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SGC SG-211 and SG-239

American company SGC is well knows for its range of microprocessor-based automatic antenna tuners. Steve White reviews two models that were introduced into the SGC range relatively recently

Curiously, both the SGC SG-211 and SG-239 Smartuners™ retail for the same price, so why does SGC offer them both? And at £189.95 each, these two models cost a lot less than other Smartuners, so where has SGC compromised?

SG-211

The aluminium-cased SG-211 MiniSmartuner is primarily intended as a companion for low power transceivers such as the SGC SG-2020, the Yaesu FT-817 (and FT-897 if operated from its internal batteries) and the Icom IC-703, but it will work with any transceiver as long as the output does not exceed 20 watts continuous or 60 watts PEP. Four rubber feet are fitted for worktop use, and there are four holes in one end of the case, presumably for a carry strap or hooking it on to a vertical surface. The input connection is an SO239 and the output connections are wingnuts. The only external control is a toggle switch, used to prevent the tuner from repeatedly hunting to find a tuned position, and a single red LED for status indication. It is not weather proofed.

The tuner consists of a 4:1 step-down balun, followed by an L-network. The inclusion of a balun means it is ideal for dipole and loop antennas. Long wires and inverted Ls can be accommodated by strapping one of the output terminals to ground and employing radials or a counterpoise, SGC making a point of stressing this in the instruction booklet. They also mention that in some instances you may find a balanced antenna will work better when connected as unbalanced, and vice versa.

One plus point about the SG-211 is that it will tune up to 54MHz, making it ideal to snatch some 6m contacts with an antenna that other tuners can't handle. Another is the impedance range over which it will tune; 0.3 to 6000 ohms. Last - but by no means least - it requires no external power source, being powered from four internal penlight cells.

In the SG-211 SGC has employed latching relays, which means that once they have clicked into position no current is required to keep them there. The practical upshot of this is a tuner that draws no more than microamperes, except when it is actually in the process of tuning, hence SGC's claim that the internal batteries can be expected to last five years. The downside is that the average tuning cycle is longer than other models of SGC tuner when finding a new match (SGC quotes 2.5 seconds). Reverting to a previously tuned (and memorised) position takes less than 50 milliseconds.

The SG-211 MiniSmartuner is ideal for applications where power supply is at a premium, but its power handling capability is limited.

SG-239

The SG-239 is a little larger and heavier than the SG-211. It too is cased in aluminium. In contrast to the SG-211, the SG-239 employs a pi-section matching network. It does not incorporate a balun so is primarily intended to tune unbalanced antennas, but balanced antennas can be connected directly or via an external balun. It requires a minimum of 1.5 watts to tune and is capable of handling up to 80W continuous or 200 watts PEP. Once again it is not weatherproofed, SGC's suggested method of keeping the water out being to house it in a plastic food container or under an upturned plastic waste bin. All external connections are via screw-down terminals. At 0.2 to 5000 ohms it is intended to match antennas over a similar range of impedances to the SG-211.

The SG-239 does not use latching relays, so it requires an external power source of 12V DC at 230mA to operate. It offers approximately 125,000 tuning combinations, the same as the SG-211, but fewer than other SGC Smartuners which typically offer half a million combinations. The SG-239 is a dedicated HF tuner, covering 1.8 - 30MHz. SGC quotes the tuning time as under two seconds and the retuning time as under 10ms.

Unlike the SG-211, the SG-239 can be tuned manually. There is a slide switch to switch between automatic and manual operation, buttons to increase and decrease the values of capacitance and inductance of the matching circuit, and a button to store manually tuned settings in memory. There's also a number of miniature status LEDs, one of which can be extended back to the shack to indicate when a satisfactory match has been achieved.

INSTRUCTIONS

Each tuner is supplied with an instruction booklet. As you would expect, both explain the theory of operation and how to install them. The 48-page booklet for the SG-211 contains a good number of illustrations on how to connect various types of antenna, but most of them are nothing more than hand-drawn sketches. Those produced by a drawing package are unsophisticated, and the reproduction of photographs is grainy and lacks contrast. By contrast, the 36-page instruction booklet for the SG-239 is very nicely produced on glossy paper, with full circuit diagrams. However, it doesn't provide as much detail about connecting various types of antenna.

HOW THEY WORKED

I decided to test the tuners from home into my main HF doublet and in a portable type environment into single wire antennas that had been erected temporarily. What I wanted to do was determine the relative efficiency of the tuners, so I used an RF ammeter to measure how much current each one delivered into each antenna on each band. The results can be seen in **Table 1**. In all cases I was running 20 watts. At this point I need to stress that (1) the RF current measured should be looked upon only as a relative indication of efficiency, and (2) due to the nature of current distribution on antennas, one should expect quite different currents to be measured from band to band.

SG-211

Never having used a Smartuner before, I was curious to discover how they operated. I connected it to the first antenna in my test sequence (a 100ft-long inverted-L) and pressed the transmit button. After a brief pause the 16 relays started to chatter, indicating that tuning was under way. After several seconds the chattering

Smartuners

ceased and the SG-211's solitary LED lit for two seconds, indicating that it had finished and was satisfied with the result. When I changed bands and went to transmit, tuning to a new setting took anything from under one second to about eight seconds. When returning to a band where the tuner had previously memorised a setting, re-tuning generally took no more than a fraction of a second. The relays are operated sequentially when re-tuning, rather than all at the same time. This is a function of the SG-211's limited microprocessor capability and - presumably - the limited capability of the penlight cells.

