Radar System Laboratory

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Master Degree in Telecommunication Engineering
University of Pisa

francesco.mancuso@phd.unipi.it

Activities Overview

FMCW Radar Lab Measurements

- EVALKIT SiRad Simple®
- Board configuration
- MATLAB acquisition
- A little bit of processing

EVALKIT SiRad Simple®

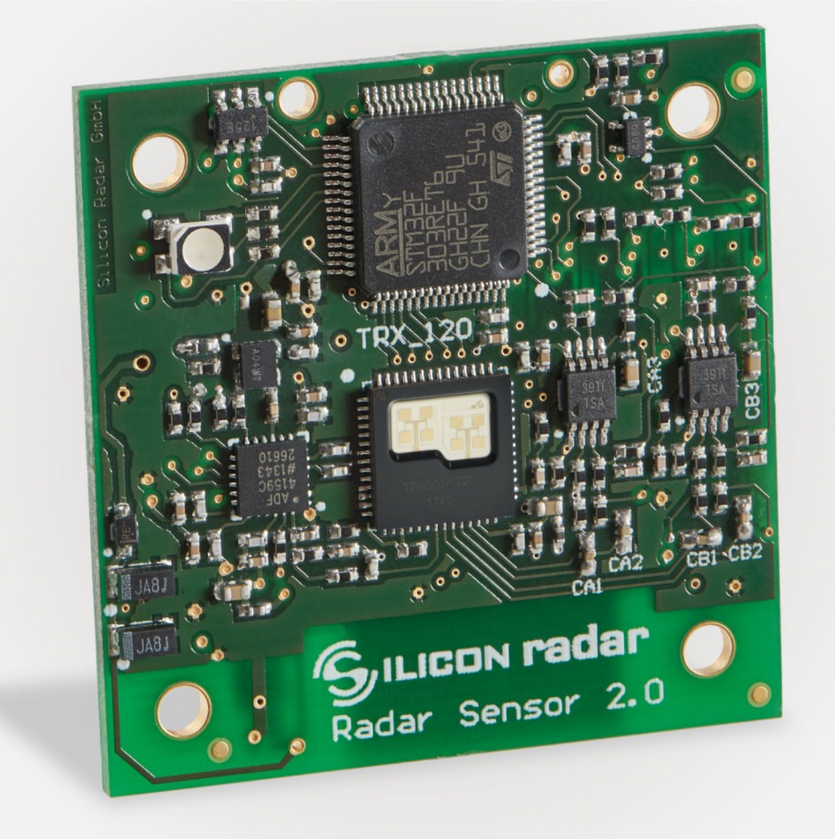
120GHz radar evaluation kit

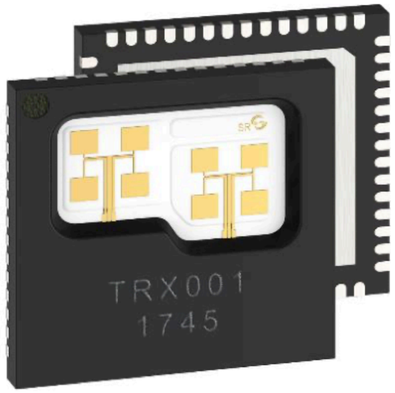
EVALKIT SiRad Simple®

120GHz radar evaluation kit

…recently deprecated 😬

TRX_120_001 (1)

