

User's Guide for the software

Leda

LISAMOBILE system

REV. 0.7

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Glossary

Azimuth	Calculated distance of the back scattered electromagnetic signal from a point of the target area. It is the projection of the position of the point along the system's linear positioner longitudinal direction.
Back scattering	Signal reflected by an object hit by a radar impulse.
Displacement/deformation maps	Large scale and detailed extended areal graphical representations of the movements and/or displacements of the target.
Frequency	The number of times in which a periodical phenomenon happens in the unit of time.
Interferogram	Complex image resulting from the complex conjugated product of two radar images. Represented in phase, provide information related to the movements happened during the time interval between two acquisitions.
JRC	Joint Research Centre. European Commission research centre.
Line of sight	Line or direction joining two points. It joins the point in which is located the system to a specific point under observation located in the target area.
LiSA	Linear Synthetic Aperture radar. The system is able to measure the behavior and the damage of structures, such as ground displacement typical of landslide activity. Such a system uses a ground based interferometric sensor (GBInSAR) based on the technique of synthetic radar aperture, completed and integrated by specific software packages, developed for this purpose, to purchase, process and analyze data collected from the sensor.
LiSALab (technology)	Derivative technology developed by Ellegi srl on the basis of the original LiSA and of the GBInSAR LiSA sensor. This technology belongs exclusively to Ellegi srl.

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Microwaves	Electromagnetic waves with a wave length between 25mm and 600mm.
Power or Phase images	Each pixels of a complex image representing a part (or cell) of the region in which the raw data are focalized. It can be associated to information related to the reflected signals from everything contained in the cell; therefore there are available two ways to represent the same image, in power and in phase. The first one provide an indication on the intensity level of the back scattered signals, the second one on its phase.
Radiometric amplitude	Intensity level of irradiated energy.
Range	Distance calculated by means of the signal "time of flight" and assuming that the electromagnetic waves have a speed equal to the light (3×10^8 m/s). It gives the distance of a point of the target area perpendicular to the system's linear positioner longitudinal direction.
SAR	Synthetic Aperture Radar. Radar antenna whose dimension is simulated to be bigger than the real one, sampling the antenna signals when it is in movement. This technique is useful to increase spatial resolution.
Signal to noise ratio	Shortened in 'S/N ratio'. It is the ratio between useful signal measured and the present background noise signal.
Scan frequency	Coherent emission and receiving of a frequency band in discrete packets.
Scatterometer	Scatterometer is a radar able to measure the capability of objects to reflect the electromagnetic energy that hits them.
Spatial resolution	In radar technology, it is the dimension of a measuring cell (pixel). Two objects of dimensions smaller than cell's ones have to belong to two different cells to be discriminated and/or measured.

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User's guide for the LISAMOBILE setting parameters software

The LEDA © is the program that manages the data acquisition performed by the GBInSAR LISAMOBILE © system.

In the upper left portion of its interface, in the “**Check Instr**” box, the LEDA © performs a control of the status of the main components of the GBInSAR LISAMOBILE © system. If a device is in a “NOK” (Not OK) status in the “Action” menu the command “Recheck Instr” will perform again the instruments check, the “Go on” command will continue the process and the “Quit & SD” command will quit the application and shut down the machine. When the green indicator is switched on the correspondent component is working properly. If all the devices work correctly a green notification (“All instruments OK”) will appear in the lower part of the check instr box Figure 2). The devices that are checked are:

- the display;
- the GPS receiver;
- the temperature controller;
- the linear positioner;
- the GSM modem
- the UPS;
- the radio frequency components.

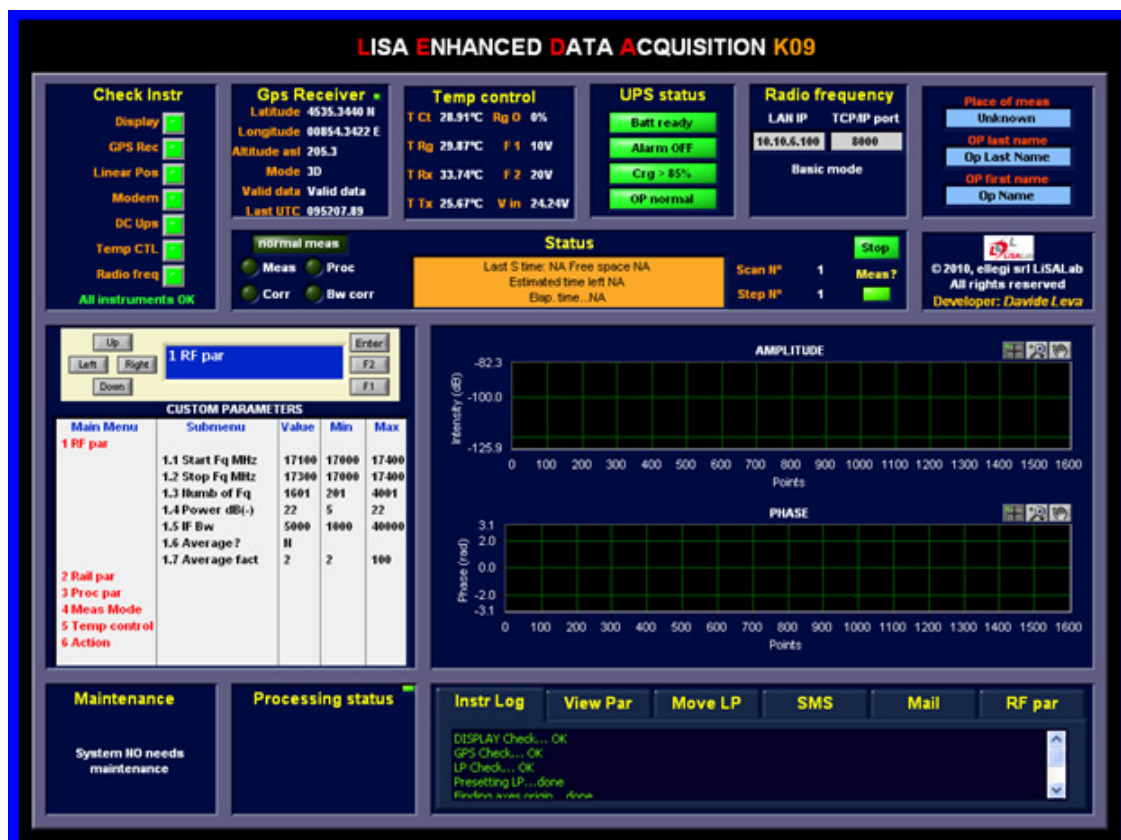


Figure 1: the GBInSAR LISAMOBILE system interface: the LEDA .

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Figure 2: the "Check Instr" box of the LEDA © interface.

