

Kärmekallion tuulivoima- hanke, Sastamala

LIITE 7B: MELU- JA VÄLKEMALLINNUKSEN LIITTEET

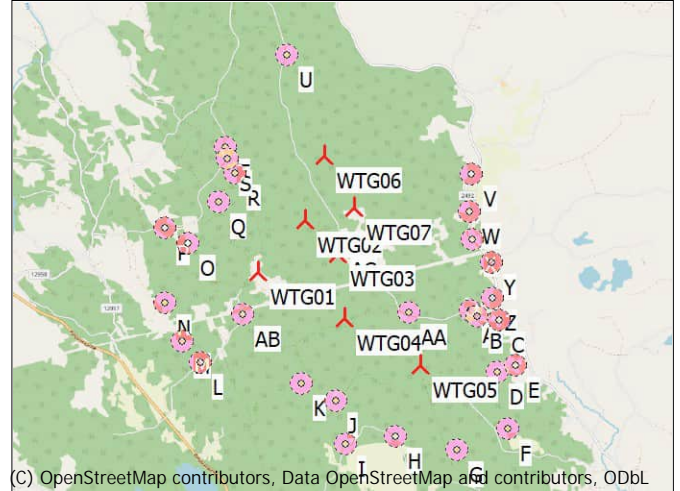
Liite 1. Melun leviämismallinnuksen tulokset ISO 9613-2, YM 2 /2014 - Hankevaihtoehto VE1

DECIBEL - Main Result

Calculation: Karmekallio_SG6.6-155x7x182

Calculation is done according to Finnish guideline " Ympäristöhallinnon ohjeita 2 | 2014" from the Ministry of the Environment of Finland

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data		Wind speed [m/s]	LwA,ref [dB(A)]
					Valid	Manufact.	Type-generator				Creator	Name		
WTG01	270 799	6 816 832	94,5	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG02	271 620	6 817 635	97,1	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG03	272 124	6 817 043	102,5	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG04	272 182	6 815 966	95,0	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG05	273 392	6 815 102	107,5	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG06	272 023	6 818 678	85,0	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG07	272 463	6 817 780	90,2	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0

Calculation Results

Sound level

Noise sensitive area

No.	Name	East	North	Z	Immission height [m]	Demands Noise [dB(A)]	Sound level		Distance to noise demand [m]	2 dB penalty applied for one or more WTGs
							From WTGs [dB(A)]			
A	Asuinrakennus A (Orisuo)	274 265	6 815 959	82,5	4,0	40,0	30,9		789	No
B	Asuinrakennus B (Kallio)	274 364	6 815 858	82,5	4,0	40,0	30,6		800	No
C	Asuinrakennus C (Lannemaa)	274 730	6 815 777	80,0	4,0	40,0	28,5		1 070	No
D	Lomarakennus D (Koluojja)	274 635	6 814 919	86,3	4,0	40,0	29,5		829	No
E	Asuinrakennus E (Maunula)	274 952	6 815 004	81,2	4,0	40,0	27,4		1 135	No
F	Asuinrakennus F (Kalliorinne)	274 763	6 813 962	95,0	4,0	40,0	25,7		1 354	No
G	Asuinrakennus G (Pajuojja)	273 897	6 813 673	100,5	4,0	40,0	27,5		1 084	No
H	Asuinrakennus H (Vuorenoja)	272 896	6 813 954	89,1	4,0	40,0	30,0		819	No
I	Lomarakennus I (Hirvisuontie)	272 059	6 813 889	85,0	4,0	40,0	27,6		1 368	No
J	Asuinrakennus J (Riihimäki)	271 933	6 814 607	95,0	4,0	40,0	30,9		921	No
K	Asuinrakennus K (Toivola)	271 384	6 814 949	92,5	4,0	40,0	31,2		833	No
L	Asuinrakennus L (Palomäki)	269 752	6 815 392	75,7	4,0	40,0	27,5		1 332	No
M	Asuinrakennus M (Heliseva)	269 461	6 815 767	77,0	4,0	40,0	27,5		1 264	No
N	Asuinrakennus N (Kulmala)	269 214	6 816 426	81,8	4,0	40,0	27,8		1 190	No
O	Asuinrakennus O (Lammilampi)	269 648	6 817 378	77,9	4,0	40,0	30,7		825	No
P	Asuinrakennus P (Vormula)	269 285	6 817 676	75,0	4,0	40,0	27,9		1 283	No
Q	Asuinrakennus Q (Saarela)	270 219	6 818 023	82,5	4,0	40,0	32,1		854	No
R	Asuinrakennus R (Lammikko)	270 518	6 818 492	77,5	4,0	40,0	32,1		888	No
S	Asuinrakennus S (Tammisto)	270 408	6 818 733	77,5	4,0	40,0	30,7		1 125	No
T	Asuinrakennus T (Veittimäki)	270 386	6 818 928	75,0	4,0	40,0	29,9		1 184	No
U	Lomarakennus U (Santala)	271 508	6 820 385	87,9	4,0	40,0	26,9		1 333	No
V	Asuinrakennus V (Rossi)	274 436	6 818 205	77,5	4,0	40,0	27,3		1 531	No
W	Asuinrakennus W (Makiniemi)	274 364	6 817 588	86,5	4,0	40,0	28,3		1 421	No
X	Asuinrakennus X (Kuusela)	274 388	6 817 127	88,3	4,0	40,0	28,4		1 533	No
Y	Asuinrakennus Y (Miekkajarventie)	274 658	6 816 731	81,5	4,0	40,0	27,5		1 631	No

To be continued on next page...

DECIBEL - Main Result

Calculation: Karmekallio_SG6.6-155x7x182

...continued from previous page

Noise sensitive area		East	North	Z	Immission height	Demands Noise	Sound level From WTGs	Distance to noise demand	2 dB penalty applied for one or more WTGs
No.	Name				[m]	[dB(A)]	[dB(A)]	[m]	
Z	Asuinrakennus Z (Lahdesmaki)	274 649	6 816 143	78,1	4,0	40,0	28,3	1 199	No
AA	Asuinrakennus AA (Lantee)	273 246	6 815 997	95,0	4,0	40,0	35,6	460	No
AB	Asuinrakennus AB (Portaanpaa)	270 488	6 816 146	89,8	4,0	40,0	35,6	302	No
AC	Rakennus AC (Vuohijoki)	272 155	6 817 191	95,5	4,0	40,0	47,4	-555	No

Distances (m)

NSA	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07
A	3573	3129	2398	2082	1223	3522	2561
B	3694	3267	2533	2183	1231	3663	2702
C	4068	3620	2895	2554	1498	3965	3024
D	4284	4055	3287	2666	1255	4575	3590
E	4535	4243	3484	2931	1562	4696	3727
F	4891	4831	4054	3266	1782	5451	4455
G	4422	4567	3806	2862	1515	5341	4348
H	3559	3894	3182	2134	1250	4801	3849
I	3199	3769	3153	2079	1801	4787	3910
J	2496	3042	2442	1381	1540	4070	3216
K	1971	2695	2220	1292	2013	3781	3029
L	1779	2918	2889	2496	3650	3993	3612
M	1709	2854	2952	2727	3985	3876	3613
N	1635	2692	2974	3002	4381	3599	3518
O	1273	1988	2498	2899	4379	2706	2842
P	1732	2334	2908	3362	4845	2914	3178
Q	1324	1453	2141	2842	4311	1919	2256
R	1683	1396	2162	3023	4442	1516	2070
S	1940	1635	2407	3285	4698	1616	2264
T	2135	1787	2563	3462	4863	1656	2372
U	3621	2751	3396	4468	5606	1782	2773
V	3886	2871	2586	3175	3272	2457	2017
W	3643	2743	2304	2717	2668	2581	1910
X	3599	2812	2264	2492	2256	2826	2032
Y	3859	3168	2551	2590	2062	3274	2432
Z	3909	3374	2679	2472	1631	3648	2730
AA	2584	2306	1533	1064	907	2945	1947
AB	752	1870	1865	1703	3085	2960	2562
AC	1402	694	151	1225	2427	1492	665

Project:

P47816_Karmekallio

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Calculated:
13.6.2024 11.25/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x7x182

Noise calculation model:

ISO 9613-2 Finland

Wind speed (in 10 m height):

8,0 m/s

Ground attenuation:

General, Ground factor: 0,4

Meteorological coefficient, CO:

0,0 dB

Type of demand in calculation:

1: WTG noise is compared to demand (DK, DE, SE, NL etc.)

Noise values in calculation:

All noise values are mean values (Lwa) (Normal)

Pure tones:

Pure tones penalty is added to total noise impact at receptors

Noise sensitive area

Height above ground level, when no value in NSA object:

4,0 m; Don't allow override of model height with height from NSA object

Uncertainty margin:

0,0 dB; Uncertainty margin in NSA has priority

Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:

0,0 dB(A)

Octave data required

Frequency dependent air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0,10	0,38	1,12	2,36	4,08	8,78	26,60	95,00

All coordinates are in

Finish TM ETRS-TM35FIN-ETRS89

WTG: Siemens Gamesa SG 6.6-155 103 dB 6600 155.0 !O!

Noise: (AM 0, 6.6MW) - 103+2dB(A)

Source	Source/Date	Creator	Edited
Siemens Gamesa	24.1.2023	USER	13.6.2024 11.21

Document ID: Noise Rev. 0_IEC ed. 3_230830_ExtID1446_summary

Status	Hub height [m]	Wind speed [m/s]	LwA_ref [dB(A)]	Pure tones	Octave data							
					63	125	250	500	1000	2000	4000	8000
From Windcat	182,5	8,0	105,0	No	85,4	91,8	95,6	97,1	98,9	100,1	94,3	79,6

Noise sensitive area: A Asuinrakennus A (Orisuo)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: B Asuinrakennus B (Kallio)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: C Asuinrakennus C (Lannemaa)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Project:

P47816_Karmekallio

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Calculated:
13.6.2024 11.25/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x7x182

Noise sensitive area: D Lomarakennus D (Koluojja)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: E Asuinrakennus E (Maunula)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: F Asuinrakennus F (Kalliorinne)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: G Asuinrakennus G (Pajuoja)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: H Asuinrakennus H (Vuorenoja)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: I Lomarakennus I (Hirvisuontie)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: J Asuinrakennus J (Riihimaki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: K Asuinrakennus K (Toivola)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

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Calculated:
13.6.2024 11.25/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x7x182

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: L Asuinrakennus L (Palomaki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: M Asuinrakennus M (Heliseva)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: N Asuinrakennus N (Kulmala)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: O Asuinrakennus O (Lammi)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: P Asuinrakennus P (Vormula)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: Q Asuinrakennus Q (Saarela)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: R Asuinrakennus R (Lammikko)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Project:

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Calculated:
13.6.2024 11.25/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x7x182

Noise sensitive area: S Asuinrakennus S (Tammisto)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: T Asuinrakennus T (Veittimäki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: U Lomarakennus U (Santala)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: V Asuinrakennus V (Rossi)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: W Asuinrakennus W (Makiniemi)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: X Asuinrakennus X (Kuusela)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: Y Asuinrakennus Y (Miekkajarventie)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: Z Asuinrakennus Z (Lahdesmäki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Project:

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Calculated:

13.6.2024 11.25/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x7x182

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: AA Asuinrakennus AA (Lantee)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: AB Asuinrakennus AB (Portaanpaa)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: AC Rakennus AC (Vuohijoki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

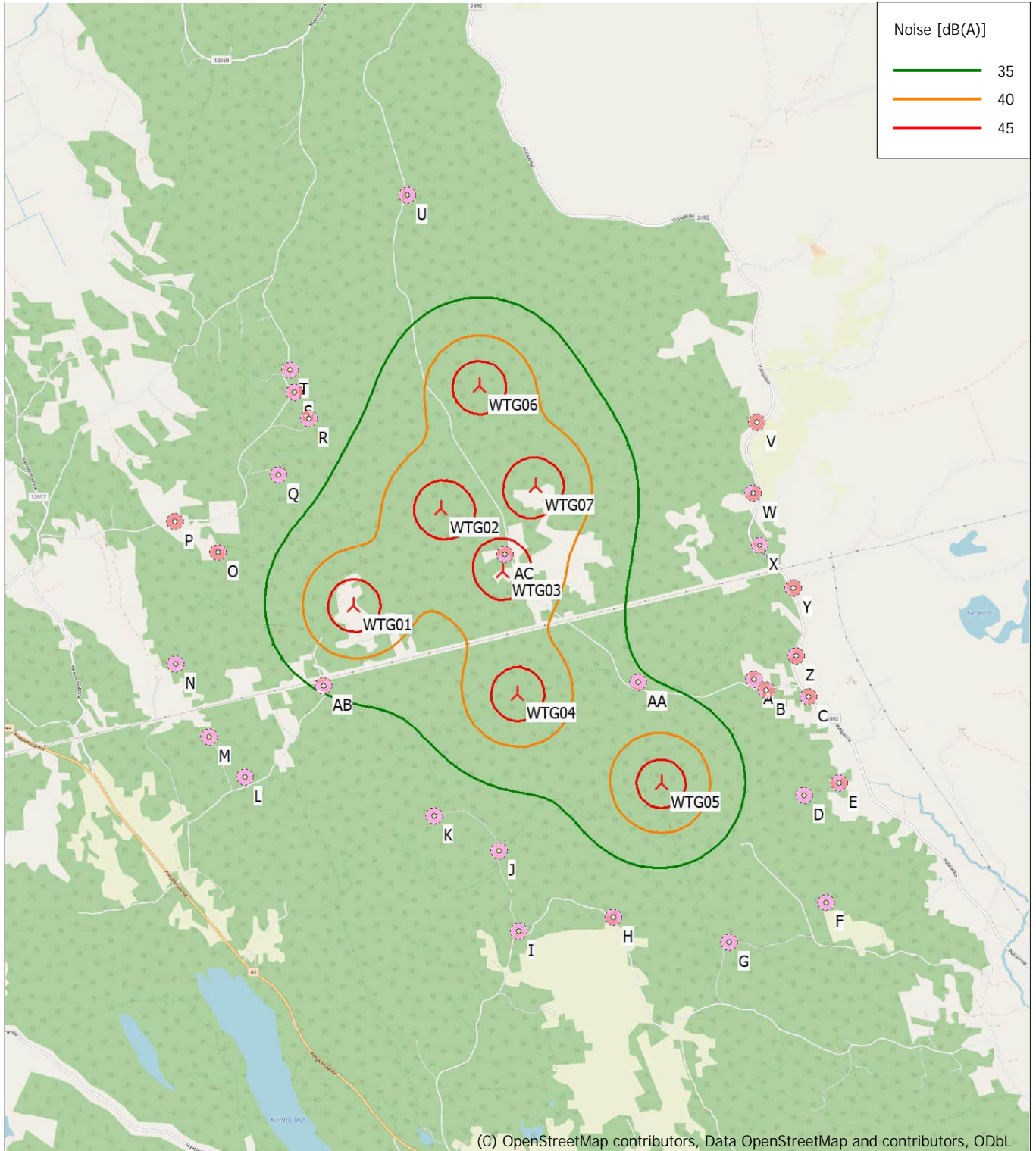
Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

DECIBEL - Map 8,0 m/s

Calculation: Karmekallio_SG6.6-155x7x182



(C) OpenStreetMap contributors, Data OpenStreetMap and contributors, ODbL

0 500 1000 1500 2000 m

Map: EMD OpenStreetMap, Print scale 1:50 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 272 095 North: 6 816 890

New WTG

Noise sensitive area

Noise calculation model: ISO 9613-2 Finland. Wind speed: 8,0 m/s
Height above sea level from active line object

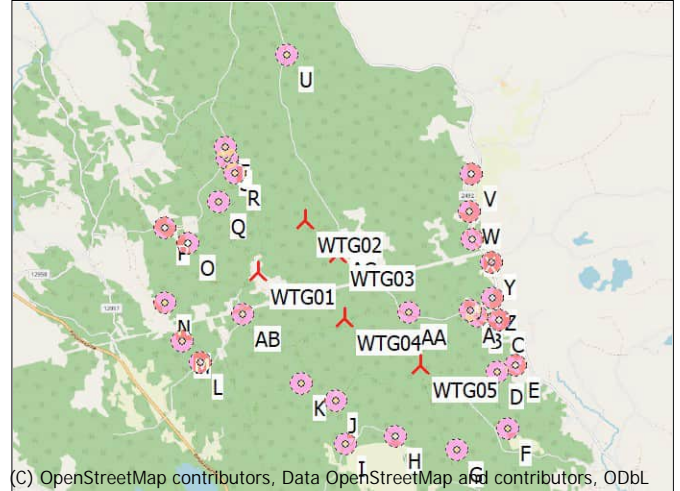
Liite 2. Melun leviämismallinnuksen tulokset ISO 9613-2, YM 2 /2014 - Hankevaihtoehto VE2

DECIBEL - Main Result

Calculation: Karmekallio_SG6.6-155x5x182

Calculation is done according to Finnish guideline " Ympäristöhallinnon ohjeita 2 | 2014" from the Ministry of the Environment of Finland

All coordinates are in
 Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Noise data		Wind speed [m/s]	LwA,ref [dB(A)]
					Valid	Manufact.	Type-generator				Creator	Name		
WTG01	270 799	6 816 832	94,5	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
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WTG03	272 124	6 817 043	102,5	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG04	272 182	6 815 966	95,0	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0
WTG05	273 392	6 815 102	107,5	Siemens Gamesa SG 6.6-155 ...	Yes	Siemens Gamesa	SG 6.6-155 103 dB-6 600	6 600	155,0	182,5	USER	(AM 0, 6.6MW) - 103+2dB(A)	8,0	105,0

Calculation Results

Sound level

Noise sensitive area

No.	Name	East	North	Z	Immission height [m]	Demands Noise [dB(A)]	Sound level		Distance to noise demand [m]	2 dB penalty applied for one or more WTGs
							From WTGs [dB(A)]			
A	Asuinrakennus A (Orisuo)	274 265	6 815 959	82,5	4,0	40,0	30,4	794	No	
B	Asuinrakennus B (Kallio)	274 364	6 815 858	82,5	4,0	40,0	30,2	803	No	
C	Asuinrakennus C (Lannemaa)	274 730	6 815 777	80,0	4,0	40,0	28,0	1 072	No	
D	Lomarakennus D (Koluojja)	274 635	6 814 919	86,3	4,0	40,0	29,3	831	No	
E	Asuinrakennus E (Maunula)	274 952	6 815 004	81,2	4,0	40,0	27,0	1 138	No	
F	Asuinrakennus F (Kalliorinne)	274 763	6 813 962	95,0	4,0	40,0	25,4	1 355	No	
G	Asuinrakennus G (Pajuojja)	273 897	6 813 673	100,5	4,0	40,0	27,3	1 084	No	
H	Asuinrakennus H (Vuorenoja)	272 896	6 813 954	89,1	4,0	40,0	29,8	821	No	
I	Lomarakennus I (Hirvisuontie)	272 059	6 813 889	85,0	4,0	40,0	27,3	1 369	No	
J	Asuinrakennus J (Riihimäki)	271 933	6 814 607	95,0	4,0	40,0	30,7	926	No	
K	Asuinrakennus K (Toivola)	271 384	6 814 949	92,5	4,0	40,0	30,9	837	No	
L	Asuinrakennus L (Palomäki)	269 752	6 815 392	75,7	4,0	40,0	27,0	1 336	No	
M	Asuinrakennus M (Heliseva)	269 461	6 815 767	77,0	4,0	40,0	27,1	1 268	No	
N	Asuinrakennus N (Kulmala)	269 214	6 816 426	81,8	4,0	40,0	27,3	1 195	No	
O	Asuinrakennus O (Lammi)	269 648	6 817 378	77,9	4,0	40,0	30,1	830	No	
P	Asuinrakennus P (Vormula)	269 285	6 817 676	75,0	4,0	40,0	27,1	1 289	No	
Q	Asuinrakennus Q (Saarela)	270 219	6 818 023	82,5	4,0	40,0	31,1	865	No	
R	Asuinrakennus R (Lammikko)	270 518	6 818 492	77,5	4,0	40,0	30,2	937	No	
S	Asuinrakennus S (Tammisto)	270 408	6 818 733	77,5	4,0	40,0	28,4	1 179	No	
T	Asuinrakennus T (Veittimäki)	270 386	6 818 928	75,0	4,0	40,0	27,4	1 332	No	
U	Lomarakennus U (Santala)	271 508	6 820 385	87,9	4,0	40,0	22,1	2 300	No	
V	Asuinrakennus V (Rossi)	274 436	6 818 205	77,5	4,0	40,0	24,2	2 112	No	
W	Asuinrakennus W (Mäkinäemi)	274 364	6 817 588	86,5	4,0	40,0	25,7	1 832	No	
X	Asuinrakennus X (Kuusela)	274 388	6 817 127	88,3	4,0	40,0	26,5	1 792	No	
Y	Asuinrakennus Y (Miekkajarventie)	274 658	6 816 731	81,5	4,0	40,0	26,2	1 631	No	
Z	Asuinrakennus Z (Lahdesmäki)	274 649	6 816 143	78,1	4,0	40,0	27,6	1 202	No	
AA	Asuinrakennus AA (Lantee)	273 246	6 815 997	95,0	4,0	40,0	35,3	464	No	

To be continued on next page...

DECIBEL - Main Result

Calculation: Karmekallio_SG6.6-155x5x182

...continued from previous page

Noise sensitive area		East	North	Z	Immission height	Demands Noise	Sound level From WTGs	Distance to noise demand	2 dB penalty applied for one or more WTGs
No.	Name				[m]	[dB(A)]	[dB(A)]	[m]	
AB	Asuinrakennus AB (Portaanpaa)	270 488	6 816 146	89,8	4,0	40,0	35,4	308	No
AC	Rakennus AC (Vuohijoki)	272 155	6 817 191	95,5	4,0	40,0	47,1	-365	No

Distances (m)

NSA	WTG				
	WTG01	WTG02	WTG03	WTG04	WTG05
A	3573	3129	2398	2082	1223
B	3694	3267	2533	2183	1231
C	4068	3620	2895	2554	1498
D	4284	4055	3287	2666	1255
E	4535	4243	3484	2931	1562
F	4891	4831	4054	3266	1782
G	4422	4567	3806	2862	1515
H	3559	3894	3182	2134	1250
I	3199	3769	3153	2079	1801
J	2496	3042	2442	1381	1540
K	1971	2695	2220	1292	2013
L	1779	2918	2889	2496	3650
M	1709	2854	2952	2727	3985
N	1635	2692	2974	3002	4381
O	1273	1988	2498	2899	4379
P	1732	2334	2908	3362	4845
Q	1324	1453	2141	2842	4311
R	1683	1396	2162	3023	4442
S	1940	1635	2407	3285	4698
T	2135	1787	2563	3462	4863
U	3621	2751	3396	4468	5606
V	3886	2871	2586	3175	3272
W	3643	2743	2304	2717	2668
X	3599	2812	2264	2492	2256
Y	3859	3168	2551	2590	2062
Z	3909	3374	2679	2472	1631
AA	2584	2306	1533	1064	907
AB	752	1870	1865	1703	3085
AC	1402	694	151	1225	2427

Project:

P47816_Karmekallio

Licensed user:

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Henri Korhonen / henri.korhonen@fcg.fi
Calculated:
13.6.2024 11.26/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x5x182

Noise calculation model:

ISO 9613-2 Finland

Wind speed (in 10 m height):

8,0 m/s

Ground attenuation:

General, Ground factor: 0,4

Meteorological coefficient, CO:

0,0 dB

Type of demand in calculation:

1: WTG noise is compared to demand (DK, DE, SE, NL etc.)

Noise values in calculation:

All noise values are mean values (Lwa) (Normal)

Pure tones:

Pure tones penalty is added to total noise impact at receptors

Noise sensitive area

Height above ground level, when no value in NSA object:

4,0 m; Don't allow override of model height with height from NSA object

Uncertainty margin:

0,0 dB; Uncertainty margin in NSA has priority

Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:

0,0 dB(A)

Octave data required

Frequency dependent air absorption

63	125	250	500	1 000	2 000	4 000	8 000
[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]	[dB/km]
0,10	0,38	1,12	2,36	4,08	8,78	26,60	95,00

All coordinates are in

Finish TM ETRS-TM35FIN-ETRS89

WTG: Siemens Gamesa SG 6.6-155 103 dB 6600 155.0 !O!

Noise: (AM 0, 6.6MW) - 103+2dB(A)

Source	Source/Date	Creator	Edited
Siemens Gamesa	24.1.2023	USER	13.6.2024 11.21

Document ID: Noise Rev. 0_IEC ed. 3_230830_ExtID1446_summary

Status	Hub height [m]	Wind speed [m/s]	LwA_ref [dB(A)]	Pure tones	Octave data							
					63	125	250	500	1000	2000	4000	8000
From Windcat	182,5	8,0	105,0	No	85,4	91,8	95,6	97,1	98,9	100,1	94,3	79,6

Noise sensitive area: A Asuinrakennus A (Orisuo)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: B Asuinrakennus B (Kallio)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: C Asuinrakennus C (Lannemaa)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Project:

P47816_Karmekallio

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Calculated:
13.6.2024 11.26/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x5x182

Noise sensitive area: D Lomarakennus D (Koluoja)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: E Asuinrakennus E (Maunula)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: F Asuinrakennus F (Kalliorinne)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: G Asuinrakennus G (Pajuoja)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: H Asuinrakennus H (Vuorenoja)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: I Lomarakennus I (Hirvisuontie)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: J Asuinrakennus J (Riihimäki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: K Asuinrakennus K (Toivola)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

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Calculated:

13.6.2024 11.26/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x5x182

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: L Asuinrakennus L (Palomaki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: M Asuinrakennus M (Heliseva)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: N Asuinrakennus N (Kulmala)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: O Asuinrakennus O (Lammi)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: P Asuinrakennus P (Vormula)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: Q Asuinrakennus Q (Saarela)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: R Asuinrakennus R (Lammikko)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

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DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x5x182

Noise sensitive area: S Asuinrakennus S (Tammisto)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: T Asuinrakennus T (Veittimäki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: U Lomarakennus U (Santala)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: V Asuinrakennus V (Rossi)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: W Asuinrakennus W (Makiniemi)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: X Asuinrakennus X (Kuusela)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: Y Asuinrakennus Y (Miekkajarventie)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: Z Asuinrakennus Z (Lahdesmäki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Project:

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Calculated:

13.6.2024 11.26/3.6.355

DECIBEL - Assumptions for noise calculation

Calculation: Karmekallio_SG6.6-155x5x182

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: AA Asuinrakennus AA (Lantee)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: AB Asuinrakennus AB (Portaanpaa)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

Noise demand: 40,0 dB(A)

No distance demand

Pure tone penalty: 0 dB

Noise sensitive area: AC Rakennus AC (Vuohijoki)

Predefined calculation standard:

Immission height(a.g.l.): Use standard value from calculation model

Uncertainty margin: Use default value from calculation model

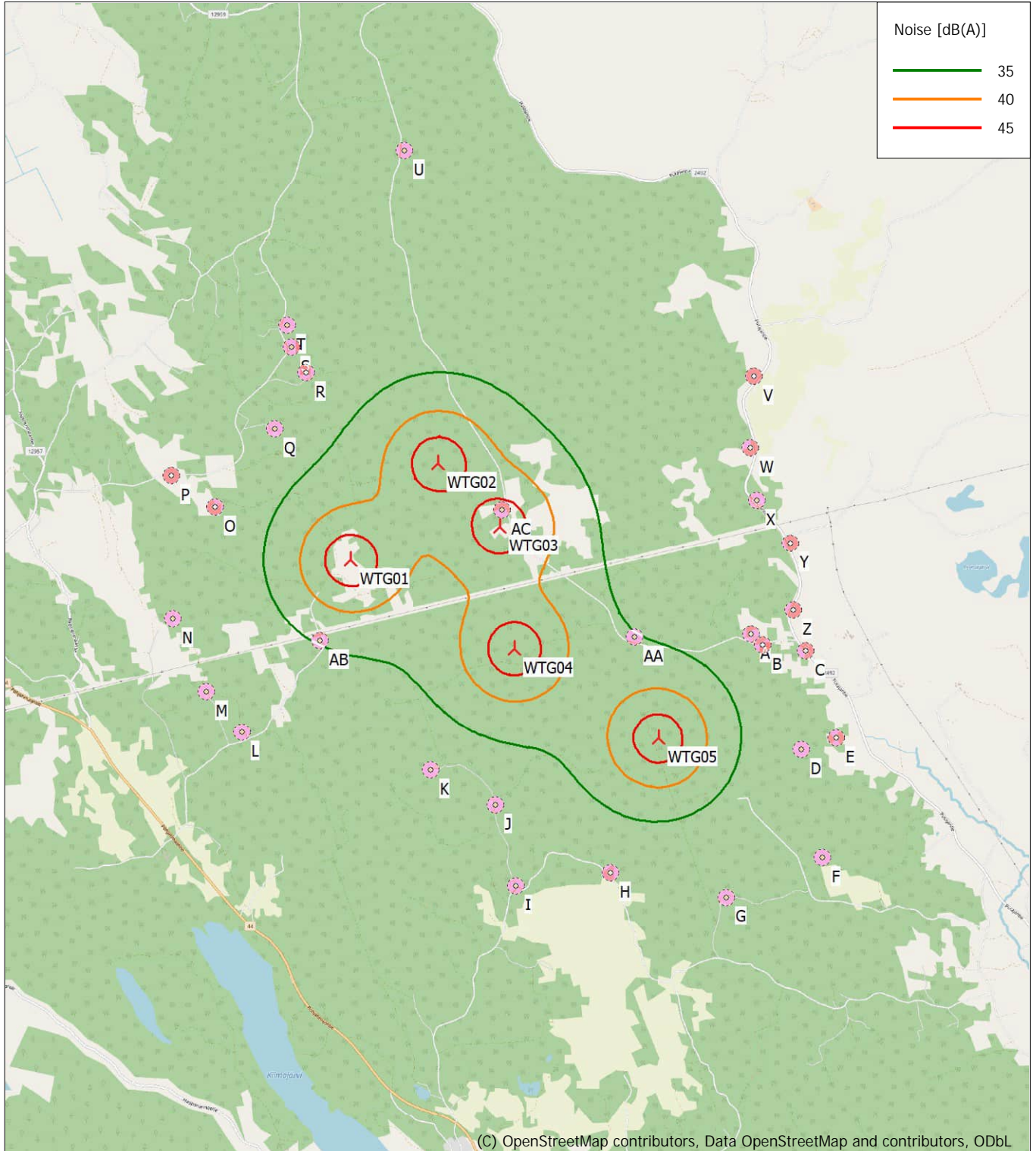
Noise demand: 40,0 dB(A)

No distance demand

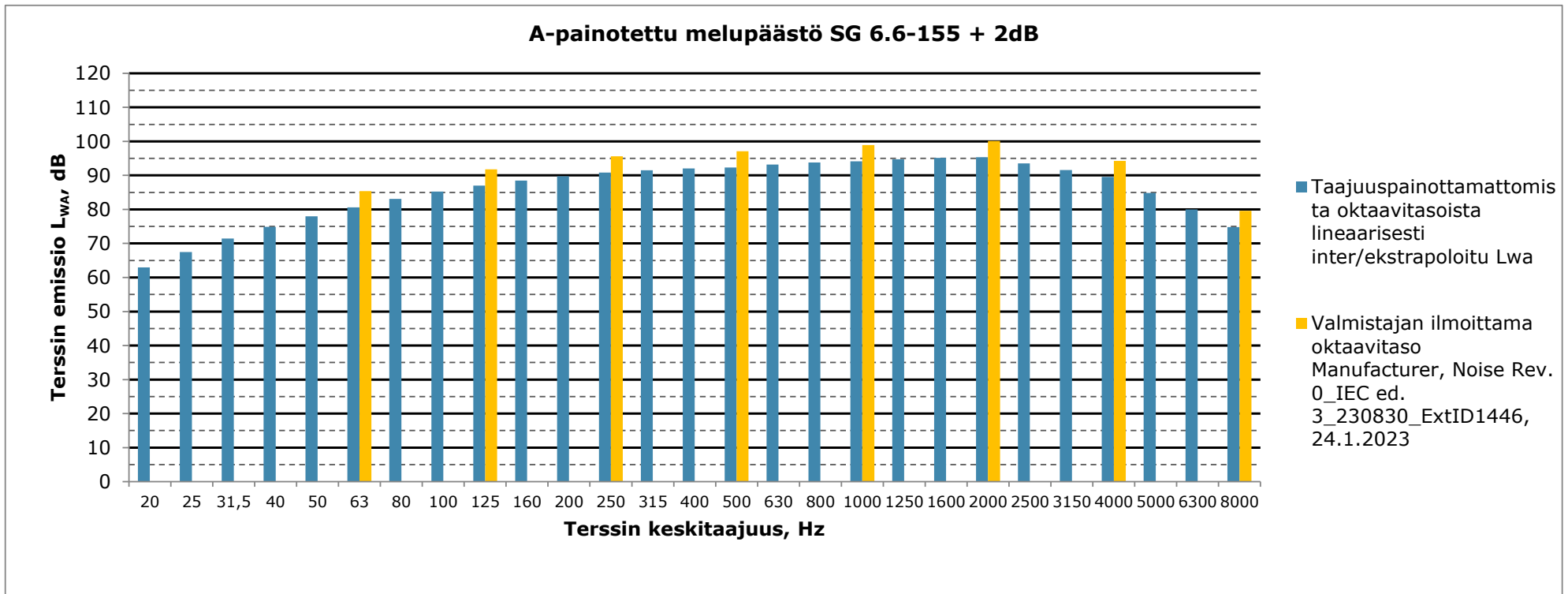
Pure tone penalty: 0 dB

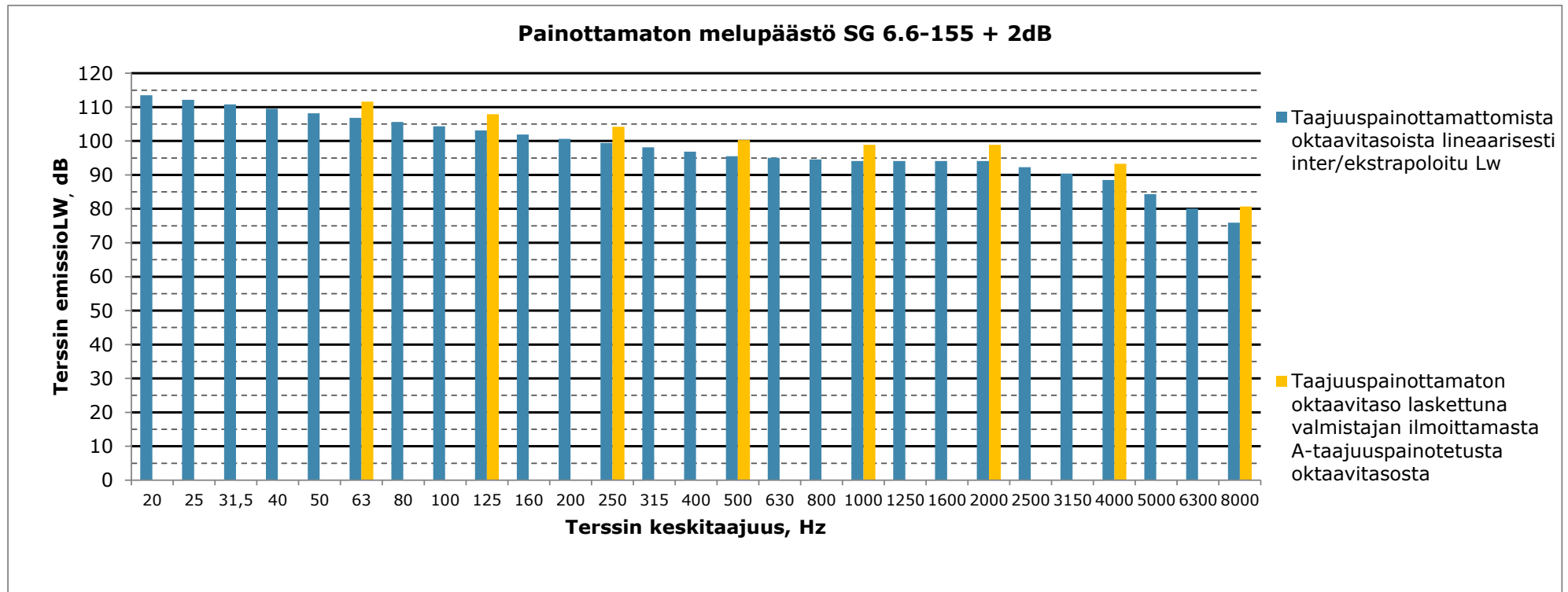
DECIBEL - Map 8,0 m/s

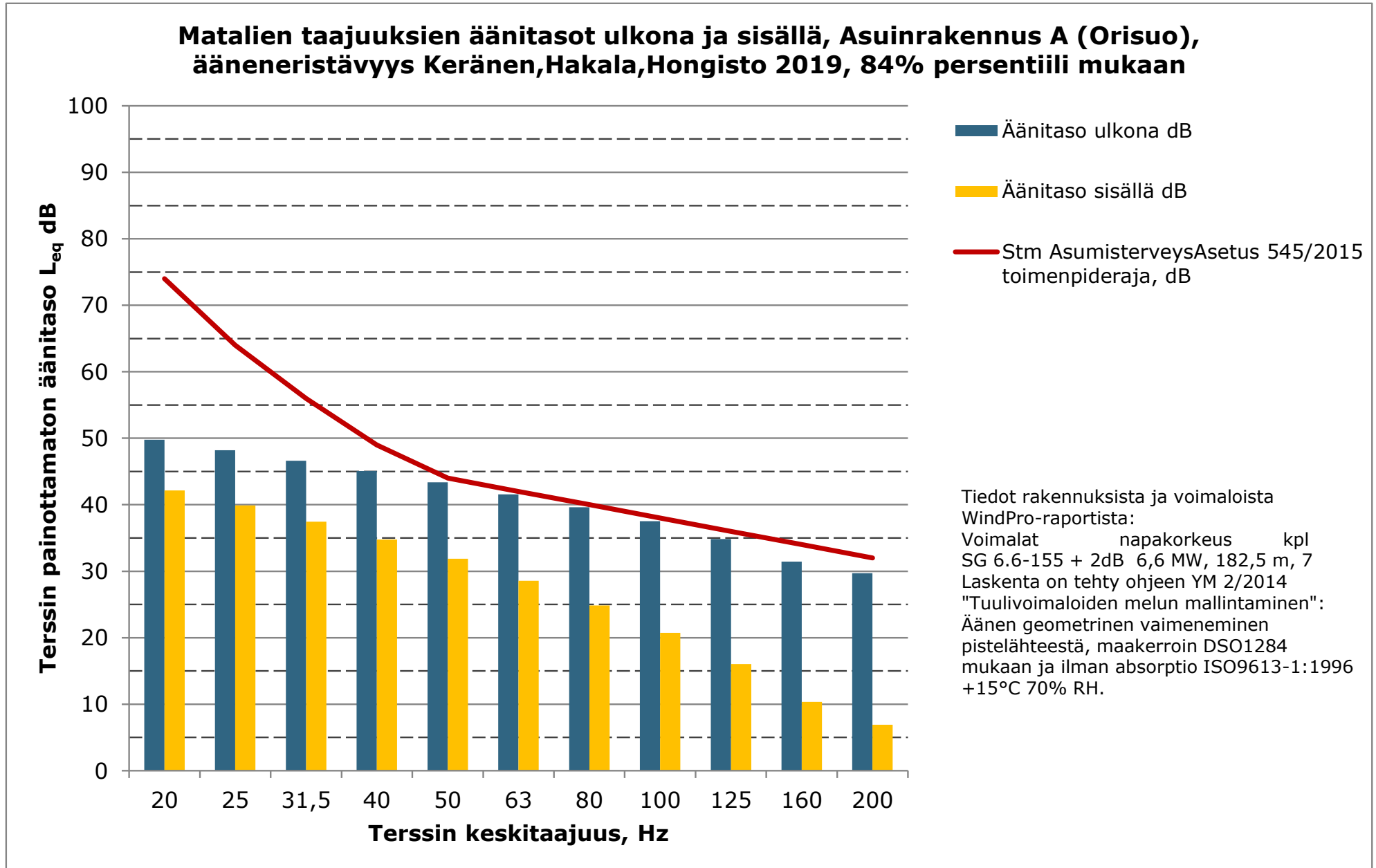
Calculation: Karmekallio_SG6.6-155x5x182



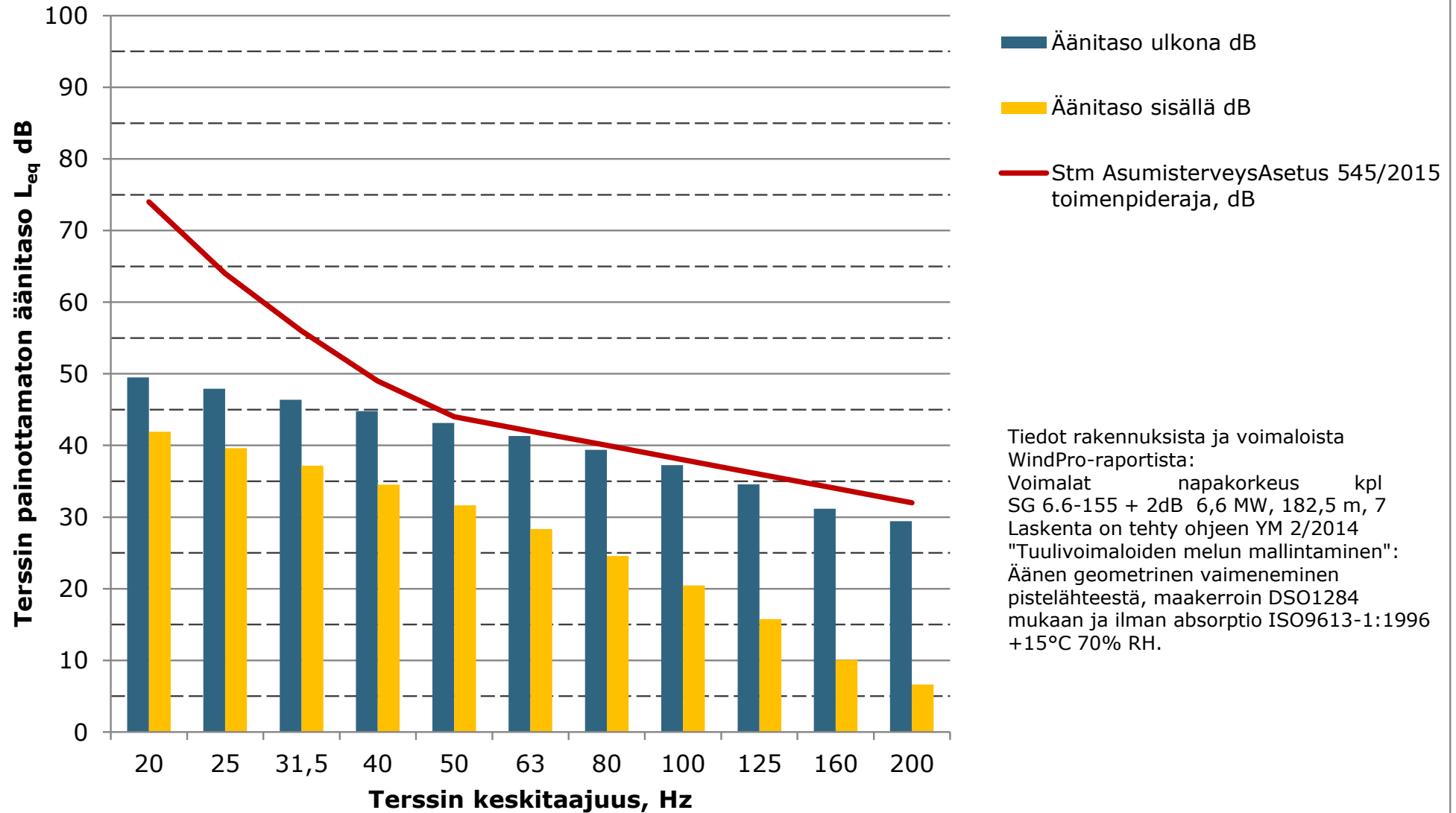
Liite 3. Pienitaajuisen melun rakennuskohtaiset arvot - Hankevaihtoehto VE1