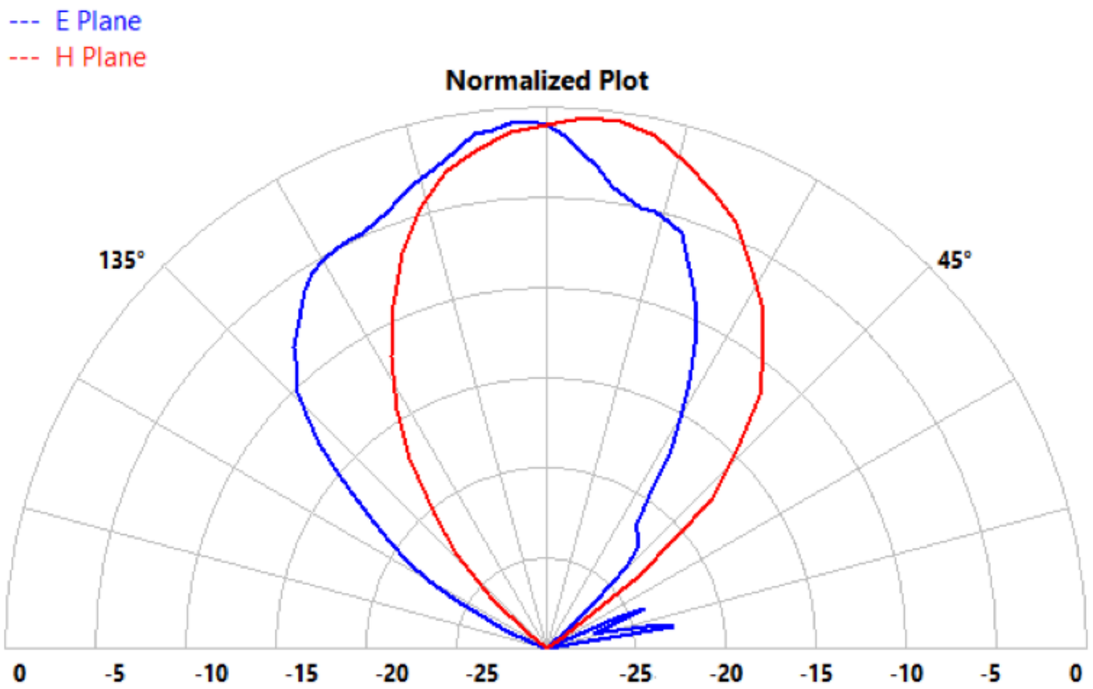


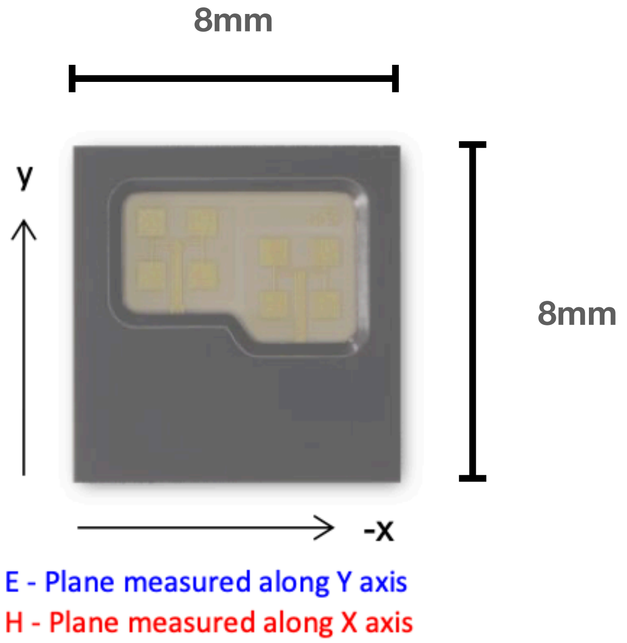


- Radar front end (RFE) with antennas in package for 122-GHz ISM band
- Wide bandwidth of up to 6 GHz
- Single supply voltage of 3.3 V

https://siliconradar.com/datasheets/Datasheet_TRX_120_001_V1.4.pdf

TRX_120_001 (2)



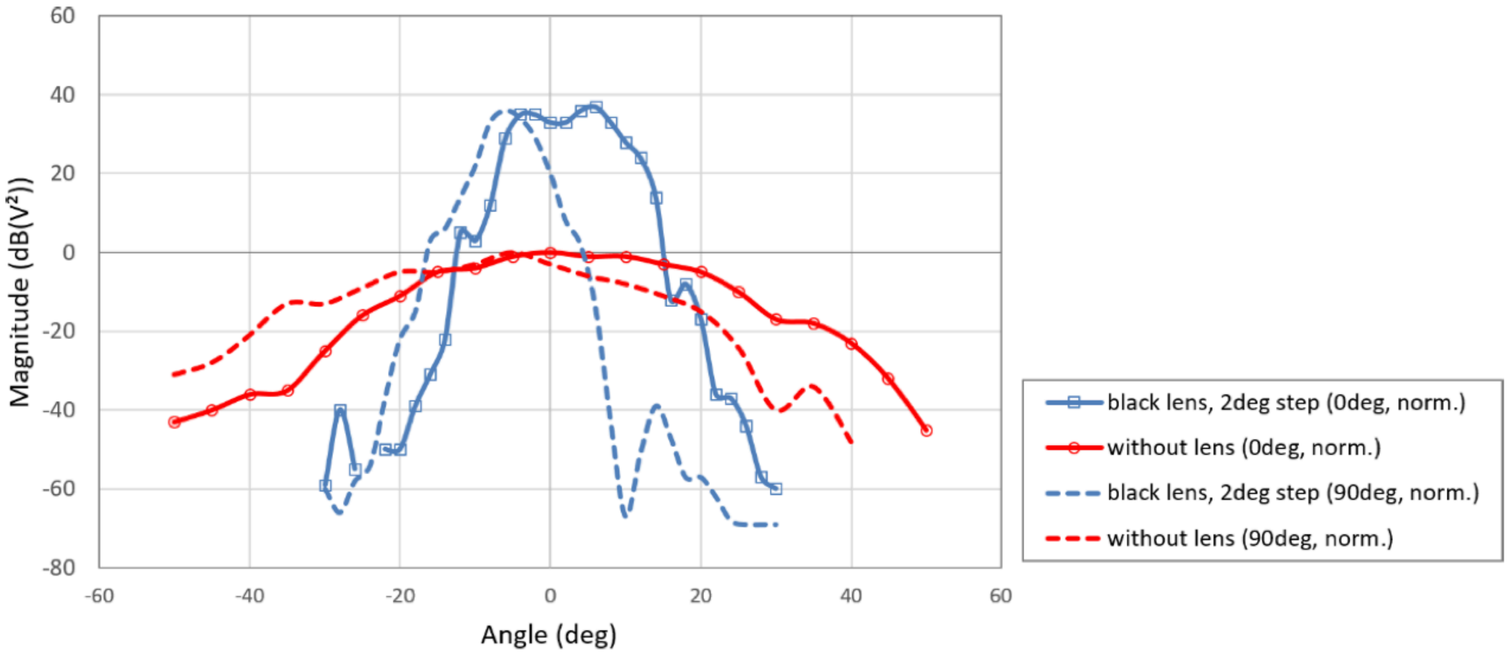


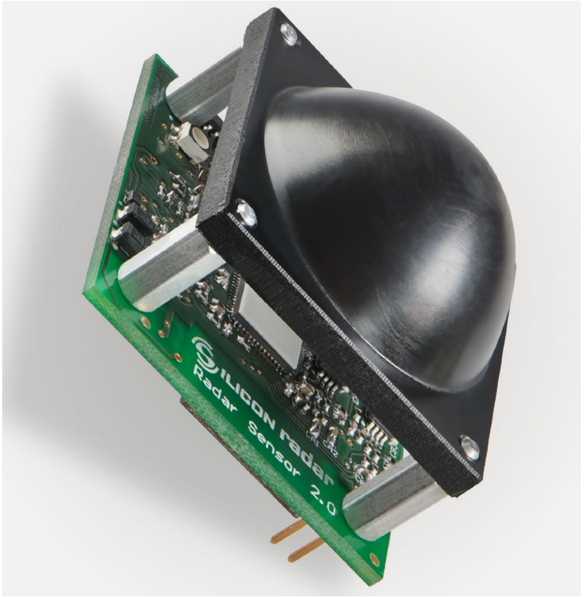
Combined Radiation Pattern Measurements of TX and RX Patch Antennas

https://siliconradar.com/datasheets/Datasheet_TRX_120_001_V1.4.pdf

Collimator lens

- Optional accessory for evaluation kit ***SiRad Simple***®, it focuses the beam of the radar front end





