



Recommendation ITU-R BT.1358-1
(09/2007)

**Studio parameters of 625 and 525 line
progressive television systems**

BT Series
Broadcasting service
(television)



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Series	Title
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BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

Electronic Publication
Geneva, 2010

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RECOMMENDATION ITU-R BT. 1358-1*

Studio parameters of 625 and 525 line progressive television systems**

(Question ITU-R 1/6)

(1998-2007)

Scope

This Recommendation defines the signal parameters for 625 and 525 line progressive systems. Commonality with Recommendation ITU-R BT.601 signal parameters is maintained through some direct references.

The ITU Radiocommunication Assembly,

considering

- a) that progressive scan systems have been applied to enhanced analogue services and for digital television broadcasting;
- b) that the progressive signal offers improved vertical and temporal resolution over the 525/625 line interlaced Standard Definition Television¹ (SDTV) signal;
- c) that parameter values for the progressive systems should have maximum commonality with the existing SDTV and High-Definition Television² (HDTV) systems;
- d) that progressive systems can be scaled up from SDTV interlaced 625 and 525 line systems;
- e) that 625 and 525 line progressive systems can be scaled down from high-definition television systems which will embody internationally agreed unified colorimetric parameters;
- f) that the above two approaches could lead to systems with different parameters, for example colorimetry and synchronizing waveforms,

recommends

- 1** that the following parameters derived from interlaced SDTV systems should be used for SDTV 625 and 525 line progressive television systems.

* Radiocommunication Study Group 6 made editorial amendments to this Recommendation in November 2009 and May 2012 in accordance with Resolution ITU-R 1.

** Future use of this Recommendation for programme production is not encouraged.

¹ SDTV in the context of this Recommendation is as defined by Recommendation ITU-R BT.601.

² HDTV is as defined in Recommendation ITU-R BT.709.

Annex 1

Signal parameter values for 625/50/P and 525/59.94/P SDTV progressive systems derived from interlaced SDTV 625 and 525 line standards

1 Opto-electronic conversion

Item	Characteristics		
	Parameter	625/50/P	525/59.94/P
1.1	Chromaticity coordinates, CIE 1931 ⁽¹⁾	See Recommendation ITU-R BT.601 § 3.6.1	
1.2	Assumed chromaticity for equal primary signals - Reference white $E_R = E_G = E_B$	See Recommendation ITU-R BT.601 § 3.6.2	
1.3	Opto-electronic transfer characteristics before non-linear precorrection	See Recommendation ITU-R BT.601 § 3.6.3	
1.4	Overall opto-electronic transfer characteristic at source	See Recommendation ITU-R BT.601 § 3.6.4	

⁽¹⁾ Chromaticity coordinates specified are those currently used by 625-line and 525-line interlaced SDTV systems.

NOTE 1 – See Recommendation ITU-R BT.1361 – Worldwide unified colorimetry and related characteristics of future television and imaging systems.

2 Picture and scanning characteristics

Item	Characteristics		
	Parameter	625/50/P	525/59.94/P
2.1	Order of scanning	Left to right, top to bottom	
2.2	Scanning format	Progressive	
2.3	Picture rate (Hz)	50	60/1.001
2.4	Total number of lines	625	525
2.5	Active lines per picture	576 (lines 45 - 620)	483 (line 43 - 525)
2.6	Aspect ratio ⁽¹⁾	16:9 (4:3)	
2.7	Line frequency (Hz)	31 250 ± 0.0001%	31 500/1.001 ± 3 ppm

⁽¹⁾ The aspect ratio for HDTV applications will normally be 16:9. It is possible that SDTV progressive systems will have an aspect ratio of 16:9 or 4:3. Parameters for such systems are contained within standard parenthesis, i.e. (4:3).

3 Analogue representation

The terms E'_R , E'_G , E'_B , E'_Y , E'_{P_B} (or E'_{C_B}), E'_{P_R} (or E'_{C_R}) refer to gamma pre-corrected analogue signals.

