



NCRA • TIFR

RADIO ASTRONOMY CENTRE, OOTY

# MASER ROOM ISOLATION REPORT

---

A Technical report on the maser room RFI shielding effectiveness test

29/08/2018

|                           |                                    |  |
|---------------------------|------------------------------------|--|
| <b>Author</b><br>Harish.G | <b>Date of Issue</b><br>29/08/2018 | <b>Scope</b>                             |
| <b>Approved by</b>        | <b>Status/Version</b>              | <b>Internal Technical Report<br/>No.</b> |

# **ABSTRACT**

iMaser-119 has been installed at Radio Astronomy Centre, Ooty. Shielding effectiveness testing determines the ability of material to reduce the electromagnetic field in a space by blocking the field with barriers made of conductive and/or magnetic materials. This report presents the RFI shielding effectiveness tests performed for the room inside which the maser has been installed.

## Contents

|                       |   |
|-----------------------|---|
| 1.Introduction: ..... | 1 |
| 2.Procedure : .....   | 2 |
| 3.Output Plots: ..... | 3 |
| 4.Results : .....     | 4 |

### List of figures:

|   |   |
|---|---|
| Figure 1.1: Dipole antenna used as transmitter .....    | 4 |
| Figure 1.2: Outside view of the maser room.....         | 5 |
| Figure 1.3: PONDER system GUI used to record plots..... | 5 |
| Figure 2.1: Setup for maser room RFI measurements.....  | 5 |

PONDER Frequency vs. Power plots when the dipole transmits from inside the maser room and the door is opened.

|   |    |
|---|----|
| Figure 3.1 : Plot captured using PONDER when there is no radiation from the dipole..... | 7  |
| Figure 3.2: Plot at 320MHz.....   | 8  |
| Figure 3.3: Plot at 322MHz.....   | 8  |
| Figure 3.4: Plot at 324MHz.....   | 9  |
| Figure 3.5: Plot at 326MHz.....   | 9  |
| Figure 3.6: Plot at 328MHz.....   | 10 |

Figure 3.7: Plot at 330MHz.....10

Figure 3.8: Plot at 332MHz.....11

PONDER Frequency vs. Power plots when the dipole transmits from inside the maser room and the room door is closed.

Figure 3.9: Plot at 320MHz.....12

Figure 3.10: Plot at 324MHz.....12

Figure 3.11: Plot at 326MHz.....13

Figure 3.12: Plot at 328MHz.....13

Figure 3.13: Plot at 330MHz.....14

Figure 3.14: Plot at 332MHz.....14

## 1.Introduction:

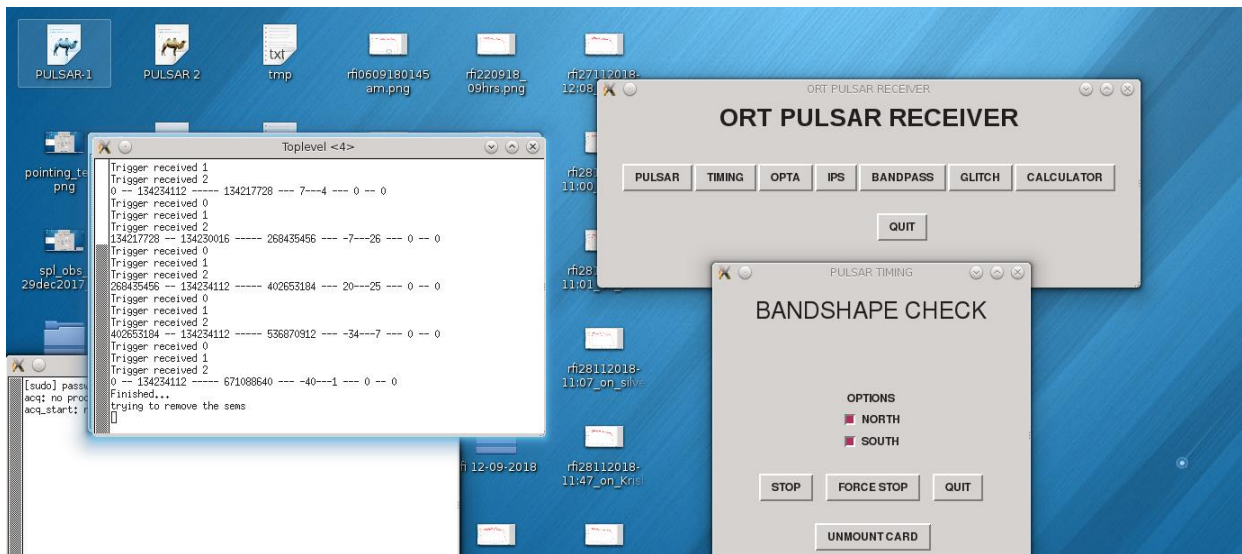
Shielding effectiveness testing determines the ability of material to reduce the electromagnetic field in a space by blocking the field with barriers made of conductive and/or magnetic materials. MASER Room RFI shielding effectiveness in the 318MHz -334MHz band has been tested by using a dipole antenna to transmit RF signals in the 318MHz - 334MHz band. Frequency vs. power plots of ORT in the same band are captured using PONDER software. Dipole antenna transmits signal of -10dbm power generated from an agilent signal generator (power level remains same for every measurement taken in 318-334MHz band) inside the maser room when the room door is open and when it is closed. The difference in power levels in both conditions as obtained from the PONDER plots gives us the attenuation/isolation offered by the shielded room.



