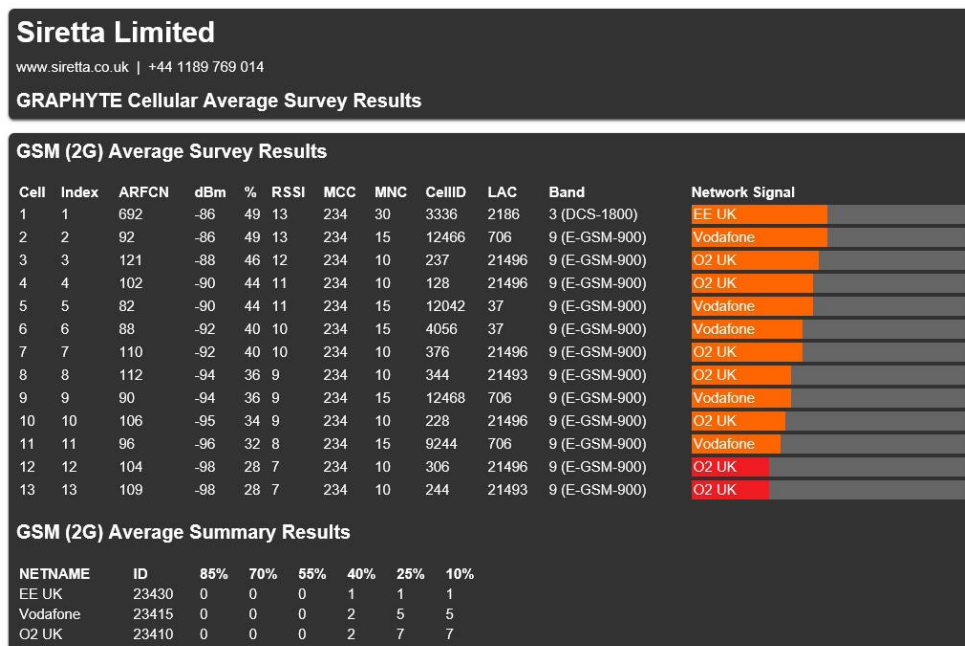


**Step 3.** Use copy and paste to transfer files from the SNYPER-LTE Graphyte to the desired location on your PC.



**Step 4.** Double click the .htm file to open it using the default web browser on your PC. Results will be shown like those shown below.

Figure 30. HTML results



**Step 5.** To disable the PC connection, select 'Disable' on your SNYPER-LTE Graphyte and remove the USB cable.

Your SNYPER-LTE Graphyte will now be back to normal operation.

Press the back button on your SNYPER product to return to the 'Main Menu'.

**NOTE:** When the SNYPER-LTE Graphyte is connected to the PC, deleting files from PC hard drive will not delete the files from the SNYPER-LTE Graphyte's internal memory.

