

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 an overly commercial 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.

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Domestic RF distribution systems for television and radio, Part 1

Bill Wright

The home with only one TV set is almost a thing of the past, and most homes have a TV distribution system of one sort or another. Your system can be as simple or as complex as you want to make it. Bill Wright looks here at systems ranging from those within the scope of the competent DIYer to those needing the services of an experienced installer with good test equipment. If you think you might become that installer, read on! There's a large market nowadays for home distribution systems. Bill shows how a system can be designed and installed to incorporate the Sky remote eye system and various other innovations, providing the user with maximum value from their TV reception equipment. It's often necessary to introduce customers to the full range of facilities that a modern TV distribution system can offer.

Back in 1995 I had a memorable customer – Mr Fred Clutter, with his chaotic household and unruly family. His TV distribution system provided reception of four off-air TV channels and the outputs of a VCR and a satellite receiver. Just six channels, yet at the time the system was 'state of the art'! I wrote about Fred and his TV system, and the article, *Domestic Multichannel TV Systems* is on this website. Re-reading it really makes me realise how things have changed since then!

Ten years of change

There was no Channel Five or terrestrial digital television in 1995, so the UHF band was, unlike Mr Clutter's front room, fairly clear of obstructions. Nowadays the over-population of the UHF TV channels can be a problem in many areas of the country when a distribution system is planned.

In 1995 VCRs still cost a week's wage for most people and the vast majority of households had only one, so it was worthwhile to distribute the output to all the TV sets in the house. Of course the VCR was the only means of recording and replaying TV programmes there were no recordable DVDs or hard drive based machines.

Satellite television had about thirty channels (which seemed a lot at the time!), and of course there were only four terrestrial channels. The word 'digital' as far as I was concerned meant 'appertaining to the fingers', and not much more. How little we knew of the revolution about to engulf us!

Back to the present

In 1995 Mr Clutter's unsocial son Matt was obsessed with computer gaming. Primitive as the pastime was in that era it was enough to keep him from his homework, one reason why he left school with few GCSEs and fewer prospects. When our acquaintance was renewed last year I was interested to find that he had metamorphosed into a smart Information Technology Consultant. He now wears a suit and drives a Lexus and earns a lot of 'moolah', as he calls it,



Fig 1. Juvenile rebellion can brew if dad is too stingy to provide decent TV reception!



Fig 2. This dish needed adjustment, and it would have been folly to attempt the job using ladders. The sharp railings might have influenced our decision!

and he lives with his partner in un-wedded bliss with their two children in a new detached four bedroomed house. He has inherited his dad's liking for gadgets, so he buys pretty well every new gismo as soon as it appears on the market. His partner earns a good whack as a supervisor in a call centre. They're relaxed about money because they've got plenty of it. Just the sort of customer I like.

Children these days demand a television set in their bedroom almost as soon as they can speak, and Matt's are no exception. Matt made a stand for a while, muttering hypocritically and untruthfully that 'there was none of this in my young day', but when he suddenly realised that he was starting to sound just like his own dad he finally relented. In any case, he thought, a quiet life is worth far more than the cost of two small TV sets. But what he didn't yet realise was that the TV sets were the tip of the iceberg.

Six months ago Matt bought Sky+ and he was very pleased with it. The Sky installer suggested a cable from the RF2 output to his bedroom ("£40 cash in me hand mate") so he could watch Sky in bed, and even change channel using the little tvLINK digital eye on top of the set.

Excellent, but it would be nice to have Sky in the study and the kitchen as well.

Father Christmas duly delivered the kids' new TV sets, and by lunchtime on Christmas Day the shortcomings of the wire loop aerials had become all too apparent. The kids couldn't watch Sky in their rooms, and howled their dismay at this deprivation. There were also 'issues' as Matt was to tell me later, with DVD players and game machines.

"Something will have to be done," mused Matt, "but what?" Here's a man who is happy to divest himself of a significant quantity of moolah in the pursuit of domestic harmony. How can we help him achieve this laudable goal?

What do you want the system to do?

