A preliminary study on empirical analysis of conducted EMI from electrical appliances

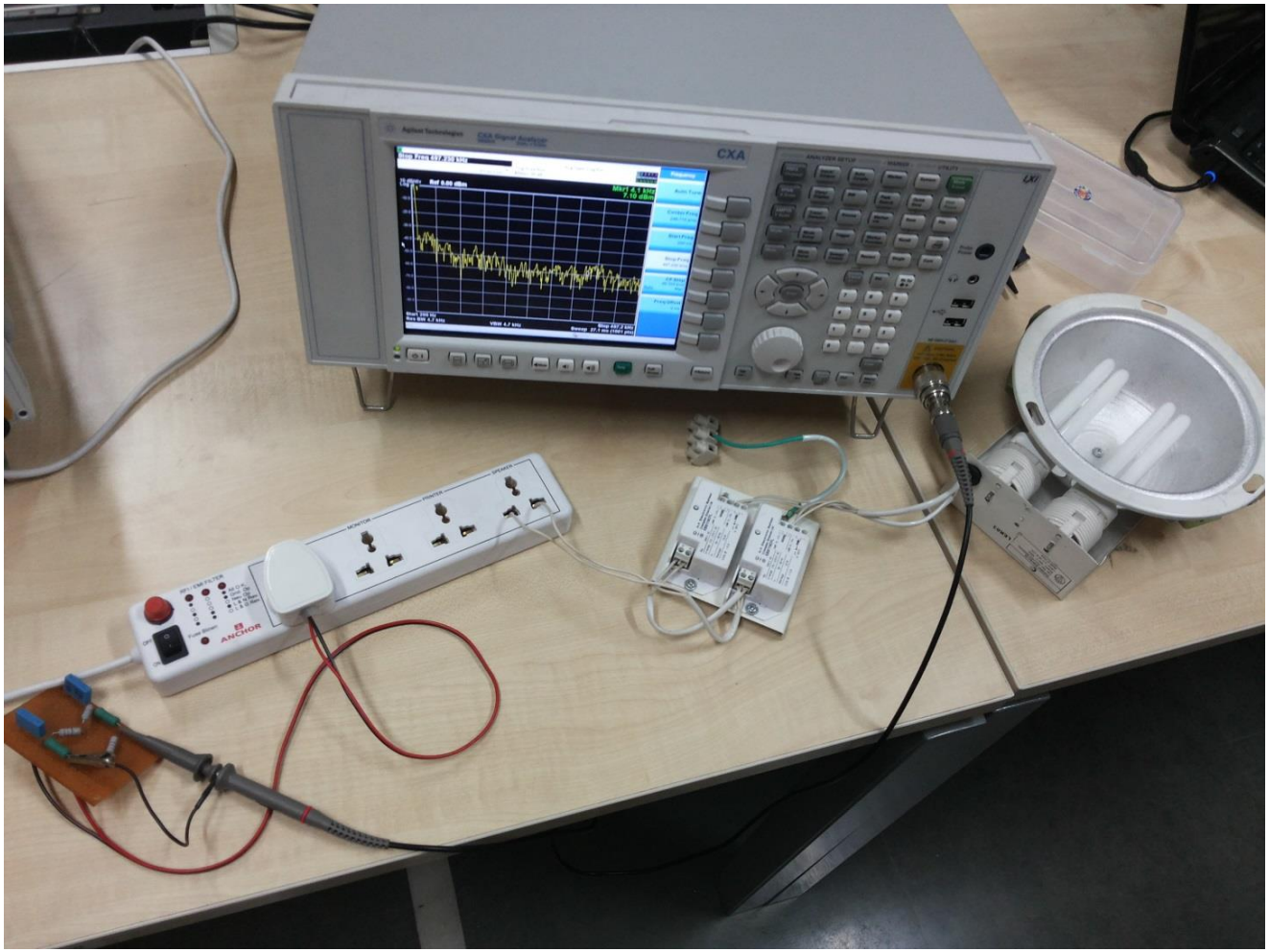
Ver1.3

25-03-2014

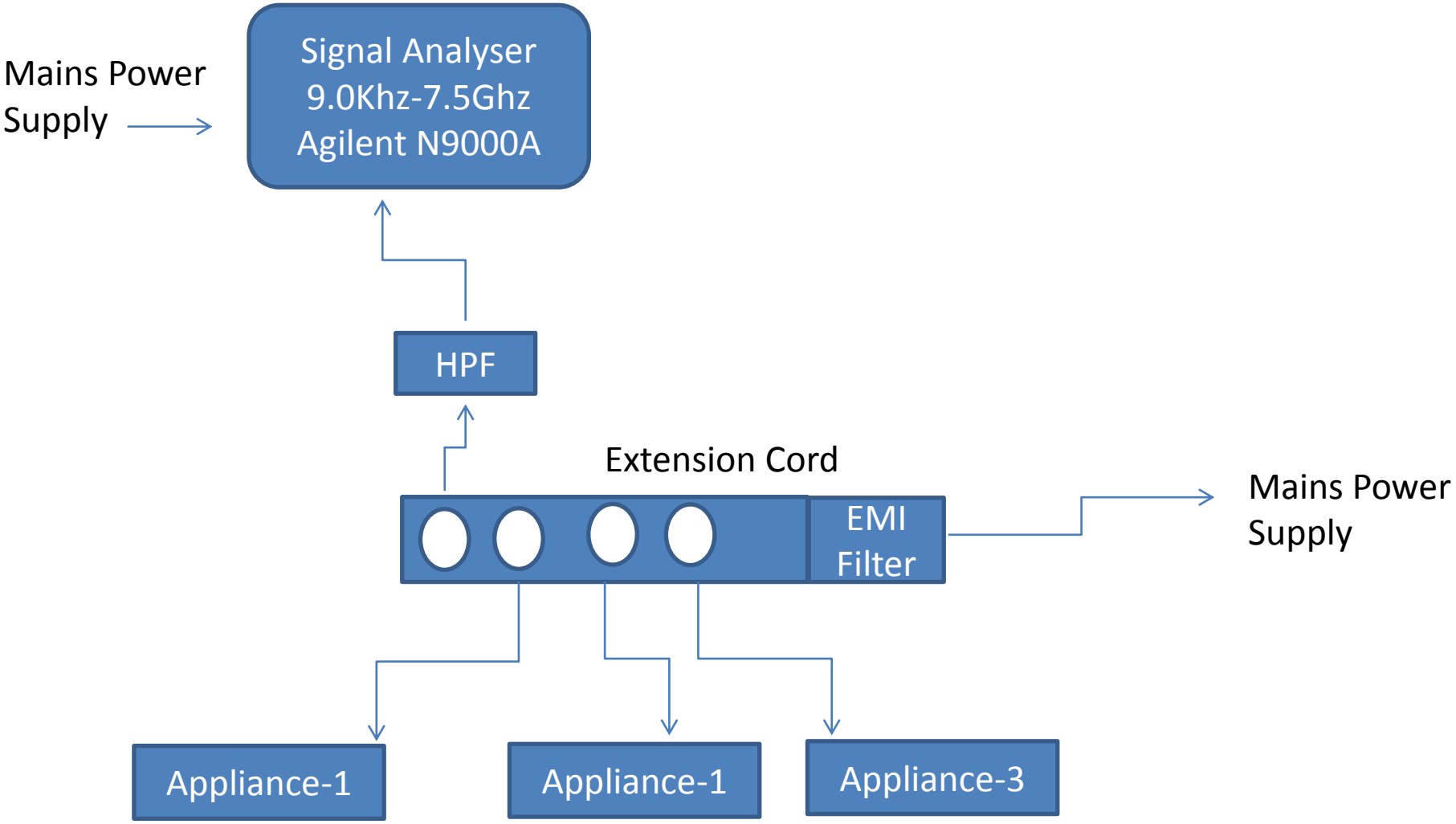
Short forms and considerations

- BGN: Background noise
- PLL: Power load line meant for 15Amp loads
- By default the frequency range is from 10Khz-1Mhz unless defined explicitly.