Levels are specified in millivolts measured across a matched 75 Ω termination.

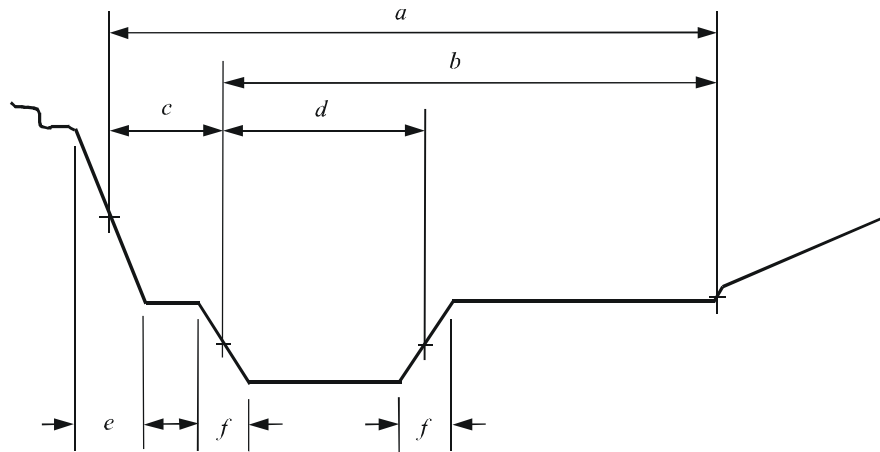
Item	Characteristics		
	Parameter	625/50/P	525/59.94/P
3.1	Primary signals nominal level, Standard colorimetry, E'_R, E'_G, E'_B :	Reference black: 0%, 0 mV Reference peak level: 100%, 700 mV	
3.2	Derivation of luminance component signal E'_Y ⁽¹⁾	$E'_Y = 0.299 E'_R + 0.587 E'_G + 0.114 E'_B$	
3.3	Derivation of colour-difference component signals E'_{P_B}, E'_{P_R} ⁽¹⁾	$E'_{P_B} = \frac{E'_B - E'_Y}{1.772}$ $= -0.169 E'_R - 0.331 E'_G + 0.500 E'_B$ $E'_{P_R} = \frac{E'_R - E'_Y}{1.402}$ $= 0.500 E'_R - 0.419 E'_G - 0.081 E'_B$	
3.4	Component signals nominal level, Standard and extended colorimetry, Luminance E'_Y : Colour difference E'_{P_B}, E'_{P_R} :	Reference black: 0%, 0 mV Reference White: 100%, 700 mV No signal: 0%, 0 mV Maximum colour difference: $\pm 50\%$, ± 350 mV	
3.5	Maximum signal bandwidth E'_R, E'_G, E'_B, E'_Y E'_{P_B}, E'_{P_R}	12 MHz 6 MHz	
3.6	Form of synchronizing signal on primary and component signals ⁽²⁾	Bi-level bipolar (Fig. 1)	
3.7	Horizontal sync timing reference	O_H (Fig. 1)	
3.8	Sync level (mV)	-300 ± 7.5 mV	
3.9	Inter-component timing accuracy	± 10 ns	
3.10	Horizontal sync and blanking interval signal timing	Fig. 1 and Table 1	
3.11	Vertical sync and blanking interval signal timing	Fig. 2 and Tables 2 and 3	

⁽¹⁾ The luminance and colour difference encoding equations used here are equivalent to those used in Recommendation ITU-R BT.601.

⁽²⁾ Addition of synchronizing signal on R, B, P_B and P_R signals is optional.

