CORNET® ED-88TPlus2 Electrosmog meter user's manual v.1

06/27/2021

CORNET Microsystem Inc., **ED-88TPlus2** Electrosmog meter is a **Tri-mode device** for quick measurement of both High frequency (RF) Electromagnetic wave field strength/power density level, Low frequency (LF) Magnetic field level(Gauss, Tesla), and Low frequency (ELF) Electric Field(V/m) for living environments. It is an excellent device for individual or company with Electromagnetic wave safety concerns. It has RF bandwidth of 100MHz to 8GHz with high sensitivity (0.5uw/m² to 1.8w/m²), LF Magnetic field bandwidth of 50Hz to 10kHz (or 50Hz to 1kHz) with sensitivity of 0.1uT to 60uT(1mG-600mG) or 0.01uT to 1uT(0.1mG to 10mG), E-field bandwidth of 50Hz-50KHz with sensitivity of 10v/m to 1000v/m. it also has build-in RF Frequency counter function (100MHz-2.7GHz) and very fast samplying rate (25000 samples /second), It can detect very short burst of digital RF signals down to 100usec. **Data Logging function of upto 50 hours of data can be stored and displayed on the meter** is also included.

Applications:

- High frequency RF Electromagnetic wave field strength, power density and frequency measurement
- Low frequency LF Magnetic field measurement (Gauss meter function)
- Low frequency ELF Electric field measurement (E-field meter function)
- Mobile phone base station antenna radiation power density measurement
- Wireless communications, both Analog & Digital RF signals (AM/FM, TDMA, GSM, DECT,CDMA, 3G,4G, 5G(600MHz-6GHz band)
- RF power measurement for radio transmitters
- Wireless LAN (Wi-Fi 2.4GHz, 5.8GHz), WiFi6, Bluetooth, Ultra-wide-band detection, installation, optimization
- Spy camera, wireless bug finder, IOT devices
- Cellular/Cordless phone radiation safety level, Electrical Utilities SMART METER radiation level measure
- AC power line, High voltage tower, Power Transformer, motors and small appliance EMF detection
- Microwave oven leakage detection
- Personal living environment EMF safety evaluation

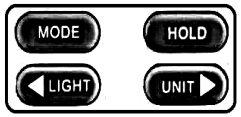
Please download new version of manual from: www.cornetmicro.com

Usage guide:

(1) Put the 9V battery in the ED88TPlus2, Handle the unit with right hand in vertical direction, and turn on the volume/power switch to turn on the power, it will come up with RF meter mode after power on.

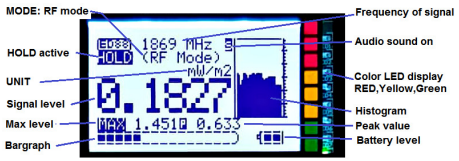
(2) The RF sensor is located in the left hand side of the ED88TPlus2; the LF sensor is located in the top right side of the ED88TPlus2, the E-field sensor is located in the middle top side of the ED88TPlus2, **Please do not cover the sensor area with fingers/hand or other objects**.

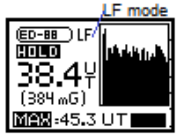
(3) There are 4 push button on the ED88TPlus2: **"MODE", "HOLD", "LIGHT",** and **"UNIT"** button,



"MODE" button is used to switch in between RF mode, two LF modes, and E-field mode.
"HOLD" button is used to halt the data measurement. Push the button again to exit the "Hold" condition. a **"HOLD"** Mark is shown on the LCD screen to indicate the "Hold" condition.
"UNIT" button select the mw/m2,v/m,or dBm unit.
"LIGHT" button turn on/off the LCD backlight and Audio sound.

(4) **RF mode**: measured RF field strength, power density is shown on the digital LCD display (with dBm, v/m, or mw/m²). 8 LED lights with Red, Yellow, and Green color are used for quick RF signal level indications. 3 Red LEDs are used to indicate the 3 country's safety ranges. The power level of each LED can be found in the table on the ED-88TPlus2 back panel. Frequency of signal detected is also displayed on the LCD display in realtime.





