

DTV MASK FILTER CHOICES

- Spectral Mask
 - Relaxed
 - Tight
- Transmitter Response
 - Typical output plot
- Mask Filters
 - Power ratings
 - Designs
 - Performance
- Summary of Choices

Presented by
Dennis Heymans



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Canadian Spectral Mask

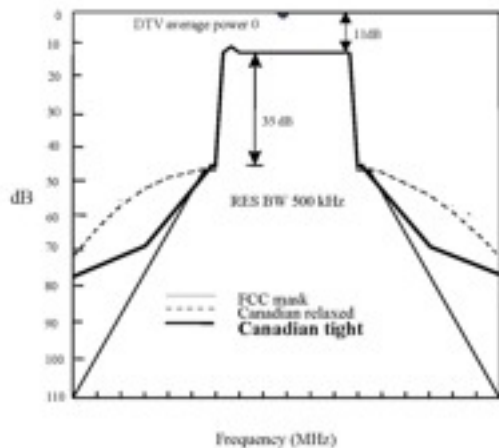


Figure 1 Canadian Spectral Mask

Note:

- The values proposed in figure 1 are normalised on a 500 kHz resolution bandwidth, if the spectrum analyser in use operates at a different resolution bandwidth a factor of: $-10 \log(\text{res BW}) - 10 \log(500)$ has to be applied.
- The proposed values are not measurable in practice at the output of the spectral mask filter (they would require a spectrum analyser with a dynamic range of over 100 dB, which does not exist). Those values can be obtained using a measurement taken directly at the output of the transmitter to which we add the attenuation of the spectral mask filter as measured at each specific frequency.