**Figure 1.1: Dipole antenna used as transmitter (center frequency of dipole 326.5MHz)**



**Figure 1.2 : Outside view of the maser room.**

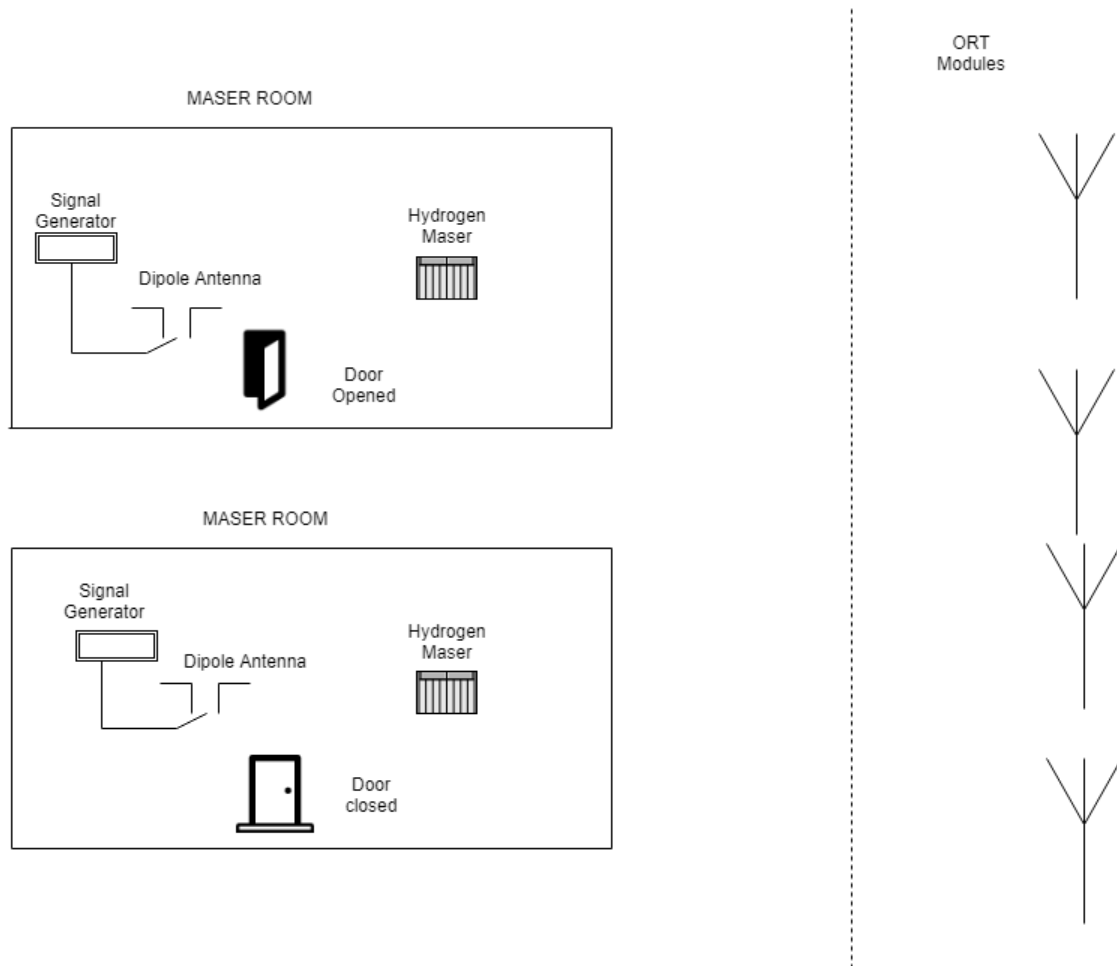


**Figure 1.3: PONDOR system GUI used to record plots.**

## 2.Procedure:

The dipole antenna transmits signal of -10dbm power across 318MHz-334MHz band, its responses are recorded using the PONDER system present in pulsar receiver room. PONDER system generates a .fil which is converted to ascii file using the command:

Bandpass <filename>.fil > <outputfilename>.ascii.



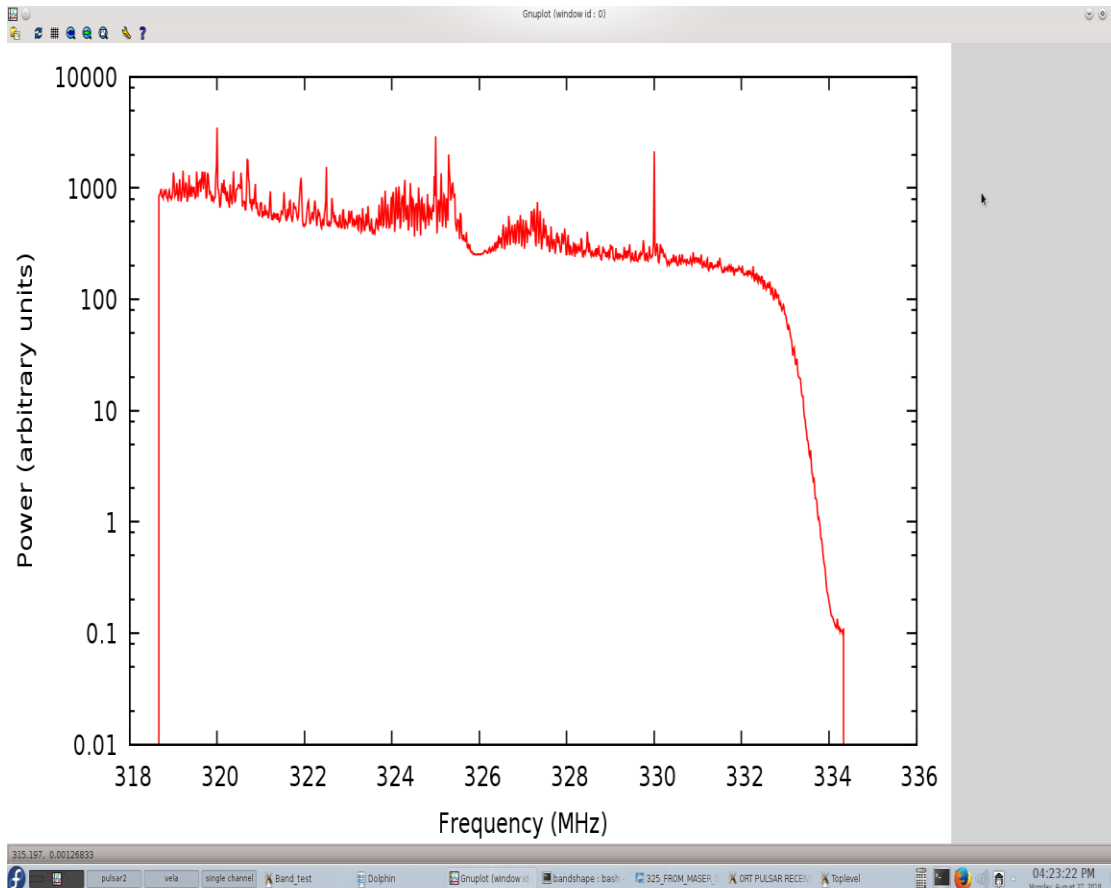
**Figure 2.1: Setup for maser room RFI measurements.**



### 3. Output Plots:

This ascii file is used to plot the response using gnuplot as shown in figure .

