KLJ INSTRUMENTS

SQTR-2M
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
Dec 2011	A			Initial Release

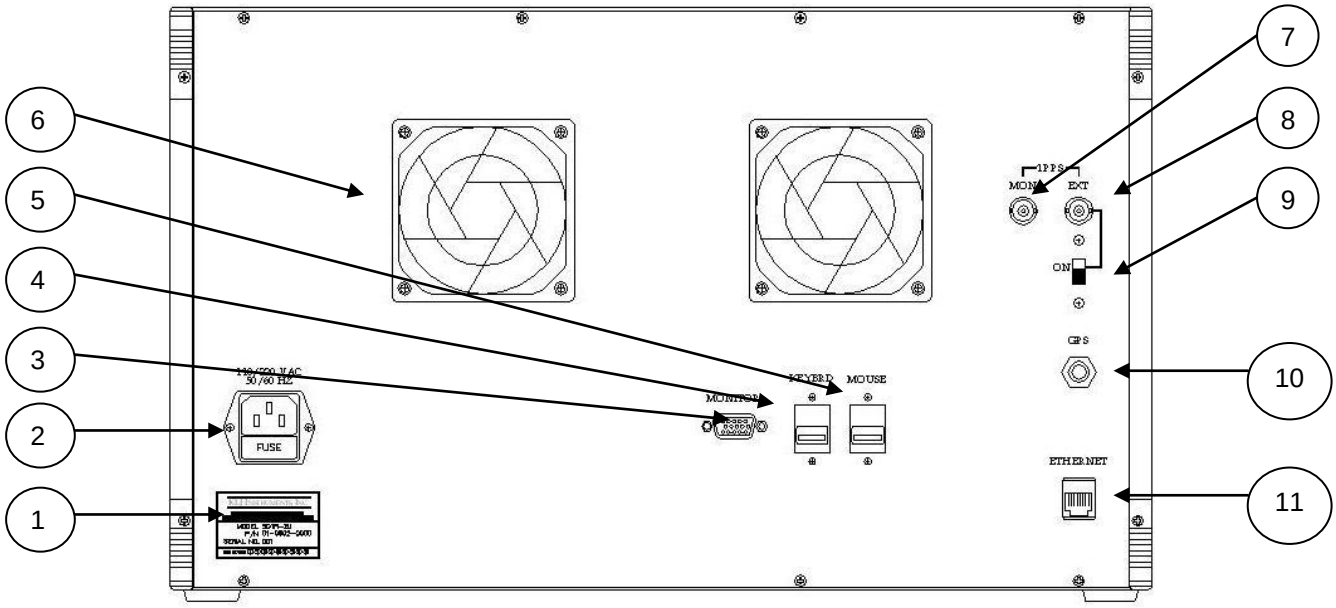
INTRODUCTION

1.1 Manual Description

The SQTR-2M provides capability for generating Universal Access Transceiver (UAT) ADS-B messages. The purpose of this manual is to provide instructions for use of the SQTR-2M.

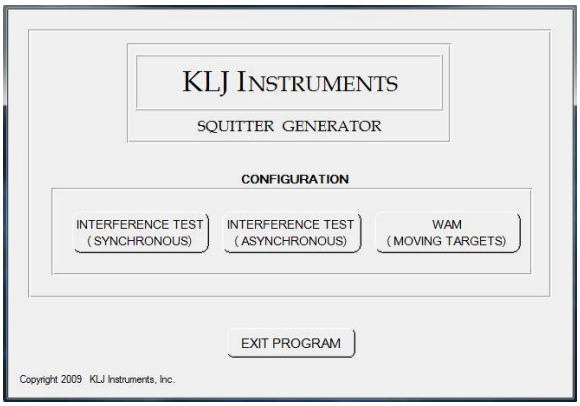
1.2 Front and Rear Panel Description

SQTR-2 Front Panel		
1	SCOPE SYNC	3.3V, 1us pulse at the beginning of each transmission is output at this BNC connector (same for all channels)
2	VIDEO OUTPUT	Detected video of the transmitted pulse modulation is output at this BNC connector (same for all channels)
3	RF OUT	Channel 0 thru Channel 5 RF signals are combined and output on this Type N connector
4	RF 1 IN AND RF 2 IN	L band RF signals applied to these TNC jacks is summed with the Channel 0 and Channel 1 RF signals and output at the RF OUT jack. There is approximately 13 dB attenuation between each RF1 IN jack and the RF OUT jack
5	EXT TRIGGER	This BNC jack accepts a 3.3V, 1 us pulse to trigger Channel 0. This input must be enabled via the GUI
6	MLAT 1 to MLAT 4	RF output for MLAT receivers
7	USB	This is a general purpose USB port commonly used for a flash drive
8	POWER SWITCH	



SQTR-2 Rear Panel		
1	SERIAL TAG	Shows serial number as well as Ethernet IP Address for SQTR-2
2	INPUT POWER	Input for 110/220 VAC, 50/60 Hz
3	MONITOR	15-in D-sub connector for external VGA monitor (supplied)
4	KEYBOARD	USB connection for external keyboard (supplied)
5	MOUSE	USB connection for external mouse (supplied)
6	FANS (2)	
7	1 PPS MONITOR	BNC connector that outputs the 3.3V, 1 PPS signal from the internal GPS receiver
8	1 PPS EXTERNAL	BNC connector for applications of an external 3.3V, 1PPS signal
9	PPS SELECT	Allows selection of internal or external 3.3V, 1 PPS signal
10	GPS	TNC jack to connect the supplied GPS Antenna Cable to the internal GPS receiver
11	ETHERNET	RJ45 connection to Ethernet for remote login

1.3 SQTR-2M - Use of Graphical User Interface



The graphical user interface (GUI) for the SQTR-2M Squitter Generator allows the user to create synchronous and asynchronous scenarios plus Wide Area Multilateration (WAM) targets. When you invoke the SQTR-2M GUI you will be presented with a screen with three selections: Interference Test (Synchronous), Interference Test (Asynchronous), and WAM (Moving targets). When you select either of these options you will be provided with further screens that will allow you to define, store and run synchronous and asynchronous scenarios. These three test modes and the associated screens will be described in the following sections.

1.4 Interference Test (Synchronous)

The synchronous mode is used to define, store and run synchronous scenarios. In synchronous scenarios Channel 0, the 'master' channel, will generate ADS-B squitters. Channels 1-5, the 'slave' channels, will be able to generate random ATCRBS, random short Mode S or random long mode S messages.

The transmission time of each slave channel relative to the master channel is adjustable from -120 microseconds to + 120 microseconds +/- 1 microsecond. The timing is referenced to the leading edge of the first preamble pulse of each channel 0 ADS-B message. The User will be able to specify the exact time offset or range of time offsets for each non-ADS-B channel. The time offset will be normally distributed over the User defined range.

The power for each slave channel is adjustable from 0 to -90 dBm and may be set to a specific power or range of powers. If a range is selected the power will be normally distributed over the range.

The frequency for each slave channel is adjustable from 1090 MHz +/- 3 MHz and may be set to a specific frequency or range of frequencies. If a range is selected the frequencies will be normally distributed over the range.

