

SC Requirements to Design Traceability

SC Version 3.1.0

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| **Requirement Number** | **Requirement Text** | **Software Design Element** | **Applicable Software Functions** | |
| SC1000 | Upon receipt of a No-Op command, SC shall increment the SC Valid Command Counter and generate an event message. | Execution | SC\_NoOpCmd | |
| SC1001 | Upon receipt of a Reset command, SC shall reset the following housekeeping variables to a value of zero:  a) Valid Command Counter  b) Command Rejected Counter  c) ATS Command Counter  d) ATS Command Error Counter  e) RTS Command Counter  f) RTS Command Error Counter  g) Number of RTS Started Counter  h) Number of RTS Started Error Counter | Execution | SC\_ResetCountersCmd | |
| SC1002 | For all SC commands, if the length contained in the message header is not equal to the expected length, SC shall reject the command and issue an event message. | Execution | SC\_VerifyCmdLength  SC\_NoOpCmd  SC\_ResetCountersCmd  SC\_StartAtsCmd  SC\_StopAtsCmd  SC\_StartRtsCmd  SC\_StopRtsCmd  SC\_DisableRtsCmd  SC\_EnableRtsCmd  SC\_GroundSwitchCmd  SC\_JumpAtsCmd  SC\_ContinueAtsOnFailureCmd  SC\_AppendAtsCmd  SC\_TableManageCmd  SC\_StartRtsGrpCmd  SC\_StopRtsGrpCmd  SC\_DisableRtsGrpCmd  SC\_EnableRtsGrpCmd | |
| SC1004 | If SC accepts any command as valid, SC shall execute the command, increment the SC Valid Command Counter and issue an event message. | Execution | SC\_NoOpCmd  SC\_ResetCountersCmd  SC\_StartAtsCmd  SC\_StopAtsCmd  SC\_StartRtsCmd  SC\_StopRtsCmd  SC\_DisableRtsCmd  SC\_EnableRtsCmd  SC\_GroundSwitchCmd  SC\_JumpAtsCmd  SC\_ContinueAtsOnFailureCmd  SC\_AppendAtsCmd  SC\_TableManageCmd  SC\_StartRtsGrpCmd  SC\_StopRtsGrpCmd  SC\_DisableRtsGrpCmd  SC\_EnableRtsGrpCmd | |
| SC1005 | If SC rejects any command, SC shall abort the command execution, increment the SC Command Rejected Counter and issue an error event message. | Execution | SC\_NoOpCmd  SC\_ResetCountersCmd  SC\_StartAtsCmd  SC\_StopAtsCmd  SC\_StartRtsCmd  SC\_StopRtsCmd  SC\_DisableRtsCmd  SC\_EnableRtsCmd  SC\_GroundSwitchCmd  SC\_JumpAtsCmd  SC\_ContinueAtsOnFailureCmd  SC\_AppendAtsCmd  SC\_TableManageCmd  SC\_StartRtsGrpCmd  SC\_StopRtsGrpCmd  SC\_DisableRtsGrpCmd  SC\_EnableRtsGrpCmd  SC\_ProcessCommand  SC\_VerifyCmdLength | |
| SC2000 | SC shall define <PLATFORM\_DEFINED> bytes of storage for each of two (2) Absolute Time-tagged command Sequence (ATS) tables. | Execution | SC\_InitTables | |
| SC2000.1 | SC shall resolve time to 1 second for Absolute Time Command Sequences (ATS). | Execution | SC\_ProcessAtpCmd  SC\_ProcessRequest | |
| SC2000.2 | SC shall accept a maximum of <PLATFORM\_DEFINED> commands per ATS. | Execution | SC\_InitTables | |
| SC2000.3 | SC shall accept a variable number of variable length commands from each ATS. Each ATS command shall contain:  a) A command number  b) A time tag denoting the time at which to execute the command  c) A variable length command | Execution | SC\_LoadDefaultTables  SC\_ProcessAtpCmd | |
| SC2000.4 | SC shall use the <PLATFORM\_DEFINED> time format (UTC or TAI). | Execution | SC\_GetCurrentTime | |
| SC2001 | Upon receipt of a table update indication for an ATS Table, SC shall validate the following for the ATS table:   a) Duplicate command numbers   b) Invalid command lengths   c) Commands that run off of the end of the table   d) Command number | Execution | SC\_ValidateAts  SC\_VerifyAtsTable  SC\_VerifyAtsEntry | |
| SC2002 | SC shall allocate <PLATFORM\_DEFINED> Relative Time-tagged Sequences (RTSs) with each capable of storing <PLATFORM\_DEFINED> bytes of stored command data. | Execution | SC\_InitTables  SC\_RegisterAllTables | |
| SC2002.1 | SC shall resolve time to 1 second for Relative Time Command Sequences (RTS). | Execution | SC\_ProcessRtpCommand  SC\_ProcessRequest | |
| SC2002.2 | SC shall accept variable length packed RTS commands within the <PLATFORM\_DEFINED> byte relative time-tagged sequences. | Execution | SC\_InitTables | |
| SC2002.3 | Each individual command within the sequence shall consist of:   a) Time tag with a one second resolution   b) A variable length command, with a maximum length of <PLATFORM\_DEFINED> bytes | Execution | SC\_LoadDefaultTables  SC\_ProcessRtpCommand | |
| SC2003 | Upon receipt of a table update indication for an RTS Table, SC shall set the RTS status to DISABLED. | Execution | SC\_TableManageCmd  SC\_ManageRtsTable  SC\_LoadRts | |