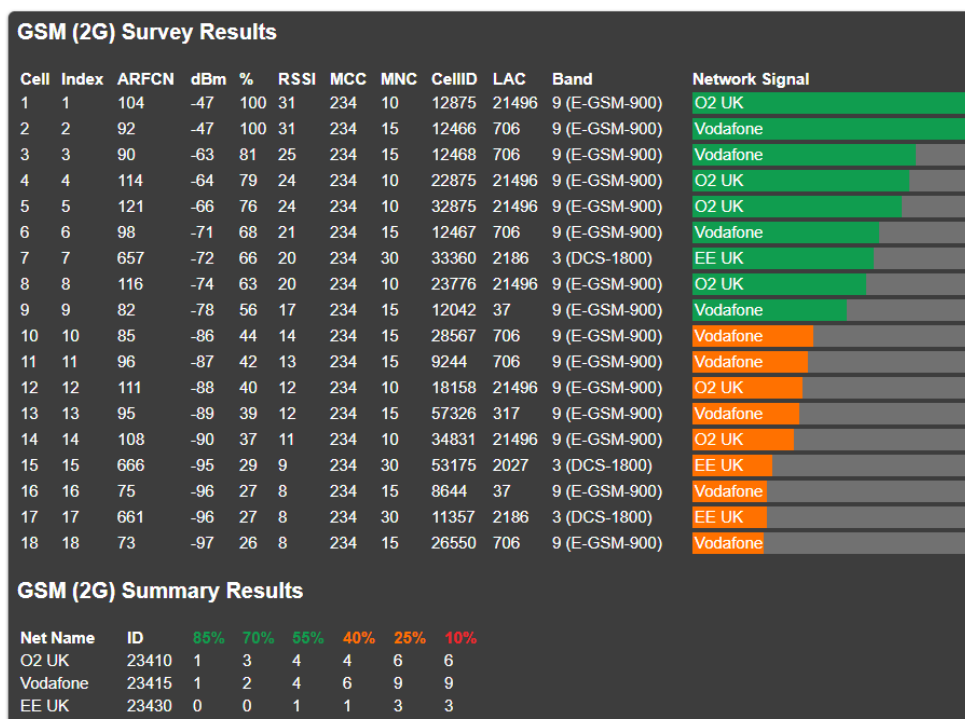
### Viewing Single Survey Results on a PC

A single survey will create 2 files in a new directory. The directory created will be in the root of the Graphyte's file system and the name of the directory and files will be the date and time. The files will be in .htm and .csv format.

#### .htm Report

The information recorded in the .htm report will depend on the survey type you performed.

Figure 31. .htm report





### .csv Report

The information recorded in the .csv report will depend on the survey type you selected. The information displayed is the same as the .htm file, however in spreadsheet format. Additionally, the .csv file reports a timestamp field, which is the UNIX time version of the file creation time.

Figure 32. .csv report

=====													
Siretta Limited													
=====													
GRAPHYTE Network Survey Results													
www.siretta.com													
+44 1189 769 014													
Survey Type		Full											
File Created		29/03/2019 13:18											
IMEI Number		'351622073254829											
Hardware Version		'GRAPHYTE-LTE V3											
Application Version		'6.8.36											
Firmware Version		'20.00.403											
Filename		'03291315.csv											
Timestamp		'1553865501											
=====													
2G Survey Results													
=====													
Index:	ARFCN:	dBm:	%:	RSSI:	MCC:	MNC:	CellID:	LAC:	Band Num	Band:	Net Name Signal:		
1	104	-47	100	31	234	10	12875	21496	9	E-GSM-900	O2 UK		

## Viewing Multiple Cycle Survey Results on a PC

A multiple cycle survey will create 3 files in a new directory. The directory created will be in the root of the Graphyte's file system and the name of the directory and files will be coded with date and time identifiers.

For multiple cycle surveys, there is an additional .csv file containing all the data logged from all the individual surveys. This larger .csv file has the letter 'L' as its first character to indicate that it contains all the logged data.

### .htm Report

The information recorded in the .htm report will depend on the survey type you selected. Multiple cycle surveys also report the following:

- » 'Seen' column - Count of how many surveys that each cell appeared in, and in brackets what percentage of surveys that represents.
- » dBm, % and RSSI column - Average signal strength of these parameters. Surveys where the cell was not detected are not included in the average.
- » Summary results are based on the average % of the seen cells.
- » At the bottom of each section (GSM [SNYPER-LTE Graphyte (EU) only], UMTS and LTE) there is a section called 'Signal Log'. This shows how a cells signal strength varies over time.

**NOTE -** With large logs, these graphs can get very busy. Similar plots may be generated by the user using the log .csv file that is generated, where user filters can be applied to make interpretation easier.

