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## c1\_modulation.m

```
%{  
Description:  
    This script implements the modulation for a dual-band system. It  
    uses as  
        input the data collected in Cadence sources. The transmitted signal  
        is saved in a .pwl file.  
  
Input:  
    - source_signal_1 (f1_source_data)  
  
Output:  
    - transmitted_signal.pwl  
%}  
clear; clc; close all;  
tic
```

## Parameters

```
freq_carrier_1 = 1.8e9;  
freq_carrier_2 = 5.4e9;  
gain = 0.02;
```

## Importing functions

```
current_folder = fileparts(mfilename('fullpath'));  
root_folder = fileparts(current_folder);  
functions_folder = fullfile(root_folder, 'f0_functions');  
addpath(functions_folder);
```

## Importing data

```
source_folder = fullfile(root_folder, 'f1_source_data');  
source_file = fullfile(source_folder, 'source_signal_1.mat')
```

---

```
load(source_file)

source_file =
'C:\Users\Shoit\Desktop\pa_db_1p8_5p4\f1_source_data
\source_signal_1.mat'
```

## Resample to RF

Creating oversampled time vector

```
freq_oversampling = 7 * max(freq_carrier_1, freq_carrier_2)
duration = time_baseband(end) - time_baseband(1)
time_oversampled = (0: freq_oversampling*duration).' /
freq_oversampling;

% Computing interpolation
s1_oversampled = interp1(time_baseband, s1_baseband,
time_oversampled);
s2_oversampled = interp1(time_baseband, s2_baseband,
time_oversampled);

freq_oversampling =
3.7800e+10

duration =
4.0642e-05
```

## Normalization

```
s1_baseband = s1_baseband / max(abs(s1_baseband));
s2_baseband = s2_baseband / max(abs(s2_baseband));

max_val_1 = max(abs(s1_baseband))
max_val_2 = max(abs(s2_baseband))

max_val_1 =
1.0000

max_val_2 =
1
```

---

# Shift

Computing carrier

```
positive_carrier_1 = exp(1i*2*pi*freq_carrier_1*time_oversampled);
positive_carrier_2 = exp(1i*2*pi*freq_carrier_2*time_oversampled);

% Computing shift
s1_passband = s1_oversampled .* positive_carrier_1;
s2_passband = s2_oversampled .* positive_carrier_2;
```

