



EQUIPMENT REVIEW

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THE STANDARD C8900E TWO METRE FM TRANSCEIVER

The C8900E is an ultra-compact ten watt mobile transceiver covering 144.000 to 147.975 MHz in 25 kHz steps. Notable features are a tilting LED frequency display and a very sensitive receiver using a GaAs FET. Its small size would make it very attractive for mounting in vehicles with limited space.

DESIGN CONCEPT

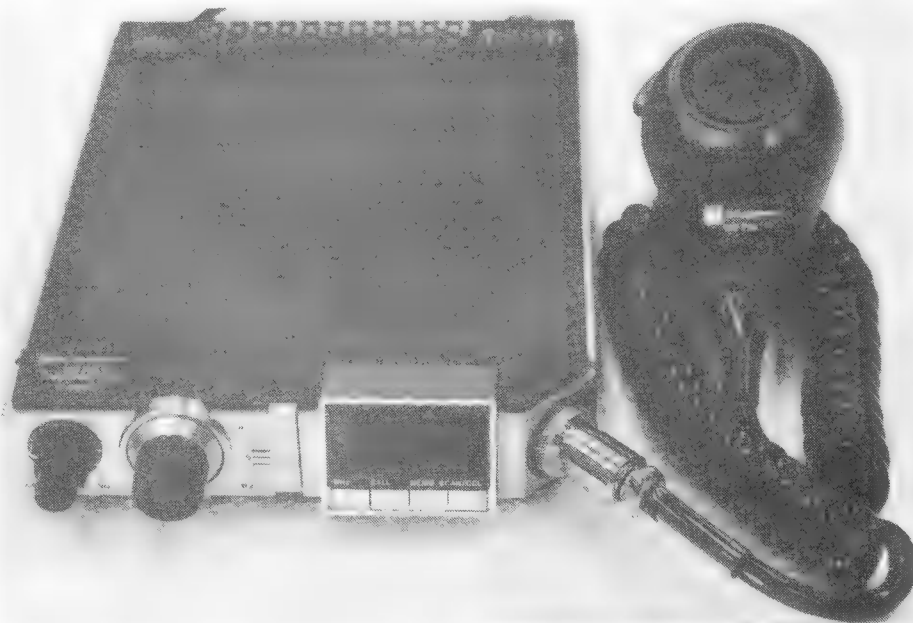
The C8900E seems to be designed especially for installation in small cars, where there is often very little spare room under the dashboard. To get its size (138 W x 31 H x 178 D m/m) into perspective I compared it with the size of this page and discovered that two would sit nicely on this page and still leave a 25 mm margin down one side! To complete the image of a sensible and convenient mobile package Standard (a division of Marantz, Japan, Inc) have provided modest memory and scanning facilities, a minimum of controls, and a pushbutton/LED display unit which can be tilted upwards by 15° to facilitate visibility under a dashboard. The 10 watt output power seems quite in keeping with the concept and is quite adequate for most uses. The very sensitive GaAs FET front end is a pleasant bonus which any manufacturer should now be able to offer at virtually no extra cost.

With so many "microprocessor controlled" transceivers appearing on the market nowadays, and features such as memories and scanning becoming commonplace, considerations such as ergonomics and "user-friendliness" are becoming more important to amateurs trying to choose a radio. It is a great challenge to designers using microprocessors to come up with more appealing and user-friendly schemes of frequency and mode selection. The C8900E shows some unique approaches to certain operations and I shall refer in more detail to these below.

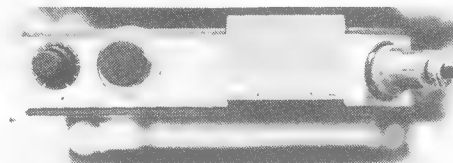
OPERATING

The C8900E has a dual-concentric on-off, volume and squelch control on the left-hand side of the front panel — refer photo. Frequency selection in steps of 25 kHz (only) is by means of an optically encoded rotary switch just to the right of this, or by the up/down switch on the microphone. Steps of 25 kHz are very convenient for mobile use as one can fairly quickly tune through most channels of interest without stopping anywhere but on-centre of any occupied channel. In effect the 25 kHz steps reduce the need for lots of memory channels. My only criticism here would be that the knob is small and the clicks are rather firm limiting the rate at which tuning can be accomplished. On the other hand, for a driver counting clicks without looking, the very positive resistance of the tuning knob is ideal.