At the right side of the "Check Instr" box are found the **"GPS Receiver"** and the **"Temp control"** boxes. In these two boxes are displayed the information about the GPS position and the temperatures measured by the system sensors (Figure 3). These information are:

- The measured latitude, longitude and altitude above the sea level;
- Mode, it can be 2D, 3D or Not available depending on the number of visible satellites;
- A green led to show the GPS status;
- Valid data, indicates if valid data is available;
- Last UTC, is the last Coordinated Universal Time registered;
- T Ct, is the temperature on the fans;
- T Rg, is the temperature of the fan controller;
- T Rx and T Tx, are the temperatures of the receiver and transmitter devices;
- F1, fan 1 voltage;
- F2, fan 2 voltage;
- V in, measuring head input voltage.

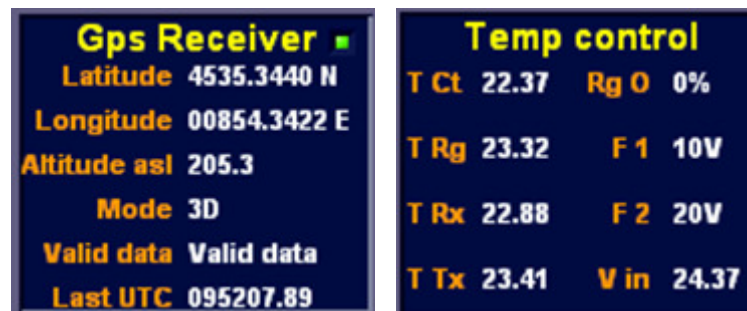


Figure 3: the "Gps Receiver" and the "Temp control" boxes of the LEDA © interface.

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The “**UPS status**” box is at the right side of the modem control box and displays information on the UPS status (Figure 4). There are four green indicators that turn to red if there is a warning on the UPS status. The four indicators are:

- Batt ready;
- Alarm ;
- Crg < 85%;
- OP normal.



Figure 4: the “UPS status” box of the LEDA © interface.

The “**Status**” box is at the center of the LEDA © interface and displays information on the status of the acquisitions and of the system (Figure 5). The “normal meas” indicator can turn to red and display the “meas restart” warning if the acquisitions for some reason were stopped and restarted. The “Stop/move” green and red indicators displays in real time when the system head is moving.

There are four indicators that will turn to green if:

- Meas, the system is measuring;
- Proc, the system is processing the acquired images;
- Corr, the system is correcting the processed images;
- Bw corr, dummy flag for future use.

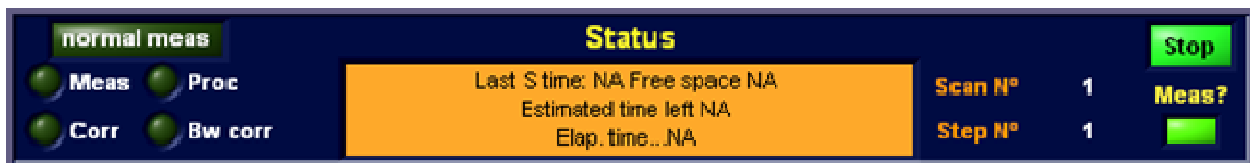


Figure 5: the “Status” box of the LEDA © interface.

The displayed information are:

- Last scan time;
- Free space (left on the system for the images storage);
- Estimated time left (before running out of storage space on the system);
- Elapsed time (from the beginning of the measurements);
- Scan N°;
- Step N° (of the current scan).

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The **system display emulator and the command menu box** are in the central right part of the LEDA © interface (Figure 6). In the command menu under the display emulator are displayed the command options, the custom parameters currently set and the actual position inside the command menu (highlighted with a light blue color).

The display emulator reproduces the command display found on the power base and is managed with the same logic: the menu has different “layers” and the “up” and “down” commands allow to move inside a layer, while the “left” and “right” commands allow to move in the lower or in the upper layers.

The “Enter” command allows changing the value of the highlighted feature, its value can be changed with the “up”, “down”, “left” and “right” commands and set to the new value using again the “Enter” command.

The “F1” button is associated to the “esc” function that is “escape without saving parameters.

The “F2” button is a dummy for future use. In the following pictures (Figure 7, Figure 8 and Figure 9) are presented the main layers of the control menu with a brief explication of the various sub menu layers.

Note: depending on the operating state of the system some features of the command menu might be hidden. For all the submenus in the “Value” field is shown the value currently set, and in the “Min” and “Max” field are shown the minimum and maximum values that can be selected.



Figure 6: the display emulator of the LEDA © interface.

CUSTOM PARAMETERS					CUSTOM PARAMETERS				
Main Menu	Submenu	Value	Min	Max	Main Menu	Submenu	Value	Min	Max
1 RF par					1 RF par				
	1.1 Start Fq MHz	17100	17000	17400	2 Rail par	2.1 Start mm	0	0	3000
	1.2 Stop Fq MHz	17300	17000	17400		2.2 Stop mm	3000	0	3000
	1.3 Numb of Fq	1601	201	4001		2.3 Num of step	601	3	5001
	1.4 Power dB(-)	22	5	22		2.4 Speed	2000	100	5000
	1.5 IF Bw	5000	1000	40000		2.5 Ret Speed	5000	100	5000
	1.6 Average?	N							
	1.7 Average fact	2	2	100					
2 Rail par					3 Proc par				
3 Proc par					4 Meas Mode				
4 Meas Mode					5 Temp control				
5 Temp control					6 Action				
6 Action									

Figure 7: the “RF par” and the “Rail par” submenus of the LEDA © interface command menu box.

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The “RF par” submenu (Figure 7) allows setting all the “radio frequency” parameters of the system, that are the start and the stop frequencies (expressed in MHz), the number of frequencies used inside the selected band, the emitted power (expressed in dBm), the IF bandwidth, the presence of the average option and the average factor. For further information on the choice of the system parameters please refer to “Appendix A”. The “Rail par” submenu (Figure 7) allows setting the linear position parameters that are the start and the stop position of the synthetic aperture, the number of steps performed inside the aperture, the moving speed of the carriage during the acquisition and the moving speed of the carriage when returning to the start position.

CUSTOM PARAMETERS					CUSTOM PARAMETERS				
Main Menu	Submenu	Value	Min	Max	Main Menu	Submenu	Value	Min	Max
1 RF par					1 RF par				
2 Rail par					2 Rail par				
3 Proc par					3 Proc par				
	3.1 Image size	801	51	1201	4 Meas Mode				
	3.2 Range min	5	5	4001		4.1 Stop&GO	Y		
	3.3 Range MAX	1005	5	4001		4.2 Processing	N		
4 Meas Mode						4.3 Join Work	N		
5 Temp control					5 Temp control				
6 Action					6 Action				

Figure 8: the “Proc par” and the “Meas Mode” submenus of the LEDA © interface command menu.

The “Proc par” submenu (Figure 8) allows setting the dimensions of the images that will be produced by the system (if the “processing” option is activated in the “Meas Mode” submenu) that are the image size (in pixels) and the image minimum and maximum range values. The produced images will have the same sizes in both the range and azimuth directions and the azimuth dimensions are symmetric.