| SC2004 | SC shall execute commands in the ATS table in ascending order, based upon the time-tag of the commands, regardless of the order in which the commands are stored in the ATS table. | Execution | SC\_ProcessAtpCmd  SC\_GetNextAtsCommand | |
| SC2005 | SC shall execute no more than <PLATFORM\_DEFINED> commands per second from all currently executing RTS tables and/or ATS tables. | Execution | SC\_ProcessRequest |
| SC2005.1 | SC shall defer execution of pending RTS commands, when the combined execution count, of ATS and RTS, exceeds the command per second limit. | Execution | SC\_ProcessRequest | |
| SC2005.2 | SC shall allow up to the maximum number of defined RTSs to be active concurrently. | Execution | SC\_ProcessRequest | |
| SC2006 | SC shall execute the RTSs in priority order based on the RTS number where RTS #1 has the highest priority. | Execution | SC\_ProcessRtpCommand  SC\_GetNextRtsCommand | |
| SC2007 | SC shall define <PLATFORM\_DEFINED> bytes of storage for an ATS Append Table. | Execution | SC\_RegisterAllTables  SC\_InitTables | |
| SC2007.1 | The ATS Append Table format is the same as the ATS tables | Execution | SC\_RegisterAllTables | |
| SC2008 | Upon receipt of an Apply ATS Append Table command SC shall append the ATS Append Table contents to the command-specified ATS table.. | Execution | SC\_AppendAtsCmd  SC\_ProcessAppend | |
| SC2008.1 | The Append command may be performed on either ATS table. | Execution | SC\_AppendAtsCmd | |
| SC2008.2 | If the number of entries in the ATS and ATS Append Table exceeds the size of the ATS table SC shall reject the Apply ATS Append Table command. | Execution | SC\_AppendAtsCmd | |
| SC2008.3 | The Apply ATS Append Table command shall add all ATS Append Table data to the end of the command-specified ATS table. | Execution | SC\_ProcessAppend | |
| SC2008.4 | The Apply ATS Append Table command shall provide the ability to add new commands to the ATS buffer | Execution | SC\_ProcessAppend | |
| SC2008.5 | The Apply ATS Append Table command shall provide the ability to modify existing commands in the ATS buffer | Execution | SC\_ProcessAppend | |
| SC2008.6 | Upon completion of the Apply ATS Append Table Command, SC shall issue an info event message indicating the number of commands that were appended to the ATS | Execution | SC\_AppendAtsCmd  CFE\_EVS\_SendEvent | |
| SC2008.7 | Upon completion of the Apply ATS Append Table Command, SC shall recompute the command execution sequence. | Execution | SC\_BuildTimeIndexTable  SC\_ProcessAppend | |
| SC2009 | Upon receipt of a table update indication for an ATS Append Table, SC shall validate the following for the ATS table:  a) Duplicate command numbers  b) Invalid command lengths  c) Commands that run off the end of the table  d) Command number | Execution | SC\_TableManageCmd  SC\_ManageAppendTable | |
| SC3000 | Upon receipt of a Start ATS command, SC shall start the command-specified ATS provided all of the following conditions are satisfied:  a) The command-specified ATS table identification is valid  b) The ATS table contains at least one command  c) Neither of the two ATS tables is currently executing | Execution | SC\_StartAtsCmd  SC\_BeginAts | |
| SC3000.1 | SC shall mark all ATS commands with time less-than the current time as SKIPPED and an event message shall be generated. | Execution | SC\_BeginAts | |
| SC3000.3 | Prior to the dispatch of each individual ATS command, SC shall verify the Data Integrity Check Value of the stored command. | Execution | SC\_ProcessAtpCmd  CFE\_MSG\_ValidateChecksum | |
| SC3000.3.1 | For any ATS command which fails the Data Integrity Check Value, the following shall be performed:   a) Discard the command   b) Mark the command with DATA INTEGRITY CHECK VALUE VERIFICATION FAILED   c) Issue an event message | Execution | SC\_ProcessAtpCmd  CFE\_EVS\_SendEvent | |
| SC3000.3.2 | If the Continuation Execution of ATS On Error Flag is Disabled, SC shall terminate the execution of the ATS. | Execution | SC\_ProcessAtpCmd  SC\_KillAts | |
| SC3001 | Upon receipt of a Stop ATS Command, SC shall   a) Stop processing the currently executing ATS   b) Set the state of that ATS to IDLE | Execution | SC\_StopAtsCmd | |
| SC3001.1 | If no ATS is executing, SC shall increment the Valid Command Counter. | Execution | SC\_StopAtsCmd  SC\_KillAts | |
