

# Frequency Assignment Planning Criteria

## Frequency Management Webinar

ICAO MID-Office , 11 – 12 November 2020  
“Virtual”

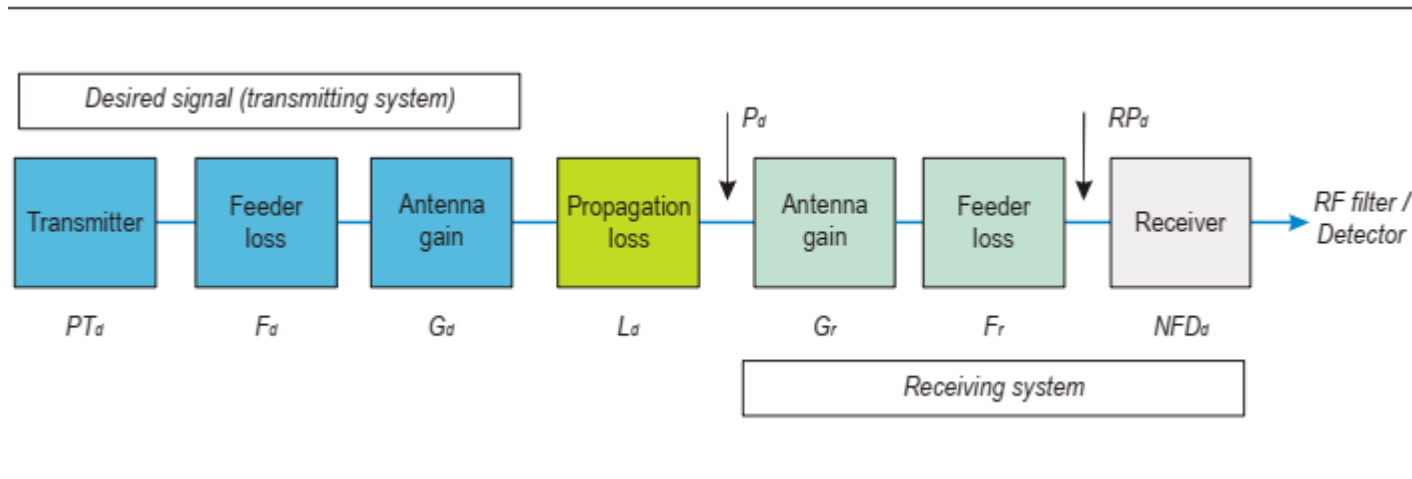
**Presented By**

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**Senior ANS/CNS Safety Oversight  
Inspector**

# Vol. II – Ch2 – VHF COM systems

## Interference model (co-frequency separation)

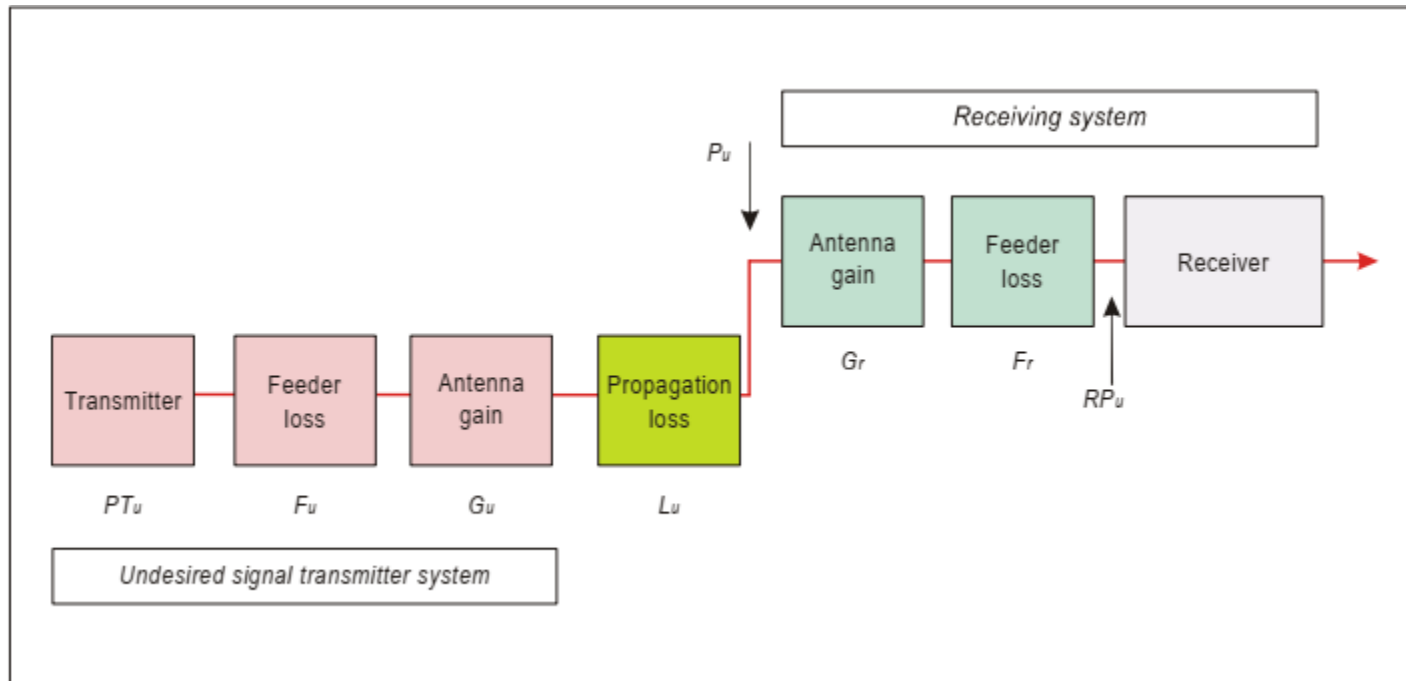
- Conforms to the general methodology in Chapter 1
- Model for establishing separation distances to prevent air-to-air interference:



$$P_d = PT_d - F_d + G_d - L_d \quad (1)$$

# Vol. II – Ch2 – VHF COM systems

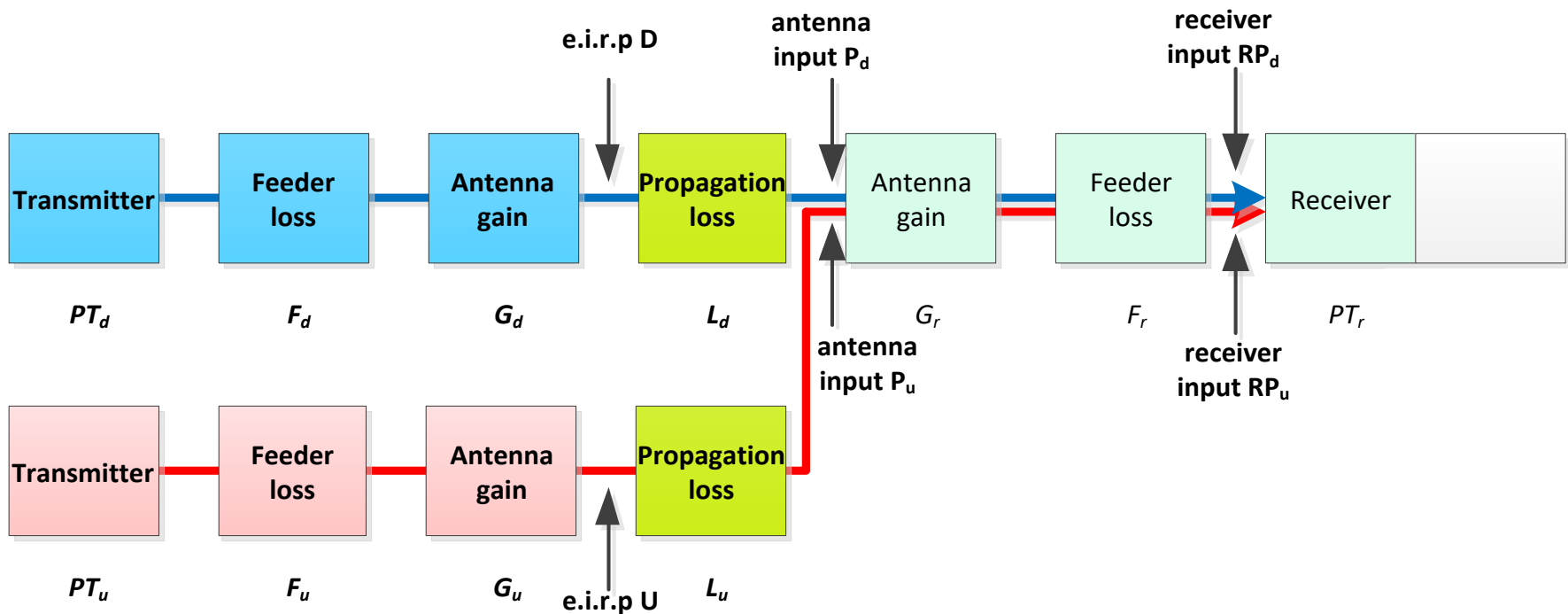
## Interference model (co-frequency separation (1))