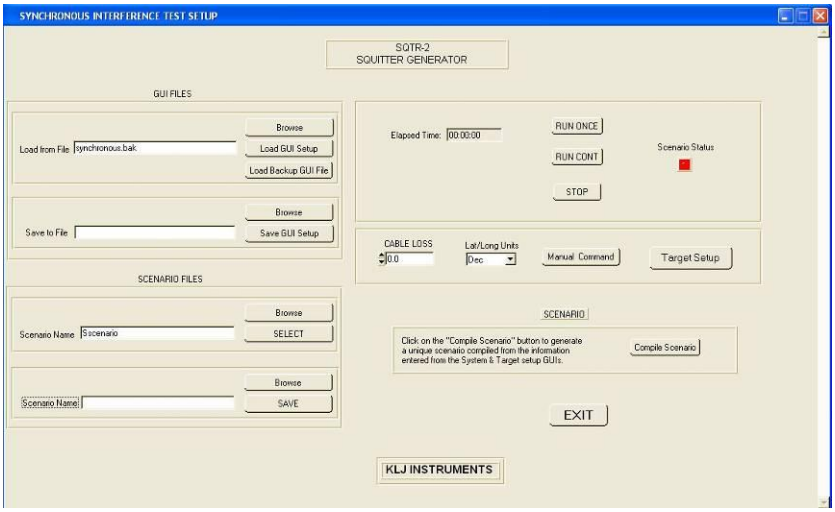
There are three screens that allow the user to define, save and run synchronous scenarios. They are:

- the Synchronous Interference Test Setup screen
- the Synchronous Target Setup screen
- The Synchronous Interference Setup screen

Descriptions of these screens and how to navigate between them will be described in the following sections.

1.4.1 Synchronous Interference Test Setup

From this screen you can perform these functions:



- Store and recall synchronous GUI setup files
- Store and recall synchronous scenario files
- Run synchronous scenarios
- Set the cable loss
- Define the latitude and longitude data format
- Enter manual commands (used for calibration)
- Go to the Synchronous Target Setup Screen
- Compile a new scenario using the existing GUI settings

GUI Setup File

1.4.1.1 Saving GUI Setup Files

Once all of the parameters for a scenario have been defined or entered it may be appropriate to save these settings for use in the future. To do this enter the file name for the GUI Setup in the “Save to File” box. A path may be entered with filename. If an existing GUI setup file is being modified the Browse button above the “Save GUI Setup” box may be used to search for it. It is suggested that .bin be used as the extension for GUI setup files. Once the filename has been entered select the “Save GUI Setup” button to complete the save operation.

1.4.1.2 Loading GUI Setup Files

If a GUI setup has been previously saved to a file it may be recalled. Enter the name of the GUI setup file in the “Load from File” box or use the Browse button above the “Load GUI Setup” button to locate it. Once the filename has been entered select the “Load GUI Setup” button to complete the load operation.

1.4.1.3 Backup GUI Setup Files

There is also a “Load Backup GUI File” button. Each time you exit the Synchronous Interference Test Setup screen the GUI setup will be saved in the file synchronous.bak. If you want to recall the last GUI setup select the “Load Backup GUI File” button.

1.4.2 Scenario Files

Scenario files are created when the “Compile Scenario” button is selected. A file will be created for channel 0 and for any interference channel 1-5 that is enabled. These files are named Scenario_#.scn where ‘#’ is the channel number 0 to 5. Since the interference messages are random, you will get a different scenario every time you select the compile button even if the GUI setup remains constant.

1.4.2.1 Saving Scenario Files

Since the files created when the compile button is selected are always named Scenario_#.scn, if it is desired to save a scenario for future use it must be saved in a different location and/or with a different name or it will be overwritten the next time the compile button is selected. To save a scenario, enter the file name chosen in the “Scenario Name” box next to the “SAVE” button. Do not enter an extension. A path may be entered with filename. Once the filename has been entered select the “SAVE” button. A prompt will be provided to enter a

brief description of the scenario. This description will be stored in a .txt file in the same directory as the scenario files with the same name as that given to the scenario. For example, if a scenario is saved with the name test1 the channel 0 file will be named test1_0.scn. If channel 1 is enabled in the scenario the channel 1 file will be named test1_1.scn. Likewise for channels 1 through 5. The description provided will be stored in a file named test1.txt.

If an existing scenario is being replaced the “Browse” button above the “SAVE” box may be used to search for the associated .txt file.

1.4.2.2 Loading Scenario Files

If a scenario has been previously saved it may be recalled. Enter the name of the scenario in “Scenario Name” box next to the “SELECT” box or use the “Browse” button above the “SELECT” button to locate the associated .txt file. Once the filename has been entered select the “SELECT” button to complete the scenario selection operation.

1.4.3 Running a Scenario

Once a scenario has been “loaded” i.e. selected for running, press the “RUN ONCE” button. A prompt will be displayed to verify the selected scenario. If “No-Cancel” is selected the scenario will be cancelled. If “Yes-Run” is selected the prompt will be replaced with one indicating that the FPGA is being programmed. It takes approximately 5 seconds to program the FPGAs. After 5 second this prompt will be replaced with another prompt while general scenario data is being downloaded to the channels to initialize the FPGAs. The next prompt is displayed while the scenario files are read into RAM. If the scenario is long enough the next prompt indicates that the data queues on each channel are being filled. Once the queues are filled the scenario begins running and the elapsed timer begins counting. While the scenario is running the LEDs on the front of the SQTR-2 will blink each time a message is transmitted. A 1 microsecond, 3.3 volt scope sync is provided with each squitter/transmission. Detected video of each transmission is provided for each channel. When the scenario completes the “Scenario Running” prompt will be removed, the elapsed timer will stop counting and the Scenario Status indicator will turn from green to red.

1.4.4 Manual Commands

All manual commands presently implemented are for maintenance and calibration of the test set.

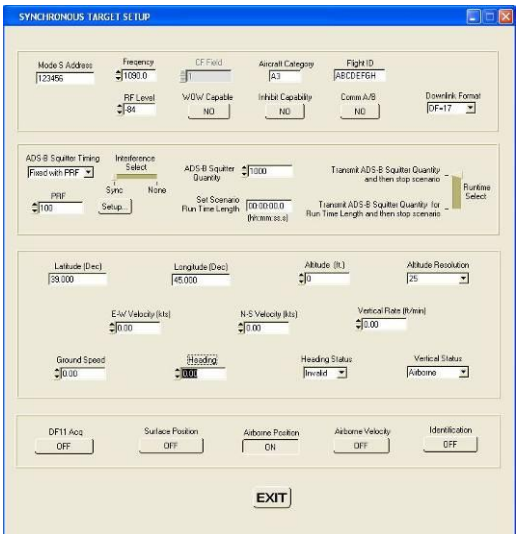
1.4.5 Cable Loss

Cable loss for the system may be entered on this screen and may range from 0dB to 3dB. Cable loss is stored with a scenario when a scenario is compiled. When a scenario is run the present cable loss setting is compared to the cable loss that was stored with the scenario when it was compiled and if they are different a prompt will be provided to select which cable loss to account for when setting RF levels.

1.4.6 Lat/Long Units

The units for latitude and longitude may be entered or displayed as decimal or as degrees, minutes, and seconds.

1.4.7 Target Setup



For the channel 0 target the following may be defined:

- Mode S address
- RF frequency
- RF level
- CF field (if Downlink Format is set to DF=18)
- Aircraft Category
- Flight ID
- WOW Capability (not the state of WOW)
- Inhibit Capability – the ability to inhibit acquisition squitters during extended squitter transmissions
- Comm A/B Capability (if Downlink Format is set to DF=17)
- Downlink Format (DF17, DF18 or DF19)
- Latitude
- Longitude
- Altitude
- Altitude Resolution – 25 or 100 foot
- E-W velocity
- N-S velocity
- Vertical Rate
- Ground Speed
- Heading
- Heading Status
- Vertical Status

At the bottom of this screen are buttons to turn ON/OFF each type of channel 0 squitter: DF11 acquisition, Surface Position, Airborne Position, Airborne Velocity and/or Identification.

