

EME SYSTEM V7.0a

By Jean-Jacques F1EHN – 01/2018

This document is a quick manual of EME System. It briefly explains and shows the main features of EME System and what it is possible to do with it. For more information, please, read the EME_Doc_V7.pdf documentation.

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1. What is there into an “EME System” ?

[EME System](#) is divided into:

- A front-end module ([launcher](#)) to manage EME System and launch directly the other modules
- An initialization module ([emesetup](#)) to set the parameters (call sign, location, serial port, end-stops, station parameters, frequency, angular correction...) called by the control software.
- A control module ([tracking](#)) capable of handling an EME station in real time (Automatic tracking of sources, traffic periods, Doppler, polarization and Rx/Tx management, signal level and antenna diagram measurements, common window, sky temperature..).
- A module ([planner](#)) to plan the EME activity (Moon location, Common window, Doppler, sky temperature).
- A module to edit the prefix and countries DXCC database ([dxccedit](#)).
- A module to help the operator about EME calculation to evaluate the average performance of the EME station ([emecalc](#)).
- A [hardware interface](#) between the control software and the EME station (Motors, angles monitoring, receiver...). This interface is optional.

2. Supported interfaces and protocols

This chapter gives a non-exhaustive list of the supported interfaces and protocols by the real time tracking module. The next chapter (chapter 3) explains each running with more details.

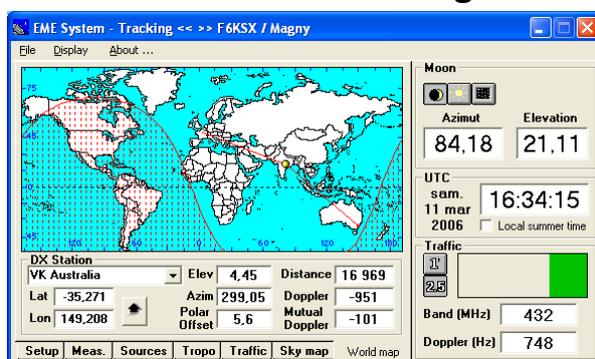
Supported interfaces and protocols	Remarks and comments
Green Heron (RT21)	Using GH tracker (see chapter 3.2)
ARS EA4TX	DDE dialog (see chapter 3.2)
Yeesu G5500	Using GS232 protocol (see chapter 3.3)
Alfa Spid rotator, F1TE, G6LVB ...	Using GS232 protocol (see chapter 3.3)
F1TE, G6LVB ... (or any GS232 compatible interfaces)	Using GS232 protocol (see chapter 3.3)
DL7AOT (or any EasyComm1 compatible interfaces)	Using EasyComm1 protocol (see chapter 3.4)
EGIS rotator system (via EPR103/203)	(see chapter 3.5)
Pro. Sis. Tel rotator system (via CBox D)	(see chapter 3.6)
F1EHN interface	(see chapter 3.7)
MK-EHN interface	(see chapter 3.7)
W2DRZ or F1EHN compatible interfaces	(see chapter 3.7)

Adaptors USB/RS232 are supported..

3. How does EME System work?

The following chapters show the use of the different modules of EME System. This chapter is dedicated to the main uses and utilities of the tracking module. Tracking starts with loading the “*.dat” file done with EME Setup and selected by the operator.

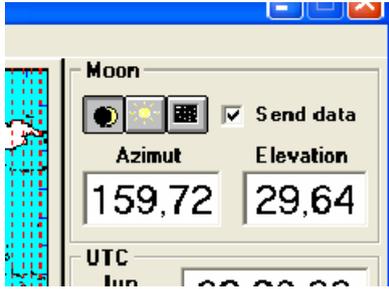
3.1. Manual running



Tracking is able to run without any antenna interface. It displays all the real time parameters which are necessary for the EME traffic (moon position, Doppler shift, Common window, radio sources position or any astronomic object with entering its Ra and Decl coordinates).

To use this running, set the Interface dialog to “Without” in EME Setup.

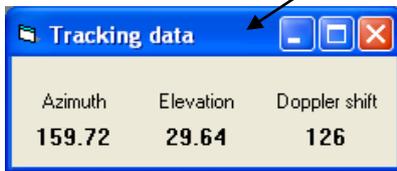
3.2. Automatic tracking with DDE dialog



Tracking is able to dialog with external applications via a dedicated DDE channel.

The document "DDE_Dialog.pdf" describes how to develop your own DDE application. To use this mode, set the Interface dialog to "DDE Server" in EME Setup.

