

ALTIMETER/RADAR TARGET SIMULATOR (SRT – 2944)

Technical Specifications

T&R



Content

DEFINITION	. 2
	2
	, ,
SOFTWARE	. 4



DEFINITION

This document aims to explain details of SRT-2944 which conducts the tests for altimeters and radars. Document describes general architecture and software interface.

FREQUENCY- System works between 0.2GHz-6GHz with an instantaneous bandwidth of 160MHz. If there is a need for higher frequencies, users can select two options for frequency extensions up to 18 or 40 GHz.

FUNCTION- System replaces the actual target and the environment, SRT-2944 could be used in cabled mode or over the air. System is independent to radar parameters like PRI, signal type or transmit power. SRT-2944 receives the signal which is transmitted from the radar and generates the target signals according to user input. Users can generate still targets manually or create a trajectory scenario. Architecture of the system is as below:



Şekil 1 Target Generation Block Diagram

SYSTEM SPECIFICATIONS- SRT 2944 accommodates Hardware and Software specifications below:

- SRT 2944 can generate 2 targets independently.
- Each target could be used manually or an automatic trajectory scenario.
- Each target range can set independent from 150 mt to 300km.
- Each target is capable of generating +- 10 kHz doppler.
- Optionally, user can connect the system to a simulation computer enable HIL(Hardware in the Loop) mode for Real-Time scenario execution.
- Small size and lightweight system is suitable for working in lab or field conditions.
- Standard 6GHz frequency could be extended up to 18 GHz or 40 GHz.
- Instantaneous bandwidth is 160MHz, there are two more options for 1 GHz and 1.2GHz.



HARDWARE ARCHITECTURE

System utilizes an NI USPR RIO 2944 Software Defined Radio and a Lenovo Workstation. System computer has a PCMCIA interface to transmit/receive IQ data from/to USRP.

NI PCI Express Cable and NI8360b Express card is used for MXI connection.



The USRP RIO has a mainboard which houses the FPGA, ADC and DAC components. Signal conversion daughter boards are selected upon frequency needs, which UBX-160 in this system. UBX-160 is 1x1 transceiver daughterboard with 10MHz to 6GHz frequency range with 160 MHz IBW. This daughterboard is connected directly to the FPGA model Kintex7-410T which is placed on mainboard.



CALIBRATION- SRT 2944 has 2 daughterboards which makes the system 2x2 system. 1 transmit and receive channel is used for target generation. The other channel is used to calibrate frequency and amplitude by connecting to a rigid frequency source. Calibration scheme is as follows:



Amplitude and frequency will be read from channel 2 and calibration parameters for amplitude and frequency will be calculated online. This method ensures frequency stability and amplitude control.



SOFTWARE

The software consists of two applications for Windows Host and embedded FPGA. All software developed using NI Labview.

User can reach all functions without interfering to FPGA or Windows coding. The GUI explained below is targeted for all types of users.

- Main Windows User Screen

The screen below is the main user interface of the system. To avoid complication and mistakes, GUI objects will enable/disable themselves according to test states. This welcome screen will allow user to select Scenario creation, Scenario loading, scenario modes and RF ON/OFF.





- RF On State

Once the user selects RF ON, the software will allow user to enter scenarios and starts indicating whole 160 MHz IBW spectrum signal on the graph and starts calculating peak power.





- Scenario Creation and Execution

User can input scenario steps and can select either mode from 4 different scenario execution schemes.



Active Checkbox : Disable/Enable Scenario.

Finite-Continuous : Indicates if the scenario should start over once it is done. User can select a number of start overs or continuous.

Standing-Moving : In moving mode, users will enter the scenario steps and automatically interpolate the values if entered with missing ranges. Any step could be disabled online. In standing mode, only 1 step is active and system only generates a standing target. If needed user can input a speed to simulate discrete targets for debugging.

