KLJ INSTRUMENTS

SQTR-3BB
1030/1090/UAT
ADS-B Squitter Generator

Operators Manual

REVISION

A	B	C	D	E	F	G	H	J	K	L	M	N
P	R	S	T	U	V	W	X	Y	Z			

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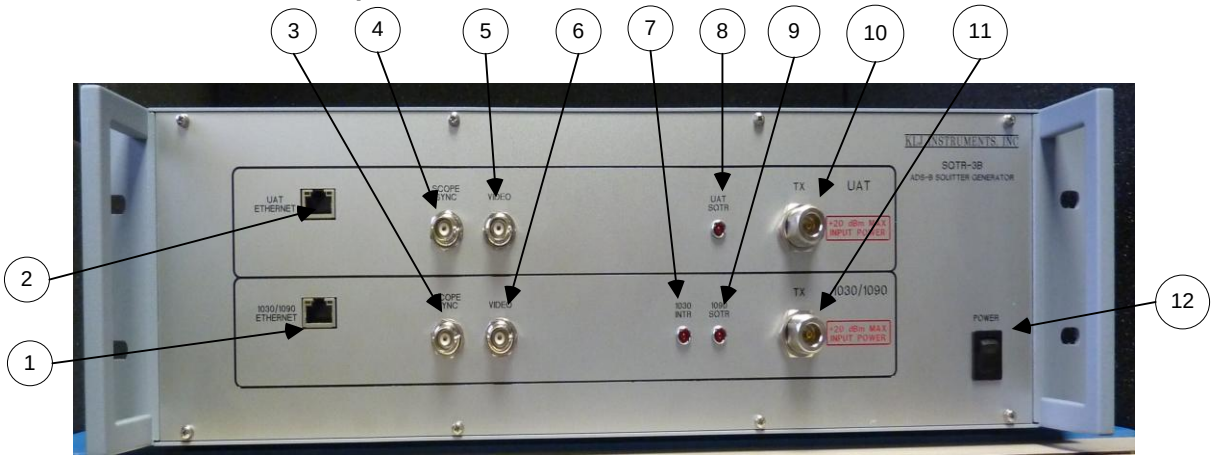
Date	REV	ECO	Page	Description
Nov 2010	A			Initial Release
Mar 2011	B			Add updated GUI screens

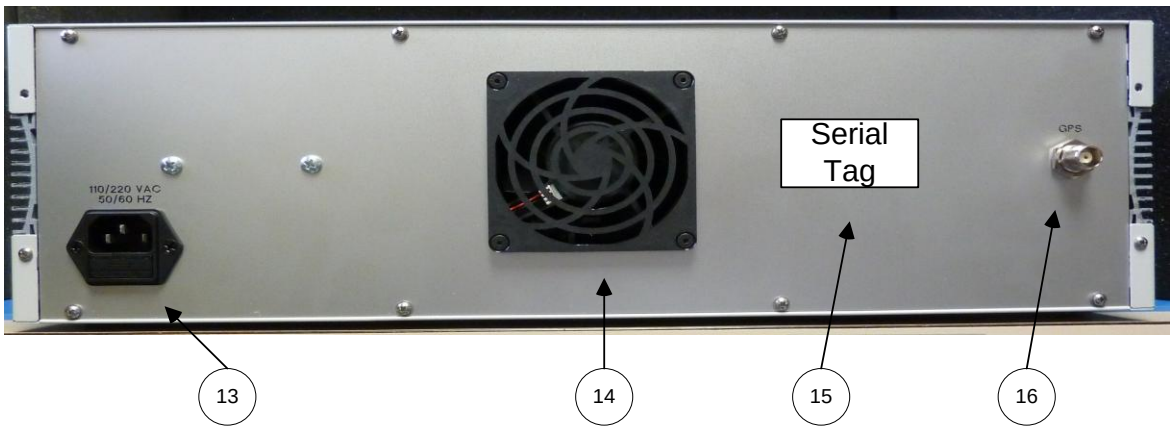
INTRODUCTION

1.1 Manual Description

The SQTR-3BB provides capability for generating ADS-B information (1090 MHz DF17 Squitters and Universal Access Transceiver (UAT) Messages) and 1030 MHz Mode S Interrogations. The purpose of this manual is to provide instructions for use of the SQTR-3BB.

1.2 Front and Rear Panel Description





SQTR-3BB Front and Rear Panel		
1	1030/1090 ETHERNET	Ethernet connection for 1030/1090 Board
2	UAT ETHERNET	Ethernet connection for UAT Board
3	1030/1090 SCOPE	Scope Sync output for each 1030 Interrogation or 1090 DF17 Squitters
4	UAT SCOPE	Scope Sync output for each UAT Messages
5	UAT VIDEO	Detected waveform of UAT Messages
6	1030/1090 VIDEO	Detected waveform of 1030 Interrogations or 1090 DF17 Squitters
7	1030 Interrogations	Flashes when transmitting 1030 Interrogations
8	UAT Squitters	Flashes when transmitting UAT messages
9	1090 Squitters	Flashes when transmitting 1090 DF 17 squitters
10	TX UAT	Output for UAT Messages
11	TX 1030/1090	Output for 1030 Interrogations or 1090 DF17 Squitters
12	POWER	Power Switch
13	INPUT POWER	Input for 110/220 VAC, 50/60 Hz
14	FAN	
15	SERIAL TAG	Shows SQTR-3BB information as well as Ethernet IP Address for UAT and 1030/1090 Board
16	3.3 VDC GPS ANTENNA	Connection for external GPS antenna

1.3 SQTR-3BB Function

The SQTR-3BB provides capability for generating the following signals:

- Simulation of forty-five (45) 1090 MHz squitters (10 moving and 35 stationary)
- Simulation of ten (10) UAT messages
- Simulation of 1030 MHz (Modes A, C, Mode A/Mode S All Call, Mode C/Mode S All Call, and Mode S) interrogations

The SQTR-3BB provides capability for generating scenarios for generating airborne targets transmitting data via ADS-B, either UAT messages or 1090 MHz DF-17/18/19 squitters.
The Waypoint data for each target can be set. The GPS position (latitude and longitude) of each target can be set to occur at a selected time. The SQTR-3BB will generate the moving GPS position between each waypoint. The scenario can be set to run for a specific time or the SQTR-3BB will continue to simulate a moving target after passing the last selected waypoint (unless a scenario run-time length is set in the System Setup screen.

Each target can be configured for specific event-points in which various actions can be programmed to occur. The actions that can be configured include:

- Event Squitter Data – Event-driven squitters
- Surveillance Status
    - Special Position Identification (18 second)
    - Permanent Emergency Alert (Alert)
    - Temporary Alert (Squawk)
- RF Level Offset from RF Level selected in System Setup screen (0 to +31 dB)
- Change status (change or unchanged) of Squitter types (DF 11 Acquisition, DF 17/18 Surface Position, DF17/18, DF17/18 Airborne Position, DF 17/18 Airborne Velocity, or DF17/18 Identification and Category) selected in 1090 Target Setup screen
- Encode data in Type 23 (Test), Type 28 (Aircraft Status), Type 29 (Target State), or Type 31 (Aircraft Operational Status) Squitters

1.4 Initial Setup

The SQTR-3BB consists of two transmit channels, one for either 1030 or 1090 MHz and the second for UAT messages. Each of the two transmitter channels is controlled using an Ethernet connection. The IP address for each board is shown on a tag mounted on the rear of the SQTR-3BB. The SQTR-3BB is shipped from the factory with the following IP addresses:

- 1030.1090 Board: 192.168.0.58
- UAT Board: 192.168.0.59

You must configure the unit so that it can communicate on a network with your serial device. You can use the following procedures remotely or locally:

- Use a Telnet connection to configure the unit over the network.
- Use a terminal or terminal emulation program to access the serial port locally.

The series of prompts at which you enter configuration settings is called ***Setup Mode***. The unit's configuration is stored in nonvolatile memory and is retained without power. You can change the configuration at any time. The unit performs a reset after the configuration has been changed and stored.
This chapter tells you how to access Setup Mode and the general procedure for accessing Setup Mode:

(Note – a summary of the method to access the SQTR-3B to change the IP address described below is as follows: Select '0' from the menu. Type in the new address in 'chunks' i.e. 192 <ENTER>, 168 <ENTER> 0 <ENTER> 243 <ENTER>. Then just press ENTER to keep all of the other settings until you get back to the menu. Then press 9 to Save and Exit)

Telnet Connection
To configure the unit over the network, establish a Telnet connection to port **9999**.
To establish a Telnet connection:
1. From the Windows **Start** menu, click **Run** and type the following command, where x.x.x.x is the IP address, and **9999** is the unit's fixed network configuration port number:
Windows: telnet x.x.x.x 9999
UNIX: telnet x.x.x.x:9999
2. Click **OK**. The following information displays.
3. To enter Setup Mode, **press Enter within 5 seconds**. The configuration settings display, followed by the **Change Setup** menu.
4. Select an option on the menu by entering the number of the option in the **Your choice**? field and pressing **Enter**.
5. To enter a value for a parameter, type the value and press **Enter**, or to confirm a current value, just press **Enter**.
6. When you are finished, save the new configuration (option 9). The unit reboots.

Serial Port Connection
To configure the unit through a serial connection:
1. Connect a console terminal or PC running a terminal emulation program to your unit's serial port. The default serial port settings are **9600 baud, 8 bits, no parity, 1-stop bit, no-flow control**.
2. Reset the XPort Direct unit by cycling the unit's power (turning the power off and back on). Immediately upon resetting the device, enter three lowercase **x** characters (**xxx**).
Note: *The easiest way to enter Setup Mode is to hold down the* ***x*** *key atthe terminal (or emulation) while resetting the unit.* ***You must do this within three seconds of resetting the*** XPort Direct*.* At this point, the screen display is the same as when you use a Telnet connection. To continue, go to step 4 in *Telnet Connection, above.*

Exiting Setup Mode
To exit setup mode:
You have two options:
- To save all changes and reboot the device, select option **9 Save and exit** from the **Change Setup** menu. All values are stored in nonvolatile memory.
- To exit the configuration mode without saving any changes or rebooting. Select option **8 Exit without save** from the **Change Setup** menu.

The SQTR-3BB can be controlled using the graphical user interface (GUI) that is supplied with the unit or by the use of a terminal emulation program. KLJ recommends the use of a terminal emulation program called Tera Term Pro Web (instructions in this manual are written around Tera Term Version 3.1.3) which is a freeware program that can be downloaded from www.ayera.com/teraterm. After downloading the Tera Term program to your computer,

connect to the SQTR-3BB via your local Ethernet network or directly from your computer to the SQTR-3BB via a CAT 5E X-Over patch cable. If using the X-over patch cable, your computer IP Address must be configured to "talk" to the SQTR-3BB (suggest address of 192.168.0.40 for your computer) using START/CONTROL PANEL/NETWORK CONNECTIONS/LOCAL AREA CONNECTIONS/INTERNET PROTOCOL (TCP/IP). If you are using the Tera Term Web 3.1 program, FILE/NEW CONNECTION. Select TCP/IP and set Host to 192.168.0.58. Select OTHER and set TCP Port # to 10001. Press OK. You should see 192.168.0.58 VT if TeraTerm has connected to the SQTR-3BB. Select SETUP/TERMINAL and check the box next to LOCAL ECHO. To test the connection, type RFR?. The Tera Term program will show the current version of the RF board software loaded in the SQTR, i.e. SQTR 3(DA2): 0,9; Date 2/24/09. Some types of firewall programs can block the return of data from the SQTR-3BB. You may need to configure your firewall to accept the SQTR-3BB data.

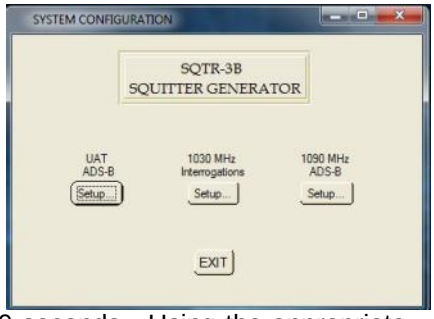
1.5 Graphical User Interface (GUI) Program

The SQTR-3B is supplied with a distribution disk that contains the GUI file that allows the test set operator to configure the SQTR-3B for operation. Insert the disk supplied with the SQTR-3B into test computer drive. Copy the information on the disk to a folder on the test computer. After copying the files to the test computer, use computer Explorer program to view the files loaded onto the test computer. Click on Setup.Exe and follow the prompts for installation of the GUI. After installation of the GUI program, you can click on Client.Exe to start the SQTR-3B GUI.

