GNSS Signal Interference Analyzer

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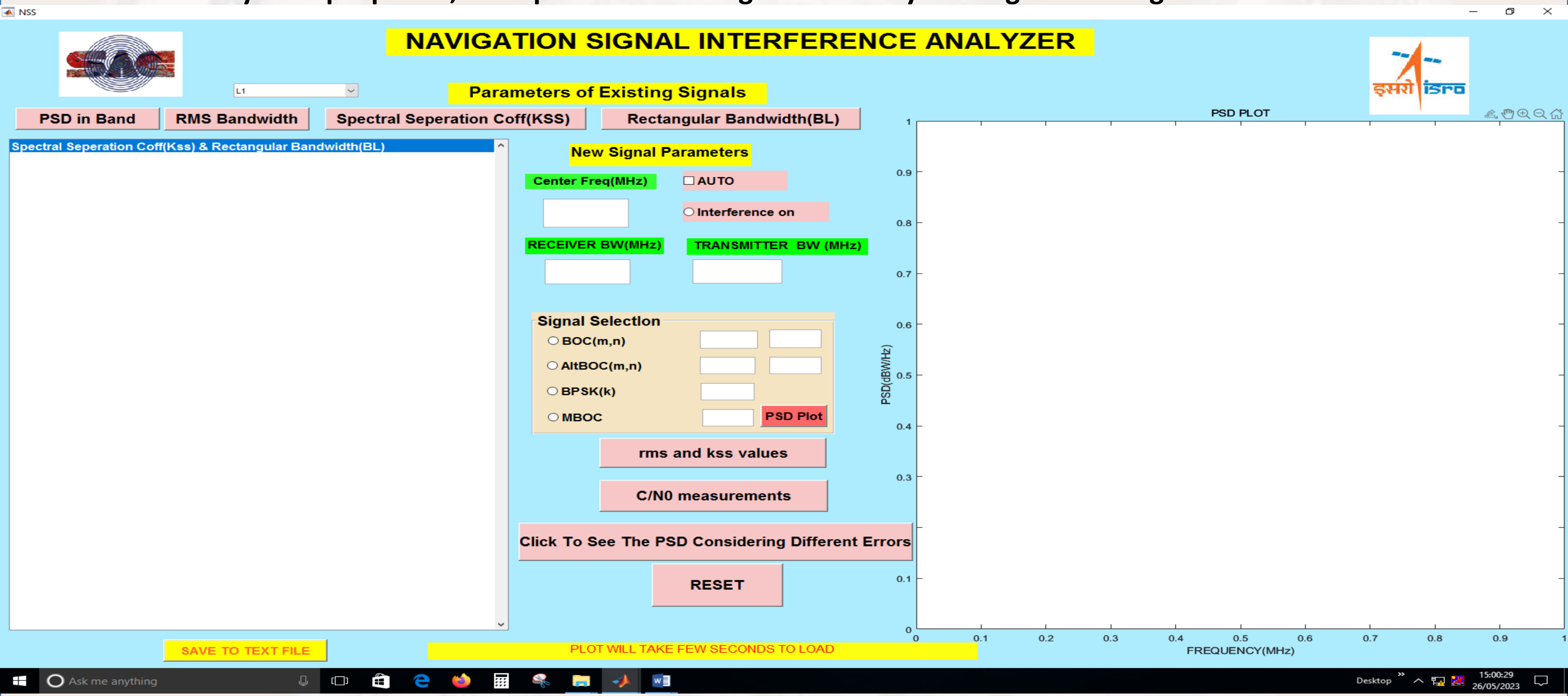
GNSS Signal Interference Analyzer

- Interoperability and compatibility is the main goal for current GNSS systems. A concept of Global Navigation Satellite System (GNSS) is to use all navigation system together to provide better capabilities compared with those that would be achieved relying solely on one service or signal. Compatibility, on the other hand, assures that existing GNSS signal is not degrading each other below certain threshold. GNSS provider is concerned about their own signal as well as other signals from different service provider for co-existence. For this reason interference analysis of current GNSS signal is the most needed requirement in current scenario.
- An in-house tool is developed with suitable Graphic User Interface (GUI) which provides static analysis of different type of interference parameters and indicates its compatibility with already existing signals. Primary objective of the tool is

Objective

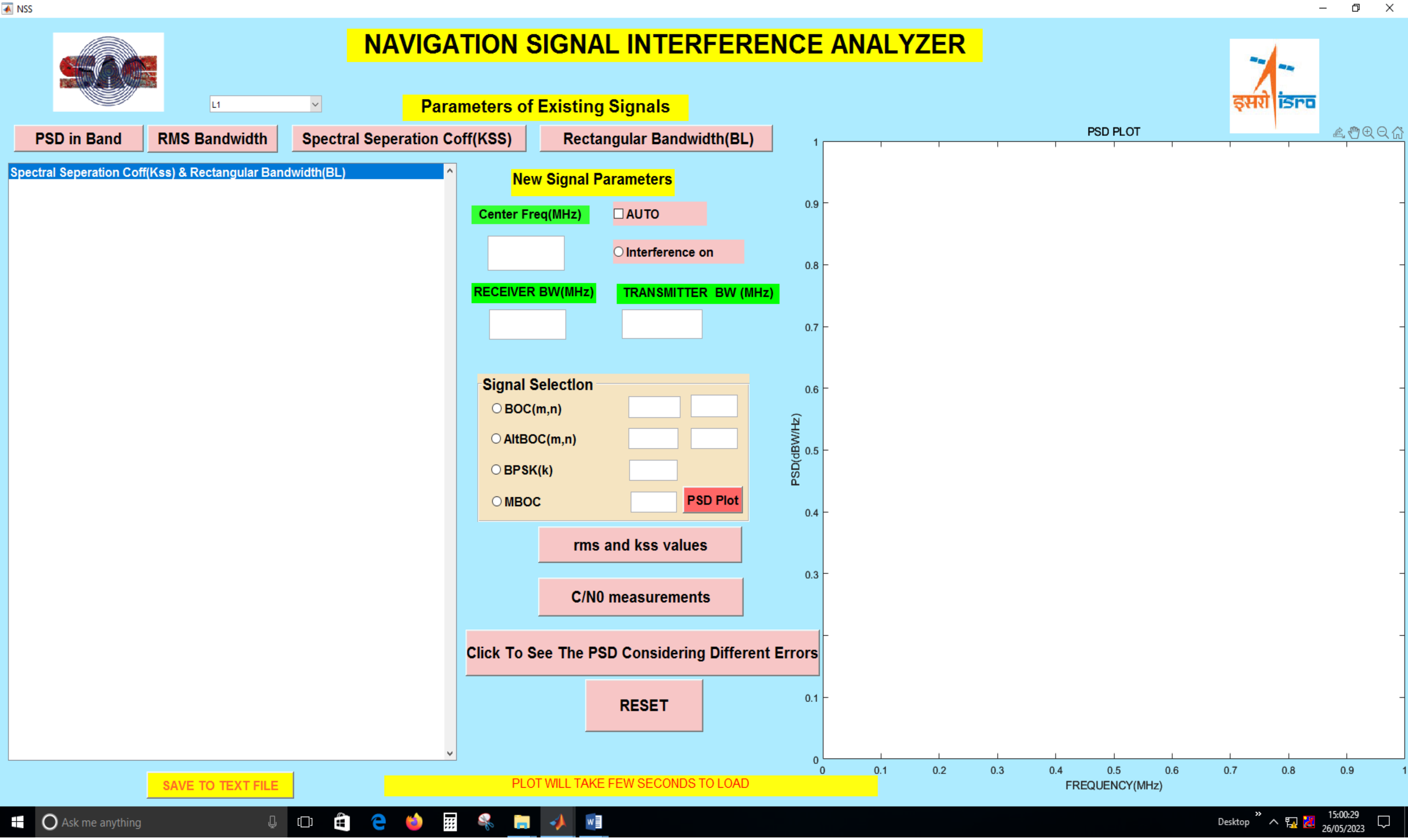
- To Analyze Inter and Intra system Interference parameter in each Navigation Band.
- To do the interference analysis due to any new signal proposed in any Navigation band.
- To compute C/No degradation due to current signal or any new proposed signal.
- To analyze multipath error budget due to proposed new signal.
- To analyze tropospheric, ionospheric error budget due to any new signal in navigation band.



