

FCC Allocation Engineering

Stephen Lockwood – AM

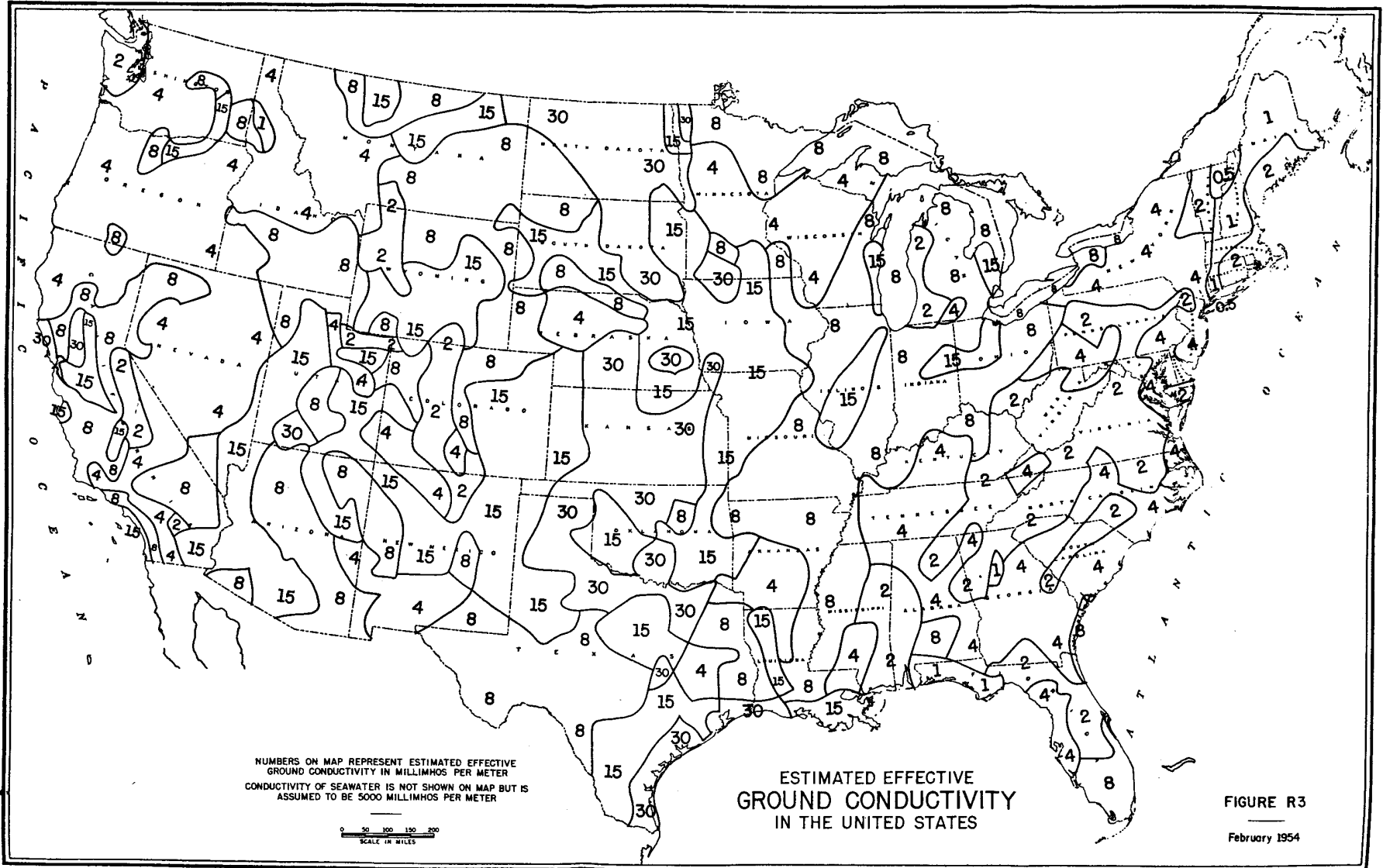
Erik Swanson – FM & TV

AM Allocations

- Goals – Cover Where the People Live
- Constraints - FCC Rules
 - Interference to Other Radio Stations
 - Daytime Propagation
 - Nighttime Propagation
 - City of License Coverage
 - Daytime 5 mV/m
 - Nighttime NIF

Daytime Allocation

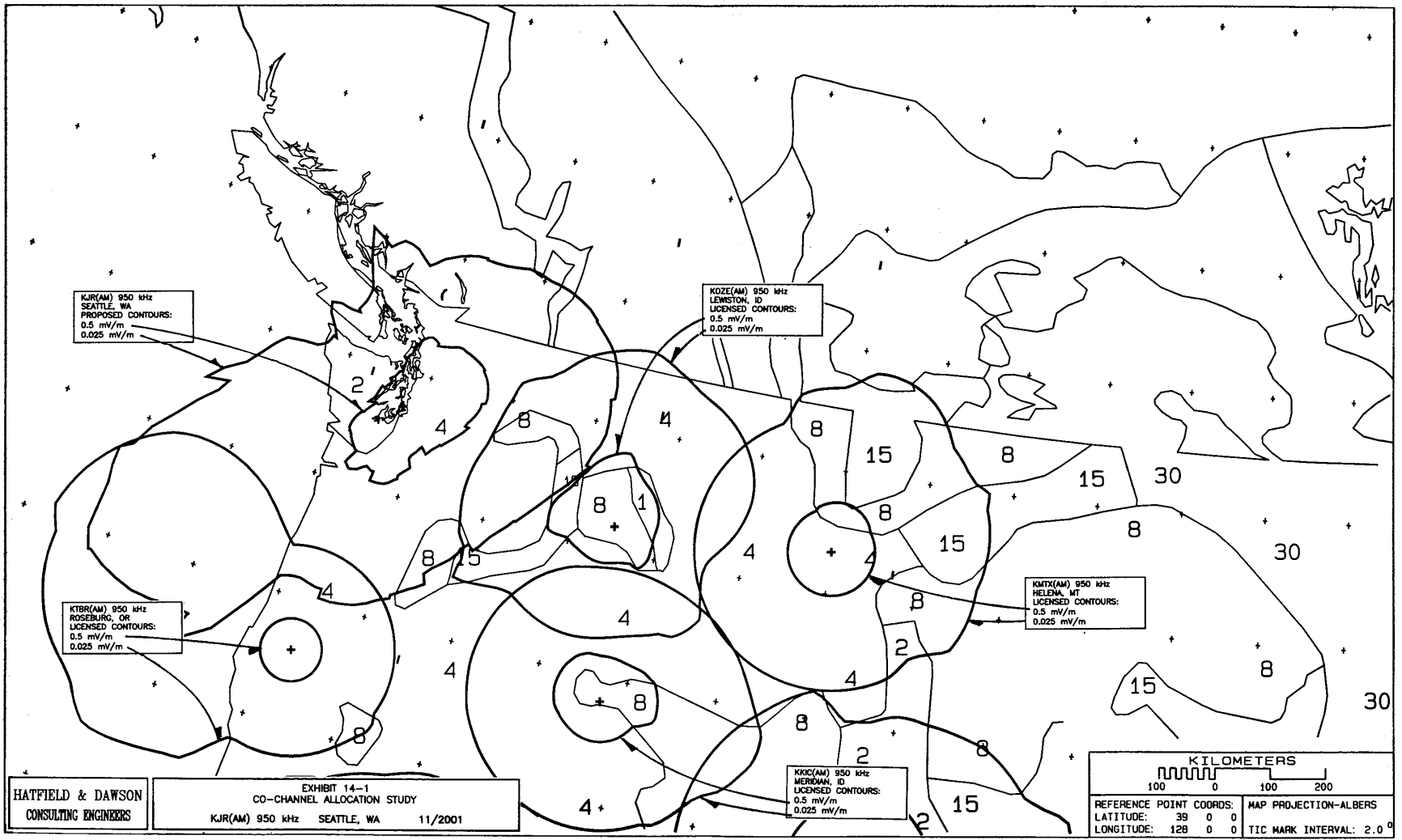
- Propagation Based on FCC's Groundwave Curves From Norton Model (~1935)
- Figure M3 Conductivity
 - Be careful with digitized databases - M3, R2
 - Accepted changes not in database – Puget Sound
- Measured Conductivity
 - $\pm 10^\circ$ of Radial
 - From Proof-of-Performance
 - Measured radials