The GUI allows the test set operator to configure the SQTR-3B for transmitting 1030 Interrogations, 1090 MHz ADS-B Squitters or UAT ADS-B Messages.

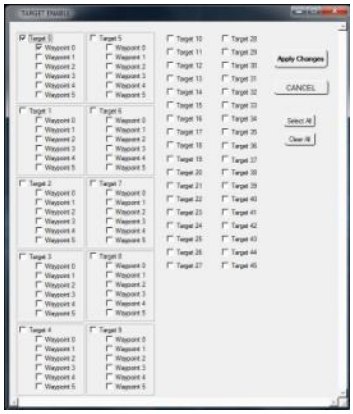
1.6 Example of Setup for typical 1090 MHz ADS-B Squitter Scenario

The SQTR-3B provides the capability for generation Mode S ADS-B Squitters, UAT Messages (Squitters), and Mode S Uplink Messages. Each of these functions has a similar operation in the SQTR-3B. The following is an example for setup of Mode S ADS-B Squitters.



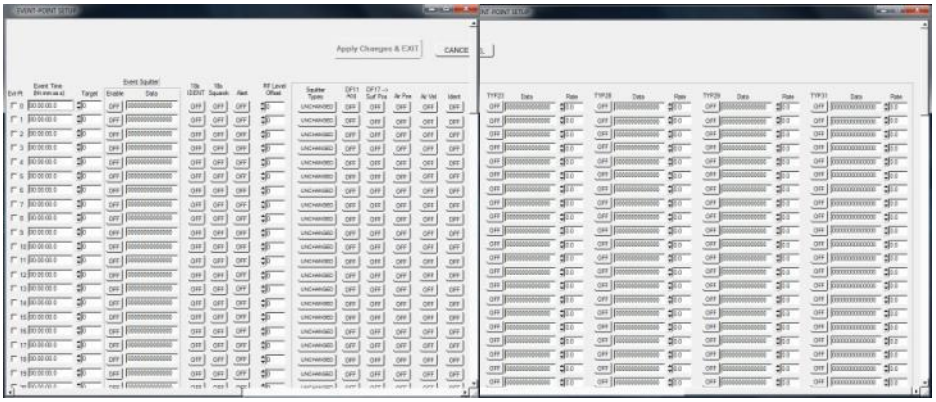
Connect control computer to SQTR-3B 1030/1090 UAT connector. The computer can be connected to the SQTR-3B through a router or directly from computer to SQTR-3B using a crossover cable. Start SQTR-3B GUI program. The System Setup screen will appear. Enter the address of the 1030/1090 Ethernet port (marked on tag on back of SQTR-3B) in the IP Address field and Port 10001 n the Port Number field. Press the Connect 1030/1090 button and the green light indicating a valid connection should appear within ~30 seconds. Using the appropriate 1090 MHz fields and buttons on the right side of the screen, configure the SQTR-3B values (i.e. 1090 GPS coupled ON/OFF (leave OFF for now), Mode (leave at 0 for now), RF level (set to desired value), and Set Scenario Run Time Length (do not change for now).

Press the Configure the SQTR-3B button. The System Configuration screen will appear. Press the 1090 MHz ADS-B Button and the Target Setup for 1090 MHz screen will appear. The test set operator must setup a Scenario that specifies the number of targets and the information that will be transmitted by each target.

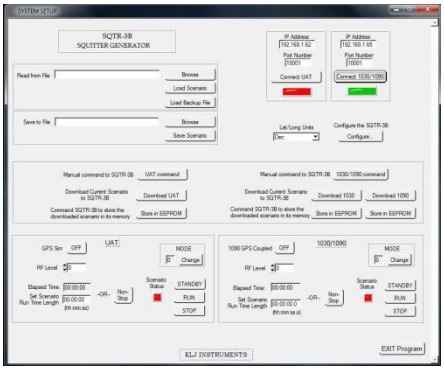


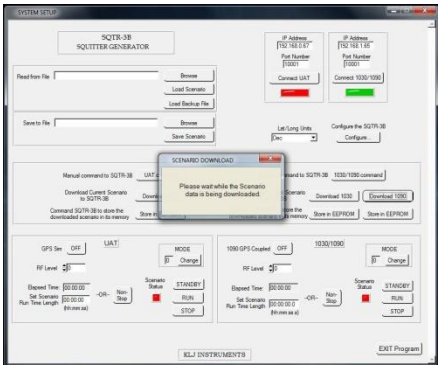
We will create a single 1090 MHz target that is stationary. The information to be transmitted in a 1090 MHz squitter is setup for each target. Use the Target # screen to enter a target number (i.e. Target # 0). Enter the information to be transmitted in Target # 0 (i.e. Mode S Address, RF Level Offset from value set in the System Setup Screen, Flight ID, etc.). The Waypoint field is used to make the target move if desired. To make the target move, calculate the latitude and longitude and the time for up to six waypoints. For

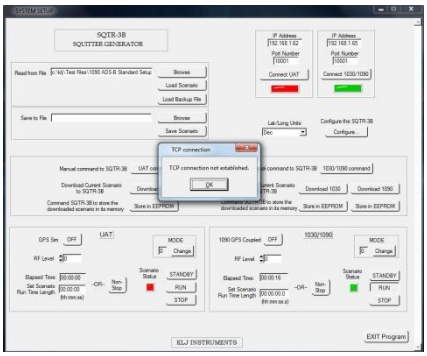
now, set waypoint 0 to latitude and longitude location of test set and leave the time fields set to zero. Additional parameters for each target can be selected. Set altitude to 2000 ft., and Vertical Status to Airborne. Press DF11 ACQ and Airborne Position buttons so that ON is displayed. Press the Enable Targets button and the Target Enable screen will appear. Select Target 0 and Waypoint 0 and press the Apply Changes button. This will return you to the Target Setup for 1090 MHz screen.



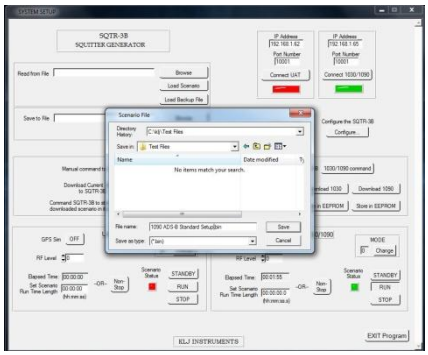
Press the Event Point Setup screen and the Event-Point Setup screen will appear. The Event-Point Setup screen allows you to program various events to occur during a scenario. For now, do not program any events. Press the Cancel button and return to the Target Setup screen. If target information is completed for this scenario, press Exit (twice) and return to the System Setup Screen.

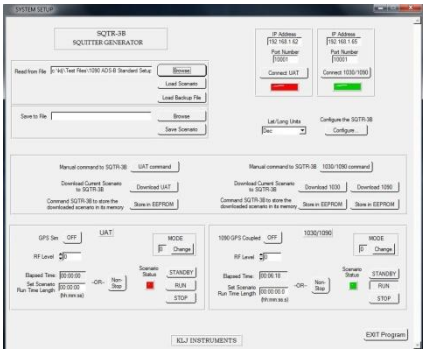


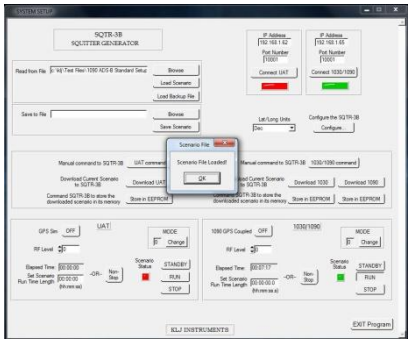




After configuration is completed, press the Download 1090 button. The GUI will display a Scenario Download screen to indicate that the scenario is being downloaded into the SQTR-3B. After completion of the download, press RUN to start the scenario causing the RUN button to turn green and the 1090 SQTR light should begin to flash. The SQTR-3B will continue to transmit ADS-B squitters at the standard rate for the type of squitter that was selected (you cannot change the rate) until the STOP button is pressed. The STOP button should always be pressed before a new configuration is programmed. If you do not press STOP and you press the Configure the SQTR-3B button, you will see a TCP connection error screen.



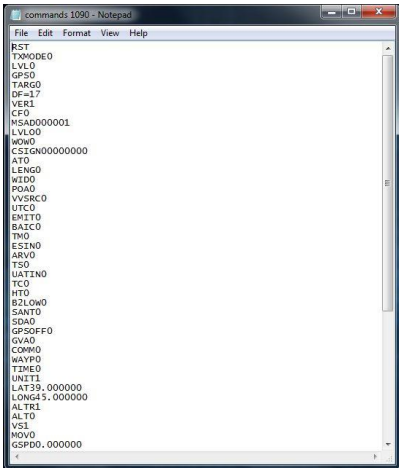




A scenario that has been loaded into the SQTR-3B can be saved and recalled for later use. To Save a scenario, press the Browse button in the Save to File section of the System Setup screen. A pop-up screen will allow you to name and save a scenario in a selected location. The scenario file will be saved as a binary (*.bin) file with a name selected by the test set operator (Note: the binary file cannot be changed using a text editor). To recall a saved scenario, press the Browse button in the Read from File section on the left side of the System Setup screen, locate

the saved file, highlight the file and press Select. After returning to the System Setup screen, press the Load Scenario button and then press the Download 1090 button. The saved scenario will be loaded into the SQTR-3B. After loading, press the RUN button and the scenario will begin to run.

A scenario for 1090 Squitters can also be created using commands described in Appendix A. A scenario can be created using a text editor such as Notepad (Note: do not use programs such as Microsoft Word as these types of programs insert additional hidden characters). A text file can be loaded into the SQTR-3B using a program like Tera Term as described in Section 1.4 of this manual (use send file operation of Tera Term). The SQTR-3B GUI can be used to create a sample text file for viewing of the commands described in Appendix A. The sample text file for 1090 squitters is created after a scenario is created using the GUI, downloading the scenario into the SQTR-3B, and pressing the RUN button. After the RUN button is pressed, use your computer Explorer program to view the folder that contains the GUI program and look for a file called “commands 1090”. The commands 1090 file can be opened using a text editor like Notepad. After you open the commands 1090 file, you can see the commands that were sent by the GUI file to the SQTR-3B to run the scenario. For future reference, the commands 1090 file should be saved with a new name, as the file will be over-ridden each time a new scenario is downloaded to the SQTR-3B by the GUI.



1.7 GPS Antenna Setup

The SQTR-3B is supplied with a GPS antenna and 50 ft. of cable. A suitable cable may be used in place of the cable supplied with the SQTR-3B.

1.8 User Control – General Description

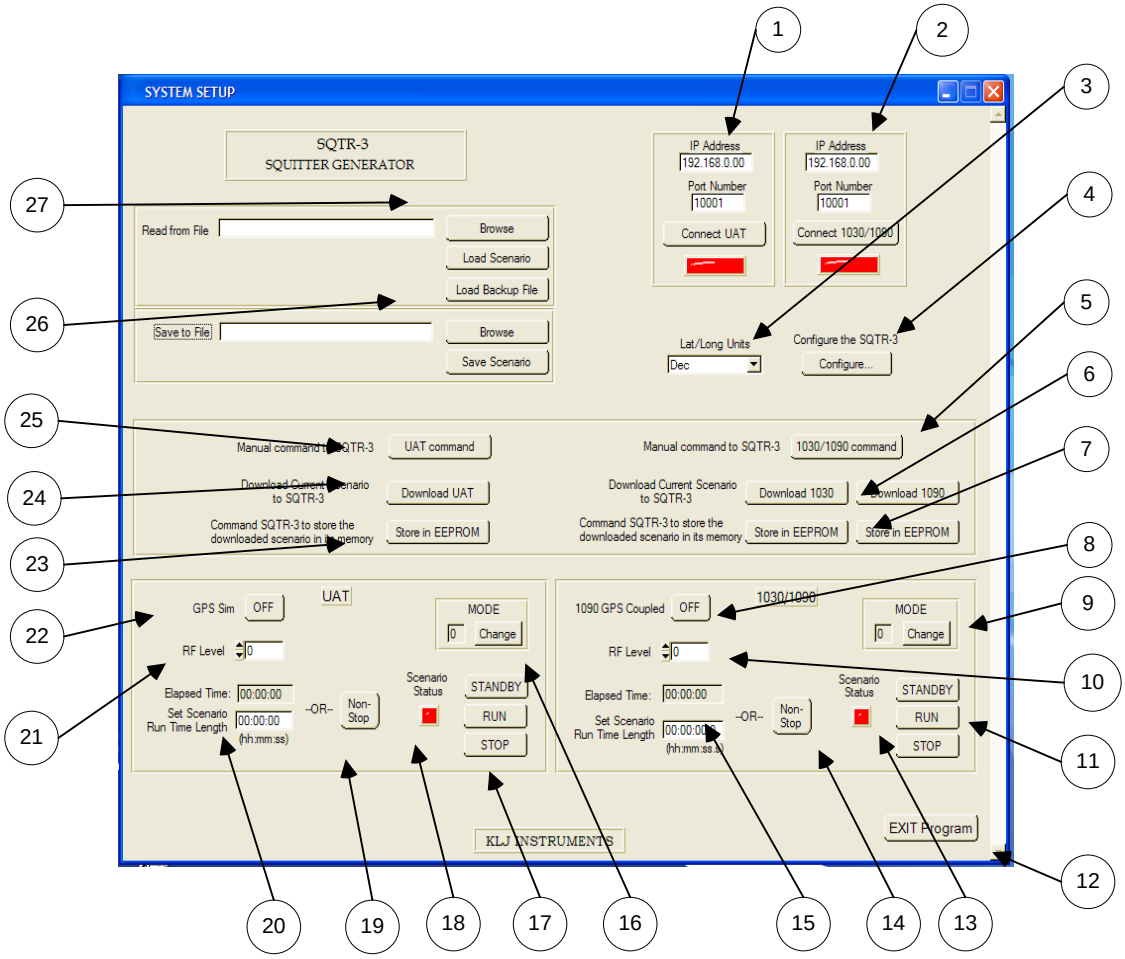
The SQTR-3BB can be controlled using a graphical user interface that allows limited control of the SQTR-3BB functions or through the use of manual user commands that allows control of all test set functions. The manual user commands can be sent to the SQTR-3BB using the Tera Term Web program.

