Written in 2005, this feature was due to appear in 'Television' magazine when that journal was suddenly closed down by its new owner. The first two parts of the feature subsequently appeared in 'Technology at Home', but before the last two sections could be published that magazine ceased publication as well!
Written at the original editor's request for readers who are small traders, the article is slanted a little bit towards the money-making aspect of TV system installation, and reading it now (2008) it seems to have a slightly cynical tone in places.
This article was written before the advent of Sky HD, BBC/ITV Freesat, or the devices that allow several Sky boxes to be controlled via the same return path.
Bill Wright 2008

Domestic RF distribution systems for television and radio, Part 3

Bill Wright

Mini-systems – a major improvement

I've written the previous section with gritted teeth. I recognise that commercial constraints (also known as skinflint customers) often force us to install systems that are, to use a nice euphemism, technically 'sub-optimal'. But if you have to fit a notch filter in front of the satellite receiver you are pushing the 'daisy chain' principle to its limit. Since the whole daisy-chaining principle is, as I've shown, technically pretty dubious, you might like to do something significantly better. If so read on. This is where it gets interesting!

The rest of this section is based on the arrangement shown in Fig 12, overleaf. This is a way of combining the aerial signals with the satellite channel using a channelpass filter and a double notch filter. It greatly alleviates most of the problems associated with the 'daisy chain'. The cost of the extra bits and pieces totals about £50.

Unless the cable linking the satellite receiver to the amplifiers is very short it will be necessary to use a 12dB amplifier to compensate for subsequent combining losses. The satellite receiver output then passes through a single channel pass filter which greatly attenuates any out-of-channel modulator noise. Fig 13 shows a tunable two stage single channel pass filter.

The aerial signal passes through a double notch filter that is tuned to the channel used for the satellite receiver's RF output. The outputs of the two filters are combined using a screened inductive splitter. Total through-loss on the aerial line is about 6dB, so a pre-amplifier will be necessary if the analogue signal levels are less than about 10dBmV.

After initial installation the signal levels at one of the distribution amplifier outputs should be measured. It might seem strange, but having fitted two pre-amplifiers it might be necessary to attenuate one or both signal feeds slightly. Aim for about 14dBmV on all analogue signals. If both signal feeds need the same amount of attenuation fit an attenuator between the combiner and the bypass kit. If they need different amounts fit attenuators on the outputs of the pre-amplifiers. Yes, the outputs! At this sort of signal level noise is the enemy, not cross-modulation.

If tvLINK operation is required it will be necessary to fit a tvLINK bypass unit. This carries the 9VDC supply (if used) and the 7MHz return signals. Note that one of the two coaxial connectors at each end of the Global bypass kit is marked 'DA'. That port is blocked for DC and 7MHz. This is because Global's original concept was that the unit would bypass an existing amplifier, allowing one outlet (only) to have the tvLINK facility. The ports marked 'DA' mean 'distribution amplifier', but in this application the distribution amplifier will pass the tvLINK signal and we are bypassing a pre-amplifier, filter, and combiner.

Channelpass filter/levellers

The Taylor TCFL-1 channel filter leveller is supplied tuned to your nominated channel, but can be re-tuned by about 10 channels. Ideally a noise generator and analyser will be used, but if you only have a meter don't just tune for maximum vision carrier signal. The vision/sound carrier