FIGURE 1

Analogue horizontal synchronizing pulse

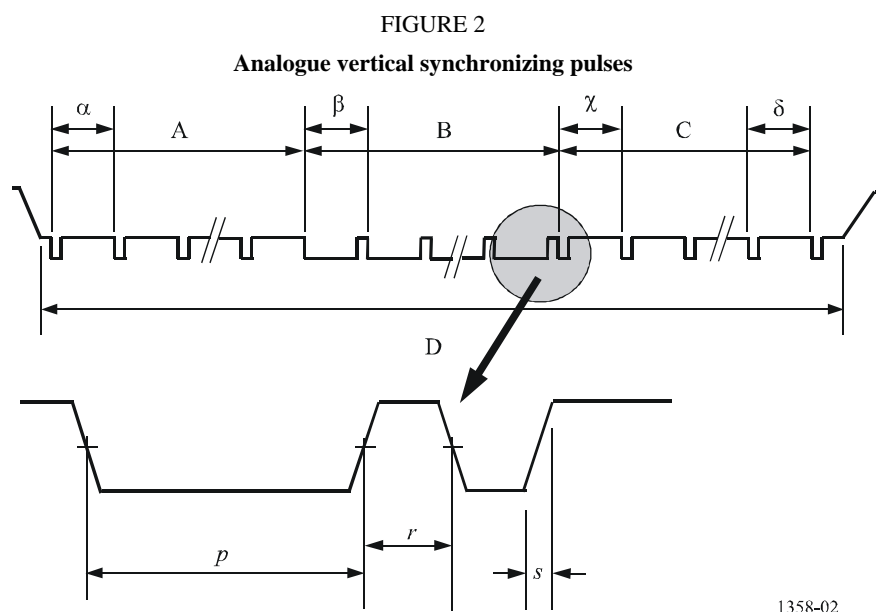


1358-01

TABLE 1

Details of analogue horizontal synchronizing signals

Symbol	Characteristics	625/50/P	525/59.94/P
H	Nominal line period (μs)	32	1001/31.5 (31.778)
a	Horizontal blanking interval (μs)	6.0 ± 1.5	$5.35 + 0.15$ -0.1
b	Interval between time datum, O_H , and back edge of horizontal blanking pulse (μs)	5.25	$4.6 + 0.1$ -0.05
c	Front porch (μs)	0.75 ± 0.15	0.75 ± 0.05
d	Synchronizing pulse (μs)	2.35 ± 0.1	2.35 ± 0.05
e	Build-up time (10 to 90%) of the edges of the horizontal blanking pulse (μs)	0.15 ± 0.05	0.07 ± 0.01
f	Build-up time (10 to 90%) of the edges of the horizontal synchronizing pulses (μs)	0.1 ± 0.05	0.07 ± 0.01



1358-02

TABLE 2
Details of analogue vertical synchronizing signals

Symbol	Characteristics	625/50/P	525/59.94/P
V	Nominal frame period (ms)	20	1001/60 (16.683)
D	Vertical blanking interval	$49H + a^{(1)}$	$42H + a^{(1)}$
–	Build-up time (10 to 90%) of the edges of vertical blanking pulse (μ s)	0.15 ± 0.05	0.07 ± 0.01
A	Interval between front edge of vertical blanking interval and front edge of first vertical synchronizing pulse	$5H^{(1)}$	$6H^{(1)}$
C	Interval between back edge of last vertical synchronizing pulse and back edge of vertical blanking interval	$39H^{(1)}$	$30H^{(1)}$
B	Duration of sequence of vertical synchronizing pulses	$5H^{(1)}$	$6H^{(1)}$
p	Duration of vertical synchronizing pulse (μ s)	29.65 ± 0.1	29.428 ± 0.05
r	Interval between vertical synchronizing pulse (μ s)	2.35 ± 0.1	2.35 ± 0.05
s	Build-up time (10 to 90%) of the vertical synchronizing pulses (μ s)	0.1 ± 0.05	0.07 ± 0.01

⁽¹⁾ For H and a , see Table 1.