Apparent re-tuning when reverting to a previously tuned band was sometimes noted, as was re-entering the tuning cycle after it had apparently finished. Both of these are mentioned in the instruction booklet, along with explanations. Having said that, the convenience of not having to tune manually soon had me hopping from band to band, checking the current that the tuner would deliver into the antennas.

At 1/8 million, the number of tuning combinations of the SG-211 is less than other SGC tuners (most offer 1/2 million tuning combinations). Consequently some residual reflected power can be expected, indeed "Typical match <2:1" is printed on the case. Some reflected power was indeed observed on some bands. Because of variations in antennas, the bands that I observed reflected power on would not be the same as anyone else would, but for the record I do indicate in the table with the letter "R" where noticeable reflected power was observed and "NT" (for No Tune) where the tuner could not find a satisfactory match.

SG-239

The SG-239 has the same number of tuning combinations as the SG-211, but typically it didn't take as long to find a match because the relays aren't self-latching and operate faster. Once again it is stated that it should achieve a match of better than 2:1. In some instances it still took up to about eight seconds to find a new match, but the SG-239 has 17 relays to switch back and forth. Returning to a previously matched and memorised setting was almost instant.

On a couple of bands where reflected power was noted after automatic tuning, I switched to 'manual' and tried to improve the match. The tuner ignored all presses of the buttons that change the values of L and C. By experimentation I discovered that it is necessary to switch to the 'manual' tuning position while *not* transmitting, then go to transmit, then press the buttons. I couldn't find anywhere in the instruction booklet that this sequence was described. Having determined how manual tuning could be accomplished, I found that the automatic function had already found a match that I couldn't improve on (although this may not always be the case).

The SG-239 could not achieve a reasonable match with the 8ft wire on the lowest two frequency bands, but the shortest length of antenna that is recommended for this model of tuner is 40ft, so what was surprising wasn't that it *couldn't* tune, it was that it *could* tune such a short wire on all the other bands!

INTERPRETING THE RESULTS

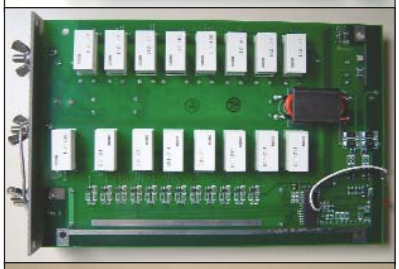
The tuners delivered similar currents into the antennas, but general patterns of current delivery were noted:

1. On the low bands, the SG-211 would not tune a particularly long wire, whereas the SG-239 would not tune a particularly short wire.
2. Into a short wire, the SG-211 delivered more current on the high bands than the SG-239.
3. Into a long wire, the SG-239 delivered more current on the high bands than the SG-211.
4. Into the doublet there was no clear winner, but the SG-239 would not tune the doublet on 1.8MHz unless it was connected via a balun.

Table 1: Current delivered into various antennas by the tuners
('NT' = No Tune achieved, 'R' = residual Reflected power).

	100ft wire + counterpoise		30ft wire + counterpoise		8ft wire + counterpoise		200ft Doublet	
	SG-211	SG-239	SG-211	SG-239	SG-211	SG-239	SG-211	SG-239
1.9MHz	NT	0.31	0.22R	0.14R	0.18	NT	NT	0.48
3.6MHz	NT	0.24	0.39	0.34	0.28	NT	0.50R	0.60
7MHz	0.31	0.32	0.37	0.39	0.39	0.30	0.28	0.28
10.1MHz	0.21	0.23	0.27	0.29	0.37	0.41	0.28	0.32
14MHz	0.11	0.12	0.11	0.10	0.21	0.22	0.47	0.34R
18.1MHz	0.13	0.12	0.20	0.17	0.30	0.28	0.10	0.15
21.2MHz	0.23	0.24	0.27	0.15	0.28	0.20	0.14	0.15
24.9MHz	0.20	0.26	0.27	0.22	0.30	0.23	0.14	0.20
28.5MHz	0.12	0.16	0.21	0.14	0.31	0.21	0.21	0.16
50.15MHz	0.12	-	0.10	-	0.30	-	0.26	-

The side of the PCB you can see when you take the lid off the SG-211.



The side of the PCB you can't see when you take the lid off the SG-211.

The SG-239 budget Smartuner.

Inside the SG-239. There are no components on the reverse side. The board locates on four small lugs on the bottom half of the case and is attached to it with a single clip. When the top half of the case is fitted the board is simply sandwiched into place. Note the screw terminals, LEDs and manual controls, which protrude through the case.

CONCLUSIONS

The SG-211 is better suited to short- to medium-length antennas, whereas the SG-239 is better suited to medium to long antennas. Each tuner has its relative merits, the SG-211's lack of requirement for external power being counteracted by its lower power rating and relatively slow tuning cycle, the opposite being true for the SG-239. They both performed as per the manufacturer's specifications.

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