The first step is to listen carefully to the customer's requirements, or to what he perceives as his requirements, because when you start to explain the possibilities it is likely that the wish list will expand considerably. DIY installers should perhaps listen carefully to the requirements of the wife and the kids! The wish list is likely to be pretty well what I've described above – good reception of the terrestrial analogue channels and of Sky in all rooms, and that's it. You

should explain that you could do much more than that. Here's a list of possible enhancements to the basic system:

- The ability to control the satellite receiver from every viewing room using tvLINK.
- The addition of a second satellite receiver, with the output distributed to every viewing room.
- Aerial improvements for both analogue and digital TV channels.
- Aerials for VHF FM radio and DAB radio.
- Extra outlets.
- The distribution of the output from a cable TV receiver or a DVD recorder or player.
- Improvements to the AV connections, particularly in the living room.
- The addition of one or more surveillance cameras.
- Reception of non-Sky satellite channels, for instance from 13°E.

I'll deal with these possibilities before I get to the actual business of the installation, as they will affect your preliminary discussions with the customer. This sort of in-depth confabulation can seem a bit tedious and you'll probably be itching to get the tools out and make a start, but establishing exactly what you're going to do and explaining the benefits is an essential preliminary. Apart from anything else it will give you a chance to get to know the customer.

Identifying potential problems

Personally I always make a preliminary visit, with no thought at all of doing any 'actual work' on that occasion, other than possibly checking off-air reception, and of course lifting a cup of tea to my lips. As well as dealing with the issues outlined above this is an opportunity to assess the difficulties and complications of the job – in fact, to decide whether or not you actually want it. This isn't a foregone conclusion. You might find the building, the customer, or both unacceptably forbidding. You should have a checklist, mental or otherwise.

- Will there be any problems with terrestrial reception? It might be necessary to climb onto the roof to find out.
- Are there any special Health and Safety issues? If the building is a difficult one to work on with ladders you might need to hire access equipment in order to do the job safely. Fig 2. The cost must be added to your quotation and if that means that you lose the job, well, that's just fine. Please don't ever cut corners on safety for the sake of getting work.
- Is there a suitable location for the dish? In doubtful cases you might need to check the line-of-sight. You must discuss the location of the dish with the customer because the appearance of a satellite dish is still an aesthetic hot potato in some quarters.
- Is the building listed or covenanted? If so the customer will have to sort out the necessary permissions for dish and aerial. This also applies to apartment blocks, where the external walls and roof might be the joint property of the various owners. Some local councils can still be a bit 'funny' about satellite dishes on tenants' dwellings.
- Will there be special difficulties in running cables or drilling walls? Are the walls three feet thick and full of rubble? Will external or internal cables look terrible, or can you find hidden routes for them?
- Are there access problems? Is there off-street parking? If not, are there double yellow lines stretching to every horizon? In the latter case I'd decline the job, but maybe that's just my stress avoidance policy kicking in.

During these discussions you will learn something of the customer's personality, although first impressions can of course be misleading. What's your general feeling about him though? If your instinct suggests that he is going to give you a lot of hassle, now's the time to retreat. It's important to differentiate between the man who wants a good job doing (and who will appreciate it) and the man who wants to nit-pick for the sake of it.

Sometimes people are quite unrealistic about the costs of this sort of installation so it's a good idea to give them some rough prices at this stage, followed later by a proper itemised

quotation. This gives them the opportunity to withdraw gracefully if they really can't afford it, or to delete items that they feel aren't worthwhile. In my opinion this is the only fair way to do it. You should always avoid the hard sell approach. I have heard many times of firms starting work on the reluctant say-so of only one partner, just to have the other one come home and throw a fit. Even if the job continues this is not a happy situation, and personally I would hate to find myself working in someone's home under circumstances like that.

Talking of working in someone's home, never forget that many people find the presence of a stranger in the home very intrusive, and can actually be quite seriously freaked out by it. Try to maintain a 'low profile'. Don't make unnecessary noise. Don't burst into a room without knocking, and before starting work ask if it's alright to 'go in all the rooms as necessary'. Whatever you do, don't smoke in the house, don't swear and shout, don't trail dirt in, don't suddenly join in private conversations, don't import a loud radio (you aren't a builder after all), and just try to show some general consideration.

Next I'll run through the things you need to discuss with the customer.

