

# FAT 2710

## User Manual



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## Description

FAT 2710 has been designed to give the user an all in one handheld instrument with a synthesized RF generator. The wide coverage generator consists of two octave coverage PLL's which are combined to give the full coverage from 30 MHz to 270 MHz in order to meet the demand for most communication bands in use today and in the years to come. The generator has been designed using state of the art GaAs MMIC's and mixers. Extensive filtering is used in order to reduce the level of harmonics of the generator.

The test frequencies are selected by choosing a center frequency and sweep range of interest for the test object from the keyboard. The test frequencies are indicated on screen as a start frequency in the bottom left, a stop frequency at the bottom right and a center/curser frequency in the middle. The screen will display the frequencies in MHz from 100 to 2700 MHz with one MHz resolution and in the 30 to 100 MHz range with 0.1 MHz resolution. The accuracy of the synthesized RF generator is crystal controlled and very accurate.

Once the test frequencies have been selected, an internal bridge and analog amplifiers feed the computer VSWR data. These data are calculated into VSWR or return loss. The calculated data are displayed as a XY plot onto the screen, the frequencies on the X axis and the VSWR or return loss on the Y axis. At the curser location you will have the corresponding frequency and the calculated VSWR or return loss displayed as a decimal value.

All of the internal circuitry is powered by 4 size AA NiMH rechargeable batteries. The batteries feed a SMPS giving various voltages for tuning, logic, oscillators, Real Time Clock, microprocessor, serial and USB adaptor.

The microprocessor control all functions by a Mini Operating Program (MOP). While in power OFF the processor is in sleep mode and handles Real Time Clock and wakeup interrupts.

In Power ON mode the processor handle the RF PLL generator, VSWR calculations, Keiyboard, LCD Graphic Screen, RS232 serial interface communication, USB adaptor for memory and PC connection, RTC and Power OFF/Sleep.

## Operating

Operating FAT 2710 is easy. In order to switch the unit ON press the "ON/OFF" button firmly. The display will come alive and display a Welcome Screen.

When FAT 2710 is switched on for the first time or if the batteries for some reasons have been replaced or completely discharged you will have to setup basic information like time and day, operator ID and baud rate. Pressing the menu button will display several menu functions. Set the time of day information by selecting hour, minute, day, month and year, you can enter by using the numeric keys or by using the left arrows for backspace followed by enter key. Enter the Operator ID by using the alphanumeric keys ended by pressing enter. To exit the menu press enter until you are back to the frequency display. To enter frequency information select the "Fe Mhz" and enter the center frequency by using the numeric keys followed by enter.

The center frequency can be set from 30 MHz to 2700 MHz. To enter the frequency span select the frequency span "FΔ MHz" and enter the span by using the numeric keys followed by enter.

The center frequency will have priority over the frequency span "FΔ MHz" and will be adjusted within the range of the instrument.

The range of the frequency span can be set from 0 to 2670 MHz. When frequency center or frequency span is entered the instrument will start sweeping and a small sweep indicator will run under the X axis.

When sweeping the screen will display start and stop frequencies and a cursor at the center frequency. The frequencies will be displayed in integer numbers calculated from the number of sweeping points giving a number closest to the calculation. This cursor at the center frequency can be moved to the left or right by using the arrow keys. Holding down the arrow keys will move a small fast cursor and when you release the key the cursor moves into position. When the cursor has been moved to a point of interest, the sweep can be centered around this by pressing the "FE MHz" the cursor position will become the new center frequency.

The "HOLD" button will stop the instrument from sweeping and hold the present measurement on the screen. When the instrument is in "HOLD" mode the leaf will be lit on the status display line. If the "HOLD" button is pressed again the sweep will restart.

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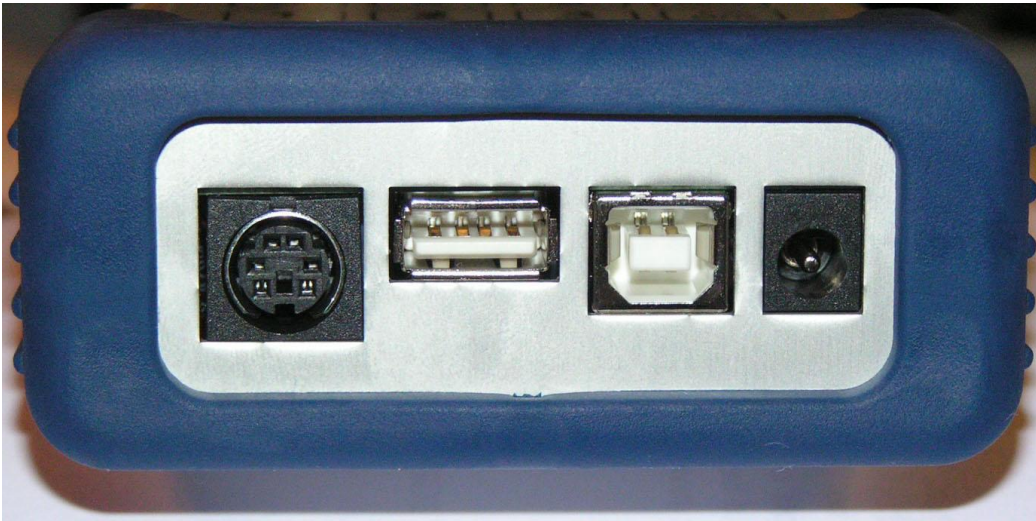