$$P_u = PT_u - F_u + G_u - L_u \quad (3)$$

# Vol. II – Ch2 – VHF COM systems

## Interference model (co-frequency separation (1))



$$P_d - P_u = \frac{D}{U} \quad (4)$$

# Vol. II – Ch2 – VHF COM systems

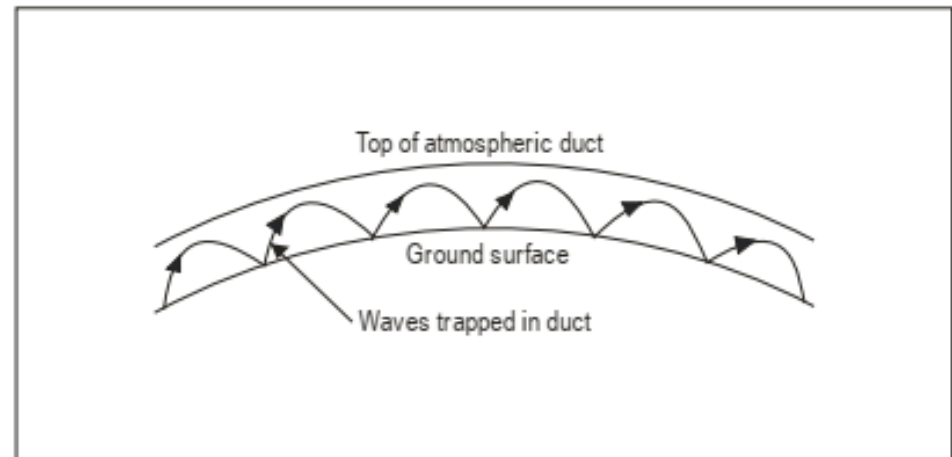
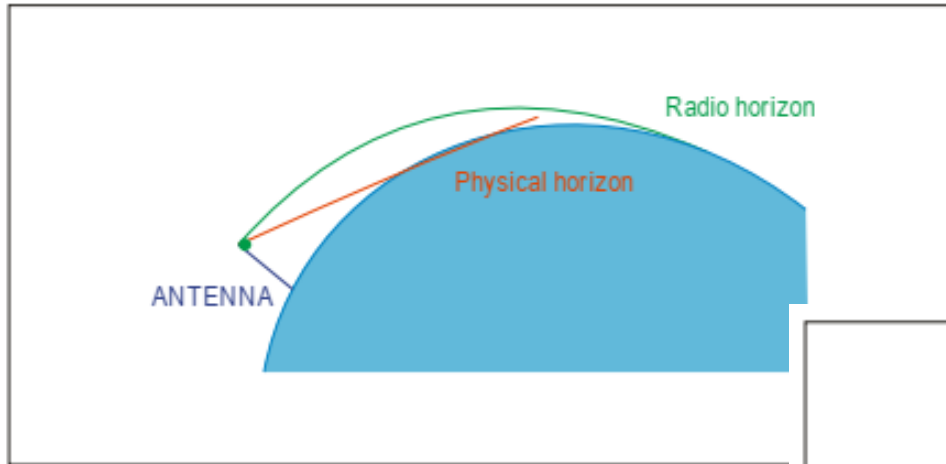
## Radio wave Propagation model

- Propagation model – Based on free space propagation (Re. Recommendation ITU-R P.525)
- Propagation model does not accommodate certain phenomena which are difficult to predict such as
  - Changes in the refractive index of the atmosphere
  - Ducting
- ITU has developed propagation curves for aeronautical communication and navigation systems.