“Relaxed” (simple) Mask

No special filter requirements

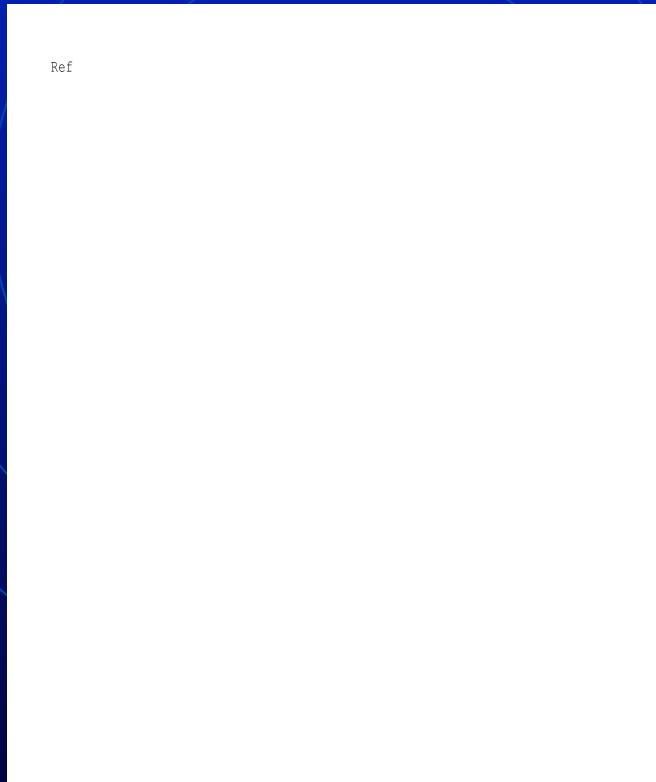
“Tight” (stringent) Mask

Tighter filter specifications
due to adjacent channels



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DTV Transmitter Plot

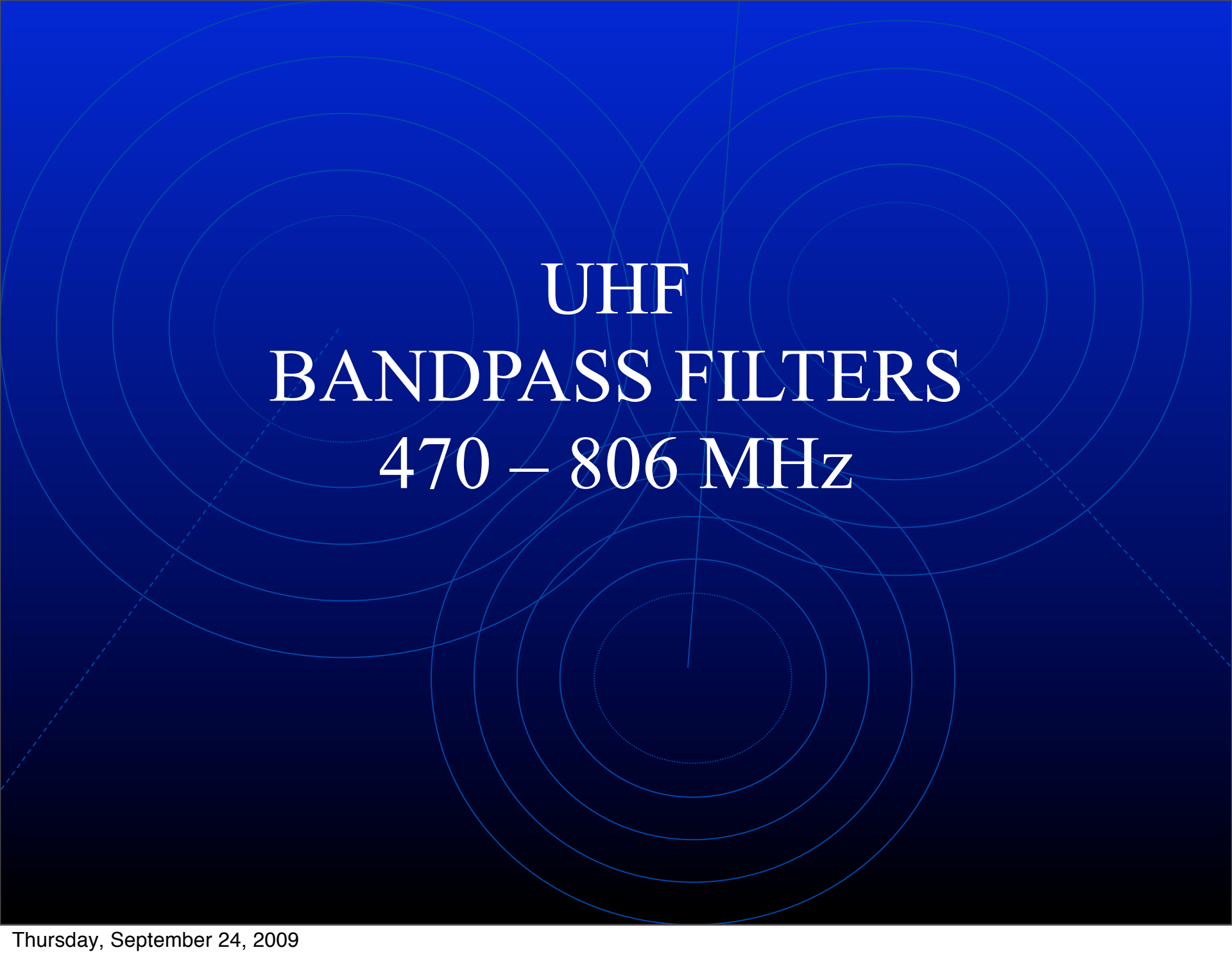


- DTV Bandwidth: $F_c \pm 2.69\text{MHz}$
- Excellent band edge rejection
- Rejection
 $F_c \pm 9\text{MHz} \sim 55\text{dB}$
(need $>60\text{dB}$ to meet mask)

Rohde Schwarz NV8610



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UHF
BANDPASS FILTERS
470 – 806 MHz