TABLE 3
Vertical blanking interval line numbers

	Line number			
	α	β	χ	δ
625/50/P	621	1	6	44
525/59.94/P	1	7	13	42

4 Digital representation

The terms R , G , B , Y , C_B , C_R , refer to quantized and digitally encoded signals. These signals are obtained from gamma pre-corrected signals.

The digital representation in the following table follows Recommendation ITU-R BT.601 which defines the 4:2:2 and 4:4:4; family of 13.5 MHz sampled signals for 4:3 and for wide-screen 16:9 aspect ratio systems.

Item	Characteristics		
	Parameter	625/50/P	525/59.94/P
4.1	Coded signal	R , G , B , or Y , C_B , C_R	
4.2	Sampling lattice R , G , B , Y	Orthogonal, line and picture repetitive	
4.3	Sampling lattice C_B , C_R	Orthogonal, line and picture repetitive, co-sited with odd (1st, 3rd, 5th, etc.) Y active samples in each line	
4.4	Sampling frequency R , G , B , Y Sampling frequency C_B , C_R	27 MHz \pm 3 ppm Half luminance sampling frequency 13.5 MHz \pm 3 ppm	
4.5	Number of samples per full line R , G , B , Y C_B , C_R	864 432	858 429
4.6	Number of samples per active line R , G , B , Y C_B , C_R	720 360	
4.7	Coding format	Linear, 8 or 10 bits/sample for each primary and component signal	
4.8	Quantization: Primary signals R , G , B :	See Recommendation ITU-R BT.601 § 3.5.3	
4.9	Quantization: Component signal Y : Component signals C_B , C_R :	See Recommendation ITU-R BT.601 § 3.5.3	
4.10	Derivation of Y , C_B , C_R from quantized primary signals R , G , B : ⁽¹⁾	See Recommendation ITU-R BT.601 § 3.5.4	
4.11	Timing relationship between analogue sync reference, O_H , and video data	132 samples at 27 MHz (Fig. 3)	122 samples at 27 MHz (Fig. 3)
4.12	Quantization level assignment: Video data: Timing references:	1.00 through 254.75 0.00 to 0.75 and 255.00 to 255.75	
4.13	Filter characteristics ⁽¹⁾ R , G , B , Y C_B , C_R	Fig. 4 Fig. 5	

⁽¹⁾ The filter templates are shown in Fig. 4 and Fig. 5 as a guideline.

