
User Manual

SCOS

Course Project for "Instrumentation and Measurements for
Communication Systems"
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Graphical User Interface

It is possible to divide the graphical user interface of this instrument in two parts: Input/Request Section and Output Section.

The first section on the left contains all the requests, functions that an user can select.

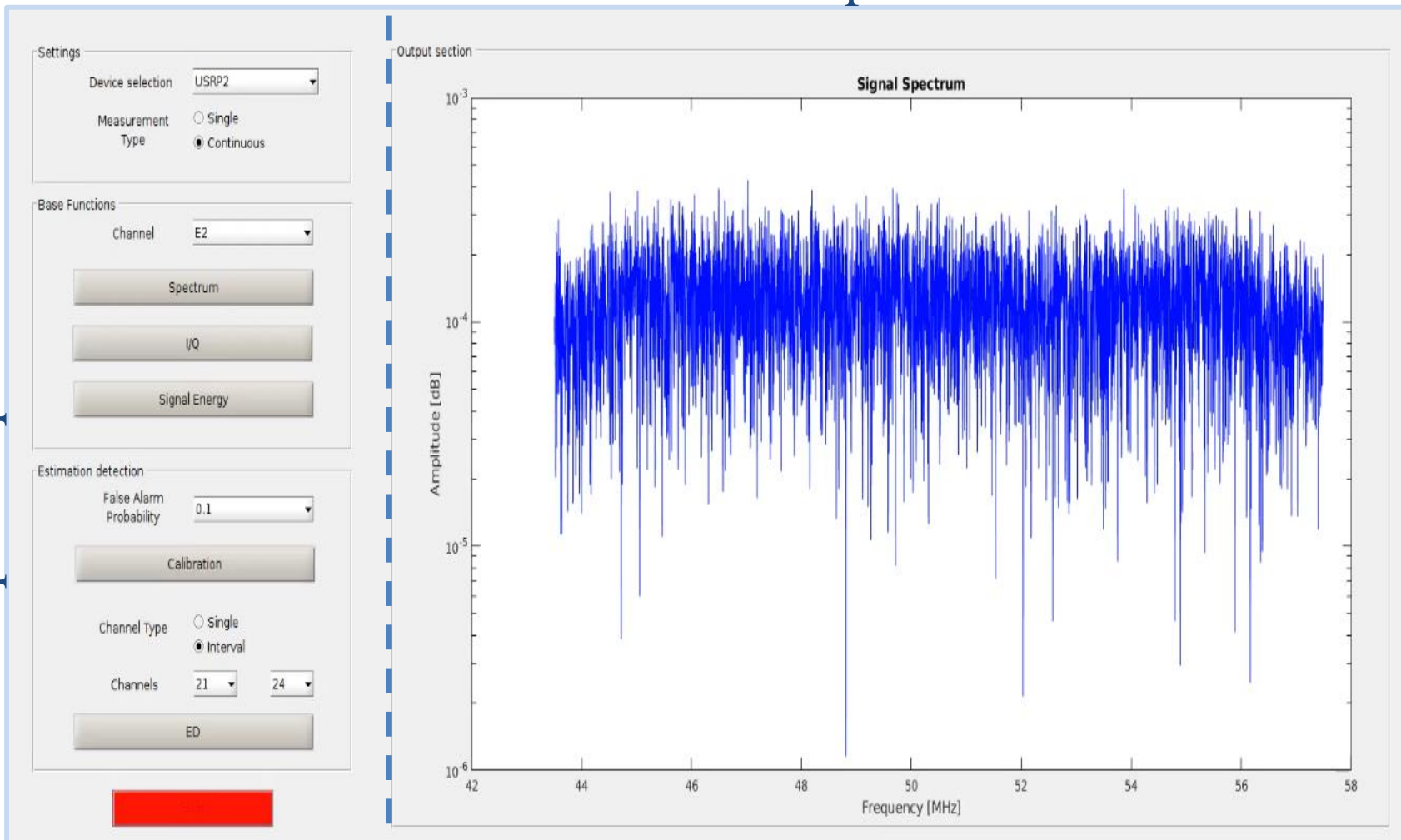
The other section on the right, the output section, is used to display all the results.



