

## DAC 2202 / 2302 Command Description

### Approval:

| Approving Authority    | Signature                           | Date       |
|------------------------|-------------------------------------|------------|
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### Revision History

| Revision | Description of Change                                                                                                                                                                               | Date     |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| E        | Added new CommIF Commands ([L, [O, [Q, [S, [T, [X and [Y)                                                                                                                                           | 05/18/10 |
| F        | Added new Ku/X Band Tracking Display Index                                                                                                                                                          | 07/09/10 |
| G        | Updated CommIF section to indicate built-in command help.                                                                                                                                           | 10/15/10 |
| H        | Update Tracking Display table, added OpenAMIP X command, [M CommIF command and \0065, \0066, \0067 and \0082 ACU commands.                                                                          | 02/28/11 |
| I        | Revision Skipped.                                                                                                                                                                                   |          |
| J        | Updated CommIF section to include new commands for parameter dumping to the command prompt.                                                                                                         | 04/18/11 |
| K        | Added commands for Dual Reflector Switching<br>Updated PCU Error Status Word<br>Added Tracking Display Index of 1 and 128<br>Updated Tracking Display and Voltage for Tracking Display Index of 190 | 06/27/11 |

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|              |                          |                             |
|--------------|--------------------------|-----------------------------|
| Page 1 of 17 | <b>Sea Tel</b><br>COBHAM | Document No<br>127060 Rev-K |
|--------------|--------------------------|-----------------------------|

### ***Recent Software Versions***

Denoted version below indicates from that version forward.

| Revision | DAC 2202 Version | DAC 2302 Version | CommIF Version   |
|----------|------------------|------------------|------------------|
| H        | 6.08             | 7.08             | 1.15             |
| I        | Revision Skipped | Revision Skipped | Revision Skipped |
| J        | 6.08             | 7.08             | 1.15c            |
| K        | 6.08g            |                  | 1.15p            |

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## DAC 2202 / 2302 Command Description

### 1.0 COMMAND SUMMARY

| <u>CONTROL CODES:</u> | <u>FUNCTION</u>                                                               |
|-----------------------|-------------------------------------------------------------------------------|
| Aaaaa.↓               | Move Azimuth to 'aaa.a' degrees.                                              |
| Baaaa.↓               | Set ships heading to 'aaa.a' degrees.                                         |
| baaaa.↓               | Set ships heading to 'aaa.a' degrees without changing azimuth.                |
| C                     | Tracking (Step Track / DishScan) ON.                                          |
| cnnnn.↓               | Set MHz tuning to 'nnnn' MHz. Set DVB/RF modes for 'nnnn' = 0032 to 0049.     |
| D                     | Tracking (Step Track / DishScan) OFF.                                         |
| dnnnn.↓               | Set Baudrate to 'nnnn'*4 kSPS. Set KHz tuning to 'nnnn' kHz.                  |
| Eaaaa.↓               | Move Elevation to 'aaa.a' degrees.                                            |
| F.↓                   | Target the satellite defined by the current parameter settings (Find).        |
| gnnn.↓                | Set 24v polang position to 'nnn'.                                             |
| help.↓                |                                                                               |
| hnnn.↓                | Set 5v PWM polang position to 'nnn'.                                          |
| laaaa.↓               | Move Cross Level to 'aaa.a' degrees.                                          |
| i,j,kxxxx.↓           | Differential Cl, Lv, Az target commands (see individual descriptions).        |
| Jaaaa.↓               | Move azimuth to ship relative 'aaa.a' degrees.                                |
| Lnnnn.↓               | External modem Lock update.                                                   |
| labcd.↓               | Lumped i, j, k differential command (see detailed description).               |
| mAnnn.↓               | Set or Read DAC parameter at index 'A' with value 'nnn'.                      |
| Nnnn.↓                | Renamed to '_nnn.↓'.                                                          |
| nAnnn.↓               | Set or Read PCU "N" parameter at index 'A' with value 'nnn'.                  |
| Oxxxx.↓               | Set PCU Digital output ports to 'xxxx'.                                       |
| R                     | Begin Spiral search.                                                          |
| Tnnnn.↓               | Set satellite longitude to 'aaa.a' degrees West and go there.                 |
| txxxx.↓               | Set target NID to 'xxxx'.                                                     |
| U                     | Disabled, was force cable unwrap (limited azimuth antennas only).             |
| W                     | Write parameters to NV RAM. Use '\0087.↓'.                                    |
| wAxxx.↓               | Send Utility command 'Axxx' to DVB receiver. See section 2.3 for details.     |
| Xnnn.↓                | Set azimuth step track / DishScan sensitivity to 'nnn' steps. (0-255, 0-15)   |
| Ynnn.↓                | Set elevation step track / DishScan sensitivity to 'nnn' steps. (0-255, 0-15) |
| Znnnn.↓               | Reserved for Start diagnostic test 'nnnn'.                                    |
| #xxxx.↓               | Send extended Utility / Flash programming command to selected device.         |
| \$mmmm.↓              | NMEA Latitude - Longitude / Heading input (GLL / HDT / HDM format).           |
| [Annnn.↓              | Send Utility command 'A' or 'Annnn' to Comm IF module. See section 2.4.       |
| \nnnn.↓               | Send Utility command '\nnnn' to ACU. See section 2.2 for details              |
| ^nnnn.↓               | Send Utility command '^nnnn' to PCU. See PCU command summary.                 |
| _nnn.↓                | Set step track integral to 'nnn' (was 'Nnnn'). (0-255)                        |
| esc                   | Cancel pending command.                                                       |

## DAC 2202 / 2302 Command Description

### MONITOR CODES:

|      |                                     |
|------|-------------------------------------|
| H    | Relative Az, Ship Heading           |
| P    | Az/EI/CI Position Decimal           |
| p    | Az/EI/CI Position Hex               |
| q    | Read Tuning Frequencies, Rec NID    |
| S    | DAC Status/Signal Strength          |
| u    | Read Polang, Aux/Ext AGC, Threshold |
| V    | Software Version                    |
| %    | Read Signal Strength                |
| &    | Clear Error Status                  |
| ?a↵  | Remote Monitor Request              |
| ?@ ↵ | Qualified Lat/Lon Position, 1 min   |
| @    | Report Lat / Lon Position, 0.1 deg  |

