Wright's Aerials

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To: xxxxxxxxxxxxx
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Dear Xxxxxx,

Xxxxx Xxxxx Apartments: TV, radio, and satellite distribution system

Further to your request, the following is an account of the condition and efficiency of the distribution system. This account is based on an examination of the aerials, the head-end, and the multiswitch serving apartment 15 and near neighbours.

1. Satellite dish

The satellite dish was fixed to a 2-inch diameter aluminium aerial mast, at a point approximately 1.5 metres above the highest wall bracket. The dish was above the roofline, fully exposed to the wind. The mast had a tube wall thickness of only 1.8mm. Masts of this sort are designed to carry aerials or other loads that have little wind resistance. This mast could not withstand the buffeting of the wind on the dish. The dish was 790mm x 660mm, or half a square metre in area. An attempt had been made to reinforce the installation with guy ropes, but this was so badly done that it is unlikely to have helped very much. Various photographs of the installation, taken after it collapsed in mid-December, are enclosed.
The connections to the LNB (dish electronics) were not waterproofed.

2. Aerials

There are three aerials, one each for UHF TV, VHF DAB radio, and VHF FM radio. The aerials are much too close together to function efficiently. They will each detract from the others' performance (see photograph).
The VHF DAB aerial has the wrong polarity (it is mounted horizontally but all DAB signals require a vertical aerial; see photograph) so it is producing a very poor quality signal.
The VHF-FM aerial is a non-directional type that has very poor sensitivity. The aerial is screened through approximately 130˚ by the building, so all in all it is a highly inefficient means of reception.
The reflector of the TV aerial is loose.

3. Distribution head-end

(a) Physical layout

The equipment is located in an electrical riser near to the aerials. The three main amplifiers are fixed to a backboard that straddles the traywork. (The lower amplifier is only fixed at one end). Some of the equipment, however, is loosely cable tied to the traywork, loose on the floor, or hanging from the cables (see photographs). Cable fixing is inadequate. Equipment of this kind should be in a wallbox or at the very least should be carefully fixed to a backboard with cables fixed down to the board. In the latter case the board should be located where there is sufficient space for it.

(b) Connections

Most connections are by screw-on 'f' type plugs. All 44 plugs at the head end were loose. In some cases the plug was barely screwed onto the socket. If this is the case throughout the system it will be a significant source of unreliability.

Push-on 'f' connectors have been used between the satellite IF tap-off units and the multiswitches (see photograph). Since the tap-off units are otherwise unsupported the push-on connectors (which are designed to be a fairly loose fit) are making precarious contact. I have never known a manufacturer recommend the use of push-on connectors in this way, but if this manufacturer has it will certainly only be on the basis that the items on both sides of the connection are firmly secured. At this head-end, where the multiswitch is loosely cable tied to the traywork and the tap-off units are unsupported, the whole arrangement is very flimsy.

(c) Satellite signal levels

There are two satellite amplifier units. These are both four amplifiers in one, because they boost the four sets of satellite signals separately. One unit serves the smaller block and the other serves the main block. The amplifier for the smaller block has no equalisation adjustment. A fixed amount of equalisation is built in. The amplifier for the main block has adjustable equalisation, and is set for minimum equalisation. Because the final signal levels (at the outlets) are rather low it is not possible to use the equalisation adjustment without making things worse. Both amplifiers have the gain (amount of amplification) set to maximum.

As a test we attempted to improve reception by increasing the satellite signal levels available from the head end. This showed that the amplifiers were already 'flat out' , so the addition of pre-amplifiers simply drove them into an overloaded condition.

(d) Terrestrial television signal levels

The aerial is aligned on the Xxxxxxxxx transmitter, and receives five analogue channels and six digital multiplexes (groups of channels). The strengths of the various channels and multiplexes sent out by the Xxxxxxxxx transmitter are not even and on a large system like this it is necessary that they can be adjusted individually so that they are reasonably level when distributed. The signal levels leaving this head end have a 13dB variation across the analogue channels and a 10dB variation across the digital multiplexes. If allowance is made for correct equalisation the analogue inequality becomes approximately 17dB. These figures are enough to make correct signal level planning impossible. There are no channel filters or other means of setting the levels of the channels individually on this system. The levels received by the aerial pass through the system unchanged, except that the imbalance is even worse at outlets away from the head end because of higher cable losses on the higher channels. The benefits of channel filters would be considerable.

As a test we attempted to adjust the terrestrial head end signal levels. This showed that any increase caused the main amplifiers and the multiswitches to become

overloaded (causing analogue picture faults) and any reduction caused analogue channel xx ('five') and three of the multiplexes to become unacceptably weak at the outlets. This confirms that individual channel processing of some sort is essential.

(e) The VHF-FM and VHF DAB signal levels

The DAB signal levels were very high indeed because the amplifier adjustment was at maximum . This might have been a misguided attempt to compensate for the incorrect aerial polarity. DAB Bit Error Rate (signal quality) is very poor, presumably because of the incorrect aerial alignment.

VHF FM signal levels from Xxxxxxxxxx are correct. Signals from all other transmitters are very weak.

(f) The surveillance channels

Cables from the four surveillance cameras are connected to modulators at the head end. A modulator is a device that converts a camera output into a TV signal that can be distributed like any other channel. The front entrance camera output signal is faulty. There is a synchronisation fault, so the picture is unstable.