FCC § 73.190 FIGURE R3

Co-channel Stations

- 20:1 Ratio
 - Our 0.025 mV/m contour cannot overlap their 0.5 mV/m contour
 - Their 0.025 mV/m contour cannot overlap our 0.5 mV/m contour
- For Class A Co-channel Stations
 - Our 0.005 mV/m contour cannot overlap their 0.1 mV/m contour



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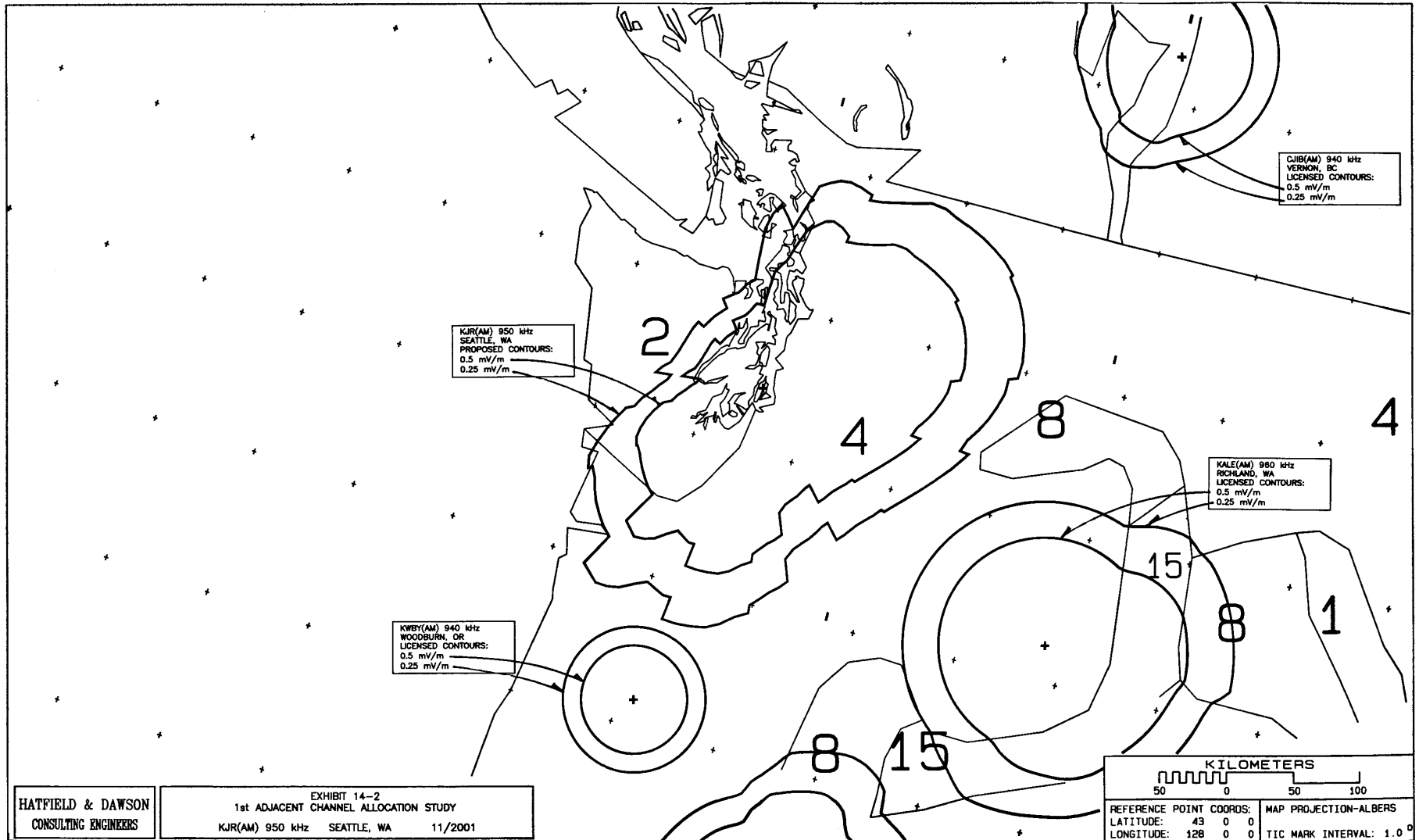
EXHIBIT 14-1
CO-CHANNEL ALLOCATION STUDY
KJR(AM) 950 kHz SEATTLE, WA 11/2001