### DAC RESPONSE

RaaaaHaaaa \r\n >  
EaaaaAaaaaCaaaa \r\n >  
ExxxxAxxxxCxxxx \r\n >  
Qnnnnn nnnn xxxx \r\n >  
S@@@@Lnnnn RL \r\n >  
GnnnnU/VnnnnTnnnn \r\n >  
DAC-2X02 VER n.nn \r\n >  
Lnnnn RL \r\n >  
None  
PCU response to 'a' + \r\n  
DDmm,N,DDDmm,W,A \r\n  
NDDdWDDd \r\n >

### ABBREVIATIONS:

|             |                                           |
|-------------|-------------------------------------------|
| aaaa        | ASCII number of degrees in tenths.        |
| xxxx        | ASCII hex I/O data 0000 – FFFF range      |
| nnnnn       | ASCII decimal number (0000 - 99999)       |
| nnnn        | ASCII decimal number (0000 - 9999)        |
| nnn         | ASCII decimal number (0 - 255)            |
| sss         | ASCII string of characters.               |
| DDd         | Lat/Lon in degrees (DDD), decimal deg (d) |
| DDmm        | Lat/Lon in degrees (DDD), minutes (mm)    |
| @@ or RL    | ASCII System Status words defined below   |
| If or \n    | Line Feed (New Line)                      |
| ↵, cr or \r | Carriage Return (Enter)                   |

## DAC 2202 / 2302 Command Description

### 2.0 CONTROL CODE DETAILS

For the following descriptions, one step equals 1/24 degree for x97, x00 and x07 systems (2.0m and larger), 1/12 degree for x03, x04, x06, x09 systems (1.0m to 1.5m) and 1/6 degree for USATx systems (0.6m to 1.0m).

|         |                                                                                                                                                                                                                                                                                                                                                                                           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aaaaa.↓ | Move azimuth to aaa.a degrees true.<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                                                                                                                                                                                                                                |
| Baaaa.↓ | Set ships compass heading to aaa.a degrees. Sets Heading Valid flag (Bit 3, word 2). Resets calculated azimuth position (P command) to ships heading + azimuth relative position module 360.0 degrees. The ships heading is automatically updated by the gyro compass inputs to the ACU. Not valid for 1:1 gyro compass interface.<br>DAC Response: cr, lf, ">" when command is accepted. |
| baaaa.↓ | Set ships compass heading to aaa.a degrees without changing azimuth position. Similar to "Baaaa", this command is used to incrementally update the ships heading information when derived from a serial NMEA gyro interface.<br>DAC Response: None                                                                                                                                        |
| C       | Tracking ON. Sets TRACKING ON status flag (bit 3 word 1). Enables step track or DishScan movements. Default state OFF.<br>DAC Response: None.                                                                                                                                                                                                                                             |
| cnnnn.↓ | Sets MHz tuning for DVB or SCPC receiver when nnnn = 0050 – 2047.<br>Sets External AGC mode when nnnn = 0000.<br>Sets special DVB receiver modes when nnnn = 0032 – 0049. See page 5 for details.<br>DAC Response: "Lnnnn RL", cr, lf, ">" when command is accepted.                                                                                                                      |
| D       | Tracking OFF. Clears TRACKING ON status flag (bit 3 word 1). Disables tracking.<br>DAC Response: None                                                                                                                                                                                                                                                                                     |
| dnnnn.↓ | Sets BaudRate (Symbol Rate) for DVB receiver or KHz tuning for SCPC receiver.<br>BaudRate is set to nnnn x 4. KHz tuning is set to nnnn.<br>DAC Response: "Lnnnn RL", cr, lf, ">" when command is accepted.                                                                                                                                                                               |
| Eaaaa.↓ | Move Elevation to aaa.a degrees.<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                                                                                                                                                                                                                                   |
| F.↓     | Commands the DAC to execute a satellite target using the parameters set in memory (Find).<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                                                                                                                                                                          |
| gnnn.↓  | Set 24v Polang position to nnn. For 24v polang systems 30 to 210 corresponds to approximately -90 to +90 degrees from vertical. For 3 axis antennas, multiple gnnn.↓ commands must be sent to move the polang position to its final target.<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                        |
| hnnn.↓  | Set 5v PWM Polang position to nnn. For 5v polang systems 50 to 200 corresponds to a probe angle of approximately -90 to +90 degrees from vertical. Multiple hnnn.↓ commands must be sent to move the polang position to its final target<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                           |
| laaaa.↓ | Move Cross Level to aaa.a degrees. 90.0 degrees equals the nominal horizontal position. Used to position the antenna for high overhead pass optimization.<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                                                                                                          |

## DAC 2202 / 2302 Command Description

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ixxxx.↓ | <p>Cross Level differential position command. Command format is ASCII HEX. Angular range is 0000 – FFFF. 4000 = nominal position of 90 degrees. The command computes the difference between current command and the last valid differential or absolute command and adds this difference to the present target position. Since tracking modifies the target position, this differential method provides a method for keeping the tracking information cumulative while forward correcting the position information to keep the pointing errors to a minimum. The numeric format of this command allows 1/182 degree differential position resolution.</p> <p>DAC Response: cr, lf, "&gt;" when command is accepted.</p>                                                                                                                          |
| Jaana.↓ | <p>Move azimuth to ship relative position. Azimuth stabilization, Unwrap and Tracking mode remain active after a J command.</p> <p>DAC Response: cr, lf, "&gt;" when command is accepted.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| jxxxx.↓ | <p>Level (Elevation) differential position command. Functions just like the ixxxx command above but in the Elevation axis.</p> <p>DAC Response: cr, lf, "&gt;" when command is accepted.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| kxxxx.↓ | <p>Azimuth differential position command. Functions just like the ixxxx command above but in the Azimuth axis.</p> <p>DAC Response: cr, lf, "&gt;" when command is accepted.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Lnnnn.↓ | <p>External modem lock update. Currently an ASCII binary indicator of locked status.</p> <p>DAC Response: None.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| labcd.↓ | <p>Lumped "i", "j", "k" command. Allows up to 8 bit resolution of the differential i, j and k commands to be sent as one command with an automatic position report from the PCU to reduce the communications channel overhead. The lower 8 or 9* bits of the individual i, j and k commands are packed into ASCII characters as follows:</p> <p>a = CL lsb &amp; 11000000 /4 + LV lsb &amp; 11000000 /16 + AZ lsb &amp; 11000000 /64 + "@"</p> <p>b = CL lsb &amp; 00111111 + "@"</p> <p>c = LV lsb &amp; 00111111 + "@"</p> <p>d = AZ lsb &amp; 00111111 + "@"                      "@" = 01000000</p> <p>* For increased range, some PCU software versions expect to see the resolution reduced from 1/182 to 1/96 degrees by pre-dividing the differential commands by 2 before packing with the above scheme.</p> <p>DAC Response: None.</p> |
| mAnnn.↓ | <p>Set / Read DAC parameter at index 'A'. Sets DAC parameter at index 'A' to nnn when nnn is 000 to 255. Reads DAC parameter at index 'A' when nnn &gt; 255. See section 5 for parameter index details</p> <p>DAC Response: "m0nnn", cr, lf, "&gt;" when command is accepted.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Nnnn.↓  | <p>Replace by "_nnn.↓".</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| nAnnn.↓ | <p>Set / Read PCU 'N' parameter at index 'A'. Sets the 'N' parameter at index 'A' to 'nnn' when nnn is 000 to 255. Reads the 'N' parameter at index 'A' when nnn &gt; 255. Used to set pedestal system type, adjust individual axis gains and set reference offsets.</p> <p>DAC Response: "0nnn", cr, lf, "&gt;" when command is processed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Oxxxx.↓ | <p>Set PCU digital output port to 'xxxx'. Changes logic state of output lines DI3, DI2, DO2, DO1, DO0. Data is sent as ASCII hexadecimal. Allowable range of 'xxxx' is 0000 to 001F.</p> <p>DAC Response: cr, lf, "&gt;" when command is accepted.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| R       | <p>Starts two axis spiral search pattern for satellite (SEARCH2). Sets Searching status flag (bit 0, word 2) and Steptrack ON status flag (bit 3 word 1). Search pattern size and increment is pre-set by the DAC-2X02 Setup parameters. Search is terminated by signal level above threshold, end of search pattern or a new Az or EL position command. If no signal is found then antenna is returned to its original azimuth and elevation position.</p> <p>DAC Response: None</p>                                                                                                                                                                                                                                                                                                                                                            |