The modulators are loose on the floor in the riser (see photograph).

The modulators are connected together in a 'daisy-chain' which has the aerial signals passing through all four modulators. The output is connected into the system without channel filters. This is highly unsatisfactory. The out-of-channel RF noise from the modulators degrades reception of all channels.

(g) Electrical installation

The supplies for the various head-end components are connected with a domestic four-way mains extension unit (see photograph). This is not secured in any way. None of the components has an earth connection via the 13A plug. There is no separate earth bonding at the head-end. These are perhaps the most important points made in this report.

4. System network

(a) Satellite signal level and carrier/noise ratio planning

We have not traced the system layout in detail. However, it appears that there are polarity switches at a number of locations throughout both buildings. Each switch serves a small number of apartments. The switches are fed from distribution trunk cables, via tap-off units. It is possible to adjust the gain (amount of amplification) of the polarity switches. On a system of this design the provision of correct signal levels across the band and adequate carrier to noise ratios can be a very complex task, requiring careful planning and then accurate adjustment at many different points. This design and installation task has not been performed adequately. In essence it appears that the head-end and the multiswitches together are producing signals at the outlets that are in some cases not strong enough, and are to varying degrees degraded by thermal noise and intermodulation products. The latter is a significant factor because the head-end amplifiers are working at the very limit of their output capabilities. In many apartments a combination of high noise levels (due to the amplifiers working at their limits) and indifferent signal levels mean that the higher satellite channels are unreliable or absent.

A test adjustment of the signal levels at the multiswitch serving apartment 15 and others produced only a slight theoretical improvement, not enough to make any real difference to reception.

(b) Electrical safety

The switch in the electrical cupboard near No. 15 is shown in the accompanying photographs. An earthing rail and a length of earthing cable have been fitted, but the

latter is not connected to anything.

(c) Physical layout

As at the head-end, push-on 'f' connectors have been used to connect the tap-off units to the polarity switch, with the tap-off units otherwise unsupported. All the screw-on 'f' connectors were loose. There is no housing or backboard, as the components are fixed directly to the wall.

(d) Satellite signal levels and quality at No. 15

We measured the strength and quality of the satellite signals at the inputs and outputs of the multiswitch near No. 15, and also at the outlets in that apartment. It is assumed that signal levels there are reasonably typical of the whole system.

The signal levels and carrier/noise ratios available at the living room outlet of No. 15 are not adequate. Towards the low end of the frequency band signal levels are lower than they should be but will provide good reception for most of the time. There is not much 'safety margin' though, so when signal levels drop due to heavy rain or snow reception might become unreliable. Signal levels and carrier/noise ratios towards the high end of the band are borderline. This is why the resident cannot receive certain channels.

(e) Terrestrial signal levels and quality

The signal level inequalities present at the head end carry through to the outlets, as would be expected.

5. Within the apartments

We have only looked in detail at No. 15. The apartment has three TV sockets. The one in the living room is a multi-function type for satellite and terrestrial. The other two are ordinary isolated single wallplates. By some means unknown to us all three sockets are connected to the one output port on the multiswitch. Presumably there is a splitter somewhere probably above the ceiling. Certainly the signal loss from multiswitch to living room outlet is higher than would be expected if the connection was direct. This is especially true on the higher satellite channels.

The other minor consequence is that satellite signals are available from the bedroom outlets, but the polarity/band is not selectable from there, being controlled by the living room satellite receiver. This is an oddity but there are no adverse consequences. This is the only system I have ever seen where the terrestrial-only outlets have been connected via a splitter to the satellite/terrestrial cable that feeds the main outlet. It will make the planning of the system that much more exacting because of the unnecessary satellite signal losses. The conventional approach would be to take the terrestrial-only cables back to a separate terrestrial-only amplifier near each polarity switch. Alternatively a 'mini distribution system' could be installed in each apartment. Although adding significant cost these options are technically far better and as I implied, are the methods universally applied in my experience to date.

6. Possible remedial action

(a) The replacement of the aerials.

(b) The whole distribution network needs to be traced and re-planned. This will allow the calculation of necessary signal levels throughout the system, including those needed from the head end. Because of the loose connections, unsecured cables, and lack of earthing that has already been found no part of the system can safely be left unexamined.

(c) The installation of a new head end. This would include UHF channel filters and

amplifiers capable of providing adequate satellite and terrestrial signal levels. Once the whole system has been drawn up and re-planned it might or might not prove possible to reuse the existing amplifiers.
The new head end will need to be built into steel housings. There is not enough room for these at the present location.
(d) It might be possible to re-use the multiswitches that are installed at various locations. However, it might prove more cost-effective to make use of the mains supplies provided (for the purpose?) in the electric cupboards and use mains powered rather than line powered switches.
The multiswitches will need to be housed in wallboxes, or at the least built up with the other components in a secure manner on backboards.
(e) The splitter arrangement within no. 15 presents a dilemma if all the apartments are wired up that way. To be practical I doubt if the splitters will prove to be accessible, and even if they are, what then? It would be difficult to get new cables through to the multiswitches, I should think. Probably the splitter arrangement will have to be retained, and signal levels available from the multiswitches adjusted to compensate for the losses. This is very regrettable technically.

Best regards,

Bill Wright