Communications Research Centre Canada
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FM-IBOC Lab Tests
Communications Research Centre Canada (CRC)

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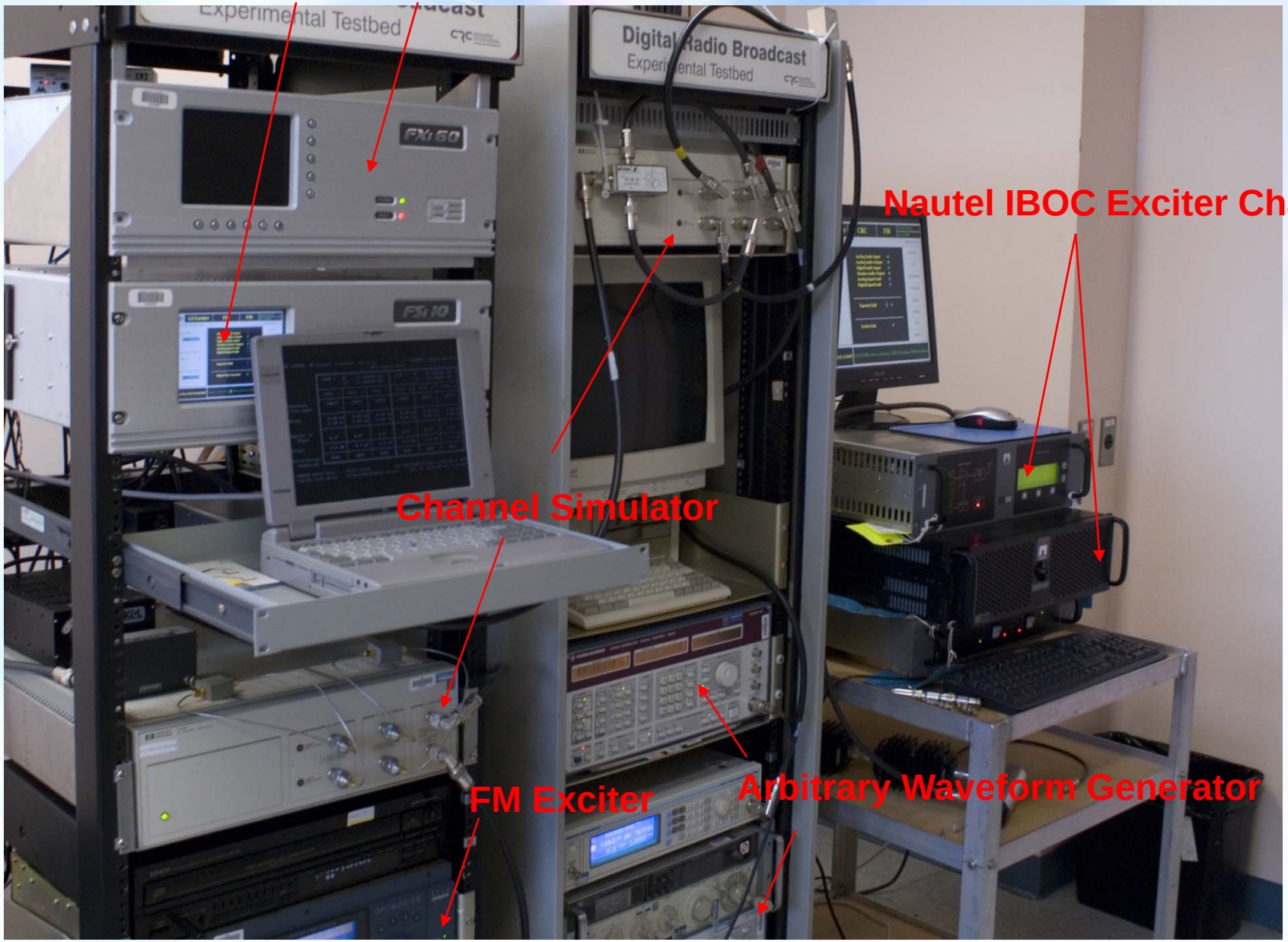
CCBE 2008, Barrie, Ontario
September, 2008

