



Telecommunications  
Standards Advisory  
Committee (TSAC)

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Next Generation  
National Broadband  
Network (NGNBN)

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Coaxial Cable Home  
Networking

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**IDA TS CCHN**  
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Infocomm Development Authority of Singapore  
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IDA TS CCHN Issue 1, XXX 2013	Technical Specification for Coaxial Cable Home Networking (CCHN)
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## **PART A INTRODUCTION**

### **1 SCOPE**

- 1.1 This specification describes the use of in-premises coaxial cabling for high speed data networking within the home. The Specification defines the minimum technical requirements for the connection of Home Networking Transceivers (HNT) over the in-premises coaxial cabling.
- 1.2 The use of the coaxial cable home networking must not interfere with the licensed TV or broadband access services carried in the same medium.

### **2 GENERAL REQUIREMENTS**

#### **2.1 Power Supply**

The HNT may be a.c. or d.c. powered. For an a.c. powered equipment, the Specification shall be complied with when operating from an a.c. mains supply of voltage,  $230V \pm 10\%$  and frequency,  $50 \text{ Hz} \pm 2\%$ . Where external power supply is used, e.g. AC adaptor, it shall not affect the capability of the equipment to meet the Specification.

#### **2.2 Identification of Equipment**

The HNT equipment shall be marked with the supplier or manufacturer's name or identification mark, and the supplier or manufacturer's model or type reference. The marking required shall be legible, indelible and readily visible.

### **3 SAFETY REQUIREMENTS**

The HNT equipment shall be tested for compliance with the International Electrotechnical Commission IEC 60950-1 [1] safety standard<sup>1</sup>. The requirements in IEC 60950-1 that are applicable to the equipment (e.g. class of equipment, type of TNV circuit and types of components) shall be identified and complied with.

### **4 ELECTROMAGNETIC COMPATIBILITY (EMC) REQUIREMENTS**

The HNT equipment shall comply with the EMC requirements defined in IEC CISPR 22 [2].

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<sup>1</sup> The safety standard includes, among others, protection of telecommunications network service personnel and users of other equipment connected to the network from hazards in the HNT.

## 5 REFERENCES

- [1] IEC 60950-1(2005-12), International Electrotechnical Commission – Safety of Information Technology Equipment
- [2] IEC CISPR 22 (2008), Information Technology Equipment - Radio disturbance characteristics – Limits and methods of measurement
- [3] ITU-T Rec G.9954 (01/2007), Home Networking Transceivers – Enhanced Physical, Media Access, and Link Layer Specifications
- [4] COPIF 2008 (09/2008), Code of Practice for Info-communications Facilities in Buildings



**6 ABBREVIATIONS**

DOCSIS	Data over Cable Services Interface Specifications
HNT	Home Networking Transceivers
IF	Isolation Filter
IFG	Inter-Frame Gap
LLC	Link Layer Control
MAC	Media Access Control
MII	Media Independent Interface
PSD	Power Spectral Density
RG	Residential Gateway
WAN	Wide Area Network

## PART B HOME NETWORKING TRANSCEIVERS (based on ITU-T Rec. G.9954 01/2007 [3])

### 1 SYSTEM REFERENCE MODEL FOR COAXIAL CABLE HOME NETWORKING TRANSCEIVERS

1.1 Figure 1-1 shows the basic reference model for in-premises coaxial cable home networking transceivers (HNT). The interface of concern in this Specification is the wire-side electrical and logical interface (W1) between a HNT station and the coaxial cable.

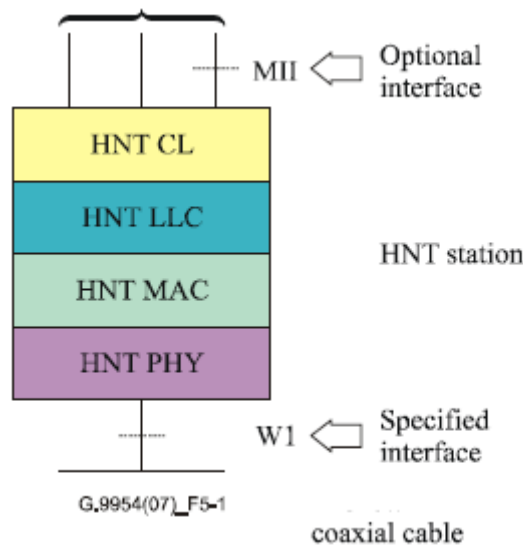


Figure 1-1 (Figure 5-1/G.9954): **Basic Reference Model**

1.2 The HNT system implements a *shared medium* single-segment network, as shown in Figure 1-2 (Figure 5-3/G.9954) below. All stations on a segment are logically connected to the same shared channel on the coaxial cable.