TvLINK

Most readers will be familiar with the Global tvLINK system, but I'll go through the basics



Fig 3. TvLINK infrared sensors.

very briefly. All Sky receivers have two RF outputs. Both carry the output from the receiver's modulator, which of course shows the current satellite channel. The aerial signals are looped through the box and are also available on both RF outputs. RF1 and RF2 differ though, in that RF2 can be made to provide a 9VDC supply for one or more tvLINK infra red sensors, or 'eyes'. The sensors are connected in-line with the aerial cable at the 'remote' TV sets. They receive IR signals from the handset and send them along the coax to the Skybox RF2 socket in the form of 7MHz pulsed signals. In this way the user can control the Sky receiver from a different room. Say what you like about Murdoch's 'evil empire', you have to hand it to Sky for pioneering the technology that provides exactly what Matt Clutter and thousands like him want. Although the name 'tvLINK' is registered by Global, it seems to have become the generic term.

Many customers assume that they can only control the Sky receiver from one extra room, so the offer of a system that allows control from all rooms is likely to be favourably received. Just say casually, “So obviously you'll want to change Sky channels from every room?” There's an almost imperceptible pause as they think “Didn't know you could do that” then they'll say, “Err yes, that'll be great.”

A second satellite receiver

Sky always fit a four-output LNB (the electronic unit on the dish) when they install Sky+, so there are two spare outputs, one or both of which can be used for extra receivers. When existing Sky customers convert to Sky+ the old receiver might be reinstalled in another room or it might be left unused. Customers with the ‘Sky Homes’ package will have two boxes installed, usually in two different rooms. But if there isn't a second receiver available, new ones are now on sale for about £100 + VAT, which allows a healthy retail margin.

The benefit of having two receivers is, of course, that different members of the family can watch different satellite channels at the same time. Some thought has to be given to the tvLINK arrangements if there are two receivers. I usually suggest that the living room Sky receiver (whether Sky+ or not) is not controllable via tvLINK. By ‘living room’ I mean the main viewing location. When the customer is a home cinema enthusiast, this might be a dedicated ‘television room’. In some cases the main viewing location might seem very eccentric to you, but it's important that you find out where it is. The way people use their living space is not always apparent from a simple look round the house. But for brevity I'll say ‘living room’ from now on.

The second receiver, which can be installed almost anywhere in the house, should be controllable via tvLINK from any room except the living room. It's a complication if the second receiver is controllable from the living room because the remote handset is likely to operate both receivers at once. This doesn't apply though if the living room receiver is a Sky+ unit.

Of course the outputs of both receivers are available all the time to every TV set (and recording device) in the house. Normally you would tune-in every TV set and recording device in the house so that they receive the two satellite receivers on, say, presets 6 and 7. The logic of this arrangement is that Dad can sit in the living room watching sport, safe in the knowledge that the kids can't change channel on his receiver from their bedrooms. The kids can watch what they like on the ‘house’ receiver, and Dad can flick onto preset 7 to check up on their viewing whenever he likes. If a barney breaks out upstairs, with two Sky remotes battling for supremacy, Dad can turn up the sound in the living room and ignore the problem.

It's important to discuss the location of the second satellite receiver with the customer. They will not realise at first that since it is to be controlled remotely it can be installed pretty well anywhere. It doesn't even have to be with a TV set, although the master bedroom is often the best place. There are a few ‘don'ts’, though. Don't install it in the loft, because it is domestic equipment and therefore not intended to operate unattended, so there would be a liability question if it started a fire. Very unlikely I know, but what if someone throws a duvet or something through the loft hatch without looking where it lands?

For the same reason, think carefully before installing the receiver in a cupboard. A high shelf in a storeroom should be all right, as long as the storeroom is used on a daily basis. Don't put the receiver anywhere where it is likely to be covered. Skyboxes get hot enough anyway without being smothered.

It isn't a good idea to stack the ‘house’ receiver with the ‘living room’ one, (unless one of them is Sky+) because it will respond to the remote handset commands intended for the latter. It is surprisingly difficult to disable the IR sensor in a Skybox without actually operating on the box, and if you do that it could be a nuisance if the box is ever ‘redeployed’. Black tape on the front of the box doesn't usually work.

It's up to the customer, of course, to set up his subscription deal with Sky. The only concern you have is that the Sky Homes deal needs both receivers to have a permanent connection to the same telephone line.

The customer might decide not to have a Sky subscription for the second box, in which case he

will have a 'Free to View' card. At present these cost £20. This is a popular option in areas where there is no DTT (Digital Terrestrial Television). In those areas the customer might even opt to have a Sky receiver with every TV set, and abandon terrestrial reception completely.