The frequency selected is shown by a four digit red LED display (starting with 6.000 for



146.000 MHz at switch-on) in a tilting housing shown tilted up by 15° in Photo 1. Under the frequency display there are five LEDs for signal strength and power output and under these a set of four pushbuttons. The left-hand button, labelled "MHz", increases the display frequency by 1 MHz, and like all other buttons, causes a pleasant audible beep each time it is pressed.



On-off volume and squelch control to the left of the front panel.

The remaining three buttons in the display housing are labelled "call", "mems" (memory) and "scan/ccl" (scan/clear) respectively. The call button transmits a signal with a 1750 Hz tone burst, which is not of much interest in Australia. It might be useful for some modification. There are five memories, numbered one to five, and selected by pressing the memory button the corresponding number of times. When a memory is first selected the display shows E.E.E with the second decimal point blinking which means "enter" and not "error", which worried me for a while!



LED Display.

The frequency is entered by operating the rotary frequency selection knob and then by pressing "mems" and "scan/ccl". Scanning is possible in three different modes and is started or stopped by the "scan/ccl" button. The scan mode is determined in a rather unusual manner by the status of memories 4 and 5. Band scanning is performed when any frequency is stored in memory 4, but none in memory 5. Scanning of the current MHz range is performed if no frequency is stored in memory 4. Finally, when frequencies are stored in both memory 4 (M4) and memory 5



The C8900E showing the LED display tilted at 15 degrees, the microphone socket is to the right and on the extreme right are the external meter and speaker sockets.

(M5) scanning proceeds upwards from M4 until M5 is reached and then back to M4. If M5 is less than M4 the radio quite logically scans from M4 to 147.875 MHz and then from 144.000 MHz to M5 before returning to M4 and starting again.

There is no provision for scanning the memories. One curious thing is that the handbook mentions a sixth memory to allow non-standard repeater offsets but does not give instructions on how to use it. I could not work out how to use it but since the feature is not of much interest here I didn't try too hard either. Probably M6 can be accessed by pressing more than one button in some particular sequences — it could be an interesting challenge for someone with the right kind of mind!

Repeater operation is selected by the vertical slide switch in the centre of the front panel (Photo 1), and is again most unusual in its operation. Starting from the centre simplex position, labelled S, and sliding the switch upwards to the R1 position instantly increases the display and receiving frequency upwards by 600 kHz. The frequency then jumps downwards by 600 kHz on transmit. Sliding the switch downwards from S to R2 has no effect on the display or receiving frequency but causes the frequency to jump upwards by 600 kHz on transmit. This arrangement gets the most out of one switch, allowing both Tx-up and Tx-down duplex and reverse duplex operation on both, but it takes a little thought to use.

The important thing to remember is to select the required mode (R1 for Tx-down, S or R2 for Tx-up) before changing frequency otherwise you can find yourself selecting the required frequency twice!

ON AIR

I operated the C8900E on the passenger seat for a few days and was grateful for the top mounted speaker which, I think, would never be a disadvantage. The tilting display was very useful in this situation and would be equally suitable for under-dash mounting. Unfortunately the LED display, which was extremely clear and appealing at night, was not too visible in daylight but would be at less disadvantage under the dashboard in a more conventional installation. The pushbuttons were hard to find at night, but are not often needed in mobile operation.

The quality of the received audio and the smoothness of the squelch circuit were excellent, with the result that the set could be left scanning with a minimum of aural discomfort. The sensitivity of the receiver immediately asserts itself in this mode of operation; even mobile I was hearing repeaters that I did not usually know about! Reports on the quality of the transmitted audio were equally good. I shall deal in more detail with the receiver and transmitter in the sections below.

RECEIVER

As mentioned already, the receiver owes its sensitivity to a GaAs FET front end. The device used is the 3SK97 which is the current best Japanese consumer GaAs FET. The quoted sensitivity is 0.15 μV for 12 dB SINAD or 0.2 μV for 20 dB quieting. Unfortunately I cannot do SINAD measurements but in Table 2 I show measured quieting as a function of applied signal strength.