The “Meas Mode” submenu (Figure 8) allows enabling and disabling the “Stop&GO” mode, the “Processing” option and the “Join Work” option. These functions are enabled if the “Y” value is set, otherwise are disabled if the “N” value is set.

If the “Stop&GO” mode is disabled the system will acquire images in the “Continuous” mode, that is much faster because the system will perform the acquisitions without stopping at each step. The “Processing” mode enables the images processing, if is disabled only the raw data will be acquired and stored. The “Join Work” option stores the acquired data in the same work, even if the acquisitions are aborted or the system is switched off. If this option is disabled the system will create a new work at every restart.

The “Temp control” submenu (Figure 9) allows setting the parameters of the two measuring head fans. These parameters are the Target temperature, the functioning mode (always “off”, always “on” or “automatic”) and the low speed and high speed voltages.

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The “Action” submenu (Figure 9) allows selecting the desired action to be performed: “start mesa” starts the acquisitions, “Quit & SD” quits the application and shuts down the machine, “load def par” loads the default parameters, “save user par” saves the current parameters as user parameters, “load user par” loads the previously saved user parameters and “del user par” deletes the user parameters.

CUSTOM PARAMETERS					CUSTOM PARAMETERS				
Main Menu	Submenu	Value	Min	Max	Main Menu	Submenu	Value	Min	Max
1 RF par					1 RF par				
2 Rail par					2 Rail par				
3 Proc par					3 Proc par				
4 Meas Mode					4 Meas Mode				
5 Temp control					5 Temp control				
	5.1 F1 T deg	0	0	100	6 Action				
	5.2 F1 (10ff 20n 3A)	3	1	3		6.1 Start meas	N		
	5.3 F1 Volt min	10	10	24		6.2 Quit & SD	N		
	5.4 F1 Volt MAX	20	10	24		6.3 Load def par	N		
	5.5 F2 T deg	0	0	100		6.4 Save user par	N		
	5.6 F2 (10ff 20n 3A)	3	1	3		6.5 Load user par	N		
	5.7 F2 Volt min	10	10	24		6.6 Del user par	N		
	5.8 F2 Volt MAX	20	10	24					
6 Action									

Figure 9: the “Temp control” and the “Action” submenus of the LEDA © interface command menu.

The Maintenance and the Processing Status boxes (Figure 10) are under the command menu box and are used to display maintenance information and processing status information.



Figure 10: the “Maintenance” and the “Processing status” boxes of the LEDA © interface.

If the “RF maintenance” warning appears in the Maintenance box contact as soon as possible Ellegi i.e. for an RF maintenance intervention.

The Signal’s Amplitude and Phase screens (Figure 11) are in the central part of the LEDA © interface under the command menu box and are used to display in real time the amplitude and the phase values of the received radar signal. In the following figure (Figure 11) is shown an example of phase and amplitude responses having the system working correctly. In Figure 12 is shown an example of phase and amplitude responses having the system not working correctly.

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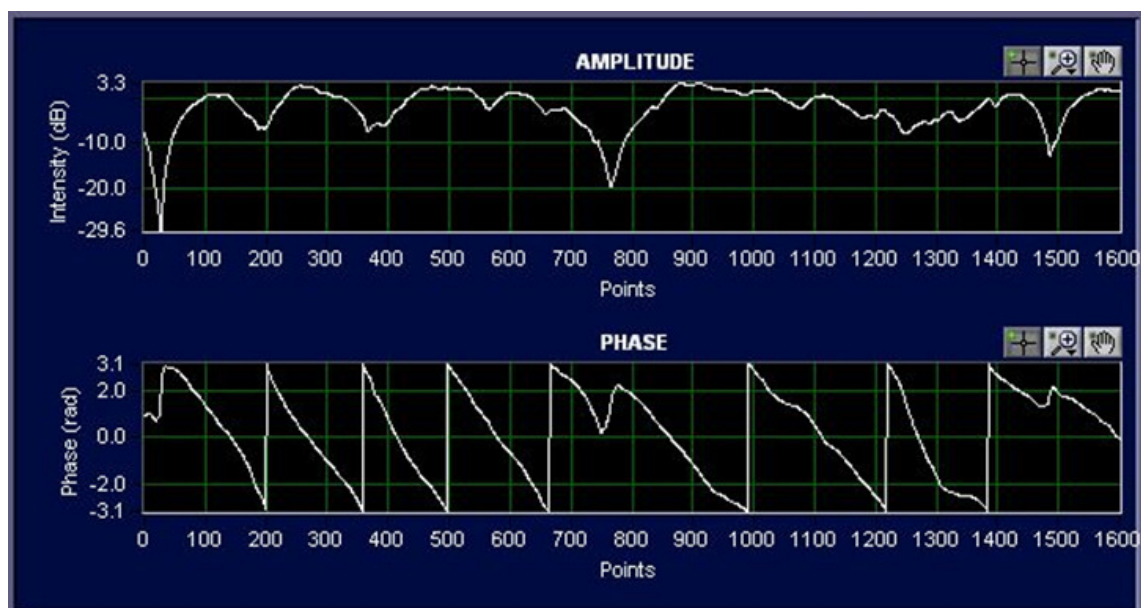


Figure 11: the Amplitude and Phase screens of the LEDA © interface - system working correctly.

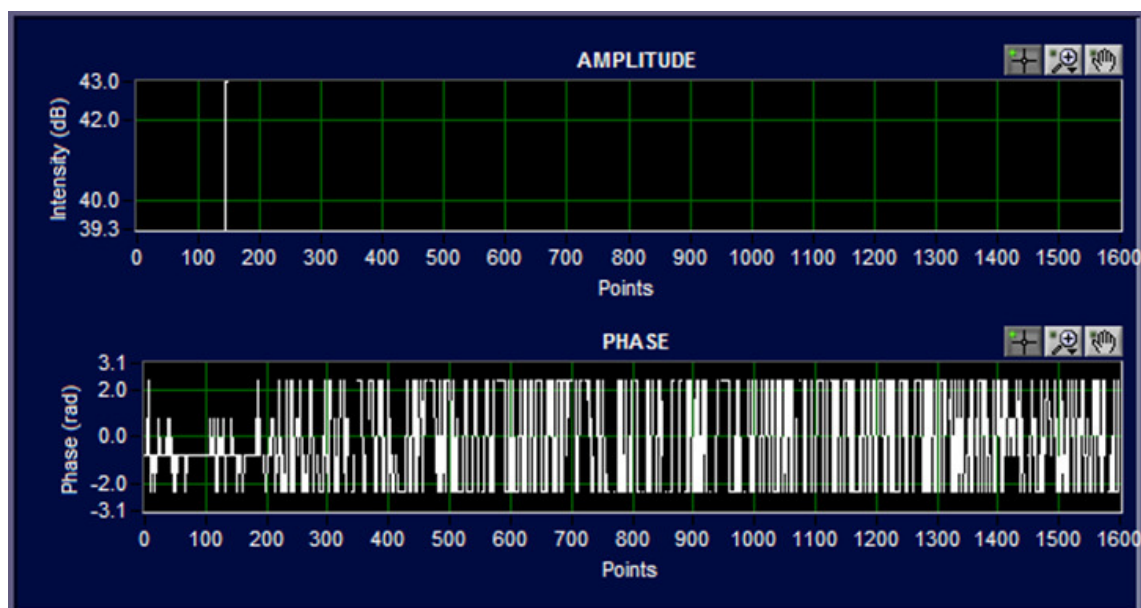


Figure 12: the Amplitude and Phase screens of the LEDA © interface- system not working correctly.