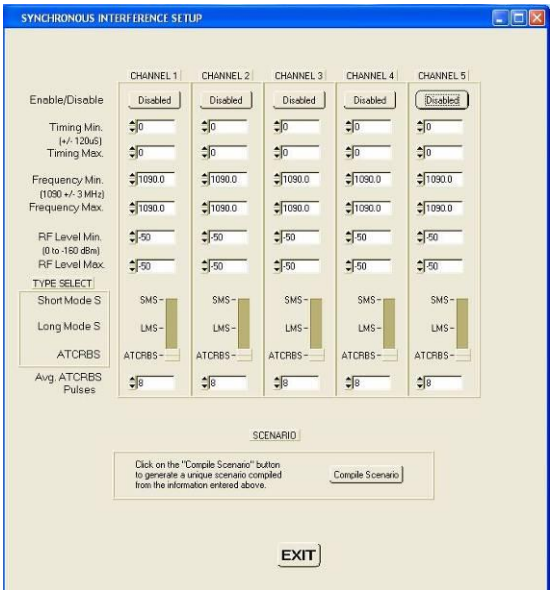
In the middle of the page are controls for transmission rate and scenario length. If the ADS-B Squitter Timing is set to “Jitter” the selected channel 0 squitters will be transmitted based on the timing as defined in DO–260. For example, if the Vertical Status is set to “Gnd Stopped” Airborne Position and Airborne Velocity squitters will not be transmitted (even if turned ON) and Surface Position squitters will be transmitted every 4.8 to 5.2 seconds if turned ON.

However, if the ADS-B Squitter Timing is set to “Fixed with PRF”, channel 0 squitters that are turned ON will be transmitted in order from left to right at the specified PRF. For example, if DF11 Acq and Surface Position squitters are turned ON and the others are turned OFF and the PRF is set to 1 then at time t=1 second the DF11 squitter will be transmitted. At time t=2 seconds the DF17 even Surface Position squitter will be transmitted. At time t=3 seconds the DF11 squitter will be transmitted again. At time t=4 seconds the DF 17 odd Surface Position squitter will be transmitted. And so on and so on.

If the Runtime Select slider is set to “Transmit ADS-B Squitter Quantity and then stop scenario” the scenario will run until the ADS-B Squitter Qty of channel 0 squitters have been transmitted. If the Runtime Select slider is set to “Transmit ADS-B Squitter Quantity for Run Time Length and then stop scenario” the scenario will run for the length of time specified in the “Set Scenario Run Time Length” field.

If interference is desired set the Interference Select slider to Sync. To define the interference select the Setup button below the Interference Select slider.

1.4.8 Synchronous Interference Setup



This screen is used to setup the interference messages from channels 1-5.

Each channel can be enabled or disabled.

The timing of the interference can be set to +/- 120us with respect to the channel 0 message. If a range is selected the time offset will be normally distributed over the range.

The frequency of the interference can be set to 1090MHz +/- 3MHz. If a range is selected the frequency will be normally distributed over the range.

The level of the interference can be set from 0dBm to –90dBm. If a range is selected the level will be normally distributed over the range.

The interference for each channel can be set to ATCRBS, short mode S or long mode S. If ATCRBS is chosen the average number of ATCRBS pulses may be selected. If ATCRBS is chosen the framing pulses are always present and the X pulse is never present. If short mode S is chosen the data will be random, the DF type will be randomly selected from 0, 4, 5 and 11 and parity is calculated. If long mode S is chosen the data will be random, the DF type will be randomly selected from 16, 17, 18,19,20,21 or 24 and parity is calculated.

The Compile Scenario button on this screen is identical to the Compile Scenario button on the Synchronous Interference Test Setup screen.

1.5 Interference Test (Asynchronous)

The asynchronous mode is used to define, store and run asynchronous scenarios. In asynchronous scenarios Channel 0, the ‘master’ channel, will generate ADS-B squitters for up to 250 individual targets. Channels 1-5, the interference channels, will, combined, generate up to 58910 random ATCRBS messages per second and up to 10460 random mode S messages per second.

The frequency for each slave channel is adjustable from 1090 MHz +/- 3 MHz and may be set to a specific frequency or range of frequencies. If a range is selected the frequencies will be normally distributed over the range.

The average number of ATCRBS pulses is settable for each channel

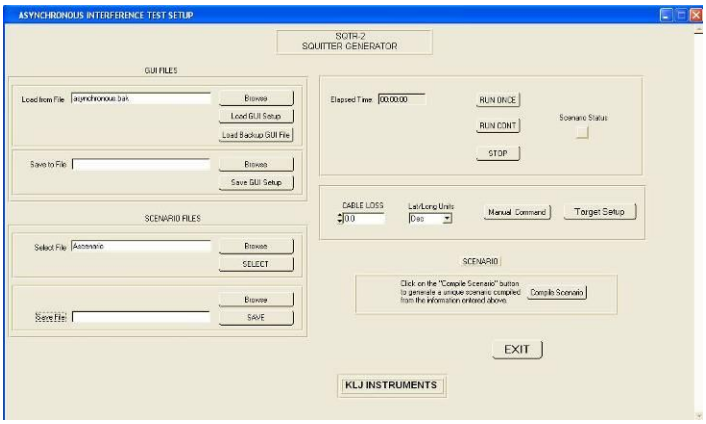
The power for level of the interference is defined in a matrix. Enter the number of ATCRBS, short mode S and long mode S messages desired at each RF Level from 0 to –90 dBm. The messages will be distributed across the 5 interference channels. The number of ATCRBS messages at all of the levels must not add up to more than 58910 per second. The number of mode S messages must not add up to more than 10460 per second.

There are four screens that allow the user to define, save and run asynchronous scenarios. They are:

- the Asynchronous Interference Test Setup screen
- the Asynchronous Target Setup screen
- the Asynchronous Target Enable screen
- The Asynchronous Interference Setup screen

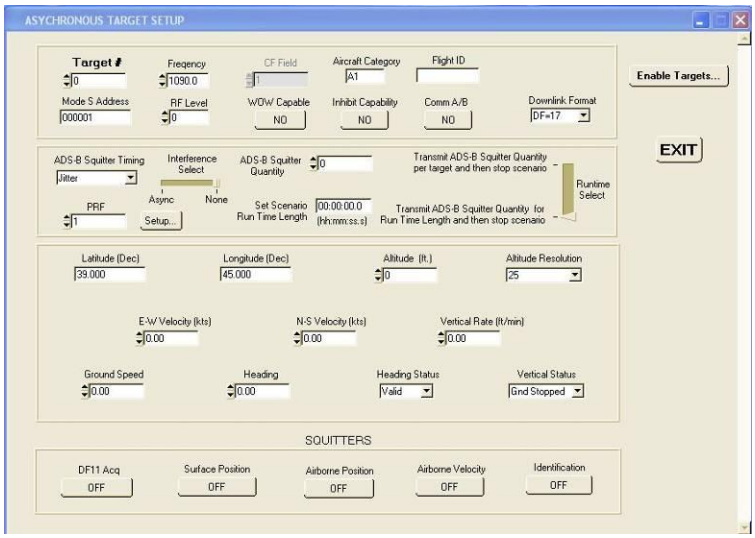
Descriptions of these screens and how to navigate between them will be described in the following sections.

1.5.1 Asynchronous Interference Test Setup



From this screen you can perform the identical functions for asynchronous scenarios as for synchronous scenarios from the Synchronous Interference Test Setup screen.

1.5.2 Target Setup



This following screen is used to up the channel 0 targets as well as the length of the scenario and the rate of transmission of channel 0 messages.