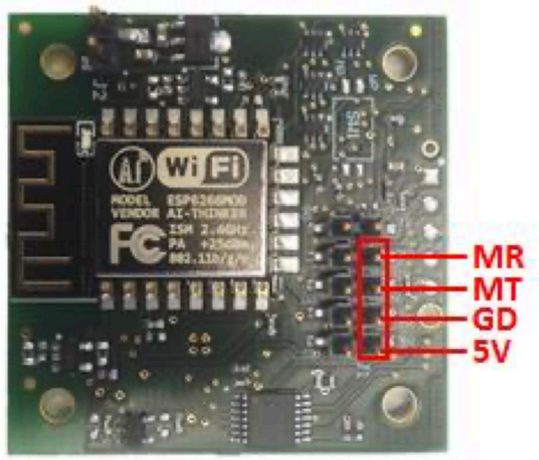
±4° @ -6dB

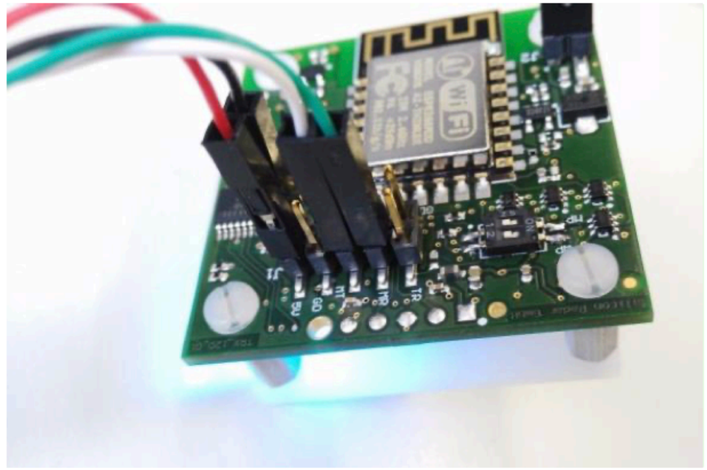
https://siliconradar.com/datasheets/Datasheet_Collimator_Lens_V1.1.pdf

Board configuration

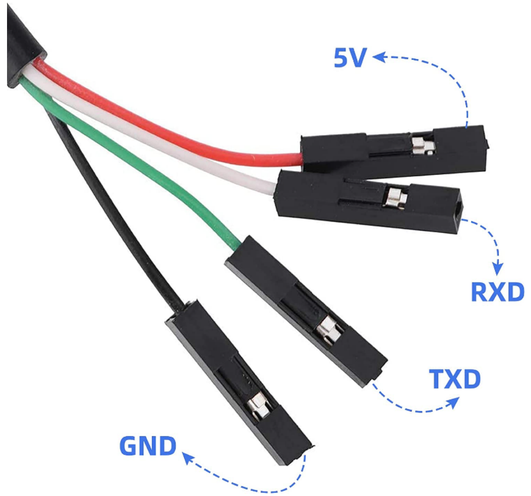
USB-to-UART Bridge

Serial/USB data connection





FTDI cable		Board
5V	→	5V
GND	→	GD
TXD	→	MR
RXD	→	MT



Make sure that both DIP switches are in their OFF positions and the power jumper (J2) for the WiFi module is open (switched off).

System configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SYS_CONFIG	SelfTrigDelay			res	LOG	FMT	LED		reserved				Protocol			AGC	Gain		SER2	SER1	ERR	ST	TL	C	R	P	CPL	RAW	res	res	SLF	PRE

SelfTrigDelay			
0	0	0	0 ms
0	0	1	2 ms
0	1	0	4 ms
0	1	1	8 ms
1	0	0	16 ms
1	0	1	32 ms
1	1	0	64 ms
1	1	1	128 ms

LED		
0	0	off
0	1	1st target
1	0	reserved
1	1	reserved

Gain		
0	0	8 dB
0	1	21 dB
1	0	43 dB
1	1	56 dB

SER2	
0	output on SER2 off
1	output on SER2 on

SER1	
0	output on SER1 off
1	output on SER1 on

FMT	
0	TL mm distance
1	TL cm distance

LOG	
0	log MAG
1	linear MAG

data frames		off	on
RAW	raw ADC	0	1
CPL	cmplx FFT	0	1
P	phase	0	1
R	magnitude	0	1
C	CFAR	0	1
TL	target list	0	1
ST	status	0	1
ERR	error	0	1

Protocol			
0	0	0	WebGUI
0	0	1	TSV output
0	1	0	BIN output
x	x	x	reserved

SLF	
0	external trig mode
1	standard mode

PRE	
0	standard mode
1	use pre-trigger

AGC	
0	auto gain control off
1	auto gain control on

*Reserved bit will have 0 as default value

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

System configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SYS_CONFIG	SelfTrigDelay			res	LOG	FMT	LED		reserved				Protocol			AGC	Gain		SER2	SER1	ERR	ST	TL	C	R	P	CPL	RAW	res	res	SLF	PRE

SelfTrigDelay			
0	0	0	0 ms
0	0	1	2 ms
0	1	0	4 ms
0	1	1	8 ms
1	0	0	16 ms
1	0	1	32 ms
1	1	0	64 ms
1	1	1	128 ms

LED		
0	0	off
0	1	1st target
1	0	reserved
1	1	reserved

Gain		
0	0	8 dB
0	1	21 dB
1	0	43 dB
1	1	56 dB

SER2	
0	output on SER2 off
1	output on SER2 on

SER1	
0	output on SER1 off
1	output on SER1 on

FMT	
0	TL mm distance
1	TL cm distance

LOG	
0	log MAG
1	linear MAG

data frames		off	on
RAW	raw ADC	0	1
CPL	cmplx FFT	0	1
P	phase	0	1
R	magnitude	0	1
C	CFAR	0	1
TL	target list	0	1
ST	status	0	1
ERR	error	0	1

Protocol			
0	0	0	WebGUI
0	0	1	TSV output
0	1	0	BIN output
x	x	x	reserved

SLF	
0	external trig mode
1	standard mode

PRE	
0	standard mode
1	use pre-trigger

AGC	
0	auto gain control off
1	auto gain control on

*Reserved bit will have 0 as default value

000 X 1 0 00 XXXX 001 0 00 0 1 00000001 X X 1 0

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

System configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SYS_CONFIG	SelfTrigDelay			res	LOG	FMT	LED		reserved				Protocol			AGC	Gain		SER2	SER1	ERR	ST	TL	C	R	P	CPL	RAW	res	res	SLF	PRE

