Telecommunications Standards Advisory Committee (TSAC)

Next Generation National Broadband Network (NGNBN)

Coaxial Cable Home Networking

IDA TS 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. It shall comprise HNT equipment (a pair of HNT or more) and associated Isolation Filter (IF) that conform with requirements set out in Part B of this Specification.

2 GENERAL REQUIREMENTS

2.1 Isolation Filter

Service providers who offer the coaxial cable home networking option, and suppliers of HNT equipment are required to ensure that the HNT equipment shall be supplied together with IF of overall length not exceeding 56 mm and diameter not exceeding 21 mm. This is intended for facilitating the deployment of IF at the distribution tap that will not cause any obstruction to future work at the distribution tap.

2.2 Power Supply

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

2.3 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.

2.4 Safety Requirements

The HNT equipment shall be tested for compliance with the International Electrotechnical Commission IEC 60950-1 [1] safety standard[1]. 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.

2.5 Electromagnetic Compatibility (EMC) Requirements

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

[1] 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.

3 ABBREVIATIONS

AC	Alternating Current
BPF	Bandpass Filter
BSP	Band-stop Filter
CL	Convergence Layer
DC	Direct Current
DOCSIS	Data over Cable Services Interface Specifications
HNT	Home Networking Transceivers
HPNA	HomePNA (former Home Phoneline Networking Alliance)
IF	Isolation Filter
IFG	Inter-Frame Gap
IP	Internet Protocol
LLC	Link Layer Control
MAC	Media Access Control
MII	Media Independent Interface
PHY	Physical Layer
PSD	Power Spectral Density
RG	Residential Gateway
STB	Set-Top-Box

4 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

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.

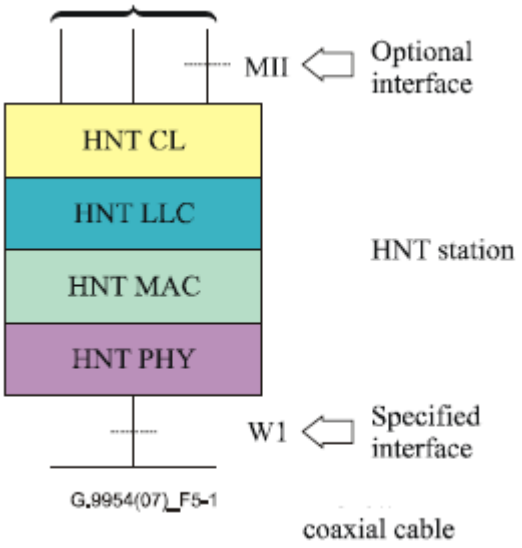

Figure 1-1 (Figure 5-1/G.9954): **Basic Reference Model**

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.

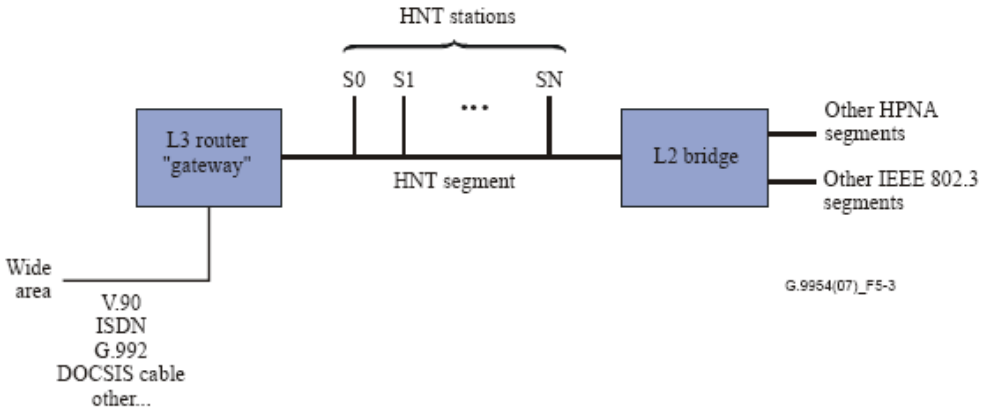

Figure 1-2 (figure 5-3/G.9954): **HNT shared medium network segment on the co-axial cable**

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).

