Appendix

%The MATLAB code for GUI

```
function varargout = GUIdesign(varargin)
% GUIDESIGN MATLAB code for GUIdesign.fig
% Begin initialization code - DO NOT EDIT
gui_Singleton = 1;
gui_State = struct('gui_Name',       mfilename, ...
                   'gui_Singleton',  gui_Singleton, ...
                   'gui_OpeningFcn', @GUIdesign_OpeningFcn, ...
                   'gui_OutputFcn',  @GUIdesign_OutputFcn, ...
                   'gui_LayoutFcn',  [] , ...
                   'gui_Callback',   []);
if nargin && ischar(varargin{1})
    gui_State.gui_Callback = str2func(varargin{1});
end

if nargout
    [varargout{1:nargout}] = gui_mainfcn(gui_State, varargin{:});
else
    gui_mainfcn(varargin{:});
end
% End initialization code - DO NOT EDIT


% --- Executes just before GUIdesign is made visible.
function GUIdesign_OpeningFcn(hObject, eventdata, handles, varargin)
% This function has no output args, see OutputFcn.

% Choose default command line output for GUIdesign
handles.output = hObject;

% Update handles structure
guidata(hObject, handles);

% --- Outputs from this function are returned to the command line.
function varargout = GUIdesign_OutputFcn(hObject, eventdata, handles)
% Get default command line output from handles structure
varargout{1} = handles.output;
```

```
% --- Executes on selection change in freq.
function freq_Callback(hObject, eventdata, handles)

% --- Executes during object creation, after setting all properties.
function freq_CreateFcn(hObject, eventdata, handles)
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end



function elevation_Callback(hObject, eventdata, handles)

% --- Executes during object creation, after setting all properties.
function elevation_CreateFcn(hObject, eventdata, handles)
.
%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end

function latitude_Callback(hObject, eventdata, handles)

% --- Executes during object creation, after setting all properties.
function latitude_CreateFcn(hObject, eventdata, handles)

%       See ISPC and COMPUTER.
if ispc && isequal(get(hObject,'BackgroundColor'),
get(0,'defaultUicontrolBackgroundColor'))
    set(hObject,'BackgroundColor','white');
end
```

```
% --- Executes on button press in click.
function click_Callback(hObject, eventdata, handles)
R=str2 (get(handles.rainrate,'string'));
theta=str2 (get(handles.elevation,'string'));
vai=str2(get(handles.latitude,'string'));
if vai>23
   hr=(5000-(0.075*(abs(vai)-23)));
elseif vai>=-21 && vai<=23
   hr=5000;
elseif vai>=-71 && vai<-21
   hr=(5000+(0.1*(abs(vai)+21)));
elseif vai<-71
   hr=0;
end
popup_sel_index = get(handles.freq, 'Value');
switch
   case 1
      f=2.1;

   case 2
      f=27;

   case 3
      f=47;

end
FSL=125.9;
K=-228.6;
if f==2.1
    EIRP=5.46;
    Rb=39;
  GtoT=-29.62;
  a=0.0000387;
  b=0.912;
elseif f==27
     EIRP=24.2;
  Rb=63;
  GtoT=-1.5;
  a=0.187;
  b=1.021;
```

```
elseif f==47
      EIRP=27.8;
   Rb=63;
  GtoT=-6.5;
    a=0.35;
    b=0.939;
end
 v='64QAM';
 c='16QAM';
 ll='8QAM';
 ro='8PSK';
 if vai==15.8
rR=((hr-450)/sind(theta));
 elseif vai==4.8
     rR=((hr-600)/sind(theta));
 end
mm=(R^b);
s=a*mm;
ra=s*rR;

if R==0
    RA=0;
    CtoN=EIRP+GtoT-FSL-Rb-K;
else

RA=10*log10(ra);
CtoN=EIRP+GtoT-FSL-RA-Rb-K;
end
set(handles.rainattenuation,'string',RA);
set(handles.carriertonoise,'string',CtoN);
if CtoN>=20
    set(handles.modtype,'string',v);
elseif CtoN>=15 && CtoN<20
    set(handles.modtype,'string',c);
 elseif CtoN>=10 && CtoN<15
    set(handles.modtype,'string',ll);
elseif CtoN<10
    set(handles.modtype,'string',ro);
end
```

```
function rainrate_Callback(hObject, eventdata, handles)
% --- Executes during object creation, after setting all properties.
function rainrate_CreateFcn(hObject, eventdata, handles)


% --- Executes on button press in update.
function update_Callback(hObject, eventdata, handles)
popup_sel_index = get(handles.freq, 'Value');
switch popup_sel_index
   case 1

      y='=90 deg';
      set(handles.text5,'string',y);
   case 2

       y='>20 deg';
      set(handles.text5,'string',y);
   case 3

       y='from 30-90 deg';
      set(handles.text5,'string',y);
end
```