## DAC 2202 / 2302 Command Description

|           |                                                                                                                                                                                                                                                                                                                                |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| s         | Disabled. This command was multiple input receiver select but is no longer supported in DAC-03, DAC-2200 and DAC-2X02 systems with a DVB or L-Band SCPC receiver.                                                                                                                                                              |
| Tnnnn.↓   | Set Satellite Longitude to nnn.n degrees West. Set East longitude as 3600 – East longitude x 10. i.e 13.0 East is set as T3470.<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                                                                         |
| txxx.↓    | Set target NID to 'xxxx'.<br>DAC Response: cr, lf, ">" when command is accepted.                                                                                                                                                                                                                                               |
| U         | Disabled, was force cable unwrap. Previously applied to limited azimuth antennas only.<br>DAC Response: none. .                                                                                                                                                                                                                |
| W         | Write all DAC setup parameters to NVRAM / FLASH. Still supported but the general purpose ACU utility command, \0087.↓, is recommended□<br>DAC Response for either command: "W". cr, lf, ">" when FLASH write is complete                                                                                                       |
| wAxxx.↓   | Send Utility command to DVB receiver. See section 2.3 for command details.                                                                                                                                                                                                                                                     |
| Xnnn.↓    | Set azimuth step track size or DishScan sensitivity to nnn steps. Allowable range is 0 to 255 for step track, 0 to 15 for DishScan. The maximum DishScan sensitivity setting is 0. Increasing the setting by one decreases the DishScan sensitivity by a factor of 2.<br>DAC Response: cr, lf, ">" when command is accepted    |
| Ynnn.↓    | Set elevation step track size or DishScan sensitivity to nnn steps. Allowable range is 0 to 255 for step track, 0 to 15 for DishScan. The maximum DishScan sensitivity setting is 0. Increasing the setting by one decreases the DishScan sensitivity by a factor of 2.<br>DAC Response: cr, lf, ">" when command is accepted. |
| Znnnn.↓   | Reserved to start diagnostic test number 'nnnn'.                                                                                                                                                                                                                                                                               |
| #nnnn.↓   | Send extended FLASH programming string to selected module (PCU, DVB, CommIF).                                                                                                                                                                                                                                                  |
| \$mmmm.↓  | NMEA Latitude / Longitude input. Sentence format as follows:<br>\$GPGLL,DDmm.mmmm,N,DDDmm.mmmm,W (,UTC optional)(,*CS optional) <cr><br>Latitude/Longitude in Degrees, Minutes, Decimal minutes, N = North, S = South, etc.                                                                                                    |
| [Annnnn.↓ | Send Utility command to Comm IF module. See section 2.4 for command details.                                                                                                                                                                                                                                                   |
| \nnnn.↓   | Send Utility command to ACU. See section 2.2 for command details.                                                                                                                                                                                                                                                              |
| ^nnnn.↓   | Send Utility command to PCU. See PCU Command Summary document for details.                                                                                                                                                                                                                                                     |
| _nnnn.↓   | Set number of signal strength updates to accumulate for each step track movement. Allowable range is 0 to 255. A 0 setting disables step track and enables DishScan. For Step Track operation, the nominal setting is 40 to 80 (1 to 2 second accumulation time).<br>DAC Response: cr, lf, ">" when command is accepted.       |
| esc       | <escape> Cancels a pending buffered command (ALT+027).                                                                                                                                                                                                                                                                         |

## DAC 2202 / 2302 Command Description

### 2.1 RF Select - Control Code Descriptions

|         |                                                          |              |
|---------|----------------------------------------------------------|--------------|
| c0028.↓ | Set ADE Band Aux OFF(Xp) and Reflector B                 |              |
| c0029.↓ | Set ADE Band Aux ON(Cp) and Reflector B                  |              |
| c0030.↓ | Set active Reflector to Reflector A                      |              |
| c0031.↓ | Set active Reflector to Reflector B                      |              |
| c0032.↓ | Set DVB receiver tone OFF                                |              |
| c0033.↓ | Set DVB receiver tone ON                                 |              |
| c0034.↓ | Set DVB receiver volt = 13 V                             |              |
| c0035.↓ | Set DVB receiver volt = 18 V                             |              |
| c0036.↓ | Set ADE Band Aux Off (C/X, Xp, CNV1, PA off)             |              |
| c0037.↓ | Set ADE Band Aux On (KuHi/KuLo, Cp, CNV2, PA on)         |              |
| c0038.↓ | Set ADE Band V Off, BDE S2 Off (C, KuLo, 13V, Bnd1/Bnd2) |              |
| c0039.↓ | Set ADE Band V On, BDE S2 On (X, KuHi, 18V, Bnd3/Bnd4)   |              |
| c0040.↓ | Set ADE Band T, Band V, Band Aux (0,0,0)                 | Status R = @ |
| c0041.↓ | Set ADE Band T, Band V, Band Aux (0,1,0)                 | Status R = H |
| c0042.↓ | Set ADE Band T, Band V, Band Aux (0,0,1)*                | Status R = A |
| c0043.↓ | Set ADE Band T, Band V, Band Aux (0,1,1)                 | Status R = I |
| c0044.↓ | Set ADE Band T, Band V, Band Aux (1,0,0)                 | Status R = P |
| c0045.↓ | Set ADE Band T, Band V, Band Aux (1,1,0)                 | Status R = X |
| c0046.↓ | Set ADE Band T, Band V, Band Aux (1,0,1)                 | Status R = Q |
| c0047.↓ | Set ADE Band T, Band V, Band Aux (1,1,1)                 | Status R = Y |
| c0048.↓ | Set ADE Band T Off (Tone Off, Bnd1/Bnd3)                 |              |
| c0049.↓ | Set ADE Band T On (Tone On, Bnd2/Bnd4)                   |              |