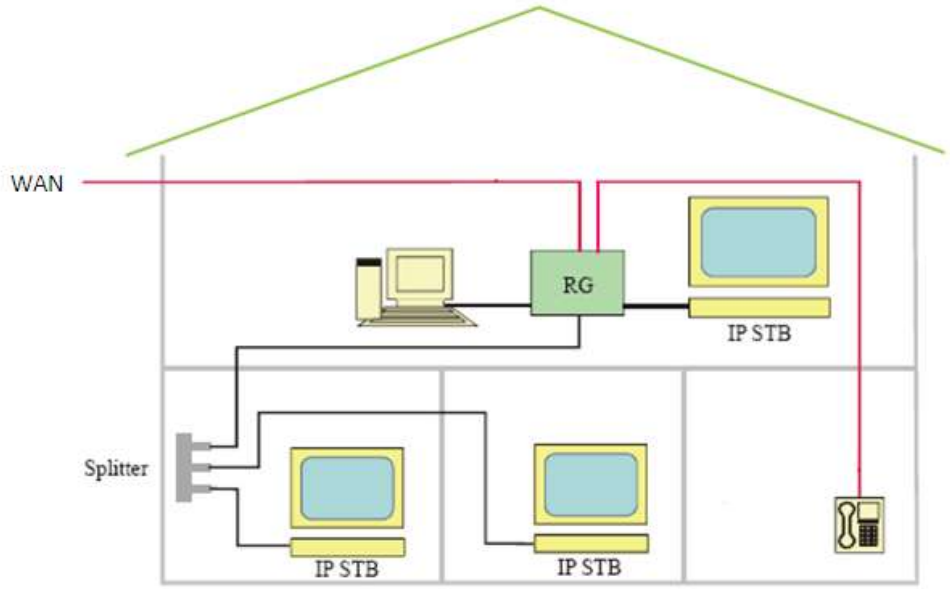

Figure 1-3 (modified from Figure 5-4/G.9954): **Home network using the coaxial cable**

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 to ensure network separation between neighbours and isolate the coaxial cable home network 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.

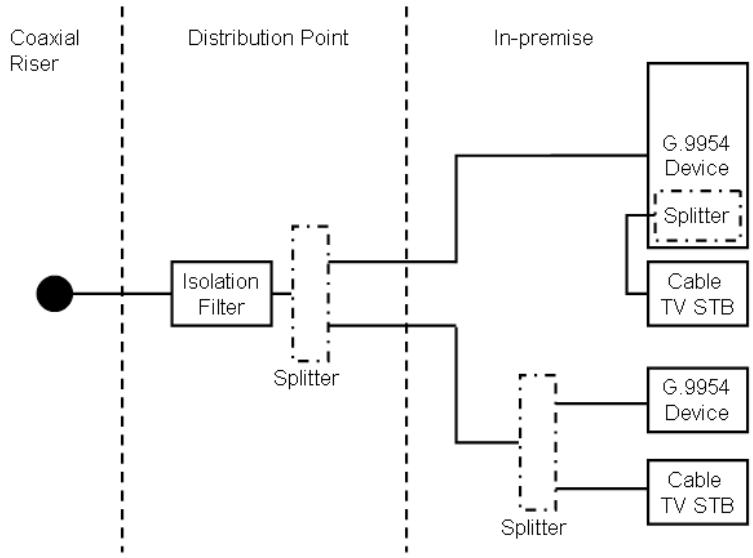

Figure 1-4a: **Isolation Filter**

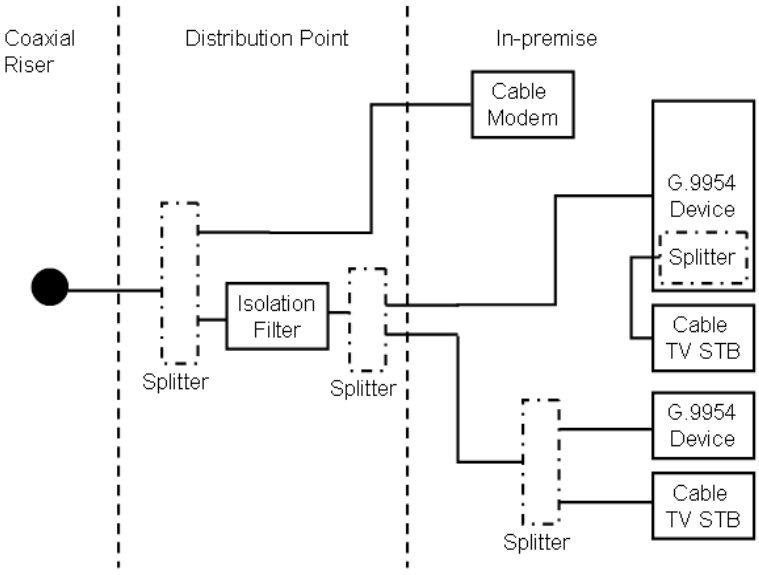

Figure 1-4b: **Isolation Filter (with Co-existence of DOCSIS)**

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 <= 42MHz	<= 1dB[2]
	42MHz < f < 52MHz	>= (1 + (f-42)*40/10)dB
	52MHz <= f <= 68MHz	>= 41dB
	68MHz < f < 85MHz	<= (41 - (f-68)*40/17)dB
	f >= 85MHz	<= 1dB
2	Return Loss	
	f <= 42MHz	>= 12dB
	42MHz < f < 52MHz	<= (12 - (f-42)*11/10)dB
	52MHz <= f <= 68MHz	<= 1dB
	68MHz < f < 85MHz	>= (1 + (f-68)*11/17)dB
	f >= 85MHz	>= 12dB
3	Ripple	<= 2dB