1.8.1 Graphical User Interface (GUI)

The graphical user interface (GUI) is shipped with the SQTR-3BB on a CD-ROM. To install the GUI on your computer, insert the CD-ROM into your CD/DVD drive. Using your Windows Explorer program, view the files contained on the CD-ROM. Select SETUP using your computer mouse. The SQTR-3BB will install the GUI on your computer (Note: Press OK if you get a message asking you to insert Disk 2, select OK). The GUI can be started using the CLIENT.EXE file.

The SQTR-3BB GUI is launched by selecting CLIENT.EXE in the directory where the GUI is installed (unless changed during installation, the directory will be C:\KLJ\SQTR3GEN). The following screen will be shown:

1.8.1.1 System Setup



SYSTEM SETUP Screen

System Setup Screen	
1	UAT - Used to connect GUI control to UAT Board. The computer must be connected to the UAT Ethernet connector. The UAT indicator light will turn green if connection is successful.
2	1030/1090 - Used to connect GUI control to 1030/1090 Board. The computer must be connected to the 1030/1090 Ethernet connector. Press 1030/1090 button and the screens shown in Figures 1 and 2 will pop-up. The UAT indicator light will turn green if connection is successful.
3	Lat/Long Units - Used to select Decimal or Degrees/Minutes/Seconds for display of GPS coordinates
4	SQTR-3BB Configure - Used to configure the output of the SQTR-3BB. Press the Configure button and the screen shown in Figure 1 will pop-up. Select function to be configured. Depending on selection, the 1090 MHz ADS-B (see Figure 7), UAT ADS-B (Figure 10) or, 1030 MHz interrogations.
5	1030/1090 Manual Commands - Used to send user-defined commands to SQTR-3BB that do not have a control on a GUI screen (see Appendix A for list of commands). Press 1030/1090 button and Figure 2 will pop-up.
6	Download 1030 or Download 1090 - Used to download the configuration or scenario for 1030 Interrogations or 1090 ADS-B from the control computer to the SQTR-3BB (a screen will pop-up indicating that the configuration is being downloaded to the SQTR-3BB). The SQTR-3BB 1030/1090 Board can transmit 1030 Interrogations or 1090 ADS-B – not both at the same time.

7	Store EEPROM - Used to store in EEPROM the 1030 or 1090 configuration currently downloaded in the SQTR-3BB. Press the Store in EEPROM and a warning button (Figure 4) will pop-up with the stating that storing the information will take approximately 3.5 minutes. Press the “Yes, Continue” or “No, Cancel” button.
8	1090 GPS Coupled - Used to set the time applicability of the 1090 position messages. GPS Coupled On means that the latitude and longitude of the targets are set exactly to the 0.2 second UTC epoch to which the position data is extrapolated. GPS Coupled Off means that the latitude and longitude are extrapolated to the time of message transmission.
9	1030/1090 Mode - Used to select the SQTR-3B Start-Up Mode for 1030 and 1090. Press the Mode button and the SQTR Generator Mode 1030/1090 screen shown in Figure 3 will pop-up. Mode 0 is the default mode where the user must configure the SQTR-3B 1030 and 1090 functions. For Mode 1, the SQTR-3B at power-on will load the 1090 configuration stored in EEPROM and wait for the user to press the 1030/1090 Run button (item 11) to begin transmitting 1090 ADS-B (GUI must be re-connected to SQTR-3B. For Mode 2, the SQTR-3B at power-on will load the 1090 configuration stored in EEPROM and run the scenario until the time specified in the Set Scenario Run Time Length (item 16). For Mode 3, the SQTR-3B at power-on will load the 1090 configuration stored in EEPROM and run the scenario until the time specified in the Set Scenario Run Time Length (item 16) and then keep repeating the scenario. For Mode 4, the SQTR-3B at power-on will load the 1030 configuration stored in EEPROM and wait for the user to press the Run button (item 11) to begin transmitting 1090 ADS-B (GUI must be re-connected to SQTR-3B. For Mode 5, the SQTR-3B at power-on will load the 1030 configuration stored in EEPROM and continuously run the scenario. If the SQTR-3B has been sent a Mode 1, 2, 3, or 4, a Mode 0 must be sent to the SQTR-3B in order to return to normal operation where a new scenario can be configured and loaded.
10	RF Level - Used to set the RF level of the 1030 and 1090 transmissions from +13 to -91 dBm
11	Standby/Run/Stop - Used to control scenario – Run starts scenario, Standby pauses scenario (hit Run to continue), and Stop (hit Run to re-start scenario)
12	Exit Program – Used to exit and close GUI
13	Scenario Status – Indicates if 1030 or 1090 scenario is running (green), in standby (yellow) or stopped (red)
14	Non-Stop – Used to set scenario as configured with Waypoint settings to continuously run versus using Scenario Run Time Length (item 15)
15	Set Scenario Run Time Length and Scenario Elapsed Time – Used to show scenario run and stop times as configured with Waypoint settings and the elapsed time for the 1030 or 1090 scenario.
16	UAT Mode – Used to select the SQTR-3B Start-Up Mode for UAT. Press the Mode button and the SQTR Generator Mode 1030/1090 screen shown in Figure 6 will pop-up. Mode 0 is the default mode where the user must configure the SQTR-3B UAT function. For Mode 1, the SQTR-3B at power-on will load the UAT configuration stored in EEPROM and wait for the user to press the UAT Run button (item 18) to begin transmitting 1090 ADS-B (GUI must be re-connected to SQTR-3B. For Mode 2, the SQTR-3B at power-on will load the UAT configuration stored in EEPROM and run the scenario until the time specified in the Set Scenario Run Time Length (item 21). For Mode 3, the SQTR-3B at power-on will load the UAT configuration stored in EEPROM and run the scenario until the time specified in the Set Scenario Run Time Length (item 21) and then keep repeating the scenario. If the SQTR-3B has been sent a Mode 1, 2, or 3, a Mode 0 command must be sent to the SQTR-3B in order to return to normal operation where a new scenario can be configured and loaded.
17	Standby/Run/Stop - Used to control scenario – Run starts scenario, Standby pauses scenario (hit Run to continue), and Stop (hit Run to re-start scenario)
18	Scenario Status – Indicates if UAT scenario is running (green), in standby (yellow) or stopped (red)
19	Non-Stop – Used to set scenario as configured with Waypoint settings to continuously run versus using Scenario Run Time Length (item 20)
20	Set Scenario Run Time Length and Scenario Elapsed Time – Used to show set scenario run time and the elapsed time for the UAT scenario.
21	RF Level - Used to set the RF level of the UAT transmissions from 0 to -101 dBm

22	GPS Simulator – Used to internally generate 1 PPS timing signal if external GPS signal not available for SQTR-3B
23	Store EEPROM - Used to store in EEPROM the UAT configuration currently downloaded in the SQTR-3B. Press the Store in EEPROM and a warning button (Figure 5) will pop-up with the stating that storing the information will take approximately 3.5 minutes. Press the "Yes, Continue" or "No, Cancel" button.
24	Download UAT - Used to download the configuration or scenario for UAT ADS-B from the control computer to the SQTR-3B (a screen will pop-up indicating that the configuration is being downloaded to the SQTR-3B).
25	1030/1090 Manual Commands - Used to send user-defined commands to SQTR-3BB that do not have a control on a GUI screen (see Appendix A for list of commands). Press 1030/1090 button and Figure 2 will pop-up.
26	Save to File – Used to store the current configuration as set by GUI currently downloaded into the SQTR-3B. UAT/1090 or UAT/1030 is saved in a file on the control computer. Use the Browse button to select the location for the file. Type a name for the file to be saved and then press the Save Scenario button to store the file. If you are going to replace a file or use the name of an existing file, use the Browse button to locate the file and press save. A message will pop-up asking if the file is going to be replaced – press Yes, and then press the Save Scenario button to store the file.
27	Read from File – Used to load a configuration file that was previously stored on the control computer. Use the Browse button to locate the file. Select the file to be loaded. Press the Load Scenario button to load the file. Download the file selected into the SQTR-3B using the appropriate Download buttons (items 7 and 26) – the control computer must be connected to the correct Ethernet port for downloading.