The “Instr Log” tab (Figure 13) is in the central part of the LEDA © interface under the amplitude and phase screens and it is used to resume the Logs of the instruments. The scroll bar at the right side of the tab allows scrolling all the registered LOGs.

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Figure 13: the "Instr Log" tab of the LEDA © interface.

The **"View Par"** tab (Figure 14) is in the central part of the LEDA © interface under the amplitude and phase screens and it is used to display the acquisition and processing parameters. The visualized information are the start and the stop frequencies (expressed in GHz), the number of frequencies used inside the selected band, the start and the stop position of the synthetic aperture, the number of steps performed inside the aperture, the maximum and minimum range of the processed image, the image size, the IF bandwidth, the microwave board serial number and the UPS battery level for the forced shutdown (Min indicates that the forced shut down will be performed as soon as the power line is missing). The "Proc?" indicator is switched on if the images processing is enabled. The other two indicators are dummies for future developments.



Figure 14: the "View Par" tab of the LEDA © interface.

The **"Move LP"** tab (Figure 15) is in the central part of the LEDA © interface under the amplitude and phase screens and it contains the commands to manually move the linear positioner carriage. The desired position of the carriage (expressed in cm) has to be typed in the "Position (cm)" display, and the desired moving speed has to be typed in the "Speed (cm/min)" display. The "GO" button will send the command and move the carriage at the selected speed to the desired position.

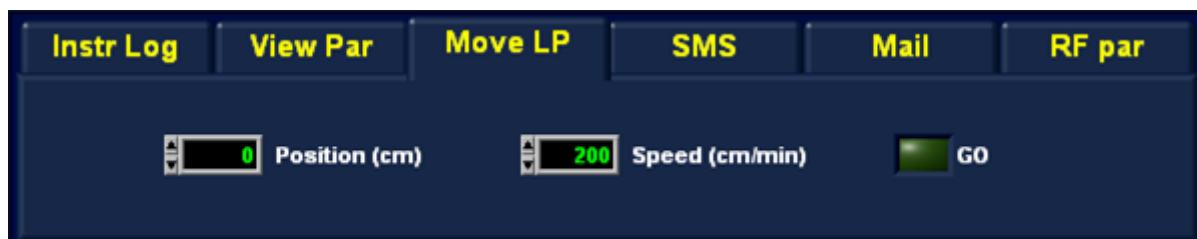


Figure 15: the "Instr Log" tab of the LEDA © interface.

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The **“SMS” tab** (Figure 16) is in the central part of the LEDA © interface under the amplitude and phase screens and it contains the commands to set the SMS notifications frequencies and the recipients list. It also features an indicator to display the instantaneous GSM field intensity.

The numeric indicator at the left side of the sending list is used to scroll the recipients' telephone numbers. The **“Add”** button opens a dialogue box (Figure 17) where the user can write the new name and the telephone number to be added to the e-mail sending list; the **“Send?”** switch enables the notifications via SMS to this recipient. The **“Del”** button is used to delete from the sending list the entry currently displayed, while the **“Chg”** button is used to enable/disable the SMS notifications towards the entry currently displayed (when the green indicator at the right of the entry telephone number is switched on the SMS notifications are enabled). The **“Par”** button opens a dialogue box (Figure 17) where the user can set the notifications frequencies (the interval between two notifications, expressed in number of scans).

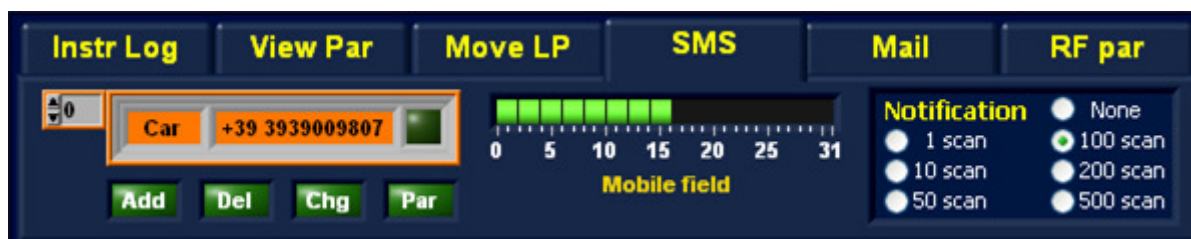


Figure 16: the “SMS” tab of the LEDA © interface.

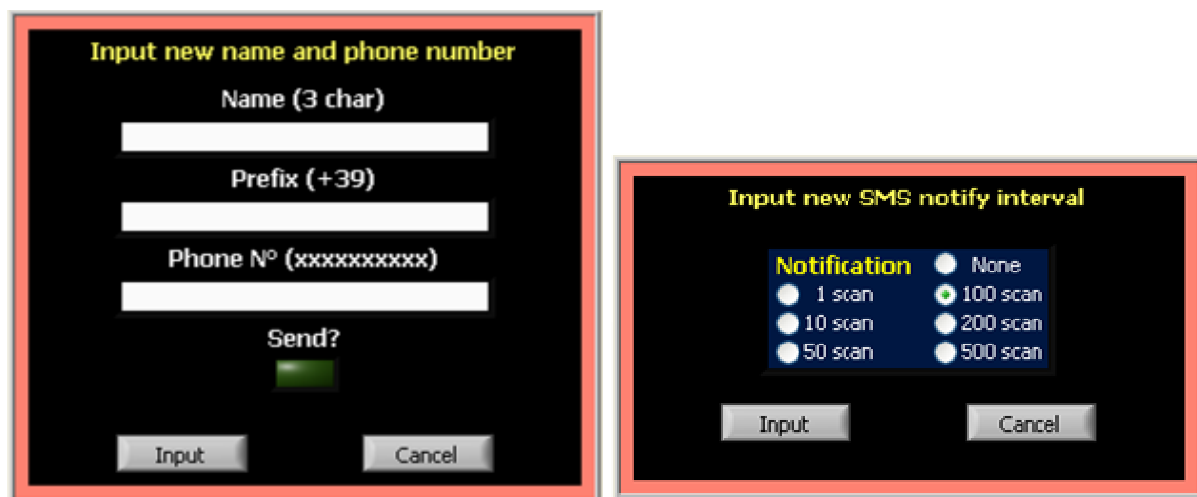


Figure 17: the dialogue boxes used to add a new name and phone number to the SMS sending list (left) and to set the notifications frequency.

