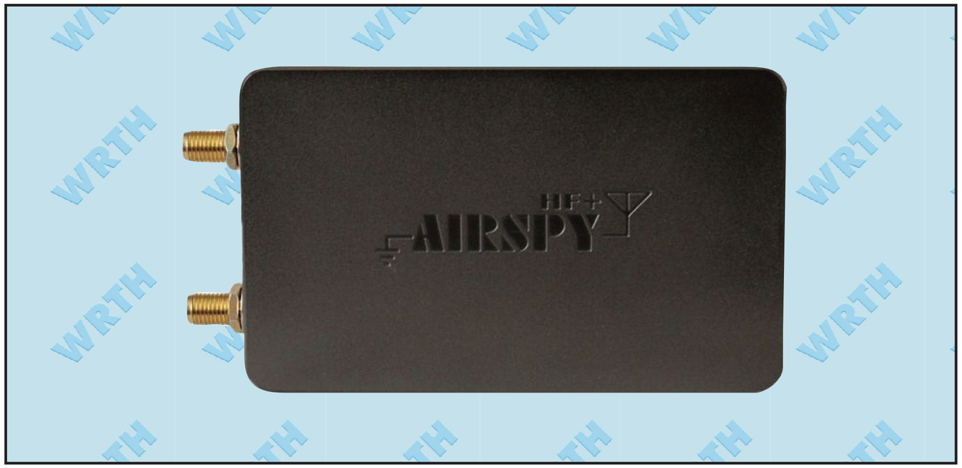

Airspy HF+

US$199 £230 €260

OVERVIEW

The origins of Airspy lie with the appearance some years ago of low-cost software-defined 'dongles' intended for digital television reception. With some creative modifications these could be made to receive a much wider frequency range than that used for DTV although their strong-signal performance could be best described as poor. One of the most popular programs used to control them was (and remains) 'SDR#' commonly referred to as 'SDR Sharp' and written chiefly by Youssef Touil. As well as being a skilled software designer, Touil was a hardware engineer who was well aware of the limitations of the simple dongle. In 2014 he designed the first of the 'Airspy' range of SDRs which was an immediate success. Today there are four receivers in the Airspy range of which the HF+ is the subject of this review. It was jointly developed by Airspy, the Shenzhen-based iTead Studio and ST Microelectronics with the intention of producing a high-grade SDR for broadcast reception.

FEATURES

The Airspy HF+ coverage is 1kHz-31MHz and 60-260MHz with a maximum bandwidth of 768kHz. In fact 48, 96, 192, 384 & 768kHz are all available, with the caveat that 660kHz is the maximum alias-free bandwidth. There are of course a number of SDRs which offer larger bandwidths than this but Airspy's literature suggests that one of the main intentions of the design was the achievement of very good strong-signal handling in conjunction with a sensitivity figure appropriate to the coverage. We have discussed this area of receiver design on several occasions in the pages of *WRTH* but in essence the issue is one of dynamic range – essentially the 'window' between the weakest signal the receiver can resolve and the strongest it can handle without some form of overload setting in. So the designer of an SDR (or for that matter any other receiver) has to consider two parameters carefully. One is the overall amount of dynamic range available. The other is where the 'window' should be placed. A wideband receiver can make use of high sensitivity at higher frequencies because these are not noise-limited in the same way that frequencies in the AM broadcast spectrum tend to be. What matters at lower frequencies is the ability to handle strong signals without overloading. Lack of absolute sensitivity is not likely to be an issue.

The HF+ is not a direct-sampling receiver; it adopts the arrangement of a bandpass filter followed by a tuner and a 16-bit sigma-delta ADC. This is followed by a decimating 18-bit DDC. Airspy does not give details but the front end apparently uses "polyphase harmonic rejection" architecture. The web site explains that "…essentially this means that harmonics produced in the mixing stages are naturally rejected, making the front-end filtering requirements much more relaxed. So unlike the tuners used in other SDRs, this one is extremely unlikely [to] overload in the mixing stage." On this basis Airspy claims a "best in class" strong-signal performance.

Realised as a very well finished metal box 90 x 55 x 10mm in size, the HF+ uses two SMA inputs for the antenna connections and a standard USB socket. Being familiar with SDR# we used this on our admittedly elderly office PC running a fully patched version of Windows 10. Apart from the limitations introduced by the computer we had no difficulty with this arrangement during the review period. We gather that in addition the Airspy HF+ can be used with 'SDR-Console' for

Windows and GQRX for the MacOS and Linux. Most listening tests were conducted with the resident Wellbrook loop with various other wire antennas used as required. The main receiver used for comparison was a Racal RA3791.