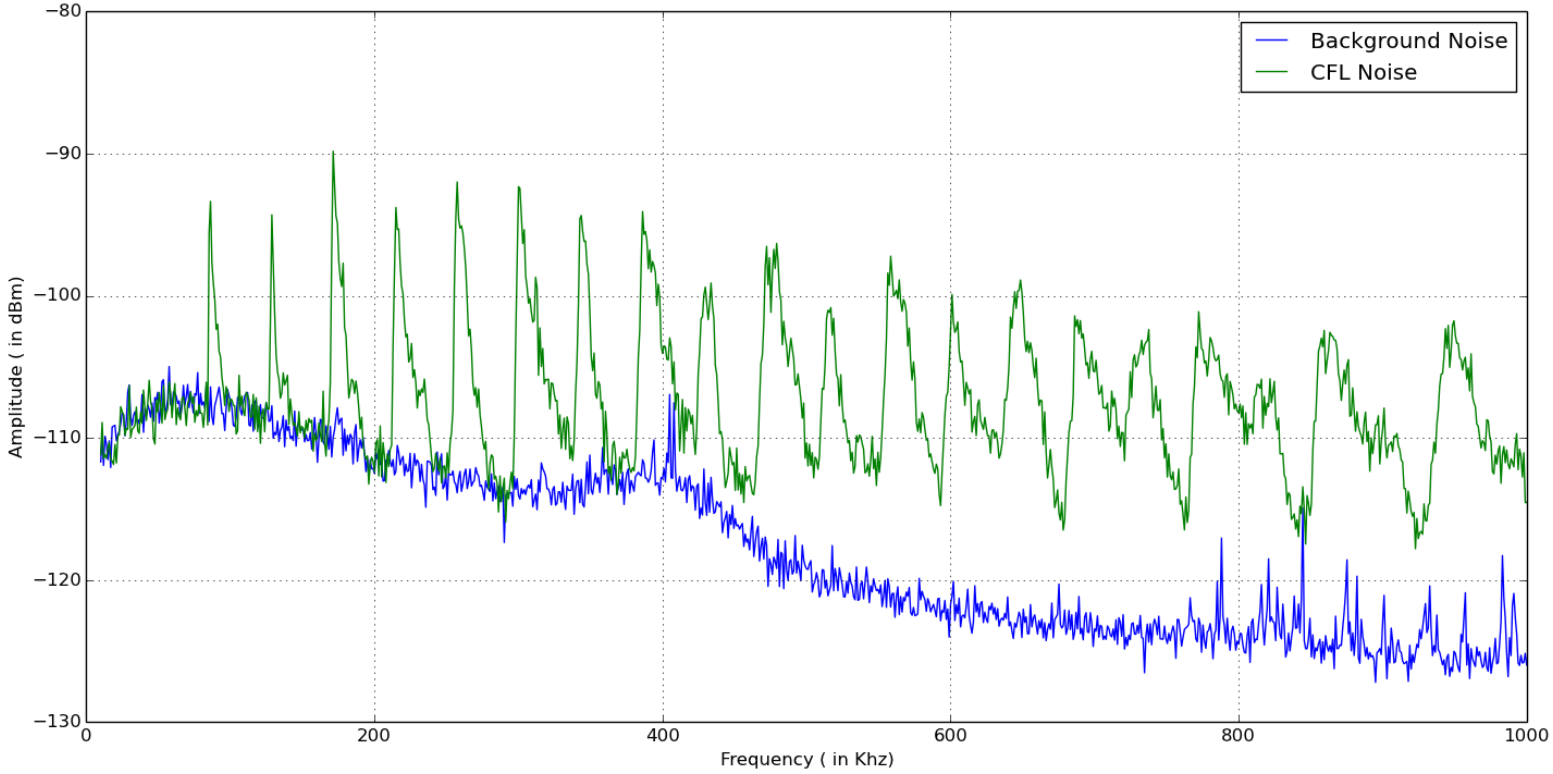
Hardware Setup for < 5Amp loads



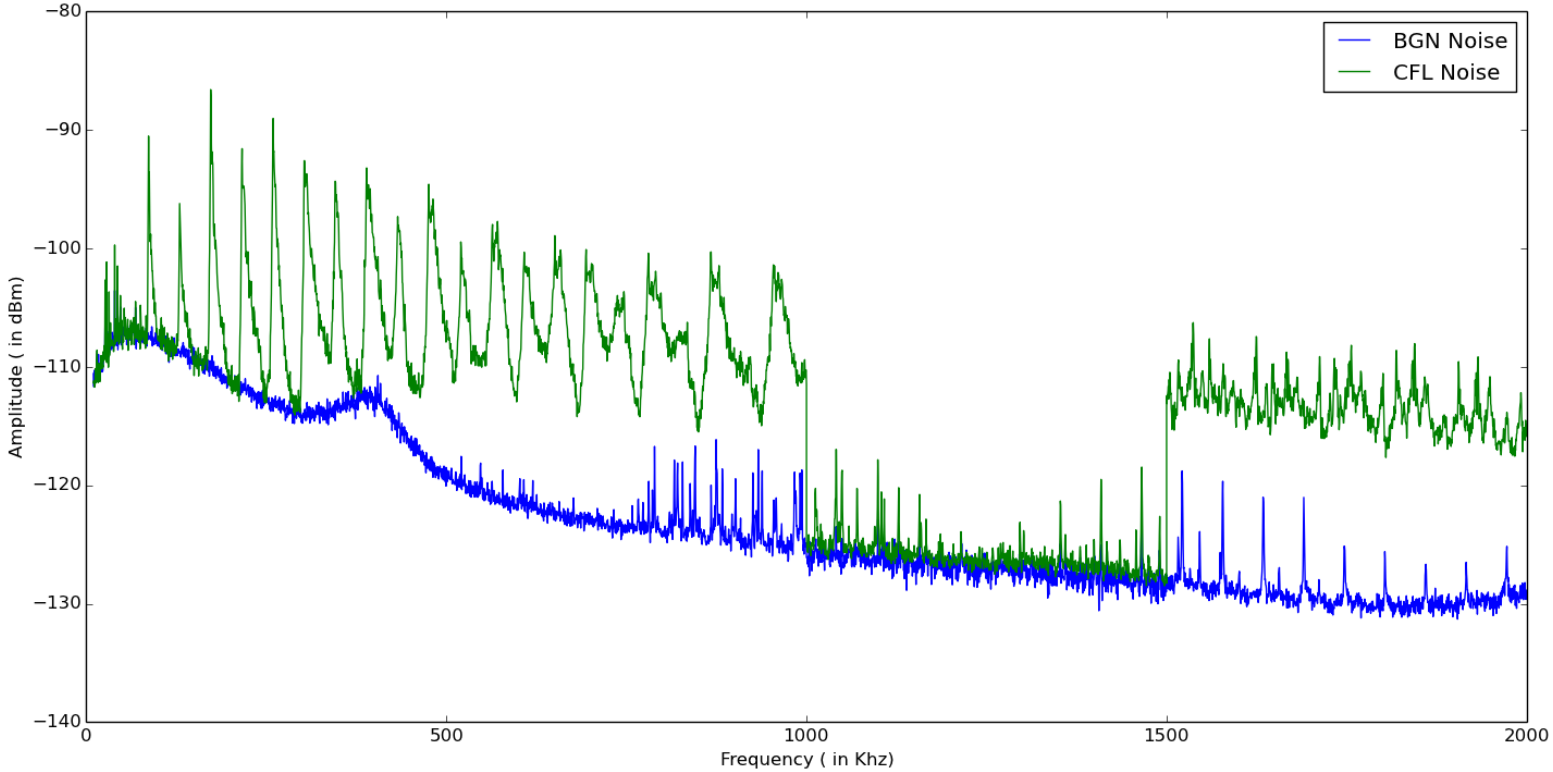
Hardware Setup: EMI sensing



Noise from CFL and BGN



Noise from CFL and BGN

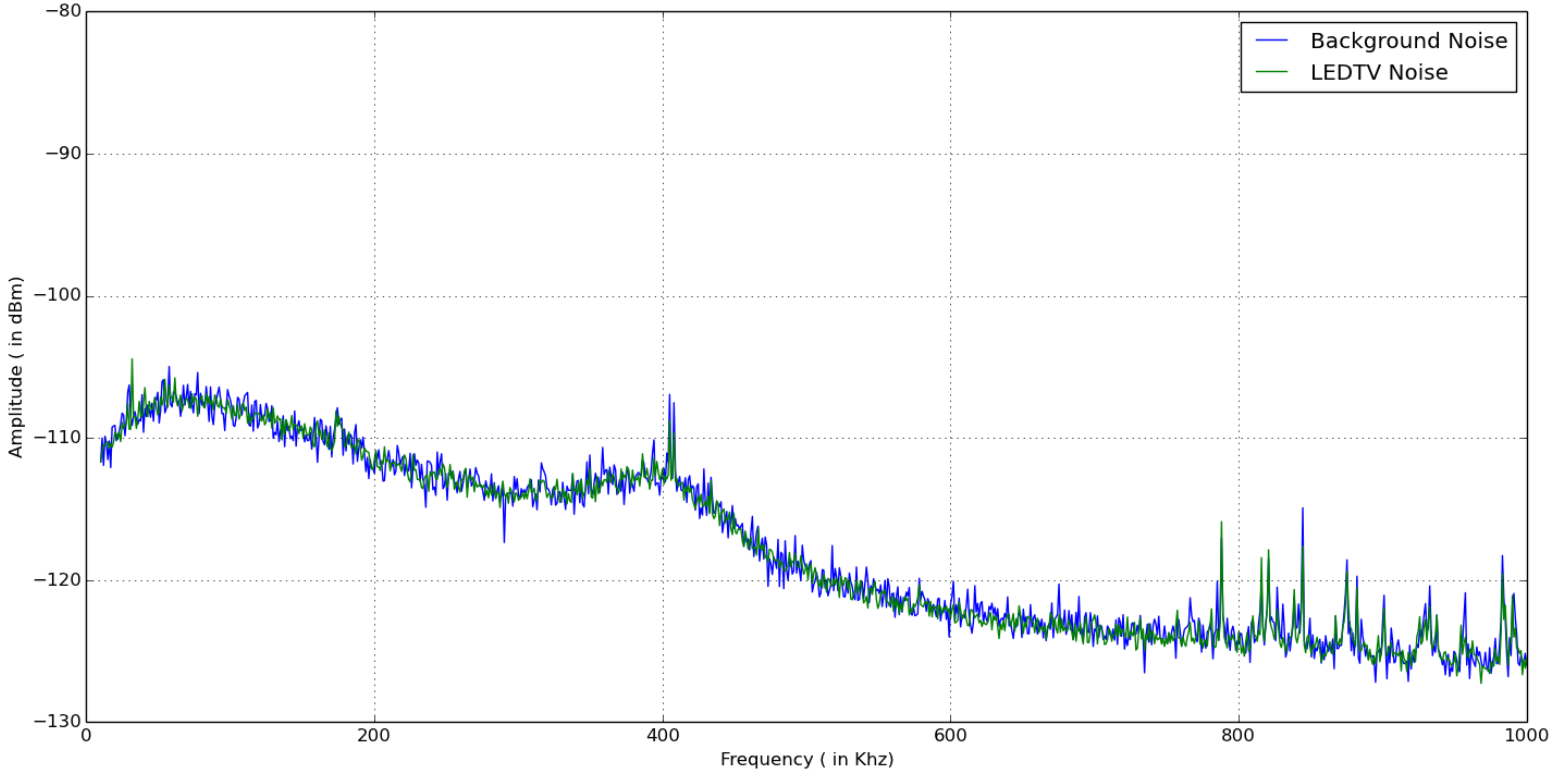


Observations

- EMI noise is quite significant from 60Khz and stays for long.
- Amplitude goes down from -90dBm to -100dBm with higher frequencies.
- Even amplitude of harmonics is significant enough -100dBm.
- In freq. range 600Khz - 1Mhz Vmin of noise amplitude is roughly 10dB higher then baseline noise.

- Not very much sure but a slightly low cut-off HPF may give some more information in LF range.

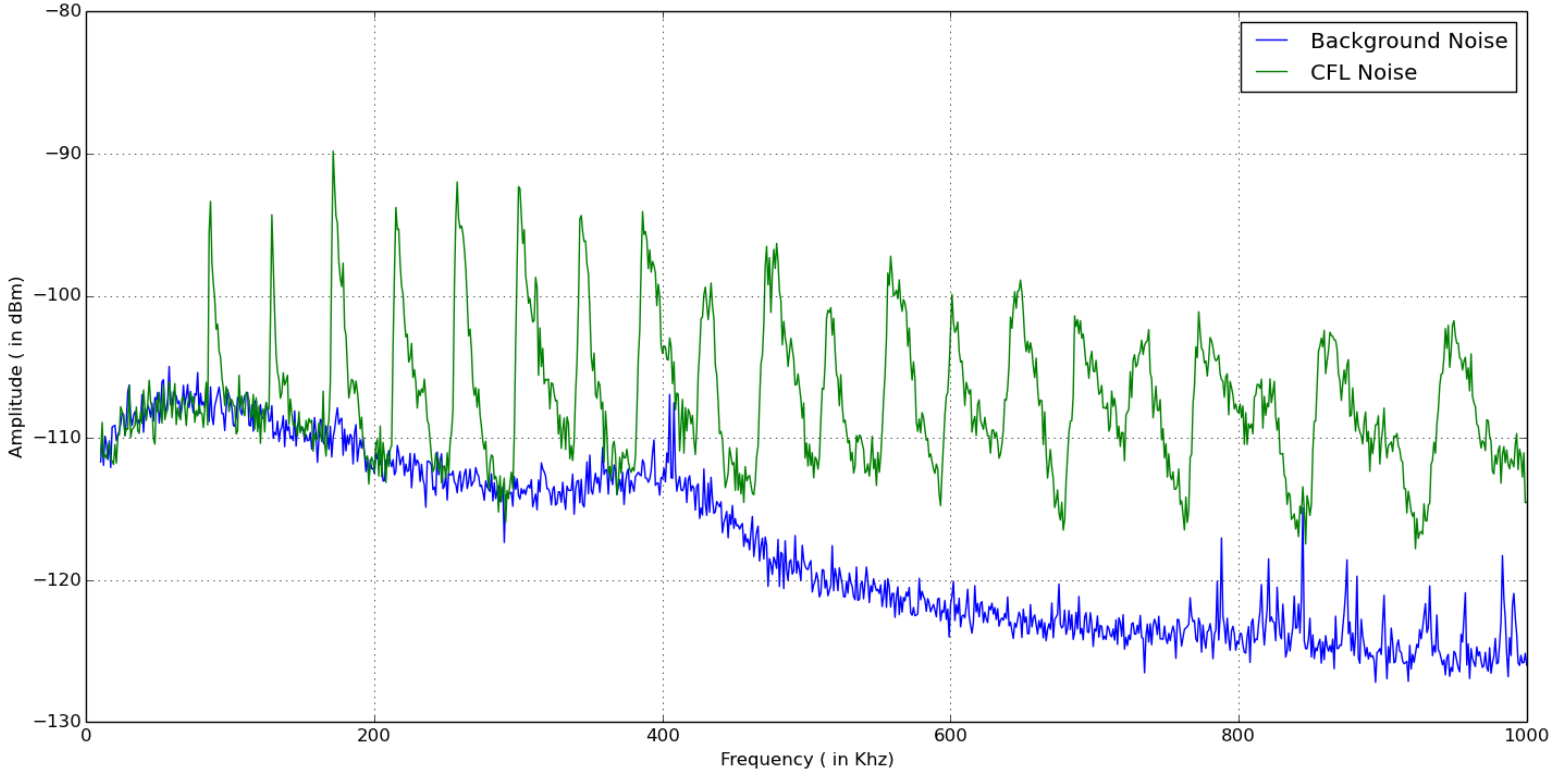
Noise from LEDTV and BGN



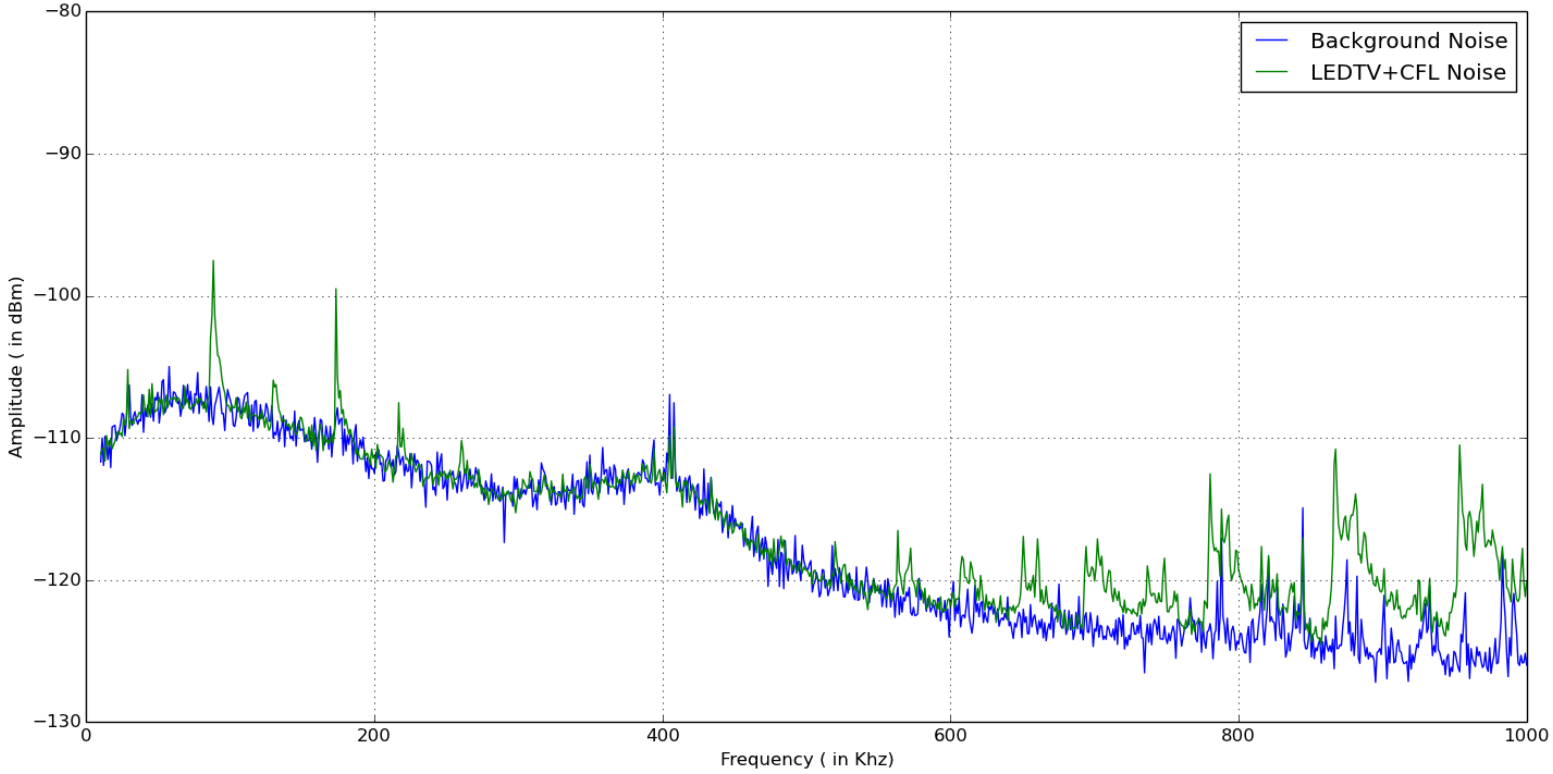
Observations

- EMI noise is completely suppressed by inbuilt EMI filter in current freq. range from 10hz to 1Mhz.
- Hardly any change is noticed in visible spectrum.