Calibration: Plot captured using PONDER when there is no radiation from the dipole.



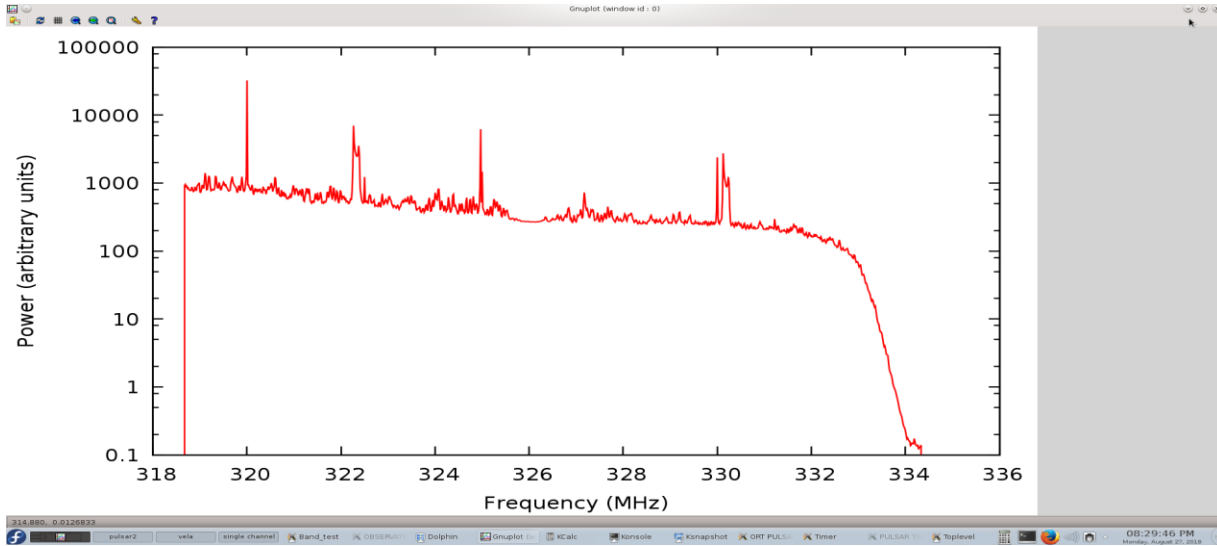
**Figure 3.1 : Plot captured using PONDER when there is no radiation from the dipole.**

*PONDER Frequency vs. Power plots when the dipole transmits from inside the maser room and the door is opened.*

The signal generator is set at 320MHz with -10dbm level and fed to dipole, now the response of the ORT is recorded using PONDER as shown in figure 1.4.1 the peak response in power level is at 320MHz. Similar measurements are performed with an interval of 2MHz.