Graphical Interface Presentation

Output Section

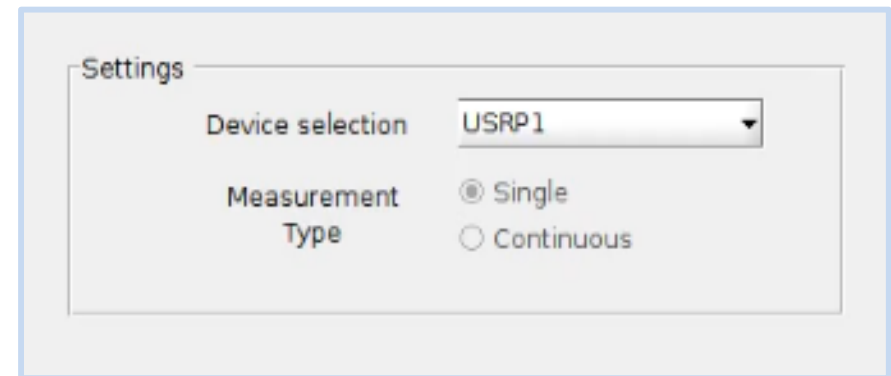
Input/Request Section





2. Settings

In the Settings Panel is possible to select the available devices for the measurements and the measurement type: single or continuous.



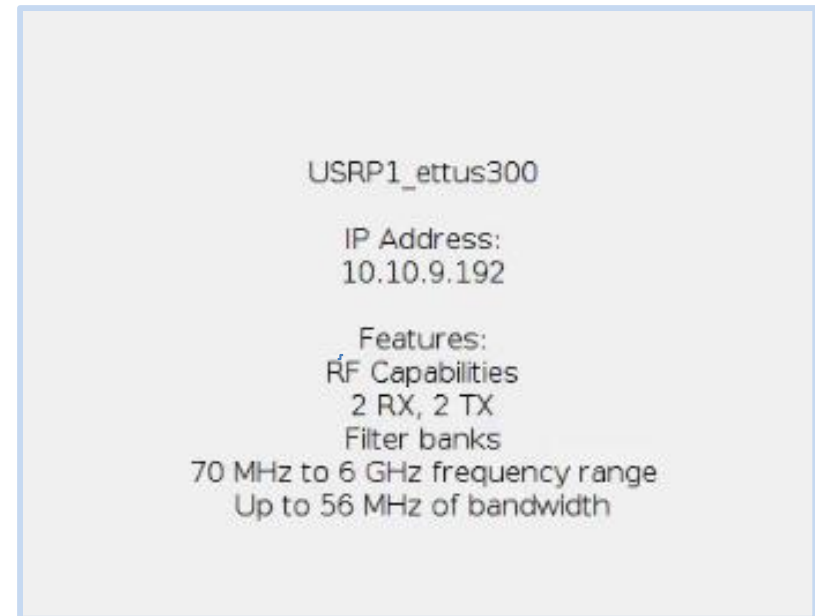
2.1 Device Selection



The Device Selection option shows the list of the connected devices that are available for performing measurements: USRP1 or USRP2.

When one of these is selected, some characteristics are shown in the output section:

- name;
- IP Address;
- features.





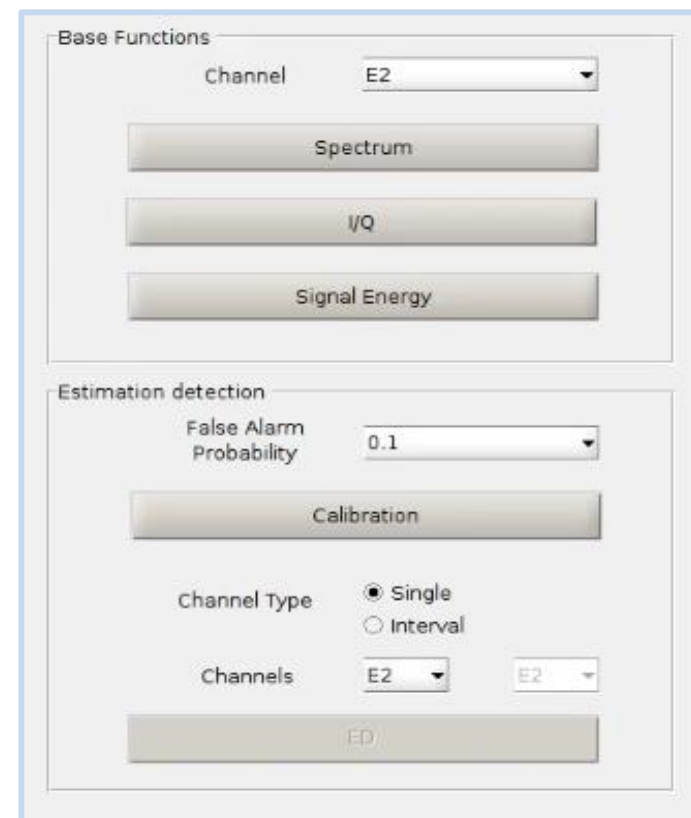
2.2 Measurement Type

The Measurement Type settings allows user to choose a single or a continuous measurement.

In single measurement setting the analysis is performed only one time and the result is updated in the output section.

In the continuous measurement setting the analysis and the result are continuously refreshed.