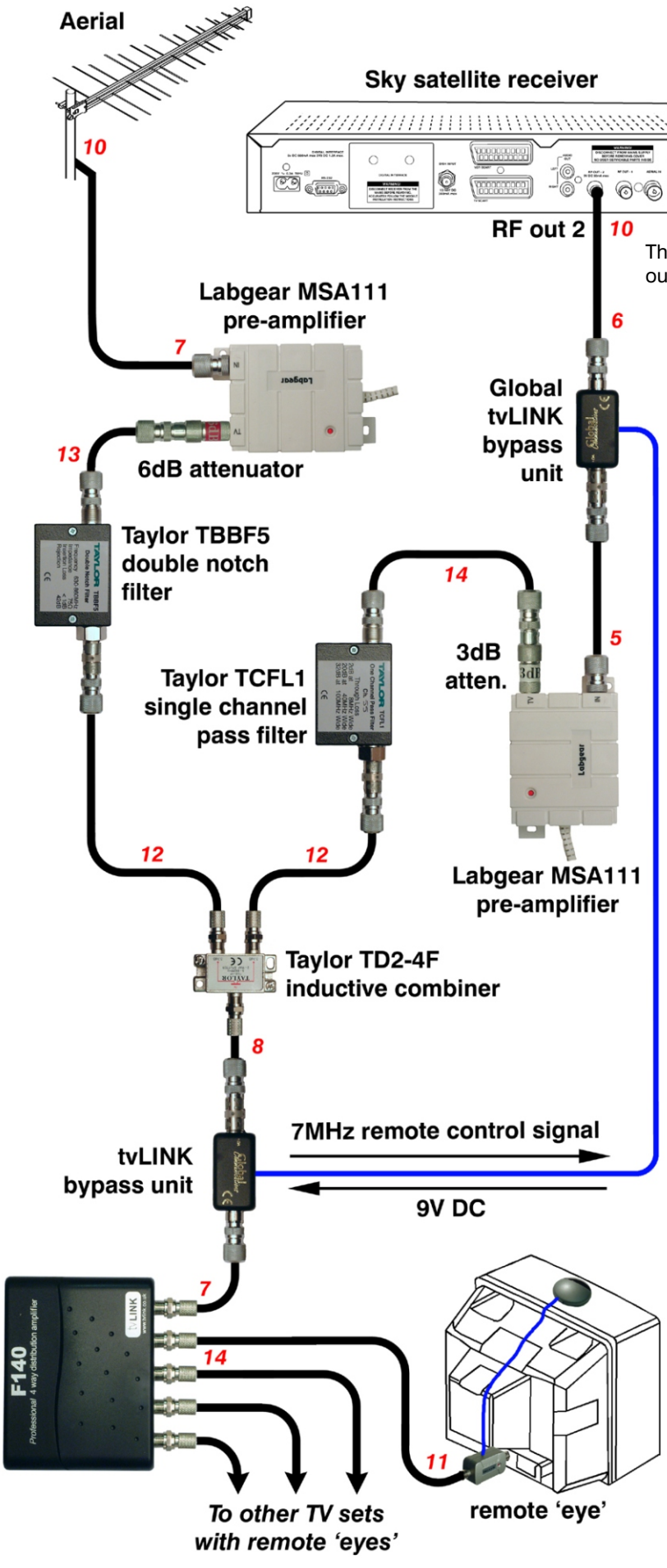

Fig 12. The 'enhanced minisystem'. A simple method of combining the satellite receiver RF output with the aerial signals, using a notch filter and a channelpass filter. In this example there is a 3dB attenuator on the satellite receiver output feed and a 6dB attenuator on the aerial feed. The Labgear pre-amplifiers have 12dB gain. Approximate analogue signal levels are shown in red, in dBmV (add 60 for dBµV).