For each of the 250 channel 0 targets the following may be defined:

- Mode S address
- RF frequency
- RF level
- CF field (if Downlink Format is set to DF=18)
- Aircraft Category
- Flight ID
- WOW Capability (not the state of WOW)
- Inhibit Capability – the ability to inhibit acquisition squitters during extended squitter transmissions
- Comm A/B Capability (if Downlink Format is set to DF=17)
- Downlink Format (DF17, DF18 or DF19)
- Latitude
- Longitude
- Altitude
- Altitude Resolution – 25 or 100 foot
- E-W velocity
- N-S velocity
- Vertical Rate
- Ground Speed
- Heading
- Heading Status
- Vertical Status

At the bottom of this screen are buttons to turn ON/OFF each type of channel 0 squitter: DF11 acquisition, Surface Position, Airborne Position, Airborne Velocity and/or Identification.

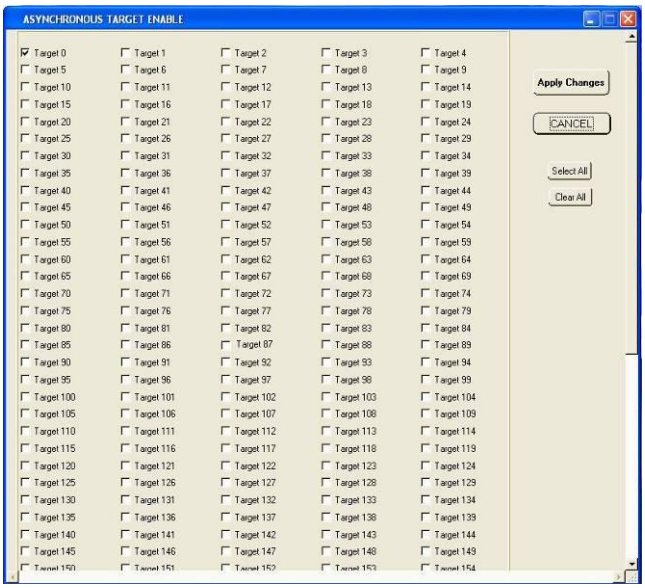
In the middle of the page are controls for transmission rate and scenario length. If the ADS-B Squitter Timing is set to “Jitter” the selected channel 0 squitters will be transmitted based on the timing as defined in DO–260. For example, if the Vertical Status is set to “Gnd Stopped” Airborne Position and Airborne Velocity squitters will

not be transmitted (even if turned ON) and Surface Position squitters will be transmitted every 4.8 to 5.2 seconds if turned ON.

However, if the ADS-B Squitter Timing is set to “Fixed with PRF”, channel 0 squitters that are turned ON will be transmitted starting with target 0 (or the lowest target number that is enabled) and in order from left to right at the specified PRF. For example, if only target 0 and target 1 are enabled and only DF11 Acq squitters are turned ON for each of these targets and the PRF is set to 1 then at time t=1 second the target 0 DF11 squitter will be transmitted. At time t=2 seconds the target 1 DF11 squitter will be transmitted. At time t=3 seconds the target 0 DF11 squitter will be transmitted again. And so on and so on.

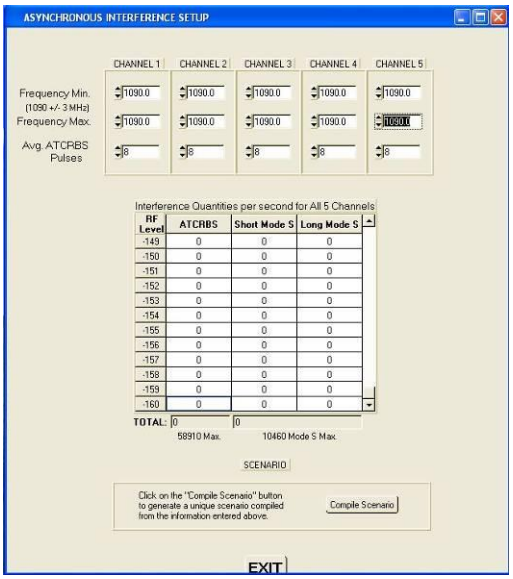
If the Runtime Select slider is set to “Transmit ADS-B Squitter Quantity and then stop scenario” the scenario will run until the ADS-B Squitter Qty of channel 0 squitters have been transmitted. If the Runtime Select slider is set to “Transmit ADS-B Squitter Quantity for Run Time Length and then stop scenario” the scenario will run for the length of time specified in the “Set Scenario Run Time Length” field.

In the upper right hand corner is an Enable Targets… button. Each of the 250 targets must be enabled or turned on using the Target Enable screen in order for its messages to be transmitted. This allows you to use as many or as few of the 250 targets as you want.



If interference is desired set the Interference Select slider to Async. To define the interference select the Setup button below the Interference Select slider.

1.5.3 Asynchronous Interference Setup



This screen is used to setup the interference messages from channels 1-5.

The frequency of the interference can be set to 1090MHz +/- 3MHz. If a range is selected the frequency will be normally distributed over the range.

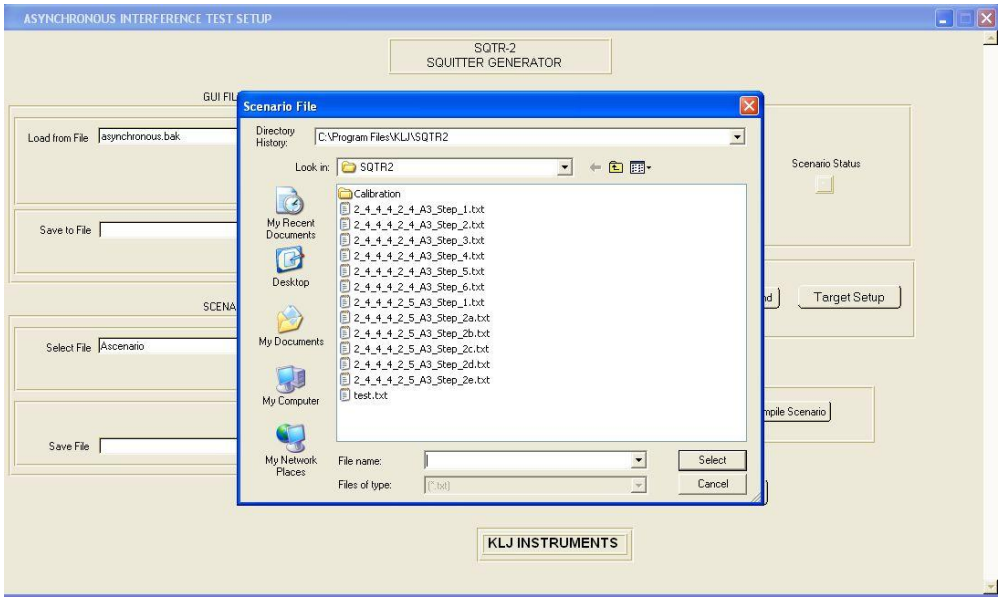
The average number of ATCRBS pulses is settable for each channel

The power for level of the interference is defined in a matrix. Enter the number of ATCRBS, short mode S and long mode S messages desired at each RF Level from 0 to –90 dBm. The messages will be distributed across the 5 interference channels. The number of ATCRBS messages at all of the levels must not add up to more than 58910 per second. The number of mode S messages must not add up to more than 10460 per second.

The Compile Scenario button on this screen is identical to the Compile Scenario button on the Synchronous Interference Test Setup screen.

1.6 Examples of DO-260B MOPS Tests

The software that is shipped with the SQTR-2 includes the scenarios for performing the tests described in DO-260B Minimum Operational Performance Standards (MOPS) for 1090 MHz Extended Squitter Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services - Broadcast (TIS-B) paragraphs 2.4.4.4.2.4 (Combined Preamble and Data Block Tests with Mode A/C FRUIT) and 2.4.4.4.2.5 (Data Block Tests with Mode S Fruit). The scenario files for the MOPS tests can be loaded via the Scenario Files section.