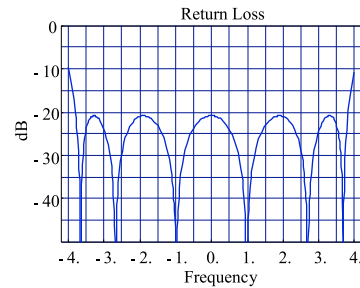
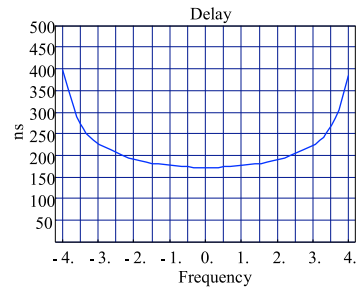
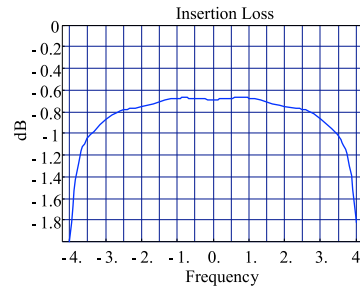
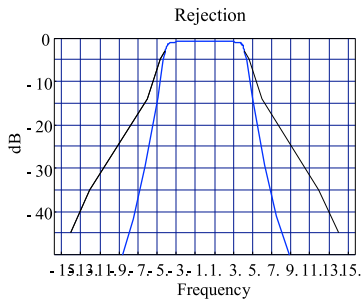
COMMON DESIGNS

TYPE	CHARACTERISTICS
TEM (Coax mode)	Low to medium powers. Tunable
Evanescent mode	Medium powers. Low loss. Tunable
Waveguide mode	High powers. Very low loss. Channel specific
Important Features	<p>Thermal stability: Needed to maintain emissions mask</p> <p>Insertion loss: Larger filters mean lower loss and less heat generated.</p> <p>Power handling: Limited by heating and breakdown.</p> <p>Breakdown: Voltage safety factor should be a minimum of 2 at the maximum rate power.</p> <p>Heating: Natural convection, air or water cooled.</p>



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UHF 6 SECTION BANDPASS 200 Watts



TEM

Loss:
dB_{Fc}

0.70

Rejection:

Fc +/- 9.0 MHz > 60 dB



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UHF 6 SECTION BANDPASS 1-2kW



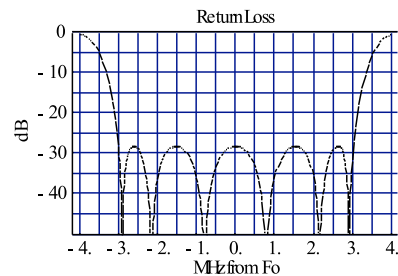
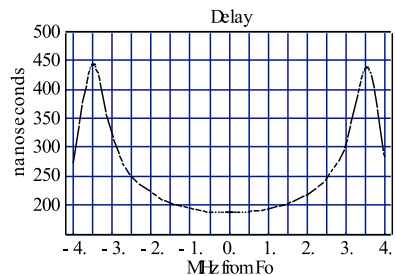
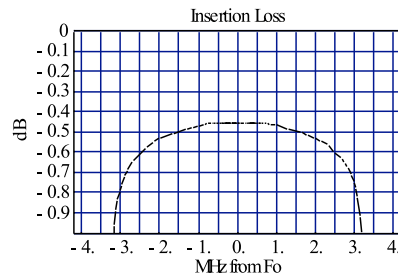
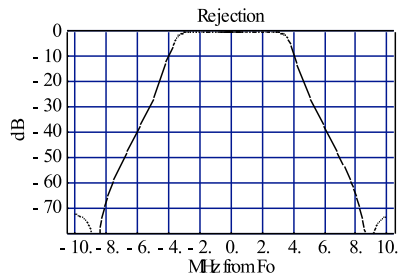
Evanescent

Loss:
dB_{Fc}

0.45

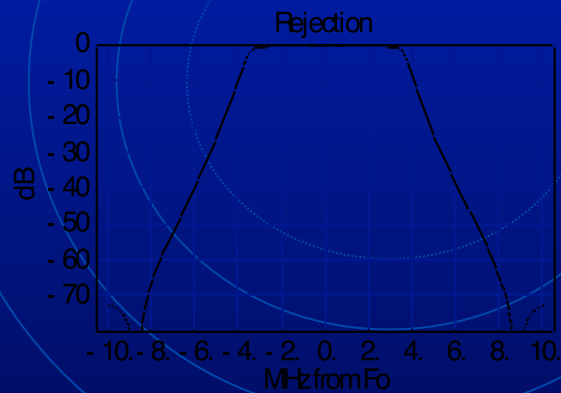
Rejection:

Fc +/- 9.0 MHz > 60dB



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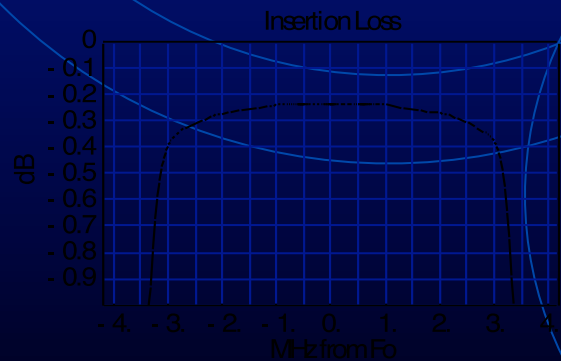
UHF 6 SECTION BANDPASS 3-6kW



Evanescent

Loss:
Fc
dB

0.25



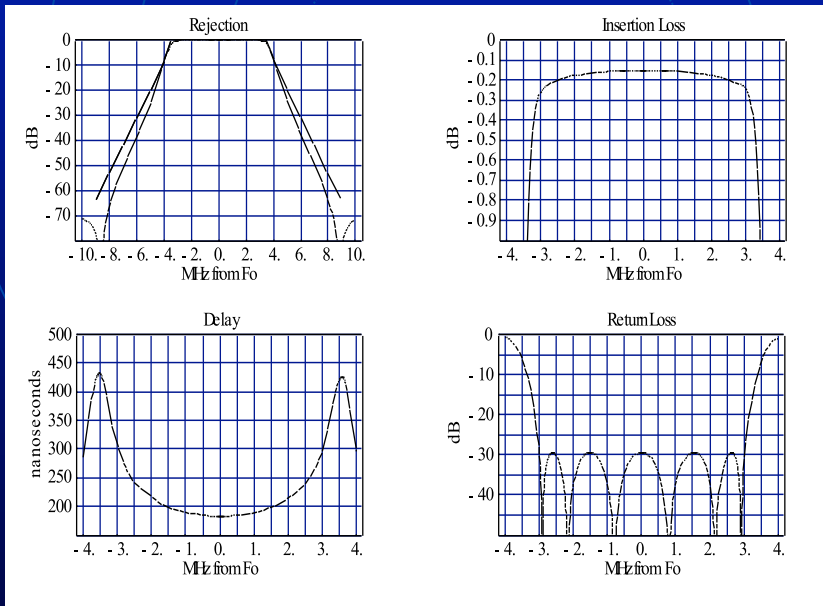
Rejection:

Fc +/- 9.0 MHz > 60dB



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UHF 6 SECTION BANDPASS 6-15kW