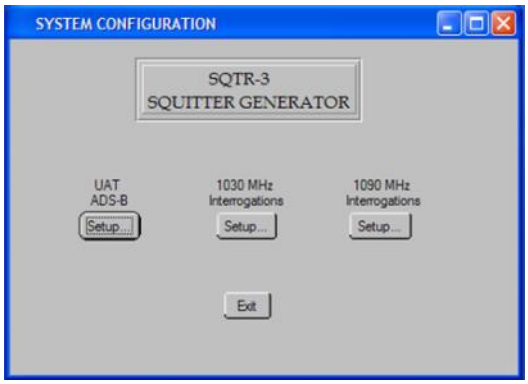


Figure 1

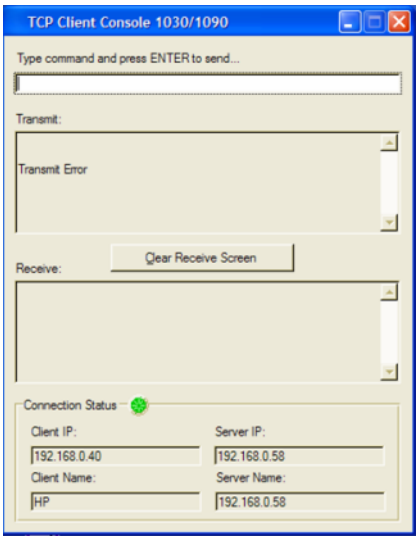


Figure 2

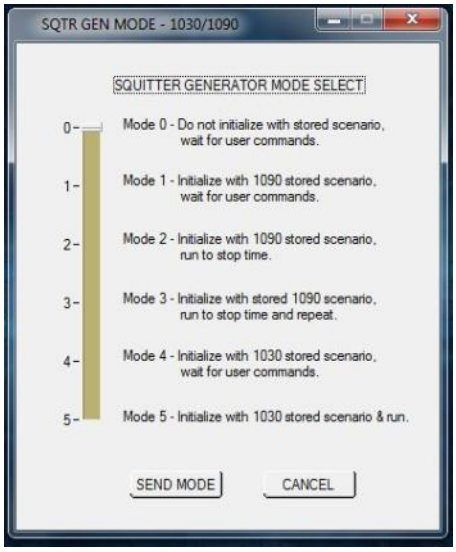


Figure 3

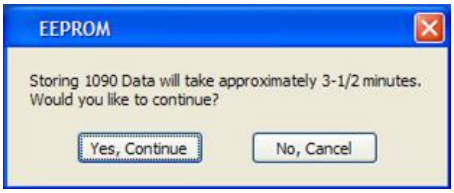


Figure 4

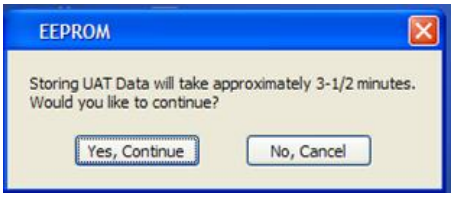


Figure 5

Figure 6

1.8.1.2 Target Setup for 1090 MHz Squitters

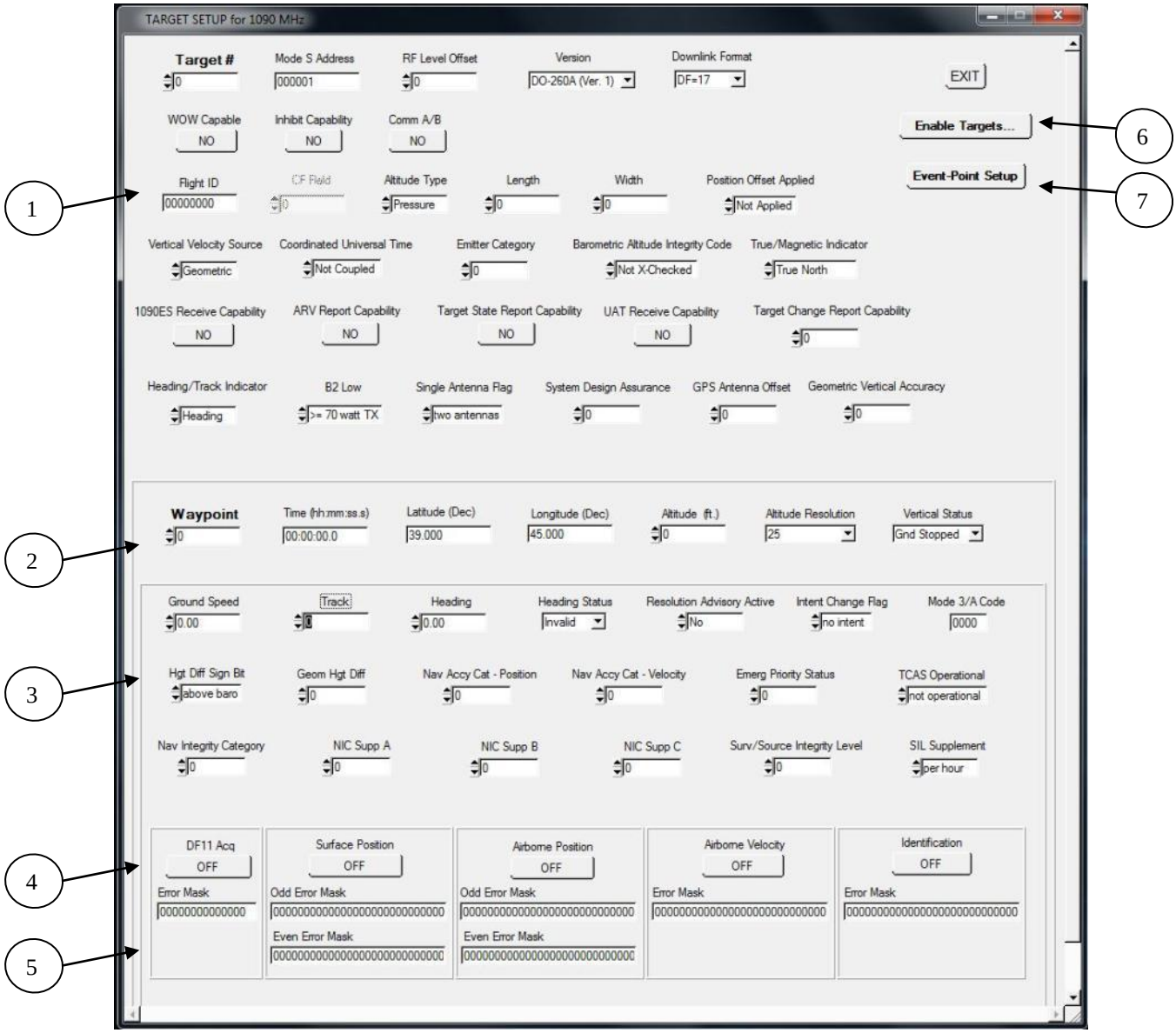
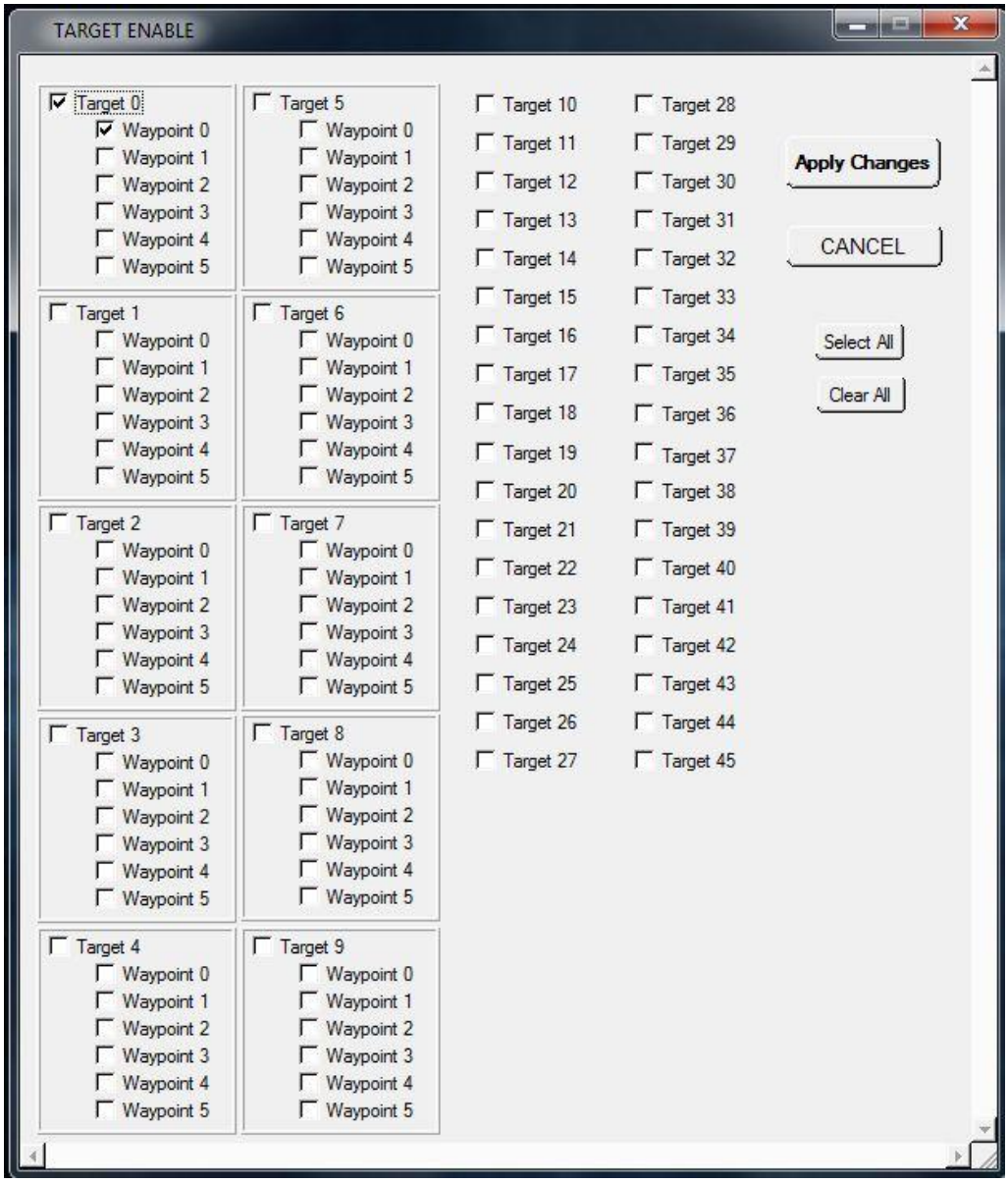


Figure 7

TARGET SETUP for 1090 MHz Screen

Target Setup Screen for 1090 MHz ADS-B Squitters (Figure 7)		
1	Target Setup	Used to setup Target parameters
2	Waypoint Setup	Used to setup Waypoint parameters for each Target
3	Target Data Setup	Used to setup parameters for data in each target
4	Squitter Activation Buttons	Used to activate squitter types
5	Error Mask	Used to XORed squitter data with information contained in mask
6	Enable Targets	Used to access TARGET ENABLE setup screen (Figure 8)
7	Event-Point Setup	Used to access EVENT POINT setup screen (Figure 9)
8	Exit	



A target and at least one waypoint must be selected or enabled for each Target in the Target Setup Screen (Figure 7)

Event Point Setup Screen (Figure 9 – next page)		
1	Event Point Select	Used to enable an event point
2	Event Time	Used to set time for event point
3	Target #	Used to set Target # for this event
4	Event Driven Enable	Used to enable an event squitter
5	Event Squitter Data	Used to configure data contained in event squitter
6	Surveillance Status	Used to set Surveillance Status bits in this event
7	RF Level Offset	Used to set RF Level Offset from RF Level set in System Setup screen
8	Change Squitter	Used to enable specific squitter types for this event
9	Event Squitters	Used to enable and to configure data contained in Squitter Types 23, 28, 29, and 31 and to set squitter rate


EVENT-POINT SETUP
1
2
3
4
5
6
7
8
9
Apply Changes & EXIT
CANCE
CANCEL
Event Time (hh:mm:ss.s)
Target
Event Squitter
Enable
Data
18s IDENT
18s Squawk
Alert
RF Level Offset
Squitter Types
DF11 Acq
DF17 --> Surf Pos
Air Pos
Air Vel
Ident
Evt-Pt
TYP23
TYP28
TYP29
TYP31
Rate
Screen continues below

Figure 9

1.8.1.3 Target Setup for UAT Messages

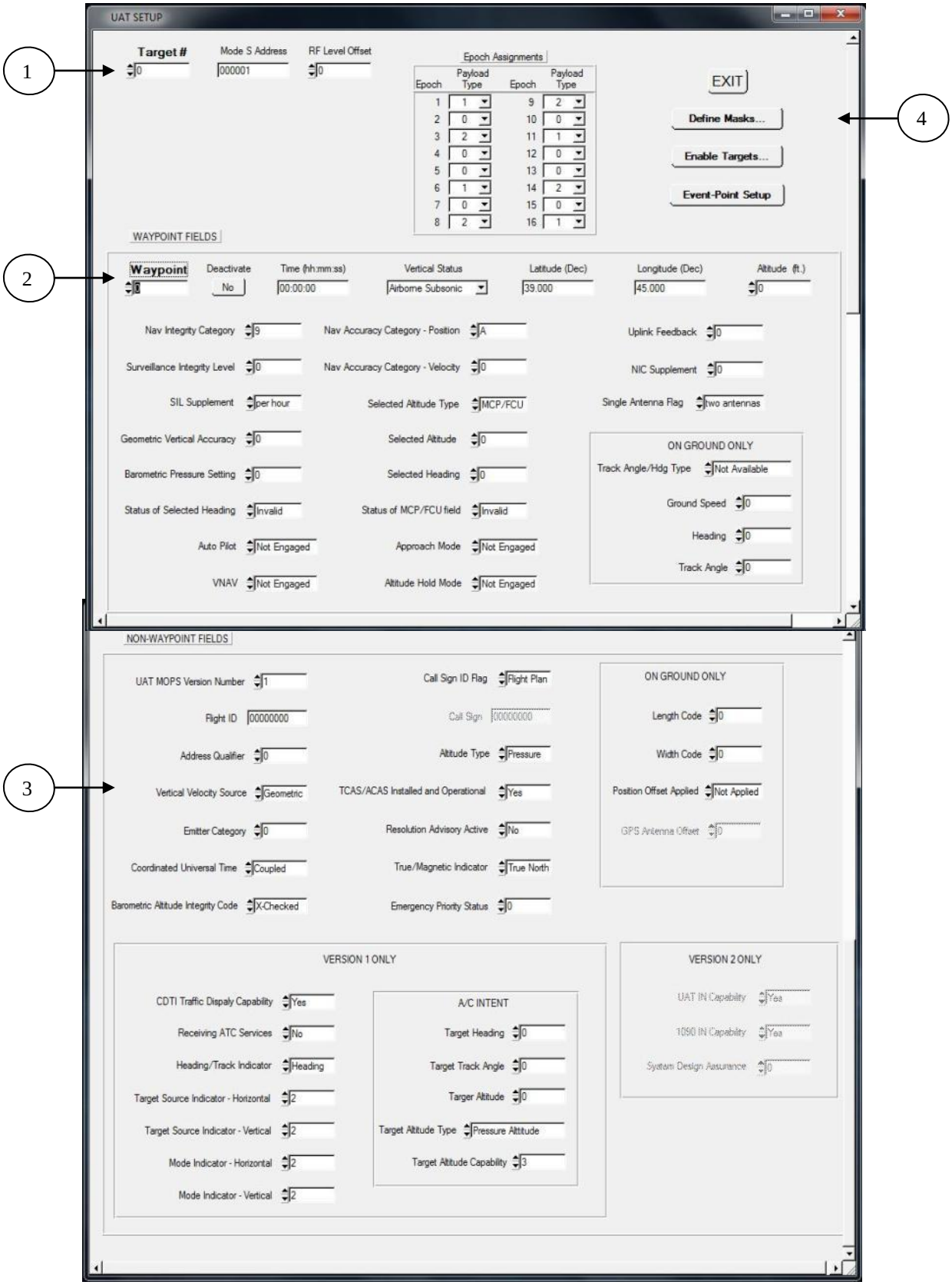
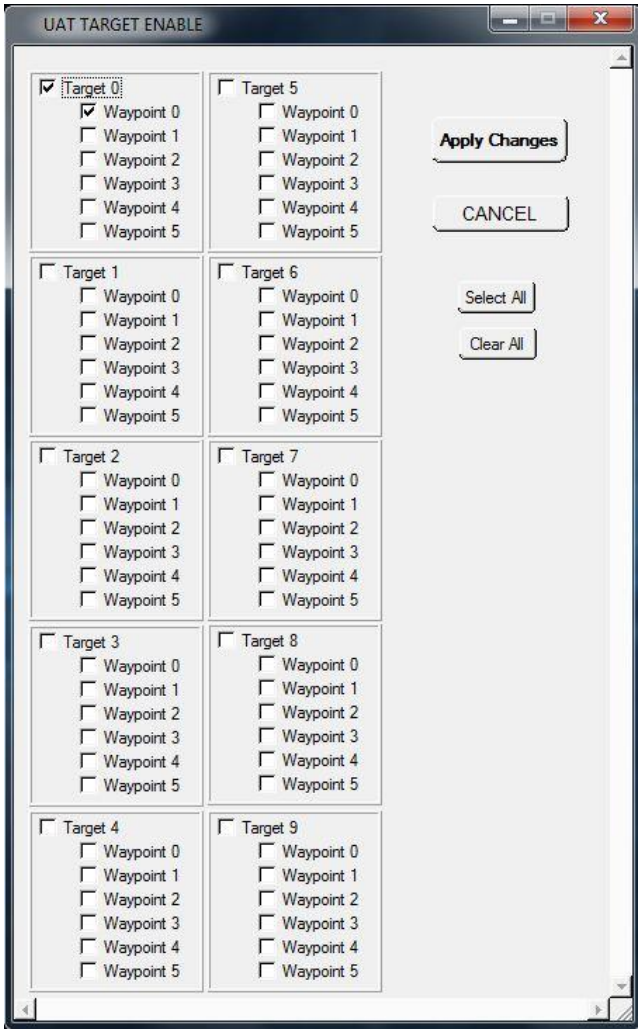


