FOXTEL MANAGEMENT PTY LIMITED

Satellite Installation Manual – SIM
for

Multi-Dwelling Units
Multi-Residential Estates and
Commercial Installations

FD/T/E/2207

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ISSUE 9 Revision 9

Document Control

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Issue #	Issue Date	Revision	Revision Date	Comments	Prepared By	Authorised By
1	15/1/03			First release in new Engineering format.	Steve Circosta	Peter Sneesby
		1	22/1/03	Correcting One-off Installs section.	Steve Circosta	Peter Sneesby
		2, 3	02/07/04 19/07/04	Minor edits, addition of new commissioning form, addition of 12 way multiswitch and earthing	Cliff Hobson Cosmos Vlahopoulos Tod Gudde	Steve Circosta
2			6/10/04	Restructured iaw Content Specification and meeting with S Circosta/T Gudde	Cliff Hobson	Paul Trimble
		1	27/10/04	Second release in new Engineering format for Personal Digital Recorder and multi satellite.	Cliff Hobson Bill Ertner Steve Circosta Tod Gudde	Paul Trimble
3			29/10/04	Released for Digital review.	Cliff Hobson Bill Ertner Steve Circosta Tod Gudde	Paul Trimble
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		2	8/11/04	Amendments from review by Tod Gudde	Cliff Hobson	Paul Trimble
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		2	18/11/04	Addition of IPL processes, changes to Technical Specifications in App C; added graphic of sticker used in Commercial Installations	Cliff Hobson	Paul Trimble
5			18/11/04	Released	Cliff Hobson	Paul Trimble
		1	19/11/04	Added Passive Equipment Specifications	Cliff Hobson	Paul Trimble

Issue #	Issue Date	Revision	Revision Date	Comments	Prepared By	Authorised By
				to Appx C		
		2	24/11/04	Added Section 6.5.1.2 – LNB Tests; replaced Commissioning Data Log Example form in Appendix F3	Cliff Hobson	Paul Trimble
		3	26/11/04	Various edits – removed sections of table in App C.1	Cliff Hobson	Paul Trimble
		4	2/12/04	Added App D.1 and D.2	Cliff Hobson	Paul Trimble
6	13/12/04	0		Released as Issue 6. Amended copyright statement, added instruction information for Designer companies. Added Acceptance Testing sampling information in Appendix D.2.	Cliff Hobson	Paul Trimble
6		1	21/12/04	Changed contact point for return of signed page to Engineering MDU Manager	Cliff Hobson	Paul Trimble
		2	24/12/04	Changed summary page and other minor edits	Cliff Hobson	Paul Trimble
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		1	13/1/05	Revised sign-off table on page 5; added issue number to footers	Cliff Hobson	Paul Trimble
8	11/02/05	0		Released to the field as Version 8	Cliff Hobson	Paul Trimble
		1	21/02/05	Minor amendments	Cliff Hobson	Paul Trimble
		2	26/04/05	Amendments in accordance with feedback from Users. Updated design drawings to reflect quad LNBs. Merged PDR Compliant and Future MDU Compliant in Terminology Section	Cliff Hobson	Paul Trimble
		3	05/05/05	Replaced drawing in Sect 8.2.1.1. Added earth connection to drawing in Sect 8.2.1.2. Replaced 2LNR code in Table 10 and Sect 9.1.2.3.4 with 2LR. Added Request for Design Number Form in Appendix F.5.	Cliff Hobson	Paul Trimble

Issue #	Issue Date	Revision	Revision Date	Comments	Prepared By	Authorised By
		4	09/08/05	Changed feedback email address throughout. Section 4.5 – Added requirement to supply laminated copy of the commissioning data log performance figures. Updated Sample Design figures. Table 10 – Updated Installation Codes Section 9.1.2.3 – Updated Section 9.1.2.5 – Updated Section 9.1.4 – Updated Table 12 – Updated Transponder Frequencies in Added 4 barrel grounding blocker Section 8.2.5.2. Appendix D1. – Updated Contact table Appendix D2 – Reworked (Acceptance Testing Methods) Removed Scope of Work Form and Commissioning Form.	Cliff Hobson	Paul Trimble
		5	13/02/07	Inserted new logos. Updated distribution list	Cliff Hobson	Paul Trimble
9		0	15/05/07	Restructured iaw discussions between S Circosta and P O'Connor	Cliff Hobson	Paul Trimble
		1	24/05/07	Updated email addresses and website details	Cliff Hobson	Paul Trimble
		2	16/08/07	Changed header to be Unclassified	Robert Phillips	Paul Trimble
		3	12/08/08	Amend Transponder 1 frequencies for Downlink	Cliff Hobson	Paul Trimble

Issue #	Issue Date	Revision	Revision Date	Comments	Prepared By	Authorised By
9		4	28/09/09	Changes as per J Mitsios request: P14 – Updated contractor emails P26 – changed ducting length P27 – Changed test transponders P59 – Added D3 transponder listing P64 – Amended Test equipment table P83 – Deleted sample form (old Appendix E) P85 – Changed FOXTEL website address	Cliff Hobson	Paul Trimble
9		5	22/10/09	Amended Distribution List	Cliff Hobson	Paul Trimble
9		6	03/11/09	Updated DVBC 256QAM details in Table 3and Table 5	Cliff Hobson	Paul Trimble
9		7	11/11/09	Amendments to correct website URL	Cliff Hobson	Paul Trimble
9		8	09/06/10	Updated transponder details in Section 6.5.3.1 Updated symbol rates for T19 and T21 in Table 10	Cliff Hobson	Paul Trimble
9		9	17/06/10	Amended QPSK level in Table 5. Changed D3 transponder details in Section 6.5.3.1	Cliff Hobson	Paul Trimble

Internal Distribution List

Name	Position	Company
Steve O'Connor	National MDU Sales Manager	FOXTEL
Jason Galea	Installations Solutions Manager	FOXTEL
John Mitsios	Installations Solutions – MDU Specialist	FOXTEL
Steve Circosta	CE Product Engineer	FOXTEL
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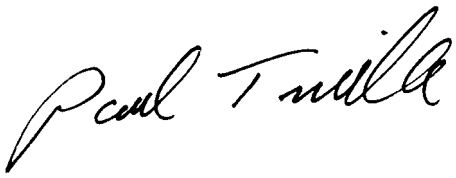
Document Approval

Name: Paul Trimble Customer Equipment Engineering Manager



15 May 2007

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Summary of the Satellite MDU Specification in this manual

The FOXTEL Standard is for a 4 cable backbone (5 cables if integrated with Open Broadcast (OB) television), with two laterals to every outlet. All designs will use RG6 cabling with one amplifier for every four floors. The details for implementing the specifications are presented in this manual.

There are three categories by building type:

- **New** (planned or under construction now)
- **Existing unwired** (no FOXTEL related wiring)
- **Existing wired** (with a single or double backbone FOXTEL related backbone)

The summary specification for wiring existing wired MDU modules is:

- Install a dish with at least a quad LNB with lead-in cables and then for:

    i. Integrated with the OB cable – requires a 5 cable backbone. This type of installation requires the cascading taps to be connected to at least one 5-input, or one 3-input and one 2-input multiswitch on each floor.

    The third cable on the 3-input multiswitch carries the OB signal which will require one lateral to every outlet on the floor. (There is negligible cost in installing additional laterals to every outlet at this time, but this is an optional extra for the Body Corporate to consider.)

    Any unused outputs from both multiswitches are to be terminated at the multiswitch.

    ii. Standalone: (no OB cable) – requires a 4 cable backbone. This type of installation requires the cascading taps to be connected to at least one 5-input multiswitch or two 2-input multiswitches on each floor – unused outputs from this multiswitch are to be terminated at the multiswitch.

Terminology

The following list provides standard terminology for referring to satellite installation configurations irrespective of whether an Open Broadcast system is available in the building:

- *Non-compliant:* there is no FOXTEL compliant cabling in the building.
- *PDR Compliant:* a distribution system that can support FOXTEL services without cabling upgrades over the life of the C1 and D3 satellites and two outlet ports to support up to four tuners in the STU to enable programme recording. It consists of:
  - A satellite dish with at least a quad output polarity LNB
  - All four LNB RF outlets connected to the building distribution system
  - Four quad RG6 cables to each multiswitch (backbone)
  - Two quad RG6 (or greater) cables going from the end of line multiswitch to each twin wallplate
  - Telephone outlet incorporated into or adjacent to the twin wallplate
  - One un-terminated Cat-5e cable (optional).

1. Purpose

In recent years FOXTEL has launched new channels, interactive services and products (such as Near Video On Demand, Multiview, Personal Digital Recorders) that required changes to FOXTEL installation techniques. The new services use the vertical and horizontal polarities of the satellite. Therefore, new FOXTEL SMATV systems require more sophisticated multiple backbone and twin lateral cabling systems so that the new services and products can be distributed to the subscriber's home.

The purpose of this manual is to:

- Outline the specifications for designing installations to FOXTEL's expectations
- Provide the **knowledge** necessary to appreciate the complexities of satellite distribution installations.

From time to time, the requirements within this manual will change as the FOXTEL business matures. This could be due to introduction of new technology or identification of field difficulties, which require clearer detail to ensure the quality expectations of the business are met. Changes will be distributed via electronic field bulletins or listed on the FOXTEL website.

2. Scope

This manual applies to all entities associated directly or indirectly with providing FOXTEL satellite connectivity to potential subscribers. In this manual, these entities are referred to as Clients.

This manual is only relevant to satellite installations and is divided into sections applicable to distinct audiences.

- Section 4 is applicable to third party installation companies. It describes how to request a FOXTEL installation.
- Section 6 contains design guidelines and is applicable to FOXTEL Industry Designers.
- Section 8 contains installation requirements as well as technical reference and troubleshooting information.

> Note: FOXTEL expects that all FOXTEL Industry Designers, contracted installation technicians and quality audit inspectors involved in satellite installations will be able to understand the information within this manual, comply with the requirements described, and have the skills and abilities required to perform the work. If additional information is required for simple domestic installations then this may be found in FOXTEL's Satellite Installation Manual – Domestic (SIM-DOM).

3. Feedback

Questions, noted inconsistencies or suggestions for improvements to this manual can be emailed directly to FOXTEL at installation.solutions@FOXTEL.com.au.

4. Requests for a FOXTEL Installation

4.1. Creating the Conceptual Design

An accurate initial assessment of the building is one of the most important aspects of the overall build process as this will assist in creating a conceptual design that is suitable for the building.

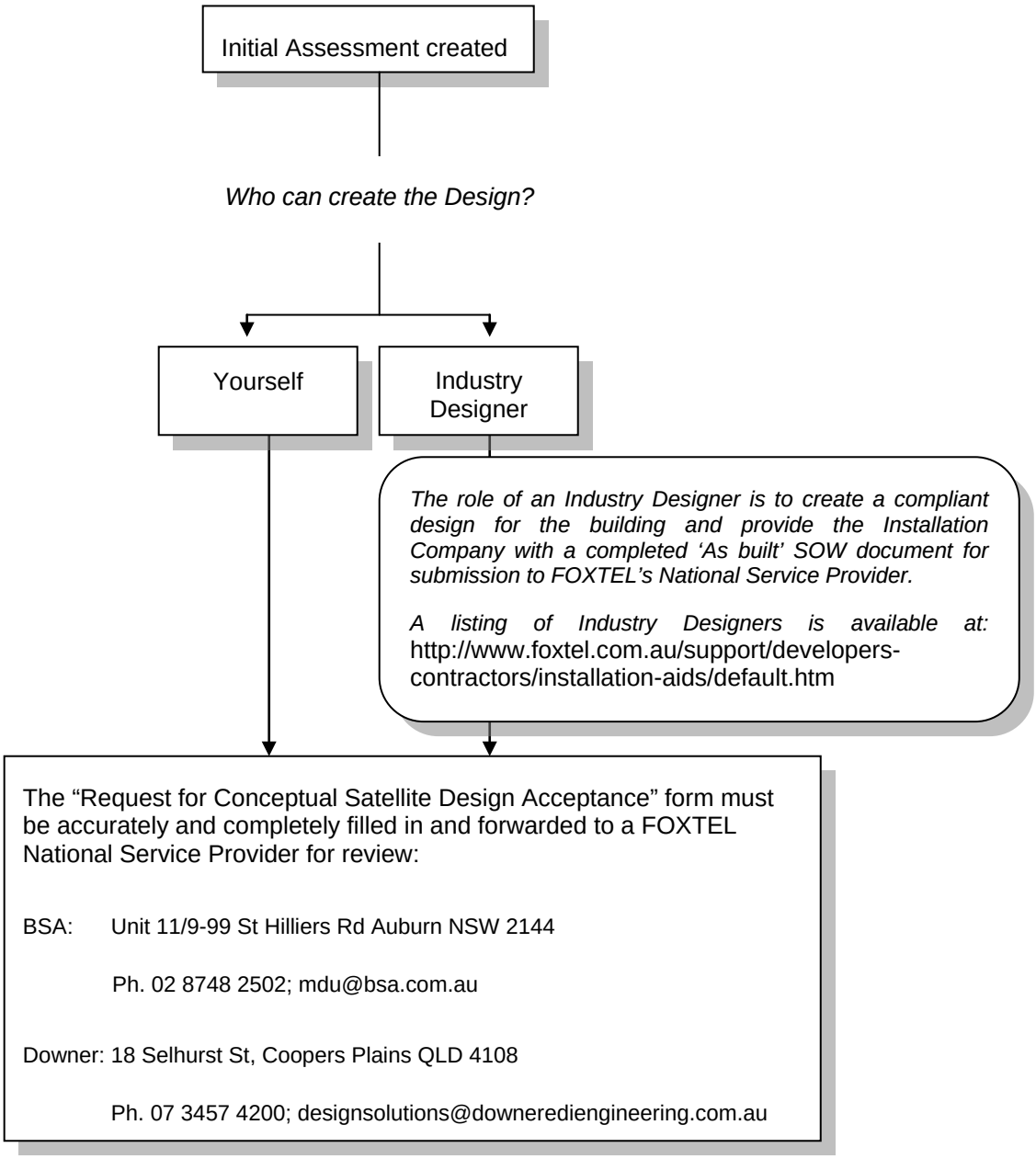

Figure 1 – Conceptual Design Process

4.2. Request for Conceptual Satellite Design Acceptance Form

FOXTEL

Request for Conceptual Satellite Design Acceptance

Installation Company Details:

Company Name:	Date Submitted:
Contact Person:	Email Address:
Phone Number:	Fax Number:

Building Information:

Building name:

Building address:

New or existing build: New ☐ Existing ☐

Number of buildings in complex	Distance between buildings	Number of floors	Distance between floors (equipment locations)	Number of units per fl

Total units in complex	Number of wallplates per unit	Distance dish to 1st device (equipment location)	Lateral shortest distance (riser to unit)	Lateral longest dist (riser to

Acceptance Request Checklist:

Building checked?:	Yes ☐	No ☐
Line of Site available?:	Yes ☐	No ☐
Twin cables to required wallplates?:	Yes ☐	No ☐
Cables wired to required wallplates?:	Yes ☐	No ☐
All cables in units run to common location?:	Yes ☐	No ☐
Commom locations being Riser, MDF room, Electrical riser etc.		
Conceptual design attached to this request form?:	Yes ☐	No ☐
eg. AutoCAD, MS Visio or hand drawn sketch.		
Conceptual design meets 2005 specification?:	Yes ☐	No ☐
If no provide explanatory notes below		

Comments (explanatory notes):

FOXTEL National Service Provider Use Only

Provider Details:

Provider Name:	Conceptual Design Accepted?:
Contact Person:	Yes ☐ No ☐
Phone Number:	
Email Address:	Date of Review:

Comments (explanatory notes):

Ensure all details on the form are correctly completed

Ensure you provide a full Brief scope of works under the Comments (explanatory notes) heading which may include:

- If Open Broadcasting system (i.e. FTA) is to be integrated
- If cable will be run in cavity, risers or externally in ducting
- Any unique aspect relative to the building that will assist in the design process.

Upon receiving an accepted "Request for Conceptual Satellite Design Acceptance" form back from a FOXTEL National Service Provider, you may then provide a quotation to the client and if successful with your quotation, begin the installation works.

5. Quality Control

FOXTEL's quality expectations and processes focus on ensuring that the design and field installation process is positive and beneficial to everyone involved in the FOXTEL process and that they will happily recommend the FOXTEL process to others.

FOXTEL, or one of our National Service Providers, reserve the right to actively inspect the work performed by Third Parties to ensure that their work meets the required standards. If subsequently the work is found to be of an inferior standard then the Third Party installer will be required to make the necessary reparations.

6. Design Guidelines

This section outlines the requirements for companies designing FOXTEL satellite installations.

6.1. Outdoor Unit (ODU) – Dish and LNB

This section details the steps required to select and install the satellite dish and LNB.

6.1.1. Dish Selection

The step of selecting the correct dish performance is to ensure that it will provide appropriate increase in margin of Bit Error Rate, Modulation Error Ratio (in band noise ratio) and Digital Channel Power performance to ensure it will cater for rain fade margin and distribution system degradation. Figure 2 provides information on the four satellite coverage zones and the appropriate size dish required for an installation at this location.

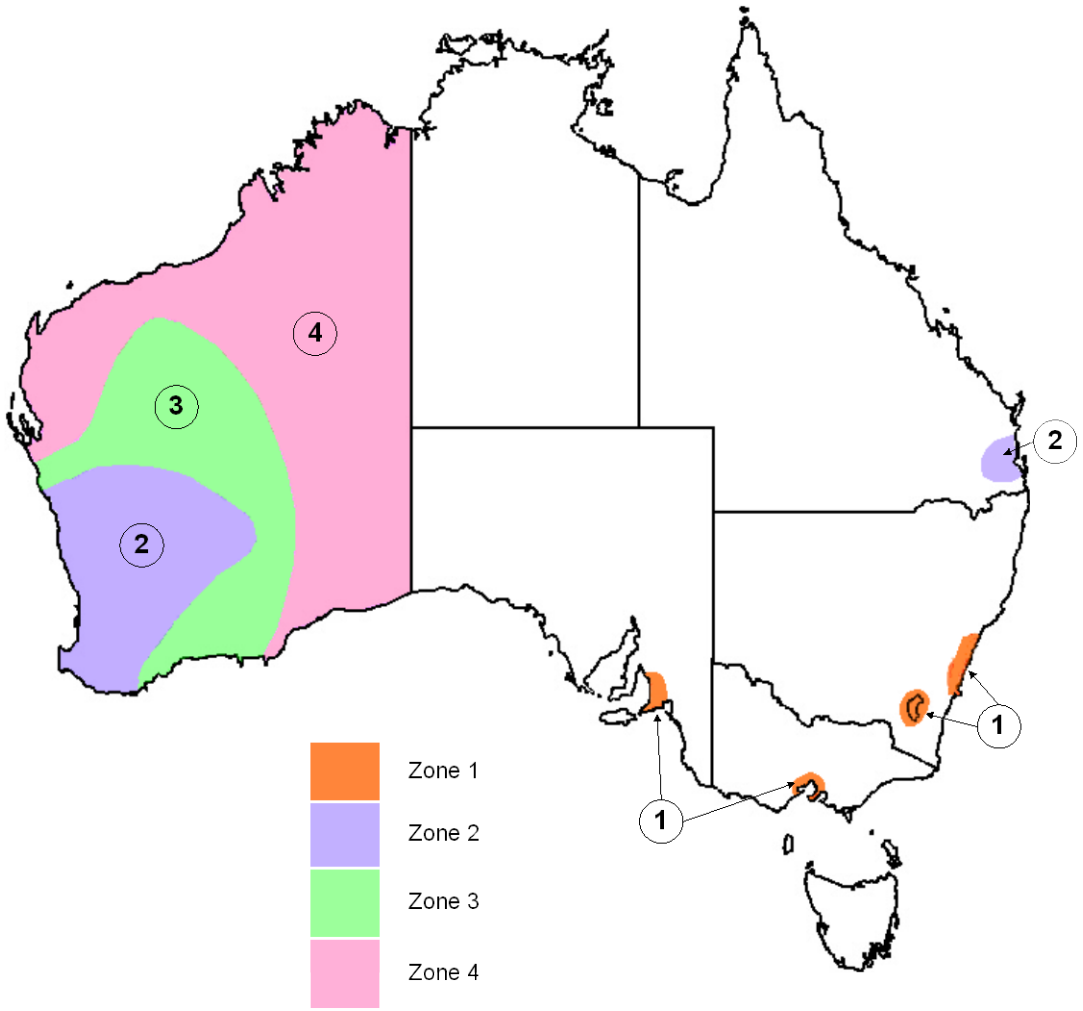

Figure 2 – Optus C1 FOXTEL Satellite Coverage Zone Map

Table 1 – Dish Location Zone to Size Selection Matrix

	Multi-Dwelling Unit ≤ 3 stories	Multi-Dwelling Unit ≥ 3 stories	Multi-Residential Estates	Commercial (Hotel, Multi-Dwelling Unit)	Commercial (Single Dwelling Residence)
Zone 1	65cm	90cm	90cm*	90cm	65cm
Zone 2	80cm	90cm	90cm*	90cm	80cm
Zone 3	90cm	1.2m	1.2m*	1.2m	90cm
Zone 4	1.2m	>1.2m*	>1.2m*	>1.2m*	1.2m

* Note: Depending on system size

Note: Installation of any combination of dish and LNBF must conform to all the manufacturer's instructions.

6.1.2. Dish Alignment

There are two steps to aligning a satellite dish for optimum performance, Azimuth elevation setup and cross-polarisation. A meter must be used for all dish alignment (see Installer Product List for current models). FOXTEL has selected these new meters to make the dish alignment process more accurate and efficient. See Section 8.1.2 for step by step installation procedures.

6.2. Mounts

This section describes how to select a mount and where to install it.

> Note: No mount is to exceed its maximum rated dish size or wind rating specifications. All mounts must be installed in accordance with the manufacturer's instructions.

> Note: For further information on mount specifications and details, refer to the Domestic Installation Manual – (Satellite Installation Manual – Domestic (SIM-DOM)) or the Manufacturer's instructions provided with the mount, or refer to the Manufacturer's website.

6.2.1. Mount Selection

When selecting a mount, it needs to be suitable for the size of the dish and the prevailing wind conditions in the area where it will be used. Australia can be divided into four regions for prevailing wind conditions:

- Region A: Normal
- Region B: Intermediate
- Region C: Tropical cyclones
- Region D: Severe tropical cyclones

Use the map in Figure 3 and Table 2 to select the appropriate mount for the location. For further clarification on the suitability of the mount required for your location in all regions other than Region A, contact the mount manufacturer.