| SC3002 | Upon receipt of a Switch ATS Command, SC shall   a ) Terminate the processing of the current ATS table after processing all of the commands within the current second   b) Start processing of the alternate ATS table | Execution | SC\_GroundSwitchCmd  SC\_ToggleAtsIndex  SC\_KillAts  SC\_BeginAts | |
| SC3002.1 | SC shall begin processing the first ATS command after the next 1 second occurs containing a time which is greater-than-or-equal-to the current time. | Execution | SC\_GroundSwitchCmd  SC\_ServiceSwitchPend | |
| SC3002.2 | SC shall mark all ATS commands with time less-than the current time as SKIPPED and an event message shall be generated. | Execution | SC\_GroundSwitchCmd | |
| SC3002.3 | If the alternate ATS table has not been loaded, SC shall reject the command. | Execution | SC\_GroundSwitchCmd | |
| SC3002.4 | If the Switch command is located within an ATS, SC shall immediately execute the switch command. | Execution | SC\_InlineSwitch  SC\_KillAts  SC\_BeginAts | |
| SC3003 | Upon receipt of a Jump Command, SC shall transfer execution to the command within the currently executing ATS table whose time-tag is equal to a command-specified time value. | Execution | SC\_JumpAtsCmd  SC\_CompareAbsTime | |
| SC3003.1 | If no command exists that is equal to the command-specified jump time, SC shall wait for the first command after the jump time. | Execution | SC\_JumpAtsCmd | |
| SC3003.2 | If the command-specified time value is less-than or equal-to the current time, SC shall skip all of the commands in the past. | Execution | SC\_JumpAtsCmd  SC\_CompareAbsTime | |
| SC3003.2.1 | The status of all ATS commands skipped over as a result of the Jump command shall be marked as SKIPPED and an event message shall be generated. | Execution | SC\_JumpAtsCmd | |
| SC3003.2.2 | If all of the commands in the ATS have been skipped, SC shall stop the ATS and issue an event message. | Execution | SC\_JumpAtsCmd  SC\_KillAts  CFE\_EVS\_SendEvent | |
| SC3003.3 | If neither of the two ATS tables are currently executing, SC shall reject the Jump command. | Execution | SC\_JumpAtsCmd | |
| SC3003.4 | If multiple commands exist that satisfy the JUMP condition, the commands shall be executed in ascending command number order (as they exist in the ATS table). | Execution | SC\_JumpAtsCmd | |
| SC3004 | Upon receipt of an Enable Continuation Execution of ATS On Error Command, SC shall set the Continuation Execution of ATS On Error Flag to ENABLED. | Execution | SC\_ContinueAtsOnFailureCmd | |
| SC3005 | Upon receipt of a Disable Continuation Execution of ATS On Error Command, SC shall set the Continuation Execution of ATS On Error Flag to DISABLED. | Execution | SC\_ContinueAtsOnFailureCmd | |
| SC4000 | Upon receipt of a Start RTS Command, SC shall execute the command-specified RTS, or range of RTS, provided all of the following conditions are met:   a)The command-specified RTS, or range of RTS, is not currently executing   b) The RTS, or range of RTS, table(s) is Enabled   c) The RTS, or range of RTS, table(s) has been Loaded | Execution | SC\_StartRtsCmd | |
| SC4000.1 | If the conditions are met, SC shall issue an event message indicating the RTS started if the RTS number is less than <PLATFORM\_DEFINED> RTS number. | Execution | SC\_StartRtsCmd | |
| SC4000.2 | If the conditions are not met, SC shall reject the command and send an event message. | Execution | SC\_StartRtsCmd | |
| SC4001 | SC shall dispatch commands within the RTS table, in position order, as the relative time-tag specified in the RTS command expires. | Execution | SC\_GetNextRtsCommand | |
| SC4001.1 | The time-tag shall be interpreted as the number of seconds to delay relative to the previous RTS command dispatched from that RTS table. | Execution | SC\_GetNextRtsTime | |
| SC4001.2 | For the first command in an RTS table, the delay time shall be relative to the receipt of the RTS Start Command. | Execution | SC\_StartRtsCmd  SC\_ComputeAbsTime | |
| SC4001.3 | Prior to the dispatch of each individual RTS command, SC shall verify the validity of the following command parameters:  a) RTS command length  b) Embedded command Data Integrity Check Value | Execution | SC\_ProcessRtpCommand  SC\_GetNextRtsCommand  CFE\_MSG\_ValidateChecksum | |
| SC4001.3.1 | In the event an RTS command fails the validation checks, SC shall:  a) Discard the invalid RTS command  b) Generate an event message    c) ABORT the execution of that specific RTS | Execution | SC\_ProcessRtpCommand  CFE\_EVS\_SendEvent | |
