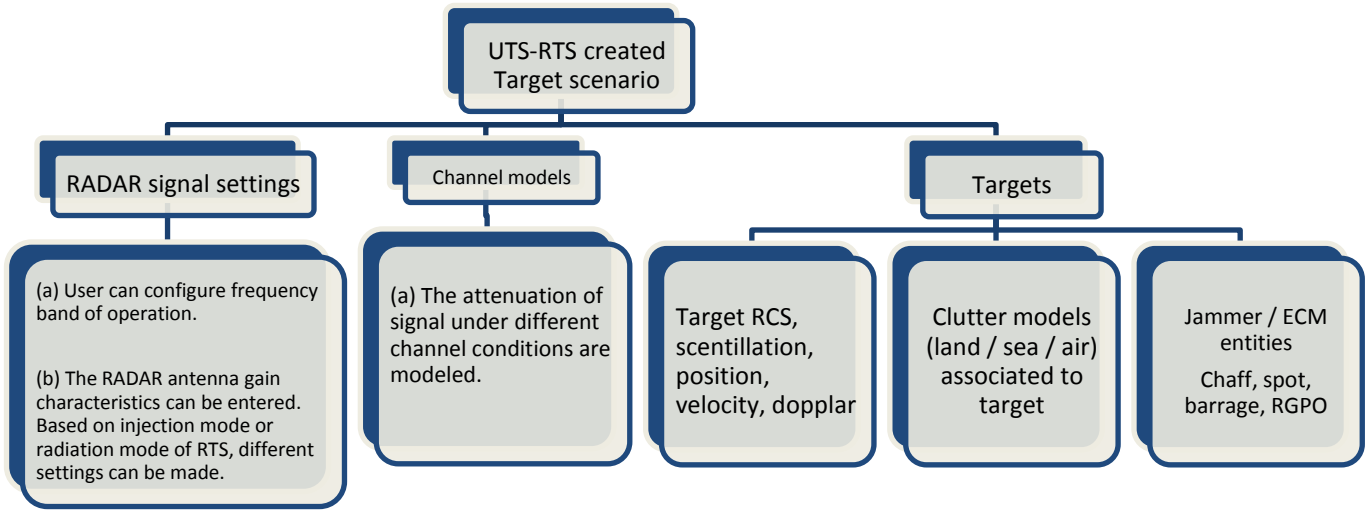
Unistring Tech Solutions

UTS - RADAR Target Simulator

RADAR Target simulation is very effective means of test and validation of several features of modern RADARs. The Target simulators can also be used as Built In Test Equipment (BITE) for on site testing. UTS offered RTS takes the RADAR signal and generates target echo with effects simulating target parameters, clutter and onboard jammer (ECM) entities. The UTS-RTS provides user friendly GUI to configure different entities as shown in below figure



The UTS-RTS can be used for testing RADAR systems in injection mode and radiation mode. Both the conventional RADAR signal types and LPI signals can be applied as input. The simulator also has provisions for enabling ECM at target side, so that testing ECCM features of RADAR (DUT) is possible. The unit is highly portable and controlled through Ethernet from user friendly GUI running on PC.

Pulse Trigger and Full length DRFM Architectures - Comparison

The UTS offered RADAR Target Simulator is available in two different architectures, as described below.

(a) Pulse trigger based DRFM (Pulsed waveform only)

In this the pulse presence in the input signal will be detected based on the threshold value and instantaneous power of input signal. The threshold can be set by user or can leave for algorithm to detect automatically. The captured pulse samples are stored in Digital Radio Frequency Memory (DRFM) and played back

(b) Full length DRFM (Pulse/CW all types of RADAR waveform)

To cater for CW RADAR waveforms the full length DRFM (Catering the total delay between RADAR generated waveform and echo) based architecture has higher memory and does not employ any pulse detection logic. The input RADAR waveform is delayed for the required total to-and-fro path delay and generates echo. This type of RTS can be used with both Pulse and CW type RADAR waveforms. The following table compares these architectures.

Parameter	Pulse Trigger based DRFM	Full length DRFM
Principle of operation	Pulse presence in the input signal will be detected (based on threshold) and stored in DRFM. Based on the target echo delay the output will be produced.	The input RADAR waveform is delayed for the required total to-and-fro path delay and generates echo.
Type of RADAR waveforms for which RTS can be used	All types of Pulsed RADAR waveforms. (including Pulse Doppler and Pulsed LFM waveforms)	All types of RADAR waveforms including CW variants.
Target Range simulation	Since the Pulse part of signal only is stored in DRFM, target ranges without any upper limit can be simulated. Target ranges up to 2000 Km (even beyond) can be simulated.	The total waveform is passed to DRFM. So there is a tradeoff between bandwidth and maximum range simulation. However the UTS architecture with scalable architecture allows addition of multiple FPGA cards with memory chips to increase the simulation ranges.