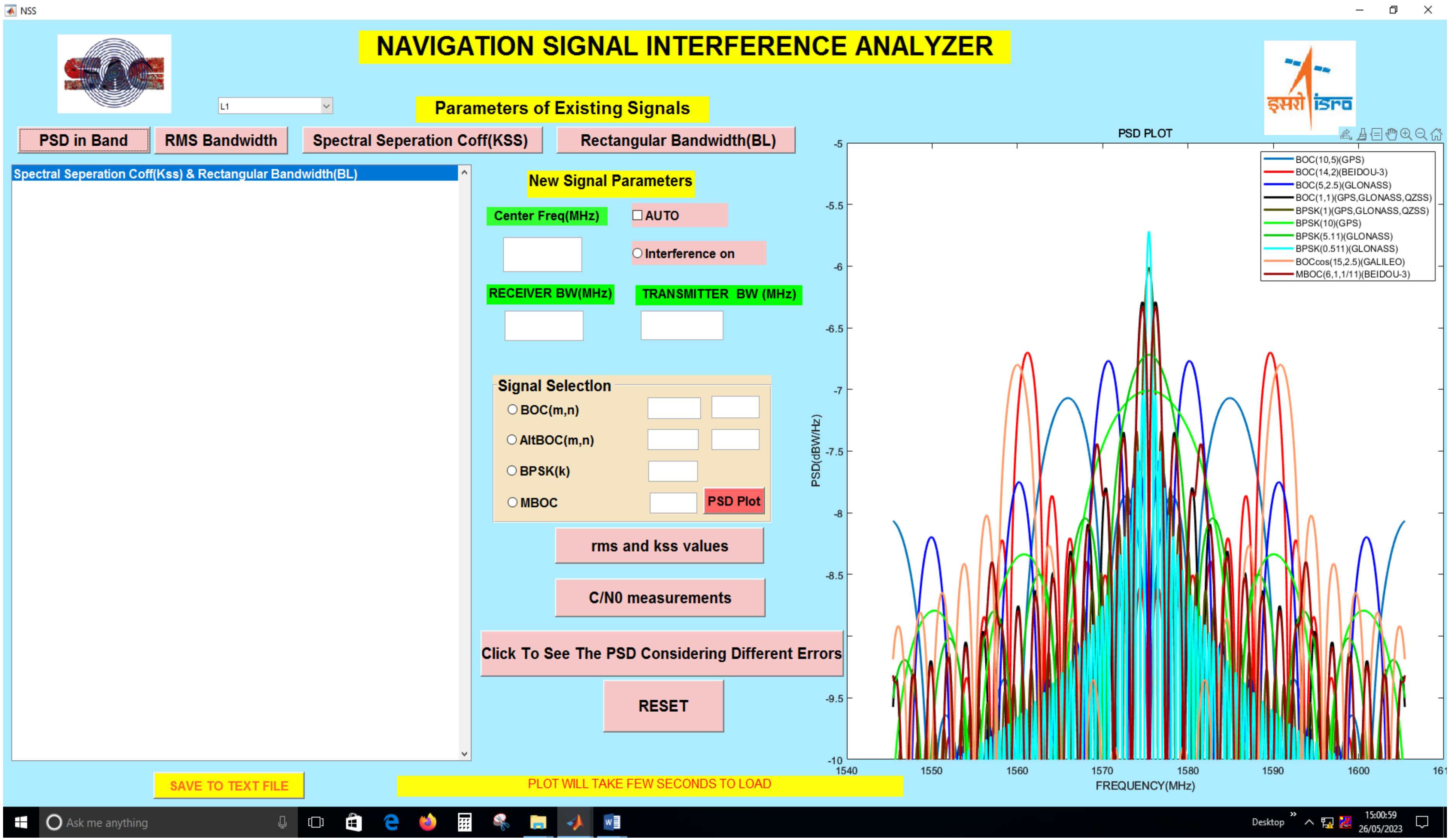
Interference parameters under consideration

- Power Spectral Density
- Spectral Separation Coefficient
- Root mean square Bandwidth
- Rectangular bandwidth
- Carrier Power to noise density ratio
- Tropospheric refraction
- Ionospheric Refraction
- Multipath Analysis