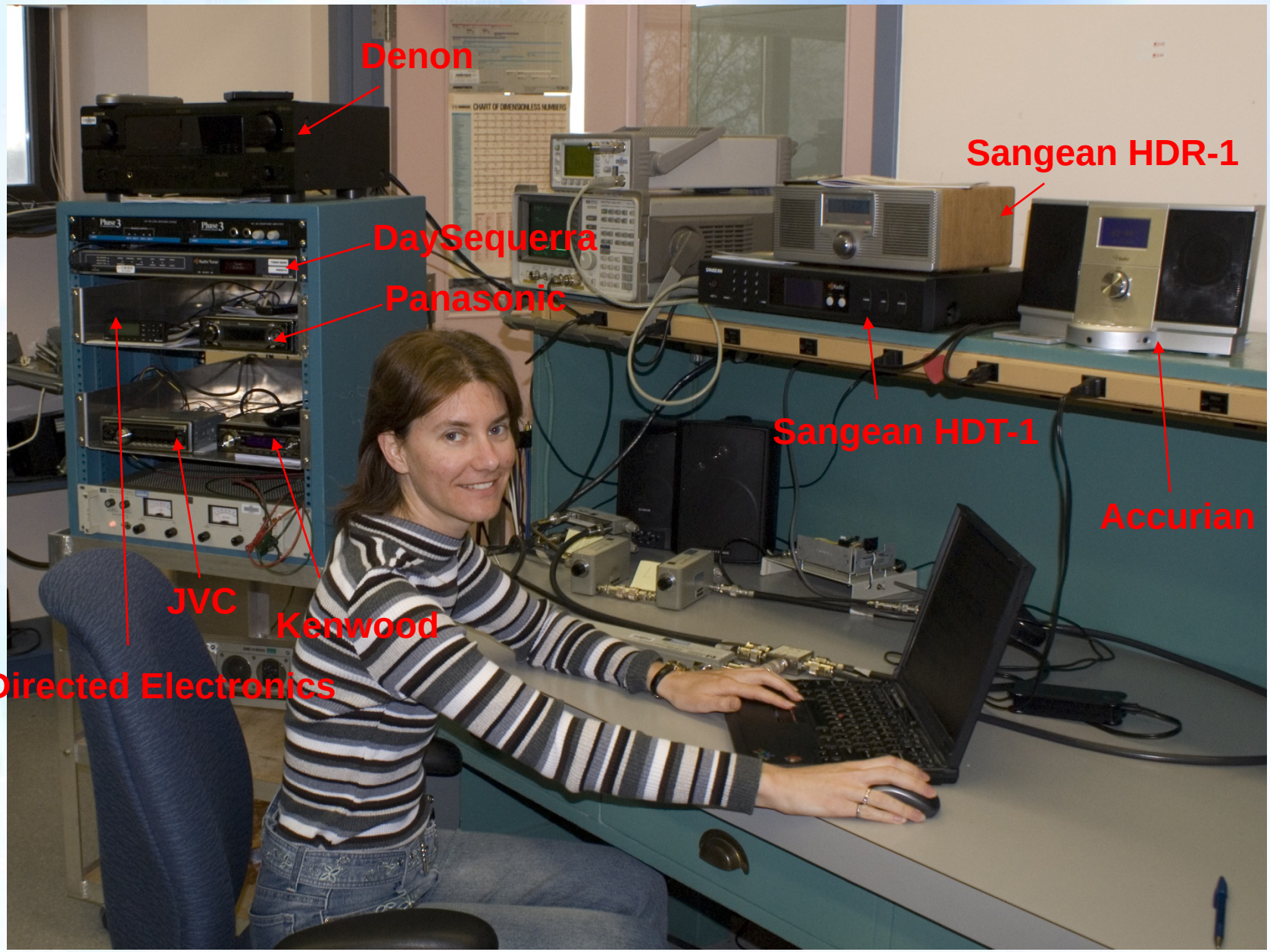
Canada

CRC

Test Objectives

- Gain further understanding of the technology from a Canadian spectrum management perspective
- Complement earlier evaluation initiatives (CBC, NRSC, NPR, …)
- Obtain empirical data to validate the FM-IBOC module in CRC-COVLAB


BE IBOC Exciter Chain
Nautel IBOC Exciter Chain
Channel Simulator
FM Exciter
Arbitrary Waveform Generator


Denon
Sangean HDR-1
DaySequerra
Panasonic
Sangean HDT-1
Accurian
JVC
Kenwood
Directed Electronics

Results to Date

- All results are interim and subject to change as further lab data is obtained
- Some trends are starting to emerge

Selected observations and findings appear in the next slides

Two Assessment Categories

1- Impact of IBOC on analog signals

2- IBOC digital performance

Two Assessment Categories

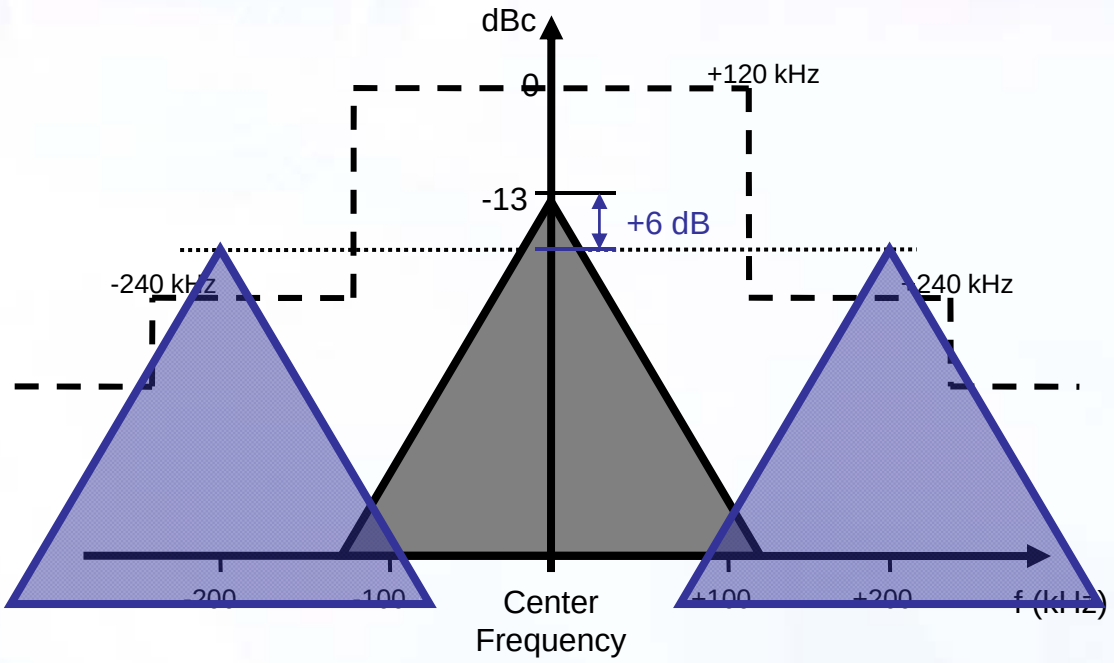
1- Impact of IBOC on analog signals

2- IBOC digital performance

Co-channel Interference

- No perceptible change with the addition of the digital signal, as we expected.