Figure 33. .htm report

Siretta Limited												
www.siretta.com   +44 1189 769 014												
GRAPHYTE Cellular Average Survey Results												
GSM (2G) Average Survey Results												
Cell	Index	Seen	ARFCN	AV dBm	AV %	AV RSSI	MCC	MNC	CellID	LAC	Band	Network Signal
1	1	97 (97%)	96	-71	68	21	234	15	7568	304	9 (E-GSM-900)	Vodafone
2	2	100 (100%)	87	-76	60	19	234	15	6053	304	9 (E-GSM-900)	Vodafone
3	3	100 (100%)	101	-76	60	19	234	10	35251	21481	9 (E-GSM-900)	O2 UK
4	4	100 (100%)	111	-81	52	16	234	10	20184	21481	9 (E-GSM-900)	O2 UK

Hovering over a data point with the mouse shows more information about that data point: The survey number, the network with index number in brackets, and the signal strength.

On a 50 or greater cycle survey, 'Summary Graph Data' and 'Detailed Graph Data' option buttons are displayed. The Summary Graph Data can be selected for 50+ cycle surveys, this cuts out some data points in order to de-clutter the view. The detailed graph view is the view used for surveys below 50 cycles. The Detailed Graph Data is the view used for surveys below 50 cycles.

**NOTE** - In both views, where there are multiple data points with the same signal strength it is only possible to display one data point (the strongest is chosen). Networks are colour coded.

Figure 34. Summary Graph Data

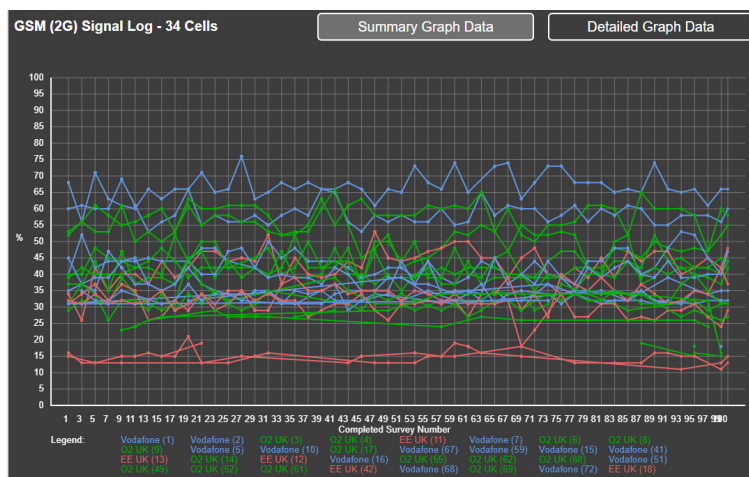
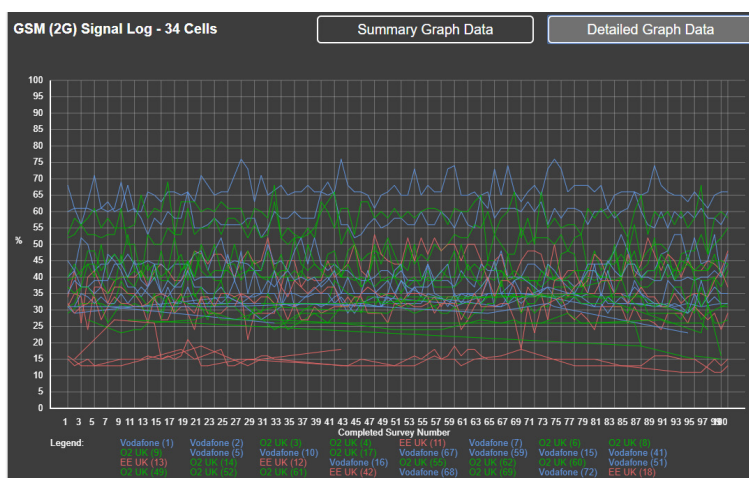


Figure 35. Detailed Graph Data



### .csv Report

There are two .CSV files produced by a multiple cycle survey. The first is very similar to the single cycle survey and the file name has the same format. This contains the averaged summary of all the cell measurements.