FIGURE 3

Timing relationship between analogue sync reference, O_H , and video data

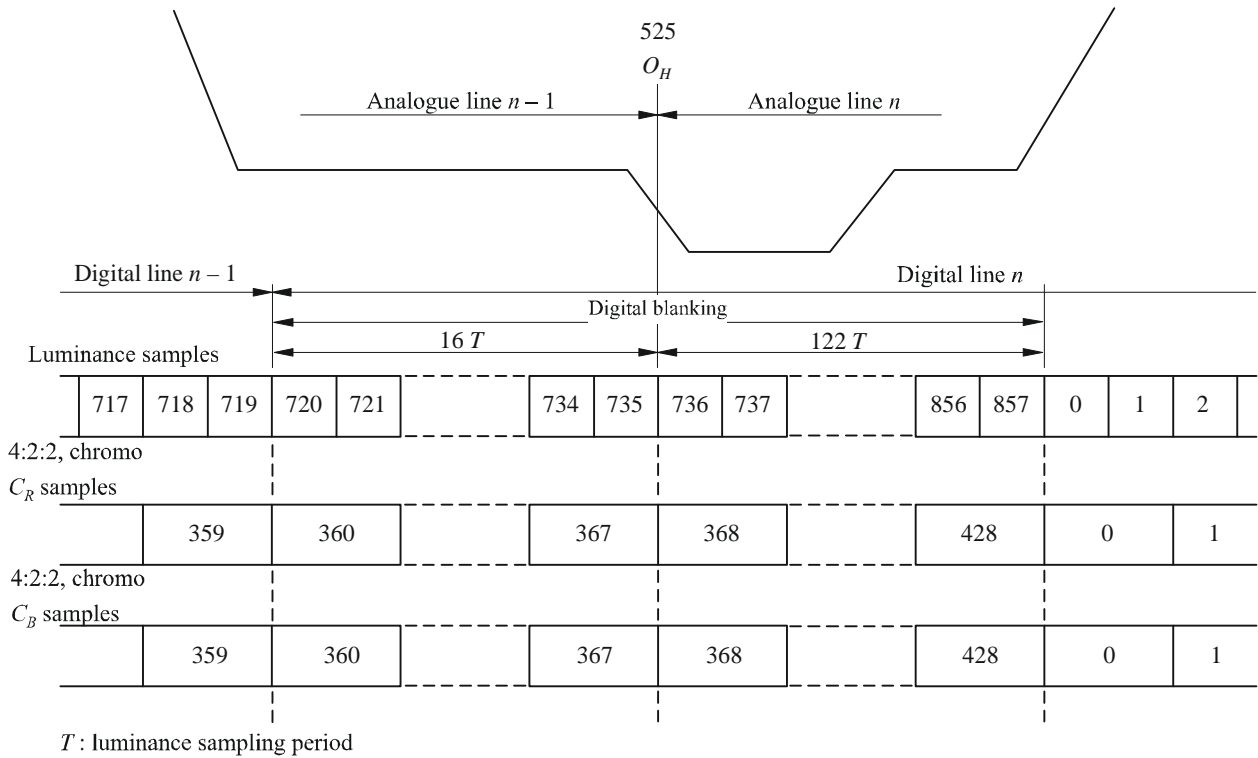