(5) **LF mode**: measured LF magnetic field strength is shown on the digital LCD display (with uT and mGauss). Two LF modes can be selected by using the **"MODE"** button:
(a) **LF30 mode:** has high sensitivity (0.1mG-10mG), but with lower frequency range (50Hz – 1kHz) to reduce the high frequency noise. (The Histogram and LED segment display can still display go up to 30mG)
(b) **LF600 mode** (1mG-600mG) has higher frequency coverage (50Hz -10kHz).
8 color LED lights are also available to show the magnetic field level.
*When measuring the high frequency digital/pulse type of signals (such as switching power supply), the LF30 mode might have lower reading than the LF600 mode, this is due to the lower frequency coverage range of the LF30 mode.

(6) **E-field mode**: measured ELF electric field strength is shown on the digital LCD display with V/m.

(7) **Histogram:** Previous 30 signal level readings are recorded and shown as moving graph on the LCD display for RF, LF, and E-field modes. It can be used to find the direction of signal source and for recording digital RF burst signals such as signals from AC smart meter.

(8) **MAX:** Maximum measured data value since the last power-on is shown on the LCD display.

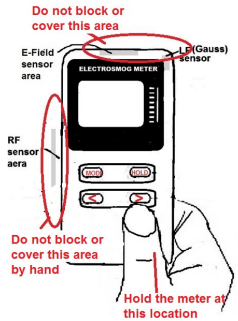
(9) **Average:** whole-Average or Peak-average value is displayed on the LCD with **"A"** or **"P"** mark. The Whole-**A**verage is the sum of all sampled data divided by the number of data within the screen update time, the **P**eak-average is the average of the 30 data in the histogram.

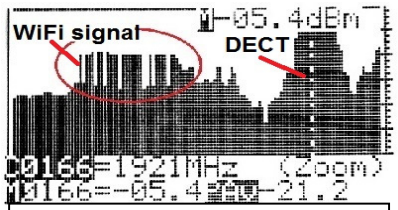
(10) **Sound function** & **LCD backlight:** Toggling the **"LIGHT"** button can turn-on/off the LCD back light and the Audio Sound function, (a **"S"** mark on the LCD indicates the sound mode is on). Wheel volume control can be used to adjust the sound level. Audio Sound can be used to detect very low level RF signals (down to 0.05uw/m²) especially for the modern digital RF burst signals**.** To reduce the battery current consumption please turn-off the LCD back light or the sound when it is not needed.

(11) **SysSetup Menu:** Push and hold the "UNIT" button then push the "HOLD" button to get into the SysSetup menu. Use the ">" button to move the cursor in the Menu and use the "<" button to enable/disable the functions In the SysSetup menu:
(a) **EXIT:** exit the SysSetup menu, return to normal mode
(b) **RF level Unit select:** select default mw/m², v/m, or dBm mode when meter is powered on.
(c) **LED Level:** used to adjust the color LED segment display level for custom safety standards OFF,-5,-10,-15, or -20dB. (use -20dB for "SBM2008 Building Biology Testing Methods")
(d) **Average/Frequency:** select Peak average, whole Average, or Frequency of **MAX** value display.
(e) **MAX_Clear** bit: If the **MAX_Clear** is "ON" the **MAX** value can be cleared by toggling the "HOLD" button. If it is "OFF" the **MAX** value can be cleared only by power-off the meter.
(f) **Alarm:** ON/OFF or one of the 8 trigger levels (0, -5,-10,-15,-20,-25,-30,-35dBm) can be selected to trigger the audio Alarm. *(Alarm function is for RF mode only).
(e) **RESET:** Reset to default (mw/m², LED Level OFF, MAX_CLEAR ON, Alarm OFF, PeakAvg).
(g) **SAVE:** push the "<" button to save the changes of setup to EEPROM memory. **Do not power off meter, Wait until save is done!** (if **EXIT** without **SAVE** to memory first, the changes will still functional, but it will be lost if the meter is power-off).

(12) While in LF or E-field mode (magnetic/electric field measurement), please hold the meter steady to get good stable reading, avoid fast moving of the meter to prevent the sudden change of the reading caused by the Earth magnetic field or the induced electric field from nearby objects.