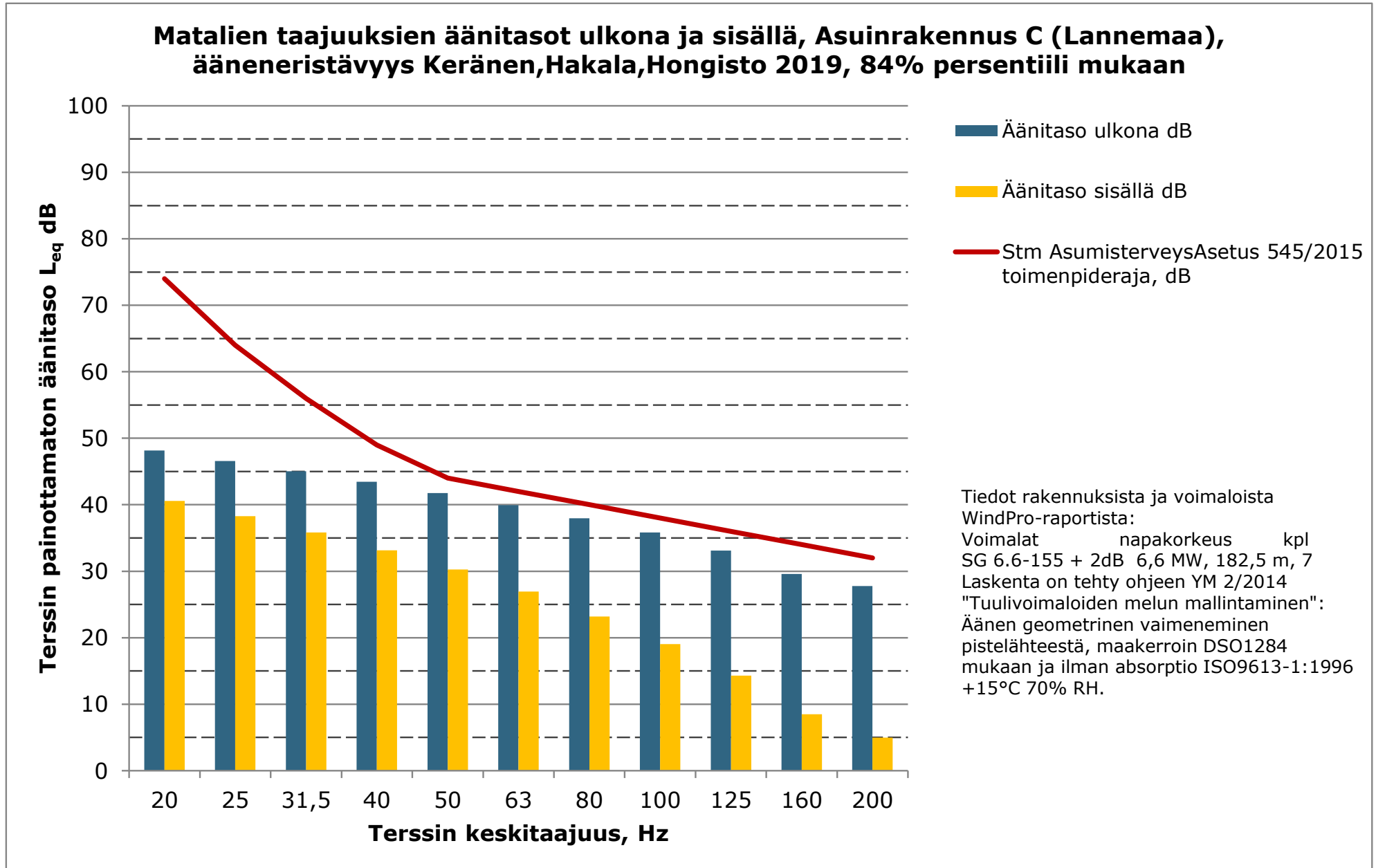


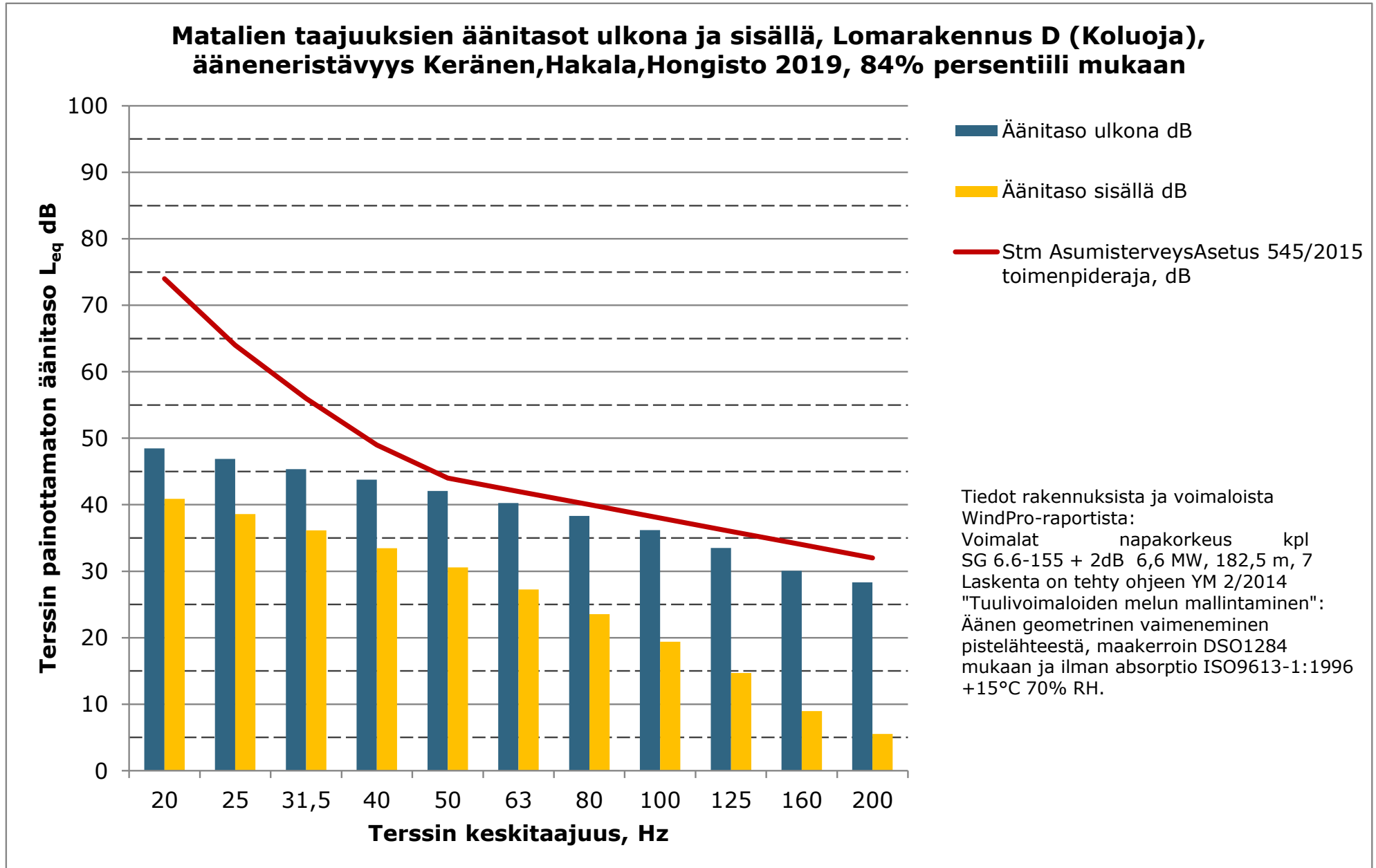


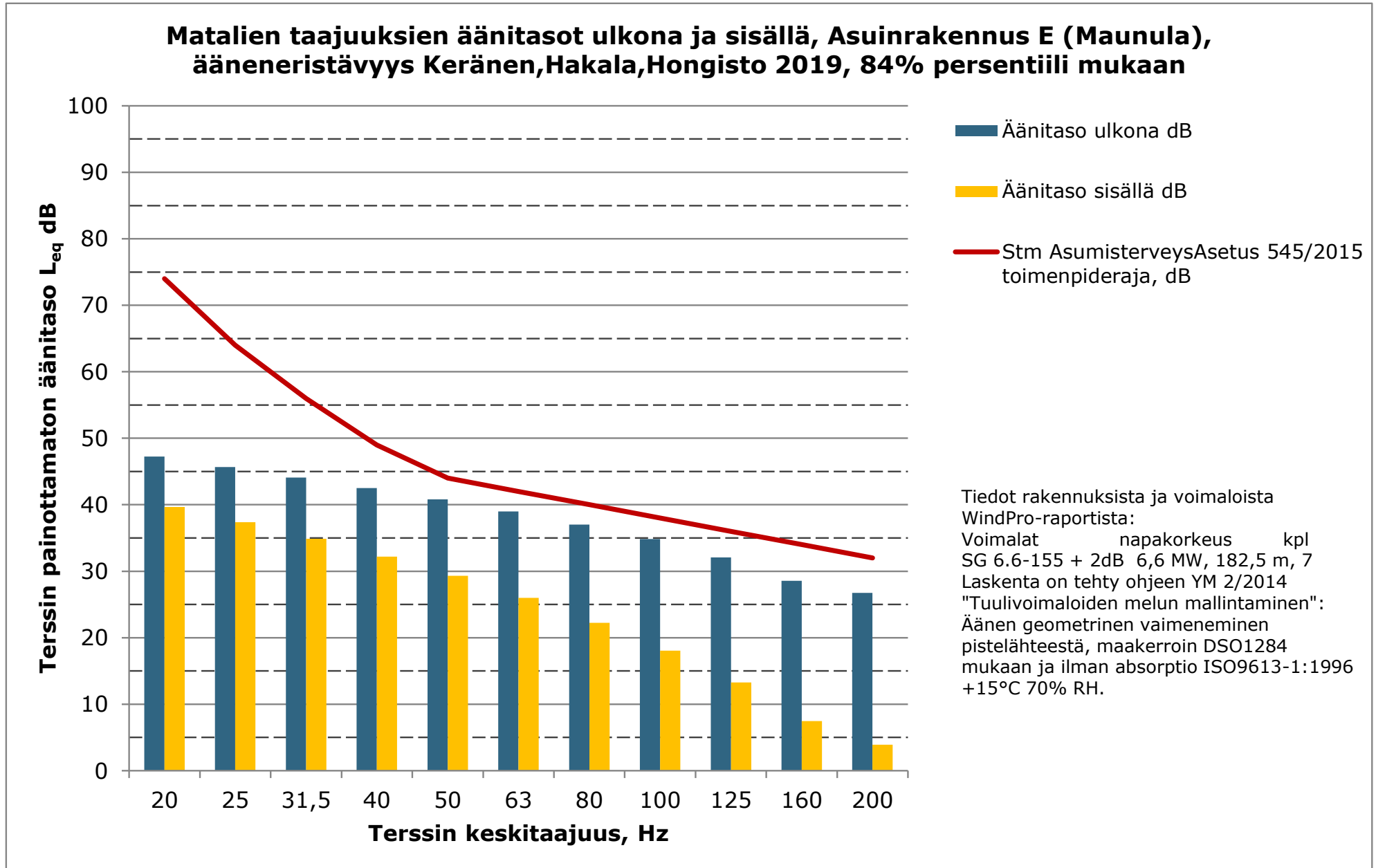


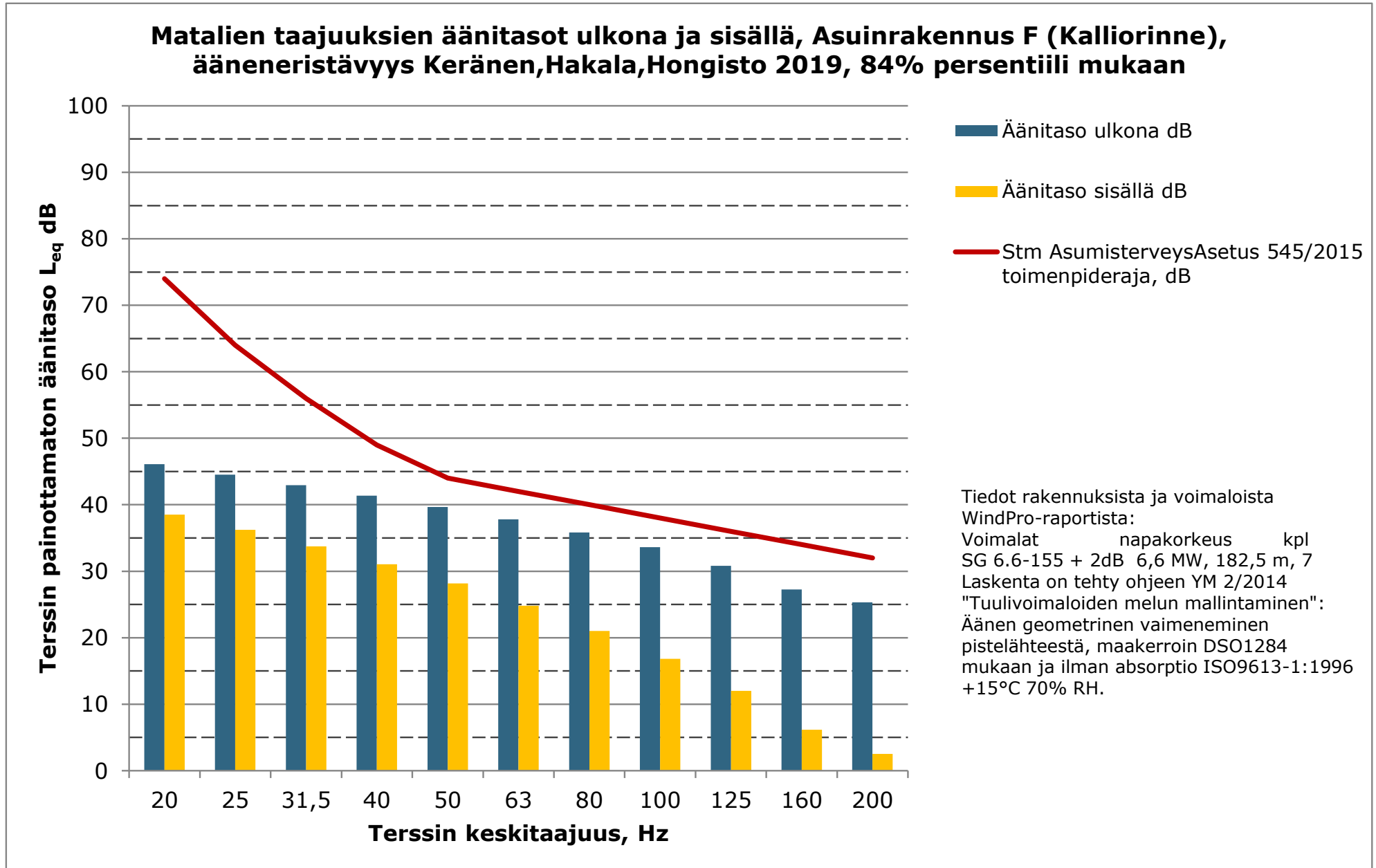
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus B (Kallio), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan

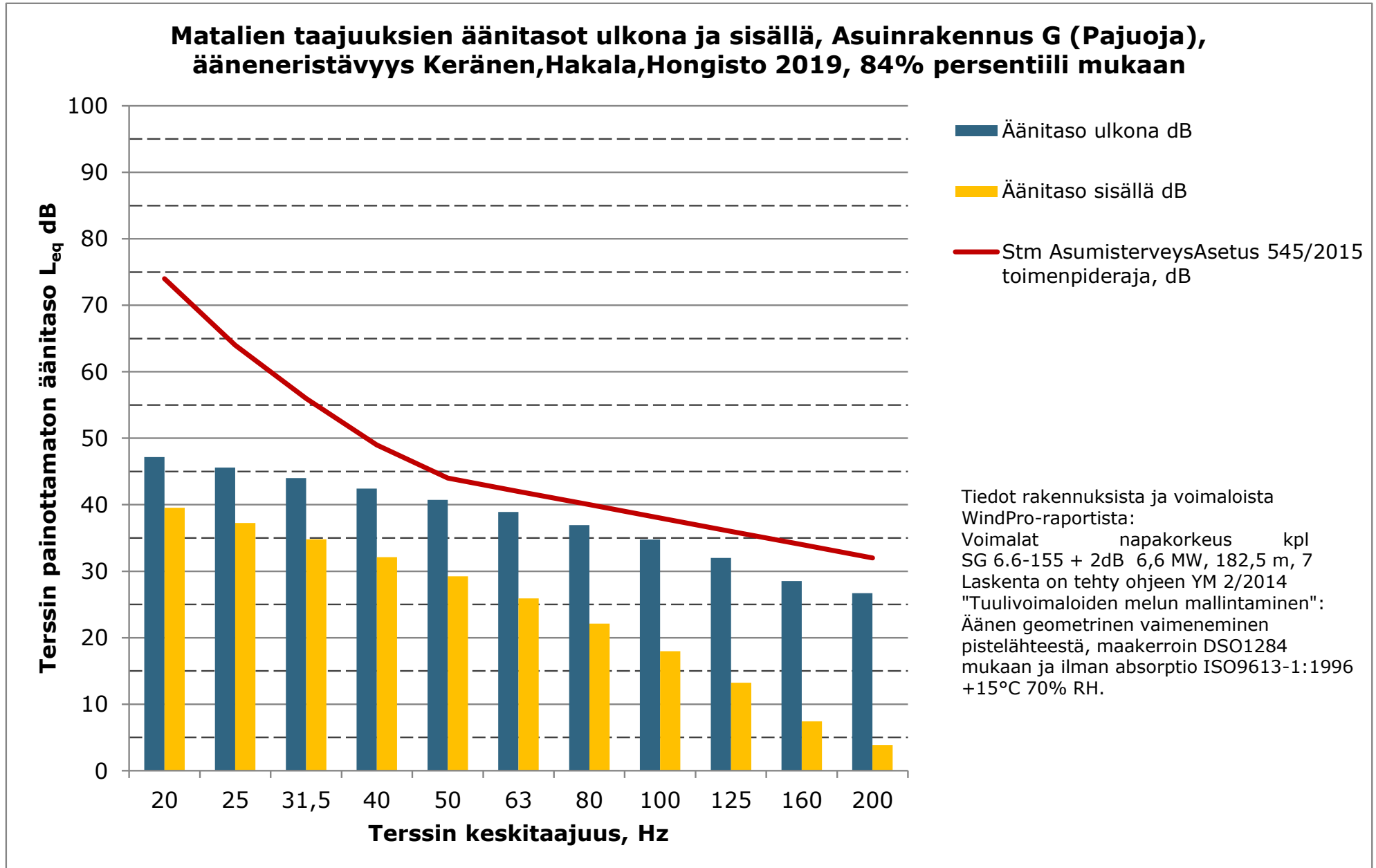


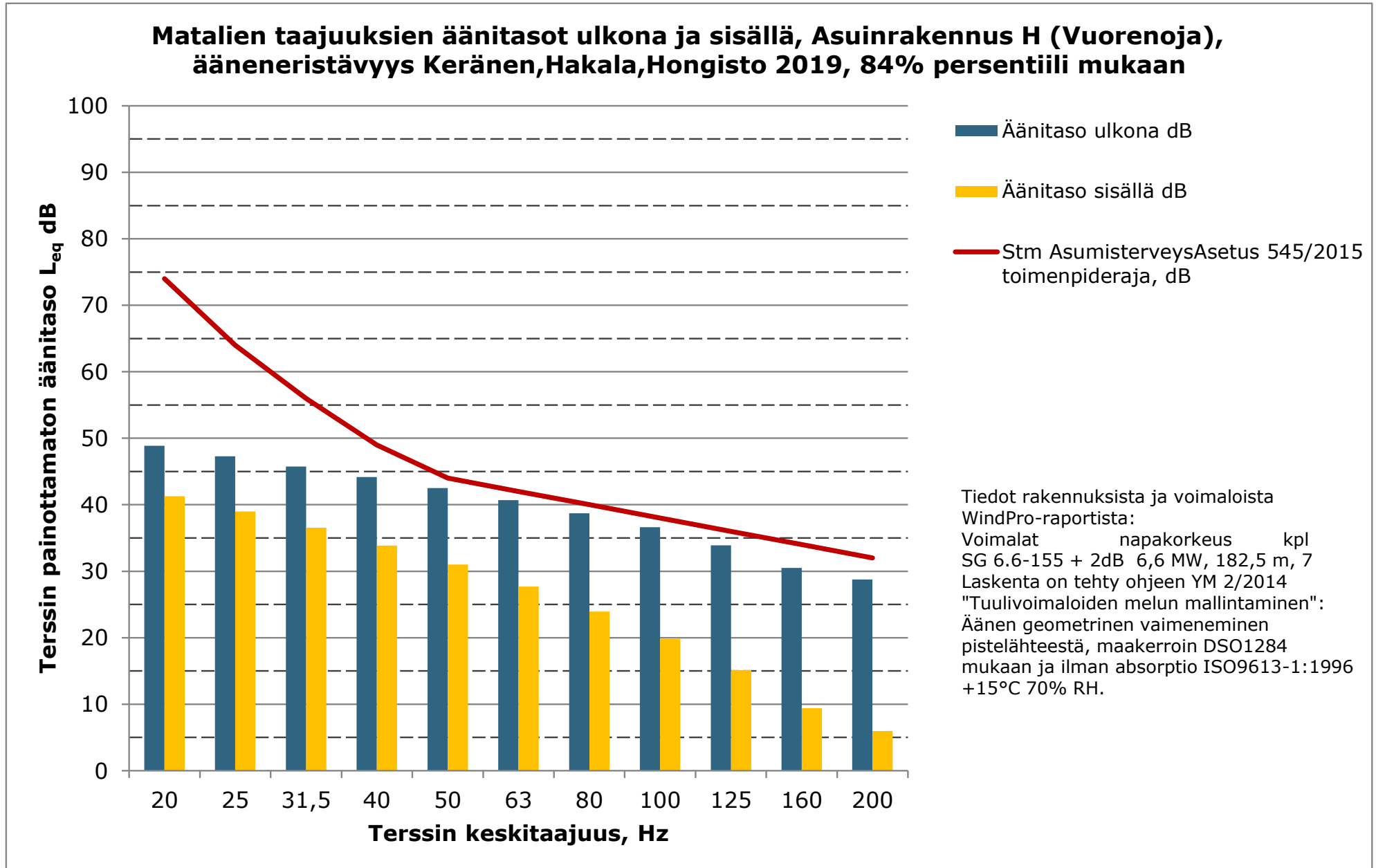




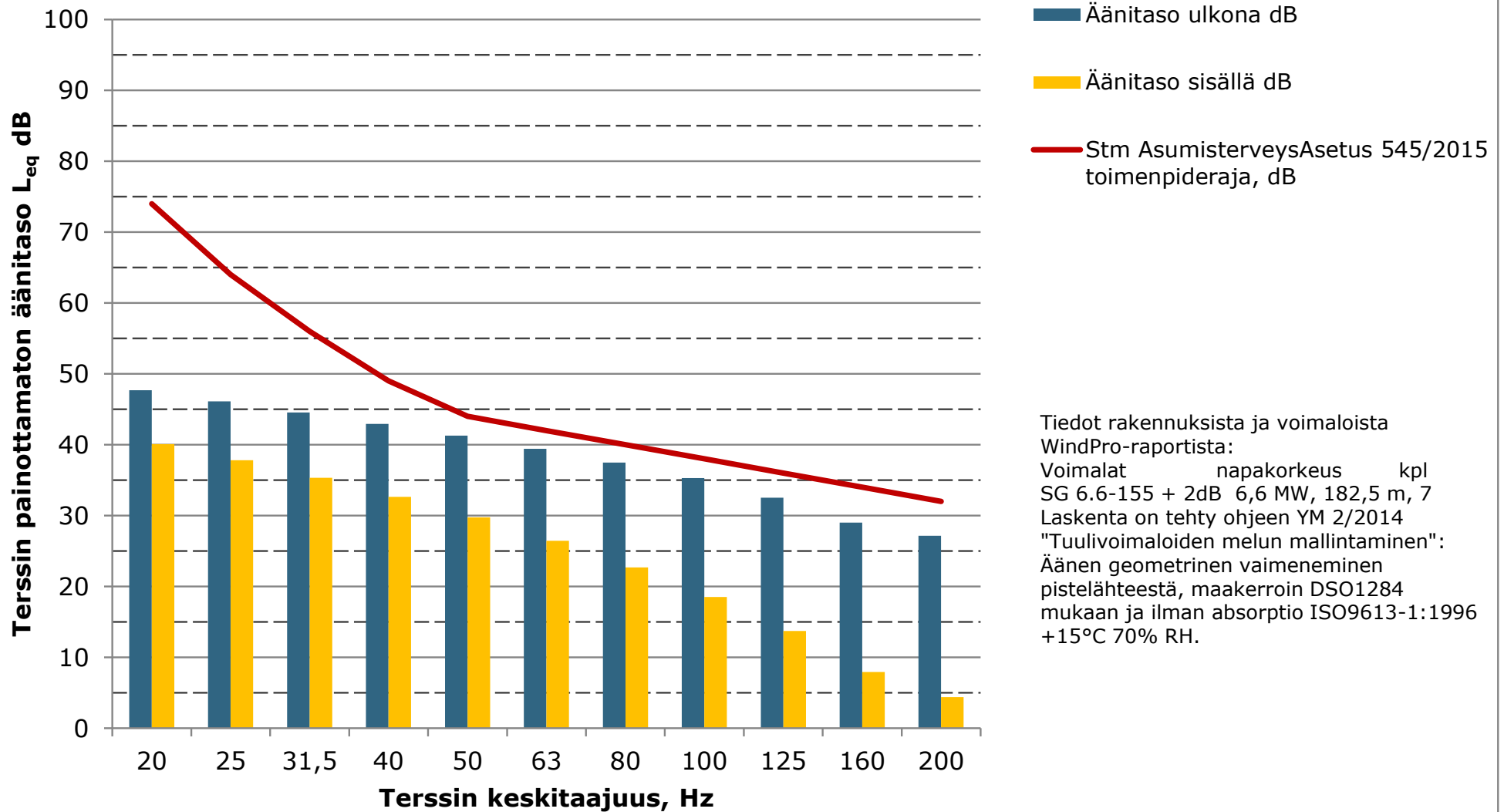




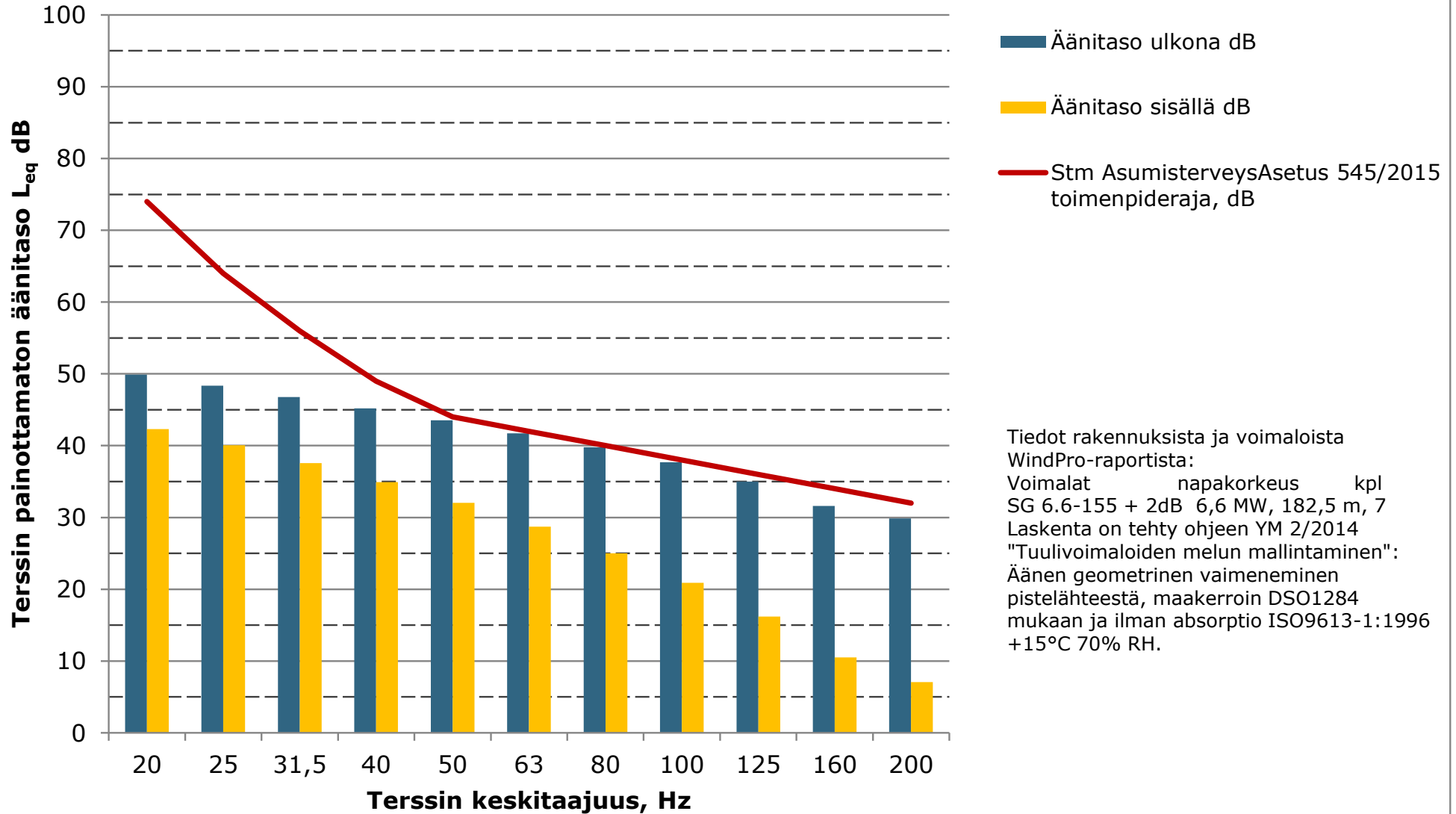


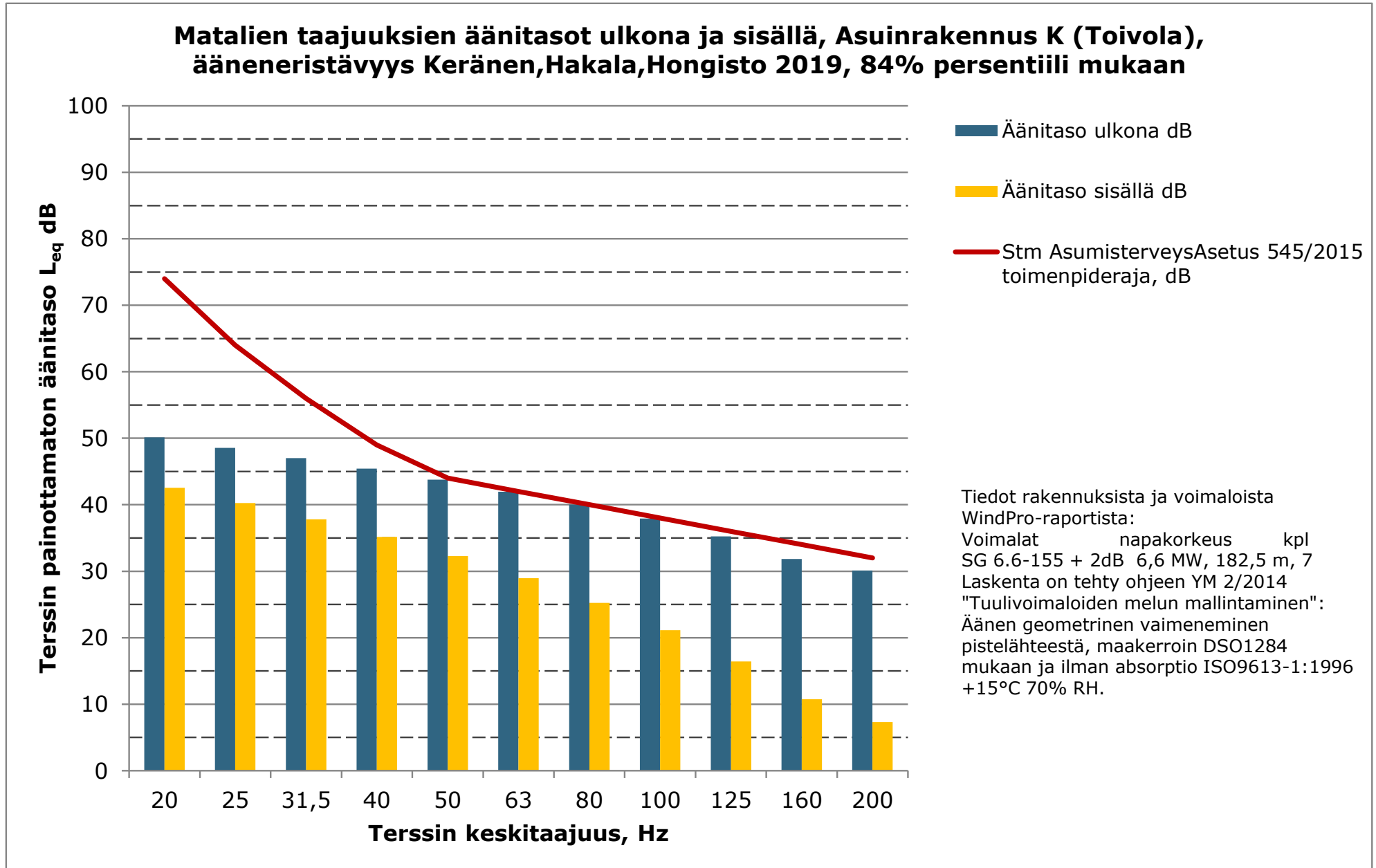


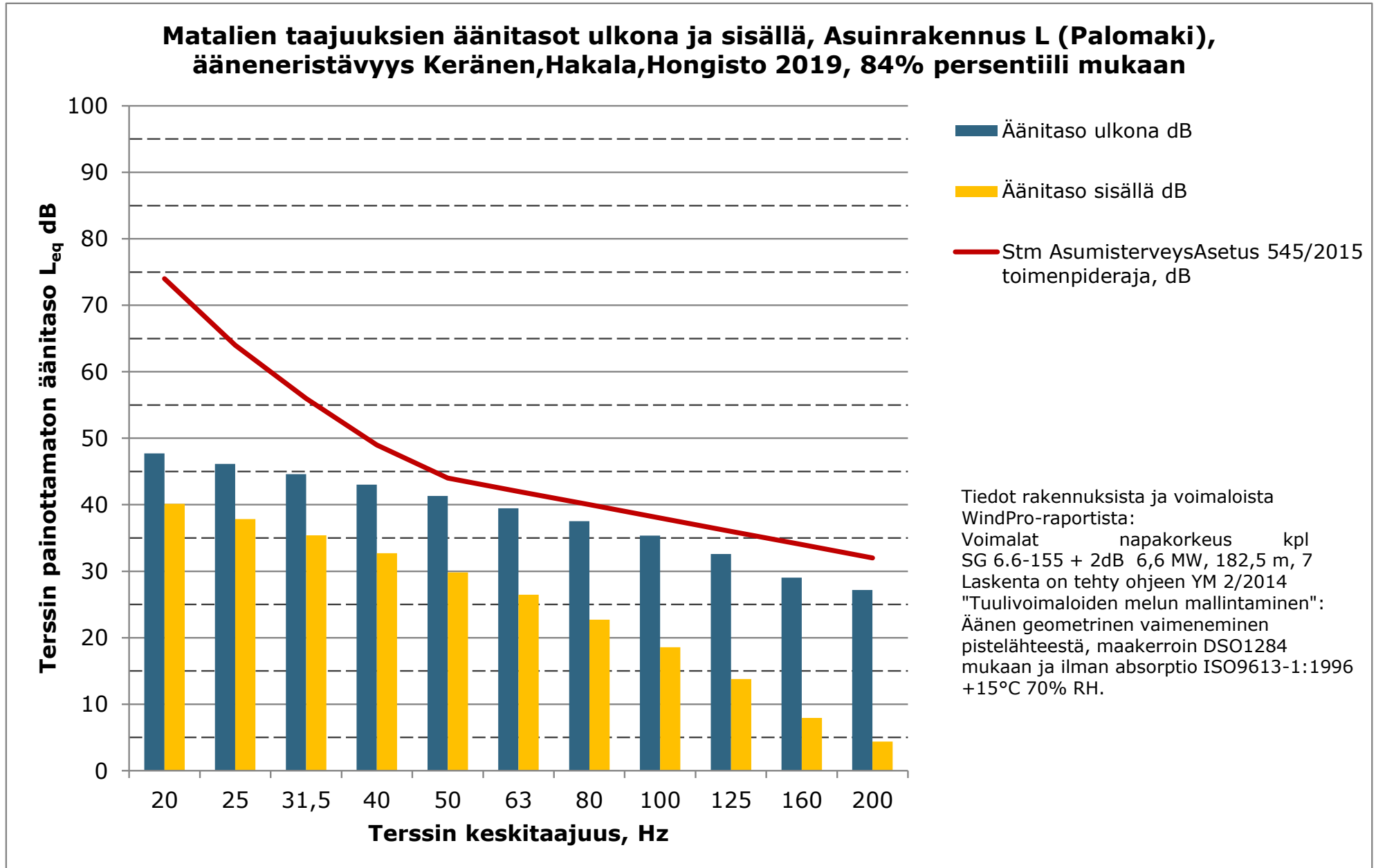
**Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus I
(Hirvisuontie), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84%
persentiili mukaan**

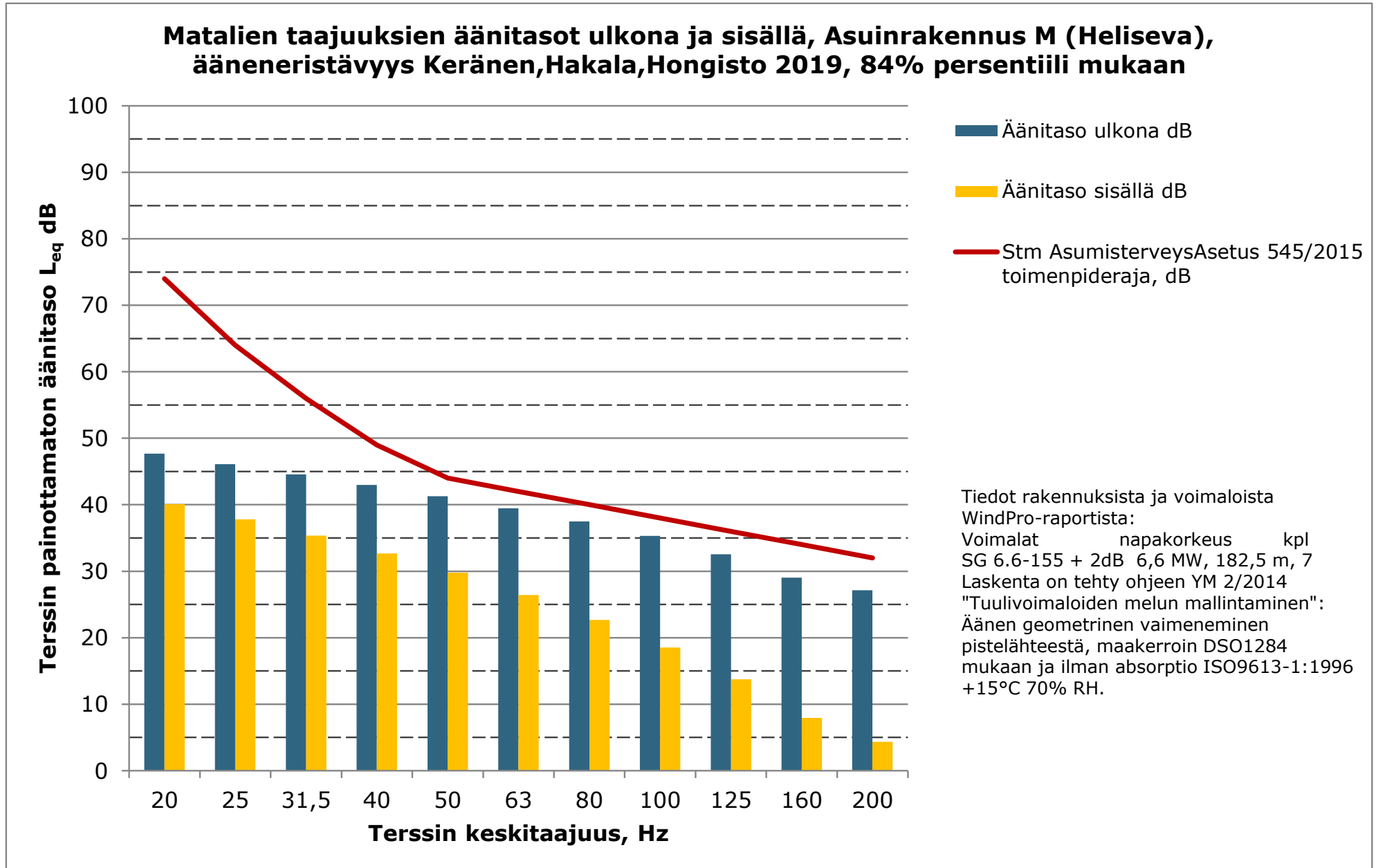


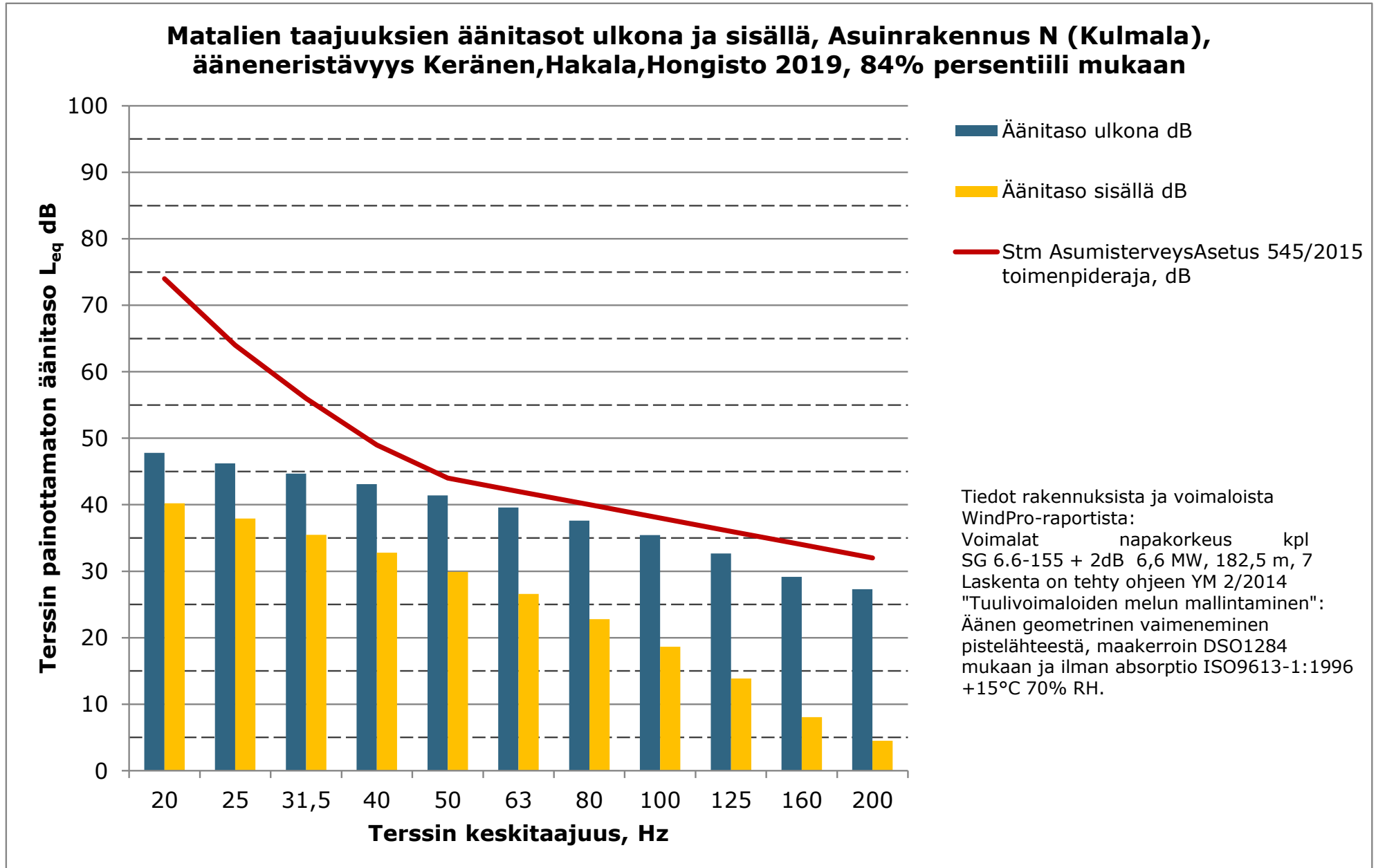
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus J (Riihimäki), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan

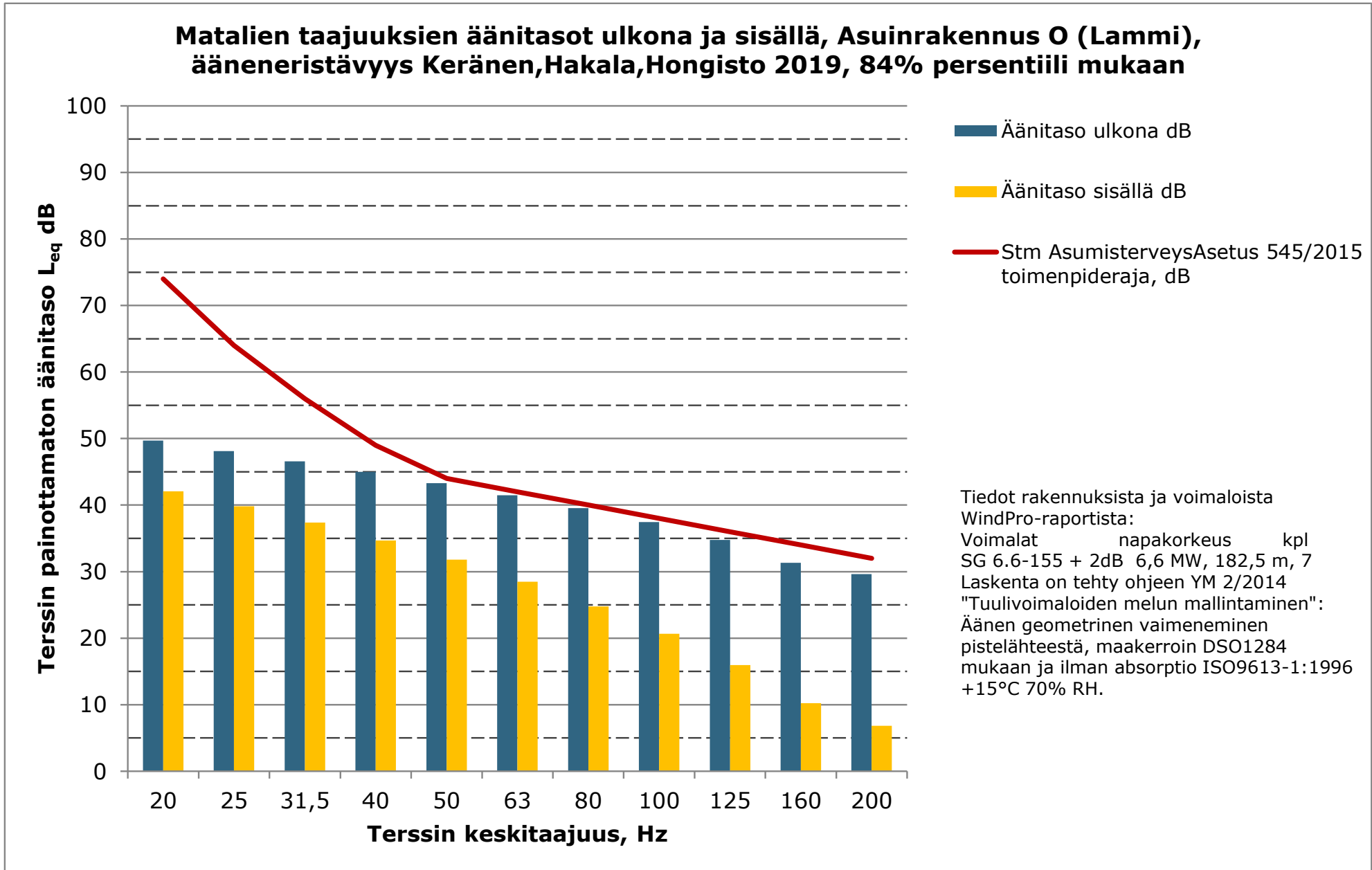


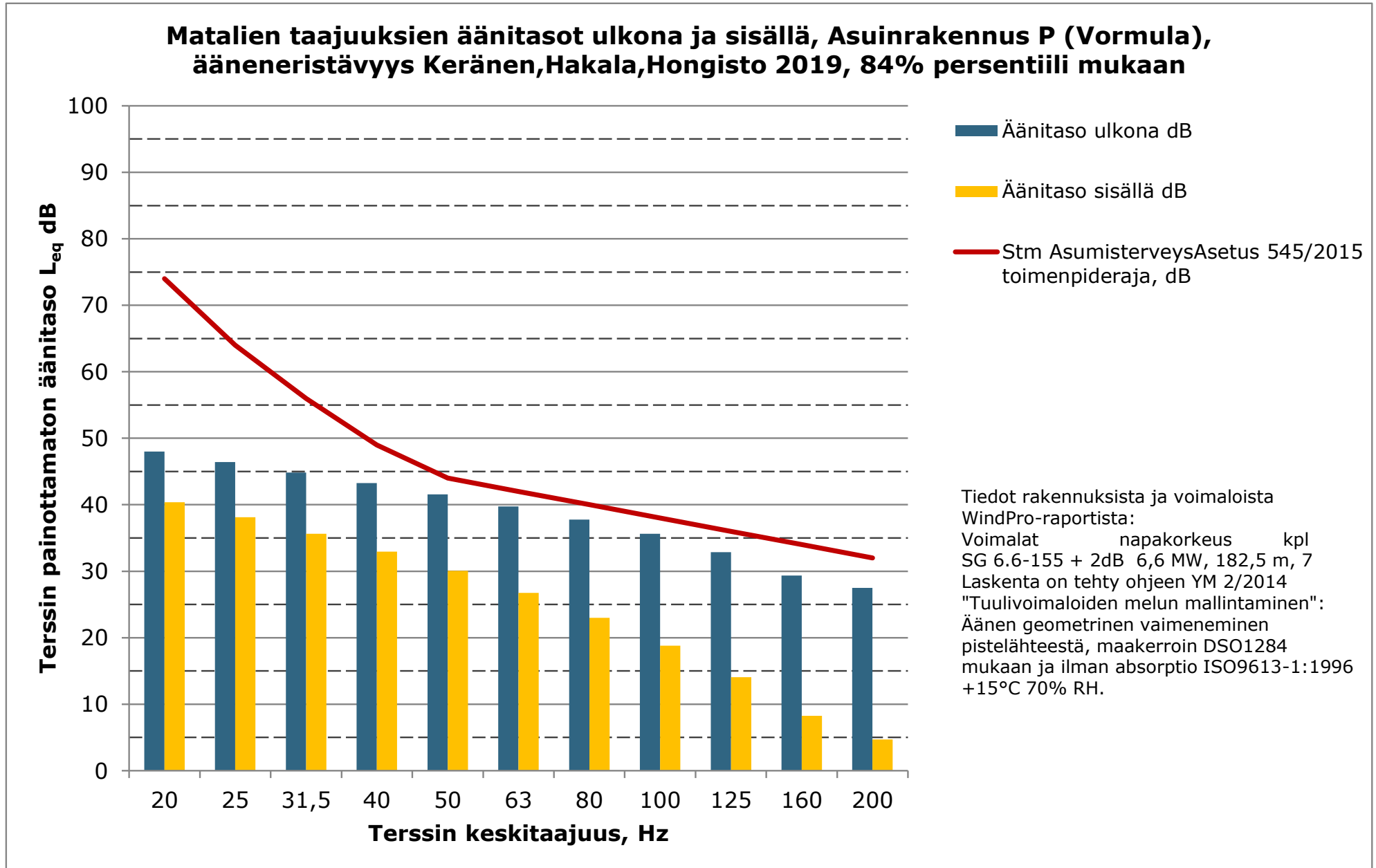


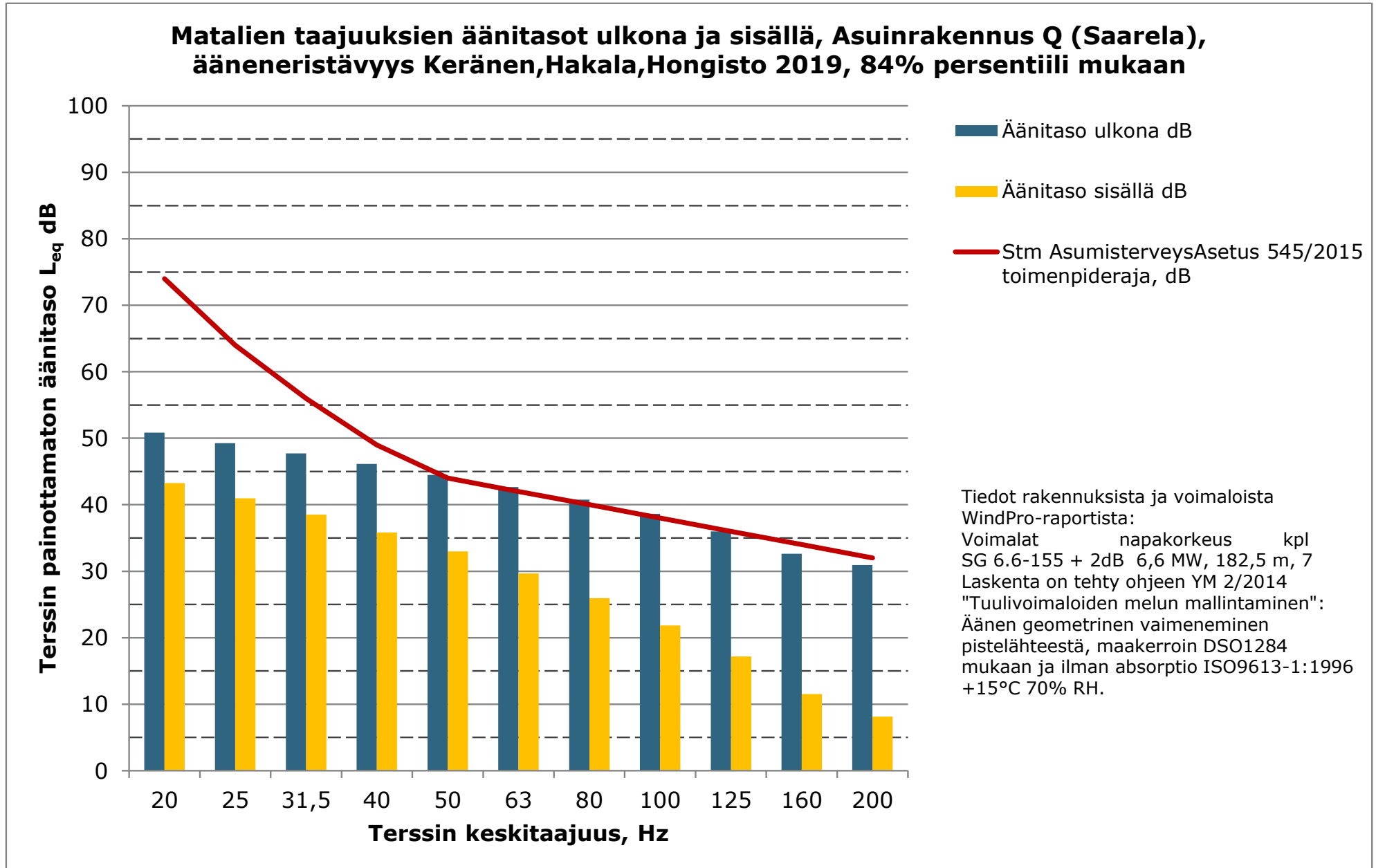


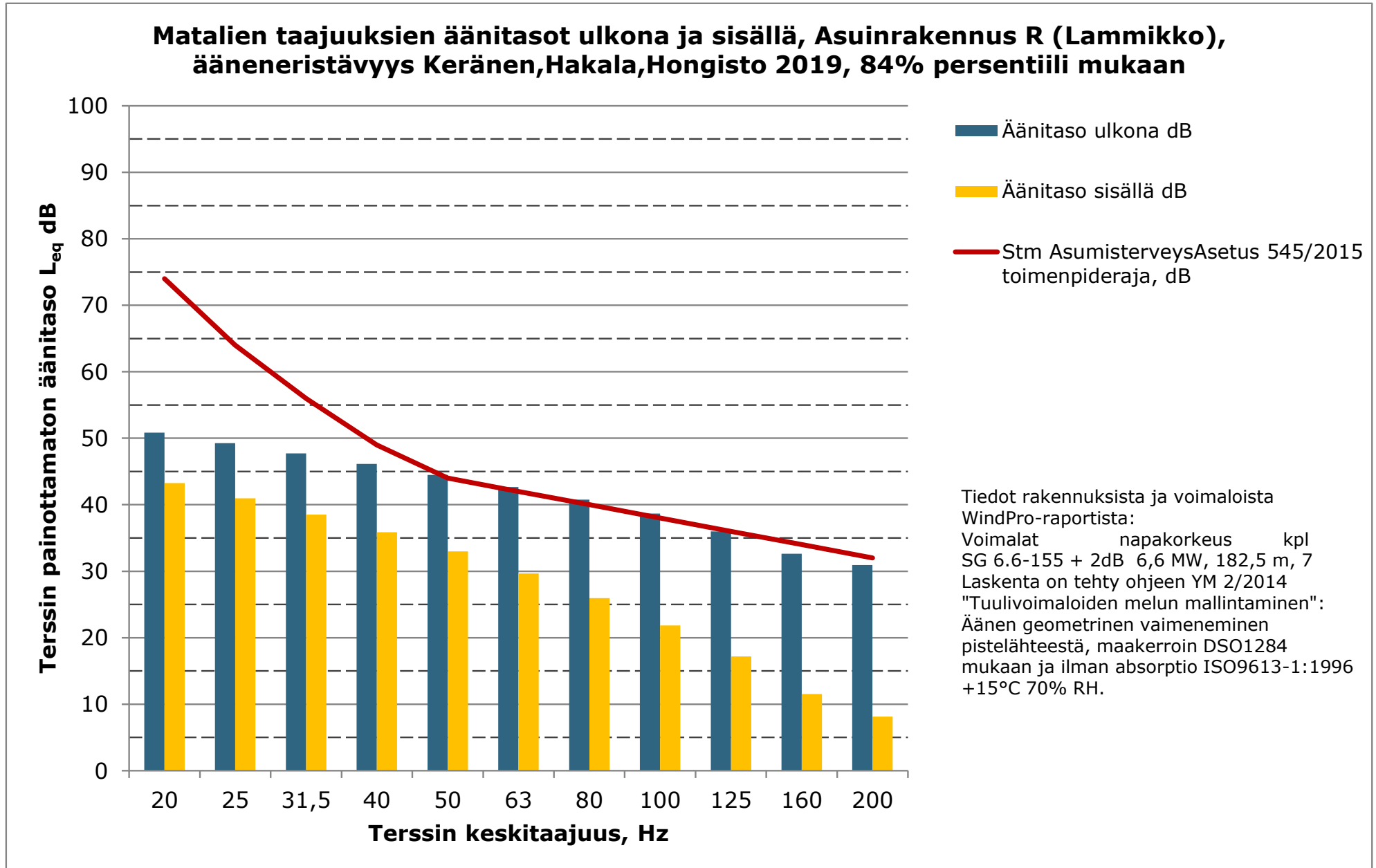


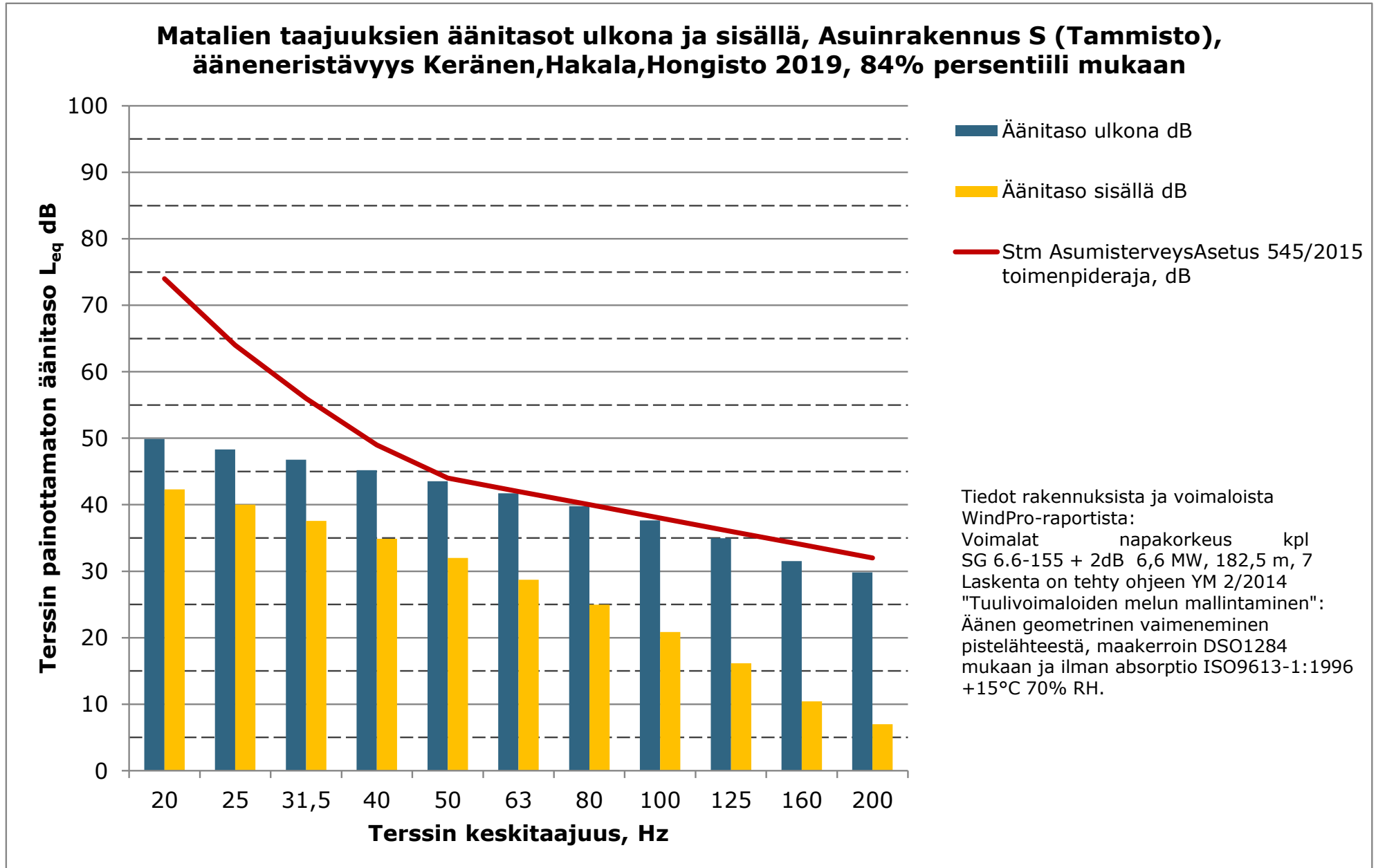


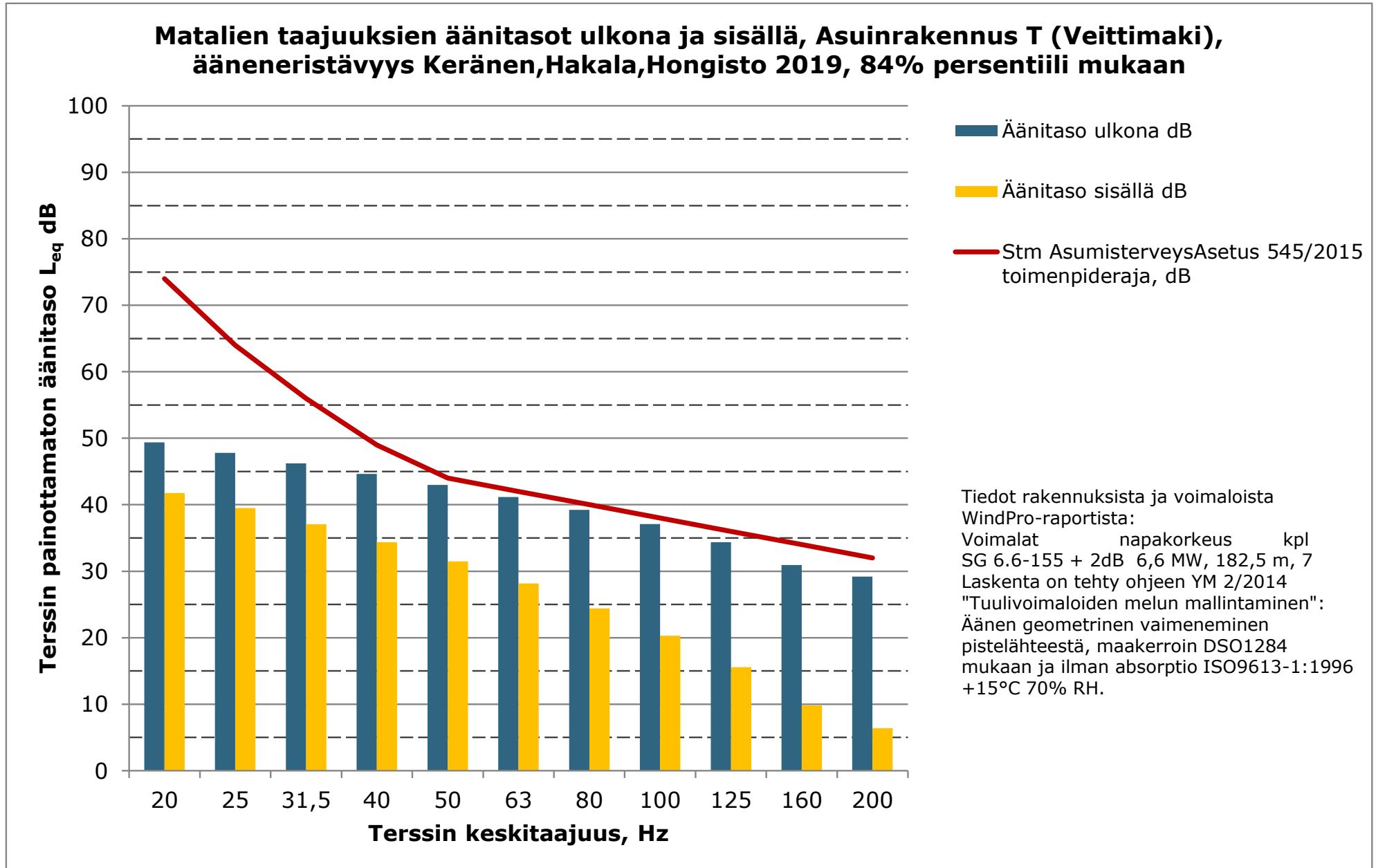


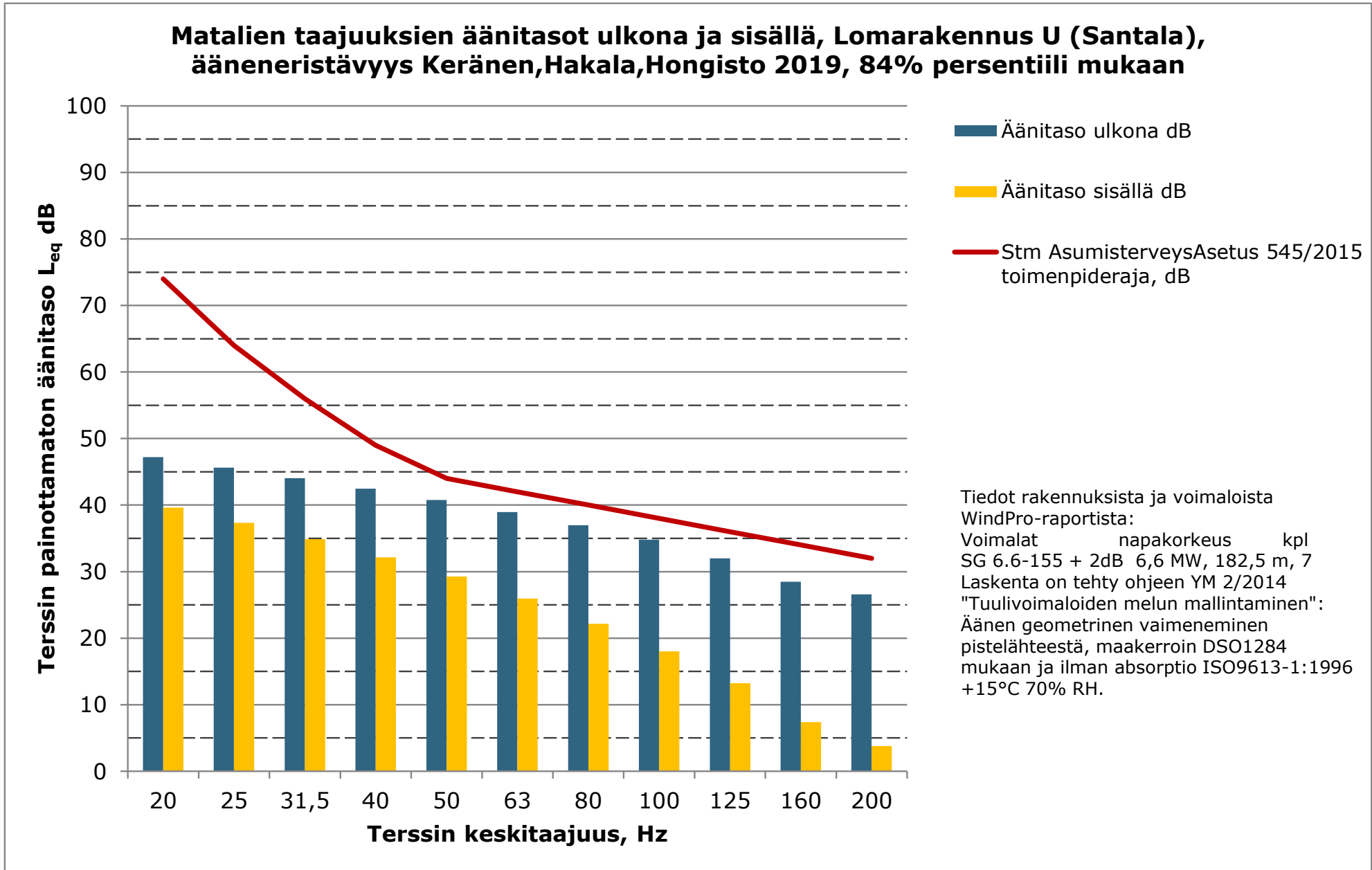


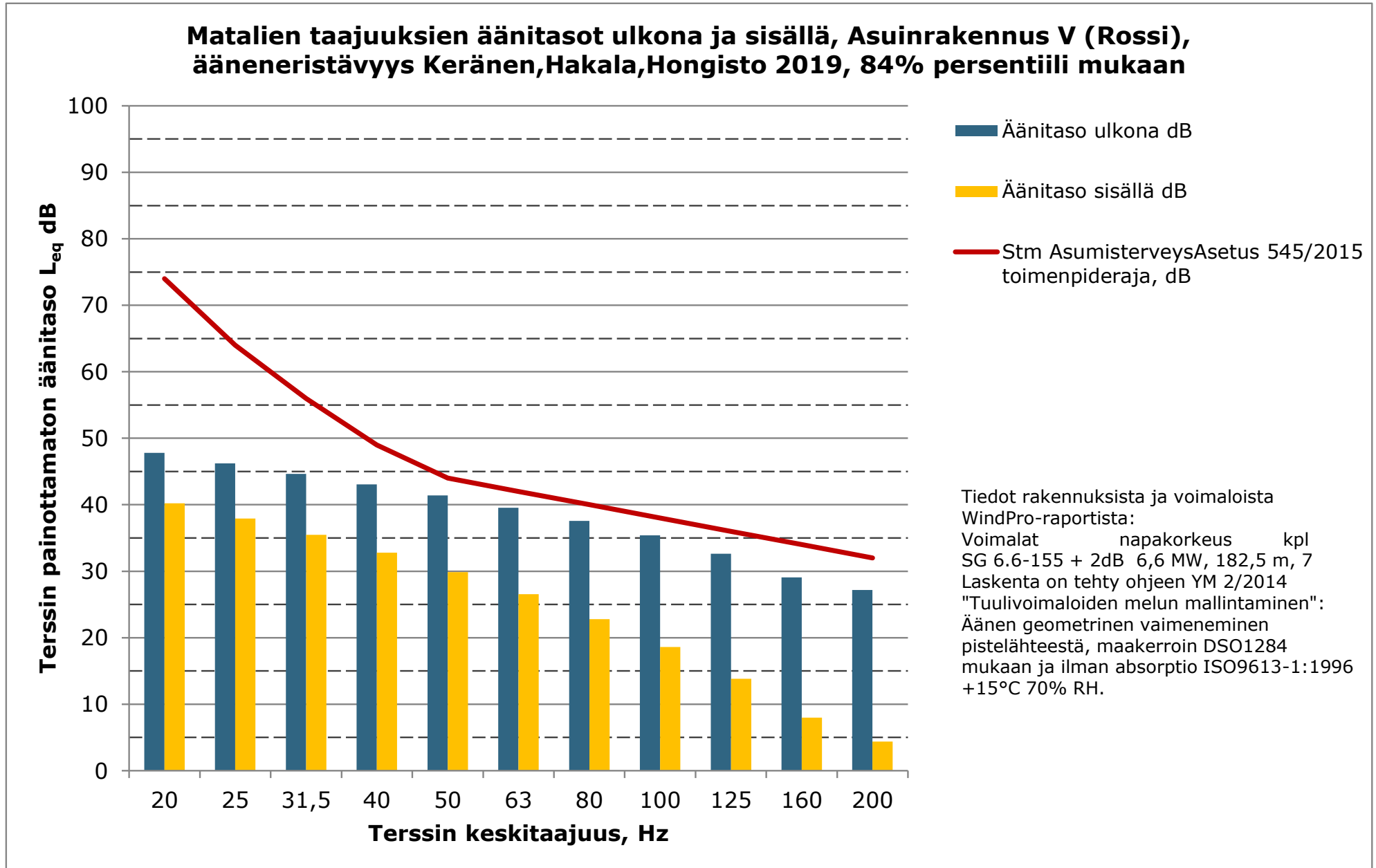




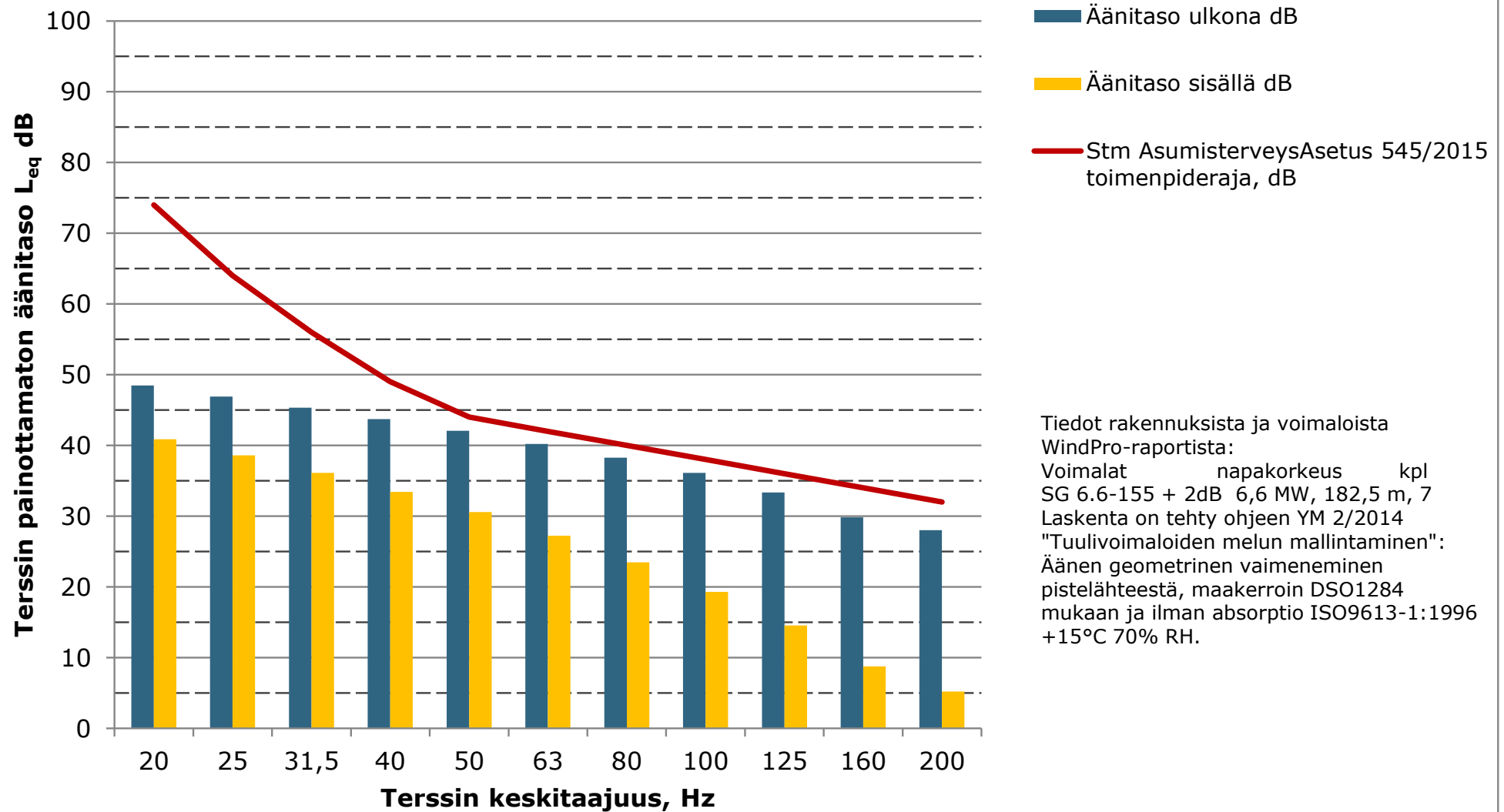


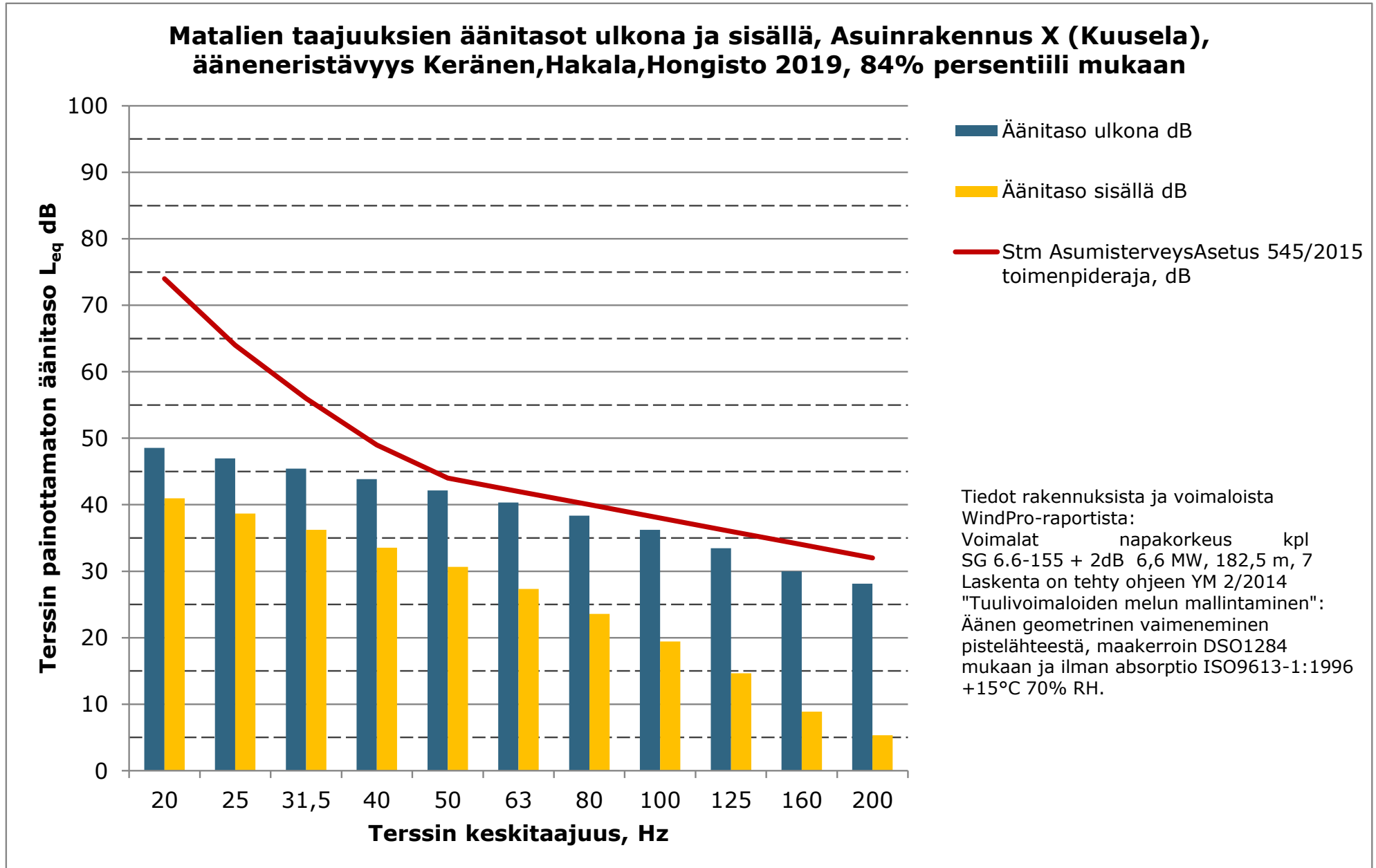




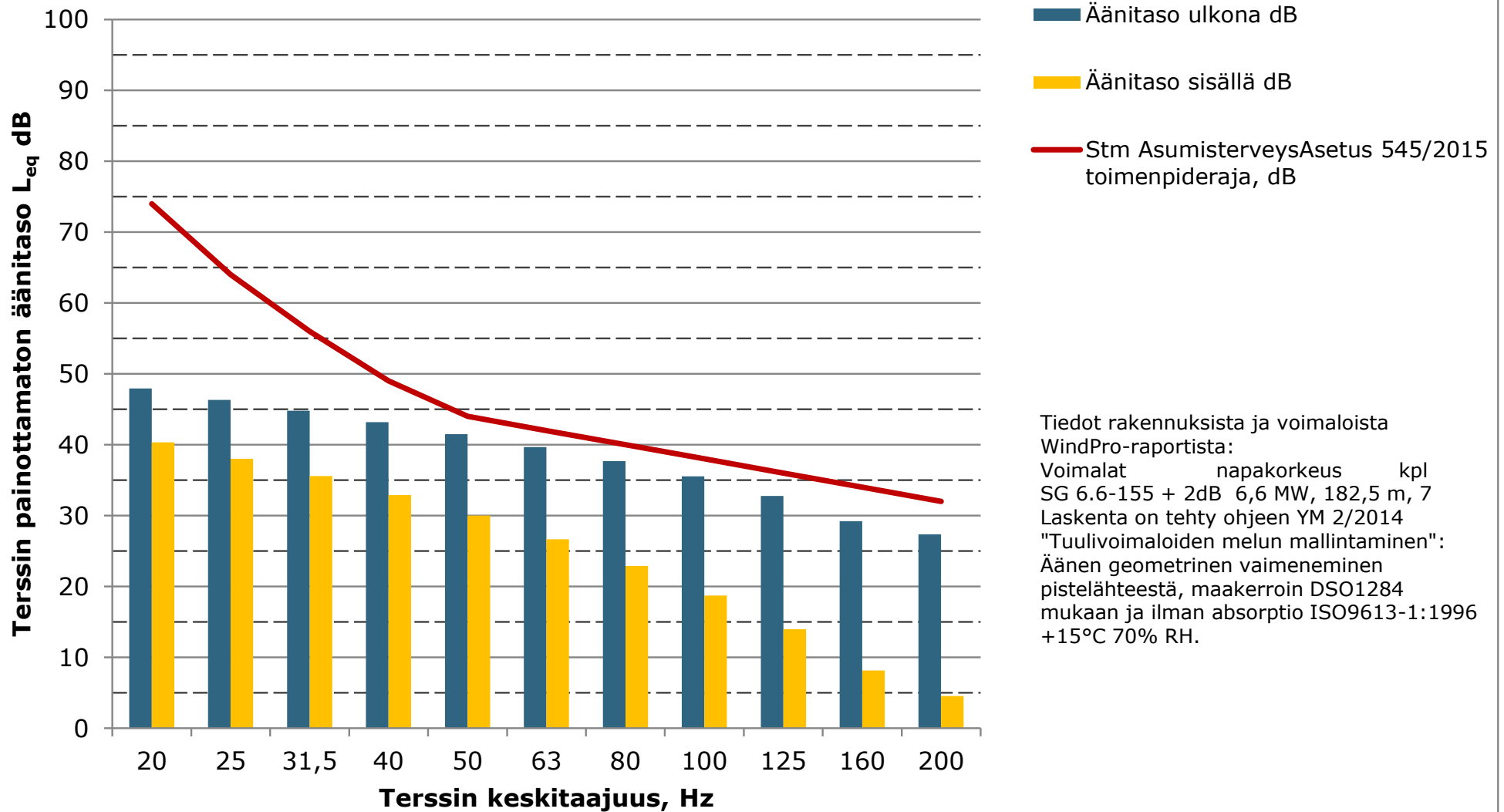


**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus W
(Makiniemi), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili
mukaan**

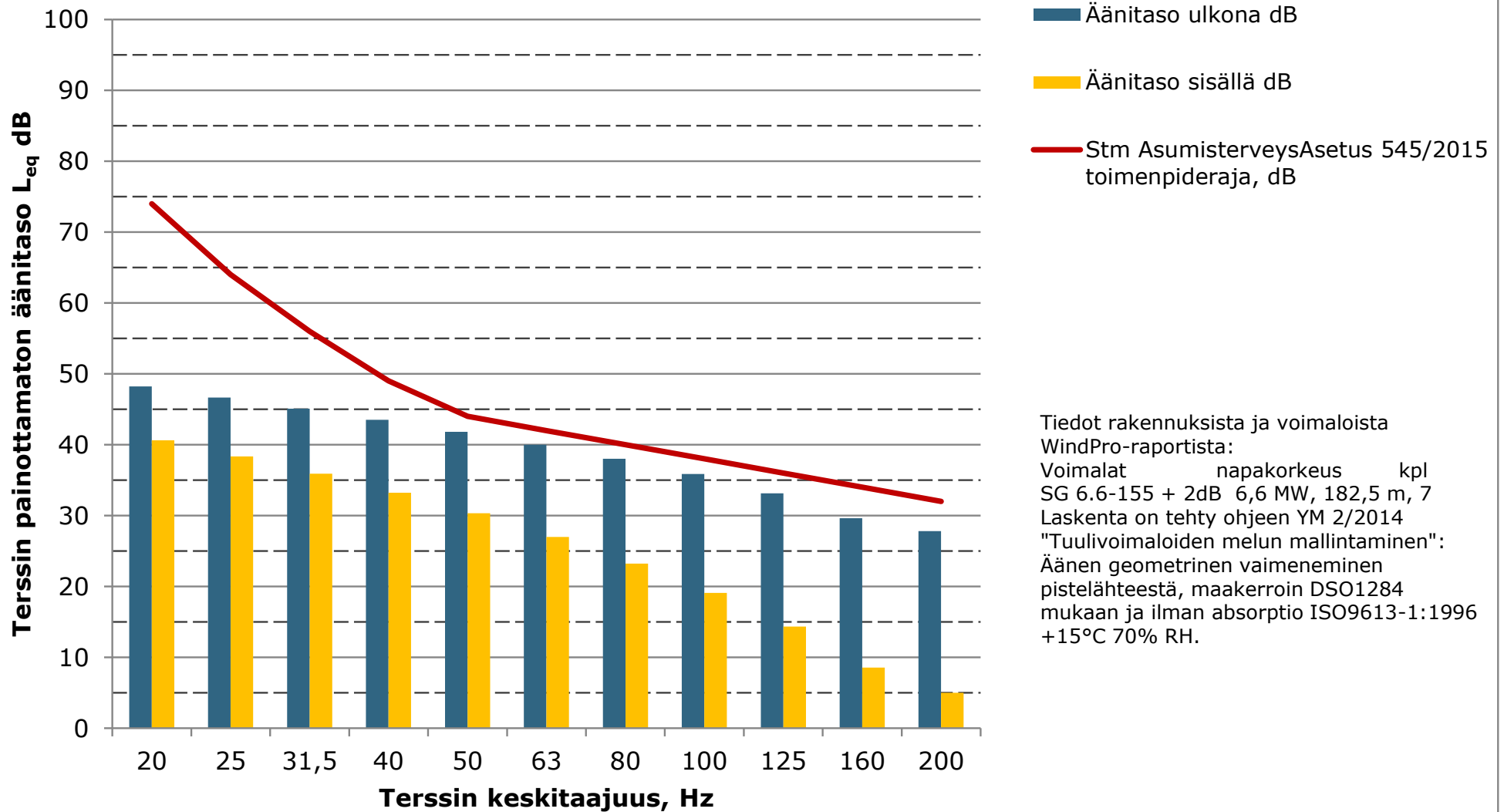


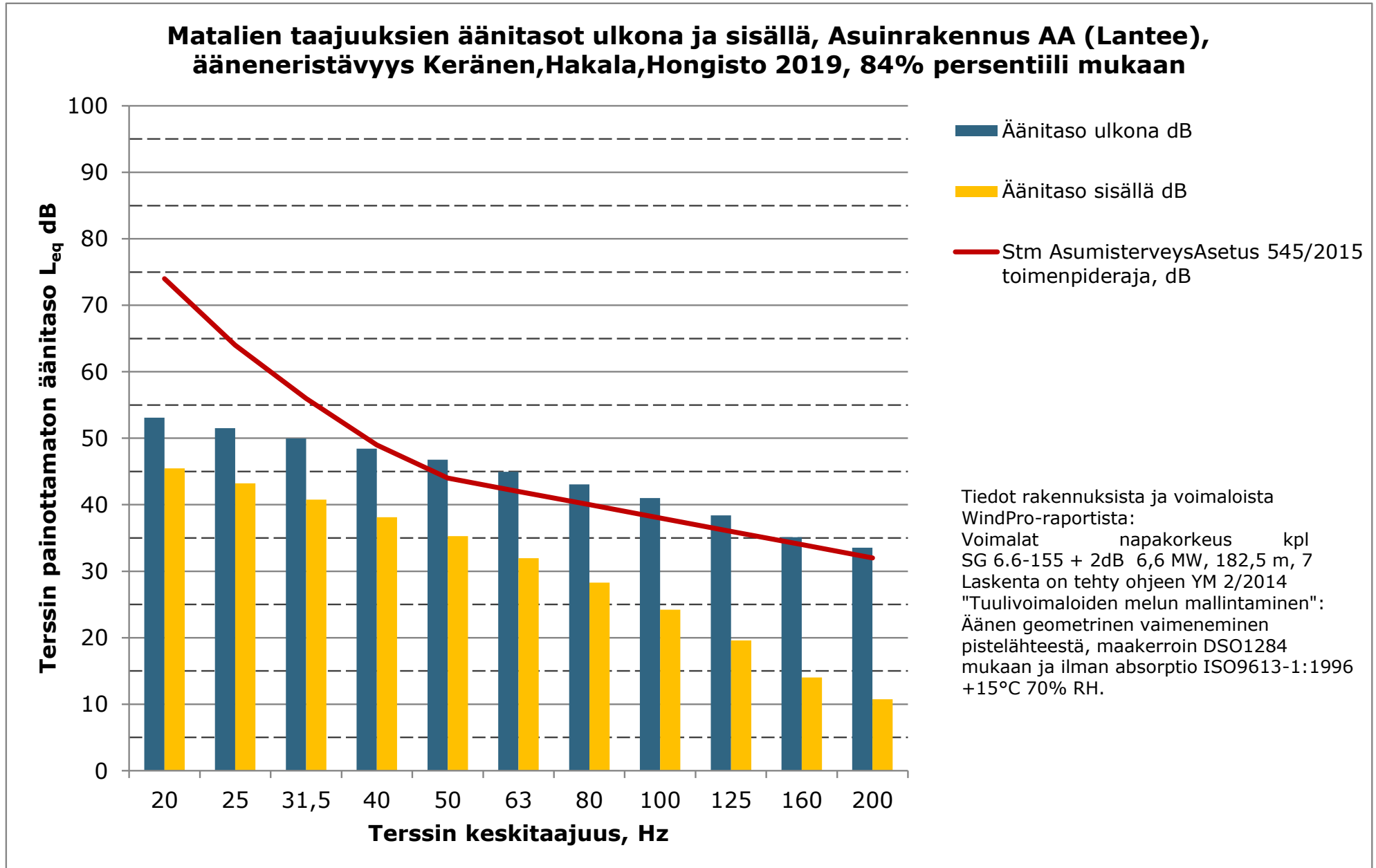


**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus Y
(Miekkajarventie), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84%
persentiili mukaan**

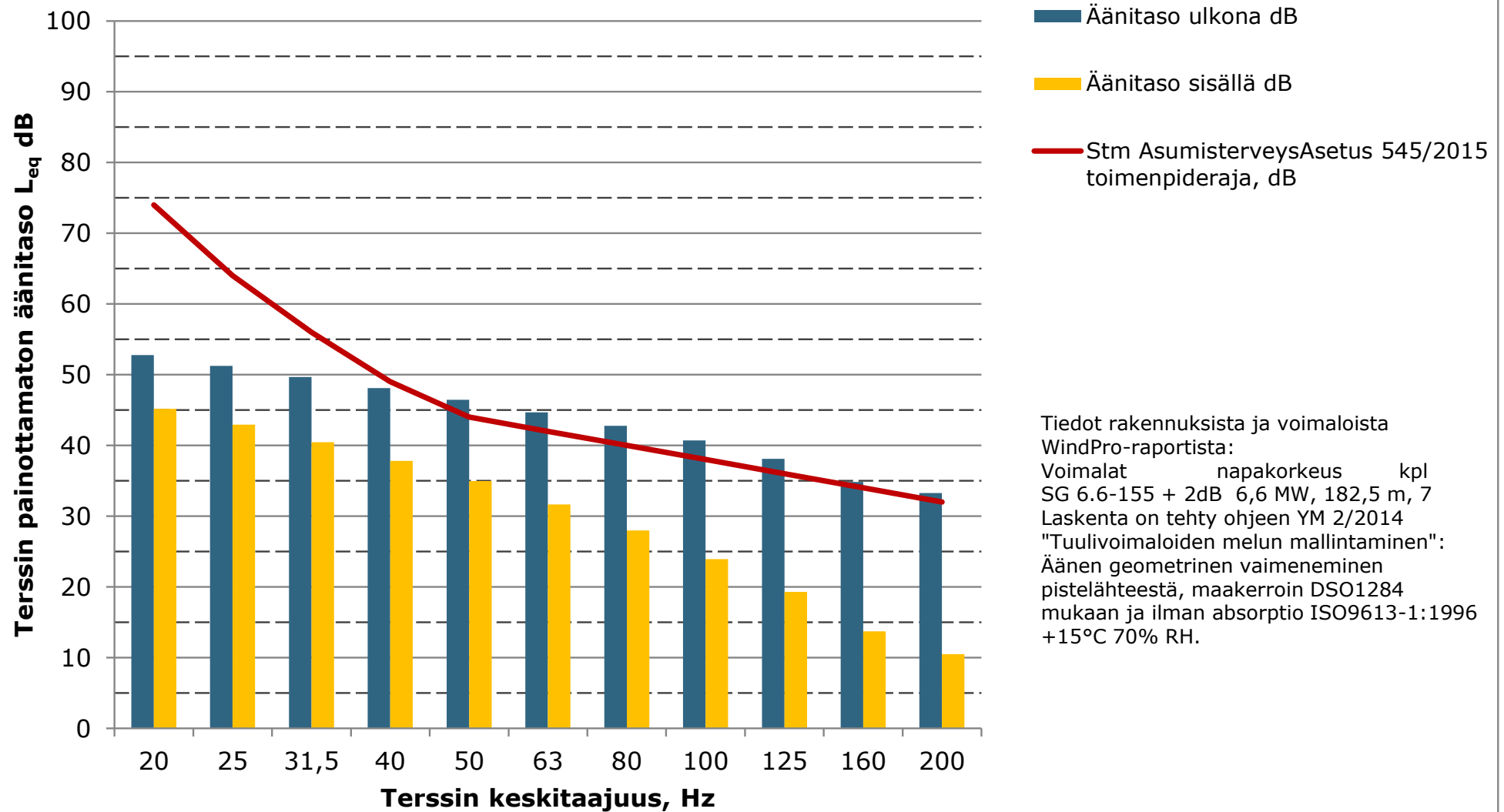


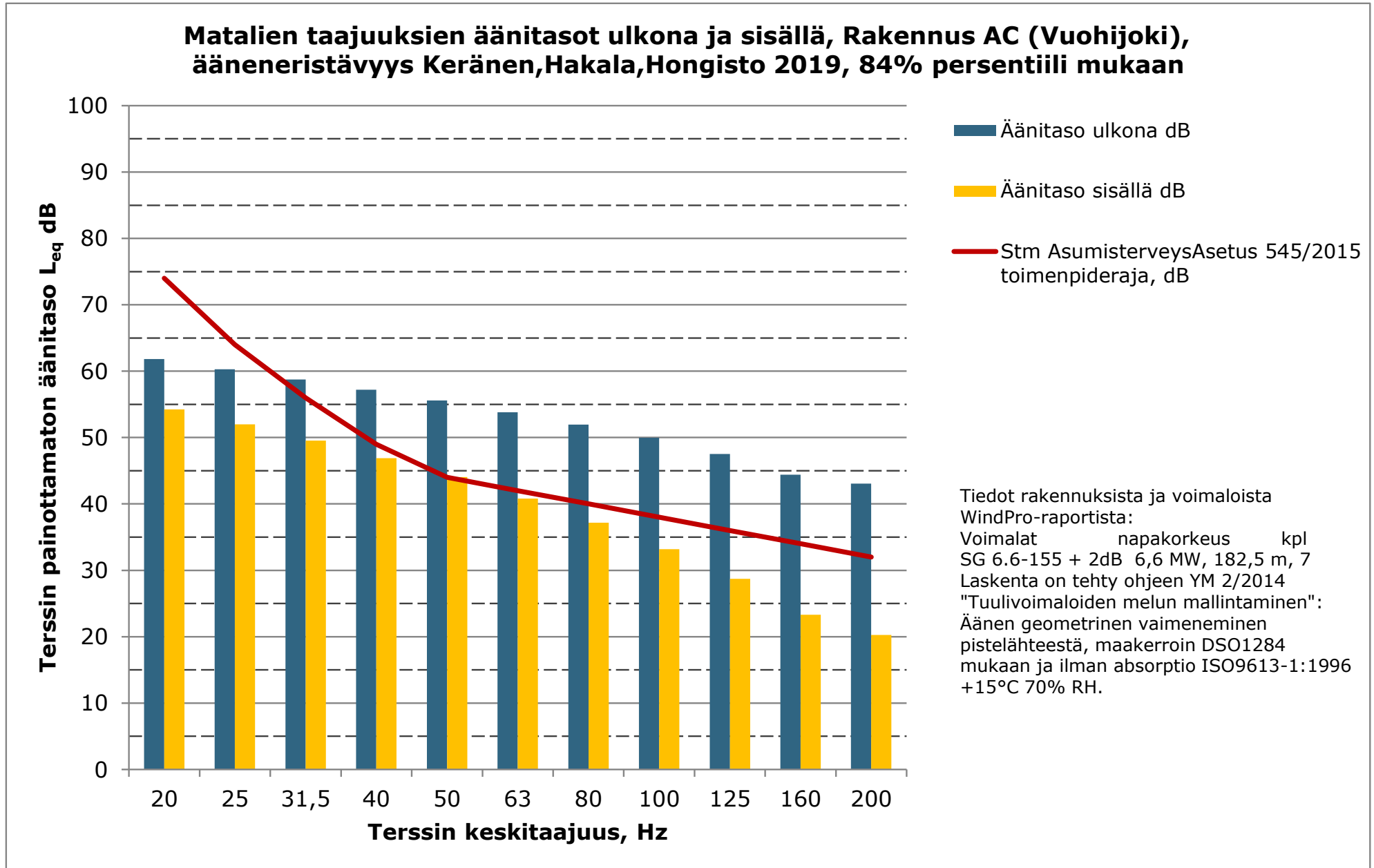
**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus Z
(Lahdesmaki), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84%
persentiili mukaan**



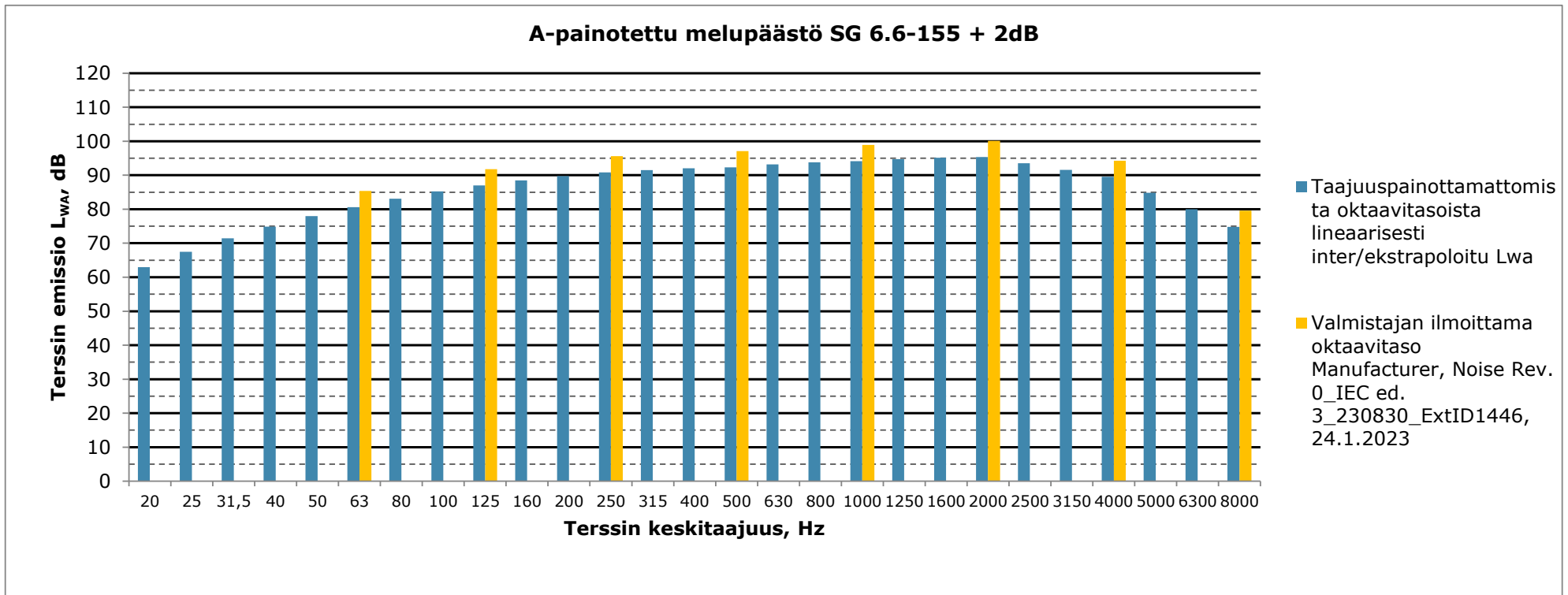


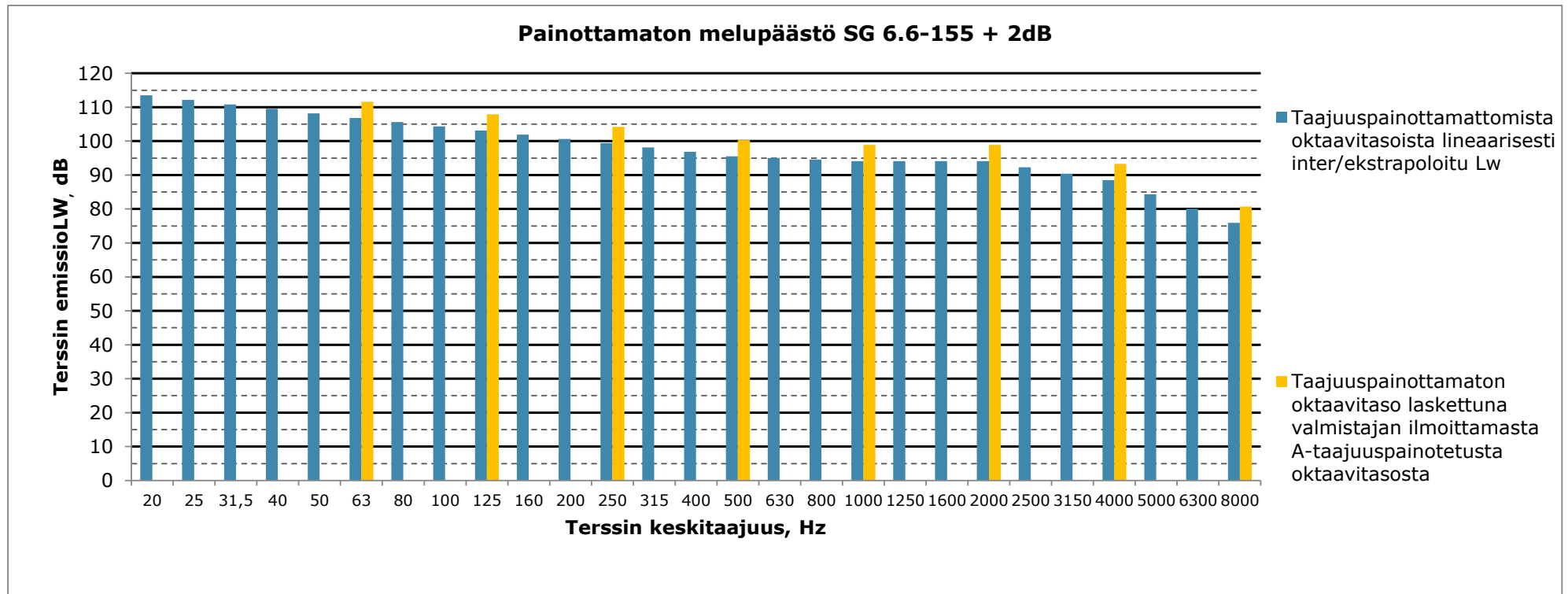
**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus AB
(Portaanpaa), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili
mukaan**