KKIC(AM) 950 kHz
MERIDIAN, ID
LICENSED CONTOURS:
0.5 mV/m
0.025 mV/m

KILOMETERS	
REFERENCE POINT COORDS:	MAP PROJECTION-ALBERS
LATITUDE: 39 0 0	LONGITUDE: 128 0 0
TIC MARK INTERVAL: 2.0	

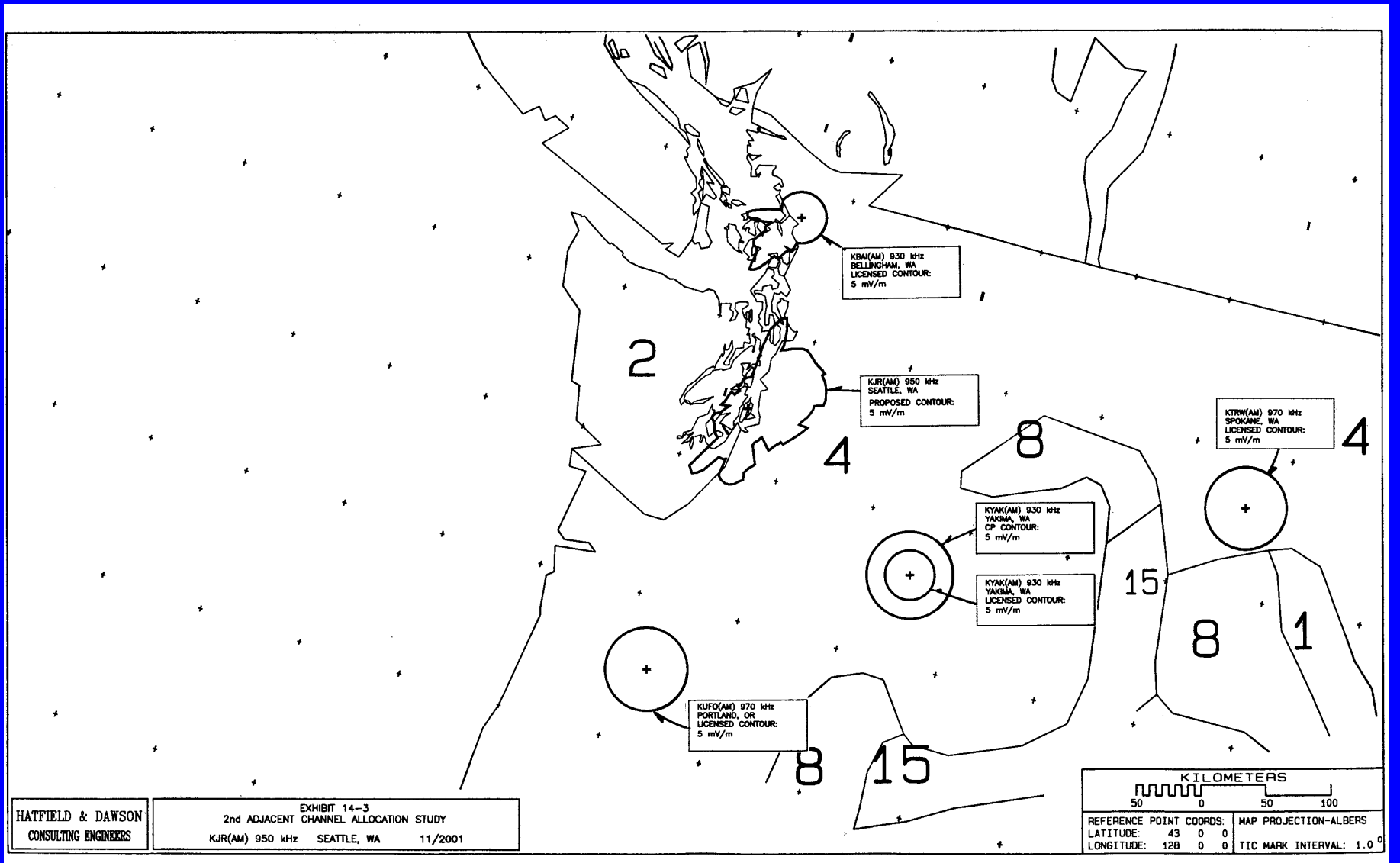
1st Adjacent Channel Stations

- 2:1 Ratio
 - Our 0.25 mV/m contour cannot overlap their 0.5 mV/m contour
 - Their 0.25 mV/m contours cannot overlap our 0.5 mV/m contour



2nd & 3rd Adjacent Channel Stations

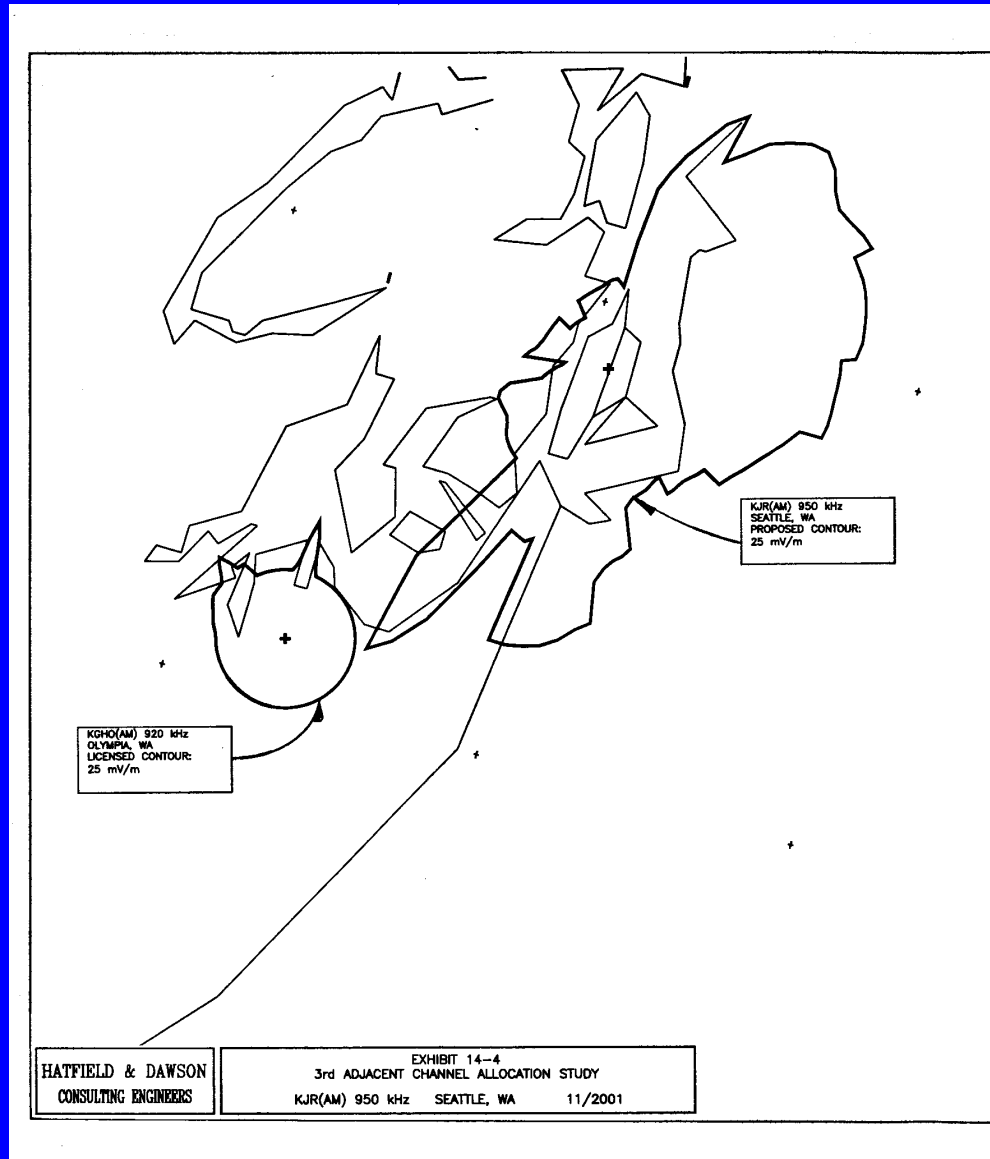
- 2nd Adjacent Channel Stations
 - 5 mV/m contours cannot overlap
- 3rd Adjacent Channel Stations
 - 25 mV/m contours cannot overlap



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EXHIBIT 14-3
2nd ADJACENT CHANNEL ALLOCATION STUDY
KJR(AM) 950 kHz SEATTLE, WA 11/2001

KILOMETERS
50 0 50 100
REFERENCE POINT COORDS: MAP PROJECTION-ALBERS
LATITUDE: 43 0 0
LONGITUDE: 128 0 0
TIC MARK INTERVAL: 1.0