Waveguide

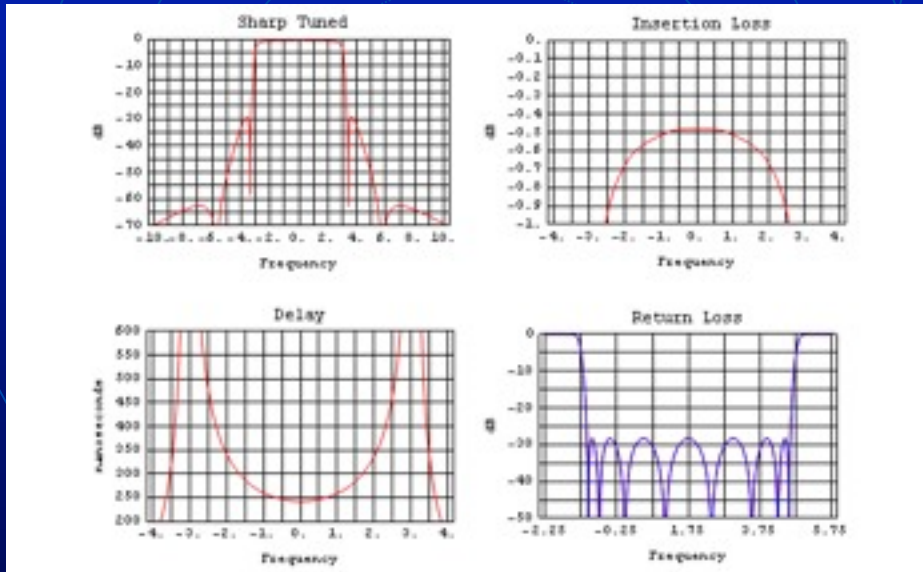
Loss:
dB_{Fc} 0.15

Rejection:
Fc +/- 9.0 MHz > 60dB



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UHF 8 SECTION "STF" BANDPASS 1-3kW



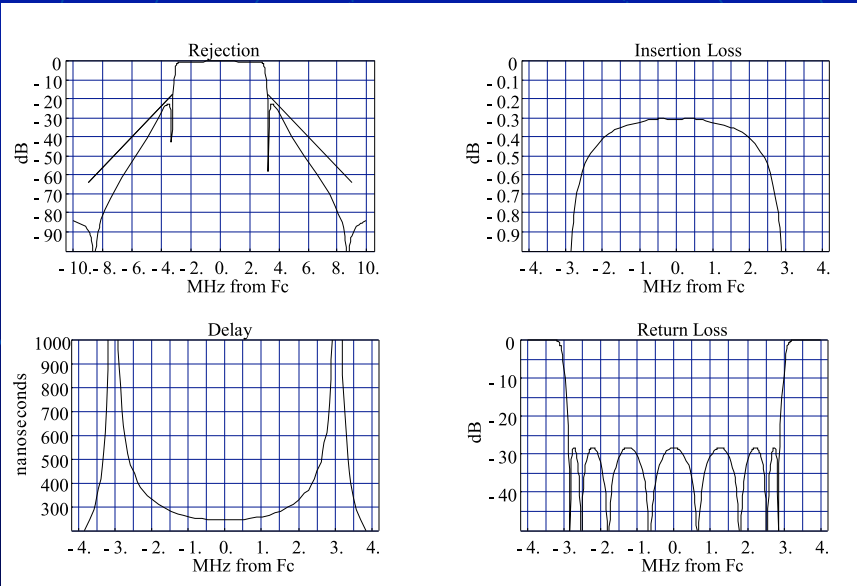
Evanescent
Adjacent
Channels

Loss:
dB_{Fc} 0.5
Rejection:
Fc +/- 9.0 MHz > 70dB



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UHF 8 SECTION "STF" BANDPASS 3-5kW



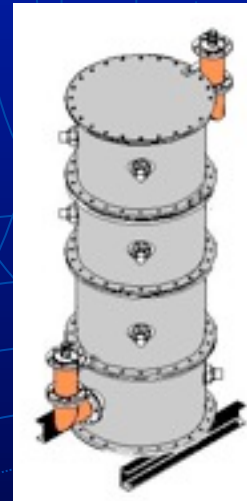
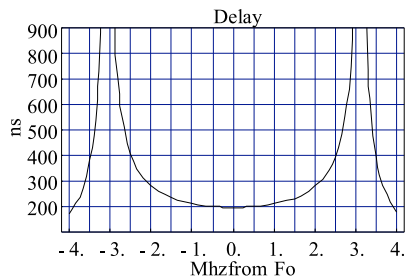
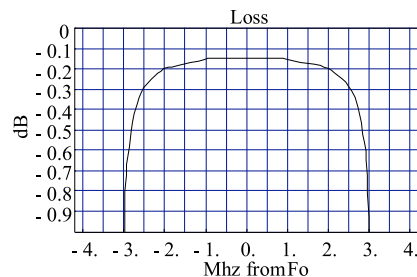
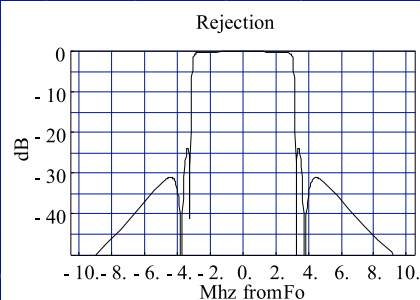
Evanescent
Adjacent
Channels