Noise from CFL and BGN



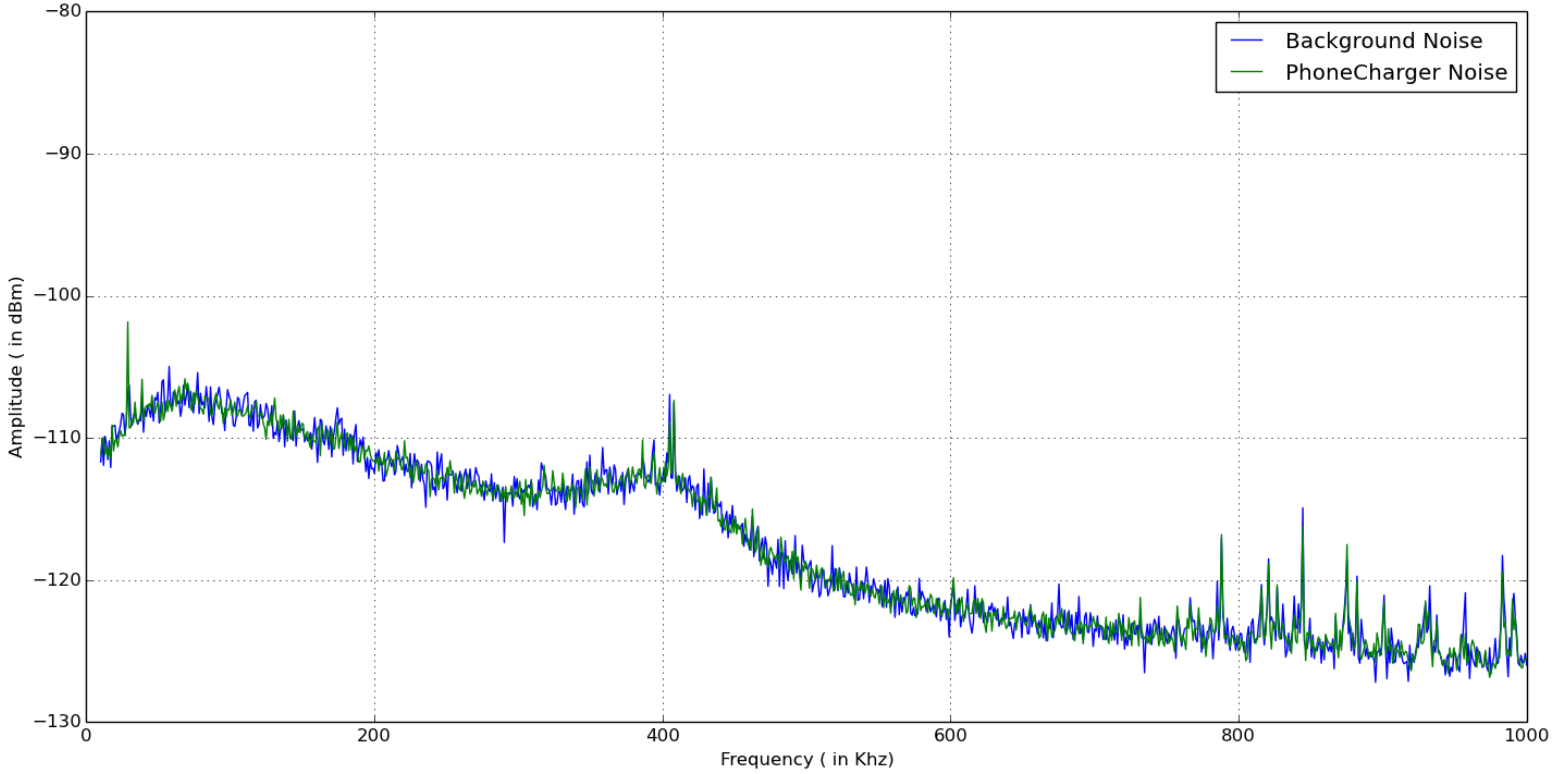
Noise from LEDTV+CFL and BGN



Observations

- Current combination of LEDTV and CFL gave some nice results.
- For ease of comparison same trace of CFL is copied above.
- EMI noise is completely suppressed from 200Khz to 550Khz.
- Amplitude of EMI noise(CFL) from 550KHz to 1Mhz is reduced by 10dB.
- Similar was case for EMI from 10Hz to 200Khz range amplitude reduced by 10dB.

Noise from Phone charger and BGN

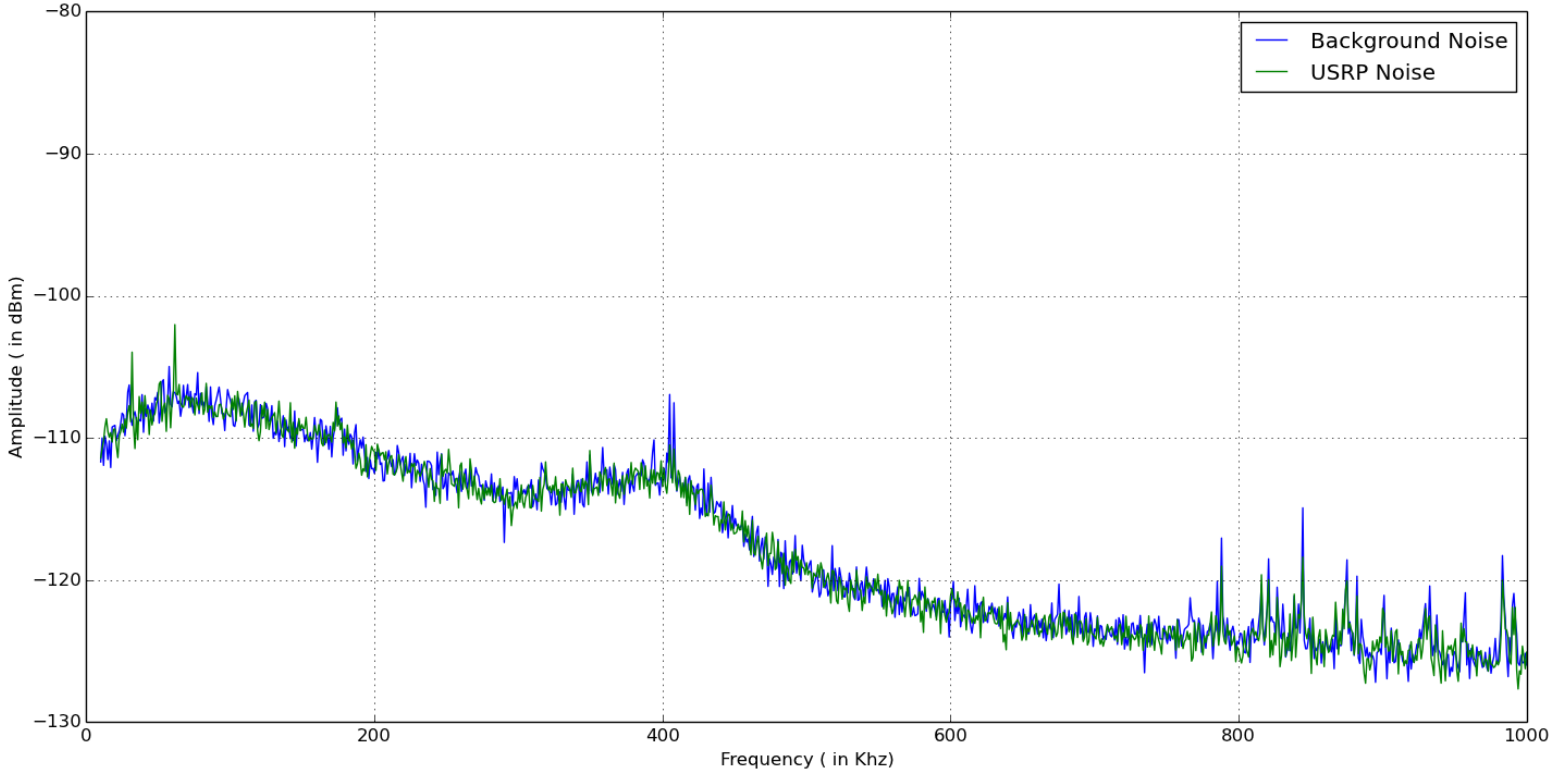


Noise from Phone charger and BGN from 10Khz-5Mhz

Observations

- EMI noise is completely suppressed by inbuilt EMI filter in current freq. range from 10hz to 1Mhz.
- Hardly any change is noticed in visible spectrum.