SelfTrigDelay			
0	0	0	0 ms
0	0	1	2 ms
0	1	0	4 ms
0	1	1	8 ms
1	0	0	16 ms
1	0	1	32 ms
1	1	0	64 ms
1	1	1	128 ms

LED		
0	0	off
0	1	1st target
1	0	reserved
1	1	reserved

Gain		
0	0	8 dB
0	1	21 dB
1	0	43 dB
1	1	56 dB

SER2	
0	output on SER2 off
1	output on SER2 on

SER1	
0	output on SER1 off
1	output on SER1 on

FMT	
0	TL mm distance
1	TL cm distance

LOG	
0	log MAG
1	linear MAG

data frames		off	on
RAW	raw ADC	0	1
CPL	cmplx FFT	0	1
P	phase	0	1
R	magnitude	0	1
C	CFAR	0	1
TL	target list	0	1
ST	status	0	1
ERR	error	0	1

Protocol			
0	0	0	WebGUI
0	0	1	TSV output
0	1	0	BIN output
x	x	x	reserved

SLF	
0	external trig mode
1	standard mode

PRE	
0	standard mode
1	use pre-trigger

AGC	
0	auto gain control off
1	auto gain control on

*Reserved bit will have 0 as default value

000 X 1 0 00 XXXX 001 0 00 0 1 00000001 X X 1 0

!S 0000 1000 0000 0010 0001 0000 0001 0010 \r\n

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

System configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SYS_CONFIG	SelfTrigDelay			res	LOG	FMT	LED		reserved				Protocol			AGC	Gain		SER2	SER1	ERR	ST	TL	C	R	P	CPL	RAW	res	res	SLF	PRE

SelfTrigDelay			
0	0	0	0 ms
0	0	1	2 ms
0	1	0	4 ms
0	1	1	8 ms
1	0	0	16 ms
1	0	1	32 ms
1	1	0	64 ms
1	1	1	128 ms

LED		
0	0	off
0	1	1st target
1	0	reserved
1	1	reserved

Gain		
0	0	8 dB
0	1	21 dB
1	0	43 dB
1	1	56 dB

SER2	
0	output on SER2 off
1	output on SER2 on

SER1	
0	output on SER1 off
1	output on SER1 on

FMT	
0	TL mm distance
1	TL cm distance

LOG	
0	log MAG
1	linear MAG

data frames		off	on
RAW	raw ADC	0	1
CPL	cmplx FFT	0	1
P	phase	0	1
R	magnitude	0	1
C	CFAR	0	1
TL	target list	0	1
ST	status	0	1
ERR	error	0	1

Protocol			
0	0	0	WebGUI
0	0	1	TSV output
0	1	0	BIN output
x	x	x	reserved

SLF	
0	external trig mode
1	standard mode

PRE	
0	standard mode
1	use pre-trigger

AGC	
0	auto gain control off
1	auto gain control on

*Reserved bit will have 0 as default value

000 X 1 0 00 XXXX 001 0 00 0 1 00000001 X X 1 0

!S 0000 1000 0000 0010 0001 0000 0001 0010 \r\n → **'!S08021012\r\n'**

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

PLL configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PLL_CONFIG	reserved																Bandwidth [MHz] (16 Bits)																

Bandwidth [MHz] (16 Bits)																
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-2	MHz
1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	-4	MHz
...																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-65536	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	MHz
...															...	
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	+65534	MHz

Format Field	Field Size	Description
Bandwidth	16 bits	Negative values result in a falling ramp slope, positive values in a rising saw tooth shape; representation is in two‘s complement

*Reserved bit will have 0 as default value

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

PLL configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PLL_CONFIG	reserved																Bandwidth [MHz] (16 Bits)															

Bandwidth [MHz] (16 Bits)																
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-2	MHz
1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	-4	MHz
...																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-65536	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	MHz
...															...	
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	+65534	MHz

Format Field	Field Size	Description
Bandwidth	16 bits	Negative values result in a falling ramp slope, positive values in a rising saw tooth shape; representation is in two's complement

*Reserved bit will have 0 as default value

XXXXXXXXXXXXXXXX 0000000111110100

BW = 1 GHz

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

PLL configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PLL_CONFIG	reserved																Bandwidth [MHz] (16 Bits)																

Bandwidth [MHz] (16 Bits)																
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-2	MHz
1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	-4	MHz
...																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-65536	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	MHz
...															...	
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	+65534	MHz

Format Field	Field Size	Description
Bandwidth	16 bits	Negative values result in a falling ramp slope, positive values in a rising saw tooth shape; representation is in two's complement

*Reserved bit will have 0 as default value

XXXXXXXXXXXXXXXX 0000000111110100

BW = 1 GHz

!P 0000 0000 0000 0000 0000 0001 1111 0100 \r\n

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

PLL configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PLL_CONFIG	reserved																Bandwidth [MHz] (16 Bits)															

Bandwidth [MHz] (16 Bits)																
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-2	MHz
1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	-4	MHz
…																
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-65536	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MHz
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	MHz
…															…	
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	+65534	MHz

Format Field	Field Size	Description
Bandwidth	16 bits	Negative values result in a falling ramp slope, positive values in a rising saw tooth shape; representation is in two‘s complement

*Reserved bit will have 0 as default value

XXXXXXXXXXXXXXXX 0000000111110100

BW = 1 GHz

!P 0000 0000 0000 0000 0000 0001 1111 0100 \r\n → **'!P000001F4\r\n'**

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

Baseband configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
BB_CONFIG	WIN	FIR	DC	CFAR		CFAR Threshold [dB]				CFAR Size				CFAR Grd		Average n		FFT Size			Down sample			# Ramps			# Samples			ADC ClkDiv		

WIN	
0	windowing off
1	windowing on

FIR	
0	FIR filter off
1	FIR filter on

DC	
0	DC cancellation off
1	DC cancellation on

FFT Size			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

Down sample			
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	4
1	0	0	8
1	0	1	16
1	1	0	32
1	1	1	64