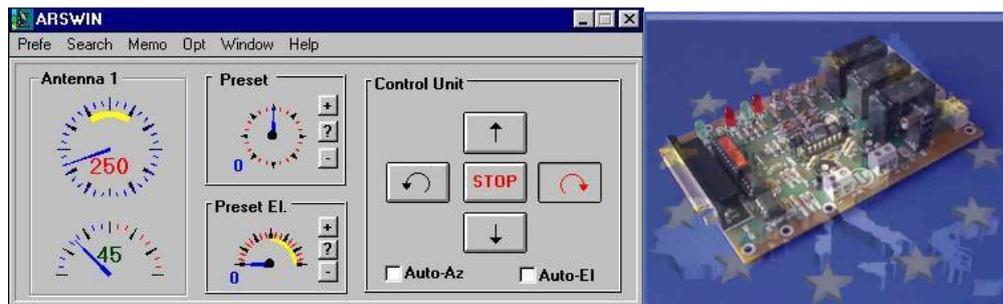
Moreover, the known interface ARSWin from EA4TX is compatible with tracking. Set the Interface dialog to "ARS EA4TX" in EME Setup.



With checking the "Send data" check box, you allow tracking to send data to the external application via a DDE channel.

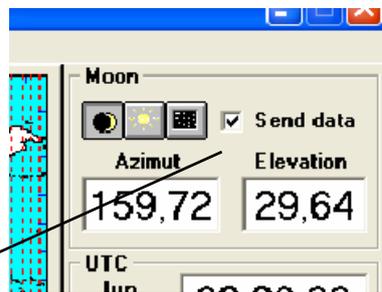
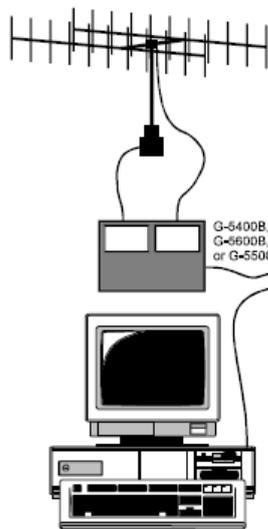
The accuracy is limited to 0.1° with the ARSWin program and 0.01° with the DDE server.

ARS Win from EA4TX (<http://www.ea4tx.com/>)



The Green Heron engineers have developed a small middleware piece called GH Tracker. It converts the tracking data to DCU-1 protocol compatible with their Rotators as RT21 system (more information at <http://www.greenheronengineering.com/TechSupport/support.html>)

3.3. Automatic tracking with GS232 protocol



Tracking is compatible with external devices using a GS232 protocol. The GS232 protocol is supplied with the devices documentation like Yaesu Gs232-G5500. Tracking sends only the Azimuth

and Elevation data.

Checking the "Send data" check box allows tracking to send data to the external devices compatible with the GS232 protocol via a RS232 serial port.

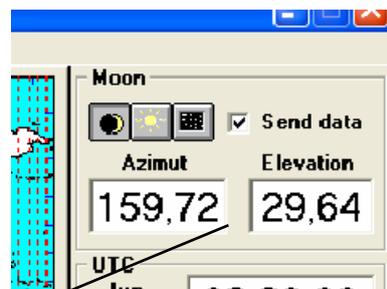
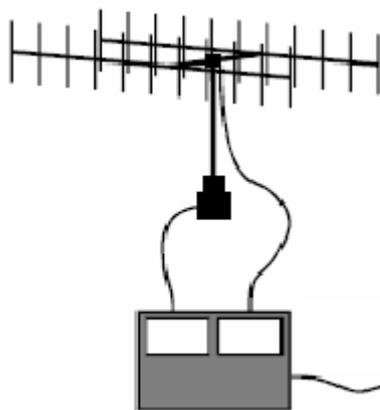
The data flow can be set from 600 to 38600 baud.

The data interval can be set from 1 to 30 s. (10s by default).

The accuracy is limited to 1°.

This mode is compatible with ALFASPID rotator (Rot2Prog interface => RAS or RAK rotator with more information at <http://www.spid.alpha.pl/english/01.php>), the F1TE interface (http://www.f1te.org/Tracker/tracker_gb.htm), the G6LVB tracker (<http://www.g6lvb.com/Articles/LVBTracker/>) and all the rotator systems using the GS232 protocol.

3.4. Automatic tracking with EasyComm1 protocol



Tracking is compatible with external devices using an EasyComm1 protocol.

Checking the "Send data" check box allows tracking to send data to the external devices compatible with the EasyComm1 protocol via a RS232 serial port.