\* = for the c0042 command, when TDisp is set to 230, Voltage=18.

### 2.2 ACU Utility commands

|         |                                                         |
|---------|---------------------------------------------------------|
| \0065.↓ | Perform Auto Trim.                                      |
| \0066.↓ | Perform Auto Trim and start Auto Threshold calculation. |
| \0067.↓ | Complete Auto Threshold calculation.                    |
| \0080.↓ | Start ACU FLASH Programming Mode.                       |
| \0082.↓ | Reset ACU parameters to factory defaults.               |
| \0087.↓ | Write ACU Parameters to Non Volatile storage.           |
| \0090.↓ | Reboot the ACU.                                         |

### 2.3 DVB Utility commands

|         |                                     |
|---------|-------------------------------------|
| wV***.↓ | Read DVB Version.                   |
| wS***.↓ | Read DVB Status (NID / Diagnostic). |
| wP***.↓ | Start DVB FLASH Programming Mode.   |
| w^578.↓ | Erase DVB FLASH in protected mode.  |
| w!***.↓ | End DVB command and echo response   |



## DAC 2202 / 2302 Command Description

### 2.4 Comm IF Module - Monitor and Control Descriptions

#### CONTROL CODES:

[0nnnnn  
[1nnnnn  
[2nnnnn  
[Annnnn or [A  
[Bnnnnn or [B  
[Cnnnnn or [C  
[Dxnnnnn or [Dx  
[Gnnn.nnn.nnn.nnn  
[Hsss or [H  
[Innn.nnn.nnn.nnn  
[L  
[M  
[Nnnn.nnn.nnn.nnn  
[Onnn or [O  
[Pn or [P  
[Qnnn or [Q  
[S  
[Tnnnnn  
[Unnnnn  
[W  
[Xssssssss  
[Yssssssss  
[Z

#### FUNCTION

\* Set TCP/IP-0 port number (M&C Port 0, Sea Tel)  
\* Set TCP/IP-1 port number (M&C Port 1, Sea Tel)  
\* Set TCP/IP-2 port number (M&C Port 2, OpenAMIP).  
\* Set NMEA A baud rate (NMEA Port A)  
\* Set NMEA B baud rate (NMEA Port B)  
\* Set M&C baud rate (M&C Port C)  
\* Set the local oscillator on band 'x' to nnnnn.  
\* Set Gateway address  
\* Set NEMA Heading ID selection to "sss" (typically HDT/HDM, etc).  
\* Set IP address  
Lock all other ports and front panel.  
Unlock ports and front panel.  
\* Set Net mask.  
\* Set the port enabled mask.  
\* Select preset n and target where n = (favorite number - 1) \* 2  
\* Set the port security mask.  
Start serial upload mode (for advanced users only)  
\* Set HTTP port number (Webserver).  
\* Set UDP port number (SHD Software Upload)  
Write Comm IF parameters to flash.  
\* Set the access username to "ssssssss". Must be 4-8 characters long.  
\* Set the access password to "ssssssss". Must be 4-8 characters long.  
Soft reboot the Comm IF module.

#### MONITOR CODES:

[?x.]

#### FUNCTION

View settings for 'x' where 'x' is any combination of:

- Null for CommIF settings (legacy default)
- A for Antenna Control Unit settings.
- P for Pedestal Control Unit settings
- M for Motor Control Unit firmware version
- > for Above Decks Modem firmware version
- < for Below Decks Modem firmware version
- R for Receiver firmware version
- C for CommIF settings
- Z for a parameter dump of all settings
- F for Favorites settings

Examples:

"[?" will echo CommIF settings.

"[?A" will echo ACU settings.

"[?AP" will echo ACU then PCU settings.

"[?ACP" will echo ACU then CommIF then PCU settings.

"[?APM><RC" will echo all the settings

"[?Z" is the same as typing "[?APM><RC"

[V.]

View CommIF version.

\* - 'n' or 's' is optional. If not provided, user menu prompt appears.

## DAC 2202 / 2302 Command Description

### 2.5 OpenAMIP – Antenna and Modem Command Descriptions

| <u>To Antenna</u> | <u>Description</u>                                                                                          | <u>Response</u> |
|-------------------|-------------------------------------------------------------------------------------------------------------|-----------------|
| A i               | Set keep alive in seconds. (0=off)                                                                          | 's' command     |
| B f1 f2           | Set expected receive (f1) and transmit (f2) LO frequency in MHz.                                            | None            |
| F                 | Find the satellite with the current settings.                                                               | 's' command     |
| H f1 f2           | Set target hunt IF frequency (f1) and bandwidth (f2) in MHz.                                                | None            |
| I s1 s2           | Set modem vendor (s1) and device (s2).                                                                      | None            |
| L b1 b2           | Set modem lock (b1) and free to transmit (b2) status.                                                       | None            |
| P c1 c2           | Set receive (c1) and transmit (c2) polarity.                                                                | None            |
| S f1 f2 f3        | Set satellite longitude (f1), latitude variance (f2) and satellite polarity skew (f3).                      | None            |
| W i               | Set GPS information update period in seconds. (0=off)                                                       | 'w' command     |
| X s1,s2,s3...     | Execute comma separated M&C commands s1, s2, s3, etc. as defined in the "extras" of the modem options file. | None            |

| <u>To Modem</u> | <u>Description</u>                                                                                       | <u>Response</u> |
|-----------------|----------------------------------------------------------------------------------------------------------|-----------------|
| a i             | Set keep alive in seconds. (0=off)                                                                       | 'L' command     |
| i s1 s2         | Set antenna vendor (s1) and device (s2).                                                                 | None            |
| s b1 b2         | Antenna status – functional (b1), tx allowed (b2).                                                       | None            |
| w b1 f1 f2 t1   | Set GPS position – validity flag (b1), latitude (f1) S=-, longitude (f2) W=-, time (t1) or 0 if unknown. | None            |

| <u>Abbreviations:</u> | <u>Description</u>                       |
|-----------------------|------------------------------------------|
| b                     | Binary value (0,1)                       |
| c                     | Single character value (no white space). |
| f                     | Float value (i, i. or i.i).              |
| i                     | Integer value (0-9).                     |
| s                     | String value (no white space).           |