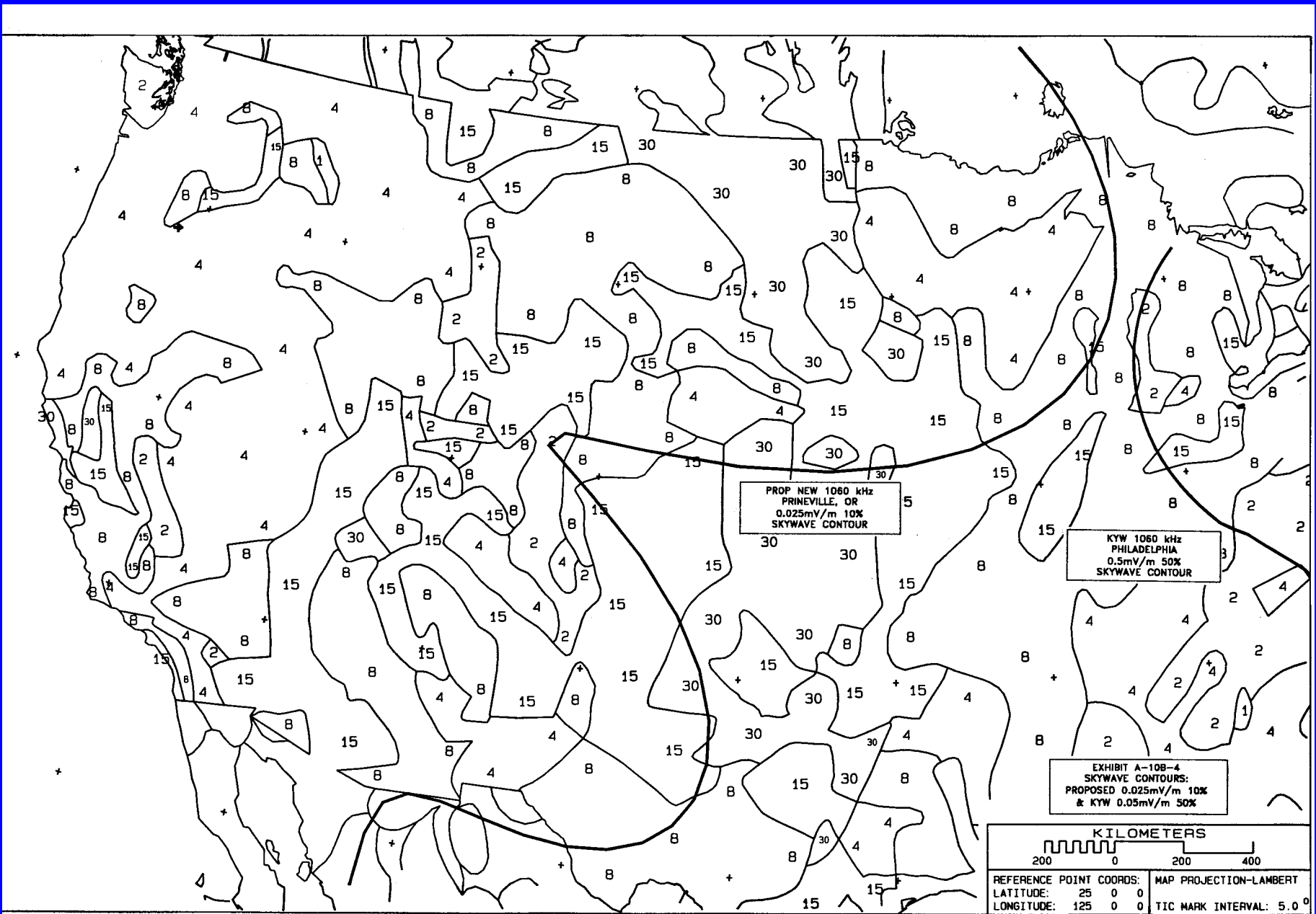


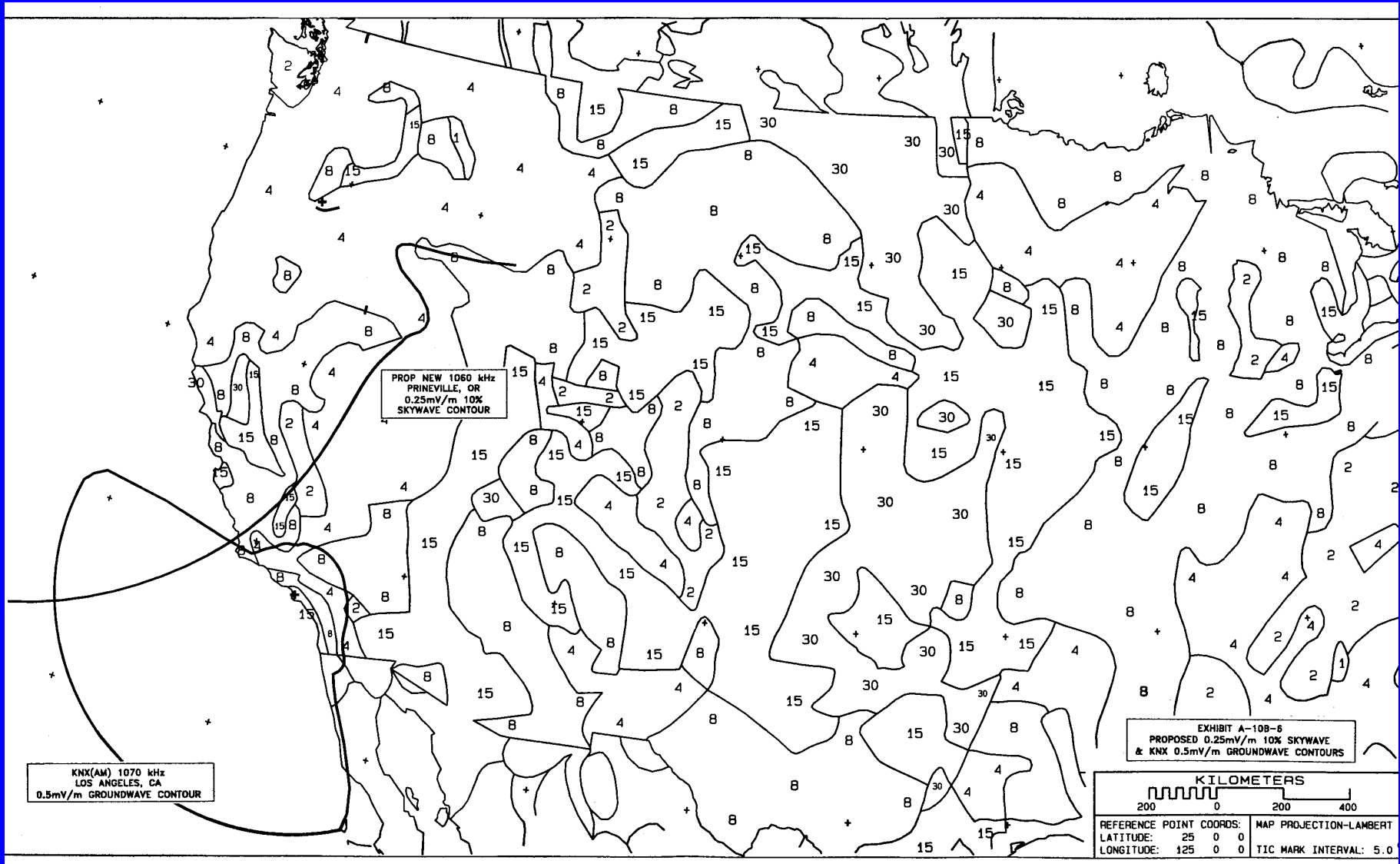
Daytime Allocation

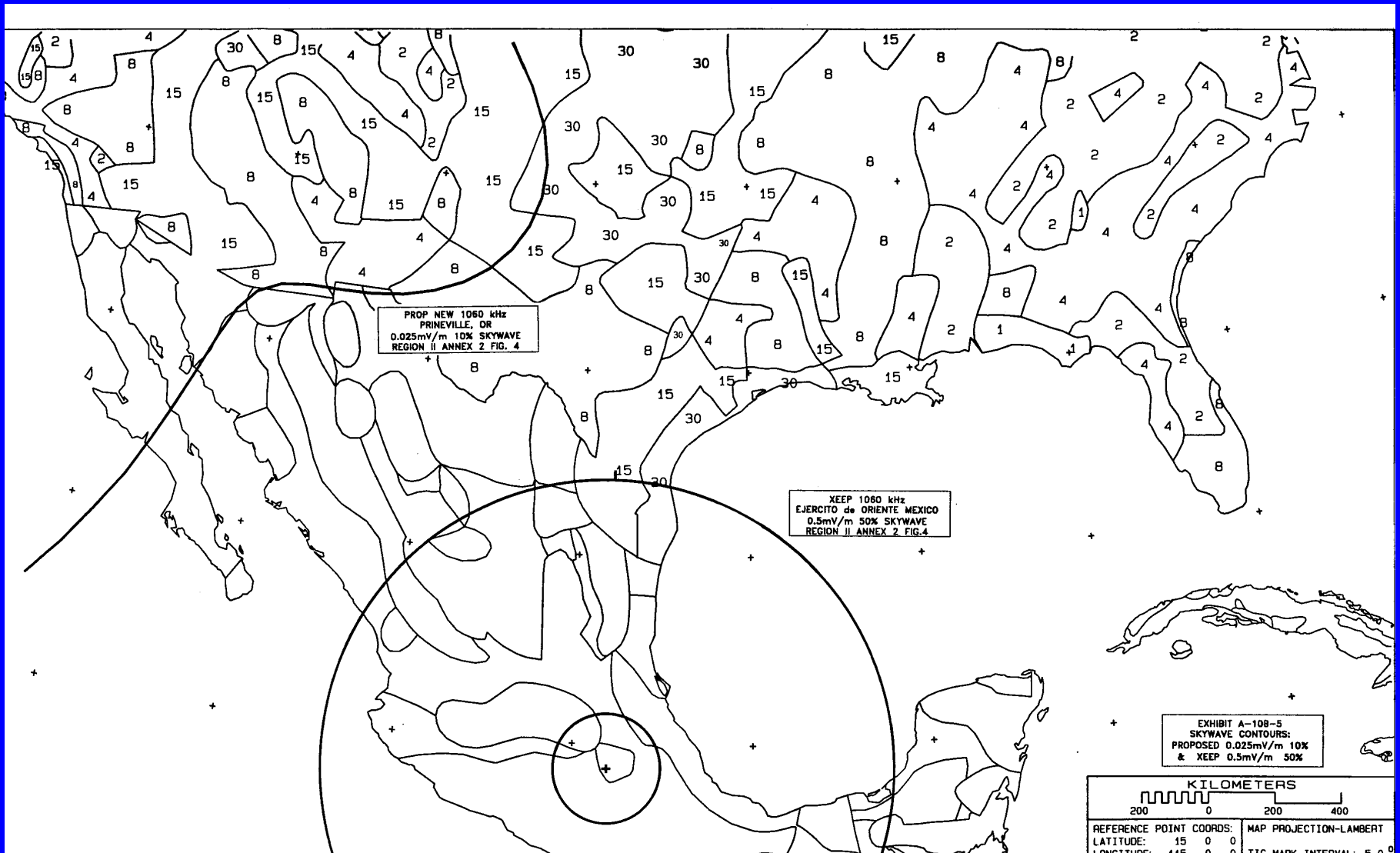
- Special Cases
 - Existing Overlap is Grandfathered
 - Any changes cannot increase overlap
 - Calculated on Overlap Area (km²)
 - Overlap Over Water is Excluded
 - Overlap With International Stations on US Territory are Not Protected

Nighttime Allocation

- Site to Site RSS Calculation to all Co-channel Stations in Region II (Western Hemisphere) and Domestic 1st Adjacent Channel Stations
- Protection to Class A Contours
 - 0.5 mV/m 50% Skywave Contour for Co-channel Stations
 - 0.5 mV/m Groundwave Contour for 1st Adjacent Stations
- International Class A Contours on US Territory are Not Protected







RSS – Root Sum Squared

$$RSS = \sqrt{(x_1^2 + x_2^2 + x_3^2 + \dots x_n^2)}$$

Example RSS Calculation

Point: KSRV

Frequency: 1380 kHz

Station Call	Distance (km)	Bearing (degs.)	Theta (degs.)	Radiation (mV/m)	SW Mult. (uV/m)	IF Level (mV/m)	RSS (mV/m)