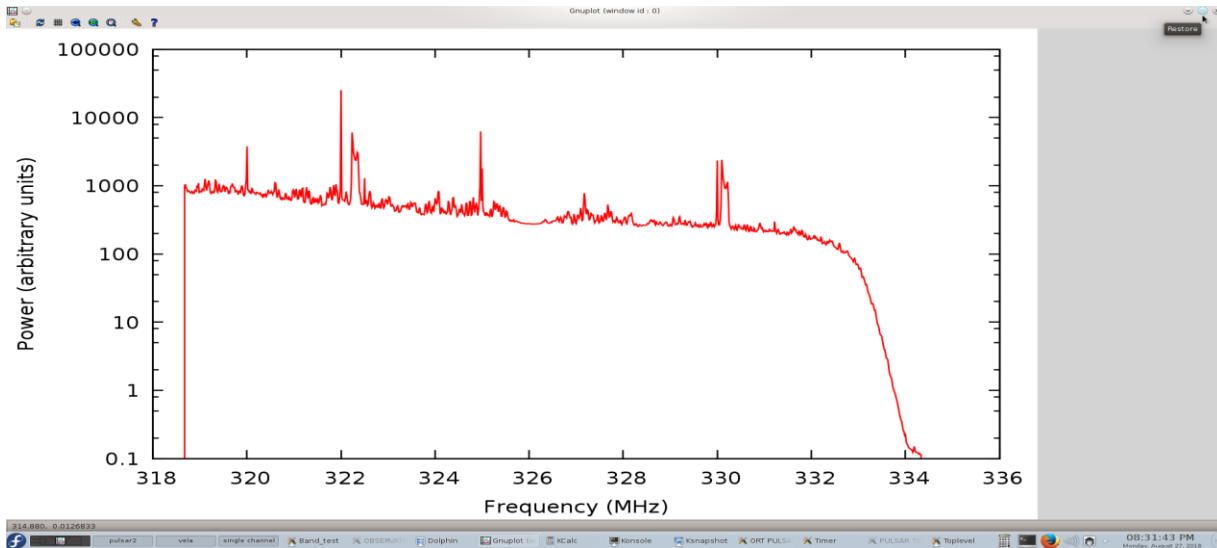


At 320MHz



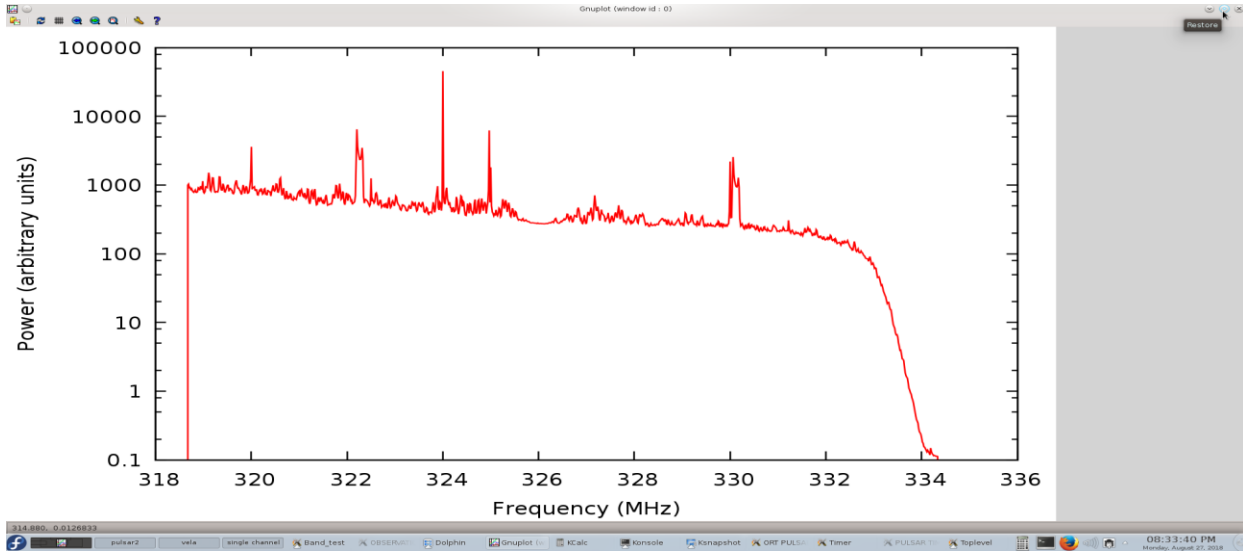
**Figure 3.2: Plot at 320MHz**

At 322MHz



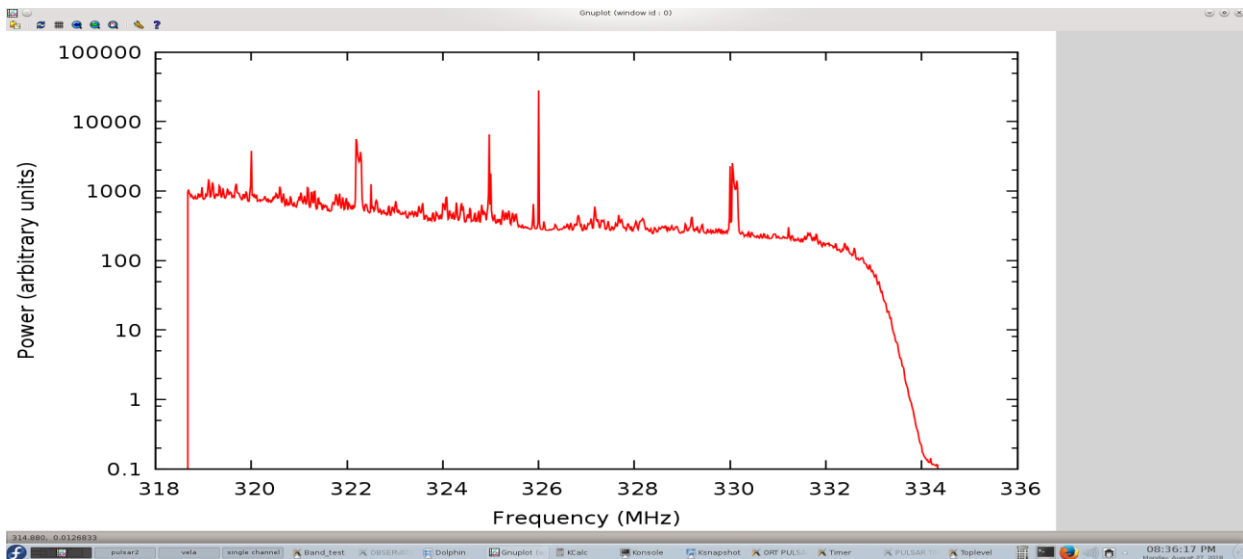
**Figure 3.3: Plot at 322MHz**

At 324MHz



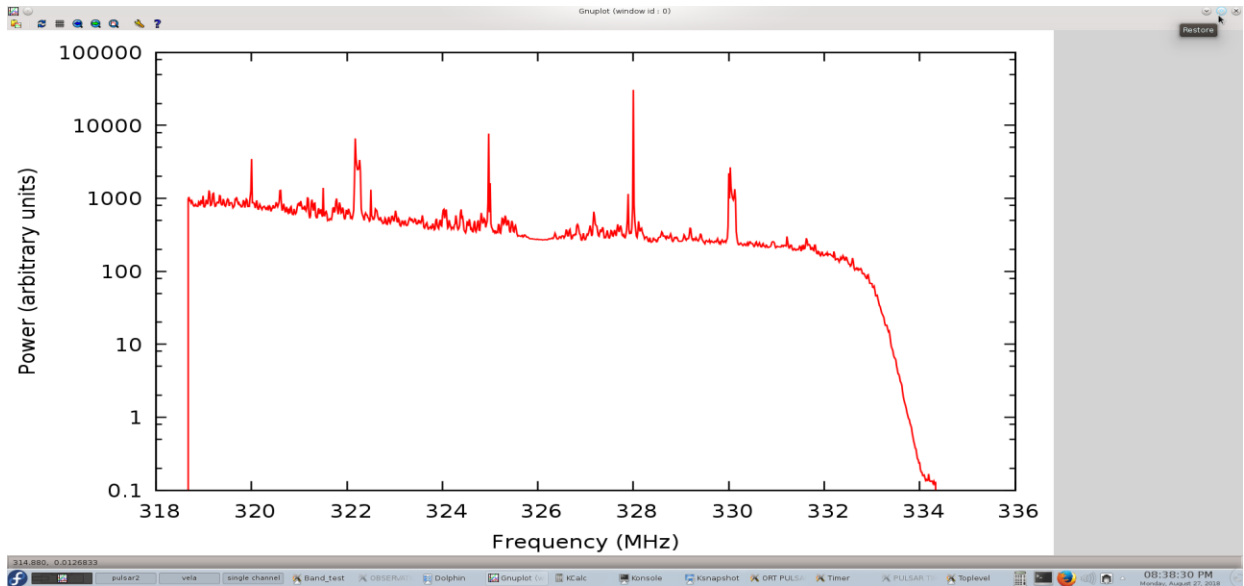