Figure 10

UAT Message Setup Screen (Figure 10)		
1	Target Setup	Used to configure Target parameters
2	Waypoint Fields Setup	Used to configure Waypoint parameters for each Target
3	Non-Waypoint Fields Setup	Used to configure data contained in Payload Fields
4	Define Masks	Used to access MASK SETUP screen (Figure 11)
5	Enable Targets	Used to access TARGET ENABLE setup screen (Figure 12)
6	Event-Point Setup	Used to access EVENT Point setup screen (Figure 13)

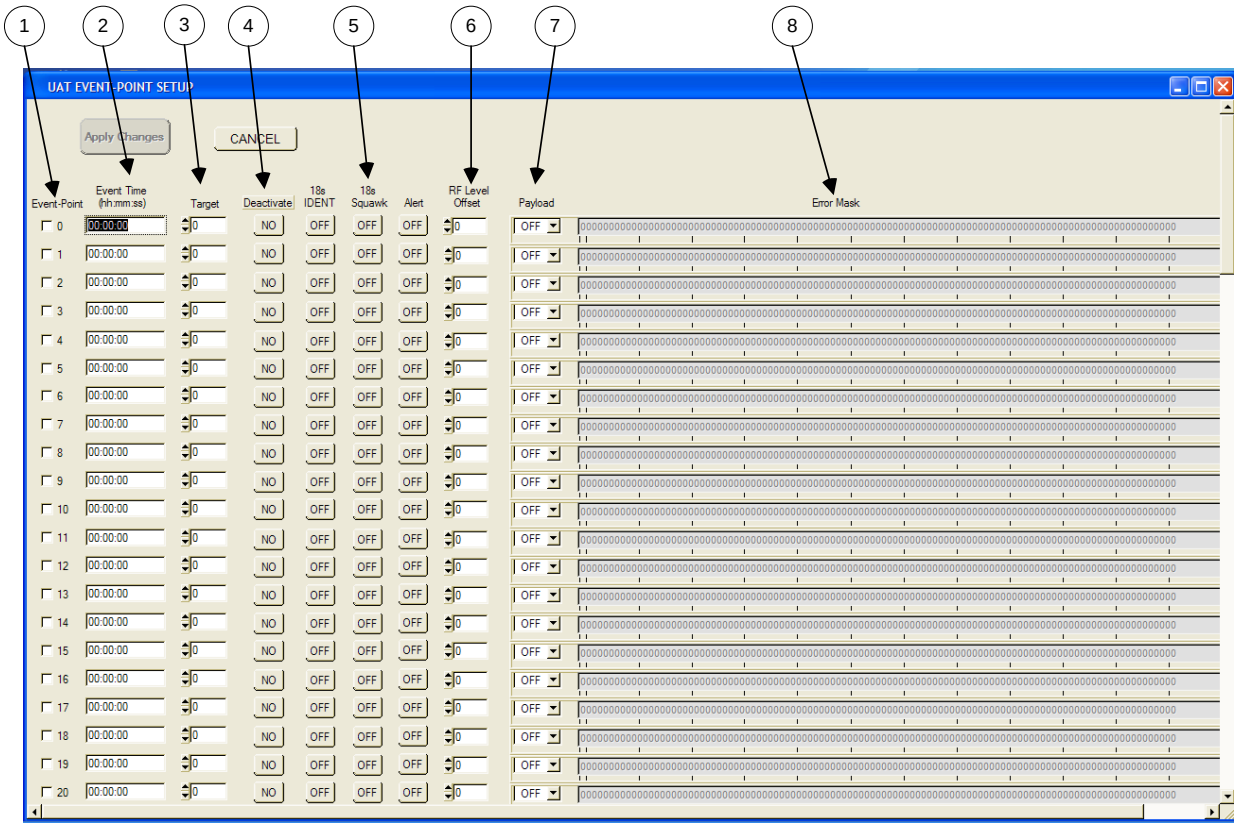
Figure 11

The UAT Mask Setup is used to enter data for each Payload Type and to enter a Payload Errors for each Payload Type. The data contained in the Error Mask will be XORed with the data in the Payload Bit Mask.



The UAT Target Enable screen is used to activate the target and waypoint that were setup on the UAT Setup screen. You must have a minimum of one target and one waypoint selected in order to generate a UAT target. After activation of the target and waypoint, press the Apply Changes button. You will be returned to the UAT Setup screen.

Figure 12

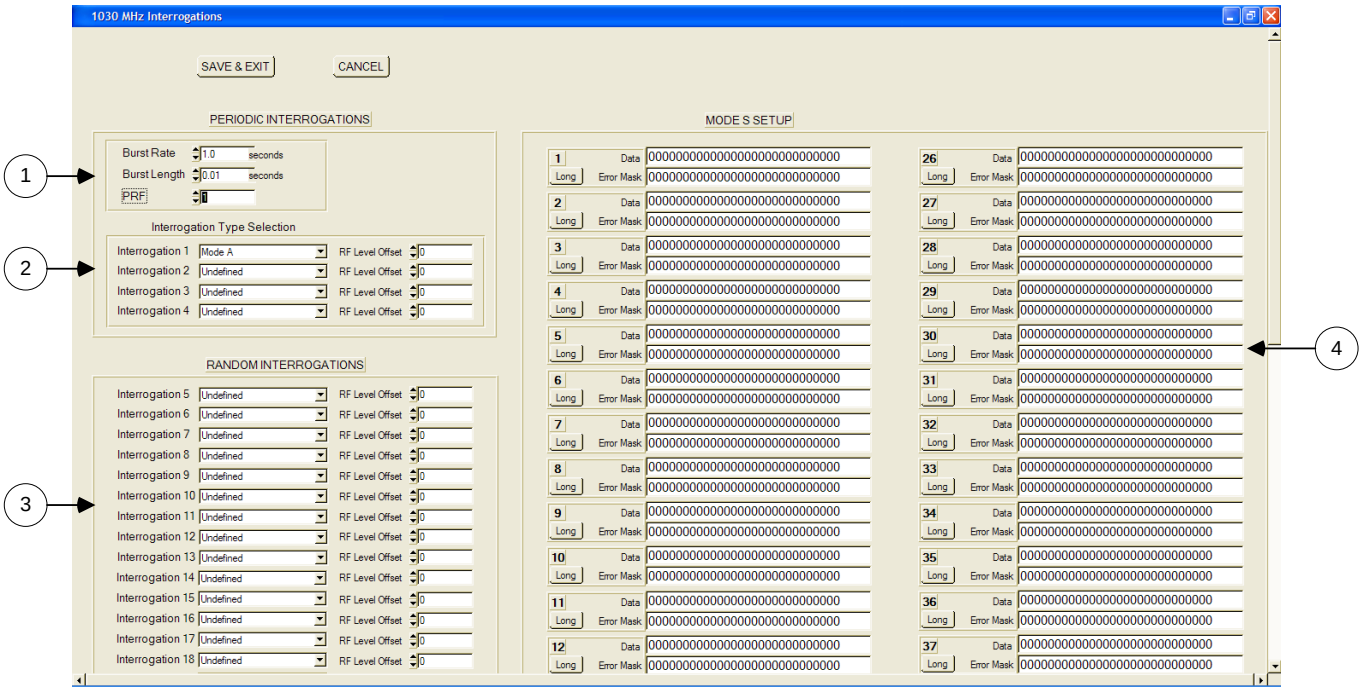


UAT EVENT POINT SETUP
Figure 13

UAT Event Point Setup Screen		
1	Event Point Select	Used to enable an event point
2	Event Time	Used to set time for event point
3	Target #	Used to set Target # for this event
4	Deactivate	Used to deactivate an event point
5	Surveillance Status	Used to set Surveillance Status bits in this event
6	RF Level Offset	Used to set RF Level Offset from RF Level set in System Setup screen
7	Payload	Used to select Payload Type for this event
8	Payload Error	Used to XORed message data with information contained in mask

1.8.1.4 1030 MHz Interrogations

The 1030 MHz Interrogations screen is used to configure the 1030 Interrogations.



1030 MHz INTERROGATIONS
Figure 14

1	Periodic Interrogations	Setup	Used to set Burst Rate, Burst Length, and PRF of interrogations
2	Periodic Interrogations	Type	Used to set Interrogation Type and RF Level Offset from value set in System Setup Screen for each Periodic Interrogation
3	Random Interrogations		Used to set Interrogation Type and RF Level Offset from value set in System Setup Screen for each Random Interrogation
3	Mode S Setup		Used to set Mode S type (Short or Long), Data, and Error Mask for each of 50 interrogations

1.8.2 Manual Commands

A list of manual commands for the SQTR-3B is contained in Appendix A of this manual. Scenarios can be created for each of the three functions using MS Notepad. After creating the scenario file, it can be downloaded to the SQTR-3B using Tera Term Pro Web (see Section 1.3). Each time that a scenario is configured and downloaded from the GUI to the SQTR-3B (1030 MHz Interrogation, 1090 Squitters, or UAT messages), the SQTR-3B generates three files in the directory containing the SQTR-3B program. The three files (commands 1030, commands 1090, or commands UAT) can be used by a new user of the SQTR-3B to view an example of the structure of the commands used to generate a scenario. This is useful for learning how to manually program the SQTR-3B.