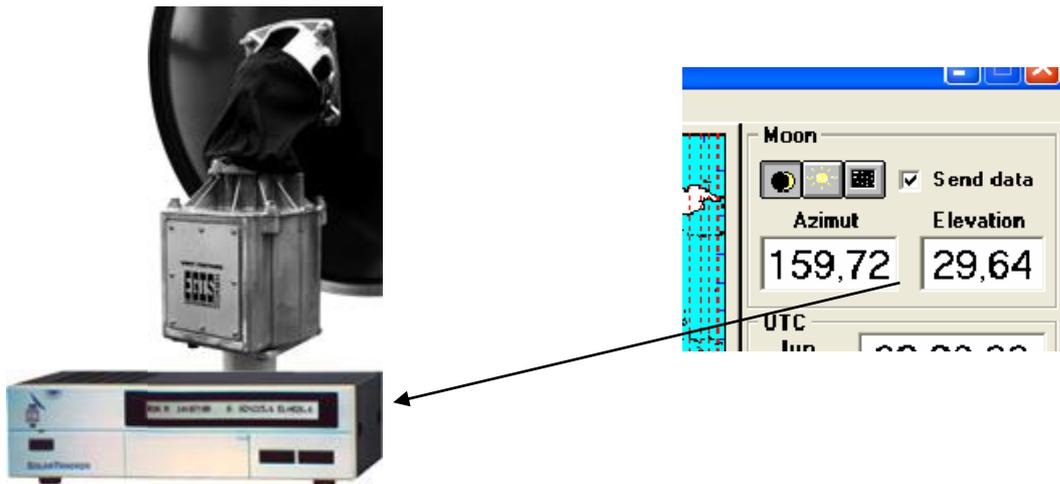
The data flow can be set from 600 to 38600 baud.

The data interval can be set from 1 to 30 s. (10s by default)

The accuracy is limited to 0.1°.

This mode is compatible with the known DL7AOT interface and all the rotator systems using the EasyComm1 protocol.

3.5. Automatic tracking with EGIS rotator system



Tracking is compatible with the EGIS rotator system using the EPR-103/203 interface box.

Checking the “Send data” check box allows tracking to send data to the external devices via a RS232 serial port .

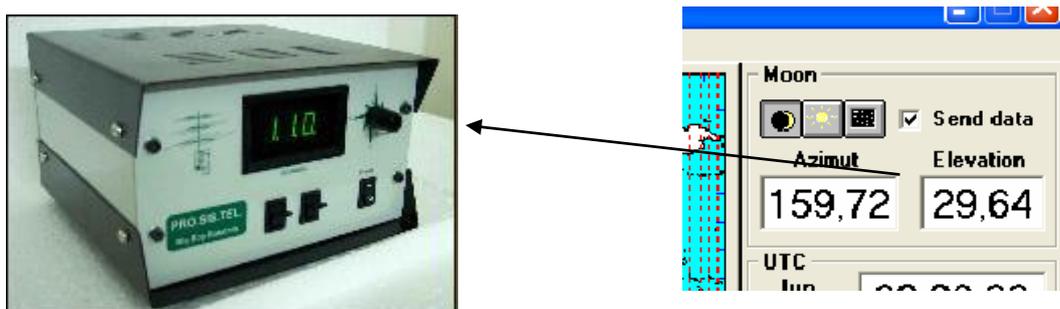
The data flow can be set from 600 to 38600 baud (1200 baud is recommended).

The data interval can be set from 1 to 30 s. (5s by default)

The accuracy is limited to 0.01°.

More information on the EGIS Bi-Axial-Rotor at http://www.egis.org/aroto_us.html

3.6. Automatic tracking with PROSISTEL rotator system



Tracking is compatible with the Pro. Sis. Tel. rotator system using the Control BOX “D” interface.

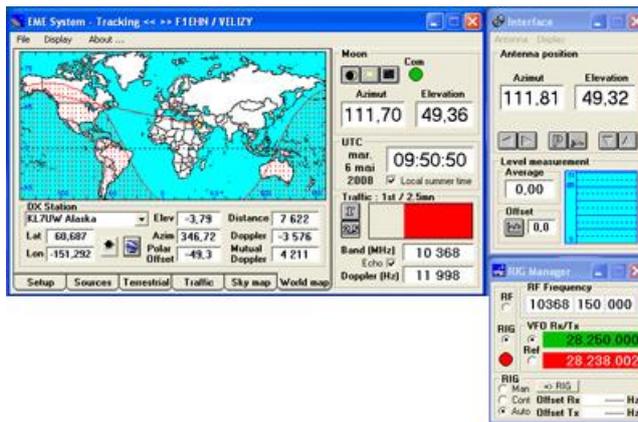
Checking the “Send data” check box allows tracking to send data to the external devices.