(13) AC Smart Meter radiates RF signal in short burst every few minutes, user can use the Data Logging function of ED88TPlus2 to capture and view the RF signals from smart meter on the LCD screen.





Data Loggin mode captured data and display it on LCD display window

(14) **Data Logging menu:** Push and hold the "UNIT" button then click the "MODE" button to go into the **Logger_Setup** menu. Please download /see the "**ED88TPlus2 Data Logging user Guide**" from www.cornetmicro.com for details of how to transfer the Data Logging data to PC computer through USB serial interface cable.

Data Logging view mode:

The ED88TPlus2 can record the measured data in the meter's internal memory automatically upto 50 hours of data and view it on the LCD display, This is an excellent tool for measuring the signals with short hign level burst and long period of zero signal level time (such as AC smart meter) or to monitor the signal overnight to see the signal variations or to get average signal levels in long period of time.(such as 1min. 3 min. or 6 mins

average value as in some safety standards). The logged data can be stored in the meter, view it on the LCD display or transfer it to PC computer through USB serial interface cable for further processing.

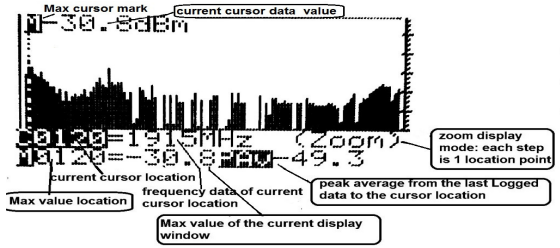
There are 1024 cell of **Data Logging Buffer memory**(Buffer memory) and 1024 cell of **Data Logging Flash memory** in the ED88TPlus2 to store the data for the RF mode data logging. Both memory are organized as ring type of memory. The data is Logged into the Buffer memory continuously based on the **Logg time** in the Logger_setup menu when the meter is in the RF mode. (up to 50 hours of data can be logged if the Logg_time is set to 3min.).The Buffer memory will not retain the stored data if the meter is power-off. If the user wants to keep the recorded data after the meter is power-off the user must save the data from Buffer memory to the **Data Logging Flash memory** before the meter is power-off. The **Data Logging Flash memory** will keep the stored data even if the meter is power-off.

(1) To get into and out of the **Data Logging view mode:**
Push the "**HOLD**" button to get into the **Hold mode** then push the "**MODE**" button to get into the **Data Logging view mode.** While in the **Data Logging view mode,** push the "**HOLD**" button will get into the **Temp HOLD mode.** While in the **Temp HOLD mode,** you have two options**:**

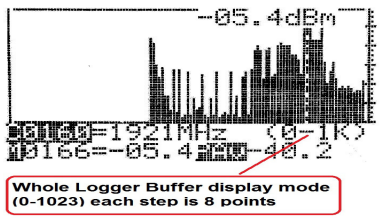
a) Push the "**HOLD**" button will get out of the **Data Logging view** mode and back to **HOLD mode.**
b) Push the **"MODE"** button will return to the **Data Logging view mode** again**.**

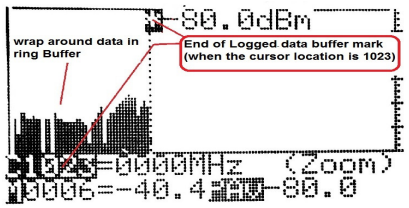
(2) To switch in between the two **Data Logging view mode LCD display window:**
While in the **Data Logging view mode** clicking the "**MODE**" button will toggle the LCD display window in between the **(0-1K) display mode** and **(Zoom) display mode**. Each display mode can display the Logged data in the Buffer memory with the window size of 122 points on the LCD display.

(0-1K) display mode: the whole 1024 Logged data in the Buffer memory is scaled down and displayed within the 0-122 point LCD display window (the step size is 8 for each display point).
(Zoom) display mode: the 122 point display window is sliding through the whole 0-1024 cell Buffer memory (with step size of 1 for each display point). The 122 point display window will be slide moved automatically when the cursor reached the two edge of the window display.

