

Updated Public Safety Spectrum Needs.

The Public Safety Wireless Advisory Committee (PSWAC) did the most comprehensive study of Public Safety spectrum needs as a part of the Spectrum Subcommittee work (SRSC)¹. That study uses data from several sources as input to a mathematical model to determine a total amount of spectrum required by 2010 for public safety use.

A review of the model and parameters, revealed parameters that should be up dated given it is just over five years since the report was published. The SRSC also recommended periodical review at five-year intervals². A review of some parameters is required for understanding what should be updated.

The model looks at voice, data (low speed), status messaging, wideband data and video spectrum needs for public safety. Of those, the first three are mainstream essential applications requiring spectrum. The last two are new applications for public safety. While wideband channels are allocated in the 700 MHz spectrum and there is an open docket to allocate spectrum in the 4.9 GHz for high speed data applications, there are no systems in place today to evaluate the predictions of the model. Given the short time frame to file these comments and lack of real world experience for high-speed data systems we will not attempt to make new forecasts for those applications.

The assumptions for bandwidth needed for a voice or low speed data channel were very aggressive in the model. The RF Transmission Rate (RATE) is assumed to be a composite averaging 1.5 bit/sec/Hz. For this to be true some systems being installed today should be at least 3.5 bit/sec/Hz. Yet, most public safety voice systems still use analog modulation in a 25 kHz bandwidth. This is equivalent to 0.39 bit/sec/Hz when compared to a digital voice using 9.6 kbps in a 12.5 kHz bandwidth. Certainly, unless the conversion to digital technologies actually using 1.5 bit/sec/Hz is started within the next year for all public safety systems, there is no way the PSWAC model prediction would be met. The impact is either more spectrum (actual amount shown below) is needed for voice use or the service levels will degrade significantly. Today, the digital technologies for voice that are offered for sale to public safety place one voice channel in 25 kHz or in 12.5 kHz of bandwidth. The modulation rate is either 0.39 bit/sec/Hz or 0.77 bit/sec/Hz. Therefore it is unreasonable to assume an average of 1.5 bit/sec/Hz in use by 2010.

The following tables show the PSWAC projections for Spectrum and an updated projections assuming 0.77bit/sec/Hz rate for voice low speed data and status messaging.

¹ Public Safety Wireless Advisory Committee Final Report – Appendix D – SRSC Final Report

² PSWAC Final Report – Appendix D – SRSC Final Report, Page 79 paragraph 1.

PSWAC STUDY

SPECTRUM COMPUTATION FOR POLICE THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.0538	89.4	65	58.11	6	2	1.5	54.5	2.5	50	9.2
Data	0.0087	89.4	35	31.29	6	1	1.5	54.5	2.5	50	1.6
Stat/Messg	0.0004	89.4	31	27.71	6	2	1.5	54.5	2.5	50	0.0
W.B. Data	0.014	89.4	23	20.56	384	3	3.5	54.5	4	50	9.7
Video	0.024	89.4	14	12.52	384	3	3.5	54.5	4	50	10.1

SPECTRUM COMPUTATION FOR FIRE THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.0484	164.7	51	84.00	6	2	1.5	54.5	2.5	50	11.9
Data	0.0087	164.7	27	44.47	6	1	1.5	54.5	2.5	50	2.3
Stat/Messg	0.0004	164.7	31	51.06	6	2	1.5	54.5	2.5	50	0.1
W.B. Data	0.014	164.7	28	46.12	384	3	3.5	54.5	4	50	21.7
Video	0.024	164.7	20	32.94	384	3	3.5	54.5	4	50	26.5

SPECTRUM COMPUTATION FOR EMS THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.0484	55.8	47	26.23	6	2	1.5	54.5	2.5	50	3.7
Data	0.0087	55.8	45	25.11	6	1	1.5	54.5	2.5	50	1.3
Stat/Messg	0.0004	55.8	34	18.97	6	2	1.5	54.5	2.5	50	0.0
W.B. Data	0.014	55.8	31	17.30	384	3	3.5	54.5	4	50	8.1
Video	0.024	55.8	17	9.49	384	3	3.5	54.5	4	50	7.6

SPECTRUM COMPUTATION FOR POLICE THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.043	269.8	22	59.36	6	2	1.5	54.5	2.5	50	7.5
Data	0.0087	269.8	1	2.70	6	1	1.5	54.5	2.5	50	0.1
Stat/Messg	0.0004	269.8	16	43.17	6	2	1.5	54.5	2.5	50	0.1
W.B. Data	0.014	269.8	1	2.70	384	3	3.5	54.5	4	50	1.3
Video	0.024	269.8	3	8.09	384	3	3.5	54.5	4	50	6.5