**Figure 3.4: Plot at 324MHz**

At 326MHz



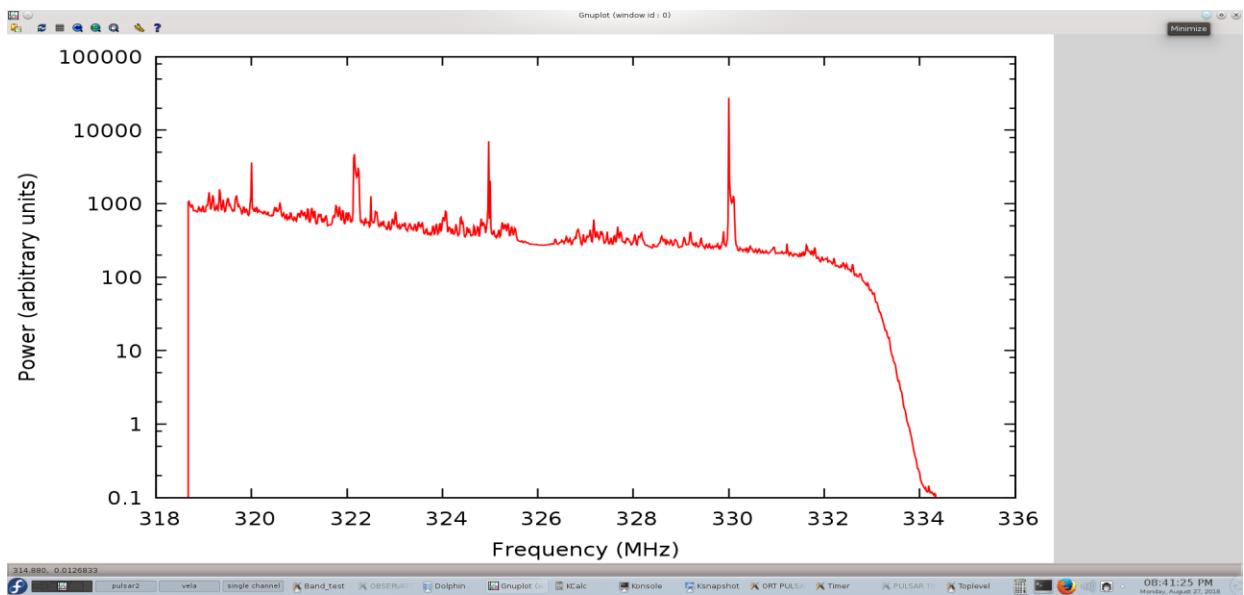
**Figure 3.5: Plot at 326MHz**

At 328MHz



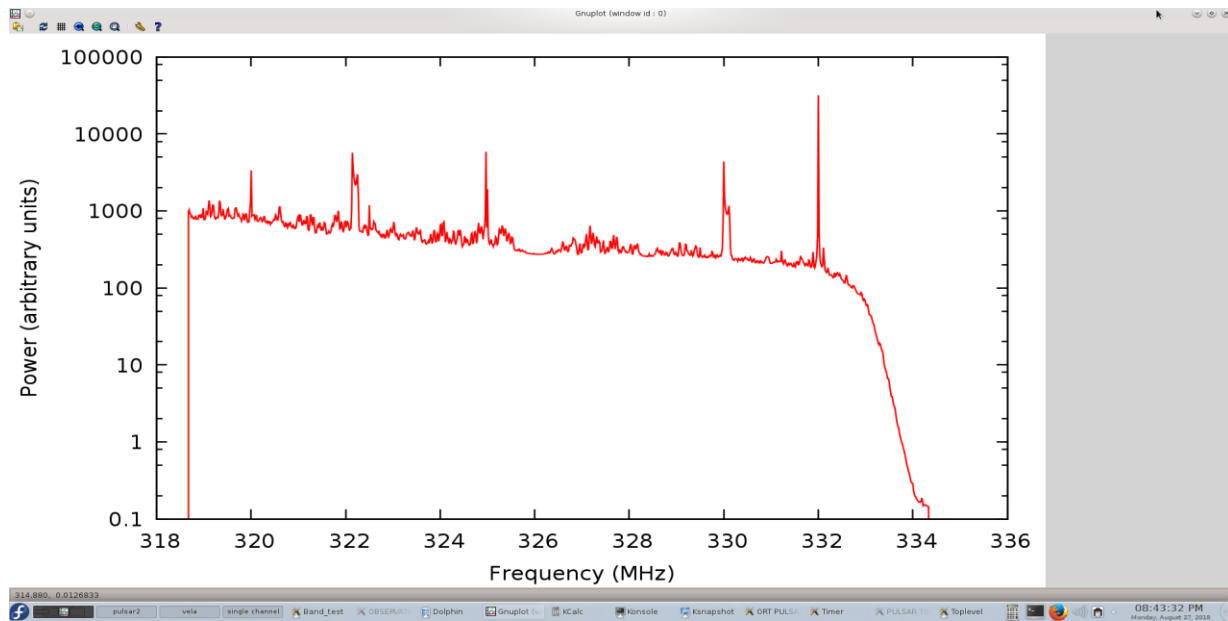
**Figure 3.6: Plot at 328MHz**

At 330MHz



**Figure 3.7: Plot at 330MHz**

At 332MHz