For 90cm or larger dishes, refer to the manufacturer's website for further information relating to mount selection.

Jonsa website:	http://www.je.au.com/Product_Catalogues.php
Other manufacturers websites	Yet to be provided

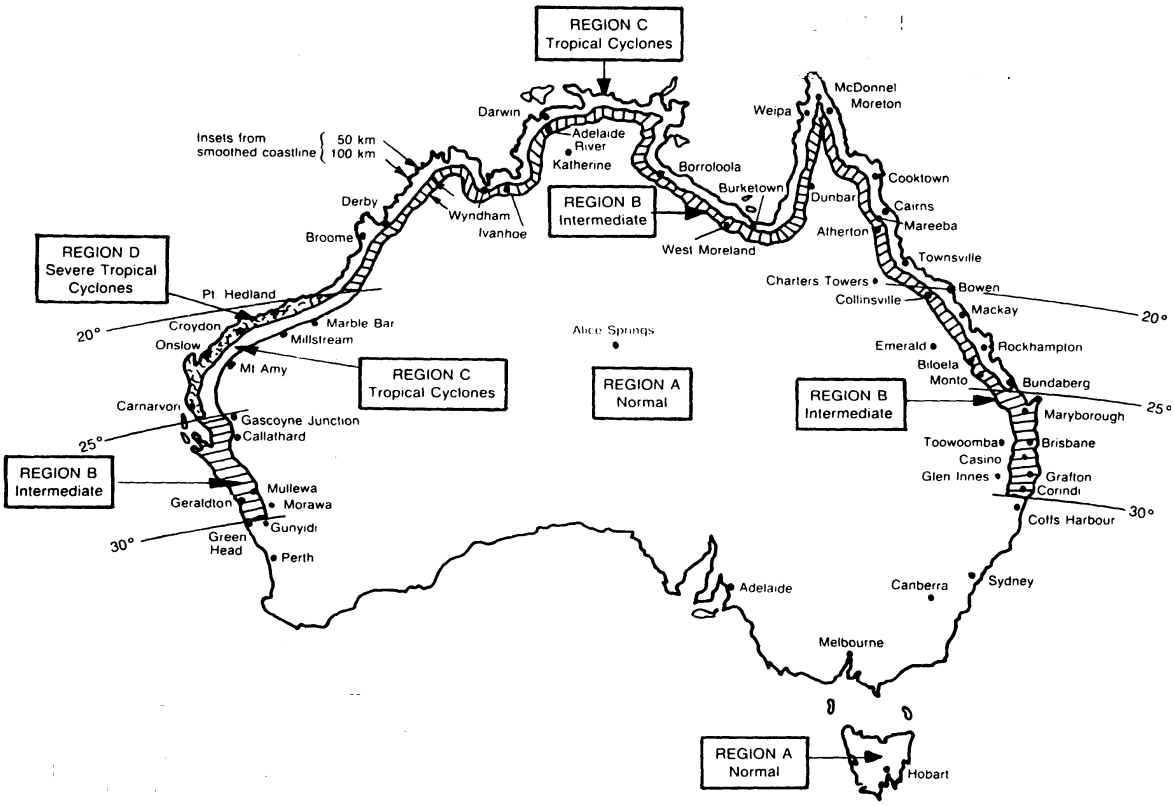

Figure 3 – Prevailing Wind Condition Zones

Table 2 – Mount Selection – Wind Rating Chart

	Multi-Dwelling Unit ≤ 3 stories	Multi-Dwelling Unit ≥4 stories	Multi-Residential Estates	Commercial	Commercial (Single Dwelling Residence)
Region A	W41	W50	W50	W50	W41
Region B	W41*	W50*	W50*	W50*	W41*
Region C	W50*	W50*	W50*	W50*	W50*
Region D	*	*	*	*	*

Note: *Refer to manufacturer for appropriate mount.

6.2.2. Location of Mount

For the FOXTEL satellite installation to work correctly there must be a clear Line of Sight to the FOXTEL satellite. Locations with a limited Line of Sight can result in intermittent or complete loss of signal. There should be no obstructions, for example, trees or parts of buildings in the signal path. An inclinometer should be used to survey the signal path to ensure a clear Line of Sight. If there is any uncertainty as to whether the Line of Sight will remain clear in the future (due to vegetation growth), use a different mount location.

6.2.3. Mount and Dish Placement

Placement of the mount for the dish on a building is aesthetically important and an essential part of the design for all existing buildings. A photo of the proposed mount/dish location is to be added to the Scope of Work document, thus ensuring the Client, for example, the Body Corporate, knows where the dish will be located before they sign off on the Scope of Work and design. Figure 4 provides guidance on the preferred mount and dish location where number 1 is the most preferred location (towards back of building) and 4 (front/side of building) is the least preferred option.

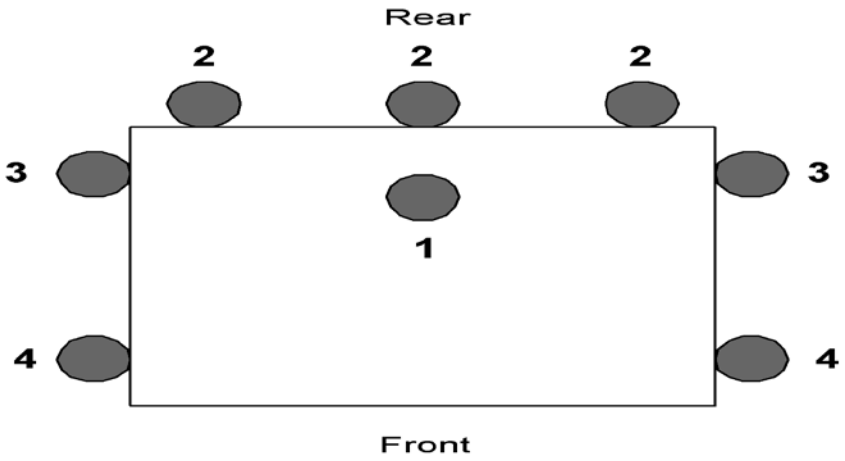

Figure 4 – Preferred Dish Locations

Note: The dish should not be located at the front of the building unless it has been clearly identified in the Scope of Work documentation submitted to the Body Corporate (or equivalent).

Note: Where the mount is installed on either a pre-cast concrete slab, block or wall, or a pre-mixed concrete slab, block or wall, the mount anchorage points must be greater than 300mm from any corner or edge of the slab, block or wall.

6.3. Roofing

Where necessary, clip-lock tin roof sheets (on flat roofs) may be removed for running cable through roof. If removed, ensure the roof sheet is re-clipped back into its original position.

CAUTION: Any damage caused through this action remains the responsibility of the Contracting company and/or the Customer Service Technician.

If sarking (water resistant foil membrane used for insulation) needs to be penetrated, carefully cut the sarking along the joist and repair using sarking tape.

6.4. Distribution System

This section describes requirements for installing cabling from the dish to the twin wallplate in a range of installation types:

- Multi-Dwelling Unit Installations:
  - Small
  - Large
- Multi-Residential Estates:
  - Coaxial
  - Fibre
- Commercial installations:
  - Hotel RF integration
  - High rise buildings
  - Single Dwelling Residence.

Example designs for these installation types are provided in Section 7.

6.4.1. Cabling System Topologies

There are typically only two types of cabling system layouts or topologies, Home Run (star wired) and Cascaded Taps (directional couplers – tree and branch). In reality, there is a third system, which uses Home Run and Cascaded Tap systems together, known as HRCT hybrid. FOXTEL recommends the Home Run system be used with all commercial Single Dwelling Residences and Small MDUs with the hybrid system being used with MDUs, Multi-Residential Estates and commercial high-rise buildings.

6.4.1.1. Home Run

The Home Run is the simplest installation and commonly used in small buildings (generally less than 4 storeys in height). Quad cables must be run from the wallplate to an area that provides future accessibility, for example, building service riser, communication riser or structured services cupboard.

6.4.1.1.1. Home Run LNB to First Device

A minimum of four (4) cables are to be run from the quad LNB to the first device (multiswitch or power injector) then earthed and terminated using an appropriate device, for example, 4 barrel grounding block.

6.4.1.2. Cascaded Tap

FOXTEL has migrated from the old legacy compliant distribution network which only used the Cascaded Tap standard. All new PDR compliant and MDU future compliant installations can only use either the Home Run or HRCT hybrid configuration.

6.4.1.3. HRCT Hybrid

The HRCT hybrid is a more complex installation and has to be used in larger buildings (greater than 12 units). FOXTEL requires that a minimum of four cables be run between the headend and each cascadable tap, which supplies each Home Run node. The major advantage of the HRCT hybrid system is that a modular approach can be used when designing and cabling a building. For more information on the HRCT hybrid design, refer to Section 7 or a FOXTEL Industry Designer.

6.4.2. Other Subscription Broadcast Provider Boundary Issues

1. Under no circumstances are you to use another Subscription Broadcasting provider's cable in total or in part.
2. Another carrier's outlet should not be used regardless of whether it is active or inactive.

6.4.3. Cable Selection

The appropriate cable for the installation environment should be used, for example:

- Underground installation – cable with flooding compound
- Aerial installation – cable with inbuilt messenger
- Common areas requiring fire retardant cable – plenum type cable (fire-rated) as required.

6.4.4. System Earthing

All FOXTEL installations incorporating two or more wallplates or STUs must be earthed. Systems with only a quad LNB must have an 4 barrel grounding blocker fitted. SMDUs and MDUs must have all amplifiers, power injectors, multiswitches, splitters and/or taps to be earthed as per Section 7.2.5.

6.4.5. System and Wallplate Specifications for Installations

> FOXTEL requires all system and wallplate performance testing to be carried out with a meter listed in the Installer Product List and that readings within a system comply with those in Table 3, Table 4, Table 5 and
> Note: Measured values may be +/- 2dB from the levels listed owing to accuracy of meters.

Table 6. If any wallplate performance is substandard, troubleshooting will be required to rectify the fault. To aid in future maintenance and installation problem solving, all active equipment and wallplates are to be tested and documented using the Commissioning Form found in the SOW Document.

Table 3 – Wallplate Digital Performance

Broadcast type		Bit Error Rate		Modulation Error Ratio *(In band noise ratio)*
Standard	***Modulation Type***	**Pre-Viterbi**	**Pre – RS or Post-Viterbi**	**Minimum (dB)**
DVB-C	64 QAM		<2E-7	30
DVB-C	256 QAM		<2E-7	36
DVB-S	QPSK	<2E-4	<2E-7	12.5+
DVB-T	COFDM 64 QAM	<2E-4	<2E-7	24
Analogue	RF Integrated Channels Terrestrial OB	–	–	SNR >43 dB

Note: + Clear sky weather conditions level.

Table 4 – Wallplate Signal Level

Broadcast Type		Wallplate Level (dBµV)			
		Commercial Single Dwelling Residence (SDR) ONLY		**Multi-Dwelling Unit, Multi-Residential Estate and Large Commercial Systems >20 RF Channels**	
Standard	***Modulation type***	**Min**	**Max**	**Min**	**Max**
Analogue	FM radio	45	80	54	71
Analogue	RF Integrated Channels Terrestrial OB	60	86	60	77
DVB-C	64 QAM	N/A	N/A	56	70
DVB-S	QPSK	58	79	58	76
DVB-T	COFDM 64 QAM	40	75	54	77
T-DAB	COFDM QPSK	50	80	45	67

Note: All digital levels are RMS voltage or Digital Channel Power. Digital Channel Power measured values may be +/- 2 dB from the levels listed due to accuracy of meters.

Table 5 – Wallplate Digital Slope / Tilt Performance

Broadcast Type		Wallplate Level Slope Tilt (dB)	
Standard	***Modulation Type***	**Maximum level difference at single wallplate**	**Maximum level difference ALL wallplates in system**
Analogue	RF Integrated Channels Terrestrial OB	6	12
DVB-C	64 QAM	6	12
DVB-C	256 QAM	6	12
DVB-S	QPSK	12	18
DVB-T	COFDM 64 QAM	6	12

Note: Measured values may be +/- 2dB from the levels listed owing to accuracy of meters.

Table 6 – Post Installation Certification Test Locations

Broadcast Type		Test Locations	
Standard	***Modulation type***	***Amplifiers***	***Multiswitches and wallplates***
Analogue	RF Integrated Channels Terrestrial OB	All channels	Low and High channels (all RF integrated Channels)
DVB-C	64 QAM	All carriers	7 carriers
DVB-S	QPSK	7 Transponders	7 transponders
DVB-T	COFDM 64 QAM	All channels	Highest and lowest channels

6.4.6. Placement of Equipment / Devices

All active equipment must be located in common accessible areas, for example, in communications equipment room/communication riser or cupboard.

All end of line equipment must be installed in a position which will allow a ‘standard connection’ to the wallplate. (See definition below.)

Placement of end of line devices

When the multiswitch is installed within a LU, the end of line devices are to be placed in a dry accessible location for future servicing. Typically this can be in a hub area within the kitchen.

External cables may be installed and enclosed within ducting/conduit as a last resort.

For buildings which have flat tin or concrete roofs with no common roof areas, a weather resistant housing (aluminium colourbond or UV stable plastic) may be installed under the eaves or in a common area to house the multiswitch and provide mechanical protection as well as an aesthetically pleasing finish.

A 'standard connection' may be defined as:

- One where the lateral cables from the multiswitch to the wallplate are less than 40 metres
- A connection utilising existing cavities/ communications equipment room/ communication riser or cupboard /roof space and preferably not externally run using ducting/conduit.

  Where exposed interior cabling will be present, up to 2 lengths of ducting may be used to complete the installation.
- One which excludes the creation and repair of plaster wall/ceiling access holes within the unit.

6.4.7. Cable Pathways

For new developments using conduit from the communications riser to the wallplate, a 25mm diameter conduit is to be used. When more than two wallplates are located in a unit, it is recommended that a minimum of four cables be run from the riser to a communication cupboard in the unit from which all cables from each wallplate are connected.

6.5. Post Installation

At the completion of installation, an approved 'as built' SOW document should be forwarded to FOXTEL to enable the building to be activated for the FOXTEL service.

> Note: The National Service Provider submits an electronic copy of the 'as built' Scope of Work document to FOXTEL.

6.5.1. Installation 'As Built' Drawings

The installation company is to clearly mark the original FOXTEL design to accurately show all the equipment that has been installed in the system. Where the design has been modified, the modified design is re-submitted to Designer for the completion of an electronic 'as built' design.

6.5.2. Installation Photographs

Photographs may be provided as appropriate for:

- Dish location – showing skyline and weather conditions
- Dish; LNB; Mount – close up photo

- Headend site
- Multiswitch location(s) showing communications riser and earthing.

6.5.3. Installation Certification Testing

Post installation testing involves completion of a commissioning sheet with Digital Channel Power, Modulation Error Ratio and Bit Error Rate levels by the installation company and all tests must comply with the wallplate specifications for installations tables. Testing by data logging an installation is also acceptable.

6.5.3.1. LNB Tests

LNBs must be tested by the installation company for Digital Channel Power, Modulation Error Ratio and Bit Error Rate for the following Transponders (as a minimum).

C1	D3
T14, T20	T10, T12, T14, T19, T24

6.5.3.2. Amplifier Tests

All amplifiers must be tested by the installation company for Digital Channel Power, Modulation Error Ratio and Bit Error Rate for Transponders as per Section 6.5.3.1 (as a minimum). This will ensure all satellite transponders are being received to specification.

6.5.3.3. Multiswitch and Wallplate Tests

All multiswitches and wallplates must be tested for Digital Channel Power, Modulation Error Ratio and Bit Error Rate for Transponders as per Section 6.5.3.1 (as a minimum). This will give a good indication of the reception performance of all satellite transponders.

> Note: If access to all wallplates in the MDU is not possible, testing should be undertaken at each multiswitch and at the nearest and farthest end of line wallplate.

7. Sample Designs

This section presents the basic design requirements for a FOXTEL installation. It contains an overview of the essential elements of an installation and contains samples of typical designs for different types and sizes of FOXTEL installations. For specific installation requirements, FOXTEL recommends always using a FOXTEL Industry Designer to create the design for each individual installation.

7.1. Design Essentials

All Third Parties involved in FOXTEL satellite installations need to be aware of a number of design essentials for both SMDU and MDU installations.

7.1.1. Small MDUs

- All wallplates installed during an installation are to be twin (not single) wallplates
- A phone outlet should be installed next to each twin wallplate
- Two cables are to be run from each twin wallplate to a multiswitch
- All LNB outputs are to be connected to the first device (multiswitch).

7.1.2. MDUs

- All wallplates installed during an installation are to be twin (not single) wallplates
- A phone outlet should be installed next to each twin wallplate
- Two cables are to be run from each twin wallplate to a multiswitch
- A four cable backbone is to be installed for stand-alone FOXTEL installations
- A five cable backbone is to be used where FOXTEL is integrated with terrestrial signals (free-to-air)
- An amplifier is generally required every 4-8 floors
- All LNB outputs are to be connected to the amplifier.

7.2. Typical Designs

The following typical sample designs cover small to large installations and are categorised into the following:

- Small Multi Dwelling Unit
- Large Multi-Dwelling Unit
- Multi-Residential Estate
- Commercial - Single Dwelling Residence, hotel (RF integration) and business high rise buildings

7.2.1. Small Multi-Dwelling Unit Designs

7.2.1.1. 4 Units, 4 Twin Wallplates

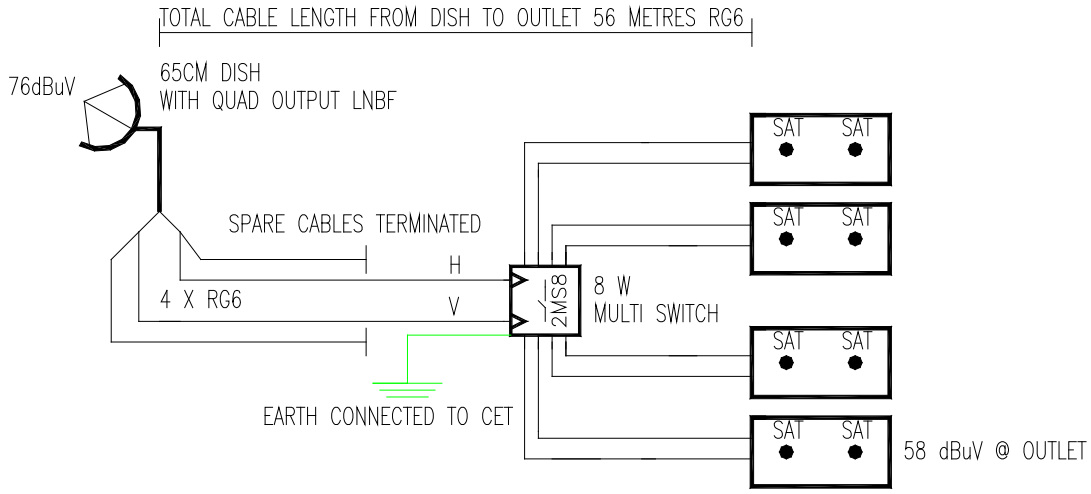

Figure 5 – MS1–4–1 (4 Personal Digital Recorder)

> Note: Total allowable cable length may change dependant on the LNB / multiswitch gain and location of installation.

7.2.1.2. 6 Units, 6 Twin Wallplates

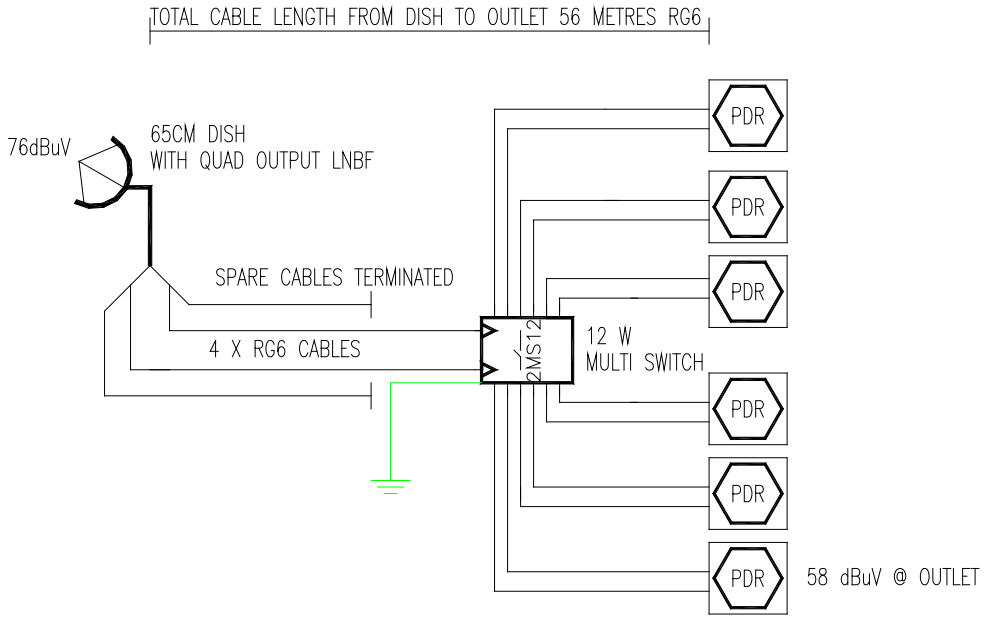

Figure 6 – MS1–12–1

Note: Total allowable cable length may change dependant on the LNB / multiswitch gain and location of installation.