## DAC 2202 / 2302 Command Description

### 3.0 MONITOR CODE DETAILS

- H Relative AZ / Ships Heading position report. Reports simultaneous value of Antenna Relative position and Ships heading position in tenths of degrees.  
DAC Response: "RrrrrHaaaa", cr, lf, ">"
- P Az/EI/CI Position. Response is one line of ASCII characters representing the antenna elevation, true azimuth and cross level positions in tenths of a degree.  
DAC Response: "EeeeeAaaaaCaaaa", cr, lf, ">"
- p Az/EI position. Response is one line of ASCII characters representing the antenna elevation, azimuth and cross level positions to a resolution of 0.05 degree. Data format is ASCII HEX with a range of 0000-FFFF representing 000 to 359.95 degrees.  
DAC Response: "ExxxxAxxxxCxxxx", cr, lf, ">"
- q Tuner Settings. For DVB receiver selection, response is MHz tuning, Symbol rate and Received NID. For SCPC or NBIF receiver selection, response is MHz portion, KHz portion and a null NID response. Symbol rate is displayed as Ksps rate / 4, i.e. 20,000 Ksps is displayed as 5000.  
DAC Response: "Qnnnn nnnn xxxx", cr, lf, ">"
- S DAC Status. Response is four ASCII status bytes, followed by the signal strength and Remote/Local RF switching status.  
DAC Response: "S@@@@Lnnnn RL", cr, lf, ">"

**@@@@ and RL Status Words (See page 16/17 for decoding tables):**

| WORD 1 (@)                                | WORD 2 (@)                                   |
|-------------------------------------------|----------------------------------------------|
| Bit 7 = 0                                 | Bit 7 = 0                                    |
| Bit 6 = 1                                 | Bit 6 = 1                                    |
| Bit 5 = Slow Scan Mode (PCU)              | Bit 5 = Azimuth targeting (PCU)              |
| Bit 4 = Sat Ref Mode (PCU)                | Bit 4 = Elevation/Polang targeting (PCU+ACU) |
| Bit 3 = Tracking On                       | Bit 3 = Inclined Orbit Initial Target        |
| Bit 2 = Unwrap in progress (PCU)          | Bit 2 = Block/Mute (PCU+ACU)                 |
| Bit 1 = PCU Status Bit 1 (PCU)            | Bit 1 = Initializing (PCU)                   |
| Bit 0 = PCU Status Bit 0 (PCU)            | Bit 0 = Searching                            |
| WORD 3 (ACU Errors) (@)                   | WORD 4 (PCU Errors) (@)                      |
| Bit 7 = 0                                 | Bit 7 = 0                                    |
| Bit 6 = 1                                 | Bit 6 = 1                                    |
| Bit 5 = Satellite out of range            | Bit 5 = Critical Error                       |
| Bit 4 = DishScan Disk Error               | Bit 4 = Stabilization Limit                  |
| Bit 3 = PCU Error                         | Bit 3 = AZ Reference Error                   |
| Bit 2 = PCU Communication Error           | Bit 2 = AZ Servo Limit Error                 |
| Bit 1 = Wrong Synchro Converter Type      | Bit 1 = LV Servo Limit Error                 |
| Bit 0 = Gyro Read Error                   | Bit 0 = CL Servo Limit Error                 |
| Remote RF Status Word (R)                 | Local RF Status Word (L)                     |
| Bit 7 = 0                                 | Bit 7 = 0                                    |
| Bit 6 = 1                                 | Bit 6 = 1                                    |
| Bit 5 = 0                                 | Bit 5 = Volt (18/13)                         |
| Bit 4 = Band Tone (ADE Tone)              | Bit 4 = Tone (On/Off)                        |
| Bit 3 = Band Volt (18V/13V) (legacy Tone) | Bit 3 = Force NID                            |
| Bit 2 = M2 Polang Drive                   | Bit 2 = FEC 2                                |
| Bit 1 = M1 Polang Drive                   | Bit 1 = FEC 1                                |
| Bit 0 = Band Aux (C/Ku, Xp/Cp, CNV, PA)   | Bit 0 = FEC 0                                |

## DAC 2202 / 2302 Command Description

- u Polang / ExtA/D / Threshold or Polang / AuxA/D / Threshold. Format is currently selectable by assembly option. Response is PCU polang position (Gnnnn), PCU Aux A/D (Unnnn) or External AGC (Vnnnn) and ACU Threshold (Tnnnn). Polang reading is scaled to degrees for 24 volt polang systems and polang PWM output for 5v systems.  
DAC Response: "GnnnnUnnnnTnnnn", cr, lf, ">"  
or "GnnnnVnnnnTnnnn", cr, lf, ">"
- V Software Version. ASCII string defining DAC model and software version number.  
DAC Response: "DAC-2X02 VER N.NN", cr, lf, ">"
- % Signal Strength. Response is average AGC signal strength over previous 200 mSeconds followed by the Remote and Local RF switching status. Range of AGC response is 0000 to 4095. Obsolete command now that signal strength is appended to the status word response.  
DAC Response: "LnnnnRL", cr, lf, ">"
- & Clear Error Status. Resets the DAC error code register and sends a "&" character to the PCU to clear the PCU error status.  
DAC Response: None.
- ?a. Remote PCU Monitor (Tunnel) Request. Sends the "a" monitor command to the PCU and echoes the PCU response less checksums. "a" can be any PCU Monitor request including:
- S ?S. gets PCU status.
  - V ?V. gets PCU Version Number.
  - @ ?@. gets qualified coarse (1 min) PCU GPS position.
  - ? ?? gets raw coarse PCU GPS position.
  - = ?= gets raw fine PCU GPS position.
- DAC Response: "PCU status response" + cr only. Note, no lf, ">" sequence is echoed for this command.
- @ Latitude / Longitude Position Read. Reports North/South Latitude and East/West Longitude read from DAC front panel. Value may be from manual input or automatic GPS update. Resolution is in tenths of degrees. NOTE: Higher resolution data is available from systems with built in GPS (x03, x04, x06, x97A, x97B, x07, x09 and x10 antennas) by using the "?@." command.  
DAC Response: "NDDdWDDd", cr, lf, ">".