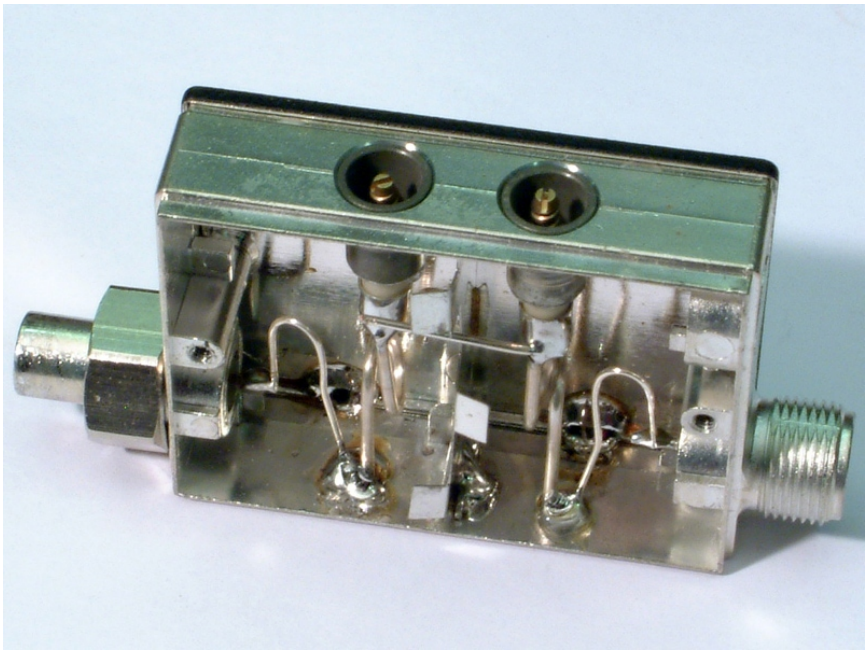

Fig 13. A two stage single channel pass filter with the side cover removed.

ratio of 10dB should be maintained. In practice, tune both slugs for maximum video then tune one of them slightly higher (anticlockwise) to maximise the FM sound carrier and the 4.43MHz colour subcarrier. These will both maximise at virtually the same adjustment point. Then re-check the first slug, and finally check that the audio/video carriers are in the ratio of about 10dB. Taylors don't really approve of us re-tuning their filters, but we know what we're doing, don't we? But if you don't have a meter capable of making these measurements I suggest that you don't attempt to tune these filters. It certainly can't be done by looking at the TV picture.

Notch filters

The double notch filter shown in fig 11 (in the previous section) is the Taylor TBBF4, tunable across channels 21 to 37. The TBBF5 is tunable across channels 34 to 68. The similar Televés products are items 4162 and 1472 . Notch filters are also known as 'stop filters'.
These filters are simple passive devices and they do not have the perfect frequency response that would stop one channel dead and leave all the others totally unscathed, as you can see in fig 14 . Channels one or two on either side of the tuned frequency are attenuated to some degree and have a sloping response imposed across them, so the satellite receiver's RF output and thus the notch filter should be set to a channel at least three away from any wanted broadcast signal.
Notch filters need to be tuned to the desired frequency with some precision. Ideally this is done using a noise generator and spectrum analyser, but since the object of the exercise is simply to attenuate the vision carrier frequency of the nominated channel as much as possible there is a more straightforward way. Temporarily connect the notch filter in line with the satellite receiver's RF output (RF1 or RF2) and adjust both sections of the filter for minimum signal on the vision carrier, or alternatively adjust one section for the vision carrier and the other for the sound carrier. The minimum test equipment for this exercise is a signal strength meter. Using the TV picture can be deceptive.

Combined channelpass filter and notch filter

Taylor Bros sell a unit that has the filters and combiner all in one package. This is the factory-tuned TCFL1-1CH, as shown in Fig 16. It can be a handy solution if you know in advance which channel you intend to use, but the notch depth does not equal that of a tunable double notch filter.

Enhanced mini-system layout

The 'enhanced mini-system' described above can be built onto a wooden board 12 inches by 36 inches. Alas it is very difficult to fit the components and cables on the board as neatly as in the

illustration! Strangely enough the average customer isn't keen to have such a work of art fixed to the wall behind the television set, and telling them that it's by Damien Hurst cuts no ice at all. In practice the board usually has to go in the loft or somewhere else out of sight.
Even if the amplifiers are 'double insulated' I normally earth the system at the board. The inductive splitter/combiners have an earth screw.