1st Adjacent Interference



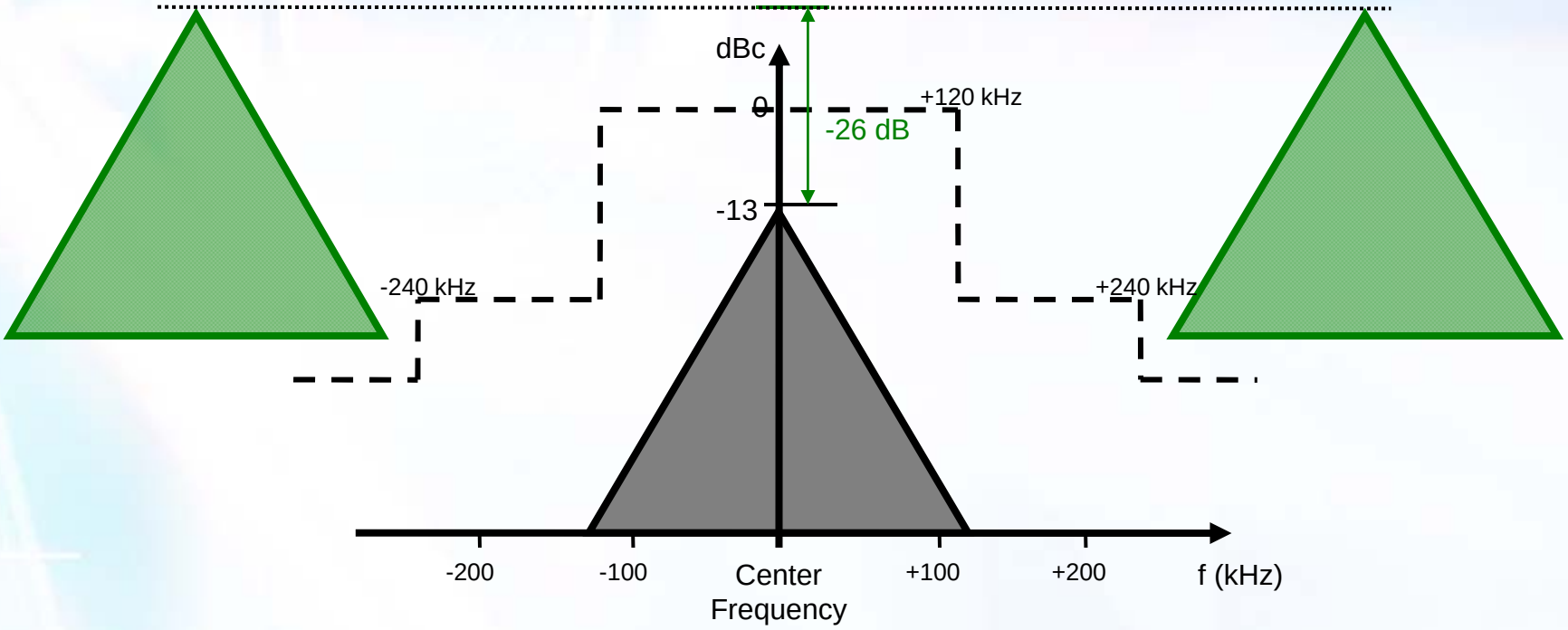
Analog D/U Ratio = +6 dB

1st Adjacent Interference

Additional protection margin required

- Stereophonic FM : 10.5 to 17 dB
  - *New D/U 16.5 to 23 = ~ 20 dB*
- Monophonic FM : 15 to 20 dB
  - *New D/U 21 to 26 = ~ 24 dB*