### 4.0 GENERAL NOTES

Unless otherwise noted, the cr, lf, ">" echo indicates that the DAC has accepted a command and is ready to process the next command. Any additional commands will not be accepted until after the DAC echoes cr, lf, ">".

The nominal command latency for Monitor or Control commands to the ACU is 5 milliseconds. The nominal command latency for tunnel commands such as "?S." or "?V." is 20 milliseconds.

### 5.0 PARAMETER INDEX TABLE

The table on page 13 correlates the index value 'A' for the "mAnnn" command with the various readable and settable parameters in the DAC-2X02. For 2 byte parameters, both the upper and the lower bytes must be read or set to change the parameter. The most significant byte is always the first byte in the list. Multiply this value by 256 and add the least significant byte to get the full parameter value. For m Command Index values less than 127, you can type the "m" command + ' ASCII' index with keyboard strokes. For m Command Index values of 127 and above, type "m" + ALT (hold), 0nnn, (ALT release).

### 6.0 TDISP INDEX TABLE

The table on page 14 shows the relationship between the TDisp option settings, the c0032-c0035 individual and the c0040 – c0047 lumped ADE commands, the Status word R reply and the ADE Tone, Voltage and Aux states.

## DAC 2202 / 2302 Command Description

| Memory Allocation    | Bytes | M&C     |       | Auxiliary Command |    |           |      |       |    |       |
|----------------------|-------|---------|-------|-------------------|----|-----------|------|-------|----|-------|
|                      |       | Command |       | Count             |    | m Command |      | Hex   |    | ASCII |
|                      |       | Read    | Write | Index             |    | Index     |      | Index |    | Index |
| El Trim              | 2     |         |       | 0                 | 1  | 65        | 66   | 41    | 42 | A B   |
| Az Trim              | 2     |         |       | 2                 | 3  | 67        | 68   | 43    | 44 | C D   |
| mode                 | 1     |         |       |                   | 4  |           | 69   |       | 45 | E     |
| agc th               | 1     |         |       |                   | 5  |           | 70   |       | 46 | F     |
| El Step Size         | 1     |         | Y     |                   | 6  |           | 71   |       | 47 | G     |
| Az Step Size         | 1     |         | X     |                   | 7  |           | 72   |       | 48 | H     |
| Step Integral        | 1     |         |       |                   | 8  |           | 73   |       | 49 | I     |
| Search Inc           | 1     |         |       |                   | 9  |           | 74   |       | 4A | J     |
| Search Limit         | 1     |         |       |                   | 10 |           | 75   |       | 4B | K     |
| Search Delay         | 1     |         |       |                   | 11 |           | 76   |       | 4C | L     |
| Sweep Increment      | 1     |         |       |                   | 12 |           | 77   |       | 4D | M     |
| System Type          | 1     |         |       |                   | 13 |           | 78   |       | 4E | N     |
| Gyro Type            | 1     |         |       |                   | 14 |           | 79   |       | 4F | O     |
| Polang Type          | 1     |         |       |                   | 15 |           | 80   |       | 50 | P     |
| 24v Polang Offset    | 1     |         |       |                   | 16 |           | 81   |       | 51 | Q     |
| 24v Polang Scale     | 1     |         |       |                   | 17 |           | 82   |       | 52 | R     |
| Az Limit 1           | 2     |         |       | 18                | 19 |           | 84   | 53    | 54 | S T   |
| AZ Limit 2           | 2     |         |       | 20                | 21 |           | 86   | 55    | 56 | U V   |
| Polang Tx Type       | 1     |         |       |                   | 22 |           | 87   |       | 57 | W     |
| Error Type           | 1     |         |       |                   | 23 |           | 88   |       | 58 | X     |
| AZ Limit3            | 2     |         |       | 24                | 25 | 89        | 90   | 59    | 5A | Y Z   |
| AZ Limit4            | 2     |         |       | 26                | 27 | 91        | 92   | 5B    | 5C | [ \   |
| AZ Limit5            | 2     |         |       | 28                | 29 | 93        | 94   | 5D    | 5E | ] ^   |
| AZ Limit6            | 2     |         |       | 30                | 31 | 95        | 96   | 5F    | 60 | _ `   |
| Init Heading A5      | 1     |         |       |                   | 32 |           | 97   |       | 61 | a     |
| Lat                  | 2     | @       |       | 33                | 34 | 98        | 99   | 62    | 63 | b c   |
| Lat ns               | 1     | @       |       |                   | 35 |           | 100  |       | 64 | d     |
| Lon                  | 2     | @       |       | 36                | 37 | 101       | 102  | 65    | 66 | e f   |
| Lon ew               | 1     | @       |       |                   | 38 |           | 103  |       | 67 | g     |
| SAT                  | 2     |         | T     | 39                | 40 | 104       | 105  | 68    | 69 | h i   |
| Sat ew               | 1     |         | T     |                   | 41 |           | 106  |       | 6A | j     |
| Hdg                  | 2     |         |       | 42                | 43 | 107       | 108  | 6B    | 6C | k l   |
| R Hdg                | 2     | H       | B     | 44                | 45 | 109       | 110  | 6D    | 6E | m n   |
| THRS                 | 2     |         | B     | 46                | 47 | 111       | 112  | 6F    | 70 | o p   |
| MHZ                  | 2     | q       | c     | 48                | 49 | 113       | 114  | 71    | 72 | q r   |
| KHZ                  | 2     | q       | d     | 50                | 51 | 115       | 116  | 73    | 74 | s t   |
| FEC Tone Volt        | 1     |         |       |                   | 52 | 65        | 117  |       | 75 | u     |
| POL SEL              | 1     |         |       |                   | 53 | 65        | 118  |       | 76 | v     |
| AGC                  | 2     | S,%     |       | 54                | 55 | 119       | 120  | 77    | 78 | w x   |
| Modem Lck/Ext AGC    | 2     | u       |       | 56                | 57 | 121       | 122  | 79    | 7A | y z   |
| Remote POL           | 2     | u       | g     | 58                | 59 | 123       | 124  | 7B    | 7C | {     |
| Saved (Target) NID   | 2     |         | t     | 60                | 61 | 125       | 126  | 7D    | 7E | } ~   |
| Dispt                | 1     | S,%     |       |                   | 62 |           | 127  |       | 7F | □     |
| KuDisp               | 1     | S,%     |       |                   | 63 |           | 0128 |       | 80 | €     |
| TDisp                | 1     |         |       |                   | 64 |           | 0129 |       | 81 | •     |
| AZ Limit7 / Pol5 O/S | 2     |         |       | 65                | 66 | 0130      | 0131 | 82    | 83 | , f   |
| AZ Limit8            | 2     |         |       | 67                | 68 | 0132      | 0133 | 84    | 85 | „ ... |
| EL Limit12           | 1     |         |       |                   | 69 |           | 0134 |       | 86 | †     |
| EL Limit34           | 1     |         |       |                   | 70 |           | 0135 |       | 87 | ‡     |
| EL Limit56           | 1     |         |       |                   | 71 |           | 0136 |       | 88 | ^     |
| EL Limit78           | 1     |         |       |                   | 72 |           | 0137 |       | 89 | %     |
| SatSkew              | 1     |         |       |                   | 73 |           | 0138 |       | 8A | §     |