1.6.1 Instructions for developing MOPS files

The following steps were used to develop the MOPS tests included with the SQTR-2M. These steps are for guidance in development of additional tests by the test set user. The tests are broken into individual test steps that can be recalled for testing.

1.6.1.1 Test 2.4.4.4.2.4 Combined Preamble and Data Block Tests with Mode A/C Fruit

Step 1

1. Select Interference Test (Synchronous) to bring up the Synchronous Interference Test Setup window.
2. Select Target Setup button to bring up the Synchronous Target Setup window.
3. Enter Mode S Address
4. Set Frequency to 1090.0
5. Enter Aircraft Category
6. Enter Flight ID
7. Enter RF Level according to equipment class.
8. Set 'WOW Capability, Inhibit Capability, and Comm A/B as desired.
9. Set Downlink Format to DF=17.
10. Set ADS-B Squitter Timing to Fixed with PRF.
11. Set PRF to 100.
12. Set Interference Select to Sync.
13. Set ADS-B Squitter Quantity to 1000.
14. Set Runtime Select to Transmit ADS-B Squitter Quantity and then stop scenario.
15. Enter values for Latitude, Longitude, Altitude, Altitude Resolution, E-W Velocity, N-S Velocity, Vertical Rate, Ground Speed, Heading, and Heading Status as desired.
16. Set Vertical Status to Airborne.
17. Set DF11 Acq, Surface Position, Airborne Velocity, and Identification to OFF.

18. Set Airborne Position to ON.
19. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
20. Set Enable/Disable for Channels 1 through 5 to Disabled.
21. Exit the Synchronous Interference Setup window.
22. Exit the Synchronous Target Setup window.
23. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_4_A3_Step_1.bin and select the Save GUI Setup button to save the data entered in the previous steps.
24. Select the Compile Scenario button.
25. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_4_A3_Step_1 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
26. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_4_A3_Step_1) and click the SELECT button.
27. Select RUN ONCE. You will be prompted to confirm the file name.

Step 2

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 Enable/Disable to Enabled.
4. Set Channels 2-5 to Disabled.
5. Set Channel 1 Timing Min to -20 us.
6. Set Channel 1 Timing Max to +100 us.
7. Set Channel 1 Frequency Min and Frequency Max to 1090.0 MHz
8. Set Channel 1 RF Level Min to -72 dBm.
9. Set Channel 1 RF Level Max to -72 dBm.
10. Set Channel 1 TYPE SELECT slider to ATCRBS.
11. Set Channel 1 Avg ATCRBS Pulses to 5
12. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
13. Select the Compile Scenario button.
14. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_4_A3_Step_2.bin and select the Save GUI Setup button to save the data entered in the previous steps.
15. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_4_A3_Step_2 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
16. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_4_A3_Step_2) and click the SELECT button.
17. Select RUN ONCE. You will be prompted to confirm the file name.
18. You will see the following sequence of events:

Step 3

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Max and Min to -74 dBm.
4. Set Channel 2 to Enabled.
5. Set Channel 2 Timing Min to -20 us.
6. Set Channel 2 Timing Max to +100 us.
7. Set Channel 2 Frequency Min and Frequency Max to 1090.0 MHz
8. Set Channel 2 RF Level Min to -70 dBm.
9. Set Channel 2 RF Level Max to -70 dBm.
10. Set Channel 2 TYPE SELECT slider to ATCRBS.
11. Set Channel 2 Avg ATCRBS Pulses to 5
12. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
13. Select the Compile Scenario button.

14. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_4_A3_Step_3.bin and select the Save GUI Setup button to save the data entered in the previous steps.
15. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_4_A3_Step_3 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
16. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_4_A3_Step_3) and click the SELECT button.
17. Select RUN ONCE. You will be prompted to confirm the file name.
18. You will see the following sequence of events:

Step 4

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Max and Min to -76 dBm.
4. Set Channel 2 RF Level Max and Min to -72 dBm.
5. Set Channel 3 to Enabled.
6. Set Channel 3 Timing Min to -20 us.
7. Set Channel 3 Timing Max to +100 us.
8. Set Channel 3 Frequency Min and Frequency Max to 1090.0 MHz
9. Set Channel 3 RF Level Min to -68 dBm.
10. Set Channel 3 RF Level Max to -68 dBm.
11. Set Channel 3 TYPE SELECT slider to ATCRBS.
12. Set Channel 3 Avg ATCRBS Pulses to 5
13. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
14. Select the Compile Scenario button.
15. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_4_A3_Step_4.bin and select the Save GUI Setup button to save the data entered in the previous steps.
16. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_4_A3_Step_4 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
17. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_4_A3_Step_4) and click the SELECT button.
18. Select RUN ONCE. You will be prompted to confirm the file name.
19. You will see the following sequence of events:

Step 5

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Max and Min to -78 dBm.
4. Set Channel 2 RF Level Max and Min to -74 dBm.
5. Set Channel 3 RF Level Max and Min to -70 dBm.
6. Set Channel 4 to Enabled.
7. Set Channel 4 Timing Min to -20 us.
8. Set Channel 4 Timing Max to +100 us.
9. Set Channel 4 Frequency Min and Frequency Max to 1090.0 MHz
10. Set Channel 4 RF Level Min to -66 dBm.
11. Set Channel 4 RF Level Max to -66 dBm.
12. Set Channel 4 TYPE SELECT slider to ATCRBS.
13. Set Channel 4 Avg ATCRBS Pulses to 5
14. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
15. Select the Compile Scenario button.
16. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_4_A3_Step_5.bin and select the Save GUI Setup button to save the data entered in the

previous steps.

17. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_4_A3_Step_5 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
18. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_4_A3_Step_5) and click the SELECT button.
19. Select RUN ONCE. You will be prompted to confirm the file name.
20. You will see the following sequence of events:

Step 6

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Max and Min to -80 dBm.
4. Set Channel 2 RF Level Max and Min to -76 dBm.
5. Set Channel 3 RF Level Max and Min to -72 dBm.
6. Set Channel 4 RF Level Max and Min to -68 dBm.
7. Set Channel 5 to Enabled.
8. Set Channel 5 Timing Min to -20 us.
9. Set Channel 5 Timing Max to +100 us.
10. Set Channel 5 Frequency Min and Frequency Max to 1090.0 MHz
11. Set Channel 5 RF Level Min to -64 dBm.
12. Set Channel 5 RF Level Max to -64 dBm.
13. Set Channel 5 TYPE SELECT slider to ATCRBS.
14. Set Channel 5 Avg ATCRBS Pulses to 5
15. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
16. Select the Compile Scenario button.
17. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_4_A3_Step_5.bin and select the Save GUI Setup button to save the data entered in the previous steps.
18. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_4_A3_Step_5 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
19. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_4_A3_Step_5) and click the SELECT button.
20. Select RUN ONCE. You will be prompted to confirm the file name.
21. You will see the following sequence of events:

1.6.1.2 Test 2.4.4.4.2.5 Data Block Tests with Mode S Fruit

Step 1

1. Select Interference Test (Synchronous) to bring up the Synchronous Interference Test Setup window.
2. Select Target Setup button to bring up the Synchronous Target Setup window.
3. Enter Mode S Address
4. Set Frequency to 1090.0
5. Enter Aircraft Category
6. Enter Flight ID
7. Enter RF Level according to equipment class.
8. Set 'WOW Capability, Inhibit Capability, and Comm A/B as desired.
9. Set Downlink Format to DF=17.
10. Set ADS-B Squitter Timing to Fixed with PRF.
11. Set PRF to 100.
12. Set Interference Select to Sync.
13. Set ADS-B Squitter Quantity to 1000.
14. Set Runtime Select to Transmit ADS-B Squitter Quantity and then stop scenario.
15. Enter values for Latitude, Longitude, Altitude, Altitude Resolution, E-W Velocity, N-S Velocity, Vertical Rate, Ground Speed, Heading, and Heading Status as desired.