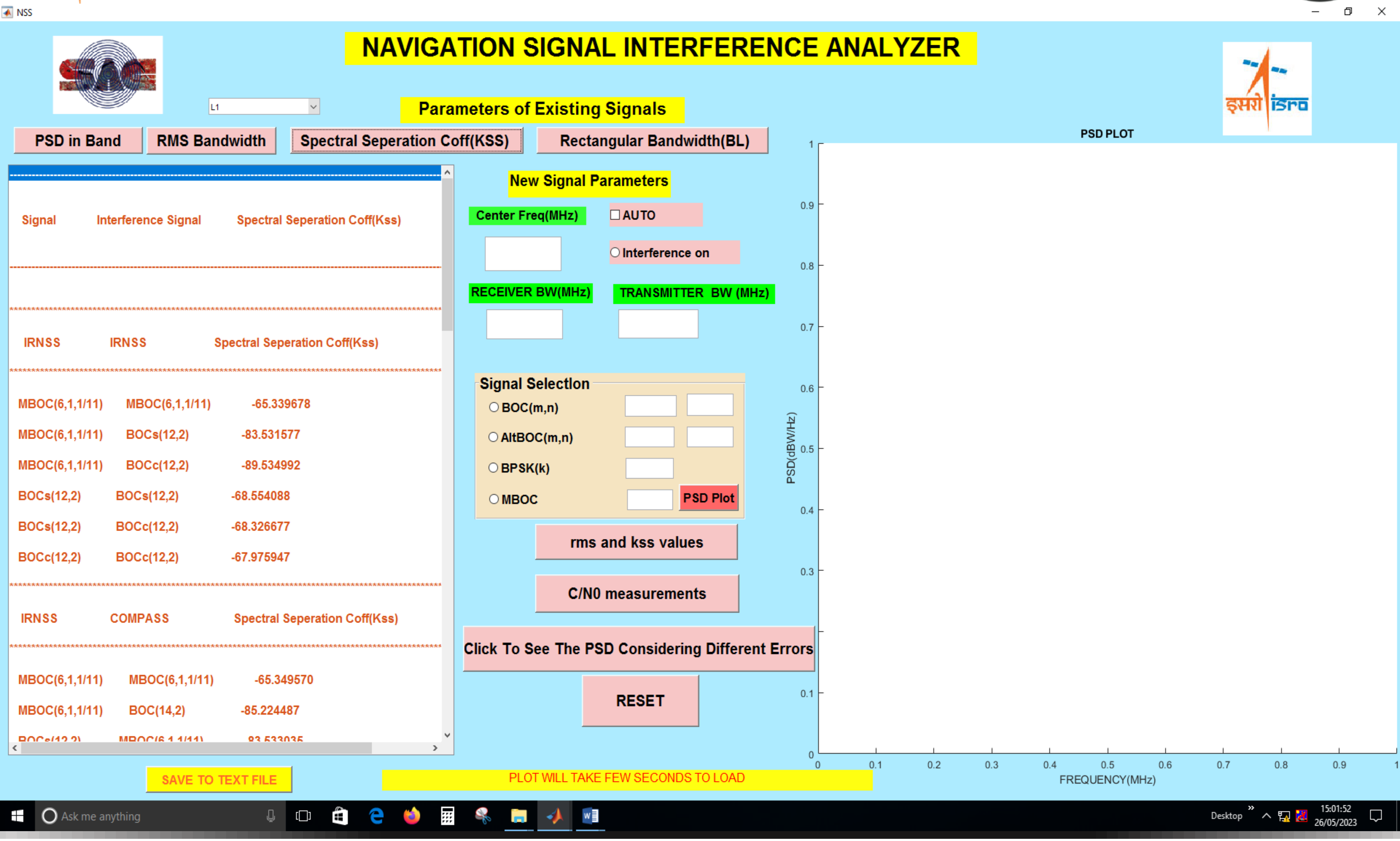
Main Gui


NSS
NAVIGATION SIGNAL INTERFERENCE ANALYZER
L1
Parameters of Existing Signals
PSD in Band
RMS Bandwidth
Spectral Seperation Coff(KSS)
Rectangular Bandwidth(BL)
Spectral Seperation Coff(Kss) & Rectangular Bandwidth(BL)
New Signal Parameters
Center Freq(MHz)
AUTO
Interference on
RECEIVER BW(MHz)
TRANSMITTER BW (MHz)
Signal Selection
BOC(m,n)
AltBOC(m,n)
BPSK(k)
MBOC
PSD Plot
rms and kss values
C/N0 measurements
Click To See The PSD Considering Different Errors
RESET
SAVE TO TEXT FILE
PLOT WILL TAKE FEW SECONDS TO LOAD
PSD PLOT
PSD(dBW/Hz)
FREQUENCY(MHz)
Ask me anything
Desktop
15:00:29
26/05/2023