1090/1030 SYSTEM COMMANDS

Command	Format	Definition
DLD		Download the microprocessor code
PGM	PGM – Programs the FPGA directly from the downloaded file PGM0 – store the downloaded file in the onboard EEPROM for FPGA1 PGM1 – Programs the FPGAs with the images contained in the onboard EEPROM PGM2 – store the downloaded file in the onboard EEPROM for FPGA2	Download RF Board FPGA code
RST		Reset the RF Board to its power-up state
TXF	TXF<float>, 952 – 1223 MHz	Set the Transmit synthesizer frequency
BTR?	Return example: SQTR3 Boot Rev: 0.1; Date: 03/28/2008	Request the BOOT code revision string.
GAR?	Return example: FPGA Rev Number: 65	Request the FPGA1 revision string
RFR?	Return example: SQTR Gen Rev: 0.01; Date: 10/12/07	Request the RF board revision string
SBY		Pauses the scenario
RUN		Starts the scenario
STOP		Stop the scenario
STOP	STOP<long>	Set the stop time for the scenario. LSB is 100ms. Setting the stop time to the maximum value (2147483647) essentially makes the scenario infinite. Range: 0 to 2147483647 Resolution: 100ms
LVL	LVLd	Set the RF Level. Range: 13 to –111dBm Resolution: 1dBm
SAVE		Save the scenario to EEPROM

MODE	MODEd	Set the operating mode of the SQTR1. 0 = do not initialize with stored scenario, wait for user commands 1 = initialize with the stored scenario, wait for user commands 2 = initialize with the stored scenario, run to stop time 3 = initialize with the stored scenario, run to stop time and repeat
RAW?	return example:	Return the average raw temperature reading.
TMP?	return example:	Return the computed temperature (using the average raw temperature reading, calibrated slope and calibrated offset).
TMPO	TMPO<float>	Set the offset for the temperature sensor transfer function.
TMPO?	return example:	Return the offset for the temperature sensor transfer function.
TMPS	TMPS<float>	Set the slope for the temperature sensor transfer function.
TMPS?	return example:	Return the slope for the temperature sensor transfer function.
CATT	CATT<coarse attenuation cal table>	Download the coarse attenuation calibration table. The CATT table is a two dimensional table (RF level vs. attenuator) containing values to be written to the 4 digital attenuators and an index into the FATT tables used to set the pin diode attenuator for each RF level setting from 13 to -111.

FATT	FATTd<fine attenuation cal table> FATT0 – download the FATT table for the UAT frequency of 978 MHz FATT1 - download the FATT table for the ground station frequency of 1030 MHz FATT2 - download the FATT table for the squitter frequency of 1090 MHz	Download the fine attenuation tables. The FATT tables are two dimensional tables (index from the CATT table vs. temperature) containing values to be added to the value obtained from the BATT table and written to the pin-diode to achieve the "tweak" required to achieve the requested RF level once the four digital attenuators are set to get as close to it as possible
BATT	BATTd<frequency band attenuation cal table> BATT0 – download the BATT table for the UAT frequency of 978 MHz BATT1 - download the BATT table for the ground station frequency of 1030 MHz BATT2 - download the BATT table for the squitter frequency of 1090 MHz	Download the frequency band attenuation tables. The BATT tables are two dimensional tables (index from the CATT table vs. frequency offset band) containing values to be added to the value obtained from the FATT table and written to the pin-diode to achieve the "tweak" required to achieve the requested RF level once the four digital attenuators are set to get as close to it as possible
CW	CW<channel><on/off> CW10 – turn CW OFF on channel 1 CW11 – turn CW ON on channel 1 CW20 – turn CW OFF on channel 1 CW21 – turn CW ON on channel 1 CW30 – turn CW OFF on channel 1 CW31 – turn CW ON on channel 1	Turn CW mode on or off on each of the three channels.
CAL	CAL<on/off> CAL0 – turn CAL mode OFF CAL1 – turn CAL mode ON	Turn CAL mode off and on.
ATT	ATT<attenuator><level> Where attenuator is 1, 2, 3 or 4 and <level> must be a 2 digit hex number. Valid values for <level> are 0 through 31 corresponding to 0dB through 31dB. The upper 3 bits are masked and so are therefore no cares.	Set the digital attenuators.
STD	STD<delay> Where delay is a decimal multiple of 20ns and can range from 0 to 255.	Set the scope trigger delay.

STD?	return the scope trigger delay, a number from 0 to 255	Return the scope trigger delay.
TXMODE	TXMODEd TXMODE0 – 1090 mode TXMODE1 – 1030 mode	Set the transmit mode of the 1090/1030 board.
GPS	GPS0 – GPS mode off GPS1 – GPS mode on	If the GPS1 command is received and odd/even second information has not been received from the Resolution T GPS board a question mark will be returned and GPS mode will not be turned on. In GPS mode a scenario is started on an even PPS. When not in GPS mode a scenario is started whenever the RUN command is received
//	Comment Line	Used for inline commenting
The following 16 commands are for internal use only		
FSCR		Set Freq Synth clock rate in KHz
FSCR?		Request Freq Synth clock rate in KHz
FSBC		Set Freq Synth bit count
FSBC?		Request Freq Synth bit count
FSD		Set Freq Synth data
FSD?		Request Freq Synth data
FSR		Reset the Freq Synth and the DDS
DDSBC		Set DDS bit count
DDSBC?		Request DDS bit count
DDSCR		Set DDS clock rate in KHz
DDSCR?		Request DDS clock rate in KHz
DDSD		Set DDS data
DDSD?		Request DDS data
DEST		Set the destination for the DDS commands
DEST?		Request the destination for the DDS commands
REST		Pass command strings on to the Resolution T GPSbBoard

1090 NON-WAYPOINT SPECIFIC COMMANDS

Command	Format	Definition
TARG	TARG<int>, 0 to 44	Select the target to define. Only targets 0-9 can have associated waypoints
DF=	DF=17 DF=18 DF=19	Select what type of squitters we are transmitting.
DF17	various (see below)	Set the default DF17 data for the selected target. The AA field will be overwritten by the provided mode S address. If no mode S address is provided all zeroes will be used. The latitude, longitude and altitude will be overwritten by values as determined while the scenario is running. The airborne velocities will be overwritten by values as determined while the scenario is running. The CA and SSS fields will be overwritten by values as determined while the scenario is running based on TI and TC timers and the ALERT flag. The PI field will be calculated.
MSAD	MSADhhhhhh	Set the mode S address for the selected target in hex
UNIT	UNIT0 = DMS UNIT1 = floating point	Define the units for the LAT and LONG commands
WOW	WOW0 = no weight on wheels WOW1 = weight on wheels	Set the weight on wheels detection capability for the present target
COMM	COMM0 = no COMM1 = yes	Set the COMM A/B capability for the present target

VER	VERd, 0 to 2 VER0 = DO-260 VER1 = DO-260A VER2 = DO-260B	Set whether we use DO-260 defined type codes (version 0), DO-260A defined type codes (version 1), or DO-260B defined type codes (version 2)
LVLO	LVLOd	Set the attenuation for the present target. Range: 0 to 31dBm Resolution: 1dBm
CF	CFd, 0 to 7	Define the CF field for the selected target
CSIGN	CSIGNaaaaaaaa, where aaaaaaaa is 8 ascii characters, 0-9, A-Z, or space. If you want to set one of the characters to one of the other available values use the following: \ = 37 (not available)] = 38 (reserved) ^ = 39 (reserved)	Define the call sign/flight ID for the selected target.
LENG	LENGd, 0 to 7	Define the length code field for the selected target.
WID	WIDd, 0 or 1	Define the width code field for the selected target.
POA	POA0 = not applied POA1 = applied	Define the position offset applied flag for the selected target. (Only applies to V1 targets)
VVSRC	VVSRC0 = geometric VVSRC1 = barometric	Define the vertical velocity source field for the selected target.
UTC	UTC0 = not coupled UTC1 = coupled	Define the UTC field for the selected target.
EMIT	EMIT<int>, 0 to 31 Set A = EMIT 0 to 7; Set B = EMIT 8 to 15; Set C = EMIT 16 to 23; Set D = EMIT 24 to 31; D7 = EMIT 32+	Define the emitter category for the selected target.
BAIC	BAIC0 = Barometric Pressure Altitude has NOT been cross checked BAIC1 = Barometric Pressure Altitude has been cross checked	Define the Barometric Altitude Integrity Code for the selected target
TM	TM0 = referenced to true north TM1 = referenced to magnetic north	Define the True/Magnetic Indicator flag for the selected target
HT	HT0 = heading HT1 = track	Define the Heading/Track Indicator flag for the selected target
ESIN	1090IN0 = No 1090 Receive capability 1090IN1 = 1090 Receive capability	Define the 1090ES IN field for the selected target
ARV	ARV0 = No ARV Capability ARV1 = ARV Capability	Define the Air-referenced Velocity Report Capability field for the selected target

TS	TS0 = No Target State Report Capability TS1 = Target State Report Capability	Define the Target State Report Capability field for the selected target
TC	TCd, 0 to 3	Define the Target Change Report Capability field for the selected target
UATIN	UATIN0 = No UAT Receive Capability UATIN1 = No UAT Receive Capability	Define the UAT IN field for the selected target
B2LOW	B2LOW0 = Greater than or equal to 70W Tx B2LOW1 = Less than 70W Tx	Define the B2 Low Field for the selected target
SANT	SANT0 = Systems with two functioning antennas SANT1 = Systems that use only one antenna	Define the Single Antenna Flag Field for the selected target
SDA	SDAd, 0 to 3	Define the System Design Assurance Field for the selected target
GPSOFF	GPSOFFd, 0 to 255	Define the GPS Antenna Offset Field for the selected target. (Only applies to V2 targets)
GVA	GVAd, 0 to 3	Define the GVA for the selected target

1090 WAYPOINT COMMANDS

Command	Format	Definition
WAYP	WAYP<int>, 0 to 5	Select the waypoint to define for the selected target.
TIME	TIMEd, 0 to 214748364.6 seconds, lsb is 100ms	Set the UTC TIME for the present waypoint/target
MODS	MODShh, Enable (1) or Disable (0): bit 0 –DF11 Acq Squitter bit 1 –DF17 Ident Squitter bit 2 –DF17 Surface Position Squitter bit 3 –DF17 Airborne Position Squitter bit 4 –DF17 Airborne Velocity Squitter bit 5 – Inhibit mode	Enable/Disable the squitter types for the selected target

LAT	if the UNIT0 command was received, the LAT command will be:
	
	LAT<deg>,<min>,<sec>
	
	<deg>, degrees, 0 to 90 for North, 0 to -
	
	90 for South
	
	<min>, minutes, 0 to 59
	<sec>, seconds, 0 to 59
	
	if the UNIT1 command was received, the LAT command will be:
	
	LAT<float>, 0.0 to 90.0 for North, 0.0 to -90.0 for South
		Set the latitude for the present waypoint/target

LONG	if the UNIT0 command was received, the LONG command will be:
	
	LONG<deg>,<min>,<sec>
	
	<deg>, degrees, 0 to 180 for East, 0 to -180 for West
	<min>, minutes, 0 to 59
	<sec>, seconds, 0 to 59
	
	if the UNIT1 command was received, the LONG commands will be:
	
	LONG<float>, 0.0 to 180.0 for East, 0.0 to -180.0 for West
		Set the longitude for the present waypoint/target

AT	AT0 = pressure AT1 = geometric	Define the altitude type for the selected target

ALT	ALT<long>, -1000 to 126500 feet	Set the altitude for the present waypoint/target
ALTR	ALTR1 = 25 foot resolution ALTR0 = 100 foot resolution	Set the altitude resolution for the present waypoint/target
ICF	ICF0 = No Intent Change ICF1 = Intent Change	Define the Intent Change Flag field for the selected target
GSIGN	GSIGN0 = Above Baro GSIGN1 = Below Baro	Define the Difference Sign Bit field for the selected target
GHD	GHD<int>, -25 to 3150 feet (25' steps) (where -25 represents an ALL ZEROs encoding)	Define the Geometric Height Difference from Baro Alt. field for the selected target
VS	VS0 = in the air VS1 = on the ground	Set the vertical status for the present waypoint/target
TRK	TRK<int>, 0 to 360 degrees	Define the track angle for the selected target
HDG	HDG<float>, 0 to 360 degrees Resolution = 360/128 degrees	Set the Heading/Ground Track field in the surface message
HDGS	HDGS0 = heading invalid HDGS1 = heading valid	Set the status for Heading/Ground Track
MOV	MOV0 = stopped MOV1 = moving	Set the on-the-ground moving status for the present waypoint/target
GSPD	GPSDd<float>	Set the ground speed (kts) for the present waypoint/target
NACP	NACPh, 0x0 to 0xf	Define NACP field for the selected target.
NACV	NACV d, 0 to 7	Define NACV field for the selected target.
NIC	NIC.h, 0 to f note: the . between the command and the data is necessary when the command is less than four characters and the data is alpha i.e. the characters a-f in hex numbers.	Define the NIC field for the selected target
NICA	NICA0 = Set NIC Supplement A to 0 NICA1 = Set NIC Supplement A to 1	Define the NIC Supplement A field for the selected target
NICB	NICB0 = Set NIC Supplement B to 0 NICB1 = Set NIC Supplement B to 1	Define the NIC Supplement B field for the selected target
NICC	NICC0 = Set NIC Supplement C to 0 NICC1 = Set NIC Supplement C to 1	Define the NIC Supplement C field for the selected target
MODA	MODAd, where d is the decoded Mode 3/A code in octal representation (i.e. 1200)	Define the Mode 3/A code for the selected target.