16. Set Vertical Status to Airborne.
17. Set DF11 Acq, Surface Position, Airborne Velocity, and Identification to OFF.
18. Set Airborne Position to ON.
19. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
20. Set Enable/Disable for Channels 1 through 5 to Disabled.
21. Exit the Synchronous Interference Setup window.
22. Exit the Synchronous Target Setup window.
23. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_5_A3_Step_1.bin and select the Save GUI Setup button to save the data entered in the previous steps.
24. Select the Compile Scenario button.
25. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_5_A3_Step_1 and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: Validation of Class A3 Equipment.
26. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_5_A3_Step_1) and click the SELECT button.
27. Select RUN ONCE. You will be prompted to confirm the file name.

Step 2a

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 Enable/Disable to Enabled.
4. Set Channels 2-5 to Disabled.
5. Set Channel 1 Timing Max to +90 us.
6. Set Channel 1 Timing Min to +8 us.
7. Set Channel 1 Frequency Min and Frequency Max to 1090.0 MHz
8. Set Channel 1 RF Level Min to -72 dBm.
9. Set Channel 1 RF Level Max to -72 dBm.
10. Set Channel 1 TYPE SELECT slider to LMS.
11. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
12. Select the Compile Scenario button.
13. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2a.bin and select the Save GUI Setup button to save the data entered in the previous steps.
14. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2a and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: S/I=0.
15. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_5_A3_Step_2a) and click the SELECT button.
16. Select RUN ONCE. You will be prompted to confirm the file name.

Step 2b

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Min to -76 dBm.
4. Set Channel 1 RF Level Max to -76 dBm.
5. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
6. Select the Compile Scenario button.
7. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2b.bin and select the Save GUI Setup button to save the data entered in the previous steps.
8. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2b and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type:

S/I=4.

9. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_5_A3_Step_2b) and click the SELECT button.
10. Select RUN ONCE. You will be prompted to confirm the file name.

Step 2c

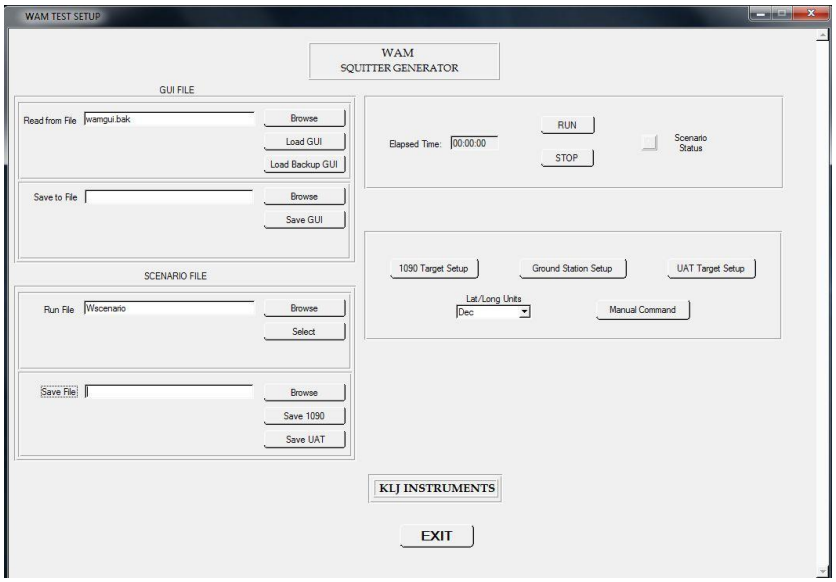
1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Min to -80 dBm.
4. Set Channel 1 RF Level Max to -80 dBm.
5. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
6. Select the Compile Scenario button.
7. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2c.bin and select the Save GUI Setup button to save the data entered in the previous steps.
8. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2c and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: S/I=8.
9. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_5_A3_Step_2c) and click the SELECT button.
10. Select RUN ONCE. You will be prompted to confirm the file name.

Step 2d

1. Select Target Setup button to bring up the Synchronous Target Setup window.
2. Select the (Sync) Setup.. button to bring up the Synchronous Interference Setup window.
3. Set Channel 1 RF Level Min to -84 dBm.
4. Set Channel 1 RF Level Max to -84 dBm.
5. Select EXIT to return to the Synchronous Target Setup window and EXIT to return to the Synchronous Interference Test Setup window.
6. Select the Compile Scenario button.
7. Go to the Save to File function in the GUI FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2d.bin and select the Save GUI Setup button to save the data entered in the previous steps.
8. Go to the lower Scenario Name function in the SCENARIO FILES area and type in the file name 2_4_4_4_2_5_A3_Step_2d and select the SAVE button to save the data that was compiled from the GUI entries. You will be prompted to enter a brief description that will be stored with the file. Type: S/I=12.
9. Go to the upper Scenario Name function in the SCENARIO FILES area, select the Browse button and select the file that was just created (2_4_4_4_2_5_A3_Step_2d) and click the SELECT button.
10. Select RUN ONCE. You will be prompted to confirm the file name.

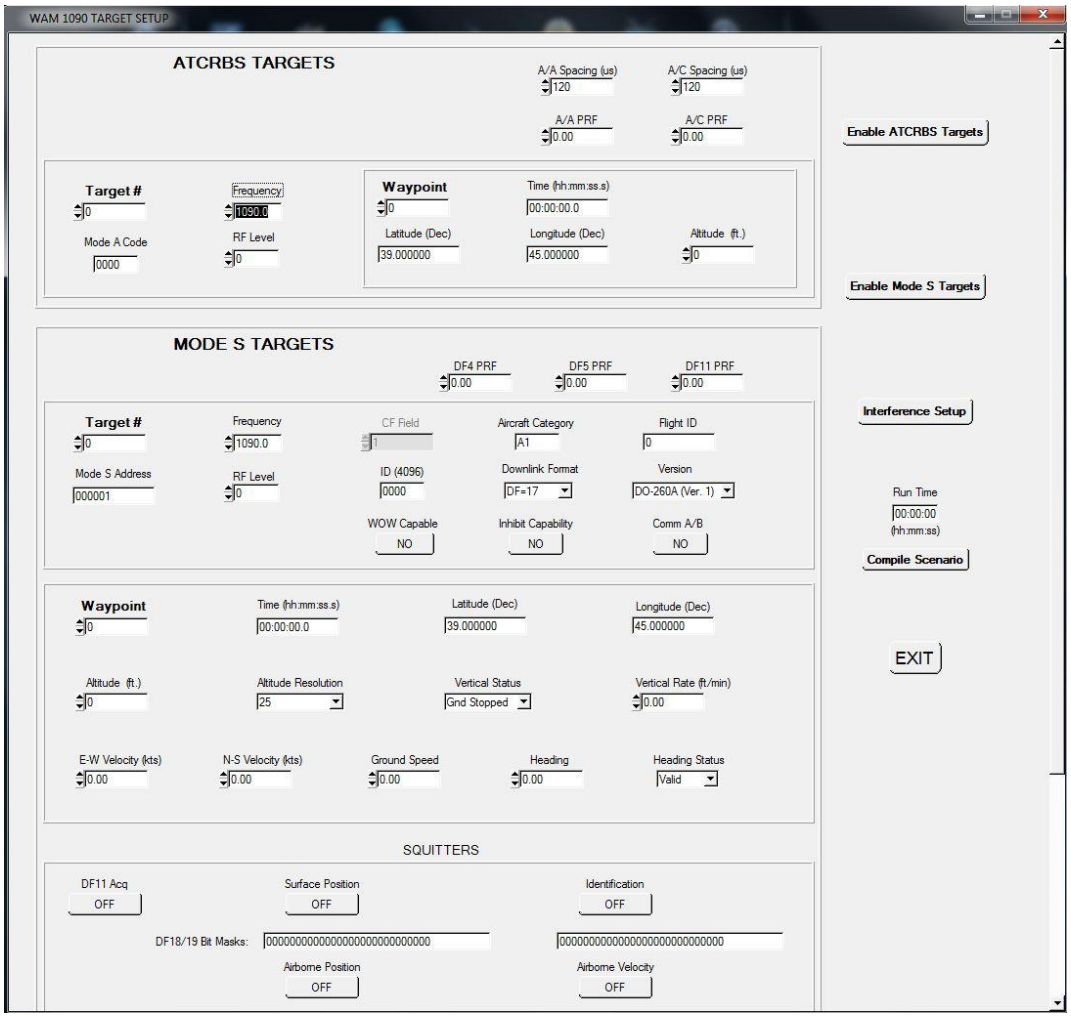
1.7 WAM (Moving Targets)