If single measurement type is chosen all the possible functions are shown.





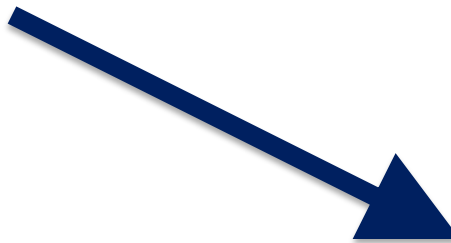
2.2 Measurement Type

The same happens for the continuous case.

All the operations can be executed in a continuous way, except the calibration.

Another button, 'Stop', appears.

It is necessary in order to stop the continuously execution of the desired function.



Settings

Device selection USRP1

Measurement Type Single Contin...

Base Functions

Channel E2

Spectrum

I/Q

Signal Energy

Estimation detection

False Alarm Probability 0.1

Calibration

Channel Type Single Interval

Channels E2 E2

ED

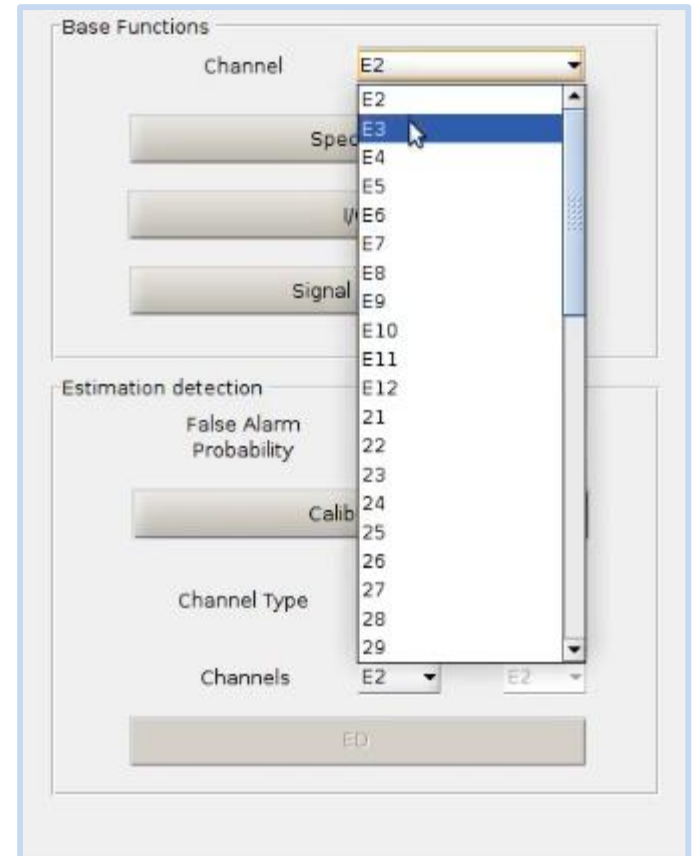
Stop



3. Base Functions

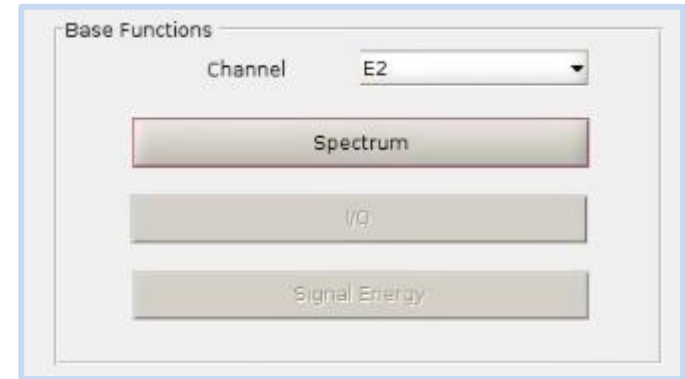
3.1 Channel

Channel:
List of TV channels available for the measurements.