# Ramps			
0	0	0	1
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	64
1	1	1	128

# Samples			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

ADC ClkDiv			MS/s
0	0	0	2,571
0	0	1	2,400
0	1	0	2,118
0	1	1	1,800
1	0	0	1,125
1	0	1	0,487
1	1	0	0,186
1	1	1	0,059

CFAR		
0	0	CA-CFAR
0	1	CFAR_GO
1	0	CFAR_SO
1	1	reserved

CFAR Threshold [dB]				dB
0	0	0	0	0
0	0	0	1	2
				...
1	1	1	1	30

CFAR Size				
0	0	0	0	0
0	0	0	1	1
...				
1	1	1	1	15

CFAR Grd		
0	0	0
0	1	1
1	0	2
1	1	3

Average n		
0	0	0
0	1	1
1	0	2
1	1	3

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

Baseband configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
BB_CONFIG	WIN	FIR	DC	CFAR		CFAR Threshold [dB]				CFAR Size				CFAR Grd		Average n		FFT Size			Down sample			# Ramps			# Samples			ADC ClkDiv		

WIN	
0	windowing off
1	windowing on

FIR	
0	FIR filter off
1	FIR filter on

DC	
0	DC cancellation off
1	DC cancellation on

FFT Size			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

Down sample			
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	4
1	0	0	8
1	0	1	16
1	1	0	32
1	1	1	64

# Ramps			
0	0	0	1
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	64
1	1	1	128

# Samples			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

ADC ClkDiv			MS/s
0	0	0	2,571
0	0	1	2,400
0	1	0	2,118
0	1	1	1,800
1	0	0	1,125
1	0	1	0,487
1	1	0	0,186
1	1	1	0,059

CFAR		
0	0	CA-CFAR
0	1	CFAR_GO
1	0	CFAR_SO
1	1	reserved

CFAR Threshold [dB]				dB
0	0	0	0	0
0	0	0	1	2
				...
1	1	1	1	30

CFAR Size				
0	0	0	0	0
0	0	0	1	1
...				
1	1	1	1	15

CFAR Grd		
0	0	0
0	1	1
1	0	2
1	1	3

Average n		
0	0	0
0	1	1
1	0	2
1	1	3

0 0 1 00 0000 0000 00 00 000 000 000 000 000

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

Baseband configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
BB_CONFIG	WIN	FIR	DC	CFAR		CFAR Threshold [dB]				CFAR Size				CFAR Grd		Average n		FFT Size			Down sample			# Ramps			# Samples			ADC ClkDiv		

WIN	
0	windowing off
1	windowing on

FIR	
0	FIR filter off
1	FIR filter on

DC	
0	DC cancellation off
1	DC cancellation on

FFT Size			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

Down sample			
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	4
1	0	0	8
1	0	1	16
1	1	0	32
1	1	1	64

# Ramps			
0	0	0	1
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	64
1	1	1	128

# Samples			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

ADC ClkDiv			MS/s
0	0	0	2,571
0	0	1	2,400
0	1	0	2,118
0	1	1	1,800
1	0	0	1,125
1	0	1	0,487
1	1	0	0,186
1	1	1	0,059

CFAR		
0	0	CA-CFAR
0	1	CFAR_GO
1	0	CFAR_SO
1	1	reserved

CFAR Threshold [dB]				dB
0	0	0	0	0
0	0	0	1	2
				...
1	1	1	1	30

CFAR Size				
0	0	0	0	0
0	0	0	1	1
...				
1	1	1	1	15

CFAR Grd		
0	0	0
0	1	1
1	0	2
1	1	3

Average n		
0	0	0
0	1	1
1	0	2
1	1	3

0 0 1 00 0000 0000 00 00 000 000 000 000 000

!B 0010 0000 0000 0000 0000 0000 0000 0000 \r\n

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

Baseband configuration

Bit	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
BB_CONFIG	WIN	FIR	DC	CFAR		CFAR Threshold [dB]				CFAR Size				CFAR Grd		Average n		FFT Size			Down sample			# Ramps			# Samples			ADC ClkDiv		

WIN	
0	windowing off
1	windowing on

FIR	
0	FIR filter off
1	FIR filter on

DC	
0	DC cancellation off
1	DC cancellation on

FFT Size			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

Down sample			
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	4
1	0	0	8
1	0	1	16
1	1	0	32
1	1	1	64

# Ramps			
0	0	0	1
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	64
1	1	1	128

# Samples			
0	0	0	32
0	0	1	64
0	1	0	128
0	1	1	256
1	0	0	512
1	0	1	1024
1	1	0	2048
1	1	1	reserved

ADC ClkDiv			MS/s
0	0	0	2,571
0	0	1	2,400
0	1	0	2,118
0	1	1	1,800
1	0	0	1,125
1	0	1	0,487
1	1	0	0,186
1	1	1	0,059

CFAR		
0	0	CA-CFAR
0	1	CFAR_GO
1	0	CFAR_SO
1	1	reserved

CFAR Threshold [dB]				dB
0	0	0	0	0
0	0	0	1	2
				...
1	1	1	1	30

CFAR Size				
0	0	0	0	0
0	0	0	1	1
...				
1	1	1	1	15

CFAR Grd		
0	0	0
0	1	1
1	0	2
1	1	3

Average n		
0	0	0
0	1	1
1	0	2
1	1	3

0 0 1 00 0000 0000 00 00 000 000 000 000 000

!B 0010 0000 0000 0000 0000 0000 0000 0000 \r\n → **'!B20000000\r\n'**

https://siliconradar.com/datasheets/Protocol_Description_Easy_Simple_V2.4.pdf

MATLAB acquisition

```
s = serialport("COM3", 1000000);
```

Serial port configuration

```
sPort = serialportlist;
baudRate = 1e6;

serialPort = sPort(2);
fprintf("Connecting to %s …\n", serialPort)
com_port = serialport(serialPort, baudRate);

set(com_port, "DataBits", 8);
set(com_port, "Parity", 'none');
set(com_port, "StopBits", 1);
set(com_port, "Timeout", 1);
configureTerminator(com_port,'CR/LF');
```