7.2.1.3. 8 Units, 8 Twin Wallplates

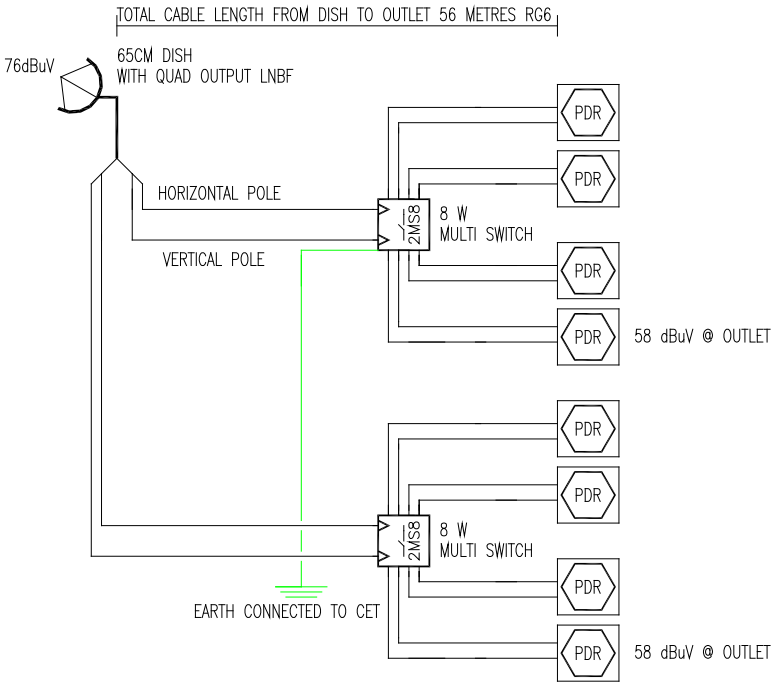

Figure 7 – 8 Units, 8 Twin Wallplates

7.2.1.4. 8 Units, 8 Twin Wallplates with Active Multiswitch

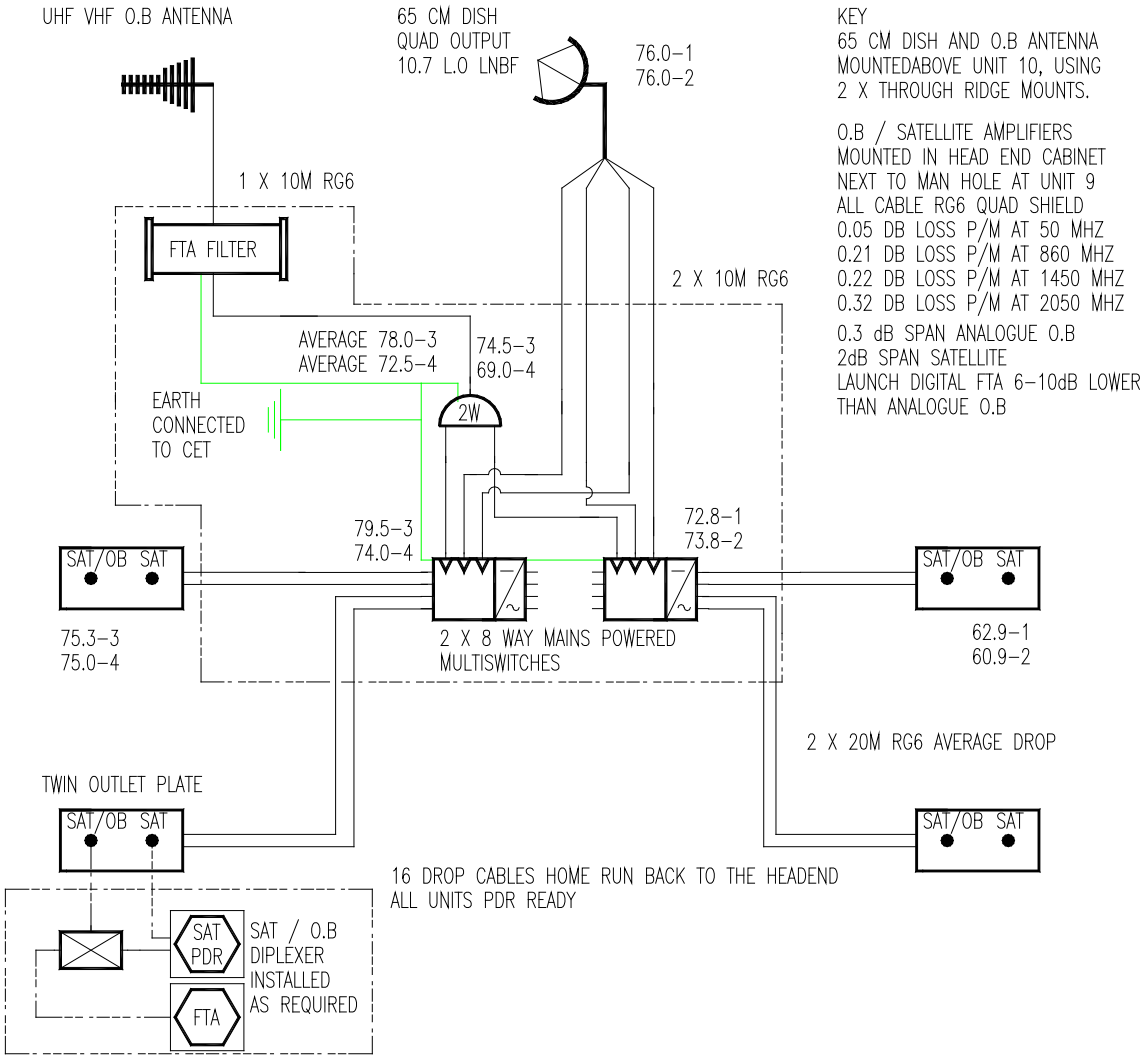

Figure 8 – MS06–1

7.2.2. Multi-Dwelling Unit Designs

7.2.2.1. 20 Townhouse Villa Buildings (Satellite Only)

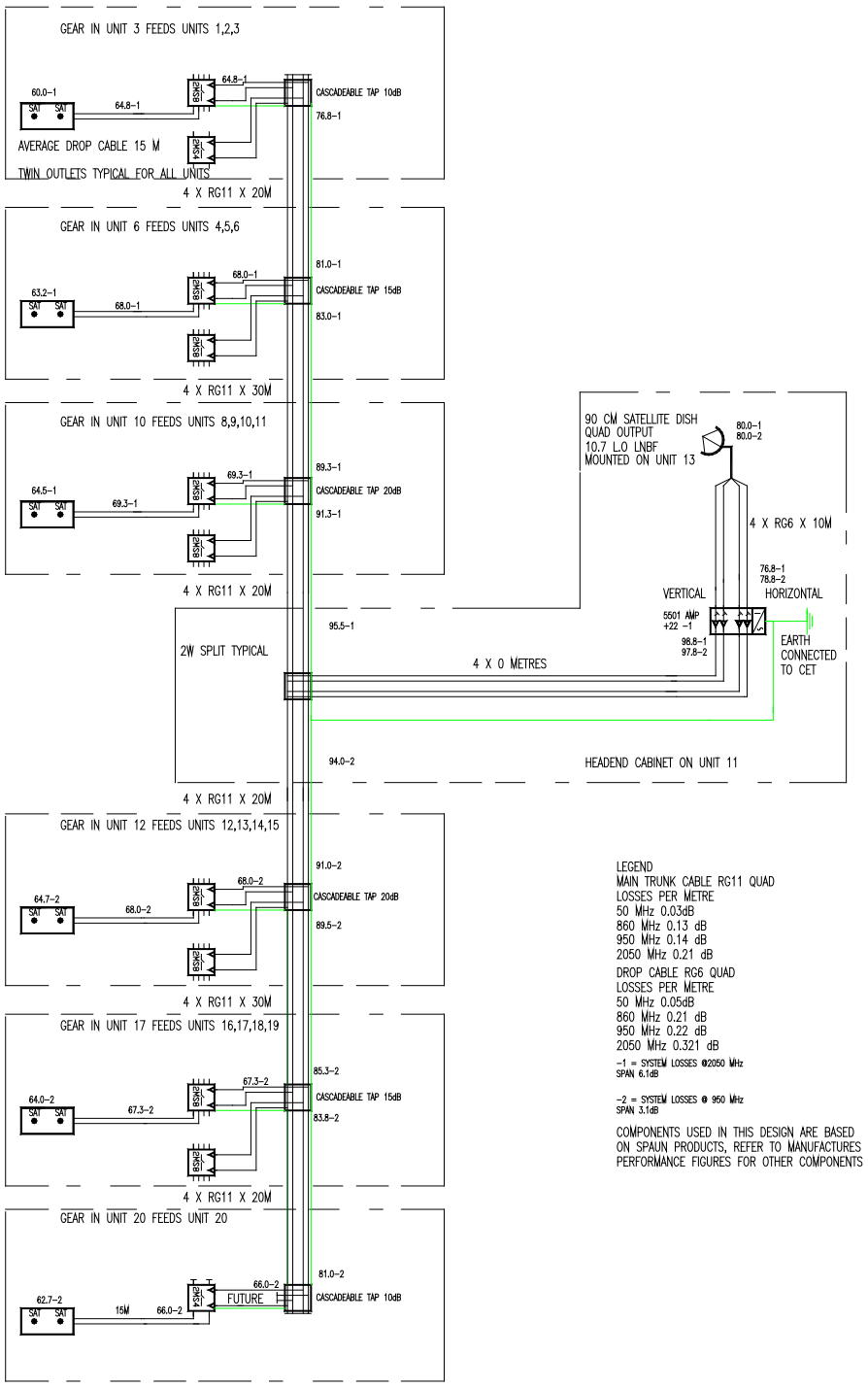

Figure 9 – MS02–1

7.2.2.2. Townhouse Villa Buildings (Satellite and OB)

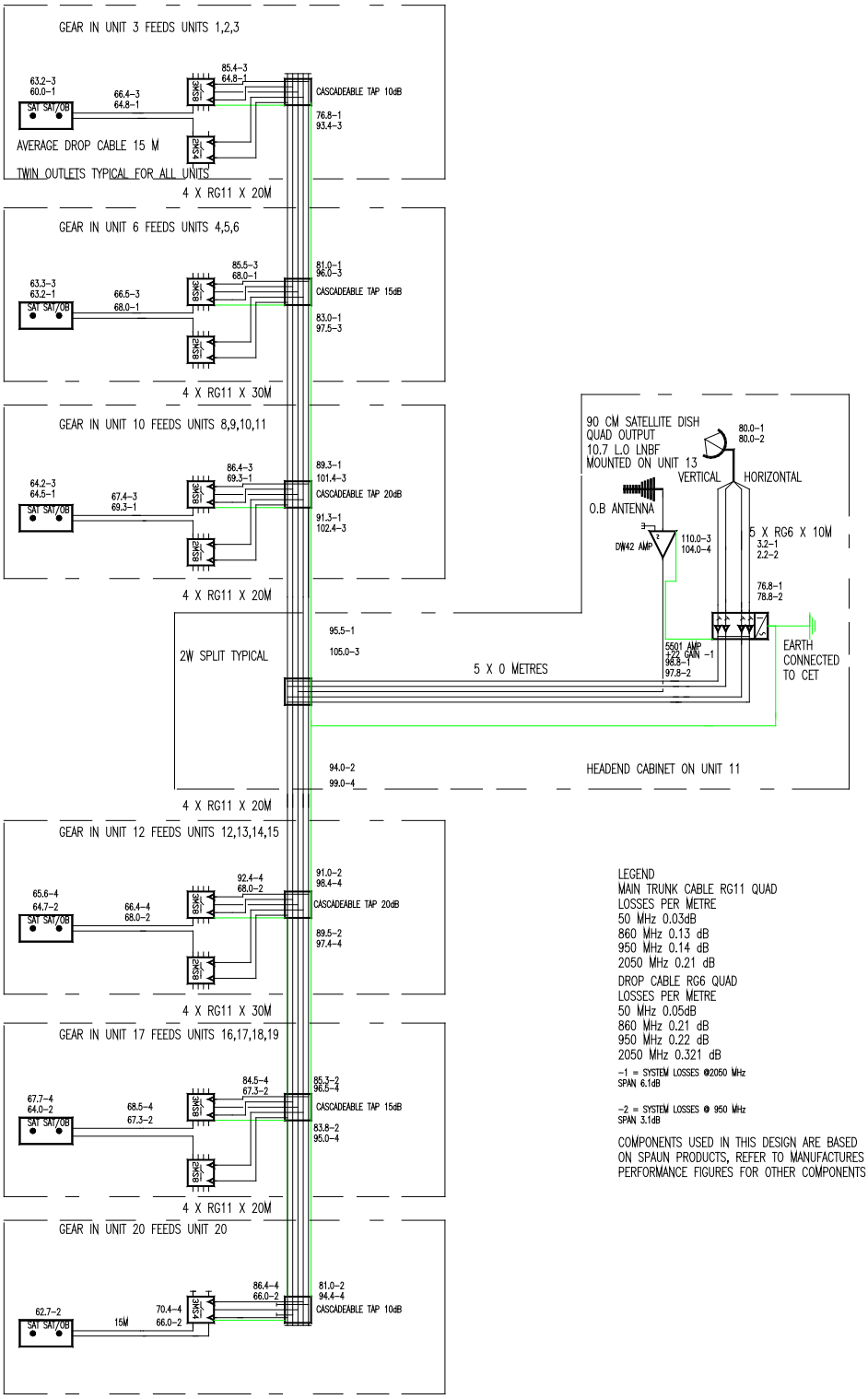

Figure 10 – MS01–1

7.2.2.3. 4 Storey Building, 48 Twin Wallplates (Satellite Only)

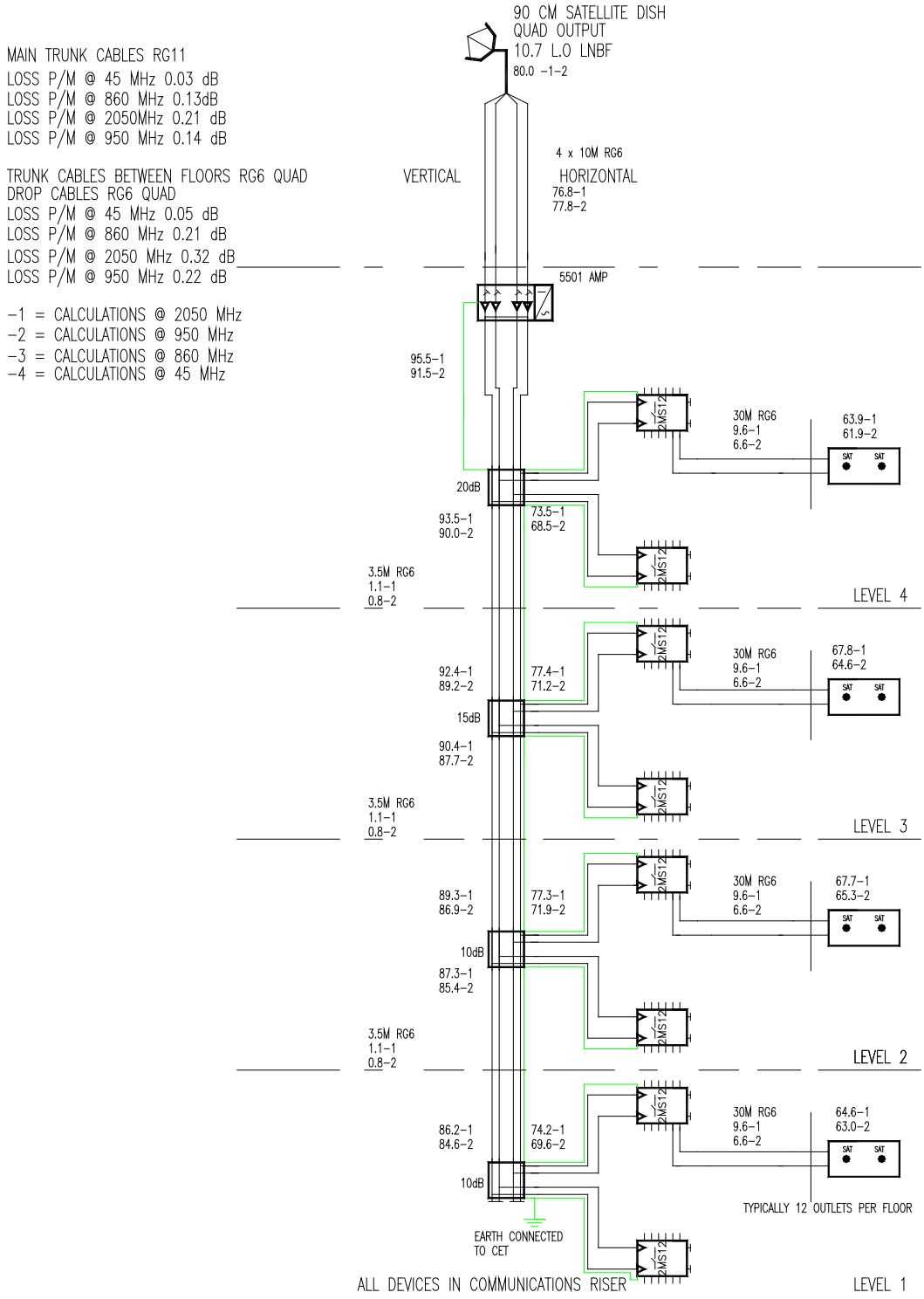

Figure 11 – MS20–3A

7.2.2.4. 4 Storey Building, 48 Twin Wallplates (Integrated Satellite and OB)

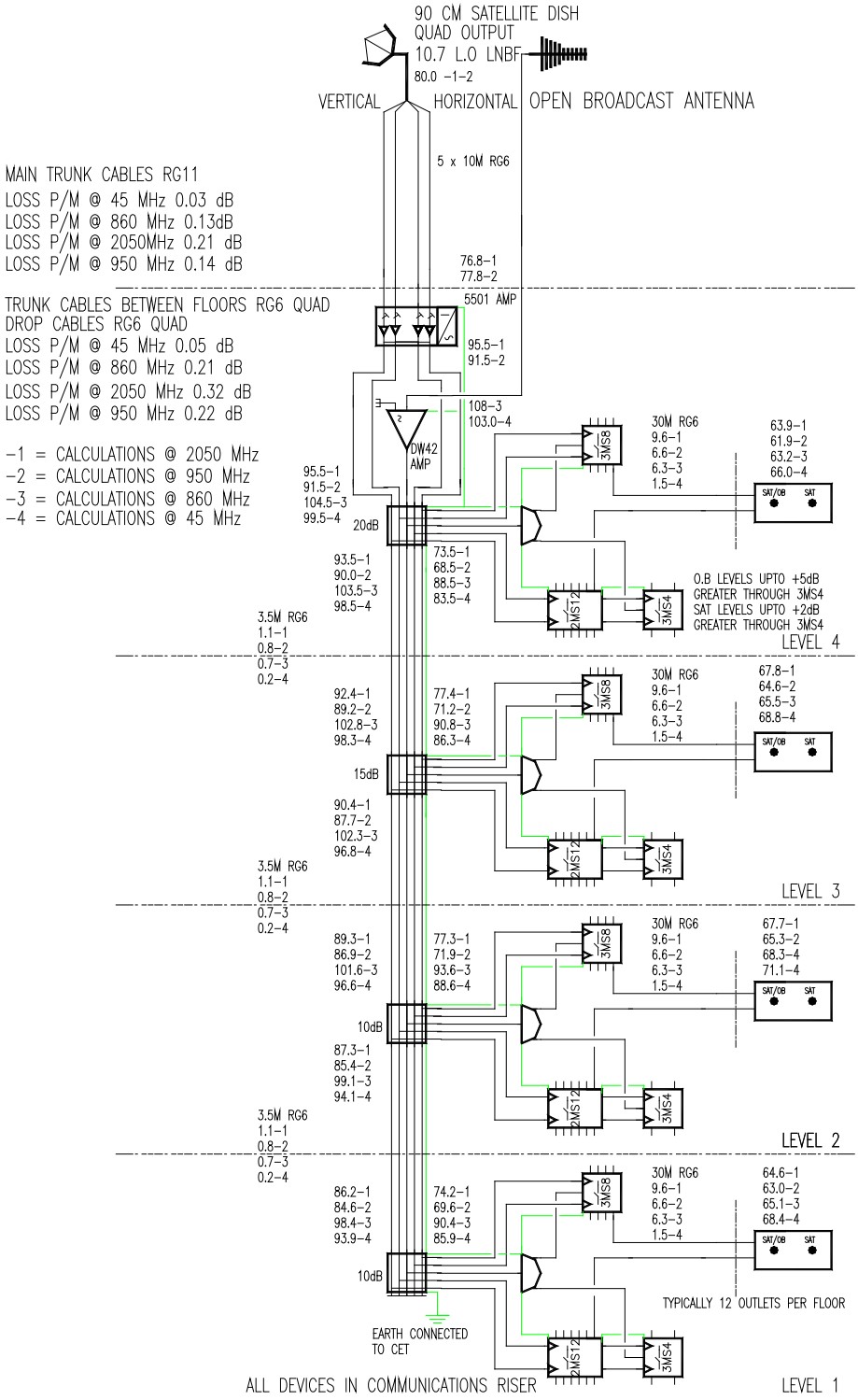

Figure 12 – MS20–4A

7.2.2.5. Optional: 4 Storey Building, 24 Twin Wallplates Integrated Satellite and OB to End of Line 5 Wire Multiswitch

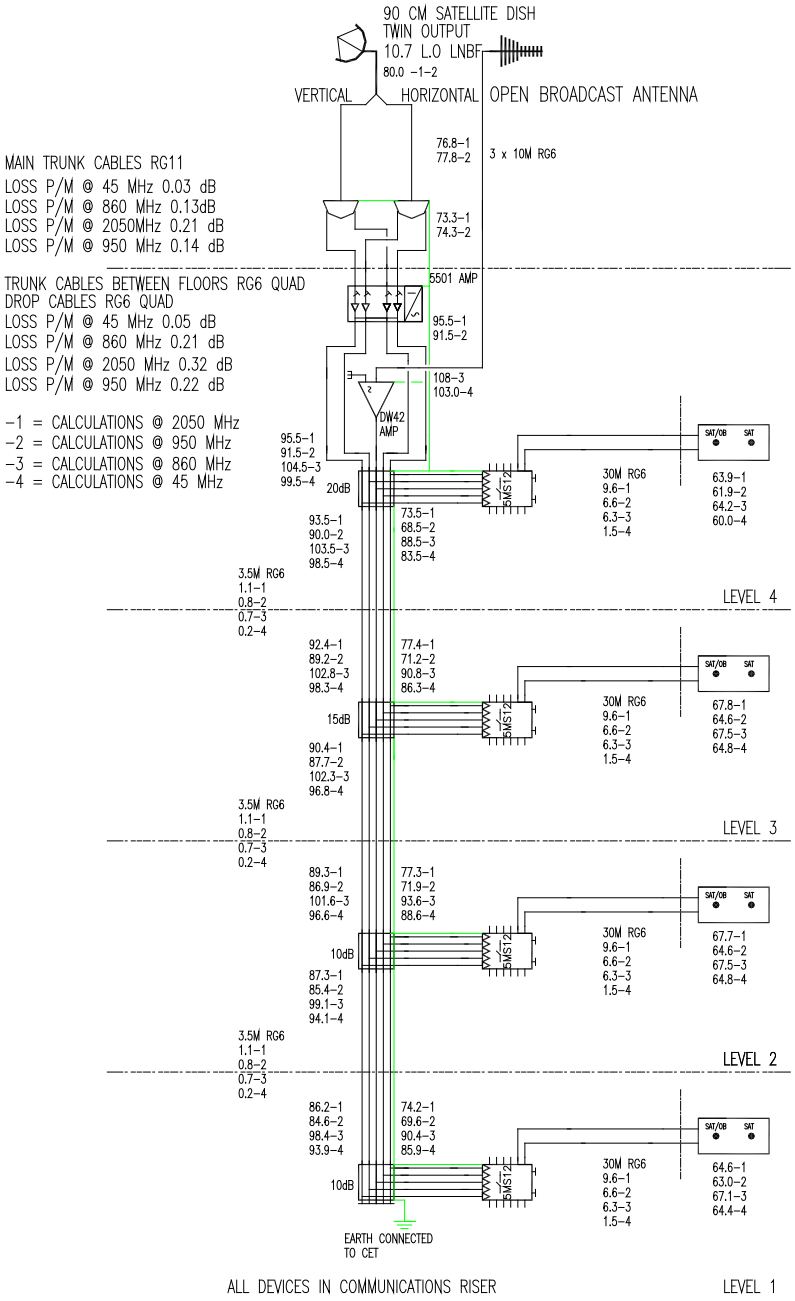

Figure 13 – 4 Storey, 24 Twin Wallplates Integrated Satellite and OB to End of Line 5 wire Multiswitch

> Note: As an option, you can install a 5 wire backbone and 5 wire multiswitch. This will allow the reticulation of a satellite in another orbital slot by switching on the 22KHz tone in the STU.