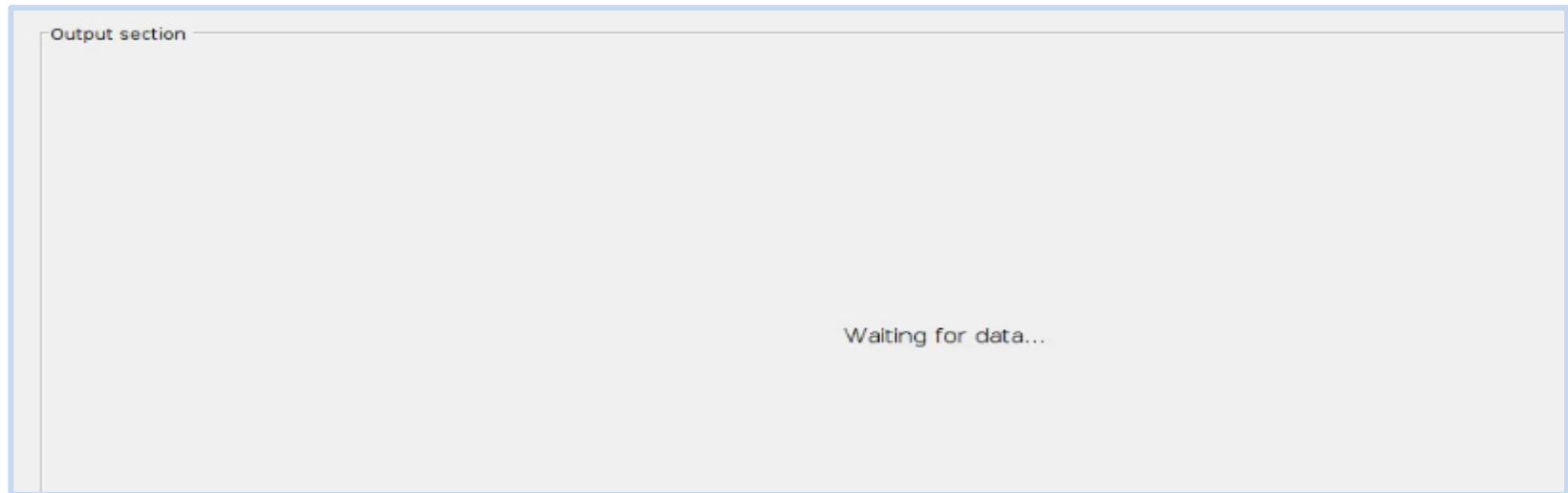


3.2 Spectrum

With the Spectrum button is possible to perform the spectrum analysis of the input signal.



The output data are processed ...