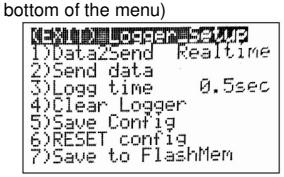


(3) To **move the cursor** in the display window: The cursor in the display window is pointing to the cell address of the Buffer memory. The 1024 signal level and frequency data stored in Buffer memory can be displayed by Moving the cursor with "<" and ">" button in the **Data Logging view mode.**
(4) The **current cursor location** is displayed as **Cxxxx=yyyyMHz**, the **xxxx** is the cursor location (the cell address of the 1024 cell Buffer memory), the **yyyy** is the **Frequency** of the signal at the cursor location, the **signal level** of the cursor location is displayed on the top of the dash cursor line in the window display**.**
(5) The **Max value within the displayed window** is shown as **Mxxxx=yyyy**, the **xxxx is** cursor location (the cell address), and the **yyyy** is the **Max value** of the122 data within the window.
(6) The **Peak average value** is displayed as **PAVxxxx,** the peak average value is the average of all the data from the latest logged data (cell address 0000) to the current cursor location.
NOTE: The Data Logging Buffer memory (Buffer Memory) is organized as **FIFO** buffer (first in-first out)**,** the latest new data is always stored in the cell address 0000 of the Buffer memory, the old data in the cell address 0000 is pushed into the next available cell (cell address 0001) of the memory when the new data is coming in. When the data stored in the Buffer memory is full or more than 1024 the oldest data will be lost and get overwrited by the new data. The Data Logging view mode display the data stored in the Buffer memory. To view the data inside the Data Loggin Flash memory you need to read it into the Buffer memory first.

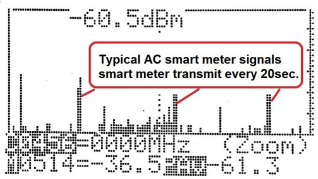




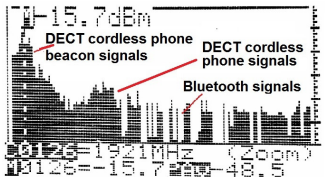
(7) End of Buffer cursor mark: When the cursor moved to the cell #1023 of the Buffer memory it will show a "*"sign on the top of the dash cursor line, the cursor will stop moving after it reached the cell#1023. Please ignore the data on the left hand side of cursor when it reached the cell#1023 (it is the replicate of the data beginning from cell address#0000 again since the display window is implemented as a ring type of display window).
(8) To save the data from Buffer memory to the Data Logging Flash memory: Push the "**HOLD**" button first to get into the **Temp HOLD mode,** push and hold the **UNIT** button then click the **MODE** button to get into **Logger_Setup menu,** move the cursor by **">"** button to item# 7" **Save to FlashMem",** press **"<"** button to activate the **save** command.
(9) To read the data from Data Logging Flash memory to the Buffer memory: Push the "**HOLD**" button first to get into the **Temp HOLD mode,** push and hold the **UNIT** button then click the **MODE** button to get into **Logger_Setup menu,** move the cursor by **">"** button to item# 8" **Read from FlashMem" ,** press **"<"** button to activate the **read** command. (the menu will scroll up automatically to item#8 when the menu cursor reached the bottom of the menu)



(10) Calculate the time Average value: The **Peak average value (PAv)** of the data within certain period of time (from the latest Logged data backward to the cursor location data) can be displayed on the display window. Setup the **Logg time** in the item#3 "**Logg time"** in the **Logger_Setup menu** first then move the cursor to the 1min, 2min, 3min,… etc time location, the time average value will be displayed as **PAv**. For example: if the **Logg time** is setup to 0.5sec. the Data Logger will Logg the data every 0.5sec. By moving the cursor location to 120 (which is 0.5sec.x120=60sec). the **PAv** will be the **1min. time average** value (from the latest Logged data at cell#0000 to cell#120). Again, moving the cursor to location 240 you will get the 2min. average in **PAv**