KXTL *	405.1	238.9	18.6	653.1	142.239	1.8579	1.8579
KRKO	590.2	135.1	12.4	106.2	84.293	1.7898	2.5797
KXCA	1908.0	309.0	.0	584.1	12.826	1.4984	2.9833 #
KHEY	1649.2	328.9	1.3	246.3	18.492	.9109	3.1193
XECO	3202.4	332.8	.0	654.8	6.080	.7962	3.2193
KOTA	1100.5	274.9	5.0	120.8	30.101	.7272	
KBBO *	391.2	134.7	19.3	240.2	149.826	.7197	
KOTA	1100.5	274.9	5.0	113.2	30.101	.6813	

* - indicates an adjacent channel station.

- 50% RSS for Nighttime Interference Free Contour

Nighttime Limits

- RSS Interference Level Below 2 mV/m for Class B Stations
- Up to 25% of a stations RSS Limit
- Existing Contributor to RSS Limit in 25% - 50% Cannot Increase Contribution
- Existing Contributor to RSS limit Greater Than 50% Must Decrease by 10%
 - Remember Hardship Waiver!

Nighttime Limits

City: EVERETT

, WA

Call: KRKO

1992 Allocation Rules

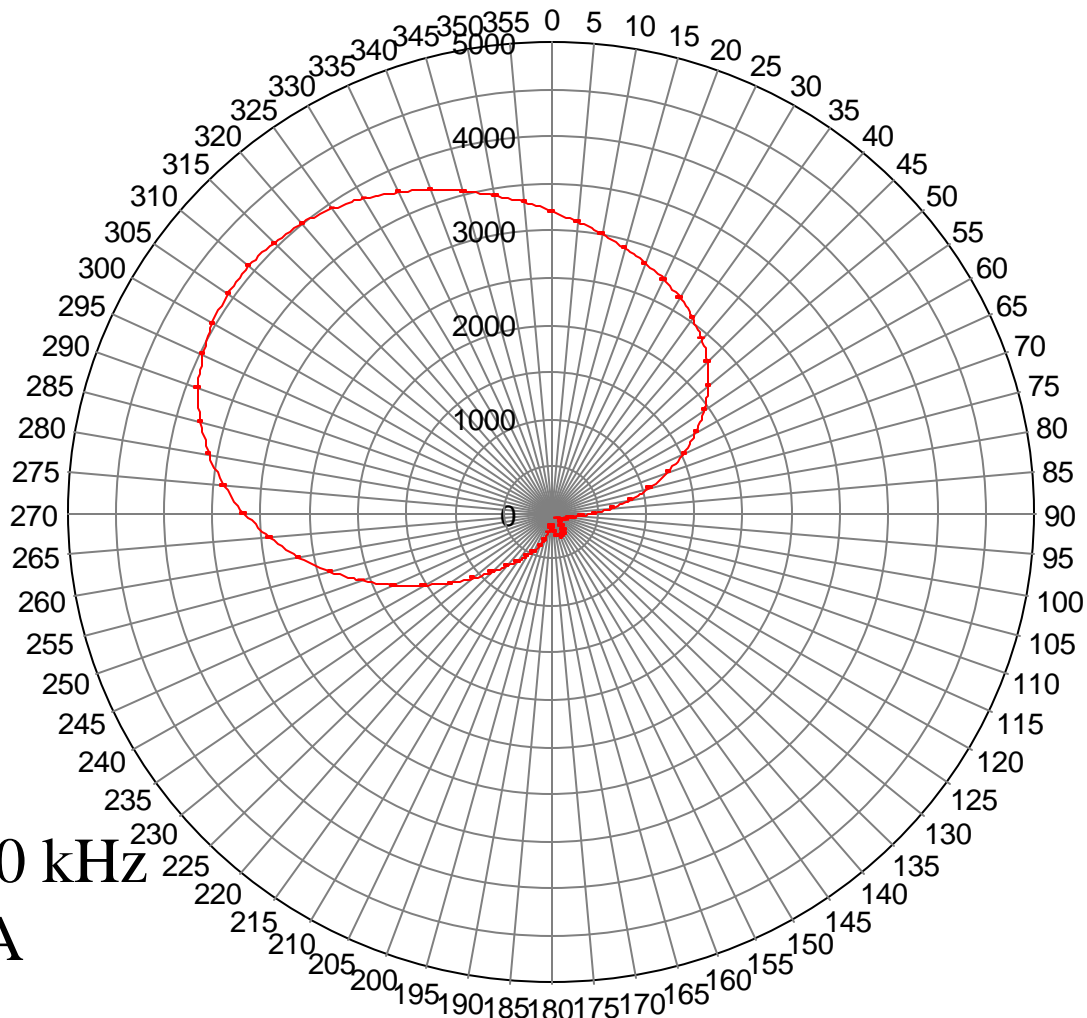
Transmitter site coordinates: N 47 52 32 W 122 4 42

