

## **Guidelines for Upgrading the In-building Coaxial Cable Distribution System for Reception of Digital Terrestrial Television**

### **Purpose**

This guideline provides information to property owners, building managers and other concerned parties including technical personnel in the planning and upgrading of the In-building Coaxial Cable Distribution Systems (“IBCCDS”) for the reception and distribution of analogue and digital terrestrial television (“DTT”) signals.

### **Implementation Programme of DTT**

2. On 4 June 2007, the Telecommunications Authority issued a statement announcing his decision to adopt the national DTT standard “GB20600-2006” as the transmission standard for DTT broadcasting in Hong Kong. The two free-to-air television broadcasters, Asia Television Limited (“ATV”) and Television Broadcasts Limited (“TVB”), would provide DTT coverage to different parts of Hong Kong by a number of transmitting stations in phases.

3. In the initial phase, ATV and TVB would start DTT broadcasting at Temple Hill transmitting station by end 2007. In 2008, another five transmitting stations would also be brought into service. The locations and targeted coverage areas of these transmitting stations are shown in the attached Table 1 and Map 1.

### **The Need to Upgrade IBCCDS**

4. In order to provide DTT service to the public, additional frequency channels (also known as “multiplexes”) would be assigned to ATV and TVB. These multiplexes would be deployed at the above mentioned six principal transmitting stations as shown in Table 2. These multiplexes would be used to provide the current four free-to-air television programmes in digital format as well as new free-to-air television programmes.

5. The current four free-to-air television programmes will continue to be broadcast in analogue format. Subject to further market and technical studies, the Government aims at switching off analogue television broadcast in 2012 (“digital switchover”). Before the digital switchover, ATV and TVB will transmit the four existing television programmes in both the analogue and digital formats (“simulcast”). Since existing IBCCDS are designed and installed for the

purpose of distributing the four analogue television programmes and would continue to be used for such purpose, additional equipment are therefore required in the IBCCDS for the reception of the DTT programmes carried in the new multiplexes. To enable the occupants in the premises to continue to receive the analogue TV programmes during the simulcast, the upgraded IBCCDS should be able to handle both analogue television and DTT signals.

### **Upgrading the IBCCDS**

6. An IBCCDS comprises aerial, head-end equipment and co-axial cable network. It is installed primarily for the reception and distribution of free-to-air terrestrial television and FM radio broadcast. In some buildings, it is also used to distribute cable television, satellite television, closed circuit television (“CCTV”) and Internet Protocol telecommunications services. The following paragraphs explain the details on how the various components of the IBCCDS should be upgraded for the reception of both the analogue and digital terrestrial television.

### **Upgrading of Aerial**

7. In Hong Kong, frequency spectrum 470 MHz – 806 MHz is allocated mainly for broadcasting services. The channel number and the corresponding frequency ranges of these channels are shown in Table 3. Aerials for television reception are normally designed to operate over the frequency band from channel 21 to channel 62. These receiving aerials, if in a good state of conditions, may continue to be used for receiving DTT. No upgrading of these aerials is necessary.

8. In some buildings, a pre-amplifier may be incorporated as part of the aerial system. If a pre-amplifier is installed, it is recommended to check and ensure that the operating range of the pre-amplifier would be capable of operating at the frequencies of the new DTT multiplexes.

### **Upgrading of Head-end Equipment**

9. Depending on the needs and number of outlets of individual buildings, different types of head-end equipment are employed. For example, a dedicated amplifier is normally installed for receiving each frequency channel in buildings with large number of outlets whereas a single wideband amplifier is installed for receiving all frequency channels in buildings with smaller number of outlets. For head-end equipment in Hong Kong, there are three common configurations:

- wideband amplifier head-end;

- channel filter head-end; and
- channel amplifier head-end.

### **Wideband Amplifier Head-end Upgrade**

10. The typical configuration of wideband amplifier head-end is shown in Figure 1. The operating frequency range and signal gain of wideband amplifier head-end would normally cater for the additional DTT frequency channels. If clear DTT pictures are received, no upgrading work to the wideband amplifier head-end is necessary. However, if the wideband amplifier is already operating at its maximum gain, the additional DTT frequency channels might overload the wideband amplifier head-end. Under this circumstance, the wideband amplifier would need to be replaced by one with sufficient gain.