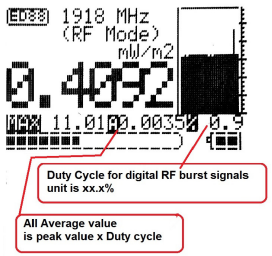
AC Smart meter signals

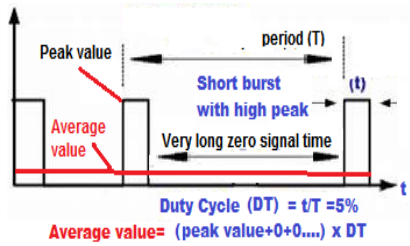


DECT Cordless phone base unit beacon signal, handset signal, Bluetooth signal

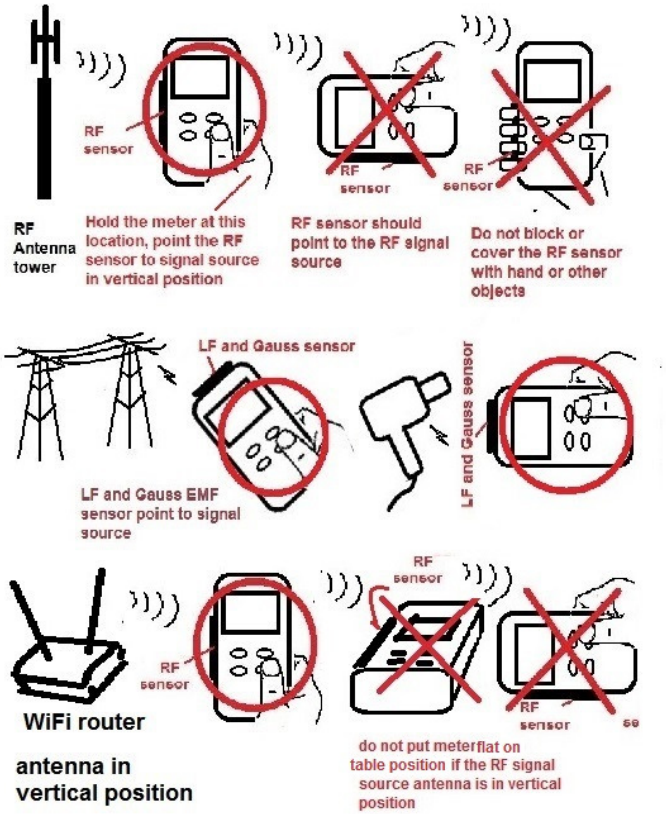
Duty Cycle of the digital RF burst signal:

The **Duty Cycle** of digital RF burst signal is the percentage of the **"ON" time** when it is transmitting the signal. The modern date digital RF burst signal transmits very high level of signal with very short burst time **(**the**"ON" time**) and with zero or very low signal level when it is not tranmitting the signal (the **"OFF" time**). The Average value of all these short but high signal level **"ON" time** value and the long but very low level **"OFF" time** value is shown as the **wholel Average value** in the ED88TPlus2.
*The **whole Average value** could be very low even if the signal level of the very short **"ON" time** signal ls very high. The **Duty Cycle** can be use to calculate the **whole Average value** or to indicate the signal is a digital RF burst type of signal. Typical Duty cycle value of the WiFi, DECT, Bluetooth signal is less than 1% if the device is with low data traffic. The **Duty Cycle** of the continue wave analog AM/FM signal will be close to 100%.





How to hold the ED88TPlus2 to measure different signals:



Field strength/power density of LED readout:

ED88TPlus2 use 8 high brightness LED to indicate the measured power density with 3 safety Indications of three countries. *Action is reference to ICNIRP (for reference only).