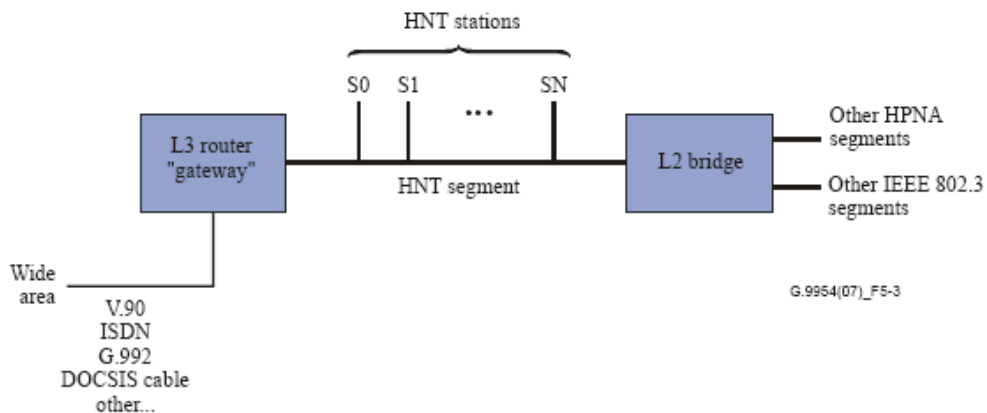


Figure 1-2 (figure 5-3/G.9954): **HNT shared medium network segment on the coaxial cable**

- 1.3 Figure 1-3 below shows an example of the home network using Coaxial Cable Home Networking, where a variety of types of network devices (e.g. IP Set-top Boxes) are connected via the coaxial cables in the home, to a Internet Gateway Device (RG) and possible bridges to other home network segments, possibly based on other home networking technologies (e.g. wireless, power-line).

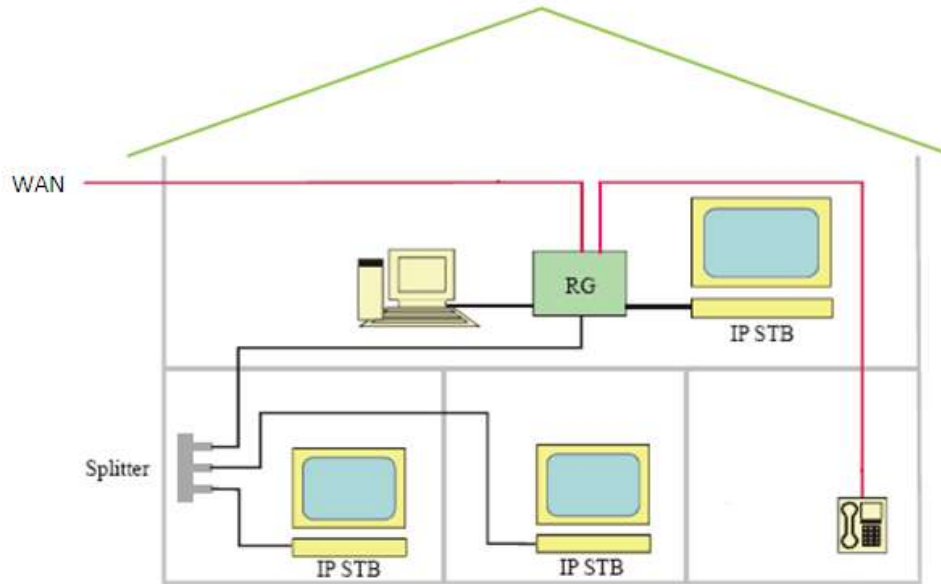


Figure 1-3 (modified from Figure 5-4/G.9954): **Home network using the coaxial cable**