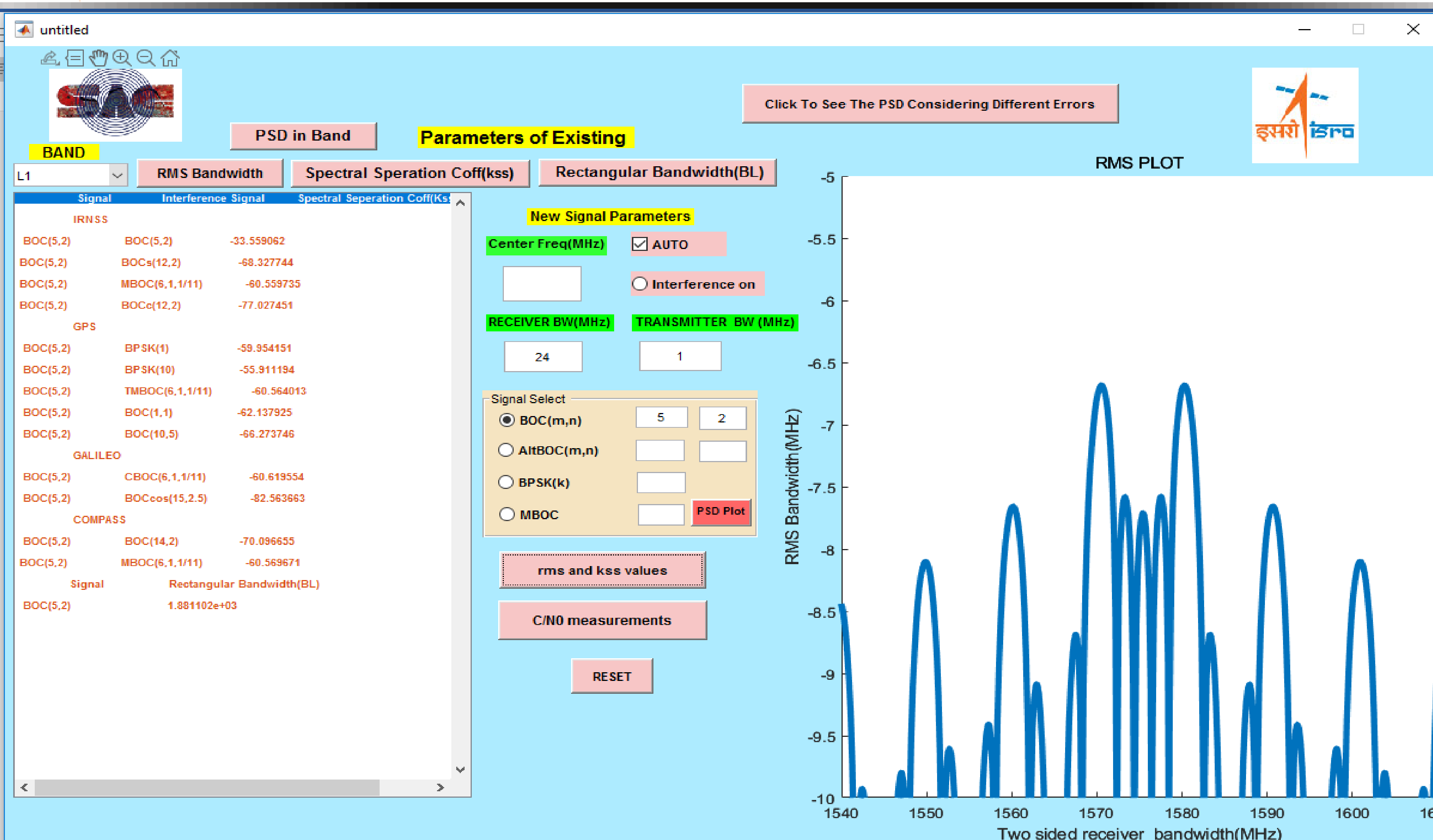
Signals in Band



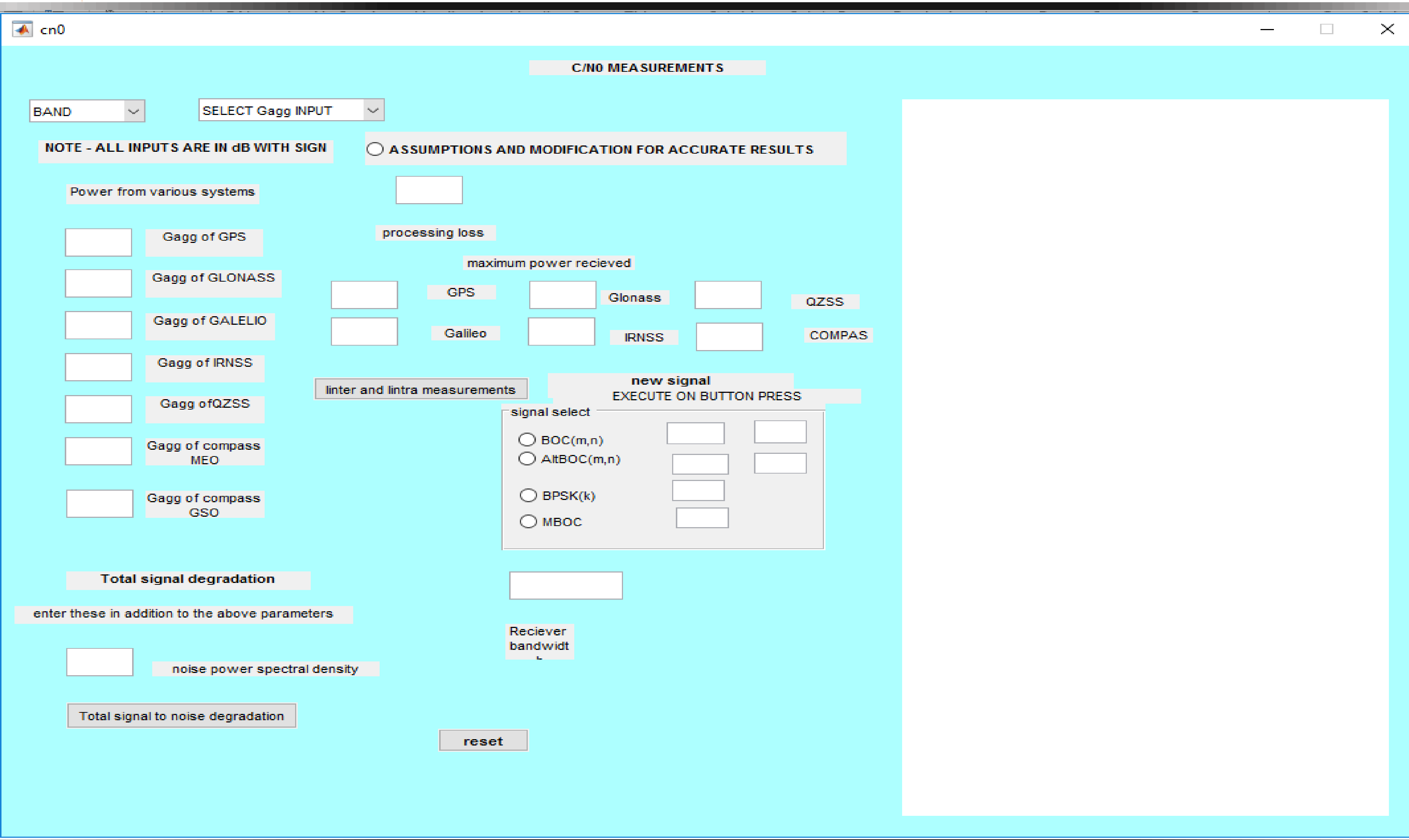
Spectral Seperation Coff(kss)