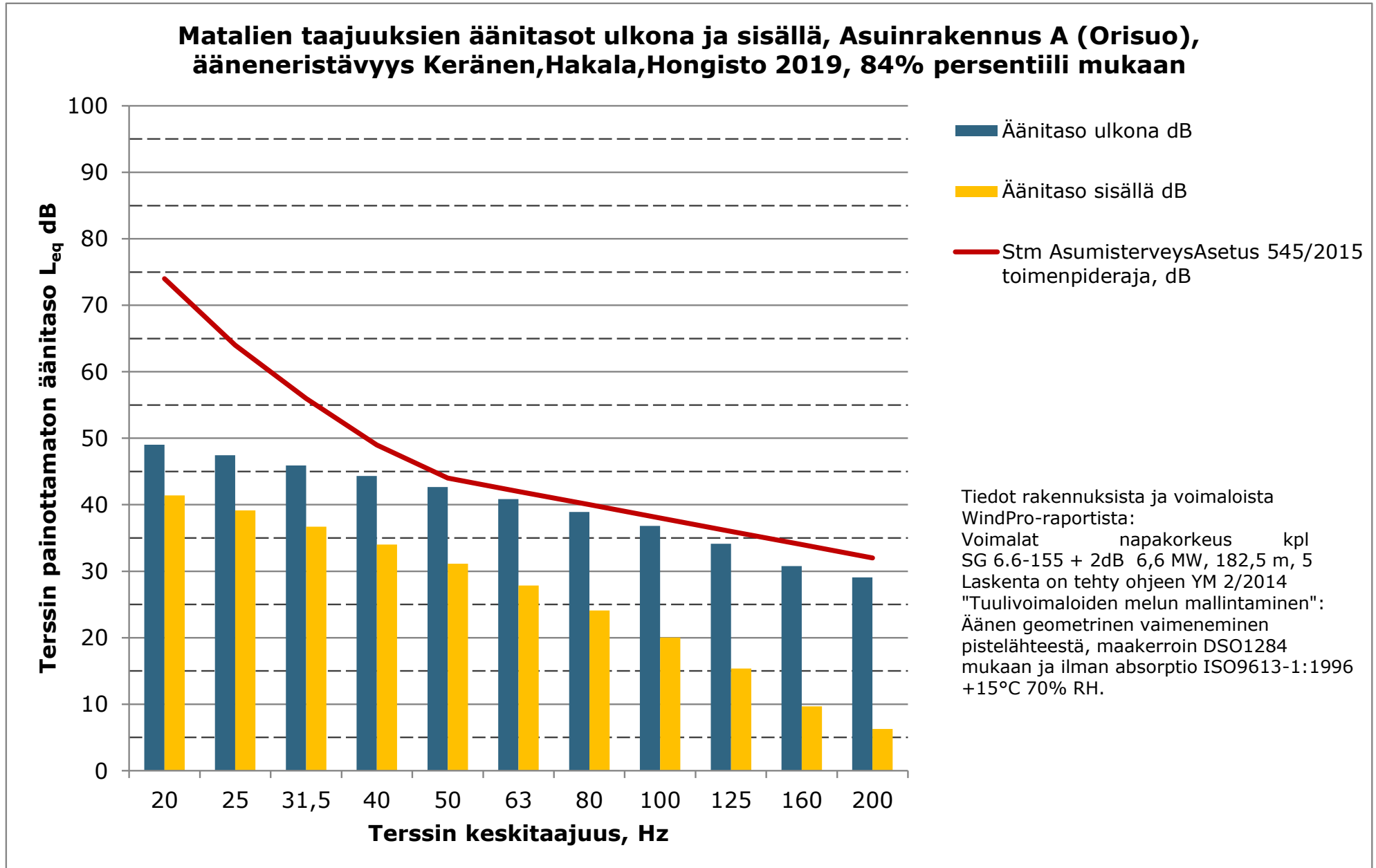


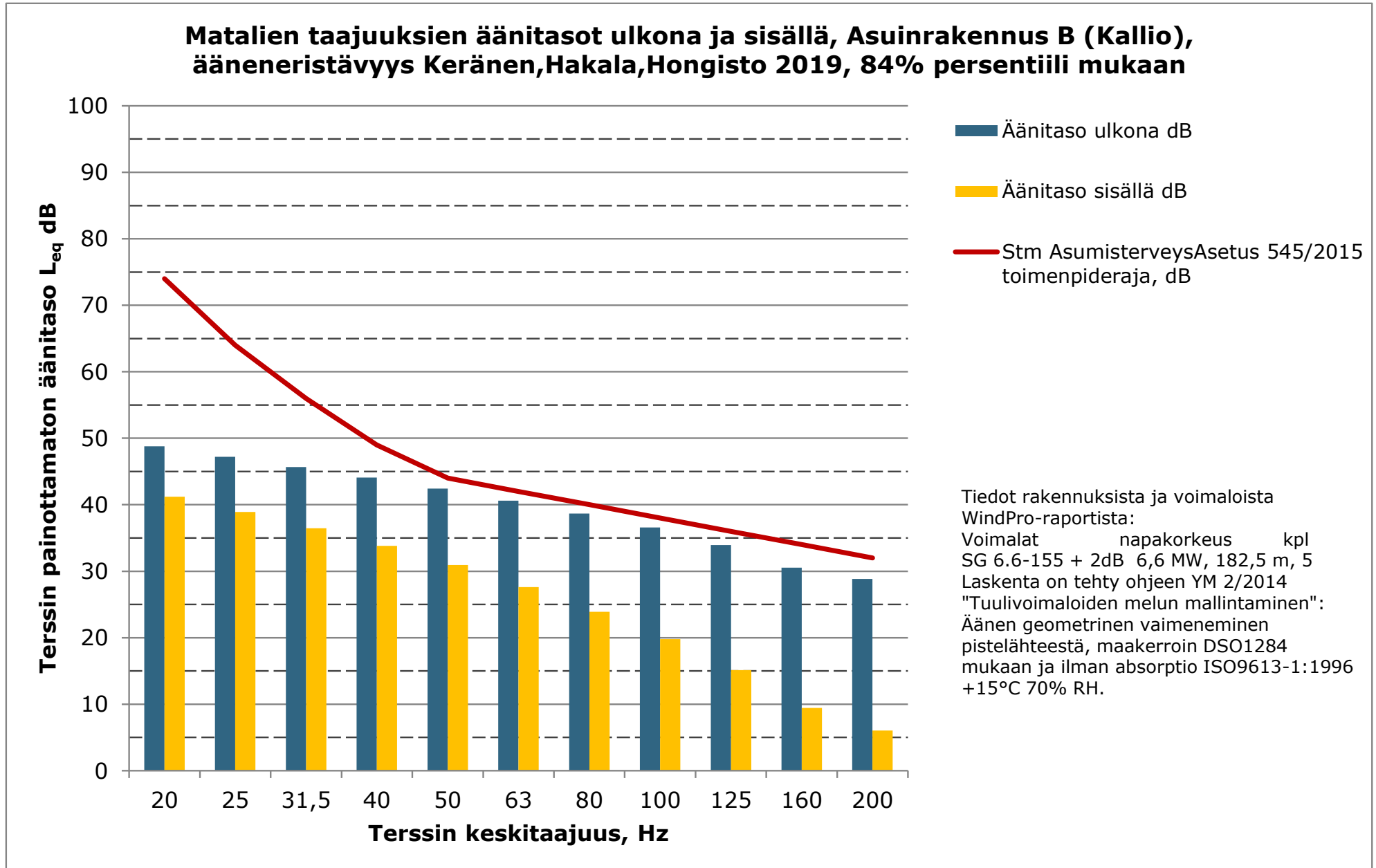


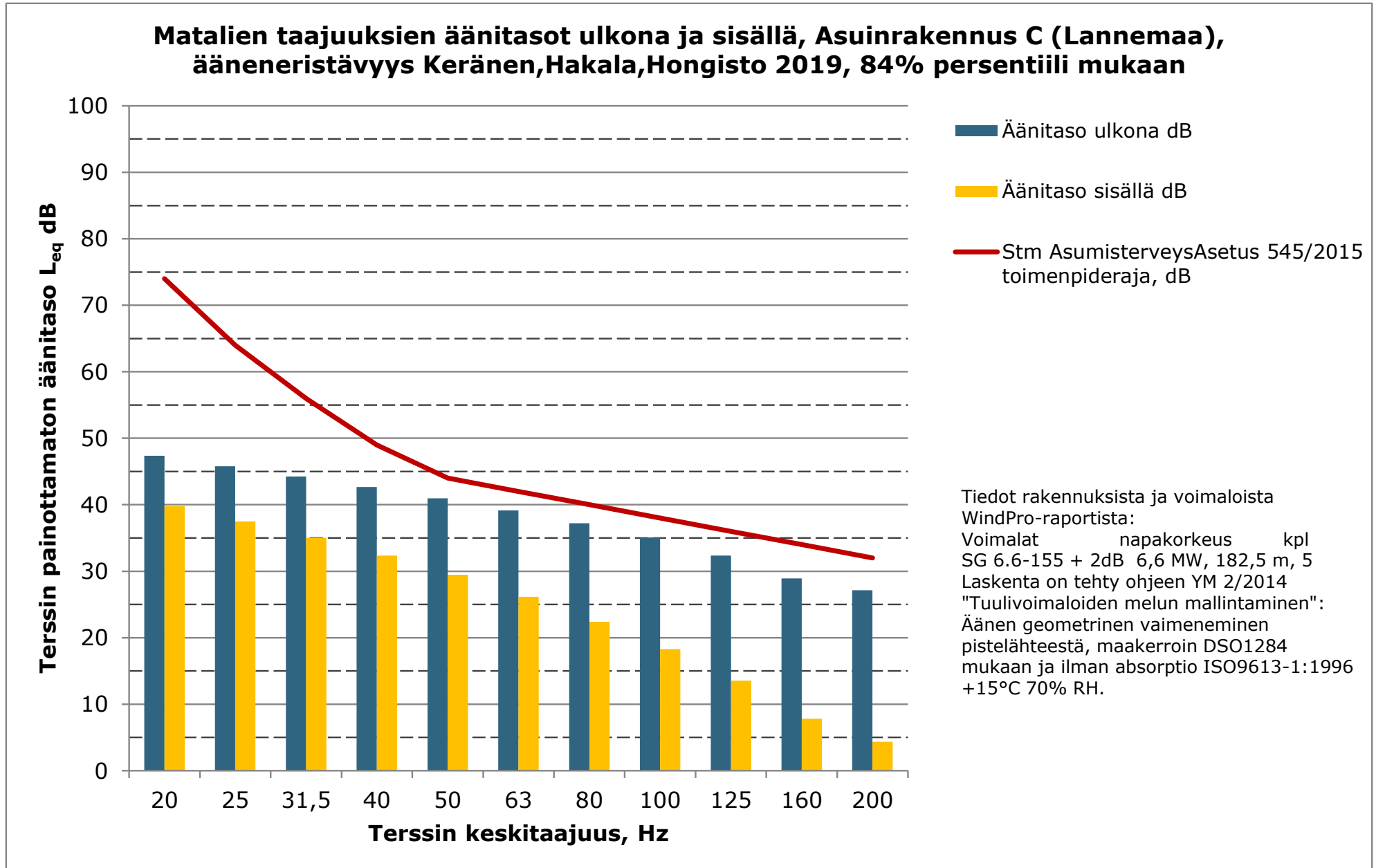
Liite 4. Pienitaajuisen melun rakennuskohtaiset arvot - Hankevaihtoehto VE2

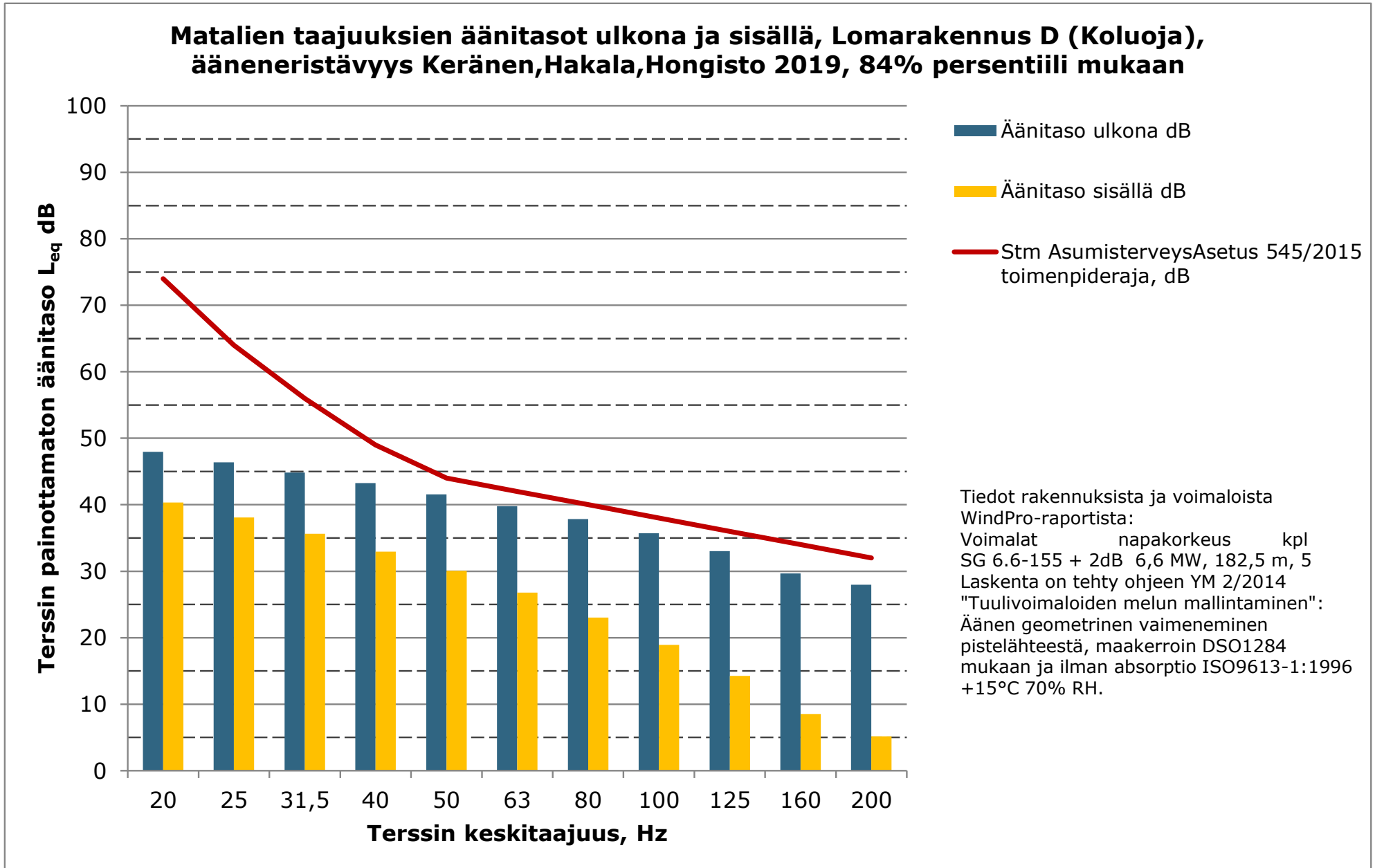


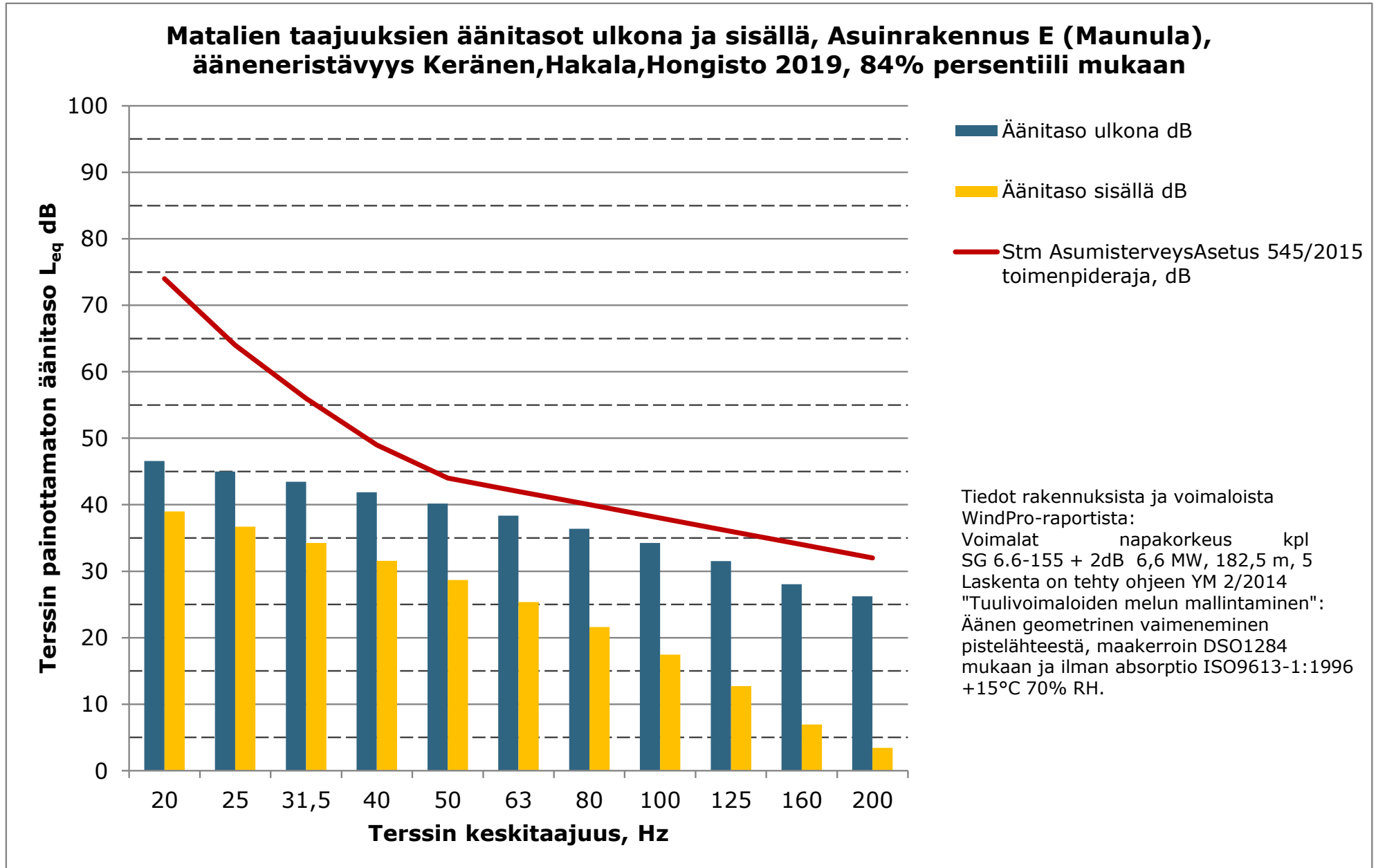


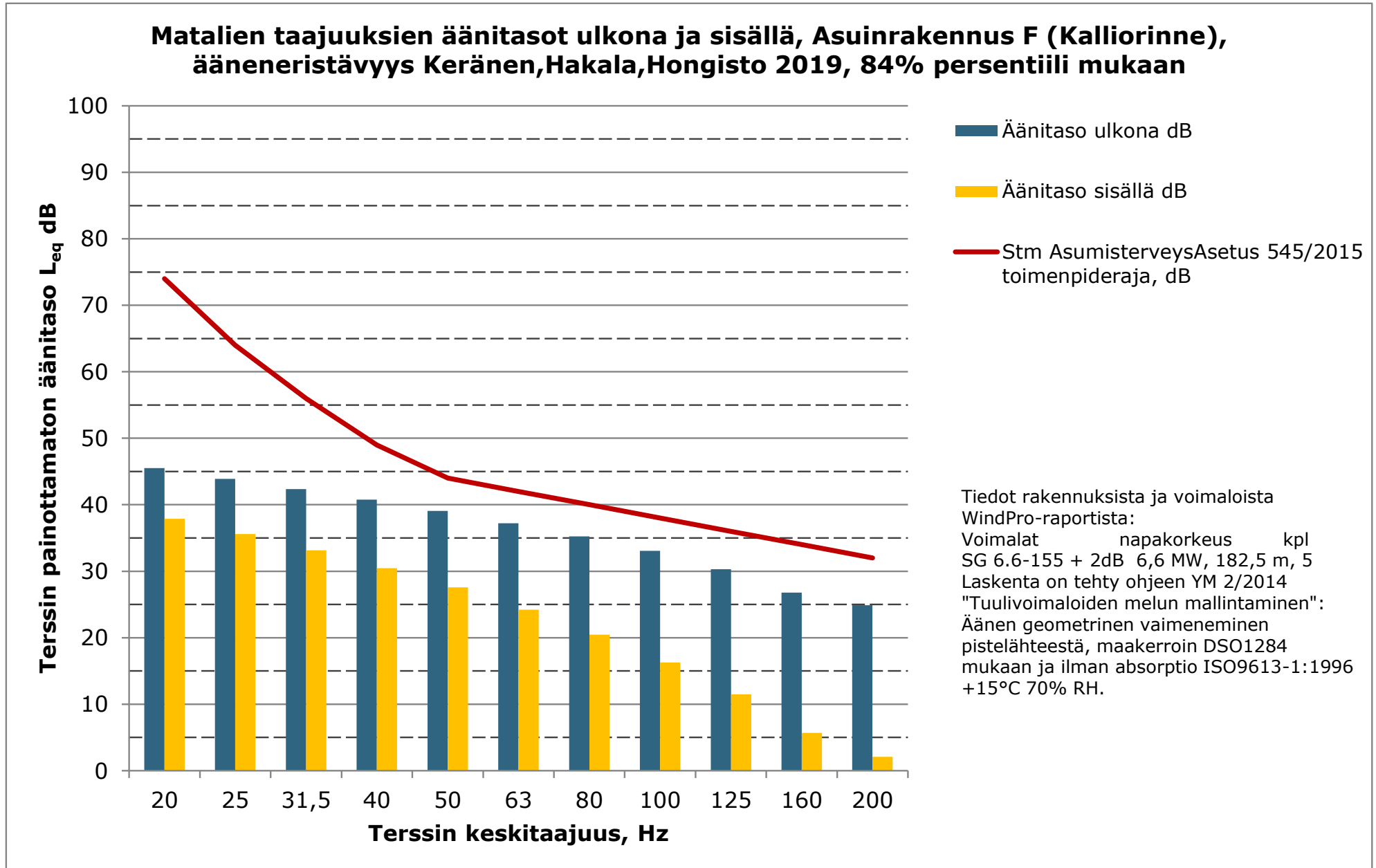


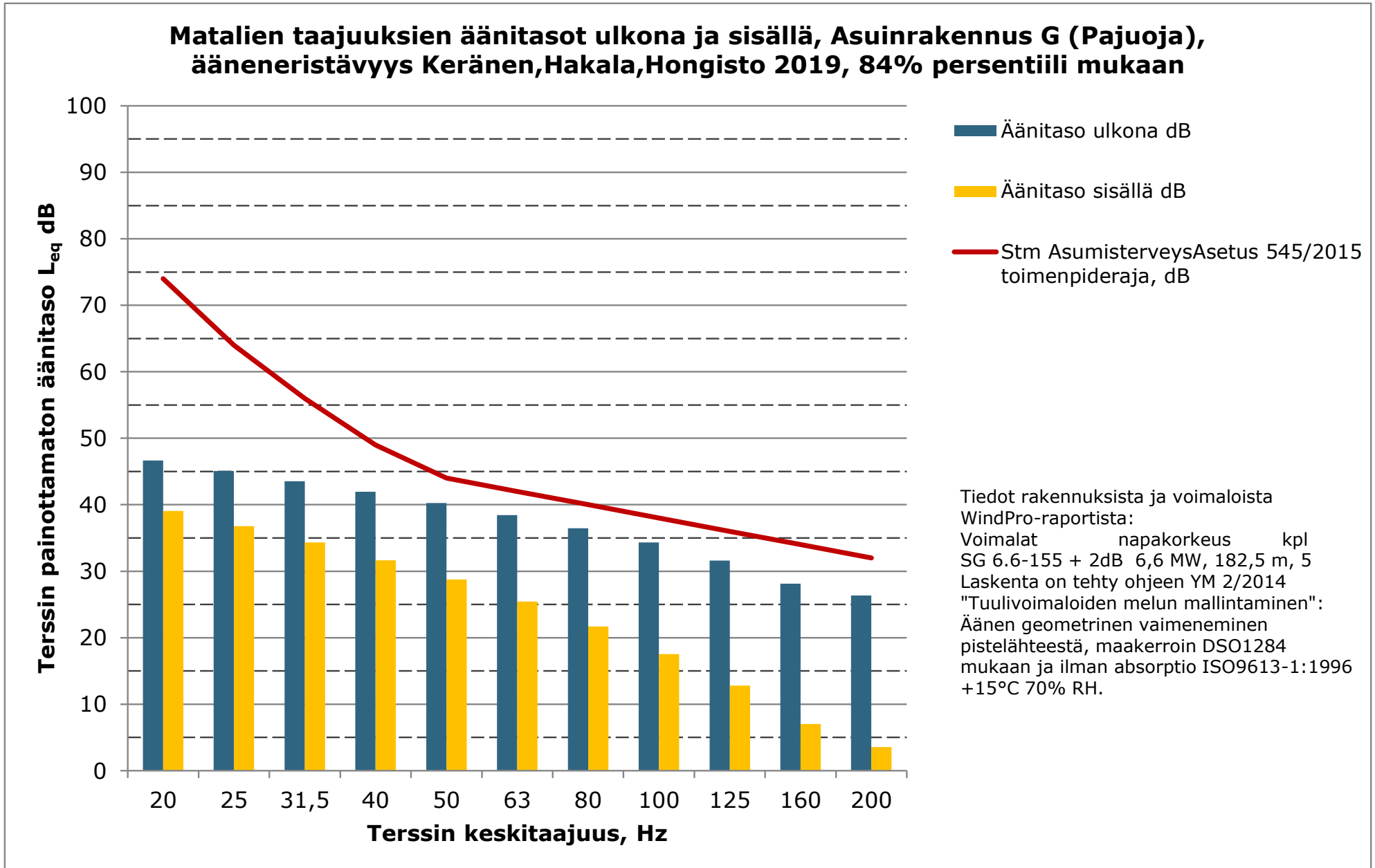


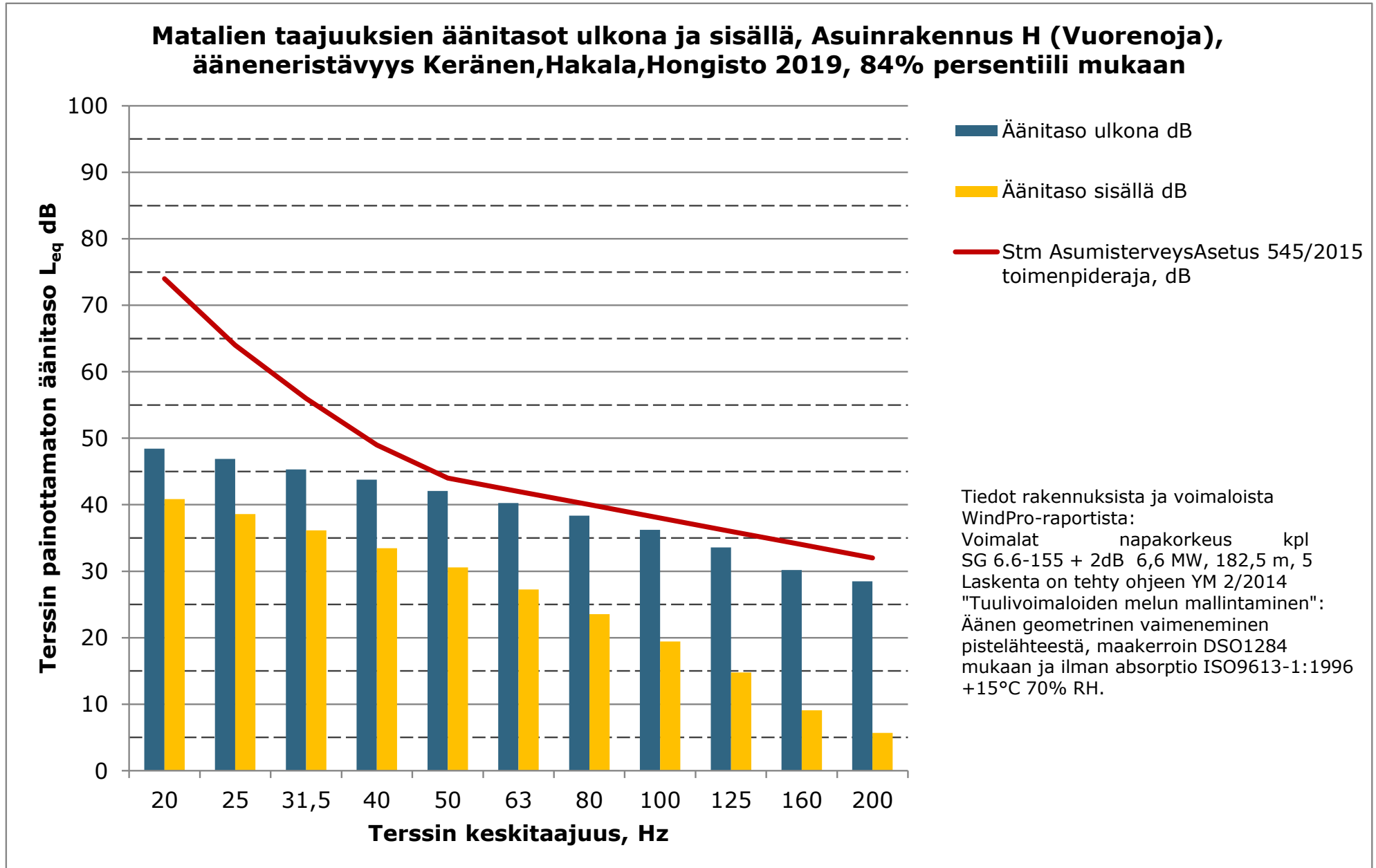




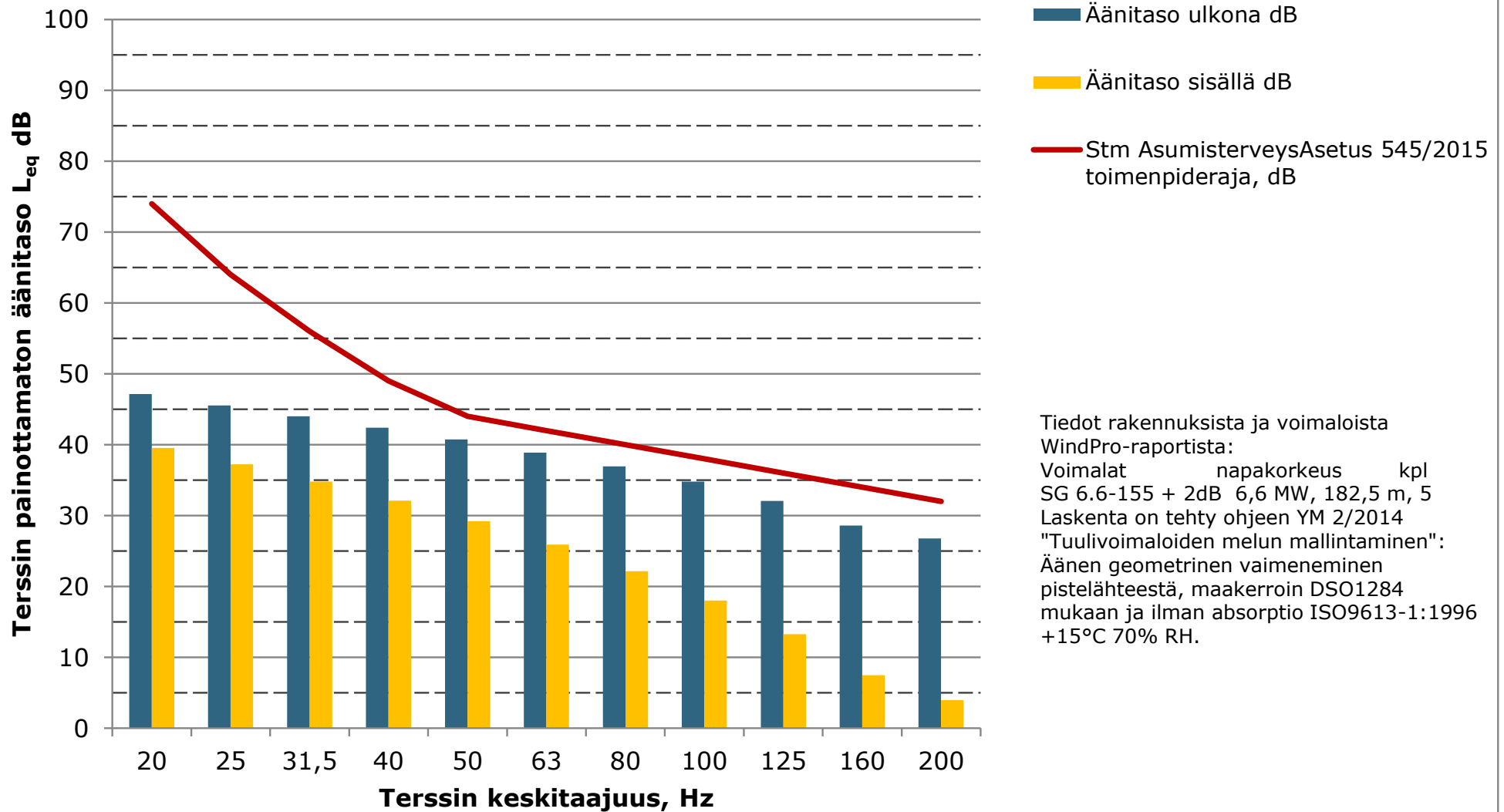




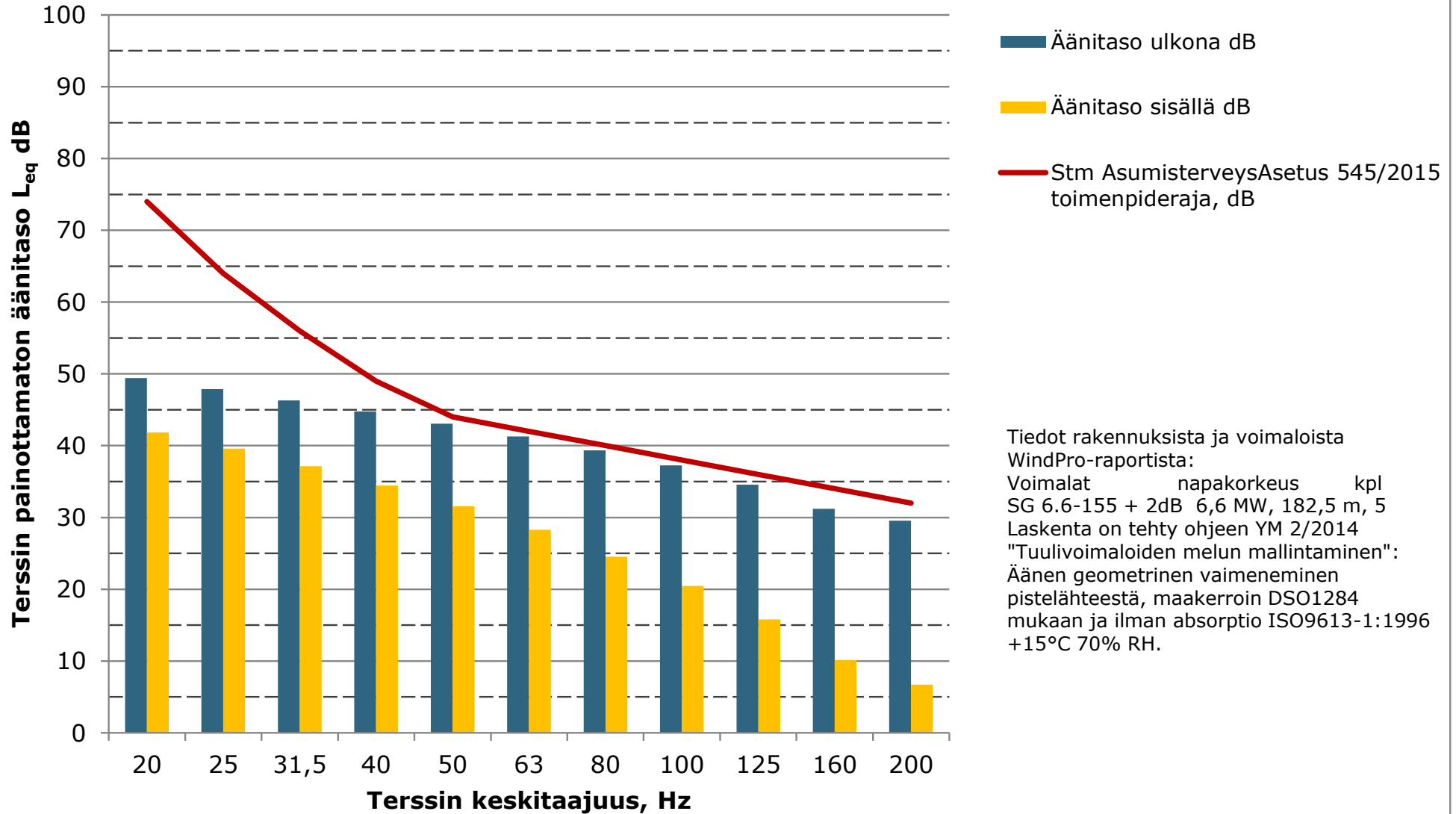


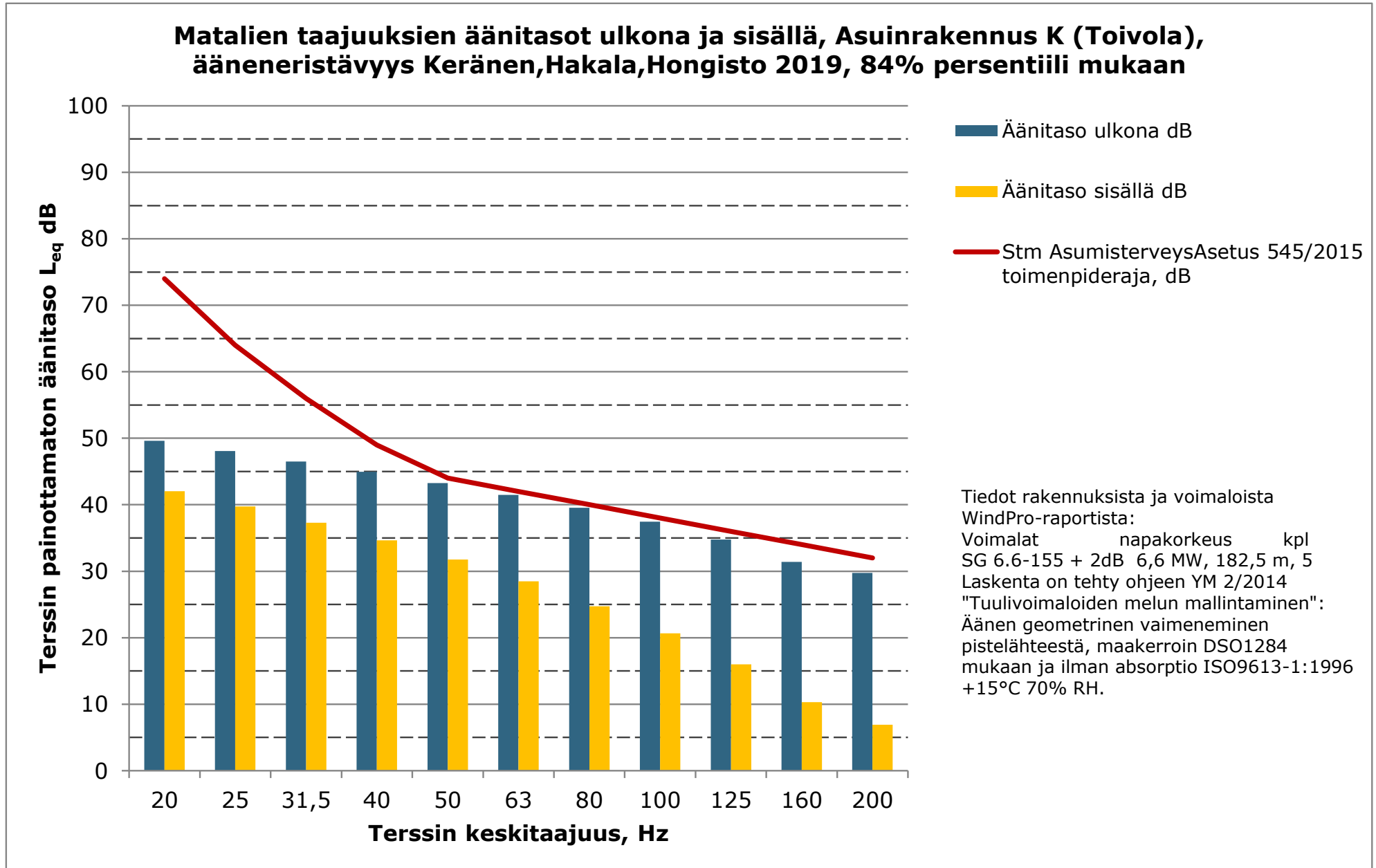


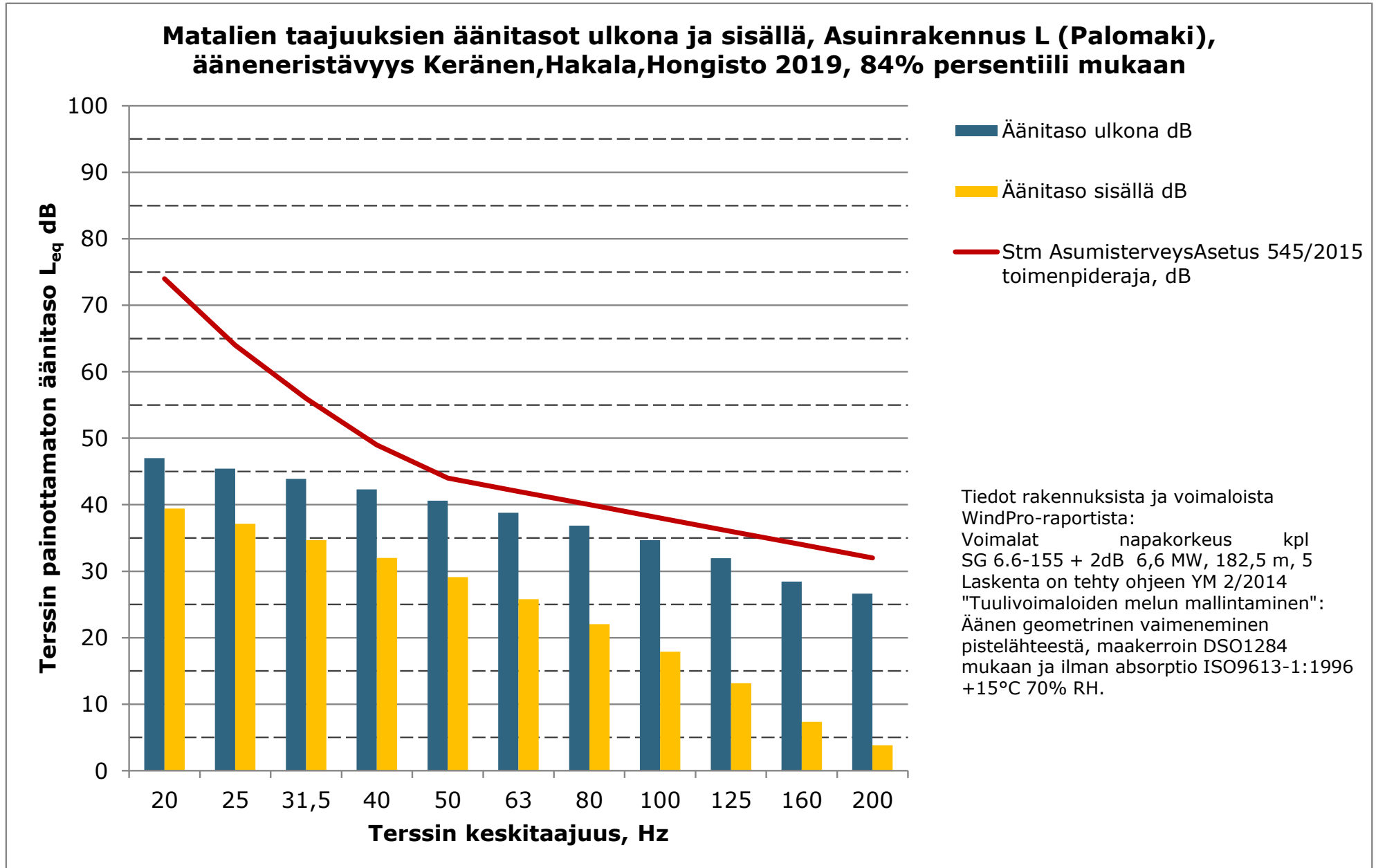
**Matalien taajuuksien äänitasot ulkona ja sisällä, Lomarakennus I
(Hirvisuontie), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84%
persentiili mukaan**

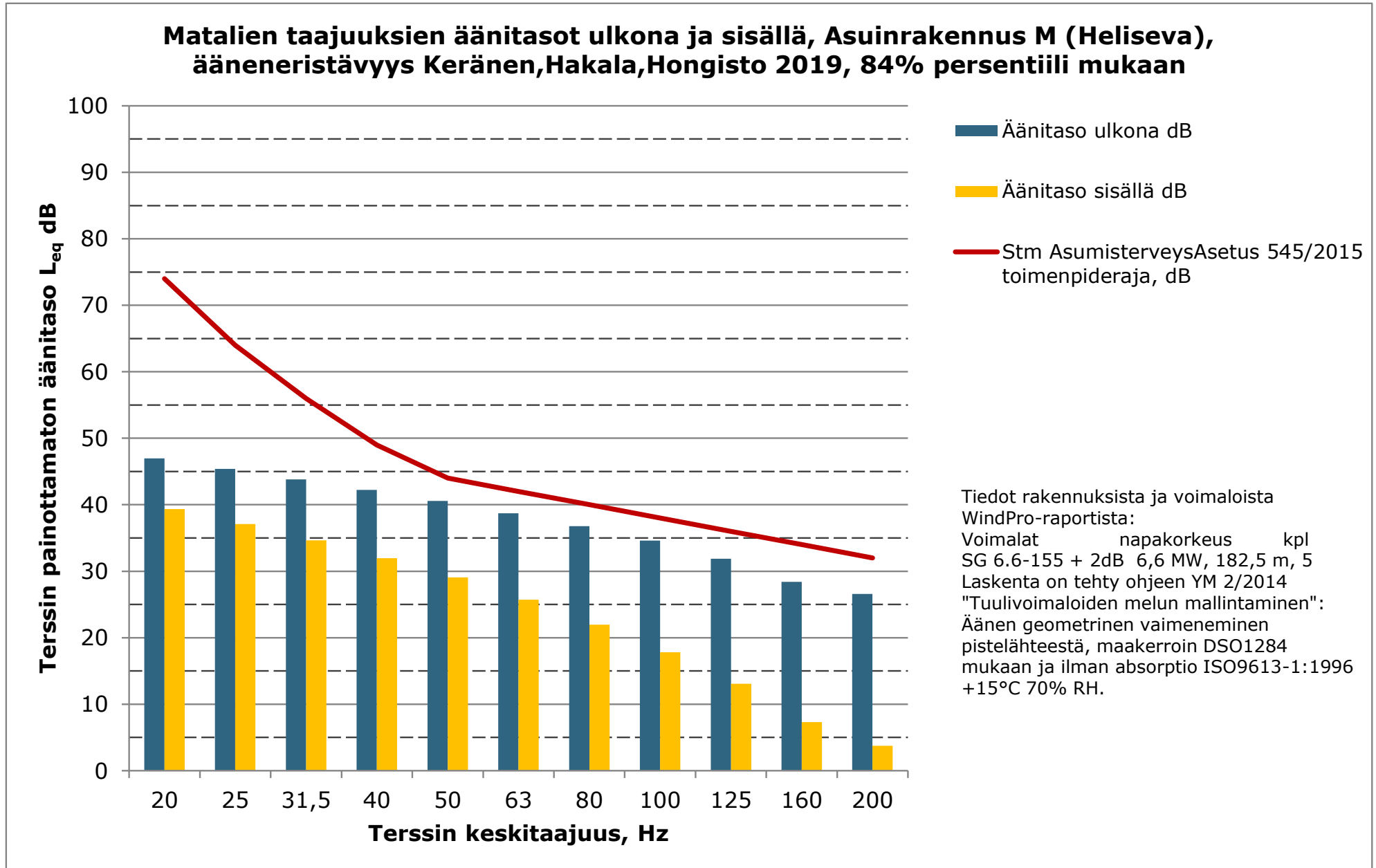


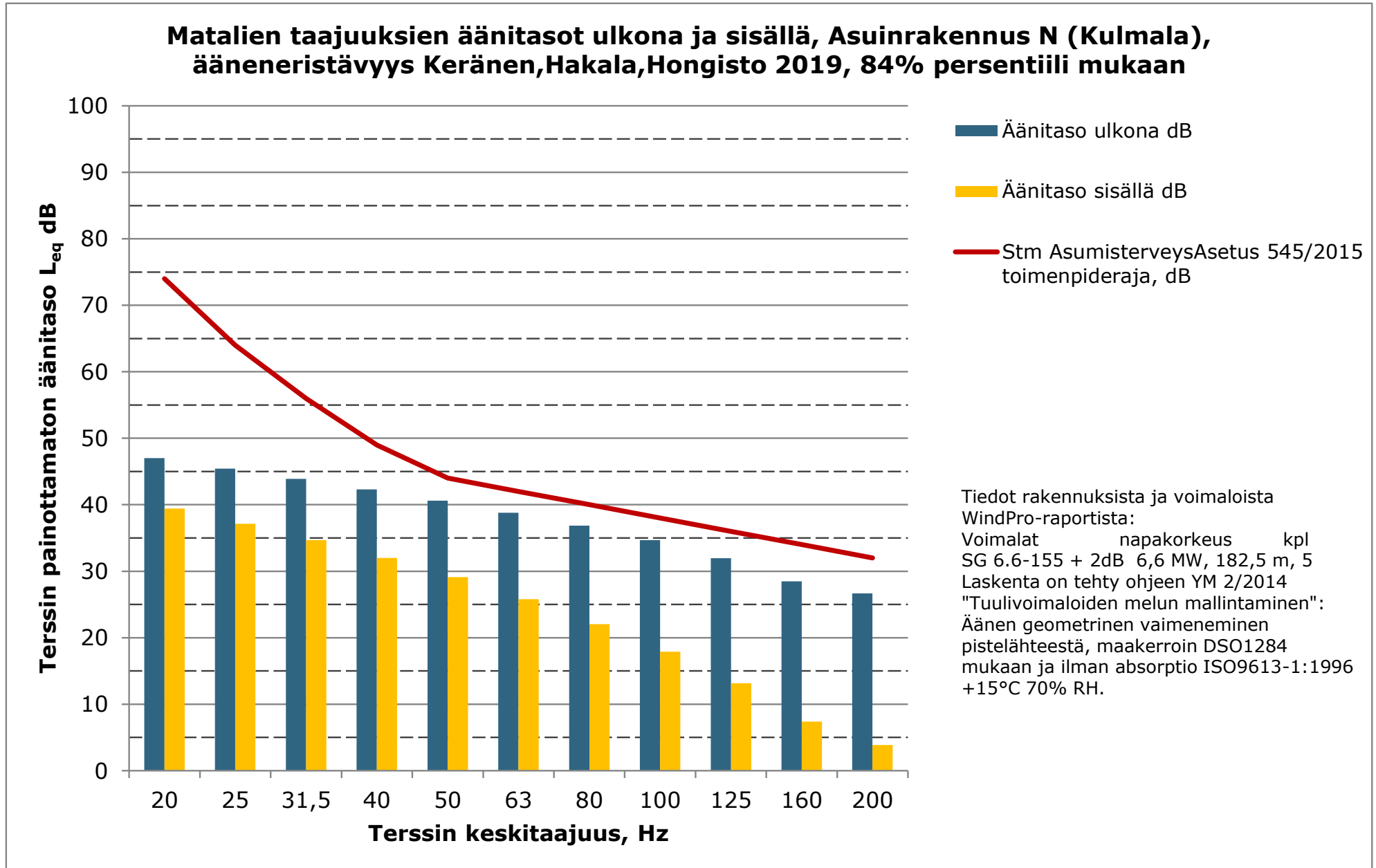
Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus J (Riihimäki), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan

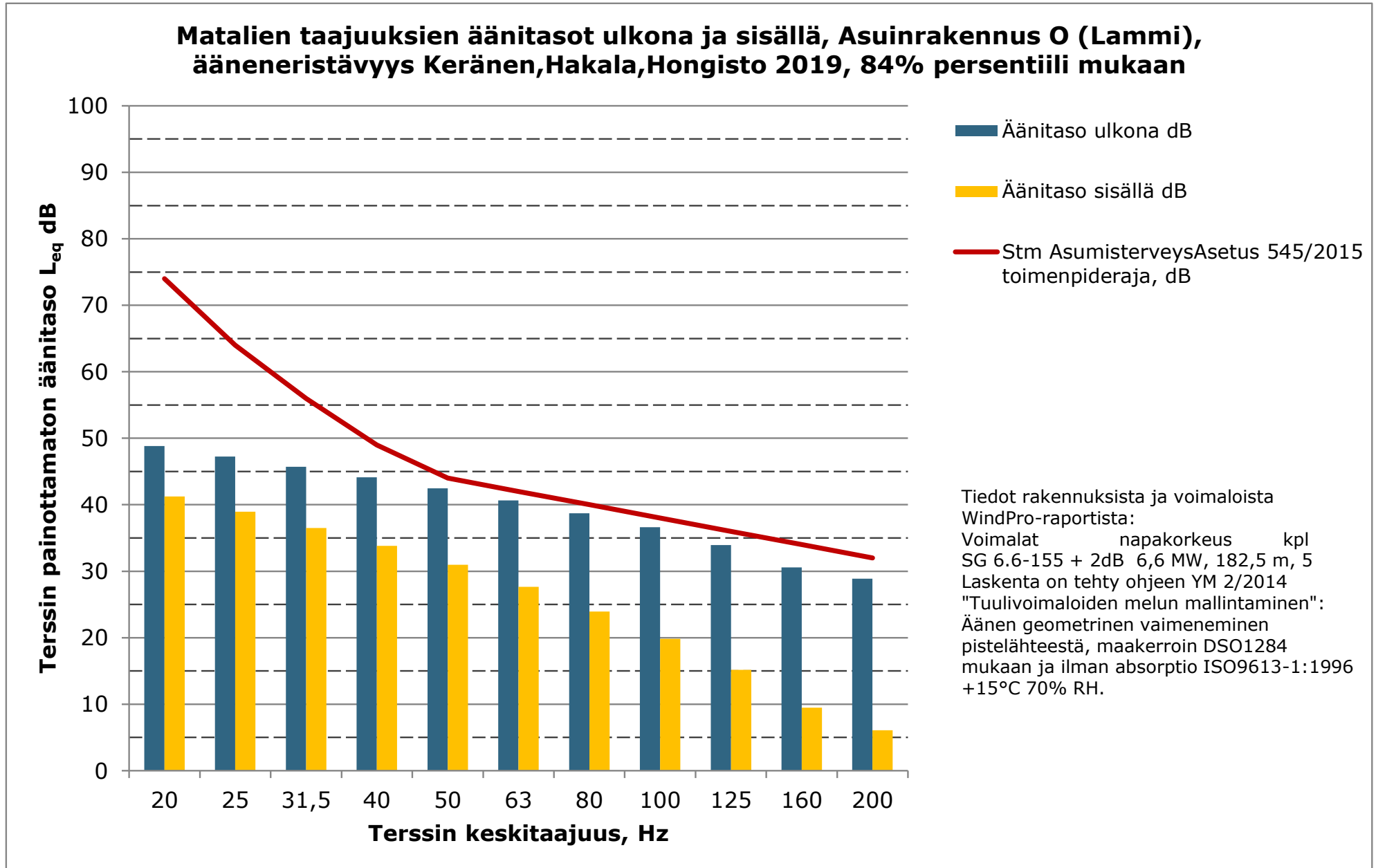


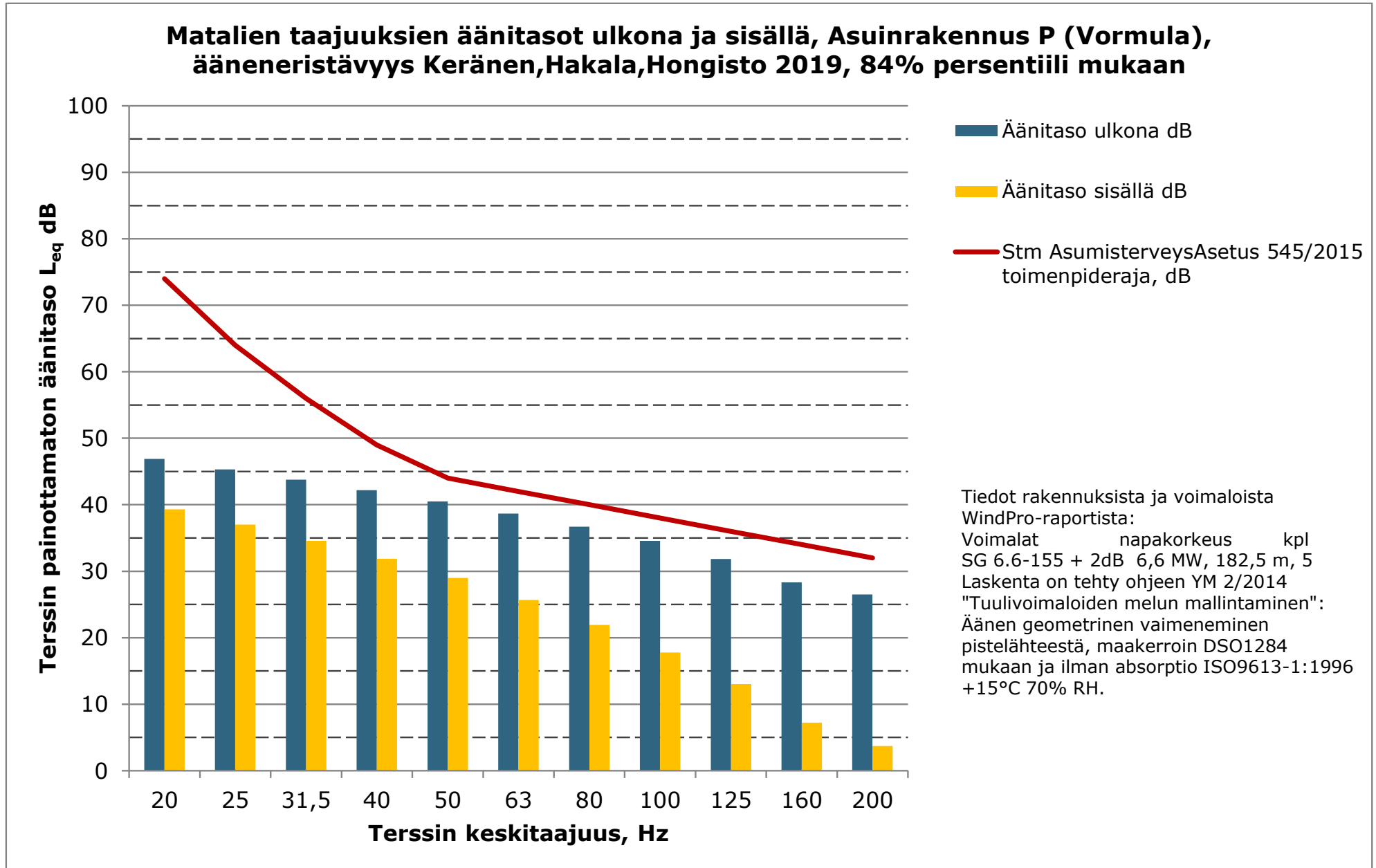


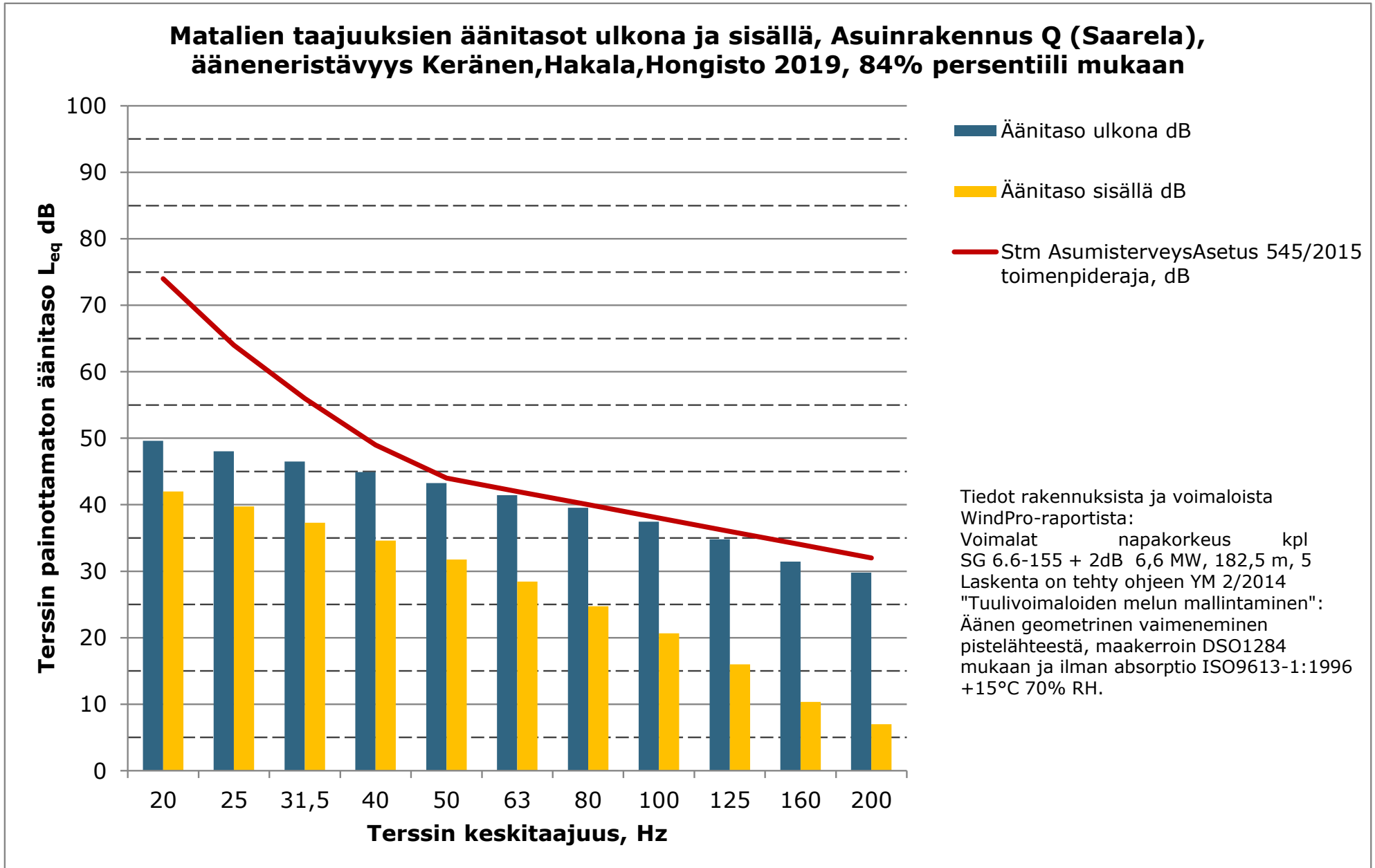


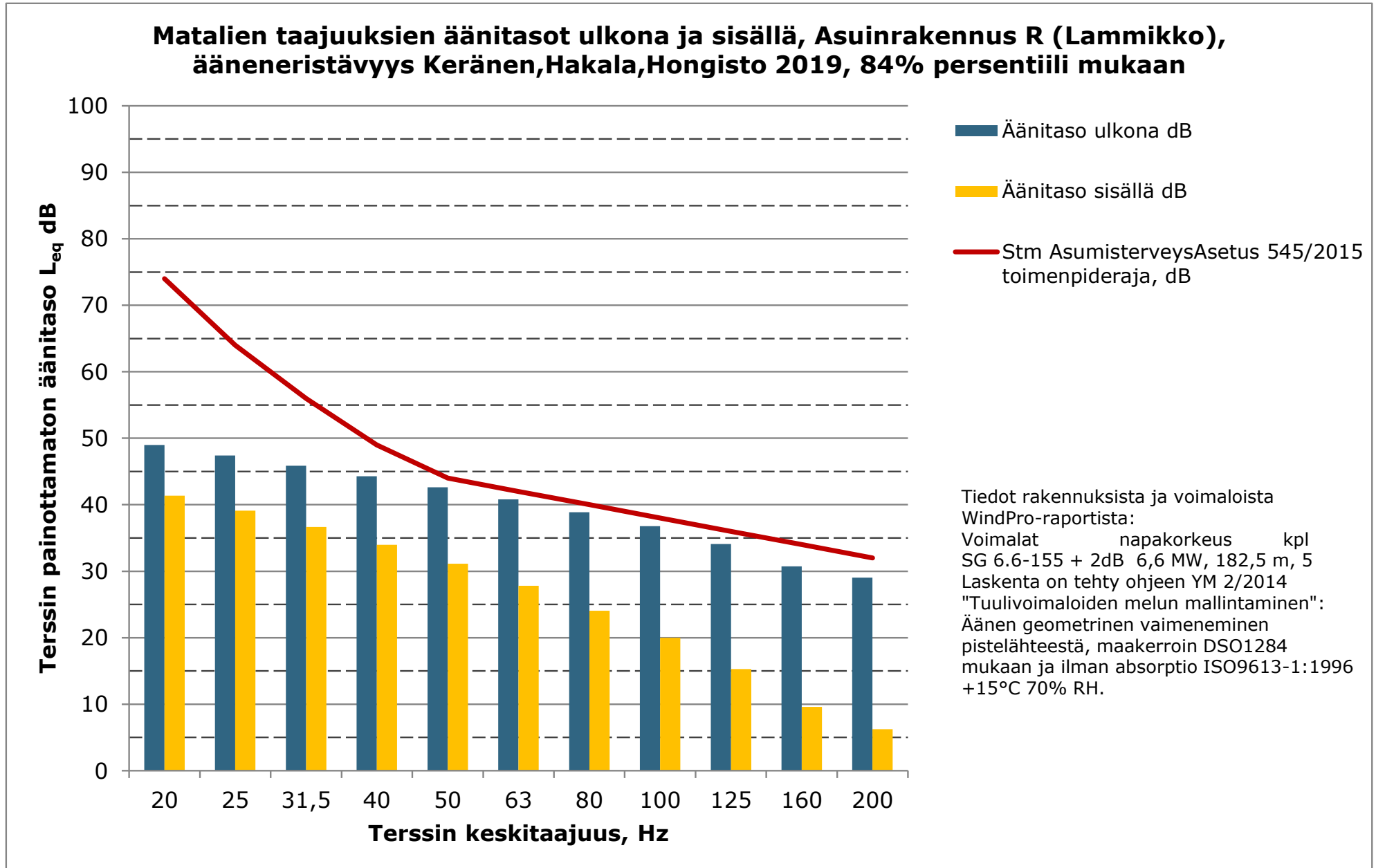


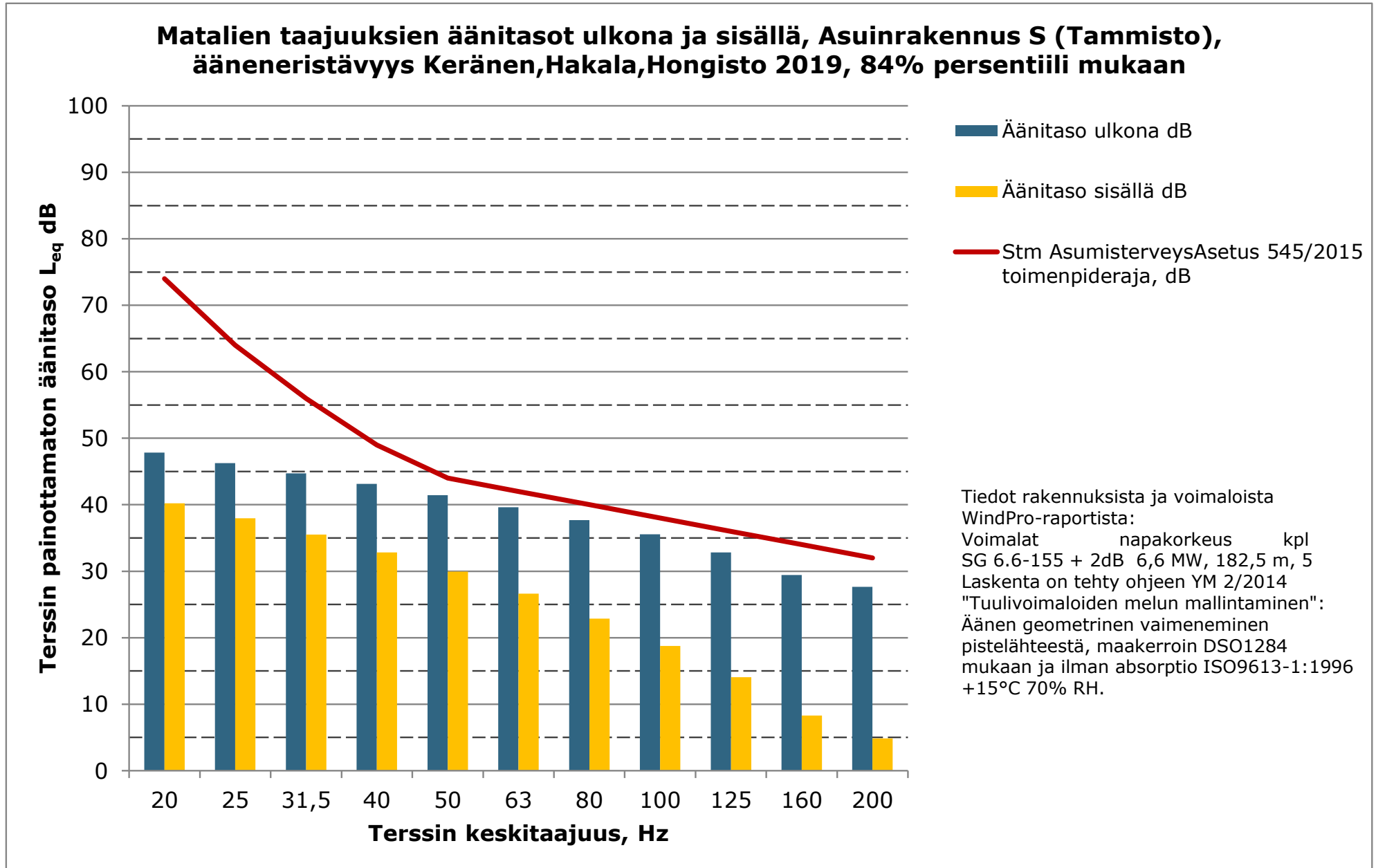


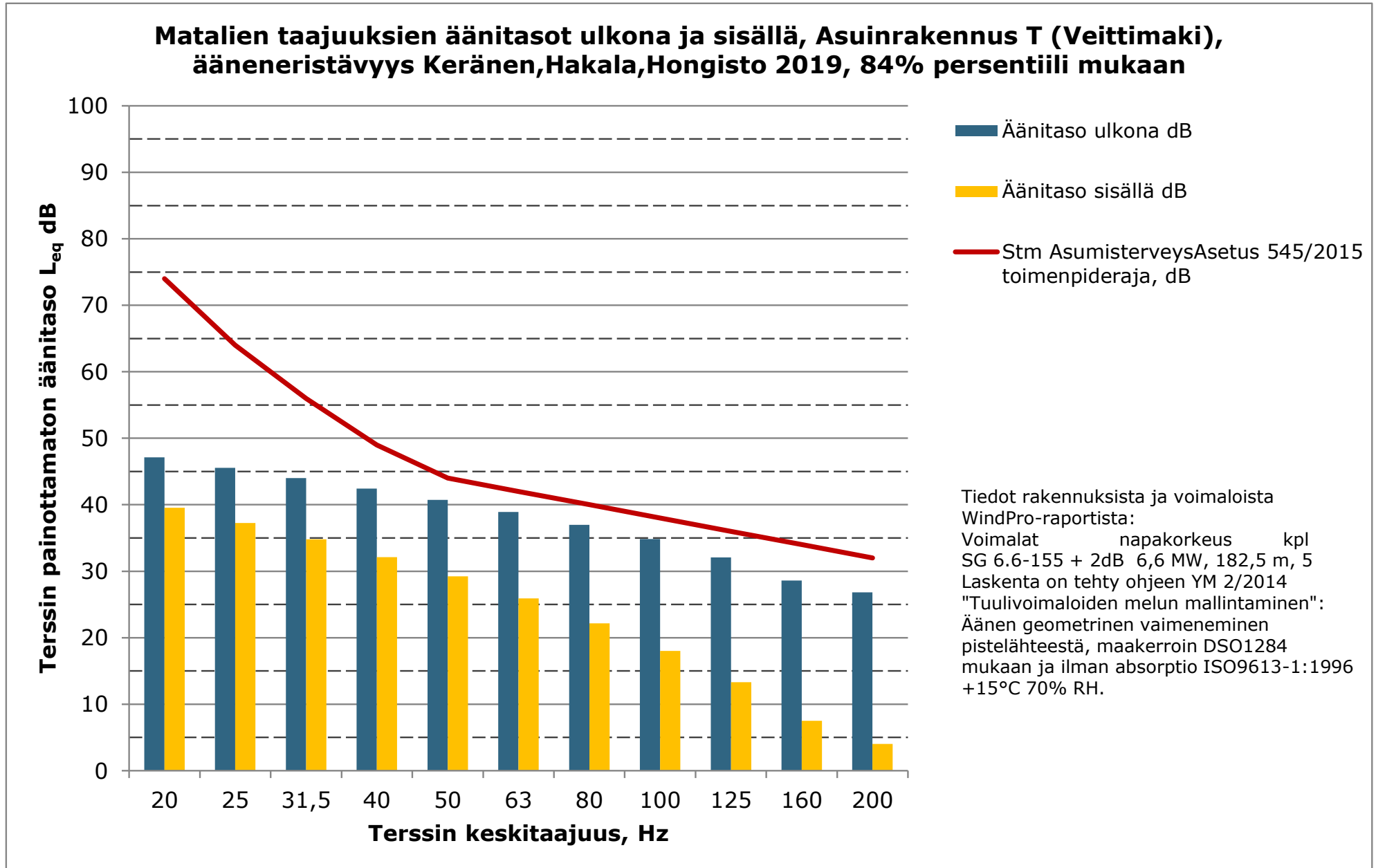


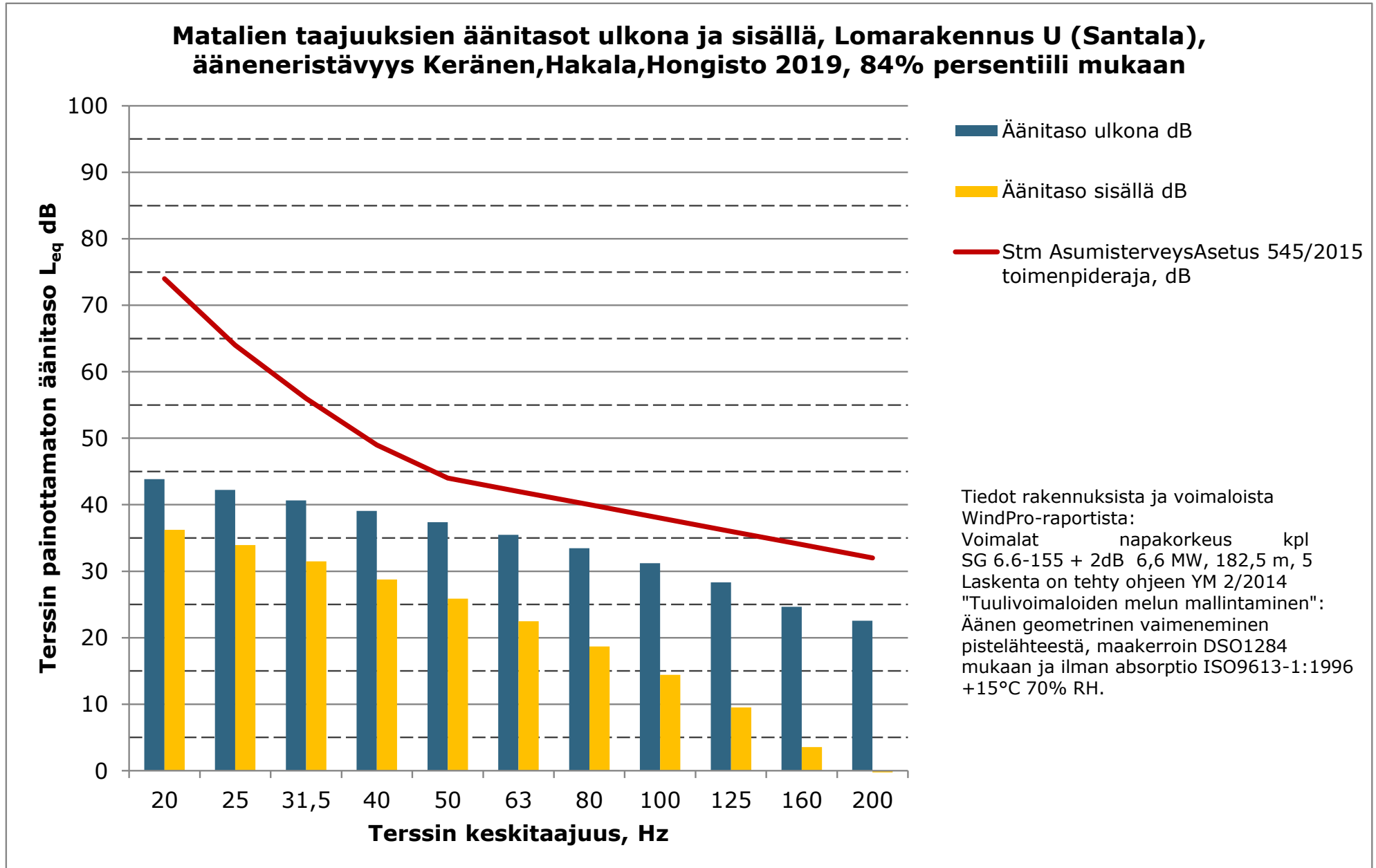


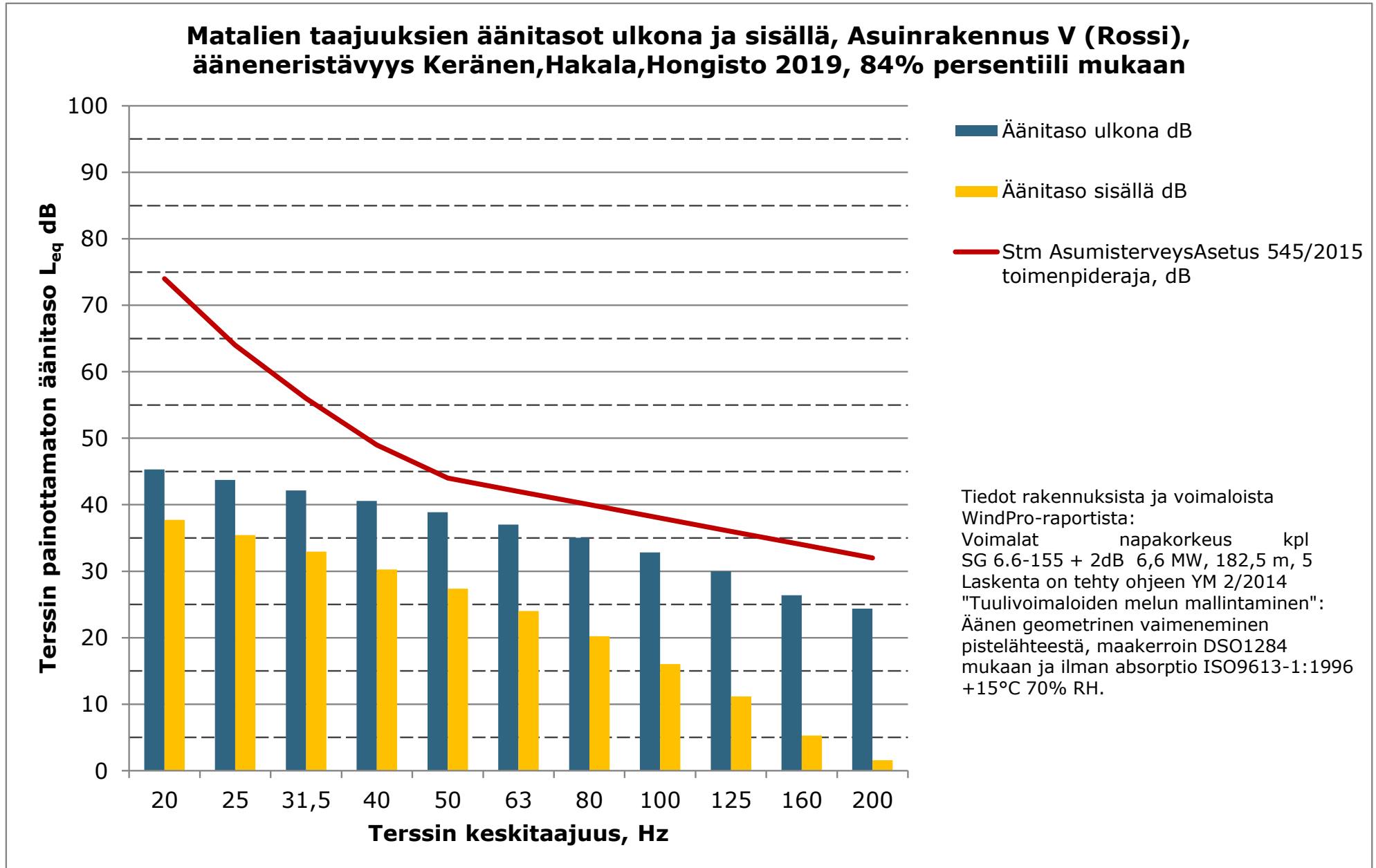




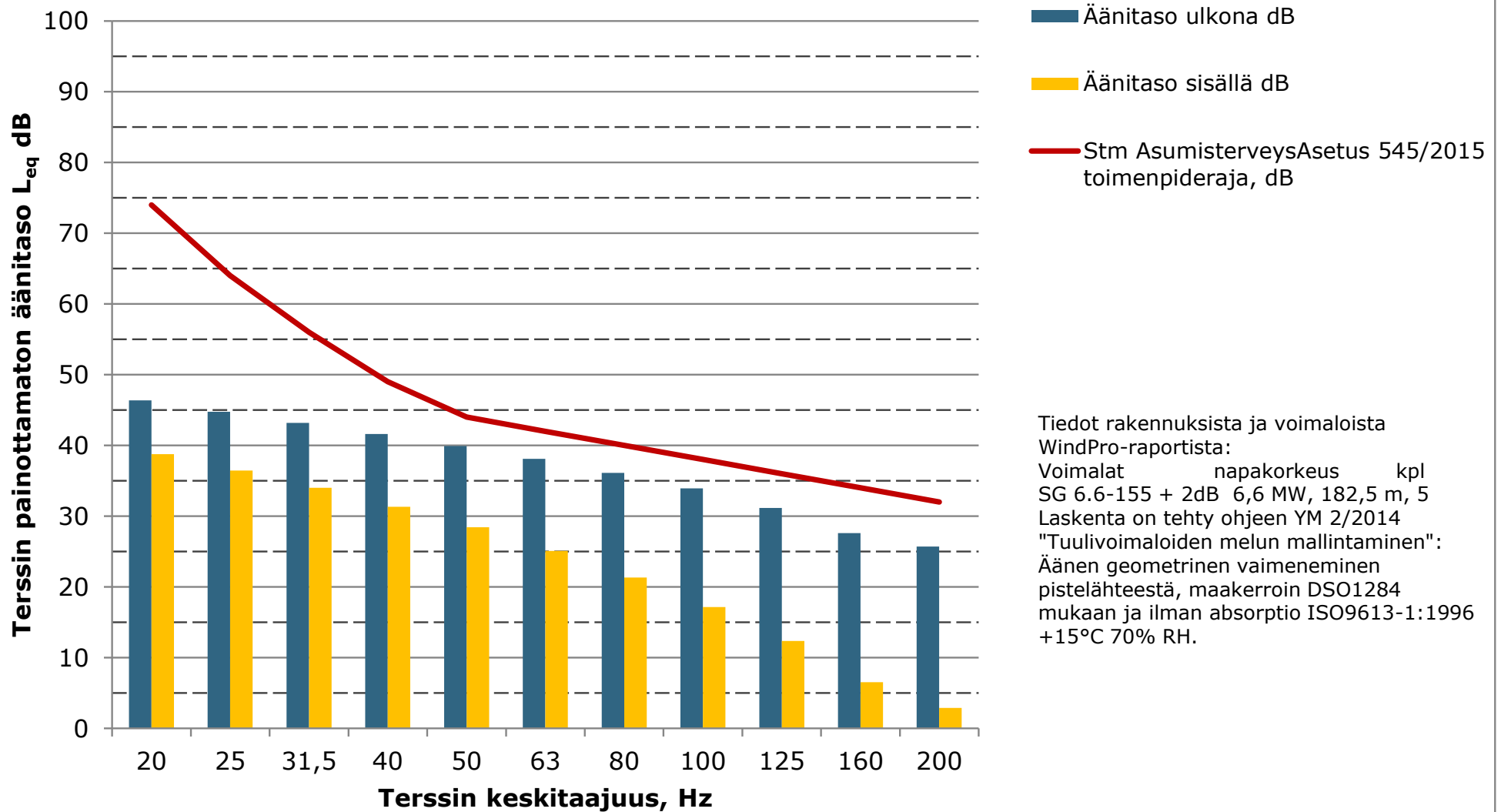


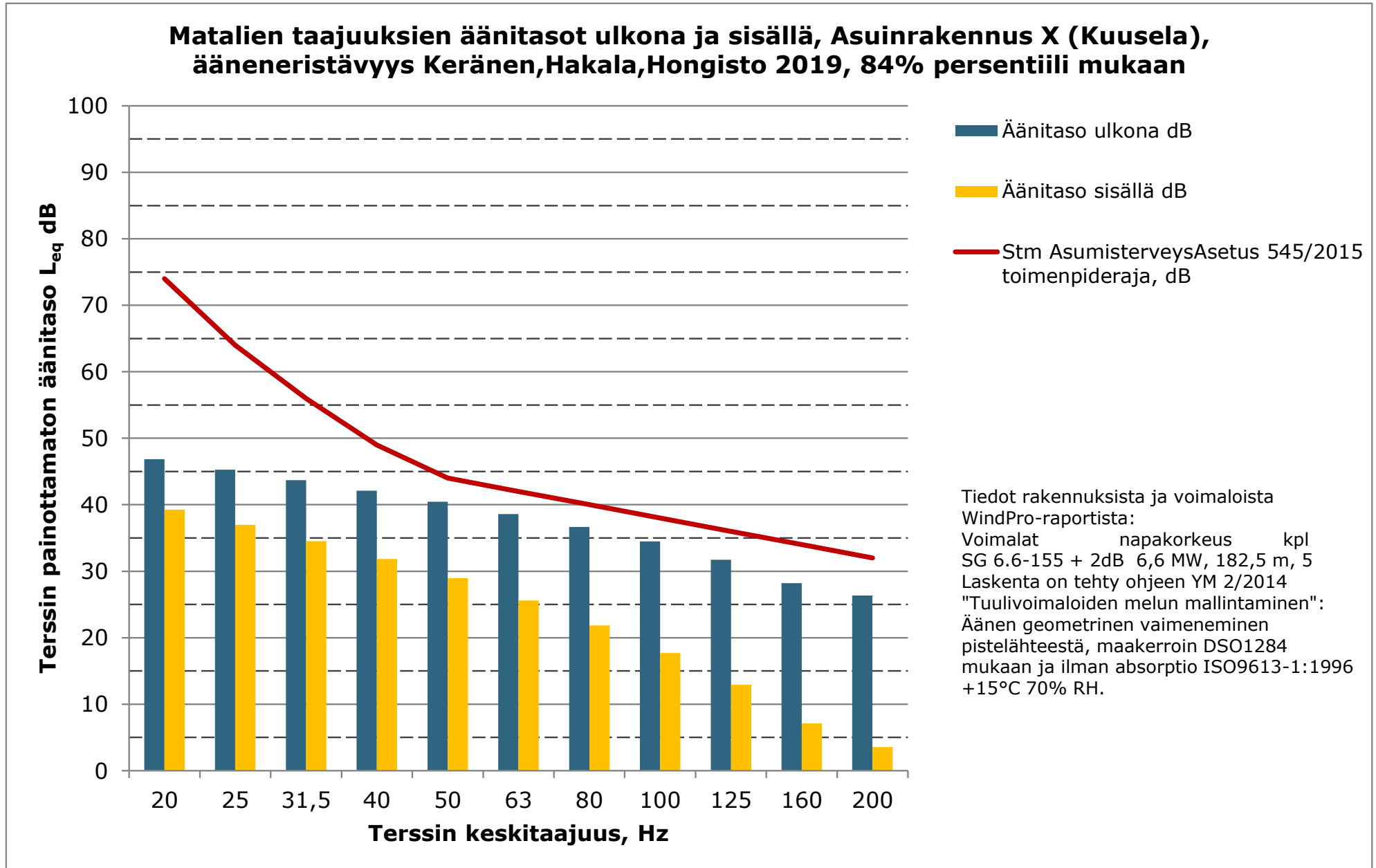




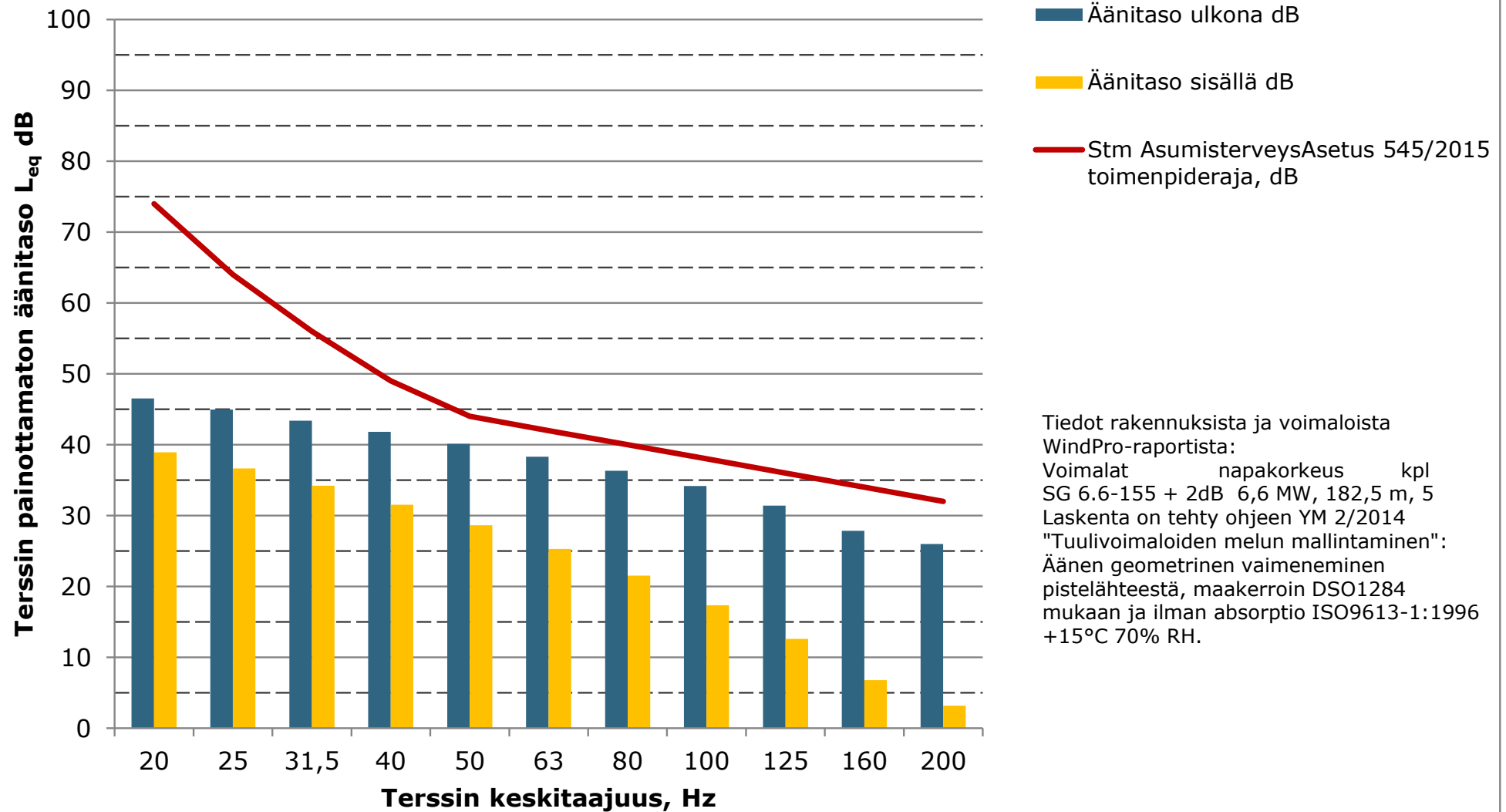


**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus W
(Makiniemi), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persentiili
mukaan**

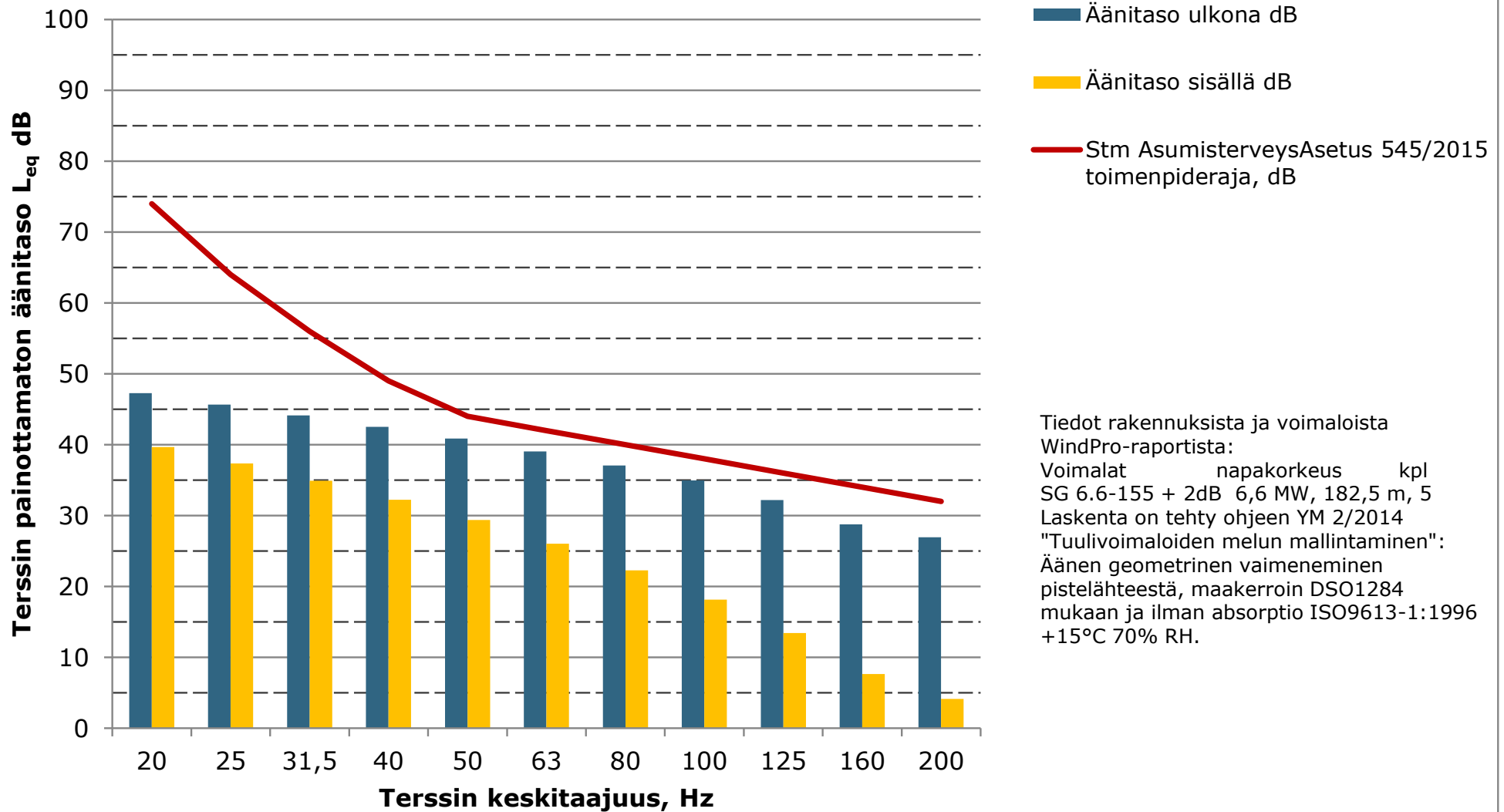


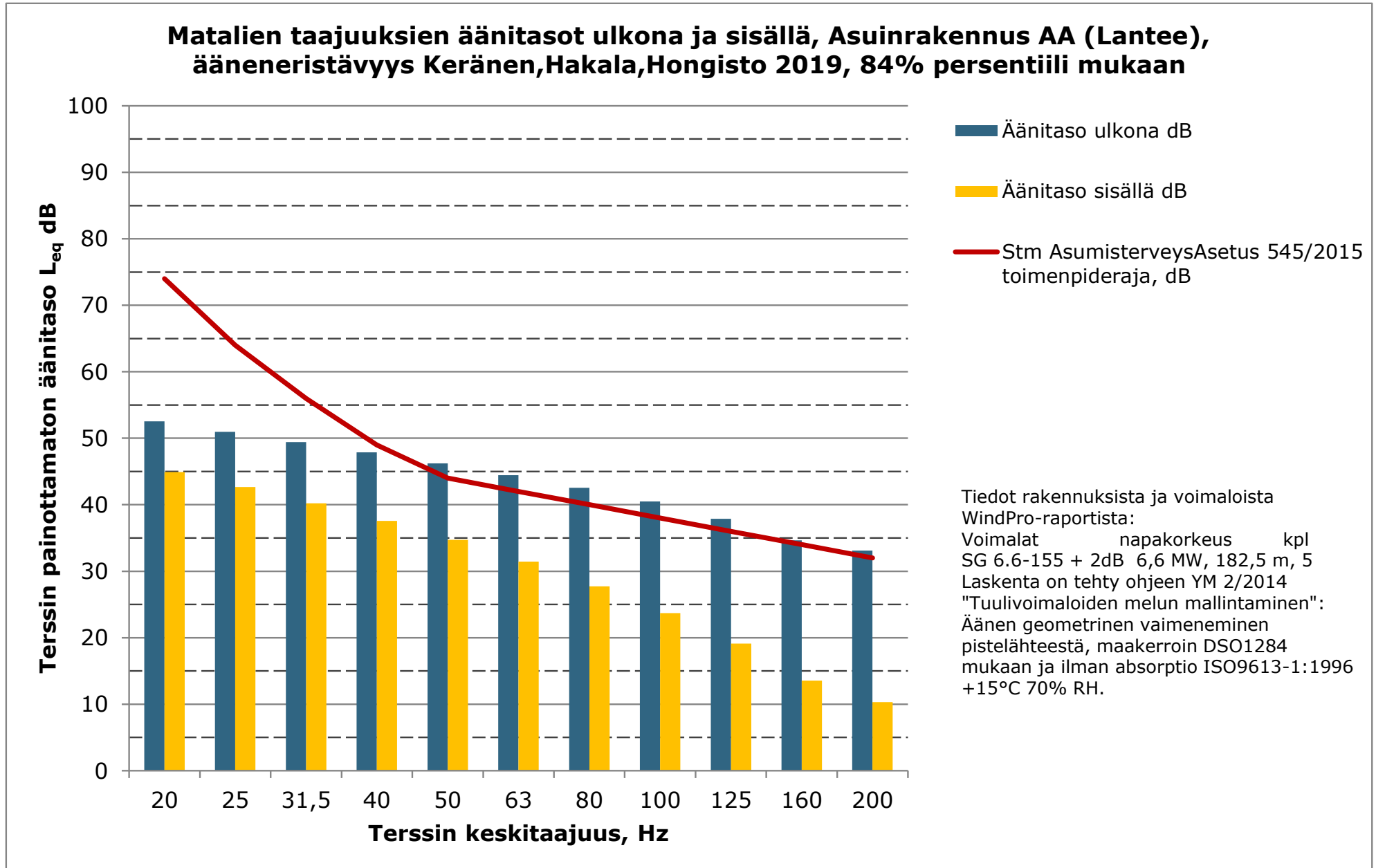


**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus Y
(Miekkajarventie), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84%
persentiili mukaan**

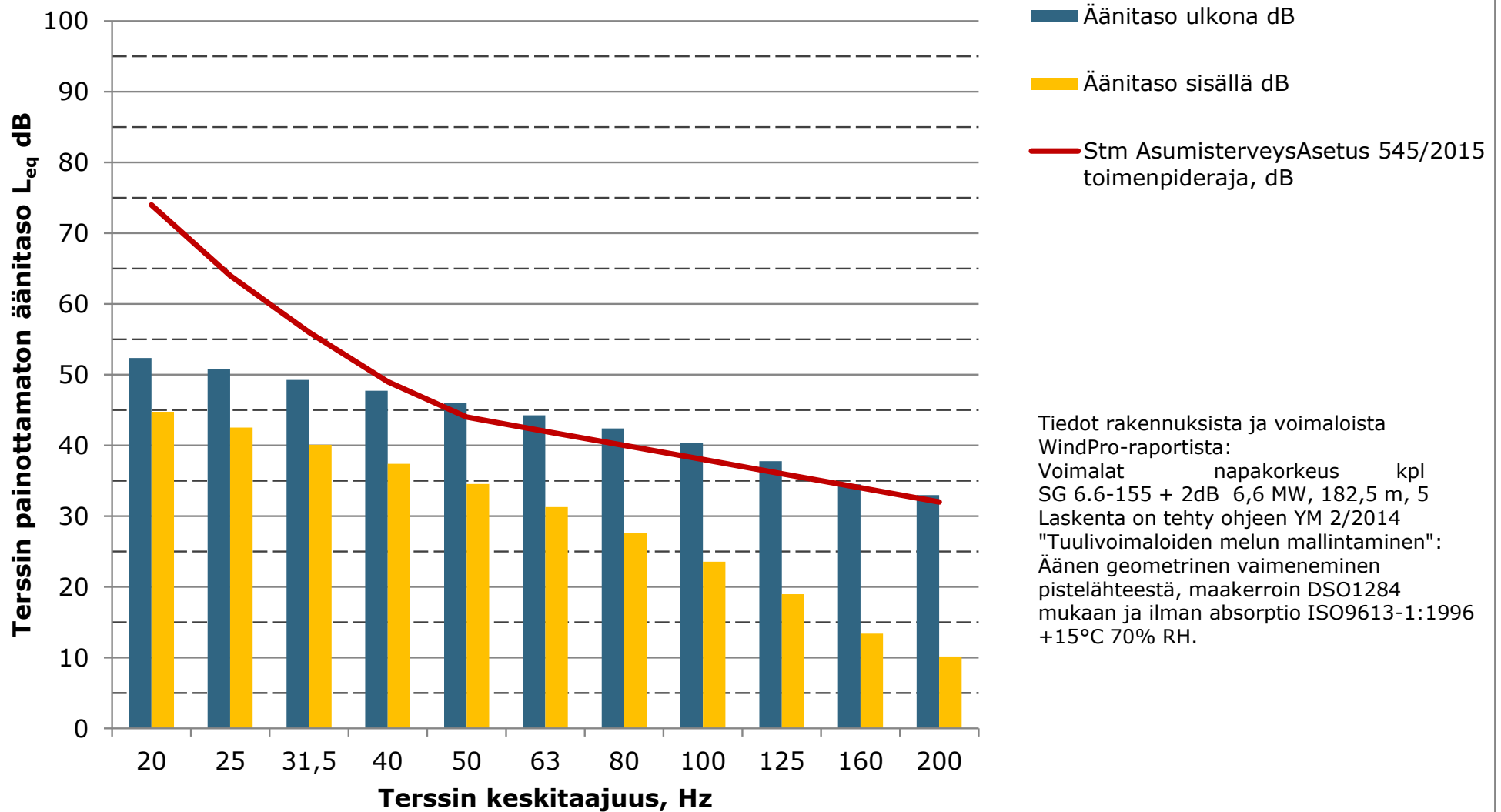


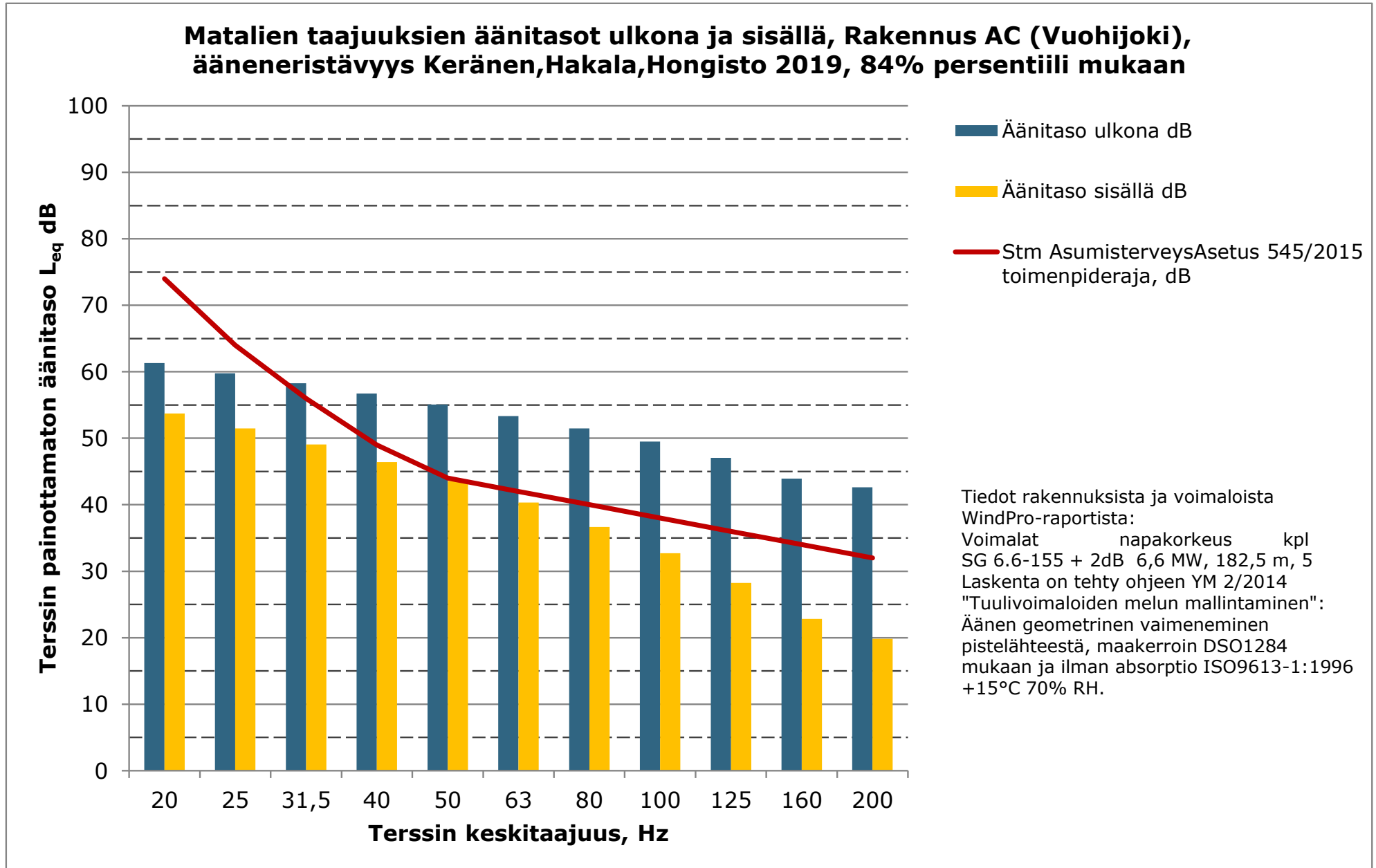
**Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus Z
(Lahdesmaki), ääneneristävyys Keränen, Hakala, Hongisto 2019, 84%
persentiili mukaan**