- 1.4 An Isolation Filter (IF) shall be implemented, where the in-premise coaxial cable network is not physically disconnected from the coaxial cable access network, to prevent interference between HNT devices operating on in-premises cabling with the licensed TV or broadband access services carried in the same medium.
- 1.5 The IF shall be installed at the distribution point, i.e. before the coaxial cable splitter point where the main cable is split into the different room points.
- 1.6 The IF serves two functions: to ensure network separation between neighbours and to isolate the coaxial cable home networking from the coaxial cable broadband access network.
- 1.7 The IF shall provide a minimum of 40dB isolation and shall allow the licensed TV or broadcast access services carried in the same medium to pass through to the home network and isolate the Sub-Mode F frequency spectrum from 52 - 68 MHz.

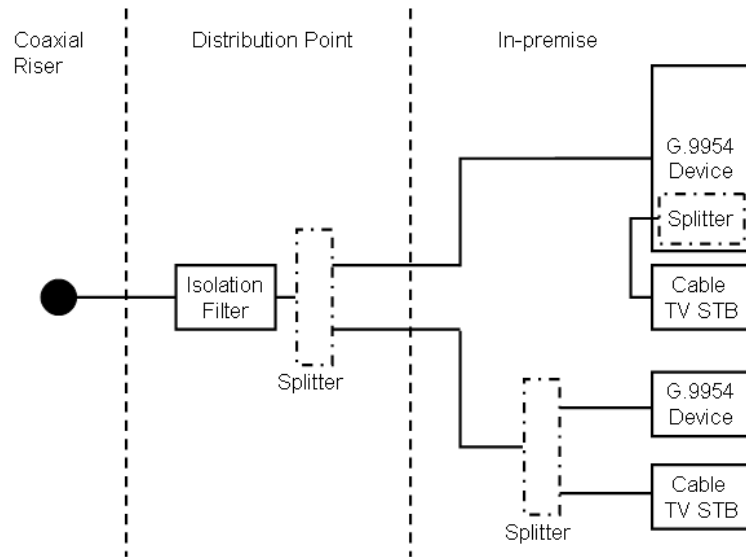


Figure 1-4a: Isolation Filter

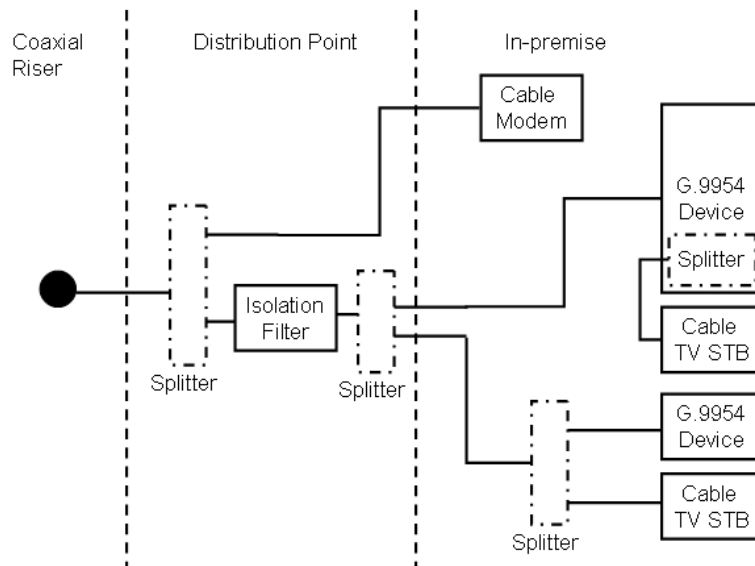


Figure 1-4b: Isolation Filter (with Co-existence of DOCSIS)

- 1.8 The technical performance requirements of the broadband coaxial cable system as defined in COPIF 2008 [4] Chapter 13 Section 2 shall be complied with after the introduction of the IF.

## 2 FREQUENCY AND POWER SPECTRAL DENSITY

### 2.1 Frequency Spectrum

The HNT shall operate in the Sub-mode F frequency spectrum from 52 to 68 MHz.

2.2 Isolation Filter Requirements

The IF shall be installed to (1) pass through broadcast FM and TV signals and cable TV signals; (2) provide isolation from Docsis network; and/or (3) isolate HNT from neighbours. The IF shall minimally fulfil the specifications as provided in Table 2-2 and Figure 2-2 below.

