GNU Radio

INTRO OF GNU

- GNU Radio Companion (GRC) is a graphical user interface that allows us to build GNU Radio flow graphs.

- Steps to open gnu terminal window :--

Open a terminal window using: Applications > Accessories > Terminal (gnu companion).

BLOCKS USED

- Variable Block
- WAV File Source
- Audio Sink
- WBFM Transmitter
- QT GUI Frequency Sink

Options and variable are always added by default to the gnu radio companion.

❑ OPTIONS BLOCK :--

Option Block is used to set global parameters. When we double click on options block we get general parameters for the flow graph:

- Id : name of generated python file
- Title : Title of main GUI window, or name of Hierarchical block
- Window size : GRC canvas size
- Generate options : Type of code to generate are as follows:

  WX GUI : GUI app using WX toolkit (use WX GUI blocks)

  Qt GUI : GUI app using Qt toolkit (use Qt GUI blocks)

  No GUI : Command-line app without GUI (text-based, run in a console)

  Hier GUI : Create a Hierarchical block that will appear in the block list

❑ VARIABLE :--

A block that contains an arbitrary Python expression and used to calculate sample rate .Its parameters are

- Id: python variable name , 'samp_rate’ is always added by default in a new flowgraph
- Value : Arbitrary Python expression. e.g 32000 (the default): an integer 32e6: 32000.0 (floating-point number)

Here sample rate of our audio signal is 44.1 Thousand :an integer 44.1e3: 44.1k(floating point number)

- Signal source : Synthesises a sine wave.

❑ QT GUI FREQ SINK :-

A graphical sink to display multiple signals in frequency.

This is a QT-based graphical sink that takes set of a floating point streams and plots the PSD. Each signal is plotted with a different colour, and the functions can be used to change the label and colour for a given input number.

The sink supports plotting streaming float data or messages. The message port is named "in". The two modes cannot be used simultaneously, and should be set to 0 when using the message mode. GRC handles this issue by providing the "Float Message" type that removes the streaming port(s).

Its parameters are:

- Fft size :- size of the FFT to compute and display. If using the PDU message port to plot samples, the length of each PDU must be a multiple of the FFT size.
- Wintype :- type of window to apply (see gr:: fft ::window:: win_type)
- Center Frequency :- center frequency of signal (only used for x-axis labels)
- Bandwidth :- bandwidth of signal (used to set x-axis labels)
- Name :- title for the plot

WBFM TRANSMITTER : Takes a single float input stream of audio samples in the range [-1,+1] and produces a single FM modulated complex baseband output. The only difference with NBFM Transmit is the size of the internal low pass filter for interpolation.

Its parameters are :--

Audio Rate :- Sample rate of audio stream, >= 16k (integer)

Quadrature Rate :- Sample rate of output stream (integer). Must be an integer multiple of audio rate.

Tau :- Pre - emphasis time constant (default 75e-6) (float)

Max Deviation :- Maximum deviation in Hz (default 75e3) (float)

Pre - emphasis High Corner Freq :-High frequency at which to flatten pre-emphasis; < 0 means default of 0.925*quad rate/2.0 (float).

❑ Audio Sink :--

Allows a signal to be played through your speakers or other audio device

- Sample Rate :-- To set the Audio sampling rate, click the drop-down menu to see popular rates. Note: not all sampling rates will be supported by your hardware. For typical applications, this should be set to 48kHz.
- Device Name :-- Leave the device name blank to choose the default audio device.
- OK to Block :-- On by default, which should be used when this sink is not throttled by any other block.
- Num Inputs :-- The audio sink can have multiple inputs depending upon your hardware. For example, set the inputs to 2 for stereo or 1 for mono.

PROCEDURE INVOLVED

I. On the right side of the window is a list of the blocks that are available. By expanding any of the categories (click on triangle to the left) we can see the blocks available. Exploring each of the categories and proceeding further.

II. Setting generate option to QT GUI, run to autorun and real time schedule to off , titled it as generating the audio and closing the option window by clicking on apply. In variable, changing ID to gnu_Radio and setting value as 44.1k.

III. Open the Sources category and double click on the Signal Source. Note that a Signal Source block will now appear in the main window. Double click on the block and the properties window will open. Adjust the settings to match those as shown in the figure below and close the window. This Signal Source is now set to output a real valued 1KHz sinusoid with an amplitude of 5.

IV. Connect the WAV source file to Wide Band FM Transmitter with audio - 100 and quad rate - 44.1k and tau - 75 u and max deviation – 5k. In order to connect these two blocks, click once on the "out" port of the Signal Source, and then once on the "in" port of the WBFM . Connect two Rational Resamplers with interpolation 100 and decimation 1 and vice versa for demodulational.