The data flow can be set from 600 to 38600 baud (9600 baud is recommended).

The data interval can be set from 1 to 30 s. (10s by default). The accuracy is limited to 1°.

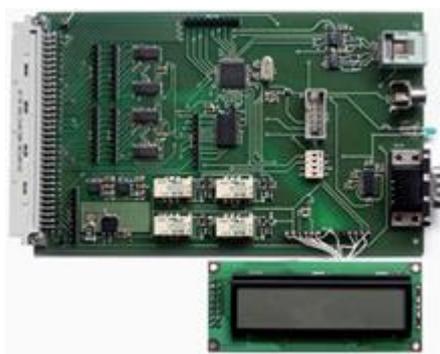
More information on the Pro. Sis. Tel system at <http://www.prosistel.net/home-e/default.html>.

3.7. Automatic tracking with F1EHN or MK-EHN interface



Tracking dialogs with the MK-EHN (or F1EHN) interface through a RS232 serial com port. It is also compatible with USB/RS232 adaptors.

This interface allows very accurate tracking (0.01°) and a complete antenna management (motor drive with or without speed control). Read the “rotation_modes.pdf” documentation.



For more information about the interface, read the documentation or the PCB_Wiring document including schematics, components list ...

The accuracy is determined by the Azim / Elev measurement encoders. Tracking is compatible up to 16 bits resolution (0.005°).

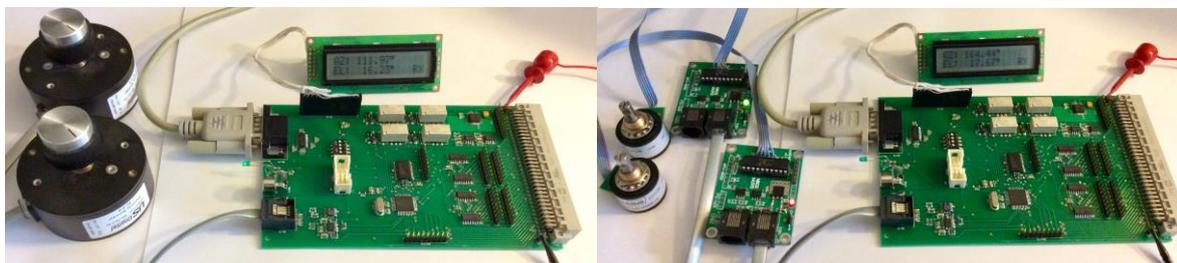
This interface has 2 kinds of input. A “parallel 16 bit” input to allow to connect any encoder having a binary or gray code from 8 to 16 bits. A lot of EMERs use dedicated angular measurements by using your

own encoders design.

The second input is dedicated for the use of US Digital encoders (A2 series). Please, report to the “USD&MAB_encoders.pdf” note.

Now, it is also possible to connect MAB encoders (from MEGATRON) by using the small MABMPU interface developed by Gary N8CQ. This interface is connected via the USD port (RS485)

The picture below show the use of A2 USD encoders (left) and MAB encoders (right). The system is very simple to use..



The performance is also coming from the time of latency of the interface. The MK/EHN interface is optimized to reduce this latency to the minimum value (the information is renewed each 60 ms). Be careful if you are looking for a very accurate system. For an antenna rotation speed of 1°/sec the accuracy is then limited to $1 \cdot 0.06 \Rightarrow$ an angular error of 0.06°.

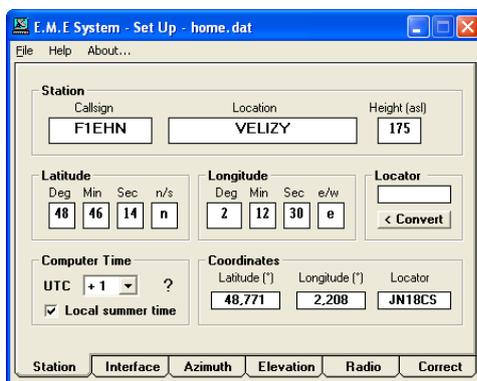
4. Launcher



It concentrates the launch of the different modules. It allows creating shortcuts and so launching directly your favourite program with your favorite setup file.

To edit and update a setup file (*.dat), select an existing file then press the "Planner" button or press the "New" button.