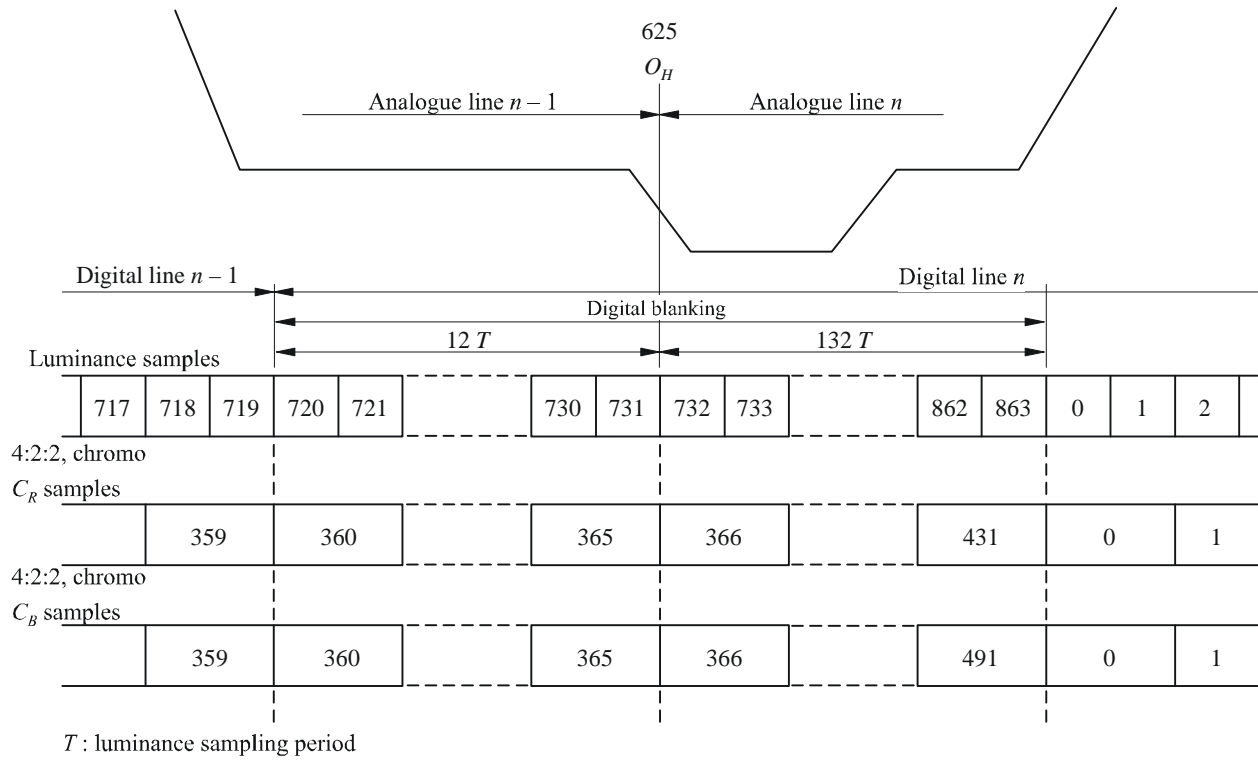
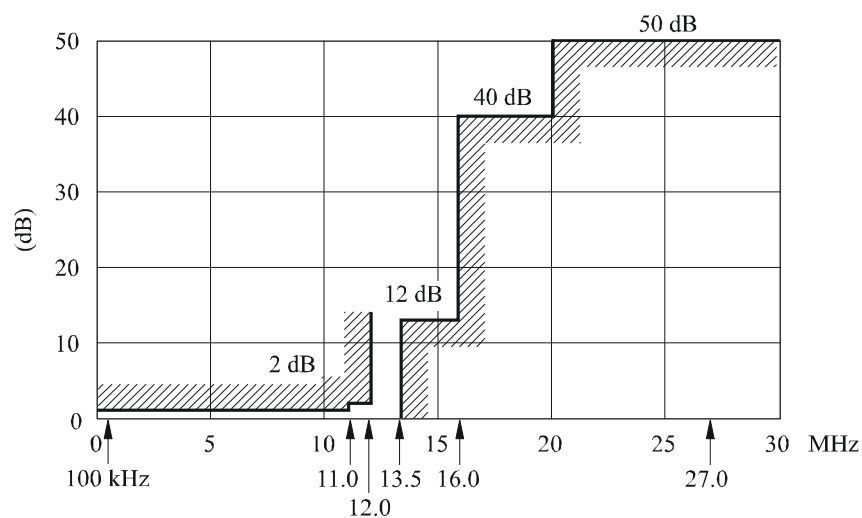
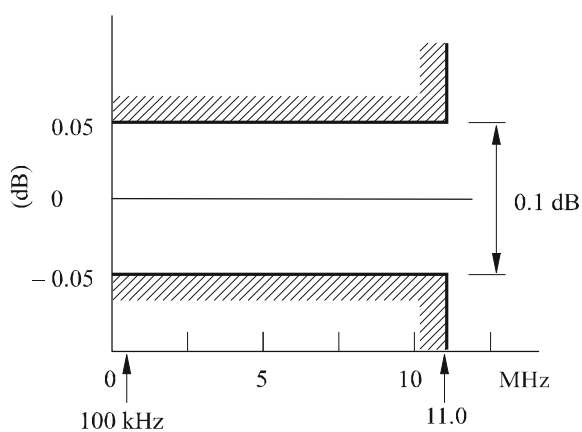