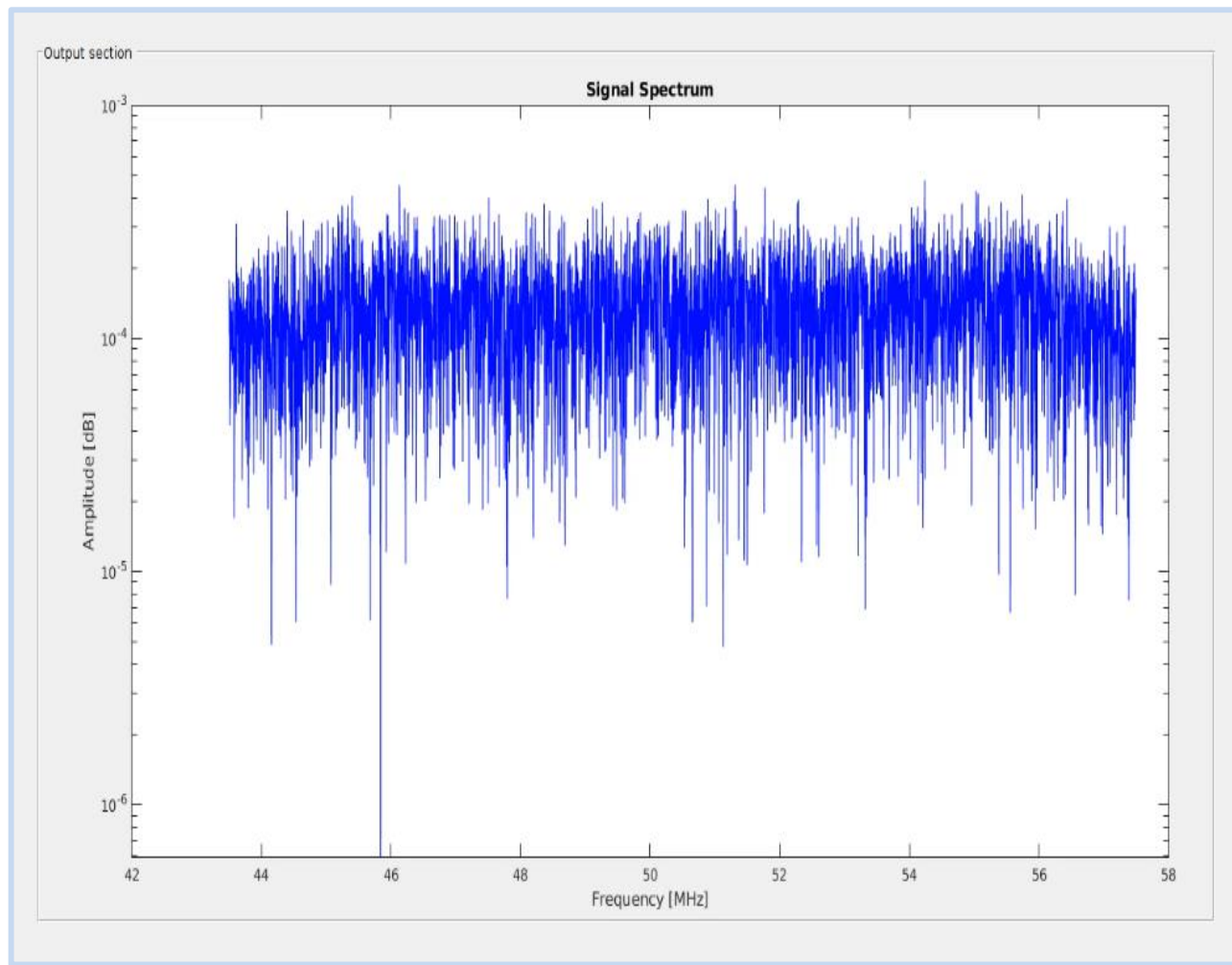




3.2 Spectrum

The result appears in the output section.

The amplitude value is reported in dB.





3.2 Spectrum

The same analysis can be done in a continuous mode. The result is continuously updated.

In this case the Stop button becomes available.

When it is pressed the analysis stops and all the other functions become available.

Base Functions

Channel: E2

Spectrum

I/Q

Signal Energy

Estimation detection

False Alarm Probability: 0.1

Calibration

Channel Type: Single Interval

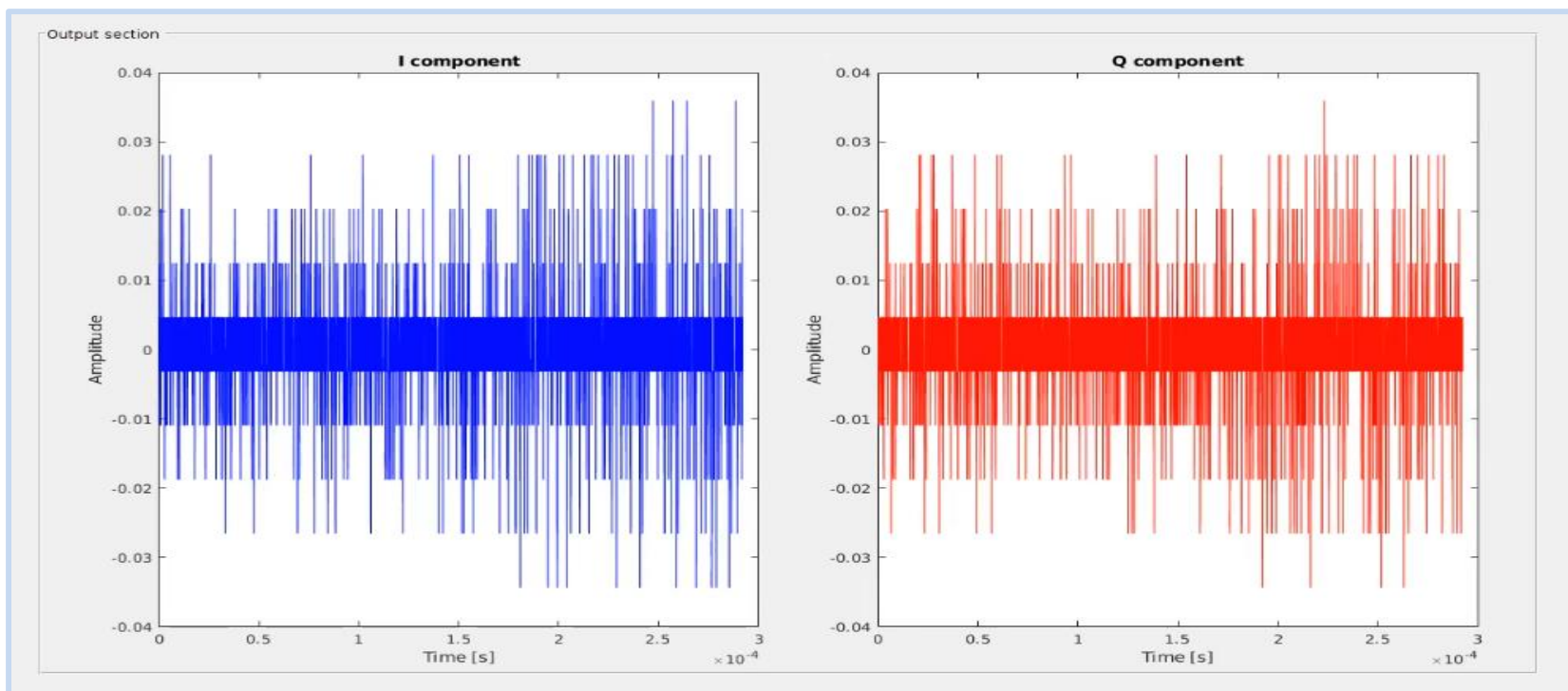
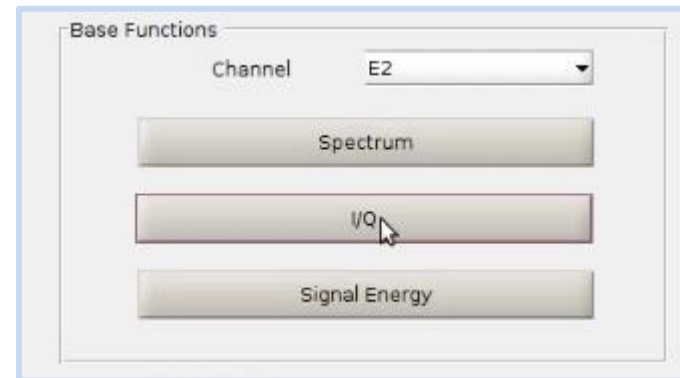
Channels: 21 24