The **“Mail” tab** (Figure 18) is in the central part of the LEDA © interface under the amplitude and phase screens and it contains the commands to set the e-mail notifications frequencies and the recipients list. The recipients list displays its entries one by one and it can be scrolled using the numeric indicator on its left side.

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The “Add” button opens a dialogue box (Figure 19) where the user can write the new e-mail address to be added to the e-mail sending list; the “Send?” switch enables the notifications via e-mail to this recipient. The “Del” button is used to delete from the sending list the entry currently displayed, while the “Chg” button is used to enable/disable the SMS notifications towards the entry currently displayed (when the green indicator at the right of the entry telephone number is switched on the SMS notifications are enabled). The “Par” button opens a dialogue box (Figure 19) where the user can set the notifications frequencies (the interval between two notifications, expressed in number of scans) and the e-mail parameters (Smtp Server name, LISAMOBILE system address, Remote connection name and the connection type that can be “remote”, “LAN” or “none”).



Figure 18: the “Mail” tab of the LEDA © interface.

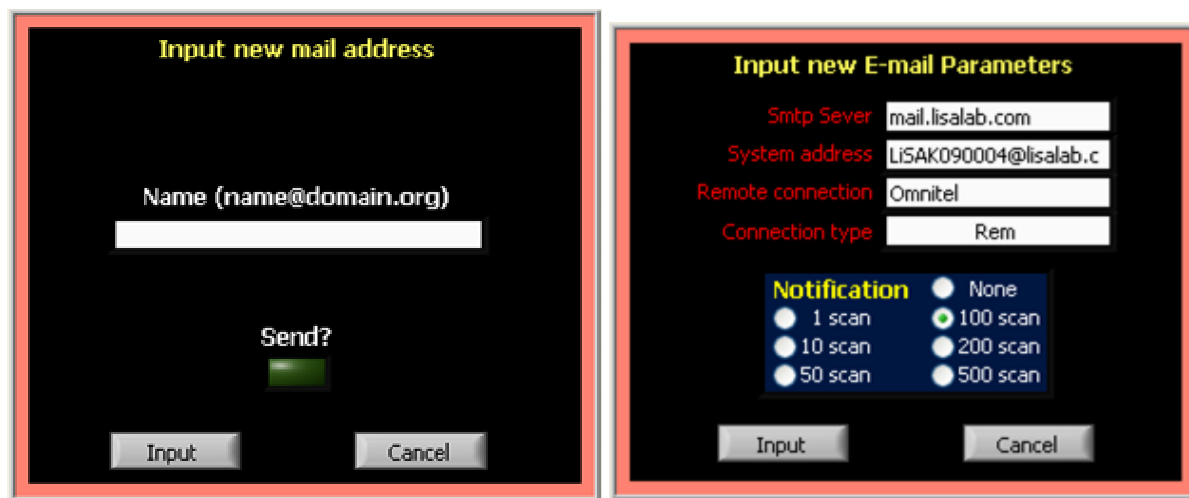


Figure 19: the dialogue boxes used to add a new e-mail address to the e-mail sending list (left) and to set the notifications properties.

The “RF par” tab (Figure 20) is in the central part of the LEDA © interface under the amplitude and phase screens and it contains commands only available in the advanced mode.

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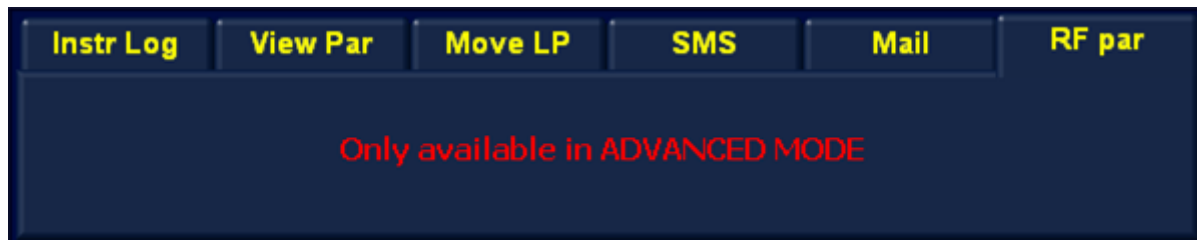


Figure 20: the “RF par” tab of the LEDA © interface.

The campaign and operator information box (Figure 21) is in the lower left corner of the LEDA © interface and it contains the information about the place of measurement and the operator name and surname.



Figure 21: the campaign and operator information box of the LEDA © interface.

LiSAMobile system tune up

The LEDA © is the program that manages the data acquisition performed by the GBInSAR LISAMOBILE© system.

The “RF par” submenu (Figure 7) allows user setting all the “radio frequency” parameters of the system, that are:

- the start frequency (expressed in MHz);
- the stop frequency (expressed in MHz),
- the emitted power (expressed in dBm) this value represents the power at the antenna input.

All these values can be set by users between two predefined software limits, the user cannot overtake these limits.

These are the limits:

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Parameters	Lower limit	Upper limit	Minimum Variable step
Start frequencies	17,105 MHz	17,295 MHz	1 MHz
Stop frequency	17,105 MHz	17,295 MHz	1 MHz
Emitted power at the antenna input	5 dBm	14 dBm	1 dBm

The maximum EIRP output power using antennas with 10dB gain is dBm $14 \pm 0,5 \text{ dB} + 10 \text{ dB} = 24 \text{ dBm} \pm 0,5 \text{ dB}$.

Using the “limited power” modality the user is forced by the software to use only values of the above parameters that are respectful of the ETSI, FCC and IC normatives according the market in which the system is used.

- For European market according the antennas’ gain the LiSamobile subsystem regulates the values of the power output to be always below the 26dBm of EIRP.
- For Canada the EIRP is limited to 24.7dBm average.
- In USA the max EIRP is related to the extension of the frequencies, according the FCC par 90 the EIRP is calculated accordingly. The system limits the maximum “Emitted power at the antenna input” in order to respect the calculated EIRP given the extension of the frequency.

The system start always in the “limited power modality” and the user can regulates the EIRP according the antennas gain its currently using.

The changes are made using the “Manage Antennas” menu.

When the “Manage Antennas” button is pushed on the “Main LiSamobile” control bar the Antennas Manager Window appears on the user’s screen (Figure 22).

This module allow the user to select the specific antenna models are mounted and used on the system and to consequently set the system power output in order to fulfill the emission thresholds regulations. It also allow to import new antennas characteristics and to therefore create an “antennas database” on the LiSamobile system that could be then used in order to select the better antennas for each monitoring campaign respectful of the varius normatives.