$$L_{bf} = 37.8 + 20 \log f + 20 \log d \quad (8)$$

# Vol. II – Ch2 – VHF COM systems

## Radio wave Propagation model

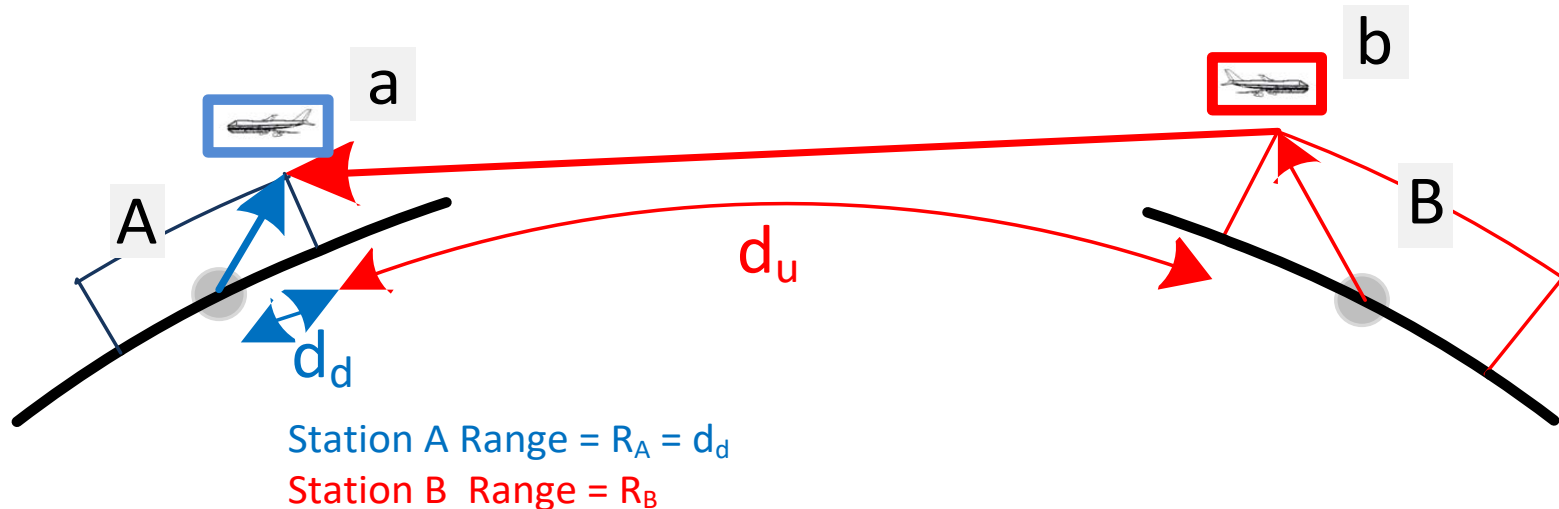


$$L_{bf} = 37.8 + 20 \log f + 20 \log d \quad (8)$$

# Vol. II – Ch2 – VHF COM systems

## Interference model (co-frequency separation (1))

- Minimum separation between stations A and B:  
**Range A + Radio horizon A + Radio Horizon B + Range B**