EPS	EPSd, 0 to 7	Define the Emergency Priority Status field for the selected target.
SIL	SILd, 0 to 3	Define Surveillance Integrity Level field for the selected target.
SSUP	SSUP0 = Prob of exceeding NIC on “per hour” SSUP1 = Prob of exceeding NIC on “per sample”	Define SIL Supplement field for the selected target.
TCAS	TCAS0 = Not Operational TCAS1 = Operational	Define the TCAS Operational field for the selected target
RA	RA0 = no RA1 = yes	Define the TCAS Resolution Advisory Active flag for the selected target
ERRM	various (see below), the error mask will be XORed with the DF17 data prior to transmission	Define the error mask for a specific squitter type for the selected target
ERRM11	ERRM110xhhhhhhhhhhhhh	Set the DF11 error mask
ERRM	ERRM0xhhhhhhhhhhhhhhhhhhhhhhhhhh	Set the DF17 Ident error mask
ERRMSPO	ERRMSPO0xhhhhhhhhhhhhhhhhhhhhhhhhhhhhh	Set the DF17 Surface Position – ODD epoch error mask
ERRMSPE	ERRMSPE0xhhhhhhhhhhhhhhhhhhhhhhhhhhhhh	Set the DF17 Surface Position data – EVEN epoch error mask
ERRMAPO	ERRMAPO0xhhhhhhhhhhhhhhhhhhhhhhhhhhhhh	Set the DF17 Airborne Position – ODD epoch error mask
ERRMAPE	ERRMAPE0xhhhhhhhhhhhhhhhhhhhhhhhhhhhhh	Set the DF17 Airborne Position – EVEN epoch error mask
ERRMAV	ERRMAV0xhhhhhhhhhhhhhhhhhhhhhhhhhhhhh	Set the DF17 Airborne Velocity error mask

Note: The waypoint commands, with the exception of WAYP and TIME are also valid for non-moving targets.

1090 EVENT-POINT COMMANDS

ETIME	ETIMEd, d = 0 to 214748364.6 seconds, lsb is 100ms	Set an event and its associated Start time for the present target. Events must be defined in sequential order. You may define up to 100 event points total across all of the targets. An event point can have any or all of the event types associated with it.
RATE23	RATE23d where d = d = 0 to 214748364.7 seconds, lsb is 100ms	Set a HTC23 event's interval time for the present target. Transmit randomly within +/- 0.2s of specified interval.
RATE28	RATE28d where d = d = 0 to 214748364.7 seconds, lsb is 100ms	Set a HTC28 event's interval time for the present target. Transmit randomly within +/- 0.2s of specified interval.
RATE29	RATE29d where d = d = 0 to 214748364.7 seconds, lsb is 100ms	Set a HTC29 event's interval time for the present target. Transmit randomly within +/- 0.2s of specified interval.
RATE31	RATE31d where d = d = 0 to 214748364.7 seconds, lsb is 100ms	Set a HTC31 event's interval time for the present target. Transmit randomly within +/- 0.2s of specified interval.
IDENT		Set an IDENT event point for the selected target
SQUAWK		Set a SQUAWK event point for the selected target
ALERT		Set an ALERT event point for the selected target. If you want to turn the ALERT off send an ETIME command followed by no event types
LVLO	LVLOd	Set an ATTENuation for the selected target. Range: 0 to 31dBm Resolution: 1dBm
DF17TC23	DF17HTC230xhhhhhhhhhhhhhh, the 14 hex digits are bytes 5 through 11 of the reply data with the msb being bit 1 of byte 5.	Set the DF17 Type 23 message for the selected target.

DF17TC28	DF17HTC280xhhhhhhhhhhhhhh, the 14 hex digits are bytes 5 through 11 of the reply data with the msb being bit 1 of byte 5.	Set the DF17 Type 28 message for the selected target. The EPS and MODA fields will be overwritten with data from those commands.
DF17TC29	DF17HTC290xhhhhhhhhhhhhhh, the 14 hex digits are bytes 5 through 11 of the reply data with the msb being bit 1 of byte 5.	Set the DF17 Type 29 message for the selected target. The NACP, BAIC, SIL, TCAS, SSUP (ver 2), RA (ver 1) and EPS (ver 1) fields will be overwritten with data from those commands.
DF17TC31	DF17HTC310xhhhhhhhhhhhhhh, the 14 hex digits are bytes 5 through 11 of the reply data with the msb being bit 1 of byte 5.	Set the DF17 Type 31message for the selected target. The POA, ESIN, B2LOW, LENG, WID, RA, DO260VER, NICA, NACP, SIL, HT, TM, ARV, TS, TC, BAIC, SSUP, UATIN, NACV, NICC, SANT, SDA, GPSOFF, TCAS, GVA and SIL fields will be overwritten with data from those commands depending on what version of the mops the target is emulating and vertical status of the target
EVSQ	EVSQh, Enable (1) or Disable (0): bit 0, Enable (1) or Disable (0) DF17 type code 23 bit 1, Enable (1) or Disable (0) DF17 type code 28 bit 2, Enable (1) or Disable (0) DF17 type code 29 bit 3, Enable (1) or Disable (0) DF17 type code 31	Enable/Disable the squitter types for the selected target Note: Any time you use the EVSQ you may want to also send associated DF17TC commands to define the bits in the squitter that are not defined by other commands.
EVMS	EVMShh, Enable (1) or Disable (0): bit 0, Enable (1) or Disable (0) DF11 Acquisition Squitter bit 1, Enable (1) or Disable (0) DF17 Ident Squitter bit 2, Enable (1) or Disable (0) DF17 Surface Position Squitter bit 3, Enable (1) or Disable (0) DF17 Airborne Position Squitter bit 4, Enable (1) or Disable (0) DF17 Airborne Velocity Squitter	Enable/Disable the squitter types for the selected target

1030 COMMANDS

BRAT	BRAT<float>, 1.0 – 16.0 seconds	Define the burst rate, i.e. the rotation rate of the antenna. Resolution is 0.1 second.
BLEN	BLEN<float>, 1.0 – 16.0 seconds	Define the burst length, i.e. the “beam width” of the antenna. Resolution is 0.01 second. Must be no bigger than the burst rate.
IT	ITdd,<type> where dd is the interrogation number 01-04 are the beam interrogations 05-50 are the random interrogations <type> is one of the following: A – ATCRBS mode A AA – ATCRBS mode A, all call AOA – ATCRBS mode A only, all call C – ATCRBS mode C CA – ATCRBS mode C, all call COA – ATCRBS mode C only, all call Sdd, where the dd selects one of up to 50 different possible mode S definitions	Define the 50 different interrogations that will appear in the antenna beam.
PRF	PRF<int>, 1 to 500 interrogations per second	Define the interrogation rate for the interrogations in the antenna beam
SDAT	SDATdd<14 hex characters> or SDATdd<28 hex characters> where dd, 01 to 50, must be two characters	Specify the data for one of the 50 possible mode S interrogations. Provide 14 hex characters to define a short mode S, 28 hex characters to define a long mode S.
SMSK	SDATdd<14 hex characters> or SDATdd<28 hex characters> where dd, 01 to 50, must be two characters	Specify the error mask for one of the 50 possible mode S interrogations. Provide 14 hex characters for a short mode S, 28 hex characters for a long mode S. The error mask is XORed with the mode S data so a one bit in the mask introduces an error.
STON	STON<slot> where <slot> is 1 to 4	Turn the scope trigger ON for the specified interrogation slot in the antenna beam.

STOFF	STOFF<slot> where <slot> is 1 to 4	Turn the scope trigger OFF for the specified interrogation slot in the antenna beam.
LVLO	LVLOdd<offset> Where dd is the interrogation number 01 – 04 are the beam interrogations 05-50 are the random interrogations <offset> is 0 to 31 dBm with 1 dBm increments	Set the attenuation for the present target.

UAT SYSTEM COMMANDS

Command	Format	Definition
DLD		Download the microprocessor code
PGM	PGM – Programs the FPGA directly from the downloaded file PGM0 – store the downloaded file in the onboard EEPROM for FPGA1 PGM1 – Programs the FPGAs with the images contained in the onboard EEPROM PGM2 – store the downloaded file in the onboard EEPROM for FPGA2	Download RF Board FPGA code
RST		Reset the RF Board to its power-up state
TXF	TXF<float>, 952.00 – 1223.00 MHz	Set the Transmit synthesizer frequency
BTR?	Return example: KOR RF Bd Boot Rev: 0.1; Date: 02/24/2006	Request the BOOT code revision string.
GAR?	Return example: FPGA Rev Number: 65	Request the FPGA1 revision string
RFR?	Return example: SQTR Gen Rev: 0.01; Date: 10/12/07	Request the RF board revision string
SBY		Pauses the scenario
RUN		Starts the scenario
STOP		Stop the scenario
STOP	STOP<long>	Set the stop time for the scenario. LSB is 100ms. Setting the stop time to the maximum value (2147483647) essentially makes the scenario infinite. Range: 0 to 2147483647 Resolution: 100ms
LVL	LVLd	Set the RF Level. Range: 13 to –111dBm Resolution: 1dBm
SAVE		Save the scenario to EEPROM

MODE	MODEd	Set the operating mode of the SQTR1. 0 = do not initialize with stored scenario, wait for user commands 1 = initialize with the stored scenario, wait for user commands 2 = initialize with the stored scenario, run to stop time 3 = initialize with the stored scenario, run to stop time and repeat
RAW?	return example:	Return the average raw temperature reading.
TMP?	return example:	Return the computed temperature (using the average raw temperature reading, calibrated slope and calibrated offset).
TMPO	TMPO<float>	Set the offset for the temperature sensor transfer function.
TMPO?	return example:	Return the offset for the temperature sensor transfer function.
TMPS	TMPS<float>	Set the slope for the temperature sensor transfer function.
TMPS?	return example:	Return the slope for the temperature sensor transfer function.
CATT	CATT<coarse attenuation cal table>	Download the coarse attenuation calibration table. The CATT table is a two dimensional table (RF level vs. attenuator) containing values to be written to the 4 digital attenuators and an index into the FATT tables used to set the pin diode attenuator for each RF level setting from 13 to -111.

FATT	FATTd<fine attenuation cal table> FATT0 – download the FATT table for the UAT frequency of 978 MHz FATT1 - download the FATT table for the ground station frequency of 1030 MHz FATT2 - download the FATT table for the squitter frequency of 1090 MHz	Download the fine attenuation tables. The FATT tables are two dimensional tables (index from the CATT table vs. temperature) containing values to be added to the value obtained from the BATT table and written to the pin-diode to achieve the "tweak" required to achieve the requested RF level once the four digital attenuators are set to get as close to it as possible
BATT	BATTd<frequency band attenuation cal table> BATT0 – download the BATT table for the UAT frequency of 978 MHz BATT1 - download the BATT table for the ground station frequency of 1030 MHz BATT2 - download the BATT table for the squitter frequency of 1090 MHz	Download the frequency band attenuation tables. The BATT tables are two dimensional tables (index from the CATT table vs. frequency offset band) containing values to be added to the value obtained from the FATT table and written to the pin-diode to achieve the "tweak" required to achieve the requested RF level once the four digital attenuators are set to get as close to it as possible
CW	CW<channel><on/off> CW10 – turn CW OFF on channel 1 CW11 – turn CW ON on channel 1 CW20 – turn CW OFF on channel 1 CW21 – turn CW ON on channel 1 CW30 – turn CW OFF on channel 1 CW31 – turn CW ON on channel 1	Turn CW mode on or off on each of the three channels.
CAL	CAL<on/off> CAL0 – turn CAL mode OFF CAL1 – turn CAL mode ON	Turn CAL mode off and on.
ATT	ATT<attenuator><level> Where attenuator is 1, 2, 3 or 4 and <level> must be a 2 digit hex number. Valid values for <level> are 0 through 31 corresponding to 0dB through 31dB. The upper 3 bits are masked and so are therefore no cares.	Set the digital attenuators.
STD	STD<delay> Where delay is a decimal multiple of 20ns and can range from 0 to 255.	Set the scope trigger delay.