## DAC 2202 / 2302 Command Description

| Tracking Display      | TDisp Index | cNNNN' Command         | Status Word R | Tone | Volt | Aux | BDE sw1 | Details                                                                                                                     |
|-----------------------|-------------|------------------------|---------------|------|------|-----|---------|-----------------------------------------------------------------------------------------------------------------------------|
| C                     | 0           | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Legacy C/X, KuLo/KuHi<br>Band Relay driven by AUX<br>Uses standard PCU SW                                                   |
| X                     |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| KuLo                  |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| KuHi                  |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| CNV1A                 | 20          | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Dual Converter/Dual LNA -50<br>Cnv BB switch driven by AUX<br>LNA BB switch driven by PWM-<br>Requires Tone Switch PCU SW   |
| CNV1B                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| CNV2A                 |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| CNV2B                 |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| Xp 13                 | 40          | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Xp/Cp, Dual Band LNB<br>Pol Relay driven by AUX<br>Uses standard PCU SW                                                     |
| Xp 18                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| Cp 13                 |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| Cp 18                 |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| LNB A                 | 60          | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Dual LNA, x97A config (NR)<br>LNA BB switch driven by PWM-<br>PWM- controlled by Volt Select<br>Requires Tone Switch PCU SW |
| LNB B                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| LNB A                 |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| LNB B                 |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| RHCP                  | 80          | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Dual Circular Polarity<br>POL BB switch driven by AUX<br>Uses standard PCU SW                                               |
| RHCP                  |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| LHCP                  |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| LHCP                  |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| PAOFF                 | 100         | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | PA Mute Forward Logic<br>Mute driven by AUX<br>Uses standard PCU SW                                                         |
| PAOFF                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| PA ON                 |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| PA ON                 |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| PAON                  | 110         | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | PA Mute Reverse Logic<br>Mute driven by AUX<br>Uses standard PCU SW                                                         |
| PAON                  |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| PAOFF                 |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| PAOFF                 |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| Xp B1                 | 130         | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Xp/Cp, Quad Band LNB<br>Tone switch driven by PWM-<br>PWM- controlled by Tone Select<br>Requires TVA enabled PCU SW         |
| Xp B2                 |             | 0044 or 0049,0038,0036 | P             | 1    | 13   | 0   | Off     |                                                                                                                             |
| Xp B3                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| Xp B4                 |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                                                                                             |
| Co B1                 |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                                                                                             |
| Co B2                 |             | 0046 or 0049,0038,0037 | Q             | 1    | 13   | 1   | Off     |                                                                                                                             |
| Co B3                 |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                                                                                             |
| Co B4                 |             | 0047 or 0049,0039,0037 | Y             | 1    | 18   | 1   | On      |                                                                                                                             |
| Band1                 | 170         | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Xp only, Quad Band LNB<br>Tone switch driven by PWM-<br>PWM- controlled by Tone Select<br>Requires TVA enabled PCU SW       |
| Band2                 |             | 0044 or 0049,0038,0036 | P             | 1    | 13   | 0   | Off     |                                                                                                                             |
| Band3                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| Band4                 |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                                                                                             |
| Lin P                 | 190         | 0040 or 0048,0038,0036 | @             | 0    | 18*  | 0   | Off     | Lin/Circ C Band<br>Circ Selectable by Tx Pol 1/3                                                                            |
| Lin P                 |             | 0044 or 0049,0038,0036 | P             | 1    | 18*  | 0   | Off     |                                                                                                                             |
| Circ P                |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| Circ P                |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                                                                                             |
| LNB A                 | 210         | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Dual LNA, x97B config<br>BB switch driven by PWM-<br>PWM- controlled by Tone Select<br>Requires TVA enabled PCU SW          |
| LNB B                 |             | 0044 or 0049,0038,0036 | P             | 1    | 13   | 0   | Off     |                                                                                                                             |
| LNB A                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| LNB B                 |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                                                                                             |
| Ku B1                 | 230         | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | Quad Ku/Single X Band config<br>Band relay driven by AUX<br>Requires 09MK2 PCU                                              |
| Ku B2                 |             | 0044 or 0049,0038,0036 | P             | 1    | 13   | 0   | Off     |                                                                                                                             |
| Ku B3                 |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                                                                                             |
| Ku B4                 |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                                                                                             |
| XBand + 18V override* |             | 0042 or 0048,0038,0037 | A             | 0    | 18*  | 1   | Off     |                                                                                                                             |