PERFORMANCE

Airspy makes some very impressive specification claims for the HF+ and we were able to substantiate almost all of them. These include typical MDS of -141.0dBm (0.02 μV/50 ohms) in a 500Hz bandwidth at HF (we measured -139dB which was almost at our reliable measurement limit) and -141.5dBm MDS at 500Hz bandwidth at 60-108MHz. The latter is rather a meaningless claim since the number of occasions on which you would want to receive a signal in that frequency range with such a small bandwidth must be exceedingly limited. However, it is correct to within a dB or so. The claimed IPI_3 at maximum gain on HF is +26dBm although the frequency spacing is not stated. We tend to think that the classical IPI_3 measurement is not particularly useful when assessing an SDR but the Airspy HF+ certainly appears to have very good odd-order intermodulation performance and had no difficulty with some extremely strong 6/7MHz broadcast signals at night. Interestingly it also did very well with low-power aeronautical non-directional beacons (NDBs) in the LF and MF range and managed to produce copy when even the RA3791 with its excellent DSP filters was struggling to do so. We imagine the Airspy HF+ is capable of producing very good results on MW DX if used with a suitable antenna.

Some brief tests with the 'other' antenna input suggested that the performance in the VHF spectrum was very good. FM broadcasts were well received using a four-element outdoor antenna; since the review period included a spell of tropospheric enhancement, it was no great surprise to receive French and Dutch FM stations at good strength and fully quieting. Aircraft-band reception via the resident Icom discone was also very effective with two or three VOLMET stations not normally heard at the test site easily audible. In passing we noted that the frequency setting and stability of the HF+ were both excellent.

Interestingly Airspy claims a blocking dynamic range (BDR) of 110dB at HF. This is the first time we have seen an explicit specification claim for BDR by the manufacturer of an SDR although it is an important measurement in conventional receivers. "Blocking" is the degree to which a receiver's sensitivity is reduced by the presence of high-power signals adjacent to the frequency to which it is currently tuned. The BDR is usually defined as the difference in dB between the level of an incoming signal which will cause 1dB of gain compression to the wanted signal and the level of the receiver noise floor. It is sometimes referred to as the "1dB compression point". A typical high-grade conventional HF receiver would be expected to exhibit a BDR of somewhere in the region of 110-120dB; for example, our RA3791 is about 118dB at 10MHz and slightly better than that at higher frequencies. It is a remarkably difficult parameter to measure with accuracy and very capable test equipment is required but the claimed BDR for the Airspy HF+ is certainly around the 110dB mark at 10MHz and we would estimate an uncertainty of perhaps 2dB either way in that figure. In comparison the BDR of most SDRs we have measured would be expected to be considerably less. Most simple 'dongle' SDRs would probably be 30-40dB worse and possibly worse than that in some cases.

AIRSPY HF+

BEST VALUE HF SDR

In practical terms this implies that the Airspy HF+ can be expected to give a very good account of itself when used with relatively large antennas and also when operating in frequency bands where very strong signals are adjacent. Our listening tests suggested that it did both these things with aplomb. We carried out some tests on the amateur 7MHz band when a major contest was in progress and some extremely strong local signals were encountered. Using a full-size 7MHz three-element Yagi antenna at 30m (90ft) we expected major problems of overloading and spurious responses but found none whatsoever apart from very occasional and small increases in the local noise floor when an extremely strong local CW signal was encountered. This was a remarkable performance for any receiver, let alone a low-cost SDR, and one which many high-grade professional receivers from an earlier era would have found difficult to emulate. Another interesting point to emerge from the listening tests is that the Airspy sounds remarkably 'quiet' and unfatiguing in use, unlike many SDRs in its overall price class. This is presumably the result of careful design of the DDC and audio system.

CONCLUSION

We were very impressed by the Airspy HF+. As with many SDRs, the unimpressive metal box contains some state-of-the-art and very effective electronics which in conjunction with 'SDR#' provides a highly capable receiving system. It would appear that the price point for SDRs at which the law of diminishing returns sets in is becoming lower every year, which can of course only benefit us all in the long run.