The receiver was well within its specification. Standard have complimented the low

GENERAL

Frequency range	144 ~ 148 MHz
Mode of operation	16 F3
Power supply	DC 13.8 V
Power drain	Tx: 2.8 Amp
	Rx: stand-by 0.4 Amp
Microphone input impedance	600 ohms
Audio output impedance	8 ohms
Antenna impedance	50 ohms
Polarity	Minus grounding only
Dimensions	138 (W) x 31 (H) x 178 (D) mm
Weight	1.1 kg

TRANSMITTER

RF output power	10 watt
Spurious emission	60 dB
Maximum deviation	±5 kHz
Modulation	Reactance method

RECEIVER

Type of reception	Double superheterodyne
Intermediate frequency	1st IF 10.7 MHz
	2nd IF 455 kHz
Sensitivity (12 dB SINAD)	0.15 μV
(20 dB QS)	0.2 μV
Threshold sensitivity	0.085 μV
Bandwidth	±7.5 kHz (-6 dB)
Selectivity	More than 60 dB
Audio output	2 watt at 10% distortion

Table 1: Manufacturers Specifications

Signal (μV)	Noise Quieting (dB)
0.056	3
0.078	6
0.095	9
0.11	12
0.13	15
0.15	18
0.17 (< 0.2)	20
0.27	25
0.44	30
1.4	40

Table 2: Receiver Sensitivity

Signal (μV)	No of LEDs
0.07	1
1.7	2
2.4	3
3.2	4
4.2	5

Table 3: Signal Strength LED Calibration

Signal (μV)	Output (mV)
0	0.2
0.05	0.3
0.1	0.5
0.2	0.7
0.4	3.7
0.8	35
1.6	140
3.2	370
6.4	800
12.8	1.4 V
25.6	1.9 V
57.2	2.1 V
100	2.1 V
200	2.1 V

Table 4: Signal Strength Output Calibration

Supply Voltage (V)	Rx Current (mA)	Tx Current (A)	Power Output (W)
14	290	2.8	10.5
13.8	290	2.8	10.5
13	290	2.8	10.5
12	290	2.8	10.3
11	285	2.7	10
10	280	2.4	8
9	265	2.1	5.5
8	250	1.9	3.5

Table 5: Current Drain and Power Output

noise figure of the 3SK97 with a high quality dual helical filter at the input. The mixer (a 3SK102) is then protected from many embarrassments by a triple helical filter of the same quality. The first IF is at 10.7 MHz, using a pair of MCFs, and then the rest of the RF signal processing (2nd local oscillator, conversion to 455 kHz, squelch and detection) occurs in the now-ubiquitous MC3357. Despite the vintage of this chip it all works very smoothly. A sample of the 455 kHz IF is taken from the MC3357, which does not have a signal strength output, to a two stage meter amplifier (FET plus BIPOLAR) and detector to drive the signal strength LEDs and the external meter output. Table 3 shows the signal strength required to light the specified number of LEDs, which, not surprisingly, do not cover a very wide dynamic range. The signal strength output is better in this regard, as shown in Table 4.

TRANSMITTER

The transmitter uses an RF power amplifier module with the type number QTO4-SAV5. An impressive feature of this module is its ability to produce full rated power with supply voltages down to 11 V, as shown in Table 5. Thus full power is available even from a relatively flat battery in a vehicle without the engine running! Table 5 also shows current drain on both receive and transmit, as a function of supply voltage. It is interesting that no increase of power is achieved by increasing the supply voltage above 13 volts.

GENERAL COMMENTS

The external speaker and external meter sockets are 3.5 mm phono types and are located on the side panel just behind the microphone plug. They can be seen in profile, one above the other in Photo 2. Just to the rear of these there is a "memory backup" slide switch, which can also be seen in profile in the

photo. I was disappointed to find that, rather than isolating an internal backup battery, this switch lets you decide whether you want a continuous 45 mA drain from your car battery, when the set is switched off. By the way, the currents given in Table 5 are for memory backup on.

Photo 3 shows the interior view of the radio from the top, the view from the bottom being a continuous piece of fibreglass circuit board. The quality of components and construction appears excellent throughout. The top and bottom covers are in one piece, bent into a U-shape, with perforations at the back to allow ventilation of the heatsink.

The radio comes very well packaged, with the Standard MP716 microphone, a new type of "low-profile" mounting bracket that clamps the radio firmly between non-scratching rubber blocks, a fused (5 A) power cord and numerous plugs, fuses, rubber feet, nuts and bolts. A very satisfactory manual is supplied, which includes a fold-out A3-size circuit that is easy to read, block diagram and a "device by device" operating description.

Accessories available for the C8900E are a speaker microphone (MP736) and an extension speaker (C207M).