Aerial improvements

For customers who don't have a satellite receiver or a cable box, the aerial is the source of all off-air television. Even when they do have satellite or cable, you should point out that a lot of viewing and recording will still be via the aerial. Once the Sky box is in use anyone wanting to view or record another channel has to rely on the aerial. Sky+ allows the simultaneous recording of one channel and the viewing of another, but even that can be a severe limitation. It's also worth mentioning the danger of 'putting all your eggs in one basket'. What if Sky goes bust? (hollow laugh). More realistically, what if the Skybox or the dish fails on Christmas Eve? Good clean signals from the aerial are still essential for a normal domestic distribution system. Customers often run away with the idea that they don't need an aerial because they've got satellite, but it really isn't a good idea in areas where decent terrestrial reception is available.



Fig 4. Good clean incoming signals are the essential starting point for every system. From top to bottom: Vertically polarised UHF TV aerial, four element VHF DAB aerial, two element VHF FM aerial.

In areas where VHF FM and DAB digital radio reception is poor it could be worth the customer's while for you to add aerials for these services. The signals will be available at every TV outlet, and a splitter or diplexer can be used to feed the nearby tuner. If the tuner doesn't have a TV outlet nearby an extra one can be added. But if there's only one location where radio reception is needed it's best to connect the aerial directly to the outlet, rather than passing the signal through the distribution amplifier. Both VHF FM and DAB can sometimes be received surprisingly well in the loft by the way, if the customer is unhappy about the extra aluminium on the roof.

The number of outlets and their positions

Quite often when I'm looking round the house with the customer, discussing which rooms are to have TV outlets, I catch sight of a portable television in a workroom or an office. No mention being made to me about this set, I ask about it. "Oh we aren't bothered about that one."

It's only for when she's ironing," is a typical reply. Having turned the set on and looked at the dreadful picture it isn't usually hard to persuade them to include it in the system. The extra cost is minimal. Always involve the chief ironer in this discussion.

Customers moving into new houses will often be very unsure about where they are going to put the TV sets, so I sometimes suggest that the job be done in two parts. On Day One of their occupation the aerial is installed, giving them TV reception in the living room. When they've had a few days to think about the way each room will be arranged the job can be completed. Of course in brand new houses the cables might already be in the walls, so it will be too late to decide which corner of the room will have the TV outlet.

Once you've installed a system for someone the chances are they'll want you to do it again if they move house, and quite often people having a house built from scratch will have the sense to call you in at an early stage. This provides a brilliant opportunity to get the cables installed invisibly. The result is a really smart job.

Distribution of cable, PVR, and DVD channels

Customers without satellite might have a cable receiver in the living room. These usually have an RF output and this can be added to the distribution system. There is no cable box equivalent to the tvLINK system as far as I know, so those wishing to change the cable channel from the bedroom will need a 433MHz remote control extender, the best known being the 'Powermid'. These devices work well in general, but can be stopped in their tracks by local interference or thick stone walls. A radio remote control extender can also be used in conjunction with the hard drive-based recording device (or PVR personal video recorder) in the living room. It's worthwhile distributing the output from a PVR because the recording medium isn't portable in other words it isn't like a videotape that can be taken upstairs and played in another machine. Global have recently introduced the tvLINK Plus, which works just like the ordinary tvLINK but also operates virtually any make of DVD player, DTT receiver, etc. This is a good alternative to a radio remote control extender in a very large house where the latter might well not have enough range.

As far as I know all the PVRs on the market the Pace Twin, the Fusion FVR100, the Thompson DHD-4000, the Humax PVR-800T and others have built-in RF modulators. It's worth checking though, just in case you need to include the cost of an external modulator in that section of your quotation.

DVD players (as opposed to recorders) are now ten a penny, so if a customer asks about distributing the output of one of these devices I always suggest that they would be better spending their money on a couple of cheap players for the bedrooms. Since DVD players rarely have a built in RF modulator the cost of adding the output to the distribution system is out of proportion to the (limited) benefit, compared to buying extra players.

