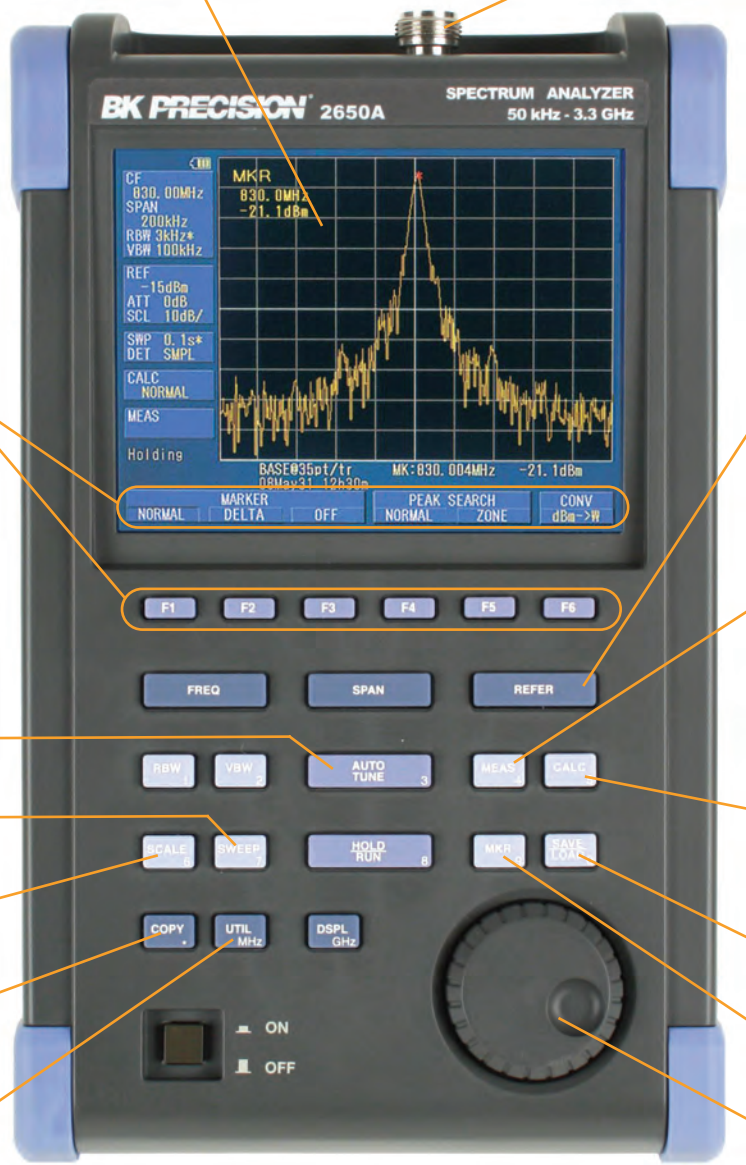
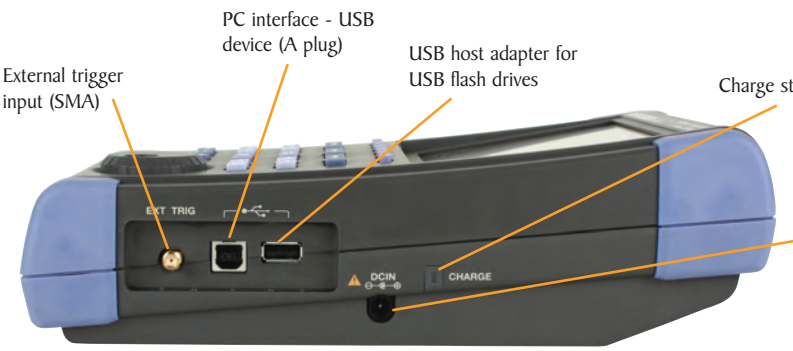
▲ Front panel