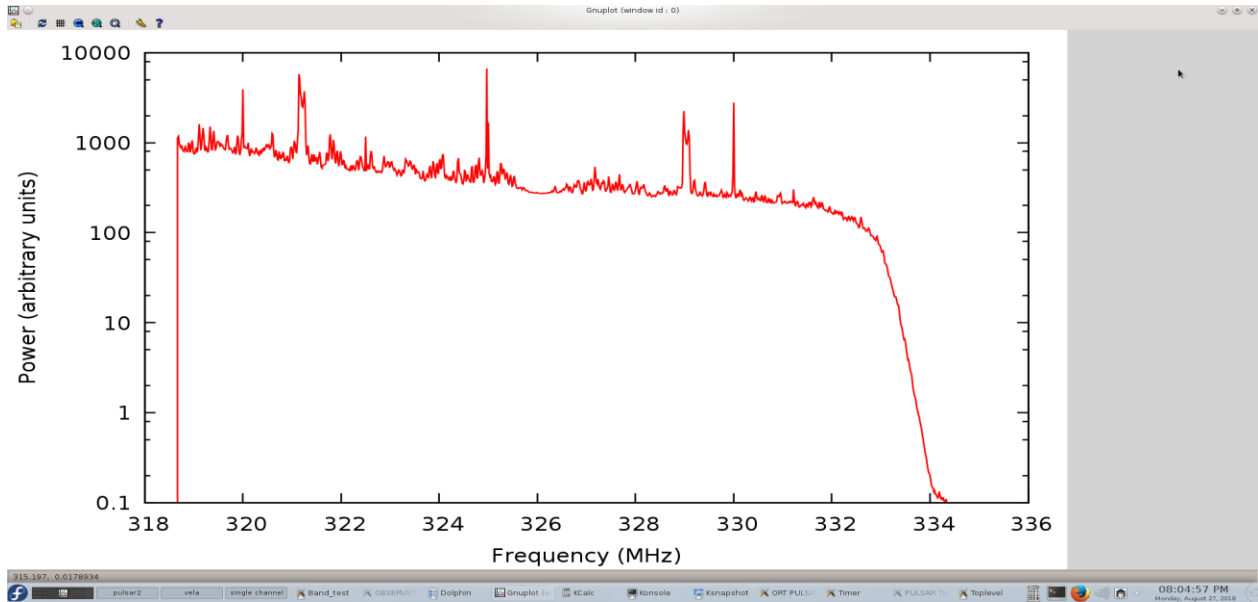


**Figure 3.8: Plot at 332MHz**

---

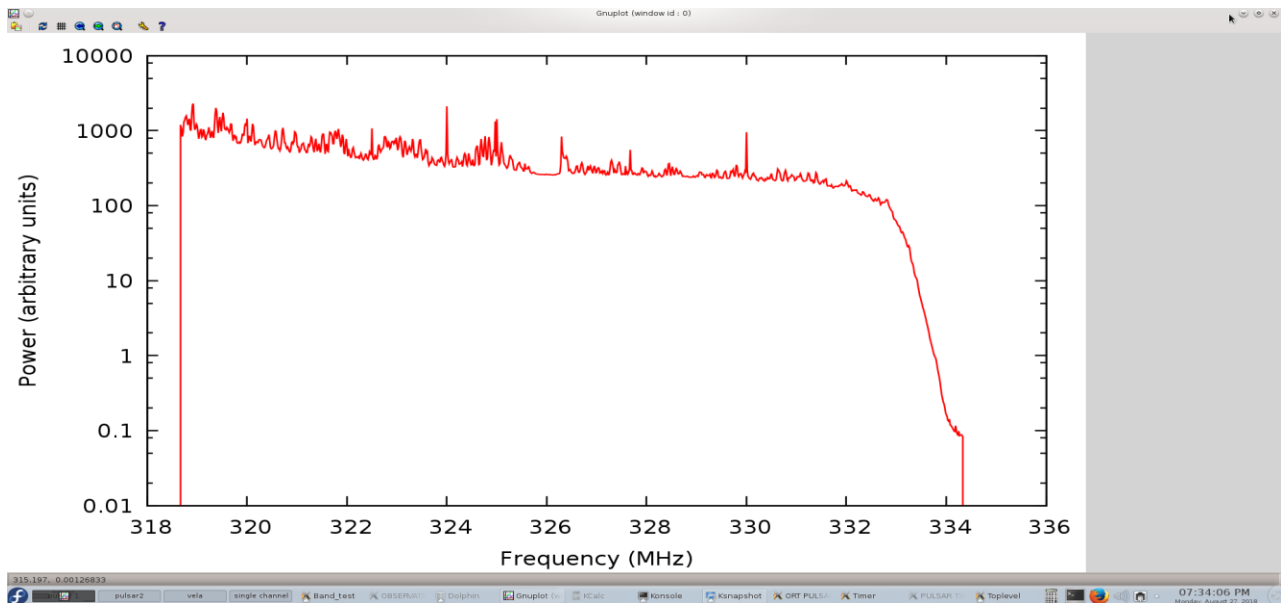
*PONDER Frequency vs. Power plots when the dipole transmits from inside the maser room and the room door is closed.*