Figure 36. .csv report

=====													
Siretta Limited													
=====													
GRAPHYTE Network Survey Results													
www.siretta.com													
+44 1189 769 014													
Survey Type		Full											
File Created		09/04/2019 23:18											
IMEI Number		'351622073254829											
Hardware Version		'GRAPHYTE-LTE V3											
Application Version		6.8.36											
Firmware Version		'20.00.403											
Filename		'04091433.csv											
Timestamp		'1554851916											
=====													
2G Survey Results													
=====													
Index:	Num Cells:	ARFCN:	AV dBm:	AV %:	AV RSSI:	MCC:	MNC:	CellID:	LAC:	Band Num	Band:	Net Name	Signal:
1	97 (97%)	96	-71	68	21	234	15	7568	304	9	E-GSM-900	Vodafone	
2	100 (100%)	87	-76	60	19	234	15	6053	304	9	E-GSM-900	Vodafone	
3	100 (100%)	101	-76	60	19	234	10	35251	21481	9	E-GSM-900	O2 UK	

The second file can be recognised by the first character of the file name being changed to 'L' to indicate that it contains logging data. The header follows the same format as the first .CSV file. It differs from the first in that it contains all the measurements taken during the logging process. This means that there are extra columns of data including index, timestamp and network.

Figure 37. .csv logging report

=====																
Siretta Limited																
=====																
GRAPHYTE Network Survey Results																
www.siretta.com																
+44 1189 769 014																
Survey Type		Full														
File Created		09/04/2019 14:36														
IMEI Number		'351622073254829														
Hardware Version		'GRAPHYTE Network Survey Results														
GRAPHYTE-LTE V3																
Application Version		'6.8.36														
Firmware Version		'20.00.403														
Filename		'L4091433.csv.csv														
Timestamp		'1554820564														
Survey:	Timestamp:	Network:	Index:	xRFCN:	dBm:	%:	RSSI:	MCC:	MNC:	CellID:	LAC/TAC:	Band Num	Band:	Net Name	Signal:	
	1	09/04/2019 14:36	2G	1	96	-71	68	21	234	15	7568	304	9	E-GSM-900	Vodafone	
	1	09/04/2019 14:36	2G	2	87	-76	60	19	234	15	6053	304	9	E-GSM-900	Vodafone	
	1	09/04/2019 14:36	2G	3	101	-80	53	16	234	10	35251	21481	9	E-GSM-900	O2 UK	

### Viewing liveSCAN Results on a PC

If liveSCAN logging was enabled during your liveSCAN, you can find the log results in the same directory as the survey logs. There is no .htm version of the liveSCAN log, only a .CSV file.

The first liveSCAN survey log file is named LL000000.CSV, the second LL000001.CSV, etc.

Each reading taken in the liveSCAN survey takes around 1.96 seconds to complete. The smallest time unit that the Graphyte uses is a second. For this reason, there is not an entry in the log for every second.

Figure 38. liveSCAN report

=====					
Siretta Limited					
=====					
GRAPHYTE LiveSCAN Survey Results					
www.siretta.com					
+44 1189 769 014					
File Created	29/03/2019 14:53				
IMEI Number	'351622073254829				
Hardware Version	'GRAPHYTE-LTE V3				
Application Version	'6.8.36				
Firmware Version	'20.00.403				
Filename	'LL000000.csv				
Timestamp	'1553871211				
Network	EE UK				
Technology	LTE				
EARFCN = 6225	MCC = 234	MNC = 30	CELLID = 8118796		
Index	15				
Time:	Elapsed:	dBm:	%:	RSSI:	
	0	00:00:00	-73	36	27
	2	00:00:02	-72	37	28
	4	00:00:04	-79	28	21

## Power Off

After use, remember to power off your SNYPER-LTE Graphyte. The device can be powered off in the following 2 ways:

- » Selecting the 'Power Off' option from the main menu. The device will display a power off message as shown below in **figure 40**.

