ATSC M/H Broadcast Scenarios

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Assumptions

Video: 3 Options	Audio: 3 Options	Coding: 2 Options
High Quality **550 kbps**	High Quality **32 kbps**	SCCC Outer Code 1/4, 1/4, 1/4, 1/4 **Efficiency = 17.1%**
Medium Quality **400 kbps**	Medium Quality **24 kbps**	SCCC Outer Code 1/2, 1/4, 1/4, 1/4 **Efficiency = 26.4%**
Low Quality **256 kbps**	Low Quality **16 kbps**	

Notes:

- A range of 0 to 200 kbps is reserved for overhead (ESG, null bits, etc.), this value has been adjusted to try to optimize scenarios.
- Coding rates will impact the robustness of the signal, that is, how easily the signal can be received. This can be thought of as the number of locations within a coverage area that have good reception. "Quarter rate" is the most robust code rate available, but consumes more bits for the same throughput. In most cases, "mixed rate" has been shown to be close in performance, but it is much more efficient in terms of bits consumed.
- All bit rate calculations are estimates, and not necessarily accurate down to the bit/sec.

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- Eleven use cases were developed and analyzed for consumed bit rate
- Each case calculates bit rates for the two levels of coding

1. One mid-quality program
2. Two mid-quality programs
3. Two high-quality programs
4. Four mid-quality programs
5. Two mid-quality and one high-quality programs
6. High number of lower-quality programs
7. Two mid-quality programs and four high-quality audio services
8. Two mid-quality programs and ten high and medium quality audio services
9. Twenty medium-quality and twenty high-quality audio services
10. High number of medium quality audio services
11. One max-quality program

Summary of Cases

Single Program		High Number Of Video Programs (9 Or 14)	
One Mid-quality Program – 1/2, 1/4, 1/4, 1/4		**High Number of Lower-quality Programs – 1/2, 1/4, 1/4, 1/4 = 14**	
Video Bit Rate	400 kbps	Video Bit Rate	3584 kbps
Audio Bit Rate	24 kbps	Audio Bit Rate	224 kbps
Overhead	60 kbps	Overhead	65 kbps
Total MH Bandwidth	1.834 Mbps	Total MH Bandwidth	14.672 Mbps
Remaining Legacy DTV Bandwidth	17.556 Mbps	Remaining Legacy DTV Bandwidth	4.718 Mbps
One Max-quality Program – 1/4, 1/4, 1/4, 1/4		**High Number of Lower-quality Programs – 1/4, 1/4, 1/4, 1/4 = 9**	
Video Bit Rate	768 kbps	Video Bit Rate	2304 kbps
Audio Bit Rate	24 kbps	Audio Bit Rate	144 kbps
Overhead	148 kbps	Overhead	60 kbps
Total MH Bandwidth	5.502 Mbps	Total MH Bandwidth	14.672 Mbps
Remaining Legacy DTV Bandwidth	13.888 Mbps	Remaining Legacy DTV Bandwidth	4.718 Mbps

Appendix

All Cases

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Case 1: One Mid-quality Program

One Mid-quality Program – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	400 kbps
Audio Bit Rate	24 kbps
Overhead	60 kbps
Total MH Bandwidth	1.834 Mbps
Remaining Legacy DTV Bandwidth	17.556 Mbps
One Mid-quality Program – 1/4, 1/4, 1/4, ¼	
Video Bit Rate	400 kbps
Audio Bit Rate	24 kbps
Overhead	46 kbps
Total MH Bandwidth	2.751 Mbps
Remaining Legacy DTV Bandwidth	16.639 Mbps

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Case 2: Two Mid-quality Programs

Two Mid-quality Programs – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	800 kbps
Audio Bit Rate	48 kbps
Overhead	20 kbps
Total MH Bandwidth	3.668 Mbps
Remaining Legacy DTV Bandwidth	15.722 Mbps
Two Mid-quality Programs – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	800 kbps
Audio Bit Rate	48 kbps
Overhead	92 kbps
Total MH Bandwidth	5.502 Mbps
Remaining Legacy DTV Bandwidth	13.888 Mbps

Case 3: Two High-quality Programs

Two High-quality Programs – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	1100 kbps
Audio Bit Rate	48 kbps
Overhead	62 kbps
Total MH Bandwidth	4.585 Mbps
Remaining Legacy DTV Bandwidth	14.805 Mbps
Two High-quality Programs – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	1100 kbps
Audio Bit Rate	48 kbps
Overhead	106 kbps
Total MH Bandwidth	7.336 Mbps
Remaining Legacy DTV Bandwidth	12.054 Mbps