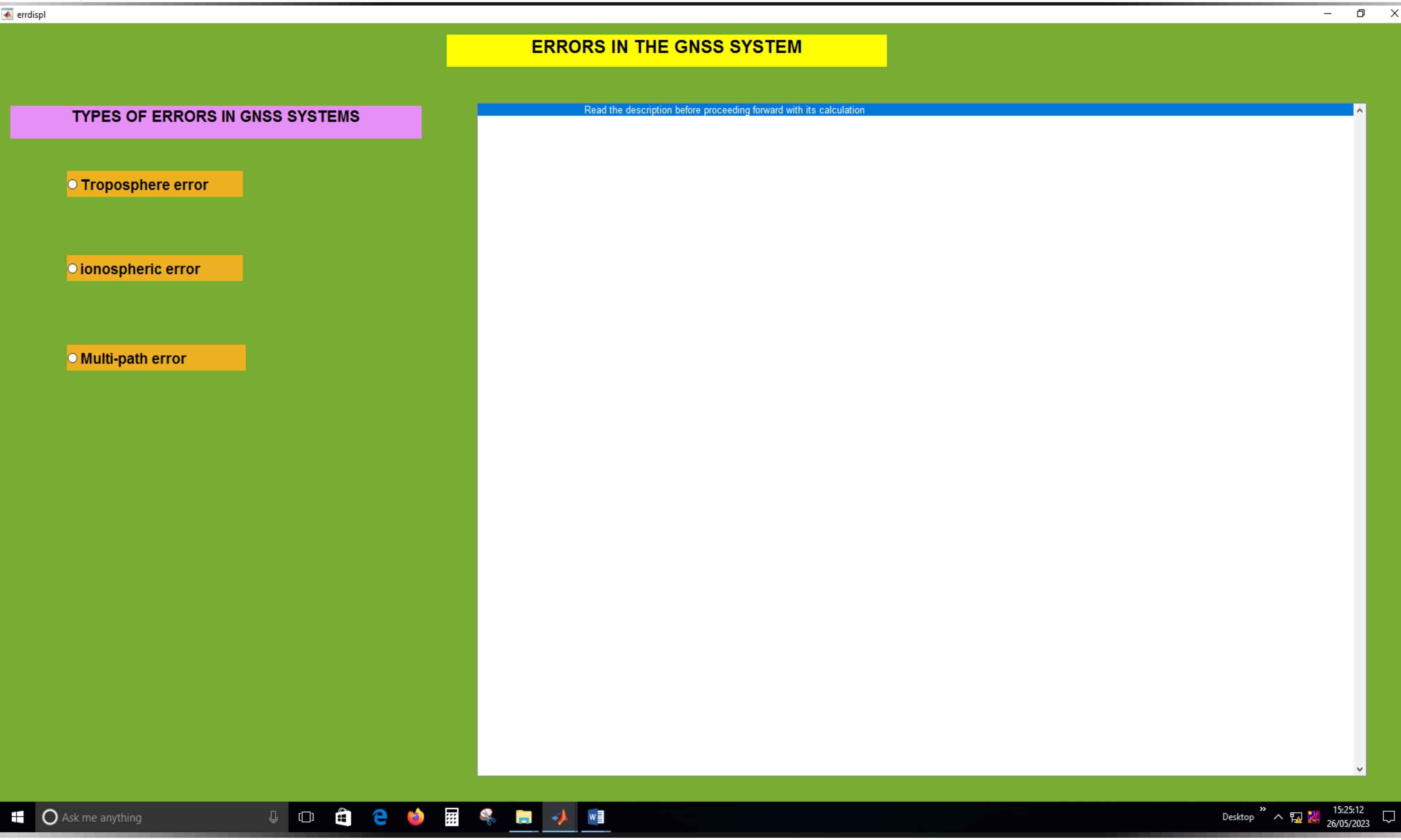
New Signal Analysis



C/No measurements

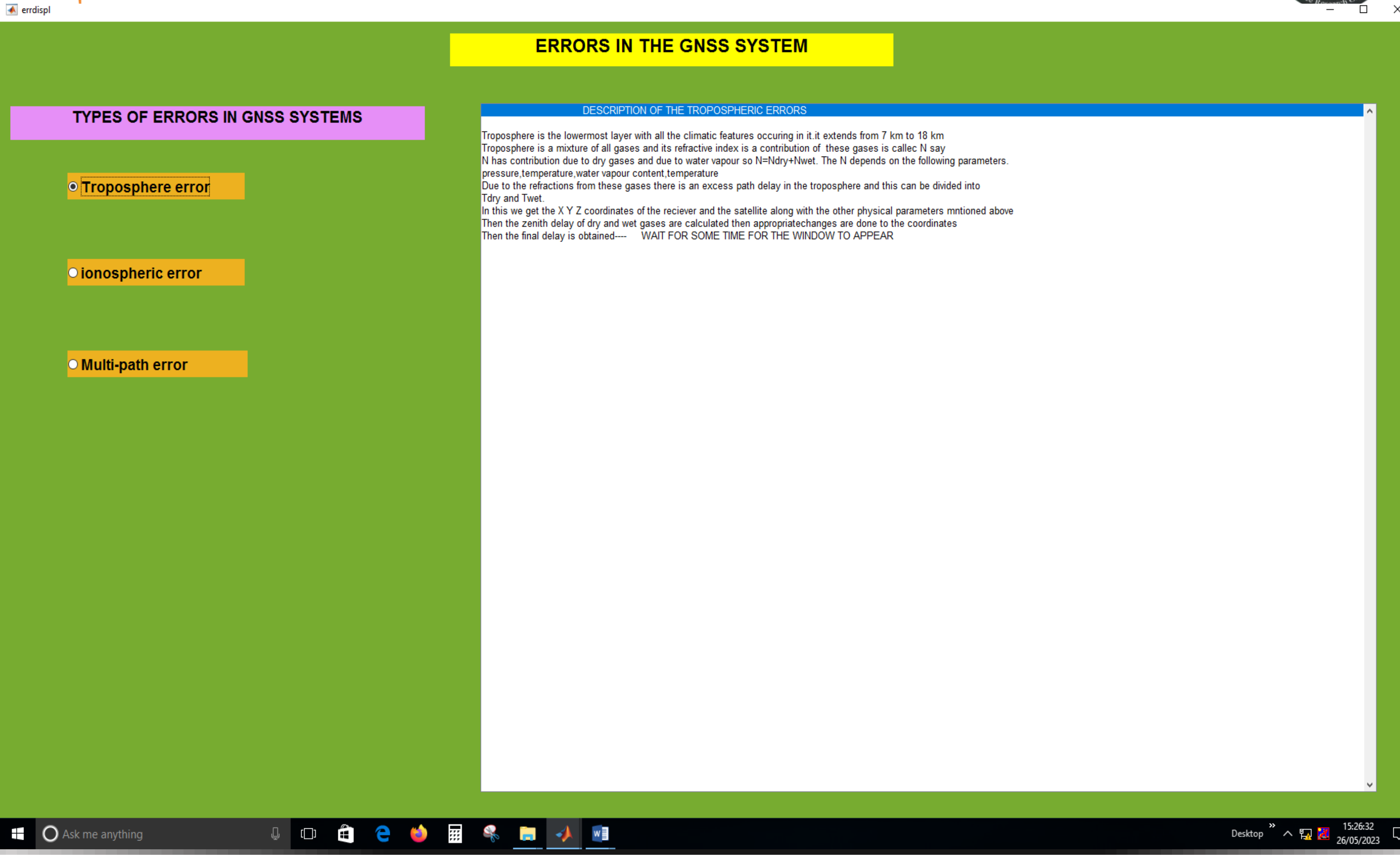


Other Error

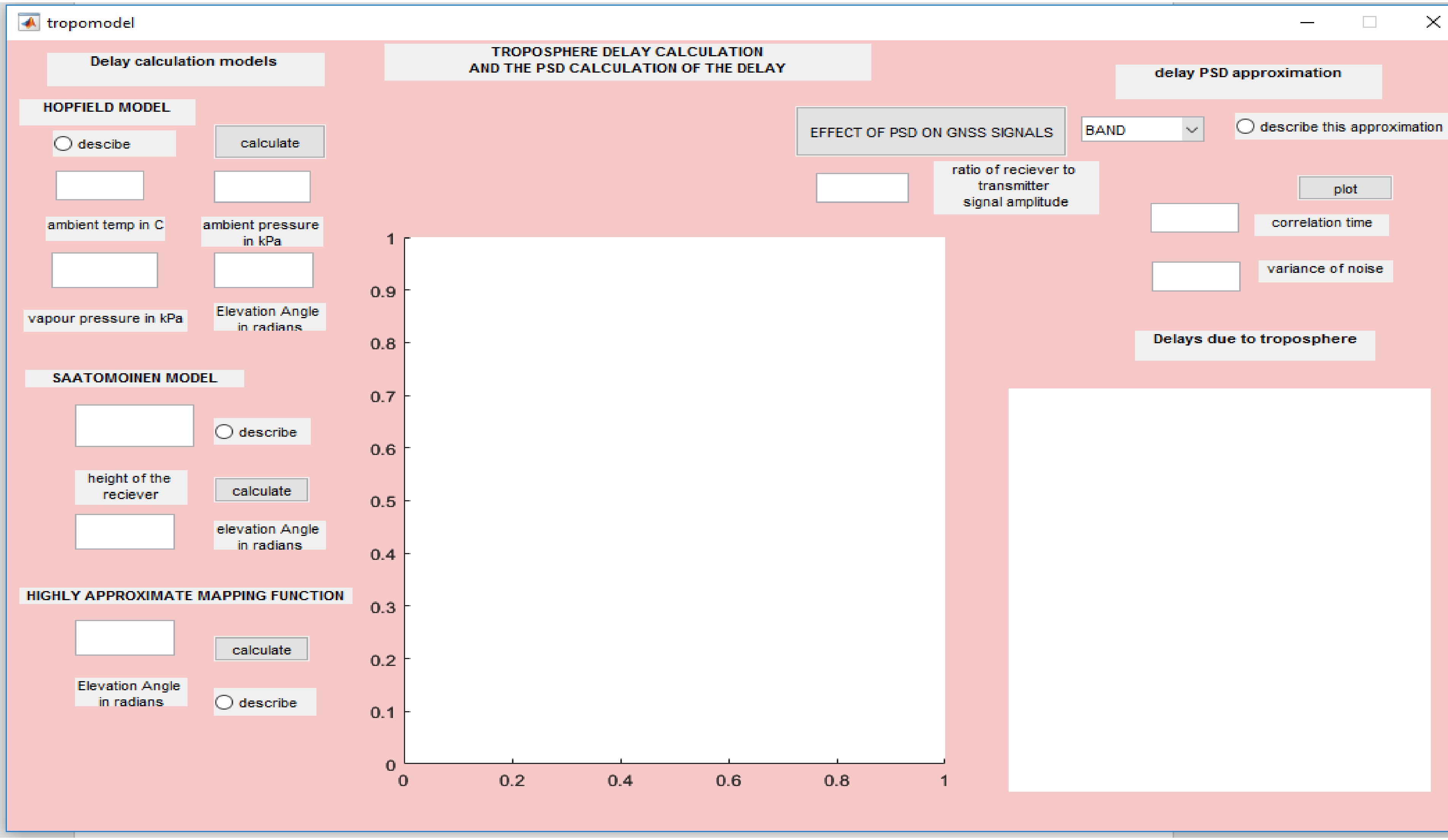


errdispl
ERRORS IN THE GNSS SYSTEM
TYPES OF ERRORS IN GNSS SYSTEMS
Troposphere error
ionospheric error
Multi-path error
Read the description before proceeding forward with its calculation
Ask me anything
Desktop
15:25:12
26/05/2023

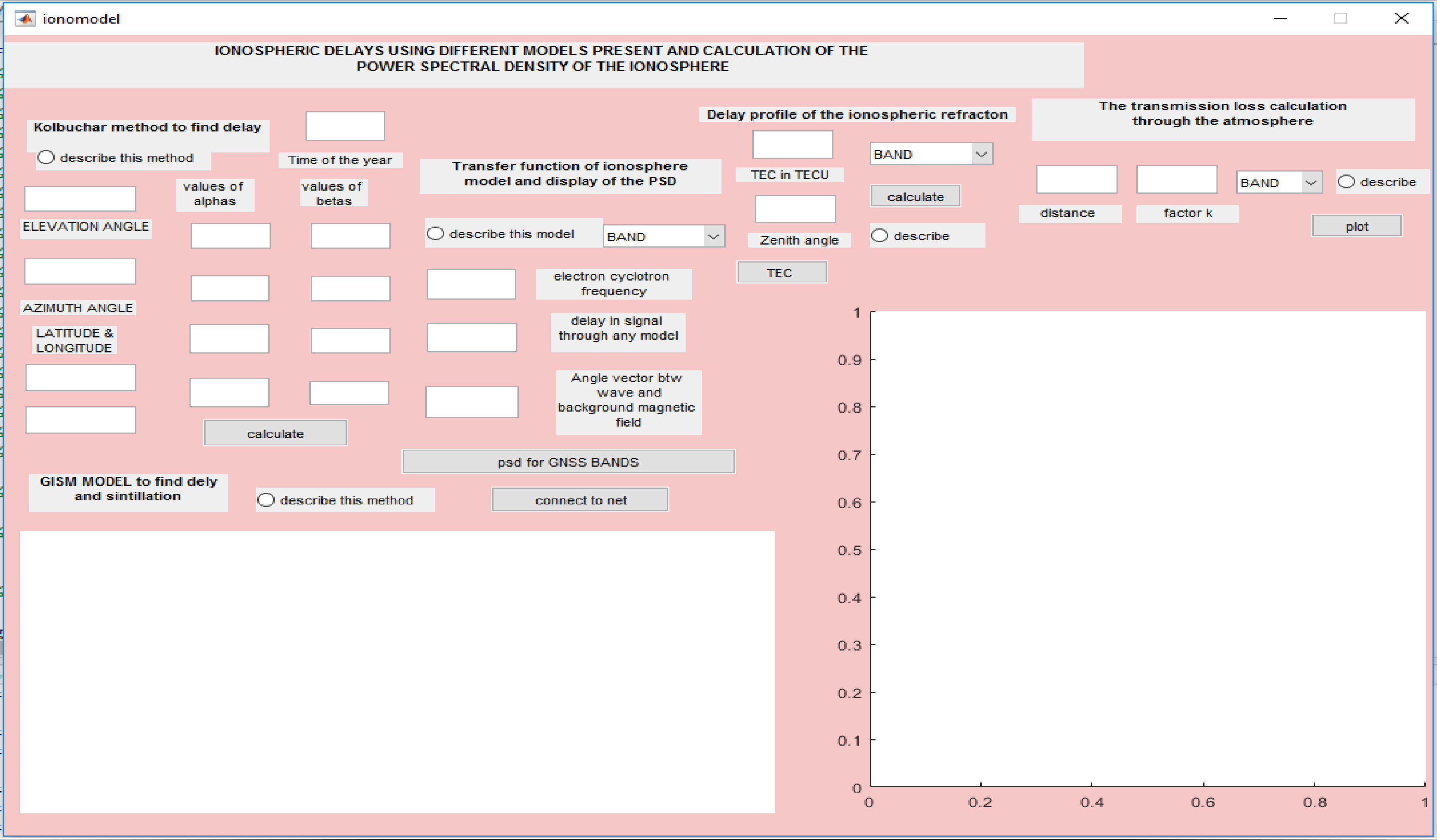
Other Error


errdispl
ERRORS IN THE GNSS SYSTEM
TYPES OF ERRORS IN GNSS SYSTEMS
Troposphere error
ionospheric error
Multi-path error
DESCRIPTION OF THE TROPOSPHERIC ERRORS
Troposphere is the lowermost layer with all the climatic features occuring in it.it extends from 7 km to 18 km
Troposphere is a mixture of all gases and its refractive index is a contribution of these gases is callec N say
N has contribution due to dry gases and due to water vapour so N=Ndry+Nwet. The N depends on the following parameters.
pressure,temperature,water vapour content,temperature
Due to the refractions from these gases there is an excess path delay in the troposphere and this can be divided into
Tdry and Twet.
In this we get the X Y Z coordinates of the reciever and the satellite along with the other physical parameters mntioned above
Then the zenith delay of dry and wet gases are calculated then appropriatechanges are done to the coordinates
Then the final delay is obtained---- WAIT FOR SOME TIME FOR THE WINDOW TO APPEAR
Ask me anything
Desktop
15:26:32
26/05/2023