At 320MHz



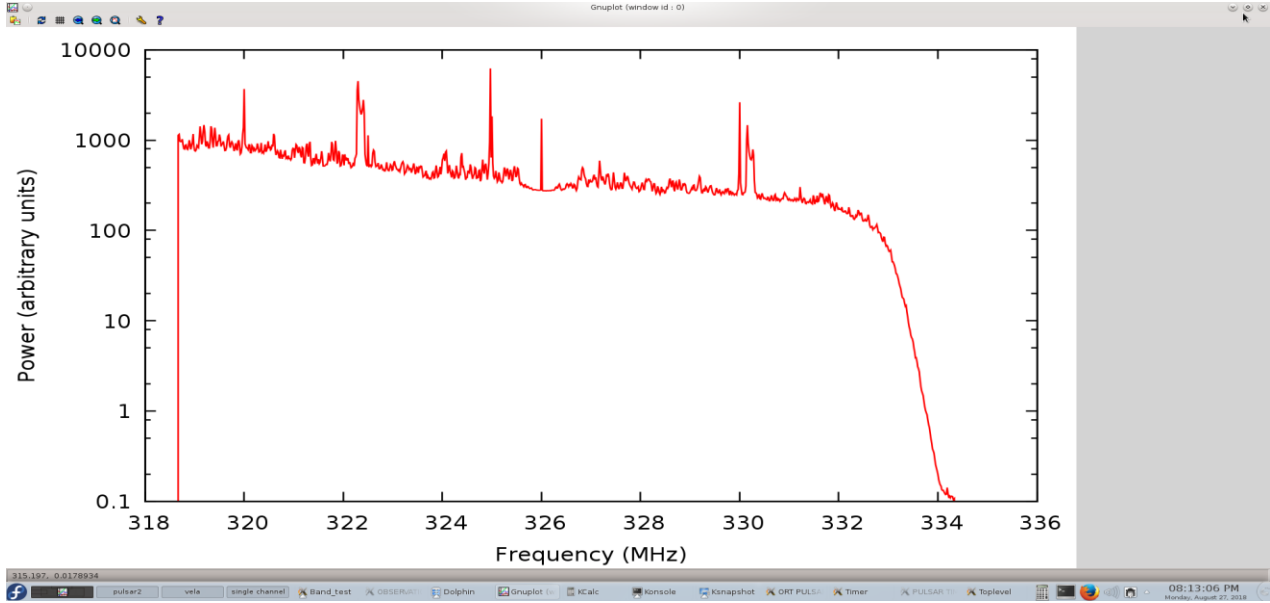
**Figure 3.9: Plot at 320MHz**

At 324MHz



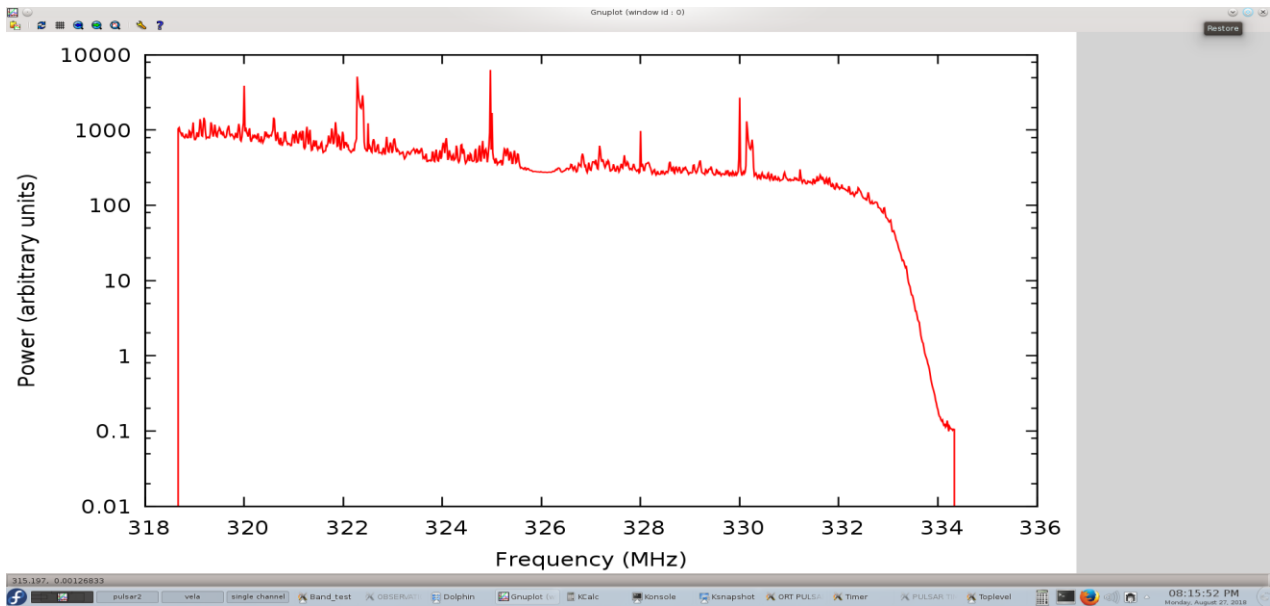
**Figure 3.10: Plot at 324MHz**

At 326MHz



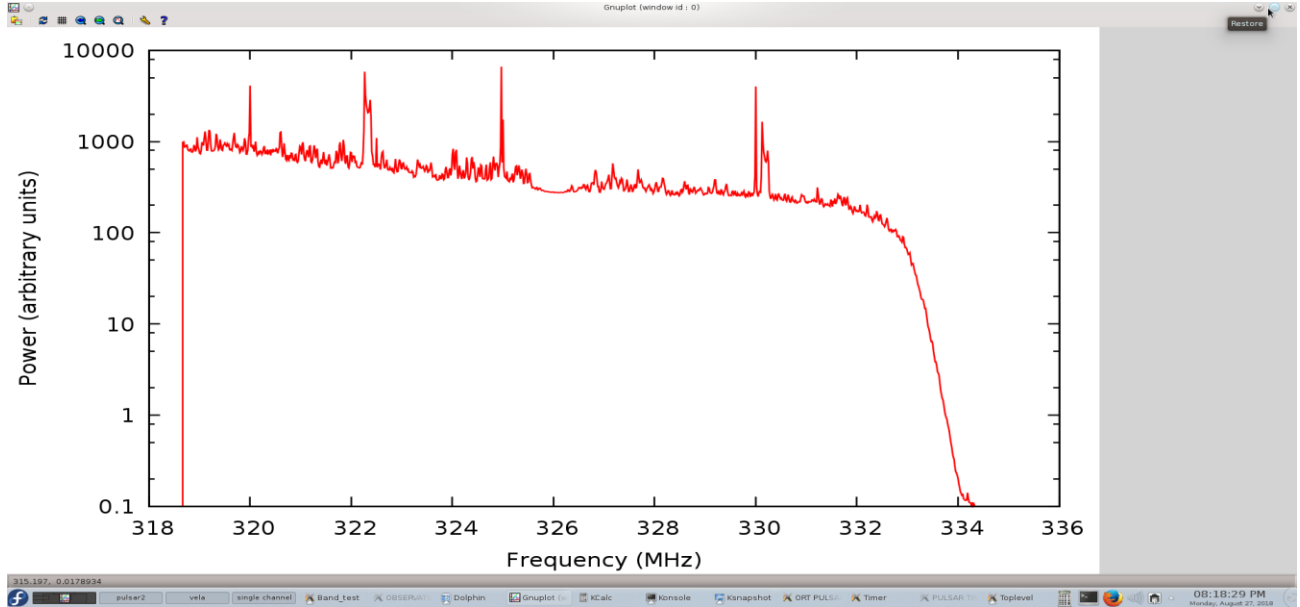
**Figure 3.11: Plot at 326MHz**

At 328MHz



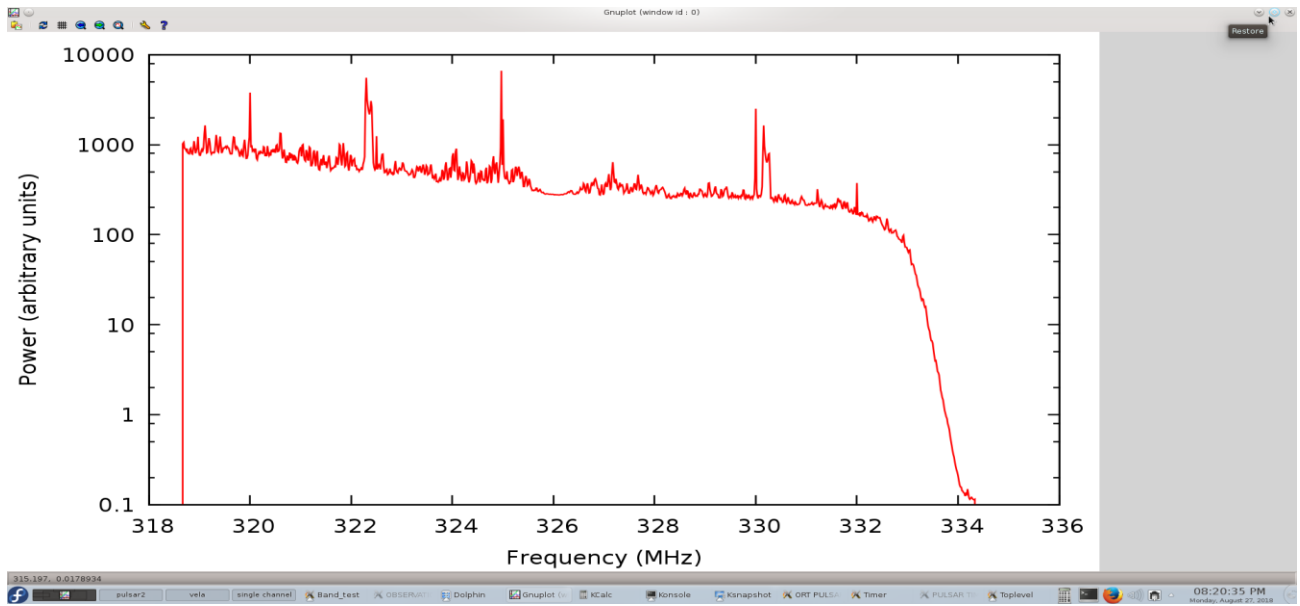
**Figure 3.12: Plot at 328MHz**

At 330MHz



**Figure 3.13: Plot at 330MHz**

At 332MHz



**Figure 3.14: Plot at 332MHz**



## Results:

Calculation of attenuation offered by the maser room at 320MHz frequency using data from gnuplots(point the cursor to the datapoint on the gnuplot to get readings at that datapoint).

Power at 320 MHz from PONDER plot when the maser room is open : 36506

Power at 320 MHz from PONDER plot when the maser room is closed : 3870