Figure 39. Select 'Power Off'

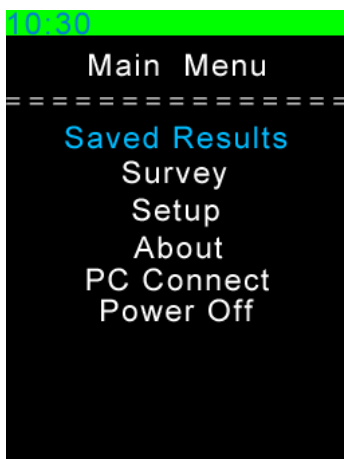


Figure 40. Power off message

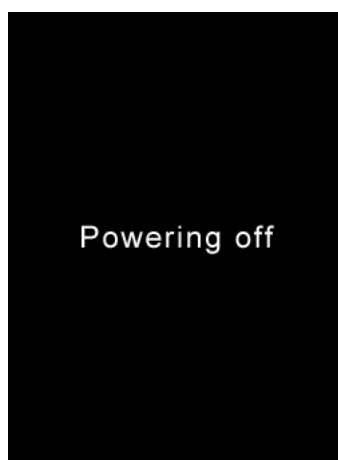


- » Press and hold the ON/OFF button on the device for >2 seconds. The screen will display a power off message as shown below in **figure 42**.

Figure 41. ON/OFF button



Figure 42. Power off message



ON/OFF Button



# Updating the SNYPER-LTE Graphyte Software

From time to time Siretta may make software updates available for the SNYPER-LTE Graphyte. Normally, these software updates will be made available as a complimentary service on the Siretta website. Updated Software may contain improvements and/or new features.

**WARNING:** Updating the firmware could cause loss of survey data. Please back up any surveys to a PC before starting the firmware upgrade procedure. User settings are retained throughout the upgrade process.

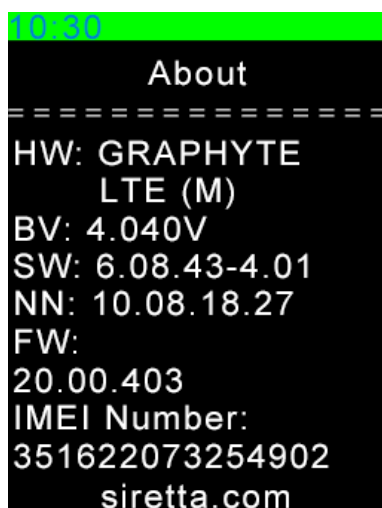
To perform a software update, follow the steps below:

**Step 1.** Go to <https://www.siretta.com/software-library/> and download and save latest SNYPER-LTE Graphyte software.

The firmware version is part of the file name. For example, the file name for Version 6.08.43 firmware is `SnyperV060843.v6u`. If the firmware has been supplied in a compressed file format such as a .zip or .rar file, it should be uncompressed before use.

**Step 2.** Verify that the new software is an update before proceeding further. You can do this by checking the 'About' menu on the SNYPER-LTE Graphyte.

Figure 43. Current software version



Here the software version shown is 6.08.41, so 6.08.43 will be an upgrade



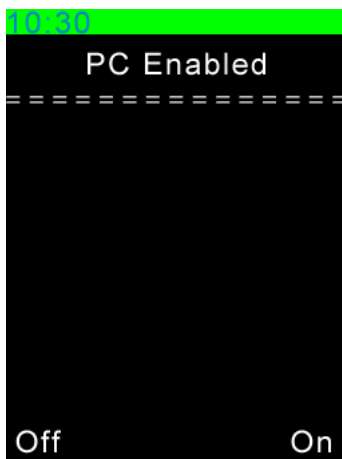
## SNYPER-LTE Graphyte User Manual

**Step 3.** Connect supplied USB cable to your SNYPER-LTE Graphyte and PC.

**Step 4.** Select 'PC Connect' from the main menu, and use the RIGHT button to enable PC Connect.

Windows Explorer will open automatically with a drive named 'GRAPHYTE'. If Windows explorer does not open automatically, open it by pressing and holding the Windows key and 'e'.