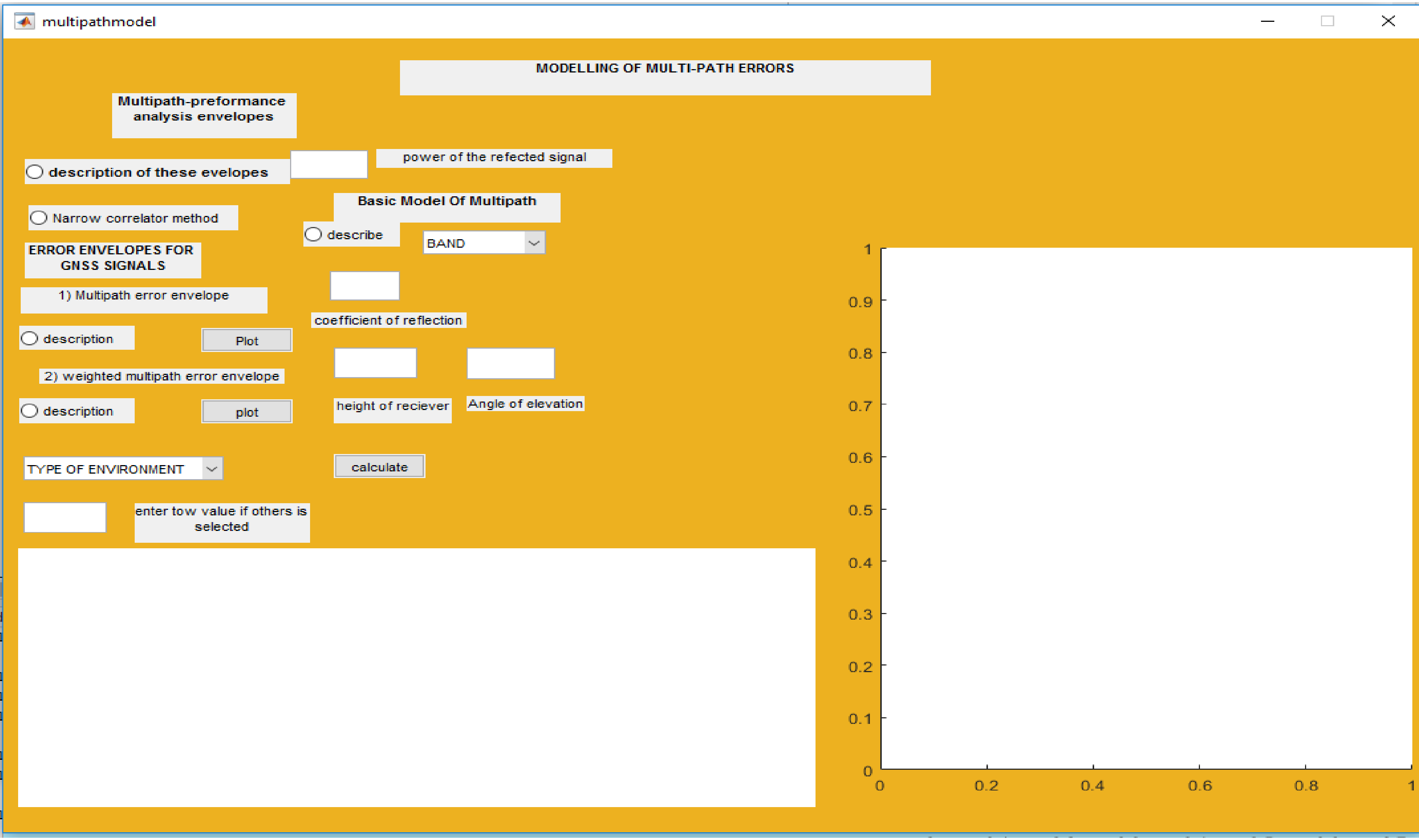
Tropospheric Error GUI



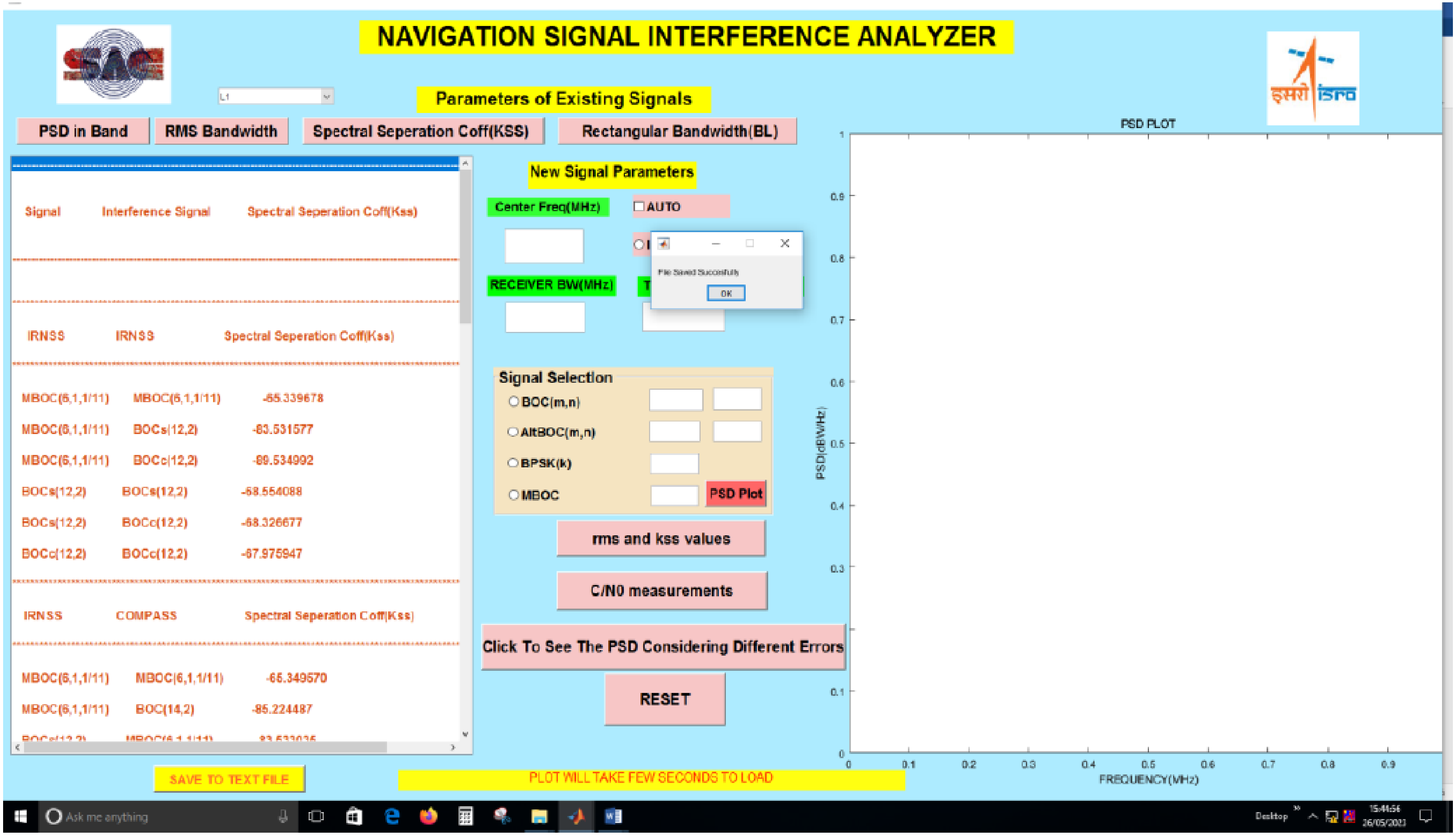
Ionospheric Error GUI

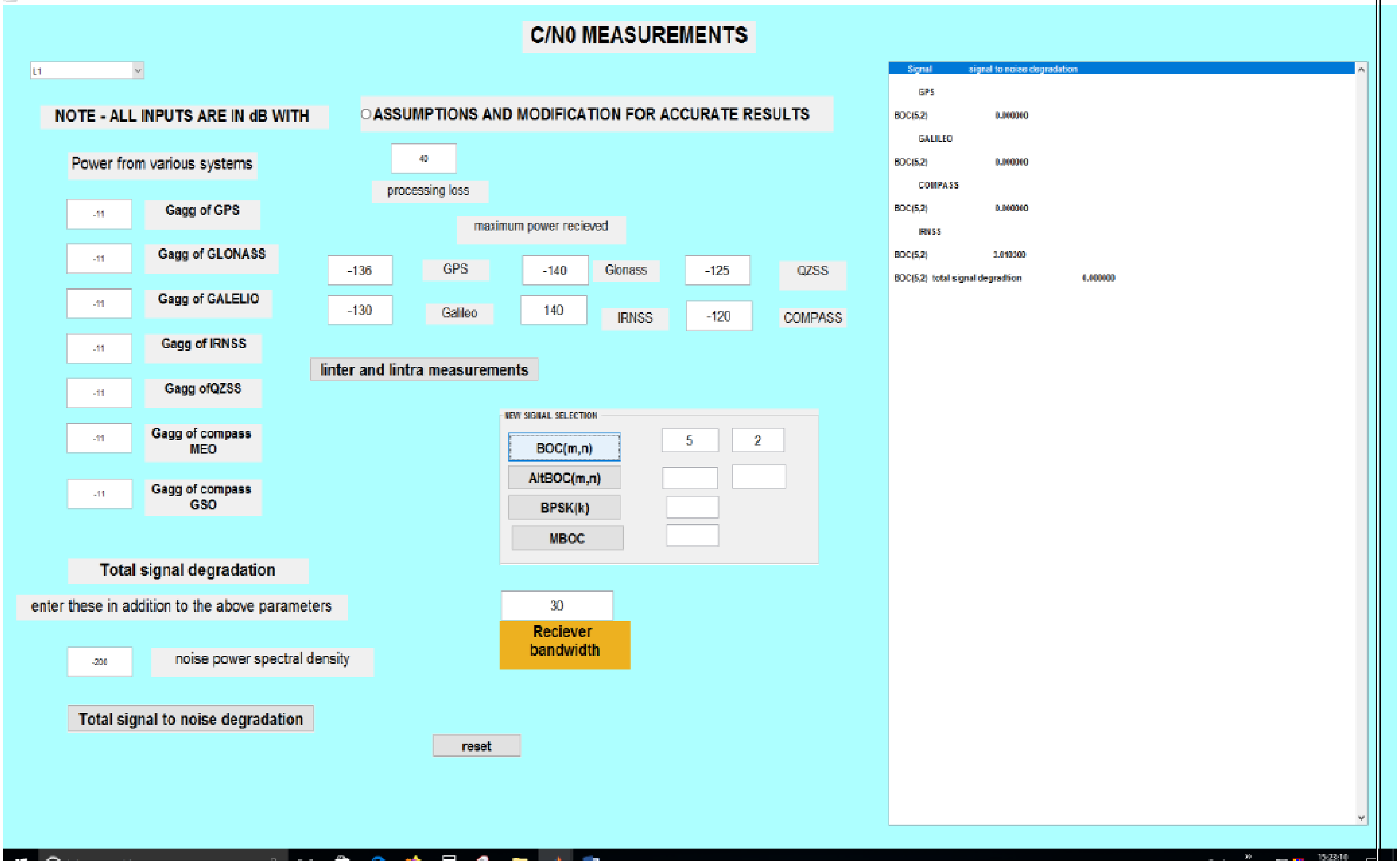


Multipath Error GUI



Snapshots

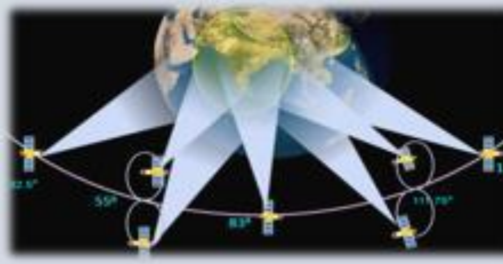

NAVIGATION SIGNAL INTERFERENCE ANALYZER
Parameters of Existing Signals
PSD in Band
RMS Bandwidth
Spectral Seperation Coff(KSS)
Rectangular Bandwidth(BL)
Signal
Interference Signal
Spectral Seperation Coff(Kss)
IRNSS
IRNSS
Spectral Seperation Coff(Kss)
MBOC(6,1,1/11) MBOC(6,1,1/11) -65.339678
MBOC(6,1,1/11) BOCs(12,2) -83.531577
MBOC(6,1,1/11) BOCc(12,2) -89.534992
BOCs(12,2) BOCs(12,2) -68.554088
BOCs(12,2) BOCc(12,2) -68.326677
BOCc(12,2) BOCc(12,2) -67.975947
IRNSS
COMPASS
Spectral Seperation Coff(Kss)
MBOC(6,1,1/11) MBOC(6,1,1/11) -65.349570
MBOC(6,1,1/11) BOC(14,2) -85.224487
New Signal Parameters
Center Freq(MHz)
AUTO
RECEIVER BW(MHz)
Signal Selection
BOC(m,n)
AltBOC(m,n)
BPSK(k)
MBOC
PSD Plot
rms and kss values
C/N0 measurements
Click To See The PSD Considering Different Errors
RESET
SAVE TO TEXT FILE
PLOT WILL TAKE FEW SECONDS TO LOAD
PSD PLOT
PSD(dBW/Hz)
FREQUENCY(MHz)


C/N0 MEASUREMENTS
L1
NOTE - ALL INPUTS ARE IN dB WITH
ASSUMPTIONS AND MODIFICATION FOR ACCURATE RESULTS
Power from various systems