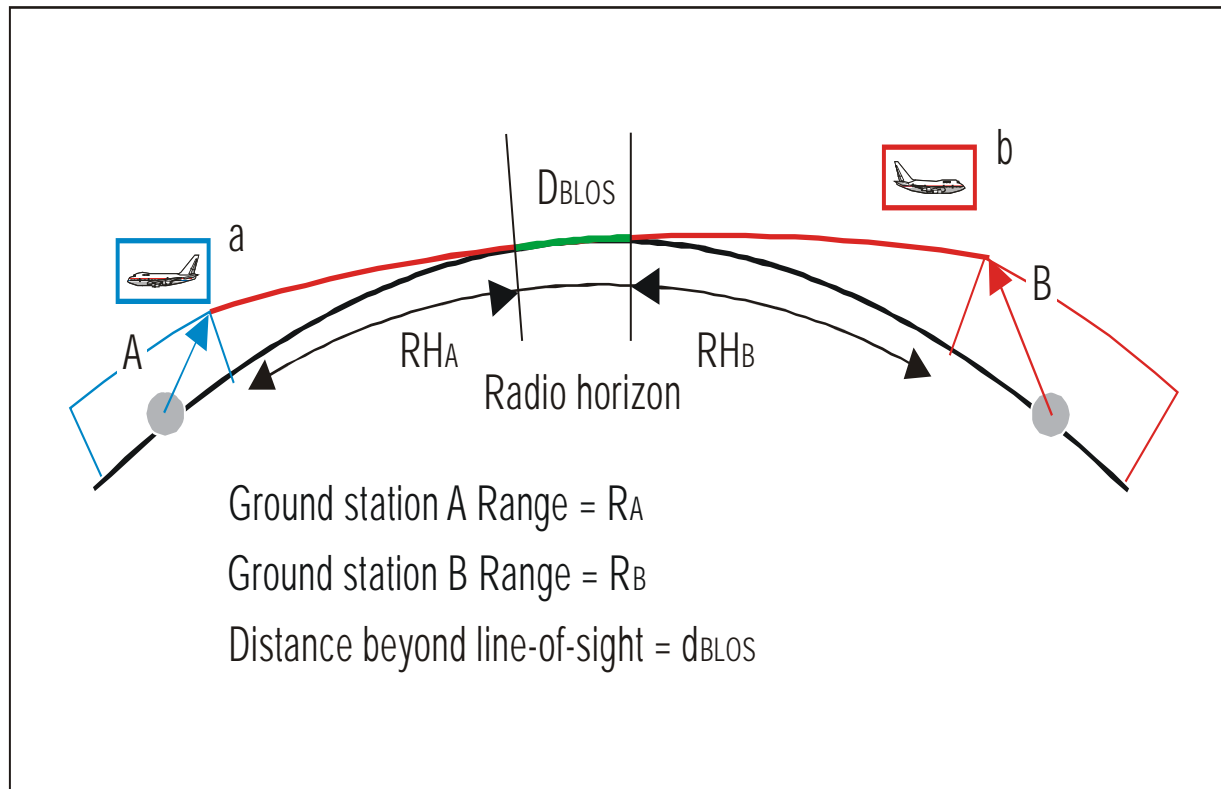


$$d_{RH} = 1.23(\sqrt{h_{TX}} + \sqrt{h_{RX}})$$

# Vol. II – Frequency assignment planning

## Interference model (co-frequency separation (2))

- Effect of the radio horizon (att. beyond  $R_h = 0.5 * D_{LOS}$ )



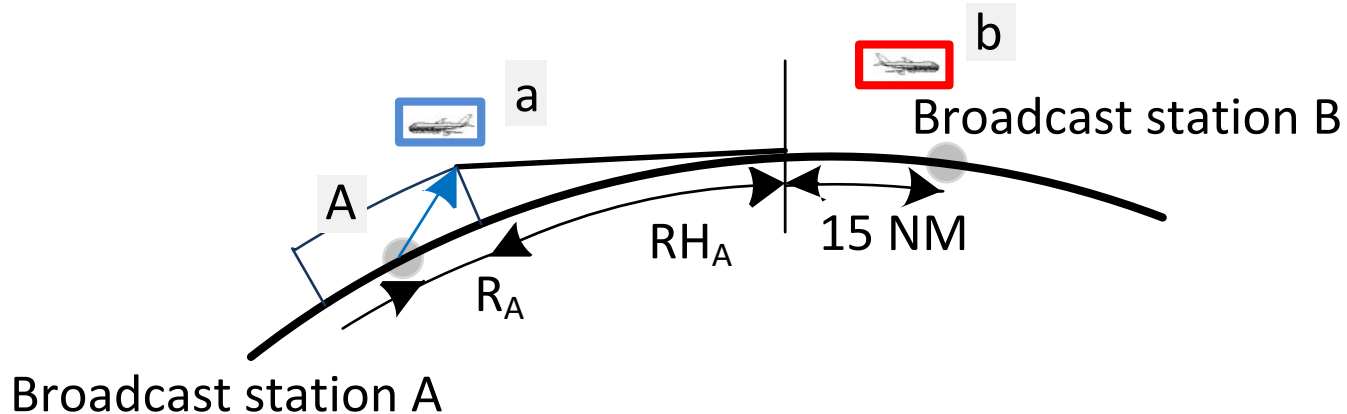


# Vol. II – Frequency assignment planning

## Interference model (co-frequency separation (1))

– Between Aeronautical broadcast stations  
(ATIS, VOLMET)

- Do not involve aircraft transmission
- Separation distances are less compared to both stations providing air-ground communications



