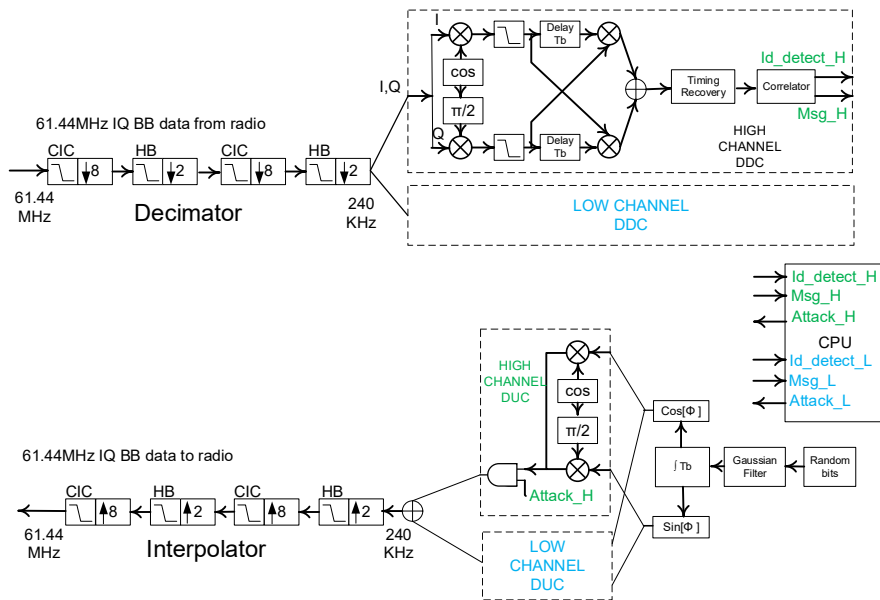
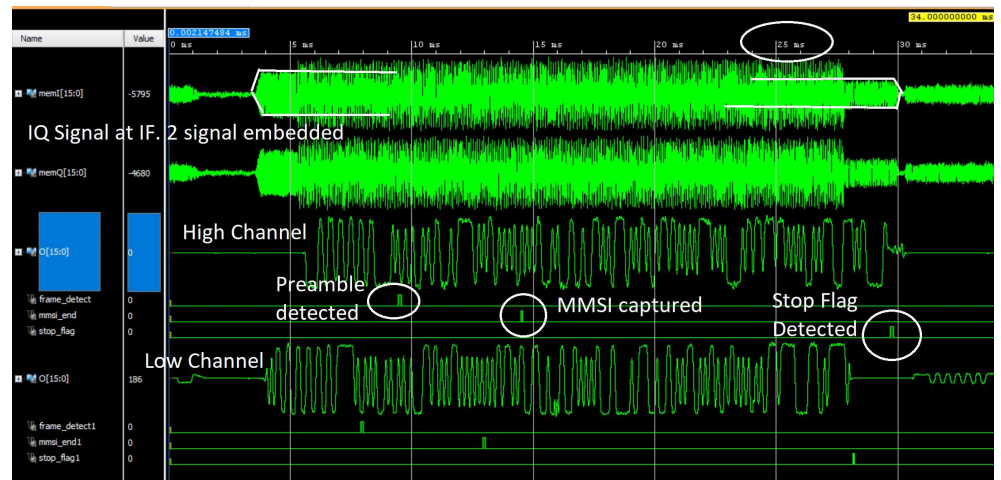


Signal Disruption of AIS

- Understood task requirement through architecture research and study
- Setup python environment to simulate signal chain
- HDL coding of filtering, decimation, down-conversion, timing recovery and etc



Firmware Architecture of Signal Disruptor



Results of Signal Recovery Simulation using Xilinx Vivado

- Synthesis and implementation of design to hardware
- Software (C coding) to coordinate actions of various hardware modules.

```

61
62 void block_int_bin(unsigned int in, int count, int* out);
63 int block_bin_int(int count, int* out);
64 unsigned int block_freq_to_nco(int freq);
65 int block_check_jam_list(int mmsi);
66 void block_update_ddc(struct block_bb *p);
67 void block_write_ddc(struct block_bb *p);
68 void block_handler(struct block_bb *p);
69 void block_extract_mmsi(struct block_bb *p, int quite);
70 void block_jam(char ch);
71 void st_led_on(int led_no);
72 void st_led_off(int led_no);
73 void st_led_on_off(int led_no, int ms_duration);
74 int st_read_pb(int pb_no);
75
76 void IntrHandling_block_H(void *callback_func);
77 void IntrHandling_block_L(void *callback_func);
78
79
80
81
82
83
84
85

```

```

71 void block_get_jam_list(double* param, int param_no);
72 void block_set_jam_list(double* param, int param_no);
73
74 void block_get_bb_freq(double* param, int param_no);
75 void block_set_bb_freq(double* param, int param_no);
76 void block_get_test(double* param, int param_no);
77 void block_set_test(double* param, int param_no);
78 void block_get_scan(double* param, int param_no);
79 void block_set_scan(double* param, int param_no);
80 void block_scan_start(double* param, int param_no);
81 void block_stat(double* param, int param_no);
82 void block_demo(double* param, int param_no);
83 void st_run1(double* param, int param_no);
84 void st_run2(double* param, int param_no);
85