40
processing loss
maximum power recieved
-11
Gagg of GPS
-11
Gagg of GLONASS
-11
Gagg of GALELIO
-11
Gagg of IRNSS
-11
Gagg ofQZSS
-11
Gagg of compass MEO
-11
Gagg of compass GSO
-136
GPS
-140
Glonass
-125
QZSS
-130
Galileo
140
IRNSS
-120
COMPASS
Iinter and Iintra measurements
NEW SIGNAL SELECTION
BOC(m,n)
5
2
AltBOC(m,n)
BPSK(k)
MBOC
Total signal degradation
enter these in addition to the above parameters
30
Reciever bandwidth
noise power spectral density
Total signal to noise degradation
reset
Signal
signal to noise degradation
GPS
BOC(5,2) 0.000000
GALILEO
BOC(5,2) 0.000000
COMPASS
BOC(5,2) 0.000000
IRNSS
BOC(5,2)
BOC(5,2) total signal degradtion 0.000000

Tropospheric Delay

satellite type	longitude at the equator(°E)	elevation angle (rad)	delay measured (meters)		
			Hopfield	saastamoinen	Cho's mapping function
geostationary	32.5	0.6429	3.9681	3.9658	3.3297
	83	0.288	8.1849	8.2914	6.97
	131.5	0.4724	5.1849	5.2146	4.3846
geosynchronous	55	1.0507	2.7772	2.7438	2.3
	111	0.84795	3.1961	3.1736	2.6652

- The Hopfield and the Saastamoinen model almost give the same result for different elevation angles. The cho's mapping function is valid for elevation angles less than 10 degrees but it is a fairly good approximation for the larger angles also.



Thank You