The Antennas database is displayed in the upper left list where a checkmark indicates the antennas in use. For each entry of this list are displayed the amplitudes expressed in degrees of the Horizontal and Vertical lobes (“H lobe” and “V lobe”), the antennas gain expressed in dB and a brief comment.

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The “Add” control button will add a new entry to the antennas list and the user can insert the lobe dimensions, the gain and a comment in the correspondent fields. When an entry of the list is selected the control buttons “Del”, “Edit” and “Use” will respectively allow to delete, edit or use the selected antennas. The “Limit Pow” control button allow to change the acquisition mode from “Power Not Limited” to “Power Limited”. If the “Power Limited” option is selected and confirmed this software taking into account the declared gain of the antennas in use will automatically limit the emitted power of the LiSAmobile system in order to fulfill the emission thresholds of the various regulations active in the territories in which the system is operated.

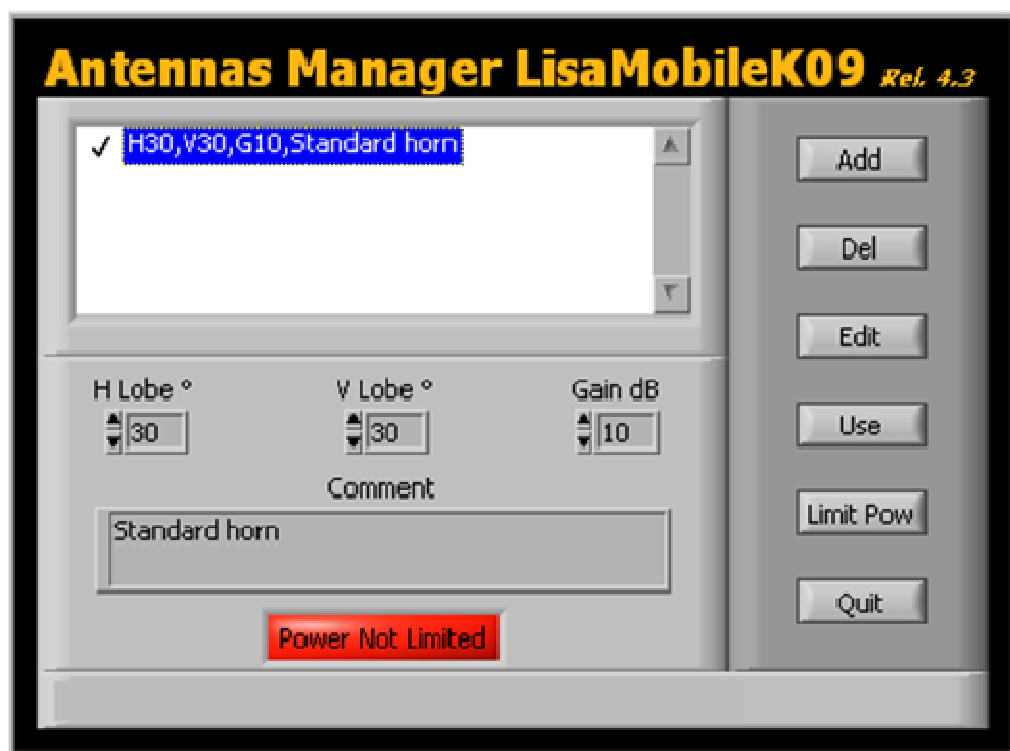


Figure 22: The Antennas Manager Window and normative power output limit anable control.

WARNING: USERS ARE HOWEVER EVENTUALLY RESPOSABILITY TO CROSS CHECK THAT THE LISAMOBILE SYSTEM HAVE ALL THE RADIOFREQUENCY PARAMETERS SET IN SUCH A WAY TO BE RESPECTFUL OF THE LOCAL TRANSMISSION RULES.

USERS MUST BE SURE TO HAVE REQUESTED AND OBTAINED A LICENSE TO TRANSMIT OF REQUESTED BY LOCAL NORMATIVES IF NECESSARY AND BE AWARE ABOUT THE RESTRICTIONS ON THE OPERATION OF SYSTEM.

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APPENDIX A - Technical information and recommendations

Spatial Resolution graphs and parameters setting depending on the distance from the monitored target

The LISAMOBILE[®] system produces images having a spatial resolution (resolutions in the range and in the azimuth directions) that varies depending on the selected measuring parameters and on the distance of the observed target. Also the maximum range (distance reachable) is linked to the selected parameters.

In the following graphs are presented the LISAMOBILE system's theoretical range and azimuth resolution graphs (Figure 23 and Figure 24) and the LISAMOBILE system maximum range graph (Figure 25).

The theoretical range resolution varies only depending on the used bandwidth. The bigger is the used bandwidth the better will be the range resolution.

The theoretical azimuth resolution at a fixed central frequency (in this case is 17.2 GHz) depends on the synthetic aperture length and on the distance from the system. The longest is the synthetic aperture and the closest is the target, the better will be the obtained azimuth resolution.

The maximum range depends on the used bandwidth and on the number of frequency points. The highest is the number of frequency points and the smallest is the used bandwidth, the greater will be the obtainable maximum range.

Therefore, as shown on the graphs of Figure 24 and Figure 25, for normal applications it can be stated that the LISAMOBILE optimal range is up to 3 km, between 3 km and 4.2 km the quality of the results could be highly affected by the local conditions, and over 4.25 km the feasibility of the measurements can not be guaranteed without a detailed inspection on the particular situation.

Having more frequency points will increase the time required for the acquisition of each single radar image, and decreasing the bandwidth will decrease as well the range resolution of the image. Therefore the user should set the measuring parameters taking into account the trade off that exists between having high performances in terms of range resolution and having high performances in terms of maximum range.

Also the time required for the acquisition of a single radar image could be important, for example in the monitoring of fast displacements, and therefore the trade off between smaller acquisition times and high performances in terms of maximum range can become crucial.