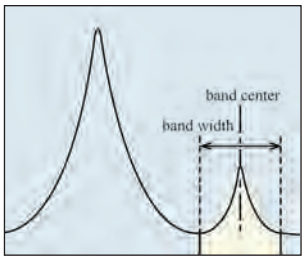


▲ Interface

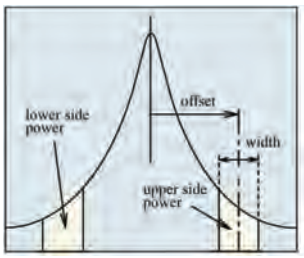


▲ Versatile measurement functions

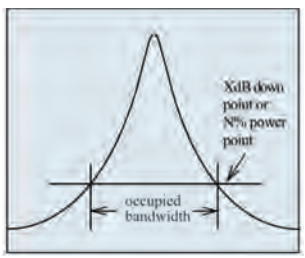
Channel power measurement
Allows you to measure the total power or noise power in a user-specified bandwidth.



Adjacent channel power
Measure the ratio of power leakage (from the wanted signal) into adjacent channels. Center frequency, adjacent channel bandwidth, and offset between main carrier and adjacent channels can be set.
Users can select from any of the following three measurement methods based on the reference carrier definition: total power (of displayed spectrum), peak power (reference level) and in-band power (user-specified band width).



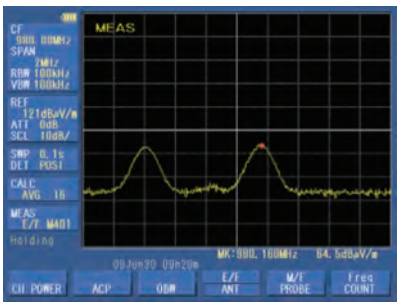
Occupied Bandwidth
This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. Two measurement methods are available: The user can specify N% of total power or the X dB down point relative to the carrier peak level.



Electric field strength measurement
A dipole antenna (options M401 – M406) connected to the RF input enables the measurement of electric field strength. Users can choose from 6 antennas based on the frequency range under investigation. Each antenna's resonance point is optimized for the frequency spectrum of a specific wireless standard:

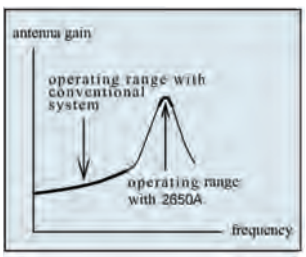
- M401 is suitable for GSM 850/900
- M403 for W-CDMA and GSM 1800/1900
- M404 for 2.4 GHz wireless LAN and Bluetooth
- M406 for 5 GHz wireless LAN

Combined with the MAX HOLD function and a 10 ms sweep time, the M404 dipole antenna is capable of measuring the electric field strength of



Bluetooth systems and systems using direct sequence spread spectrum/frequency hopping modulation techniques.

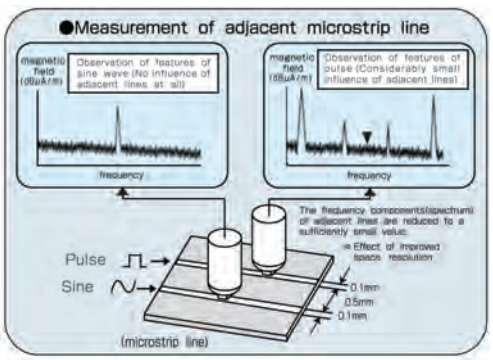
Using multiple dedicated dipole antennas leads to better measurement results compared to the conventional method of using only a single wide band antenna in which case the frequency range under investigation is typically located far away form the antenna's resonance point, resulting in poor dynamic range. Measuring at or near the resonance point where the antenna gain is at a maximum translates into high dynamic measurement range.



Since the antenna gain factor compensation data is preloaded into the analyzer, the field strength is displayed directly in dBuV/m. The analyzers also support downloading of user-defined gain factor tables for custom antennas.