SPECTRUM COMPUTATION FOR PUBLIC SAFETY THROUGH THE YEAR 2010

	Police	Fire	EMS	Gen. Govt.	Total
Voice	9.2	11.9	3.7	7.5	32.3
Data	1.6	2.3	1.3	0.1	5.3
Stat/Message	0.0	0.1	0.0	0.1	0.2
W.B. Data	9.7	21.7	8.1	1.3	40.7
Video	10.1	26.5	7.6	6.5	50.8
TOTAL	30.5	62.5	20.8	15.5	129.3
Existing Spectrum					-23.4
Spectrum From Commercial Services					-10.6
Net Spectrum Need By 2010					95.3

Spectrum Need with Rate of 0.77 b/s/Hz for Voive, Data, and Stat. Message

SPECTRUM COMPUTATION FOR POLICE THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.0538	89.4	65	58.11	6	2	0.8	54.5	2.5	50	17.9
Data	0.0087	89.4	35	31.29	6	1	0.8	54.5	2.5	50	3.1
Stat/Messg	0.0004	89.4	31	27.71	6	2	0.8	54.5	2.5	50	0.1
W.B. Data	0.014	89.4	23	20.56	384	3	3.5	54.5	4	50	9.7
Video	0.024	89.4	14	12.52	384	3	3.5	54.5	4	50	10.1

SPECTRUM COMPUTATION FOR FIRE THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.0484	164.7	51	84.00	6	2	0.77	54.5	2.5	50	23.3
Data	0.0087	164.7	27	44.47	6	1	0.77	54.5	2.5	50	4.4
Stat/Messg	0.0004	164.7	31	51.06	6	2	0.77	54.5	2.5	50	0.1
W.B. Data	0.014	164.7	28	46.12	384	3	3.5	54.5	4	50	21.7
Video	0.024	164.7	20	32.94	384	3	3.5	54.5	4	50	26.5

SPECTRUM COMPUTATION FOR EMS THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
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Voice	0.0484	55.8	47	26.23	6	2	0.77	54.5	2.5	50	7.3
Data	0.0087	55.8	45	25.11	6	1	0.77	54.5	2.5	50	2.5
Stat/Messg	0.0004	55.8	34	18.97	6	2	0.77	54.5	2.5	50	0.0
W.B. Data	0.014	55.8	31	17.30	384	3	3.5	54.5	4	50	8.1
Video	0.024	55.8	17	9.49	384	3	3.5	54.5	4	50	7.6

SPECTRUM COMPUTATION FOR POLICE THROUGH THE YEAR 2010

	Ave. ERL/User	POP in thou	Pen %	Computed Net POP, thou	SRC, kbps	COD	RATE b/s/Hz	LOAD, %	Reuse	Err, %	Computed MHz in 2010
Voice	0.043	269.8	22	59.36	6	2	0.77	54.5	2.5	50	14.6
Data	0.0087	269.8	1	2.70	6	1	0.77	54.5	2.5	50	0.3
Stat/Messg	0.0004	269.8	16	43.17	6	2	0.77	54.5	2.5	50	0.1
W.B. Data	0.014	269.8	1	2.70	384	3	3.5	54.5	4	50	1.3
Video	0.024	269.8	3	8.09	384	3	3.5	54.5	4	50	6.5

SPECTRUM COMPUTATION FOR PUBLIC SAFETY THROUGH THE YEAR 2010

	Police	Fire	EMS	Gen. Govt.	Total
Voice	17.9	23.3	7.3	14.6	63.0
Data	3.1	4.4	2.5	0.3	10.3
Stat/Message	0.1	0.1	0.0	0.1	0.3
W.B. Data	9.7	21.7	8.1	1.3	40.7
Video	10.1	26.5	7.6	6.5	50.8
TOTAL	40.8	76.0	25.6	22.7	165.1
Existing Spectrum					-23.4
Spectrum From Commercial Services					-14.2
Net Spectrum Need By 2010					127.5

The effect of not meeting the aggressive technology implementing higher modulation rates shows in the different totals for net spectrum required. The PSWAC study predicts 95 MHz needed by 2010 and the update using 0.77 bit/sec/Hz rate predicts 127 MHz. That is a difference of 32 MHz of additional spectrum needed by 2010.