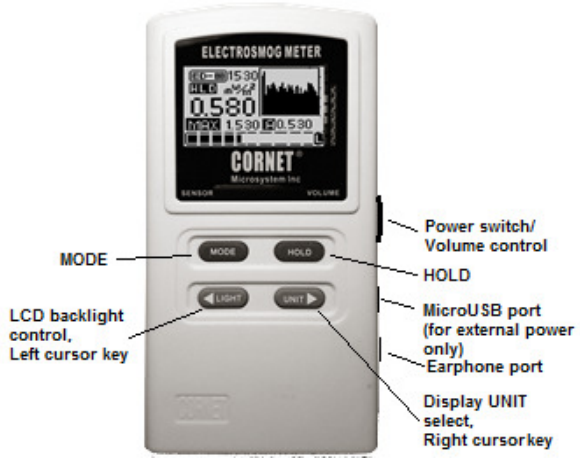
LED color	*RF Power level*	*RF Power density*	*LF600/LF30 level*	*E-field level*	*Indication*	*Action*
RED3	-5 dBm up	0.18 w/m^2	30uT/3uT up	500 v/m	Italy RF safety standard (0.1w/m^2)	Caution!
RED2	-10 dBm	0.058 w/m^2	20uT/2uT	200 v/m	Swiss RF safety standard (0.04w/m^2)	Caution!
RED1	-15 dBm	0.018 w/m^2	10uT/1uT	100 v/m	Russian RF safety standard (0.02w/m^2)	Caution!
YELLOW3	-20 dBm	5.8 mw/m^2	5uT/0.5uT	75 v/m		Safe*
YELLOW2	-25 dBm	1.8 mw/m^2	2uT/0.2uT	50 v/m		Safe*
YELLOW1	-30 dBm	0.58 mw/m^2	0.5uT/0.05uT	30 v/m		Safe*
GREEN3	-35 dBm	0.18 mw/m^2	0.2uT/0.02uT	20 v/m	WiFi Wireless LAN typically in this range	Safe*
GREEN2	-40 dBm down	0.06 mw/m^2	0.2uT/0.02uT down	10vm	Some signal source around	Safe*

NOTE:

- **Most high frequency RF antenna such as Mobile phone base station is vertical polarized (in vertical direction), therefore while in RF mode, the ED88TPlus2 is normally used in vertical direction. For LF mode, the LF sensor is located in the top right hand of the meter and the meter is normally used in Horizontal position in LF mode. For E-field mode, the E-field sensor is located in the top middle of the meter, point the sensor to the ELF source. Please rotate the meter to find the maximum reading direction in either case. The maximum reading will also increase as you approach the source. It can be used to find the location of signal source.**
- **ED88TPlus2 measures the Peak power density of the signal with very fast sampling time (25000 samples/sec.). It can detect downto 100nsec. RF burst signal. The DECT phone base unit transmit beacon signal continuesly with very high level signal but only 150nsec burst time, the duty cycle is less than 1% and not every EMF meter can detect it. The ED88TPlus2 is able to detect it and show the signal level and frequency of it.**
- **Electromagnetic wave field strength/power density reduces very fast with distance (distance square), keep a good distance from the high frequency RF signal source can reduce the high frequency radiation effect. Alumina foil or window sun reflector film (silver color) can be used as an effective and low cost shielding material for most of RF radiations.**
- **ED88TPlus2 is designed for quick living environment RF radiation evaluation for home use and is for reference use only. Official RF safety radiation measurement procedure is complicate and should be handled by trained technical person with lab instruments. Safety range standard listed below is for reference only. ED88TPlus2 is not a medical instrument, Please do not use it in medical, legal, commercial rental purpose or other related applications. (for personal use only)**
- **Turn the volume control to minimum first before plug in the earphone to the meter to avoid damage to your ear by accident from high level audio sound produced by digital RF signals.**
- **The audio sound output of the sound function is the demodulated RF signal, it is good for AM and modern digital RF signals (pulse/burst) detection, it is not for FM or constant amplitude RF signals or LF/ELF modes. it is an excellent tool for RF signal type indication. (different RF signal such as Wifi, GSM, DECT, •••.etc., all has different sound frequency signature of the demodulated RF signal) and for very low level signal detection.**
- **When in E-field mode, the electric field induced by human body or large objects nearby can affect the measurement results, hold the meter by hand on the lower right side of the meter, do not cover the E-field sensor area (top of the meter) by hand or other objects, keep away from large metal door or objects. Point the top of the meter to the high voltage AC power line (with the meter at least 1 meter above the ground) when measuring the VLF/ELF E-field radiation from AC power lines or towers. Average value is displayed in E-field mode to reduce background noise, Reading will be lower for narrow spike type of E-field radiation such as from FL lamp.**
- **RF Power density is the RF power divided by the area receiving the RF power, if the distance in between the RF source and the meter is closed to zero the "area" will be almost zero and the Power density will become infinite large. Keep some distance from RF source when doing the measurement. The standard distance of most of the safety standard is 1 meter or 3 meter.**