Sorting out the SCARTS

At some stage in the discussion the customer might mention the poor functionality of the AV connections in the living room or elsewhere. Sometimes though they don't mention it, because they take it for granted! They don't realise that it can be better. At this stage I usually tell them that it can be sorted, but that I'll discuss it with them after the RF part of the job is finished. It might be that a 'sort out' and a bit of customer education is all that's needed, but if they have the all-too common problem of not having enough scart sockets on the TV set they are going to need some sort of automatic scart switcher. It's best, I think, if the customer doesn't perceive the cost of this and its installation as part of the cost of the RF distribution system, so leave it alone until the main job is done and invoiced.

Cameras all round the house?

I'm not talking about a serious surveillance system here, with six cameras, infra-red lights, and a hard drive recorder. This article is about television distribution systems, and I just want to make the point that sometimes you can add one or two cheap or mid-range cameras. For most customers though, when you mention cameras it's a big no-no. They don't want a surveillance system because they don't want to think about the possibility of intruders. But once they've



Fig 5. This B-Tech Quintro+ automatic scart switch (top) presides over the customer's motley collection of satellite receivers and VCRs. The Quintro has five RGB/composite inputs. These can be selected automatically or manually for routing to the TV set. At the same time the device can route signals between input devices for recording. Automatic scart switchers provide a good solution when the TV set hasn't enough A/V inputs.



Fig 6. The addition of a surveillance channel to the TV distribution system can be an effective sales point.

actually had a burglary or a car taken off the drive their attitude might change. It isn't expensive to add a single camera and a modulator, thus letting the customer see what's happening in the carport at dead of night without getting out of bed. To the customer this simple addition can be a boon, once you've pointed out that it's possible. People don't realise how good surveillance pictures can be, so it might be worthwhile showing them a VCR or DVD recording from another installation (but of course respect your previous customer's security).

At this stage customers are unlikely to want the expense or complication of a dedicated recording device. This is not evidence-gathering surveillance, it's merely reassurance surveillance.

You won't sell surveillance to someone in a really big posh house – they will already have it. Surprisingly though, it often comes as a revelation to such people that you can make the camera pictures visible on all the TV sets in the house. This can be really useful for them, so you might well find yourself adding four or more modulators to your system.

Other satellites

There aren't many ethnicities or languages left unrepresented on the European satellites. This is another opportunity to give your customer something he probably didn't know was possible. If the lady of the house hails from foreign parts hubby will probably be well pleased to give her a few TV channels from home. "Keeps her quiet," he'll whisper when she goes to make the tea. Language students are another good bet.

Try to avoid pay channels if at all possible, unless the customer has a specific channel in mind. The digital 'free-to-air' receivers are cheaper, and the last thing you want is involvement in subscription buying, encryption changes, and so on. The idea of paying a subscription will scare off a lot of customers. Buy a copy of 'What Satellite' and look at the digital channel listings. Look for a group of free-to-air channels of the appropriate language, and check that the necessary dish size is feasible. Also take a look at Lyngsat. The Hot Bird satellites at 13°E have hundreds of free-to-air channels. Look also at the listings for 19.2°E and 16°E. [Fig 7]. A 65cm dish is usually adequate. If there are planning problems with a second dish, reception of Sky might be possible from the same dish using a second LNB on an offset arm.



Fig 7. Satellite doesn't begin and end with Sky! There are plenty of free channels available at other orbital slots.



Fig 8. A 65cm Hirschmann dish, suitable for the Hotbird satellites at 13°E.

As well as the foreign language enthusiasts there are the Sky refuseniks, and I'm proud to be one myself. Some people would like a wider range of channels but don't want to subscribe to Sky. These people aren't enthusiasts, by which I mean they don't want the hassle of a motorised dish or multiple subscriptions. They just want a bit of choice. I have a lot of customers with 65cm dishes fixed on 13°E and a cheap free-to-air receiver. This gives them hundreds of television and radio channels for a total outlay of about £250. As I write this I have Swiss Classic playing in the background. Uninterrupted classical music – Classic FM without the adverts and self-promotion! I wouldn't be without my 13°E!

Some free-to-air receivers can be programed to automatically crack various soft-encrypted signals, and this gives a worthwhile increase in the total number of channels for about £10. Having discussed every possible enhancement with the customer, and made a note of any possible installation problems, you should now have a good idea of what the job entails. Get that quotation sent off! Next I'll look at a few sample installations, paying particular attention to the problems of cramming extra channels into the congested UHF band and ensuring that the various signal sources don't interfere with each other.