Magnetic field strength measurement
Using a magnetic field probe (option PR 26M), the 2650A series is capable of accurately measuring the magnetic field distribution on a PCB (printed circuit board) or IC (integrated circuit). The magnetic field strength detector inside the probe consists of a shielded loop structure using a glass ceramic multi-layer board technology with high frequency characteristics. This enables the detection of magnetic field components only. The probe can measure over a wide frequency range of 10 MHz to 3 GHz. Since the probe's compensation data is already preloaded into the analyzer, the magnetic field strength is displayed directly in dBuA/m.

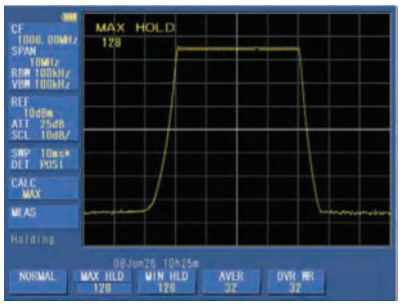
Typical applications of this magnetic field probe are evaluation of the effectiveness of a bypass capacitor located near the power supply terminal of an IC or evaluation of the microstrip layout on a PCB. Due to the probe's high spatial resolution (approximately 0.25 mm), it is not affected by adjacent patterns.



▲ Calculation and Marker functions

Max and Min Hold

Max Hold: At each displayed frequency, the currently-measured value is compared to the previously-measured value and the larger one is retained and displayed. This feature is useful for observing a bursted or intermittent signal or for measuring the electric field strength of systems using direct sequence spread spectrum/frequency hopping modulation techniques.

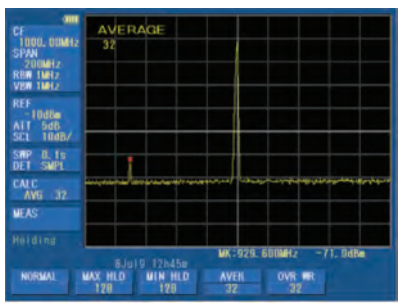


Min hold: At each displayed frequency, the currently-measured value is compared to the previously-measured value and the smaller one is retained and displayed.

In both cases, the number of sweeps can be set to 2^N, where N is from 1 to 10 or infinite.

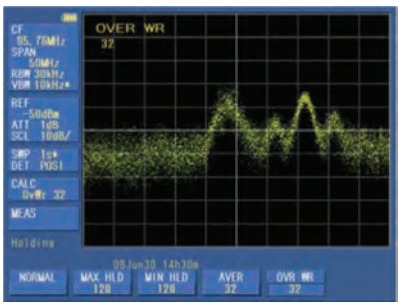
Averaging

The analyzer continuously sweeps, then calculates and displays the average value over the total number of sweeps. The number of sweeps can be set to 2^N, where N is from 1 to 10. Averaging is useful for detecting signals buried in the noise floor because random noise is averaged out.



Overwrite

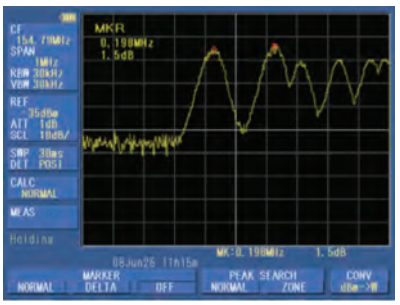
The results of each consecutive sweep are displayed and the screen is not cleared after each sweep. This lets you observe the long term variations of a signal.