# Transmitted signal

Combine signals

```
transmitted_signal = real(s1_passband + s2_passband);

% Normalize signal
max_val = max(abs(transmitted_signal));
transmitted_signal = transmitted_signal / max_val;
transmitted_signal = transmitted_signal * gain;

% Optional: check
check_max_value = max(abs(transmitted_signal))

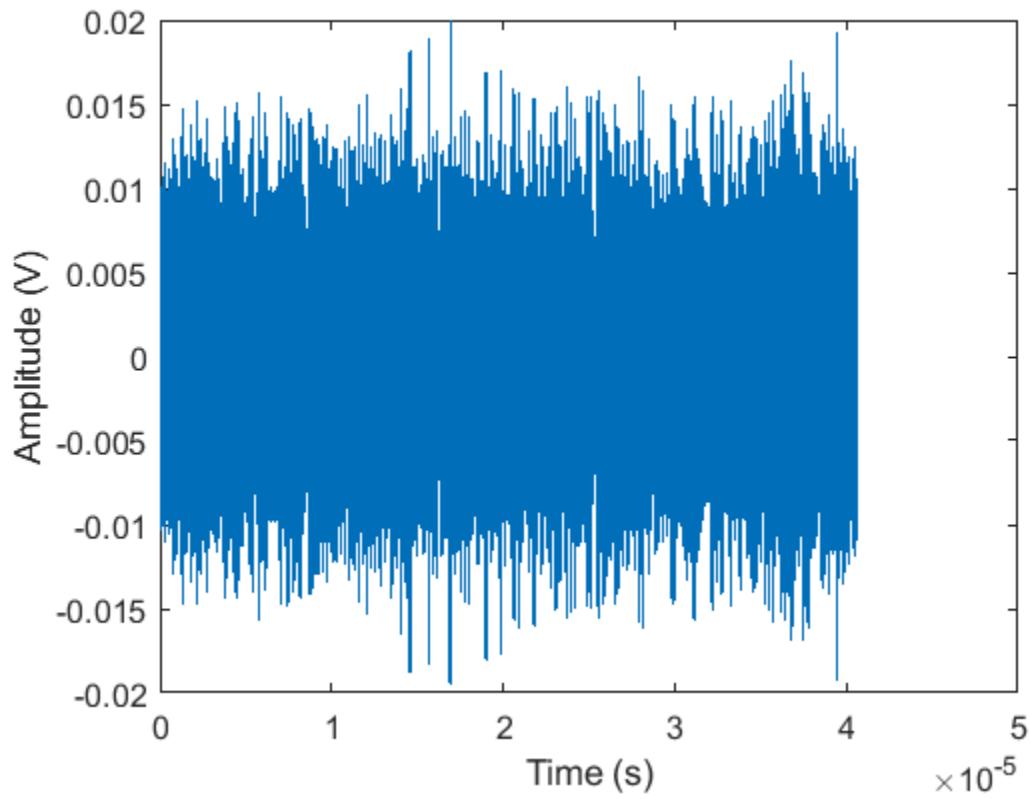
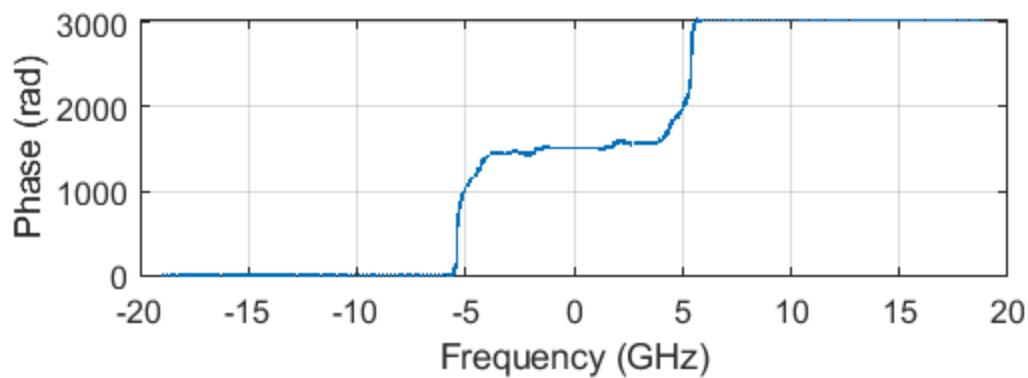
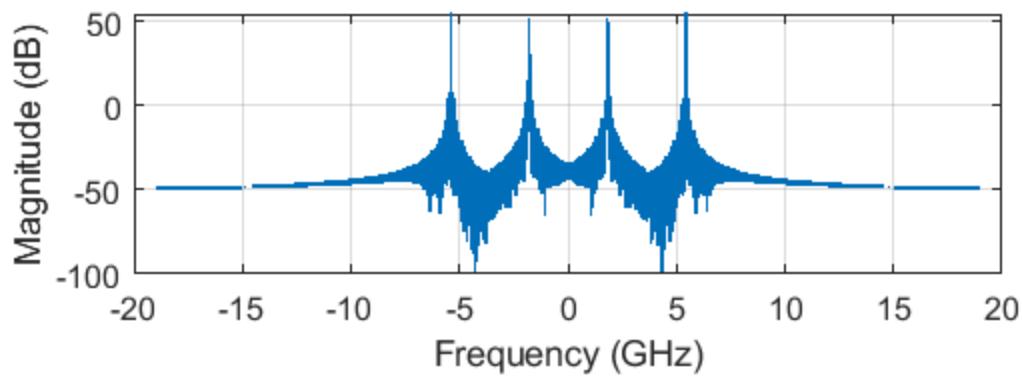
check_max_value =
0.0200
```

# Plot

Frequency domain

```
plot_spectrum(transmitted_signal, freq_oversampling, 'Transmitted
Signal')

% Time domain
figure();
plot(time_oversampled, transmitted_signal);
xlabel('Time (s)');
ylabel('Amplitude (V)');
ax = gca;
set(ax,'FontSize',12,'LineWidth',1);
```



---

## Save in .pwl file

Get folder of current script

```
script_folder = fileparts(mfilename('fullpath'));
pwl_filename = fullfile(script_folder, 'transmitted_signal.pwl');

% Combine time and signal into two columns
data_to_save = [time_oversampled, transmitted_signal];

% Open file
fid = fopen(pwl_filename, 'w');
if fid == -1
    error('Could not open file %s for writing.', pwl_filename);
end

% Write data as two columns: time, signal
% note the transpose for column-wise fprintf
fprintf(fid, '%.16e,%.16e\n', data_to_save.');
fclose(fid);

disp(['Data saved as: ', pwl_filename]);

toc

Data saved as: C:\Users\Shoit\Desktop\pa_db_1p8_5p4\f2_pa_mod
\transmitted_signal.pwl
Elapsed time is 4.385939 seconds.
```

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