STD?	return example:	Return the scope trigger delay.
GPS	GPS0 – simulate PPS GPS1 – use PPS from Resolution T GPS board	Select the source for the PPS. This allows you to simulate the PPS if you are not receiving one from the GPS board. The default setting is to use the PPS from the GPS board.
//	Comment Line	Used for inline commenting
The following 16 commands are for internal use only		
FSCR?		Request Freq Synth clock rate in KHz
FSBC		Set Freq Synth bit count
FSBC?		Request Freq Synth bit count
FSD		Set Freq Synth data
FSD?		Request Freq Synth data
FSR		Reset the Freq Synth and the DDS
DDSBC		Set DDS bit count
DDSBC?		Request DDS bit count
DDSCR		Set DDS clock rate in KHz
DDSCR?		Request DDS clock rate in KHz
DDSD		Set DDS data
DDSD?		Request DDS data
DEST		Set the destination for the DDS commands
DEST?		Request the destination for the DDS commands
REST		Pass command strings on to the Resolution T GPSbBoard

UAT **NON-WAYPOINT SPECIFIC COMMANDS**

Command	Format	Definition
TARG	TARG<int>, 0 to 9	Select the target to define.
ACT	ACT<int>, 0 to 9	Activates a target
DATA	DATA<payl><28 or 60 hex digits>	Set the default data for the specified payload for the selected target. Payloads 00 to 06 correspond to payload types 0 to 6. (Most of the bits will be overwritten by data for the specific fields.) Payloads 07 to 12 are not defined to be certain payload types and can be defined by the user. (Since these payloads are not defined to be any specific type they will not be overwritten by data for specific fields.)
MSAD	MSADhhhhhh	Set the mode S address for the selected target in hex
UNIT	UNIT0 = DMS UNIT1 = floating point	Define the units for the LAT and LONG commands
LVLO	LVLOd	Set the attenuation for the present target. Range: 0 to 31dBm Resolution: 1dBm

EPOCH	EPOCHdd,dd,dd,dd,dd,dd,dd,dd,dd,dd,dd,dd,dd,dd,dd,dd dd, 0 through 12, is the slot number for the message area of the present target. In the message area slots 0 to 6 correspond to payload types 0 to 6. Slots 7 to 12 are not defined to be certain payload types and can be defined by the user. Each of the 16 elements are initialized to 0x20 to indicate undefined. If you want a target to skip an epoch, set that element to 0x20.	Define the payload type for each of the 16 epochs for the present target.
AQ	AQd, 0 to 7	Define the address qualifier field for the selected target
AT	AT0 = pressure AT1 = geometric	Define the altitude type for the selected target
LENG	LENGd, 0 to 7	Define the length code field for the selected target.
WID	WIDd, 0 or 1	Define the width code field for the selected target.
POA	POA0 = not applied POA1 = applied	Define the position offset applied flag for the selected target. (For Version 1 targets only)
GPSOFF	GPSOFFd, 0 to 63	Define the GPS Antenna Offset Field for the selected target. (For Version 2 targets only)
VVSRC	VVSRC0 = geometric VVSRC1 = barometric	Define the vertical velocity source field for the selected target.
UTC	UTC0 = not coupled UTC1 = coupled	Define the UTC field for the selected target.
EMIT	EMIT<int>, 0 to 39	Define the emitter category for the selected target.
CSIGN	CSIGNaaaaaaaa, where aaaaaaaa is 8 ascii characters, 0-9, A-Z, or space. If you want to set one of the characters to one of the other available values use the following: \ = 37 (not available)] = 38 (reserved) ^ = 39 (reserved)	Define the call sign (tail number) field for the selected target.

FLID	FLIDaaaaaaaa, where aaaaaaaa is 8 ascii characters, 0-9, A-Z, or space. If you want to set one of the characters to one of the other available values use the following: \ = 37 (not available)] = 38 (reserved) ^ = 39 (reserved)	Define the flight plan ID (Mode 3/A) field for the selected target.
EPS	EPSd, 0 to 7	Define the Emergency Priority Status field for the selected target.
UMV	UMVd, 0 to 7	Define UAT MOPS Version Number field for the selected target.
SDA	SDAd, 0 to 3	Define the System Design Assurance Field for the selected target
BAIC	BAIC0 = Barometric Pressure Altitude has NOT been cross checked BAIC1 = Barometric Pressure Altitude has been cross checked	Define the Barometric Altitude Integrity Code for the selected target
CC1	CC10 = no CC11 = yes	Define the UAT IN Capability flag for the selected target
CC2	CC20 = no CC21 = yes	Define the 1090 IN Capability flag for the selected target
CC3	CC30 = no CC31 = yes	Define the TCAS/ACAS Installed and Operational flag for the selected target
RA	RA0 = no RA1 = yes	Define the Resolution Advisory Active flag for the selected target
RAS	RAS0 = no RAS1 = yes	Define the Receiving ATC Services flag for the selected target
TM	TM0 = referenced to true north TM1 = referenced to magnetic north	Define the True/Magnetic Indicator flag for the selected target
CSID	CSIDd, 0 to 2 CSID0 = flight plan ID (Mode 3A) CSID1 = call sign (tail number) CSID2 = Alternate Call Sign/Flight ID between flight plan ID and call sign (every other message)	Define the Call Sign ID flag and Call Sign/Flight Plan ID field contents for the selected target
HT	HT0 = heading HT1 = track	Define the Heading/Track Indicator flag for the selected target
TSIH	TSIHd, 0 to 3	Define the Target Source Indicator (Horizontal) for the selected target

MIH	MIHd, 0 to 3	Define the Mode Indicator (Horizontal) for the selected target
TSIV	TSIVd, 0 to 3	Define the Target Source Indicator (Vertical) for the selected target
MIV	MIVd, 0 to 3	Define the Mode Indicator (Vertical) for the selected target
THDG	THDGd, 0 to 360 degrees	Define the Target Heading for the selected target
TTRK	TTRKd, 0 to 360 degrees	Define the Target Track Angle for the selected target
TALT	TALT<int>, -1000 to 101150 feet	Define the Target Altitude for the selected target (100 foot resolution)
TAT	TAT0 = Pressure Altitude (''Flight Level'') - target altitude is above transition level TAT1 = Baro-Corrected Altitude (''MSL'') - target altitude is below transition level	Define Target Altitude Type for the selected target
TAC	TACd, 0 to 3	Define the Target Altitude Capability for the selected target
SYNC	SYNChhhhhhhhhh, where hhhhhhhhhh represents the 36 bits of left justified SYNC	Define the 36 bit synchronization sequence if you want them to be non-standard. If you do not send this command the synchronization sequence will default to the defined ADS-B sequence.

UAT **WAYPOINT COMMANDS**

Command	Format	Definition
WAYP	WAYP<int>, 0 to 5	Select the waypoint to define for the selected target.
TIME	TIMEd, 0 to 214748364 seconds, lsb is 1 s	Set the UTC TIME for the present waypoint/target

LAT	if the UNIT0 command was received, the LAT command will be:
	
	LAT<deg>,<min>,<sec>
	
	<deg>, degrees, 0 to 90 for North, 0 to -90
	
	for South
	
	<min>, minutes, 0 to 59
	<sec>, seconds, 0 to 59
	
	if the UNIT1 command was received, the LAT command will be:
	
	LAT<float>, 0.0 to 90.0 for North, 0.0 to -90.0 for South
		Set the latitude for the present waypoint/target

LONG	if the UNIT0 command was received, the LONG command will be:
	
	LONG<deg>,<min>,<sec>
	
	<deg>, degrees, 0 to 180 for East, 0 to -180 for West
	<min>, minutes, 0 to 59
	<sec>, seconds, 0 to 59
	
	if the UNIT1 command was received, the LONG commands will be:
	
	LONG<float>, 0.0 to 180.0 for East, 0.0 to -180.0 for West
		Set the longitude for the present waypoint/target

ALT	ALT<long>, -1000 to 101338 feet	Set the altitude for the present waypoint/target
SALT	SALT<long>, -1000 to 101338 feet	Set the secondary altitude for the present waypoint/target
AG	AG0 = airborne – subsonic AG1 = airborne – supersonic AG2 = on the ground	Set the A/G state for the present waypoint/target

DACT	DACTd, 0 or 1 0 – activate squittering (default) 1 – deactivate squittering	Set the squittering state for the present waypoint/target
TAH	TAHd, 0 to 3	Define the track angle/heading type field for the selected target
TRK	TRK<int>, 0 to 360 degrees	Define the track angle for the selected target
HDG	HDG<int>, 0 to 360 degrees	Define the heading for the selected target
GSPD	GPSD<int>, 0 to 1022 knots	Define the ground speed for the selected target
NACP	NACPh, 0x0 to 0xf	Define NACP field for the selected target.
NACV	NACVd, 0 to 7	Define NACV field for the selected target.
SIL	SILd, 0 to 3	Define Surveillance Integrity Level field for the selected target.
SSUP	SSUP0 = Prob of exceeding NIC on “per hour” SSUP1 = Prob of exceeding NIC on “per sample”	Define SIL Supplement field for the selected target.
NIC	NIC.h, 0 to f note: the . between the command and the data is necessary when the command is less than four characters and the data is alpha i.e. the characters a-f in hex numbers.	Define the NIC field for the selected target
GVA	GVAd, 0 to 3	Define the GVA for the selected target
SANT	SANT0 = Systems with two functioning antennas SANT1 = Systems that use only one antenna	Define the Single Antenna Flag Field for the selected target
SAT	SAT0 = MCP/FCU SAT1 = FMS	Define the Selected Altitude Type field for the selected target.
SA	SA<int>, -32 to 65472 feet	Define the Selected Altitude for the selected target (32 foot resolution)
BPS	BPSd, 0 to 511	Define the Barometric Pressure Setting for the selected target.
STAT	STAT0 = Status of Selected Heading fields invalid STAT1 = Status of Selected Heading fields valid	Define the Status of Selected Heading Fields for the selected target
SHDG	SHDGd, 0 to 360 degrees	Define the Selected Heading and Sign for the selected target
ST	ST0 = Status of MCP/FCU field invalid ST1 = Status of MCP/FCU field valid	Define the Status of MCP/FCU Mode Bits for the selected target

AP	AP0 = Autopilot Not Engaged AP1 = Autopilot Engaged	Define the AP Mode Indicator field for the selected target
VNAV	VNAV0 = VNAV Not Engaged VNAV1 = VNAV Engaged	Define the VNAV Mode Indicator field for the selected target
MALT	MALT0 = Altitude Hold Mode Not Engaged MALT1 = Altitude Hold Mode Engaged	Define the ALT Mode Indicator field for the selected target
APP	APP0 = Approach Mode Not Engaged APP1 = Approach Mode Engaged	Define the APP Mode Indicator field for the selected target
UPFB	UPFBd, 0 to 7	Define Uplink Feedback field for the selected target
NICS	NICS0 = NIC Rc is default value NICS1 = NIC Rc is 0.3 NM	Define NIC Supplement field for the selected target
BITM	BITMdd hhhhhhhh..... Where dd selects which payload the bit mask applies to, 0 to 12 (must be two digits) Where hhhh… is the 36 (payload 0) or 68 (payloads 1 to 12) hex digits of the ADS-B Message Payload	Define the bitmask for a specific payload type for the selected target. This bit mask is XOR'd with the Payload of the outgoing message BEFORE Reed/Solomon Parity calculations.
ERRM	ERRMddhhhhhhhhh..... where dd selects which payload the error mask applies to, 0 to 12 (must be two digits) where hhhh.... is the 69 (payload 0) or 105 (payloads 1 to 12) hex digits	Define the error mask for a specific payload type for the selected target. This bit mask is XOR'd with the Payload of the outgoing message AFTER Reed/Solomon Parity calculations.

UAT EVENT-POINT COMMANDS

ETIME	ETIMEd, d = 0 to 2147483647 seconds	Set an event and its associated Start time for the present target. Events must be defined in sequential order. You may define up to 100 event points total across all of the targets. An event point can have any or all of the event types associated with it.
IDENT		Set an IDENT event point for the selected target
SQUAWK		Set a SQUAWK event point for the selected target
ALERT		Set an ALERT event point for the selected target. If you want to turn the ALERT off send an ETIME command followed by no event types
LVLO	LVLOd	Set an ATTENuation for the selected target. Range: 0 to 31dBm Resolution: 1dBm
ERRME	ERRMddhhhhhhhh..... where dd selects which payload the error mask applies to, 0 to 12 (must be two digits) where hhhh.... is the 69 (payload 0) or 105 (payloads 1 to 12) hex digits	Define the error mask for a specific payload type for the selected target to be applied at this eventpoint. This bit mask is XOR'd with the Payload of the outgoing message AFTER Reed/Solomon Parity calculations.
EVDA	EVDA1 = deactivate EVDA0 = activate	Activate/Deactivate the selected target at this eventpoint