Figure 44. Enabling PC connect



The SNYPER-LTE Graphyte will turn on its USB port and appear as a USB drive named 'Graphyte' on the PC.

**Step 5.** Using Windows, copy the new software file to the Graphyte USB drive.

**Step 6.** Disconnect the SNYPER-LTE Graphyte from the PC by clicking the LEFT button, this will disable the USB drive connection. Do not physically unplug the USB cable until the update process has completed, so that power is supplied to the Graphyte throughout the update process.

**Step 7.** Press the back button to initiate software update.

**Step 8.** You will be prompted to confirm the software update. Click the RIGHT button to confirm performing a software update.

Figure 45. Confirm software update



Once you have confirmed the software update, the process will begin automatically. A progress bar will be displayed whilst the software update is installing, this will take approximately 25 seconds.

Figure 45. Progress bar



Once the software update is complete, the SNYPER-LTE Graphyte will turn off for approximately 90 seconds then power itself on.

On power up, a white spinning symbol will be displayed for approximately 60 seconds and then the SNYPER-LTE Graphyte will display the main menu.

**Step 9.** Confirm the software has updated by checking the 'About' menu. If successful, your SNYPER-LTE Graphyte is now ready for use.

If the software update was not successful, please contact your Siretta support representative.



# Safety and Product Care

## General Precautions

- » Do not exceed the environmental and electrical limits as specified.
- » Avoid exposing your SNYPER product to lit cigarettes, naked flames or to extreme hot or cold temperatures.
- » Never try to dismantle your SNYPER product. There are no components on your SNYPER product that can be serviced by the user. If you attempt to dismantle your SNYPER product, you will invalidate the warranty.
- » Do not connect any incompatible component or product to your SNYPER product signal analysers.



## Safety Recommendations

### PLEASE READ CAREFULLY

Be sure the use of this product is allowed in the country intended and the environment required. The use of this product may be dangerous and has to be used with caution in the following areas:

- » Where it can interfere with other electronic devices in environments such as hospitals, airports, aircrafts, etc
- » Where there is risk of explosion such as gasoline stations, oil refineries, gas works etc

It is responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product, any mark of tampering will compromise the warranty.

Should there be any doubt, please refer to the technical documentation and the regulations in force.



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Please refer to the Siretta Ltd website for the latest software and documents.

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## Definitions

Term	Definition
2G	2nd Generation Mobile Telecommunications
3G	3rd Generation Mobile Telecommunications
4G	4th Generation Mobile Telecommunications
ARFCN	Absolute Radio Frequency Channel Number
BSIC	Base Station Identity Code
CID	Cell Identity
dBm	Measured signal strength of the network in dBm
DL	Downlink
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
ECIO	Ratio of Energy Chip / Interference (broadband) in dB
EDGE	Enhanced Data rates for GSM Evolution
E-UTRA	Evolved UMTS Terrestrial Radio Access
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HSDPA	High Speed Downlink Packet Access
HSPA+	Evolved High-Speed Packet Access
IMEI	International Mobile Equipment Identity
ITU	International Telecommunication Union
LAC	Location Area Code
LAI	Location Area Identification
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LTE	Long Term Evolution

MCC	Mobile Country Code
MNC	Mobile Network Code
MNO	Mobile Network Operator
PCI	Physical layer Cell Identity
RSCP	Received Signal Code Power
RSRP	Reference Signals Received Power
RSRQ	Reference Signals Received Quality
RSSI	Received Signal Strength Indicator
SCR	Basestation Scrambling Code
SIM	Subscriber Identity Module
SMA	Sub Miniature version A
TAC	Tracking Area Code (Assigned by MNO)
UARFCN	UTRA Absolute Radio Frequency Channel Number
UL	Uplink
UMTS	Universal Mobile Telecommunications System (Same as 3G)
USB	Universal Serial Bus
UTRA	Universal Terrestrial Radio Access

For full list of SNYPER glossary terms see:

<https://www.siretta.com/snyper-glossary>



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