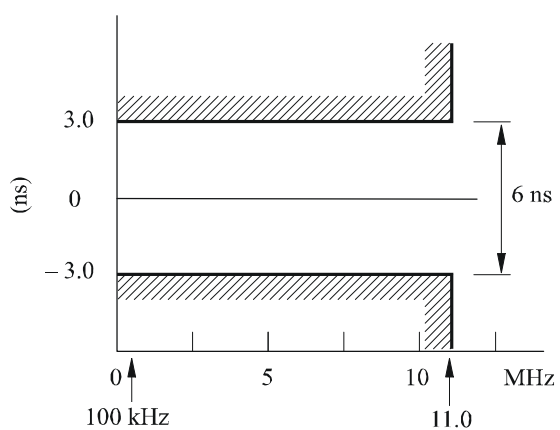
FIGURE 4
Filter templates for *R*, *G*, *B*, and *Y* signals



a) Template for insertion loss



b) Pass-band ripple tolerance

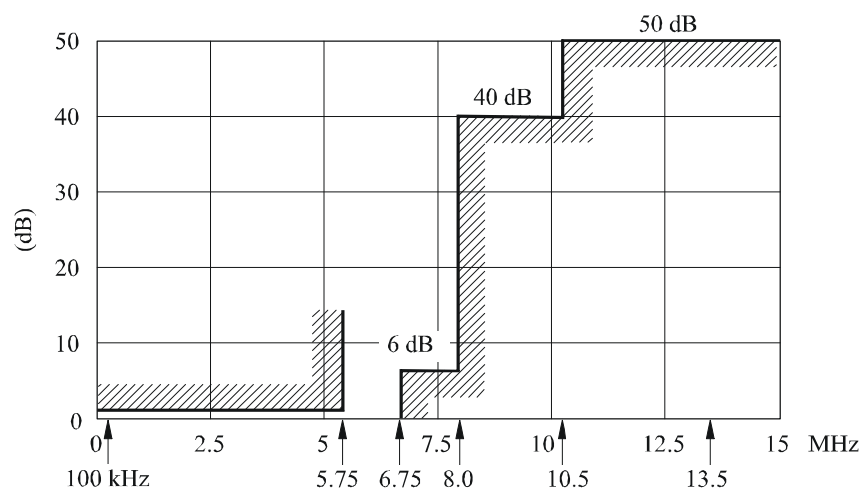


c) Passband group-delay tolerance

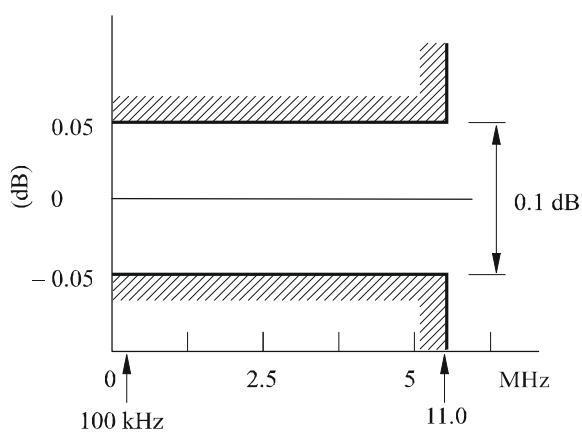
Note 1 – Ripple and group-delay are specified relative to values at 100 kHz.

FIGURE 5

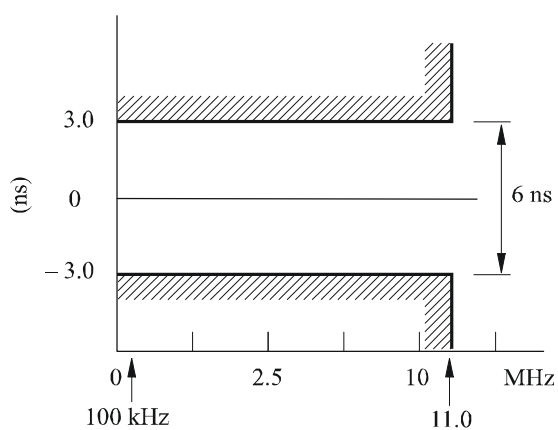
Filter templates for P_B , P_R signals



a) Template for insertion loss



b) Pass-band ripple tolerance



c) Passband group-delay tolerance

Note 1 – Ripple and group-delay are specified relative to values at 100 kHz.