Note for Linux users: I had some problems with Ubuntu, the OS wanted all the permissions to the serial ports. Type in Terminal: **`sudo chmod 666 /dev/tty*`**

https://www.mathworks.com/help/matlab/ref/serialport.html

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`serialportlist()` lists all the serial devices

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On my PC, it was the second element;
this must be adapted

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```

`serialportlist()` lists all the serial devices

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this must be adapted

Configuration of the serial port

Note for Linux users: I had some problems with Ubuntu, the OS wanted all the permissions to the serial ports. Type in Terminal: **`sudo chmod 666 /dev/tty*`**

https://www.mathworks.com/help/matlab/ref/serialport.html

Data acquisition

External trigger

```
while true
    writeline(com_port, "!N");
    buf = '';
    while isempty(buf) || ~startsWith(buf,'!M')
        buf = readline(com_port);
    end

    frameM = split(buf);
    frameM = frameM(4:end);

    dataM = str2double(frameM);
    dataI = dataM(1:2:end-1);
    dataQ = dataM(2:2:end);

    complexData = (dataI + 1i*dataQ).';

    /—— GENERIC PROCESSING ——/
end
```

Data acquisition

External trigger

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    dataQ = dataM(2:2:end);

    complexData = (dataI + 1i*dataQ).';

    /—— GENERIC PROCESSING ——/
end
```

Trigger acquisition

Since it may happen that the received buffer is empty, or it does not start with the right control character (i.e., error frame, information frame), the `readline()` is repeated until the data is acquired properly

Data acquisition

External trigger

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    writeline(com_port, "!N");
    buf = '';
    while isempty(buf) || ~startsWith(buf,'!M')
        buf = readline(com_port);
    end

    frameM = split(buf);
    frameM = frameM(4:end);

    dataM = str2double(frameM);
    dataI = dataM(1:2:end-1);
    dataQ = dataM(2:2:end);

    complexData = (dataI + 1i*dataQ).';

    /—— GENERIC PROCESSING ——/
end
```

Trigger acquisition

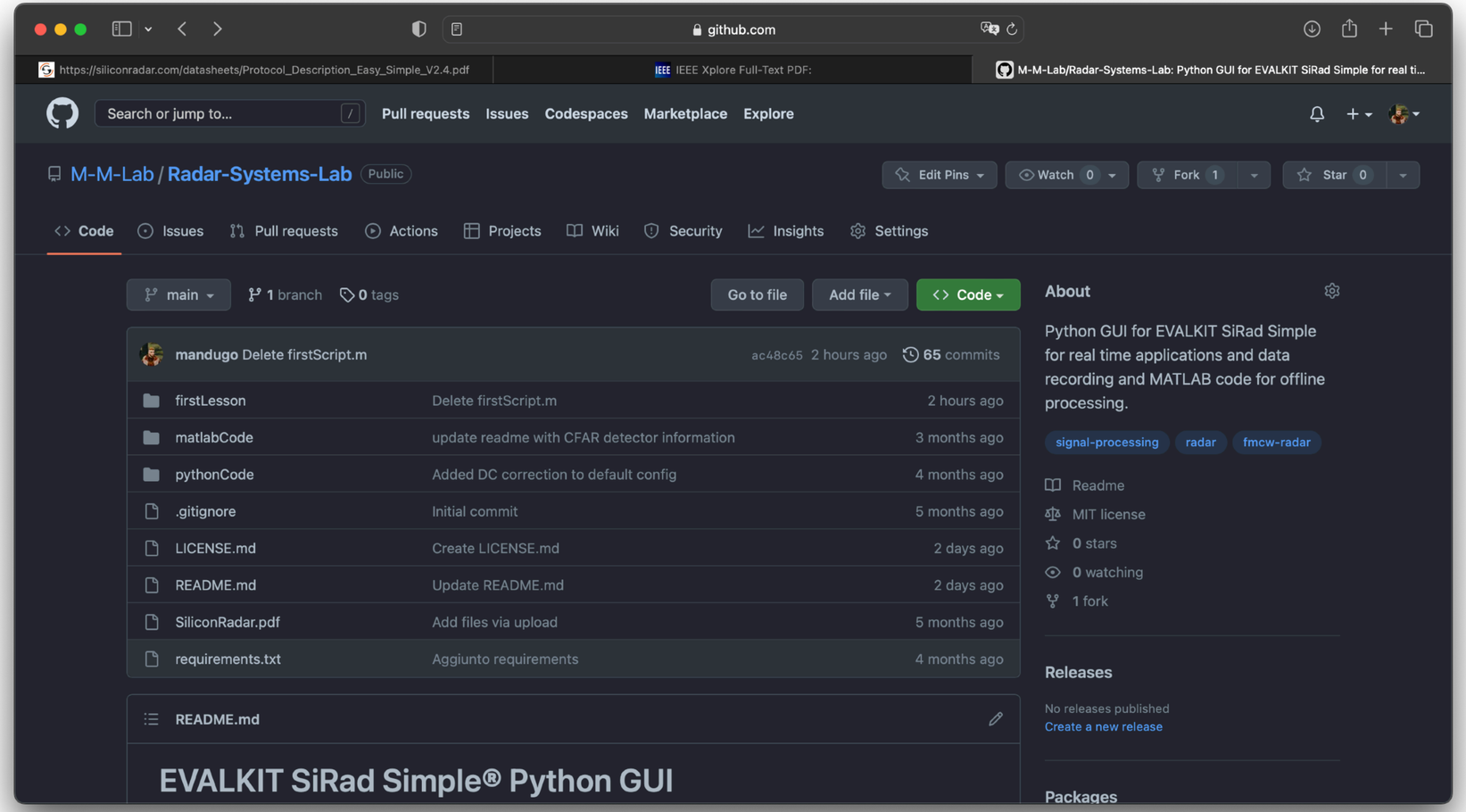
Since it may happen that the received buffer is empty, or it does not start with the right control character (i.e., error frame, information frame), the `readline()` is repeated until the data is acquired properly