| SC4001.4 | Upon completion of the execution of the RTS, SC shall send an event message indicating that the RTS completed. | Execution | SC\_GetNextRtsCommand | |
| SC4002 | SC shall terminate the execution of an RTS table upon detection of:  a) A Stop RTS Command within the RTS command table  b) Null data  c) The physical end of the RTS table | Execution | SC\_ProcessRtpCommand  SC\_KillRts | |
| SC4003 | Upon receipt of a Stop RTS Command, SC shall terminate the execution of the command-specified RTS table, or range of RTS table. | Execution | SC\_StopRtsCmd  SC\_KillRts | |
| SC4004 | Upon receipt of an Enable RTS Command, SC shall set the status of the command-specified RTS to Enabled. | Execution | SC\_EnableRtsCmd | |
| SC4005 | Upon receipt of an Disable RTS Command, SC shall set the status of the command-specified RTS to Disabled. | Execution | SC\_DisableRtsCmd | |
| SC4005.1 | If the RTS is currently executing when the Disable RTS Command is received, the current execution of this RTS table shall:  a) Be executed until completion  b) Set to RTS state to Disabled, preventing it from future execution | Execution | SC\_DisableRtsCmd | |
| SC8000 | SC shall generate a housekeeping message containing the following:  a) Valid Command Counter  b) Command Rejected Counter  c) Total count of commands dispatched from ATSs  d) Total count of commands dispatched from RTSs  e) Total count of commands which failed dispatch from ATSs  f) Total count of commands which failed dispatch from RTSs  g) ATS Table #1 free byte count h) ATS Table #2 free byte count  i) Absolute Time Command Processing State  j) Identifier of the active ATS table   k) Number of the next ATS command pending execution  l) ATS switch pending flag  m) Time the next ATS command is due to be dispatched  n) The identifier of the ATS table for which the most recent ATS command failed to dispatch  o) The identifier of most recent ATS command which failed to dispatch from the ATS tables  p) RTS table activation count  q) RTS table activation error count  r) Number of active RTSs  s) Identifier of the next RTS table to dispatch a command  t) Time the next RTS command is due to be dispatched  u) Execution status for each RTS table  v) Enable status for each RTS table  w) Identifier of the RTS table for which the most recent RTS command dispatch error occurred  x) The word offset within the RTS for the most recent RTS command which failed to dispatch   y) ATS Continue-On-Failure status z) The last append ApId  aa) The last ATS Append Table command count  bb) The last appended count | Execution | SC\_SendHkPacket | |
| SC9000 | Upon a power-on or processor reset SC shall initialize the following Housekeeping data to Zero (or value specified):   a) Valid Command Counter   b) Command Rejected Counter   c) Total count of commands dispatched from ATSs   d) Total count of commands dispatched from RTSs   e) Total count of commands which failed dispatch from ATSs   f) Total count of commands which failed dispatch from RTSs   g) ATS Table #1 free byte count   h) ATS Table #2 free byte count   i) Absolute Time Command Processing State - DISABLED   j) Identifier of the active ATS table - None   k) Number of the next ATS command pending execution   l) ATS switch pending flag   m) Time of the next ATS command dispatch   n) The identifier of the ATS table for which the most recent ATS command failed to dispatch   o) The identifier of most recent ATS command which failed to dispatch from the ATS tables   p) RTS table activation count   q) RTS table activation error count   r) Number of active RTSs   s) Identifier of the next RTS table to dispatch a command   t) Time the next RTS command is due to be dispatched   u) Execution status for each RTS table - IDLE   v) Status for each RTS table - DISABLED   w) Identifier of the RTS table for which the most recent RTS command dispatch error occurred   x) The word offset within the RTS for the most recent RTS command which failed to dispatch   y) ATS Continue-On-Failure status <PLATFORM\_DEFINED>   z) The last append ApId   aa) The last ATS Append Table command count   bb) The last appended coun | Initialization | SC\_AppInit | |
| SC9004 | Upon a power-on reset, SC shall start RTS #1. | Initialization | SC\_ProcessRequest  SC\_AutoStartRts  SC\_AppInit  CFE\_ES\_GetResetType | |
| SC9005 | Upon a processor reset, SC shall start RTS #2. | Initialization | SC\_ProcessRequest  SC\_AutoStartRts  SC\_AppInit  CFE\_ES\_GetResetType | |