5. EME Setup

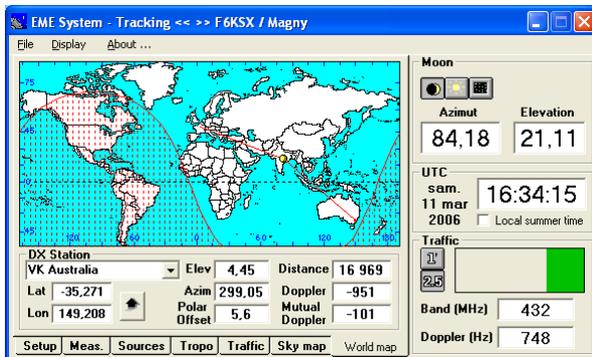


Use it during the first use of EME System or to adjust your EME station parameters. All the parameters are stored in a "*.dat" file. The 6 tabs allow to set :

- Coordinates of the station (Call sign, latitude, longitude...)
- Interface: to define the dialogue between your interface and your computer
- Azimuth: to set the parameters of the antenna azimuth axis (encoder, end stop...)
- Elevation: to set the parameters of the antenna elevation axis (encoder, end stop...)
- EME station to enter all the characteristics of the station (power, NF, antenna gain, cables losses...)
- Correct : to create or modify a correction file of your antenna angular measurement. With this file, the Tracking module is able to compensate the drift of your mechanical antenna system by adding the correction values to the angular measurement. This feature is available for the other protocols (different as F1EHN). Then Tracking adds the correction values to the angular position of the tracked source.

6. Tracking

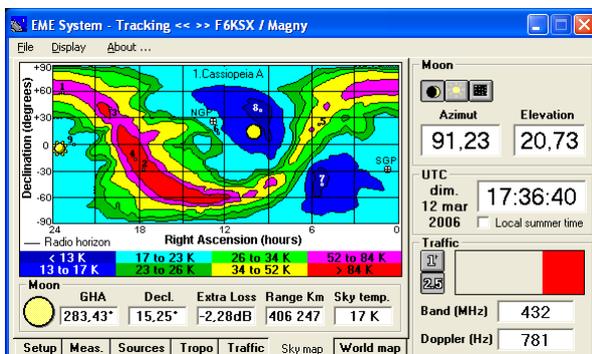
Tracking starts with loading the setup file. It displays 3 fixed frames for :



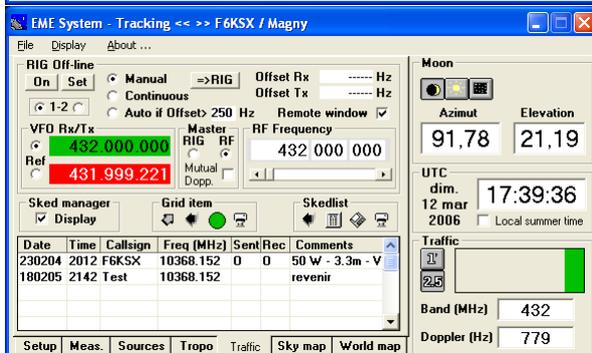
- The position of the selected source.
- The UTC coordinates
- The traffic information with the traffic period, the frequency and the Doppler shift.

Tracking has 6 selectable tabs to display:

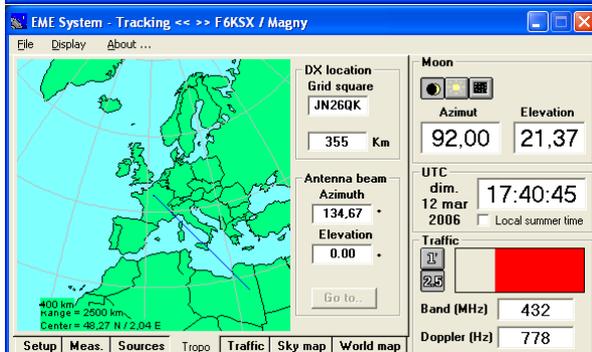
- World map tab : it is dedicated to the EME traffic (common window, polar, DXCC data..)
- Sky Map tab : it is dedicated to the astronomical information and displays a Brightness sky map (isothermic curves) and a few astronomic information (phase, GHa, Decl, Range of the moon ...)