Specification

Sensor type:	Electric field sensor and Magnetic field sensor
Frequency range & Sensitivity:	**RF:** 100MHz to 8GHz (-60dBm to +5dBm),(0.5uw/m^2 to 1.8w/m^2), (14mv/m to 26.2v/m) **LF1:** 50Hz to 10kHz (0.1uT to 60uT)/(1mG to600mG) **LF2:** 50Hz to 1kHz (0.01uT to 1uT)/(0.1mG to 10mG) **E-field/ELF:** 50Hz to 50kHz (10v/m to 1000v/m) **Frequency counter:** for RF mode only, 100MHz-2.7GHz, -35dBm minimum signal input required
RF Peak power measurement:	0.5uw/m² to 1.8w/m²
Display type:	digital LCD graphic display
Unit of measurements:	dBm, mw/m², v/m, uT, mG, MHz
LCD back light:	15 seconds auto-off and manual on/off control
Display of data:	LCD 4 and 5 digit, 8 LED color segment, Moving Histogram (level/time) of previous 30 recorded data, Analog segment bar
Data update rate:	Sampling rate: 25000/sec. Display update rate: 2/sec.
Error rate:	RF: +/- 3.5dBm, LF: 20%, E-field: 25%
Functions:	Hold, Max, Average, Sound signature, Alarm, Frequency, Duty cycle
Sound & Alarm:	Sound on/off/volume control, programmable Alarm triggering level
Safety standard indication:	3 safety range indication by 3 Red LED, adjustable LED level
Data Logging:	1000 data storage memory cell for logging/recording measured RF signal level, (RF level, RF Frequency), up to 50 hours of data can be stored in the build-in memory and displayed on the LCD display. Magnetic field level, Electric field level can also be logged and transfered to PC computer through USB serial interface.
Battery used:	9V alkaline battery or external power supply through USB port (5V)
Battery life:	>20 hours



The European Community provided general guidelines in its Council Recommendation of July 1999.1 ICNIRP published similar guidelines in April 1998.2 Table I gives a sampling of the international and national field-strength limit values for the general public and continuous exposure (for Reference only !)

		950Mhz	1850Mhz
International	Council Recommendation 1999/519/EC	42 V/m (4.75W/m^2)	59 V/m (9.25W/m^2)
International	ICNIRP Guidelines, April 1998	42 V/m (4.75W/m^2)	59 V/m (9.25W/m^2)
Austria	ÖNORM S1120	49 V/m (6.33W/m^2)	61 V/m (10W/m^2)
Belgium	Belgisch Staatsblad F.2001-1365	21 V/m (1.18W/m^2)	30 V/m (2.31W/m^2)
Germany	26. Deutsche Verordnung	42 V/m (4.75W/m^2)	59 V/m (9.25W/m^2)
Italy	Decreto n. 381, 1998	6 V/m (0.1W/m^2) 20 V/m (1W/m^2)	6 V/m (0.1W/m^2) 20 V/m (1W/m^2)
The Netherlands	Health Council	51 V/m (6.92W/m^2)	83 V/m (18W/m^2)
Switzerland	Verordnung 1999	4 V/m (0.04W/m^2)	6 V/m (0.1W/m^2)
United States	IEEE C95.1	49 V/m (6.33W/m^2)	68 V/m (12W/m^2)
China	Draft: National Quality Technology Monitoring Bureau	49 V/m (6.33W/m^2)	61 V/m (10W/m^2)
Japan	Radio-Radiation Protection Guidelines, 1990	49 V/m (6.33W/m^2)	61 V/m (10W/m^2)

SBM2008 Building Biology Institute- Recommended EMF exposure Level

	Units	No Concern	Slight Concern	Severe Concern	Extreme Concern
ELF Electric	V/m	<0.3	0.3-1.5	1.5-10	>10
ELF Magnetic	mG	<0.2	0.2-1	1-5	>5
RF	mw/m2	<0.0001	0.0001-0.01	0.01-1	>1