Parameter	Pulse Trigger based DRFM	Full length DRFM
Maximum Pulse width (PW) constraint.	Since memory length covering the maximum PW is used for capture, the firmware configured for required maximum PW value.	No limitation of maximum PW value.
PRI constraint	Any PRI values can be supported	Any PRI values can be supported
Support for frequency agility	Frequency agility in input pulse can be supported with in the input RF bandwidth	Frequency agility in input pulse can be supported with in the input RF bandwidth

Table 1 - Comparison between " Pulse trigger based DRFM" and "Full length DRFM"

Depending on the Radar type under test, one of the above architecture can be selected. For majority of surveillance RADARs the pulse trigger based DRFM architecture is suitable. For FMCW category (e.g. Altimeter) applications the "Full length DRFM" is desired.

RTS GUI front end & Features

The graphical front end of UTS-RTS is shown in below figure.

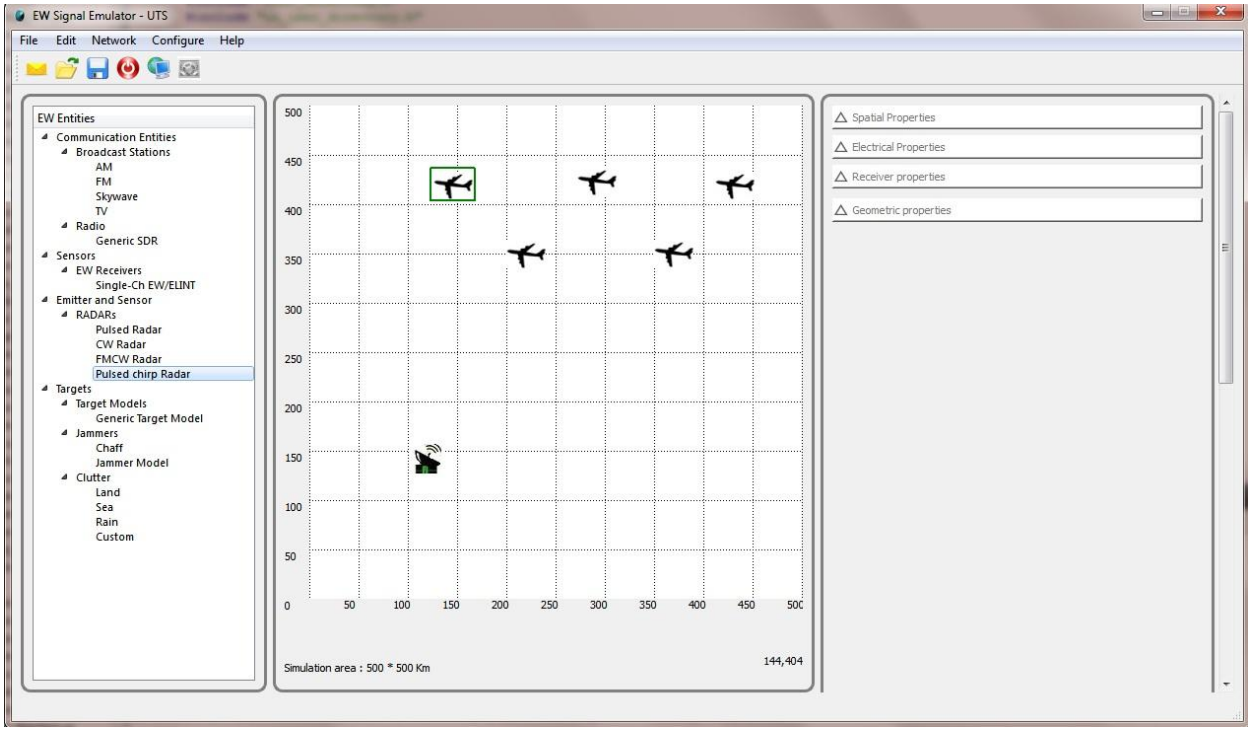
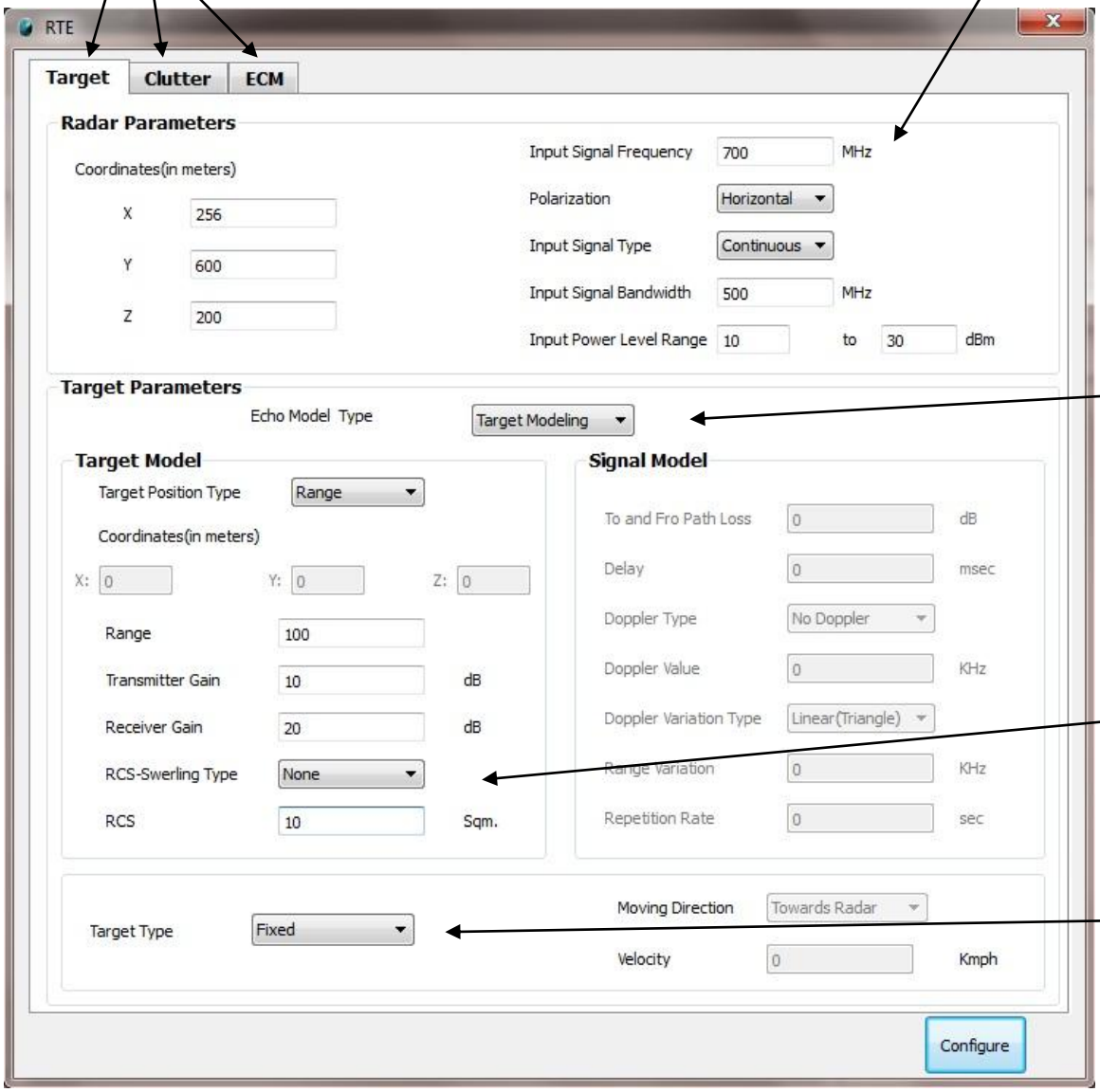