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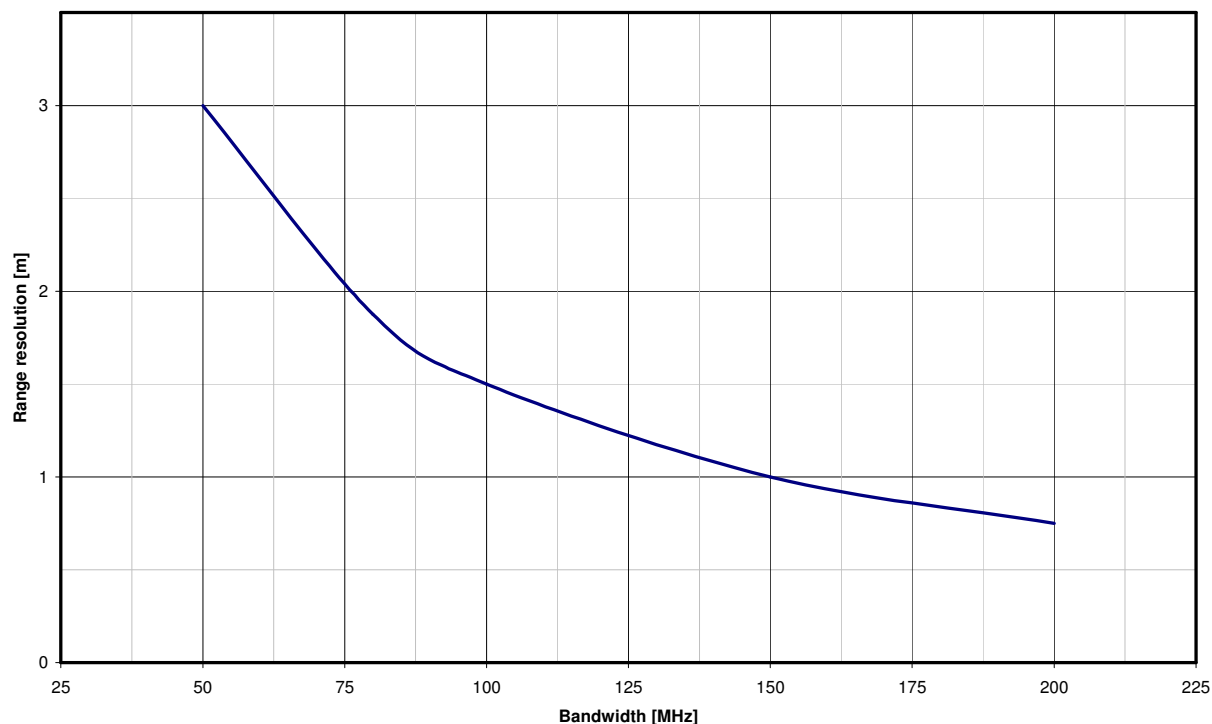


Figure 23: Range resolution graph.

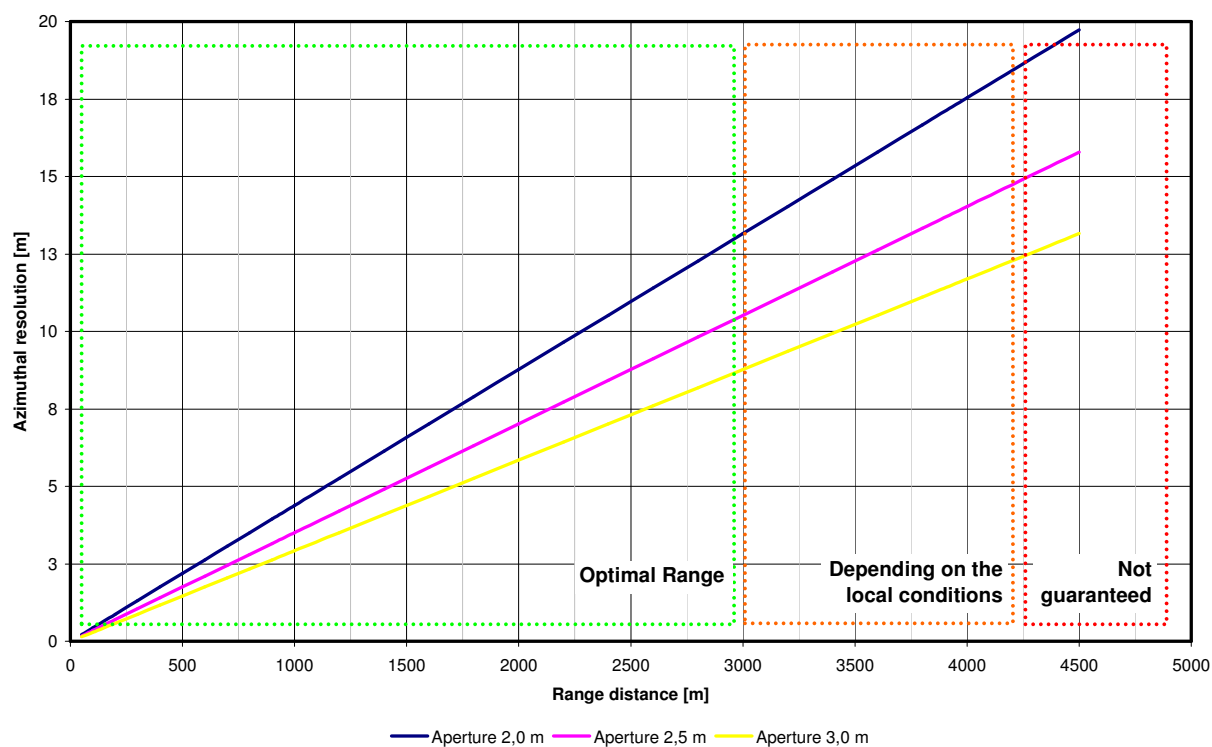


Figure 24: Azimuth resolution graph.

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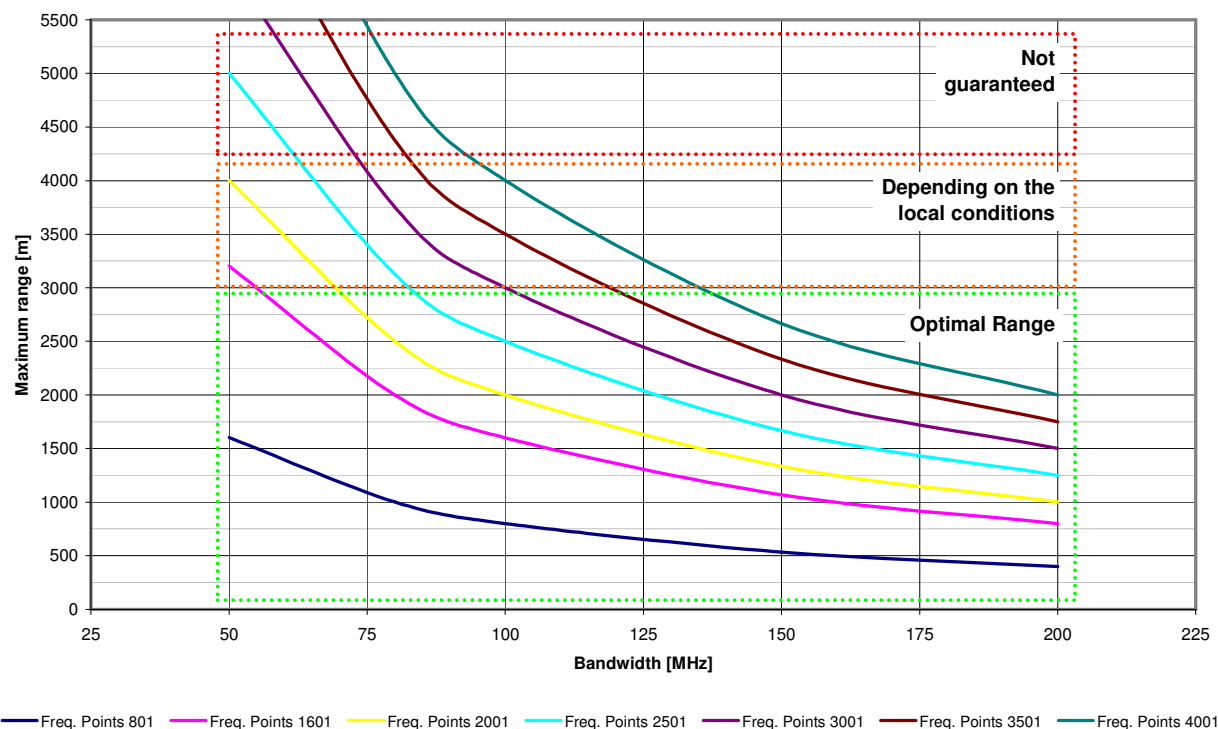


Figure 25: Maximum range graph.