- Traffic tab : it is dedicated to give a help around the EME traffic with the ability to manage a transceiver and a list of schedules

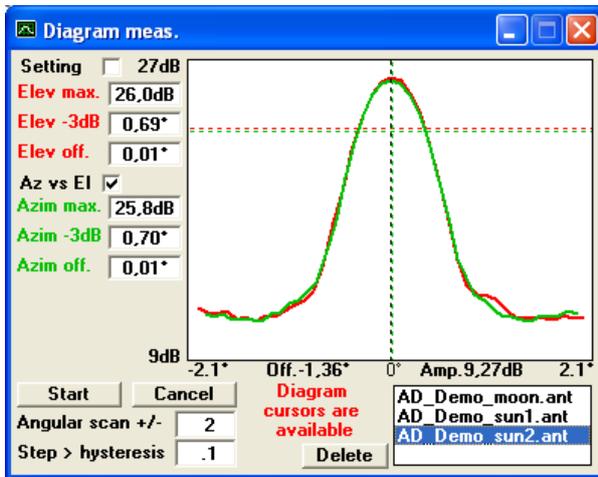


- Terrestrial tab : it brings a useful help for the operator using their EME antenna for the terrestrial traffic. It also displays a local map and antenna position.

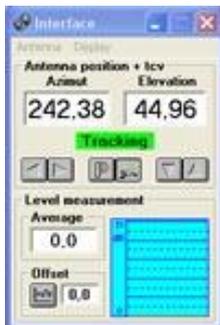


- Sources tab : it offers a complete choice of sources (Sun or Moon, Radio sources, Cold sky area, Deep Space Network object with a complete compatibility with the Horizons tools (from JPL), fixed point or User define sources)

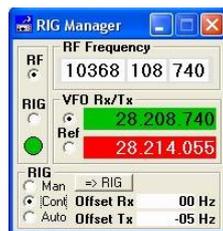
- Setup tab : it displays the general parameters (coordinates, traffic, frequency, interface dialog...) and the tracking parameters (angular configuration, level or polar measurement...).



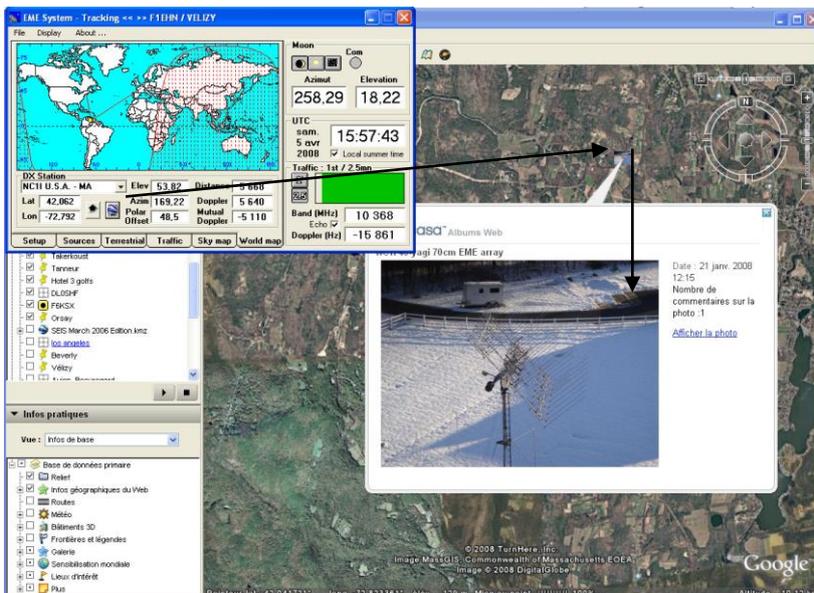
- Meas. window : it allows to do an antenna diagram measurement. It displays the antenna aperture on both Az/EI axis and results (-3 dB aperture, Beam offset, Cursors measurement). By using a RF detector or similar connected to the analog input, tracking is able to do an automatic antenna diagram measurement.



- Moreover, Tracking displays a dedicated Interface window for the F1EHN interface



and a RIG manager window.



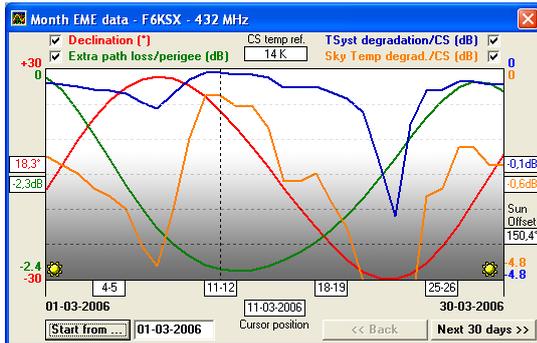
- Select the DX station into Tracking which automatically links the DX info to Google Earth. If a geo-localized photo is present in the EME antenna photos database**, then view the antenna of your DX station by clicking the icone available into Google Earth.

** a collection of photos of the EME antennas is available on the download page of the F1EHN web site. These photos are geo-localized and visible into Google Earth. More information on the F1EHN web site.