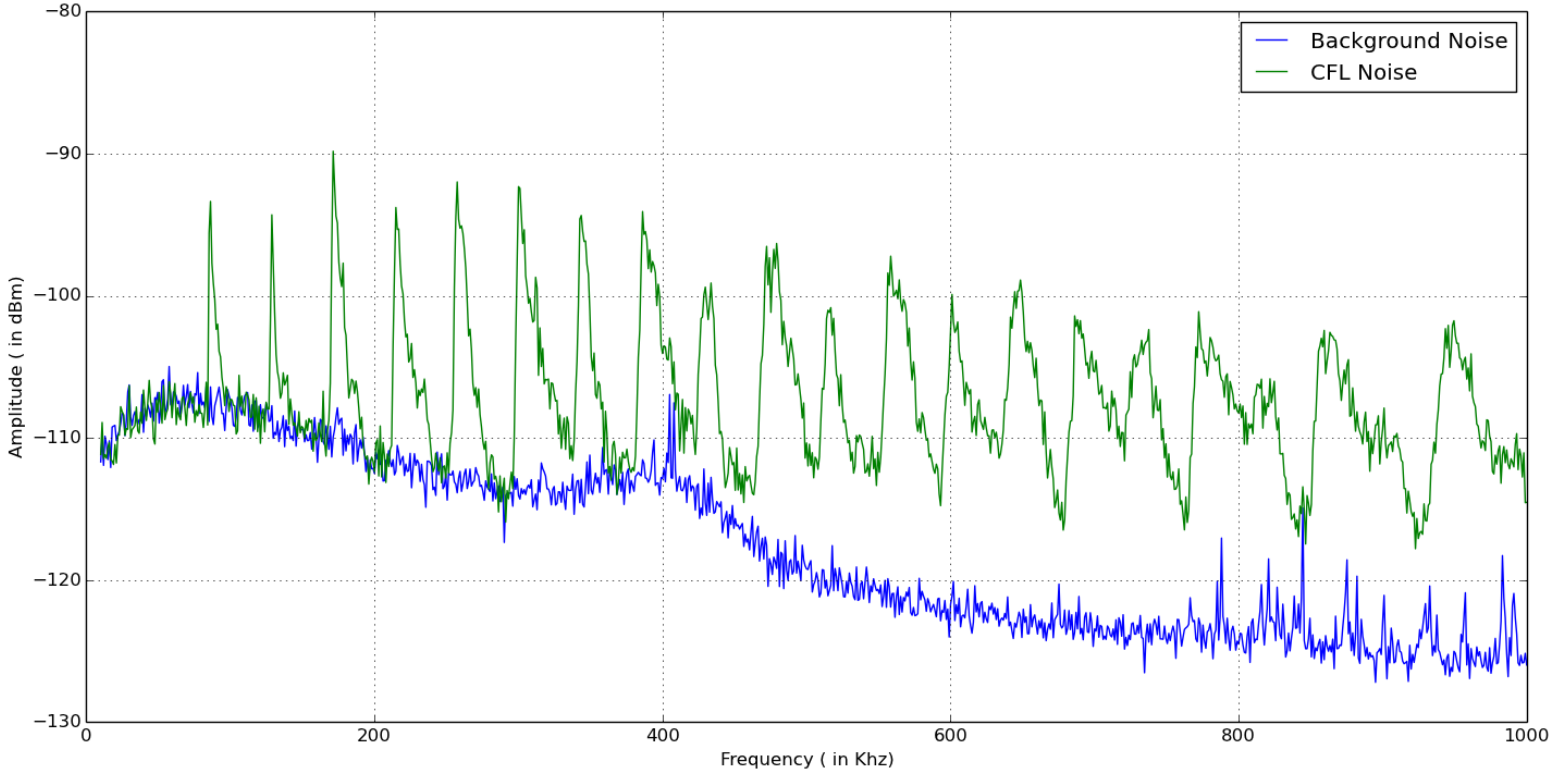
Noise from USRP and BGN



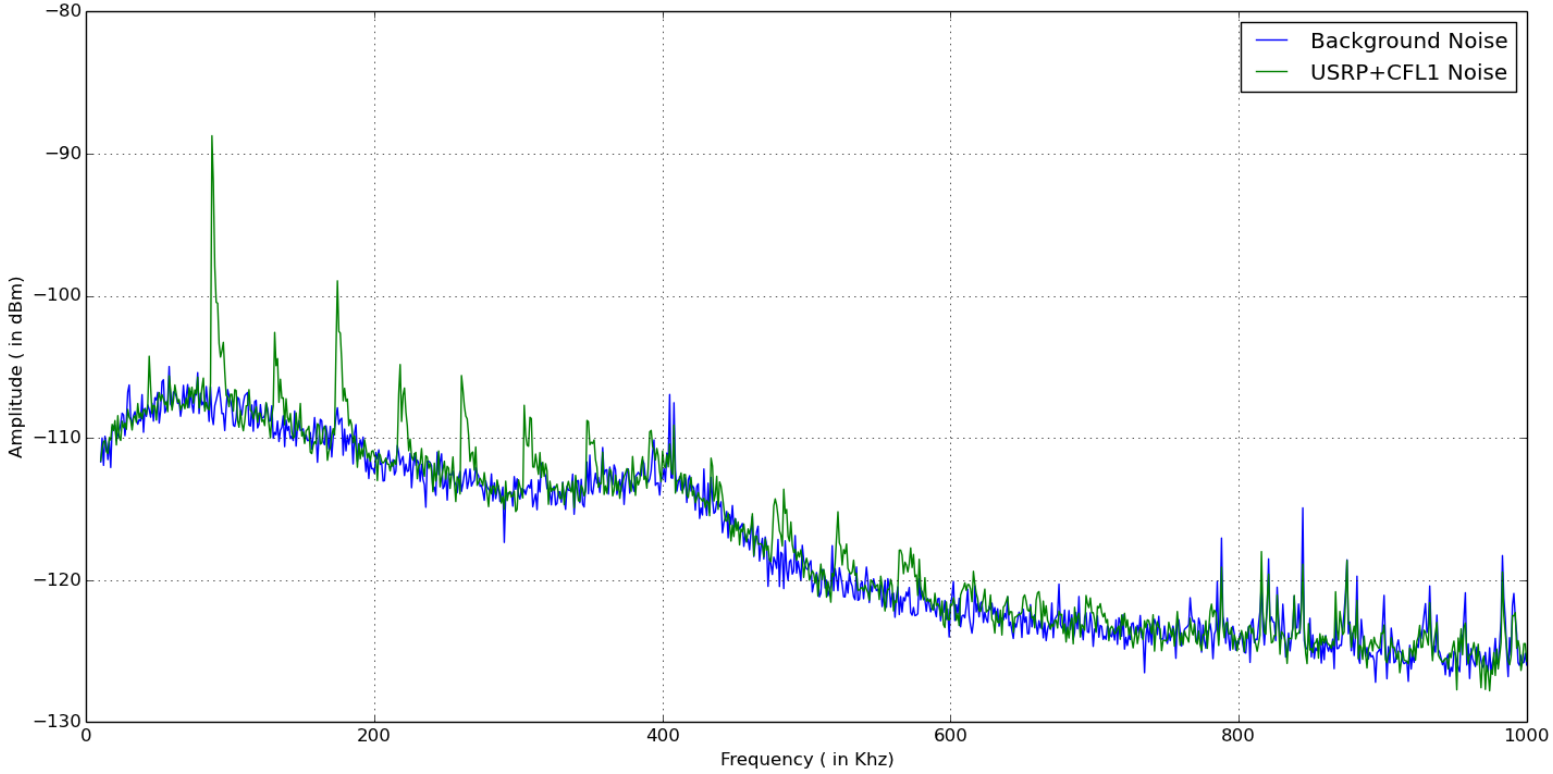
Observations

- EMI noise is completely suppressed by inbuilt EMI filter in current freq. range from 10hz to 1Mhz.
- Hardly any change is noticed in visible spectrum.

Noise from CFL and BGN



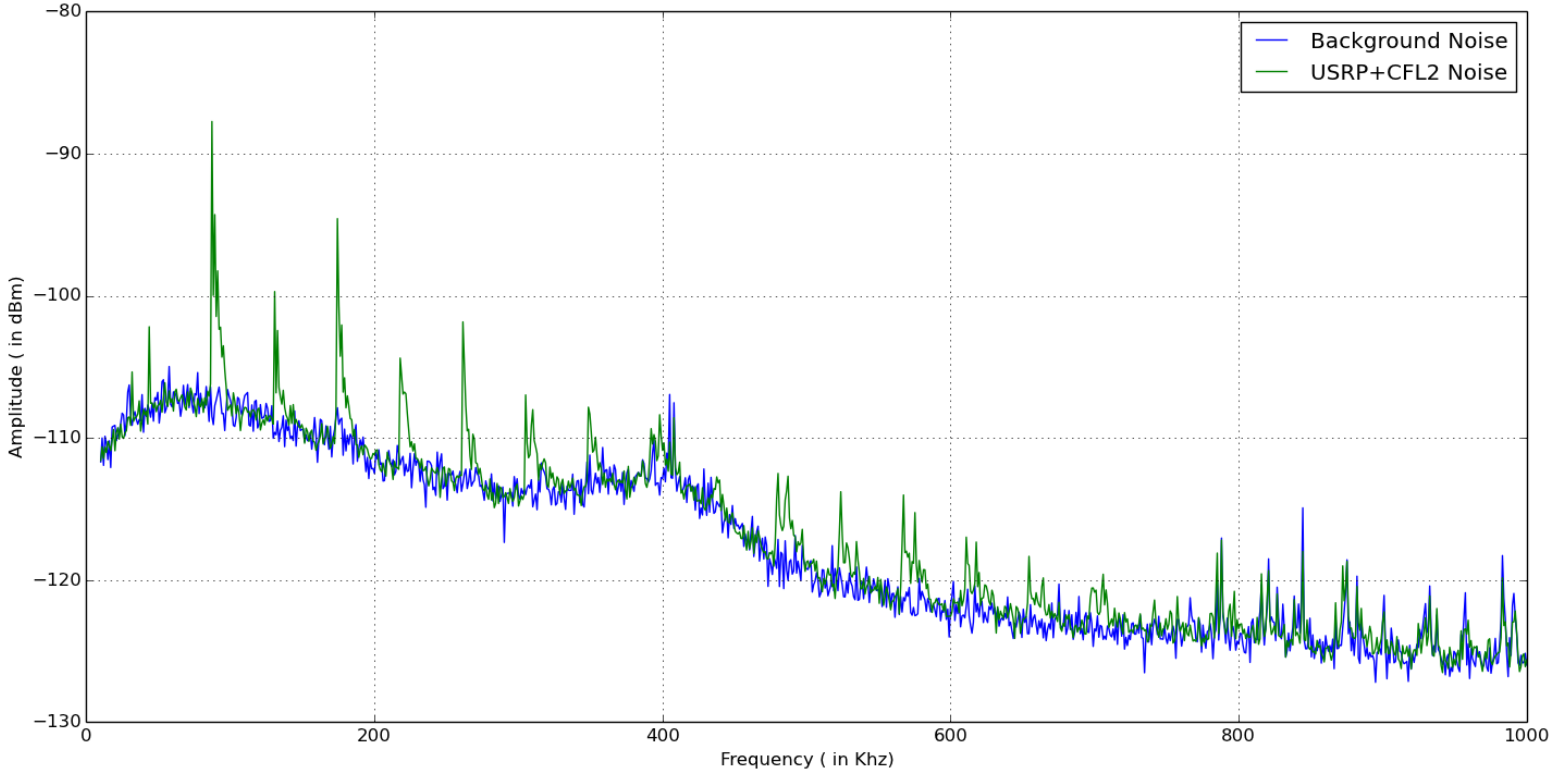
Noise from USRP+CFL1 and BGN



Observations

- Current combination of USRP and CFL gave some nice results.
- For ease of comparison same trace of CFL is copied above.
- Amplitude of EMI noise(CFL) from 100KHz to 1Mhz is reduced by 15dB and at some points by 10dB.
- In higher frequency range from 650Khz to 1Mhz hardly anything is visible almost whole noise spectrum is suppressed.

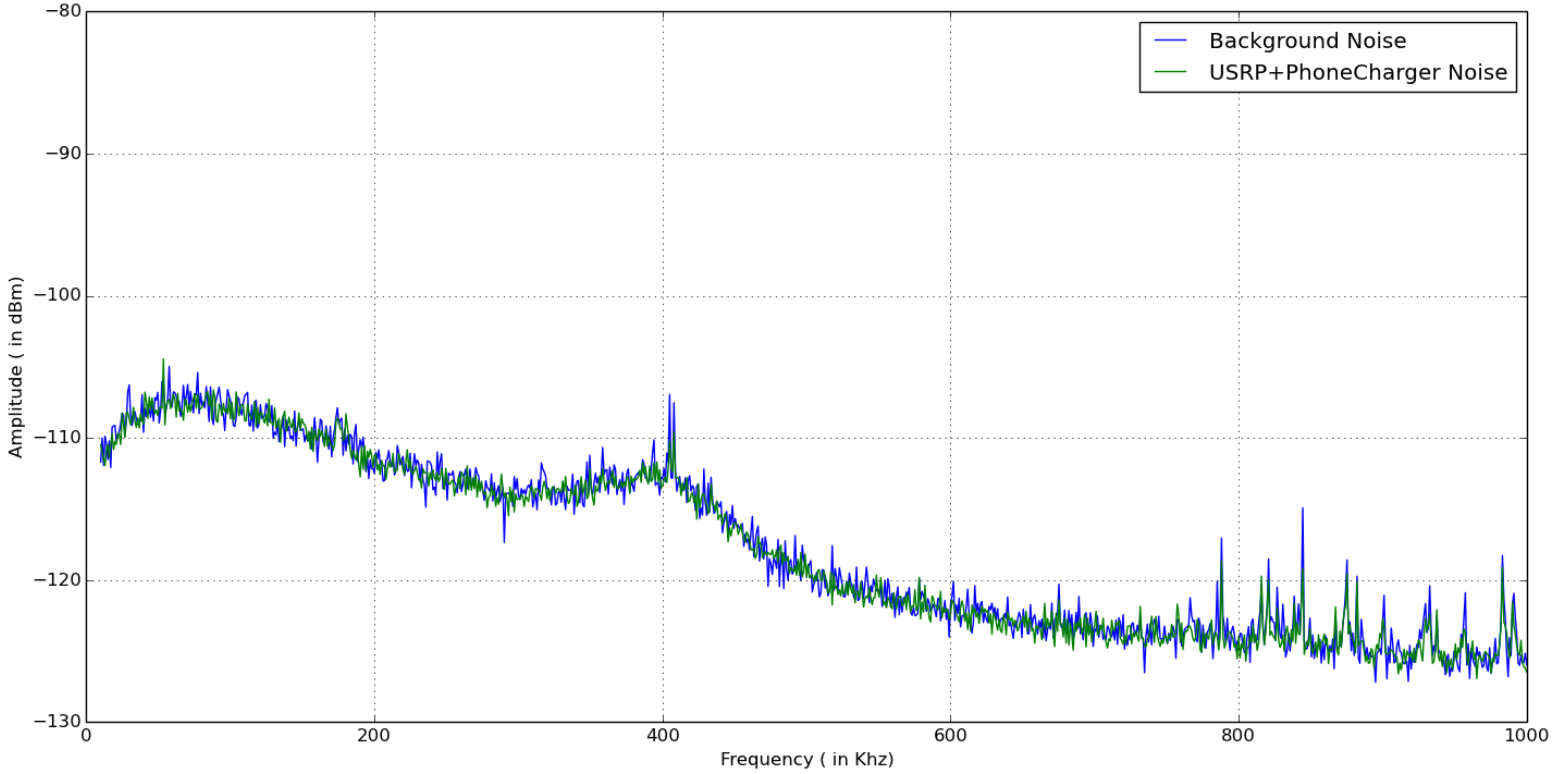
Noise from USRP+CFL2 and BGN



Observations

- Same as previous one took another trace after some time to validate results.