### **Channel Filter Head-end Upgrade**

11. The typical configuration of a channel filter head-end is shown in Figure 2. This type of head-end could be upgraded by adding a filter or an equaliser of the appropriate frequency range. The pre-requisite requirement is that the digital multiplexes to be received are not adjacent to any of the existing analogue multiplexes. If the DTT and the analogue signals in the IBCCDS are adjacent to each other, the following solutions can be considered:

- use cluster filter; or
- change the channel filter head-end to the channel amplifier head-end.

### **Channel Amplifier Head-end Upgrade**

12. The typical configuration of channel amplifier head-end is shown in Figure 3. This type of head-end offers the best quality of service than the other types. The head-end equipment could be upgraded to carry the digital multiplexes by inserting additional channel amplifiers or processors of the appropriate frequency range.

13. If the analogue and digital signals are adjacent to each other, the following technical solutions are recommended in order to avoid any potential adjacent channel interference:

- use channel amplifiers specially designed for adjacent channel operation;  
or
- use channel converters or processors to change the channel frequency.

## Co-axial Cable Network Upgrade

14. The co-axial cable networks are typically tree-and-branch networks equipped with splitters and line amplifiers. In order to avoid interference among the analogue and digital signals, the line amplifiers should be adjusted so that the television signal levels at the outlets will meet the following limits:

**(a) Level Difference Between Digital Multiplexes**

The maximum level difference between any two adjacent digital multiplexes shall be 3 dB.

**(b) Level Difference Between Television Signals**

The signal level of a digital multiplex shall be at least 5 dB lower than that of a wanted adjacent analogue television signal.

**(c) Operating Range**

Subject to the above conditions, the recommended range of signal levels for analogue television channels and DTT multiplexes are shown below:

	<b>Minimum</b>	<b>Maximum</b>
Analogue television channels	+57dB $\mu$ V	+80dB $\mu$ V
Digital multiplexes	+50dB $\mu$ V	+74dB $\mu$ V

## **Enquiries**

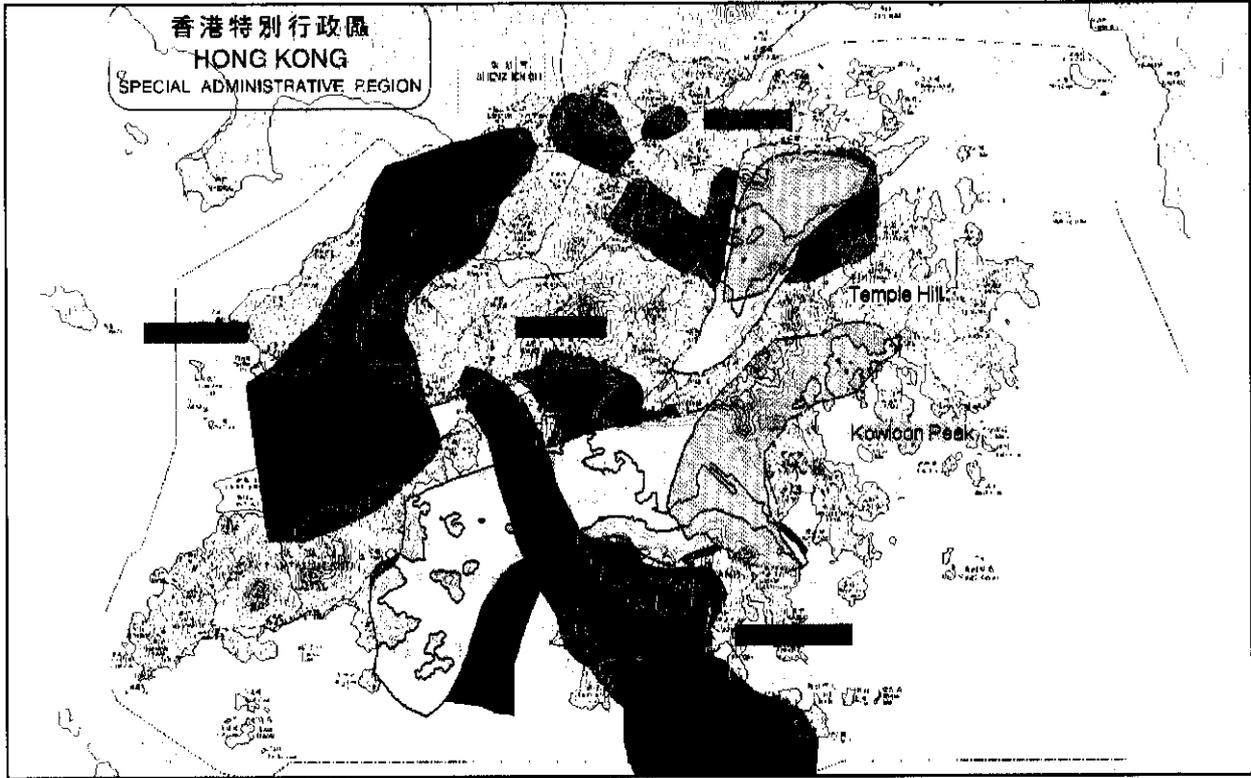
15. Any enquiries concerning this guideline may be directed to:

Senior Telecommunications Engineer (Advisory & Support 2)  
Office of the Telecommunications Authority  
29/F., Wu Chung House,  
213 Queen's Road East,  
Wan Chai, Hong Kong.  
Telephone: 2961 6738  
Facsimile: 2803 5113

**Office of the Telecommunications Authority**  
30 July 2007

Map 1

Map showing DTT Coverage by end 2008



**Table 1**

**DTT Targeted Coverage Areas by end 2008**

<b>Transmitting Station</b>	<b>Ready Date</b>	<b>Targeted Coverage Areas</b>
Temple Hill	2007	<ul style="list-style-type: none"><li>• Northern part of Hong Kong Island</li><li>• Kowloon Peninsula</li><li>• Shatin</li><li>• Eastern part of Lantau Island</li></ul>
Castle Peak	2008	<ul style="list-style-type: none"><li>• Tuen Mun</li><li>• Yuen Long</li><li>• Northern part of Lantau Island</li></ul>
Cloudy Hill	2008	<ul style="list-style-type: none"><li>• Northern part of New Territories (including Tai Po, Fanling and Sheung Shui)</li></ul>
Kowloon Peak	2008	<ul style="list-style-type: none"><li>• Tseung Kwan O</li><li>• Sai Kung</li><li>• Eastern part of Hong Kong Island</li></ul>
Lamma Island	2008	<ul style="list-style-type: none"><li>• Southern part of Hong Kong Island</li></ul>
Golden Hill	2008	<ul style="list-style-type: none"><li>• Kwai Chung</li><li>• Tseun Wan</li></ul>

For more information, please refer to the targeted coverage areas of the above transmitting stations indicated on the map at Map 1.

**Table 2**

**Deployment of DTT Multiplexes**

<b>Transmitting Stations</b>	<b>Planned DTT Multiplexes (given in channel number)</b>
Temple Hill	22, 35, 37
Castle Peak	43, 35, 37
Cloudy Hill	30, 35, 37
Kowloon Peak	32, 35, 37
Lamma Island	30, 35, 37
Golden Hill	40, 35, 37

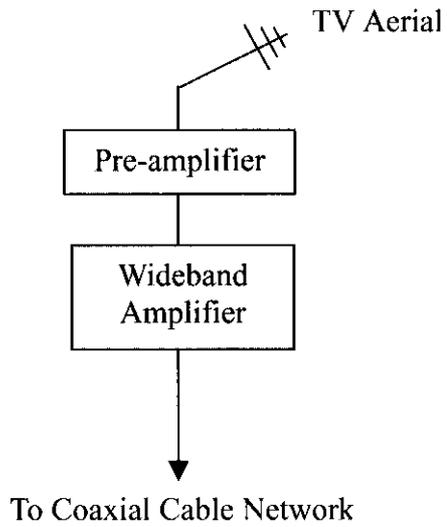
The frequency ranges of these multiplexes could be found in Table 3.