2nd Adjacent Interference



Analog D/U Ratio = -26 dB

2nd Adjacent Interference

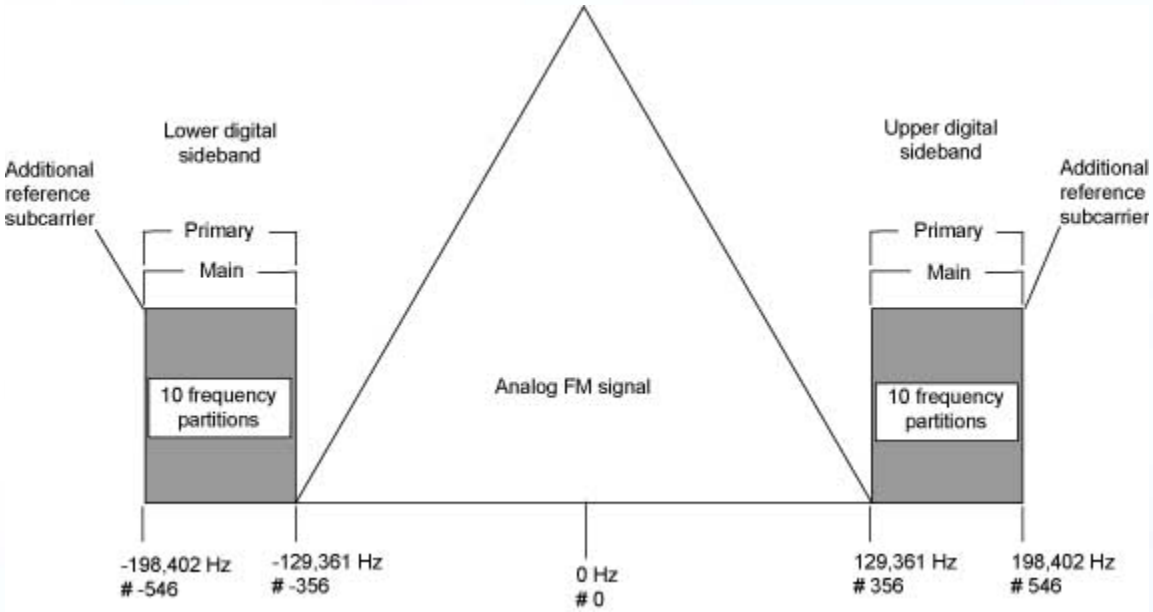
Additional protection margin required

- Stereophonic FM : 7.5 to 12.5 dB
  - *New D/U -18.5 to -13.5 = ~ -16 dB*

Analog Host Interference

Additional protection margin required

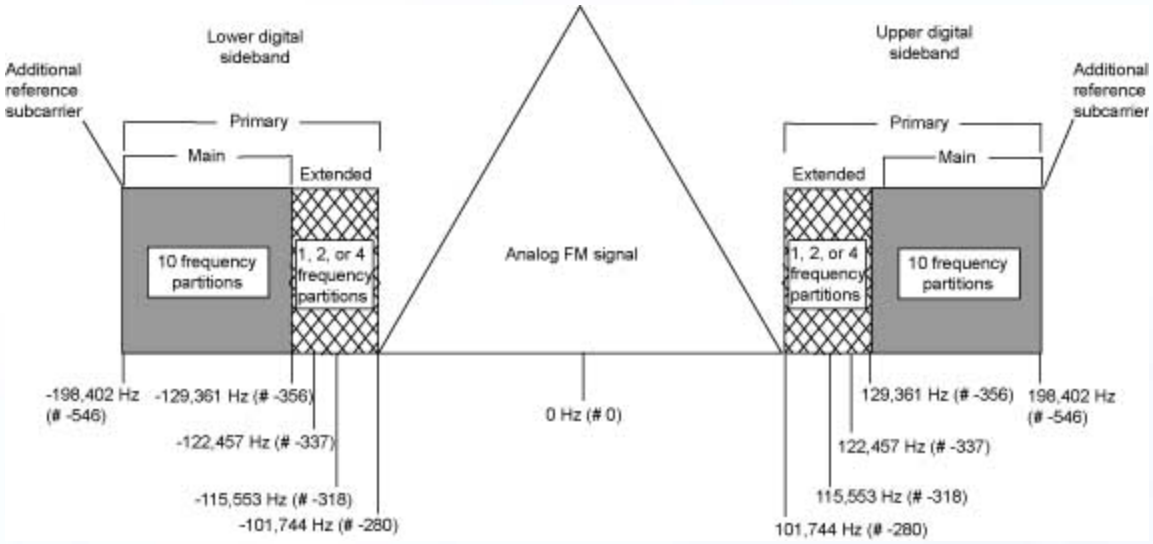
- Stereophonic FM : 1.5 to 4.5 dB



Analog Host Interference

Additional protection margin required

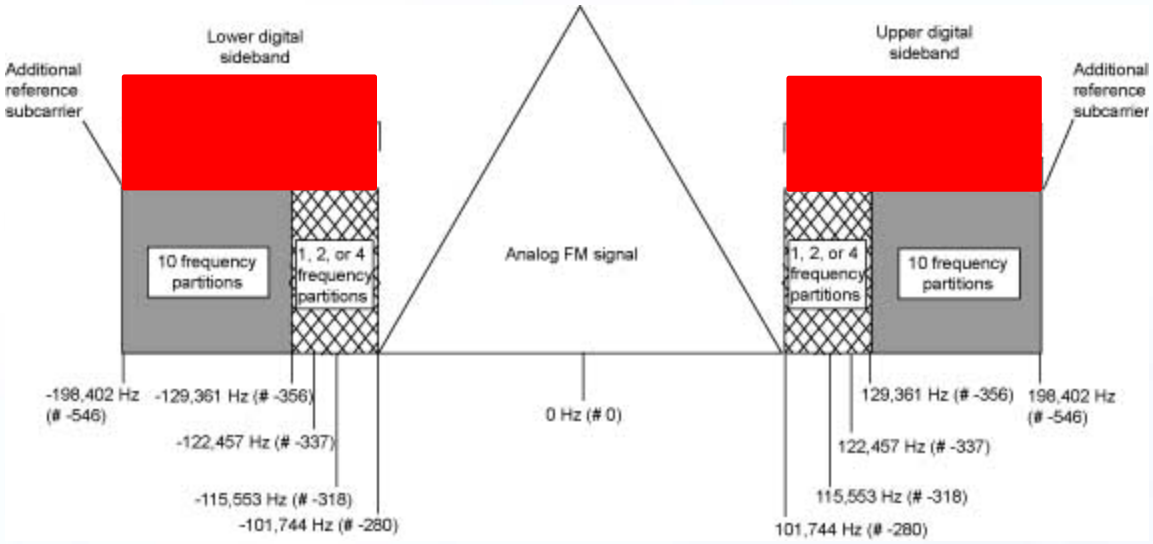
- Stereophonic FM : 1.5 to 4.5 dB
  - Impact of FM-IBOC extended mode : ?



Analog Host Interference

Additional protection margin required

- Stereophonic FM : 1.5 to 4.5 dB
  - Impact of higher digital power levels (10 dB) : ?