```

Software Modules Developed

block_ip_cic8	block_jam_bb	block_wf_time_24_26
block_ip_dds	block_jam_f2p_wrapper	block_wf_time_25_25
block_ip_fir	block_mem_file.coe	block_wf_time_26_26
block_ip_fir2	block_mux	block_wf_time_27_27
block_ip_gauss	block_pn7	block_write_reg
block_ip_mem	block_shiftreg	tb_block_ddc
block_ip_mem_acc	block_slicer	tb_block_filter
block_ip_mul	block_source_4port	tb_block_fir
block_ip_mult	block_source_4port_ddc	tb_block_ip_mult_xilinx
block_ip_sub16	block_source_4port_filter	tb_block_mult
block_jam_div	block_source_4port_slicer	tb_block_slicer
block_jam_f2p	block_tb_common	tb_block_slicer_old
block_baseband	block_tester	tb_block_source
block_baseband_ctrl	block_try_and	tb_block_try_and
block_cic8fir2	block_two_complement	tb_block_try_and1
block_cic8fir2_IQ	block_wf_4tone_16b	tb_block_two_complement
block_clocking	block_wf_4tone_20b	tb_counter_decr
block_control	block_wf_4tone_20b_c8f2	tb_idelay2
block_corr	block_wf_4tone_20b_fir2	tb_rx_deser_dual
block_ddc	block_wf_5pkt_1350xx	tb_rx_deser_dual_behav.wcfg
block_duc	block_wf_5pkt_1495xx	wf_default.wcfg
block_FIR_16b_9K_24K_0p5dB_70dB.coe	block_wf_frame	
block_FIR_16b_gaussian.coe	block_wf_iq_if	
block_FIR_20b_dec2.coe	block_wf_sec2_74158	
block_fm_demod	block_wf_sec2_75058	
block_ip_cic8_wrapper	block_wf_sec2_110464	
block_ip_dds_wrapper	block_wf_sec2_149651	
block_ip_fir_wrapper	block_wf_sec2_both1	
block_ip_fir2_wrapper	block_wf_time_23_23	
block_ip_gauss_wrapper	block_wf_time_23_27	
block_ip_mul_wrapper	block_wf_time_23_27_ramp	
block_ip_mult_wrapper	block_wf_time_24_24	

HDL Modules Developed

- Trade-offs between firmware and software to deliver on time
- Inserted module for disruption

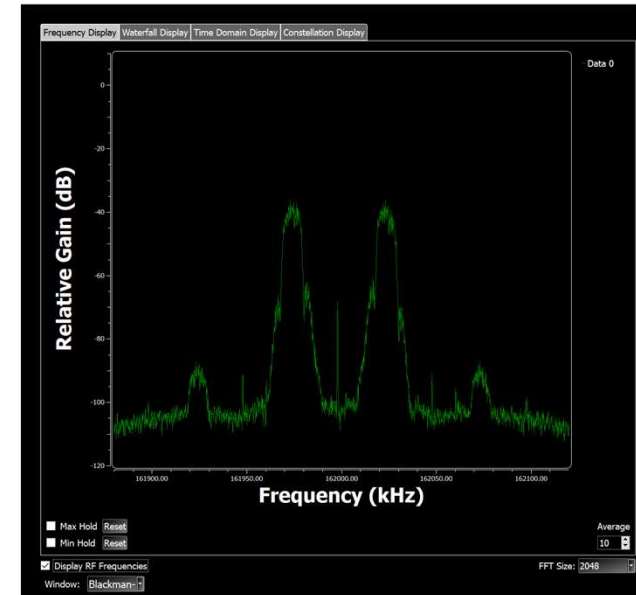
Here is the jam list (0 means empty):

Id: 0, MMSI: 563029220
Id: 1, MMSI: 565554000
Id: 2, MMSI: 563066540
Id: 3, MMSI: 565101872
Id: 4, MMSI: 565233000
Console>

User Console
In Jamming Mode

```
In mode 3, 0=normal, 1=demo slow, 2=demo fast, 3=jam, 4=always-jam
Console> 565101872 acted upon...
563029220 acted upon...
563066540 acted upon...
565233000 acted upon...
565101872 acted upon...
565554000 acted upon...
563029220 acted upon...
563066540 acted upon...
565233000 acted upon...
565101872 acted upon...
565554000 acted upon...
565233000 acted upon...
563029220 acted upon...
563066540 acted upon...
565233000 acted upon...
565101872 acted upon...
565554000 acted upon...
563066540 acted upon...
565233000 acted upon...
565101872 acted upon...
565554000 acted upon...
563029220 acted upon...
565233000 acted upon...
```

RF Spectrum of Jamming Signal



Essential modules completed. Demo to be conducted

Latency:

- CPU Core running at 800MHz.
- 1000 C code statement with 10 clk per statement, processing time require is 12.5us.
- 1 bit duration is ~100us. Latency not an issue and hence processing should be done on software.