7.2.2.6. 8 Storey Building, 96 Twin Wallplates (Satellite only)

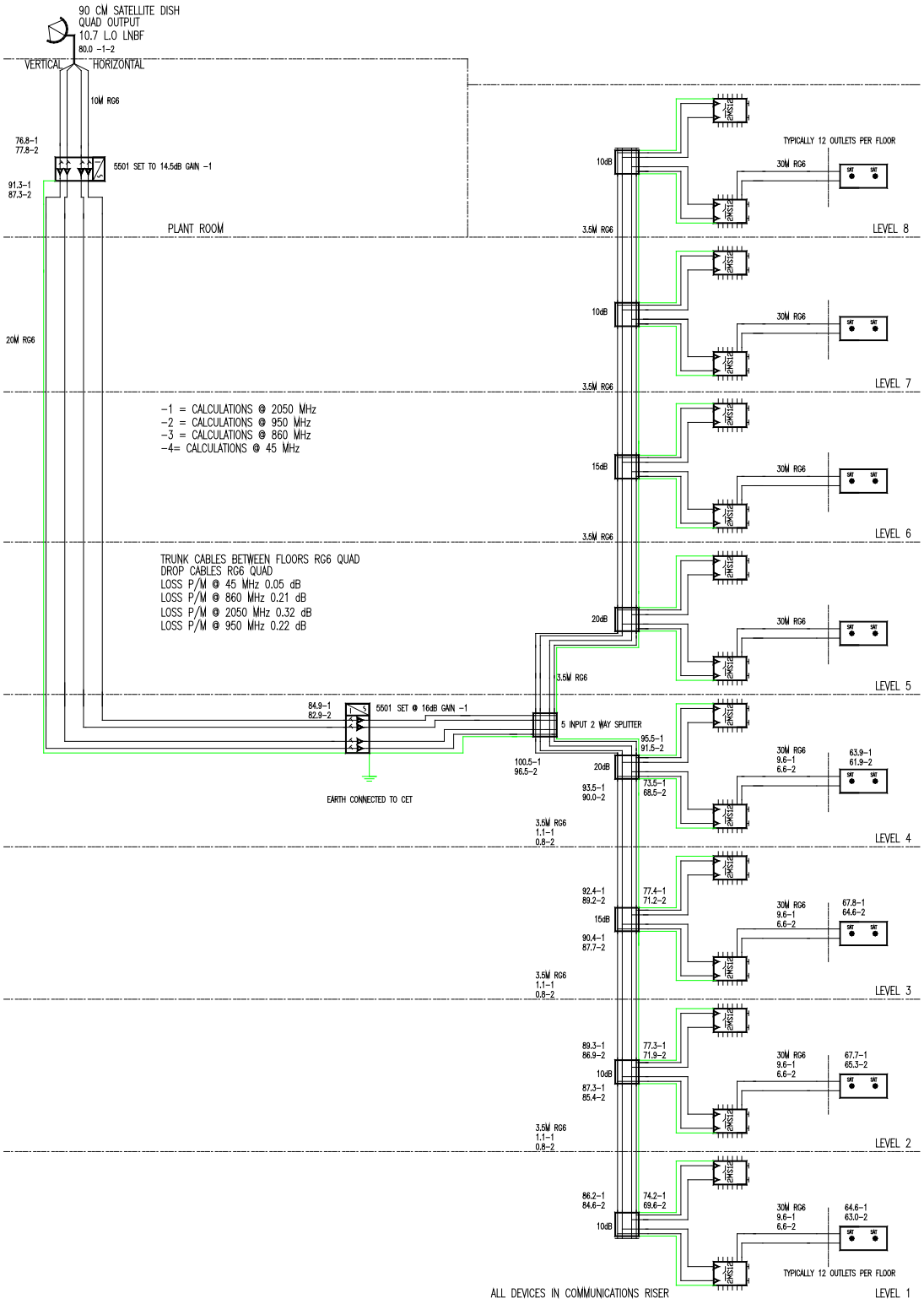

Figure 14 – MS08–2A

7.2.2.7. 8 Storey Building, Feeding 96 Twin Wallplates (Integrated Satellite and OB

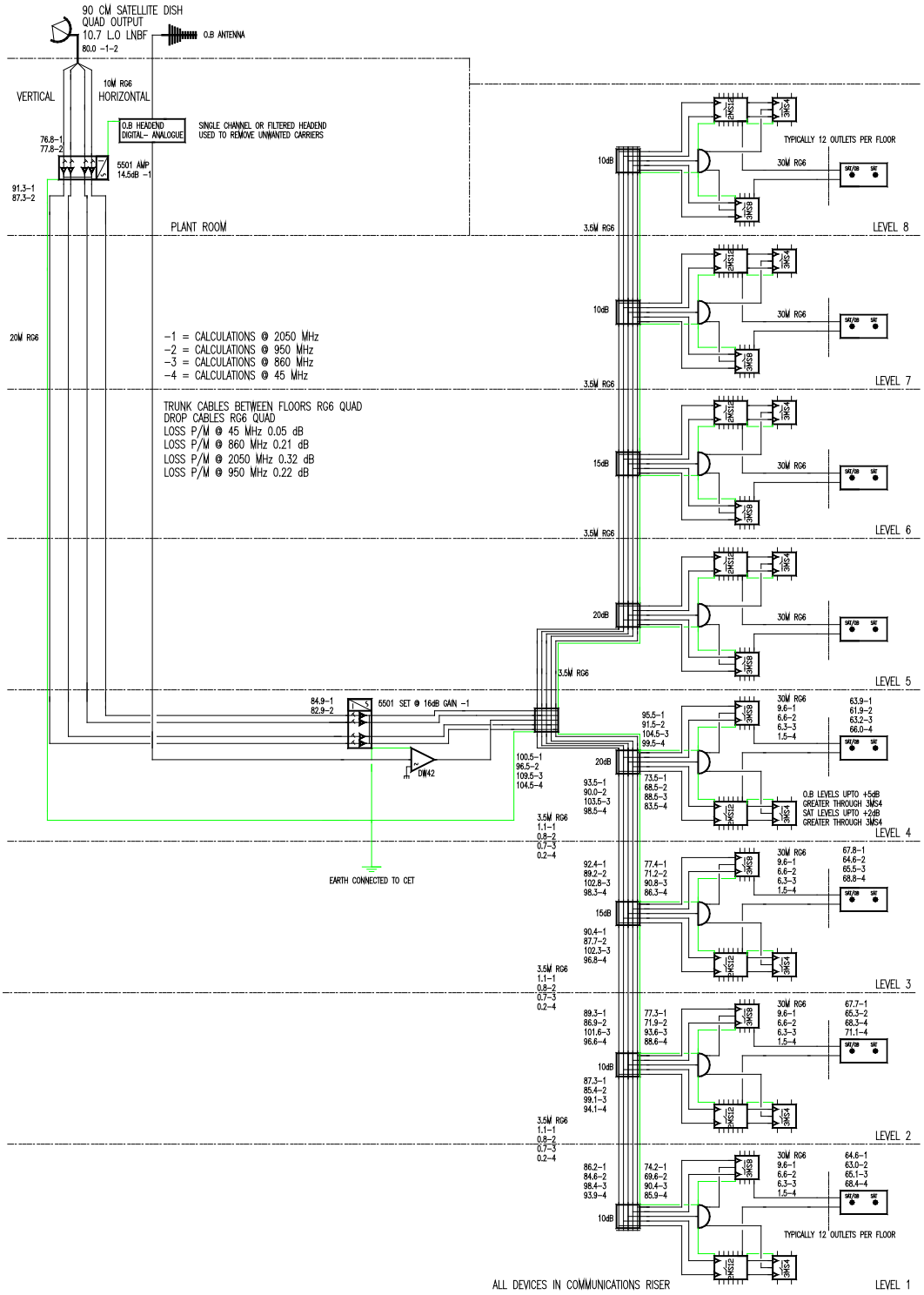

Figure 15 – MS08–1A

7.2.2.8. 24 Storey Building 288 Twin Wallplates (Satellite Only)

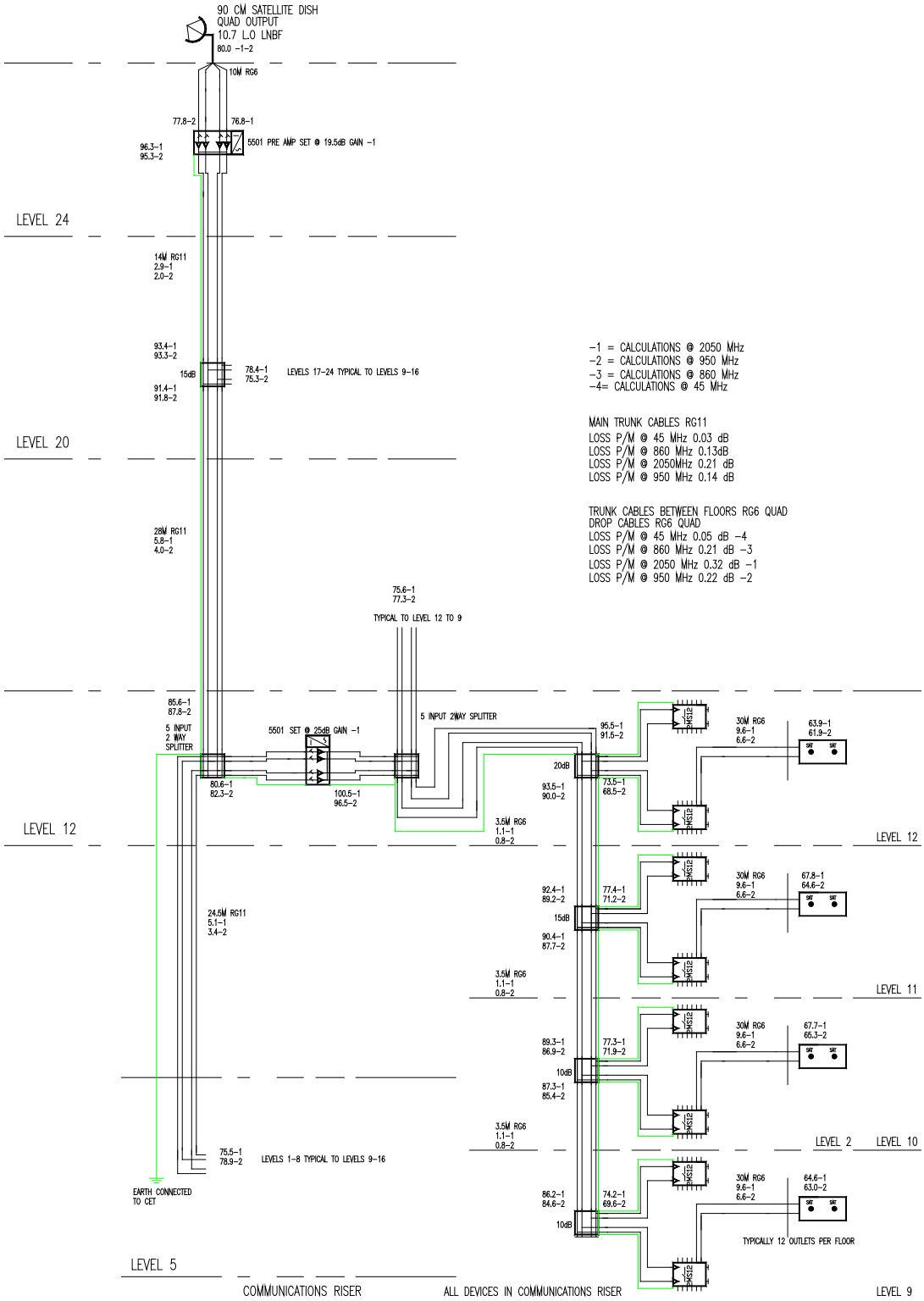

Figure 16 – MS20–2A

7.2.2.9. 24 Storey Building, 288 Twin Wallplates (Integrated Satellite and OB)

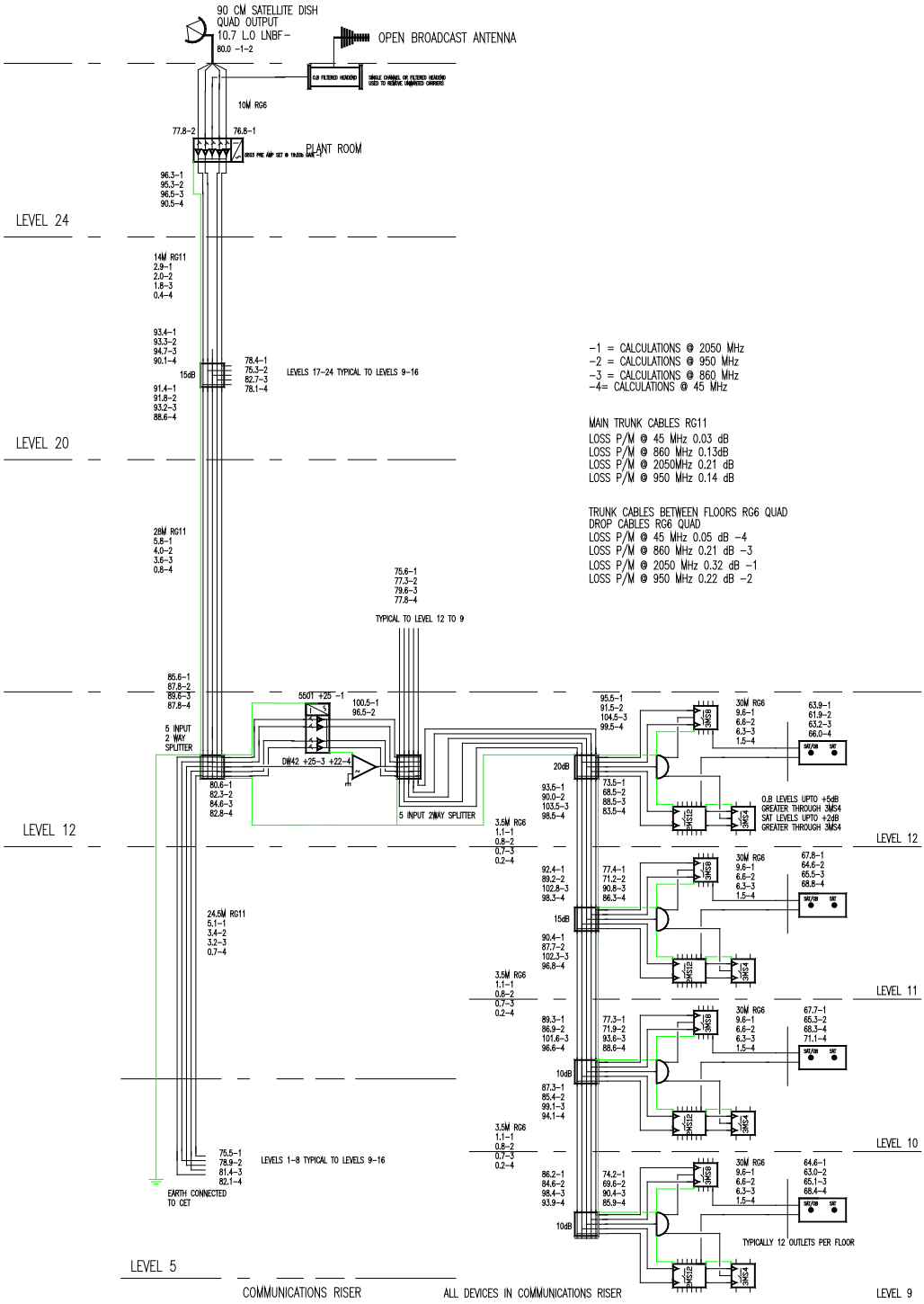

Figure 17 – MS20–1AA

7.2.3. Commercial Designs

7.2.3.1. Single Dwelling Residence – Single Wallplate

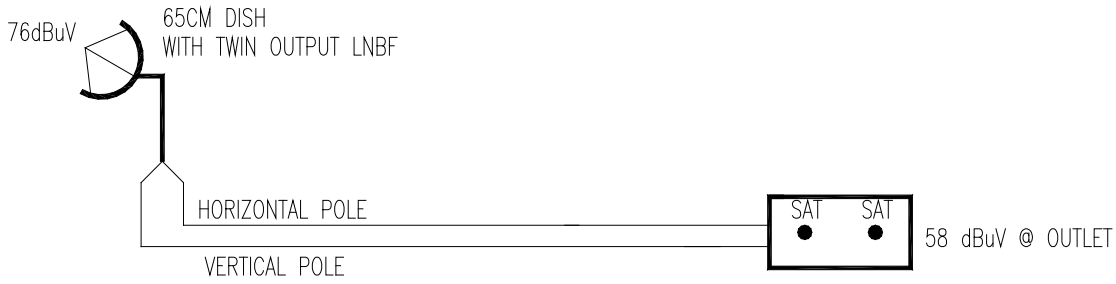

Figure 18 – MS1–4–1 (1 Personal Digital Recorder)

Note: Total allowable cable length may change dependant on the LNB gain and location of installation.

7.2.3.2. Single Dwelling Residence – Single 2 x Wallplates

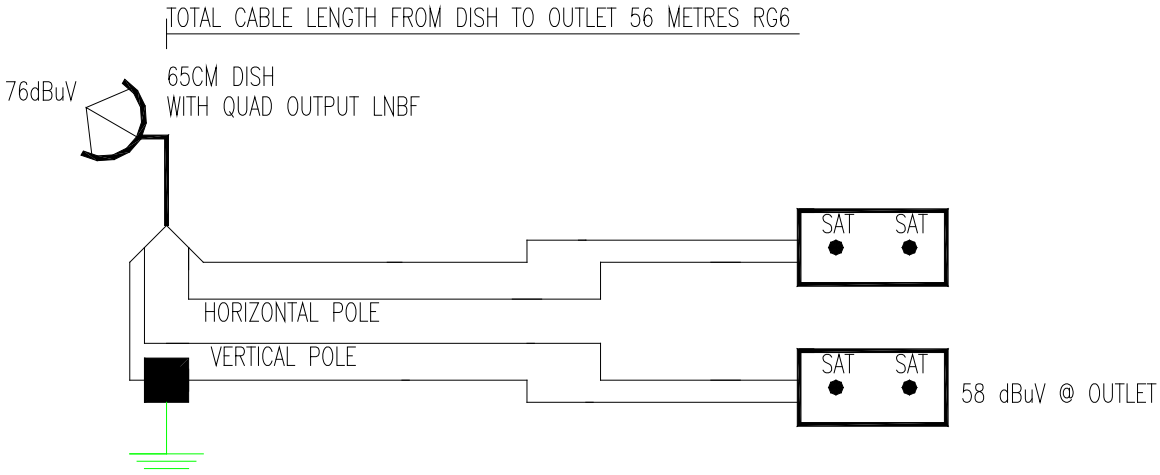

Figure 19 – MS1–4–1 (2 Personal Digital Recorder)

Note: Total allowable cable length may change dependant on the LNB and location of installation.
Earth connected to CET via 2GHz grounding block.