**Table 3**

**Channel Number and Frequency Ranges for Television Broadcasting**

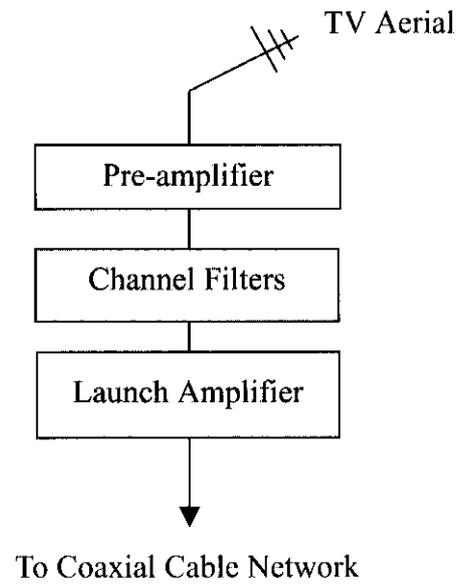
<b>Channel Number</b>	<b>Frequency (MHz)</b>
21	470 - 478
22	478 - 486
23	486 - 494
24	494 - 502
25	502 - 510
26	510 - 518
27	518 - 526
28	526 - 534
29	534 - 542
30	542 - 550
31	550 - 558
32	558 - 566
33	566 - 574
34	574 - 582
35	582 - 590
36	590 - 598
37	598 - 606
38	606 - 614
39	614 - 622
40	622 - 630
41	630 - 638
42	638 - 646
43	646 - 654
44	654 - 662
45	662 - 670
46	670 - 678
47	678 - 686
48	686 - 694
49	694 - 702
50	702 - 710
51	710 - 718
52	718 - 726
53	726 - 734
54	734 - 742
55	742 - 750
56	750 - 758
57	758 - 766
58	766 - 774
59	774 - 782
60	782 - 790
61	790 - 798
62	798 - 806