Matalien taajuuksien äänitasot ulkona ja sisällä, Asuinrakennus AB (Portaanpaa), ääneneristävyys Keränen,Hakala,Hongisto 2019, 84% persenttiili mukaan





Liite 5. Varjostusmallinnuksen tulokset "Real Case, No forest" - Hankevaihtoehto VE1

SHADOW - Main Result

Calculation: Karmekallio_RD155x7xHH182_NoForest
Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

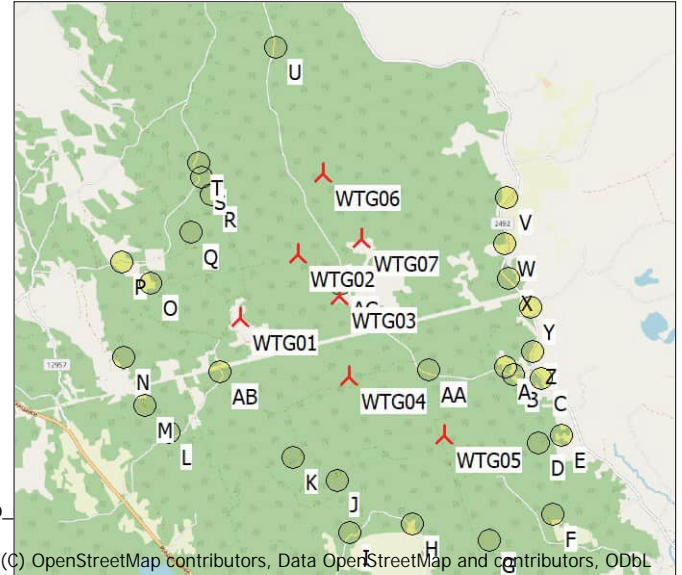
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [JOKIOINEN]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,16 2,61 3,94 5,80 8,65 8,98 8,14 6,70 4,15 2,67 1,18 0,89

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
717 652 423 350 431 669 978 1 225 840 592 472 499 7 848

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_P47816_Karmekallio
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z	Row data/Description	WTG type			Shadow data			
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]
WTG01	270 799	6 816 832	94,5	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4
WTG02	271 620	6 817 635	97,1	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4
WTG03	272 124	6 817 043	102,5	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4
WTG04	272 182	6 815 966	95,0	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4
WTG05	273 392	6 815 102	107,5	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4
WTG06	272 023	6 818 678	85,0	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4
WTG07	272 463	6 817 780	90,2	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Asuinrakennus A (Orisuo)	274 265	6 815 959	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B (Kallio)	274 364	6 815 858	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Asuinrakennus C (Lannemaa)	274 730	6 815 777	80,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Lomarakennus D (Koluojja)	274 635	6 814 919	86,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Asuinrakennus E (Maunula)	274 952	6 815 004	81,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Kalliorinne)	274 763	6 813 962	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Pajuojja)	273 897	6 813 673	100,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Vuorenoja)	272 896	6 813 954	89,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I (Hirvisuontie)	272 059	6 813 889	85,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Asuinrakennus J (Riihimäki)	271 933	6 814 607	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Asuinrakennus K (Toivola)	271 384	6 814 949	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Palomäki)	269 752	6 815 392	75,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Helisevä)	269 461	6 815 767	77,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
N	Asuinrakennus N (Kulmala)	269 214	6 816 426	81,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
O	Asuinrakennus O (Lammi)	269 648	6 817 378	77,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
P	Asuinrakennus P (Vormula)	269 285	6 817 676	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Q	Asuinrakennus Q (Saarela)	270 219	6 818 023	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
R	Asuinrakennus R (Lammikko)	270 518	6 818 492	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
S	Asuinrakennus S (Tammisto)	270 408	6 818 733	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
T	Asuinrakennus T (Veittimäki)	270 386	6 818 928	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
U	Lomarakennus U (Santala)	271 508	6 820 385	87,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
V	Asuinrakennus V (Rossi)	274 436	6 818 205	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
W	Asuinrakennus W (Makiniemi)	274 364	6 817 588	86,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

SHADOW - Main Result

Calculation: Kärmeekallio_RD155x7xHH182_NoForest

...continued from previous page

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
X	Asuinrakennus X (Kuusela)	274 388	6 817 127	88,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Y	Asuinrakennus Y (Miekkajarventie)	274 658	6 816 731	81,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Z	Asuinrakennus Z (Lahdesmaki)	274 649	6 816 143	78,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AA	Rakennus AA (Lantee)	273 246	6 815 997	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AB	Rakennus AB (Portaanpaa)	270 488	6 816 146	89,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AC	Rakennus AC (Vuohijoki)	272 155	6 817 191	95,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Asuinrakennus A (Orisuo)	2:44
B	Asuinrakennus B (Kallio)	2:34
C	Asuinrakennus C (Lannemaa)	1:41
D	Lomarakennus D (Koluojja)	3:10
E	Asuinrakennus E (Maunula)	1:45
F	Asuinrakennus F (Kalliorinne)	5:38
G	Asuinrakennus G (Pajuojja)	0:00
H	Asuinrakennus H (Vuorenoja)	0:00
I	Lomarakennus I (Hirvisuontie)	0:00
J	Asuinrakennus J (Riihimaki)	3:27
K	Asuinrakennus K (Toivola)	0:00
L	Asuinrakennus L (Palomaki)	0:00
M	Asuinrakennus M (Heliseva)	2:45
N	Asuinrakennus N (Kulmala)	2:27
O	Asuinrakennus O (Lammi)	2:11
P	Asuinrakennus P (Vormula)	1:11
Q	Asuinrakennus Q (Saarela)	4:03
R	Asuinrakennus R (Lammikko)	6:43
S	Asuinrakennus S (Tammisto)	3:05
T	Asuinrakennus T (Veittimaki)	2:39
U	Lomarakennus U (Santala)	2:03
V	Asuinrakennus V (Rossi)	0:00
W	Asuinrakennus W (Makinieniemi)	0:00
X	Asuinrakennus X (Kuusela)	0:00
Y	Asuinrakennus Y (Miekkajarventie)	0:00
Z	Asuinrakennus Z (Lahdesmaki)	1:30
AA	Rakennus AA (Lantee)	13:46
AB	Rakennus AB (Portaanpaa)	5:05
AC	Rakennus AC (Vuohijoki)	105:25

Total amount of flickering on the shadow receptors caused by each WTG

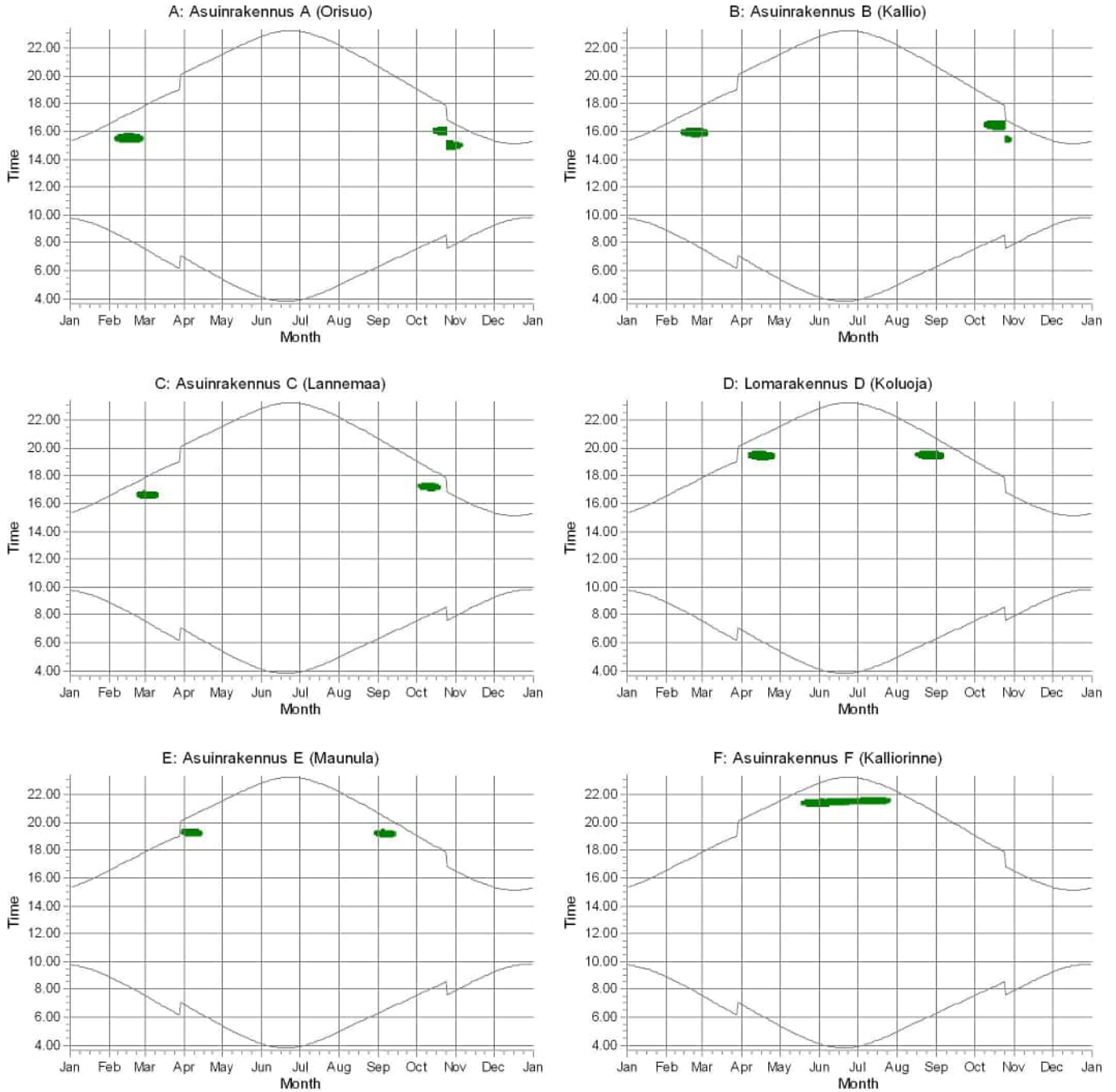
No.	Name	Expected [h/year]
WTG01	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (3)	14:46
WTG02	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)	6:58
WTG03	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (4)	107:19
WTG04	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (2)	8:54
WTG05	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (1)	25:53
WTG06	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (7)	7:25
WTG07	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (6)	0:00

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x7xHH182_NoForest

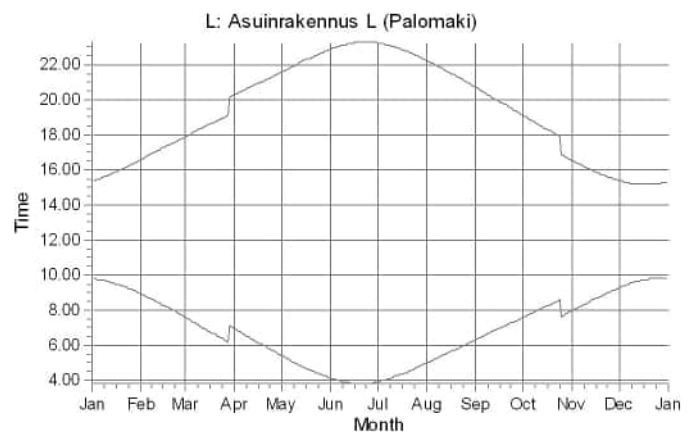
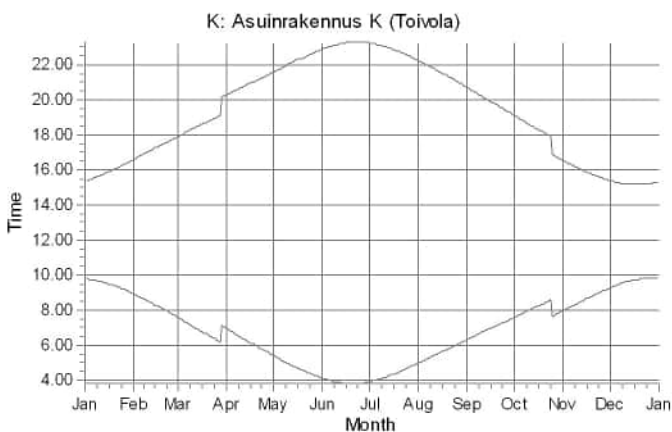
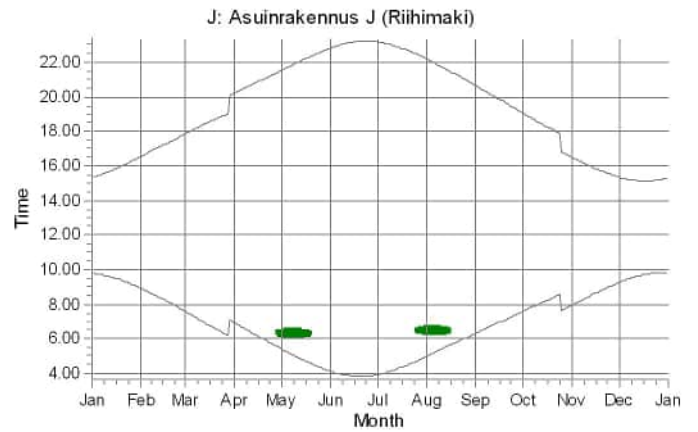
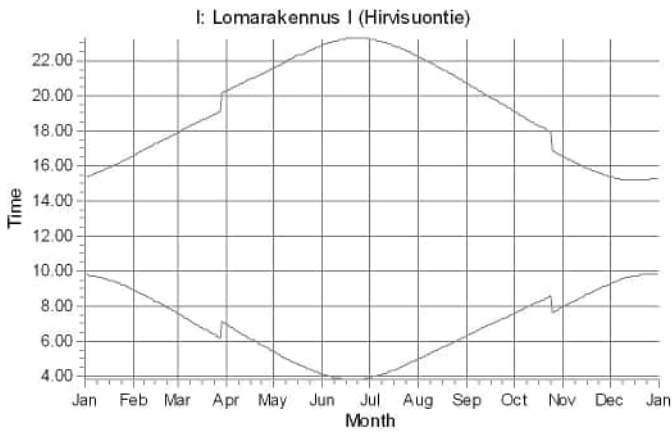
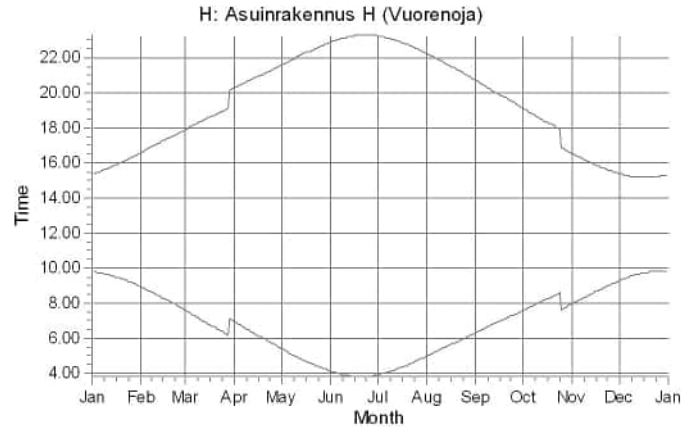
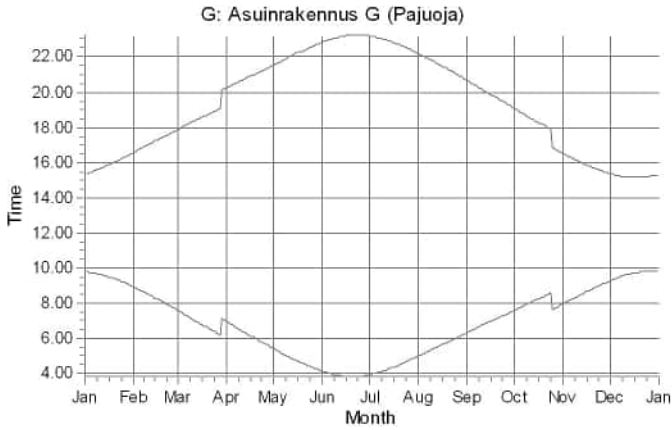


WTGs

WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (1)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x7xHH182_NoForest

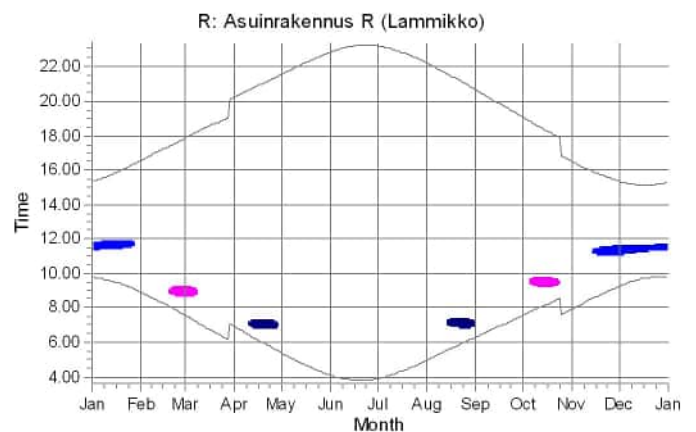
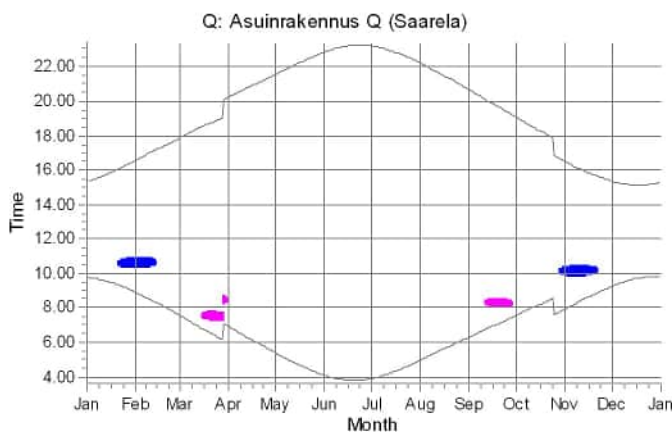
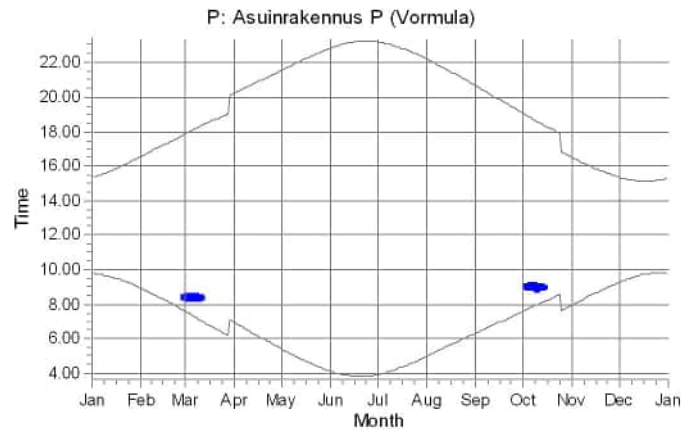
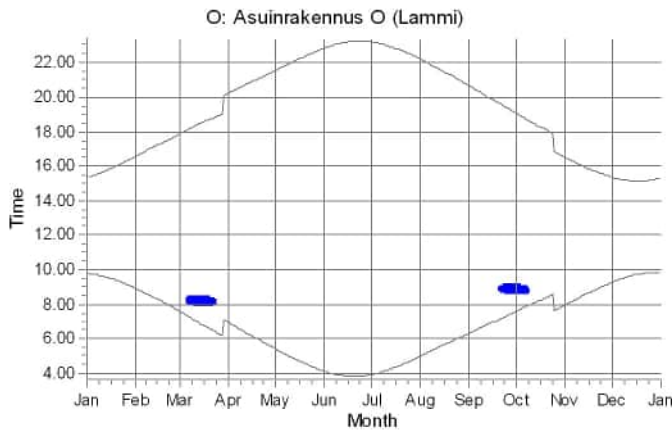
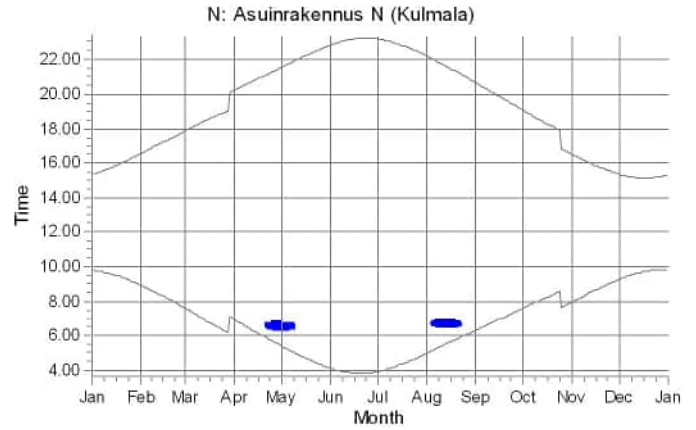
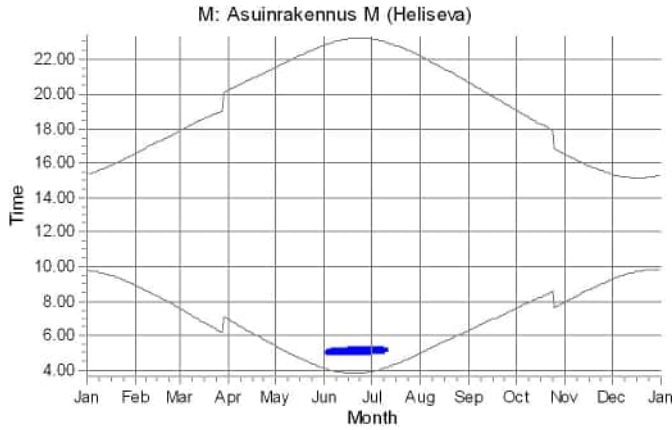


WTGs

WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (1)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x7xHH182_NoForest

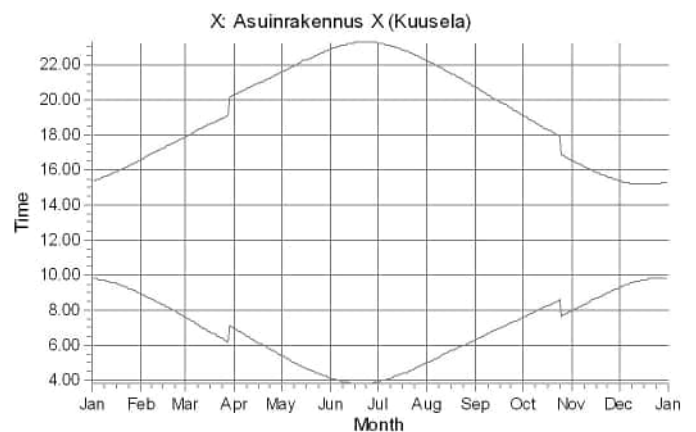
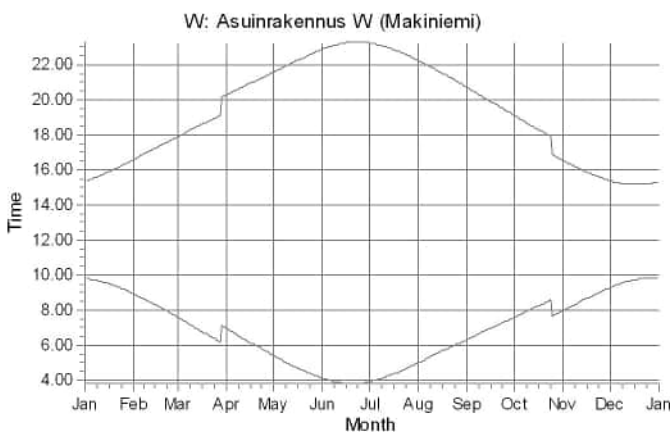
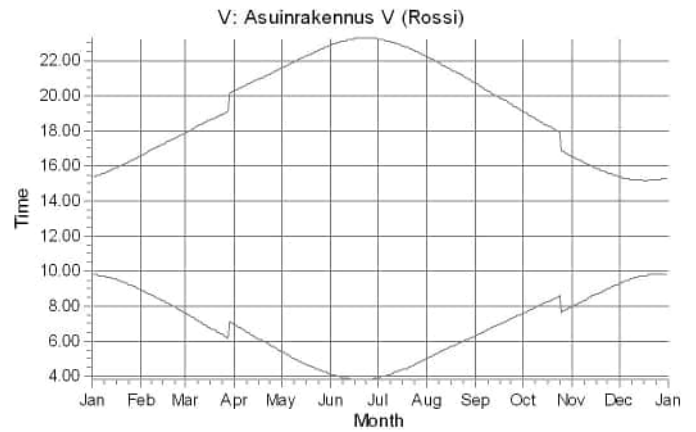
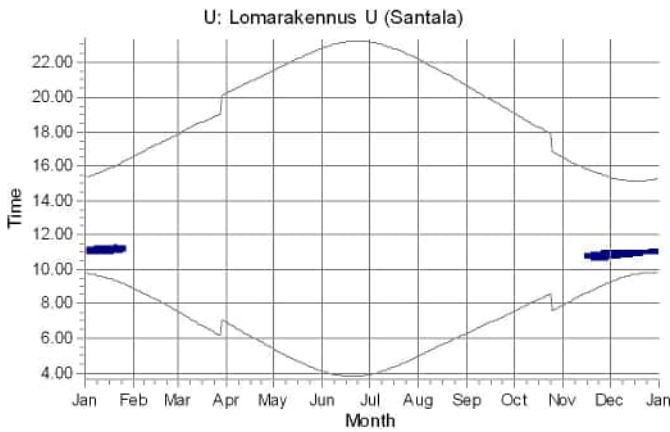
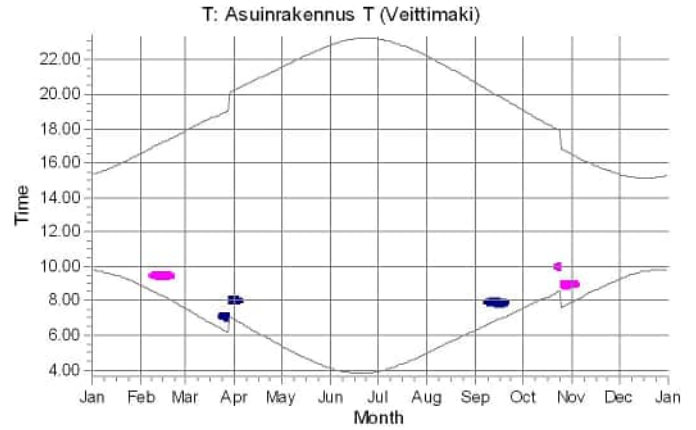
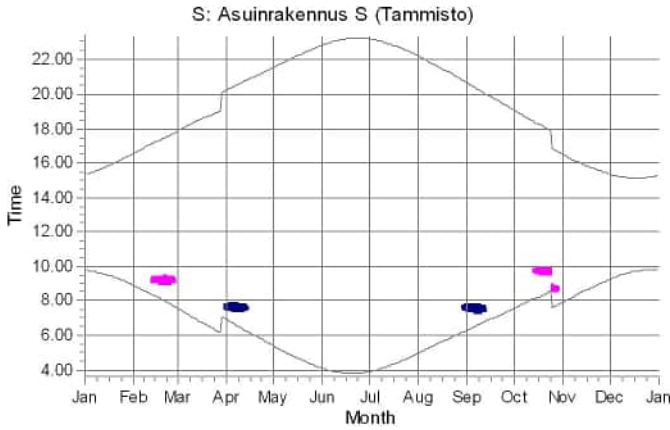


WTGs

- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (3)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)
- WTG06: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (7)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x7xHH182_NoForest

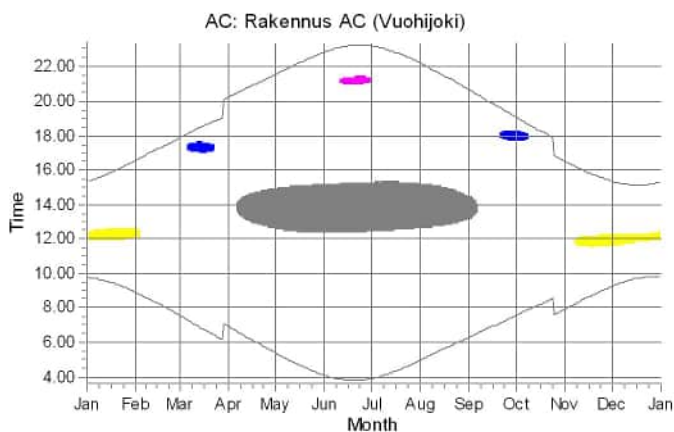
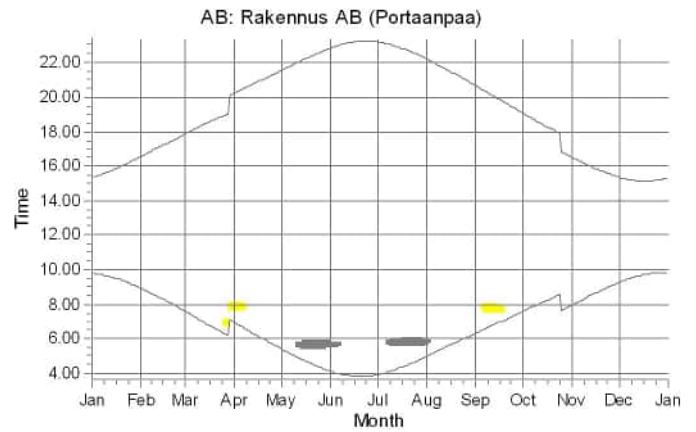
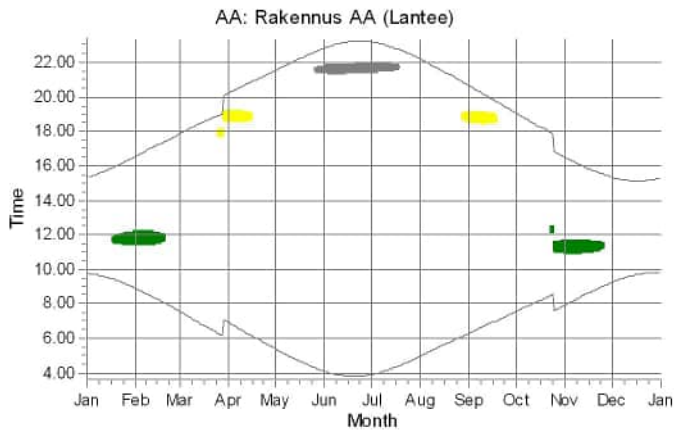
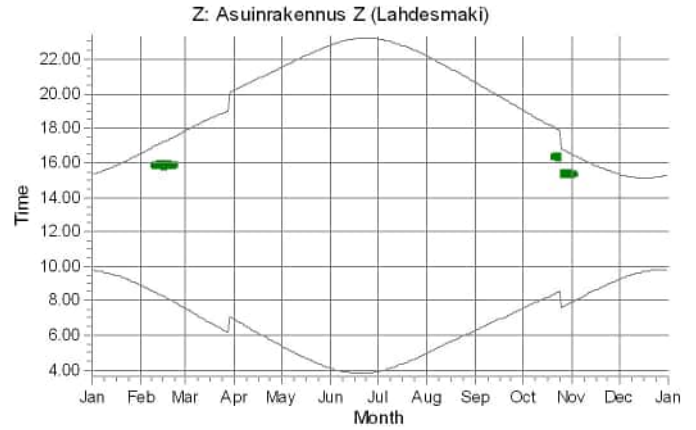
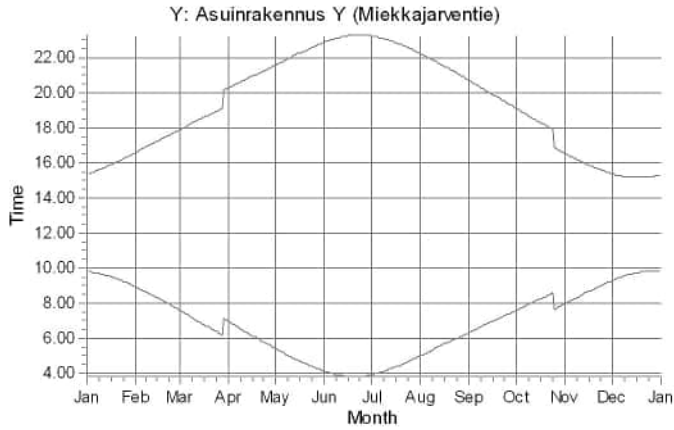


WTGs

- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)
- WTG06: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (7)

SHADOW - Calendar, graphical

Calculation: Kärmeekallio_RD155x7xHH182_NoForest

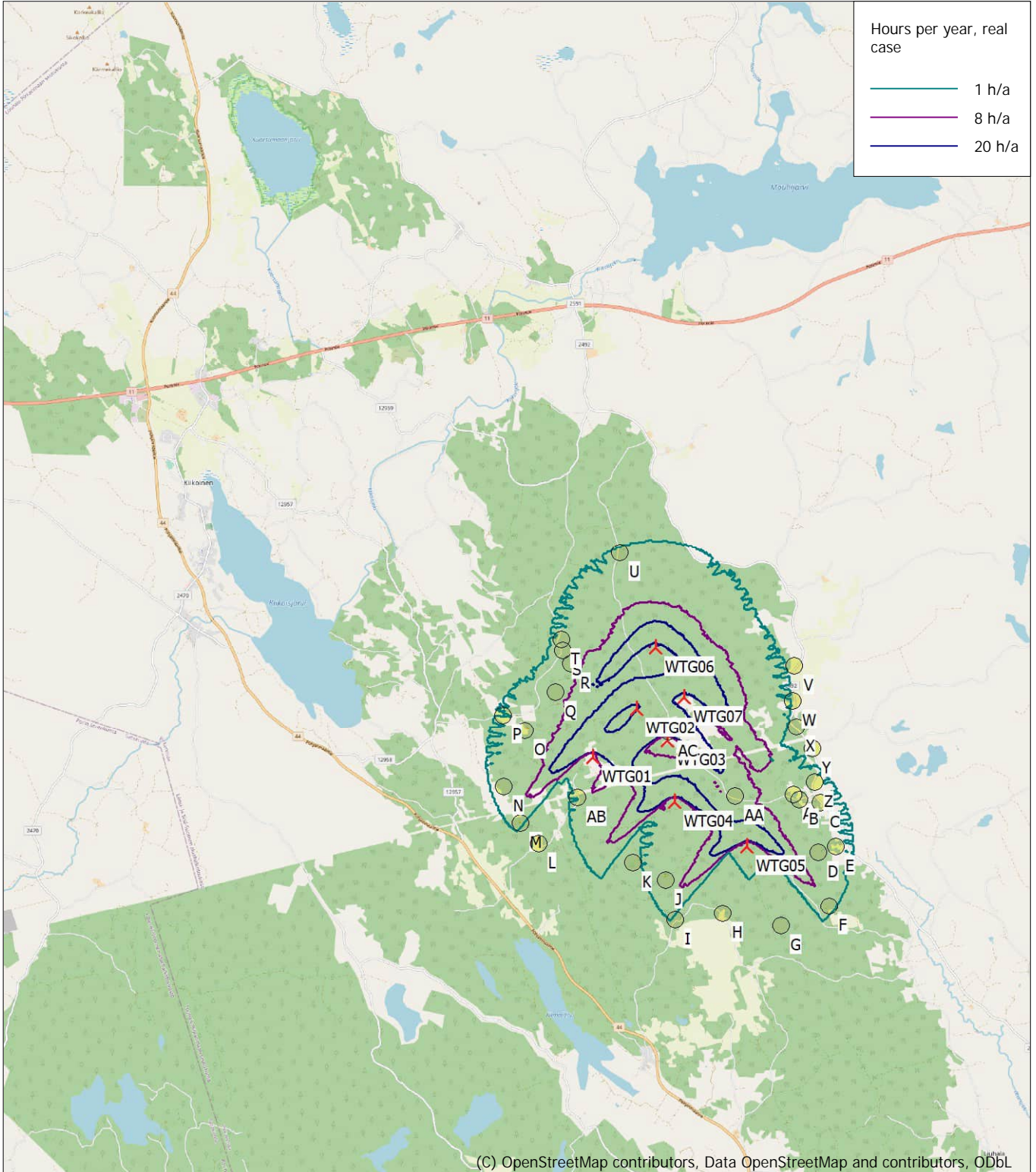


WTGs

- WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (1)
- WTG04: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (2)
- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (3)
- WTG03: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (4)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)

SHADOW - Map

Calculation: Karmekallio_RD155x7xHH182_NoForest



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 269 370 North: 6 819 720
New WTG Shadow receptor
Flicker map level: Height Contours: CONTOURLINE_P47816_Karmekallio_0.wpo (1)
Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 6. Varjostusmallinnuksen tulokset "Real Case, Luke forest" - Hankevaihtoehto VE1

SHADOW - Main Result

Calculation: Karmekallio_RD155x7xHH182_Luke_Forest
Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

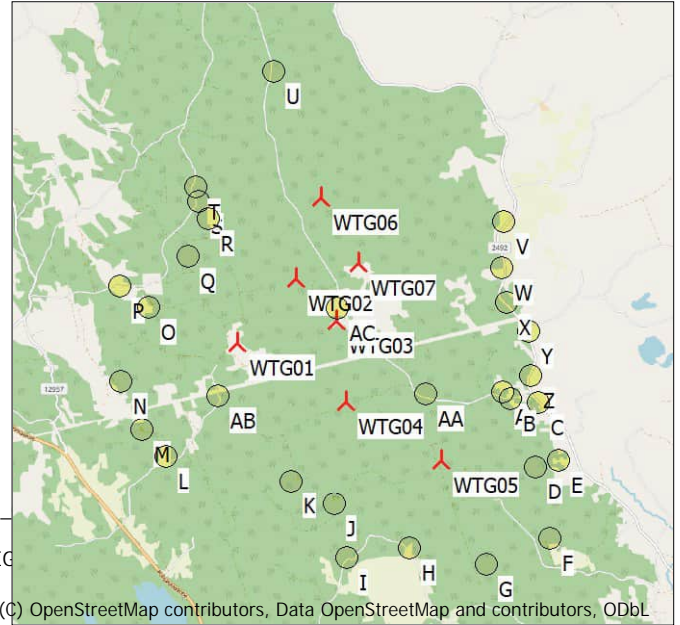
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [JOKIOINEN]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,16 2,61 3,94 5,80 8,65 8,98 8,14 6,70 4,15 2,67 1,18 0,89

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
717 652 423 350 431 669 978 1 225 840 592 472 499 7 848

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_P47816_Karmekallio...
Area object(s) used in calculation:
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC...
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
WTG01	270 799	6 816 832	94,5	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG02	271 620	6 817 635	97,1	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG03	272 124	6 817 043	102,5	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG04	272 182	6 815 966	95,0	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG05	273 392	6 815 102	107,5	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG06	272 023	6 818 678	85,0	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG07	272 463	6 817 780	90,2	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Asuinrakennus A (Orisuo)	274 265	6 815 959	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B (Kallio)	274 364	6 815 858	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Asuinrakennus C (Lannemaa)	274 730	6 815 777	80,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Lomarakennus D (Koluoja)	274 635	6 814 919	86,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Asuinrakennus E (Maunula)	274 952	6 815 004	81,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Kalliorinne)	274 763	6 813 962	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Pajuoja)	273 897	6 813 673	100,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Vuorenoja)	272 896	6 813 954	89,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I (Hirvisuontie)	272 059	6 813 889	85,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Asuinrakennus J (Riihimäki)	271 933	6 814 607	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Asuinrakennus K (Toivola)	271 384	6 814 949	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Palomäki)	269 752	6 815 392	75,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Heliseva)	269 461	6 815 767	77,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
N	Asuinrakennus N (Kulmala)	269 214	6 816 426	81,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
O	Asuinrakennus O (Lammi)	269 648	6 817 378	77,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
P	Asuinrakennus P (Vormula)	269 285	6 817 676	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Q	Asuinrakennus Q (Saarela)	270 219	6 818 023	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
R	Asuinrakennus R (Lammikko)	270 518	6 818 492	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
S	Asuinrakennus S (Tammisto)	270 408	6 818 733	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
T	Asuinrakennus T (Veittimäki)	270 386	6 818 928	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
U	Lomarakennus U (Santala)	271 508	6 820 385	87,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

SHADOW - Main Result

Calculation: Karmekallio_RD155x7xHH182_Luke_Forest

...continued from previous page

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
V	Asuinrakennus V (Rossi)	274 436	6 818 205	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
W	Asuinrakennus W (Makiniemi)	274 364	6 817 588	86,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
X	Asuinrakennus X (Kuusela)	274 388	6 817 127	88,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Y	Asuinrakennus Y (Miekkajarventie)	274 658	6 816 731	81,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Z	Asuinrakennus Z (Lahdesmaki)	274 649	6 816 143	78,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AA	Rakennus AA (Lantee)	273 246	6 815 997	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AB	Rakennus AB (Portaanpaa)	270 488	6 816 146	89,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AC	Rakennus AC (Vuohijoki)	272 155	6 817 191	95,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Asuinrakennus A (Orisuo)	2:44
B	Asuinrakennus B (Kallio)	2:34
C	Asuinrakennus C (Lannemaa)	1:41
D	Lomarakennus D (Koluojja)	0:00
E	Asuinrakennus E (Maunula)	1:45
F	Asuinrakennus F (Kalliorinne)	0:00
G	Asuinrakennus G (Pajuojja)	0:00
H	Asuinrakennus H (Vuorenoja)	0:00
I	Lomarakennus I (Hirvisuontie)	0:00
J	Asuinrakennus J (Riihimaki)	0:00
K	Asuinrakennus K (Toivola)	0:00
L	Asuinrakennus L (Palomaki)	0:00
M	Asuinrakennus M (Heliseva)	2:45
N	Asuinrakennus N (Kulmala)	0:00
O	Asuinrakennus O (Lammi)	2:11
P	Asuinrakennus P (Vormula)	1:11
Q	Asuinrakennus Q (Saarela)	4:03
R	Asuinrakennus R (Lammikko)	2:20
S	Asuinrakennus S (Tammisto)	0:00
T	Asuinrakennus T (Veittimaki)	1:13
U	Lomarakennus U (Santala)	0:00
V	Asuinrakennus V (Rossi)	0:00
W	Asuinrakennus W (Makiniemi)	0:00
X	Asuinrakennus X (Kuusela)	0:00
Y	Asuinrakennus Y (Miekkajarventie)	0:00
Z	Asuinrakennus Z (Lahdesmaki)	0:00
AA	Rakennus AA (Lantee)	8:30
AB	Rakennus AB (Portaanpaa)	5:05
AC	Rakennus AC (Vuohijoki)	101:32

Total amount of flickering on the shadow receptors caused by each WTG

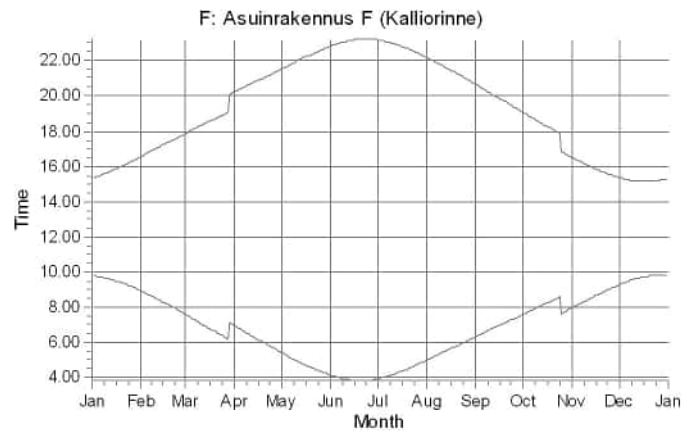
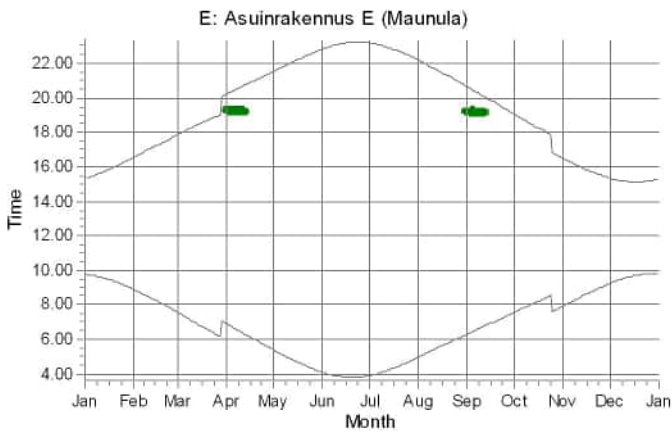
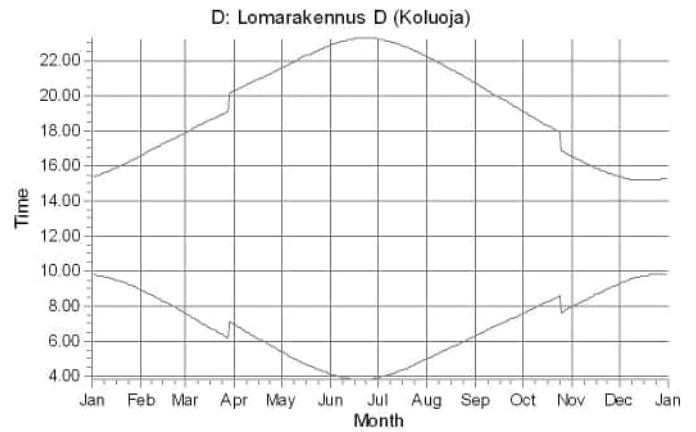
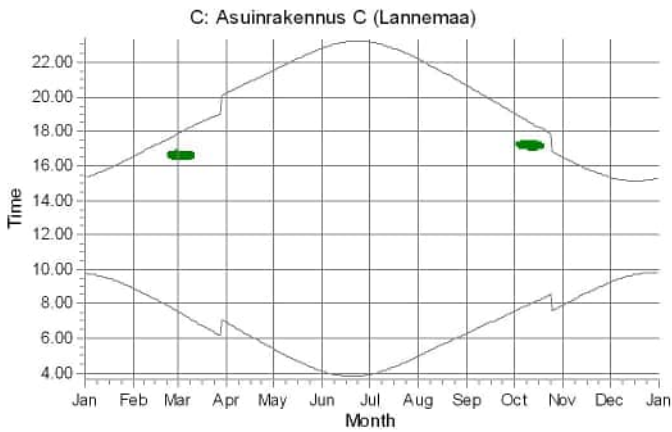
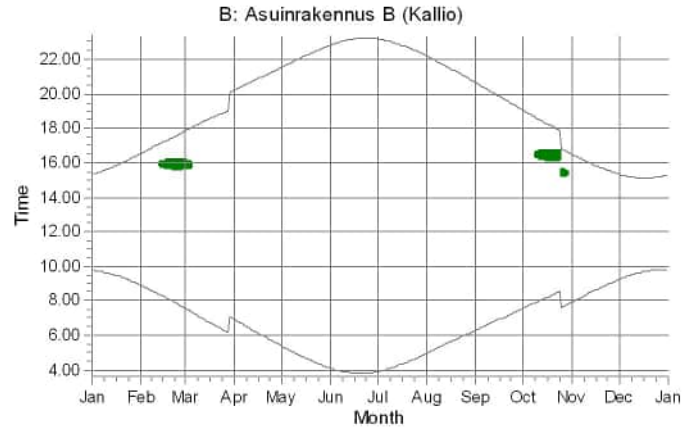
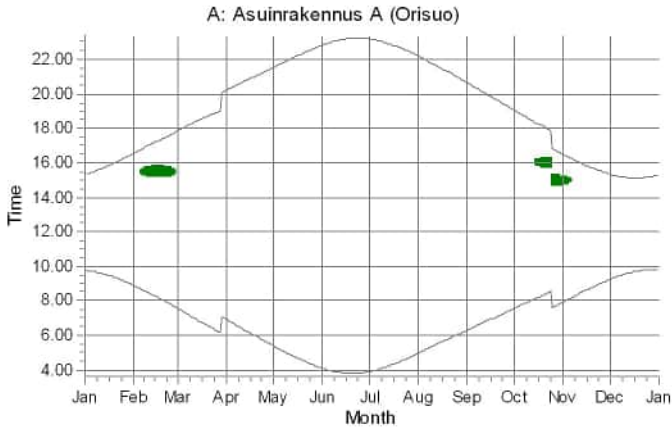
No.	Name	Expected [h/year]
WTG01	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (3)	12:19
WTG02	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)	4:05
WTG03	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (4)	107:19
WTG04	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (2)	5:01
WTG05	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (1)	8:38
WTG06	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (7)	0:00
WTG07	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (6)	0:00