S/N	Specification (w.r.t. 75 Ohm Impedance), f (MHz)	Min Requirements
1	Attenuation	
	$f \leq 42\text{MHz}$	$\leq 1\text{dB}^2$
	$42\text{MHz} < f < 52\text{MHz}$	$\geq (1 + (f-42)*40/10)\text{dB}$
	$52\text{MHz} \leq f \leq 68\text{MHz}$	$\geq 41\text{dB}$
	$68\text{MHz} < f < 85\text{MHz}$	$\leq (41 - (f-68)*40/17)\text{dB}$
	$f \geq 85\text{MHz}$	$\leq 1\text{dB}$
2	Return Loss	
	$f \leq 42\text{MHz}$	$\geq 12\text{dB}$
	$42\text{MHz} < f < 52\text{MHz}$	$\leq (12 - (f-42)*11/10)\text{dB}$
	$52\text{MHz} \leq f \leq 68\text{MHz}$	$\leq 1\text{dB}$
	$68\text{MHz} < f < 85\text{MHz}$	$\geq (1 + (f-68)*11/17)\text{dB}$
	$f \geq 85\text{MHz}$	$\geq 12\text{dB}$
3	Ripple	$\leq 2\text{dB}$

Table 2-2: Isolation Filter (IF) Specifications

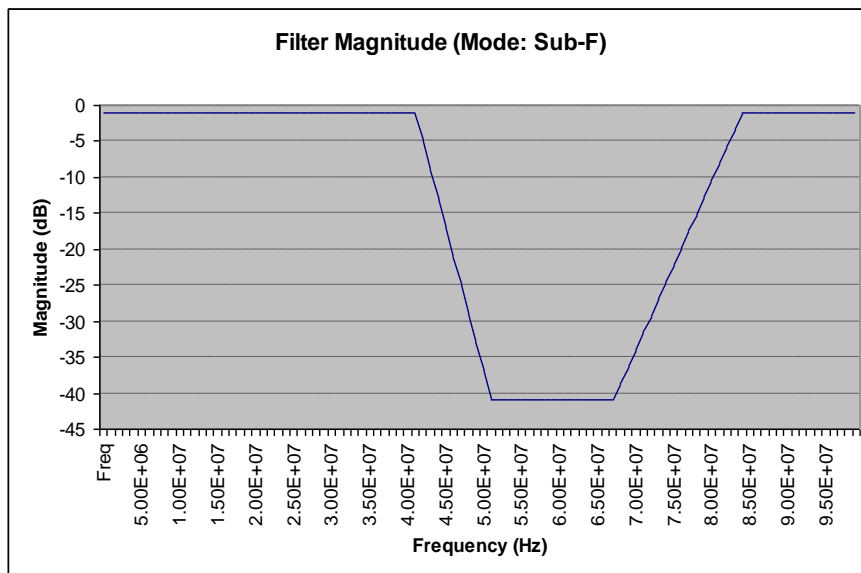


Figure 2-2: Isolation Filter for Sub-Mode F (52~68 MHz)

<sup>2</sup> The filter may exclude 0 - 5MHz for the purpose of lightning/surge protection, if desired.

