

SATlt 1.3

I. Introduction. Satellite communications -- light (SATlt) routines provide pointing angles and sun interference information based on satellite earth station location and satellite longitude. SATlt is the light version of SATCO, which provides extended features including link budgeting. For users who do not need link budgeting, SATlt is probably a better choice. SATlt 1.3 was written and tested on the HP48GX/G+ and HP49G. There are separate versions for each.

II. Installation.

1. Select the SATlt file to transfer from the appropriate folder. Use binary transfer for speed and accuracy. SATlt should take about 7 k of memory, but you should have at least double that amount available if you want to store and retrieve setups.
2. Hiding Variables (HP48 only; optional but recommended). After initial installation, all the variables will be available in the SATlt directory and all sub-directories. To avoid mistakes and present a clean interface, it is recommended you hide all unused variables by pressing [CST] [NXT] [NXT] and [HIDE]. To make them re-appear, press [SHOW]. These actions will take a few seconds, so please be patient. The SHOW/HIDE routine operates on John Myers' hidevars program, also available at <http://www.hpcalc.org/utills/memory/hidevars.zip>. The basic program is stored in the variable HV in SATlt. You may wish to move it to your HOME directory. Better yet, download the latest version and store it as HV in your HOME directory, and then delete the original HV from SATlt with 'HV' [PURGE]. For HP49 users, you can use or hack your own hide/show routine once SATlt has been installed.
3. See instructions below for optional satellite and city data base installations.

III. Operation:

1. Basic operation.

- a. The [VAR] soft key menu should be as follows:

<u>Soft Key</u>	<u>Description</u>
OPEN	Opens a stored quick setup
SAVE	Stores a quick setup
YEAR	Selects year for sun conjunction
SEAS	Selects a season for sun conjunction
RPRT	Displays report
RECL	Recalls last setup to stack for editing
PRDEV	Selects printing device (wire or IR -- HP48 only)
PRINT	Prints report
SETUP	Directory for storage of earth station and satellite setups

- b. Enter the name or ID of the earth station in quotes (optional).

- c. Enter the earth station latitude in degrees. Positive for North, negative for South.
- d. Enter the earth station longitude in degrees East.
(If you have only the degrees West, subtract this from 360 to get the degrees East)

Note: When using the city data base, the SCRIBE record on stack level 1 negates the need to enter b, c, and d. See below.

- e. Enter the satellite longitude in degrees East.

Note: When using the satellite data base, the SCRIBE on stack level 1 negates the need to enter the actual satellite longitude. See below.

- f. Press [RPRT]. You will get a report on the display:

<u>Report</u>	<u>Explanation</u>
Ankara•Turkey	(or the name that you entered in step 2)
40.03° N 32.9° E	geographic coordinates of earth station
sat 359° E	longitude of satellite
az 226.3° el 32.1°	azimuth and apparent elevation pointing angles to the satellite
pol offset 34° cw	degrees of polarity offset (from horizontal or vertical) for linear polarized systems as viewed from rear of antenna.
range 38428 km	distance from earth station to satellite
TUE 10/08/02 12:09z	peak day and time of sun conjunction

Note: Sun conjunctions occur only in the spring and fall. They last up to 8 or 10 minutes on the peak day, and shorter periods 2 or 3 days before and after the peak day. The time estimate is based on a relatively simple algorithm that could have an error of up to 5 minutes. The time is given in Greenwich Mean Time (GMT or z). You need to convert to the standard time at your location.

- g. If you wish to save this setup, then press [SAVE]. You will be prompted for the name of the storage record. Type in the name and press [ENTER].

- h. If you wish to select another year or season for the sun conjunction, press [YEAR] or [SEAS]. YEAR works like a variable key, i.e. no shift recalls the current contents and left shift takes the year on stack level 1 and stores it in the year variable. SEAS calls up a menu to select SPR or FAL for the spring or fall season. When you make the selection, you automatically return to the main VAR menu. Press [RPRT] for a report with the newly selected year and season.

- i. To change the satellite location, press [RECL]. This recalls the quick setup to the stack. Press [DROP] and enter the new satellite longitude (or a satellite record from SCRIBE). Press [RPRT] to get a report with the new satellite location.

j. For a printed report, press [PRINT]. This sends the report to the infrared or wire connected printer you have chosen. If you wish to change the IR/WIRE selection, press [PRDEV] (HP48 only).

k. To open a previously saved setup, press [OPEN]. Use [NXT] and [PREV] to scroll to the record you wish to retrieve. Press the soft key for that record and [ENTER]. This will return the record to the stack.

l. To clean up the stored setups, enter the SETUP directory and add/purge/modify the stored records. The CST menu has a SORT routine that alphabetizes the records, and an ESC key to return to the main SATlt directory.

2. Custom menu. [CST] reveals the custom menu. Most are handy routines that support satellite communications system engineering and installations:

<u>Soft Key</u>	<u>Description</u>
->dB	Converts power ratio on stack level 1 to decibels $= 10 * \text{LOG}(\text{level } 1)$
dB->	Converts decibels on stack level 1 to power ratio $= \text{A} \text{LOG}[(\text{level } 1)/10]$
dB	Sums decibels on stack level 1 and 2 $= 10 * \text{LOG}[\text{dB->}(\text{level } 2) + \text{dB->}(\text{level } 1)]$
dB-	Subtracts decibels (stack level 1 from level 2) $= 10 * \text{LOG}[\text{dB->}(\text{level } 2) - \text{dB->}(\text{level } 1)]$
dB%	Returns decibel percentage (level 1/ level 2) $= 1000 * \text{LOG}[\text{dB->}(\text{level } 1) / \text{dB->}(\text{level } 2)]$