IF value setting

The value of the IF parameter affects the speed of the GBInSAR LISAMOBILE © system's measurements: the higher is the IF value the smaller will be the time required for a single measure, that in some applications might result in decreasing the impact of the atmospheric effects on a single image. On the other hand, higher IF values result in lower levels of the images signal-to-noise ratio, and therefore lower performances in terms of precision and accuracy of the measurements.

The measurements speed should be set depending on the observed phenomenon features, on the scenario's characteristics and on the trade off between fast or precise (and accurate) measurements. A good compromise is found in the default value of the IF parameter, which is normally set to 5.000.

The LEDA software's system display emulator (Figure 7) allows the IF parameter value to be set between 1.000 and 40.000, but it is recommended to change it only if necessary. A good solution could be to firstly change it to a value of 10.000 and perform some measurements to appreciate if changing the IF value is effective in improving the measurements quality concerning the atmospheric effects impact, and to further increase it using the same procedure to a maximum 15.000.

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Anyway it is always recommended to ask Ellegi technical support and recommendations before setting the IF parameter to a value that is different to its default one of 5.000.

Example: a procedure for the system's parameters setting

The optimal setting of the system's parameters depends on the observed scenario characteristics and on the desired output features.

The following procedure should help the user in the choice of the system's parameters:

1. Chose the desired range resolution and consequently select the needed bandwidth according to the graph of Figure 23;
2. Knowing the maximum distance of the target area to be measured, select the synthetic aperture length needed to achieve the desired azimuthal resolution, according to the graph of Figure 24. It is recommended to select the system parameters in order to have similar or equal range and azimuthal resolution dimentions, extremely stretched resolution cells might produce poor quality results;
3. Knowing the maximum distance of the target area to be measured and the bandwidth selected in the first step of this procedure, select the number of frequency points according to the graph of Figure 25. the maximum range indicated in the graph must be grater than the maximum distance of the target area;
4. Perform a measure to decide weather or not the time required for the acquisition of a single measure and the impact of the atmospheric effects suits the monitoring requirements;
5. If the monitoring requirements are not satisfied, an increase the IF value, a decrease of the number of frequency points and/or a decrease of the synthetic aperture's length will decrease the time required for a single acquisition.

Antennas types and emission diagrams

The GBInSAR LISAMOBILE © system can be used with different horn antennas. Different antennas have different emission diagrams that means wider or narrower visible sceneries, therefore depending on the monitored scenario one kind of antenna might be more suitable than another.

Because of the peculiar characteristics of each monitoring scenario, the choice of the optimal antenna is an issue that often requires on field testing.

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In the following picture (Figure 26) are presented two emission diagrams for the SGHA-15 and the SGHA-10 antennas. From these emission diagrams it can be observed that the SGHA-15 has a -3 dB emission beam width of approximately 30°, while the SGHA-10 has a -3 dB emission beam width of approximately 60°. The area illuminated by the emitted signal is normally wider than the -3 dB emission beam. The -3 dB beam width is generally used as a safety value.

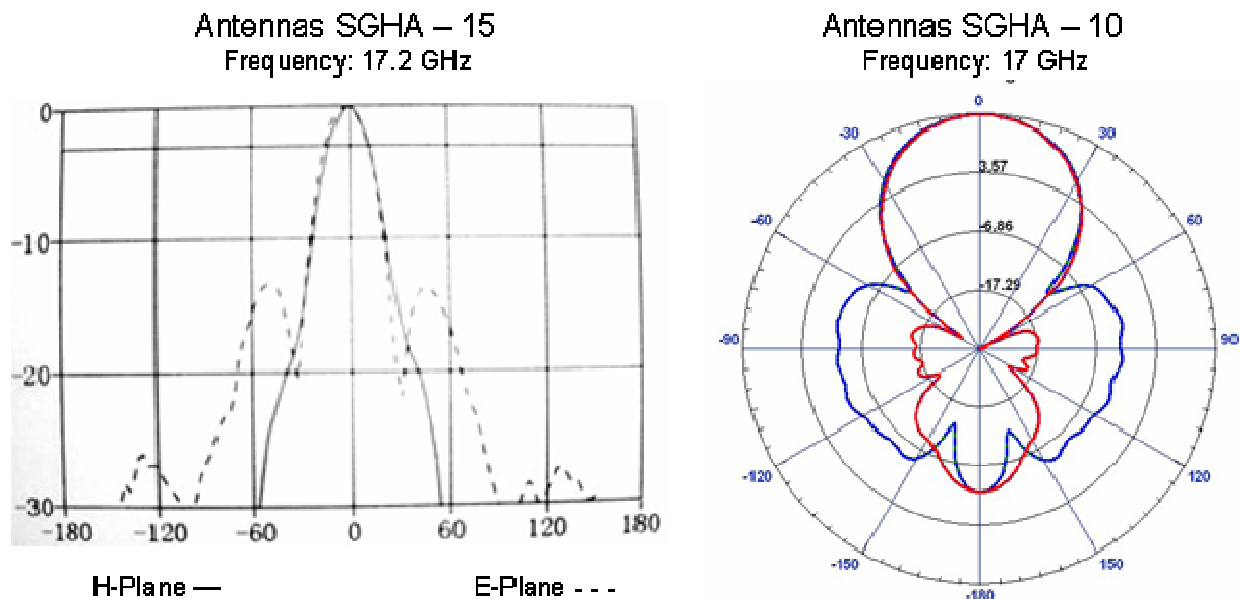


Figure 26: Emission diagrams for the SGHA-15 antennas (left) and the SGHA-10 antennas (right).

Precautions for the system switching off

To definitively switch off the LISAMOBILE system at the end of a measuring session (e.g. after a periodical check campaign or before a maintenance intervention) execute the “Quit” command, then execute the “Load default parameters” command and finally execute the “shut down” command.

Turn off the LP and MW switches and afterwards the power base main power switch ONLY after having verified that the display on the power base has completely switched off.

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