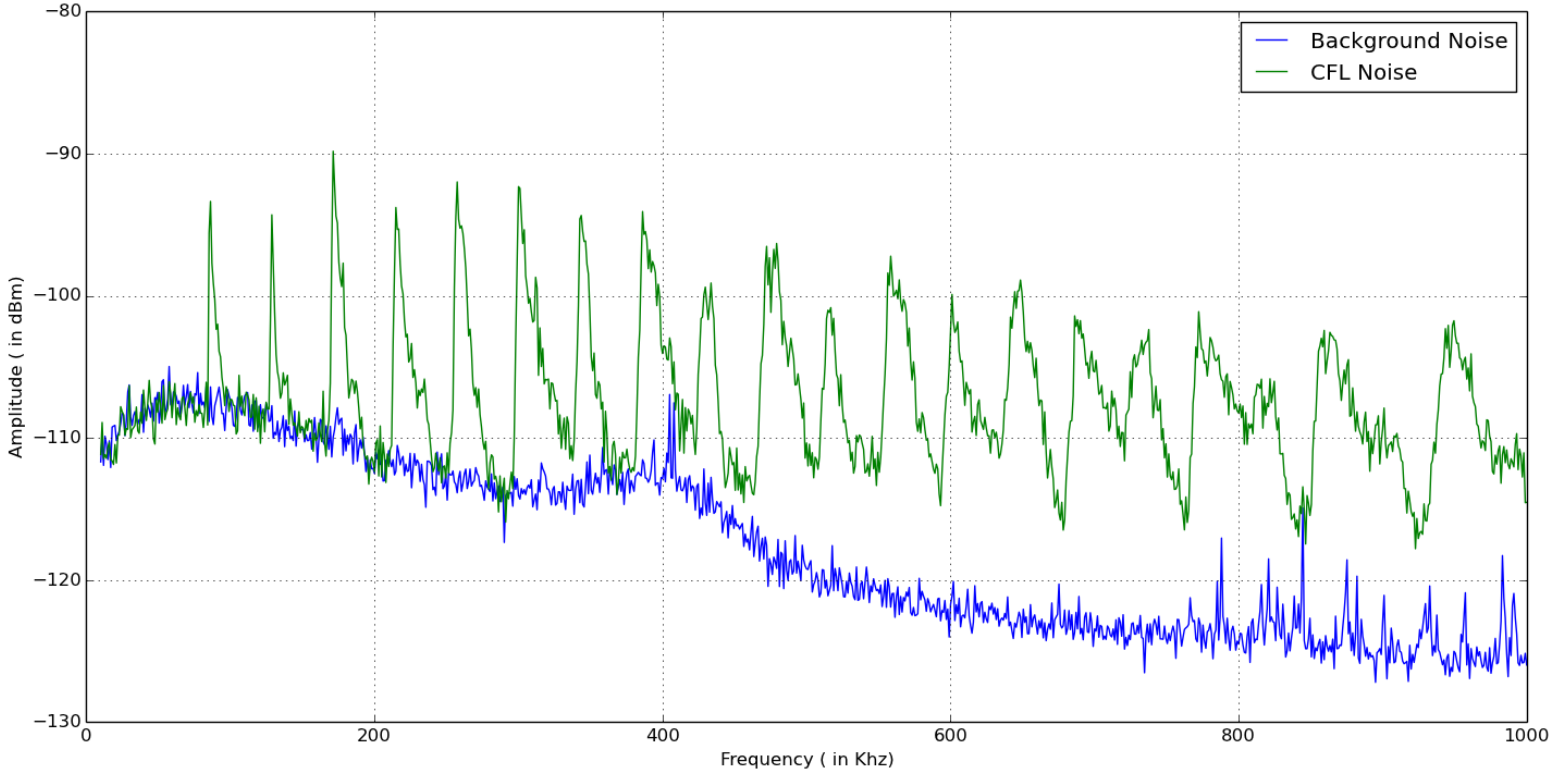
Noise from USRP+Phonecharger and BGN



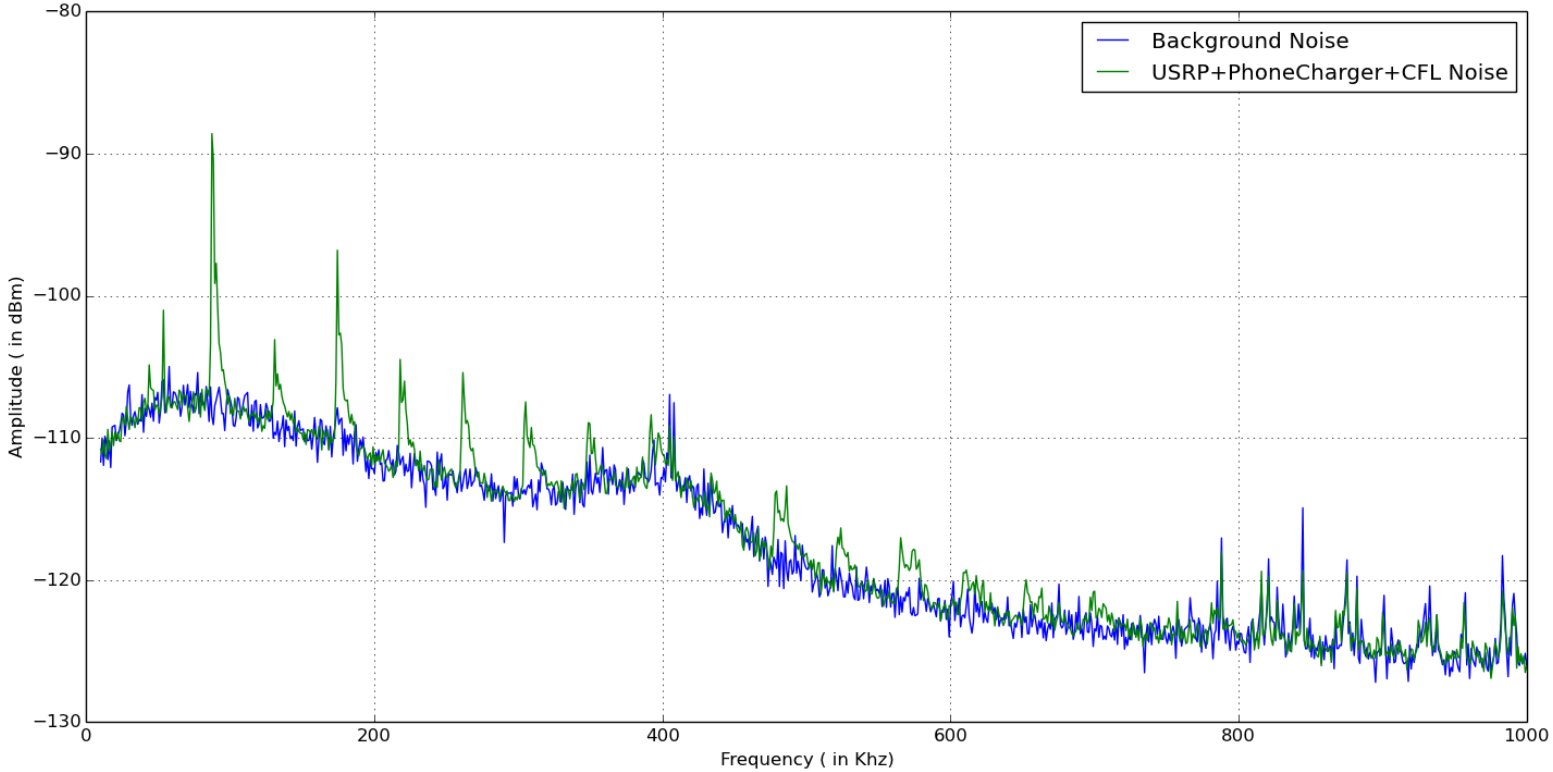
Observations

- EMI noise is completely suppressed by inbuilt EMI filter in current freq. range from 10hz to 1Mhz.
- Hardly any change is noticed in visible spectrum.

Noise from CFL and BGN



Noise from USRP+Phonecharger+CFL and BGN

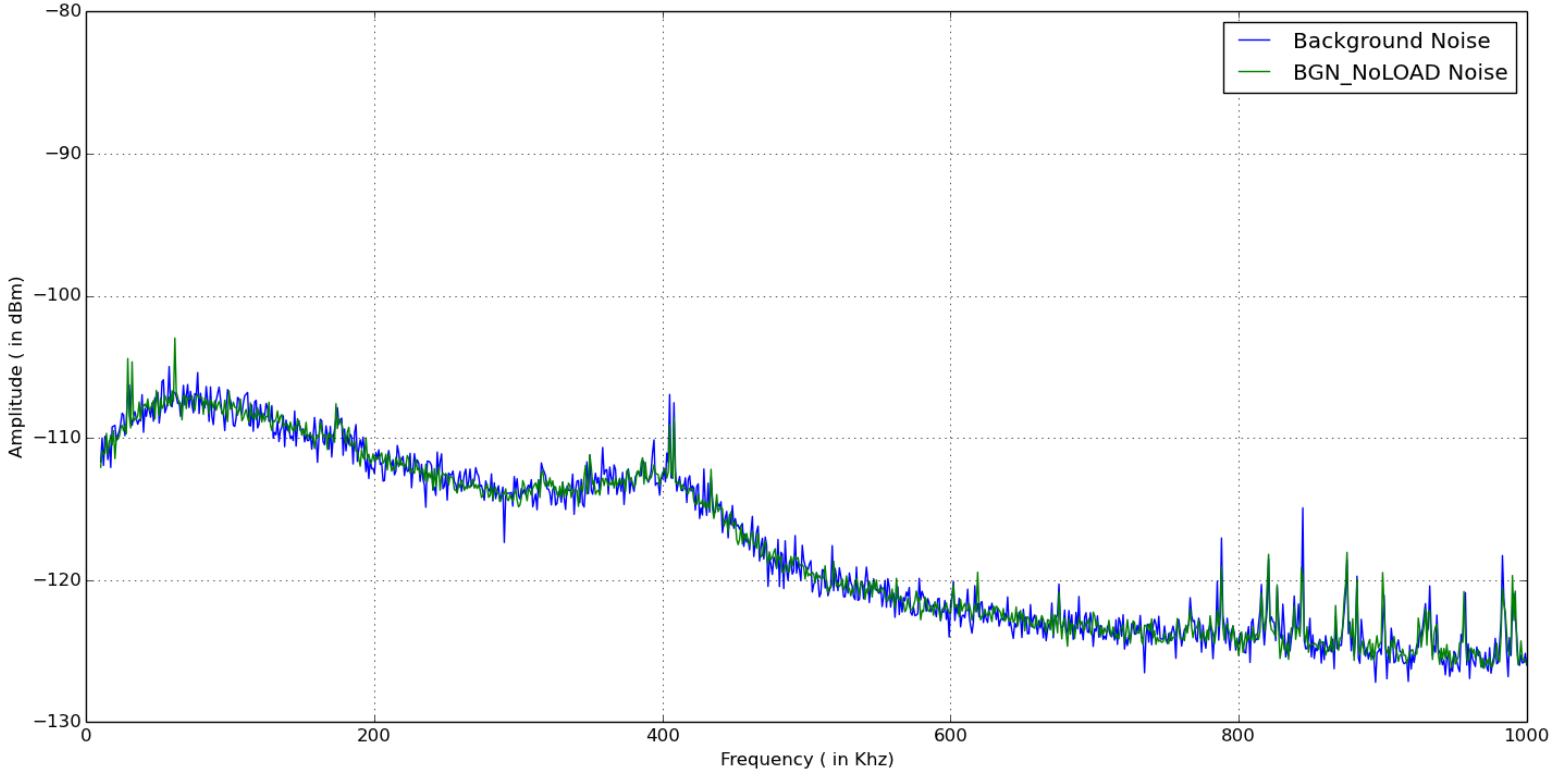


Observations

- Current combination of USRP and CFL gave some nice results.
- For ease of comparison same trace of CFL is copied above.
- Amplitude of EMI noise(CFL) from 100KHz to 1Mhz is reduced by 8dB and at some points by 10dB.
- In higher frequency range above 700Khz hardly anything is visible almost whole noise spectrum is suppressed.

- One interesting change was in freq. range less than 100Khz EMI noise from CFL was increased by 5dB.