DATB Calls the SCRIBE data base library. (See below)

WIRE Converts American Wire Gauge (AWG) to diameter and area. Press WIRE to get an input dialog or enter the AWG number beforehand and press WIRE. A typical report would be:

AmWireGuage	12	AWG number
Area	6.525 MCM	Thousands of circular mils
Area	3.305 sqmm	Square millimeters
Diameter	2.051 mm	Millimeters
Diameter	.081 in	Inches

There are other soft keys that facilitate Carrier to Noise (C/N) calculations:

->C&N/N	Converts C/N ratio on level 1 to (C+N)/N $= ->\text{dB}(\text{dB->}(\text{level } 1) + 1)$
->C/N	Converts (C+N)/N ratio on level 1 to C/N $= ->\text{dB}(\text{dB->}(\text{level } 1) - 1)$
CN	Combines C/N ratios on levels 1 and 2 $= ->\text{dB}\{1/[1/(\text{dB->}(\text{level } 2)) + 1/(\text{dB->}(\text{level } 1))]\}$

CN-	Extracts level 1 C/N from level 2 = ->dB{ 1/[1/(dB->(level 2))- 1/(dB->(level 1))]}
EXIT	Exits SATIt
SHOW	Shows all variables (HP48 only)
HIDE	Hides unused variables (HP48 only)

HP48 note: There is a variable "SLV" which contains the list of variables to remain visible when [HIDE] is pressed. You can change this. If for some reason you accidentally hide too many variables, you should still be able to use [SHOW] in the CST menu. In a panic, type the alpha characters HV on an empty stack and press [ENTER].

3. Optional data bases. The SCRIBE database library is required. It is available at www.hpcalc.org/hp48/apps/database/scrib101.zip. It is an excellent, fast database program developed by Jack Levy and others. I recommend you read the instructions carefully to get the most out of SCRIBE and take a few moments to send Jack an email.

a. Installation. SCRIBE should be installed first. Then transfer either the DBsmall or DBlarge directory to the HP48GX/+ or HP49. DBsmall contains a database of some 220 cities and 250 satellites plus an installation routine. DBlarge (about 70 k) has those databases plus a 2000 cities group of 25 SCRIBE files arranged alphabetically, i.e. Acity, Bcity, ...Zcity (excludes Xcity). The DBlarge group is a 70 kb memory hog, so as a practical matter, plenty of RAM should be available, preferably in a port. After transferring the DB directory, enter it and press [INSTALL]. Dialogs will then allow installation of any or all of the 3 databases in a chosen port(s), with the option of purging the ports beforehand. After installation, the DB directory can be deleted from system memory with PGDIR.

b. Operation. Enter the SCRIBE library or press [DATB] key in the SATIt CST menu. Press a number key for the port where the desired databases are stored. Select a city first and press [->STK] to put that city's record on the stack. Select a satellite and press [->STK] to put that satellite record on the stack. After that [EXIT] from SCRIBE, and press [RPRT] in the SATIt VAR menu to get a report for that city and satellite.

Database management hints:

1. To save port memory, you can compress the database files. Enter SCRIBE, select [OPT], then turn on [BZ] for compression. [ENTER] returns to basic database operations. Then press [VIEW] and then [DSEL] for each of the data files. They will then be stored in compressed format.

2. Use SCRIBE instructions to add, delete, or edit city or satellite records. The satellite data base contains 1 line records. For satellite records to work properly, the same format must be maintained, i.e. leading spaces (optional), then the satellite east longitude, then "°E", and then other description of the satellite. The SATIt report program assumes the number is east longitude, and extracts the number based on it being followed immediately by "°E".

IV. Hackers. Here is an explanation of the other variables:

A = Azimuth pointing angle of the last calculation.
AJEL = Check for positive elevation and convert geometric to apparent
AZEL = Program to calculate the azimuth and elevation angles.
AZX = Expression for the azimuth pointing angle.
E = Elevation pointing angle of the last calculation.
ELX = Expression for the elevation pointing angle.
H = Hemisphere constant used in calculations.
HV = hidevars routine by John Myers*
N->S = Name to string routine from "1 minute marvels".*
OLST = List ordering function. Makes list of items on level 1
followed by other VARS in alpha order.*
ORDR = Order variables in SATlt.
P = Range to satellite of the last calculation.
R = Radius of the earth in km. Change if you know a better number.
REL = Remove item from list from "1 minute marvels".*
REPLS = Routine to replace spaces with period.
RGX = Expression for the range.
S = Radius of the satellite orbit in km. Change if you know a better number.
SETUP = Directory where the setups are stored and retrieved.
S->N = String to Name routine from "1 minute marvels".*
WIRE = Converts AWG to wire diameter and area sizes.
X = Earth station latitude.
Y = Earth station longitude.
Z = Satellite longitude.
tstr = Routine to format the date/time string.
The remaining variables in order:
v#1 Site name storage
v#2 Report storage
v#3 Season 1=spring 2=fall

* These are of general utility and make good candidates for transfer to your HOME directory.

V. Revision history:

Initial Release. 10 Feb 00.

Release 1.1 15 March 00. Adds delay for IR printer. Changes report routine for compatibility with SCRIBE databases. Makes setup database sorting an option. Adds directory ordering routine. Includes city database in SCRIBE format. Fixes flag 42 bug. Adds C/N and (C+N)/N conversions. Updates Intelsat reference.

Release 1.2 20 Dec 00. Adds polarity offset. Tightens code on some routines. Fixes database open bug.

Release 1.3 25 March 02. Changes geometric elevation to apparent elevation. Restructures SCRIBE data bases and includes satellite data base. Includes installation routines for the data bases. Other minor cosmetic changes.

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VII. References:

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