Marker Function

Two different modes are available for marker measurements:

- Normal marker mode measures the frequency and level of the marked point
- Delta marker mode measures the frequency and level differences between the two markers (see image)

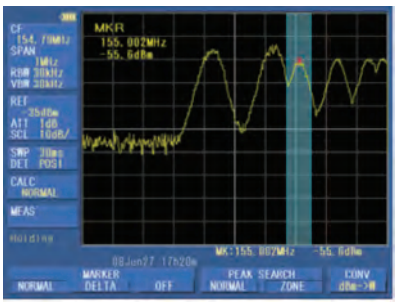


Delta marker measurement

Peak Function

Two different modes are available for peak search:

- Normal peak search mode searches for the highest level on the screen. In this mode, you can also use the NEXT button to locate the marker on the next smaller peak.
- In-zone peak search mode searches for the peak level in the range specified by the center value and width.



The picture shown demonstrates in-zone peak search.

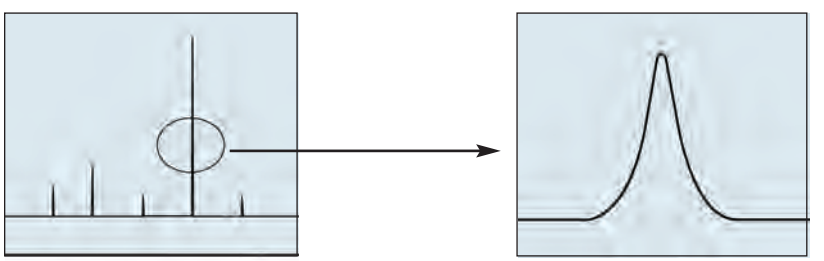
▲ Easy operation

The 2650A series handheld spectrum analyzers are straightforward to operate and provide many functions to facilitate quick and easy measurements:

- Smart one button "Auto Tune" function which automatically scans the full frequency range, detects and centers the maximum signal, and configures optimum values for RBW, VBW, sweep time and reference level
- Input attenuator and internal preamp are set automatically to optimal values based on the reference level
- Easy configuration of frequency, span, and amplitude
- Marker and peak search functions enabling rapid measurements
- 200 setups and reference spectrum measurements can be stored and recalled from either internal memory or USB flash drive
- Filenames can be customized and include a date and time stamp.
- Large easy-to-read display. The backlight is adjustable and monochrome mode can be used for extreme lighting conditions

Long battery life

The 2650A provides a battery operating time of up to 4 hours (approximatly 3 ½ hours with back light set to typical settings). Battery replacement is simple and doesn't require any hand tools. To fully charge the lithium-ion battery takes only approximately 4 hours (analyzer must be turned off). A two color LED indicates the charging status "charging", "charge completed", "no battery detected" and "charging error".

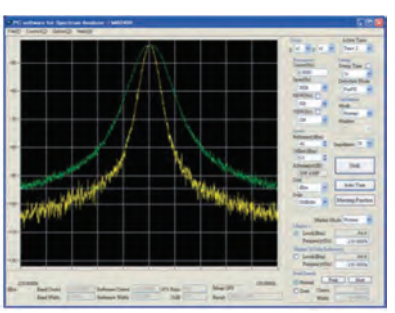


Detect the maximum level within full span.

Center the maximum signal, configure optimum parameters

▲ Simple and flexible documentation of your measurements

PC software



The 2650A series includes easy-to-use software for documentation and further analysis of your measurements. Connect the analyzer via USB cable to your PC, configure the analyzer remotely, then download measurement data and instrument settings for storage and further analysis.

- Continuously sweep and transfer trace data to the PC.
- Capture 1001 trace data points (twice the number of display dots) and store the data in CSV (comma separated values) format for detailed analysis (e.g., import into a spread sheet)
- Save the screen to a bitmap file or to the clipboard
- Control all instrument settings from the PC
- Download custom antenna gain factor compensation data to the instrument

Hardcopy to USB printer

Generate a hard copy of the display by directly connecting the optional USB printer model PT2650A to the 2650A series analyzer.