The I samples are on odd indices, while the Q samples are on even indices

A little bit of processing

Range profiles evaluation

GitHub repo Radar-Systems-Lab



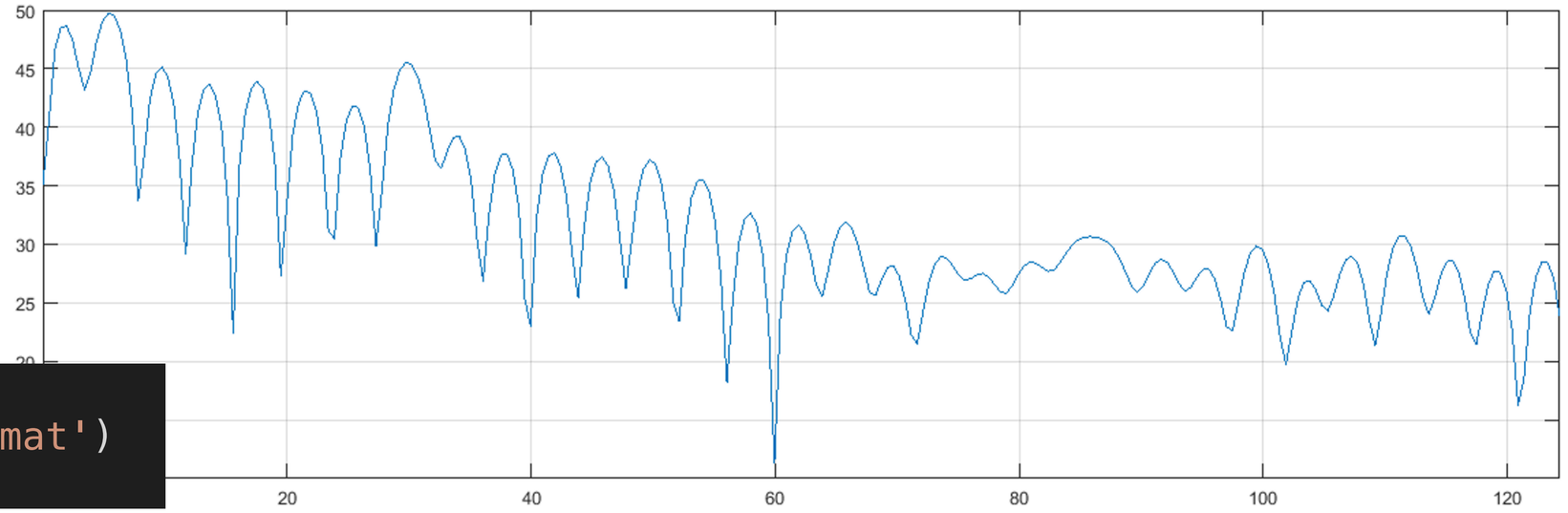
https://github.com/M-M-Lab/Radar-Systems-Lab

Radar-Sistems-Lab/firstLesson

- First example: range profile evaluation
- Second example: live range profile plot
- Third example: basic signal processing
- Fourth example: CFAR detection

…/firstLesson/firstExample.mlx

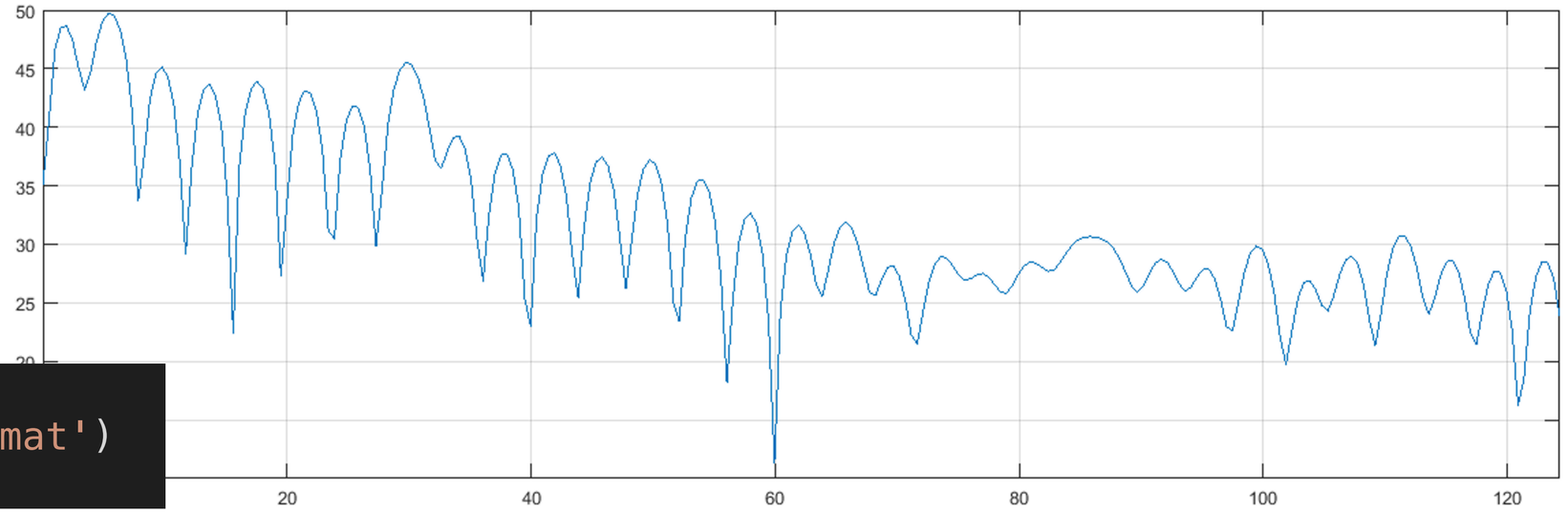
```
if length(complexData) == nSamples
    rangeProfile = fft(complexData,nfft);
    curveToPlot = abs(rangeProfile(1:end/2));
    [m,i] = max(curveToPlot);
    set(h(1),'YData',20*log10(curveToPlot));
    set(h(2),'XData',rangeVec(i),'YData',mag2db(m),'Marker','o','Color','r');
    title('Range Profile',strcat("maximum at ",num2str(round(rangeVec(i),2))," cm"))
end
```




```
load('target30.mat')
```