The WAM (Wide Area Multilateration) mode is used to define, store and run WAM scenarios. The SQTR-2M provides capability for connecting of up to four (4) WAM ground station receivers using front panel connectors and can generate 1090 MHz (Mode S and ATCRBS) and Universal Access Transceiver (UAT) targets. Channels 0 to 3 are used to generate the WAM targets. Channels 4 and 5 are used to generate interference targets.



From the opening screen, select WAM (Moving Targets) to access the WAM Squitter Generator GUI shown above. From this screen, you can load and save GUI And Scenario Files, select Lat/Long Units, Manual Commands, and Scenario Run time in the same manner as with the Synchronous and Asynchronous screens.

1.7.1 WAM 1090 Target Setup



Select 1090 Targets on the WAM Squitter Generator screen to access the WAM 1090 Target Setup Screen. The SQTR-2M can simulate ATCRBS (10 moving & 240 stationary) and Mode S (20 moving & 480 stationary) targets.

For each ATCRBS target by Target #, the test set can be configured for:

- RF Frequency
- Waypoints for simulation of movement (Non-moving targets only have Waypoint 0)
- Target altitude for each target
- Mode A (4096) code for each target
- RF level
- Mode A to Mode A spacing
- Mode A to Mode A PRF
- Mode A to Mode C spacing
- Mode A to Mode C PRF

For each Mode S target by Target #, the test set can be configured for:

- Mode S address
- RF frequency
- RF level
- Mode S 4096 code

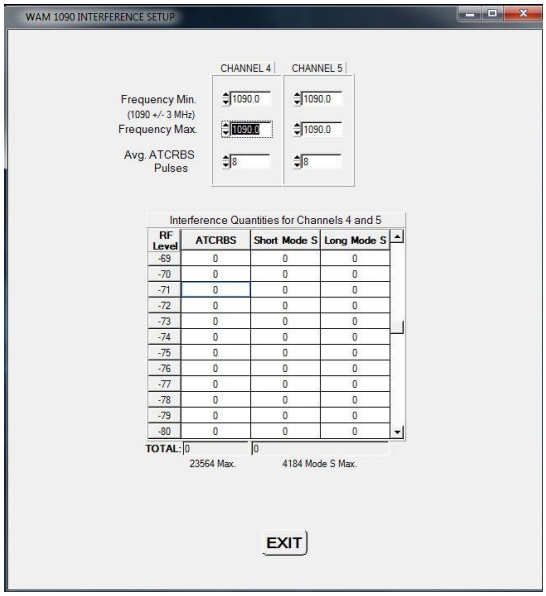
- CF field (if Downlink Format is set to DF=18)
- Aircraft Category
- Flight ID
- WOW Capability (not the state of WOW)
- Inhibit Capability – the ability to inhibit acquisition squitters during extended squitter transmissions
- Comm A/B Capability (if Downlink Format is set to DF=17)
- Downlink Format (DF17, DF18 or DF19)
- Transponder version (DO-260 Ver. 0, DO-260A Ver. 1, and DO-260B Ver. 2)
- PRF for DF4, DF5, and DF11 Latitude
- Waypoint number for moving targets (stationary targets only have Waypoint 0)
- Longitude
- Latitude
- Altitude
- Altitude Resolution – 25 or 100 foot
- E-W velocity
- N-S velocity
- Vertical Rate
- Ground Speed
- Heading
- Heading Status
- Vertical Status

At the bottom of this screen are buttons to turn ON/OFF each type of squitter: DF11 acquisition, Surface Position, Airborne Position, Airborne Velocity, Identification, Operational Status, and Emergency Status. Fields are provided for entering DF18/19 bit masks for each of the Squitter types. It is important to remember that the appropriate squitter types must be turned on. DF4, DF5, and DF11 Replies can be turned ON/OFF with a field for entering data bits.

The Enable ATCRBS Targets and Enable Mode S Targets buttons allows access to screens which allow test set user to turn targets ON or OFF.

The Interference Setup button allows access to a screen where Interference targets can be configured. Interference targets are randomly generated based on the information setup on this screen including:

- Frequency Minimum and Maximum
- Average number of pulses contained in the ATCRBS targets
- RF level and number of targets (ATCRBS, Short Mode S, and Long Mode S) - Maximum number of interference targets is 23,564 each ATCRBS and 4,184 each Mode S