**Fig. 1**



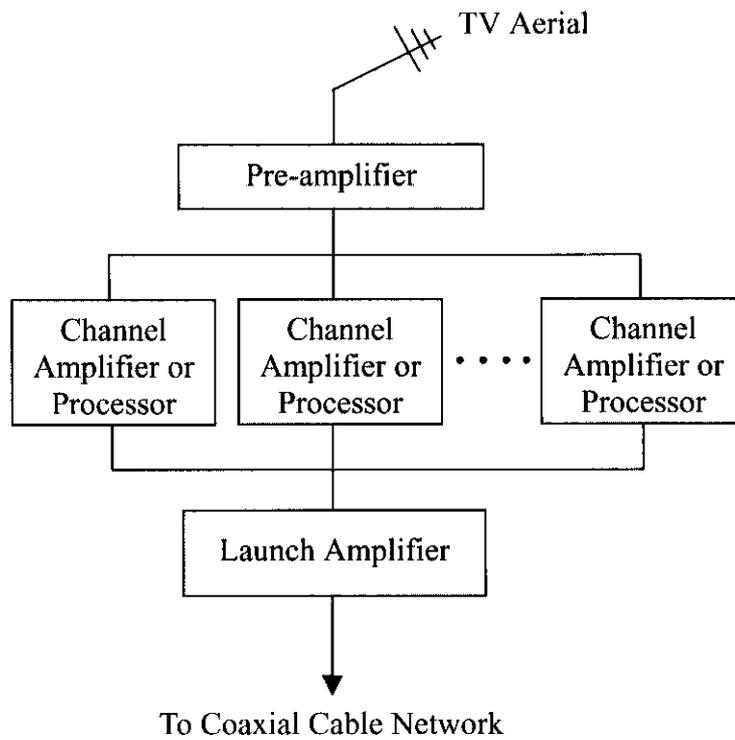
**Wideband Amplifier Head-end**

**Fig. 2**



**Channel Filter Head-end**

**Fig. 3**



**Channel Amplifier Head-end**

HKTA 1104  
ISSUE 5  
July 2007

**PERFORMANCE REQUIREMENTS**  
**FOR**  
**IN-BUILDING COAXIAL CABLE DISTRIBUTION SYSTEM**  
**(IBCCDS)**



**TELECOMMUNICATIONS AUTHORITY**  
**HONG KONG**

## **FOREWORD**

1. This specification sets out the performance requirements for the In-Building Coaxial Cable Distribution System (IBCCDS) which refers to the coaxial cable systems in buildings for the distribution and relaying of signals for telecommunications, broadcasting and security services. The IBCCDS may include Communal Aerial Broadcast Distribution (CABD) Systems, Satellite Master Antenna Television (SMATV) Systems, Closed Circuit Television (CCTV) Systems, Cable Television (CTV) Systems or any combination of these systems.
2. The Telecommunications Authority (TA) issued the TA Statement on 15 July 1999 on the Frequency Layout Plan of In-Building Coaxial Cable Distribution Systems. The TA Statement specifies a number of technical requirements of IBCCDS. The Statement may be downloaded in the web site of the Office of the Telecommunications Authority (OFTA) at <http://www.ofa.gov.hk>.
3. The technical requirements prescribed in this specification are applicable to the IBCCDS installed in Hong Kong for distributing and relaying broadcasting and telecommunications signals. For the IBCCDS which are required to be upgraded in accordance with the TA Statement, they should comply with all the relevant requirements set out in this specification.
4. The TA reserves the right to revise the contents of this specification without prior notice. Amendments or re-issues of this specification may not be distributed automatically to the parties concerned and it will be the responsibility of the parties concerned to ensure that their systems/equipment conform to the latest requirements.
5. In case of any doubt about the interpretation of this specification and the methods of carrying out the tests, the decision of the TA shall be final.
6. The HKTA series specifications are issued by the TA. The documents can be downloaded direct through the OFTA's Interent Home Page at <http://www.ofa.gov.hk>.
7. The publications from the European Committee for Electrotechnical Standardisation (CENELEC) can be obtained from

European Committee for Electrotechnical Standardization  
35, rue de Stassartstraat  
B-1050 Brussels  
Belgium  
Tel: +32 2 519 68 71  
Fax: +32 2 519 69 19

8. The publications from the Electronic Industries Alliance / Telecommunications Industry Association (EIA/TIA) can be obtained from

Telecommunications Industry Association  
2500 Wilson Blvd., Suite 300  
Arlington, VA 22201-3834  
USA

Tel: +1 703 907 7700

Fax: +1 703 907 7727

9. The publications from the International Electrotechnical Commission (IEC) can be obtained from

International Electrotechnical Commission (IEC)  
3, rue de Varembe  
P.O. Box 131  
CH-1211 Geneva 20  
Switzerland

Tel: +41 22 919 02 11

Fax: +41 22 919 03 00

10. If further information is required, please contact:

Senior Telecommunications Engineer (Advisory and Support 2)  
Office of the Telecommunications Authority  
29/F, Wu Chung House,  
213 Queen's Road East,  
Wanchai,  
Hong Kong.

Tel: +852 2961 6738

Fax: +852 2803 5113

## **CONTENTS**

1. GENERAL
2. CHANNEL PLAN AND FREQUENCY ALLOCATION
3. PERFORMANCE REQUIREMENTS FOR DISTRIBUTING ANALOGUE TELEVISION AND SOUND SIGNALS IN THE IBCCDS
4. PERFORMANCE REQUIREMENTS FOR DISTRIBUTING DIGITAL TELEVISION SIGNALS IN THE IBCCDS
5. PERFORMANCE REQUIREMENTS FOR RELAYING SIGNALS FOR TELECOMMUNICATIONS SERVICES BY THE IBCCDS
6. PREVENTION OF INTERFERENCE
7. SAFETY REQUIREMENTS

## **1. GENERAL**

- 1.1 The In-Building Coaxial Cable Distribution System (IBCCDS) refers to the coaxial cable systems installed inside buildings for distributing and relaying signals for telecommunications, broadcasting and security services to a number of users. The IBCCDS may include Communal Aerial Broadcast Distribution (CABD) System, Satellite Master Antenna Television (SMATV) System, Closed Circuit Television (CCTV) System, Cable Television (CTV) System or any combination of these systems.
- 1.2 The provisions of the latest edition of **IEC 60728-1** "Cabled Distribution Systems for Television and Sound Signals - Part 1: Methods of Measurement and System Performance" published by International Electrotechnical Commission (IEC) will apply for those measurement methods not specifically given in this document.