EP

Stop

3.3 I/Q

The result of the I/Q button are the I and Q components of the input analyzing signal. The operating principle of the continuous mode is the same described before for the spectrum.



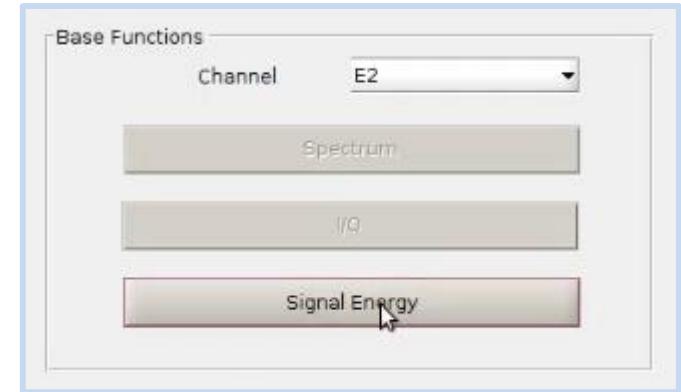


3.3 Signal Energy

The Signal Energy button shows the energy of the signal.

Also in this case the result is visible in the output section.

In the continuous mode this value is continuously refreshed.





4. Estimation Detection

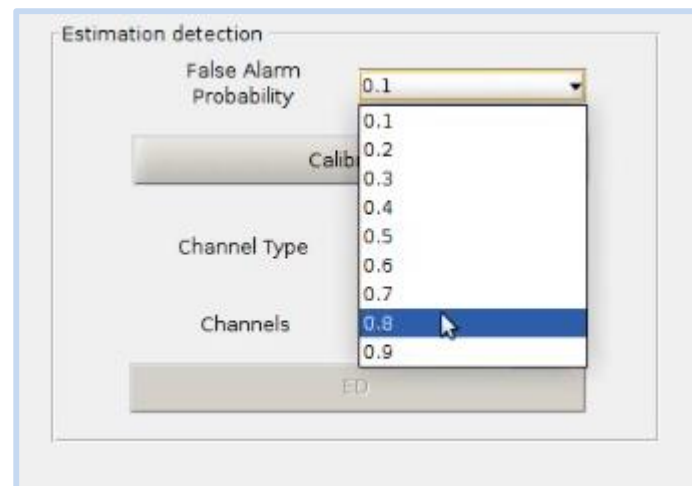
4.1 False Alarm Probability

In this section is possible to perform a calibration of the instrument to set the threshold value used in the error detection operation for detecting if a channel is free or not.

A False Alarm Probability can be selected, from 0.1 up to 0.9, in order to generate a threshold value.

FAP = 0.1 corresponds to the highest threshold value.

FAP = 0.9 corresponds to the lowest threshold value.





4.2 Calibration

After that a False Alarm Probability value is chosen, it is possible to perform a calibration.

The calibration is evaluated considering the channel chosen in the Base Functions Panel.

Estimation detection

False Alarm Probability: 0.1

Calibration

Channel Type: Single Interval

Channels: E2 E2

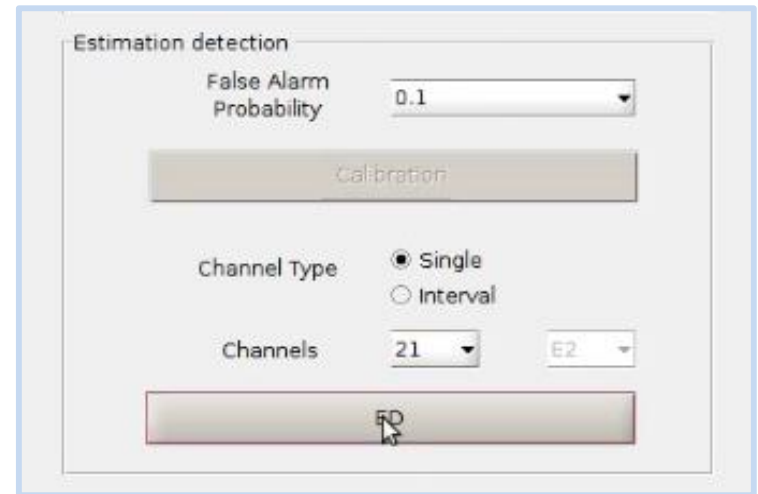
Calibration

Calibration completed...