Conveniently save measurement data to USB flash drive

Easily save and recall measurement data and settings in CSV format directly to and from the USB flash drive. Filenames can be customized and have a time and date stamp. Users can choose to store measurement data and setups in separate files or combined in one file.
Using the Copy function, a screen image in bitmap format (BMP) can be directly stored to the USB drive. CSV data residing in internal memory can be stored to the USB drive in a lump sum.

▲ Spectrum Analyzer with Tracking Generator, 50 kHz – 3.3 GHz Model 2652A

Built-in transmission measurement
The 2652A is a 2650A with a tracking generator added. The 2652A can be used to rapidly determine transmission characteristics of two-port RF devices.

Tracking generator specifications	
Frequency range	5 MHz to 3.3 GHz
Output Level	-10 dBm ± 1 dB @ 1 GHz (output level is fixed)
Output flatness	±1.5dB
Output impedance	50 Ω
Output connectors	N (J)

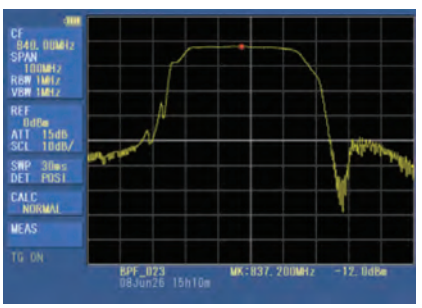
Tracking generators are ideal for tuning filters, determining the usable frequency range of amplifiers and attenuators and aligning receiver IF stages.

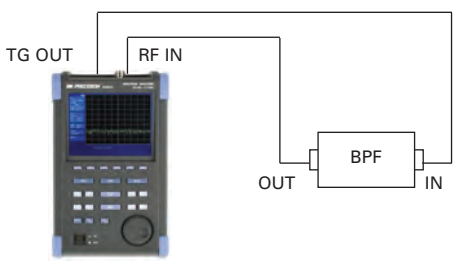
The tracking generator's output frequency is the same as the frequency the spectrum analyzer is tuned to. This lets you see the amplitude response of a circuit on the spectrum analyzer screen.

The analyzer's normalize function can be used to remove the effects of the cable(s) connecting the device. This allows you to differentially measure a device's response without worrying about cable effects.

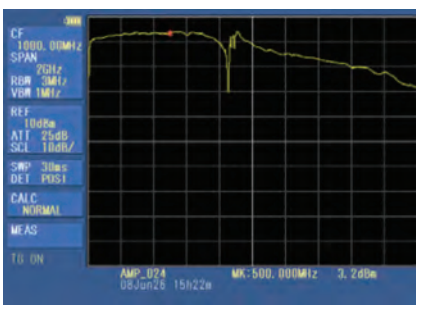
APPLICATIONS

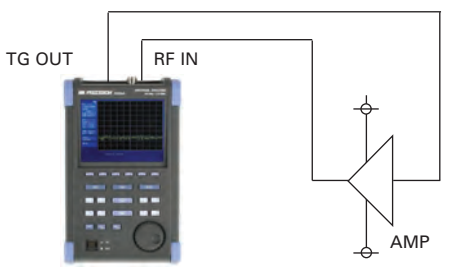
Characterize the frequency response of a filter
Measure the frequency response of a passive component, e.g a filter, over the 2652A's full range of 5 MHz to 3.3 GHz.



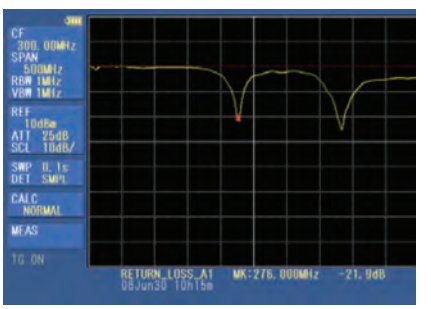


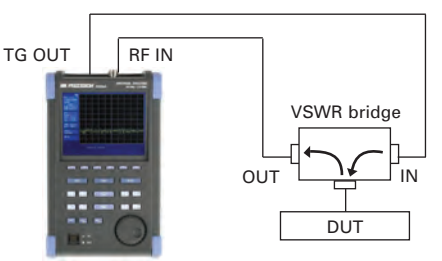
Determine the gain characteristics of an amplifier
Characterize the frequency response of an active circuit such as an amplifier.