EVALUATION AND ON AIR TEST — THE STANDARD C8900E

APPEARANCE

Packaging
 *** Much bigger than the radio.
 Size
 **** Very small.
 Weight
 *** 1.1 kg.
 External Finish
 *** Elegant case style.
 Construction Quality
 *** Very good throughout.

FRONT PANEL

Location of controls

 Size of knobs
 ** Small: Inevitable on such a small unit.
 Labelling
 ** Not self explanatory but sensible.
 Meter
 ** LED type. Small dynamic range.
 VFO knob
 NA
 Memory knob
 ** Small pushbuttons, hard to find in the dark.
 Keyboard
 NA

DIAL READOUT

Digital
 *** Large bright red LED display.
 Status indicators
 ** All in tilting LED display.

REAR PANEL

** Antenna socket only. External meter and speaker sockets on RH side.

RECEIVER OPERATION

Memories
 ** Only five.
 Sensitivity
 **** Can copy 0.15 μ V signals.
 Noise rejection
 *** Ignition noise not a problem.
 Squelch action
 **** Very smooth, no speaker clicks.
 "S" Meter
 ** Five LEDs. Small dynamic range.
 Signal handling
 **** Five helical filter stages.
 Spurious responses
 **** Non heard.
 Quality of received audio
 *** Very pleasant.

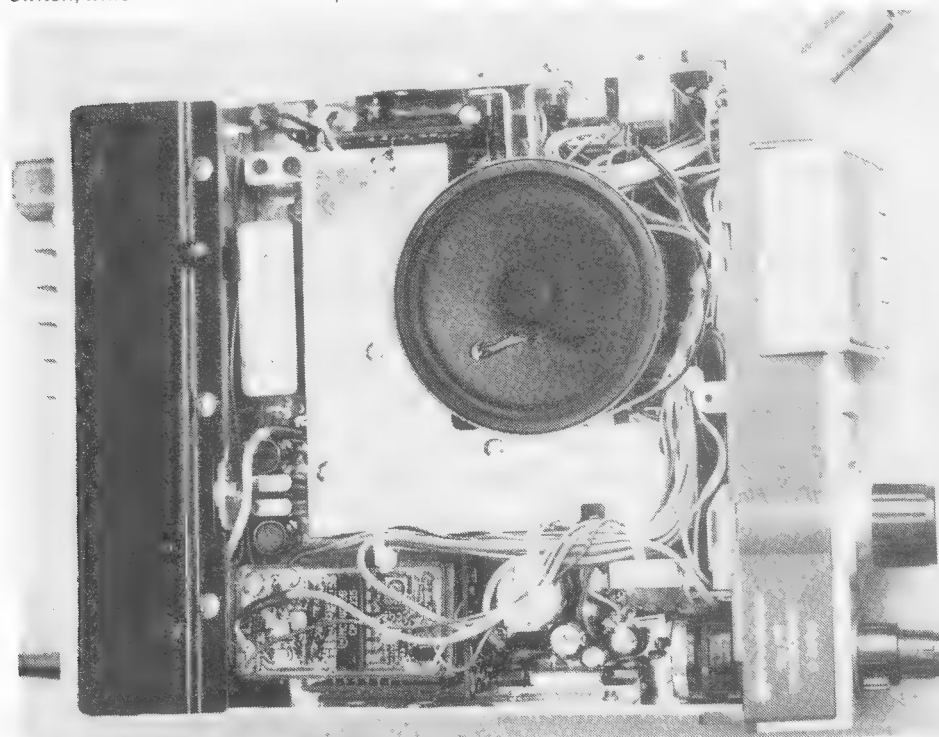
TRANSMIT OPERATION

Power output
 *** 10 watts or more down to 11 V supply voltage.
 Audio response
 *** Natural.
 Metering
 ** All LEDs light regardless of power output.
 Cooling
 **** Well ventilated heatsink at back.
 Frequency stability
 *** Within ± 150 Hz at 20°C whenever measured.

Rating code. Poor * Satisfactory **
 Very good *** Excellent ****

SUMMARY

The C8900E was a pleasure to use and should appeal to anyone with a "space problem" in a small car. A matching unit for 70 cm, the C7900E, is also available and provision is made on the mounting brackets of the units for "piggy-back" mounting. The review unit was kindly loaned by Greg Whiter at GFS Electronic Imports and the current price is \$413.



Interior view from the top.