4.3 ED

After single Channel option is selected, clicking on ED button is possible to perform an error detection and know if the channel is busy or free using the threshold value obtained from calibration process.

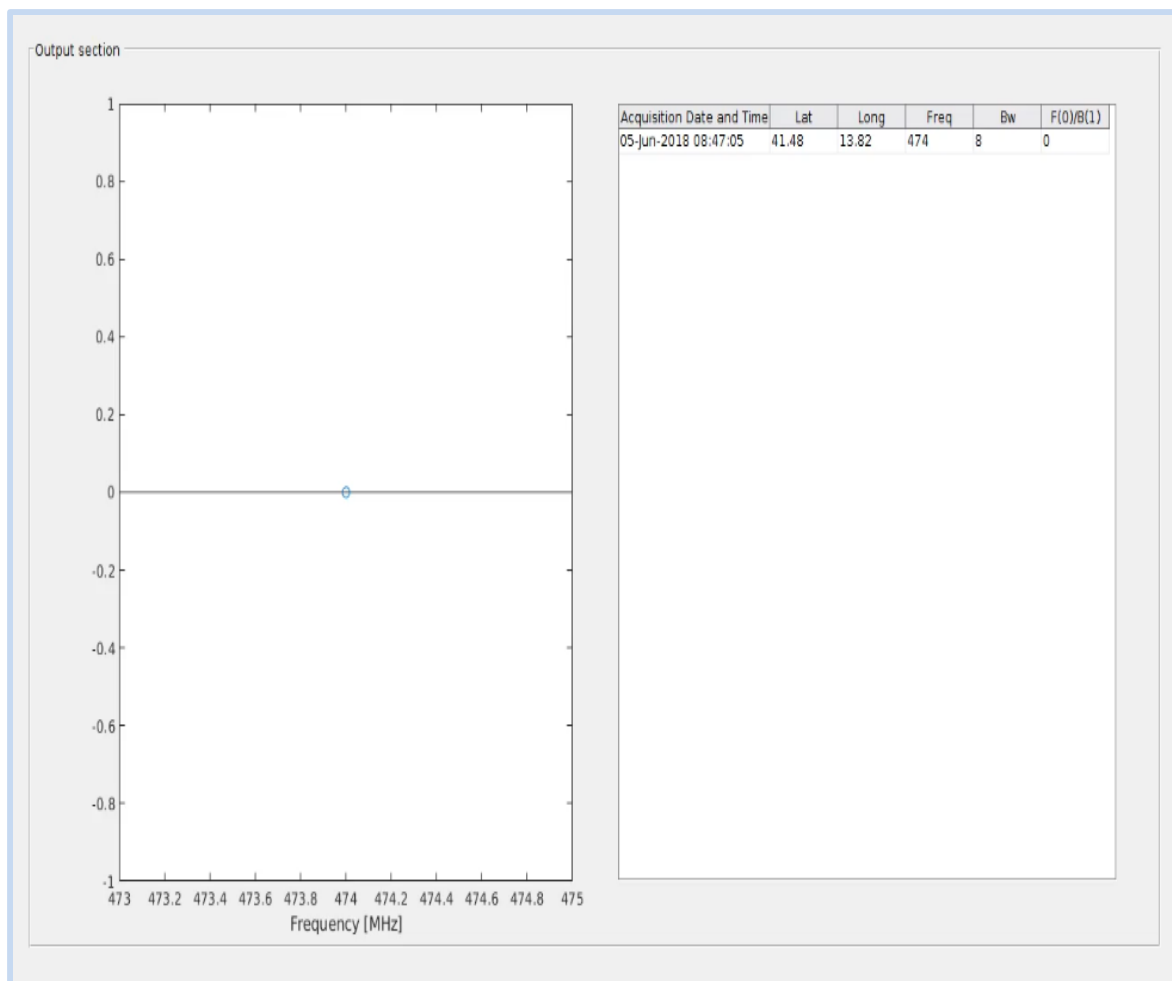




4.3 ED

In the left side of the output section appears a plot. In this plot the x-axis represents the frequencies while the y-axis gives a value equal to 0 if the channel is free or equal to 1 if it is busy. In the right side of the output section additional informations are logged:

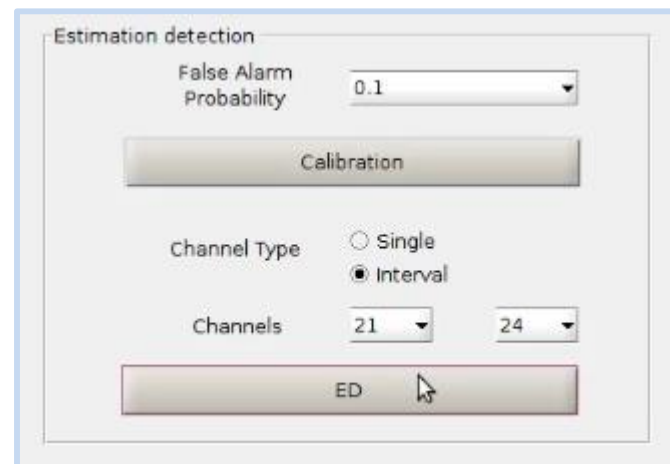
- acquisition data;
- time of the measurement;
- locations of the selected device;
- frequency;
- bandwidth;
- state of the channel.





4.3 ED

Selecting Interval in Channel Type options and specifying the start and stop channel the ED procedure is performed for each selected channel.

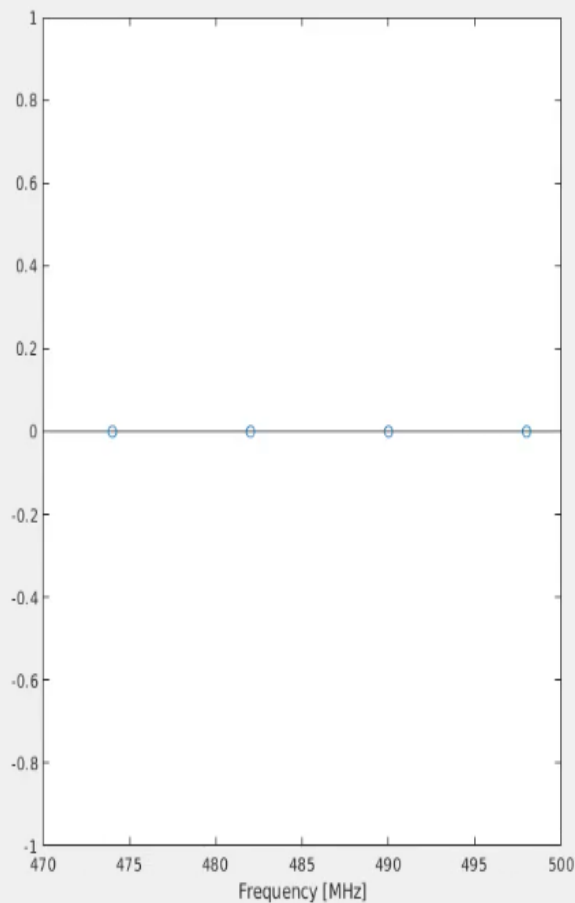




4.3 ED

The error detection operation is applied for each channel.

Output section



Acquisition Date and Time	Lat	Long	Freq	Bw	F(0)/B(1)
05-Jun-2018 08:48:16	41.48	13.82	474	8	0
05-Jun-2018 08:48:22	41.48	13.82	482	8	0
05-Jun-2018 08:48:29	41.48	13.82	490	8	0
05-Jun-2018 08:48:35	41.48	13.82	498	8	0



4.3 ED

The channel estimation can be executed in a continuous mode, selecting in the Setting Panel continuous measurement type and in the Estimation detection an interval of channels to analyze.



4.3 ED

Settings

Device selection: USRP2

Measurement Type: Single Continuous

Base Functions

Channel: E2

Spectrum

I/Q

Signal Energy

Estimation detection

False Alarm Probability: 0.1

Calibration

Channel Type: Single Interval

Channels: E2 E5

ED

Stop

Output section

Acquisition Date and Time	Lat	Long	Freq	Bw	F(0)/B(1)
05-Jun-2018 08:52:45	41.48	13.82	50.5	7	0
05-Jun-2018 08:52:51	41.48	13.82	57.5	7	1
05-Jun-2018 08:52:58	41.48	13.82	64.5	7	1
05-Jun-2018 08:53:04	41.48	13.82	177.5	7	0
05-Jun-2018 08:53:11	41.48	13.82	50.5	7	1
05-Jun-2018 08:53:17	41.48	13.82	57.5	7	1
05-Jun-2018 08:53:23	41.48	13.82	64.5	7	1
05-Jun-2018 08:53:30	41.48	13.82	177.5	7	0



5. References

The project is developed using:

- Matlab;
- Gnu Radio.