## **2. CHANNEL PLAN AND FREQUENCY ALLOCATION**

### **2.1 Channel Plan**

- 2.1.1 The following frequency bands within the IBCCDS shall be allocated for distributing or relaying television and telecommunication services:
- (a) 5 MHz to 50 MHz for upstream signals;
  - (b) 50 MHz to 53.275 MHz as the guard band to separate the upstream and downstream signals; and
  - (c) 53.275 MHz to 862 MHz for downstream signals.
- 2.1.2 The frequency band intended for downstream signals shall be segmented primarily into 8 MHz channels.
- 2.1.3 The IBCCDS shall at all times be operated and maintained in such a manner that signals in the IBCCDS do not interfere with each other.

### **2.2 Frequency Allocation**

- 2.2.1 The frequency channels within the IBCCDS shall be allocated in accordance with the plans given in the latest edition of HKTA 1105. The plans will be updated and published by the TA from time to time to reflect the latest changes to the frequency allocation in the IBCCDS.
- 2.2.2 Some of the vacant frequency bands in 54 - 470 MHz with bandwidths less than 8 MHz will be allocated to downstream signals for digital telecommunication and digital television services.

## **3. PERFORMANCE REQUIREMENTS FOR DISTRIBUTING ANALOGUE TELEVISION AND SOUND SIGNALS IN THE IBCCDS**

- 3.1 For distributing Phase Alternation Line (PAL) television and sound signals, the signals and the IBCCDS shall meet all the relevant technical requirements stipulated in the latest edition of: -

**EN 50083-7**, "Cabled Distribution Systems for Television and Sound Signals, Part 7: System Performance", published by the European Committee for Electrotechnical Standardization (CENELEC)

- 3.2 For distributing National Television Systems Committee (NTSC) television and sound signals, the signals and the IBCCDS shall meet the following requirements:-
- (a) all the relevant technical requirements stipulated in the latest edition of **EIA/TIA-250-C**, "Electrical Performance for Television Transmission Systems", published by the Electronics Industries Alliance / Telecommunications Industry Association (EIA/TIA); and
  - (b) the signals shall be carried within an 8 MHz channel as shown in the latest edition of HKTA 1105 and shall have the vision carriers be positioned in agreement with HKTA 1105.
- 3.3 For the distribution of other analogue television signals, it shall meet the relevant technical performance standards and it shall not affect or cause interference to other signals and services in the IBCCDS. The spacing of the vision carriers shall be 8 MHz and shall be aligned with the other television signals of 8 MHz channel bandwidth. The wanted and unwanted signal levels and the spurious emissions outside the 8 MHz channel bandwidth shall be controlled such that other signals and services being distributed or relayed in the IBCCDS will not be affected.

#### **4. PERFORMANCE REQUIREMENTS FOR DISTRIBUTING DIGITAL TELEVISION SIGNALS IN THE IBCCDS**

- 4.1 The distribution of digital television signals shall not affect or interfere with other services in the IBCCDS. The wanted and unwanted signal levels and the spurious emissions outside the 8 MHz channel bandwidth shall be controlled such that other signals and services being distributed in the IBCCDS will not be affected.
- 4.2 For distributing digital terrestrial television broadcast signals, the signals and IBCCDS shall meet the following technical requirements:-

##### 4.2.1 Impedance

The nominal impedance of the system including all coaxial feeder cables and system outlets shall be 75 Ω.