V. In order to view this wave we need one of the graphical sinks. Expand the Graphical Sink category and double click on the Scope Sink. It should appear in the main window. Double click on the block and change the Type to Float. Leave the other Parameters at their default values and close the properties window.

VI. Add two QT GUI FREQ SINK (under Graphical Sinks) to your window. Change the Type to Float and leave the remaining parameters at their default values. Connect this to the output of the Signal Source by clicking on the out port of the Signal Source and then the in port of the QT GUI FREQ Sink.

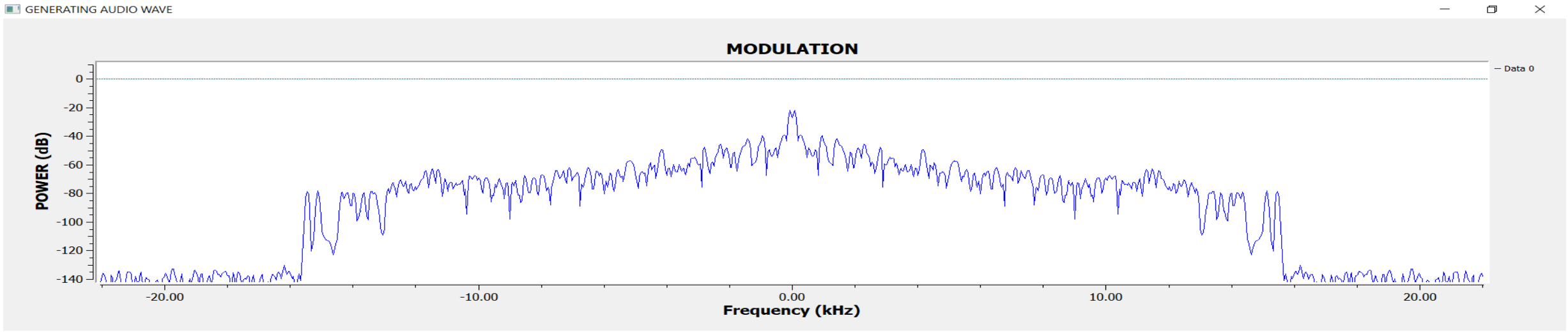
VII. Create the flow graph shown . The Audio Sink is found in the Sinks category. Generate and execute the flow graph. The graphical display of the scope and QT GUI should open as before. However, now you should also hear the 1KHz tone. The Audio Sink block directs the signal to the audio card of your computer.

VIII. In order to observe the operation of this simple system we must generate the flow graph and then execute it. Click first on the "Generate the flow graph" icon. A box will come up in which you enter the name of the file. Name this file: 20190802012.grc and save.

IX. Click on run to see output (graph).

RESULT

WE GET TWO GRAPHS IN QT GUI AT THE END , ONE IS OF MODULATION AND ANOTHER FOR DEMODULATION.



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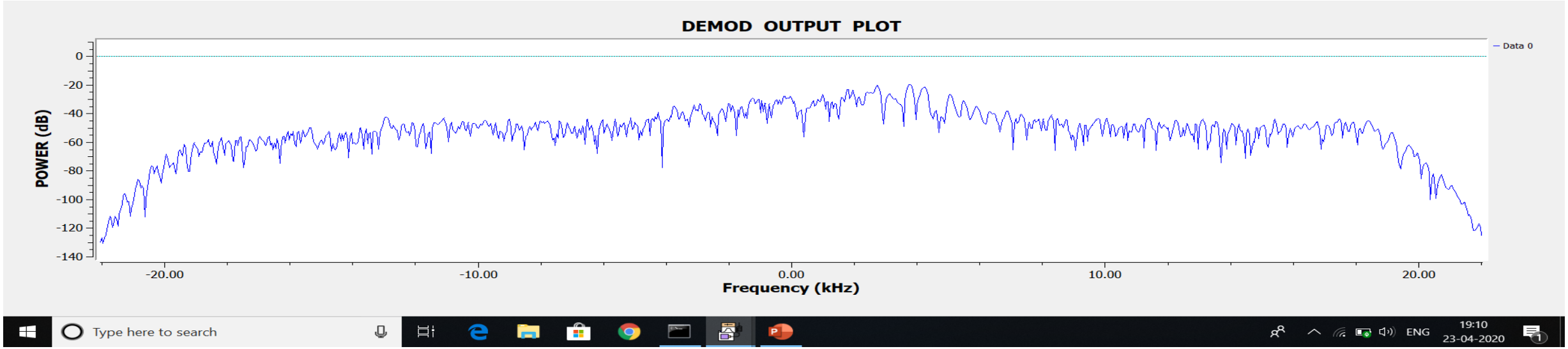

SAME GRAPH IN WX GUI CAN WE REPRESENTED AS BELOW . HERE WE AS ADJUST THE NOISE AND VOLUME USING SO CALLED SLIDERS.