7.2.3.3. 9 Storey High Rise Building (one off install)

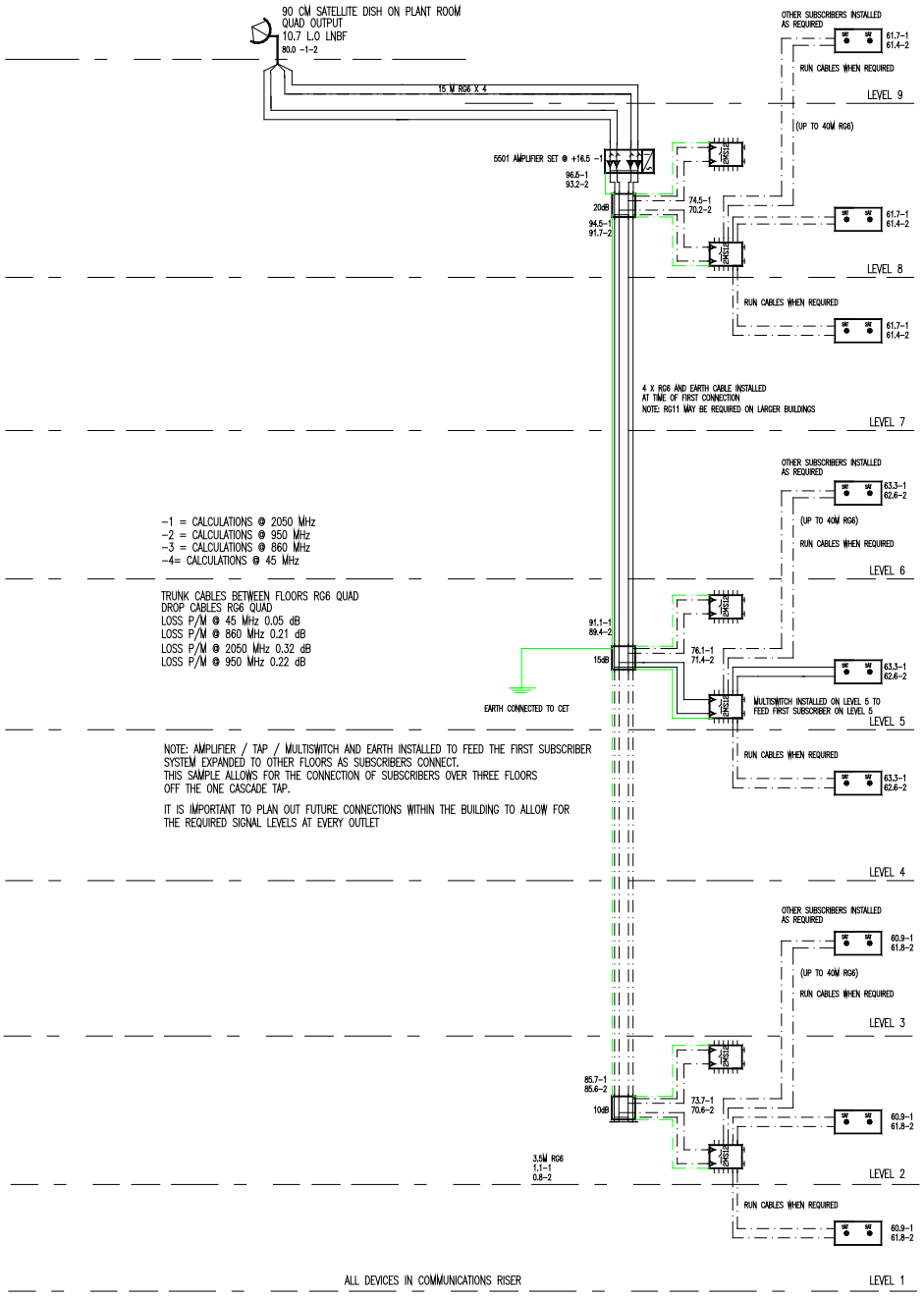

Figure 20 – MS08-3A

Note: Amplifier / tap / multiswitch and earth installed to feed the first subscriber. System expanded to other floors as subscribers connect.
This system allows for the connection of subscribers over three floors from the one cascade tap.

> It is important to plan out future connections within the building to allow for the required signal levels at every outlet.

7.2.3.4. Hotel RF Integration

This section describes the minimum requirement for the integration of FOXTEL in a commercial premise via the output of the Set Top Unit. Single channel amplifiers are recommended on the existing Open Broadcast (OB) headend and FOXTEL headend to minimise the chance of interference from unwanted carriers.

To reduce the chance of ingress, existing cables must be at least RG59 dual shield. If new cables are required we recommend that RG11 quad shield is used for trunk cables, and RG6 quad shield for drop cables.

7.2.3.4.1. Satellite Feeds to STU

Installation of satellite feeds to the STU shall be as per Section 6 for small or large MDUs. The STU outputs are then to be modulated onto different frequencies for distribution through the MATV system (see Figure 22, Figure 23 and Figure 24).

7.2.3.4.2. MATV RF Integration

Typically, MATV systems are only designed to distribute approximately 10 OB channels. The following items must be checked at time of site survey and documented in the Scope of Work:

- Television tuner performance
- Amplifiers (type and output levels)
- Number of channels to be integrated and bandwidth requirements.

7.2.3.4.3. Television Tuner Performance

Inspect television type(s) and document manufacturer and model in Scope of Work.

Test tuners capability by using a modulator. Proposed integration frequencies may not operate correctly on hotels televisions. Check to see if mono or stereo modulators are required.

7.2.3.4.4. Amplifier Performance

Document amplifier type as well as input and output of existing amplifiers in MATV system in the Scope of Work documentation.

> The Industry Designer is to use the information from the Scope of Work to calculate whether existing amplifiers and television tuners will operate to FOXTEL wallplate performance specifications as detailed in Table 3, Table 4, Table 5 or Note: Measured values may be +/- 2dB from the levels listed owing to accuracy of meters.

Table 6 with the proposed additional frequencies to be integrated into the MATV system.

7.2.3.4.5. Bandwidth, Additional Channel Loading

During site visit, if proposed frequencies are higher than those currently distributed in the MATV system, a modulator (STU RF output) needs to be temporarily integrated, and signal level performance needs to be tested at each end of line wallplate locations at the extremities of the distribution network.

Document the room number and level for all channels in the Scope of Work documentation.

Figure 21 shows the sticker which is placed on all STUs in commercial installations to facilitate troubleshooting over the phone by the FOXTEL Technical Support Team. The sticker shows which channel the STU is tuned to, and the output of the STU.

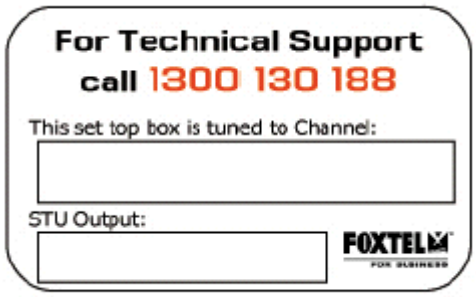

Figure 21 – Technical Support Sticker

7.2.3.4.6. RF Integration

The preferred method of RF integration is the use of modulators.

Modulators for RF integration include:

- VSB modulators (mono)
- VSB modulators (stereo)

7.2.3.4.7. Channel Allocation

If the use of UHF frequencies are required, Table 7 should be used as a guide for selecting the correct frequencies,

> Note: Preference should be given to the channels shown in Table 7, with the condition that a one channel gap is left between selected channels and existing services.

The use of frequencies allocated for future Digital services should not be used for the distribution of FOXTEL services.

Table 7 shows the output channels in order of preference that should be used in the relevant areas to minimise the chance of poor pictures when connecting via a filter. These channels can also be used when channel filters are used

> **Important Note:** **It is highly recommended that VSB modulators be used for commercial integrations to minimise the chance of ingress from unwanted carriers. However, where output frequencies are not interfered with by an Open Broadcast analogue or digital carrier, and where FOXTEL will be the only in-room entertainment TV system, DSB modulation (or filtered output in regional WA) may be quoted and used upon customer understanding of the above limitations.**

Table 7 – STU Output Channel Recommendations Chart

	Option 1	Option 2	Option 3
Brisbane (refer to Note 1)			
	63	66	57
	33		
Gold Coast (refer to Note 1)			
	63	66	57
	34 North of Currumbin	60 Currumbin area	35 Currumbin area
Newcastle (refer to Note 2)			
	27	28	
	31		
NSW Central Coast (refer to Note 3)			
	27		
	31		
Sydney (refer to Note 1)			
	41	40	43
	32	40	41
Victoria			
Geelong and Western Port Philip Bay (refer to Note 1)			
	50	47	44
	44	47	50
Mornington Peninsula, south-east, north-east and north-west suburbs, (excluding Dandenong region, as they are co-channel with Fern Tree Gully and may not work). (Refer to Note 1)			
	62	65	68
	68	65	62
Adelaide (refer to Note 1)			
	62	65	
	32	29	
Western Australia			
Perth (refer to notes 1 and 4)			
	55	58	
	30	33	39
Viewers of analogue services from Roleystone and Mandurah (refer to Notes 1 and 4)			
	68	69	

Notes:

1. If interference is still present then a **Band I to IV LPF** and standard channels (that is, **36 and 38**) should be used for viewers watching main station services (2, 7, 9, 10, 28, 31). For viewers watching translator

services a band stop filter for channels 36, 37, 38 should be used and standard channels (**36 and 38**) installed.

2. For viewers in the north and south watching translator services, if interference is still present then a **band gap filter** for channels **36, 37, 38** should be used and standard channels (**36 and 38**) installed.

3. If 27 and/or 31 are unsuccessful then the use of a **band gap filter** is required on the Central Coast.

4. **Channels 30, 33 or 39**. The DSB output of the STU on **30** may cause interference to viewers of Wagin in the South and may suffer interference from Morawa in the north. In the latter case **33 or 39** can be used, however these may suffer co-channel interference from analogue Bunbury services

7.2.3.4.8. FOXTEL Integration in Bar Areas

When FOXTEL is integrated into an MATV system that feeds FOXSPORTS 1 and 2, plus other channels into a Bar area and Hotel it is a condition of FOXTEL that FOXSPORTS 1 and 2 are not visible in the Bar area. To ensure these channels are not visible the installation of 2 filters in-line should be installed in the drop cable that feeds the Bar area. Figure 23 shows a typical installation.

7.2.3.4.9. Outlet Levels

To ensure that the filters work correctly the signal level at the bar area outlets must not exceed 70dBuV. If the signal is greater than 70dBuV an in line attenuator can be fitted before the filters to reduce signal power. (Refer to Figure 23.)

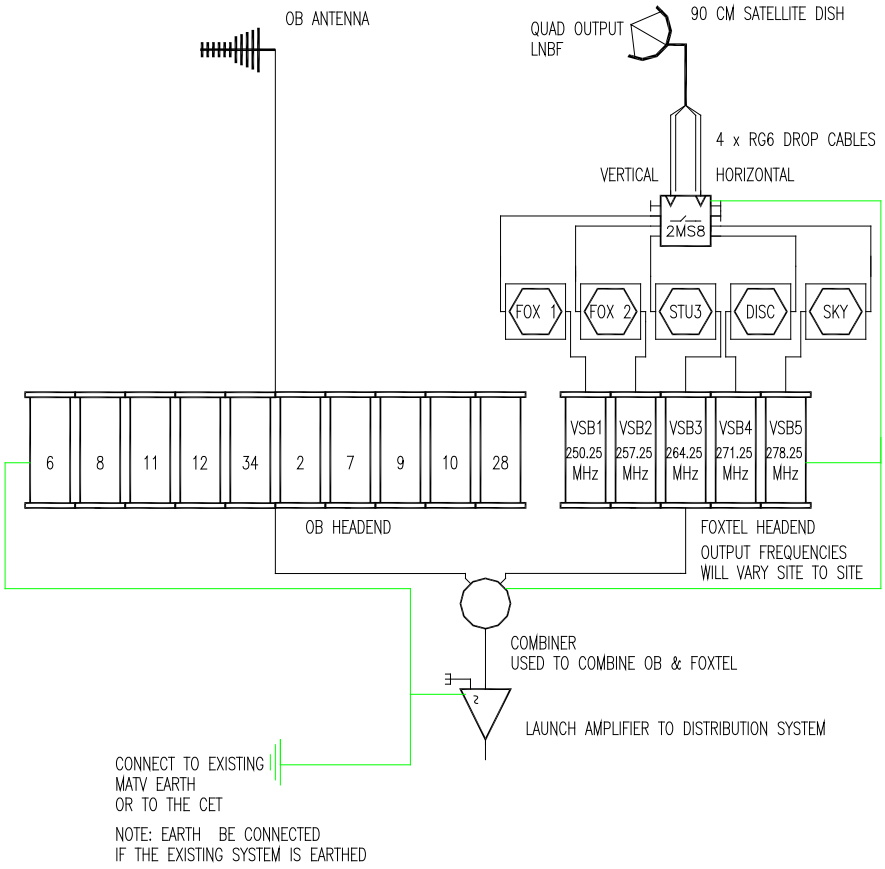

Figure 22 – MS11–1 (Example shown for Sydney)

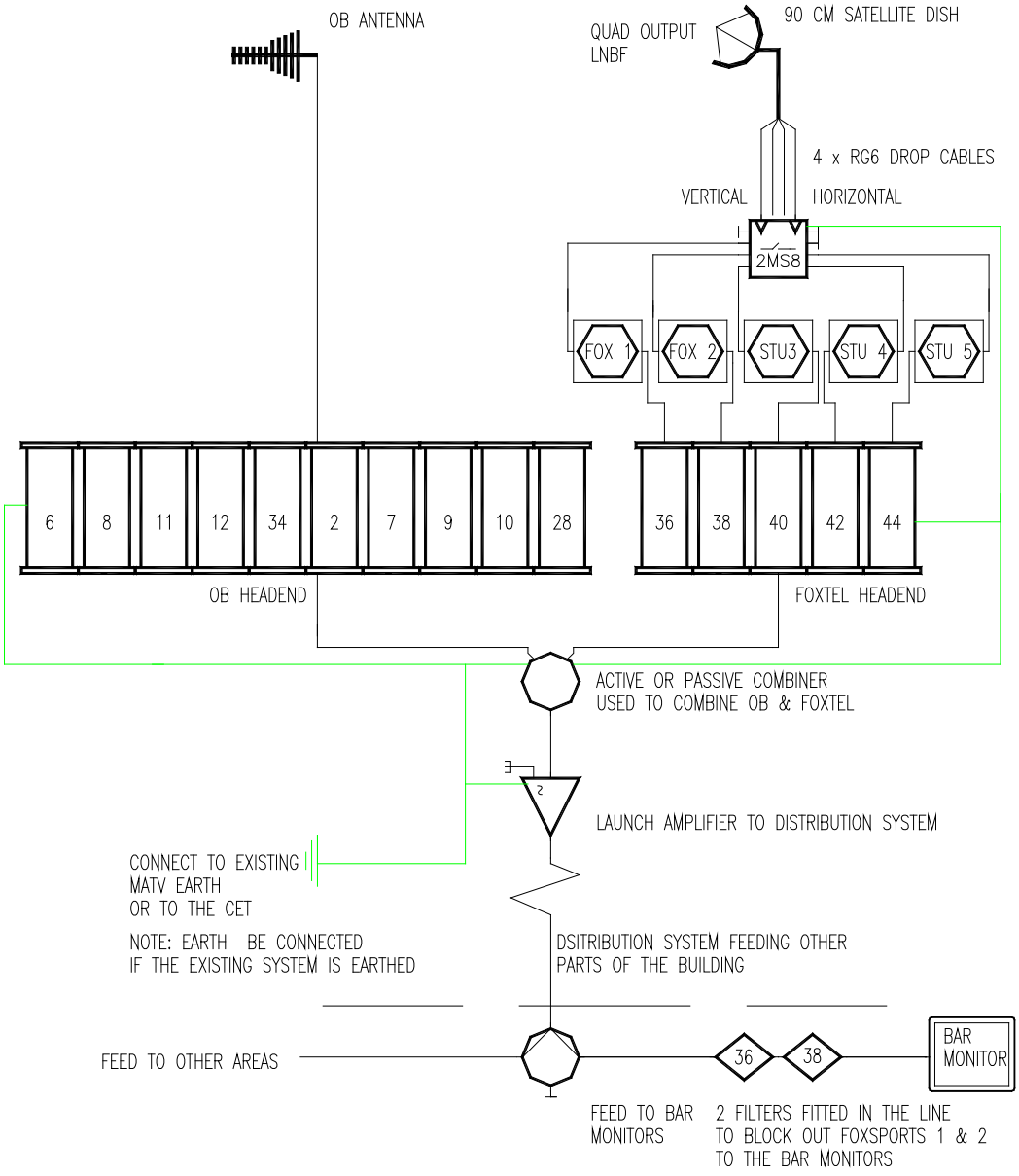

Figure 23 – Bar Installation Example Using Filters (Example shown for Sydney)

7.2.3.4.10. Hotel RF Integration VSB Modulators

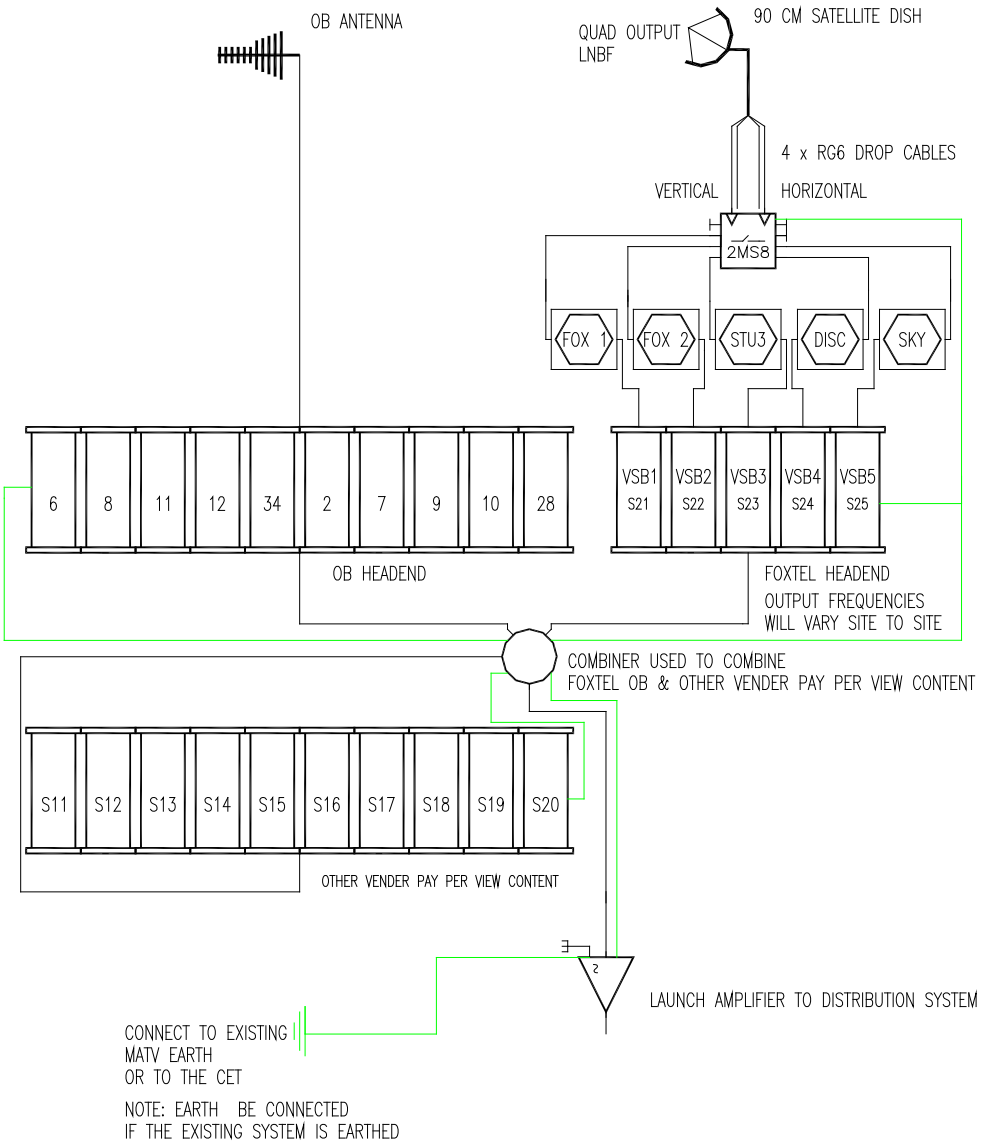

Figure 24 – MS10–1 (Example shown for Sydney)

7.2.4. Multi-Residential Estate Designs

7.2.4.1. Coaxial Trunk Cable, Small System

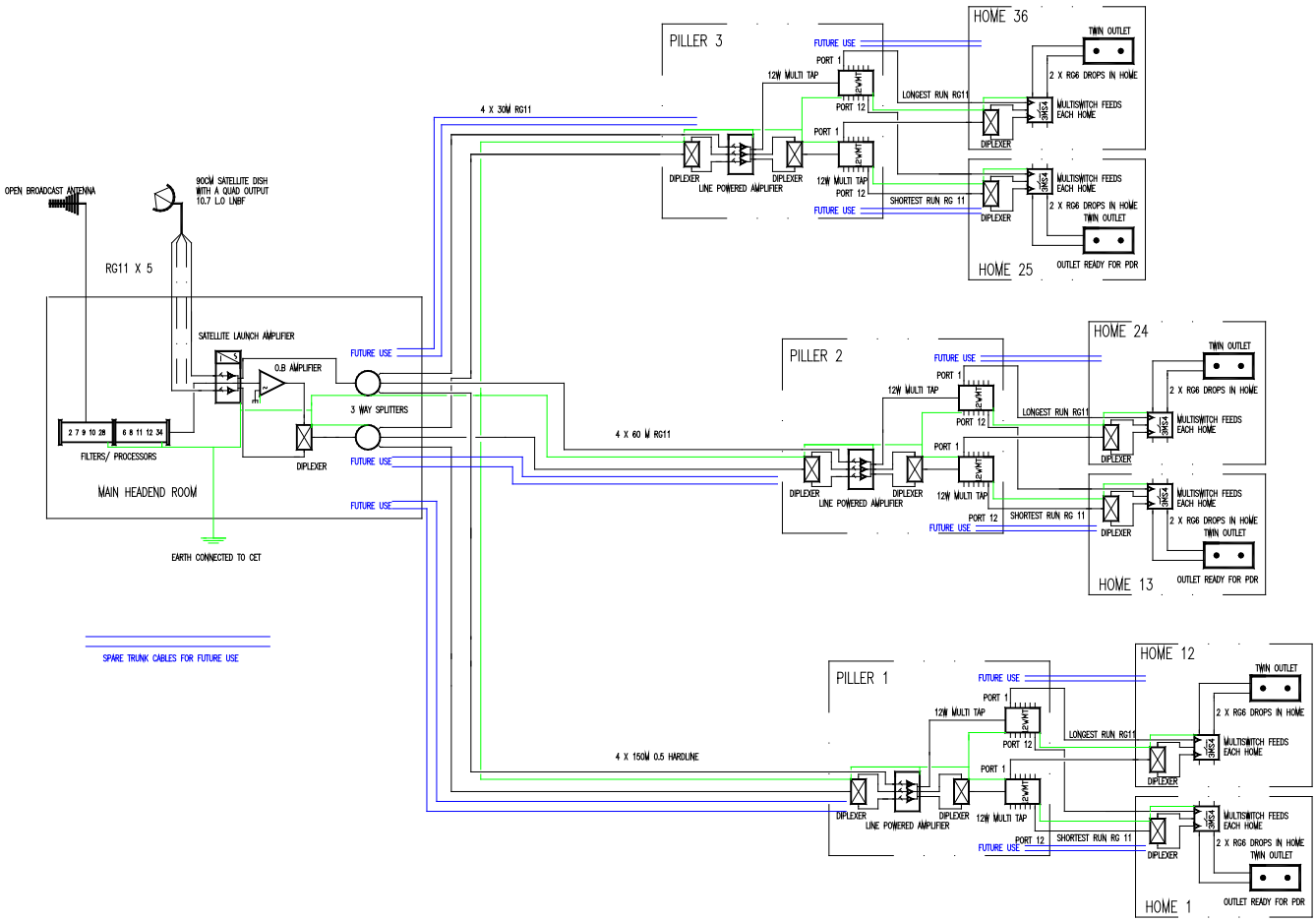

Figure 25 – MS14–1A (Townhouse design)

7.2.4.2. Quad Fibre Optic Tx, Twin Lead in, Twin Wallplates (Large System)

The objective with this type of Multi-Residential Estate installation is to use one optical transmitter to feed the OB and FOXTEL satellite polarity signal and the other to feed the second satellite polarity. Homes are fed using twin lead-in cables, connected to a multiswitch which supplies twin Home Run cables to each twin wallplate in the home. The spare fibres allow for future expansion of the system when required.