7. Planner



The Planner module helps you to plan the EME activity, to prepare your skeds or traffic periods with calculating and displaying the Moon location, DX Common window, Doppler shift, polarization offset, sky temperature, phase of the moon... Planner is able to simulate and calculate the EME data for a month, the EME forecast for a wished date and a common window forecast to prepare your skeds.



The "Month EME data" window displays up to 4 curves for the :

- Declination of the Moon
- Extra path loss
- Sky temperature degradation
- System temp. degradation.

Local	Azim	Elev	Echo	Azim	Elev	Azim	Elev
01:00	244,89	48,69	-576	359,29	-45,11	256,66	68,33
01:20	249,83	45,67	-626	6,35	-44,94	261,86	65,08
01:40	254,40	42,56	-671	13,32	-44,37	266,31	61,79
02:00	258,66	39,39	-712	20,12	-43,42	270,25	58,49
02:20	262,67	36,17	-749	26,67	-42,10	273,84	55,18
02:40	266,48	32,92	-781	32,94	-40,46	277,18	51,89
03:00	270,14	29,67	-807	38,90	-38,52	280,35	48,63
03:20	273,68	26,41	-828	44,54	-36,32	283,39	45,39
03:40	277,13	23,18	-844	49,88	-33,89	286,34	42,20
04:00	280,54	19,97	-854	54,92	-31,28	289,25	39,05
04:20	283,90	16,83	-858	59,70	-28,50	292,12	35,96
04:40	287,26	13,73	-857	64,25	-25,58	294,99	32,93
05:00	290,63	10,67	-850	68,59	-22,55	297,86	29,96
05:20	294,02	7,70	-838	72,77	-19,44	300,75	27,08

Planner calculates all the steps and displays a new EME forecast window for each day, including date, time, sky noise temperature for the moon position, the extra loss (Loss/Perigee), the moon declination, the moon position and Doppler frequency shift, the sun location and a radio source location.

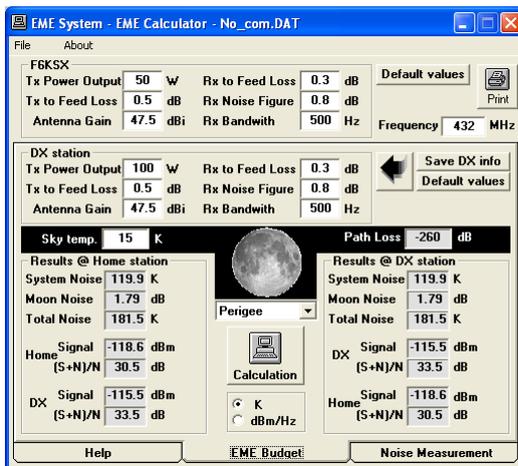
Planner displays the "Common window" window including 3 different tabs :

- Sources : to select the wished common source (Planner supports the same sources data as Tracking)
- Sky Map : to display Astronomical and Sky information
- World Map : it is dedicated to the EME traffic (common window, polar, DXCC data..)

UTC	Local	Azim	Elev	Hz	Hz	Deg	Azim	Elev
00:00	01:00	244,89	48,69	576	-96	82,1	120,03	55,96
00:20	01:20	249,83	45,67	626	-152	80,3	126,51	50,85
00:40	01:40	254,40	42,56	671	-208	77,0	133,93	45,48
01:00	02:00	258,66	39,39	712	-262	72,9	142,44	40,77
01:20	02:20	262,67	36,17	749	-316	66,0	152,15	35,62
01:40	02:40	266,48	32,92	-781	-368	58,2	162,98	30,91
02:00	03:00	270,14	29,67	-807	-417	49,4	174,62	27,54
02:20	03:20	273,68	26,41	-828	-464	40,2	186,91	24,45
02:40	03:40	277,13	23,18	-844	-509	31,0	198,00	21,66
03:00	04:00	280,54	19,97	-854	-549	22,7	209,00	19,22
03:20	04:20	283,90	16,83	-858	-587	15,3	219,03	17,24
03:40	04:40	287,26	13,73	-857	-621	8,9	228,26	15,84
04:00	05:00	290,63	10,67	-850	-650	3,5	233,47	15,12

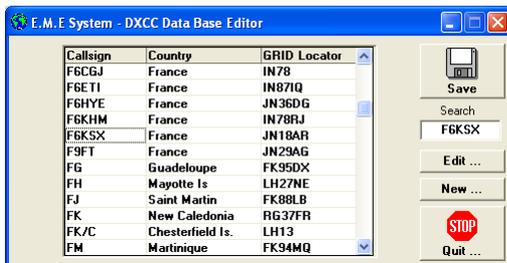
By selecting a DXCC, Planner is able to display a complete forecast for the common window between the station and DXCC.