BGN taken at two different time intervals

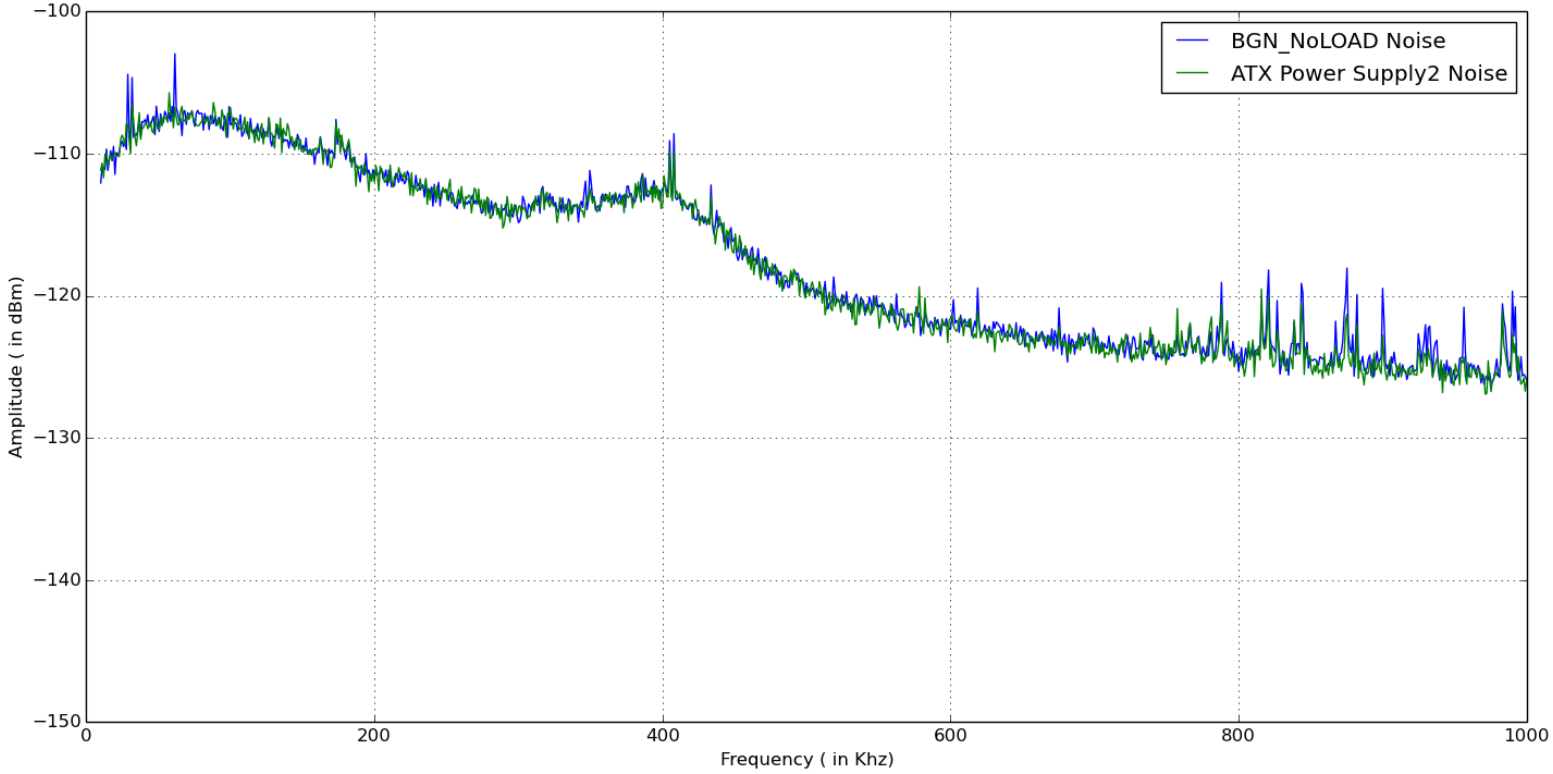


Observations

- Two traces of Background noise were taken to check consistency of noise as we are comparing noise with BGN in all plots.

- Above results show that both the traces fairly overlap eachother and BGN is consistent with time.

Noise from ATX power supply and BGN

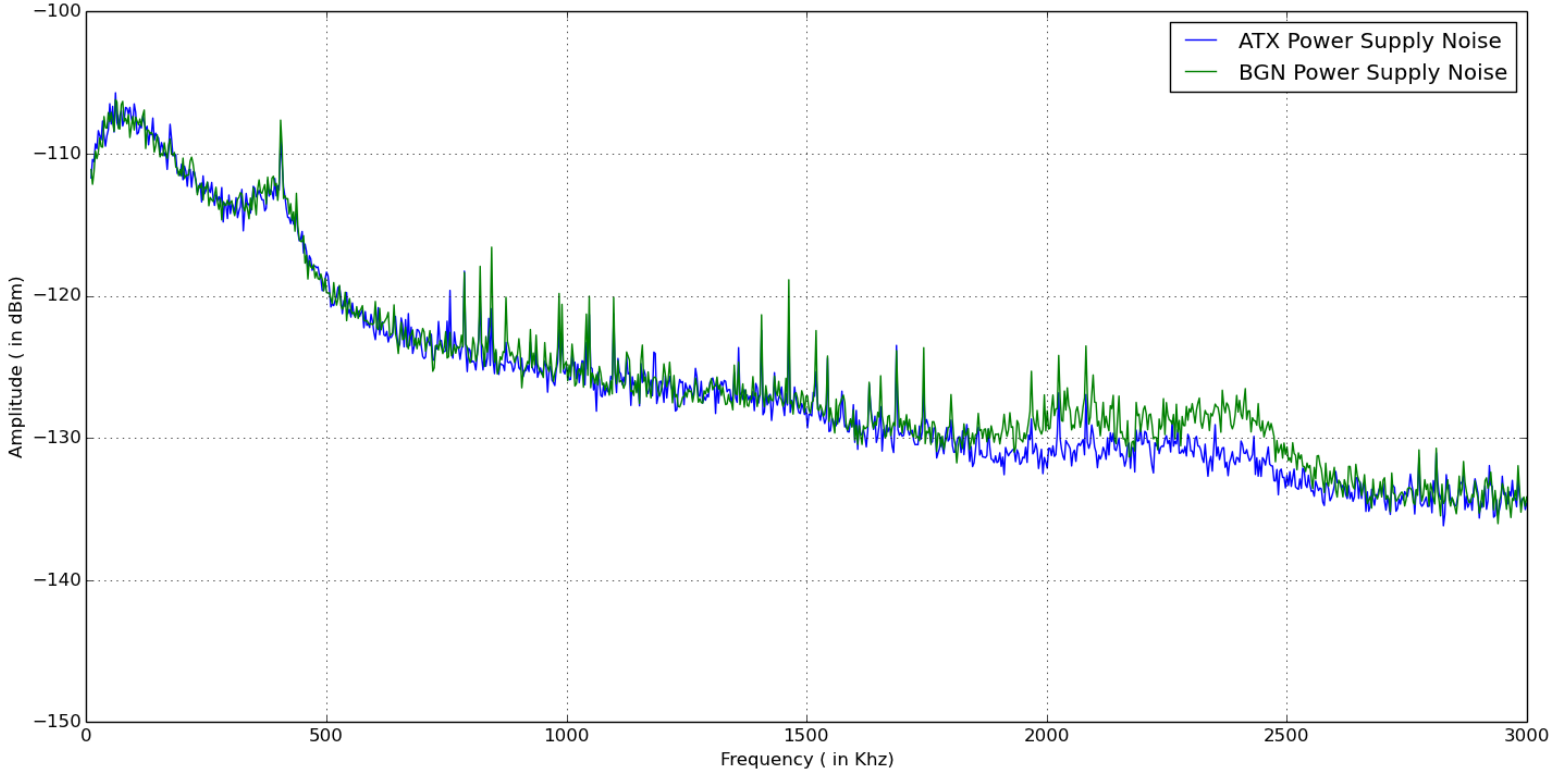


Observations

- EMI noise is completely suppressed by inbuilt EMI filter in current freq. range from 10hz to 1Mhz.

- Only some noise spikes have shown increase in amplitude in the visible spectrum.

Noise from ATX power supply and BGN from 10Khz-3Mhz



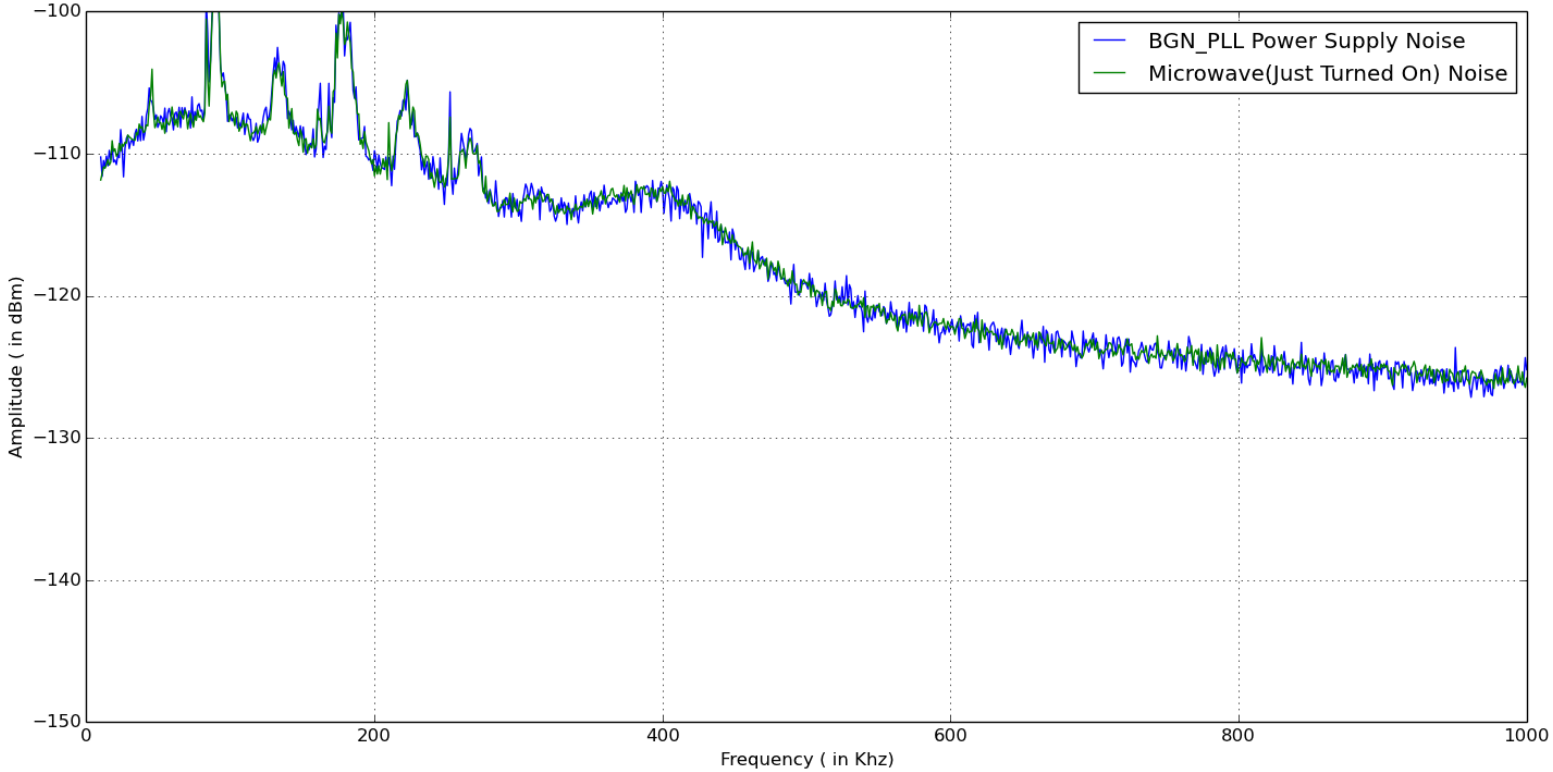
Observations

- EMI noise is showed up when observation range was modified to 10hz to 3Mhz earlier upper limit was 1Mhz.

- Some noise spikes have shown increase in amplitude from 600Khz to 1.75Mhz.

- A nice change is visible in freq. range from 1.75Mhz to 2.75Mhz with a amplitude of roughly 3-4dB.