Frequency: 1380 kHz

Point		Distance (km)	Bearing (degs)	Theta Min. (degs)	Theta Max. (degs)	RSS Limit (mV/m)	Reqd. Prot. (mV/m)	Skywv. Mult. (uV/m)	Allowed Radiation (mV/m @ 1 km)
KXTL	*	745.9	102.6	9.2	16.1	2.37	5.93	55.20	537.0
KAST	*	231.8	216.0	31.3	45.3	9.48	23.70	254.29	465.9
CKPC		3259.7	83.7	.0	.0	4.77	2.17	2.96	3665.9
XEKT		1765.3	163.2	2.2	2.2	6.42	3.18	15.50	1026.1
KTKZ		1038.5	175.7	5.5	10.6	6.65	1.66	37.59	221.1
KTOM		1243.4	178.1	3.8	8.1	4.89	1.22	28.39	215.1
KIFO		4340.1	240.1	.0	.0	2.23	.54	3.63	748.4
KOTA		1517.0	99.3	2.0	5.5	3.50	.87	14.50	300.2
KSLM	*	329.1	193.7	22.9	35.2	4.04	9.97	181.96	273.9
KBBO	*	189.9	139.2	36.7	51.1	9.75	24.38	293.91	414.8

* - indicates an adjacent channel station.

KRKO 1380 kHz
Everett WA



Questions on AM ?

Basics of FM Allocations

Erik Swanson

Hatfield & Dawson Consulting Engineers

2002

Primary Principles

- Full Spacing (no interference)
- Coverage of Community of License

Full Spacing (no interference)

- Spacing table in 73.207 of the FCC Rules is designed to prevent overlap of service and interfering contours
- Required spacing varies according to Class of stations, and channel relationships

FM Station Classes

Most of the United States

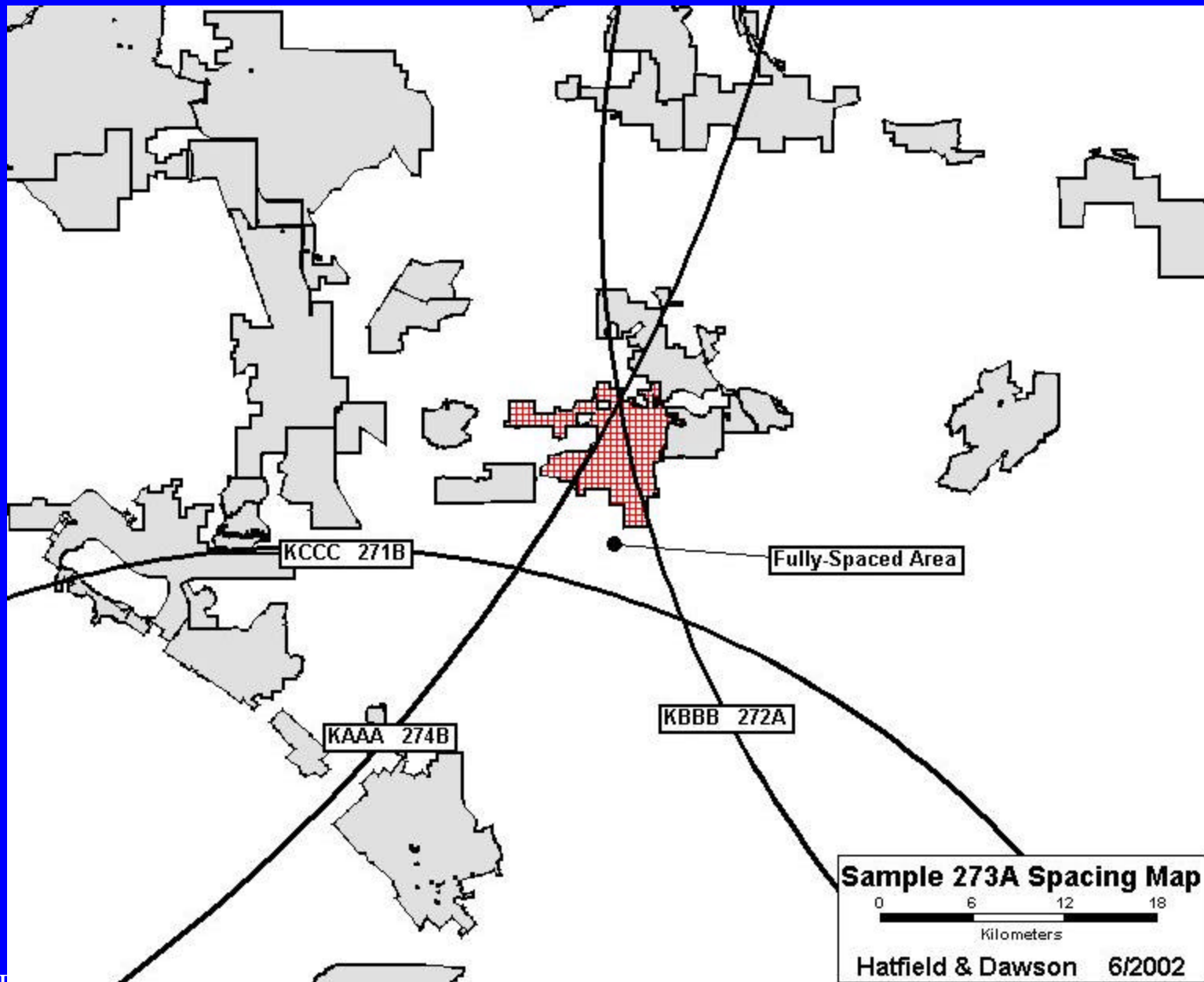
- A (6 kW at 100 m HAAT)
- C3 (25 kW at 100 m HAAT)
- C2 (50 kW at 150 m HAAT)
- C1 (100 kW at 299 m HAAT)
- C0 (100 kW at 450 m HAAT)
- C (100 kW at 600 m HAAT)

California (SF south) and the East

- A (6 kW at 100 m HAAT)
- B1 (25 kW at 100 m HAAT)
- B (50 kW at 100 m HAAT)

Table A--Minimum Distance Separation Requirements in Kilometers (miles)

Relation	Co-channel	200 kHz	400/600 kHz	10.6/10.8 MHz
A to A	115 (71)	72 (45)	31 (19)	10 (6)
A to B1	143 (89)	96 (60)	48 (30)	12 (7)
A to B	178 (111)	113 (70)	69 (43)	15 (9)
A to C3	142 (88)	89 (55)	42 (26)	12 (7)
A to C2	166 (103)	106 (66)	55 (34)	15 (9)
A to C1	200 (124)	133 (83)	75 (47)	22 (14)
A to C0	215 (134)	152 (94)	86 (53)	25 (16)
A to C	226 (140)	165 (103)	95 (59)	29 (18)
B1 to B1	175 (109)	114 (71)	50 (31)	14 (9)
B1 to B	211 (131)	145 (90)	71 (44)	17 (11)
B1 to C3	175 (109)	114 (71)	50 (31)	14 (9)
B1 to C2	200 (124)	134 (83)	56 (35)	17 (11)
B1 to C1	233 (145)	161 (100)	77 (48)	24 (15)
B1 to C0	248 (154)	180 (112)	87 (54)	27 (17)
B1 to C	259 (161)	193 (120)	105 (65)	31 (19)
B to B	241 (150)	169 (105)	74 (46)	20 (12)
B to C3	211 (131)	145 (90)	71 (44)	17 (11)
B to C2	241 (150)	169 (105)	74 (46)	20 (12)
B to C1	270 (168)	195 (121)	79 (49)	27 (17)
B to C0	272 (169)	214 (133)	89 (55)	31 (19)
B to C	274 (170)	217 (135)	105 (65)	35 (22)
C3 to C3	153 (95)	99 (62)	43 (27)	14 (9)
C3 to C2	177 (110)	117 (73)	56 (35)	17 (11)
C3 to C1	211 (131)	144 (90)	76 (47)	24 (15)
C3 to C0	226 (140)	163 (101)	87 (54)	27 (17)
C3 to C	237 (147)	176 (109)	96 (60)	31 (19)
C2 to C2	190 (118)	130 (81)	58 (36)	20 (12)
C2 to C1	224 (139)	158 (98)	79 (49)	27 (17)
C2 to C0	239 (148)	176 (109)	89 (55)	31 (19)
C2 to C	249 (155)	188 (117)	105 (65)	35 (22)
C1 to C1	245 (152)	177 (110)	82 (51)	34 (21)
C1 to C0	259 (161)	196 (122)	94 (58)	37 (23)
C1 to C	270 (168)	209 (130)	105 (65)	41 (25)
C0 to C0	270 (168)	207 (129)	96 (60)	41 (25)
C0 to C	281 (175)	220 (137)	105 (65)	45 (28)
C to C	290 (180)	241 (150)	105 (65)	48 (30)