When the USB Memory key is inserted into the USB "A" connector the "Speaker" ICON will be lit on top of the screen. Pressing the "COPY" button will initiate a screen dump to the USB memory key inserted into the USB "A" connector at the bottom of the instrument. The memory key must have a SWR Test directory before this function will be able to store screen dump. When you press the copy button and the memory key is in place the "BUSY" Icon in the upper left on the screen will be on as long as the screen dump takes place. The screen dump will be stored in 'bmp' format compatible with most PC picture viewers.



## Connections

At the rear end of the instruments are 4 connectors:



From left to right:

A 6 Pole Mini DIN connector used for RS232 Communication to a PC with a serial terminal programm at default 38400BpS.

This connector is also used for program updates.

- Pin 1: RS232 RX - in
- Pin 2: RS232 TX - out
- Pin 3: Programmer Clock
- Pin 4: Programmer Data
- Pin 5: Programmer Control
- Pin 6: Ground

USB "A" type for Memory Key

USB "B" type for serial USB to PC

DC Plug for charger + 7.5 Volt at center 5.5 mm/2.1 mm.

## Making Measurement

### Connecting antennas

Observe the utmost care when connecting antennas via cables as these cables can be connected to transmitters and / or power sources! Make sure you have chosen the antenna you intend to test!!

Connection to transmitters and/or sources can destroy the instrument or cause hazardous electrical conditions.

When connecting the the "N" female connector on the instrument make sure you are using either "N" male antenna or cable connector.

If antenna or cable is fitted with another type of connector, use appropriate adapter. Please observe that the use of adapters and cable connections of poor quality may influence the SWR and give higher readings than the actual antenna SWR.

Once the antenna has been connected to the instrument you switch the FAT 2710 on and select the relevant test frequency and sweep range. By using the "Cursor" arrows you can move to the frequencies of interest while observing the SWR at the cursor readout on screen. Antennas are usually designed to have a SWR below a given value within the band for which it is designed. As an example a GSM 900 antenna could have the following specifications: Range 890 – 960 MHz SWR less than 2.0:1 typical 1.5:1.

### Nearby objects

When testing SWR on low gain antennas (Gain <3dBd) the influence from nearby objects is small when the objects are more than  $\frac{1}{2} \lambda$  away (15 cm at GSM900). When testing high gain antennas (e.g. Yagi's and panel's) you should avoid objects in the direction of radiation.

### Strong RF Fields

When testing SWR on antennas located in strong RF fields the reading you will get on the SWR meter may be incorrect, because the strong RF field present will be indicated as reflected power coming from the antenna. If a precise reading is needed you must switch off the disturbing source of RF or move the antenna under test out of the RF field.

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### Bandwidth

Some Antennas may need tuning by adjusting the length of an element or by other means in order to cover the entire band of interest, please refer to antenna manufacturers for details.

### Duplex operation

When checking antennas to be used for duplex operation, make sure the antenna SWR is adjusted for the lowest possible SWR in both receive and transmit band.

### General hints

Always refer to antenna manufacturers specifications! Antennas may have more than one resonance frequency! A very narrow resonance frequency may indicate resonance of cable instead of antenna (Cable broken or shorted)!  
Keep connectors clean and tight!

## Service

The FAT 2710 requires no regular service or maintenance, however should you experience any malfunctions, the instrument may be returned for service according to the service agreement you have chosen. Before you return the instrument for service please check for correct battery voltage to ensure that the fault is not due to battery problems. The nominal voltage of each cell is 1.2 Volt and when fully charged the voltage will be 1.4 Volt approximately.

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### Battery charging

The internal batteries are NiMH type rechargeable. These batteries are superior in capacity and charge operation as there is no memory effect and they hold a high energy to weight ratio. When the "Battery bar 1" indicator comes on there will be a capacity sufficient for approximately 2 hours of normal use left. The recharge can be done from either the 230 Volt AC charger or the optional "Automobile cigarette lighter regulated charger". The charger is a constant current type and will fully recharge the batteries in 20 hours. After full charge the charger will trickle charge the batteries with no damage until disconnected. As a consequence you may leave the charger connected at all times when convenient.

### Battery replacement

The NiMH batteries should endure at least 1000 discharges. To determine if a battery must be replaced you should check if one of the batteries has lower voltage than the others. The nominal voltage after 20 hours of charge is 1.41 volts per cell. If you decide to replace one or more batteries you should be careful not to short-circuit the cell and make sure not to reverse polarity.