Difference in power levels gives attenuation offered by the shielded room = 32636.

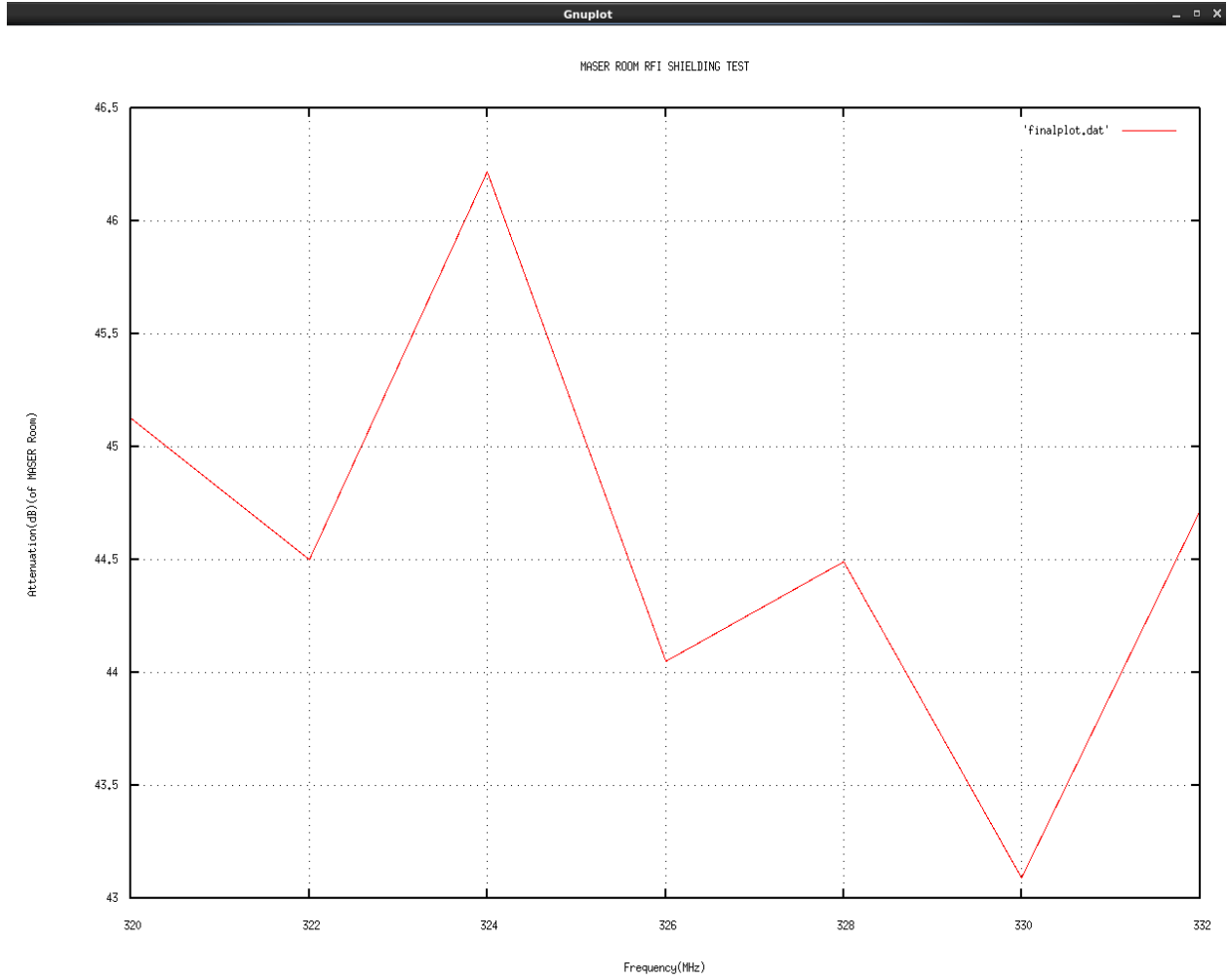
Attenuation in dB =  $10\log(32636) = 10 * 4.5136 = 45.13\text{dB}$ .

Summary table:

| Frequency(MHz) | Attenuation(dB) |
|----------------|-----------------|
| 320            | 45.13           |
| 322            | 44.50           |
| 324            | 46.22           |
| 326            | 44.05           |
| 328            | 44.49           |
| 330            | 43.09           |
| 332            | 44.72           |

Table showing the attenuation offered by shield at different frequencies

Final plot recorded for different frequencies:



**Figure 3.15: gnuplot showing the attenuation offered by shield at different frequencies**