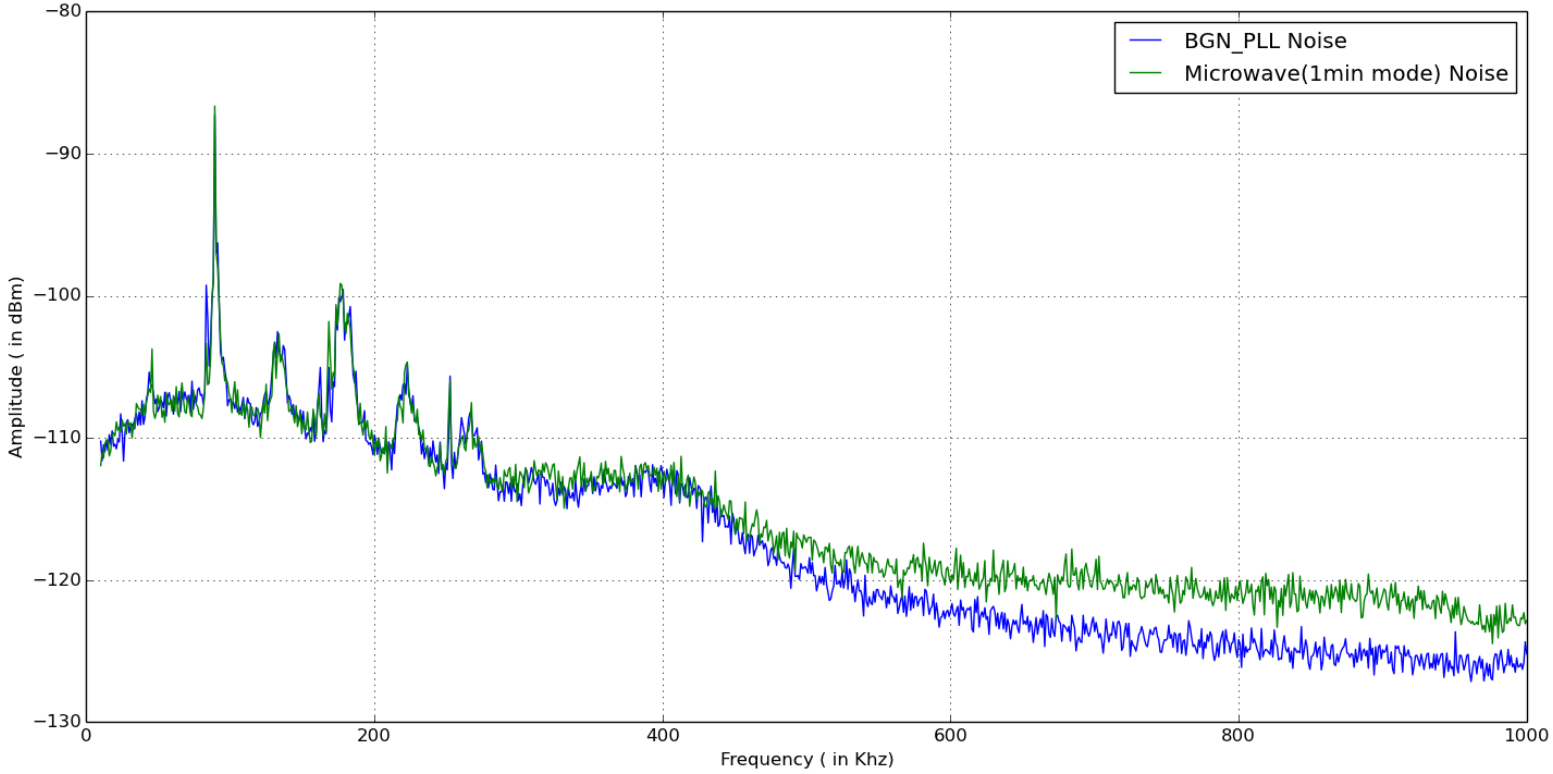
Noise from Microwave(Turned on) and BGN



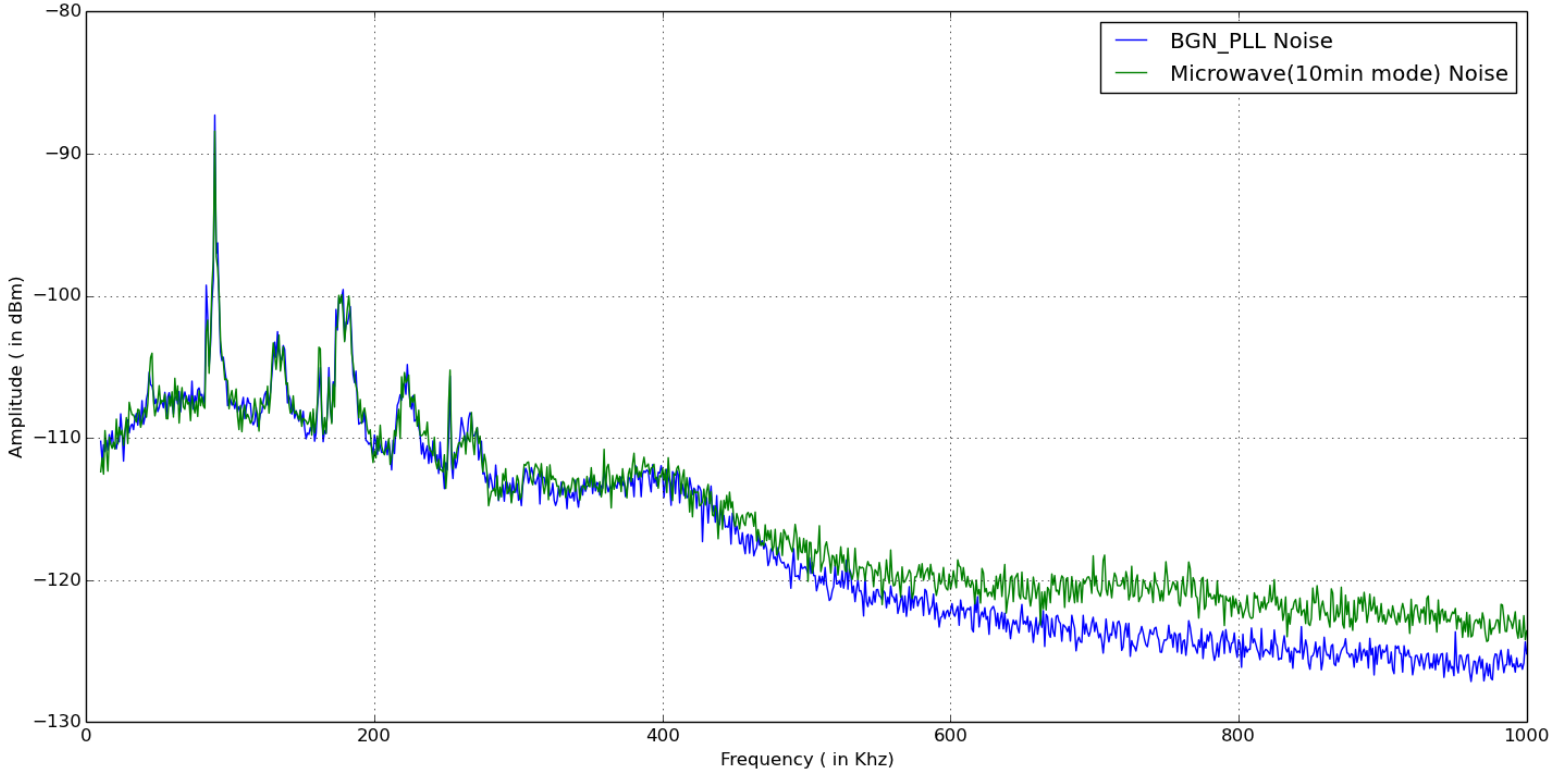
Observations

- EMI noise is completely suppressed by inbuilt EMI filter in current freq. range from 10hz to 1Mhz.
- Hardly any change is noticed in visible spectrum.

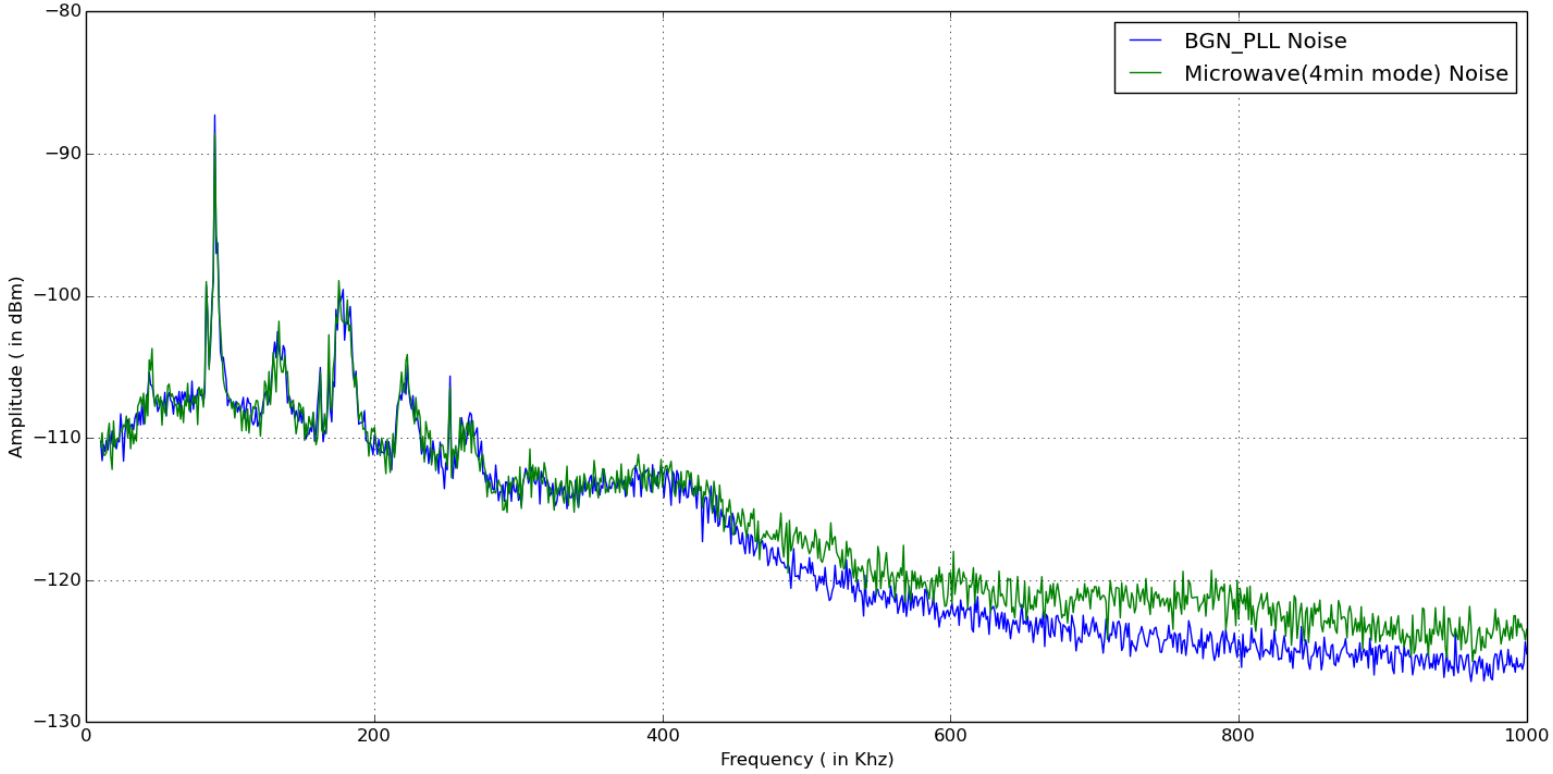
Noise from Microwave(1min mode) and BGN



Noise from Microwave(10min mode) and BGN



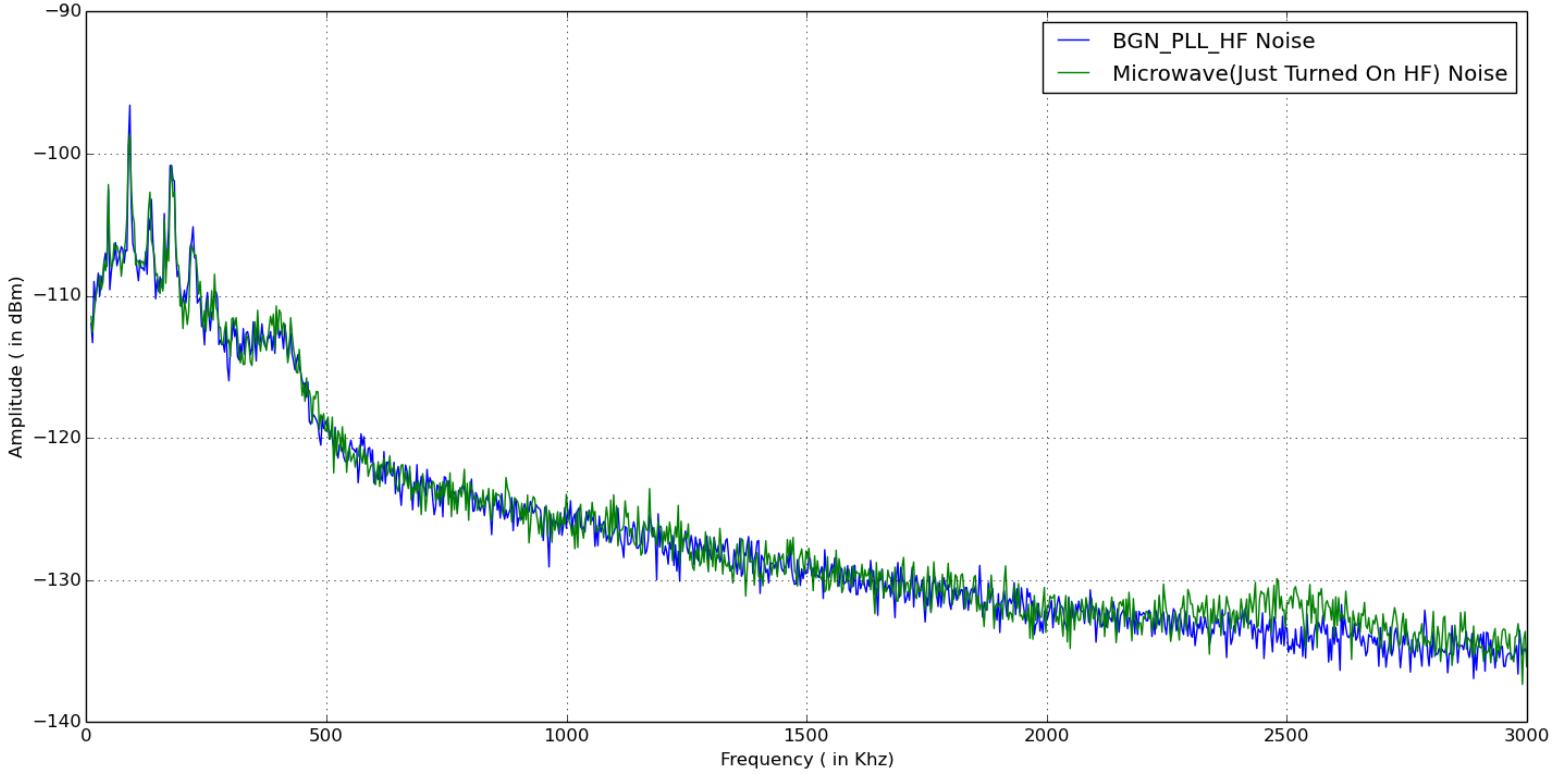
Noise from Microwave(4min mode) and BGN



Observations

- EMI noise taken from 3 operational modes of Microwave has shown a small but noticeable change in freq. range 400Khz to 1Mhz roughly 2-3dB.