Case 4: Four Mid-quality Programs

Four Mid-quality Programs – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	1600 kbps
Audio Bit Rate	96 kbps
Overhead	240 kbps
Total MH Bandwidth	7.336 Mbps
Remaining Legacy DTV Bandwidth	12.054 Mbps
Four Mid-quality Programs – 1/4, 1/4, 1/4, ¼	
Video Bit Rate	1600 kbps
Audio Bit Rate	96 kbps
Overhead	185 kbps
Total MH Bandwidth	11.004 Mbps
Remaining Legacy DTV Bandwidth	8.386 Mbps

Case 5: Two Mid-quality & One High-quality Program

Two Mid-quality & One High-quality Program – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	1350 kbps
Audio Bit Rate	72 kbps
Overhead	30 kbps
Total MH Bandwidth	5.502 Mbps
Remaining Legacy DTV Bandwidth	13.888 Mbps
Two Mid-quality & One High-quality Program – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	1350 kbps
Audio Bit Rate	72 kbps
Overhead	146 kbps
Total MH Bandwidth	9.17 Mbps
Remaining Legacy DTV Bandwidth	10.22 Mbps

Case 6: High Number of Lower-quality Programs

High Number of Lower-quality Programs (14) – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	3584 kbps
Audio Bit Rate	224 kbps
Overhead	65 kbps
Total MH Bandwidth	14.672 Mbps
Remaining Legacy DTV Bandwidth	4.718 Mbps
High Number of Lower-quality Programs (9) – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	2304 kbps
Audio Bit Rate	144 kbps
Overhead	60 kbps
Total MH Bandwidth	14.672 Mbps
Remaining Legacy DTV Bandwidth	4.718 Mbps

Case 7: Two Mid-quality Programs & Four High-quality Audio Services

Two Mid-quality Programs & Four High-quality Audio Services – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	800 kbps
Audio Bit Rate of Program	176 kbps
Audio Bit Rate of Audio Services (48 kbps)	192 kbps
Overhead	42 Kbps
Total MH Bandwidth	4.585 Mbps
Remaining Legacy DTV Bandwidth	14.805 Mbps
Two Mid-quality Programs & Four High-quality Audio Services – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	800 kbps
Audio Bit Rate of Program	48 kbps
Audio Bit Rate of Audio Services (48 kbps)	96 kbps
Overhead	153 kbps
Total MH Bandwidth	6.419 Mbps
Remaining Legacy DTV Bandwidth	12.971 Mbps

Case 8: Two Mid-quality Programs & Ten High/Mid-quality Audio Services

Two Mid-quality Programs & Ten High-quality Audio Services – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	800 kbps
Audio Bit Rate of Program	48 kbps
Audio Bit Rate of Audio Services (48 kbps)	320 kbps
Overhead	284 kbps
Total MH Bandwidth	5.502 Mbps
Remaining Legacy DTV Bandwidth	13.888 Mbps
Two Mid-quality Programs & Ten High-quality Audio Services – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	800 kbps
Audio Bit Rate of Program	48 kbps
Audio Bit Rate of Audio Services (48 kbps)	320 kbps
Overhead	86 kbps
Total MH Bandwidth	7.336 Mbps
Remaining Legacy DTV Bandwidth	12.054 Mbps

Case 9: Twenty Mid-quality & Twenty High-quality Audio Services

Twenty Mid-quality & Twenty High-quality Audio Services – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	1120 kbps
Overhead	90 kbps
Total MH Bandwidth	4.585 Mbps
Remaining Legacy DTV Bandwidth	14.805 Mbps
Twenty Mid-quality & Twenty High-quality Audio Services – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	1120 kbps
Overhead	134 kbps
Total MH Bandwidth	7.336 Mbps
Remaining Legacy DTV Bandwidth	12.054 Mbps

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Case 10: High Number of Mid-quality Audio Services

Reasonable Upper Limit of Mid-quality Audio Services (155) – 1/2, 1/4, 1/4, 1/4	
Audio Bit Rate of Audio Services (24 kbps)	3720 kbps
Overhead	153 kbps
Total MH Bandwidth	14.672 Mbps
Remaining Legacy DTV Bandwidth	4.718 Mbps
Reasonable Upper Limit of Mid-quality Audio Services (98) – 1/4, 1/4, 1/4, 1/4	
Audio Bit Rate of Audio Services (24 kbps)	2352 kbps
Overhead	156 kbps
Total MH Bandwidth	14.672 Mbps
Remaining Legacy DTV Bandwidth	4.718 Mbps

Case 11: One Max-quality Program

One Max-quality Program – 1/2, 1/4, 1/4, 1/4	
Video Bit Rate	768 kbps
Audio Bit Rate	24 kbps
Overhead	176 kbps
Total MH Bandwidth	3.668 Mbps
Remaining Legacy DTV Bandwidth	15.722 Mbps
One Max-quality Program – 1/4, 1/4, 1/4, 1/4	
Video Bit Rate	768 kbps
Audio Bit Rate	24 kbps
Overhead	148 kbps
Total MH Bandwidth	5.502 Mbps
Remaining Legacy DTV Bandwidth	13.888 Mbps