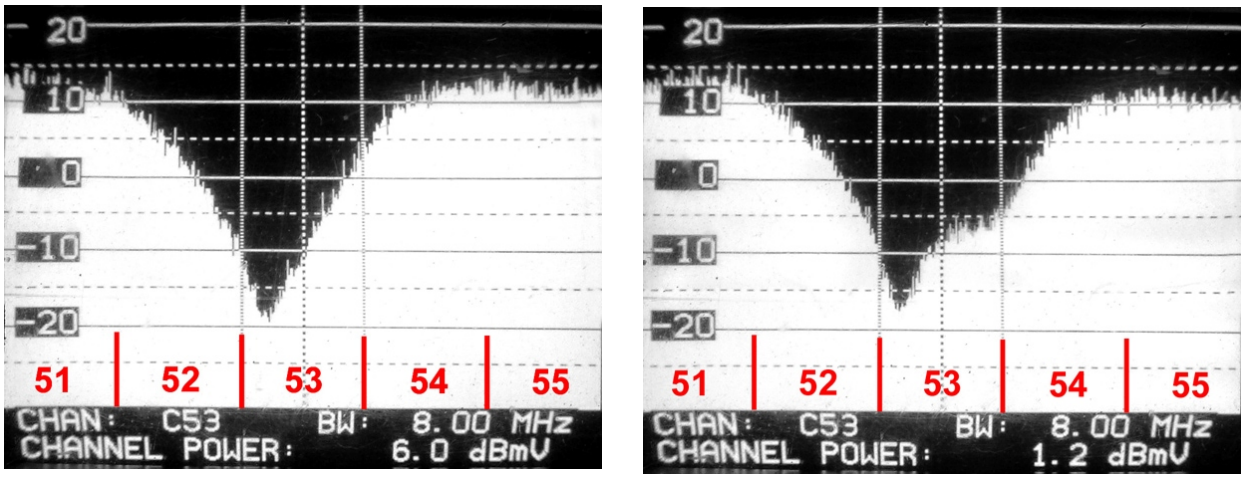

Fig 14. The response of a double notch filter, on the left above with both notches tuned to the channel's analogue vision carrier frequency and on the right above with the tuning staggered slightly to give better rejection of the higher frequencies within the channel. A noise generator was connected to the notch filter input for these pictures.

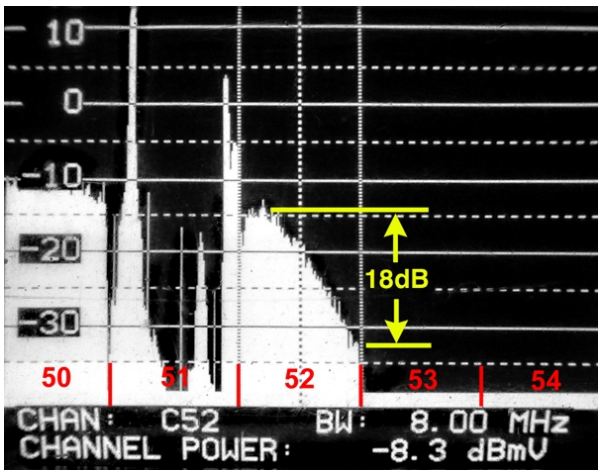

Fig 15 (left). The deleterious effect on a mux if a notch filter is tuned to an adjacent channel. In this case the notch filter was tuned to the channel 53 analogue video frequency. The mux on ch 52 is obviously suffering! The robust modulation system used by DTT allows a surprising degree of slope across a mux as long as no part of the mux has an inadequate carrier to noise ratio. Nevertheless, don't risk it! Reliable reception becomes less likely once the slope across a mux exceeds 6dB.

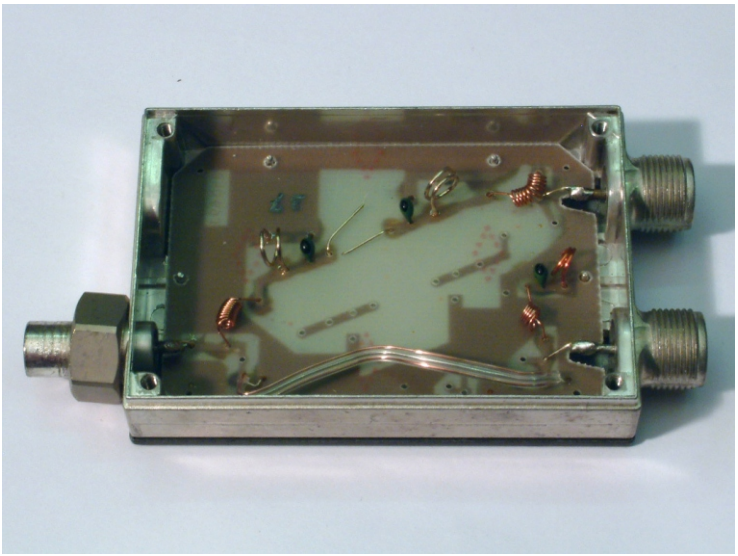

Fig 16. The Taylor TCFL1-1CH combined notch filter and single channel pass filter.