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x7xHH182_Luke_Forest

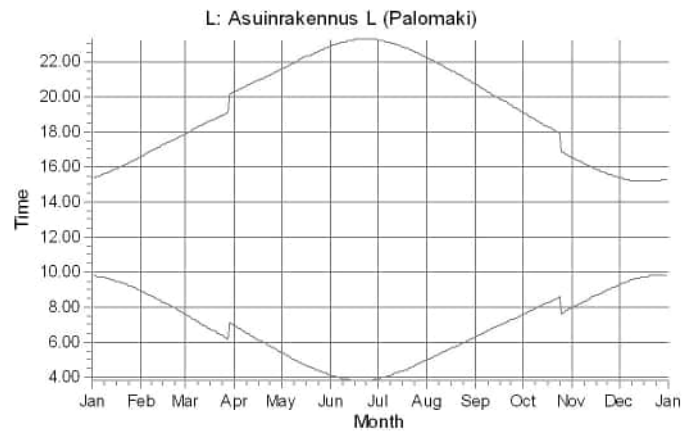
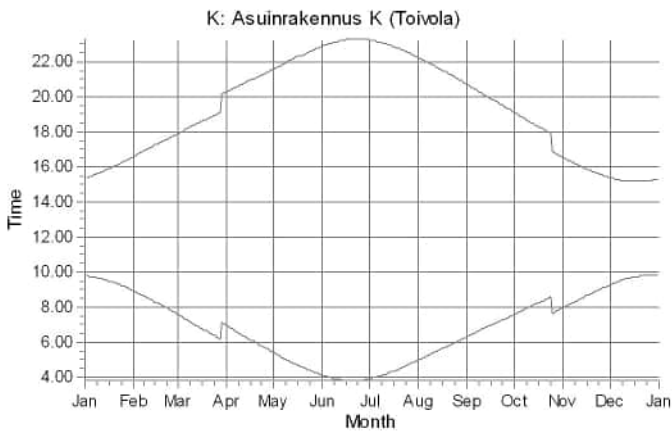
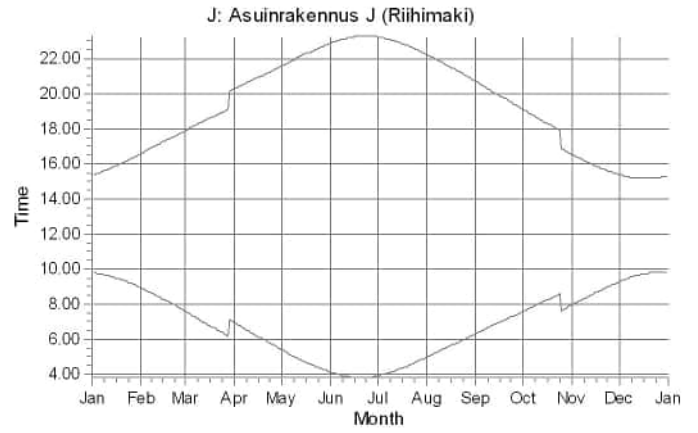
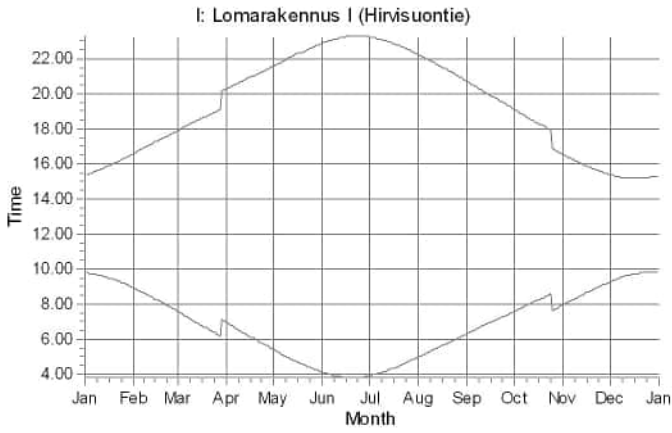
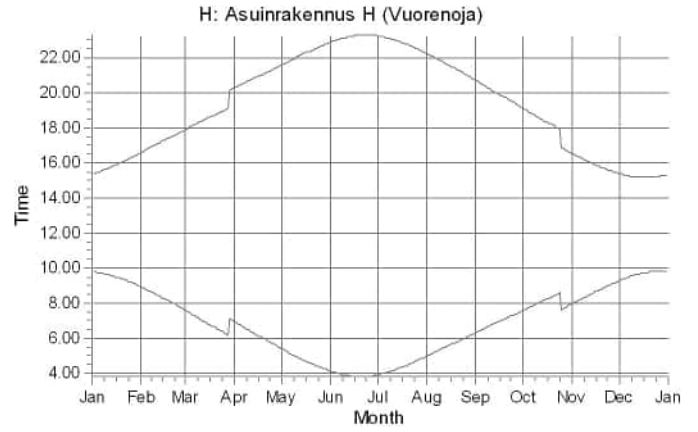
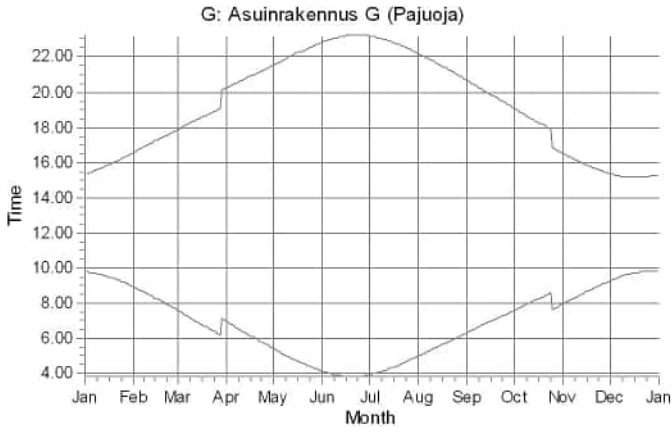


WTGs

WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (1)

SHADOW - Calendar, graphical

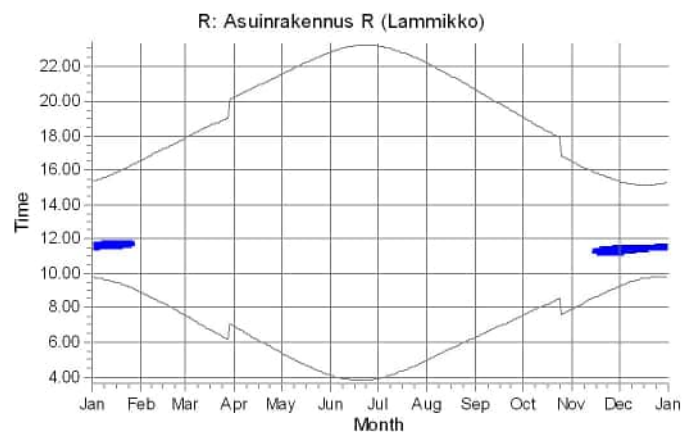
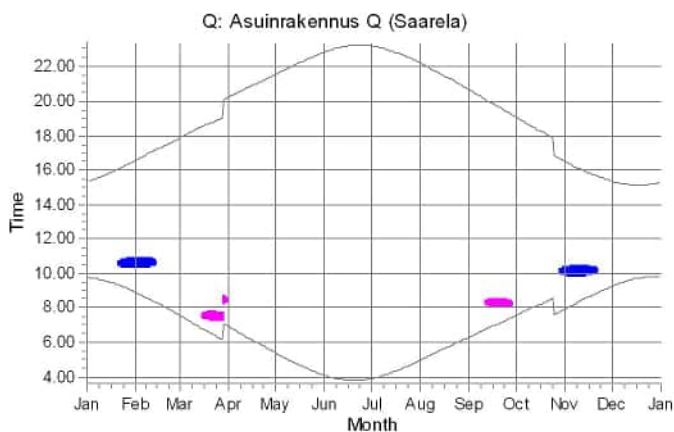
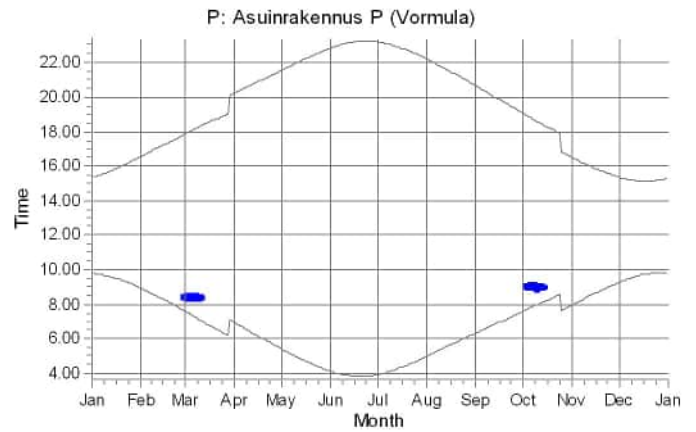
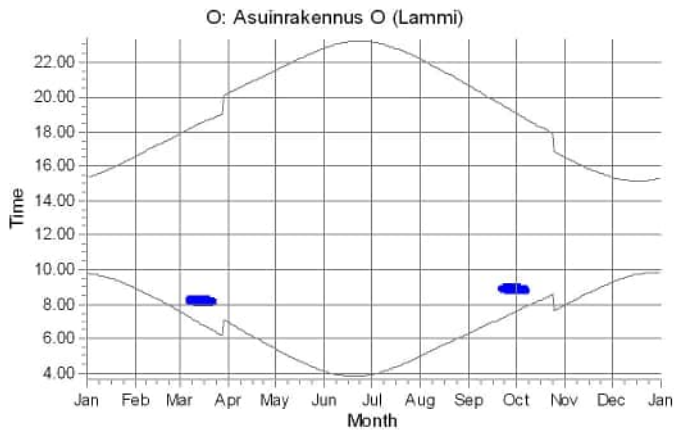
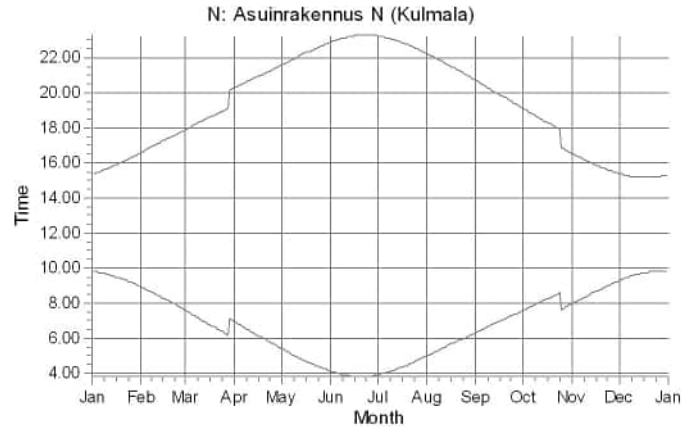
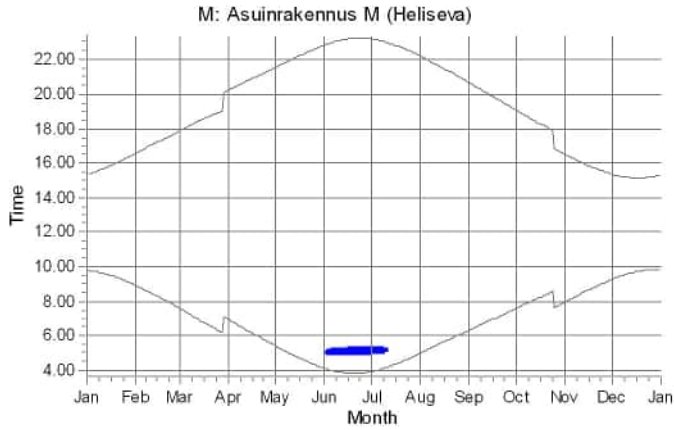
Calculation: Kärme­kallio_RD155x7xHH182_Luke_Forest



WTGs

SHADOW - Calendar, graphical

Calculation: Kärme­kallio_RD155x7xHH182_Luke_Forest

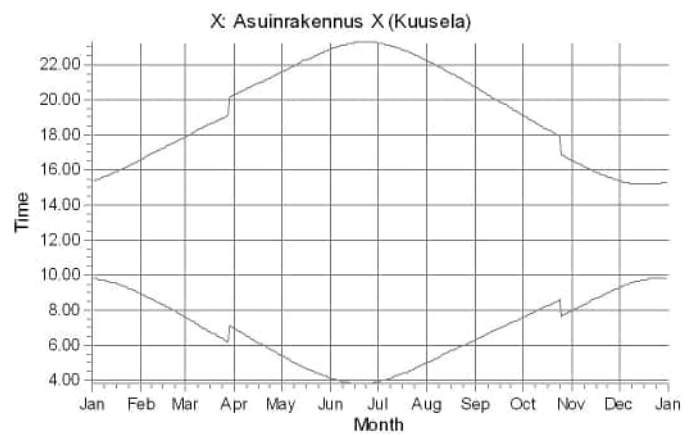
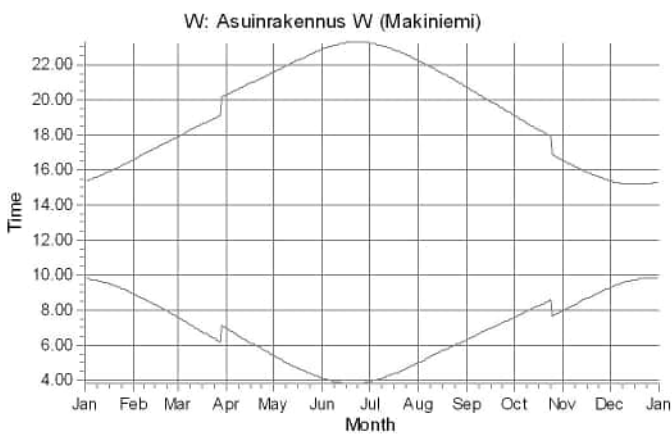
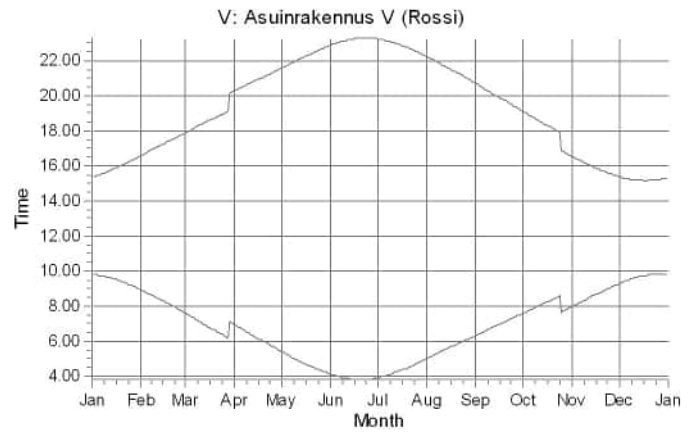
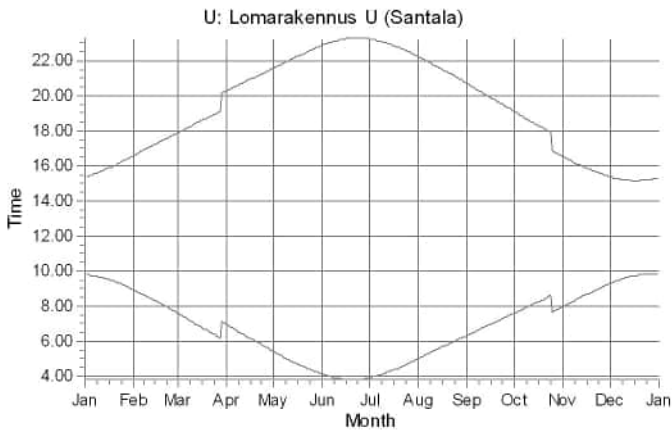
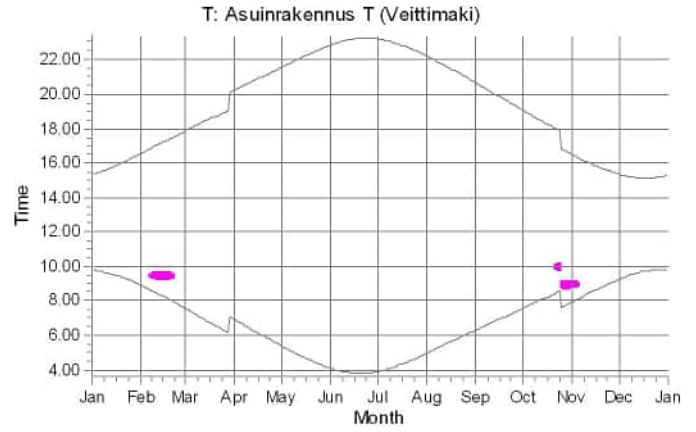
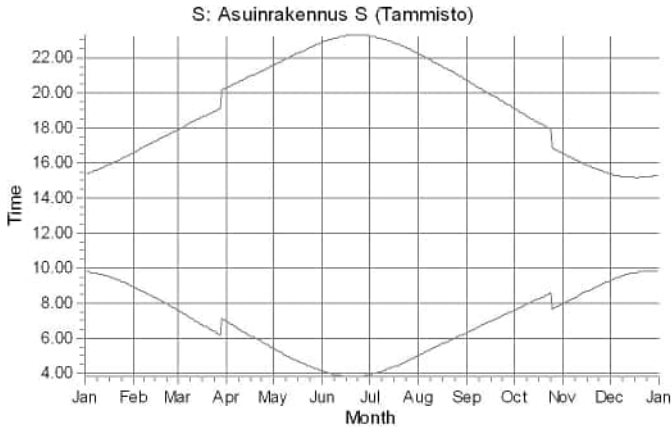


WTGs

- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (3)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)

SHADOW - Calendar, graphical

Calculation: Kärme­kallio_RD155x7xHH182_Luke_Forest

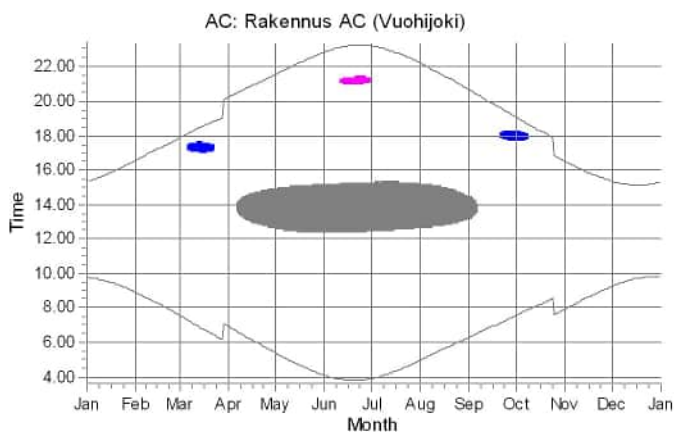
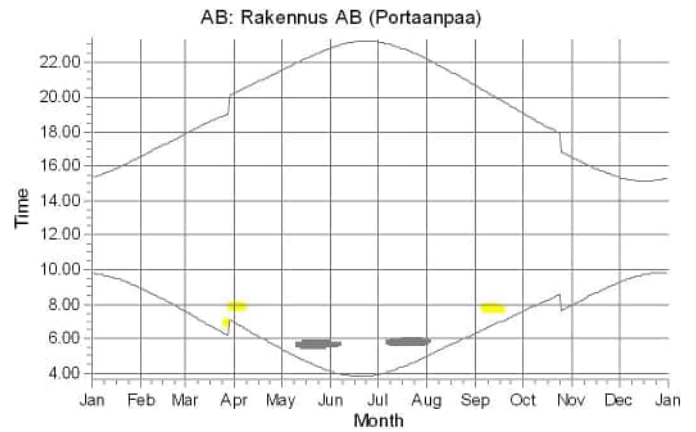
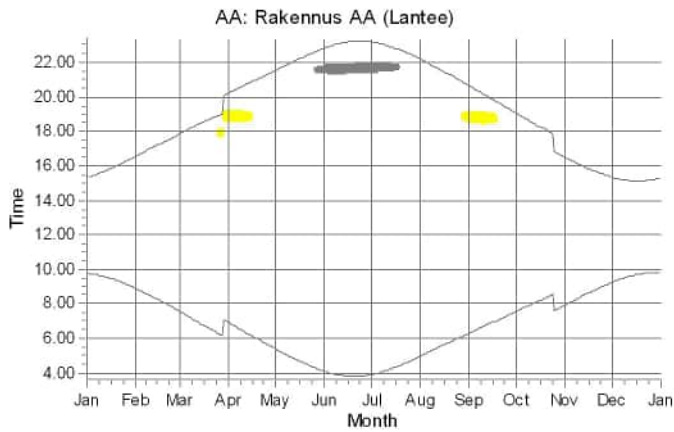
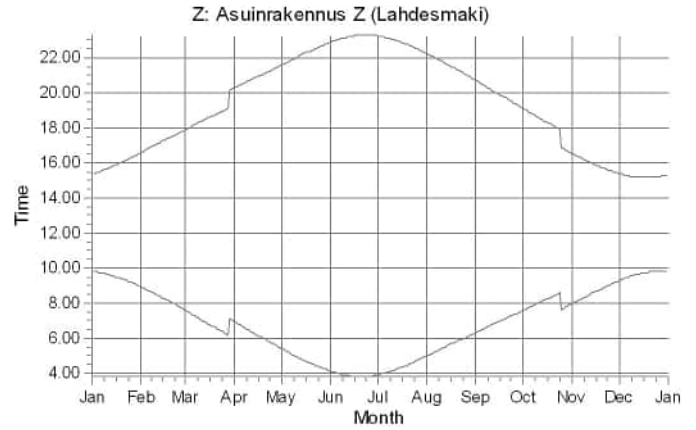
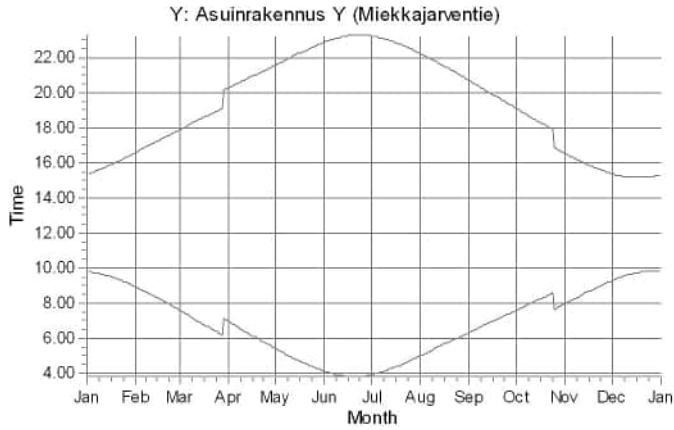


WTGs

WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)

SHADOW - Calendar, graphical

Calculation: Kärmeekallio_RD155x7xHH182_Luke_Forest

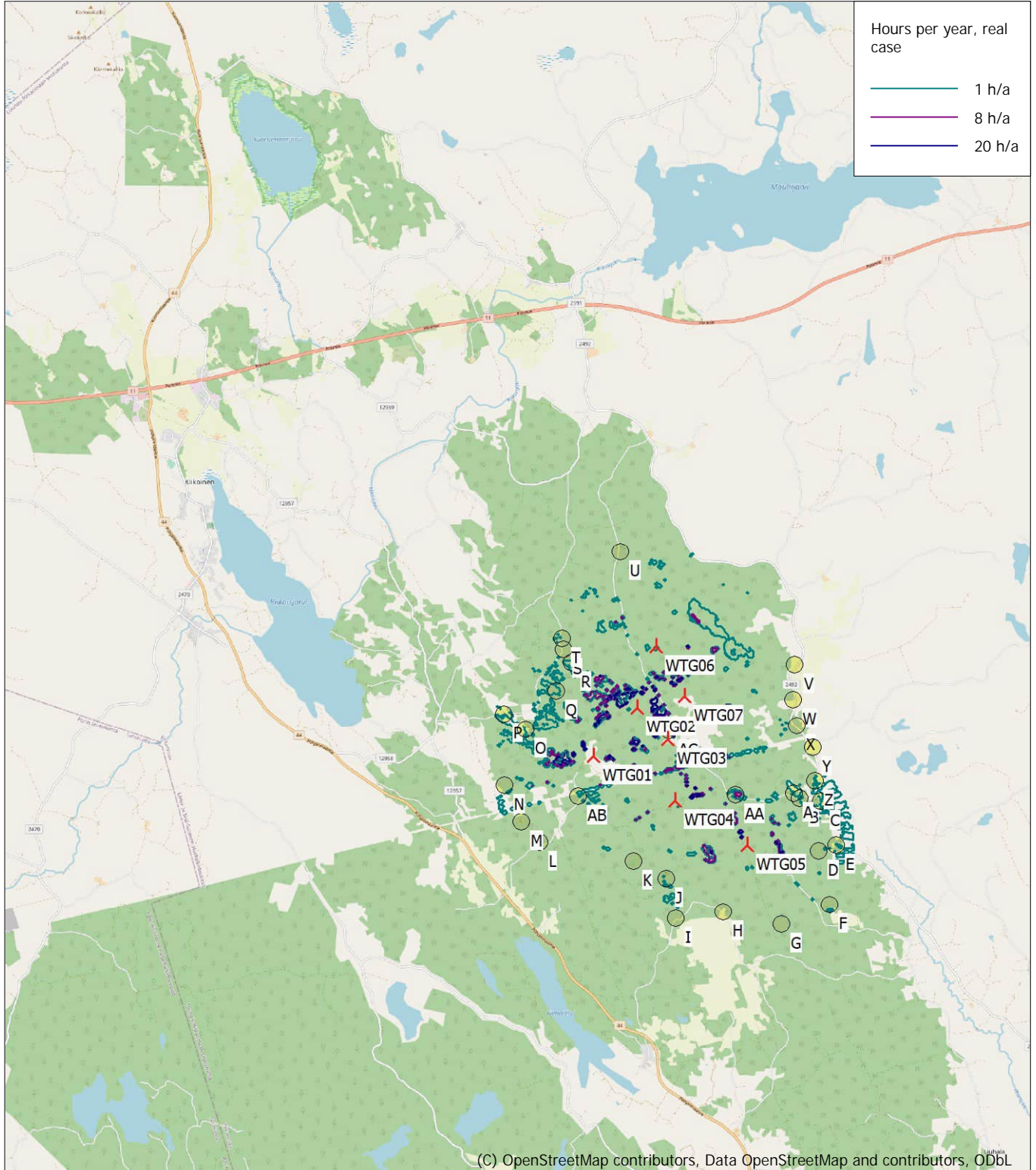


WTGs

- WTG04: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (2)
- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (3)
- WTG03: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (4)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (5)

SHADOW - Map

Calculation: Karmekallio_RD155x7xHH182_Luke_Forest



Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 269 370 North: 6 819 720

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_P47816_Karmekallio_0.wpo (1)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 7. Varjostusmallinnuksen tulokset "Real Case, No forest" - Hankevaihtoehto VE2

SHADOW - Main Result

Calculation: Karmekallio_RD155x5xHH182_NoForest
Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

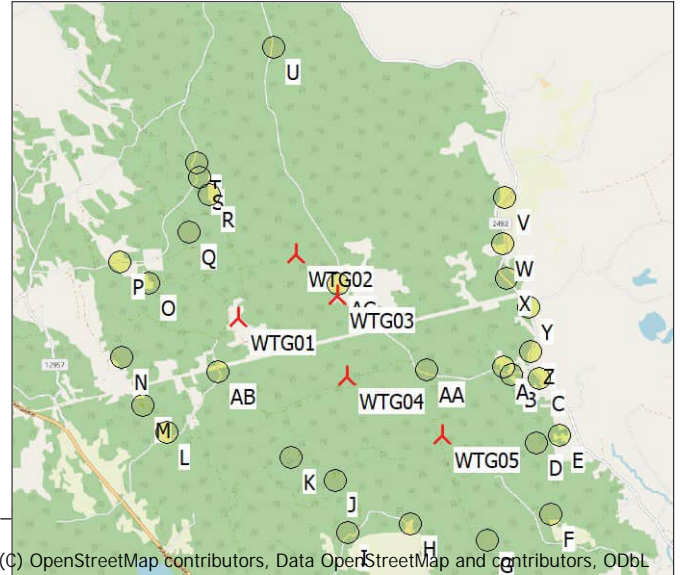
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [JOKIOINEN]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,16 2,61 3,94 5,80 8,65 8,98 8,14 6,70 4,15 2,67 1,18 0,89

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
717 652 423 350 431 669 978 1 225 840 592 472 499 7 848

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_P47816_Karmekallio
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z	Row data/Description	WTG type				Shadow data			
					Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
WTG01	270 799	6 816 832	94,5	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5	600	5 600	155,0	182,5	1 882	10,4
WTG02	271 620	6 817 635	97,1	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5	600	5 600	155,0	182,5	1 882	10,4
WTG03	272 124	6 817 043	102,5	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5	600	5 600	155,0	182,5	1 882	10,4
WTG04	272 182	6 815 966	95,0	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5	600	5 600	155,0	182,5	1 882	10,4
WTG05	273 392	6 815 102	107,5	Generic RD155 5600 155,0 !O... Yes	Generic	RD155-5	600	5 600	155,0	182,5	1 882	10,4

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Asuinrakennus A (Orisuo)	274 265	6 815 959	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B (Kallio)	274 364	6 815 858	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Asuinrakennus C (Lannemaa)	274 730	6 815 777	80,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Lomarakennus D (Koluoja)	274 635	6 814 919	86,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Asuinrakennus E (Maunula)	274 952	6 815 004	81,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Kalliorinne)	274 763	6 813 962	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Pajuoja)	273 897	6 813 673	100,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Vuorenoja)	272 896	6 813 954	89,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I (Hirvisuontie)	272 059	6 813 889	85,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Asuinrakennus J (Riihimäki)	271 933	6 814 607	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Asuinrakennus K (Toivola)	271 384	6 814 949	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Palomäki)	269 752	6 815 392	75,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Helisevä)	269 461	6 815 767	77,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
N	Asuinrakennus N (Kulmala)	269 214	6 816 426	81,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
O	Asuinrakennus O (Lammi)	269 648	6 817 378	77,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
P	Asuinrakennus P (Vormula)	269 285	6 817 676	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Q	Asuinrakennus Q (Saarela)	270 219	6 818 023	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
R	Asuinrakennus R (Lammikko)	270 518	6 818 492	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
S	Asuinrakennus S (Tammisto)	270 408	6 818 733	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
T	Asuinrakennus T (Veittimäki)	270 386	6 818 928	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
U	Lomarakennus U (Santala)	271 508	6 820 385	87,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
V	Asuinrakennus V (Rossi)	274 436	6 818 205	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
W	Asuinrakennus W (Makiniemi)	274 364	6 817 588	86,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
X	Asuinrakennus X (Kuusela)	274 388	6 817 127	88,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Y	Asuinrakennus Y (Miekkajarventie)	274 658	6 816 731	81,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

SHADOW - Main Result

Calculation: Kärmeekallio_RD155x5xHH182_NoForest

...continued from previous page

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
	Z Asuinrakennus Z (Lahdesmaki)	274 649	6 816 143	78,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
	AA Rakennus AA (Lantee)	273 246	6 815 997	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
	AB Rakennus AB (Portaanpaa)	270 488	6 816 146	89,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
	AC Rakennus AC (Vuohijoki)	272 155	6 817 191	95,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Asuinrakennus A (Orisuo)	2:44
B	Asuinrakennus B (Kallio)	2:34
C	Asuinrakennus C (Lannemaa)	1:41
D	Lomarakennus D (Koluojja)	3:10
E	Asuinrakennus E (Maunula)	1:45
F	Asuinrakennus F (Kalliorinne)	5:38
G	Asuinrakennus G (Pajuojja)	0:00
H	Asuinrakennus H (Vuorenoja)	0:00
I	Lomarakennus I (Hirvisuontie)	0:00
J	Asuinrakennus J (Riihimaki)	3:27
K	Asuinrakennus K (Toivola)	0:00
L	Asuinrakennus L (Palomaki)	0:00
M	Asuinrakennus M (Heliseva)	2:45
N	Asuinrakennus N (Kulmala)	2:27
O	Asuinrakennus O (Lammi)	2:11
P	Asuinrakennus P (Vormula)	1:11
Q	Asuinrakennus Q (Saarela)	4:03
R	Asuinrakennus R (Lammikko)	4:16
S	Asuinrakennus S (Tammisto)	1:24
T	Asuinrakennus T (Veittimaki)	1:13
U	Lomarakennus U (Santala)	0:00
V	Asuinrakennus V (Rossi)	0:00
W	Asuinrakennus W (Makinieniemi)	0:00
X	Asuinrakennus X (Kuusela)	0:00
Y	Asuinrakennus Y (Miekkajarventie)	0:00
Z	Asuinrakennus Z (Lahdesmaki)	1:30
AA	Rakennus AA (Lantee)	13:46
AB	Rakennus AB (Portaanpaa)	5:05
AC	Rakennus AC (Vuohijoki)	105:25

Total amount of flickering on the shadow receptors caused by each WTG

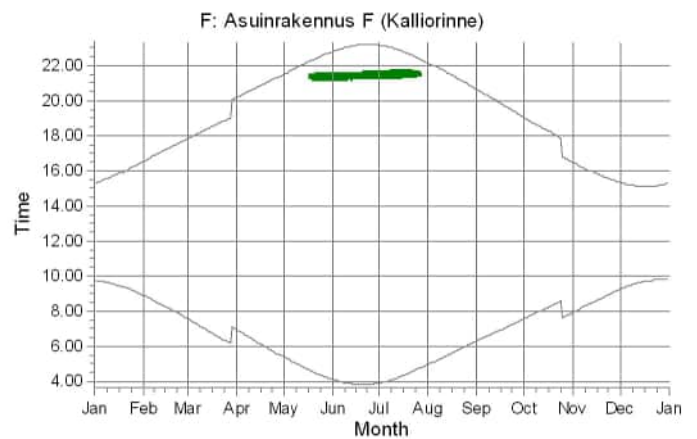
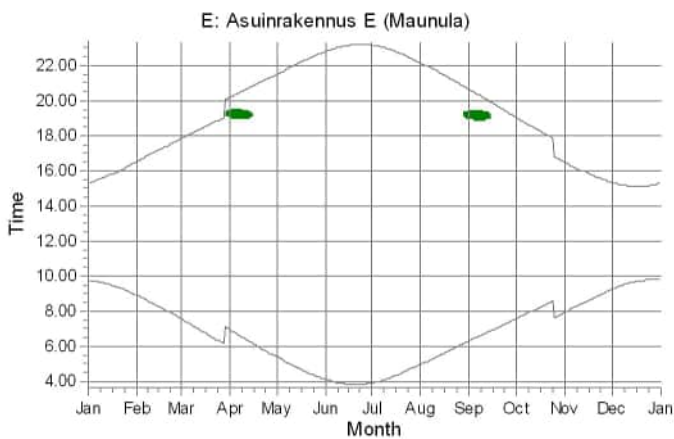
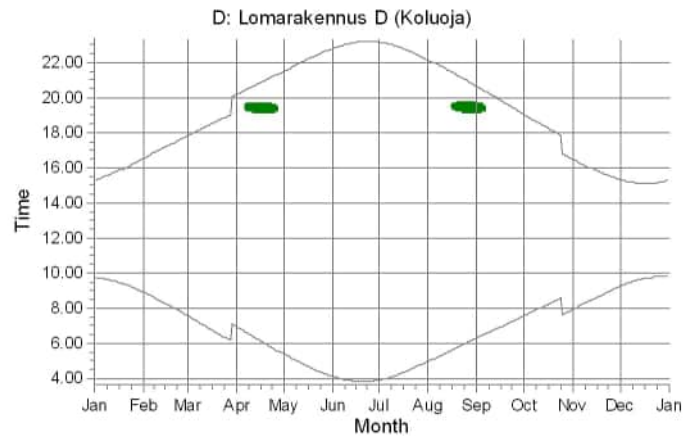
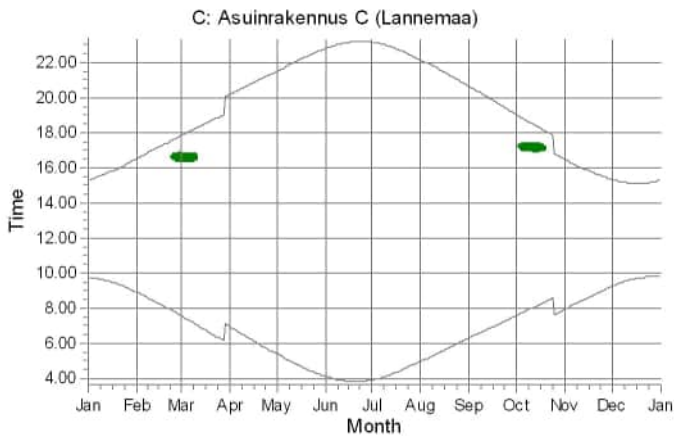
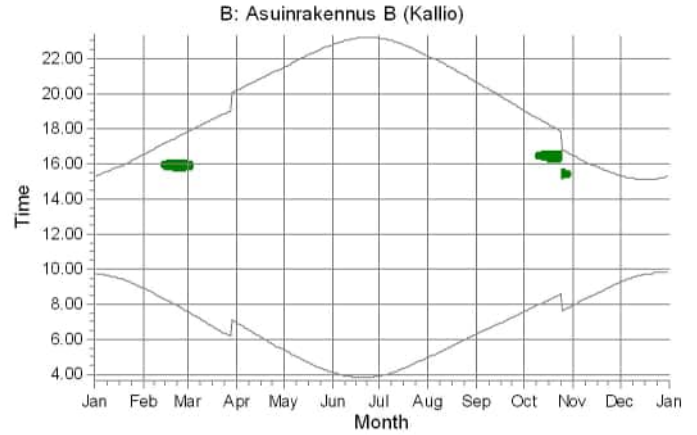
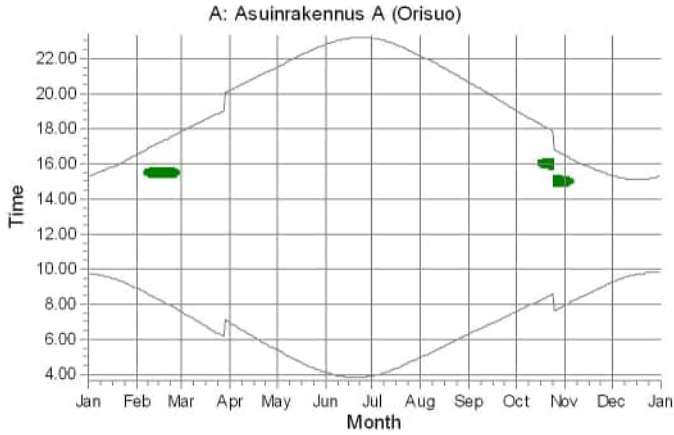
No.	Name	Expected [h/year]
WTG01	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (10)	14:46
WTG02	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)	6:58
WTG03	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (11)	107:19
WTG04	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (9)	8:54
WTG05	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (8)	25:53

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x5xHH182_NoForest

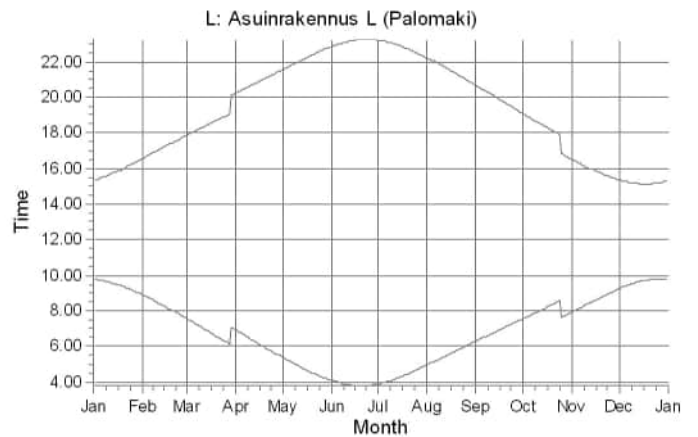
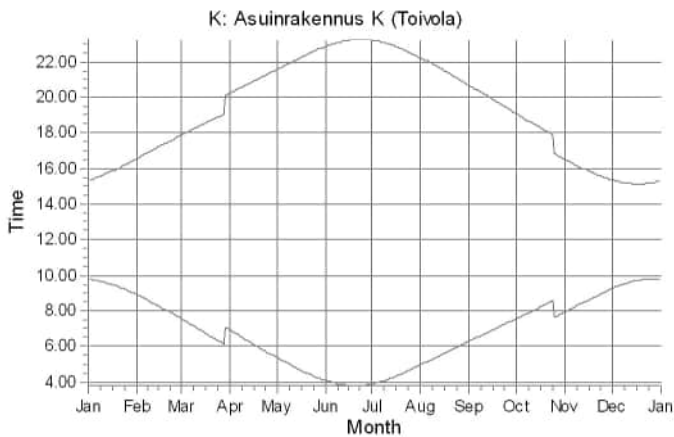
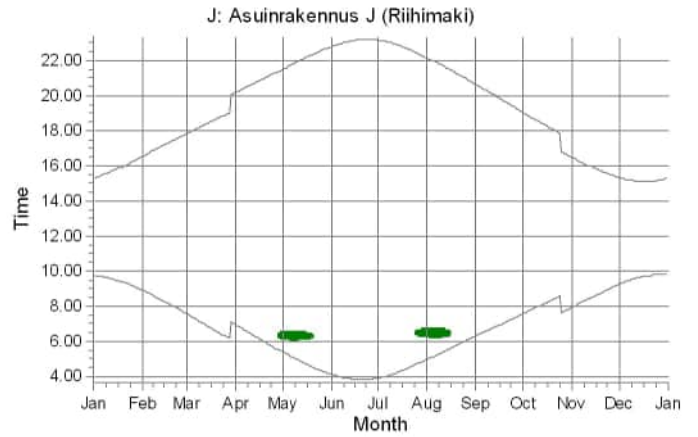
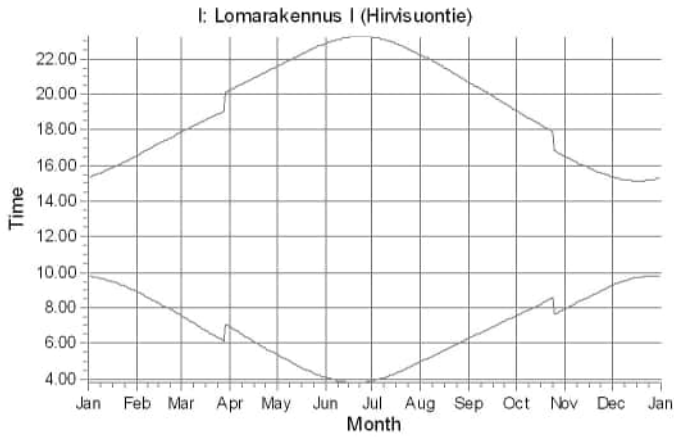
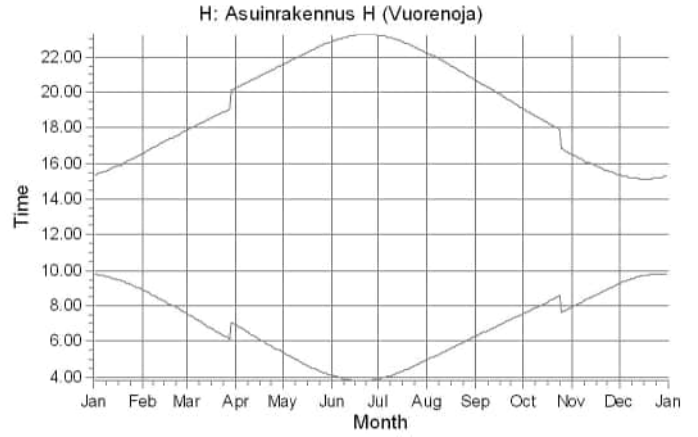
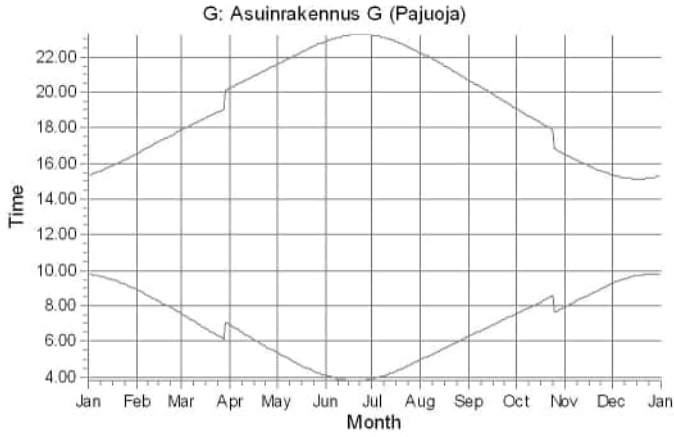


WTGs

WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (8)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x5xHH182_NoForest

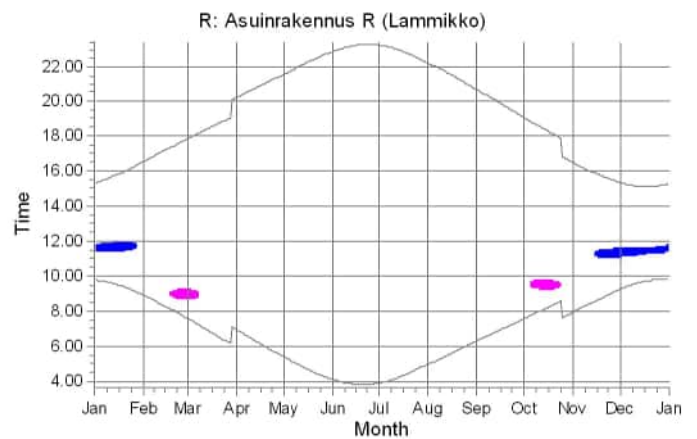
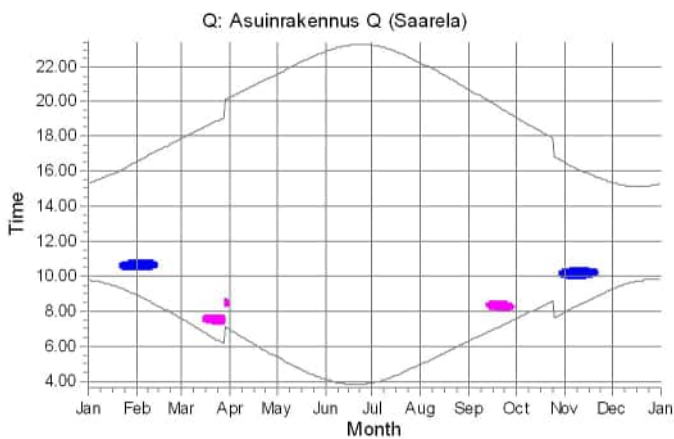
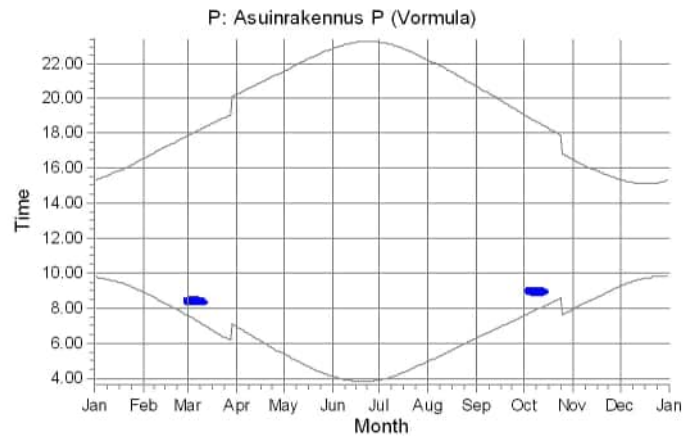
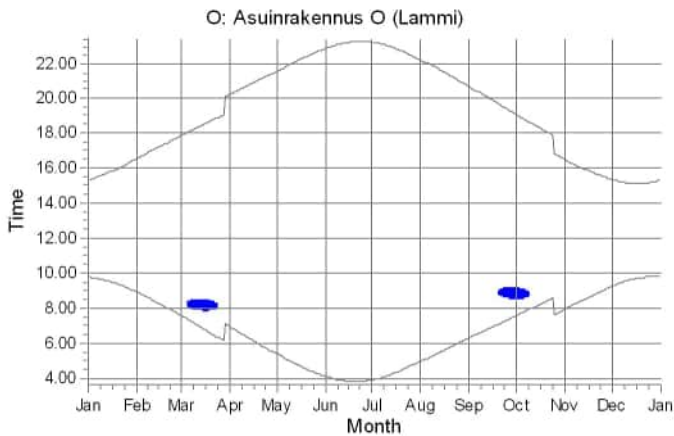
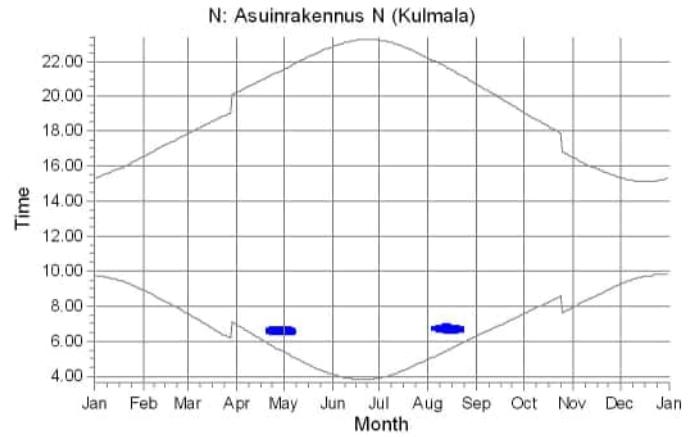
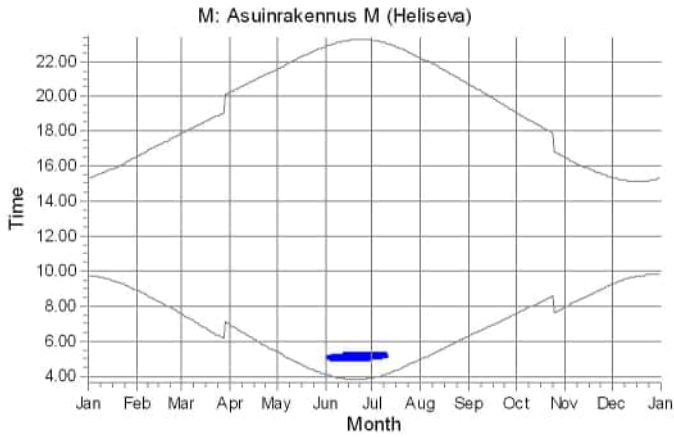


WTGs

WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (8)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x5xHH182_NoForest