Summary: Impact on Analog

- The hybrid FM-IBOC signal will cause increased interference to service areas of existing FM stations.
- Existing coverage outside the protected contour is at a high risk of being compromised.
- FM service within the protected contour stands to also be affected.

Two Assessment Categories

1- Impact of IBOC on analog signals

2- IBOC digital performance

Digital Sensitivity

Fixed reception (Gaussian channel)

- Required digital S/N=8 dB
- Assuming a unity gain receiving antenna, coverage would extend to approximately the 55 dBu contour.

Monophonic analog FM (for comparison)

S/N=12 dB (approximately)

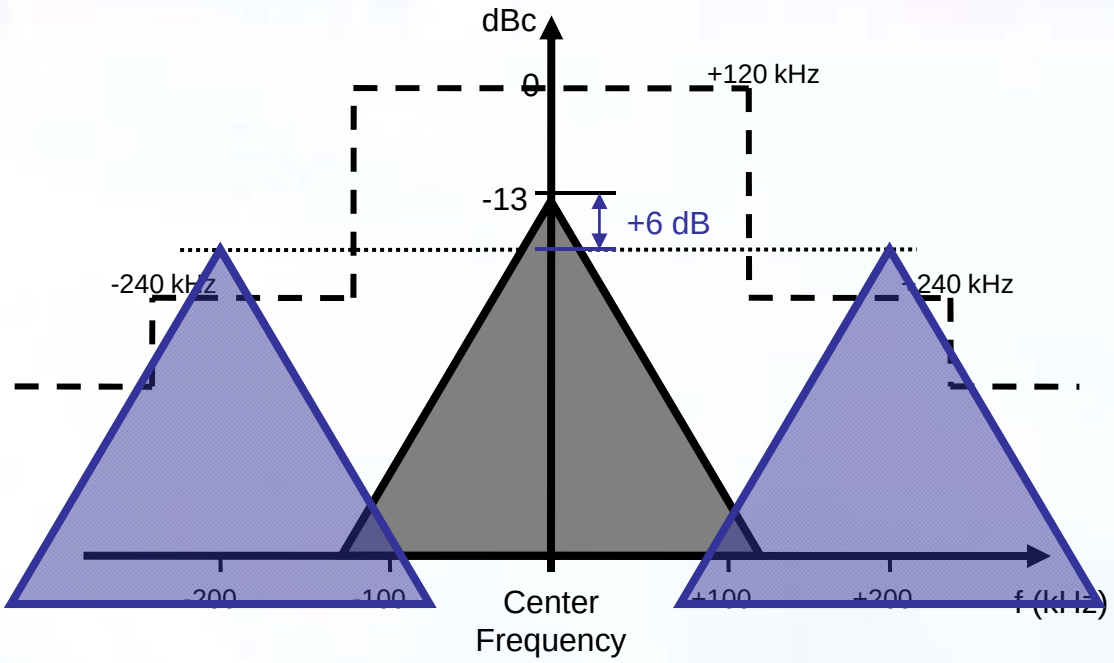
BUT……

…… this applies to non-congested spectrum situations……

What happens if we add adjacent channel interference to the picture ?