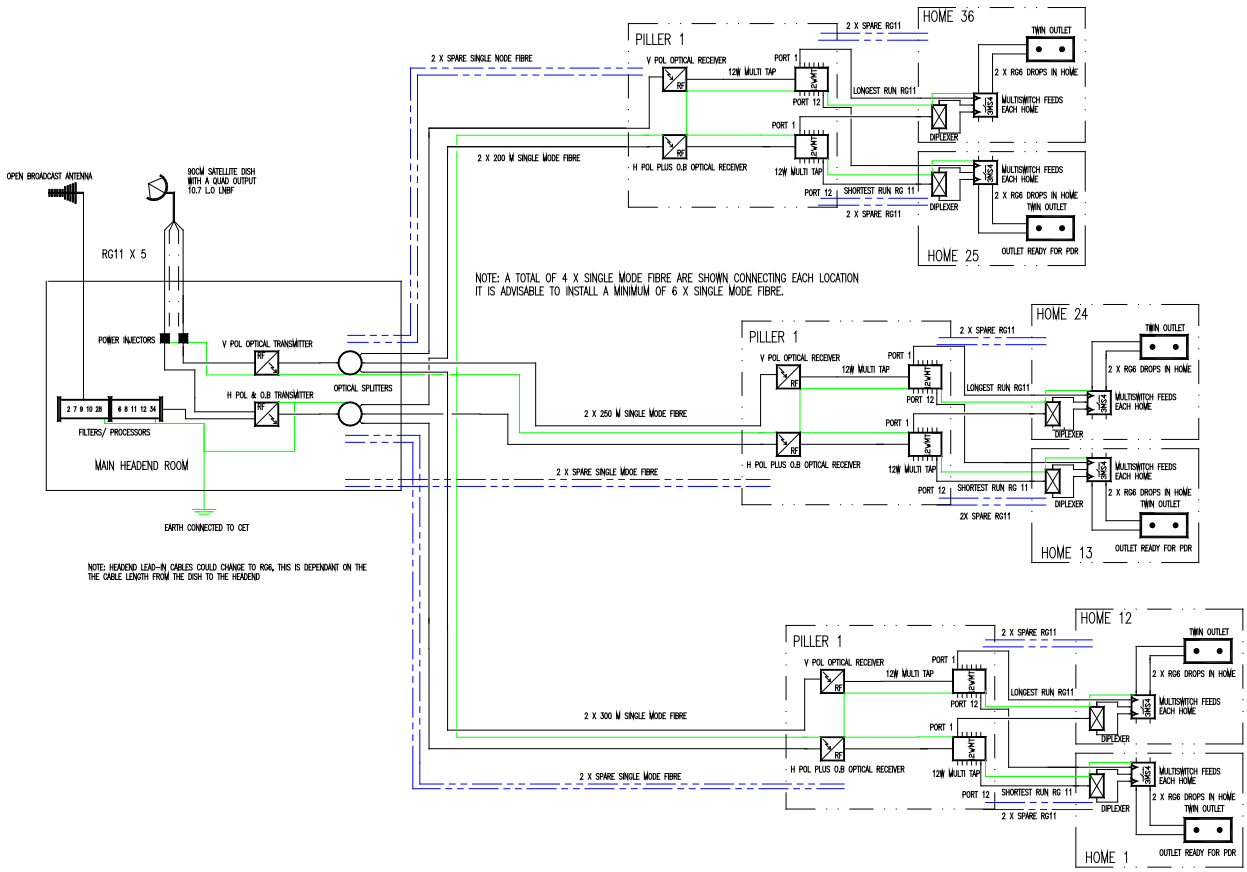

Figure 26 – MS14–2A

7.2.5. Earthing and Equipotential Bonding (CET) Designs

All system components must be earthed in compliance with AS/NZS 1367:2000, AS/NZS3000, (earthing conductors), and AS/ACIF S009:2001.

Equipotential bonding is used to ensure that no hazardous voltages are present on the outer conductors of a cable or any metallic component within the network.

A licensed electrician must carry out connections within the electrical switchboard.

> Note: A suitably qualified person can carry out the connection for protective earthing external to the switchboard.

Refer to the following designs for specific diagrams for earthing outline the preferred methods for connection of a CET and bonding conductor.

7.2.5.1. Equipotential Bonding Commercial Installation (Single Dwelling Residence – more than one Wallplate)

Figure 27 shows the method for Equipotential Bonding in a commercial (Single Dwelling Residence) single premise installation with more than one outlet.

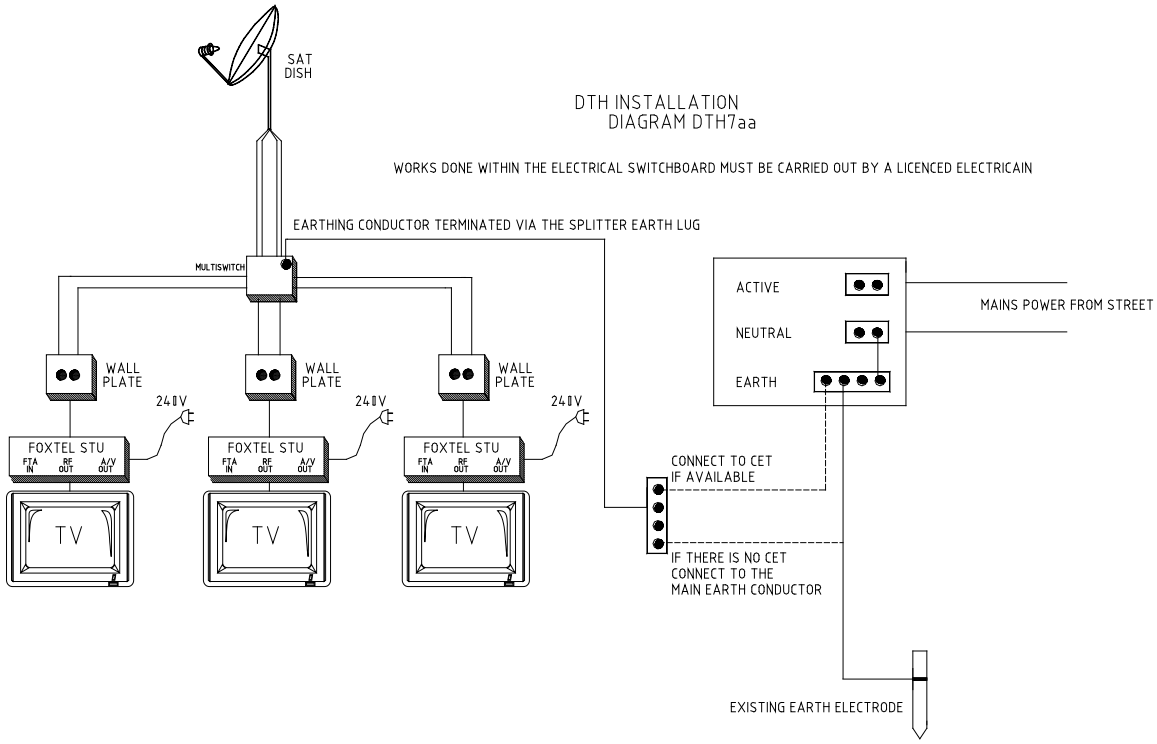

Figure 27 – Equipotential Bonding in Single Premises

7.2.5.2. Equipotential Bonding Multi-Dwelling Unit or Commercial Installation

Figure 28 shows the method for Equipotential Bonding in a Multi-Dwelling Unit or commercial multiple premise installation.

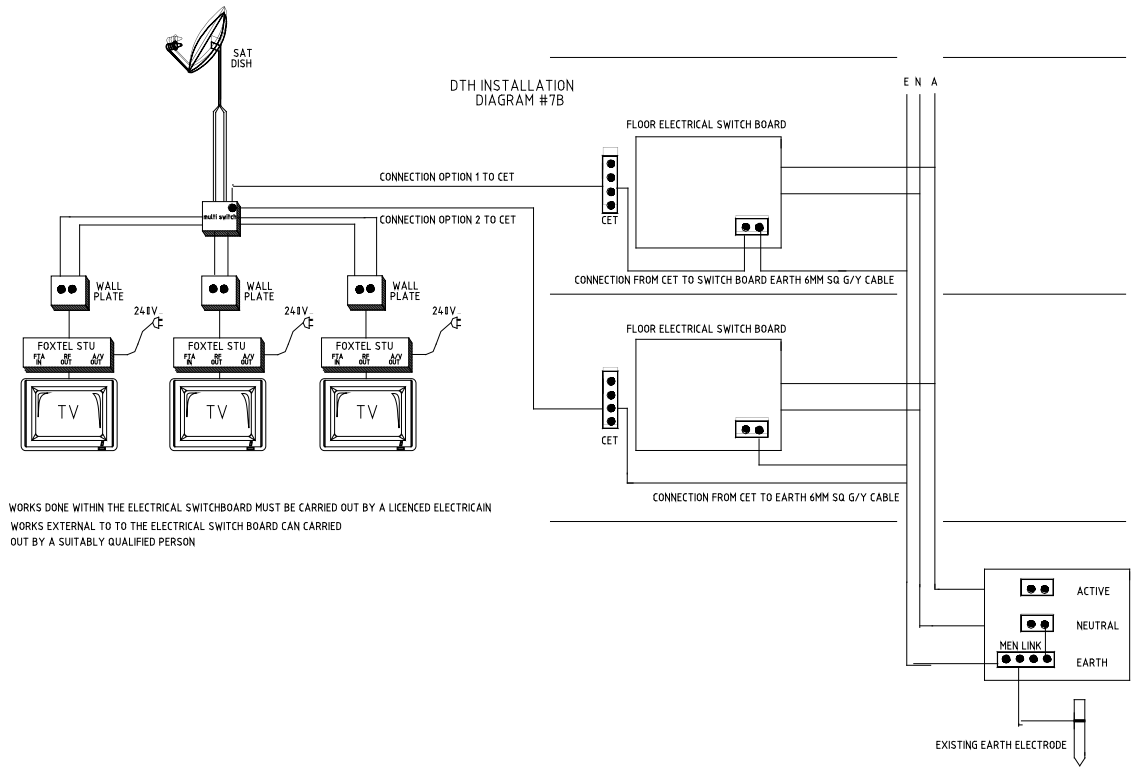

Figure 28 – Equipotential Bonding Multi-Dwelling Unit and Commercial Premises

Earthing of the system is achieved via the methods shown in Figure 29 and Figure 30:

Passive Method

1. Connect all incoming cables to passive 4 barrel grounding block
2. Connect all outgoing cables to passive 4 barrel grounding block
3. Connect multiswitch to passive 4 barrel grounding block using a 2.5mm^2 yellow green earth wire
4. Connect earthing conductor using a 6mm^2 yellow green earth wire to the passive 4 barrel grounding block
5. Run the 6mm^2 earth down the riser to the building CET or building earth.

Figure 29 – Earthing Examples – Passive

> Note: If requested by FOXTEL or by a Regulatory body, the Installation Company must be able to provide certification that the earthing carried out by a licensed electrician meets the required standards.

Active Method

1. Connect multiswitch to the CET using a 2.5mm^2 yellow green earth wire
2. Connect the CET and the Earthing Conductor using a 6mm^2 yellow green earth wire.
3. Run the 6mm^2 earth down the riser to the building CET or building earth.

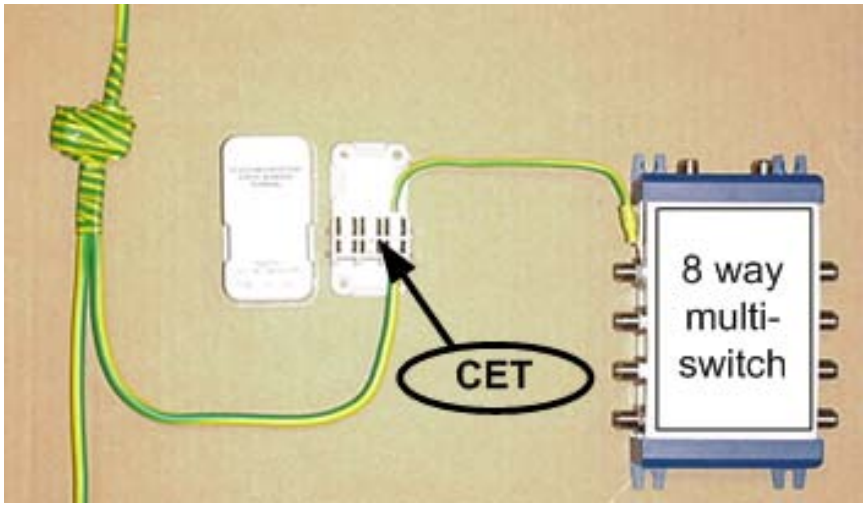

Figure 30 – Earthing Example – Active

8. Technical Reference Information

This section contains general information for installation companies and any other parties needing to broaden their understanding of the technical aspects of FOXTEL installations.

> Note: For FOXTEL satellite installation requirements and processes, see Section 6.

8.1. Quick Reference

The following sub-sections provide a useful overview of the most commonly requested information:

- Packages and main features of FOXTEL — Section 8.1.1
- Dish alignment procedure — Section 8.1.2
- Wind loading information — Section 8.1.4
- Test equipment — Section 8.1.6

8.1.1. Main Features of FOXTEL

Refer to the latest distribution pack of FOXTEL literature.

8.1.2. Aligning a Satellite Dish

The Scope of Work will be used to select the appropriate mount and dish and the selection will be confirmed as appropriate for the installation location by a FOXTEL Industry Designer. The preferred method for alignment is to use a Multi-Dwelling Unit meter or dish-pointing meter (see Installer Product List). When using these meters there are four steps to aligning a dish:

1. Ascertain the capital city azimuth elevation using Table 8. For other non capital city locations use the following web site link:

   http://202.174.101.77/test/Angles/

2. Use a compass for the azimuth setting and an inclinometer for the correct elevation for the location (ensure the mount is plumb vertically).
3. Adjust the dish precisely by panning horizontally (azimuth) and vertically (elevation) to receive maximum signal strength.
4. Align the LNB to obtain maximum cross-polarisation adjustment (maximum Modulation Error Ratio level).

Table 8 – Capital City Azimuth and Elevation Information

Location	Azimuth Compass (degrees)	Elevation Inclinometer (degrees)
Adelaide	21.54	45.33
Brisbane	-4.74	57.81
Canberra	-0.10	48.41
Melbourne	6.74	44.65
Perth	60.83	33.17
Sydney	-3.63	50.26

An alternative method is to find your location longitude and latitude at the following site:

- http://www.ga.gov.au/map/names/

then go to the following site and enter the longitude and latitude of the desired location to find the azimuth elevation setting:

- https://www.sciteq.com.au/calculators.php

Table 8 provides additional dish alignment information for Section 6.1.2.

8.1.3. OPTUS C1 Transponder Listings

Table 9 provides transponder information for the C1 satellite.

Table 9 – Optus C1 Transponder Frequencies

Down Link Transponder	Down Link Polarity	Downlink Centre Frequency MHz	Symbol Rate	FEC	10.7 L.O Centre Frequency MHz
1	Vertical	12287.0	27800	¾	1587.0
2	Vertical	12367.0	27800	¾	1667.0
3	Vertical	12407.0	30000	¾	1707.0
4	Vertical	12447.0	27800	¾	1747.0
5	Vertical	12487.0	27800	¾	1787.0
6	Vertical	12527.0	30000	¾	1827.0
7	Vertical	12567.0	27800	¾	1867.0
8	Vertical	12607.0	27800	¾	1907.0
9	Vertical	12647.0	27800	¾	1947.0
10A	Vertical	12692.5	28650	½	1992.5
10B	Vertical	12728.25	28650	½	2028.25
11	Horizontal	12305.0	30000	¾	1605.0
12	Horizontal	12358.0	27800	¾	1658.0
13	Horizontal	12398.0	27800	¾	1698.0
14	Horizontal	12438.0	27800	¾	1738.0
15	Horizontal	12478.0	27800	¾	1778.0
16	Horizontal	12518.0	27800	¾	1818.0
17	Horizontal	12558.0	27800	¾	1858.0
18	Horizontal	12598.0	27800	¾	1898.0
19	Horizontal	12638.0	27800	¾	1938.0
20	Horizontal	12688.8	27800	¾	1988.8

Table 10 provides transponder information for the D3 satellite.

Table 10 – Optus D3 Transponder Frequencies

Down Link Transponder	Down Link Polarity	Downlink Centre Frequency MHz	Symbol Rate	FEC	10.7 L.O Centre Frequency MHz
1	Vertical	11720.5	27800	¾	1020.5
2	Vertical	11762.0	27800	¾	1062.0
3	Vertical	11803.5	27800	¾	1103.5
4	Vertical	11845.0	27800	¾	1145.0
5	Vertical	11886.5	27800	¾	1186.5
6	Vertical	11928.0	27800	¾	1228.0
7	Vertical	11969.5	27800	¾	1269.5
8	Vertical	12011.0	27800	¾	1311.0
9	Vertical	12052.5	27800	¾	1352.5
10	Vertical	12094.0	27800	¾	1394.0
11	Vertical	12135.5	27800	¾	1435.5
12	Vertical	12177.0	27800	¾	1477.0
13	Horizontal	11720.5	29455	3/5	1020.5
14	Horizontal	11762.0	27800	¾	1062.0
15	Horizontal	11803.5	27800	¾	1103.5
16	Horizontal	11845.0	27800	¾	1145.0
17	Horizontal	11886.5	27800	¾	1186.5
18	Horizontal	11928.0	27800	¾	1228.0
19	Horizontal	11969.5	27800	¾	1269.5
20	Horizontal	12011.0	29455	3/5	1311.0
21	Horizontal	12052.5	29455	3/5	1352.5
22	Horizontal	12094.0	27800	¾	1394.0
23	Horizontal	12135.5	27800	¾	1435.5
24	Horizontal	12177.0	27800	¾	1477.0

8.1.4. Wind Loading Conditions

This subsection provides additional information for mount selection (see Section 6.2.1).

Table 11 shows the Wind Loading Conditions for the designated regions.

Table 11 – Wind Loading Conditions

Description	Mount Wind Rating
Region A – Flat Suburbia	W28
Region A – Structures built adjacent to an oval or large vacant lot and subjected to prevailing winds, or structures on undulating terrain in suburbia Region B – Flat Suburbia	W33
Region A – Structures sited in sparsely populated, undulating terrain Region B – Adjacent to the sea front Region C – Flat Suburbia	W41
Region C – Adjacent to sea front	W50

8.1.5. Satellite Dish Wind Loads

The force of the wind on a satellite dish is related to the wind speed V, the area of the reflector A in the direction of the wind and the drag coefficient of the reflector shape C_d. The horizontal force at the dish mounting bracket is given the formula:

$$F = C_d \times A \times 0.6 \times V^2 / 1000$$

Drag coefficients for various wind directions and dish sizes and shapes have been measured in wind tunnels. In the case of domestic satellite dishes, wind direction and dish elevation (which affects the projected area of the reflector) can not be practically determined for every installation, so worst case values are used.

However, the wind speed V is a critical factor, since the wind force is related to the square of the wind speed.

The procedure for determining the design wind speed, and hence the wind force, for any location in Australia has been laid out in detail in the Australian Standard *SAA Loading Code Part 2: Wind loads.*

The design wind speed is determined by taking into account the following factors:

- The regional wind speed. This value is based on recordings over a long period of time at locations throughout Australia. It is chosen so that there is only a 5% probability of the wind speed exceeded within a fifty year period. Australia has been divided into wind speed regions A, B, C and D as shown in the chart.
- The height of the structure above the ground.
- The type of local terrain, for example, sea coast, open country, built-up area or city centre.
- The local topography, for example, on the crest of a hill, on the slope of a hill.
- Shielding, for example, directly protected by other buildings, trees, etc.

Thus the wind force varies considerably depending on site location and conditions. Unfortunately, it is often greater in locations where the satellite footprint is weakest, and the larger size reflectors are needed.

To simplify the wind speed problem for domestic structures, a rationalised wind classification system has been introduced (refer to *AS 4055-1192 Wind loads for housing*). In this system, the wind speed has been rationalised to just a few values, including the commonly used classifications W33 and W41.

To accurately assess the wind speed classification relating to a site, each of the factors outlined above must be categorised and applied to the wind classification table shown in Table 12.

Table 12 – Wind Classifications

REGION	TERRAIN	WIND CLASSIFICATIONS														
		TOPOGRAPHIC CLASSIFICATION														
		T1			T2			T3			T4			T5		
		SHIELDING CLASSIFICATION														
		FS	PS	NS	FS	PS	NS	FS	PS	NS	FS	PS	NS	FS	PS	NS
A	3	W28	W28	W33	W28	W33	W33	W33	W41	W41	W41	W41	W41	W41	W50	W50
	2.5	W28	W33	W33	W33	W41	W41	W33	W41	W41	W41	W50	W50	W41	W50	W50
	2	W33	W33	W41	W41	W41	W41	W41	W41	W50	W41	W50	W50	W50	***	***
	1	W41	W41	W41	W41	W50	W50	W50	W50	W50	W50	***	***	***	***	***
B	3	W33	W33	W41	W33	W41	W41	W41	W41	W50	W41	W50	W50	W50	W50	***
	2.5	W33	W41	W41	W41	W41	W50	W41	W50	W50	W50	W50	***	W50	***	***
	2	W41	W41	W41	W41	W50	W50	W50	W50	***	W50	***	***	***	***	***
	1	W41	W50	W50	W50	***	***	W50	***	***	***	***	***	***	***	***
C	3	W41	W41	W50	W50	W50	W50	W50	W50	***	***	***	***	***	***	***
	2.5	W41	W50	W50	W50	W50	***	W50	***	***	***	***	***	***	***	***
	2	W50	W50	W50	W50	***	***	***	***	***	***	***	***	***	***	***

Topographic Classification:

T5: top ⅓ of a hill with an average slope ≥ 1 in 3

T4: top ⅓ of a hill with an average slope ≥ 1 in 5

T3: top ⅓ of a hill with an average slope ≥ 1 in 7.5, or
mid ⅓ of a hill with an average slope ≥ 1 in 3

T2: top ⅓ of a hill with an average slope ≥ 1 in 10, or
mid ⅓ of a hill with an average slope ≥ 1 in 5

T1: most other locations

Terrain Category Classification:

TC3: typical suburban locations, but not less than 200m from open areas such as parks, golf courses or open water.