Return loss measurement
Measure the return loss of an electric component or circuit with a VSWR bridge





Specifications		2650A, 2652A	2658A
Frequency section			
Frequency range		50 kHz to 3.3 GHz	50 kHz to 8.5 GHz
Center frequency	Setting	20 kHz	
	resolution	Settable with rotary encoder, numeric or function key	
	Accuracy	within ± (30+20T) kHz±1 dot @frequency span: 200 kHz to 10 MHz, RBW 3 kHz, 23±5 °C within ± (60+300T) kHz±1dot @frequency span: 20 MHz to max. frequency (3.3 GHz or 8.5 GHz), RBW 100 kHz, 23±5 °C T: sweep time (s)	
	RBW frequency error	within ±4 kHz @ 3 kHz, 10 kHz, 30 kHz within 20% of RBW @ RBW: 100 kHz, 300 kHz within 10% of RBW @ RBW: 1 MHz, 3 MHz	
Frequency span	Range	0 Hz (zero span), 200 kHz to 2 GHz (1-2-5 step) and 3.3 GHz (full span)	0 Hz (zero span), 200 kHz to 5 GHz (1-2-5 step) and 8.5 GHz (Full span)
	Accuracy	within ±3% ±1dot @ sweep time of 0.3s, 23±5 °C	
Display resolution # of points per trace		501dots on LCD screen, 1001dots readout via PC (501 dots are visible on the display, 1001 dots of trace data are captured internally and can be transferred to a PC via USB device interface.)	
Resolution	Bandwidth	3 dB bandwidth	
	Range	3 kHz to 3 MHz (1-3 sequence) and AUTO	
	Accuracy	±20%	
	Selectivity	1:12 (typical, 3 dB : 60 dB)	
Video bandwidth		100 Hz to 1 MHz (1-3 step) and AUTO	
SSB phase noise		-90 dBc/Hz (typical) @100 kHz offset, RBW : 3 kHz, VBW : 100 Hz, sweep time: 1 s	
Spurious response		less than -60 dBc	
Harmonics		less than -40 dBc @ ≥ 100 MHz	
Amplitude section			
Reference level	Range	+10 to -60 dBm (1dB step)	
	Accuracy	within ± 0.8 dB ± 1 dot @ center frequency : 100 MHz, RBW : 3 MHz, VBW : 1 MHz, REF : -15 dBm, 23±5 °C	
	Unit	dBm, dBV, dBmV, dBµV, dBµV/m, dBµA/m (dBµV/m and dBµA/m are used for measurement functions)	
Average noise level		-127 dBm (typical) @ CF : 1 GHz, RBW : 3 kHz, VBW : 100 Hz, Ref. level < - 40 dBm (preamp automatically ON)	
Frequency response		within ±2.0 dB ± 1 dot @50 kHz to 100 MHz within ±1.0 dB ± 1 dot @100 MHz to max. frequency (3.3 GHz or 8.5 GHz)	
Input impedance		50 Ω	
Input VSWR		< 2.0	
Input attenuator	Operating range	0 to 25 dB (1 dB step), coupled with reference level	
	Switching error	±0.6 dB @100 MHz	
RBW switching error		±0.6 dB typical	
Display resolution (vertical)		381 dots/10 div	
Display scale	Scale	10 dB/div, 5 dB/div, 2 dB/div	
	Accuracy	±(0.2 dB+1dot)/2 dB ±(0.4 dB+1dot)/5 dB ±(0.8 dB+1dot)/10 dB ±(1.8 dB+1dot)/83 dB	
Input damage level		+27 dBm (CW average power), 25 VDC	
Sweep section			
Sweep time	Range (1-3 step)	10 ms to 30 s and AUTO @frequency span : 0 to 2 GHz 30 ms to 30 s and AUTO @frequency span : full span	10 ms to 30 s and AUTO @frequency span : 0 to 2 GHz 30 ms to 30 s and AUTO @frequency span : 5 GHz, full span
	Accuracy	Within ±0.1 % ±1 dot @frequency span: 0 to 2 GHz within ±1.5 % ±1 dot @ full span	Within ±0.1 % ±1 dot @frequency span: 0 to 5 GHz within ±2.5 % ±1 dot @ full span