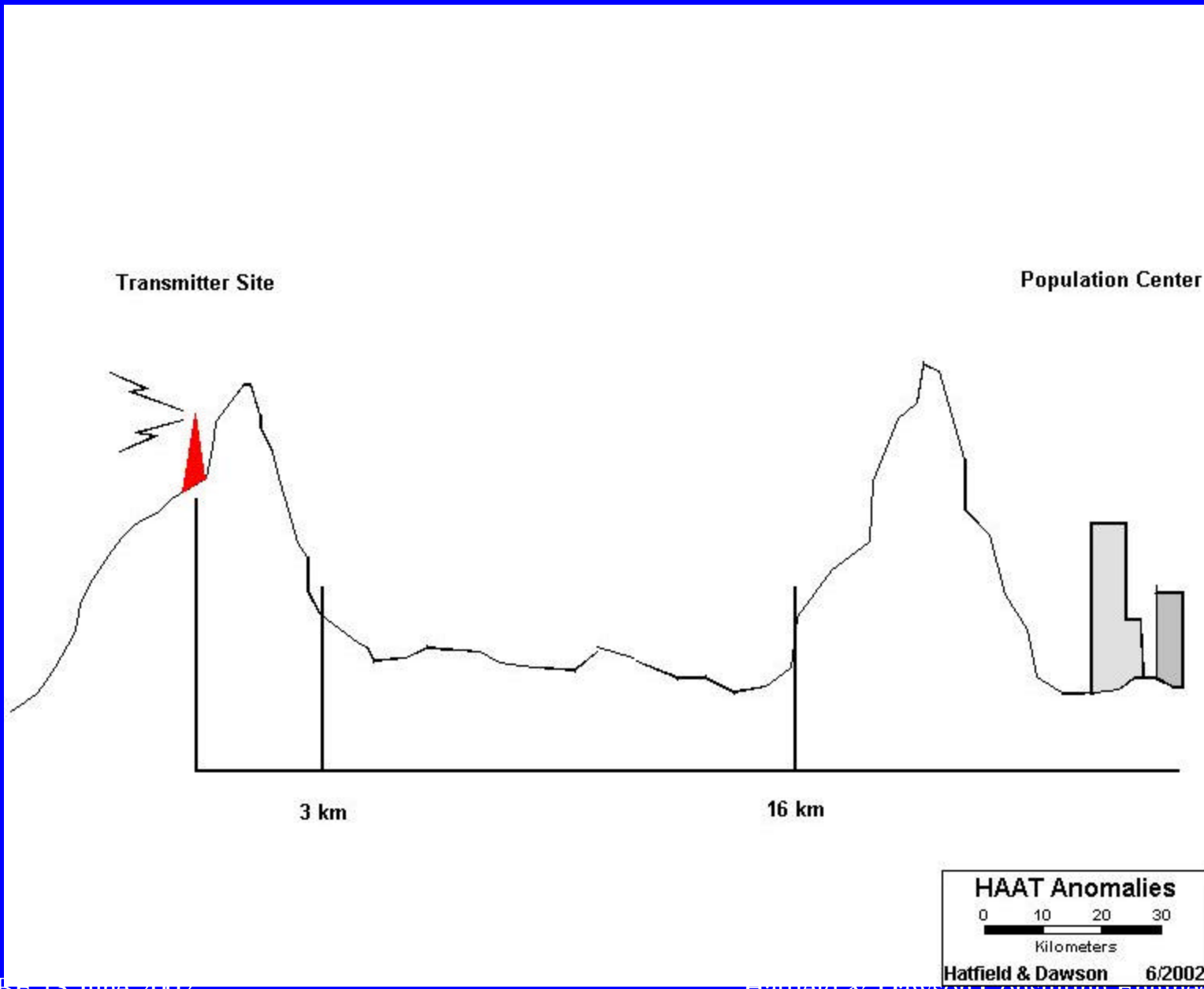
Spacing Table

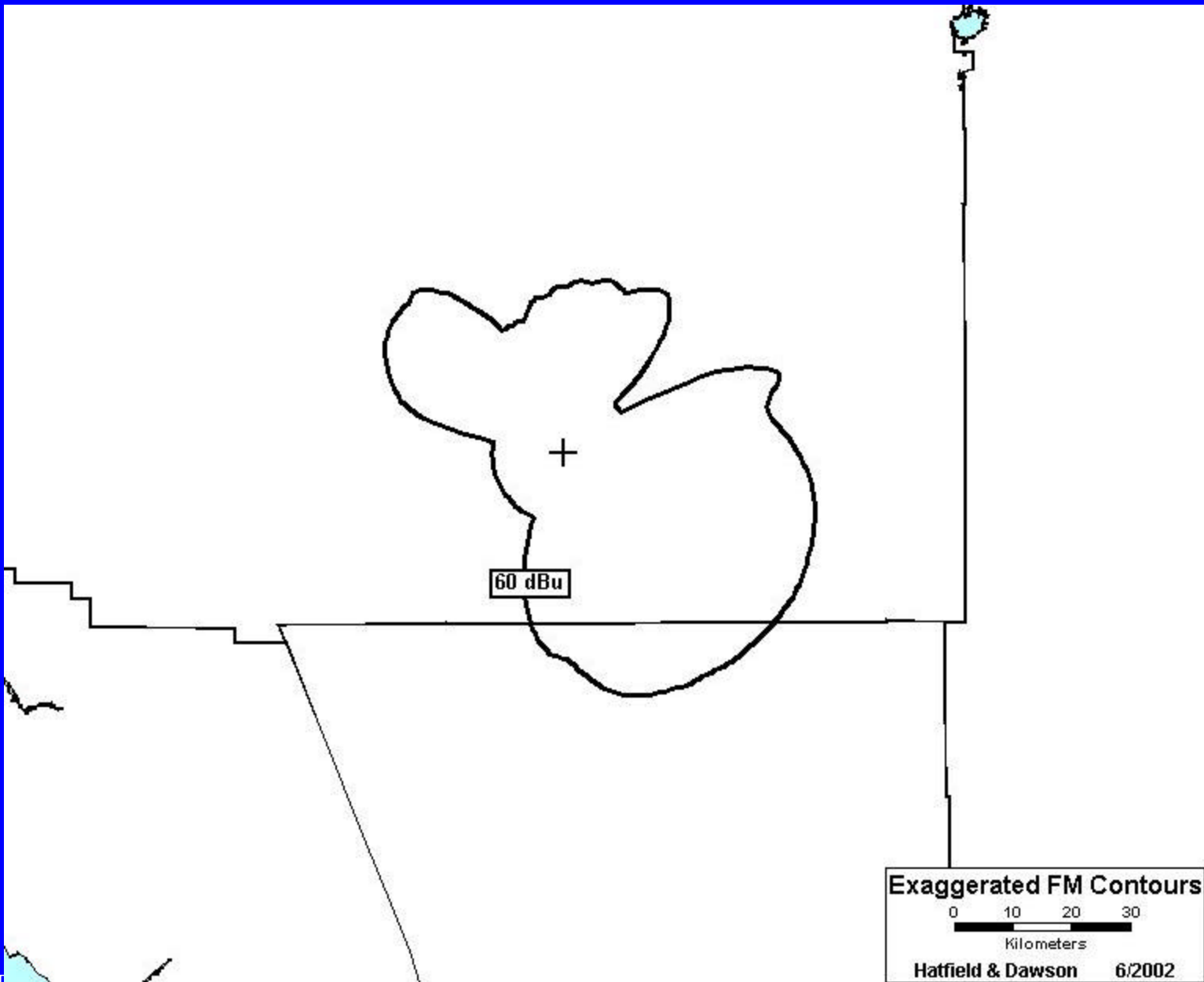
- Based on “flat earth” or “uniform terrain” assumptions