…/firstLesson/secondExample.mlx

```
if length(complexData) == nSamples
    rangeProfile = fft(complexData,nfft);
    curveToPlot = abs(rangeProfile(1:end/2));
    [m,i] = max(curveToPlot);
    set(h(1),'YData',20*log10(curveToPlot));
    set(h(2),'XData',rangeVec(i),'YData',mag2db(m),'Marker','o','Color','r');
    title('Range Profile',strcat("maximum at ",num2str(round(rangeVec(i),2))," cm"))
end
```

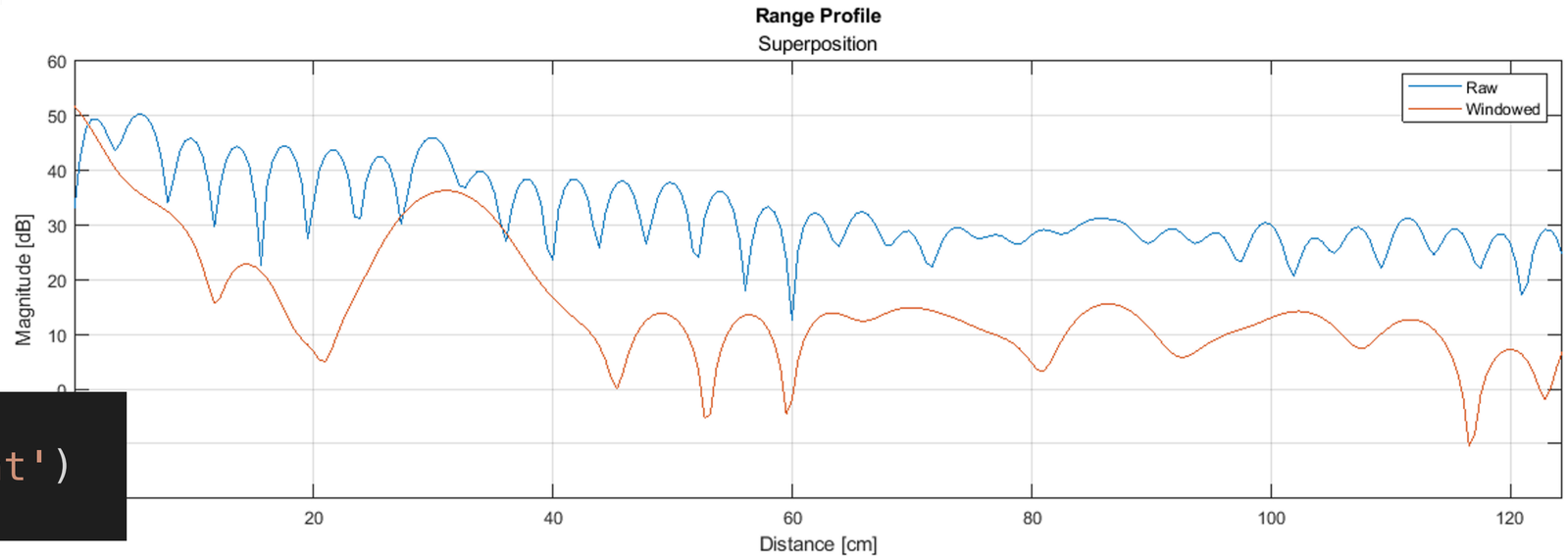



```
load('target30.mat')
```

…/firstLesson/thirdExample.mlx

```
windowHann = hann(nSamples).';
rangeProfileWHann = fft(complexData.*windowHann,nfft);
curveToPlotWHann = abs(rangeProfileWHann(1:end/2));

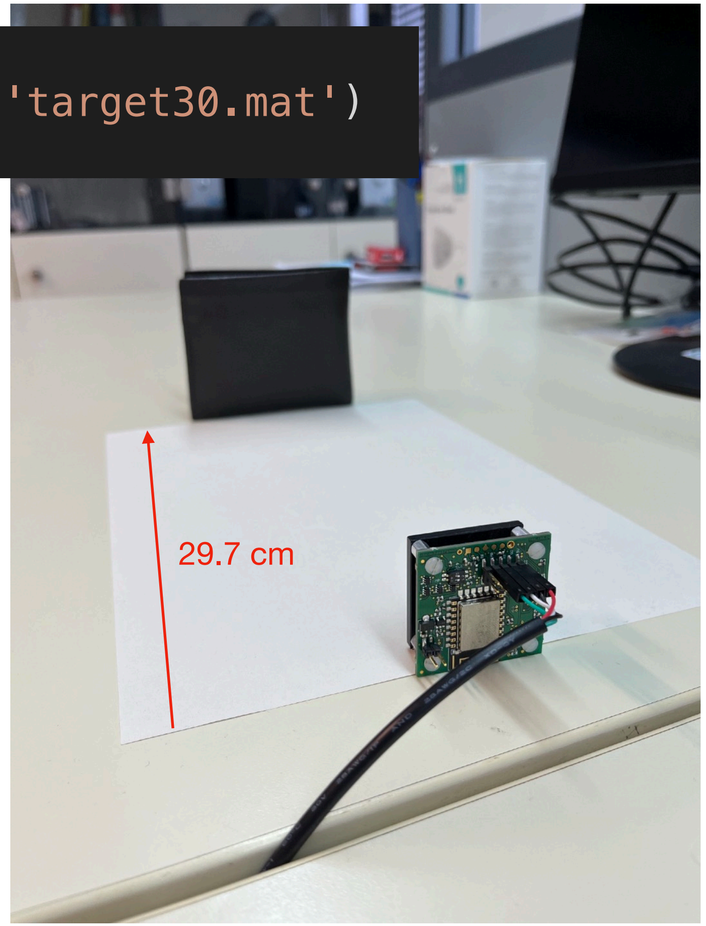
figure
plot(rangeVec,20*log10(curveToPlot))
hold on
plot(rangeVec,20*log10(curveToPlotWHann))
```




```
load('target30.mat')
```

…/firstLesson/fourthExample.mlx

```
load('target30.mat')
```




```
load(‘target60.mat')
```