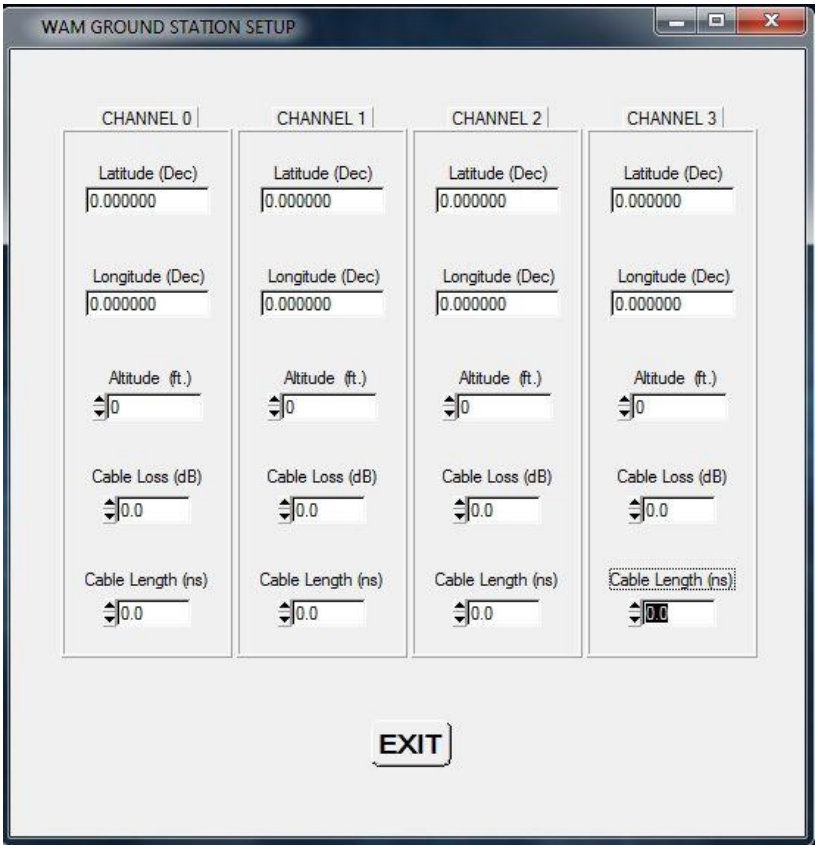


1.7.2 WAM Ground Station Setup

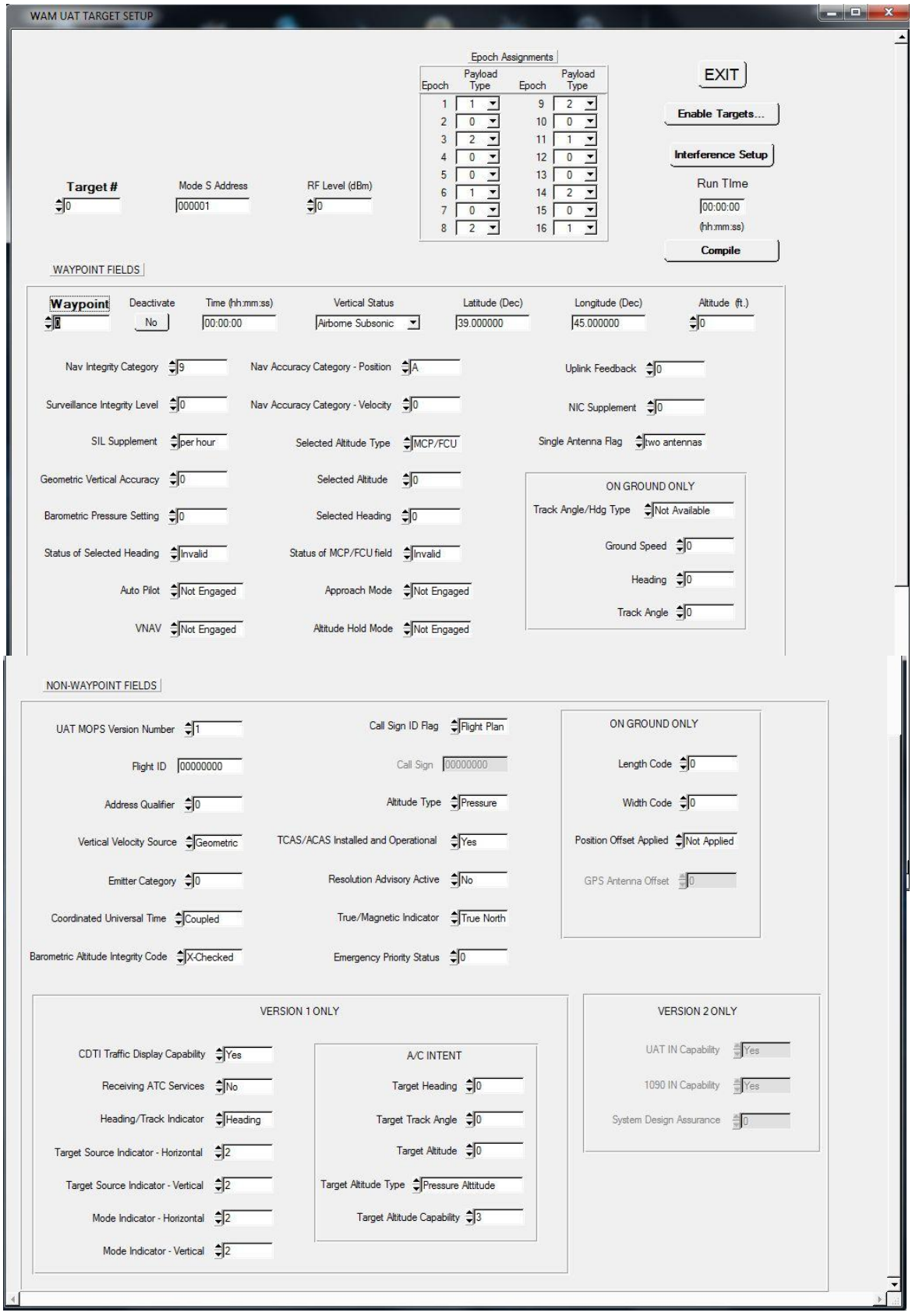
Select Ground Station on the WAM Squitter Generator screen to access the setup screen for the Ground Stations.

The Ground Station Setup allows test set user to enter parameters for the four (4) Ground Stations including:

- Latitude
- Longitude
- Altitude
- Cable Loss between SQTR-2 MLAT connector and Ground Station Receiver
- Cable Length in nanoseconds (this value is used for control of the Time of Arrival for each channel)



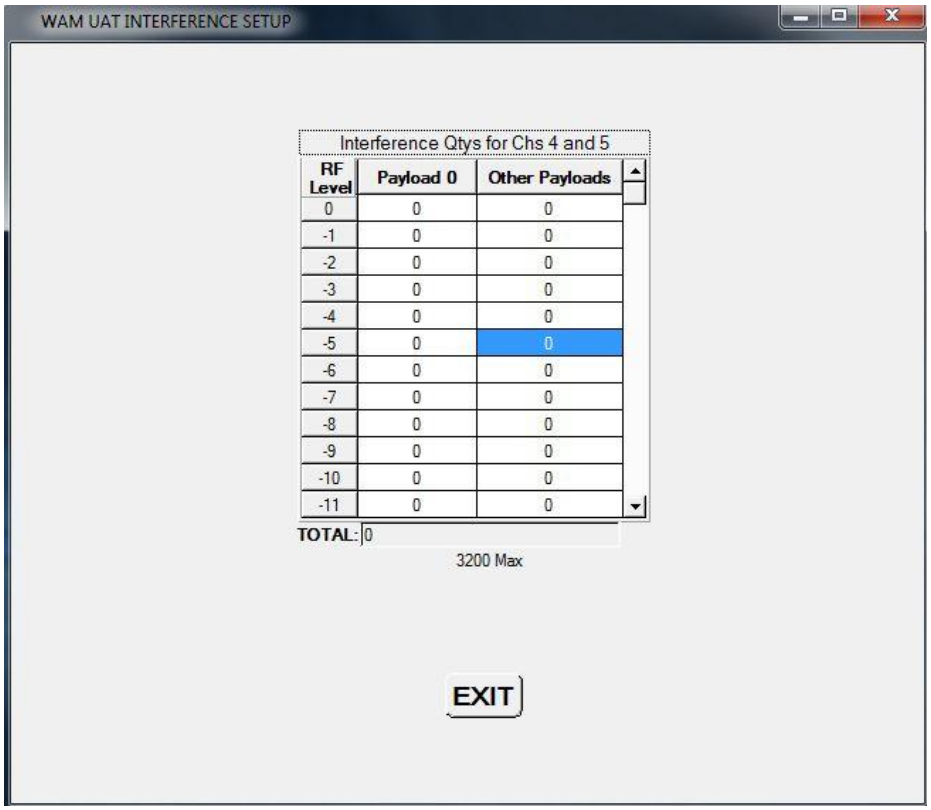
1.7.3 WAM UAT Target Setup



Select the UAT Target Setup button on the WAM Squitter Generator screen to access the UAT Target Setup screen. The SQTR-2M can be configured to generate UAT targets (10 moving and 240 stationary). Data for each target can be entered using the WAM UAT Target Setup screen. The Enable Targets button will provide access to the Target Enable screen for turning each target ON or OFF and to enable waypoints for the 10 moving targets.

The Interference Setup button allows access to the UAT Interference Setup screen.

The UAT Interference Screen allows setup of the RF Level for Payload) and Other Payloads. The maximum number of Interference targets is 3,200.



After all setup has been completed, the data contained in the various screen will be saved in a Scenario using one of several Compile buttons. It is recommended that the Scenario be saved on the WAM Squitter Generator screen. The WAM Squitter Generator screen allows a compiled scenario to be saved to a location on the computer hard drive. You can save a scenario for 1090 or UAT targets.