Loss:
dB_{Fc} 0.30
Rejection:
Fc +/- 9.0 MHz > 70dB



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UHF 8 SECTION "STF" BANDPASS 6-15kW



Waveguide
Adjacent
Channels

Loss:
dB Fc 0.15
Rejection:
Fc +/- 9.0 MHz > 70dB



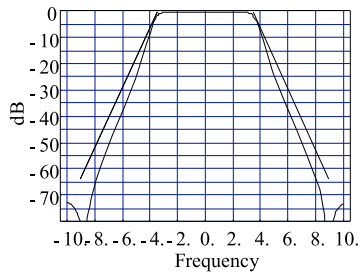
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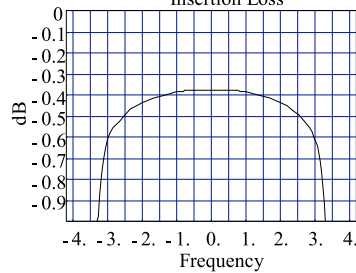
HI VHF
BANDPASS FILTERS
174 – 216 MHz

HI VHF 6 SECTION BANDPASS 500-750 Watts

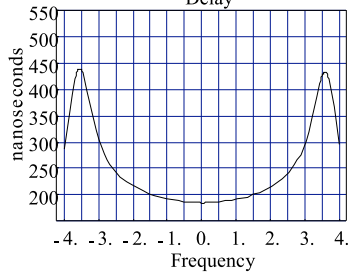
Rejection



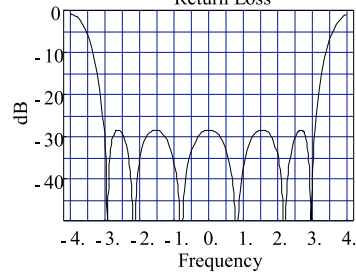
Insertion Loss



Delay



Return Loss



TEM

Loss:

F_c 0.40
dB

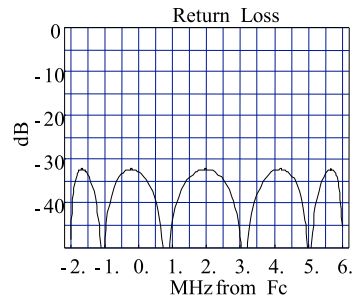
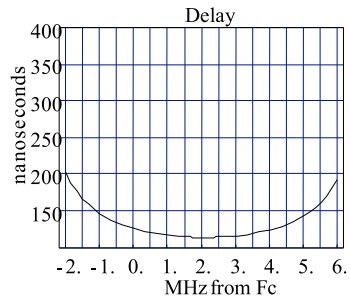
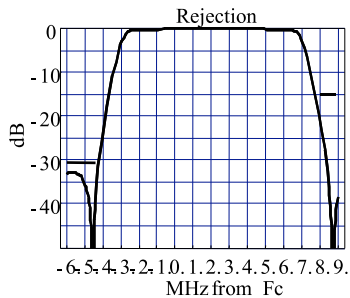
Rejection:

$F_c \pm 9.0 \text{ MHz} > 60\text{dB}$



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HI VHF 6 SECTION BANDPASS 1-3 kW