# Vol. II – Frequency assignment planning

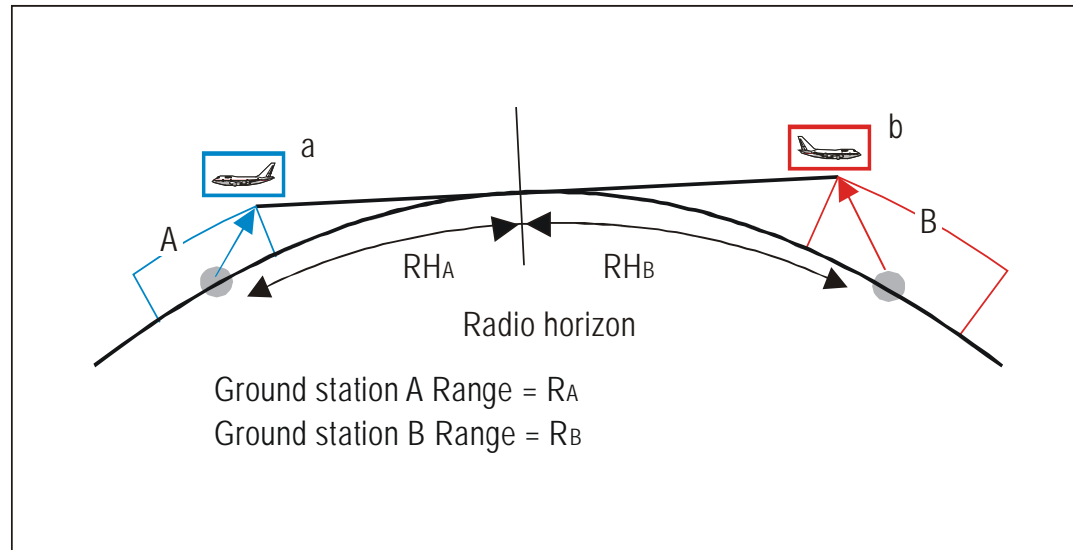
## Table of uniform designated operational coverage (DOC)

Service	Designated operational coverage (DOC)		
	Range (NM) Height (ft)	Range (NM) Height (ft)	comment
TWR	25	4000	Height above ground
AFIS	25	4000	Height above ground
AS (Note 2)			25
APP-U	150	45000	
APP-I	75	25000	
APP-L	50	12000	
VOLMET	200	45000	
ATIS	200	45000	

# Distance to radio horizon with aircraft at maximum altitude

<i>Symbol</i>	<i>Service range (NM)</i>	<i>Service height</i>	<i>Radio horizon</i>
TWR	25 NM	4 000 ft	78 NM
AFIS	25 NM	4 000 ft	78 NM
AS	Limits of aerodrome	Surface	N/A
APP-U	150 NM	45 000 ft	260 NM
APP-I	75 NM	25 000 ft	195 NM
APP-L	50 NM	12 000 ft	134 NM
ACC-U	Specified area	45 000 ft	260 NM
ACC-L	Specified area	25 000 ft	195 NM
FIS-U	Specified area	45 000 ft	260 NM
FIS-L	Specified area	25 000 ft	195 NM
VOLMET	260 NM	45 000 ft	260 NM
ATIS	260 NM	45 000 ft	260 NM

# Frequency assignment planning for VHF air/ground communication systems (1)



Separation distance between air ground communication services

$$R_A + R_{H_A} + R_{H_B} + R_B$$

Example: A = TWR (25NM, 4000ft) and B = APP-U (150 NM, 45000 ft)

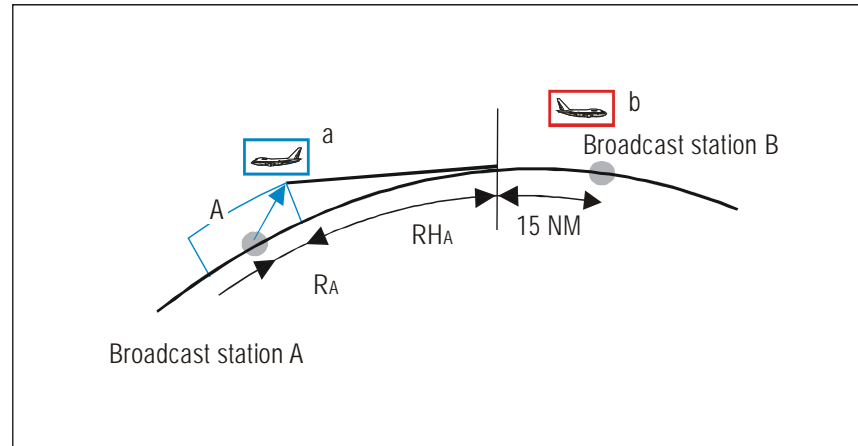
Min. Sep distance =  $25+78+150+261=514$  NM (between the stations)