Sweep section (cont.)			
Trigger	Trigger mode		AUTO (Available only for zero span)
	Trigger source		Internal and External
	External trigger	Input voltage range	1 to 10 Vp-p
		Frequency range	DC to 5 MHz
		Input coupling	DC coupling
		Trigger level	approx. 0.56 V(fix)
		Input RC	approx. 10 kΩ / less than 15 pF
		Input damage level	±50 V(DC+AC peak)
		Input connector	SMA(J)
Detection mode			Positive peak, Negative peak, Sample
Function			
Marker measurement			NORM displays frequency (8 digits max) and level (4 digits max) at marker point. DELTA displays frequency difference and level difference between two markers.
Peak search			NORM: searches peak point within 10div (full freq. range). This mode also supports NEXT peak (up to 10). ZONE: searches peak point within a zone designated by center and width
Calculations			NORM, MAX HOLD, MIN HOLD, AVERAGE, OVER WRITE MAX/MIN HOLD: 2 to 1024 AVERAGE: 2 to 256
Measurements			Measure Channel power, Adjacent channel leakage power, Occupied frequency bandwidth, Electric field strength (requires antenna), Magnetic field strength (requires magnetic field probe).
Auto tuning			Automatically scans the full bandwidth, sets center frequency to the maximum signal within full span and centers it onscreen. Automatically adjusts reference level, RBW, VBW and sweep time to optimum values
Save/Load	Save		Saves 200 reference spectrum measurements and 200 setups
	Load		Loads one reference spectrum measurement and one setup
General			
RF Input connector			N(J) connector
USB Communication	Protocol		USB version 1.1 (will also work with USB 2.0 devices)
	Device Connector		B plug
	Transfer rate		12 Mbps
Hard copy			USB printer (option) connected to A plug (host) enables hard copy of screen.
Host connector			A plug
Display	Display		5.7 inch color TFT LCD
	Backlight		LED backlight
	Number of dots		640(H) x 480(V) dots
Power supply	Dedicated		Input : 100 to 240 VAC
	AC adaptor		Output : 9 VDC/2.6 A
	Lithium-ion battery		7.4 V/5000 mAh Li-Ion battery (MB400)
	Charge function		Capable of charging during power-off. Indicates 4 conditions with two color LED
	Charge indicator		5 level indicator of remaining battery charge
Environmental and Size			
Operating temperature			0 to 50° C (guaranteed at 23±10 °C, without soft carrying case)
Operating humidity			less than 40 °C/80 %RH (guaranteed at less than 33 °C/70 %RH, without soft carrying case)
Storage temperature			-20 to 60 °C, less than 60 °C/70 %RH
Dimensions			6.38 (W) x 2.80 (H) x 10.43 (D) inch, 162(W) x 71(H) x 265(D) mm (excluding projections, protection bumper and stand)
Weight			approx. 1.8 kg or 4 lbs (including battery)
			Three-Year Warranty
Included Accessories			User manual, AC adaptor MA400, soft carrying case LC2650A, accessory pouch, PC software and USB cable, Lithium-Ion battery MB400, certificate of calibration.
Optional Accessories			Dipole antennas M401 – M406, magnetic field probe PR 26M, printer PT2650A and extra roll paper PX2650A