Table 2-2: **Isolation Filter (IF) Specifications**

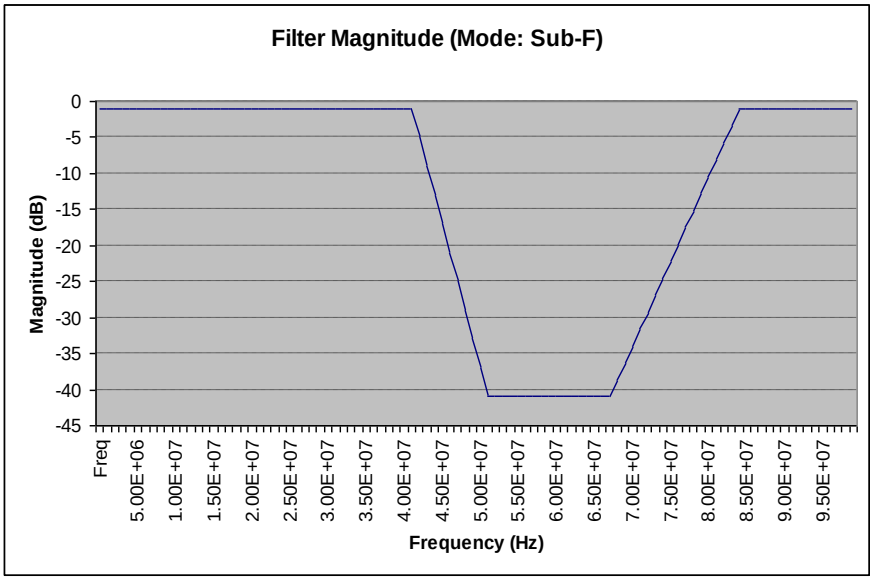

Figure 2-2: **Isolation Filter for Sub-Mode F (52~68 MHz)**

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

2.3 Spectral Mask

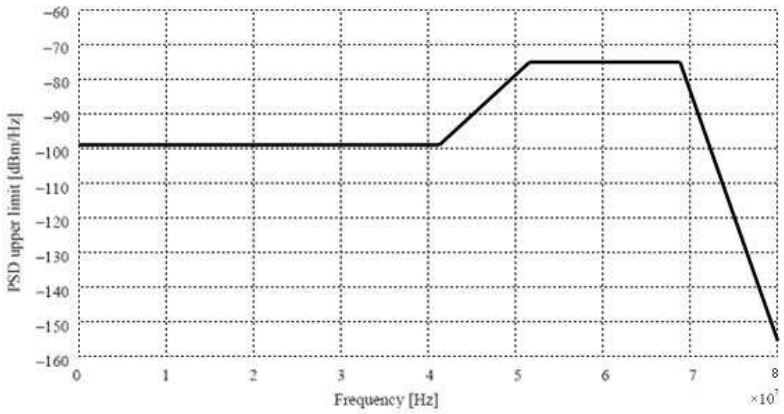

Figure 2-3: **Transmit PSD upper bound for sub-Spectral Mode F**

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.

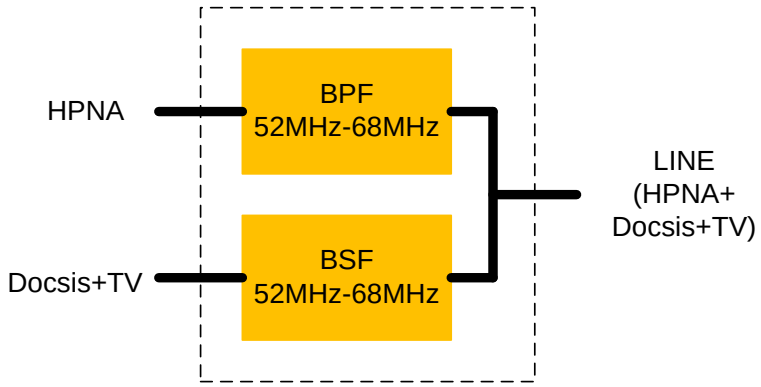

Figure 4: **Pass-through Port (Diplexer Structure)**

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

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