Figure. Main User interface window of RTS

The simulation region shows 500 X 500 sq-km (which can be configured) where user can position RADAR and multiple targets. The coordinates of all entities can be given in (x,y,z) scale. By double clicking on target model the target windows opens as shown in below figure. Each target can be configured independently.

Each target associated **echo** parameters, **clutter** and on board **ECM** entities can be simulated

Input RADAR signal parameters can be defined



Can choose to define target parameters or desired echo characteristics

Can define Target's RCS and swerling types

Can define velocity and resulting Doppler value and variation profile.

Figure. UTS-RTS Target parameter window

The clutter tab can be used to select the required clutter model. Three types of clutter models (land, sea and volume/cloud clutter) are provided. Associated parameters for each clutter can also be configured.

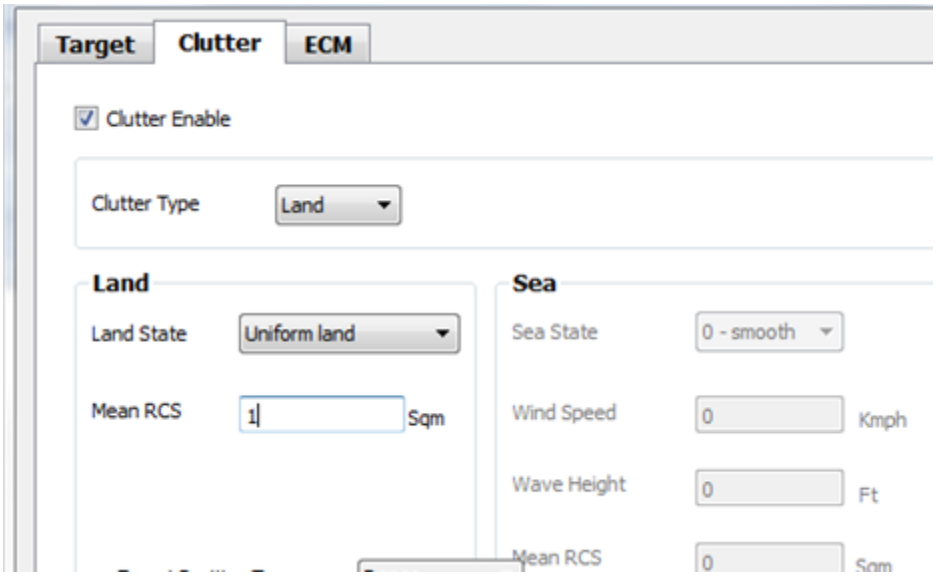


Figure. UTS-RTS clutter modeling features

Using the ECM options, an on-board jammer of target can be simulated. Both mechanical (Chaff) and electronic jammer types can be simulated. The Spot, Barrage and sweep jammer can be configured with required J/S ratio. The ECM modeling feature is very useful for testing the ECCM capable RADARs.

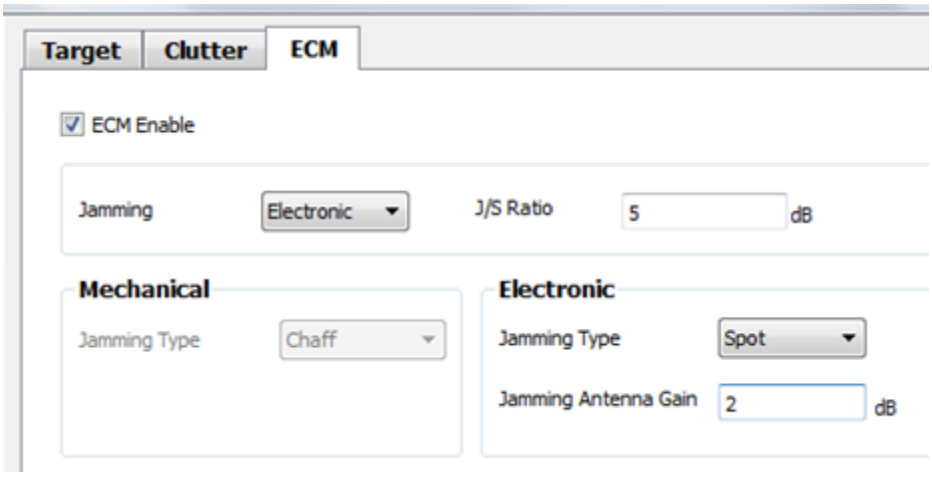


Figure. UTS-RTS Target On-board jammer modeling features

RTS models and specifications

Following are the key specifications of product. Based on user requirements improved specifications can be offered.

- Frequency range : 100 MHz to 5.9 GHz
- Maximum Instantaneous Bandwidth: 50/100/200/500 MHz
- Maximum number of targets / reflectors : 10 (Extendable)
- Range: 200 m - 150 Km (Extendable up to 2000 Km)
- Range resolution - 3 / 6 / 12 meters
- User friendly GUI (with optional maps feature)
- Can model RF parameters of RADAR systems
- Configurable RCS for targets
- Programmable clutter models
- User can make the RADAR system to be static or moving type
- Programmable Target speeds (Doppler shift based on relative motion)
- User can create, save and load profiles consisting typical target scenarios
- Power supply AC 240 V , 50 Hz, +/-10% (Also available for 28V DC power – Optional feature)

Applications

- Injection mode testing of surveillance/tracking RADARs
- Seeker development and testing
- LPI RADAR signal processing algorithm development and testing.
- Developing ECCM techniques for RADARs
- Performance analysis of Bi-static RADARs
- BITE module for RADAR

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Other related products

- RADAR signal emulator
- Carrier to Noise generator
- RADAR and Communication IPs
- Communication Signal Simulator
- Radar Jamming Effectiveness simulator