Target - 1 Enable	Start Range (m)	Finish Range (m)	Doppler	Doppler Unit	Active Step	\checkmark	Active	Target - 2 Enable	Start Range (m)	Finish Range (m)	Doppler	Doppler Unit	Active Step	<u>/</u>	Active
	150k	150k	0	m/s		C	Finite 1	\checkmark	120k	150k	7000	m/s		Э	Finite 1
	120k	120k	0	m/s		·	Continuous	\checkmark	190k	170k	-4000	m/s		•	
\checkmark	170k	170k	0	m/s			Standing		110k	170k	7000	m/s			
	110k	110k	0	m/s		Ŀ	Standing		50k	110k	8000	m/s			Standing
	50k	50k	0	m/s			Moving	\checkmark	0	50k	3000	m/s		•	Moving
	0	0	0	m/s	$\left \right $		Incoming		0	70k	6000	m/s			
	70k	70k	0	m/s		L)	\checkmark	0	70k	4500	m/s			Incoming
	0	0	0	Hz]	·	Outgoing		0	0	0	Hz		•	Outgoing
Elapsed Step T	īme (s)	Step Time (s) Elapsed	Total Time	(s) Currer	it Cycl	e	Elapsed Step 1	lime (s)	Step Time (s) Elapsed	Total Time	(s) Current C	ycle	
0s		0s	0s		0			0s		0s	0s		0		



Incoming-Outgoing : This selection will arrange the doppler according to approaching or receding objects.

Target - 1 Enable	Start Range (m)	Finish Range (m)	Doppler	Doppler Unit	Active Step		Active	Target - 1 Enable	Start Range (m)	Finish Range (m)	Doppler	Doppler Unit	Active Step		Active
\checkmark	150k	120k	-5000	m/s		C	Finite 1	\checkmark	120k	150k	5000	m/s		Ο	Finite 1
\checkmark	170k	120k	-9000	m/s		·	Continuous	\checkmark	120k	170k	9000	m/s		•	Continuous
\checkmark	170k	110k	-8000	m/s			Standing	\checkmark	110k	170k	8000	m/s			Standing
\checkmark	110k	50k	-6000	m/s				\checkmark	50k	110k	6000	m/s			Standing
\checkmark	50k	0	- 5000	m/s		·	Moving	\checkmark	0	50k	5000	m/s		O	Moving
\checkmark	70k	0	-10000	m/s				\checkmark	0	70k	10000	m/s			
\checkmark	70k	0	-9000	m/s	$\overline{\mathbf{O}}$	Ŀ	incoming	\checkmark	0	70k	9000	m/s		O	Incoming
	0	0	0	Hz	•		Outgoing		0	0	0	Hz	-	O	Outgoing
Elapsed Step T	ïme (s)	Step Time (s) Elapsed	Total Time	(s) Currer	nt Cycl	e	Elapsed Step T	ïme (s)	Step Time (s) Elapsed	Total Time	(s) Curren	t Cycle	;
Os		0s	0s		0			0s		0s	Os		0		

Speed Input Conversions

User can select speed input as meters per second or Doppler as Hz. Doppler will be converter automatically after entering the speed value.

Target - 1 Enable	Start Range (m)	Finish Range (m)	Doppler	Doppler Unit	Active Step	Doppler Unit	A S	Target - 1 Enable	Start Range	Finish Range	Doppler	Doppler Unit
		(,		1		Hz			(m)	(m)		
\checkmark	150k	120k	-5000	m/s		√m/s	3	\checkmark	150k	120k	-66666.7	Hz
\checkmark	120k	170k	9000	m/s		m/s	10		120k	170k	120000	Hz
\checkmark	170k	110k	-8000	m/s			\Rightarrow					
	110k	50k	-6000	m/s	Õ	m/s	(170k	110k	-106667	Hz
	50k	0	-5000	m/s	ŏ	m/s		\checkmark	110k	50k	-80000	Hz
	0	70k	10000	m/s	ŏ	m/s		\checkmark	50k	0	-66666.7	Hz
	70k	0	-9000	m/s	Õ	m/s	K	\checkmark	0	70k	133333	Hz
	0	0	0	Hz		m/s	1	\checkmark	70k	0	-120000	Hz