TC2.5: typical developing outer suburban area with a few trees.

TC2: open terrain including grassland with few well scattered obstructions.

Shielding Classification:

FS: full shielding where at least two rows of housing or heavily wooded areas surround the site.

PS: partial shielding applies to intermediate locations where there are at least 2.5 houses or similar obstructions per hectare.

NS: no shielding applies where there are less than 2.5 houses or similar obstructions per hectare, or the first two rows of houses adjacent to open water.

8.1.6. Identification of Cables

Service identification labels (Panduit – PLDR-1) or equivalent are required for each lateral and or home run cable to identify a particular subscriber's cable at the cascadable tap and/or multiswitch. This label is to show the house or unit number and final destination location, for example, U24 lounge.

Figure 31 shows a multiswitch with Service Identification Labels attached to the cables.

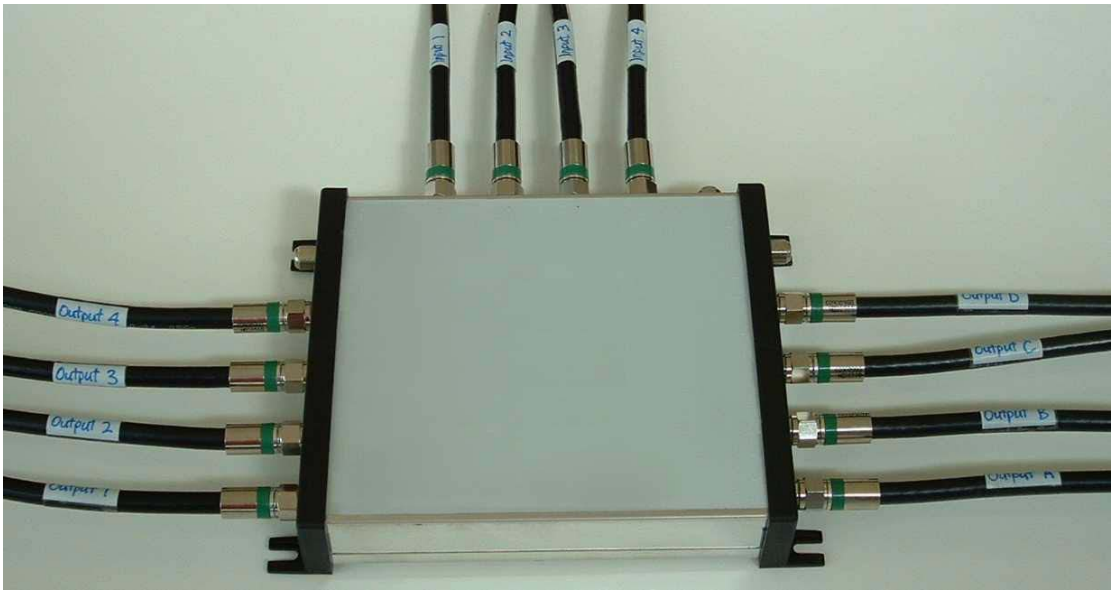

Figure 31 – Service Identification Labels

8.1.7. Test Equipment

Test equipment to be used on FOXTEL installations have been categorised into the following work requirement types

a. Dish pointing for Single Dwelling Residence installs

b. Installation, service calls – troubleshooting and commissioning work for Small MDUs, MDUs, MREs and commercial (satellite only)

c. Quality Audit Inspections (QAI), installation, service calls – troubleshooting and commissioning work for integrated RF or OB and satellite MDUs, MREs and commercial work

Figure 32 shows a meter used for MDU and MRE installations.

Figure 32 –MDU Installation Service Call Meter

Table 13 shows the equipment for each work type.

Table 13 – Work Specific Test Equipment

Test Equipment Use Description	Work Type	Dish pointing audio	DCP	MER	BER		Data logging
					pre V	Pre RS	
Horizon	A	✔	indicative	indicative			
Unaohm S20	B	✔	✔	✔	✔	✔	✔
Unaohm EP300	C	✖	✔	✔	✔	✔	✔
Promax Premium + Series	C		✔	✔	✔	✔	✔
Roversat DL3	C		✔	✔	✔	✔	✔

Note: A = Dish pointer device
B = MDU Installation / Service Call Out / Troubleshooting meter
C = MDU / MRE / Commercial meter

9. Troubleshooting

This section provides an overview of the fault-finding process, which will help identify faults that have arisen during the installation, for example, wallplate performance does not comply with FOXTEL specifications. A Multi-Dwelling Unit digital test meter is an essential tool for successful fault analysis and identification. Details on these meters are provided in the Installer Product List

Satellite installation faults can be diagnosed by using the installation design as a signal flow map. By tracing the signal path from the wallplate to the LNB and testing each component along the path, it will become clear which section (fault zone) contains the fault.

There are three steps in the fault-finding process:

1. Analysis of the fault (where to use test equipment and what to measure)
    - symptoms of the fault
    - description of why it occurs
2. Identification of the cause
    - a list of possible causes
3. Fault rectification (using test equipment to confirm fault is fixed)
    - a list of possible solutions

Table 14 can be used to enter Fault Analysis and Identification details.

Table 14 – Fault Analysis and Identification

Analyse		Identify	Rectify
Problem / Symptom	**Why it occurs?**	**Possible Cause**	**Solution**
Low Digital Channel Power at wallplate			

Appendix A. Glossary

Table 15 – Glossary

Term / Acronym	Meaning
AC	Alternating current
Active Components	Equipment used in SMATV systems, which require power to operate.
Adjacent TV Channels	Any two channels with video carriers separated by a statutory guard band.
Amplifier	An active device used to boost RF signal levels.
Amplifier Antenna (Mast Head)	(Antenna amplifier) An amplifier directly associated with an antenna should be low noise to improve system signal to noise ratio.
Amplifier Cascaded (Cascaded amplifier)	An amplifier, which amplifies a signal already, amplified by another amplifier, must be de-rated by 3dB for each doubling of the cascade
Amplifier Distribution (Distribution amplifier)	An amplifier, located at the head-end of the system, designed to compensate for the system losses and to provide the necessary levels at the system outlets.
Amplifier Repeater (Repeater amplifier)	An amplifier designed to compensate for the system losses and to provide the necessary levels at the system outlets. Note: must be de-rated by 3dB for each doubling of the cascade
Amplifier Single Channel (Single channel amplifier)	A distribution amplifier designed to amplify a single channel only and to provide rejection of other channels.
Amplifier Wide (Wide band amplifier)	A distribution amplifier or a repeater amplifier designed to amplify a multiplicity of channels (for example, VHF-UHF and SAT). Limited bandwidth Amplifiers are intended to amplify no more than 10TV channels.
Attenuator	A passive device used to reduce the level of a RF signal.
Automatic Gain Control Amplifier	An amplifier designed to compensate for fluctuations of the input signal and to provide a constant output signal.
Backbone Cabling	All cable plant from the headend to any subdistribution node points. Typically the backbone cable is RG11Q in large systems.
Bandwidth	A specific range of frequencies.
Bit Error Rate (BER) post Viterbi	Used in digital transmission system to indicate the quality of the transmission (defined by number of error bits/total bits after Viterbi error correction)
Bit Error Rate (BER) pre Viterbi)	Used in digital transmission system to indicate the quality of the transmission (defined by number of error bits/total bits before Viterbi error correction)
Block Converter	A device uniformly changing frequencies of all signals in a particular block of channels.
Braid	Strands of wire woven together to form an electrical shield.
By-pass Mode	When activated on a VCR the input channels are shunted straight to its output.

Term / Acronym	Meaning
Carrier to Noise	The difference expressed in dB between the vision and noise floor level, at a given point in the system. The C/N is the difference between a wanted signal and unwanted noise.
Carrier to Inter-modulation Ratio	The difference expressed in dB, at a specified point of the system between the levels of the carrier and of the inter-modulation product.
Cascadable Tap	A passive device with multiple 5 inputs, 5 line outputs and 5 resistive tapped outputs with slope or tilt.
Cascadable Tap System	A complex cabling system method or topology. Also known as Tree and branch or drop tap system in MATV/CATV systems. Uses Taps (cascaded) to supply signal to the multiple wallplates
Channel Combiner	A device used to combine ports carrying VHF and/or UHF channels into a single port. (NOTE: Most devices can be used in reverse to split the channels, eg. diplexer)
Channel Converter	A device changing frequency of all signals in a particular channel by the same amount.
Channel Loading	Number of TV channels in operation. Maximum Channel Loading refers to the maximum number of channels for which the system is designed. The output level performance of wide band amplifiers depends on channel loading. Amplifiers require de-rating depending on the number of channels being amplified. The manufacturer will provide the de-rating factors on their data sheet.
Chrominance	A characteristic of a composite TV signals describing the colour. Requires luminance to be visible.
Chrominance/ Luminance delay Inequality	Delay between associated chrominance and luminance signals within a single channel (4.43 MHz) measured in nanoseconds. The performance and worst case channel must be quoted.
Composite Second Order (CSO)	Amplitude distortion due to second order composite non-linearities of the system. The worst case (for any channel) must be specified.
Composite Triple Beat (CTB)	Amplitude distortion due to the third order composite non-linearity of the system. The worst case (for any channel) must be specified.
Composite Cross Modulation (CCM)	Refers to cross-modulation at maximum channel loading.
Commissioning	Tests which confirm that an installation is operating to designed specifications.
Conifer	A brand name for MPS antennas and downconverters.
Cross-modulation	Interfering (unwanted) modulation of carrier by modulation of another carrier or carriers due to non-linearities of the equipment.
Customer Tap (-off)	A device designed to obtain signal from a trunk cable node and incorporating means for connection to the subscriber's feeder. Customer lateral feeder is also referred to as customer drop cable. The tap should be the last device between outlet plates and the through port terminated with a 75 Ohm load.
Customer wallplate	A device fitted in the user's premises for connection of the receiving equipment. It is also referred to as a system outlet or TV outlet.
dBi – Decibel	Antenna gains in decibels compared to an Isotropic antenna. The logarithm of a ratio of two powers multiplied by 10.

Term / Acronym	Meaning
dBuV –Decibel Microvolt	Microvolts expressed as a decibel ratio. The logarithm of the value of a signal measured in uV multiplied by 20 (to convert dBuV to dBmV deduct 60 from the value expressed in dBuV).
dBmV – Decibel Millivolt	Millivolts expressed as a decibel ratio. The logarithm of the value of a signal measured in mV multiplied by 20 (to convert dBmV to dBuV add 60 from the value expressed in dBmV).
DC	Direct Current.
Decibel Ratio	The logarithmic ratio of two powers multiplied by 10 log or two voltages multiplied by 20 log.
Dielectric	Insulative material used to separate two electrical conductors.
Directional Coupler	A coupler sensitive to the direction of the flow of the energy and intended to minimise the effect of unwanted reflected signals.
Directivity	The ability of a device to discern the direction of the flow of electro-magnetic energy.
Display Channels	Programmable memory location in a receiver, which stores the actual TV frequency.
Distribution Amp.	An active device used after a launch amplifier to compensate for system losses.
Down converter	A device used to translate a high frequency to a lower frequency.
Diplexer	A device in which the signal energy at one (input) port, which covers a frequency band, is divided between two or more (output) ports, each of which covers a part of that frequency band. Note: this device can be used in reverse direction for combining the two signals of different frequency.
F connector	Type of connector used in open broadcast and subscription television systems.
F type barrel	Used to facilitate connection between two F type connector also known as F-81.
Feeder-Node	A feeder node is a point in the SMATV that may consist of amplifiers, splitters and couplers that the lateral cable feeding the subscriber's unit is connected to.
Filter	A device designed to pass or block a single (pre-determined) frequency or a range (band) of frequencies with a minimum of loss, and the same time, to attenuate all other frequencies.
Filter (band-pass)	A device designed to pass a range (band) of frequencies.
Filter (band-stop)	A device designed to stop (eliminate) a range (band) of frequencies.
Filter (high-pass)	A device designed to pass high frequencies.
Filter (low-pass)	A device designed to pass low frequencies.
Gain	The ratio of the output power to the input power expressed in dB.
GPO	General Purpose Outlet (240Volt power point).
Ghosting	When multiple images appear on the TV picture due to multi-path or ingress of unwanted reflected signal into the system due to poor screening may also cause leading edge ghosting.
HAM	A colloquial term used to describe an Amateur Radio Operator.
Head-end	Location from which all signals are launched in a distribution system.

Term / Acronym	Meaning
Home run (Star wired)	A simple cabling system method or topology. Where all cable(s) are run from the wallplate(s) to a central location where a end of line device, for example, multiswitch is usually installed
HRCT	A more complex cabling system method or topology. A hybrid of Home Run and Cascaded Tap systems together, known as HRCT hybrid wiring method
Impedance	A complex resistance of inductive, capacitive reactance and DC resistance.
Ingress	Any amount of unwanted RF signals entering a device or cable system.
Inter-modulation	The process in which the non-linearity of the equipment produces spurious signals (Inter-modulation products) at frequencies being linear combinations of those of the input signals. In other words, when two or more signals beat together to produce new signals.
Insertion Loss	The attenuation of the signal strength due to the insertion of passive devices in a distribution system.
Isolation	The attenuation between two ports usually expressed in dB. AC isolation refers to isolation of the device from AC, for example,, of isolation in a system outlet of both inner and outer conductors of the coaxial cable from the outlet.
Impedance Matching	A process by which two impedances are made relatively equal (a well-matched test set up has at least 20dB return-loss-ratio relative to the system impedance).
LBand	Frequencies located in the band 950-2150 MHz (Satellite IF Band)
Low Noise Block Feed or LNB	Low Noise Block Feed – a down-converter which sits in the front or centre of the dish, and collects all the reflected microwaves from the dish. The LNB has an integrated feed horn. The waves travel along the feed horn and enter the LNB where they are converted and transferred to the satellite receiver via the coax cable.
LNC	Low Noise Converter (converts high frequencies to lower frequencies).
Lateral Cable	A cable, which connects, from the termination point or sub-distribution point to the wallplate
Lead in cable (subscriber feed)	Feeder cable connecting premise from cascadable tap to sub-distribution point (node with all premise lateral cables)
Launch Amplifier (twin)	An active device located at the Head-end which boosts RF signal levels.
Local Origination	The production of local programs or services through a channel or channels in a distribution system not involving broadcast signals.
Luminance	A characteristic of a composite television signal (represented by Ey) describing light intensity. Measured in lux.
MATV	Master Antenna Television. Where multiple rooms or units in the one building (for example a hotel) receive TV and radio channels through a common, master antenna.
Modulation Error Ratio (MER)	Modulation Error Ratio (in band noise ratio)
Modulator	A modulator converts the video (and/or audio) output of the STU to an RF signal so that it can be received on a standard TV.

Term / Acronym	Meaning
MHz	Mega Hertz (One Million Hertz)
Multi-path	Occurs when an analogue terrestrial TV signal suffers refraction or is reflected by external objects.
Noise	Unwanted electromagnetic radiation.
Noise Figure	Noise factor expressed in dB.
OB TV	Open Broadcast Television also known as FTA or OFF AIR. This term includes analogue and digital.
PAL	Phase Alternation by Line (phase error correction method for colour TV signals) in Australia.
Passive Components	A circuit, equipment or network used in Pay-TV systems which do not require power to operate.
Personal Digital Recorder	Personal Digital Recorder (PDR) – receives digital information via cable or satellite, decodes this information and sends it to the TV. Also has ability to record and play back TV programmes
Polarisation	Describes the direction of the electric field in an electromagnetic wave.
Radiation system (System radiation)	The unwanted transmission of signals from any part of the system (cables, amplifiers and passive devices) to air.
Radiation spurious (Spurious radiation)	Any radiated signal transmitted outside the allocated channels (this may interfere with other services).
Radio Interference	Unwanted RF signals which can degrade the reception of TV services.
Reflection	The reflection of electromagnetic energy due to a poor impedance matching.
Reflection Coefficient	A measure of the reflected signal, defined as a ratio of the reflected wave to the forward wave.
Return Loss (RL)	Defined as the logarithm of the reciprocal value of the reflection coefficient, multiplied by 20 and expressed in dB. In other words, a measurement of impedance mismatches.
RF	Radio Frequency
SMS	Subscriber Management System
Set Top Unit/Box	An addressable receiver used to receive and decode the FOXTEL services. Also referred to as an IRD (Integrated Receiving Device)
Signal to Noise Ratio (SNR)	Ratio of the signal level to the noise level measured at the same point in the system and expressed in dB.
Single Channel Amplifier	An active device that is tuned to amplify only one TV channel.
Slope (also Tilt)	Plot of frequency versus signal amplitude over a specified bandwidth. This is also known as the tilt of the system.
SMATV	Satellite Master Antenna TeleVision. Where multiple rooms or units in the one building (for example a hotel) receive TV and radio channels through a common, master satellite receiver.
Splitter	A device designed to separate a specified amount of RF signal into equal parts from the main transmission.
Scope of Work	Scope of Work detailed information required to produce RF design and quotation for installation of system

Term / Acronym	Meaning
Spurious	Unwanted signals generated from an active device, for example,, an amplifier.
Structural Return Loss	The return loss characteristic of a cable due to periodic structural variations of the cable during manufacturing.
Sub-distribution Node Point	A junction where a number of cables carrying the RF signals converge. A point in a distribution system where backbone cabling splits into drop cables. All Node points must be earthed.
Subscriber Termination Point	The connection point for a drop cable just prior to entering a subscriber dwelling. This point is also known as the point of entry
Subscription TV	TV channels which the subscriber pays a fee to receive.
System Immunity	The ability of the system to operate without visible impairments in the presence of unwanted outside electro-magnetic fields. Standards Australia AS1367:2000 defines the “figure of merit” for *synchronous working* as the ratio of the working signal level or ‘picked up’ signal at the same outlet, with all system inputs terminated.
System outlet	see wallplate
Tap	A passive device with one input, one-line output and one or more resistive tapped outputs.
Transparent Digital Transmodulator	Transparent Digital Transmodulation converts a QPSK carrier (satellite) to QAM carrier (cable) so that they can be reticulated through a CATV or SMATV system.
Tee-Off	See directional coupler, Tap
Terminator (75 ohm)	A passive device fitted to an unused RF output or input port to inhibit reflections into the SMATV system.
Trunk Cable (twin)	Feeder cable to which branch feeder is connected. Note: This may not exist in smaller installations.
Trunk cabling	Main cable carrying RF signals through a building also known as a backbone cable.
Twin wallplate	Wallplate with two subscription television outlet plugs.
UV	Ultra Violet
VAC	Volt Amp Current.
VCR	Video Cassette Recorder
VSWR	Voltage Standing Wave Ratio –A ratio of adjacent maxima of a standing wave created by forward and reflected waves. It is related to the reflection coefficient by the expression: VWSR= 1 + [r] , where [r] is the absolute value of the reflection coefficient.