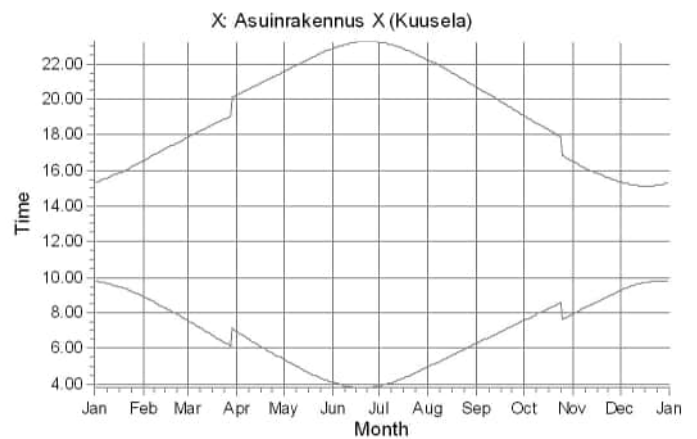
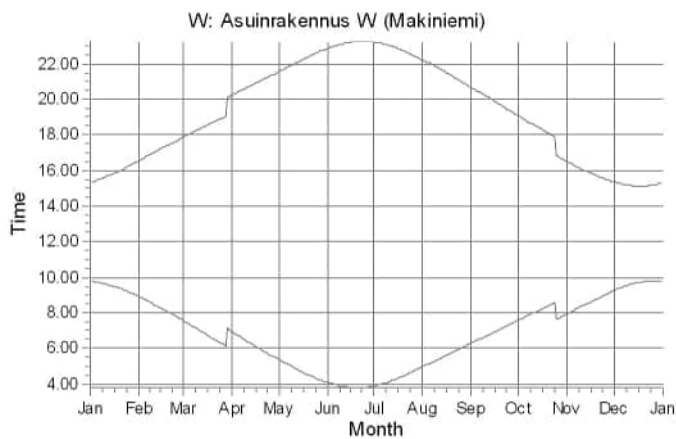
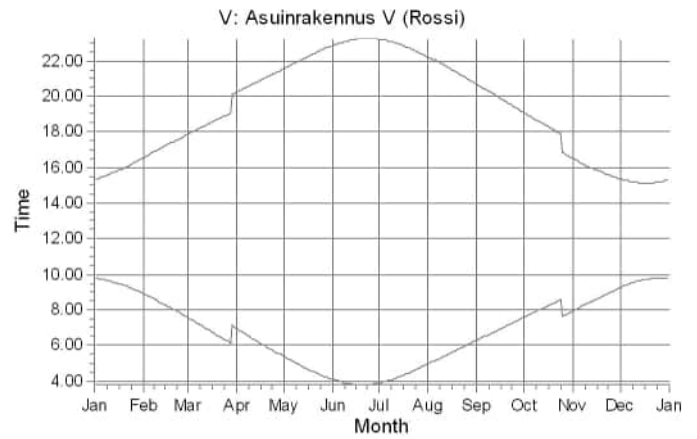
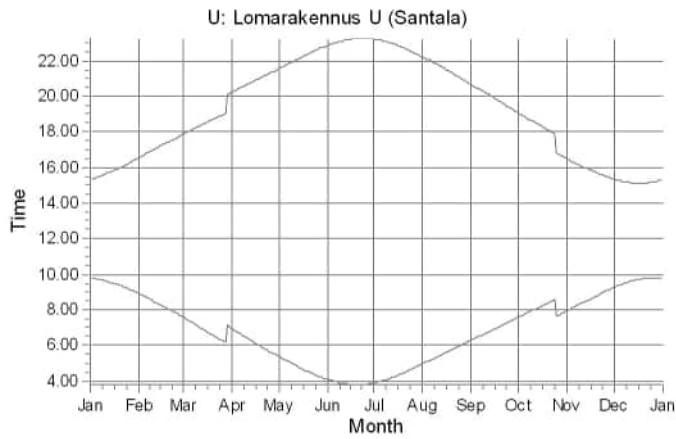
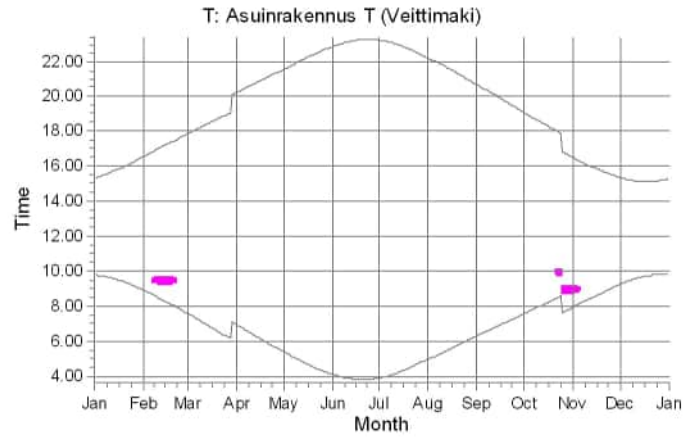
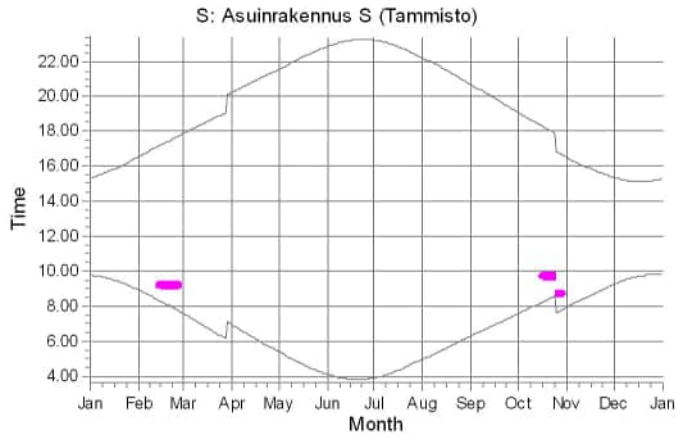


WTGs

- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (10)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x5xHH182_NoForest

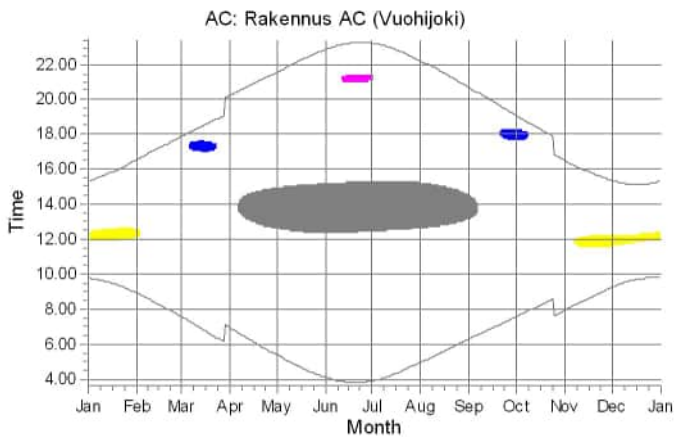
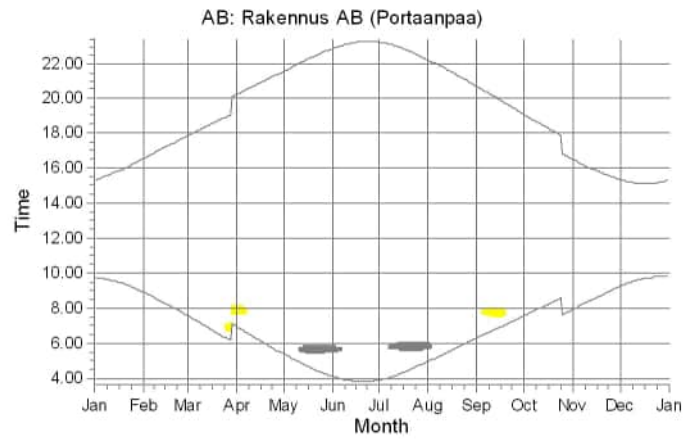
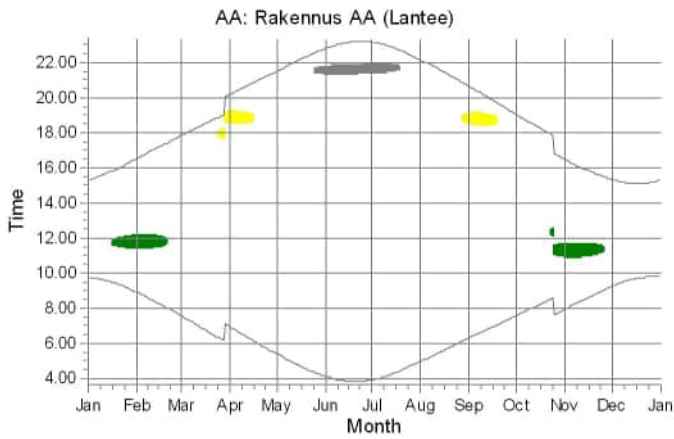
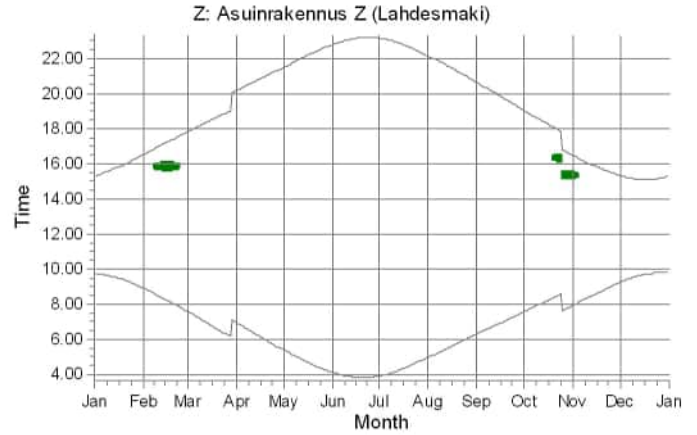
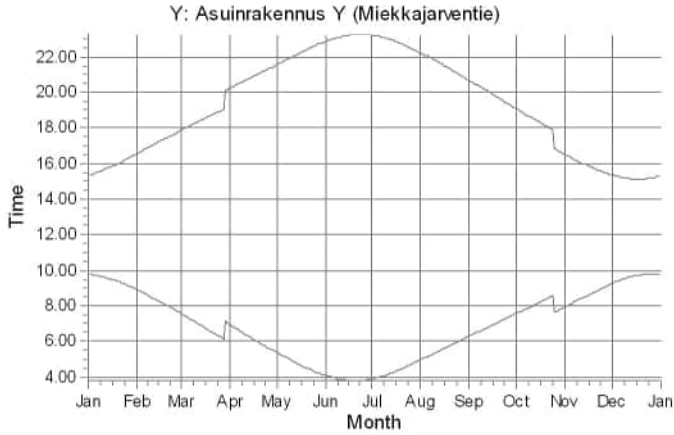


WTGs

WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x5xHH182_NoForest

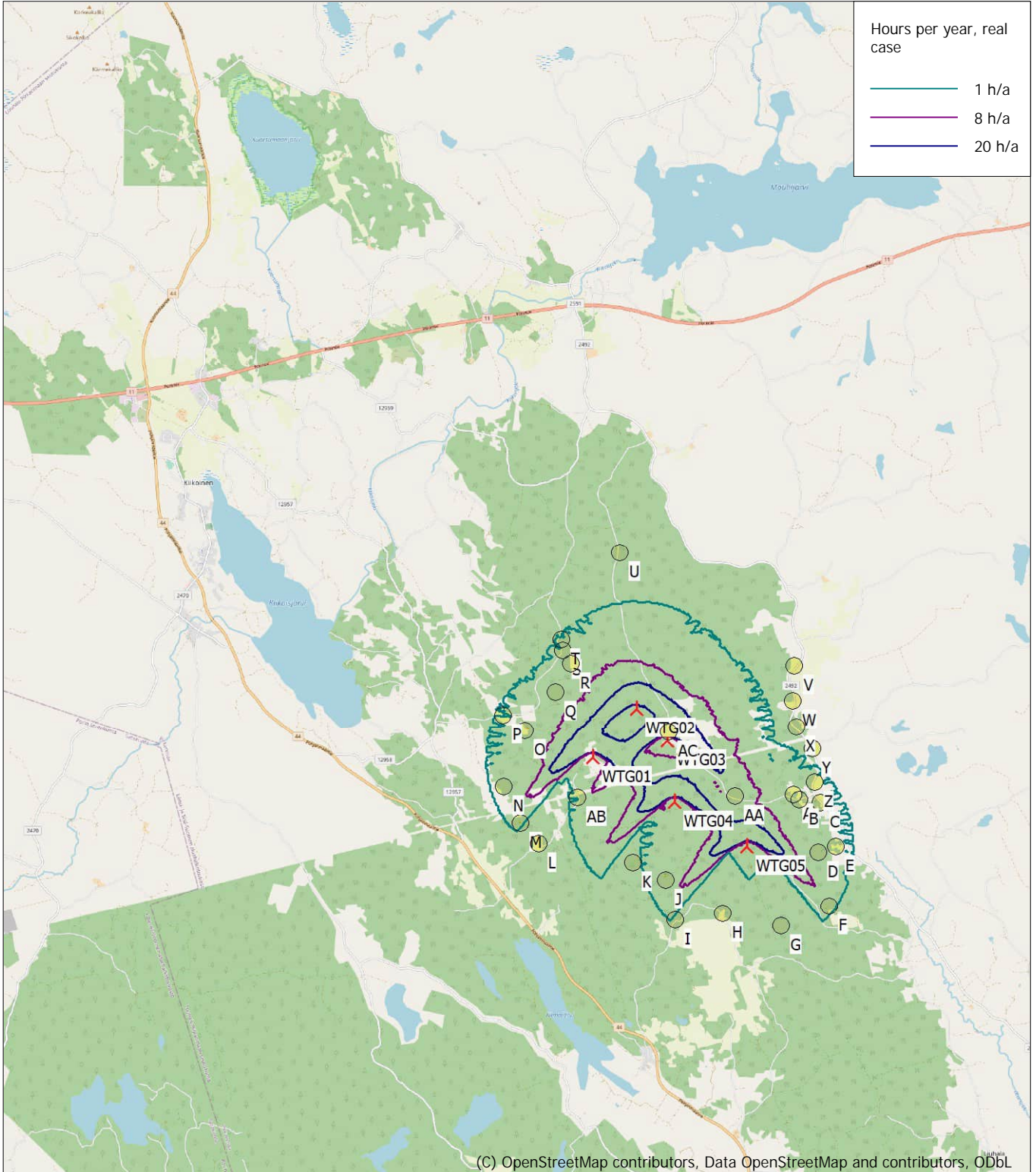


WTGs

- WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (8)
- WTG04: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (9)
- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (10)
- WTG03: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (11)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)

SHADOW - Map

Calculation: Karmekallio_RD155x5xHH182_NoForest



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 269 370 North: 6 819 720

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_P47816_Karmekallio_0.wpo (1)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m

Liite 8. Varjostusmallinnuksen tulokset "Real Case, Luke forest" - Hankevaihtoehto VE2

SHADOW - Main Result

Calculation: Karmekallio_RD155x5xHH182_Luke_Forest
Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

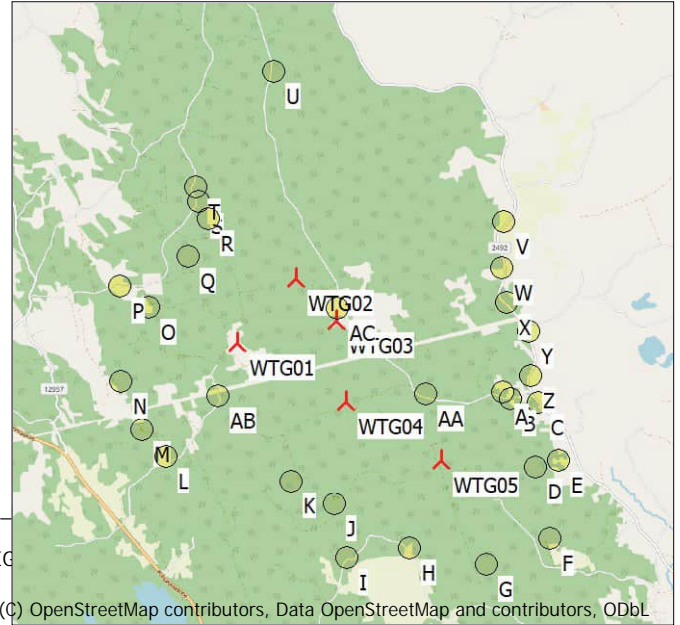
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [JOKIOINEN]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1,16 2,61 3,94 5,80 8,65 8,98 8,14 6,70 4,15 2,67 1,18 0,89

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
717 652 423 350 431 669 978 1 225 840 592 472 499 7 848

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_P47816_Karmekallio...
Area object(s) used in calculation:
Area object (Heights a.g.l. for e.g. Forest (ORA tool) or ZVI obstructions): REC...
Receptor grid resolution: 1,0 m

All coordinates are in
Finish TM ETRS-TM35FIN-ETRS89



WTGs

	East	North	Z	Row data/Description	WTG type			Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
					Valid	Manufact.	Type-generator				Calculation distance [m]	RPM [RPM]
WTG01	270 799	6 816 832	94,5	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG02	271 620	6 817 635	97,1	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG03	272 124	6 817 043	102,5	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG04	272 182	6 815 966	95,0	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	
WTG05	273 392	6 815 102	107,5	Generic RD155 5600 155.0 !O... Yes	Generic	RD155-5 600	5 600	155,0	182,5	1 882	10,4	

Shadow receptor-Input

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	Asuinrakennus A (Orisuo)	274 265	6 815 959	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
B	Asuinrakennus B (Kallio)	274 364	6 815 858	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
C	Asuinrakennus C (Lannemaa)	274 730	6 815 777	80,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
D	Lomarakennus D (Koluojja)	274 635	6 814 919	86,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
E	Asuinrakennus E (Maunula)	274 952	6 815 004	81,2	5,0	5,0	1,0	90,0	"Green house mode"	6,0
F	Asuinrakennus F (Kalliorinne)	274 763	6 813 962	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
G	Asuinrakennus G (Pajuojja)	273 897	6 813 673	100,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
H	Asuinrakennus H (Vuorenoja)	272 896	6 813 954	89,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
I	Lomarakennus I (Hirvisuontie)	272 059	6 813 889	85,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
J	Asuinrakennus J (Riihimaki)	271 933	6 814 607	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
K	Asuinrakennus K (Toivola)	271 384	6 814 949	92,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
L	Asuinrakennus L (Palomaki)	269 752	6 815 392	75,7	5,0	5,0	1,0	90,0	"Green house mode"	6,0
M	Asuinrakennus M (Heliseva)	269 461	6 815 767	77,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
N	Asuinrakennus N (Kulmala)	269 214	6 816 426	81,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
O	Asuinrakennus O (Lammii)	269 648	6 817 378	77,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
P	Asuinrakennus P (Vormula)	269 285	6 817 676	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Q	Asuinrakennus Q (Saarela)	270 219	6 818 023	82,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
R	Asuinrakennus R (Lammikko)	270 518	6 818 492	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
S	Asuinrakennus S (Tammisto)	270 408	6 818 733	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
T	Asuinrakennus T (Veittimaki)	270 386	6 818 928	75,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
U	Lomarakennus U (Santala)	271 508	6 820 385	87,9	5,0	5,0	1,0	90,0	"Green house mode"	6,0
V	Asuinrakennus V (Rossi)	274 436	6 818 205	77,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
W	Asuinrakennus W (Makiniemi)	274 364	6 817 588	86,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

To be continued on next page...

SHADOW - Main Result

Calculation: Karmekallio_RD155x5xHH182_Luke_Forest

...continued from previous page

No.	Name	East	North	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
X	Asuinrakennus X (Kuusela)	274 388	6 817 127	88,3	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Y	Asuinrakennus Y (Miekkajarventie)	274 658	6 816 731	81,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0
Z	Asuinrakennus Z (Lahdesmaki)	274 649	6 816 143	78,1	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AA	Rakennus AA (Lantee)	273 246	6 815 997	95,0	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AB	Rakennus AB (Portaanpaa)	270 488	6 816 146	89,8	5,0	5,0	1,0	90,0	"Green house mode"	6,0
AC	Rakennus AC (Vuohijoki)	272 155	6 817 191	95,5	5,0	5,0	1,0	90,0	"Green house mode"	6,0

Calculation Results

Shadow receptor

No.	Name	Shadow, expected values Shadow hours per year [h/year]
A	Asuinrakennus A (Orisuo)	2:44
B	Asuinrakennus B (Kallio)	2:34
C	Asuinrakennus C (Lannemaa)	1:41
D	Lomarakennus D (Koluojja)	0:00
E	Asuinrakennus E (Maunula)	1:45
F	Asuinrakennus F (Kalliorinne)	0:00
G	Asuinrakennus G (Pajuojja)	0:00
H	Asuinrakennus H (Vuorenoja)	0:00
I	Lomarakennus I (Hirvisuontie)	0:00
J	Asuinrakennus J (Riihimaki)	0:00
K	Asuinrakennus K (Toivola)	0:00
L	Asuinrakennus L (Palomaki)	0:00
M	Asuinrakennus M (Heliseva)	2:45
N	Asuinrakennus N (Kulmala)	0:00
O	Asuinrakennus O (Lammi)	2:11
P	Asuinrakennus P (Vormula)	1:11
Q	Asuinrakennus Q (Saarela)	4:03
R	Asuinrakennus R (Lammikko)	2:20
S	Asuinrakennus S (Tammisto)	0:00
T	Asuinrakennus T (Veittimaki)	1:13
U	Lomarakennus U (Santala)	0:00
V	Asuinrakennus V (Rossi)	0:00
W	Asuinrakennus W (Makinieniemi)	0:00
X	Asuinrakennus X (Kuusela)	0:00
Y	Asuinrakennus Y (Miekkajarventie)	0:00
Z	Asuinrakennus Z (Lahdesmaki)	0:00
AA	Rakennus AA (Lantee)	8:30
AB	Rakennus AB (Portaanpaa)	5:05
AC	Rakennus AC (Vuohijoki)	101:32

Total amount of flickering on the shadow receptors caused by each WTG

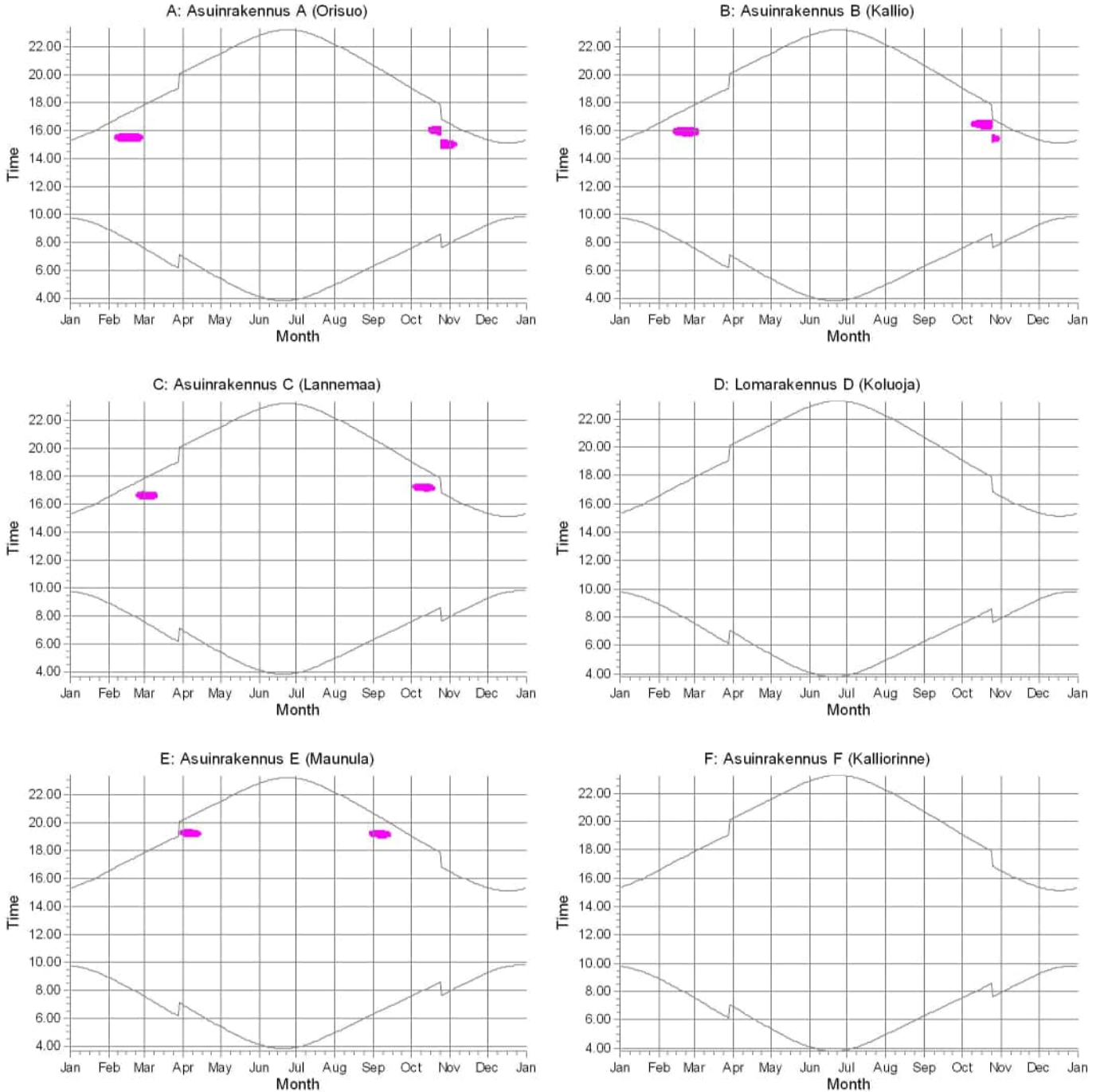
No.	Name	Expected [h/year]
WTG01	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (10)	12:19
WTG02	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)	4:05
WTG03	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (11)	107:19
WTG04	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (9)	5:01
WTG05	Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (8)	8:33

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

SHADOW - Calendar, graphical

Calculation: KärmeKallio_RD155x5xHH182_Luke_Forest

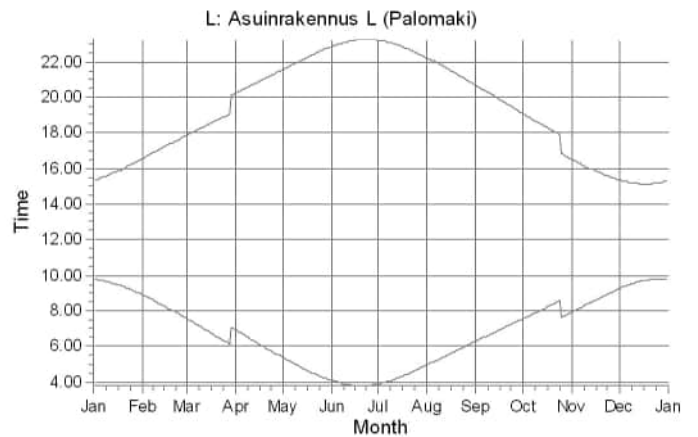
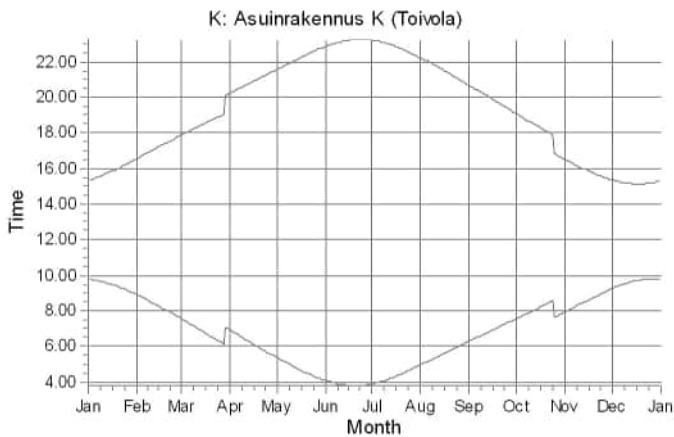
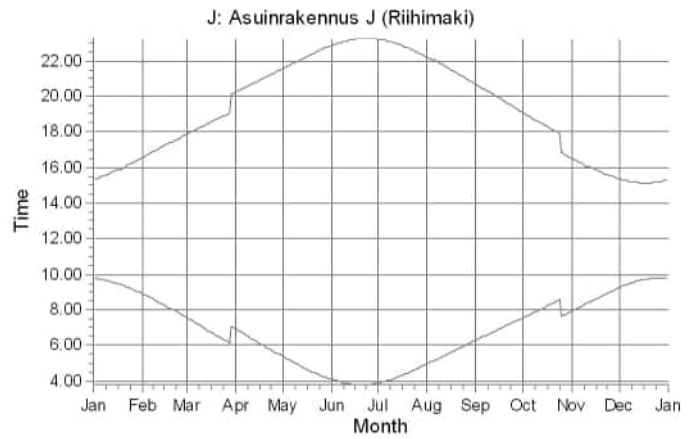
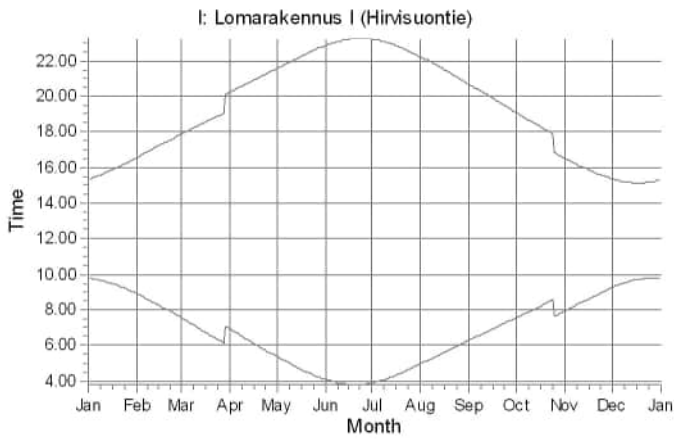
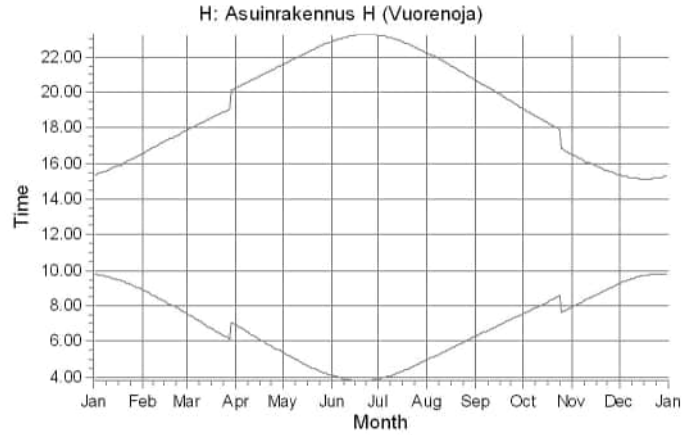
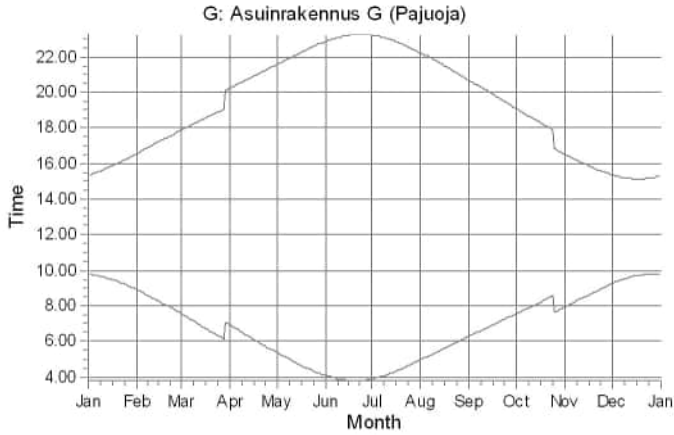


WTGs

WTG05: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (8)

SHADOW - Calendar, graphical

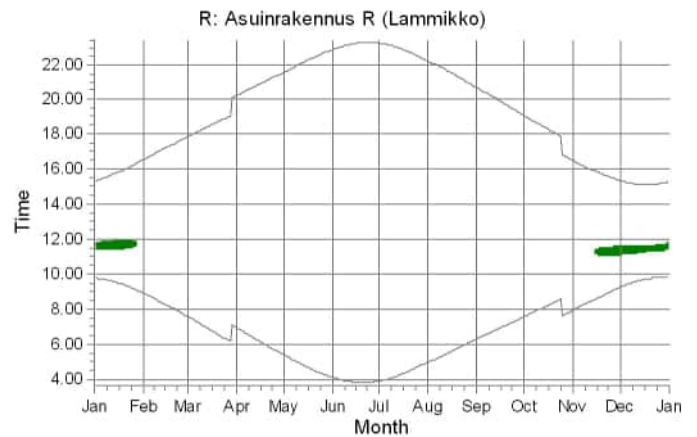
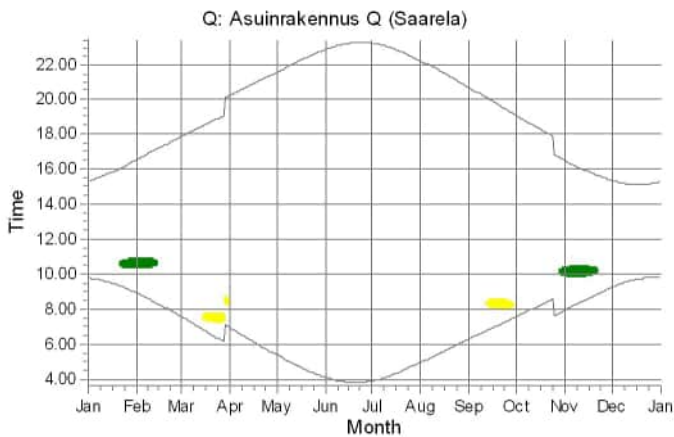
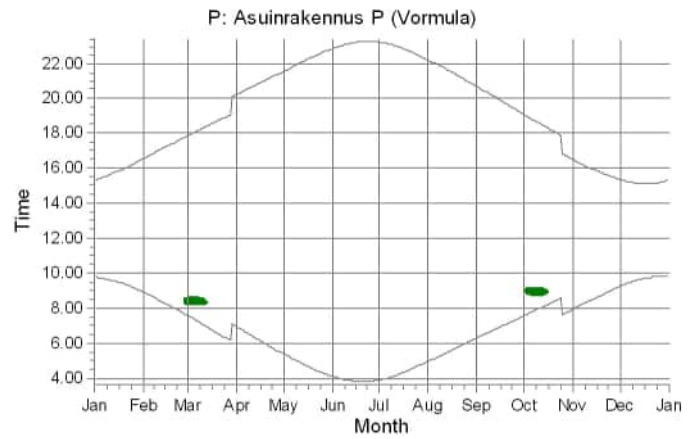
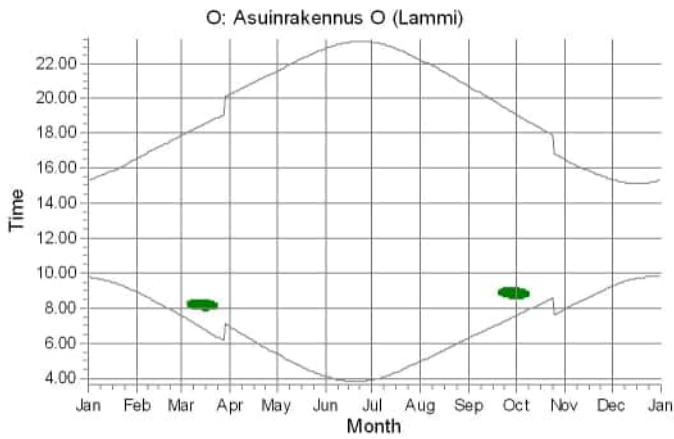
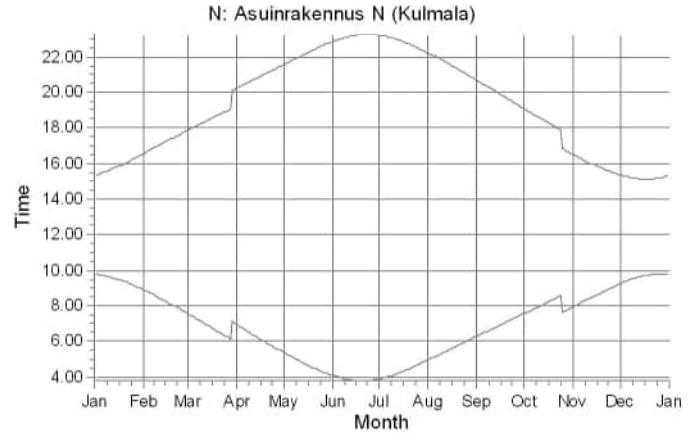
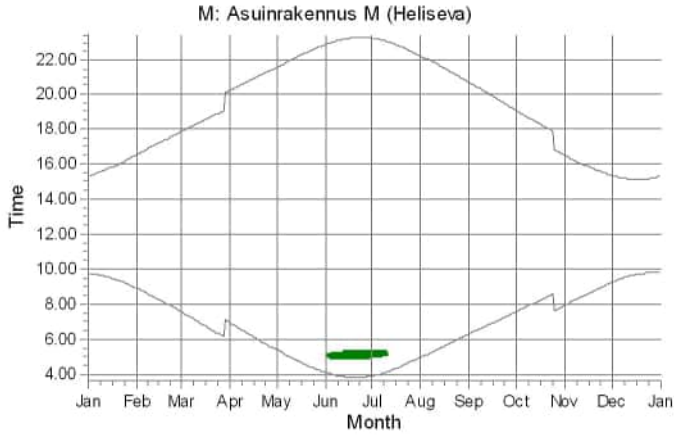
Calculation: Kärmeekallio_RD155x5xHH182_Luke_Forest



WTGs

SHADOW - Calendar, graphical

Calculation: Kärme­kallio_RD155x5xHH182_Luke_Forest

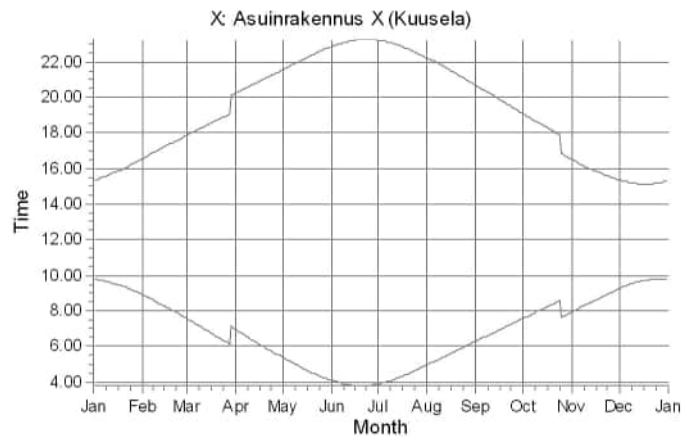
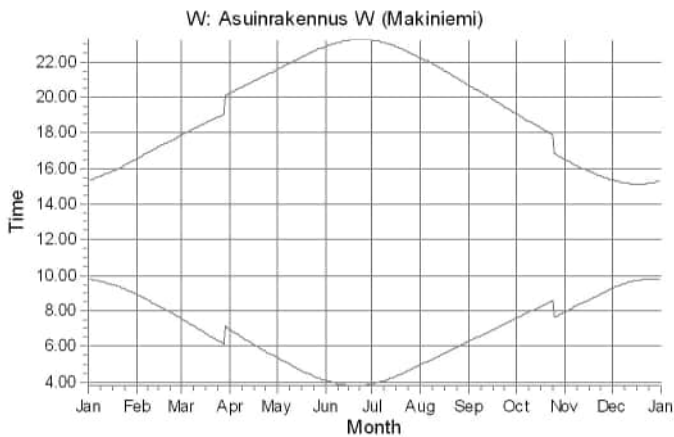
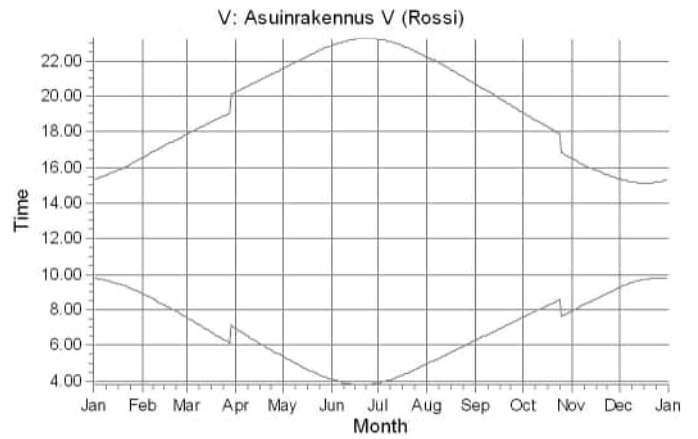
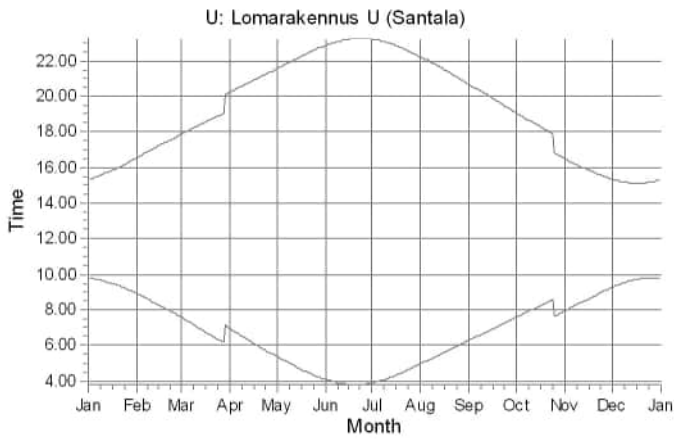
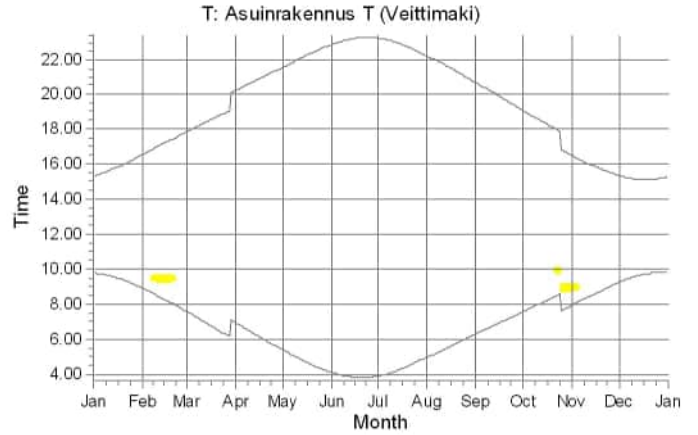
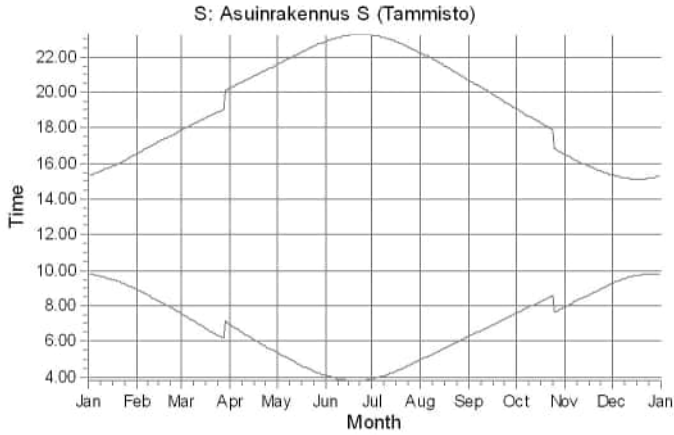


WTGs

- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (10)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)

SHADOW - Calendar, graphical

Calculation: Karmekallio_RD155x5xHH182_Luke_Forest

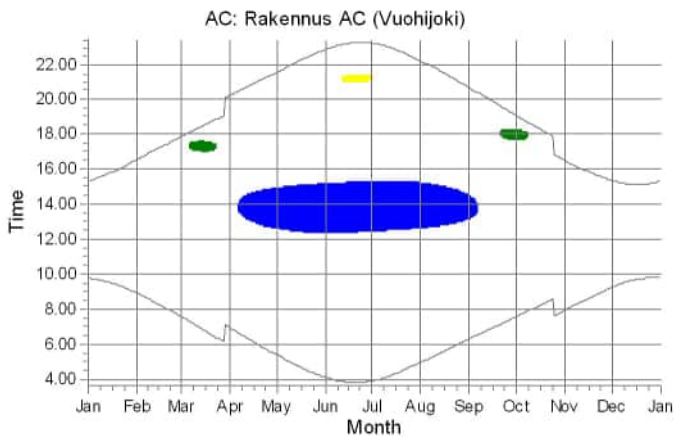
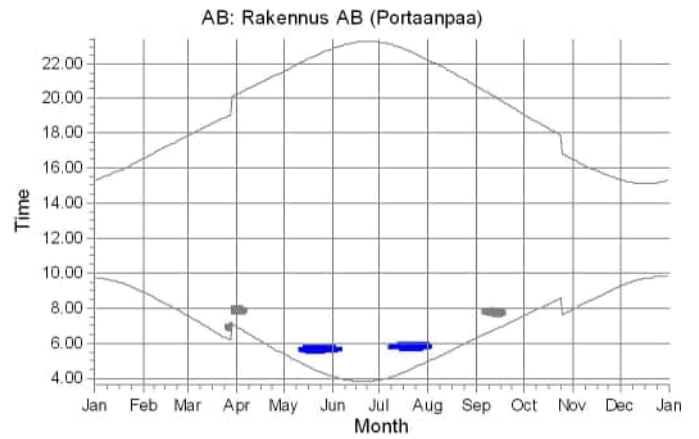
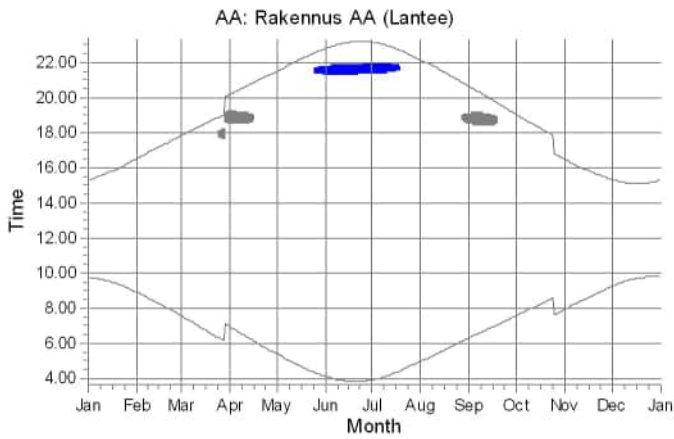
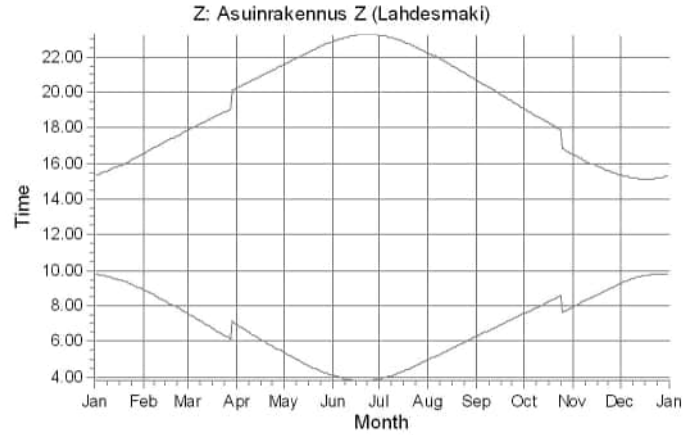
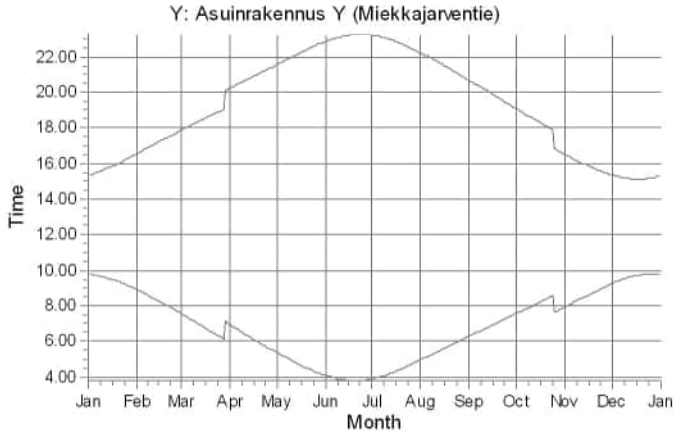


WTGs

WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)

SHADOW - Calendar, graphical

Calculation: Kärme­kallio_RD155x5xHH182_Luke_Forest

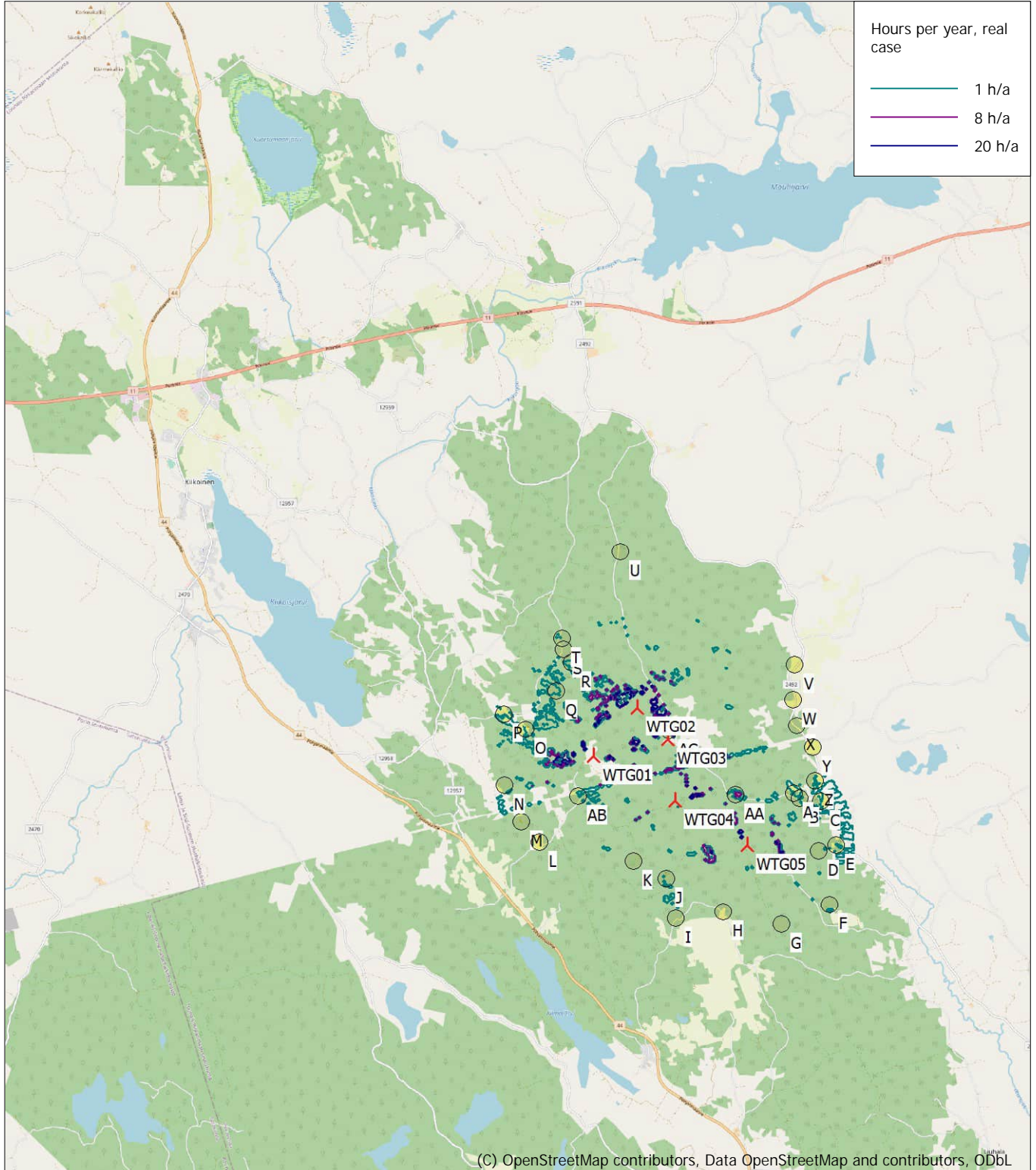


WTGs

- WTG01: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (10)
- WTG02: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (12)
- WTG03: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (11)
- WTG04: Generic RD155 5600 155.0 !O! hub: 182,5 m (TOT: 260,0 m) (9)

SHADOW - Map

Calculation: Karmekallio_RD155x5xHH182_Luke_Forest



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:100 000, Map center Finish TM ETRS-TM35FIN-ETRS89 East: 269 370 North: 6 819 720

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_P47816_Karmekallio_0.wpo (1)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1,5 m