Distance to Contours

In the Rest of the World

- Distance to contours calculated based on antenna's height above average terrain (HAAT)
- Averages only the terrain 3-16 km (2-10 miles) from the transmitter site
- Terrain obstructions lying <3 or >16 km are ignored





Coverage of Community of License

- FCC Rules require 70 dBu (3.16 mV/m) signal to community of license, using standard methodology
- We can sometimes use alternate methods (Longley-Rice), on a case by case basis

FM Short-Spacings

Two Basic Types:

- Grandfathered

Arising from changes in FCC Rules

- “Voluntary”

Application under 73.215 of the Rules

Grandfathered Short-Spacings

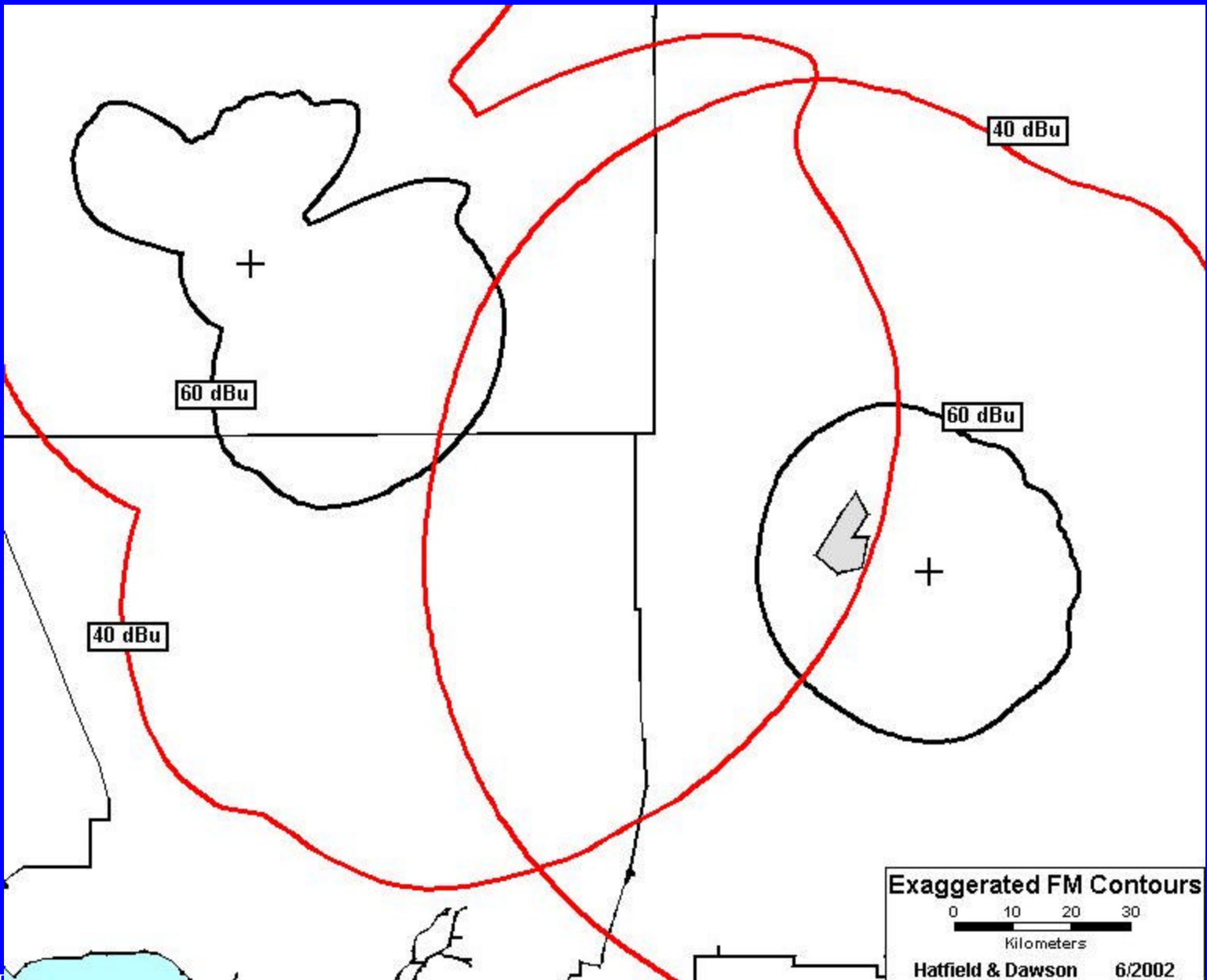
- “Pre 1964”
Created before FCC adopted spacing table
- “Pre 1989”
6 kW Class A stations

Grandfathered Short-Spacings

- Criteria used to evaluate grandfathered short-spacings are complex
- Re-read the Rules, do the research

“Voluntary” Short-Spacings

- Created by application filed using 73.215, the contour protection rules
- Must first meet absolute minimum spacings
- Then contour protection is applied (this is same as non-comm allocations)
- Creates some anomalous situations



Station Class Upgrades

Allotment Site

- Fully-spaced
- 70 dBu to Community of License

Transmitter Site

- Can be short-spaced
- 70 dBu to Community of License

Station Class Upgrades

- Preferable to use “one-step” application process
- Can also use Rulemaking process, but this is more risky

Canada Border Issues

- Within 320 km (200 miles) of border
- More restrictive spacings
- Protection only in home country

Mexican Border Issues

- Within 320 km (200 miles) of border
- Spacing requirements essentially the same as domestic US spacings
- Stations are protected past the border

Applicant Agreements

- Negotiated interference not permitted
- Coordinated applications are permitted

Low Power FM

- LP100 (100 W at 30 m HAAT)
- LP10 (10 W at 30 m HAAT)

- No grants in Washington yet
- Oregon will see grants soon

Low Power FM

- LPFM must meet spacings to existing stations
- Full power stations do not have to meet spacings to LPFM

Class C0

- Halfway between C1 and full Class C
- Can be used for upgrades
- Class C can be forced to reclassify C0 by “triggering” application

(Very) Basics of TV Allocations

Erik Swanson

Hatfield & Dawson Consulting Engineers

2002

TV-to-TV Allocations

- Only one Class of primary NTSC station
- Allocations historically based on full spacing

TV Short-Spacings

- No TV-to-TV short-spacing rules equivalent to the FM short-spacing rules
- TV short-spacings unusual
 - Waivers
 - “Equivalent Protection”

DTV in the Mix

- Spacing Rules
 - TV-to-TV
- Longley-Rice Interference Analysis
 - TV-to-DTV
 - DTV-to-TV
 - DTV-to-DTV

Longley-Rice Interference Analysis

- Can cause interference to no more than 2% of the population which is:
 - Within Grade B or Noise Limited contour
 - Predicted to receive Grade B or Int-Free
- Up to cumulative 10% population interference