Appendix B. Drawing Symbols

A standard drawing symbol chart from AS/NZ:1367

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
CH IN / CH OUT	PROCESSOR	3MS4	3 INPUT 4W MULTISWITCH END OF LINE ACTIVE FTA & SAT		2 WAY CUSTOMER TAP		VARIABLE EQUALISER
		3MS4	3 INPUT 4W MULTISWITCH END OF LINE ACTIVE SAT PASSIVE FTA		4 WAY CUSTOMER TAP		IN LINE EQUALISER
AV / CH OUT	MODULATOR	3MS8	3 INPUT 8W MULTISWITCH END OF LINE ACTIVE FTA & SAT		8 WAY CUSTOMER TAP		TERMINATOR
CH	CHANNEL AMPLIFIER	2MS8	2 INPUT 8W MULTISWITCH END OF LINE ACTIVE SAT		2 WAY CUSTOMER TAP SELF TERMINATING		DC BLOCK
		3MS4	3 INPUT 4W M/SEND OF LINE MAINS POWERED ACTIVE FTA & SAT		4 WAY CUSTOMER TAP SELF TERMINATING		POWER SUPPLY
RF	OPTICAL TRANSMITTER	3MS8	3 INPUT 8W M/S END OF LINE MAINS POWERED ACTIVE FTA & SAT		8 WAY CUSTOMER TAP SELF TERMINATING		POWER INSERTER
RF	OPTICAL RECEIVER	3MS4	3 INPUT 4W MULTISWITCH CASCADABLE PASSIVE FTA & SAT		2 WAY SPLITTER		AMPLIFIER FORWARD PATH ONLY
	OPTICAL SPLICE	3MS6	3 INPUT 6W MULTISWITCH CASCADABLE PASSIVE FTA & SAT		3 WAY SPLITTER 1 HIGH/2 EQUAL O/P's HIGH O/P DENOTED •		AMPLIFIER WITH REV PATH MODULE
	OPTICAL SPLITTER	2MS12	2 INPUT 12W MULTISWITCH END OF LINE ACTIVE SAT		3 WAY SPLITTER 3 EQUAL OUTPUTS		HEADEND
	DIPLEXER	2MS12	2 INPUT 12W MULTISWITCH CASCADABLE ACTIVE SAT		4 WAY SPLITTER		CABLE SPLICE
	LOW PASS FILTER	5MS8	5 INPUT 8W MULTISWITCH CASCADABLE PASSIVE FTA & SAT		DIRECTIONAL COUPLER		ELECTRICAL EARTH (CET)
	HIGH PASS FILTER	5MS12	5 INPUT 12W MULTISWITCH CASCADABLE ACTIVE FTA & SAT		3 INPUT / 3 OUTPUT MULTITAP		UHF ANTENNA
	BAND PASS FILTER	5MS16	5 INPUT 16W MULTISWITCH CASCADABLE ACTIVE FTA & SAT		5 INPUT / 5 OUTPUT MULTITAP		VHF / UHF ANTENNA
	ATTENUATOR	5MS12	5 INPUT 12W M/S END OF LINE MAINS POWERED ACTIVE FTA & SAT		5 INPUT / 5 OUTPUT TWO WAY SPLITTER		VHF ANTENNA
	OUTLET	5MS16	5 INPUT 16W M/S END OF LINE MAINS POWERED ACTIVE FTA & SAT		5 INPUT 5 OUTPUT LAUNCH AMPLFIER MAINS POWERED		SATELLITE ANTENNA
IRD	INTEGRATED RECEIVER DECODER		3 INPUT 2 OUTPUT LAUNCH AMPLFIER MAINS POWERED		3 INPUT 3 OUTPUT LAUNCH AMP LINE POWERED		2 INPUT 2 OUTPUT FTA–SAT SPLIT BAND AMPLIFIER LINE POWERED
	3 INPUT 3 OUTPUT LAUNCH AMPLFIER MAINS POWERED						

Figure 33 – Standard Drawing Design Symbols

Appendix C. Technical Specification

C.1. Passive Equipment

Equipment/Reading	Requirement
Terminal Fly-leads:	• Terminal fly-leads are defined as those cables that connect a terminal device to a system outlet and/or those cables that connect a subscriber's terminal device to any device connected between the system outlet and the input to the terminal device. • All connectors fitted to terminal fly-leads shall comply with IEC 60169-24. • The return loss of the terminal fly-lead when terminated with a precision termination should be: ≥ 24dB in the range 5MHz to 862MHz ≥ 18dB in the range 950MHz to 2150MHz • The terminal fly-lead shall be constructed from cable having the same structural return loss as that specified under coaxial cable in this section. • The screening effectiveness of the fly-lead, measured according to IEC 60996-1 Amendment 1, should be ≥ 95dB in the range 30MHz to 1000MHz and ≥ 85dB in the range above 1000MHz to 2150MHz. • To minimise the chances of damage, the dielectric of the fly-lead should be continuous along its entire length in the manner specified under coaxial cable in this section.
System Outlet:	• The return loss of any TV interface port, located on the system outlet, should be ≥ 20dB in the range 40MHz to 2150MHz. • The screening effectiveness of the system outlet, measured according to IEC 60996-1, should be ≥ 75dB in the range 30MHz to 1000MHz and ≥ 65dB in the range above 1000MHz to 2150MHz. • Mains isolation is not permitted as it will disable the switching function, all systems should be earthed for Safety in accordance with AS1367.
Splitters:	• The return loss for all ports located on splitters shall be ≥ 10dB in the range 40MHz to 862MHz and ≥ 10dB in the range 950MHz to 2150MHz. • For all splitters, the peak-to-peak narrowband flatness from input to output and, input to any customer tap port, shall be ± 0.5dB for any 36MHz segment. • The isolation between the output ports for a splitter shall be ≥ 18dB in the range 5MHz to 862MHz and ≥ 14dB in the range 950MHz to 2150MHz. • In the case of splitters with unequal output division, the above requirements for isolation shall be increased by the difference in attenuation between the output ports. • Linearity to be ± 0.5dB in the range 950MHz to 2150MHz.

Equipment/Reading	Requirement
Cascadable Taps:	• The return loss for all ports located on taps shall be ≥ 10dB in the range 40MHz to 862MHz and ≥ 10dB in the range 950MHz to 2150MHz. • For all cascadable taps, the peak-to-peak narrowband flatness from input to output and, input to any customer tap port, shall be ± 0.5dB for any 36MHz segment. • The cascadable tap branch shall have positive slope between 950MHz and 2150MHz; the higher the tap value the lower the slope, for example, 1/10 = 3 or 4dB slope, 1/20 = 1 or 2dB slope. • The RF mutual isolation between output ports for directional couplers and distribution taps shall be ≥ 27dB within the band 5 MHz to 862 MHz and ≥ 17dB within the band 950 MHz to 2150 MHz. These values shall be published. • The screening effectiveness of any splitter or tap, measured according to IEC 60996-1 shall be ≥ 75dB in the range 30MHz to 1000MHz and ≥ 65dB in the range above 1000MHz to 2150MHz.
Coaxial Cable:	• To minimise the chance of damage during installation and corrosion after installation, flexible cables, for example, RG6 and RG11, must have a continuous dielectric such that the centre solid conductor is in full contact with the dielectric and homogenous to the shield, along the entire length of the cable. Cables that comply with this standard include those constructed with solid, foam or cellularised-polymer dielectrics as long as they comply with all parts of this section where appropriate. Flexible cables constructed without this characteristic, such as air-spaced or semi-air spaced cables, or cables with a multi-strand centre conductor do not comply with this specification. The use of backbond hardline cables constructed with a sealed cell dielectric, or equivalent, that prevents moisture entry is permitted. • All cables installed underground must be of the flooded type. • The screening effectiveness of super trunk feeders, trunk feeders and branch feeders, measured according to IEC 60996-1 Amendment 1, should be ≥ 95dB in the range 30MHz to 1000MHz and ≥ 85dB in the range above 1000MHz to 2150MHz. • The screening effectiveness of subscriber's drop feeders, measured according to IEC 60996-1 Amendment 1, should be ≥ 95dB in the range 30MHz to 1000MHz and ≥ 85dB in the range above 1000MHz to 2150MHz. • The structural return loss for all cables, including terminal fly-leads, should be not less than 26dB. **Note:** Cables that meet these specifications are typically RG6 and RG11 quad shield cables manufactured by ***Commscope, Trilogy, Belden and Timesfibre***.

Equipment/Reading	Requirement
Coaxial Connectors:	• Only compression F-type connectors should be used at the interface between passive devices and flexible cables unless otherwise specified. • The connectors specified above should comply with IEC 60169-24. • The connectors used in conjunction with backbone hardline cables should be pin type in construction. The use of feed through connectors on these cables does not comply with this Specification. • The return loss of the connectors specified above should be ≥ 20dB in the range 5MHz to 2150MHz, measured in accordance with IEC 60169-24. • The screening effectiveness of the connectors specified above measured according to IEC 60996-1., should be ≥ 75dB in the range 30MHz to 1000MHz and ≥ 65dB in the range above 1000MHz to 2150MHz. • It is a requirement of the Specification that in addition to the specifications mentioned above, all connectors used to terminate cables should meet those specifications published by the applicable cable manufacturer.
Other passive devices:	• These devices include transfer points, power inserters/injectors, cable splices, galvanic isolators, terminating resistors, filters and equalisers. • The return or loss on all ports of these devices should be ≥ 10dB in the range 40MHz to 862MHz and ≥ 10dB in the range 950MHz to 2150MHz. • The peak-to-peak narrowband flatness from input to output passive, one and two port devices should be ± 0.2dB for any 0.5MHz and ± 0.5dB for any 7MHz segment. • The screening effectiveness of these devices, measured according to IEC 60996-1, should be ≥ 75dB in the range 30MHz to 1000MHz and ≥ 65dB in the range above 1000MHz to 2150MHz.
Nominal Impedance:	The nominal impedance of all passive equipment should be 75 ohms. All measurements are to be referred to this impedance.

Table 16 – Passive Equipment Specifications

New FOXTEL items for satellite installations	Return Loss	Insertion thru loss	Linearity
RG6 “F” connectors	>20dB	<0.5dB	.+/- 0.25dB
RG11 “F” connectors (compression type)	>20dB	<0.5dB	.+/- 0.25dB
F-81 barrels	>20dB	<0.5dB	.+/- 0.25dB
Twin wall plates with F-81 barrels	>20dB	<0.5dB	.+/- 0.25dB
75 Ohm terminators	>20dB	N/A	N/A
3, 6 & 10dB Attenuators	>20dB	#	.+/- 0.5dB
Power injectors	>10dB	<1.5dB	.+/- 1.0dB
Splitters	>10dB	various	.+/- 0.5dB
Cascadable multi taps 5 inputs *	>10dB	<1.5dB	.+/- 0.5dB
Cascadable multi 2 way splitter, 5 inputs *	>10dB	<5.0dB	.+/- 0.5dB

Notes:

* Cascadable multi taps with 5 inputs (to replace existing directional couplers) and shall have 0 to +4dB pre tilt from 950-2150Mhz.

Insertion thru loss will be dependant on manufacturers equipment specifications.

C.2. Active Equipment

Equipment/Reading	Requirement
Active Distribution Equipment:	• This specification is applicable to all coaxial limited bandwidth and broadband amplifiers used in cable distribution systems in the frequency range 5MHz to 2150MHz. • Amplifiers that comply with the specifications may be exclusively forward path or reverse path amplifiers or possess both forward and reverse path capability. • All amplifiers should incorporate F Type input and output ports.
Satellite Amplifier:	Separate Launch and line amplifiers or Launch and line amplifiers that are capable of combining OB services where applicable as well as separate vertical and horizontal services from the satellite. Where signals are to be distributed through out a system the amplifier should have four or five outputs to allow separation of OB, vertical and horizontal services. The number of outputs will depend on the type of equipment used. Where required the amplifier should have built in line powering option to provide voltage to the LNB and or next line amplifier/ multiswitch where required. If the amplifier does not have line powering options power inserters should be allowed for with the correct voltage and current for the application on hand.
Frequency Range:	The frequency range or ranges, over which the equipment is specified shall be published.
Nominal Impedance:	The nominal impedance of all amplifier ports including test points should be 75 ohms. All measurements are to be referred to this impedance.
Return Loss:	• The return loss specification of all input and output ports of an amplifier should be achieved under all specified conditions of automatic and manual gain and slope controls and with any combination of plug-in equalisers and attenuators fitted. • The return loss of all ports of any broadband or limited bandwidth amplifier should be ≥ 10dB in the range 40MHz to 862MHz and ≥ 10dB in the range 950MHz to 2150MHz.
Gain and slope control:	• The variable gain control may be either plug-in pad or potentiometer. Typically 0 – 20dB. • The variable slope control may be either plug-in pad or potentiometer. Typically 0 – 12dB.
Flatness:	• The flatness specifications should be achieved in all specified conditions of automatic gain control, manual gain control with any combination of plug-in equalisers and attenuators specified for use with the device. • The flatness of the amplitude frequency response from the input to the output ports shall be published. Slope is assumed to be eliminated either by calculation or by cable. • The peak-to-peak narrowband flatness from the input port to any output port should be ± 0.5dB for any 36MHz segment.
Broadband Amplifiers:	A broadband amplifier in this context is defined as one having a continuous bandwidth greater than 10 television channels.

Equipment/Reading	Requirement
Maximum Amplifier Output Level	The maximum output level figure assumes a channel bandwidth of 32MHz and a channel loading using a fully loaded noise spectrum 950MHz – 2150MHz (See C.2.1.1 – Digital Service Rating).
Screening Effectiveness of Equipment:	The screening effectiveness of all active distribution equipment including multiswitches measured according to IEC 728 should be ≥ 75dB in the range 30MHz to 100MHz and be ≥ 65dB in the range above 1000MHz to 2150MHz.
Power Supply:	The power supplies of all active distribution equipment should be capable of continuous operation and rated to meet local AC mains specifications and have a 'Certificate of Suitability' from the relevant Australian energy authority (except where the unit is a line powered device).
Multiswitches:	• Where a stand alone dual polarity satellite I.F system is installed the device should have a minimum of two input ports, and the correct number of output or switching ports depending on the application at hand. • If a looped multiswitch system is used the device should have two input ports, two looped or through ports with the correct number of output or switching ports to suit the application at hand. • Where an integrated OB / dual polarity satellite I.F system is used the device should have a minimum of three input ports depending on the product used for the application, this is explained in more detail in system design samples. The number of outputs may vary depending on the application at hand. • If a looped multiswitch system is used the device should have a minimum of two looped or through ports, with the correct number of output ports to suit the application at hand.

Table 17 – Standalone Multi Switch 14/18 Volt Satellite Only

Subscriber Connections	4 Ports	6 Ports	8 Ports	12 Ports
Inputs	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical
Frequency Range	950-2050 MHz	950-2050 MHz	950-2050 MHz	950-2050 MHz
Tap GAIN mid band 1.5GHz (4)	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +2dB
Gain slope (pre-tilt) across band	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +2dB
Isolation Horizontal / Vertical	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)
Isolation Port To Port	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)
Isolation trunk to trunk	NA	NA	NA	NA
Operation Horizontal	15.5 to 20 V	15.5 to 20 V	15.5 to 20 V	15.5 to 20 V
Operation Vertical	11.5 to 14.5 V	11.5 to 14.5 V	11.5 to 14.5 V	11.5 to 14.5 V
Control switch window	14.5 to 15.5 V	14.5 to 15.5 V	14.5 to 15.5 V	14.5 to 15.5 V
Current Capacity min	400mA	400mA	400mA	400mA
Current Drain Per Subscriber 13V to 18V	<80 mA	<80 mA	<80 mA	<80 mA
Supply Voltage	Via STU	Via STU	Via STU	Via STU
Return Loss Input	>10 dB	>10 dB	>10 dB	>10 dB
Return Loss Output	>10 dB	>10 dB	>10 dB	>10 dB
Minimum Output Level in 36 MHz	58dBµV (2)	58dBµV (2)	58dBµV (2)	58dBµV (2)
Maximum Output Level in 36 MHz	85dBµV (3)	85dBµV (3)	85dBµV (3)	85dBµV (3)
Maximum compression (4) at Maximum or Minimum operating level	<0.5dB	<0.5dB	<0.5dB	<0.5dB
Through loss	NA	NA	NA	NA

Notes:

(1) Worse case isolation over operating band on or between any combinations of outputs as applicable

(2) Minimum output level in 32 MHz BW is to be 58dBuV (using digital service rating)

(3) Maximum output level in 32 MHz BW is to be 85dBuV (using digital service rating)

(4) Higher gain can be submitted for consideration

All products must be in compliance with AS/NZS1367

Table 18 – Standalone Multi Switch 14/18 Volt satellite, plus OB Passive

Subscriber Connections	4 Ports	6 Ports	8 Ports
Inputs	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical
Frequency Range	950-2050 MHz	950-2050 MHz	950-2050 MHz
Tap GAIN mid band 1.5GHz (4)	+0 to 2dB	+0 to 2dB	+0 to 2dB
Gain slope (pre-tilt) across band	+0 to +2dB	+0 to +2dB	+0 to +2dB
Isolation Horizontal / Vertical	>24dB (1)	>24dB (1)	>24dB (1)
Isolation Port To Port	>24dB (1)	>24dB (1)	>24dB (1)
Operation Horizontal	15.5 to 20 V	15.5 to 20 V	15.5 to 20 V
Operation Vertical	11.5 to 14.5 V	11.5 to 14.5 V	11.5 to 14.5 V
Control switch window	14.5 to 15.5 V	14.5 to 15.5 V	14.5 to 15.5 V
Current Capacity min	400mA	400mA	400mA
Current Drain Per Subscriber 13V to 18V	<80 mA	<80 mA	<80 mA
Supply Voltage	Via STU	Via STU	Via STU
Return Loss Input	>10 dB	>10 dB	>10 dB
Return Loss Output	>10 dB	>10 dB	>10 dB
Minimum Output Level in 32 MHz	58dBµV (2)	58dBµV (2)	58dBµV (2)
Maximum Output Level in 32 MHz	85dBµV (3)	85dBµV (3)	85dBµV (3)
Maximum compression (4) at Maximum or Minimum operating level	<0.5dB	<0.5dB	<0.5dB
Open Broadcast Freq Range	5-862 MHz	5-862 MHz	5-862 MHz
Rejection OB /SAT	>24dB	>24dB	>24dB
Rejection SAT / OB	>45dB	>45dB	>45dB
OB Isolation port to port	>24dB (1)	>24dB (1)	>24dB (1)
Open Broadcast loss	Passive -10dB typically	Passive -14dB typically	Passive -16dB typically

Notes:

(1) Worse case isolation over operating band on or between any combinations of outputs as applicable

(2) Minimum output level in 32 MHz BW is to be 58dBµV (using digital service rating)

(3) Maximum output level in 32 MHz BW is to be 85dBµV (using digital service rating)

(4) Higher gain can be submitted for consideration

All products must be in compliance with AS/NZS1367

Table 19 – Standalone Multi Switch 14/18 Volt Satellite, plus OB Active

Subscriber Connections	4 Ports	6 Ports	8 Ports	12 Ports	16 Ports
Inputs	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical	Horizontal / Vertical
Frequency Range	950-2050 MHz	950-2050 MHz	950-2050 MHz	950-2050 MHz	950-2050 MHz
Tap GAIN mid band 1.5GHz (4)	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +2dB
Gain slope (pre-tilt) across band	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +4dB	+0 to +4dB
Isolation Horizontal / Vertical	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)
Isolation Port To Port	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)
Operation Horizontal	15.5 to 20 V	15.5 to 20 V	15.5 to 20 V	15.5 to 20 V	15.5 to 20 V
Operation Vertical	11.5 to 14.5 V	11.5 to 14.5 V	11.5 to 14.5 V	11.5 to 14.5 V	11.5 to 14.5 V
Control switch window	14.5 to 15.5 V	14.5 to 15.5 V	14.5 to 15.5 V	14.5 to 15.5 V	14.5 to 15.5 V
Current Capacity min	400mA	400mA	400mA	400mA	400mA
Current Drain Per Subscriber 13V to 18V	<110 mA	<110 mA	<110 mA	<110 mA	<110 mA
Supply Voltage for SAT sections	Via STU	Via STU	Via STU	Via STU	Via STU
Supply Voltage for OB section	External supply obligatory	External supply obligatory	External supply obligatory	External supply obligatory	External supply obligatory
Return Loss Input	>10 dB	>10 dB	>10 dB	>10 dB	>10 dB
Return Loss Output	>10 dB	>10 dB	>10 dB	>10 dB	>10 dB
Minimum Output Level in 36 MHz	58dBµV (2)	58dBµV (2)	58dBµV (2)	58dBµV (2)	58dBµV (2)
Maximum Output Level in 36 MHz	85dBµV (3)	85dBµV (3)	85dBµV (3)	85dBµV (3)	85dBµV (3)
Maximum compression (4) at Maximum or Minimum operating level	<0.5dB	<0.5dB	<0.5dB	<0.5dB	<0.5dB
Open Broadcast Freq Range	5-862 MHz	5-862 MHz	5-862 MHz	5-862 MHz	5-862 MHz
Rejection OB /SAT	>24dB	>24dB	>24dB	>24dB	>24dB
Rejection SAT / OB	>45dB	>45dB	>45dB	>45dB	>45dB

Subscriber Connections	4 Ports	6 Ports	8 Ports	12 Ports	16 Ports
OB Isolation port to port	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)	>24dB (1)
Open Broadcast loss	Active +4dB typically	Active +4-8dB typically	Active +4-8dB typically	Active +6-12dB typically	Active +4-12dB typically
OB gain slope	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +2dB	+0 to +2dB

Notes:

(1) Worse case isolation over operating band on or between any combinations of outputs as applicable

(2) Minimum output level in 32 MHz BW is to be 58dBuV (using digital service rating)

(3) Maximum output level in 32 MHz BW is to be 85dBuV (using digital service rating)

(4) Higher gain can be submitted for consideration

All products must be in compliance with AS/NZS1367

C.2.1. Amplifier Maximum Output Test Method

An alternative method for the measurement of the maximum level or more correctly channel power of a service in a group of services, may be specified a measurement that is based upon a specified level of IM's when the active device is provided with an input of wideband Gaussian noise. This is called Digital Service Rating.

C.2.1.1. Digital Service Rating

The level of IM's may be measured by the use of an amplitude notch in the noise spectrum that has depth greater than the IM's that are being measured. For the Terrestrial Band, a FM Band II trap is typically sufficient for this test. For the Satellite IF Band, a BNC "T" piece with a BNC male barrel on the stub of the T piece on the output of the noise generator, will typically provide a -35dB depth notch around 1.3GHz. The channel power is measured at a maximum (average of any ripple) in the spectrum at a specified bandwidth.

The recommended IM level rating for the Terrestrial Band is –30dB and for the Satellite IF Band –25dB IM is appropriate. –25dB IM is approximately equivalent to 1dB compression.

The recommended level measurement bandwidth is 7 MHz for DVB-T applications and 32 MHz for the Satellite IF Band. Other bandwidth can me be calculated from these base measurement bandwidths.

This wideband noise method for the rating of the level handling capacity of active devices will provide a very practical guide in systems that are intended to carry Digital services. The full bandwidth wideband noise will inherently provide a margin to allow the ability to handle a maximum number of channels in the useable spectrum.

The method allows the measurement to be conducted both in a testing laboratory and in the field with readily available and economical test equipment.

During system commissioning the method should be used to adjust the gains in the system with the noise input equal to the maximum transponder and / or DVB-T and / or DVB-C service. This method will substantially cater for increased loading of the Bands.

Appendix D. Reference Standards

Table 20 – Australian Standards

Number	Title	Published
AS/NZS 1367:2000	Coaxial cable systems for the distribution of analogue television and sound signals in single and multiple unit installations.	5-Jan-00
AS/NZS 3000:2000	Electrical installations (known as the Australian and New Zealand Wiring Rules)	15-Sep-99
AS/ACIF S008 - 2001	Requirements for authorised cabling products	24-Dec-01
AS/ACIF S009 - 2001	Installation requirements for Customer Cabling (Wiring Rules)	
Communications Cabling Handbook SAA HB29 2000	Segregation distances of cables refer to	
AS 1170.1-1989: Part 1	Loading Code AS 1170.1-1989: Part 1 – Dead and live loads and load combinations	
AS 1170.2-1989: Part 2	Loading Code AS 1170.2-1989: Part 2 – Wind Loads	
AS 1199.1-2003	Sampling Procedures for inspection by attributes – Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	28-Jul-2003
AS 1720.1-1997: Part 1	Timber Structures AS 1720.1-1997: Part 1 – Design Methods	
AS 3700-1998	Masonry Structures AS 3700-1998	
AS 3815 - 1998	A Guide to Coaxial Cabling in Single and Multiple Premises	5-Apr-98
AS 4055-1992	Wind Loads for Housing AS 4055-1992	
AS 4100-1998	Steel Structures AS 4100-1998	

Note: FOXTEL specifications are to be used if they are higher than the referenced standards.

Appendix E. Installer Product List

The latest Installer Product List (IPL) is available on the FOXTEL website (http://www.foxtel.com.au/support/developers-contractors/installation-aids/default.htm).

The IPL is updated on a regular basis, therefore the website should be checked on a regular basis to ensure the most up-to-date list is being used.