TEM

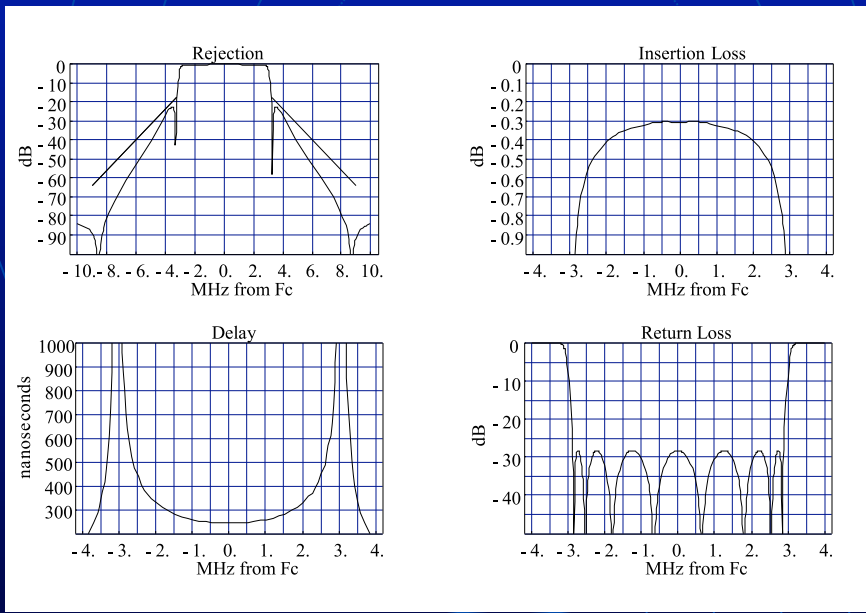
Loss:
dB_{Fc} 0.30

Rejection:
Fc +/- 9.0 MHz > 60dB



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HI VHF 8 SECTION "STF" BANDPASS 1-8kW



TEM
Adjacent
Channels

Loss:
dB Fc 0.30
Rejection:
Fc +/- 9.0 MHz > 70dB



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PERFORMANCE SUMMARY

6 SECTION

	F _c	F _c +/- 2.69	F _c +/- 3.25	F _c +/- 9.0
Power Rating	Insertion loss	Rejection	Rejection	Rejection
200 watt	0.7 dB	1 dB	2 - 3 dB	> 60 dB
1-2 kW	0.45 dB	1 dB	4 - 5 dB	> 60 dB
3-6 kW	0.2 - 0.3 dB	0.3 - 0.5 dB	0.5 - 0.7 dB	> 60 dB
6-15kW	0.15 - 0.2 dB	0.2 - 0.5 dB	0.5 - 0.7 dB	> 60 dB

8 SECTION "STF"

1-3 kW	0.5 dB	< 2 dB	> 18 dB	> 65 dB
3-5 kW	0.3 - 0.4 dB	0.6 - 0.7 dB	> 18 dB	> 65 dB
6-15kW	0.18 - 0.26 dB	0.3 - 0.5 dB	> 18 dB	> 65 dB



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Tx Power Requirements

(input power required)

6 SECTION

Fc Insertion loss	Rejection @ Fc +/- 2.69	DTV Integrated loss (efficiency)	Power Required into filter	Power Out of filter
0.7 dB	1 dB	0.8dB (83%)	240 watts	200 watts
0.45 dB	1 dB	0.6dB (87%)	1.15kW	1kW
0.2 - 0.3 dB	0.3 - 0.5 dB	0.35dB (92%)	3.25kW	3kW
0.15 - 0.2 dB	0.2 - 0.5 dB	0.3dB (93%)	6.43kW	6kW

8 SECTION "STF"

0.5 dB	< 2 dB	1dB (79%)	1.26kW	1kW
0.3 - 0.4 dB	0.6 - 0.7 dB	0.5dB (89%)	3.37kW	3kW
0.18 - 0.26 dB	0.3 - 0.5 dB	0.35dB (92%)	6.5kW	6kW



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SUMMARY

- Filter Design Selection to meet mask:
 - 6 section – non-adjacent channel markets
 - 8 section – adjacent channel markets
- Performance:
 - Lower Loss = less heating = larger filter
 - Thermal stability is important
- Power Handling:
 - Select proper power rating
 - Consider possible future TPO increases



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Thank You

- CCBE
- CBC Technology
- Rohde & Schwarz



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