Interference D/U Ratios

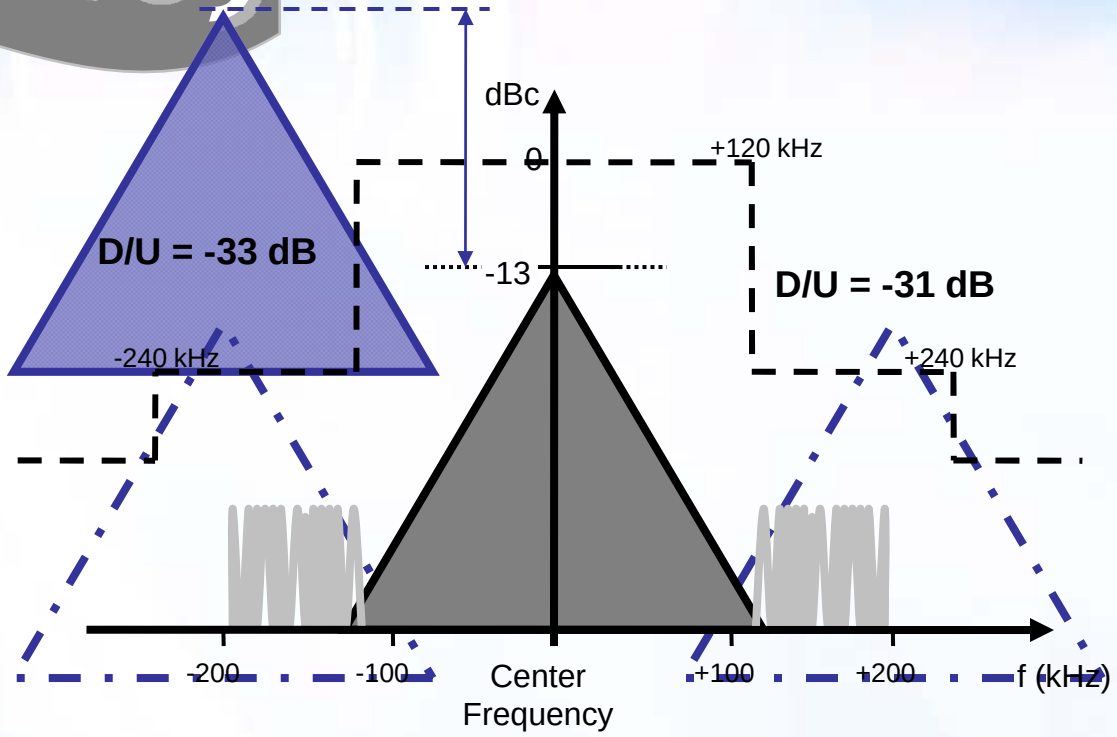
1st adj



Analog D/U Ratio = +6 dB

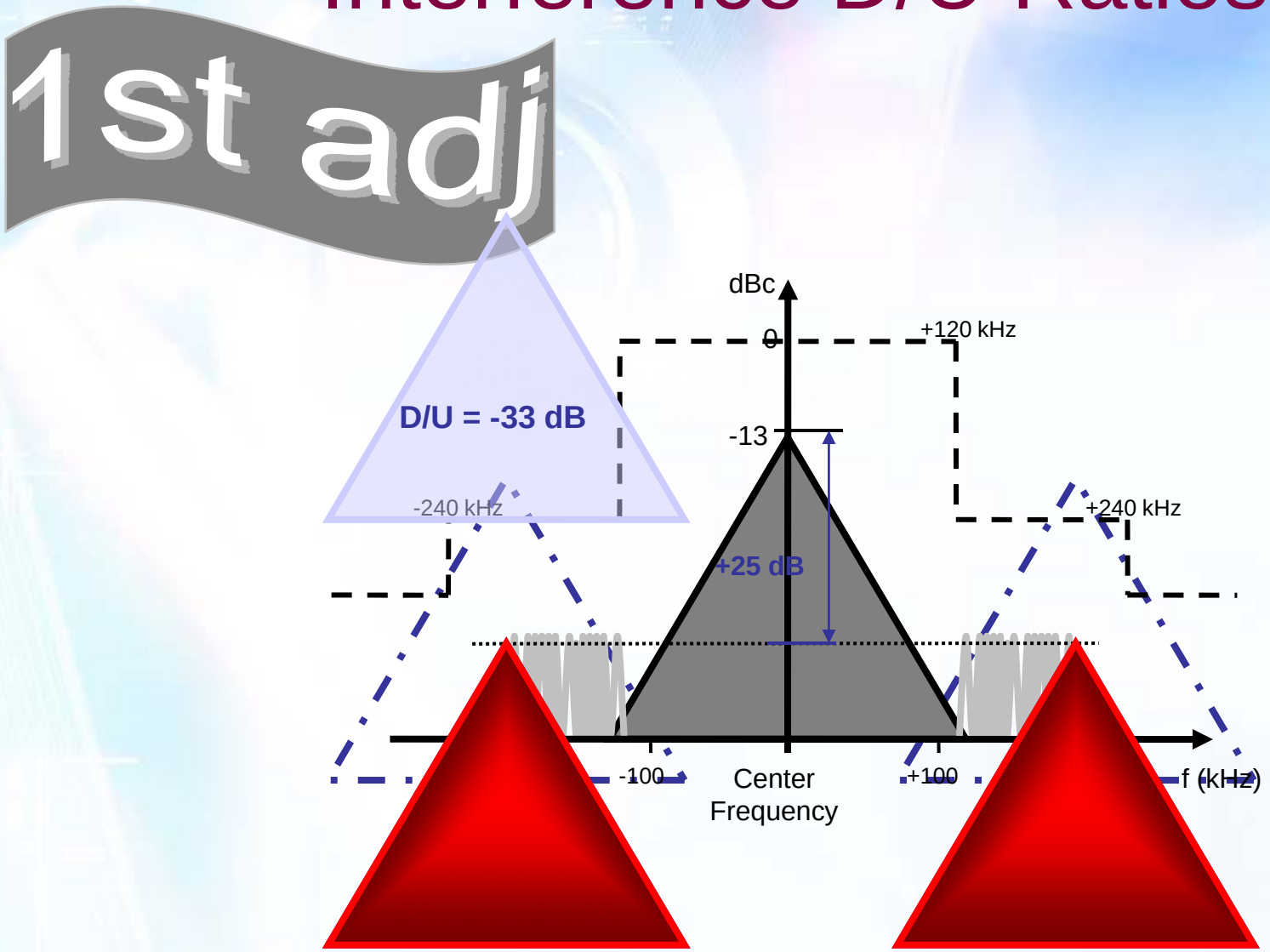
Interference D/U Ratios

1st adj



Upper Digital Band D/U Ratio = -33 dB

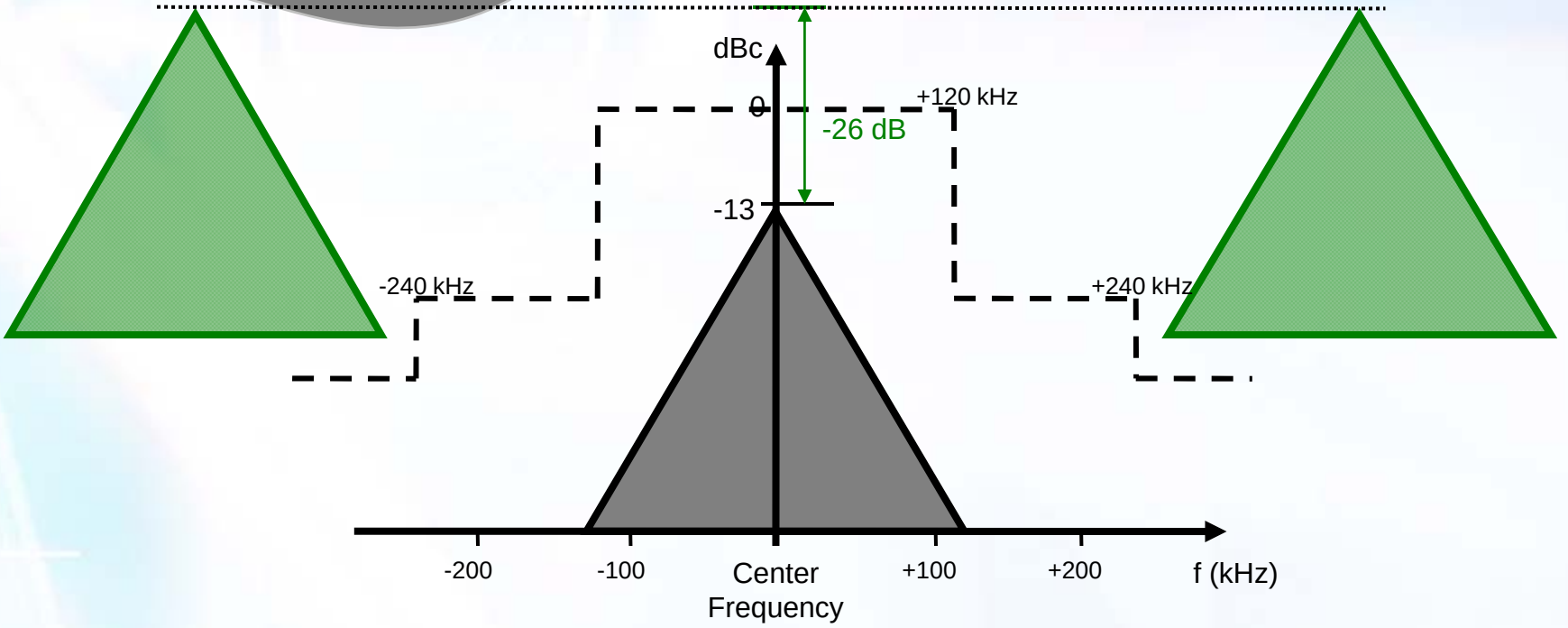
Interference D/U Ratios



Dual Digital D/U Ratio = +25 dB

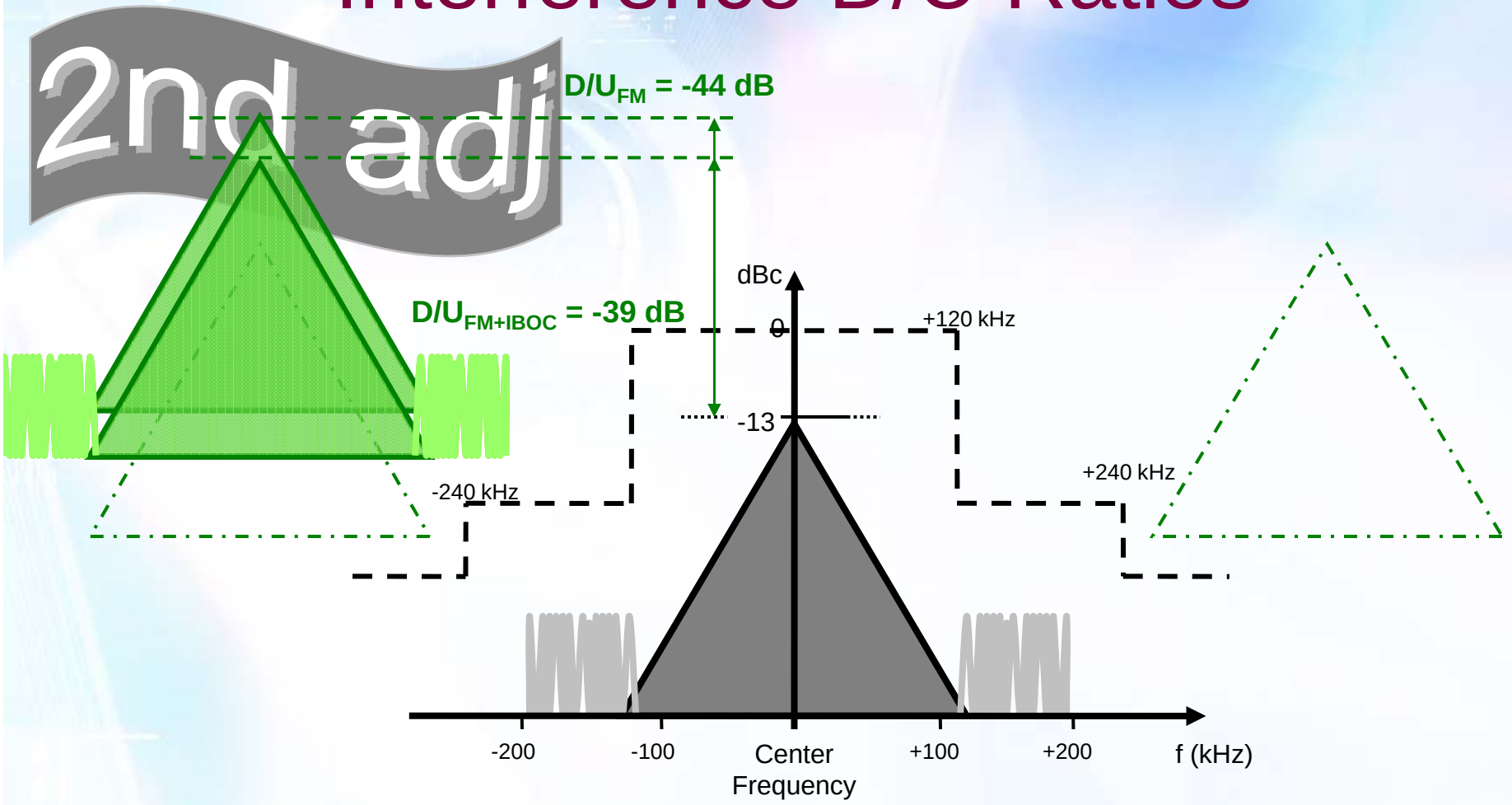
Interference D/U Ratios

2nd adj



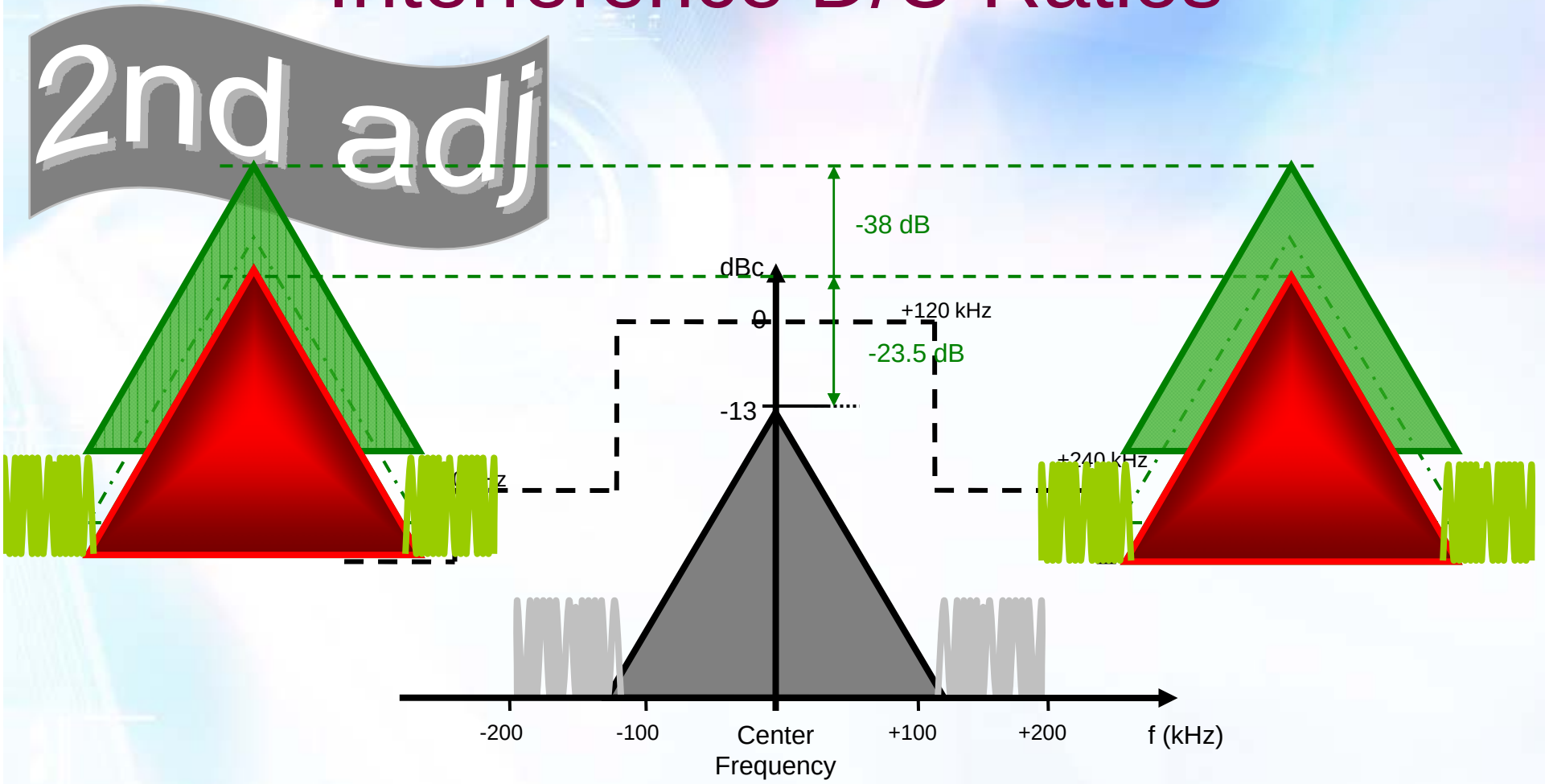
Analog D/U Ratio = -26 dB

Interference D/U Ratios



Upper Digital Band D/U Ratio = -40 dB + IBOC = -39 dB

Interference D/U Ratios



Dual Digital Band D/U Ratio = -38 dB + IBOC = -23.5 dB

Summary: Digital Performance

- The expected digital coverage area would normally extend to approximately the stereophonic FM contour, or a little less.
- First and second adjacent single-sided interferers do not pose problem, due to dual sidebands
- The IBOC digital signal appears to be quite vulnerable to dual-sided channel adjacencies.
- Digital coverage stands to suffer significant losses in spectrally congested areas.
- Multicast programming may then be reliably available only to curtailed audiences.

What’s next ?

Merci -Thank You

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Acknowledgements

André Carr, CRC

Julie Phaneuf, CRC

Barry McLarnon, BDMComm

Nautel Limited (Canada)

Digital Radio Co-ordinating Group (DRCG)

Industry Canada

iBiquity Digital Corporation