# Frequency assignment planning for VHF air/ground communication systems (2)

Service	VICTIM											
Interfer	TWR 25/400	AFIS 25/4000	AS Surface	APP-U 150/450	APP-I 75/250	APP-L 50/120	ACC-U A/450	ACC/L A/250	FIS-U A/450	FIS/L A/250	VOLMET 260/450	ATIS 200/450
TWR	156	156	---	338	273	212	338	273	338	273	338	338

- Example of separation distances required between a TWR Service and other ATC Services
  - Separation distances are between the edges of the relevant Designated Operational Coverage (DOC)

# Frequency assignment planning for VHF air/ground communication systems (3)



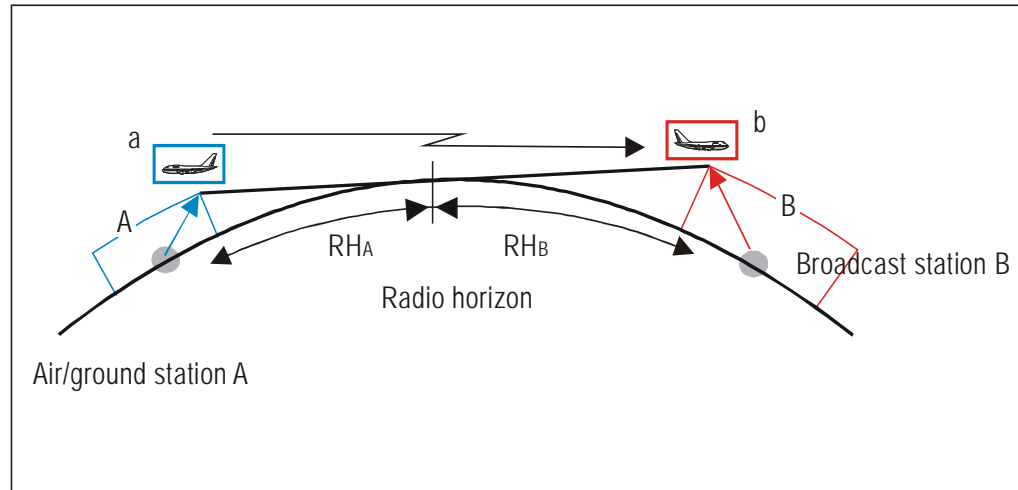
Separation distance between two stations providing aeronautical broadcast services; max range is 200 NM

$$\text{(Max) } R_A + R_{H_A} + 15 \quad \text{or} \quad R_B + R_{H_B} + 15$$

Example: A = ATIS (200NM, 45000ft) and B = VOLMET (200 NM, 45000 ft)

Min. Sep distance =  $200 + 261 + 15 = 476$  NM (between the stations) or 75 NM between the DOC of the stations

# Frequency assignment planning for VHF air/ground communication systems (4)



- Separation distance between two stations where one station is for air-ground communication and the other is providing aeronautical broadcast services
- Separation distances are the same as for two stations providing air-ground communications

# Minimum geographical co-frequency separation distances between the edges of the DOC

		VICTIM											
	Service	TWR 25/4000	AFIS 25/4000	AS Surface	APP-U 150/450	APP-I 75/250	APP-L 50/120	ACC-U Area/450	ACC-L Area/250	FIS-U Area/450	FIS-L Area/250	VOLMET 260/450	ATIS 200/450
<b>INTERFER</b>	TWR	156	156		338	273	212	338	273	338	273	338	338
	AFIS	156	156		338	273	212	338	273	338	273	338	338
	AS (Note 2)			25									
	APP-U	338	338		520	455	394	520	455	520	455	520	520
	APP-I	273	273		455	390	329	325	390	455	390	455	455
	APP-L	212	212		394	329	268	394	329	394	329	394	394
	ACC-U (Note 1)	338	338		520	455	394	520	455	520	455	520	520
	ACC-L (Note 1)	273	273		455	390	329	455	390	455	390	455	455
	FIS-U (Note 1)	338	338		520	455	394	520	455	520	455	520	520
	FIS-L (Note 1)	273	273		455	390	329	455	390	455	390	455	455
	VOLMET	338	338		520	455	394	520	455	520	455	15	15
	ATIS	338	338		520	455	394	520	455	520	455	15	15





Thank you for your Attention