## DAC 2202 / 2302 Command Description

| Tracking Display | Reflector | TDisp Index | cNNNN' Command         | Status Word R | Tone | Volt | Aux | BDE sw1 | Details                                                 |
|------------------|-----------|-------------|------------------------|---------------|------|------|-----|---------|---------------------------------------------------------|
| C                | A         | 1           | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     | QOR Dual C, Quad Ku                                     |
| X                | A         |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                         |
| KuLo             | B         |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                         |
| KuHi             | B         |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                         |
| Lin P            | A         | 128         | 0040 or 0048,0038,0036 | @             | 0    | 18*  | 0   | Off     | QOR Lin/Circ C, Lin Ku Circ<br>Selectable by Tx Pol 1/3 |
| Lin P            | A         |             | 0044 or 0049,0038,0036 | P             | 1    | 18*  | 0   | Off     |                                                         |
| Circ P           | A         |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                         |
| Circ P           | A         |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                         |
| Xp B1            | B         |             | 0040 or 0048,0038,0036 | @             | 0    | 13   | 0   | Off     |                                                         |
| Xp B2            | B         |             | 0044 or 0049,0038,0036 | P             | 1    | 13   | 0   | Off     |                                                         |
| Xp B3            | B         |             | 0041 or 0048,0039,0036 | H             | 0    | 18   | 0   | On      |                                                         |
| Xp B4            | B         |             | 0045 or 0049,0039,0036 | X             | 1    | 18   | 0   | On      |                                                         |
| Cp B1            | B         |             | 0042 or 0048,0038,0037 | A             | 0    | 13   | 1   | Off     |                                                         |
| Cp B2            | B         |             | 0046 or 0049,0038,0037 | Q             | 1    | 13   | 1   | Off     |                                                         |
| Cp B3            | B         |             | 0043 or 0048,0039,0037 | I             | 0    | 18   | 1   | On      |                                                         |
| Cp B4            | B         |             | 0047 or 0049,0039,0037 | Y             | 1    | 18   | 1   | On      |                                                         |

## DAC 2202 / 2302 Command Description

### ACU Status Word Decoding Table

| WORD 1            |        |                   |        |  | WORD2            |        |                  |        |
|-------------------|--------|-------------------|--------|--|------------------|--------|------------------|--------|
| Tracking---       | Unwrap | Tracking---       | Unwrap |  | Hdg Valid---     | Block  | Hdg Valid---     | Block  |
| Sat Ref --+   +-- | Data1  | Sat Ref --+   +-- | Data1  |  | El Trg --+   +-- | Init   | El Trg --+   +-- | Init   |
| SlowScn -+    +-  | Data0  | SlowScn -+    +-  | Data0  |  | Az Trg -+    +-  | Search | Az Trg -+    +-  | Search |
|                   |        |                   |        |  |                  |        |                  |        |
| @                 | 000000 | `                 | 100000 |  | @                | 000000 | `                | 100000 |
| A                 | 000001 | a                 | 100001 |  | A                | 000001 | a                | 100001 |
| B                 | 000010 | b                 | 100010 |  | B                | 000010 | b                | 100010 |
| C                 | 000011 | c                 | 100011 |  | C                | 000011 | c                | 100011 |
| D                 | 000100 | d                 | 100100 |  | D                | 000100 | d                | 100100 |
| E                 | 000101 | e                 | 100101 |  | E                | 000101 | e                | 100101 |
| F                 | 000110 | f                 | 100110 |  | F                | 000110 | f                | 100110 |
| G                 | 000111 | g                 | 100111 |  | G                | 000111 | g                | 100111 |
| H                 | 001000 | h                 | 101000 |  | H                | 001000 | h                | 101000 |
| I                 | 001001 | i                 | 101001 |  | I                | 001001 | i                | 101001 |
| J                 | 001010 | j                 | 101010 |  | J                | 001010 | j                | 101010 |
| K                 | 001011 | k                 | 101011 |  | K                | 001011 | k                | 101011 |
| L                 | 001100 | l                 | 101100 |  | L                | 001100 | l                | 101100 |
| M                 | 001101 | m                 | 101101 |  | M                | 001101 | m                | 101101 |
| N                 | 001110 | n                 | 101110 |  | N                | 001110 | n                | 101110 |
| O                 | 001111 | o                 | 101111 |  | O                | 001111 | o                | 101111 |
| P                 | 010000 | p                 | 110000 |  | P                | 010000 | p                | 110000 |
| Q                 | 010001 | q                 | 110001 |  | Q                | 010001 | q                | 110001 |
| R                 | 010010 | r                 | 110010 |  | R                | 010010 | r                | 110010 |
| S                 | 010011 | s                 | 110011 |  | S                | 010011 | s                | 110011 |
| T                 | 010100 | t                 | 110100 |  | T                | 010100 | t                | 110100 |
| U                 | 010101 | u                 | 110101 |  | U                | 010101 | u                | 110101 |
| V                 | 010110 | v                 | 110110 |  | V                | 010110 | v                | 110110 |
| W                 | 010111 | w                 | 110111 |  | W                | 010111 | w                | 110111 |
| X                 | 011000 | x                 | 111000 |  | X                | 011000 | x                | 111000 |
| Y                 | 011001 | y                 | 111001 |  | Y                | 011001 | y                | 111001 |
| Z                 | 011010 | z                 | 111010 |  | Z                | 011010 | z                | 111010 |
| [                 | 011011 | {                 | 111011 |  | [                | 011011 | {                | 111011 |
| \                 | 011100 |                   | 111100 |  | \                | 011100 |                  | 111100 |
| ]                 | 011101 | }                 | 111101 |  | ]                | 011101 | }                | 111101 |
| ^                 | 011110 | ~                 | 111110 |  | ^                | 011110 | ~                | 111110 |
| _                 | 011111 | C                 | 111111 |  | _                | 011111 | C                | 111111 |



## DAC 2202 / 2302 Command Description

### ACU Status Word Decoding Table

| WORD 3 (ACU Errors) |                      |         |                      |         |                |         |                |         |                      | WORD 4 (PCU Errors) |                      |          |                |          |                |   |   |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |
|---------------------|----------------------|---------|----------------------|---------|----------------|---------|----------------|---------|----------------------|---------------------|----------------------|----------|----------------|----------|----------------|---|---|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----|-----|---|---|---|---|-----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| PCU Err             | ----+---PCU Comm     | PCU Err | ----+---PCU Comm     | Az Ref  | ----+---Az Lim | Az Ref  | ----+---Az Lim | PCU Err | ----+---PCU Comm     | PCU Err             | ----+---PCU Comm     | Az Ref   | ----+---Az Lim | Az Ref   | ----+---Az Lim |   |   |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |    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| Con                 | Disk--++ +--Conv Typ | Con     | Disk--++ +--Conv Typ | StabLim | --+ +--Lv Lim  | StabLim | --+ +--Lv Lim  | Con     | Disk--++ +--Conv Typ | Con                 | Disk--++ +--Conv Typ | Critical | --+ +--Cl Lim  | Critical | --+ +--Cl Lim  |   |   |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |     |   |   |   |   |     |    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| Sat                 | Rng                  | +       | +                    | +       | +              | +       | +              | Sat     | Rng                  | +                   | +                    | +        | +              | Sat      | Rng            | + | + | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng | + | + | + | + | Sat | Rng |