Replace only with same type and capacity cell to avoid malfunctions and safety hazards.

## Calibration

The FAT 2710 should be calibrated once a year to make sure it is complying with specifications.

### SWR

The FAT 2710 is calibrated at time of manufacturing against a precision mismatch over the full specified frequency range. On the entire frequency range the minimum and maximum SWR values are recorded according to the specifications in the Calibration Certificate.

### Harmonics and spurious:

The RF generator in the FAT 2710 consists of two PLL's and a mixer, which – besides the test signal – will produce harmonics and spurious signals. To make sure these unwanted signals will not result in incorrect SWR readings they must be as low as possible.

The general level is checked by connection of a spectrum analyzer to the test port and measuring the level of unwanted signals at six selected frequencies. The levels are recorded in the Calibration Certificate.

### RF generator

The frequency generation is controlled by connecting an external counter or a spectrum analyzer with counter option to the test port. The FAT 2710 is checked over the entire frequency range and should be accurate within +/- 50 ppm. The result at two selected frequencies are recorded in the Calibration Certificate.

### Battery Indicator

The battery indicator at the top of the Screen have four indications: with 3 bars lit the batteries are 100% charged; with 2 bars lit 50% charge is left; with 1 bar lit 25% charge is left and when no bars are lit the charge is near end and the batteries need recharging.

### The charger

The DC charge current from the charger is checked and recorded in the certificate.

## Accessories

### Standard accessories:

Battery Charger:           Input: 230 Volt AC 50 Hz  
                                  Output: 7.5 Volt DC 700 mA  
                                  Type: PS-500ST

Batteries:                 Standard size AA, IEC HR6,  
                                  Mignon, VH 1101.  
                                  4 pcs. NiMH Rechargeable  
                                  1.2 Volt, 1.8 Ah  
                                  GP Green Charge - GB180AAH C

### Optional accessories:

Automobile cigarette lighter regulated charger  
                                  1.8 meter cable with lighter jack and 5,5 mm DC plug.  
                                  7,5 Volt DC 1200

Coaxial adapters to fit "N" at the Test port:

- N male / FME male
- N male / BNC female
- N male / TNC female
- N male / mini-UHF female

Soft canvas case

## Warrenty

FAT 2710 has a one year total warrenty covering parts and labour as long as the instrument has been used according to the instructions in this manual, and has not been subject to any abuse. Warrenty will cover the return shipment after repairs.

If a service agreement has been signed please refert to contract tor further details regarding repair and loan of subsitute instrument etc.

## Safety

FAT 2710 should only be used for its intended purpose and never be connected to cables carrying hazardous voltages.

When handlich NiMh batteries great care sholud bei observed preventing polarity reversal and short circuit as the batteries may explode or catch fire.

## Abbreviations

SWR	Standing Wave Ratio
RF	Radio Frequency
MHz	MegaHertz
GaAs	Gallium Arsenide
MMIC	Monolithic Microwave Integrated Circuit
SMPS	Switched Mode Power Supply
GSM	Global System for Mobile
dBm	deciBell referenced to 1 milli Watt
dBd	deciBell referenced to halfwave dipole
ppm	parts per million
LCD	Liquid Crystal Display
AC	Alternating Current
NiMH	Nickel Metall Hydride

### Specifications

Application	Measurement of SWR in 50 $\Omega$ transmission lines
Frequency range	30->2700 MHz entered as centre and span
Center Frequency	30 to 2700 MHz.
Span	0 to 2670 MHz.
Frequency stability	$\pm 50$ ppm
Measurement range	1.0<SWR<9.9, 0<dB<-30dB
Impedance	Nom. 50 $\Omega$
Generator output	Approx. -4dBm
Max. input on test terminal	100 mW
Tolerance on SWR reading	30-650MHz) $\pm 10\%$ ; 650-1450MHz $\pm 10\%$ ; and 1450-2700MHz $\pm 15\%$
Operating temperature range	0° C-> + 50° C
Storage temperature range	-30°C -> + 50° C
Connectors	"N"-female RF test connector. USB A type for memory key. USB B type for serial PC communication. Mini DIN for RS232 communication up to 38400 Baud
Power supply	4 NiMH type AA rechargeable batteries (Batteries, NiMH rechargeable and 230VAC/7.5VDC charger supplied)
Auto Power off (no failure!)	For battery economy, FAT 2710 automatically turns off 3 min. after last entry
Normal operating use	Fully charged: More than 10 hours.
Colour	Silver/blue
Width	82 mm
Depth	31 mm
Height	165 mm
Weight	500 gram (incl. Batteries)
EMC	Complies with directive 89/336EEC as amended by 92/31EEC and 93/68/EEC
Standards	Emissions: EN 61000-6-4: 2001 Immunity: EN 61000-6-2: 2005