2.3 Spectral Masks

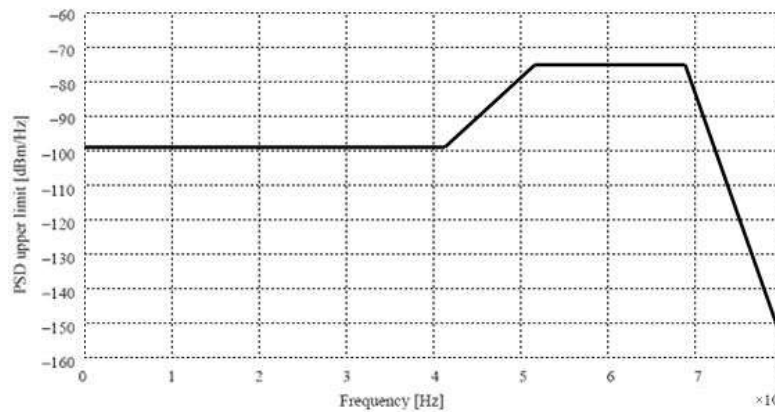


Figure 2-3: **Transmit PSD upper bound for sub-Spectral Mode F**

When transmitting in spectral sub-mode F, the resolution bandwidth used to make this measurement shall be 10 kHz for frequencies between 2.5 and 80.0 MHz, and 3 kHz for frequencies between 0.015 and 2.5 MHz. An averaging window of 213 seconds shall be used, and 1500-octet MTUs separated by an IFG duration of silence shall be assumed. A total of 50 kHz of possibly non-contiguous bands may exceed the limit line under 2.5 MHz, with no sub-band greater than 20 dB above the limit line. A total of 50 kHz of possibly non-contiguous bands may exceed the limit line between 80.0 and 100.0 MHz, with no sub-band greater than 20 dB above the limit line.

3 ELECTRICAL CHARACTERISTICS

3.1 Transmit Power

Stations shall transmit according to the transmit power limitations described in Table 3-1 (Table 7-7/G.9960), corresponding to the spectral mode they transmit. Transmit power shall be measured during the header, across a 75-ohm load between centre and ground, integrated from 0 to 100 MHz.

Spectral mode	Transmit power limit [dBm]
F	[-2 +1]

Table 3-1 (Table 7-7/G.9954): **Transmit Power Requirements**

3.2 Transmit Voltage

Stations that are not transmitting shall emit less than -85 dBVrms measured across a 75-ohm load between centre and ground.

4 RF Pass-through Port (Optional)

Where a secondary RF Pass-through Port is provided on the HNT device, the Pass through Port shall comply with the following specifications. The provision of the RF pass-through port is optional.

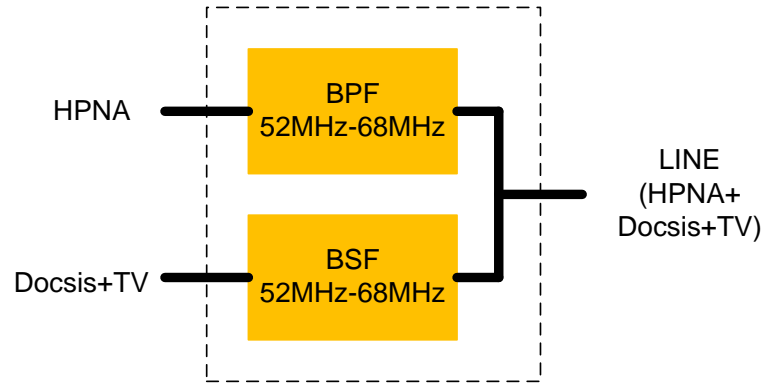


Figure 4: **Pass-through Port (Diplexer Structure)**

Port	Parameter	Frequency	Condition	Required Value
Line To HPNA	Insertion Loss	5MHz - 42MHz 52MHz – 68MHz 75MHz – 860MHz		<b>&gt;35dB</b> <b>&lt;4dB</b> <b>&gt;45dB</b>
	Return Loss (Reflection)	52MHz – 68MHz	Measured from Line to HPNA Port. HPNA Port should be 75Ω Terminated.	<b>&gt;15dB</b>
	Group Delay	52MHz – 68MHz		<b>&lt;100nSec</b>
Line To DOCSIS + TV	Insertion Loss	5MHz - 42MHz 52MHz – 68MHz 75MHz – 860MHz		<b>&lt;2dB</b> <b>&gt;45dB</b> <b>&lt;2dB</b>
	Return Loss (Reflection)	5MHz - 42MHz 75MHz – 860MHz	Measured from Line to DOCSIS/TV Port. DOCSIS/TV Port should be 75Ω Terminated.	<b>&gt;15dB</b> <b>&gt;15dB</b>
	Group Delay	5MHz - 42MHz 75MHz – 860MHz		<b>&lt;75nSec</b> <b>&lt;25nSec</b>
HPNA To DOCSIS + TV	Isolation	5MHz - 42MHz 75MHz – 860MHz		<b>&gt;40dB</b> <b>&gt;45dB</b>
DOCSIS + TV To HPNA	Isolation	52MHz – 68MHz		<b>&gt;45dB</b>

Table 4: **RF Pass-through Port (Optional) Requirements**