##### 4.2.2 Signal level

At any system outlet, the carrier level in the digital terrestrial television signals shall be:

Frequency range (MHz)	Minimum signal level (dBμV)	Maximum signal level (dBμV)
470 – 862	50	74

##### 4.2.3 Minimum carrier-to-noise ratio

The carrier-to-noise ratio at any system outlet shall be equal to or greater than 34 dB, with the test signal applied to the system input at a level equal to that normally available at that point. The carrier-to-noise ratio is the ratio of the total power of the channel carrying the digital modulated signal to the total power of the noise in the same channel and measured using the nominal bandwidth of 7.56 MHz.

#### 4.2.4 Bit error rate

The bit error rate (BER) of the signal after error correction shall be better than  $3 \times 10^{-6}$ .

#### 4.2.5 Modulation error ratio

The modulation error ratio (MER) shall be not less than 30 dB.

#### 4.2.6 Level difference between adjacent channels

4.2.6.1 The maximum level difference at any system outlet between any two distributed digital terrestrial television broadcast channels shall be 3 dB.

4.2.6.2 The signal level of a distributed digital terrestrial television broadcast channel shall be at least 5 dB lower than that of a wanted adjacent analogue television channel.

#### 4.2.7 Mutual isolation between system outlets

The mutual isolation between outlets connected separately to a spur feeder shall be equal to or greater than 33 dB.

### **5. PERFORMANCE REQUIREMENTS FOR RELAYING SIGNALS FOR TELECOMMUNICATIONS SERVICES BY THE IBCCDS**

5.1 All the telecommunications signals and services to be conveyed in the IBCCDS shall occupy a bandwidth of 8 MHz or less and adopt the frequency allocation and channel plan as shown in the latest edition of HKTA 1105.

5.2 The transport of signals for telecommunications services shall not affect or cause interference to other services in the IBCCDS. The wanted and unwanted signal levels and the spurious emissions outside the 8 MHz channel bandwidth shall be controlled at such a level that other signals and services being distributed or relayed in the IBCCDS will not be affected.

### **6. PREVENTION OF INTERFERENCE**

6.1 The IBCCDS shall at all times be operated and maintained in such a manner that it does not cause interference with any other authorized telecommunications services including the reception of off-air broadcast sound and television signals.

#### 6.2 Radiation leakage from IBCCDS

The level of radiation emitted from the IBCCDS shall not exceed the limits as specified in the latest edition of HKTA 1102.

#### 6.3 Immunity to ingress noise

The immunity of IBCCDS shall be properly designed such that the performance of the distributed television or telecommunication services is not affected. A list of the maximum permissible effective radiated power of authorized radiocommunication services in Hong Kong and in the neighbouring territories is given in the latest edition of HKTA 1105.

#### 6.4 Out-of-channel components within IBCCDS

The out-of-band signal generated or emitted from a system in a IBCCDS channel shall not degrade the lowest carrier-to-single-frequency-interference ratio of any other system in the same IBCCDS to less than:

- 57 dB if the other system is a television channel of Amplitude Modulation (AM) signals;
- 35 dB if the other system is a Digital Video Broadcasting (DVB) television channel of 64-Quadrature Amplitude Modulation (64-QAM) signals; and
- 13 dB if the other system is a Digital Video Broadcasting (DVB) television channel of Quaternary Phase Shift Keying (QPSK) signals.

### 7. SAFETY REQUIREMENTS

Equipment or apparatus comprising the IBCCDS shall comply with the latest editions of the following specifications and regulation:-

- (a) **IEC 60950-1**, “Information technology equipment – Safety – Part 1: General requirements” issued by International Electrotechnical Commission (IEC)

or

**EN 60950-1**, “Information technology equipment – Safety – Part 1: General requirements” issued by European Committee for Electrotechnical Standardization (CENELEC)

or

**UL 60950-1**, “Information technology equipment – Safety – Part 1: General requirements” issued by Underwriters’ Laboratories, Inc

and

- (b) **EN 60065**, “Audio, video and similar electronic apparatus – Safety requirements”, published by CENELEC

and

- (c) Electrical Products (Safety) Regulation of the Electricity Ordinance (Cap. 406), Hong Kong Law