Noise from Microwave(Turned on) and BGN from 10Khz-3Mhz

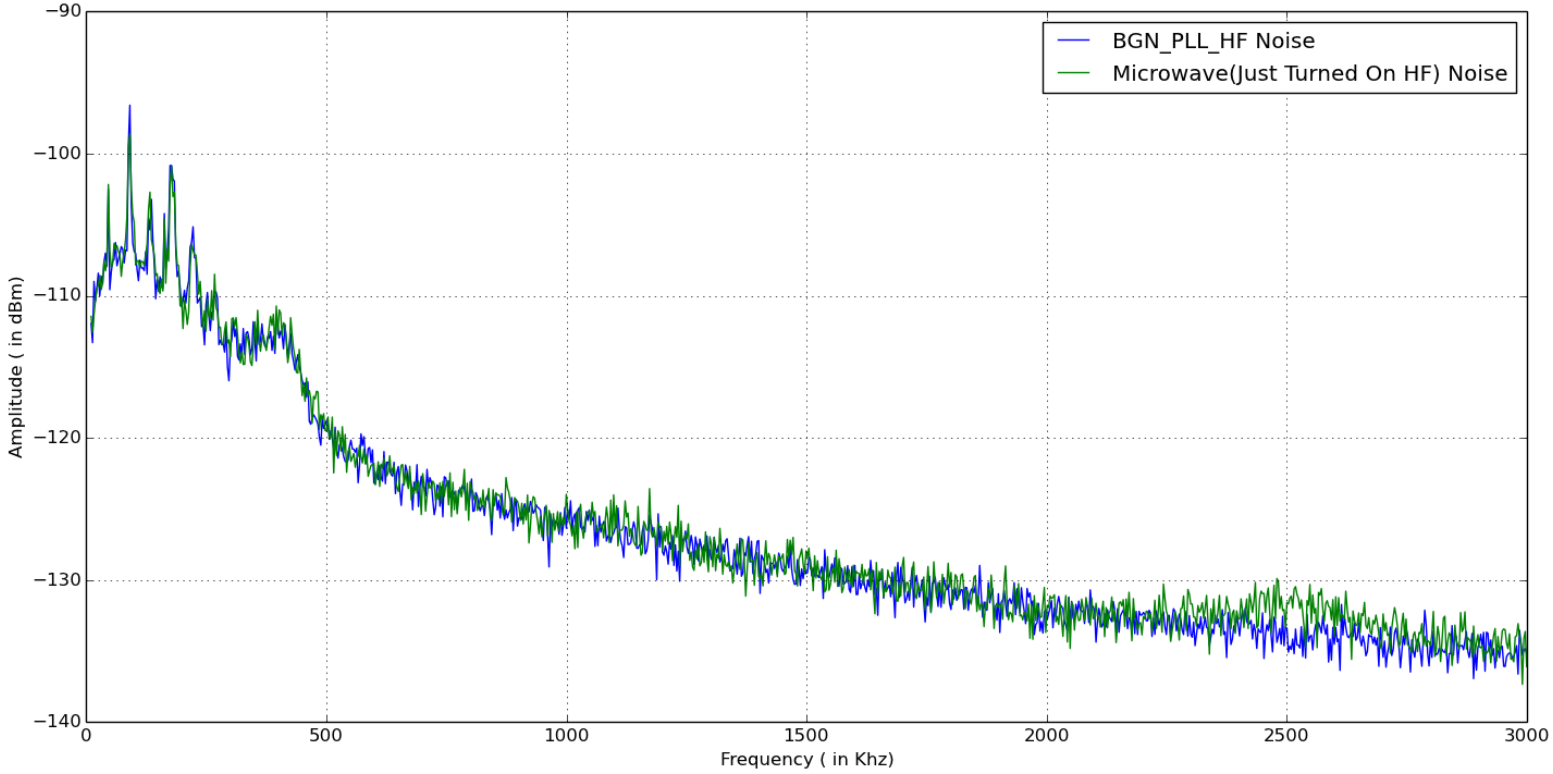


Observations

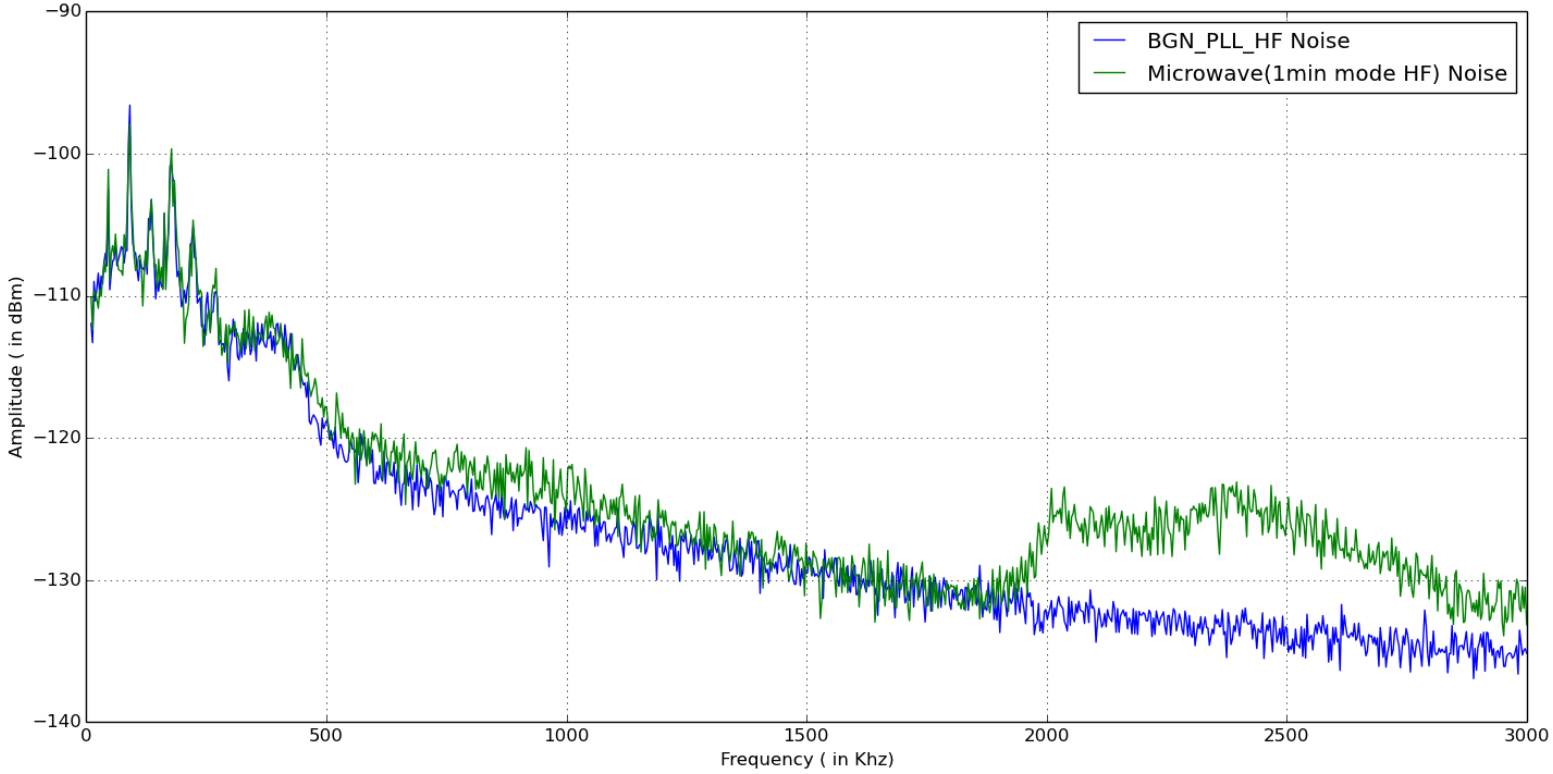
- EMI noise shows a small change from 2.25Mhz to 2.75Mhz roughly around 2-3dB.

- Earlier in while observing in 10Khz to 1Mhz range their was hardly any noticeable change.

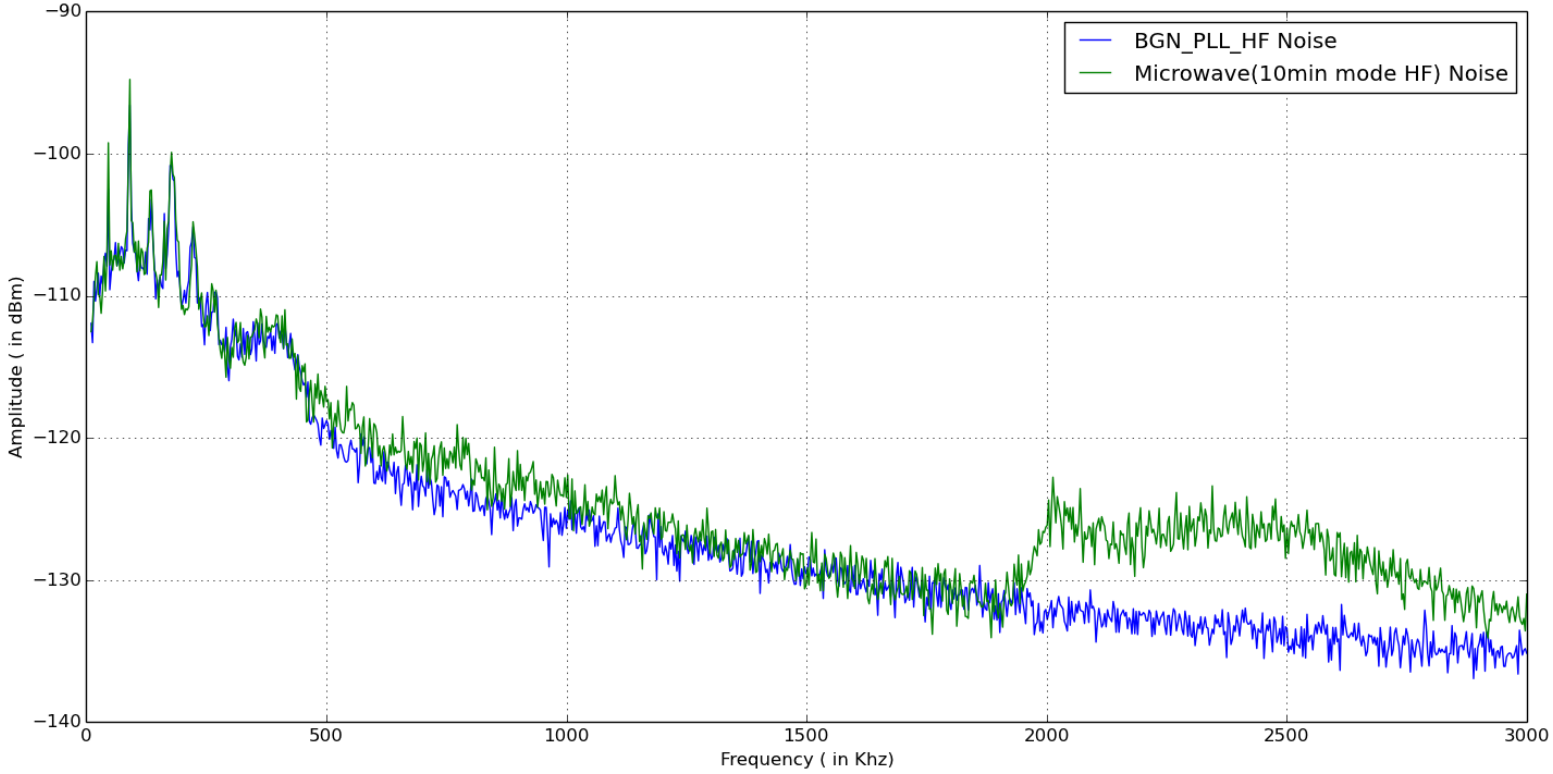
Noise from Microwave(Turned on) and BGN from 10Khz-3Mhz



Noise from Microwave(1min mode) and BGN from 10Khz-3Mhz



Noise from Microwave(10min mode) and BGN from 10Khz-3Mhz



Observations

- EMI noise taken from 2 operational modes of Microwave has shown a significant change in freq. range 1.8Mhz to 3Mhz compared to just turned on state of microwave.

- Compared to both operational states even there is a small change in amplitude when operational in 10min mode then to 1 min mode in the same frequency spectrum.

BGN taken at two different time intervals from 10Khz-3Mhz