8. EME Calculator



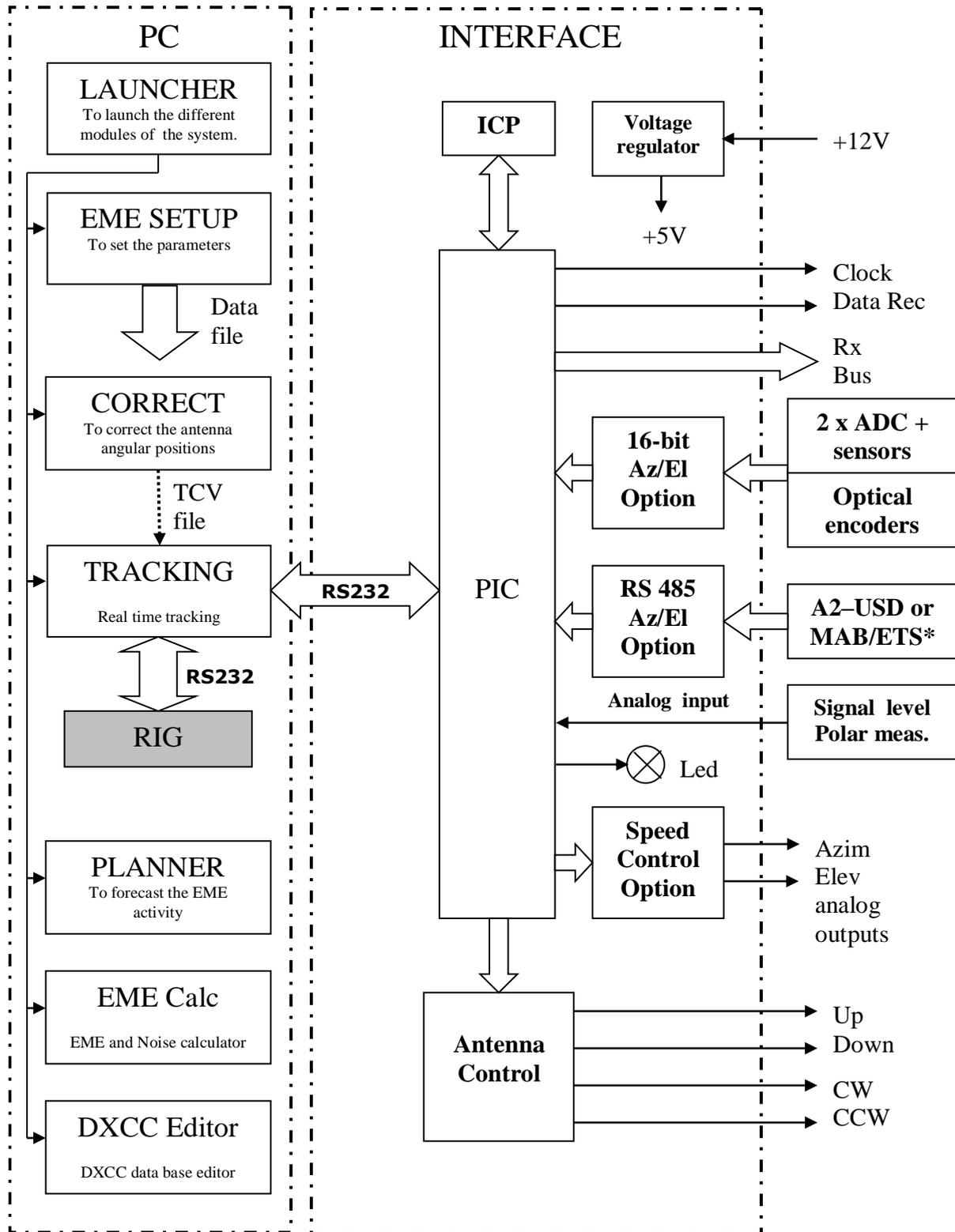
The EME calculator module helps you to evaluate or to gauge the performance of your EME station. Use EMECalc to do an EME budget or to calculate the average performance of your station with noise measurement.

9. DXCC Edit



The DXCC editor module helps you to edit the DXCC database, to modify or update the information, to create a new DXCC or delete obsolete information.

10. EME System diagram



*** MAB and ETS encoders from Megatron need an MABMPU adaptor. A2 is an encoder type from US Digital. Read the "USD&MAB_encoders.pdf" note for more information**